SPECIAL

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Advanced Intelligence, Supreme Productivity

Canon

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// EDITORIAL

Dear Readers,

I am pleased to introduce the 4th MRI Global Edition of our VISIONS Magazine. VISIONS Magazine Global Edition MRI Special is Canon Medical Systems' customer magazine to introduce our latest technologies and applications for magnetic resonance imaging (MRI).

Recently, Canon has launched a brand new 3T system, "Vantage Galan 3T / Supreme Edition" at the International Technical Exhibition of Medical Imaging (ITEM) 2024 Conference in Yokohama, Japan. With this system, we achieved our long-held dream of an "All Canon 3T MRI system". This means that all of the main MR hardware components (magnet, gradient coil, and RF system) are now completely made by Canon.

Vantage Galan 3T / Supreme Edition is the result of a complete re-think and optimization of the key components required for a premium MRI system manufactured entirely by Canon, and is launched as a "Value-added MRI system" to the market. In addition, Canon has implemented AI based technologies into the product from an early stage. Therefore, this system has a range of unique AI boosted solutions, and we believe Vantage Galan 3T / Supreme Edition can enhance your "Clinical Confidence".

This edition of our magazine is focused on highlighting the key value of Vantage Galan 3T / Supreme Edition, including technical articles from our engineering specialists and initial experiences from our customers. I hope you will be able to feel our engineers' passion in developing this system and our ongoing spirit of innovation.

Together with our customers, we would like to continue to move our MR technology forward and to provide intelligent solutions for faster and more efficient examinations.

Please enjoy reading this VISIONS Magazine and I look forward to hearing your feedback about this publication.

Kind regards,

Akira Adachi
General Manager,
MRI Systems Division,
Canon Medical Systems Corporation

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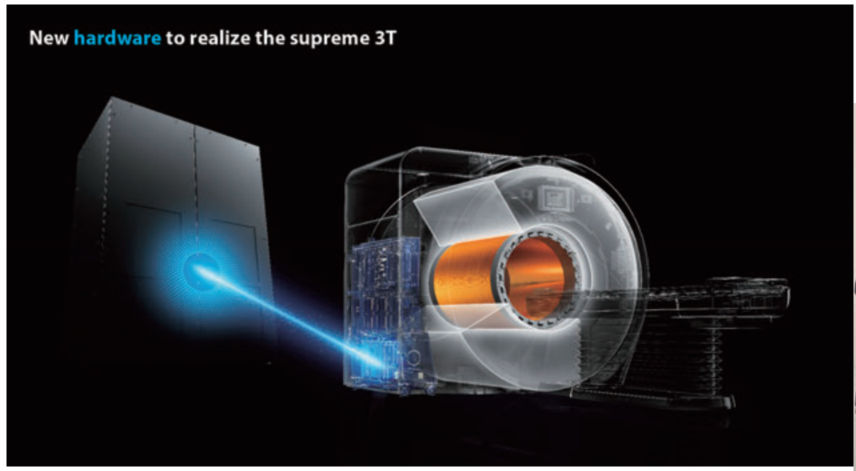
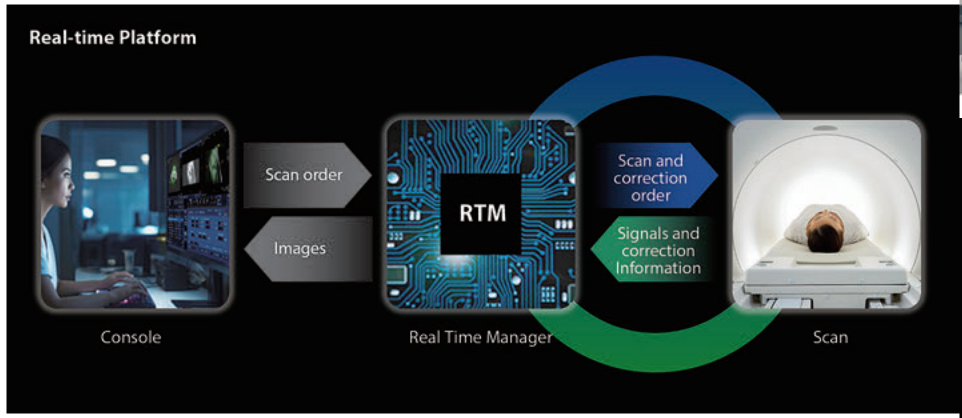


New hardware to realize the supreme 3T



Real-time Platform
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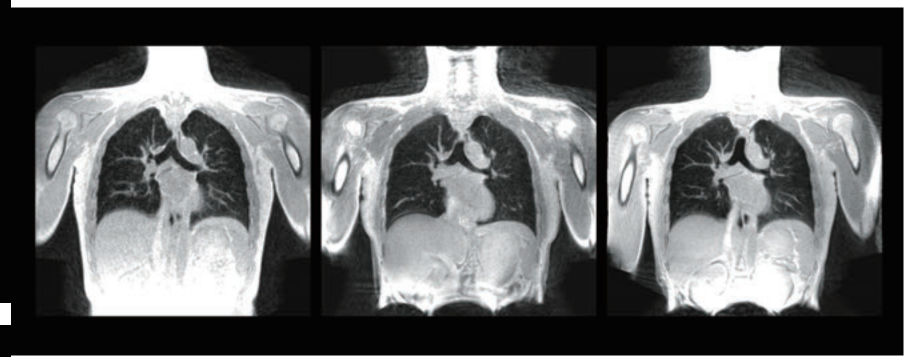
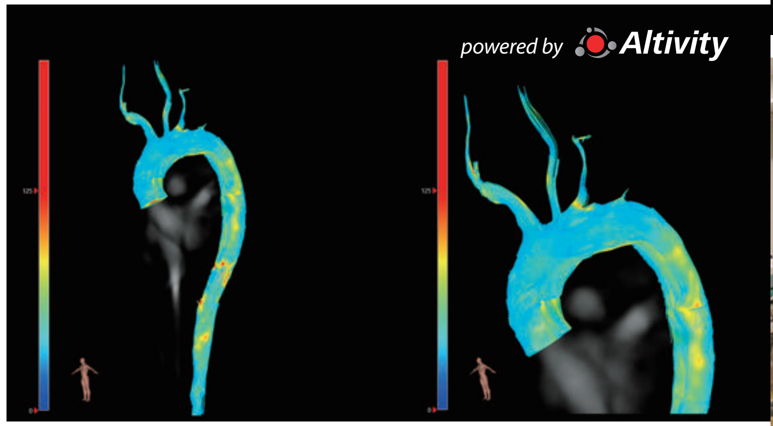
Scan





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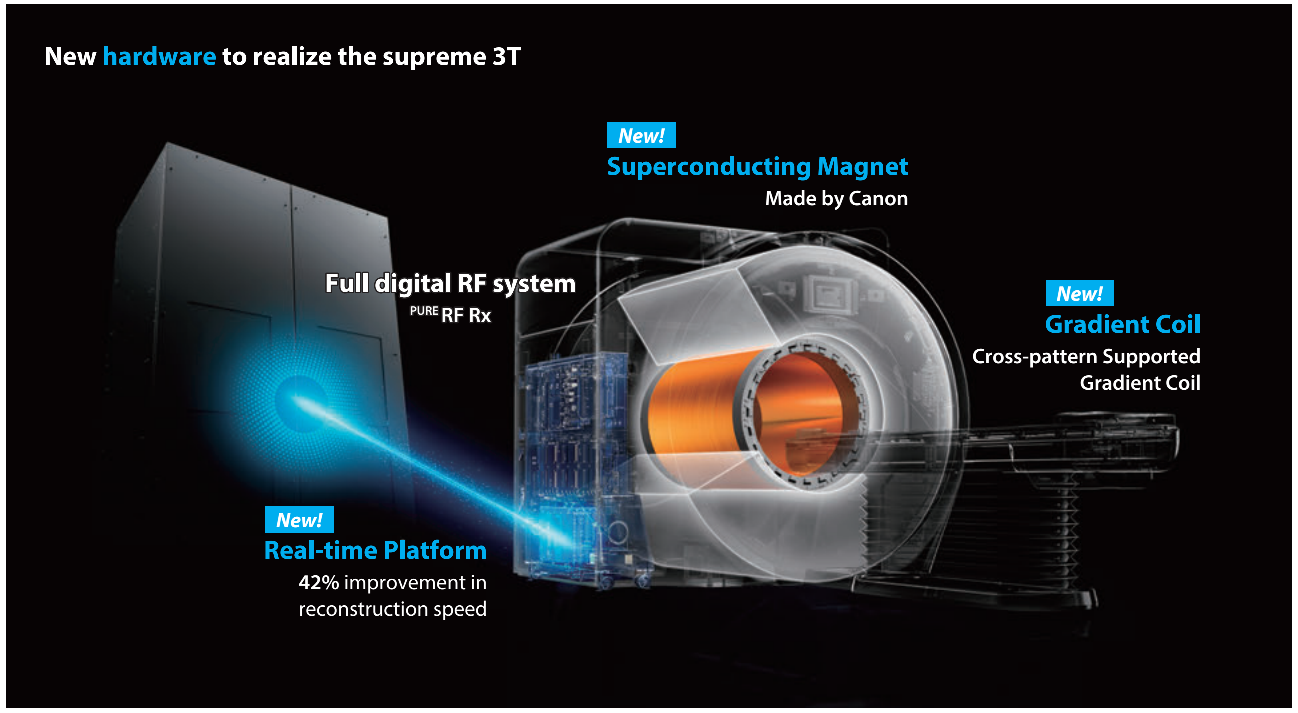
Development of Next Generation MR Technology for a New Era: Introducing Vantage Galan 3T / Supreme Edition

Kota Watanabe

Canon Medical Systems Corporation has recently developed a new 3T MRI system, Vantage Galan 3T / Supreme Edition. In this version of VISIONS Magazine we are pleased to introduce in detail the technology and initial user experience of the Vantage Galan 3T / Supreme Edition, which is equipped with our latest technology.
Vantage Galan 3T / Supreme Edition has completely re-designed hardware. The most notable feature is an in-house developed 3T magnet, which has delivered a more homogeneous magnetic field than previously, and has also expanded the field of view (FOV).
In addition, a new internal platform we call Real-time Platform has been implemented. Real-time Platform enables the system to aggregate information in a timely manner and control the system by configuring the Real-time Manager (RTM) module at the center of communications. The communication method between each module has also been improved to achieve high-speed communication. This not only speeds up reconstruction, but also improves image quality stability through real-time feedback of correction values.
All of the main components of the MRI hardware are now manufactured by Canon. It allows precise system control, contributing to improved image quality and stability.

Vantage Galan 3T / Supreme Edition features Advanced intelligent Clear-IQ Engine (AiCE) and Precise IQ Engine (PIQE). The latest software version installed in the Vantage Galan 3T / Supreme Edition expands the applicable sequences of PIQE, making it possible to scan a wider range of body regions with various contrasts. Therefore, the usability of PIQE has been improved, which has been well received by our users.
While there were many design challenges, we began with the in-house development of a 3T magnet and new hardware such as the gradient magnetic field system and focusing on the systematic integration and optimization of these components. In order to solve these issues, the engineering group of Canon Medical Systems came together as one in cooperation with Japan based and overseas group companies, and was able to complete a 3T MRI system that brings together the best of our technology and knowledge. We are proud to deliver the optimized All Canon 3T MRI system to you. We hope that everyone will experience the benefits of the Vantage Galan 3T / Supreme Edition. //



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A Brave New World: The Story of Canon's New 3T Magnet Development and Manufacture

Hajime Tanabe

In-house developed 3T magnet

Recently we have developed a new superconducting magnet in-house, which has been refined to focus on image quality. During development, the engineering team determined two important points to be improved.

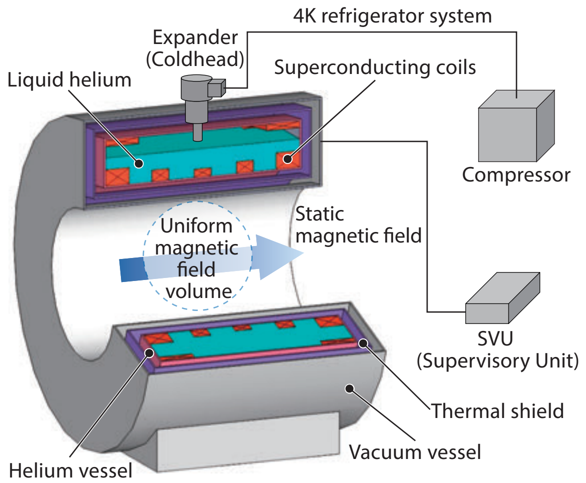
The first point was high magnetic field homogeneity, which is one of the most important factors in obtaining high image quality. The new magnet has better homogeneity than the conventional one. As a result, the maximum field of view (FOV) has expanded, so that wider and more stable images can be acquired.

The second point was to achieve a low quench rate through high quench resistance performance. A quench is the loss of superconducting state, which means the loss of magnetic field homogeneity and when it occurs the MRI system cannot be used. It takes time and cost to recover the magnetic field. The new magnet has improved quench resistance compared to conventional magnets and it is much less likely that a quench occurs, increasing confidence in continuous use of the MRI.

High magnetic field homogeneity and expansion of maximum FOV

There are various indices of magnetic field homogeneity, but as one example, the new magnet achieves 0.05 ppm at 30 cm DSV. It allows you to obtain a large FOV of 55 × 55 × 50 cm. To realize this, a high-level of improvement and process management at both design and manufacturing stage is required.

Magnet Construction



During design, coil position is optimized at micron-level precision by utilizing a dedicated optimization tool and specific know-how in implementation. At this time, it is necessary to optimize not only magnetic field homogeneity but also to satisfy many other requirements. This is a really important process in the upstream design stage. In addition, robust production is also important to minimize errors for stable mass production. This new magnet achieves high magnetic field homogeneity and is robust against production errors.

During manufacturing, the accuracy of the superconducting coil position has been improved by more than double compared to a conventional magnet. For example, the length of the superconducting coil is from 3 m to 5 m per circumference, but it is wound with a tolerance of less than ±1 mm to the design value. Moreover, this tolerance is maintained over the entire length of nearly 100 km. It has been made possible through high-level winding skills and sophisticated position control even though this is a very complicated technique.

In order to achieve the high magnetic field homogeneity, it is necessary to achieve and maintain a good balance between design and manufacturing. While it is challenging, the results achieved are very rewarding.

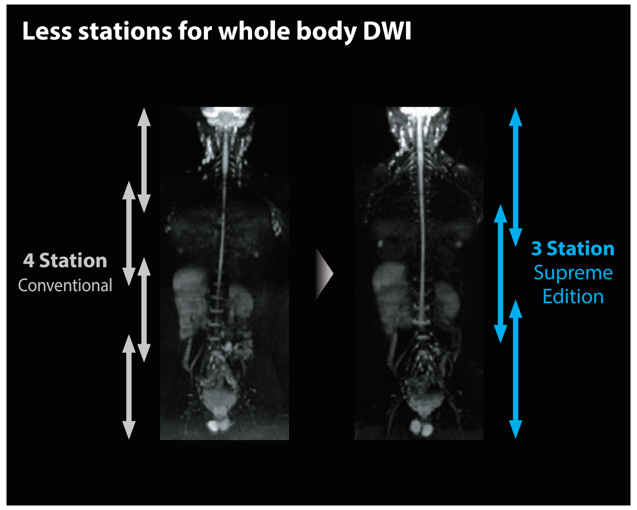
Low quench rate through high quench resistance performance

It is not easy to achieve high quench resistance in a superconducting magnet. It is not a matter of calculation, but the result of years of accumulated experience and know-how.

In the past our engineers experienced quenches, however each time this happened, they investigated the causes and took measures to improve the situation. Our new magnet has achieved a low quench rate through high quench resistance performance, taking maximum advantage of this experience and efforts to consider the solutions in design.

To realize these points, high-level improvement and process management at both design and manufacturing stages were required.

During design, an appropriate superconducting margin (quench margin) was considered. For example, the value of minimum quench energy (MQE), which is an indicator of superconducting margin, has been decided based on accumulated experience and know-how, while taking cost into account. In addition, the magnet had to satisfy magnetic field homogeneity and many other design and manufacturing requirements. Furthermore, the structure of the superconducting coil was optimized to minimize mechanical stress. The superconducting coil is used at an extremely low temperature of 4.2 K (-269 °C). Thus, the stress when cooling from room temperature to extremely low temperatures is many times higher than that caused by the electromagnetic force of 3T. The superconducting coil is made up of a variety of materials, so the stress analysis of the cooling process has been conducted with multiple patterns of a superconducting coil model. Finally, the process that provides the optimal balance between stress after cooling and strength for each part has been adopted.



During manufacturing, appropriate processing of the superconducting coil components made it possible to double the adhesive strength of the epoxy that solidifies and fixes the superconducting magnet properly compared to conventional methods. The management of the epoxy and solidification process is also based on the accumulated experience and know-how of our engineers.

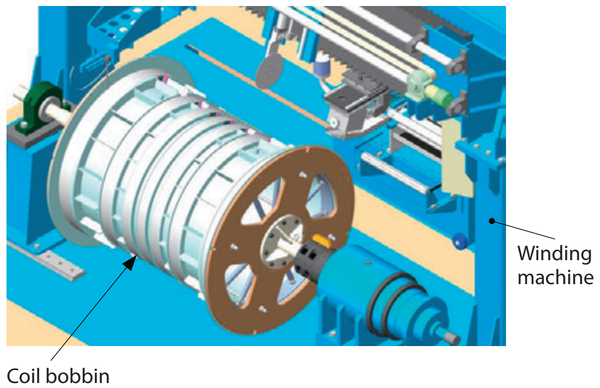
There is a risk of quench if the temperature rises by just 1 °C from 4.2 K (-269 °C) due to heat generated by cracking of the epoxy or friction caused by movement. Moreover, under an extremely low temperature, the specific heat is lower by two to three orders than at room temperature, which makes it easier for the temperature to increase. The new magnet has quite a high quench resistance even under extreme conditions, so customers can scan with confidence and peace of mind.

Conclusion

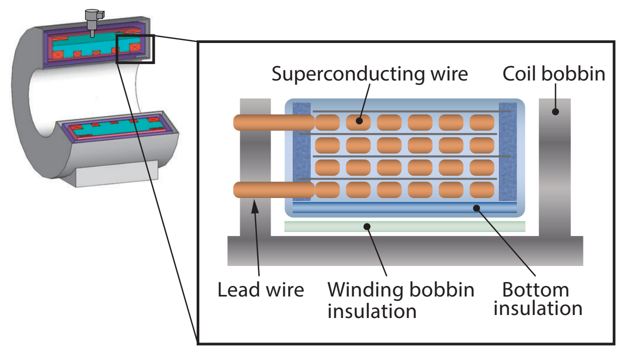
When developing Vantage Galan 3T / Supreme Edition, several technical matters have been addressed during development, even though there were no issues with the superconducting magnet itself. Engineers from each department worked closely together and were able to discover unique solutions. This is one of the benefits of Vantage Galan 3T / Supreme Edition being developed in-house, which we like to refer to as All Canon 3T MRI system.

The quest to improve magnet design and performance never ends. We aim to continue to maintain high quality and develop products that will satisfy customer's clinical requirements even further. //

High precision winding machine



Structure of superconducting coil for better quench performance



Hajime Tanabe
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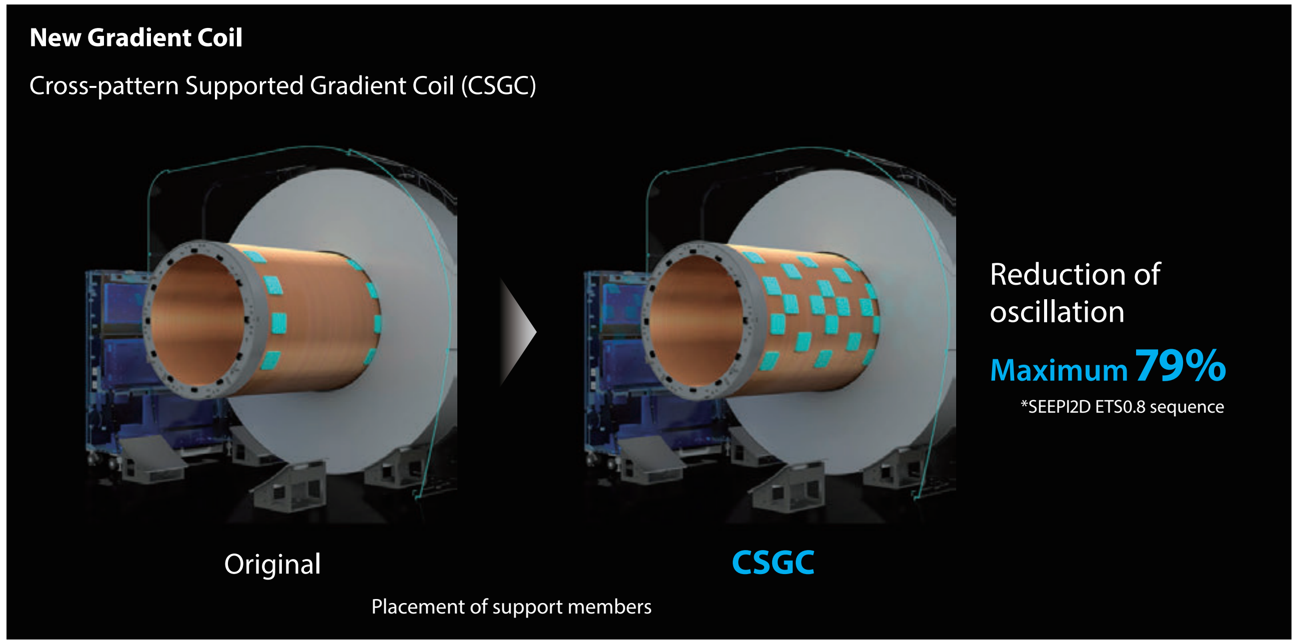
Development of New Gradient System – For Seamless Hardware Development

Motohiro Miura

Canon Medical Systems Corporation has recently developed a new in-house magnet, making it possible to produce the entire imaging system core components, including the gradient magnetic field and RF system. Therefore, we took this opportunity to review and redesign the architecture of the gradient magnetic field and static magnetic field.
In MRI systems, gradient coils are placed in an extremely large static magnetic field of 3T. Then, images with various contrasts can be obtained by switching several hundred amperes of current flowing through the gradient coils in several hundred microseconds based on pulse sequences for imaging.
As is known from the principle of a motor, when current is passed through a wire placed in a magnetic field, force is applied to the wire. If this force causes the wires to move, the movement will disrupt the gradient magnetic field and give damage to image quality. MRI systems have a gradient coil structure that eliminates this movement of the wires, but as can be observed from the acoustic noise during scanning, small movements still occur in the entire gradient coils. When this movement is transmitted to the magnet, it causes mechanical resonance, which leads to increased oscillation and acoustic noise in the entire magnetic system. The oscillation of the entire magnetic system causes a loss of image quality, especially for fast scanning sequences, and the increased acoustic noise directly impacts to patient comfort. Therefore, by reconsidering the support system for the gradient coil, we developed a new gradient magnetic field system called Cross-pattern Supported Gradient Coil (CSGC) that reduces the mechanical connection between the gradient coil and the magnet.
CSGC made it possible to reduce the transmission of oscillation to the magnet, and as a result, it suppressed the transmission of oscillation to the patient table. In addition, by optimizing the oscillation transmission to the magnet, the noise generated by the oscillation of the gradient coil being transmitted to the magnet was reduced, making it possible to reduce the scanning acoustic noise of the entire system.
This new gradient system not only reduces oscillation and acoustic noise, but also improves the current sensitivity and reduces heat generation in the gradient coil, thereby improving the effective Gmax and effective slew rate (SR). Therefore, it is possible to realize sequences with shorter TE, resulting in improved image quality and an increase in the number of imaging slices for the same TR.
In addition, the effective Gmax and effective SR have also been improved by improving the gradient coil itself. Moreover, various other innovations have been added through collaboration between the gradient system engineers and magnet system engineers. This is because all of the main hardware is now collaboratively designed and developed in-house. Furthermore, we have worked closely with the magnetic field hardware team, RF hardware team, software team, and sequence development team, and we are proud to have created a 3T system that has been optimized for image quality, patient comfort, and various other aspects. Canon's engineers will continue to work collaboratively as one to provide systems that deliver satisfaction to staff and patients. //

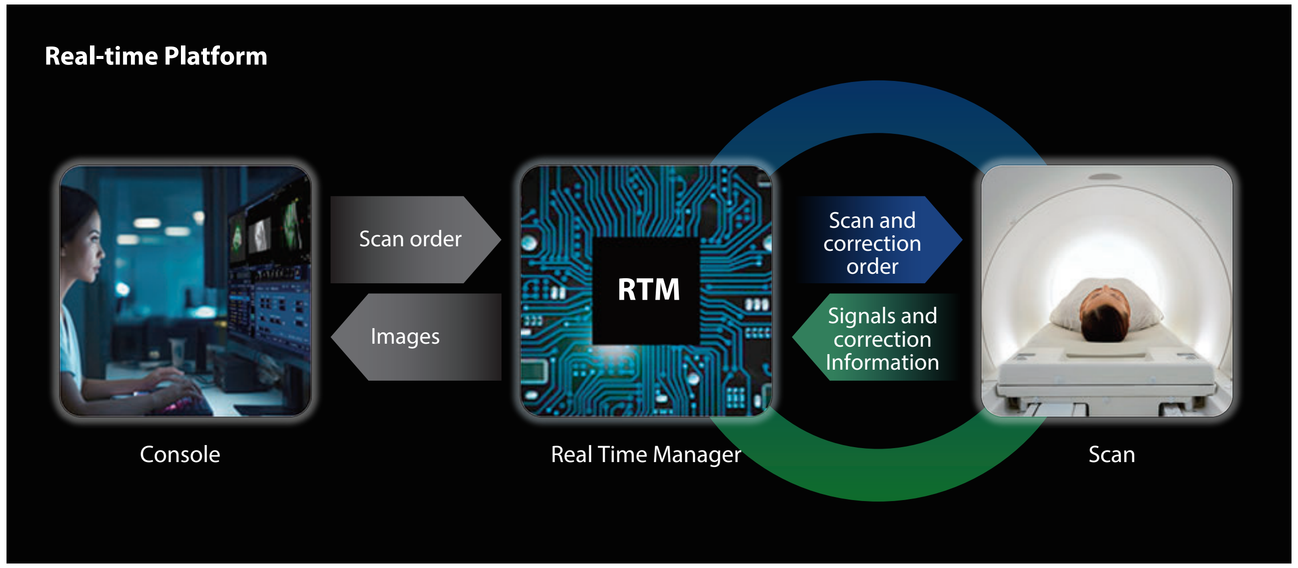


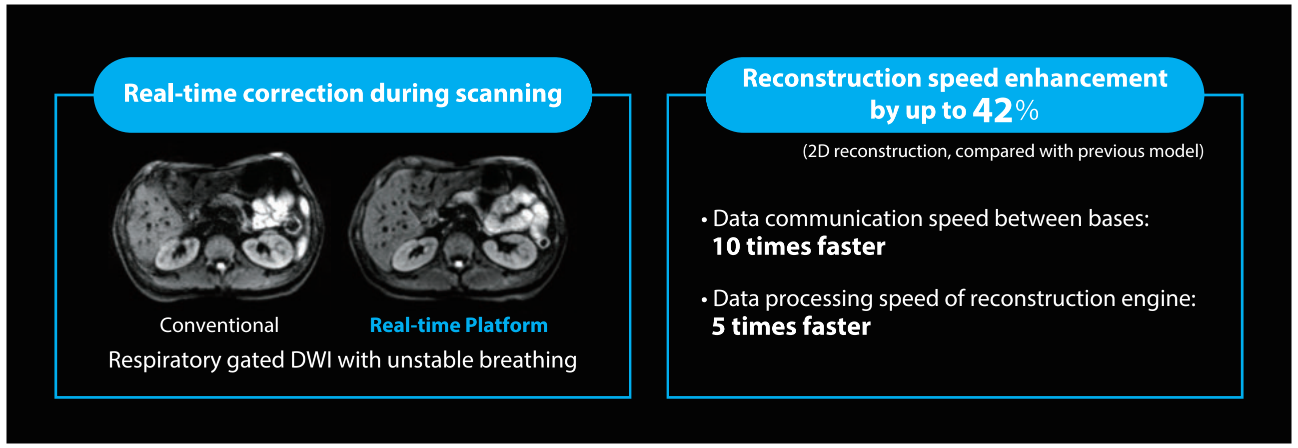
Motohiro Miura
Hardware Technologies Group, MRI Systems Development Department, MRI Systems Division, Canon Medical Systems Corporation

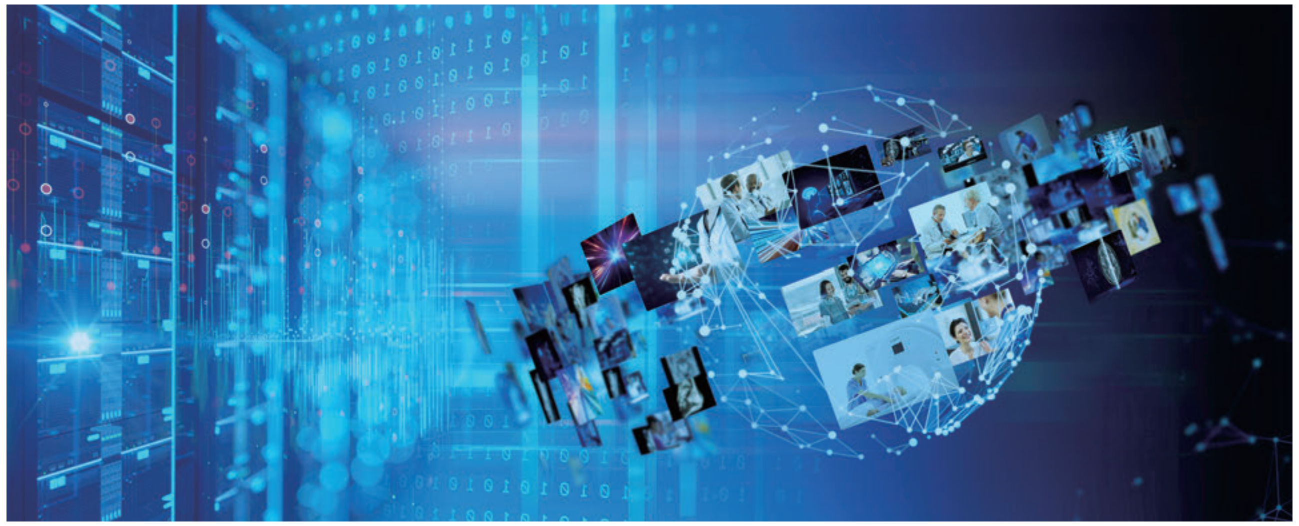
Development of High-speed Communication Platform – Real-time Platform

Haruki Nakamura

Previously, it has been challenging to control scan information in a timely manner because communication methods were subject to delays between software and hardware.
However, with the introduction of Canon's Real-time Platform, a high-speed communications platform for controlling changes in real time has been developed. This new hardware adopts a high-spec computer called Real Time Manager (RTM) for the Real-time Platform to facilitate real-time communication control. In addition, an intelligent algorithm was developed to operate the RTM efficiently. As a result, RTM is now able to aggregate all information related to scanning and read changes during scanning, making it possible to adjust sequences in a timely manner.
There are two main benefits of Real-time Platform.
The first is image quality improvement. The real-time control improves the correction accuracy. Sufficient image quality for diagnosis can be ensured even if breathing is unstable, particularly when scanning respiratory-gated DWI.







In addition, the stability of the control clock used to receive MR signals has been improved by 33 times compared to conventional. Large clock fluctuations lead to fluctuations in the signal phase, resulting in negative effects such as image fluctuations and decrease in signal-to-noise ratio (SNR). By improving the stability of the clock, these negative effects are reduced, contributing to image quality improvement.
The second key benefit is reconstruction speed enhancement. The data communication speed between bases is 10 times faster and the data processing speed of the reconstruction engine is five times faster. In addition, the reconstruction software for Real-time Platform is optimized. In total, reconstruction speed is enhanced by up to 42% on 2D sequences.
Real-time Platform focuses on expanding out features. It can handle developments with changing frequencies, such as various magnetic field strengths and multiple nuclei imaging. It can also support modern high-speed communications because it is constructed with highly versatile hardware. Moreover, we are considering applying this technology to research-oriented functions, like Pulseq. With the advantage of ease of expansion, we will continue to develop products that will help improve the quality of MRI examinations, such as improving serviceability, enhancing image quality by improving various correction accuracy, and applying Real-time Platform to pulse sequences. //

Haruki Nakamura
Senior Engineer,
Hardware Technologies Group, MRI Systems Development Department, MRI Systems Division, Canon Medical Systems Corporation

Expansion of Applicable Sequences of Precise IQ Engine (PIQE)

Kensuke Shinoda

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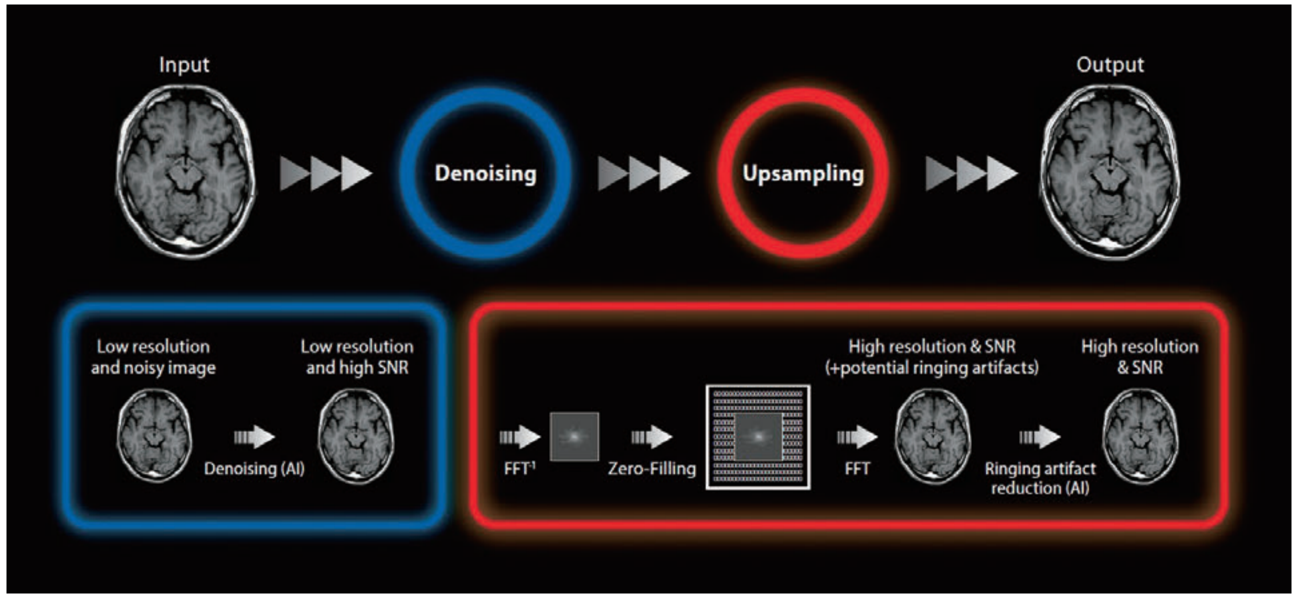

Figure 1: PIQE reconstruction pipeline.

In magnetic resonance imaging (MRI), there is an inherent trade-off between signal-to-noise ratio (SNR), acquisition time, and spatial resolution. Precise IQ Engine (PIQE) has been developed as a novel reconstruction technology to overcome the trade-off. Utilizing two dedicated neural networks, PIQE enables up-sampling the acquired MR images, resulting in sharper images while keeping the truncation artifacts (aka Gibbs' ringing artifacts) suppressed.

When PIQE was first commercialized, it was solely available with 2D Fast Spin Echo (FSE2D) sequences. However, now PIQE can be used with other sequences as well. The expansion of the applicable sequences of PIQE was achieved through its original design. PIQE consists of two separated neural networks for denoising and up-scaling as its key components. Although the first release of PIQE was focused on FSE2D, both of the two neural networks had been trained with the data sets which cover a wider range of contrast (PDw, T1w, T2w, FLAIR, T2*w, diffusion weighted, and so on), body parts (brain, spine, and MSK regions), and magnetic field strengths (3T and 1.5T). This training strategy has resulted in making PIQE very robust and reliable for various contrasts from many kinds of pulse sequences.

Some previous studies [1,2,3] demonstrate better SNR and sharpness with reduced Gibbs ringing artifacts versus standard reconstruction used in routine clinical practices. This article demonstrates further test results that PIQE enables high-resolution imaging or short acquisition time preserving structural detail and reducing Gibbs ringing artifact on typical brain scan protocols of T1w with 2D Spin Echo (SE2D), T2*w with 2D Field Echo (FE2D), and EPI-DWI. The standard protocol was acquired with 288 PE matrix in 2 minutes 44 seconds, while the fast protocol was acquired with 224 PE matrix in 2 minutes 10 seconds.

The standard protocol was acquired with 320 PE matrix in 1 minute 56 seconds, while the fast protocol was acquired with 224 PE matrix in 1 minute 24 seconds. FineRecon, so called ZIP, was applied in cases of NONE and DSD by 2.

Figures 2 and 3 show brain T1w images with SE2D and T2*w images with FE2D sequences respectively. The fast protocol was acquired with less PE matrix size in a shorter scan time than the standard protocol. In both cases, NONE × 2 of the fast protocol makes Gibbs ringing artifacts more noticeable due to the reduced matrix size. Conventional filter DSD of the standard protocol (Standard-DSD × 2) and the fast protocol (Fast-DSD × 2) could mitigate Gibbs ringing artifacts

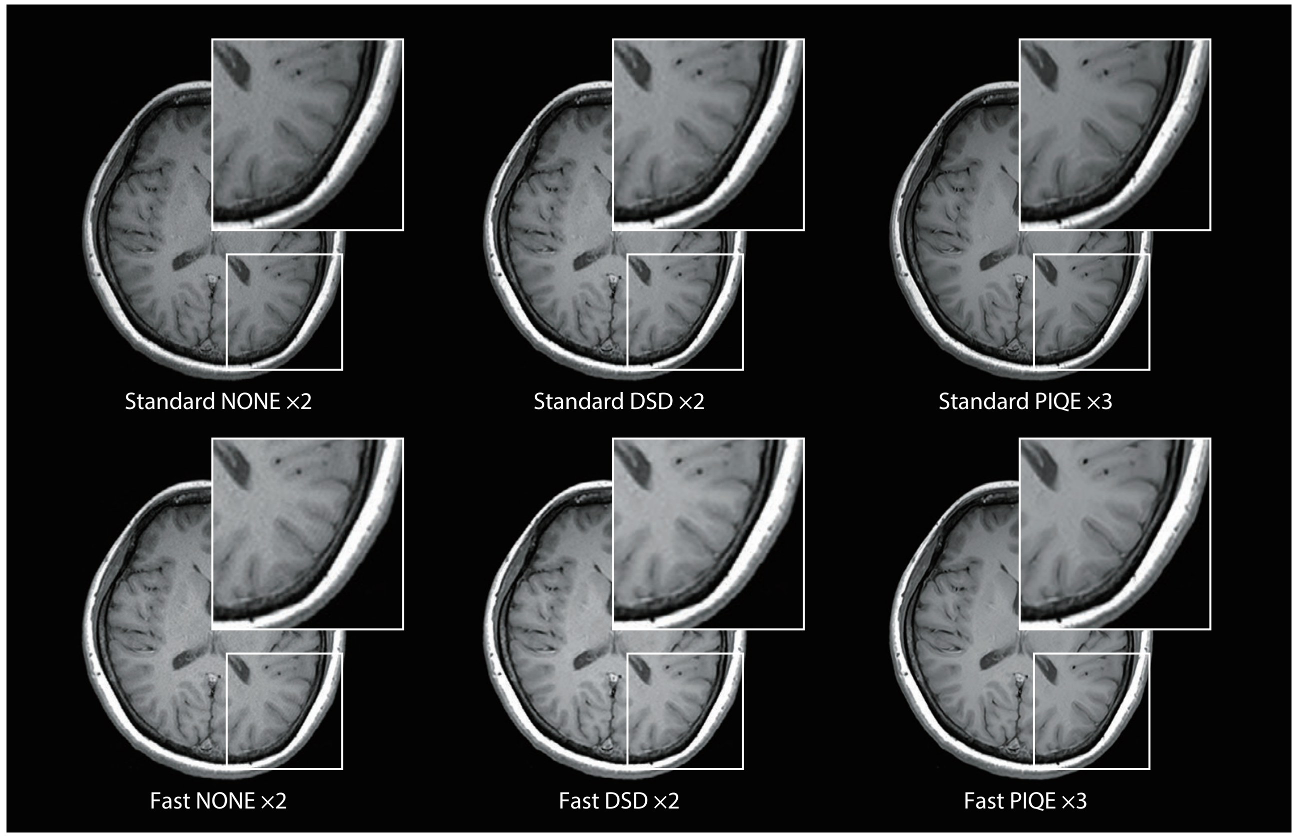

Figure 2: Brain Axial T1w with 2D Spin Echo (SE2D) sequence.

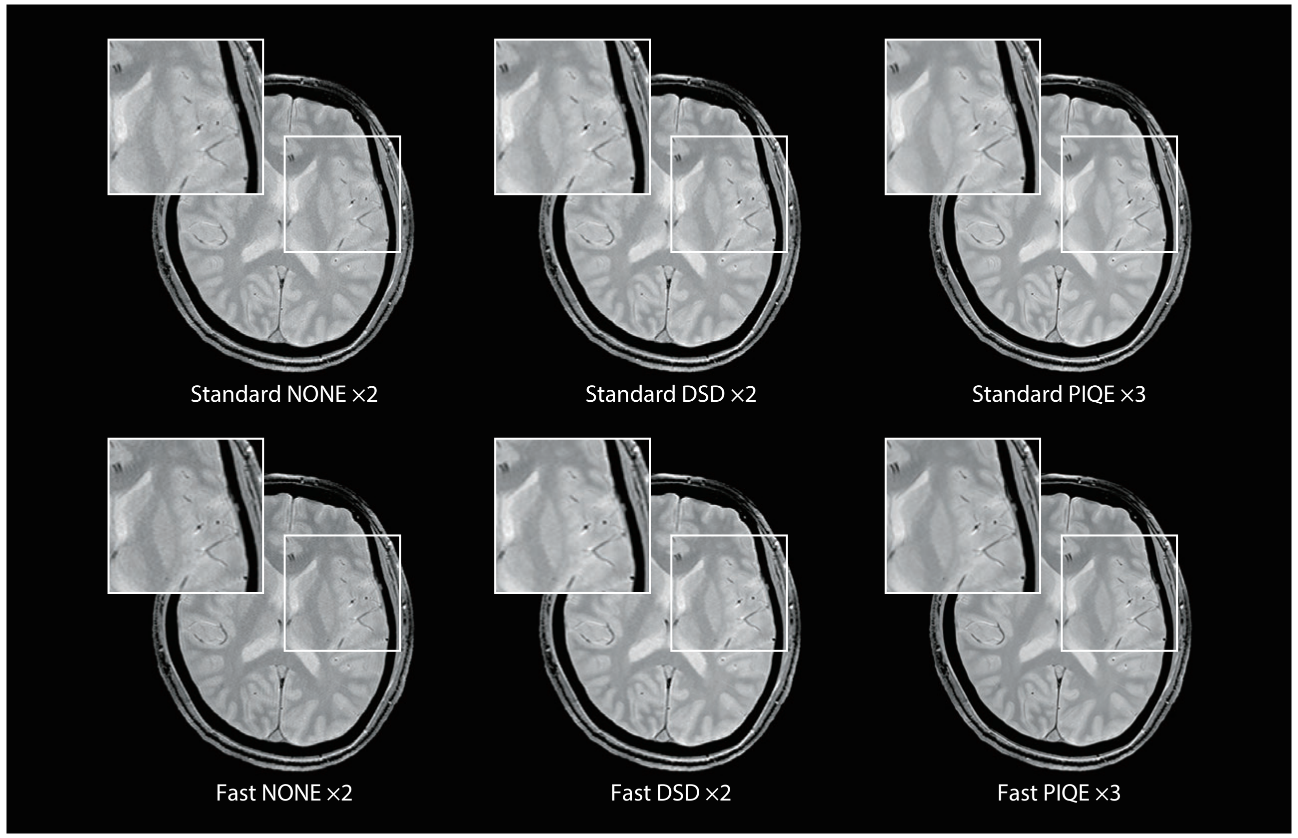

*Figure 3: Brain Axial T2*w with 2D Field Echo (FE2D) sequence.*

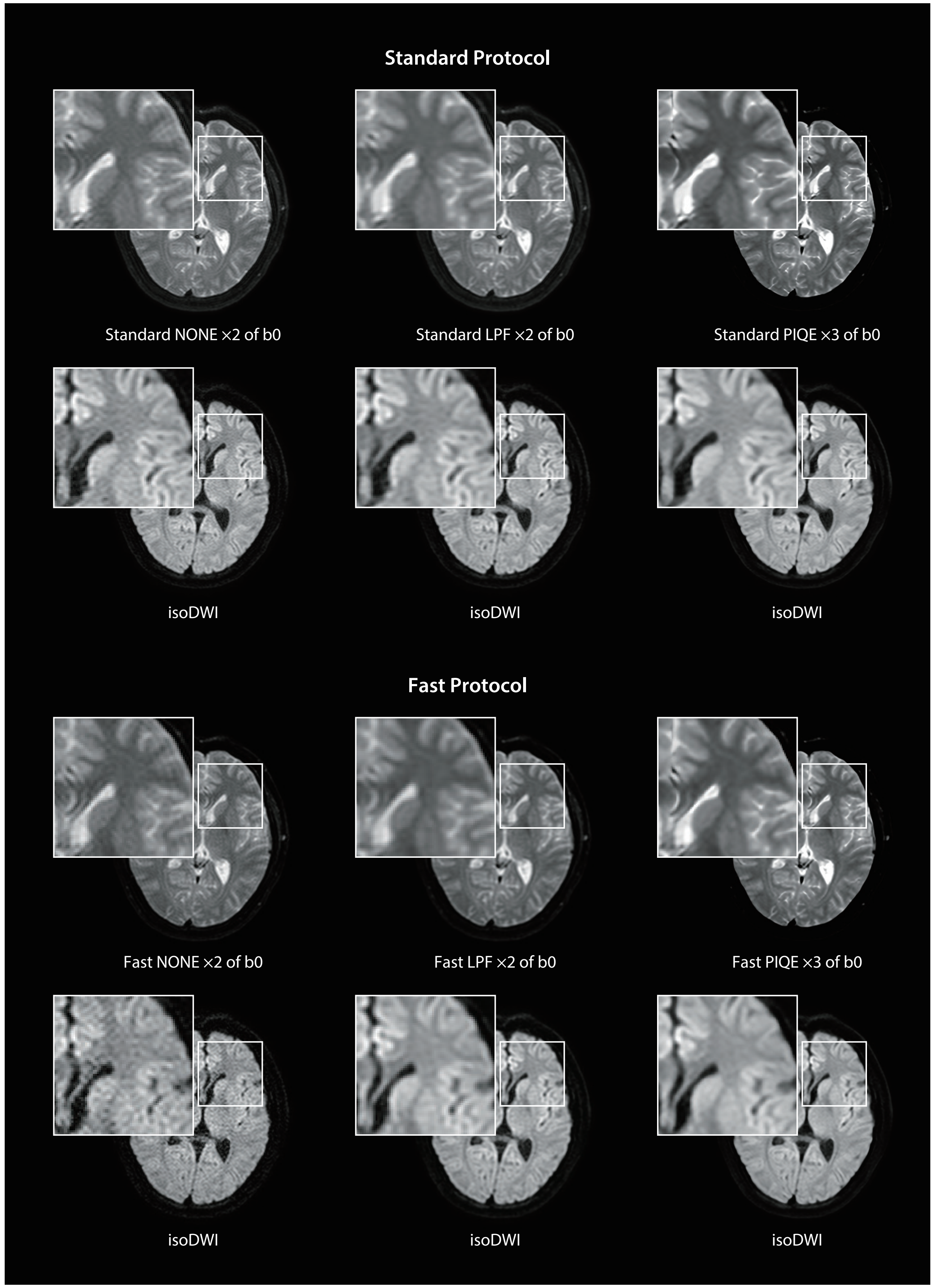

Figure 4: Brain Axial EPI-DWI of b0 and isoDWI.

at the expense of blurring. PIQE × 3 with standard protocol provides the highest sharpness and the highest SNR of the other methods. Also, Fast-PIQE × 3 reduces Gibbs ringing artifacts while providing sharpness and noise reduction compared to Fast-DSD × 2 and Standard-DSD × 2 as well, which requires a longer scan time.

Figure 4 shows Brain Axial b0 images and isoDWI of Spin Echo EPI-DWI sequences. The standard protocol was acquired with TR/TE = 5700/75 ms, echo train spacing (ETS) = 0.9 ms, Bandwidth = 1302 Hz, b-value = 0 and 1000 in 3-axis, acquisition matrix =160, and the number of acquisitions (NAQ) = 3, while the fast protocol was scanned with TR/TE = 4603/75 ms, ETS = 0.7 ms, Bandwidth = 1953 Hz, b-value = 0 and 1000 in 3-axis, acquisition matrix = 128, and NAQ = 1. Therefore, the scan time is 92 s for the standard protocol, and 42 s for the fast protocol by reducing matrix size and NAQ.

In both standard and fast of NONE × 2, Gibbs ringing artifacts can be observed because single shot EPI-DWI is acquired with small matrix size to shorten the scan time and/or EPI readout duration. In LPF × 2, the Gibbs ringing artifacts are reduced, but image blurring occurs. Standard PIQE × 3 shows the highest sharpness and denoising effect, while suppressing Gibbs artifacts better than the others. Fast PIQE × 3 also shows better or equivalent image quality compared to Standard LPF × 2 in terms of sharpness, SNR and the ringing artifacts.

These results show that PIQE can successfully improve image quality in terms of sharpness, denoising, and artifact reduction for Spin Echo, Field Echo and EPI as well. Also, these results demonstrate that PIQE can be used for both achieving high-resolution reconstruction and short time acquisition with preserving structural details and reducing noise and Gibbs artifacts. //

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Disclaimer

Zoom DWI – DWI without Aliasing Artifact

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When scanning small organs like prostate and spinal cord, implementation of a small field of view (FOV) and high spatial resolution is required. However, if FOV of phase encoding direction (PE-FOV) is small, it can cause aliasing artifacts. Therefore, some special methods are suggested to prevent these types of aliasing artifacts[1-7].
Canon Medical Systems Corporation implements Zoom diffusion-weighted imaging (DWI) applications to remove aliasing artifacts. In Zoom DWI, the excitation pulses are rotated by a certain angle related to the refocus pulses to selectively excite the acquisition FOV, making it possible to eliminate aliasing artifacts in the PE direction. The rotation angle of the excitation pulses depends on the gap between the acquisition, FOV and the slice. Therefore, it is recommended to set a large gap or perform multi-coverage acquisition such as Coverage Interleave or Double Coverage Interleave. To support multi-slice acquisition, the signals in the transition FOVs (regions where the excitation pulse interacts with the refocus pulse outside the PE-FOV) are suppressed by the outer volume suppression (OVS) pulses. Aliasing artifacts caused by the side lobes of the radio frequency (RF) pulses generated by the OVS pulses are suppressed by setting NoWrap.
This makes it possible to narrow PE-FOV, which also makes it possible to reduce distortion in principle.
This article demonstrates the effectiveness of Zoom DWI.
Firstly, aliasing artifacts were evaluated.

Target: ACR phantom
Scan conditions: PE × RO matrix = 160 × 160
FOV = 12 × 24 cm (Zoom DWI), 24 × 24 cm (Conventional DWI)
ST = 4 mm, Slice = 30 slices, Plane = Axial,
Averaging = 1, Echo Space = 0.9 ms
SPEEDER acceleration factor = 2.0 (Exsper)

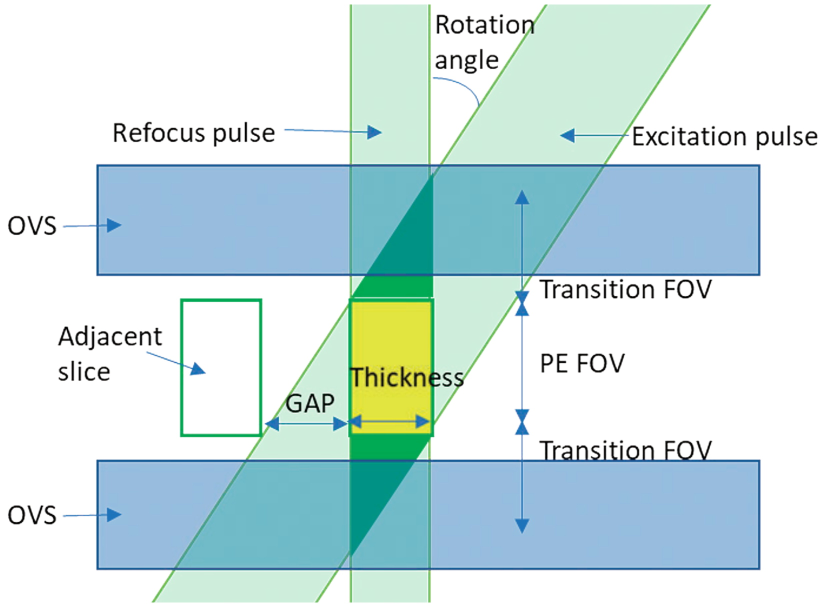

Figure 1: Schematic representation of Zoom DWI.

Conventional DWI and Zoom DWI were acquired under the FOV 12 × 24 cm, where aliasing artifacts were found in Conventional DWI.
Below is the comparison image between Zoom DWI and Conventional DWI.
It is demonstrated that Zoom DWI enables the ability to reduce aliasing artifacts while Conventional DWI does not (red arrow).
Secondly, distortion was evaluated.
Conventional DWI (FOV 24 × 24 cm) and Zoom DWI (FOV12 × 24 cm) were acquired.
The amount of distortion is measured by setting a straight-line region of interest (ROI) with respect to the grid at the center of the grid phantom and measuring the amount of deviation between the grid and the straight-line ROI.
The amount of distortion on Zoom DWI is 2.2 mm and on Conventional DWI is 4.4 mm, demonstrating that the amount of distortion is halved under the half PE-FOV condition.
This demonstrates that Zoom DWI enables the ability to reduce distortion correctly.
Finally, volunteer images were evaluated.

Scan conditions: TR = 4400 ms, TE = 72 ms
PE × RO =96 × 96 (Zoom DWI),
PE × RO = 112 × 112 (Conventional DWI)
FOV=13 × 13 cm (Zoom DWI),
24 × 24 cm (Conventional DWI)
ST = 3 mm, Slice = 30 slices, Plane = Axial,
Averaging = 7, EchoSpace = 0.7 ms
SPEEDER acceleration factor = 2.0 (Exsper)
Fatsat = SPAIR (Zoom DWI),
PASTA+SPAIR (Conventional DWI)

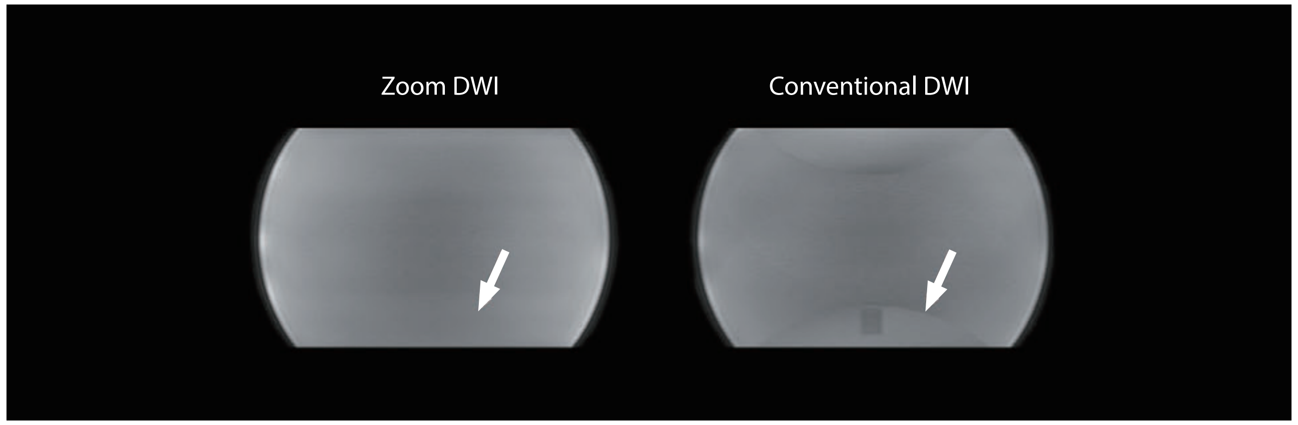

Figure 2: Comparison between Zoom DWI and Conventional DWI in terms of aliasing artifacts.

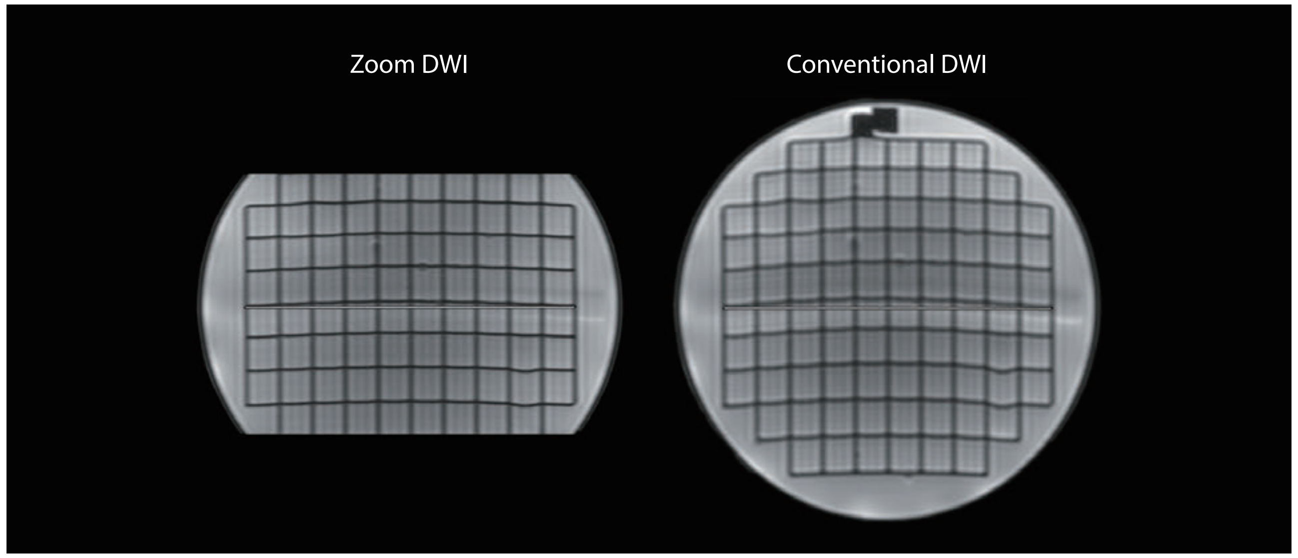

Figure 3: Comparison between Zoom DWI and Conventional DWI in terms of distortion.

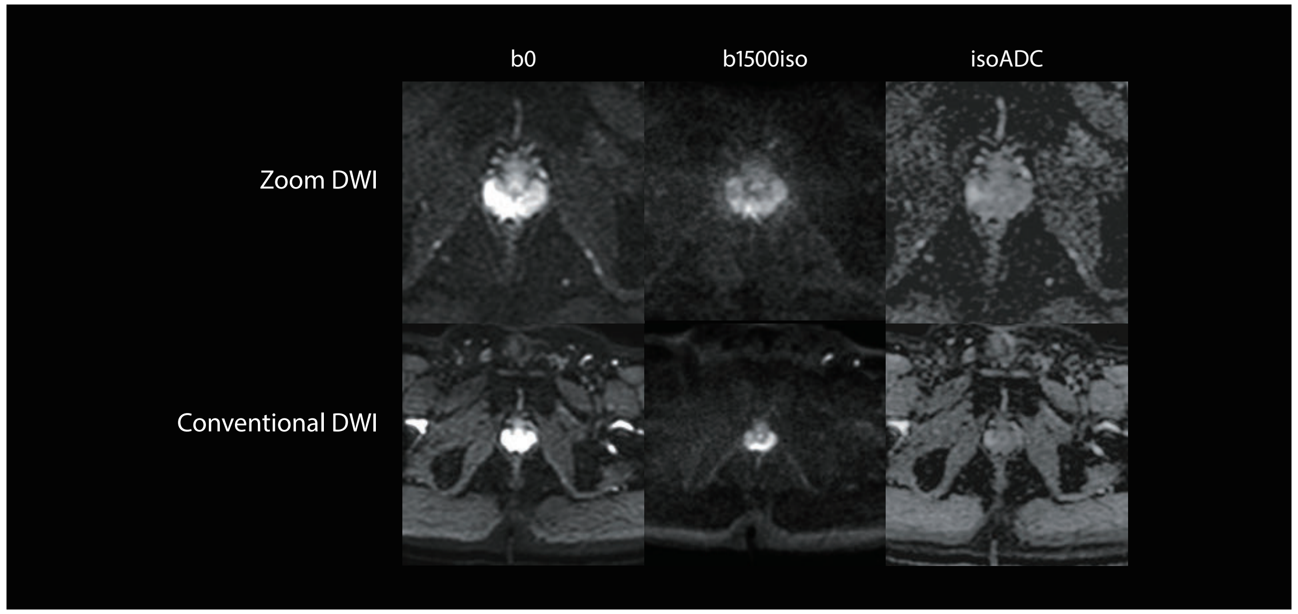

Figure 4: Prostate image (Volunteer).

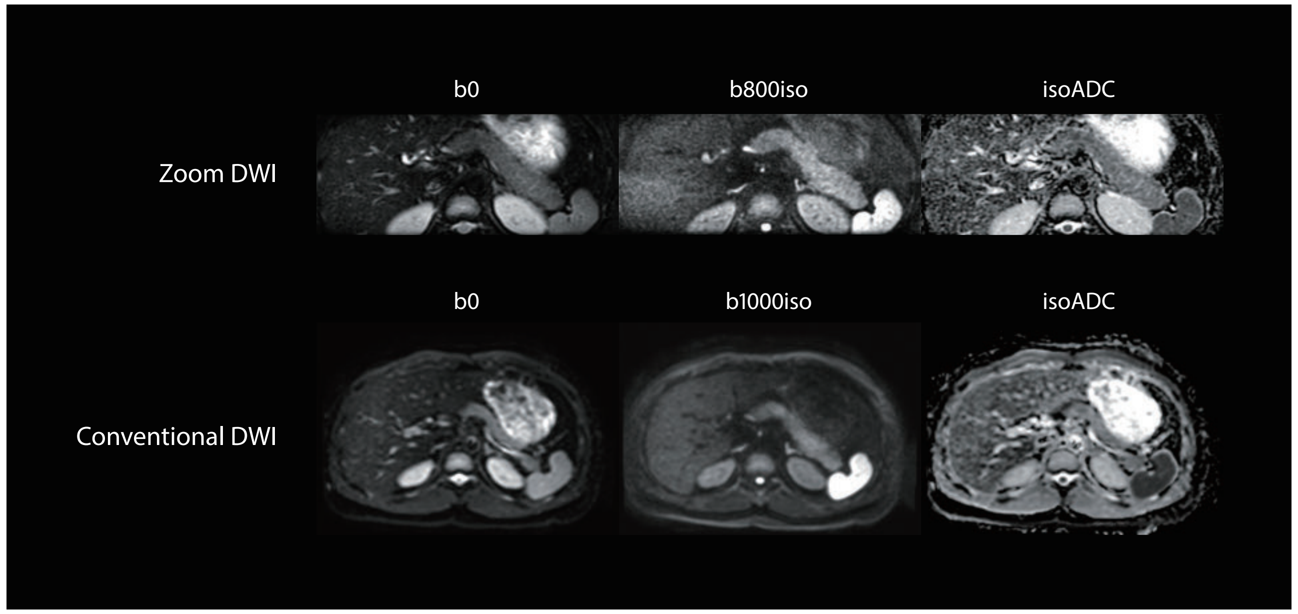

Figure 5: Pancreas image (Volunteer).

It is shown that aliasing artifacts do not occur, and the amount of distortion is reduced even when the PE-FOV is reduced. In addition, small PE-FOV makes it possible to eliminate signals from unwanted tissues outside the ROI. While resolution is increased, signal-to-noise ratio (SNR) is decreased by narrowing PE-FOV.

In conclusion, Zoom DWI has been shown to reduce aliasing artifacts and the amount of distortion by narrowing PE-FOV. //

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4D Flow MRI

Sho Tanaka

Three-dimensional time-resolved phase shift cardiovascular magnetic resonance imaging (4D Flow MRI) enables the ability to measure and visualize the temporal changes of complex blood flow patterns within an acquired 3D volume, and can evaluate various aspects such as streamlines, path lines, wall share stress, and energy loss at any cross section with external analytical software. 4D Flow MRI is one of the methods for evaluating blood flow distribution in three-dimensional space non-invasively, and its clinical application is becoming more widespread due to the recent development of high-speed scanning.
In our 4D Flow MRI, electrocardiogram (ECG) gating or peripheral-pulse gating is used in Cine/Retro scanning with PS3D sequence to perform 4-point acquisition, making it possible to acquire three-dimensional data for flow velocity in each phase.
4D Flow requires a long scan time and free breathing in which motion artifacts can affect image quality. To help reduce motion artifacts, Realtime Motion Correction (RMC) is recommended, and a real-time position correction is applied for each heartbeat.
4D Flow is compatible with View Sharing segmentation, which makes it possible to increase the number of time phases of a heartbeat artificially by reconstructing the image. In addition, Segmented Swirl is compatible.

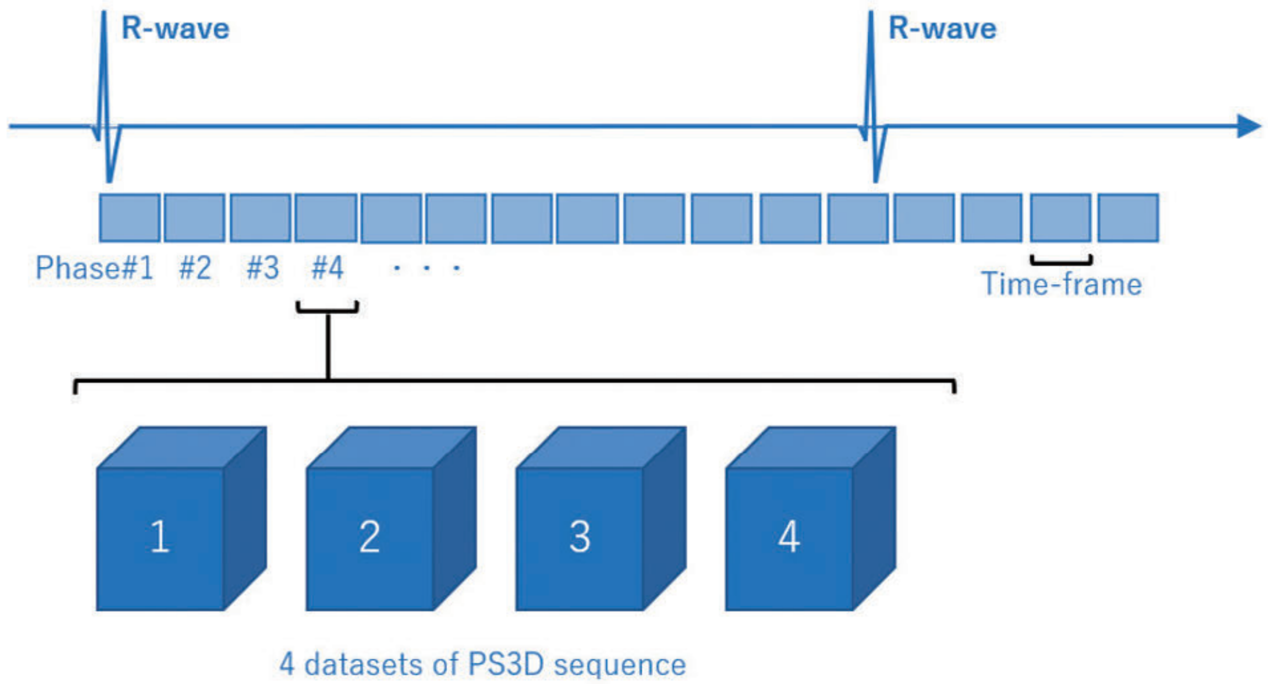

Figure 1: Outline drawing of 4D Flow data acquisition.

Segmented Swirl is robust against motion in the slice direction because data acquisition is performed by dividing the k-space into segments from the center of the k-space for phase encoding and slice encoding toward the outside of the k-space, and is used in conjunction with the Fast 3D function, which achieves fast scanning by not acquiring high frequency components.
Most importantly, 4D Flow is applicable with Precise IQ Engine (PIQE), which is our unique deep learning-based reconstruction technology to make image matrix larger than acquisition image matrix while denoising. Low matrix acquisition combined with parallel imaging contributes to reducing imaging time, which is a challenge for 4D Flow. 4D Flow analysis using low matrix data with PIQE produced results equivalent to those obtained under standard matrix imaging conditions[1]. It is expected that this technology will be used clinically in the future to reduce scan times.
Figures 2 and 3 show the results of streamlined analysis of the Aorta images of a healthy volunteer scanned at Canon Medical Systems Corporation using the CAAS 4D Flow application from Pie Medical Imaging B.V. //

Scan condition: 3T MRI (Canon)
TE/TR = 3.5/6.8 ms
PE × RO matrix = 96 × 128
Cardiac phase = 20
PIQE ratio = 3

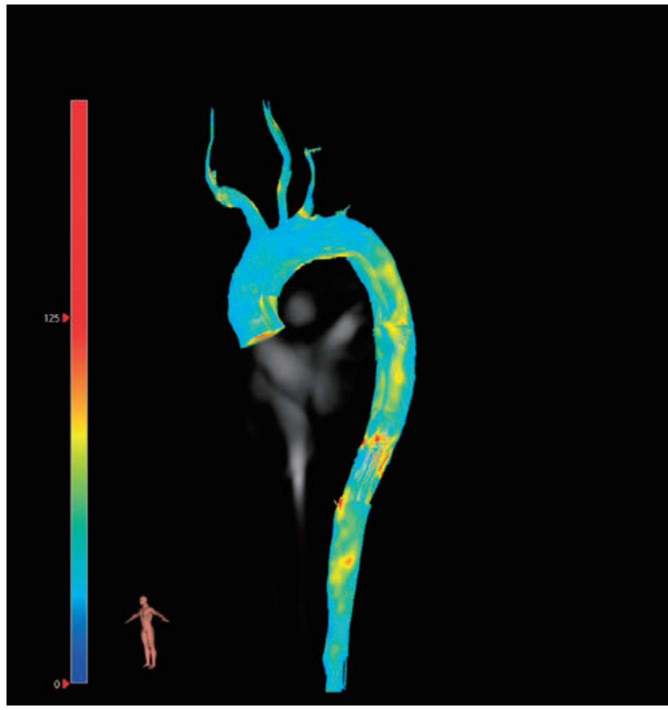

Figure 2: Aorta streamline image of healthy volunteer (Whole).

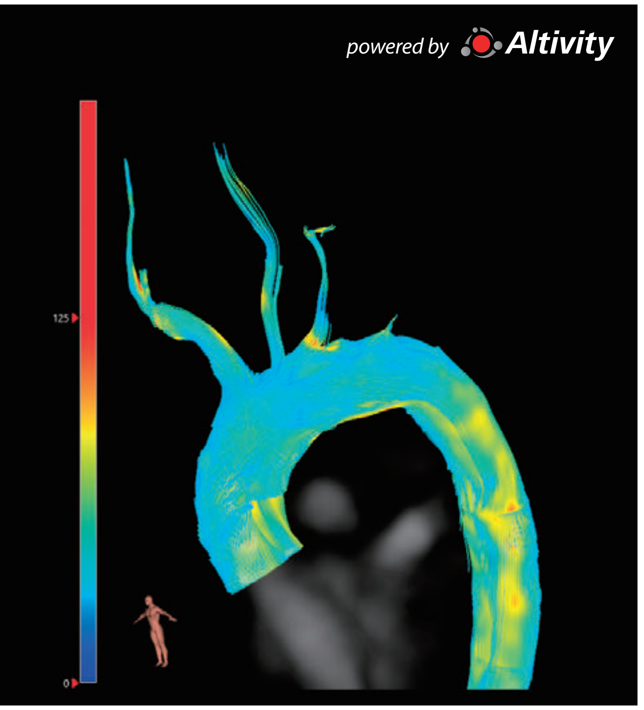

Figure 3: Aorta streamline image of healthy volunteer (Arch).

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The AI technology was trained during the development phase. When implemented into the product, the AI function no longer self-learns.

Initial Experience of Vantage Galan 3T / Supreme Edition

Kazumitsu Honjo, MD, PhD

Why Vantage Galan 3T / Supreme Edition

I have been involved in MRI diagnosis for 37 years and have been looking forward to the further development of MRI, which combines high spatial resolution, high contrast resolution and functional imaging. In the past, I have used foreign-made MRI systems, but I was very interested in the new 3T MRI system developed in-house by Canon Medical Systems Corporation which incorporates the latest hardware and software technologies, including a newly developed magnet. Better imaging diagnosis for patients is provided by high magnetic field homogeneity, all made-in-Japan hardware such as the new gradient coil and the new high-speed calculation system, and AI based reconstruction technologies like Advanced intelligent Clear-IQ Engine (AiCE) and Precise IQ Engine (PIQE), which are expected to provide the ultimate in clinical MRI diagnosis at present.
As a result, I decided to install this 3T MRI system packed full of Canon's advanced technology.

New in-house made-in-Japan magnet

The magnet is at the core of MRI system, and image quality and resolution depend on the magnetic field homogeneity. Also, distortion occurring at the edges of the image due to the magnetic field inhomogeneity can become a problem when imaging a wide area of the torso.
When we reviewed images scanned with Vantage Galan 3T / Supreme Edition, we were surprised at how little distortion there was. For example, even when imaging the spine with a 50 cm field of view (FOV), very clear images could be obtained with almost no distortion.
When I visited the magnet factory in Ako, Hyogo Prefecture, Japan, I was impressed by the craftsmanship of the manufacturing staff, who used a high level of skill and care in every step of the manufacturing process to produce magnets with high magnetic field homogeneity.

Initial experience with PIQE

PIQE is the deep learning-based reconstruction technology not only for noise reduction but also for increasing resolution. Utilizing PIQE, high-resolution images can be obtained in many clinical regions that is beyond current expectations.
Now, PIQE is applicable with almost all 2D pulse sequences and generates higher spatial resolution images with the ability to triple the matrix in both in-plane directions, making it very useful. Images with micron-level resolution have been acquired not only in the central nervous system and spinal cord regions, but also in breath-hold imaging of the upper abdominal region.
For example, in pancreatic examinations, pancreatic duct can be depicted very clearly even in T1-weighted images, and small pancreatic cysts of 1 to 2 mm can be detected that were previously difficult to capture.
Also, gallbladder images with a spatial resolution of about 100 micrometers has been achieved. Specifically, the ability to detect the surface structure of the gallbladder and small cholesterol polyps has improved.
The other benefit of PIQE is scan time reduction. For example, if the number of phase encoding of conventional image matrix (for example 256 × 256) is reduced by half (256 × 128), the scan time can be reduced by half. By applying PIQE to the image with a reduced number of phase encoding, image resolution becomes the equivalent to or greater than that of conventional images while reducing scan time. This is extremely useful for abdominal region examinations for those who have difficulty holding their breath. When PIQE was applied to FASE 2D, one of the sequences for fast scanning, it allowed further reduction of scan time and burden on patient. In addition, PIQE has a lot of use cases. For example, phase encoding matrix is reduced to save scan time, which can be used to increase the number of images. PIQE enables the ability to set scan conditions depending on the situation.

Initial experience of Zoom DWI

Zoom DWI is a function that rotates the excitation pulse by a specific angle relative to the refocusing pulse to obtain images without aliasing artifacts in the phase encoding direction. At our hospital, Zoom DWI is used mostly in the pancreas and the prostate, resulting in the acquisition of diffusion images with higher resolution compared with conventional images.
Also, typically when scanning DWI of the trunk using a 3T system, the signal is often not homogeneous, but when using Zoom DWI on the Vantage Galan 3T / Supreme Edition, the signal becomes homogeneous. Utilizing this technology, pancreatic head cancer of approximately 1 cm has been found. When comparing Zoom DWI with a conventional scan, lesions that could not be captured under conventional conditions were depicted as high signals, which truly amazed us.
In prostate examination, it is now possible to acquire images that show anatomical structures such as the surgical capsule and the boundary between the inner and outer linings, which were not visible with conventional diffusion techniques. Zoom DWI can be used with PIQE and can measure apparent diffusion coefficient (ADC) accurately, making it a very useful application.

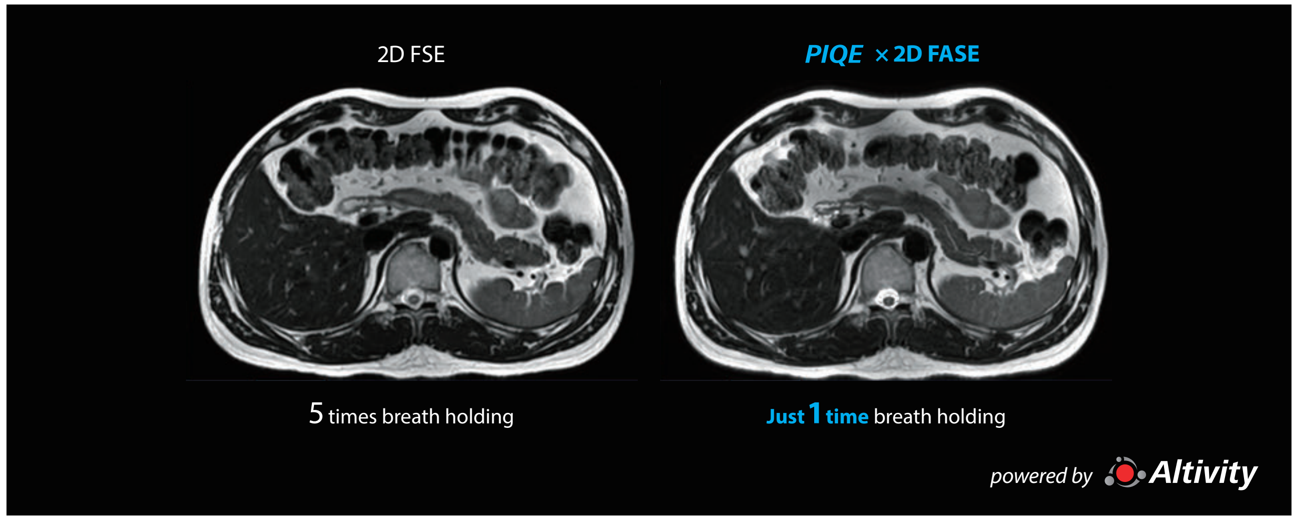

Figure 1

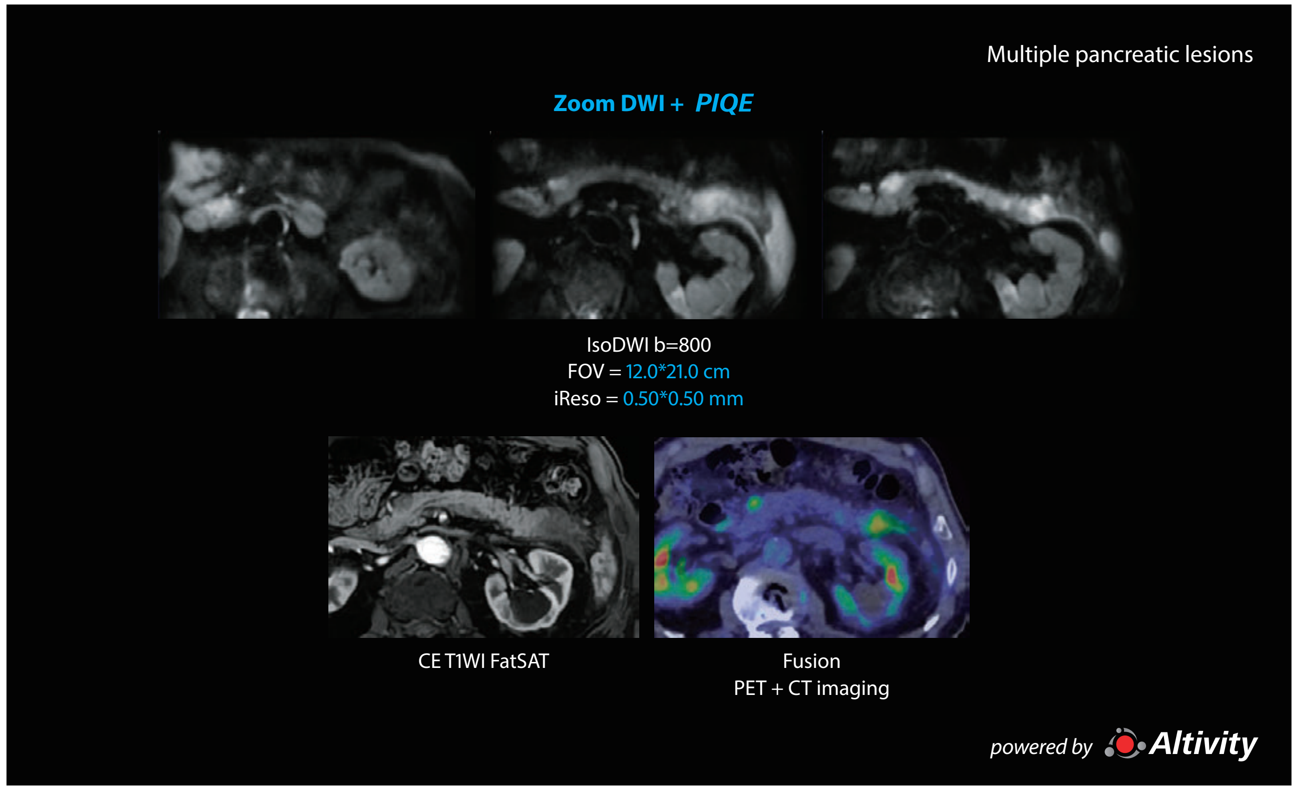

Figure 2

Conclusion

We have enjoyed scanning with Vantage Galan 3T / Supreme Edition. Especially in the trunk, images with higher resolution than conventional ones have been acquired. In addition to patient comfort and operability, it also features re-designed hardware, software and AI-based applications like PIQE. We can feel the pride of Canon in this new system. Although it has just begun to be used clinically, there are lots of discoveries. We are now working on the early diagnosis of pancreatic cancer. We would like to take on the challenge of capturing early changes in pancreatic cancer, called PanIN, with this latest, high-quality MRI. //

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The AI technology was trained during the development phase. When implemented into the product, the AI function no longer self-learns.

The Future Prospects of Vantage Galan 3T / Supreme Edition Based on Initial Experience

Yoshiharu Ohno, MD, PhD

At Fujita Health University School of Medicine, Vantage Galan 3T / Supreme Edition, a new 3T system manufactured by Canon Medical Systems Corporation, has been in operation since April 2024. The magnet, which is the key to image quality, has been developed in-house by Canon. The new magnet makes it possible to improve magnetic field homogeneity as compared with currently applied magnets and scan with a larger field of view (FOV) than other 3T MRI systems produced by Canon Medical Systems. Moreover, deep learning-based super high-resolution technology named Precise IQ Engine (PIQE) can be applied to various sequences with the most recent system software. In addition, Zoom DWI for scanning smaller FOV is also available in this MR system. In this article, our initial experience with Vantage Galan 3T / Supreme Edition will be described.

Image quality improvement by re-designed hardware

•Canon Medical Systems manufactured magnet

The magnet for the Vantage Galan 3T / Supreme Edition is developed in-house at Canon Medical Systems' factory in Ako City, Hyogo Prefecture, Japan. For the magnet design, the coil position is optimized to meet a variety of conditions simultaneously with micron-level precision, so during the manufacturing stage they use extremely high-precision winding machines that can control it to the micron-level. With optimization of the design and manufacturing, a high magnetic field homogeneity of 0.05 ppm at a 30 cm diameter spherical volume (DSV) has been achieved.

The improved magnetic homogeneity achieved by this new in-house magnet enables the ability to obtain excellent MR images with a larger FOV than previously applied magnets. Figures 1 and 2 show T2-weighted imaging (T2WI) of the T-spine and L-spine taken with a conventional 1.5T or Canon Medical Systems' 3T MRI system with an FOV of 30 × 30 cm, and original T2WI taken with a Vantage Galan 3T/ Supreme Edition with an FOV of 40 × 30 cm, and the image enlarged to be equivalent size to an FOV of 30 × 30 cm. Even when scanning with an FOV of 40 × 30 cm, the magnetic field homogeneity is equivalent to that of the conventional FOV of 30 × 30 cm. In addition, when an image with an FOV of 40 × 30 cm is enlarged to the same extent as an FOV of 30 × 30 cm, it is comparable to an image taken with an FOV of 30 × 30 cm, which means that stable large FOV examination is available. Therefore, it has become possible to improve the image quality of spine and whole-body MRI examinations, and to perform abdominal and pelvic examinations in one scan, which previously had to be done in two scans. Vantage Galan 3T / Supreme Edition now enables screening of various trunk diseases and tumor diseases with high image quality.

Currently, lung MRI is considered as one of the promising research fields, and ultra-short TE (UTE: TE<200 μs) technique is one of the keys for lung MRI. Lung MRI with UTE, which is called as UTE-MRI, can overcome the fundamental drawback for image quality due to the shorter T2* at 3T than 1.5T MR systems. However, the high magnetic field homogeneity of Vantage Galan 3T / Supreme Edition provides better images with a higher signal-to-noise ratio (SNR) than other conventional 3T MRI with the same sequence and imaging conditions, and image quality of UTE-MR of the Vantage Galan 3T / Supreme Edition is considered as equal to or better than that at other 1.5T MR systems. Therefore, it is expected that Vantage Galan 3T / Supreme Edition will lead to further advances in lung MRI and progress lung MR examinations as proficiently as 1.5T MRI.

•Cross-pattern Supported Gradient Coil (CSGC)

Vantage Galan 3T / Supreme Edition also features a completely new gradient coil. The arrangement of the gradient coil support structure has been changed from a parallel to a cross pattern, making it possible to reduce vibration by up to 79%. This has resulted in an improvement in effective Gmax of 107% and effective slew rate of 110% compared to conventional models, and further improvements in image quality are expected.

New System Software

•Expanded Precise IQ Engine (PIQE) Applications

PIQE is a deep learning-based super high-resolution technology to generate high resolution images with higher SNR from low resolution images with low SNR. When applying the neural networks, PIQE improves and optimizes blurring and ringing that occurs during zero-fill interpolation (ZIP). Therefore, PIQE makes image resolution higher and improves sharpness and SNR on generated MR images.

Previously, PIQE was only applicable to FSE 2D, but now, it can be applied to other 2D sequences including FSE. When applied to 2D FASE as a single-shot imaging sequence for increasing the resolution, it has problems with blurring and extended scan time due to the increased number of echoes. However, with PIQE, it is possible to achieve high resolution while maintaining the advantage of single-shot imaging, which is short and resistant to movement.

Figure 4 shows T2WI, diffusion-weighted imaging (DWI),

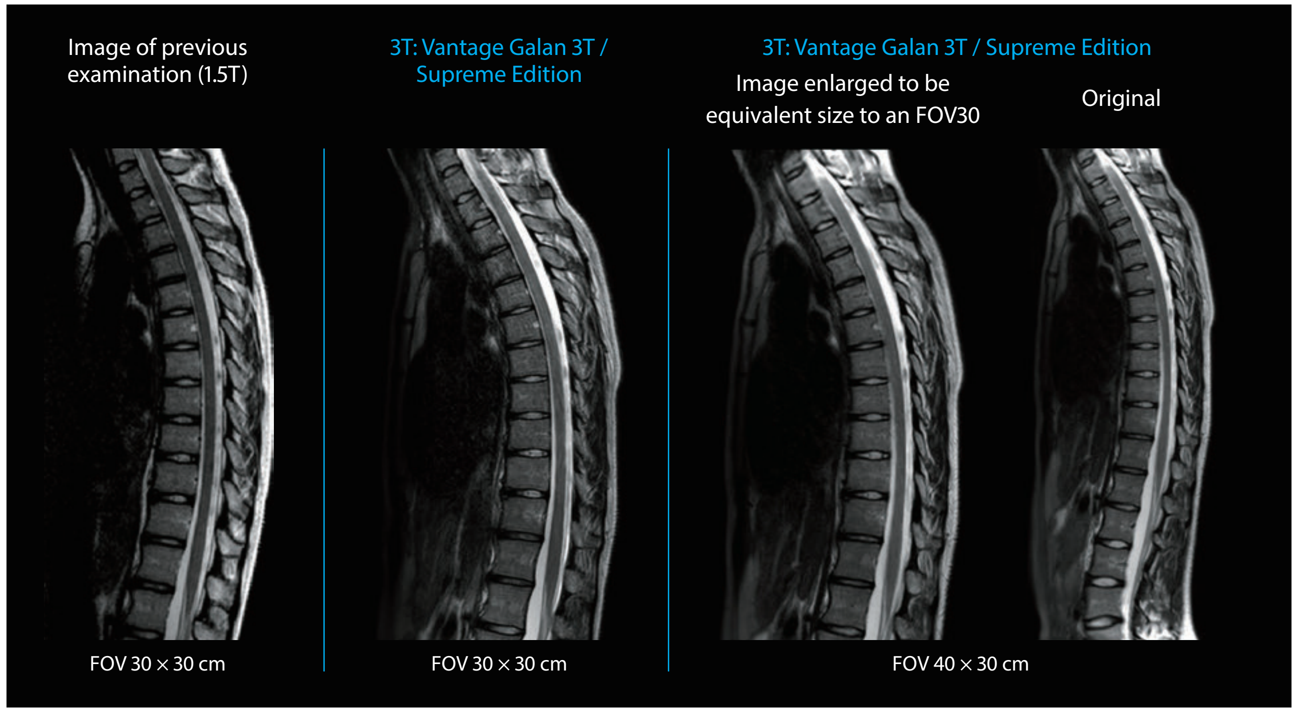

Figure 1: Same patient comparison of FOV difference of thoracic spine MRI on a 1.5T system with standard FOV and new 3T system with standard and large FOVs.

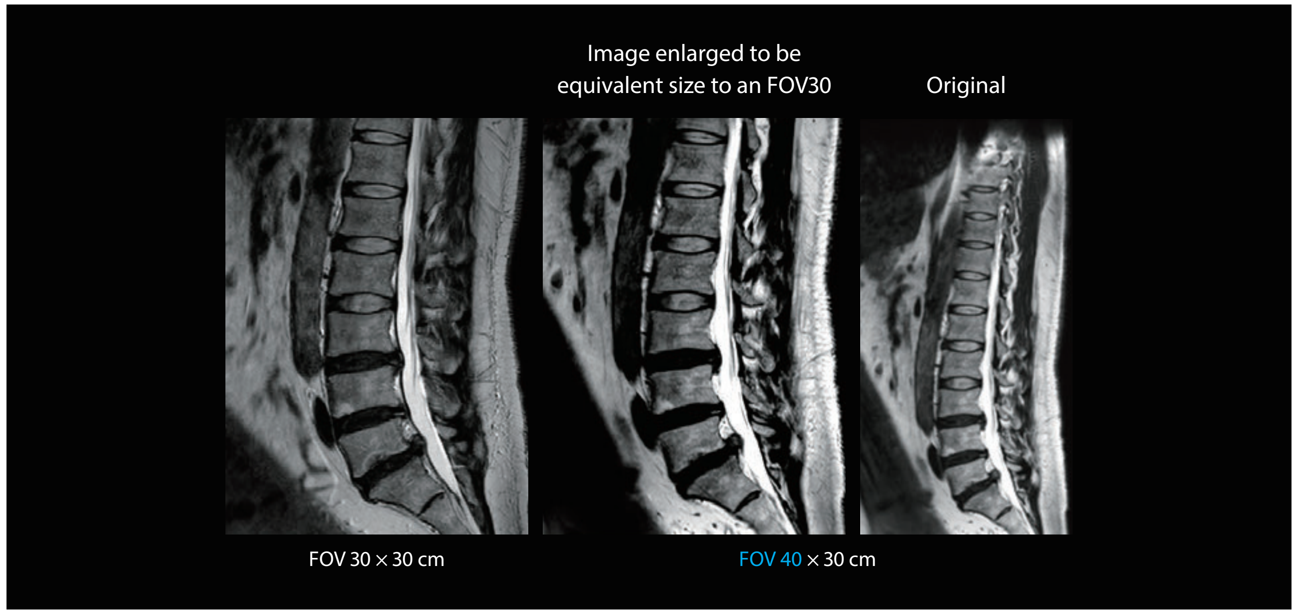

Figure 2: Comparison of FOV difference of lumber spine MRI on new 3T system with standard and large FOVs.

and dynamic MRI of a patient with breast cancer in the right CD region. Also Figure 5 shows a case of hepatic hemangioma, and Figure 6 shows a case of carcinoma of head of the pancreas. When PIQE is applied to fat-suppressed T2WI of the breast, T2WI of liver or fat-suppressed T2WI of the pancreas, PIQE provides 9 times higher spatial resolution with better image quality as compared with original T2WI with conventional reconstruction. Therefore, there is no need for rescanning or prolonging each examination time. With clinical installation of PIQE with Vantage Galan 3T / Supreme Edition, high-resolution MR images will become available in daily clinical practice with various clinical aims. Therefore, we can expect PIQE will improve diagnostic capabilities of DWI or dynamic MRI with better morphological images demonstrating macroscopic pathology as more accurately than currently used images.

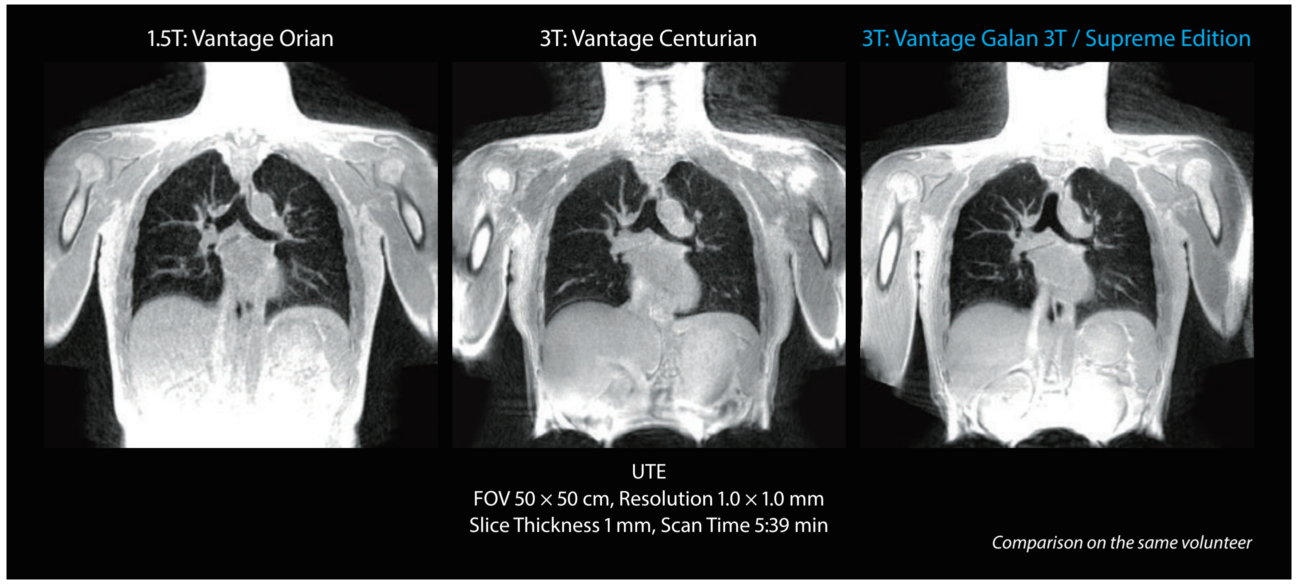

Figure 3: Comparison of UTE-MRI images between three systems on the same volunteer.

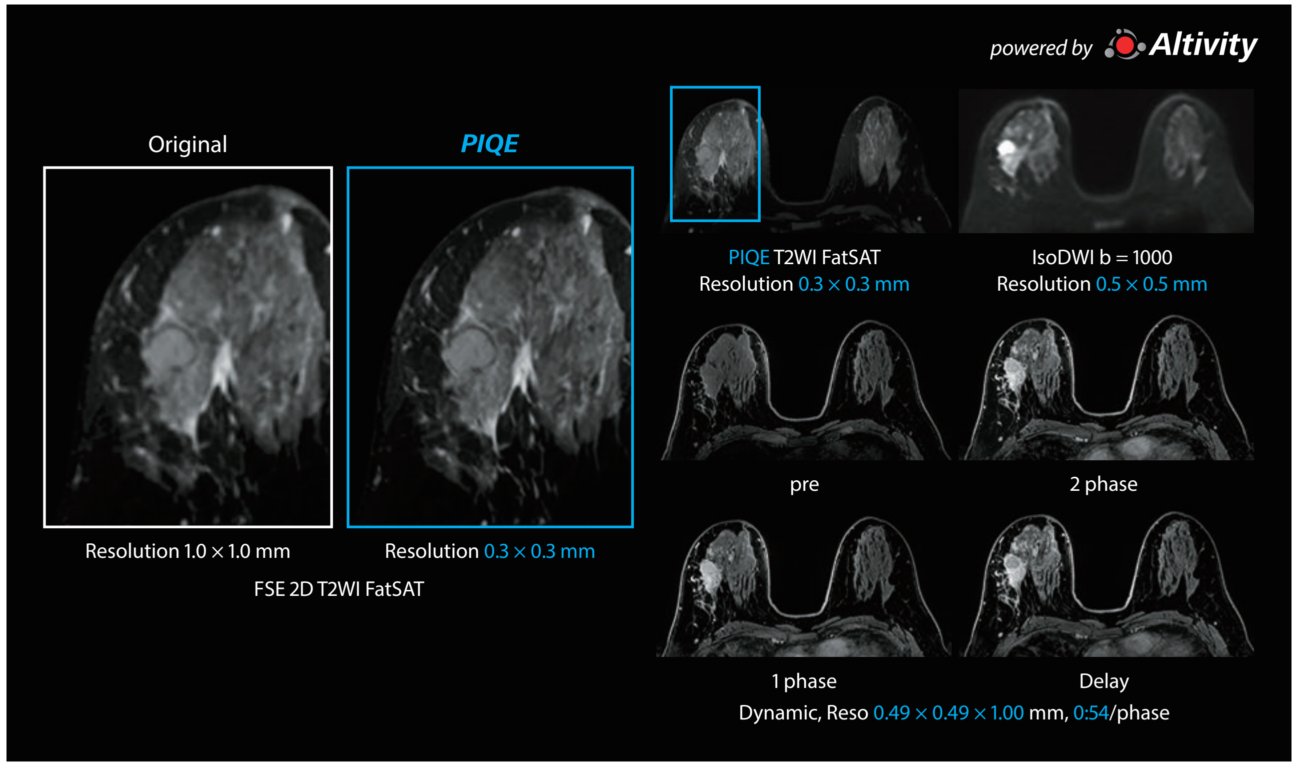

Figure 4: Right breast cancer.

•Zoom DWI
Zoom DWI is a small FOV imaging technique for DWI. Since the excitation pulses are rotated by a certain angle related to the refocus pulses, it is possible to eliminate aliasing artifacts in the PE direction. Zoom DWI is also used with PIQE. Figure 7 shows conventional DWI and Zoom DWI in a patient with carcinoma of the head of the pancreas. Zoom DWI was reconstructed with PIQE with higher resolution images than conventional DWI images. With the combination of Zoom DWI and PIQE to examine appropriate clinical purposes, DWI can provide higher resolution with better SNR images than conventional DWI and improve diagnostic performance or patient management in routine clinical practice.
Figure 8 shows T2WI, conventional DWI and Zoom DWI in a patient with prostate cancer.
T2WIs were reconstructed by conventional reconstruction method and PIQE. In contrast to T2WI, conventional DWI was obtained with larger FOV and reconstructed with conventional reconstruction, although Zoom DWI was obtained smaller FOV and reconstructed with PIQE. Zoom DWI reconstructed by PIQE shows higher spatial resolution and better SNR, when both DWIs obtained with the same scan conditions and times. When comparing Zoom DWI with conventional DWI, image quality of Zoom DWI at b=1500 s/mm^2 and apparent diffusion coefficient (ADC) map from Zoom DWI were markedly and significantly improved than those from conventional DWI with improving image distortion and depicting smaller lesions with better image quality.

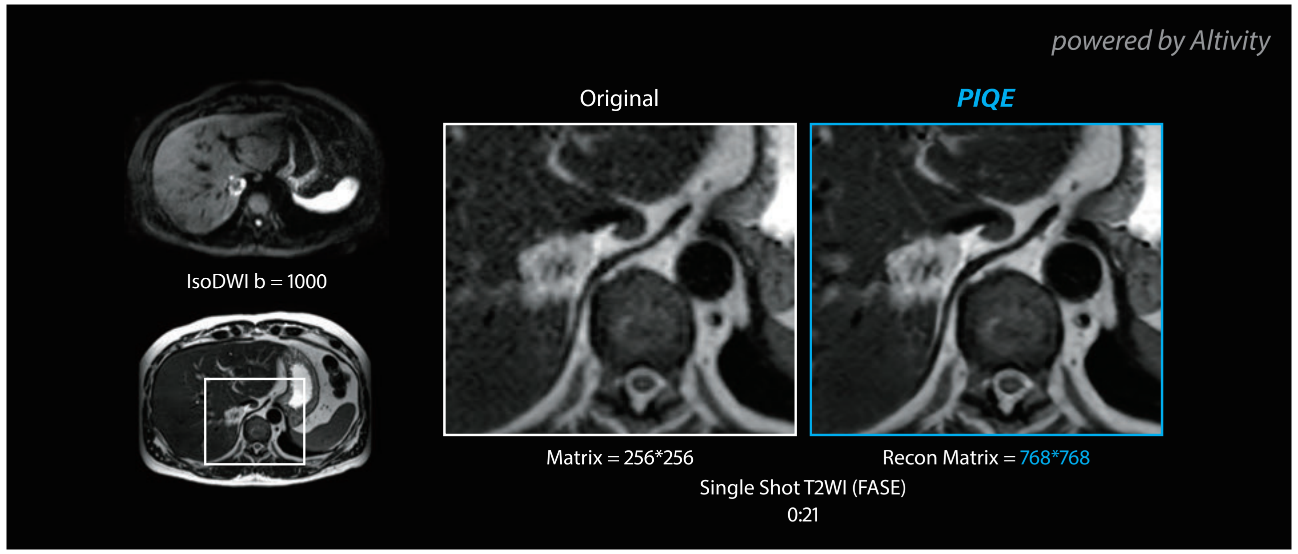

Figure 5: Hepatic hemangioma.

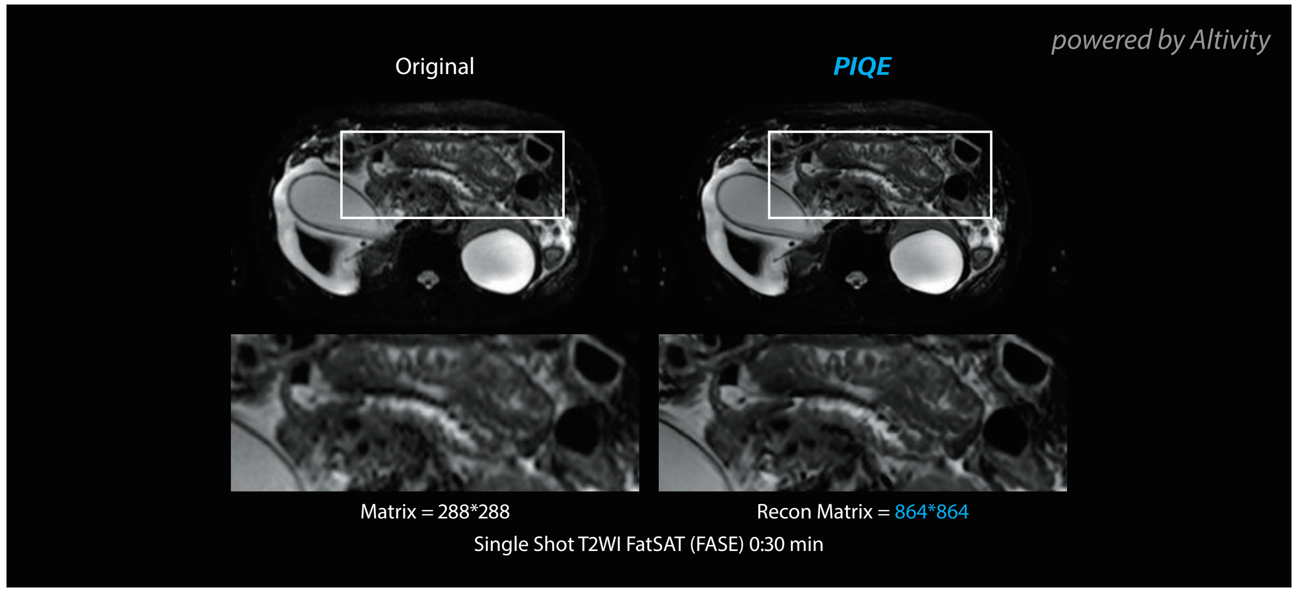

Figure 6: Pancreas head cancer.

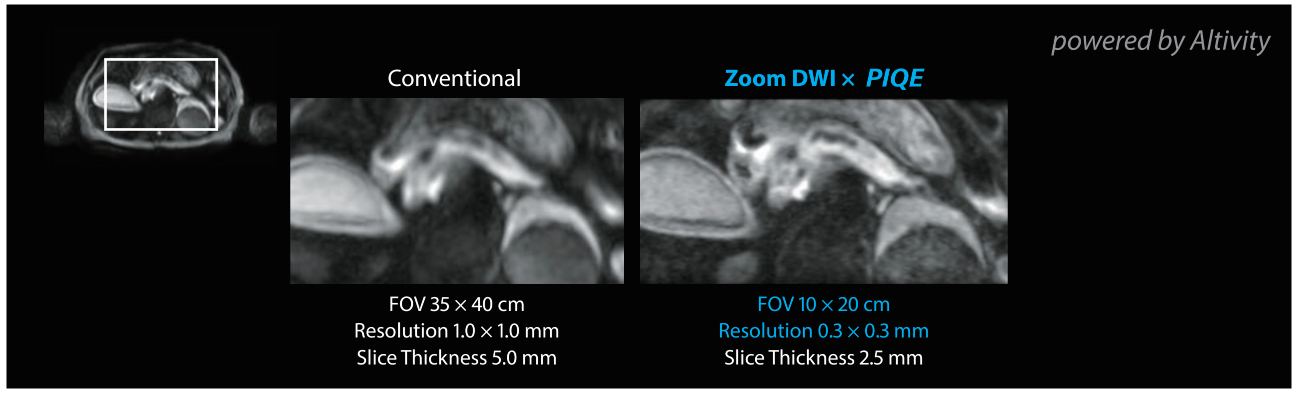

Figure 7: Carcinoma of head of the pancreas.

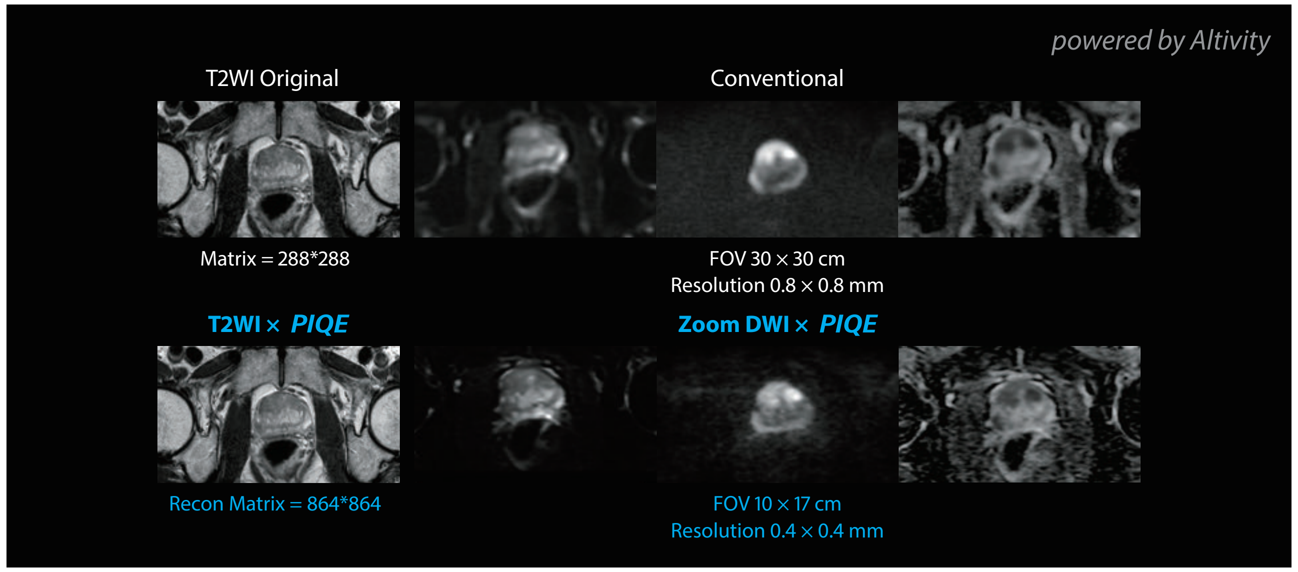

Figure 8: Prostate Cancer.

Conclusion
Canon Medical Systems provides a new 3T system, Vantage Galan 3T / Supreme Edition, with a new in-house developed magnet and clinically set the newest system software, which enables the ability to obtain MR images with large FOV, improve image quality of UTE-MRI, expand the applications of deep learning-based super-high reconstruction technique so called PIQE and acquire Zoom DWI with smaller FOV. Therefore, image quality in trunk region has been improved. With the above-mentioned new products and techniques, we believe further clinical potential and relevance will be demonstrated by this new 3T system in the near future. //

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The Vantage Galan 3T / Supreme Edition Makes its Own Path in 3-Tesla MRI Systems?

Takanobu Yamashiro, RT, PhD

Minoh City Hospital is a 317-bed core community hospital located in the northern region of Osaka Prefecture. Since its opening in 1981, our hospital has provided patient-centered, safe, and high-quality medical care, based on our hospital's philosophy, contributing to community healthcare.
In April 2024, our hospital replaced our existing 3T MRI system manufactured by another vendor with the Vantage Galan 3T / Supreme Edition manufactured by Canon Medical Systems Corporation. In this case study we summarize our experience as a user of the Vantage Galan 3T / Supreme Edition, complemented by the presented clinical MR images.

Why Vantage Galan 3T / Supreme Edition?

There are three main reasons why we decided on the Vantage Galan 3T / Supreme Edition from several candidates:
The first is that it employs a high-quality 3T magnet with the superior static magnetic field (B0) homogeneity (0.05 ppm over a 30 cm DSV), which is newly developed by Canon Medical Systems Corporation. We expected that the 3T system employing the new magnet would allow larger field of view (FOV) imaging (up to $55 \times 55 \times 50\ cm^3$), more homogenous fat suppression, and distortion-reduced diffusion-weighted image acquisition, compared to the previous 3T system (Figure 1).
The second reason is that the 3T system incorporates two types of deep learning-based reconstruction (DLR) technologies: one is Advanced intelligent Clear-IQ Engine (AiCE) for the noise reduction[1], the other is Precise IQ Engine (PIQE) for the super resolution[2]. In particular, PIQE enables high-signal-to-noise ratio (SNR) and high-resolution images to be generated from low-SNR and low-resolution images via two deep convolutional neural networks (DCNNs) not only for denoising but also for upsampling (Figure 2). PIQE might be a groundbreaking approach to accelerate the acquisition or to improve the image quality compared to conventional techniques, since it allows a more flexible adjustment of the number of phase-encoding steps contributing to the acquisition time and image quality. Also, since PIQE permits the retrospective reconstruction for previously acquired images, it seemed to be user-friendly to be able to efficiently optimize the image quality, adjusting the denoising level after acquisition.
The third reason is that the 3T system employs the MR Theater, which allows patients to watch virtual reality videos projected onto the dome-shaped screen inside the bore during MRI examinations. With the MR theater, we wondered if the claustrophobic or pediatric patients could undergo the MRI examinations without anxiety.
For these reasons, our decision-makers concluded that the 3T system was the most suitable for our hospital's philosophy.

The effects of the superior B0 homogeneity of the magnet on clinical MR images

The B0 homogeneity of the MRI magnet is directly related to the image quality.
As expected, we receive benefits from the high-quality magnet on the Vantage Galan 3T / Supreme Edition, especially in fat-suppressed images.
Generally, with fat saturation techniques based on CHESS or SPAIR, fat suppression is not likely to be homogenous and robust, especially in the complex-shaped regions containing a lot of air (e.g., neck, breast, pelvis)[3], and in the off-centered regions (e.g., shoulder).

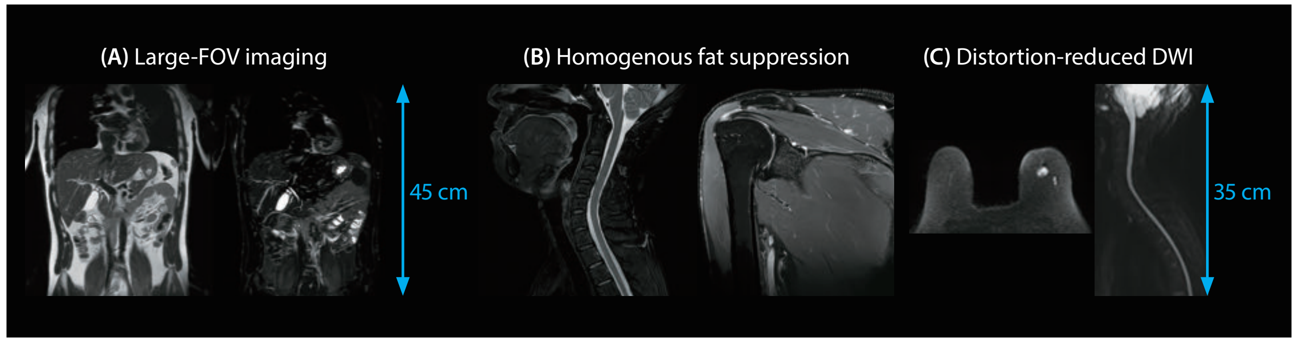

Figure 1: Expectations for the high-quality magnet with the superior static magnetic field homogeneity.
(A) T2-weighted image (left) and STIR image (right) of the abdomen in the coronal plane with FASE 2D. (B) Fat-suppressed T2-weighted image with SPAIR of the cervical spine in the sagittal plane (left) and of the shoulder in the coronal plane (right) with FSE 2D. (C) Diffusion-weighted image with SPAIR of the breast in the axial plane (left) and of the cervical spine in the sagittal plane (right) with SE-EPI.

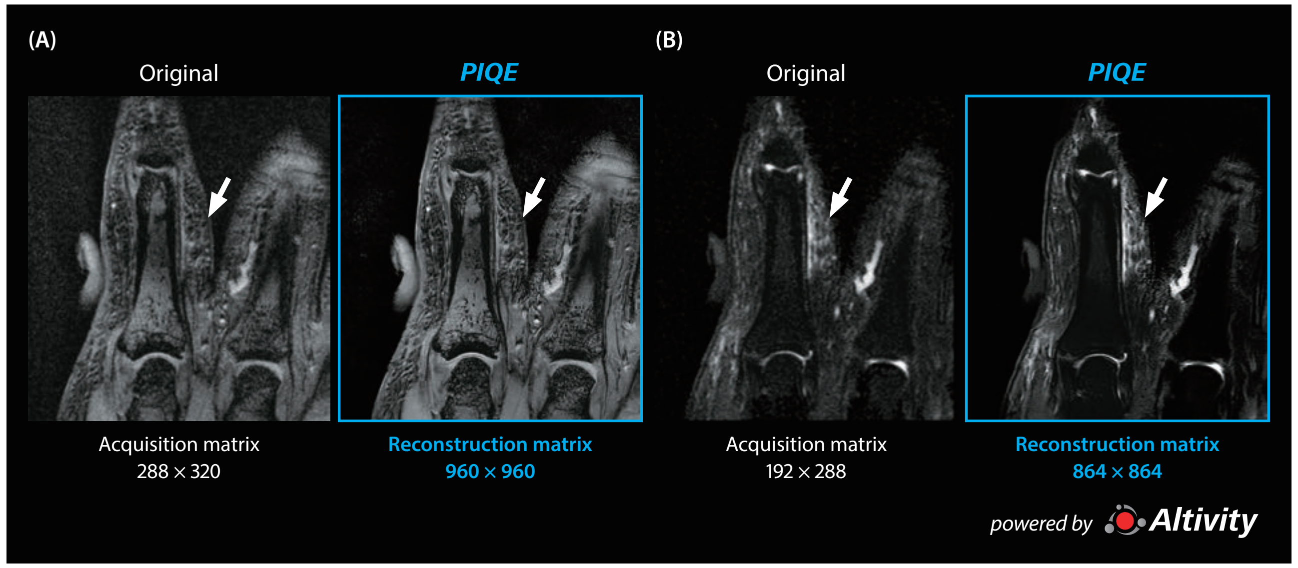

Figure 2: The effect of Precise IQ Engine (PIQE) on small-FOV imaging.
(A) T2-weighted image of the fingers in the coronal plane without PIQE (left) and with PIQE (right). (B) Fat-suppressed T2-weighted image with SPAIR of the fingers in the coronal plane without PIQE (left) and with PIQE (right). White arrows in (A), (B) indicate lesions.*

Figure 3 shows the MR images in a case of recurrent breast cancer, which were acquired on the first day of MRI examinations. The fat suppression on the T2-weighted images with SPAIR seemed to be homogeneous and effective enough to observe the lesion. In this case, the breast shape was anatomically asymmetric, because the patient had undergone a segmental mastectomy for left breast cancer.
On conventional MRI systems, we would often struggle with fat suppression inhomogeneity, especially in the asymmetrically shaped breast, where it is difficult to separate the spectral peaks between fat and water due to B0 inhomogeneity. However, on the Vantage Galan 3T / Supreme Edition, we can acquire more homogeneous and effective fat-suppressed images as shown in Figure 3.
Therefore, we are confident that the homogenous fat suppression can be attributed to the superior B0 homogeneity of its magnet and precise active shimming to separate the spectral peaks.
In addition, there are various robust fat suppression techniques including Dixon techniques on the 3T system, in which Enhanced Fat Free is the most useful in the dynamic contrast-enhanced MRI of the breast because it is a unique technique with a dual CHESS pulse to reduce fat suppression inhomogeneity[4].
We have observed that the strongest point on this 3T system is robust fat suppression due to the superior B0 homogeneity and many options for the suppression.

The new approach to high-acceleration imaging revolutionized by PIQE

One of the biggest issues in MRI examinations is long acquisition time. Furthermore, there is a trade-off between acquisition time and image quality.
To accelerate the MRI acquisition, it is common to use some acceleration techniques such as parallel imaging and compressed sensing, which regularly or randomly undersample phase-encoding steps contributing to the acquisition time. However, since these techniques result in SNR degradation on the acquired images, it is desirable to use them for the protocols maintaining SNR to a certain level.
As an alternative to accelerate the acquisition, we often reduce the number of phase-encoding steps which leads to a decrease in the in-plane resolution. PIQE seems to be the most useful in this case because it can improve the resolution down to one-ninth of the pixel size by its reconstruction. In other words, PIQE enables highly accelerated acquisition while maintaining in-plane resolution.
More interestingly, this approach conversely allows an increase in SNR unlike conventional acceleration techniques since the acquired pixel size is increased by reducing the number of phase-encoding steps. Previously there has been no such approach to enable the ability to flexibly adjust the number of phase-encoding steps contributing to the acquisition time and image quality. Additionally, there is no artifact particular to the conventional acceleration techniques in this approach, since the number of phase-encoding steps are adjusted just before the acquisition.
Thus, PIQE has broken the mold in terms of simultaneously improving acquisition time, in-plane resolution, SNR, and artifact generation.

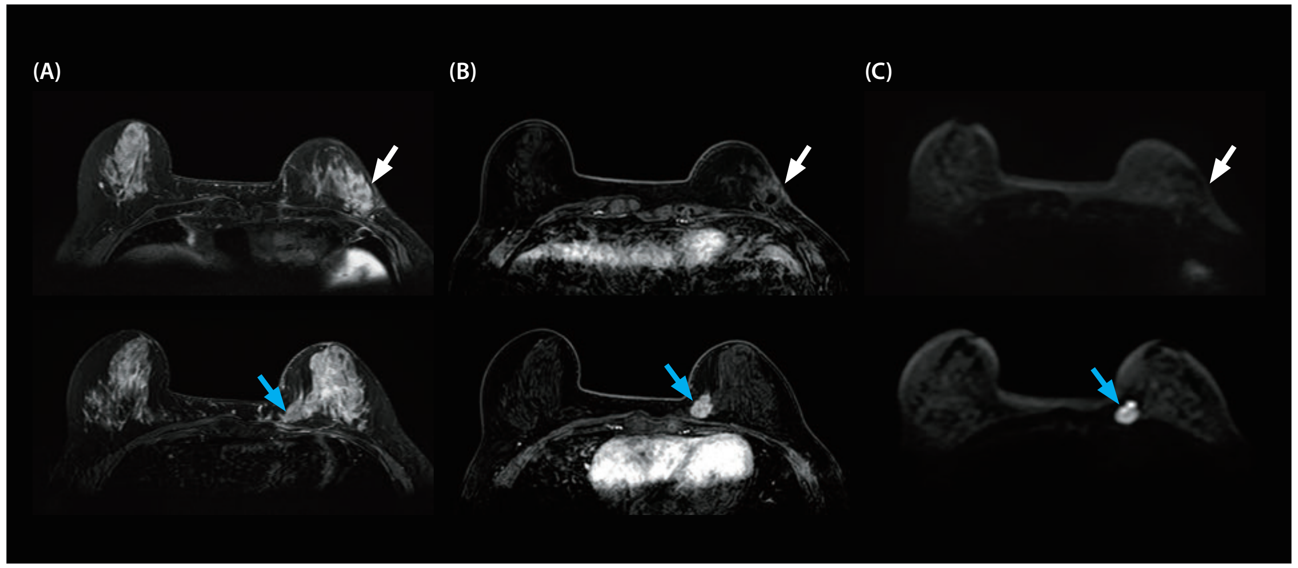

Figure 3: Homogenous fat-suppressed images with robust fat suppression techniques in breast MRI.
(A) Fat-suppressed T2-weighted images with SPAIR of the breast in the axial plane. (B) Fat-suppressed dynamic contrast-enhanced MR images with Enhanced Fat Free of the breast in the axial plane. (C) Diffusion-weighted images with SPAIR of the breast in the axial plane. The white arrows in the upper images indicate the region undergoing a segmental mastectomy. The blue arrows in the lower images indicate the lesion of recurrent breast cancer.

The balance between high acceleration and high quality in prostate MRI with PIQE

In the diagnosis of prostate cancer, MRI is one of the major modalities for locoregional cancer staging and targeted prostate biopsy. Therefore, to standardize the acquisition and interpretation in prostate MRI, Prostate Imaging-Reporting and Data System (PI-RADS®) has been published[5].
As shown in PI-RADS v2.1 scoring system, multiparametric MRI (mpMRI), which combines morphologic assessment (i.e., T2-weighted image) with functional assessment (i.e., diffusion-weighted image and dynamic contrast-enhanced MRI), has a major role in prostate MRI. It has been reported that the image quality in mpMRI is associated with the diagnostic quality of prostate cancer[6]. Therefore, it is critical for us to acquire the high-quality images in mpMRI.
Optimizing MR image quality requires balancing trade-offs between SNR, spatial resolution, tissue contrast resolution, and acquisition time. For example, to deblur and to enhance the tissue contrast resolution in T2-weighted images, it is desirable to reduce echo train lengths (ETLs) if possible, but that results in extending the acquisition time, which is likely to generate respiratory motion artifacts.
Figure 4 shows the clinical images in mpMRI of the prostate. The high-spatial resolution T2-weighted images (reconstruction resolution: 0.2×0.2×2 mm^3) were acquired with PIQE (Figure 4A), which enabled the reduction of the acquisition time by approximately two minutes while increasing the SNR, because the number of phase-encoding steps could be reduced instead of increasing ETLs. Moreover, increasing SNR broadens the options to change other imaging parameters such as receiver bandwidth to reduce the respiratory motion artifacts in the pelvic MRI.
Thus, PIQE delivers exceptional-quality T2-weighted images in mpMRI with higher-spatial resolution than PI-RADS recommends, and with shorter acquisition time than before.

Immersive experiences inside the bore to distract the patient's attention

Our hospital has aimed to offer a patient-friendly environment to patients undergoing MRI examinations.
The MR Theater, which delivers virtual reality videos inside the bore to distract the patient's attention during the scan has played a critical role in that respect. In addition, it allows any video content that patients like to be played, resulting in calming their anxiety. Actually, there were some cases where some patients with claustrophobia were able to undergo an MRI examination by distracting their attention, even though they had never been able to previously.

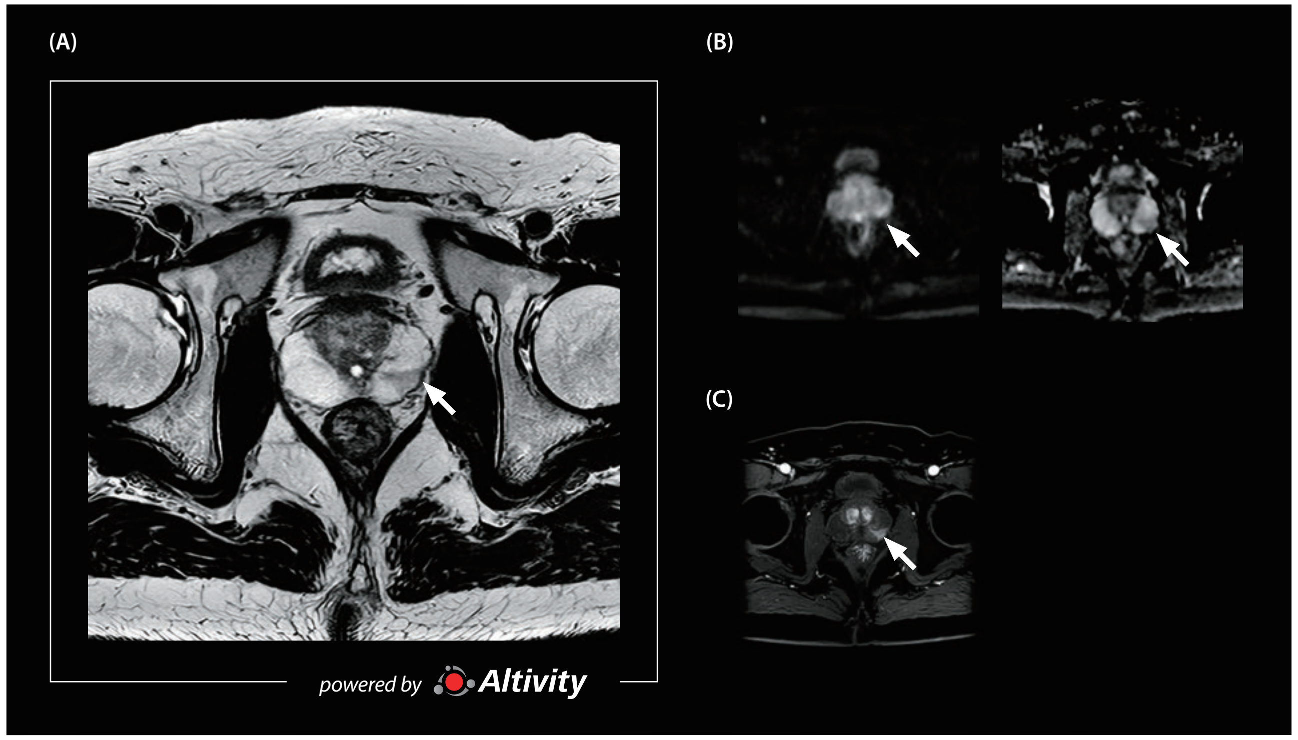

Figure 4: Multiparametric MRI combing morphologic assessment with functional assessment in prostate MRI.
(A) 2 mm-slice T2-weighted image of the prostate in the axial plane with PIQE. (B) Diffusion-weighted image with a b-value of 1400 s/mm^2 of the prostate in the axial plane. (C) Fat-suppressed dynamic contrast-enhanced MR image with Enhanced Fat Free of the prostate in the axial plane. White arrows in (A)-(C) indicate the lesions of prostate cancer.

In the future we are wondering if the MR Theater will enable pediatric MRI examinations without sedation, which is associated with side effects such as respiratory depression. To realize non-sedated pediatric MRI examinations, we would like to study what kind of video content will calm pediatric patients during scanning, utilizing original content made by our hospital.

In the case study we have summarized our experience as a user of the Vantage Galan 3T / Supreme Edition. In particular, its high-quality magnet, DLR technologies, and MR Theater make a significant difference to our MRI examinations, which would not be the case with other MRI systems. However, this case study reflects only a part of our experiences of a few months since the replacement with the Vantage Galan 3T / Supreme Edition. We still have some challenges to work on with the 3T system, for which we have high expectations.

Going forward, we will continue to find unique clinical values on the Vantage Galan 3T / Supreme Edition, also utilizing other applications such as Zoom DWI, along with the rock-solid follow-up service from Canon Medical Systems Corporation. //

Figure 5: The MR Theater delivering a patient-friendly environment inside the bore.
During the MRI examinations, the MR Theater distracts patient's attention inside the bore. In addition to the MR Theater, the exterior of the scanner is decorated with Japanese maple leaves to calm patient's anxiety.

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ITEM2024 Report

Hisae Chiba

Canon Medical Systems Corporation launched a new 3T MRI system, Vantage Galan 3T / Supreme Edition at the International Technical Exhibition of Medical Imaging (ITEM) 2024 Conference in Yokohama, Japan from April 12th to 14th. This was the first time the Vantage Galan 3T / Supreme Edition was exhibited publicly anywhere in the world (Figure 1). This article describes the exhibition summary and voice of visitors.

Exhibition summary

Vantage Galan 3T / Supreme Edition with completely new hardware

Vantage Galan 3T / Supreme Edition is a system that has completely new and optimized hardware, which is the key to refined image quality. In particular, a new magnet which contributes to optimized image quality has been developed in-house and features precise Japanese craftmanship. By designing and manufacturing the coil windings at micron-level precision, a higher magnetic field uniformity than previously has been achieved (0.2 ppm → 0.05 ppm @30 cm DSV (Typical)) and expanded the maximum field of view (FOV) (Figure 2). Additionally, Vantage Galan 3T / Supreme Edition implements an optimized gradient coil called CSGC, short for Cross-pattern Supported Gradient Coil, and Real-time Platform for faster data communication between hardware and software. This all-new hardware maximizes the performance of our AI solutions, such as Precise IQ Engine (PIQE), a deep learning-based high-resolution technology, and Advanced intelligent Clear-IQ Engine (AiCE) deep learning-based noise reduction technology. Overall, Vantage Galan 3T / Supreme Edition delivers high quality, fast and stable examinations (Figure 3).

Further evolution of PIQE

The recently released PIQE has now expanded applicable sequences to almost all 2D sequences, making it possible to enhance image quality and reduce scan time for a wide range of examinations. In particular, the impact of use with FASE 2D sequences is significant and was rated highly by many visitors to the congress exhibit (Figure 4).

Voice of visitors at ITEM2024

Vantage Galan 3T / Supreme Edition's new hardware and software received praise from many visitors who viewed the product and images during ITEM2024. In particular, many positive comments were received regarding the passion of the engineers towards the in-house development of the new magnet. Comments like "I can see that Canon is investing strongly into MR", "The momentum of Canon MR is very strong" and "I was surprised that 3T had as large a FOV as 1.5T (HF direction)". In terms of PIQE sequence expansion, comments such as "This technology is going beyond what we understand about MRI", "It would be helpful if these high-resolution images are obtained in routine examinations" and "When I think of deep learning technology, the first company that comes to mind is Canon. It has been installed in many facilities and is highly reliable".

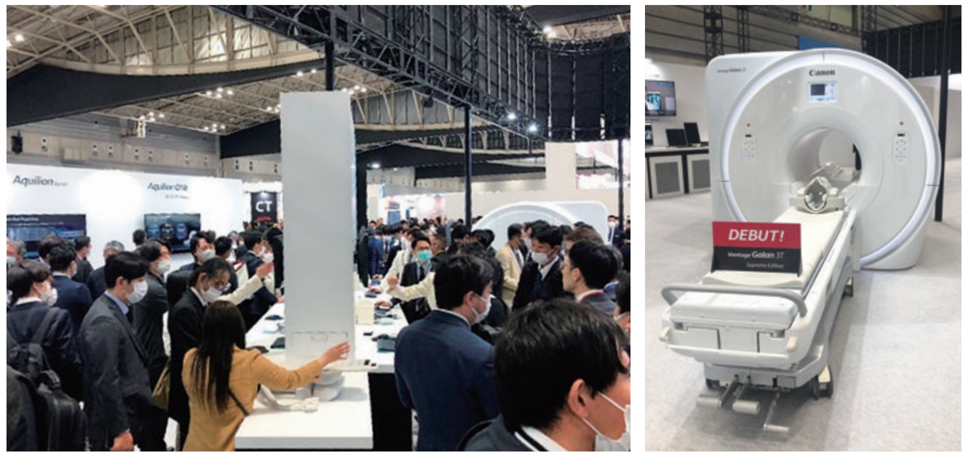

Figure 1: Canon MR booth at ITEM2024.

Conclusion

The MRI exhibition at ITEM2024 resulted in very positive feedback for the new Vantage Galan 3T / Supreme Edition, with the new system making a strong statement about the exciting future of Canon's MRI. //

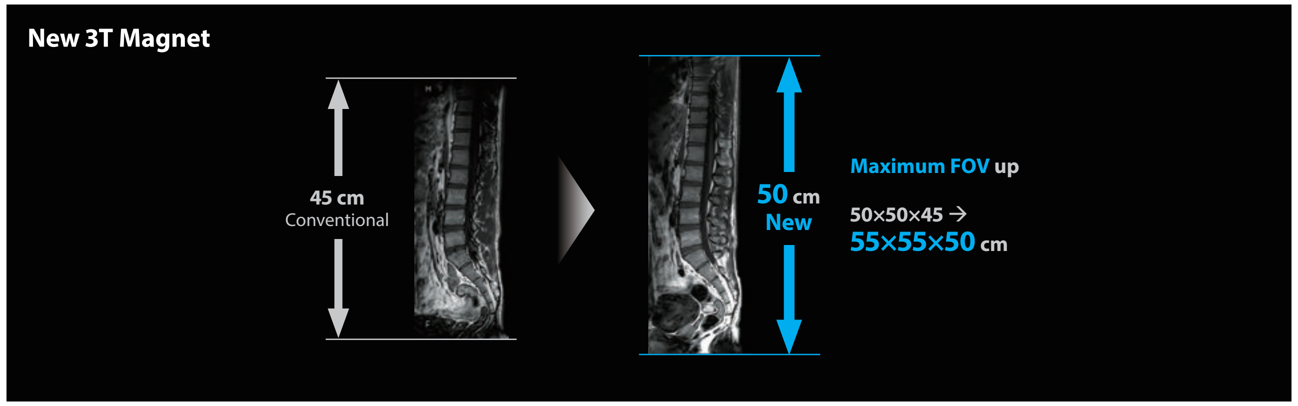

Figure 2: Expands the maximum FOV.

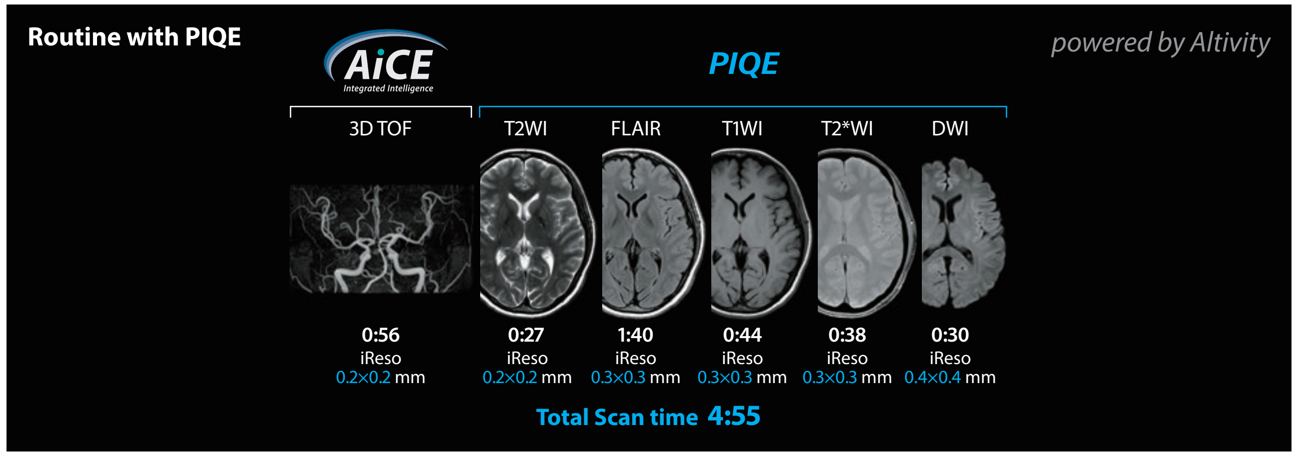

Figure 3: Routine high-resolution head images obtained with shorter scan time.

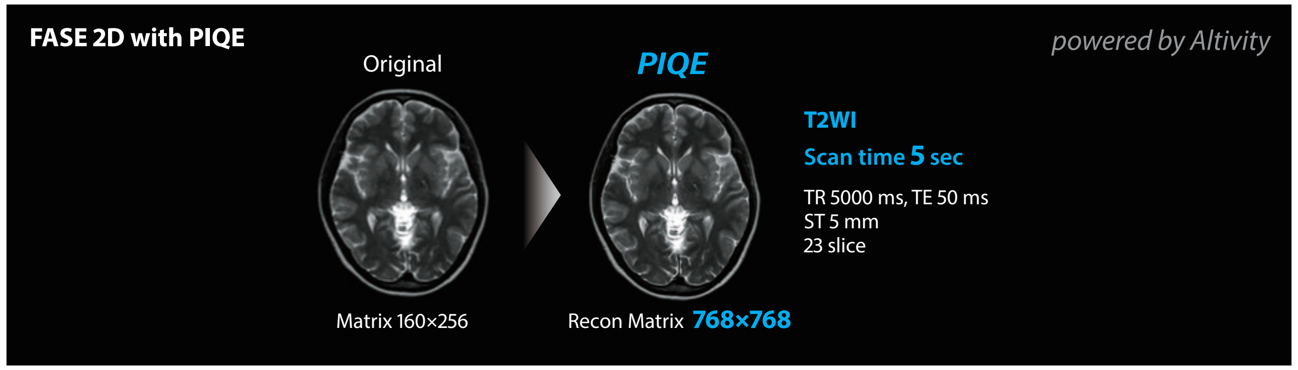

Figure 4: 5-second scan of FASE 2D with PIQE.

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The AI technology was trained during the development phase. When implemented into the product, the AI function no longer self-learns.

Altivity Altivity is Canon Medical's new approach to AI innovation. It is a multimodality, overarching brand, which pulls together all the AI technology that Canon Medical provides under one name.

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