

SOMATOM

Instructions for Use – Force
syngo CT VB30

siemens-healthineers.com

SIEMENS Healthineers

Legend

	Indicates a hint Is used to provide information on how to avoid operating errors or information emphasizing important details
	Indicates the solution of a problem Is used to provide troubleshooting information or answers to frequently asked questions
■	Indicates a list item
✓	Indicates a prerequisite Is used for a condition that has to be fulfilled before starting a particular operation
◆	Indicates a one-step operation
1 2 3	Indicates steps within operating sequences
Italic	Is used for references and for table or figure titles
➔	Is used to identify a link to related information as well as previous or next steps
Bold	Is used to identify window titles, menu items, function names, buttons, and keys, for example, the Save button Is used for on-screen output of the system including code-related elements or commands
Orange	Is used to emphasize particularly important sections of the text
`Courier`	Is used to identify inputs you need to provide
Menu > Menu Item	Is used for the navigation to a certain submenu entry
<variable>	Is used to identify variables or parameters, for example, within a string
⚠ CAUTION	CAUTION Used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury or material damage. CAUTION consists of the following elements: • Information about the nature of a hazardous situation • Consequences of not avoiding a hazardous situation • Methods of avoiding a hazardous situation

WARNING

WARNING

Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

WARNING consists of the following elements:

- Information about the nature of a hazardous situation
- Consequences of not avoiding a hazardous situation
- Methods of avoiding a hazardous situation

1 Introduction 10
1.1 Scope 10

2 Safety information 11
2.1 General safety information 11
2.1.1 Residual risk 12
2.1.2 Qualification and competence 12
2.1.3 Statutory regulations 12
2.1.4 In the event of fire 13
2.1.5 In the event of liquids in the vicinity of the medical equipment 13
2.1.6 Risk of electric shock 14
2.1.7 In case of a malfunction 15
2.1.8 Terminating system movements and radiation 15
2.1.9 Shutdown in case of emergency 16
2.1.10 Remote access 17
2.1.11 During scanning 18
2.1.12 Working at the console 18
2.1.13 Radiation protection 19
2.1.14 Radiation protection equipment 21
2.1.15 Operating conditions 22
2.1.16 Emergency access 26
2.1.17 *syngo* System Security 26
2.1.18 Disposal of the system 28
2.2 Safety information on working with patient data 28
2.2.1 Registering a patient 28
2.2.2 Updating patient data 29
2.2.3 Searching patient data 30
2.2.4 Deleting patient data 31
2.3 Safety information on patient transport and positioning 32
2.3.1 Patient table 33
2.3.2 Accessories 36
2.3.3 Laser lightmarker 48
2.3.4 3D camera 48
2.3.5 During system movements 48
2.3.6 Turbo Flash mode 51
2.4 Safety information on patients with implanted devices 52
2.5 Safety information on performing an examination 52
2.5.1 Entering patient examination data 53
2.5.2 Switching to Single Tube Operation 53
2.5.3 Examination settings 54
2.5.4 Communication with the patient 55
2.5.5 Additional information on Cardiac CT examinations 56
2.5.6 Additional information on contrast examinations 58
2.5.7 Additional information on Turbo Flash Spiral Cardiac examinations 60
2.5.8 Additional information on interventional examinations 61
2.5.9 *syngo*.via postprocessing applications 61
2.5.10 PET CT 61
2.6 Safety information on animal patients 61
2.6.1 Injury to the operator, personnel, or attendants 62
2.6.2 Injury to the patient 62
2.6.3 Cleaning media 63
2.7 Safety information on reconstruction parameters 63

2.8 Safety information on basic image review 64
2.8.1 Loading or selecting images 64
2.8.2 Viewing 65
2.8.3 Evaluating pixels with the pixel lens 65
2.8.4 Modifications in medical images 66
2.8.5 2D and 3D evaluation 67
2.8.6 Image artifacts 67
2.9 Safety information on documenting and reporting 70
2.9.1 Viewing structured reports 71
2.10 Safety information on storing and archiving 72
2.10.1 Storing data 72
2.10.2 Exporting data 73
2.10.3 Transferring data 76
2.11 Safety information on postprocessing applications 77
2.11.1 *syngo* 3D 77
2.11.2 Fly Through 80
2.11.3 Dental 80
2.11.4 *syngo* Volume Perfusion CT – Neuro 80
2.11.5 *syngo* Volume Perfusion CT – Body 81
2.11.6 Camtasia 82
2.12 Safety information on quality assurance 82
2.12.1 Specific national regulations 83
2.13 Safety information on system maintenance 84
2.13.1 Safety information for cleaning and disinfection 84
2.13.2 Remote service 86
2.14 Safety information on shutting down 86

3 System description 88
3.1 System overview 88
3.2 Scan unit (gantry) 89
3.2.1 Gantry front 89
3.2.2 Gantry rear 90
3.2.3 Gantry operator panels 92
3.2.4 Connectors 108
3.3 Patient Table 109
3.3.1 Patient table with 2000 mm scan range 109
3.3.2 Multi-purpose table 113
3.3.3 Definitions and limit values 117
3.4 Camera system (optional) 119
3.4.1 3D camera 120
3.5 *syngo* Acquisition Workplace 121
3.5.1 Functions 122
3.5.2 Location of use 123
3.5.3 Workplace computer 123
3.5.4 Control box 124
3.6 Heat exchanger 128
3.7 Accessories 128
3.7.1 Positioning aids 129
3.7.2 Accessories of Cardiac CT 146
3.7.3 Bolus injector (CARE Contrast CT) 150
3.7.4 Distance enlargements 151
3.7.5 Infusion bottle holder 152
3.7.6 i-Control (interventional panel) 152
3.7.7 Foot switch 158

4 System operation 160

4.1 Switching the system on and off 160
4.1.1 Switching on 160
4.1.2 Shutting down the system 164
4.1.3 Exceptional situations 168
4.1.4 Saving energy 172
4.2 Function tests 173
4.2.1 Checking the STOP keys 173
4.2.2 Testing the keys on gantry operator panel 174
4.2.3 Checking radiation block and warning lamps 174
4.2.4 Checking the laser lightmarker 174
4.2.5 Checking the intercom system 175
4.2.6 Checking the table top 175
4.2.7 Using the Customer CTDI service function 175
4.3 Operation of the patient table 178
4.3.1 Patient table movements 179
4.3.2 Moving the patient table using the gantry operator panel with Touch Panel 179
4.3.3 Moving the patient table using the gantry operator panel 183
4.3.4 Moving the patient table using the foot switch 186
4.3.5 Moving the table manually 186
4.3.6 Changing the MPT table top 187

5 Dose management and optimization 189

5.1 Dose optimization features 189
5.1.1 Dose Notification 189
5.1.2 Dose Alert 189
5.1.3 CARE Dose4D 191
5.1.4 CARE kV 193
5.1.5 X-CARE 194
5.1.6 HandCARE 195
5.1.7 Sinogram Affirmed Iterative Reconstruction (SAFIRE) / Advanced Modeled Iterative Reconstruction (ADMIRE) 195
5.1.8 Neuro BestContrast 196
5.1.9 Turbo Flash Spiral Cardiac 197
5.1.10 ECG Pulsing and MinDose 197
5.1.11 Pitch Adaptation 198
5.1.12 Adaptive Cardiac Sequence 199
5.1.13 Adaptive Dose Shield 199
5.1.14 Filters in the tube collimator 200
5.1.15 Tin filtration for Dual Energy examinations 201
5.1.16 Fields of use for tin filtration 201
5.1.17 Tin filtration for low dose scanning 201
5.2 Performing a dose-optimized workflow 202
5.2.1 Checking the examination configuration parameters 202
5.2.2 Configuring limits and notification values 208
5.2.3 Activating password protection for the Dose Alert 211
5.2.4 Checking the parameter settings 211
5.2.5 Positioning the patient 216
5.2.6 Acquiring a topogram 217
5.2.7 Handling parameter conflicts 218
5.2.8 Viewing the dose documentation 224

5.3 Considerations for pediatric scanning 225
5.3.1 Characteristics of child protocols 225
5.3.2 Checking the examination configuration parameters 226
5.3.3 Positioning the patient 226
5.4 Considerations for Cardiac CT 227
5.4.1 Initial situation and scan mode 227
5.4.2 Scanning a prospectively ECG-triggered sequence 227
5.4.3 Scanning a retrospectively ECG-gated spiral 230
5.4.4 Scanning with Turbo Flash Spiral Cardiac 232
5.4.5 Using CARE Dose4D and CARE kV 233

6 Examination 235
6.1 Examination procedure overview 235
6.1.1 Registering the patient and selecting the scan protocol 236
6.1.2 Preparing the examination 236
6.1.3 Obtaining a topogram 237
6.1.4 Checking the scan protocol in the chronicle 237
6.1.5 Planning the scan ranges 237
6.1.6 Performing scans 237
6.1.7 Reconstructing, evaluating, and manipulating images 238
6.1.8 Completing and ending the examination 238
6.1.9 Postprocessing the images with other applications 238
6.1.10 Archiving and sending images 238
6.2 Configuration of examination settings 238
6.2.1 Using the Configuration Panel 238
6.2.2 Configuring the display of the Touch Panel 238
6.2.3 Scan Protocol Assistant 239
6.3 Preparations 262
6.3.1 Registering a Patient 263
6.3.2 Calling up the Patient Model Dialog 266
6.3.3 Using automatic functions 269
6.4 Positioning the patient 277
6.4.1 Important safety information 277
6.4.2 Preparing the patient table 279
6.4.3 Preparing the patient 285
6.4.4 Moving the patient to the scan start position 287
6.4.5 Using the 3D camera 293
6.4.6 Radiotherapy functions 299
6.4.7 Talking to the user at the console 303
6.4.8 Stopping system movements and radiation 303
6.5 Positioning animal patients 304
6.5.1 Immobilizing animal patients 304
6.6 Scan 306
6.6.1 Monitoring patients 307
6.6.2 Talking to the patient 307
6.6.3 Acquiring a Topogram 308
6.6.4 Planning an Examination 310
6.6.5 Acquiring a Sequence 315
6.6.6 Acquiring a Multiscan 318
6.6.7 Acquiring a Spiral 318
6.6.8 Acquiring an Adaptive 4D spiral 320
6.6.9 Acquiring a Dual Energy scan 323
6.6.10 Acquiring a Turbo Flash Spiral 324
6.6.11 Ultra High Resolution (UHR) modes 326

6.7 Reconstruction 326
6.7.1 Defining the reconstruction target 327
6.7.2 Defining the Precision Matrix 327
6.7.3 Creating new reconstruction jobs 328
6.7.4 Performing a reconstruction 329
6.7.5 Performing a 3D reconstruction 332
6.7.6 Performing a FAST 3D reconstruction 333
6.7.7 Performing a reconstruction with reduced metal artifacts (iMAR) 334
6.7.8 Performing a DirectDensity™ reconstruction 336
6.7.9 Performing an iterative reconstruction (SAFIRE/ADMIRE) 337
6.7.10 Performing a Dual Energy reconstruction 338
6.7.11 Optimizing the image display 340

7 Enhanced examination 343
7.1 CARE Bolus CT 343
7.1.1 Activating Bolus Tracking 343
7.1.2 Performing a PreMonitoring Scan 344
7.1.3 Preparing Monitoring Scan and Diagnostic Scan 345
7.1.4 Starting Bolus Tracking 346
7.1.5 Bolus Tracking with FAST Bolus 347
7.2 CARE Contrast CT 349
7.2.1 Activating the coupled mode 350
7.2.2 Checking the parameter settings 353
7.2.3 Performing a scan in coupled mode 356
7.2.4 Canceling a scan in coupled mode 357
7.2.5 Saving a contrast protocol 358
7.3 Cardiac CT 359
7.3.1 Preparing the Acquisition 360
7.3.2 Acquiring an ECG-Gated Spiral 361
7.3.3 Acquiring an ECG-Triggered Sequence 365
7.3.4 Turbo Flash Spiral Cardiac/Chest Pain 368
7.3.5 Acquiring a Heart Perfusion scan 373
7.3.6 Reconstructing 374
7.4 Adaptive 3D Intervention 381
7.4.1 Using the Intervention parameter card and tool bar 383
7.4.2 Using i-Control 386
7.4.3 Using i-Control 394
7.4.4 Using the foot switch 400
7.4.5 Using the monitor cart and monitor ceiling system 400
7.4.6 Preparing Intervention 402
7.4.7 Selecting the Interventional Scan Mode 403
7.4.8 Displaying the parameters 404
7.4.9 Setting the parameters 405
7.4.10 Setting a tube position for HandCARE 405
7.4.11 Defining the table movement 406
7.4.12 Defining the table repositioning 406
7.4.13 Defining the image order 407
7.4.14 Selecting the default screen layout 407
7.4.15 Selecting the default window settings 407
7.4.16 Starting the acquisition 408
7.4.17 Acquiring images in i-PrecisionView mode 408
7.4.18 Modifying the scan range 409
7.4.19 Modifying the window values 409
7.4.20 Auto stopping the table 409

7.4.21 Moving the table with the function Same TP 410
7.4.22 Scrolling through images 410
7.4.23 Loading different series in a segment 412
7.4.24 Loading a different recon job 412
7.4.25 Using 3D Intervention 412
7.4.26 Saving Key Images 420
7.4.27 Ending Intervention 421

8 Maintenance 422
8.1 Service 423
8.1.1 Warranty 423
8.2 Cleaning and disinfection 423

9 Quality assurance 424
9.1 Accessories for quality measurement 424
9.1.1 Quality phantom 425
9.1.2 Low contrast phantom 425
9.1.3 Low contrast phantom (predecessor) 426
9.1.4 Mounting the phantoms to the patient table 428
9.1.5 Positioning the phantoms 428
9.1.6 Removing the phantom assembly 430
9.2 Daily quality measurements 431
9.2.1 Performing quality measurements 431
9.3 Constancy test 435
9.3.1 Performing the constancy test 435
9.3.2 Performing the lightmarker test (z-position) 439
9.3.3 Performing the external lightmarker test 440
9.3.4 Performing the sagittal/coronal lightmarker test 441
9.3.5 Performing the Topogram position test 442
9.3.6 Performing the slice thickness test 443
9.3.7 Performing the homogeneity test 445
9.3.8 Performing the pixel noise test 445
9.3.9 Performing Image Inspection 446
9.3.10 Performing the MTF test 447
9.3.11 Performing the table position test 447
9.3.12 Performing the CTDI Air test 448
9.3.13 Exiting the constancy test 449
9.3.14 Output of results 449
9.4 Low contrast test 452
9.4.1 Starting the test 452
9.4.2 Evaluating the test 454
9.5 Camera test 454
9.5.1 Performing the camera test 455
9.6 Constancy test of the monitor 457
9.6.1 Image quality of the monitor 457
9.6.2 Starting the constancy tests of the monitor 458
9.6.3 Performing the daily constancy test of the monitor 458
9.6.4 Performing the biannual visual tests of the monitor 460
9.6.5 Performing the biannual metrological tests 461

Index 463

1 Introduction

These instructions for use provide you with detailed information about the *syngo* CT software, your CT system, the system components, and the accessories.

1.1 Scope

The Instructions for Use are only valid for the stated software version, in conjunction with the latest Release Information.

These Instructions for Use apply to the following devices:

- SOMATOM Force

The Release Information can extend the validity of the Instructions for Use for these medical devices.

Components or software functionalities that may not be part of your system configuration are nevertheless described in the present Instructions for Use. It may be that not all of them are marked explicitly as optional. The availability of these components or software functionalities depends on your purchase contract.

2 Safety information

Follow the safety information in this document.

To ensure the safe use of your product and the safety of people, you must adhere to the safety information provided in the Instructions for Use. In addition, also observe your country-specific regulations and guidelines.

Safety information is located in the safety section and repeated within context where a hazardous situation may occur. To make sure safety information is understood, always read it in context of the situation.

WARNING and CAUTION are highlighted in the text:

WARNING	Indicates a hazardous situation which, if not avoided, could result in death or serious injury.
CAUTION	Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

WARNING and CAUTION have the same structure. The following example CAUTION instructs you how to read a WARNING or a CAUTION:

CAUTION

This text describes the hazardous situation: Images with lossy compression are used for diagnosis!

This text describes the hazard: **Wrong diagnosis.**

- **This text describes how to avoid the hazardous situation:** Always verify your evaluation results with the original DICOM images (first reader duty).
- Never use lossy ...

2.1 General safety information

For the secure operation of your medical device, it is the responsibility of the system owner to ensure that each person who operates the system reads and understands the provided Instructions for Use.

WARNING

Not observing the Instructions for Use and the safety information of the medical device and the equipment!

Injury to the patient or personnel, and damage to the equipment.

- Always observe the Instructions for Use of the particular units used. This includes the labels applied on the equipment as well as the Instructions for Use documents.
- Always use this Instructions for Use document in conjunction with all Instructions for Use documents provided.
- Follow the safety instructions and safety signs.
- For references purposes, store the Instructions for Use near your workplace.

Electronic Instructions for Use are provided on your CT system and on the workplace.

2.1.1 Residual risk

The residual risk has been judged as being acceptable. User-relevant safety information is provided in the Instructions for Use documents of the medical device.

2.1.2 Qualification and competence

WARNING

Operation of the system, applications, or functionality by non-trained users!

Injury to the patient or personnel, or damage to the equipment.

- Only trained and qualified users, certified in accordance with country-specific regulations, are authorized to operate the system. For example, physicians, radiologists, or technologists.

  For appropriate training, contact your Representative at Siemens Healthineers.

2.1.3 Statutory regulations

The *System Owner Manual* provides information that is part of the *Instructions for Use* and information that is required for your SOMATOM CT system.

These documents must be observed for the following subjects:

- Tests to be performed by the system owner, see *Standards and statutory regulations*.
- Operating conditions, see *Technical specification*.
- Dose information, see *Dosimetry and imaging performance report*.
- Forms for recording test results, see *Introduction*.
- Labeling, see *Location of labels*.
- Preventative maintenance, see *Maintenance plan*.
- Disposal, see *Green performance and disposal*.

- Tube description, see *X-ray tube technical description*.
- Use of OSS software, see *Open source software notice*.

Required documents for your SOMATOM CT system, for example:

- Files according to country-specific regulations
- Upgrades and additional documentation

2.1.4 In the event of fire

WARNING

Fire inside or in the vicinity of the system!

Injury to the patient or the personnel, or damage to the equipment. Gas poisoning due to burning plastic.

- Switch off the acquisition system in the event of fire.
- Make sure that you and the patient know where the escape routes are.
- Make sure that you know where the fire extinguishers are located and familiarize yourself with the use of them.

2.1.5 In the event of liquids in the vicinity of the medical equipment

Observe the following safety information in the vicinity of the medical equipment.

WARNING

Liquids or food and drinks in the vicinity of medical equipment!

Injury to the patient or personnel, and malfunction of or damage to the equipment.

- Shut down the system immediately if liquid is detected within the equipment.
- Contact, and leave all repairs to, the Customer Service at Siemens Healthineers.
- Clean the equipment with a damp, not wet, cloth.
- Wring the cloth out well and make sure that no liquids get onto, or into, the equipment.
- After cleaning, make sure that no water remains on the floor to avoid slipping.
- Keep food and drinks away from the equipment.

2.1.6 Risk of electric shock

At the system

CAUTION

The system carries line voltage!

Electric shock or burn from high short-circuit current.

- Never open components of the system.
- Contact, and leave all repairs to, the Customer Service at Siemens Healthineers.
- Make sure that no objects, for example, necklaces, paperclips, or liquids can get into the interior of the system (electric shock, short circuit).

At the uninterruptible power supply (UPS)

WARNING

Wrong handling of batteries!

Electric shock or burn from high short-circuit current.

- Observe proper precautions.
- Servicing should be performed by qualified service personnel knowledgeable of batteries and required precautions.
- Keep unauthorized personnel away from batteries.

At the monitor

WARNING

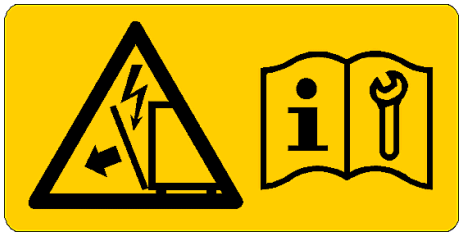
Unauthorized manipulation on or improper use of the system!

Electric shock

- Never open the monitor.
- Contact, and leave all repairs to, the Customer Service at Siemens Healthineers.
- Never place cups, glasses or other vessels containing liquid on or near the monitor, in case of accidental spillage.
- Make sure that no objects, for example, necklaces, paperclips, or liquids can get into the interior of the device (electric shock, short circuit).

Warning label

Warning, risk of electric shock



Risk of electric shock. Do not remove cover or back. Service must be performed by qualified service personnel. Consult accompanying documents. Call service.

2.1.7 In case of a malfunction

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

WARNING

Use of damaged system components or accessories!

Injury to the patient or personnel and damage to the equipment.

- Perform visual check of system components or accessories before usage to check if parts are broken or mechanical damaged. Do not use damaged system components or accessories.

  Replace damaged system components or accessories immediately.

  Contact, and leave all repairs to, the Customer Service at Siemens Healthineers.

CAUTION

Monitor failure!

Uncontrolled system.

- Do not make any more entries via the keyboard.
- Interrupt the examination.
- If necessary, press a **STOP** key or, in case of an emergency, an **EMERGENCY OFF** button.

2.1.8 Terminating system movements and radiation



In the event of a risk of injury or damage, you can stop system movements and radiation by using the **STOP** keys.

After pressing the **STOP** key, the patient table may move up to 10 mm before it stops completely. Subsequently, no motorized system movements are possible.

You can then pull the patient table out of the opening of the gantry manually.
(→ Page 186 *Moving the table manually*)

To continue working, you must reactivate the system by selecting **Setup > Continue** at the workplace computer.

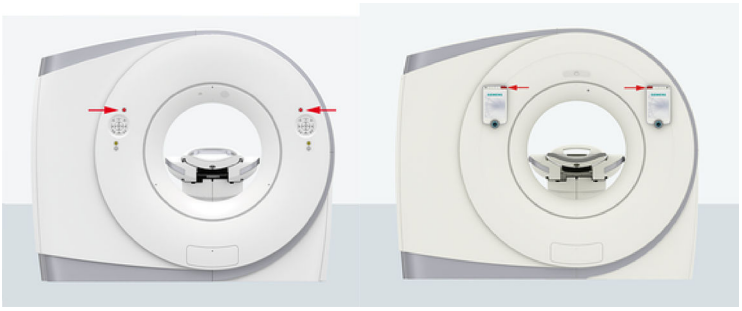
Location of STOP keys

The **STOP** keys are located on the gantry control panels and on the control box.

At the front of the gantry



At the rear of the gantry



At the control box



2.1.9 Shutdown in case of emergency

In addition to the **STOP** keys on the *syngo* CT unit, **EMERGENCY OFF** keys provided by the customer must be easily visible and within reach.

Country-specific regulations must be observed.

EMERGENCY OFF keys interrupt the power supply of the system. Radiation and system movements will be stopped. Data may be lost.

The **EMERGENCY OFF** key must also be pressed if situations arise that could cause injury to the patient or user or damage to the equipment, for example, liquids, fire, or particles getting into the equipment.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

Unless absolutely necessary, do not switch off the system at the **EMERGENCY OFF** key because the **EMERGENCY OFF** key switches off the system immediately without UPS assistance.

You have to calibrate the system when you restart it. (➔ Page 162 *System checkup and calibration*)

2.1.10 Remote access

CAUTION

Misuse of data handling!

Wrong diagnosis

- Make sure that only a trained user gets remote access to the system.

CAUTION

The display quality at the remote assistance workplace cannot be guaranteed!

Wrong basis for diagnosis.

- If the remote assistance workplace shall be used for diagnostic purposes, make sure that all necessary regulatory and legal requirements for the monitor are fulfilled.

CAUTION

Remote and uncontrolled patient movement!

Possible injury to the patient by moving parts.

- Do not leave the *syngo* Acquisition Workplace unattended if full access is enabled. Local user still has full responsibility for appropriate usage of system.

CAUTION

Using *syngo* directly on a public or private network may lead to insufficient system performance!

Possible degradation of system performance or unexpected system behavior.

- Only use *syngo* in a secure and load-adapted network.

CAUTION

Wrong configuration of **Presentation State** support when configuring network nodes!

Loss of post-processing results.

- When configuring network nodes, enable **Presentation State** support only after verifying the remote node for PR support.

Only use remote access in high performance networks with powerful PCs to avoid insufficient display quality.

2.1.11 During scanning

Despite the design of the CT scanner, it is not possible to completely eliminate the risk of injury, including risk due to collision, contusion, and radiation.

CAUTION

Locked screen when removing the PKI card during acquisiton!

Undesired radiation exposure.

- Do not remove the PKI card during acquisition.

- Never leave the CT scanner unsupervised during an examination.
- Never remove the PKI card during an examination.
- Take protective measures to avoid undesired radiation exposure. (→ Page 19 *Radiation protection*)

2.1.12 Working at the console

Observe the following safety information for your workplace.

WARNING

Liquids or food and drinks in the vicinity of medical equipment!

Injury to the patient or personnel, and malfunction of or damage to the equipment.

- Shut down the system immediately if liquid is detected within the equipment.
- Contact, and leave all repairs to, the Customer Service at Siemens Healthineers.
- Clean the equipment with a damp, not wet, cloth.
- Wring the cloth out well and make sure that no liquids get onto, or into, the equipment.
- After cleaning, make sure that no water remains on the floor to avoid slipping.
- Keep food and drinks away from the equipment.

2.1.13 Radiation protection

For your own protection and the patient's protection, you must observe the radiation protection regulations.

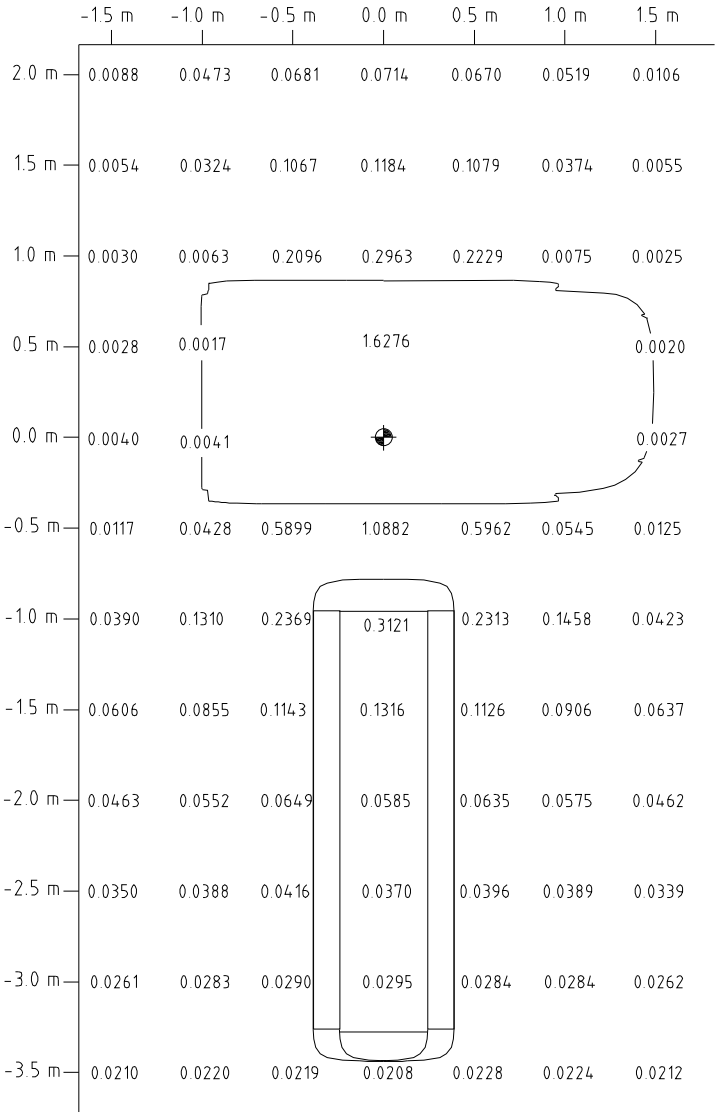
The following diagrams show the distribution of stray radiation in the horizontal and vertical planes based on the scanner coordinate system (intersection of scanner axis with scan plane) for all configuration types of the SOMATOM Force (according to the IEC 60601-2-44 standard). The values shown are Air Kerma in µGy per mAs.

For the measurement, a cylindrical PMMA phantom with a diameter of 32 cm and a length of 15 cm ± 1 cm was centered in the scan plane.

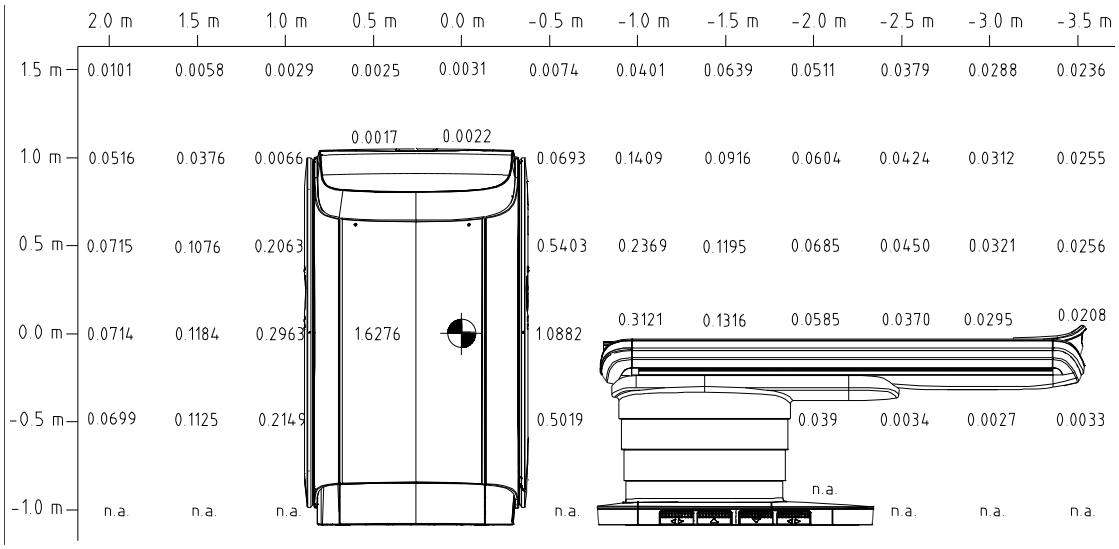
The scanning was performed using the maximum tube voltage of 150 kV and the maximum collimation of 96 x 0.6 mm.

The shown values are valid for single tube operation as well as for dual tube operation if the stated mAs value corresponds to the total mAs value of both tubes.

SOMATOM Force (top view)



SOMATOM Force (side view)



2.1.14 Radiation protection equipment

Special equipment is part of the radiation protection regulations.

Control area

The console is located outside the radiation control area. The patient can be observed through a lead glass window. The gantry and the patient table can be operated by remote control.

- When scanning, operate the system from the console whenever possible.

Radiation shielding

If scans need to be released from inside the control area, or if accompanying personnel need to remain there, safety measures must be taken. For example, lead aprons, protective walls, and so forth. (➔ Page 21 *Protective measures*)

Protective measures

Take the following measures to protect both yourself and the patient.

CAUTION

Radiation in the examination room after the **Start** key has been pressed!

Undesired radiation exposure.

- ◆ Leave the examination room before initiating scanning or for interventional CT examination, wear protective clothing.

Personnel

Anyone who needs to be near the patient during scanning must observe the following precautions:

- Wear protective clothing, for example, a lead apron.
- Wear a PEN dosimeter and/or film badge.
- Stay in the zone shielded by the system i.e., to the side of the gantry or behind a mobile protective wall.

Patients

You are responsible for protecting the patient from unnecessary radiation, for example:

- Always use a gonadal shield, if possible.
- Use the pediatric mode for children.
- Use *CARE* products.

Reduction of the radiation exposure

You can avoid repeating a measurement and therefore reduce the radiation exposure to the patient by taking certain precautions. (➔ Page 277 *Important safety information*)

- Observe the calibration and maintenance instructions in the manual. (➔ Page 422 *Maintenance*) (➔ Page 162 *System checkup and calibration*)

2.1.15 Operating conditions

Only operate the system in rooms intended for medical purposes.

The following requirements must be fulfilled for operation of the system:

(➔ Page 22 *Climatic requirements in the examinations room*) (➔ Page 22 *Explosion protection*) (➔ Page 22 *Electromagnetic compatibility*) (➔ Page 23 *Protective measures*) (➔ Page 23 *Safety equipment*)

Climatic requirements in the examinations room

CAUTION

System is operated outside of the specified temperature range!

Wrong diagnosis possible (artifacts may occur).

◆ If the working conditions specified cannot be met, the room must be equipped with air-conditioning or the system must be shut down.

The air inside the examination room must fulfill the following requirements while running the CT system:

Temperature range: 18 – 28 °C (64.4 – 82.4 °F)

Relative humidity: 20 – 75 %

For further information, see *System Owner Manual*, chapter *Technical specification*.

Explosion protection

The CT system, components, and accessories are not suitable for operation or storage in areas containing explosive gases.

Electromagnetic compatibility

The system complies with the EMC stipulations, see *System Owner Manual*, chapter *Technical specification*.

Certain items of equipment, for example, radio telephones (mobiles) exceed the limit values of the EMC stipulations. In extreme cases, use of such items can cause interference.

- Do not use a radio telephone or similar equipment in the vicinity of the system.

Protective measures

The following protective measures must be followed when installing the system:

- (→ Page 23 *Power connection*)
- (→ Page 23 *Fire extinguishers*)
- (→ Page 23 *Site On/Off switch*)
- (→ Page 23 *Radiation warning lamps*)

Power connection

The power supply must be provided to all products operated as part of an X-ray system through a fixed wiring connection and a multipole interrupting device provided by the customer. The equipment must be installed according to specification IEC 60364-7-710 or must meet the respective national regulations.

Fire extinguishers

Fire extinguishers must be located in easily accessible and visible locations.

Site On/Off switch

An **On/Off** switch (EMERGENCY OFF) must be installed on site by the customer.

Operating the **Site On/Off** switch connects or disconnects the system to the main power supply. The **On/Off** state must be visible.

If the **Site On/Off** switch is used for switching off, the uninterruptible power supply (UPS) starts up. If a power failure occurs directly afterwards, the UPS may not have enough energy to supply the system.

Unless absolutely necessary, do not switch off the system using the **Site On/Off** switch. Otherwise you have to calibrate the system several times when you restart it. (→ Page 162 *System checkup and calibration*)

Radiation warning lamps

Radiation warning lamps are recommended to be installed on all doors of the examination room. They must be visible from all areas where radiation can be released.

Safety equipment

The system contains several items of safety equipment to protect the patient, the operating personnel, accompanying people and the system itself.

In addition to the measures already mentioned, the system has the following safety equipment:

(→ Page 23 *Temperature monitoring of the X-ray tube assembly*)
(→ Page 24 *Uninterruptible power supply, UPS*)

Temperature monitoring of the X-ray tube assembly

The temperature of the X-ray tube assembly is permanently monitored and calculated in advance. This function runs in the background. If the temperature rises above the limit value, a warning is given.

If necessary, scanning is postponed until the required cooling period has elapsed. This means that you might have to wait a certain time before you can continue with the examination as planned.

Overheating

The possible causes of overheating are:

- Ambient temperature too high
- Ventilation openings covered
- Defective cooling system
- Dirty air filters

To change the air filters, see *System Owner Manual*.

If certain parts of the equipment overheat, a warning is displayed on the monitor. (➔ Page 168 *Exceptional situations*)

◆ In this case, complete the current measurement as quickly as possible and shut down the system. (➔ Page 169 *Shutdown*) (➔ Page 169 *Restart*)

Uninterruptible power supply, UPS

The computers are equipped with an uninterruptible power supply (UPS). Furthermore, the entire system can be connected to the emergency power supply of the hospital.

If the uninterruptible power supply is active, a message or an acoustic signal indicates this. (➔ Page 168 *Exceptional situations*)

◆ Complete the current examination as quickly as possible and shut down the system.

Equipment modifications

Modifications of the system must be made in compliance with all legal stipulations by Siemens Healthineers Service or other authorized personnel.

Limitation of liability

As the manufacturer, assembler, installer, or importer of the system, Siemens Healthineers does not accept liability for the safety functions, reliability, or performance of the system if one of the following circumstances applies:

- Installation, upgrade, readjustment, modification, repair, or upgrading by persons not authorized to do so by Siemens Healthineers.
- Components not properly replaced with original parts from Siemens Healthineers.
- Electrical installation in the examination room that does not comply with the requirements of the currently valid standard DIN VDE 0100 Part 710 or other binding codes of practice.
- Operation of the system in a way which deviates from the instructions given in these manuals.

Certificate of conformity from other manufacturers

We therefore recommend that you obtain a certificate of conformity containing the following information:

- Type, extent and date of the work performed on the system
- Names of all those involved in the work (and their companies)
- Their signatures

Please note that this does *not* imply that the repairs are authorized. Siemens Healthineers does *not* accept liability for repairs that are carried out without our written permission.

Equipment of other manufacturers

If you are planning to install equipment of other manufacturers, you must obtain information about potential dangers in connecting or using systems or equipment of other manufacturers. This information can be drawn from the system specification.

If this information is not sufficient, you must consult the manufacturer of such systems/equipment or a specialist about the following topics:

- Reliability and performance of the systems/equipment
- Potential safety risks for people and equipment

Accessory equipment connected to the analog and digital interfaces must be certified according to the respective IEC standards. Furthermore, all configurations must comply with the applicable standards, for example, IEC 60950 for data processing equipment and IEC 60601-1 for medical electrical equipment. For further information, see *System Owner Manual*, chapter *Standards and statutory regulations*.

Any person who connects additional equipment to the signal input part or signal output part is configuring a medical system and is therefore responsible for ensuring that the system complies with the applicable standards.

For further information, contact your local Siemens Healthineers Representative or your Siemens Healthineers Country Organization.

Software manipulation

Installations or upgrades of the system must be made in compliance with all legal stipulations by Siemens Healthineers service or other authorized personnel.
(→ Page 24 *Limitation of liability*)

CAUTION

Unauthorized access to operating system!

Software manipulation

- Users are working on operating system level at their own risk. Siemens Healthineers does not take any responsibilities for adverse effects of the system generated by such actions. Any software manipulation is forbidden.

CAUTION

Third party software offers the user the possibility to modify files in the system!

Manipulated software leads to loss of or inconsistent data, or damage to the system.

- Do not modify files in the file menu, except within folders explicitly allowed by the Instructions for Use.

  Any software manipulation is forbidden.

CAUTION

Impermissible or faulty manipulations or changes of the hardware or software, or connection of the system to a network can cause the system to malfunction!

Unauthorized access, injury to the patient or damage to the equipment.

- Make sure that all necessary precautions with respect to the existing level of security are considered when adding a functionality or altering the shipped configuration.
- Do not open or remove the cover of the equipment nor install third-party software.

CAUTION

System infected by computer virus!

Manipulation of the software.

- *Never* use a data medium that could contain a computer virus, for example game CD.
- Check disks for viruses *before* using them.

2.1.16 Emergency access

CAUTION

User access may be prevented due to forgotten or unknown accounts or passwords, account lockout policy, or wrong setup, for example, in case of an emergency!

Inaccessible system

- Define a general user account for emergency access and assign it to a group and a role both called **Emergency Access**.
- Define a local user account for emergencies. The password for this account should never expire.
- Do not allow users to change the password for the emergency account.
- The users shall contact administrators immediately in case of problems.

2.1.17 *syngo* System Security

CAUTION

After activating the security system, access is limited to only the defined users!

Limited access to the system.

- Make sure you have read and completed all preparatory steps.
- Back up your complete system as done after installation before activating the security system.

CAUTION

Behavior of secured systems. The hospital's security policy affects the behavior of the *syngo* system. For example, password strength requirements, enabled empty passwords, or locking of an account after a specific number of failed logins!

Inaccessible system or data.

- Establish a user model for your hospital and verify it before the security system is activated.
- Establish a proper procedure for emergency access.
- Note that if you enable an empty password for the emergency account, this is enabled for all other users as well. Nevertheless, instruct the users to use strong passwords.
- Always back up your system before enabling the security system and before any major changes.
- Inform all users about any changes and settings. The users shall contact administrators immediately in case of problems.

CAUTION

User access may be prevented due to forgotten or unknown accounts or passwords, account lockout policy, or wrong setup, for example, in case of an emergency!

Inaccessible system

- Define a general user account for emergency access and assign it to a group and a role both called **Emergency Access**.
- Define a local user account for emergencies. The password for this account should never expire.
- Do not allow users to change the password for the emergency account.
- The users shall contact administrators immediately in case of problems.

CAUTION

Protection of data is changed!

The access to the data is no longer possible.

- If not enough permissions for data access are available, the person responsible for user management in hospital should add users to the groups until access is possible.

CAUTION

The system blocks when the audit trail is filled due to too many records, or too much drive space covered!

In this case, it is not possible to work with the system. Emergency access is also not possible.

- To prevent system blockage, you must archive the log files and remove them from the audit trail on a regular basis.
- When the audit trail blocks the system, proceed as described in your Instructions for Use of your SOMATOM CT system. See Instructions for Use, syngo System Security, chapter Configuring Audit Trail settings.

2.1.18 Disposal of the system

CAUTION

Incorrect disposal of the system or parts of the system!

Pollution of the environment.

- System components hazardous to persons or the environment must be disposed of with care and in compliance with legally binding ordinances.

  Examples of environmentally relevant components are accumulators and batteries, transformers, capacitors, monitor picture tubes, and phantoms.

  For details, contact your local Representative at Siemens Healthineers.

For further information about disposal, see *System Owner Manual*.

2.2 Safety information on working with patient data

Observe the following sections when updating or deleting data in the **Patient Browser**.

2.2.1 Registering a patient

Observe the following safety information before performing an examination. Ensure that the registered patient data and patient position are correct.

CAUTION

Wrong entry of patient sex or age!

Wrong basis for diagnosis.

- Make sure that the patient sex and age are correct.

CAUTION

The operating system may not support all characters for the received DICOM document!

The display of the name, for example, the patient name may be incomplete or misleading.

- *syngo* will not change the used characters, for example, minority characters, even if it cannot display them.
- Use other attributes for identification, if possible.

CAUTION

When working with several monitors, the patient name displayed in the folder of a task card belongs only to this task card. Any other visible task card may contain data from another patient!

Possible wrong diagnosis.

- Use patient demographics displayed in the image text for clear identification.

2.2.2 Updating patient data

Observe the following safety information when updating the patient data after the examination and reconstruction of images.

CAUTION

Rearranging series or images to another series may lead to wrong image information if the selected images or series are not compatible!

Wrong diagnosis due to wrong image information.

- Correct the attributes which do not correspond first and then rearrange the series or images.

CAUTION

Correcting or rearranging objects containing references!

Possible loss of references.

- Rearrange the entire hierarchical group containing all objects with references in order to maintain the references.
- Only references found within the selection will be adapted.

CAUTION

Inconsistent patient data or image information for *syngo* CT and *syngo*.CT postprocessing applications!

Wrong basis for diagnosis.

- Do not modify patient data (**Edit > Correct** in the **Browser** menu) after results have been calculated.

CAUTION

Mix-up of patients due to changed image data!

Wrong diagnosis due to wrong information.

- Always verify that all corrected or rearranged data belongs to the correct patient.
- Take special care when using drag and drop.

CAUTION

Mix-up of patients due to insufficient configuration of image text!

Wrong diagnosis due to wrong information.

- Always apply full image text to avoid mix-up of patients.
- Make sure that customized image text contains at least the main patient demographics, for example, patient ID, name, date of birth, and sex.

Additional information on radiation therapy objects

CAUTION

If any Radiotherapy (RT) object is involved in a correction or rearrangement, the references to and from other objects are not updated. The Correct and Rearrange function checks if any RT objects are involved and prompts for confirmation!

Possible loss of references between images and RT objects.

- Use the application that was used to generate the RT object for managing their references.
- First correct images, for example, patient demographics, before using them within RT.

2.2.3 Searching patient data

CAUTION

If the Patient ID is not unique, studies may be listed, which do not belong to the patient selected and displayed in the information area!

Import of wrong patient data possible.

- Always check the patient data before importing them into your system.

2.2.4 Deleting patient data

Observe the following safety information before deleting patient data in the **Patient Browser**.

CAUTION

Deletion confirmation deactivated!

Possible loss of data.

- The option in the **General** tab card to configure the **Delete Confirmation** dialog box should not be switched off.
- Be careful when activating a filter for auto deletion of data sets that it fits to your workflow as well.

CAUTION

Deletion confirmation deactivated!

Possible loss of data.

- The option in the **General** tab card to configure the **Delete Confirmation** dialog box should not be switched off.
- Be careful when setting permissions to delete documents without check if flags are not set.

CAUTION

Deactivation of the **Delete Confirmation** dialog box for **Auto Delete**!

Loss of data, delay of diagnosis or therapy.

- The **Delete Confirmation** dialog box for **Auto Delete** should always be switched on, especially on modalities.
- If the **Delete Confirmation** dialog box for **Auto Delete** is switched off, **Auto Delete** will start without user confirmation.

CAUTION

The **Delete Confirmation** dialog box for auto deletion is kept open for a long time on scanner systems!

Loss of data if objects chosen for auto deletion are updated by acquisition when the Delete Confirmation dialog box is open.

- Do not keep the **Delete Confirmation** dialog box open for a long time in parallel during a patient examination, and close it before a patient registration.

CAUTION

Conflicting **Auto Delete Configuration** and **Transfer Configuration**!

Loss of data if both functionalities start in parallel.

- Do not use the **Sent** flag for rule "Delete all Series with flags..." if auto transfer is configured to start when the **Sent** flag is set in combination.
- Use storage commitment whenever the sending and receiving systems supported it.
- If this combination is not avoidable, always crosscheck if the data chosen for auto deletion is actually stored on the receiving system before confirming auto deletion.

2.3 Safety information on patient transport and positioning

For safe and secure patient transport and patient positioning, observe the following sections depending on your workflow.

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

WARNING

Incorrect patient positioning!

Injury to the patient or personnel, and damage to the equipment.

- Always verify that the patient is correctly positioned.
- Always observe the patient during system movements.

WARNING

Incorrect patient positioning!

Injury to the patient by moving parts.

- Make sure that neither the patient's clothing nor hair can get caught in mechanical parts.
- Make sure that infusion lines and respiration tubes, catheters and ECG cables cannot get caught in the space between the table top and the side parts. These components must not be put under tensile stress in any other way.
- Make sure that patient bedding cannot get caught by moving parts of the patient table.
- Use positioning aids as described.

The patient table and accessories are designed for certain maximum loads.

WARNING

Exceeding the maximum load of the equipment, for example, patient table, overlays, accessories, and the assembly of accessories!

Injury to the patient or the personnel, or damage to the equipment.

- Make sure that the permissible maximum load of the equipment is not exceeded. The permissible maximum load of the equipment is displayed on the applied labels.
- Verify that the permissible maximum load is not exceeded for:
  - Each single item of equipment applied or plugged into the patient table. For example, positioning aids and overlays.
  - Equipment to which other equipment is attached. For example, accessory rail or infusion bottle holder.

The patient must always be positioned on the patient table.

Never position the patient directly in the gantry!

2.3.1 Patient table

WARNING

Horizontal table top movement!

Possible injury to the hand (warning label).

- Do not place your hand in the gap of the table top support.

WARNING

Lowering the patient table!

Body parts can get caught.

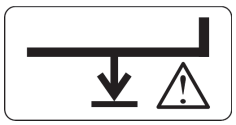
- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.

Warning, crushing hazard for hand



Increased risk that hands can get pinched between table top and patient table.

Caution, leg injuries



Increased risk that body parts can get pinched between table and floor.
Take care when lowering the patient table to avoid injury to body parts.
To avoid damaging the patient table, make sure no accessories (for example, a trolley or cart) are placed underneath the patient table while lowering it.

Patient table with 2000 mm scan range

Maximum load capacity



The maximum permissible load must not exceed 227 kg (500 lbs), which is approximately 2226 N.

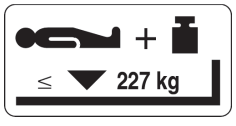
The weight of a patient sitting on the extended part at the head end has to be derated (max. 150 kg/330 lbs).

Multi purpose table

The maximum load of the multi purpose table depends on the table top used.

Standard table top and the RTP table top

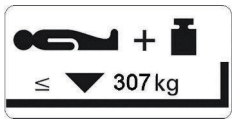
Maximum load capacity



The maximum permissible load must not exceed 227 kg (500 lbs), which is approximately 2226 N.

High capacity table top

Maximum load capacity



The maximum permissible load must not exceed 307 kg (677 lbs), which is approximately 3010 N.

Coded surgical rail

Take care when lowering the patient table to avoid damage to the surgical rail. Remove accessories, for example, trolleys or carts, under the patient table.

Maximum load capacity



The maximum permissible load must not exceed 15 kg (33 lbs), which is approximately 147 N.

i-Control (interventional panel)

Observe the following safety information when using the i-Control (interventional panel).

WARNING

Uncontrolled system movement due to unintended signal activation by users!

Injury to the patient or damage to the system.

- Always observe the patient directly. Press the nearest **STOP** key immediately if an undesired system movement is performed.

WARNING

Unintentional patient movement!

Unintentional activation of the device by the patient.

- Always fix and observe the patient when using the device.

WARNING

Operation of the i-Control in the wrong examination room!

Injury to the patient or damage to the system.

- Always keep the i-Control at the associated CT scanner.

WARNING

Uncontrolled system movement due to unintended signal activation by users!

Injury to the patient or damage to the system.

- Always keep the activated intervention device at the CT scanner to prevent unauthorized use.

Foot switches

Observe the following safety information when using a foot switch.

CAUTION

Impermissible or faulty manipulations or changes of the hardware or software, or connection of the system to a network can cause the system to malfunction!

Unauthorized access, injury to the patient or damage to the equipment.

- Make sure that all necessary precautions with respect to the existing level of security are considered when adding a functionality or altering the shipped configuration.
- Do not open or remove the cover of the equipment nor install third-party software.

2.3.2 Accessories

This section provides safety information on the accessories supplied with your system.

Patient transport (CARE TransX)

Observe the following safety information when using CARE TransX.

Trolley

CAUTION

Overload of the trolley!

Breakdown of the trolley.

- Always observe the permissible maximum load of the patient trolley.

CAUTION

Arms, legs or hairs are hanging down at the sides of the trolley!

Injury to the patient.

- Make sure that neither the patient's arms, legs nor hair can hang down at the sides.

WARNING

The patient is not fixed correctly with the restraint straps!

The patient may fall off the trolley.

- Always firmly close the restraint straps to prevent the patient from falling off the trolley.

WARNING

Faulty patient positioning using the CARE TransX trolley!

The patient may fall off the trolley.

- Before transferring the patient between trolley and table, always make sure that the caster brakes are locked to render the trolley immobile, and that the table top is exactly level with the trolley stretcher top at the outwards end position to avoid collision.
- Make sure that any infusion tubes are not squeezed or displaced during the transfer procedure.
- Also make sure that patient hair does not become entangled.
- Position the CARE TransX stretcher in a way that it is centered about the longitudinal axis of the table top and cannot hang over at the foot end or the head end.

Take care when lowering the patient table to avoid damage to the surgical rail. Remove accessories, for example, trolleys or carts, under the patient table.

Stretcher

WARNING

During transport with the stretcher the patient is not firmly strapped to the stretcher!

The patient may fall off the stretcher.

- Strap the patient firmly to the stretcher before transport.

WARNING

During transport the transport straps are not correctly attached to hold the stretcher unit securely!

The patient may fall off the stretcher.

- Before transport make sure that the transport straps are correctly attached in order to ensure that you can hold the stretcher unit securely.

WARNING

During patient transport the stretcher is not carried horizontally!

The patient may fall off the stretcher.

- Always carry the stretcher horizontally during transport.

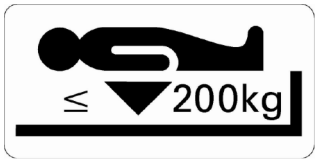
Label

Warning, collision of the patient with the equipment



Indicates possible collision points.
Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Maximum load capacity



The maximum permissible load must not exceed 200 kg (441 lbs), which is approximately 1961 N.

Radiation Therapy Planning (RTP) table top

Observe the following safety information when using the Radiation Therapy Planning (RTP) table top.

CAUTION

Use of the RTP table top!

Contusion of patient's fingers during table movement.

- Always use both arm supports with RTP table top.
- Observe that the hands of the patient are completely covered by the arm support.
- Always fix and observe the patient during table movement.

Positioning aids

Observe the safety information on positioning aids supplied with your system.

Positioning aids are subject to wear and tear. They must be replaced with original parts if they become dirty or damaged.

CAUTION

Incorrect use and use of non-original and non-released equipment!

Wrong diagnosis

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

WARNING

Incorrect use and use of non-original and non-released equipment!

Injury to the patient and personnel or damage to the equipment. Image quality may also decrease.

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

WARNING

Exceeding the maximum load of the equipment, for example, patient table, overlays, accessories, and the assembly of accessories!

Injury to the patient or the personnel, or damage to the equipment.

- Make sure that the permissible maximum load of the equipment is not exceeded. The permissible maximum load of the equipment is displayed on the applied labels.
- Verify that the permissible maximum load is not exceeded for:
  - Each single item of equipment applied or plugged into the patient table. For example, positioning aids and overlays.
  - Equipment to which other equipment is attached. For example, accessory rail or infusion bottle holder.

Head holder

WARNING

If a head holder or support does not engage securely, it can come loose!

Injury to the patient.

- Make sure that the pluggable positioning aids are seated firmly and securely engaged in the receptacle at the end of the table top.

Warning, collision of the patient with the equipment



Indicates possible collision points.
Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Maximum load capacity



The maximum permissible load must not exceed 180 N, which is approximately 18 kg (40 lbs).
Depending on the delivery date of the system, the position of this label can be inside of the bowl of the head holder.

Tiltable head holder

WARNING

If a head holder or support does not engage securely, it can come loose!

Injury to the patient.

- Make sure that the pluggable positioning aids are seated firmly and securely engaged in the receptacle at the end of the table top.

WARNING

Tiltable head holder not correctly locked in place!

Undesired radiation exposure due to repetition of the scan.

- Always make sure that the tiltable head holder is correctly locked in place.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

Warning, collision of the patient with the equipment



Indicates possible collision points.
Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Maximum load capacity



The maximum permissible load must not exceed 200 N, which is approximately 20 kg (44 lbs).

The head holder can get damaged when movable parts are pinched in the tilt adjustment mechanism or when lateral forces bigger than 250 N are applied to the head holder.

Movable parts are, for example, patient bedding, straps, cables, or tubes.



- Only touch the areas marked in yellow with the palm of your hand to adjust the tiltable head holder.
- Take care not to pinch any movable parts.
- Do not lean or push laterally against the tiltable head holder.
- Ensure that the tilt adjustment mechanism is completely engaged to avoid unintended tilting. Do not use the tiltable head holder if the tilt adjustment does not fit properly.
- Contact your local customer service representative or your Siemens Healthineers Country Organization if the tiltable head holder is damaged.

Head-arm support

WARNING

If a head holder or support does not engage securely, it can come loose!

Injury to the patient.

- Make sure that the pluggable positioning aids are seated firmly and securely engaged in the receptacle at the end of the table top.

Warning, collision of the patient with the equipment



Indicates possible collision points.
Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Knee support

Warning, collision of the patient with the equipment



Indicates possible collision points.
Indicates possible collision of the patient with the gantry. Take special care if the table height does not correspond to the isocenter of the patient.

Table top extension

Maximum load capacity



The maximum permissible load must not exceed 500 N, which is approximately 50 kg (110 lbs).

If you use the table top extension image artifacts might occur.

Bariatric positioning aids

WARNING

Exceeding the maximum load of the equipment, for example, patient table, overlays, accessories, and the assembly of accessories!

Injury to the patient or the personnel, or damage to the equipment.

- Make sure that the permissible maximum load of the equipment is not exceeded. The permissible maximum load of the equipment is displayed on the applied labels.
- Verify that the permissible maximum load is not exceeded for:
  - Each single item of equipment applied or plugged into the patient table. For example, positioning aids and overlays.
  - Equipment to which other equipment is attached. For example, accessory rail or infusion bottle holder.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

Maximum load capacity



The maximum permissible load must not exceed 500 N, which is approximately 50 kg (110 lbs).

Baby mattress

Warning, collision of the patient with the equipment



Indicates possible collision points.
Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Immobilizing the patient

Different straps are supplied to safely immobilize the patient. Observe the following safety precautions when using straps.

WARNING

The restraint straps are not permanently attached to the table!

They cannot prevent the patient from falling off the table.

Patients who do not keep still may fall off the table.

- Take special care with those patients.

Furniture

Monitor cart

Observe the following safety information when using the monitor cart.

CAUTION

Tripping of user and other persons!

Injury to the patient, the personnel, or other persons.

- Make sure that cables are installed in such a way that nobody can stumble over them.

Maximum load label



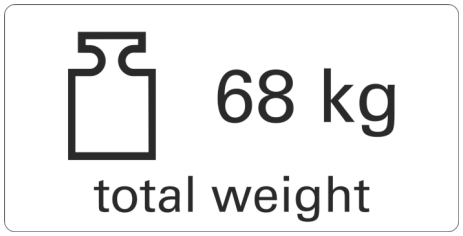
The maximum permissible load must not exceed 25 kg (55 lbs), which is approximately 245 N.

Total weight label



Mono cart: The total weight with one monitor (mono cart) is 60 kg (132 lbs), which is approximately 588 N.

Total weight label



Dual cart: The total weight with two monitors (dual cart) is 68 kg (150 lbs), which is approximately 667 N.

Monitor ceiling system

Observe the following safety information when using the monitor ceiling system.

WARNING

Liquids in the monitor ceiling system, power supply cables are laid inside!

Electric shock

- Make sure that no liquids, for example cleaning fluids, can get into the interior of the monitor ceiling system.

WARNING

Cleaning and disinfection of parts of the system while the system is connected to the power supply!

Electric shock due to possible contact with line voltage.

- Always switch the system off at the main power switch before cleaning and disinfecting.

CAUTION

Raising and moving the monitor ceiling system!

Damage to the monitor ceiling system.

- Do not use force when moving the device into the limit positions.
- Make sure that the monitor ceiling system does not collide with other components.

CAUTION

Dirt and liquid in the monitor arm of the ceiling mounted monitor!

Infection possible

- Clean the monitor and monitor arm after use.

CAUTION

Raising and moving the monitor ceiling system!

Injury to the personnel, damage to monitor ceiling system.

- Do not use force when moving the device into the limit positions.Make sure that the ceiling system does not collide with other components.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

Accessory cart

Observe the following safety information when using the accessory cart.

CAUTION

Using improper cleaning agents and disinfectants!

Injury to the cleaning personnel (allergic reaction or allergic shock) and damage to the equipment.

- Follow the cleaning and disinfecting instructions of the Instructions for Use.

  Do not use unsuitable cleaning agents and disinfectants.

  Follow the instructions of the cleaning and disinfectant manufacturer and follow their dosage instructions.

2.3.3 Laser lightmarker

CAUTION

Looking into laser beam with optical instruments!

Loss of sight possible.

- Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces.

CAUTION

Laser radiation!

Possible loss of eyesight due to laser radiation.

- Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces during adjustment.

2.3.4 3D camera

CAUTION

Incorrect calibration of the camera!

Unintended radiation exposure

- Always verify the patient positioning with the laser light marker.
- Use the camera for assisted patient positioning, only.

2.3.5 During system movements

Observe the following safety information during system movements to avoid injuries and radiation damage.

CAUTION

Unexpected movement or malfunction of the system or equipment!

Injury to the patient or personnel. Damage to the system or equipment.

- Contact, and leave all repairs to, the Customer Service at Siemens Healthineers.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

CAUTION

Unobserved movement of the patient table or gantry when using accessories and other supports!

Collision of the patient with the gantry.

- Monitor the patient continuously during table movement and gantry movement.
- Take special care of the patient when tilting the gantry.
- Follow the marking on the accessories.

WARNING

Unintentional activation of table movement keys of the control box!

Possible injury to the patient by moving parts.

- Make yourself familiar with the function of the control box keys.
- Always keep an eye on the patient during table movements.

WARNING

Braking forces due to high table speed!

Emergency patient suffers fractures.

- Use the default settings of the SIEMENS Trauma protocol to ensure the safety for the patient.

Uncontrolled movement of the patient

CAUTION

Unintentional patient movement!

Injury to the patient.

- Always fix and observe the patient during the measurement.

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

WARNING

Incorrect patient positioning!

Injury to the patient or personnel, and damage to the equipment.

- Always verify that the patient is correctly positioned.
- Always observe the patient during system movements.

Contusion points and contusion areas

WARNING

Movable parts of the CT system!

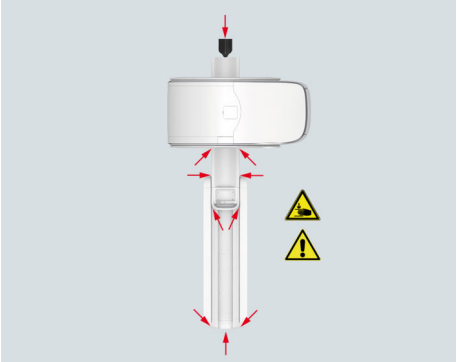
Possible injury to the patient by moving parts.

- Always observe the possible contusion points shown in the following pictures.

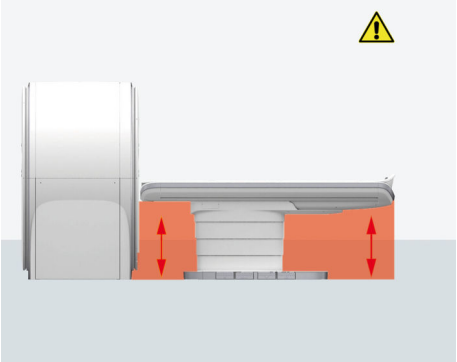
Particularly hazardous points are marked with red arrows and hazardous areas are colored red in the following drawings.

Contusion points at the gantry and patient table





Contusion areas at the patient table



Tensile stress on infusion tubes

WARNING

Use of short infusion tubes!

Tensile stress on infusion tubes when moving the table top. Tubes can get caught.

- Only use infusion tubes that are long enough.

2.3.6 Turbo Flash mode

Observe the following safety information when using the Turbo Flash mode.

WARNING

Weight limitation for Turbo Flash mode. Blocking scan due to exceeding the maximum load!

No scan in Turbo Flash mode possible.

- Check the maximum weight of the patient and the accessories, before positioning the patient.

WARNING

Short period of time to press the STOP key due to high table speed!

Contusions of the patient's body. Extractions of infusion lines or needles.

- Perform a test run of the table movement to ensure a risk free movement during Turbo Flash Spiral.

2.4 Safety information on patients with implanted devices

Observe the following safety information when examining patients with implanted devices.

WARNING

Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or arrhythmia!

ECG leads to wrong diagnosis.

- Keep pacemaker patients under close surveillance.

CAUTION

Scanning patients with implanted devices such as pacemakers or neuro stimulators!

Interferences may cause malfunctions of the implanted device.

- Observe the patient closely during examination.

Contact the manufacturer of the active implanted device for more information.

2.5 Safety information on performing an examination

Observe the following safety information before and during an examination.

CAUTION

Radiation in the examination room after the **Start** key has been pressed!

Undesired radiation exposure.

- Leave the examination room before initiating scanning or for interventional CT examination, wear protective clothing.

2.5.1 Entering patient examination data

CAUTION

Wrong entry of patient position!

Wrong basis for diagnosis.

- Make sure that the patient position is correct.

CAUTION

Wrong labeling of the sides when the patient is repositioned!

Wrong basis for diagnosis and treatment.

- Correct the patient orientation when the patient is repositioned.
- Review the labeling of the sides, to avoid wrong operative intervention.

2.5.2 Switching to Single Tube Operation

In case of emergency power or malfunction of tube B you can switch from the **Dual Tube** operation mode to **Single Tube Operation**. If you switch to **Single Tube Operation**, tube B will be switched off and the Dual Source scan protocols are not available.

1 Select **Options > Service > Local Service...** from the main menu.

The **Authentication** window is displayed.

2 Delete all entries from the entry fields.



3 Click the **OK** button.

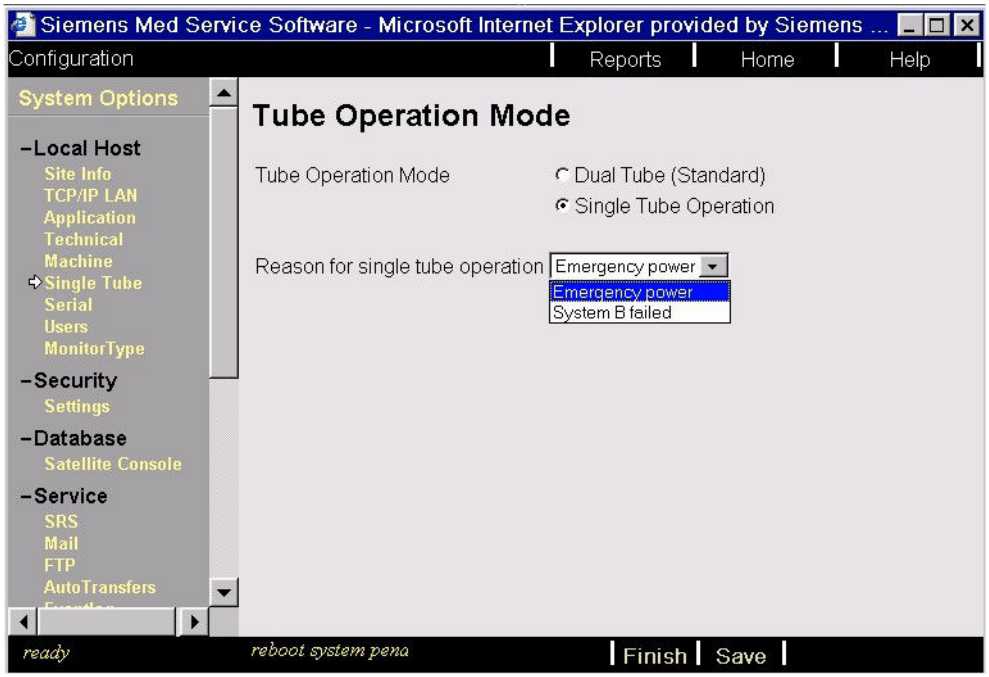
The **Service Software** window is displayed.



4 Click the **Configuration** button.

5 Select **Single Tube** from the navigation bar on the left.

The **Tube Operation Mode** window is displayed.



6 Select the **Single Tube Operation** option and the reason.

7 Click the **Save** button to save the changes you made.

8 Click the **Home** button.

The **Restart Application** dialog box is displayed.

9 Restart the system.

Discarding last changes

If you do not want to save you can discard your last changes.

1 Click the **Finish** button to discard your last changes.

A system message is displayed.

2 Click the **OK** button to continue without saving.

– or –

Click the **Cancel** button to return.

2.5.3 Examination settings

Check the examination settings before scanning.

CAUTION

Wrong table feed direction!

X-ray not, or only partially, usable.

- Always keep an eye on the patient.
- Stop scanning in case of wrong table feed direction.

CAUTION

Changed scan parameters are unsuitable!

Dose not as desired.

- Verify the changed scan parameters before scanning.

CAUTION

Superimposition by subfunctions, for example, SOMATOM life!

Scan parameters are superimposed. Dose not as desired.

- Close subfunctions before scan start.

CAUTION

Native Windows configuration dialog box does not disappear while radiation is started. The dialog box remains visible, as it is a dialog box displayed by "Windows" and not a *syngo* dialog box!

This may cause confusion.

- Avoid opening this dialog box while radiation can be applied. The computer and the *syngo* system should never be configured during an acquisition.

CAUTION

The quality reference parameters exceed the system limit for CARE Dose 4D!

The *mAs* curve of the topogram turns yellow in the respective area. Locally increased image noise.

- Adjust the scan parameters to allow for a higher mAs value.
- Modify scan time, pitch, or rotation time.
- Adapt the injection protocols, if necessary.

CAUTION

mA proposal of CARE Dose not adequate due to wrong attenuation data from topogram!

X-ray not, or only partially, usable.

- Check plausibility of the automatically selected scan parameters before scanning.

2.5.4 Communication with the patient

Observe the following safety information to ensure constant attention to the patient.

CAUTION

Blinking of displays!

Seizures may occur in epileptic patients.

- Pay special attention to those patients.

CAUTION

Patient intercom system nonfunctional!

Patient cannot be understood in case of an emergency.

- Leave the intercom system switched on during the examination (**Listen to patient** key).
- Keep eye contact with the patient when talking or listening to him or her.

2.5.5 Additional information on Cardiac CT examinations

WARNING

Exceeded safety limits of total leakage current when using different electronic devices on one patient in combination with the CT scanner!

Heart arrhythmia

- Do not use more electronic devices on the patient than absolutely necessary.
- Always consider the total leakage current when using external electronic devices in combination with the CT scanner.
- The correct functionality of your external equipment may also be affected, for example, ECG equipment.

CAUTION

Contact between conductive parts of the ECG electrodes or other conductive parts!

Heart arrhythmia

- To ensure patient safety, the conductive parts of the ECG electrodes (including associated connectors) and other patient-applied parts, should not contact other conductive parts, including earth ground, at any time.

CAUTION

Impermissible or faulty manipulations or changes of the hardware or software, or connection of the system to a network can cause the system to malfunction!

Unauthorized access, injury to the patient or damage to the equipment.

- Make sure that all necessary precautions with respect to the existing level of security are considered when adding a functionality or altering the shipped configuration.
- Do not open or remove the cover of the equipment nor install third-party software.

CAUTION

Wrong ECG signal detection!

Undesired radiation

- Check the correct position of the ECG electrodes before scan start.

CAUTION

Wrong setting in display!

Ionizing radiation

- Set the ECG pulsing window to clinically relevant value.

WARNING

Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or arrhythmia!

ECG leads to wrong diagnosis.

- Keep pacemaker patients under close surveillance.

WARNING

ECG functionality is incorrectly used as a survival equipment or a diagnostic equipment!

Wrong diagnosis due to incorrect usage.

- The ECG functionality is not intended for monitoring the patient. It may only be used in conjunction with the HeartView/Cardiac CT option, as described.

CAUTION

Use of defibrillator!

Patient injury (burn) and destroying the ECG unit.

- The CT plate is grounded. Follow the instructions in the Instructions for Use of the defibrillator before using it.

CAUTION

Missing ECG-Sync due to the disconnection of the patient's ECG-electrodes!

X-ray not, or only partially, usable.

- Check the ECG electrodes before scanning.
- A contrast enhanced scan should not be aborted but operated with synthetic ECG-data.

Performing a retrospective spiral

CAUTION

Performing Cardio examinations in a retrospective spiral mode with a very wide acquisition window, either manually selected or due to very irregular heart rate!

Dose higher than expected and possible increase in image noise for a considerable fraction of the scan range.

- Prior to the examination: Select a positive millisecond acquisition window setting, for example end-systolic window, for suppression of width adjustment.

2.5.6 Additional information on contrast examinations

Observe the following safety information when performing a contrast examination.

CAUTION

Unintended activation of coupled mode!

Undesired radiation

- Verify that uncoupled mode is activated before starting the injection.

CAUTION

Misunderstanding of reference point for start delay in bolus examination!

Faulty synchronization between bolus and scanning.

- Make sure that the chosen delay time fits to the characteristics of the bolus injection.

CAUTION

Scanning with uncoupled contrast medium injection but coupled mode is expected!

Contrast medium not usable.

- Before starting the injection, verify that coupled mode is activated.
- Follow the Instructions for Use of your bolus injector.

CAUTION

Wrong start delay!

X-ray not, or only partially, usable.

- For acquisition with contrast medium, select the flooding time of the contrast medium as the delay.

CAUTION

Required injection protocol on the injector and the CT scanner do not match for the planned scan!

X-ray not, or only partially, usable.

- Before performing the coupled scan, verify that the:
  - Correct injection protocol has been transferred to the CT scanner and that it matches the injection protocol on the injector.
  - Patient data, contrast media parameters, and scan parameters are correct on the injector and the CT scanner.
  - Correct injection protocol has been selected when bringing the injector in the Ready status to start.

CAUTION

Injection stopped at the injector by the user without suspending the scan!

X-ray not, or only partially, usable.

- Press **Suspend** at scanner if not enough contrast media was administered.
- Stopping the injection at the injector does not stop automatically the scan.

CAUTION

Coupled start is not activated!

Injection will not be started automatically, if coupled start is not activated.

- Check in **Scan** subtask card whether a coupled start is activated or not.

2.5.7 Additional information on Turbo Flash Spiral Cardiac examinations

CAUTION

Flash Spiral Cardio: The usable scan field is smaller than the standard one, and it is limited by the completely acquired field of view!

Body parts beyond the inner scan field are not diagnosable.

- Mind the smaller scan field.
- Observe the shutter on the topogram and position the patient accordingly.

CAUTION

Flash Spiral: The usable scan field is smaller than the standard one, and it is limited by the completely acquired field of view!

Body parts beyond the inner scan field are not diagnosable.

- Mind the smaller scan field.
- Observe the shutter on the topogram and position the patient accordingly.

CAUTION

Insufficient results of scanning and image reconstruction within parts of the heart anatomy in Cardiac ECG-gated examinations and ECG-triggered examinations!

Wrong diagnosis

- Make sure that the heart rate and the heart rhythm of the patient is within the recommended range for ECG-gated examinations and ECG-triggered examinations of the CT system.
- Consider possible changes of the heart rate and the heart rhythm due to patient breathing instructions, bolus injection, medication or patient's stress.

CAUTION

Turbo Flash Spiral Cardiac: The usable scan field is smaller than the standard one, and it is limited by the completely acquired field of view!

Body parts beyond the inner scan field are not diagnosable.

- Mind the smaller scan field.
- Observe the shutter on the topogram and position the patient accordingly.

CAUTION

Turbo Flash Spiral: The usable scan field is smaller than the standard one, and it is limited by the completely acquired field of view!

Body parts beyond the inner scan field are not diagnosable.

- Mind the smaller scan field.
- Observe the shutter on the topogram and position the patient accordingly.

2.5.8 Additional information on interventional examinations

Observe the following safety information when you perform an interventional examination.

2.5.9 *syngo*.via postprocessing applications

Observe the following safety information when using *syngo*.via postprocessing applications.

CAUTION

Relevant information is hidden by *syngo*.via application windows!

Delayed diagnosis

- Operate *syngo*.via on the secondary monitor of the workplace.
- Minimize or close *syngo*.via before scanning.
- Do not start *syngo*.via while preparing or starting a scan.

2.5.10 PET CT

CAUTION

Configuration used for masking noise observed in PET slices around a circular ring near the edges is not adequate!

Masks diagnosis relevant information also.

- Users are recommended not to rely on rotating MIP as primary means for diagnosis.

2.6 Safety information on animal patients

Additionally, observe the following sections when examining animal patients.

2.6.1 Injury to the operator, personnel, or attendants

CAUTION

The animal is not immobilized!

Contusion, fractures of the operator, personnel or attendant. Damage to the equipment.

- Always anesthetize or sedate the animal before scanning.
- Keep the number of persons in the examination room as low as possible.

2.6.2 Injury to the patient

CAUTION

Using an animal protocol for scanning a human!

Injury to the human or radiation damage.

- The scan protocols must be uniquely assigned as animal protocols.
- Do not use animal protocols for humans.

Uncontrolled movements causing image artifacts

CAUTION

The animal is not immobilized!

Wrong diagnosis due to wrong image information.

- Always anesthetize or sedate the animal before scanning.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

CAUTION

Unintentional patient movement!

Injury to the patient.

- Always fix and observe the patient during the measurement.

Possibility of electric shock

CAUTION

Body fluid (blood, urine etc.) comes into contact with electrical components!

Possibility of electric shock.

- Always make sure that the animal cannot lose uncontrolled body fluid during scanning, for example by using catheters or diapers.

2.6.3 Cleaning media

CAUTION

Using of cleaning media not approved for humans!

Allergic reaction or allergic shock.

- Always use cleaning media also approved for humans.

CAUTION

Insufficient cleaning and disinfection of the equipment!

Infection risk for the patient or the personnel (bio hazard).

- Always clean and disinfect the equipment after use. Follow the instructions for cleaning and disinfecting.

  Check if system components or accessories are worn out to ensure proper cleaning and disinfection. Replace worn out components or accessories immediately.

  Make sure that the table and the accessories are cleaned and covered, for example, with paper or medical drapes.

2.7 Safety information on reconstruction parameters

CAUTION

Reduced image quality caused by the Extended FoV and the HD FoV!

Wrong diagnosis due to insufficient image information.

- For diagnosis, do not use the image area outside the regular field of view. It has reduced quality and may contain artifacts.

CAUTION

Raw data has been deleted, but additional reconstructions are needed for the final diagnosis!

Wrong diagnosis or additional radiation neccessary because of insufficient information.

- Before deleting raw data make sure that all potentially neccessary reconstructions are available for final diagnosis.

2.8 Safety information on basic image review

CAUTION

Images with lossy compression are used for diagnosis!

Wrong basis for diagnosis.

- Always verify your evaluation results with the original DICOM images (first reader duty).
- Never use lossy compressed images for primary diagnosis.
- Check the image text for information on lossy compression before starting an evaluation.

2.8.1 Loading or selecting images

CAUTION

Loading image data sets of different patients!

Mix-up of patients and incorrect diagnosis.

- When loading two or more reference series or model series, make sure that you select the data of the same patient.

CAUTION

If you load large data sets, the image pixel data will be downsampled!

Possible insufficient image quality.

- Be aware of reduced image quality if indicated in image display.

CAUTION

If *syngo* receives images but the study or series UID is already available in the local database, the data will be assigned to this locally existing patient. This happens regardless of the patient identification (name, date of birth, gender and patient ID) of the received images. Changes of patient information on other systems will not automatically change the patient information in *syngo*!

Data retrieved from PACS or other nodes seems to be misaligned or lost, but is stored elsewhere in the database.

- Imported data will always be appended to the already existing patient on the local system, based on matching DICOM UIDs.
- If you imported data, but cannot find them on the local system under a certain name, use other criteria from the study or series to search for the imported data, or filter the data.
- To completely avoid these inconsistencies, always delete the local patient data after you have successfully archived them.

2.8.2 Viewing

CAUTION

The zoom factor for reference image display is selected such that the complete volume can be displayed. This pre-selected zoom factor influences the spatial resolution for reconstruction. The spatial resolution may be lower than the spatial resolution of the original images!

Reduced image quality (lower resolution) due to default zoom level.

- Center the relevant area, and select a suitable zoom factor before starting calculation of ranges or resampling.

2.8.3 Evaluating pixels with the pixel lens

CAUTION

The pixel lens has a constant size and is independent of the zoom factor of the image!

Wrong diagnosis due to misleading image information.

- Please note that the pixel lens is only a pointer indicating the position (not the size) of the measured area.

CAUTION

Use of pixel lens in the **Viewing** task card and in the **3D** task card!

The pixel lens may display different values.

- Be aware of differences in pixel lens measurements. The pixel lens measurement in the **Viewing** task card considers a rectangle around the clicked point, whereas measurement in the **3D** task card considers a cube surrounding the clicked point.

2.8.4 Modifications in medical images

CAUTION

Mix-up of patients due to changed image data!

Wrong diagnosis due to wrong information.

- Always verify that all corrected or rearranged data belongs to the correct patient.
- Take special care when using drag and drop.

CAUTION

Mix-up of patients due to insufficient configuration of image text!

Wrong diagnosis due to wrong information.

- Always apply full image text to avoid mix-up of patients.
- Make sure that customized image text contains at least the main patient demographics, for example, patient ID, name, date of birth, and sex.

CAUTION

Modifications in medical images are not saved automatically in the same way as image comment! Additionally, in case of a user switch where the new user has no adequate access rights, modifications of the image text may also be lost.

Possible loss of image modifications.

- Choose **Patient > Save As...** in order to save the image with modifications as a new image.

2.8.5 2D and 3D evaluation

CAUTION

Distance and angle measurements in the topogram!

Incorrect measurement values due to the projection technique used.

- Only perform distance measurements in the topogram in the longitudinal direction (head-foot direction).
- Do not perform angle measurements.

CAUTION

Evaluation and visualization of results may become imprecise for example because of display size, round-off errors, sub-pixel precision, and zooming!

Inaccurate measurement results.

- Only perform measurements with images displayed in a ratio of 1:1 (1 display pixel = 1 acquired pixel).
- Be aware of precision limitations when using calculated measurement values.

CAUTION

Thickness, length, and angular measurements on MIP and SSD images do not reflect the actual anatomical conditions!

Wrong basis for diagnosis.

- Do not perform thickness and length measurements on MIP and SSD images.

2.8.6 Image artifacts

Even with a carefully manufactured, calibrated and maintained CT system, patterns can sometimes appear in images which are not part of the computed tomography image. Such patterns are called *artifacts*.

For best image quality results, we strongly recommend to position the patient such that the organ to be examined is in the center of the scan field.

Artifacts can have various causes which can in general be divided into 2 groups: *measurement related* artifacts and *system related* artifacts.

Measurement related artifacts

The most significant measurement related artifacts are the following:

- Patient table accessories
- Partial volume effects
- Beam hardening
- Metal artifacts
- Motion artifacts

Patient table accessories

The optional slicker is a cover for the patient mattress. It has overhanging parts (flaps).

CAUTION

Flaps outside the scan field of view!

Image artifacts

- Always use the patient restraint straps to fix the flaps on the patient.
- Make sure that the flaps at the head end are positioned under the patient.
- Do not scan the foot end region.

Partial volume effects

Thick slices are often preferred instead of thin slices. This helps to increase signal to noise ratio and to limit the examination time by reducing the number of slices. However, this may result in partial volume effects. These are caused by high density tissues (such as a bone) or objects (such as pacemakers) projecting only partly into the slice plane. One such well-known artifact is the so-called Hounsfield bar between the petrous bones. Other regions of the skull are also problematic with regard to partial volume effects which are visible as dark streaks. Additional correction and / or special parameter settings (head modes) help to minimize these effects.

- To avoid partial volume effects use thinner slices.

Beam hardening

When X-ray beams pass through tissue, the average energy of the radiation spectrum is shifted towards higher energy. This is known as *beam hardening*. It depends on the material density and thickness of the tissue through which the X-ray beam passes.

The effect of this beam hardening can lead to areas with reduced or increased CT values. The influence of the beam hardening on CT values can be reduced by using dedicated algorithms.

Additional corrections help to minimize these effects. Yet, they cannot fully eliminate them.

Metal artifacts

Metal objects such as dental fillings, surgical clips, jewelry, hair clips, belts or hip prostheses etc. can cause extreme forms of beam hardening artifacts. Depending on density and size, they can lead to total absorption of the radiation. This results in corresponding strong black or white streaks or star-shaped artifacts.

To reduce metal artifacts, **iterative Metal Artifact Reduction** (**iMAR**) is available. (➔ Page 334 *Performing a reconstruction with reduced metal artifacts (iMAR)*)

Motion artifacts

Movement of organs in the slice or displacement of the entire slice during scanning likewise causes bright and dark artifacts. These are usually seen as streaks or in areas of low density. To reduce motion artifacts use the automatic patient instructions (API) function for breathing and swallowing commands.

Greater difficulties are encountered with peristalsis. Heartbeat artifacts are also problematic. To solve the problem of heartbeat artifacts the **ECG Triggering** and **ECG Gating** functions are available as an option.

System related artifacts

System related artifacts may be due to the following:

- Uncalibrated system
- Detector deviations

CAUTION

When you restart the system, the detector has not yet reached operating temperature!

Wrong diagnosis due to image artifacts.

- Calibrate the system as part of the checkup. Repeat calibration if ring artifacts occur.

Calibration

If the CT system is not properly set up (for example, no checkup performed) CT scale displacements and inhomogeneities can result. This may result just after switching on the unit, during warm-up to operational temperature (calibration), or due to an extended length of service of the X-ray tube. The same applies to defects in the measurement system.

The daily quality checkup usually detects and reports such discrepancies.

Other system defects or calibration deviations cause streaks or (partial) rings to appear in the CT image.

Detector deviations

In CT systems with a rotating combined tube-detector system, even minimal deviations of individual detector channels from the original calibration level may lead to rings or partial ring artifact structures in the CT image. The closer such channels lie to the detector center, the greater are these effects.

In an extreme case, rings may appear concentrated as a blurred spot in the center of the scan field (the scan field center appears at the image center if the **Center X** and **Y** image parameters are both zero). Such rings are easily recognizable, however, a blurred spot in the center of the scan field might lead to inaccurate diagnoses.

Repeating scans

Measurement related or system related artifacts cannot always be excluded. Therefore the scan should be repeated if a tomographic structure appears questionable. This should be done after slightly shifting the patient's position within the slice, e.g., by changing vertical position of the table by more than 5 mm. The result can be used to exclude system-dependent long-term or temporary equipment faults as the artifact cause.

Persisting object related artifacts can be considered measurement related with a high probability. They should be recognizable as such by an experienced radiologist.

CAUTION

Artifacts affecting the diagnosis are evident or suspected in a patient image, or the patient may have moved during scanning!

Improper diagnosis possible.

- Scanning must, under all circumstances, be repeated with a slight shift in patient position.

2.9 Safety information on documenting and reporting

CAUTION

Using scalable page mode may reduce the image quality. The resulting image quality may no longer be sufficient. The scalable page mode does not support real size!

Possible wrong diagnosis.

- Be aware of image quality reduction if scalable page mode is configured.

CAUTION

Use of paper printouts for diagnosis!

Wrong diagnosis due to wrong image information.

- Only use images on film for diagnostic purpose.

CAUTION

The image quality on paper printouts might be reduced so that the printouts may not be sufficient for diagnosis!

Possible wrong diagnosis.

- Only use images on film for diagnostic purposes.
- You may use printouts for diagnosis if the printer has been evaluated and released for this purpose by the manufacturer.

CAUTION

True Size printouts depend on printer settings, calibration, or other factors!

True Size printouts do not correlate to the real anatomic dimensions.

- Check and validate the precision limitations when printing in True Size.

  Usage of True Size printouts is in your own responsibility.

  Always compare the image scale bar on printed images with a physical measurement unit, for example, a ruler.

CAUTION

The printed flag is set if the images are successfully transferred to the printer control. Not all printers, for example, paper printers, may be able to solve printing problems themselves!

Possible loss of image printout.

- Verify that the printouts are available before you delete images.

CAUTION

Transferring manipulated non-square matrices or viewing segments!

Diagnostically relevant areas of images may be lost.

- When manipulated images are exported or sent to another workstation, the related original images should be sent, as well. It is strongly recommended to base the final diagnosis always on the original images and not on modified or manipulated images.

CAUTION

Exposing images with a non-verified camera!

Wrong basis for diagnosis.

- Only use cameras released by Siemens Healthineers or by your system owner.

CAUTION

Missing camera test!

Wrong basis for diagnosis.

- Perform the camera test regularly at the recommended intervals.

2.9.1 Viewing structured reports

CAUTION

If there is no specific style sheet available locally for display of a SR document, then the generic style sheet is applied instead!

Not all information might be present or displayed correctly as a consequence, especially when private attributes are included in the structured reports.

- In the display of the report and in exported documents it will be indicated that only a generic mechanism has been applied.

CAUTION

When opening a SR document for further processing, an old version of a structured report document is accidentally opened!

Existing processing results within the latest version of the document might get lost because the currently opened document can now be saved as latest version.

- When opening and editing a structured report document, always assure that you use the latest version. The version information is recognizable within the *syngo* Patient Browser.

CAUTION

The image quality of images which are viewed within the Structured Report viewer might not be sufficient for reading purposes!

Possible wrong diagnosis.

- Do not base your diagnosis on images which were only displayed in the Structured Report viewer application.

2.10 Safety information on storing and archiving

Observe the following safety information and the following sections when storing and archiving images.

2.10.1 Storing data

CAUTION

The internal identification of patient data, for example, studies, series and images, uses the system time for generation of the patient identification. If it is necessary to turn the system clock back, duplicate identifiers may be created!

Data may be assigned to wrong patient.

- If it is necessary to turn the system clock back for synchronization purposes, wait until the previous clock setting has been passed before creating new patient data.

CAUTION

Patient folders containing data from other patient or series, for example, after patient merge, import of data from external media!

The diagnosis or treatment may be made on the basis of incorrect information.

- Check that data is assigned to the correct patient and series before using the data.

CAUTION

Insufficient memory or disk space may lead to an instable or blocked system!

System is not available in emergency cases.

- Do not ignore the storage capacity warning icons.
- Do not ignore the warning message.

CAUTION

Systems that do not use storage commitment only report back to the sending system when the data has been fully received (flags A and S). A user or an auto-delete mechanism at the sending system might subsequently delete the sent data. However, this response does not imply that the data has already been stored at the receiving system!

In the case that the receiving system cannot store the data, the data might irrevocably be lost.

- Double-check that the data is actually stored on the receiving system. Use storage commitment whenever it is supported by the sending and receiving systems.

CAUTION

Misleading or misinterpretation of the storage commitment flags AC/SC. Storage Commitment means storage to hard disk but this may not fulfill or guarantee regulatory requirements about long-term archiving. You can delete the committed objects!

Possible loss of data within the required period for retention.

- Observe the regulatory requirements regarding long-term archiving.

Pay attention to the storage capacity of the hard disk displayed by icons in the status bar of the task cards.

As soon as a predefined percentage of the storage capacity of the hard disk is reached, a warning icon is displayed in the status bar. The color of the icon depends on the storage capacity:

- Yellow icon: If 75% of the storage capacity is reached
- Red icon: If 90% of the storage capacity is reached

2.10.2 Exporting data

CAUTION

Archiving to media already containing clinical data!

Loss of data due to corruption of removable media.

- Avoid recording on removable media which already contains clinical data.

CAUTION

Taking out the CD-R, CD or DVD too early!

Loss of data and destruction of the CD-R, CD or DVD possible.

- Do not remove the CD-R, CD or DVD from the recorder until the recording process has been completed and the status LED has gone out.
- Use the **Transfer** menu to eject media.

CAUTION

When you simultaneously export data to a device, like CD-R, DVD-R drive, Blu-Ray, USB, Network share, and try to read data from the same device with external (non-*syngo*-based) applications, one job or both jobs can fail (depending on the timing)!

Possible loss of data. When data is being written to a drive, any external access at the same time will destroy the current write job and could even damage the storage disk.

Data already stored on a multi-session disk might also become unreadable.

- Do not try to access the device with non-*syngo*-based applications while it is writing data or reading data.
- To ensure successful writing or reading, check the **Local Job Status** to see if there are any write or import jobs in progress.

CAUTION

Switching off a device while writing to the device!

Possible loss of all data and damage of media.

- Never switch off the device while writing to the device.

CAUTION

DVD-R or Blu-Ray Medium used for export or archive may get corrupted or may not be readable with other DVD or Blu-Ray devices!

Loss of data or user perception of loss of data.

- Configure and use local media only as 'archive' media if the requirements regarding retention and readability are sufficiently fulfilled, for example, the manufacturer approved the media for archiving.
- Verify readability of the data on the medium before the data is deleted in the database.

CAUTION

Use of non-integrated USB storage device!

Reboot request of the operating system.

- Ignore the reboot request and press **Cancel**.
- Finish your examination or application.
- Restart the system.

CAUTION

Using USB devices without own power supply!

The USB controller can be permanently damaged.

- Use USB devices as recommended by the manufacturer of the device.

CAUTION

Removal of USB device without deactivation by the software!

Possible loss of data, damage of the operating system, and damage of media.

- Do not immediately unplug a USB device.
- Always use the software functionality for safe removal before unplugging.

CAUTION

Plugging or unplugging USB devices during acquisition can make the system unstable which may affect other processes like running acquisition tasks!

Loss of data, acquisition process disturbed.

- Do not plug in or unplug USB devices during acquisition tasks or other critical processes.

CAUTION

Removal of USB device without deactivation by the software!

Possible loss of data, damage of the operating system, and damage of media.

- Do not immediately unplug a USB device.
- Always use the software functionality for safe removal before unplugging.

CAUTION

A recording error may make a medium unusable!

In multi-session mode, all data previously stored on that medium could be lost, too.

If this happens, any archive flags set to this data in the database become invalid.

- Only delete the data that you have archived on a media from the local database after you have successfully finalized and verified the media.

CAUTION

Switching to multi session mode may destroy data previously recorded on this medium!

Previously stored data can no longer be read.

- Only delete the data that you have exported on a CD-R from the local database after you have completed the session.

CAUTION

A medium is not finalized!

Another system or device may show this medium as empty or defective, or the data of the last session is missing.

- Use **Eject with finalize** to complete the work on this medium and to ensure that the medium is readable on other systems or devices.
- If a medium on which you expected to find data seems to be empty or defective or the last data is missing, try to use original or another *syngo* system to finalize the medium for further read-only access.

2.10.3 Transferring data

CAUTION

Lossy compression is selected for data transfer!

Image quality of the lossy compressed images may no longer be adequate for diagnostic purpose.

- Do not use lossy JPEG compression for sending data to a report or primary diagnosis workstation.
- Do not use lossy JPEG compression for archiving.

2.11 Safety information on postprocessing applications

CAUTION

Not all graphic and evaluation results created by one software can be interpreted!

Not all information from post-processing available for diagnosis.

- A message box appears if not all information can be loaded and displayed.
- Be aware when using such data for diagnosis.
- Use original application to view the post processing results.

CAUTION

Modifications in medical images are not saved automatically in the same way as image comment. Additionally, in case of a user switch where the new user has no adequate access rights, modifications of the image text may also be lost!

Image modifications may be lost.

- Use **Patient > Save...** in order to save the image comment and **Patient > Save As...** to save the image with modifications as a new image.

2.11.1 *syngo* 3D

CAUTION

Automatic registration for compare layout is not sufficient!

Insufficient basis of diagnosis.

- Check registration and use manual registration functionality to re-adjust registration if automatic registration is not sufficient.

CAUTION

Measurements in projected images!

Possible wrong diagnosis.

- Do not use measurements in projected images for diagnostic purposes.

CAUTION

Using non-planar slice images for diagnostic purposes!

Wrong diagnosis

- Be careful when interpreting orientation labels. Keep the shape of the curved cut and its orientation in the volume in mind.

CAUTION

The evaluation of distances, angles and ROIs in 3D (VRT or SSD) and projection (plain-film X-ray or fluoroscopic) images can be inaccurate!

Wrong measurement results and wrong diagnosis.

- Do not use uncalibrated projection images to make critical measurements.
- Do not assume that the image calibration is correct.

Loading image data sets

CAUTION

Loading image data sets of different patients!

Mix-up of patients and incorrect diagnosis.

- When loading two or more reference series or model series, make sure that you select the data of the same patient.

CAUTION

Unintentional loading of series of different patients in 3D compare mode!

Possible mix-up of patient series and wrong diagnosis.

- Do not load data of different patients in 3D compare mode.

CAUTION

Unintentional loading of series of different patients in **Fusion** mode!

Mix-up of patients and incorrect diagnosis.

- Do not load data of different patients in **Fusion** mode.

3D Bone Removal

CAUTION

The semiautomatic algorithm used for bone removal may remove tissue, for example, vessels, stents, or plaques, or leave bone fragments!

Not all relevant structures of the tissue may be visible or not relevant fragments impact further calculations.

- Verify the masking using the parameter for the threshold, size and noise and add or remove relevant items in the bone mask or the non-bone mask.

CAUTION

The image is displayed with lower resolution when the bone and non-bone masks are being refined!

Not all relevant structures of the tissue may be visible.

- Verify the diagnosis after finishing bone masking on images with normal resolution.

Fusion function

CAUTION

Using fused images for diagnosis!

Wrong diagnosis

- Do not use fused images for diagnosis if the history of manipulations is not well known.

CAUTION

Image with earliest acquisition date and time is not included in the data set which is used for SUV calculation!

Earliest acquisition date and time is used in SUV calculation for the following scenarios:

1. Series Time is more recent than acquisition date and time (mMR datasets).

2. SUV calculation is for data sets for manufacturers other than Siemens Healthineers or GE where the decay correction units is expressed in Bq/ml.

Wrong diagnosis due to incorrect SUV calculation.

- Make sure that the first image is included in the data set for correct calculation.

CAUTION

Reduced resolution of the fused range series!

Wrong diagnosis due to insufficient image quality.

- The resolution of fused range series is calculated as described below:
- When **Always resample with original resolution** is cleared (default configuration), the resolution of the fused range series is same as the resolution of the reference series (series loaded first).
- When **Always resample with original resolution** is selected, the higher resolution between the reference and model series is used for the fused range series irrespective of the loading order.

2.11.2 Fly Through

CAUTION

Exclusive use of CT endoscopic or angiographic procedures for diagnosis!

Possible wrong basis for diagnosis or wrong treatment.

- Please note that this procedure has not been demonstrated to be a replacement for any conventional endoscopic or angiographic procedure.

2.11.3 Dental

CAUTION

True Size printouts depend on printer settings, calibration, or other factors!

True Size printouts do not correlate to the real anatomic dimensions.

- Check and validate the precision limitations when printing in True Size.

  Usage of True Size printouts is in your own responsibility.

  Always compare the image scale bar on printed images with a physical measurement unit, for example, a ruler.

2.11.4 *syngo* Volume Perfusion CT – Neuro

CAUTION

Running the application on *syngo* Acquisition workplace!

Data acquisition interrupted due to system load.

- Avoid running the application during scanning.

CAUTION

Misregistration of input data sets!

Wrong basis for diagnosis.

- Make sure that the registration results are adequate.
- If registration is not correct, navigate back to registration step and correct manually.

CAUTION

Deletion of correct or keeping incorrect time points!

Wrong basis for diagnosis.

- Make sure that only the correct time points are used for the calculation.

CAUTION

Removal of relevant brain parts due to automatic segmentation!

Wrong basis for diagnosis.

- Make sure that the segmentation results are adequate.
- If segmentation is not correct, navigate back to segmentation step and correct manually.

CAUTION

Exclusion of important brain parts from the defined VOI!

Wrong basis for diagnosis.

- Make sure that the defined VOI is adequate before accepting them.

CAUTION

Definition of wrong reference vessel!

Wrong basis for diagnosis.

- Make sure that the automatically suggested reference vessel is correct before accepting it.

CAUTION

Wrong normalization suggestion!

Wrong basis for diagnosis.

- Make sure that the selected healthy brain side is correct before accepting it.

CAUTION

Evaluation settings are not adapted!

Wrong diagnosis

- Check that the thresholds for CBF and CBV are the intended ones.

2.11.5 *syngo* Volume Perfusion CT – Body

CAUTION

Running the application on *syngo* Acquisition workplace!

Data acquisition interrupted due to system load.

- Avoid running the application during scanning.

CAUTION

Misregistration of input data sets!

Wrong basis for diagnosis.

- Make sure that the registration results are adequate.
- If registration is not correct, navigate back to registration step and correct manually.

CAUTION

Deletion of correct or keeping incorrect time points!

Wrong basis for diagnosis.

- Make sure that only the correct time points are used for the calculation.

2.11.6 Camtasia

Observe the following safety information when using the software tool **Camtasia**.

CAUTION

Using results from Camtasia for diagnosis or reading!

Wrong diagnosis due to inadequate image quality.

- The results from Camtasia are only intended to be used for training and communication.

CAUTION

Due to Camtasia screen capturing, the data disk fills up!

Examination is no longer possible or examination may be aborted.

- Only use Camtasia for short recording sequences. Do not use Camtasia for recording in parallel to the acquisition.

CAUTION

Using another directory for Camtasia data files!

Data disk is full and no further examination possible. You cannot delete files any more.

- Use only the configured directory for saving the Camtasia data files.

2.12 Safety information on quality assurance

Make sure to regularly perform the necessary tests on the equipment.

CAUTION

Lightmarker not positioned correctly!

X-ray not, or only partially, usable.

- Perform the lightmarker test regularly as part of the monthly constancy test.

CAUTION

Wrong correction tables!

X-ray not, or only partially, usable.

- Perform the daily quality tests every day before you start the actual examinations.

CAUTION

Missing maintenance of the scanning system!

Scan abortion or reduced image quality due to malfunction of the scanner.

- Make sure that maintenance is performed at the recommended intervals.
- Check the imaging performance with the monthly constancy test.

CAUTION

Missing constancy test of the monitor!

Wrong basis for diagnosis.

- Perform the monitor test regularly at the recommended intervals.

CAUTION

Missing camera test!

Wrong basis for diagnosis.

- Perform the camera test regularly at the recommended intervals.

2.12.1 Specific national regulations

The CT system and its components comply with the major relevant statutory and environmental protection regulations. See *System Owner Manual*, chapter *Standards and statutory regulations*.

Country-specific regulations must be observed for electromagnetic compatibility and power supply, as well as performing the following quality tests:

- Daily quality test (➔ Page 431 *Daily quality measurements*)
- Monthly quality test (➔ Page 435 *Constancy test*)

- Low contrast test (➔ Page 452 *Low contrast test*)
- Camera test (➔ Page 454 *Camera test*)
- Constancy test for image display devices (➔ Page 457 *Constancy test of the monitor*)

2.13 Safety information on system maintenance

◆ Do not perform a patient examination during periodic maintenance, routine checks, and service activities.

2.13.1 Safety information for cleaning and disinfection

Safety information for cleaning or disinfection of the equipment

CAUTION

Damaged or unhealthy skin comes into contact with the surface of the medical device and its equipment!

Injury to the patient or the personnel (Bio hazard).

◆ Make sure that the surfaces of the medical device and its equipment only come into contact with undamaged, healthy skin.

◆ Make sure that measures are taken to protect damaged or unhealthy skin if contact cannot be avoided.

CAUTION

Insufficient cleaning and disinfection of the equipment!

Infection risk for the patient or the personnel (bio hazard).

◆ Always clean and disinfect the equipment after use. Follow the instructions for cleaning and disinfecting.

Check if system components or accessories are worn out to ensure proper cleaning and disinfection. Replace worn out components or accessories immediately.

Make sure that the table and the accessories are cleaned and covered, for example, with paper or medical drapes.

CAUTION

Using improper cleaning agents and disinfectants!

Injury to the cleaning personnel (allergic reaction or allergic shock) and damage to the equipment.

- Follow the cleaning and disinfecting instructions of the Instructions for Use.

  Do not use unsuitable cleaning agents and disinfectants.

  Follow the instructions of the cleaning and disinfectant manufacturer and follow their dosage instructions.

WARNING

Liquids or food and drinks in the vicinity of medical equipment!

Injury to the patient or personnel, and malfunction of or damage to the equipment.

- Shut down the system immediately if liquid is detected within the equipment.
- Contact, and leave all repairs to, the Customer Service at Siemens Healthineers.
- Clean the equipment with a damp, not wet, cloth.
- Wring the cloth out well and make sure that no liquids get onto, or into, the equipment.
- After cleaning, make sure that no water remains on the floor to avoid slipping.
- Keep food and drinks away from the equipment.

Safety information for cleaning and disinfection of the monitor and the monitor ceiling system

WARNING

Cleaning and disinfection of parts of the system while the system is connected to the power supply!

Electric shock due to possible contact with line voltage.

- Always switch the system off at the main power switch before cleaning and disinfecting.

WARNING

Cleaning of the monitor housing during operation!

Electric shock

- Only clean the housing when the monitor is switched off.

WARNING

Liquids in the monitor ceiling system, power supply cables are laid inside!

Electric shock

- Make sure that no liquids, for example cleaning fluids, can get into the interior of the monitor ceiling system.

CAUTION

Dirt and liquid in the monitor arm of the ceiling mounted monitor!

Infection possible

- Clean the monitor and monitor arm after use.

2.13.2 Remote service

Your system can also be serviced by Siemens Healthineers Service remotely through the internet.

CAUTION

Terminating remote service without consultation with the service engineers!

Terminating the remote service ends all service processes and may cause system malfunctions.

- Always coordinate termination with the service engineer before terminating the remote service.

CAUTION

Service session, for example, with limited access, running in parallel to data acquisition!

A dialog box may appear and cause confusion.

- Always close Service UI when work is done; do not minimize it.

2.14 Safety information on shutting down

CAUTION

Switching off the computer in Standby mode or without shutting down!

Possible loss of data, data corruption or system damage.

- Shut down the computer before switching off.

CAUTION

Switch user, shut down, logoff or restart without saving data!

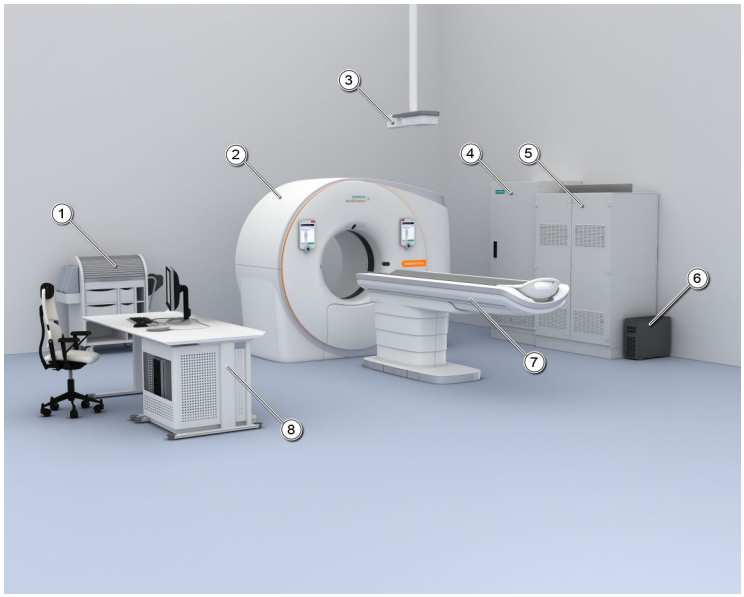
Possible loss of unsaved changes.

- Save data before switching user, shutting down, or restarting the system.

3 System description

This section provides information about the CT system, the system components, and accessories.

3.1 System overview



(1) Accessories
Description of positioning aids (➔ Page 129 *Positioning aids*)
Use of positioning aids (➔ Page 277 *Positioning the patient*)
(2) Scan unit (➔ Page 89 *Scan unit (gantry)*)
Connectors (➔ Page 108 *Connectors*)
(3) 3D camera
(➔ Page 119 *Camera system (optional)*)
Description of the 3D camera (➔ Page 120 *3D camera*)
Patient positioning using the 3D camera (➔ Page 293 *Using the 3D camera*)
(4) Heat exchanger (➔ Page 128 *Heat exchanger*)
(5) Power distribution cabinet
The entire system is powered by one power distribution cabinet which connects the CT system to the site power supply.
(6) Image reconstruction system (IRS)
(7) Patient table
(➔ Page 109 *Patient table with 2000 mm scan range*)
(➔ Page 113 *Multi-purpose table*)
(8) Console

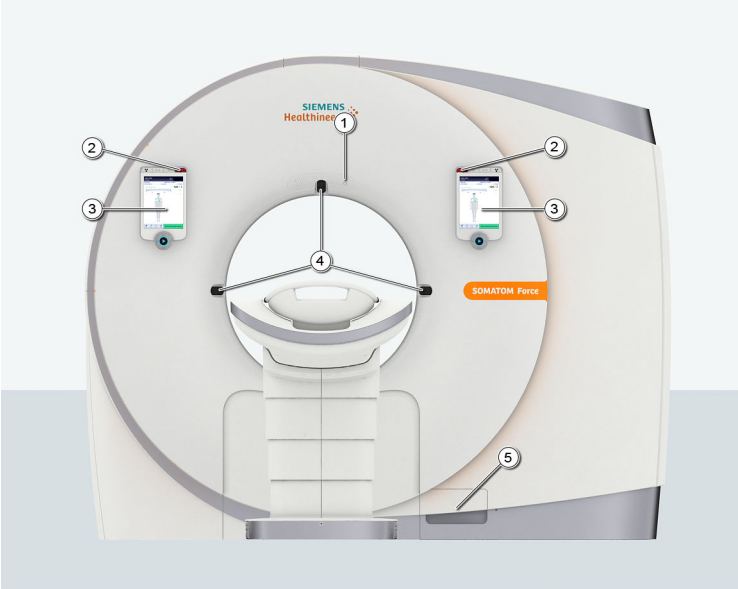
Components or software functionalities that may not be part of your system configuration are nevertheless described in the present instructions for use. It may be that not all of them are marked explicitly as optional. The availability of these components or software functionalities depends on your purchase contract.

3.2 Scan unit (gantry)

This section describes displays, operating elements, and connectors of the scan unit (gantry).

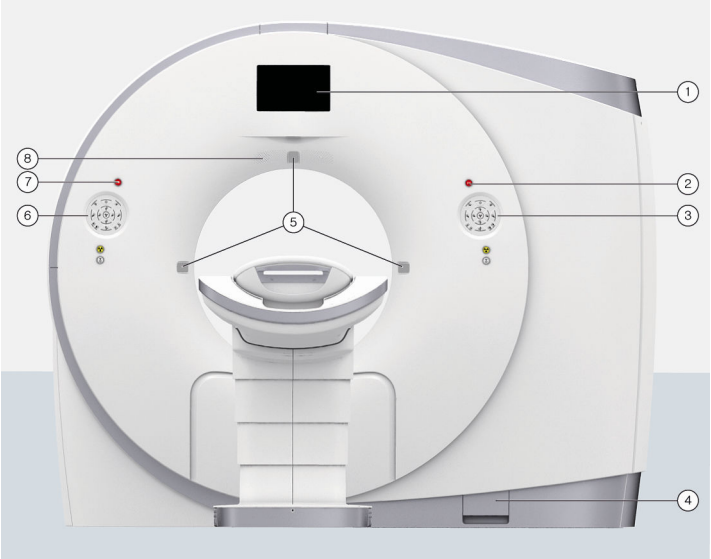
3.2.1 Gantry front

The front of the gantry provides the following operating elements:



(1) Intercom system (➔ Page 307 *Talking to the patient*)
(2) **STOP** key
Terminating system movements and radiation (➔ Page 15 *Terminating system movements and radiation*)
(3) Gantry operator panel (➔ Page 93 *Gantry operator panel*) (➔ Page 102 *Touch Panel*)
User guidance concept (➔ Page 107 *User guidance*)
Moving the patient table (➔ Page 183 *Moving the patient table using the gantry operator panel*) (➔ Page 179 *Moving the patient table using the gantry operator panel with Touch Panel*)
(4) Laser lightmarker (➔ Page 101 *Laser lightmarkers*) (➔ Page 290 *Using the internal laser lightmarker*)
(5) Connectors (➔ Page 108 *Connectors*)
Description of the connector elements (➔ Page 108 *Connector elements*)

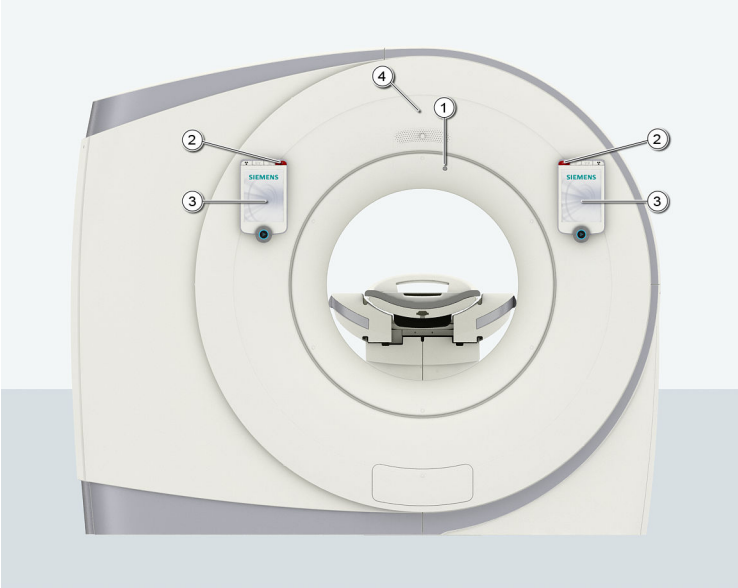
Design of predecessor



(1) Display (➔ Page 96 *Gantry display*)
(2) **STOP** key
Terminating system movements and radiation (➔ Page 15 *Terminating system movements and radiation*)
(3) Gantry operator panel
User guidance concept (➔ Page 99 *User guidance*)
Moving the patient table (➔ Page 183 *Moving the patient table using the gantry operator panel*)
(4) Connectors (➔ Page 108 *Connectors*)
Line On/Off reset button (➔ Page 109 *Line On/Off reset button*)
(5) Laser lightmarkers and transaxial laser lightmarker (➔ Page 101 *Laser lightmarkers*) (➔ Page 96 *Laser lightmarker*)
(6) Gantry operator panel
User guidance concept (➔ Page 99 *User guidance*)
Moving the patient table (➔ Page 183 *Moving the patient table using the gantry operator panel*)
(7) **STOP** key
Terminating system movements and radiation (➔ Page 15 *Terminating system movements and radiation*)
(8) Intercom system (➔ Page 307 *Talking to the patient*)

3.2.2 Gantry rear

The rear of the gantry provides the following operating elements:



(1) Intercom system
Description of the intercom system
Use of the intercom system (➔ Page 307 *Monitoring patients*)

(2) STOP keys
Terminating system movements and radiation (➔ Page 15 *Terminating system movements and radiation*)

(3) Gantry operator panel
Description of the operator panel (➔ Page 93 *Gantry operator panel*)
User guidance concept (➔ Page 107 *User guidance*)
Moving the patient table (➔ Page 179 *Moving the patient table using the gantry operator panel with Touch Panel*)

(4) Radiation warning lamp (optional)

Design of predecessor



(1) **STOP** key
Terminating system movements and radiation (➔ Page 15 *Terminating system movements and radiation*)
(2) Gantry operator panel
Description of the operator panel
User guidance concept (➔ Page 99 *User guidance*)
Moving the patient table (➔ Page 183 *Moving the patient table using the gantry operator panel*)
(3) Intercom system
Description of the intercom system
(4) Radiation warning lamp (optional)

3.2.3 Gantry operator panels

With the operator panels, you control the gantry functions, the movement of the patient table and trigger scanning.

Depending on the configuration, the system has one of the following gantry operator panels. The workflow for positioning the patient depends on the gantry operator panel. Continue with the relevant section that is indicated for your gantry operator panel.





(1) Gantry operator panel (➔ Page 93 *Gantry operator panel*)
(2) Gantry operator panel with Touch Panel (➔ Page 99 *Gantry operator panel with Touch Panel*)

The operator panel is located left and right hand at the front and rear of the gantry.

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

Gantry operator panel

The gantry operator panel allows you to control the gantry functions, the movement of the patient table, and trigger scanning.

The gantry operator panel is located to the left and right hand side of the front and rear of the gantry. The gantry operator panels at the rear are optional.



(1) **Laser lightmarker** key
With this key, you switch the laser lightmarker on and off. (➔ Page 290 *Using the internal laser lightmarker*)

(2) **Vertical table movement** keys
Pressing one of these keys elevates or lowers the table. (➔ Page 179 *Moving the table top vertically*) (➔ Page 288 *Setting the table height*)

(3) **Offset** key
With this key, the table is moved from the outer lightmarker position to the inner scan position.

(4) **Movement speed increase** keys
Pressing the **Table in fast** key moves the table into the gantry with increased speed, and raises the table if it is below the minimum height.
Pressing the **Table out fast** key moves the table out of the gantry with increased speed.

(5) **Horizontal table movement** keys
Pressing one of these keys moves the table in or out of the gantry.

(6) **Intercom** keys
With the **Intercom** keys, the operator in the examination room can communicate with the user at the console.
By pressing the key on the left, you can talk to the user at the console as long as you keep the key pressed.
By pressing this key on the right, you can talk to the user at the console until you press the key again.

(7) **Patient unload** key
Pressing this key moves the table out of the gantry opening and lowers it.

(8) **Suspend** key
Pressing this key interrupts the currently performed scan. The examination can be continued by pressing the **Start** key.

(9) **Start** key / radiation warning
Use this key to trigger scanning. The color of the illuminated ring indicates the operating state of the system. (➔ Page 95 *Start key/radiation warning*)

(10) **Predefined table position** keys
With the **A** and **B** keys, you can move the table to predefined horizontal and vertical positions.
(➔ Page 184 *Configuring predefined table positions*)

(11) **Horizontal zeroing** key
You can set the display for the horizontal table top position to zero with this key.
(➔ Page 291 *Setting the table position to zero*)

(12) **Stop** key
Terminating system movements and radiation (➔ Page 96 *STOP key*)

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

Start key/radiation warning

Use this key to trigger scanning. The color of the illuminated ring indicates the operating state of the system.



Encircling ring:

- *Green*: ready for scanning
- *Yellow*: radiation warning

STOP key



If you press the red **STOP** key, unit movements are interrupted and radiation is stopped immediately. The functions of the keys for system movements on the gantry operator panel are also blocked. (➔ Page 15 *Terminating system movements and radiation*)

Laser lightmarker



This key turns on and off the laser lightmarkers.

The laser lightmarkers are laser beams that emanate from three marked points in the gantry opening. The laser beams create line marks. The beams can cross and create intersections.

The laser lightmarkers indicate the position of the scan center and the slice plane in the middle of the detector rows for the inner scan level and the outer offset level.



For interventional examinations, the laser lightmarkers are switched off automatically after approximately one minute.

Gantry display



The gantry display is located at the front of the gantry. In this display you can observe your system operation.

The following information is displayed:

- Scan parameter (➔ Page 96 *Scan parameters displays*)
- Table positions and tube mode (➔ Page 97 *Display of table positions and tube mode*)
- ECG monitor (➔ Page 98 *ECG monitor*)
- Others, for example, patient name, radiation indication (➔ Page 97 *Variable additional displays*)

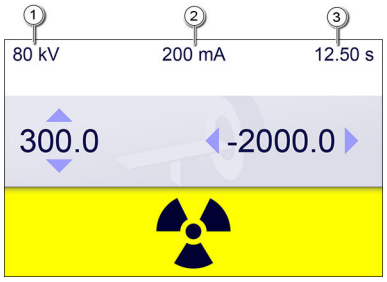
User guidance

For user guidance color indicators help to inform about the current operation:

- White icons: possible operation
- White icons blinking: next required operation

Scan parameters displays

The following scan parameters are displayed in the upper part of the gantry display (example: single tube mode).

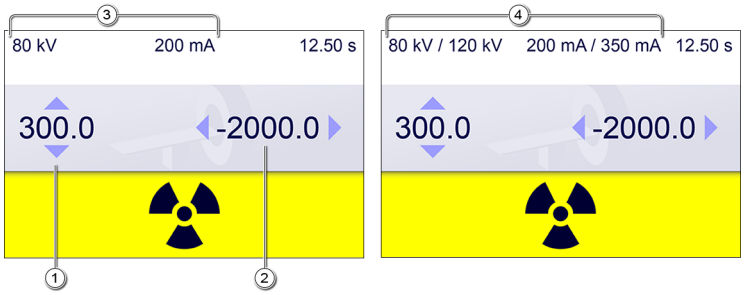


(1) Tube voltage (kV)
(2) Tube current (mA)
(3) Scan time (topograms or sequences) / Rotation time (spirals)

If dual source mode is active, the values for voltage and current are displayed separately for both tubes.

Display of table positions and tube mode

The following information is displayed in the middle of the gantry display.



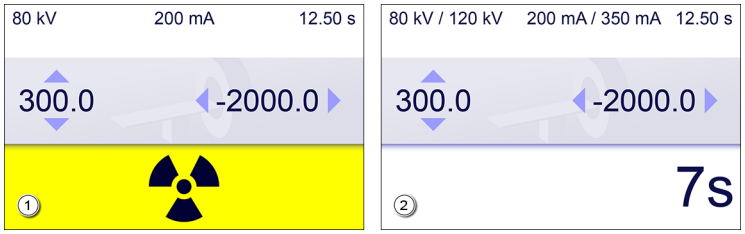
(1) Vertical table position (table height)
(2) Horizontal table position
(3) Single source mode
(4) Dual source mode

The value of table height is measured relative to the scan field axis of the gantry.

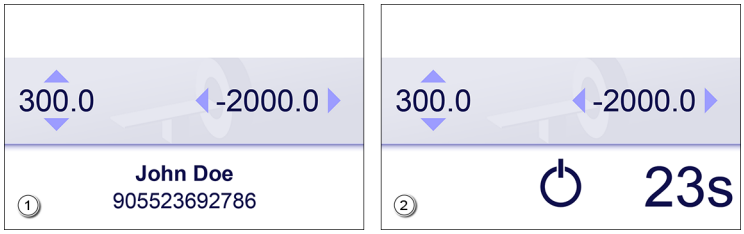
The value of horizontal table position is displayed with reference to a reference zero position, generally an anatomical marking. Movement towards the gantry is displayed as a negative value and movement out of the gantry opening as a positive value.

Variable additional displays

The display in the lower part of the gantry display depends on the current operation.



(1) Radiation warning
(2) Delay time



(1) Patient name
(2) Delay time until system shutdown (after wall switch off was pressed)

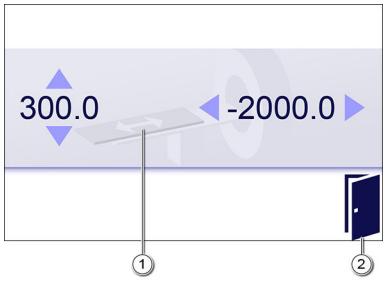
The patient name is shown at the gantry display. If displaying the patient name is not desired, the respective configuration can be performed by a service technician.

The patient name is removed from the display after the first scan entry was performed.

If a delay time is set, it is displayed instead of the patient name.

The radiation warning signal must light up in the gantry display if scanning has been triggered.

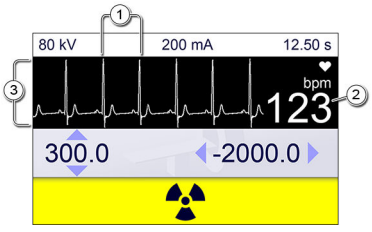
Move Table Top Only mode monitor



(1) Status: Move Table Top Only mode on
(2) Status: Door of the examination room open

If the Move Table Top Only mode is used, an **Move Table Top Only mode** monitor is integrated in the gantry display.

ECG monitor



(1) R-peaks
(2) Heart rate
(3) ECG signal

If the HeartView option is used and ECG electrodes are positioned, an ECG monitor is integrated in the gantry display.

User guidance

For user guidance color indicators help to inform about the current operation:

- Possible operation/ready for operation: indicated by illuminated keys or highlighted icons (gantry display)
- Next required operation: indicated by blinking keys or blinking icons (gantry display)

Blinking stops when the operation is finished (e.g., reached position).

For safety reasons the **STOP** keys are not backlit but certainly always available.

CAUTION

Blinking of displays!

Seizures may occur in epileptic patients.

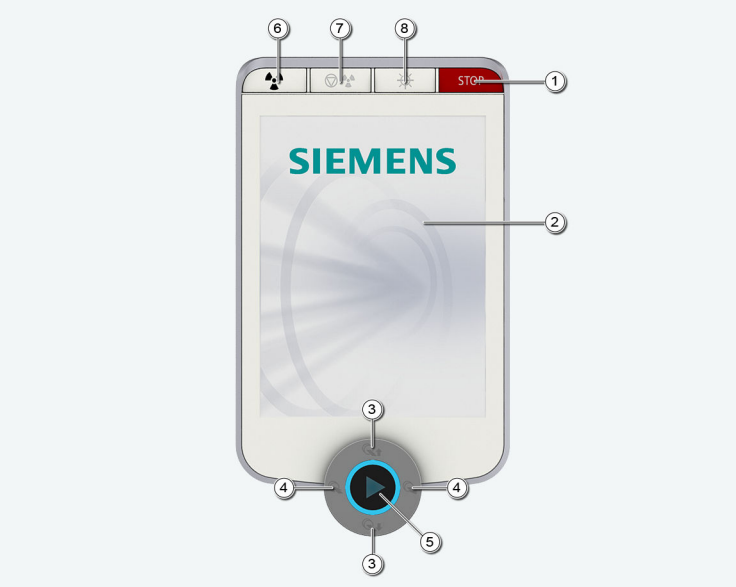
◆ Pay special attention to those patients.

Gantry operator panel with Touch Panel

The gantry operator panel allows you to control the gantry functions, the movement of the patient table, and trigger scanning.

The gantry operator panel is located to the left and right hand side of the front and rear of the gantry. The gantry operator panels at the rear are optional.

The top keys of the Touch Panel are mirrored on each side of the gantry. On the left-hand side of the gantry the **Stop** key is located on the right, as shown below, and on the right-hand side of the gantry the **Stop** key is located on the left.



(1) Stop key
Press the **STOP** key to interrupt unit movements. Radiation is stopped immediately.
(2) Touch Panel
Displays scan parameters and can be used to control defined CT scanner functions. (➔ Page 102 *Touch Panel*)
(3) Vertical patient table movement
Press these keys to elevate or lower the patient table. (➔ Page 179 *Moving the table top vertically*)
(4) Horizontal patient table movement
Press these keys to move the patient table in or out of the gantry. (➔ Page 180 *Moving the table top horizontally*)
(5) Move key
Press the **Move** key to move the patient table to a predefined horizontal and vertical position. (➔ Page 185 *Unloading the patient*) (➔ Page 289 *Moving the patient into the scan plane*)
(6) Start key
Press the **Start** key to trigger scanning.
(7) Suspend key
Press the **Suspend** key to interrupt the current scan.
(8) Laser lightmarker key
Use this key to switch the laser lightmarker on and off. It turns off automatically after 60 seconds. (➔ Page 290 *Using the internal laser lightmarker*)

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

Start key/radiation warning

Use this key to trigger scanning. The color of the illuminated ring indicates the operating state of the system.



Encircling ring:

- *Green*: ready for scanning
- *Yellow*: radiation warning

STOP key



If you press the red **STOP** key, unit movements are interrupted and radiation is stopped immediately. The functions of the keys for system movements on the gantry operator panel are also blocked. (➔ Page 15 *Terminating system movements and radiation*)

Laser lightmarkers



This key turns on and off the laser lightmarkers.

The laser lightmarkers are laser beams that emanate from three marked points in the gantry opening. The laser beams create line marks. The beams can cross and create intersections.

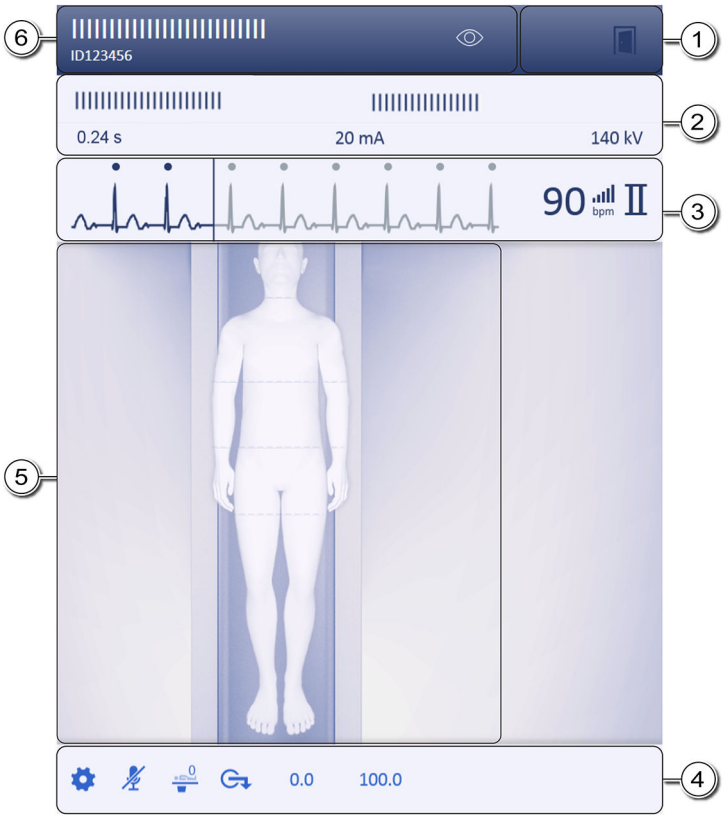
The laser lightmarkers indicate the position of the scan center and the slice plane in the middle of the detector rows.

For interventional examinations, the laser lightmarkers are switched off automatically after approximately one minute.

You can optionally use the **Auto Laser** function to turn on or off the laser lightmarkers upon arriving at the start position. To activate the **Auto Laser**, in the settings popover on the Touch Panel go to **General** settings. (➔ Page 105 *General settings*)

Touch Panel

The Touch Panel is part of the gantry operator panel. It displays scan parameters and can be used to control defined CT scanner functions.



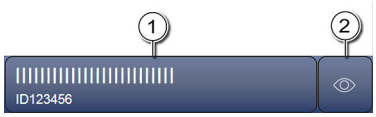
(1) Information icons display (➔ Page 103 *Information icons display*)
(2) Scan parameters display (➔ Page 103 *Scan parameters display*)
(3) Physiological data display (➔ Page 104 *Physiological data display*)
(4) Tools area (➔ Page 105 *Tools area*)
(5) Patient model area (➔ Page 105 *Patient table position planning display*)
(6) Patient data display (➔ Page 103 *Patient data display*)

The Touch Panel screen saver cannot be stopped by touching the panel.

Stop the screen saver at your *syngo* Acquisition Workplace.

Patient data display

The patient data display presents the current patient information once the **Patient Registration** dialog box has been confirmed and closed. (➔ Page 263 *Registering a Patient*)



(1) **Patient Information** display
You can configure the content in the **Examination Configuration** dialog box. (➔ Page 238 *Configuring the display of the Touch Panel*)

(2) **Show/Hide patient data** icon
Show or hide the patient data on the Touch Panel.
Tap the **Patient Information** display to toggle between the display of the patient-specific data and the data-minimized **Patient Registered** display.

Information icons display

The following information icons are available:



(1) **Move Table Top Only mode** icon
Indicates that the **Move Table Top Only mode** is active. (➔ Page 182 *Moving the patient table in Move Table Top Only mode*)

(2) **Door Open** icon
Indicates that the door to the examination room is open (only visible if a door switch is installed). When the door is closed, no icon is displayed.

Scan parameters display

The scan parameters are displayed in the preparation and scanning screen, for example, single tube mode.

The scan parameters are displayed once you have selected a scan protocol in the Patient Model Dialog. (➔ Page 176 *Loading the routine scan protocol*)



(1) Patient Orientation
Displays the patient position during scanning.
The patient position is displayed once the corresponding position and orientation of the patient has been selected.
The patient position is cleared after the scan was performed.

(2) Scan parameters of the current range
Displays the tube current (mA / mAs), tube voltage (kV), and scan time (topograms or sequences) or rotation time (spirals).

(3) Protocol information
Displays the protocol name and patient type (**Adult** or **Child**) once the **Patient Model Dialog** has been confirmed. If no protocol name has been assigned, **No Protocol loaded** is displayed.

If dual source mode is active, the values for voltage and current are displayed separately for both tubes (tube A / tube B):

- Voltage: 150 kV / 80 kV
- Current: 50 mA / 213 mA or 50 mAs / 213 mAs

If the Tin Filter is used, the value for voltage is displayed as the following example:

- Voltage: Sn150 kV

Physiological data display

The physiological data display is only visible if physiological data is available.

ECG monitor

The ECG monitor is initially hidden and opens as soon as the HeartView option is used and ECG electrodes are positioned.

A straight line is displayed when the electrocardiogram (ECG) signal is being searched:



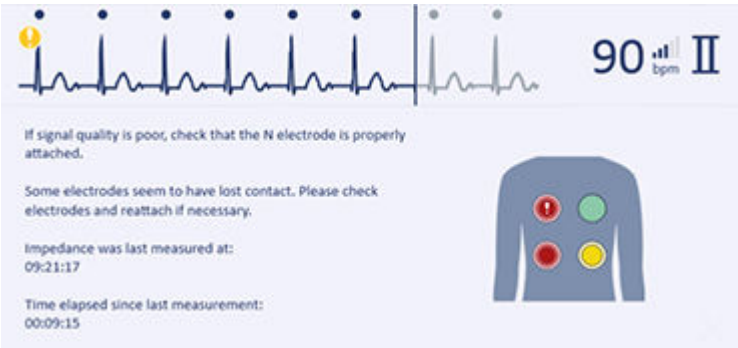
ECG curve – no signal available

As soon as an ECG signal is available, the ECG curve is displayed:



ECG curve – signal available

Tapping the ECG monitor opens a popover providing feedback about the quality of the ECG signal:



ECG signal quality – feedback

If the signal is lost or the signal quality is poor, check if the electrodes are properly attached.

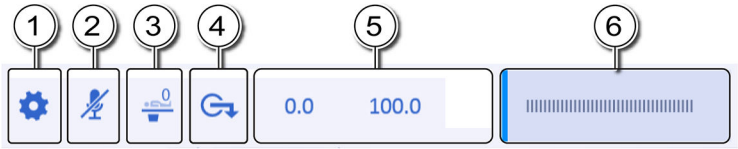
An ECG is typically used in cardiac examinations to reduce motion artifacts in the acquired images. For more information about Cardiac CT, see (➔ Page 359 *Cardiac CT*)

Patient table position planning display

The patient position, selected on the **Patient Model Dialog**, is displayed in the center of the Touch Panel. If no patient position has been selected, the **Head first – supine** position is displayed by default.

Tools area

The tools area at the bottom of the screen comprises controls for adapting examination settings and the instruction message display.



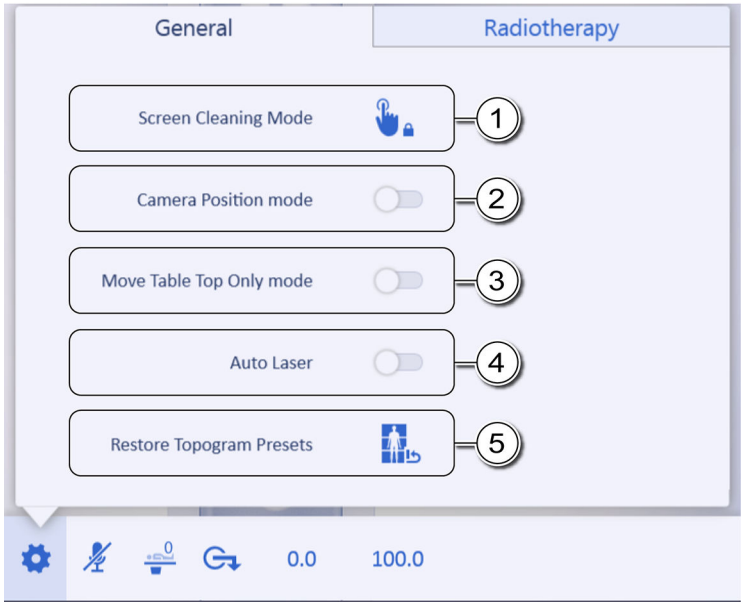
(1) **Settings** icon
Opens or closes the **Settings** popover. (➔ Page 105 *Settings popover*)
(2) **Intercom** icon
Switches on or off the intercom between the examination room and the control room.
(3) **Horizontal zeroing** icon
Sets the display for the horizontal table top position to zero. (➔ Page 291 *Setting the patient table position to zero*)
(4) **Patient Unload** icon
Activates the table movement request to unload the patient. (➔ Page 183 *Using the Touch Panel and panel keys*)
(5) **Table Position** display
Displays the current values for the table position.
(6) **Instruction message** area
Area to display workflow instructions, warnings, and error messages. (➔ Page 107 *User guidance*)

Settings popover

The settings popover enables you to configure **General** information and **Radiotherapy** functions. Tap the **Settings** icon to open the settings popover.

General settings

The **General** settings enable you to activate the cleaning mode, the 3D camera, the **Move Table Top Only mode**, as well as the **Auto Laser** or to restore the topogram presets.



(1) **Screen Cleaning Mode**
Turns on or off the locked screen to be able to clean the Touch Panel.

(2) **Camera Position mode** (optional)
Turns on or off the 3D camera to enable camera guided patient positioning.
(➔ Page 293 *Using the 3D camera*)

(3) **Move Table Top Only mode**
Turns on or off the **Move Table Top Only mode**. (➔ Page 182 *Moving the patient table in Move Table Top Only mode*)

(4) **Auto Laser**
Automatically turns on or off the laser lightmarkers at arrival of the start position. In the 3D camera workflow (optional): Automatically turns on or off the laser lightmarkers at arrival of the internal (CT) laser.

(5) **Restore Topogram Presets**
Restores default topogram start positions. (➔ Page 181 *Restore Topogram Presets*)

Radiotherapy functions

Radiotherapy functions enable the functionality to easily move the patient table the distance between the external (RT) laser and the internal (CT) laser.



(1) **Radiotherapy Functions**
Turns the **Radiotherapy Functions** for patient positioning on or off. This function is only available for patient positioning without 3D camera.
Turning on **Radiotherapy Functions** gives access to radiotherapy controls on the positioning screen.

(2) **Automated Table Zeroing**
Turns the **Automated Table Zeroing** on or off.

(3) **CT/RT Laser** buttons
CT Laser button: Sets the **Automated Table Zeroing** at the internal (CT) laser.
RT Laser button: Sets the **Automated Table Zeroing** at the external (RT) laser.

(4) **Offset** display
Displays the measured distance between the external (RT) laser and the internal (CT) laser.

Automated Table Zeroing

On	This function allows you to perform automated horizontal zeroing in addition to table movement. Select where automated zeroing shall be performed, either at the internal (CT) laser or the external (RT) laser. (➔ Page 299 *Automated table zeroing at the CT Laser*) (➔ Page 301 *Automated table zeroing at the RT Laser*)
Off	The radiotherapy controls allow you to save the table position at the external (RT) laser, thereby enabling you to return to the saved position external (RT) laser position after the scan. (➔ Page 302 *Positioning the patient for radiotherapy without automated zeroing*)

User guidance

Color indicators and instruction messages help to inform you about the current operation:

- Illuminated keys or highlighted icons indicate that the system is ready for operation.
- A circular progress bar indicates the time an icon needs to be held to complete the action.

For safety reasons, the **STOP** keys are not backlit but are always available.

Instruction message area

The instruction messages inform you of the next steps required for the operation, completed steps or warnings. The list below illustrated the color indications of the message area for the different message types.



Next required operation

The background color of the instruction message area turns blue and displays an active move request message.



Finished operation

The background color of the instruction message area turns green and displays a success message.



No operation possible

The background color of the instruction message area turns yellow and displays an error or warning message.

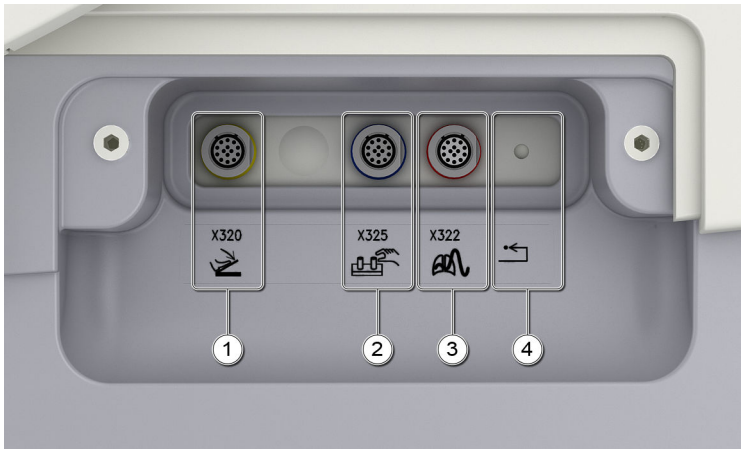
3.2.4 Connectors

The lower right front side of the gantry provides several connectors and a **Line On/Off** reset button. For access the faceplate must be pulled and taken off.



Only connect equipment released by Siemens Healthineers.

Connector elements The following elements are located behind the faceplate:



(1) Foot switch connector (optional)
(2) i-Control connector (optional)
(3) Respiratory Gating connector (not supported)
(4) **Line On/Off** reset button

Line On/Off reset button

With the **Line On/Off** reset button, you can disconnect the entire system from the mains power supply immediately. After releasing the **Line On/Off** reset button, the system always returns to its previous state.

The system does not automatically check whether it is safe to shut down. If you need to disconnect the entire system, you must first close all open applications and, if possible, shut down the operating system at the console. Then press and hold the **Line On/Off** reset button on the gantry for approximately 10 seconds. After approximately 30 seconds, the system starts up automatically.

3.3 Patient Table

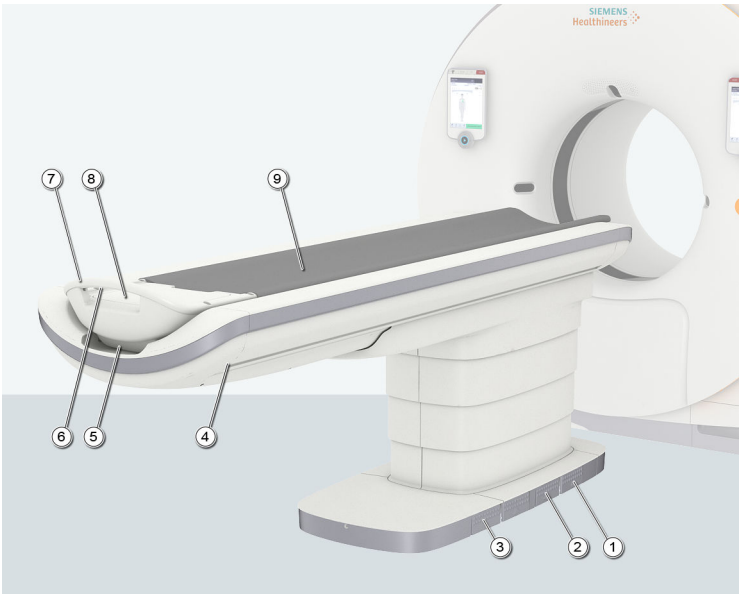
The following patient tables are available with your system.

(➔ Page 109 *Patient table with 2000 mm scan range*)

(➔ Page 113 *Multi-purpose table*)

3.3.1 Patient table with 2000 mm scan range

The patient table consists of the following parts.



(1) Patient load foot switch
Moving the patient table (➔ Page 184 *Moving the table top horizontally*)
(2) Table top release foot switch
Moving the table in interventional examinations (➔ Page 185 *Moving the table in Move Table Top Only mode*)
(3) Up or down foot switch
Moving the patient table (➔ Page 186 *Moving the patient table using the foot switch*)
(4) Warning label: Risk of contusion
(5) Label: Type B
(6) Release push button
Moving the table in interventional examinations (➔ Page 185 *Moving the table in Move Table Top Only mode*)
Moving the table in case of emergency (➔ Page 187 *Moving the patient table in case of emergency or power failure*)
(7) Table handle
(8) PMM box
Description of the PMM box (➔ Page 111 *Physiological measurement module for patient table with 2000 mm scan range*)
ECG electrodes (Cardiac CT) (➔ Page 147 *ECG electrodes*) (➔ Page 146 *ECG monitor*)
(9) Table top (➔ Page 280 *Positioning the mattress*)

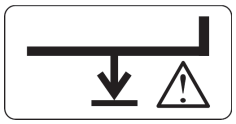
Labels You find the depicted labels adhered to the patient table:

Type B applied part



Equipment is not suitable for direct cardiac application.
Indicates the degree of patient protection of this applied part (Type B applied part according to IEC 60601-1).

Caution, leg injuries



Increased risk that body parts can get pinched between table and floor.
Take care when lowering the patient table to avoid injury to body parts.
To avoid damaging the patient table, make sure no accessories (for example, a trolley or cart) are placed underneath the patient table while lowering it.

Material

The table top consists of material that is impervious to water.

Operating elements and connectors

At the patient table, there are components and operating elements for manual movement as well as the Physiological Measurement Module.

(➔ Page 182 *Moving the patient table in Move Table Top Only mode*)

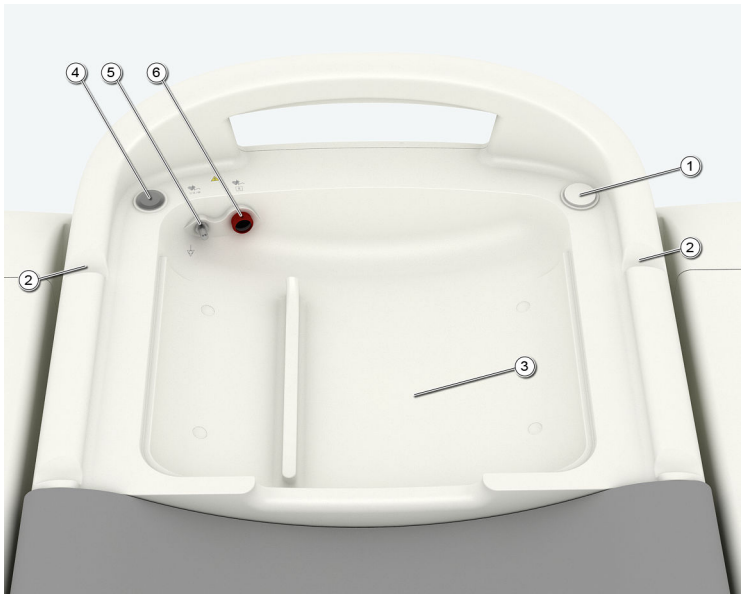
(➔ Page 111 *Physiological measurement module for patient table with 2000 mm scan range*)

Equipotential bonding connector pin

The connector pin is used for potential equalization with other medical devices according to IEC 60601-1:2005, IEC 60601-1:1988 and DIN 42801-2. For further information, see *System Owner Manual*, chapter *Standards and statutory regulations*.

Physiological measurement module for patient table with 2000 mm scan range

The physiological measurement module (PMM) provides the receptacle for the ECG electrodes and a push button for changing the ECG channel.



(1) Adapter bush for the infusion bottle holder (optional)
(2) Notch for paper roll holder
Paper roll holder (➔ Page 142 *Paper roll holder*)
(3) Storage tray for cables and accessories
(4) Push button for ECG channel selection
(5) Potential equalization conductor and label
Connect the grounding cable to this pin to earth the patient.
(6) ECG socket and label (Cardiac CT)
ECG monitor (➔ Page 146 *ECG monitor*)
ECG electrodes (➔ Page 147 *Europe version*)

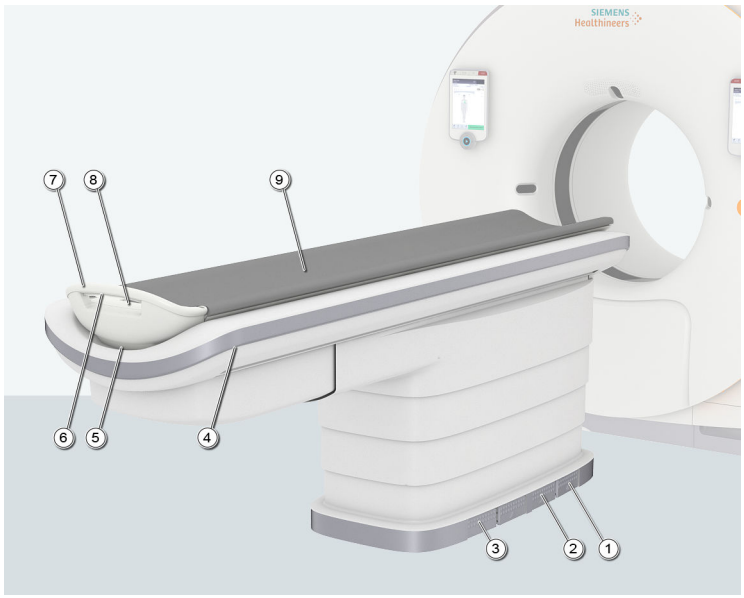
Physiological measurement module (PMM) of the predecessor



(1) PMM box

3.3.2 Multi-purpose table

For special clinical requirements, a multi-purpose table (MPT) is available as an option. The patient table can be equipped with different optional table tops, each with a dedicated purpose.



(1) Patient load foot switch
Moving the patient table (➔ Page 184 *Moving the table top horizontally*)
(2) Table top release foot switch
Moving the table in interventional examinations (➔ Page 185 *Moving the table in Move Table Top Only mode*)
(3) Up or down foot switch
Moving the patient table (➔ Page 186 *Moving the patient table using the foot switch*)
(4) Label: Risk of contusion
(5) Label: Type B
(6) Release push button
Moving the table in interventional examinations (➔ Page 185 *Moving the table in Move Table Top Only mode*)
Moving the table in case of emergency (➔ Page 187 *Moving the patient table in case of emergency or power failure*)
(7) Table handle
(8) Physiological Measurement Module (PMM)
Description of the PMM (➔ Page 111 *Physiological measurement module for patient table with 2000 mm scan range*)
ECG electrodes (Cardiac CT) (➔ Page 147 *ECG electrodes*) (➔ Page 146 *ECG monitor*)
(9) Multi-purpose table top
(➔ Page 115 *High capacity table top*)
(➔ Page 115 *Radiation Therapy Planning (RTP) table top*)
(➔ Page 187 *Changing the MPT table top*)

Operating elements and connectors

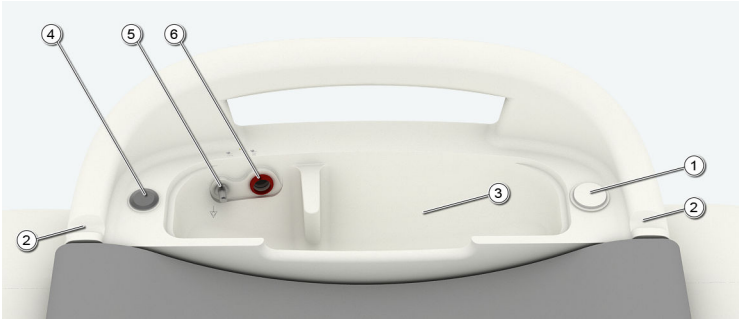
The appearance and the functionality of the multi purpose table slightly differ from the standard patient table.

Equipotential bonding connector pin

The connector pin is used for potential equalization with other medical devices according to IEC 60601-1:2005 and DIN 42801-2. For further information, see *System Owner Manual*, chapter *Standards and statutory regulations*.

Physiological measurement module for multi-purpose table

The Physiological Measurement Module (PMM) provides the receptacle for the ECG electrodes and a push button for changing the ECG channel.



(1) Adapter bush for the infusion bottle holder (optional)
(2) Notch for paper roll holder
Paper roll holder (➔ Page 142 *Paper roll holder*)
(3) Storage tray for cables and accessories
(4) Push button for ECG channel selection
(5) Potential equalization conductor and label
Connect the grounding cable to this pin to earth the patient.
(6) ECG socket and label (Cardiac CT)
ECG monitor (➔ Page 146 *ECG monitor*)
ECG electrodes (➔ Page 147 *Europe version*)

Physiological measurement module (PMM) of the predecessor



(1) PMM box

Fixed strap system

For a secure attachment of straps the multi purpose table is equipped with the same fixed strap system as the standard table.

Position and appearance of the slots slightly differ from the standard table.

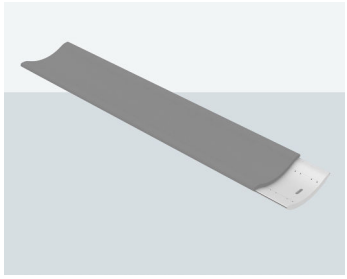
Table tops for the multi-purpose table

A variety of patient table tops are available for the multi-purpose table:

- (➔ Page 115 *Standard table top*)
- (➔ Page 115 *High capacity table top*)
- (➔ Page 115 *Radiation Therapy Planning (RTP) table top*)

Standard table top

The standard table top is used for standard examinations with no special requirements concerning the design of the table.



The standard table top has a curved surface.

Maximum load capacity

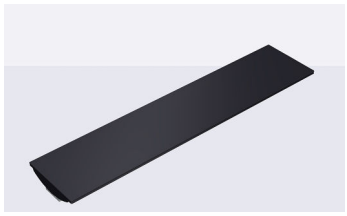


The maximum permissible load must not exceed 227 kg (500 lbs), which is approximately 2226 N.

Different accessories are available. (➔ Page 129 *Positioning aids*)

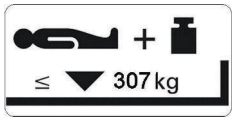
High capacity table top

The high capacity table top is compatible to standard slide boards used for the transfer of trauma patients and bariatric patients with a weight up to 300 kg (661 lbs).



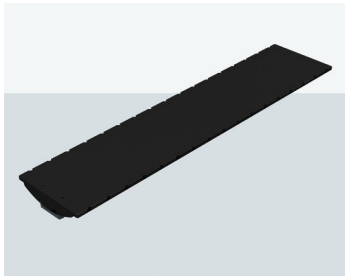
The table top has a flat surface.

Maximum load capacity



The maximum permissible load must not exceed 307 kg (677 lbs), which is approximately 3010 N.

Radiation Therapy Planning (RTP) table top



The RTP table top is an exchangeable table top used for exact and reproducible patient positioning in RTP as well as for standard examinations. It is designed regarding stiffness and bending.

The RTP table top has a flat surface with an integrated indexing system on both sides.

CAUTION

Use of the RTP table top!

Contusion of patient's fingers during table movement.

- Always use both arm supports with RTP table top.
- Observe that the hands of the patient are completely covered by the arm support.
- Always fix and observe the patient during table movement.

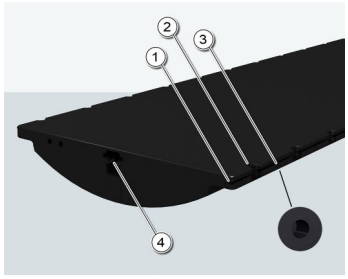
Maximum load capacity



The maximum permissible load must not exceed 227 kg (500 lbs), which is approximately 2226 N.

RTP adaptor connections

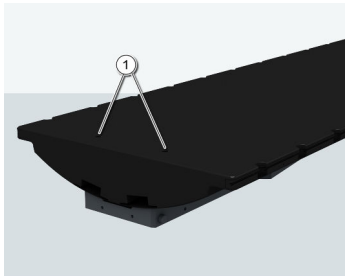
For a standardized patient setup, the table top provides different mounting possibilities (indexing systems). (➔ Page 48 *During system movements*)



(1) Slots along both sides of the RTP table top (for restraint straps)
(2) Indentation (Interloc Indexing)
(3) Bore hole
(4) Plug connection for positioning aids

The indentations are used to mount adaptors.

The bore holes can be furnished with lens head screws. The screws are used to mount different accessories (for example, adaptors, rulers). The indexing systems are compatible with most of the accessories used in radiation therapy.

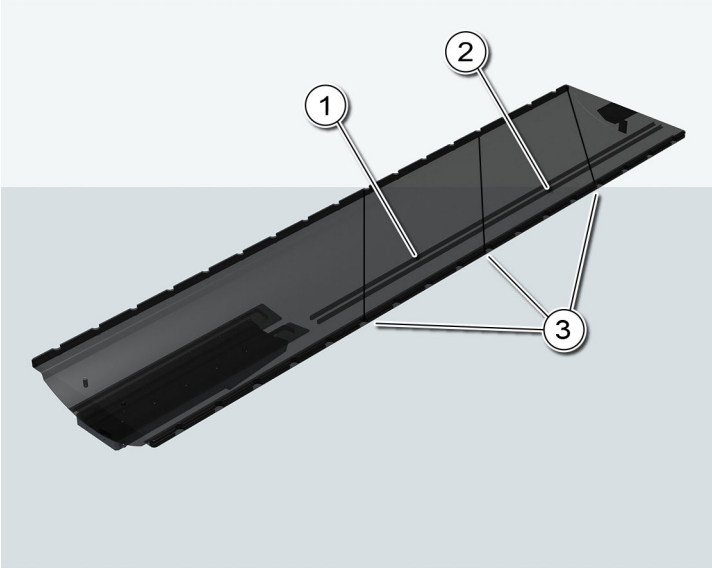


(1) Screw sockets located on the foot end for external devices

For instructions using accessories see the instruction for use of the manufacturer.

Orientation aids

The RTP table top is equipped with several orientation aids to facilitate the determination of position and density in the resulting CT image.



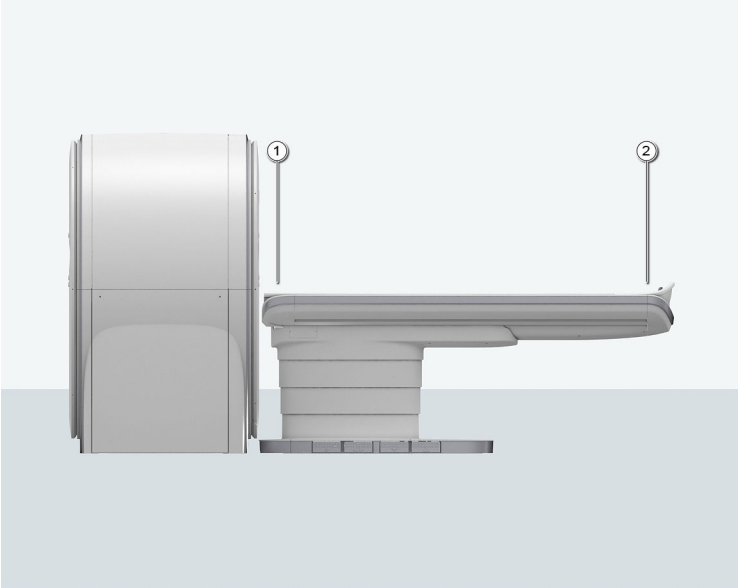
(1) Air filled plastic tube
(2) Perspex rod
(3) Copper wires

Object	Position	Function
Air filled plastic tube	Left side of table top, x-direction	Area with air density
Perspex rod	Left side of table top, x-direction	Areas with water equivalent density
3 copper wires	Diagonal across scannable range (angle 45°)	Enables z-coding

3.3.3 Definitions and limit values

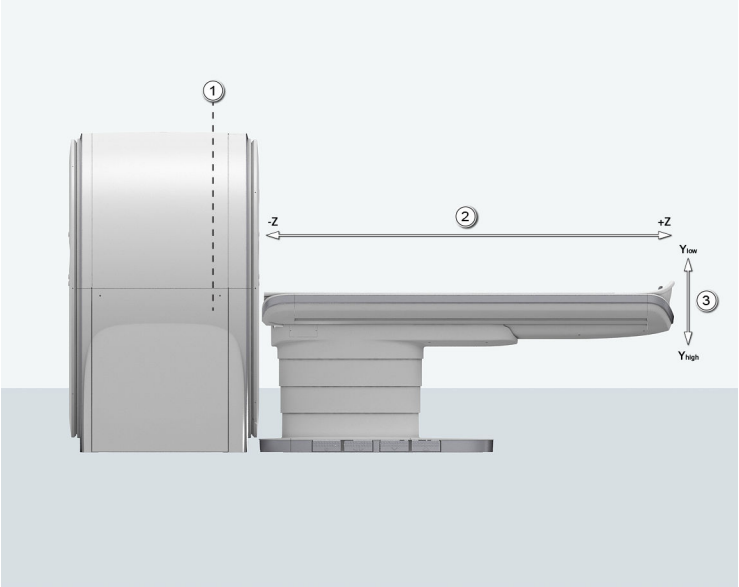
To enter the patient position correctly, you must be familiar with certain definitions concerning the patient table.

The head end and the foot end of the patient table are at the following positions.



(1) The head end is the end of the patient table closer to the gantry.
(2) The foot end is the end of the patient table furthest away from the gantry.

Directions



(1) Scan field
(2) Vertical movement of the patient table (y_{low} to y_{high})
(3) Horizontal movement of the patient table (-z to +z)

Limit values For vertical movement of the patient table, you must be familiar with limitations.

WARNING

Lowering the patient table!

Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.

During patient positioning the table top can be lowered to the following levels:

- 490 mm (patient table with 2000mm scan range)
- 550 mm (multi purpose table)

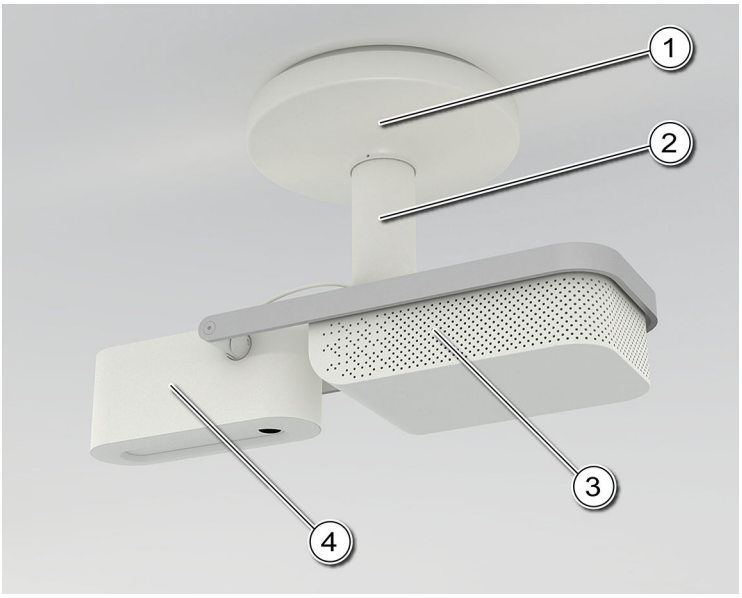
The usual working height corresponds to the height of gantry opening of the system.

Before you can lower the patient table to its minimum height, you must retract the table top entirely.

3.4 Camera system (optional)

The camera system is available as an option and allows automatic patient positioning in the examination room.

The camera system consists of several components.



(1) Ceiling flange
The ceiling flange covers the fixation to the concrete or suspended ceiling.
(2) Ceiling extension
The length of the ceiling extension is variable to allow an installation of the 3D camera at different room heights.
(3) Camera Interface Computer (CIC)
The computer is connected to the 3D camera and to the *syngo* Acquisition Workplace.
(4) 3D camera
The camera produces an image of the patient structure in three dimensions.

The 3D camera is installed at a position to view the patient from above to provide accurate image data.

If the 3D camera moves out of position, call Siemens Healthineers Service for recalibration. Do not use the 3D camera before recalibration.

3.4.1 3D camera

The 3D camera produces an image of the patient structure in three dimensions and is equipped with an infrared light source and sensor as well as an RGB camera.

The 3D camera is positioned above the patient table. You can see the live image taken with the 3D camera on the Touch Panel.



The infrared sensor may interfere with other infrared devices, including remote controls. Do not use any other infrared devices at the same time as capturing a 3D image of the patient.

The infrared laser may affect the operation of other electronic equipment, causing them to malfunction.

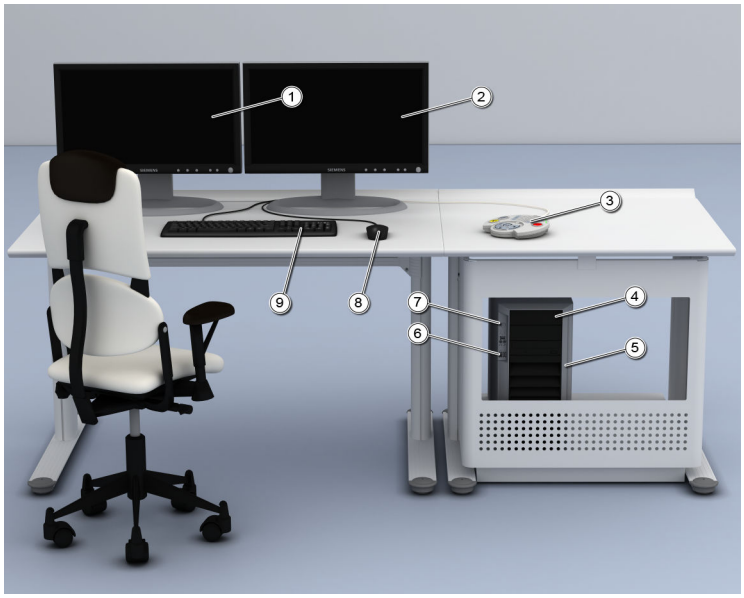
Do not obstruct the view to the patient, so that the isocenter can be accurately calculated.

The 3D camera is not intended for the positioning of infants and small children. Use manual positioning with the internal laser lightmarkers instead.

For further instructions, refer to the Instructions for Use of the 3D camera manufacturer.

3.5 *syngo* Acquisition Workplace

This section describes the operating elements of the console components.



(1) Monitor (*syngo* Acquisition Workplace)
Description of the monitor
(2) Dual monitor (optional)
Description of the monitor
(3) Control box
Description of the control box (➔ Page 124 *Control box*)
(4) DVD drive
Description of the DVD drive
(5) Computer
Description of the computer (➔ Page 123 *Workplace computer*)
(6) USB Device
Description of the USB device
(7) Power key (not for use!)
(8) Mouse
Description of the mouse
(9) Keyboard
Description of the keyboard

The pictures of the console components shown here are only examples. The appearance of your devices may be slightly different.

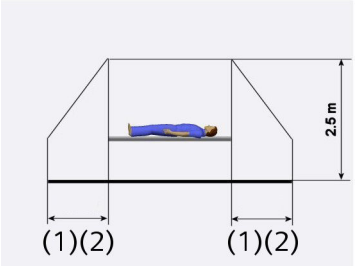
3.5.1 Functions

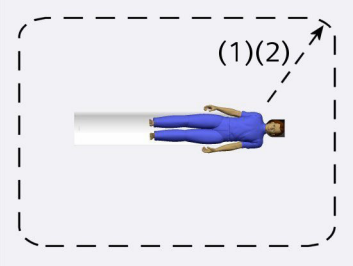
With the operating elements of the console, you can switch the system on and off, enter patient data, plan the examination, and trigger measurement.

You acquire the CT data and use it to reconstruct the CT images, which you can then evaluate.

3.5.2 Location of use

All console components, for example, *syngo* Acquisition Workplace, input units and monitor, including second acquisition monitor, and non-medical equipment are only to be operated outside the patient vicinity. For minimum distances, refer to the following diagrams.





(1) USA: 1.83 m
(2) All other countries: 1.50 m

The minimum distances do not apply to the monitors mounted on the monitor cart or the ceiling-mounted support.

3.5.3 Workplace computer

One workplace computer is delivered with your system.

The pictures shown here are only examples. The appearance of your device may be slightly different.



You use this computer to perform the following activities:

- Controlling the CT scanner
- Evaluating studies
- Storing studies

The workplace computer provides several components, for example, USB ports, DVD recorder. The location and the design of these components may vary.

Do not use the **Computer On/Off** key. The computer must be switched on and off by using control box and software only.

If you switch off the computer via the **Computer On/Off** key, it is not able to receive the start-up signal from the control box. In this case, you need to press the **Computer On/Off** key again to switch on the computer.

3.5.4 Control box

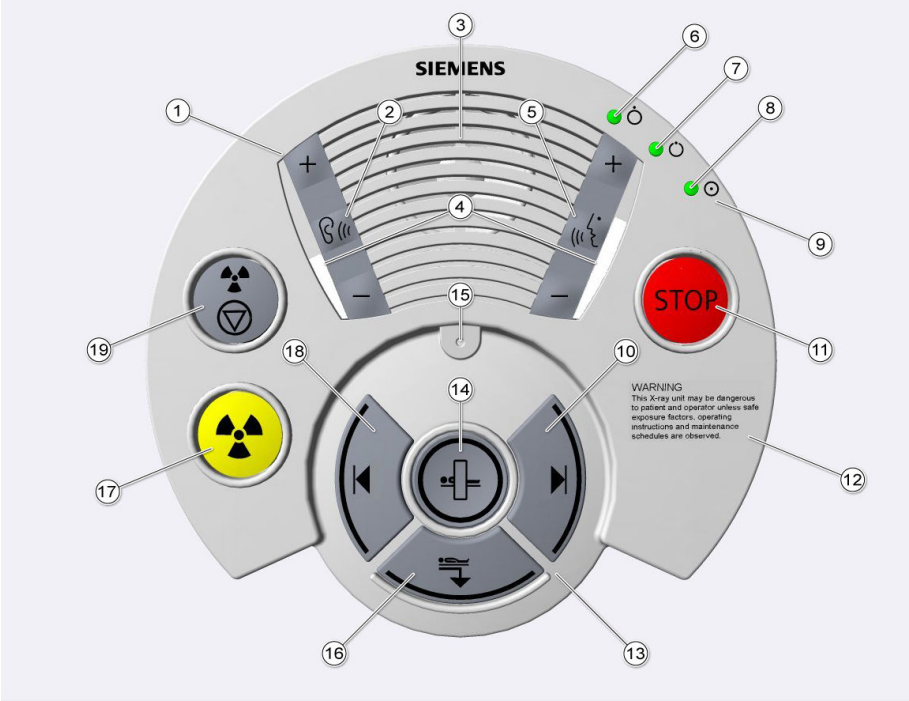
The control box can be used to control measurements and the patient table.

- You can switch on or off the system.
- You can start or stop a measurement.
- You can move the patient table from outside of the examination room.
- You can communicate with the patient from outside of the examination room.

It is within the responsibility of the personnel to make sure that no conflictive table movements or software actions are performed when the control box, the gantry operator panels, or the panel of the i-Control are in use.

A radiation warning lamp lights up and a warning signal sounds when X-radiation is being generated.

Operating elements



(1) Communication system
Equipment for communication with the patient

(2) Listen to patient
Pressing the center of this key activates the intercom connection to the patient (listen). Pressing the key again closes the connection.
Pressing **+** and **-** in the upper and lower edges of the key adjusts the volume of the gantry loudspeaker.
Using the intercom system (➔ Page 307 *Monitoring patients*)

(3) Loudspeaker
Equipment for communication with the patient
Adjusting the volume, see (5) Talk to patient.

(4) Volume adjustment
Equipment for communication with the patient
Adjusting the volume, see (5) Talk to patient.

(5) Talk to patient
Pressing the center of this key enables you to talk to the patient. The patient can hear you as long as the key is pressed.
Pressing **+** and **-** in the upper and lower edges of the key adjusts the loudspeaker volume.
Using the intercom system (➔ Page 307 *Talking to the patient*)

(6) System Off
Description of System Off key (➔ Page 165 *Shutdown and switching off*)

(7) Comp On
Description of Comp On key (➔ Page 161 *Switching on the computer only*)

(8) Sys On
Description of Sys On key

(9) Switching the system on and off
(➔ Page 160 *Switching the system on and off*)

(10) Step out
Pressing this key moves the patient table stepwise away from the gantry.

(11) STOP key

With the **STOP** key, you interrupt table movements in an emergency and switch off radiation.
If you press the red **STOP** key, unit movements are interrupted and radiation is stopped. The functions of the keys for system movements are also blocked.
(➔ Page 15 *Terminating system movements and radiation*)

(12) Warning label (USA only)

(13) Patient table movement keys
Controlling table movement and measurement, see (14) **Move** key, (18) **Step in** key, (10) **Step out** key and (16) **Unload** key

(14) Move key
Pressing this key moves the patient table to the preselected scanning position.

(15) Microphone
Equipment for communication with the patient
Adjusting the volume, see (2) Listen to patient.

(16) Unload key
Pressing this key moves the patient table out of the gantry and lowers it simultaneously.

(17) Start key
With this key, you trigger scanning or you can resume a scan after a scan was suspended.

(18) Step in
Pressing this key moves the patient table stepwise towards the gantry.

(19) Suspend key
Pressing this key interrupts the currently performed scan. The examination can be continued by pressing the **Start** key.

Control box keys

You can move the patient table, for example, by retracting or lowering it, by using the corresponding keys of the control box at the *syngo* Acquisition Workplace console.
(➔ Page 124 *Control box*)

WARNING

Unintentional activation of table movement keys of the control box!

Possible injury to the patient by moving parts.

- Make yourself familiar with the function of the control box keys.
- Always keep an eye on the patient during table movements.

On/Off keys

On the rear of the control box, you will find keys for switching the computed tomography system on and off (power control).

System On



With the **System On** key, you can switch on the complete system for examinations.

The corresponding LED blinks and no further inputs are received by the system until the system is ready for operation. As long as the system is running, the corresponding LED is illuminated.

Computer On



With the **Computer On** key, you can switch on the computer only, for example, if you want to perform evaluations.

System Off



With the **System Off** key, you can switch off the system if the normal shutdown procedure via software fails. For normal shutdown, the software or the wall switch must be used. If the *syngo* Acquisition Workplace and the gantry are running, only the gantry will switch off when this key is pressed.

(➔ Page 164 *Shutting down the system*)

(➔ Page 172 *Switching off the system by using the wall switch*)

The key can be pressed using a pointed item only, for example, a ballpoint pen or paper clip.

The corresponding LED blinks and no further inputs are received by the system until the system is switched off.

Pressing the **System Off** key will not disconnect the system from the mains. To disconnect the system you need to use the **Site On/Off** switch provided by the system owner or the wall switch, if installed.

The *System Off* LED indicates that the entire system is switched off. Only the control box is still working and the data measurement system (DMS) is tempered.

3.6 Heat exchanger

The gantry can be cooled by an optional water/air heat exchanger in combination with an external fan assembly, usually mounted on the roof.





(1) Heat exchanger
(2) External fan assembly

3.7 Accessories

This section gives you an overview of available accessories for your system.

For a complete list of accessories see the *Quick Guide*.

CAUTION

Incorrect use and use of non-original and non-released equipment!

Wrong diagnosis

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

WARNING

Incorrect use and use of non-original and non-released equipment!

Injury to the patient and personnel or damage to the equipment. Image quality may also decrease.

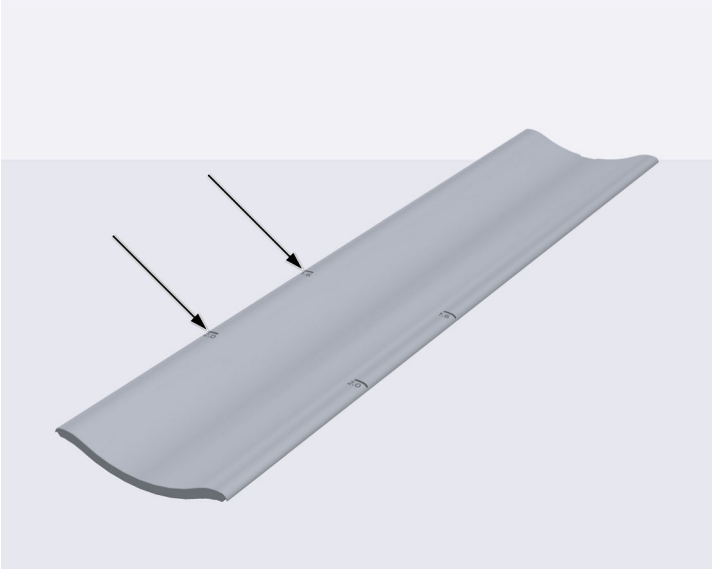
- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

3.7.1 Positioning aids

Your system is equipped with several accessories for positioning the patient safely and comfortably. Thus, you prevent motion artifacts.

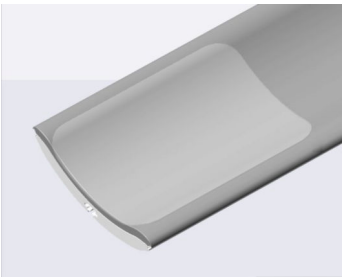
Depending on your system configuration some accessories may be optional.

Positioning mattress Mattresses are placed on the moving part of the table top. They allow the patient to be positioned more comfortably and can be fastened with Velcro straps, if required.



The positioning mattress must be correctly secured. For example, folding the mattress using force should be avoided.

Protective cover A protective cover is available for preventing the foot end of the positioning mattress from abrasion.



Slicker The slicker is an exchangeable cover for the positioning mattress. It can prevent fluids from infiltrating into the table and also aid patient positioning.

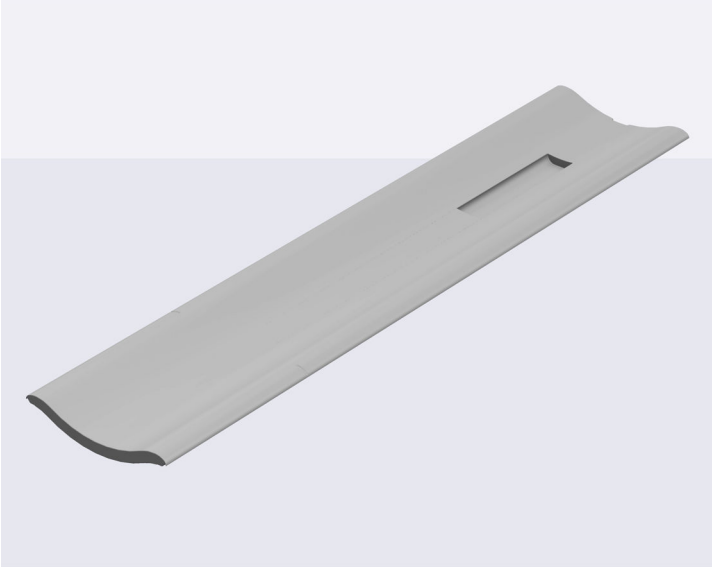
For detailed information on the operation of the slicker, refer to the operator manual of the slicker manufacturer (RadScan Medical Equipment, Inc).

Osteo set

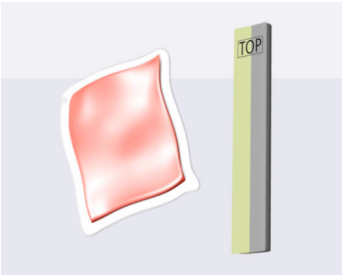
The Osteo equipment provides tools to perform CT examinations for bone density measurements. The equipment consists of a reference phantom, a mattress in which a reference phantom can be placed, a gel pack to support patient positioning, and a PE pad for the cut-out. The phantom will be visible in the CT images and provides reference values for a diagnosis.

Osteo mattress

Use the Osteo positioning mattress to position the patient appropriately for the Osteo examination. The table top mattress has a cut-out in the vertebral region for the reference phantom and the gel pack.



Reference phantom and gel pack



Use the table top mattress in combination with the reference phantom and the gel pack.

Other non-Osteo examinations

For standard examinations, use the Osteo positioning mattress with the PE pad.

Mattress with spill protection

The mattress with spill protection prevents body fluids from coming into contact with the table and possibly damaging it. This is especially relevant for use with patients in a state of trauma.

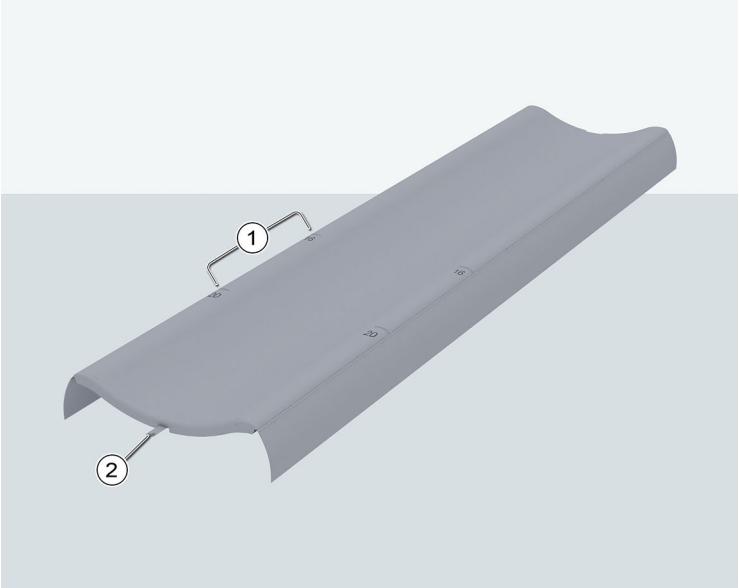
The indentations on the mattresses indicate the scan range limits 1600 mm and 2000 mm. The scan range depends on the configuration of the table.

The mattress with spill protection consists of antistatic material.

The mattress is equipped with an equipotential bonding connector pin. This pin allows you to connect an equipotential bonding cable to ensure the potential equalization of the mattress with other medical devices.

(➔ Page 131 *Equipotential bonding connector pin*)

(➔ Page 280 *Connecting the equipotential bonding cable*)



1 Scan range limits (1600 mm and 2000 mm)
2 Equipotential bonding connector pin

Equipotential bonding connector pin

The connector pin is used for potential equalization with other medical devices according to IEC 60601-1:2005 and DIN 42801-2. For further information, see *System Owner Manual*, chapter *Standards and statutory regulations*.

Mattress with flat surface



For clinical settings that require an even surface for patient positioning, the mattress with flat surface is used to even out concave table tops.

CAUTION

Use of the mattress with flat surface!

Contusion of patient's fingers during table movement.

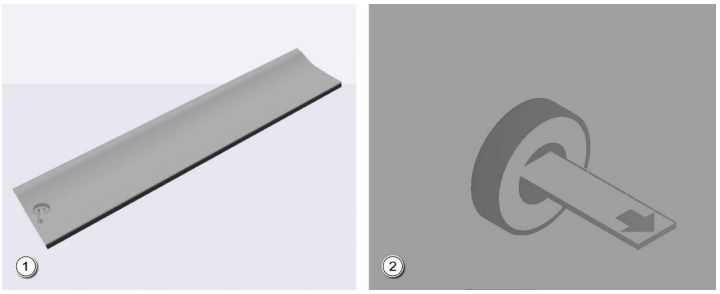
- Always use both arm supports with the mattress with flat surface.
- Observe that the hands of the patient are completely covered by the arm support.
- Always fix and observe the patient during table movement.

Note that the shape and dimensions of the mattress with flat surface differ from those of the standard positioning mattress. This might affect the operation of the mattress with flat surface.

Mattress for flat table top

For standard examinations on a flat table top the purpose-built mattress is used. The lower side is also flat and fits exactly on the flat table top. The upper side is curved and allows a more convenient positioning of the patient.

The mattress can also be used for examinations with the high capacity table top.

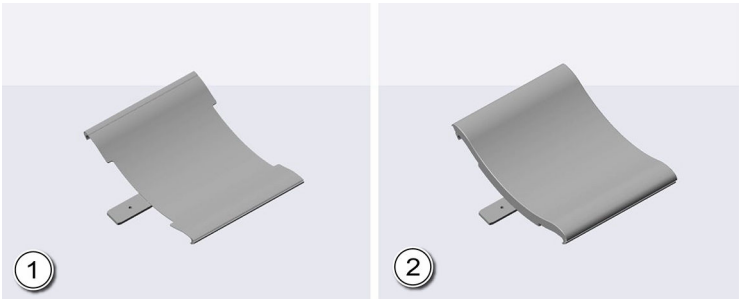


(1) Mattress for flat table top
(2) Logo indicating the foot end

The mattress must be positioned on the table in a way that the logo on the mattress is located at the foot end of the table.

Table top extension

The table top extension is used to extend the surface of the table, for example, for full body scans. To protect the surface of the extension, a mattress is available.



(1) Table top extension
(2) Table top extension with mattress

The table top extension is attached at the head end of the patient table.
(→ Page 283 *Using positioning aids*)

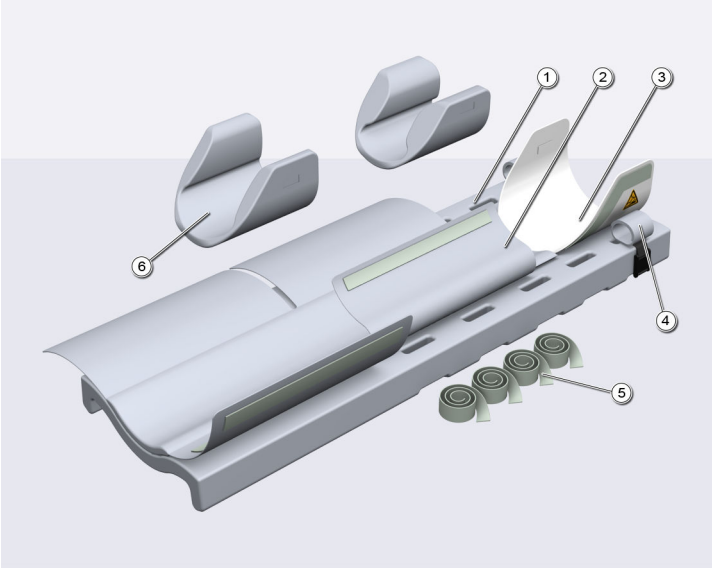
You can use the table top extension for the following examinations:

- Neck and cervical spine examinations
- Examinations of thorax and abdomen
- Upper and lower extremities

(→ Page 277 *Positioning the patient*)

Pediatric cradle

The pediatric cradle is used for the positioning and fixation of pediatric patients during a CT scan. The pediatric cradle provides you with special equipment.



(1) Body support
(2) Mattress with flaps
(3) Head holder
(4) Velcro straps for arm fixation
(5) Velcro straps for head and body fixation
(6) Cushions

Body support

The body support is an underlay for the mattress. There are different positions for the Velcro strap fixation on both sides of the body support.

Mattress

The mattress provides a comfortable and secure positioning of the pediatric patient on the patient table. It is equipped with flaps.

The flaps secure the body of the pediatric patient. For the positioning of larger patients, use the Velcro straps to fasten the flaps.

Head holder

The head holder is used for the comfortable positioning of the patient's head. Different cushions can be placed inside. For better immobilization, the head holder has Velcro on both sides. Here, you can attach the Velcro straps.

Warning, collision of the patient with the equipment



Indicates possible collision points.
Indicates possible collision of the patient with the gantry. Always watch the patient while the table is moving.

Velcro straps for arm fixation

The Velcro straps for arm fixation secure the arms of the patient. There are various positions for the Velcro straps for arm fixation along the body support on both sides.

Velcro straps for head and body fixation

The Velcro straps secure the head of the patient. For better immobilization, you can attach the Velcro straps to both sides of the head holder.

For the positioning of larger patients, the Velcro straps are used for the fixation of the flaps.

Cushions

The cushions are supplied to position the head of the patient safely and comfortably. They need to be placed inside the head holder.

Head holder



This head holder is used to position the patient's head. It is provided with various cushions, including flat and wedge shaped cushions, which can be inserted to secure the head of the patient. For better immobilization, you can attach Velcro straps on both sides of the head holder.

The head holder is attached at the head end of the table. (➔ Page 283 *Using positioning aids*)

You can use the head holder for the following cranial examinations:

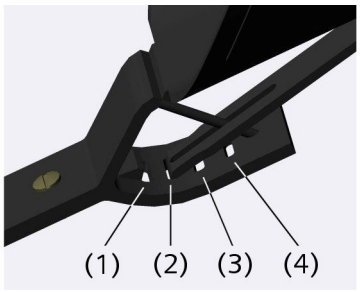
- Standard cranial examination (supine)

(➔ Page 277 *Positioning the patient*)

Tiltable head holder

In contrast to the standard head holder the angle of the tiltable head holder can be adjusted to the special requirements of the performed examination (4 possible angles). It is supplied with different cushions (flat or wedge shaped), which can be placed inside.





(1) Tilt -15°
(2) Tilt 0°
(3) Tilt +15°
(4) Tilt +30°

Hold the bar of the tiltable head holder locked when changing the tilt position, because the noise of the lock mechanism may make the patient uncomfortable.

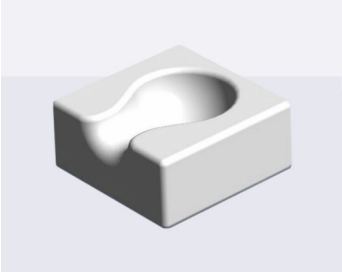
The tiltable head holder is attached at the head end of the table. (➔ Page 283 *Using positioning aids*)

You can use the tiltable head holder for the following cranial examinations:

- Standard cranial examination, supine (all angles)
- Sinus paranasales, supine (-15°)

(➔ Page 277 *Positioning the patient*)

Headrest



The headrest is for the comfortable positioning of the patient's head. It can be placed directly on the patient table within the scan range (head end/foot end or on the table top extension).

You can use the headrest for the following examinations:

- Cranial examinations, standard (supine)
- Neck and cervical spine examinations
- Examinations of thorax and abdomen

(→ Page 277 *Positioning the patient*)

Head-arm support

The head-arm support is used to position the patient comfortably with arms crossed above their head. You can place the head-arm support directly on the patient table within the scan range. The head-arm support is supplied with a flat cushion, which can be placed inside.

CAUTION

Incorrect use and use of non-original and non-released equipment!

Wrong diagnosis

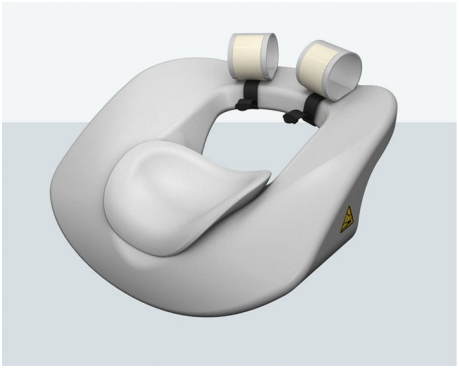
- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

WARNING

Incorrect use and use of non-original and non-released equipment!

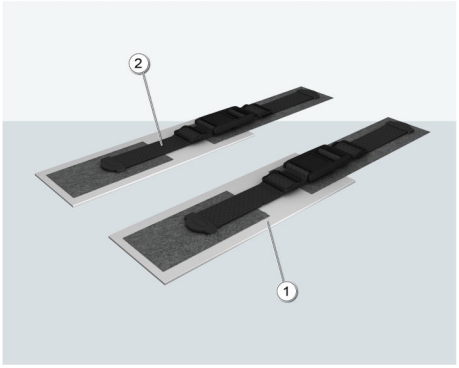
Injury to the patient and personnel or damage to the equipment. Image quality may also decrease.

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.



Head-arm support with straps and cushion

For better immobilization, the support provides two fixation straps to immobilize the patient's hands or wrists.



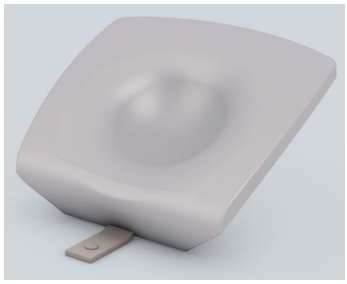
(1) Velcro strap for fixation of the patient's wrists
(2) Fixation for head-arm support

You can use the head-arm support for the following examinations:

- Thoracic and lumbar spine examinations
- Pelvis
- Thorax and abdomen
- Lower extremities

This head-arm support is not recommended for head and neck examinations.

Head-arm rest



The head-arm rest is used for a comfortable positioning of the patient with his or her arms crossed above the head.

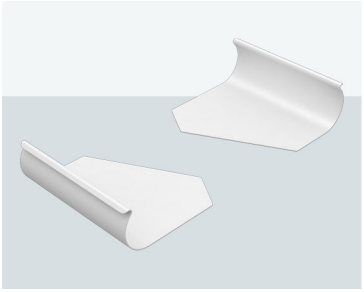
You can use the head-arm rest for the following examinations:

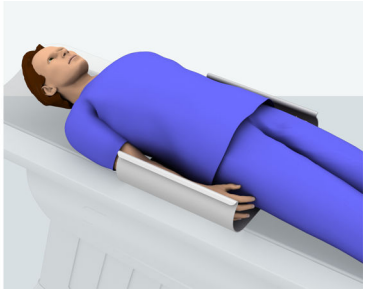
- Examinations of thorax and abdomen

(➔ Page 277 *Positioning the patient*)

Arm support

You can use the arm supports for examinations if you need to position the patient's arms next to the body. Use the arm supports in pairs to allow a safe and more comfortable positioning of the arms.





Position the arm supports between patient and table so that the arms lie tight against the patient's body. Position the arm supports so that the lateral dimensions of the patient table are not exceeded. Ensure that the hand of the patient is completely covered by the arm support.

You can use the arm supports for the following examinations:

- Cranial examinations
- Neck and cervical spine examinations

(➔ Page 277 *Positioning the patient*)

Knee support



With the knee support, you can position the lower extremities comfortably and reduce lordosis of the lumbar vertebrae. The patient is positioned more stable. You can place the knee support directly on the patient table.

It can be used for several supine examinations.

⚠ CAUTION

Incorrect use and use of non-original and non-released equipment!

Wrong diagnosis

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

WARNING

Incorrect use and use of non-original and non-released equipment!

Injury to the patient and personnel or damage to the equipment. Image quality may also decrease.

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

Cushions

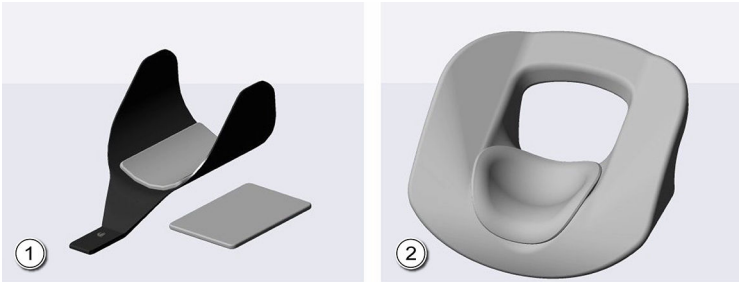
Different cushions are supplied to position the patient safely and comfortably:

- Flat cushions
- Wedge shaped cushions
- Pads

Cushions can be used in several examinations.

Flat cushions

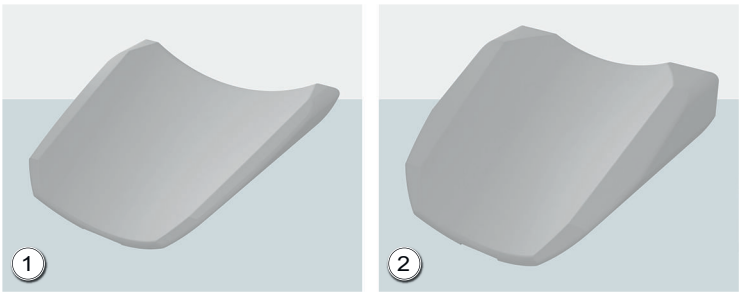
Flat cushions are used for comfortable positioning of the patient's head in a head support. They are delivered together with the positioning aid that they are used in.



(1) Flat cushion: head holder/tiltable head holder
(2) Flat cushion: head arm support

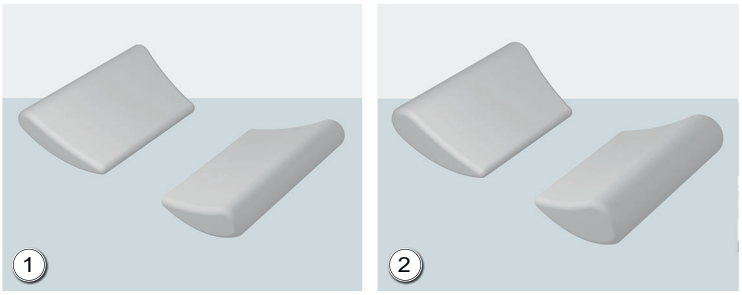
Wedge shaped cushions

Wedge shaped cushions are used for a more comfortable or accurate positioning of the patient's head.



(1) Head cushion 15°
(2) Head cushion 25°

Pads Pads are typically used for lateral immobilization of the patient's head in a head holder.



(1) Pad thin
(2) Pad thick

Straps Different straps are supplied to immobilize the patient safely during the examination:

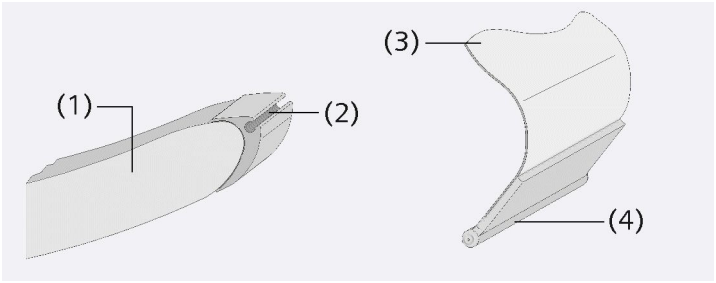
- Body support straps
- Forehead support straps
- Chin support straps

For a secure attachment of straps at the table top the table is equipped with a special fixed strap system.

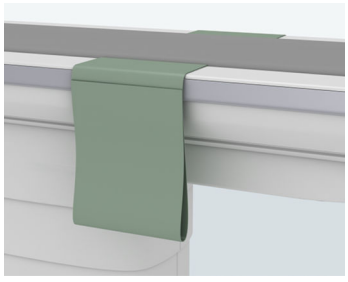
Fixed strap system

This system is used to attach body straps securely at the table. It consists of two rails with slots at both sides of the table top. For attaching you can insert the guide rods of the body support straps in these slots.

Slots for attaching straps are located on both sides of the table top extension.



(1) Cross section of patient table
(2) Slots along both sides of the table top
(3) Body support strap
(4) Guide rod



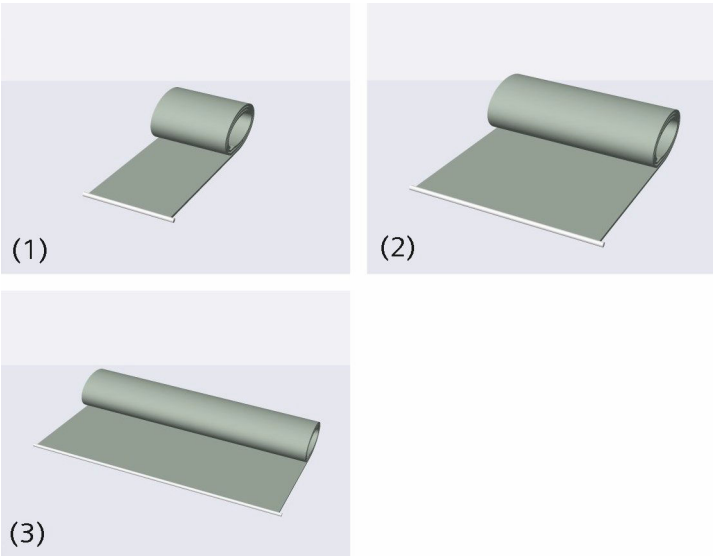
The loose ends of the body straps can be folded and secured using the Velcro fastener to prevent them from touching the floor.

If not used, the attached straps should be placed on the table top to avoid collisions with objects in the vicinity, for example, parts of the patient table.

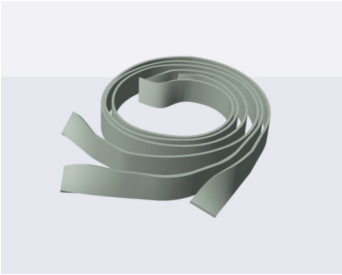
Take care with folded straps on the table as the straps may jam in the patient table when it is moving.

Body support straps

Body support straps are used to immobilize the patient safely during the examination. They are available in different sizes and are equipped with guide rods for attaching in the fixed strap system of the table.



(1) Body support strap (10 cm x 165 cm)
(2) Body support strap (20 cm x 180 cm)
(3) Body support strap (40 cm x 180 cm)



Forehead support straps

Forehead support straps are used to immobilize the patient's head.



Chin support straps

Chin support straps are used to position and immobilize the patient's head/jaw even more securely. Therefore the straps have a slit to place over the chin.

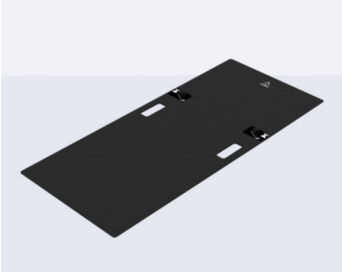
Bariatric accessories set

The bariatric accessories set provides you with special equipment for the examination of patients with a weight up to 300 kg (660 lbs). It must only be used in combination with the high capacity table top on the multi purpose table.

The bariatric accessories set consists of the following parts:

- Bariatric table top extension
- Bariatric head holder
- Adapter of head-arm support
- Body support straps 40 cm

Bariatric table top extension



The bariatric table top extension is used to extend the surface of the table.

You can use the bariatric table top extension for the following examinations:

- Upper and lower extremities
- Examinations of thorax and abdomen

Bariatric head holder



The bariatric head holder is used to position the head of obese patients.

It is supplied with different cushions (flat or wedge shaped), which can be placed inside. For better immobilization the bariatric head holder has Velcro on both sides. Here, you can attach straps.

You can use the bariatric head holder for the following cranial examinations:

- Standard cranial examination (supine)

Adapter of head-arm support



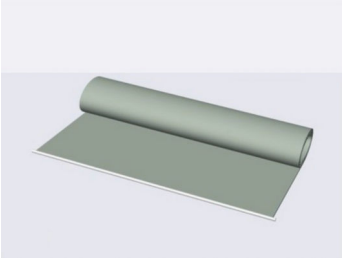
For examinations with the head-arm support on the high capacity table top the adapter of head-arm support is used. This allows a secure positioning of obese patients.

You can use the head-arm support for the following examinations:

- Thoracal and lumbal spine examinations
- Pelvis
- Thorax and abdomen
- Lower extremities

This support is not recommended for head and neck examinations.

Body support straps 40 cm



The body support straps 40 cm are supplied to immobilize obese patients safely during the examination on the high capacity table top. (➔ Page 139 *Straps*)

Paper roll holder



The optional paper roll holder is used for easy changing of the crepe paper on the table. It can be placed on the patient table or on any other surface.

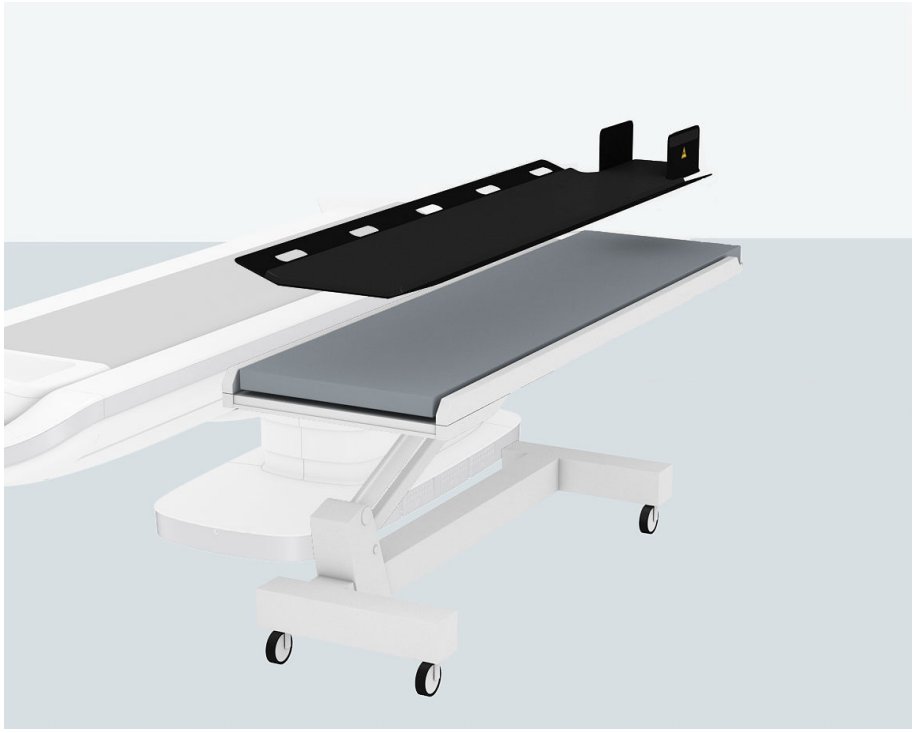
To avoid collisions, the paper roll holder should not be placed on the head end of the table when the patient table height is set to the minimum.

Disposal of crepe paper needs to be environmentally compatible.

CARE TransX

CARE TransX is a radiolucent, portable stretcher for universal patient transport and positioning.

Use CARE TransX for trauma patients and for fast patient transfer.



WARNING

During patient transport the stretcher is not carried horizontally!

The patient may fall off the stretcher.

- Always carry the stretcher horizontally during transport.

CARE TransX can be used with any trolley. For instructions of using the trolley, refer to the operator manuals of the trolley manufacturer.

CARE TransX stretcher

The CARE TransX stretcher comprises of the following parts and accessories.

WARNING

During transport with the stretcher the patient is not firmly strapped to the stretcher!

The patient may fall off the stretcher.

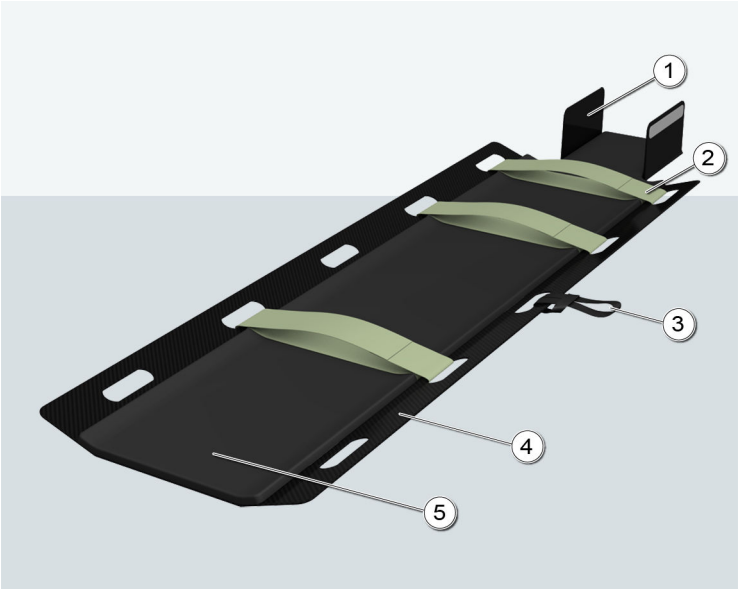
- Strap the patient firmly to the stretcher before transport.

WARNING

During transport the transport straps are not correctly attached to hold the stretcher unit securely!

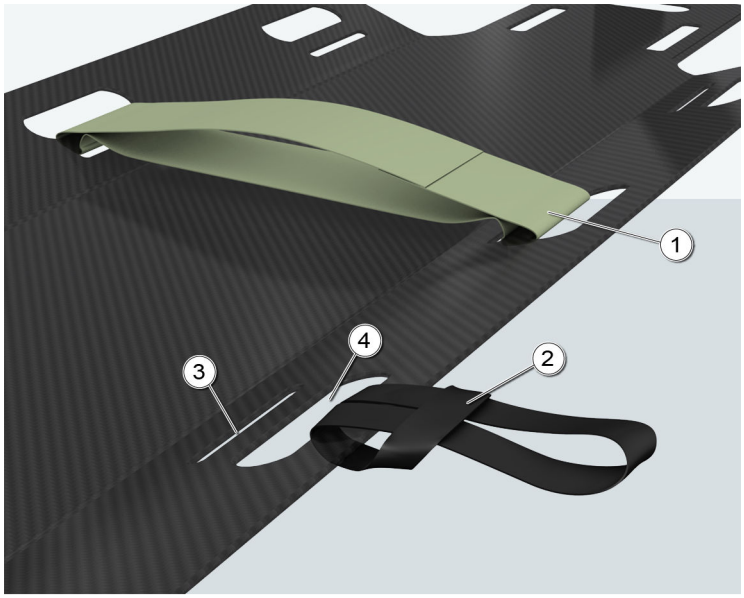
The patient may fall off the stretcher.

- Before transport make sure that the transport straps are correctly attached in order to ensure that you can hold the stretcher unit securely.



(1) Headrest (optional)
(2) Restraint strap
(3) Transport strap
(4) Stretcher
(5) Mattress (optional)

Straps The CARE TransX stretcher is equipped with restraint and transport straps. The straps are attached to the slots at each side of the stretcher. The transport straps can be attached to the hand grips of the stretcher.



(1) Restraint strap
(2) Transport strap
(3) Strap slot
(4) Hand grip

Trolley CARE TransX can be used with any trolley. Siemens Healthineers recommends the use of the following trolley (of the following manufacturer):

- Transmobil (MAQUET)

For instructions using the trolley, refer to the operator manuals of the trolley manufacturer.

WARNING

During transport with the stretcher the patient is not firmly strapped to the stretcher!

The patient may fall off the stretcher.

◆ Strap the patient firmly to the stretcher before transport.

WARNING

During transport the transport straps are not correctly attached to hold the stretcher unit securely!

The patient may fall off the stretcher.

◆ Before transport make sure that the transport straps are correctly attached in order to ensure that you can hold the stretcher unit securely.

3.7.2 Accessories of Cardiac CT

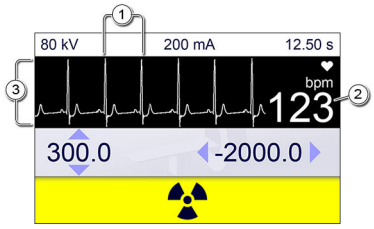
For motion artifact-free CT images in the heart region, an ECG triggering and gating function (HeartView option) is available.

ECG monitor



(1) Channel
(2) Heart rate
(3) ECG signal
(4) R-peaks
(5) Signal strength
The strength of the ECG signal is displayed in 6 levels.

ECG monitor of the predecessor



(1) R-peaks
(2) Heart rate
(3) ECG signal

The HeartView option requires the Siemens Healthineers ECG monitor. The ECG monitor signal is displayed on the gantry display.

The ECG monitor must not be used to establish a diagnosis.

WARNING

ECG functionality is incorrectly used as a survival equipment or a diagnostic equipment!

Wrong diagnosis due to incorrect usage.

- The ECG functionality is not intended for monitoring the patient. It may only be used in conjunction with the HeartView/Cardiac CT option, as described.

WARNING

Rate meters may continue to count the pacemaker rate during occurrences of cardiac arrest or arrhythmia!

ECG leads to wrong diagnosis.

- Keep pacemaker patients under close surveillance.

ECG electrodes

The ECG electrodes are connected to the interface at the PMM (Physiological Measurement Module) at the patient table. (➔ Page 111 *Operating elements and connectors*)

The loose ECG cables can be secured with non-metal clips.

When applying the ECG electrodes to the patient, one of the following color coding is recommended.

- Europe version: IEC (International Electrotechnical Commission)
- US version: AHA (American Heart Association)

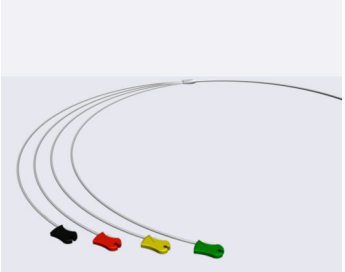
As an option you can use advanced radiotranslucent ECG extensions in order to avoid artifacts during scanning (for example, when examining children).

The real-time triggering requires a reliable signal. Therefore, you are recommended to use ECG electrode patches that fulfill the following requirements:

- Diameter 55 mm
- Strongly adhesive
- Wet gel pad

ECG gating is required for all cardiac examinations. The proper placement of ECG electrodes is essential for a strong and stable signal. The loss of the ECG signal during the acquisition may result in images without diagnostic value.

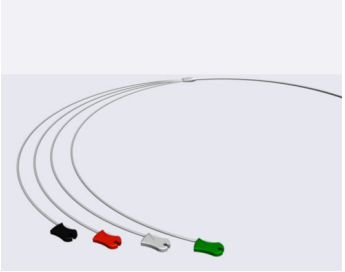
Europe version



Color coding according to IEC

- *Yellow electrode* – on the left mid-clavicular line, directly below the clavicle
- *Green electrode* – on the left mid-clavicular line, 6th or 7th intercostal space
- *Red electrode* – on the right mid-clavicular line, directly below the clavicle
- *Black electrode* – on the right mid-clavicular line, 6th or 7th intercostal space

US version



Color coding according to AHA

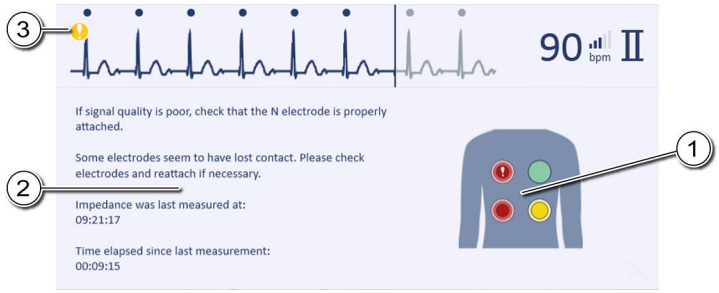
- *Black electrode* – on the left mid-clavicular line, directly below the clavicle
- *Red electrode* – on the left mid-clavicular line, 6th or 7th intercostal space
- *White electrode* – on the right mid-clavicular line, directly below the clavicle
- *Green electrode* – on the right mid-clavicular line, 6th or 7th intercostal space

When attaching the ECG electrodes, the cables must be secured at the outer edge of the radiation area. Cable loops must be avoided.

Signal quality with FAST ECG

With **FAST ECG** check, the electrical impedance of each connected ECG electrode and the ECG signal strength is measured. The strength of the ECG signal is displayed on the Touch Panel.

The impedance measurement starts automatically as soon as the electrodes are connected to the Physiological Measurement Module (PMM). The ECG monitor on the Touch Panel displays a progress bar that indicates the time remaining until the measurement is finished.



(1) ECG quality feedback display
(2) Information text area
Problem-solving hints in case of poor signal quality
Time stamp of the last impedance measurement
(3) Warning icon
The warning icon is displayed if the skin impedance is above a predefined threshold.

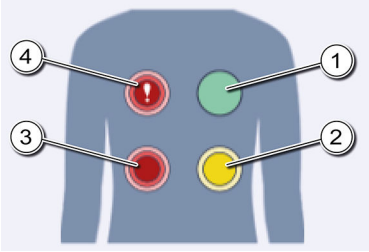
The quality of the ECG signal is strongly influenced by the contact of the ECG electrodes with the patient's skin.

To manually trigger the measurement of the signal quality, press the **ECG channel selection** button at the Physiological Measurement Module (PMM) and keep it pressed for longer than two seconds.

(➔ Page 111 *Physiological measurement module for patient table with 2000 mm scan range*)

(➔ Page 114 *Physiological measurement module for multi-purpose table*)

After the measurement of the signal quality, you can open the **ECG quality feedback** display by tapping the **ECG monitor** on the Touch Panel. Failed impedance measurement is visualized by changing the background color of the physiological data display.
(➔ Page 104 *Physiological data display*)



(1) Sufficient contact
(2) Insufficient contact
Check the electrode and reattach if necessary.
(3) Poor contact
Check the electrode and reattach if necessary.
(4) Lost contact
Check the electrode and reattach if necessary.

The table below gives an overview of the actions of the **ECG quality feedback** display for different results of the signal quality.

Symbol	Signal quality	Warning icon	ECG quality feedback display
	good	-	Tap on the ECG monitor to open the ECG quality feedback display.
	medium		Tap on the ECG monitor to open the ECG quality feedback display.
	poor		ECG quality feedback display opens automatically.
	lost		ECG quality feedback display opens automatically.

Quality of bonding

The quality of the ECG signal is strongly influenced by the contact of the ECG electrodes with the patient's skin.

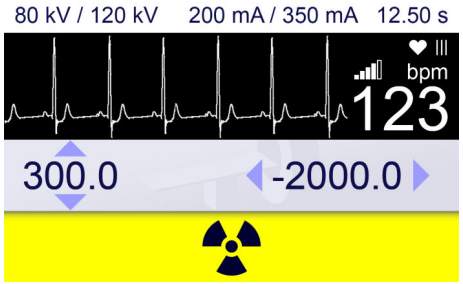
The system automatically checks if all electrodes are connected. The bonding of the electrodes to the skin and the strength of the ECG signal are displayed at the gantry display after a few seconds.

The measured strength of the ECG signal is continuously updated. The quality of the bonding is automatically checked once the system detects that all four electrodes are connected. To manually trigger the measurement of the bonding quality, click the channel selection button at the physiological monitoring module (PMM) and keep it pressed for longer than two seconds.

A warning is displayed in the gantry display if the electrodes are not connected.



A warning icon is displayed if the bonding value does not reach the required threshold.



ECG signal

The quality of the ECG signal is displayed as strength bars. The measured strength of the ECG signal is continuously updated.

Signal strength bars	Corresponding values [mV]
no strength bar	0.0 - 0.2
1 strength bar	0.2 - 0.4
2 strength bars	0.4 - 0.8
3 strength bars	0.8 - 1.2
4 strength bars	1.2 - 1.6
5 strength bars	≥ 1.6

If the signal quality is poor, check that the N electrode is properly attached.

The PMM requires a signal strength of at least two strength bars.

QRS recognition reliability

In lowest ECG signals the PMM may detect more R-peaks than existing.

The reliability of QRS recognition can be improved by considering the following suggestions:

- Manual selection of a specific channel (I, II or III) to reduce the information and so the number of artificial R-peaks
- Cleaning especially dry skin surfaces with medical soap and attaching the electrode patch again with some pressure to achieve optimal contact between skin and electrode gel

3.7.3 Bolus injector (CARE Contrast CT)

If the CARE Contrast option is active (coupled operation mode), it is possible to start the injector and the CT scanner with one single start button either at the CT control box, or at the injector. See also (➔ Page 349 *CARE Contrast CT*).

Released bolus injectors

The following hints have to be considered.

Only use accessories that are released for your system. Please contact your Siemens Healthineers representative for more information. (➔ Page 25 *Equipment of other manufacturers*)

For further instructions concerning the injector, please refer to the operator manuals of the injector manufacturers.

The injector is connected to the CT system via a permanently installed cable. The installation of the cable must be done by a Siemens Healthineers service technician.

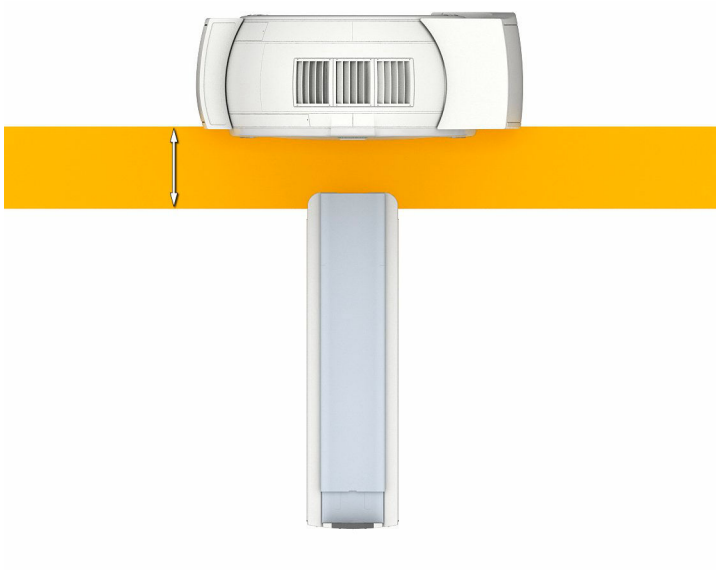
3.7.4 Distance enlargements

The distance enlargement SOMATOM Force can only be used in conjunction with the multi-purpose table. The necessary cables are laid below the floor.

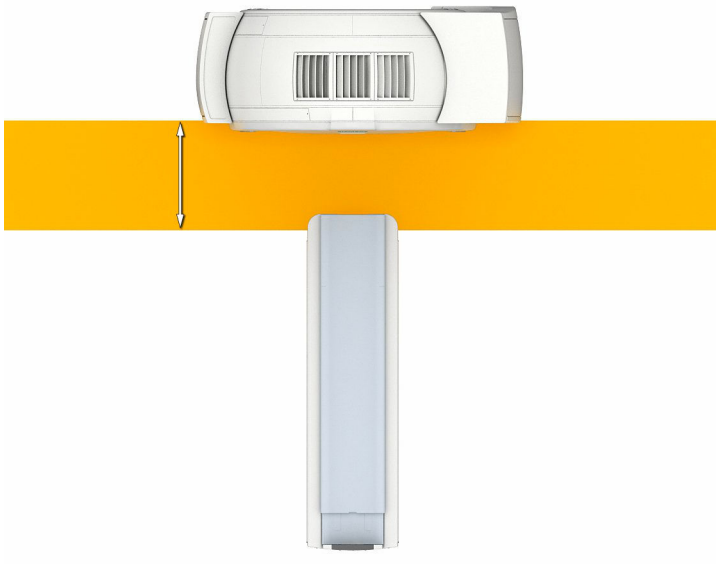
During the initial installation you can enlarge the distance between gantry and multi-purpose table by the following distances:

- 20 cm
- 40 cm

Distance enlargement 20 cm



Distance enlargement 40 cm



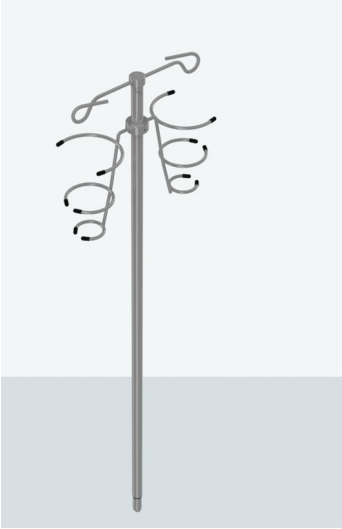
Scan ranges

The different distance enlargements decrease the scan ranges of the multi-purpose table.

The respective maximum scan ranges are the following:

- 1800 mm (20 cm distance enlargement)
- 1600 mm (40 cm distance enlargement)

3.7.5 Infusion bottle holder



You can put the infusion bottle holder into the adapter bush on the patient table.

(➔ Page 285 *Adapting the infusion bottle holder*)

WARNING

Exceeding the maximum load of the equipment, for example, patient table, overlays, accessories, and the assembly of accessories!

Injury to the patient or the personnel, or damage to the equipment.

- ◆ Make sure that the permissible maximum load of the equipment is not exceeded. The permissible maximum load of the equipment is displayed on the applied labels.
- ◆ Verify that the permissible maximum load is not exceeded for:
  - Each single item of equipment applied or plugged into the patient table. For example, positioning aids and overlays.
  - Equipment to which other equipment is attached. For example, accessory rail or infusion bottle holder.

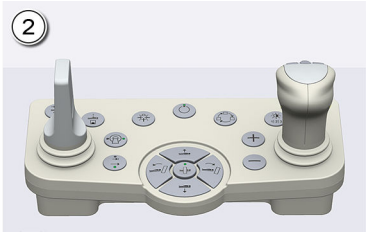
The infusion bottle holder is used for up to two infusion bottles, with a maximum load of 20 N, which is approximately 2 kg (4,4 lbs), per hook.

3.7.6 i-Control (interventional panel)

Using the optional i-Control, you can operate some of the CT functions as an alternative to the gantry operating panel and the input units at the console.

Depending on the configuration, the system has one of the following i-Control. The workflow for positioning the patient or software actions depends on the i-Control. Continue with the relevant section that is indicated for your i-Control.

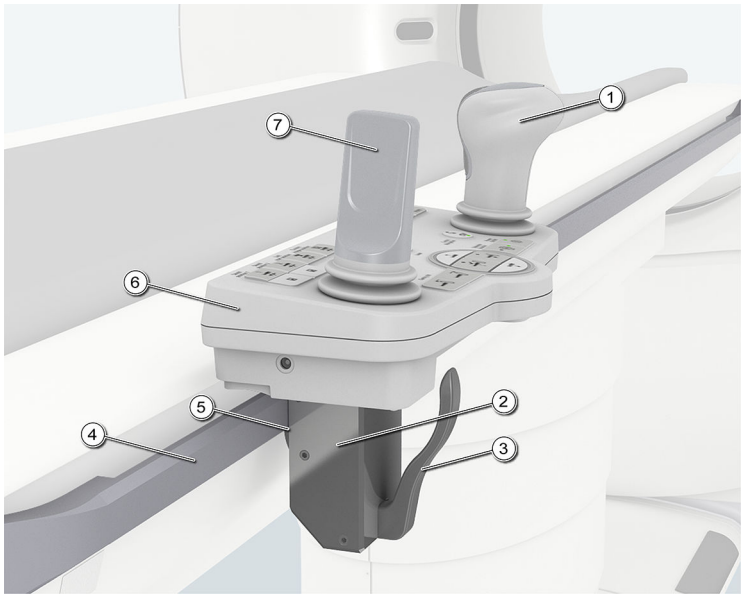




(1) i-Control (➔ Page 154 *i-Control operating panel*)
For more information on how to use the i-Control, see the following links:
(➔ Page 386 *Using i-Control*)
(➔ Page 390 *Moving the patient table*)
(➔ Page 392 *Operating the syngo software*)

(2) i-Control (➔ Page 156 *i-Control operating panel*)
For more information on how to use the i-Control, see the following links:
(➔ Page 394 *Using i-Control*)
(➔ Page 398 *Moving the patient table*)
(➔ Page 399 *Operating the syngo software*)

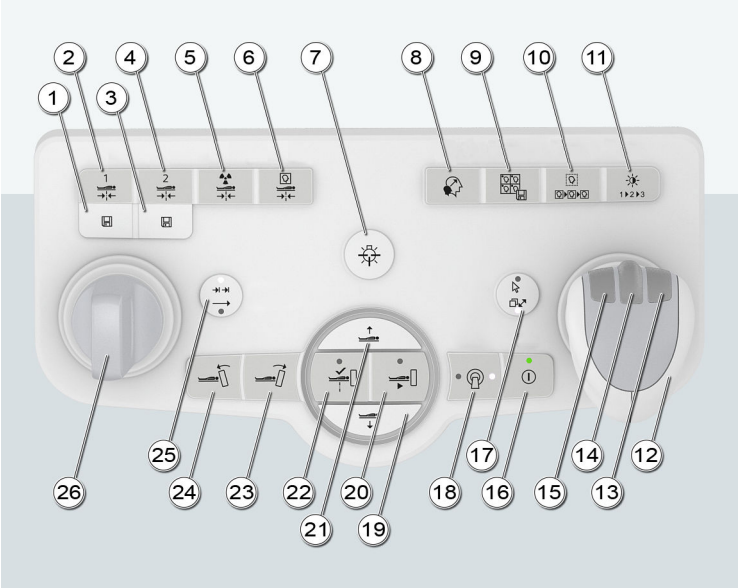
i-Control mounted to the coded surgical rail



(1) Mouse joystick
You can toggle between two function modes of the mouse joystick:
Image-scroll mode: Scroll through the image stack. This mode is active by default. (➔ Page 393 *Scrolling through the image stack*)
Mouse-cursor mode: Control the software as you would when using the standard computer mouse of the *syngo* Acquisition Workplace. (➔ Page 393 *Controlling the syngo software*)
(2) i-Control fixation
Mounting the i-Control at the accessory rail
(3) Fixing lever
(4) Surgical rail
(5) Mounting fixtures
(6) i-Control panel
(7) Table joystick
Move the table top into, or away from, the gantry. (➔ Page 390 *Moving the patient table*)

i-Control operating panel

The i-Control operating panel offers the following CT functions as an alternative to the gantry control panels and the input units at the console.



(1) Saves the current patient table position as the predefined table position 1.
(2) **Saved position 1**: Moves the patient table to the predefined table position 1.
(3) Saves the current patient table position as the predefined table position 2.
(4) **Saved position 2**: Moves the patient table to the predefined table position 2.
(5) **Last scan position**: Move the patient table to the scan position used for the last scan.
(6) **Current image position**: Move the patient table to the displayed image position.
(7) **Laser**: Switches on or off the laser lightmarker.
(8) **Blowup image**: Blow up view for the currently selected image.
(9) **Save displayed images**: Save all displayed images as key images.
(10) **Move active segment**: Toggles the focus between image segments.
(11) **Toggle Window**: Toggles between three organ window settings.
The window settings must be configured with **Examination Configuration**.
(12) Mouse joystick
(13) Right mouse key
(14) Middle mouse key
(15) Left mouse key
(16) **Power On/Off**: Switches on or off i-Control.
(➔ Page 388 *Turning on i-Control*)
(17) **Cursor / Navigation**: Toggle between the joystick functions, mouse-cursor mode and image-scroll mode.
(18) **Tableside location**: Selects the side of the patient table from which you operate the system via the i-Control
The current mode is indicated by the illuminated LED on the key. If i-Control is in a position where operation is not possible, both LEDs are off.
(19) Lower the patient table.
(20) Move the patient table horizontally to the selected position.
This function is only available if a move request is active, for example, after mode loading.
(21) Elevate the patient table.
(22) **Cancel move**: Stop movement of the patient table.
This function is only available if a move request is active, for example, after mode loading.
(23) Not supported
(24) Not supported

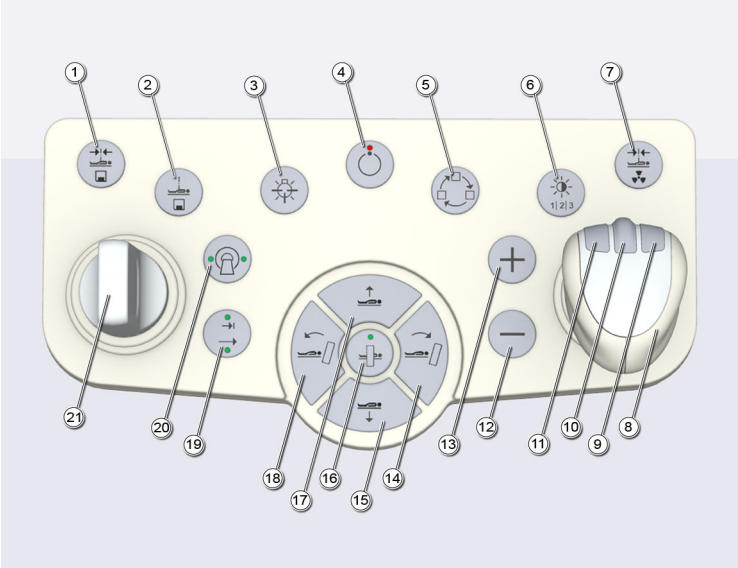
(25) **Continuous / Incremental**: Toggles between continuous and incremental table movement.
The current mode is indicated by the illuminated LED on the key.
(26) Table joystick
Joystick for horizontal table movement.

Only charge i-Control using the power adaptor provided.

i-Control operating panel

With the optional i-Control, you can control some of the CT functions as an alternative to the gantry control panels and the input units at the console.

The operating panel provides the following operating elements:



(1) **Saved position**: Moves the patient table to the predefined position.
(➔ Page 399 *Moving the table to predefined positions*)
(2) Saves the current patient table position as the predefined position.
(3) **Laser**: Switches on or off the laser lightmarker.
(4) **Power On/Off**: Switches on or off the i-Control.
(➔ Page 396 *Turning on i-Control*)
(5) **Move active segment**: Toggles the focus between image segments.
(6) **Toggle window**: Toggles between three organ window settings.
The window settings must be configured with **Examination Configuration**.
(7) **Last scan position**: Move the patient table to the scan position used for the last scan.
(8) Mouse joystick
(9) Right mouse key
(10) Middle mouse key
(11) Left mouse key
(12) Backward navigation through the image stack of the selected segment
Operating the *syngo* software (➔ Page 399 *Operating the syngo software*)
(13) Forward navigation through the image stack of the selected segment
Operating the *syngo* software (➔ Page 399 *Operating the syngo software*)
(14) Not supported
(15) Lower the patient table
(16) Move the table to the preselected scanning position
(17) Elevate the patient table
(18) Not supported
(19) **Continuous / Incremental**: Toggles between continuous and incremental table movement.
The current mode is indicated by the illuminated LED on the key.
(20) **Tableside location**: Selects the side of the patient table from which you operate the system via the i-Control.
The current mode is indicated by the illuminated LED on the key. If the i-Control is in a position where operation is not possible, both LEDs are off.
(21) Table joystick
Joystick for horizontal table movement

Optical and acoustical indications

During operation, i-Control emits optical and acoustical indications to inform you about the current operating state or critical conditions.

These indications are described in the following tables.

Optical indications

The LED at the **Power ON/OFF** key emits the optical indications.

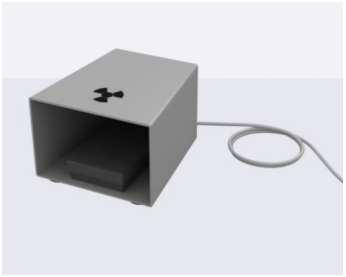


Signal	Meaning
LED green	i-Control active, normal operation
LED yellow	Battery charging
LED red	Error Contact Siemens Healthineers Service.
LED slowly blinking green	i-Control in standby mode
LED quickly blinking green	i-Control establishing radio connection to CT system
LED blinking yellow	Battery low, charging recommended
LED blinking red	Battery empty, charging required
LED quickly blinking red	i-Control lost radio contact to CT system

Acoustical indications

Signal	Meaning
1 beep	• **Power ON/OFF** key pressed, establishing radio connection • i-Control shutting down Possible reasons: battery empty, no radio connection possible, charging complete
2 beeps	Battery low, charging recommended
3 beeps	Battery empty, charging required
1 short beep	• Cable disconnected, establishing radio connection • Cable connected
2 short beeps, continuous	i-Control lost radio contact

3.7.7 Foot switch



With the optional foot switch, you can trigger scanning as an alternative to using the **Start** key.

In some countries, the foot switch is only supplied with the second monitor.

The foot switch is connected to the receptacle at the gantry. (➔ Page 108 *Connectors*)

4 System operation

This section provides information on system start-up and switching it off. You learn about function tests, data handling and how to configure the system settings.

4.1 Switching the system on and off

In this section you find information on how to start the system: switching it on and off, starting the operating system and the *syngo* software.

You then learn what you have to pay attention to when you shut down the system.

4.1.1 Switching on

The computed tomography system consists of the scanner and the computer.

You can either start the computer only (e.g., for evaluation and management), or the entire system (computer and scanner). Before you can perform examinations, you must switch on both components.

System start-up and calibration usually take about 8 minutes. From time to time, pre-heating the tube is necessary, which adds about 30 seconds.

One to three times a month, additional scans are required. These scans prolong the start-up significantly. The checkup screen informs you about the details. In emergency cases, you can cancel the process.

To assure best system performance it is recommended to reboot the system once a day. (➔ Page 166 *Shutdown and restart*)

If a *syngo* CT Workplace is connected, it starts up with the system.

If the system was shut down (System End) but the computers are running the next morning, it indicates that a power failure happened during the night. This will have no impact on the system and you can continue working as usual.

Switching on the system



- Press the **Sys On** key located on the back of the control box. (➔ Page 124 *Control box*)

  – or –

  If a wall switch is installed, press the wall switch **ON** button.

Both the computer and the gantry are started. The LED blinks during start-up and lights up when the systems are ready for operation.

Full operability is reached when both the gantry operator panels and the LED at the control box light up.

Switching on the computer only



- Press the **Comp On** key at the back of the control box.

The computer is started. The gantry is not activated. The LED blinks during start-up and lights up when the computer is ready for operation.

Switching the system on again

If you only wish to switch off the system for a few moments or have switched it off accidentally, do not switch it on again immediately.

- Wait for approx. one minute before switching the system on again.

CAUTION

When you restart the system, the detector has not yet reached operating temperature!

Wrong diagnosis due to image artifacts.

- Calibrate the system as part of the checkup. Repeat calibration if ring artifacts occur.

Starting procedures

After you have switched on the system, booting of the computer is performed in the following sequence:

- Start-up of the operating system
- Start-up of *syngo*
- System checkup and calibration (optional)

Start-up of the operating system

When you switch on the system, the Windows 10® operating system is started.

Standard login

If *syngo* System Security is not active you are automatically logged on as a *syngo* user.

Passing the license check

Each time you start up the system the software checks whether it is correctly installed.

- Check if the operating system starts up without displaying a license error message.

A license error occurs and an error message is displayed.

You cannot use the system due to an incorrect license number.

- Call Siemens Healthineers Service.

Start-up of *syngo*

After the operating system has started, *syngo* is started automatically.

- Check if *syngo* starts up without displaying an error message.

  The **Start-up** window is displayed.

An error message is displayed.

syngo cannot be started.



- Click on **Retry** in the dialog box displayed.

The application is restarted.

or



- Click on **Cancel**.

Starting is interrupted.

- Log off and call Siemens Healthineers Service.

System checkup and calibration

After *syngo* has started up, you should start system checkup and calibration to enable the system for scanning.

CAUTION

When you restart the system, the detector has not yet reached operating temperature!

Wrong diagnosis due to image artifacts.

- Calibrate the system as part of the checkup. Repeat calibration if ring artifacts occur.

If you switch on the computer only, system checkup and calibration is not necessary.

The checkup procedure is started in the **Checkup** dialog box which will be displayed after system start-up. If the **Checkup** dialog box does not appear automatically, select **Setup > Checkup**.

To avoid faulty operation, do not change the system time during running operation .

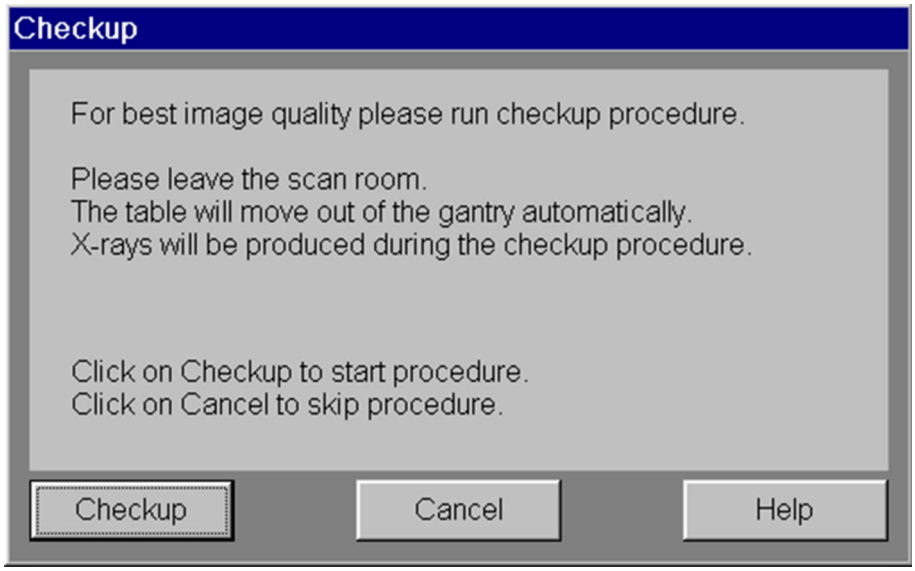
If the last checkup has been completed no longer than 12 hours ago, the time since the last complete checkup is indicated.

You have the option of skipping the checkup. If necessary, you can calibrate the system later (**Setup > Calibration**).

✓ One to three times a month, additional scans are required. These scans prolong the start-up significantly. The checkup screen informs you about the details. In emergency cases, you can cancel the process.

Starting the checkup procedure

After starting up *syngo*, the **Examination** task card and the **Checkup** dialog box open.



1 Wait approximately three minutes to start the check-up procedure after restarting the system. Otherwise, an error may occur due to overheating the gantry.

2 On the **Checkup** dialog box, click **Checkup**.

3 When prompted, press the **Start** key on the control box.

The checkup performs:

- A warm up of the gantry
- Calibration
- Checks of the scanning system

In case of emergency, you can skip the checkup procedure by pressing the **Cancel** key. The image quality, however, may be less than optimal. The checkup has then to be performed as soon as possible.

The length and process of the checkup varies depending on the results of the test scans.

Scan protocols available for import from teamplay Protocols

If scan protocols are available for import from teamplay Protocols at system startup, a corresponding message is displayed.



Additionally, the teamplay icon is displayed in the status bar of the **Examination** task card.

1 Click **OK** to close the message.

2 Call up the **Scan Protocol Assistant**. (➔ Page 240 *Calling up and closing the Scan Protocol Assistant*)

3 Select **Import from teamplay** to import the protocols. (➔ Page 255 *Importing from teamplay Protocols*)

4.1.2 Shutting down the system

The system shuts down in the following stages:

- Shutdown of the scan system except some components
- Termination of *syngo*
- Shutdown of the operating system

CAUTION

Switch user, shut down, logoff or restart without saving data!

Possible loss of unsaved changes.

◆ Save data before switching user, shutting down, or restarting the system.

CAUTION

Switching off the computer in Standby mode or without shutting down!

Possible loss of data, data corruption or system damage.

◆ Shut down the computer before switching off.

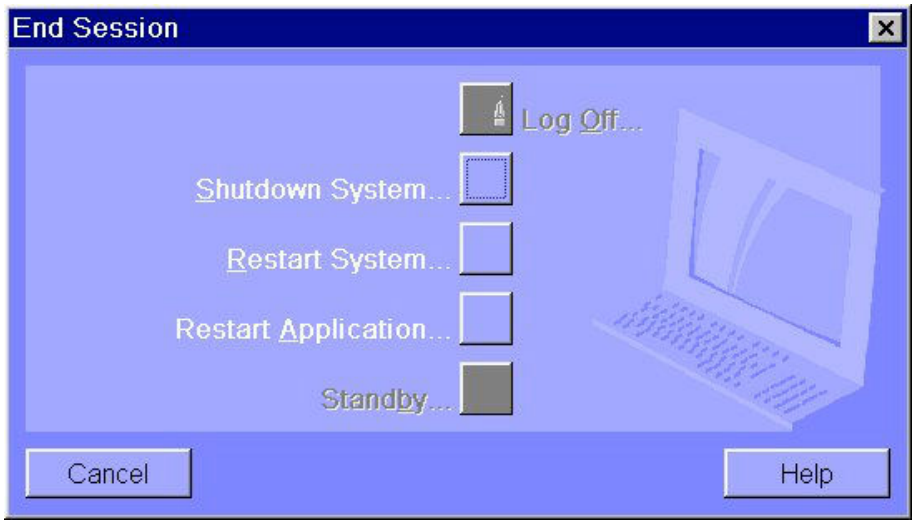
Before you can shut down the system, you must exit all examinations and applications.

A *syngo* CT Workplace that is connected to the system must be shut down first. Otherwise a corresponding dialog box appears.

Calling up the End dialog box

- Call up **System > End** in the main menu.

The **End Session** dialog box is displayed.



If you do not want to exit *syngo*, click on **Cancel**. You return to the user interface.

Shutdown and switching off

With the **End Session** dialog box, you shut down and switch off the system.

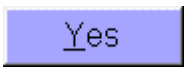
Shutting down the operating system

✓ If the connected *syngo* CT Workplace is still running, shut down the *syngo* CT Workplace before shutting down the *syngo* Acquisition Workplace.



1 Click on **Shutdown System**.

The **Shut Down System** dialog box opens.



2 Click **Yes**.

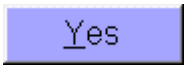
The system is shut down.

Terminating active applications

✓ A dialog box is displayed if applications are still active.

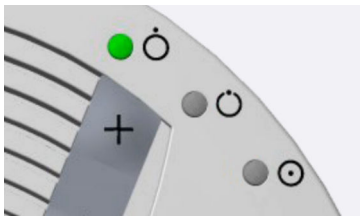


✓ A similar dialog is displayed when a patient examination is still running, or a connected *syngo* CT Workplace is still active.



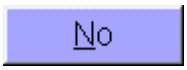
1 Click on **Yes**.

All applications will be closed. The system will continue to shut down and both the CT scanner and the *syngo* Acquisition Workplace console will switch off automatically. If allowed, Somaris first initiates a shutdown of IPS and then performs its own (i.e. *syngo* Acquisition Workplace) shutdown. Meanwhile, the **System Off** LED is blinking.



After shutdown, the **System Off** LED lights up constantly.

– or –



Click on **No**.

You return to the user interface.

2 Exit all applications on the user interface.

Disconnecting the system from mains power

After system shutdown you have the possibility to disconnect the entire system from mains power.

However, you must disconnect the system from mains power after a system failure.

✓ System shutdown is completed.

◆ Press the **Line On/Off** reset button behind the faceplate at the lower right side of the gantry.



Before restarting, the system remains disconnected as long as you push the **Line On/Off** reset button.

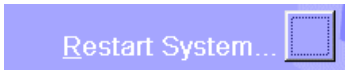
Shutdown and restart

With the second option in the **End Session** dialog box, you shut down the system and restart it.

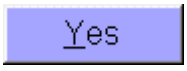


To assure best system performance it is recommended to reboot the system once a day.

Restarting the system



1 Click on **Restart System** in the **End Session** dialog box.

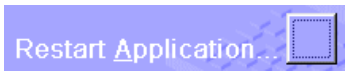


2 Confirm with **Yes** in the dialog box displayed.

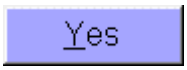
The system is restarted. (➔ Page 161 *Starting procedures*)

Restarting the application

If you want to close all applications and restart the *syngo* application only, use the third option in the **End Session** dialog box.



1 Click on **Restart Application** in the **End Session** dialog box.



2 Confirm with **Yes** in the dialog box displayed.

The applications terminate and *syngo* are restarted automatically.

Restarting after system emergency stop

In case the system has been switched off by pressing the **EMERGENCY OFF** key in the examination room, for example, by accident, a controlled restart has to be performed.

Country-specific regulations must be observed.

✓ All causes of danger have been found and remedied.

1 Release the **EMERGENCY OFF** key provided by the customer.

2 Switch off and on again the **Site On/Off** switch provided by the customer.

– or –

If provided, press the wall switch **Off** button, then press the wall switch **On** button.

3 Perform the usual checkup procedure to calibrate the system.

If you only want to switch on the computer, press the **Comp On** key at the back of the control box to switch off the gantry after the system restarted. This may take several minutes. (➔ Page 173 *Shutting down the gantry only*)

Shutting down the system after computer failure

If the workplace computer does not respond, follow the instructions:

1 Check the screen at the *syngo* Aquisition Workplace.

2 Click **Restart** if the dialog box **System UI Life Check** is visible.

– or –

If the dialog box **System UI Life Check** is not visible, press the **System Off** key on the control box (➔ Page 126 *On/Off keys*).

3 If the system does not shut down, use the **Line On/Off** reset button behind the faceplate at the lower right side of the gantry. (➔ Page 109 *Line On/Off reset button*)

Press and hold the **Line On/Off** reset button for approximately 10 seconds to shut down the system. After about 30 seconds, the system starts up automatically.

– or –

If a wall switch is installed, press the wall switch **Off** button. (➔ Page 172 *Wall switch*)

After using the wall switch to shutdown the system, you need to press the wall switch **On** button to restart the system.

Maintenance shutdown

During a maintenance shutdown, the system cleans up unused pixel data and defragments the image directories for faster access. This operation may take several hours.

During the maintenance shutdown, access to the user interface or operating system is not possible.

Once a maintenance shutdown is started, it must not be interrupted or suspended.

1 Make sure that the CT system will not be used for several hours.

2 Choose **System > Run** from the main menu.

3 Choose **System Clean Up and Shutdown**.

The **System Clean Up and Shutdown** dialog box opens.

4 If you want to restart the system after maintenance shutdown, select the **Restart the system after shutdown** check box.

5 Click the **Start** button.

After clean-up, the system will shutdown or shutdown and restart if you have selected the check box.

Make sure that maintenance is performed at recommended intervals. See *System Owner Manual*.

4.1.3 Exceptional situations

Special circumstances can force the system to shut itself down or to reduce its function temporarily until a defined operating state is achieved.

There are three types of exceptional situations:

- Gantry temperature deviating from the specified limits (➔ Page 169 *Gantry temperature outside permissible range*)
- Overheating of the computer system (➔ Page 170 *Overheating of the computer system*)
- Power failure (➔ Page 171 *Power failure*)

The system responds to such exceptional situations in several steps:

Countdown

If the system reaches a critical state, a countdown is started to shut down the system. During this time, do not perform any examinations and terminate any current application(s).

Recovery

If the system returns to the normal state during countdown (temperature dropped, power supply restored), you can resume examination.

Shutdown

If the countdown has elapsed, the system is shut down.

Restart

If the system is shut down, a restart has to be performed once the exceptional situation has been remedied.

The system does not restart automatically.

Gantry temperature outside permissible range

Accurate measurements are only possible if the temperature inside the gantry is within a certain range.

If the temperature in the gantry falls below a specified limit, the quality of the images is affected because calibration is no longer correct.

Overheating or low temperature

If the temperature of the gantry exceeds the permissible range, countdown starts. A temperature warning is displayed.

Recovery

If the temperature moves back into the permissible range during countdown, the countdown stops. You can then return to the user interface.

Shutdown

When the countdown has finished, measurement is disabled. A message is displayed in the status line. Measurement can be restarted manually as soon as the temperature reaches a permissible range again.

Restart

After a shutdown due to overheating the system has to be restarted manually.

If the temperature in the gantry rises above a maximum value, e.g., as the result of a defective cooling system, the gantry is automatically switched off. A message appears stating that the gantry is no longer ready for operation.

Resolving the temperature warning

✓ Temperature warning dialog box is displayed.

✓ Countdown has started.

1 Finish the current examination and check the cooling system.

2 Confirm with **OK** in the dialog box displayed.

The dialog box is closed.

A text is displayed in the status bar during countdown.

Returning to the user interface

✓ The temperature moves back into the permissible range. Countdown stops.

✓ A dialog box is displayed.

◆ Confirm with **OK**.

The dialog box is closed.

You return to the user interface.

Restarting the system after automatic shutdown

✓ The system has shut down due to overheating.

◆ Restart the system after waiting for at least 10 minutes. (➔ Page 160 *Switching the system on and off*)

The system is restarted.

⚠ CAUTION

When you restart the system, the detector has not yet reached operating temperature!

Wrong diagnosis due to image artifacts.

◆ Calibrate the system as part of the checkup. Repeat calibration if ring artifacts occur.

Overheating of the computer system

Parts of the computer system might overheat during operation. In this case, reliable operation and data security are endangered.

Keep the ventilation slots of the computers clear.

Warning

If the temperature of the computer system rises above a certain threshold value, a dialog box indicates this to you.

Recovery

If the temperature of the system falls below the threshold value, a message is displayed. You can continue operation.

If the temperature continues to rise and reaches a critical value, countdown is initiated.

Countdown

As long as the countdown is running, you have the option of completing current actions and storing your data. A dialog box is displayed.

If the temperature falls below the threshold value during countdown, you can continue operation.

Shutdown

If the countdown has finished and the temperature is still above the critical value, the system is shut down. A message is displayed in the status bar.

Restart

When the computer system has cooled down, you can restart the system.

Resolving the temperature warning

✓ Temperature warning dialog box is displayed.

1 Check the room temperature and the ventilation slots of the computer.

2 Confirm with **OK** in the dialog box displayed.

The dialog box is closed.

A text is displayed in the status bar.

Continuing operation

✓ The temperature moves back into the permissible range. Countdown stops.

✓ A dialog box is displayed.

◆ Confirm with **OK**.

The dialog box is closed.

You can continue operation.

Restarting the system after automatic shutdown

✓ The system has shut down.

1 Wait for the computer system to cool down.

2 Restart the system. (➔ Page 160 *Switching on*)

Power failure

The uninterruptible power supply takes over the power supply of your computer system temporarily during a power failure.

However, during a power failure, the power to the measuring system is interrupted.

Countdown

When a power failure occurs, a dialog box is displayed and a 5-minute countdown starts.

If the power failure is remedied during the first 4 minutes, you can continue with normal operation after clicking the **Continue** button.

Nevertheless you should start completing current actions as long as the countdown is running. When the countdown is finished, the system shuts down.

Recovery

Countdown is stopped if the normal power supply is available again.

Shutdown

After the countdown has elapsed, shutdown is initiated.

Restart

As soon as the normal power supply is reactivated you can restart your system.

Resetting the system

✓ Countdown is stopped.

✓ A corresponding dialog box is displayed.

1 Confirm with **OK**.

The dialog box is closed.

2 Call up **System > Continue**.

The system resets.

Restarting the system

✓ Normal power supply is reactivated.

CAUTION

When you restart the system, the detector has not yet reached operating temperature!

Wrong diagnosis due to image artifacts.

◆ Calibrate the system as part of the checkup. Repeat calibration if ring artifacts occur.

◆ Restart the system. (➔ Page 160 *Switching on*)

Starting the Image Reconstruction System (IRS)

In some cases, when the IRS is defective, the system may shut down immediately after start. Contact Siemens Healthineers Customer Service.

- Disconnect the IRS from Ethernet and power and restart the system to allow extraction of service relevant information from the event log.

4.1.4 Saving energy

If you only need to use the computer, for example, to evaluate patient images, you can switch the gantry off to save energy. (➔ Page 173 *Shutting down the gantry only*)

Note that the system consumes power when it is shut down by using the software.

Use the **Site On/Off** switch to shut down the system and disconnect it from the main power supply. (➔ Page 172 *Site On/Off switch*)

Site On/Off switch

An **On/Off** switch (EMERGENCY OFF) must be installed on site by the customer.

Operating the **Site On/Off** switch connects or disconnects the system to the main power supply. The **On/Off** state must be visible.

If the **Site On/Off** switch is used for switching off, the uninterruptible power supply (UPS) starts up. If a power failure occurs directly afterwards, the UPS may not have enough energy to supply the system.

Unless absolutely necessary, do not switch off the system using the **Site On/Off** switch. Otherwise you have to calibrate the system several times when you restart it. (➔ Page 162 *System checkup and calibration*)

Wall switch

You can install an optional wall switch which allows you to disconnect the system from the main power supply, resulting in zero power consumption. Operating the wall switch initiates an automatic start-up or shutdown of the system.

In contrast, operating the **Site On/Off** switch connects or disconnects the system to the main power supply.

Switching off the system by using the wall switch

If a wall switch is installed, you can use it to shut down the system.

- Press the wall switch **OFF** button.

  A countdown is started to shut down the system.

As long as the countdown is running, you can interrupt the shutdown by pressing the wall switch **ON** button.

Standby mode

If you do not scan for some time, the system goes into *Standby* mode.

In this operating state, the gantry stops rotating after a while.

Cancel standby mode

- Start with the next scan.

The gantry starts rotating. Standby mode is canceled.

Low power mode

The low power mode is used when the gantry is switched off and only the computer is switched on.

(➔ Page 173 *Shutting down the gantry only*)

Shutting down the gantry only

If the entire system is running and you no longer need to use the gantry, you can shut down the gantry only. The rest of the system remains in operating state.



✓ The entire system is running.

◆ Press the **Comp On** key located on the back of the control box.

During the gantry shutdown, on the control box, the **Comp On** LED blinks.

After completion of the gantry shutdown, only the computer remains in an operating state and the **Comp On** LED is illuminated.

Pressing the **Sys On** key located on the back of the control box reactivates the gantry.

This may take several minutes.

Screen saver

To increase the lifetime of your monitor and prevent image retention, a screen saver is preconfigured.

By default, the screen saver is activated after 15 minutes. You can change the default activation time under **Options > Configuration > Screen Saver**.

The screen saver is automatically deactived as long as a patient is opened on the **Examination** or the **Recon** task card.

4.2 Function tests

To ensure that the system is ready for operation and all functions relevant to safety are working correctly, you must perform function tests daily before beginning with the actual examination procedures.

For further information, see (➔ Page 174 *Testing the keys on gantry operator panel*) or *System Owner Manual*.

4.2.1 Checking the STOP keys



1 Press and hold one of the table movement keys on the gantry operator panel.



2 When the patient table moves, press the **STOP** key.

The table movement must stop immediately.

3 Check whether you can move the patient table out of the gantry manually after you have pressed a **STOP** key. (➔ Page 186 *Moving the table manually*)

After you have pressed a **STOP** key, you must restore system readiness with **System > Continue**.

4.2.2 Testing the keys on gantry operator panel

You must check the following keys on the gantry operator panel:

- Table positioning
- Switching on the lightmarker (➔ Page 174 *Checking the laser lightmarker*)
- Zero position of the horizontal table coordinates
- Moving the table from the lightmarker position to the inner scan plane
- Retracting the table (➔ Page 175 *Checking the table top*)

◆ Check the keys when you switch on the unit.

4.2.3 Checking radiation block and warning lamps

You must check the radiation warning lamps on the control box, the gantry (operator panel and display) and, if present, next to the doors of the examination room.

1 Check the proper function of the radiation warning lamps during the daily image quality tests.

The radiation warning lamps must light up when X-radiation is generated.

2 **Optional:** Make sure that radiation stops immediately when a door of the examination room is opened.

When the door is closed again you must restore system readiness with **System > Continue**.

4.2.4 Checking the laser lightmarker

CAUTION

Laser radiation!

Possible loss of eyesight due to laser radiation.

◆ Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces during adjustment.



- Switch on the laser lightmarker and check the projections of the light beams on a white sheet of paper.

The laser beam must project a cross hair and the reference level laser beam a line mark.

The laser lightmarker does not work.

- Stop scanning to rule out any danger to patients.
- Call Siemens Healthineers Customer Service.

4.2.5 Checking the intercom system

- Apply the **Listen to patient** and **Talk to patient** keys on the control box. (➔ Page 124 *Control box*)

The intercom system must work in both directions.

4.2.6 Checking the table top

You must check the mobility and cleanness of the table top.

1 Make sure that you can manually retract the table top from the gantry. (➔ Page 186 *Moving the table manually*)

2 Make sure that the scan field is free of residual contrast medium, blood or other contaminations.

4.2.7 Using the Customer CTDI service function

The Customer CTDI service function allows you to carry out CTDI measurement procedures using parameters and collimation values that correspond to arbitrary routine clinical scan protocols. CTDI measurements can be carried out according to the IEC 60601-2-44 regulations.

Using the Customer CTDI service function, clinical scan protocols are adapted to a single axial scan.

You can modify a scan protocol and configure its scan and reconstruction parameters according to your requirements.

We recommend that only appropriately trained personnel carry out CTDI measurements using the Customer CTDI service function.

Defining a special scan protocol for CTDI measurement

Only routine scan protocols are available for the Customer CTDI service function. When loading some special scan modes such as Cardiac modes or UHR modes, a failure will occur.

Loading the routine scan protocol

You can define the examination data in the **Patient Model Dialog**.

The protocols are assigned to the respective regions of the body image by moving over the body regions. Further protocols are grouped in various categories: Dual Energy, Cardiac, Vascular, RT, Specials, or Private (depending on the available licenses).

✓ All current examinations are closed.

✓ The desired patient is registered.

✓ The **Patient Model Dialog** is opened.

✓ The desired patient is selected.

1 Click **Adult** or **Child** to load the set of scan protocols.

2 Select the desired scan protocol by clicking on the anatomical region you want to examine.

– or –

Select the desired scan protocol from the list at the right side of the body image.

The set of scan protocols is loaded.

3 Select the scan protocol in the displayed selection list.

4 Select the API language.

5 Click the **Save** button to confirm your entries.

The **Patient Model Dialog** is closed and the scan protocol is loaded.

Deleting all non-used ranges and recon jobs

Only one scan entry and one recon job are allowed for a CTDI measurement using the Customer CTDI service function.

✓ The scan protocol is loaded.

1 Select the non-used range.

2 Right-click on the non-used range and select **Cut** in the context menu.

The range is deleted.

3 Repeat these steps for all non-used ranges.

4 Select the non-used recon job.

5 Right-click on the non-used recon job and select **Delete Recon Job** in the context menu.

The recon job is deleted.

6 Repeat these steps for all non-used recon jobs.

Adapting the scan protocol parameters

✓ The desired scan protocol is loaded.

✓ Only one scan entry and one recon job are available.

1 Select the required range.

2 Click on the **Recon** parameter card.

3 If necessary, adapt the reconstruction parameters according to your requirements.

4 Click on the **Scan** parameter card.

5 Deactivate **CARE Dose4D**.

Make sure that the **CARE Dose4D** is disabled.

6 Click **Edit > Save Scan Protocol** to save the examination.

The required examination range is defined and the **Save Scan Protocol** box opens.

Saving the defined scan protocol

Assign the special scan protocol with a file name starting with "CTDI_".

Save the protocol in the **Special** folder.

CTDI measurement using the Customer CTDI service function can only be done if the protocols are assigned with these special file names and file types.

✓ The required examination is defined.

✓ The reconstruction parameters are entered.

✓ **CARE Dose4D** is deselected.

✓ The **Save Scan Protocol** box is opened.

1 Select the required folder in the browser.

2 Enter the required file name and type.

3 Click the **Save** button to confirm your entries.

4 Click **Patient** > **Close Patient** in the main menu to close the current patient.

The defined scan protocol is saved.

Starting CTDI measurement

You do not need a personal account and password for the Customer CTDI service function.

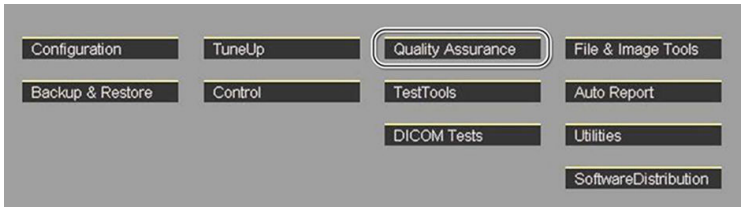
✓ The special scan protocols have been defined according to your requirements.

✓ The scan protocols are saved in the special folder with the required file names and file types.

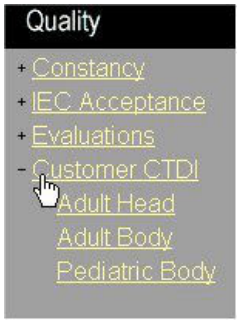
✓ The current patient study is closed.

1 Call up **Options > Service > Local Service**, delete the password entries, and click **OK**.

The **Home Menu** dialog window is displayed.



2 Click on the **Quality Assurance** button to display the **Quality** window.



3 Select **Quality > Customer CTDI** in the **Quality** window.

4 The software is displaying a list of the scan protocols in the **Special** folder. Select the desired scan protocol from the list, and a sequence scan is generated and parameters are displayed on the screen.

The protocol is loaded.

If no protocol could be loaded, check the following steps:

- Remove non-used ranges and recon jobs. (➔ Page 176 *Deleting all non-used ranges and recon jobs*)
- Deactivate CARE Dose4D on the Scan parameter card. (➔ Page 176 *Adapting the scan protocol parameters*)
- Save the scan protocol as CTDI_* in the **Special** folder. (➔ Page 177 *Saving the defined scan protocol*)

5 If the protocol has been loaded successfully, you are prompted to insert the required CTDI phantom and prepare the dosimeter.



6 Click **Go** when you have completed your preparations.

Follow the instructions on the screen to perform the CTDI measurement.



7 Press the **Start** key on the control box.

The system starts the CTDI measurement.

8 When the scan is successfully completed, an image is automatically saved to the **Service Patient** in the Customer CTDI study.

The image is assigned with a series for each scan protocol type used. Each series also carries the same name as the protocol type associated with it.

9 Click **Repeat** to repeat the measurement.

New CTDI measurements generate another image in the image series.

The images are overwritten when starting a new CTDI measurement with the same scan mode. To archive the data of the CTDI measurement, use another storage or storage media.

– or –

Click **Done** to finish the CTDI measurement.

The Customer CTDI service function is completed and the database is automatically cleaned up.

4.3 Operation of the patient table

In this section, you learn how to move the patient table automatically and manually. Furthermore, the change of the MPT table top is described.

Most of the pictures in this section show the standard patient table. Nevertheless, all described actions are also applicable for the multi purpose table.

4.3.1 Patient table movements

During examination, the table movement is controlled from either the console, directly on the gantry control panel, or from the i-Control during interventional examinations..

CAUTION

Wrong table feed direction!

X-ray not, or only partially, usable.

- Always keep an eye on the patient.
- Stop scanning in case of wrong table feed direction.

STOP keys



With the **STOP** keys, you can interrupt table movements in an emergency and switch off radiation.

If you press one of the **STOP** keys, unit movements are interrupted and radiation is stopped. The functions of the keys for system movements are blocked as well. (➔ Page 15 *Terminating system movements and radiation*)

Displays

The table height and relative table feed are displayed both on the gantry display and on the screen.

Safety advice for biopsy

If the patient has a needle for biopsy, always be aware of the location of the needle in relationship to the gantry. Unplanned advancement of the needle could occur.

4.3.2 Moving the patient table using the gantry operator panel with Touch Panel

You can adjust the table height and move the table into and out of the gantry directly using the gantry operator panel with Touch Panel. (➔ Page 92 *Gantry operator panels*)

Always ensure that the movement is not obstructed by any objects.

Do not place any objects underneath the patient table.

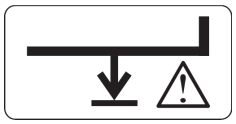
To avoid injuries due to acceleration and deceleration of the patient table in high pitch modes, we recommend performing scanning without the head holder.

Moving the table top vertically

With the **Table movement** keys, you can adjust the vertical table movements.

Before you lower the patient table to a minimum height, you must completely retract the table top out of the gantry.

Caution, leg injuries



Increased risk that body parts can get pinched between table and floor.
Take care when lowering the patient table to avoid injury to body parts.
To avoid damaging the patient table, make sure no accessories (for example, a trolley or cart) are placed underneath the patient table while lowering it.

WARNING

Lowering the patient table!

Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.



- Press the **Table up** or **Table down** key and hold it down until the table is correctly positioned.

  The new vertical table top position (in mm) is displayed.

Moving the table top horizontally

The current horizontal table position will always be shown as a relative value on the **Routine** parameter card and on the Touch Panel.

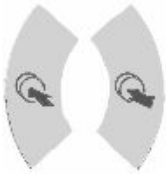


WARNING

Horizontal table top movement!

Possible injury to the hand (warning label).

- Do not place your hand in the gap of the table top support.



- Press the **Table in** or **Table out** key to the first pressure point and keep it pressed until the table is correctly positioned.

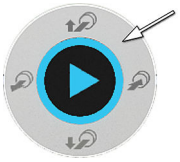
  – or –

  Press the **Table in** or **Table out** key to the second pressure point to move the patient table into the gantry with increased speed.

The new table top position (in mm) is displayed.

A negative value indicates that the patient table has been moved towards the gantry.

Loading the patient using the gantry control panel



- Press and hold the area between the **Up** and **In** patient table movement buttons.

  The patient table moves up and into the gantry simultaneously to position the patient for examination. The patient table movement is adjusted to avoid collision with the gantry.

Configuring predefined table positions

You can overwrite default and user-saved table positions at any time.



1 Press the vertical or horizontal **Table movement** keys to move the patient table to the desired topogram start position.



2 On the Touch Panel, touch and hold a body region on the patient model, where you want to save the new start position, until the circular progress bar is fully loaded.

The new topogram start position is saved and can be used to position other patients.

If you save a new position for the same body region, the former position is overwritten.

The error message **Saving not possible** occurs when configuring the scan start positions.

- You may not have the rights to configure table positions or, the internal system storage is full. Please contact your system administrator.

Restore Topogram Presets

Topogram start positions are assigned for various scan ranges by default. When a topogram start position has been overwritten, you can restore the default position at any time.

1 On the Touch Panel, tap the **Settings** icon in the tools area. (➔ Page 105 *Tools area*)

The **Settings** popover opens. (➔ Page 105 *Settings popover*)

2 Touch and hold **Restore Topogram Presets** until the circular progress bar is fully loaded.

The default table position for each scan start position is now restored.

For **Head-first** and **Feet-first** position, all user defined table positions will be overwritten by the default positions.

Moving the patient table in Move Table Top Only mode

This function provides more space, for example for additional devices, between the patient table base and the gantry during an intervention.

1 On the **Settings** popover on the Touch Panel, turn on the **Move Table Top Only mode**. (➔ Page 105 *Settings popover*)

If the patient table is already completely retracted, the **Move Table Top Only mode** is activated. If not, the **Move** key lights up.



2 Press and hold the **Move** key until the patient table is completely retracted.

The **Move Table Top Only mode** is activated.

A second move request is shown on the Touch Panel and the **Move** key lights up again.

3 Press and hold the **Move** key below the Touch Panel until the table top moves to the initial position.

– or –

If the initial table position is not valid anymore, press and hold the **Move** key until the table top moves to the required position.

The scan range is limited to 1600 mm when the table top is moved out.

The **Move Table Top Only mode** is not supported for Cardio flash scans and Adaptive 4D scans. (➔ Page 182 *Deactivating the Move Table Top Only mode*) (➔ Page 185 *Deactivating the Move Table Top Only mode*)

The **Move Table Top Only mode** is not supported for Adaptive 4D scans.

Deactivating the Move Table Top Only mode

To deactivate the **Move Table Top Only mode**:

1 On the **Settings** popover on the Touch Panel, turn off the **Move Table Top Only mode**. (➔ Page 106)

The table top moves back to the initial position.

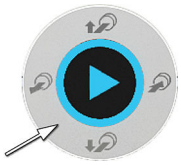
2 If you need to retract the patient table, then follow the steps to unload the patient. (➔ Page 182 *Unloading the patient*) (➔ Page 186 *Moving the patient table using the foot switch*)

Unloading the patient

You can choose between two options to unload the patient using the gantry operator panel.

Using the panel keys

✓ The scan is completed.



1 Press and hold the area between the **Table down** and **Table out** keys.

The patient table moves down and out of the gantry simultaneously and stops automatically when it is completely retracted. The patient table movement is adjusted to avoid collision with the gantry.

2 Press and hold the same area again and keep it pressed to completely unload the patient.

The patient table is lowered to its minimum height.

✓ The scan is completed.

Using the Touch Panel and panel keys



1 On the Touch Panel, tap the **Unload** icon in the tools area.

Check the instruction message on the display.



2 Press and hold the **Move** key until table retraction is finished.

An instruction message is displayed to notify you that the unload has finished.

If the **Move** key is released before the unload has finished, press the **Move** key again to continue table movement. If the **Move** key is not pressed within 2 minutes, table retraction will automatically deactivate.

You can cancel the table retraction movement by tapping the **Unload** button again.

4.3.3 Moving the patient table using the gantry operator panel



You can adjust the vertical and horizontal patient table positions using the gantry operator panel.

For special instructions, see:

- (➔ Page 183 *Moving the table top vertically*)
- (➔ Page 184 *Moving the table top horizontally*)
- (➔ Page 184 *Configuring predefined table positions*)
- (➔ Page 185 *Moving the table in Move Table Top Only mode*)
- (➔ Page 185 *Unloading the patient*)

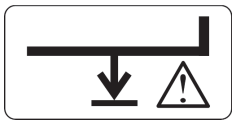
To avoid injuries due to acceleration and deceleration of the patient table in high pitch modes, we recommend performing scanning without the head holder.

Moving the table top vertically

You can use the table adjust keys on the gantry operator panel and the table up/down foot switch in parallel. (➔ Page 186 *Moving the patient table using the foot switch*)

Before you lower the patient table to a minimum height, you must completely retract the table top out of the gantry.

Caution, leg injuries



Increased risk that body parts can get pinched between table and floor.
Take care when lowering the patient table to avoid injury to body parts.
To avoid damaging the patient table, make sure no accessories (for example, a trolley or cart) are placed underneath the patient table while lowering it.

WARNING

Lowering the patient table!

Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.



- Press the **Table up** or **Table down** key and hold it down until the table is correctly positioned.

  The new vertical table top position (in mm) is displayed.

Moving the table top horizontally



WARNING

Horizontal table top movement!

Possible injury to the hand (warning label).

- Do not place your hand in the gap of the table top support.



1 Press the **Table in** or **Table out** key and hold it pressed until the table is correctly positioned.



2 Press the **Table in fast** or **Table out fast** key to move the patient table into the gantry with increased speed.

The new table top position (in mm) is displayed on the gantry display (➔ Page 97 *Display of table positions and tube mode*)

Configuring predefined table positions

With the **A** and **B** keys, you can move the table to predefined horizontal and vertical positions.



1 Move the table to the desired position.



2 Press the **Horizontal zeroing** key and the **A** key simultaneously until the **A** key starts blinking to save the position.

3 Move the table to another position you want to save.

You can save another position by performing the same workflow steps for the **B** key.

If you save a new position for the **A** and the **B** keys, the former position will be overwritten.

Moving the table in Move Table Top Only mode

This function provides more space, for example, for additional devices, between the table base and the gantry during an intervention.

The scan range is limited to 1600 mm when the table top is moved out.

To activate the Move Table Top Only mode, do the following:



1 Press the **Zeroing** key and the **Offset** key simultaneously for 2 seconds.

The movement keys flash.



2 Press the **Table out** key

The table moves away from the gantry.

The movement keys flash when the table has reached the final position.



3 Press the **Table in** key

The table top moves to the gantry.

Deactivating the Move Table Top Only mode

To deactivate the Move Table Top Only mode, do the following:



- Press the **Zeroing** key and the **Offset** key simultaneously for 2 seconds.

The table top moves back to the initial position.

Unloading the patient

✓ The scan is completed.

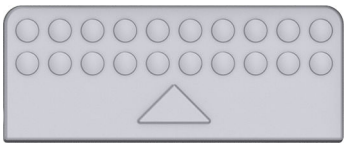
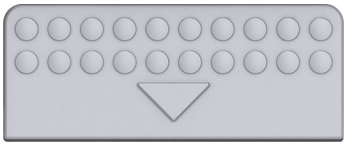
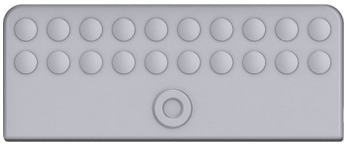
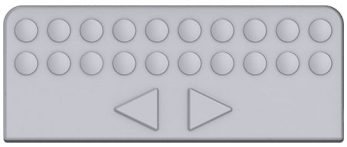


- Press the **Unload** key.

  The table is moved out of the gantry and lowered simultaneously.

4.3.4 Moving the patient table using the foot switch

You can move the patient table with the foot switches.

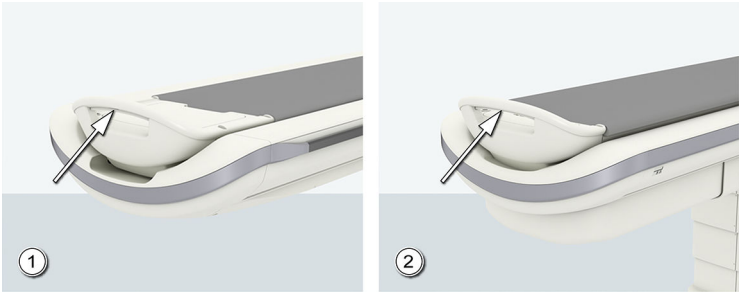
Foot switch	Function at the CT system with the gantry operator panel with Touch Panel	Function at the CT system with the gantry operator panel
	**Load** foot switch Press this foot switch to move the patient table up or out of the gantry to position the patient for examination	**Table up** foot switch Press this foot switch to raise the patient table.
	**Unload** foot switch Press this foot switch to move the patient table out of the gantry and down to unload the patient.	**Table down** foot switch Press this foot switch to lower the patient table.
	**Move** foot switch Press this foot switch to move the patient table to a predefined horizontal and vertical position.	**Load** foot switch Press this foot switch to move the patient table up to position the patient for examination.
	**Table top release** foot switch Press this foot switch to move the table top horizontally into the desired position. Due to patient weight you may need more strength to move the table top. To engage the table top release the foot switch.	

4.3.5 Moving the table manually

In some situations, manual table movement can be necessary.

For this purpose, you can use the foot switch or the release mechanism integrated in the handle of the table.

Moving the patient table in case of emergency or power failure



(1) **Release** push button at the patient table with 2000 mm scan range
(2) **Release** push button at the multi-purpose table

1 Press the **Release** push button as illustrated in the images above.

2 Pull the table top forcefully out of the gantry.

Due to patient weight you may need more strength to move the table top.

Do not press the **Release** push button during scanning. This causes a scan abort. This can also happen due to mechanical problems (for example, if the table top gets stuck due to a blanket or a cable).

4.3.6 Changing the MPT table top

The optional table top of the multi purpose table can be changed according to your clinical needs.

For a better and safer handling use two people to move the table tops.

Exchanging a table top

When exchanging table tops on the multi purpose table (MPT), you proceed as follows:

1 Remove the table top from the MPT.

2 Take care of your hands.

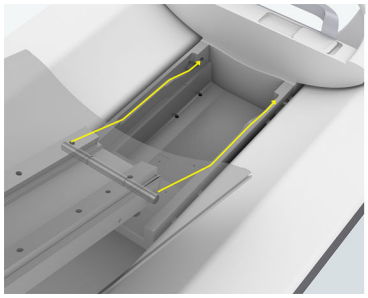
3 Place the table top in the wall holder vertically, with the heavy side down.

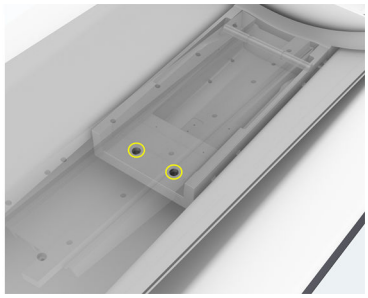
The illumination on the gantry operator panel, and on the control box remains.

You cannot move the table without a table top.

4 Place a new table top on the MPT.

5 Press down the table top until it locks in place.





After exchanging the table top

The illumination on the gantry operator panel, and on the control box remains.

- Press any key on the control box, or on the gantry operator panel.

5 Dose management and optimization

As with every imaging modality that uses ionizing radiation, CT scanning must be used in an appropriate manner. To reduce the exposure to patients, determine appropriate clinical indications before performing a CT examination.

5.1 Dose optimization features

During a CT examination, the patient is exposed to a certain amount of radiation. Therefore, it is important to limit the patient dose by using dose reduction techniques and applications.

The common practice is to apply the As Low As Reasonably Achievable (ALARA) principle. The aim of ALARA is to reduce the risk of radioactive exposure to a level that is necessary to obtain the desired diagnostic information.

The CARE Dashboard (optional) gives a quick overview of the dose optimization features and technologies for each scan range of the current examination. The features which are currently activated are indicated in green.

5.1.1 Dose Notification

The Dose Notification monitors the dose for each scan range. It informs you if the user-specified notification values are exceeded.

You can set the notification values individually for each scan using the **Scan Protocol Assistant**. (➔ Page 209 *Setting the values for the Dose Notification*)

If you load a scan range for which the configured notification values are exceeded, the $CTDI_{vol}$ and DLP values on the **Scan** and **Routine** parameter cards are marked yellow. You must adjust the parameters before scanning is possible. (➔ Page 219 *Using the Adjust button (optional)*)

You can configure the system to additionally display a **Dose Notification** dialog box if the notification values are exceeded. In the **Dose Notification** dialog box, you can enter a diagnostic reason for the exceedance. (➔ Page 207 *Configuring the display of the Dose Notification dialog box*)

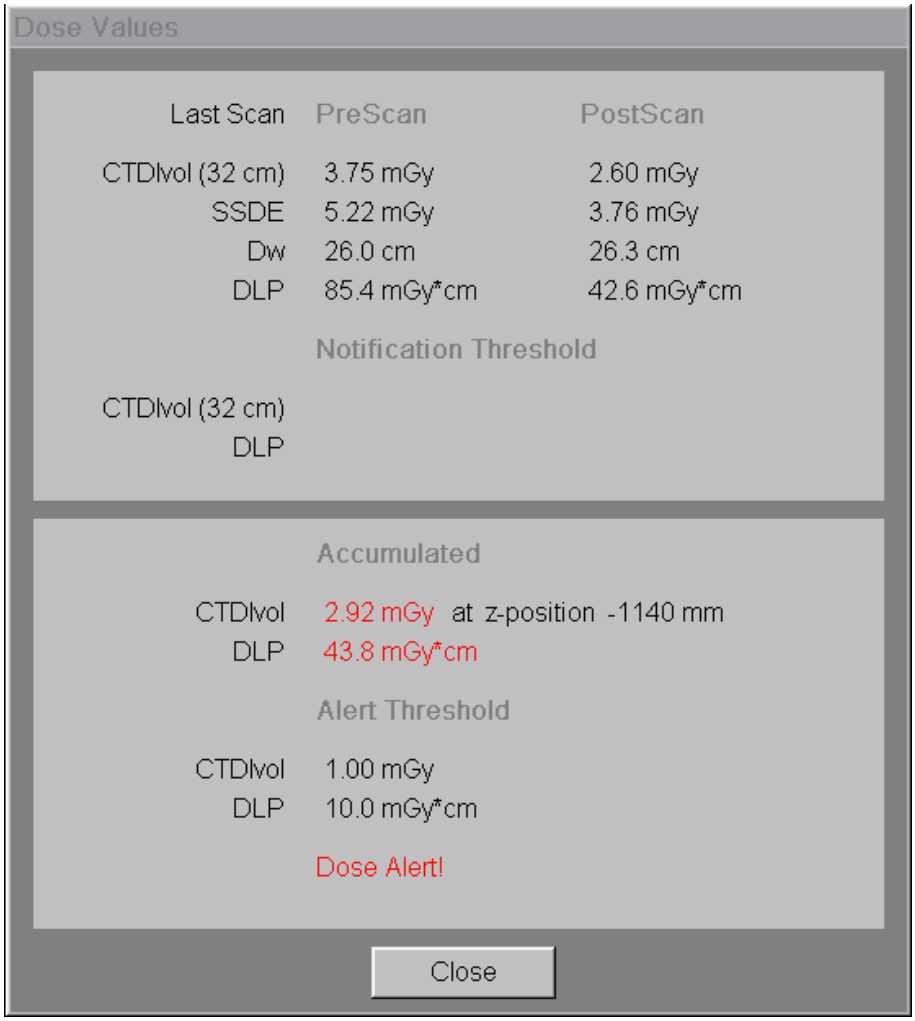
5.1.2 Dose Alert

For all scan ranges the maximum of accumulated $CTDI_{vol}$ at any z-position and the accumulated DLP will be monitored. The dose alert informs if the user-specified alert values are exceeded.

You can configure the alert values in the **Examination Configuration** dialog box. (➔ Page 207 *Configuring the dose alert values*)

If the configured alert values are exceeded, the **Dose Alert** dialog box is displayed. (➔ Page 223 *Handling the Dose Alert*)

Dose Values dialog box shows pre-calculated dose values from the topogram and real dose values after the tomogram scan. On the subtask-cards for Routine, Scan, and Intervention you can check the dose values over the button ....



The **Dose Alert** can be suppressed only during an intervention examination.

The values for the dose alert of child protocols and adult protocols can be defined separately.

A maximum dose value is predictable by the following:

- The system
- The predicted scan time (max. 100 s)
- The selected scan range
- The scan parameters

If this value exceeds the configured alert value, the **Dose Alert** dialog box is displayed.

5.1.3 CARE Dose4D

CARE Dose4D is an automated exposure control which provides constant image quality for all body sizes and body regions at an optimized dose. It automatically adapts the tube current to the specific anatomical characteristics of each individual patient to deliver diagnostic image quality consistently.

CARE Dose4D combines different adaptation methods:

- (→ Page 191 *Dose adaptation to the patient size*)
- (→ Page 191 *Dose adaptation along the z-axis*)
- (→ Page 192 *Angular modulation*)

Dose adaptation to the patient size

Larger patient sizes lead to more attenuation and a reduced number of X-ray quanta reaching the detector, resulting in increased noise in the images. This adverse effect can be limited with dose adjustment according to the body size.

CARE Dose4D automatically modifies the tube current during acquisition. A Quality Reference mAs is used to define the baseline image quality based on the selected scan protocols. The Quality Reference mAs is used to establish the image quality for a reference patient weighing 70 kg to 80 kg (155 lbs to 180 lbs), even for child protocols.

The actual patient attenuation is determined from the topogram. Depending on the selected scan protocols and the patient size, the effective mAs (**Eff. mAs**) may increase or decrease during the acquisition.

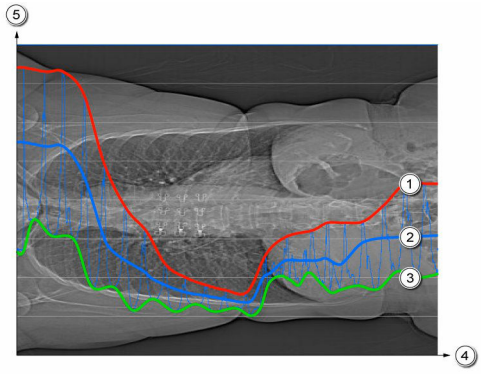
Dose adaptation along the z-axis

Based on a single topogram either in the Anterior-Posterior (AP) or lateral position, the attenuation profile along the z-axis of the patient is measured in the direction of the X-ray projection. The attenuation profile is calculated for the perpendicular projection by a dedicated algorithm. For example, if the topogram is in the AP position, the attenuation profile is measured in the AP direction and calculated for a lateral projection and vice versa.



If the patient is not positioned correctly in the isocenter, the dose modulation based on the topogram may be wrong.

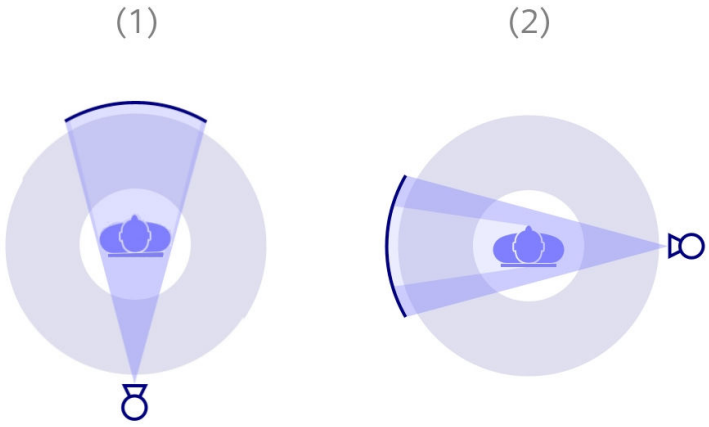
Based on these attenuation profiles, axial tube current profiles (both lateral and AP) and the resulting effective mAs for every table position are calculated. The correlation between attenuation and tube current is defined by an analytical function. This function results in an optimized dose and image noise in every slice of the scan. The correlation is based on a clinical assessment of diagnostic image quality. This assessment showed that, for good diagnostic image quality at a reasonably low dose level, the image noise does not need to be constant for all body sizes and body regions.



(1) Lateral mAs profile
(2) Mean mAs calculated from both mAs profiles
(3) AP mAs profile
(4) Z-direction
(5) mAs

Angular modulation

Without modulation, the attenuation of the X-ray beam for elliptical body regions such as the shoulders varies strongly with the tube rotation angle:



(1) In a back-to-front direction, the section is thinner and the X-ray attenuation is lower
(2) In a lateral direction, the section is thicker and the X-ray attenuation is higher

The angular modulation adapts the tube current over each single tube rotation according to the angular attenuation profile:

- For the low attenuation areas, the tube current is reduced to avoid excessive dose.
- For the high attenuation areas, the tube current is increased to reduce image noise.

The angular attenuation profile is measured during each single tube rotation. The appropriate modulation is applied for the next rotation with a delay of only half a rotation so that consistent image quality can be achieved.

Combined adaptations

CARE Dose4D automatically combines the following tube current adaptations, each of them bringing its specific benefits for optimum dose utilization:

Tube current adaptation	Operation
Dose adaptation to the patient size	General effective mAs level adjustment
Dose adaptation along the z-axis	Tube current changes depending on the local attenuation of the scanned section
Angular modulation	Tube current varies for different angular positons depending on the section shape

For certain examination protocols, the CARE Dose4D operation is modified to meet specific conditions.

, (➔ Page 203 *Adapting the CARE Dose4D settings*), (➔ Page 211 *Setting CARE Dose4D*)

5.1.4 CARE kV

Conventional dose modulation approaches control only the X-ray tube current, while the X-ray tube voltage (the kV setting) is left untouched. Yet there is considerable potential for dose reduction by adapting the kV setting, and therefore the radiation energy to the diagnostic task. In this way, an optimized contrast-to-noise-ratio is achieved.

CARE kV is an extension of CARE Dose4D which supports optimizing radiation exposure to patients.

If CARE kV is activated, the system automatically proposes the appropriate kV and effective mAs settings. They optimize the applied dose while the image quality is maintained.

The proposal is based on the following parameters:

- Patient attenuation calculated based on the topogram
- Examination type (adjustable) (➔ Page 212 *Adjusting the examination type*)
- Quality reference mAs (adjustable) (➔ Page 213 *Setting the image quality*) (➔ Page 213 *Setting the image quality*)

Image quality

The quality of CT images is characterized by the following parameters:

- Contrast
- Noise
- Sharpness (spatial resolution)

Improving these parameters will render a better image and enable the reading physician to make a more precise diagnosis. If, for example, the contrast is high and the noise is low, the image quality improves.

Additionally, an iodine contrast medium is often administered to improve contrast and therefore the visibility of organ structures, particularly in CT Angiography (CTA) examinations. The contrast is best with lowered X-ray tube voltage, since the low energy X-rays are better absorbed by the dense iodine than by the surrounding tissue. In order to maintain low noise levels, the tube current usually requires an adjustment.

For larger patients who have a higher X-ray attenuation, the output of the X-ray tube at lower kV settings may not be sufficient to produce the required contrast-to-noise-ratios. For these patients, higher X-ray tube voltages must be selected, despite reduced iodine contrasts.

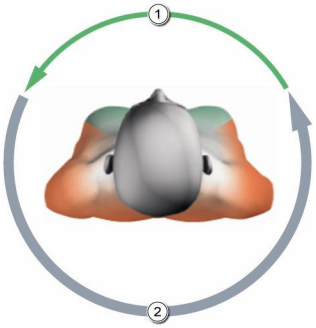
(➔ Page 212 *CARE kV settings*), (➔ Page 208 *Setting the CARE kV limits*)
(➔ Page 209 *Setting the CARE kV limits*)

5.1.5 X-CARE

X-CARE protects the eyes and the breast of the patient. When using X-CARE scan protocols, the tube current will be reduced in a predefined area at the front side of the patient during the whole scan. At the opposite area, the tube current is increased accordingly to maintain the image quality in comparison with a scan without X-CARE.

X-CARE reduces radiation dose at the surface, that is, for peripheral organs, in the frontal angle segment. However, dose reduction will not be reflected in the CT Dose Index (CTDI) or Dose Length Product (DLP) as they are defined by averaging over a full rotation.

X-CARE is applicable for spiral scans, except interventional scans, cardio scans, and high pitch spiral scans (4D scans).



(1) Reduced dose
(2) Increased dose

If X-CARE is on, the breast of the patient is irradiated with reduced dose (green color).

X-CARE adapts to the patient orientation. When an X-CARE protocol is chosen, the default orientation is selected. If another patient orientation is selected, the X-CARE protocol is adapted to the new selection.

If you have selected an X-CARE scan protocol, the pitch value is limited to a maximum of 0.6.

The area with reduced tube current for the patient is shown in the image on the **Routine** parameter card in green. The position of the displayed area takes the position of the patient into account. As soon as you change the patient position, the display is updated accordingly.

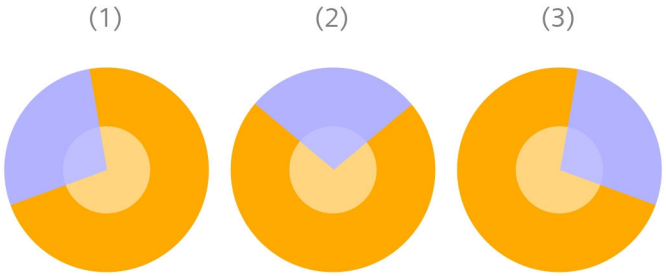
It is not possible to deactivate X-CARE in an X-CARE protocol. To deactivate X-CARE, select another protocol.

After scanning, "X-CARE" is inserted in the comment line of the image text. The use of X-CARE is documented as a comment within the dose report.

5.1.6 HandCARE

HandCARE is a function for reducing the dose to the hand of the operator and patient during a CT intervention by switching off the radiation for a fixed sector during the tube rotation. It is available only in the i-Sequence and i-Fluoro modes.

You can select three different positions to switch off the exposure: 10:00, 12:00, and 2:00 o' clock. These positions usually correspond to the user-preferred side or entry point during the procedure.



(1) 10:00 o'clock
(2) 12:00 o'clock
(3) 2:00 o'clock

For information on using HandCARE, see (→ Page 405 *Setting a tube position for HandCARE*) .

The use of HandCARE results in a slower frame rate for image display when using the i-Fluoro mode. It still permits continuous visualization and tracking of the needle.

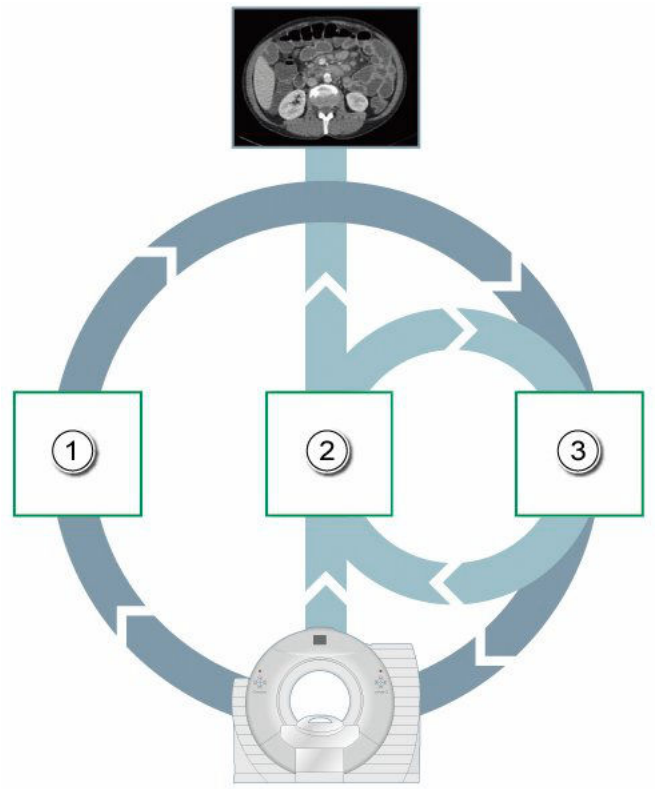
5.1.7 Sinogram Affirmed Iterative Reconstruction (SAFIRE) / Advanced Modeled Iterative Reconstruction (ADMIRE)

Iterative reconstruction approaches allow decoupling of spatial resolution and image noise.

With the Sinogram Affirmed Iterative Reconstruction (SAFIRE) or the Advanced Modeled Iterative Reconstruction (ADMIRE), correction loops are introduced into the image generation process. These iteration loops utilize raw-data information to significantly improve image quality.

Additionally, image noise is removed in the iterative corrections without degrading image sharpness. The noise texture of the images is comparable to the standard convolution kernels.

SAFIRE or ADMIRE results in an improved image quality with reduced noise and increased image sharpness.



(1) Raw data reconstruction
(2) Image data reconstruction
(3) Image correction

(→ Page 216 *Setting the reconstruction parameters for SAFIRE / ADMIRE*)

5.1.8 Neuro BestContrast

Neuro BestContrast improves image quality during the image reconstruction phase of head examinations. It improves contrast enhancement with a minimal increase in image noise.

Neuro BestContrast is applied to all head kernels with a kernel sharpness value of < 45 and with iBHC turned on (for example, bone or iodine).

The image is divided into two data sets:

- Low spatial frequencies

  The low frequency pass image is reconstructed and tissue contrast is improved. During this reconstruction phase, the increase in noise is minimal.

- High spatial frequencies

  The high frequency pass image data contains the sharp details and original noise. During this reconstruction phase, noise is curbed.

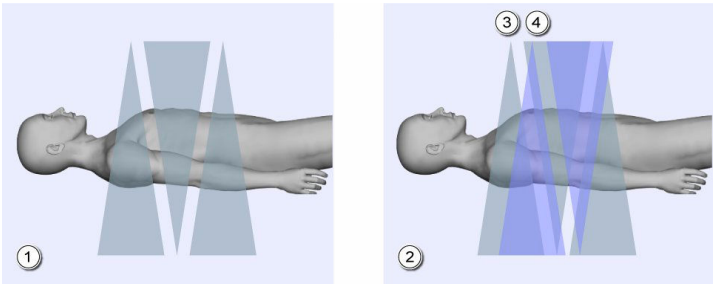
Finally, both data sets are merged, resulting in an improved image that has a better contrast-to-noise ratio.

5.1.9 Turbo Flash Spiral Cardiac

SOMATOM Force offers a way to scan the heart within one heartbeat.

With single source CT, the spiral pitch is limited to values below 1.5 to ensure gapless volume coverage along the z-axis. If the pitch is increased, sampling gaps occur that hamper the reconstruction of images with well-defined narrow slice sensitivity profiles and can result in excessive image artifacts.

With dual source systems, data acquired with the second measurement system a quarter rotation later can be used to fill these gaps.



(1) Single source CT
(2) Dual source CT
(3) Tube A
(4) Tube B

In this way the pitch can be increased up to 3.4 in a Field of View (FoV) that is covered by both detectors. Since no redundant data is acquired due to the high pitch, a quarter rotation of data per measurement system is used for image reconstruction. Each of the individual axial images has a temporal resolution of a quarter of the rotation time.

Since no overlapping data is acquired, the radiation dose of this mode is as low as technically possible and below the dose values of ECG-triggered sequential scanning.

First publications have demonstrated that reliable coronary CTA is feasible at radiation dose values below 1 mSv[3,4].

[3] Alkadhi H, Leschka S, Stolzmann P, Desbiolles L, Baumueller S, Goetti R, et al. Diagnostic accuracy of high-pitch dual-source CT for the assessment of coronary stenoses: first experience. Eur Radiol. 2009;19(12):2896-903.

[4] Achenbach S, Marwan M, Ropers D, Schepis T, Pflederer T, Anders K, et al. Coronary computed tomography angiography with a consistent dose below 1 mSv using prospectively electrocardiogram-triggered high-pitch spiral acquisition. Eur Heart J. 2010 Feb;31(3):340-6

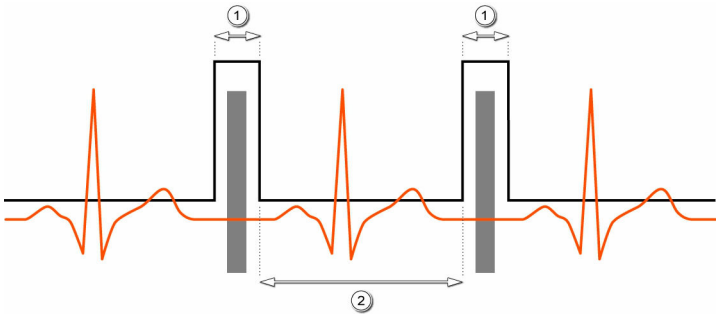
(➔ Page 232 *Scanning with Turbo Flash Spiral Cardiac*)

5.1.10 ECG Pulsing and MinDose

ECG Pulsing is a method to modulate the radiation dose during a gated spiral CT scan.

The tube current is maintained at 100% of the desired level only during a predefined diagnostically relevant phase of the cardiac cycle.

During the rest of the time, the tube current is modulated by default to 25% of the nominal current. The resulting images are appropriate for a functional analysis and sufficient for a coronary evaluation.

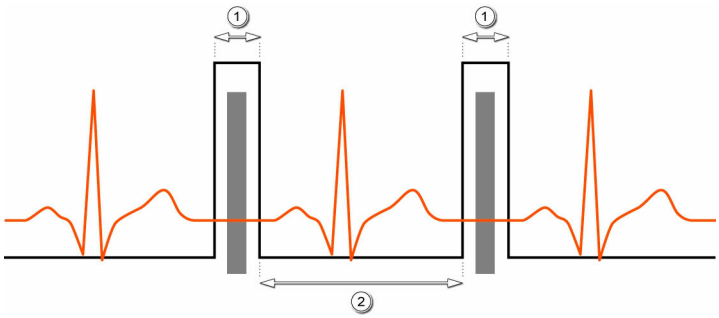


(1) High dose level
(2) Low dose level

(➔ Page 230 *Using ECG Pulsing*)

MinDose

For MinDose, the tube current is reduced to 4% of the nominal current outside the diagnostically relevant heart phase. Therefore, the mean radiation dose is further reduced compared to the normal ECG pulsing setting.



(1) High dose level
(2) Low dose level

ECG-controlled dose modulation is based on the continuous monitoring of the ECG. An algorithm predicts when the desired ECG phase will start by calculating the mean durations of the preceding cardiac cycles. Therefore ECG Pulsing can react flexibly to arrhythmia and ectopic beats.

(➔ Page 231 *Using MinDose*)

5.1.11 Pitch Adaptation

When scanning a retrospective ECG-gated spiral, you only achieve continuous volume coverage in the same cardiac phase when the pitch or scanning speed is adapted to the heart rate of the patient. In general, low scanning speeds or pitch values are employed to provide sufficient overlap of the scanned volume in each rotation of the gated acquisition. This method ensures that there are no gaps in the volume data for retrospective cardiac reconstruction.

In the past, cardiac protocols employed fixed pitch values. The heart rate of the patient had to be observed and the appropriate scan protocol had to be selected. It had to be ensured that the heart rate of the patient did not vary out of range after loading the protocol and during the entire scan procedure. The pitch was intentionally preset to a lower value in order to meet the requirements for wider ranges for heart rates. As a result, the radiation doses with these protocols were high, especially when imaging patients with moderate to high heart rate ranges. Adapting the pitch value to the heart rate can therefore reduce the dose.

Currently you can change the scan pitch by choosing the appropriate heart rate range after selecting a cardiac protocol. Siemens Healthineers recommends selecting the pitch manually only to experienced users in the event of a clear clinical indication.

Siemens Healthineers recommends using the automatic pitch adaptation which is activated in the default protocols. It allows the system to monitor the heart rate of the patient over the last ten cardiac cycles. Additionally, it adapts the pitch instantly before initiation of the scan which is based on the lowest heart rate measured within these ten cycles. The CT scanner increases the pitch with higher heart rates, resulting in a faster scan and, therefore, a reduced dose.

(➔ Page 232 *Adapting the pitch*)

5.1.12 Adaptive Cardiac Sequence

Prospective ECG triggering combined with step-and-shoot acquisition of axial slices offers a way to scan a wide variety of patients. The ECG signal of the patient is monitored during the examination. Axial scans are started with a pre-defined time offset relative to the R waves.

With conventional approaches, the method reaches its limitations for patients with arrhythmia, since ECG-triggered axial scanning depends on a reliable prediction of the next cardiac cycle. Thereby the mean length of the preceding cardiac cycles is used.

With the Adaptive Cardiac Sequence, a more refined analysis of the ECG is performed. The acquisition window can be extended within the diastolic phase of the cardiac cycle to find the optimum reconstruction phase. Additionally, the variance of the heart rate is taken into account for the calculation of reconstruction time points. In case of ectopic heartbeats, the scan can be repeated at the same position.

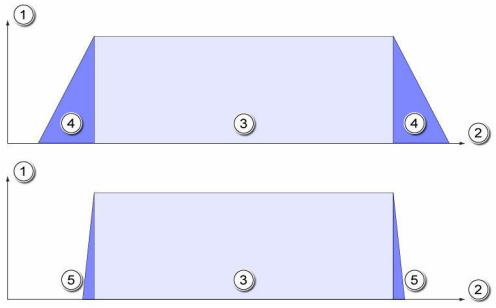
(➔ Page 228 *Using the Adaptive Cardiac Sequence*)

5.1.13 Adaptive Dose Shield

The Adaptive Dose Shield dynamically adapts the collimation to reduce the excess dose applied at the edges of the scanned volume for spiral acquisitions.

In spiral scan modes, to collect all the raw data needed for image reconstruction, the scan range must exceed the imaged range. This over-scanning may lead to unused dose when the beam collimation width is kept constant during the scan.

The excess dose can be reduced with the use of dynamic collimation, which controls the aperture of the X-ray tube collimator at the start and end of the spiral acquisition. The spiral scan starts with the smallest possible aperture and gradually opens to the nominal collimation. Then it closes again at the end of the scan range.

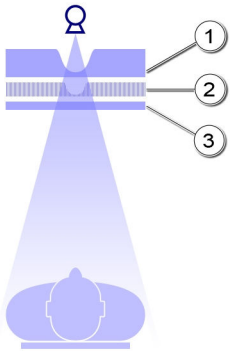


(1) Dose
(2) Z-direction
(3) Nominal spiral length with full dose
(4) Additional dose without Adaptive Dose Shield
(5) Additional dose with Adaptive Dose Shield

The $CTDI_{vol}$ is not affected by the Adaptive Dose Shield, but the DLP is corrected when the Adaptive Dose Shield is employed for the scan.

5.1.14 Filters in the tube collimator

The tube collimator houses two shaped X-ray beam filters and one Tin Filter, which can be combined.



(1) Standard shaped X-ray beam filter in tube A and B
(2) Narrow shaped X-ray beam filter in tube A and B
(3) Tin Filter in tube A and B (➔ Page 201 *Tin filtration for low dose scanning*)

The shaped X-ray beam filters allow you to perform examinations where the best diagnostic image is focused on the targeted part of the scan field, for example, for imaging the heart.

The standard shaped X-ray beam filter is permanently set.

The Siemens Healthineers default protocols ensure an optimized dose and image quality. Depending on the protocol type and the use case, the CT scanner automatically selects the required filter.

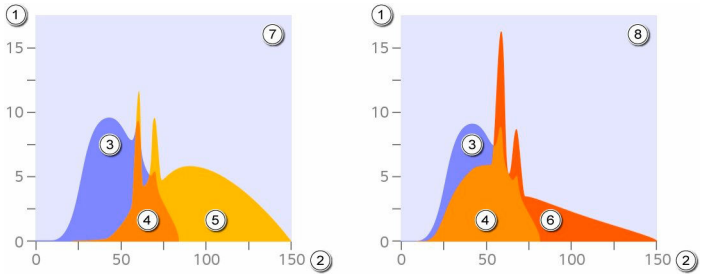
During examinations of the body, the narrow filter setting reduces the dose in the outer region of the scan field by approximately 20% compared to the standard setting.

5.1.15 Tin filtration for Dual Energy examinations

The Tin Filter in the pre-patient X-ray path blocks low energy photons from the tube spectrum.

The Tin Filter in tube B is used for Dual Energy examinations, and increases the spectral separation of the two tube spectra by absorbing the low energy photons out of the high energy spectrum. The result is a better separation of the low kV and the high kV images with the additional benefits of noise reduction and dose reduction.

Function principle



(1) Number of quanta
(2) Photon energy (keV)
(3) 80 kV, 90 kV, or 100 kV
(4) Overlap
(5) Sn 150 kV
(6) 150 kV
(7) With Tin Filter
(8) Without Tin Filter

5.1.16 Fields of use for tin filtration

Your CT scanner is equipped with a Tin Filter in tube A and tube B. (➔ Page 200 *Filters in the tube collimator*)

Depending on the system configuration and the purchased licenses, you can apply the tin filtration in different combinations depending on the following fields of use:

- In Dual Energy CT examinations, for achieving a better separation of the low kV and the high kV images with the additional benefits of noise reduction and dose reduction. (➔ Page 201 *Tin filtration for Dual Energy examinations*)
- In Dual Source CT examinations and Single Energy CT examinations, for low dose scanning. (➔ Page 201 *Tin filtration for low dose scanning*)

5.1.17 Tin filtration for low dose scanning

Tin filtration can be used for low dose scanning in Dual Source CT examinations and Single Source CT examinations. Depending on the voltage setting, the tin filtration reduces the dose by a factor of about 4 to 10.

Usage	Available voltages
Single Source CT examinations	Sn100 kV, Sn120 kV or Sn150 kV in tube collimator A

Usage	Available voltages
Dual Source CT examinations	Sn100 kV, Sn120 kV or Sn150 kV in tube collimators A and B

The tin filtered spectra are available in dedicated scan protocols for non-contrast studies. These protocols are marked with the suffix **_Sn**. CARE kV selects Sn100 kV, Sn120 kV or Sn150 kV, respectively, depending on patient size and application.

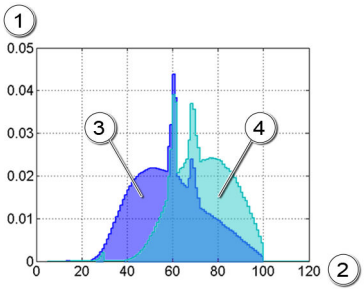
The Tin Filter in both tubes can be used simultaneously within Turbo Flash protocols or Calcium Scoring protocols.

As the tube spectrum that is filtered with the tin filters is suited only for non-contrast scans, using Bolus Tracking in Single Source or Dual Source CT examinations with tin filtration is not recommended.

However, if the tin filtration is used in combination with Bolus Tracking, the start delay between the monitoring scan and the diagnostic scan is increased.

Function principle

The Tin Filter absorbs the low energy photons which results in a hardening of the spectrum.



(1) Number of quanta (arbitrary unit)
(2) Photon energy (keV)
(3) 100 kV (normalized curve)
(4) Sn100 kV (normalized curve)

5.2 Performing a dose-optimized workflow

The following workflow describes how you can adapt the configuration settings and the scan parameters for dose-optimized scanning. You are also informed about how you can proceed if conflicts occur and where the applied dose is documented.

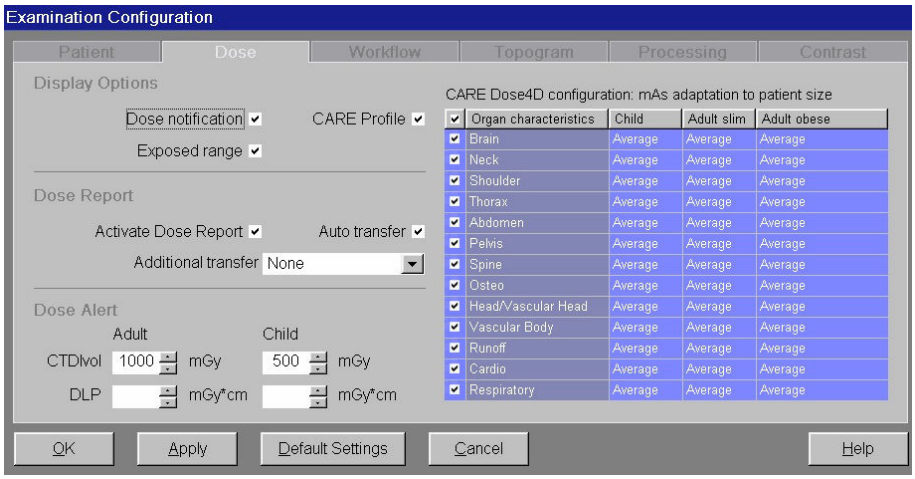
If you are not familiar with the basic procedures of preparing and performing a scan, see (➔ Page 306 *Scan*).

5.2.1 Checking the examination configuration parameters

1 In the **Options** menu, choose **Configuration...**.

2 In the **Somaris/7 – Configuration Panel**, double-click the **Examination** icon.

3 Click the **Dose** tab card of the **Examination Configuration** dialog box to adapt the dose settings, if necessary.



Adapting the CARE Dose4D settings

In the field **CARE Dose4D configuration: mAs adaptation to patient size**, you can select a different CARE Dose4D adaptation strength to the patient size.

The adaptation strength can be set individually for the various organ characteristics and various patient sizes (**Child**, **Adult slim**, **Adult obese**).

1 For a specific organ characteristic, for example, **Abdomen**, click into the CARE Dose4D curve setting of a patient size, for example, **Adult slim**.

2 In the selection list, select a CARE Dose4D adaptation strength.

You can choose between **Very Weak**, **Weak**, **Average**, **Strong**, and **Very Strong**.

The setting of the adaptation strength is effective for all protocols with CARE Dose4D.

The organ characteristic is displayed on the **Scan** parameter card.

The CARE Dose4D curve is simultaneously adapted for all selected organ characteristics.

You can select all organ characteristics at once if you select the **Organ characteristics** checkbox.

For **Adult slim**, **Adult obese**, and **Child**, the **Siemens Healthineers** default settings are **Average** for all organ characteristics.

If all images of slim patients are too noisy, select a weaker CARE Dose4D curve.

If all images of obese patients are too noisy, select a stronger CARE Dose4D curve.

For adapting the child-specific settings, see (➔ Page 226 *Adapting the dose to the patient size*).

CARE Profile

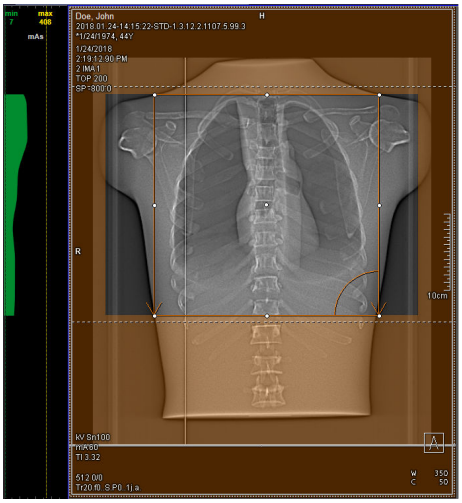
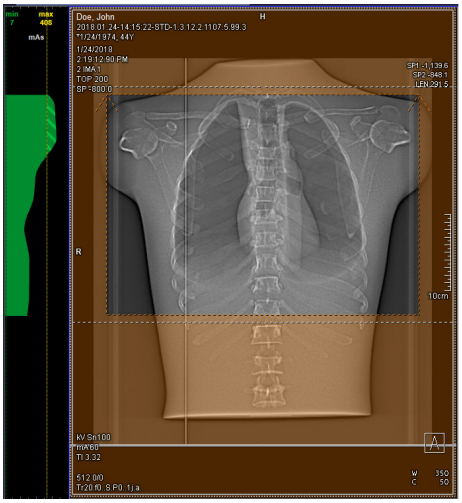
CARE Profile indicates the mAs that will be applied to the patient for a scan range, depending on the z-position. The *syngo* Acquisition Workplace displays the CARE Profile for the ranges that are selected in the timeline or in the **Recon Ranges** area.

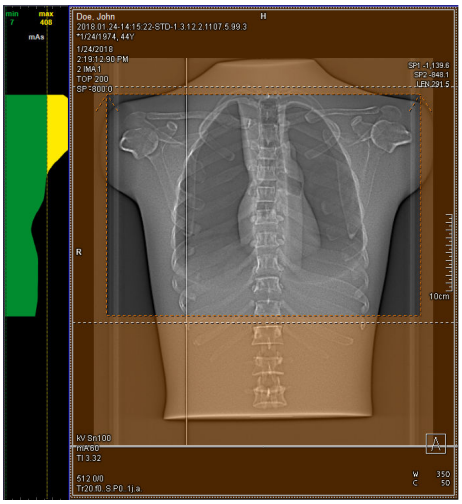
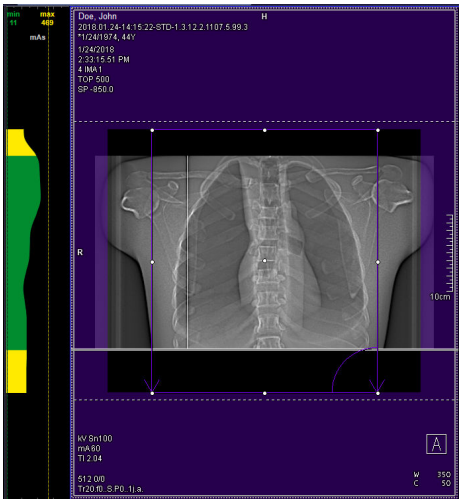
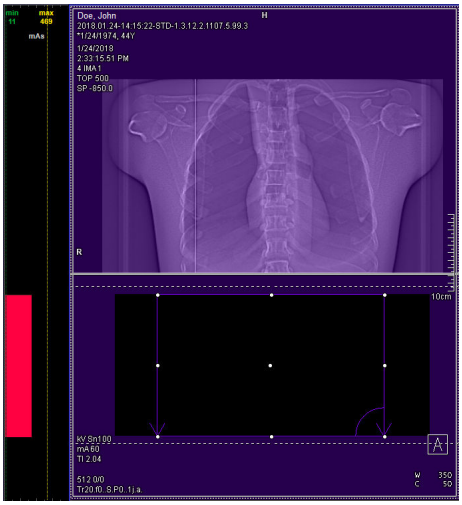
For scan modes with continuous table movement, such as for spiral ranges, the CARE Profile is displayed as a curve in z-direction along the topogram segment.

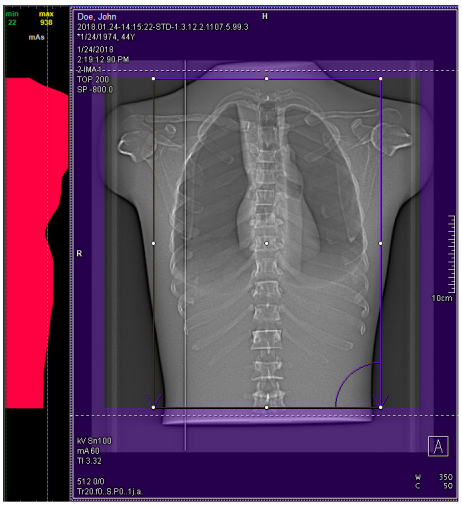
If the scan range, for which the CARE Profile is displayed, has a scan mode with discrete table positions, such as for sequence ranges, the displays the CARE Profile as bars.

The CARE Profile is displayed from the start position of the lowest table start position of a range to the highest table end position of a range.

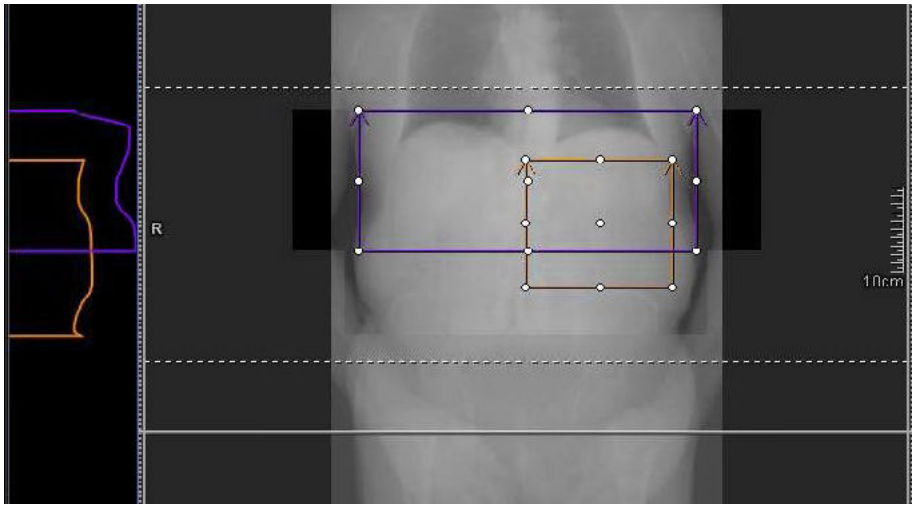
If only one range is selected, the CARE Profile is filled with a distinct color.

CARE Profile with topogram	
	If no conflict occurs, CARE Profile is green.
	The mAs slightly exceeds the system limits for some regions. Loading the scan range is recommended, since the impact on the image quality will be negligible. The CARE Profile peak will be lowered to the maximum possible mAs in this case.

CARE Profile with topogram	
	In case of an image quality conflict, the theoretically optimal tube current profile cannot be applied because it exceeds the maximum possible tube current. In the yellow areas in z-direction, the image quality may be reduced.
	If the topogram only partially covers the scan range, all uncovered parts are yellow. In the yellow areas in z-direction, the image quality may be reduced.
	The topogram does not cover the scan range at all.

CARE Profile with topogram	
	The tube cooling time exceeds 10 minutes.

If more than one range is selected, only the outlines of the CARE Profile are displayed in the color of the corresponding ranges:



CARE Profile of two recon ranges of two different scan ranges

When you click **GO** to load a range for scanning, only the CARE Profile for the tomogram range to be scanned next is displayed.

Configuring the display of the CARE Profile (optional)

The CARE Profile displays the dose to be applied along the z-axis of the patient. It is displayed next to the topogram for a selected range.

- In the **Display Options** field of the **Dose** tab card, select the **CARE Profile** checkbox to display the mAs profile in the topogram.

  – or –

  Deselect the **CARE Profile** checkbox if you do not want to display the mAs profile in the topogram.

If a conflict occurs, the CARE Profile appears, even if it is deactivated or if no license is available.

Configuring the display of the exposed range

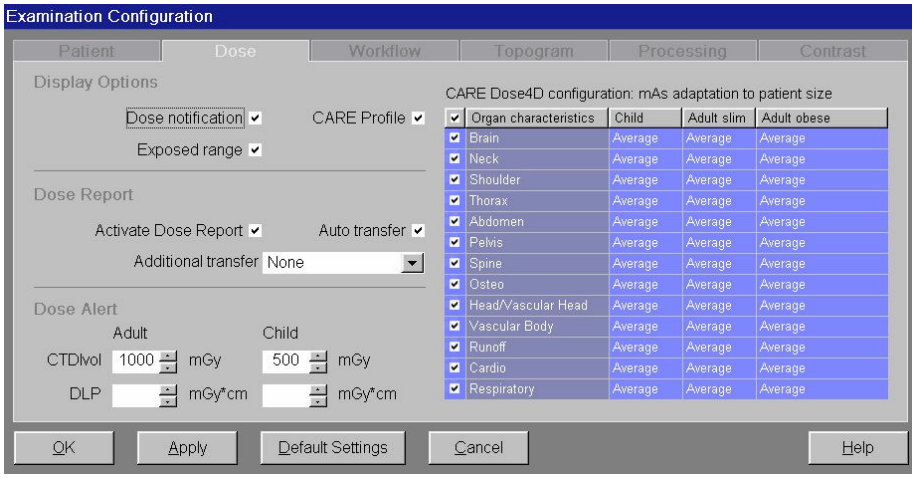
The exposed range is displayed as dashed orange lines on the topogram by default.

- In the **Display Options** field of the **Dose** tab card, deselect the **Exposed range** checkbox if you do not want to display the exposed range in the topogram.

Changes will be applied after you have restarted the system.

Configuring the display of the Dose Notification dialog box

The **Dose Notification** dialog box informs you if the notification values either for $CTDI_{vol}$ or DLP are exceeded. In the **Dose Notification** dialog box, you can enter a diagnostic reason for the exceedance.



- In the **Display Options** field of the **Dose** tab card, select the **Dose Notification** check box.

  To configure the notification values for **$CTDI_{vol}$** and **DLP** of the **Dose Notification**, see (➔ Page 209 *Setting the values for the Dose Notification*).

Configuring the dose alert values

The **Dose Alert** dialog box informs you if the accumulated dose of the examination exceeds the configured alert values either for **$CTDI_{vol}$** or **DLP** with the next scan range or the next scan ranges.

- In the **Dose Alert** field of the **Dose** tab card, configure the **$CTDI_{vol}$** and **DLP** alert values for **Adult** and **Child**. (➔ Page 202 *Checking the examination configuration parameters*)

In contrast to the **DLP**, the calculation of the accumulated **$CTDI_{vol}$** is specific to a z-position.

If no alert values are configured, the **Dose Alert** dialog box is not displayed.

For adapting the child-specific settings, see (→ Page 226 *Setting the dose alert values*).

Configuring the Dose Structured Report

You can configure the creation and the auto transfer of the dose report in the **Dose Report** field of the **Dose** tab card.

1 Select the **Activate Dose Report** checkbox to activate the automatic creation of the DICOM Dose Structured Report.

2 Select the **Auto transfer** checkbox to activate the automatic transfer of the dose report together with the image data, for example, to a DVD drive or network node.

3 In the **Additional transfer** selection list, select a network node to specify an additional destination node for the dose report.

5.2.2 Configuring limits and notification values

In the **Scan Protocol Assistant**, you can configure the dose-relevant limits and dose notification values.

The Siemens Healthineers default protocols provide the best compromise between optimizing image quality, scan time, and dose.

1 In the main menu, choose **Options > Configuration...**.

2 In the **Somaris/7 – Configuration Panel**, double-click the **Scan Protocol Assistant** icon.

If you are not familiar with the functionalities of the **Scan Protocol Assistant**, see (→ Page 241 *Modifying scan protocols*).

3 In the **Scan Protocol Assistant** dialog box, click the step **3** button.

4 In the upper area of the **Scan Protocol Assistant** dialog box, click the **Scan** button to open the **Scan** page.

5 Click the **Dose** tab card.

Setting the CARE kV limits

For individual scan ranges, certain kV values can be excluded if the CARE kV limits are configured.

- In the **CARE kV** selection list, select the minimum and maximum **kV** values for each scan, for example, **min. kV** = 80 kV; **max. kV** = 140 kV.

  The limits are displayed in the tooltip of the **kV** item on the **Scan** parameter card.

  CARE kV will select the tube voltage for an examination only within the configured CARE kV limits.

For scans within a CARE kV group with different limits, CARE kV selects the kV values within the defined limits for all scans of this CARE kV group. (➔ Page 214 *Adding scan ranges to a CARE kV group*)

If there is no appropriate value within these limits, the **Ref. kV** value will be used.

Do not select license-based kV values for **Ref. kV**, **min. kV**, or **max. kV** if you are using trial licenses. License-based kV values can be, for example, 70 kV, 90 kV, 110 kV, 130 kV.

If the license expires, these values are invalid. The relevant scan protocol entries cannot be executed.

For contrast enhanced scans, it is strongly recommended that you exclude the values of 150 kV or 150 kV Sn from the **max. kV** setting and use values below that. The use of the highest voltage settings leads to substantially reduced iodine contrast in the image.

Setting the CARE kV limits

For individual scan ranges, certain kV values can be excluded if the CARE kV limits are configured.

- In the **CARE kV** selection list, select the minimum and maximum **kV** values for each scan, for example, **min. kV** = 80 kV; **max. kV** = 140 kV.

  The limits are displayed in the tooltip of the **kV** item on the **Scan** parameter card.

  CARE kV will select the tube voltage for an examination only within the configured CARE kV limits.

For scans within a CARE kV group with different limits, CARE kV selects the kV values within the defined limits for all scans of this CARE kV group. (➔ Page 214 *Adding scan ranges to a CARE kV group*)

If there is no appropriate value within these limits, the **Ref. kV** value will be used.

For contrast enhanced scans, it is strongly recommended that you exclude the values of 150 kV or 150 kV Sn from the **max. kV** setting and use values below that. The use of the highest voltage settings leads to substantially reduced iodine contrast in the image.

Setting the values for the Dose Notification

For each scan, you can set the notification values either for **CTDI$_{vol}$** or **DLP** or for both.

When you select one or more scan protocols in the **Scan Protocol Assistant**, all corresponding scan ranges and monitoring ranges, when indicated, are also selected.

If you then set the notification values for the **Dose Notification**, the values are also applied for the monitoring ranges.

When loading the monitoring ranges for an examination, the $CTDI_{vol}$ is calculated for a defined number of monitoring scans, usually 30 scans. Therefore the **Dose Notification** dialog box opens unnecessarily.

Make sure to set the notification values only for diagnostic scans.

1 In the **Range name** column, deselect the check boxes of the monitoring ranges, where necessary.

2 In the **$CTDI_{vol}$** and **DLP** spin box of the **Dose Notification** field, set the notification values.

Effect of the Dose Notification values

If you load a scan range for which the configured notification values are exceeded, you will be notified:

- The $CTDI_{vol}$ and DLP values on the **Scan** and **Routine** parameter cards are marked yellow.
- The **Dose Notification** dialog box opens, if configured. (➔ Page 222 *Handling the Dose Notification*)

If no notification values are set, the **Dose Notification** is switched off. In this case, the **$CTDI_{vol}$** and **DLP** notification values on the **Scan** parameter card always retain their color and the **Dose Notification** dialog box is not displayed.

The Siemens Healthineers scan protocols are delivered without default notification values.

Setting the limits for FAST Adjust

Limits must be configured first to use FAST Adjust if the system limits are exceeded. Within these limits, the scan time can be increased or the **Eff. mAs** value can be reduced by using the Fully Automated Scanner Technology **FAST Adjust**. (➔ Page 219 *Using the Adjust button (optional)*)

1 In the **Upper limit max. scan time** spin box of the **FAST Adjust** field, set the maximum scan time for each scan range.

The maximum scan time can only be configured for non-cardiac spirals.

2 In the **Lower limit max. mAs** spin box of the **FAST Adjust** field, set the lower limit for the maximum mAs reduction (in %) from the peak value for each scan range.

The configured limits are displayed in the tooltip of the **Adjust** button. They are also displayed in blue in the **FAST Scan Assistant** dialog box.

If no limits for **FAST Adjust** are configured, the **Adjust** button will not be displayed.

Adapt the limits to the different kinds of examinations, for example, the maximum acceptable scan time for contrast scans.

(➔ Page 219 *Using FAST Adjust (optional) and FAST Scan Assistant*)

5.2.3 Activating password protection for the Dose Alert

You can activate password protection for the **Dose Alert** to allow only authorized persons to continue scanning in case the alert values are exceeded.

By default, password protection is deactivated.

1 In the main menu choose **Options > Service > Local Service...** to open the **Local Service** configuration.

  The **Authentication** window is displayed.

2 Delete all entries from the entry fields.

3 Click **OK**.

  The **Service Software** window is displayed.

4 Click the **Configuration** button.

5 Select the **Application** option.

6 In the **Dose Alert Password** field, enter a password.

7 Repeat the password in the field below.

8 Click **Save**.

  Password protection is activated.

If the **Dose Alert** dialog box appears during an examination, the configured password must be entered to continue scanning. Otherwise the scan range cannot be loaded.

The respective dose log file will document whether a password was configured or not.

5.2.4 Checking the parameter settings

After choosing a scan protocol from the selection list of the **Patient Model Dialog**, you can check and adapt the scan parameter settings in the parameter cards individually for each scan range.

Setting CARE Dose4D

Dose modulation provides constant image quality for all body sizes and body regions at an optimized dose. (➔ Page 191 *CARE Dose4D*)

- On the **Scan** parameter card, select the **CARE Dose4D** checkbox.

  After scanning the topogram, the average **Eff. mAs** value calculated by CARE Dose4D for the following scan is displayed on the **Routine** parameter card and the **Scan** parameter card.

Siemens Healthineers recommends to keep CARE Dose4D activated.

As soon as the scan is completed, this value will be updated to the mAs actually applied. The value may differ slightly due to the online modulation according to the angular attenuation profile of the patient.

If CARE Dose4D is deactivated, adapt the **Eff. mAs** manually.

CARE kV settings

If CARE kV is activated, the system automatically sets the appropriate **kV** and **Eff. mAs** settings. They optimize the applied dose while keeping the image quality constant (→ Page 193 *CARE kV*). The image quality is defined by the **Quality Ref. mAs** and the **Ref. kV**.

CARE kV is only available for scans with CARE Dose4D. For Dual Energy scans, CARE kV is not available.

CARE kV scanning is performed with a constant kV value (no online modulation of the voltage).

Activating CARE kV

For **CARE kV On**, an optimized **kV** value is automatically set by the system. This value is set within the limits configured in the **Scan Protocol Assistant** and based on the examination type defined by the setting of the **Dose Optimization** slider (→ Page 208 *Setting the CARE kV limits*) (→ Page 209 *Setting the CARE kV limits*).

✓ CARE Dose4D is activated.

◆ In the **CARE kV** selection list of the **Scan** parameter card, select **On**.

The **CARE kV** value is calculated for the next scan to be performed. This scan is indicated by a white triangle on the selected scan range.

If **CARE kV** is set to **On**, the values for **Eff. mAs** / **mAs**, **kV**, **CTDIvol**, and **DLP** are displayed on the parameter cards after CARE kV has been calculated for the current scan range.

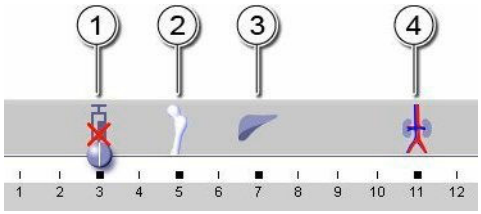
For repeated scans with **CARE kV On** or **CARE kV Semi**, always check the examination type.

If **CARE kV** is set to **Semi** or **On**, select the **FAST Window** checkbox on the **Recon** parameter card to automatically get the window values adapted.

Adjusting the examination type



1 Click the dose settings icon to open the **Dose Optimization** dialog box.



(1) **Non contrast**
(2) **Bone**
(3) **Soft tissue contrast**
(4) **Vascular**

2 In the **Dose Optimization** dialog box, drag the **Dose Optimization** slider with the mouse to the relevant examination type.

For contrast enhanced scans, ensure that the slider is set to a value higher than **3** (that is, to a position on the right-hand side of the **Non contrast** icon).

To move the slider, you can also use the arrow keys on your keyboard.

Setting the image quality

If you want to change the image quality, you can adapt the **Qual. Ref. mAs** value and the **Ref. kV** value.

1 In the **Qual. Ref. mAs** field, enter the value.

2 From the **Ref. kV** list, select the value.

For some examination types and patient sizes, CARE kV can set a higher kV value than the **Ref. kV** value.

For contrast enhanced scans, ensure that the slider is set to a value higher than **3**, which is to a position on the right-hand side of the **Non contrast** icon.

Setting the image quality

If you want to change the image quality, you can adapt the **Qual. Ref. mAs** and the **Ref. kV** value.

1 In the **Qual. Ref. mAs** spin box, set the value.

2 In the **Ref. kV** selection list, select the value.

For some examination types and patient sizes, CARE kV can set a higher kV value than the **Ref. kV** value.

For contrast enhanced scans, ensure that the slider is set to a value higher than **3** (that is, to a position on the right-hand side of the **Non contrast** icon).

Defining a kV value for follow-up examinations

You can select **CARE kV Semi** to scan with a defined **kV** value, for example, to perform a follow-up examination which requires the same kV setting as in the prior scan.

✓ CARE Dose4D is activated.

1 In the **CARE kV** selection list, select **Semi** to set a defined **kV** value.

2 In the **kV** selection list, select the **kV** value.

The **Eff. mAs** value is calculated depending on the examination type which is defined by the **Dose Optimization** slider.

For repeated scans with **CARE kV On** or **CARE kV Semi**, always check the examination type.

If **CARE kV** is set to **Semi** or **On**, select the **FAST** Window checkbox on the **Recon** parameter card to automatically get the window values adapted.

Adding scan ranges to a CARE kV group

You can add scan entries to a CARE kV group to set the same kV value for all scan ranges at once, for example, to perform a three-phase liver examination.

✓ CARE kV is set to **On**.

✓ All scan entries have the same **Ref. kV** value.

✓ At least one value of the interval between **min. kV** and **max. kV** configured in the **Scan Protocol Assistant** must match. Otherwise the scan range cannot be added. See (➔ Page 208 *Setting the CARE kV limits*) (➔ Page 209 *Setting the CARE kV limits*).

1 In the chronicle, right-click the scan entries to be grouped.

2 In the context menu of these scan entries, choose **Add to CARE kV group**.

Scan entries belonging to a CARE kV group are marked by a chain symbol in the chronicle.

All scan ranges which are added to a CARE kV group are scanned with the same kV value while the other settings are kept.

Copied or repeated scan entries within a CARE kV group are automatically a member of this group.

For a scan range which is added to a CARE kV group, **CARE kV On** is set automatically.

Via the context menu, you can also remove a scan entry from the CARE kV group.

Setting scan parameters for post-processing applications

If you use one of the following post-processing applications, observe the specific recommendations:

(➔ Page 215 *Calcium Scoring*)

(➔ Page 215 *NeuroDSA and NeuroPBV*)

(➔ Page 215 *Follow-up*)

(➔ Page 215 *LungCAD*)

(➔ Page 215 *Colon PEV*)

Calcium Scoring

For an Agatston-equivalent calcium score, perform a cardiac scan with the following settings:

- Slice thickness: 3.0 mm
- Increment: 1.5 mm
- Kernel: Qr36 at a tube voltage of 120 kV (➔ Page 215 *Qr36 kernel*)

  Or, optionally, use the voltage-independent kernel Sa36 (Artifical120). (➔ Page 215 *Sa36 kernel (Artifical120)*)

Qr36 kernel

When using **CARE kV** in combination with the Qr36 kernel, ensure to set the CARE kV limits for **min. kV** and **max. kV** to 120 kV in the Scan Protocol Assistant. (➔ Page 208 *Setting the CARE kV limits*) (➔ Page 209 *Setting the CARE kV limits*)

Sa36 kernel (Artifical120)

The Series description of Artifical120 recon jobs adds the suffix **Artifical120**. On reconstructed Artifical120 images, the label **Artifical120** is displayed in the image comment area.

Series that were reconstructed using the Artifical120 kernel cannot be loaded into the Dual Energy postprocessing application.

When using **CARE kV** in combination with the Sa36 kernel, ensure to set the CARE kV limits for **min. kV**, for example, to 70 kV and the **max. kV** to 130 kV in the Scan Protocol Assistant. (➔ Page 208 *Setting the CARE kV limits*) (➔ Page 209 *Setting the CARE kV limits*)

In the **Dose Optimization** dialog box, set the slider to **Bone** (**4**). (➔ Page 212 *Adjusting the examination type*)

NeuroDSA and NeuroPBV

When using **CARE kV**, make sure that both the CTA and the non-contrast scan are grouped in a CARE kV group (chain symbol) (➔ Page 214 *Adding scan ranges to a CARE kV group*).

Follow-up

For a reliable follow-up comparison of volumetric or density measurements between two time points, perform these scans with the same kV setting as that from the prior.

LungCAD

You can achieve an optimized performance with a tube voltage of 120 kV.

KV settings that differ from settings ranging from 120 kV to 140 kV may influence the performance of the LungCAD algorithm with regard to sensitivity or specificity.

Colon PEV

For scans without intravenous contrast, use a standard exposure for supine and prone position of at least 50 mAs and 30 mAs respectively.

When using **CARE kV**, make sure to set the CARE kV limits for **min. kV** and **max. kV** in the Scan Protocol Assistant to 120 kV (➔ Page 208 *Setting the CARE kV limits*) (➔ Page 209 *Setting the CARE kV limits*).

You can achieve an optimized resolution with the following settings:

- Collimation: ≤ 1 mm
- Slice width of ≤ 1 mm with 30% overlap
- Kernel: Br38/Br34 for supine data, Br32 for prone data

Setting the reconstruction parameters for SAFIRE / ADMIRE

Use an appropriate reconstruction technique like the Sinogram Affirmed Iterative Reconstruction (SAFIRE) or the Advanced Modeled Iterative Reconstruction (ADMIRE), if available.

◆ On the **Recon** parameter card, select the **SAFIRE** or **ADMIRE** checkbox.

Avoid submillimeter slices. Select thicker slices, smoother kernels and wider windowing to reduce image noise, and in return to reduce dose if scan parameters are changed for future examinations.

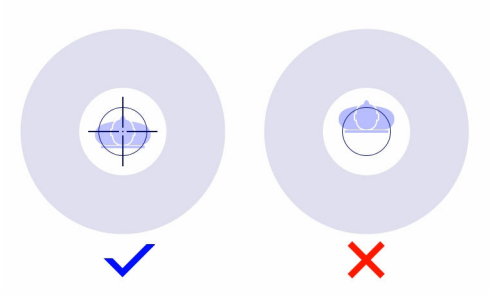
5.2.5 Positioning the patient

◆ Replace defective accessories with new original accessories immediately. Refer to (➔ Page 36 *Accessories*).

For adapting the child-specific settings, see (➔ Page 226 *Positioning the patient*).

Centering the patient

1 For optimum image quality and dose application to patient size and body shape with CARE Dose4D, position the patient in the isocenter of the gantry.



2 Double-check and verify the position of the patient with the laser lightmarker as well as in the topogram.

If the patient is positioned too high, the mAs for the subsequent scan is increased.

If the patient is positioned too low, the mAs for the subsequent scan is reduced and the images show increased noise.

For head scans with **Auto Isocenter**, you may be prompted to raise or lower the patient table. This has no impact on the dose modulation with CARE Dose4D.

Positioning the arms of the patient

- For optimum CARE Dose4D utilization, position the arms of the patient for thorax and body scans on the head-arm support.

5.2.6 Acquiring a topogram

If you are not familiar with the basic functionalities of acquiring a topogram, see (→ Page 308 *Acquiring a Topogram*).

If there is no topogram, CARE Dose4D and CARE kV cannot be activated.

1 From the **Specials** folder of the **Patient Model Dialog**, select an **Sn** topogram protocol, if available.

The availability of Tin Filter protocols depends on the system configuration and the purchased licenses.

2 Scan a topogram.

- If more than one topogram from the same tube position is available, the most recent one will be used to determine the **Eff. mAs** within its range. Outside the range of the most recent topogram, older topograms are also taken into account.

  If two topograms from different tube positions are available, for example, AP and lateral, both topograms will be used to determine the **Eff. mAs**.

  The calculated **Eff.mAs** value for both topograms takes a correction of the patient position into account and corresponds to the **Eff.mAs** value for one topogram with the isocentrical position of the patient.

- If the scan range exceeds the topogram range, the **Eff. mAs** value which was calculated at the last position of the topogram will be used.

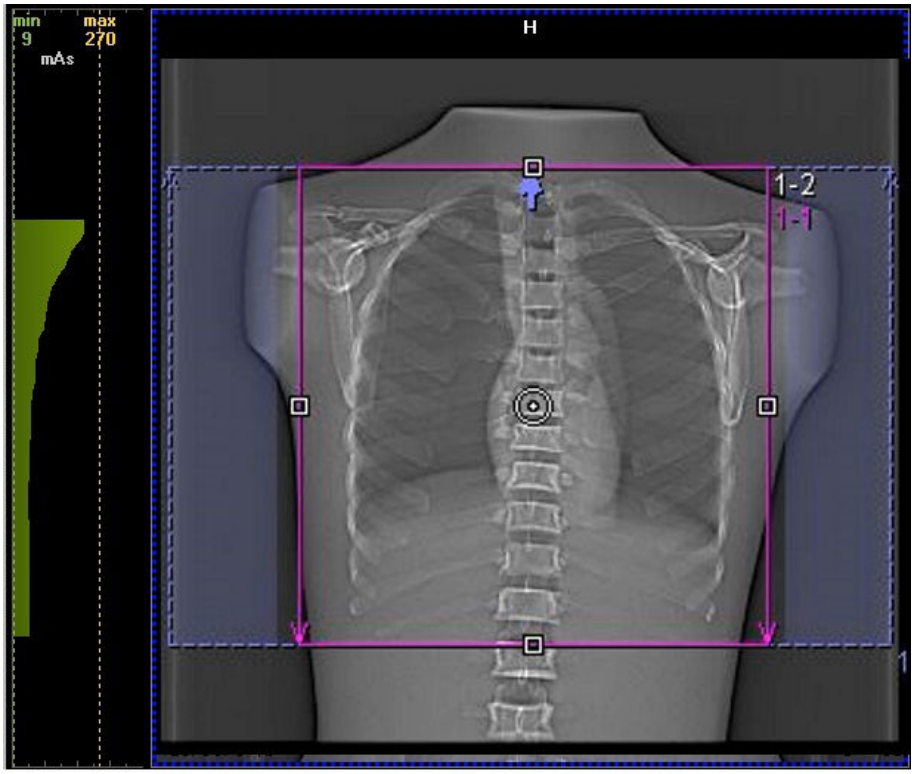
Avoid repositioning of the patient on the patient table and excessive motion of the patient between the topogram and the scan.

Best image quality is achieved when using protocols with CARE Dose4D for the body regions they are designed for. Use child protocols for children.

Check that the organ characteristic, which is displayed in the **Scan** parameter card, matches the scan to be performed.

Always check whether the scan range settings by FAST Planning are reasonable. (→ Page 311 *Using recon planning for spirals*)

If configured in the **Examination Configuration** dialog box, the **CARE Profile** is displayed to the left of the topogram. (➔ Page 206 *Configuring the display of the CARE Profile (optional)*)



The CARE Profile shows the distribution of the dose to be applied along the z-axis of the patient for a selected scan range. The system limits for the maximum possible mAs are displayed.

Depending on the examination, for example, Sequence, Spiral, or cardiac scan, the CARE Profile may look different. For a cardiac scan, the mean **mAs** for the whole scan range is displayed.

5.2.7 Handling parameter conflicts

A conflict occurs in the following situations:

- The system limits are exceeded.
- The amount of exceedance affects the dose to be applied or the image quality.

In case of a conflict, the CARE Profile may be displayed in the following colors:

- Green CARE Profile with green-striped peak
- Green CARE Profile with yellow peak
- Yellow CARE Profile

The area of the CARE Profile which exceeds the limits is colored depending on the amount of the exceedance.

If a conflict occurs, the CARE Profile appears, even if it is deactivated or if no license is available. (➔ Page 206 *Configuring the display of the CARE Profile (optional)*)

Green CARE Profile with green-striped peak



The mAs, which is calculated by CARE Dose4D and which is needed for achieving an appropriate image quality, slightly exceeds the system limits for some regions.

Loading is recommended since the impact on the image quality will be negligible. The peak of the CARE Profile will be lowered to the maximum possible mAs in this case.

Green CARE Profile with yellow peak



The mAs which is needed for some regions of the scan exceeds the limits of the system.

There are two possibilities to continue scanning:

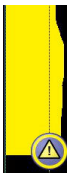
- Load the scan.

  The peak of the CARE Profile will be lowered to the maximum possible mAs. The image quality may be reduced in this area.

- Click the **Adjust** button to resolve the conflict. (➔ Page 219 *Using the Adjust button (optional)*)

  The scan time will be increased within the limits configured in the **Scan Protocol Assistant**. (➔ Page 210 *Setting the limits for FAST Adjust*)

Yellow CARE Profile



The mAs which is needed for the scan exceeds the limit of the system. Loading of the scan range is not possible. The scan range is invalid.

Adapt the scan parameters. (➔ Page 219 *Using the Adjust button (optional)*), (➔ Page 221 *Using the FAST Scan Assistant*)

CAUTION

The quality reference parameters exceed the system limit for CARE Dose 4D!

The *mAs* curve of the topogram turns yellow in the respective area. Locally increased image noise.

- Adjust the scan parameters to allow for a higher mAs value.
- Modify scan time, pitch, or rotation time.
- Adapt the injection protocols, if necessary.

Using FAST Adjust (optional) and FAST Scan Assistant

If a conflict occurs, the **Adjust** button (optional) and the **FAST Scan Assistant** can be displayed.

The **Adjust** button is displayed if the peak of the CARE Profile or the whole CARE Profile is yellow. The **FAST Scan Assistant** is only displayed if the whole CARE Profile is yellow.

With **FAST Adjust** and the **FAST Scan Assistant**, scan parameter conflicts can be resolved automatically.

Using the Adjust button (optional)

If the system limits are exceeded, the **Adjust** button is displayed on the bottom of the chronicle.

The tooltip of the **Adjust** button displays the limits for scan time and the maximum mAs decrease configured in the **Scan Protocol Assistant**. (➔ Page 210 *Setting the limits for FAST Adjust*)

✓ The limits for **FAST Adjust** are configured in the **Scan Protocol Assistant**.

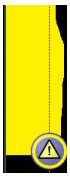
✓ The scan parameters are adjustable within the configured limits.

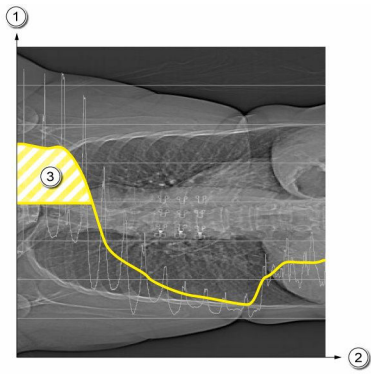


◆ Click the **Adjust** button to resolve the conflict automatically.

The values are automatically adapted within the limits configured in the **Scan Protocol Assistant**.

If the **Adjust** button is clicked, the tooltip displays the adjusted values.

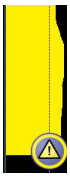
Color of the CARE Profile	Reducing or solving the conflict
	If only the peak of the CARE Profile is yellow, the scan time will be increased until the conflict is resolved or the configured limit is reached.
	If the whole CARE Profile is yellow, first the scan time will be increased until the conflict is resolved. If increasing the scan time is not sufficient to resolve the conflict, the **Eff. mAs** will be additionally decreased until the conflict is resolved or the configured limit is reached. For example, the system allows for a **Eff. mAs** of 600 mAs, and the configured limit allows for a decrease of up to 25%. Then the **Eff. mAs** will be decreased until the conflict is resolved or until the lower limit of 450 mAs is reached. The mAs is only decreased for areas where system limits would be exceeded. Otherwise the mAs remains unchanged.



(1) mAs
(2) Z-direction
(3) Decrease of the mAs if the system limits are exceeded

As long as an adjusted scan range is not scanned, you can revoke the adaptations by clicking the **Adjust** button again.

Using the FAST Scan Assistant

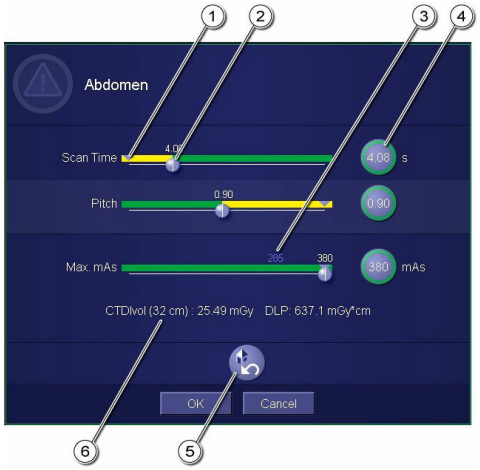


If a cooling or a scan parameter conflict occurs, the **FAST Scan Assistant** button is displayed. The invalid scan ranges and scan parameters are indicated in yellow in the parameter cards.

With the **FAST Scan Assistant**, you can check and change the settings made by the **Adjust** button.



1 Click the **FAST Scan Assistant** button to open the **FAST Scan Assistant** dialog box.



(1) Original value
(2) Currently set value
(3) Configured limit for the **Adjust** button
(4) Value which resolves the conflict
(5) **Undo** button
(6) Dose descriptors



If the system requires cooling time, a clock icon indicates the remaining cooling time in the **FAST Scan Assistant** dialog box.

The limits for **Scan Time** increase and **Max. mAs** decrease of **FAST Adjust**, which are configured in the **Scan Protocol Assistant**, are displayed above the sliders. (➔ Page 210 *Setting the limits for FAST Adjust*)

If a slider is positioned in the green zone, the scan parameter is valid and scannable. As long as one of the sliders is positioned in the yellow zone, the scan is invalid.

The buttons on the right-hand side display the values which resolve the conflict for the corresponding slider by either increasing the scan time or decreasing the maximum mean mAs. Clicking one of the buttons changes the value of the corresponding slider.

For Dual Energy scans, only a maximum mAs slider for tube A is displayed in the **FAST Scan Assistant** dialog box. The maximum mAs settings of tube B are adapted correspondingly.

2 Adapt the scan parameters such that they are suitable for the patient and the examination.

To move the sliders manually, you can also use the arrow keys on the keyboard.

3 Click **OK**.

The **FAST Scan Assistant** dialog box is closed.

If the conflict is resolved, you can load the scan.

As long as an adjusted scan range is not scanned, you can revoke the adaptations by clicking the **Undo** button in the **FAST Scan Assistant** dialog box.

In the following cases, the changes by **FAST Adjust** and the **FAST Scan Assistant** for maximum mAs decrease are automatically revoked:

- CARE Dose4D has been activated or deactivated in the **Scan** parameter card.
- The **Eff. mAs** or the **mAs** value has been manually changed in the **Scan** parameter card.
- ECG Pulsing has been activated or deactivated in the **Trigger** parameter card.

Handling the Dose Notification

If you load a scan range for which the configured notification values are exceeded, you will be notified:

- The $CTDI_{vol}$ and DLP values on the **Scan** and **Routine** parameter cards are marked yellow.
- The **Dose Notification** dialog box opens, if configured.

1 Check if the scan parameters are suitable for the examination.

2 Continue a scan without correcting the exceeded scan parameters only if clinically justifiable.

If the **Dose Notification** dialog box opens, enter the **Diagnostic reason** (optional).

After confirming the **Dose Notification**, the exceedance of the dose parameters will be documented in the folder `H:\SiteData\DoseLogs` including the following information:

- Type (Dose Notification)
- Date and time
- Patient ID
- Diagnostic reason
- Scan range name
- Actual $CTDI_{vol}$ and $CTDI_{vol}$ notification value
- Actual DLP and DLP notification value

You are responsible for creating backups of the dose log files.

Use a calculator program, for example Microsoft Excel, to open a dose log file for a structured display of the content.

Handling the Dose Alert

If you are loading a scan for which the accumulated $CTDI_{vol}$ at any z-position or the accumulated DLP for the next scan range exceeds the alert values configured in the **Examination Configuration**, the **Dose Alert** dialog box will be displayed.

CAUTION

Changed scan parameters are unsuitable!

Dose not as desired.

◆ Verify the changed scan parameters before scanning.

1 Check if the current scan parameters are suitable for the examination.

2 Continue a scan without correcting the exceeded scan parameters only if clinically justifiable.

In this case, enter your **User name** (mandatory) and the **Diagnostic reason** (optional) into the **Dose Alert** dialog box.

3 If password protection is activated, enter the configured password to continue scanning.

Otherwise the scan range cannot be loaded. See (➔ Page 211 *Activating password protection for the Dose Alert*).

After confirming the **Dose Alert**, the scan continues until the next scan range that exceeds the configured alert values is reached.

4 Repeat steps 1 to 3.

In examinations that have a clinical requirement to exceed the alert value and where a repeated acknowledgment of the **Dose Alert** dialog box would severely affect the workflow, for example, interventional examinations, you may activate the **Do not show again for the remaining examination** check box as an exception.

After confirming the **Dose Alert**, the scan protocol can no longer be saved.

The exceedance of the dose parameters will be documented in the folder `H:\SiteData\DoseLogs` including the following information:

- Type (Dose Alert)
- Date and time
- Patient ID
- User name
- Diagnostic reason
- Actual $CTDI_{vol}$ and $CTDI_{vol}$ alert value
- Actual DLP and DLP alert value
- Configuration of password protection

You are responsible for creating backups of the dose log files.

Use a calculator program, for example Microsoft Excel, to open a dose log file for a structured display of the content.

5.2.8 Viewing the dose documentation

The applied dose can be documented in the Patient Protocol and in the DICOM Dose Structured Report for each scan.

Viewing a Patient Protocol

If configured, the system creates the Patient Protocol at the end of an examination.

The automatic creation of the Patient Protocol and the **Auto filming** function is set in the **Examination Configuration** dialog box.

◆ To view the Patient Protocol, load it into *syngo* **Viewing**.

If you click the **Hide Graphics** icon on the **Filming** task card, you also hide the Patient Protocol.

Viewing a DICOM Dose Structured Report

If configured, a Dose SR is generated automatically according to the DICOM standard for archiving and evaluation purposes at the end of an examination (→ Page 208 *Configuring the Dose Structured Report*). The Dose SR cannot be modified.

✓ The *syngo* Structured Report (SR) Viewer is installed.



◆ Double-click the icon in the content area of the Patient Browser to view the dose report in the *syngo* SR Viewer.

The complete information of the dose report is listed in the *syngo* SR Viewer despite the converse note displayed in the header line of the report.

5.3 Considerations for pediatric scanning

For the description of a basic dose-optimized workflow, see (→ Page 202 *Performing a dose-optimized workflow*). In the following chapter you will find the settings which must be taken into account for dose-optimized scanning of children.

Anatomical and physiological differences between children and adults require special attention when imaging pediatric patients. Image quality requirements are different, because of smaller structures, as well as higher heart rates and difficulties in cooperating during the scan, to name just a few reasons.

Adjusting imaging parameters is important to meet image quality requirements and in addition is essential to reduce dose as children are more sensitive to radiation than adults. The smaller the cross section of the patient, the higher the radiation dose that is actually absorbed.

Nevertheless, computed tomography imaging is of great importance for the treatment of pediatric patients, especially for complex lung imaging, for the treatment of congenital malformations, and in intensive care.

As a consequence, the ALARA principle (As Low As Reasonably Achievable) is of particular importance in pediatric patients. It calls for always selecting the dose that is as low as possible, yet sufficient for a reliable diagnosis.

Adjust the dose for each individual scan carefully to achieve the necessary image quality. Scans with lower radiation dose may have higher image noise, but deliver diagnostic image quality.

The $CTDI_{vol}$ and DLP for pediatric head scans are reported in the 16-cm CTDI phantom.

The $CTDI_{vol}$ and DLP for pediatric body scans are reported in the 32-cm CTDI phantom.

5.3.1 Characteristics of child protocols

For CT examinations of children, Siemens Healthineers offers special child protocols in combination with accurate dose modulation.

You can access child protocols in the **Patient Model Dialog**. Based on the entered patient birth date or age, child protocols are automatically displayed in the **Patient Model Dialog** if the age of the patient is equal to or below the maximum child age. The default value for the maximum child age is 11 years. Child protocols incorporate features and optimized parameters at appropriate dose levels.

- Dose modulation parameters for CARE Dose4D dedicated to children
- Special kernels for head examinations (Hp38)
- Faster rotation times to shorten scan times and to reduce motion artifacts
- 70 kV (optional), for some protocols, for higher contrast-to-noise ratio, and lower dose level

The **Quality Reference mAs** for CARE Dose4D is defined for a patient weighing 70 kg to 80 kg, even for child protocols. Based on this value, the system adapts the **Eff. mAs** to the size and shape of the current patient.

5.3.2 Checking the examination configuration parameters

1 In the **Options** menu, choose **Configuration**.

2 In the **Somaris/7 – Configuration Panel**, double-click the **Examination** icon.

Adapting the dose to the patient size

You can adapt the settings of the CARE Dose4D adaptation strength separately for children.

For **Child**, the Siemens Healthineers default settings for the CARE Dose4D adaptation strengths are **Average** for all organ characteristics.

1 In the **Examination Configuration** dialog box, click the **Dose** tab card.

2 In the selection lists for **Child** of the field **CARE Dose4D configuration: mAs adaptation to patient size**, select a CARE Dose4D adaptation strength, if necessary.

Setting the dose alert values

You can set the **Dose Alert** values separately for children.

The **Dose Alert** dialog box informs you if the alert values for **$CTDI_{vol}$** or **DLP** are exceeded for the whole examination.

1 In the **Examination Configuration** dialog box, click the **Dose** tab card.

2 In the **Dose Alert** field for **Child**, set the **$CTDI_{vol}$** and **DLP** alert values.

In contrast to the **DLP**, the calculation of the accumulated **$CTDI_{vol}$** is specific to a z-position.

If no alert values are configured, the **Dose Alert** dialog box is not displayed.

Adapting the maximum child age

1 In the **Examination Configuration** dialog box, click the **Patient** tab card.

2 In the **Max. child age** spin box of the **Patient Data** field, set the maximum age.

The default value for the maximum child age is 11 years.

The **Child** option is automatically selected when opening the **Patient Model Dialog** if a corresponding patient has been registered.

5.3.3 Positioning the patient

You can position babies comfortably and securely on the patient table by using the baby mattress (pediatric cradle). (➔ Page 132 *Pediatric cradle*).

- For infants and small children, use the baby mattress (pediatric cradle).

5.4 Considerations for Cardiac CT

For the description of a basic dose-optimized workflow, see (➔ Page 202 *Performing a dose-optimized workflow*). In the following chapter you will find the settings which must be taken into account for dose-optimized Cardiac CT scanning.

5.4.1 Initial situation and scan mode

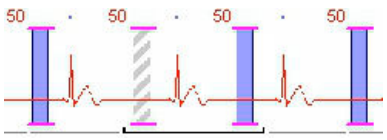
SOMATOM Force provides the following Cardiac CT modes:

- Turbo Flash Spiral Cardiac
- ECG-triggered sequence
- ECG-gated spiral
- BiSegment spiral

Initial situation	Recommended scan mode
• Regular sinus rhythm • Low to moderate heart rate • Limited variance	• Turbo Flash Spiral Cardiac (➔ Page 232 *Scanning with Turbo Flash Spiral Cardiac*)
• Regular sinus rhythm • Moderate to high heart rate • Increased variance • Several ectopic beats	• ECG-triggered sequence (➔ Page 227 *Scanning a prospectively ECG-triggered sequence*)
• High to very high heart rate • Very irregular heart rate, which needs a high flexibility in reconstruction up to editing the ECG	• ECG-gated spiral (➔ Page 230 *Scanning a retrospectively ECG-gated spiral*)

5.4.2 Scanning a prospectively ECG-triggered sequence

Prospective ECG triggering combined with step-and-shoot acquisition of axial slices acquires the appropriate amount of scan data needed for image reconstruction during the previously selected heart phase. The ECG signal of the patient is monitored during examination, and axial scans are started with a pre-defined time offset relative to the R-waves. Irregularities are reliably detected, and in case of an ectopic beat, the scan is repeated at the same position.



The patient table moves the patient to the first z-position. The scan is triggered depending on the ECG. Then the patient is moved to the next z-position. The procedure is repeated until the range to be scanned is completed.

For low heart rates up to moderate heart rates, the optimum time point for data acquisition is in the end-diastolic phase at a heart phase of approximately 70%.

Using the Adaptive Cardiac Sequence

For the Adaptive Cardiac Sequence, the trigger timing for a scan is prospectively estimated based on the preceding three cardiac cycles.

If not activated by default, you can activate the Adaptive Cardiac Sequence mode in the **Scan Protocol Assistant** (➔ Page 366 *Activating the Adaptive Cardiac Sequence mode*).

Defining the scan range

Define the start and end phase of the scan.

◆ On the **Trigger** parameter card, enter the values in the **Scan** entry fields for the start and end phase of the scan.

Defining the recon range

For an Adaptive Cardiac Sequence scan with Dual Energy, you can choose between the following recon ranges:

- **quick plus** (95° reconstruction) for vessel evaluation: Only one image series, which consists of a mixture of both spectra, is reconstructed.
- **quick** (180° reconstruction) for vessel evaluation: Both spectra are separately reconstructed.
- **full** (360° reconstruction) for Heart PBV (Perfused Blood Volume) evaluation: Both spectra are separately reconstructed.

✓ The **Trigger** parameter card is open.

◆ From the **Recon** list, select the reconstruction mode.

Setting the acquisition angle

For an Adaptive Cardiac Sequence with Dual Energy, you can define the extent of the scan and pulsing window by setting the acquisition angle.

✓ The **Scan Protocol Assistant** is open.

✓ The **Trigger** page of step **3** is displayed.

1 For a wide scan and pulsing window, select **360** from the **Acquisition Angle** selection list.

The scan will be acquired with higher dose.

2 If a narrow scan and pulsing window is sufficient, select **180** from the **Acquisition Angle** selection list.

The scan will be acquired with lower dose.

Using ECG Pulsing

You can combine the Adaptive Cardiac Sequence with ECG Pulsing for individually defining the time points for the acquisition (**Range**) as well as the high dose level (**Pulsing**) used for ECG Pulsing.

Automatic definition of the scan and ECG Pulsing ranges

You can set the **auto** mode on the **Trigger** parameter card, to use the predefined values of the configuration.

These predefined values are determined by a heart rate type in combination with a variability type of the heart rate. These values are configured in the **Auto Trigger** tab of the **HeartView Configuration** dialog box.

The **auto** mode is suitable for all types of heart rates (**Low**, **Moderate**, **High**) and variabilities (**Regular**, **Unstable**, **Arrhythmic**).

In **auto** mode, scan ranges and pulsing ranges are identical. You can define a separate window for functional imaging.



- On the **Trigger** parameter card, from the **Scan** list, select **auto** to use the predefined values of the configuration.

Manual definition of the scan and ECG pulsing ranges

1. On the **Trigger** parameter card, from the **Scan** list , select **manual**.
2. From the **Unit** list, select **ms** or **%**.
3. In the **Range** fields, enter the values for the scan window.
4. In the **Pulsing** fields, enter the values for the pulsing window.

If you enter a positive value in ms, the scan window and the pulsing window stay constant. Therefore, heart rate variances do not lead to an extension of the scan window or the pulsing window.

Setting the reconstruction time point

The **Phase Start** value of 70% RR (diastolic phase) is set as a default value in the standard protocols.

Setting Phase Start

From the **BestPhase** list, if you select **manual**, the following applies:

1. In the **Unit** selection list of the **Trigger** parameter card, select **ms** (absolute delay) or **%** (relative delay) as the trigger unit.
2. In the **Phase Start** spin box, set the recon delay, if necessary.

Setting Cardio BestPhase

Cardio BestPhase is used to identify the best diastolic or best systolic phases for image reconstruction.

The determined best phase represents the optimum image quality in the systolic phase (0-50% RR) or in the diastolic phase (50-100% RR).

- On the **Trigger** parameter card, from the **BestPhase** list, select **auto** to allow the system to select whether the systolic phase (**BestSyst**) or the diastolic (**BestDiast**) phase will be used for the BestPhase reconstruction.

  – or –

  Manually select **BestSyst** or **BestDiast**.

If the scan has started and irregular heartbeats are detected, a message in the ECG trigger field is displayed and that the scan is repeated.

5.4.3 Scanning a retrospectively ECG-gated spiral

In the spiral mode, data acquisition continuously proceeds while the patient table is moving forward with a constant pitch.

Due to the continuous data acquisition, the spiral mode allows maximum flexibility for data reconstruction. If necessary, you can also edit the ECG in this mode for challenging patients.

Since, compared with non-gated spirals, the pitch depends on the heart rate of the patient, very low pitch values of approximately 0.2 are needed. This may be at the expense of a higher radiation dose.

To alleviate this effect, the tube current should be modulated with ECG Pulsing and MinDose depending on the current heart phase.

Using ECG Pulsing

ECG Pulsing reduces the applied dose down to 25% of the nominal current.

Use ECG Pulsing if you want to perform a functional analysis on the reconstructed images, and a functional image impression based on a reduced dose level is acceptable.

Automatic definition of the ECG Pulsing ranges

You can set the **auto** mode on the **Trigger** parameter card, to use the predefined values of the configuration.

These predefined values are determined by a heart rate type in combination with a variability type of the heart rate. These values are configured in the **Auto Trigger** tab of the **HeartView Configuration** dialog box.

The **auto** mode is suitable for all types of heart rates (**Low**, **Moderate**, **High**) and variabilities (**Regular**, **Unstable**, **Arrhythmic**).

- On the **Trigger** parameter card, from the **Pulsing** list, select **auto** to use the predefined values of the configuration.



Manual definition of the ECG pulsing ranges

1 On the **Trigger** parameter card, from the **Pulsing** list, select **manual**.

2 From the **Unit** selection list, select **ms** or **%**.

3 In the **Range** fields, enter the values for the scan window.

4 In the **Pulsing** fields, enter the values for the pulsing window.

If you enter a positive value in ms, the scan window and the pulsing window stay constant. Therefore, heart rate variances do not lead to an extension of the scan window or the pulsing window.

For scanning patients with high heart rate variances, you can set the positive absolute delay values in the systolic phase (Range setting: 300 – 400 ms) for the pulsing window. This will ensure accurate triggering of the scan at a high dose in the systolic phase without an increase in patient dose.

The reconstruction has to be performed in ms in every setting of Cardio BestPhase as well.

Using MinDose

MinDose reduces the applied dose down to 4% of the nominal current. On average, around 20% of the dose can be reduced compared to the normal ECG pulsing setting.

Use MinDose if you do not want to perform a functional analysis on the reconstructed images.

- In the **ECG Pulsing** selection list of the **Trigger** parameter card, select **MinDose - manual** to define the start and the end point in the diastolic phase.

  – or –

  In the **ECG Pulsing** selection list, select **MinDose - auto** to activate the automatic dose modulation.

Adapting the pitch

The automatic pitch adaptation is set by default. This mode is activated when the estimated heart rate (**Est. HR**) is set to **auto**.

Select a manual pitch adaptation with the estimated heart rate only if clinically indicated, for example, in case of bigeminus, or if the heart rate decreases by about 10 beats during the breath-hold command.

Setting the reconstruction time point

The **Phase Start** value of 70% RR (diastolic phase) is set as a default value in the standard protocols.

Setting Phase Start

1 In the **Unit** selection list of the **Trigger** parameter card, select **ms** (absolute delay) or **%** (relative delay) as the trigger unit.

2 In the **Phase Start** spin box, set the recon delay, if necessary.

For sequences, enter the time when the scan shall be started.

For spirals, enter at which time the raw data is selected for reconstruction.

- For an absolute delay, use **ms**.
- For a percentage delay, use **%**.

Setting Cardio BestPhase

Cardio BestPhase is used to identify the best diastolic or best systolic phases for image reconstruction.

The determined best phase represents the optimum image quality in the systolic phase (0-50% RR) or in the diastolic phase (50-100% RR).

◆ On the **Trigger** parameter card, from the **BestPhase** list, select **auto** to allow the system to select whether the systolic phase (**BestSyst**) or the diastolic (**BestDiast**) phase will be used for the BestPhase reconstruction.

– or –

Manually select **BestSyst** or **BestDiast**.

5.4.4 Scanning with Turbo Flash Spiral Cardiac

Data acquisition is performed with an ECG-triggered high-pitch spiral for the whole heart during the diastolic phase within one cardiac cycle.

Due to the high pitch of 3.4, only as much data as needed is acquired for reconstructing a dual source image at the separate slice positions. The heart phase is slightly moved from slice position to slice position.

The **Phase Start** value is fixed in the diastolic phase at 65% by default. You can only change the value in the **Scan Protocol Assistant**.

With Turbo Flash Spiral Cardiac, you can scan patients with a regular heart rate of 62 ± 2 beats per minute (bpm) and below.

Performing FlashCheck

The data acquisition for an ECG-triggered Turbo Flash Spiral Cardiac scan must be timed correctly.

For a typical scan length of 12 cm, the scan takes approximately 280 ms. Therefore, an exact prediction of the upcoming two heart cycles is necessary, since the patient table requires around 1 s to accelerate to the required speed.

FlashCheck is mandatory and cannot be ignored. Perform a FlashCheck test before adapting the scan parameters. Consider the results before you perform the scan.

You can repeat FlashCheck as often as you want.

1 Select a Turbo Flash Spiral Cardiac range.



2 Click the **FlashCheck** button to start the first test step.

FlashCheck checks whether the heart rate is regular. A white shutter in the topogram indicates the area of potential motion.

The scan data may contain motion artifacts when the acquisition starts before 65% RR, or if it extends beyond the 85% RR interval with a heart rate higher than 70 bpm.

On the **Trigger** parameter card and in the chronicle, you can see if the current ECG and the area of potential motion are applicable for the scan.

Color	Meaning
Green	The ECG is applicable for scanning. The heart rate is regular.
Red	The ECG is not applicable for scanning. The heart rate variance exceeds the limits. Perform an Adaptive Cardiac Sequence scan instead.

FlashCheck must be performed each time after changing the API command.

5.4.5 Using CARE Dose4D and CARE kV

The use of CARE Dose4D and CARE kV is valid for all cardiac workflows.

Using CARE Dose4D For cardiac scan protocols, CARE Dose4D is activated by default.

It is highly recommended to keep CARE Dose4D activated.

For cardiac scan protocols, the mAs/rot. setting is adjusted to the patient size. Additionally, ECG modulation is used.

Using CARE kV CARE kV is activated by default.

It is recommended to keep CARE kV activated.

CARE kV optimizes the applied dose for a defined image quality level by automatically adapting the tube voltage and the tube current.

If CARE kV is activated, scanning is performed with a constant kV value (no online modulation of the voltage).

- In the **Dose Optimization** dialog box, set the slider to **Vascular**.

Setting kV manually

If you do not have the CARE kV option, set the tube voltage manually.

For CTA examinations, scanning with 100 kV provides images with a considerably higher contrast compared to 120 kV.

✓ Patient weight up to 80 kg (175 lbs)

- On the **Scan** parameter card, from the **kV** selection list, select **100 kV** tube voltage.

For patients weighing more than 80 kg, select **120 kV**.

For contrast-enhanced scans, it is strongly recommended that you do not select 150 kV or 150 kV Sn as tube voltage settings for the scan. The use of the highest voltage settings leads to substantially reduced iodine contrast in the image.

If you set the tube voltage manually, you also have to adapt the **Quality Ref. mAs**.

6 Examination

The following chapters describe how to register patients, handle scan protocols, move the patient table, scan patients, and reconstruct images.

6.1 Examination procedure overview

A CT examination workflow consists of steps that are performed in the examination room at the gantry and steps that are performed in the control room at the *syngo* Acquisition Workplace.

Workflow using the gantry operator panel with Touch Panel

If one person takes care of the control room tasks and a second person takes care of the examination room tasks, some steps can be performed in parallel.

Step	Control room	Examination room	Comments
1	(→ Page 236 *Registering the patient and selecting the scan protocol*)	(→ Page 236 *Preparing the examination*)	You can perform these steps in parallel or prepare the patient before registering.
2	(→ Page 237 *Obtaining a topogram*)		
3	(→ Page 237 *Checking the scan protocol in the chronicle*)		
4	(→ Page 237 *Planning the scan ranges*)		
5	(→ Page 237 *Performing scans*)		
6	(→ Page 238 *Reconstructing, evaluating, and manipulating images*)		
7	(→ Page 238 *Completing and ending the examination*)		
8	(→ Page 238 *Postprocessing the images with other applications*)	(→ Page 183 *Using the Touch Panel and panel keys*)	You can perform these steps in parallel when you unload the patient using the Touch Panel. To prepare a new patient for the next examination, go back to step 1.
9	(→ Page 238 *Archiving and sending images*)		

Workflow using the gantry operator panel of the predecessor

Step	Control room	Examination room
1	(→ Page 236 *Registering the patient and selecting the scan protocol*)	
2		(→ Page 236 *Preparing the examination*)

Step	Control room	Examination room
3	(➔ Page 237 *Obtaining a topogram*)	
4	(➔ Page 237 *Checking the scan protocol in the chronicle*)	
5	(➔ Page 237 *Planning the scan ranges*)	
6	(➔ Page 237 *Performing scans*)	
7	(➔ Page 238 *Reconstructing, evaluating, and manipulating images*)	
8	(➔ Page 238 *Completing and ending the examination*)	
9		(➔ Page 182 *Unloading the patient*)
10	(➔ Page 238 *Postprocessing the images with other applications*)	
11	(➔ Page 238 *Archiving and sending images*)	

6.1.1 Registering the patient and selecting the scan protocol

In the **Patient Registration** dialog box, enter the data of the patient and select a scan protocol. Then start the examination. The scan protocol is loaded into the chronicle. (➔ Page 263 *Registering a Patient*)

- If a patient is admitted who is in a critical condition and must therefore be examined and treated immediately, call up emergency registration. It reduces the time before you can begin the examination to a minimum. (➔ Page 265 *Performing an emergency registration*)
- Do not ignore warning messages about the weight of the patient. Ensure you use only the appropriate protocols for heavy weight patients. Otherwise, the scan may be aborted due to the wrong table speed and an additional dose of radiation may be applied to the patient.
- To prepare the system to examine a patient at a later point in time, you can preregister the patient. For example, you can enter the data in the morning for all the patients to be examined during the day. To begin an examination, call up this data in the scheduler and edit it, if required. This saves time during the examinations.

6.1.2 Preparing the examination

To scan the topogram, position the patient on the patient table. (➔ Page 277 *Positioning the patient*),

- (➔ Page 279 *Preparing the patient table*)
- (➔ Page 285 *Preparing the patient*)
- (➔ Page 289 *Moving the patient into the scan plane*)
- (➔ Page 293 *Using the 3D camera*)

If required, at the gantry or on the topogram **Routine** parameter card, zero the table at the desired table position. (➔ Page 291 *Setting the patient table position to zero*) (➔ Page 291 *Setting the table position to zero*)

Check the registered data, the patient position in the **Patient Model Dialog**, and the scan protocol in the chronicle.

6.1.3 Obtaining a topogram

The examination steps (scan protocol) are listed in the chronicle. The first step is activated, typically a topogram. The topogram is used to define the examination ranges. (➔ Page 308 *Acquiring a Topogram*)

For spiral examinations, you can plan and store different scan and recon ranges for the spiral examination directly after scanning the topogram.

You can omit scanning a topogram and define scan ranges without a topogram.

6.1.4 Checking the scan protocol in the chronicle

- Is the order of the steps correct?

  You may insert or delete protocol steps or even add another scan protocol. In the **Edit** menu and in the context menu, the **Cut**, **Copy**, **Repeat**, and **Paste** functions are available. Special protocol entries, such as a pause or memo, can be inserted using either the **Insert** menu or the context menu.

- Are the parameters of each step correct?

  You can check the parameters by clicking each protocol step. The parameters are displayed in the parameter cards.

  Check the scan parameters before scanning.

You can modify the scan protocol before, and even during, the examination.

6.1.5 Planning the scan ranges

Define the scan ranges according to the anatomy of the patient. (➔ Page 310 *Planning an Examination*)

You can modify the ranges:

- With the mouse, by pulling the handles of the graphical representation of the scan range in the topo segment, which is easier.
- By setting the parameters on the parameter cards appropriately, which is more precise (for example, to use the same parameters of a previous scan).

6.1.6 Performing scans

Click the **Load** button in the chronicle to load the parameters of the current protocol step. As soon as you click the **Load** button, the topogram is zoomed and moved in a way that the whole planned scan range is displayed.

Press the **MOVE** key on the control box to move the table to the start position of the range.

Press the **START** key to start scanning.

(→ Page 317 *Performing a sequence scan*)

6.1.7 Reconstructing, evaluating, and manipulating images

Images are reconstructed from the collected raw data and are automatically stored.

6.1.8 Completing and ending the examination

If you have obtained all the images required for the diagnostic study, complete and end the examination and export the E-Logbook before releasing the patient. You can then register the next patient for examination or you can preregister a new patient.

6.1.9 Postprocessing the images with other applications

Afterwards, you can use other applications to evaluate and postprocess the images.

6.1.10 Archiving and sending images

You can archive and send images by using the transfer functions. It is also possible to configure the auto transfer and auto send functions.

6.2 Configuration of examination settings

You can configure different settings for examination.

6.2.1 Using the Configuration Panel

Depending on the application, you can configure task cards, windows, and individual functions of the program to adapt them to your requirements.

1 From the main menu, choose **Options > Configuration...**.

  The **Somaris/7 – Configuration Panel** opens.

2 Double-click the icon that represents the application to open the corresponding configuration window.

3 Adapt the functions of the application to your individual requirements.

6.2.2 Configuring the display of the Touch Panel

In the **Examination Configuration** dialog box, you can configure what type of patient information is displayed on the Touch Panel.

1 From the main menu, choose **Options > Configuration...**.

  The **Somaris/7 – Configuration Panel** opens.



2 Double-click the **Examination Configuration** icon.

The **Examination Configuration** dialog box opens.

3 Click the **Touch Panel** tab.

4 Modify the required settings for **Display Patient Data** and **1st Line** / **2nd Line**.

Possible settings

Parameter	Possible settings	Meaning
Display Patient Data	**Always**	The selected settings for **1st Line** and **2nd Line** are always displayed.
	Never (default setting)	The selected settings for **1st Line** and **2nd Line** are never displayed.
	Until First Scan	The selected settings for **1st Line** and **2nd Line** are displayed until the first scan starts.
	Until Last Scan	The selected settings for **1st Line** and **2nd Line** are displayed until the last scan starts.
1st Line / **2nd Line**	**Patient ID** (default setting)	The patient ID is displayed in the selected line according to the setting in **Display Patient Data**.
	Patient Date of Birth	The patient's date of birth is displayed in the selected line according to the setting in **Display Patient Data**.
	Patient Name (default setting)	The patient name is displayed in the selected line according to the setting in **Display Patient Data**.
	Patient Sex	The patient's sex is displayed in the selected line according to the setting in **Display Patient Data**.

6.2.3 Scan Protocol Assistant

The **Scan Protocol Assistant** is a tool for creating, exporting, listing, and editing single scan protocols or groups of scan protocols, as well as for defining, listing, importing, and exporting contrast protocols.

Two different categories of scan protocols are available:

- Siemens Healthineers default protocols
- User protocols

The number of available protocols has a high impact on the performance of the **Scan Protocol Assistant**. When you use the **Scan Protocol Assistant** very often, Siemens Healthineers recommends reducing the number of protocols as far as possible.

Siemens Healthineers default scan protocols provide an optimized set of parameters balancing image quality, scan time, and patient dose. They are defined to be applied directly to your examination after minor adaptions of, for example, the language of the Automatic Patient Instructions. Special clinical conditions and applications may require the adaption of the default recommendations. As the final diagnosis is the sole responsibility of the user, the user always has to make sure that the chosen scan protocol meets the requirements of the examination.

You can only manipulate and create user protocols.

The availability of scan protocols depends on your license.

Additionally, the availability of features depends on your user account. For this reason, Siemens Healthineers recommends closing the **Scan Protocol Assistant** and logging off before changing user.

Calling up and closing the Scan Protocol Assistant

You call up the **Scan Protocol Assistant** via the **Somaris/7 – Configuration Panel**.



1 Select **Options > Configuration...** to open the **Somaris/7 – Configuration Panel**.

2 Double-click the **Scan Protocol Assistant** icon in the **Somaris/7 – Configuration Panel** to open the **Scan Protocol Assistant**.

The step **1** page of the Scan Protocol Assistant is displayed.



Click the **Quit** icon to close the **Scan Protocol Assistant** without saving the changes.

Operations in the Scan Protocol Assistant

On the step **1** page, you can select one of the following operations:

- **Manipulate scan protocols (cut/copy/paste/delete)**
- **Change parameters**
- **Import user scan protocols**
- **Import from teamplay**
- **Export scan protocols**

- **Mapping syngo.via workflow**

  Only available if a *syngo*.via server has been configured in **Local Service** and is online.
- **Restore scan protocols to Siemens default**
- **Define contrast protocols**
- **List/import/export contrast protocols**

Additionally, the **Update customer protocols** button is available. The Siemens Healthineers Service uses the **Update customer protocols** button to convert customer protocols from former software versions. After the conversion the button displays the status **Done**.

Workflow

Depending on which operation you select after opening the **Scan Protocol Assistant**, it takes 3 to 5 steps to finalize it:

- Select the operation page.
- Perform the operation in one or two operation-specific windows.
- Confirm the modifications.
- Finalize the operation by quitting or continuing with a new operation.

Modifying scan protocols

You can cut, copy, paste, remove scan protocols, and assign an **Emergency** protocol.

Adult and **Child** protocols are managed separately.



Dual Source and Dual Energy scan protocols are marked in the list with a special icon.

1 Click the **Manipulate scan protocols (cut/copy/paste/delete)** option on the step **1** page of the **Scan Protocol Assistant**.



2 Click the step **2** button.

  The step **2** page is displayed, in which all scan protocols are listed according to body region.

3 Select **Adult** or **Child.**

4 Drag a single protocol to sort the order of the scan protocols.

  – or –

  Activate the check box of the scan protocol you want to modify.

  – or –

  Activate the **Select invalid protocols** check box to show all invalid scan protocols.

If you want, you can export a list of the invalid protocols. (➔ Page 257 *Listing scan protocols*)

5 Right-click the scan protocol.

  The context menu is displayed.

6 From the context menu, choose **Cut**, **Copy**, **Remove**, or **Paste**.

The selected action is performed and the scan protocol lists within the relevant body regions are adapted accordingly.

You cannot remove the **Emergency** protocol.

Assigning an Emergency protocol

You can set one scan protocol as the **Emergency** protocol with the **Emergency** icon in front of its name.

1 Select the protocol you want to set as the **Emergency** protocol on the step **2** page.



2 Click the **Set Emergency Protocol** icon.

3 Click **OK** to confirm.



4 Click the step **3** button.

The **Confirmation** page is displayed.

Confirming the changes

The **Confirmation** page lists all regions where the protocol is manipulated. This includes information about the deleted protocol name, the destination folder of the changed protocol, and the name of the changed emergency protocol.

1 Check the modifications that you have performed.

2 If necessary, clear the check box in front of the protocol to discard the changes.

3 Click the **Yes** button to save the changes.

The **Changes saved** page is displayed.

If a password protection is activated in the Local Service configuration, the **Save Scan Protocol** dialog box opens. See (➔ Page 262 *Activating a password protection*). Enter the configured password. Otherwise the scan protocol cannot be saved.

4 Click the **Yes** button to make further changes.

– or –

Click the **End** button to exit the **Scan Protocol Assistant**.

5 Restart the system to activate a new default **Emergency** protocol.

Changing parameters

Using the **Scan Protocol Assistant**, you can modify all scan protocols and save them as customized protocols. You can change the parameters of several scan protocols simultaneously.

You can select the following groups of scan protocols:

- All scan protocols
- Axial recon jobs
- 3D recon jobs
- SAFIRE/ADMIRE recon jobs
- All scan protocols with ECG
- Protocols with Dual Source and Dual Energy
- Interventional protocols
- All customized scan protocols
- All Siemens Healthineers default protocols
- Single scan protocols
- All scan protocols within a body region
- Several body regions

The display of the scan protocol parameters depends on the selected section.

1 Click the **Change parameters** option on the step **1** page of the **Scan Protocol Assistant**.



2 Click the step **2** button.

The **Change parameters** page is displayed.

3 Select **Adult** or **Child**.

If the **Child** checkbox is selected, a text is shown to tell you about the definition of **Quality ref. mAs** value for child scan protocols.

When you change the **Quality ref. mAs** value for a child protocol and if the protocol is from an older software version, a notice window informs you to adjust the value to the new reference patient size.

---

4 Select the required scan protocols for changing parameters.

– or –

Activate the **Select invalid protocols** checkbox to show all invalid scan protocols.



5 Click the step **3** button.

The **Change parameters** dialog box is displayed. The dialog box shows the following buttons in the upper area of the **Scan Protocol Assistant** dialog box:

Protocol (displayed first by default), **Topogram**, **Scan**, **Recon**, **Auto Tasking**, **Trigger**, **Intervention**, and **Contrast**.

6 Click the required button.

The corresponding **Change parameters** page opens.

7 Double-click the parameter entry in a cell of the grid.

8 Change the parameters in the cell.

– or –

Select the required item from the selection list.

Special characters (for example, * ! = ; ? % /) are not allowed to be included in the name of a scan protocol.

9 Click another parameter entry to confirm your changes.

The background of the modified parameters is displayed in different colors, depending on the status of the parameters:

- Green: Valid modified parameters
- Yellow: Invalid modified parameters
- White: Existing, not modified or saved parameters

These color rules only work for the selected protocols. After saving, the modified parameters change to having white as a background color.



10 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (➔ Page 251 *Confirming changes*).

Modifying protocol parameters

On the **Change parameters** - **Protocol** page, you can change the following protocol parameters, for example:

- Protocol name
- Default patient position
- Auto reference lines
- Language
- Body region

1 Select the check box in front of a protocol.

– or –

Select all protocols to make changes to all protocols at once.

2 Make your changes in the selected protocols.



3 Click the step **4** icon in the upper area.

The **Confirm changes** page is displayed, listing all protocols with their modified protocol parameters, including the protocol name, old value, and new value. See (➔ Page 251 *Confirming changes*).

Modifying topogram parameters

On the **Change parameters** - **Topogram** page, you can change the following topogram parameters, for example:

- **mA**
- **Topogram length**
- **Tube position**
- **kV**
- **Topo Region**
- **API**
- **Direction**
- **Auto viewing**
- **Auto filming**
- **Auto transfer**

1 Select the check box in front of a protocol.

– or –

Select all protocols to make changes to all protocols at once.

2 From the context menu, choose **Remove Topo** or **Append Topo** to append or remove a topogram.

3 Make your changes in the selected protocols.



4 Click the step **4** icon in the upper area.

The **Confirm changes** page is displayed, listing all protocols with their modified topogram parameters, including the protocol name, old value, and new value. See (➔ Page 251 *Confirming changes*).

Modifying scan parameters

On the **Change parameters** - **Scan** page, you can change the following scan parameters, for example:

- **mAs / (Eff.) mAs**
- **CARE Dose type**
- **Dose modulation**
- **Quality Ref. mAs**
- **Ref. kV / kV**
- **Slice**
- **Cycle time**
- **Cycle time table** (for Adaptive 4D Spiral and non-gated perfusion sequence)
- **Rotation time**
- **Pitch**
- **Scan time**

- **Scan direction**
- **Start delay**
- **API**
- **Range name**
- **Scan start**
- **Comments**
- **Dose saving optimization**
- **FAST Adjust**
- **CARE kV**
- **Dose Notification**

The topogram information is listed if the **including topogram** check box is selected.

The parameter area of the **Change parameters** page is divided into two subtask cards: **Dose** and **Parameter**. You can easily find dose-related parameters on the **Dose** subtask card.

The **Dose saving optimization** parameter will be disabled if the license for CARE kV is not available or if the CAREDose type is CARE Dose.

The **Upper limit max. scan time** parameter and **Lower limit max. mAs parameter** are disabled if the license for FAST adjust is not available.

1 Select the required protocol type to which you want to apply changes:

   - **Select all**
   - **Sequence Scans**
   - **Spiral Scans**
   - **Multiscans**
   - **Interventional**
   - **Adaptive 4D spiral scans**
   - **i-Sequence**
   - **i-Spiral**
   - **i-Fluoro**

2 Right-click on the entry you want to change.

   A context menu with the following functions is provided:

   - Appending or deleting a protocol (**Append**, **Delete**).
   - Inserting or removing a pause in an auto-range (**Insert Pause**, **Remove Pause**).
   - Adding the current scan entry to CARE kV group or removing it (**Add to CARE kV group**, **Remove from CARE kV group**) if the license for CARE kV is available.

3 Make your changes in the selected protocols.



4 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (➔ Page 251 *Confirming changes*).

Modifying recon parameters

On the **Change parameters** -**Recon** page, you can change the following recon parameters, for example:

- **Slice**
- **Position Increment**
- **iMAR**
- **Matrix size**
- **Kernel**
- **iBHC**
- **SAFIRE/ADMIRE**
- **Strength**
- **Window**
- **FoV**
- **HD/Extended FoV**
- **Recon Job Type**
- **Recon Axis**
- **Recon Type**
- **Mirroring**
- **Image Order**
- **No. of Images**

1 Select the required protocol type to which you want to apply changes:

  - **Select all**
  - **Sequence Scans**
  - **Spiral Scans**
  - **Multiscans**
  - **Interventional**
  - **Adaptive 4D spiral scans**
  - **I-Sequence**
  - **I-Spiral**
  - **I-Fluoro**

A context menu with the following functions is provided:

- Copying the current recon job to the end (**Append Recon Job**).
- Deleting the current recon job (**Delete Recon Job**).

2 Make your changes in the selected protocols.



3 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (➔ Page 251 *Confirming changes*).

Modifying Auto tasking parameters

On the **Change parameters** - **Auto tasking** page, you can change the following auto-tasking parameters, for example:

- **Auto transfer 1**
- **Auto transfer 2**
- **Auto transfer 3**
- **Auto viewing**
- **Auto filming**
- **Auto Recon**
- **Auto postprocessing**
- **Auto Reference Lines**
- **every**
- **Body part examined**

1 Select the required protocol type to which you want to apply changes:

- **Select all**
- **Axial recon jobs**
- **3D recon jobs**

2 Make your changes in the selected protocols.



3 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (➔ Page 251 *Confirming changes*).

Modifying Trigger parameters

On the **Change parameters** - **Trigger** page, you can change the following trigger parameters, for example:

- **Best phase**
- **Phase start**
- **Pulsing**

- **Multi phase**
- **Cardio API Delay**

Only scan protocols with ECG are displayed on the **Trigger** page.

The scan and recon information is displayed if the included scan and recon information check box is activated.

1 Select the required protocol type to which you want to apply changes:
   - **Select all**
   - **Cardio sequence scans**
   - **Cardio spiral scans**
   - **Cardio flash scans**
2 Make your changes in the selected protocols.



3 Click the step **4** button.

   The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (➔ Page 251 *Confirming changes*).

Modifying Interventional parameters

On the **Change parameters** - **Interventional** page, you can change the following interventional parameters, for example:

- **CARE Dose type**
- **kV**
- **i-Precision view**
- **Slice**
- **No. of images**
- **Layout**
- **Kernel**
- **Window**
- **Key images**

The topogram information is displayed if the **including topogram** check box is activated.

1 Select the required protocol type to which you want to apply changes:
   - **Select all**
   - **i-Sequence**
   - **i-Spiral**
   - **i-Fluoro**
2 Make your changes in the selected protocols.



3 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (➔ Page 251 *Confirming changes*).

Modifying Contrast parameters

On the **Change parameters** - **Contrast** page, you can change the following contrast parameters, for example:

- **Scan start**
- **Contrast protocol**
- **FAST Bolus**
- **FAST Bolus delay**
- **Insert**

1 Select the required protocol type to which you want to apply changes:

- **Select all**
- **Sequence scans**
- **Spiral scans**
- **Multiscans**
- **Interventional**
- **Adaptive 4D spiral scans**
- **i-Sequence**
- **i-Spiral**
- **i-Fluoro**

2 To insert a contrast entry, right-click on the scan protocol entry above the point at which you want to insert it.

A context menu with the following functions is provided:

- **Insert Contrast**
- **Insert Bolus Tracking**
- **Insert TestBolus**

3 Select the required action.

The contrast entry is inserted.

4 To remove a contrast entry, right-click on this entry.

A context menu with the following functions is provided:

- **Remove Contrast**
- **Remove Bolus Tracking**
- **Remove TestBolus**

5 Select the required action.

The contrast entry is removed.

6 Make your changes in the selected protocols.



7 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (➔ Page 251 *Confirming changes*).

Linking to a scan protocol

You can link a contrast to a scan protocol. If a contrast protocol has been linked to a scan protocol, when you load the scan protocol into the chronicle during a patient examination the linked contrast will also be loaded into the chronicle automatically.

1 Right-click on a scan entry that you want to link.

2 From the context menu, choose **Insert Contrast**.

3 Double-click on the parameter of **Scan start** on the contrast entry.

4 Select **Injector coupled** (start button) or **Injector coupled** (foot switch) from the list.

5 Double-click on the **Contrast protocol** parameter on the contrast entry.

6 Select a contrast protocol that you want to be linked from the list.



7 Click the step **4** button.

The **Confirmation Page** page is displayed, including names of modified protocols and relevant parameters as well as old and new values of the modified parameters. See (➔ Page 251 *Confirming changes*).

If the linked contrast protocol is removed, the **Contrast protocol** parameter on the contrast entry will be set to **Manual.**

Confirming changes

On the **Confirmation** page, you confirm the changes.

◆ Click **Yes** to save the changes.

If a password protection is activated in the Local Service configuration, the **Save Scan Protocol** dialog box opens. See (➔ Page 262 *Activating a password protection*). Enter the configured password. Otherwise the scan protocol cannot be saved.

The **Changes saved** dialog is displayed.

– or –



Click **Back** to go back.

Changing the parameter panel set

You can change the view of the parameter panel and call up special functions on the **Change parameters** page.

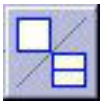


1 Click the **Column Configuration** icon to change the view of the parameter panel if necessary.

You can change the order of the columns, as well as their width, and show or hide them in the panel.

When you have finished your changes, click the required button:

- **Apply** to confirm the changes.
- **Cancel** to abort the changes.
- **Set Default** to restore the default settings.



2 Click the **Show/Hide Parameter** to show or hide the parameter modification area if necessary.



3 Click the **Parameter Property** if necessary.

You can see the **Minimum value**, **Maximum value**, **Increment**, and **Unit** of the parameters.



4 Click **Find / Replace** to find the parameter you want to change and replace it with a new one.

Set Auto filming by condition

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1 Click **Auto tasking**.

2 Click **Find/Replace**.

3 Select the **Auto filming** column on the column header.

4 Select **Special Task**.

5 Select the **Set Auto filming on** function.

6 Select < or ≤ from the list and enter a value for the slice width (for example slice thickness = 5 mm, or 2 mm < slice < 8 mm).

7 Click **Find next** to search for the next condition-matching cell and highlight it.

8 Click **Replace** to replace the currently highlighted value with the new desired value.

– or –

Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Set CDBURNING by condition

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1 Click **Auto tasking**.

2 Click **Find/Replace**.

3 Select the **Auto transfer 1**, **Auto transfer 2**, or **Auto transfer 3** column on the column header.

4 Select **Special Task**.

5 Select the **Set CDBURNING** function.

6 Select < or ≤ from the list and enter a value for the slice width (for example slice thickness = 5 mm, or 2 mm < slice < 8 mm).

7 Click **Find next** to search for the next condition-matching cell and highlight it.

8 Click **Replace** to replace the currently highlighted value with the new desired value.

– or –

Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Assign Transfer Node

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1 Click **Auto tasking**.

2 Click **Find/Replace**.

3 Select the **Auto transfer 1**, **Auto transfer 2**, or **Auto transfer 3** column on the column header.

4 Select **Special Task**.

5 Select the **Assign Auto Transfer Node** function.

6 Select the required node from the **Node** selection list.

7 Select < or ≤ from the list and enter a value for the slice width (for example slice thickness = 5 mm, or 2 mm < slice < 8 mm).

8 Click **Find next** to search for the next condition-matching cell and highlight it.

9 Click **Replace** to replace the currently highlighted value with the new desired value.

– or –

Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Increase/Decrease (eff.)mAs

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1 Click **Auto tasking**.

2 Click **Find/Replace**.

3 Select the **(Eff.)mAs** column on the column header.

4 Select **Special Task**.

5 Select the **Increase/Decrease value by X %** function.

6 Enter a value for X percent.

The default value for **(Eff.)mAs** is 10%.

7 Click **Find next** to search for the next condition-matching cell and highlight it.

8 Click **Replace** to replace the currently highlighted value with the new desired value.

– or –

Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Recon increment according to the slice

For several functions, you can further specify the search items and set the configurations for predefined conditions when performing **Find/Replace**.

1 Click **Auto tasking**.

2 Click **Find/Replace**.

3 Select the **Recon increment** column on the column header.

4 Select **Special Task**.

5 Select the **Set to X% of Slice** function.

6 Enter a value for X percent.

Calculate the recon increment value depending of the slice width and an individual percent value (for example, slice width: 5 mm, percent value: 80%, recon increment is calculated to 4 mm).

7 Click **Find next** to search for the next condition-matching cell and highlight it.

8 Click **Replace** to replace the currently highlighted value with the new desired value.

– or –

Click **Replace all** to search for all condition-matching cells and replace them with the new desired value.

Importing user scan protocols

You can import scan protocols from a CD-R/DVD-R or a USB device.

The scan protocols that are displayed depend on your system licenses.

You can only import scan protocols that have been exported from an equivalent CT system having the same or an older software version.

1 Insert the medium on which the scan protocols are stored.

2 Copy the scan protocols data to the `H:\SiteData\ImportScanProtocols` folder via the **File Browser**.

3 Click the **Import user scan protocols** option on the step **1** page of the **Scan Protocol Assistant**.



4 Click the step **2** button.

The list of scan protocols to be imported is displayed.

5 Select the protocols you want to import.

6 Click the **Import** button to import the selected scan protocols.

The selected scan protocols are copied to the system and placed on the corresponding body region in the **Scan Protocol Assistant**.



7 Click the step **3** button.

The step **3 Confirmation** page is displayed.

8 Click the **Yes** button to make further changes.

– or –

Click the **End** button to finish the import.

Importing from teamplay Protocols

You can import scan protocols that are available from teamplay Protocols.

You are notified of new protocols:

- By the teamplay icon that is displayed in the status bar of the **Examination** task card.
- By a corresponding message at system startup.

1 Click the **Import from teamplay** option on the step **1** page of the **Scan Protocol Assistant**.



2 Click the step **2** button.

The protocols that are available for import are displayed on the corresponding body region.

3 Select the protocols you want to import.

4 Click the **Import** button.

The selected scan protocols are imported.



5 Click the step **3** button.

The step **3 Confirmation** page is displayed.

6 Click the **End** button to finish the import.

If the Scan Protocol Assistant detects incompatible protocols, these protocols are not imported.

A message informs you that they have been moved to the following folder:

`H:\SiteData\teamplay\ScanProtocols\NotImported`.

Exporting scan protocols

You can export scan protocols to the `H:\SiteData\ExportedScanProtocols` folder and use the **File Browser** to transfer them to the peripheral equipment.

1 Click the **Export scan protocols** option on the step **1** page.



2 Click the step **2** button.

3 Select a scan protocol or a group of scan protocols.



4 Click the step **3** button.

The list of scan protocols to be exported is displayed in the **Export overview** window.

5 Click the **Yes** button to confirm the export.

A message box is displayed to inform you that the scan protocols have been exported to the `H:\SiteData\ExportedScanProtocols` folder.

6 Click the **OK** button.

Step **4** page is displayed.

7 Click the **Yes** button to make further changes.

– or –

Click the **End** button.

Restoring scan protocols to Siemens Healthineers default

You can restore the scan protocols that you have modified to the Siemens Healthineers default.

1 Click the **Restore scan protocols to Siemens default** option on the step **1** page of the **Scan Protocol Assistant**.



2 Click the step **2** button.

The step **2** page is displayed, in which all modified scan protocols are listed according to body region.

3 Select **Adult** or **Child**

4 Select all the modified protocols that you want to restore to the Siemens Healthineers default.

– or –

Activate the **Select all protocols** check box if you want to restore all protocols to the Siemens Healthineers default.

– or –

Activate the **Select deleted Siemens scan protocols** check box if you want to restore all deleted Siemens Healthineers scan protocols.

Replacing protocols

1 Select the modified scan protocols you want to restore to the Siemens Healthineers default.

2 Select **Replace customized protocols with same name**.



3 Click the step **3** button.

All selected protocols are displayed.

4 Click the **Yes** button on the confirmation page to confirm the substitution.

All selected scan protocols are replaced with the Siemens Healthineers default scan protocols. The changed protocols will be replaced.



If a scan protocol with the same name exists, new copies are numbered.

Confirming changes

On the **Confirmation** page, you confirm the changes.

- Click **Yes** to save the changes.

  If a password protection is activated in the Local Service configuration, the **Save Scan Protocol** dialog box opens. See (→ Page 262 *Activating a password protection*). Enter the configured password. Otherwise the scan protocol cannot be saved.

  The **Changes saved** dialog is displayed.

  – or –



  Click **Back** to go back.

Duplicating protocols

1 Select the scan protocols you want to duplicate.

2 Select **Add Siemens protocols as duplicates**.



3 Click the step **3** button.

  All selected protocols are displayed.

4 Click the **Yes** button to confirm the duplication.

  All modified scan protocols having the same name as original Siemens Healthineers protocols are saved with the extension **Customized**.

  The original Siemens Healthineers protocols are copied to the corresponding body region folder.



You can activate the **Select all** checkbox to view all deleted and modified Siemens Healthineers default scan protocols for the current body size.

Listing scan protocols

You can have all or the selected scan protocols listed in an overview window, and can also export a scan protocol list.

The displayed parameters of the list are set by the system.



1 Click the **List all protocols** icon in the lower left corner of the **Scan Protocol Assistant** to list all scan protocols.

  – or –



  Click the **List selected protocols** icon to list all currently selected scan protocols.

  The **Scan protocol listing** dialog box is displayed.

2 Click the **Export** button to export the list.

The scan protocol list is exported to `H:\SiteData\protocols` for reuse in Microsoft Excel on an external computer.

You have to use the **File Browser** to transfer the XML file and the corresponding XSLT stylesheet to the peripheral equipment, for example, with a USB device.

Mapping *syngo*.via workflow

You can map the *syngo*.via workflows to scan protocols in the **Scan Protocol Assistant** and in the **Auto Tasking** parameter card. The list of available workflows depends on whether your system is connected to *syngo*.via or not.

1 Click the **syngo.via** option on the step **1** page of the **Scan Protocol Assistant**.



2 Click the step **2** button.

The step **2** - **Connect to syngo.via page** is displayed.

3 Select **Adult** or **Child**.

4 Select the check box of one or more scan protocols.



5 Click the step **3** button.

The list of scan protocols to be defined is displayed.

6 Double-click the **Workflow** entry in a cell of the grid and select a workflow from the selection list.

7 Select the check box of the required recon job.

8 Double-click the **Data role** entry in a cell of the grid and select a data role from the selection list.



9 Click the step **4** button.

The scan protocols with changes are listed.

10 Clear the **Apply** check boxes of the scan protocols in case you do not want to change them.

11 Click **Yes** to save the changes.

The step **5** - **Changes saved** page is displayed.

If a password protection is activated in the Local Service configuration, the **Save Scan Protocol** dialog box opens. See (➔ Page 262 *Activating a password protection*). Enter the configured password. Otherwise, the scan protocol cannot be saved.

12 Click **Yes** to make further changes.

– or –

Click **End** to exit the **Scan Protocol Assistant**.

Defining contrast protocols

Using the Scan Protocol Assistant, you can select, copy, paste, add, remove and define contrast protocols.

Manipulating contrast protocols

1 Click the **Define contrast protocols** option on the step **1** page of the **Scan Protocol Assistant**.



2 Click the step **2** button.

The step **2** page is displayed.

3 Right-click the contrast protocol.

The context menu is displayed.

4 From the context menu, choose **Copy**, **Paste** or **Remove**.

The selected action is performed and the contrast protocol list is adapted accordingly.

The contrast protocols cannot be restored after being removed.

A contrast protocol can be linked to a scan protocol on the **Contrast** page under the **Change parameters** task. If the linked contrast protocol is removed, the parameter of the **Contrast protocol** on the contrast entry will be set to **Manual**.

5 Click the **Add new protocol** button to create a new contrast protocol if necessary.

The step **3** page is displayed.

The newly created contrast protocol initially only consists of a contrast phase and a saline phase.

Defining contrast protocols

1 Activate the checkbox of the required contrast protocol on the step **2** page.

2 Click the step **3** button.

The **Define contrast protocols** page is displayed.

3 Right-click on a phase in the parameter grid.

The context menu is displayed.

4 Select **Insert phase** or **Delete phase** if necessary.

It is impossible to insert more than 10 phases in a contrast protocol. The last remaining phase is not deletable.

5 Double-click the parameter entry you want to change in a cell of the grid.

6 Change the parameter in the cell.

– or –

Select the desired item from the selection list.

7 Click another parameter entry to confirm the changes.

The background of the modified parameters is displayed in different colors, depending on the status of the parameters:

- Green: Valid modified parameters
- Yellow: Invalid modified parameters
- White: Existing, not modified or saved parameters

These color rules only work for the selected protocols. After saving, the modified parameters change to having white as a background color.



8 Click the step **4** button.

All relevant information is displayed on the **Confirmation Page**, including names of modified protocols and relevant parameters, as well as old and new values of the modified parameters.

9 Deactivate the **Apply** checkboxes of the protocols in case you do not want to change them.

10 Click the **Yes** button to save the changes.

Step **5** is displayed.

If a password protection is activated in the Local Service configuration, the Save Scan Protocol dialog box opens. See (➔ Page 262 *Activating a password protection*). Enter the configured password. Otherwise, the scan protocol cannot be saved.

11 Click the **Yes** button to make further changes.

– or –

Click the **End** button to exit the **Scan Protocol Assistant**.

Listing/importing/exporting contrast protocols

You can list the contrast protocols, and import them from or export them to a CD-R/DVD-R or a USB device.

You can only import contrast protocols that have been exported from an equivalent CT system having the same or an older software version.

1 Click the **List/import/export contrast protocols** option on the step **1** page of the **Scan Protocol Assistant**.



2 Click the step **2** button.

The **Select contrast protocols** page is displayed with a list of the contrast protocols.

3 Select the desired contrast protocol from the list.

Now you can carry out the following operations for the selected contrast protocol, if a contrast license is available.

Listing contrast protocols



1 Click the **List all contrast protocols** button in the lower left corner of the **Scan Protocol Assistant** to list all contrast protocols.

– or –



Click the **List selected contrast protocols** button to list all selected contrast protocols.

A message box is displayed to inform you that the contrast protocols have been successfully exported.

2 Click the **OK** button to confirm.

The **Contrast protocol listing** dialog box is displayed.

The contrast protocol list is exported to `H:\SiteData\ContrastProtocols` for reuse in Microsoft Excel on an external computer.

You have to transfer the XML file and the corresponding XSLT stylesheet, for example, with a USB device.

Importing contrast protocols

You can import protocols from a CD-R/DVD-R or a USB device.

1 Insert the medium on which the contrast protocols are stored.

2 Copy the contrast protocols data to the `H:\SiteData\ImportContrastProtocols` folder via the **File Browser**.



3 Click the **Import contrast protocols** button in the lower left corner of the **Scan Protocol Assistant**.

The list of contrast protocols that can be imported is displayed.

4 Select the protocols you want to import.

5 Click the **Import** button.

The step **3** page is displayed to inform you that the selected contrast protocols have been successfully imported.



6 Click the step **4** button.

The step **4** page is displayed.

7 Click the **Yes** button to make further changes.

– or –

Click the **End** button to finish the import operation.

Exporting contrast protocols

1 Select the contrast protocol you want to export on the step **2** page.



2 Click the **Export selected contrast protocols** button in the lower left corner of the **Scan Protocol Assistant**.

3 Click the **Export** button to confirm the export.

A message box is displayed to inform you that the contrast protocols have been successfully exported to the `H:\SiteData\ExportedContrastProtocols` folder.

4 Click the **OK** button.

The step **4** page is displayed.

5 Click the **Yes** button to make further changes.

– or –

Click the **End** button.

Activating a password protection

You can activate a password protection to allow only authorized persons to save changes to a scan protocol.

By default, the password protection is deactivated.

1 In the main menu, choose **Options > Service > Local Service...** to open the **Local Service** configuration.

The **Authentication** window is displayed.

2 Delete all entries from the entry fields.

3 Click **OK**.

The **Service Software** window is displayed.

4 Click the **Configuration** button.

5 Select the **Application** option.

6 In the field **Scan Protocol Password**, enter a password.

7 Repeat the password in the line below.

8 Click **Save**.

The password protection is activated. When saving a scan protocol, you must enter the configured password.

Ending the Scan Protocol Assistant

In the **Changes saved** dialog box you have the following options:

- Click **Yes** to go back to the operation selection in step 1 to make further changes.

  – or –

  Click **End** to close the Scan Protocol Assistant.

6.3 Preparations

Before you can examine a patient with your system, register the patient. Registration means that you give your system all the information about a patient that it requires for an examination.

If a patient is admitted who is in a critical condition and must therefore be examined and treated immediately, call up emergency registration. It reduces the time before you can begin the examination to a minimum. (➔ Page 265 *Performing an emergency registration*)

If you want to prepare the system to examine a patient at a later point in time, then you can preregister the patient.

For example, you can enter the data in the morning for all the patients to be examined during the day. When you want to begin an examination, simply call up this data via scheduler and edit it, if necessary. It saves time during the examinations.

If your system is linked to, licensed and registered for an HIS/RIS system (hospital and radiology information system), you can call up data for the patient to be examined.

When *syngo* System Security is activated, you can register a patient only if you are authorized to do so. InvokeRegistration is the privilege that allows you to open the registration form and perform registration.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

6.3.1 Registering a Patient

Before you can examine a patient with your system, register the patient. You can do that in one of the following ways:

- Entering the new patient with all the patient data
- Selecting known patients from the database
- Using scheduler for preregistered patients or patients from HIS/RIS
- Registering an emergency patient

If a current examination is not completed, a corresponding dialog box is displayed.

CAUTION

The operating system may not support all characters for the received DICOM document!

The display of the name, for example, the patient name may be incomplete or misleading.

- *syngo* will not change the used characters, for example, minority characters, even if it cannot display them.
- Use other attributes for identification, if possible.

CAUTION

When working with several monitors, the patient name displayed in the folder of a task card belongs only to this task card. Any other visible task card may contain data from another patient!

Possible wrong diagnosis.

- Use patient demographics displayed in the image text for clear identification.

CAUTION

Wrong entry of patient sex or age!

Wrong basis for diagnosis.

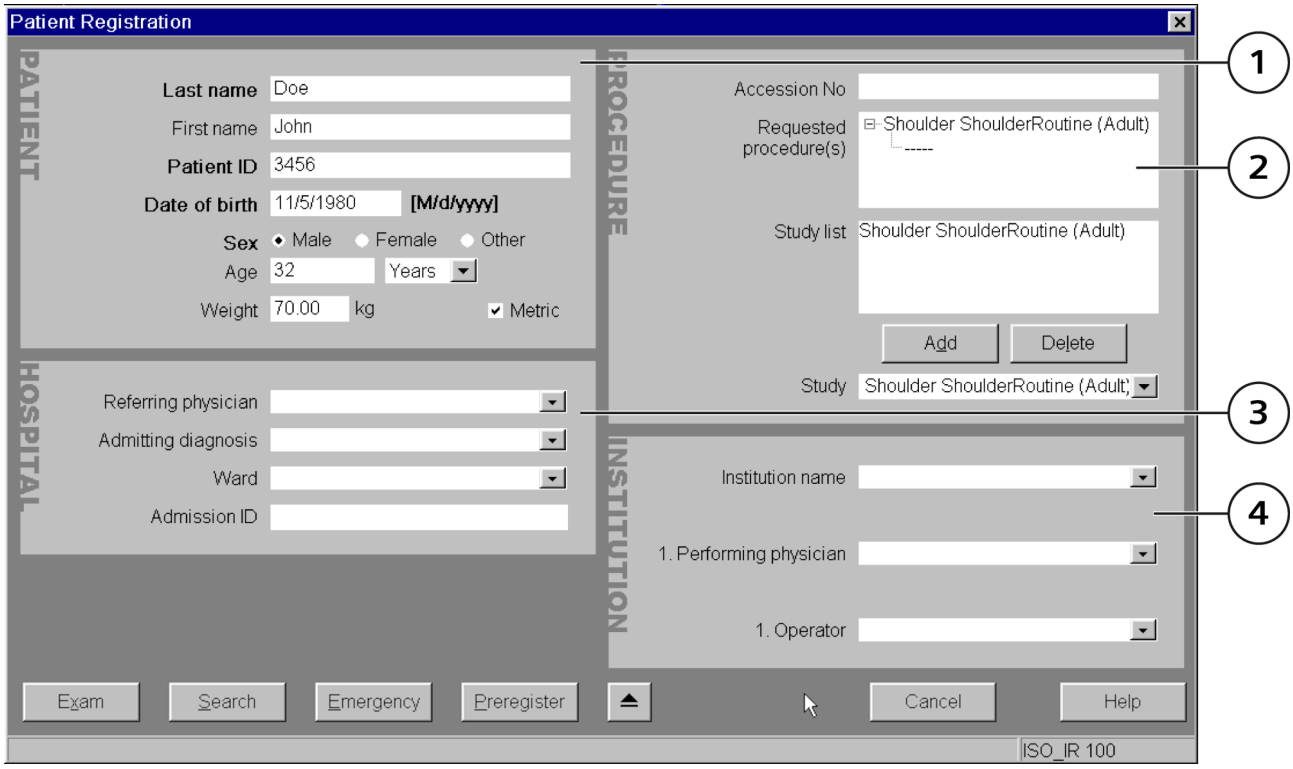
- Make sure that the patient sex and age are correct.

Registering a new patient

With the **Emergency** button in the **Patient Registration** dialog box, you can start emergency registration at any time.



1 Click the **Patient Registration** icon to open the **Patient Registration** dialog box.



(1) Personal data of the patient (PATIENT)
(2) Study-specific data (PROCEDURE)
(3) Referral data (HOSPITAL)
(4) Institution data (INSTITUTION)

2 Fill out at least the fields, which are displayed in boldface type.

3 Click the **Exam** button to examine the patient immediately.

– or –

Click the **Preregister** button.

The patient information is then saved for a later examination.

If you preregister a new patient (or there is a HIS/RIS), you only have to call up the patient data from the scheduler database when you perform the examination.

Performing an emergency registration

You can only change the name of an emergency patient prior to sending the corresponding MPPS to the RIS.

You cannot change the name of an emergency patient before all raw data are reconstructed.



1 Click the **Emergency Patient** icon in the **Patient Browser**.

2 Enter the date of birth and sex in the **Emergency Registration** dialog box.

– or –

Skip these data with the **Tab** key.

3 Click the **Exam** button.

6.3.2 Calling up the Patient Model Dialog

You can define the examination data in the **Patient Model Dialog**.

The **Patient Model Dialog** is used for two tasks:

- To check and modify the characteristics of the current patient before scanning.
- To select a predefined scan protocol for the examination.

◆ Click the **Exam** button in the **Patient Registration** dialog box to call up the **Patient Model Dialog**.

– or –



To open the **Patient Model Dialog** manually, click the **Select or change exam** icon on the **Examination** task card.

Entering the patient examination data

The protocols are grouped by body regions. Further protocols are grouped in various categories: Dual Energy, Cardiac, Vascular, RT, Specials, or Private (depending on the available licenses).

Siemens Healthineers default scan protocols provide an optimized set of parameters balancing image quality, scan time, and patient dose. They are defined to be applied directly to your examination after minor adaptions of, for example, the language of the Automatic Patient Instructions. Special clinical conditions and applications may require the adaption of the default recommendations. As the final diagnosis is the sole responsibility of the user, the user always has to make sure that the chosen scan protocol meets the requirements of the examination.

CAUTION

Wrong entry of patient position!

Wrong basis for diagnosis.

◆ Make sure that the patient position is correct.

CAUTION

Wrong labeling of the sides when the patient is repositioned!

Wrong basis for diagnosis and treatment.

- Correct the patient orientation when the patient is repositioned.
- Review the labeling of the sides, to avoid wrong operative intervention.

✓ If the local service established a configured *syngo*.via node on your CT system, the *syngo*.via icon as well as the **Workflow** field are displayed in the **Patient Model Dialog**.

1 Select the set of scan protocols by checking **Adult** or **Child**.

2 Select the desired scan protocol by moving the mouse cursor over the anatomical region you want to examine or to the non-anatomical regions on the right.

3 Select the protocol in the displayed selection list.

If you selected a predefined mapping or if you defined a *syngo*.via workflow for the selected scan protocol in the **Scan Protocol Assistant** or in the **Auto Tasking** parameter card, the defined workflow is displayed in the **Workflow** field of the **Patient Model Dialog**. To define a *syngo*.via workflow for a scan protocol, see (➔ Page 258 *Mapping syngo.via workflow*) or (➔ Page 271 *Documentation parameters*).

4 Confirm the patient position.

5 Select **Replace** to replace the last unscanned entries of the chronicle.

– or –

Select **Append** to add the protocol.

6 Select **Keep** to add a topogram when appending or replacing a new protocol to the chronicle.

– or –

Select **Cut** if a topogram should not be added.

7 Select the API language.

8 Select if and how reference lines are applied to all tomogram recon jobs of the scan.

The corresponding orientation markers will be shown on the reconstructed images.

9 Confirm your entries with the **OK** button.

Changing the patient position

If it is necessary to change the patient's position either before the examination starts or during the examination, you must update the patient's examination data in the **Patient Model Dialog** as this is not done automatically by the CT system.

CAUTION

Wrong entry of patient position!

Wrong basis for diagnosis.

- Make sure that the patient position is correct.

CAUTION

Wrong labeling of the sides when the patient is repositioned!

Wrong basis for diagnosis and treatment.

- Correct the patient orientation when the patient is repositioned.
- Review the labeling of the sides, to avoid wrong operative intervention.

If you have already started the examination, proceed with step 1. If the **Patient Model Dialog** is still open, proceed with step 2.



1 Click the **Select or change exam** icon on the left-hand side of the chronicle.

The **Patient Model Dialog** dialog box opens.



2 Click the **Change patient position** icon.

The icons for the patient position are operable again.

3 Select the new patient position.

4 Click **OK** to confirm your changes.

The entry new position is displayed in the chronicle.

Appending or replacing a scan protocol

In the **Patient Model Dialog**, you can append or replace the current scan protocol with another scan protocol.

Modifications are only valid for the current examination. The predefined scan protocol will not be changed. Each scan protocol can contain up to 100 entries.

The **Append** and **Replace** options are only operable when at least one scan protocol has been loaded into the chronicle. The selected scan protocol will be added after, or instead of, the current protocol.



1 Click the **Select or change exam** icon to open the **Patient Model Dialog**.

2 Select **Append** to append the protocols.

– or –

Select **Replace** to replace the entries of the current scan protocol with the newly selected scan protocol.

The new protocol will be created. The not yet executed protocol steps will be deleted.

3 Click the respective body part of the displayed graphic or the buttons for the special scan protocol (for example, **Cardiac**, **Specials**, or **RT**).

A list of scan protocols is displayed.

4 Mark the relevant name in the list of the scan protocols.

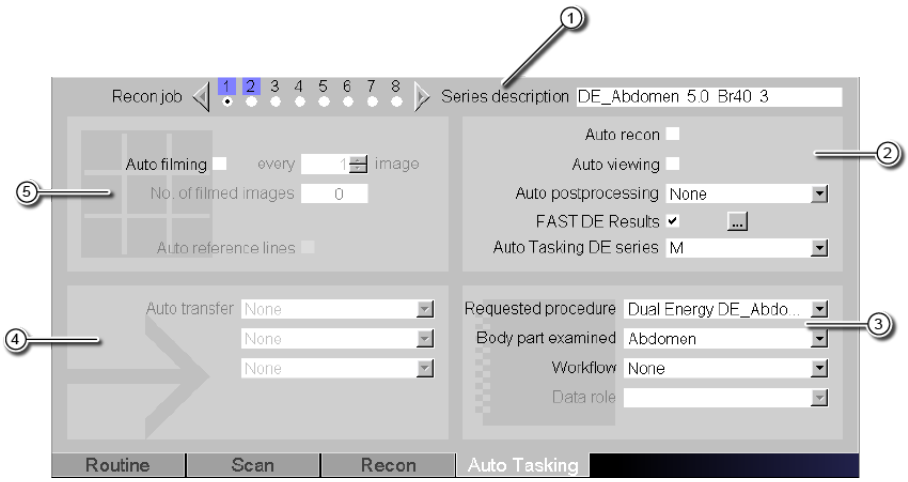
6.3.3 Using automatic functions

Your system provides several automatic functions for routine examinations:

- Automatic processing of consecutive acquisitions (**Auto Range**): Auto ranges are marked by brackets in the chronicle.
- Automatic patient instruction (API) system: This function is active if a patient instruction is selected on the **Scan** parameter card and the **API** icon is switched on.
- Automatic transferring of topograms and all images after reconstruction and automatic transferring of images and data to other applications for each Recon job (**Auto Tasking** parameter card)
- Time-saving Real Time Display (RTD) reconstruction of the images simultaneous with scanning.

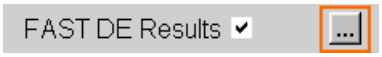
RTD images are reconstructed to observe the scan progress. **RTD** images are not intended to be used for diagnosis.

You can make the following settings on the **Auto Tasking** parameter card.



(1) Series description
The length of the Series description is limited to a maximum of 64 characters. In case the range name contains an asterisk, equals sign, backslash or caret, the symbols are replaced by blanks in the Series description.
(2) Postprocessing functions
(➔ Page 270 *Postprocessing parameters*)
(3) Documentation parameters
(➔ Page 271 *Documentation parameters*)
(4) Auto transfer parameters
(➔ Page 271 *Transfer parameters*)
(5) Filming parameters
(➔ Page 272 *Filming parameters*)

Postprocessing parameters

Parameter	Meaning
Auto recon	If the recon job was not processed during scanning, it will be started automatically when the single scan entry or the last scan entry of the autorange is finished.
Auto viewing	Images are automatically loaded to the **Viewing** task card.
Auto postprocessing	Specifies the postprocessing function for the selected recon job. The selected function is applied to all resulting image series of the recon job and is executed when all series are finished. The available entries depend on the scan mode and the active licenses. The entries are grouped according to their purpose: • Entry for applying no postprocessing function: **None**. • Entries for selecting the image type of the series that will be automatically transferred to the **3D** task card: – **MPR** – **MPR Range** – **MIP Thin** – **MIP Thin Range** • Entries for selecting the postprocessing application to which the image series will be transferred.
FAST DE Results	Select this check box to activate FAST DE Results. Up to nine series can be reconstructed based on a single reconstruction of the type A+B or A+B+M.
	Opens or closes the FAST DE Results parameter dialog box. • **Application class** Select up to three application classes. • **Output type** From the selection lists, select the corresponding output types. There is a maximum of three per application class. • **Output series description** Enter the prefix of the series to be created. Short tags indicating the result type of each series will be automatically appended. If this field is empty, a default series description will be generated. • **Original settings** Select this check box if you want the original settings for slice thickness and increment to be applied. • **Slice** If **Original settings** is not selected, enter the slice thickness of the series to be created. The maximum input slice thickness is 2 mm. The output slice thickness ranges from 3 mm to 10 mm.

Parameter	Meaning
	• **Increment** If **Original settings** is not selected, enter the distance between two slices for the series to be created. The maximum input increment is 1.5 mm. The output increment ranges between 0.1 mm and 10 mm. – The slice thickness must not be smaller than the increment. – The slice must not be thicker than double the increment. • **Auto transfer** Select one of the preconfigured DICOM nodes.

Documentation parameters

Parameter	Meaning
Requested Procedure	Defines the type of MPPS associated to the series.
Body part examined	You can assign the organ or body region to the image series that was scanned. • Select the organ or body region from the selection list. • To enter a new list element, select **New Entry**.
Workflow	You can map the *syngo*.via workflows to the first recon job of the first scan protocol of the examination. The mapping is then copied to all following recon jobs of all scan protocols of the patient examination. • From the selection list, select the workflow.
Data role	For each recon job you can map several data roles to the selected *syngo*.via workflow. • From the selection list, select the data role.

Transfer parameters

The **Workflow** and **Data role** defined in the **Scan Protocol Assistant** will be displayed on the **Auto Tasking** parameter card and can be edited. If *syngo*.via is not installed yet, a default list of all selectable workflows and data roles is available. (➔ Page 258 *Mapping syngo.via workflow*)

For Dual Energy reconstructions only:

The auto transfer targets are used for sending the original series. Results series from FAST DE Results have a separate auto transfer target node selected in the FAST DE Results parameter dialog box.

Parameter	Meaning
Auto transfer	Destinations to which the images are sent. You can send the images to up to three destinations. **None** means that images are not sent.

Filming parameters

Parameter	Meaning
Auto filming	Activates automatic filming. Reconstructed images are automatically transferred to the virtual film sheet (**Filming** task card). Auto filming parameters are set individually for each recon job on the **Auto Tasking** parameter card. When **Auto filming** is selected, each new series is automatically transferred to the Virtual Film Sheet. The images of a patient are collected in a film job. • RTD images are never automatically filmed. • Images of cancelled recon jobs are transferred to the **Filming** task card when you close the patient. To expand workflow automation, additional features are provided in the configuration, for example, automatic exposure of film jobs or the automatic filming of a patient protocol.
every ... image	Defines whether every n-th image or all images (n=1) of this recon job are to be transferred to the **Filming** task card.
No. of filmed images	Shows the number of images to be filmed.
Auto reference lines	Creates reference lines for topograms or reference images. If the **Auto reference lines** mode is switched on in the **Patient Model Dialog**, the corresponding item is checked automatically for the first recon job of each scan range, independent of study or series level. All reference lines for one study will be displayed on one topogram or each series will be displayed on one topogram.

Automatic postprocessing of Dual Energy images

FAST DE Results calculates Dual Energy images immediately after the two required reconstructions have finished.

It is possible to generate Dual Energy result images by using either the same slice thickness and increment or by generating reformatted thick slice axial result images.

Thick slice mixed images can also be generated from FAST DE Results, so that a comparison with reformatted VNC or Iodine images becomes possible.

It is also possible to modify the default Series description of the result series and select a separate DICOM node, where the output images are automatically sent after completion of the calculation.

The FAST DE Results configuration can be used to set calculation parameters and in particular switch from iodine density to iodine concentration images if required.

FAST DE Results, in the current software version, takes over the auto post-processing jobs from FAST DE Results in previous software versions. However, in order to improve calculation performance, reconstructions that are based on the same scan range should be combined into a single FAST DE Results processing job.

Observe the following recommendations to achieve the best image quality with FAST DE Results:

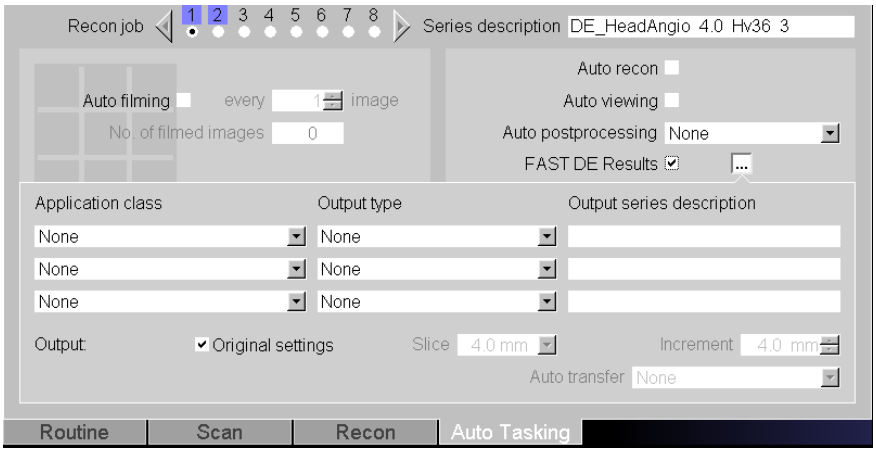
- The slice thickness of the reconstructed input images should not exceed 2 mm.
- The slice increment of the reconstructed input images should not exceed 1.5 mm.
- The slice thickness must not be smaller than the increment.
- The slice must not be thicker than double the increment.

For each reconstruction job, you can assign three Dual Energy application classes.

1 Open the **Auto Tasking** parameter card.

2 Select the **FAST DE Results** check box and click the **...** button.

The FAST DE Results parameter dialog box opens.



3 Select up to three application classes and the corresponding output types.

4 Enter a Series description.

If the **Output series description** field is empty, the default name will be used.

When a reconstruction is finished, up to three series per processing algorithm are calculated. Automatic archiving of these series is possible when auto transfer is configured in the FAST DE Results parameter dialog box.

If in previous versions any global auto transfer rule has been configured in the **Transfer Configuration** dialog box, you have to delete this rule to avoid that data is sent twice.

It is not possible to automatically generate fused iodine and VNC images, where the VNC image is shown in gray scale and the iodine image is shown as color overlay. However, it is possible to create these images manually by completing the following:

- Generate thin slice iodine and VNC images using FAST DE Results.
- Load VNC images into the **3D** task card and use the **Fusion** function to load iodine images in fused mode.
- Create parallel ranges to save the series of fused images.

Series descriptions of FAST DE Results series

The Series description of the FAST DE Series is generated based on your entry in the **Output series description** field.

To your entry the following suffix is added:

- <Filter name> of the selected Dual Energy application class, for example, **Mono40**

  The Series description may be, for example, **Arterial Mono40**.

If you leave the **Output series description** field empty, the name of the original reconstruction is used, with the following suffixes:

- <Filter name> of the selected Dual Energy application class, for example, **Mono40**
- **_S**<series number of the first series>**_S**<series number of the second series>**_1** for the series numbers of both of the two original reconstructions

  The Series description may be, for example, **DE_Abdomen 5.0 D30f Mono40_S2_S3_1**.

Image comments

In the image comment area of the result images, the following information is displayed:

- For all FAST DE Results images: **Automatic Results**
- For DE MonoenergeticPlus application class: **DE Monoenergetic E=**<Voltage> **keV**
- For the DE Optimum Contrast application class: **DE Blended c=**<Blending Center slider value>**, w=**<Blending Width slider value>
- For the DE Mixed application class: **DE Mixed w=**<Mixing ratio>
- For the DE LungPBV application class: **DE LungPBV**
- For the Liver VNC application class, series are calculated with different image comments: **Liver VNC/VNC**, **Liver VNC Iodine** and **Liver VNC Iodine CE**
- For the DE Virtual Unenhanced application class, series are calculated with different image comments: **DE VNC**, **DE Iodine** and **DE Iodine CE**
- For the **DE Rho/Z** application class two series are calculated with different image comments: **DE Rho** for electron density and **DE Z** for effective atomic number.

The Dual Energy processing algorithm parameters can be configured in the **FAST DE Results Configuration** dialog box.

The progress of the FAST DE Results algorithm is displayed in the **Examination Job Status** window.

Application classes

For Dual Energy FAST DE Results application classes for certain diagnostic tasks are provided:

- The **Monoenergetic Plus** application class simulates images that are equivalent to images scanned with a single photon energy beam, depending on the energy (keV). By changing the energy (keV), you can enhance the contrast between different materials.
- The **Virtual Unenhanced** application class allows you to visualize the contrast agent concentration in soft body tissue without the need of an additional non-contrast scan. It is designed for organs which contain only minor amounts of fat, such as the lungs or kidneys. It is not recommended for the analysis of a potentially fatty liver. The application class generates virtual non-contrast (VNC) images by subtracting iodine from the Dual Energy data sets. The VNC images can be used for baseline density measurements.
- The **Liver VNC** (Virtual Non-Contrast & Contrast Image) application class allows you to visualize the contrast agent concentration in the liver without an additional non-contrast scan, even if there are irregular fatty infiltrations or necrotic areas. The application class generates virtual non-contrast (VNC) images by subtracting iodine from the Dual Energy data sets. The VNC images can be used for baseline density measurements.
- The **LungPBV** application class is designed to visualize and quantify the iodine uptake in the lung parenchyma.
- With the **Rho/Z** application class you can measure electron density as well as effective atomic number and thus perform a basic characterization of the material of interest.

Application class Virtual Unenhanced and FAST DE Results in Dual Energy reconstructions

Observe the following limitations:

- CT values of bone and calcifications will be lower in VNC (virtual non-contrast) images than in true non-contrast images. Small calcifications below 3 mm in diameter may not be visible in the VNC image.
- Differences between CT values in VNC images and true non-contrast images are typically within ±10 HU.
- The **Virtual Unenhanced** application class should not be used for images of the heart that were acquired without ECG-gating or triggering.
- For a reliable evaluation of CT values of soft-tissue lesions on the **Virtual Unenhanced** application class image, ROI diameter should at least be 10 mm.
- The CT value of subcutaneous and visceral fat will be higher in the VNC image than in the true non-contrast image.
- The VNC image may not be appropriate for characterization of lesions where the presence or absence of fat is of clinical concern, for example adrenal tumors.

Application class Rho/Z algorithm and FAST DE Results in Dual Energy reconstructions

If the application class **Rho/Z** is selected in the FAST DE Results parameter dialog box, electron density images and effective atomic number images are generated.

The electron density image shows the electron density relative to water by using the Hounsfield Unit (HU) scale.

This means that air receives a value of -1000 HU and water receives a value of 0 HU. The electron density of bone (measured in HU) is substantially lower than the CT values of bone in standard CT images.

The effective atomic number image shows the effective atomic number in units of **1**. For pure chemical elements, the effective atomic number is equal to the real atomic number.

For mixtures of chemical elements, the following equation is used to calculate the effective atomic number:

$$Z_{eff} = \left(\frac{\sum_i n_i Z_i^{n+1}}{\sum_i n_i Z_i} \right)^{1/n}$$

n_i: number density of atom type i

Z_i: atomic number of atom type i

n: recommended value 3.1

Limitations

- These image types are only valid for natural body materials such as fat, soft tissue or bone. Results for materials with higher atomic number, especially contrast agent, may not be correct.
- These image types are not valid if there are obvious image artifacts in the original images, for example, metal artifacts.

Application class Liver VNC and FAST DE Results in Dual Energy reconstructions

Observe the following limitations:

- CT values of bone and calcifications will be lower in VNC images than in true non-contrast images. Small calcifications below 3 mm in diameter may not be visible in the VNC image.
- For a reliable evaluation of CT values of soft-tissue lesions on the VNC image, the ROI diameter should be at least 10 mm.
- Differences between CT values in VNC images and true non-contrast images are typically within ±10 HU.

Application class LungPBV and FAST DE Results in Dual Energy reconstructions

Observe the following limitations:

- Always use the Dual Energy results in addition to a standard evaluation of the low energy CT image or the mixed CT image.
- Reduced iodine uptake of the lung parenchyma may be due to pulmonary embolism or other causes, such as emphysema or oncological reasons.
- Only obstructing blood clots in vessels can cause perfusion defects and are thus potentially detectable on Lung PBV or Lung Vessels images.
- Artifacts may originate from heart motion and dense contrast agent in the vena cava, as well as from the brachial vein.

Resolving FAST DE Results issues

Issues that occur during **FAST DE Results** postprocessing are displayed in the status bar at the bottom of the task card.

◆ Follow the instructions below for each message.

FAST DE Results failed: Insufficient memory.

- Create a reconstruction job with fewer images.
- Close an application and start a new reconstruction.

FAST DE Results failed: Different number of images at low kV or high kV.

Reconstruction aborted.

- On the FAST DE Results parameter dialog box, select a Dual Energy application class.
- Start a new reconstruction.

6.4 Positioning the patient

This section gives you information about positioning the patient.

We start with important information about positioning. Then, you learn how to position the patient correctly.

After that, the use of accessories for positioning in various examinations is discussed.

The CT images shown in this section are only examples.

6.4.1 Important safety information

WARNING

Incorrect patient positioning!

Injury to the patient or personnel, and damage to the equipment.

- Always verify that the patient is correctly positioned.
- Always observe the patient during system movements.

Safety stop function of the patient table

The patient table is equipped with a safety stop function. The patient table stops when malfunctions occur.

- If the patient table is not movable anymore, call Siemens Healthineers customer service.

Positioning aids

To avoid danger of injuring the patient during table movements, only positioning aids released by Siemens Healthineers should be used. In this way also artifacts can be avoided which degrade the image quality. (➔ Page 36 *Accessories*)

CAUTION

Incorrect use and use of non-original and non-released equipment!

Wrong diagnosis

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

WARNING

Incorrect use and use of non-original and non-released equipment!

Injury to the patient and personnel or damage to the equipment. Image quality may also decrease.

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

- Replace damaged or worn positioning accessories, especially if mechanical strength is in question.

Radio translucency

Positioning aids that are used in the region of interest must be made of special radio translucent material. They are shaped in such a way that they do not cause image artifacts affecting the examination results.

- Nevertheless, use the positioning aids in such a way that they do not protrude into the slice plane, if possible.

Cleanliness

- Remove all impurities, especially residual contrast medium, as quickly as possible. Always observe the additional cleaning and disinfecting instructions provided in the Instructions for Use – Cleaning and disinfection.

Artifacts

Various influences can cause a distorted image. (➔ Page 67 *Image artifacts*)

When positioning the patient, please ensure that the object of interest is as near to the center of the measuring field as possible. If it is not, image artifacts may appear on subsequent reconstructions, such as MPR, 3D etc..

- Follow the operating instructions and safety information to avoid repetition of scans and, therefore, additional radiation exposure to the patient.
- Reconstruct an overview image if streaky artifacts impair the image quality. Use a larger window.

  This makes it easier to find the causes of the streaks and to avoid them (e.g., residual contrast medium, hair clips etc.).

Examination limits

The black lines on the table top mark the limits of the examination region.

- If necessary, reposition the patient.

Patient information

You must inform the patient about all the necessary facts of the examination which you are about to perform.

Patient comfort

The patient should be positioned comfortably in an anatomically correct position in the middle of the table top.

- Use positioning aids, if necessary.

This makes it easier for the patient to rest calmly during the examination.

Avoid delays

- Prepare the patient for the examination.
- Place the contrast medium within reach before the examination is started.

In this way, you avoid delays.

Correct respiration

The patient must hold his or her breath during CT acquisitions. This especially applies to examinations of the thorax and abdomen, of course. However, the slight movement that respiration inevitably causes, can also lead to artifacts in other regions.

- Explain to the patient before the examination how he or she should breathe.
- Explain to the patient that he or she must hold his or her breath for a relatively long time.
- Use the intercom system to give the patient breathing instructions.

Patient weight

Patients weighing up to 227 kg (500 lbs) can be examined without any restriction. The patient weight must be distributed according to IEC 6060-1.

- Before you extend the table top, the patient must be lying down.
- The patient may only sit on the table top when it is fully retracted.
- Be especially careful when positioning heavy patients on the table.
- Before you start the examination convince yourself that the patient is not endangered by the movement of the table.

Problematic patients

Special caution is required with obese, unconscious, apathetic, unresponsive or pediatric patients.

6.4.2 Preparing the patient table

Before you can position the patient onto the patient table, prepare the patient table, position a mattress, and attach positioning aids, if necessary.

WARNING

Lowering the patient table!

Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.



1 Lower the patient table until the patient can easily sit down or be placed on it.

2 Use any positioning accessories which might be necessary. (➔ Page 277 *Positioning the patient*)

The positioning mattress must be correctly secured.

We recommend covering the mattress with paper, for example with HOSTESS paper cloths no. 75312 (Length 50 m, width 60 cm, perforation every 28 cm).

Positioning the mattress

This section describes the accessories for positioning a mattress and the available mattresses.

Fixing the mattress with spill protection

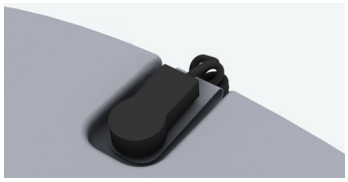
The mattress with spill protection must be fixed to the patient table.

- When positioning the mattress with spill protection, use Velcro to fix the mattress to the table.

The mattress is now fixed to the table and cannot move.

Connecting the equipotential bonding cable

Connect the equipotential bonding cable to ensure the potential equalization of the mattress with other medical devices.



1 Connect the equipotential bonding cable to the equipotential bonding connector pin at the backside of the mattress with spill protection.



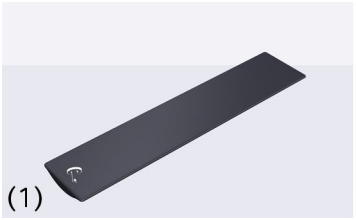
2 Connect the equipotential bonding cable to the potential equalization conductor at the Physiological Measurement Module.

When the equipotential bonding cable is connected, the equipotential bonding connector pin is covered by the mattress and only the cable is still visible.



Positioning the mattress with flat surface

The mattress with flat surface is used with concave table tops.



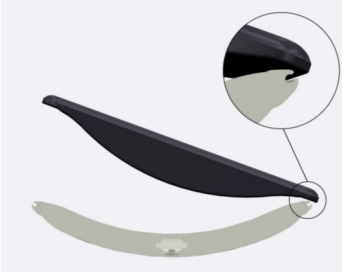


(1) Mattress with flat surface
(2) Logo indicating the foot end

When positioning the mattress with flat surface on the patient table, do the following:

1 Remove the supported mattress from the table top.

2 Position the side of the mattress with flat surface with the logo on the table top side furthest away from the gantry.



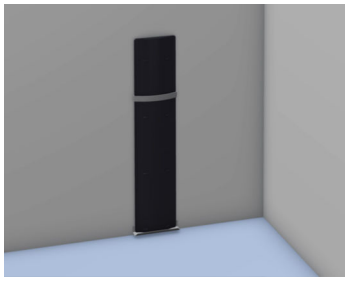
3 Apply the side edge of the mattress with flat surface over the side edge of the table top.

4 Press the mattress with flat surface onto the Velcro straps fixing points.

Please make sure that the Velcro straps of the mattress with flat surface are attached on the table top.

Storing the mattress with flat surface

You can store the mattress with flat surface in the wall holder.



- Place the mattress with flat surface in the storage holder vertically, and fix it with the Velcro straps in such a way that the mattress lays flat against the wall.

Please observe the manufacturer's notes in the attached assembly instructions.

Positioning the arm supports

The arm supports are placed under the patient and fixed by the patient's weight. The arm supports should be positioned outside the scan area, if possible.

CAUTION

Use of the mattress with flat surface!

Contusion of patient's fingers during table movement.

- Always use both arm supports with the mattress with flat surface.
- Observe that the hands of the patient are completely covered by the arm support.
- Always fix and observe the patient during table movement.

✓ The patient is correctly positioned.



1 Slightly lift the patient at the level of his or her arms.

2 Push the first arm support with its flat side into the space between patient and table.

3 Position the arm support in a way that the patient's arm lies tight and comfortable against his or her body.

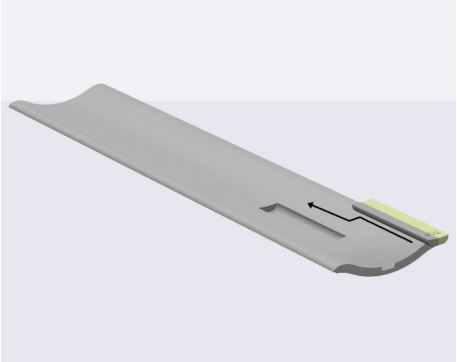


4 Ensure that the patient's hand is completely covered by the arm support.

5 Proceed to position the second arm support on the other side of the patient's body similarly.

After finishing the examination, the arm supports must be removed before the patient gets up from the table.

Using the Osteo positioning mattress



- Position the reference phantom in the cut out of the Osteo positioning mattress.

Position the reference phantom in such a way that the marking “TOP” points up toward the gantry.

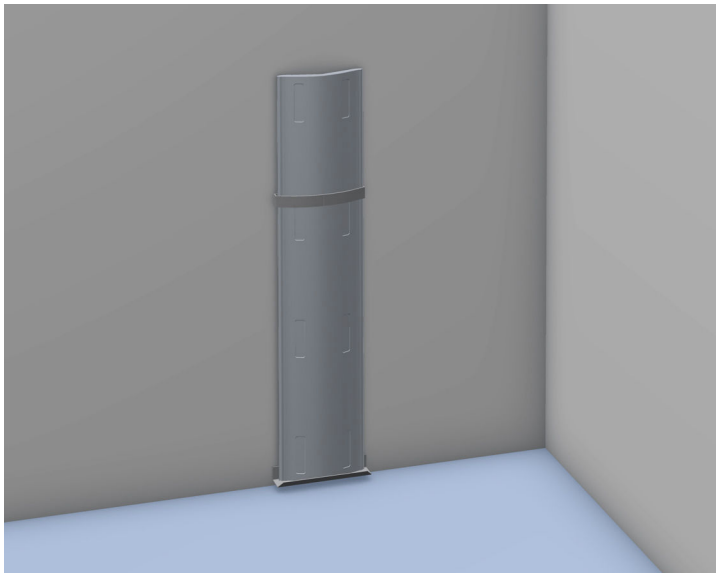
Inserting the gel pack

Normally, there is a space between the spine of the patient and the reference phantom. This falsifies the evaluation.

- Use the gel pack to fill the space.

Storing the Osteo positioning mattress

With the Velcro strap supplied you can hang the Osteo postioning mattress on the wall when not in use.



1 Attach the self-adhesive Velcro strap vertically to the wall in a suitable location in the examination room.

2 To store, press the fluffy reverse side of the mattress onto the Velcro strap.

Using positioning aids

The following positioning aids are mounted in the same way at the head end of the patient table:

- Head holder
- Head-arm rest
- Tiltable head holder
- Table top extension

WARNING

If a head holder or support does not engage securely, it can come loose!

Injury to the patient.

◆ Make sure that the pluggable positioning aids are seated firmly and securely engaged in the receptacle at the end of the table top.

WARNING

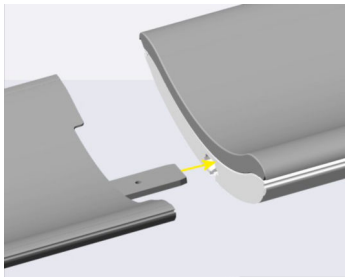
Tiltable head holder not correctly locked in place!

Undesired radiation exposure due to repetition of the scan.

◆ Always make sure that the tiltable head holder is correctly locked in place.

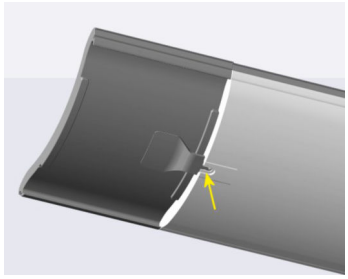
To avoid injuries, the safety information concerning the tiltable head holder must be observed. (➔ Page 40 *Tiltable head holder*)

Attaching a positioning accessory



◆ Push the holding bracket into the receptacle at the head end of the table until it is firmly engaged.

Removing a positioning accessory



◆ Press the release key from below and pull the positioning accessory out of the receptacle.

Adapting the infusion bottle holder



1 Put the infusion bottle holder into the adapter bush.

2 Turn the infusion bottle holder carefully until the notch on the bottom of the infusion bottle holder fits the pins on the bottom of the adapter bush.

3 Ensure that the notch on the bottom of the infusion bottle holder fits properly to the pins on the bottom of the adapter bush.

   Only in this position the infusion bottle holder fits in the adapter bush correctly and is secured against rotation.

6.4.3 Preparing the patient

This section describes how to prepare the patient for an examination and how to position the patient on the patient table. In addition, the use of accessories for positioning in various examinations is discussed.

⚠ WARNING

Incorrect patient positioning!

Injury to the patient by moving parts.

- Make sure that neither the patient's clothing nor hair can get caught in mechanical parts.
- Make sure that infusion lines and respiration tubes, catheters and ECG cables cannot get caught in the space between the table top and the side parts. These components must not be put under tensile stress in any other way.
- Make sure that patient bedding cannot get caught by moving parts of the patient table.
- Use positioning aids as described.

1 Make sure that there is no metal in the scanning area. Jewelry, glasses, and prostheses, for example, must be removed from the body region to be examined.

2 Use any suitable positioning aid which might be necessary (for example, cushions) to position the patient safely and comfortably.

It is only possible to scan the region of the body that is inside the range marked on the table top.

Immobilizing the patient

If necessary, immobilize the patient with one or more restraint straps, such that the patient is centered on the table with the extremities secured.

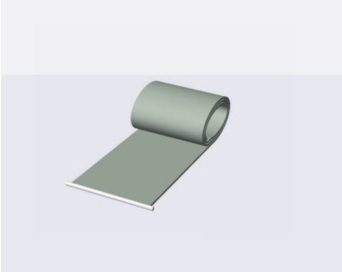
WARNING

The restraint straps are not permanently attached to the table!

They cannot prevent the patient from falling off the table.

Patients who do not keep still may fall off the table.

- Take special care with those patients.



1 Insert the straps in the slots at the sides of the patient table.

2 Position the straps by overlapping them across the patient and secure them with the Velcro strip.

Using the flaps and the restraint straps

✓ The patient is positioned on a mattress with spill protection.

- Close the flaps around the patient's body. If necessary, fix the flaps with one or more restraint straps.

The flaps are now protecting the table against body fluids.

The restraint straps are used to secure the flaps around the patient's body. They are not used to prevent the patient from falling off the table.

CAUTION

Incorrect use and use of non-original and non-released equipment!

Wrong diagnosis

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

WARNING

Incorrect use and use of non-original and non-released equipment!

Injury to the patient and personnel or damage to the equipment. Image quality may also decrease.

- Use only the original accessories and equipment or equipment that is released by Siemens Healthineers. This includes, for example, phantoms, footswitches, ECG-cables, positioning aids, or table extensions.
- Use the released equipment exclusively for its original purpose.
- Always follow the instructions for use of the particular units used. This includes the labels applied on to the equipment as well as the instructions for use documents.

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

Applying infusion tubes

WARNING

Use of short infusion tubes!

Tensile stress on infusion tubes when moving the table top. Tubes can get caught.

- Only use infusion tubes that are long enough.

- Make quite sure that tubes cannot get caught anywhere.

6.4.4 Moving the patient to the scan start position

In this section you will find out how to move the patient on the patient table to the topo scan position.

Setting the patient orientation

✓ When no scan protocol has been loaded before patient positioning, the orientation of the patient can be changed on the Touch Panel (**Head first**, **Feet first**) for correct patient positioning.

Check the position of the patient on the patient table. In case of mismatch, change the position on the positioning screen.



1 Tap the **Rotate patient** icon to change the orientation of the patient (**Head first**, **Feet first**).

2 Position the patient table for the scan. (➔ Page 178 *Operation of the patient table*)

3 After positioning the patient, confirm the patient position in the **Patient Model Dialog** at the console.

The **Rotate patient** icon is only visible when no scan protocol is loaded or the **Camera Position mode** is not active.

Setting the table height

Position the patient in the isocenter of the gantry by setting the height of the patient table.

WARNING

Lowering the patient table!

Body parts can get caught.

- Make sure that the patients body parts are above the patient table.
- Make sure that neither body parts of anybody nor any objects are below the patient table.





- Use the gantry operator panel keys to set the table height such that the region of interest is in the center of the scan field.

  (➔ Page 179 *Moving the table top vertically*)

  (➔ Page 183 *Moving the table top vertically*)

You can achieve optimum image quality if the center of the measuring object coincides with the light beam of the lateral lightmarker. The lightmarker marks the center of the measuring field.

If the optional **Camera Position mode** is active, the isocenter of the patient is captured and the patient table is positioned automatically. It is not necessary to adjust the table height manually. (➔ Page 182 *Deactivating the Move Table Top Only mode*) (➔ Page 185 *Deactivating the Move Table Top Only mode*)

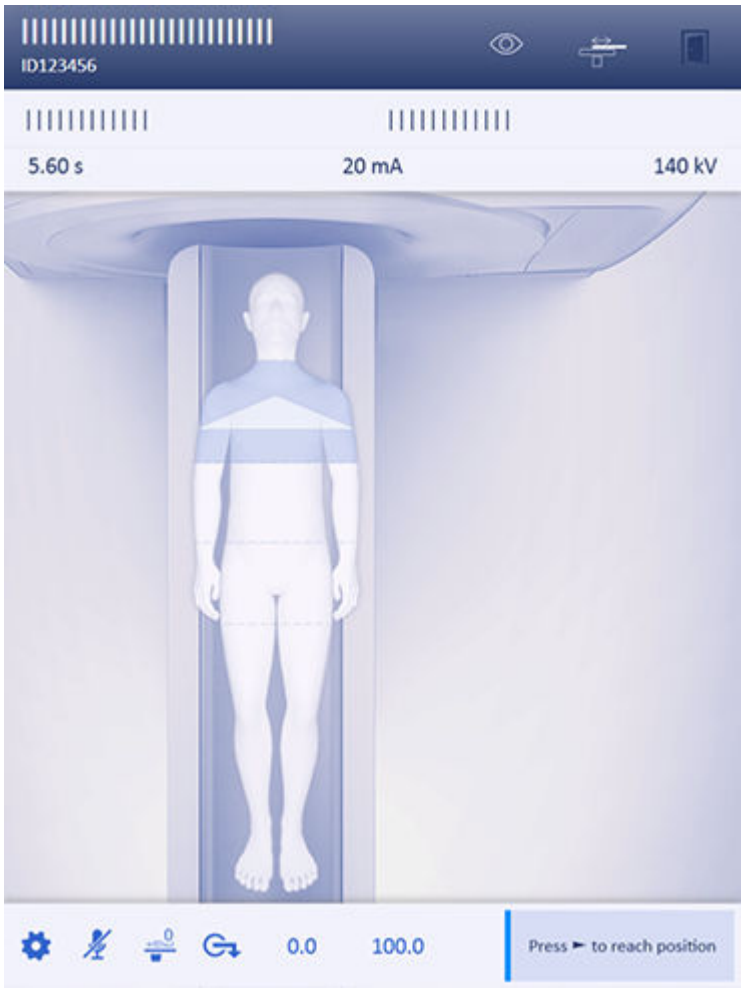
Moving toward the gantry



- Use the gantry operator panel key to move the table top with the patient towards the gantry. (➔ Page 180 *Moving the table top horizontally*)

You can use the Touch Panel to move the patient table to predefined positions. (➔ Page 289 *Moving the patient into the scan plane*)

Moving the patient into the scan plane



1 On the positioning screen, select the start position by tapping on the body region you want to scan.

The selected body region on the patient position display is highlighted and the scan direction is displayed as arrows.

Note the instruction message. The **Move** key is activated.



2 Press and hold the **Move** key until planned start position is reached.

The table movement stops automatically as soon as the planned start position is reached.

Using the internal laser lightmarker

You can either switch on the laser manually or use the **Auto Laser** on the Touch Panel.

CAUTION

Looking into laser beam with optical instruments!

Loss of sight possible.

- Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces.

CAUTION

Laser radiation!

Possible loss of eyesight due to laser radiation.

- Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces during adjustment.

The patient must not wear glasses or contact lenses.

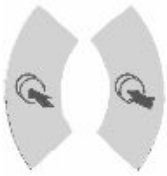
1 Instruct the patient not to look directly into the laser beam.



2 On the gantry operator panel, press the **Laser lightmarker** key to switch on the laser.

– or –

If you have activated the **Auto Laser** in the settings popover and reached the topogram start position, the internal laser is switched on automatically at arrival of the internal (CT) laser. (➔ Page 105 *General settings*)



3 Adjust the longitudinal position of the patient table using the keys for horizontal table movement.



4 Adjust the height of the patient table using the keys for vertical table movement.

The vertical lightmarker indicates that the examination region is in the center of the scan field.

Ensure that the laser lightmarkers coincide with the scanning plane.



5 Press the **Laser lightmarker** key to switch off the laser lightmarker.

The patient must lie still for the remainder of the examination.

Setting the table position to zero



- Press the **Zeroing** key.

  This will set the starting point of the topogram to zero.

Zeroing is only possible between patient registration and the start of the very first scan.

Setting the patient table position to zero



- On the Touch Panel, tap and hold the **Set zero position** button until the circular progress bar is fully loaded.

  The system will set the patient table position to zero. The patient table position is displayed.

At the *syngo* Acquisition Workplace, zeroing is only possible between patient registration and the start of the very first scan. On the Touch Panel, zeroing is possible even before registering the patient.

Checking the patient position

CAUTION

Wrong labeling of the sides when the patient is repositioned!

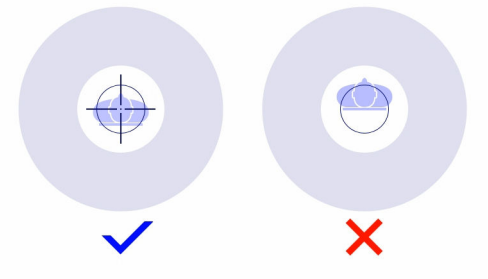
Wrong basis for diagnosis and treatment.

- Correct the patient orientation when the patient is repositioned.
- Review the labeling of the sides, to avoid wrong operative intervention.

- Check whether the position and orientation of the patient were correctly entered when the patient data were entered.

Centering the patient

1 For optimum image quality and dose application to patient size and body shape with CARE Dose4D, position the patient in the isocenter of the gantry.



2 Double-check and verify the position of the patient with the laser lightmarker as well as in the topogram.

If the patient is positioned too high, the mAs for the subsequent scan is increased.

If the patient is positioned too low, the mAs for the subsequent scan is reduced and the images show increased noise.

For head scans with **Auto Isocenter**, you may be prompted to raise or lower the patient table. This has no impact on the dose modulation with CARE Dose4D.

Checking patient safety

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

1 Before starting the examination, make sure that table top movement toward the gantry opening is not obstructed.

2 Ensure that the patient cannot be injured by a movement of the table.

Always observe agitated and unresponsive patients all the time during the examination.

6.4.5 Using the 3D camera

This section describes the workflow to position the patient using the 3D camera.
(➔ Page 105 *General settings*)

CAUTION

Incorrect calibration of the camera!

Unintended radiation exposure

- Always verify the patient positioning with the laser light marker.
- Use the camera for assisted patient positioning, only.

Fields of use

The 3D camera workflow is intended for routine examinations of adult and adolescent patients.

The 3D camera workflow is not optimized for examinations requiring special equipment that could prevent the proper detection of body landmarks or the iso center of a patient.

It is **not** recommended to use the 3D camera for the following examinations:

- Scanning infants
- Scanning trauma patients
- Scanning patients for radiotherapy treatment planning

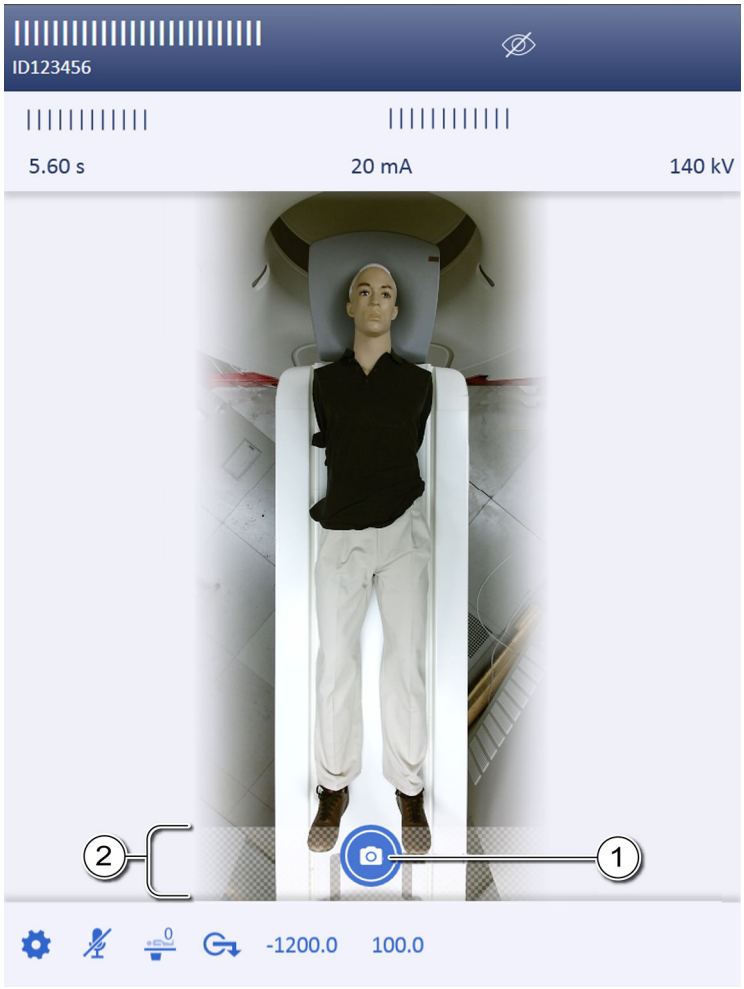
Taking a planning image

On the positioning screen, you can take a planning image of the patient.

✓ The patient is positioned on the patient table directly below the camera system.
(➔ Page 285 *Preparing the patient*)

Make sure that the entire patient, from head to toe and with sufficient additional clearance, is visible on the Touch Panel screen.

✓ A live image of the patient is displayed on the positioning screen.



(1) **Camera** icon
(2) Shaded area
The shaded area represents the range which cannot be scanned.
You can take planning images at any vertical table position, even when a part of the Touch Panel screen is shaded.



1 Tap the **Camera** icon.

A planning image of the patient is captured and displayed on the positioning screen.

As the planning image is created, an algorithm runs in the background detecting the following points automatically:

- Patient position (**Head first**, **Feet first**, **prone** / **supine**)
- Body landmarks of the patient
- Isocenter of the patient

The body landmarks and the iso-center of the patient could not be detected and the **Preset** icons are dimmed.

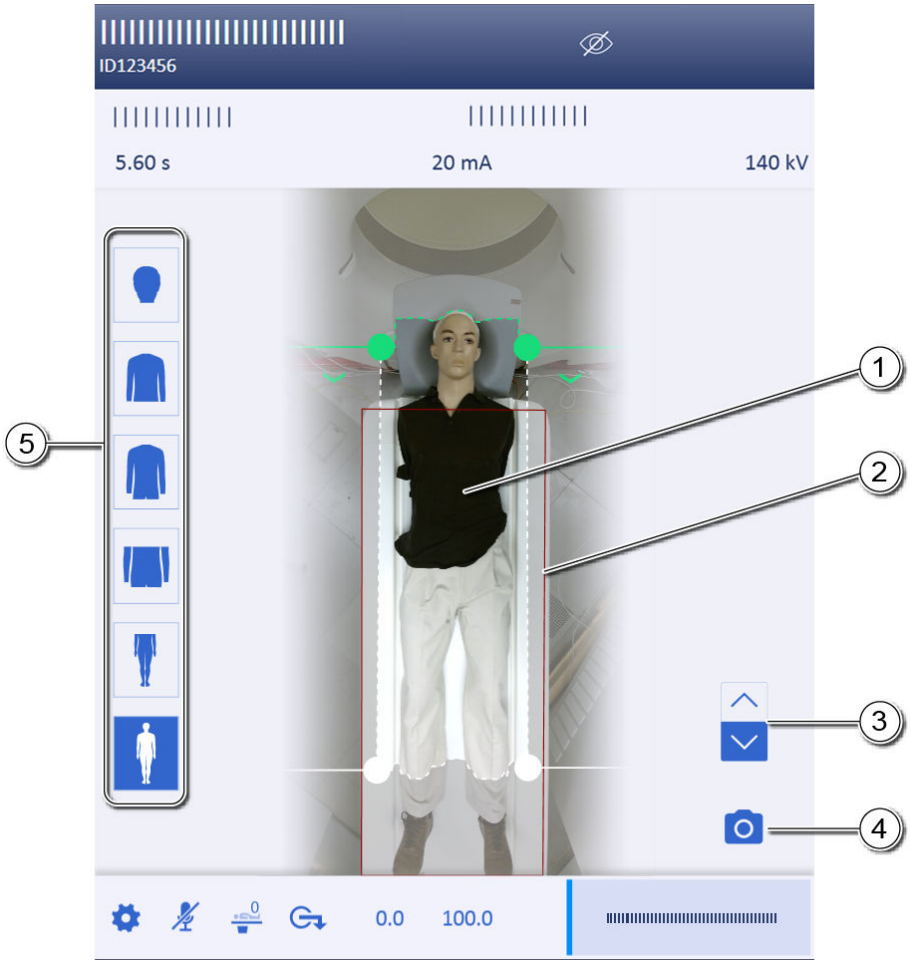
- Position the patient directly below the camera and retake the planning image.
- Move away any device which obstructs the view on the patient and retake the planning image.
- Position the patient manually by using the movement keys on the gantry operator panel.



2 Optional: If you wish to retake a planning image, tap the blue **Camera** icon to go back.

A live image of the patient is displayed again.

Planning the scan ranges You can modify the topogram scan ranges manually or by choosing presets.



(1) **Topogram scan range**
Green line: Scan start position
White line: Scan end position
Arrows: Indicate the scan direction

(2) **Red frame**: Indication for correct camera calibration
If the red frame does not overlap the patient table, call Siemens Healthineers service for recalibration of the 3D camera.

(3) **Scan direction** icons
Tap the corresponding icon to change the scan direction.

(4) **Camera** icon
If you wish to retake a planning image, tap the camera icon.

(5) **Preset** icons

Using the scan range presets

You can select a scan range preset that was automatically calculated and shown on the planning screen.

✓ The patient has been registered and a scan protocol has been selected according to the Instruction for Use.

✓ If the patient has not been registered and a scan range has not been selected in the scan protocol, the scan range is set to the whole body of the patient.

1 If you want to change the preconfigured scan range, tap a **Preset** icon that you want to scan.

The body region is marked on the planning image of the patient and a notification of the body region name pops up for three seconds.

The **Preset** icon is dimmed and a default scan range is marked on the planning image when the system could not detect a specific landmark.

- Retake a planning image. (➔ Page 293 *Taking a planning image*)

  If possible, remove positioning aids, blankets, or other devices out of the field of view of the 3D camera when capturing the planning image.
- Adjust the topogram scan range manually. (➔ Page 297 *Manually adjusting the scan range*)

---

2 Check the preconfigured scan range on the planning image of the patient.

If the scan range is configured correctly, move the patient table to the scan start position. (➔ Page 297 *Moving the patient table to the scan start position*)

If the topogram scan start or end position is not placed correctly, adjust the scan range manually.

Manually adjusting the scan range

You can change the scan range manually on the patient.

✓ A planning image of the patient was taken and a scan range preset is marked on the patient model.

1 Touch and drag the scan range to move it vertically along the planning image of the patient to your desired position.

– or –

Touch and drag the scan start line (green) or end line (white) to move them to your desired position.

2 Press and hold the **Move** key to reach the new topogram scan start position.

Use the zoom and pan function to better visualize the body parts on the planning image.

On the Touch Panel, move two fingers away from each other to zoom in and touch and drag the image to pan.

Moving the patient table to the scan start position

✓ When you have finished planning the scan ranges, move the patient to the planned scan start position.



- On the gantry operator panel, press and hold the **Move** key until the patient table has reached the scan start position.

  The table movement stops automatically as soon as the planned start position is reached.

  The instruction message area shows **Planned Start Position Reached**.

Checking the patient position

The patient position and the isocenter are calculated when the planning image is captured. However, check whether the patient is correctly positioned and properly placed in the isocenter. Use the laser lightmarker. You can either switch on the laser manually or use the **Auto Laser** on the Touch Panel.

CAUTION

Incorrect calibration of the camera!

Unintended radiation exposure

- Always verify the patient positioning with the laser light marker.
- Use the camera for assisted patient positioning, only.

CAUTION

Looking into laser beam with optical instruments!

Loss of sight possible.

- Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces.

CAUTION

Laser radiation!

Possible loss of eyesight due to laser radiation.

- Do not look directly into the laser beam or at its reflection on smooth, mirror-like surfaces during adjustment.

The patient must not wear glasses or contact lenses.

1 Instruct the patient not to look directly into the laser beam.

2 On the gantry operator panel, press the **Laser lightmarker** key to switch on the laser.



– or –

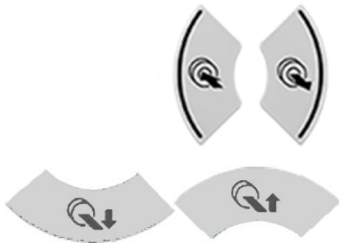
If you have activated the **Auto Laser** in the settings popover and reached the topogram start position, the internal laser is switched on automatically at arrival of the internal (CT) laser. (➔ Page 105 *General settings*)

3 Use the laser lightmarker to check the scan start position.



If necessary, adjust the longitudinal position using the keys for horizontal patient table movement.

4 Use the laser lightmarker to check whether the patient is positioned in the isocenter.



If required, adjust the height of the patient table using the keys for vertical table movement.

5 Use the laser lightmarker to check whether the patient is positioned in the center of the scan start line.

If required, reposition the patient.

6 Press the **Laser lightmarker** key to switch off the laser lightmarker.



The patient must lie still for the remainder of the examination.

6.4.6 Radiotherapy functions

You have the choice of three workflows to position the patient for RTP.

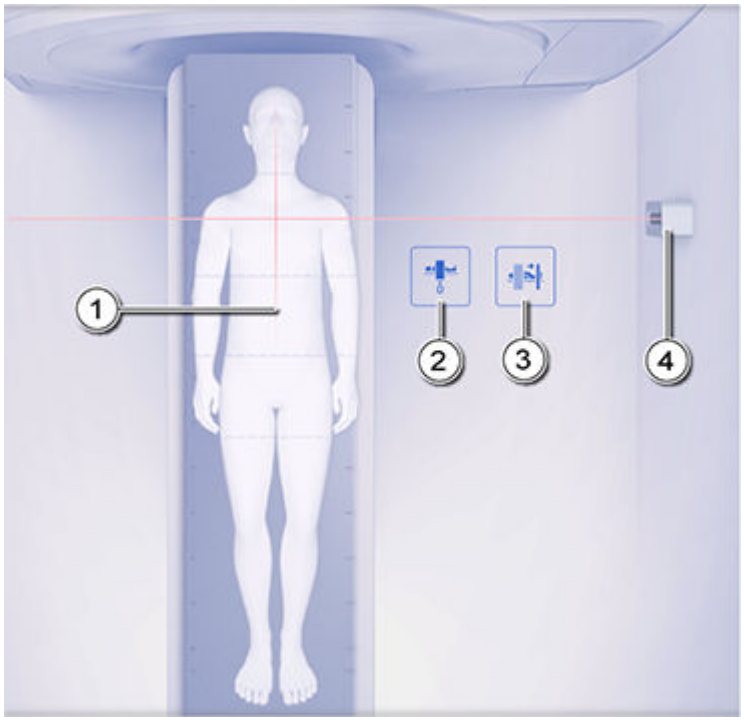
✓ **Radiotherapy functions** are turned on. (➔ Page 105 *Settings popover*)

✓ The patient is positioned so that the area to be marked is lined up with the **RT Laser**. Draw reference marks onto the patient's skin and optionally stick radio-opaque markers onto the drawn marks.

Automated table zeroing at the CT Laser

✓ **Automated table zeroing** is turned on and the **CT Laser** is set.

✓ The positioning screen has changed and the following icons are available:



(1) Patient model
(2) **Zero at CT Laser** icon
Saves the position at the external (RT) laser.
Table position is zeroed when internal (CT) laser position has been reached.
(3) **Move to RT Laser** icon
Moves the patient table back to the external (RT) laser position.
(4) External (RT) laser



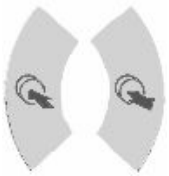
1 Tap the **Zero at CT Laser** icon to save the current table position and to activate the move request of the patient table.

The current table position at the external (RT) Laser is saved.



2 Press and hold the **Move** key until the table movement has stopped and the instruction message area has turned green.

The patient table has moved to the internal (CT) Laser lightmarkers and the table position has been zeroed automatically.



3 Use the **Table In/Out** keys on the gantry operator panel to move the patient table to the scan start position.

You can now perform a scan.

Do not select a body region on the patient model to position the patient as the table height could change.



4 After the scan, tap the **Move to RT Laser** icon to activate the move request.



5 Press and hold the **Move** key until the patient table has reached the saved position at the RT Laser.

The marks on the patient are lined up with the external RT Laser again.

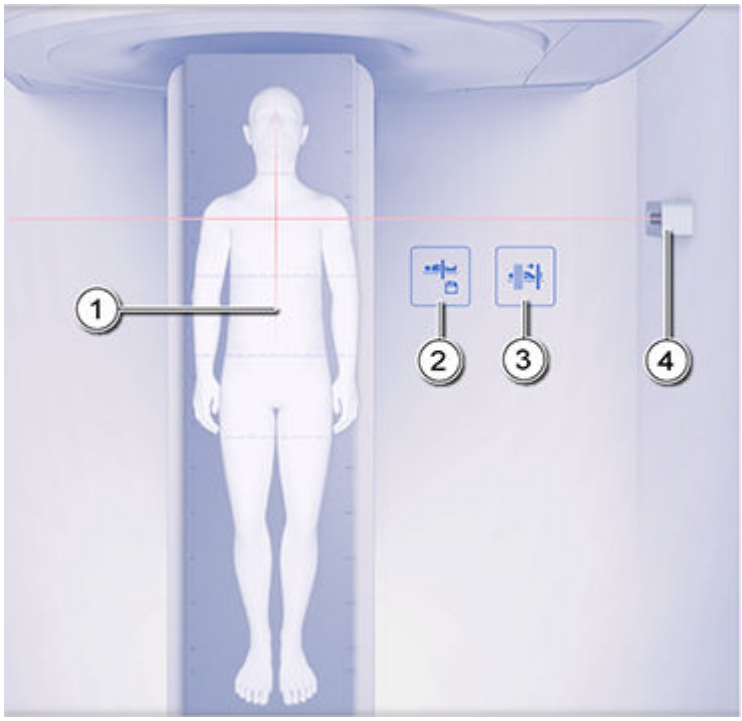


If you configured the **Automatic table zeroing** and manually set the table position to zero in the tools area after automated zeroing has been performed, the manual set zero overwrites the automated set zero.

Automated table zeroing at the RT Laser

✓ **Automated table zeroing** is turned on and the **RT Laser** is set.

✓ The positioning screen has changed and the following icons are available:

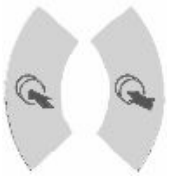


(1) Patient model
(2) **Save at RT Laser** icon
Saves the position at the external (RT) laser.
Zeros table position at the external (RT) laser.
(3) **Move to RT Laser** icon
Moves the patient table back to the external (RT) laser position.
(4) External (RT) laser



1 Tap the **Save at RT Laser** icon.

The current table position is zeroed at the RT Laser position. This enables the functionality to move the patient table back to zero (external (RT) laser position) after the scan.



2 On the gantry operator panel, use the **Table In/Out** keys to move the patient table to the scan start position.

You can now perform a scan.



3 After the scan, tap the **Move to RT Laser** icon.

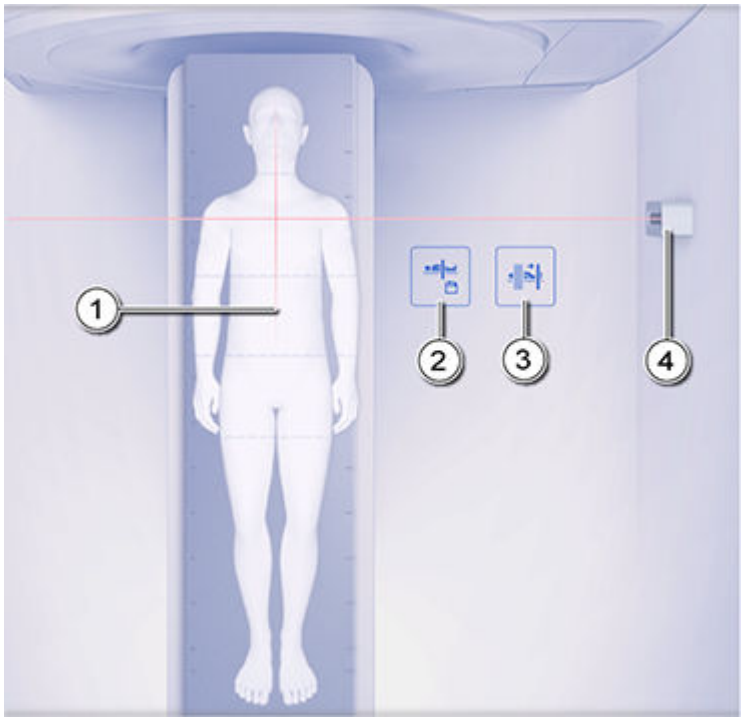


4 Press and hold the **Move** key until the patient table has moved back to zero position at the RT Laser.

Positioning the patient for radiotherapy without automated zeroing

✓ **Automated table zeroing** is turned off.

✓ The positioning screen has changed and the following icons are available:



(1) Patient model
(2) **Save at RT Laser** icon
Saves the position at the external (RT) laser.
(3) **Move to RT Laser** icon
Moves the patient table back to the external (RT) laser position.
(4) External (RT) laser



1 Tap the **Save at RT Laser** icon to save the current table position at the external (RT) Laser and to activate the move request of the patient table.

The current table position at the external (RT) Laser is saved.

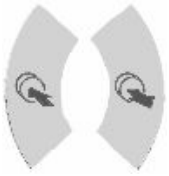


2 Optional: Press and hold the **Move** key until movement stops.

The patient table moved to the internal (CT) Laser.



3 Optional: Zero the patient table at the internal CT Laser. Tap and hold the **Horizontal zeroing** icon.



4 Use the **Table In/Out** keys to move the patient table to the scan start position.

You can now perform a scan.



5 Tap the **Move to RT Laser** icon.



6 Press and hold the **Move** key until the patient table has reached the saved position at the RT Laser.

The marks on the patient are lined up with the external laser lightmarker again.

6.4.7 Talking to the user at the console

At any time during patient preparation you can talk to the user at the console with the **Intercom** button on the Touch Panel.

You can operate the intercom at the gantry.



1 Touch and hold the **Intercom** icon to talk to the user at the console.

(➔ Page 105 *Tools area*)

2 Release the **Intercom** icon to cancel the communication channel.

6.4.8 Stopping system movements and radiation

In case of an emergency, all system movements and radiation can be interrupted by pressing the **STOP** or **EMERGENCY OFF** key.

1 Make sure that you know where the **STOP** keys and **EMERGENCY OFF** key are located. (➔ Page 15 *Terminating system movements and radiation*) (➔ Page 16 *Shutdown in case of emergency*)

You find **STOP** keys at the gantry and on the control box.



2 Always observe the patient directly. In critical situations press the nearest **STOP** key.

All system movements are stopped immediately. Radiation is shut down. (➔ Page 15 *Terminating system movements and radiation*)

3 Press an **EMERGENCY OFF** if the system does not respond to the **STOP** keys in any hazardous situation.

The **EMERGENCY OFF** key interrupts the power supply of the system. Data can be lost.

6.5 Positioning animal patients

The SOMATOM CT system can be used for both animal and human patients. Besides those restrictions implied by technical specifications of the SOMATOM CT system (for example, aperture of the gantry), there are no additional restrictions when using the system for animal patients.

The technical specifications for the SOMATOM CT system equipment are given in: *System Owner Manual*. For more information on the relevant safety measures, refer to: (➔ Page 61 *Safety information on animal patients*).

United States federal law restricts this device to sale by or on the order of a physician or veterinarian (21 CFR 801.109(b)(1)).

Veterinary use does not cover laboratory or other primary scientific animal use.

CAUTION

Body fluid (blood, urine etc.) comes into contact with electrical components!

Possibility of electric shock.

- Always make sure that the animal cannot lose uncontrolled body fluid during scanning, for example by using catheters or diapers.

CAUTION

Using an animal protocol for scanning a human!

Injury to the human or radiation damage.

- The scan protocols must be uniquely assigned as animal protocols.
- Do not use animal protocols for humans.

6.5.1 Immobilizing animal patients

Sedate or anesthetize

Veterinary use of the SOMATOM CT system requires that you sedate or anesthetize the animal patient before scanning. This is done to prevent injury to the animal patient or attending personnel, damage to the equipment, or misdiagnosis due to movement of the animal patient during scanning.

CAUTION

The animal is not immobilized!

Contusion, fractures of the operator, personnel or attendant. Damage to the equipment.

- Always anesthetize or sedate the animal before scanning.
- Keep the number of persons in the examination room as low as possible.

CAUTION

The animal is not immobilized!

Wrong diagnosis due to wrong image information.

- Always anesthetize or sedate the animal before scanning.

Movement during scanning

If the effect of the sedation or anesthetization weakens during scanning, uncontrolled movements of the animal patient could also result in injury or misdiagnosis. Therefore the animal patient needs to be observed at all times.

CAUTION

Unintentional patient movement!

Injury to the patient.

- Always fix and observe the patient during the measurement.

WARNING

Incorrect patient positioning, unintended patient movement, and unobserved movement of the patient table or gantry!

Injury to the patient, for example, contusions of the patient's extremities and unusable radiation.

- Always fix the patient with accessories, as described in the instructions for use, to avoid unintentional patient movement. For example, use restraint straps and arm supports.
- Monitor the patient continuously as long as the table top and gantry are moving. Take special care if the tilt of the gantry is anything other than zero degrees or the table height is anything other than the isocenter.
- Make sure that nothing can get caught while the table or gantry are moving. For example, parts of the body or clothing, any needles, infusion tubes, respiration tubes, catheters, ECG cables, or sheets and blankets.
- Follow the markings and labels on the equipment.
- Press a STOP key if an injury to the patient can occur.

6.6 Scan

When examining a patient, you need to perform the following workflow steps:

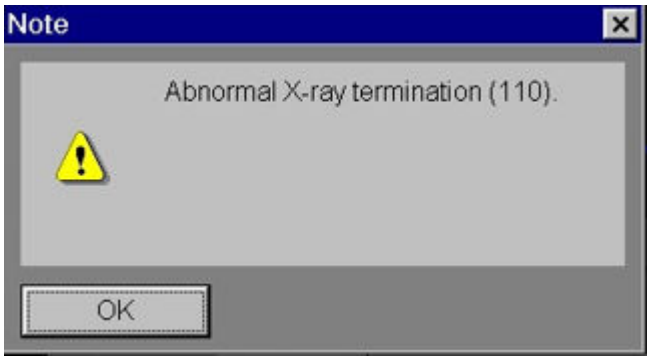
- Scan a topogram
- Plan scan and reconstruction jobs
- Scan a tomogram

syngo provides many ways of optimizing the dose applied to a patient. For more information, see (➔ Page 189 *Dose management and optimization*).

If you use the keyboard to change values, you then need to press the **Enter** key to confirm them.

In the chronicle, you may see delays inserted between the scan ranges. Delays are automatically added to prevent the X-ray tube from overheating. If the actual tube temperature after a scan is lower than that expected, the system will remove the delay before the next scan. This can occur, for example, because of a pause between scans.

Every scan has a preset scan time. If the preset scan time is exceeded by 110%, the scan is aborted and the following dialog box opens:



If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

CAUTION

Scanning patients with implanted devices such as pacemakers or neuro stimulators!

Interferences may cause malfunctions of the implanted device.

◆ Observe the patient closely during examination.

CAUTION

Native Windows configuration dialog box does not disappear while radiation is started. The dialog box remains visible, as it is a dialog box displayed by "Windows" and not a *syngo* dialog box!

This may cause confusion.

- Avoid opening this dialog box while radiation can be applied. The computer and the *syngo* system should never be configured during an acquisition.

CAUTION

Superimposition by subfunctions, for example, SOMATOM life!

Scan parameters are superimposed. Dose not as desired.

- Close subfunctions before scan start.

6.6.1 Monitoring patients

As long as the table or scanning unit is moving during scanning, the patient must always be visible and the intercom system must be switched on to hear the patient.

Special care is required if contrast medium is injected intravenously during an examination with table feed (for example, spiral scans).

CAUTION

Patient intercom system nonfunctional!

Patient cannot be understood in case of an emergency.

- Leave the intercom system switched on during the examination (**Listen to patient** key).
- Keep eye contact with the patient when talking or listening to him or her.

✓ The patient is informed to speak loudly during the communication process.



1 At the control box, press the center of the **Listen to patient** key to turn on the listening connection.

The icon on the **Listen to patient** key is backlit. You can hear the patient talking.

2 Press **+** and **-** in the upper and lower edges of the key to adjust the volume of the gantry loudspeaker.

3 Press the **Listen to patient** key again to cut off the listening connection.

6.6.2 Talking to the patient

With the intercom system, you can talk to the patient or play back several permanently stored patient instructions. It is also possible to record two additional announcements with a maximum length of 30 seconds each.



1 Press the center of the **Talk to patient** key and keep it pressed while talking into the microphone.

2 Press **+** and **-** in the upper and lower edges of the key to adjust the loudspeaker volume.

3 Release the **Talk to patient** key to cut off the connection.

When talking to the patient, a distance of approximately 30 to 40 cm (10 to 15 in) to the microphone of the control box is recommended. If there is a high noise level the distance should be 20 to 30 cm (8 to 10 in.).

When recording a patient instruction, a distance of approximately 20 to 30 cm (8 to 10 in) to the microphone of the control box is recommended.

6.6.3 Acquiring a Topogram

A topogram is used as follows:

- To plan the scan and recon ranges
- To watch the progress of an active tomogram scan
- To document the reconstructed slices with reference lines

Checking the topogram parameters



1 Select the topogram step of your scan protocol in the chronicle.

2 Check the topogram parameters set on the **Routine** parameter card.

If necessary, you can correct the topogram length.

3 In the **Topogram length** field, enter the required length of the topogram range.

If necessary, you can correct the tube position.

4 Click the relevant button:

- **Top**: Radiation top down; tube is in top position
- **Bottom**: Radiation bottom up; tube is in bottom position
- **Lateral**: Radiation from the side of the gantry

If the topogram cannot be scanned in full length because of the current table position, a message pops up in the status bar. A shortened topogram will then be scanned and reconstructed.

Topogram scan sequences for Auto reference line usage

For best results when using the **Auto reference lines** function, consider the following recommendations.

When scanning several topograms for separate body areas, observe the following sequence: After scanning the topogram for a specific body area, scan the tomogram for the same body area. Repeat this sequence for each body area to be examined.

Starting the topogram scan

If you have a scan room door observation, a yellow message is displayed after you have loaded the scan protocol, and the door of the examination room is not closed.

A transparent blue shutter is displayed on the topogram, which indicates the available FoV. It is shown when the corresponding tomogram scan entry is selected.

The area where image quality prevails is inside the blue shutter, and needs to be kept in mind for patient positioning:

- Cardiac, Chest Pain, Obese, and Heart VPCT: The blue shutters in the resulting topogram indicate the parts with reduced temporal resolution.
- Turbo Flash Spiral, Turbo Flash Thorax, Turbo Flash Spiral Cardiac: The blue shutter in the resulting topogram indicates the part that cannot be reconstructed.
- Dual Energy: The blue shutter in the resulting topogram indicates that the outer part is reconstructed only with tube A.
- Head and UHR: The blue shutter in the resulting topogram indicates the part that cannot be reconstructed.

To achieve the required images, it is necessary to position the patient correctly.

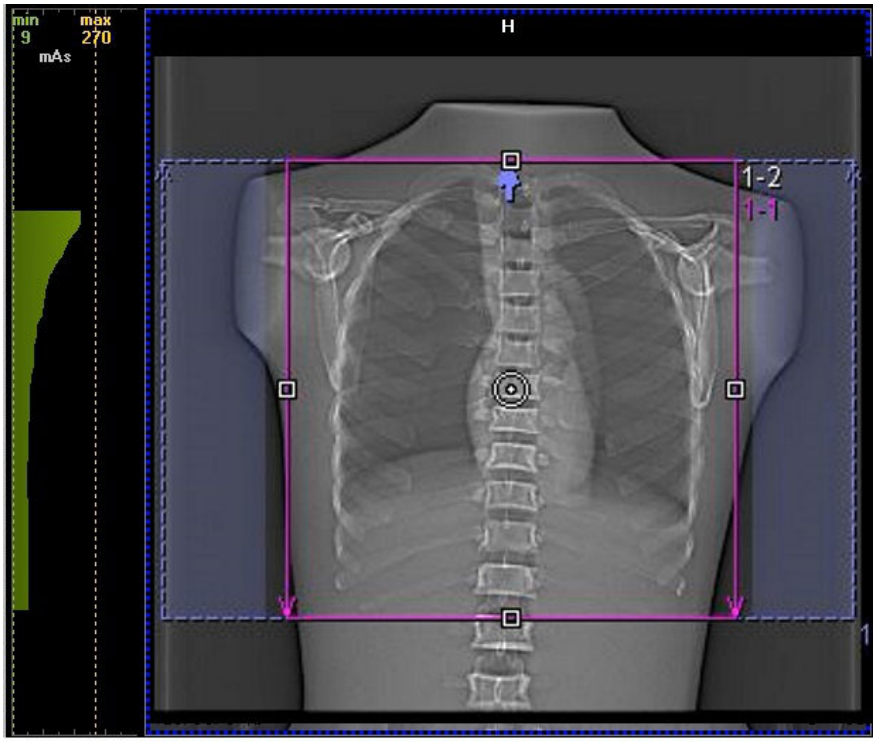
1 When positioning the patient, zero the table position at the gantry or on the topogram **Routine** parameter card in a way that future table positions always refer to this position.

2 Click the **Load** button to confirm the scan parameters.



3 Press the **START** key on the control box.

The topogram and the **CARE Profile** are displayed in the upper left segment of the **Examination** task card.



The **CARE Profile** shows the distribution of the dose to be applied along the z-axis of the patient for the selected scan range.

In the topogram, two dashed orange lines are displayed. These lines delimitate the area in which the patient may be exposed to radiation for the tomogram scan.

The topogram is displayed in real time. You can stop the scan with the **Suspend** button as soon as enough data is acquired.



4 On the **Routine** parameter card, adjust the table position stepwise, if necessary.

You have to pay special attention while moving the patient table to avoid any risk of injury to the patient.

6.6.4 Planning an Examination

There are many possibilities to optimize the dose applied to a patient. For more information, see (➔ Page 189 *Dose management and optimization*).

There are two recon and scan planning modes, one for spirals and one for the other scan modes.

CAUTION

Wrong start delay!

X-ray not, or only partially, usable.

- For acquisition with contrast medium, select the flooding time of the contrast medium as the delay.

CAUTION

Misunderstanding of reference point for start delay in bolus examination!

Faulty synchronization between bolus and scanning.

- Make sure that the chosen delay time fits to the characteristics of the bolus injection.

CAUTION

Artifacts affecting the diagnosis are evident or suspected in a patient image, or the patient may have moved during scanning!

Improper diagnosis possible.

- Scanning must, under all circumstances, be repeated with a slight shift in patient position.

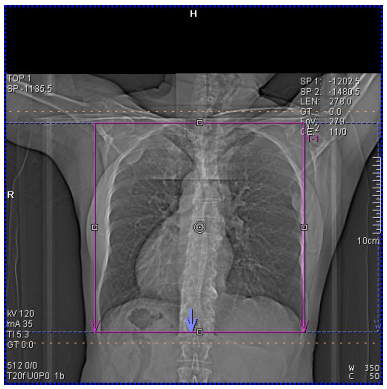
Using recon planning for spirals

You can plan and store different scan and reconstruction ranges for spiral examination directly after scanning the topogram, before scanning the tomogram.

After scanning the topogram, the recon planning is active whenever a recon job is selected. The recon range frame in the topo segment is displayed in magenta.

Recon planning before scanning allows you to do the following procedures:

- Plan and scan adjoining, overlapping recon ranges, and recon ranges with gaps in-between
- Predefine adjoining recon ranges, in one scan, for example, thorax and abdomen



The ranges are indicated as follows:

- Scan range in blue, blue dotted during recon planning
- Recon range in magenta

1 Use the dog-ear to select another image in the tomo segment to set the recon target (if the range has already been scanned).

2 To display the recon target, scale down the tomogram image with the zoom function first.

– or –

Click the **Overview** button on the **Recon** parameter card. An overview image covering the maximum FoV is reconstructed and displayed.

Detecting regions

FAST Planning positions the recon range and the scan range on regions specified in the scan protocol. After acquiring a topogram, you can detect further regions.

1 Select the **Recon** parameter card.

2 From the **Recon Region** drop-down list, select another region to be detected.

3 Select **Wide** to include soft tissue.

– or –

Select **Narrow** if you do not want soft tissue included.

The recon range is adapted.

You are prompted to move the patient table to achieve best image quality if the head is not in the isocenter when loading the head range, or if two topograms of the same body region are performed and the scan is planned in both topograms.

Only for head examinations: The FoV is adjusted to at least 200 mm.

Adapting FoV manually

1 Select the recon job using the **Recon** icon in the chronicle.

2 Check in the topo segment whether the position of the FoV in the tomogram is correct. If not, move the center.

3 Change the size of the FoV with the side handles to keep the manually adapted FoV.

When to FoV is adapted, the entry in the **Recon Region** drop-down list is set to None.

Performing the recon planning

Recon range planning is possible on selected parameter cards (**Routine**, **Recon**, **Auto Tasking**, **Intervention**, or **Trigger**), except for the **Scan** parameter card.

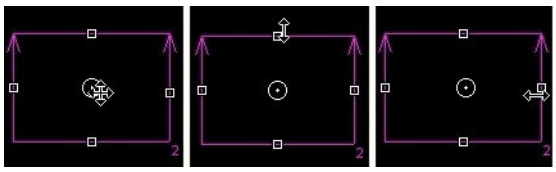
If a recon range manipulation causes one or more axial gaps, a message box is displayed informing you about it. This message box is displayed after saving a scan protocol or pressing the **LOAD** button.

The FoV is inherited if the recon jobs have the same FoV and center position, irrespective of their beginning or end position.

The recon jobs of a scan range define the length of the scan range. You can modify the length by the recon jobs. Resizing the scan range is possible with recon planning.

1 Select the recon job in the chronicle you want to edit.

2 Move the range or the cutlines by dragging the center.





3 Modify the length of the range by dragging one of the handles (upper/lower handle - range begin/end position handles) or the FoV of the range (side handles).



4 To avoid modifications of the following ranges with the same FoV and the same center position, use the **Shift** key.

The parameters defining the reconstruction area are passed on from one recon job to another. The scan range size is adapted corresponding to the applied recon range operation.

5 Perform the spiral and subsequent reconstructions in the usual way. For how to proceed: (➔ Page 318 *Performing the spiral acquisition*)

6 Select **Edit > Save Scan Protocol** in the main menu whenever you want to save the current scan protocols during the examination.

The scan protocol is saved.

You can view the scan protocols and edit their parameters in the **Scan Protocol Assistant**.

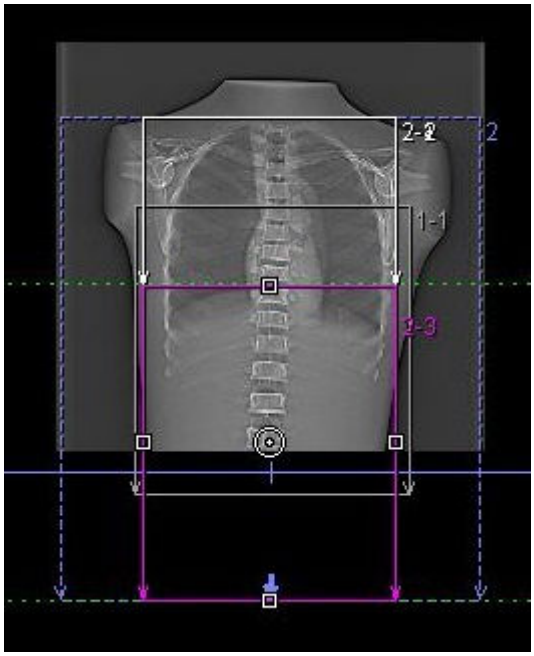
ThorAbd (Thorax Abdomen) protocol

With the ThorAbd protocol, you can examine the thorax and the abdomen range by using one scan procedure.

- The ThorAbd protocol contains a thorax range with reduced dose and a standard dose abdomen range.
- The scan range is divided into typically one or two ranges with reduced dose and a cardiac/standard dose range by a special standard dose recon job.

You cannot delete the special standard dose recon job. A copy of this recon job will only inherit the normal parameters but not the property for defining the cardiac/standard dose range.

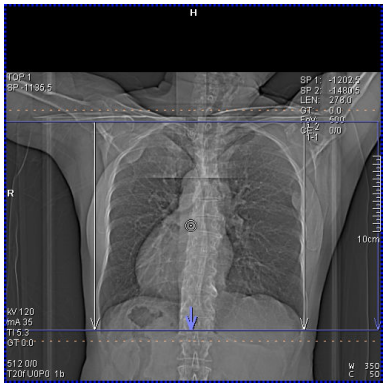
- The range with reduced dose is above and/or below the cardiac/standard dose range.
- Dashed green lines show the limits of the cardiac/standard dose range in table direction.



If you resize the range of the standard dose recon job or move it, the values will be adapted.

Using scan planning for spirals

Scan range planning is possible on the **Scan** parameter card.



The ranges are indicated as follows:

- Scan range in blue
- Deselected scan ranges in gray
- Recon ranges in white

The scan range contains the recon ranges of the current scan. The chronicle entry is surrounded by a blue selection rectangle.

You cannot resize a scan range; you can move the scan range only vertically. You cannot adapt the FoV during the scan planning. You cannot tilt a scan range.

If you move a scan range, all recon ranges inside this scan range are moved.

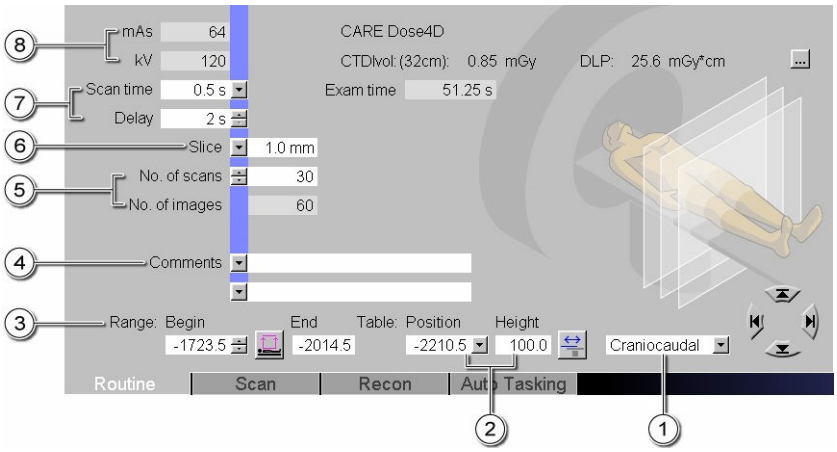
When planning spiral scan ranges with very low pitch, it may happen that the recon range frame can only be moved in short steps in the topogram image. In that case, select the **Scan** parameter card before moving the scan range frame to the desired position in the topogram image directly.

6.6.5 Acquiring a Sequence

Acquiring a sequence scan includes following steps:

- (➔ Page 315 *Checking parameter settings*)
- (➔ Page 316 *Optimizing the applied dose with CARE Dose4D and CARE kV*)

Checking parameter settings



(1) Examination direction
(2) Table position (horizontal/vertical)
(3) Examination range
(4) Comment lines
(5) Number of scans and images
(6) Slice thickness
(7) Time settings
(8) Radiation parameters

The **Scan** parameter card contains further parameter settings for scanning.

CAUTION

Changed scan parameters are unsuitable!

Dose not as desired.

- Verify the changed scan parameters before scanning.

- On the **Routine** parameter card, check the default scan parameters, and adapt them if necessary.

For certain sequence scan protocols, the values in the **No. of scans** and **Feed** fields are adapted automatically and, therefore, are not editable.

Certain modes of operation allow selections of scan parameters that may lead to a peripheral $CTDI_{100}$ of more than 1 Gy. This dose may exceed the threshold for deterministic radiation effects on the patient's skin or eye lenses. For information on dose reduction techniques, see: (➔ Page 189 *Dose management and optimization*). For general dose information on the CT system, see: *System Owner Manual*.

Optimizing the applied dose with CARE Dose4D and CARE kV

CARE Dose4D calculates optimized scan parameters from attenuation data of the topogram.

CARE kV optimizes the applied dose for the defined image quality level, and reduces influences due to technical limits of the system. To achieve this, **CARE kV** adapts the tube voltage and the tube current.

CAUTION

mA proposal of CARE Dose not adequate due to wrong attenuation data from topogram!

X-ray not, or only partially, usable.

- Check plausibility of the automatically selected scan parameters before scanning.

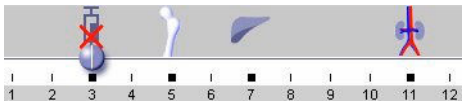
1 Select the **Scan** parameter card.

2 Select **CARE Dose4D** for the current scan.

3 From the **CARE kV** drop-down list, select **On** or **Semi**.



4 Click the dose settings icon.



5 Select an examination type with the slider.

The system optimizes the dose for the defined image quality. For more information, see (➔ Page 189 *Dose optimization features*).

The **CARE Profile** and scan parameters are yellow.

A scan parameter conflict occurred.

◆ See (→ Page 218 *Handling parameter conflicts*).

Performing a sequence scan

After you changed scan parameters, you must confirm the new settings with **Load** before starting the scan.

If the sequence is part of an auto range and not all ranges have been selected at least once, a parameter overview is displayed. You can display this overview manually with **View > Examination Overview...**.

1 Click the **Load** button to confirm the scan parameters.

As soon as you click the **Load** button, the topogram is zoomed and moved in a way that the whole planned scan range is displayed.



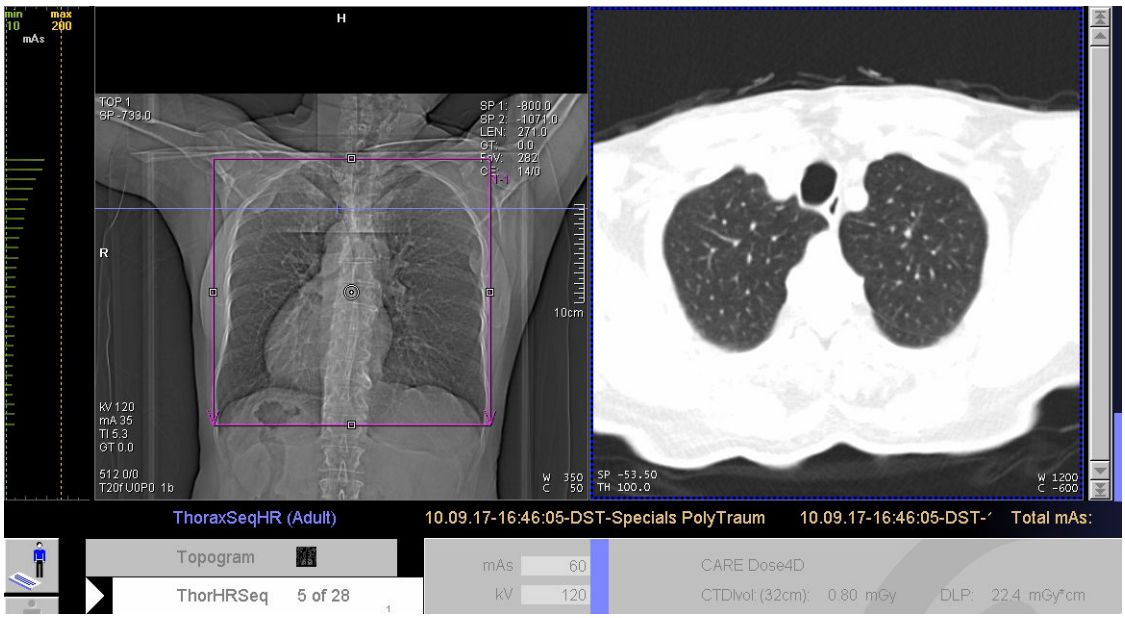
2 Press the **MOVE** key on the control box until table movement stops.

– or –

Click the **Cancel Move** button to begin the sequence at the current table position.



3 Press the **START** key on the control box.



You can observe the progress of the sequence on the screen:

- In the chronicle, you can see the number of scans already acquired and the total number of scans to be performed.
- In the topogram, the current scan position is displayed.
- In the tomo segment, the calculated tomograms are displayed.

RTD (Real Time Display) images are reconstructed to observe the scan progress.

4 Reconstruct the scan series with full image quality at the end of scanning.

Canceling in an emergency

You can interrupt the scan at any time with the **Suspend** button or the **Suspend** key on the control box.



1 In an emergency press the **STOP** key on the control box.

Radiation is stopped immediately and the entire system is blocked. A message box is displayed.

2 Click the **Continue** button to enable the system again.

6.6.6 Acquiring a Multiscan

A Multiscan is a multiple-rotation scan without table feed. It allows reconstructions at variable points of time with the same table position.

If you want to perform Multiscan reconstruction jobs, 3D functions in the **Auto postprocessing** selection list on the **Auto Tasking** parameter card are not available.

1 On the **Routine** parameter card, check the default scan parameters, and adapt them if necessary.

Certain modes of operation allow selections of scan parameters that may lead to a peripheral $CTDI_{100}$ of more than 1 Gy. This dose may exceed the threshold for deterministic radiation effects on the patient's skin or eye lenses. For information on dose reduction techniques, see: (➔ Page 189 *Dose management and optimization*). For general dose information on the CT system, see: *System Owner Manual*.

2 Perform a Multiscan in the usual way. (➔ Page 318 *Acquiring a Spiral*)

3 Observe the instructions on handling the **Dose Alert**, if the **Dose Alert** dialog box is displayed. (➔ Page 223 *Handling the Dose Alert*)

4 Perform the subsequent reconstructions in the usual way.

6.6.7 Acquiring a Spiral

Acquiring a spiral scan includes following steps:

- (➔ Page 316 *Optimizing the applied dose with CARE Dose4D and CARE kV*)
- (➔ Page 318 *Performing the spiral acquisition*)

Performing the spiral acquisition

After you changed scan parameters, you must confirm the new settings with **Load** before starting the scan.

If the spiral is part of an auto range and not all ranges have been selected at least once, a parameter overview is displayed. You can display this overview manually with **View > Examination Overview...**.

1 Click the **Load** button to confirm the scan parameters.

As soon as you click the **Load** button, the topogram is zoomed and moved in a way that the whole planned scan range is displayed.



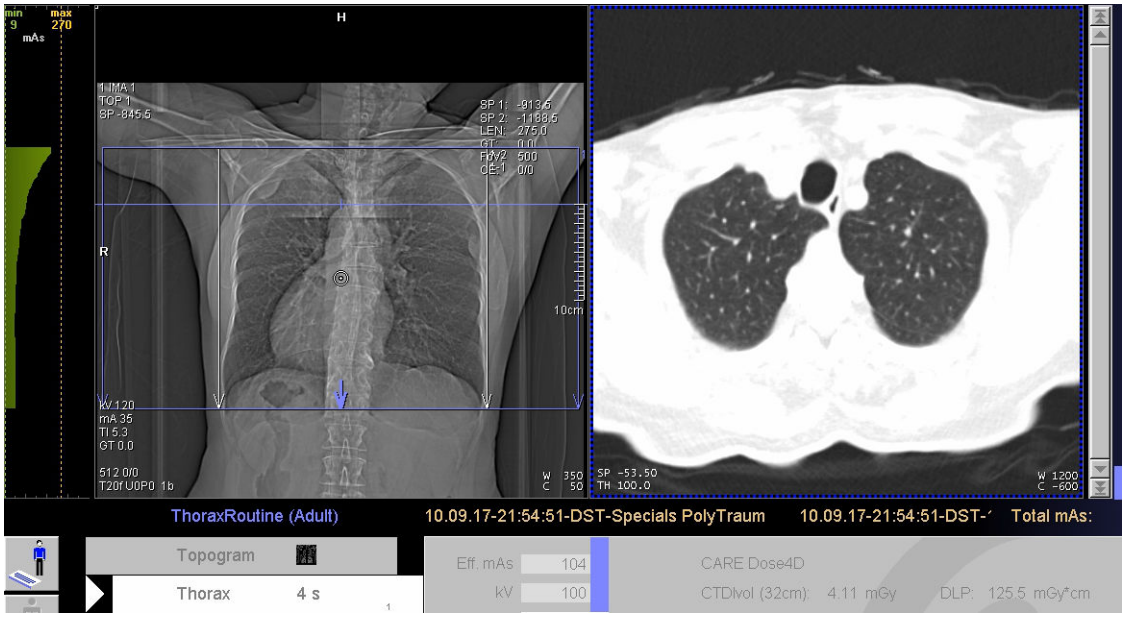
2 Press the **MOVE** key on the control box until table movement stops.

– or –

Click the **Cancel Move** button to begin the spiral at the current table position.



3 Press the **START** key on the control box.



You can observe the progress of your scan on the screen:

- In the chronicle, you can see the remaining scan time.
- In the topogram, the current scan position is displayed.
- In the tomo segment, the calculated tomograms are displayed.

RTD (Real Time Display) images are reconstructed to observe the scan progress.



4 Use the **MOVE** key to move to the starting position of the next range.

5 Begin with the next scan.

– or –

Reconstruct the scan series with full image quality.

6 Conclude the examination by creating a topographic image. For how to proceed: (➔ Page 326 *Reconstruction*), (➔ Page 331 *Concluding an Examination*)

6.6.8 Acquiring an Adaptive 4D spiral

Adaptive 4D spiral scans are spiral scans with continual table movement back and forth. They allow you to scan a volume larger than the detector length and allow image reconstruction at variable points in time. You can use it for example for measuring the extension of an infarcted area.

For the Adaptive 4D spiral, the scan range and temporal resolution are linked with each other. The highest temporal resolution can be achieved for small scan ranges. If a maximum temporal resolution is not required, the scan range can be extended accordingly.

The availability of Adaptive 4D spiral scans depends on the scan protocol.

Adaptive 4D Spiral scans are not possible in the **Move Table Top Only** mode.

Adaptive 4D spiral scans are not available for the patient table with 1600 mm scan range.

Checking parameter settings

The **Scan** parameter card contains further parameter settings for scanning.

The **4D Range** entry shows the scan range length and the corresponding time. You cannot modify it graphically.

The complete examination time on the **Scan** parameter card displays more than the total scan time for the adaptive 4D spiral scan. The patient table movement contributes to the total examination time.

CAUTION

Changed scan parameters are unsuitable!

Dose not as desired.

- Verify the changed scan parameters before scanning.

- On the **Routine** parameter card, check the default scan parameters, and adapt them if necessary.

Certain modes of operation allow selections of scan parameters that may lead to a peripheral $CTDI_{100}$ of more than 1 Gy. This dose may exceed the threshold for deterministic radiation effects on the patient's skin or eye lenses. For information on dose reduction techniques, see: (➔ Page 189 *Dose management and optimization*). For general dose information on the CT system, see: *System Owner Manual*.

Displaying the Cycle time table dialog box

You can define different cycle times for one Adaptive 4D Spiral scan in the **Cycle time table** dialog box.



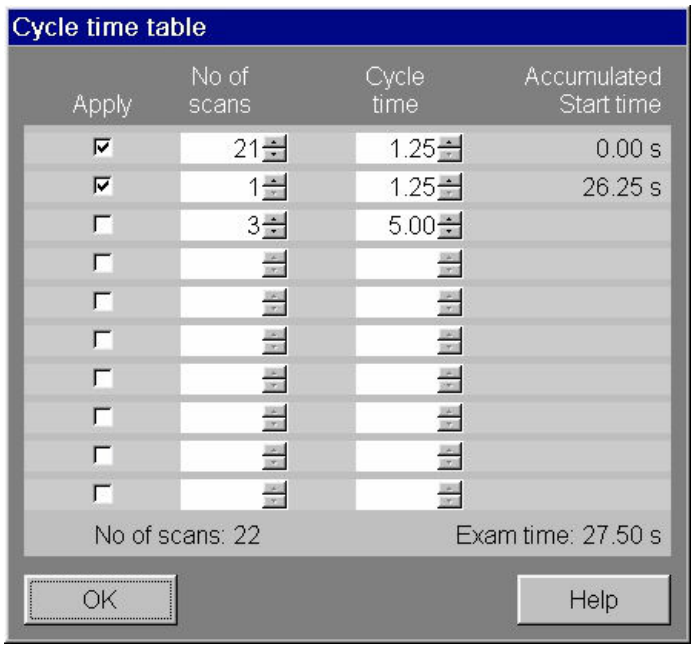
1 Click the **Activate cycle time table** icon on the **Scan** parameter card.

The **Cycle time** entry changes to **Multiple**.



2 Right-click the **Edit cycle time table** icon.

The **Cycle time table** dialog box is displayed.



You can use the cycle time table also for certain scan protocols without table feed, for example, non-gated perfusion sequence scans.

Defining different cycle times

You can define different cycle times for one Adaptive 4D Spiral scan in the **Cycle time table** dialog box.

The values that are displayed in **No of scans** and **Cycle time** are derived from the scan protocol or the current scan entry. You can change these entries and add more entries.

Already scanned entries are dimmed.

✓ The **Cycle time table** dialog box is open.

1 Enter how many scans have to be performed with a specified cycle time into the **No of scans** field.

2 Specify the cycle time in the **Cycle time** field.

3 Repeat this for each cycle time. You can define up to ten cycle times.

4 Select the **Apply** check boxes for all cycle times that you want to scan.

5 Click **OK**.

To synchronize the reconstruction of the images (displayed in the tomo segment) with scanning, you can increase the cycle time.

You can use the Cycle time table also for certain scan protocols without table feed, for example, non-gated perfusion sequence scans.

Performing acquisition

After you changed scan parameters, you must confirm the new settings with **Load** before starting the scan.

1 Click the **Load** button to confirm the scan parameters.

As soon as you click the **Load** button, the topogram is zoomed and moved in a way that the whole planned scan range is displayed.



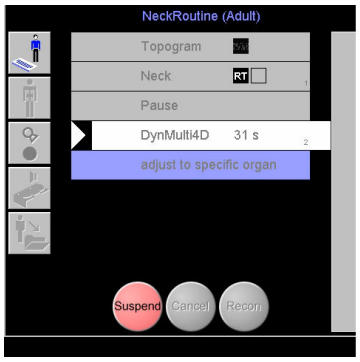
2 Press the **MOVE** key on the control box until table movement stops.

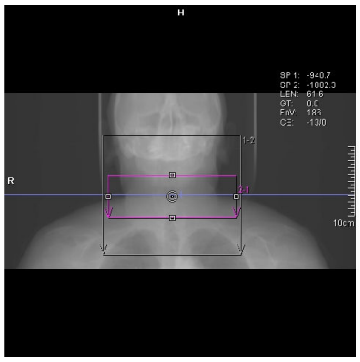
– or –

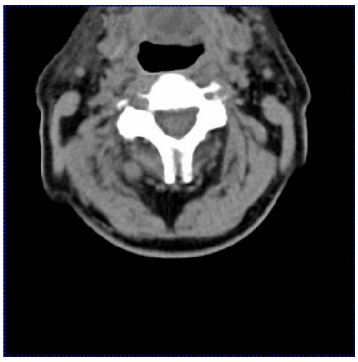
Click the **Cancel Move** button to begin the spiral at the current table position.



3 Press the **START** key on the control box.







You can observe the progress of your scan on the screen:

- In the chronicle, you can see the remaining scan time.
- In the topogram, the current scan position is displayed.
- In the tomo segment, the calculated tomograms are displayed.

RTD (Real Time Display) images are reconstructed to observe the scan progress.

4 Reconstruct the scan series with full image quality at the end of scanning.

5 Conclude the examination by creating a topographic image. For how to proceed: (➔ Page 326 *Reconstruction*), (➔ Page 331 *Concluding an Examination*)

Real Time Display reconstruction mode

RTD provides real-time reconstruction during scanning with reduced resolution. Gaps are left to keep track with the scanning procedure, so that real-time imaging is possible.

Full image reconstruction starts after you click the **Recon** button without defining an additional recon job.

Real Time Display reconstruction mode (RTD) is used for all scans (except for Intervention, Premonitoring, and Monitoring scan).

Canceling in an emergency

You can interrupt the scan at any time with the **Suspend** button or the **Suspend** key on the control box.



1 In an emergency press the **STOP** key on the control box.

Radiation is stopped immediately and the entire system is blocked. A message box is displayed.

2 Click the **Continue** button to enable the system again.

6.6.9 Acquiring a Dual Energy scan

1 In the **Patient Model Dialog**, select an appropriate Dual Energy protocol.

2 Perform the spiral or sequence acquisition. (➔ Page 318 *Acquiring a Spiral*), (➔ Page 315 *Acquiring a Sequence*)

Using the Tin Filter

For Dual Energy spiral scans and Dual Energy sequence scans, you can enable a Tin Filter for better separation of the X-ray spectra. The lower area of the 150 kV spectrum is filtered out.

- Select one of the **Sn** entries in the **kV** list on the **Routine** or **Scan** parameter card to activate the Tin Filter.

  For reasons of image quality, the mAs value is adapted.

After scanning, **Sn** is inserted as the first element in the first line of the image comment. Only 26 characters are allowed in the comment line when you enter additional text.

If you copy a Dual Energy recon job, the entry in the **Auto Tasking DE series** list will automatically be changed to the maximum number of exportable series. After copying a Dual Energy recon job, check and, if necessary, adapt the setting in the **Auto Tasking DE series** list of the **Auto Tasking** parameter card.

The setting in the **Auto Tasking DE series** list has no impact on FAST DE Results auto postprocessing.

Research Dual Energy (RDE) protocols

When scanning with Dual Energy, you can determine the **Eff. mAs**, the **mAs/rot.**, the **Quality ref. mAs**, and the **Quality ref. mAs/rot.** only for tube A. The values for tube B are derived from the values of tube A. For Research Dual Energy (RDE) protocols, you can determine these values for each X-ray tube separately.

Additionally, more voltage pairs are available.

6.6.10 Acquiring a Turbo Flash Spiral

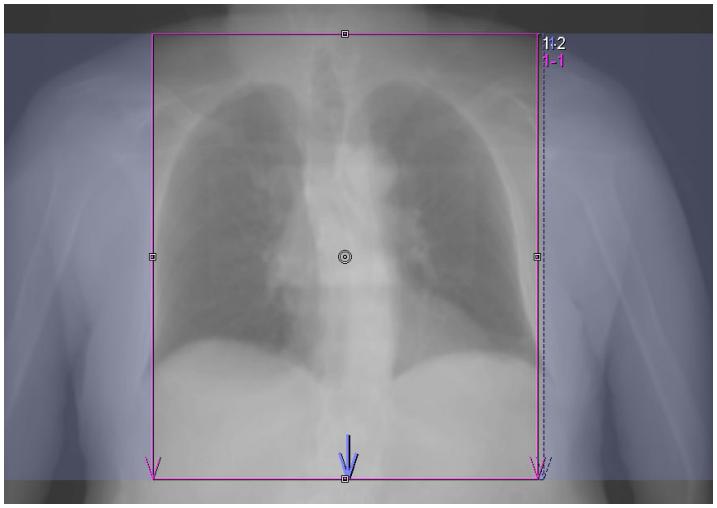
WARNING

Weight limitation for Turbo Flash mode. Blocking scan due to exceeding the maximum load!

No scan in Turbo Flash mode possible.

- Check the maximum weight of the patient and the accessories, before positioning the patient.

The Turbo Flash Spiral mode is a regular dual source spiral mode, but with a pitch value > 1.5 and a limited field of view. The field of view is dynamically adjusted. The field of view is highlighted in the topogram by the blue shutter.



You can change the pitch value in a limited range.

Because of the high pitch, the table needs a larger acceleration run and follow-up movement compared to standard spiral scans.

The patient table runs at high speed during the scan, therefore, it may not be possible to stop it in time in the event of a collision. Therefore, you may be prompted to perform a test run at limited speed before starting the scan.

1 Load a Turbo Flash Spiral scan protocol into the chronicle.

   If no patient weight is available, a dialog box is displayed prompting you to insert the patient weight.

   If the patient weight exceeds 220 kg, you are prompted to reduce the table speed, for example, by changing the pitch.

2 Scan a topogram.

3 Click the **Load** button.

   The **Turbo Flash Training** dialog box is displayed, prompting you to perform a test run of the patient table.

WARNING

Short period of time to press the STOP key due to high table speed!

Contusions of the patient's body. Extractions of infusion lines or needles.

- Perform a test run of the table movement to ensure a risk free movement during Turbo Flash Spiral.

You are also prompted to insert the patient weight, if required.

4 On the **Turbo Flash Training** dialog box, click **Start**.

5 To move the patient table to its starting position, you are prompted to press the **Move** key. Follow the instructions on the screen.

The test run of the patient table is performed for all scan ranges of a Turbo Flash scan protocol.

CAUTION

Turbo Flash Spiral: The usable scan field is smaller than the standard one, and it is limited by the completely acquired field of view!

Body parts beyond the inner scan field are not diagnosable.

- Mind the smaller scan field.
- Observe the shutter on the topogram and position the patient accordingly.

WARNING

Braking forces due to high table speed!

Emergency patient suffers fractures.

- Use the default settings of the SIEMENS Trauma protocol to ensure the safety for the patient.

6 Perform the spiral acquisition. (➔ Page 318 *Acquiring a Spiral*)

Turbo Flash Spiral scans are not possible in the **Move Table Top Only** mode.

Adjusting the Scan Field of View

For high pitch spirals, the Scan Field of View (**Scan FoV**) defines the limit of the **FoV** for axial recon jobs.

✓ A high pitch spiral scan protocol is loaded.

✓ The **Scan** parameter card is displayed.

- To scale up or scale down the **Scan FoV**, change the value in the **Pitch** spin box.

6.6.11 Ultra High Resolution (UHR) modes

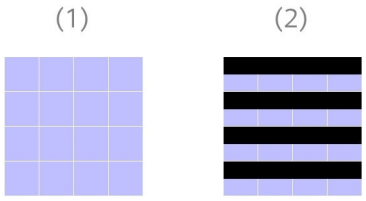
Ultra High Resolution (UHR) mode is the scanning mode that provides the highest spatial resolution.

An in-plane resolution of up to 32 lp/cm (line pairs per centimeter) is achieved with the use of a post-patient comb filter to reduce the aperture size over detector elements along the fan angle.

With a rotation time of 1.0 s and Edge Technology, a minimal resultant slice thickness (slice width) of 0.4 mm can be achieved.

With a rotation time of 0.5 s, a minimal resultant slice thickness (slice width) of 0.6 mm can be achieved.

The following graphic illustrates how the comb filter is displayed in the UHR mode:



(1) Standard mode: Full aperture in both directions
(2) UHR mode: Detector is covered with the comb filter in the shape of bars, covering half of the area of each detector element in one direction.

6.7 Reconstruction

Every CT examination collects raw data. From one raw data set, it is possible to reconstruct several image sets with different parameter settings (recon jobs).

Before performing a reconstruction, you can plan the recon jobs (if you did not plan them before scanning).

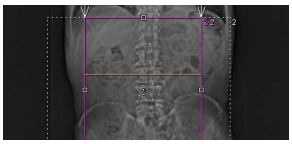
When the system is switched off, the jobs are stopped and their current state is saved. After restart the execution of the reconstruction jobs continues.

Adapting the FoV before starting the reconstruction allows an appropriate spatial resolution for the resulting reconstructed image.

If **Auto transfer** is activated, the export of the data to the DVD drive only begins if all Recon jobs of a patient are finished and the patient is closed (Exam card). There is one session per study created on the DVD instead of one session per series. The number of burn sessions on one DVD is limited to 30 sessions.

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key.

6.7.1 Defining the reconstruction target



An orange line represents the position of the currently displayed tomo image movements, and displays interactively the corresponding tomo image.

The following functionalities are described in the subsequent sections:

- (→ Page 327 *Adapting the FoV manually*)
- (→ Page 327 *Reconstructing images with Extended FoV and HD FoV*)

Adapting the FoV manually

You can adapt the FoV (Field of View) manually by using the mouse.

- Adapt the FoV (Field of View) in the tomo segment to the region of interest using the mouse.

Reconstructing images with Extended FoV and HD FoV

The **Extended FoV** reconstruction and the **HD FoV** reconstruction (up to the bore size) provide a FoV including the area outside of the FoM (Field of Measurement).

If you have activated the **HD FoV** checkbox, the patient contour is estimated automatically outside the field of measurement. The **HD FoV** function is especially useful for radiation therapy planning (RTP).

The reconstructed images contain a dotted red circle to indicate where the area of the regular FoV ends.

CAUTION

Reduced image quality caused by the Extended FoV and the HD FoV!

Wrong diagnosis due to insufficient image information.

- For diagnosis, do not use the image area outside the regular field of view. It has reduced quality and may contain artifacts.

- On the **Recon** parameter card, select the **Extended FoV** checkbox.

  – or –

  On the **Recon** parameter card, select the **HD FoV** checkbox.

Depending on your system configuration and the selected scan mode, the **Extended FoV** and the **HD FoV** option may not be available.

You can delete the circle from the reconstructed images in the **Viewing** task card.

6.7.2 Defining the Precision Matrix

You can select a matrix size matching the defined FoV (Field of View).

If you select **Auto**, the system determines the most appropriate matrix size according to the defined FoV and the selected kernel.

In Siemens Healthineers default scan protocols, Precision Matrix values are predefined.

LungFastHR protocols, for example, combine Precision Matrix values with fast rotation times and lead to sharp images of the lungs.

1 In the **Examination Configuration** dialog box, on the **Workflow** tab, select a matrix size from the **Matrix size upper limit** list.

If you select a matrix size above 512, the created images cannot be opened in some post-processing applications on your scanner or in applications of *syngo* .via software version > VB10.

syngo .via software version VB10 and older have not been tested.

2 On the **Recon** parameter card, open **Advanced reconstruction options**, and select a FoV matrix from the **Matrix size** list:

- **Auto**
- **256**
- **512**
- **768**
- **1024**

High matrix sizes cause the reconstruction to take longer and the images need more disk space.

6.7.3 Creating new reconstruction jobs

1 Select the acquisition series that you want to reconstruct again in the chronicle.



2 Click the second radio button on the **Recon** parameter card to plan a second recon job.

3 As soon as you have defined eight recon jobs, the arrow to the right becomes active. To define more than eight recon jobs, click on the arrow.

The row moves by two recon jobs to the right.

4 Click the radio button number nine to define the next recon job.

5 Repeat the above steps as often as required.

Depending on your license, you can define between eight and eighteen recon jobs for one range.

If you need more than eight recon jobs in spite of your license, proceed as follows: Execute the eight jobs in the first run. Afterwards, delete one recon job and define then an additional one. The images are not deleted automatically from the local database.

6.7.4 Performing a reconstruction

The following chapter describes the basic concepts of common reconstructions.

Starting reconstruction

The bar display on the right-hand edge indicates the progress of reconstruction.

- Click the **Recon** button to start reconstruction of the currently selected recon job.

  In the tomo segment, all the images calculated are displayed one after the other.

State of Reconstruction

The position of the icon on the scan entry corresponds to the number of the recon job on the **Recon** or **Auto Tasking** parameter card. There are up to eighteen icons on each scan entry: Up to six recon icons in a row and up to three rows. The following icons indicate the status of a recon job:

	A defined but not yet executed recon job.
	Indicates that the recon job is selected.
	Indicates that it is a planned 3D recon job.
	Indicates that images will be executed with RTD (real-time display) recon.
	• Indicates that images have been reconstructed with RTD (realtime display). • Click the **Recon** button to reconstruct these images with full quality.
	Indicates that the recon job has been executed with reduced resolution.
	Indicates that the recon job has been interrupted.
	Indicates that the recon job was interrupted by the system because of a scanning process.
	Indicates that the recon job is being executed.
	Indicates that the recon job is queued.

	• Indicates that images have been reconstructed. • Click this icon to display the images of the reconstructed series in the tomo segment. • With the dog-ear and scroll bar, you can scroll through the images. • Exception: Topograms are displayed in the topo segment. • If you move the cursor to this icon, the Series description of the corresponding recon job is displayed.

Performing retrospective reconstruction

You can reconstruct the images of an examination after the examination is closed as long as the raw data was not deleted.

Depending on the detector system of your scanner, the reconstruction of raw data acquired at a different detector system may not be possible.

1 Select the required study or series of the patient for image reconstruction.

2 Choose **Patient > Reconstruction** to transfer the selected data to the **Examination** or **Recon** task card.

– or –



On the tool bar of the **Patient Browser**, click the **Reconstruction** icon.

3 Start the unprocessed reconstruction jobs or define new ones.

By activating **Patient > Mode Reference Lines**, you can document the scans as ranges and cutlines in the topogram even after completing an examination.

Interrupting and resuming reconstruction

You can interrupt and resume the reconstruction, for example to correct the FoV.

1 Click the **Hold Recon** button, for example, to correct the FoV.

If a scanned entry is selected, the selected recon job will be stopped. If no protocol entry is selected, all recon jobs will be stopped.

2 Click the **Recon** button to resume reconstruction.

Reconstruction can be continued without any gaps or double images, even if you have scanned another patient in the meantime.

Using Automatic Post-Processing

On the **Auto Tasking** parameter card, you define in which way a reconstructed series is automatically post-processed. Depending on the type of scan, not all options may be available.

Auto Tasking parameters are set individually for each recon job.

- Define on the **Auto Tasking** parameter card in which way you want to post-process the reconstructed series. (➔ Page 269 *Using automatic functions*)

Concluding an Examination

You can create **Auto reference lines** for a specific tomogram recon job. To do so, activate the checkbox in the **Patient Model Dialog** and on the **Auto Tasking** parameter card.

Getting an examination overview by creating a reference lines image

The reference lines function is used to create an examination overview. Images that have been reconstructed are visualized as cut lines on the topogram. These graphics can be stored with the topogram image.

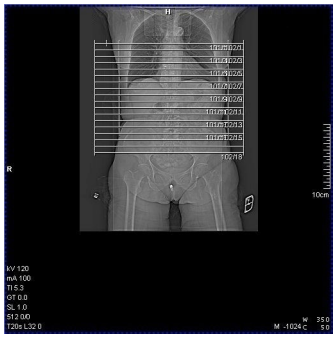
Creating a reference lines image by using drag-and-drop

1 Select a topogram in the chronicle.

2 Select the recon icon of a reconstructed series in the chronicle.

3 Drag the recon icon to the topo segment and drop it onto the topogram.

The images of the recon job are drawn in and saved as cutlines in the topogram.



Creating a reference lines image by using the main menu

1 Select the **View > Start Reference Lines** menu item.

The system enters the reference lines mode. The **Patient Browser** appears and the current examination is selected. Based on the preselection, all the images are visualized, that have been reconstructed so far.

2 Leave the preselection unchanged.

– or –

Select the images or series of this examination that you want to display on the topogram. Multiple selection is possible.

3 In the **Patient Browser**, select the **Patient > Update Reference Lines** menu item.

Cut lines for single images for series will be drawn onto the topogram.

4 To remove all graphics, clear the **Patient > Mode Reference Lines** menu item in the **Patient Browser**.

– or –

Clear the **View > Mode Reference Lines** menu item in the **Examination** task card.

The display mode of the topo segment switches from reference lines mode to graphical slice positioning (GSP) mode.

5 To switch back to the normal topogram display, deselect the **View > Mode Reference Lines** menu item.

Storing the reference lines image

Documenting the scans as ranges and cut lines in the topogram is part of completing an examination.

To store the drawn cut lines and ranges with the topogram, the reference lines mode needs to be activated when closing the patient.

◆ Drag-and-drop the icon to the topogram.

– or –

On the **Examination** task card, select the **View > Mode Reference Lines** menu item.

– or –

In the **Patient Browser**, select the **Patient > Mode Reference Lines** menu item.

Close the **Patient Browser** and proceed with closing the patient.

Ending the examination



1 Click the **Close current patient** icon.

If configured, the E-Logbook is displayed.

2 Modify the desired fields in the E-Logbook input window.

3 Click **OK** to save the changes and to end the examination.

6.7.5 Performing a 3D reconstruction

You can start the 3D recon jobs on the **Examination** task card and on the **Recon** task card directly after spiral scanning. The axial images created during scanning are used as a planning base (3D Graphical Reconstruction Planning (GRP) Base). The default RT FoV is 500 mm x 500 mm.

1 Select **3D** as recon job type in the **Recon** parameter card after scanning.

The three 3D Recon segments (coronal, axial, sagittal) are displayed instead of the standard tomo segment and topo segment.

Each 3D segment shows one plane of the image volume (default: coronal, axial, sagittal). The coordinate axes are perpendicular to each other. You cannot change the angles between the axes.

For good performance, a slice thickness of 3 mm is used for the 3D GRP even when you have specified a slice thickness of less than 3 mm for the recon job. When the reconstruction starts, the specified slice thickness for the recon job is used.

2 Optimize the image display by interacting in the three segments.

If you tilt reconstruction axes within a 45° range, the selected orientation of the recon job will be kept and displayed in the Series description. If you tilt the reconstruction axes outside this range, the orientation will be adapted accordingly.

3 Click the **Recon** button to start reconstruction.

The system returns to the standard display if you start the reconstruction of the 3D recon job. The reconstructed images are displayed in the tomo segment, the reference image in the topo segment.

If a 3D reconstructed series is sent to a 3D application, the reference image will not be sent.

6.7.6 Performing a FAST 3D reconstruction

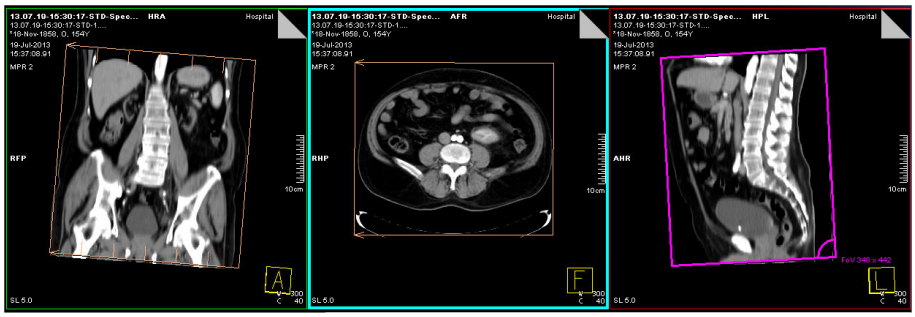
For 3D recon jobs, the **FAST 3D** option provides automatic centering and aligning of a scanned volume. As a result, three 3D Recon segments (coronal, sagittal, axial) are calculated which contain the complete aligned body region without black images.

The Real Time Displays (RTDs) are used as planning base if nothing else is specified.

FAST 3D can be enabled or disabled for each 3D recon job either in the scan protocol or in the **Recon** parameter card.

As soon as Real Time Displays (RTDs) are available, FAST 3D detects the boundaries and the centerline of the data set, based on the bone structures that are visible in the scanned area.

As a result, the 3D Recon segments are displayed with the reconstruction axes aligned to the patient's anatomy.



The results are well suited to be automatically reconstructed, but it is still possible to tilt the reconstruction axes manually to further improve the alignment.

If **Auto recon** has been set as a parameter in **Auto Tasking**, the **FAST 3D** reconstruction will be automatically executed in the background.

When creating a new 3D recon job, **FAST 3D** is selected by default.

With a scan that shows only a few bone structures, the automatic calculation of the 3D Recon segments might not work properly. This might be the case, for example, when scanning the liver without inclusion of the pelvis or ribs. You can tilt the reconstruction axes manually to improve the alignment.

FAST 3D is not available for examinations of the extremities.

6.7.7 Performing a reconstruction with reduced metal artifacts (iMAR)

Metal objects, such as metal implants or metal markers, can cause beam hardening artifacts. Depending on density and size, these metal artifacts can lead to a total absorption of the radiation resulting in strong black or white streaks or in star-shaped artifacts.

The iterative Metal Artifact Reduction (iMAR) reduces the effects of metal artifacts.

The following implants are supported:

- **Neuro coils**
- **Dental fillings**
- **Spine implants**
- **Shoulder implants**
- **Pacemaker**
- **Thoracic coils**
- **Hip implants**
- **Extremity implants**

The image impression of images which are reconstructed with iMAR can differ from images which are reconstructed with a conventional method. Furthermore, the iMAR algorithm can occasionally introduce artifacts, particularly in the close vicinity of metal implants. Therefore, it is recommended to perform an additional conventional image reconstruction. Compare the iMAR images with the conventional images side-by-side.

iMAR is available for the reconstruction jobs of most modes except for the following modes:

- i-Fluoro
- Real Time Display
- CARE Bolus CT
- TestBolus
- Osteo

Image reconstruction with iMAR is not possible at high kernel sharpness levels above sharpness level 59. In these cases, the **iMAR** list is dimmed.

Do not load images that were reconstructed with iMAR into *syngo* Osteo CT and *syngo* Calcium Scoring.

Reconstruction with iMAR takes longer than conventional reconstruction. Consider this when choosing iMAR.

Selecting a metal implant



✓ A kernel that supports iMAR is selected.

1 On the **Recon** parameter card, click the **Advanced reconstruction options** icon.

The **Advanced reconstruction options** dialog box opens.

2 From the **iMAR** list, select an implant.

3 Click the **Advanced reconstruction options** icon again to close the **Artifact correction** dialog box.

To deactivate **iMAR**, select **None** from the **iMAR** list.

4 Start the reconstruction. See (➔ Page 329 *Starting reconstruction*).

The following labels are displayed in the image comment area of the reconstructed images:

- For **Neuro coils**: **iMARne**
- For **Dental fillings**: **iMARde**
- For **Spine implants**: **iMARsp**
- For **Shoulder implants**: **iMARsh**
- For **Pacemaker**: **iMARpa**
- For **Thoracic coils**: **iMARth**
- For **Hip implants**: **iMARhi**
- For **Extremity implants**: **iMARex**

Series descriptions

For Series descriptions of iMAR recon jobs, the following suffix is added:

- **iMAR**

The suffix is not shown in the **Recon** parameter card.

6.7.8 Performing a DirectDensity™ reconstruction

DirectDensity reconstruction is designed for use in Radiation Therapy Planning (RTP) only. Images delivered by the system using DirectDensity reconstruction can be used by trained staff as an aid for Radiation Therapy Planning. DirectDensity reconstruction is not intended to be used for diagnostic imaging.

Reconstructions with DirectDensity algorithms generate CT images that show the electron density or the mass density of a material relative to the electron or mass density of water, nearly independently of the tube voltage in the examination.

The electron or mass density ratio is mapped to gray scale values in the same way as attenuation ratios are mapped in the Hounsfield Unit (HU) scale.

This means that air receives a value of -1000 and water a value of 0.

In this modified scale, the electron or mass density ratio of bone is substantially lower than the CT values of bone in HU, in standard CT images.

By default, DirectDensity images are shown in gray scale.

DirectDensity algorithms are available for conventional reconstructions and for iterative reconstructions (SAFIRE/ADMIRE).

The DirectDensity algorithms are compatible with the following functionalities:

- Iterative reconstructions (SAFIRE/ADMIRE)
- iMAR

The DirectDensity algorithms are designed for reconstructing natural body materials, such as fat, water, or bone. Image artifacts and different materials, such as contrast agents or metal implants decrease the accuracy of the results within their own volume and the surrounding volume.

DirectDensity reconstructions are marked with specific labels:

- **eDDensity**: Electron density reconstruction
- **mDDensity**: Mass density reconstruction

This label is added to the Series description and to the image comment of the DirectDensity recon job.

The suffix is not shown in the **Recon** parameter card.

Selecting a DirectDensity algorithm

DirectDensity algorithms are not available for the following recon job types:

- Recon jobs from pre-monitoring scans
- Recon jobs from monitoring scans

For all other recon jobs, DirectDensity algorithms are available if the **HD FoV** / **eFoV** check box is cleared on the **Recon** parameter card.

Series that were reconstructed using a DirectDensity algorithm cannot be loaded into the Dual Energy postprocessing application.

1 On the **Recon** parameter card, select **Sd40** for electron density reconstruction, or **Sm40** for mass density reconstruction from the **Kernel** list.

2 If required, activate iterative reconstruction (SAFIRE/ADMIRE). (➔ Page 338 *Activating SAFIRE/ADMIRE*)

3 Start the reconstruction. (➔ Page 329 *Starting reconstruction*).

6.7.9 Performing an iterative reconstruction (SAFIRE/ADMIRE)

The sinogram affirmed iterative reconstruction (SAFIRE) and the advanced modeled iterative reconstruction (ADMIRE) allow you to use low-dose scans to reconstruct scans with less noise and increased image sharpness.

The available algorithm (SAFIRE or ADMIRE) depends on your configuration.

Not available when **Extended CT Scale** is selected.

The noise reduction performance of SAFIRE or ADMIRE may be reduced for small reconstructed FoV or for slice thicknesses > 5 mm.

The image impression of images which are reconstructed with SAFIRE or ADMIRE can differ from the images which are reconstructed with a conventional method.

Compare the SAFIRE or ADMIRE images with the conventional images side-by-side.

Images reconstructed with ADMIRE, are not intended to be evaluated with *syngo* Calcium Scoring.

syngo offers many possibilities to optimize the dose applied to a patient.

SAFIRE or ADMIRE are available for the recon jobs of the following scan modes:

- Spiral scans without interventional examination
- Sequence scans with feed and subsequent cone beam correction reconstructions
- Adaptive 4D spiral scans for HeadAngio and FastCTA

Activating SAFIRE/ADMIRE

You can select SAFIRE/ADMIRE for each kernel. In the Siemens Healthineers protocols, **3** is preset as a suitable **Strength** value. This value can be adapted, if necessary.

1 On the **Recon** parameter card, select the **SAFIRE**/**ADMIRE** check box.

2 In the **Strength** field, adapt the value (between 1 and 5), if necessary.

The reconstructed images become more artificial the higher the **Strength** value is.

6.7.10 Performing a Dual Energy reconstruction

Dual Energy recon jobs define the following series:

- **A**: Series of acquisition system A
- **B**: Series of acquisition system B
- **M**: Derived mixed series of both acquisition systems, weighted average of series A and B
- **FAST DE**: Derived combined series of both acquisition systems, similar to the mixed series:
  - Reduction of metal artefacts possible
  - 3D reconstruction possible
  - Extended CT scale possible
  - Calculation can be much faster than the calculation of an **A+B+M** series
  - Less image noise than in **M** images for a Dual Energy composition close to 0 or 1

M images and **FAST DE** images show the same image information with minimal deviations due to different calculation methods.

Series that were reconstructed using the Sd40 kernel (eDDensity), the Sa36 kernel (Artificial120) or the Sm40 (mDDensity) kernel cannot be loaded into the Dual Energy postprocessing application.

Series descriptions

For series descriptions of Dual Energy recon jobs, the following suffixes are added:

- For tube A: **A_**<Voltage A>**kV**
- For tube B: **B_**<Voltage B>**kV**
- For mixed series: **M_**<DE Composition>
- For combined **FAST DE** series: **F_**<DE Composition>

The suffix is not shown in the **Recon** parameter card.

The series description may be, for example, **Abdomen DE A_140kV** or **Abdomen F_-0.6**.

Selecting a reconstruction series

On the **Recon** parameter card, select the reconstruction series from the **Series** selection list:

1 To reconstruct series A and B, select **A+B**.

2 To reconstruct series A, B, and M, select **A+B+M**.

3 To reconstruct a combined series, for example to reduce metal artefacts, select **FAST DE**.

Selecting a Dual Energy 3D recon job

✓ The **Recon** parameter card is displayed.

✓ **FAST DE** is selected in the **Series** selection list of a Dual Energy spiral scan.

◆ In the **Recon job type** area, select **3D**.

The displayed image reconstructions parameters change. The following **3D** relevant parameters are displayed: **Recon axis**, **Type**, **FAST 3D**. For more information on the parameters, press the F1 key.

Recon job type **3D** only supports **FAST DE** series.

3D images do not contain a red circle, which indicates the field of view.

If a vessel, for example, is located at the boundary of a measuring field, you have to check the vessel in an axial image.

If you observe anomalous iodine enhancement in a vessel, make sure that this effect is not caused by the field of view of acquisition system B.

3D reconstructions cannot be loaded into the Dual Energy postprocessing application.

Adjusting the composition factor

You can adjust the composition factor in the **DE Composition** dialog box of the **Recon** parameter card.

The range of the composition factor depends on the selected series:

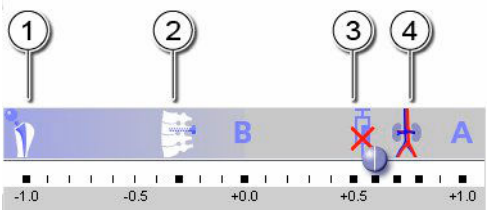
- **A**, **B**, or **M** series: Range from 0.1 to 0.9
- **FAST DE** series: Range from -1.0 to 1.0

If you switch from series **FAST DE** with a negative composition factor to series **A+B** or **A+B+M**, the composition factor is automatically adjusted to the value **0.5**.

This selection has no impact on FAST DE Results.



1 To open the **DE Composition dialog box**, click the DE composition icon.



(1) **Prothesis imaging** (Strong setting)
(2) **Prothesis imaging** (Standard setting)
(3) **Non contrast**
(4) **Vascular**

The scale numbering indicates the weight of the low kV image for the calculation of the mixed CT series. The sum of the low kV and high kV value results in 1.

Examples:

- If the low kV value is 0.4, the high kV value is 0.6.
- If the low kV value is -0.3, the high kV value is 1.3.

2 In the **DE Composition** dialog box, drag the slider with the mouse to the composition factor of the applicable examination type.

The **DE Composition** dialog box is not displayed in the **Scan Protocol Assistant**.

FAST DE images and **M** images cannot be loaded into *syngo* Dual Energy.

6.7.11 Optimizing the image display

Image series requirements for the 3D GRP Base are:

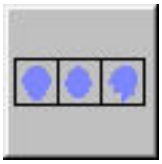
✓ Extended FoV is off
✓ Center X, Center Y, and FoV are the same for all images of the series

1 Select a segment.

2 Click the following icons from the tool bar on the **Examination** or on the **Recon** task card.



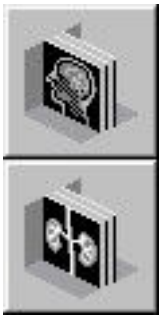
3 Click the **Free Mode** icon if you want to rotate the axes in any segment.



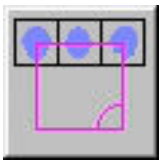
4 Click the **Default Orientation** icon if you want to set the orientation of the 3D Recon segments to their defaults.



5 Click the **Hide Reference Lines** icon if you want to suppress the cutlines in the 3D Recon segments.



6 Click the **MPR Thick** and **MIP Thin** icons if you want to select the image type for the 3D GRP Base.



7 Click the **Set FoV Segment** icon if you want to define the active 3D Recon segment as new FoV segment.



8 Click the **Set Reference Segment** icon if you want to define the active segment as new segment for the reference image. Zoom, pan, and window the image.



9 Click the **Preview Image** icon if you want to check whether the reconstruction parameters you set are suitable.

10 Select an existing 3D GRP Base from the **Planning base** selection list for the current and the following 3D recon jobs.

11 From the **Matrix Size** selection list, select a FoV matrix for the 3D reconstruction of spiral scans.

- **Auto**: The system determines the optimum matrix size according to FoV and kernel.
- **512**
- **256**
- **768**
- **1024**

For each matrix, choose the format:

- **Square**: The FoV is quadratic.
- **Non square**: You can adjust the FoV as a rectangle according to your needs.

If you use the non-square matrix and extend the side length of your FoV to more than the maximum ratio, the shorter side is stretched so that the maximum ratio applies again.

12 From the **Planning base** selection list, select an existing image series for the oblique recon jobs. Only images with a resolution below or equal to 512 are supported as a planning base.

7 Enhanced examination

The following chapters describe how to perform contrast examinations, as well as cardiac and interventional examinations.

7.1 CARE Bolus CT

Many CT examinations are performed with intravenous (I.V.) injection of contrast medium (CM).

For all vascular examinations, it is essential to have a precise timing of the contrast medium. This means that the scan must be performed when the organ or vessel of interest has the optimal contrast enhancement.

Bolus Tracking (CARE Bolus) monitors the flow of CM in the vessel, and triggers the scan at a predefined HU value. It does not require an additional injection of CM but uses the injected CM for the diagnostic scan (spiral, sequence, adaptive 4D spiral, multiscan, Heart Perfusion scan, etc.).

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

7.1.1 Activating Bolus Tracking

You can use Bolus Tracking for most of the diagnostic scan modes.

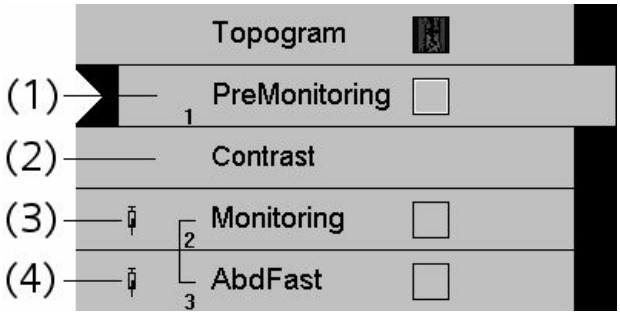
The scan parameters of the diagnostic scan are used to determine the parameter settings of the **PreMonitoring** and **Monitoring** scan. If the parameters of the monitoring scan and diagnostic scan differ, the system will increase the delay time between monitoring scans and diagnostic scans.

You can only activate Bolus Tracking if the scan you selected was not examined yet.

1 Select the diagnostic scan entry you want to scan with Bolus Tracking in the chronicle.

2 Right-click the diagnostic scan entry and select **Bolus Tracking** from the context menu.

All the examination steps required for Bolus Tracking are displayed in the chronicle.



(1) PreMonitoring scan
(2) Contrast medium pause (Contrast)
(3) Monitoring scan
(4) Diagnostic scan for imaging

7.1.2 Performing a PreMonitoring Scan

A **PreMonitoring** scan is always acquired using sequence mode without contrast medium.

- Select the **PreMonitoring** scan in the chronicle.

Setting the scan parameters

You can modify the parameters of the **PreMonitoring** scan on the **Routine** parameter card, if necessary.

When inserting Bolus Tracking, for example, via the main menu, the optimal start delay for the diagnostic scan defines the position of the **PreMonitoring**/**Monitoring** scan.

While the mAs value for the diagnostic scan must be high enough to ensure diagnostic image quality, lower mAs values are sufficient for the monitoring scans.

You can define default values for the **mAs** on the **PreMonitoring** tab card of the **Bolus Tracking Configuration** dialog box.

On the **Recon** parameter card, the kernel setting for all Premonitoring scans and Monitoring scans is fixed to **Br36**.

In Turbo Flash mode, the BolusTracking scans are positioned in the middle of the scan range.

1 Check and adapt the mAs values, if necessary.



2 Define the position and the FoV in the topogram, depending on the organ to be examined.



The position of the **Monitoring** and **PreMonitoring** scan must be the same.

Initiating scanning

1 Confirm the parameters of the **PreMonitoring** scan with **Load**.

2 Move the table.



3 Press the **Start** key on the control box.

If necessary, you can repeat the **PreMonitoring** scan.

7.1.3 Preparing Monitoring Scan and Diagnostic Scan

The **PreMonitoring** scan is displayed in the tomo segment. **Contrast** is now selected in the chronicle.

Defining the trigger ROI

On very small structures, you can zoom the **PreMonitoring** scan to make it easier to draw the ROI.

The **PreMonitoring** image is used as a reference for the enhancement calculation during the monitoring phase. Thus the enhancement values calculated in the monitoring phase are relative and not absolute.

You can define a default value for the ROI size on the **Trigger** tab card of the **Bolus Tracking Configuration** dialog box.

1 Click into the tomo segment to position the ROI.

The ROI is divided into two areas:

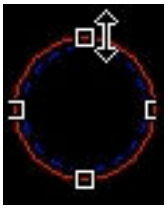
- The solid red circle is the one you work with.
- The dotted blue circle is used for evaluation (and takes patient movement into account).

The red circle must be completely inside the vessel.

You can show or hide the blue circle in the **Bolus Tracking Configuration** dialog box.



2 Click into the ROI keeping the left mouse button pressed and move the ROI to the required position.



3 Click the outline of the ROI and, keeping the left mouse button pressed, move it out (larger) or in (smaller).

4 Click the **Accept** button to confirm the previously defined ROI.

Defining the Contrast parameters

You can save the entered information with the scan protocol at the end of the examination. For that purpose, you can call up **Edit > Save Scan Protocol** in the main menu. If you insert Bolus Tracking into a scan protocol afterwards, all contrast medium values are reset to 0.

When you save the protocol, only the used monitoring scans are saved as well. For example, if the monitoring only takes 2 scans, this is what will be saved for all patients. Therefore, you should raise the monitoring to a minimum of 15 scans.

1 Edit the contrast medium parameters on the **Contrast** parameter card, if necessary.

2 Set the trigger threshold value using the **Level** spin box.

You enter a value for the difference of HU values, for example, the relative density increase caused by the contrast medium. For a native value of 80 HU, for example, enter 120 to achieve an absolute trigger level of 200 HU.

You can define default values for the **Trigger Level [HU]** on the **Trigger** tab card of the **Bolus Tracking Configuration** dialog box.

With the **Auto trigger** mode activated, the diagnostic scan is initiated automatically after reaching the trigger level selected by default.

You can also correct the trigger level value on the **Trigger** parameter card with the mouse. Click the **Monitoring** step in the chronicle and then click the **Trigger** parameter card. Drag the blue line to the HU level.

7.1.4 Starting Bolus Tracking

As soon as the set threshold value within the ROI is reached, the diagnostic scan is started automatically.

You can also start the scan manually with the **Start** key on the control box. This may be necessary if the measured vessel has moved outside the trigger ROI or if the trigger threshold is too high.

The contrast medium parameters and the trigger parameters for the **Contrast** step are entered into the **Contrast** parameter card.

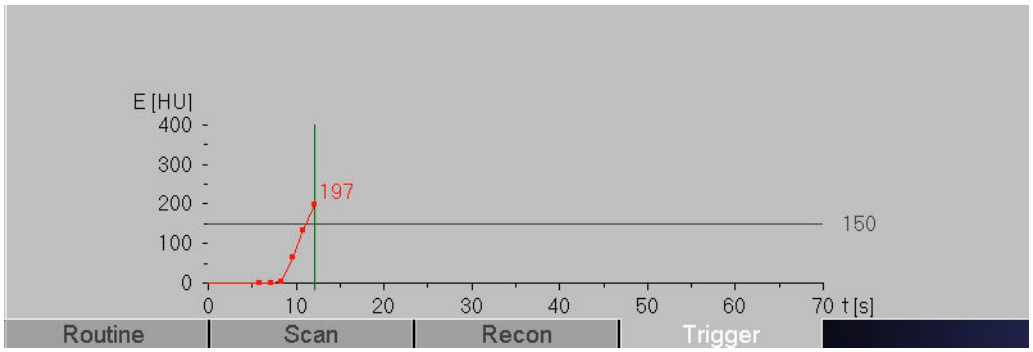
✓ The bolus tracking scan protocol is loaded after you have clicked the **Accept** button for the monitoring ROI.

1 If you have changed parameters after accepting the monitoring ROI, click the **Load** button, and follow the suggestions of the program.

2 Start contrast medium administration by using the bolus injector and the **Monitoring** scan simultaneously with the **Start** key or the foot switch.

The CARE Contrast CT option allows a coupled start of scanning and injection, either via the CT scanner or via the bolus injector. (➔ Page 349 *CARE Contrast CT*)

Starting the Monitoring scan After the specified delay time, the system starts the **Monitoring** scan.



1 Check the time-density curve of the contrast enhancement on the **Trigger** parameter card.

If the contrast enhancement does not increase after a few scans, the scanning must be stopped and the bolus injector equipment, the needle, or the vein must be checked.

2 Start the scan if there is contrast enhancement visible in the tomo segment.

After suspending a **Monitoring** scan, you can start the range manually or repeat the **Monitoring** scans.

If the trigger level is not reached or **Auto trigger** is disabled, a message appears after the defined number of monitoring scans. Repeat the monitoring scan or start the diagnostic scan immediately by pressing the **Start** key on the control box.

7.1.5 Bolus Tracking with FAST Bolus

You can use **FAST Bolus** to optimize Bolus Tracking (CARE Bolus). Bolus Tracking with a fixed trigger delay covers the variability in the individual blood circulation system only partly. FAST Bolus uses an automated algorithm to calculate a patient-specific scan delay. It is applicable for aortic enhanced CT angiography. The feature requires values from the contrast protocol and the CT enhancements in the ROI. Therefore contrast phase information must be entered manually or automatically (CARE Contrast). CT enhancements are measured during the monitoring scans.

The scan is triggered automatically after transgression of the trigger value plus the calculated patient-specific delay. FAST Bolus ensures the optimal timing of the scan at the peak of the contrast bolus saturation.

Constraints:

- FAST Bolus is not approved for pediatric patients.
- Applicable only for contrast within the aorta.
- The workflow is based on the use of a coupled injector and auto trigger.

The availability of FAST Bolus depends on the system configuration and the purchased licenses.

Performing a scan with FAST Bolus

To perform a scan with FAST Bolus, follow the Bolus Tracking workflow.

- 1 (➔ Page 343 *Activating Bolus Tracking*)
- 2 (➔ Page 344 *Performing a PreMonitoring Scan*)
- 3 (➔ Page 345 *Preparing Monitoring Scan and Diagnostic Scan*)
- 4 (➔ Page 346 *Starting Bolus Tracking*)

In step 3, FAST Bolus requires specific settings to be configured on the **Contrast** parameter card.

✓ A minimum of 4 monitoring scans is available.

✓ The coupled injector is active.

✓ You have activated Bolus Tracking, see (➔ Page 343 *Activating Bolus Tracking*).

Configure the required settings for FAST Bolus in the tomo segment on the **Contrast** parameter card. Then start the Monitoring Scan.

1 Define the trigger ROI in the tomo segment. (➔ Page 345 *Defining the trigger ROI*)

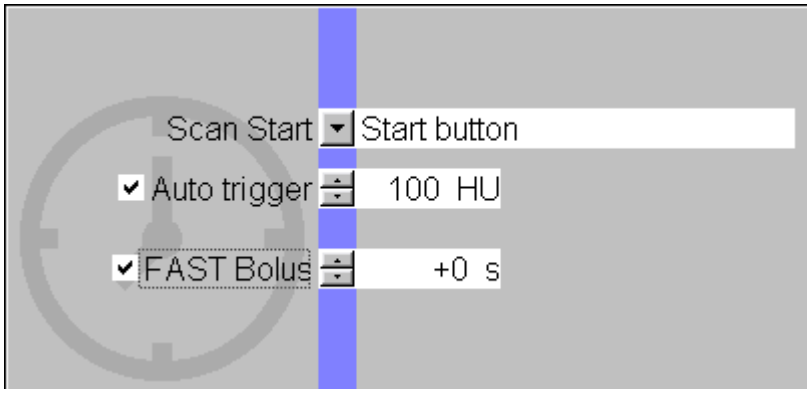
Choose the extent of the ROI carefully. The ROI must cover enough pixels to measure the CT enhancement. Also, the red circle must be completely inside the vessel. It is important that the ROI does not touch the vessel wall.

2 Select the **Contrast** parameter card.

3 Check the contrast medium parameters on the **Contrast** parameter card..

4 Ensure that **Auto trigger** is selected.

5 Select the **FAST Bolus** check box.



6 Enter an individual scan start offset in the input field at the right of the **FAST Bolus** check box, if required.

The numeric value in seconds can range between -60 s and +60 s. The scan offset is added to, or subtracted from, the calculated delay value.

If you need a protocol-specific scan offset, you can edit this value in the Scan Protocol Assistant. (➔ Page 250 *Modifying Contrast parameters*)

7 Check the scan parameters on the **Contrast** parameter card.

8 Ensure that contrast phases are specified on the **Contrast parameter** card. (➔ Page 353 *Checking the parameter settings*)

The contrast phase information can be entered manually or automatically (CARE Contrast).

9 Select the **Name of CM**.

If there is no contrast medium defined, go to the **Contrast** tab card of the **Examination Configuration** dialog box and configure a set of contrast medium data, see.

The FAST Bolus algorithm needs the **Iodine concentration** of the contrast medium for the calculation.

10 To confirm your settings, click **Accept**.

11 Start contrast medium administration by using the bolus injector and the **Monitoring** scan simultaneously with the **Start** button or the foot switch.

The progression of the contrast enhancement is displayed on the **Trigger** parameter card.

A minimum of 4 monitoring scans must be available. If not, the fixed trigger delay will be used.

Due to patient movements, the vessel will move and may leave the triggering ROI.

◆ Start the monitoring scan as soon as possible after defining the trigger ROI.

The diagnostic scan is started automatically after the calculated delay.

If the calculation is not successful, a default protocol-specific delay value is used.

7.2 CARE Contrast CT

The majority of CT examinations are performed with intravenous (i.v.) injection of contrast media (CM). The contrast scan yields good results only, if the acquisition occurs during the optimal phase of enhancement in the region of interest. Therefore, it is essential to determine the exact timing of the contrast injection and the scan. It is also necessary to map this timing onto the CT scanner and bolus injector in a synchronized way.

CARE Contrast CT couples the CT scanner with bolus injectors. Connecting both systems allows the scanner to interact with the bolus injector and vice versa.

If your CT scanner is connected to a bolus injector, communication allows you to start injection and scanning, and stop injection either via the CT scanner or via the bolus injector. You can set the bolus injector parameters on both systems. The parameters are automatically adopted by the other system, and are displayed on the **Contrast** parameter card. The CT system documents the injection parameters. (➔ Page 351 *Start/Stop behavior in coupled/uncoupled mode*)

We do not recommend establishing a connection to the bolus injector, or switching on the bolus injector during the scan.

For more information on scanning in coupled mode, refer to the operator manual of the used bolus injector.

You can predefine the coupled mode for your contrast enhanced scan protocols in the **Scan Protocol Assistant**.

For interventional scan protocols, only the first i-Spiral can be acquired in coupled mode.

In compliance with country-specific regulations, only bolus injectors released by Siemens Healthineers are supported. As soon as the bolus injector is connected, the software checks whether the bolus injector is authorized. It is also checked whether the parameter transfer from the scanner to the bolus injector is available for your bolus injector, or only the transfer from the bolus injector to the scanner.

Contact your Siemens Healthineers representative for more information on the released bolus injectors.

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

7.2.1 Activating the coupled mode

You can couple the CT scanner and the bolus injector so that you can start and stop both systems, and transfer the injection parameters between the two systems. The scanner gets extended operational control over the bolus injector. The scanner is able to retrieve information from the bolus injector about the applied injection.

If you paste or repeat a coupled range, the new range is reset to uncoupled.

You can see the status of the bolus injector by different icons in the status bar of the monitor:

Icon	Meaning
	Bolus injector coupling rejected
	Bolus injector available
	Bolus injector ready
	Local procedure on bolus injector active

By selecting **Edit > Save Scan Protocol** from the main menu, you can save scan protocols with **Injector coupled** as predefined scan start.

Scan ranges are marked within the chronicle to distinguish an unscanned from an already finished or uncoupled scan range.

Icon	Meaning
	Coupled unscanned scan range
	Coupled scanned scan range
	Uncoupled scan range
	Coupled unscanned scan range with FAST Bolus
	Coupled scanned scan range with FAST Bolus

Start/Stop behavior in coupled/uncoupled mode

	Mode	Action	Result
Start	Uncoupled	**Start** key/foot switch	• Scan starts • Injection will not start • Injection parameters can only be entered for documentation purposes
	Coupled (start button)	• **Start** key at the control box • **Start** key at the gantry • Bolus injector console • Bolus injector head	• Injection protocol is sent to or received from the bolus injector • Injection and scan will start simultaneously

	Mode	Action	Result
	Coupled (foot switch)	• Foot switch at the CT scanner • Bolus injector console • Bolus injector head	• Injection protocol is sent to or received from the bolus injector • Injection and scan will start simultaneously
Stop	Coupled (start button or foot switch)	**Stop** key at the CT scanner	• Injection is canceled • Scan is canceled
		• **Suspend** key at the CT scanner • **Suspend** button on the **Examination** task card	• Injection is canceled • Scan is canceled
		Stop injection at the bolus injector	• Injection is canceled • Scan is not canceled
		Bolus injector stops injection due to an incident	• Injection is canceled • Scan is not canceled
		CT scanner stops scan due to an incident	• Injection is canceled • Scan is canceled

Setting the coupled mode

Please observe the safety instructions in the operator manual of the bolus injector manufacturer.

CAUTION

Unintended activation of coupled mode!

Undesired radiation

◆ Verify that uncoupled mode is activated before starting the injection.

CAUTION

Scanning with uncoupled contrast medium injection but coupled mode is expected!

Contrast medium not usable.

◆ Before starting the injection, verify that coupled mode is activated.

◆ Follow the Instructions for Use of your bolus injector.

CAUTION

Coupled start is not activated!

Injection will not be started automatically, if coupled start is not activated.

- Check in **Scan** subtask card whether a coupled start is activated or not.

1 Load a scan protocol with **Contrast** entry.

– or –

Right-click the chronicle.

2 Choose **Contrast**, **Bolus Tracking**, or **TestBolus** on the context menu.

You can change the scan start (**Scan** parameter card) to any coupled option. In this case, a **Contrast** entry is inserted automatically.

3 Select the **Contrast** entry in the chronicle.

The **Contrast** parameter card is displayed.

4 Select **Injector coupled (start button)** or **Injector coupled (foot switch)** from the **Scan start** selection list.

You can save the new settings as default start options for this scan protocol.

You can predefine the coupled mode for any contrast enhanced scan protocol via the **Scan Protocol Assistant**.

Autoranges in coupled mode

In an autorange, select the **Injector coupled** setting for the first scan range only. The injector is automatically coupled for all remaining ranges.

If you suspend the scan in an autorange, the injection is canceled immediately for the current scan range.

7.2.2 Checking the parameter settings

As the CT scanner and the bolus injector start simultaneously, you have to adjust the scan delay time.

If you activate the coupled mode by inserting a **Contrast** entry, the injection parameters are received from the bolus injector. You can then edit the parameters either on the **Contrast** parameter card, or on the bolus injector, depending on the selected contrast protocol.

Invalid parameters are displayed with a yellow background color.

Changing the injection parameters on the **Contrast** parameter card may not be possible on your system. Change the parameters on the bolus injector instead.

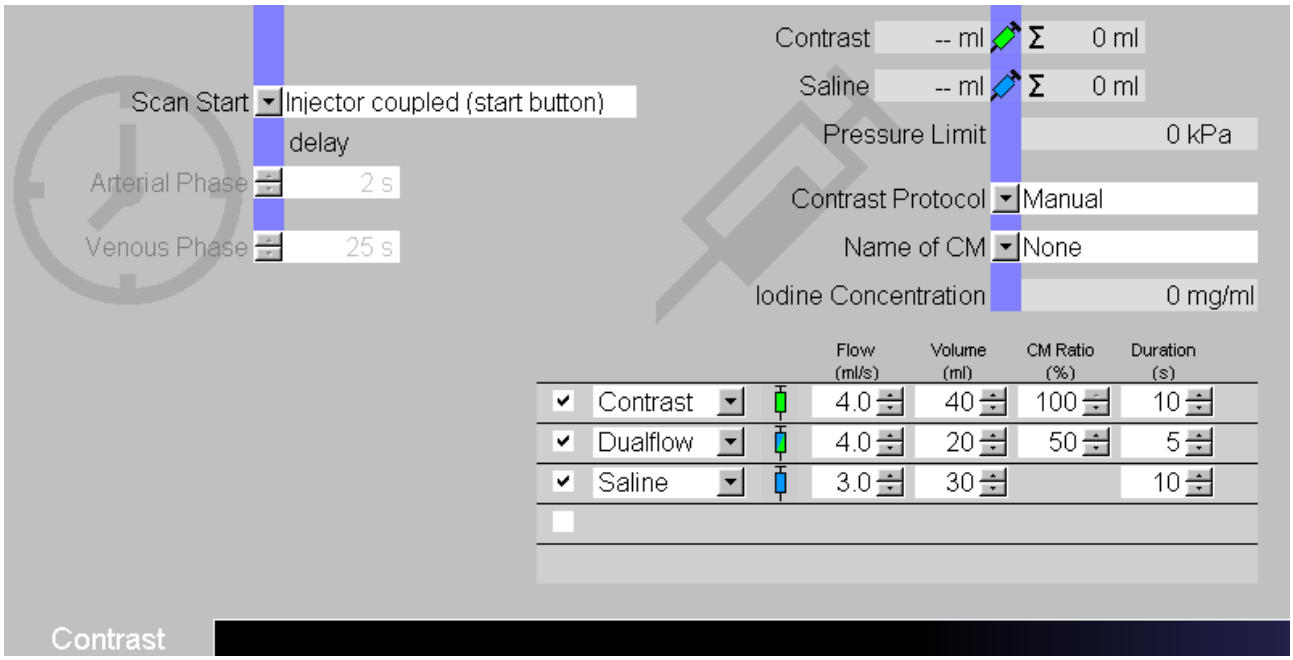
We recommend placing the remote control of the bolus injector close to the *syngo* Acquisition Workplace to observe additional messages coming from the bolus injector.

On the **Contrast** parameter card, up to 10 injection phases (incl. delay phases) can be displayed. You cannot see additional phases from the bolus injector.

The **Contrast** parameter card is subdivided into three different areas:

- Left part: Scan parameters
- Upper right part: Injector status, pressure limit read from the injector, selected contrast protocol, contrast medium information
- Lower right part: Contrast protocol (injection parameters)

In the upper right part of the **Contrast** parameter card, you can see the total amount of remaining contrast medium and saline. ∑ indicates the total amount of the contrast medium and saline to be applied.



From the selection list on the **Contrast** parameter card, you can choose the different kinds of bolus injector parameter handling:

- **Injector**: The injection parameters are received from the bolus injector and are displayed on the **Contrast** parameter card.
- **Manual**: In the coupled mode, the injection parameters are editable and will be immediately transferred to the bolus injector for parametrizing.
- User-defined contrast protocols: The injection parameters of the user-defined contrast protocols are used for setting the parameters of the bolus injection.

Check the pressure limit at the bolus injector before each scan.

The CT system is supposed to only send protocol data to the injector if the injector is in a ready-to-receive mode. This implies that no other functions are active on the injector. Other functions are active if, for example, the injector is prompting user interaction, such as filling the syringes or confirming the air free state. You can easily check the current operating state at the touch screen of the injector remote control.

Only valid contrast protocols can be sent to the bolus injector. The contrast protocols of the CT system and the bolus injector will only match if valid parameters are set.

1 In the chronicle, select the **Contrast**, **TestBolus**, or **Bolus Tracking** entry.

  The **Contrast** parameter card is displayed.

2 From the **Contrast Protocol** selection list, select the desired contrast protocol.

  The injection parameters on the bolus injector will be overwritten.

3 On the **Contrast** parameter card or on the bolus injector, check the injection parameters.

Instead of clicking each injection parameter value separately, you can also use the **Tab** key of your keyboard.

4 On the **Contrast** parameter card or on the bolus injector, change the parameters, if necessary.

  After changing the parameters on the **Contrast** parameter card, they are sent immediately to the bolus injector. The entry in the **Contrast Protocol** selection list changes to **Manual**.

5 In the **Name of CM** selection list, check the used contrast medium and change it, if necessary.

On the **Contrast** tab card of the **Examination Configuration** dialog box, you can add more contrast media to the **Name of CM** selection list.

In the **Apply** selection list, choose **Dualflow** instead of **Saline** or **Contrast** to apply saline and contrast medium at the same time. **Dualflow** is only available for the coupled mode if the connected bolus injector supports this feature. In the **CM Ratio%** entry field, you can adjust the amount of the applied contrast medium.

6 Select the diagnostic scan entry in the chronicle.

7 Check the default scan parameters on the **Routine** parameter card and correct them, if necessary.

Defining the start delay

You can perform a TestBolus scan with a small amount of contrast medium to define the start delay. Therefore choose **TestBolus** from the context menu of the chronicle. Load the acquired images in *syngo* Dynamic Evaluation to evaluate the time to peak enhancement. This time can then be used as the optimal start delay time for the diagnostic scan.

CAUTION

Misunderstanding of reference point for start delay in bolus examination!

Faulty synchronization between bolus and scanning.

- Make sure that the chosen delay time fits to the characteristics of the bolus injection.

- Enter the required scan delay time in the **Delay** entry field.

  On the **Contrast** parameter card, the delay is updated accordingly (read-only).

7.2.3 Performing a scan in coupled mode

If your CT scanner is connected to a bolus injector, communication allows you to start injection and scanning, and stop injection either via the CT scanner or via the bolus injector. If the bolus injector is released for the injection parameter transfer from the CT scanner to the bolus injector, the injection parameter are also editable on the **Contrast** parameter card.

1 Perform the scan in the usual way. (→ Page 306 *Scan*)

  If the connected bolus injector is not ready for injection yet, a yellow message bubble will be displayed that prompts you to check the bolus injector.

2 Check the bolus injector as described in the operator manual of the bolus injector.

3 Enable the bolus injector for injection.



  If you have checked it already before loading, the yellow message bubbles **Press foot switch** or **Press START** together with a syringe icon indicate that both systems are ready for scanning.

  As soon as the bolus injector is enabled for injection, the parameters are dimmed on the **Contrast** parameter card.

For more information on the remote CT scanner start, refer to the operator manual of the configured bolus injector.

4 Press the **START** key on the control box or the foot switch of the CT scanner to start both systems.

  – or –

  Press the **START** key on the bolus injector to start both systems.

  After the injection, the effectively used injection parameters are updated on the **Contrast** parameter card, and are documented by the CT system.

Depending on the bolus injector, the bolus injector console shows nominal values of the injection protocol after the injection. On the **Contrast** parameter card, the achieved values are displayed.

For further instructions on switching the display to the achieved values of the injection (flow and pressure curve), refer to the operator manuals of the bolus injector manufacturer.

The values for the injection phase duration and pressure limit which are displayed at the bolus injector and the **Contrast** parameter card can slightly differ. This behavior is caused by different rounding methods.

The contrast management and the injection parameters are documented via the following features:

- MPPS
- Patient protocol
- E-Logbook

7.2.4 Canceling a scan in coupled mode

For more information on the bolus injector handling, see the operator manual of the bolus injector manufacturer.

Observe the safety instructions in the operator manual of the bolus injector manufacturer.

CAUTION

Required injection protocol on the injector and the CT scanner do not match for the planned scan!

X-ray not, or only partially, usable.

◆ Before performing the coupled scan, verify that the:

- Correct injection protocol has been transferred to the CT scanner and that it matches the injection protocol on the injector.
- Patient data, contrast media parameters, and scan parameters are correct on the injector and the CT scanner.
- Correct injection protocol has been selected when bringing the injector in the Ready status to start.

CAUTION

Injection stopped at the injector by the user without suspending the scan!

X-ray not, or only partially, usable.

◆ Press **Suspend** at scanner if not enough contrast media was administered.

◆ Stopping the injection at the injector does not stop automatically the scan.

◆ Click the **Suspend** button to cancel both, injection of contrast medium and radiation.

If the injection is canceled at the bolus injector, the scan is not automatically stopped. (➔ Page 351 *Start/Stop behavior in coupled/uncoupled mode*)

– or –

Press the **STOP** key on the control box or the gantry panel to stop both systems.

Radiation and the injection of contrast medium is stopped immediately, and the entire system is blocked.

7.2.5 Saving a contrast protocol

A contrast protocol is part of the scan protocol.

When you save a scan protocol, the corresponding contrast protocol is also saved.

Instead of saving the contrast protocol along with the scan protocol, you can save the contrast parameter settings separately. Then you can append the saved contrast protocol to any scan protocol.

Saving the contrast protocols may not be possible on your system, depending on the bolus injector and your country-specific regulations.

1 On the **Contrast** parameter card, change the injection parameters.

2 On the main menu, choose **Edit > Save Contrast Protocol** to overwrite the current contrast protocol.

– or –

Choose **Edit > Save Contrast Protocol As...** to save a new contrast protocol.

3 In the **File name** entry field of the **Save Contrast Protocol** dialog box, enter the name of the contrast protocol.

4 Click the **Save** button.

Appending a contrast protocol to a scan protocol

The same contrast protocol can be appended to different **Contrast** entries in different scan protocols. This means that changing a contrast protocol influences all scan protocols which are linked with this particular contrast protocol.

1 Load a scan protocol.

2 Insert a **Contrast**, **TestBolus**, or **Bolus Tracking** entry.

3 From the **Contrast Protocol** selection list, select a contrast protocol.

In the Scan Protocol Assistant, you can also append a contrast protocol to a scan protocol.

7.3 Cardiac CT

The HeartView Turbo Flash option uses an ECG as a trigger for capturing images at the same heart phase. It reduces or even suppresses motion artifacts.

The image data is synchronized to the heart cycle. To achieve the synchronization, several methods are available, which belong to the mode of data acquisition:

- For an ultra fast scanning of the heart (Turbo Flash Spiral Cardiac), a special ECG triggered spiral technique is employed. The ECG signal is used prospectively to acquire images of the whole heart within one cardiac cycle. It uses the motionless phase of the myocardium to avoid motion artifacts.
- For monitoring the heart perfusion during high heart rates under stress, the Heart Perfusion scan mode is employed. The measurement is performed in the end-systolic phase by scans at two positions according to the ECG signal.
- For prospective triggering sequences are employed. The ECG signal is used to trigger a CT scan at the appropriate heart phase. It is triggered with a certain delay after the R-wave.
- For ECG mode spirals are employed. The ECG and the CT raw data are recorded simultaneously. Then retrospective gating selects only a portion of the spiral data to reconstruct images of the selected heart phase.

For monitoring and controlling the Cardiac CT option, the **Trigger** parameter card is displayed as soon as you choose a cardiac scan mode. On this parameter card, you can monitor the ECG from the connected electrocardiograph and set the necessary parameters.

We recommend the use of images with 1 mm width for MPRs and VRTs.

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key afterwards.

syngo offers many possibilities to optimize the dose applied to a patient. For more information, see (➔ Page 189 *Dose management and optimization*).

For a dose optimized cardiac workflow, see (➔ Page 227 *Considerations for Cardiac CT*).

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

CAUTION

Missing ECG-Sync due to the disconnection of the patient's ECG-electrodes!

X-ray not, or only partially, usable.

- Check the ECG electrodes before scanning.
- A contrast enhanced scan should not be aborted but operated with synthetic ECG-data.

7.3.1 Preparing the Acquisition

In addition to the usual preparations in the examination room and on the console, some actions specific to Cardiac CT are required.

If you register the patient for a Cardiac CT examination and the ECG electrodes have not been connected yet, a dialog box is displayed. Connect the ECG electrodes, and then click the **Try again** button.

Using CARE Bolus CT you can synchronize the cardiac scan with administration of the contrast medium. Insert the CARE Bolus examination steps into the chronicle after you have set the scan and trigger parameters of the scan. The cardiac scan is started like any CARE Bolus examination as soon as the defined Bolus threshold is reached. As soon as you start the monitoring scan, the **Trigger** parameter card moves to the foreground. In addition to the ECG signal, it now also displays the threshold value diagram

For scans with contrast medium, always activate the synthetic trigger so that a scan does not stop if problems arise with the ECG signal. (➔ Page 362 *Setting gating parameters*), (➔ Page 365 *Setting trigger parameters*)

For training and presentation you can use the **ECG Monitor Demo Mode**. After loading a scan protocol, the DEMO MODE is displayed on the ECG curve of the **Trigger** parameter card.

Make sure to end the ECG Monitor Demo Mode by clicking the **Close Patient** icon before starting a normal Cardiac CT scan.

1 Position the patient on the patient table.

2 Use positioning aids to ensure that the patient is in a comfortable and secure position.

3 Immobilize the patient, if necessary.

4 Make sure that the patient is warm and relaxed.

5 To enable a proper placement of the ECG electrodes, shave the relevant skin area.

6 Thorougly clean the shaved skin area with medical soap to allow for an oil-free surface.

7 Wait until the skin is dry and apply the electrolyte gel.

CAUTION

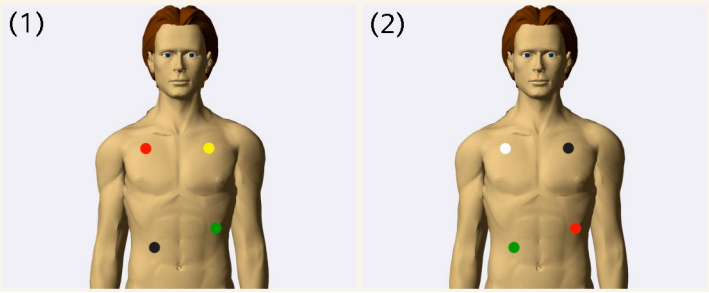
Wrong ECG signal detection!

Undesired radiation

- Check the correct position of the ECG electrodes before scan start.

8 Place the ECG electrodes.

The correct placement of the ECG leads is illustrated in the following diagrams. Different color codings of ECG leads are used for Europe and the USA.



(1) Europe
(2) USA

9 Connect the ECG cable to the socket at the bottom end of the table. .

The ECG cables shall be applied outside the heart region to avoid artifacts.

Use the grounding cable to avoid ECG irritation.

10 Check the ECG signal with the Physiological Measurement Module (PMM). Toggle through the different channels (I, II or III) and select the best signal. (➔ Page 111 *Physiological measurement module for patient table with 2000 mm scan range*) (➔ Page 114 *Physiological measurement module for multi-purpose table*) (➔ Page 149 *Quality of bonding*) (➔ Page 148 *Signal quality with FAST ECG*)

Usually channel II provides the best signal. If you use channel I, make sure that the chest electrodes are placed at a reasonable distance to each other.

11 Select the required **Cardiac** scan protocol in the **Patient Model Dialog** and register the patient for examination.

The **Trigger** parameter card is available for controlling Cardiac CT. It is also accessible for non-cardiac steps to monitor the heart rate.

12 Scan a topogram and define the ranges for the spiral, sequence or perfusion scan.

13 Prepare for scanning with contrast medium, if applicable.

7.3.2 Acquiring an ECG-Gated Spiral

In the spiral mode, data acquisition continuously proceeds while the patient table is moving forward with a constant pitch.

Due to the continuous data acquisition, the spiral mode allows maximum flexibility for data reconstruction. If necessary, you can also edit the ECG in this mode for challenging patients.

Since, compared with non-gated spirals, the pitch depends on the heart rate of the patient, very low pitch values of approximately 0.2 are needed. This may be at the expense of a higher radiation dose.

To alleviate this effect, the tube current should be modulated with ECG Pulsing and MinDose depending on the current heart phase.

If an image is marked in the comment line with “RQ, ...” the image was reconstructed with projections from low dose window and may show increased image noise.

Setting scan parameters

You cannot modify the **Scan time** and the **Pitch** on the **Scan** parameter card.

- Check the scan parameters preset in the scan protocol on the **Routine** and the **Scan** parameter card and adapt them, if necessary.

Setting gating parameters

You can modify the predefined values of the configuration and set the recon delay.



1. Select **Options > Configuration** from the main menu.
2. Double-click the **HeartView** button.
3. Select the **ECG Synthetic Trigger / Sync** check box, and click the **OK** button to activate the synthetic sync for examinations with contrast medium in particular.

You can activate the **ECG Synthetic Trigger / Sync** check box in an examination with ECG pulsing. If the system detects a missing ECG signal during measurement, the ECG pulsing will be switched off automatically. At that time, the mAs (tube current) will be set back to 100% of the initially adjusted value.

4. From the **Unit** selection box, select **ms** (absolute delay) or **%** (relative delay) as the trigger unit.
5. Set the recon delay in the **Phase Start** field. (➔ Page 232 *Setting Phase Start*)

A positive value in the **Phase Start** field means a delay after the R wave. A negative value means that the starting point of the scan window is before the next estimated R wave.

Adapting the pitch

It is possible to adapt the pitch automatically or manually according to the heart rate of the patient.

The heart rate is monitored during at least 10 heart cycles to achieve a stable heart rate overview.

By clicking the **LOAD** button, the current heart rate and the estimated heart rate is compared. If the estimated heart rate setting exceeds the actual heart rate, a message box opens:

- By clicking the **Start** button, the scan is continued without pitch adaptation
- By clicking the **Reload** button, the system adapts the estimated heart rate automatically
- By clicking the **Cancel** button, the mode is canceled

1 Select the estimated heart rate of the patient from the **Est. HR** selection list on the **Trigger** parameter card to activate the manual pitch adaptation.

2 Select **auto** to activate the automatic pitch adaption.

Based on the last 10 heart cycles, the pitch is calculated.

During the breath hold command, the heart rate may drop with a delta beyond 8 beats per minute (bpm). Therefore, artifacts may be caused. Observe the heart rate of the patient also during the breath hold command.

Selecting ECG channels



The heart symbol and the channel numbers I-III on the **Trigger** parameter card below the diagram show the currently selected ECG recording channel.

◆ Toggle through the different channels to find the optimal channel.

The second ECG channel with the best amplitude enables high-quality scan data.

Scanning with ECG Pulsing

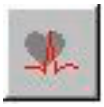
Scanning with ECG Pulsing offers you the option to activate a dose modulation mechanism. With ECG Pulsing, you can reduce the dose beyond the high dose plateau. (➔ Page 197 *ECG Pulsing and MinDose*)

Heart examinations are a typical application of ECG Pulsing where one of the following points is required:

- Functional analysis is desired
- A functional image impression based on a reduced dose level is acceptable

If ECG Pulsing is enabled, the dose value on the **Routine** parameter card is adapted to the actual ECG pulsing dose reduction potential.

Only data acquired in the scan window can be reconstructed with high image quality if ECG Pulsing is activated.



You can modify the predefined values of the configuration by clicking the **Auto Trigger configuration** icon on the **Trigger** parameter card. The **HeartView** configuration dialog box opens, and you can make your modifications for each heart rate.

1 Select **manual** in the **Pulsing** selection list on the **Trigger** parameter card to activate dose modulation for reducing dose during scanning.

CAUTION

Wrong setting in display!

Ionizing radiation

- Set the ECG pulsing window to clinically relevant value.

CAUTION

Performing Cardio examinations in a retrospective spiral mode with a very wide acquisition window, either manually selected or due to very irregular heart rate!

Dose higher than expected and possible increase in image noise for a considerable fraction of the scan range.

- Prior to the examination: Select a positive millisecond acquisition window setting, for example end-systolic window, for suppression of width adjustment.

2 Modify the start and end point of the high dose plateau in the entry fields on the **Trigger** parameter card.

– or –

Select **auto** in the **Pulsing** selection list on the **Trigger** parameter card to use the predefined values of the configuration depending on the heart rate.

Using MinDose

The scanning with the **MinDose** option provides you the ability to activate an enforced dose modulation mechanism. In this way, you can reduce the dose beyond the high dose plateau down to a minimum of 4%. If MinDose is not available, the value of the dose plateau is reduced to 25%.

A typical application of MinDose are heart examinations where the functional analysis is not desired. Reconstructions outside the high dose plateau are possible but images do not have sufficient image quality for reporting or functional imaging.

Images obtained beyond the high dose plateau are of reduced image quality. Postprocessing applications may not accept these images.

You can modify the start and the end point of the high dose plateau also for the **MinDose** option.

1 On the **Trigger** parameter card, use the **Pulsing** selection list to switch between standard dose and **MinDose**.

2 Select **MinDose - manual** to activate the manual dose modulation for reducing the dose beyond the high dose plateau.

– or –

Select **MinDose - auto** to activate the automatic dose modulation for reducing the dose beyond the high dose plateau.

3 Load the mode.

A message box is displayed to inform you that the image quality for diagnostic purposes is not guaranteed.

Acquiring the spiral

You can synchronize an ECG-gated spiral with application of the contrast medium.

- Perform the spiral acquisition in the usual way. (➔ Page 318 *Acquiring a Spiral*)

Make sure that you give the patient breathing instructions.

During scanning, the **Trigger** parameter card automatically pops up so that you can monitor the scan.

7.3.3 Acquiring an ECG-Triggered Sequence

Prospective ECG triggering combined with step-and-shoot acquisition of axial slices acquires the appropriate amount of scan data needed for image reconstruction during the previously selected heart phase. The ECG signal of the patient is monitored during examination, and axial scans are started with a pre-defined time offset relative to the R-waves. Irregularities are reliably detected, and in case of an ectopic beat, the scan is repeated at the same position.

In the ECG-triggered sequence mode, the patient table moves the patient to the first z-position. The scan is triggered depending on the ECG. Then the patient is moved to the next z-position. The procedure is repeated until the range to be scanned is completed.

Setting scan parameters

When scanning with API, sequence scans are clustered (except Adaptive Cardiac Sequences), and scan pauses are inserted accordingly.

Check the correct setting of the breathhold time via **Options > Configuration > Examination > Patient** from the main menu.

1 Check the default scan parameters on the **Routine** and **Scan** parameter cards, and change them, if necessary. (➔ Page 315 *Checking parameter settings*)

The **Scan time** represents the single length of a scan. The examination time of the sequence depends on the heart rate. The more irregular the heart rate, the longer the sequence scanning will take.

2 If necessary, select another **Scan time** or modify the **Feed** of the table (“0” is available, for example, for contrast examinations).

Setting trigger parameters

If **Synthetic Trigger** is activated, the scans are continued in case of ECG signal loss.

1 Select **Options > Configuration** from the main menu.

2 Double-click the **HeartView** button.

3 Select the **ECG Synthetic Trigger / Sync** check box, and click the **OK** button to activate the synthetic sync for examinations with contrast medium in particular.

You can activate the **ECG Synthetic Trigger / Sync** check box in an examination with ECG pulsing. If the system detects a missing ECG signal during measurement, the ECG pulsing will be switched off automatically. At that time, the mAs (tube current) will be reset to 100% of the initially adjusted value.

4 Select **ms** (absolute delay) or **%** (relative delay) as the trigger unit in the selection box on the **Trigger** parameter card.

5 Change the **Phase Start** on the **Trigger** parameter card to move the recon window to the desired position.

Acquiring the sequence

After you started the scan, the scan windows are marked with magenta lines. It is then no longer possible to change the trigger delay time.

- Perform the sequence and subsequent reconstructions in the usual way. (➔ Page 315 *Acquiring a Sequence*)

Ensure that you give the patient breathing instructions.

Adaptive Cardiac Sequence

The Adaptive Cardiac Sequence is a special scan mode, that monitors the ECG of the patient while the scan is being performed. It is able to detect irregular heartbeats and repeat scans at a certain z-position, if necessary. It also allows more than one phase of the heart cycle to be scanned.

You can adapt the scan range within two R-peaks according to your needs. You can find the most appropriate heart phase by retrospectively selecting the phase start from the final scan.

In this sequence mode, it is possible to include the systolic and diastolic phases within the same scan to examine patients with a heart rate higher than 65 bpm.

You can use the Adaptive Cardiac Sequence mode for all 3D cardio sequences. It is also possible to use it for Calcium Scoring and Coronary CT Angiography examinations.

syngo 3D and *syngo*.via applications can postprocess the images scanned with Adaptive Cardiac Sequence.

If during scanning no R-peak is detected for more than 3 s and you have activated the **Synthetic Trigger** option, the scan will continue to run. If you have not activated the **Synthetic Trigger** option, the scan will be aborted after 3 s.

Activating the Adaptive Cardiac Sequence mode

You can activate the Adaptive Cardiac Sequence in the **Scan Protocol Assistant**.

✓ The **Trigger** page of step **3** in the **Scan Protocol Assistant** is open.

✓ The scan protocol is selected.

1 Double-click the cell in the **Adaptive Cardio Sequence** column.

2 To activate the Adaptive Cardiac Sequence mode, select **on** from the selection list.

3 Save the scan protocol.

Acquiring an Adaptive Cardiac Sequence

On the **Trigger** parameter card, you can choose between automatic and manual selection of the scan range and the ECG pulsing window for acquiring an Adaptive Cardiac Sequence.

Automatic selection on the Trigger parameter card

✓ The **Trigger** parameter card is selected.

1 From the **Scan** list on the **Trigger** parameter card, select **auto**.

The position of the scan range and the ECG plusing window is set by the system, based on the settings in the **Auto Trigger** tab of the HeartView configuration.

2 Perform the sequence. (➔ Page 315 *Acquiring a Sequence*)

If an irregular heartbeat is detected, a status bar message is displayed to inform you about the detected arrhythmia and that the scan will be repeated.

The system repeats the scan automatically at the same z-position.

If you suspend a running Adaptive Cardiac Sequence, the current scan is completed.

On the **Scan** parameter card, you can select an item from the **Rotation time** selection list. Depending on the heart rate of the patient, or due to changes in the **Rotation time**, the values for **Scan time**, **CTDI$_{vol}$**, and **DLP** may be gradually adapted.

Manual selection on the Trigger parameter card

✓ The **Trigger** parameter card is selected.

1 From the **Scan** list on the **Trigger** parameter card, select **manual**.

2 In the **Range** fields, define the start phase and end phase of the scan. The valid phase values range from 0% to 100% and from -2000 ms to 2000 ms.

3 In the **Pulsing** fields, enter the ECG pulsing window range in 1% or 1-ms steps.

A preview of the current scan range and the ECG pulsing window is displayed.

4 Perform the sequence. (➔ Page 315 *Acquiring a Sequence*)

If an irregular heartbeat is detected, a status bar message is displayed to inform you about the detected arrhythmia and that the scan will be repeated.

The system repeats the scan automatically at the same z-position.

If you suspend a running Adaptive Cardiac Sequence, the current scan is completed.

Heart phase selection for reconstruction

You can find the most appropriate heart phase by retrospectively selecting the phase start from the final scan.

If there are repeated scans (arrhythmia), the first scan will be disabled by default. It is displayed in gray stripes. The second scan is reconstructed by default.

We recommend viewing both scans with the same z-position to decide which of them is more appropriate for reconstruction.

You can enable exactly one scan for every z-position by right-clicking the recon bar and selecting the **Enable Sync** menu entry. The state of the other scan box at the same z-position is adapted automatically.

If a phase start exceeds the reconstructable range, the display changes as follows:

- The corresponding recon window is displayed as a horizontally striped bar with an attention sign above.
- A second light blue bar is displayed at the actually used reconstruction phase within the performed scan (represented by the magenta lines).

The reconstruction phase is shifted to the range of reconstructable data. Reconstruction of images is still possible.

You can also use Auto Recon.

Clustering is not possible for Adaptive Cardiac Sequences.

You cannot scan the Adaptive Cardiac Sequence with the feed set to zero.

To move the recon window to the required position, the Phase Start can be changed on the **Trigger** parameter card.

Reconstruction options

- The reconstruction of Adaptive Cardiac Sequences with Cardio BestPhase is only performed on the scanned phases. (➔ Page 375 *Reconstructing with Cardio BestPhase*)
- To reconstruct a multiphase series, you can only select those phases for reconstruction that are common to all scans of the mode. If the Adaptive Cardiac Sequence range has no common phases, the multiphase reconstruction is not possible. (➔ Page 377 *Reconstructing a Multiphase series*), (➔ Page 378 *Selecting phases for Multiphase reconstruction*), (➔ Page 379 *Modifying Multiphase parameters*)
- To perform a TrueStack reconstruction, see (➔ Page 379 *Performing a TrueStack reconstruction*).

7.3.4 Turbo Flash Spiral Cardiac/Chest Pain

The Turbo Flash Spiral Cardiac and Turbo Flash Spiral Chest Pain modes are special scan protocols with a high pitch. Within one single heartbeat, you can acquire the whole anatomical structure of the heart and the coronary vessels.

The chest pain scan protocols have the aim to examine lung emboli, heart infarct with the coronary arteries and the aorta dissection. With this examination, the radiologist can examine three lethal diseases in emergency case.

If there is a gap between the start position of the recon job of the heart range and the end of the area with motion artifacts, and the recon job of the heart range is overlapping the area of motion artifacts, consider changing the scan direction.

You can also reconstruct and view the scanned phase. For more information, refer to: (➔ Page 374 *Reconstructing*), (➔ Page 379 *Using the Direct Viewer*)

Setting scan parameters

You can modify several scan parameters, if necessary.

- Do not use the Turbo Flash mode in combination with a scan range of 27 mm or less.
- When you selec t the Turbo Flash mode, extend the scan range beyond 27 mm.
- If a scan range with less than 27 mm is mandatory, select a different scan mode.

◆ Check the default scan parameters on the **Routine** and **Scan** parameter card and adapt them, if necessary.

You cannot modify the **Scan time**, **Rotation time** and the **Pitch** on the **Scan** parameter card.

FlashCheck



FlashCheck tries to determine the predictability of the current heart rate of a patient, and therefore, to determine how reliable the desired start phase can be realized in the actual data acquisition.

To determine a possible heart rate decrease during a breath-hold instruction, a scan procedure is simulated to give a safe prognosis.

On the **Trigger** parameter card and in the chronicle, you can see if the current ECG is suitable for the scan.

Color	Meaning
green	The ECG is suitable for scanning (stable heart rate).
red	The ECG is not suitable. The heart rate variance exceeds the heart rate limits. We recommend performing an Adaptive Cardiac Sequence scan instead.

FlashCheck is mandatory and cannot be ignored. Perform a FlashCheck test before adapting the scan parameters. Consider the results before you perform the scan.

Performing FlashCheck

WARNING

Short period of time to press the STOP key due to high table speed!

Contusions of the patient's body. Extractions of infusion lines or needles.

- Perform a test run of the table movement to ensure a risk free movement during Turbo Flash Spiral.

1 Load a Turbo Flash Spiral Cardiac or a Turbo Flash Spiral Chest Pain scan protocol into the chronicle.

If no patient weight is available, a dialog box is displayed prompting you to insert the patient weight.

WARNING

Weight limitation for Turbo Flash mode. Blocking scan due to exceeding the maximum load!

No scan in Turbo Flash mode possible.

- Check the maximum weight of the patient and the accessories, before positioning the patient.

If the patient weight exceeds 220 kg, use another scan acquisition mode instead.

2 Select a Turbo Flash Spiral Cardiac or Turbo Flash Spiral Chest Pain scan range.



3 Click the **FlashCheck** button.

If a topogram is available, the **Turbo Flash Training** dialog box is displayed, prompting you to perform a test run of the patient table.

You are also prompted to insert the patient weight, if required.

4 On the **Turbo Flash Training** dialog box, click **Start**.

5 To move the patient table to its starting position, you are prompted to press the **Move** key. Follow the instructions on the screen.

The test run of the patient table and FlashCheck are started simultaneously.

The test run of the patient table is performed for all scan ranges of a Turbo Flash scan protocol.

The scan entry and the **Load** button are enabled. The results of the FlashCheck steps are saved for the selected range and all unscanned modes with comparable parameters.

CAUTION

Insufficient results of scanning and image reconstruction within parts of the heart anatomy in Cardiac ECG-gated examinations and ECG-triggered examinations!

Wrong diagnosis

- Make sure that the heart rate and the heart rhythm of the patient is within the recommended range for ECG-gated examinations and ECG-triggered examinations of the CT system.
- Consider possible changes of the heart rate and the heart rhythm due to patient breathing instructions, bolus injection, medication or patient's stress.

If no suitable heart rate can be achieved, we recommend performing an Adaptive Cardiac Sequence scan for Cardiac CT examinations or a standard ChestPain scan for chest pain examinations.

FlashCheck is possible with or without an instruction text. If no instruction text is selected, the evaluation is performed immediately.

You can repeat the FlashCheck as often as required.

If an autorange contains a Turbo Flash Spiral Cardiac or Turbo Flash Spiral Chest Pain scan, you need to perform FlashCheck before you can start the autorange for every Turbo Flash scan with different scan parameters.

Turbo Flash Spiral Cardiac scan range

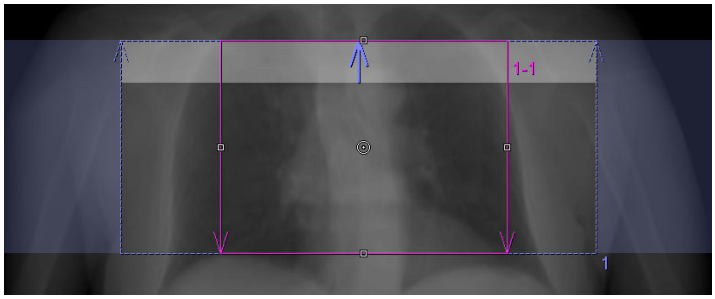
The area of potential motion artifacts is marked in the topogram. It shows the estimated position in the scan when the heart motion is most likely to occur.

CAUTION

Turbo Flash Spiral Cardiac: The usable scan field is smaller than the standard one, and it is limited by the completely acquired field of view!

Body parts beyond the inner scan field are not diagnosable.

- Mind the smaller scan field.
- Observe the shutter on the topogram and position the patient accordingly.



- Blue box: Spiral scan range
- Magenta box: Selected range

You can adapt the scan range in the usual way. (➔ Page 310 *Planning an Examination*)

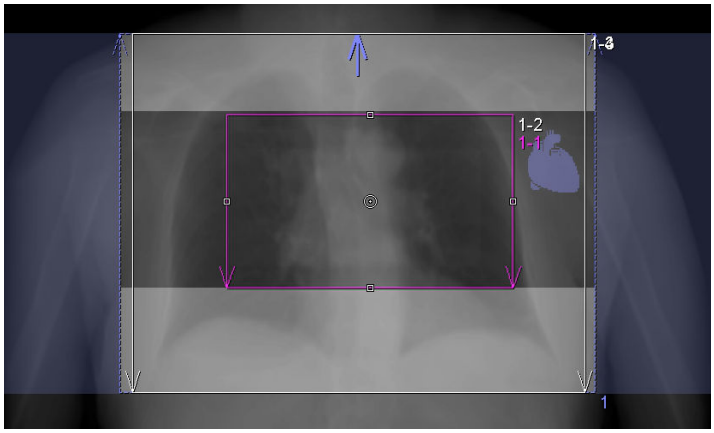
Turbo Flash Spiral Chest Pain scan range

For the chest pain scan protocols, the chest pain FoV and a Chest Pain icon will be displayed in the topogram to show the cardiac or the standard dose range for the scan of the tomogram. Additionally, the recommended FoV is displayed.

The cardiac/standard dose range is always displayed, irrespective of the selected recon range. If you select another scan, the area will not be displayed.

Two areas of potential motion artifacts are marked in the topogram. They show the estimated position in the scan, when the heart motion is most likely to occur.

The recon job, which is displayed with the heart icon next to it, defines the heart region of the scan.



- Blue box: Spiral scan range
- Magenta box: Selected range
- White boxes: Non-selected ranges of the selected scan

You cannot delete the cardiac/standard dose recon job. A copy of this recon job will only inherit the normal parameters but not the property for defining the cardiac/standard dose range.

If you resize the range of the cardiac/standard dose recon job or move it, the values will be adapted.

You can adapt the scan range in the usual way. (➔ Page 310 *Planning an Examination*)

Acquiring a Turbo Flash Spiral Cardiac / Chest Pain

WARNING

Weight limitation for Turbo Flash mode. Blocking scan due to exceeding the maximum load!

No scan in Turbo Flash mode possible.

◆ Check the maximum weight of the patient and the accessories, before positioning the patient.

The patient table runs at high speed during the scan, therefore, it may not be possible to stop it in time in the event of a collision. You may be prompted to perform a test run at limited speed before starting the scan.

1 Load a Turbo Flash Spiral Cardiac or a Turbo Flash Spiral Chest Pain scan protocol into the chronicle.

If no patient weight is available, a dialog box is displayed prompting you to insert the patient weight.

If the patient weight exceeds 220 kg, use another scan acquisition mode instead.

2 Select a Turbo Flash Spiral Cardiac or Turbo Flash Spiral Chest Pain scan range.



3 Click the **FlashCheck** button.

If a topogram is available, the **Turbo Flash Training** dialog box is displayed, prompting you to perform a test run of the patient table.

You are also prompted to insert the patient weight, if required.

4 On the **Turbo Flash Training** dialog box, click **Start**.

5 To move the patient table to its starting position, you are prompted to press the **Move** key. Follow the instructions on the screen.

The test run of the patient table and FlashCheck are started simultaneously.

The test run of the patient table is performed for all scan ranges of a Turbo Flash scan protocol.

The scan entry and the **Load** button are enabled. The results of the FlashCheck steps are saved for the selected range and all unscanned modes with comparable parameters.

CAUTION

Insufficient results of scanning and image reconstruction within parts of the heart anatomy in Cardiac ECG-gated examinations and ECG-triggered examinations!

Wrong diagnosis

- Make sure that the heart rate and the heart rhythm of the patient is within the recommended range for ECG-gated examinations and ECG-triggered examinations of the CT system.
- Consider possible changes of the heart rate and the heart rhythm due to patient breathing instructions, bolus injection, medication or patient's stress.

If no suitable heart rate can be achieved, we recommend performing an Adaptive Cardiac Sequence for Cardiac CT examinations or a standard ChestPain for chest pain examinations.

FlashCheck is possible with or without API text. If no API text is selected, the evaluation is performed immediately.

You can repeat the FlashCheck as often as required.

If an autorange contains a Turbo Flash Spiral Cardiac or Turbo Flash Spiral Chest Pain scan, you have to perform FlashCheck before you can start the autorange for every Turbo Flash scan with different scan parameters.

6 Perform the spiral acquisition. (➔ Page 318 *Acquiring a Spiral*)

Turbo Flash Spiral scans are not possible in the **Move Table Top Only** mode.

7.3.5 Acquiring a Heart Perfusion scan

The Heart Perfusion mode is used for dynamic scanning with maximal temporal resolution. It covers the myocardium with a measurement of scans at two positions.

The table moves back and forth from the first position to the second according to the ECG signal. A combined volume will be reconstructed.

Preparing the Heart Perfusion scan

The ECG triggered scans are performed in the selected heart phase. The reconstruction is performed at two overlapping z-positions.

1 Select a protocol containing a Heart Perfusion scan.

If necessary, you can modify or define the following parameters:

- Collimation (on the **Routine** and **Scan** parameter card)
- Table direction (on the **Routine** and **Scan** parameter card)
- Examination time (on the **Routine** and **Scan** parameter card)
- Phase start (on the **Trigger** parameter card)

The number of perfusion scans is calculated from the current heart rate and the examination time and therefore cannot be changed.

2 Check the default scan parameters on the **Routine** and the **Scan** parameter card and adapt them, if necessary.

Acquiring the Heart Perfusion scan

◆ Perform the Heart Perfusion scan in the usual way. (➔ Page 315 *Acquiring a Sequence*)

The system observes the elapsed examination time, which started with the first scan. If the planned examination time of the scan entry is over, the currently performed volume scan is done to the end. No further volume scan is started.

The actual number of scans depends on the patient's heart rate and can differ from the calculated number of scans.

The **Synthetic Sync** function is not available for this scan. If the ECG signal got lost, the scan is aborted after 3 s.

Reconstructing with the Heart Perfusion filter

To remove artifacts, the Heart Perfusion filter for Heart Perfusion scans is enabled automatically for all quick recon jobs.

1 Select **quick plus** in the **Recon** selection list on the **Trigger** parameter card to use the filter for Heart Perfusion scans.

The number behind the entries in the **Recon** selection list shows the temporal resolution of the reconstructed images.

To reconstruct a Heart Perfusion series, you can modify the slice and the recon time increment.

2 On the Recon parameter card, set the **Begin** and the **End** time to define which part of the range you want to reconstruct.

All reconstructed images of one recon job belong to the same series. If you want to split the series automatically into several series, you can select the **Series splitting** option. A split series includes one perfusion scan. All series include the same number of images.

7.3.6 Reconstructing

The values you can select depend on the current scan protocol. The selected value is indicated in the comment line of the second image.



1 Select a reconstruction job in the chronicle.

2 Select the **Trigger** parameter card.

3 Ensure that **BestPhase** is set to **manual**.

4 Change the **Phase Start** to move the recon window to the scanned position.

5 Select the temporal resolution you need (in ms) in the **Unit** selection list.

6 Select the **Recon** parameter card.

7 Define further reconstruction parameters where necessary and then start reconstruction.

With **Original ECG**, you can switch between the original and the modified ECG signal (ECG editing).

For the first recon job of ECG-triggered sequences, the whole range is always reconstructed. Therefore, **Recon begin** and **Recon end** cannot be changed. You can repeat the image reconstruction with different recon parameters.

Achieving a maximum temporal resolution

To reduce motion artifacts, you can use a special parameter setting for cardiac Dual Energy spiral scans.

To set the recon parameters of cardiac Dual Energy sequence scans, see (→ Page 228 *Defining the recon range*).

✓ A Dual Energy spiral was scanned.

◆ Select **mono plus** in the **Recon** selection list on the **Trigger** parameter card.

In comparison to the regular Dual Energy reconstruction, only one image series is reconstructed.

The number behind the entries in the **Recon** selection list shows the temporal resolution of the reconstructed images.

Reconstructing with Cardio BestPhase

Cardio BestPhase enables you to minimize the heart motion effects and to choose the most appropriate heart phase for postprocessing.

The determined best phase represents optimal image quality in systolic phase (0-50% RR) or in diastolic phase (50-100% RR).

Use Cardio BestPhase to reconstruct the images automatically irrespective of the heart motion.

As the system software defines the phase start for Cardio BestPhase reconstruction automatically, the **Phase Start** settings are dimmed. The **Multiphase** and **Test series** buttons are inactive. This phase is updated after the recon finished.

- In the **BestPhase** list of the **Trigger** parameter card, select the appropriate option for the reconstruction phase:
  - **auto**

    If you select **auto**, the system determines if a systole phase or a diastole phase is best suited for the reconstruction. Depending on the patient's heart rate, the system selects the best suited phase and sets the appropriate **Unit**.
  - **BestSyst**

    If you select **BestSyst**, the system determines the best systole phase for the reconstruction. You have to select the appropriate **Unit**.
  - **BestDiast**

    If you select **BestDiast**, the system determines the best diastole phase for the reconstruction. You have to select the **Unit**.
  - **manual**

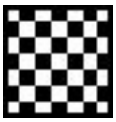
    If you select **manual**, you have to select the required heart phase that is to be used for the reconstruction. You have to select the **Unit**.

  The reconstruction is performed based on the delay value of the determined phase.

  The best phase is displayed on the **Trigger** parameter card. After the reconstruction is finished, the recon boxes will be set to the right phase.

Reducing the image resolution

To achieve a faster performance in transfer, loading and processing, it is possible to reduce the image resolution for axial spiral cardiac reconstruction.



Recon jobs performed with reduced image resolution are marked with a **Reduced Matrix** icon in the chronicle.

- Select **256** from the **Matrix size** list in the **Advanced reconstruction options**.

Reconstructing a Preview series

For Cardiac CT spirals, a preview series can be used to find out the optimum phase start for additional reconstruction. A preview series consists of several images at one slice position, each with a different delay. Offset mode, interval, and number of images are set up in the **HeartView Configuration** dialog box.

✓ The **Recon** parameter card is open.

1 On the **Recon** parameter card, set the reconstruction parameters as desired.

2 In the tomo segment, display the image of the slice position.

Use the dog-ear for scrolling.

3 On the **Trigger** parameter card, enter the offset in the **Phase Start** field.

- For an absolute delay, use the **ms** unit.
- For a percentage delay, use the **%** unit.



4 Click the **Preview Series** icon.

Images with different delays are reconstructed, stored in a separate series, and displayed in the tomo segment.

The actual trigger delay is displayed in the lower center of the images.

Offset mode	Interval	No. of Images	ECG Pulsing Start	Offset delay depends on ECG Pulsing Start and offset mode	Trigger delays resulting images
Start	+50 ms	3	400 ms		400 ms, 450 ms, 500 ms
Center	+50 ms	3	400 ms		350 ms, 400 ms, 450 ms
End	+50 ms	3	400 ms		300 ms, 350 ms, 400 ms
Start	+10%	3	55%		55%, 65%, 75%
Center	+10%	3	55%		45%, 55%, 65%
End	+10%	3	55%		35%, 45%, 55%

Example for a Preview Series

5 Scroll through the preview images to find the delay best suited for reconstruction.

You can create further preview series with different offsets.

6 Set the gating parameters for reconstruction.

Reconstructing a Multiphase series

With multiphase, it is possible to reconstruct up to 24 different heart phases within one recon job.

Start delay, end delay, and the increment between start and end delay are set up on the **Multiphase** tab card of the **HeartView Configuration** dialog box.



With the **Preview Series** icon, you can reconstruct images at a scan position with different delays to optimize the phase start setting (configurable).

If you create a preview series, some image processing steps are skipped for reasons of performance. Therefore, cone beam artifacts may occur in the images.

1 Set the reconstruction parameters as desired on the **Recon** parameter card.



2 Click the **Multiphase** icon on the **Trigger** parameter card.

3 Click the **Recon** button to start reconstruction.

The images are reconstructed and stored in one series.

The ECG data of the spiral acquisition is stored together with the raw data to the local database.

Selecting phases for Multiphase reconstruction

For Multiphase reconstruction, select the desired phases first.



- Select phases in the range 0% to 100% or -2000 ms to 2000 ms in the list on the **Trigger** parameter card.

  – or –

  Select a range of phases by clicking and dragging the mouse in the blue bar.

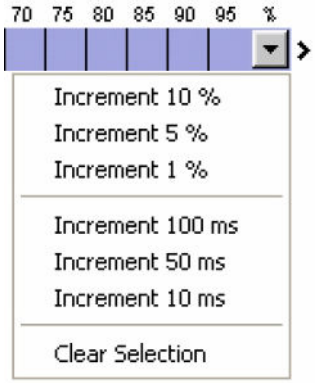
If all phases cannot be displayed at once, you can scroll the multiphase list to the left and to the right.

If you have not selected a phase, it changes to yellow.

– or –

Scroll through the list of phases if too many phases are displayed.

Modifying Multiphase parameters



You can change the parameters for Multiphase reconstruction according to your needs.

1 Click the dropdown icon next to the multiphase list on the **Trigger** parameter card.

2 Change the increment and unit via the selection list.

Performing a TrueStack reconstruction

With TrueStack reconstruction, the individual cardiac cycles are displayed without data overlap. By performing a reconstruction with TrueStack, you can create a reconstruction without stack mixing, generating an image set with sharp boundaries.

- Select the desired **TrueStack** item in the **Recon** selection list on the **Trigger** parameter card to perform a reconstruction without stack overlapping.

Using the Direct Viewer

The Direct Viewer is intended to complete the workflow of best phase finding. It provides you with direct viewing in 3D and supports you in finding the most suitable heart phase for reconstruction. It also supports you in easy checking the quality of the phase determined by the Cardio BestPhase algorithm.

The Direct Viewer is only available for already scanned cardiac spirals.

1 Reconstruct a recon job.

2 Select a not executed recon job in the chronicle.



3 Click the **Direct Viewer** icon on the **Trigger** parameter card.

The **Direct Viewer** floating toolbar is displayed.

4 Select the already reconstructed series from the selection list as a planning base.

The selected series is displayed as VRT in the topo segment. A MIP projection is displayed in the tomo segment.



5 Click the **Phase Viewer Heart Isolation** icon to activate the Heart Isolation function.



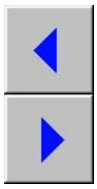
6 Click the **VRT rotation** icon to rotate the VRT images.

If you deselect the **VRT rotation** icon and click on the VRT image, a **MIP Thin** image is displayed in the right segment.



7 Click the **Phase Viewer Gallery** icon to open the **VRT Gallery** dialog box and modify the settings, if necessary.

If the loaded recon series is a multiphase series, you can navigate between the different phases.



8 Click these icons to navigate backwards or forwards to the different phases.

The topo and tomo segments with the VRT and MIP projections are updated accordingly.

To facilitate the best phase selection, you can rotate both projections freely.

9 Select the best heart phase.

The selected phase is considered as Phase Start.

10 Click the **Recon** button to start reconstruction.

You can also perform the phase selection by starting the **Direct Viewer** immediately for a reconstructed job. You perform the same steps, but the selected phase is not considered as Phase Start.

Adaptive Cardio Volume (ACV)

For Cardiac CT Spirals only.

Heartbeats cause motion artifacts on the images. The shorter the temporal resolution of the images, the less motion artifacts the images will have.

For the reconstruction of Cardiac CT spirals, you can use the ACV option to freeze the heart motion.

Monophase reconstruction (mono) as well as biphase reconstruction (bi) can be selected in the **Recon** selection list on the **Trigger** parameter card.

- mono: Images are reconstructed from the raw data of one RR-interval. This option is recommended for irregular ECG-curves, for example, an ECG with extrasystoles and for obese patients.
- bi: Images with a smaller temporal resolution are reconstructed from the raw data of up to two neighboring RR-Intervals. This feature is only available for special scan protocols and for heart rates higher than 75 bpm.

Reconstructing after editing syncs

For additional reconstruction of Cardiac CT spirals, you can insert, move, and disable syncs on the cardiogram. The syncs are indicated by dots that are located above the R-peaks.

For reconstruction, you can switch between the original and the modified ECG signal with the **Original ECG** check box on the **Trigger** parameter card.

Example: You can reposition a sync in case the system has misinterpreted a high P-wave as an R-peak.

1 To move a sync, use the mouse to drag-and-drop the sync above the R-peak.

2 To insert a sync, right-click between two syncs and select **Insert Sync** from the context menu.

The corresponding scan window will be considered for image reconstruction.

Example: You can disable a sync to skip extrasystoles.

3 To disable a sync, right-click the sync and select **Disable Sync** from the context menu.

The scan window is displayed in light blue. The scan window is not considered for image reconstruction.

To re-enable a sync, right-click and select **Enable Sync** from the context menu.

4 To remove a sync, right-click the sync and select **Delete Sync** from the context menu.

5 To switch between the edited and the original ECG, click the **Original ECG** check box.

- **Original ECG** on: The original ECG is displayed.
- **Original ECG** off: The edited ECG is displayed.

For reconstruction, the currently displayed ECG is used.

If you modify the original ECG a second time, you are prompted to decide whether you want to open the formerly edited ECG or overwrite it.

7.4 Adaptive 3D Intervention

Adaptive 3D Intervention is a special examination mode for interventions under CT control like biopsies or drainages. The examining physician can trigger individual scans in the examination room at a valid table position.

The **Examination** task card is displayed on a monitor inside the examination room. In that way, the examining physician can plan the movement of the surgical instrument precisely to avoid injuries of sensitive structures like vessels or nerves.

In an Adaptive 3D Intervention, you can use three different scan modes:

- **i-Sequence**

  i-Sequence is suitable for interventions in which the instrument stays within a few reconstructed slices.

- **i-Spiral**

  The i-spiral can be used if an extended range is of interest.

- **i-Fluoro**

  In the i-Fluoro mode, images are continuously displayed. The examining physician can monitor the movement of the surgical instrument.

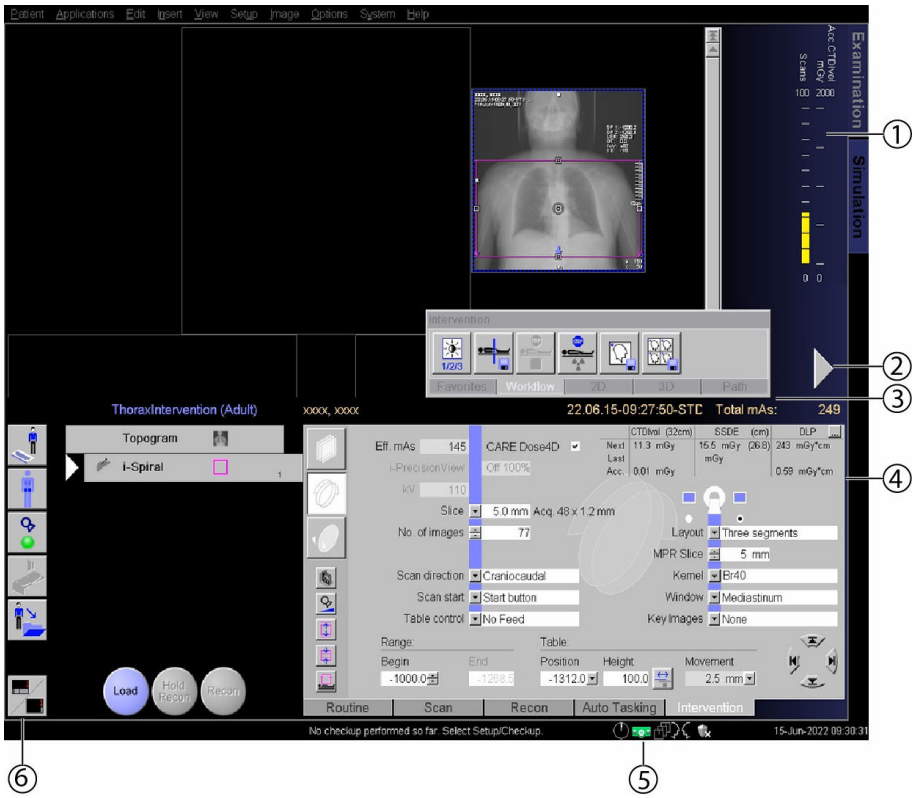
Observe the instructions on handling the **Dose Alert**, if the **Dose Alert** dialog box is displayed. (➔ Page 223 *Handling the Dose Alert*)

During a scan, you cannot load images into any task card.

If you change any values via keyboard, it is necessary that you confirm them by pressing the **Enter** key afterwards.

If you are not familiar with the basic functionalities of the *syngo* software, refer to the (➔ *Basic functionalities section*) in the *Basic applications* document.

7.4.1 Using the Intervention parameter card and tool bar



(1) Dose display
(2) Show/Hide Intervention tool bar
(3) Intervention tool bar
(4) Intervention parameter card
(5) i-Control icon
(6) Show/Hide parameter card and chronicle

Functions of the Intervention tool bar

The **Intervention** tool bar is displayed, as soon as an interventional protocol step is selected in the chronicle.

The **Intervention** tool bar consists of five tab cards:

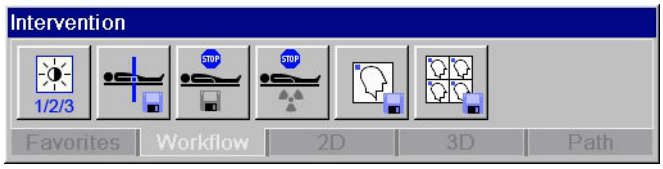
- **Favorites** tab card
- **Workflow** tab card
- **2D** tab card
- **3D** tab card
- **Path** tab card

Favorites tab card

On the **Favorites** tab card, which is empty at delivery, you can assemble frequently used icons from the other tab cards. For how to proceed: (➔ Page 385 *Assembling frequently used icons (favorites)*)

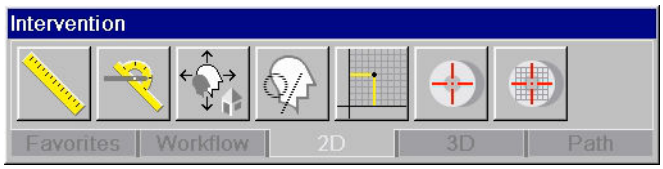
Workflow tab card

The **Workflow** tab card contains icons for windowing, autostopping table, and saving key images. For how to proceed:, (➔ Page 420 *Saving Key Images*)



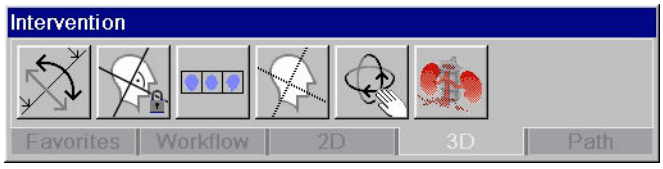
2D tab card

The **2D** tab card provides functions for the 2D evaluation of images. For how to proceed: (➔ Page 385 *Using 2D tools*)



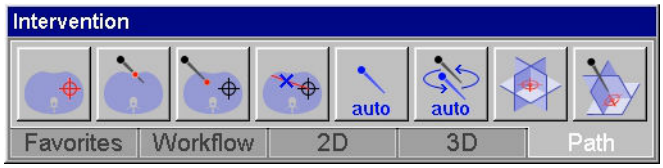
3D tab card

The **3D** tab card provides functions for the 3D intervention. For how to proceed: (➔ Page 412 *Using 3D Intervention*)



Path tab card

Via the icons of the **Path** tab card, you can define the target point, the entry point, the needle path, activate needle detection, and select a 3D view mode. For how to proceed: (➔ Page 415 *Planning the needle path*), (➔ Page 419 *Detecting the needle*), (➔ Page 420 *Saving Key Images*)



Showing/hiding the Intervention tool bar



1 Click the **Intervention Toolbar Switch** icon to show the **Intervention** tool bar.



2 Click the **Intervention Toolbar Switch** icon to hide the **Intervention** tool bar.

Moving the chronicle and the parameter card in/out

The parameter cards and the chronicle can be hidden, what is beneficial if you select a screen layout with image segments in the lower screen area. With the scan start, the parameter cards and the chronicle are hidden automatically.



- Click the **Move Chronicle and STC out/in** icon to show or hide the chronicle and parameter cards manually.

If you have selected the **Intervention** parameter card, the icons on the left border always remain visible for a direct control.

Assembling frequently used icons (favorites)

You can define frequently used icons available on the **Favorites** tab card.

Adding favorite icons

You can add an icon from the other tab cards of the **Intervention** tool bar to the **Favorites** tab card.

1 Right-click the icon you want to add.

2 Select **Add to Favorites** from the context menu.

Removing favorite icons

You can remove an icon from the **Favorites** tab card.

1 Right-click the icon you want to remove.

2 Select **Remove from Favorites** from the context menu.

Using 2D tools

The **2D** tab card of the **Intervention** tool bar provides functions for the 2D evaluation of images.

Measuring a distance



1 Click the **Distance** icon.

2 Drag out a line between two points in the image while holding the left mouse button down to display the distance in the image.

Measuring an angle



1 Click the **Angle** icon.

2 Drag out a line while holding the left mouse button down to define the first leg of the angle.

3 Draw another line for the second leg.

Restoring the zoom factor



- Click the **Home Zoom/Pan** icon.

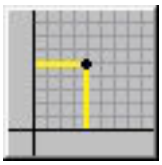
Hiding graphics



- Click the **Hide Graphics** icon.

Displaying a crosshair with scales

You can display a crosshair in the selected segment.



1 Click the **Crosshair** icon.

2 Click in the image to position the crosshair.

Displaying the laser crosshair

In axial segments, you can display a crosshair, which represents the lightmarker.



- Click the **Laser Crosshair** icon to display the crosshair of the lightmarker (without grid lines).

  – or –



Click the **Laser Grid** icon to display the crosshair of the lightmarker and grid lines.

7.4.2 Using i-Control

In interventional CT examinations, you can operate the entire system using i-Control.

You can use i-Control:

- Wired and fixed to the trolley
- Wired/wireless and fixed to the patient table

In all other modes, i-Control is not operable. The power button LEDs are still lighting, but the gantry orientation button LEDs are turned off, and the **i-Control** icon on the user interface is dimmed.

For the operating panel of i-Control, see

WARNING

Uncontrolled system movement due to unintended signal activation by users!

Injury to the patient or damage to the system.

- Always observe the patient directly. Press the nearest **STOP** key immediately if an undesired system movement is performed.

WARNING

Unintentional patient movement!

Unintentional activation of the device by the patient.

- Always fix and observe the patient when using the device.

WARNING

Operation of the i-Control in the wrong examination room!

Injury to the patient or damage to the system.

- Always keep the i-Control at the associated CT scanner.

WARNING

Uncontrolled system movement due to unintended signal activation by users!

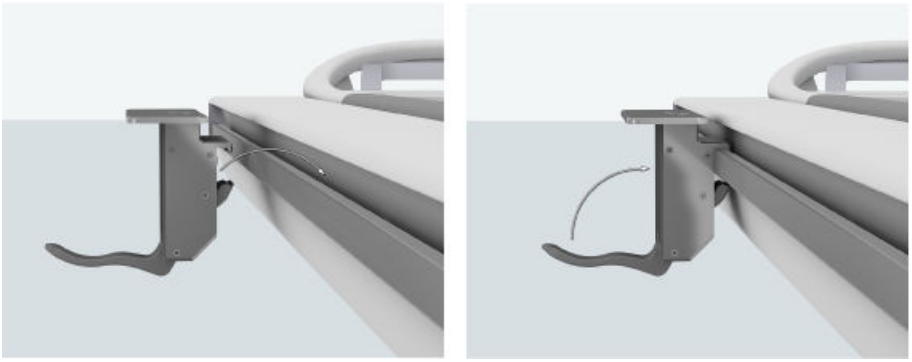
Injury to the patient or damage to the system.

- Always keep the activated intervention device at the CT scanner to prevent unauthorized use.

Mounting i-Control to the coded surgical rail

i-Control can be mounted to both sides of the patient table. Therefore, the mounting fixtures must be attached to the patient table first.

If i-Control is mounted at the surgical rail, the movement direction for the table joystick is set automatically.



1 Attach the guiding rod to the mounting fixture.

2 Move the lever to tighten the guiding rod to the mount fixture.

Attaching i-Control to the guiding rod



1 Push and hold the two keys at the bottom of i-Control.

2 Attach i-Control to the fixation, as displayed, until it locks in place.

Shifting the mounting fixtures



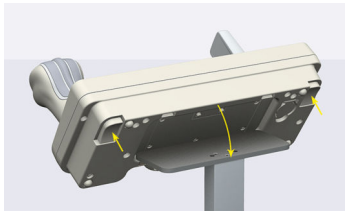
1 Move the lever to loosen the mounting fixture from the surgical rail.

2 Shift the mounting fixture along the surgical rail.

3 After shifting the i-Control, fix the mounting fixture again.

Mounting i-Control to the trolley

i-Control can be mounted on the trolley.



- Push the two keys at the bottom of i-Control and attach i-Control to the top of the trolley as displayed until it locks in place.

Prior to operation, press the **Tableside location** key on i-Control to select the desired table movement direction. (➔ Page 390 *Setting tableside location*)

Turning on i-Control

How to turn on i-Control depends on the current operation state.

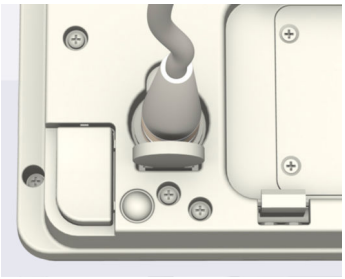
- wired mode
- wireless mode
- standby

You can change between wired and wireless mode at any time during operation. When you change back to wireless operation, i-Control establishes a radio controlled connection to the system, if possible.

Operation of i-Control in wired mode

If a wireless operation is not possible, you can use i-Control in wired mode.

Connecting the cable



1 Connect one plug of the cable to the i-Control receptacle.

2 Connect the other plug of the cable to the gantry receptacle. (→ Page 108 *Connectors*)

When connected to the gantry, i-Control battery is charged, if necessary.

Turning on in wired mode



◆ The LED at the **Power On/Off** key is off. Press the **Power On/Off** key.

The LED lights up green and i-Control is ready for operation.

Wireless operation of i-Control (optional)

You can operate i-Control in wireless mode if the battery is charged and wireless operation is legal in your country.

You can change to wired mode at any time during the operation. (→ Page 389 *Operation of i-Control in wired mode*)

Charge the battery of i-Control, if the LED by the **Power On/Off** key blinks yellow or red.

The i-Control battery must be changed by Siemens Healthineers Customer Service only.

Charging the i-Control battery

You must charge the battery of i-Control prior to wireless operation. Therefore, connect the power adapter to i-Control.



1 Connect one plug of the cable to the i-Control receptacle.

2 Connect the other plug of the cable to the socket.

The LED by the **Power On/Off** key lights up yellow while charging.

When the cable is removed or the battery is charged completely, the LED lights up green.

Turning on in wireless mode



1 The LED at the **Power On/Off** key is off. Press the **Power On/Off** key.

The LED blinks green quickly as long as i-Control tries to establish the radio connection to the CT system.

2 Wait until the LED constantly lights up green.

The i-Control is ready for operation.

The LED by the **Power On/Off** key blinks red quickly.

i-Control cannot establish the radio connection to the CT system or has lost contact.

- Connect i-Control using the cable to the gantry.
- Contact Siemens Healthineers Customer Service.

Turning on from standby

✓ The LED by the **Power On/Off** key blinks green (standby) slowly.

- Slightly move the mouse or table joystick.

The LED lights up green and i-Control is ready for operation.

Operating the system using i-Control

You can control the following CT functions using i-Control:

- Horizontal and vertical table movements
- Software actions on the *syngo* Acquisition Workplace

It is within the responsibility of the personnel to make sure that no conflictive table movements or software actions are performed when both, control box and i-Control are in use.

Moving the patient table

You can perform horizontal and vertical movements of the patient table using i-Control.

Setting tableside location

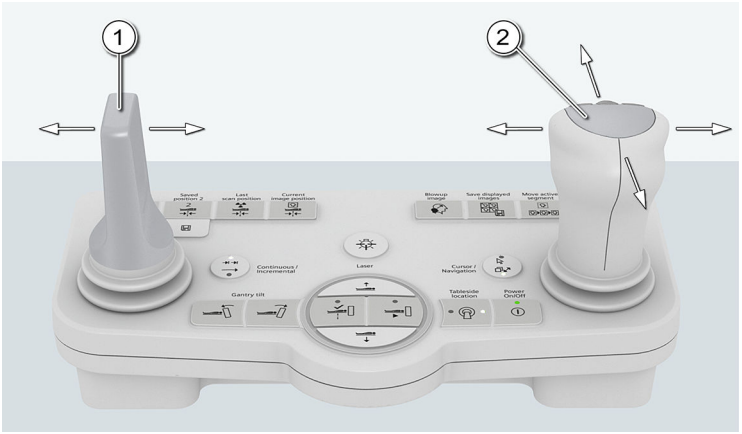
If i-Control is not mounted on the surgical rail, you must set the direction of patient table movements corresponding to the table joystick.



- Press the **Tableside location** key to set the correct movement direction.

The corresponding LED indicates the side of the patient table where i-Control is operated.

Moving the patient table to any position



(1) Table joystick
(2) Mouse joystick

1 Move the **Table joystick** to the left or to the right, to cause a horizontal movement of the patient table.



2 Switch between incremental or continuous patient table movement.



3 Elevate the patient table.



4 Lower the patient table.

Moving the patient table to predefined positions

You can stop the patient table automatically at any other position, which is saved before as the table home position.

1 Move the table to the desired patient table position.



2 Set the current position as predefined patient table position 1 or patient table position 2.



3 Press and hold the **Saved position 1** key to move the patient table to the predefined table position 1.

The patient table stops automatically at the predefined table position 1.

– or –



Press and hold the **Saved position 2** key to move the patient table to the predefined table position 2.

The patient table stops automatically at the predefined table position 2.

Moving the patient table to the position of the last scan

The position of a scan is saved automatically. You can set an automatical table stop at the position of the last scan.



- Press and hold the **Last scan position** key to move the patient table to the scan position used for the last scan.

Moving the patient table to the predefined position

You can set a patient table stop at a predefined position.



- Move the table to the preselected scanning position.

  The patient table stops automatically at the preselected scanning position.

Moving the patient table to the image position

You can position the patient table at the same horizontal table position as the image which is displayed in the selected tomo segment on the console.

✓ An axial segment is selected.



1 Press the **Move to image position** key.

  The light at the **Move** key is blinking.



2 Press and hold the **Move** key until the patient table stops moving.

  The patient table is repositioned so that the middle of the scan range is located at the horizontal table position of the selected image.



The horizontal slice position of the resulting nearest image might differ up to half the slice width.



Make sure to select an axial segment. This function is not supported for segments, such as topogram, 3D, or reference segments.

Cancelling patient table movement

You can cancel a table move request if you wish to start scanning at the current patient table position.

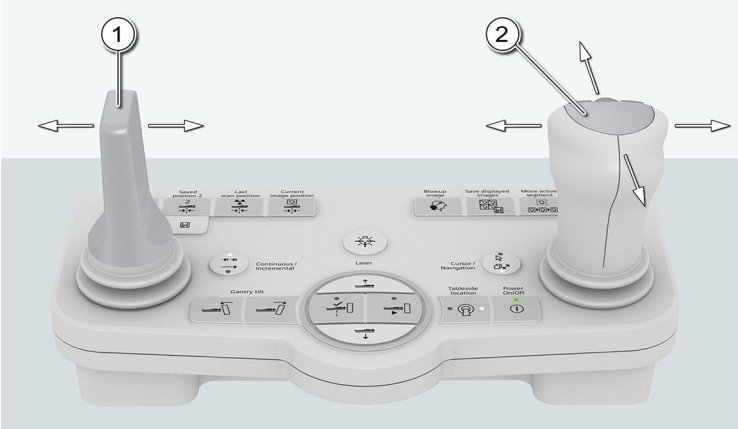
✓ A move request is active and the light at the **Move** key is blinking.



- Press the **Cancel move** key to begin the scan at the current patient table position and gantry tilt.

Operating the *syngo* software

You can operate some of the software functionalities using i-Control.



(1) Table joystick
(2) Mouse joystick

Scrolling through the image stack

✓ Image segment is selected.

✓ The image-scroll mode is active by default.



1 If the image-scroll mode is currently not active, press the **Cursor / Navigation** key to activate the image-scroll mode.

The lower LED lights up.

2 Move the **Mouse joystick** up or down to scroll through the images.

The joystick direction corresponds to the scroll bar on the screen at the console.

Controlling the *syngo* software

✓ The image-scroll mode is active.



1 Press the **Cursor / Navigation** key to activate the mouse-cursor mode.

The upper LED lights up.

2 Use the **Mouse joystick** and the mouse keys to control the mouse cursor of the *syngo* software.

Toggling between image segments



◆ Toggle between the image segments.

Toggling between window settings

✓ The three organ window settings are configured with **Examination Configuration**.



◆ Toggle between the organ window settings.

Using the Blow-up mode



1 Press the **Blow-up image** key to activate the **Blow-up** view for the currently selected image.

2 Press the **Blow-up image** key again to return to the initial layout of the chosen segment.

Saving displayed images as key images

✓ You can document the interventional examination by saving all displayed images as key images.



◆ Press the **Save displayed images** key to save all displayed images as key images.

7.4.3 Using i-Control

In interventional CT examinations, you can operate the entire system using i-Control.

You can use i-Control:

- Wired and fixed to the trolley
- Wired/wireless and fixed to the patient table

In all other modes, i-Control is not operable. The power button LEDs are still lighting, but the gantry orientation button LEDs are turned off, and the **i-Control** icon on the user interface is dimmed.

For the operating panel of i-Control, see

WARNING

Uncontrolled system movement due to unintended signal activation by users!

Injury to the patient or damage to the system.

◆ Always observe the patient directly. Press the nearest **STOP** key immediately if an undesired system movement is performed.

WARNING

Unintentional patient movement!

Unintentional activation of the device by the patient.

◆ Always fix and observe the patient when using the device.

WARNING

Operation of the i-Control in the wrong examination room!

Injury to the patient or damage to the system.

◆ Always keep the i-Control at the associated CT scanner.

WARNING

Uncontrolled system movement due to unintended signal activation by users!

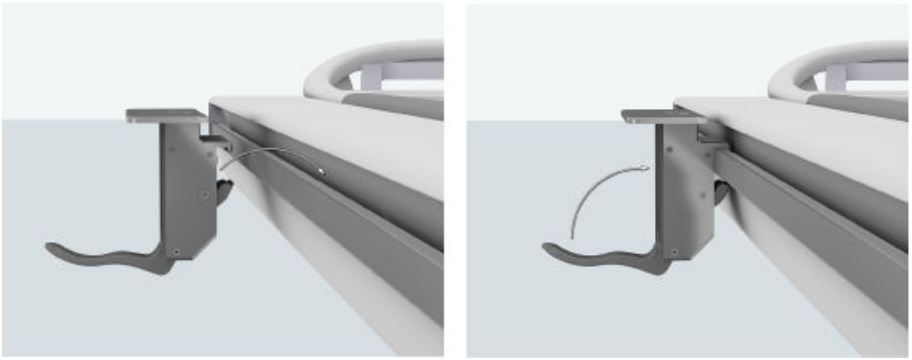
Injury to the patient or damage to the system.

- Always keep the activated intervention device at the CT scanner to prevent unauthorized use.

Mounting i-Control to the coded surgical rail

i-Control can be mounted to both sides of the patient table. Therefore, the mounting fixtures must be attached to the patient table first.

If i-Control is mounted at the surgical rail, the movement direction for the table joystick is set automatically.



1 Attach the guiding rod to the mounting fixture.

2 Move the lever to tighten the guiding rod to the mount fixture.

Attaching i-Control to the guiding rod



1 Push and hold the two keys at the bottom of i-Control.

2 Attach i-Control to the fixation, as displayed, until it locks in place.

Shifting the mounting fixtures



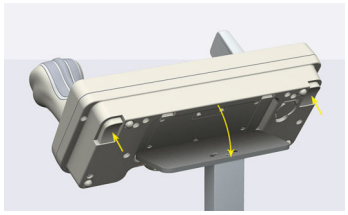
1 Move the lever to loosen the mounting fixture from the surgical rail.

2 Shift the mounting fixture along the surgical rail.

3 After shifting the i-Control, fix the mounting fixture again.

Mounting i-Control to the trolley

i-Control can be mounted on the trolley.



- Push the two keys at the bottom of i-Control and attach i-Control to the top of the trolley as displayed until it locks in place.

Prior to operation, press the **Tableside location** key on i-Control to select the desired table movement direction. (➔ Page 390 *Setting tableside location*)

Turning on i-Control

How to turn on i-Control depends on the current operation state.

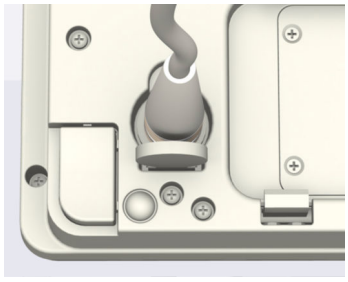
- wired mode
- wireless mode
- standby

You can change between wired and wireless mode at any time during operation. When you change back to wireless operation, i-Control establishes a radio controlled connection to the system, if possible.

Operation of i-Control in wired mode

If a wireless operation is not possible, you can use i-Control in wired mode.

Connecting the cable



1 Connect one plug of the cable to the i-Control receptacle.

2 Connect the other plug of the cable to the gantry receptacle. (➔ Page 108 *Connectors*)

When connected to the gantry, i-Control battery is charged, if necessary.

Turning on in wired mode



- The LED at the **Power On/Off** key is off. Press the **Power On/Off** key.

  The LED lights up green and i-Control is ready for operation.

Wireless operation of i-Control (optional)

You can operate i-Control in wireless mode if the battery is charged and wireless operation is legal in your country.

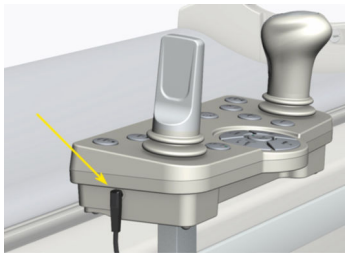
You can change to wired mode at any time during the operation. (→ Page 396 *Operation of i-Control in wired mode*)

Charge the battery of i-Control, if the LED by the **Power On/Off** key blinks yellow or red.

The i-Control battery must be changed by Siemens Healthineers Customer Service only.

Charging the i-Control battery

You must charge the battery of i-Control prior to wireless operation. Therefore, connect the power adapter to i-Control.



1. Connect one plug of the cable to the i-Control receptacle.
2. Connect the other plug of the cable to the socket.

   The LED by the **Power On/Off** key lights up yellow while charging.

   When the cable is removed or the battery is charged completely, the LED lights up green.

Turning on in wireless mode



1. The LED at the **Power On/Off** key is off. Press the **Power On/Off** key.

   The LED blinks green quickly as long as i-Control tries to establish the radio connection to the CT system.
2. Wait until the LED constantly lights up green.

   The i-Control is ready for operation.

The LED by the **Power On/Off** key blinks red quickly.

i-Control cannot establish the radio connection to the CT system or has lost contact.

- Connect i-Control using the cable to the gantry.
- Contact Siemens Healthineers customer service.

Turning on from standby

✓ The LED by the **Power On/Off** key blinks green (standby) slowly.

- Slightly move the mouse or table joystick.

The LED lights up green and i-Control is ready for operation.

Operating the system using i-Control

You can control the following CT functions using i-Control:

- Horizontal and vertical table movements
- Software actions on the *syngo* Acquisition Workplace

It is within the responsibility of the personnel to make sure that no conflictive table movements or software actions are performed when both, control box and i-Control are in use.

Moving the patient table

Horizontal and vertical movements of the patient table can be performed with the i-Control.

Choosing table movement direction

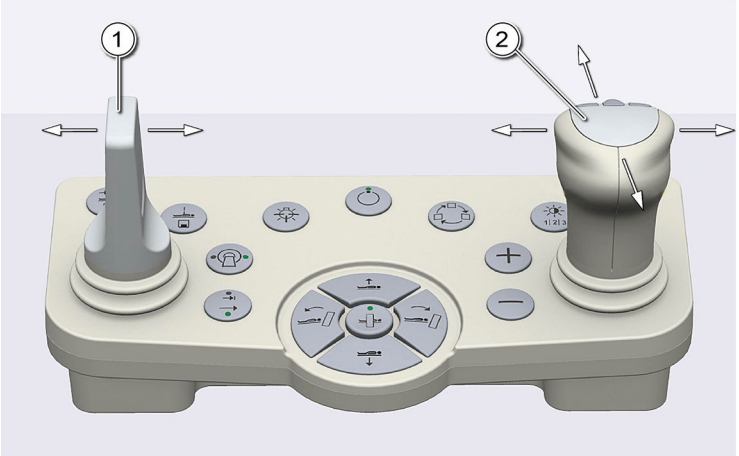
If the i-Control is not mounted at the surgical rail, the direction of table movements corresponding to the table joystick must be set.



◆ Press the **table direction** key to set the correct movement direction.

The corresponding LED indicates the side of the patient table where the i-Control is operated.

Moving the table to any position



(1) Table joystick
(2) Mouse joystick

1 Move the **table joystick** to the left or to the right to cause a horizontal movement of the patient table.



2 Switch between incremental or continuous table movement.



3 Elevate the patient table.



4 Lower the patient table.

Moving the table to predefined positions

You can toggle between two table positions, for example, scan and working position.

Stopping automatically at the position of the last scan

The position of a scan is saved automatically. You can make the table stop automatically at the position of the last scan.



- Press this key to move the table to the scan position used for the last scan.

Stopping automatically at any other position

You can also make the table stop automatically at any other position, which is saved before as home table position.

1 Move the table to the desired table position.



2 Set the current position as predefined table position.



3 Move the table to the predefined table position.

The table automatically stops at the predefined table position.

Stopping at a predefined position

You can make the table stop at the predefined position.



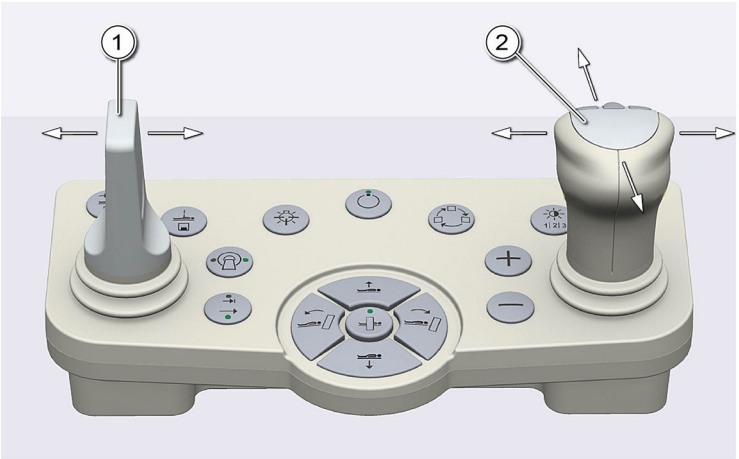
- Move the table to the preselected scanning position.

  The table automatically stops at the preselected scanning position.

Operating the *syngo* software

You can operate some of the software functionalities using the previous i-Control.

Use the mouse joystick and the mouse buttons to control the mouse cursor of the *syngo* software.

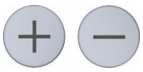


(1) Table joystick
(2) Mouse joystick

- Use the mouse joystick to move the mouse, similarly to using your standard computer mouse. Additionally, you can use the software keys, for example, to scroll through the image stack.

Scrolling through the image stack

✓ Image segment is selected.



◆ Scroll forward or backward through the image stack.

Toggling between image segments



◆ Toggle between the image segments.

Toggling between window settings

✓ The three organ window settings are configured with **Examination Configuration**.



◆ Toggle between the organ window settings.

7.4.4 Using the foot switch

In interventional CT examinations, a scan can be controlled with the foot switch in the examination room.

For radiation protection, see (➔ Page 19 *Radiation protection*).

You can use the foot switch and the keys on the gantry control panel in parallel.

CAUTION

Impermissible or faulty manipulations or changes of the hardware or software, or connection of the system to a network can cause the system to malfunction!

Unauthorized access, injury to the patient or damage to the equipment.

- ◆ Make sure that all necessary precautions with respect to the existing level of security are considered when adding a functionality or altering the shipped configuration.
- ◆ Do not open or remove the cover of the equipment nor install third-party software.

Triggering the scan

◆ Press the foot switch and keep it pressed.

The scan is performed for as long as the foot switch remains pressed.

Terminating the scan

◆ Release the foot switch.

Scanning is terminated. The system is again ready to scan.

7.4.5 Using the monitor cart and monitor ceiling system

The monitor cart and monitor ceiling system are movable as described in this section.

WARNING

Liquids in the monitor ceiling system, power supply cables are laid inside!

Electric shock

- Make sure that no liquids, for example cleaning fluids, can get into the interior of the monitor ceiling system.

CAUTION

Dirt and liquid in the monitor arm of the ceiling mounted monitor!

Infection possible

- Clean the monitor and monitor arm after use.

CAUTION

Raising and moving the monitor ceiling system!

Damage to the monitor ceiling system.

- Do not use force when moving the device into the limit positions.
- Make sure that the monitor ceiling system does not collide with other components.

CAUTION

Raising and moving the monitor ceiling system!

Injury to the personnel, damage to monitor ceiling system.

- Do not use force when moving the device into the limit positions.Make sure that the ceiling system does not collide with other components.

Positioning the monitor cart



1 Move the monitor cart by using the handle only.

CAUTION

Tripping of user and other persons!

Injury to the patient, the personnel, or other persons.

- Make sure that cables are installed in such a way that nobody can stumble over them.

2 Place the monitor cart at any position and lock the brakes.

Using the monitor ceiling system

The following section provides instructions on how to bring the monitor into the most convenient working position.

CAUTION

Raising and moving the monitor ceiling system!

Damage to the monitor ceiling system.

- Do not use force when moving the device into the limit positions.
- Make sure that the monitor ceiling system does not collide with other components.

WARNING

Malfunction of the system or the equipment!

Injury to the patient or personnel, unintended radiation exposure or damage to the equipment.

- Press a **STOP** key at any unintentional system movement and in any hazardous situation.
- Press an **EMERGENCY OFF** key if the system does not respond to the STOP keys in any hazardous situation.
- Shut down the system immediately if system malfunctions are detected and notify the Customer Service at Siemens Healthineers.

CAUTION

Raising and moving the monitor ceiling system!

Injury to the personnel, damage to monitor ceiling system.

- Do not use force when moving the device into the limit positions.Make sure that the ceiling system does not collide with other components.

Adjusting the horizontal position

- Pull or push the monitor frame gently into the desired horizontal position.

Adjusting the vertical position

- Pull or push the monitor frame gently into the desired vertical position.

Parking the monitor ceiling system

- Select a parking position for the monitor ceiling system that is outside the working range.

7.4.6 Preparing Intervention

You activate Adaptive 3D Intervention by selecting an interventional scan protocol from the corresponding body region in the **Patient Model Dialog**.

CAUTION

Real-time images that are used for guiding an interventional examination are covered by the *syngo*.via application!

Injury to the patient.

- Close *syngo*.via manually before you start an interventional examination.

✓ Online Help windows on the **Examination** task card are not closed automatically when a scan is started. Make sure all Online Help windows are closed before starting an interventional examination.

1 Select the protocol.

2 Scan a topogram and define the examination ranges.

3 Perform a reference scan if necessary.

You can also use an i-Spiral as a reference scan.

7.4.7 Selecting the Interventional Scan Mode



1 On the **Intervention** parameter card, click the **i-Sequence** icon.

– or –



On the **Intervention** parameter card, click the **i-Spiral** icon.

– or –



On the **Intervention** parameter card, click the **i-Fluoro** icon.

The parameters of the selected scan mode are displayed on the **Intervention** parameter card.

2 Check the settings and modify them, if necessary. (➔ Page 405 *Setting the parameters*)

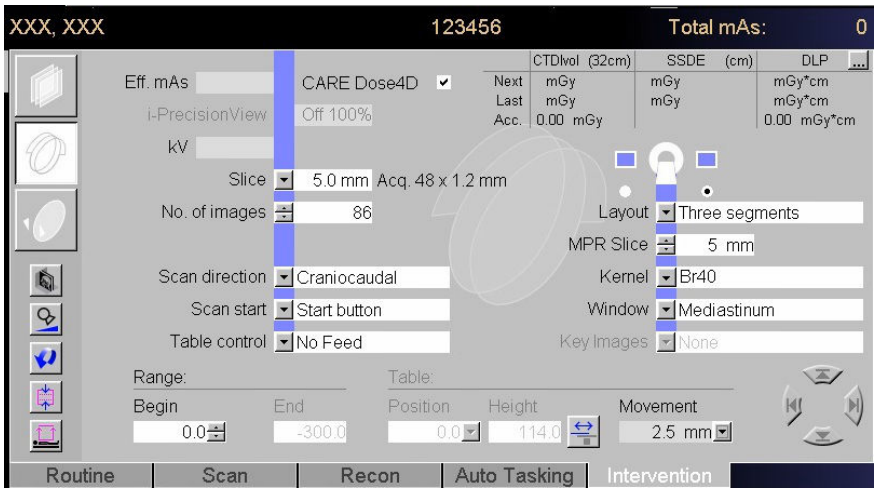
In the i-Sequence and i-Spiral modes, the raw data of the last scan is saved. You can reconstruct additional images after you have completed the Adaptive 3D Intervention.

In the i-Sequence and i-Spiral modes, you can also add recon jobs by right-clicking the relevant icon on the **Intervention** parameter card.

7.4.8 Displaying the parameters

1 Click the **Intervention** protocol step in the chronicle.

The **Intervention** parameter card is displayed.



The parameters of the respective interventional scan mode are displayed.

Certain modes of operation allow selections of scan parameters that may lead to a peripheral $CTDI_{100}$ of more than 1 Gy. This dose may exceed the threshold for deterministic radiation effects on the patient's skin or eye lenses. *syngo* offers many possibilities to optimize the dose applied to a patient. (➔ Page 189 *Dose management and optimization*).

For general dose information on the CT system, see: *System Owner Manual*.

The following dose values are displayed: **$CTDI_{vol}$ (accumulated)**, **SSDE** with **Dw** and **DLP (accumulated)**. For interventional examination predicted values for **Next scan**, values from **Last scan** and accumulated dose values (only max. of **$CTDI_{vol}$** and **DLP**) are displayed.

The **SSDE**- value is calculated from the **$CTDI_{vol}$**- value and **Dw**- value.

Dose values from additional scans based on other scan protocols, that are executed between the interventional scans, are also included in the accumulated values.

2 Click the icon of the respective interventional scan mode on the **Intervention** parameter card. (➔ Page 403 *Selecting the Interventional Scan Mode*)

A new chronicle entry is added in the following cases:

- For i-Spiral scans, after each scan
- For i-Sequence scans, after 100 scans of the sequence
- For i-Sequence scans and i-Fluoro scans, after you changed a scan-relevant or a recon-relevant parameter.

7.4.9 Setting the parameters

1 Set the parameters on the **Intervention** parameter card.

2 On the **Routine** and on the **Scan** parameter card, check the default scan parameters.

3 Correct them, if necessary.

In the majority of cases, you modify the parameters on the **Intervention** parameter card only. Otherwise you can change the parameters on the **Routine** and/or **Scan** parameter card for each of the three scan modes separately.

In the i-Sequence and i-Spiral modes, the raw data of the last scan is saved. You can reconstruct additional images after you have completed the Adaptive 3D Intervention.

4 In i-Sequence or i-Spiral mode, select **Start button** or **Foot Switch** from the **Scan Start** selection list.

In i-Fluoro mode, you always perform a scan with the foot switch.

7.4.10 Setting a tube position for HandCARE

HandCARE helps to reduce radiation dose for operators inside the examination room.

HandCARE is only available in the i-Sequence and i-Fluoro scan modes.
(→ Page 195 *HandCARE*)

◆ From the **HandCARE** selection list, select a tube position - for example, **10 o'clock position** - where the radiation is paused.

HandCARE setting	10 o'clock	12 o'clock	2 o'clock	None
HandCARE symbol for i-Sequence				
HandCARE symbol for i-Fluoro				

HandCARE is displayed as watermark on the **Intervention** parameter card, on the scan mode icons for i-Sequence and i-Fluoro, and on the **Routine** parameter card.

If **HandCARE** is switched off, the maximum length of an i-Fluoro scan is 100 s. If **HandCARE** is switched on, the maximum length of an i-Fluoro scan is 50 s.

7.4.11 Defining the table movement

In the **Movement** selection list, you specify the step length the table moves when you use the table joystick on i-Control or press the symbol keys at the gantry panel.

You can change the step length by entering the desired value in the field. The default step length is half the slice width.

If you press a key at the gantry panel to move the table or push the table joystick on i-Control longer than half a second, the table continuously moves to the intended direction.

- Select **Incremental** to move the table by half of the slice width on every interaction.

  – or –

  Select **User defined** to move the table with a user-defined feed and enter the desired step length in the input field.



You can click the **Move Table Top Only** icon to move only the table top. This function provides more space, for example, for additional devices, between the table base and the gantry during an intervention. A message box informs you when the table top must be moved out of the gantry first.

The **Move Table Top Only mode** is not supported for Cardio flash scans and Adaptive 4D scans. (➔ Page 182 *Deactivating the Move Table Top Only mode*) (➔ Page 185 *Deactivating the Move Table Top Only mode*)

The **Move Table Top Only mode** is not supported for Adaptive 4D scans.

7.4.12 Defining the table repositioning

Via the items of the **Table control** selection list, you define the automatic table repositioning after each i-Spiral.

To define the table repositioning, there are prerequisites:

✓ The i-Spiral scan mode is active.

- Select **No Feed** to position the table at the end of the preceding i-Spiral.

  – or –

  Select **Feed to Begin Position** to position the table at the begin of the preceding i-Spiral.

  – or –

  Select **Feed to i-Sequence Scan Position** or **Feed to i-Fluoro Scan Position** to position the table at the previous i-Sequence or i-Fluoro scan position.

The items **Feed to i-Sequence Scan Position** or **Feed to i-Fluoro Scan Position** are only available if i-Sequence or i-Fluoro has been scanned in the current intervention.

7.4.13 Defining the image order

The image order on the monitor of the *syngo* Acquisition Workplace depends on the in-room monitor position and the patient position.

The image order is as follows:

Patient orientation	Monitor left of the gantry	Monitor right of the gantry
Head first	Feet-Center-Head	Head-Center-Feet
Feet first	Head-Center-Feet	Feet-Center-Head



- Select the side of the patient table from which you operate the system via the i-Control.

  The images are labeled according to the image order.

7.4.14 Selecting the default screen layout

You can define screen layouts according to your needs.

- Select the desired screen layout of the image area in the **Layout** selection list.

In the i-Fluoro mode, all acquired images are immediately displayed. Therefore, the list of available screen layouts depends on the No. of images per collimation. If you have modified the parameter **No. of images**, the system verifies if the selected screen layout has a sufficient number of axial segments. If there are not enough axial segments, the system automatically switches to a suitable screen layout.

7.4.15 Selecting the default window settings

- Select the desired window settings in the **Window** selection list.

7.4.16 Starting the acquisition

As soon as you defined the scan and reconstruction parameters, you can start the acquisition.

The scan start type is predefined on the **Intervention** parameter card.

1 Confirm the scan parameters with **Load**.

2 Start the scan.

You can interact on the CT system during scans (i-Fluoro) and scan pauses.

3 Use the table joystick on the i-Control or the keys at the gantry to move the table horizontally.

4 Modify the settings for the next scan.

You can modify, for example, the following settings for the next scan:

- (→ Page 403 *Selecting the Interventional Scan Mode*)
- (→ Page 408 *Acquiring images in i-PrecisionView mode*)
- (→ Page 412 *Switching to 3D Intervention*) (i-Sequence or i-Spiral only)
- (→ Page 413 *Refreshing 3D images*)
- (→ Page 409 *Auto stopping the table*)

7.4.17 Acquiring images in i-PrecisionView mode

The i-PrecisionView mode is used to acquire images with a higher or lower eff. mAs/mAs value.

If you click the **i-PrecisionView** icon, you can edit or view the following fields:

- You can edit the **i-PrecisionView** field on the **Intervention** parameter card. The % value defines the eff. mAs/mAs value for the next scan, whereas the value 100% correspond to the default eff. mAs/mAs value.
- The **Eff. mAs/mAs** field is dimmed. It displays the calculated eff. mAs/mAs value to be used for the next scan in the same mode.

Example: If the default eff. mAs value is 50 mAs and the i-PrecisionView value is set to 120%, the new calculated eff. mAs value is 60 mAs. If the default eff. mAs value is 50 mAs and the i-PrecisionView value is set to 80%, the new calculated eff. mAs value is 40 mAs.



1 On the **Intervention** parameter card, click the **i-PrecisionView** icon.

2 Enter the % value for the i-PrecisionView.

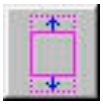
The **i-PrecisionView %** and the **Eff. mAs/mAs** values are updated. The mAs values are only used for the next scan. The %-value is retained.

After the scan, the i-PrecisionView mode is deselected automatically, and the default eff. mAs/mAs value is set again. **Off** is displayed and the item is dimmed.

7.4.18 Modifying the scan range

To modify the scan range, there are prerequisites:

✓ The i-Spiral scan mode is active.



1 Click the **Increase Range** icon on the **Intervention** parameter card to enlarge the scan range.



2 Click the **Decrease Range** icon to shorten the scan range.

The scan range is enlarged or shortened at begin and end position by one slice.

If enlarging or shortening is not possible, the respective icon is dimmed.

7.4.19 Modifying the window values

You can predefine up to three interventional window settings on the **General** tab card of the **Intervention Configuration** dialog box.

1 Select the image you want to modify.



2 Click the **Window Toggle Button** icon on the **Workflow** tab card of the **Intervention** tool bar.

The window switches to the next of four values: The three configured window settings and the value which was manually set before.

7.4.20 Auto stopping the table

The Auto stop functions are used to toggle between two table positions, for example, scan and working position.

Stopping the patient table at a scan position

The position of a scan is saved automatically. You can make the table stop automatically at the position of the last scan:



◆ Click the **Auto Scan TP** icon on the **Workflow** tab card of the **Intervention** tool bar.

Stopping the patient table at a working position

You can also make the table stop automatically at any other position, which is saved before as working position:

1 Move the table to the desired table position.



2 Click the **Save TP** icon.



3 Click the **Auto Save TP** icon to make the table automatically stop at the saved table position 1.

As soon as the auto stop table position has been reached, the corresponding icon is highlighted in green.

If the home table position is invalid or not set, the **Auto Home TP** icon is dimmed.

7.4.21 Moving the table with the function Same TP

You can use the **Same TP** function to position the table at the same horizontal table position as the image which is displayed in the selected tomo segment.



- Click the **Move scan range to Displayed table position** icon.

  – or –

  From the **Position** selection list on the **Routine** or the **Intervention** parameter card, select the **Same TP** option.

The table is repositioned so that the middle of the scan range is located at the horizontal table position of the selected image.

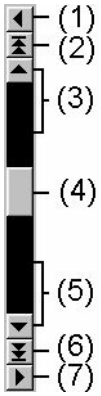
The horizontal slice position of the resulting nearest image might differ up to half the slice width.

7.4.22 Scrolling through images

To the right of the image display area, the interventional scroll bar is displayed.

The scroll bar provides two different scrolling functions:

- Scrolling through the images *within* an interventional scan
- Scrolling through the images *across* interventional scans



(1) Previous scan
(2) First image
(3) Previous image
(4) Slider
(5) Next image
(6) Last image
(7) Next scan

When scrolling through the images within a scan using the interventional scroll bar, **n of m images** is displayed on the mouse pointer:

- **n** = the number of the image in the axial center segment
- **m** = the total number of images of the interventional scan

When scrolling through the images across the scans using the interventional scroll bar, **n of m scans** is displayed on the mouse pointer:

- **n** = the number of the currently displayed scan
- **m** = the total number of scans

For scrolling through the images within an i-Spiral or i-Sequence scan, you can also use the dog ears and the keys on the symbol keypad.

If you have used the screen layout during the i-Fluoro scan, only the stored images are displayed when scrolling through the images.

If not all images are available, the corresponding segments remain empty. Independent of the configured **i-Fluoro Image Storage Rate**, the last images of the currently performed i-Fluoro scan can be displayed during the intervention.

1 Click the previous scan icon to display the images of the previous scan.

2 Click the first image icon to display the first image of the currently displayed scan.

3 Click the previous image icon to display the previous image of the currently displayed scan.

4 Drag the slider to scroll through the images of the currently displayed scan.

5 Click the next image icon to display the next image of the currently displayed scan.

6 Click the last image icon to display the last image of the currently displayed scan.

7 Click the next scan icon to display the images of the next scan.

Navigating between MPRs and axial images

MPRs and axial images are connected. This function helps you, for example, to display a needle entry point.

1 In the MPR segment, scroll to the needle position.

2 Click the needle.

The axial images that correspond best to this position are displayed. In this example, the needle entry point is displayed.

7.4.23 Loading different series in a segment

You can load a different series (for example, a reference series) from the chronicle or the **Patient Browser** in the predefined reference segment.

- Load the series via drag-and-drop in the reference segment.

When working with dual monitors, dragging from the chronicle is only possible on the main monitor.

7.4.24 Loading a different recon job

In the 3D layout, you can load any recon job (except i-Fluoro) of the current interventional examination from the chronicle. You can then use these data sets to plan a needle path.

1 Load a recon job via drag-and-drop in the MPR segment.

2 Plan the needle path (➔ Page 415 *Planning the needle path*).

7.4.25 Using 3D Intervention

In 3D Intervention mode, axial, coronal, and sagittal MPR projections are automatically displayed for i-Spiral and i-Sequence. Furthermore, you can display a VRT projection. You can use the 3D Intervention for improved targeting and navigation during instrument path planning.

Switching to 3D Intervention



- On the **Intervention** parameter card, click the **i-3D** icon.

  The screen layout switches to the corresponding 3D layout. For i-Spiral, you can immediately see the images. For i-Sequence, you can see the images when the scan starts.

If you have performed a new scan, e.g., a 2D scan, and 3D images from the previous scan are still displayed, they are marked by the image text **Not from current scan** and framed gray.

Defining the MPR slice thickness

You can modify the slice thickness of the 3D MPR projections. This parameter is relevant when using 3D intervention. The maximum slice thickness is 20 mm.

- Enter the desired slice thickness in the **MPR Slice** field on the **Intervention** parameter card.

  – or –



  Press and move the mouse at the bottom of a 3D MPR image to the right or left to increase or decrease the slice thickness.

  The new value is applied to all 3D MPR images.

Refreshing 3D images

If there are 3D projections from a previous scan, you can refresh the last 3D images easily.



- On the **Intervention** parameter card, click the **i-Refresh** icon to repeat the previous 3D scan (i-Spiral) and refresh the 3D projections if you have a 2D i-Sequence or i-Fluoro scan.

  – or –



  Press the **START** key on the control box to refresh the 3D projections if you have a 3D scan.

  – or –



  On the **Intervention** parameter card, click the **i-3D** icon to refresh the 3D projections if you have a 2D Spiral scan.

  In order to refresh the displayed 3D projections, the system repeats the previous 3D scan automatically. After the 3D scan is completed, the previous 2D scan mode is repeated automatically.

If there are no 3D projections from a previous scan, or if the current scan is a 3D scan or an i-Spiral, the **i-Refresh** icon is dimmed.

Using 3D tools

The **3D** tab card of the **Intervention** tool bar provides functions for the 3D evaluation of images.

In order to change position and orientation of the 3D projections, you can perform the following workflow steps:

- Move the reference lines (MPR only)
- Rotate the reference lines (MPR only)
- Rotate images with the mouse (VRT only)

Activating free mode for MPR projections



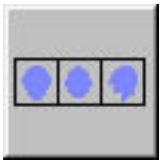
- Click the **Free Mode** icon on the **3D** tab card to rotate the axes in any segment.

Unlocking the reference lines in MPR projections



- Click the **Unlock Reference Lines** icon on the **3D** tab card to move or rotate the reference lines separately.

Resetting the orientation of an MPR projection



- Click the **Default Orientation** icon on the **3D** tab card to reset the orientation of all 3D segments.

Hiding the reference lines in MPR projections



- Click the **Hide Reference Lines** icon on the **3D** tab card to show or hide the reference lines.

Activating VRT rotation mode



- Click the **VRT Rotation** icon on the **3D** tab card to rotate the images with the mouse.

Opening the VRT Gallery



- Click the **VRT Gallery Dialog** icon to open the **VRT Gallery** dialog box.

You can predefine the VRT gallery presets on the **3D** task card. The last selected preset is displayed the next time automatically.

Planning the needle path

To navigate the needle safely during the intervention, you plan the needle path by marking the target point and the entry point.

The 3D visualization of the planned needle path makes it easier to identify areas of risk alongside the path.

It is not possible to set the path points into the topogram or VRT image. You can adjust the path by redefining the path points. For more information, refer to: (➔ Page 417 *Adjusting the needle path*)

It is also possible to define a target point only. Then the 3D images are centered to the target.



1 On the **Intervention** parameter card, click the **i-3D** icon.



2 Click the **Needle Target Point** icon on the **Path** tab card of the **Intervention** tool bar.

3 Use the image that suits best for setting the target point and the entry point (coronal, sagittal, or axial image).

4 Click the target in the image.

The target point is marked and the 3D projections are centered to the target.

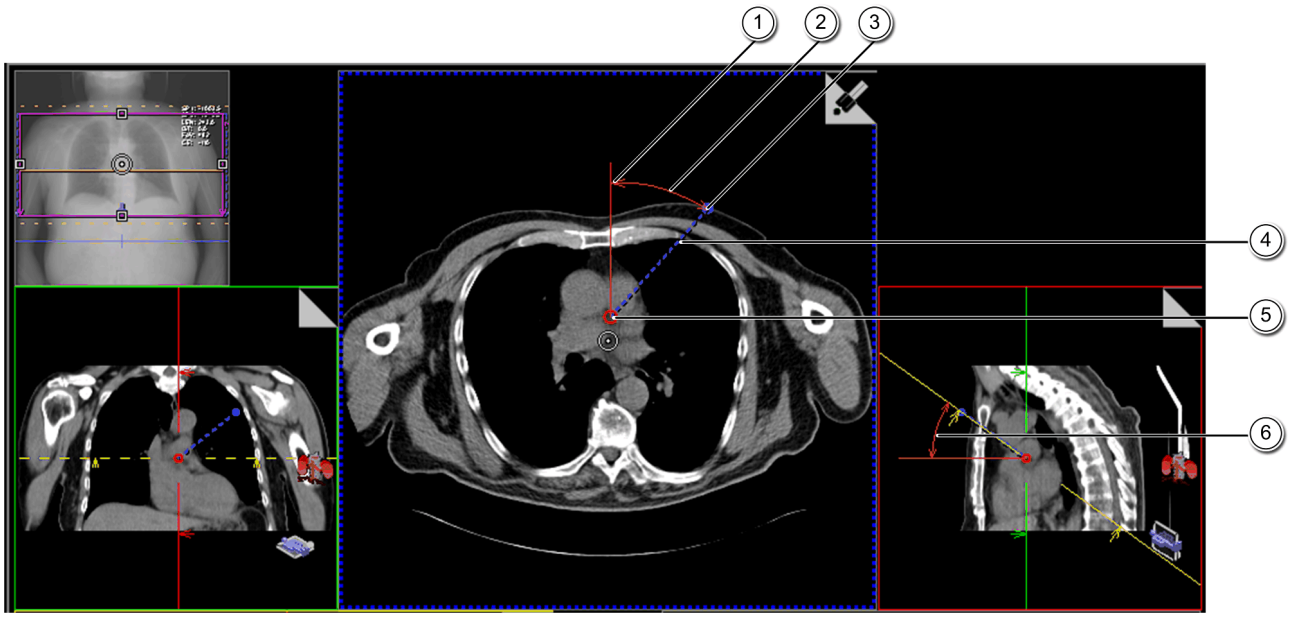


5 Click the **Needle Entry Point** icon on the **Path** tab card of the **Intervention** tool bar.

6 If necessary, scroll to a different image in the image stack.

7 Click the entry point in the image.

The entry point is marked and the path is drawn. The path is applied for the subsequent interventional scans.



(1) Y-axis
Not shown on the actual image. Serves as reference axis for measuring the angles in the x-direction the z-direction.
(2) Angle (x-direction)
Indicates the angle between the needle path and the y-axis in the axial plane.
(3) Entry point
(4) Needle path
(5) Target point
(6) Angle (z-direction)
Indicates the angle between the needle path and the y-axis in the sagittal plane.

You can correct the position of the target or entry point.

8 Set a new target respectively at a new entry point.

– or –

Move the entry point by dragging it to the correct position.

The values for the angles change accordingly:

Angle (x-direction): in the axial image

The values change between 0 degrees and 180 degrees if the entry point is on the right of the y-axis that goes through the target point. In that case, the entry point is to the right from the sagittal plane that goes through the target point.

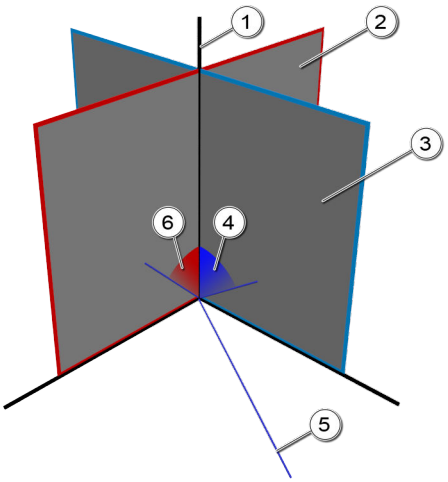
The values change between 0 degrees and -180 degrees if the entry point is on the left of the y-axis that goes through the target point. In that case, the entry point is to the left from the sagittal plane that goes through the target point.

Angle (z-direction): in the sagittal image

The values change between 0 degrees and 90 degrees if the entry point is above the y-axis that goes through target point. In that case, the entry point is behind the axial plane that goes through the target point.

The values change between 0 degrees and -90 degrees if the entry point is below the y-axis that goes through target point. In that case, the entry point is in front of the axial plane that goes through the target point.

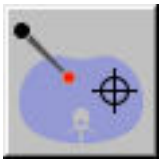
Example of a needle path in a 3D model



(1) Y-axis through the target point
(2) Sagittal plane
(3) Axial plane
(4) Angle in x-direction
(5) Needle path
(6) Angle in z-direction

Adjusting the needle path

If the needle deviates from the planned path, you can adjust the path during the intervention.



1 Click the **Needle Tip Point** icon on the **Path** tab card of the **Intervention** tool bar.

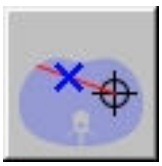
2 Click the needle tip in the image.

The needle path is displayed extended between needle tip point and toward the target to the vertical. Needle-oriented images are updated.

- The target point remains marked.
- The angle values in the MPR projections display the deviation of the new path from the line between entry and target point.
- If no path is defined, the **Needle Tip Point** icon is dimmed.

For more information, refer to: (➔ Page 419 *Detecting the needle*)

Deleting the needle path



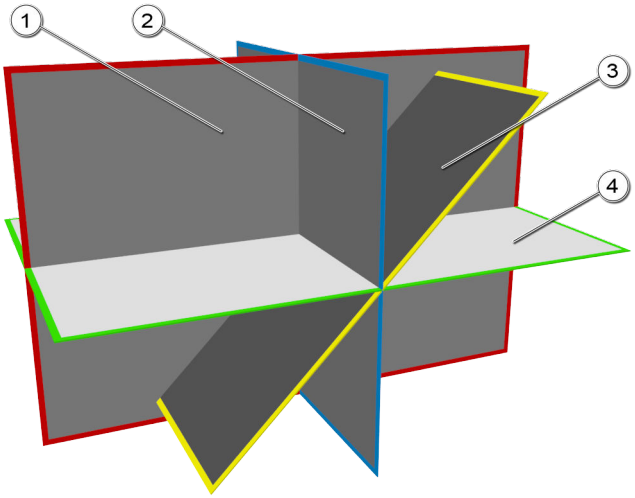
◆ Click the **Delete Needle Path** icon on the **Path** tab card of the **Intervention** tool bar.

Switching to the 3D view mode

In an Adaptive 3D Intervention, the system provides two different 3D view modes.

Patient-oriented view

In the patient-oriented view, the 3D planes meet in the center of the volume. The axial, coronal, and sagittal planes meet in the target point. You can switch the axial image to the i-VirtualTilt projection. The i-VirtualTilt projection shows a virtual gantry tilt according to the needle.

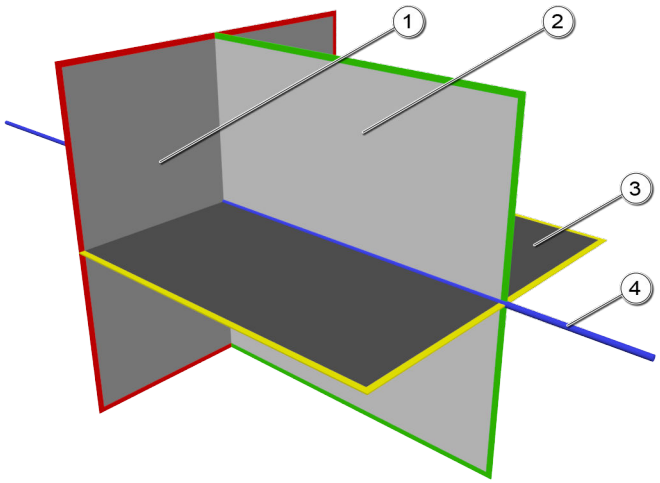


(1) Sagittal image plane
(2) Axial image plane
(3) i-VirtualTilt image plane
(4) Coronal image plane

The needle path defines the i-VirtualTilt image plane. It displays the needle path completely. The i-VirtualTilt segment is framed in yellow. Instead of the cyan reference line, the image plane is displayed as yellow reference line in the other MPR segments.

Needle-oriented view

The needle-oriented view consists of an i-VirtualTilt image and a needle view image (view through the needle). The plane of the third image is orthogonal to the i-VirtualTilt and the needle view.



(1) Needle view plane
(2) Third image plane
(3) i-VirtualTilt image plane
(4) Needle



- Click the **Patient Oriented View** icon on the **Path** tab card of the **Intervention** tool bar.

  – or –



  Click the **Needle Oriented View** icon.

Detecting the needle

There are two possibilities for needle detection:

- Start automatically after each 3D scan
- Start manually after a 3D scan

The Needle Detection algorithm also detects if the needle is curved. If a curved needle is used, the calculated distance and angles values are not correct. Therefore, the label is extended for curved needles with: **Curved needle!**



1 Click the **Auto Needle Detection** icon on the **Path** tab card of the **Intervention** tool bar to start detection automatically.

– or –



Click the **Single Needle Detection** icon to start detection manually.

Needle-oriented images are updated.

2 Click the **Single Needle Detection** icon again to switch to the next needle in a multi needle intervention.

Selecting the image type of a 3D segment

At the right border of the 3D MPR segments, there are icons to switch the image type.

Toggling VRT view and MPR view



◆ Click the **VRT** icon to switch to VRT view.

– or –



Click the **MPR** icon to switch to MPR view.

Toggling i-VirtualTilt view and axial view

If a needle path is defined, you can select two further image types for the axial segment of the patient-oriented view. You can also switch to these views without a defined needle path, but you can only see a difference after planning the path.



◆ Click the **i-VirtualTilt** icon to switch to i-VirtualTilt view.

– or –



Click the **3D Axial** icon to switch to axial view.

7.4.26 Saving Key Images

During the intervention, you can save images that you want to keep for reporting.

On the **Storage** tab card of the **Intervention Configuration** dialog box, you can activate the auto saving of recently displayed images.

Defining a transfer destination

You can define a transfer destination for the key images. All key images are saved in one dedicated key image series.

- Select the desired transfer destination for the key images in the **Key Images** selection list on the **Intervention** parameter card.

Saving all displayed images



- Click the **Save all displayed images as key images** icon on the **Workflow** tab card of the **Intervention** tool bar.

Saving a single image

1 Select the segment with the image you want to save.



2 Click the **Save Key Image** icon on the **Workflow** tab card of the **Intervention** tool bar.

7.4.27 Ending Intervention

Once you have completed the last scan required for the intervention you close the intervention mode.

1 Click the **Cancel** button to cancel the intervention.



2 Continue with the next scan listed in the chronicle or close the examination with the **Close current patient** icon.

With **Close current patient**, the display for the entire radiation dose is reset. It restarts from the beginning at the next examination. If you use **StudyContinue**, the primary dose is used as basis.

8 Maintenance

Regular maintenance and service is important for the safety of patients, personnel, and people accompanying the patient as well as for the functional integrity of the system.

For that reason, all maintenance work with exception of the cleaning of equipment and accessories should be performed by Siemens Healthineers Service.

Technical documents

On request, technical documents can be obtained from Siemens Healthineers at a small charge.

Malfunctions

If the system does not function perfectly, it must be checked immediately.

- Notify Siemens Healthineers Customer Service.

Maintenance contract

On request, maintenance work can be performed regularly by Siemens Healthineers Customer Service.

- Contact your Siemens Healthineers Service to agree on a maintenance contract for your system.

Maintenance intervals

CAUTION

Missing maintenance of the scanning system!

Scan abortion or reduced image quality due to malfunction of the scanner.

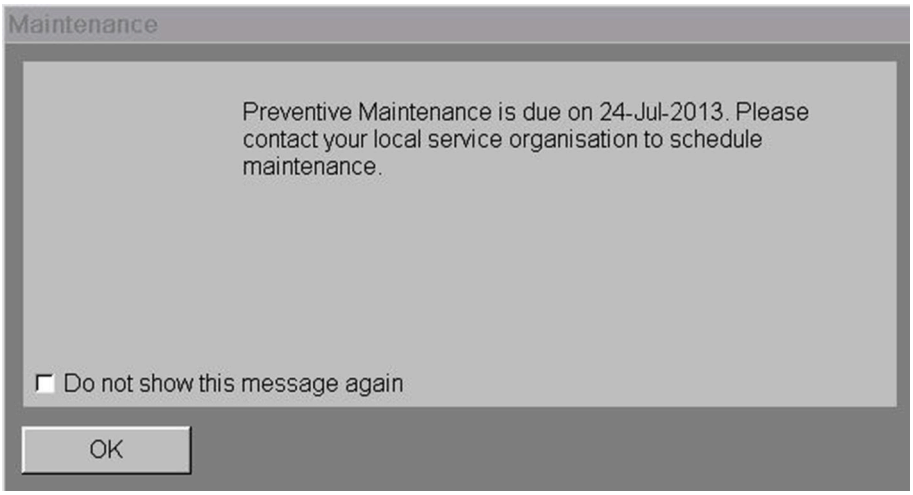
- ◆ Make sure that maintenance is performed at the recommended intervals.
- ◆ Check the imaging performance with the monthly constancy test.

- For further information on maintenance and maintenance intervals, consult the *System Owner Manual*

Software guided maintenance

The system calculates and reports the required maintenance content and time schedule by itself.

If the function is enabled by the local service organization, the following message window may come up during system start-up:



Please contact your local service organisation to schedule maintenance in this case.

8.1 Service

If you require technical support or additional assistance with applications, please call your local Siemens Healthineers Country Organization or Customer Care Center (CCC).

Contacting Uptime Service Center

You can obtain the required contact information (e.g., phone number) via Internet, e.g. via: *www.siemens-healthineers.com > Services > Customer Services*.

If you experience an issue with your SOMATOM system or the syngo CT software, contact your local Siemens Healthineers Customer Service or send an email to imcrct-complaint.team@siemens-healthineers.com.

Information required

To be able to help you quickly, we require the following information:

- Software version and service packs

  (Call up **Options > Version** in the main menu to display this information)
- Model and serial number of your system
- Brief description of the problem
- Your name and your telephone number

8.1.1 Warranty

For warranty terms, please refer to your purchase contract.

8.2 Cleaning and disinfection

Always observe the cleaning and disinfecting instructions provided in the Instructions for Use – Cleaning and disinfection.

9 Quality assurance

To ensure a constantly high image quality, you must perform quality measurements regularly.

After switch on

Whenever you start the system, you can perform automatic checks and a series of warm-up scans. (➔ Page 162 *System checkup and calibration*)

Regular checks

Quality tests are performed in several steps:

- Daily quality measurements
- Monthly quality measurements (constancy test)
- Camera test

We recommend having the constancy test performed by Siemens Healthineers Customer Service as part of a service contract. (➔ Page 435 *Constancy test*)

All parameters and images shown in this section are examples. Only the parameters displayed by your system are definite.

9.1 Accessories for quality measurement

You require the set of phantoms for the quality measurement and possibly additional accessories for the constancy test.

Accessories for daily quality measurement

The following components are required for the daily quality measurement:

- Phantom holder (➔ Page 428 *Using the long phantom holder*)
- Quality phantom (➔ Page 425 *Quality phantom*)

Accessories for the monthly constancy test

For the monthly constancy test, you require the following phantoms and accessories:

- Phantom holder (➔ Page 428 *Using the long phantom holder*)
- Quality phantom (➔ Page 425 *Quality phantom*)
- 100 kg (220 lbs) weight (a patient equivalent load not exceeding 135 kg (297 lbs))
- Ruler, 40 cm or longer

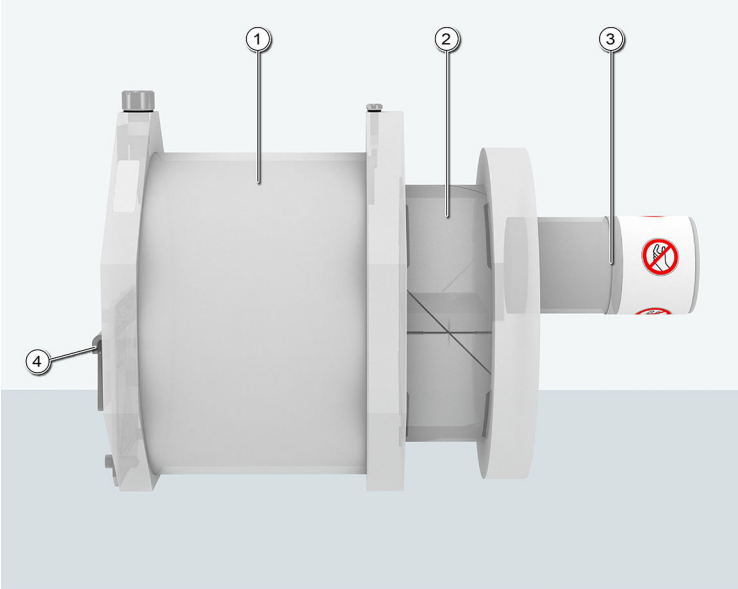
Accessories for the Low Contrast test

For the low contrast test, you require the following phantoms and accessories:

- Phantom holder (➔ Page 428 *Using the long phantom holder*)
- Low contrast phantom (➔ Page 425 *Quality phantom*)

9.1.1 Quality phantom

The quality phantom comprises the water phantom, the slice thickness phantom and the wire and ball phantom.

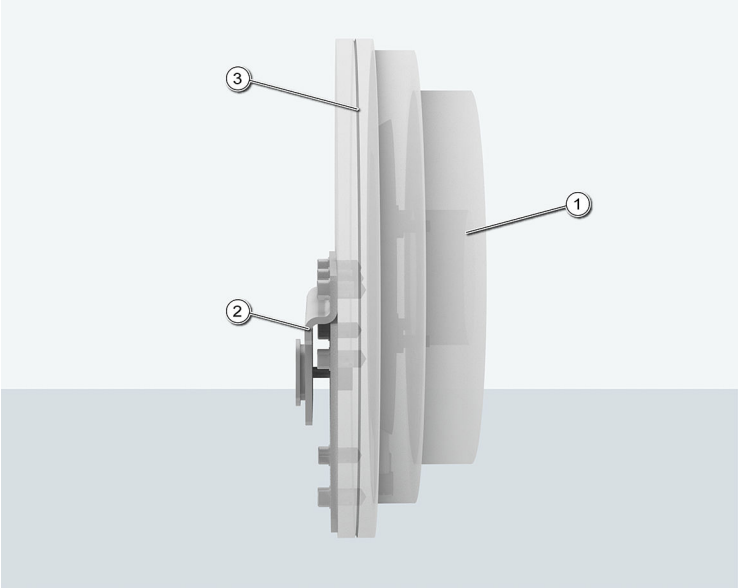


(1) Water phantom
(2) Slice thickness phantom with reference markings
(3) Wire and ball phantom
(4) Phantom holder bracket

Depending on the delivery date, the wire and ball phantom is removable or not.

9.1.2 Low contrast phantom

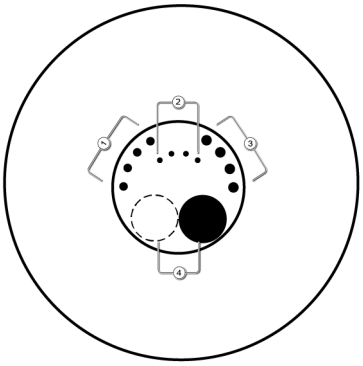
Use the low contrast phantom to perform the low contrast test.



(1) Low contrast phantom
(2) Phantom holder bracket
(3) Phantom holder with reference markings

The low contrast phantom consists of a 165 mm diameter, 25 mm thick, water-equivalent, brown plastic cylinder.

A clear plastic insert at the center contains three sets of low contrast pins (with diameters of 3, 4, and 5 mm, each set with four pins) and two 20 mm diameter measurement areas.

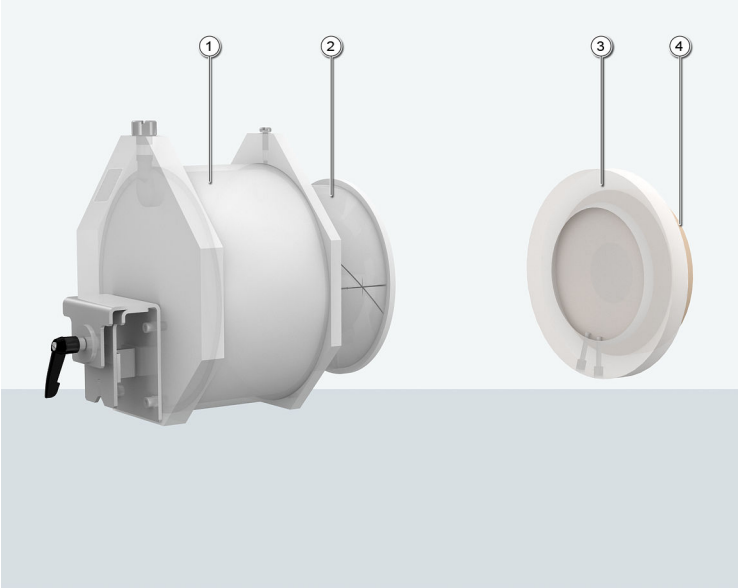


(1) 4 mm pins
(2) 3 mm pins
(3) 5 mm pins
(4) 20 mm measurement areas

The two 20 mm diameter measurement areas are used to establish low contrast differences between the pins and the surrounding area. The rated contrast between the pins and the surrounding area is 6 HU ± 1 HU (0.6 % ± 0.1 % contrast).

9.1.3 Low contrast phantom (predecessor)

To use the predecessor quality phantom for the low contrast test, the wire and ball phantom needs to be removed and the low contrast phantom needs to be added.



(1) Water phantom
(2) Slice thickness phantom with reference markings
(3) Phantom holder
(4) Low contrast phantom

Preparing the predecessor low contrast phantom

1 Remove the wire and ball phantom from the quality phantom set.

Touching prohibited



Do not touch the ball phantom on the labeled parts for mounting or transportation.

2 If the low contrast phantom is attached to the phantom holder with reference markings, remove it by loosening the two mounting screws. (➔ Page 425 *Low contrast phantom*)

3 Attach the low contrast phantom to the slice thickness phantom by using the dovetail connection and the two mounting screws.

4 Mount the phantom set to the patient table at normal body height. (➔ Page 428 *Using the long phantom holder*)

5 Position the phantom set using the markings on the slice thickness phantom. (➔ Page 428 *Positioning the phantoms*)

Mounting the low contrast phantom to the predecessor quality phantom

✓ The low contrast phantom is mounted to the phantom holder with reference markings.

Remove the low contrast phantom from the phantom holder with reference markings. (➔ Page 425 *Low contrast phantom*)

1 Loosen the two mounting screws at the low contrast phantom.

2 Use the two mounting screws to attach the low contrast phantom to the slice thickness phantom.

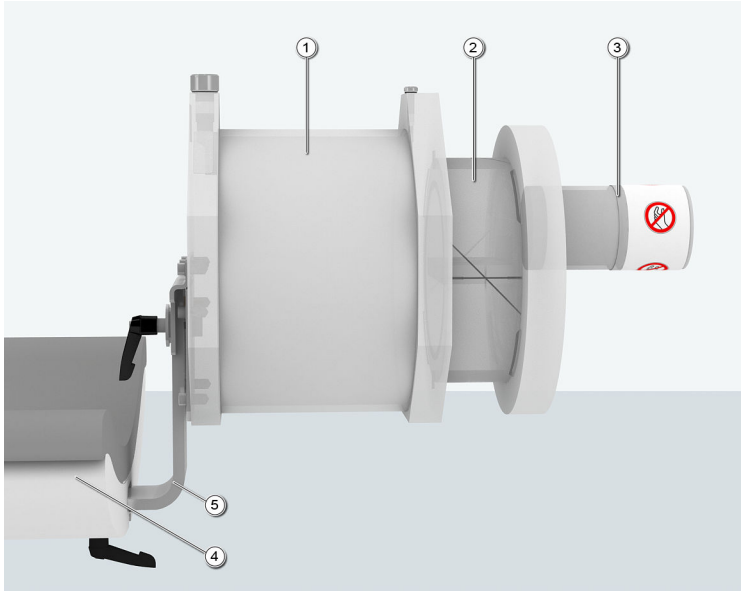
9.1.4 Mounting the phantoms to the patient table

- Mount the quality phantom (set) or the low contrast phantom to the patient table using a phantom holder.
  - (➔ Page 428 *Using the long phantom holder*)

Using the long phantom holder

1 Attach the long phantom holder with the phantom at the head end of the patient table until it clicks into place.

2 Start the quality measurement.



(1) Water phantom
(2) Slice thickness phantom with reference markings
(3) Wire and ball phantom
(4) Patient table
(5) Long phantom holder

9.1.5 Positioning the phantoms



1 Press the **Laser lightmarker** key to activate the laser lightmarker.

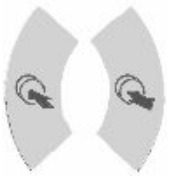




2 Set the appropriate table height using the lightmarker.

The beam of the horizontal lightmarker has to be aligned with the reference mark of the slice phantom.

The numerical value for the correct table height is displayed after the phantom position check.



3 Move the patient table into the gantry.

The beam of the vertical lightmarker has to be aligned with the reference mark of the slice phantom.

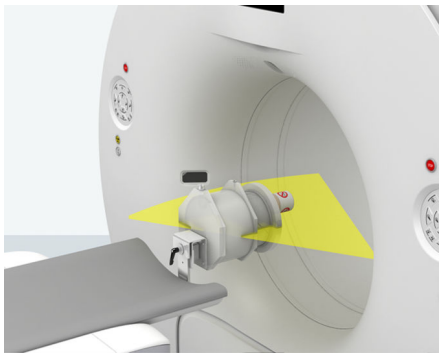
Using the gantry operator panel of the predecessor



1 Press the **Laser lightmarker** key to activate the laser lightmarker.



2 Set the appropriate table height using the lightmarker.

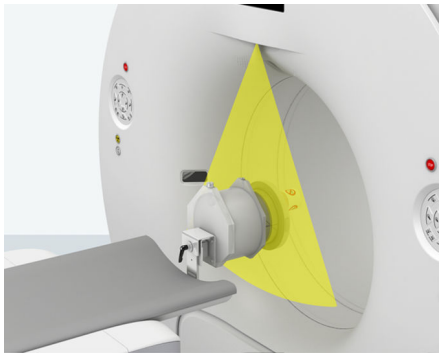


The numerical value for the correct table height is displayed after the phantom position check.



3 Move the patient table into the gantry.

The beam of the lightmarker at the outer offset level has to be aligned with the reference marking of the slice thickness phantom.





4 Press and hold the **Offset** key until the table movement stops.

9.1.6 Removing the phantom assembly

This section describes the steps to remove the phantom assembly from the patient table.

Removing the phantom assembly and long phantom holder

The long phantom holder is secured by a locking mechanism underneath the patient table.

1 Loosen the upper clamp screw.

2 Lift the phantom of the long phantom holder.

3 Loosen the clamp screw under the patient table and push the button next to the clamp screw.

4 Pull out the long phantom holder.

Removing the phantom assembly and short phantom holder

The short phantom holder is secured by a locking mechanism underneath the patient table.

1 Loosen the star knob screw.

2 Lift the phantom of the short phantom holder.

3 Push the button underneath the patient table.

4 Pull out the short phantom holder.

9.2 Daily quality measurements

The daily quality measurements only require checking of three parameters on the water phantom:

- The CT value of water and the homogeneity of the images are calculated in Hounsfield units (HU)
- The pixel noise of images is calculated as a standard deviation
- Tube voltages are measured directly at the X-ray tube

These measurements are performed for the head mode, the body mode and the body dual source mode.

Storage

The images of the **Daily Quality Check** measurements are stored as images of the "Quality Assurance Patient".

All values of the **Daily Quality Check** measurements are stored in the **Report Files**. (➔ Page 450 *Viewing the measurement report*)

9.2.1 Performing quality measurements

CAUTION

Wrong correction tables!

X-ray not, or only partially, usable.

◆ Perform the daily quality tests every day before you start the actual examinations.

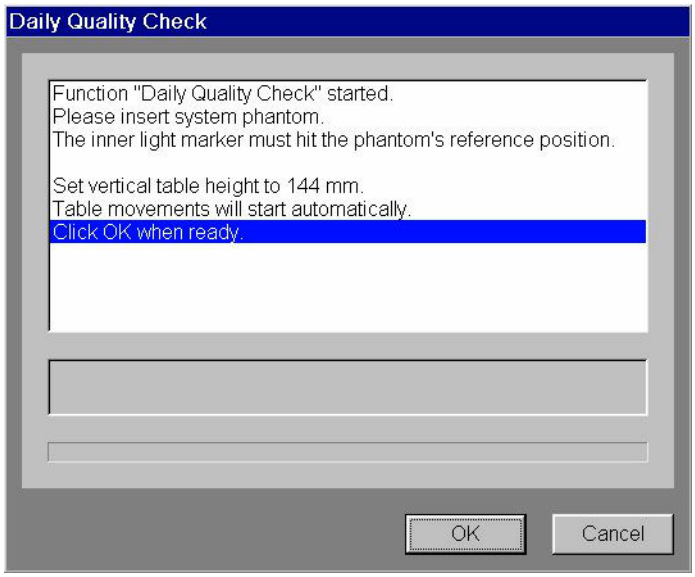
You must perform calibration before you start quality measurement.

1 Call up **Setup > Calibration**. (➔ Page 162 *System checkup and calibration*)

2 Position the phantom. (➔ Page 428 *Positioning the phantoms*)

3 Call up **Setup > Quality**.

The **Daily Quality Check** dialog box is displayed.

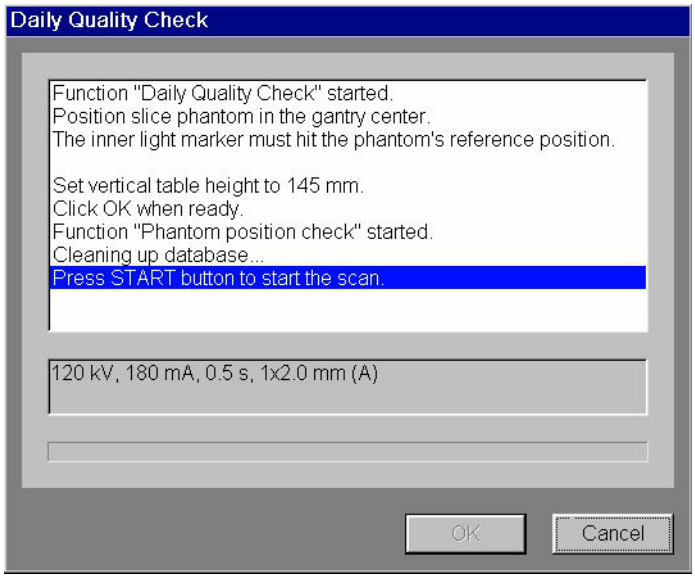


4 Position the patient table such that the slice thickness phantom with reference markings is in the scan plane.

5 Click **OK**.

The “Quality Assurance Patient” is automatically selected. Table movement starts automatically.

In the **Daily Quality Check** dialog box you are prompted to initiate radiation.





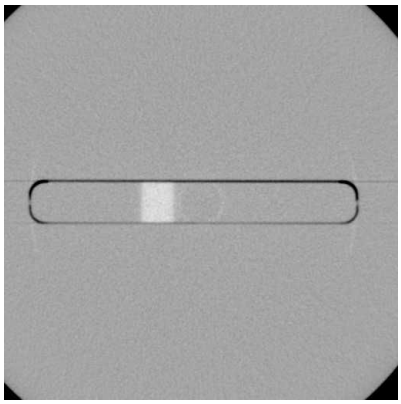
6 Press the **Start** key on the control box.

The position of the phantom set is checked and displayed. Then, the first measurement is started automatically.



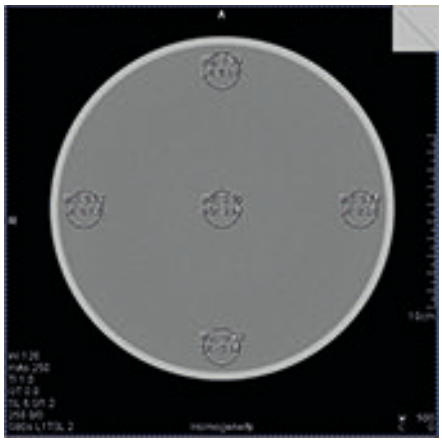
For incorrect positioning of the phantom set, a message is displayed. Correct the position, if necessary.

After the first measurement, a CT-image of the slice phantom is displayed in the active segment.



The next measurements are started automatically. An image is displayed with the following evaluations:

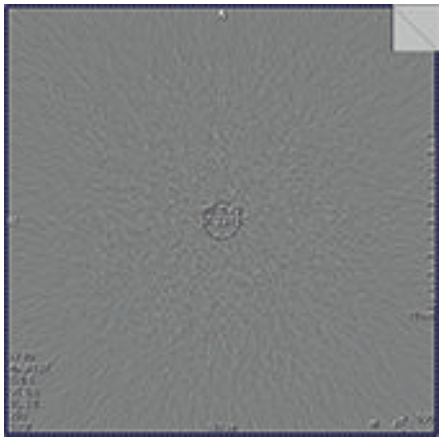
- ROIs in image center and 3, 6, 9, and 12 o'clock position
- Mean value of the CT value
- Standard deviation



The homogeneity is calculated by evaluating a central and four different outer ROIs. For the noise measurement, the difference between the first and the second measurement is calculated and displayed.

The following evaluations are shown:

- ROIs
- Mean value of the CT value
- Sigma value (measure for pixel noise)



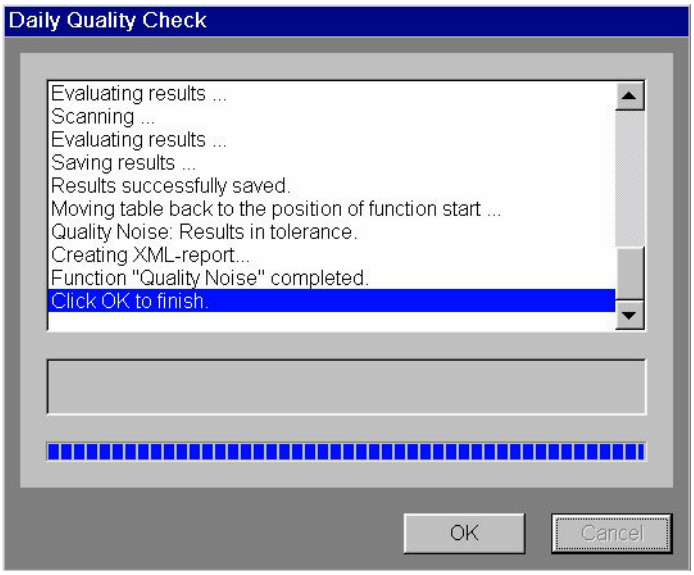
The measurements are done automatically for each defined mode.

Stopping measurement

- Click **Cancel**.

  The **Daily Quality Check** measurement is aborted.

  You have to repeat the quality measurement from the beginning before you start the actual examinations.



All measurements were performed and evaluated.

Test results are displayed in the **Daily Quality Check** dialog box.

7 Click **OK**.

The **Daily Quality Check** measurement is terminated.

Test results of the **Daily Quality Check** measurement are out of tolerance.

- Call your Siemens Healthineers Customer Service.

9.3 Constancy test

Together with other characteristic values, the daily test values are checked for constancy monthly. These tests are performed on the complete set of phantoms.

In addition, the CTDI (CT Dose Index) must be measured at least once every six months. The CTDI must also be measured after any maintenance work that might have altered the test results.

We recommend having the constancy test and the CTDI measurement performed by appropriately trained personnel.

Failure to conduct regular constancy tests and CTDI measurements may compromise the status of the operating license. Please observe the law of your country.

If you want to conduct the constancy test and the CTDI measurement yourself, you must perform all steps of the constancy test or the CTDI measurement under your own responsibility.

In the settings for **Quality Assurance**, a "Standard for Quality" has been configured by Siemens Healthineers Customer Service. According to the country-specific regulatory standard, the "Standard for Quality" is set to one of two options: **IEC 61223-3-5 (Ed. 2)** or **IEC 61223-3-5 (Ed. 1) / IEC 61223-2-6 (Ed. 2)**. Depending on the setting, different checks are performed during the IEC Constancy test. All mandatory tests according to the configured "Standard for Quality" are preset and cannot be changed.

9.3.1 Performing the constancy test

The monthly quality test is performed via the **Quality IEC Constancy** dialog box of the **Additional Service** window.

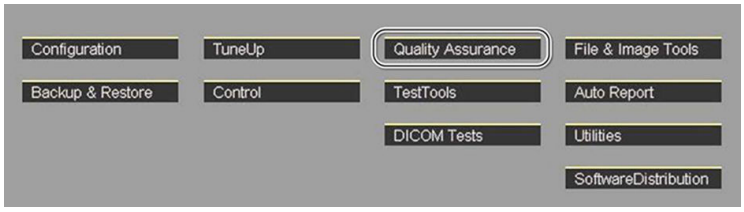
In the constancy test, the following factors are checked:

- Phantom and phantom position check
- Position of the lightmarker; **Lightmarker**
- Position of the external lightmarker, if the hardware is available; **External Lightm**.
- Position of the sagittal and coronal lightmarker; **Sag./Cor. Lightm**.
- Automatic positioning of the tomographic plane using a preview image; **Topogram Pos**.
- Tomographic slice thickness; **Slice**
- Homogeneity; **Homogeneity/Water**
- Pixel noise; **Noise**
- Spatial resolution by calculation of the Modulation transfer function; **MTF**
- Position of the patient table; **Table Position**
- Measurement of the Computed Tomography Dose Index; **CTDI-Air**

If using the MPT, the *standard table top* must be positioned to perform the constancy test.

1 Call up **Options > Service > Local Service**, leave the password entries empty, and click **OK**.

The **Home Menu** dialog window is displayed.



2 Click **Quality Assurance** to display the **Quality Assurance** dialog box.



3 Select the **IEC Constancy** procedure.

The **Quality IEC Constancy** dialog box is displayed.



(1) Content area
(2) Status and error message area
(3) Command buttons
(4) Quality functions
The single functions of the constancy test are preselected with a checkmark. Deselect the tests that you do not require by clicking on them.
(5) Mode button(s)
(6) Title bar

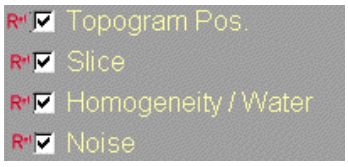
Selecting reference measurements

Evaluation of the constancy test results are based on a comparison with reference data that are stored in your system. These are determined by Siemens Healthineers Service.

If you have any of the system parts replaced (e.g., tubes), the reference data must be determined again. You can do this with a reference measurement.



- Click the field **REFERENCE/NORMAL** to toggle between a normal constancy measurement and a reference measurement.



In reference mode, the individual selected tests are marked by an “Ref”. The test results are used as reference data in the future.

We recommend that Siemens Healthineers Service always performs your reference measurements.

Starting the IEC constancy test

A reference measurement follows the same sequence as a normal constancy test.



1 Confirm selection of the constancy test with **Go**.

You are prompted to enter the name of the tester and the material numbers of the phantoms.

2 Enter your name and the data required.

3 Prepare the measurement as described. (➔ Page 424 *Quality assurance*)

Table movement starts automatically.



4 Click **Go** when you have completed your preparations.

The "Quality Assurance Patient" is selected.

A **Calibration** is performed.

You are prompted to press **Start**.



5 Press the **Start** key on the control box.

You are prompted to select the required phantom.

6 Select the radio button of the phantom that is used for the current test.

- **System phantom with aluminum ball** (➔ Page 425 *Quality phantom*)
- **System phantom with low contrast** (➔ Page 425 *Low contrast phantom*) (➔ Page 426 *Low contrast phantom (predecessor)*)



7 Confirm the settings with **Go**.

The phantom position is checked.

The system alerts you if the phantom is positioned incorrectly. Correct the position, if necessary.

The system then starts the first quality measurement. This is usually checking the **Lightmarker** position (z-positioning).

The several selected functions are started automatically.

Interrupting the IEC constancy test

You can interrupt each test within a constancy measurement.



◆ Click on the **Cancel** button.

The current measurement and the complete procedure is aborted.

Successfully saved results of already completed quality measurements within the procedure are not deleted.

9.3.2 Performing the lightmarker test (z-position)

With the quality measurement, you determine the deviation of inner lightmarker from the current slice plane.

✓ The set of phantoms is positioned in such a way that the inner lightmarker points on the reference marking on the slice thickness phantom.

✓ The **Lightmarker** test mode is loaded.

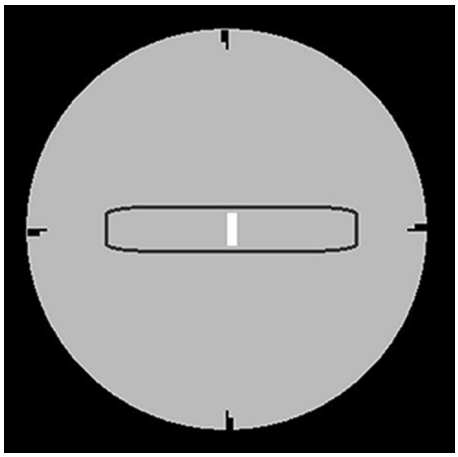
✓ You are prompted to press **Start**.

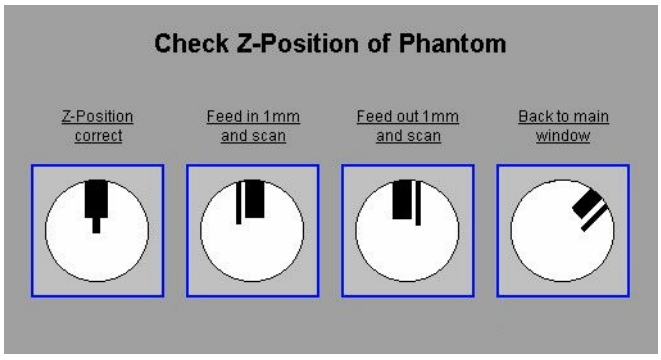


1 Press the **Start** key on the control box.

Scanning is started.

In the image area, the phantom is displayed as a circle in the image. For the lightmarker test, the short and the long strip need to be in the 12 o'clock position.





2 Compare the position of the short / long strip on the image with the options displayed in the content area of the **Quality IEC Constancy** dialog box.

3 Correct the table position by clicking **Feed In** or **Feed Out**.

With **Feed In** and **Feed Out**, you can move the table by 1 mm.

4 Compare the position of the strips again after an image was recorded.

5 Repeat the correction of the table position until you have set the correct z-position.

6 Click on **Continue**.

The result of the test is displayed in the content area of the **Quality IEC Constancy** dialog box.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.

9.3.3 Performing the external lightmarker test

With the quality measurement, you determine the position of external lightmarker.

This test is only available if the required hardware is available.

✓ The set of phantoms is positioned in such a way that the external lightmarker points to the reference marking on the slice thickness phantom. (→ Page 428 *Positioning the phantoms*)

✓ The phantom is positioned at the inner lightmarker position.

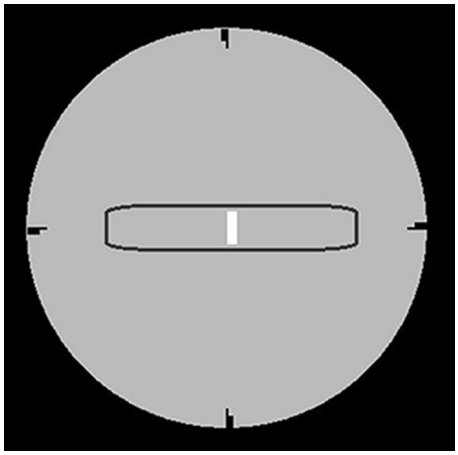
✓ The **External Lightm**. test mode is loaded.

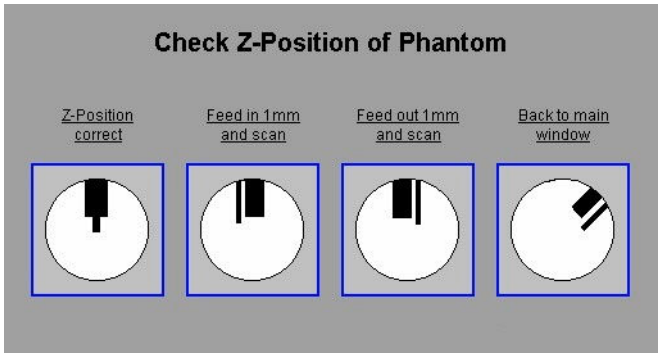
✓ You are prompted to press **Start**.

1 Press the **Start** key on the control box.

Scanning is started.

In the image area, the phantom is displayed as a circle in the image. For the lightmarker test it is important to have the short and the long strip in the 12 o'clock position.





2 Compare the position of the short / long strip on the image with the options displayed in the content area of the **Quality IEC Constancy** dialog box.

Feed In

Feed Out

3 Correct the table position by clicking **Feed In** or **Feed Out**.

With **Feed In** and **Feed Out**, you can move the table by 1 mm.

4 Compare the position of the strips again after an image was recorded.

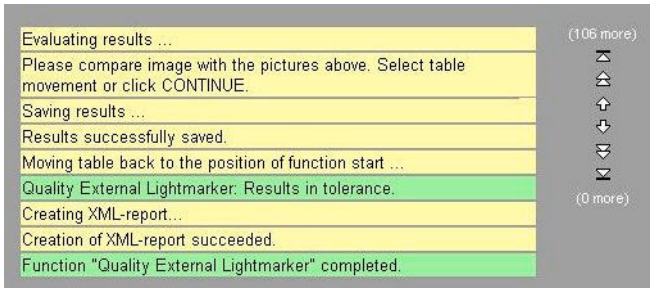
5 Repeat the correction of the table position until you have set the correct position.

Continue

6 Click on **Continue**.

The result of the test is displayed in the content area of the **Quality IEC Constancy** dialog box.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.4 Performing the sagittal/coronal lightmarker test

With the quality measurement, you determine the position of the sagittal/ coronal lightmarker.

✓ The slice thickness phantom is positioned in such a way that the sagittal and horizontal lightmarkers mark the horizontal and vertical center.

✓ The phantom is positioned at the laser lightmarker position. The **Sag./Cor. Lightm.** test mode is loaded.

✓ You are prompted to press **Start**.



- Press the **Start** key on the control box.

  Scanning is started.

In the image, the middle of the phantom is determined. The result is the deviation from the horizontal and vertical middle of the image to the middle of the phantom.

The result of the test is displayed in the content area of the **Quality IEC Constancy** dialog box.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.

9.3.5 Performing the Topogram position test

With the quality measurement, you determine the automatic positioning of the tomographic plane using a preview image.

✓ The set of phantoms is positioned in such a way that the inner lightmarker points to the reference marking on the slice thickness phantom.

✓ The table height is set so that the phantom is in the gantry isocenter.

✓ The **Topogram Pos.** test mode is loaded.

✓ You are prompted to press **Start**.



1 Press the **Start** key on the control box.

  In the **Quality IEC Constancy** dialog box the topogram image is displayed. You can see a horizontal line in the image and the corresponding table position to the line position is shown.

2 Move the horizontal line and mark the position of the middle of the slice thickness phantom where the lines are crossing.

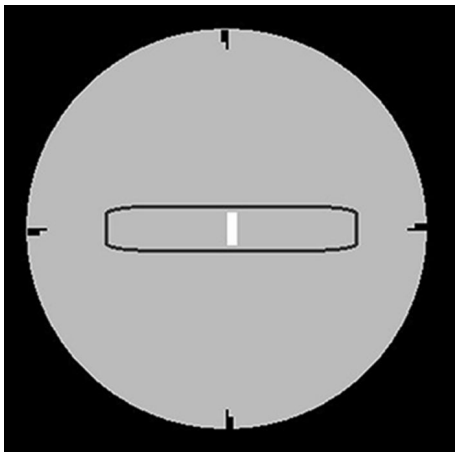


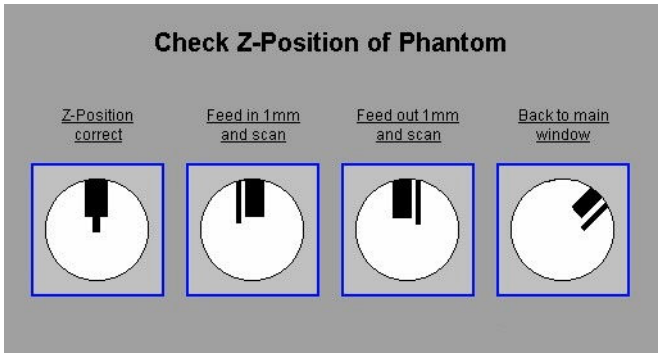
3 Click on **Go**.

  The patient table moves automatically to the marked position.

  Scanning is started.

  In the image area, the phantom is displayed as a circle in the image. For the preview image it is important to have the short and the long strip in the 12 o'clock position.





4 Compare the position of the short / long strip on the image with the options displayed in the content area of the **Quality IEC Constancy** dialog box.

Feed In

Feed Out

5 Correct the table position by clicking **Feed In** or **Feed Out**.

With **Feed In** and **Feed Out**, you can move the table by 1 mm.

6 Compare the position of the strips again after an image was recorded.

7 Repeat the correction of the table position until you have set the correct position.

Continue

8 Click on **Continue**.

The result of the test is displayed in the content area of the **Quality IEC Constancy** dialog box.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.

9.3.6 Performing the slice thickness test

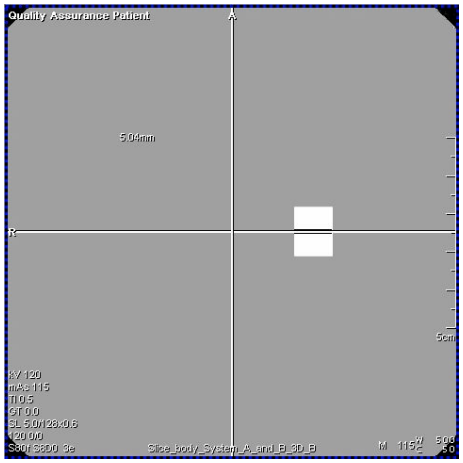
The slice thickness is determined with the slice thickness phantom. For each slice thickness, a tomogram of the phantom is recorded and the reconstructed slice thickness is calculated from this.



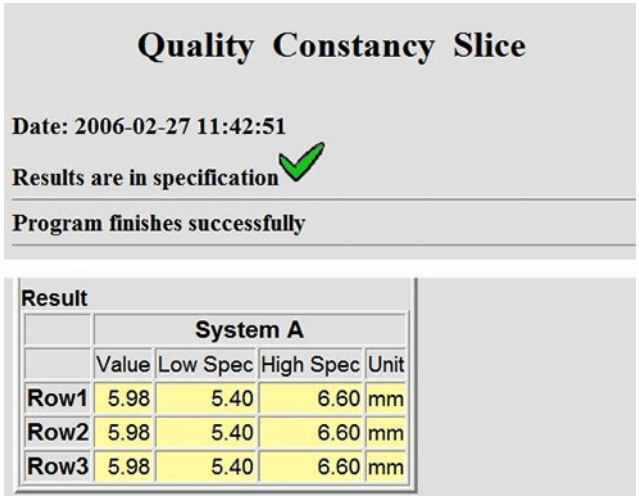
- Press the **Start** key on the control box.

  Scanning is started.

An image of the slice thickness phantom is displayed in the image area and the slice thickness is calculated. The procedure is repeated automatically for all defined modes.



After all slice thicknesses have been evaluated, the result of the test is displayed in the content area of the **Quality IEC Constancy** dialog box.



Quality Constancy Slice

Date: 2006-02-27 11:42:51

Results are in specification

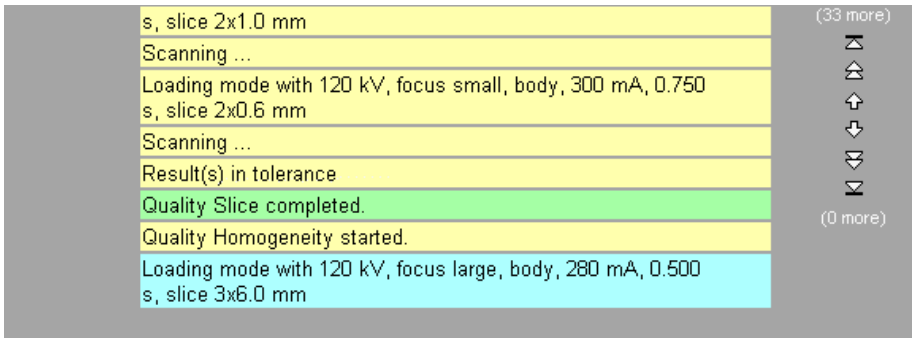
Program finishes successfully

Result

	System A			
	Value	Low Spec	High Spec	Unit
Row1	5.98	5.40	6.60	mm
Row2	5.98	5.40	6.60	mm
Row3	5.98	5.40	6.60	mm

Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.



9.3.7 Performing the homogeneity test

With this test, you measure the homogeneity of the CT values in 5 regions of the water phantom.

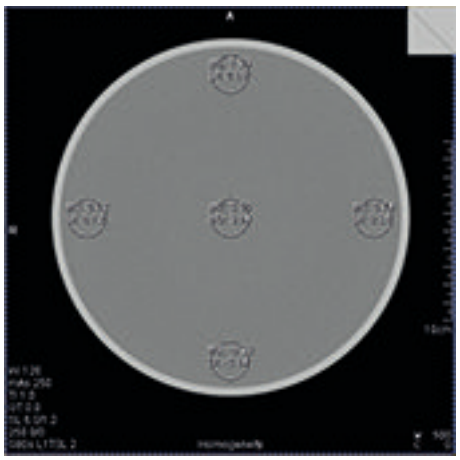
- Press the **Start** key on the control box.

  Scanning is started.

An image of the water phantom is recorded. 5 ROIs are marked in the image, one central and four peripheral.

In addition to the ROIs, the mean values and standard deviations of the CT values are displayed.

The difference between the mean values of the central ROI and the peripheral ROIs is displayed.



The measurement is repeated automatically for all defined modes. The results of the test are output in the content area of the **Quality IEC Constancy** dialog box.

Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.

9.3.8 Performing the pixel noise test

The pixel noise is determined from two tomograms of the water phantom in the same way as for the daily quality measurement. (➔ Page 431 *Daily quality measurements*)

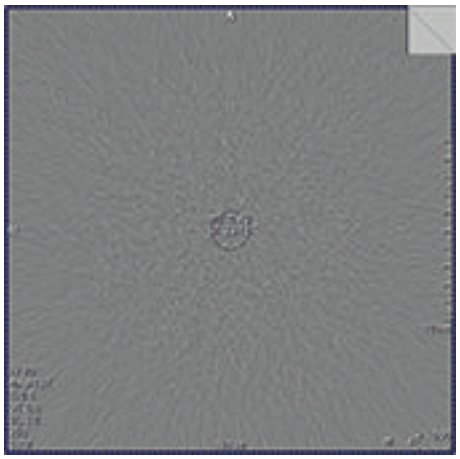
- Press the **Start** key on the control box.

  Scanning is started.

Two images of the water phantom are recorded with identical parameters. The difference between the first and the second measurement is shown.

The following evaluations are displayed:

- ROI
- Mean value of the CT value
- Sigma value (pixel noise)



The measurement is repeated automatically for all defined modes. The results of the test are output in the content area of the **Quality IEC Constancy** dialog box.

Result

	Results for System A					Results for System B				
	Value	Low Spec	High Spec	Ref. Value	Unit	Value	Low Spec	High Spec	Ref. Value	Unit
Row1	8.15	7.37	8.80	8.19	HU	8.23	7.35	8.80	8.17	HU
Row2	8.15	7.37	8.80	8.19	HU	8.23	7.36	8.80	8.18	HU
Row3	8.14	7.35	8.80	8.17	HU	8.13	7.42	8.80	8.25	HU
Row4	8.18	7.40	8.80	8.22	HU	8.18	7.35	8.80	8.17	HU
Row5	8.17	7.34	8.80	8.16	HU	8.20	7.34	8.80	8.16	HU
Row6	8.13	7.33	8.80	8.14	HU	8.21	7.38	8.80	8.20	HU

Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.

9.3.9 Performing Image Inspection

The function **Image inspection** is available only for IEC standard 61223-3-5 (Ed. 2).

During the homogeneity test and the pixel noise test water images are generated. You need to inspect those images at the end of the constancy test and exclude any artifacts in the results.

✓ You have performed the homogeneity test. (➔ Page 445 *Performing the homogeneity test*)

✓ You have performed the pixel noise test. (➔ Page 445 *Performing the pixel noise test*)

✓ You have selected the required images in the **Patient Browser**.

◆ A list of noise and homogeneity images is displayed in the **Viewing** task card. Check the items in the **Viewing** task card. If there are no artifacts, confirm.

Confirmed images are removed from the list.

A report is generated that contains the study and series names of the inspected images.

9.3.10 Performing the MTF test

The spatial resolution is characterized through the modulation transfer function (MTF). The MTF describes the sharpness of the reconstructed image. The test determines the contribution of spatial frequencies to the image. Images are measured with the wire phantom.



◆ Press the **Start** key on the control box.

Scanning is started.

The MTF is represented graphically as a function of the spatial frequency (object modulation, measured in line pairs per cm, LP/cm). In addition, several characteristic values, for example, 50% MTF, 10% MTF and 2% MTF are displayed.

10% MTF means that the frequency content has dropped to 10% of the value obtained at 0 Lp/cm.

The scan is displayed in the image area. The result image is calculated and stored in the local database.

The result image can be displayed in the **Viewing** task card after the constancy test has been completed. (➔ Page 449 *Output of results*)

The evaluation is done for several modes using different kernels. The results of the test are output in the content area of the **Quality IEC Constancy** dialog box.

Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.

9.3.11 Performing the table position test

With this quality measurement, you test whether the actual table position matches the table position displayed. The test shall be performed with a person-equivalent load not exceeding 135 kg (297 lbs) on the patient support.

The **Table Position** test is performed without triggering radiation. It is started with **Go** in the **Quality IEC Constancy** dialog box. (➔ Page 435 *Performing the constancy test*)

1 Mount a ruler at the mobile part of the patient table so that the 0 mm mark of the ruler is aligned with the stationary part of the table.

2 Place a patient equivalent load on the patient table that does not exceed 135 kg (297 lbs) (a weight of 100 kg (220 lbs) is recommended by Siemens Healthineers).

3 Set the horizontal table position to 0.

Go

4 Start the measurement with **Go**.

The table top moves 300 mm in the direction of the gantry.

5 Read the -300 m position on the ruler.



6 Enter the value in the entry field of the content area.

Continue

7 Click on **Continue**.

Three more table positions are checked this way.

8 Enter the particular values when prompted and confirm with **Continue**.

The table top now moves stepwise into the gantry (300 mm) and back.

9 Enter the actual values for all checked table positions in the entry field again.

The deviations of the actual from the displayed positions are calculated. The results of the test are output in the content area of the **Quality IEC Constancy** dialog box.

Use the vertical scroll bar to view all test results.

In the status and error message area the result of this test (in tolerance or out of tolerance) is displayed.

9.3.12 Performing the CTDI Air test

With this quality measurement you measure the dose in the system axis.

Measurement is performed using a 100 mm ionization chamber with the necessary accessories.

The dosimeter is not supplied with the system.

Please follow the instructions for use supplied by the manufacturer of the measuring device.

Please note that the lead connecting the dosimeter and the ionization chamber is very sensitive.

✓ The ionization chamber is centered in the axial direction in the system axis. The slice plane has to run through the center of the chamber. An appropriate dosimeter is connected to the ionization chamber.

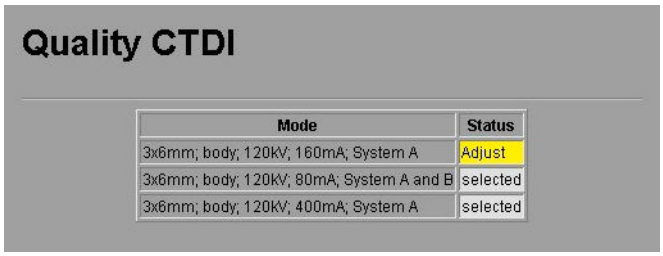
✓ The **CTDI-Air** test mode is loaded.

✓ You are prompted to press **Start**.



1 Press the **Start** key on the control box.

Scanning is started.



2 Read off the dose length product on the dosimeter. Enter this value in mGy*cm in the entry field of the **Quality IEC Constancy** dialog box.

3 Continue with the next mode.

The results of the test are output in the **Siemens Med Service Software** window.

Use the vertical scroll bar to view all test results.

In the status and error message area, the result of this test (in tolerance or out of tolerance) is displayed.

9.3.13 Exiting the constancy test

After the final test has been completed, you terminate the monthly constancy test and return to the **Home Menu** dialog box.

In **Reference** mode, all results in the tolerance range are saved automatically.

1 Close the additional window where the constancy test has been performed.

You return to the **Home** window.

You can now view the measurement report with the results of the current and previous tests. (➔ Page 450 *Viewing the measurement report*)

2 Close the **Siemens Med Service Software** window.

You return to the *syngo* user interface.

9.3.14 Output of results

The results are stored as reports, see (➔ Page 450 *Viewing the measurement report*).

The images recorded during measurement are stored as images of the “Quality Assurance Patient”.

Viewing the measurement report

You can view the results of the daily and monthly quality test with the **Report** function of the **Local Service**.

1 Call up **Options > Service > Local Service**, delete the password entries, and click on **OK**.



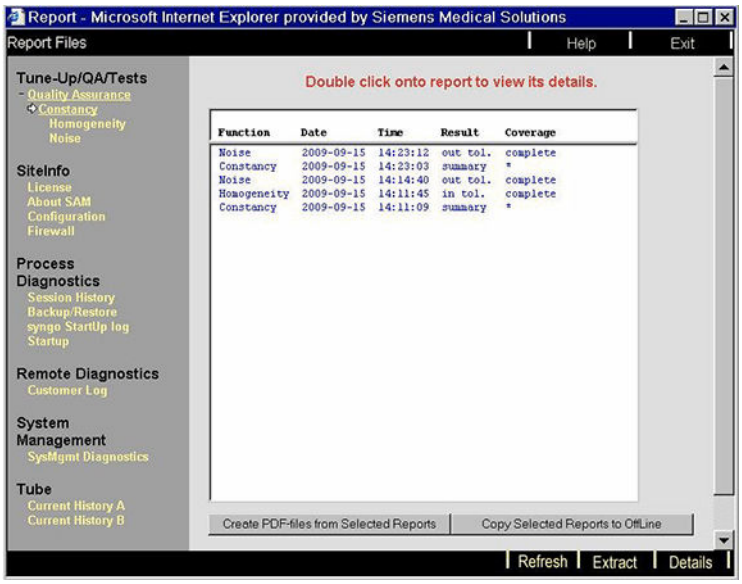
2 Click on **Reports** in the **Home Menu** dialog window.

The **Report Files** dialog box is displayed.



3 Select **Quality Assurance**.

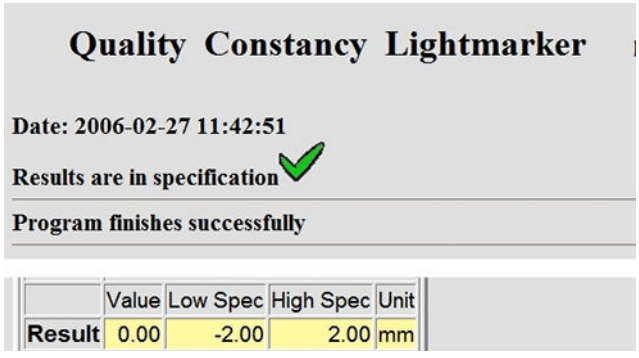
A list of the quality measurements performed (daily quality tests and constancy tests) is displayed sorted by date.



4 Double-click on a quality test in the list to have more detailed information displayed.

A click on the **Extract** button generates a compressed file of report data and stores this file in a specific folder. This function is for service purposes only.

The results of the selected quality test are displayed in the content area.



Any test results outside the tolerance range are marked "<" or ">". Alternatively, results outside the tolerance range are displayed on a red background while results within tolerance have a yellow background.

Documenting results

The forms are generated automatically and must be printed out, signed and filed in the System Owner Manual. See *System Owner Manual*

Test films and test forms must be stored for at least two years. The date of the generated form is part of the file name.

1 Call up **Options > FileBrowser** in the main menu.

2 Open the folder **ConstancyReports**.

3 Select one or more of the PDF-files named **Quality_Constancy_DATE.pdf**.

When you select a PDF file from the File Browser, by default it opens in the **Protected View** and you cannot print it.

- To print a PDF-file from the File Browser, open it in Acrobat Reader. Then click **Enable All Features** in the upper right corner of the PDF. The **Protected View** is deactivated and you can print the PDF.

4 Printing is only available for a single file. Call up **File > Print** in the menu of Acrobat Reader to send the selected files to the predefined printer.

– or –

Call up **Send To > BurnFolder** in the context menu of the **FileBrowser** to burn the selected files to a storage medium and print them on another system.

Viewing quality test images

You can view the quality images (i.e., the result images of the MTF test) in the **Viewing** task card.

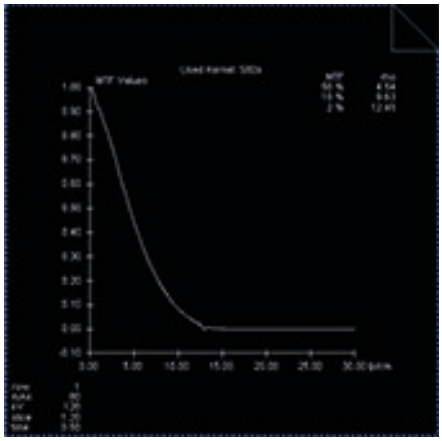
1 Open the **Patient Browser**.

2 Select the desired images of the "Quality Assurance Patient".

3 Call up **Patient > Load to Viewing**.

The images are displayed in the **Viewing** task card.

Example: Result images of the MTF test.



4 Call up **Patient > Close patient** to close the data set.

Closing the report function

- Click on **Exit**.

You return to the **Home Menu** dialog box.

9.4 Low contrast test

This section describes how to use the low contrast phantom and how to do the low contrast test.

The low contrast test has to be performed during system installation and after the replacement of image quality related components.

The availability of the low contrast test is country-specific. It has to be activated by Siemens Healthineers Service.

9.4.1 Starting the test

The **Low Contrast** test is performed in the **Quality IEC Constancy** dialog box of the **Siemens Med Service Software** window.

1 Open the **Quality IEC Constancy** dialog box.



2 Select **Phantom Check** and **Low Contrast**.

Go

3 Confirm selection of the IEC constancy test with **Go**.

You are prompted to enter the name of the tester and the serial numbers of the phantoms.

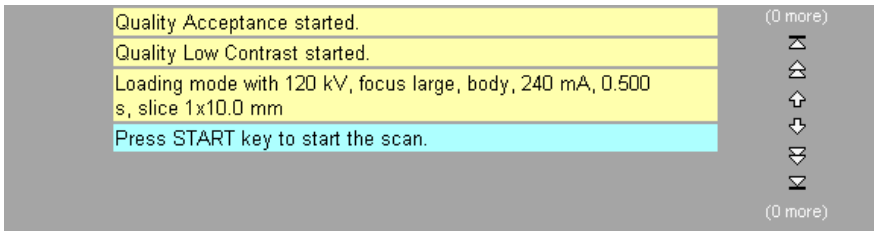
4 Enter your name and the data required.

Go

5 Start the low contrast test with **Go**.

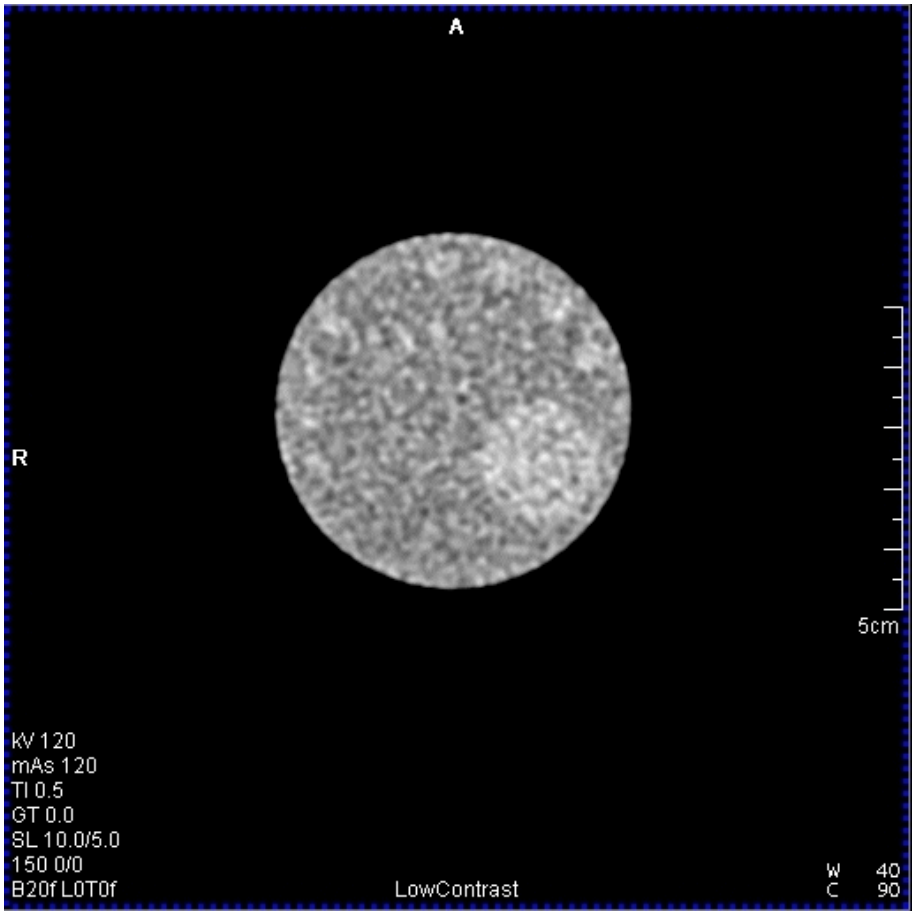
The “Quality Assurance Patient” is selected.

You are prompted to press **Start**.



6 Press **Start** on the control box.

The phantom position and the gantry inclination are checked.



The image of the low contrast phantom is displayed in the image area.

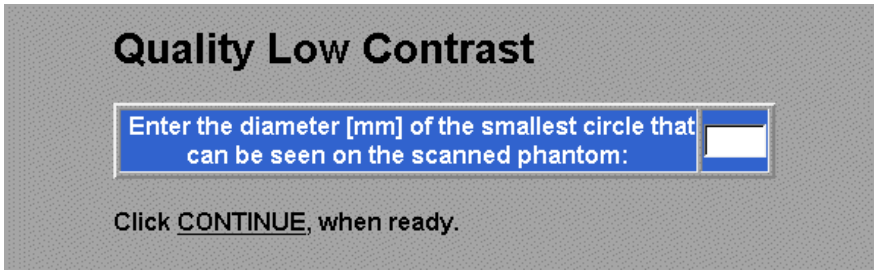
9.4.2 Evaluating the test

Normally one scan is sufficient to discern the pins in the row with the smallest diameter (3 mm). However, the procedure may be repeated if desired. Low contrast measurements are directly affected by the level of noise ("sigma") in the CT system, which may vary from scan to scan within a specified range. Low contrast estimations involve visual verification methods that are somewhat subjective. It is normal to expect some variations in assessing low contrast of the smallest (3 mm) pins.

1 Adjust the window width and center to improve visualization (adequate starting values: 40 width / 90 center).

2 Observe the region where the small pins are located just above the two 20 mm measurement areas.

It may help to observe the image in a semi-darkened room and from distance of up to 1,5 m.



3 Enter the resolution in the corresponding entry field of the content area.

Continue

4 Click on **Continue**.

The result of the test is output in the content area of the **Quality IEC Constancy** dialog box.

In the status and error message area the result of this test (in tolerance or out of tolerance) is output.

Test is out of tolerance.

◆ Contact Siemens Healthineers Customer Service.

9.5 Camera test

With the camera test, the image quality and the camera settings are checked.

You can also film test images of the quality measurement in order to meet requirements for documentation.

Image quality of the camera

The camera was set for optimum image quality during installation and should not be changed.

Please note the following points:

- Use the correct film type (emulsion number)
- Keep the developer bath at a constant temperature
- Use the correct chemicals
- Follow the development instructions supplied by the film manufacturer

Test film

After installation, a test film is recorded and evaluated. The results are summarized in a table. These values are used as reference values for the daily quality check of the camera.

If the equipment or the emulsion number of the film is changed, the camera must be readjusted by a customer service technician who is authorized to do so. After this, another camera test is required.

Camera test report

You find a form for the test report in *System Owner Manual*.

9.5.1 Performing the camera test

With the camera test (Film Demo), you can check the settings of the camera by filming the images of the "Reference Images" patient.

You also have the option of filming the images of a previous constancy test to check the camera settings (Film Quality).

CAUTION

Missing camera test!

Wrong basis for diagnosis.

◆ Perform the camera test regularly at the recommended intervals.

Starting the test

1 Open the **Patient Browser**.

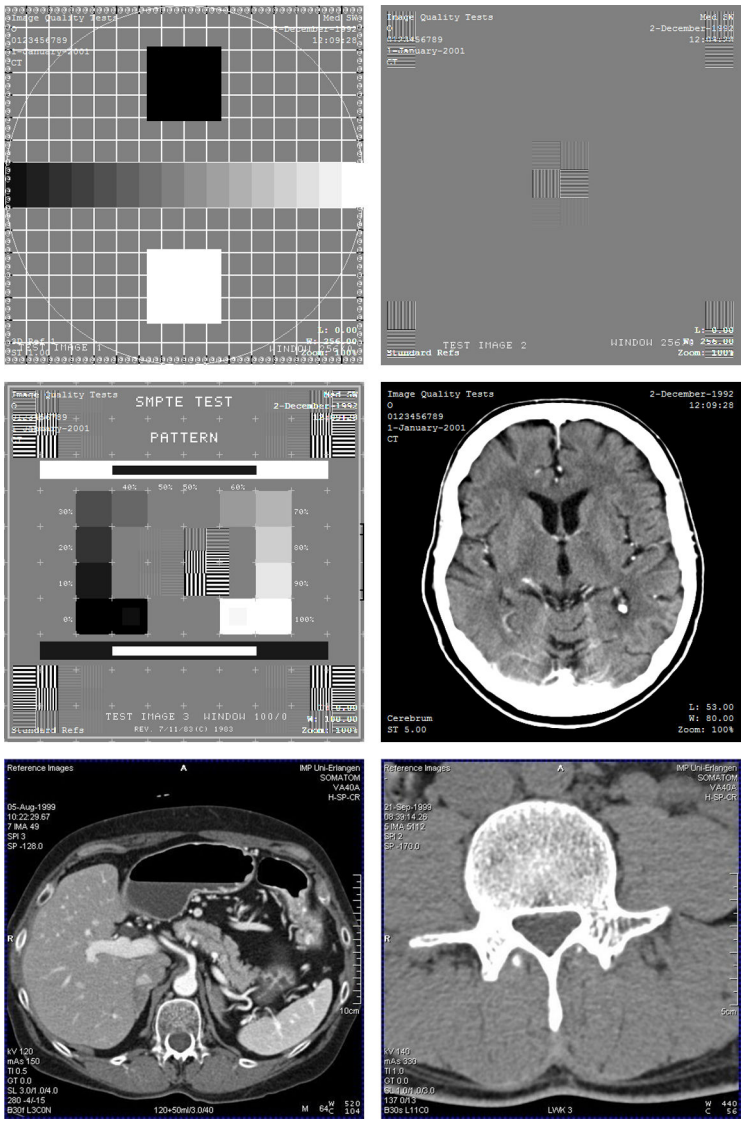
2 Import the test images, if required.

Select in the menu **Transfer > Import from Offline** and enter the path to the reference images: **`H:SiteData\ReferenceImages`**. Select the required images and press **OK**.

3 In the **Patient Browser**, transfer the test images of the "Reference Images" patient to the **Viewing** task card.

4 In the **Viewing** task card, film the test images of the "Reference Images" patient.

Examples of test images



Evaluating the test

1 Compare the test results with the reference values.

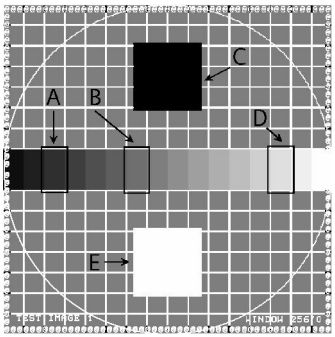
2 Measure the fields marked in the first test image with the densitometer (X-RITE 331).

3 Enter the measured values in the constancy test report.

Test is out of tolerance.

- Contact Siemens Healthineers Customer Service.

Example



Here is an example of test image 1 with measurement fields marked by the technologist.

9.6 Constancy test of the monitor

Monitors are subject to a constancy test to ensure that image quality and measured values lie within a defined range.

CAUTION

Missing constancy test of the monitor!

Wrong basis for diagnosis.

- Perform the monitor test regularly at the recommended intervals.

The constancy test described here complies with DIN 6868-157:2014 Image quality assurance in diagnostic X-ray departments – Part 157: X-ray ordinance acceptance and constancy test of image display systems in their environment.

To ensure the image quality of the monitors, you must perform tests daily and biannually.

It is recommended that the biannual constancy tests of the monitor and the collection of the reference values are performed and documented by Siemens Healthineers Service.

If any alterations are made to the device that affect the image quality, for example, repairs, replacement of parts, or readjustments, the acceptance test according to the Germany X-ray regulations must be repeated.

9.6.1 Image quality of the monitor

The acceptance test performed during initial start up commissioning ensures optimum image quality of the device.

The results of these measurements are documented in an acceptance test report and serve as reference values for the follow up constancy test.

You will find the test report of the acceptance test in the System Owner Manual.

9.6.2 Starting the constancy tests of the monitor

The room class is defined according to the standard (DIN 6868-157: 2014) by the radiation protection officer of the organization or the hospital.

1 Clean the monitor according to the cleaning instructions in the SOMATOM Instructions for Use.

2 Switch on the monitor and keep it connected to power for at least 30 minutes.

3 To ensure that the criteria of the constancy test are met, ensure that the requirements for the room lighting are met or restored according to the acceptance test performed during initial start up.

4 In the **Patient Browser**, select the test images stored in the database under **Local Database/Image Quality Test/TG 18/TG 18 Testimages Monochrome**.

5 Load all test images into the **Viewing** task card.

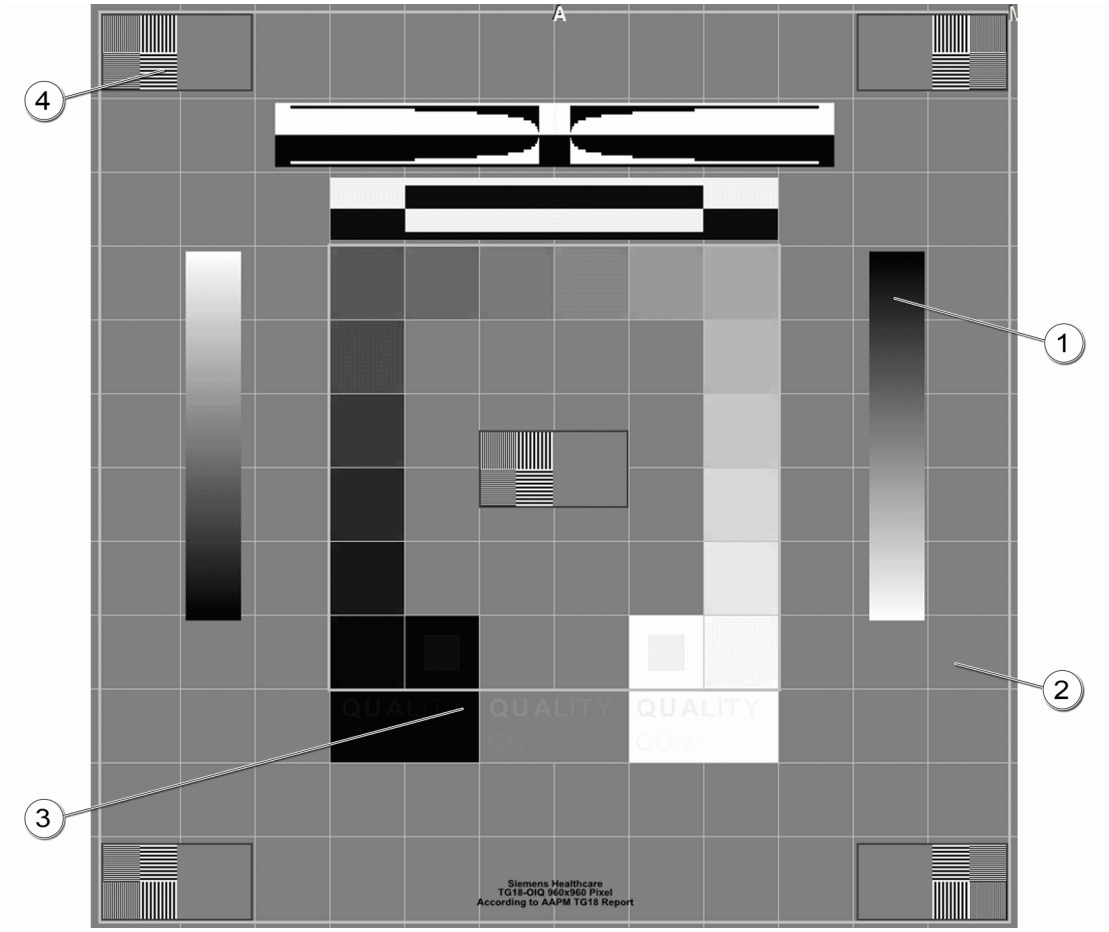
6 On the **View** subtask card, select the **1:1** layout.

If no test images are stored in the database, proceed as follows: In the **Patient Browser**, go to **Transfer > Import from Off-line**. Ensure that the path is set to **H:\SiteData\ReferenceImages** and select all TechDIN6868 image files. Once the images are selected, click **Import**.

9.6.3 Performing the daily constancy test of the monitor

You must perform the following test of the overall image quality daily.

1 In the **Viewing** task card, scroll to the test image TG18-OIQ.



(1) Process bar
(2) Line grid
(3) Low contrast letters
(4) Linepair grid

2 Check image element 1 for the continuity of the process bar:

The appearance of the process bar must be sustainable.

3 Check image element 2 for the visibility of lines and grids:

The frontiers, lines, and the centering of the grid must be visible in the active area of the monitor.

4 Check image element 3 for the visibility with low contrast:

QUALITY CONTROL

The following letters must be visible in the white and grey field:

QUALITY CONTROL

For room class 1 (≤ 50 lx), the following letters must be visible in the black field:

QUALITY CONTRO

For room class 2 (≤ 100 lx), the following letters must be visible in the black field:

QUALITY CONT

5 Check image element 4 for the general visibility:

The line pair grid has to be straight visible, without slidings, blurs, or deletions.

A linepair grid, width two pixel, with low contrast must be visible in the middle and in the four corners of the test image.

6 Document your test results and confirm them with date and initials.

The test result shows deviations.

◆ Contact Siemens Healthineers Service to set information.

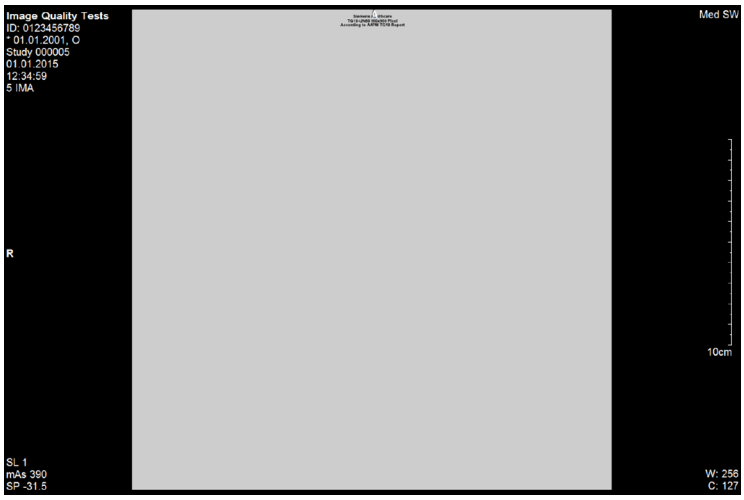
9.6.4 Performing the biannual visual tests of the monitor

The following visual tests must be performed biannually to ensure the image quality of the monitor.

It is highly recommended that the biannual tests are performed by Siemens Healthineers Service.

Biannually testing the luminance homogeneity

1 In the **Viewing** task card, scroll to test image TG18-UN80.



2 Check the test image for interferences from the middle to the edges.

Typical LCDs contain asymmetric inequalities. As the human eye in general has a small sensibility for differences at low local frequencies, the inequalities are negligible, as long as the differences are not too distinct.

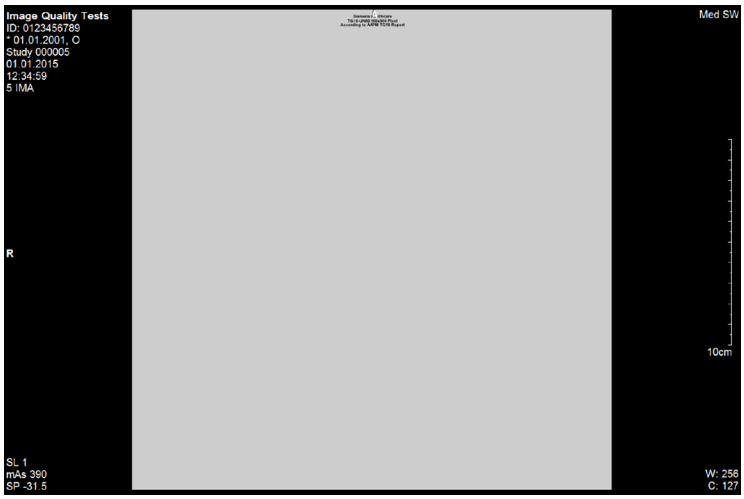
3 Document your test results and confirm them with date and initials.

The test result shows deviations.

◆ Contact Siemens Healthineers Service to set information.

Biannually testing the color effect and equality

1 In the **Viewing** task card, scroll to test image TG18-UN80.



2 Visually check the color effect of the test image for color equality.

3 Document your test results and confirm them with date and initials.

The test result shows deviations.

◆ Contact Siemens Healthineers Service to set information.

9.6.5 Performing the biannual metrological tests

It is highly recommended that the biannual tests are performed by Siemens Healthineers Service.

If you prefer to perform the tests by yourself, make sure that the tests and the documentation of the test results are compliant to DIN 6868-157: 2014.

---

1 In the **Patient Browser**, select the test images stored in the database under Local Database/Image Quality Test/TG 18/TG 18 Testimages Monochrome.

2 Load the test images into the **Viewing** task card.

3 On the **View** subtask card, select the **1:1** layout.

4 Perform the following tests.

- Minimum luminance
- Maximum luminance
- Veiling glare
- Illuminance
- Homogeneity of multiple monitors
- Luminance response

5 Document your test results and confirm them with date and initials.

The test result shows deviations up to 20%.

- You can contact Siemens Healthineers Service to set information.

The test result shows deviations of 30% or more.

- You must contact Siemens Healthineers Service that the monitor must be newly adjusted.

1, 2, 3 ...

2D tools
  interventional examination 385
3D
  reconstructing 332
3D camera
  description 120
  infrared laser 120
  infrared sensor 120
  position 120
3D camera system
  3D camera 119, 120
  camera interface computer (CIC) 119
  ceiling extension 119
  ceiling flange 119
  components 119
3D GRP Base
  reconstructing 332
3D Intervention 412
3D reconstruction
  FAST 3D 333
3D tools
  interventional examination 413

A

accessories 128
accessory
  quality measurement 424
activating
  iMAR 335
Adaptive 3D Intervention 381
  scan modes 403
Adaptive Cardiac Sequence 199, 228, 366
Adaptive Dose Shield 199
Adjust 219
ADMIRE 337
  dose optimization 195
animals
  scanning 304
arm support 137
Auto Trigger 228, 230

B

baby mattress (pediatric cradle)
  description 132
bariatric accessories set 141
  adapter of head-arm support 141
  bariatric head holder 141
  bariatric table top extension 141
  body support straps 40 cm 142
bed 109
BestDiast 375
BestPhase 375
BestSyst 375
bolus injector 150
  contrast parameters 353
Bolus Tracking 343, 347
bonding
  electrodes and skin 149
buttons
  operating panel 92

C

calibration 162
camera
  image quality 454
  test 454
  test images 455
camera test
  performing 455
Cardiac CT
  accessory 146
Cardiac CT examination 359
CARE Bolus CT 343
CARE Contrast CT
  bolus injector 150
CARE Dose4D 191, 203, 211, 226, 233, 316
CARE kV 193, 208, 209, 212, 233, 316
  group 214
CARE Profile 204, 206
CARE TransX
  description 142
changing
  MPT table top 187
checkup
  image quality 162
Cleaning and disinfection 423
communication
  Talk to patient key 307
computer
  overheating 170
  switching on 160, 161
  workplace 123
configuring
  touch panel display 238
constancy test 435
  interrupting 438
  performing 435
  results 449
contact
  impedance 148, 149
contrast parameters
  bolus injector 353
contrast settings 343
control box
  intercom system 124
  on/off keys 124, 126
  operating elements 124, 125
  operating keys 125
couch 109
cover
  mattress 129
CTDI-Air
  test 448
cushions 138

D

Default table position 181
defining scan and pulsing ranges
  automatically 228, 230
  manually 229, 231
detecting regions 312
Direct Viewer 379
display
  additional 97
  ECG 104
  gantry 102
  patient data 103
  position 97
  radiation 96, 103
Display
  Gantry 96
disposal of the system 28
Dose Alert 189, 207, 223, 226
Dose Notification 189, 207, 209, 222
dose report 208, 224
Dose SR 208, 224
dose-optimized workflow
  Sn topogram 217
dual energy
  reconstructing 338
Dual Energy
  tin filtration 201

E

ECG
  electrodes 147
  monitor 146
  sequence 227, 365
  signal 148, 149
  spiral 230, 361
ECG Pulsing 363
  dose optimization 197, 228, 230
ECG-gated spiral 230, 361
ECG-triggered sequence 227, 365
emergency Off key 16
equipment
  modification 24
examination type 212
exceptional situations 168
exposed range 207
Extended FoV 327
external lightmarker
  test 440

F

FAST 3D 333
FAST Adjust 210, 219
FAST Bolus 347, 348
FAST DE
  reconstructing 338

Fast DE Results
limitations for Liver VNC 276
limitations for LungPBV 276
limitations for Virtual Unenhanced 275
FAST DE Results
image comments 274
sending 272
Series description 274
FAST ECG 148
FAST Planning 312
FAST Scan Assistant 221
FlashCheck 232, 369, 372
foot switch
scan trigger 158, 400
table height 183
full 228
function
test 173

G

gantry
display 102
gantry operator panel 93
gantry operator panel with Touch Panel 99
gantry temperature 169
intercom 303
operator panels 92
shutdown 173
temperature 169
touch panel 105, 288, 289
Gantry display 96
gantry operator panel 93
Touch Panel 99

H

HandCARE 195
HD FoV 327
head holder 134
tiltable 134
head-arm rest 136
head-arm support 135
headrest 135
heart examination 359
Heart Perfusion 373
homogeneity
test 445

I

i-Control
optical and acoustical indications 158
i-PrecisionView 408
i-Control
attaching 388, 395
mounted to coded rail 154
mounting on the trolley 388, 396
mounting to coded surgical rail 387, 395
movement keys 156
moving patient table 390
moving the patient 390, 398
operating panel 154
operating the syngo software 390, 392, 398, 399
operating the system 390, 398
shifting the mounting fixtures 388, 396
turning on 388, 396
turning on - standby 390
turning on from standby 397
use 386, 394
wired operation 389, 396
wireless operation 389, 397
i-Control (interventional panel) 152
Image Inspection
test 446
image quality 213
camera 454
monitor 457
iMAR
reconstructing 334
selecting 335
immobilization
patient 286
impedance 148, 149
importing
teamplay Protocols 255
information icons 103
infusions 287
injector
contrast parameters 353
intercom system 124
interventional examination 381
2D tools 385
3D Intervention 412
3D tools 413
parameter card 383
scan modes 403

K

keys
operating panel 92
knee support 137

L

laser light marker
using 290
laser lightmarker
use 96, 101
lightmarker
test, external lightmarker 440
test, sagittal/coronal lightmarker 441
test, z-position 439
use 96, 101
line on/off 109
line on/off reset button 166
Line On/Off reset button 108, 109
Listen to patient key 307
Liver VNC
limitations for FAST DE Results 276
loading the patient 181
login 161
low contrast
test 452
low contrast test
phantom 425
phantom set 426, 427
low power mode 173
low temperature
gantry temperature 169
LungPBV
limitations for FAST DE Results 276

M

mains power 165, 166
maintenance 422
contract 422
intervals 422
no patient examination 84
software guided 422
Maintenance shutdown
no interruption 168
malfunctions 422
mat 129
mattress 129
baby mattress (pediatric cradle) 132
cover 129
for flat table top 131
positioning 129
with flat surface 131
MinDose 364
dose optimization 197, 231
modification
of equipment 24
modulation transfer function test 447
monitor
ECG display 102
image quality 457
monitor cart 400
monitor ceiling system 400
test 457
Monitor
ECG display 96
MPT
multi purpose table 113
MTF test 447
multi purpose table 113
high capacity table top 115
PMM 114
standard table top 115
table tops 113
Multi purpose table
RTP table top 115
multi purpose table top
high capacity 34
RTP 34
standard 34
Multiphase 377

N

Neuro BestContrast 196

O

on/off
- keys 124, 126

operating buttons
- control box 125

operating conditions 22
- climatic conditions 22
- electromagnetic compatibility 22
- explosion protection 22
- protective measures 23
- safety equipment 23

operating elements
- control box 124, 125
- gantry 92

operating keys
- control box 125

operating panel
- gantry 92
- i-Control 154, 156

Orientation aids 115

Osteo
- positioning aid 130

overheating
- computer system 170
- gantry temperature 169

P

pads 138

paper roll holder 142

parameter conflicts 218

patient
- immobilizing 286
- monitoring 307
- positioning 287
- Talk to patient 307

patient positioning
- 3D camera 293
- adjusting scan range 297
- check patient position 298
- move patient table 297
- planning scan ranges 295
- presets 295
- radiotherapy functions 299
- taking planning image 293

Patient Protocol 224

patient table 109
- 2000 mm 109
- connectors 108
- definitions 117
- foot switch 186
- limit values 117
- moving table manually 186
- moving table top 182, 185
- PMM 111
- position test 447
- positioning 105, 288, 289
- table tops 113
- vertical movement 179

phantoms
- positioning 428
- removing 430

Physiological Measurement Module 111, 114

pitch adaptation 198, 232

pixel noise
- test 445

planning screen
- zoom 297

PMM 111, 114

PMM (Physiological Measurement Module) 111, 113

positioning 287, 401
- accessories 129
- aids 129
- mattress 129
- Osteo 130

positioning aid
- head-arm rest 136

positioning aids 283

power
- failure 171

power supply 172

protective measures
- fire extinguisher 23
- power connection 23
- radiation warning lamp 23
- site On/Off switch 23, 172

Protective measures
- Patients 21
- Personnel 21
- Reduction of the radiation exposure 21

pulsing 363

Q

quality assurance 424

quality check 424

quality measurement 424
- accessory 424
- camera 454
- daily 431
- low contrast 452
- monitor 457
- monthly 435
- performing 431, 435
- quality phantom 425

quality test 424

quick 228

quick plus 228

R

Radiation protection
- Protective measures 21
- Radiation protection equipment 21

Radiation protection equipment
- Control area 21
- Radiation shielding 21

Radiotherapy settings 106

reconstructing
- 3D 332
- dual energy 338
- FAST DE 338
- iMAR 334

recovery
- gantry temperature 169

region detection 312

reset button
- see line on/off

restart
- gantry temperature 169

result
- documenting 451
- viewing quality test images 451

results
- constancy test 449

room
- climatic conditions 22

RTP adaptor connections 115

S

safety equipment
- overheating 23
- temperature monitoring 23
- uninterruptible power supply 23

safety information
- accessory cart 47
- cleanliness 278
- image quality 278
- monitor cart 45
- monitor ceiling system 46
- patient information 279
- patient positioning 277, 279
- patient table 277
- patient weight 279
- positioning aids 277
- problematic patients 279
- Radio translucency 278
- respiration 279
- time 279

Safety information 11

SAFIRE 337
- dose optimization 195

sagittal/coronal lightmarker
- test 441

saving energy 172

scan protocol
- ThorAbd 313
- thorax abdomen 313

scan protocols
- available for import 164

scan unit
- gantry operator panel with Touch Panel 99

screen saver 173

selecting
- iMAR 335

service 423

settings
Radiotherapy 106
Settings menu
General settings 105
shaped filter 200
shutdown
gantry temperature 169
signal quality
electrodes and skin 148
slice thickness
test 443
slicker 129
Sn topogram
dose-optimized workflow 217
specific national regulations 83
standby mode 172
start-up
error 162
syngo 162
system 161
straps 139
surgical rail
maximum load 35
syngo Acquisition Workplace 121
system
checkup 162
disposal 28
modification 24
overview 88
restart 166
restart after emergency stop 167
restart of the application 167
shut down 164
start-up 161
switching on 160

T

table
2000 mm 109
MPT 113
multi purpose table 113
setting table height 288
Table movement
unloading the patient 182, 185
table top
bariatric table top extension 141
changing the MPT table top 187
extension 132
standard 115
Table top
RTP 115
Talk to patient key 307
teamplay
scan protocols for import 164
test
camera 454
constancy test 435
constancy test of the monitor 457
daily 431
function 173
images 455
low contrast 452
monthly 435
quality assurance 424
ThorAbd
scan protocol 313
tiltable head holder 134
tin filtration
Dual Energy 201
fields of use 201
topogram position
test 442
touch panel
configuring display 238
instruction area 105
tools 105
Touch Panel
intercom 303
Settings menu 105
TrueStack 379

U

UPS 23
user guidance
control box key 99
gantry display 99
gantry operator panel 99
gantry panel assembly 107
touch panel 107

V

Virtual Unenhanced
limitations for FAST DE Results 275

W

wall switch 172
warranty 423
workplace computer 123

X

X-CARE 194

Z

z-position lightmarker
test 439

CE
0123

Manufacturer's note:

The CE marking applies only to Medical Devices which have been put on the market according to the EU Regulation.

Unauthorized changes to this product are not covered by the CE mark and the related Declaration of Conformity.

Caution: Federal law restricts this device to sale by or on the order of a physician, dentist, or veterinarian (21 CFR 801.109(b)(1)).

Gender inclusivity: At Siemens Healthineers, we want to address all genders equally in our Instructions for Use. It is not our intention to exclude anyone. We continue to update our documentation with this in mind.

The original language of this document is English.

Siemens Healthineers Headquarters
Siemens Healthcare GmbH
Henkestr. 127
91052 Erlangen
Germany
Phone: +49 9131 84-0
siemens-healthineers.com

Manufacturer
Siemens Healthcare GmbH
Henkestr. 127
91052 Erlangen
Germany

Published by Siemens Healthcare GmbH / Print No. C2-058-G.621.01.02.02 / © Siemens Healthcare GmbH, 2022 - 2023
Date of first issue: 2022-07 / Revision date: 2023-03