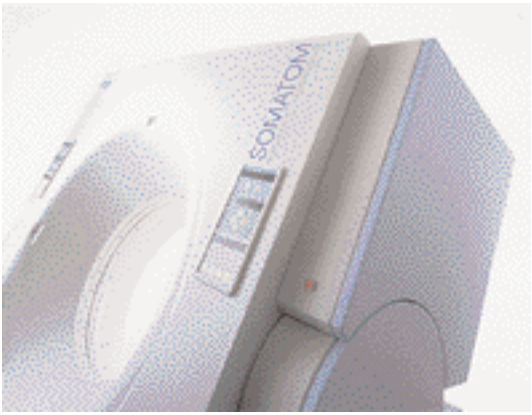
SIEMENS

SOMATOM Volume Access
Application Guide



syngo

Special Protocols
Software Version A40

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

Special thanks to Loke-Gie Haw, Claudia Scherf, Bernd Ohnesorge, Christoph Suess, Lutz Guendel, and Ernst Klotz for their valuable assistance.

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HeartView CT is a clinical application package specifically tailored to cardiovascular CT studies.

The basics

Important anatomical structures of the heart

Four chambers:

- Right atrium – receives the deoxygenated blood back from the body circulation through the superior and inferior vena cava, and pumps it into the right ventricle
- Right ventricle – receives the deoxygenated blood from the right atrium, and pumps it into the pulmonary circulation through the pulmonary arteries
- Left atrium – receives the oxygenated blood back from the pulmonary circulation through the pulmonary veins, and pumps it into the left ventricle
- Left ventricle – receives the oxygenated blood from the left atrium, and pump it into the body circulation through the aorta

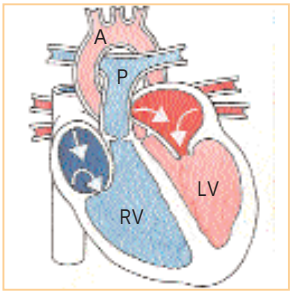


Fig. 1: Blood fills both atria

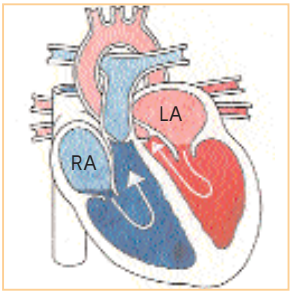


Fig. 2: Atria contract, blood enters ventricles

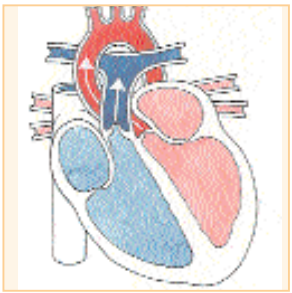


Fig. 3: Ventricles contract, blood enters into aorta and pulmonary arteries

A: Aorta
P: Pulmonary Artery
RV: Right Ventricle
LV: Left Ventricle
RA: Right Atrium
LA: Left Atrium

Coronary arteries:

• Right coronary artery (RCA)

Right coronary artery supplies blood to the right atrium, right ventricle, a small part of the ventricular septum.

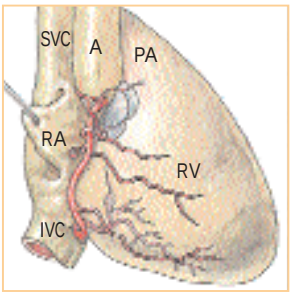


Fig. 4: Front view

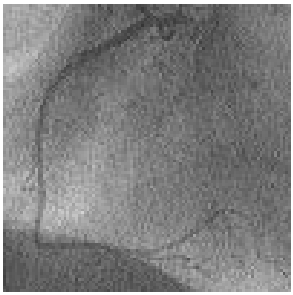


Fig. 5: Conventional Angiography

SVC: Superior Vena Cava
IVC: Inferior Vena Cava
RA: Right Atrium
RV: Right Ventricle
A: Aorta
PA: Pulmonary Artery

• Left coronary artery (LCA)

Left coronary artery supplies blood to the left atrium, left ventricle and a large part of the ventricular septum.

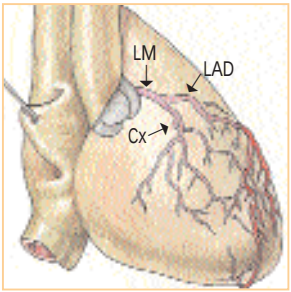


Fig. 6: Front view

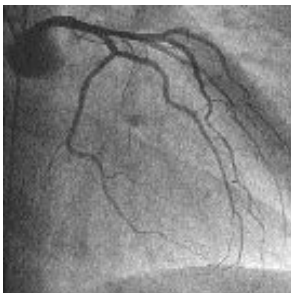


Fig. 7: Conventional Angiography

LM: Left Main Artery
LAD: Left Anterior Desending Artery
Cx: Circumflex Artery

Cardiac cycle and ECG

The heart contracts when pumping blood and rests when receiving blood. This activity and lack of activity form a cardiac cycle, which can be illustrated by an Electro-cardiograph (ECG) (Fig. 8).

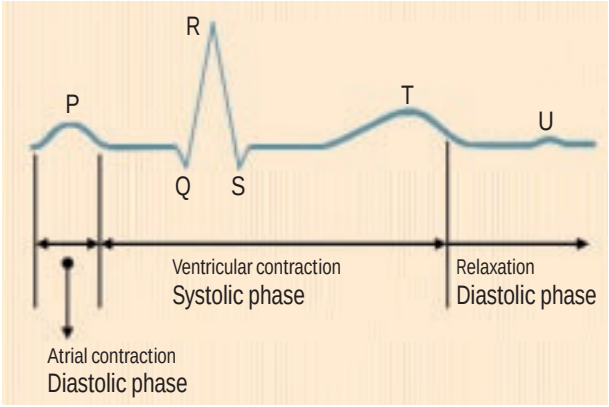


Fig. 8

To minimize motion artifacts in cardiac images, the following two requirements are mandatory for a CT system:

- Fast gantry rotation time in order to achieve fast image acquisition time
- Prospective synchronization of image acquisition based on the ECG recording in order to produce the image during the diastolic phase when the least motion happens.

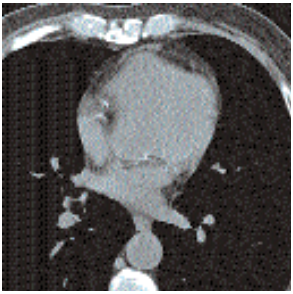


Fig. 9:
500 ms scan without ECG-Trigger

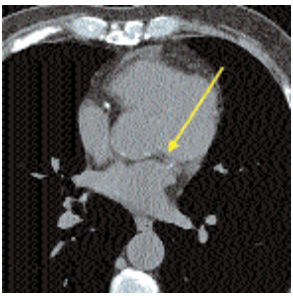


Fig. 10:
500 ms scan with ECG-Trigger

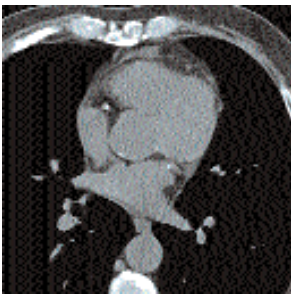


Fig. 11:
250 ms scan with ECG-Trigger

Temporal resolution

Temporal resolution, also called time resolution, represents the time window of the data that is used for image reconstruction. It is essential for cardiac CT imaging – the higher the temporal resolution, the fewer the motion artifacts. With the SOMATOM Volume Access, temporal resolution for cardiac imaging can be achieved at down to 250 ms.

Technical principles

Figure 12 shows the technical principle of sequential scanning with prospective ECG triggering. An ECG is recorded and used to initiate prospective image acquisition. Two images are acquired during each rotation.

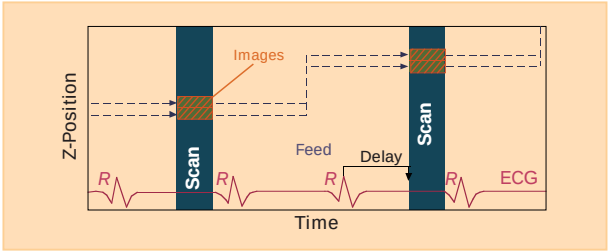


Fig. 12

A given temporal relation relative to the R-waves is predefined and can be applied with the following possibilities:

Relative – delay: a given percentage of R-R interval (ϑ_{RR}) relative to the onset of the previous or the next R-wave (Fig. 13, 14).

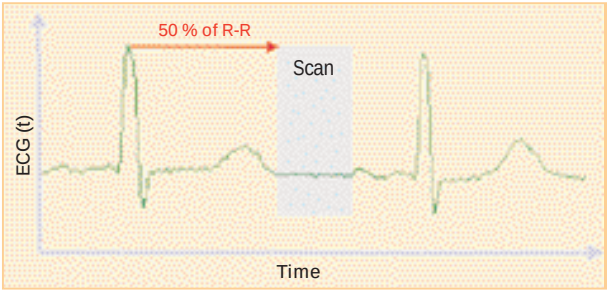


Fig. 13

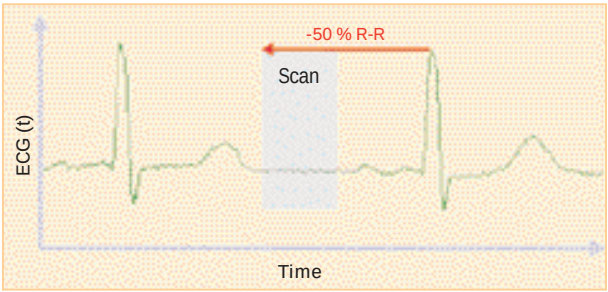


Fig. 14

Absolute – delay: a fixed time delay after the onset of the R-wave (Fig. 15).

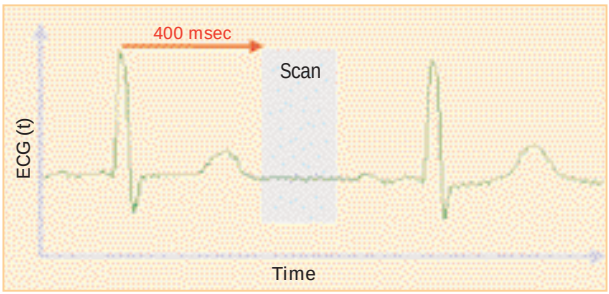


Fig. 15

Absolute – reverse: a fixed time delay prior to the onset of the next R-wave (Fig. 16).

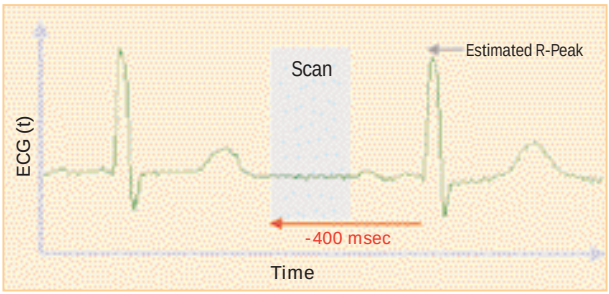


Fig. 16

Recommended reconstruction relative to the R-wave:

In principle, the best image quality can be achieved if the image acquisition or reconstruction is positioned in the "ideal time window", i.e. between the end of the T wave and the beginning of the P wave. However, the optimal timing may vary for the individual patient. Recommendations to start with are listed below. Adjustment according to the individual heart rate may be necessary.

1. For LCA (Left Coronary Artery)

HR [bpm]	T-Reverse [msec]	RR-Delay [%]
40-59	-450	50%
60-65	-400	55%
>65	-350	55%

2. For RCA (Right Coronary Artery)

HR [bpm]	T-Reverse [msec]	RR-Delay [%]
40-59	-450	50%
60-65	-400	55%
>65	-500	40%

Effective mAs:

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

$$D_{seq} = D_{CTDIw} \times mAs$$

In spiral scanning, however, the applied dose (D_{spiral}) is influenced additionally by the pitch factor. For example, if a multislice CT scanner (2-slice) is used, the actual dose applied to the patient in spiral scanning will be decreased when pitch is larger than 2, and increased when pitch is smaller than 2. Therefore, the dose in spiral scanning has to be corrected by the pitch factor:

$$D_{spiral} = (D_{CTDIw} \times mAs) / pitch$$

To make it easier for the users, the concept of "Effective mAs" was introduced with the SOMATOM Volume Access. The Effective mAs takes into account the influence of pitch on both the image quality and dose:

$$Eff.\ mAs = mAs \times 2 / pitch$$

To calculate the dose on the SOMATOM Volume Access, you simply have to multiply the CTDIw per mAs with the effective mAs:

$$D_{spiral,VZ} = D_{CTDIw} \times Eff.\ mAs$$

The Effective mAs can be selected by the user for a defined image quality and dose, independent of pitch. The tube current will be adapted according to:

$$mA = (Eff.\ mAs / Rotation\ time) \times (Pitch/2)$$

You should change the mAs according to the patient size, however when the tube load (mA) reaches its highest limitation, the "Scan Assistant" will be available to give you the possibility to adjust either the scan time or the mAs value.

You should always define the scan range before you change the mAs.

Dose information:

The dose as described by CTDIw is displayed on the user interface for the selected scan parameters. The CTDI is measured in the dedicated plastic phantoms – 16 cm diameter for head and 32 cm diameter for body (as defined in IEC 60601 - 2 - 44). This dose number gives a good estimate for 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 value displayed can deviate from the dose in the scanned volume.

The CTDIw value does not provide the entire information of the radiation risk associated with the 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 done by sophisticated programs. These have to take into account the scan parameters, the system design of 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 would allow 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 comparing the applied x-ray exposure to the natural background radiation, e. g. 2-3 mSv per year in Germany.

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

The calculation was done by the commercially available program “WinDose”(Wellhoefer Dosimetry) – as shown in figure 1-3.

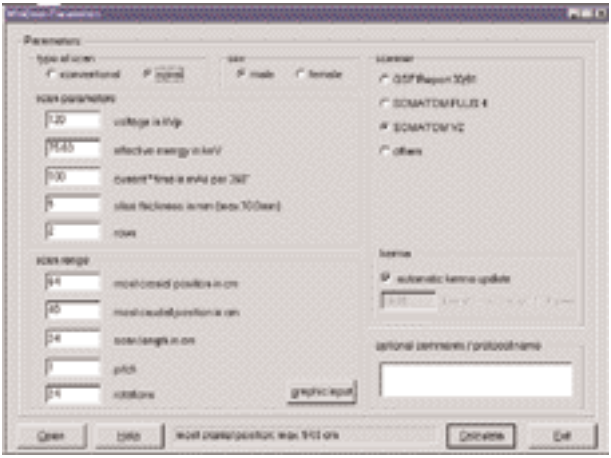


Fig. 1: User interface of the PC program WinDose. All parameters necessary for the effective dose calculation have to be specified.

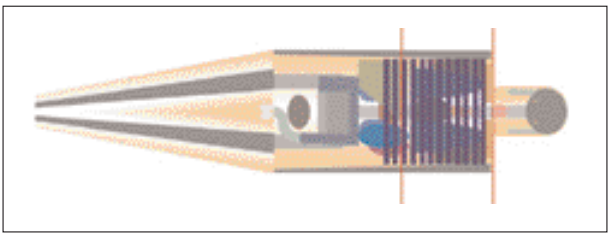


Fig. 2: A graphic interface of WinDose allows to specify the anatomical scan range.

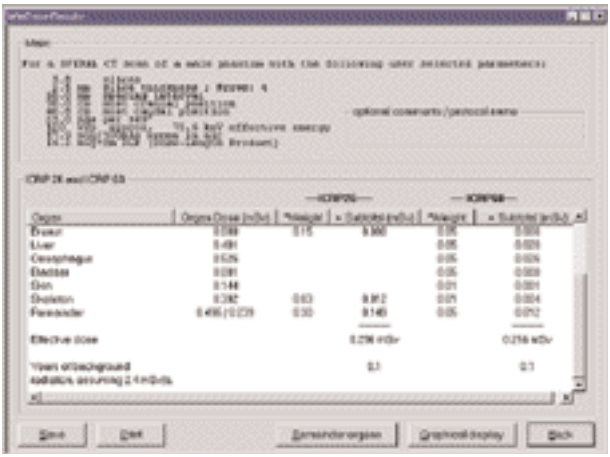


Fig. 3: Results as output of WinDose with the organ dose readings and the effective dose according to ICRP26 (previous version) and ICRP60 (currently valid).

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

How to do it

Calcium scoring

This application is used for identification and quantification of calcified lesions in the coronary arteries. It is performed with prospective ECG triggering (sequential scanning) technique on the SOMATOM Volume Access. And there is one scan protocol predifined:

- CaScoreSeq
  - Sequential scanning protocol with prospective ECG triggering.

Hints in general:

- Kernel B35f is dedicated to calcium scoring studies. To ensure the best image quality and correlation to known reference data, other kernels are not recommended.

Placement of ECG Electrodes (Fig. 17):

1. Right arm (RA): on the right mid-clavicular line, directly below the clavicle

2. Left arm (LA): on the left mid-clavicular line, directly below the clavicle

3. left leg (LL): on the left mid-clavicular line, at the 6th or 7th intercostal space.

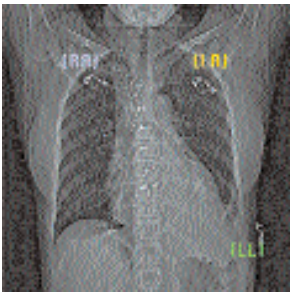
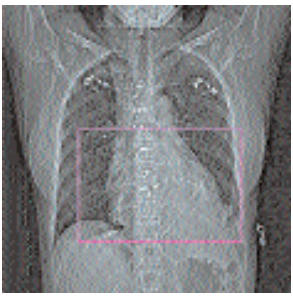


Fig. 17

CaScoreSeq

Indications: This is a sequential scanning protocol using an ECG triggering technique for coronary calcium scoring studies.



Topogram: AP, 512 mm.

From the carina until the apex of the heart.

Fig. 18

kV	120
Effective mAs	35
Slice collimation	2 x 2.5 mm
Slice width	2.5 mm
Feed/Scan	5 mm
Rotation time	0.5 s
Temporal resolution	250 ms
Kernel	B35f
CTDIw	3.3 mGy
Scan range	117.5 mm
Effective Dose	male: 0.5 mSv female: 0.8 mSv

If you apply API for image acquisition, please make sure that the breath-hold 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 breath-hold interval. This does not apply when API is not activated.

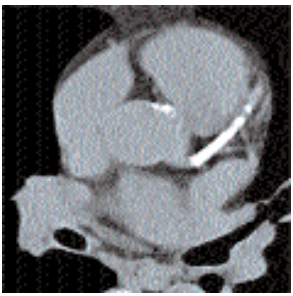


Fig. 19

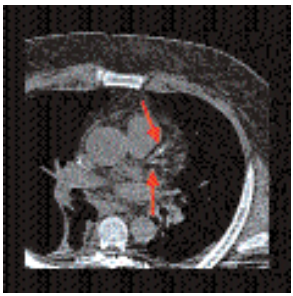


Fig. 20

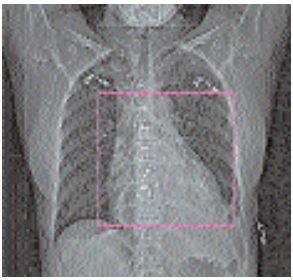
Coronary CTA

This is an application for imaging of the coronary arteries with contrast medium. It is performed with ECG triggering technique. The following scan protocols are predefined:

- ECGTrigCTA
  - Sequential scanning protocol with ECG triggering.
- CoronarySharp
  - Sequential scanning protocol with ECG triggering and dedicated reconstruction kernel.

ECGTrigCTA

Indications: This is a sequential scanning protocol with an ECG triggering technique for coronary CTA studies. It could also be applied for aortic CTA studies, e. g. aortic dissection.



Topogram: AP, 512 mm.

From the aortic arch until the apex of the heart.

Fig. 21

kV	120
Effective mAs	120
Slice collimation	2 x 2.5 mm
Slice width	2.5 mm
Feed/Scan	5 mm
Rotation time	0.5 s
Temporal resolution	250 ms
Kernel	B30f
CTDIw	11.3 mGy
Scan range	117.5 mm
Effective Dose	male: 1.8 mSv female: 2.7 mSv

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 can not 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.

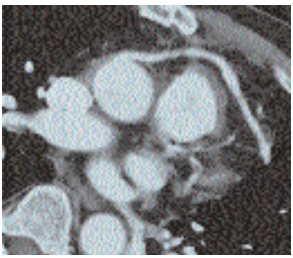


Fig. 22

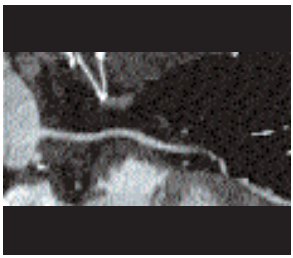
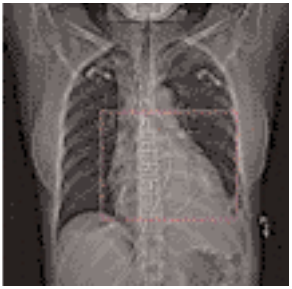


Fig. 23

CoronarySharp

Indications: This is a sequential scanning protocol using ECG triggering technique and a dedicated cardiac reconstruction kernel. Edge definition, e. g. follow up studies of calcified bypss grafts may be improved.



Topogram: AP, 512 mm. Approximately, from the carina until till the apex of the heart.

kV	120
Effective mAs	120
Slice collimation	2 x 2.5 mm
Slice width	2.5 mm
Feed/Rotation	5 mm
Rotation time	0.5 s
Temporal resolution	250 ms
Kernel	B46f
CTDIw	11.3 mGy
Scan range	117.5 mm
Effective Dose	male: 1.8 mSv female: 2.7 mSv

Pulmonary studies

This application can be used for high-resolution interstitial lung studies with an ECG triggering technique, and there is one scan protocol predefined:

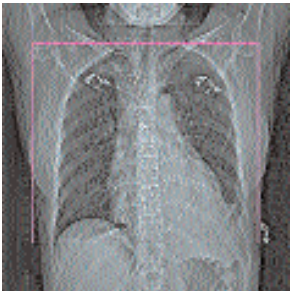
- LungECGHires
  - Sequential scanning protocol with ECG triggering.

General Hints:

- The general purpose of these applications is to reduce motion artifacts in the lungs due to the cardiac pulsation.
- The LungECGHires protocol is recommended for detection and localization of the lesions adjacent to the heart or the interlobar fissures.

LungECGHires

Indications: This is a sequential scanning protocol with an ECG triggering technique for interstitial studies of the lungs, especially for the lesions in the pericardial region.



Topogram: AP, 512 mm.

From the apex of the lung till the lung base.

Fig. 24

kV	120
Effective mAs	120
Slice collimation	2 x 1 mm
Slice width	1 mm
Feed/Scan	15 mm
Rotation time	0.75 s
Temporal resolution	375 ms
Kernel	B70s
CTDIw	13.7 mGy
Scan range	300 mm
Effective Dose	male: 1.5 mSv female: 1.9 mSv

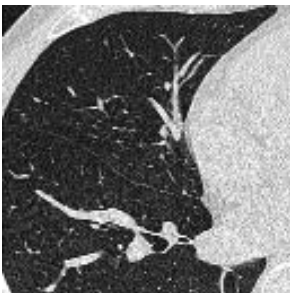


Fig. 25
750 msec, 1 mm
without ECG-trigger

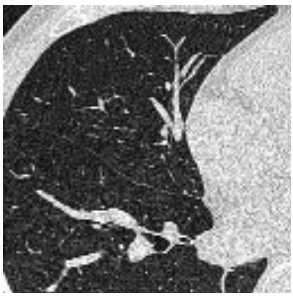


Fig. 26
375 msec, 1 mm
with ECG-trigger

Additional important information

- While all the other arteries receive arterial blood supply during the systolic phase, the coronary arteries are most appropriately supplied with blood during the diastolic phase. Therefore, for imaging the coronary arteries, image reconstruction is usually performed in the diastolic phase – not only for minimal motion artifact, but also for optimally filled coronary arteries.
- You may see different heart rates displayed on the in-room ECG monitor and the monitor on the console since they are calculated in different ways:

  1. On the ECG monitor – the heart rate displayed is based on the "R-R" intervals for every 15 s.

  2. On the console – the heart rate displayed for ECG gating is based on every "R-R" interval, and for ECG triggering, it is based on the average of the previous 3 or 5 "R-R" intervals (this can be configured with Option/Configuration/HeartView).
- For the LungECGHires protocol, it is recommended to use the cluster scanning mode. You can set up the pre-defined breathhold interval in the "Patient Model Dialog."

- By default, the “Synthetic Trigger” (ECG triggered scanning) is activated for all predefined cardiac scan protocols (Fig. 27). And it is recommended to keep it always activated for examinations with contrast medium. In case of ECG signal loss during the acquisition, this will ensure the continuation of the triggered scans or allows an ECG to be simulated for retrospective gating. If it is deactivated, the scanning will be aborted in case of ECG signal loss during the acquisition.

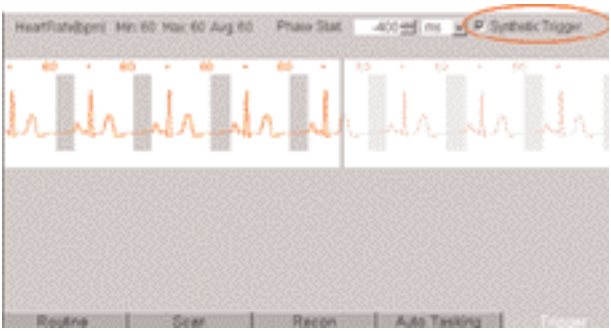


Fig. 27

• Calcium Scoring evaluation is performed on a separate *syngo* task card:

1. The threshold of 130 HU is applied for score calculation by default, however, you can modify it accordingly.

2. In addition to the seeding method, you can use free-hand ROI for the definition of lesions.

3. The separation and modification of lesions within a defined volume (depth in mm) can be performed not only on 2D slices, but also with 3D editing.

4. For easier identification of small lesions, you can blow-up the display.

5. You can customize hospital/office information on the final report using Report Configuration.

6. You can generate HTML report including site specific information, free text and clinical images. This then can be saved on floppy disc and/or printed.

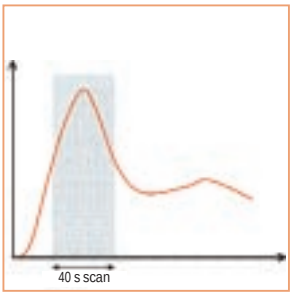
7. The results are displayed online in a separate segment includiong the following information:

- Area (in mm^3)
- Peak density (in HU)
- Volume (in mm^3)
- Calcium mass (mg calcium Hydroxyapatite)
- Score (Agatston method)

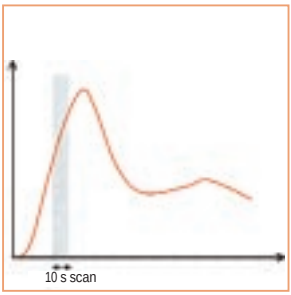
8. The results cab be printed on laser film, paper printer or saved into data base.

The basics

The administration of intravenous (IV) contrast material during spiral scanning improves the detection and characterization of lesions, as well as the opacity of vessels. The contrast scan will yield good results only if the acquisition occurs 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 speed and shorter acquisition time, it is even more critical to get the right timing to achieve optimal results (Fig. 1a, 1b).



Longer scan time Fig. 1a



Shorter scan time Fig. 1b

The dynamics of the contrast enhancement is determined by:

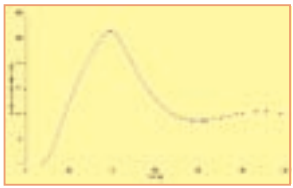
- Patient cardiac output
- Injection rate (Fig. 2a, 2b)
- Total volume of contrast medium injected (Fig. 3a, 3b)
- Concentration of the contrast medium (Fig. 3b, 4a)
- Type of injection – uni-phasic or bi-phasic (Fig. 4a, 4b)
- Patient pathology

Bolus tracking

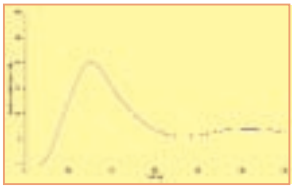
Aortic time-enhancement curves after i.v. contrast injection (computer simulation*).

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

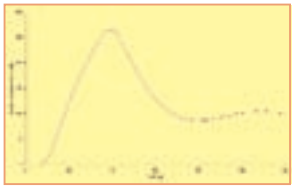
2 ml/s, 120 ml, 300 mg I/ml Fig. 2a



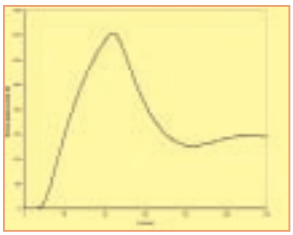
4 ml/s, 120 ml, 300 mg I/ml Fig. 2b



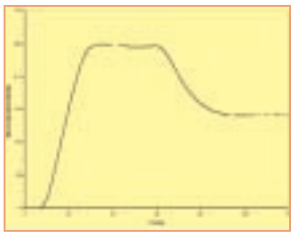
80 ml, 4 ml/s, 300 mg I/ml Fig. 3a



120 ml, 4 ml/s, 300 mg I/ml Fig. 3b



Uni-phase Fig. 4a
140 ml, 4 ml/s, 370 mg I/ml



Bi-phase Fig. 4b
70 ml, 4 ml/s, plus 70 ml,
2 ml/s, 370 mg I/ml

*Radiology 1998; 207:647-655

How to do it

To achieve optimal results in contrast studies, use of CARE Bolus is recommended (optional). In case it is not available, use Test Bolus.

CARE Bolus (optional)

This is an automatic bolus tracking program, which enables triggering of the spiral scanning at the optimal phase of the contrast enhancement.

General Hints:

1. This mode can be applied in combination with any spiral scanning routine 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 monitoring scan protocol. You can also save the entire set up as your own scan protocols (please refer to the application guide for routine protocols).

2. The pre-monitoring scan is used to determine the level of monitoring scans. It can be performed at any level of interest. You can even predefine several pre-monitoring scans by defining a short range and then selecting the optimal image in which to place the trigger ROI. 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 **towards** 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 an ROI on the target area or vessel used for triggering. (The ROI is defined with double circles – the outer circle is used for easy positioning, and the inner circle is used for the actual evaluation). You can also zoom the reference image for easier positioning of the ROI.

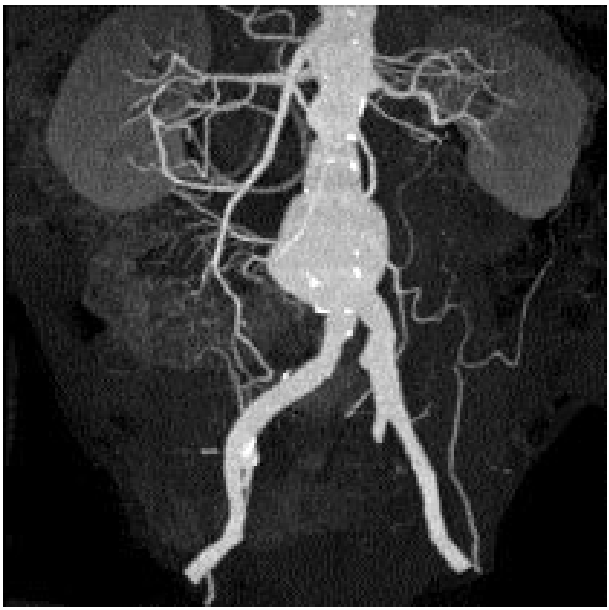
5. Set the appropriate trigger threshold, and initiate the contrast injection and monitoring scans at the same time. During the monitoring scans, there will be simultaneous display of the relative enhancement of the target ROI. When the predefined density is reached, the spiral acquisition will be triggered automatically.

6. You can also initiate the spiral any time during the monitoring phase manually – either by pressing the START button or by clicking the START key.

If you do not want to use automatic triggering, you can set the trigger level to its maximum (800 HU), and start the trigger manually.

If you would like more information on this option, please contact your local Siemens representative. If you do not have this option, you can also use the "Test Bolus".

An image example is shown below (Fig. 5).



Abdominal aortic aneurysm (MIP) Fig. 5

Test Bolus

Indications: This mode can be used to test the start delay of an optimal enhancement after the contrast medium injection.

	TestBolus
kV	120
mAs	30
Slice collimation	2 x 5 mm
Slice width	10 mm
Feed/Rot.	0
Rot. time	0.5 s
Kernel	B30f
Cycle time	2 s

Application procedures:

1. Select the spiral mode that you want to perform, and then "Append" the TestBolus mode under **Special** protocols.

2. Insert the Test Bolus mode above the spiral mode for contrast scan by "cut/paste" (with right mouse button).

3. Perform the Topogram, and define the slice position for TestBolus.

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 following spiral scan. Start the contrast media injection and the scan at the same time.

6. Load the images into the Dynamic Evaluation function and determine the time to the 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 "Δt" 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.

Additional important information

1. The preset start delay time for monitoring scans depends on whether the subsequent spiral scan will be acquired during the arterial phase or venous phase. The default value is 10 s. You can modify it accordingly.

2. It should be pointed out that when using "Test Bolus", there may be residual contrast in the liver and kidneys prior to scanning. This may result in an inaccurate arterial and equilibrium phase.

3. The trigger threshold is not an absolute value but a relative value compared to the non-contrast scan. E. g. if the CT value is 50 HU in the non-contrast image, and your trigger level is 100 MU, then the absolute CT value in the contrast image will be 150 HU.

4. If you change slice collimation, rotation time or kV in the spiral scanning protocol after CARE Bolus is inserted, a longer spiral start delay time will be the result, e. g. 14 s. This is due to the necessary mechanical adjustments, e. g. moving the slice collimators. Therefore, it is recommended that you modify the parameters of the spiral scanning **before** inserting the CARE Bolus.

5. If API is used in conjunction with CARE Bolus, the actual start delay time for the spiral will be as long as the length of API including the predefined start delay time. E. g. if the predefined the start delay is 2 s, and the API lasts 5 s, the spiral will start 5 s after the threshold is reached.

6. In case you have to interrupte the monitoring scanning due to injection problem, you can repeat it afterwards by inserting CARE bolus again with a right mouse click. The same Topogram can still be used.

This is an application package for reformatting panoramic views and paraxial slices through the upper and lower jaw. It enables the display and measurement of the bone structures of the upper and lower jaw (especially for a 1:1 scale) as the basis for OR planning in oral surgery.

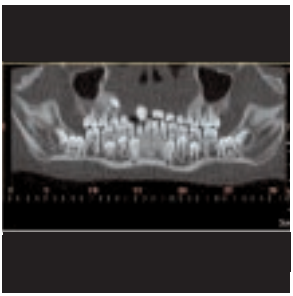
The basics

What is the relevant anatomical information for oral surgery planning and dental implantation?

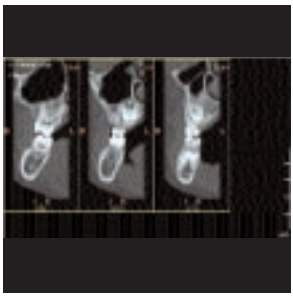
- Location of the socket for dental implant,
- Buccal and lingual thickness of the cortical component of the alveolar process,
- Position of the mandibular canal and the mental foramen,
- Extent of the nasal sinuses and
- Position and width of the floor of the nasal cavity.

What can Dental CT do?

- Reformatting of a curvilinear range of panoramic views along the jaw-bone.
- Reformatting of linear views of selectable length and at selectable intervals perpendicular to the panoramic views.
- Presentation of results in the form of multiple image display with reference markings.
- Images are documented on film in “life-size” so that the direct measurement of the anatomic information with a ruler is possible. The layout of the film sheet is pre-defined such that it can accommodate the maximum number of reformatted images.



Panoramic view Fig. 1



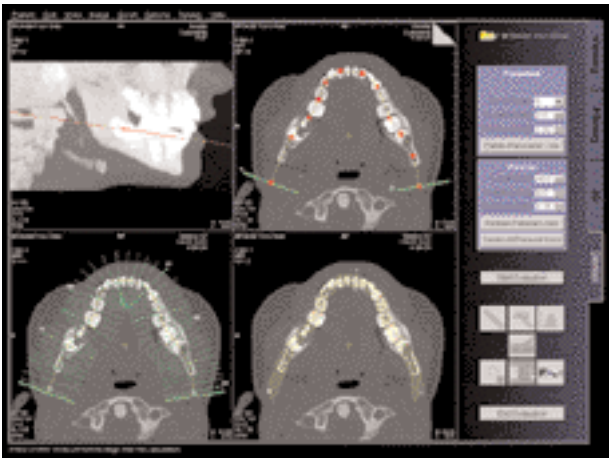
Paraxial view Fig. 2

How to do it

Scan protocol:

	Dental CT
kV	120
mAs	70
Slice collimation	2 x 1 mm
Slice width	1 mm
Feed/Rot.	3 mm
Rot. time	1 s
Kernel	H60s
Increment	1 mm
Scan range	45 mm
CTDIw	19.3 mGy
Effective Dose	male: 0.3 mSv female: 0.3 mSv

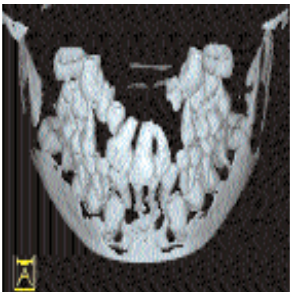
- It is mandatory to position the patient head in the center of the scan field – use the lateral laser light marker for positioning.
- Gantry tilt is not necessary since you have the possibility to tilt the reference line to generate an axial reformatted image at the desired plane. However, in order to minimize the scan length for the same anatomical region, it is recommended to position the patient's head at the appropriate scan plane whenever possible:
  - For the upper and lower jaw: occlusal plane in parallel to the scan plane.
  - For either jaw: jaw bone in parallel to the scan plane.
- It is recommended to end the exam first, and then start the Dental evaluation.



Delineation of the desired views Fig. 3

Additional important information

- This protocol delivers high resolution images for dental CT evaluation, however, you can also reconstruct images with softer kernel, e.g. H20s, for 3D/SSD postprocessing.



AP-cranial view Fig. 4a

Caudal view Fig. 4b

- Image orientation:
  - In the paraxial view, a “B” indicates buccal and a “L” lingual. The lingual marker “+” must always be positioned at the tongue. If not, simply drag & drop it back.
  - In the panoramic view, a “B” stands for “Begin" and an “E” for “End".
- Since Dental CT provides you with the possibility to generate the curved MPR in a range, you may try to use it for the evaluation of the other anatomic region, such as vessels.
- Filming: for the maximum use of the film, film directly from the dental card instead of Patient Browser.

  For easy reprinting, the results of the latest Dental CT Film are stored in the Patient Browser in the folder “Film”.
- It is better to change the image windowing on the virtual film sheet.
- A semi-automatic detection tool can be used to mark and outline the mandibular canal on both paraxial and panoramic images for easy viewing and filming.
- Multiple paraxial ranges can be defined on one reference image by “cluster & copy function”. I. e., you can group a number of paraxial lines and copy the lines to another location, e. g. over individual sockets at different locations (Fig.5).
- ROI definition for statistical evaluations and deletion of graphics are possible.

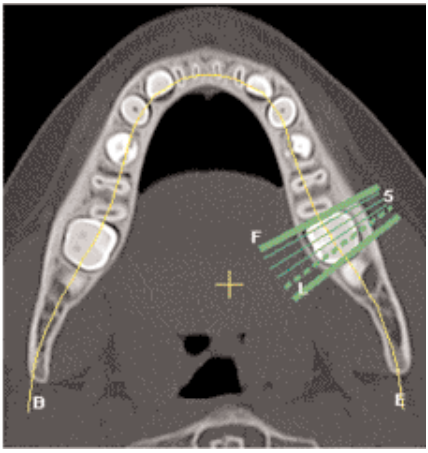


Fig. 5

This is an application package for the quantitative assessment of vertebral bone mineral density for the diagnosis and follow-up of osteopenia and osteoporosis.

The basics

This program enables the quantitative determination of bone mineral density of the spine in mg/ml of calcium hydroxyapatite (CaHA) for the diagnosis, staging, and follow-up of osteopenia and osteoporosis with CT. The patient is scanned together with the water- and bone-equivalent calibration phantom.

What is "T-score"?

This is the deviation of average BMD of the patient from that of a young healthy control. It represents bone loss with reference to the peak bone mass.

What is "Z-score"?

This is the deviation of average BMD of the patient from that of a healthy person of the same age. It is an indicator of biological variability.

Siemens reference data:

The Siemens reference data was acquired at three European centers, including 135 male and 139 female subjects, 20 to 80 years of age.

How to do it

	Osteo	OsteoObese
kV	80	80
mAs	125	350
Slice collimation	2 x 5 mm	2 x 5 mm
Slice width	10 mm	10 mm
Feed/Rot.	0 mm	0 mm
Rot. time	0.5 s	1.5 s
Kernel	S80f	S80f
Cycle time	3 s	3 s
CTDIw	3.6 mGy	10.2 mGy
Effective Dose	male: 0.03-0.04 mSv female: 0.05-0.1 mSv	male: 0.1 mSv female: 0.1-0.3 mSv

Patient positioning:

- Set the table height at 125. The gantry tilt will be available from –28.5° to +30°.
- Patients should be positioned so they are as parallel to the patient table as possible. Support the knees to compensate for lordosis.
- The calibration phantom should be positioned directly below the target region. Put the Gel-pad between the calibration phantom and the patient to exclude air pockets.

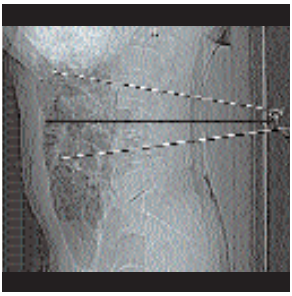
Scanning:

- Typically, one scan each is performed at L1, L2 and L3 levels. It is recommended to use image comments ***L1, L2, L3*** prior to scanning. These comments will be displayed with the Osteo evaluation results.

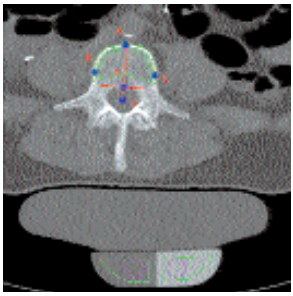
Note: no blanks or other deviations are allowed for the comments, e.g. use ***L3*** instead of ***L 3,*** or ***T12*** instead of ***TH12.***

- Before ending the examination, you can drag&drop the chronicles to the topogram segment to get the Topographics, i. e. the cut-lines for each vertebra on the topogram.

- Select the appropriate scan protocol according to the patient size, i. e. use “OsteoObese” for obese patient.
- Position the cut line of scanning through the middle of the vertebra, i. e. bi-sector between the angle of the upper and lower end plate.
- The phantom must be included in the FOV of the images for evaluation.
- It is recommended to end the exam first, and then start the Osteo evaluation.



Topographic Fig. 1



Phantom inside the FOV Fig. 2

Additional important information

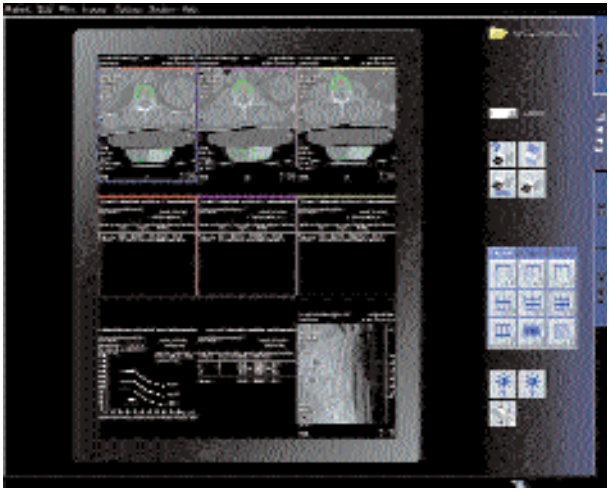
1. Fractured vertebrae are not suited for Osteo CT evaluation since the more compact nature of these vertebrae result in bone mineral density value that is much higher than one would expect.

2. How to save the results on your PC?

- Select Option/Configuration from the main menu and click icon "CT Osteo."
- Activate the checkbox “Enable Export of Results.”
- “Exit” the configuration dialog.
- Call up the Osteo card and you will see the new icon “Export results” on the lower, right part of the screen
- Click this icon to copy the evaluation results to floppy disk (Note: with every mouseclick on the icon, the previous result file will be appended).
- The data file can be transferred to your PC for further evaluation, e.g. with MS Excel.

Note: for detailed information about the data file, please refer to the Appendix.

3. It is recommended to film directly from the Osteo card. Select images or series with Edit > Select all, and click “film” icon, you will get a standard layout of 9 segments as seen in Fig. 3.



Filming layout Fig. 3

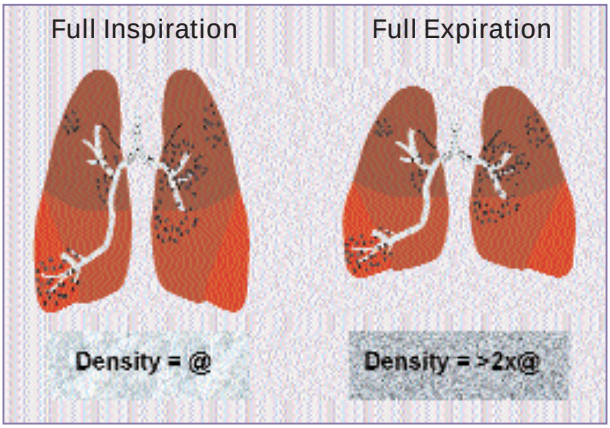
Note: it is not recommended to use filming setting of 4x5 segments since the image text elements of the result image are overlapped and hard to read.

This is an application package, which serves for quantitative evaluation of the lung density to aid the diagnosis and follow-up of diffuse lung diseases, such as pulmonary emphysema, sarcoidosis, panbronchiolitis and silicosis.

The basics

- No specific scan protocols were set up for this option. Scan protocols for routine thorax imaging can be used. The scan parameters used are dependent on the indications and objectives of the study design. For example, spiral mode for lung volume evaluation or HR sequence mode for interstitial lung diseases.

- Lung density is influenced by respiratory status (Fig.1).



Lung density at full inspiration/expiration Fig. 1

- Examinations should be acquired at the same respiratory level, usually at either full inspiration or full expiration. Studies had shown that reproducibility is high and is unlikely to be improved by using spirometric gating [1].

Literatures
1 Repeatability of Quantitative CT Indexes of Emphysema in Patients Evaluated for Lung Volume Reduction Surgery. David s. Gierada et al, Radiology 2001 220: 448-454

• Siemens reference data:

It was acquired from lung healthy individuals at 50 % vital capacity. Since Pulmo CT program does not provide spirometric triggering for the acquisition of the data set, it is not meaningful to use Siemens reference data for comparison unless the data is acquired under the same conditions.

• User-specific reference data

It is possible to integrate in your own reference data, e.g. data acquired at full inspiration, for the evaluation. Please contact the local Siemens representative for further information.

How to do it

It is recommended to end the exam first, and then start the Pulmo evaluation.

Select the images that you want to evaluate, and activiate the program by clicking on the “Pulmo” icon.

Additional important information

1. How to export the evaluation results to a floppy disc?

- Select Option/Configuration from the main menu and click icon "Pulmo".
- Activate the checkbox "Enable Export of Results".
- "Exit" the configuration dialog.
- Call up the Pulmo card and you will see the new icon "Export results" on the lower, right part of the screen.
- Click this icon to copy the evaluation results onto floppy disk. (Note: with every mouseclick on the icon, the previous result file on the floppy will be appended).
- The data file can be transferred to your PC for further evaluation, e.g. with MS Excel.

Note: for detail information about the data file, please refer to the Appendix.

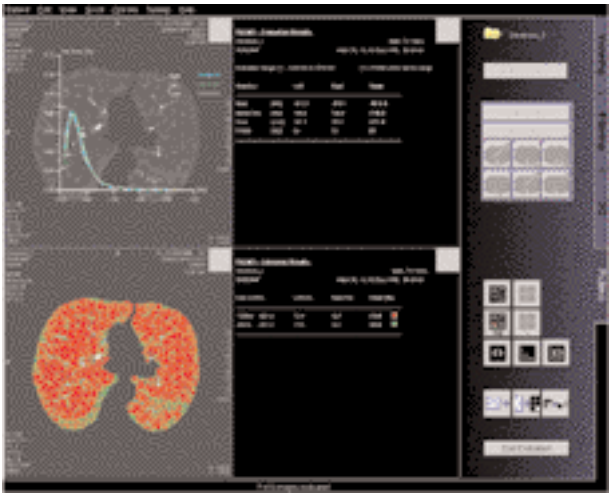
2. Standard and expert mode can be configured to your needs.

- Select Option/Configuration/Pulmo.

For example, if you want to determine the percentage area of the lung within a specific HU range, use the card "Subranges" on the Configuration/Pulmo dialog.

3. Color-coded display of HU subranges and percentiles is possible. This allows direct visualization of the different densities distribution within the lung.

4. The auto-contour detection can be used as editing function for 3D postprocessing of lung images.



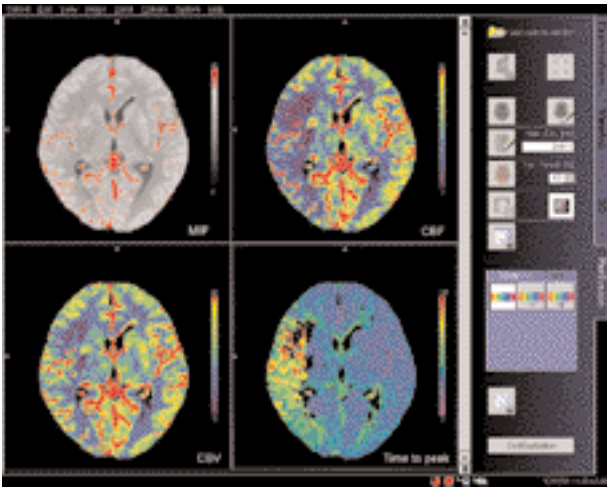
Pulmo CT task card.

This is an application software package for the quantitative evaluation of dynamic CT data of the brain following injection of a highly concentrated iodine contrast bolus. The main application is in the differential diagnosis and management of acute ischemic stroke.

The basics

- The current software is available with the *syngo* implementation, which allows multi-slice processing.
- The software optimally supports the stringent time and workflow requirements in an emergency setting where time is brain.
- Parameters generated include among others cerebral blood flow (CBF), cerebral blood volume (CBV), the time to local perfusion onset (Time-to-Start) and the time to local perfusion peak (Time-to-Peak).

Example: A 44-year-old man was brought to the hospital about 2 hours after the start of severe neurological symptoms of stroke in the right hemisphere.



The CBF image shows a severe perfusion disturbance (flow close to zero) in the insular cortex and the posterior portion of the lentiform nucleus. In comparison to the left hemisphere the remaining supply area of the middle cerebral artery shows moderately reduced flow.

- The CBV image shows the same severe reduction in insular cortex and lentiform nucleus. In contrast to the CBF image, however, the blood volume in the remaining right MCA territory is close to normal, if it is compared to the same area on the left side.
- The time-to-peak image shows a general prolongation of values in the MCA territory indicating delayed bolus arrival.

How to do it

Scan protocols:

BrainPerfCT	Multiscan
kV	80
mAs	250
Effective Dose	2.7 mSv
Slice Collimation	10 mm
Feed/Rot.	0 mm
Rot. time	1 s
Scan time	40 s
Kernel	H30s
Increment	1 s

Such a standard protocol may be slightly modified for specific reasons; e.g. the start delay can be increased by a few seconds for patients with very low cardiac output.

I. V. injection protocol:

Contrast medium	Non-ionic
Concentration	300 - 370
Injection rate	8 ml/s
Total volume	40 ml
Total injection time	~ 5 s
Start delay time	4 s

The technique requires a short bolus. The original studies were performed mostly using 50 ml injected at 10 ml/s. The routine application has shown, that by sacrificing some of the spatial resolution, the examination can also be done with smaller amounts of contrast (35 to 40 ml) and correspondingly smaller flow rates. The smaller the total amount the more helpful it is to consider a saline chaser bolus. In any case, a state-of-the-art power injector is recommended.

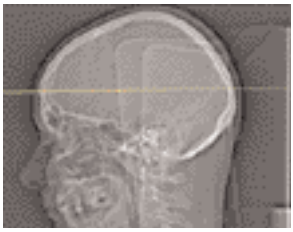
If a flow rate of 8 ml/s is considered not recommendable for a specific patient, the protocol can be reduced to 40 ml at 5ml/s. Image quality will be reduced but the technique will still be diagnostic.

- Additional measures to facilitate the injection, like using a large gauge cannula (16 or 18 are usually sufficient) and warming the contrast media to body temperature to reduce its viscosity, should be considered.

Note: As with any contrast medium application, verify that the particular models and brands that you use in the chain injector/contrast medium/cannula are approved by their respective manufactures for the use with the parameters you select.

- Motion during acquisition must be avoided. Therefore, if at all possible you should try to explain the course of the examination to the patient and use additional head fixation in any case.
- The standard examination slice is best positioned such that it cuts through the basal ganglia at the level of the inner capsule. This selection includes those vascular territories of the brain that are frequently affected by perfusion impairment associated with acute stroke in the carotid territory.

- The slice should be selected "flatter" than in normal head CT scan, the angulation should be adjusted perpendicular to the occipital segment of the superior sagittal sinus well above the confluence of sinuses.
- The eye lens should never be positioned in the scan plane.



Example of a standard slice through the basal ganglia in a lateral topogram.

Additional important information

- Why short injection times are necessary?

The brain has a very short transit time (approx. 3 to 5 seconds) and a relatively small fractional blood volume (approx. 2 to 5%). This requires a compact bolus for optimal time resolution and a certain minimum amount of contrast for optimal signal to noise ratio. Bolus definition can be significantly improved and the amount of contrast necessary reduced by using a saline chaser bolus with the same flow rate directly following the CM injection.

- What do normal, contrast-enhanced and Perfusion CT images show?

In order to interpret Perfusion CT images correctly, it is essential to understand that they are "functional" or "parameter" images that display a different type of information than standard CT images:

Normal CT images basically show only morphological properties of tissues by displaying their x-ray attenuation relative to that of water as CT-values in HU-units.

Standard contrast-enhanced CT extends this limitation either to make a compartment visible that normally has low contrast (e. g. vascular structures in CTA) or to qualitatively display major perfusion differences of tissues (e. g. tumors or multiphase liver studies).

Perfusion CT tries to utilize all the information hidden in the temporal changes of contrast enhancement by fitting a mathematical model to the local time attenuation curves. For each voxel this process yields a variety of numbers which describe different aspects of tissue perfusion. As the human eye is so much faster and better suited to interpret images than large amounts of numbers it makes sense to display these quantities in the form of images.

• What do pixel values mean in the Perfusion CT images?

It is very important to realize that pixel values now have a different meaning, which depends on the type of image currently displayed. So if you point the cursor into a parameter image bear in mind that you do not read a CT-value but a functional unit. A time-to-peak image, for example, displays numbers proportional to the time until the bolus peak is reached; so higher numbers mean later bolus arrival. A CBF image, on the other hand, displays numbers proportional to blood flow; so smaller numbers indicate lower flow.

• Filming color images

If a color hardcopy device is connected to the system, color images can be printed via the filming task card. It is recommended to send the color images from the Viewing task card after having saved them on the Perfusion task card.

• How to fine-tune the color mapping?

1. For "flow images" (CBF and CBV) – the color palette for the flow image is designed such, that after optimal adjustment with the arrow buttons the following approximate correspondence will result for a normal brain:

red	→	vessels
green/yellow	→	gray matter
blue	→	white matter
black	→	no calculation (CSF space)

After adjustment (use non-ischemic hemisphere as guideline) ischemic areas will therefore be displayed either in violet (very low flow) or as a mismatch with the non-ischemic side (gray matter is blue instead of green).

2. For "Time images" (Time to Start and Time to Peak) – the color palette for the time images maps increasing time values on a spectral scale:

Violet → blue → green → yellow → red

Display should be adjusted with the arrow buttons such that the areas with latest arrival times are just slightly red. As with the flow image black means no calculation (CSF space, or areas with extremely low flow → no time assessment possible).

To facilitate CT interventional procedures, the following programs are provided:

• Biopsy

This is the multislice biopsy mode. 2 slices (e. g. 5 mm each) will be reconstructed and displayed for each scan.

• BiopsyCombine

This is the biopsy mode with 1 combined slice.

• CARE Vision CT

This is a CT Fluoroscopic mode with 1 combined slice and up to 7 images/sec. display.

The basics

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.

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, e. g. a short range of spiral scanning for the biopsy region. If you need only few slices, you can also de-activate the soft key – “Biopsy” in the routine card, and move the table by changing the table feed.

The table height can be adjusted to minimum 255 mm.

Gantry tilt is possible whenever necessary.

HandCARE™ is a dedicated algorithm for dose reduction during the interventional procedure (Fig. 1). It switches off the x-ray exposure between 10:00 and 2:00 o’clock position, thus provides a significant dose saving to the operator’s hand and to the patient, especially those sensitive organs, while maintaining effective mAs to assure image quality.

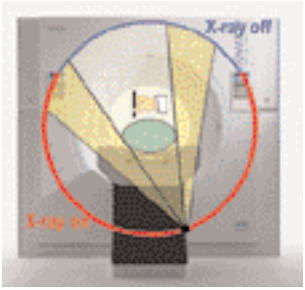


Fig.1: Principle of HandCARE™.

How to do it

Biopsy

Indications: This is the multislice biopsy mode. Two slices (5 mm each) will be reconstructed and displayed for each scan. It can be appended to any other scan protocol, e.g. ThoraxRoutine for biopsy procedures in the thorax. Change the mAs setting accordingly before you load the mode.

	Biopsy
kV	120
mAs	150*
Slice collimation	2 x 5 mm
Slice width	5 mm
Feed/Rot.	0
Rot. time	0.5 s
Kernel	B30f

*region of interest and study dependent.

Application procedures:

1. Perform a spiral scan first to define a target slice.

2. Click "Same TP" under Table position in the routine card, and move the table.

3. Turn on the light marker to localize the Entry point, and then start the patient preparation.

4. Select "Biopsy" mode under Special protocols, and then click "Append".

5. Click "Load" and then "Cancel move". Press the "Start" button and 2 images will be displayed.

6. Press "Start" again, you'll get another 2 images with the same slice position. This can be repeated 10 times as default, however, you can increase this by changing the number of scans in the Routine card.

BiopsyCombine

Indications: This is the biopsy mode with 1 combined slice. It can be appended to any other scan protocol, e.g. ThoraxRoutine for biopsy procedures in the thorax. Change the mAs setting accordingly before you load the mode.

	BiopsyCombine
kV	120
mAs	150*
Slice collimation	2 x 5 mm
Slice width	10 mm
Feed/Rot.	0
Rot. time	0.5 s
Kernel	B30f

*region of interest and study dependent.

Application procedures:

1. Perform a spiral scan first to define a target slice.

2. Click "Same TP" under Table position in the routine card, and move the table.

3. Turn on the light marker to localize the Entry point, and then start the patient preparation.

4. Select "BiopsyCombine" mode under Special protocols, and then click "Append".

5. Click "Load" and then "Cancel move". Press the "Start" button and 1 image will be displayed.

6. Press "Start" again, you'll get another image with the same slice position. This can be repeated 10 times as default, however, you can increase this by changing the number of scans in the Routine card.

CARE Vision CT

Indications: This is a CT fluoroscopic mode with 1 combined slice and up to 7 images/sec. display. It can be appended to any other scan protocol, e.g. ThoraxRoutine for biopsy procedures in the thorax. Change the mAs setting accordingly before you load the mode.

	CARE Vision CT
kV	120
mAs	21
Slice collimation	2 x 5 mm
Slice width	10 mm
Feed/Rot.	0
Rot. time	0.5 s
Kernel	B30f

Application procedures:

1. Perform a spiral scan first to define a target slice.
2. Click "Same TP" under Table position in the routine card, and move the table.
3. Turn on the light marker to localize the Entry point, and then start the patient preparation.
4. Select "CARE VisionCT" mode under Special protocols, and then click "Append".
5. Click "Load" and then "Cancel move". Press the footswitch to start the scan or keep it pressed for continuous scanning.

Additional important information

- In the BiopsyCombine mode, the slice position, table position, table begin and table end are all the same.
- In the Biopsy mode, the slice position, table position, table begin and table end are different.
- Image is displayed with full screen and 1024 x 1024 matrix.
- You can chose either “Continuous” or “Incremental” mode for table movement (Fig. 2). In the “Continuous” mode, the table will move 0.5 mm each time you touch the joystick shortly. And in the “Incremental” mode, you can define incremental table movement in mm. It might be advisable to choose the increment either equal to the slice width or half of the slice width so that it is easier to adjust the table position to visualize the needle.
- Dose & Time Watch is displayed for continuous observation (Fig. 3).

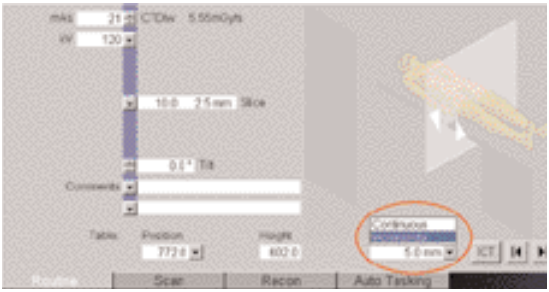


Fig. 2

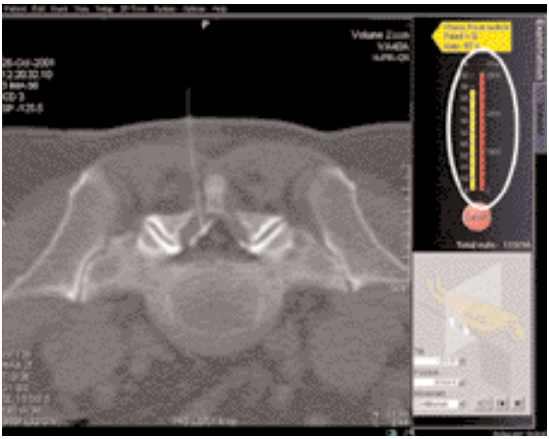


Fig. 3

a) The SP (slice position) in each image means the center of the image (Fig. 1).

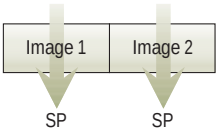


Fig. 1

b) The "Table position" means the central position of the 2 images and will also be the position of the positioning light marker (Fig. 2).

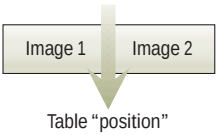


Fig. 2

c) The table "Begin" means the center of the first image, and the table "End" means the center of the last image (Fig. 3).

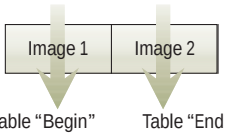
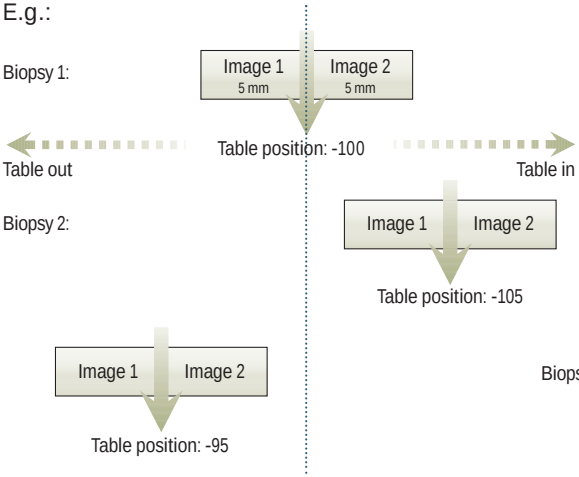


Fig. 3

- How to shift the center of the four image?
  The principle is "plus shift" for table out or "minus shift" for table in. And then, type the value into the "Table position".

E.g.:



In any trauma situation, time means life and the quality of life for the survivor. In order to facilitate the examinations, two protocols are provided:

• PolyTrauma
This is a combined mode for the examination of multiple ranges, e.g. head, neck, thorax, abdomen and pelvis.

• Trauma
This is a one-range mode for fast screening.

The basics

1. 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.

2. Prepare the CT room before admitting the patient, e.g., load IV contrast into the injector.

3. Know, observe and practice the standard hospital operating policy for handling a patient in distress e.g. Code Blue for cardiac and respiratory arrest.

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

5. Ensure that all vital lines e.g., 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.

6. Never leave patients unattended at any time during the procedure.

7. Observe the vital signs e. g. ECG, respiration, etc. at all times during the procedure.

8. Finish the examination in the shortest possible time.

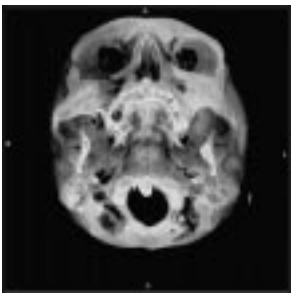
How to do it

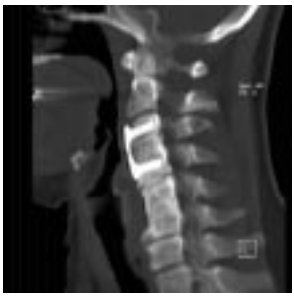
PolyTrauma

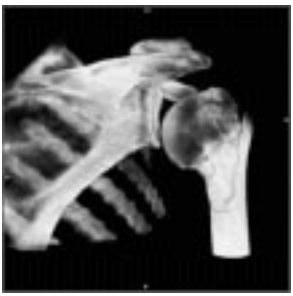
Scan Protocol:

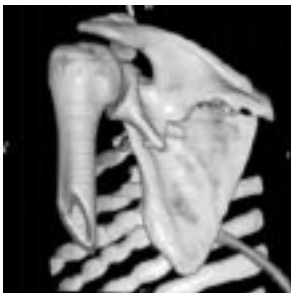
	HeadFastSpi	NeckFastSpi	ThoraxFast	AbdPelvFast
kV	120	120	140	120
mAs	260	140	100	140
Slice collimation	2 x 5 mm	2 x 5 mm	2 x 5 mm	2 x 5 mm
Slice width	8 mm	7 mm	8 mm	8 mm
Feed/Rot.	16 mm	12.5 mm	20 mm	20 mm
Rot. time	0.75 s	0.5 s	0.5 s	0.5 s
Kernel	H30s	B30f	B40f	B30f
Increment	8 mm	7 mm	8 mm	8 mm
Direction	cr-ca	cr-ca	cr-ca	cr-ca
Scan range	110 mm	150 mm	250 mm	400 mm
CTDIw	59 mGy	14.1 mGy	9.5 mGy	13.3 mGy
Effective Dose	male: 2.0 mSv female: 2.1 mSv	male: 2.0 mSv female: 2.1 mSv	male: 3.2 mSv female: 4.2 mSv	male: 8.0 mSv female: 11.6 mSv

In different polytrauma cases, you could either combine different protocols, or delete any of the chronicle from the predefined protocol if they are not needed.









Trauma

Scan Protocol:

	Trauma
kV	120
mAs	115
Slice collimation	8 mm
Slice width	10 mm
Feed/Rot.	16 mm
Rot. time	0.5 s
Kernel	B30f
Increment	7
Direction	cr-ca
Scan range	720 mm
CTDIw	9.9 mGy

You can adjust the mAs setting according to the region to be examined.

Additional important information

1. For long range scanning, please pay attention to the mark of scannable range on the table mattress while positioning the patient.

2. If a Topo length of 1024mm is not long enough, record the table position of the desired scan range while positioning the patient, and type them into the routine card as "table begin" and "table end".

3. In some cases, it might be advisable to position the patient as Feet first so that there will be more space for the intensive care equipment around.

CARE Dose is a clinical application package (optional) that provides real-time tube current modulation for Spiral and Sequential Scanning.

The basics

CARE Dose reduces patient dose significantly, especially in the regions of shoulder and pelvis. It decreases tube load, which extends the capacity for volume scanning with thinner slices, larger volumes or Multi-phase studies. It can also improve image quality by increasing mA and thus reducing image noise on the lateral views.

How does it work

It reduces the mA for low attenuation views up to 90% and keeps the nominal higher mA for high attenuation views, e.g. in the lateral projection (Fig. 1). This is done “on-the-fly”, i. e. the scanner adapts the mA in real-time, according to the patient’s attenuation profile (Fig. 2).

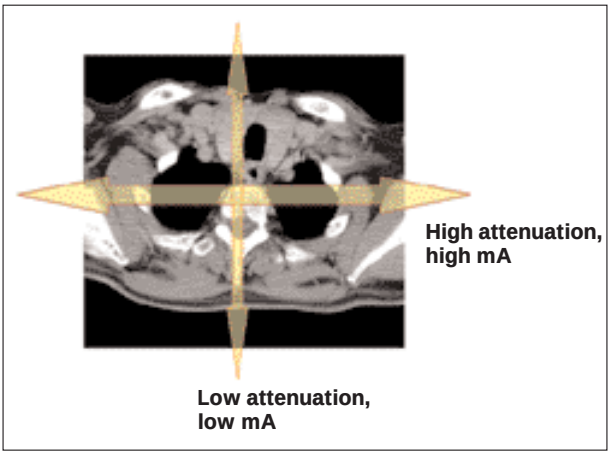


Fig. 1: Example of scanning in the region of shoulder.

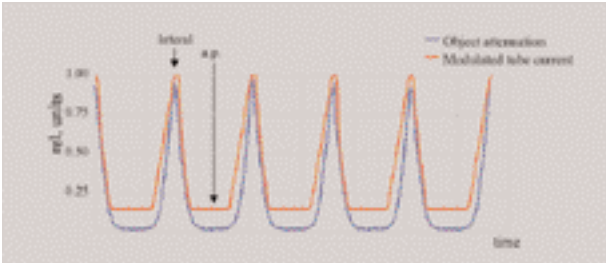


Fig. 2: Principle of CARE Dose tube current adaptation.

Additional important information

- CARE Dose is pre-selected by default for all standard protocols*. It can be switched on/off in the scan card with a mouse click (Fig. 3).
- The application of CARE Dose does not require any changes in the scan parameters. The mean value of the mAs applied will be lower than what you have selected.
- The mean value of the effective mAs applied is shown in the image text.

Fig. 3: CARE Dose can be switched on/off in the scan card with a mouse click.

* In case of software upgrade, e. g. from VA20 to VA40, you have to switch CARE Dose on for your former scan protocols manually. If you want to make it as default for a scan protocol, simply switch it on and save the protocol.

BodyPerfCT and BodyDynCT

These are protocols templates for the analysis of contrast enhancement dynamics in the body. Scan parameter details such as mAs, slice width, increment etc. depend on the organ to be studied.

These may be used with the Dynamic Evaluation function for the descriptive analysis of contrast enhancement of tissues.

Osteo CT

Example for one patient with three Osteo tomograms:

PATIENT; John Smith; 007; 64; Male

IMAGE; L2; 234; 2; 27-JAN-1998; 11:12:17; 61.7; 48.9; 55.3; 20.8; 20.1; 21.5; 205.8; 192.0; 198.7; 50.6; 47.5; 49.5

IMAGE; L3; 236; 3; 27-JAN-1998; 11:12:18; 60.4; 54.5; 49.3; 22.3; 21.1; 21.8; 210.5; 191.9; 180.7; 50.4; 47.5; 52.3

IMAGE; L4; 238; 4; 27-JAN-1998; 11:12:18; 59.3; 43.1; 55.0; 20.6; 29.0; 23.3; 201.8; 178.1; 192.3; 43.6; 45.9; 44.2

REFDATA; 64; Male; 20; -4.35; -3.12; 75.4; 125.3; 26.5

Data Structure of the result file:

PATIENT; <Patient name>; <Patient ID>; <Age of patient>; <Sex of patient>

IMAGE; <Vertebra name>; <Image number>; <Scan number>; <Scan date>; <Scan time>; <TML>; <TMR>; <TMT>; <TSL>; <TSR>; <TST>; <CML>; <CMR>; <CMT>; <CSL>; <CSR>; <CST>

REFDATA; <Age of patient>; <Sex of patient>; <Age of young normal>; <T-Score>;

<Z-Score>; <BMD reference data, age matched>; <BMD reference data, young control>; <Standard deviation reference data>

Abbreviations:

TML	Trabecular Mean Left
TMR	Trabecular Mean Right
TMT	Trabecular Mean Total
TSL	Trabecular Standard Deviation Left
TSR	Trabecular Standard Deviation Right
TST	Trabecular Standard Deviation Total
CML	Cortical Mean Left
CMR	Cortical Mean Right
CMT	Cortical Mean Total
CSL	Cortical Standard Deviation Left
CSR	Cortical Standard Deviation Right
CST	Cortical Standard Deviation Total

Pulmo CT

Example of result file:

START; 20-FEB-1998 12:01:17

PATIENT; John Smith; 007; 64; Male

IMAGE; 234; 21; 27-JAN-1998 11:12:17;-200;1

RESULTS; LEFT; 234; -1024; 3071; -905; 43.4; 22.5; 112; 34.5; 0.1

RESULTS; RIGHT; 234; -1024; 3071; -899; 33.4; 19.5; 85; 30.1; 0.1

RESULTS; TOTAL; 234; -1024; 3071; -903; 38.1; 21.0; 93; 64.6; 0.1

SUBRANGE; LEFT; 234; 1; -1000; -400; 200; 75.0; 15.9; 3.3

SUBRANGE; RIGHT; 234; 1; -1000; -400; 200; 80.9; 15.1; 2.2

SUBRANGE; TOTAL; 234; 1; -1000; -400; 200; 78.0; 15.5; 2.8

SUBRANGE; LEFT; 234; 2; -1024; 1000; 0; 100.0

SUBRANGE; RIGHT; 234; 2; -1024; 1000; 0; 100.0

SUBRANGE; TOTAL; 234; 2; -1024; 1000; 0; 100.0

PERCENTILE; LEFT; 234; 1; 0; 100; 25; -1012; -954; -953; -885; -884; -800; -799; -112

PERCENTILE; RIGHT; 234; 1; 0; 100; 25; -1023; -934; -933; -888; -887; -785; -784; -211

PERCENTILE; TOTAL; 234; 1; 0; 100; 25; -1023; -944; -943; -886; -885; -793; -793; -112

……

Data structure of the result file:

START; <Date and Time of the evaluation start>

PATIENT; <Patient name>; <Patient ID>; <Age of patient>; <Sex of patient>

IMAGE; <Image number>; <Scan number>; <Scan date and time>; <Threshold Contour>; <Number of Shrinkings>

RESULTS; <LEFT / RIGHT / TOTAL>; <Image number>; <Lower eval. limit>; <Upper eval. limit>; <Mean>; <Standard Deviation>; <Area>; <FWHM>; <Accumulated Volume>; <Accumulated Height>

SUBRANGE; <LEFT / RIGHT /TOTAL>; <Image number>; <Subrange Number>; <Lower Limit>; <Upper Limit>; <Increment>; <Percent Area first subrange>; ..... ; <Percent Area last subrange>

PERCENTILE; <LEFT / RIGHT /TOTAL>; <Image number>; <Percentile range number>; <Lower Limit>; <Upper Limit>; <Increment>; <Lower HU value first percentile>; <Upper HU value first percentile>; ..... ; <Lower HU value last percentile>; <Upper HU value last percentile>

AUTOSEGMENT; <LEFT / RIGHT >; <Image number>; <Segmentation number>; <W=Whole / C=Central / P=Peripheral >; <A=Area / H=Heights>; <Number of segments>; <Distance>; <ROI width>; <AP gradient : 0=no / 1=yes>; <Mean value first segment>;.... ; <Mean value last segment>; <Standard deviation first segment>; ....; <Standard deviation last segment>; <Area first segment>; ....; <Area last segment>; <AP-Gradient>

MANSEGMENT; <LEFT / RIGHT >; <Image number>; <Segmentation number, always 1>; <Number of segments>; <Mean value first segment>;....; <Mean value last segment>; <Standard deviation first segment>; ....; <Standard deviation last segment>; <Area first segment>; .... ; <Area last segment>

TOTALRESULTS; <LEFT / RIGHT /TOTAL>; <Upper eval. limit>; <Lower eval. limit>; <Mean>; <Standard Deviation>; <Area>; <FWHM>; <Accumulated Volume>; <Accumulated Height>

TOTALSUBRANGE; <PATIENT / REFERENCE / RATIO>; <Subrange Number>; <Lower Limit>; <Upper Limit>; <Increment>; <Percent Area first subrange (or Ratio for RATIO)>; ..... ; <Percent Area last subrange (or Ratio for RATIO)>

TOTALPERCENTILE; <PATIENT / REFERENCE / DIFFERENCE>; <Percentile range number>; <Lower Limit>; <Upper Limit>; <Increment>; <Lower HU value first percentile (or difference for DIFFERENCE)>; <Upper HU value first percentile (or difference for DIFFERENCE)>; ..... ; <Lower HU value last percentile (or difference for DIFFERENCE)>; <Upper HU value last percentile (or difference for DIFFERENCE)>

REFDATA; <Age of patient>; <Sex of patient>; <Age of young normal>; <T-Score>; <Z-Score>; <Reference data, age matched>; <Reference data, young control>; <Standard deviation reference data>

END; <Date and Time of the evaluation end>

General Considerations

The information presented in this application guide is for illustration only and is not intended to be relied upon by the reader for instruction as to the practice of medicine. Any health care practitioner reading this information is reminded that they must use their own learning, training and expertise in dealing with their individual patients. This material does not substitute for that duty and is not intended by Siemens Medical Solutions Inc., to be used for any purpose in that regard.

The drugs and doses mentioned herein were specified to the best of our knowledge. We assume no responsibility whatsover for the correctness of this information. Variations may prove necessary for individual patients. The treating physician bears the sole responsibility for all of the parameters selected.

The pertaining operating instructions must always be strictly followed when operating the SOMATOM Volume Zoom. The statutory source for the technical data are the corresponding data sheets.

To improve future versions of this application guide, we would highly appreciate your questions, suggestions and comments.

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