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How to scan with CARE Dose4D

For all SOMATOM Scanners equipped with FAST CARE *syngo* CT 2011

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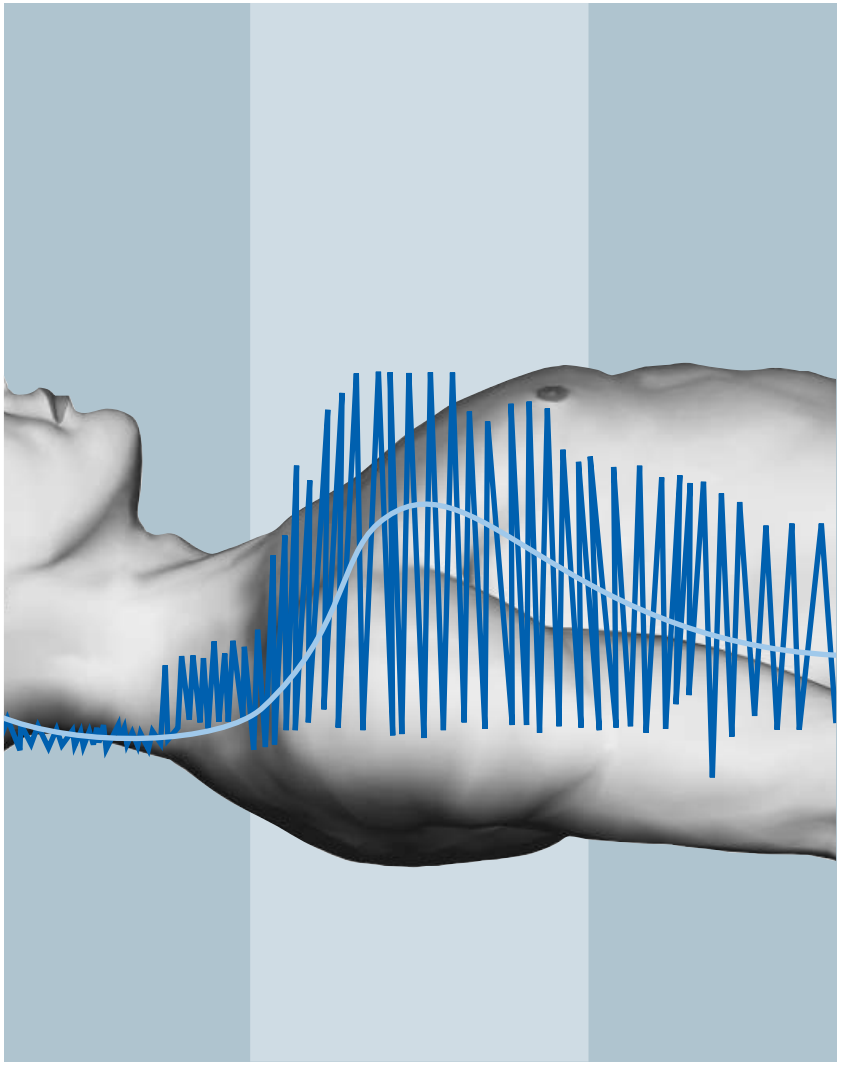


General

CARE Dose4D is an integrated system which automatically computes the X-ray tube current for the individual patient and examination. The CARE Dose4D algorithm is built on three cornerstones: The topogram, your defined reference settings and the individualized configuration of the system.

Adjusting the tube current for Computed Tomography examinations is a well-known method to establish the correct radiation dose suited for the individual patient. With CARE Dose4D Siemens SOMATOM Scanners are equipped with a fully automated, real-time tube current modulation in x-, y- and z-direction.

For the **topogram** position the patient into the iso-center of the scanner, to guarantee a reliable CARE Dose4D evaluation.

Ensure that the topogram is long enough to cover the scan range.

Configure the **"Quality reference mAs"** according to your clinical needs. Define values that you would use for a standard sized adult patient weighing 75 kg. Siemens standard protocols that come along with the system are a good starting point.

Check that the **organ characteristics** of your protocol are suitable for the exam you want to perform.

CARE Dose4D can be customized to a large degree if desired. Configure CARE Dose4D so that it fits your requirements (see page 10).

Tips and tricks

It is not necessary to modify the settings in case of an obese patient. The system not only decreases the tube current but also increases it if necessary.

In Cardio CT examinations the ECG is the main determinant for dose modulation. Therefore no variation along the z-axis is employed in these cases.

Starting with *syngo*® CT 2011 the CARE Dose4D child reference point has changed. It is now also 75 kg, but child protocols still have a separate configuration of the adjustment curves (see page 9).

If, unsure what to use for children, Siemens child standard protocols that come along with the system are a good starting point.

Note: For detailed discussion see “How to scan children with FAST CARE” (*syngo* CT 2011).

The “Quality reference mAs” are also provided in a pitch-independent form as eff. mAs:

$$\text{Effective mAs} = \text{tube current} \times \frac{\text{Rotation time}}{\text{Pitch Factor}}$$

Both parameters can be seen in the Scan Card.

Trouble shooting

When working with CARE Dose4D two types of conflicts are distinct. These conflicts are basically all related to the physical limits of the X-ray tube.

In case of a **CARE Dose4D conflict** (image 1) the tube current can not be provided as high as it would be necessary for the area highlighted in yellow.

The easiest solution is to simply press the Adjust button (image 4). Depending on the configuration the scan time is increased to fulfill the tube current requirements (image 2, solved CARE Dose4D conflict).

Loading the scan without solving the conflict is possible. However a slight decrease in image quality can be expected.

Always consider issues in terms of breath hold and contrast media administration when increasing the scan time.

In case of a **system conflict** (image 3) the limits are exceeded in such a way that scanning is not possible with these settings. This system conflict can be solved by using the Adjust button. Scan time and maximum mAs value are modified automatically. However a decrease in image quality can be expected in this case.

Image 1: CARE Dose4D conflict

Image 2: Solved CARE Dose4D conflict

Image 3: System conflict

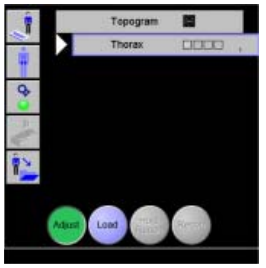


Image 4: The Adjust button can be found in the left lower corner of the Scan Card.

CARE Dose4D – the principle

The central component of the algorithm is the evaluation of the patient's X-ray attenuation derived from the topogram. The final tube current is calculated by comparison with built-in reference values.

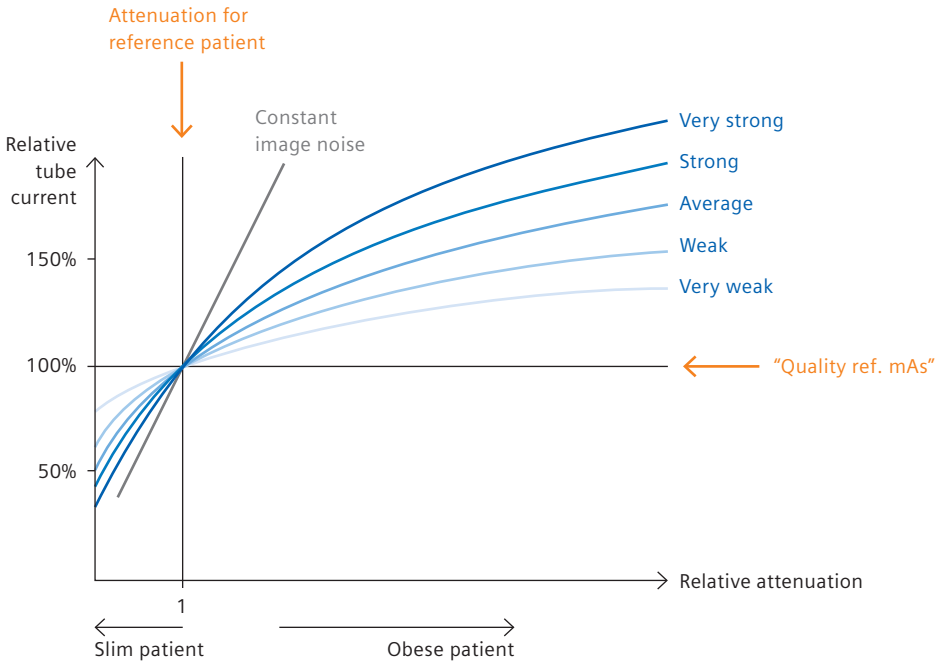
When passing through the patient the X-ray beam looses energy as part of the energy is absorbed. This is described with the so-called patient's attenuation. The attenuation of the individual patient is calculated directly from the topogram.

The user defines the "Quality reference mAs", suitable for an average sized patient weighing 75 kg.

The attenuation measured in the topogram is then compared with a stored reference patient. The relative signal change is computed.

This relative attenuation change can be directly transformed in a relative tube current change (image 5).

CARE Dose4D adjustments follow a user configurable curve to best fit your clinical needs. Five different configurations are available: very weak, weak, average, strong and very strong.



The measured values from the topogram are compared to the built-in reference value yielding a relative attenuation (x-axis). Based on the selected CARE Dose4D curve the relative change of the "Quality reference mAs" is determined (y-axis).

If all images of slim patients are too noisy, you can choose a weaker curve, meaning the decrease in dose is weaker allowing for less image noise. If all images of obese patients are too noisy, choose a stronger curve, meaning that the dose is increased a little further to avoid too high an image noise.

CARE Dose4D – the principle

Constant image noise is not desirable for the tube current adjustment. For obese patients the change is too strong as also the structures of interest get larger. For slim patients it is the other way round as the structures of interest are getting smaller.

Select a curve separately for each organ characteristic and three patient types (adult slim, adult obese, child).

CARE Dose4D configuration: mAs adaptation to patient size

Organ characteristics	Child	Adult slim	Adult obese
Brain	Average	Average	Average
Neck	Very weak	Average	Average
Shoulder	Very weak	Average	Average
Thorax	Very weak	Average	Average
Abdomen	Very weak	Average	Average
Pelvis	Very weak	Average	Average
Spine	Very weak	Average	Average
Osteo	Very weak	Average	Average
Head/Vascular Head	Average	Average	Average
Vascular Body	Very weak	Average	Average
Runoff	Very weak	Average	Average
Cardio	Very weak	Average	Average
Respiratory	Very weak	Average	Average

All configuration settings for CARE Dose4D can be adjusted in the menu Options → Configuration → Examination → Dose Tab Card

CARE Dose4D provides an optimization of the tube current, tailored for each examination and the individual patient.

Glossary

Observe patient reaction carefully, because it is important for your scan.

Have a careful look at the ECG now – it may help you in deciding the next step.

Be careful! Your contrast protocol might be influenced.

By taking these points into consideration you can significantly reduce dose.

Action required by user. Something needs to be changed in the scan protocol.

This is a technical fact with some extra explanation here.

This is a special tip for solving a difficult problem.

Carefully assure an optimized patient positioning.

How to reduce dose?