

**SIEMENS**



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# Flash Speed. Lowest Dose.

## SOMATOM Definition Flash

International version. Not for distribution in the US.

**Answers for life.**









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## Flash Speed. Lowest Dose.

For many years, Dual Source CT has established itself as the key for excellence in computed tomography. With the introduction of the SOMATOM Definition Flash and its renowned Flash Spiral, Siemens has established the gold standard for CT – well-known and highly valued for scan speed and low-dose capabilities. In addition, the world's fastest CT scanner even got better: The SOMATOM Definition Flash is equipped with two Stellar Detectors for outstanding spatial resolution, image quality, and dose efficiency. This innovation, combined with established and proven Siemens technologies, makes computed tomography more patient-centric, and increases productivity and diagnostic confidence.

Split-second scanning with an acquisition speed of up to 458 mm/s and the industry's only dose neutral Dual Energy scan mode are just some of the reasons why the SOMATOM Definition Flash is unique in the market. The growing installed base with more than 1,300 Dual Source installations in 2012 and millions of Dual Energy examinations have already offered significant patient benefit world-wide.

Therefore, by bringing together unique, innovative technologies with exceptional patient care the SOMATOM Definition Flash truly constitutes the gold standard in CT.

The SOMATOM Definition Flash: Flash Speed. Lowest Dose.





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# Product Benefits



# Split-Second Scanning

Only the Dual Source technology of the SOMATOM Definition Flash allows scanning at Flash speed so that diagnostic images can be acquired even from patients who cannot hold their breath or can not hold still.

## Faster is better

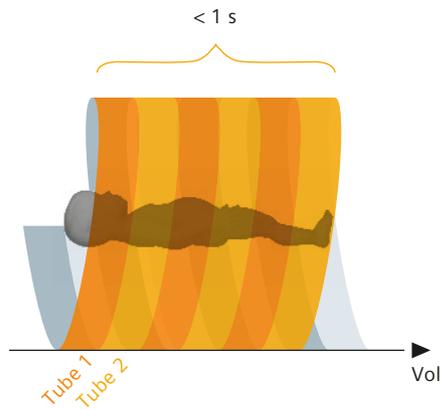
When diagnoses and CT imaging get challenging, it mainly comes down to how fast images can be acquired. Whether it's a scan of the heart with its fast-moving vessels, the rule-out of life-threatening illnesses, or dealing with uncooperative or unconscious patients, a fast acquisition is of the essence. These cases show which scanners are truly great.

## Speed for reliability

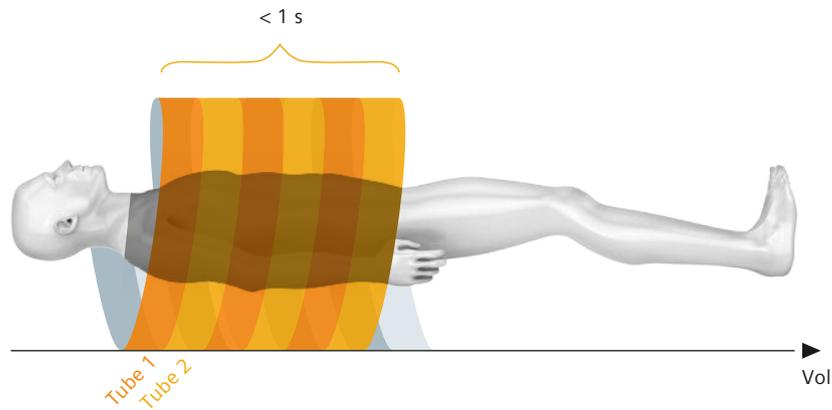
The SOMATOM Definition Flash is the fastest scanner on the market. Its Dual Source technology is so fast it can get excellent results from all patients. It produces higher quality scans with reduced prep time and significantly reduces image artifacts due to motion. It minimizes risk and anxiety for children, optimizes the golden hour for trauma patients, allows sound diagnosis in obese patients, and handles challenging cardiac cases. With the SOMATOM Definition Flash, speed means more reliable diagnosis.

## For all heart rates

The SOMATOM Definition Flash can provide images of patients with irregular heart rates or with atrial fibrillations. It only takes 250 ms, a quarter of a heartbeat, to image the heart. Cardiac motion is frozen at a heart-rate-independent temporal resolution of 75 ms. Using the Flash Cardio Sequence can make beta-blockers unnecessary and reduces patient prep times, so that patients with certain forms of pulmonary disease greatly benefit from the quick Flash Spiral scanning.



Sub-second pediatric scan without sedation or anesthesia.



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

### Breath-hold becomes optional

Chest scans are easy with the Flash Spiral mode. Patients do not necessarily need to hold their breath, or keep still, because the high scan speed and the high temporal resolution of 75 ms freeze motion. Even obese patients or young children can be scanned with significantly reduced image artifacts.<sup>1</sup> Quicker and more accurate scan results improve emergency care and have a positive impact on treatment decisions. This can also improve the 30-day adverse event rate and reduce repeat visits.<sup>2</sup>

### Child-friendly

Flash speed makes pediatric imaging easier and more patient-friendly. Children can be imaged without sedation, anesthesia, or controlled breathing while maintaining low radiation dose.<sup>1, 3</sup> This delicate patient group benefits from average examination times of only 0.49 s. No sedation also means saving time and resources, as no anesthetist is required for this potentially dangerous procedure. Flash speed thus saves prep time and repeat scans, reduces risk, and prevents anxiety in young patients.

### Rapid acute care

Long scan times in trauma imaging or patients with stroke who cannot hold still make a scan prone to motion artifacts. This may put an acute care patient at additional risk. Flash speed can image an entire body routinely in less than five seconds, providing 0.33 mm isotropic high resolution quality images over the entire 50 cm field of view and beyond. It makes the diagnosis faster, safer, and more reliable for quick and effective treatment decisions. All that optimizes the patient's golden hour and has a significant impact on clinical outcomes.

<sup>1</sup> Lell MM. et al. Invest Radiol. Sep 17, 2010. [Epub ahead of print].

<sup>2</sup> Malviya S. et al, British Journal of Anesthesia 84 (6): 743-8 (2000).

<sup>3</sup> Maryam Alkuwari, Shelby Kutty et al. Low-dose CT angiography for evaluation of great vessels and airway in arterial tortuosity syndrome. Eur Heart J Cardiovasc Imaging, July 11, 2012



# Defining Low Dose CT

**With Dual Source technology and the Stellar Detectors, the SOMATOM Definition Flash sets the benchmark for dose efficiency.**

## **How low is the right dose**

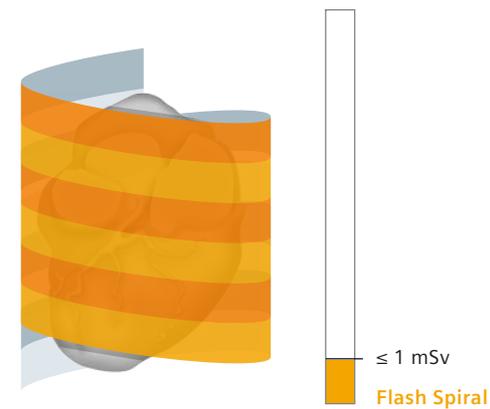
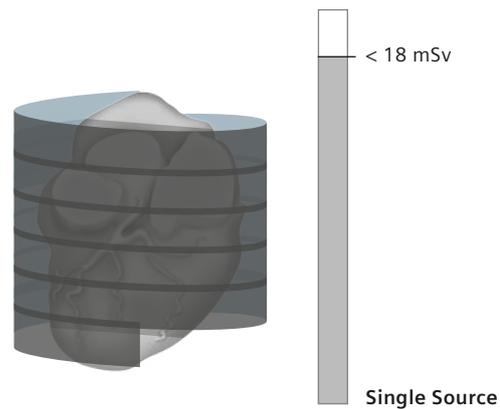
For decades, Siemens has developed revolutionary innovations for radiation reduction. With CARE Dose4D, CARE kV, and the Sinogram Affirmed Iterative Reconstruction (SAFIRE\*), Siemens offers the industry's only comprehensive dose reduction portfolio. What is needed, however, is the right dose – the perfect dose level to deliver the best possible image quality. At Siemens, these efforts are guided by the ALARA principle: As Low As Reasonably Achievable. Dual Source CT in combination with our latest dose saving technologies defines the threshold for low dose CT imaging.

## **Sub-mSv heart in clinical routine**

The Flash Spiral enables prospectively triggered high-pitch data acquisition. This means that a SOMATOM Definition Flash cardiac scan routinely delivers dose values of under 1 mSv. Even if patients cannot hold their breath or weigh up to 90 kg, radiation exposure is less than what is considered standard for diagnostic cardiac catheterization. Such high speed and low dose values make CT Angiography a viable option for early detection of coronary artery disease.

## **Triple Rule-Out routinely below 5 mSv**

Flash Spiral technology can assess pulmonary and coronary arteries, as well as the aorta, in a single split-second scan. An entire thorax can be scanned in only 0.6 seconds. Flash Spiral scanning makes possible “accurate visualization at very low radiation exposure.”<sup>1</sup> Average scan times are 0.7 s with a radiation dose of only 4.1 mSv or less. Flash Spiral use therefore “has the potential to revolutionize triple-rule-out protocols.”<sup>2</sup>



### Lower noise for lower dose

Siemens innovations focus on reducing patient radiation exposure. The new SOMATOM Definition Flash hardware and software represent the next step to improving image quality without increasing dose. TrueSignal Technology with the two fully-integrated Stellar Detectors minimizes electronic noise in the detector. The resulting higher signal-to-noise ratio (SNR) means that even low signal images are sharper and clearer. This especially benefits for obese imaging and ultra low dose examinations, for example in pediatric imaging.

### Lower dose pediatric scanning

HiDynamics in the Stellar Detectors increases the detectors' dynamic range and sensitivity, extending the scan range as low as 70 kV with the revised Straton X-ray tube and the CARE Child feature. This pediatric scan mode is safer and takes into account the specific anatomy of each child and neonate patient. The CARE Child features make possible an additional dose reduction at consistently high image quality.

<sup>1</sup> Malviya S. et al, British Journal of Anesthesia 84 (6): 743–8 (2000).

<sup>2</sup> Lell MM. et al, Invest Radiol. Sep 17, 2010. [Epub ahead of print].

\*In clinical practice, the use of SAFIRE may reduce CT patient dose depending on the clinical task, patient size, and anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task. The following test method was used to determine a 54 to 60% dose reduction when using the SAFIRE reconstruction software. Noise, CT numbers, homogeneity, low-contrast resolution, and high contrast resolution were assessed in a Gammex 438 phantom. Low dose data reconstructed with SAFIRE showed the same image quality compared to full dose data based on this test. Data on file.



# Dual Source Dual Energy for all Patients

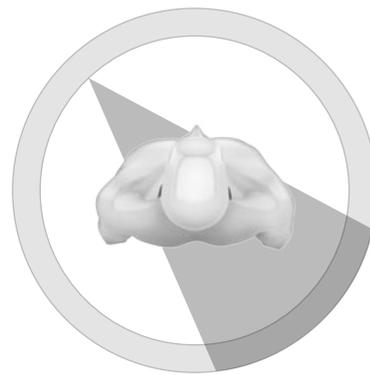
Dual Energy with Dual Source CT combines dose neutrality with functional information and can save a non-enhanced scan – in any patient.

## Dual Energy with Stellar Detectors

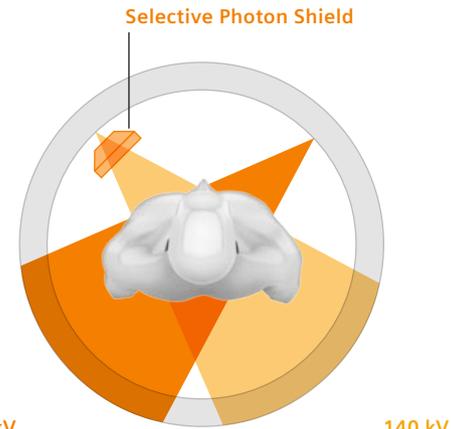
By producing two data sets at different energy levels with maximum energy separation, Dual Source Dual Energy scanning has made it possible to precisely visualize and quantify tissue composition in CT. The introduction of the Stellar Detectors delivers even more image detail through HiDynamics in the low kV-dataset. Through the excellent low-kV image quality, the fully integrated Stellar Detectors add decisive diagnostic confidence, for sound treatment decisions in a wide variety of clinical applications.

## Dual Source for safety

One acquisition phase of Dual Source Dual Energy produces two images at the same point in time. Dual Source is the only modality that enables Dual Energy scanning at doses comparable to a conventional 120 kV scan. It uses X-ray filters, the Selective Photon Shield, and iterative reconstruction methods for further spectral separation and dose reduction. With Dual Energy Virtual Non Contrast imaging, it even saves the time and dose of a non-enhanced CT scan.



Single Source



80 kV  
Attenuation B

140 kV  
Attenuation A

Dual Source

### Bringing Dual Energy into clinical routine

Dual Source Dual Energy offers a variety of clinical applications – from research to clinical routine usage. For example, the SOMATOM Definition Flash can obtain monoenergetic images. They are similar to images acquired with a synchrotron X-ray beam of single photon energy, and reduce, for instance, metal artifacts in patients with metal prosthesis. Dual Energy Optimum Contrast, another Dual Source application, achieves images with very low noise at high contrasts. This supports the visualization of occult or conspicuous soft tissue lesions.

### Cardiac Dual Energy imaging

The SOMATOM Definition Flash is unique in its ability to scan the entire heart and evaluate its morphology and coronaries with a full temporal resolution of 75 ms. A second reconstruction visualizes perfusion defects in the myocardium. Dual Energy CT is also able to highlight iodine content to visualize organ perfusion. Finally, dynamic myocardial stress perfusion imaging makes it possible to assess the hemodynamic relevance of a stenosis through blood flow quantification.

### HiDynamics for low kV images

The extended bandwidth range of HiDynamics with the Stellar Detectors increases the level of image detail, especially in low-signal and low-energy scans. The Stellar Detectors operate at different tube potentials during the synchronous CT acquisition. This avoids spectral contamination or wasting dose and image quality, compared to rapid kV-switching approaches.



# Quantitative Diagnostic Imaging with *syngo.via*

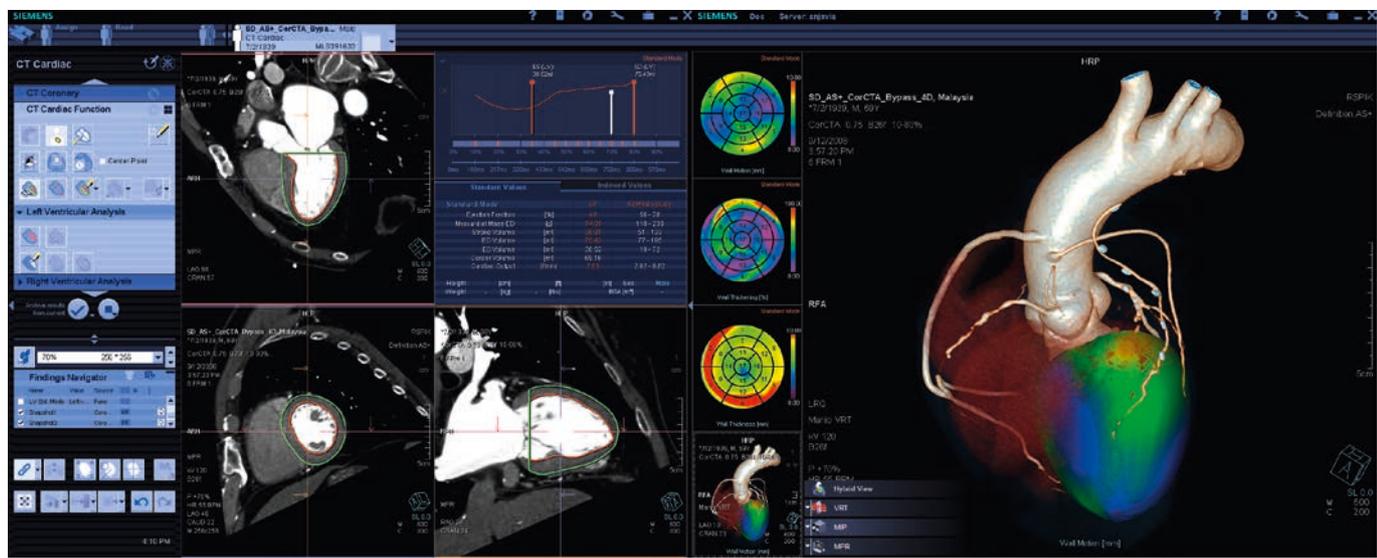
Regardless of volume or disease, *syngo.via* helps prepare cases, eases interdisciplinary collaboration, and helps generate a faster and more reliable diagnosis.

## *syngo*<sup>®</sup>.via for sustainable care

As the number of chronic disease patients rises, the demand for high-quality efficient care is increasing. *syngo.via* can help foster sustainable care by equipping physicians with workflows and applications for evaluating images from multiple modalities. In the case of cardiovascular CT, it makes possible a rule-out of coronary artery disease in less than a minute. *syngo.via*<sup>\*</sup> is state-of-the-art Siemens imaging software, which creates an exciting experience in efficiency and ease of use – anywhere.<sup>\*\*</sup>

## Automatic Case Preparation

*syngo.via* helps to analyze individual cases, prepares images, suggests an optimized workflow, and offers guidance when needed. For example, when a cardiac case is opened, the Automated Case Preparation has already pre-processed the images and displays them in the appropriate layout with the right evaluation tools. Evaluation of the coronary vessels, valves, functional parameters, and calcium score can start immediately for a full cardiac assessment in less than 4 minutes.



### Image networking

*syngo.via* speeds up the way users connect and share information with clinical partners and patients – even on the go.\*\* *syngo.via*'s client-server based nature supports a smooth, teamwork-like sharing of tasks, just as it is required in 3D labs and larger radiology departments. Images can be shared among up to 10 users at once, providing a sound basis for joint pre-procedural planning, for example, prior to Trans Aortic Valve Implantation (TAVI) interventions.

\* *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. These products are pending regulatory clearance in some countries and may therefore not yet be commercially available in all countries. Usage of *syngo.via* in operating rooms or for an emergency case requires customer to provide respective emergency measures in case of non-availability of system or network.

\*\* Prerequisites include: internet connection to clinical network, DICOM compliance, meeting of minimum hardware requirements, and adherence to local data security regulations.





# Clinical Images

HR independent  
temp resolution:  
75 ms

collimation:  
2 x 128 x 0.6 mm

spatial resolution:  
0.30 mm

scan time:  
4 s

scan length:  
107 mm

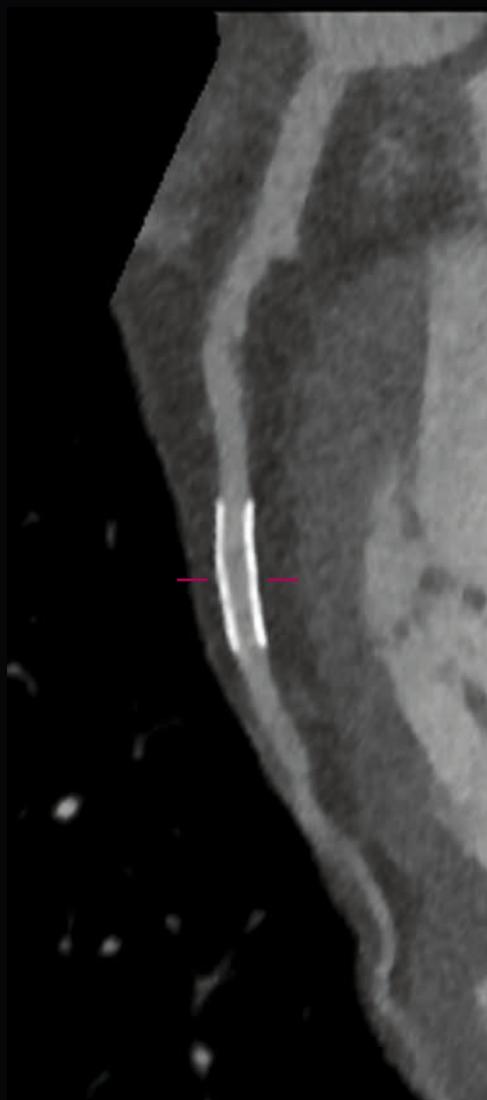
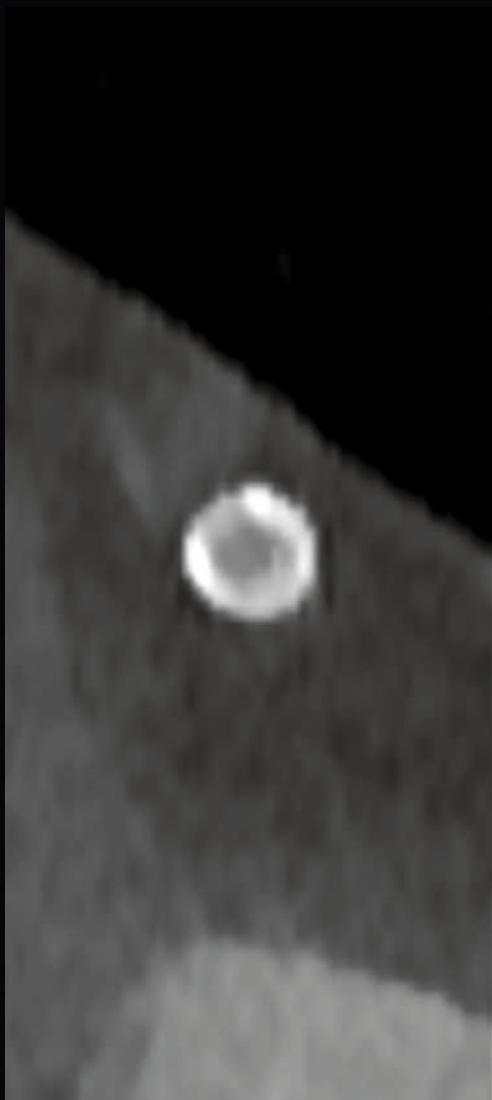
rotation time:  
0.28 s

tube settings:  
100/100 kV, 160 mAs/rot

CTDIvol:  
3.6 mGy

DLP:  
38.52 mGy cm

eff. dose:  
0.54 mSv



**Excellent coronary stent imaging –**

**imaging –**  
The Stellar Detector efficiently reduces cross-talk between neighboring detector channels and reduces image noise during acquisition. This significantly reduces slice blurring, resulting in a more precise visualization of calcified lesions and in-stent restenosis evaluation in smaller stents.



**HR independent  
temp resolution:**  
75 ms

**collimation:**  
2 x 128 x 0.6 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
1.5 s

**scan length:**  
724 mm

**rotation time:**  
0.28 s

**tube settings:**  
100/100 kV, 258 mAs/rot

**DLP:**  
209 mGy cm

**CTDIvol:**  
2.68 mGy

**eff. dose:**  
1.65 mSv

**CT TAVI planning –**  
Flash Spiral obtains all relevant structures, including coronary arteries, for pre-procedural Transcatheter Aortic Valve Implantation planning in a single scan in less than 2 s. The low radiation and contrast doses of only 40 mL significantly reduce the risk of Contrast Induced Nephropathy in these critically ill patients, who often suffer from impairment of renal function.

HR independent  
temp resolution:  
75 ms

collimation:  
2 x 128 x 0.6 mm

spatial resolution:  
0.30 mm

scan time:  
0.21 s

scan length:  
264 mm

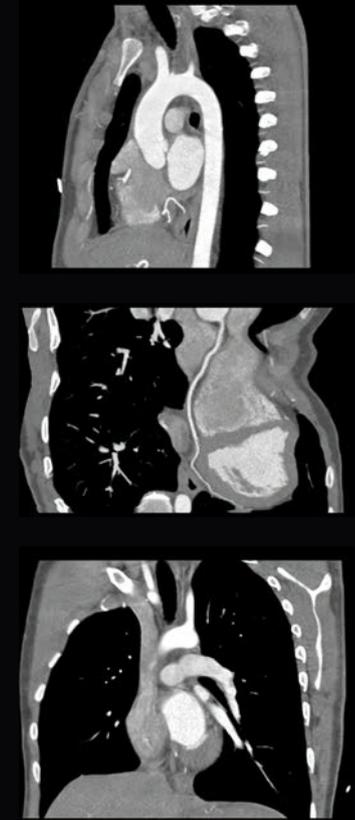
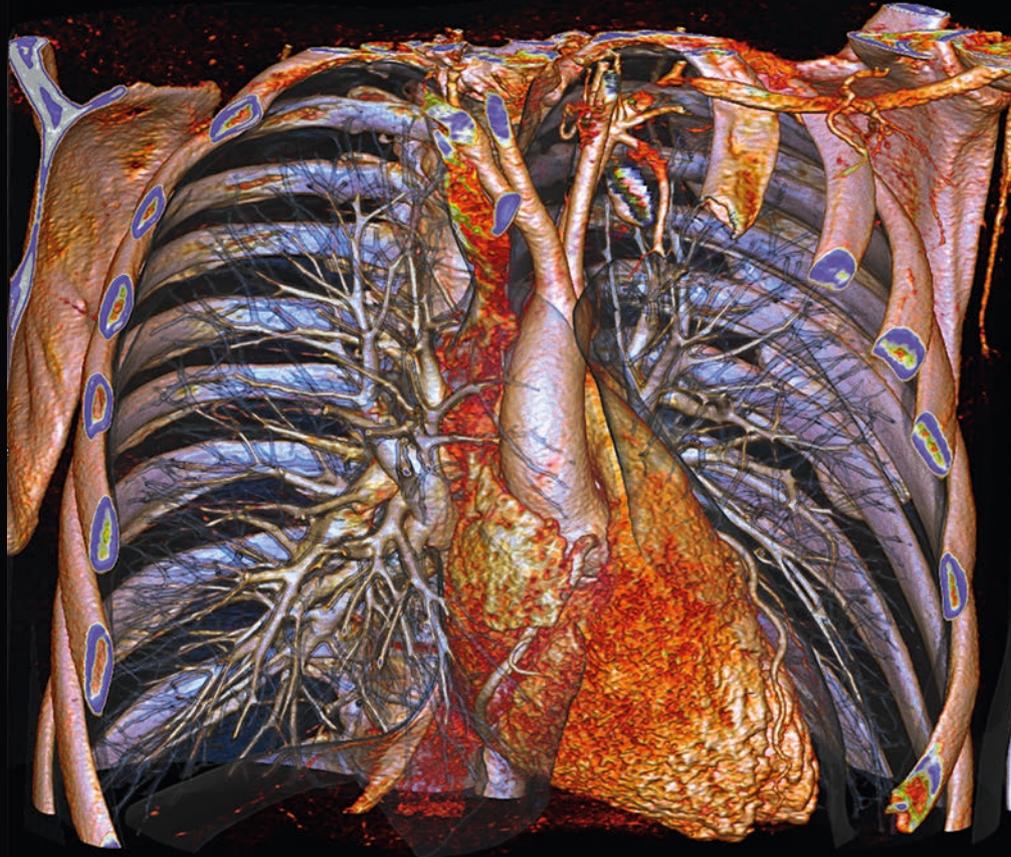
rotation time:  
0.28 s

tube settings:  
100/100 kV, 294 mAs

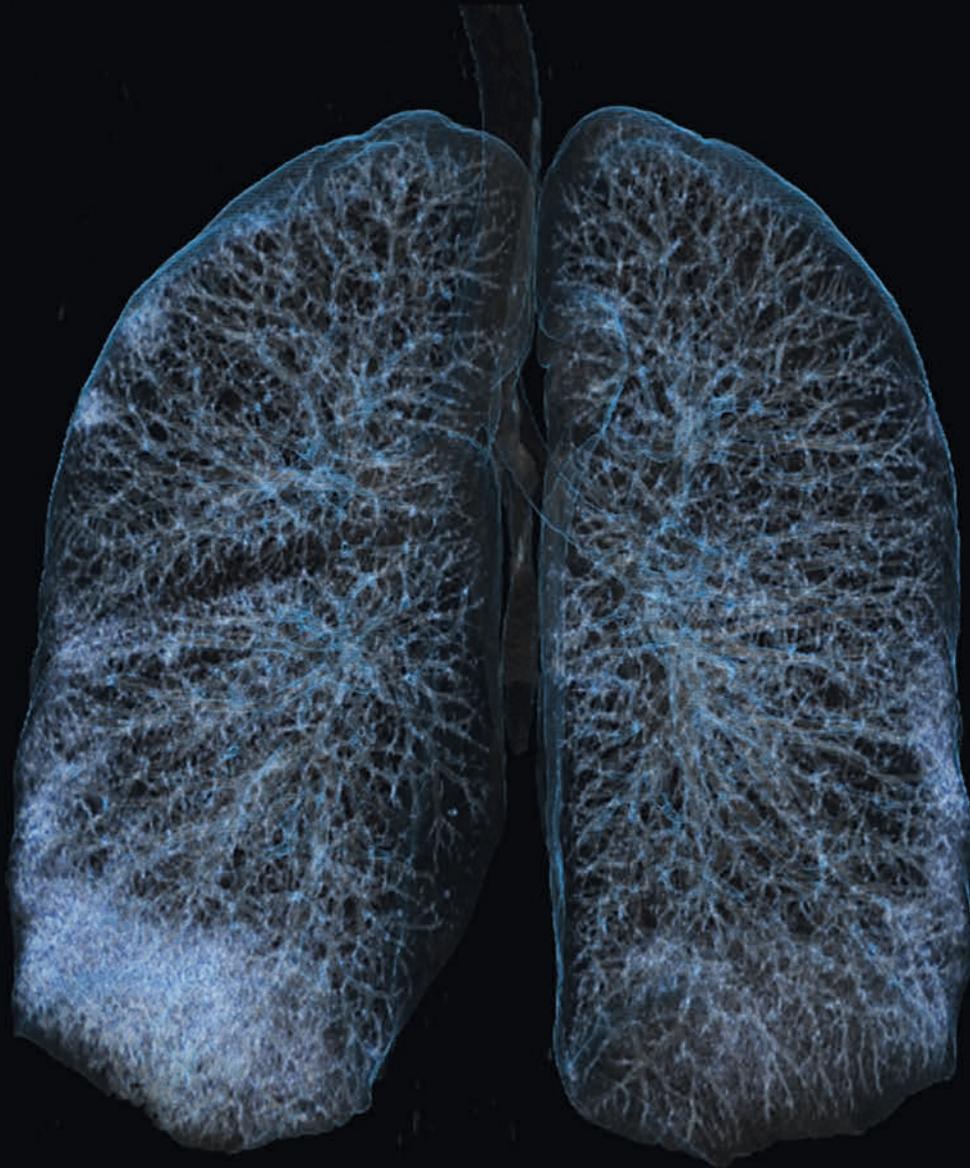
DLP:  
98 mGy cm

CTDIvol:  
3.06 mGy

eff. dose:  
1.37 mSv



**Triple rule-out –**  
One quick, triggered, sub-second  
Flash Spiral scan over the entire  
thorax for a low dose triple rule-  
out of pulmonary embolism,  
coronary heart disease, and  
aortic dissection, without the  
need for breath-hold, adds new  
quality of care to critically  
ill patients.



**collimation:**  
2 x 128 x 0.6 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
1 s

**scan length:**  
335 mm

**rotation time:**  
0.28 s

**tube settings:**  
100 kV, 82 mAs

**DLP:**  
153 mGy cm

**CTDIvol:**  
3.80 mGy

**eff. dose:**  
2.14 mSv

**High resolution lung imaging –**  
One quick, sub-second Flash spiral scan over the entire thorax for a low-dose high-resolution examination of the lung without the need for patients to hold their breath.

**collimation:**  
2 x 64 x 0.6 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
2 s

**scan length:**  
500 mm

**rotation time:**  
0.28 s

**tube settings:**  
120 kV, 90 eff. mAs

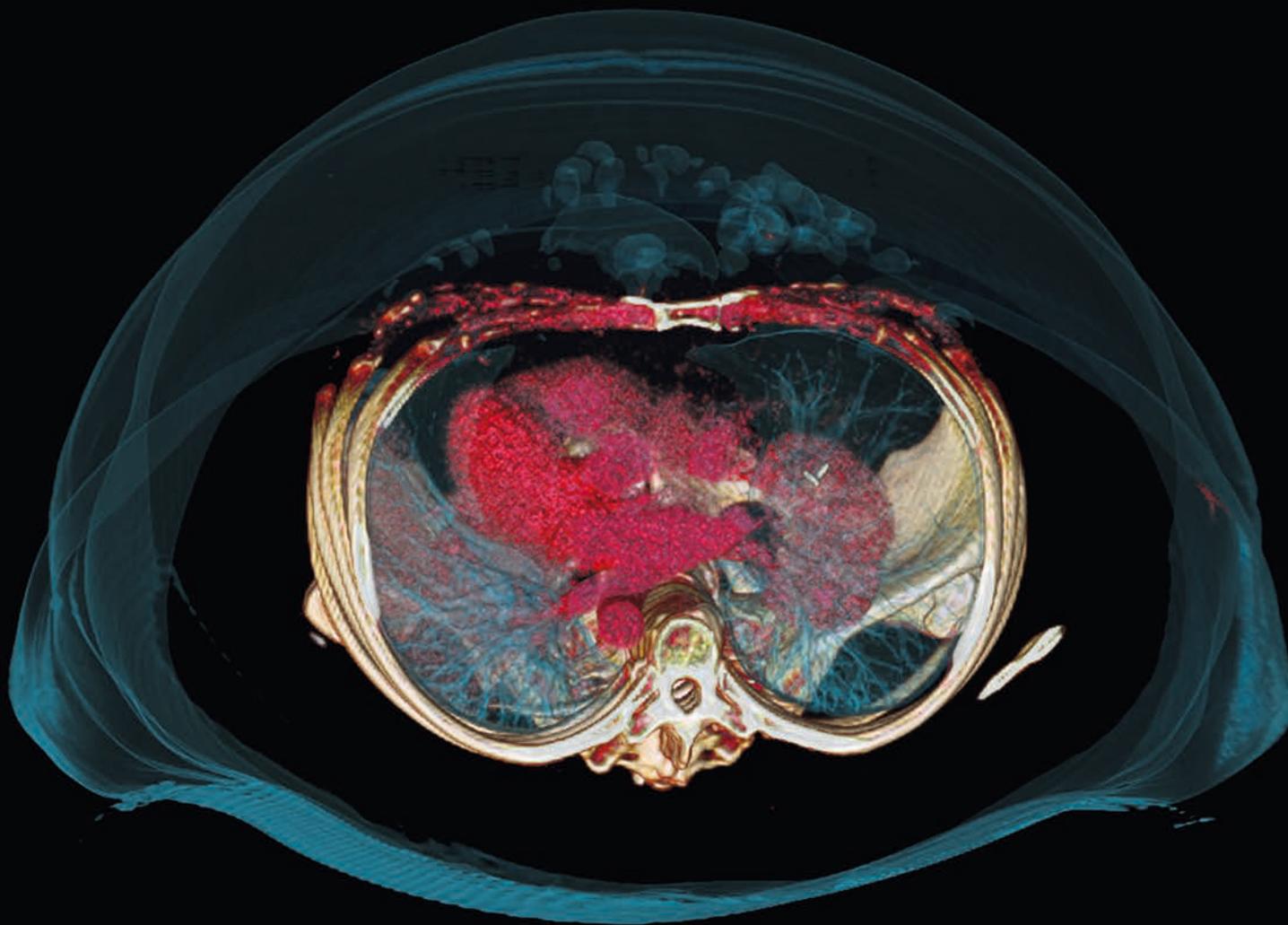
**DLP:**  
300 mGy cm

**CTDIvol:**  
6 mGy

**eff. dose:**  
4.4 mSv



**Abdominal imaging with dissection –**  
Stellar Detector Technology significantly increases detail level and sharpness, especially at the edges of organs or in vessels, in low dose or low signal imaging, such as in obese patients. This case demonstrates the outstanding visualization of the pancreatic duct and the aortic dissection.



**collimation:**  
2 x 32 x 0.6 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
31 s

**scan length:**  
480 mm

**rotation time:**  
0.5 s

**tube settings:**  
120 kV, 741 eff. mAs

**FOV:**  
780 mm

**CTDIvol:**  
60.11 mGy

**DLP:**  
2959 mGy cm

**patient weight:**  
400 lbs

**Obese imaging –**  
Dual Source is ideal for bariatric imaging due to sufficient power reserves of two sources. In addition, the Stellar Detector reduces the electronic noise effectively, so that the signal-to-noise ratio is significantly improved. This allows a much better X-ray quanta utilization, which is of particular benefit for bariatric or low-dose pediatric imaging.

**collimation:**  
2 x 128 x 0.6 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
6 s

**scan length:**  
153 mm

**rotation time:**  
1.0 s

**tube settings:**  
100/100 kV, 500 eff. mAs

**CTDIvol:**  
66.35 mGy

**DLP:**  
1015 mGy cm

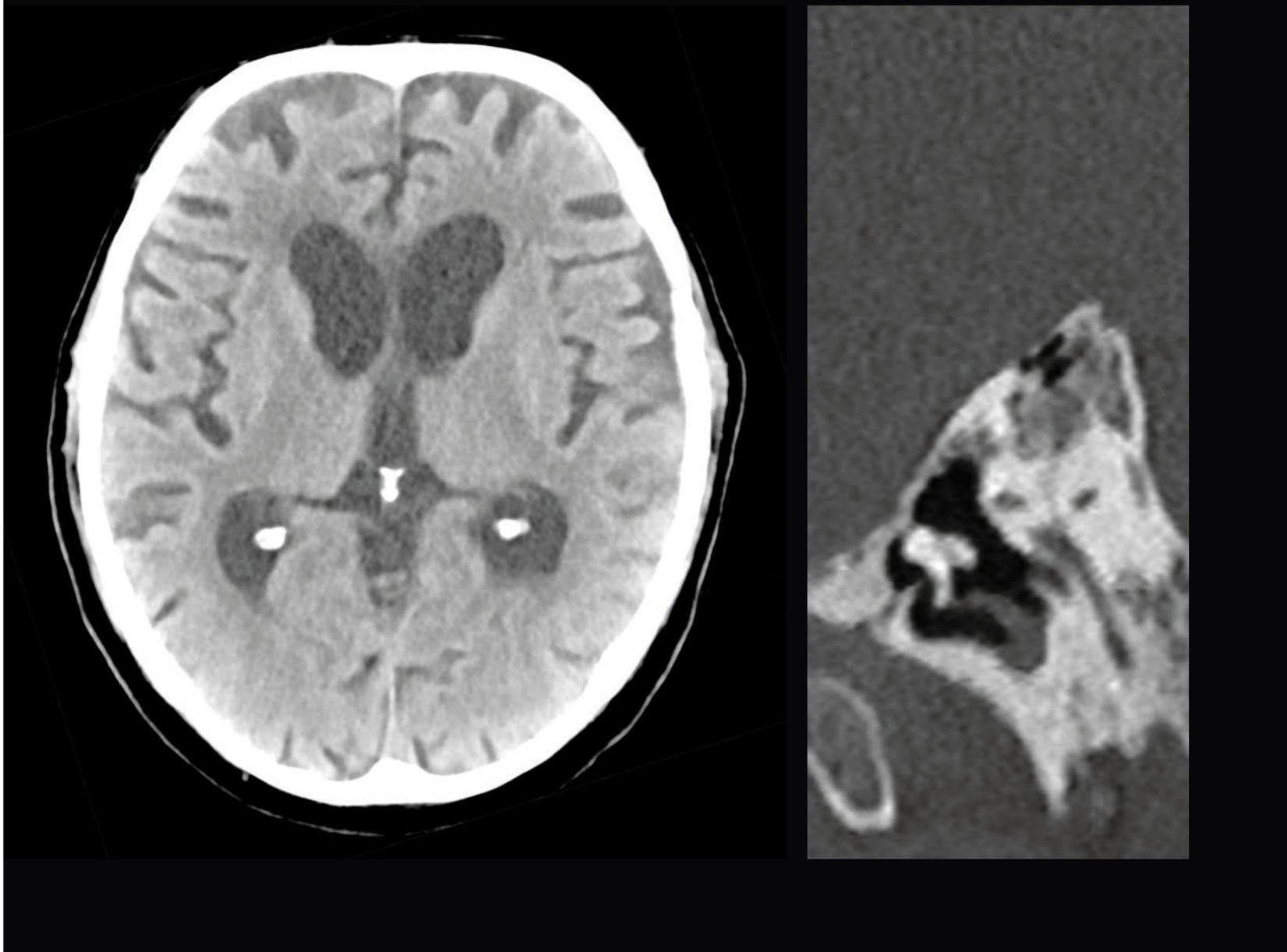
**eff. dose:**  
2.13 mSv

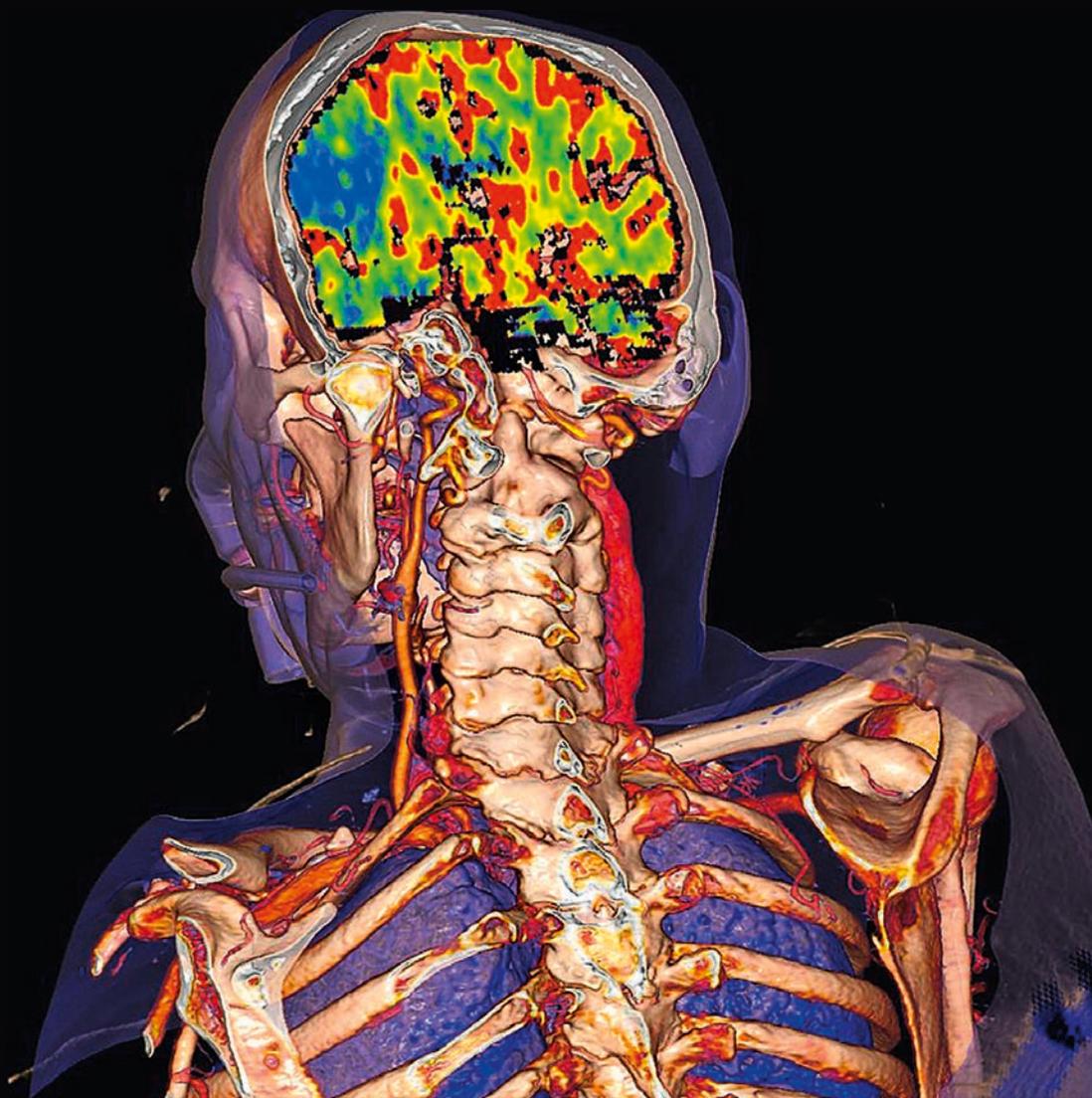
**Excellent Neuro image quality –**

Low energy photons can now be detected more efficiently while blooming is significantly reduced.

This leads to excellent gray-white matter differentiation, especially at the basal ganglia and the cortex cerebri, for increased diagnostic certainty while X-CARE protects the eyes.

The Stellar Detector's Edge Technology delivers z-UHR-like high resolution inner ear images from conventional head exams.





**collimation:**  
2 x 32 x 1.2 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
45 s

**scan length:**  
76 mm

**rotation time:**  
0.57 s

**tube settings:**  
80 kV, 200 mAs

**CTDIvol:**  
256 mGy

**DLP:**  
3036 mGy cm

**eff. dose:**  
6.3 mSv

**Whole brain perfusion –**  
Adaptive 4D Spiral Technology delivers quantitative perfusion information of whole organs and the brain without compromising results through cone beam artifacts and scatter radiation occurring with wide detectors. It enhances the ability to grade tumors, plan biopsies, monitor therapy, or to see the whole disease in stroke imaging.

**collimation:**  
2 x 128 x 0.6 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
0.3 s

**scan length:**  
189 mm

**rotation time:**  
0.28 s

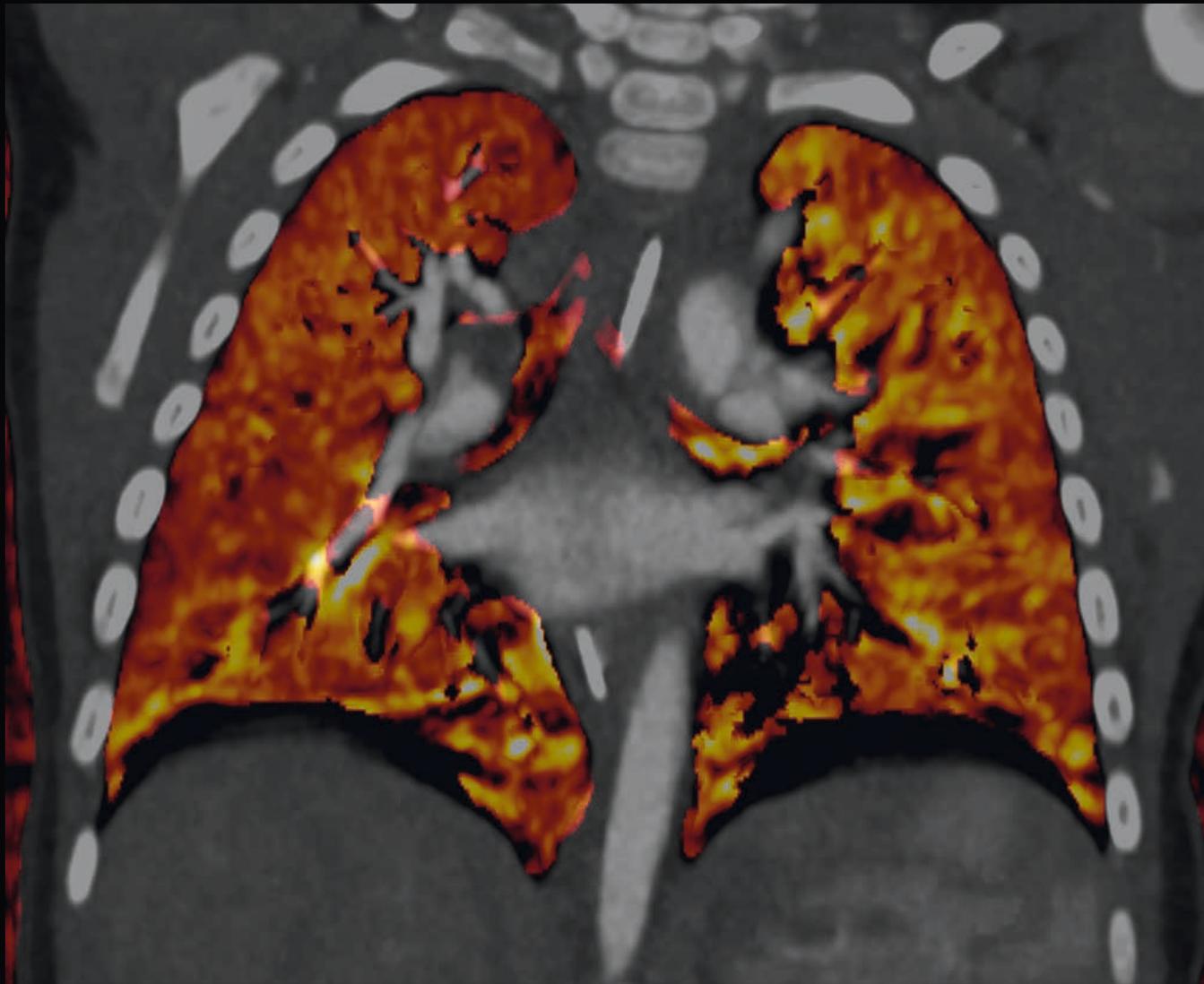
**tube settings:**  
70 kV, 81 eff. mAS

**eff. dose:**  
0.82 mSv

**patient:**  
4-year-old child



**Pediatric chest CT –**  
The Stellar Detectors' efficient utilization of low signals is of special benefit for the most fragile patients – children. Combining the Stellar Detectors with Flash Spiral acquisition at 70 kV tube voltage gives three major advantages in pediatric imaging: extremely low radiation exposure at excellent image detail and without the need for potentially harmful sedation.



**collimation:**  
2 x 64 x 0.6 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
2 s

**scan length:**  
118 mm

**rotation time:**  
0.28 s

**tube settings:**  
80/Sn 140 kV, 26/16 mAs

**DLP:**  
18 mGy cm

**eff. dose:**  
1.58 mSv

**patient:**  
7-month-old baby

**Pediatric Dual Energy –**  
Dual Energy Lung perfused  
blood volume imaging is  
comparable to pulmonary  
scintigraphy. It reliably depicts  
perfusion defects. Thanks to its  
very low radiation exposure it is  
even used in pediatric imaging  
where it shows the effect of  
a ventricular septal defect in  
this baby.

**collimation:**  
2 x 32 x 0.6 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
7 s

**scan length:**  
134 mm

**rotation time:**  
0.5 s

**tube settings:**  
100/140 kV, 99/305 mAs

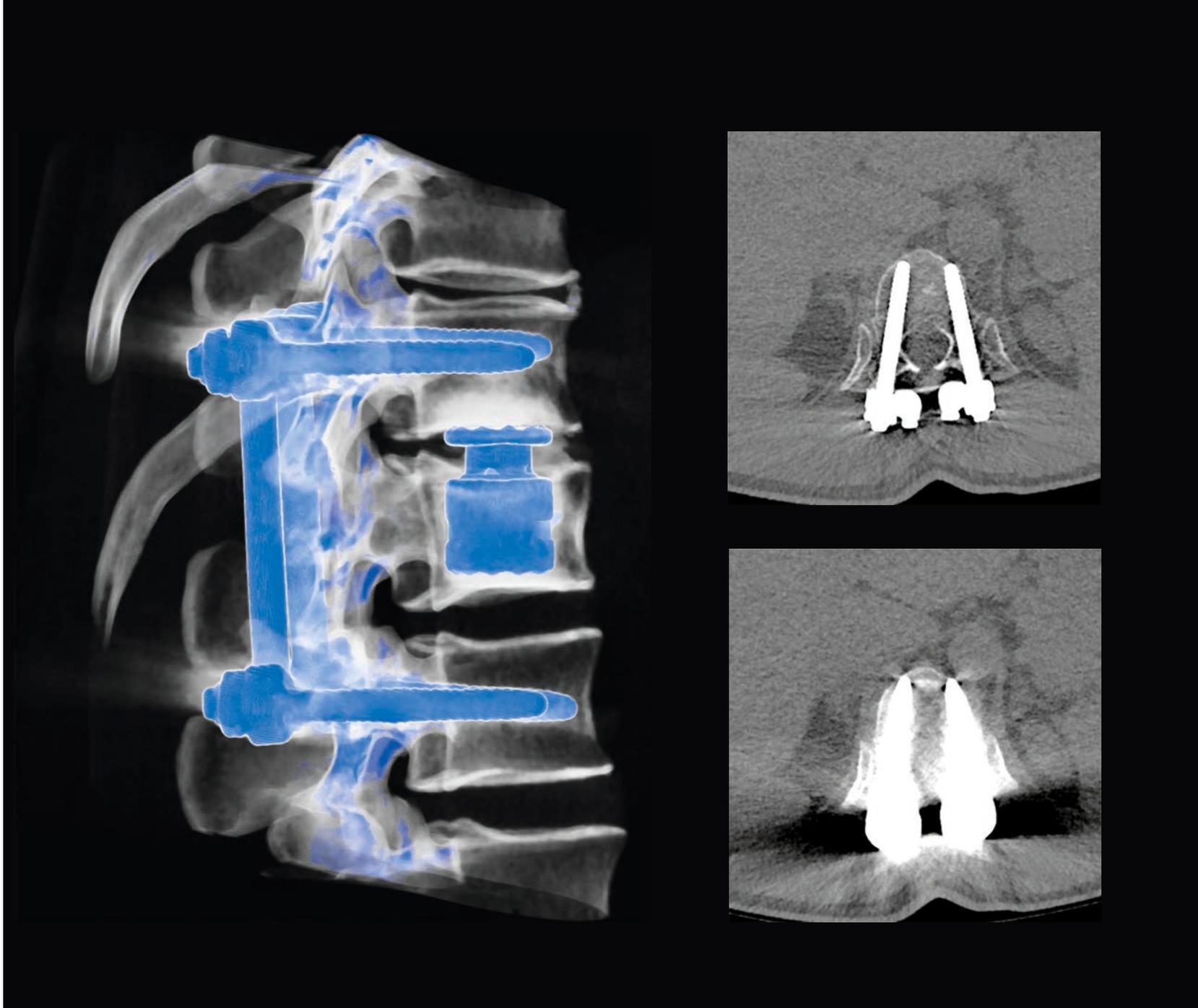
**CTDIvol:**  
4.3 mGy

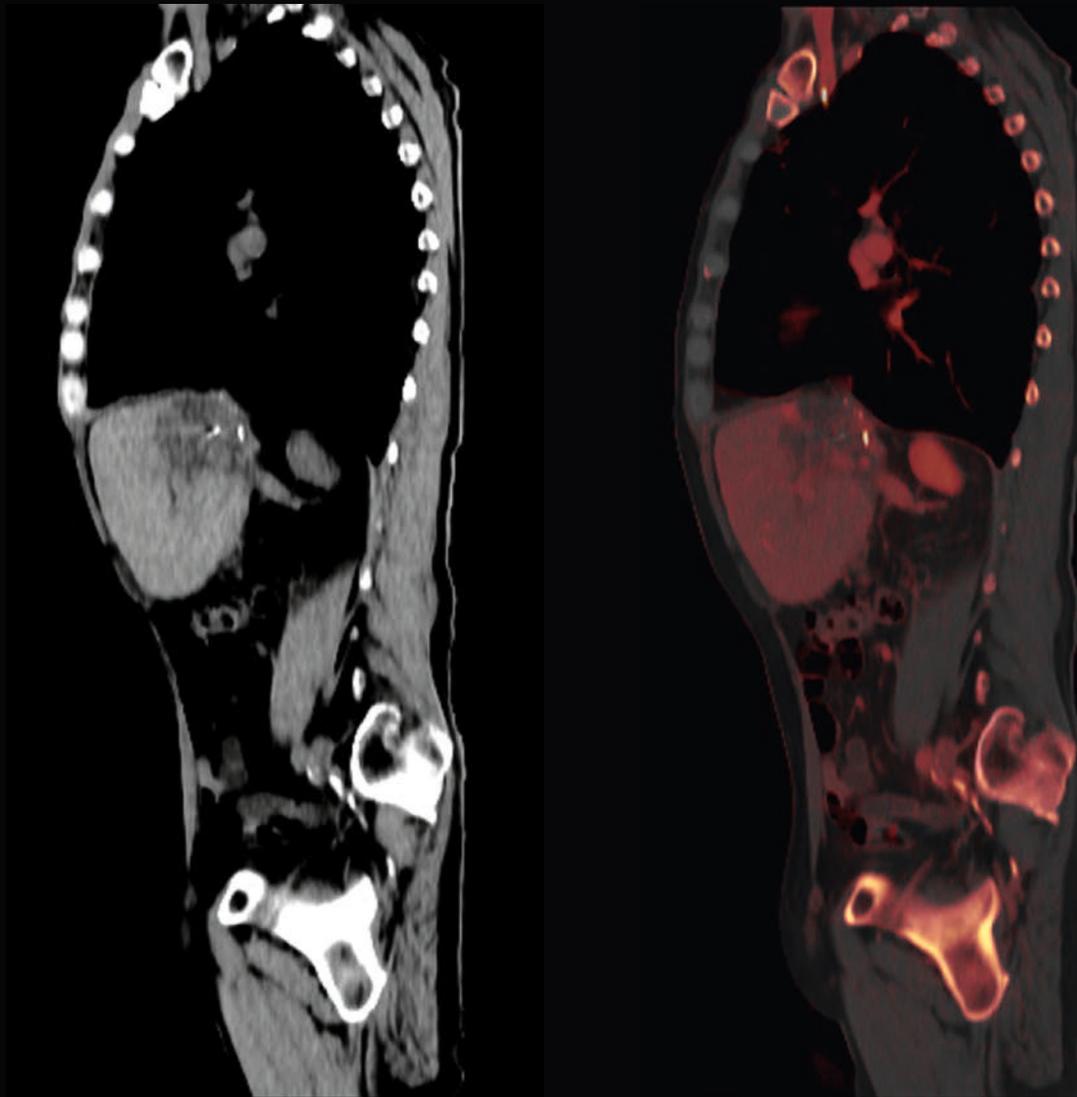
**DLP:**  
253 mGy cm

**CTDIvol:**  
16.94 mGy

**eff. dose:**  
3.8 mSv

**Metal implant follow-up –**  
The SOMATOM Definition Flash allows obtaining monoenergetic CT images. They 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. Additionally, monoenergetic imaging improves visualization of the metal screws relative to the surrounding bone structures.





**collimation:**  
2 x 32 x 0.6 mm

**spatial resolution:**  
0.30 mm

**scan time:**  
28 s

**scan length:**  
642 mm

**rotation time:**  
0.5 s

**tube settings:**  
100/140 kV, 81/68 mAs

**DLP:**  
432 mGy cm

**CTDIvol:**  
6.55 mGy

**eff. dose:**  
6.2 mSv

**DE virtual non-contrast CT –**  
Dose Neutral Dual Energy scanning with virtual non-contrast (VNC) saves the non-enhanced CT scan while adding functional information to the morphology. The Stellar Detector's extended dynamic range provides higher image detail, especially for low-signal and low energy scans, making VNC available for whole body and pediatric applications.





# Core Technologies

# Dual Source Flash Spiral for a scan speed of 458 mm/s

With Flash Spiral, dose values under 1 mSv – especially important for the most dose-sensitive patients – are so frequent they can be considered routine.

## Unique technology

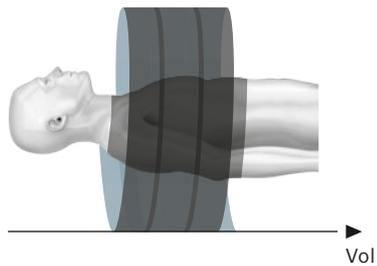
Even the most advanced single source CTs are limited in their scan speed: there is always a maximum table feed that cannot be exceeded in the acquisition of contiguous data. The SOMATOM Definition Flash breaks through this barrier by combining Dual Source technology with innovative hardware components. A gantry with a rotation speed of 0.28 s, a patient table that can handle immense table feeds, and ultra-fast data transmission technology. This is what defines the Flash Spiral.

## Overcoming single source CT limits

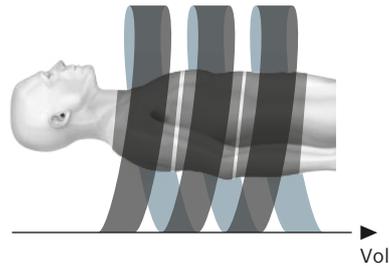
In single source CT, the spiral pitch is below 1.7 to ensure gapless coverage along the z-axis. When the pitch is increased, sampling gaps occur that hamper the image reconstruction. The second measurement system of Dual Source CT, however, fills the data gaps a quarter rotation later. In this way, the pitch can be increased up to 3.4 in a scan field of view that is covered by both detectors. Since no redundant data are acquired, a quarter rotation of data per measurement system can be used for image reconstruction.

## No spiral or sequential overlap

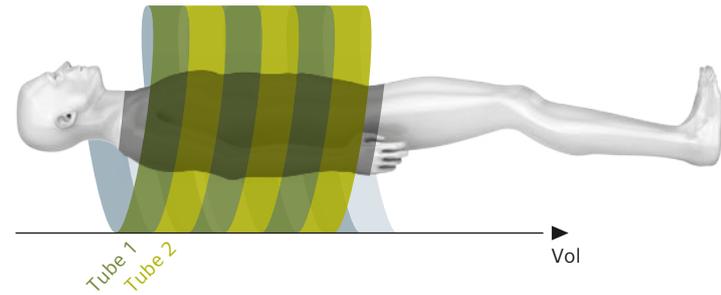
Conventional CT is limited in terms of active dose saving due to overlapping scans. In step-and-shoot scanning, each shot requires an overscan at the start and the end plus a transition range to compensate for data inconsistencies. Furthermore, the table-feed between two scans has to be smaller than the detector width to allow for overlap. Flash Spiral scanning doesn't need overlapping slices. Hence, it is even more dose effective than ECG-triggered sequential scanning. As an example, the dose level of a Flash Spiral is only 2/3 of an ECG-triggered axial scan.



Single-source CT scanners are limited to slow pitch, slow scan speed and overlapping scans



Gaps in the acquired volume occur at higher table feeds in single source CT



Dual Source CT combines the data from two sources at a table pitch of up to 3.4 without sequential or spiral scanning overlap

### Low contrast and radiation dose

The Flash Spiral makes it possible to acquire an ECG-gated-synchronized dataset of the whole chest in less than 1 second – even without patients having to hold their breath. It enables dose values consistently below 5 mSv for an application that is in the range of 25 mSv with conventional CT. An additional benefit is a contrast agent dose of as low as 40 mL.<sup>1</sup> This is a real benefit for patients with impaired renal function, as it can reduce the risk of contrast-induced nephropathy with subsequent dialysis in critically ill patients.

### Routine sub-mSv heart scans

The SOMATOM Definition Flash offers two times 38.4 mm detector z-coverage. At a pitch of 3.4, the table feed is 458 mm/s with a true temporal resolution of 75 ms for each individual image. This is sufficient to cover a heart in about 0.25 s, a quarter of a heart beat. Publications demonstrate that reliable coronary CTA is routinely feasible at radiation dose values below 1 mSv, even in patients up to 90 kg.<sup>2,3</sup> Flash users worldwide confirm effective radiation doses in the range of 0.88 to 0.9 mSv, even without the use of iterative reconstruction methods such as SAFIRE.

<sup>1</sup> Wuest W et al. Dual source multi-detector CT-angiography before Transcatheter Aortic Valve Implantation (TAVI) using a high-pitch spiral acquisition mode. *Eur Radiol.* 2012 Jan;22(1):51-8.

<sup>2</sup> Achenbach S, Marwan M, Ropers D, Schepis T, Pflederer T, Anders K, Kuettner A, Daniel WG, Uder M, Lell MM. Coronary computed tomography angiography with a consistent dose below 1 mSv using prospectively electrocardiogram-triggered high-pitch spiral acquisition. *Eur Heart J.* 2010;31(3):340-6.

<sup>3</sup> Leschka S, Stolzmann P, Desbiolles L, Baumueller S, Goetti R, Schertler T, Scheffel H, Plass A, Falk V, Feuchtner G, Marincek B, Alkadhi H. Diagnostic accuracy of high-pitch dual-source CT for the assessment of coronary stenoses: first experience. *Eur Radiol.* 2009;19(12):2896-903.

<sup>4</sup> Sommer WH, Schenzle JC, Becker CR, Nikolaou K, Graser A, Michalski G, Neumaier K, Reiser MF, Johnson TR. Saving dose in triple-rule-out computed tomography examination using a high-pitch dual spiral technique. *Invest Radiol.* 2010 Feb;45(2):64-71.

# Dual Source with Stellar Detectors for highest spatial resolution

The revolutionary Stellar Detectors and Edge Technology ensure outstanding image quality and low dose.

## Challenges with conventional CT

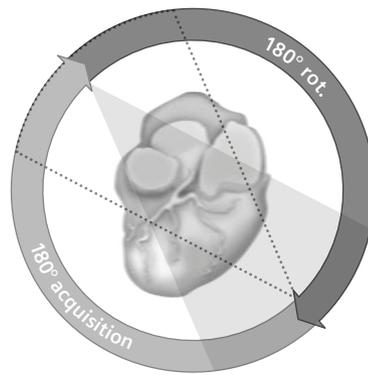
Despite all advances in single source CT, limitations such as motion artifacts in very obese patients, limited spatial resolution, and long breath-hold times remain. Stents smaller than 3 mm diameter or severely calcified arteries constitute diagnostic dilemmas, mainly due to partial volume artifacts as a consequence of insufficient longitudinal resolution. For patients with higher heart rates, careful selection of separate reconstruction intervals is mandatory. Thus, the administration of beta-blockers is still required to artificially slow down the heart rate.

## Dual Source Acquisition

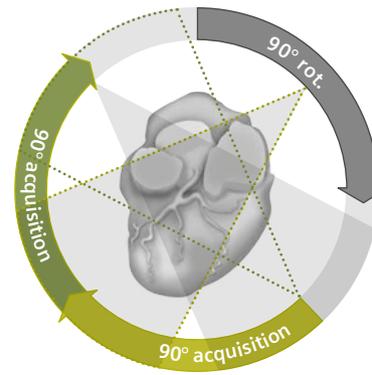
The SOMATOM Definition Flash is equipped with Dual Source technology that acquires contiguous data from two Stellar Detectors. The idea is simple: two X-ray sources and two detectors work together at the same time. Siemens has miniaturized the electronic components on the detectors, and integrated them directly into the photodiode. The Stellar Detectors generate ultra-thin slices with very high spatial resolution for an extremely high level of image detail. The SOMATOM Definition Flash therefore makes possible coronary CTA in very obese patients in whom invasive angiogram often is the only alternative.

## Faster than a beating heart

Robust imaging of the heart anatomy, including the coronary arteries, still poses a challenge in patients with high and irregular heart rates. The SOMATOM Definition Flash's 0.28 s rotation speed, two X-ray tubes, and two detectors create a heart-rate-independent temporal resolution of 75 ms of the entire heart. This extends the benefits of coronary CTA to a patient suffering from AF, traditionally considered unsuitable for coronary CTA.<sup>1</sup> Thus, SOMATOM Definition Flash provides electrophysiologists with anatomical details to optimize their ablation procedures.



**Single Source CT**  
with 180° acquisition and  
limited true temporal resolution



**Dual Source CT**  
with 90° acquisition for industries  
highest true temporal resolution

**Single Source CT**  
180° acquisition, not fast  
enough to freeze high and  
irregular heart rates

**Dual Source CT**  
2 x 90° Dual Source acquisition,  
fast enough to freeze cardiac  
motions (even for patients with  
atrial fibrillation)

### Edge Technology

The full electronic integration of Siemens' Edge Technology drastically reduces electronic noise and cross-talk, while increasing SNR. With less cross-talk, slice blurring between neighboring detector rows can be avoided, and slice profiles become much more precise. This makes possible a spatial resolution up to 30 line pairs per cm. The SOMATOM Definition Flash's unmatched temporal resolution of 75 ms plus Edge Technology helps users see even the finest details, for example, in the analysis of calcified plaque and in-stent restenosis.<sup>2</sup>

### Better low-signal results

At high signal levels, the noise produced by the Stellar Detector with TrueSignal Technology is more or less the same as the one produced by conventional CT technology. However, when the signal is lowered – either by high attenuations from obese or broad shouldered patients, or by reducing the applied mA – the impact of the Stellar Detectors increases. With lower electronic noise, the signal is less impaired, so the same noise level can be achieved with significantly lower signals.

### Higher SNR

In case of high attenuation from large patients, the detector can make better use of the resulting low signal. Alternatively, the dose could be further reduced to achieve comparable image quality. In addition, the higher SNR produced by Edge Technology results in less slice blurring, which is essential for increased spatial resolution. The combination of Dual Source technology, higher SNR thanks to TrueSignal Technology, and increased spatial resolution thanks to Edge Technology delivers outstanding and homogeneous image quality over the entire field of view.

<sup>1</sup> Sidhu MS et al. Advanced adaptive axial-sequential prospectively electrocardiogram-triggered dual-source coronary computed tomographic angiography in a patient with atrial fibrillation. *J Comput Assist Tomogr.* 2011 Nov-Dec;35(6):747-8.

<sup>2</sup> Alkadhi, et al. CT of coronary artery stents using a detector with integrated electronics: evidence from in-vitro experiments. *Investigative Radiology,* 2012

# Dual Energy with Selective Photon Shield for better spectral separation

Growing public awareness of radiation underlines the importance of Siemens' commitment to making Dual Energy as dose-efficient as any single energy scan.

## Benefit of the second source

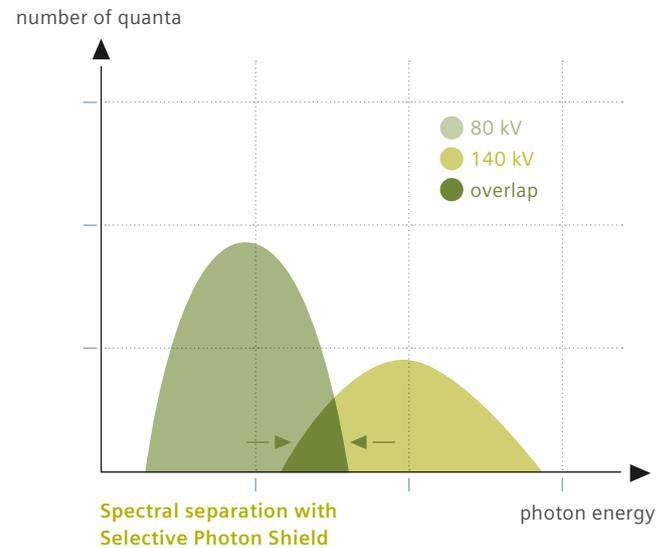
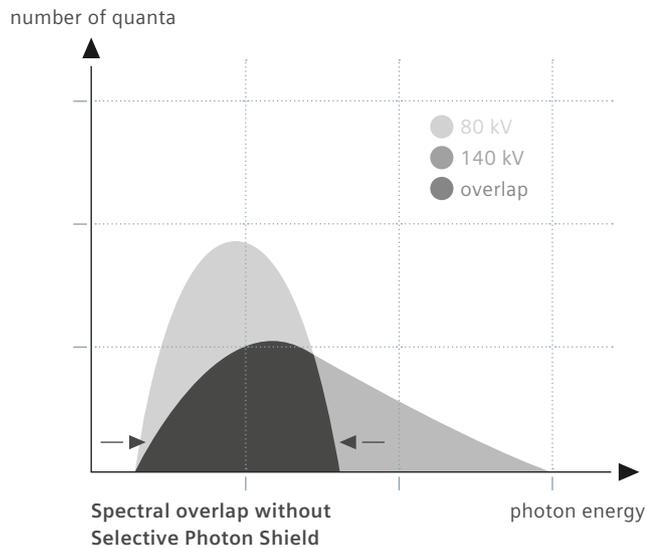
With Dual Source CT, two detectors operate at different tube potentials during synchronous acquisition. The separate adjustment of tube current for low- and high-kV scans leads to excellent image quality also in the low-kV scan. Additionally, it avoids spectral contamination or waste of applied dose occurring during kV-switching time intervals. The Dual Source approach made possible the introduction of the Selective Photon Shield for even further spectral separation. At the same time, Stellar Detector extends the dynamic range with HiDynamics for higher image detail level, especially in low signal and low-kV scans.

## Dose neutrality

The development of the Selective Photon Shield is an important factor in achieving dose neutrality in Dual Energy scanning. Blocking low-energy photons out of the high-energy X-ray spectrum results in much better separation of the 80 kV and 140 kV images. By preventing unnecessary exposure, the Selective Photon Shield assures "dose neutrality"<sup>1, 2, 3</sup> for single-dose Dual Energy, making it as dose-efficient as conventional 120 kV scans.

## More diagnostic information

Dual Source Dual Energy technology provides additional information beyond morphology with the same dose as a single energy scan. Siemens' unique solution is compatible with other dose-reduction features such as CARE kV, Adaptive Dose Shield, and X-CARE. In addition, SAFIRE\* can be applied to increase the level of diagnostic information while reducing dose.



The Selective Photon Shield increases energy separation and reduces 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.

### The focused photon spectrum

The Selective Photon Shield in the SOMATOM Definition Flash increases dose efficiency by filtering unnecessary photons out 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. Better separation of the 80/140 kV images is ideal for the head and extremities, especially CT angiographies, because bone-iodine differentiation is increased by up to 80%.

### More clinical applications

Siemens' vast number of DE functionalities covers numerous clinical fields and applications – from scientific research to the expansion of diagnostic possibilities in daily clinical practice. Additionally, the Selective Photon Shield's spectral separation makes it possible to use 100/140 kV imaging with 30% better bone-iodine contrast. Its higher power reserves for cardio, abdomen, and pelvis examinations, or for larger patients in general, make Dual Energy a viable clinical application for more patients.

### Enhanced clinical value

Non-contrast CT scans are commonly used, and often they are followed by a contrast-enhanced CT. Dual Source DE virtual non-contrast can reduce radiation exposure by almost 50%.<sup>2</sup> Requiring only one scan saves time and costs – with additional dose reduction potential, especially in pediatric CT. In case of pulmonary embolism, the Dual Source DE examination improves the detection of peripheral PE.<sup>4</sup> The SOMATOM Definition Flash clarifies which dot on the image actually is a true clot that should be treated with anticoagulation.

<sup>1</sup> Schenzle JC. et al, Radiol. 2010 Jun; 45(6): 347–53.

<sup>2</sup> Graser A. et al, Invest Radiol. 2010 Jul; 45(7): 399–405.

<sup>3</sup> Thomas C. et al, Invest Radiol. 2010 Jul; 45(7): 393–8.

<sup>4</sup> Lee CW et al. Eur Radiol. 2011 Jan;21(1):54-62.

\*In clinical practice, the use of SAFIRE may reduce CT patient dose depending on the clinical task, patient size, and anatomical location, and clinical practice. A consultation with a radiologist and a physicist should be made to determine the appropriate dose to obtain diagnostic image quality for the particular clinical task.

# Customer Services

**A range of innovative service solutions provide the answers to best support our customers in raising quality and productivity in healthcare.**

## **Maintainable healthcare**

Providing economically viable healthcare means efficiently and productively delivering the highest quality care possible. This is why Siemens works closely with its customers, offering experience and innovative solutions to increase uptime, improve performance, and optimize workflow for maintainable healthcare. This means raised quality, better productivity, and greater cost-effectiveness.

## **Increased availability with System Services**

Peak performances and higher uptime are achieved by proactively ensuring system availability with innovative service solutions. Siemens Remote Services, for example, establishes a highly efficient, secure and certified remote connection between CT systems and Siemens' service organization for remote monitoring and remote fixing in order to maximize availability and performance.

## **Proactive maintenance**

With the Siemens Guardian Program™ including TubeGuard, potential tube downtime can be predicted ahead of time. This allows healthcare institutions to schedule maintenance without impairing regular patient hours for higher system efficiency.



#### Improved operation with User Services

Personalized education and training are the key to more expertise, greater efficiency, and higher productivity of the system operators. In addition, dedicated consultancy services facilitate further improvement of system usage. Optimize CARE CT for example is a comprehensive program to help customers reduce radiation in CT scanning. The program provides expert insights, methods, and tools that assist customers in developing a customized roadmap towards improving their CT dose.

#### Optimized utilization with Management Services

Increased workflow optimization and better productivity through process optimization and consulting help improve efficiency, system utilization, and return on investment. Utilization Management Consulting combines quantitative data from the Utilization Management report with technical experience and radiological workflow management. Customers can then learn about their strengths and improvement potential across all professional groups.

# SOMATOM Definition Flash

Flash Speed. Lowest Dose.

## Split-Second Scanning

Dual Source CT for fastest acquisition with Flash speed

- All heart rates, no exclusion
- Pediatric imaging without sedation
- No breath-hold required

## Defining Low Dose CT

Dual Source CT for highest dose efficiency with Flash Spiral

- Sub-mSv heart – even in patients up to 90 kg
- Triple-rule-out routinely below 5 mSv
- Contrast doses down to 40 mL

## Dual Source DE for all Patients

Dual Source Dual Energy for true dose neutrality in clinical routine

- Selective Photon Shield for dose neutrality
- Stellar Detector with HiDynamis for excellent low-energy images
- Widest clinical portfolio – from research to daily practice





<b>Detector</b>	2 x Stellar Detector
<b>Number of slices</b>	2 x 128
<b>Rotation time</b>	0.28 s*
<b>Temporal resolution</b>	75 ms*, heart-rate independent
<b>Generator power</b>	200 kW (2 x 100 kW)
<b>kV steps</b>	70, 80, 100, 120, 140 kV
<b>Isotropic resolution</b>	0.33 mm
<b>Cross-plane resolution</b>	0.30 mm
<b>Max. scan speed</b>	458 mm/s* with Flash Spiral
<b>Table load</b>	up to 307 kg / 676 lbs*
<b>Gantry opening</b>	78 cm



\* Optional







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Order No. A91CT-06017-94C1-7600 | Printed in Germany | CC 783 02132.5 | © 02.2013, Siemens AG

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