Canon

Aquilion Precision

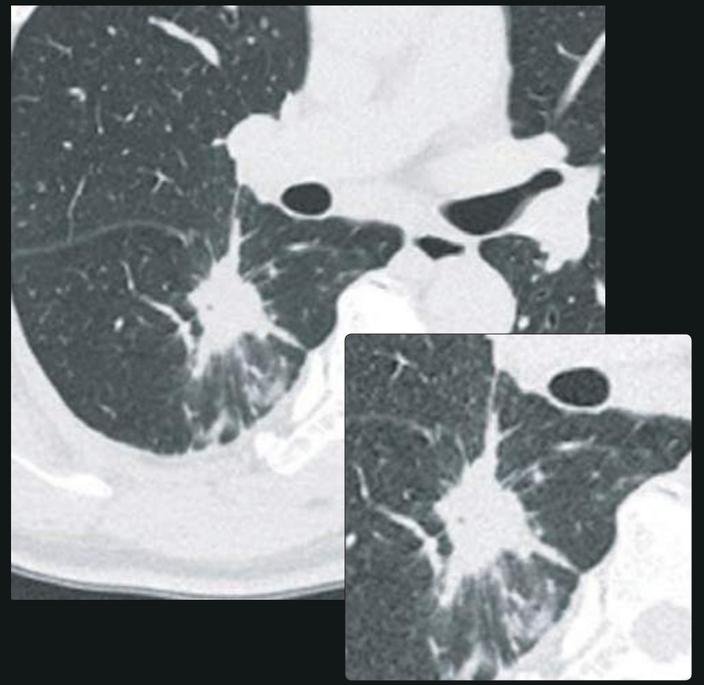
Precision in Every Detail

Ultra-High Resolution CT

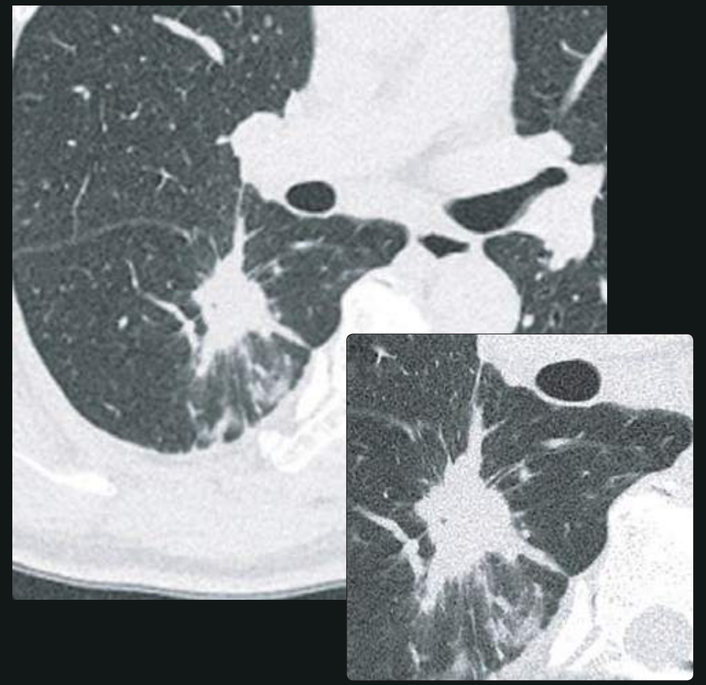
Precision in Every Detail

The world's first Ultra-High Resolution (UHR) CT system approved for clinical use.

Anatomy precisely detailed with resolution down to 0.15 mm – smaller than a grain of salt.



Standard CT resolution 0.5 mm, 512 matrix



Ultra-High Resolution CT 0.25 mm, 1024 matrix

Courtesy of Ohara General Hospital, Japan

0.25 mm, 1024 matrix Ultra-High Resolution CT

The world's first Ultra-High Resolution CT

Imaging patient anatomy at twice the resolution of a conventional CT scanner, the Aquilion Precision has particular utility in the evaluation of the vascular system for disease and collateral vessel scoring, in tumor staging and classification, as well as in pre-surgical planning and post-surgical monitoring.

Aquilion Precision represents the culmination of over 10 years of research and development of a rich array of new, patented manufacturing techniques. The application of a deep learning, artificial intelligence reconstruction algorithm was a key development that enables Ultra-High Resolution scanning (0.25 mm slice thickness, 1024 matrix) to be routinely performed at standard CT dose levels.

Aquilion Precision

Ultra-High Resolution CT

Deep Learning Reconstruction

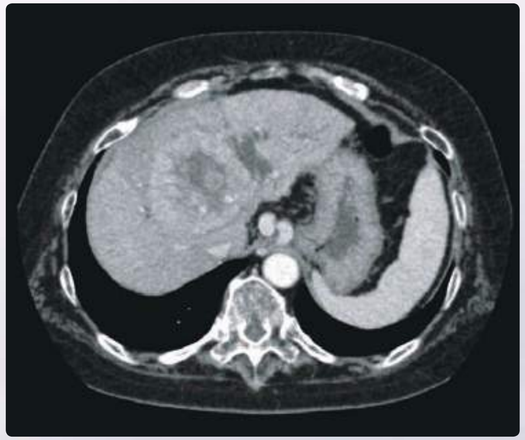
Ultra-High Resolution CT at standard CT dose

The Aquilion Precision introduces a revolutionary approach to CT reconstruction that leverages Deep Learning Neural Networks specifically trained to perform one task – reconstruct images that are sharp, clear, and distinct.

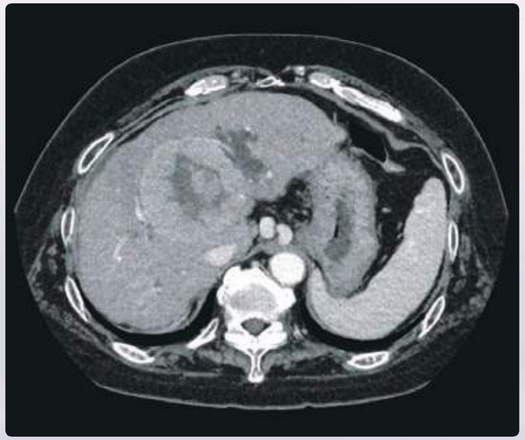
Known as AiCE (Advanced intelligent Clear-IQ Engine) this deep learning reconstruction network is trained on an advanced Model-Based Iterative Reconstruction (MBIR) algorithm to produce low noise, natural texture, and 0.25 mm, 1024 matrix Ultra-High Resolution CT images several times faster than clinical MBIR today.

AiCE – Deep Learning Reconstruction

- Exceptional low noise properties
- Enhanced anatomical resolution
- Superb image homogeneity (texture)
- Fast reconstruction – at least 4X MBIR



0.5 mm, 512 matrix
Standard CT
(CTDI vol:11.8 mGy) AIDR*2 3D



0.25 mm, 1024 matrix
UHR CT
(CTDI vol:12.4 mGy) AiCE

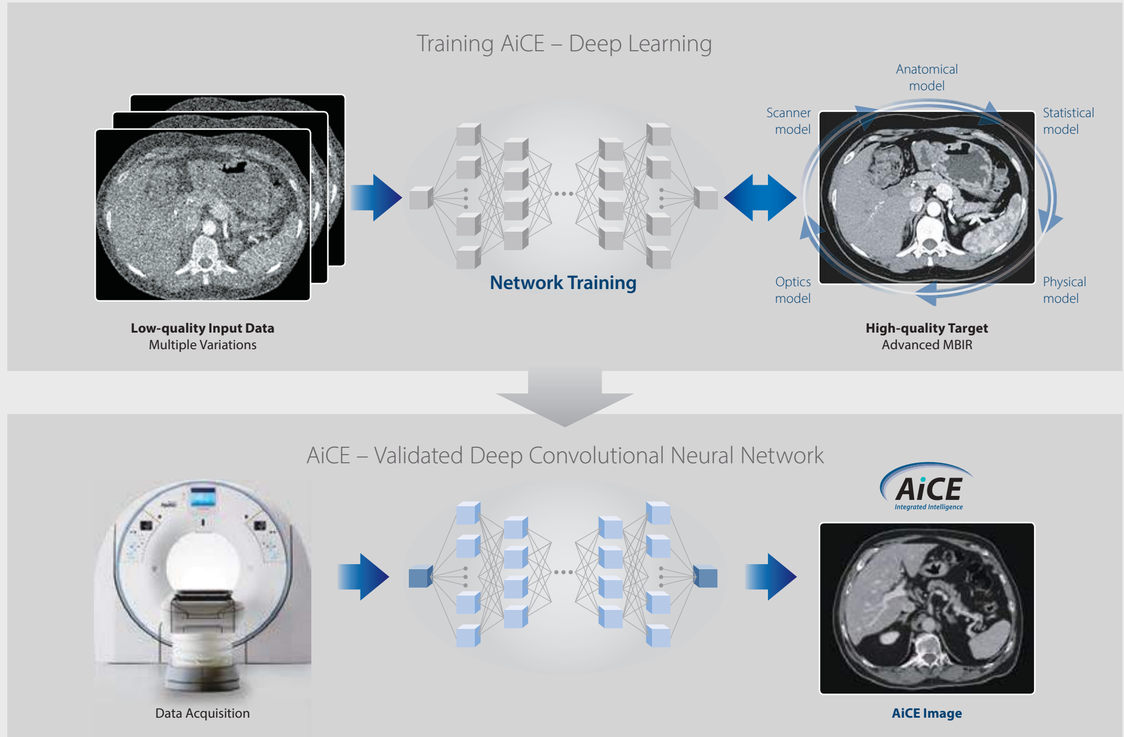
Courtesy of Fujita Health University Hospital, Japan

*2 Adaptive Iterative Dose Reduction

Deep Learning Reconstruction

Artificial intelligence technologies have taken huge steps forward in recent years, in large part due to the development of Deep Convolutional Neural Networks (DCNN)s. DCNNs process enormous amounts of data through a network of decision-making nodes, called neurons. AiCE applies the tremendous power of DCNNs to the task of image reconstruction.

AiCE was trained on vast amounts of high-quality images reconstructed with an advanced MBIR algorithm that is too computationally intensive for clinical use. This training taught AiCE to distinguish true signal from noise. The results were validated by a team of radiologists, medical physicists, AI scientists, and clinical researchers, producing a fast, fully-trained reconstruction algorithm ready for clinical use.



One giant leap for medical imaging

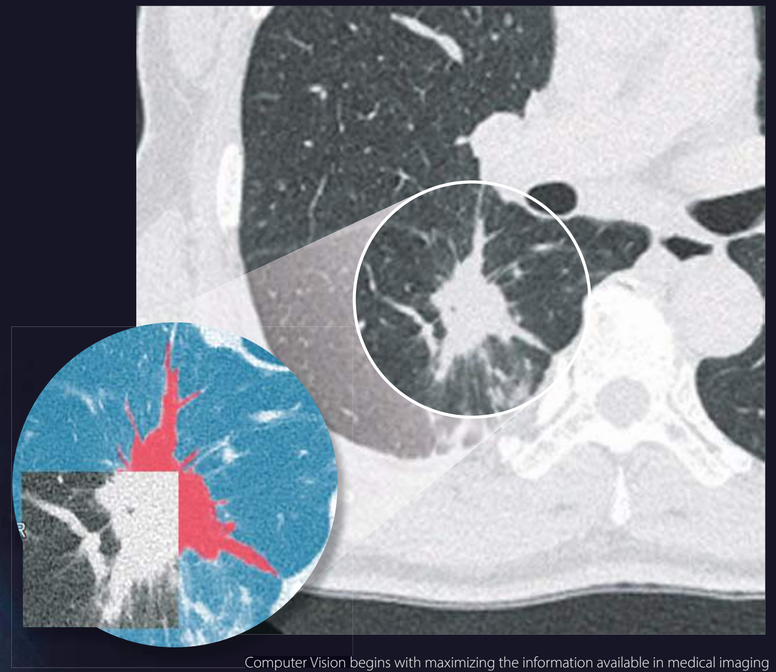
AI in radiology

The long-standing barrier to Ultra-High Resolution CT has fundamentally been the increased image noise associated with finer sampling by smaller detector elements.

The introduction of AiCE reconstruction in Precision marks a historic moment in medical imaging. As the first Deep Learning Reconstruction technology applied to CT, AiCE has established the ability to acquire Ultra-High Resolution 0.25 mm 1024 matrix examinations to be performed at the same dose levels required at standard 0.5 mm 512 matrix CT imaging.

UHR CT is a clinical reality. The noise barrier that has been the target of all manufacturers to break through for decades has been removed completely.

AiCE is a giant leap into the future – a future of Deep Learning artificial intelligence applications that will enrich medical imaging professionals ability to focus on what really matters, the patient.



Computer Vision begins with maximizing the information available in medical imaging

Courtesy of Ohara General Hospital, Japan

Ultra-High Resolution CT

Precision Clinical Imaging

CT Angiography with DSA Resolution

Courtesy of Radboud University Medical Center, the Netherlands

Ultra-High Resolution CT – staging of pancreatic malignancies

"The promise of UHR CT is a clinical reality today. I have been fortunate enough to have evaluated the system which showed great potential for early tumor detection.

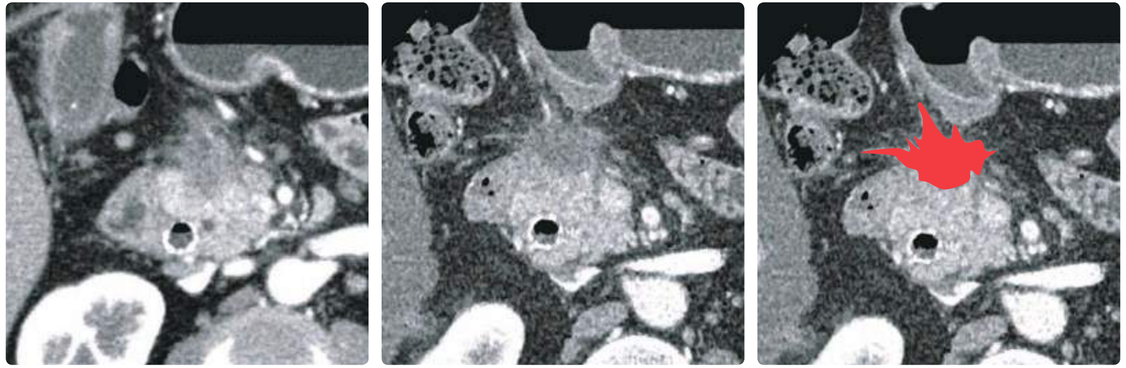
I am seeing anatomical structures resolved in clear detail that I never thought would be possible with CT, and at standard CT dose.

As radiologists worldwide gain more collective experience, there is an exciting future ahead for the paradigm change in imaging work-up of cancer guidelines that will become routine with UHR CT."

Miyuki Sone, MD

Consultant Radiologist, Department of Diagnostic Radiology,
Head of Interventional Radiology
National Cancer Center Hospital, Tokyo, Japan

Pancreatic neuro-endocrine tumor



0.5 mm, 512 matrix
Standard CT

0.25 mm, 1024 matrix
UHR CT

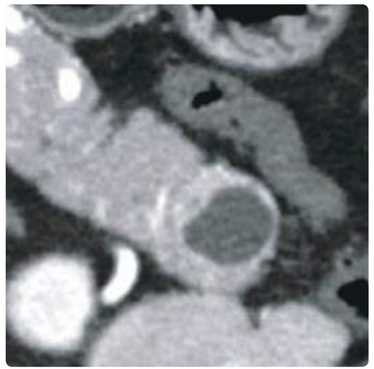
0.25 mm, 1024 matrix
UHR CT

Staging of pancreatic carcinoma is often difficult in CT and requires a needle biopsy leading to a poor prognosis for the patient. The detail afforded by Ultra-High Resolution CT shows the spiculated margins clearly from surrounding tissue and provides real ability to assess for local tumor invasion with a high degree of diagnostic confidence – one giant leap in the fight to cure patients with pancreatic cancer.

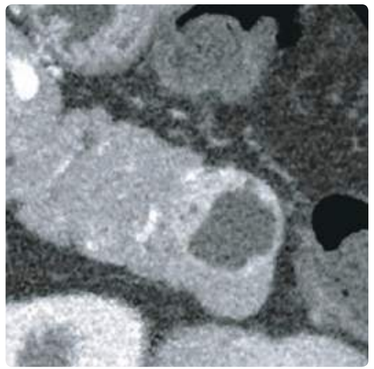
SHR scan mode, CTDI 17.1 mGy, DLP 446.4 mGy, 6.7 mSv (k factor=0.015)*

Courtesy of National Cancer Center Hospital, Japan

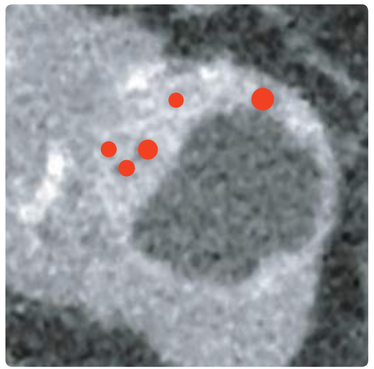
Ultra-High Resolution CT – staging of pancreatic malignancies



0.5 mm, 512 matrix
Standard CT



0.25 mm, 1024 matrix
UHR CT



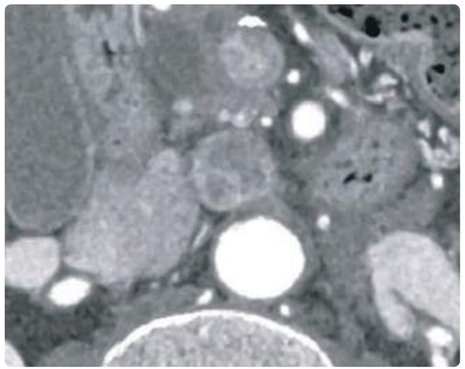
0.25 mm, 1024 matrix
UHR CT

Microcysts within a pancreatic neuro-endocrine tumor are clearly shown with Ultra-High Resolution CT imaging, providing a wealth of information regarding the classification and staging of this tumor.

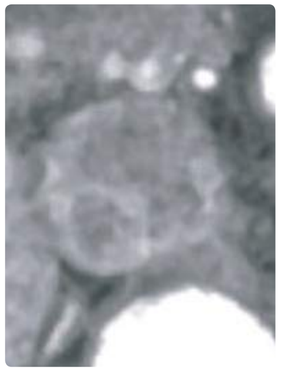
HR scan mode, CTDI 21.6 mGy, DLP 597.0 mGy, 9 mSv (k factor=0.015)*

Courtesy of National Cancer Center Hospital, Japan

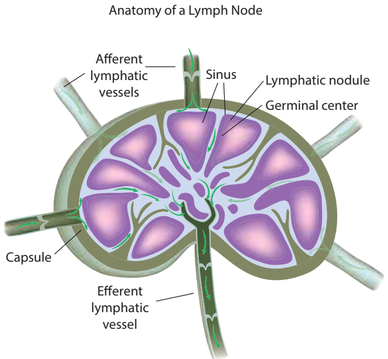
Lymphoma staging



0.25 mm, 1024 matrix
UHR CT



0.25 mm, 1024 matrix
UHR CT



Diagram

The multiple hypo-dense structures seen within the para-arotic lymph node are lymphoid follicles, clearly shown within the internal capsule, and an important indicator in the progression of lymphoma.

HR scan mode, CTDI 15.5 mGy, DLP 415.5 mGy, 6.2 mSv (k factor=0.015)*

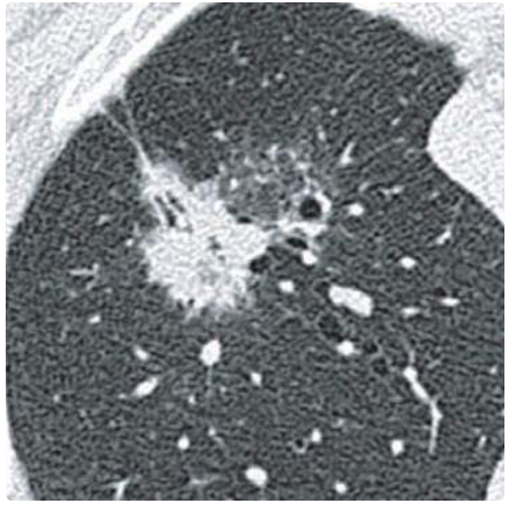
Courtesy of National Cancer Center Hospital, Japan

Ultra-High Resolution CT provides superior image quality in 90% of patients

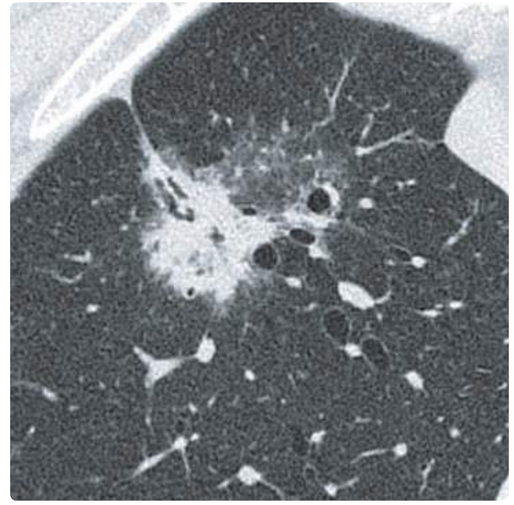
"In a study comparing UHR CT to standard CT for routine chest exams, we asked five radiologists to evaluate image quality and provide their overall impression of diagnostic detail. The UHR CT images were rated superior in 90% of the cases.

UHR CT imaging of the chest improves the radiologists ability to detect solid lesions as well as subtle ground glass opacities." (ECR, 2017)

Patrik Rogalla BS, MD
Site Director, Princess Margaret Hospital
Department of Medical Imaging
Toronto, Canada



0.5 mm, 512 matrix
Standard CT



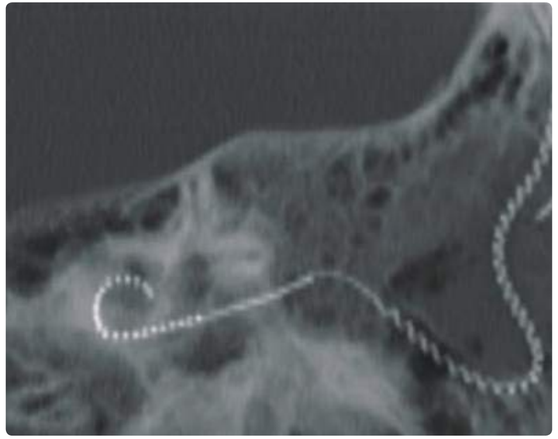
0.25 mm, 1024 matrix
UHR CT

Courtesy of Ohara General Hospital, Japan

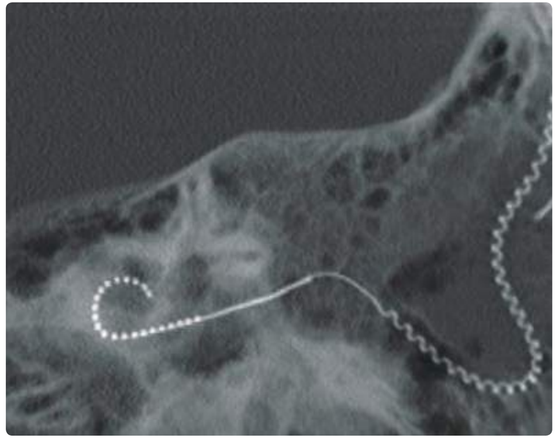
The potential of Ultra-High Resolution CT in clinical practice

"In our institution, all patients needing postoperative evaluation of cochlear implants are selectively scanned on the Aquilion Precision which provides an accurate method to evaluate the exact position of the implant within the inner ear."

Mathias Prokop, MD, PhD
Professor and Chairman of Radiology and Nuclear Medicine
Radboud University Medical Center
Nijmegen, the Netherlands



0.5 mm, 512 matrix
Standard CT



0.25 mm, 1024 matrix
UHR CT

Courtesy of Radboud University Medical Center, the Netherlands

Advantages of pre-procedure planning with Ultra-High Resolution CT

Intra-arterial therapy to treat tumors is extremely effective and several options are available. CT imaging is often required to assist with treatment planning. Ultra-High Resolution CT provides real advantages by visualizing the arterial anatomy with DSA-like resolution.

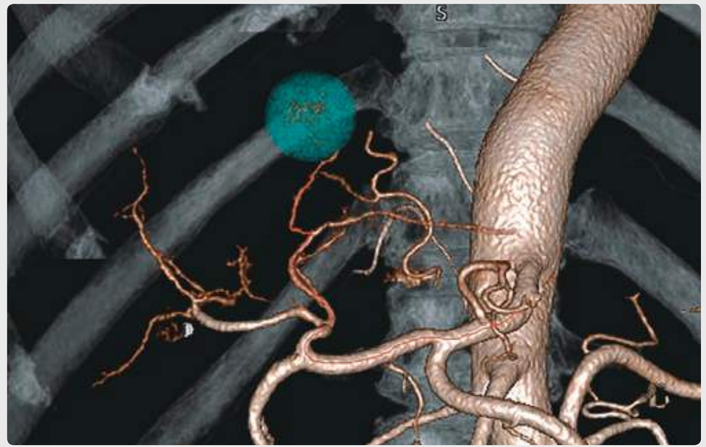
The Aquilion Precision offers these potential benefits:

- Correct identification of the feeding vessels
- Accurate prediction of procedure time
- Provides the opportunity for consultation with others
- Determines optimal therapeutic intervention

And in the Cath Lab during the procedure:

- Less contrast
- Decreased procedure time
- Decreased radiation dose

Intraoperative TACE procedure



UHR CT imaging

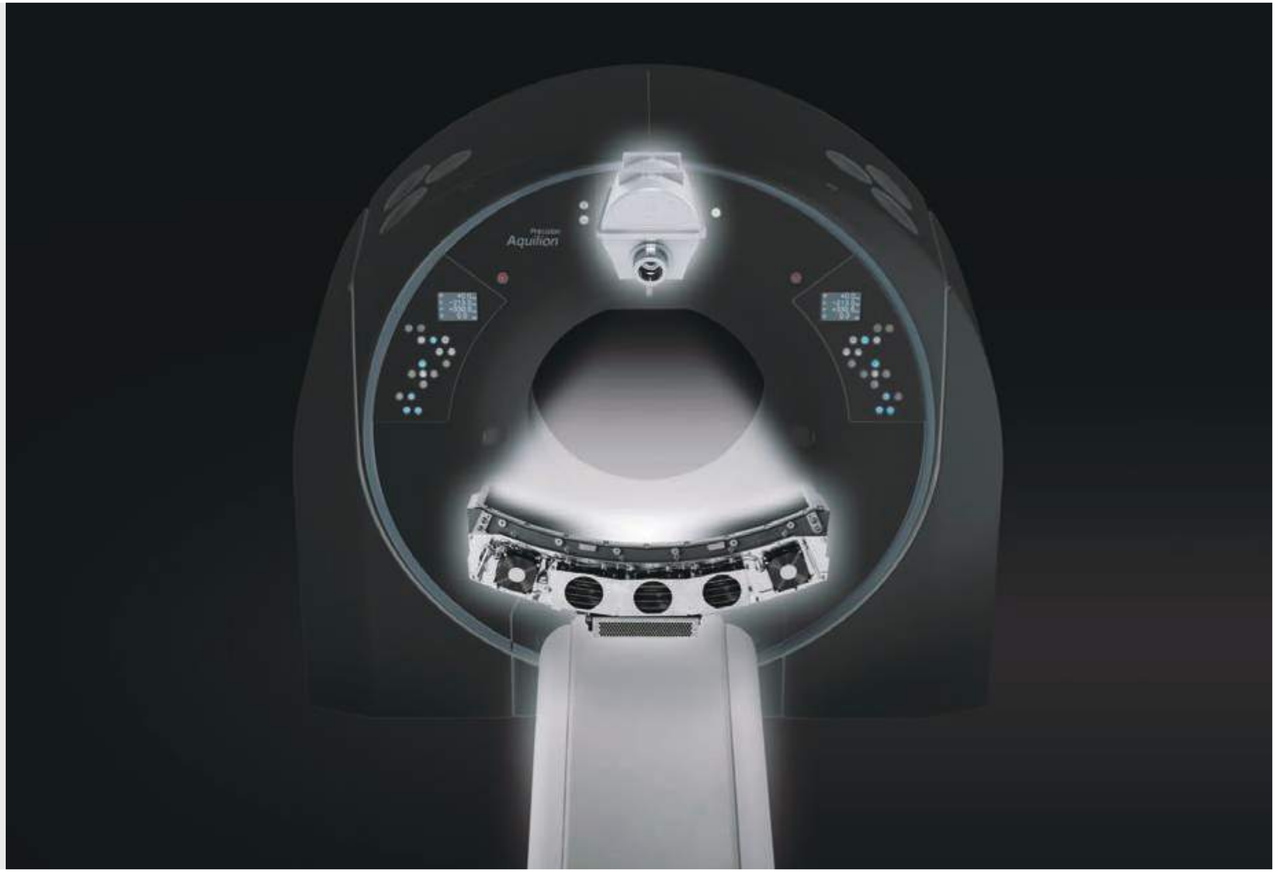
"CTA with Precision provides image details similar to a rotational DSA and allows treatment planning strategies to be considered long before the patient is lying on the operating table. Future application involving augmented reality may soon provide a realistic simulation of various interventional procedures, and will provide a realistic and safe method for new interventionalists to gain hands-on skills."

Miyuki Sone, MD

Consultant Radiologist, Department of Diagnostic Radiology,
Head of Interventional Radiology
National Cancer Center Hospital, Tokyo, Japan

Ultra-High Resolution CT

Precision Intelligence and Technology

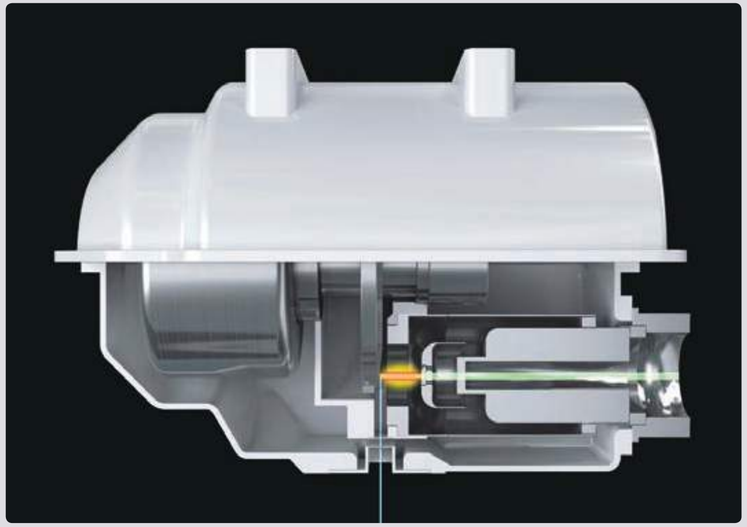


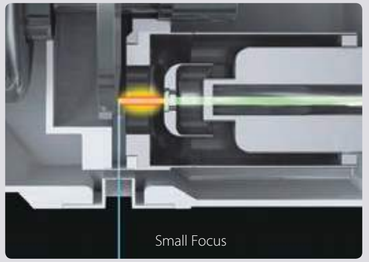
Ultra-High Resolution tube

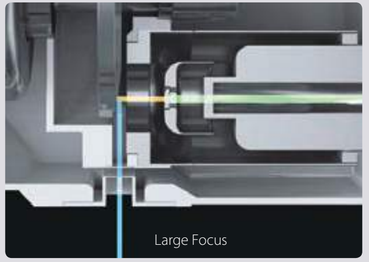
The Ultra-High Resolution tube incorporates an adaptive focal spot, capable of producing six precise focal spot sizes to meet the demands of Ultra-High Resolution CT. The focal spot adapts to the patient size, collimation, matrix and clinical task, ensuring the optimal resolution for every examination.

In clinical practice, the smallest focal spots are required when examining small structures, for example, the inner ear where details are most difficult to visualize. For larger body regions, such as the abdomen, smaller focal spots than would be found on conventional resolution CT scanners are also required, in order to ensure the Ultra-High Resolution provided by the detector is not lost. The Aquilion Precision automatically selects the smallest possible focal spot for the anatomy being scanned.

In addition, the anode spins at a remarkable 10,800 rpm (almost twice as fast as conventional tubes today) which, when combined with a liquid metal bearing, provides the rapid heat dissipation necessary to guarantee fine focal size and ensure longevity.







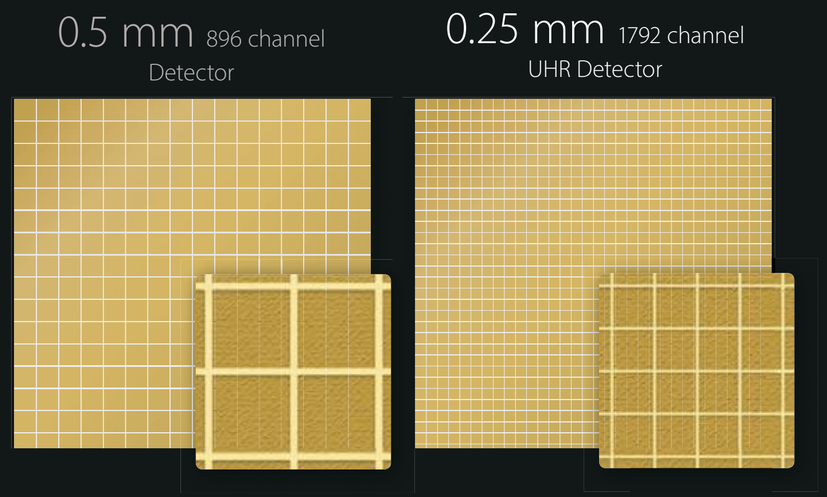
UHR X-ray tube with an adaptive focal spot

Ultra-High Resolution detector

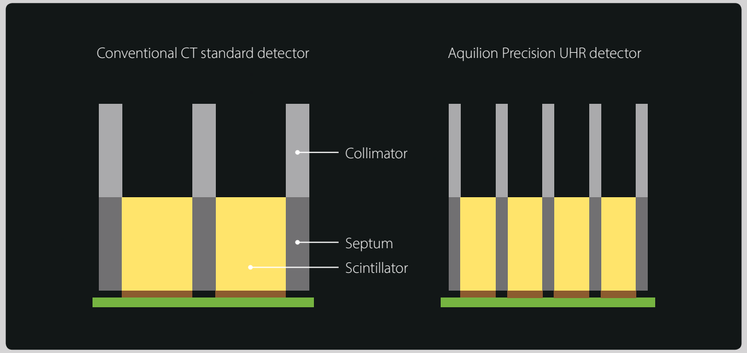
The Ultra-High Resolution detector contains four times the number of distinct detector elements with 160 detector rows and 1792 channels of only 0.25 mm thickness.

To deliver Ultra-High Resolution CT into routine clinical practice required a complete re-engineering of the detector manufacturing process. To maximize the geometric efficiency of the detector, the inter-septal gaps between the detector elements were made much thinner, maximizing the light-sensitive area on the detector.

In order to achieve this advancement, new precision cutting techniques were developed. These techniques yield discrete, 0.25 mm detector elements that are optically isolated to minimize cross talk.



The Aquilion Precision Ultra-High Resolution detector maintains the same geometric efficiency as a conventional detector even though there are four times the number of detector elements, septa and electronics.



50% Finer

- ✓ Scintillator
- ✓ Septum
- ✓ Collimator

Ultra-High Resolution couch

The improvements in resolution of the Precision require all parts of the system to be optimized. The patient couch is no exception.

Ultra-High Resolution scanning requires the couch location to be precise to within 100 microns – the size of a grain of salt. This accuracy is of course required for the clinical demands of a modern CT system and the UHR CT couch can accommodate patients as large as 315 kg (694lbs).

Patient and technologist safety features have also been included in the redesign. This Ultra-High Resolution CT couch is the industry's widest at 47 cm, and the only CT couch to provide 17 cm of lateral table movement.

The Ultra-High Resolution couch enables clear images at 0.15 mm resolution while maintaining the popular design features for patient and technologist comfort and safety.

Once on the table, perfect positioning – No push, no pull.

"Patient positioning is a CT technologist's first consideration for every CT scan. From the moment we greet the patient we are subconsciously assessing for any special needs they may require for the procedure to be comfortable and successful.

Lateral table centering allows patients to lay most comfortably, and at the same time allows for best-practice centering to be performed by all technologists – safely."

Willem Jan van der Woude

CT Specialist Radiographer
Radboud University Medical Center Nijmegen,
the Netherlands

Main Specifications		
Detector		Ultra-High Resolution detector
		160 rows, 0.25 mm
Gantry		Ultra-High Resolution tube
	Focal spot size	0.4 × 0.5 mm (6 Adaptive)
	Rotation time	0.35 s
	Generator	72 kW
	Bore aperture	78 cm
	Tilt	± 30°
Patient couch		Ultra-High Resolution couch
	Max. load	315 kg
	Max. scan range	170–200 cm※3
	Lateral movement	± 8.5 cm※4
Reconstruction speed	Helical	80 fps (1024 matrix)
Reconstruction	Deep Learning Reconstruction	AiCE※4
	Matrix	2048, 1024, 512
Installation	Power capacity	110 kVA
	Min. installation space	19 m^2 (short couch)
Image quality	Spatial resolution	50.0 lp/cm at MTF 0%※5

※3 Depending on system configuration
※4 Option
※5 For reference

* Reference for Radiation Dose Calculation
American Association of Physicists in Medicine (AAPM) Report 96, 2008.

Clinical results may vary due to clinical setting, patient presentation and other factors.
Due to local regulatory processes, some of the products included in this brochure may not be available in each country. Please contact your sales representative for the most current information.

Aquilion Precision

CANON MEDICAL SYSTEMS CORPORATION

https://global.medical.canon

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Design and specifications are subject to change without notice.
Model number: TSX-304A MCACT0336EA 2019-01 CMSC/D/Printed in Japan

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Made For life