Flash Speed. Lowest Dose.

SOMATOM Definition Flash

Answers for life.
Better healthcare for all patients is a key priority for the entire medical industry. But the realities of clinical practice often make this simple-to-understand goal quite difficult to realize: staying within budgets, reducing hospital stays, speeding up time to diagnosis, and dealing with personnel issues, while maintaining high clinical standards and throughput. At the same time, patients demand better and faster results.

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.

As a partner to our customers, we create CT innovations that lift clinical practice to the 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 900 institutions worldwide have already taken this opportunity to improve patient healthcare and push their clinical boundaries to a higher level utilizing Dual Source CT.

Pushing the boundaries again

In 2008, Siemens introduced the gold standard in CT technology, still unrivaled today: the SOMATOM® Definition Flash. And now, again, Siemens sets the standards in CT with the revolutionary Stellar Detector with TrueSignal Technology. Developed with the clear goal of providing the latest state-of-the-art CT technology. The new Detectors offer uncompromised diagnostic outcome with highest image quality, acquired at impressively low patient radiation. With the SOMATOM Definition Flash in combination with the Stellar Detectors, Siemens again pushes the boundaries of patient care.
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 even without sedation.

The revolutionary new Stellar Detector – the first fully integrated detector that virtually eliminates electronic noise – taking CT imaging where it has never gone before. By generating ultra-thin slices it delivers the highest spatial resolution and an outstanding level of sharpness in CT that visualizes even finest image details.

Our FAST CARE platform, enriched by the FAST Dual Energy 3D workstream, allows you to maximize clinical outcomes – meaning you will have the best possible clinical results, but with significantly less resources. The ultimate goal is to provide you with more time for patients and diagnosis – in effect, patient-centric productivity.

The Fully Assisting Scanner Technologies (FAST) simplify typically time-consuming procedures so that the scan process is more automated, and results become more reproducible. Integrating the capabilities of syngo®.via leads 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 significant reduction in dose which allows e.g. for sub-mSv scanning in daily cardiac imaging. Furthermore, the second generation of dual source systems enables the user to...
routinely acquire Dual Energy information at highest image quality without a dose penalty for your patient. Even more relevant, Virtual Noncontrast Dual Energy CT even proves to substantially save radiation dose. At the same time, X-CARE protects individual organs and the most radiation-sensitive body regions – for example, female breasts and the eyes – by accurately and efficiently minimizing exposure while preserving image quality. Finally the revolutionary Stellar Detector, with its minimized noise level, is designed for ultra-low signal imaging, e.g. in obese and pediatric patients. HiDynamics provides an extended dynamic bandwidth for an increased detail level especially in low-kV and Dual Energy imaging. So the Stellar Detector eliminates the contradiction of outstanding image quality with minimal dose.

With FAST CARE, Siemens introduces several innovative and new Combined Applications to Reduce Exposure (CARE). For instance CARE kV 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, and define low dose for all body regions to take best care of your patients’ well-being.
The overall goal in Computed Tomography is to achieve high-quality images, with a high spatial resolution, but at lowest possible dose. When pushing spatial resolution further with conventional detector technologies the resulting increase in noise is clinically unacceptable. Decreasing noise again would mean increasing dose which contradicts the overall goal. Therefore, further improvement of spatial resolution was limited – until now.

**The Stellar Detector**

The Stellar Detector introduces the next generation in detector technology, Siemens’ revolutionary TrueSignal Technology, the successor to gas and solid-state technology. Siemens has, for the first time, been able to miniaturize the electronic components on the detector, permitting their full integration directly with the photodiode. TrueSignal Technology drastically reduces the electronic noise and therefore increases the signal-to-noise ratio.

**Edge Technology**

By further applying Edge Technology the spatial resolution can now be increased to an unprecedented 0.30 mm, which makes it finally suitable for clinical practice as the signal-to-noise ratio is adequate without an additional increase in dose. Thus, the Stellar Detectors enable the visualization of very fine image details which are crucial, for example, for highly accurate calcified plaque and stent analysis.
Clinical Examples

High resolution imaging, without blurring, at a temporal resolution of 75 msec, for sound calcified lesion evaluation and exclusion of in-stent restenosis.

Excellent gray-white matter differentiation, especially at the basal ganglia and the cortex cerebri, for increased diagnostic certainty while X-CARE protects the eyes.
HiDynamics, Stellar Detector’s extended dynamic range, provides higher image detail level, especially for low-signal and low-energy scans, e.g., as with the 80 kV Dual Energy series.

Stellar Detector Technology also significantly increases detail level and sharpness in low dose/low signal imaging, such as in obese or pediatric patients.
Split-Second Scanning

How often has your daily practice been interrupted or delayed by fragile, sick, traumatic or pediatric patients who either cannot hold their breath, can not hold still or simply require sedation? 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/sec. With Flash Spiral scanning, holding breath and motion lose their significance, making the SOMATOM Definition Flash the optimal patient friendly CT.

Utilizing the uniqueness of the new Stellar Detector – to generate ultra-thin slices, thus delivering the highest spatial resolution in CT – you can visualize even the finest details, for example, for the most accurate calcified plaque and stent analysis.

Additionally the FAST CARE cutting-edge technology 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 daily clinical practice. Chest CT without breath hold, pediatric exams without sedation and trauma scans of an entire body in less than five seconds have been made possible by the Flash’s speed. With the help of the FAST Spine feature, making the preparation of complex vertebrae and disc reconstructions a matter of one click, we take trauma imaging and neurological CT examinations to the next efficiency level for earlier and more accurately targeted treatment.
Introduction

Split-Second Scanning

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 msec, a quarter of a heartbeat. Together with its highest temporal resolution of 75 msec, available in all cardiac scan modes, it freezes any cardiac motion safely, irrespective of the heart rate.

Edge Technology

Due to the full electronic integration of the Stellar Detector Elements, cross-talk between neighbouring detector rows is minimized. This significantly reduces slice blurring, resulting in a more precise slice profile. This enables the generation of 0.5 mm slices delivering a spatial resolution of 0.30 mm.
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.

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.

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**Automated scan and recon planning**

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**Your Benefits**

- 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
- 0.30 mm resolution for accurate calcified plaque and in-stent restenosis analysis
- Accurate spine recons with just a single click

**All heart rates, all patients**

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**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.

**Your Benefits**

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- Accurate spine recons with just a single click
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/sec, fast enough to scan an entire adult patient in less than four 4 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.”\(^1\)

Source
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 90 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 Stellar Detectors for faster table feeds above a pitch of three for revolutionary triple-rule-out scanning and barrier-free pediatric imaging without sedation.

Source
How it works

General principle in CT

Thinner slices deliver more image detail, but also less light quants per voxel, i.e., higher image noise. This lowers the signal-to-noise ratio (SNR) and leads to slice blurring. Conventional CT compensates by increasing dose. Clinical experience following the ALARA (As Low As Reasonably Achievable) principle has shown that a 0.6 mm collimator width is the optimum combination of slice thickness and dose. So further reduction of slice thickness was limited. Until now.

The Stellar Detector

The Stellar Detector introduces the next generation in detector technology, succeeding gas and solid-state technology. Siemens has made it possible to miniaturize the electronic components on the detector elements, enabling their integration directly at the photodiode. So, for the first time, the electronics of the detector elements are fully integrated in the photodiode. This full electronic integration is Siemens’ revolutionary TrueSignal Technology.

Edge Technology

Electronic noise and cross-talk are minimized thanks to full electronic integration with the photodiode. Without cross-talk, intrinsic slice blurring between neighboring detector rows can be avoided and individual slice profiles are much more precise. Siemens’ Edge Technology creates a precise model of the focal spot and detector, generating a slice thickness of 0.5 mm. Thanks to minimized electronic noise, the 0.5 mm slice has a sufficient signal contribution to be used in clinical routine. Thanks to the unmatched temporal resolution of 75 msec, together with the Edge Technology, you can robustly visualize even the finest details, for example, for the most accurate calcified plaque and in-stent restenosis analysis.

Scan to learn more about the new Stellar Detector

Minimized cross-talk from Stellar Detectors create an almost perfect model of the focal spot. The result is a slice thickness of 0.5 mm.

Conventional Technology

Cross-talk resulting from slice blurring in conventional detectors.
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 msec. Its Flash Spiral acquires the entire heart in around 250 msec – 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.
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 multiplanar 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.

Additional benefits with syngo.via

Make lifesaving decisions, when every second counts ...

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.
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 msec for motion-free and sharp coronary arteries due to unmatched 75 msec 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 while achieving high-quality images, with a high spatial resolution, is of great importance in CT. 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 considering tube voltage, tube current, and contrast changes at different voltages and attenuation in each examination. 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.

Finally the minimized noise level of the Stellar Detector together with SAFIRE – our raw-data-based iterative reconstruction - is perfect for ultra low-dose imaging, eliminating the contradiction of outstanding image quality with minimal dose. So you can get more diagnostic quality with less patient radiation.
Defining Low Dose CT

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. Siemens’ unique CARE kV now addresses this consideration, and supports the user in exploiting the remaining dose-saving capabilities in kV adaptation.

Stellar Detectors’ True Signal Technology

The full electronic integration of the Stellar Detector Elements, where no more electronic components are mounted on the elements, minimizes electronic noise so that the signal-to-noise ratio is significantly increased. It allows a much better utilization especially of low signals at the detector. Applying Edge Technology the spatial resolution can now be increased to an unprecedented 0.30 mm, which makes it finally suitable for clinical practice as the signal-to-noise ratio is adequate without an additional increase in dose.

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

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.

Your Benefits

- Routine Sub-mSv cardiac CT opens the door to early detection
- Lowest dose in all organs
- 0.30 mm spatial resolution at no additional dose
- Adaptive Dose Shields eliminate unnecessary dose
- Protect radiation-sensitive organs
- Dose reductions in a wide range of protocols with iterative reconstruction

Source
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. 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 msec – 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.

When fully flexible X-ray pulsing meets 75 msec 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.

Dose down to below 1 mSv

How it works

Sub-mSv Heart

Low dose cardiac for all heart rates

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

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Source
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.
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.
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
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 Stellar Detectors for faster table feeds above a pitch of three.
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.
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.
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. Approaches, including two subsequent scans at different tube voltages or two subsequent scans at the same position, fail to seamlessly align the imaged anatomy and to capture the same phase of contrast enhancement.

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. Utilizing Stellar Detector’s unique extended dynamic range – HiDynamics – you receive higher image detail level, especially for low-signal and low-energy scans, e.g., as with the 80 kV Dual Energy series.

Together with 12 FDA-cleared applications, Optimum Contrast and Monoenergetic imaging, which is used by more than 900 Dual Source CTs installed, 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.

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 900 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: the two Stellar 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. Moreover, with Dual Source Dual Energy you can now get motion-free diagnostic images with a temporal resolution of down to 75 msec in Cardiac Dual Energy imaging.

Source
Dual Energy for all patients

Dual Source DE 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.

Stellar Detector with HiDynamics

Due to the full electronic integration of the Stellar Detector Elements, the dynamic bandwidth is significantly extended. This increases the image detail level especially for low-contrast objects close to high contrast objects. This is of significant relevance in low-kV scans, e.g. in the 80 kV dataset of Dual Energy scans.

Already clinical routine

More than 130 peer-reviewed publications for our 12 FDA-approved DE applications, together with Optimum contrast and Monoenergetic imaging, provide evidence and identify the improvements in clinical outcome as a result of their implementation. 900,000 successful DE examinations have already helped to detect pulmonary embolisms in lung vessels, to improve metal-implant visualization, 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.

Your Benefits

- Always second contrast at no dose penalty
- Wide range of 12 FDA-cleared applications
- HiDynamics for low-kV images rich in detail
- Optimum Contrast in every image
- Improved visualization of metal prostheses
- 75 msec high temporal resolution DE freezing any cardiac motion
- syngo via automatic virtual non-contrast bone and hard plaque removal
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.

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 msec sampling time, minimizes motion artifacts, while all renown 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.
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 Stellar 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.

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Optimum Contrast

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.

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

High Temporal Resolution DE

How it works

High Temporal Resolution DE

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.

Result: high temporal resolution DE

High 75 msec 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.
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.

Speed in routine – power in challenging cases

syno.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.
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

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.
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.
With Siemens, systems and services go hand in hand. High system availability, diagnostic confidence and optimized workflow are crucial for the success of your CT.

To meet your performance expectations, we systematically focus on being pro-active. That’s why we developed our pro-active service solutions that help you increase system availability, reliability, and workflow efficiency. We also support you with different types of training and provide support for existing applications and functionalities, even remotely.

As a pro-active service provider, Siemens UPTIME Services focuses on real-time remote monitoring and preventive maintenance of medical hard- and software. That’s how we solve problems before they even occur, thus enabling increased system availability, optimized performance and workflow efficiency.

- Offering our innovative service portfolio we will keep you on track:
  - Siemens Performance Plans
  - Siemens Guardian Program™
  - Siemens Virus Protection
  - Siemens Utilization Management

Service and maintenance are highly important to prevent unscheduled downtimes and thus to improve your workflow. Siemens Performance Plans are designed to help you run your operations smoothly – with predictable costs, lower risks and higher efficiency. Modules can be combined together with your Performance Plan Pro, Plus or Top and an individual solution with substantial benefits for you can be achieved. E.g. our Siemens Virus Protection offers top-level defense in safeguarding your CT against viruses, providing exclusive and reliable support in getting your system back online again fast.
Know-how is your key to success. With our extensive portfolio of education and training programs, you can deepen your knowledge and clinical expertise.

Depending on the training type you select, you can benefit most from the wide range of choices in our portfolio:

- Individual on-site training
- Classroom training
- Web based training
- Fellowships
- Remote assistance

We offer routine application training and beyond to answer your clinical questions. For example, stroke imaging with latest applications and much more. We show you how to maximize the benefits that can be achieved with our advanced technology helping you to optimize your workflows so you can offer an even higher quality of care for your patients and faster and more efficient throughput for your clinic.
SOMATOM Definition Flash

Configuration Overview

SOMATOM Definition Flash with FAST CARE and Stellar Detector

- All routine and advanced applications for clinical practice
- Industry’s fastest Flash Spiral scanning
- Dual Energy CT without dose penalty from the vendor who introduced Dual Energy imaging in CT
- Full CARE functionality like CARE kV and CARE Child, including the redesigned 70 kV STRATON tube
- High-performance image reconstruction system with WorkStream4D, even for Dual Energy data
- Industry’s highest – heart rate independent – temporal resolution* of 75 msec for all heart rates in cardiovascular imaging – even without the need for beta blockers
- 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
- Chest and pediatric CT without breath hold*
- Two Adaptive Dose Shields blocking clinically irrelevant dose in spiral scans
- Two detector scatter collimators enhance low-contrast imaging, e.g. in neuro and abdominal imaging

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
- Dynamic myocardial stress perfusion imaging

For more details on FAST CARE benefits for your patients, please visit www.siemens.com/fastcare
<table>
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<tr>
<th>Feature</th>
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<tr>
<td>Number of slices</td>
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*Optional
On account of certain regional limitations of sales rights and service availability, we cannot guarantee that all products included in this brochure are available through the Siemens sales organization worldwide. Availability and packaging may vary by country and is subject to change without prior notice. Some/All of the features and products described herein may not be available in the United States.

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.

Siemens reserves the right to modify the design, packaging, specifications, and options described herein without prior notice. Please contact your local Siemens sales representative for the most current information.

Note: Any technical data contained in this document may vary within defined tolerances. Original images always lose a certain amount of detail when reproduced.

SOMATOM Definition Flash with the Stellar Detector is under development, and is not commercially available in the US.

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.

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

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

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