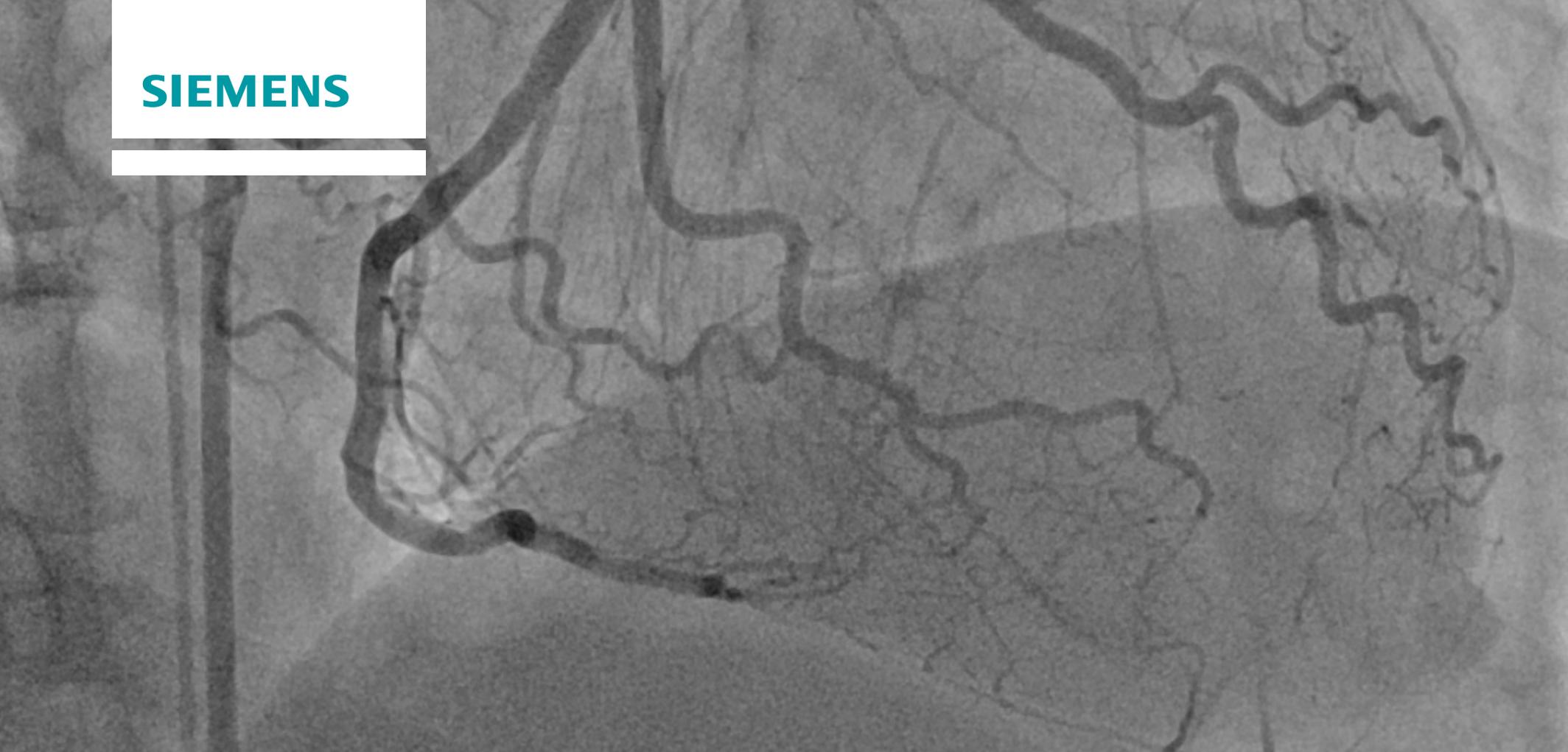




SIEMENS



[www.siemens.com/artis-q-zen-masterpieces](http://www.siemens.com/artis-q-zen-masterpieces)

# Artis Q.zen masterpieces

Discover visionary intervention at ultra-low dose

Answers for life.

# Masterpieces

that only Artis

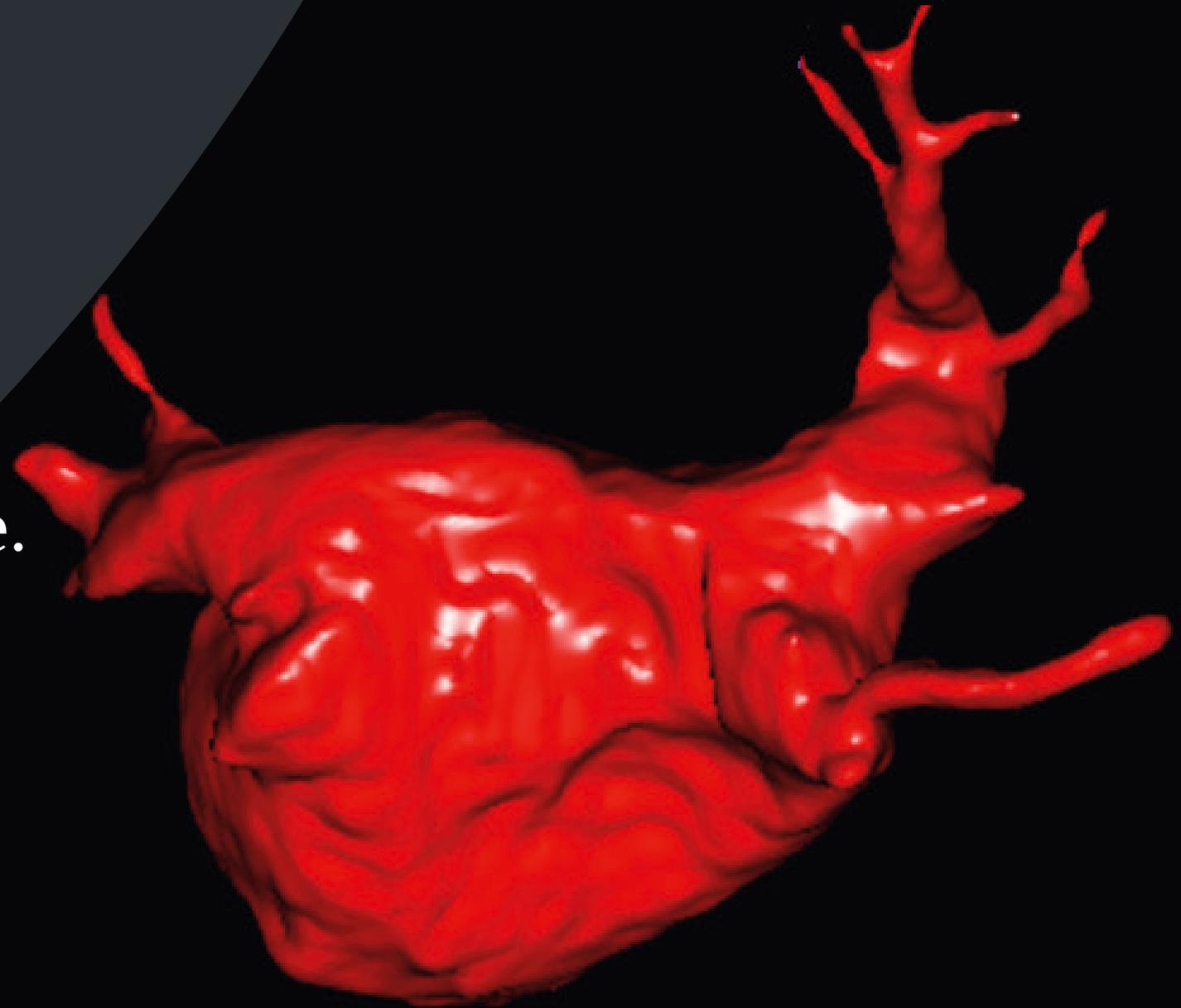
No matter what the clinical speciality in cardiology, all interventional approaches have one goal in common: To confidently provide advanced patient care, you need to reliably detect subtle details. Especially in the case of long-lasting or pediatric procedures, this has to be achieved at the lowest possible dose. Artis Q.zen supports you in achieving that goal by providing unique features, ranging from state-of-the-art X-ray generation to crystalline silicon detector technology.

What makes a masterpiece? It's not just an image that optimally guides diagnosis and treatment with the highest standard in all aspects of image quality. It's more. It's the way this image was achieved – at the lowest possible dose and in challenging situations such as steep angulations. A masterpiece is an image that finally helps you optimize your daily routine, by decreasing the need for other imaging modalities and by shortening overall procedure times. Sometimes, it even opens up new diagnostic possibilities.

Curious? Find out what's behind the masterpieces of Artis Q.zen – and see for yourself how visionary intervention turns into clinical practice.

Interventional cardiology	4-6
Electrophysiology	7-10
Congenital heart disease	11-12
Technologies enabling the Artis Q.zen masterpieces	13-15

Q.zen can achieve.



# Clearly visualize distal coronary branches

In cases of total occlusion, collateral vessels play an increasingly important role. Small and rapidly moving coronary branches can be difficult to visualize, however, which may decrease the chances of a reliable assessment of collateral blood supply.

**Your clinical benefit:** Perform a confident evaluation of even the smallest coronary vessels by revealing fine details due to a higher spatial resolution. Benefit from higher temporal resolution in the case of strongly moving coronary branches. The Artis Q.zen is equipped with the GIGALIX X-ray tube, which provides high spatial and temporal resolution. Unique technology, such as the second generation flat emitter and short X-ray pulses, paves the way for robust coronary angiography.

## The technical enablers

- GIGALIX X-ray tube – small and square-shaped focal spots for higher spatial resolution
- GIGALIX X-ray tube – short pulse widths for increased temporal resolution



Complete LAD occlusion. Double injection to visualize collateral filling.

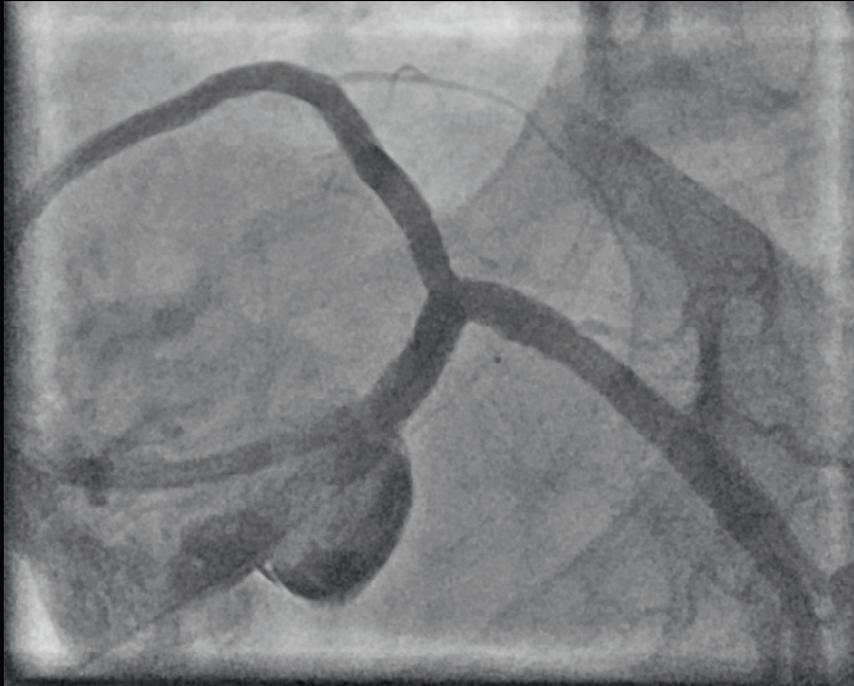
Patient height: 167 cm  
Patient weight: 65 kg  
BMI: 23.3  
(same patient as opposite)

Tube voltage: 85 kV  
Tube current: 403 mA  
Pre-filtration: 0 mm Cu  
Focal spot: small  
FOV: 26 cm  
Detector dose: 144 nGy/frame  
DAP: 2.9  $\mu\text{Gy}^2/\text{frame}$

Discover more:  
[siemens.com/  
coronary-  
branches](https://www.siemens.com/coronary-branches)



# High-contrast imaging despite steep angulations



Spider view of ostial and bifurcation lesion after stenting. In addition to increased contrast, the smaller focal spots in the GIGALIX X-ray tube allow you to clearly identify the guidewires.

Patient height: 167 cm  
Patient weight: 65 kg  
BMI: 23.3  
(same patient as opposite)

Angulation: LAO 45° / CAUD 27°  
Tube voltage: 100 kV  
Tube current: 792 mA  
Pre-filtration: 0 mm Cu  
Focal spot: large  
FOV: 20 cm  
Detector dose<sup>1</sup>: 165 nGy/frame  
DAP: 2.5  $\mu\text{Gym}^2/\text{frame}$

In order to evaluate coronary flow after a complex procedure, e.g. stenting of all three coronary arteries, an acquisition at a steep, double-oblique angulation often becomes necessary. Due to the greater amount of tissue the X-rays have to penetrate, image quality may deteriorate.

**Your clinical benefit:** Confidently perform steep angulations at maximized contrast and minimized patient dose. The GIGALIX X-ray tube provides greater power and is therefore able to deliver the required dose at lower voltages.

Steep angulations, or "spider views," usually put the X-ray tube to the test: With every 3 cm of increase in water value, the patient dose has to double to maintain low image noise. Conventional tubes therefore quickly reach their maximum tube voltage thus degrading contrast in the image.

## The technical enablers

- GIGALIX X-ray tube – greater tube power for increased contrast
- GIGALIX X-ray tube – small and square-shaped focal spots for higher spatial resolution

<sup>1</sup> Referring to a 22 cm FOV

Discover more:  
[siemens.com/  
high-contrast-  
imaging](https://www.siemens.com/high-contrast-imaging)



# Low-dose acquisition of high-grade CX stenosis

Radiation awareness has dramatically increased in interventional cardiology. As well as low patient dose, the management of operator dose has gained a higher priority. Best practice guidelines have become established, however a low-dose angiography system still remains the fundamental basis to minimize exposure.

**Your clinical benefit:** The Artis Q.zen's low-dose protocols represent a fine-tuned composition of X-ray parameters that fully leverage the system's unique technology. The acquisition on the right was acquired with a dose area product (DAP) of only  $0.31 \mu\text{Gym}^2/\text{frame}$ .

## The technical enablers

- GIGALIX X-ray tube – greater tube power for more pre-filtration and minimized patient dose
- GIGALIX X-ray tube – small and square-shaped focal spots for higher spatial resolution
- GIGALIX X-ray tube – short pulse widths for increased temporal resolution



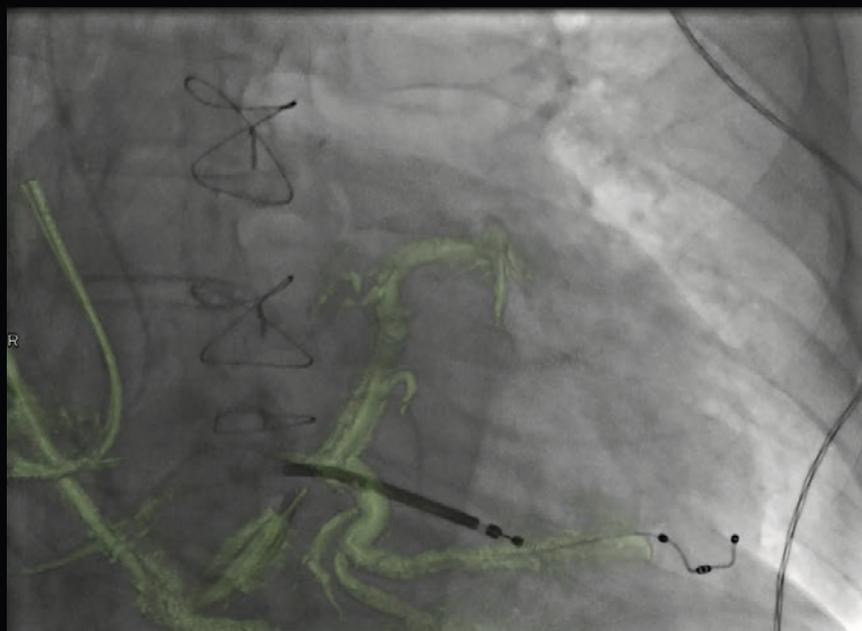
High-grade circumflex (CX) coronary artery stenosis. High contrast and spatial resolution despite low-dose protocol (detector dose of  $80 \text{ nGy}/\text{frame}$  at reference FOV).

Tube voltage: 78 kV  
Tube current: 410 mA  
Pre-filtration: 0.2 mm Cu  
Focal spot: small  
FOV: 32 cm  
Detector dose: 56 nGy/frame  
DAP:  $0.31 \mu\text{Gym}^2/\text{frame}$

Discover more:  
[siemens.com/  
cx-stenosis](https://www.siemens.com/cx-stenosis)



# Confident lead placement with *syngo* DynaCT Cardiac



Patient height: 185 cm  
Patient weight: 94 kg  
BMI: 27.5

In cardiac resynchronization therapy (CRT), transvenous implantation of coronary sinus (CS) pacing electrodes has become a frequently used approach to establish left- or biventricular pacing. Lead-related complications still make up for a significant portion of therapy failures.<sup>1</sup> What if you could use an application which supports you in placing the leads more accurately?

**Your clinical benefit:** Confidently place pacemaker leads in the CS with the help of intraprocedural rotational angiography. *syngo* DynaCT Cardiac helps you to clearly visualize the target vein for CS lead implantation. Thanks to the generated 3D images, the availability of any caudal or cranial reference view minimizes the need for additional venographies. Compared to a small detector, the mid-size detector on the Artis Q.zen facilitates patient positioning and helps you to cut time during the procedure.

## The technical enablers

- Mid-size crystalline silicon detector – increased FOV for easier patient positioning in *syngo* DynaCT studies compared to a small detector

<sup>1</sup> Gutleben et al., *Europace*. 2011 May; 13(5):675-82.

Discover more:  
[siemens.com/  
lead-placement](https://www.siemens.com/lead-placement)



# A new benchmark for ultra-low dose procedures in electrophysiology

Routine procedures in electrophysiology, such as catheter ablations to treat atrial fibrillation, are long-lasting procedures. The patient dose levels may reach 15 mSv<sup>1</sup>, which poses a risk not only to the patient, but also to the operator.

**Your clinical benefit:** Eliminate electronic noise and perform fluoroscopy at ultra-low-dose levels, i.e., below 20 nGy/frame. Fluoroscopy with conventional technology is usually performed at around 30 nGy/frame in order to compensate for the image quality deterioration due to electronic noise. Depending on the operator preference, typical Artis Q.zen fluoroscopy settings include a detector dose of only 10 nGy/frame at the same frame rate of 5 frames per second, reducing the detector dose by a factor of three compared to conventional systems. A recent study has shown that the Artis Q.zen reduces patient dose (dose area product) for EP procedures by more than 60%.<sup>2</sup>

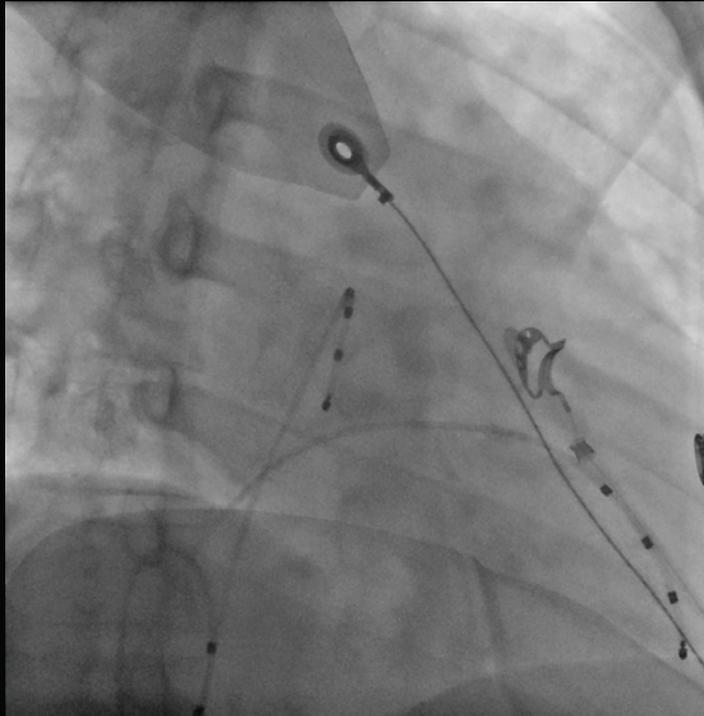
## The technical enablers

- Crystalline silicon detector – high sensitivity for ultra-low-dose imaging

<sup>1</sup> Heïdbüchel et al., *Europace*. 2014 Jul; 16(7):946-64.

<sup>2</sup> Knecht et al., *European Heart Journal*. 2014; 35 (Abstract Supplement ):710-711.

Detector dose: 39 nGy/frame



Fluoroscopy showing electrodes and electroanatomical mapping catheters during an ablation procedure. The image quality is excellent, as a conventional fluoroscopy dose of 39 nGy/frame was used.

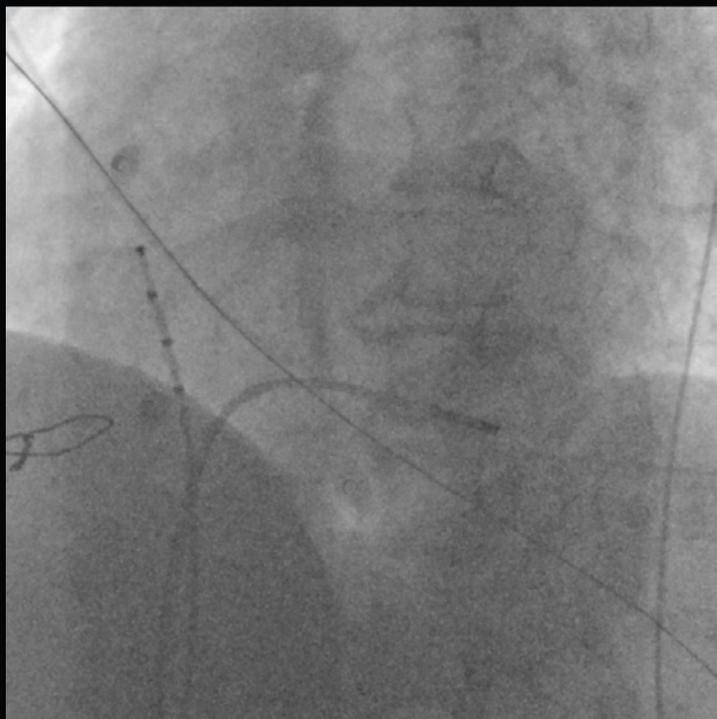
“In my view, Artis Q.zen rates as one of the world’s best angiography X-ray systems.”

Professor Stefan Osswald, MD,  
Head of Cardiology at Basel  
University Hospital, Switzerland

Discover more:  
[siemens.com/  
ultra-low-dose-  
procedure-ep](https://www.siemens.com/ultra-low-dose-procedure-ep)

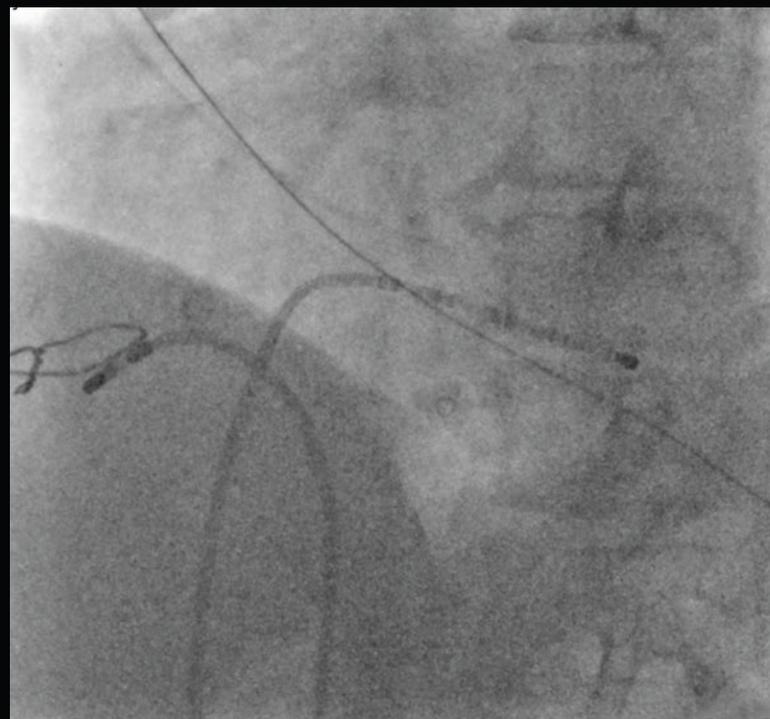


### Detector dose: 10 nGy/frame



The fluoroscopy dose was cut to 10 nGy/frame, which reflects a routine fluoroscopy dose commonly used with Artis Q.zen. The image appears grainier due to the dose reduction, but is still diagnostic as the ablation catheters can be clearly visualized. The larger size of EP catheters, as compared with other small objects, such as stents, enables dose reduction. Conventional systems, however, would suffer from much greater noise, as the contribution of electronic noise is significant at this detector dose level. The Artis Q.zen is able to achieve good image quality in the ultra-low-dose range, as the crystalline silicon technology removes electronic noise.

### Detector dose: 6 nGy/frame



The detector dose of this fluoroscopy scene is reduced to the minimum of 6 nGy/frame. Despite this immensely low detector dose, the catheters are still visible and the procedure can still be safely performed. Elimination of electronic noise with the Artis Q.zen contributes greatly to image quality in this range of detector doses.

# Precise depiction of pacemaker leads in ultra-low-dose fluoroscopy

The accurate placement of LV leads of CRT devices usually causes long procedure and fluoroscopy times. The latter worsens both patient and operator dose burden. Low-dose settings are limited by a threshold which is governed by the image quality, for example, for catheter visibility. Therefore conventional angiography systems operate with detector dose values of around 40 nGy/frame.

**Your clinical benefit:** Cut the dose by a factor of four compared to conventional systems and minimize electronic noise to increase image quality.

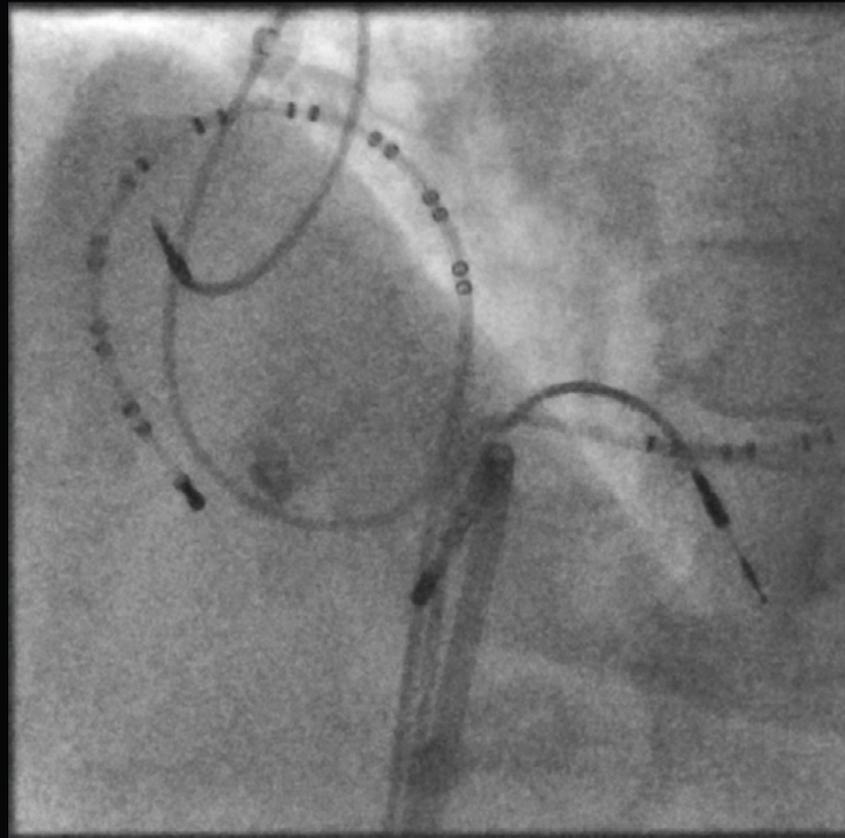
The Artis Q.zen's crystalline silicon technology allows you to place pacemaker electrodes at a detector dose of only 10 nGy/frame. To further minimize dose, the Artis Q.zen supports electroanatomic mapping and navigation systems from St. Jude Medical (Ensite™ Velocity™, MediGuide™ Technology) and Biosense Webster (CARTO®3).<sup>1</sup>

## The technical enablers

- Crystalline silicon detector – high sensitivity for ultra-low-dose imaging

<sup>1</sup> J Cardiovasc Electrophysiol. 2015 Feb;26(2):167-75.

Discover more:  
siemens.com/  
ultra-low-dose-  
pacemaker-  
leads



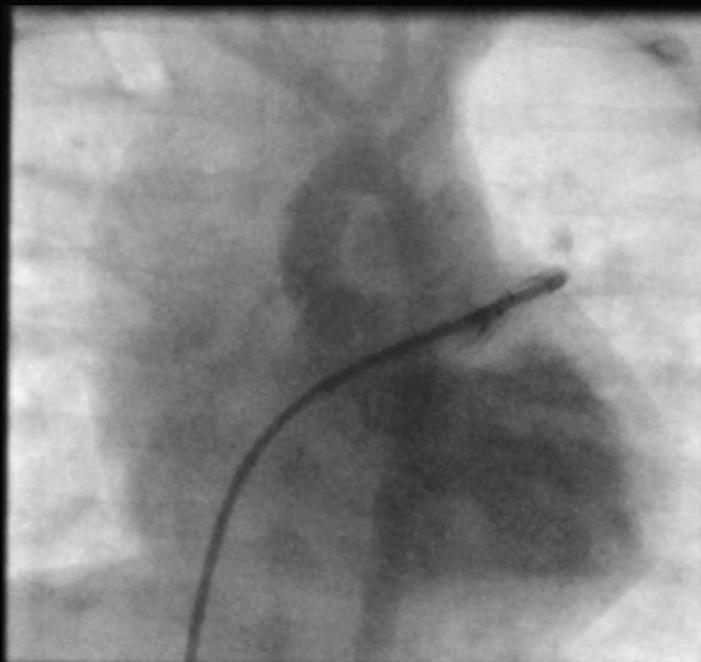
Visualization of pacemaker and electroanatomical mapping catheters at a fluoroscopy detector dose of only 10 nGy/frame.

Patient height: 168 cm  
Patient weight: 75 kg  
BMI: 26.6

Tube voltage: 77 kV  
Tube current: 143 mA  
FOV: 26 cm  
Detector dose: 10 nGy/frame

“We are confident that we are doing the best for all our patients with congenital heart disease by using the Artis Q.zen system. With Siemens ultra-low-dose imaging we achieve drastic reductions in contrast agent and radiation exposure.”

**Frank Uhlemann, MD**  
Chairman of the Center for Congenital Heart Disease,  
Olga Hospital Stuttgart, Germany



Low-dose acquisition of newborn with double right ventricular outflow tract prior to surgery.

Patient age: 3 months  
Patient weight: 3.8 kg

Tube voltage: 59 kV  
Tube current: 164 mA  
Pre-filtration: 0.6 mm Cu  
FOV: 20 cm  
Detector dose<sup>4</sup>: 64 nGy/frame  
DAP: 0.35  $\mu\text{Gym}^2$  (total),  
or 0.007  $\mu\text{Gym}^2$ /frame

## Clear delineation of a double right ventricular outflow tract at a revolutionary low-dose level

When treating pediatric patients with congenital heart disease (CHD), great care has to be taken to keep radiation dose at the utmost minimum. The younger the patients, the more sensitive the organs are to adverse radiation effects. Furthermore, patients suffering from CHD may need to undergo several examinations and interventions, increasing the overall radiation dose burden.

**Your clinical benefit:** Set a new benchmark for the ALARA<sup>1</sup> principle and treat CHD with previously unseen low radiation doses and sufficient image quality. Among a high amount of pre-filtration, the Artis Q.zen provides the means to cut the dose where it matters most – in pediatrics. The entire acquisition shown on the left achieves a total DAP of only 0.35  $\mu\text{Gym}^2$  (0.007  $\mu\text{Gym}^2$ /frame), which represents a drastic reduction compared to examinations performed with conventional technology.<sup>2,3</sup>

### The technical enablers

- GIGALIX X-ray tube – greater tube power for more pre-filtration and minimized patient dose
- Crystalline silicon detector – high sensitivity for ultra-low-dose imaging

<sup>1</sup> ALARA: As low as reasonably achievable

<sup>2</sup> Sun et al., *J Radiat Res.* 2014 Nov; 55(6):1122-30.

<sup>3</sup> Manica et al., *Arq Bras Cardiol.* 2014 Aug;103(2):131-7.

<sup>4</sup> Referring to a 22 cm FOV

Discover more:  
[siemens.com/  
ventricular-  
outflow](http://siemens.com/ventricular-outflow)



# Treatment of subclavian artery fistula

When it comes to pediatric imaging, radiation dose usually is the most prominent concern. The challenge is to use the lowest possible dose, but to obtain images that are sufficient for sound treatment decisions, which do not require repeat imaging. The exact placement of closure devices require detailed knowledge of the anatomy, which may cause an increased patient dose burden in conventional systems.

**Your clinical benefit:** Be confident to routinely work at the lowest possible dose when it matters most and gain detailed knowledge of the patient's anatomy. Choose between imaging in the ultra-low-dose range to gain an anatomical overview, for instance, or applying regular pediatric dose for excellent image quality, for instance to identify small anatomical irregularities or when visualizing small devices – always in accordance with ALARA<sup>1</sup>.

## The technical enablers

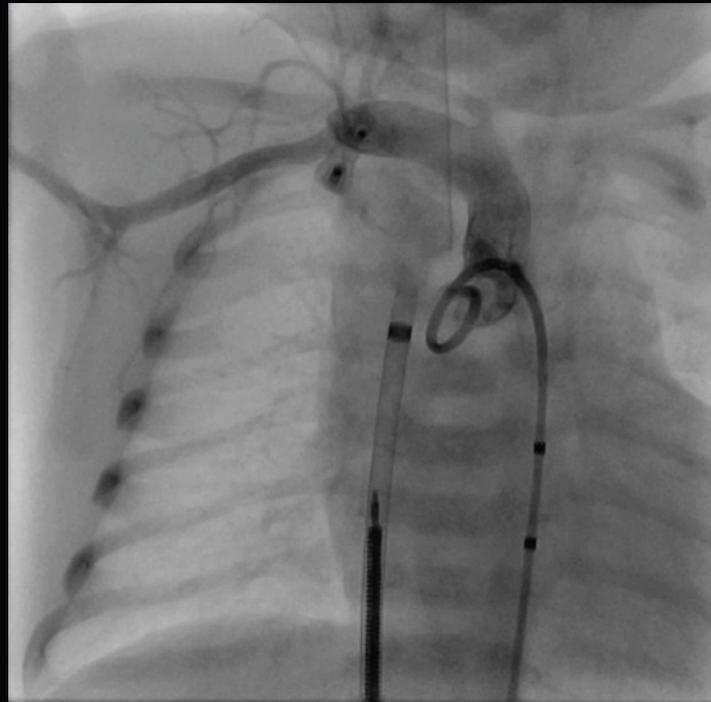
- GIGALIX X-ray tube – greater tube power for more pre-filtration and minimized patient dose
- GIGALIX X-ray tube – small and square-shaped focal spots for higher spatial resolution
- GIGALIX X-ray tube – short pulse widths for increased temporal resolution
- Crystalline silicon detector – high sensitivity for ultra-low-dose imaging

<sup>1</sup> ALARA: As low as reasonably achievable

<sup>2</sup> Ghelani et al., *JACC Cardiovasc Interv.* 2014 Sep;7(9):1060-9.

“ We looked at some of our procedures, which we did on the Artis Q.zen, and our dose is between 30% and 60% less than the figures published in current studies.<sup>2</sup> ”

Luke Lamers, MD,  
Director of the cath lab in the cardiology department  
of the American Family Children's Hospital  
at the University of Wisconsin, Madison, USA



Treatment of subclavian artery to superior vena cava fistula with closure device

Patient age: Newborn  
Patient weight: 3.5 kg

Tube voltage: 59 kV  
Tube current: 325 mA  
Pre-filtration: 0.6 mm Cu  
FOV: 26 cm  
Detector dose: 85 nGy/frame  
DAP: 4.05  $\mu\text{Gy}^2$ , respectively  
0.027  $\mu\text{Gy}^2/\text{frame}$

Discover more:  
[siemens.com/  
artery-fistula](https://www.siemens.com/artery-fistula)



# Technologies

## enabling the Artis Q.zen masterpieces

Confidently perform even the most demanding diagnostics and interventions – at ultra-low dose

The Artis Q.zen product line for interventional imaging is a visionary breakthrough in X-ray detection with unique sensitivity that enables ultra-low-dose imaging. It takes performance in X-ray generation and precision to the next level.

- **Powerful GIGALIX X-ray tube** – its flat emitter technology provides unparalleled performance for excellent image quality at the lowest possible dose.
- **Crystalline silicon detector** – on-pixel amplification eliminates electronic noise and boosts the image quality in the ultra-low-dose range of less than 20 nGy/frame.

- **Automatic Exposure Control** – automatic, real-time, and angulation-dependent setting of X-ray parameters, including pre-filtration and focal spot, for optimum image quality at minimal patient dose.
- **syngo DynaCT Cardiac** – visualize cardiac structures like the aortic root, the left atrium, or pulmonary veins in 3D, in the cath lab.

Did you know that all CARE+CLEAR packages are a standard feature in every Artis Q.zen? On our website, you can find more information on our applications for dose reduction:



GIGALIX X-ray tube – focused power



The Artis Q.zen's detector (26 cm x 29 cm) uses crystalline silicon to generate the image.

# GIGALIX X-ray tube – focused power

Certainty even in challenging situations, for example, when treating obese patients or for steep angulations.

## A breakthrough in X-ray tube technology

Increase certainty and confidence in challenging situations, for example, when treating obese patients or for steep angulations, and minimize patient dose at the same time. The GIGALIX X-ray tube of Artis Q.zen concentrates high pulse power on small square-shaped focal spots. This maximizes contrast as well as spatial and temporal resolution – and as a result improves the image quality.

The high tube power allows additional prefiltration to optimally shape the X-ray spectrum – for minimized patient and operator dose.

The benefits include:

- Improved contrast – high tube power allows acquisition of images closer to optimal tube voltage of 70 kV
- Treating obese patients even at steep angulations – with the industry's fastest 75 m/s focal spot track speed, the GIGALIX provides greater tube power on small focal spots
- Up to 60 percent less patient dose – greater tube power allows increasing prefiltration
- Increased temporal resolution – 43 percent\* shorter pulses because the GIGALIX can provide the same amount of energy in a shorter period of time

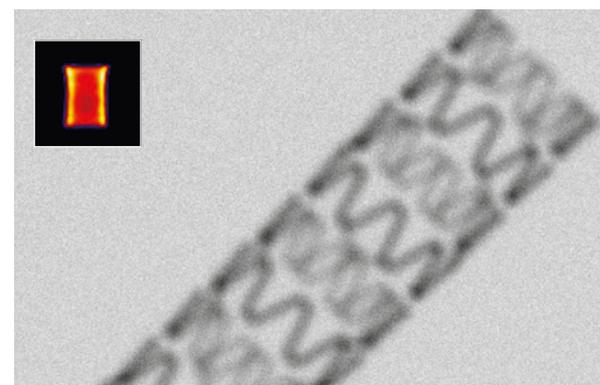


Image of coronary stent.  
Filament tube with rectangular-shaped focal spot.

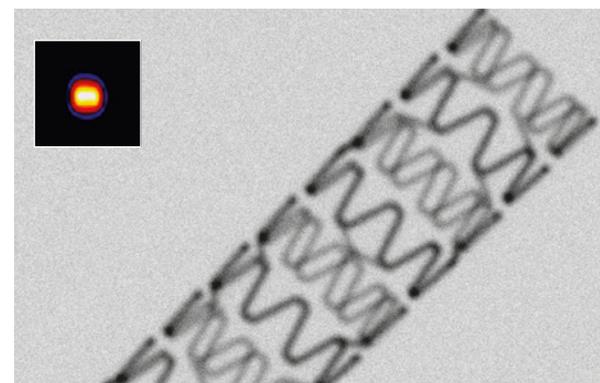


Image of coronary stent.  
Flat emitter tube with square-shaped focal spot.

The GIGALIX X-ray tube of Artis Q.zen increases the visibility of small vessels or coronary stents, for example, up to 70 percent\* compared to previous X-ray tube technology.

\* Compared to standard filament technology. Data on file.

# Crystalline silicon detector

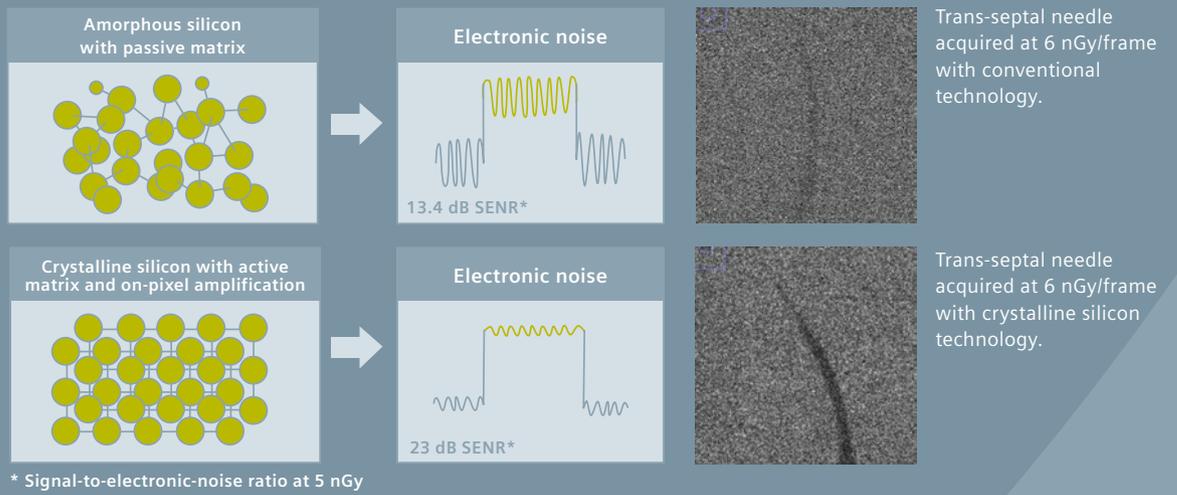
High sensitivity for ultra-low-dose imaging

## Minimize electronic noise with on-pixel amplification

The Artis Q.zen is currently the only angiography system worldwide that uses crystalline silicon in its X-ray detector. As opposed to conventional amorphous silicon technology, the electric signal is now amplified directly on the individual detector pixel. As electronic components always generate electronic noise, the less distance a signal has to travel, the less electronic noise it takes up. Artis Q.zen's on-pixel amplification drastically cuts the distance between signal generation and amplification and thus minimizes the electronic noise.

## Setting new standards in electrophysiology and congenital heart disease treatment

Common fluoroscopy detector doses are set at about 40 nGy/frame. The further the dose is decreased, the larger the role of electronic noise becomes. At 20 nGy/frame, the border to ultra-low-dose imaging, the electronic noise may drastically deteriorate the image quality, undermining confident decision-making. Here, the Artis Q.zen's crystalline detector technology sets the stage for previously unseen dose reduction, enabling electrophysiology procedures at as low as 6 nGy/frame.



\* Signal-to-electronic-noise ratio at 5 nGy

## Meet Artis Q.zen

Artis Q.zen is available in different configurations:



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