



Flash Speed. Lowest Dose.

SOMATOM Definition Flash

Answers for life.

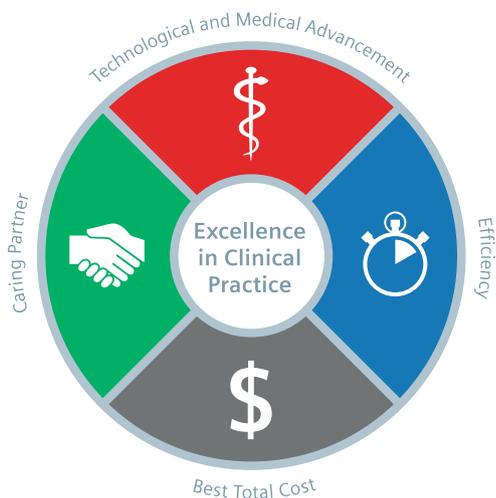
SIEMENS

SOMATOM Definition Flash

SOMATOM Definition Flash



Siemens CT Vision



Today's reality

The justification for the existence of the entire medical industry is, of course, better healthcare for all patients. But the realities of clinical practice often make this simple-to-understand goal quite difficult to realize: stay within budgets, reduce hospital stays, speed up time to diagnosis, and deal with personnel issues, while maintaining high clinical standards and volume/throughput. At the same time, patients demand better and faster results.

Our approach

In order to meet our share of responsibility in addressing these challenges, Siemens, from the earliest stages of research,

product development, and design, relies upon the advice and recommendations of external medical experts to determine our focus – and this focus has been on the needs and demands of our end users. Over the years, this focus has been fine-tuned in four key areas:

- to lead technological and medical advancement
- to maximize workflow efficiency
- to make state-of-the-art CT affordable
- to set the standard in customer care.

Our vision

As a partner of our customers, we create CT innovations, that lift clinical practice to a next level of excellence and enable wide access to better patient care. We

believe that even the farthest technical horizons are temporary and can be surpassed with consistent dedication to improved healthcare. This visionary approach, backed up by the, by far, largest R&D budgets in the healthcare industry, has made Siemens the undisputed innovation leader in CT over the last 35 years. And our ambitious global team continues to set the trend in an always changing environment, providing *Answers for Life*.

Leading patient care

Today, more than 700 institutions worldwide have already taken this opportunity to improve patient healthcare and push their clinical boundaries to a higher level utilizing Dual Source CT.

Patient-centric productivity

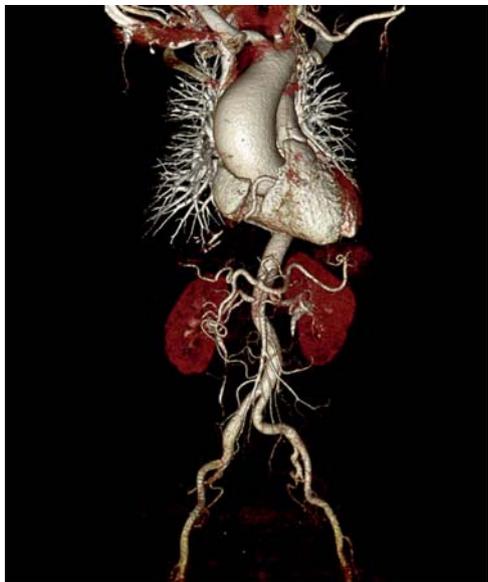
Now, we are again setting the bar higher with FAST CARE technologies. Fully Assisting Scanner Technologies (FAST) make complex procedures faster, more intuitive, and more reproducible than ever. For example, preparing an anatomically correct reconstruction of the whole spine now takes only 30 seconds, compared to 30 minutes when doing it manually. At the same time, our Combined Applications to Reduce Exposure (CARE) are now streamlined to make dose reduction easier for all examinations while providing a transparent dose-saving management. FAST CARE delivers a new dimension in clinical efficiency and patient care. We call it: patient-centric productivity.

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SOMATOM
Definition Flash





Flash speed. Lowest dose.

SOMATOM Definition Flash

Flash speed

The SOMATOM® Definition Flash opens a door to new levels of patient friendliness with the speed to cover the entire thorax in less than a second – if necessary even without a breath hold. A whole-body scan requires only five seconds, while for perfusion or dynamic vascular imaging long-range scans become routine and pediatric scans become sub-second procedures. Your patients will be off the table faster than ever before – with positive feelings about their scan experience. Flash is also the solution for scanning your most difficult patients (i.e. obese and trauma patients, restless

children, patients who cannot hold their breath for long), thus causing no time-consuming interruptions in your daily practice. And now Siemens is once again redefining speed: the new SOMATOM Definition Flash, with the new FAST CARE technology platform, allows you to maximize clinical outcomes – meaning you will have the best possible clinical results, but with significantly less resources bound to the CT system. The ultimate goal is to provide you with more time for patients and diagnosis – in effect, patient-centric productivity. Our Fully Assisting Scanner Technologies (FAST) on the new SOMATOM Definition Flash simplify typically time-consuming and

complex CT procedures: the scanning process becomes more intuitive, more automated, and results become more reproducible. Integrating the capabilities of the recently developed *syngo*®.via* image management platform with its many powerful automated preprocessing steps and intuitive user interface, the complete examination – from scan preparation, scanning, reconstruction, and data assessment – is streamlined, leading to a fast and reliable diagnosis with less patient burden. Ultimately, the combination of highest image quality and highest patient-centric productivity is the lever to maximizing your clinical outcomes.



Lowest dose

Maybe even more important – and impressive – is the incredible reduction in dose for all scans, resulting, e.g. in dose down to sub-mSv for cardiac imaging. Now in its second generation, Dual Energy automatically provides a second contrast for the best possible diagnosis and added diagnostic confidence so that each scan can now become a Dual Energy scan. At the same time, X-CARE protects individual organs and the most radiation-sensitive body regions – for example, female breasts – by accurately and efficiently minimizing exposure while preserving image quality.

With the new SOMATOM Definition Flash with FAST CARE, Siemens introduces several innovative Combined Applications to Reduce Exposure (CARE). CARE kV, for instance, is the industry's first tool that automatically solves the complex equation for optimal image quality at lowest possible dose for each individual CT exam while considering tube voltage, tube current, and contrast changes at different voltages and attenuation. This allows you to benefit from the industry's widest tube voltage range – not only 140 kV for bariatric imaging but now, if necessary, also down to 70 kV for new safety and image quality standards in pediatric imaging.

Add SAFIRE**, the first, raw-data-based iterative reconstruction, and define low dose for all body regions to take best care of your patients' well-being.

**syngo.via* can be used as a stand-alone device or together with a variety of *syngo.via*-based software options, which are medical devices in their own rights.

**The information about this product is being provided for planning purposes. The product is pending 510(k) review, and is not yet commercially available in the U.S.





Split-Second Scanning

How often has your daily practice been interrupted or delayed by fragile, sick, or traumatic patients who either cannot hold their breath or become impatient during regular scan procedures? Finding a solution to these hindrances is what has motivated us to design the world's fastest CT, by utilizing Dual Source for Flash-like scan speeds of up to 458 mm/s.

With Flash Spiral scanning, holding breath and motion lose their significance, making the SOMATOM Definition Flash the optimal patient-friendly CT. We introduce you to the new, cutting-edge of FAST CARE technology that raises the standard of your patient-centric productivity, e.g. through FAST Cardio Wizard, that breaks down the restrictions of previous CT scanning in cardiology. Today, split-second scanning is proving its value in actual practice. Emergency department trauma scans of an entire body in less than five seconds with dose usually under 5 mSv have also been made possible by the Flash's speed. Now, with the help of the FAST Spine feature, making the preparation of complex vertebrae and disc reconstructions a matter of one click and 30 seconds, we take trauma imaging and neurological CT examinations to the next efficiency level for earlier and more accurately targeted treatment.

Introduction

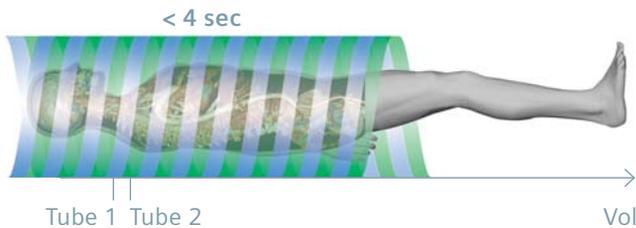
Split-Second Scanning



Sub-second thorax scan for triple-rule-out and a dose below 5 mSv.



Sub-second pediatric scan without the need for sedation or anesthesia.



Whole body imaging in less than 4 seconds without motion artifacts.

Body imaging in adult and pediatric patients

Scanning an entire thorax in only 0.6 seconds for motion-artifact-free studies that revolutionizes triple-rule-out protocols. The scan speed is fast enough to image the thorax without any breath hold and also produces crystal clear imaging of the coronary arteries, thus routinely enabling sub-second triple-rule-out with less than 5 mSv dose.

Bringing this scan speed to imaging children makes sedation a thing of the past. Now Flash Spiral scans are consistently fast enough to produce sharp pediatric images without sedation. This shortens prep time, eliminates repeating scans due to motion, and reduces risk as well as anxiety.

Fastest emergency CT

For several years now, CT has been the ideal modality for trauma cases. However, in the most severe cases the time required to produce useful images often placed the patient at risk. With Flash speed, scan time is no longer an issue. The new SOMATOM

Definition Flash with FAST CARE now offers Siemens' unique FAST (Fully Assisting Scanner Technologies) platform to support you in finding and applying the ideal settings for every individual examination to get to a safe, sound, and sustainable diagnosis.

Cardiac imaging in a quarter of a heartbeat

The system's unique split-second scanning capability allows scanning the heart in only 250 ms, a quarter of a heartbeat. Together with its highest temporal resolution of 75 ms, available in all cardiac scan modes, it freezes any cardiac motion safely, irrespective of the heart rate.

Fastest scanning preparation

The challenge for each CT scan is to find and apply the ideal settings for every individual patient, but at the same time achieve a high degree of reproducibility. Now, with FAST, scan and recon planning can become as fast and easy as just one click.

Automated scan and recon planning

Decisive for the ideal settings for scan, reconstruction, and image evaluation are the organs and body regions. Based on the respective organ, the chosen examination type, and, at the end, also expected images, in-depth knowledge of the appropriate system settings is normally required. Imagine the time the system can save you by automatically planning the subsequent reconstruction fields in a whole body trauma. The SOMATOM Definition Flash with FAST and *syngo.via* now automatically assist you in solving this challenge, making possible even shorter time to diagnosis and more interaction with patients.

All heart rates, all patients

Not only does the selection of the appropriate scan mode for imaging every cardiac patient demand expertise, but also the preparation for image evaluation is anything but trivial. It is important that you feel safe in having done everything in order to achieve the best clinical outcome

possible. FAST Cardio Wizard helps you achieve high-quality clinical outcomes in every situation.

Ready for review in one click

FAST Spine, another prominent feature of the FAST technology, enhances rapid trauma and neuro imaging, saving up to 30 minutes with a single click compared to conventional workflows. Again easing, accelerating, and standardizing the workflow in CT scanning.

syngo.via-based diagnosis

Let us look at only one example of more than 17 functions that *syngo.via*, the outstanding multimodality imaging platform, performs: a triple-rule-out assessment in less than four minutes and automatically (at no click), coronal and sagittal images for your referring physicians located anywhere in your clinical network. The reading physician can immediately start with the evaluation of the case without wasting efforts in case preparation.

- ▶ Flash Spiral scanning – no breath hold required
- ▶ Sharp coronaries at all heart rates – even without beta-blockers
- ▶ Pediatric scans without sedation
- ▶ Whole body trauma scan < 4 sec
- ▶ Both guided and standardized cardiac workflow
- ▶ Accurate spine recons with just a single click
- ▶ Immediate, organ-based scan planning

Flash Spiral

How it works

Even the most advanced single-source CTs are limited in their scan speed by the maximum table feed that can be used and still allow the acquisition of contiguous data. The SOMATOM Definition Flash breaks through this barrier primarily by simultaneously integrating data from a second source during the scan. By combining this Dual Source technology with fastest available hardware components, including a gantry that rotates at 0.28 seconds, a patient table that can handle immense table feeds, and ultra-fast data transmission technology, makes possible the fastest scan mode in CT history. The result is an unprecedented scan speed of up to 458 mm/s, fast enough to scan an entire adult patient in less than four seconds.

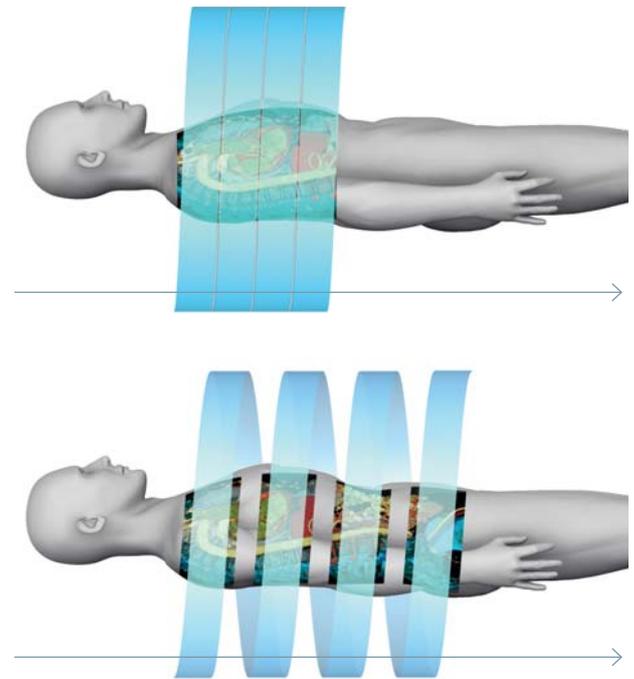
Increased patient friendliness

Patients who cannot hold their breath or suffer from shortness of breath, patients who are restless or impatient, who are uncooperative, obese patients or young children, are no longer a problem. Due to its unprecedented scan speed, the Flash Spiral mode even stops motion entirely, preventing image artifacts that might obscure image quality and affect your sound diagnosis.⁽¹⁾

The SOMATOM Definition Flash guarantees fast and accurate ED imaging by putting you in the position to achieve earlier and more accurately targeted treatment decisions that positively affect the patients 30-day adverse event rate and reduce repeated visits.⁽²⁾

Revolutionizing the triple-rule-out

In case of acute chest pain, scanning with the SOMATOM Definition Flash significantly saves time because it is now possible to assess pulmonary arteries, coronary arteries, and the aorta in a single split-second scan. Scientific validation in large cohorts demonstrate impressive results. Due to the SOMATOM Definition Flash's split-second scanning capabilities physicians obtain "motion-artifact-free and accurate visualization" in these challenging examinations "at a very low radiation exposure."⁽²⁾ Mean scan times are 0.7 seconds while a radiation dose of only 4.1 mSv or less is applied. Researchers find that the Flash Spiral technology "has the potential to revolutionize triple-rule-out protocols."⁽¹⁾



Single-source CT requires slower table feeds to prevent gaps in the acquired volume (bottom).

Source

- 1: Barns E. et al, High-pitch DSCT offers speedy images; www.AuntMinnie.com, Nov 30, 2009.
- 2: Press release, Andrew Stewart, Radiology Manager, St George's Hospital, UK, published online, Jan 1, 2010.

Barrier-free pediatric imaging

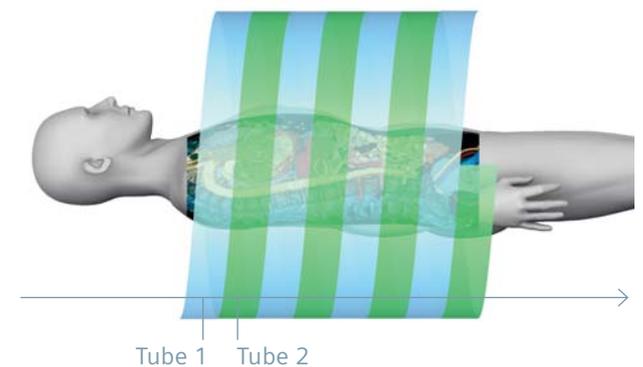
Bringing this scan speed to imaging children, the most delicate patient group, opens new possibilities by eliminating the need for sedation or anesthesia. Researchers state that mean examination times of only 0.49 seconds provide highest image quality making sedation or controlled ventilation unnecessary, while maintaining low radiation dose values.⁽¹⁾

Being independent of this time-consuming and potentially dangerous procedure can save you up to 80 minutes of preparation time and involves less personnel. A positive economic side effect of the SOMATOM Definition Flash for pediatric imaging is that you can do without the expensive services of the anesthetist.

Avoiding repetition of scans

Another and widely underestimated risk factor is eliminated as well by the Flash Spiral technology: the unnecessary repetition of scans in young children due to failed sedation, which unfortunately is the case in 29% of conventional examinations, shown in a large trial.⁽²⁾

Sub-second scanning of up to 458 mm, with a wide 78 cm bore for unrestricted access to your most sensitive patients, makes a true difference in your pediatric scanning, from saving prep time and staff, repeating scans due to motion, to reducing risk as well as anxiety. Yet another proof for the SOMATOM Definition Flash being the healthiest CT available.



Dual Source CT combines the data from two detectors for faster table feeds above a pitch of three for revolutionary triple-rule-out scanning and barrier-free pediatric imaging without sedation.

Source

1: Lell MM. et al, Invest Radiol. Sep 17, 2010. [Epub ahead of print].

2: Malviya S. et al, British Journal of Anesthesia 84 (6): 743–8 (2000).

How it works

FAST Cardio Wizard

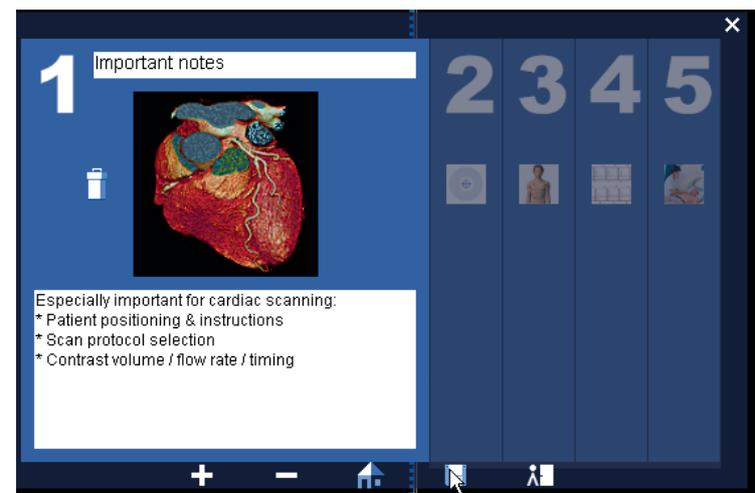
All heart rates, all patients

The SOMATOM Definition Flash is the fastest cardiac scanner in the industry, offering a true single-segment temporal resolution of 75 ms. Its Flash Spiral acquires the entire heart in around 250 ms – within a single heartbeat. It alternatively enables robust diagnostic outcomes, even in the presence of high heart rates and arrhythmia, and has been repeatedly proven by a wide range of clinical studies. This permits imaging the heart without the clinical, workflow, and financial aspects of utilizing beta-blockers when using the Flash cardio sequence. The realities of healthcare today often do not permit the interruptions in workflow, longer patient preparation times, and use of personnel required by the use of beta-blockers. Not to mention the fact that some patients should not receive beta-blockers, such as in certain cases of pulmonary disease. All this makes the Flash Cardio Sequence the industry's most versatile low dose mode for cardiac imaging.

Guidance for high-quality clinical outcomes in every situation

But cardiac CT examinations are also among the most sophisticated and demanding procedures in CT, requiring careful preparation and a high degree of expertise. All the more, it is important that the user feels sure that he has done everything correctly in order to achieve the best clinical outcome possible and to avoid any unnecessary radiation of the patient. Additionally, it allows you to define your individual institutional guided cardiac workflow for standardization to guarantee continuous high-quality clinical outcomes in every situation.

Therefore, the new SOMATOM Definition Flash offers the FAST Cardio Wizard, explaining to the operator on a step-by-step basis what needs to be done to achieve an optimal cardiac scan, either in real-time when preparing a scan or for training purposes.



The modifiable text in the guided workflow allows you to define your standards and quality goals that users have to follow in order to always achieve an optimal cardiac scan.

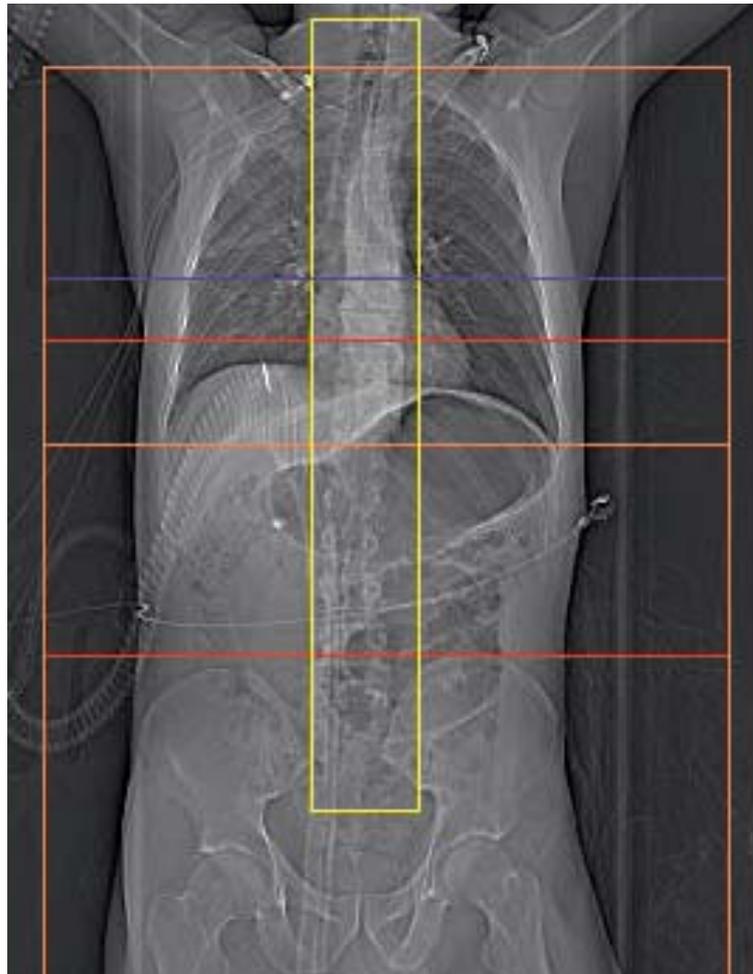
How it works

FAST Planning

Fastest emergency CT through automated planning

In time-critical emergency situations, long scan ranges involving different body regions and organs are common. The planning of the scan and reconstruction field of view is prone to error and eat up precious time to diagnosis.

FAST Planning focuses explicitly on this critical part of the scan process. Based on the topogram, FAST Planning assists the scan and reconstruction planning to provide an easier, faster, and standardized workflow in CT scanning. The selection of the anatomical region of interest (ROI) from a list automatically defines prospectively the scan and reconstruction ranges. The scan ROIs are automatically detected based on the characteristics of the organ that is to be scanned. In addition, the corresponding scan ranges are proposed in the topogram as well. In the case of head scans, the iso-center is automatically adapted according to the position of the patient's head to prevent cutting off important information during the emergency examination.



FAST Planning uses defined anatomical landmarks to set the correct recon ranges within a large scan field of view – as in trauma imaging – for faster results when every second counts.

syngo.via

Additional Benefits with syngo.via

Make lifesaving decisions, when every second counts ...

Acute Care imaging often requires multiple clinical disciplines such as radiologists, cardiologists, neurologists, and trauma surgeons to review images to develop a structured and prioritized treatment plan. *syngo.via*'s unique information sharing makes it easy to involve all required disciplines into the therapeutic decision-making process.

The client/server architecture allows you to access the data independently with up to five users for fast parallel reading. It allows clinicians to review the same images on their individual workplaces to discuss decisions remotely.

The Acute Care Engine helps you in more demanding cases by automatically adding incremental information for your diagnosis and supports you with a powerful set of intelligent tools.



For example, it enables you to conduct a thorough analysis of the major blood vessels of the body with their curved multi-planar reformations (MPR) and appropriate display layouts the moment you open the case. Additionally, it automatically provides you with coronal, sagittal reconstructions of the patient's data that can be displayed in the entire clinical network such as the ICU, the PACS workplace, the OR, or when you discuss the patient's diagnosis in your office.

Dual-monitor layout for instant emergency reading process. This is the first view directly after loading the patient.

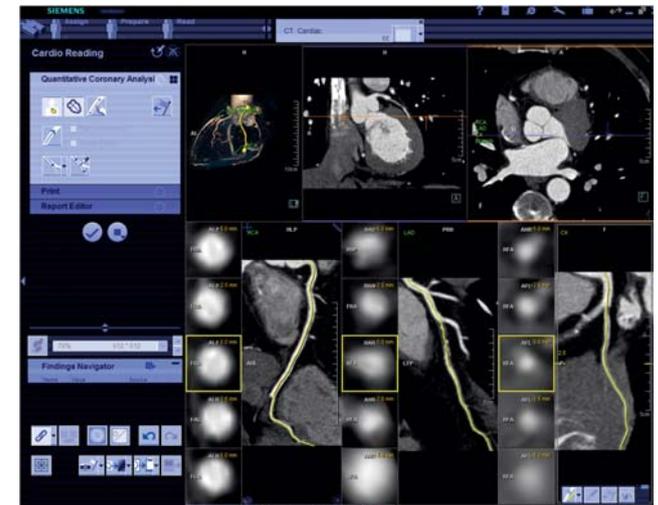
Rule out coronary heart disease in under a minute

The moment you open a cardiac case, the Automated Case Preparation has already preprocessed the images and displays them in your appropriate layout together with the adequate evaluation tools. This means that you can immediately start evaluating the coronary vessels, the functional parameters, and the prepared calcium score.

The comprehensive layout for display of multiple CPRs permits the review of the coronary tree at the blink of an eye. All your findings and key images are collected in the Findings Navigator on-the-fly as you read the case. Your result: rule-out and reporting of coronary artery disease in less than a minute.

The *syngo*.CT Cardiac Function – as part of the CT Cardio-Vascular Engine – allows you to read and diagnose CT angiography images of the left side of the heart for the evaluation of ischemia or cardiomyopathy.

Additionally, the application can evaluate the late or early myocardial enhancement of single energetic CT data which is displayed as a color overlay. The Cardio-Vascular Engine's Pro level provides right ventricular volumetric analysis,* which may have prognostic value for congestive heart failure, chronic pulmonary disease, and pulmonary emboli.

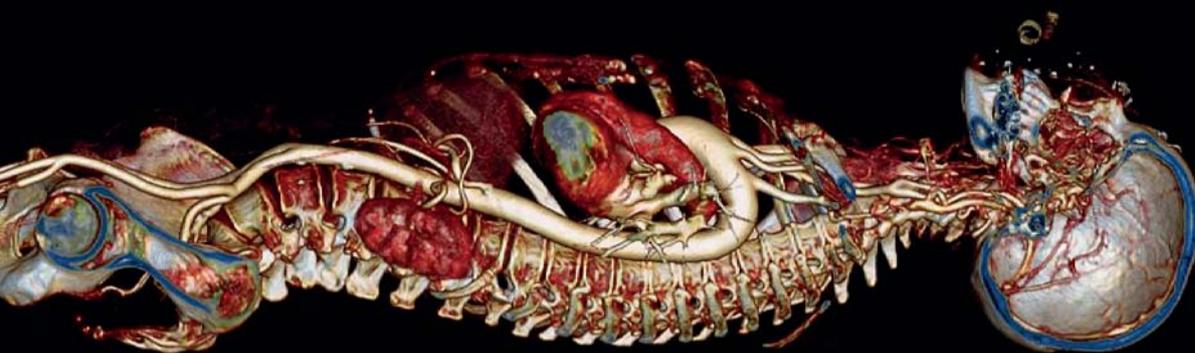


Single-click stenosis aneurysm measurement. Three reference lines are already predefined.

*The CT Acute Care Engine is pending 510(k) review and is not yet commercially available in the U.S.

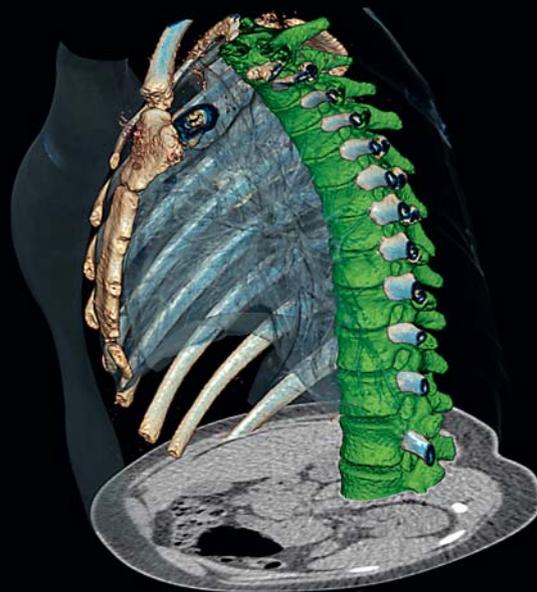
Split-second scanning

Clinical Results



Motion-free emergency room trauma Flash Spiral scans of an entire body in less than four seconds with dose usually under 5 mSv.

Split-second scanning of the human heart with Flash Spiral in only 250 ms for motion-free and sharp coronary arteries due to unmatched 75 ms temporal resolution.



Organ-based setting of scan and recon ranges with FAST Planning for a fast and more standardized workflow at the scanner. FAST Spine allows the preparation of anatomically aligned spine recons with just a single click.

Restless children or patients who cannot hold their breath no longer cause time-consuming interruptions.





Defining Low Dose CT

Applying the lowest radiation dose possible is of the utmost importance for both you and, of course, your patients. Therefore you always want to be assured that you have taken every means available to protect your patient from unnecessary radiation. This desire lies at the heart of our CARE (Combined Applications to Reduce Exposure) research and development philosophy. Consequently, with Siemens' continuing effort to achieve highest dose protection, the new SOMATOM Definition Flash now combines all features to reduce radiation as low as possible: next to its already outstanding dose protection portfolio from the initial product generation, it now adds a wide range of new and improved dose reduction features.

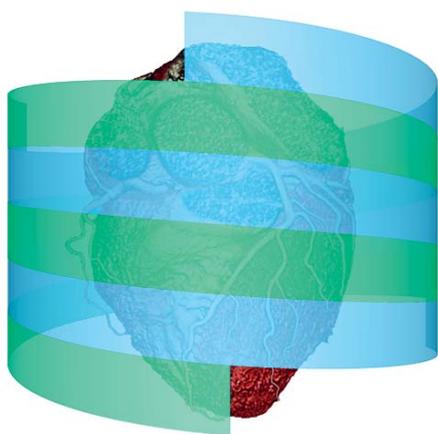
CARE kV, for instance, is the industry's first tool for automatically solving the complex equation for optimal image quality at lowest possible dose for each individual CT exam while considering tube voltage, tube current, and contrast changes at different voltages and attenuation. This allows you to benefit from the industry's widest tube voltage range – not only 140 kV for bariatric imaging but now, if necessary, also down to 70 kV where the Definition Flash sets new standards in pediatric safety.

Add the first, raw-data-based iterative reconstruction SAFIRE* and define low dose for all body regions to take best care of your patients well-being.

*The information about this product is being provided for planning purposes. The product is pending 510(k) review, and is not yet commercially available in the U.S.

Introduction

Defining Low Dose CT



< 1 mSv

Flash Spiral allows for ultra-fast spiral acquisition at 75 ms temporal resolution with scan speed of up to 458 mm/s for maximum dose efficiency in your daily clinical practice.

Sub-mSv heart – the ultimate CARE feature

Discussions regarding dose in cardiac scanning have changed because dose values down to under 1 mSv are so frequent that Sub-mSv heart can be considered routine for Siemens SOMATOM Definition Flash owners. Such low routine values have opened realistic discussions about the use of Flash Spiral for early detection of coronary artery disease.

Optimizing tube current and voltage

As early as 1994, Siemens introduced the first versions of CARE Dose4D to actively modulate the applied power for scans depending on the patient's anatomy. With FAST CARE the configuration options have now been made more flexible and can be perfectly adjusted for every patient so that you can achieve lowest possible dose at optimal image quality in every examination.

CARE kV – solving a complex equation

But CT scanning is not only about adapting mAs values: the right kV settings play an equal, if not more important, role in choosing the right parameter to achieve optimal clinical outcome at lowest possible dose. Siemens' unique CARE kV now addresses this consideration, and supports the user in exploiting the remaining dose-saving capabilities in kV adaptation.

Taking care of children

The Flash Spiral scan has proven to be a robust method for scanning children and infants without sedation while providing high image quality at lowest possible dose.⁽¹⁾

With CARE Child, offering the 70 kV STRATON tube redesign together with a set of dedicated pediatric scan protocols, the new SOMATOM Definition Flash offers a unique solution to provide even healthier scanning for your youngest patients. With CARE kV you now benefit from the industry's widest tube voltage range – down to 70 kV where the new SOMATOM Definition Flash sets new standards in low dose pediatric imaging.

Source
1: Lell MM. et al, Invest Radiol. Sep 17, 2010. [Epub ahead of print].

Preventing unnecessary radiation

SOMATOM Definition Flash eliminates unnecessary pre- and post-spiral over-radiation with its two Adaptive Dose Shields offering dose reductions up to 25%. It also protects dose-sensitive body regions, such as the female breast, eyeballs, the thyroid glands, or the gonads, through X-CARE with possible dose reductions up to 40% while preserving the image quality.

Iterative reconstruction

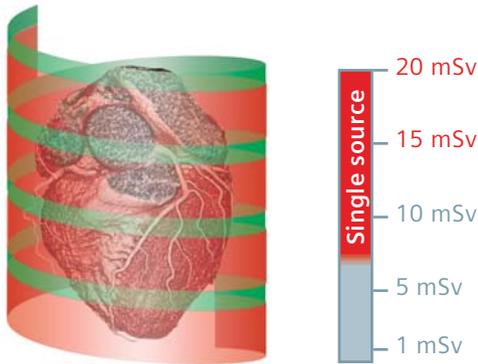
Siemens now introduces SAFIRE*, the first raw-data-based iterative reconstruction, that is a unique approach allowing for up to 60% additional dose savings.

*The information about this product is being provided for planning purposes. The product is pending 510(k) review, and is not yet commercially available in the U.S.

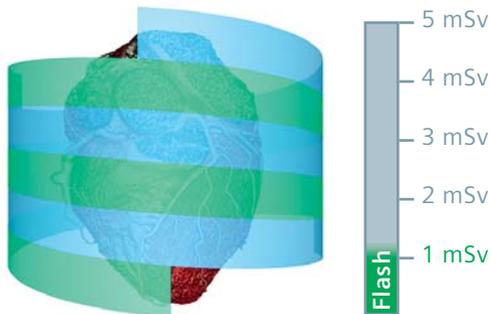
- ▶ Routine Sub-mSv cardiac CT opens the door to early detection
- ▶ Lowest dose in all organs
- ▶ Adaptive Dose Shields eliminate unnecessary dose
- ▶ Protect radiation-sensitive organs
- ▶ Dose reductions in a wide range of protocols with iterative reconstruction

How it works

Sub-mSv Heart



Single-source cardiac spiral scanning requires overlapping data acquisition, resulting in relatively high patient exposure (top).



Flash Spiral with Dual Source CT allows for ultra-fast spiral acquisition for maximum dose efficiency in your daily clinical practice (bottom).

Dose down to below 1 mSv

With the SOMATOM Definition Flash, discussions regarding high dose versus low dose cardiac scanning will change, because, even under unfavorable conditions, the patient exposure with the SOMATOM Definition Flash is less than what is required for diagnostic cardiac cath. Many clinical trials demonstrate that high dose cardiac CT no longer exists with Siemens equipment.^(1, 2, 3) With Flash Spiral, dose values down to under 1 mSv – especially important for the most dose-sensitive patients – are so frequent they can be considered routine.

Such low values can open realistic discussions about the use of CTA for early detection of coronary artery disease, taking advantage of its ability to scan the entire heart in only 250 ms – a quarter of a heartbeat. And, for less favorable conditions, such as high heart rate or arrhythmia, the Flash Cardio Sequence with its automated arrhythmia compensation still allows dose below diagnostic cath. Its unique dual pulsing even calculates the heart's ejection fraction.

Low dose cardiac for all heart rates

When fully flexible X-ray pulsing meets 75 ms of temporal resolution, the result is the Flash Cardio Sequence, the most versatile low dose cardio scan mode on the market.

The intelligently triggered sequence shuts off radiation in the systolic phase when not required and dynamically reacts to irregularities during the ECG trace. The real-time ECG monitoring reacts instantly and stops the scan until the heart rate becomes stable again. This arrhythmia compensation method allows for high dose savings and an increased robustness of the scan.

For the first time, a step-and-shoot mode is robust and fast enough to freeze the heart and visualize the coronary arteries even at high heart rates, thus allowing even low dose cardiac CT without the need for beta-blockers.

Source

- 1: Leschka S. et al, Eur Radiol. 2009 Dec; 19(12): 2896–903.
- 2: Lell M. et al, Eur Radiol. 2009 Nov; 19(11): 2576–83.
- 3: Achenbach S. et al, Eur Heart J. 2010 Feb; 31(3): 340–6.

How it works

CARE kV and CARE Child

Real-time dose modulation

CARE Dose4D aims to regulate the mAs so that image quality is uniform across the whole scan range. CARE Dose Configurator provides the user the ability to select reference curves for each body region and for each body habitus individually. With the new SOMATOM Definition Flash with FAST CARE the configuration options have now been made even more flexible for perfect adjustment for every patient.

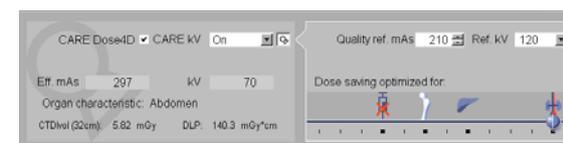
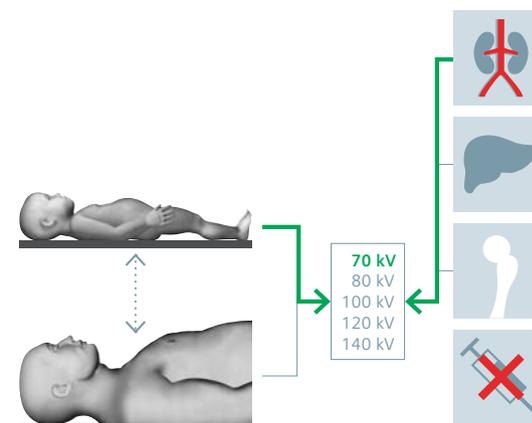
Solving a complex equation

The dose saving and image quality potential of the right kV settings play an equal, if not more important, role to achieve optimal clinical outcomes. But changing kV values always comes along with the need to adapt all other values according to the respective patient and the proposed examination. Unfortunately, up to now this had to be done manually and required a lot of expertise. These dependencies are described in a complex physical equation, so that often the full potential for dose reduction remained untapped with 120 kV being used in almost every adult patient.

CARE kV, an extension of CARE Dose4D, can now automatically suggest kV and effective mAs to optimize the contrast-to-noise-ratio (CNR) of the image while limiting the applied dose. The system's proposal is based on the attenuation as measured in the topogram and the user-defined acquisition type (non-contrast, bone, soft tissue, vascular). The system also identifies bariatric patients and consequently sets the parameters to make full use of the system's reserves. CARE kV is, of course, fully customizable, meaning that the user can choose the degree of system assistance between none, semi, and full.

Taking care of children

With the new improved STRATON tube the voltage range is extended from 80 down to 70 kV where it sets new standards in low dose pediatric imaging with CARE Child. The new 70 kV scan mode further reduces the dose to small pediatric or neonate patients. These dedicated pediatric scan modes take care of the well-being of our youngest patients. Overall, with these features, an additional dose reduction of up to 60% is possible and easy to achieve in clinical practice.



Example: For a vessel examination of a small patient, CARE kV proposes scanning with 70 kV and sets the other values for optimal image quality at lowest dose accordingly.

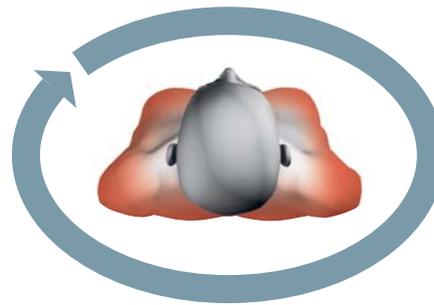
X-CARE How it works

Additional dose reduction of up to 40%

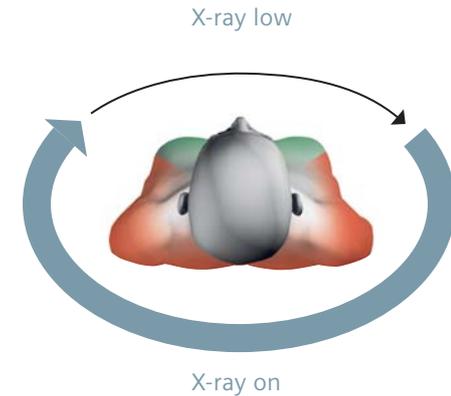
Siemens has recognized the importance of dose-sensitive scanning, especially for female patients, but also when directly radiating the eye lens or the thyroid gland. A simple but effective approach to lower dose for the most dose-sensitive body regions is partial CT scanning, that has been integrated into dedicated protocols of the SOMATOM Definition Flash.

It protects these areas from direct X-ray exposure by nearly switching the X-ray tube off for a certain range of projections, while automatically adjusting tube currents for the remaining projections to prevent deteriorating image quality.

The result with X-CARE is reduced sensitive-area exposure up to 40% without loss of image quality.



Conventional scanning applies radiation permanently during the full rotation, thus resulting in direct exposure of radiation-sensitive organs, for example for the breasts.



X-CARE nearly switches the tube current off within a certain range of projections, minimizing direct exposure for highly dose-sensitive body regions.

How it works

SAFIRE

Iterative Reconstruction

SAFIRE* – Sinogram Affirmed Iterative Reconstruction – for the first time allows to utilize the full dose-saving potential of the iterative reconstruction in clinical practice. Now, raw-data information (which is visualized in the so-called sinogram) is actually being utilized in the image improvement process.

After the initial reconstruction using the weighted filtered back projection (WFBP) the first iterative reconstruction loop is performed. The CT images are retransferred to raw data which models all relevant geometrical properties of the CT scanner. This step reproduces CT raw data like a real scanner does. By comparing this synthetic raw data with the acquired data, differences are identified. A further iteration loop compares the images

with homologous reference data. This procedure can be regarded as validating (or affirming) the current images.

An updated image is then again reconstructed, using the detected deviation information. In each iteration a dynamic raw-data-based noise model is applied that allows for reduction of image noise without noticeable loss of sharpness. This optimization process thus makes even better use of the diagnostic information contained in the raw data. Using multiple iterations, geometrical imperfections of the WFBP are corrected in addition to incrementally reducing image noise.

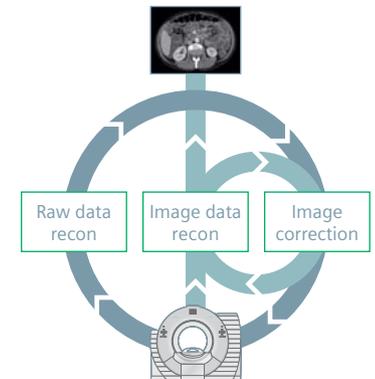
With this, SAFIRE* allows for a radiation dose reduction of up to 60% or improved image quality in regards to contrast, sharpness, and noise.

Standard Filtered Back Projection



- + Ultra-fast reconstruction without iterations
- + Well-established image impression
- Limited dose reduction

SAFIRE*



- + More powerful dose reduction than image-based methods
- + Well-established image impression
- + Superior image quality
- + Fast reconstruction in image and raw-data space and improved workflow with variable settings

*The information about this product is being provided for planning purposes. The product is pending 510(k) review, and is not yet commercially available in the U.S.

syngo.via

Additional benefits with syngo.via

CT Acute Care Engine

Make lifesaving decisions, when every second counts ...

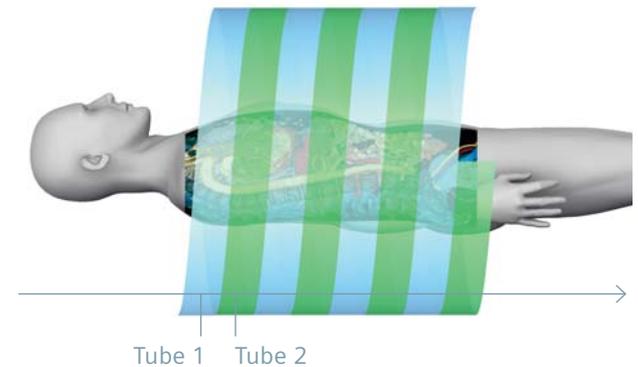
CT is the modality of choice when it comes to diagnostic imaging in acute care situations, whether it is for a triple-rule-out of acute chest pain, for stroke assessment, polytrauma, or for acute abdominal pain. The CT Acute Care Engine provides clinical functionality that delivers decisive results for all of these challenging indications. *syngo.via*'s workflow is another remarkable feature, as the Direct Image Transfer, Study Split for parallel assessment with up to five parallel readers, together with Automated Case Preparation, make the CT Acute Care Engine the zero-delay diagnostic tool. Above all, speed and dependability add confidence for critical decisions made against the clock.

The CT Acute Care Engine* provides comprehensive image-processing functionality for triple-rule-out of acute chest pain caused by coronary heart

disease, aortic dissection, or pulmonary embolism. *syngo*.CT Coronary Analysis, as a part of the CT Acute Care Engine, evaluates the coronary status and quantifies stenoses in less than one minute through Single Click Stenosis measurement. *syngo*.CT's Cardiac Function is also able to evaluate whether the myocardial function has already been affected by an infarction, while *syngo*.CT Vascular Analysis with VesselSURF is the perfect tool to assess the extent of an aortic dissection, or to evaluate a pulmonary embolism.

Flash Spiral scanning of the entire thorax below 4 mSv

The prospectively triggered Flash Spiral scan perfectly meets the need for patients who present with acute chest pain to exclude coronary artery disease, pulmonary embolism, and aortic dissection. The average dose for this high speed examination is 1.6 mSv for patients who can be scanned with 100 kV protocols and 3.2 mSv for patients who can be scanned with 120 kV protocols.

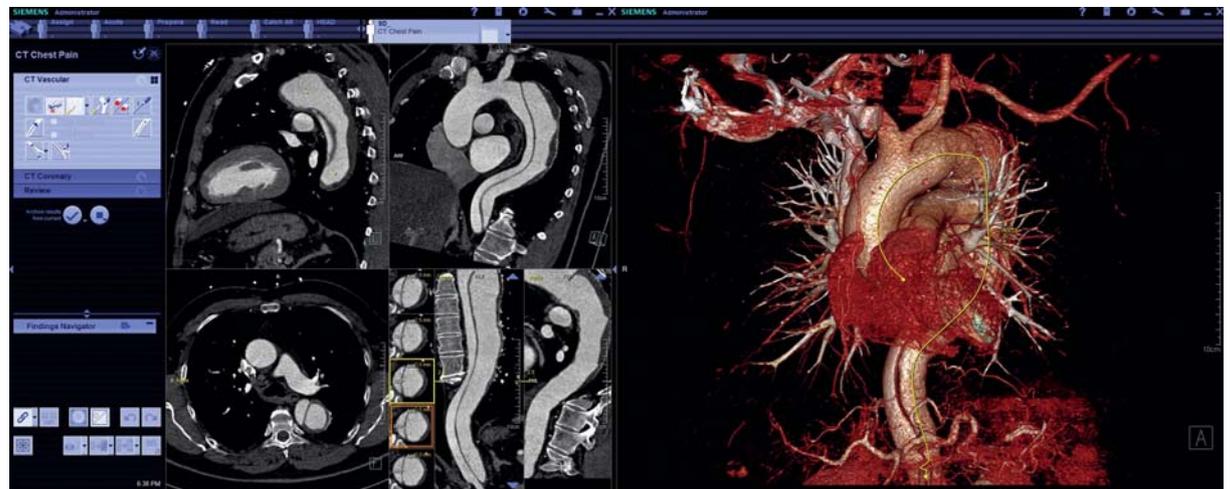


Dual Source CT combines the data from two detectors for faster table feeds above a pitch of three.

*The CT Acute Care Engine is pending 510(k) review and is not yet commercially available in the U.S.

The prospectively triggered high-pitch Flash Spiral scan mode for triple-rule-out allows motion-artifact-free and accurate visualization of the entire thoracic vessels, including the aorta, pulmonary, and coronary arteries at dose levels, before unseen, of below 4 mSv.

syngo.via automatically displays the acquired data in the appropriate layout and has preprocessed it according to the triple-rule-out specific (disease-oriented) workflow for a quick rule-out in less than four minutes.



Triple-rule-out of coronary artery disease, aortic dissection, or pulmonary embolism in less than four minutes.

Defining low dose CT

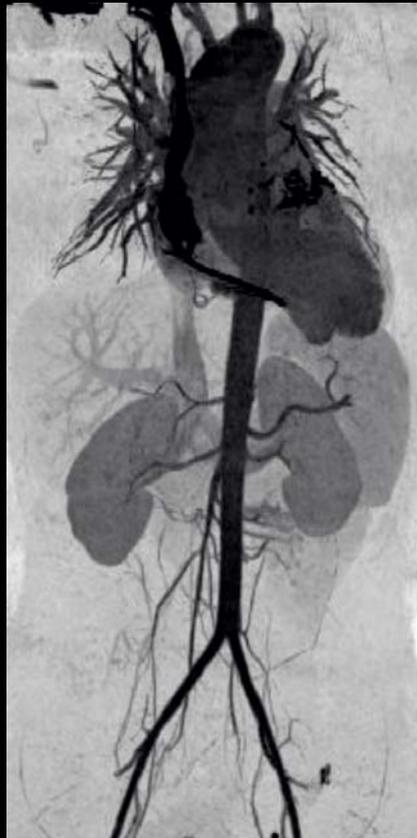
Clinical Results



CARE Child, with the 70 kV STRATON tube, defines new low dose safety and image quality standards in pediatric imaging.



Sub-mSv heart, the ultimate CARE feature. Dose values down to under 1 mSv are so frequent that Sub-mSv heart can be considered routine for SOMATOM Definition Flash users.



Thoracoabdominal aorta examination, including the coronary arteries, with dose below 5 mSv, automatically preprocessed in *syngo.via*, showing aortic insufficiency.

1.9 mSv low dose Flash Spiral scan together with iterative reconstruction of a newborn after perinatal complications.





Dual Source DE for all Patients

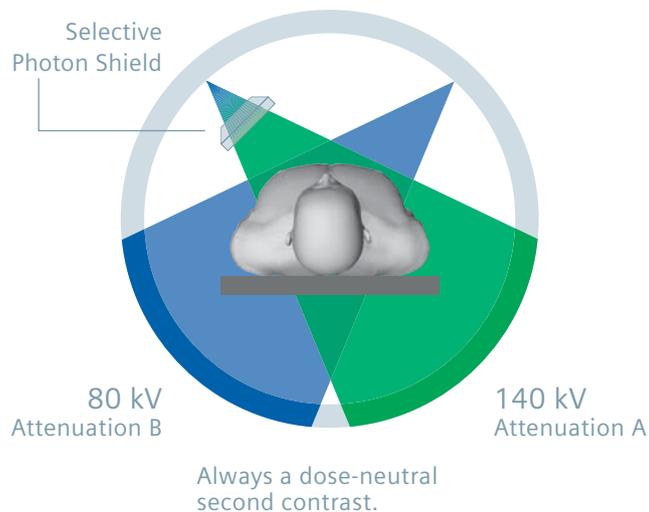
It has always been a CT goal to collect as much information as possible in order to differentiate tissues. With Dual Energy scanning, the SOMATOM Definition and SOMATOM Definition Flash open the door to a new world of characterization, visualizing the chemical composition of material. The idea of Dual Energy is not new to the CT community. Earlier approaches, including two subsequent scans at different tube voltages or two subsequent scans at the same position, failed to seamlessly align the imaged anatomy and to capture the same phase of contrast enhancement.

Dual Energy was first successfully introduced into clinical practice with Dual Source CT, i.e. two X-ray tubes and two UFC (Ultra-Fast Ceramic) detectors mounted at 90 degrees from each other and perfectly synchronized during scans. And, to date, Dual Source remains the only modality that enables the usage of Dual Energy in daily practice at a dose comparable to a conventional 120 kV scan and with optimum spectra separation for highest value DE information.

With 12 FDA-cleared applications and more than 700 Dual Source CTs installed, the number of Dual Energy scans has skyrocketed worldwide and is expected to continue increasing at an even higher rate. Dual Energy with Dual Source CT adds the decisive diagnostic confidence for sustainable and sound treatment decisions – it is the advantage that proves itself over and over in daily practice.

Introduction

Dual Source DE for all Patients



Dual Source Dual Energy setting the standards

Dual Source Dual Energy (DE) CT acquisition provides an expanded set of diagnostic capabilities and alters CT imaging in significant ways. Clinicians in 700 international institutions, working with SOMATOM Definition and Definition Flash, are setting the technological and clinical benchmark in Dual Energy imaging.

Most important and most obvious with the Dual Source approach: detector units can operate at different tube potentials during the synchronous CT acquisition. This avoids spectral contamination or waste of applied dose occurring during kV-switching time intervals. Furthermore, the Dual Source approach allows the introduction of X-ray filters such as the Selective Photon Shield for even further spectral separation.

Dose-neutral every day Dual Energy imaging

An additional benefit is the fact that all renowned dose-saving techniques, such as CARE Dose4D, Adaptive Dose Shield, and X-CARE, can be applied to effectively achieve dose-neutral Dual Energy imaging for everyday usage without a dose penalty compared to a conventional 120 kV scan.^(1, 2, 3) Moreover, with Dual Source Dual Energy you can now get motion-free diagnostic images with a temporal resolution of down to 75 ms in Cardiac Dual Energy imaging.

Source

- 1: Schenzle JC. et al, Radiol. 2010 Jun; 45(6): 347–53.
- 2: Graser A. et al, Invest Radiol. 2010 Jul; 45(7): 399–405.
- 3: Thomas C. et al, Invest Radiol. 2010 Jul; 45(7): 393–8.

Dual Energy for all patients

Dual Source DE brings new levels of contrast, for instance with Optimum Contrast, to all images over a broad range of routine examinations. It offers significant patient benefit improving diagnostic outcomes through improved lesion detection, removal of bone and plaque, improved visualization of metal prostheses, chemical analysis of normal and pathologic tissue, and iodine mapping. It may grant the decisive diagnostic information for a safe, sound, and sustainable diagnosis and treatment planning in any of the patients entrusted to you.

Already clinical routine

More than 130 peer-reviewed publications for our 12 FDA-approved DE applications provide evidence and identify the improvements in clinical outcome as a result of their implementation. 800,000 successful DE examinations have already helped to detect pulmonary embolisms in lung vessels, to directly remove bone and plaque in angiographies, to characterize renal calculi, or to allow for enhanced lesion conspicuity through Optimum Contrast, or simply to speed up workflow through Virtual Non-Contrast Imaging.

- ▶ Always second contrast at no dose penalty
- ▶ Wide range of 12 FDA-cleared applications
- ▶ Optimum Contrast in every image
- ▶ Improved visualization of metal prostheses
- ▶ 75 ms high temporal resolution DE freezing any cardiac motion
- ▶ *syngo.via* automatic virtual non-contrast bone and hard plaque removal
- ▶ *syngo.via* auto-preprocessing for immediate sagittal/coronal display

How it works

Dual Source Dual Energy (DE)

The X-ray tube's kilo voltage (kV) determines the average energy level of the X-ray beam. Changing the kV setting results in an alteration of photon energy and a changed attenuation of the materials scanned. For instance, scanning an object with 80 kV results in a different attenuation than with 140 kV. In addition, this attenuation depends also on the type of tissue scanned. While the CT value for iodine is highest at the low-energy scans, it can be less than half in the high-energy scans. The attenuation of bones, on the other hand, changes much less when exposed to low-energy scans compared to high-energy voltage examinations.

The material-specific difference in attenuation enables an easy classification of the elementary chemical composition of the scanned tissue. In addition, a fused image is provided for initial diagnosis.

*The information about this product is being provided for planning purposes. The product is pending 510(k) review, and is not yet commercially available in the U.S.

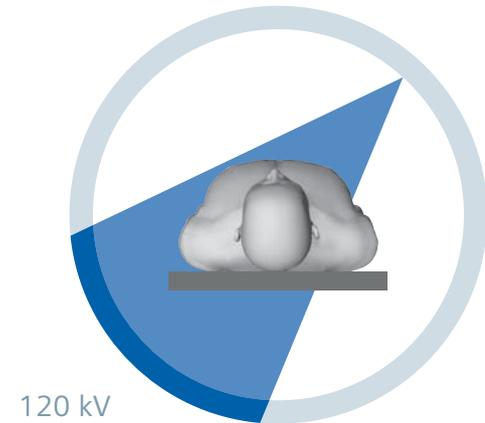
Benefits of Dual Source scanning

Using the two Z-Sharp STRATON tubes, Dual Source data acquisition allows for at least 1,152 projections per rotation and spectrum. This provides homogeneous image quality over the entire FOV. In spiral mode the same slice is acquired within the same time interval for both spectra, so the reconstructed images show no time offset. The fast gantry rotation of 0.28 seconds, with only 0.24 ms sampling time, minimizes motion artifacts, while all renowned dose-saving techniques can be applied, such as CARE Dose4D, Adaptive Dose Shield, and X-CARE. In addition, IRIS and SAFIRE* iterative reconstruction techniques can be applied.

Monoenergetic imaging

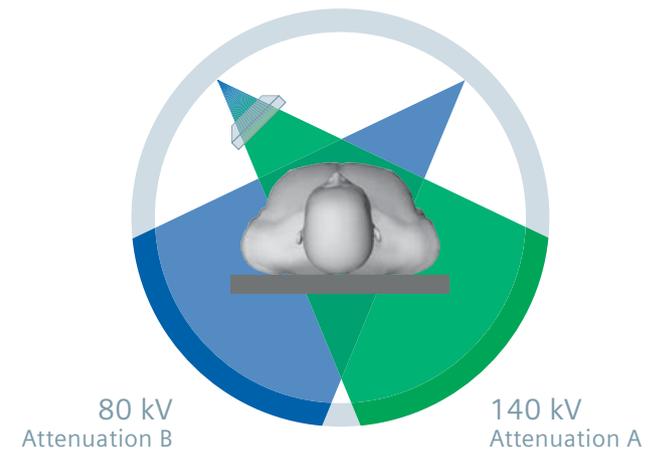
Using the SOMATOM Definition Flash also allows obtaining monoenergetic CT images. These are similar to images acquired with a synchrotron X-ray beam of single photon energy. The equivalent photon energy between 40 keV and 190 keV (151 steps) can be optimized interactively to provide best contrast for the lesion of interest.

Single-Source CT



Single-source CT only provides one energy level for morphology imaging.

Dual Source CT



Two X-ray sources set to different kV levels simultaneously acquire two data sets at different attenuation levels.

How it works

Selective Photon Shield

Eliminating unnecessary radiation

An important factor in making dose neutrality viable is the development of the Selective Photon Shield that blocks unnecessary photons of the X-ray energy spectrum. The result is a much better separation of the 80 kV and 140 kV images, as the second detector is 25% larger than previously.

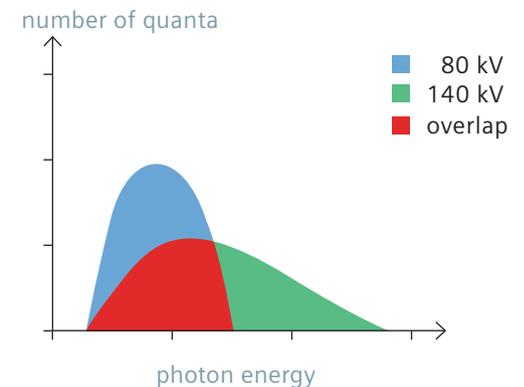
In effect, the Selective Photon Shield assures dose neutrality for single-dose Dual Energy by avoiding unnecessary exposure. Thus it makes Dual Energy as dose-efficient as conventional 120 kV scans. So all the diagnostic advantages of Dual Energy imaging are now available with the same dose as a single energy scan.

Better dose efficiency

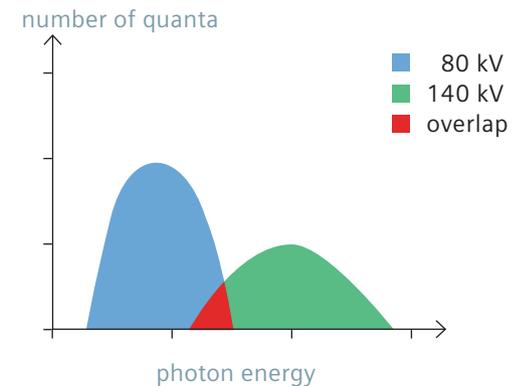
While Dual Source technology has already overcome this limitation, the Selective Photon Shield further increases dose efficiency by filtering out unnecessary photons of the high-energy X-ray tube. The remaining photon spectrum is therefore better focused and more clearly separated from the photons emitted by the low-energy tube. The result is a much better separation of the 80/140 kV images, increasing bone-iodine differentiation by up to 80% while reducing overall dose. Therefore, the high-quality 80/140 kV mode is ideal for the head and extremities, especially CT angiographies.

The spectral separation through the Selective Photon Shield on the other hand, opens the possibility to use 100/140 kV imaging with still 30% better bone-iodine contrast and more power reserves for cardio, abdomen, pelvis, and larger patients in general, making Dual Energy a clinical application for all your patients.

Without Selective Photon Shield



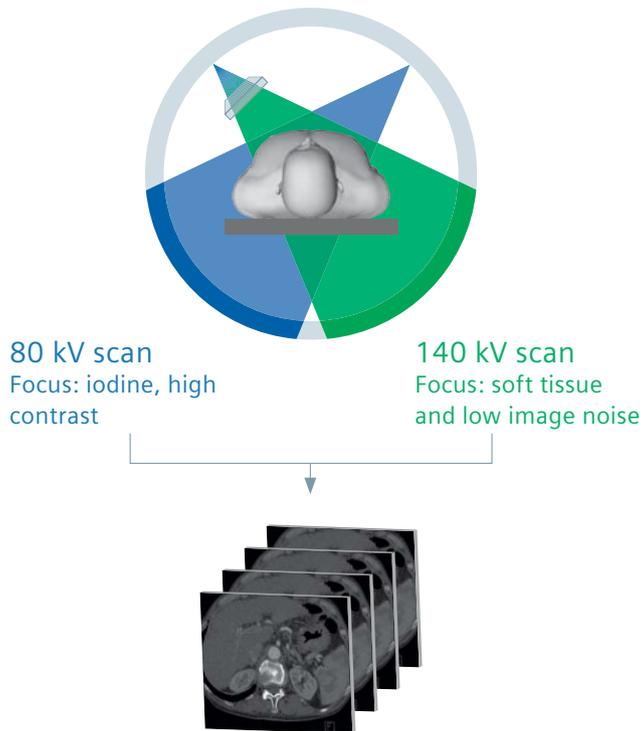
With Selective Photon Shield



The Selective Photon Shield increases energy separation and reduces unnecessary dose by blocking low-energy photons out of the high-energy X-ray tube's spectrum. This results in optimal information quality and dose neutrality compared to a conventional 120 kV scan.

How it works

Optimum Contrast



Best of both worlds to maximize anatomic information: less noise and more contrast than standard CT images.

Maximizing anatomic information

Dual Energy can be used to enhance the iodine signal. It is well-known that the iodine signal is potentiated at low tube energies (80 and 100 kV), yet lower tube energies are not employed in general CT scanning because of increased noise. This is what builds the foundation of Dual Energy Optimum Contrast.

Optimum Contrast

The images obtained at 80 and 140 kV automatically exploit the spectral behavior of certain materials or tissues in *syngo.via*. Additionally, average images can be calculated to provide a "normal" CT image, because the 140 kV images lack contrast, while the 80 kV images are naturally more noisy.

By adding more of the contrast information from the 80 kV images in areas of iodine enhancement, and more of

the detail from the 140 kV images in non-enhanced areas, an optimized image can be automatically calculated. It is especially helpful in enhancing conspicuity of lesions for a safe, sound, and sustainable therapy planning that may improve outcome, cost effectiveness, and patient comfort.

syngo.via enhanced DE imaging

syngo.via dose not only provides you with the result images, for instance of Optimum Contrast, in all standard views such as coronal, sagittal, and axial. It also automatically removes bone and hard plaque in the major vessels for a easier assessment of the true lumen.

With *syngo.via* clients, your results, such as Dual Energy Brain Hemorrhage images, can be instantaneously displayed in the OR* or the angio suite.

*Usage of *syngo.via* for an emergency case requires customer to provide respective emergency measures in case of non-availability of system or network.

How it works

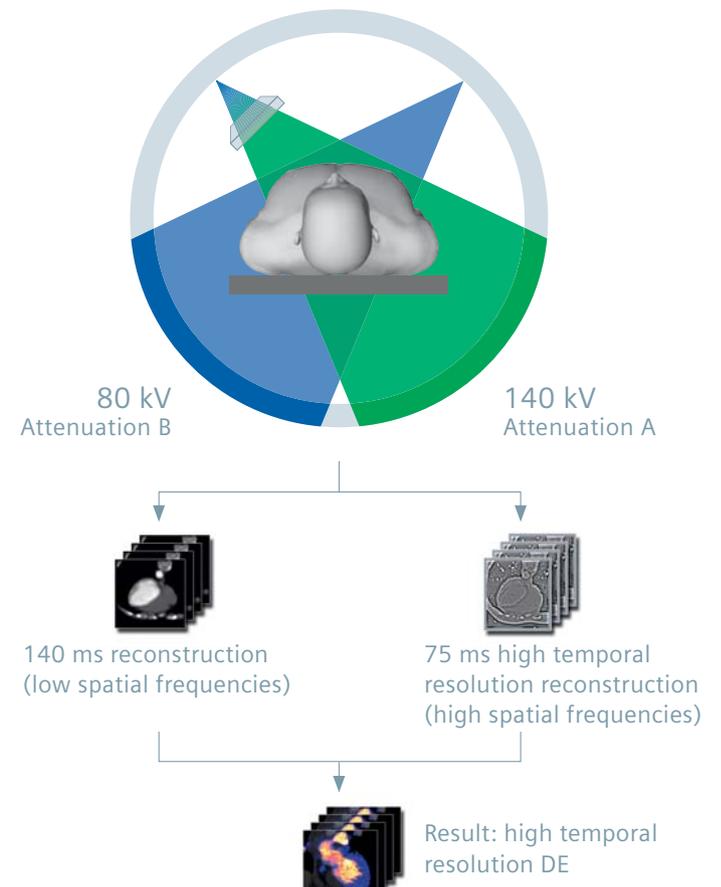
High Temporal Resolution DE

Dual Energy Flash Cardio

Another CT first: the SOMATOM Definition Flash allows scanning the entire heart, and then evaluating the coronaries with a full temporal resolution of 75 ms as well as, in a second reconstruction, visualizing perfusion defects in the myocardium, thus combining the maximum speed of Dual Source CT with Dual Energy imaging in a single scan. This has been made possible with our latest reconstruction technology, that allows achieving Dual Source temporal resolution from image components acquired at different energy levels. The result is the ability to obtain diagnostic Dual Energy CT images without the use of beta-blockers.

Dual Energy Heart Perfused Blood Volume

With its high temporal resolution, Dual Source CT has greatly improved coronary CT angiography, because it is less sensitive to high heart rates or arrhythmia than other types of scanners. With Dual Energy CT, it is now possible to highlight iodine content to visualize organ perfusion. Prospectively triggered sequence or retrospectively gated spiral acquisition modes are available for first pass or late enhancement Dual Energy myocardial perfusion studies. The corresponding *syngo* Dual Energy Heart PBV software color-codes myocardial perfusion, so that both coronary artery morphology and myocardial perfusion can be assessed in a single CT scan.



High 75 ms temporal resolution Dual Energy freezes even cardiac motion and allows color-coded perfused myocardial blood pool evaluation, for example for patients suspected of having an acute myocardial infarction.

syngo.via

Additional Benefits with syngo.via

Speed in routine – power in challenging cases

The new CT Cardio-Vascular Engine offers excellent functionality for the automatic anatomical evaluation, quantification, and functional assessment of CT angiography images of the heart or the peripheral vessels, while allowing manual interaction for challenging cases at any time.

Before you open a case, the Automated Case Preparation has already pre-processed the images, including the Dual Energy direct bone and hard plaque removal and displays them in your appropriate layout together with the adequate evaluation tools.

You can immediately start evaluating the major blood vessels of the body with their curved multi-planar reformations (MPR) and appropriate display layouts. Additionally, it automatically provides you with coronal, sagittal reconstructions of the patient's data that can be displayed in the entire clinical network such as the ICU, the PACS workplace, or when you discuss the patient's diagnosis in your office.



syngo.via showing a severely calcified thoracic aorta in which Dual Energy direct bone and hard plaque removal was automatically applied in the background – before you opened the case. A single click on your patient in your private Worklist opens the case the way it is displayed here.

*Not commercially available in the US.

From scan to diagnosis in under ten minutes

CT Neuro imaging is very often a matter of life-and-death therapeutic decision-making. From infarctions caused by stroke and extensive bleeding, to subarachnoid hemorrhage and a ruptured aneurysm – seeing them clearly is essential because of the huge difference it makes in determining treatment. The new CT Neuro Engine provides tools and workflows that help deliver a complete and accurate

status of the vascular structures and the brain tissue for these patients – from scanning to diagnosis in less than ten minutes including Dual Energy data into the disease-oriented workflow for seamless integration into your clinical practice. Using data delivered by the Adaptive 4D Spiral, perfusion assessment of the brain can easily be integrated in the assessment. The CT Neuro Engine also helps identify fractures after an accident and, for instance, uncovers the potential stenosis when looking at the vascularity of the neck.

If a Dual Energy examination, such as a Dual Energy Brain Hemorrhage calculation was made, the data is automatically displayed together with all your other pre-processed data. So Dual Energy data, seamlessly integrated in *syngo.via*, may give you the decisive diagnostic information for taking sound, safe, and sustainable treatment decisions in any patient.



Clinical Results

Dual Source DE for all patients

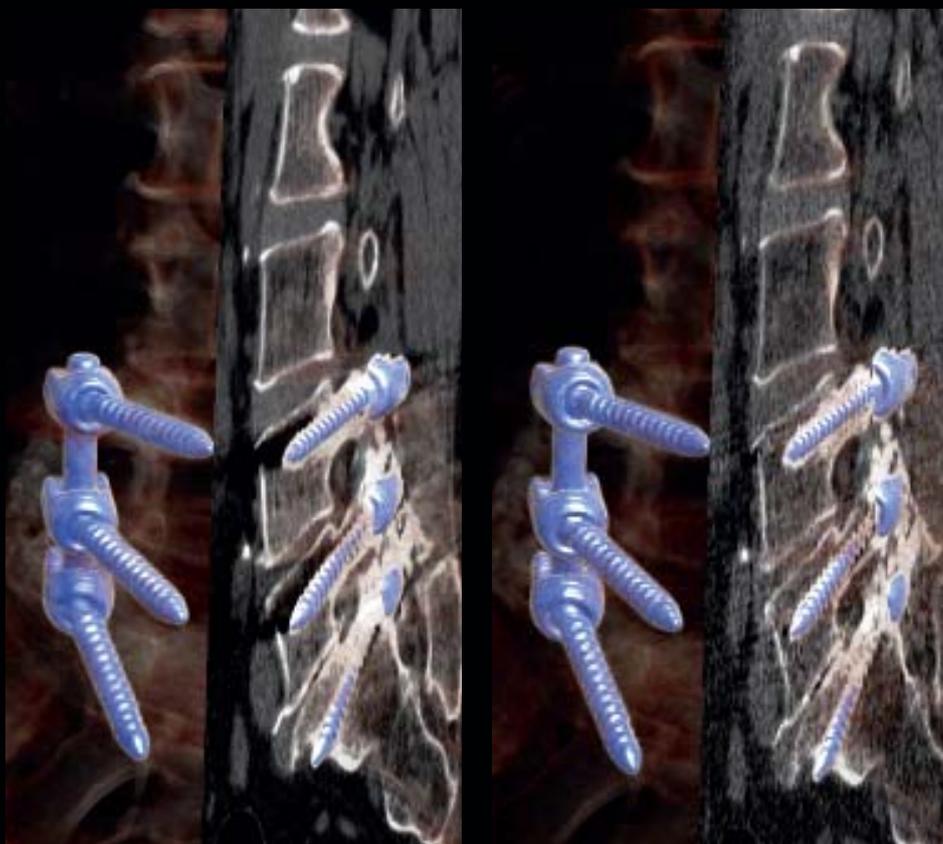


Single dose Dual Energy shows a lung perfusion defect in the right lower segment – unveiling the effect of pulmonary emboli.



Dual Energy direct hard plaque and bone removal for immediate true lumen assessment. Automatically preprocessed in *syngo.via* with coronal, sagittal, and axial reformats for sound treatment decisions.

nts



Monoenergetic imaging, on the right, provides improved visualization of the metal screws relative to the surrounding bone tissue.



Dual Energy Optimum Contrast (right) combines the advantages of low and high kV CT scans for enhanced lesion conspicuity in iodine-enhanced CT images.

Customer Care

Dedicated to Your Success

Remain one step ahead and tap the full potential of your Siemens CT system with our customer care program, Life. As a worldwide innovation leader in medical imaging, Siemens has gained unmatched knowledge in Computed Tomography. You can profit from excellent CT systems and innovative, flexible, and comprehensive service solutions that enable you to concentrate on what is most important for you: patient care. The customer care program, Life, is the unique solution from Siemens that helps you to maximize the return on investment throughout the entire life cycle of your system.

Upgrades and migration: Evolve, Expand, Elevate

Stay competitive with up-to-date systems

Due to increasing healthcare demands you have to stay on the cutting edge to be competitive. We will help you to keep your solutions up-to-date and to keep pace with the latest technological advancements through the *syngo* Evolve program. *syngo* Evolve offers certainty in budget planning, feature enhancements for your CT, access to new applications, and lower cost upgrades for your CT system.

Services and support

Feel confident with our proactive service solutions

High system availability, diagnostic confidence, and optimized workflow are crucial for the success of your CT service. To meet your performance expectations, we systematically focus on being proactive. Based on real-time system monitoring we detect system errors and alert you before problems occur. The Siemens Guardian Program™ helps to make unplanned downtime a thing of the past.

Education and training

Broaden your knowledge and expertise

Know-how is the key to success. With our extensive portfolio of education and training programs you can deepen your knowledge and clinical expertise. We show you how to maximize the benefits that can be achieved with our advanced technology. This will help you to optimize your workflows so you can offer an even higher quality of care for your patients.

Information and communication

Be informed – get connected

To ensure you are always up-to-date on what is happening in the CT world, we offer you a variety of information services including easily accessible information portals, monthly newsletters, our customer magazine SOMATOM Sessions, and the SOMATOM World Summit, our scientific user conference.



SOMATOM Definition Flash

Configuration Overview

SOMATOM Definition Flash with FAST CARE

- All routine and advanced applications for clinical practice
 - Industry's fastest Flash Spiral scanning
 - Full CARE functionality like CARE kV and CARE Child, including the redesigned 70 kV STRATON tube
 - High-performance image reconstruction system with WorkStream 4D
 - Industry's highest – heart rate independent – temporal resolution of 75 ms for all heart rates in cardiovascular imaging
 - State-of-the-art cardiovascular imaging
 - Industry's widest range of kV steps and strongest generator power
 - High-speed whole-body coverage at highest spatial resolution
 - Pediatric and bariatric CT imaging with no patient exclusion
 - Two Adaptive Dose Shields blocking clinically irrelevant dose in spiral scans
- Access to:**
- SAFIRE* – the first raw-data-based iterative reconstruction
 - Full FAST functionality like FAST Planning and FAST Spine to raise patient-centric productivity
 - 3D-guided interventional CT
 - Ultra-long-range dynamic imaging (up to 48 cm) for whole organ coverage
 - Scanner-injector coupling including injector protocol management
 - Latest *syngo.via* Engines with automated preprocessing tools for rapid, sound and sustainable diagnosis
 - Dose-neutral Dual Energy imaging at high temporal resolution with 12 FDA-cleared applications
 - Dynamic myocardial stress perfusion imaging

*The information about this product is being provided for planning purposes. The product is pending 510(k) review, and is not yet commercially available in the U.S.

For more details on FAST CARE benefits for your patients, please visit www.siemens.com/fastcare



| | |
|----------------------|--------------------------------|
| Rotation time | 0.28 s* |
| Number of slices | 2 x 128 |
| Generator | 200 kW (2 x 100 kW) |
| kV steps | 70, 80, 100, 120, 140 kV |
| Isotropic resolution | 0.33 mm |
| Temporal resolution | 75 ms*, heart-rate independent |
| Max. scan speed | 458 mm/s* with Flash Spiral |
| Table load | up to 300 kg/660 lbs* |
| Gantry opening | 78 cm |

*optional

SOMATOM Definition Flash

SOMATOM Definition Flash



In the event that upgrades require FDA approval, Siemens cannot predict whether or when the FDA will issue its approval. Therefore, if regulatory clearance is obtained and is applicable to this package, it will be made available according to the terms of this offer.

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The information in this document contains general technical descriptions of specifications and options as well as standard and optional features which do not always have to be present in individual cases.

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