syngo CT 2014A

SOMATOM Sensation 16
Application Guide

Protocols
Principles
Helpful Hints

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SIEMENS

Dear SOMATOM user,

This application guide contains information regarding your new SOMATOM Sensation 16 slice CT applications. In order to improve our future versions, we welcome any questions, suggestions, and comments.

The information presented in this application guide provided by Siemens Healthcare, is for illustration purposes only and is not intended as instruction for the practice of medicine. The treating physician bears sole responsibility for the diagnosis and treatment of the patient, including any drugs prescribed in connection with such use. Drugs and doses mentioned are consistent with the approved labeling for use and/or indication by the manufacturer.

The pertaining operating instructions must always be strictly followed when operating a SOMATOM scanner. The source of technical data used is encompassed in the corresponding data sheets.

We express our sincere gratitude to the many customers who have contributed with their valuable input.

We also would like to thank all of our Siemens colleagues, including former editors who have been involved with this effort.

For questions and support, please contact your Uptime Service Center or your local Siemens representative.

Editor: Tao Xinwei, Lu Hong

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For further information about the basic operation, please refer to the corresponding *syngo* CT Operator Manual:

***syngo* CT Operator Manual Volume 1:**

Basics
syngo Security Package
syngo Patient Browser
syngo Viewing
syngo Filming
syngo Remote Assist
syngo Data Set Conversion
Camtasia
SaveLog

***syngo* CT Operator Manual Volume 2:**

Planning an exam
Working with scan protocols
Scanning a patient
Managing contrast
Performing a cardiac exam
Performing a respiratory scan
Performing CT intervention
Reconstructing images
Concluding an exam

***syngo* CT Operator Manual Volume 3:**

syngo 3D
syngo Dynamic Evaluation
syngo Dental CT

syngo CT Operator Manual Volume 4:

syngo Pulmo CT
syngo Volume Calculation
syngo Body Perfusion CT
syngo Neuro Perfusion CT

syngo CT Operator Manual Volume 5:

syngo Calcium Scoring
syngo Osteo CT
syngo Neuro PBV CT
syngo Neuro DSA CT

syngo CT Operator Manual Volume 6:

syngo CT Oncology
syngo LungCARE CT

syngo CT Operator Manual Volume 7:

syngo InSpace 4D CT

syngo CT Operator Manual Volume 8:

syngo Colonography CT
syngo Circulation

Concept of Scan Protocols

The scan protocols for adult and children are defined according to body regions - **Head**, **Neck**, **Shoulder**, **Thorax**, **Abdomen**, **Pelvis**, **Spine**, **Upper Extremities**, **Lower Extremities**, **Vascular**, **RT**, **Specials** and optional **Cardiac**, **PET**, **SPECT** and **Private**.

The protocols for special applications are defined in the Application Guide “**Clinical Applications**” or in the case of a Heart View examination, in the Application Guide “**Cardiac CT**”.

The general concept is as follows: All protocols without a suffix are standard spiral modes. For example, “**Sinus**” means the spiral mode for the sinus.

The suffixes of the protocol name are follows:

“**Routine**“: for routine studies

“**Seq**”: for sequence studies

“**Fast**“: use a higher pitch for fast acquisition

“**ThinSlice**“: use a thinner slice collimation

“**Combi**“: use a thinner and a thicker slice collimation

“**05s**”: use the rotation time of 0.5 seconds

“**042s**”: use the rotation time of 0.42 seconds

“**037s**”: use the rotation time of 0.37 seconds

“**UHR**“: use a thinner slice width for Ultra High Resolution studies and a FoV of 300 mm

“**HR**“: use a thin slice width for High Resolution studies

“**ECG**“: ECG-gated or trigged mode

“**Vol**”: use the 3D-Recon Workflow

"**Avg**": for average CT studies

A prefix of the protocol name is as follows:

“**RT**”: for radio therapy studies

"**AC**": for attenuation correction PETCT studies

"**LM**": for list mode PETCT studies

"**HD**": for high definition/TrueX PETCT studies

The availability of scan protocols depends on the system configuration.

Scan Set Up

Scans can be simply set up by selecting a predefined examination protocol. To repeat any mode, just click the chronicle with the right mouse button for **repeat**. To delete it, select **cut**. Each range name in the chronicle can be easily changed before **load**.

Multiple ranges can be run either automatically with **auto range**, which is denoted by a bracket connecting the two ranges, or separately with a **pause** in between.

Feed in/Feed out

The performance of the different buttons (soft buttons, gantry buttons and control box buttons) is standardized as follows:

- in **NOT loaded** modes:

1 mm

- in **loaded** modes:
  - Topogram

0.5 mm

  - Spiral

Feed In/Out = Collimation

  - Multiscan

Feed In/Out = Slice Width x No. of Slices

  - Sequence with feed

$$\text{Feed In/Out} = \frac{\text{Feed}}{\text{Scan}}$$

  - Sequence without feed

Feed In/Out = Slice Width x No. of Slices

  - Biopsy and CARE Vision mode

$$\text{Feed In/Out} = \frac{\text{Slice Width}}{2}$$

Topo Length

Length [mm]	*128, 256, 512, 768, 1024, 1536*, 2048**
Slice width [mm]	*6 x 0.6*
Angle	*Top, Bottom, Lateral*

* only in combination with PET, option

Scan Modes

Sequential Scanning

This is an incremental, slice-by-slice imaging mode in which there is no table movement during data acquisition. A minimum interscan delay in between each acquisition is required to move the table to the next slice position.

Spiral Scanning

Spiral scanning is a continuous volume imaging mode. The data acquisition and table movements are performed simultaneously for the entire scan duration. There is no inter-scan delay and a typical range can be acquired in a single breath hold.

Each acquisition provides a complete volume data set, from which images with overlapping can be reconstructed at any arbitrary slice position. Unlike the sequence mode, spiral scanning does not require additional radiation to obtain overlapping slices.

Dynamic Multiscan

Multiple continuous rotations at the same table position are performed for data acquisition. Normally, it is applied for fast dynamic contrast studies, such as *syngo* Neuro Perfusion CT.

Dynamic Serioscan

Dynamic serial scanning mode without table feed. Dynamic serio can still be used for dynamic evaluation such as Test Bolus. The image order can be defined on the **Recon** subtask card.

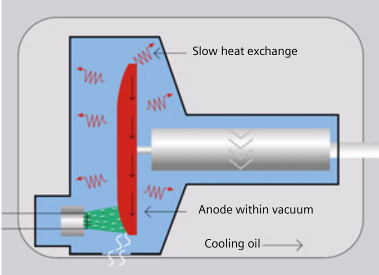
Straton-Tube

The SOMATOM Sensation 16 CT-system is now equipped with the Straton-tube.

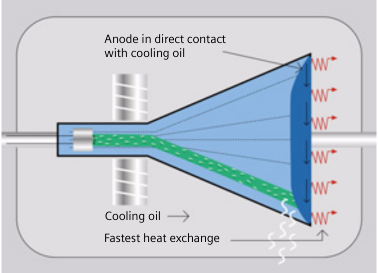
This newly developed X-ray tube offers significantly reduced cooling times for shorter interscan delays and increased power reserves. The full X-ray power of 60 kW can be applied for a 20 s spiral, providing considerable dose reserves even for adipose patients.

Example of one tube mode is the **ThoraxCombi** protocol (120 kV, 45 mAs, 0.5 s rot, 16 x 1.5 mm, pitch 0.75):

- a scan range of 150 mm can be covered in 5.17 s
- dose can be increased up to 200 mAs without reduction of the table feed.



Conventional anode cools down slowly after exposure

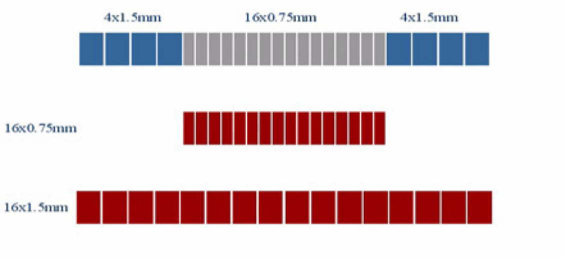


STRATON never accumulates heat during exposure

UFC detector

Siemens' proprietary, high-speed Ultra Fast Ceramic (UFC) detector enables a virtually simultaneous read-out of two projections for each detector element resulting in up to 16-slice acquisition.

The detector configuration with the routine acquisition of the Sensation 16:



Acquisition, Slice Collimation and Slice Width

Slice collimation is the slice thickness resulting from the effect of the tube-side collimator and the adaptive detector array design. In Multislice CT, the Z-coverage per rotation is given by the product of the number of active detector slices and the collimation (e.g., 16 x 0.75 mm for the SOMATOM Sensation 16).

Slice width is the FWHM (full width at half maximum) of the reconstructed image.

With the SOMATOM Sensation 16, you select the slice collimation together with the slice width desired. The slice width is independent of pitch, i.e. what you select is always what you get. Actually, you do not need to care about the algorithm any more; the software does it for you.

On the SOMATOM Sensation 16 some slice widths are marked as “fast” (blue background). These images are reconstructed with highest performance.

During scanning the user normally will get “Real Time” reconstructed images in full image quality, if the “fast ” slice has been selected.

In some cases – this depends also on Scan pitch and Reconstruction increment – the Recon icon on the chronicle will be labeled with “RT”. This indicates the Real Time display of images during scanning. The Real Time displayed image series has to be reconstructed after completion of spiral.

The **Acq** (Acquisition) is displayed on the **Examination** task card. The **Acquisition** is simply "number of slices acquired per rotation" x "width of one slice".

Spiral Mode

Slice Collimation	Slice width
0.75 mm:	0.75, 1, 1.5, 2, 3, 4, 5, 6, 7, 8, 10 mm
1.5 mm:	2, 3, 4, 5, 6, 7, 8, 10 mm

Sequence Mode

Slice Collimation	Slice width
0.75 mm:	0.75, 1.5, 3, 4.5, 9 mm
1.0 mm:	1, 2 mm
1.5 mm:	1.5, 3, 4.5, 6, 9 mm
5.0 mm:	5, 10 mm

UHR Spiral Mode

Slice Collimation	Slice width
0.6 mm:	0.6, 0.75, 1, 1.5, 2, 3, 4, 5, 6 mm (optional)
0.75 mm:	0.75, 1, 1.5, 2, 3, 4, 5, 6, 7, 8, 10 mm

UHR Sequence Mode

Slice Collimation	Slice width
0.6 mm:	0.6, 1.2 mm (optional)
0.75 mm:	0.75, 1.5, 3, 4.5, 9 mm
1.0 mm:	1, 2 mm

Increment

The increment is the distance between the reconstructed images in Z direction. When the chosen increment is smaller than the slice thickness, the images are created with an overlap. This technique is useful for reducing partial volume effect, giving you better detail of the anatomy and high quality 2D and 3D postprocessing.

The increment can be freely adapted from 0.1 - 10 mm.

Pitch

$$\text{Pitch} = \frac{\text{feed per rotation}}{\text{z-coverage}}$$

z-coverage = detector rows x collimated slice width

Feed/Rotation = table movement per rotation

The Pitch Factor can be freely adapted from 0.45 – 2.0, in Cardio, there is a fixed pitch down to 0.1.

With the SOMATOM Sensation 16, you select the slice collimation together with the slice width desired.

The slice width is independent of pitch, i.e. what you select is always what you get. Actually, you do not need to be concerned about the algorithm any more; the software does it for you.

Pitch values with a step width of 0.05 can be selected for all modes.

We recommend using a Pitch Factor of 0.45 for MPR reconstructions.

Kernels

There are 5 different types of kernels: **H** stands for Head, **B** stands for Body, **U** stands for High Resolution, **C** stands for ChildHead and **S** stands for Special Application, e.g., *syngo* Osteo CT.

The image sharpness is defined by the numbers – the higher the number, the sharper the image; the lower the number, the smoother the image.

The endings “s” or “f” depend on the rotation time.

Head Kernels:

Kernel	description
H10f, H10s	very smooth
H20f, H20s	smooth
H21f, H21s	smooth +
H22f, H22s	smooth FR
H30f, H30s	medium smooth
H31f, H31s	medium smooth +
H32f, H32s	medium smooth FR +
H37f, H37s	medium smooth
H40f, H40s	medium
H41f, H41s	medium +
H42f, H42s	medium FR +
H45f, H45s	medium
H47f, H47s	medium smooth
H48f, H48s	medium smooth
H50f, H50s	medium sharp
H60f, H60s	sharp

Body Kernels:

Kernel	description
B10f, B10s	very smooth
B20f, B20s	smooth
B30f, B30s	medium smooth
B31f, B31s	medium smooth +
B35f, B35s	HeartView medium
B36f	HeartView medium
B40f, B40s	medium
B41f, B41s	medium+
B45f, B45s	medium
B46f	HeartView sharp
B50f, B50s	medium sharp
B60f, B60s	sharp
B70f, B70s	very sharp
B75f, B75h	very sharp ORA
B80f, B80s	ultra sharp

Child Head Kernels:

Kernel	description
C20f, C20s	smooth
C30f, C30s	medium smooth
C60s	sharp

Ultra High Resolution:

Kernel	description
U30u	medium smooth
U40u	medium
U70u	sharp
U80u	very sharp
U90u	ultra sharp
U95u	special applications

Special Application:

Kernel	description
S80f, S80s	Shepp-Logan with notch filter
S90f, S90s	Shepp-Logan without notch filter

PET-Kernel:

Kernel	PET
B19s/f	smooth
B29s/f	medium smooth
B39s/f	medium
H19s/f	smooth
H29s/f	medium smooth
H39s/f	medium

Head Kernels

For soft tissue head studies, the standard kernel is H40s; softer images are obtained with H30s or H20s, H10s, sharper images with H50s. The kernels H21s, H31s, H41s yield the same visual sharpness as H20s, H30s or H40s, respectively. The image appearance, however, is more acceptable due to a "fine-grained" noise structure; quite often, the low contrast detectability is improved by using H31s, H41s instead of H30s, H40s.

In emergency examinations, kernels H22s, H32s, and H42s can be used because they allow fast reconstruction (FR) and easy patient positioning (50 cm FoV). To ensure best performance, special online bone correction (PFO) is not used.

High Resolution head studies should be performed with H50f, H60f (for example, for dental and sinuses). It is essential to position the area of interest in the center of the scan field.

For a better gray-white brain tissue differentiation use the H37s, H38s or H47s kernel.

Child Head Kernels

For head scans of small children, the kernels C20s, C30s (for example for soft tissue studies) and C60s (for example, provided for sinuses) should be chosen instead of the "adult" head kernels H20s, H30s and H60s.

Body Kernels

As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s respectively, B40s, the image appearance, however, is more acceptable due to a "fine-grained" noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.

For higher sharpness, as is required for example, in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.

Special Application Kernels and Ultra High Resolution Kernels

For special patient protocols, S80s and U90u are chosen, e. g. for osteo (S80s) and for High Resolution bone studies (U90u).

We recommend using the High Resolution specification kernel U90u only with "small" objects, like the wrist, otherwise artifacts will occur in the images.

Note:

- In the case of a 3D study only, use kernel B10s and at least a 50% overlap for image reconstruction.
- Do not use different kernels for body parts other than what they are designed for.

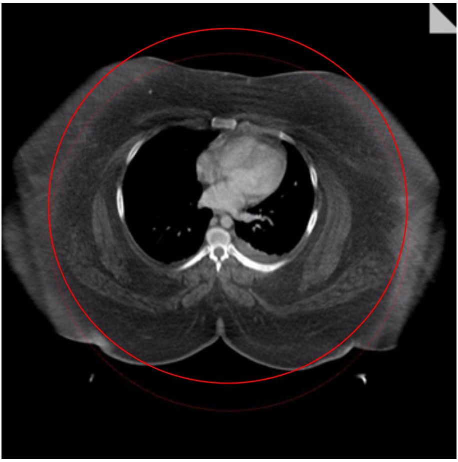
Extended FoV

SOMATOM Sensation 16 offers the extended field of view. The range can be individually adapted by the user from 50 cm up to 70 cm.

To use this feature you have to select the **extended FoV** checkbox on the **Recon** sub task card. The default setting is 65 cm, but can be modified.

Extended FoV can be used with each scan protocol.

The **extended FoV** value should be adapted carefully to the exact patient size in order to achieve best possible image quality outside the standard scan field.



Auto-FoV

After scanning a topogram the available ranges are displayed in the topo segment. They can be automatically adapted according to the patient contours. When moving the scan range over the topogram and press the "**ctrl**" key simultaneous, the adaptation will be done automatically. Please make sure, that the whole object is covered within the default FoV.

In case the FoV is too small, please press the "**ctrl**" key and move the scan range over the object once, and it will be adapted automatically.

The Auto-FoV will also work with the snap function, when an examination has two or more ranges. The snap function will also cover the Auto-FoV and therefore you have the possibility to merge different ranges. To be able to use the snap function, it is necessary to have the same FoV and the same x and y coordinates for all available ranges.

Do not use Auto-FoV for asymmetric objects (e.g., only one arm within the scan field).

Hints

- When positioning the arms along the body, the Auto-FoV will also cover the arms.
- When scanning two extremities at the same time, the Auto-FoV will also cover both extremities.

IRIS

IRIS (Iterative Reconstruction in Image Space) allows you to use low-dose images to reconstruct images with less noise and increased image sharpness.

IRIS is recommended for scans with an FoV > 150 mm.

IRIS is available for the reconstruction jobs of most modes, except for the following modes:

- Interventional examination
- PreMonitoring
- Monitoring
- Topogram
- Multiscans
- Testbolus

When IRIS is activated, the Kernel list on the Recon subtask card changes to the Algorithm list. An algorithm's name starts with the character I or J, for example, I30s or J40. Algorithm I corresponds to kernel B. Algorithm J corresponds to kernel H.

Hints:

- Use of IRIS requires a license.
- IRIS cannot work with extended FoV or extended CT scale.
- Do not use IRIS images for evaluation with the syngo Osteo or CaScoring applications.

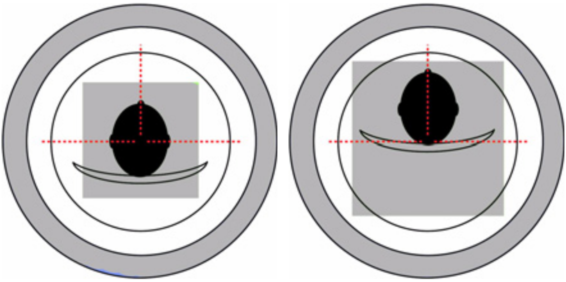
Head Imaging

The head protocols provide significant improvements regarding image quality for heads. An automatic bone correction algorithm has been included in the standard image reconstruction. Using a new iterative technique, typical artifacts arising from the beam-hardening effect, for example, Hounsfield bar, are minimized without additional post-processing. This advanced algorithm produces excellent images of the posterior fossa, but also improves head image quality in general. Bone correction is activated automatically for body region “Head”. The reconstruction algorithm for “Head” also employs special adaptive convolution kernels which help to improve the sharpness-to-noise ratio. More precisely, anatomic contours are clearly displayed while noise is suppressed at the same time without causing a blurring of edges.

Head image without correction.

Head image with corrections.

In order to optimize image quality versus radiation dose, scans in body regions “Head” and “AngioHead” are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.



correct positioning of the head   *wrong positioning of the head*

For trauma examinations of the head we provide two protocols, to be found in the specials folder:

– HeadTrauma
– HeadTraumaSeq.

The scan protocols enable you to utilize the full 50 cm FoV, resulting in easier patient positioning for trauma examinations and to ensure the highest performance, the dedicated PFO head filter is not used.

Automatic Isocenter Adaptation

Automatic adaptation of the table height allows you to position the object exactly in the isocenter in order to achieve the best image quality, it is necessary to position the patient exactly in the isocenter. You see the isocenter in the topogram graphical display and can adapt the table height after scanning the topogram. As the table moves, the graphic position is also updated.

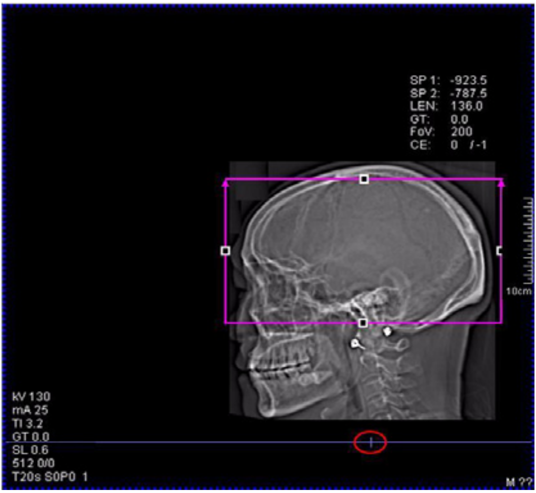


Image Filters

If you use kernels, the images are reconstructed again with the selected kernel value. If you use image filters, the images are not reconstructed again and the result is much quicker.

Three different filters are available:

LCE: The Low-contrast enhancement filter enhances low-contrast detectability. It reduces the image noise.

- Similar to reconstruction with a smoother kernel
- Reduces noise
- Enhances low-contrast detectability
- Adjustable in four steps
- Automatic post-processing

Image taken without the LCE filter

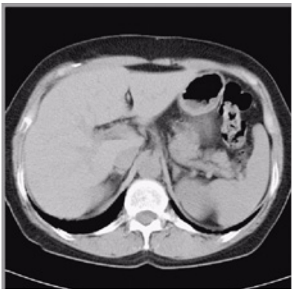


Image taken with the LCE filter

"HCE": The High-contrast enhancement (HCE) filter enhances high-contrast detectability. It increases the image sharpness, similar to reconstruction with a sharper kernel.

- Increases sharpness
- Faster than raw-data reconstruction
- Enhances high-contrast detectability
- Automatic post-processing

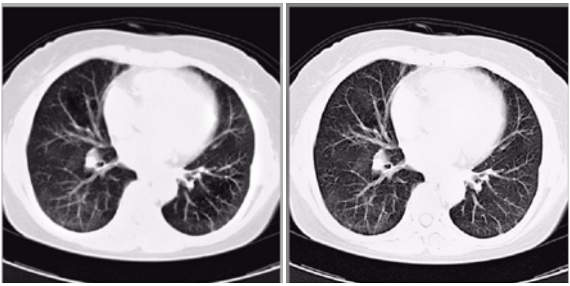


Image taken without the HCE filter

Image taken with the HCE filter

"ASA": The Advanced Smoothing Algorithm (ASA)

filter reduces noise in soft tissues while edges with high contrast are preserved.

- Reduces noise without blurring of edges
- Enhances low-contrast detectability
- Individually adaptable
- Automatic post-processing

$CTDI_w$ and $CTDI_{Vol}$

The average dose in the scan plane is best described by the $CTDI_W$ for the selected scan parameters. The $CTDI_W$ is measured in dedicated plastic phantoms – 16 cm diameter for head and 32 cm diameter for body (as defined in IEC 60601 – 2 – 44). For scan modes with z-Sharp the CTDI100 is calculated using the single number of tomographic sections (not doubled by z-Sharp) to remain within the terms of IEC 60601-2-44. The z-coverage with and without z-Sharp is the same and so is the dose. This dose index gives a good estimation of the average dose applied in the scanned volume, as long as the patient size is similar to the size of the respective dose phantoms.

Since the body size can be smaller or larger than 32 cm, the $CTDI_W$ value displayed can deviate from the dose in the scanned volume.

The $CTDI_W$ definition and measurement are based on single axial scan modes. For clinical scanning, i.e., scanning of entire volumes in patients, the average dose will also depend on the table feed between axial scans or the feed per rotation in spiral scanning. The dose, expressed as the $CTDI_W$, must therefore be corrected by the pitch factor of the spiral scan or an axial scan series to describe the average dose in the scanned volume.

For this purpose the IEC defined the term “$CTDI_{Vol}$“ in September 2002:

$$\mathbf{CTDI_{Vol}} = \frac{\mathbf{CTDI_W}}{\textbf{Pitch factor}}$$

This dose number is displayed with phantom size on the Routine and Scan task cards as well as the patient protocol.

Note: Previously the dose display on the user interface was labeled “$CTDI_W$“. This displayed $CTDI_W$ was also corrected for the pitch and was therefore identical to the current $CTDI_{Vol}$.

The $CTDI_w$ value does not provide the entire information of the radiation risk associated with CT examination. For this purpose, the concept of the “Effective Dose“ was introduced by ICRP (International Commission on Radiation Protection). The effective dose is expressed as a weighted sum of the dose applied not only to the organs in the scanned range, but also to the rest of the body. It could be measured in whole body phantoms (Alderson phantom) or simulated with Monte Carlo techniques.

The calculation of the effective dose is rather complicated and has to be performed by sophisticated programs. These have to take into account the scan parameters, the system design of the individual scanner, such as X-ray filtration and gantry geometry, the scan range, the organs involved in the scanned range and the organs affected by scattered radiation. For each organ, the respective dose delivered during the CT scanning has to be calculated and then multiplied by its radiation risk factor. Finally, the weighted organ dose numbers are added up to get the effective dose.

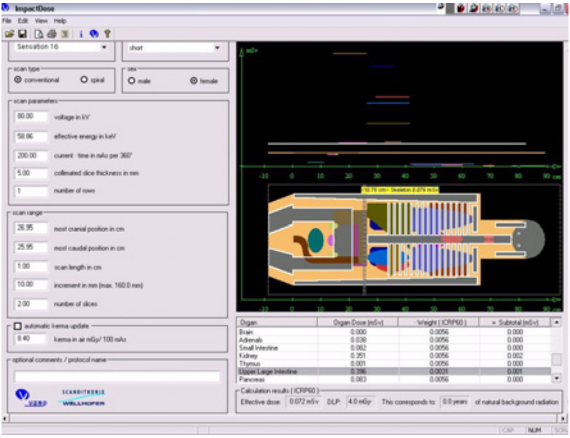
The concept of effective dose allows the comparison of radiation risk associated with different CT or X-ray exams, i.e. different exams associated with the same effective dose would have the same radiation risk for the patient. It also allows a comparison of the applied X-ray exposure to the natural background radiation, for example, 2 – 3 mSv per year in Germany.

ImpactDose

For most of the scan protocols, the effective dose numbers for standard male* and female* are calculated, and listed the result in the description of each scan protocol.

The calculation was performed using the commercially available program "ImpactDose" (Wellhoefer Dosimetry).

For pediatric protocols, the ImpactDose calculation and the correction factors published in "Radiation Exposure in Computed Tomography"** are used. These only include conversion factors for ages 8 weeks and 7 years.



*The Calculation of Dose from External Photon Exposures Using Reference Human Phantoms and Monte Carlo Methods. M. Zankl et al. GSF report 30/91

**Radiation Exposure in Computed Tomography, edited by Hans Dieter Nagel, published by COCIR c/o ZVEI, Stresemannallee 19, D-60596, Frankfurt, Germany.

Effective mAs

In sequential scanning, the dose (D_{seq}) applied to the patient is the product of the tube current-time (mAs) and the $CTDI_w$ per mAs:

$$D_{seq} = D_{CTDIw} \text{ x mAs}$$

In spiral scanning, however, the applied dose (D_{spiral}) is influenced by the conventional mAs (mA x Rot Time) and additionally by the pitch factor. For example, if a Multislice CT scanner is used, the actual dose applied to the patient in spiral scanning will be decreased when the pitch factor is greater than 1, and increased when the pitch factor is less than 1. Therefore, the dose in spiral scanning has to be corrected by the pitch factor:

$$D_{spiral} = \frac{(D_{CTDIw} \text{ x mA x Rot Time})}{\text{Pitch Factor}}$$

To simplify this task, the concept of the “effective“ mAs was introduced with the SOMATOM Multislice scanners.

The effective mAs takes into account the influence of pitch on both the image quality and dose:

$$\text{Effective mAs} = \frac{\text{mAs}}{\text{Pitch Factor}}$$

To calculate the dose, you simply multiply the $CTDI_w$ per mAs with the effective mAs of the scan:

$$D_{spiral} = D_{CTDIw} \text{ x effective mAs}$$

For spiral scan protocols, the indicated mAs is the effective mAs per image. The correlation between tube current and effective mAs of spiral scans on a Multi-slice CT scanner is expressed by the following formula:

$$\text{Effective mAs} = \frac{\text{mA x RotTime}}{\text{Pitch Factor}}$$

$$\text{Pitch Factor} = \frac{\text{Feed per Rotation}}{\text{nrow x Slice collimation}}$$

$$\text{mA} = \frac{\text{effective mAs}}{\text{RotTime}} \text{ x Pitch Factor}$$

where Slice collimation refers to the collimation of one detector row, and nrow is the number of used detector rows.

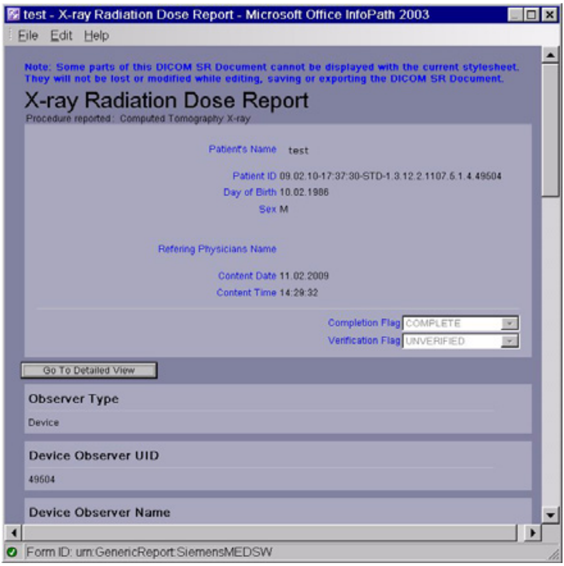
Dose Report

Dose Report has been introduced to fulfill the IEC norm for evaluation purposes. Select the patient Tabcard on the Examination Configuration Panel to switch the Dose Report on (default). Autotransfer can be enabled to send the report to the same node as the diagnostic images as well as any additional node required.

When ending the patient the Dose Report will be created automatically. The format is a DICOM structured Report. When continuing a study a new report will be generated for the new scan entries.

How to use Dose Report:

- Select a series in Patient Browser.
- Double click the Dose Report file in content area.
- The report will be displayed with SR Viewer.
- To show detailed dose values of the series, click on **Go To Detailed View** button on the report.
- To export of the Dose Report, select the desired export format from main menu **File > Export**.
- Terminology varies from the scanner as all displayed items are DICOM standard.


test - X-ray Radiation Dose Report - Microsoft Office InfoPath 2003
File Edit Help
Note: Some parts of this DICOM SR Document cannot be displayed with the current stylesheet.
They will not be lost or modified while editing, saving or exporting the DICOM SR Document.
X-ray Radiation Dose Report
Procedure reported: Computed Tomography X-ray
Patient's Name test
Patient ID 09.02.10-17:37:30-STD-1.3.12.2.1107.5.1.4.49504
Day of Birth 10.02.1986
Sex M
Refering Physicians Name
Content Date 11.02.2009
Content Time 14:29:32
Completion Flag COMPLETE
Verification Flag UNVERIFIED
Go To Detailed View
Observer Type
Device
Device Observer UID
49504
Device Observer Name
Form ID: urn:GenericReport:SiemensMEDSW

CARE Dose 4D

CARE Dose 4D is an automated exposure control, which ensures constant diagnostic image quality over all body regions at the lowest possible dose.

CARE Dose 4D combines three different adaptation methods to optimize image quality at the lowest dose level:

- Automatic adaptation of the tube current to the patient size
- Automatic adaptation of the tube current to the attenuation of the patient's long axis, the so-called z-axis.
- Automatic adaptation of the tube current to the angular attenuation profile measured online for each single tube rotation, the so-called angle modulation.

Based on a single a.p. or lateral topogram, CARE Dose 4D determines the adequate mAs level for every section of the patient. Based on these levels, CARE Dose 4D modulates the tube current automatically during each tube rotation according to the patient's angular attenuation profile. Thus, the best distribution of dose along the patient's long axis and for every viewing angle can be achieved.

Based on a user defined **Image Quality Reference mAs**, CARE Dose 4D automatically adapts the (eff.) mAs to the patient size and attenuation changes within the scan region. With the setting of the **Image Quality Reference mAs** you can adjust image quality (image noise) to the diagnostic requirements and the individual preference of the radiologist.

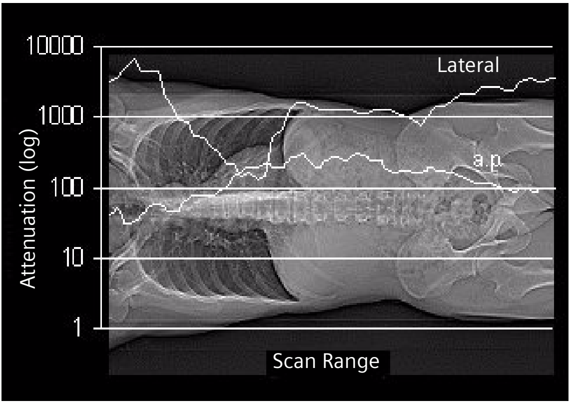
Note: The Image Quality Reference mAs should not be adjusted to the individual patient size!

How does CARE Dose 4D work?

CARE Dose 4D combines two types of tube current modulation:

1) *Axial tube current modulation:*

Based on a single Topogram (a.p. or lateral) the attenuation profile along the patient's long axis is measured in direction of the projection and estimated for the perpendicular direction by a sophisticated algorithm.

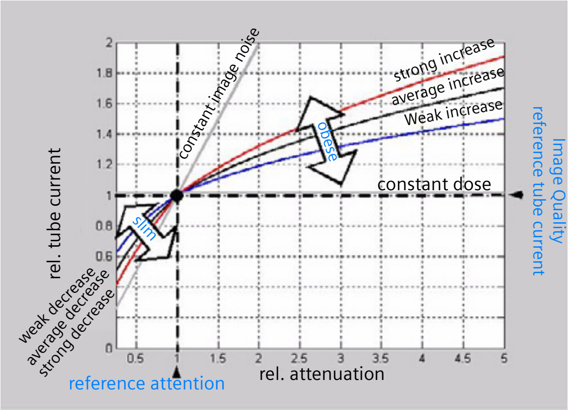


Example of lateral and a.p. attenuation profile evaluated from an a.p. Topogram.

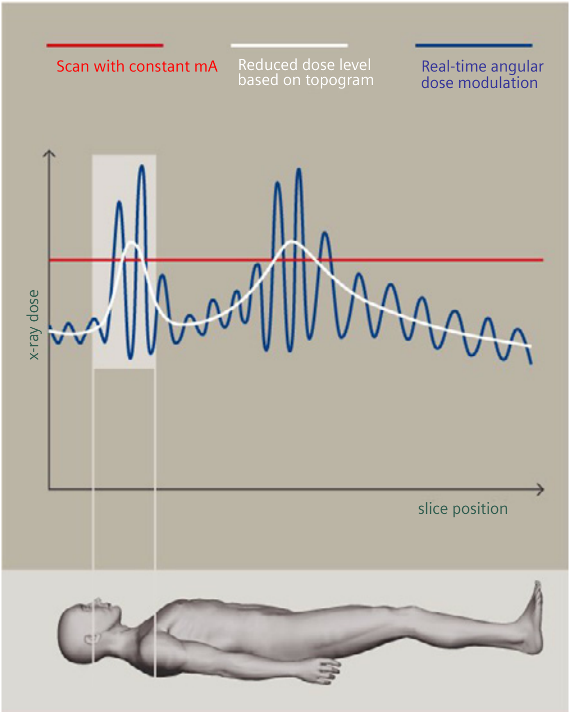
Based on these attenuation profiles, axial tube current profiles (lateral and a.p.) and the resulting eff. mAs for every table position are calculated. The correlation between attenuation and tube current is defined by an analytical function which results in an optimum of dose and image noise in every slice of the scan.

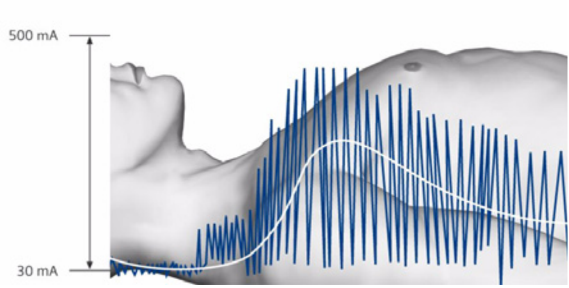
2) *Angular tube current modulation:*

Based on the above described axial eff. mAs profile, the tube current is modulated during each tube rotation. Therefore the angular attenuation profile is measured automatically during the scan and the tube current is modulated accordingly in real time to achieve an optimum distribution of the X-ray intensity for every viewing angle.



Relation between relative attenuation and relative tube current. The adaptation strength may be adjusted by user separately for the left branch (slim) and the right branch (obese) of the curve. This adjustment effects all examinations. The gray lines here indicates the theoretical limits of the adaptation (constant dose resp. constant image noise). The absolute (eff.) mAs value is scaled with the **Image Reference mAs** *value, which may be adjusted in the* **Scan** *Card by the user.*


Scan with constant mA
Reduced dose level based on topogram
Real-time angular dose modulation
x-ray dose
slice position



Principle of automatic tube current adaptation by CARE Dose 4D for a spiral scan from shoulder to pelvis (very high table feed for demonstration): High tube current and strong modulation in shoulder and pelvis, lower tube current and low modulation in abdomen and thorax. The dotted lines represent the min. and max. tube current at the corresponding table position and result from the attenuation profile of the Topogram.

The mAs value displayed in the user interface and in the patient protocol is the mean (eff.) mAs value for the scan range.

The mAs value recorded in the images is the local (eff.) mAs value.

Special Modes of CARE Dose 4D

For certain examination protocols CARE Dose 4D uses modified tube current modulation, to meet specific conditions, for example:

- for Adult Head protocols the tube current is adapted to the variation along the patient's long axis and not to the angular attenuation profile.
- for Extremities, CARE Vision, *syngo* Neuro Perfusion CT, *syngo* Body Perfusion CT and other special protocols (indicated as CARE Dose) only angular tube current modulation is supported.
- for Osteo and Cardio protocols the mAs setting is adjusted to the patient size and not modulated during the scan, except if ECG pulsing is switched on.

Scanning with CARE Dose 4D

If the settings of Image Quality Reference mAs are correctly predefined*, no further adjustment of the tube current is required to perform a scan.

CARE Dose 4D automatically adapts the tube current to different patient sizes and anatomic shapes, but it widely ignores metal implants.

Note: Otherwise the magnification of the topogram would be distorted which would lead to an underestimation or overestimation of the required eff. mAs.

For an accurate mAs adaptation to the patient's size and body shape with CARE Dose 4D, the patient should be carefully centered in the scan field. Centering of the examined organ in the scan field is not recommended except for head and cardiac scans.

When using protocols with CARE Dose 4D for body regions other than those they are designed for, the image quality should be carefully evaluated.

As CARE Dose 4D determines the (eff.) mAs for every slice of the topogram, a topogram must be obtained for use of CARE Dose 4D.

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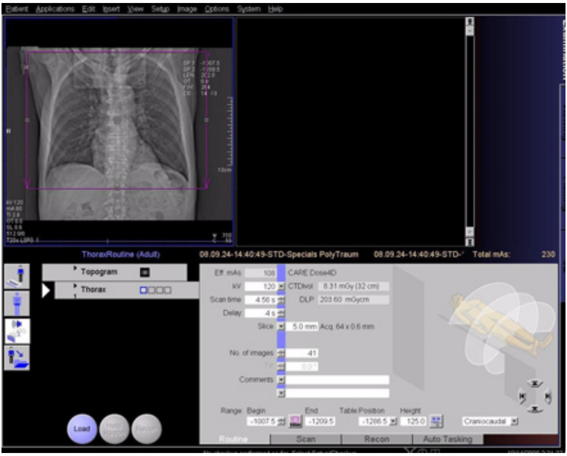
* *For Siemens scan protocols of SW version syngo CT 2009E, the settings of CARE Dose 4D are already predefined but may be changed to meet the customer's preference of image quality (image noise).*

Outside the topogram range, CARE Dose 4D will continue the scan with the last available topogram information. Without a topogram, CARE Dose 4D cannot be switched on. Repositioning of the patient on the table and excessive motion of the patient must be avoided between the topogram and the scan. If two topograms of the same projection exist for one scan range, the last acquired will be used for determining the (eff.) mAs. If a lateral and a.p. topogram exist for one scan range, both will be used for determining the (eff.) mAs. If multiple topograms exist for one scan range, the last acquired will be used for determining the (eff.) mAs.

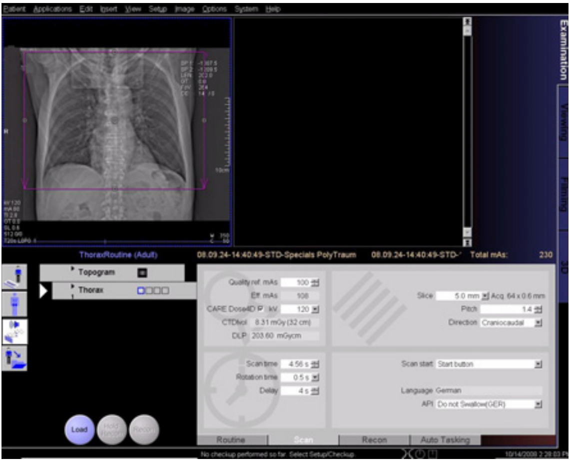
After the topogram has been scanned, the (eff.) mAs value in the **Routine** tab card displays the mean (eff.) mAs estimated by CARE Dose 4D based on the topogram*. After the scan has been performed this value is updated to the mean (eff.) mAs that was applied. The values may differ slightly due to the online modulation according to the patient's angular attenuation profile.



**When tuning the CARE Dose 4D parameter setting to the individual preference for image quality, we recommend keeping track of this value and comparing it with the values used without CARE Dose 4D.*

The **Quality reference mAs** value is displayed on the **Scan** tab card. This defines the overall image quality of the scan protocol currently being used. This value can be adapted for each protocol according to the user's individual requirements of image quality. Here you can also view the effective mAs value that the system is going to use for the current scan range.

You can also deselect CARE Dose4D on this tab card.



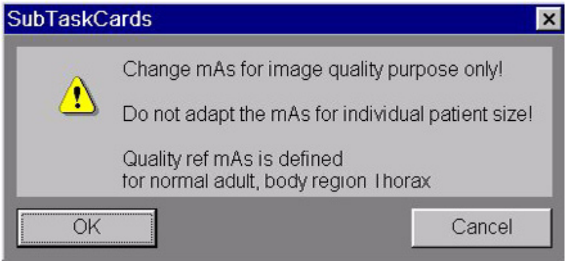
Adjusting the Image Noise

The correlation between attenuation and tube current is defined by the analytical function described above. This function may be adjusted to adapt the image quality (image noise) according to the diagnostic requirements and the individual preference of the radiologist.

– To adapt the image noise for a scan protocol the **Image Quality Reference mAs** value in the **Scan** tab card may be adjusted. This value can be adapted for each protocol according to the user's individual preferences of image quality, and reflects the mean (eff.) mAs value that the system will use for a reference patient with that protocol and the corresponding body region. The reference patient is defined as a typical adult, 70 kg to 80 kg or 155 to 180 lbs (for adult protocols), or as a typical child, 5 years, appr. 20 kg or 45 lbs (for child protocols). Based on that value, CARE Dose 4D adapts the tube current (or the mean (eff.) mAs value) to the individual patient size or body region.

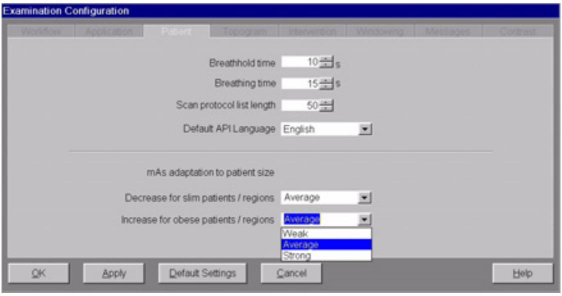
Note: Do not adapt the Image Quality Reference mAs for an individual patient's size. Only change this value if you want to adjust the image quality.

If you change the quality ref. mAs, a pop-up window is displayed.



- To change the configuration of CARE Dose 4D, please open the **Examination Configuration** dialog box under **Options > Configuration**. In the window that then appears, please double-click the **Examination** icon to display the configuration window. The adaptation strength of CARE Dose 4D may be influenced for slim, obese patients, or body parts of a patient by changing the CARE Dose 4D settings in the **Patient** tab card.
  This may be desirable:
- – if the automatic dose increase for obese patients (or patient sections) has to be stronger than the preset (choose **obese: strong increase**), resulting in less image noise and a higher dose for those images.

– if the automatic dose increase for obese patients (or patient sections) has to be more moderate than the preset (choose **obese: weak increase**), resulting in more image noise and a lower dose for those images.
– if the automatic dose decrease for slim patients (or patient sections) has to be stronger than the preset (choose **slim: strong decrease**), resulting in more image noise and a lower dose for those images.
– if the automatic dose decrease for slim patients (or patient sections) has to be more moderate than the preset (choose **slim: weak decrease**), resulting in less image noise and a higher dose for those images.



On the **Patient** tab card you can adjust the image quality (for more information see chapter **How does CARE Dose 4D work**).

Note: Changing this adaptation strength affects all protocols!

Activating and Deactivating CARE Dose 4D

CARE Dose 4D may be activated or deactivated for the current scan in the **Scan** tab card. If CARE Dose 4D is activated as default, the **Image Quality Reference mAs** value is set to the default value of the protocol. After deactivating CARE Dose 4D, the **Image Quality Reference mAs** is dimmed and the (eff.) mAs value has to be adjusted to the individual patient’s size! If CARE Dose 4D is switched on again, the Image Quality Reference mAs is reactivated. Note that the last setting of the Image Quality Reference mAs or the (eff.) mAs will be restored when you switch from and back to CARE Dose 4D usage. The default activation state of CARE Dose 4D may be set in the Scan Protocol Manager. CARE Dose 4D must be selected (column CARE Dose type). The corresponding column for activating CARE Dose 4D is called CARE Dose (4D), with possible default **on** or **off**.

Conversion of Old Protocols into Protocols with CARE Dose 4D

Protocols of SW versions VA70, VA47 and VA45 may be converted to CARE Dose 4D in the Scan Protocol Manager.

Prior to activating CARE Dose 4D an Image Quality Reference mAs value has to be set in the corresponding column.

If you are unsure about the correct Image Quality Reference mAs value, follow this simple procedure:

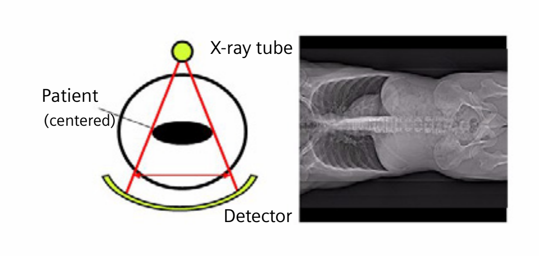
- Enter the (eff.) mAs value used for that type of protocol without CARE Dose 4D.
- There is a simple way of ascertaining what eff. mAs CARE Dose 4D will use along the scan range: When the topogram is complete shrink the scan range to its minimum. As you move this small box over the topogram you can see how the eff. mAs displayed in the **Routine** and **Scan** tab card varies along the patient's body.
  To achieve a certain eff. mAs at a patient's particular body region you can move the small scan range to this position and then adjust the Quality reference mAs so that the displayed eff. mAs value is as desired. After resizing the scan range to the range for the examination, carefully observe the displayed mean eff. mAs. After the subsequent scan is completed inspect the image quality to ensure that the chosen Quality reference mAs is the right value.

- With that setting perform the first scan and carefully inspect the image quality. In that first step the dose may not be lower than without CARE Dose 4D but will be well adapted to the patient's attenuation, resulting in improved image quality.
- Starting from that setting, reduce the Image Quality Reference mAs step by step to meet the necessary image quality level.
- Store the scan protocol with the adapted image quality reference mAs.

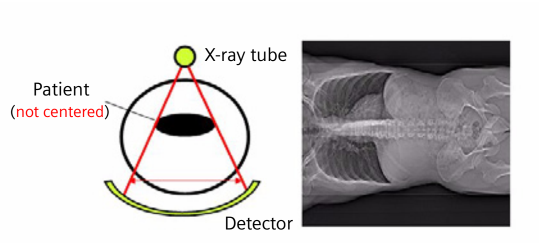
Additional Important Information

For ideal dose application it is very important to position the patient in the isocenter of the gantry. Centering of the examined organ in the scan field is not recommended except for head and cardiac scans.

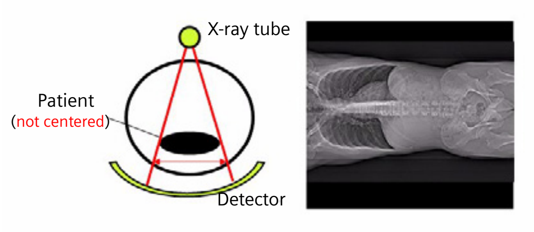
Example for an a.p. topogram:



Patient is positioned in the isocenter – optimal dose and image quality



Patient is positioned too high – increased mAs



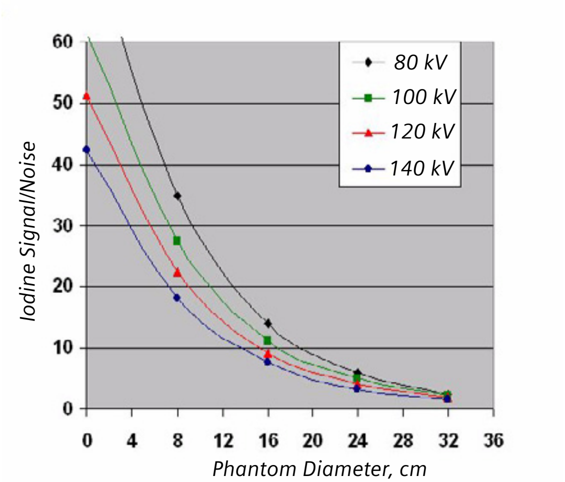
Patient is positioned too low – reduced mAs and increased noise

100kV-Protocols

The system offers a spectrum of four kV settings (80 kV, 100 kV, 120 kV and 140 kV) for individual adaptation of the patient dose in pediatric scans and for optimization of the contrast-to-noise ratio in contrast-enhanced CT angiographic studies.

In contrast enhanced studies, such as CT angiographic examinations, the contrast-to-noise ratio for fixed patient dose increases with decreasing tube voltage. As a result, to obtain a given contrast-to-noise ratio, the patient dose can be reduced by choosing lower kV-settings. This effect is even more pronounced for smaller patient diameters. It can be demonstrated by phantom measurements using small tubes filled with diluted contrast agent embedded in plastic phantoms with different diameters. The iodine contrast-to-noise ratio for various kV-settings is depicted in the following table as a function of the phantom diameter. Compared with a standard scan with 120 kV, the same contrast-to-noise ratio in a 24 cm phantom, corresponding to a slim adult, is obtained with 0.5 times the dose for 80 kV (1.5 times the mAs) and 0.7 times the dose (1.1 times the mAs) for 100 kV. Ideally, 80 kV should be used for lowest patient dose. In practice, however, the use of 80 kV for larger patients is limited by the available mA-reserves of the X-ray generator.

In these patients, 100 kV is a good compromise and the preferable choice for CTA examinations.



Iodine contrast-to-noise ratio as a function of the phantom diameter for kV-settings at a constant dose ($CTDI_w$ in these phantoms).

	80 kV	100 kV	120 kV	140 kV
Relative dose, 24 cm	*0.49*	*0.69*	*1.0*	*1.49*
Relative dose, 16 cm	*0.44*	*0.68*	*1.0*	*1.43*
Relative mAs setting	*150*	*110*	*100*	*100*

Results of iodine contrast, noise and dose measurements for different kV settings and phantom sizes. Relative dose numbers (CTDI$_w$ *in the respective phantom) and mAs settings needed for a certain contrast-to-noise ratio in the center of the 16 cm and 24 cm plastic phantoms. The required dose for the same contrast-to-noise ratio is significantly lower for lower kV values.*

WorkStream4D

Recon Jobs

In the **Recon** card, you can define up to eight reconstruction jobs for each range with different parameters either before or after you acquire the data. When you click on **Recon**, these jobs are performed automatically in the background. If you want to add more than eight recon jobs, simply click the icon for an already completed recon job in the chronicle with the right mouse button and select **delete recon job**. Another recon job will now become available on the **Recon** tab card.

Note: What you delete is just the job from the display, not the images that have been reconstructed. Once reconstructed, these completed recon jobs stay in the browser, until deleted from the local database.

You can also reconstruct images for all scans performed by not selecting any range in the chronicle, prior to clicking **Recon**.

Another entry you will find in the right mouse menu is **copy/replace recon parameters**. This function is available for spiral scans only.

The main goal is to support the transfer of volume parameters between oblique recon jobs of ranges which cover mainly the same area, e.g., two spiral scans with/without contrast media.

3D Recon

3D Recon allows you to perform oblique and/ or double oblique reconstructions in any user-defined direction directly after scanning.

No further post-processing or data loading is needed. The high-quality SPO (spiral oblique) images are calculated by using the system's raw data.

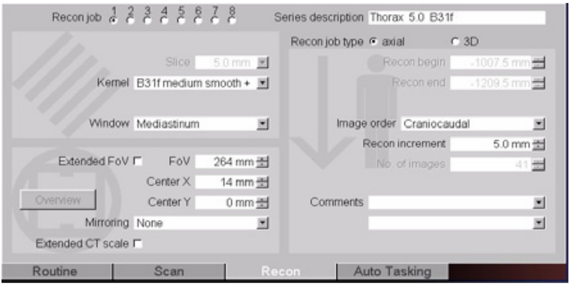
Key Features

- Reconstruction of axial, sagittal coronal and oblique/ double oblique images
- 3 planning images in the 3 standard orientations (coronal, axial, sagittal)
- Image types for planning MPR Thick (10 mm), MIP Thin (3 mm)
- Field of view and reference image definition possible in each planning segment
- Asynchronous reconstruction (several reconstruction jobs are possible in the background, axial and non-axial)
- Workstream 4D performs reconstructions on the basis of CT raw data
- If the raw data are saved you can start the 3D reconstruction on your *syngo* CT Workplace.
- It is also possible to perform the reconstruction with non-square matrix.

Workflow Description

WorkStream 4D improves your workflow whenever non-axial images of a CT scan are required, for example examinations of the spine.

3D reconstructions are possible:
- spiral scan is needed
- as soon as one scan range is finished and at least one axial reconstruction job has been performed (RTD or RTR images).

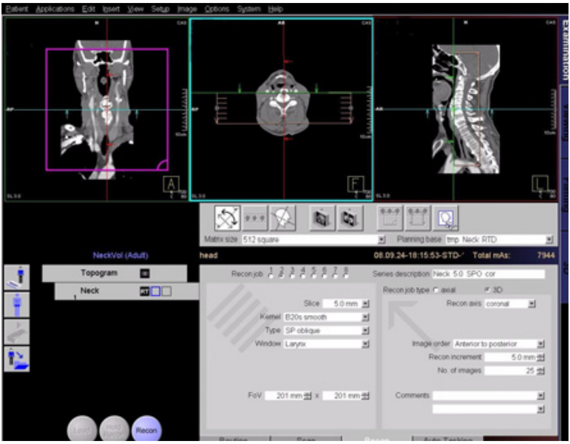


Select a new recon job and mark **Recon Job Type – 3D** on the **Recon** card. The first recon job that is suitable for the 3D reconstruction is used as **Available planning volumes**.

Additional Important Information

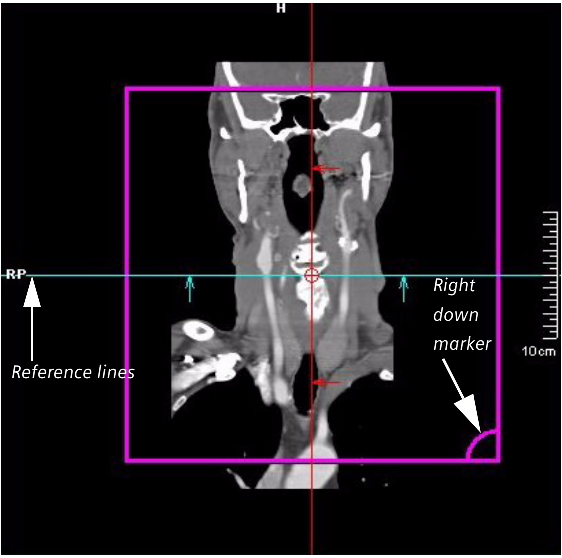
Pitch factor for 3D Recon

- For reconstruction of 3D recon jobs the maximum pitch factor is 1.5.
  If the pitch factor is > 1.5 a message window informs you that this 3D recon job cannot be started and may be deleted. In this case use the standard **3D** task card with an axial image series for reconstruction.

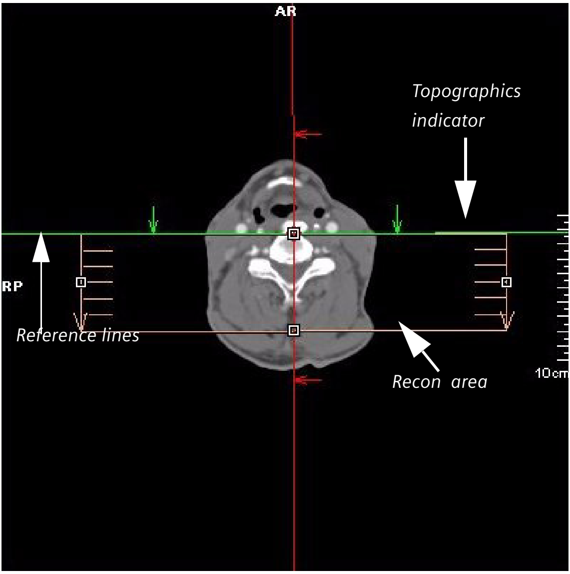


Three planning segments in perpendicular orientations will appear in the upper screen area. You can choose between **MPR Thick** (3 mm) and **MIP Thin** (10 mm) as the image type for your planning volume using the relevant buttons.

In each segment you will find a pink rectangle which represents the boundary of the result images. The image with the right down marker represents the field of view (FoV) of the result images (viewing direction).



The rectangle with the grid represents the reference image (topogram) which is added to the Topogram series including the reference lines after reconstruction.

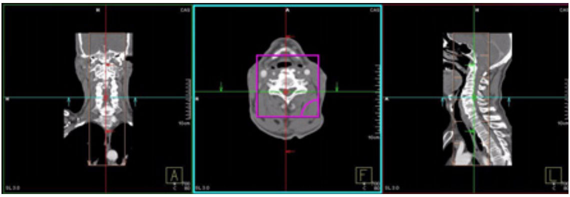


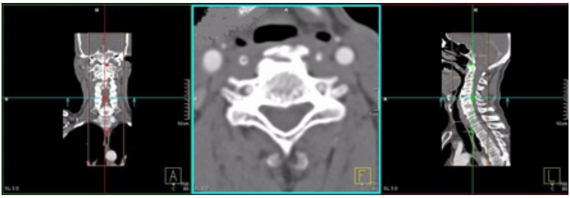
Preview Image

A preview of the actual FoV is now available.

- After pressing the button **Preview Image** the actual FoV to be reconstructed will be displayed.
- Clicking again on the button deactivates the preview image and displays the whole reference image again.
- Double clicking into the FoV image activates or deactivates the **Preview Image** function as well.

If the **Preview Image** function is active and you move or rotate the box, or change the recon begin and end position, the Preview image in the FoV segment will be updated accordingly.





Depending on the desired resultant images, choose coronal, sagittal or oblique recon axis.

1. Sagittal/Coronal Reconstructions

- Adjust the field of view size to your needs.
- It is only possible to reconstruct images with a squared matrix.

2. Oblique/Double-oblique Reconstructions

If you want to define the orientation of the result images independent of the patient’s axis:

- Enable the **Free View Mode** and rotate the reference lines in the three segments until the desired image orientation is displayed. The vertical and horizontal line is always perpendicular to each other. With the default orientation button you can reset the image orientation at any time.
- It is only possible to reconstruct images with a squared matrix.
- Set the field of view to the active segment by clicking the **Set FoV** button. The result images will then be orientated as in the FoV segment. You can adjust the extension perpendicular to the field of view in the same way in the other two segments.

To define the reference image (topogram) to the active segment, click on the **Set Reference Segment** button. This defines the orientation of the reference image which will be added to the result images.

Once you have finished the adjustment, start calculation of the result images by clicking on the **Recon** button. You can start a recon job at any time, independently of other ongoing jobs (asynchronous reconstruction). After starting the recon job the layout of the **Examination** task card changes back to the standard layout. If "auto recon" is selected, all defined recon jobs start automatically after scanning.

The progress of reconstruction is displayed by the slider in the tomo segment.

Additional Information

As soon as you define a new recon range, all recon ranges will be shown in the topo segment. The two numbers on the right-hand side at the beginning of each recon range indicate the recon job the range belongs to. The first number stands for the scan range, the second number stands for the recon job to which the range belongs. If no recon job is pending, only the scan ranges are shown in the topo segment. Only one number on the right-hand side at the beginning of each scan range indicates which scan the range belongs to.

- If the first recon job is saved as an **Oblique** recon job, RTD images are displayed after scanning and the **Examination** task card is automatically switched to **3D reconstruction**
- Patient Browser:
  for each double oblique recon job, one series is added in the Patient Browser.
- If **Auto Reference Lines** is selected the corresponding reference image is added to the 3D recon series.
- All reconstructions are performed in the background
- Do not use high resolution images
- Do not use extended FoV
- If no entry is selected in the chronicle, all open reconstructions are automatically reconstructed.
- If **Autorecon** is selected on the **Recon** tab card, this recon job (axial and oblique) will be automatically reconstructed after scanning.

Recon Planning

During planning of a 3D recon range, the image displayed in the FoV segment will be updated to the new position of the recon start and end position.

The corresponding reference line displayed in both planning segments is the reference line to the actual image displayed in the FoV segment.

One click on the start or end position of the recon range displays either the reference image to the start position of the recon range or the reference image to the end position of the recon range in the FoV segment.

Case Examples

Some scan protocols are supplied with predefined oblique reconstructions. These protocols are marked with the suffix “VOL”.

- *Coronal and sagittal reconstruction of the spine:*
  - Scan a topogram
  - Plan your axial spiral scan range
  - Reconstruction of the spiral images (RT images)
  - Select **Recon job Type** sagittal/coronal
  - Select the axial image segment
  - Press button **Set FoV Segment**
  - Adjust the FoV to your needs
  - Define your desired reconstruction parameters (for example, image type SPO)
  - Start reconstruction
  - Repeat the reconstruction steps for the other orientation (sagittal/coronal)

- *Oblique reconstruction of the sinuses:*
  - Scan a topogram
  - Plan your axial spiral scan range
  - Reconstruction of the spiral images (RT images)
  - Select **Recon job Type** oblique
  - Select the sagittal image segment
  - Enable **Free Mode**
  - Rotate the reference lines until the best view of the sinuses is displayed in one of the other segments
  - Select this segment and press the **Set FoV Segment** button
  - Adjust the FoV to your needs
  - Define your desired reconstruction parameters (e.g., image type SPO)
  - Start reconstruction

- *Oblique reconstruction of the vascular tree:*
  - Scan a topogram
  - Plan your spiral scan range
  - Axial reconstruction of the spiral images (RTD images)
  - Select **Recon job Type** oblique
  - Select button **MIP Thin** as image type for the planning volume on the toolbar
  - Enable **Free Mode**
  - Rotate the reference lines until the best view of the entire vascular tree is displayed in one of the other segments
  - Select the coronal image segment
  - Select this segment and press the **Set FoV Segment** button
  - Adjust the FoV to your needs
  - Define your desired reconstruction parameters (e.g., Type MIP Thin)
  - Start reconstruction

Non-square Matrix for 3D Recon

If you perform a 3D reconstruction of your spiral scan you have the possibility to choose between three different FoV matrices: 512 square, 512 non-square, 256 non-square. In some cases it is already saved to the scan protocol (Spine, CarotidAngio) set up a new scan protocol or want to modify an existing one you can save the non-square matrix together with the recon parameters.

- 512 square: the FoV stays quadratic with a 512x512 matrix size.
- 512 non-square: the FoV can be adjusted as a rectangle to your needs, for example spine reconstruction. Its max. side ratio is 1:4.
- 256 non-square: the FoV can be adjusted as a rectangle to your needs but with a lower matrix size and a lower resolution for example RunOff , Cardiac reconstructions. The maximum side ratio is then 1:8.

If you use the non-square matrix and you extend the side length of your FoV more then the max. ratio then the shorter side will be stretched to fit into the ratio again.

You will find the FoV displayed in the image text for the non-square matrix. It will be displayed like this: FoV X x FoV Y.

Case Examples for 3D Recon and Non-Square Matrix

Some scan protocols are delivered with predefined oblique and non-square matrix reconstructions. These protocols are marked with the suffix “VOL”.

- *Coronal and sagittal reconstruction of the spine:*
  - Scan a topogram
  - Plan your axial spiral scan range
  - Reconstruction of the spiral images (RTR/RTD images)
  - Select **Recon job Type** sagittal/coronal
  - Select the axial image segment
  - Press button **Set FoV Segment**
  - Select the Matrix size for example, non-square 512 and adjust the FoV to your needs.
  - Define your desired reconstruction parameters (e.g., image type SPO)
  - Start reconstruction
  - Repeat the reconstruction steps for the other orientation (sagittal/coronal)
- *Oblique reconstruction of the carotid:*
  - Scan a topogram
  - Plan your spiral scan range
  - Axial reconstruction of the spiral images (RTR/RTD images)
  - Select **Recon job Type** oblique
  - Select the coronal image segment
  - Enable **Free Mode**

- Rotate the reference lines until the best view on the sinuses is displayed in one of the other segments
- Select this segment and press button **Set FoV Segment** button
- Select the Matrix size for example, non-square 512 and adjust the FoV to your needs
- Define your desired reconstruction parameters (e.g., image type SPO)
- Start reconstruction

• *Double-oblique reconstructions of the heart*
For detailed information on heart reconstructions please refer to your **"Cardiac CT"** Application Guide.

Study Continuation

An existing study can be continued at a later time.

To load an existing study:

- Select the desired study in the **Patient Browser**.
- Select **Register** from the **Patient** drop-down menu.
- The patient data is loaded in the **Registration** dialog box.

The previous scan protocol is already preselected, but it is also possible to select any desired scan protocol.

After the patient has been registered, the patient is loaded into the **Examination** card.

The ranges already scanned are listed. The following chronicle entry is shown between the ranges already scanned and the new ranges: **Exam Continue <Patient Position>**.

If you want to continue a contrast media study, the system asks you if the next scan should be continued as a non-contrast scan instead.

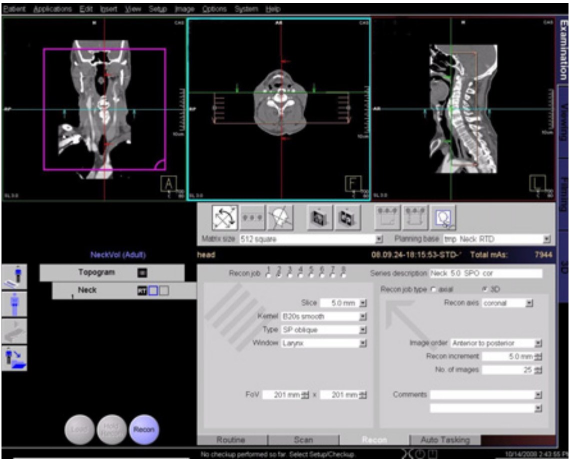
- If you want to continue as a non-contrast scan, the chronicle entry for the new scan range is indicated as a non-contrast scan. (No injector symbol is shown.)

If you continue a study as a contrast study, the chronicle entries of the new scan range are indicated as a contrast scan. (An injector symbol is shown.)

Reconstruction on the *syngo* CT Workplace

It is possible to start all reconstructions from your satellite console.

- Raw data has to be available in the local database
- Select the raw data series of the patient in the Patient Browser and load it into the **Recon** card
- Plan your recon jobs as usual



Examination Job Status

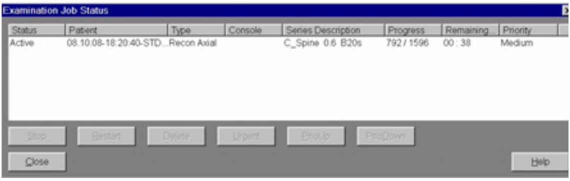
You can get an overview of all recon jobs by clicking on the **recon** task symbol in the status bar or selecting **Transfer – Examination Job status** in the patient main menu in the Patient Browser.

The **Examination Job Status** dialog box will appear where all recon jobs (completed, queued and in work) are listed. You can stop, restart and delete each job by clicking the according button. To give a selected job a higher priority click **urgent**.

The column **Type** shows you which kind of reconstruction is queued.

Two types are displayed:

- **Recon**
  all recon jobs from the **Recon** card, either on the *syngo* Acquisition Workplace or *syngo* CT Workplace.
- **Auto 3D**
  all 3D reconstructions which you have send via **Auto postprocessing** automatically into the **3D** Card. These jobs will be deleted from the job list as soon as the patient is closed in the **3D** card.



Auto Load in 3D and Postprocessing Presets

You can activate the **Auto load in 3D** function on the **Examination** task card/**Auto Tasking** and link it to a recon job, for example, the 2nd recon job with thinner slice width in some of the examination protocols. If the post-processing type is chosen from the pull-down menu, the reconstructed images will be loaded automatically into the **3D** task card on the ***syngo* Acquisition Workplace** with the corresponding post-processing type.

On the **3D** task card you can create parallel and radial ranges for Multi-Planar-Reconstruction (MPR) and Thin Maximum-Intensity-Projection (MIP Thin), which can be linked to a special series.

For example, if you always perform sagittal MPRs for a spine examination, as soon as you load a spine examination into the **3D** task card, select the image type (MPR), orientation, and open the Range Parallel function. Adapt the range settings (image thickness, distance between the images etc.) and click the link button and save your settings. You now have a predefined post-processing protocol linked to the series description of a spine examination.

The same can be done for VRT presets. In the main menu under **Type > VRT Definition**, you can link VRT presets with a series description.

Some of the scan protocols, primarily for Angio examinations, are already preset in the protocol with Auto load in 3D. If you prefer not to have this preset, deselect the Auto load in 3D and save your scan protocol.

Some of the scan protocols are preset in the protocol with links to a post-processing protocol. If you prefer not to have this preset, please delete the Range Parallel preset or overwrite them with your own settings.

Workflow

Patient Position

A default patient position can be linked and stored to each scan protocol. The SIEMENS default protocols are already linked to a default patient position.
(Head first - supine)

If a scan protocol is selected and confirmed in the **Patient Model Dialog**, the linked patient position stays active until the user changes it, even if a scan protocol with different patient position is selected.

Auto Reference Lines

The **Auto Reference lines** settings defined in the Patient Model Dialog can be linked and saved to each scan protocol.

If a scan protocol is selected and confirmed in the **Patient Model Dialog**, the linked **Auto Reference lines** settings stay active until the user changes them, even if a scan protocol with different **Auto Reference lines** settings is selected.

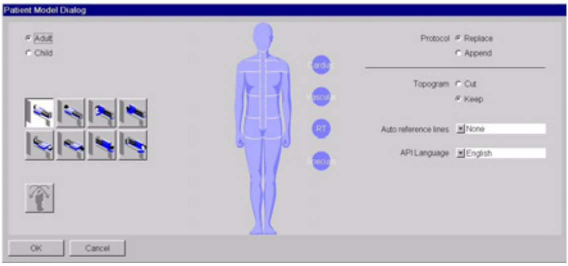
Navigation within the Topogram

Navigation within the topogram helps you to plan a reconstruction range. The minimum conditions for its use are a scanned range and the availability of RTD (Real time display) images. After scanning, an orange line is displayed within the topogram. This line corresponds to the axial image in the tomo segment.

- If you scroll through the axial image stack, the orange line in the topogram is displayed as a reference line to the currently displayed axial image in the tomo segment.
- If you change the reconstruction begin or end, the orange reference line automatically jumps to this new position and the axial image in the tomo segment will be updated accordingly to the newly selected position.
- If you move the whole recon box in the topogram, the orange reference line automatically jumps to this new position and the axial image in the tomo segment will be updated accordingly to the newly selected position.

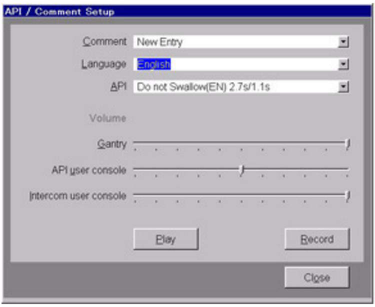
API Language

The API language can now be selected directly in the **Patient Model Dialog**.



When the API language is selected, only the relevant, language specific API entries can be selected in the **Scan** subtask card, thus increasing the ease of selection.

Before recording a new API text, first define the API language in the API setup dialog under **Setup > API/Comment Setup** in the main menu.



E-Logbook

E-Logbook offers an effective and efficient functionality to process patient examination information.

The **E-Logbook** consists of three components:

- The **E-Logbook Configuration**
- The **E-Logbook** subtask card area
- The **E-Logbook Browser**, where all examinations can be listed for viewing, sorting, searching and printing

E-Logbook Configuration

You will find the **E-Logbook Configuration** under **Options > Configuration > E-Logbook Configuration**.

The configuration is divided into three tab cards:

- General
- System Entries
- Manual Entries

Under **General** you can activate and deactivate the **E-Logbook**, as default the **E-Logbook** is activated. If the **E-Logbook** is deactivated, no patient information is recorded.

If you do not want to have the **E-Logbook** displayed in the subtask area you can switch it off, even though the system entries will be recorded.

Additionally you can select a **Default printer** from a drop down menu.

Default Time period allows you to determine how the examination will be listed inside the **E-Logbook Browser**:

- Today (which is the default setting)
- This week
- This month
- This year
- Yesterday
- Last week
- Last month
- last year

Any changes can be saved by selecting **"Apply"**.

System Entries and **Manual Entries** you wish displayed in the **E-Logbook** can be configured on the **Manual Entries** tab card. **System Entries** are automatically populated by the system and displayed in the **E-Logbook** as read-only (if configured).

Default settings are:

- Date of Examination
- Patient Name
- Patient ID
- Date of birth
- Scan Protocol Name
- Total mAs

The **Continuous Number** field is an incremental number to mark each recorded study within a defined time range. In addition the **Start No**. can be set to ensure for example an ongoing numbering after a software update.

Furthermore the **Continuous Number** can be set to:
- **Daily**
- **Monthly**
- **Yearly**

If you set **Continuous Number** to **Daily**, the continuous number starts with one each day.

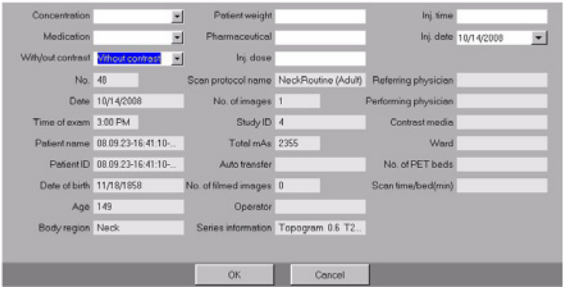
Additionally, the user can define specific **Manual Entries** which can be selected in the **E-Logbook** as a drop down menu option.

To configure new entries of the drop down menu for each **Manual Entry**, just type the desired information inside and click on add.

To remove already existing entries, just select the entry and click on delete.

Additionally you can customize up to five **Manual Entries** fields. If you want to rename the customized entry fields type select **Rename**.

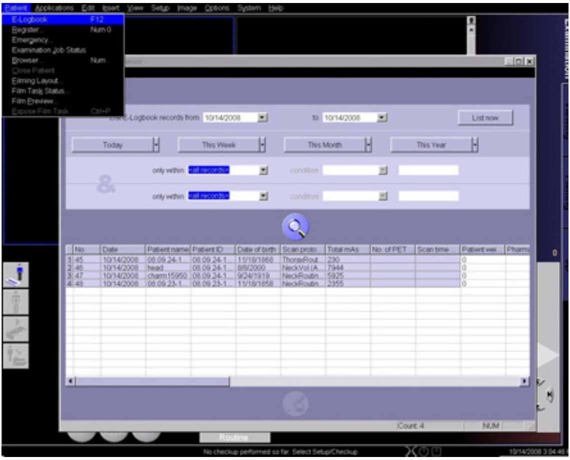
E-Logbook Subtask Card Area



When you close the current patient examination, the **E-Logbook** subtask area will appear. All configured system entries (which cannot be changed) as well as all Manual Entries (which can be edited) will appear. Click "ok" to finish and "cancel" to return to the examination.

E-Logbook Browser

You will find the **E-Logbook Browser** in the main menu under **Patient > E-Logbook browser** or you can use **F12** key on your keyboard**.**



You can list the **E-Logbook** recordings by date. Select your desired timeframe in the calendar and click **List now**.

If you want to list the **E-Logbook** recordings from today, click on **today** and the recordings will be displayed immediately, no confirmation is needed.

A shortcut to yesterday’s recordings is accessible over the black arrow on the right side of the **Today** button.

The system behaves the same if you want to list the recordings from **This Week/Last Week**, **This Month/Last Month** and **This Year/Last Year**.

Additionally, a more refined search can be accomplished from criteria defined for all entries recorded inside the **E-Logbook**.

For example, the entry **Number of images** is recorded. A search for datasets which have a certain amount of images can be defined.

Additional conditions can be defined in this case:

- **is greater than**
- **greater or equal**
- **is less than**
- **less or equal**
- **equals**

The conditions vary with the selected search criteria.

The **only within** drop-down menus contain **System** and **Manual Entries** you have configured before.

The list can be exported:

- Select from the main menu **File > Export**.
- A **Save As** dialog pops up.
- The list will be automatically exported to **H:\Site-Data\E-Logbook**.
- A file name can be given.

The number of columns inside the displayed list depends on the configurations under **Options > Configuration > E-Logbook > System/Manual Entries**.

Hints for the Record List:

1. Calling up **Patient Browser**

When you double click on any record in the **E-Logbook Browser**, the patient data of the **Patient Browser** will be opened, if still available and the customer has the chance to edit the patient information. This change will also be updated inside the **E-Logbook**.

2. Updating the **Recon List**

The **E-Logbook** is updated automatically when the examination data has changed within the **Patient Browser** with **Correct** and **Rearrange**. Patient name, date of birth, patient ID and study ID will be updated automatically.

3. Sorting data within the **Record List**

You can decide if the data in the **Record List** should be listed in ascending or descending order. The default sorting order is ascending. Just click on the column head and a small arrow will appear, clicking on it will change the sorting order.

4. Resizing and reorder the columns

It is possible to reorder the table columns by drag and drop the column head. For resizing the columns you just have to move the vertical column lines together.

5. Modify **Manual Entries**

Make a right mouse click into the cell and modify the information to your needs. The cell background color will be changed to green as an indication. Click on the enabled **"Apply"** button, then the changes will be applied to the database and the cell background color will be white again.

Scan Protocol Creation

You can modify or create your scan protocols in two different ways:

- by editing/saving scan protocols
- via Scan Protocol Assistant.

Edit/Save Scan Protocol

If you want to modify an existing protocol or create a new one, for example, you want to have two **Abdo-menRoutine Protocols** with different slice widths, we recommend you do this directly on the **Examination** task card.

User-specific scan protocols can be saved with the following basic procedure:

- Register a patient, you can choose any patient position in the **Patient Model Dialog**.
- Select an existing scan protocol in the **Patient Model Dialog**.
- Modify the scan protocol, change parameters, add new ranges etc. to adapt the new protocol to your requirements.
- Scan your patient as usual.
- Check that all parameters are as you desire.
- Select **Edit/Save Scan Protocol** in the main menu.
- Select the folder where you want the new protocol to appear and the scan protocol name in the pop-up dialog box.
- You can either use the same name to overwrite the existing scan protocol or enter a new name, which will create a new protocol name and will not alter any of the existing protocols already stored.
- If you want to save an "old" protocol again, you may have to modify the protocol name. The old protocol (with the old name) must be cancelled explicitly.

Additional important information:

- You can save your scan protocol at any time during the examination.
- It is recommended that you save your own scan protocol under a new name in order to avoid overwriting the default scan protocol.
- Do not use special characters or blanks. Allowed are all numbers from 0 to 9, all characters from A to Z and a to z and explicitly the _ (under-score), but no country-specific characters, for example, à, ê, å, ç, ñ.
- Do not rename scan protocol files at Windows level. This will lead to inconsistencies.
- You can now save your own scan protocols in any pre-defined folder. The organ characteristics will belong to the scan protocol, not to the region.
- In the **Patient Model Dialog**, the modified scan protocols are marked by a dot in front of the protocol.

Scan Protocol Assistant

If you want to modify special parameters for several existing scan protocols or you want to modify the folder structure, we recommend doing this in the **"Scan Protocol Assistant"**.

You will find the **Scan Protocol Assistant** under **<Options - Configuration>** in the main menu.

Step 1 - What do you want to do?

Six different operation types are possible:

- Manipulate Scan protocols (cut, copy, paste and delete)
- Change parameters
- Import user scan protocols
- Export scan protocols
- Update Siemens protocols
- Restore scan protocols to Siemens default

Additional important information

- Each workflow consists of up to five steps, indicated by the footprints.
- Depending on the workflow step, you can list all scan protocols or selected scan protocols.
- The selection **"Change parameters"** is preselected as default.
- Depending on the selected workflow, the **Scan Protocol Assistant** leads you through the corresponding steps.
- Within the "Change parameters" workflow, an **<Undo>** and **<Redo>** button are added. Both buttons only affect the last operation.

Manipulate scan protocols

This workflow consists of four steps.

Step 2 - Manipulate scan protocols (cut/copy/paste/delete)

Protocols can be cut, copied, pasted or deleted here. Simply right mouse click on the desired protocol to be manipulated. A menu will appear to make your selection.

To remove selected protocols, click on the "Remove selected protocols" button on the bottom of the screen.

You can move a protocol from one folder and place it in another folder by right mouse clicking on the protocol, selecting "cut" and pasting it in another folder. Consequently, you can copy and paste a desired protocol into multiple folders at once.

Adult and **Child** protocols are manipulated separately.

Setting the Emergency Protocol:

One protocol must be labeled as the **emergency** protocol, if you want to change the default **emergency** protocol you have to select the desired protocol and click onto the **Emergency** icon. An Application Restart is necessary to set the new default **emergency** protocol.

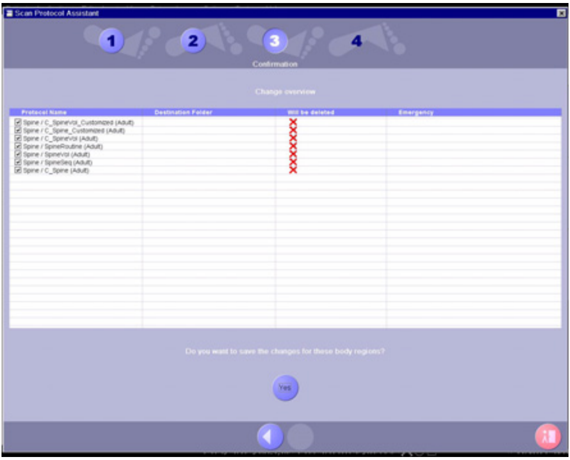
The emergency protocol is displayed with the **Emergency** icon in front of the protocol name. This protocol cannot be deleted.

Step 3 - Confirmation

Here you can check the modifications and save the changes. All relevant information such as the names of the manipulated scan protocols, destination Folder, names or deleted protocols and the changed **Emergency** protocols are displayed inside the **Change overview** panel. By deselecting the checkbox before a protocol name, you will be able to cancel all actions related to this protocol.

Step 4 - Changes saved

In this step you will have the option to make more changes or exit the **Scan Protocol Assistant**.



Change parameters

This workflow consists of five steps.

Step 2 - Select the scan protocols you want to change

Here you can select:

- scan protocols with certain recon jobs
- all scan protocols with ECG
- all respiratory protocols
- all customized or Siemens scan protocols
- all scan protocols

Additionally you can choose in the protocol list:

- single scan protocol
- all scan protocols within a body region
- several body regions

Adult and Child protocols are managed apart.

Step 3 - Change parameters

In this step a second footprint section is added, consists of:
– Protocol
– Topogram
– Scan
– Recon
– Auto tasking
– Trigger

All scan protocols selected in Step 2 are displayed. For each parameter you can select the scan protocols you want to apply your changes. The **<Select All>** check-box is convenient for the user to select and deselect all scan protocols listed. If the parameter values in the selected rows are the same, the value will appear in the corresponding entry, otherwise if the parameter values in the selected rows are different, no value is displayed in the subsection.

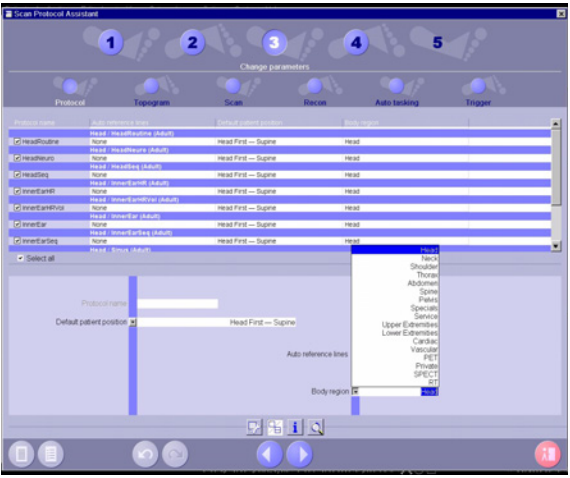
You can either change the parameter values in the sub-section area, or you can modify single parameter in the grid. By double clicking with the left mouse button in the parameters list grid, item’s value can be changed.

Protocol

Select single scan protocol or all scan protocols you want to modify in this subsection.

In the subsection Protocol the following changes can be made:

– Protocol Name
  This entry is only available in single protocol selection. Here you can rename your scan protocol.
– Default Patient Position
  Enter the patient position you want to have as default displayed in the **Patient Model Dialog**.
– Auto reference Lines
  Select where you want to display the Auto reference lines:
• On study level
• On series level
• None (the entry in the Auto tasking card cannot be selected)
– Body region
  Select in which body region the scan protocol should be saved and displayed in the **Patient Model dialog**.



The four buttons: **Column Configuration**, **Show/Hide Parameters**, **Parameter Property** and **Find/Replace** are now available.

– **Column Configuration**

With the column configuration you can include or exclude specific entries that will be displayed in the sub footprint line and also change the order of the entries with the drag&drop functionality.

– **Show/Hide Parameters**

You can decide if you want to show/hide the parameters in the parameter area of the selected protocols.

– **Parameter Property**

If you select a single cell you are able to get the parameter properties displayed as a minimum and maximum value together with the units and incremental steps.

– **Find/Replace**

For a fast and easy handling you can search for certain values and replace them with the desired value.

If you have selected for example the columns mAs, Recon increment, Auto filming, Auto transfer CD/DVD, Auto transfer Node a so called "**Function**" area will be accessible and over a drop down menu task specific instructions are selectable.

Topogram

Select single scan protocol or all scan protocols you want to modify in this subsection.

In the subsection "Topogram" the following changes can be made:

- mA
  Set the mA value for the topogram.
- Topogram length
  All available topo lengths are listed in the dropdown list.
- Tube position
  Set the tube position either to *Top Bottom* or *Lateral*.
- kV
  Can be defined individually to the Scan value.
- Auto **Viewing** and **Filming**
  Loads images automatically into the Viewing or Filming card.
- API
  Select one of the predefined breathing commands from the dropdown list.
- Direction
  Select *Head to Feet or Feet to Head* from the dropdown list.
- It is possible to append or remove the topogram by using right-click on a protocol entry in the parameter grid, a context menu should pop up, you can select "Append Topo" or "Remove Topo"

Scan Protocol Assistant
1
2
3
4
5
Change parameters
Protocol
Topogram
Scan
Recon
Auto tasking
Trigger
Select all
mA
Topogram length
Tube position
Top
Bottom
Lateral
kV
Auto viewing
Auto filming
API
Direction
None
Craniocaudal

Scan

Select single scan protocol or all scan protocols you want to modify in this subsection. Additionally you can select the scan mode entries:
– **Sequence**
– **Spiral**
– **Multiscan**
– **CAREVision**

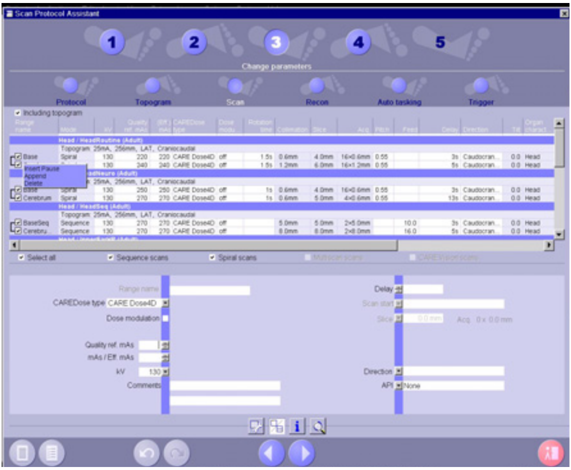
The displayed parameters depend on the selection you have made.

- If no special scan mode is selected, the so called mixed mode is active. The mixed mode means the user can choose scan ranges from different modes(**Spiral**, **Sequence**, **Multiscan**, or **CAREVision** modes). If the control in one mode is not applicable, the control in mixed mode is not shown in **<Parameters Area>**.

A checkbox **<Including topogram>** is shown above the parameter grid. When the checkbox is selected, an information line is added to the parameter grid. The line is placed immediately before the ranges belonging to the topogram. The information line shows the topogram parameters.

It is possible to append or delete scan ranges. Right-click on the protocol entry in the parameter grid and a context menu will pop up. There are 4 options:

- Append: the protocol entry is copied to the end of the protocol. A pause will always be inserted before the appended scan entry.
- Delete: the selected range will be deleted.
- Remove Pause: insert the Autorange brackets in a selected Multi Range and remove the pause from the protocol.
- Insert Pause: put a pause into your selected ranges so you are scanning the ranges separately.

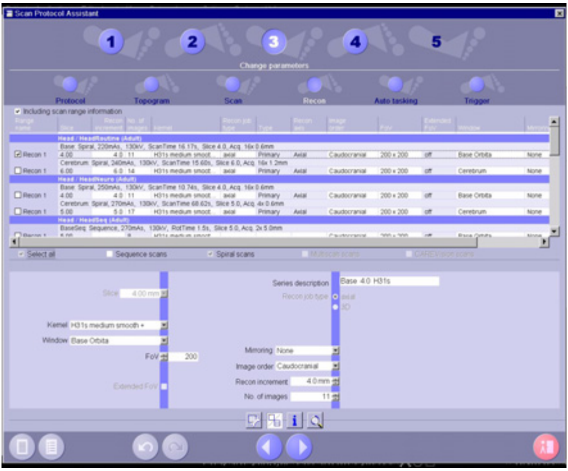


Recon

All recon job entries (Sequence, Spiral, Multi-scan, CAREVision Scan, Axial recon jobs and 3D recon jobs) can be selected which need to be modified in this sub-section. Of cause, single recon jobs can be selected from the list. Additionally, information about the scan range can be displayed.

- When <**Include scan range information**> is selected, information line pertaining to each scan range is displayed before each recon job within the scan range.
- If no special scan mode is selected, the "mixed" mode is active. The "mixed" mode allows you to choose scan ranges from different modes (**Spiral**, **Sequence**, **Multiscan**, or **CAREVision** modes) simultaneously. If the control in one mode is not applicable, the control in mixed mode is not shown in <**Parameters Area**>.

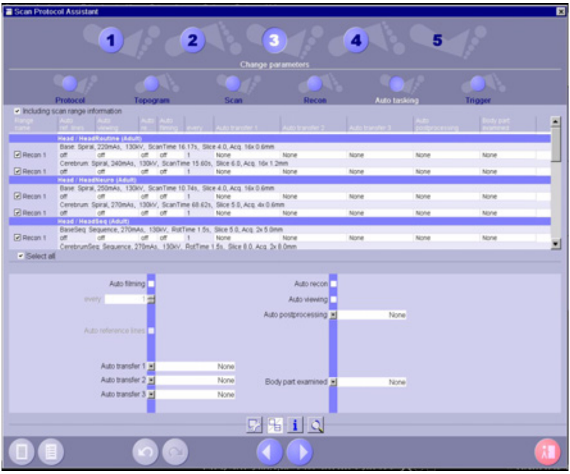
It is possible to append or delete recon jobs. Right click on a protocol entry to be deleted/appended to display a context menu. At least one axial recon job must remain.



AutoTasking

Select single recon job or all recon jobs you want to modify in this subsection. Additionally you can display information about the scan range:

- When "include scan range information" is selected, an information line for each scan range is listed before the recon jobs belonging to this scan range.



In the subsection Auto Tasking the following changes can be made:

Auto transfer 1, 2, 3

Auto Viewing

Auto Recon

Auto Filming

Auto Postprocessing

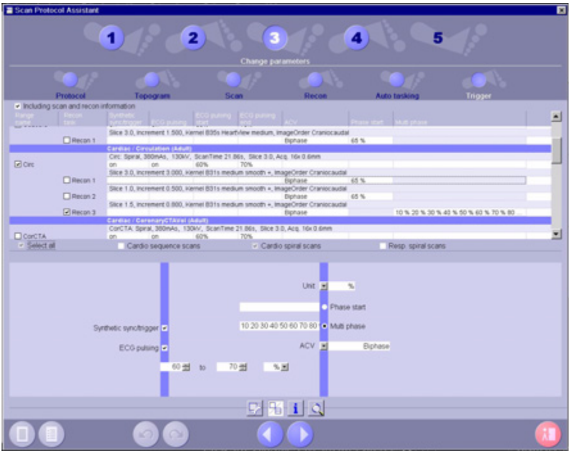
Auto Reference lines (only if selected in the protocol)

Body Part Examined

Trigger

Select single, all, all Cardio sequence, all Cardio spiral or all Resp. Spiral scan protocols with trigger.

- When "include scan range and recon information" is selected, an information line for each scan range and reconstruction is listed before the recon jobs belonging to this scan range.



Some parameters listed are associated with each other. If you input a value which influences another value and therefore causes a conflict, the influenced parameter values are auto corrected and displayed in green. If an invalid protocol is loaded, the parameters with the incorrect value will be highlighted in yellow. If you insert incorrect values these will be marked in yellow and will be auto corrected. All the values will be adjusted after the first change is made.

State	Color
valid	*white*
changed & valid (after an action)	*green*
invalid	*yellow*
read only	*gray*

Step 4 - Confirmation

In this step, the selected protocols are listed with both "old" and "changed" shown. You have the ability to deselect the checkbox in order to cancel modification.

Step 5 - Changes saved

In this step you will have the option to make more changes or exit the **Scan Protocol Assistant**.

Import user scan protocols

In this workflow, you have the ability to import scan protocols from another scanner, provided it is the same scanner and software version. These protocols are pre-defined in package "UserProtocol.ar". The Scan Protocol Assistant is capable of handing this type of file which is imported from a source medium (floppy, CD/DVD or USB device) to H:\SiteData\ImportScanProtocols\ by the user. Generally, this file will be created by the export functionality of the Scan Protocol Assistant on another machine (see "Exporting user scan protocols" in pg.120).

This workflow consists of three steps:

Step 2 - Import scan protocols

Select desired protocols to be imported. Press "Import" to start the import process. The imported files will be named with the suffix "Customized".

Step 3 - Changes saved

In this step you will have the option to make more changes or exit the **Scan Protocol Assistant**.

Export scan protocols

Export operation allows user to export scan protocols in a packager "UserProtocol.ar". and stored in H: \Site-Data\ExportedScanProtocols in order to transfer them to floppy, CD/DVD or USB device. The functionality is available via Options, in the File Browser.

Step 2 - Select the scan protocols you want to export.

Here you can select:

- scan protocols with certain recon jobs.
- all scan protocols with ECG and Respiratory.
- all scan protocols with axial or 3D recon jobs
- all customized or Siemens scan protocols for modification
- all scan protocols

Additionally you can choose in the protocol list :

- single scan protocols
- all scan protocols within a body region
- several body regions

Adult and Child protocols are managed apart.

Step 3 - Confirmation

In this step, the exported protocols are listed in the Export Overview to be confirmed. Select "Yes" and the exported protocols are then exported and saved to disc. After exporting, a message box will pop up to inform user of the path where protocols will be saved.

Step 4 - Changes saved

In this step you will have the option to make more changes or exit the **Scan Protocol Assistant**.

Update Siemens protocols

In this workflow you can import new scan protocols from CD.

This workflow consists of three steps:

Step 2 - Import scan protocols

Follow the instruction on this page to import the scan protocols.

Step 3 - Changes saved

In this step you will have the option to make more changes or exit the **Scan Protocol Assistant**.

Restore scan protocols to Siemens default

This workflow consists of four steps:

Step 2- Select the scan protocols you want to restore to Siemens default.

In this workflow you can restore Siemens default scan protocols.

- Select what you want to do

Replace customized protocols with same name.

All selected modified scan protocols will be replaced with the Siemens default scan protocol. All changed protocols made by the user which are marked with a black dot in front will be lost.

Add Siemens protocols as duplicates

Customized scan protocols with the same name as original Siemens protocols will get a new name extension "(Customized)".

If there exists a scan protocol with this name, new copies are numbered, for example:

HeadSpi_(Customized).

HeadSpi_(Customized2).

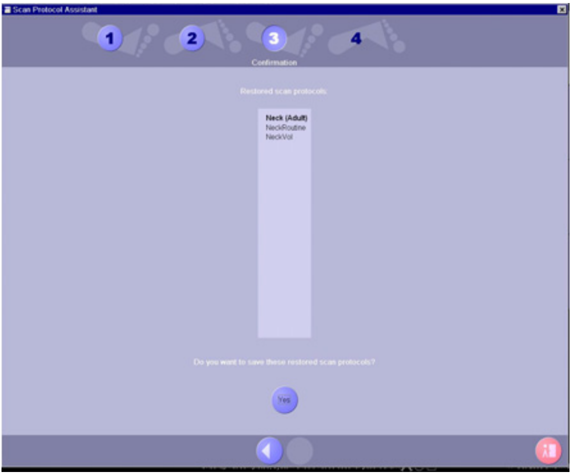
The original Siemens protocols will be copied in the corresponding body region folder.

If no customized scan protocols are selected, the radio buttons <**Replace customized protocols with same name**> and <**Add Siemens protocols as duplicates**> will be dimmed.

- Select deleted Siemens scan protocols
  - The <**Select Deleted**> checkbox is convenient for the user to select and deselect all deleted Siemens default scan protocols
  - The checkbox is in indeterminate state when some but not all deleted Siemens default scan protocols are selected in the region protocol lists.
  - The checkbox is disabled (dimmed) when there is no deleted Siemens default scan protocols.

Step 3 - Confirmation

In this step the changed protocols are listed (old and new Ones) and the changes have to be confirmed.



Step 4 -Changes saved

In this step you will have the option to make more changes or exit the **Scan Protocol Assistant**.

List all Scan Protocols and all selected Protocols

To list all available protocols, select the **List all protocols** icon in the lower left corner of any arbitrary step. Comparisons between Siemens default and customized protocols are possible with this table. You are able to print and export this sheet. When exporting the list, a .xml, .xslt and .css file are generated and saved under H:/SiteData/protocols.

To review or print these protocols:

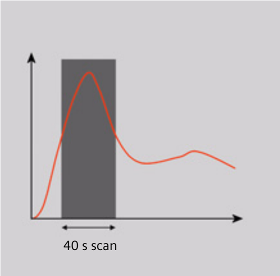
- Copy all these three files to another PC
- Right click the .xml file and select Open with from the right mouse menu and choose Microsoft Office Excel from the list
- The Import xml dialog box appears
- Enable the Open the file with the following stylesheet applied (select one) checkbox. (The correct stylesheet is usually already preselected)
- Click on Ok
- The scan protocol list opens for viewing and printing

The same can be done with all selected Protocols as well.

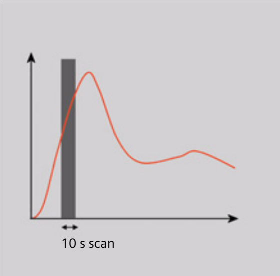
Contrast Medium

The Basics

The administration of intravenous (IV) contrast material during spiral scanning improves the tissue and lesion characterization, as well as the opacity of vessels. The contrast scan will yield good results only if acquisition is performed during the optimal phase of enhancement in the region of interest. Therefore, it is essential to initiate the acquisition with the correct start delay. Since multislice spiral CT can provide much faster speeds and shorter acquisition times, it is even more critical to get the right timing to achieve optimal results.



Longer scan time



Shorter scan time

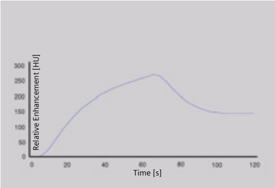
The dynamics of the contrast enhancement is determined by:

- Patient cardiac output
- Injection rate
- Total volume of contrast medium injected
- Concentration of the contrast medium
- Type of injection – uni-phasic or bi-phasic
- Patient pathology

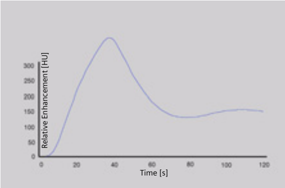
Aortic time-enhancement curves after i.v. contrast injection (computer simulation*).

All curves are based on the same patient parameters (male, 60-year-old, 75 kg).

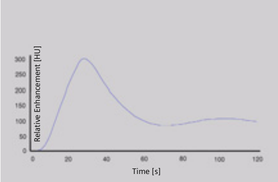
** Radiology 1998; 207:647 – 655*



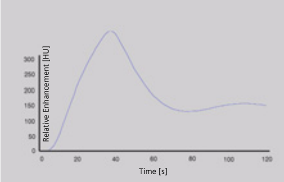
Injection rate: 2 ml/s,
120 ml, 300 mg I/ml



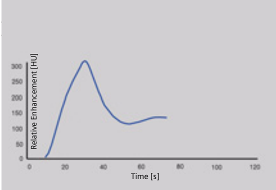
Injection rate: 4 ml/s,
120 ml, 300 mg I/ml



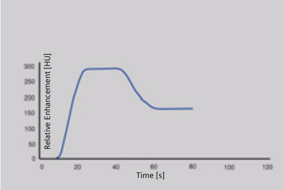
Total volume of contrast medium injected: 80 ml,
4 ml/s, 300 mg I/ml



Total volume of contrast medium injected: 120 ml,
4 ml/s, 300 mg I/ml



Type of injection: Uni-phase
140 ml, 4 ml/s,
370 mg I/ml



Type of injection: Bi-phase
70 ml, 4 ml/s,
plus 70 ml, 2 ml/s,
370 mg I/ml

IV Injection*

The administration of a contrast medium depends on the indication and on the delay times to be used during the examination. The patient's weight and circulatory situation also play a role. In general, no more than 3 ml per kg of body weight for adults and 2 ml per kg of body weight for children should be applied.

For a CTA study (arterial phase), the principle is to keep the contrast flowing throughout the duration of the scan. Thus, the total amount of contrast medium needed should be calculated with the following formula:

CM = (start delay time + scan time) x flow rate

CARE Bolus CT or **Test Bolus** may be used for optimal contrast bolus timing. Please refer to the special protocols.

To achieve optimal results in contrast studies, the use of **CARE Bolus CT** is recommended. In a case where it is not available, use **Test Bolus**. Once completed, load images into **DynEva** task card for calculation of **Time to Peak** enhancement.

For multiphase examinations, for example, three-phase liver, the maximum start delay can be set to 600 sec. The countdown of the delay always starts after scanning of the previous phase.

** For more information regarding the general use of drugs and doses mentioned in this guide please refer to page 2.*

Bolus Tracking

An automatic Bolus Tracking program is available which enables triggering of the spiral scanning at the optimal phase of the contrast enhancement.

Additional Important Information

1. This mode can be used in combination with any spiral scanning protocol. Simply insert **Bolus Tracking** by clicking the right mouse button in the chronicle. This inserts the entire set-up including pre-monitoring, i.v. bolus, and the monitoring scan protocol. You can also save the entire set-up in your own scan protocols.
2. The pre-monitoring scan is used to determine the position of the monitoring scans. It can be performed at any position of interest. You can also increase the mAs setting to reduce the image noise when necessary.
3. To achieve the shortest possible spiral start delay (2 s), the position of the monitoring scans relative to the beginning of spiral scan must be optimized. A **snapping** function is provided:

– After the topogram is performed, the predefined spiral scanning range and the optimal monitoring position will be shown.
– If you need to redefine the spiral scanning range, you should also reposition the monitoring scan in order to keep the shortest start delay time (2 s). (The distance between the beginning of the spiral scanning range and the monitoring scan will be the same).

– Move the monitoring scan line *toward* the optimal position and release the mouse button, it will be snapped automatically. (Trick: if you move the monitoring scan line *away* from the optimal position the **snapping** mechanism will be inactive).

4. Place a **ROI** in the premonitoring scan on the target area or vessel used for triggering with one left mouse click. (The ROI is defined by double circles – the outer circle is used for easy positioning, and the inner circle is used for the actual evaluation). You can also zoom in/out the reference image for easier positioning of the ROI.
5. Set the appropriate trigger threshold, and start contrast injection and monitoring scans at the same time.
   The relative enhancement of the target ROI will be displayed for the duration of the monitoring scan. When the predefined density is reached, the spiral acquisition will be triggered automatically.
6. You can also initiate the spiral any time during the monitoring phase manually – either by pressing the **START** button or by left mouse clicking the **START** radio button. If you do not want to use automatic triggering, you can set your trigger threshold number extremely high so that it will not trigger automatically and start the spiral when you want to.

Test Bolus using CARE Bolus

You can use the CARE Bolus option as a **Test Bolus**.

Method

1. Insert a **Bolus Tracking** via the context menu prior to the spiral.
2. Insert **contrast** from the context menu.
   Note: By inserting **contrast** you are interrupting the **Auto range function** preventing an automatic start of the spiral.
3. Start with the topogram.
4. Position the premonitoring scan and the spiral.
5. Perform the premonitoring scan, position and accept the ROI.
6. Start the monitoring scans and a small amount of contrast medium (20 ml/2.5 ml/sec.). The rate of the injection on the monitoring scans should match the rate of injection used for the spiral scan.
   Note: When you start the spiral manually, the system switches to the **Trigger** tab card. The trigger line is not shown at this stage.
7. Now you can read the proper delay from the **Trigger** tab card.
8. Insert the delay in the **Routine** tab card and load the spiral.
9. Start the spiral and injector at the same time with the appropriate amount of contrast for the study being performed.

Test Bolus

This is a low dose sequential protocol without table feed used to calculate the start delay of a spiral scan to ensure optimal enhancement after the contrast medium injection. The ***syngo*** **Dynamic Evaluation** function may be used to generate the time density curve. You will find the **Test Bolus** scan protocol in the chapter **Specials**.

Method

1. Select the spiral mode that you want to perform and then **Append** the **Test Bolus** mode under **Special** protocols.
2. Insert the **Test Bolus** mode above the contrast spiral scan of interest using **cut/paste** (with right mouse button).
3. Perform the topogram and define the slice position for the test bolus.
4. Check the start delay, number of scans, and cycle time before loading the mode.
5. A test bolus with 10 – 20 ml is then administered with the same flow rate as during the subsequent spiral scan. Start the contrast media injection and the scan at the same time.

6. Load the images into the **DynEva** task card and determine the time to peak enhancement. Alternatively, on the image segment, click **select series** with the right mouse button and position an ROI on the first image. This ROI will appear on all images in the test bolus series. Find the image with the peak HU value, and calculate the time **delta t** taken to reach the peak HU value (do not forget to add the preset start delay time). This time can then be used as the optimal start delay time for the spiral scan.

CARE Contrast

With the injector coupling, the bolus injector can now be connected to your CT scanner.

Key features

- Synchronized scanning and contrast injection
- One button control from the CT-console and from the injector
  - The scan start can be initiated by the injector and also by the CT scanner, without having to press both start buttons at the same time.
  - The start by the CT can also be done via the foot switch.
  - The start of the CT scanner, including the start delay can be initiated also by the start button at the bolus injector.

The injector and the CT have to be coupled explicitly. You can store protocols where the injector coupling is selected.

Workflow

To start a contrast enhanced examination in coupled mode:

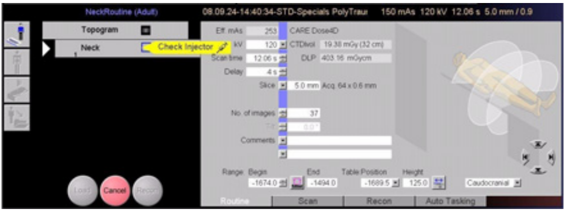
- Select the **Scan** subtask card.

- Select under the menu field **Scan Start** either the entry **Injector coupled (Start button)** or the entry **Injector coupled (Footswitch)**
  – Injector coupled (Start button): The **Start** button of the CT scanner will start the injector.
  – Injector coupled (Footswitch): The footswitch of the CT scanner will start the injector.

If an injector is connected, load the scan mode first and then arm the injector.

Depending on the injector it might be not possible to arm the injector before the scan protocol is loaded (see User manual of the injector). When the mode is loaded, the CT scanner will ask you to check the injector and to arm it. Check the parameters at the injector side and confirm the parameters. The injector is armed and ready for the examination.

Note: If the scan mode is unloaded the injector will also be disabled.



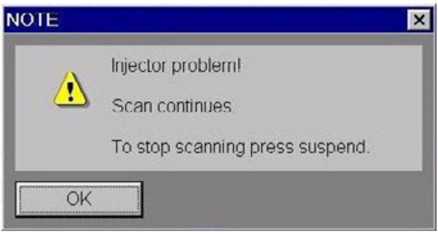
After the Injector is armed the scan and the injector can be started by pressing either the **Start** button/ Footswitch at the scanner, or the **Start** button at the injector panel outside of the scan room or directly at the injector inside the scan room.

Note: If the Injector is not ready the scan cannot be started. If both systems are ready to START and the user disarms the injector, the bubble **Check Injector** is shown again.

Additional Important Information

- If **Coupled Mode** is selected the CT checks if there is an injector available.
  The scan mode cannot be loaded if a connection cannot be established or if the injector does not accept coupling (The injector will not accept coupling while injecting).
  A message appears: Injector is not connected.
- Scanning interrupted
  If the injector does not accept the START from the CT the scan mode is cancelled.
  If the scanner is suspended by the user or if technical problems occur, the injector will be stopped too.
- Injector stopped
  If the injector is stopped by the user the scan will be stopped too.
  If the injector is interrupted, by pressing the **Hold** button the scan will be continued.

The injector reports a technical problem:
The connection between scanner and injector is interrupted, or the injection was stopped due to technical problems. In this case the scan continues and an error message pops up.
The user can decide if he wants to stop the scan or if he would like to continue.

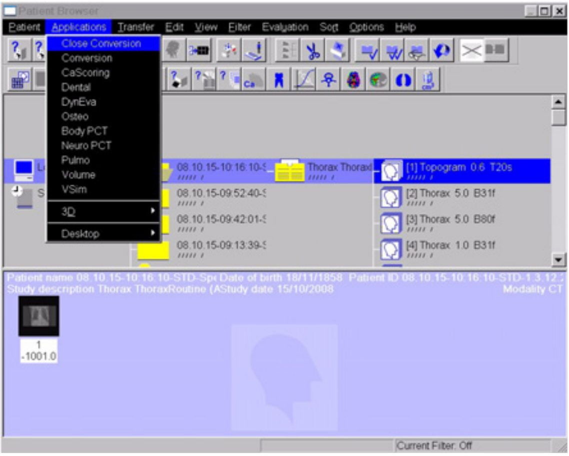


- If the injection is longer than the CT scan, the CT scanner does not stop the injection.
  A new scan mode can be loaded. If the new mode is a coupled mode, the scan can only be started if the injector is ready.
- When a coupled range is pasted or repeated, the start condition for the new scan is reset to uncoupled.

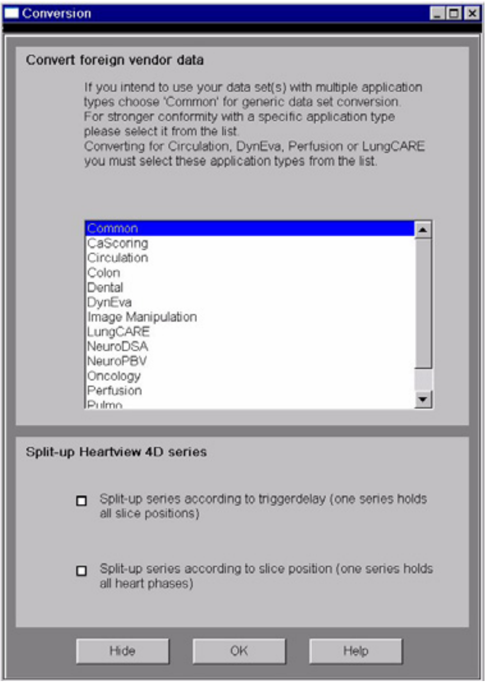
Image Converter

The CT application Common DICOM Adapter can convert different DICOM data sets to formats provided by other CT vendors.

– You will find the converter in the **Applications** menu of the **Patient Browser**.



In the pop-up window you can select the application for which you want to convert the images.



Split-Up Multi-Phase Series

1. Select **Split-up series according to trigger delay** from the section **Split-up Heartview 4D series**, if you intend to split-up the series of multi-phase heart reconstruction according to the different heart phases included.

Or

2. Select **Split-up series according to slice position** to split up the series according to the different slice positions it contains.

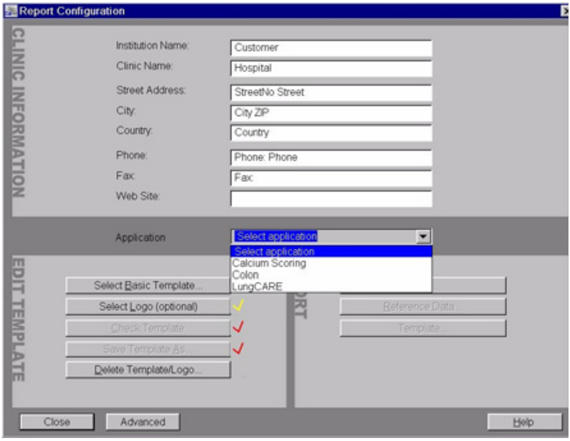
After conversion you can load these data sets into the application of your choice.

Report Template Configuration

Under **Options/Configuration** you will find the **Report Template Configuration**.

With the **Report Configuration** you can edit the basic information, e.g., clinic information for your report templates of the applications:
– ***syngo* Calcium Scoring**
– ***syngo* Colonography CT**
– ***syngo* Lung CARE CT**
– ***syngo* Circulation**
– ***syngo* Oncology**

Additionally you can insert your logo and select which reference data you want to use.



File Browser

The File Browser provides you with a secure means of accessing and managing data in a private folder, which is a well defined part of the computer file system. This user partition is strictly separated from the system operating file system.

The user partition is shared read only and may be used for transferring data from the scanner to other computers, for example, transferring DICOM images (export to offline), or transferring AVIs.

Key Features

- Copy images and files to the CD Burn folder.
- Raw data transfer.
- Access to all created reports and movies (AVI files).
- Access to the offline folder.
- Access to downloaded files.

Open the File Browser via main menu entry: **Options > File Browser**.

The File Browser provides special folders for CT applications. The created reports and movies are saved within these folders.

With an external PC connected you can access your offline data on the external PC for post-processing.

***Raw data transfer*:**

Raw data set can be transferred.

First configure the directory where the raw data should be transferred to:

- Open the File Browser.
- Choose the desired directory from the navigation tree to the left of the File Browser.
- Select the item **Set as Export Root** from the **CT Data Transfer** drop down menu.
- Select the raw data files you want to transfer in the content area of the Patient Browser.
- From the browser open the **Patient** main menu and select the item **Transfer CT Data**.
- The raw data includes the ECG file.

Transfer files to USB storage device:

- Insert an USB memory device into the USB port.

A new folder is added to the File Browser:
"USB storage device (F:)"

- Select the desired files and send them via the right mouse button menu to the USB storage device.

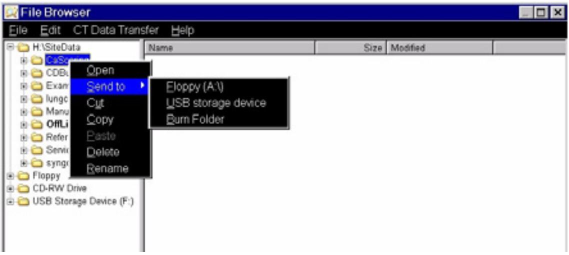
***Transfer files to floppy*:**

- Select the desired files and send them via the right mouse button menu on a floppy disk.

***Burn on CD*:**

- Do not write files to CD-R while other jobs are being transferred.
- Make sure that the volume of data to be recorded does not exceed the CD-R storage capacity.
- Select the desired files and copy & paste or drag & drop them into the folder **CDBurn** (or send them via the right mouse button menu to the folder **CDBurn**).
- Open the **LocalJobStatus** in the Patient Browser and clear all entries.
- Select **Record to Offline** in the **Transfer** menu of the Patient Browser.
- CD writing starts.
  Hint: Offline files can only be written to CD in a single session.

When recording is successfully completed the entries in the subdirectory CDBurn will be deleted automatically.



***Review reports and movies*:**

- Select the desired files and double-click on them.
- The corresponding program, for example, Movie Media Player, will be opened and you can review what you have saved.
- You can now transfer these files to floppy disk or copy them onto a CD.

Additional Important Information:

- Files with the following extensions cannot be started/ opened from the File Browser **“bat“, “cmd“, “com“, “exe“, “reg“, “dot“, “htm“, “html“, “pl“, “vbs“, “js“, “wsf“, “wsh“, “xml“.**
- To transfer avi files from the File Browser to any external storage device, for example, CD or USB stick, use RMB menu **Send to**.

Camtasia

Camtasia is a separate software tool that allows you to film your desktop activities. You can save these recordings as avi files for documentation and presentation purposes.

Key features

- Camtasia Recorder: to capture avi files.
  Before starting recording you can select the area you want to capture.

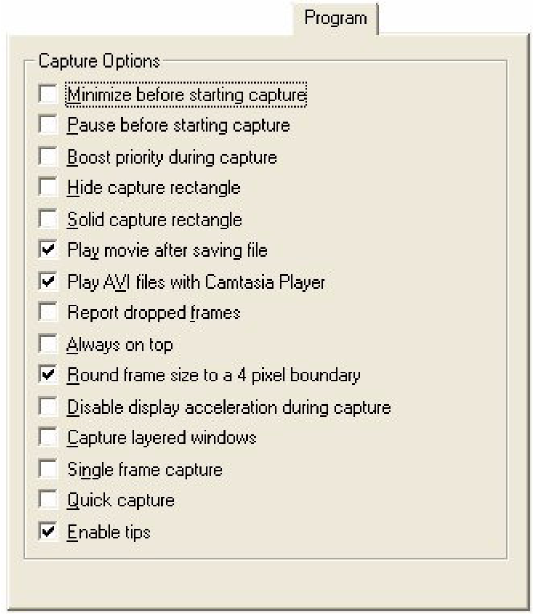
- Camtasia Player: to play avi files
- Camtasia Producer: to edit avi files

To open the **Camtasia** tool, select in the main menu **Application > Desktop > Camtasia Recorder**.

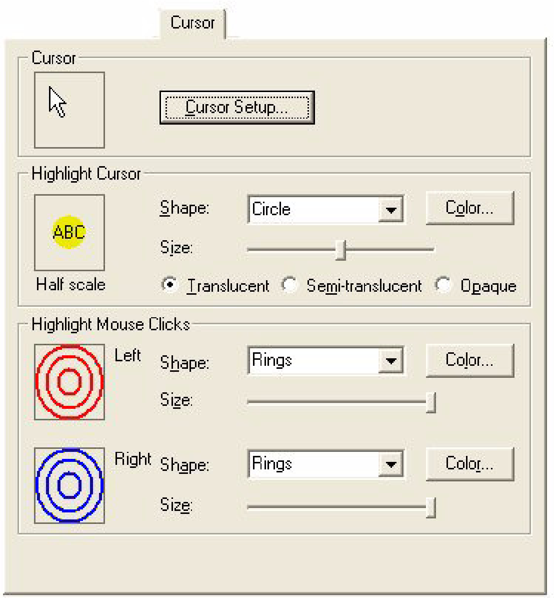
Under **Tools > Options** you can define special settings for recording:

- AVI – to define Video and Audio options
- File – to define the output options (files and folders)
- Hotkeys – to define special hotkeys, e.g., for start/ stop recording
- Live – to define live source options

- Program – to define capture options

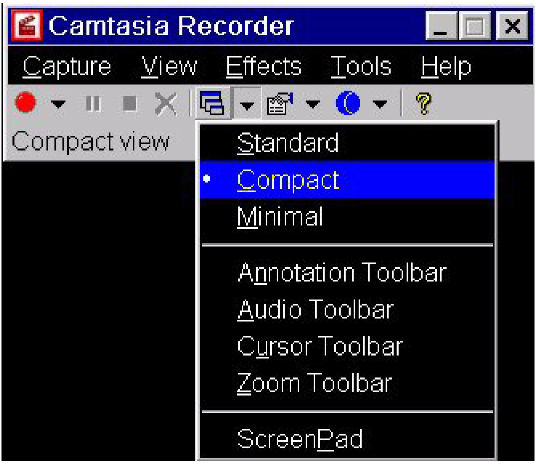


The **Effects Options** dialog allows you to set options for your recording, e.g., cursor effects.



Additional Important Information

- To transfer avi files from the file browser to any external storage device, for example, CD or USB stick, use RMB menu **Send to**. Drag & drop and copy/paste to any storage device are not possible within the File Browser.
- To display the main menu, set **ToggleView - Compact**.



- AVI files can only be played on the ***syngo* CT Workplace**.
- For further information on how to operate the **Camtasia** tool, please refer to the **Help** menu.

Patient Protocol

Scan	number of scan range
kV	kilo Volt
mAs	averaged applied mAs/eff. mAs of the range
ref. mAs	quality ref. mAs of the range
TI	Rotation Time
cSL	collimated Slice
$CTDI_{vol}$	$\frac{CTDIW}{\text{Pitch Factor}}$ Used phantom type: (a) -> 32cm (b) -> 16cm For further information please refer to the chapter “Dose Information“.
DLP	Dose Length Product $\frac{CTDI_{vol} \times (\text{length} + \text{collimated slice})}{10}$
Total DLP	DLP value of the entire examination
Total mAs	actual mAs value of the entire examination

Ward:
Physician:
Operator:

Total mAs 3007 Total DLP 870.99 mGycm

	Scan	kV	mAs / ref.	CTDIvol mGy	DLP mGycm	TI s	cSL mm
Patient Position H-SP							
Topogram	1	120				2.8	0.6
Head	2	120	380	59.66(b)	870.99	1.0	0.6

Phantom Type (a) 32cm (b) 16cm

Expert-i

The *syngo* Expert-i software enables:

- Every user to access and use the *syngo* Workplace and its full range of functionality from any Expert-i client in the network. With the latest remote access capability called **Direct Login**, there is no longer a need for a local user at the workstation.
  - Direct Login
- Experts (e.g., physicians) to support local users at any *syngo* Workplace, via a single-session password.
  - Single Session

This remote access is handled via a suitable computer (remote computer) connected to the local network. The software provides full-screen display and allows the remote user to use all *syngo* Workplace functionalities like image viewing, filming, exporting data, 3D reconstruction, and data postprocessing.

Single Session Login

Experts (e.g., physicians) can support local users at any *syngo* Workplace, accessing the *syngo* Workplace remotely via a single-session password. This enables the simultaneous operation from the *syngo* Workplace as well as from the remote computer.

Workflow at the *syngo* Workplace

In order for the remote user to be able to log into the *syngo* Workplace, the local user has to configure password and connection timeout at the *syngo* Workplace.

- Click on the tray icon in the status bar of the *syngo* Workplace.

The **Expert-i** status dialog box opens and a four-digit password is displayed.

- Select if the remote user should have **Full Access,** or **View Only** access to the *syngo* Workplace.
- Inform the remote user of the password.
- Click on the OK button to confirm the

Expert-i status dialog box.

The tray icon changes to the wait mode. After the connection is established the icon changes again.

The local user must be present at the *syngo* Workplace as long as the remote connection is established and must pay attention to actions performed remotely.

Connecting to the *syngo* Workplace

To access remotely from a PC to a customer workplace in the same local area network (LAN).

- Click on the program icon or a link in the **Start** menu or in the Windows Explorer, to start the Expert-i software at the remote computer.

The **Expert-i - Remote Client** dialog box is displayed.

- Select one of the available connections you have already configured.
- Click on the **Connect** button.

The **Authentication** dialog box is displayed on the remote computer.

Enter the password generated at the *syngo* Workplace in the Password entry field. Click on the **Log On** button.

Direct Login

With the **Direct Login** every user can access and use the *syngo* Workplace and its full range of functionality from any **Expert-i** client in the network. There is no longer a need for a local user at the *syngo* Workplace to create a temporary password.

Workflow at the *syngo* Workplace

For working as a remote user on the *syngo* Workplace the following steps have to be performed:
– Local user configures password and connection timeout at the *syngo* Workplace.
– Remote users connect to the *syngo* Workplace.

- Select **Options > Configuration** from the main menu and select the **Expert-i** icon to have the **Expert-i** Configuration dialog box displayed.
- Activate the Direct Login enabled checkbox.
- Enter a workplace-specific password.
- Enter a time between 0 and 30 seconds (default 10) in the Accept connection timeout field.
- Inform all remote users about the permanent password for direct login.

Connecting to the *syngo* Workplace

To access a customer workplace from a PC in the same local area network (LAN).

- Click on the program icon or a link in the **Start** menu or in the Windows Explorer, to start the **Expert-i** software at the remote computer.

The **Expert-i - Remote Client** dialog box is displayed.

- Select one of the available connections you have already configured as Direct Login connection.
- Click on the **Connect** button

The dialog **Expert-i - Direct Login** is displayed on the remote computer.

Enter the preconfigured, permanent password and click on the **Login** button.

Disconnecting the Active Connection

Local User

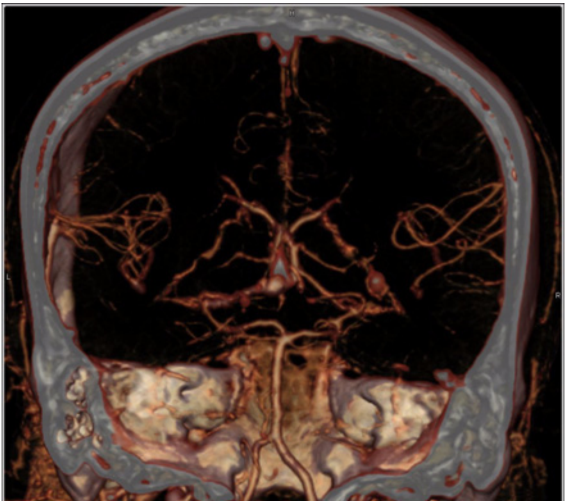
– Click the tray icon in the *syngo* Expert-i software at the *syngo* Workplace or at the remote computer to display the **Expert-i** status dialog box.
– Click on the **Terminate** button to disconnect the remote connection.

Remote User

– Move the mouse into the upper right corner of the screen. A bar with the **Minimize**, **Maximize** and **Close** icons is displayed.
– Click the Close icon.

Or

Disconnect like a local user via tray icon.



Overview

In this chapter you will find all scan protocols relating to the **Head** region, their descriptions, individual indications, and important hints on using them.

You can use the following scan protocols to clarify, for example, stroke, brain tumors, cranial trauma, cerebral atrophy, hydrocephalus, and inflammatory changes.

- **HeadRoutine**
  Spiral mode for routine head studies
- **HeadRoutine05s**
  Spiral mode for routine head studies with 0.5 s rotation time
- **HeadRoutineSeq**
  Sequential mode for routine head studies
- **HeadRoutineSeq05s**
  Sequential mode for routine head studies with 0.5 s rotation time
- **InnerEarUHR**
  Spiral mode for ultra high resolution inner ear studies
- **InnerEarUHRVol**
  Spiral mode for ultra high resolution inner ear studies and double oblique studies
- **InnerEarUHRSeq**
  Sequential mode for high resolution inner ear studies
- **Sinus**
  Spiral mode for routine sinus studies
- **SinusVol**
  Spiral mode for axial and coronal sinus studies
- **Orbit**
  Spiral mode for routine orbital studies
- **Dental**
  Spiral mode for the application *syngo* Dental CT

General Hints

- Topogram: Lateral, 256 mm.
- Patient positioning:
  Patient lying in supine position, arms resting along body, secure head well in the head holder, support lower legs.
- Gantry tilt is available for sequence scanning, not for spiral scanning.
- For all head studies, it is very important for image quality to position the patient in the center of the scan field. Use the lateral laser beam to make sure that the patient is positioned in the center.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.

Head Kernels

The endings “s” or “f” depend on the rotation time.

- For soft tissue head studies, the standard kernel is H40s; softer images are obtained with H30s or H20s, H10s, sharper images with H50s. The kernels H21s, H31s, H41s yield the same visual sharpness as H20s, H30s, H40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using H31s, H 41s instead of H30s, H40s.
- For a better gray-white brain tissue differentiation, use the H37f/s, H47f/s or H48f/s.
- High resolution head studies should be performed with H60s, H70s (e.g., for dental and sinuses).
- For very high sharpness we recommended the U70u, U80u, U90u for bone studies. UHR mode has a maximum FoV of 300 mm.

It is mandatory to position the area of interest in the center of the scan field.

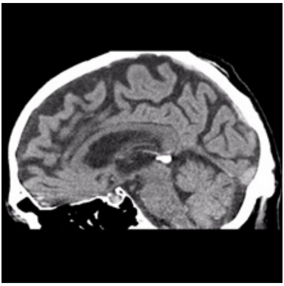
Scan Protocols

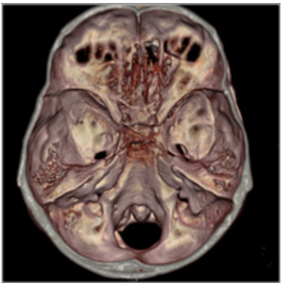
HeadRoutine

Indications:

Spiral mode for routine head studies, for example, stroke, brain tumors, cranial trauma, cerebral atrophy, hydrocephalus, and inflammation, etc.

A range for the base of 4 cm will be covered in 8.0 sec., a range for the cerebrum of 8 cm will be covered in 8.0 sec.





	Base	**Cerebrum**
kV	*120*	*120*
Effective mAs/ Quality ref. mAs	*280*	*320*
Rotation time	*1.0 sec.*	*1.0 sec.*
Aquisition	*16 x 0.75 mm*	*16 x 1.5 mm*
Slice collimation	*0.75 mm*	*1.5 mm*
Slice width	*4.0 mm*	*8.0 mm*
Feed/Rotation	*6.6 mm*	*13.2 mm*
Pitch factor	*0.55*	*0.55*
Increment	*4.0 mm*	*8.0 mm*
Kernel	*H31s*	*H31s*
$CTDI_{Vol}$	*59.1 mGy*	*60.8 mGy*
Effective dose	*Male: 1.37 mSv Female: 1.58 mSv*	*Male: 2.48 mSv Female: 2.58 mSv*

Contrast medium IV injection	
Start delay	*60 sec.*
Flow rate	*2 ml/sec.*
Total amount	*50 – 60 ml*

Hints

- If you want to set up the scan with only one range, you can easily delete one mode by clicking the chronicle with the right mouse button, and select **cut**.
- An automatic bone correction and an advanced algorithm allow for improved head image quality, without any additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.

HeadRoutine/HeadRoutine0.5s

Indications:

Spiral mode for routine head studies, e.g., stroke, brain tumors, cranial trauma, cerebral atrophy, hydrocephalus, and inflammation, etc., using a rotation time of 0.5 sec.

Two ranges are predefined for the base of the skull and cerebrum.

A range for the base of 40 mm will be covered in 4.0 sec., a range for the cerebrum of 80 mm will be covered in 4.0 sec.

	Base	**Cerebrum**
kV	*120*	*120*
Effective mAs/ Quality ref. mAs	*280*	*320*
Rotation time	*1.0/0.5 sec.*	*1.0/0.5 sec.*
Aquisition	*16 x 0.75 mm*	*16 x 1.5 mm*
Slice collimation	*0.75 mm*	*1.5 mm*
Slice width	*4.0 mm*	*8.0 mm*
Feed/Rotation	*6.6 mm*	*13.2 mm*
Pitch factor	*0.55*	*0.55*
Increment	*4.0 mm*	*8.0 mm*
Kernel	*H31f*	*H31f*
$CTDI_{Vol}$	*59.1 mGy*	*60.8 mGy*
Effective dose	*Male: 1.37 mSv Female: 1.58 mSv*	*Male: 2.48 mSv Female: 2.58 mSv*

Contrast medium IV injection	
Start delay	*60 sec.*
Flow rate	*2 ml/sec.*
Total amount	*50 – 60 ml*

Hints

- If you want to set up the scan with only one range, you can easily delete one mode by clicking the chronicle with the right mouse button, and select **cut**.
- An automatic bone correction and an advanced algorithm allow for improved head image quality, without any additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.

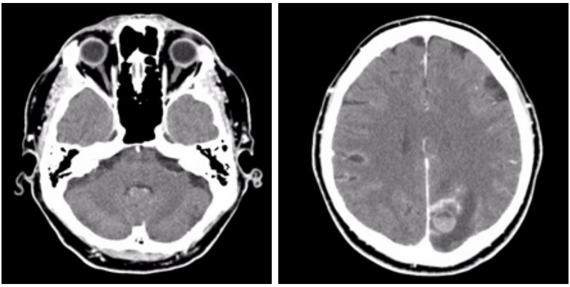
HeadRoutineSeq

Indications:

Sequence mode for routine head studies with $CTDI_{vol}$ below 60 mGy, for example, for stroke, brain tumors, cranial trauma, cerebral atrophy, hydrocephalus, and inflammation, etc.

Two ranges are predefined for the base of the skull and cerebrum.

A scan range is predefined with 12.1 cm.



	BaseSeq	**CerebrumSeq**
kV	*120*	*120*
Effective mAs/ Quality ref. mAs	*270*	*310*
Rotation Time	*1.0 sec.*	*1.0 sec.*
Acquisition	*12 x 0.75 mm*	*12 x 1.5 mm*
Slice collimation	*0.75 mm*	*1.5 mm*
Slice width	*4.5 mm*	*9.0 mm*
Feed/Scan	*9.0 mm*	*18.0 mm*
Kernel	*H31s*	*H31s*
$CTDI_{Vol}$	*60.5 mGy*	*59.5 mGy*
Effective dose	*Male: 1.13 mSv Female: 1.30 mSv*	*Male: 2.12 mSv Female: 2.27 mSv*

Contrast medium IV injection	
Start delay	*60 sec.*
Flow rate	*2 ml/sec.*
Total amount	*50 – 60 ml*

Hints

- An automatic bone correction and an advanced algorithm allow for improved head image quality, without any additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.

HeadRoutineSeq05s

Indications:

Sequence mode for routine head studies with $CTDI_{vol}$ below 60 mGy, for example for stroke, brain tumors, cranial trauma, cerebral atrophy, hydrocephalus, and inflammation, etc.

Two ranges are predefined for the base of the skull and cerebrum.

A scan range is predefined with 12.1 cm.

	BaseSeq	**CerebrumSeq**
kV	*120*	*120*
Effective mAs/ Quality ref. mAs	*250*	*250*
Rotation Time	*0.5 sec.*	*0.5 sec.*
Acquisition	*12 x 0.75 mm*	*12 x 1.5 mm*
Slice collimation	*0.75 mm*	*1.5 mm*
Slice width	*4.5 mm*	*9.0 mm*
Feed/Scan	*9.0 mm*	*18.0 mm*
Kernel	*H31f*	*H31f*
$CTDI_{Vol}$	*56.0 mGy*	*48.0 mGy*
Effective dose	*Male: 1.04 mSv Female: 1.20 mSv*	*Male: 1.67mSv Female: 1.79 mSv*

Contrast medium IV injection	
Start delay	*60 sec.*
Flow rate	*2 ml/sec.*
Total amount	*50 – 60 ml*

Hints

- An automatic bone correction and an advanced algorithm allow for improved head image quality, without any additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.

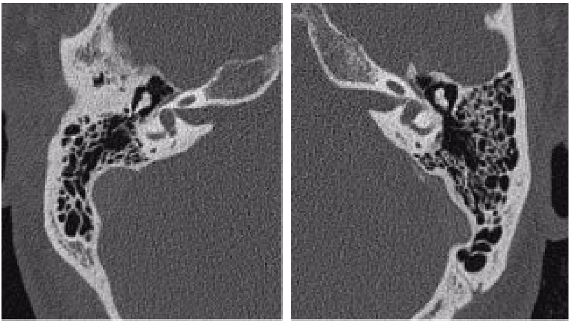
InnerEarUHR

Indications:

Spiral mode for Ultra High-Resolution inner ear studies, for example, inflammatory changes, tumorous processes of pyramids, cerebellopontine angle tumors, post-traumatic changes, etc.

Note: UHR mode has a maximum FoV of 300 mm. It is mandatory to position the patient in the center of the scan FoV.

A range of 43.5 cm will be covered in 57.7 sec.



	InnerEarUHR	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*120*	
Rotation Time	*1.0 sec.*	
Aquisition	*2 x 0.6 mm*	
Slice collimation	*0.6 mm*	
Slice width	*2.0 mm*	*0.6 mm*
Feed/Rotation	*0.8 mm*	
Pitch Factor	*0.65*	
Increment	*2.0 mm*	*0.4 mm*
Kernel	*U90u*	*U90u*
$CTDI_{Vol}$	*33.0 mGy*	
Effective dose	*Male: 0.55 mSv* *Female: 0.69 mSv*	

Contrast medium IV injection	
Start delay	*60 sec.*
Flow rate	*2 ml/sec.*
Total amount	*50 ml*

Hints

- For image reconstruction of soft tissue, use kernel U30u.
- An automatic bone correction and an advanced algorithm allow for improved head image quality, without any additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.

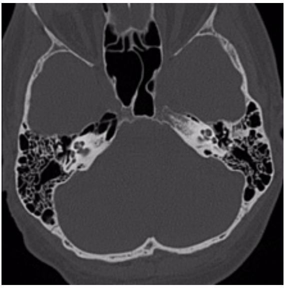
InnerEarUHRVol

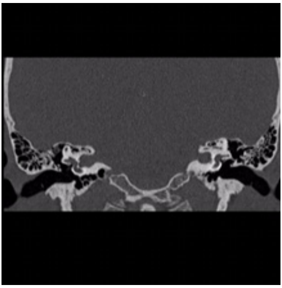
Indications:

Spiral mode for Ultra High Resolution inner ear studies and double oblique studies.

A range of 40 mm will be covered in 53.2 sec.

Three recon jobs are predefined for reconstruction: the first for axial bone structure, the second and third for the double oblique for each side in 3D images display view.





	Inner EarUHR	**2nd recon.**	**3d recon.**
kV	*120*		
Effective mAs/ Quality ref. mAs	*120*		
Rotation Time	*1.0 sec.*		
Aquisition	*2 x 0.6 mm*		
Slice collimation	*0.6 mm*		
Slice width	*2.0 mm*	*2.0 mm*	*2.0 mm*
Feed/Rotation	*0.8 mm*		
Pitch Factor	*0.65*		
Increment	*2.0 mm*	*2.0 mm*	*2.0 mm*
Kernel	*U90u*	*U90u*	*U90u*
$CTDI_{Vol}$	*33.0 mGy*		
Effective dose	*Male: 0.44 mSv Female: 0.65 mSv*		

Contrast medium IV injection	
Start delay	*60 sec.*
Flow rate	*2 ml/sec.*
Total amount	*60 ml*

Hints

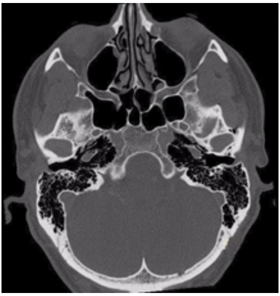
- For image reconstruction of soft tissue, use kernel U30u.
- An automatic bone correction and an advanced algorithm allow for improved head image quality, without any additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.

InnerEarUHRSeq

Indications:

Sequence mode for Ultra High-Resolution inner ear studies, for example, Inflammatory changes, tumorous processes of pyramids, cerebellopontine angle tumors, post-traumatic changes, etc.

A scan range is predefined with 43.6 mm.



	InnerEarSeq
kV	*120*
Effective mAs/ Quality ref. mAs	*120*
Rotation Time	*1.0 sec.*
Acquisition	*2 x 0.6 mm*
Slice collimation	*0.6 mm*
Slice width	*0.6 mm*
Feed/Scan	*1.0 mm*
Kernel	*U90u*
$CTDI_{Vol}$	*39.6 mGy*
Effective dose	*Male: 0.67 mSv* *Female: 0.78 mSv*

Hints

- For image reconstruction of soft tissue, use kernel U30u.
- An automatic bone correction and an advanced algorithm allow for improved head image quality, without any additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.

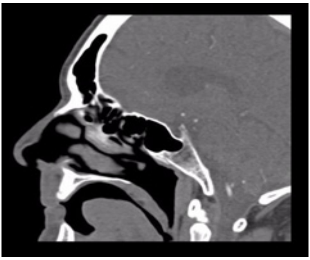
Sinus

Indications:

Spiral mode for paranasal sinuses studies, for example, sinusitis, mucocele, pneumatization, polyposis, tumor, corrections etc.

Three recon jobs are predefined for image reconstruction of the soft tissue and bone structure.

A range of 80 mm will be covered in 14.1 sec.



	Sinus	**2nd recon.**	**3rd recon.**	**4th recon.**
kV	*120*			
Effective mAs/ Quality ref. mAs	*60*			
Rotation time	*1.0 sec.*			
Acquisition	*16 x 0.75 mm*			
Slice collimation	*0.75 mm*			
Slice width	*5.0 mm*	*5.0 mm*	*1.0 mm*	*1.0 mm*
Feed/ Rotation	*6.6 mm*			
Pitch Factor	*0.55*			
Increment	*5.0 mm*	*5.0 mm*	*0.7 mm*	*0.7 mm*
Kernel	*H60s*	*H30s*	*H60s*	*H30s*
$CTDI_{Vol}$	*12.7 mGy*			
Effective dose	*Male: 0.46 mSv* *Female: 0.53 mSv*			

SinusVol

Indications:

Spiral mode for axial and coronal paranasal sinuses studies, for example, sinusitis, mucocele, polyposis, tumor, cor-rections etc.

Three recon jobs are predefined for reconstruction: the first for axial bone structure and the second for the coronal soft tissue in 3D images display view and the third for the coronal bone structure in 3D images dis-play view.

A range of 80 mm will be covered in 10.5 sec.

	Sinus	**2nd recon.**	**3d recon.**
kV	*120*		
Effective mAs/ Quality ref. mAs	*50*		
Rotation Time	*0.75 sec.*		
Aquisition	*16 x 0.75 mm*		
Slice collimation	*0.75 mm*		
Slice width	*5.0 mm*	*3.0 mm*	*3.0 mm*
Feed/Rotation	*6.6 mm*		
Pitch Factor	*0.55*		
Increment	*5.0 mm*	*3.0 mm*	*3.0 mm*
Kernel	*H60s*	*H30s*	*H60s*
$CTDI_{Vol}$	*10.6 mGy*		
Effective dose	*Male: 0.38 mSv Female: 0.42 mSv*		

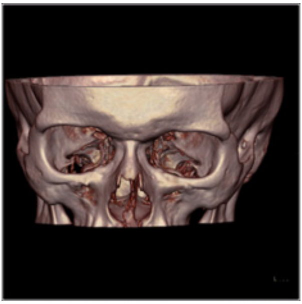
Contrast medium IV injection	
Start delay	*60 sec.*
Flow rate	*2 ml/sec.*
Total amount	*50 – 60 ml*

Orbit

Indications:

Spiral mode for orbital studies, for example, fracture.

A range of 50 mm will be covered in 7.1 sec.



	Orbit	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*100*	
Rotation Time	*0.75 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*1.0 mm*
Feed/Rotation	*6.6 mm*	
Pitch Factor	*0.55*	
Increment	*5.0 mm*	*0.5 mm*
Kernel	*H60s*	*H60s*
$CTDI_{Vol}$	*21.1 mGy*	
Effective dose	*Male: 0.53 mSv Female: 0.6 mSv*	

Contrast medium IV injection	
Start delay	*60 sec.*
Flow rate	*2 ml/sec.*
Total amount	*50 – 60 ml*

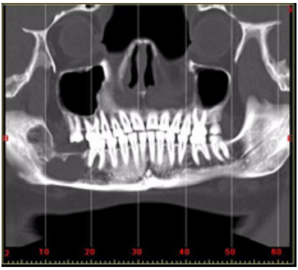
Dental

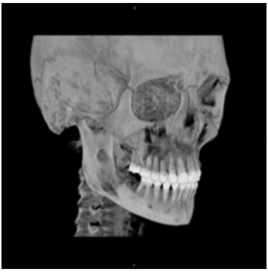
Indications:

This is the scan protocol for the ***syngo*** **Dental CT** application package. It is used to assist the physician with the evaluation and reformatting of the upper and lower jaws.

It enables the display and measurement of the bone structures of the upper and lower jaw as the basis for planning in oral surgery.

A range of 50 mm will be covered in 7.1 sec.



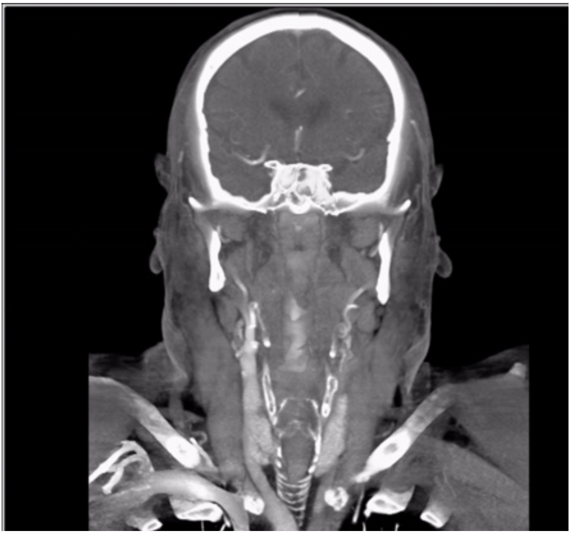


	Dental
kV	*120*
Effective mAs/ Quality ref. mAs	*80*
Rotation Time	*0.75 sec.*
Acquisition	*16 x 0.75 mm*
Slice collimation	*0.75 mm*
Slice width	*0.75 mm*
Feed/Rotation	*6.6 mm*
Pitch Factor	*0.55*
Increment	*0.5 mm*
Kernel	*H60s*
$CTDI_{Vol}$	*16.9 mGy*
Effective dose	*Male: 0.41 mSv Female: 0.43 mSv*

Load the study into the application *syngo* Dental CT. For further information, please refer to the Application Guide “Clinical Applications“.

Hints

- An automatic bone correction and an advanced algorithm allow for improved head image quality, without any additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.



Overview

In this chapter you will find all scan protocols relating to the **Neck** region, their descriptions, individual indications, and important hints on using them.

You can use the following scan protocols to clarify, for example, tumors, lymphoma, and abscesses.

- **NeckRoutine**
  Spiral mode for soft tissue routine neck studies
- **NeckThinSlice**
  Spiral mode for thin slice soft tissue neck studies
- **NeckVol**
  Spiral mode for axial, coronal and sagittal neck studies

General Hints

- Topogram: Lateral,
  Lateral, 256 mm, for CTAs AP, 512 mm.
- Patient positioning:
  Patient lying in supine position, hyperextend neck slightly, secure head well in head cradle.
- Patient respiratory instruction:
  do not breathe, do not swallow.
- For contrast studies, CARE Bolus (optional) may be used to optimize the bolus timing.
- For image reconstruction of bone structure, use kernel B60.

- Patient positioning is very important for artifact-free images. The thoracic girdle should be positioned as far as possible in the caudal direction. This can be done using a strap with a permanent loop or Velcro fastener at its end. The ends of the strap must be attached to the patient’s wrists. Then the strap must be wrapped around the patient’s feet with his legs extended and under tension. The entire thoracic girdle is thus pulled toward the patient’s feet.

Body Kernels

The endings “s” or “f” depend on the rotation time.

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, as is required, e.g., in patient protocols for cervical spine, shoulder,extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.
- The special kernels are mostly used for ”physical” measurements with phantoms, e.g., for adjustment procedures (S80s), for constancy and acceptance tests (S80s, S90s), or for specification purposes (S90s).

For special patient protocols, S80s and S90s are chosen, e.g., for osteo (S80s).

- In case of 3D study only, use kernel B10s and at least 50% overlapping for image reconstruction.

Patient positioning is very important for artifact-free images. The thoracic girdle should be positioned as far as possible in the caudal direction. This can be done using a strap with a permanent loop or Velcro fastener at its end. The ends of the strap must be attached to the patients wrists. Then the strap must be wrapped around the patients feet with his legs extended and under tension. The entire thoracic girdle is thus pulled toward the patients feet.

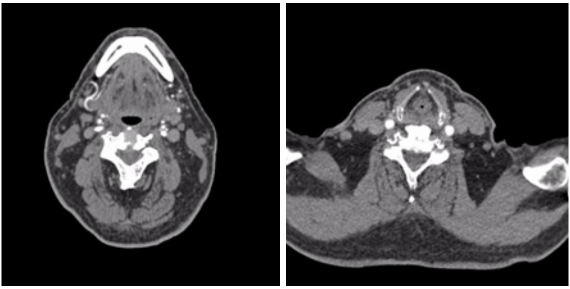
Scan Protocols

NeckRoutine

Indications:

For soft tissue spiral studies in the cervical region, for example, tumors, lymphoma, abscesses, etc.

A typical range of 20 cm will be covered in 9.3 sec.



	Neck
kV	*120*
Effective mAs/ Quality ref. mAs	*150*
Rotation Time	*0.75 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*5.0 mm*
Feed/Rotation	*19.2 mm*
Pitch Factor	*0.80*
Increment	*5.0 mm*
Kernel	*B31s*
$CTDI_{Vol}$	*10.5 mGy*
Effective dose	*Male: 2.35 mSv* *Female: 2.31 mSv*

Contrast medium IV injection	
Start delay	*45 sec.*
Flow rate	*3.0 ml/sec.*
Total amount	*100 ml*

Hints

- Due to its iodine content, the thyroid gland is hyperdense in relation to the neighboring muscles both before and after an IV CM injection. For displays of the parotid or thyroid gland or the floor of the mouth, the slice thickness should be < 5 mm and the length of the range should be adapted to match the anatomic region
- Target the FoV to ensure adequate coverage of the region of interest in the upper neck & middle neck levels as well as to include the axilla in the lower neck level if required.

NeckThinSlice

Indications:

Spiral mode using thin slices for soft tissue studies, for example, the functional study of the throat.

A typical range of 18 cm will be covered in 15.5 sec.

	NeckThinSlice	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*150*	
Rotation Time	*0.75 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*5.0 mm*	*0.7 mm*
Kernel	*B31s*	*B31s*
$CTDI_{Vol}$	*11.7 mGy*	
Effective dose	*Male: 2.17 mSv Female: 2.27 mSv*	

Contrast medium IV injection	
Start delay	*45 sec.*
Flow rate	*3 ml/sec.*
Total amount	*100 ml*

Hint

- Patient positioning is very important for artifact-free images. The thoracic girdle should be positioned as far as possible in the caudal direction. This can be done using a strap with a permanent loop or Velcro fastener at its end. The ends of the strap must be attached to the patient's wrists. Then the strap must be wrapped around the patient's feet with his legs extended and under tension. The entire thoracic girdle is thus pulled toward the patient's feet.

NeckVol

Indications:

For soft tissue spiral studies in the cervical region, for example, tumors, lymphoma, abscesses, etc.

Three recon jobs are predefined for reconstruction: the first for axial, the second for coronal and third for saggittal studies in 3D images display.

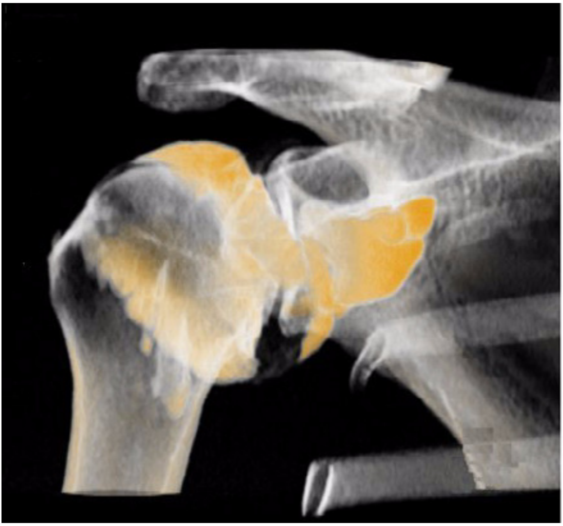
A typical range of 18 cm will be covered in 15.5 sec.

	Neck ThinSlice	2nd recon.	3rd recon.
kV	*120*		
Effective mAs/ Quality ref. mAs	*150*		
Rotation Time	*0.75 sec.*		
Acquisition	*16 x 0.75 mm*		
Slice collimation	*0.75 mm*		
Slice width	*5.0 mm*	*5.0 mm*	*5.0 mm*
Feed/Rotation	*9.6 mm*		
Pitch Factor	*0.80*		
Increment	*5.0 mm*	*5.0 mm*	*5.0 mm*
Kernel	*B31s*	*B20s*	*B20s*
$CTDI_{Vol}$	*11.7 mGy*		
Effective dose	*Male: 2.17 mSv Female: 2.27 mSv*		

Contrast medium IV injection	
Start delay	*45 sec.*
Flow rate	*3.0 ml/sec.*
Total amount	*100 ml*

Hints

- Due to its iodine content, the thyroid gland is hyperdense in relation to the neighboring muscles both before and after an IV CM injection. For displaying the parotid, thyroid or floor of the mouth, the slice thickness should be < 5 mm and the length of the range should be adapted to match the anatomic region.
- Target the FoV to ensure adequate coverage of the region of interest in the upper neck & middle neck levels as well as to include the axilla in the lower neck level if required.



Overview

In this chapter you will find all scan protocols relating to the **Shoulder** region, their descriptions, individual indications, and important hints on using them.

You can use the following scan protocols to clarify, for example, masses, trauma, dislocations, and orthopedic indications.

– **ShoulderRoutine**
  Spiral mode for bone shoulder routine studies
– **ShoulderVol**
  Spiral mode for axial, coronal and sagittal shoulder studies

General Hints

- Topogram: AP, 256 mm.
- Patient positioning:
  Patient lying in supine position, the uninjured arm placed above the head, the injured arm placed flat against his body. If only one side is under investigation, position this side in the center and support the other side with a Bocollo pillow.
- If only one side is examined, it is advisable to enter the side in the comment line.
- Contrast medium is required for soft tissue mass evaluation.
- To further optimize MPR and VRT image quality we recommend that you reduce one or more of the following: collimation, reconstruction increment and slice width for image reconstruction.

Body Kernels

The endings “s” or “f” depend on the rotation time.

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, as is required, e.g., in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.
- The special kernels are mostly used for ”physical” measurements with phantoms, e.g., for adjustment procedures (S80s), for constancy and acceptance tests (S80s, S90s), or for specification purposes (S90s).

For special patient protocols, S80s and S90s are chosen, e.g., for osteo (S80s).

- For very high sharpness we recommended the U70u, U80u, U90u for bone studies. UHR mode has a maximum FoV of 300 mm.

It is mandatory to position the area of interest in the center of the scan field. Use ExtrCombi mode when a scan FoV > 25 cm is necessary.

- In case of 3D study only, the mAs value can be reduced by 50%. Use kernel B10s and at least a 50% overlap for image reconstruction.

Scan Protocols

ShoulderRoutine

Indications:

Spiral mode for bone studies and soft tissues, for example, evaluation of joint cavities, masses, trauma, dislocations, orthopedic indications etc.

A scan range of 15 cm will be covered in 17.6 sec.

	Shoulder	2nd recon.	3rd recon.
kV	*120*		
Effective mAs/ Quality ref. mAs	*150*		
Rotation Time	*1.0 sec.*		
Acquisition	*16 x 0.75 mm*		
Slice collimation	*0.75 mm*		
Slice width	*5.0 mm*	*1.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*		
Pitch Factor	*0.80*		
Increment	*5.0 mm*	*0.7 mm*	*0.7 mm*
Kernel	*B31s*	*B31s*	*B60s*
$CTDI_{Vol}$	*11.7 mGy*		
Effective dose	*Male: 2.77 mSv* *Female: 3.51 mSv*		

Hints

- For image reconstruction of soft tissue use kernel B31s and a slice width of 5.0 mm.
- Use raw data to review a target region if necessary.
- Coronal and sagittal 2D planar reconstructions are important for evaluation of the joint space & bursa sacs in CT arthrograms.
- 3D renderings are helpful for complex fractures & dislocations.

ShoulderVol

Indications:

Spiral mode for bone studies and soft tissues, for example, evaluation of joint cavities, masses, trauma, dislocations, orthopedic indications etc.

A scan range of 15 cm will be covered in 18.6 sec.

Three recon jobs are predefined for reconstruction: the first for soft tissue axial, the second for soft tissue coronal and third for sagittal bone studies in 3D images display view.

	Shoulder	**2nd recon.**	**3rd recon.**
kV	*120*		
Effective mAs/ Quality ref. mAs	*150*		
Rotation Time	*1.0 sec.*		
Acquisition	*16 x 0.75 mm*		
Slice collimation	*0.75 mm*		
Slice width	*5.0 mm*	*5.0 mm*	*5.0 mm*
Feed/Rotation	*9.6 mm*		
Pitch Factor	*0.80*		
Increment	*5.0 mm*	*5.0 mm*	*5.0 mm*
Kernel	*B31s*	*B31s*	*B60s*
$CTDI_{Vol}$	*11.7 mGy*		
Effective dose	*Male: 2.77 mSv* *Female: 3.51 mSv*		

For the 2nd and 3rd reconstruction a non-square matrix 3D recon job is predefined.

Hints

- Use raw data to review a target region if necessary.
- 3D renderings are helpful for complex fractures & dislocations.

Overview

In this chapter you will find all scan protocols relating to the **Thorax** region, their descriptions, individual indications, and important hints on using them.

You can use the following scan protocols to clarify, for example, tumors, metastases, lymphoma, lymph nodes, vascular anomalies, and interstitial changes in the lungs.

- **ThoraxRoutine**
  Spiral mode for routine thorax studies
- **ThoraxCombi**
  Spiral mode for the combination of thin slice lung and routine thorax studies

- **ThoraxVol**
  Spiral mode for axial, coronal soft tissue and coronal lung studies
- **ThoraxHR**
  Spiral mode for high resolution lung studies
- **ThoraxHRSeq**
  Sequential mode for high resolution lung studies
- **ThoraxECGHRSeq**
  Sequential mode for high resolution, ECG-triggered lung studies
- **LungLowDose**
  Spiral mode with very low dose for early visualization of pathologies
- **LungCARE**
  Spiral mode used for the application *syngo* Lung-CARE CT

General Hints

- Topogram: AP, 512 mm.
- Patient positioning:
  Patient lying in supine position, arms positioned comfortably above the head in the head-arm rest, lower legs supported.
- Contrast medium administration: in general, IV injections are employed in all mediastinal examinations, but not in routine high resolution studies of diffused, interstitial lung diseases. An IV contrast medium injection improves the vascular opacification and facilitates the visualization of the lesions, lymph nodes and the vessels.
- Stasis of contrast medium in the arm & superior vena cava often result in high density streak artifacts either in the region of the aortic arch or in the region of the subclavian vein. A caudo-cranial (bottom to top) scanning direction should be used to reduce this artifact – by simply acquiring the data in this region at the later phase of the spiral scan. In addition, if the patient cannot hold his/her breath for the duration of the entire scan, breathing motion will be less apparent in the apex than in the lower lobes.
- CARE Bolus (optional) may be used to optimize the bolus timing. Set the ROI for monitoring scan in the aorta at the level of the diaphragm with triggering threshold of 120 HU, or use manual triggering.

- Lung images should be documented in both soft tissue window and lung window.
- It is also possible to interleave the soft tissue and lung setting images in one film sheet. This can be set up in the configuration for filming.
- To further optimize MPR and VRT image quality we recommend that you reduce one or more of the following:
  collimation, reconstruction increment and slice width for image reconstruction.

Body Kernels

The endings “s” or “f” depend on the rotation time.

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, as is required for example, in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.
- The special kernels are mostly used for ”physical” measurements with phantoms, for example, for adjustment procedures (S80s), for constancy and acceptance tests (S80s, S90s), or for specification purposes (S90s).

For special patient protocols, S80s and S90s are chosen, for example, for osteo (S80s).

- In case of 3D study only, the mAs value can be reduced by 50%. Use kernel B10s and at least a 50% overlap for image reconstruction.

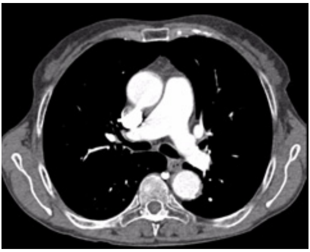
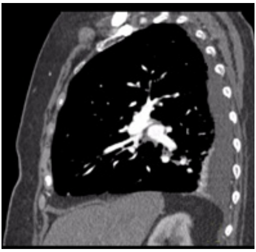
Scan Protocols

ThoraxRoutine

Indications:

Routine spiral studies for the region of thorax, for example, visualization of tumors, metastases, lymphoma, lymph nodes, vascular anomalies etc.

A range of 30 cm will be covered in 6.4 sec.

	ThorRoutine	2nd recon.
kV	*120*	
Effective mAs/ Quality ref. mAs	*100*	
Rotation Time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*5.0 mm*	*5.0 mm*
Feed/Rotation	*27.6 mm*	
Pitch Factor	*1.15*	
Increment	*5.0 mm*	*5.0 mm*
Kernel	*B31f*	*B80f*
$CTDI_{Vol}$	*7.0 mGy*	
Effective dose	*Male: 3.74 mSv* *Female: 4.77 mSv*	

Contrast medium IV injection	
Start delay	*25 – 30 sec.*
Flow rate	*2.5 ml/sec.*
Total amount	*80 ml*

Hint

- For lung cancer evaluation, this protocol can be combined with 3rd and 4th protocol **NeckRoutine**.

ThoraxCombi

Indications:

Combining thin slice lung and routine thorax studies with one spiral scan, for example, thorax studies in general and interstitial changes in the lungs.

A range of 30 cm will be covered in 11.8 sec.

	Thor Combi	**2nd recon.**	**3rd recon.**	**4th recon.**
kV	*120*			
Effective mAs/ Quality ref. mAs	*100*			
Rotation time	*0.5 sec.*			
Acquisition	*16 x 0.75 mm*			
Slice collimation	*0.75 mm*			
Slice width	*5.0 mm*	*5.0 mm*	*1.0 mm*	*1.0 mm*
Feed/ Rotation	*13.8 mm*			
Pitch Factor	*1.15*			
Increment	*5.0 mm*	*5.0 mm*	*0.7 mm*	*0.7 mm*
Kernel	*B31f*	*B80f*	*B31f*	*B70f*
$CTDI_{Vol}$	*7.8 mGy*			
Effective dose	*Male: 3.86 mSv* *Female: 4.98 mSv*			

Contrast medium IV injection	
Start delay	*25 sec.*
Flow rate	*2.5 ml/sec.*
Total amount	*80 ml*

Hints

- In addition to the mediastinum and the lungs, it may be necessary to evaluate the axillary fatty tissue and the bilateral mammary glands. A third reconstruction can be set up with a wider FoV in the Recon task card.
- You could repeat the same protocol simply by clicking the chronicle with the right mouse button for **repeat**; e.g., when both non-contrast and contrast studies are required.
- For lung cancer evaluation, this protocol can be combined with protocol **NeckRoutine**.

Thorax

ThoraxVol

Indications:

Routine spiral studies for the region of thorax, for example, visualization of tumors, metastases, lymphoma, lymph nodes, vascular anomalies etc.

Four recon jobs are predefined for reconstruction: the first for soft tissue axial, the second for lung axial, the third for soft tissue coronal and fourth for soft tissue coronal studies in 3D images display view.

A range of 30 cm will be covered in 11.8 sec.

	Thor Combi	2nd recon.	3rd recon.	4th recon.
kV	*120*			
Effective mAs/ Quality ref. mAs	*100*			
Rotation time	*0.5 sec.*			
Acquisition	*16 x 0.75 mm*			
Slice collimation	*0.75 mm*			
Slice width	*5.0 mm*	*5.0 mm*	*5.0 mm*	*5.0 mm*
Feed/ Rotation	*13.8 mm*			
Pitch Factor	*1.15*			
Increment	*5.0 mm*	*5.0 mm*	*5.0 mm*	*5.0 mm*
Kernel	*B31f*	*B70f*	*B31f*	*B70f*
$CTDI_{Vol}$	*7.8 mGy*			
Effective dose	*Male: 3.86 mSv* *Female: 4.98 mSv*			

For the 3rd and 4th reconstruction a non-square matrix 3D recon job is predefined.

Contrast medium IV injection	
Start delay	*25 sec.*
Flow rate	*2.5 ml/sec.*
Total amount	*80 ml*

Hint

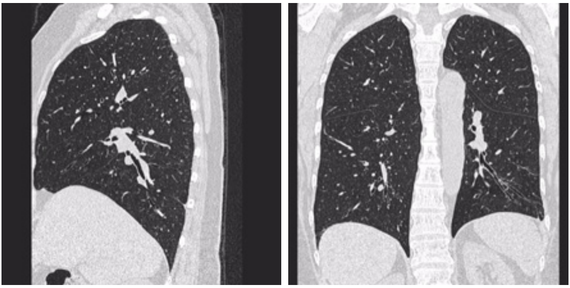
- For lung cancer evaluation, this protocol can be combined with protocol **NeckRoutine**.

ThoraxHR

Indications:

Spiral mode for High Resolution studies, for example, interstitial changes in the lungs.

A range of 30 cm for the complete thorax will be covered in 14.0 sec.



	ThorHR	2nd recon.	3rd recon.	4th recon.
kV	*120*			
Effective mAs/ Quality ref. mAs	*100*			
Rotation time	*0.75 sec .*			
Acquisition	*16 x 0.75 mm*			
Slice collimation	*0.75 mm*			
Slice width	*5.0 mm*	*5.0 mm*	*1.0 mm*	*1.0 mm*
Feed/ Rotation	*18.0 mm*			
Pitch Factor	*1.50*			
Increment	*5.0 mm*	*5.0 mm*	*0.7 mm*	*0.7 mm*
Kernel	*B80s*	*B31s*	*B70s*	*B31s*
$CTDI_{Vol}$	*7.8 mGy*			
Effective dose	*Male: 3.86 mSv* *Female: 4.98 mSv*			

Hints

- For studies performed for interstitial disease in the lungs, contrast medium is not necessary.
- This examination is normally performed following a standard thorax study or used for regular follow up studies for high risk patient groups with a history of exposure to carcinogenic agents for example, asbes-tos.

Thorax

ThoraxHRSeq

Indications:

Sequence mode for high-resolution lung studies, for example, interstitial changes in the lungs using a feed of 10 mm.

A scan range is predefined with 29.1 cm.

	ThorHRSeq
kV	*120*
Effective mAs/ Quality ref. mAs	*100*
Rotation time	*0.75 sec.*
Acquisition	*2 x 1.0 mm*
Slice collimation	*1.0 mm*
Slice width	*1.0 mm*
Feed/Scan	*10.0 mm*
Kernel	*B80s*
$CTDI_{Vol}$	*1.7 mGy*
Effective dose	*Male: 0.76 mSv* *Female: 0.91 mSv*

Hints

- If you want to reconstruct thin slices, for example, every 20 mm instead of 10 mm as predefined, simply change the feed/scan before loading the mode.
- When performing studies for interstitial lung disease, contrast medium is not necessary.

ThoraxECGHRSeq

Indications:

ECG-triggered sequence mode for High Resolution lung studies, for example, interstitial changes in the lungs using a feed of 10 mm.

A scan range is predefined with 29.1 cm.

	ThoraxECGHR
kV	*120*
Effective mAs/ Quality ref. mAs	*120*
Rotation time	*0.75 sec.*
Acquisition	*2 x 1.0 mm*
Slice collimation	*1.0 mm*
Slice width	*1.0 mm*
Feed/Scan	*10.0 mm*
Kernel	*B80s*
$CTDI_{Vol}$	*2.0 mGy*
Effective dose	*Male: 0.91 mSv Female: 1.10 mSv*

Hints

- If you want to reconstruct thin slices every 15 or 20 mm instead of 10 mm as predefined, simply change the Feed/Scan before loading the mode.
- When performing studies for Interstitial lung disease, contrast medium is not necessary.
- If you apply API for a single breathhold acquisition, please make sure that the breathhold interval in the Patient Model Dialog is longer than the total scan time, e.g., 50 s, otherwise the image acquisition will be interrupted by the default breathhold interval. This does not apply when API is not activated. For longer ranges, e.g., the entire thoracic aorta, that cannot be acquired within a single breathhold, please ensure that the breathhold interval in the Patient Model Dialog is set up correctly, according to the patient's level of cooperation.

LungLowDose

Indications:

Lung spiral study with low dose setting, for example, early visualization of pulmonary nodules.

A typical thorax study in a range of 30 cm will be covered in 9.3 sec.

	LungLowDose	**2nd recon.**	**3rd recon.**	**4th recon.**
kV	*120*			
Effective mAs/ Quality ref. mAs	*20*			
Rotation time	*0.5 sec.*			
Acquisition	*16 x 0.75 mm*			
Slice collimation	*0.75 mm*			
Slice width	*5.0 mm*	*5.0 mm*	*1.0 mm*	*1.0 mm*
Feed/ Rotation	*18.0 mm*			
Pitch Factor	*1.5*			
Increment	*5.0 mm*	*5.0 mm*	*0.7 mm*	*0.7 mm*
Kernel	*B31f*	*B80f*	*B31f*	*B70f*
$CTDI_{Vol}$	*1.6 mGy*			
Effective dose	*Male: 0.77 mSv* *Female: 1.0 mSv*			

Contrast medium IV injection	
Start delay	*30 sec.*
Flow rate	*2.5 ml/sec.*
Total amount	*50 – 70 ml*

Hints

- You could repeat the same protocol simply by clicking the chronicle with the right mouse button for **repeat**; e.g., when both non-contrast and contrast studies are required.
- For lung cancer evaluation, this protocol can be combined with protocol **NeckRoutine**.
- Low dose lung images are usually evaluated using lung window setting. Soft tissue/bone window settings may be used to visualize the presence of calcifications in the nodules.
- It is essential to use the same protocol for follow-up studies to check for progression.
- CARE Dose 4D is off as default because for LungLowDose protocols the lowest mAs values are used.

Thorax

LungCARE

Indications:

Lung spiral study for the application *syngo* LungCARE CT with low dose setting, for visualization of pulmonary nodules.

A typical thorax study in a range of 30 cm will be covered in 9.3 sec.

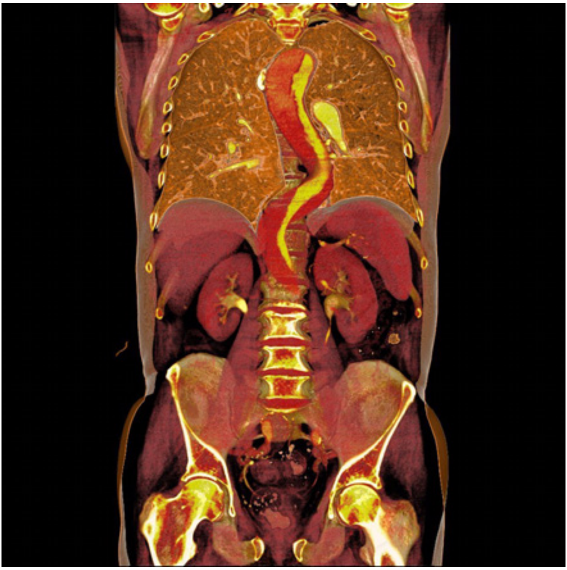
	Lung CARE	**2nd recon.**	**3rd recon.**	**4th recon.**
kV	*120*			
Effective mAs/ Quality ref. mAs	*20*			
Rotation time	*0.5 sec.*			
Acquisition	*16 x 0.75 mm*			
Slice collimation	*0.75 mm*			
Slice width	*5.0 mm*	*5.0 mm*	*1.0 mm*	*1.0 mm*
Feed/ Rotation	*18.0 mm*			
Pitch Factor	*1.5*			
Increment	*5.0 mm*	*5.0 mm*	*0.7 mm*	*0.7 mm*
Kernel	*B31f*	*B80f*	*B31f*	*B60f*
$CTDI_{Vol}$	*1.6 mGy*			
Effective dose	*Male: 0.77 mSv* *Female: 1.0 mSv*			

Contrast medium IV injection	
Start delay	*30 sec.*
Flow rate	*2.5 ml/sec.*
Total amount	*50 – 70 ml*

For further information, please refer to the Application Guide “Clinical Applications“.

Hints

- You could repeat the same protocol simply by clicking the chronicle with the right mouse button for **repeat**; e.g., when both non-contrast and contrast studies are required.
- For lung cancer evaluation, this protocol can be combined with protocol **NeckRoutine**.
- Low dose lung images are usually evaluated using lung window setting. Soft tissue/bone window settings may be used to visualize the presence of calcifications in the nodules.
- It is essential to use the same protocol for follow-up studies to check for progression.
- CARE Dose 4D is off as default because for LungLowDose protocols the lowest mAs values are used.



Overview

In this chapter you will find all scan protocols relating to the **Abdomen** region, their descriptions, individual indications, and important hints on using them.

You can use the following scan protocols to clarify, for example, liver, pancreas, and kidney abnormalities

- **AbdomenRoutine**
  Spiral mode for routine abdominal studies
- **AbdomenCombi**
  Spiral mode for the combination of thin slice and routine abdominal studies
- **AbdomenVol**
  Spiral mode for axial and coronal abdomen studies
- **AbdMultiPhase**
  Spiral mode for three phases liver studies
- **AbdSeq**
  Sequential mode for abdominal studies
- **Colonography**
  Spiral mode used for the application *syngo* Colonography

General Hints

- Topogram: AP, 512 or 768 mm.
- Patient positioning:
  Patient lying in supine position, arms positioned comfortably above the head in the head-arm rest, lower legs supported.
- Patient respiratory instructions: inspiration.
- Oral administration of contrast medium:
  For abdominal studies, it is necessary to delineate the bowel from other structures such as lymph nodes, abdominal masses & abscesses. Various types of bowel opacifying agents can be used:
  - Diluted barium suspension (1% – 2%), e.g., EZCAT
  - Water soluble agent (2% – 4%), e.g., Gastrografin
  - Water alone as a negative contrast agent.

Timing of the oral contrast administration is important to ensure its even distribution in the bowel.

Upper abdomen:
Minimum 600 ml of contrast divided into 3 cups (approximately 200 – 250 ml)
1st cup to drink 30 minutes before exam
2nd cup to drink 15 minutes before exam
3rd cup to drink 5 minutes before exam

Abdomen-Pelvis:
Minimum 1000 ml of contrast divided into 4 cups
1st cup to drink 1 hour before exam
2nd – 4th cups every subsequent 15 minutes
Start exam 5 minutes after the 4th cup is administered.

– In general, for abdominal studies such as liver, gall bladder (query stones), pancreas, gastrointestinal studies, focal lesion of the kidneys and CTA studies, it is sufficient to use just water. Water is more effective than positive oral contrast agent in depicting the linings of the stomach and intestines in post enhancement studies. In addition, the use of water will not obscure the blood vessels thus allowing CTA processing to be performed easily afterwards.
– For patients with bowel obstruction, only water or water-soluble contrast can be used. Barium suspension is a contraindication.

- Be careful when examining pheochromocytoma patients. Administration of an IV CM injection in such cases may trigger a hypertensive crisis!
- To further optimize MPR and VRT image quality we recommend that you reduce one or more of the following: collimation, reconstruction increment and slice width for image reconstruction.

Body Kernels

The endings “s” or “f” depend on the rotation time.

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, as is required for example, in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.
- The special kernels are mostly used for ”physical” measurements with phantoms, for example, for adjustment procedures (S80s), for constancy and acceptance tests (S80s, S90s), or for specification purposes (S90s).

Abdomen

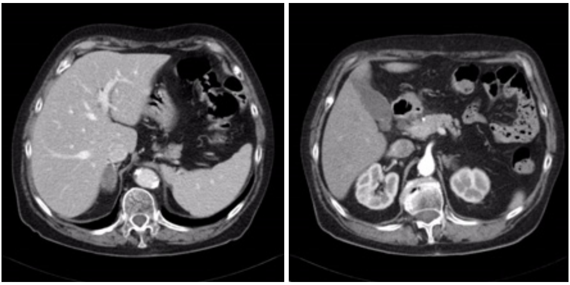
Scan Protocols

AbdomenRoutine

Indications:

Spiral mode for all routine studies in the region of abdomen, for example, follow-up examinations etc.

A scan range of 40 cm will be covered in 11.4 sec.



	AbdRoutine
kV	*120*
Effective mAs/ Quality ref. mAs	*200*
Rotation time	*0.5 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*5.0 mm*
Feed/Rotation	*19.2 mm*
Pitch Factor	*0.80*
Increment	*5.0 mm*
Kernel	*B30f*
$CTDI_{Vol}$	*14.0 mGy*
Effective dose	*Male: 11.48 mSv* *Female: 14.50 mSv*

Contrast medium IV injection	
Start delay	*50 – 60 sec.*
Flow rate	*4.0 ml/sec.*
Total amount	*100 ml*

Hints

- You could repeat the same protocol simply by clicking the chronicle with the right mouse button for **repeat**; e.g., when both non-contrast and contrast studies are required.
- Delayed scans may be required for the kidneys & bladder.
- If you want to use this protocol for a two-phase study, repeat the same protocol as mentioned above, and choose 20 to 25 sec. as the start delay time for arterial phase. In this case, the thin slice reconstruction can also be used for post-processing. Do not administer oral contrast medium, as this impairs the editing of MIP/SSD/VRT images. Water could be used instead if necessary.

- Water, rather than positive oral contrast agents should be used. Administer the last cup 200 ml just prior to positioning the patient. To ensure adequate filling of the duodenal loop, lay the patient on the right side for 5 minutes before performing the topogram.
- A pre-contrast examination is usually performed only if no CT scans were previously acquired, to exclude calculi in the common bile duct and to visualize possible lesions in the liver.
- For pancreatic studies, the arterial phase acquisition can be acquired later with a start delay of 40 – 50 sec. It may be necessary to use a thinner collimation.

Abdomen

AbdomenCombi

Indications:

Combination of thin slice and routine abdominal studies with one spiral scan.

A range of 20 cm for liver, pancreas or kidneys will be covered in 11.4 sec.

	AbdCombi	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*200*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*5.0 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*15.6 mGy*	
Effective dose	*Male: 6.24 mSv* *Female: 7.96 mSv*	

Contrast medium IV injection	
Start delay	*50 – 65 sec.*
Flow rate	*4.0 ml/sec.*
Total amount	*100 ml*

Hints

- If you want to use this protocol for a two-phase study, repeat the same protocol as mentioned above, and chose 20 to 25 sec. as the start delay time for arterial phase. In this case, the thin slice reconstruction can also be used for postprocessing. Do not administer oral contrast medium, as this impairs the editing of MIP/SSD/VRT images. Water could be used instead if necessary.
- You can repeat the same protocol simply by clicking the chronicle with the right mouse button for **repeat**. For example, when both non-contrast and contrast studies are required.
- Water, rather than positive oral contrast agents should be used. Give the last cup 200 ml just prior to positioning the patient. To ensure adequate filling of the duodenal loop, lay the patient on the right side for 5 minutes before performing the topogram.
- A pre-contrast examination is usually performed only if no CT scans were previously acquired, to exclude calculi in the common bile duct and to visualize possible lesions in the liver.
- For pancreatic studies, the arterial phase acquisition can be acquired later with a start delay of 40 sec. – 50 sec. It may be necessary to use a thinner collimation of 3 mm.

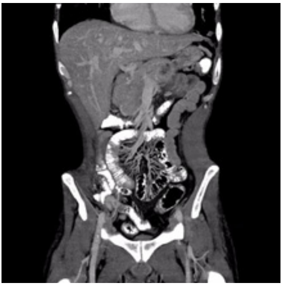
AbdomenVol

Indications:

Spiral mode for all routine studies in the region of abdomen, for example, follow-up examinations etc.

Two recon jobs are predefined for reconstruction: the first for axial, the second for coronal studies in 3D images display view.

The whole scan range of 20 cm will be covered in 11.4 sec.



	AbdCombi	**2nd recon.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*200*	
Rotation Time	*0.50*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*5.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*5.0 mm*	*5.0 mm*
Kernel	*B30f*	*B30f*
$CTDI_{Vol}$	*15.6 mGy*	
Effective dose	*Male: 6.24 mSv* *Female: 7.96 mSv*	

Contrast medium IV injection	
Start delay	*50 – 65 sec.*
Flow rate	*4.0 ml/sec.*
Total amount	*100 ml*

Hints

- You could repeat the same protocol by simply clicking the chronicle with the right mouse button for **repeat**, for example, when both non-contrast and contrast studies are required.
- Delayed scans may be required for the kidneys & bladder.
- If you want to use this protocol for a two-phase study, repeat the same protocol as mentioned above, and choose 20 to 25 sec. as the start delay time for atrerial phase. In this case, the thin slice reconstruction can also be used for post-processing. Do not administer oral contrast medium, as this impairs the editing of MIP/SSD/VRT images. Water could be used instead if necessary.

- Water, rather than positive oral contrast agents should be used. Administer the last cup 200 ml just prior to positioning the patient. To ensure adequate filling of the duodenal loop, lay the patient on the right side for 5 minutes before performing the topogram.
- A pre-contrast examination is usually performed only if no CT scans were previously acquired, to exclude calculi in the common bile duct and to visualize possible lesions in the liver.
- For pancreatic studies, the arterial phase acquisition can be acquired later with a start delay of 40 – 50 sec. It may be necessary to use a thinner collimation.

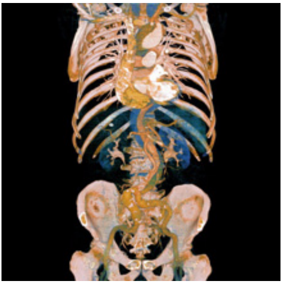
Abdomen

AbdMultiPhase

Indications:

Combination of 3 phases study.

A range of 20 cm including liver, pancreas and kidney: arterial phase acquired in 6.2 sec.



	Non Contrast
kV	*120*
Effective mAs/ Quality ref. mAs	*175*
Rotation Time	*0.5 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*5.0 mm*
Feed/Rotation	*19.2 mm*
Pitch Factor	*0.80*
Increment	*5.0 mm*
Kernel	*B30f*
$CTDI_{Vol}$	*12.3 mGy*
Effective dose	*Male: 4.95 mSv* *Female: 6.49 mSv*

A range of 20 cm including liver, pancreas and kidney: arterial phase acquired in 11.4 sec.

	Arterial Phase	**2nd recon.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*200*	
Rotation Time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*5.0 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*15.6 mGy*	
Effective dose	*Male: 6.24 mSv* *Female: 8.27 mSv*	

A range of 20 cm including liver, pancreas and kidney: arterial phase acquired in 6.2 sec.

	Venous Phase
kV	*120*
Effective mAs/ Quality ref. mAs	*175*
Rotation Time	*0.5 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*5.0 mm*
Feed/Rotation	*19.2 mm*
Pitch Factor	*0.80*
Increment	*5.0 mm*
Kernel	*B30f*
$CTDI_{Vol}$	*12.3 mGy*
Effective dose	*Male: 4.95 mSv* *Female: 6.49 mSv*

Contrast medium IV injection	
Start delay	*20 – 25 sec. (arterial phase)* *50 – 75 sec. (venous phase)*
Flow rate	*4 – 5 ml/sec.*
Total amount	*100 – 120 ml*

Hints

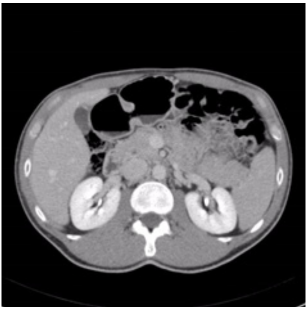
- You could repeat the same protocol by simply clicking the chronicle with the right mouse button for **repeat**, for example, when both non-contrast and contrast studies are required.
- Do not administer oral contrast medium, as this impairs the editing of MIP/SSD/VRT images. Use water instead if necessary.
- Water, rather than positive oral contrast agents should be used. Administer the last cup 200 ml just prior to positioning the patient. To ensure adequate filling of the duodenal loop, lay the patient on the right side for 5 minutes before performing the topogram.
- A pre-contrast examination is usually performed only if no CT scans were previously acquired, to exclude calculi in the common bile duct and to visualize possible lesions in the liver. Furthermore, this also ensures exact positioning for the CTA spiral.
- For pancreatic studies, the arterial phase acquisition can be acquired later with a start delay of 40 – 50 sec. It may be necessary to use a thinner collimation.

AbdomenSeq

Indications:

This protocol has been created for measurement with sequential mode in the region of the abdomen.

A scan range is predefined with 20.5 cm.



	AbdSeq
kV	*120*
Effective mAs/ Quality ref. mAs	*175*
Rotation time	*0.75 sec.*
Acquisition	*2 x 5.0 mm*
Slice collimation	*5.0 mm*
Slice width	*5.0 mm*
Feed/Scan	*10.0 mm*
Kernel	*B31s*
$CTDI_{Vol}$	*11.0 mGy*
Effective dose	*Male: 3.96 mSv Female: 4.95 mSv*

Contrast medium IV injection	
Start delay	*50 – 65 sec.*
Flow rate	*4 ml/sec.*
Total amount	*100 ml*

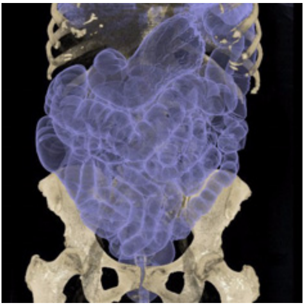
Hints

- You could repeat the same protocol simply by clicking the chronicle with the right mouse button for **repeat**. For example, when both non-contrast and contrast studies are required.
- Water, rather than positive oral contrast agents should be used. Administer the last cup 200 ml just prior positioning the patient. To ensure adequate filling of the duodenal loop, lay the patient on the right side for 5 minutes before performing the topogram.
- A pre-contrast examination is usually performed only if no CT scans were previously acquired, to exclude calculi in the common bile duct and to visualize possible lesions in the liver.

Colonography

Spiral mode used for the application *syngo* **Colonography**. Two ranges are predefined, one for supine and the second one for prone lying patient.

A complete colon in a range of 40 cm will be covered in 12.1 sec.



	Colo_supine	**Colo_prone**
kV	*120*	*120*
Effective mAs/ Quality ref. mAs	*50*	*30*
Rotation Time	*0.5 sec.*	*0.5 sec.*
Acquisition	*16 x 0.75 mm*	*16 x 0.75 mm*
Slice collimation	*0.75 mm*	*0.75 mm*
Slice width	*1.0 mm*	*1.0 mm*
Feed/Rotation	*18.0 mm*	*18.0 mm*
Pitch Factor	*1.5*	*1.5*
Increment	*0.7 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*3.9 mGy*	*2.3 mGy*
Effective dose	*Male: 2.81 mSv Female: 3.92 mSv*	*Male: 1.68 mSv Female: 2.35 mSv*

Contrast medium IV injection	
Start delay	*50 – 60 sec.*
Flow rate	*4.0 ml/sec.*
Total amount	*100 ml*

Hint

- CARE Dose 4D is off by default because for ***syngo* Colonography CT** protocols, the lowest mAs values are used.

For further information on the scan protocols and how to use ***syngo* Colonography CT**, please refer to the Application Guide "**Clinical Applications**".

Overview

In this chapter you will find all scan protocols relating to the **Spine** region, their descriptions, individual indications, and important hints on using them.

You can use the following scan protocols to clarify, for example, prolapse, degenerative changes, trauma, and tumors.

– **C-Spine**
  Spiral mode for cervical spine studies
– **C-SpineVol**
  Spiral mode for axial, sagittal soft tissue and sagittal bone studies for the cervical spine

- **SpineRoutine**
  Spiral mode for routine lumbar and thoracic spine studies
- **SpineThinSlice**
  Spiral mode for thin slice lumbar and thoracic spine studies
- **SpineVol**
  Spiral mode for axial and sagittal lumbar and thoracic spine studies
- **SpineSeq**
  Sequential mode for lumbar and thoracic evaluation of the discs
- **Osteo**
  Sequential mode used for the application *syngo* Osteo CT

General Hints

- Topogram: Lateral,
  512 mm for thoracic and lumbar spine and 256 mm for the c-spine.
- Patient positioning for thoracic and lumbar spine studies:
  Patient lying in supine position, arms positioned comfortably above the head in the head-arm rest, lower legs supported.
- For lumbar studies, place a cushion under the patients knees. This will reduce the curve in the spine and also make the patient more comfortable.
- Patient positioning for cervical spine studies:
  Patient lying in supine position, hyperextend neck slightly, secure head well in head cradle.
- Patient respiratory for thoracic and c-spine studies. Do not breathe, do not swallow.

Any possible injuries to the spinal column should be determined before beginning the examination and taken into account when repositioning the patient.

- In case of 3D study only, the mAs value can be reduced by 50%. Use kernel B10s and at least a 50% overlap for image reconstruction.
- For image reconstruction of bone study, use kernel B60.

- The CT scan following myelography must be performed within 4-6 hours of the injection, otherwise, the contrast density in the spinal canal will be too high to obtain artifact-free images. Also, if possible, it is a good idea to roll the patient once, or scan in a prone position. This will prevent the contrast from pooling posterior to the spinal cord. If a prone scan is performed, breathing instructions are recommended to avoid motion artifact in axial source and MPR images.
- With CAREDose 4D the mA values are adapted for each osteo range, according to the patient diameter. Therefore special obese protocols for the osteo and spine evaluation are not longer necessary.

Body Kernels

The endings “s” or “f” depend on the rotation time.

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, as is required for example, in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.
- The special kernels are mostly used for ”physical” measurements with phantoms, e.g., for adjustment procedures (S80s), for constancy and acceptance tests (S80s, S90s), or for specification purposes (S90s).

For special patient protocols, S80s and S90s are chosen, for example, for osteo (S80s).

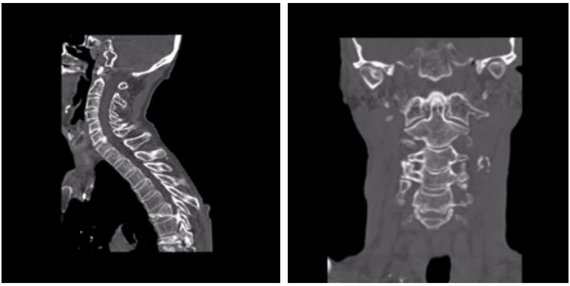
Scan Protocols

C-Spine

Indications:

Spiral mode for cervical spine studies, for example, prolapse, degenerative changes, trauma, tumors etc.

A range of 16 cm will be covered in 14.0 sec.



	C-Spine	**2nd recon.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*330*	
Rotation Time	*0.75 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*2.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*2.0 mm*	*0.7 mm*
Kernel	*B20s*	*B60s*
$CTDI_{Vol}$	*25.7 mGy*	
Effective dose	*Male: 4.78 mSv* *Female: 4.9 mSv*	

Hint

- You could repeat the same protocol by simply clicking the chronicle with the right mouse button for **repeat**.
- Please notice, if you are not satisfied with the Range preset, adapt the parameters to your needs and link them to the series.

C-SpineVol

Indications:

Spiral mode for cervical spine studies, for example, prolapse, degenerative changes, trauma, tumors etc.

Three recon jobs are predefined for reconstruction: the first for soft tissue axial, the second for soft tissue sagittal and third for sagittal bone studies in 3D images display view.

A range of 16 cm will be covered in 14.0 sec.

	C-Spine	**2nd recon.**	**3rd recon.**
kV	*120*		
Effective mAs/ Quality ref. mAs	*330*		
Rotation Time	*0.75 sec.*		
Acquisition	*16 x 0.75 mm*		
Slice collimation	*0.75 mm*		
Slice width	*2.0 mm*	*2.0 mm*	*2.0 mm*
Feed/Rotation	*9.6 mm*		
Pitch Factor	*0.80*		
Increment	*2.0 mm*	*2.0 mm*	*2.0 mm*
Kernel	*B20s*	*B20s*	*B60s*
$CTDI_{Vol}$	*25.7 mGy*		
Effective dose	*Male: 4.78 mSv* *Female: 4.9 mSv*		

Hint

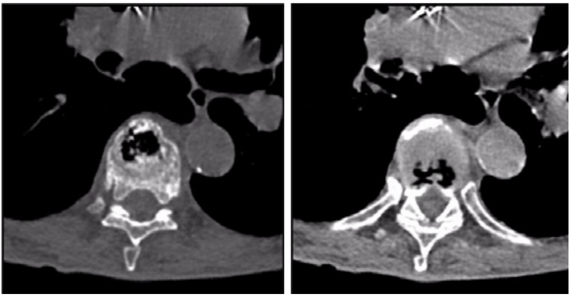
- You could repeat the same protocol by simply clicking the chronicle with the right mouse button for **repeat**.

SpineRoutine

Indications:

Spiral mode for thoracic and lumbar spine studies, for example, prolapse, degenerative changes, trauma, tumors etc.

A range of 16 cm will be covered in 7.7 sec.



	Spine Routine	**2nd recon.**	**3rd recon.**
kV	*120*		
Effective mAs/ Quality ref. mAs	*300*		
Rotation Time	*0.75 sec.*		
Acquisition	*16 x 1.5 mm*		
Slice collimation	*1.5 mm*		
Slice width	*2.0 mm*	*2.0 mm*	*2.0 mm*
Feed/Rotation	*19.2 mm*		
Pitch Factor	*0.80*		
Increment	*3.0 mm*	*1.5 mm*	*1.5 mm*
Kernel	*B20s*	*B20s*	*B60s*
$CTDI_{Vol}$	*21.0 mGy*		
Effective dose	*Male: 7.96 mSv Female: 9.41 mSv*		

Hint

- You could repeat the same protocol by simply clicking the chronicle with the right mouse button for **repeat**.
- Please notice, if you are not satisfied with the Range preset, adapt the parameters to your needs and link them to the series.

SpineThinSlice

Indications:

Spiral mode for thin slice thoracic and lumbar spine studies, e.g., prolapse, degenerative changes, trauma, tumors etc.

A range of 16 cm will be covered in 14.0 sec.

	Spine ThinSlice	**2nd recon.**	**3rd recon.**
kV	*120*		
Effective mAs/ Quality ref. mAs	*300*		
Rotation Time	*0.75 sec.*		
Acquisition	*16 x 0.75 mm*		
Slice collimation	*0.75 mm*		
Slice width	*3.0 mm*	*1.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*		
Pitch Factor	*0.80*		
Increment	*3.0 mm*	*0.7 mm*	*0.7 mm*
Kernel	*B20s*	*B20s*	*B60s*
$CTDI_{Vol}$	*23.4 mGy*		
Effective dose	*Male: 7.82 mSv* *Female: 9.36 mSv*		

Please notice, if you are not satisfied with the Range preset, adapt the parameters to your needs and link them to the series.

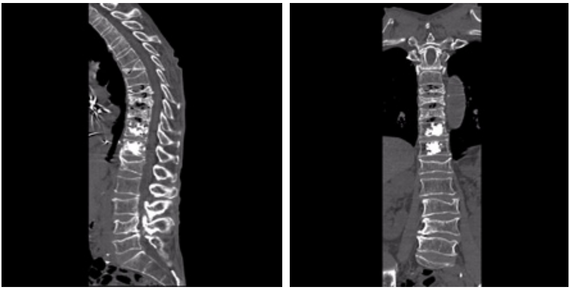
SpineVol

Indications:

Spiral mode for thoracic and lumbar spine studies, for example, prolapse, degenerative changes, trauma, tumors etc.

Three recon jobs are predefined for reconstruction: the first for soft tissue axial, the second for soft tissue sagittal and third for coronal soft tissue studies in 3D images display view.

A range of 16 cm will be covered in 14.0 sec.



	Spine ThinSlice	**2nd recon.**	**3rd recon.**
kV	*120*		
Effective mAs/ Quality ref. mAs	*300*		
Rotation Time	*0.75 sec.*		
Acquisition	*16 x 0.75 mm*		
Slice collimation	*0.75 mm*		
Slice width	*3.0 mm*	*2.0 mm*	*2.0 mm*
Feed/Rotation	*9.6 mm*		
Pitch Factor	*0.80*		
Increment	*3.0 mm*	*2.0 mm*	*2.0 mm*
Kernel	*B20s*	*B20s*	*B20s*
$CTDI_{Vol}$	*23.4 mGy*		
Effective dose	*Male: 7.82 mSv* *Female: 9.36 mSv*		

Hint

- You could repeat the same protocol by simply clicking the chronicle with the right mouse button for **repeat**.

SpineSeq

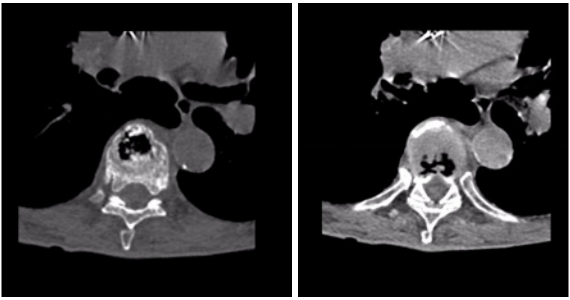
Indications:

Sequence mode for spine studies, for example, prolapse, degenerative changes, trauma, tumors etc.

This protocol contains three ranges: L3-L4, L4-L5, L5-S1.

Three different typical gantry tilts are predefined: for L3-L4: 0°, for L4-L5: +5° and for L5-S1: +15°.

A scan range is predefined with 25.5 mm.



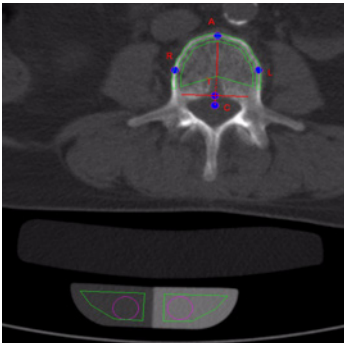
	L3-4	**L4-5**	**L5-S1**
kV	*120*	*120*	*120*
Effective mAs/ Quality ref. mAs	*200*	*200*	*220*
Rotation time	*1.0 sec.*	*1.0 sec.*	*1.0 sec.*
Acquisition	*12 x 0.75 mm*	*12 x 0.75 mm*	*12 x 0.75 mm*
Slice collimation	*0.75 mm*	*0.75 mm*	*0.75 mm*
Slice width	*1.5 mm*	*1.5 mm*	*1.5 mm*
Feed/Scan	*9.0 mm*	*9.0 mm*	*9.0 mm*
Kernel	*B31s*	*B31s*	*B31s*
$CTDI_{Vol}$	*16.8 mGy*	*16.8 mGy*	*18.5 mGy*
Effective dose			
Male:	*1.32 mSv*	*1.02 mSv*	*0.74 mSv*
Female:	*1.61 mSv*	*1.37 mSv*	*1.18 mSv*

Hint

- You could repeat the same protocol by simply clicking the chronicle with the right mouse button for **repeat**.

Osteo

This is the scan protocol for the *syngo* Osteo CT application package to assist the physician with the quantitative assessment of vertebral bone mineral density (BMD) in the diagnosis and follow-up of osteopenia and osteoporosis.



	Osteo
kV	*80*
Effective mAs/ Quality ref. mAs	*250*
Slice collimation	*5.0 mm*
Slice width	*10.0 mm*
Feed/Scan	*0.0 mm*
Kernel	*S80s*
$CTDI_{Vol}$	*5.3 mGy*
Effective dose	*Male: 0.17 mSv* *Female: 0.27 mSv*

- With CAREDose 4D the mA values are adapted for each osteo range, according to the patient diameter. Therefore special obese protocols for the osteo evaluation are not longer necessary.

Load all ranges in the application *syngo* **Osteo CT**.

For further information, please refer to the Application Guide “Clinical Applications“.

Overview

In this chapter you will find all scan protocols relating to the **Pelvis** region, their descriptions, individual indications, and important hints on using them.

You can use the following scan protocols to clarify, for example, abnormalities of the prostate, urinary bladder, rectum, joint cavity, masses, and trauma.

- **PelvisRoutine**
  Spiral mode for routine soft tissue pelvis studies
- **PelvisVol**
  Spiral mode for axial and coronal pelvis studies
- **Hip**
  Spiral mode for routine hip studies
- **HipVol**
  Spiral mode for axial and coronal hip studies
- **SI_Joints**
  Spiral mode for sacral iliac joints studies

General Hints

- Topogram: AP,
  512 mm for pelvis studies and
  256 mm for studies of the hip.
- Patient positioning:
  Patient lying in supine position, arms positioned comfortably above the head in the head-arm rest, lower legs supported.
- A breathing command is not necessarily required for the pelvic examination, since respiration does not negatively influence this region.
- Rectal contrast medium administration:
  Rectal contrast media is usually required to delineate the rectum and sigmoid colon, if lower pelvic mass or pathology is suspected. In some cases, air may be substituted for a positive contrast agent. The use of vaginal tampon may be helpful in adult female patients with suspected pelvis pathology.
- To further optimize MPR and VRT image quality we recommend that you reduce one or more of the following: collimation, reconstruction increment and slice width for image reconstruction.

Body Kernels

The endings “s” or “f” depend on the rotation time.

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, as is required for example, in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.
- The special kernels are mostly used for ”physical” measurements with phantoms, for example, for adjustment procedures (S80s), for constancy and acceptance tests (S80s, S90s), or for specification purposes (S90s).

Pelvis

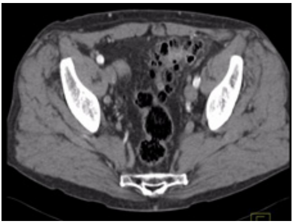
Scan Protocols

PelvisRoutine

Indications:

Spiral mode for routine pelvis studies, for example, processes of the prostate, urinary bladder, rectum, gynecological indications etc.

A typical range of 20 cm will be covered in 6.2 sec.

	Pelvis
kV	*120*
Effective mAs/ Quality ref. mAs	*200*
Rotation Time	*0.5 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*5.0 mm*
Feed/Rotation	*19.2 mm*
Pitch Factor	*0.80*
Increment	*5.0 mm*
Kernel	*B31f*
$CTDI_{Vol}$	*14.0 mGy*
Effective dose	*Male: 6.94 mSv* *Female: 8.85 mSv*

Contrast medium IV injection	
Start delay	*50 sec.* *
Flow rate	*2.0 – 3.0 ml/sec.*
Total amount	*100 – 120 ml*

* *If the examination performed requires a full urinary bladder, following administration of IV administration of contrast medium, wait at least three minutes before starting the scan.*

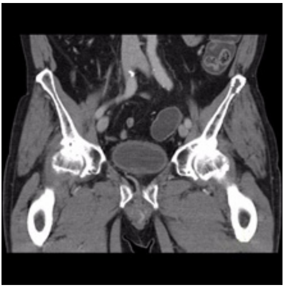
PelvisVol

Indications:

Spiral mode for pelvis studies, for example, processes of the prostate, urinary bladder, rectum, gynecological indi-cations etc.

Two recon jobs are predefined for reconstruction: the first for axial, the second for coronal studies in 3D images display view.

A typical range of 20 cm will be covered in 6.2 sec.



	Pelvis	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*200*	
Rotation Time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*5.0 mm*	*5.0 mm*
Feed/Rotation	*19.2 mm*	
Pitch Factor	*0.80*	
Increment	*5.0 mm*	*5.0 mm*
Kernel	*B31f*	*B31f*
$CTDI_{Vol}$	*14.0 mGy*	
Effective Dose	*Male: 6.94 mSv Female: 8.85 mSv*	

Contrast medium IV injection	
Start delay	*50 sec. **
Flow rate	*2.0 – 3.0 ml/sec.*
Total amount	*100 – 120 ml*

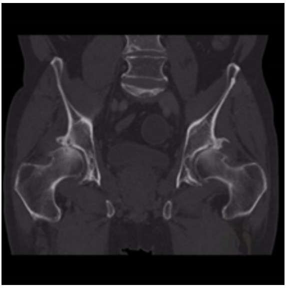
** If the examination performed requires a full urinary bladder, following administration of IV administration of contrast medium, wait at least 3 minutes before starting the scan.*

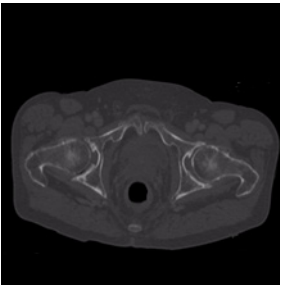
Hip

Indications:

Spiral mode for bone studies and soft tissue studies of the hip, for example, evaluation of joint cavity, masses, trauma, dysplasia, necrosis of the head of the hip, congruence evaluations, orthopedic indications etc.

A typical range of 10 cm will be covered in 12.4 sec.





	Hip	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*175*	
Rotation Time	*1.0 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*5.0 mm*	*0.7 mm*
Kernel	*B60s*	*B60s*
$CTDI_{Vol}$	*13.7 mGy*	
Effective Dose	*Male: 5.02 mSv* *Female: 1.62 mSv*	

Hints

- In case of 3D study only, the mAs value can be reduced by 50%. Use kernel B10s and at least a 50% overlap for image reconstruction.
- If only one side is examined, it is advisable to enter the side in the comment line.

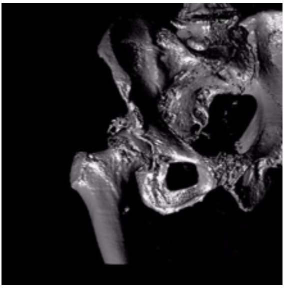
HipVol

Indications:

Spiral mode for bone studies and soft tissue studies of the hip, for example, evaluation of joint cavity, masses, trauma, dysplasia, necrosis of the head of the hip, congruence evaluations, orthopedic indications etc.

A typical range of 10 cm will be covered in 12.4 sec.

Two recon jobs are predefined for reconstruction: the first for axial, the second for coronal studies in 3D images display view.



	Hip	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*175*	
Rotation time	*1.0 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*5.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*5.0 mm*	*5.0 mm*
Kernel	*B60s*	*B60s*
$CTDI_{Vol}$	*13.7 mGy*	
Effective Dose	*Male: 5.02 mSv* *Female: 1.62 mSv*	

For the 2nd reconstruction a non-square matrix 3D recon job is predefined.

Hint

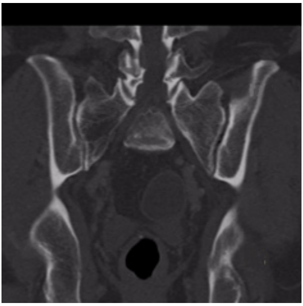
- If only one side is examined, it is advisable to enter the side in the comment line.

SI_Joints

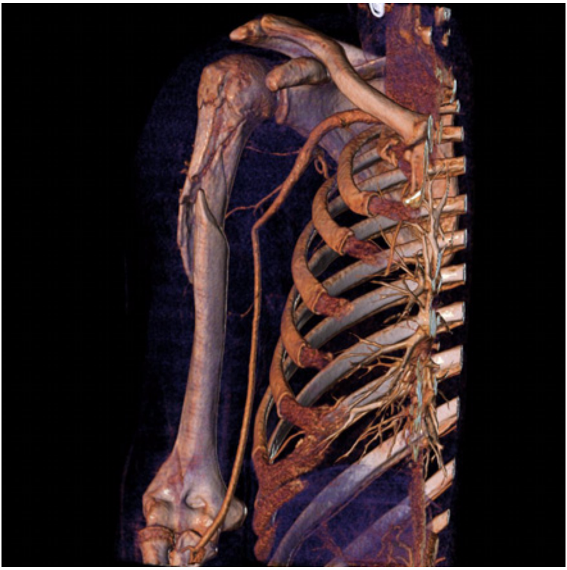
Indications:

Spiral mode for the sacroiliac joints, for example, evaluation of joint cavity, masses, trauma, dysplasia, necrosis, congruence evaluations, orthopedic indications etc.

A typical range of 8 cm will be covered in 5.1 sec.



	SI_Joints	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*200*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*3.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*3.0 mm*	*0.7 mm*
Kernel	*B60f*	*B60f*
$CTDI_{Vol}$	*15.6 mGy*	
Effective dose	*Male: 5.34 mSv* *Female: 1.77 mSv*	



Overview

In this chapter you will find the scan protocol relating to the **Upper Extremities** region, its description, individual indications, and important hints on using it.

You can use the following scan protocol to clarify, for example, trauma, masses, disorders of the joint, and orthopedic indications.

- **WristUHR**
  Spiral mode for routine high resolution wrist studies
- **ExtrRoutineUHR**
  Spiral mode for routine high resolution extremity studies
- **ExtrCombi**
  Spiral mode for the combination of thin slice and routine studies

General Hints

- Topogram: AP, 256 mm for joint studies.
- Patient positioning:
  Depends on the region of examination.
  For bilateral studies, you should always try to position the patient evenly whenever the patient can comply.

For wrists and elbow scans:
Patient lying in **prone position**, hands stretched above the head and lying flat on a Bocollo pillow, ankles supported with a pad. Both wrists should be examined together when necessary.

- Retrospective reconstruction can be done:
  a) Use B50s kernel for soft tissue evaluation.
  b) For targeted FoV images on the affected side, it is advisable to enter the side being examined in the comment line.
- In case of 3D study only, use kernel B10 and at least a 50% overlap image reconstruction.
- To further optimize MPR and VRT image quality we recommend that you reduce one or more of the following:
  collimation, reconstruction increment and slice width for image reconstruction.

Body Kernels

The endings “s” or “f” depend on the rotation time.

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, for example, as is required, e.g., in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.
- The special kernels are used most often for measurements with phantoms, for example, for adjustment procedures (S80s), for constancy and acceptance tests (S80s, S90s), or for specification purposes (S90s).

For special patient protocols, S80s and S90s are chosen, for example, for osteo (S80s).

- For very high sharpness we recommended the U70u, U80u, U90u for bone studies. UHR mode has a maximum FoV of 300 mm.

It is mandatory to position the area of interest in the center of the scan field. Use ExtrCombi mode when a scan FoV > 25 cm is necessary.

Upper Extremities

Scan Protocols

WristUHR

Indications:

Spiral mode for high-resolution bone study of the wrist, for example, trauma, orthopedic indications etc.

Note: UHR mode has a maximum FoV of 300 mm. It is mandatory to position the area of interest in the center of the scan field.

A range of 6 cm will be done in 78.9 sec.

	WristUHR	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*80*	
Rotation time	*1.0 sec.*	
Acquisition	*2 x 0.6 mm*	
Slice collimation	*0.6 mm*	
Slice width	*2.0 mm*	*1.0 mm*
Feed/Rotation	*0.8 mm*	
Pitch Factor	*0.65*	
Increment	*2.0 mm*	*0.7 mm*
Kernel	*U90u*	*U90u*
$CTDI_{Vol}$	*8.6 mGy*	
Effective dose	*Male: 0.01mSv* *Female: 0.01 mSv*	

Hints

- This protocol is used for ultra high-resolution studies.
- For image reconstruction of soft tissue, use kernel U30u.

ExtrRoutineUHR

Indications:

Spiral mode for ultra high-resolution bone study, for example, trauma, orthopedic indications etc.

Note: UHR mode has a maximum FoV of 300 mm. It is mandatory to position the area of interest in the center of the scan field.

A range of 6 cm will be done in 78.9 sec.

	ExtrUHR	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*120*	
Rotation time	*1.0 sec.*	
Acquisition	*2 x 0.6 mm*	
Slice collimation	*0.6 mm*	
Slice width	*2.0 mm*	*1.0 mm*
Feed/Rotation	*0.8 mm*	
Pitch Factor	*0.65*	
Increment	*2.0 mm*	*0.7 mm*
Kernel	*U90u*	*U90u*
$CTDI_{Vol}$	*12.8 mGy*	
Effective dose	*Male: 0.02 mSv* *Female: 0.02 mSv*	

Hint

- For image reconstruction of soft tissue, use kernel U30u.

ExtrCombi

Indications:

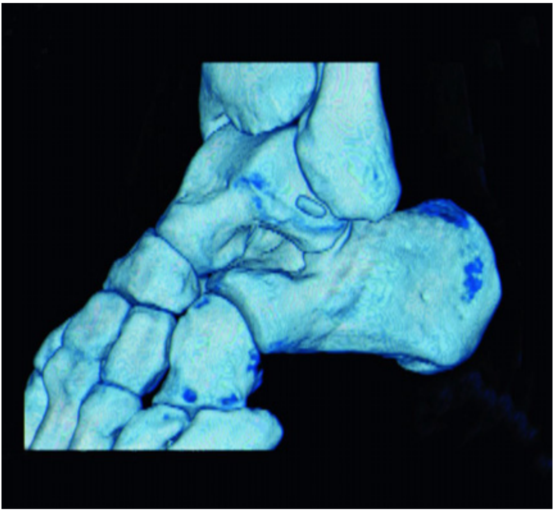
Spiral mode for the combination of bone and soft tissue studies, for example, masses, trauma, disorders of the joint etc.

A range of 15 cm will be done in 24.7 sec.

	ExtrCombi	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*90*	
Rotation time	*1.0 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*4.0 mm*	*1.0 mm*
Feed/Rotation	*6.6 mm*	
Pitch Factor	*0.55*	
Increment	*4.0 mm*	*0.7 mm*
Kernel	*B60s*	*B60s*
$CTDI_{Vol}$	*7.0 mGy*	
Effective dose	*Male: 0.02 mSv* *Female: 0.02 mSv*	

Hint

- For image reconstruction of soft tissue, use kernel B30s/B31s.



Overview

In this chapter you will find the scan protocol relating to the **Lower Extremities** region, its description, individual indications, and important hints on using it.

You can use the following scan protocol to clarify, for example, masses, disorders of the joint, and orthopedic indications.

– **KneeUHR**
  Spiral mode for routine high resolution joint studies–
– **FootUHR**
  Spiral mode for routine high resolution wrist studies
– **ExtrRoutineUHR**
  Spiral mode for routine high resolution extremity studies
– **ExtrCombi**
  Spiral mode for the combination of thin slice and routine studies

General Hints

- Topogram: AP, 256 mm for joint studies.
- Patient positioning:
  Depends on the region of examination.
  In general, for bilateral studies, you should always try to position the patient evenly whenever the patient can comply.
- For knee scan:
  Patient lying in **supine position**, **feet first**, promote relaxation by placing Bocollo pillows between knees and feet, bind feet together.
  The only exceptions are extremely light patients. The latter can remove the leg not being examined from the gantry by bending it 90° at the hip and the knee and placing the bottom of the same foot against the gantry casing.
- For ankle and feet scan:
  Patient lying in **supine position**, **feet first**.
  Bind both ankles together if necessary to assure the AP position of both feet.
  Special positioning is not necessary since the real time MPR could simulate any view of secondary reconstruction.

- Retrospective reconstruction can be done:
  a) Use B50s kernel for soft tissue evaluation.
  b) For targeted FoV images on the affected side, it is advisable to enter the side being examined in the comment line.
- In case of 3D study only, use kernel B10 and at least a 50% overlap image reconstruction.
- To further optimize MPR and VRT image quality we recommend that you reduce one or more of the following:
  collimation, reconstruction increment, and slice width for image reconstruction.

Body Kernels

The endings “s” or “f” depend on the rotation time.

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, for example, as is required, for example, in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.

- The special kernels are used most often for physical measurements with phantoms, for example, for adjustment procedures (S80s), for constancy and acceptance tests (S80s, S90s), or for specification purposes (S90s).

For special patient protocols, S80s and S90s are chosen, for example, for osteo (S80s).

- For very high sharpness we recommended the U70u, U80u, U90u for bone studies. UHR mode has a maximum FoV of 300 mm.

It is mandatory to position the area of interest in the center of the scan field. Use ExtrCombi mode when a scan FoV > 25 cm is necessary.

- In case of 3D study only, the mAs value can be reduced by 50%. Use kernel B10s and at least a 50% overlap for image reconstruction.

If the Pelvis region is included in the scan range, we recommend at least 120 kV.

Scan Protocols

KneeUHR

Indications:

Spiral mode for ultra high-resolution bone study, for example, trauma, orthopedic indications etc.

Note: UHR mode has a maximum FoV of 300 mm. It is mandatory to position the area of interest in the center of the scan field.

A range of 15 cm will be done in 41.2 sec.


	KneeUHR	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation time	*1.0 sec.*	
Acquisition	*6 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*3.0 mm*	*1.0 mm*
Feed/Rotation	*3.8 mm*	
Pitch Factor	*0.85*	
Increment	*3.0 mm*	*0.7 mm*
Kernel	*U90u*	*U90u*
$CTDI_{Vol}$	*12.7 mGy*	
Effective dose	*Male: 0.04 mSv* *Female: 0.04 mSv*	

Hints

- This protocol is used for ultra high-resolution studies.
- For image reconstruction of soft tissue, use kernel U30u.

FootUHR

Indications:

Spiral mode for ultra high-resolution bone study, for example, trauma, orthopedic indications etc.

Note: UHR mode has a maximum FoV of 300 mm. It is mandatory to position the area of interest in the center of the scan field.

A range of 15 cm will be done in 41.2 sec.

	FootUHR	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*120*	
Rotation time	*1.0 sec.*	
Acquisition	*6 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*3.0 mm*	*1.0 mm*
Feed/Rotation	*3.8 mm*	
Pitch Factor	*0.85*	
Increment	*3.0 mm*	*0.7 mm*
Kernel	*U90u*	*U90u*
$CTDI_{Vol}$	*10.9 mGy*	
Effective dose	*Male: 0.03 mSv Female: 0.03 mSv*	

Hints

- This protocol is used for ultra high-resolution studies.
- For image reconstruction of soft tissue, use kernel U30u.

ExtrRoutineUHR

Indications:

Spiral mode for ultra high-resolution bone study, for example, trauma, orthopedic indications etc.

Note: UHR mode has a maximum FoV of 300 mm. It is mandatory to position the area of interest in the center of the scan field.

A range of 6 cm will be done in 78.9 sec.

	ExtrUHR	**2nd reconstr.**
kV	*120*	
*Effective mAs/ Quality ref. mAs**	*120*	
Rotation time	*1.0 sec.*	
Acquisition	*2 x 0.6 mm*	
Slice collimation	*0.6 mm*	
Slice width	*2.0 mm*	*1.0 mm*
Feed/Rotation	*0.8 mm*	
Pitch Factor	*0.65*	
Increment	*2.0 mm*	*0.7 mm*
Kernel	*U90u*	*U90u*
$CTDI_{Vol}$	*12.8 mGy*	
Effective dose	*Male: 0.02 mSv* *Female: 0.02 mSv*	

** Adjust the mAs value to the body region.*

Hint

- For image reconstruction of soft tissue, use kernel U30u.

ExtrCombi

Indications:

Spiral mode for the combination of bone and soft tissue studies, for example, masses, trauma, disorders of the joint etc.

A range of 15 cm will be done in 24.7 sec.

	ExtrCombi	**2nd reconstr.**
kV	*120*	
*Effective mAs/ Quality ref. mAs**	*90*	
Rotation time	*1.0 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*4.0 mm*	*1.0 mm*
Feed/Rotation	*6.6 mm*	
Pitch Factor	*0.55*	
Increment	*4.0 mm*	*0.7 mm*
Kernel	*B60s*	*B60s*
$CTDI_{Vol}$	*7.0 mGy*	
Effective dose	*Male: 0.02 mSv* *Female: 0.02 mSv*	

** Adjust the mAs value to the body region.*

Hint

- For image reconstruction of soft tissue, use kernel U30u.

Overview

In this chapter you will find all scan protocols relating to the **Vascular** region, their descriptions, individual indications, and important hints on using them.

You can use the following scan protocols to clarify, for example, vascular abnormalities, stenosis or occlusions, coarse plaques anomalies, aneurysm, and embolism.

– **HeadAngioRoutine**
  Spiral mode for routine head CTAngio studies
– **HeadAngioVol**
  Spiral mode for axial and coronal HeadCTAngio studies

- **NeuroDSACT**
  Description can be found in **Clinical Applications Application Guide**
- **CarotidAngioRoutine**
  Spiral mode for carotid CTAngio studies
- **CarotidAngioVol**
  Spiral mode for axial and coronal carotid CTAngio studies
- **ThorAngioRoutine**
  Spiral mode for routine thorax CTAngio studies
- **ThorAngioVol**
  Spiral mode for axial and oblique thorax CTAngio studies
- **ThorCardioECG/ThorCardioECG037s**
  Spiral mode for ECG-gated thorax CTAngio studies
- **Embolism/Embolism042s**
  Spiral mode for routine pulmonary embolism studies
- **BodyAngioRoutine**
  Spiral mode for body CTAngio studies
- **BodyAngioFast**
  Spiral mode for fast body CTAngio studies
- **BodyAngioVol**
  Spiral mode for axial and coronal body CTAngio studies
- **AngioRunOff**
  Spiral mode for long distance extremity CTAngio studies
- **WholeBodyAngio**
  Spiral mode for whole body angio studies

General Hints

- Topogram: AP, 512/1024 or LAT 256
- Patient positioning:
  Patient lying in supine position, arms positioned comfortably above the head in the head-arm rest, lower legs supported.
- Patient respiratory instructions for carotid and body studies: inspiration.
- Oral administration of contrast medium:
  The use of water will not obscure the blood vessels thus allowing CTA post-processing to be performed easily afterwards.
- Be careful when examining pheochromocytoma patients. Administration of an IV CM injection in such cases may trigger a hypertensive crisis!
- To further optimize MPR and VRT image quality we recommend that you reduce one or more of the following:
  collimation, reconstruction increment and slice width for image reconstruction.

Head Kernels

The endings “s” or “f” depend on the rotation time.

- For soft tissue head studies, the standard kernel is H40s; softer images are obtained with H30s or H20s, H10s, sharper images with H50s. The kernels H21s, H31s, H41s yield the same visual sharpness as H20s, H30s, H40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using H31s, H 41s instead of H30s, H40s. For the standard head protocols, we propose H21s, H31s, H41s.
- For a better gray-white brain tissue differentiation use the H37f/s, H47f/s or H48f/s.
- High resolution head studies should be performed with H60s, H70s (for example, for dental and sinuses).

Body Kernels

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, for example, as is required, e.g., in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.
- In case of 3D study only, the mAs value can be reduced by 50%. Use kernel B10s and at least a 50% overlap for image reconstruction.

Vascular

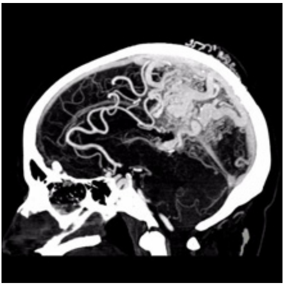
Scan Protocols

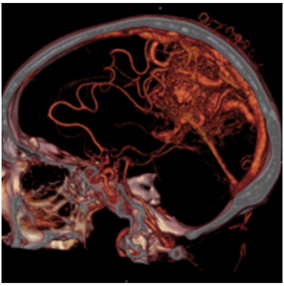
HeadAngioRoutine

Indications:

Spiral mode for cerebral CT Angio studies, for example, cerebral vascular abnormalities, tumors and follow up studies etc.

A range of 80 mm will be covered in 3.9 sec.





	HeadAngio	**2nd reconstr.**
kV	*100*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*4.0 mm*	*1.0 mm*
Feed/Rotation	*13.8 mm*	
Pitch Factor	*1.15*	
Increment	*4.0 mm*	*0.7 mm*
Kernel	*H20f*	*H10f*
$CTDI_{Vol}$	*19.7 mGy*	
Effective dose	*Male: 0.71 mSv* *Female: 0.76 mSv*	

Contrast medium IV injection	
Start delay	*18 sec.*
Flow rate	*3.5 ml/sec.*
Total amount	*75 ml*

Hint

- Use of CARE Bolus with monitoring scans positioned at the level of the basilar artery or carotid artery. Set the trigger threshold at 120 HU, or use manual triggering.

HeadAngioVol

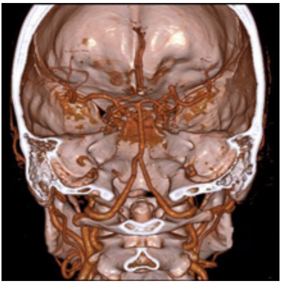
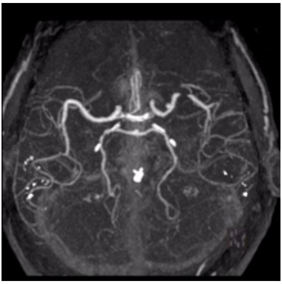
Indications:

Spiral mode for cerebral CT Angio studies, for example, cerebral vascular abnormalities, tumors and follow-up studies etc.

Two recon jobs are predefined for reconstruction: the first for axial, the second for coronal studies in 3D images display view.

The coronal view images will be reconstructed as MIP images.

A range of 12.0 cm will be covered in 5.3 sec.

	HeadAngio	**2nd reconstr.**
kV	*100*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*4.0 mm*	*4.0 mm*
Feed/Rotation	*13.8 mm*	
Pitch Factor	*1.15*	
Increment	*4.0 mm*	*4.0 mm*
Kernel	*H20f*	*H10f*
$CTDI_{Vol}$	*19.7 mGy*	
Effective dose	*Male: 0.90 mSv Female: 0.95 mSv*	

Contrast medium IV injection	
Start delay	*18 sec.*
Flow rate	*3.5 ml/sec.*
Total amount	*75 ml*

Hint

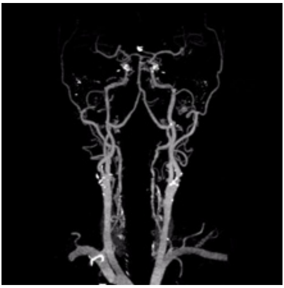
- Use of CARE Bolus with monitoring scans positioned at the level of the basilar artery or carotid artery. Set the trigger threshold at 120 HU, or use manual triggering.

CarotidAngioRoutine

Indications:

Noninvasive CT angiography of the carotid arteries, for example, carotid stenosis or occlusion, coarse plaques abnormalities of the carotids or vertebral arteries, etc.

A range of 20 cm including the aorta arch will be covered in 8.2 sec.




	CarotidAngio	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*120*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*1.0 mm*
Feed/Rotation	*13.8 mm*	
Pitch Factor	*1.15*	
Increment	*5.0 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*9.4 mGy*	
Effective dose	*Male: 2.02 mSv Female: 1.89 mSv*	

Contrast medium IV injection	
Start delay	*4 – 20 sec.*
Flow rate	*4 ml/sec.*
Total amount	*90 ml*

Hints

- CARE Bolus may be used to optimize the bolus timing.
- Set the ROI for monitoring scan in the aortic arch with triggering threshold of 120 HU, or use manual triggering.
- High quality 2D & 3D postprocessing can be achieved using a thin slice thickness and 50% overlapping increments.
- MPR Thick and MIP Thin can be created very quickly on the 3D Task Card by just clicking on the appropriate icons. The thickness of these reconstructed images can be defined by clicking on the icons with the right mouse to open the entry field.

CarotidAngioVol

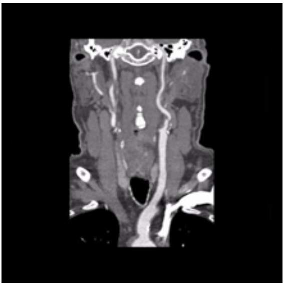
Indications:

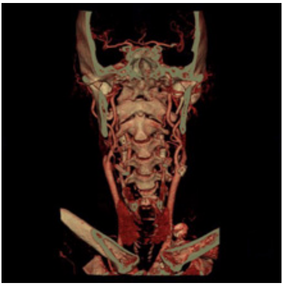
CT angiography of the carotid arteries, e.g., carotid stenosis or occlusions, coarse plaques abnormalities of the carotids and vertebral arteries, etc.

Two recon jobs are predefined for reconstruction: the first for axial, the second for coronal studies in 3D images display view.

The coronal view images will be reconstructed as MIP images.

A range of 20 cm including the aorta arch will be covered in 8.2 sec.





	CarotidAngio	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*120*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*3.0 mm*
Feed/Rotation	*13.8 mm*	
Pitch Factor	*1.15*	
Increment	*5.0 mm*	*3.0 mm*
Kernel	*B30f*	*B30f*
$CTDI_{Vol}$	*9.4 mGy*	
Effective dose	*Male: 2.02 mSv Female: 1.89 mSv*	

Contrast medium IV injection	
Start delay	*4 – 6 sec.*
Flow rate	*4 ml/sec.*
Total amount	*90 ml*

Hints

- CARE Bolus may be used to optimize the bolus timing.
- Set the ROI for monitoring scan in the aortic arch with triggering threshold of 120 HU, or use manual triggering.
- High quality 2D & 3D postprocessing can be achieved using a thin slice thickness and 50% overlapping increments.
- MPR Thick and MIP Thin images can be created very quickly on the **3D** Task Card by just clicking on the appropriate icons. The thickness of these reconstructed images can be defined by clicking on the icons with the right mouse to open the entry field. For further information about 3D reconstructions please refer to the chapter **WorkStream 4D** or chapter ***syngo* 3D** in the Application Guide **"Clinical Applications"**.

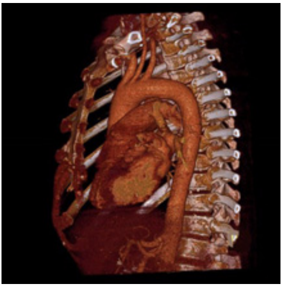
Vascular

ThorAngioRoutine

Indications:

Spiral mode for thoracal CT Angio studies, for example, visualization of tumors, metastases, lymphoma, lymph nodes, vascular anomalies etc.

A range of 40 cm will be covered in 15.4 sec.



	ThorAngio	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*120*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*1.0 mm*
Feed/Rotation	*13.8 mm*	
Pitch Factor	*1.15*	
Increment	*5.0 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*9.4 mGy*	
Effective dose	*Male: 6.14 mSv* *Female: 7.6 mSv*	

Contrast medium IV injection	
Start delay	*10 – 15 sec.*
Flow rate	*2.5 ml/sec.*
Total amount	*80 ml*

Hints

- CARE Bolus may be used to optimize the bolus timing.
- Set the ROI for monitoring scan in the aortic arch with triggering threshold of 120 HU, or use manual triggering.
- MPR Thick and MIP Thin images can be created very quickly on the 3D Task Card by just clicking on the appropriate icons. The thickness of these reconstructed images can be defined by clicking on the icons with the right mouse to open the entry field.
- Editing is necessary for SSD display of the thoracic aorta without the bone.

ThorAngioVol

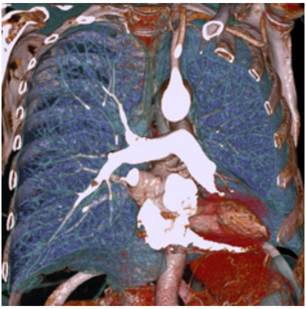
Indications:

Spiral mode for thoracic CT Angio studies, for example, visualization of tumors, metastases, lymphoma, lymph nodes, vascu-lar anomalies etc.

Two recon jobs are predefined for reconstruction: the first for axial, the second for double-oblique studies in 3D images display view.

The oblique view images will be reconstructed as MIP images.

A range of 40 cm will be covered in 15.4 sec.



	ThorAngio	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*120*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*3.0 mm*
Feed/Rotation	*13.8 mm*	
Pitch Factor	*1.15*	
Increment	*5.0 mm*	*3.0 mm*
Kernel	*B30f*	*B30f*
$CTDI_{Vol}$	*9.4 mGy*	
Effective dose	*Male: 6.14 mSv* *Female: 7.6 mSv*	

Contrast medium IV injection	
Start delay	*10 – 15 sec.*
Flow rate	*2.5 ml/sec.*
Total amount	*80 ml*

Hints

- CARE Bolus may be used to optimize the bolus timing.
- Set the ROI for monitoring scan in the aortic arch with triggering threshold of 120 HU, or use manual triggering.

ThorCardioECG

Indications:

This is a spiral scanning protocol using an ECG gating technique for thoracic Angio studies, for example, visualization of pulmonary embolism, coronary stenosis, vascular anomalies etc.

A range of 25 cm including the aorta arch will be covered in 23.8 sec.

	ThorCorECG	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*440*	
Rotation Time	*0.42 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*3.0 mm*	*1.0 mm*
Feed/Rotation	*4.6 mm*	
Pitch Factor	*0.38*	
Increment	*3.0 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
Temp. resolution[1]	*up to 94 ms*	
$CTDI_{Vol}$	*34.3 mGy*	
Effective dose	*Male: 15.19 mSv Female: 18.02 mSv*	

1. *depends on heart rate*

Contrast medium IV injection	
Start delay	*10 – 15 sec.*
Flow rate	*2.5 ml/sec.*
Total amount	*80 ml*

Hints

- CARE Bolus may be used to optimize the bolus timing.
- Set the ROI for monitoring scan in the aorta thoracalis with triggering threshold of 120 HU, or use manual triggering.

Embolism/Embolism042s

Indications:

Spiral mode for pulmonary embolism studies.

A range of 30 cm will be covered in 16.6/13.9 sec.

	Embolism	**2nd reconstr.**
kV	*100*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation Time	*0.5/0.42 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*3.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.8*	
Increment	*3.0 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*7.0 mGy*	
Effective dose	*Male: 3.63 mSv* *Female: 4.33 mSv*	

Contrast medium IV injection	
Start delay	*4 – 10 sec.*
Flow rate	*4 ml/sec.*
Total amount	*80 – 100 ml*

Hints

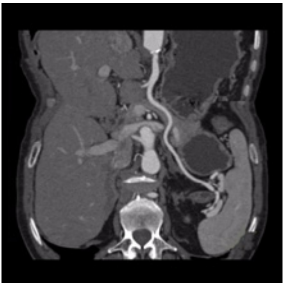
- CARE Bolus may be used to optimize the bolus timing.
- Set the ROI for monitoring scan in the pulmonary trunk with triggering threshold of 120 HU, or use manual triggering.

BodyAngioRoutine

Indications:

Spiral mode for abdominal CT Angio studies.

A typical study in a range of 40 cm will be covered in 15.4 sec.



	BodyAngio	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation Time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*1.0 mm*
Feed/Rotation	*13.8 mm*	
Pitch Factor	*1.15*	
Increment	*5.0 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*10.9 mGy*	
Effective dose	*Male: 7.16 mSv Female: 8.87 mSv*	

Contrast medium IV injection	
Start delay	*10 – 15 sec.*
Flow rate	*3.0 – 3.5 ml/sec.*
Total amount	*100 – 120 ml*

Hints

- CARE Bolus may be used to optimize bolus timing.
- Set the ROI for monitoring scan in the aorta abdominalis with triggering threshold of 120 HU, or use manual triggering.
- Do not administer oral contrast medium, as this impairs the editing of MIP/SSD/VRT images.
- Use water as oral contrast.
- You can accurately plan your contrast spiral range in the topogram, by using the table positions from the already scanned pre-contrast spiral range.
- Precontrast images are used to visualize calcification.
- Excellent post-processed images can be created using a thin slice thickness and overlapping images, i.e. the increment should be smaller than the slice thickness.

BodyAngioFast

Indications:

Spiral mode for abdominal CT Angio studies, longer coverage and larger vessels.

A typical study of the whole aorta including its branchiocephalic trunk and iliac arteries in a range of 60 cm will be covered in 11.8 sec.

	BodyAngio Fast	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation Time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*5.0 mm*	*2.0 mm*
Feed/Rotation	*27.6 mm*	
Pitch Factor	*1.15*	
Increment	*5.0 mm*	*1.5 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*9.8 mGy*	
Effective dose	*Male: 9.76 mSv* *Female: 13.99 mSv*	

Contrast medium IV injection	
Start delay	*10 sec.*
Flow rate	*3.5 ml/sec.*
Total amount	*120 ml*

Hints

- CARE Bolus may be used to optimize bolus timing.
- Set the ROI for monitoring scan in the aorta abdominalis with triggering threshold of 120 HU, or use manual triggering.
- Do not administer oral contrast medium, as this impairs the editing of MIP/SSD/VRT images.
- Use water as oral contrast.
- You can accurately plan your contrast spiral range in the topogram, by using the table positions from the already scanned pre-contrast spiral range.
- Precontrast images are used to visualize calcification.
- Excellent postprocessed images can be created using a thin slice thickness and overlapping images, i.e. the increment should be smaller than the slice thickness.

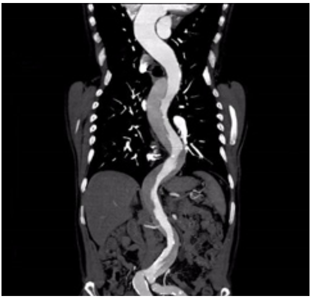
BodyAngioVol

Indications:

Spiral mode for abdominal CT Angio studies.

Two recon jobs are predefined for reconstruction: the first for axial, the second for coronal studies in 3D images display view. The coronal view images will be reconstructed as MIP images.

A typical study in a range of 40 cm will be covered in 15.4 sec.



	BodyAngio	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation Time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*3.0 mm*
Feed/Rotation	*13.8 mm*	
Pitch Factor	*1.15*	
Increment	*5.0 mm*	*3.0 mm*
Kernel	*B30f*	*B30f*
$CTDI_{Vol}$	*10.9 mGy*	
Effective dose	*Male: 7.16 mSv Female: 8.87 mSv*	

Contrast medium IV injection	
Start delay	*10 – 25 sec.*
Flow rate	*3.0 – 3.5 ml/sec.*
Total amount	*100 – 120 ml*

Hints

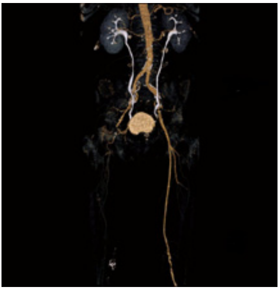
- CARE Bolus may be used to optimize the bolus timing.
- Set the ROI for monitoring scan in the aorta abdominalis with triggering threshold of 120 HU, or use manual triggering.
- Do not administer oral contrast medium, as this impairs the editing of MIP/SSD/VRT images.
- Use water as oral contrast.
- You can accurately plan your contrast spiral range in the topogram, by using the table positions from the already scanned pre-contrast spiral range.
- Precontrast images are used to visualize calcification.
- Excellent post-processed images can be created using a thin slice thickness and overlapping images, i.e. the increment should be smaller than the slice thickness.

AngioRunOff

Indications:

For CT Angio spiral studies of the extremities.

A range of 80 cm will be done in 18.5 sec.



	AngioRunOff	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation Time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*6.0 mm*	*2.0 mm*
Feed/Rotation	*22.8 mm*	
Pitch Factor	*0.95*	
Increment	*6.0 mm*	*1.5 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*9.8 mGy*	
Effective dose	*Male: 6.43 mSv Female: 6.19 mSv*	

Contrast medium IV injection	
Start delay	*10 – 20 sec.*
Flow rate	*3.0 – 3.5 ml/sec.*
Total amount	*120 – 150 ml*

Hints

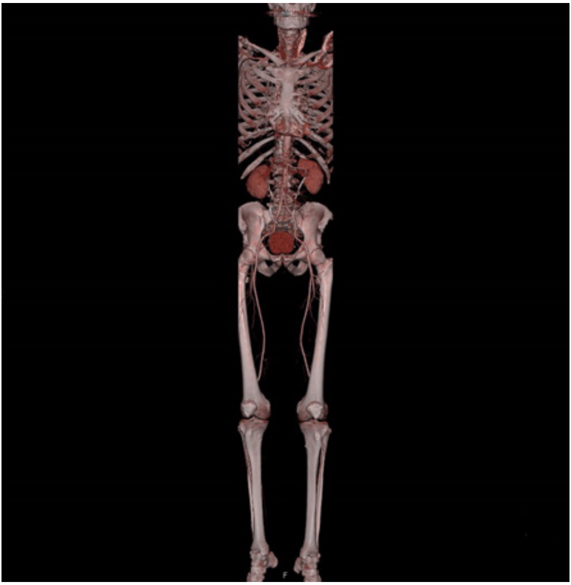
- CARE Bolus may be used to optimize the bolus timing.
- Set the ROI for monitoring scan with triggering threshold of 120 HU, or use manual triggering.
- If topogram length 1024 mm is not long enough, you can also choose the 1540 mm long topogram.
- Position the patient as feet first. Bend the feet together if necessary.

WholeBodyAngio

Indications:

For CTA studies of the whole body.

A range of 80 cm will be done in 15.4 sec.



	WholeBody	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation Time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*6.0 mm*	*2.0 mm*
Feed/Rotation	*27.6 mm*	
Pitch Factor	*1.15*	
Increment	*6.0 mm*	*1.5 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*9.8 mGy*	
Effective dose	*Male: 13.41 mSv Female: 14.9 mSv*	

Contrast medium IV injection	
Start delay	*10 – 20 sec.*
Flow rate	*3.0 – 3.5 ml/sec.*
Total amount	*120 – 150 ml*

Hints

- CARE Bolus may be used to optimize the bolus timing.
- Set the ROI for monitoring scan with triggering threshold of 120 HU, or use manual triggering.
- If topogram length 1024 mm is not long enough, you can also choose the 1540 mm long topogram.

Overview

The examination protocols designed for some of these applications are under the “Special” folder.

Trauma

In any trauma situation, time means life and the quality of life for the survivor. To facilitate the examinations, five protocols are provided.

– **Trauma**
  This is a one-range mode for fast screening
– **TraumaVol**
  This is an one-range mode for fast screening for coronal and sagittal studies
– **PolyTrauma**
  This is a combined mode for the examination of multiple ranges, for example, Head, Neck, Thorax, Abdomen and Pelvis
– **HeadTrauma**
  Spiral head protocol for trauma studies with a FoV of 500 and therefore lowered image quality
– **HeadTraumaSeq**
  Sequential head protocol for trauma studies, with a FoV of 500 and therefore lowered image quality

Interventional CT

- **Biopsy**
  This is the multislice biopsy mode. With three times 6 mm, the images will be reconstructed and displayed for each scan.
- **BiopsySingle**
  This is a single multislice biopsy mode. One 10mm slice is aquired.
- **CARE Vision**
  The CARE Vision protocol is a spiral mode without table feed, using a three times 6 mm slice thickness.
- **CARE VisionSingle**
  The CARE Vision protocol is a spiral mode without table feed, using a 10 mm slice thickness.
- **CARE VisionBone**
  The CARE Vision protocol is a spiral mode without table feed, using a three times 6 mm slice thickness with a bone kernel.

Test Bolus

- **TestBolus**
  This mode can be used to test the start delay of optimal enhancement after the contrast medium injection.

Trauma Protocols

In any trauma situation, time means life and the quality of life for the survivor.

General Information

- Check that the emergency drug trolley is well-stocked and that all accessories such as in-room oxygen supply, respirator and resuscitation equipment that may be required during the examination are in workIng order.
- Prepare the CT room before admitting the patient, for example, load IV contrast into the injector.
- Know, observe and practice the standard hospital operating policy, for example, handling a patient in distress Code Blue for cardiac and respiratory arrest.
- Any possible injuries to the spinal column should be determined before beginning the examination and taken into account when shifting and positioning the patient.
- Ensure that all vital lines for example, IV tubing and oxygen tubing are not trapped under the patient or between the table and the cradle. Make allowance for the length of tubing required for the topogram scan range.
- Never leave patients unattended at any time during the procedure.
- Observe the vital signs for example, respiration, etc. at all times during the procedure.
- Finish the examination in the shortest possible time.

Trauma

This is a one-range mode for fast screening.

A scan range of 50.4 cm will be done in 10.1 s.

	Trauma	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*140*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*7.0 mm*	*2.0 mm*
Feed/Rotation	*27.6 mm*	
Pitch Factor	*1.15*	
Increment	*7.0 mm*	*1.5 mm*
Kernel	*B31f*	*B70f*
$CTDI_{Vol}$	*9.8 mGy*	
Effective dose	*Male: 7.8 mSv* *Female: 11.9 mSv*	

TraumaVol

This is a one-range mode for fast screening. Three recon jobs are predefined for reconstruction: the first for axial, the second for coronal and the third for sagittal studies in 3D images display view.

A scan range of 75 cm will be done in 14.5 sec.

	Trauma	**2nd recon.**	**3rd recon.**
kV	*120*		
Effective mAs/ Quality ref. mAs	*140*		
Rotation time	*0.5 sec.*		
Acquisition	*16 x 1.5 mm*		
Slice collimation	*1.5 mm*		
Slice width	*7.0 mm*	*7.0 mm*	*7.0 mm*
Feed/Rotation	*27.6 mm*		
Pitch Factor	*1.15*		
Increment	*7.0 mm*	*7.0 mm*	*7.0 mm*
Kernel	*B30f*	*B30f*	*B30f*
$CTDI_{Vol}$	*9.8 mGy*		
Effective dose	*Male: 12.86 mSv* *Female: 14.41 mSv*		

	4th recon.	*5th recon.*
Slice width	*7.0 mm*	*7.0 mm*
Increment	*7.0 mm*	*7.0 mm*
Kernel	*B70f*	*B70f*

For the 2nd reconstruction a 3D coronal recon job for soft tissue, for the 3rd reconstruction a 3D sagittal recon job for soft tissue, for the 4th reconstruction a 3D coronal recon job for bone studies, for the 5th reconstruction a 3D sagittal recon job for bone studies are predefined.

PolyTrauma

Two combined ranges are predefined, head with neck and thorax with abdomen.

A scan range of 12/14 cm will be done in 11.0/4.6 sec.

	Head
kV	*120*
Effective mAs/ Quality ref. mAs	*320*
Rotation time	*1.00 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*6.0 mm*
Feed/Rotation	*13.2 mm*
Pitch Factor	*0.55*
Increment	*6.0 mm*
Kernel	*H31s*
$CTDI_{Vol}$	*60.8 mGy*
Effective dose	*Male: 3.14 mSv Female: 3.43 mSv*

	Neck
kV	*120*
Effective mAs/ Quality ref. mAs	*150*
Rotation time	*0.5 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*5.0 mm*
Feed/Rotation	*19.20 mm*
Pitch Factor	*0.80*
Increment	*5.0 mm*
Kernel	*B31f*
$CTDI_{Vol}$	*10.5 mGy*
Effective dose	*Male: 1.81 mSv* *Female: 2.06 mSv*

Take a new Topogram for the thorax and abdomen range.

A scan range of 20/40 cm will be done in 9.3/17.1 sec.

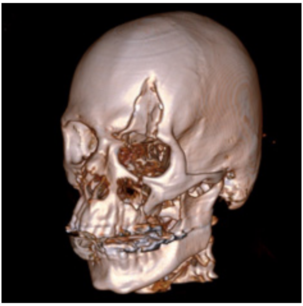
	Thorax
kV	*120*
Effective mAs/ Quality ref. mAs	*110*
Rotation time	*0.75 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*7.0 mm*
Feed/Rotation	*19.2 mm*
Pitch Factor	*0.80*
Increment	*7.0 mm*
Kernel	*B41s*
$CTDI_{Vol}$	*7.7 mGy*
Effective dose	*Male: 2.65 mSv Female: 3.48 mSv*

	AbdPelvis
kV	*120*
Effective mAs/ Quality ref. mAs	*200*
Rotation time	*0.75 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*7.0 mm*
Feed/Rotation	*19.2 mm*
Pitch Factor	*0.80*
Increment	*7.0 mm*
Kernel	*B31s*
$CTDI_{Vol}$	*14.0 mGy*
Effective dose	*Male: 11.48 mSv* *Female: 14.73 mSv*

HeadTrauma

A spiral mode for emergency head studies with a max. FoV of 500 mm.

A scan range of 12 cm will be covered in 20.1 sec.



	Head	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*320*	
Rotation time	*1.0 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*6.0 mm*	*6.0 mm*
Feed/Rotation	*6.6 mm*	
Pitch Factor	*0.55*	
Increment	*6.0 mm*	*6.0 mm*
Kernel	*H31s*	*H60s*
$CTDI_{Vol}$	*67.5 mGy*	
Effective dose	*Male: 3.16 mSv Female: 3.4 mSv*	

HeadTraumaSeq

A sequence mode for emergency head studies with a max. FoV of 500 mm.

A scan range is predefined with 11.7 cm.

	HeadSeq	
kV	*120*	
Effective mAs/ Quality ref. mAs	*310*	
Rotation time	*1.0 sec.*	
Acquisition	*12 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*9.0 mm*	*9.0 mm*
Feed/Scan	*18.0 mm*	
Kernel	*H31s*	*H60s*
$CTDI_{Vol}$	*59.5 mGy*	
Effective dose	*Male: 2.72 mSv* *Female: 2.79 mSv*	

Additional Important Information

- You can access which protocol is the emergency protocol.
- For long range scanning, please pay attention to the mark of scannable range on the table mattress while positioning the patient.
- In some cases, it might be advisable to position the patient feet first so that there will be more space for the intensive care equipment around.
- The Trauma protocol is predefined with a Topo length of 1024 mm, the Poly Trauma protocol with a Topo length of 1536 mm.
  Note: You should press the "Hold Measurement" button whenever the range shown on the real time growing topogram is long enough, in order to avoid unnecessary radiation.

Interventional CT - Biopsy

To facilitate CT interventional procedures, we created dedicated multislice and single slice sequential modes.

Any of these protocols can be appended to a spiral protocol for CT interventional procedures, such as biopsy, abscess drainage, pain therapy, minimum invasive operations, joint studies, and arthrograms. Adjust the mAs according to the body region before loading.

10 scans are predefined. You can repeat it by clicking the chronicle with the right mouse button and select **repeat**, or simply change the number of scans to 99 before you start the first scan.

You can "Append" any routine protocol after the interventional procedure for a final check and documentation, e.g., a short range of spiral scanning for the biopsy region.

The table height can be adjusted to a minimum of 255 mm.

Zoom and pan of the images is possible within the Biopsy Mode.

Biopsy

With this routine protocol images will be reconstructed with three time 6mm slice thickness.

The scan length is 1.2 cm.

	Biopsy
kV	*120*
Effective mAs/ Quality ref. mAs	*50*
Rotation time	*0.5 sec.*
Acquisition	*12 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*6.0 mm*
Feed/Scan	*0.0*
Kernel	*B30f*
$CTDI_{vol}$	*3.6 mGy*

Biopsy Single

One 10 mm slice images will be reconstructed and displayed for each scan.

	Biopsy Single
kV	*120*
Effective mAs/ Quality ref. mAs	*50*
Rotation time	*0.5 sec.*
Acquisition	*2 x 5.0 mm*
Slice collimation	*5.0 mm*
Slice width	*10.0 mm*
Feed/Scan	*0.0 mm*
Kernel	*B30f*
$CTDI_{Vol}$	*3.2 mGy*

Interventional CT - CARE Vision

CARE Vision is a CT Fluoroscopic mode for interventions with 1 or 3 combined slices and up to 10 images per sec. displayed (depending on the hardware configuration).

The Basics

Any of the predefined CARE Vision scan protocols can be appended to a spiral protocol for interventional procedures, such as biopsies, abscess drainage, pain therapy, minimum invasive operations, joint studies, and arthograms.

The raw data will not be available for image reconstruction. In case of the FoV must be changed due to movement, insert a control scan by clicking on the chronicle with the right mouse button.

You can “Append” any routine protocol after the interventional procedure for a final check and documentation, for example, a short range of spiral scanning for the biopsy region.

With gantry tilt 0° the table height can be adjusted to minimum vertical position of 255 mm.

Automatic Patient Instruction (API) is not possible for CARE Vision.

You can change the gantry tilt on the gantry panel while the protocol is loaded.

CAREVision

With this routine protocol, the image will be reconstructed and displayed using three times 6 mm slice thickness and a kernel of B30 in the CARE View mode.

	CAREVision
kV	*120*
Effective mAs/ Quality ref. mAs	*30*
Rotation time	*0.5 sec.*
Acquisition	*12 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*6.0 mm*
Feed/Scan	*0.0*
Kernel	*B30f*
$CTDI_{vol}$	*2.2 mGy*

CAREVisionSingle

The images will be reconstructed and displayed with one time 10 mm slice thickness and a kernel of B30.

	CAREVision
kV	*120*
Effective mAs/ Quality ref. mAs	*30*
Rotation time	*0.5 sec.*
Acquisition	*2 x 5.0 mm*
Slice collimation	*5.0 mm*
Slice width	*10.0 mm*
Feed/Scan	*0.0*
Kernel	*B30f*
$CTDI_{vol}$	*1.9 mGy*

CAREVisionBone

The images will be reconstructed and displayed in the CARE View mode with three times 6.0 mm slice thickness and a kernel of B50.

	CAREVision
kV	*120*
Effective mAs/ Quality ref. mAs	*30*
Rotation time	*0.5 sec.*
Acquisition	*12 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*6.0 mm*
Feed/Scan	*0.0*
Kernel	*B50f*
$CTDI_{vol}$	*2.2 mGy*

Additional Important Information

Pause CARE Vision Scan Range

If you pause the **CARE Vision Scan Range** the **SlicePosition** and TableHeight will be displayed in the Image Text.

Reference Image Display

To display a reference image during the examination procedure, the **Viewing** task card can be displayed on a second monitor.

Additional Dose Information

CARE Vision uses scan parameters and operating conditions, which are unique and may require additional care and radiation protection measures.

To avoid unnecessary exposure in any case, the scan time should be kept as short as possible.

Radiation exposure to patients

- CARE Vision applies continuous exposure at moderate mA levels.
- Due to the potentially long scan times and the limited scan volume, the dose for certain slices may increase to levels significantly higher than those known from standard CT applications.
- The patient's exposure levels is usually estimated by CTDIvol.
- This unit is designed to give the average dose in the scanned volume.
- Before starting the scan, the dose rate (CTDIvol in mGy per second) is displayed on the monitor.
- During the CARE Vision scan, the accumulated dose (CTDI vol) reflecting the patient exposure is displayed on the monitor. The display scale ranges from zero to 3000 mGy.
- If the table is shifted during the examination, the accumulated dose will be distributed to different slices and will be lower than indicated by the display.
- When a new scan is loaded, the dose display starts again from zero.

Radiation exposure to personnel

During the procedure the physician is in the scan room and close to the exposed scan plane.

- Take special care to avoid excessive and unnecessary radiation exposure.

Protection against primary x-ray exposure:

- In the worst case, any body parts in the scan plane may receive approximately the accumulated dose as shown on the CTDI display.
- Avoid being directly exposed to the x-ray beam.

Protection against stray radiation:

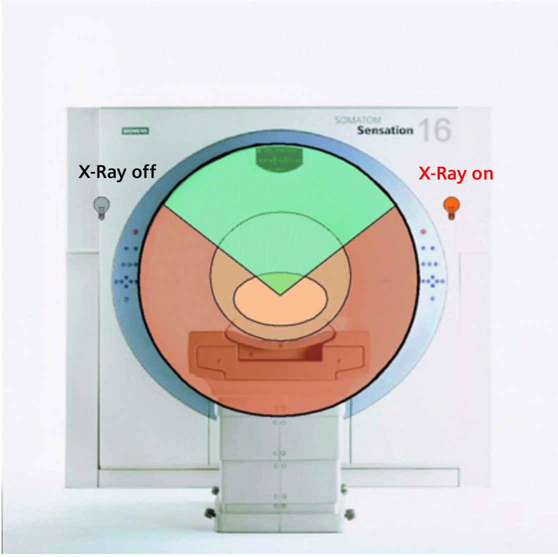
- The x-ray beam is limited to the imaged scan volume, but a significant portion of the x-rays is scattered and distributed in the scan room (stray radiation).
- Wear protective clothing to reduce exposure.
- A table with measured data of this stray radiation is included in the chapter on Safety in your SOMATOM Operator Manual.

General Information for Biopsy and CARE Vision

HandCARE

HandCARE is a dedicated algorithm for dose reduction during the interventional procedure.

It switches off the x-ray exposure for a 100° angle between three different positions (10:00, 12:00 and 2:00 o' clock).

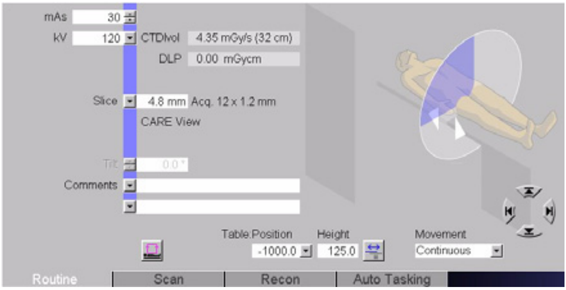


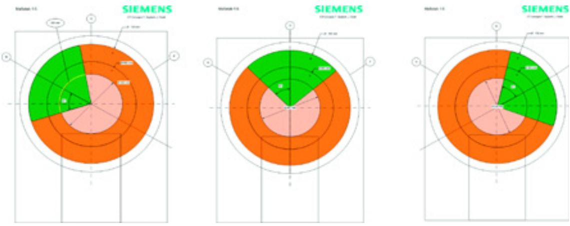
Thus provides a significant dose saving to the operator's hand, while keeping the image quality constant.

The HandCARE item list offers “None“ and three selectable protection areas. You can select this values independent of the current or a future patient position. The list elements are sorted clockwise from a view to the front of the gantry.

Values: {“None“, “10:00 o’ clock”, “12:00 o’ clock”, “2:00 o’ clock}, default: “None“, label: “HandCARE“.

The HandCARE position is graphically displayed on the **Routine** sub task card.

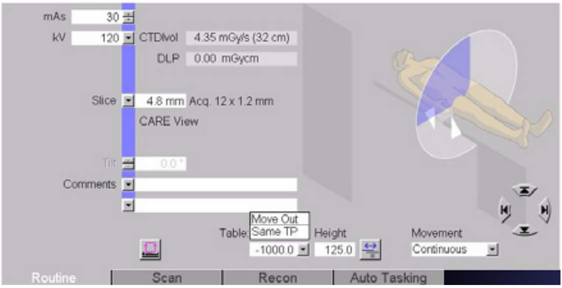


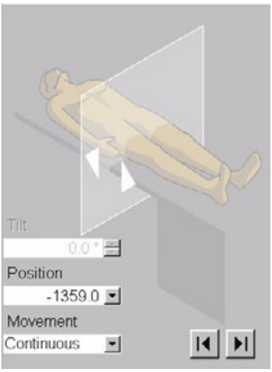


HandCARE positions

Application Procedure

1. Load and scan a spiral protocol of the interested body region.
2. Scroll through the images to define a target slice.
3. Click on **Same TP** under Table position, in the routine card. Move the table to the desired table position.
4. Turn on the light marker on the Gantry to localize the entry point, and then start patient preparation.
5. Open the **Patient Model Dialog**. Check the check-box **Append**. Select one of the predefined Biopsy or **CAREVision** scan protocols under **Specials** protocols and then click **OK**.
6. Select the **"HandCARE"** position on the scan card.
7. Click **"Load"** and the **"Cancel/Move"** to scan on the preselected table position.
8. Press the footswitch to start the fluoroscopy.





You can change the following Scan Parameters on the examination task card during radiation:

•Gantry Tilt

•Table position

•Table movement type

•Feed in/Feed out

Hints (In CAREVision mode)

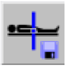
- Press the footswitch either to position the needle or to control the needle position.
- Without HandCARE every time you release the foot-switch max. the last scanned 3 sec. of acquired images are automatically saved to the local data-base.
- With HandCARE every time you release the foot-switch one image per rotation is automatically saved to the local database.
- If CARE View is used, only the middle slice of the last image is displayed after release of the footswitch.

Interventional Toolbar

If you want to perform a CAREVision or Biopsy Scan you can activate the new Interventional Tool Bar in the main menu under Image - Intervention.

The Interventional Toolbar will be displayed as soon as an Interventional Scan entry is being loaded.

Interventional Window 1/2/3

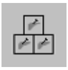


Save current Table Position (TP)

Auto Stop at Saved Table Position (TP)

Auto Stop at last Interventional Scan Position (SP)

Blow Up



CARE View

CARE View Blow Up

Laser Grid

Laser Crosshair

- **Interventional Window 1/2/3**

With the special window toggle button you can apply four different window settings to your image, the default values are: Abdomen (300/40), Lung (1200/-600), Bone (1500/450) and a manually defined window.

You can choose different window settings under **Options > Configuration > Examination > Intervention**, these settings correspond to the window values list.

- **Save and Auto Stop functions**

The icon for **Auto-Stop at saved TP** will be highlighted in green, after you have pressed the button for **save current Table Position**, you will find a new entry in the Drop down menu of the Sub task card. By moving the table to another position the icon will be displayed in gray until you reach the saved Table position, then it will turn to green again. If you activate the **Auto-Stop at saved TP** function and use the Joystick or the buttons on the Gantry, the table will stop automatically at the desired position so it is easier for you to reposition the patient again. This function will stay active until you press the button **Auto-Stop at saved TP** again.

The same behavior happens if you use the **Auto-Stop at Last Interventional Scan Position** function. If you press **Auto-Stop at Last Interventional Scan Position** and use the Gantry buttons to position your patient, the Gantry buttons will flash and show you in which direction you need to move the table to get back to your interventional table position again.

- **Screen layout**

In the interventional Toolbar for **CARE Vision** you can change the Layout of the Display. There are three different modes available.

  – Blow up (one big image)
  – CARE View (three equal sized images)
  – CARE View Blow up (one big and two smaller images on each side)

If you choose certain slice thicknesses and collimations in the Routine subtask card which are marked in bold letters, you will get in addition to your center an image that will be towards the head and one towards the feed. Then you can use the CARE View and CARE View Blow up mode as well for your interventional procedure.

You can change these modes while you are in the loaded process or while you are not applying radiation, the layout changes will be applied if you start scanning.

In the **Interventional Toolbar** for **Biopsy** you can change the layout of the display. There are three different modes available:

– Blow up (one big image)
– Two segment
– CARE View (three equal sized images)

The Image Layout can be changed in the interventional Toolbar regardless of the chosen slice thickness or collimation from Blow-up Mode to the two segment Mode. If you choose certain slice thicknesses and collimations, which are marded in bold letters, you have the option to get the images displayed in the CARE View Mode as well.

The changes will be applied directly during the Biopsy porcedure.

Laser Crosshair

The **Laser Crosshair and Laser Grid** invokes two perpendicular lines to display the measure lasers in images of Tomo segments.

Laser Grid

The **Laser Grid** invokes grid lines and two perpendicular lines to display the measure lasers images of Tomo segments. Default of distance between the grid lines: 25 mm.

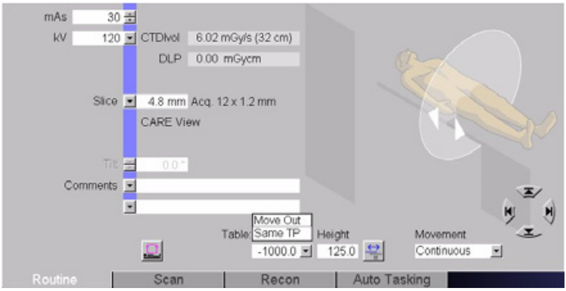
The **Laser Grid and laser Crosshair** are only enabled in the following cases, otherwise it is disabled:

– Biopsy : in all three layouts (Biopsy Blow up Mode Display, Biopsy Two Segments Mode Display, Biopsy CARE View Mode Display).

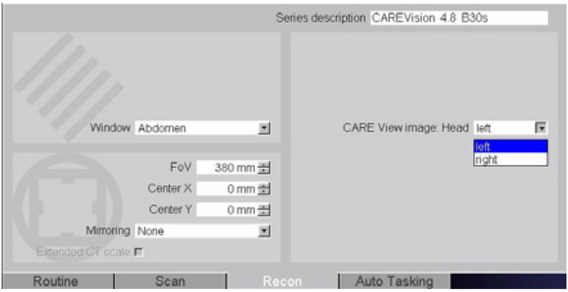
– CARE Vision: in CARE View Normal layout and CARE View Equal-size layout. Additionally, the lasers are normally displayed in all tomo segments. In CARE View Equal-size layout, the lasers are only displayed in the center image.

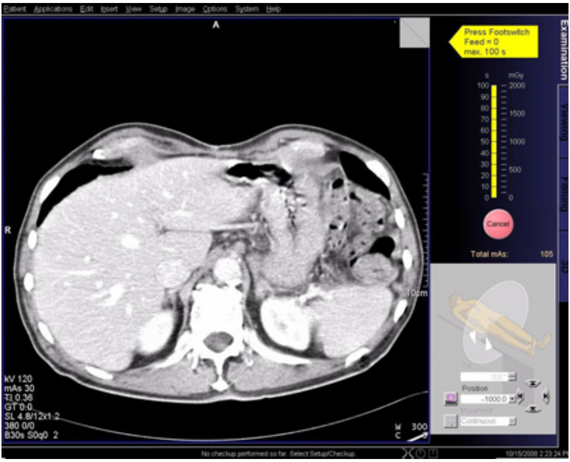
CAREView

The item CAREView indicates when a combined image is displayed. When the number of Slice Positions per scan is three, CARE View is activated and shown on the **Routine** sub task card.

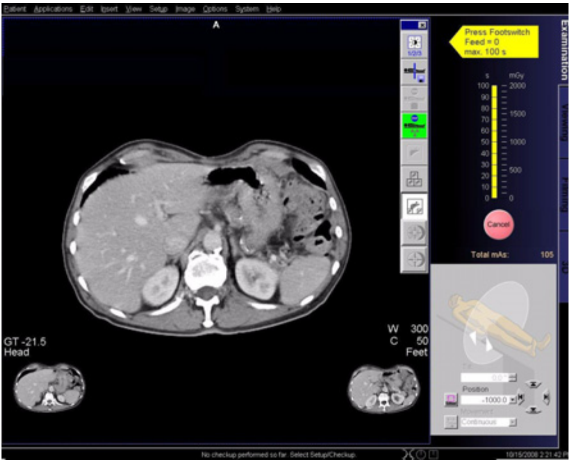


On the **Recon** sub task card you can select the CARE View image position, depending on the patient position; e.g., if you want to display the images which is closer to the head of the patient on the left hand side of the image area, select **Head – Left**.

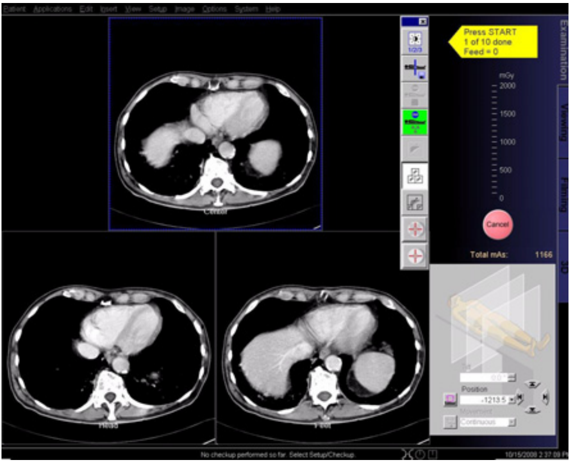




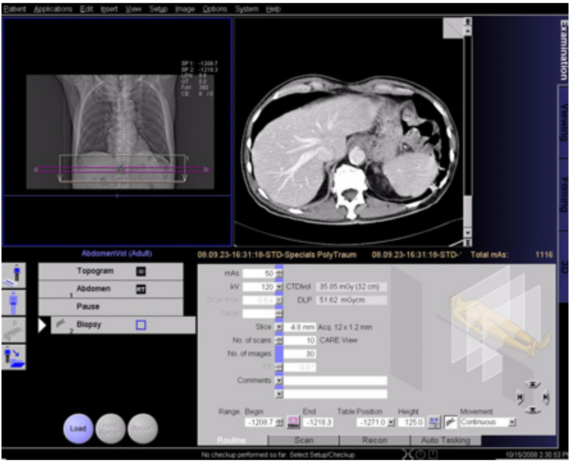
CARE Vision and Biopsy layout for Single image display



CARE Vision layout for CAREView large-size display

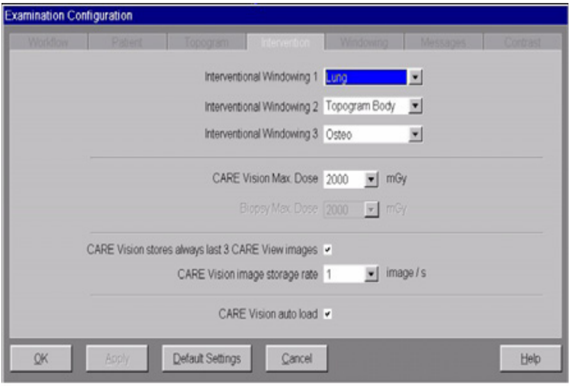


CARE Vision and Biopsy layout for CAREView equal-size display



Biopsy two segment

Configuration



Dose Display

The maximum displayed value of the Dose is set as a default to 2000 mGy. It is possible to configure this from 100-200 mGy under **Options > Configuration > Examination > Intervention**. Exceeding this configuration maximum value will not stop the scan, just the Dose scale bar will change to red. If you start scanning again the Dose scale bar will be reset.

Auto save last displayed images as key image

User can define if all currently displayed images are automatically saved during CARE Vision or Biopsy scanning under **Options > Configuration > Examination > Intervention**. All these images are saved into a separate series with the <Series Description>"Key Images". The action is triggered by the user when pressing the "Start" button/fFotSwitch or "Cancel" the scan.

Storage rate

All three CAREView images (Head, Center and Feet) can be saved if selected under **Configuration > Examination > Intervention** prior to your examination.

The image storage rate is also configurable under **Option > Configuration > Examination > Intervention** depending on your system. You can choose between an image storage rate of 1,2,4 (5 images/sec. for SOMATOM Emotion 16/6-slice configuration) and 1*3 images per second.

Example

3.5 second scan done.

Then at least four images are saved depending on configuration:

- **Conf: 1ima/s**

Central image - after 1st second

Central image - after 2nd second

Central image - after 3rd second

Central image - after 3,5 seconds (last)

All together - 4 images

- **Conf: 1ima/s + last 3 CARE View images**

Central image - after 1st second

Central image - after 2nd second

Central image - after 3rd second

Head/Central/Feet images - after 3,5 seconds

All together - 6 images

- **Conf: 1*3ima/s**

Head/Central/Feet images - after 1st second

Head/Central/Feet images - after 2nd second

Head/Central/Feet images - after 3rd second

Head/Central/Feet images - after 3,5 seconds

All together - 12 images

Auto load

You have the possibility to turn the CARE Vision auto "on". The system will then automatically load the CARE Vision Mode and display the axial images so that you can plan on which table position you want to perform your interventional procedure by using the "Move table position to displayed image position" function. If you prefer to reconstruct the images first you can switch this function off.

Routine Subtask card

Move table/scanrange to displayed image position.

The function **Move Table/Scanrange to displayed image position** in the Routine sub task card allows you to move the table to the position of the displayed tomo image in the selected segment. If you use the CARE View Mode you can use the Head of the Feet image for adjusting your table position as well.

Incremental/continuous table movement

You can switch between incremental and continuous table movement while the scan is loaded, the default step size will be changed according to the chosen slice thickness (default is always half the current slice thickness) but adapt the increment in 0.5 steps.

Biopsy Icon

In the Routine sub task card you will find a button for switching "on" the biopsy Mode for every sequential scan protocol. The box where you can define if you want to scan cranio-caudal or caudo-cranial will then change and you can decide if you want to move the table with an incremental or continuous table movement. Then the interventional Toolbar will be available as well.

Move table top only

The tabel top can be moved independently of the Fixed Tabel Support by clicking on "Move table top only" in the Routine Card.

Note: Fixed Table Support must be completely out.

Additional Important Information

Independently from the Interventional Window buttons on the **Interventional Toolbar** you can use for faster windowing the function keys F2, F3 and F4 are implemented with standard window settings for Abdomen, Lung and Bone. Modifying them is possible under **Options > Configuration > Examination > Windowing**.

If you repeat a CARE Vision or Biopsy scan range the window setting last used will be applied to your new images. Inserting the next scan range by using the **Patient Model Dialog** will reset this function so that the default window setting will be applied.

If you want to change the window values you can do this under **Option > Configuration > Viewing > Evaluation General** but be aware you do not change it for the Interventional values only but for all window settings. If you don't want to change it for all window values you can for example change it for the Abdomen to 350/50 and save this as a new window setting with a new name, then you can apply these values as your interventional window settings and have the General window settings set as before.

TestBolus

TestBolus

This mode can be used to test the start delay of an optimal enhancement after the contrast medium injection.

	TestBolus
kV	*120*
Effective mAs/ Quality ref. mAs	*40*
Rotation time	*0.5 sec.*
Acquisition	*2 x 5.0 mm*
Slice collimation	*5.0 mm*
Slice width	*10.0 mm*
Feed/Scan	*0.0*
Kernel	*B40f*
$CTDI_{vol}$	*2.5 mGy*

Specials

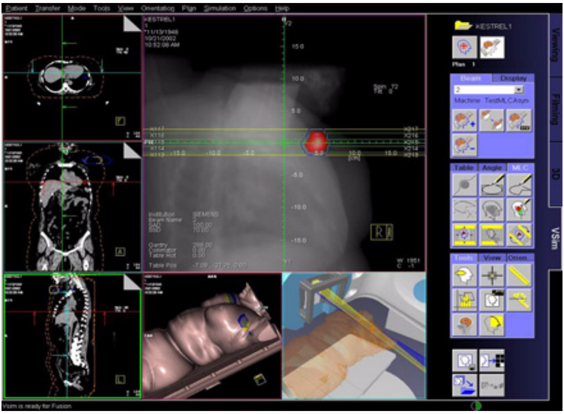
Radiation Therapy Planning

The SOMATOM Sensation 16 are very well suited to Radiation Therapy Planning (RTP) with its ergonomic enlarged gantry opening and its scan plane located only 35cm from the gantry front.

Using the external laser markers and the connected workstations, the system provides the complete procedure of Virtual Simulation in RTP much faster and more easily. The patient can leave the department after only a few minutes of CT scanning. The SOMATOM Sensation 16 table supports all kinds of patient positioning, immobilization and verification accessories, ensuring the same patient position as on the LINAC table (for example, RT table tops, Beekleys, masks, IR cameras, new laser guidance system).

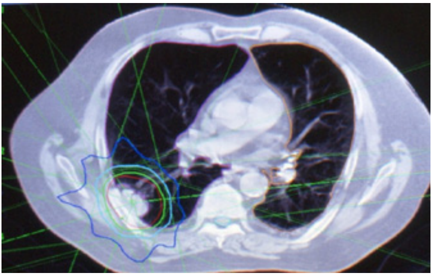
If non-diagnostic CT examinations have to be performed, dedicated low dose protocols for virtual simulation are provided.

Because external simulation SW might not be able to handle complete spiral data sets, sequence scans are available as well.
The treatment planning can be performed later, maybe when the patient is no longer present. Applications for virtual simulation are available on the COHERENCE Dosimetrist or the *syngo* Multi Modality Workplace, from where the results can be sent to the LINAC for patient treatment.

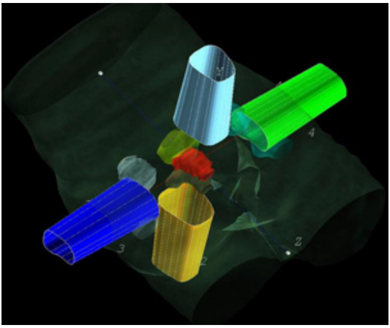


COHERENCE Dosimetrist

Remember the challenges of Radiation Therapy...



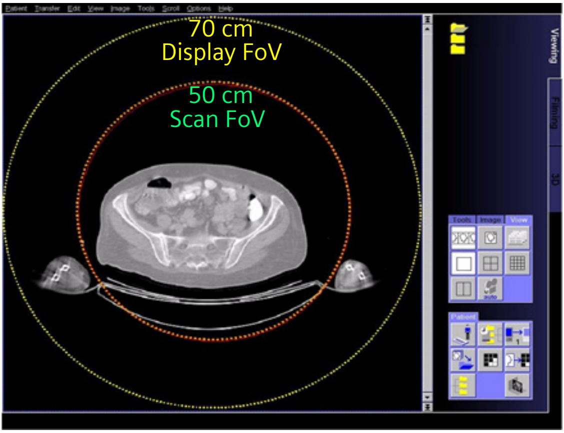
- Precisely locate and delineate the tumor volume
- Establish reliable external references on the patient surface



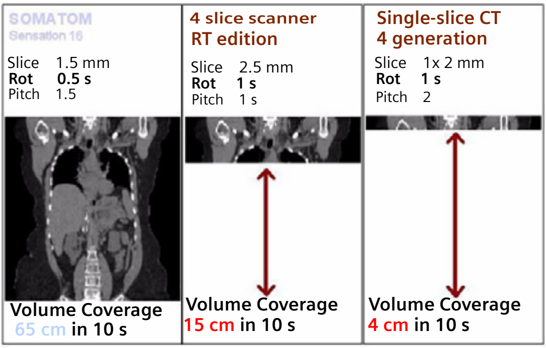
- Spare as much healthy tissue as possible
- Precisely position the patient for treatment for the entire course of treatment (typically 25-35 fractions)

Benefits

- No limitations for patient set-up within70 cm gantry opening and the ability to scan at a low table position thereby maximizing gantry "freespace"
- Complete anatomical visualization for optimized localization and dose calculation with extended 70 cm FOV

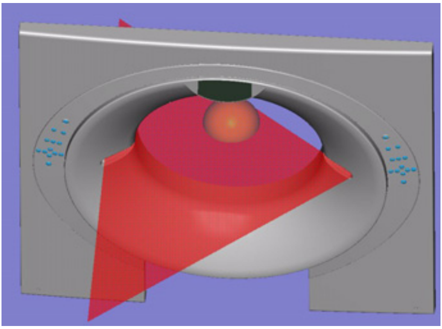


- High volume coverage in a short breath hold time, minimizing motion artifacts



- Thin slice imaging for high quality DRRs (Digitally Reconstructed Radiograph) and MPRs, especially for conformal 3D therapy and IMRT (Intensity Modulated Radiation Therapy)
- Complete CT simulation solution providing higher geometrical accuracy of table and lasers and the integration of flat table inserts

- New long-range gantry laser lights with position adjustment possible without opening gantry covers for easier installation and synchronization with room RTP lasers



- Integrated solution for Virtual Simulation with *syngo* based COHERENCE Dosimetrist or VSim on *syngo* MultiModality Workplace
- Display of gantry tilt angle in 0.5 degree increments
- Greater accuracy of X-ray tube positioning for topogram scans: +/- 1 degree
- Simplified horizontal positioning of the table. During an examination, a table feed position can be stored enabling fast and easy repositioning of a patient back to the previous table position.
- Proven DICOM connectivity to radiation therapy planning software

Workflow

Simulation:

1. Patient positioning on CT table
   (external lasers)
2. Patient marking
   (external lasers)
3. CT scan
4. Offline: Virtual Simulation and Dose Planning

Treatment:

1. Patient positioning on the therapy table
   (external lasers)
2. Verification of irradiation area
   (light field projection)
3. Treatment

The default scan protocols provide the first recon job used for soft tissue studies and the second recon job for bone structures.

Radiation Therapy

Scan Protocols

Overview

You can use the following scan protocols for the Radiation Therapy Planning:

- **RT_Head**
  Spiral mode for routine radiation therapy planning head studies
- **RT_Thorax**
  Spiral mode for routine radiation therapy planning thoracic studies
- **RT_Breast**
  Spiral mode for routine radiation therapy planning studies of the breast
- **RT_Abdomen**
  Spiral mode for routine radiation therapy planning abdominal studies
- **RT_Pelvis**
  Spiral mode for routine radiation therapy planning pelvis studies
- **RT_ThoraxAvg**
  Spiral mode for radiation therapy planning of thoracic studies using a very low pitch and very low dose.

RT_Head

Indications:

Spiral mode for routine radiation therapy planning head studies.

A range of 12 cm will be covered in 20.1 sec.

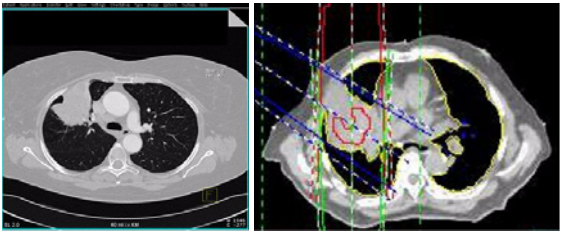
	Head	**2nd recon.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*320*	
Rotation time	*1.0 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*3.0 mm*	*3.0 mm*
Feed/Rotation	*6.6 mm*	
Pitch Factor	*0.55*	
Increment	*3.0 mm*	*3.0 mm*
Kernel	*H31s*	*H60s*
$CTDI_{Vol}$	*67.5 mGy*	
Effective dose	*Male: 3.16 mSv* *Female: 3.81 mSv*	

RT_Thorax

Indications:

Spiral mode for routine radiation therapy planning thoracic studies.

A range of 30 cm will be covered in 6.4 sec.



	Thorax	**2nd recon.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*125*	
Rotation time	*0.5 sec.*	
Aquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*8.0 mm*	*8.0 mm*
Feed/Rotation	*27.6 mm*	
Pitch Factor	*1.15*	
Increment	*8.0 mm*	*8.0 mm*
Kernel	*B41f*	*B80f*
$CTDI_{Vol}$	*8.8 mGy*	
Effective dose	*Male: 4.70 mSv* *Female: 5.96 mSv*	

RT_Breast

Indications:

Spiral mode for routine radiation therapy planning thoracic studies of the mammae.

A range of 30 cm will be covered in 6.4 sec.

	Breast	**2nd recon.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*125*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*8.0 mm*	*8.0 mm*
Feed/Rotation	*27.6 mm*	
Pitch Factor	*1.15*	
Increment	*8.0 mm*	*8.0 mm*
Kernel	*B41f*	*B80f*
$CTDI_{Vol}$	*8.8 mGy*	
Effective dose	*Male: 4.70 mSv* *Female: 5.96 mSv*	

RT_Abdomen

Indications:

Spiral mode for routine radiation therapy planning abdominal studies.

A range of 40 cm will be covered in 11.4 sec.

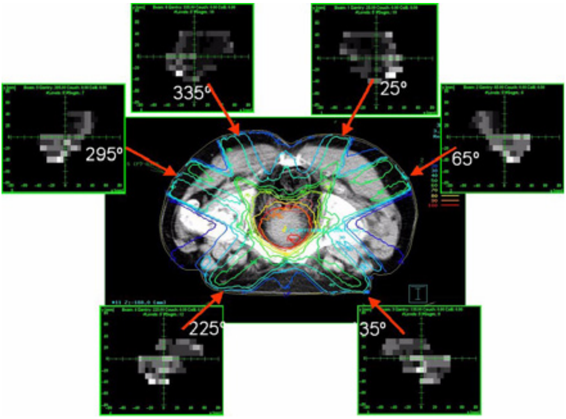
	Abdomen	**2nd recon.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*250*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*8.0 mm*	*8.0 mm*
Feed/Rotation	*19.2 mm*	
Pitch Factor	*0.80*	
Increment	*8.0 mm*	*8.0 mm*
Kernel	*B30f*	*B60f*
$CTDI_{Vol}$	*17.5 mGy*	
Effective dose	*Male: 12.88 mSv* *Female: 19.39 mSv*	

RT_Pelvis

Indications:

Spiral mode for routine radiation therapy planning pelvis studies.

A range of 20 cm will be covered in 6.2 sec.



	Pelvis	**2nd recon.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*250*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*3.0 mm*	*3.0 mm*
Feed/Rotation	*19.2 mm*	
Pitch Factor	*0.80*	
Increment	*3.0 mm*	*3.0 mm*
Kernel	*B31f*	*B60f*
$CTDI_{Vol}$	*17.5 mGy*	
Effective dose	*Male: 7.00 mSv* *Female: 11.27 mSv*	

RT_ThoraxAvg

Indications:

Spiral mode for radiation therapy planning of thoracic studies using a very low pitch and very low dose.

A range of 30 cm will be covered in 63.5 sec.

	ThoraxAvg	2nd recon.
kV	*80*	
Effective mAs/ Quality ref. mAs	*250*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*4.0 mm*	*4.0 mm*
Feed/Rotation	*2.4 mm*	
Pitch Factor	*0.10*	
Increment	*4.0 mm*	*4.0 mm*
Kernel	*B41s*	*B80f*
$CTDI_{Vol}$	*5.50 mGy*	
Effective dose	*Male: 2.95 mSv* *Female: 3.75 mSv*	

Hint

- Don’t use any API

Average CT

Due to the parameterization possibilities of CT's standard spiral mode that is currently used for attenuation correction (AC) of PETCT examinations and Radio Therapy Planning, only a subset of all patient based movements (caused by breathing, heart beat) is acquired during spiral examination and later on the base for the creation of the attenuation map. The consequence is that compared to the Radio Therapy or PET acquisition data, the CT data are without any patient/organ movements.

Average CT

- Structures such as lung lesions during breathing by low pitch spiral
- Fusion with PET images are possible and corresponding to each other
- Helps the radio-oncologists in therapy planning
- Helps visualizing the tumor excursion for a better understanding of the target volume

The Average CT mode allows acquiring a CT volume which shows organ motion as a blurred image, the system provides a special parameterization spiral mode with special parameters. The very low pitch factor gives the system the possibility to have one blurry image, covering the full breathing cycle. This mode is only possible with special scan protocols marked with the suffix Avg. On the Scan subtask card, a checkbox Average CT is displayed. When using the Average scan protocol the Checkbox is automatically set and dimmed. For Average CT only certain slice thicknesses are available. In addition Slice Collimation, Acquisition, Rotation time and Pitch are not changeable. The Series Description is extended by the suffix "AvgCT": In order to reach the lowest possible dose, the minimum tube voltage of 80 kV and the minimum tube current is used for Average CT and therefore CARE Dose4D is switched off. If Average CT mode is activated, the images are marked by "CQ!" in order to indicate explicitly that images generated with this mode and shall not be used in CT diagnostic purpose.

Additional Important Information

HU values

The HU values are of crucial importance for the therapy planning systems of radiation therapists!

- With huge objects, the CT value is independent of the kernel. With smaller objects, edge effects produced by the kernel influence the HU values as well as the scanning. Feed and collimation do not have any influence.
- An extended FoV of 800 mm means that only 500 mm are scanned, the rest will be interpolated.
- The effect on the HU values of having carbon plate tagged additionally to the patient table should be negligible and not measurable.
- CARE Dose 4D does not have any effect on the HU values.
- HU values and the conversion of the electron densities depend on the applied spectrum, e.g., kV, pr-efiltration(kV, prefiltration, etc.)
- The online bone correction (PFO) influences the CT numbers of bone and results in values comparable to body protocols. This has to be considered for radiation therapy planning provided that it is based on head routine protocols. Electron density calibration (photon therapy) or equivalent CT number based calibrations have to be performed again after installation of the new software version.

Overview

The scan protocols for children are defined according to body regions - **Head**, **Neck**, **Shoulder**, **Thorax**, **Abdomen**, **Pelvis**, **Spine**, **Upper Extremities**, **Lower Extremities**, **Vascular** and **Specials**.

As default the quality reference mAs with CARE Dose 4D is defined for 20 kg and/or five year old children. For children older than six years, use the adult protocols with the CARE Dose 4D.

For a few protocols, 80 kV is used instead of 110 kV, either to exploit the significantly higher image contrast of iodine contrast media at 80 kV or to reach a lower dose level than possible with 110 kV.

- **Head**
  - *HeadRoutine/HeadRoutine05s*
    Spiral mode for routine head studies
  - *HeadSeq/HeadSeq05s*
    Sequential mode for routine head studies
  - *InnerEarUHR*
    Spiral mode for Ultra High Resolution inner ear studies
  - *InnerEarUHRSeq*
    Sequential mode for High Resolution inner ear studies
  - *Sinus*
    Spiral mode for routine sinus studies
  - *Orbit*
    Spiral mode for routine orbital studies

- **Neck**
  - *NeckRoutine*
    Spiral mode for soft tissues routine neck studies
- **Shoulder**
  - *ShoulderRoutine*
    Spiral mode for bone studies and soft tissue
- **Thorax**
  - *ThoraxRoutine*
    Spiral mode for routine thorax studies
  - *ThoraxCombi*
    Spiral mode for the combination of thin slice lung and routine thorax studies
  - *ThoraxSeqHR*
    Sequential mode for high resolution lung studies
- **Abdomen**
  - *AbdomenRoutine*
    Spiral mode for routine abdominal studies
- **Pelvis**
  - *PelvisRoutine*
    Spiral mode for routine pelvis studies
- **Spine**
  - *SpineRoutine*
    Spiral mode for routine spine studies
  - *SpineThinSlice*
    Spiral mode for thin slice spine studies

- **Upper Extremities/Low Extremities**
  - *ExtrRoutineUHR*
    Spiral mode for routine high resolution extremity studies
  - *ExtrCombi*
    Spiral mode for the combination of thin slice and routine studies
- **Vascular**
  - *HeadAngio*
    Spiral mode for head CTAngio studies
  - *CarotidAngio/CarotidAngio042s*
    Spiral mode for carotid CTAngio studies
  - *BodyAngioRoutine/BodyAngio042s*
    Spiral mode for body CTAngio studies
- **Specials**
  - *NeonateBody/NeonateBody042s*
    Spiral mode for neonate studies

General Hints

- Topograms: 256 mm lateral topograms are defined for the head modes, and 512 mm AP topograms are defined for the body modes. Please keep in mind that the children's size can be dramatically different. You should press the "Hold Measurement" button whenever the range shown on the real-time growing topogram is long enough, in order to avoid unnecessary radiation.
  In a consistent effort to reduce the total dose of an examination, all topograms of the pediatric protocols are defined at 80 kV with minimum current (50mA).
- Gantry tilt is available for sequence scanning, not for spiral scanning.
- For all head studies, it is very important for image quality purposes to position the patient in the center of the scan field. Use the lateral laser beam to make sure that the patient is positioned in the center.
- Warm surroundings and dimmed lighting are helpful to make children more cooperative.

- Sedation: Although the advent of the Multislice CT scanner has enabled the user to scan through an area of interest much faster than ever sometimes patient motion can still result in severe motion artifacts which are seen on the resultant images. This becomes a factor especially with infants and younger children who are unable to hold still for the exam. Your institution may consider sedating such patients. Of course, appropriate protocols need to be set up at your institution. For instance, the drug of choice for specific ages/weights of these patients (taking into consideration the total time of the exam), the form of administration, patient preps, adequate monitoring of the patient (pre-scan, during the exam and post-scan) etc. should all be taken into consideration.
  The proper personnel and equipment must also be readily available in the event of a problem.

- Oral and rectal contrast administration: Depending on the reason for the exam/status of the patient, oral contrast may or may not be given to these patients. In general, oral contrast is recommended to opacify the intestinal tract, as unopacified bowel can have the appearance of abdominal fluid or mass effect. Oral, as well as rectal contrast may be required. Usually, a diluted mixture of iodine and water is used as an oral agent. Different substances can be added to this mixture to help reduce the bitter taste and make it more pleasing to the child (apple juice, fruit drink mixes are just a few of these). Barium may of course be used in some cases as well. Negative contrast agents such as water are becoming more popular for delineation of stomach or bowel wall borders, or when 3D reconstructions are needed. You need to be aware of all the contraindications of any of the contrast agents you use. Please refer to the specific veridor's recommednations.
- I.V. contrast administration: In general, 1 – 2 ml per kg of body weight should be applied, however, since the scanning can be completed in just a few seconds, please keep in mind that the total injection time should not be longer than the sum of start delay time and the scan time – do not inject contrast after the scanning is completed.

The use of CARE Bolus is recommended in order to achieve optimal contrast enhancement.

Both start delay time and injection rate are exam-/patient-dependent. I.V. injection with a power injector is recommended for all scans whenever possible. Some guidelines to follow with respect to flow rate are noted in the chart below.

Note: These injector guidelines are based on an antecubital injection site. These guidelines may need to be adjusted if the site is more peripheral.

Needle Size (gauge)	**Flow Rate (ml/sec.)**
22	*1.5*
20	*2.0 – 3.0*
18	*3.0 – 5.0*

Central lines and ports may need to be hand injected or power injected at a very low flow rate (1 ml/sec.).

PIC lines and 24 gauge (or smaller) lines are usually hand injected. All of these protocols should be decided on by your institution’s appropriate personnel.

- Applications with 80 kV: For CTA protocols, the tube voltage was set to 80 kV and the mAs values were raised by a factor of 1.5 over the reduced 110 kV values. This measure roughly reduces the dose again by a factor of 2. At a lower kV, substances with a high atomic number (such as iodine) have a significantly higher CT value (= vascular contrast). Iodine CT values at 80 kV are about 50% higher than at 110 kV. 80 kV was also used for applications when the lowest achievable mAs at 110 kV was still higher than necessary for sufficient noise level (for technical reasons, generators need to operate at a certain minimum current for stable operation). For applications such as neonate or airway scanning, the low tube output at 80 kV can be used to further reduce the dose to the patient.
- To further optimize MPR image quality we recommend that you reduce one or more of the following: collimation, reconstruction increment and slice width for image reconstruction.

Head Kernels

- For head scans of small children, the kernels C20s, C30s (for example, for soft tissue studies) and C60s (for example, for sinuses are provided) should be chosen instead of the ”adult” head kernels H20s, H30s and H60s.
- For soft tissue head studies, the standard kernel is H40s; softer images are obtained with H30s or H20s, H10s, sharper images with H50s. The kernels H21s, H31s, H41s yield the same visual sharpness as H20s, H30s, H40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using H31s, H 41s instead of H30s, H40s.
- For the standard head protocols, we propose C20s and C30s.
- High resolution head studies should be performed with H60s, H70s (for example, for dental and sinuses) and H80s, H90s (for example, inner ear).

Body Kernels

The endings “s” or “f” depend on the rotation time.

- As standard kernels for body tissue studies B30s or B40s are recommended; softer images are obtained with B20s or B10s (extremely soft). The kernels B31s or B41s have about the same visual sharpness as B30s, respectively, B40s, the image appearance, however, is more agreeable due to a ”fine-grained” noise structure; quite often, the low contrast detectability is improved by using B31s, B41s instead of B30s, B40s.
- For higher sharpness, as is required for example, in patient protocols for cervical spine, shoulder, extremities, thorax, the kernels B50s, B60s, B70s, B80s are available.
- The special kernels are mostly used for ”physical” measurements with phantoms, for example, for adjustment procedures (S80s), for constancy and acceptance tests (S80s, S90s), or for specification purposes (S90s).

For special patient protocols, S80s and S90s are chosen, for example, for osteo (S80s).

- For very high sharpness we recommended the U70u, U80u, U90u for bone studies. UHR mode has a maximum FoV of 300 mm.

It is mandatory to position the area of interest in the center of the scan field. Use ExtrCombi mode when a scan FoV > 25 cm is necessary.

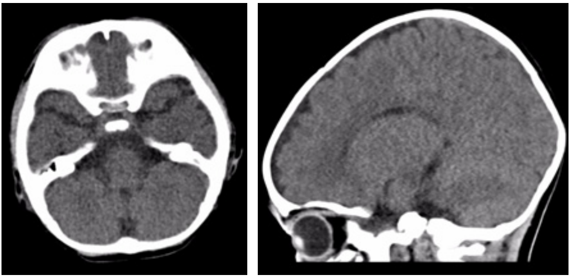
Scan Protocols

HeadRoutine

Indications:

Spiral mode for routine head studies, for example, tumors, hydrocephalus, hemorrhaging, abnormalities, etc.

A typical range of 12 cm covered in 11.0 sec.



	Head
kV	*120*
Effective mAs/ Quality ref. mAs	*150*
Rotation time	*1.00 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*4.0 mm*
Feed/Rotation	*13.2 mm*
Pitch Factor	*0.55*
Increment	*4.0 mm*
Kernel	*C30s*
$CTDI_{Vol}$	*28.5 mGy*
Effective dose	*Male: 1.78 mSv** *Female: 1.95 mSv**

** The conversion factor for a 7-year-old child, and a scan range of 120 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Children, who are older than age 6, should be scanned with an adult protocol as the skull by this time is fully grown.
- When bone structure is of interest, use kernel C60s for image reconstruction.
- An advanced algorithm allows for improved head image quality, without additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.
- To work **without** CARE Dose 4D use for children
  < 6 month 90 mAs
  6 month-3 years 150 mAs
  3-6 years 220 mAs.

HeadRoutine05s

Indications:

Spiral mode for routine head studies, for example, tumors, hydrocephalus, hemorrhaging, abnormalities, etc.

A typical range of 12 cm covered in 5.5 sec.

	Head
kV	*120*
Effective mAs/ Quality ref. mAs	*150*
Rotation time	*0.5 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*4.0 mm*
Feed/Rotation	*13.2 mm*
Pitch Factor	*0.55*
Increment	*4.0 mm*
Kernel	*C30f*
$CTDI_{Vol}$	*28.5 mGy*
Effective dose	*Male: 1.78 mSv** *Female: 1.95 mSv**

** The conversion factor for a 7-year-old child, and a scan range of 120 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Children, who are older than age 6, should be scanned with an adult protocol as the skull by this time is fully grown.
- When bone structure is of interest, use kernel C60s for image reconstruction.
- An advanced algorithm allows for improved head image quality, without additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.
- To work **without** CARE Dose 4D use for children
  < 6 month 90 mAs
  6 month-3 years 150 mAs
  3-6 years 220 mAs.

HeadSeq

Indications:

Sequential mode for routine head studies for children, for example, tumors, hydrocephalus, hemorrhaging, abnormalities, etc.

A scan range is predefined with 12.1 cm.

	HeadSeq
kV	*120*
Effective mAs/ Quality ref. mAs	*150*
Rotation time	*1.00 sec.*
Acquisition	*12 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*4.5 mm*
Feed/Scan	*18.0 mm*
Kernel	*C30s*
$CTDI_{Vol}$	*28.8 mGy*
Effective dose	*Male: 1.61 mSv** *Female: 1.85 mSv**

** The conversion factor for a 7-year-old child, and a scan range of 121 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/ Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Children, who are older than age 6, should be scanned with an adult protocol as the skull by this time is fully grown.
- When bone structure is of interest, use kernel C60s for image reconstruction.
- An advanced algorithm allows for improved head image quality, without additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.
- To work **without** CARE Dose 4D use for children
  < 6 month 90 mAs
  6 month-3 years 150 mAs
  3-6 years 220 mAs.

HeadSeq05s

Indications:

Sequential mode for routine head studies for children, with a 0.5 sec. rotation time, for example, tumors, hydrocephalus, hemorrhaging, abnormalities, etc.

A scan range is predefined with 12.1 cm.

	HeadSeq
kV	*120*
Effective mAs/ Quality ref. mAs	*150*
Rotation time	*0.5 sec.*
Acquisition	*12 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*4.5 mm*
Feed/Scan	*18.0 mm*
Kernel	*C30f*
$CTDI_{Vol}$	*28.8 mGy*
Effective dose	*Male: 1.61 mSv** *Female: 1.85 mSv**

** The conversion factor for a 7-year-old child, and a scan range of 121 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Children, who are older than age 6, should be scanned with an adult protocol as the skull by this time is fully grown.
- When bone structure is of interest, use kernel C60s for image reconstruction.
- An advanced algorithm allows for improved head image quality, without additional post-processing.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.
- To work **without** CARE Dose 4D use for children
  < 6 month 90 mAs
  6 month-3 years 150 mAs
  3-6 years 220 mAs.

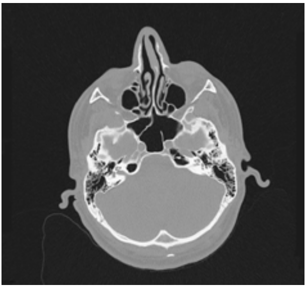
InnerEarUHR

Indications:

Spiral mode for ultra high-resolution inner ear studies, for example, malformations of the inner ear, inflammatory changes, pathologies of the mastoid process, tumor processes of the pyramids, post-traumatic changes, etc.

Note: Same as for adults except for the FoV of 300.

A typical range of 4.0 cm covered in 40.4 sec.



	InnerEarUHR
kV	*120*
Effective mAs/ Quality ref. mAs	*60*
Rotation time	*0.75 sec.*
Acquisition	*2 x 0.6 mm*
Slice collimation	*0.6 mm*
Slice width	*0.6 mm*
Feed/Rotation	*0.8 mm*
Pitch Factor	*0.65*
Increment	*0.6 mm*
Kernel	*U80u*
$CTDI_{Vol}$	*16.5 mGy*
Effective dose	*Male: 0.33 mSv** *Female: 0.34 mSv**

* *The conversion factor for a 7-year-old child, and a scan range of 40 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Children, who are older than age 6, should be scanned with an adult protocol as the skull by this time is fully grown.
- The UHR mode requires a 300 mm scan FoV. It is mandatory to position the patient in the center of the scan FoV.
- When soft tissue is of interest, use kernel U30u for image reconstruction.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.
- To work **without** CARE Dose 4D use for children
  < 3 years 40 mAs
  3-6 years 60 mAs.

InnerEarUHRSeq

Indications:

Sequential mode for Ultra High-Resolution inner ear studies, for example, Inflammatory changes, tumorous pro-cesses of pyramids, cerebellopontine angle tumors, post-traumatic changes, etc.

A scan range is predefined with 4.0 cm.

Note: Same as for adults except for the FoV of 300.

	InnerEarSeq
kV	*120*
Effective mAs/ Quality ref. mAs	*60*
Rotation time	*0.75 sec.*
Acquisition	*2 x 0.6 mm*
Slice collimation	*0.6 mm*
Slice width	*0.6 mm*
Feed/Scan	*1.0 mm*
Kernel	*U80u*
$CTDI_{Vol}$	*19.8 mGy*
Effective dose	*Male: 0.38 mSv** *Female: 0.44 mSv**

** The conversion factor for a 7-year-old child, and a scan range of 40 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

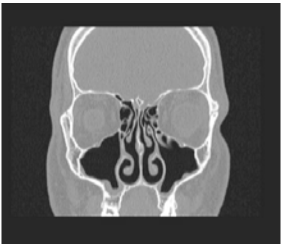
- Children, who are older than age 6, should be scanned with an adult protocol as the skull by this time is fully grown.
- The UHR mode has a maximum FoV of 300 mm. It is mandatory to position the patient in the center of the scan FoV.
- When soft tissue is of interest, use kernel U30u for image reconstruction.
- In order to optimize image quality versus radiation dose, scans are provided within a maximum scan field of 300 mm with respect to the iso-center. No recon job with a field of view exceeding those limits will be possible. Therefore, patient positioning has to be performed accurately to ensure a centered location of the skull.
- To work **without** CARE Dose 4D use for children
  < 3 years 40 mAs
  3-6 years 60 mAs.

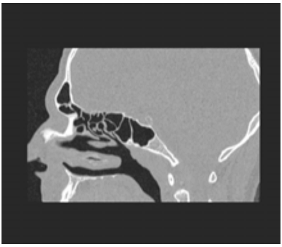
Sinus

Indications:

Spiral mode for routine spiral studies of the sinuses and paranasal sinuses, for example, sinusitis, pneumatization, polyposis, malformations, tumors etc.

A typical range of 6 cm covered in 13.1 sec.





	Sinus Orbi	**2nd recon.**	**3rd recon.**	**4th recon.**
kV	*120*			
Effective mAs/ Quality ref. mAs	*74*			
Rotation time	*1.0 sec.*			
Acquisition	*16 x 0.75 mm*			
Slice collimation	*0.75 mm*			
Slice width	*3.0 mm*	*3.0 mm*	*1.0 mm*	*1.0 mm*
Feed/ Rotation	*5.4 mm*			
Pitch Factor	*0.45*			
Increment	*3.0 mm*	*3.0 mm*	*0.7 mm*	*0.7 mm*
Kernel	*C60s*	*C30s*	*C60s*	*C30s*
$CTDI_{Vol}$	*15.6 mGy*			
Effective dose	*Male: 0.56 mSv** *Female: 0.64 mSv**			

* *The conversion factor for a 7-year-old child, and a scan range of 60 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Children older than age 6 should be scanned with an adult protocol.
- The second recon job is defined with kernel H60s and with an overlap for visualizing bone structures with MPR.
- To work **without** CARE Dose 4D use for children
  < 3 years 40 mAs
  3-6 years 60 mAs.

Orbit

Indications:

Spiral mode for routine studies of the orbitae, for example, fracture.

A typical range of 6 cm covered in 13.1 sec.

	Orbit	**2nd recon.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*74*	
Rotation time	*1.0 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*3.0 mm*	*1.0 mm*
Feed/Rotation	*5.4 mm*	
Pitch Factor	*0.45*	
Increment	*3.0 mm*	*0.7 mm*
Kernel	*C60s*	*C60s*
$CTDI_{Vol}$	*15.6 mGy*	
Effective dose	*Male: 0.56 mSv** *Female: 0.64 mSv**	

* *The conversion factor for a 7-year-old child, and a scan range of 60 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

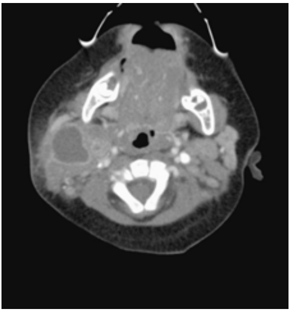
- Children older than age 6 should be scanned with an adult protocol.
- If the study is focused on bone structure only, the mAs can be reduced to 20 for all age groups.
- To work *without* CARE Dose 4D use for children
  < 3 years 40 mAs
  3 – 6 years 70 mAs.

NeckRoutine

Indications:

Spiral mode for routine neck studies, for example, tumors, lymphoma, abscesses, etc.

A typical range of 17 cm covered in 8.1 sec.



	Neck	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*60*	
Rotation time	*0.75 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*6.0 mm*	*2.0 mm*
Feed/Rotation	*19.2 mm*	
Pitch Factor	*0.80*	
Increment	*6.0 mm*	*1.5 mm*
Kernel	*B30s*	*B60s*
$CTDI_{Vol}$	*4.2 mGy*	
Effective dose	*Male: 0.99 mSv** *Female: 1.01 mSv**	

** The conversion factor for a 7-year-old child, and a scan range of 170 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- If necessary, scan down to the aortic arch or mediastinum to include the entire lesion.
- Cooperative children can be instructed to hold their breath during the acquisition.
- Children older than age 6 should be scanned with an adult protocol.
- To work **without** CARE Dose 4D use for children
  < 3 years 40 mAs
  3-6 years 60 mAs

ShoulderRoutine

Indications:

Spiral mode for bone studies and soft tissue, e.g.evulation of joint cavities,masses, trauma, dislocations, orthopedic indications etc.

A typical range of 13 cm covered in 15.5 sec.

	Shoulder	**2nd recon.**	**3rd recon.**
kV	*120*		
Effective mAs/ Quality ref. mAs	*60*		
Rotation Time	*1.0 sec.*		
Acquisition	*16 x 0.75 mm*		
Slice collimation	*0.75 mm*		
Slice width	*5.0 mm*	*1.0 mm*	*1.0 mm*
Feed/Rotation	*9.60 mm*		
Pitch Factor	*0.8*		
Increment	*5.0 mm*	*0.7 mm*	*0.7 mm*
Kernel	*B31s*	*B31s*	*B60s*
$CTDI_{Vol}$	*4.7mGy*		
Effective dose	*Male: 0.96 mSv* *Female:1.221 mSv**		

** The conversion factor for a 7-year-old child, and a scan range of 130 mm was used.*

Hints

- Use raw data to review a target region if necessary.
- For image reconstruction of soft tissue use kernel B31s and a slice width of 5.0 mm.
- Coronal and sagittal 2D planar reconstructions are important for evaluation of the joint space & bursa sacs in CT arthograms.
- 3D renderings are helpful for complex fractures & dislocations.

Children

- Children older than age 6 should be scanned with an adult protocol.

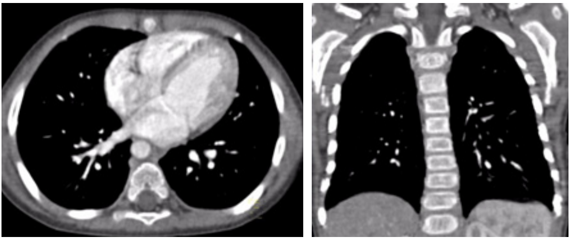
To work **without** CARE Dose 4D use for children
< 3 years 40 mAs
3-6 years 60 mAs

ThoraxRoutine

Indications:

Spiral mode for routine thorax studies,for example, pneumonia, tumors, metastases, lymphoma, vascular abnormalities etc.

A typical range of 15 cm covered in 3.7 sec.



	ThorRoutine	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*45*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*6.0 mm*	*6.0 mm*
Feed/Rotation	*27.6 mm*	
Pitch Factor	*1.15*	
Increment	*6.0 mm*	*6.0 mm*
Kernel	*B30f*	*B60f*
$CTDI_{Vol}$	*3.2 mGy*	
Effective dose	*Male: 1.41 mSv** *Female: 1.69 mSv**	

** The conversion factor for a 7-year-old child, and a scan range of 150 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- The first and second recon jobs are defined for visualization of the mediastinum and the lungs, respectively.
- To work **without** CARE Dose 4D use for children
  < 15 kg 17 mAs
  15-24 kg 20 mAs
  25-34 kg 30 mAs
  35-54 kg 60 mAs

ThoraxCombi

Indications:

Combining thin slice and routine thorax studies with one spiral scan, for example, thorax studies in general and interstitial changes in the lungs.

A typical range of 15 cm covered in 4.9 sec.

	ThorCombi	**2nd recon.**	**3rd recon.**	**4th recon.**
kV	*120*			
Effective mAs/ Quality ref. mAs	*55*			
Rotation time	*0.5 sec.*			
Acquisition	*16 x 1.5 mm*			
Slice collimation	*1.5 mm*			
Slice width	*3.0 mm*	*3.0 mm*	*2.0 mm*	*2.0 mm*
Feed/ Rotation	*19.2 mm*			
Pitch Factor	*0.80*			
Increment	*3.0 mm*	*3.0 mm*	*1.5 mm*	*1.5 mm*
Kernel	*B30f*	*B60f*	*B30f*	*B60f*
$CTDI_{Vol}$	*3.9 mGy*			
Effective dose	*Male: 1.72 mSv** *Female: 2.07 mSv**			

** The conversion factor for a 7-year-old child, and a scan range of 150 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

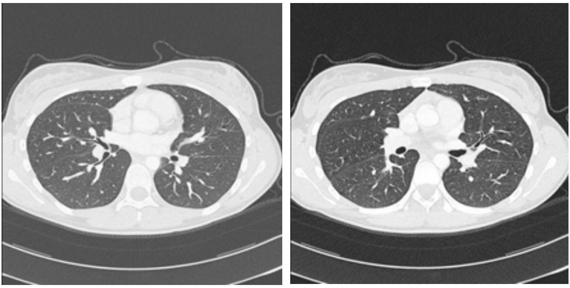
- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- For the 2nd reconstruction the Autoload into MPRthick Range on the 3D Card is activated. The images will be automatically loaded into 3D, MPRthick, and a coronal MPRthick Range will pop up. Please notice, if you are not satisfied with the Range preset, adapt the parameters to your needs and link them to the series.
- To work **without** CARE Dose 4D use for children
  < 25 kg 25 mAs
  25-34 kg 45 mAs
  35-54 kg 65 mAs

ThoraxSeqHR

Indications:

Sequence mode for high-resolution lung studies, for example, interstitial changes in the lungs, using a 10 mm feed.

A scan range is predefined with 15.1 cm.



	ThoraxSeqHR
kV	*120*
Effective mAs/ Quality ref. mAs	*45*
Rotation time	*0.75 sec.*
Acquisition	*2 x 1.0 mm*
Slice collimation	*1.0 mm*
Slice width	*1.0 mm*
Feed/Scan	*10.0 mm*
Kernel	*B70s*
$CTDI_{Vol}$	*0.8 mGy*
Effective dose	*Male: 0.26 mSv** *Female: 0.33 mSv**

** The conversion factor for a 7-year-old child, and a scan range of 151 mm was used.*

Hints

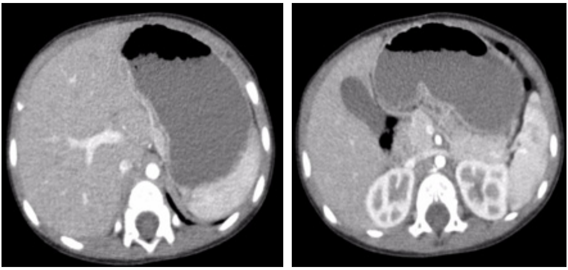
- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- If you want to acquire the patient at full inspiration or full expiration, you should practice breathing with the patient a few times before beginning the scan to improve reproductbility.
- To work **without** CARE Dose 4D use for children
  < 35 kg 30 mAs
  35-54 kg 40 mAs

AbdomenRoutine

Indications:

Spiral mode for routine studies in the region of abdomen, for example, tumors, lymphoma, abscesses, post-traumatic changes, etc.

A typical range of 20.1 cm covered in 4.6 sec.



	AbdRoutine
kV	*120*
Effective mAs/ Quality ref. mAs	*85*
Rotation time	*0.5 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*5.0 mm*
Feed/Rotation	*27.6 mm*
Pitch Factor	*1.15*
Increment	*5.0 mm*
Kernel	*B30f*
$CTDI_{Vol}$	*6.0 mGy*
Effective dose	*Male: 3.67 mSv** *Female: 4.48 mSv**

** The conversion factor for a 7-year-old child, and a scan range of 201 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Delayed scans may be required for the kidneys & bladder.
- Rectal contrast may be required for evaluation of pelvic mass.
- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- To work **without** CARE Dose 4D use for children
  < 25 kg 30 mAs
  25-34 kg 55 mAs
  35-54 kg 100 mAs

PelvisRoutine

Indications:
Spiral mode for routine studies, e.g., processes of the urinary bladder, rectum indications. etc.

A typical range of 15.0 cm covered in 4.9 sec.

	Pelvis
kV	*120*
Effective mAs/ Quality ref. mAs	*85*
Rotation time	*0.5 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*5.0 mm*
Feed/Rotation	*19.2 mm*
Pitch Factor	*0.8*
Increment	*5.0 mm*
Kernel	*B31f*
$CTDI_{Vol}$	*6.0 mGy*
Effective dose	*Male: 2.21 mSv** *Female: 2.82 mSv**

** The conversion factor for a 7-year-old child, and a scan range of 150 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

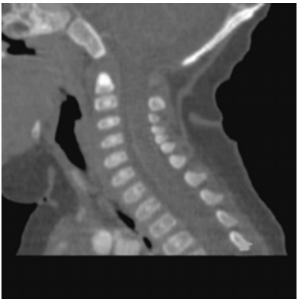
- Delayed scans may be required for the kidneys & bladder.
- Rectal contrast may be required for evaluation of pelvic mass.
- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- To work *without* CARE Dose 4D use for children
  < 25 kg 30 mAs
  25 – 34 kg 55 mAs
  35 – 54 kg 100 mAs

SpineRoutine

Indications:

Spiral mode for spine studies, for example, post-traumatic changes, tumors, malformations, orthopedic indication, etc.

A typical range of 16 cm covered in 7.7 sec.



	SpineRoutine	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*90*	
Rotation time	*0.75 sec.*	
Acquisition	*16 x 1.5 mm*	
Slice collimation	*1.5 mm*	
Slice width	*3.0 mm*	*2.0 mm*
Feed/Rotation	*19.2 mm*	
Pitch Factor	*0.80*	
Increment	*3.0 mm*	*1.5 mm*
Kernel	*B30s*	*B60s*
$CTDI_{Vol}$	*6.3 mGy*	
Effective dose	*Male: 3.34 mSv** *Female: 4.31 mSv**	

** The conversion factor for a 7-year-old child, and a scan range of 160 mm was used.*

Hints

- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- To work **without** CARE Dose 4D use for children
  < 25 kg 30 mAs
  25-34 kg 55 mAs
  35-54 kg 120 mAs

SpineThinSlice

Indications:

Spiral mode for the spine when Multi Planar Reformation (MPR) are intended, for example, post-traumatic changes, tumors, malformations, etc.

A typical range of 16 cm covered in 8.1 sec.

	SpineThinSlice	**2nd reconstr.**
kV	*120*	
Effective mAs/ Quality ref. mAs	*90*	
Rotation time	*0.75 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*2.0 mm*	*1.0 mm*
Feed/Rotation	*18.0 mm*	
Pitch Factor	*1.5*	
Increment	*2.0 mm*	*0.7 mm*
Kernel	*B30s*	*B60s*
$CTDI_{Vol}$	*7.0 mGy*	
Effective dose	*Male: 3.39 mSv** *Female: 4.32 mSv**	

** The conversion factor for a 7-year-old child, and a scan range of 160 mm was used.*

Hints

- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- To work **without** CARE Dose 4D use for children
  < 25 kg 40 mAs
  25-34 kg 70 mAs
  35-54 kg 90 mAs

ExtrRoutineUHR

Indications:

Spiral mode for ultra high-resolution bone studies, for example, tumors, post-traumatic changes, orthopedic indications, etc.

Note: UHR mode has a maximum FoV of 300 mm. It ismandatory to position the area of interest in the center of the scan field.

A typical range of 6 cm covered in 78.9 sec.

	ExtrUHR
kV	*120*
*Effective mAs/ Quality ref. mAs***	*60*
Rotation time	*1.0 sec.*
Acquisition	*2 x 0.6 mm*
Slice collimation	*0.6 mm*
Slice width	*0.6 mm*
Feed/Rotation	*0.8 mm*
Pitch Factor	*0.65*
Increment	*0.6 mm*
Kernel	*U80u*
$CTDI_{Vol}$	*6.4 mGy*
Effective dose	*Male: 0.01 mSv** *Female: 0.00 mSv**

** The conversion factor for a 7-year-old child, and a scan range of 60 mm was used.*

*** Adjust the mAs value to the body region.*

Hints

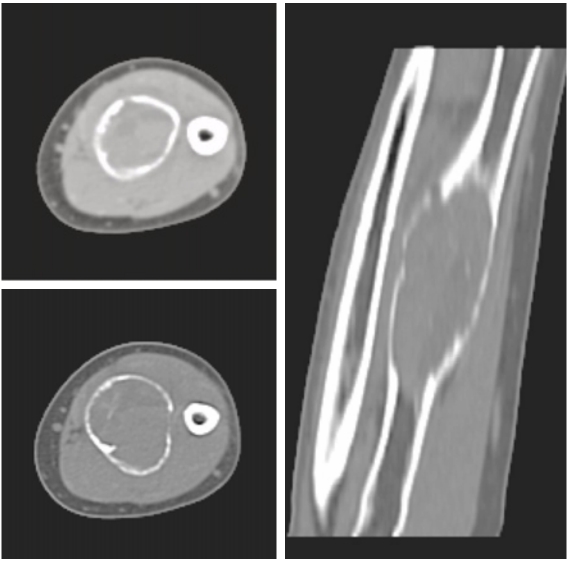
- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- The UHR mode has a maximum FoV of 300 mm. It is mandatory to position the patient in the center of the scan FoV.
- When soft tissue is of interest, use kernel U30u for image reconstruction.
- To work **without** CARE Dose 4D use for children
  < 25 kg 26 mAs
  25-34 kg 40 mAs
  35-54 kg 80 mAs

ExtremityCombi

Indications:

Spiral mode for the combination of bone and soft tissue studies, for example, masses, trauma, disorders of the joint etc.

A typical range of 10 cm covered in 12.4 sec.



	ExtrCombi	2nd reconstr.
kV	*120*	
Effective mAs/ Quality ref. mAs	*45*	
Rotation time	*1.0 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*3.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.8*	
Increment	*3.0 mm*	*0.7 mm*
Kernel	*B30s*	*B60s*
$CTDI_{Vol}$	*3.5 mGy*	
Effective dose	*Male: 0.01 mSv** *Female: 0.00 mSv**	

** The conversion factor for a 7-year-old child, and a scan range of 100 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- To work **without** CARE Dose 4D use for children
  < 25 kg 26 mAs
  25-34 kg 35 mAs
  35-54 kg 70 mAs

HeadAngio

Indications:

Spiral mode for head CT Angio studies, for example, cerebral vascular abnormalities, tumors etc.

A typical range of 6 cm covered in 5.5 sec.

	HeadAngio	**2nd reconstr.**
kV	*80*	
Effective mAs/ Quality ref. mAs	*100*	
Rotation time	*0.5 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*2.0 mm*	*1.0 mm*
Feed/Rotation	*6.6 mm*	
Pitch Factor	*0.55*	
Increment	*2.0 mm*	*0.7 mm*
Kernel	*H20f*	*H10f*
$CTDI_{Vol}$	*8.4 mGy*	
Effective dose	*Male: 0.28 mSv** *Female: 0.34 mSv**	

** The conversion factor for a 7-year-old child, and a scan range of 60 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- Children older than age 6 should be examined with an adult protocol.
- CARE Bolus may be used to optimize the bolus timing with a triggering threshold of 120 HU, or use manual triggering.
- An advanced algorithm allow for improved head image quality, without any additional post-processing.
- To work **without** CARE Dose 4D use for children
  < 3 years 100 mAs
  3-6 years 150 mAs

CarotidAngio/CarotidAngio042s

Indications:

Spiral mode for carotid CT Angio studies, for example, carotidstenosis or occlusion, vascular abnormalities of thecarotids or vertebral arteries, etc.

A typical range of 17 cm covered in 9.8/8.2 sec.

	CarotidAngio	**2nd reconstr.**
kV	*80*	
Effective mAs/ Quality ref. mAs	*100*	
Rotation time	*0.5/0.42 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*5.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*5.0 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*2.6 mGy*	
Effective dose	*Male: 0.47 mSv* Female: 0.53 mSv**	

** The conversion factor for a 7-year-old child, and a scan range of 170 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

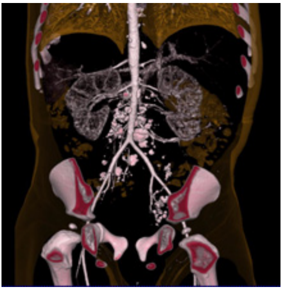
- Children older than age 6 should be scanned with an adult protocol.
- CARE Bolus may be used to optimize the bolus timing with a triggering threshold of 120 HU, or use manual triggering.
- To work **without** CARE Dose 4D use for children
  < 3 years 100 mAs
  3-6 years 150 mAs

BodyAngioRoutine/BodyAngio042s

Indications:

For abdominal CT Angio studies, for example, vascular abnormalities, aneurysms, etc.

A typical range of 20.1 cm covered in 11.4/9.6 sec.



	BodyAngio	**2nd reconstr.**
kV	*80*	
Effective mAs/ Quality ref. mAs	*75*	
Rotation time	*0.5/0.42 sec.*	
Acquisition	*16 x 0.75 mm*	
Slice collimation	*0.75 mm*	
Slice width	*3.0 mm*	*1.0 mm*
Feed/Rotation	*9.6 mm*	
Pitch Factor	*0.80*	
Increment	*3.0 mm*	*0.7 mm*
Kernel	*B30f*	*B20f*
$CTDI_{Vol}$	*2.0 mGy*	
Effective dose	*Male: 0.93 mSv*** *Female: 1.12 mSv***	

** The conversion factor for a 7-year-old child, and a scan range of 201 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

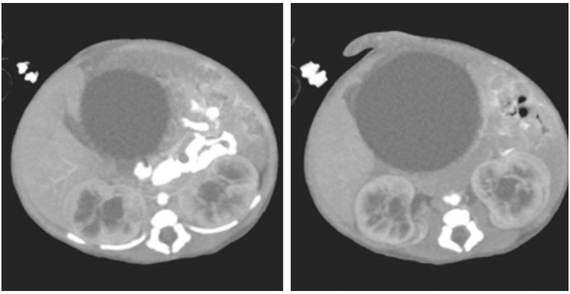
- Children with a body weight of more than 55 kg should be examined with an adult protocol.
- CARE Bolus may be used to optimize the bolus timing. Set the ROI for monitoring scan in the abdominal aorta with triggering threshold of 120 HU, or use manual triggering.
- To work **without** CARE Dose 4D use for children
  < 25 kg 40 mAs
  25-34 kg 75 mAs
  35-54 kg 130 mAs

NeonateBody/NeonateBody042s

Indications:

Spiral mode for neonate body studies, for example, tumors, abnormalities, malformations, abscesses, etc.

A typical range of 15 cm covered in 4.9/4.1 sec.



	NeonateBody
kV	*80*
Effective mAs/ Quality ref. mAs	*33/28*
Rotation time	*0.5/0.42 sec.*
Acquisition	*16 x 1.5 mm*
Slice collimation	*1.5 mm*
Slice width	*6.0 mm*
Feed/Rotation	*19.2 mm*
Pitch Factor	*0.80*
Increment	*6.0 mm*
Kernel	*B30f*
$CTDI_{Vol}$	*0.7/0.6 mGy*
Effective dose	*Male: 0.95/0.81 mSv** *Female: 1.24/1.05 mSv**

** The conversion factor for a 8-week-old child, and a scan range of 150 mm was used.*

Contrast medium IV injection	
Start delay	*exam dependent*
Flow rate	*dependent upon needle size/Access site*
Total amount	*1 – 2 ml per kg of body weight*

Hints

- CARE Bolus may be used to optimize bolus timing. Set the ROI for monitoring scan in the abdominal aorta with triggering threshold of 120 HU, or use manual triggering.

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