Publication for the Philips MRI community **Issue 60 – 2025**

FieldStrength

BlueSeal
cost savings and operational simplicity

MRI technology for ultimate precision and maximum speed

To a modern MRI without a change of magnet

Researchers unlock the diagnostic potential of sodium MRI

Dear Friends,

The healthcare industry faces increasing demand for MRI scans while battling widespread staff shortages and rising burnout among healthcare professionals worldwide. Radiology departments are under immense pressure to deliver more with fewer resources, all while ensuring diagnostic accuracy and maintaining a high standard of care. Our goal is to keep revolutionizing MRI technology to address these challenges; to enhance personalized care, tackle staff shortages, and meet rising clinical demands. Explore this 60th issue of FieldStrength to see how our MRI innovations empower users to excel and achieve outstanding progress.

Our BlueSeal technology is making a difference in over 2,000 sites worldwide, saving millions of liters of helium, while MR PowerSave+ reduces power consumption by up to 46%[1]. University Hospital Marburg has experienced cost savings and operational simplicity since installing their BlueSeal system. BHRUT in the UK praises the speed, quality, ease of use, and attractive total cost of ownership of Philips BlueSeal technology. Read these two stories!

Philips' AI-based SmartSpeed has revolutionized MRI operations for our users. At MRI practice Potsdam in Germany, SmartSpeed enabled fast, high-quality 1.5T exams across all anatomies, boosting patient throughput by about 20 percent. Kumamoto Chuo Hospital in Japan has achieved enhanced image quality and shorter imaging times with SmartSpeed on their 3.0T Elition, making diagnoses much easier.

Our commitment to workflow efficiency continues to impress our users. Explore how automation and new features made an impact at FUESMEN. Its MRI staff highlights the time-saving capabilities and the benefits of the two large screens, greatly improving efficiency for technologists and radiologists.

Our article about MR Subscription explains how you can keep your MRI system up to date. Customers can also upgrade long-standing systems to extend their lifespan. Toyonaka Municipal Hospital upgraded their nine-year-old MRI instead of buying a new magnet, bringing them cost savings, high-quality imaging, shorter exam times and improved workflow efficiency.

The educational article about Multi Nuclei imaging showcases remarkable sodium MRI imaging from researchers at VUIIS, successfully combining sodium and proton imaging in one ExamCard.

Continuing its momentum in AI-powered MR, Philips has received FDA 510(k) clearance for SmartSpeed Precise[2] MR acceleration software, marking a major milestone in the journey toward autonomous, personalized MRI. SmartSpeed Precise is the first integrated dual AI solution in the industry, delivering up to 3x faster scanning and up to 80% sharper images—all in just one click. SmartSpeed Precise is seamlessly integrated into the MR system, enabling a transformative leap in workflow efficiency and throughput, all without compromising image quality. This deep integration allows radiology teams to harness the full power of AI in a single, intuitive solution that simplifies daily operations, accelerates scans, and consistently delivers sharp, high-quality images across clinical settings.

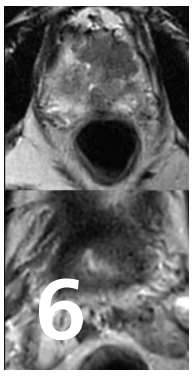
Enjoy reading!

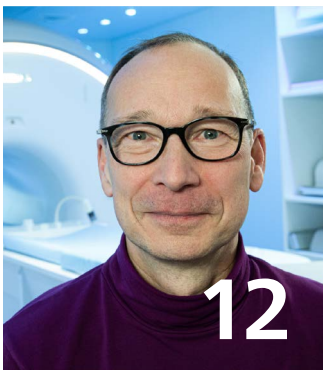
Ioannis Panagiotelis

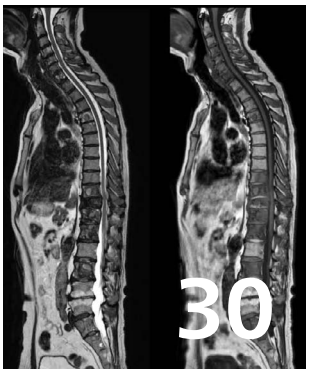
Ioannis Panagiotelis, PhD
Global BU Leader MR, Philips

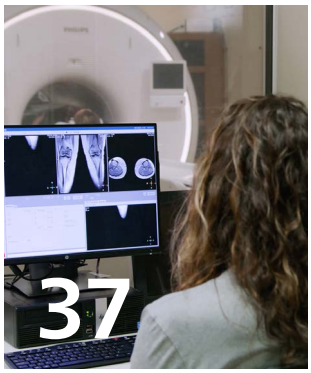
1. By switching automatically to stand-by mode when the system is not being used for scanning.
2. SmartSpeed Precise is not yet CE marked and not available for sale across the world.

BlueSeal MRI: cost savings and operational simplicity









News

User experiences

Educational

MR Subscription

Results from case studies are not predictive of results in other cases. Results in other cases may vary. Results obtained by facilities described in this issue may not be typical for all facilities.

SmartSpeed Precise MRI technology is powered by unique integrated Dual AI[1] for ultimate precision at maximum speed

At ISMRM 2025 in Hawaii, Philips highlighted SmartSpeed Precise as our next generation acceleration technique that expands the proven Compressed SENSE and SmartSpeed[4] technologies with a unique integrated Dual AI[1] innovation. SmartSpeed Precise delivers up to 80% sharper images[2] and increases imaging speed by up to a factor of 3.[3]

Ultimate precision at maximum speed with Dual AI[1]

SmartSpeed Precise uses two AI engines: one for denoising and a second for sharpening the images. With this combination, SmartSpeed Precise enhances image quality with a better signal-to-noise ratio, an increase in sharpness by up to 80% compared to conventional[2] imaging and MR images with reduced ringing.

Get ahead with maximum acceleration

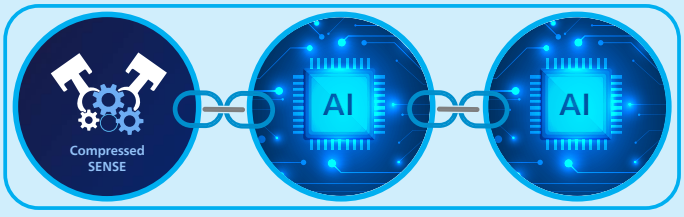
SmartSpeed Precise enables scanning that is up to three times faster[3], which helps reduce total exam time. This benefits MRI department productivity when the time gained is used to scan more patients and reduce the cost per scan, to insert unplanned patients into the schedule or to reduce staff overtime.

Feel at ease with automated workflows

The deep integration of the Dual AI engines allows single parameter workflow to deliver image quality optimization in an easy and smooth single click.

SmartSpeed Precise
Ultimate precision at maximum speed, powered by

Integrated Dual AI[1] reconstruction



Compressed SENSE

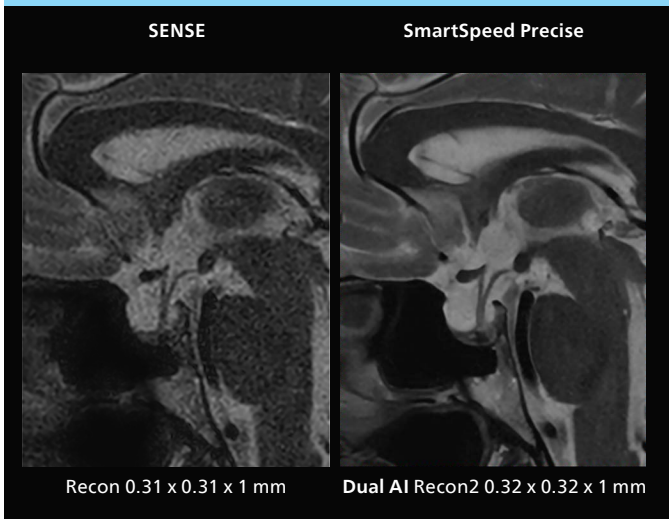
1st AI engine at source of MR signal[2]

2nd AI engine at complex image domain

Maximize speed & Maximize denoising & Maximize sharpening

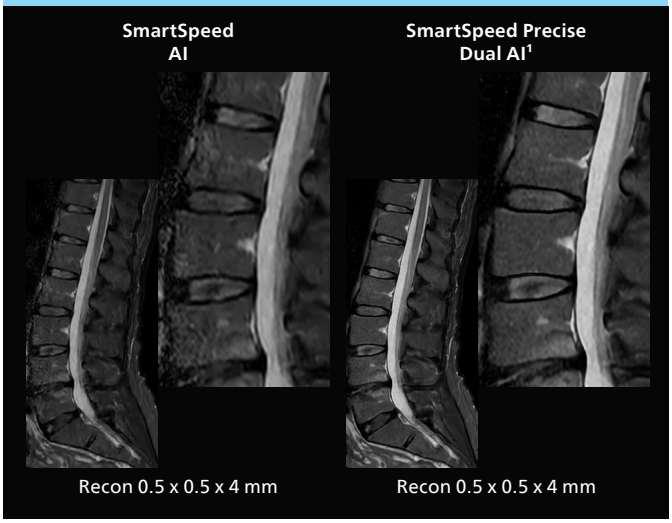
SENSE vs SmartSpeed Precise – Pituitary

Both sagittal T2 TSE images had the same scan time of 3:32 min. However, the image quality and sharpness of the SmartSpeed Precise image are clearly superior to the non-AI SENSE image.



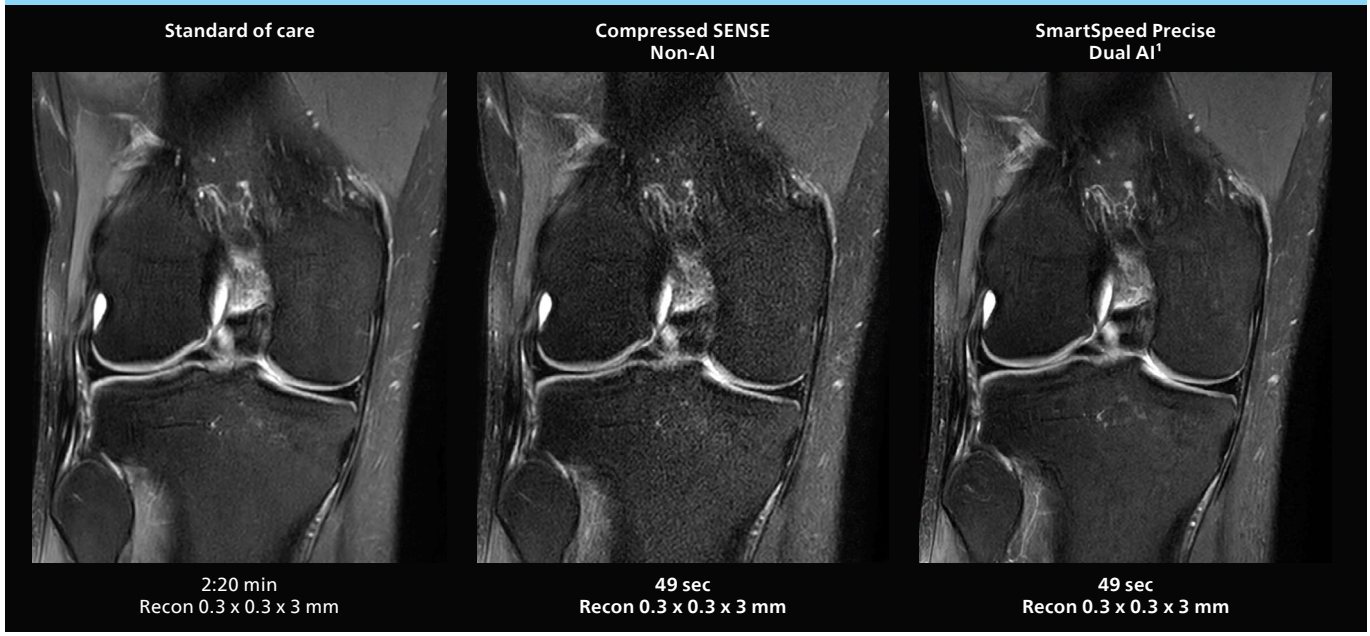
SmartSpeed vs SmartSpeed Precise – Lumbar spine

Both lumbar spine STIR scans took 1:14 min, and both voxel sizes are 0.5 x 0.5 x 4 mm recon. However, the image quality is clearly better with SmartSpeed Precise.



SmartSpeed Precise: reduced scan time with equal or better image quality[2] – Knee

Comparison of a common exam, Compressed SENSE and SmartSpeed Precise in a PD fat suppressed knee scan as an example illustrating the power of Dual AI.



1. Reconstruction technology consisting of a first AI engine applied at the source of signal (Adaptive CS-NET) and a second AI engine applied on the raw complex imaging data (Precise Image Net).
2. Compared to Philips SENSE/C-SENSE imaging.
3. Compared to Philips SENSE imaging.
4. SmartSpeed is compatible with 97% of clinical protocols on average, measured across a sample of sites from Philips MR installed base.

Disclaimer: SmartSpeed Precise is not yet CE marked and not available for sale across the world.

AI-enabled MRI boosts speed and quality at Kumamoto Chuo Hospital

At Kumamoto Chuo Hospital, Japan, Dr. Kazuhiro Katahira has been achieving fast, high quality images with AI-enabled SmartSpeed MRI technology. In use for six months, he describes the image quality improvements that he has seen in imaging of the whole body, spine, abdomen, prostate, breast and more. He also highlights the great impact of motion-free imaging in upper abdominal and prostate exams.

Dr. Kazuhiro Katahira
Radiologist at Kumamoto Chuo Hospital, focusing on diagnostic MRI, CT and RI, with an interest in IVR.

> **"In my experience, diagnosis has clearly become easier since we started using SmartSpeed. In many instances we have been able to quickly find answers to cases that we had been struggling with in the past."**
>
> Dr. Kazuhiro Katahira

Impressed by AI-enabled improvements

For Kumamoto Chuo Hospital, Japan, using SmartSpeed technology was their first experience with AI-enabled MRI acquisition. "Before that, we had been using Compressed SENSE, which was a first significant step forward in speed and quality compared to SENSE that we used before," says Dr. Kazuhiro Katahira, Radiologist at Kumamoto Chuo Hospital. He notes that after the considerable image quality improvement with Compressed SENSE, adopting AI-enabled SmartSpeed has taken fast, high-quality imaging to the next level.

"I like using SmartSpeed because our image quality has considerably improved and the time required for imaging has shortened, making it a very useful technology," he says. "In my experience, diagnosis has clearly become easier since we started using SmartSpeed. In many instances we have been able to quickly find answers to cases that we had been struggling with in the past."

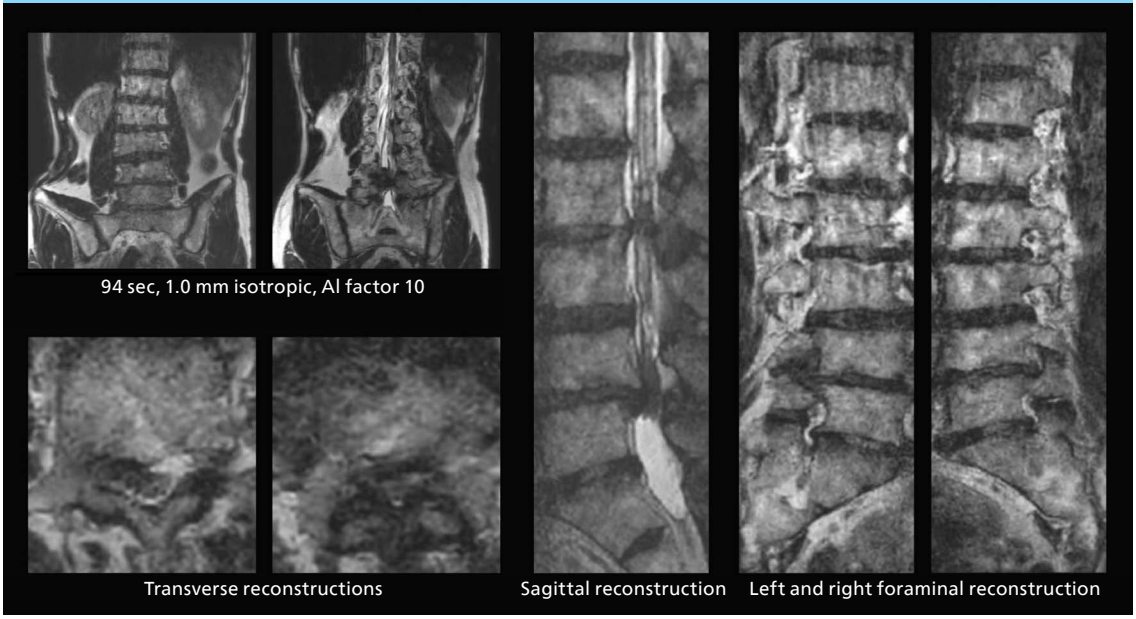
At 6 months, SmartSpeed demonstrates outstanding versatility

Kumamoto Chuo Hospital performs 7000 to 8000 MRI examinations annually. These include a large number of body imaging exams, including approximately 1200 prostate exams, 700 to 800 whole body diffusion exams, as well as liver, bile and fluid exams, and in special cases imaging of the chest area. The hospital uses two Philips MRI machines, a 3.0T Elition and a 1.5T Ingenia.

When SmartSpeed was first employed, it was clear that its AI aspect would be particularly useful. Dr. Katahira explains that it improves the SNR (signal-to-noise ratio) basically by denoising, to create beautiful images. He has identified many advantages. "When higher SNR is not needed, the improved quality can be traded for other benefits, such as shortening the scan time, increasing spatial resolution, sharpening the image quality and many other applications, making it clinically very useful," he says. ►

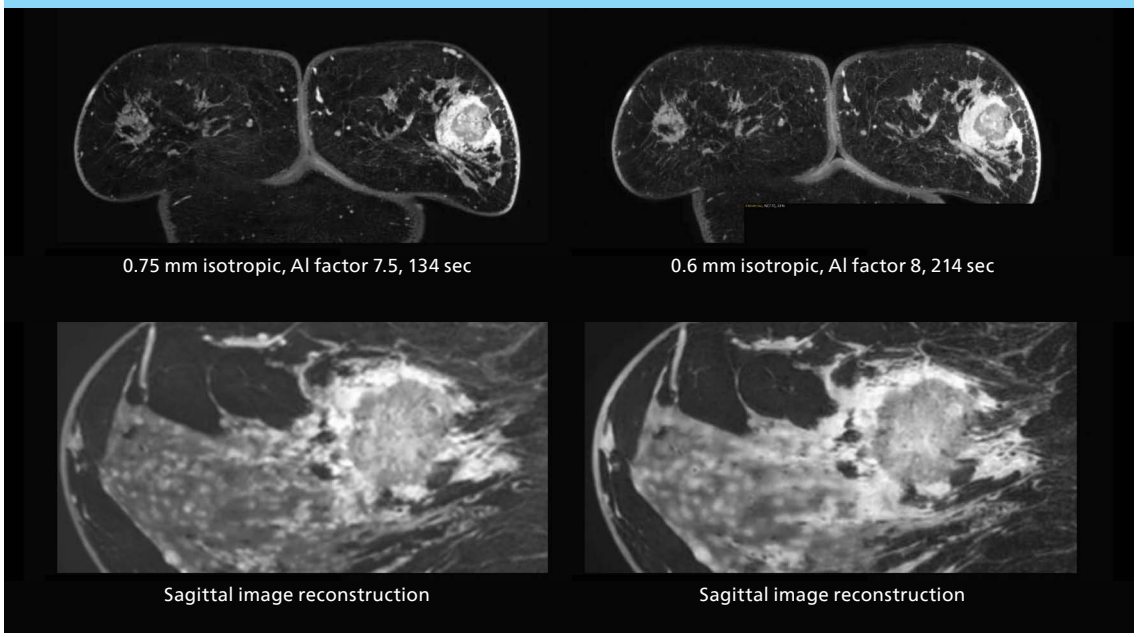
Fast lumbar spine imaging for successful exam of patient in pain

A patient saying that undergoing MRI was not possible because of severe back pain and leg pain, was imaged with SmartSpeed in only 94 seconds. The scan was diagnostic and afterwards the patient confirmed that it only took a little while. Performed on Elition X. The hospital's fast lumbar spine ExamCard includes T2W SpineVIEW, 1:40 min, 1.0 mm isotropic, acceleration factor 12.



3D MRI of breast cancer

Scanning was performed with two different voxel sizes. AI enabled volume MRI allows image reconstruction in other directions. Biopsy revealed invasive ductal carcinoma in this patient. Performed on Elition X.



After six months of use, "SmartSpeed is incorporated into all of our examinations. Its clinical advantages are very difficult to sum up in a few words," according to Dr. Katahira, so he highlights some specific examples: "It helps us in the diagnosis of breast cancer by showing great detail, allowing us to observe development in the breast duct. And in the diagnosis of rectal cancer, it helps us see the invasion of the cancer and the surrounding area in greater detail."

> "In the diagnosis of rectal cancer, it helps us see the invasion of the cancer and surrounding area in greater detail."
>
> Dr. Kazuhiro Katahira

Faster lumbar spine exams are beneficial for patients with pain

Many patients who must undergo a lumbar spine examination suffer from back pain. For these patients it is difficult to maintain the imaging position long enough to successfully complete the examination. "In such cases, using SmartSpeed allows us to perform volume imaging, so that we acquire only one high resolution 3D sequence in a short time and then reconstruct the other orientations from that," Dr. Katahira says.

"This is highly advantageous because the patient needs to only endure a short exam time, whereas before it was necessary to acquire a larger number of sequences in total. We have seen that the shorter time has allowed us to scan patients who previously could not finish the exam. This is a great advantage."

Fast, dynamic breast imaging for diagnostic confidence

Speed and high image quality are also important factors determining the diagnostic value of breast MRI. "When the spatial resolution is not high enough for making the diagnosis of breast cancer, a very difficult decision must be made," says Dr. Katahira. "Since SmartSpeed now allows us to increase the resolution, we can often easily provide a confident answer. In the past with SENSE we used 1.2 mm isotropic voxels in breast imaging after contrast admission. With Compressed SENSE that is 0.8 mm. Now with SmartSpeed we can acquire 0.6 mm isotropic voxels and the images are so clear that even tiny details are clearly visible."

"For example, we can now scan 20 consecutive, very fast dynamic images of the mammary glands with a single 3-second volume acquisition. This allows us to see how the blood flow is progressing in a very different way."

> "SmartSpeed has considerably improved our breast cancer imaging, with higher temporal resolution, higher spatial resolution, and higher SNR compared to the past."
>
> Dr. Kazuhiro Katahira

> **Now, we can do something not possible before: a DWI volume acquisition so that multiplanar reconstruction allows us to look at scan results from all directions to make the diagnosis."**
>
> Dr. Kazuhiro Katahira

"The use of SmartSpeed has considerably improved our breast cancer imaging, with higher temporal resolution, higher spatial resolution, and higher SNR compared to the past, when we were using just Compressed SENSE. In addition, the dynamic study is now more useful in diagnosis because the ultrafast dynamic scan can be taken every 3 seconds."

Notable improvement in diffusion-weighted imaging

With SmartSpeed, Kumamoto Chuo Hospital also has the ability to use EPI diffusion-weighted imaging (EPICS-DWI) with Compressed SENSE, which is an important step forward according to Dr. Katahira. "Before, our EPI diffusion was performed using SENSE, but now with Compressed SENSE it is possible to obtain very clear images," he says.

He also describes the benefit of being able to perform 3D diffusion-weighted imaging. "Previously, we only had DWI images in one direction to make a diagnosis. Now, we can do something that was not possible before: performing a DWI volume acquisition so that multiplanar reconstruction can be used, allowing us to look at scan results from all directions to make the diagnosis," Dr. Katahira says.

"What used to be a diagnosis based on just cross-sectional images, can now be based on a volume image. This is a dramatic improvement for us, because it is now possible to look at slices in various cross section directions. For example, the presence or absence of venous invasion is very important in rectal cancer patients, because venous invasion can cause metastasis in the future. The ability to reconstruct images according to the direction of the blood vessels, allows us to see venous infiltration more realistically, which is a world of difference from what we were used to."

Prostate imaging with SmartSpeed

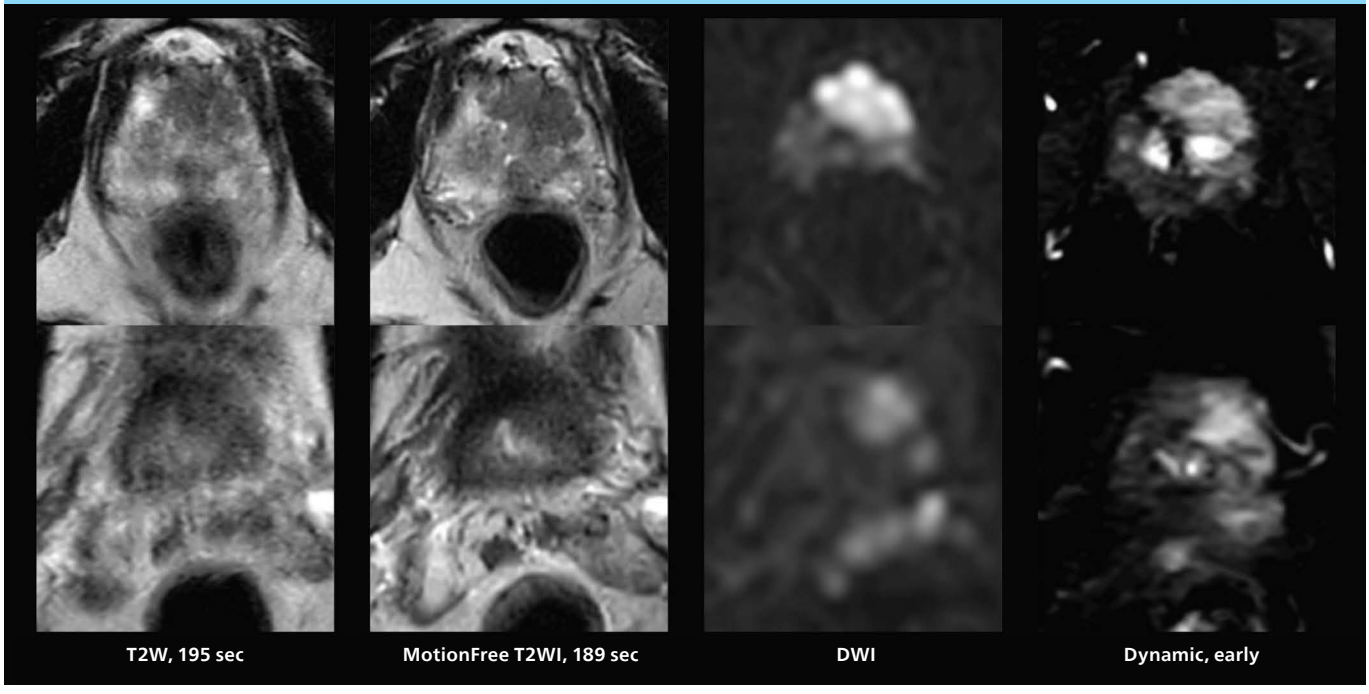
Given the high volume of prostate MRI performed at Kumamoto Chuo Hospital, the additional capabilities that SmartSpeed brings have a significant impact. "The clinical usefulness of SmartSpeed is clearly demonstrated in this area," says Dr. Katahira. "Including SmartSpeed in most of our MRI protocols helps us improve the image quality." ►

Prostate cancer MRI

MRI was performed in a patient with PSA 89.2. Evaluation of T2WI images was difficult due to rectal peristalsis. Using SmartSpeed MotionFree T2WI provided very good image quality. Seminal vesicle gland invasion is easily seen. Biopsy resulted in GS4+5=9. Performed on Elition X.

The hospital's routine ExamCard for prostate cancer includes:

- T2W with SENSE, 3.09 min, 0.66 x 0.95 x 4.0 mm, SENSE factor 1.8
- MotionFree T2W, 3.15 min, 0.75 x 0.75 x 4.0 mm, acceleration factor 2.6
- DWI EPI b2000, 2.08 min, 3.1 x 3.3 x 4.0 mm, acceleration factor 2.5
- Dyn mDIXON, 2.31 min, 1.2 x 1.2 x 4.4 mm, acceleration factor 3

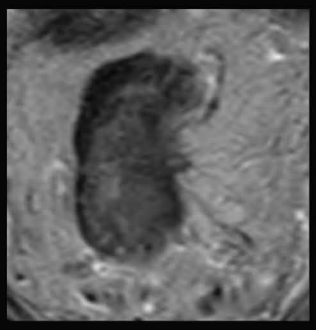


T2W, 195 sec | MotionFree T2WI, 189 sec | DWI | Dynamic, early

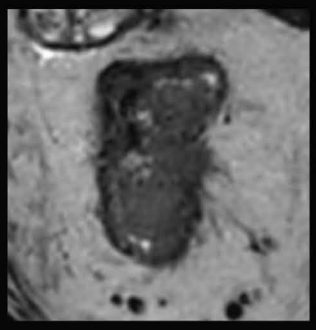
MRI of rectal cancer

In this patient MRI was done to help in diagnosing the depth of invasion. Performed on Elition X.
The hospital's pelvis-rectal-colon ExamCard includes:

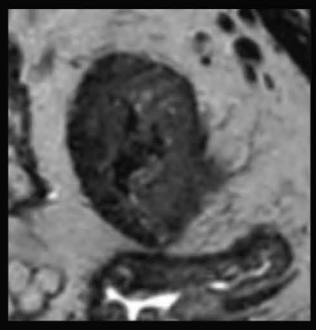
- T2 VISTA, 4.59 min, 0.75 mm isotropic, acceleration factor 12
- Dyn mDIXON TFE, 2.33 min, 12.5 sec/dynamic, 1.2 x 1.2 x 4.4 mm, acceleration factor 3
- DWI EPICS b1000, 5.06 min, 2.0 mm isotropic, acceleration factor 2.5



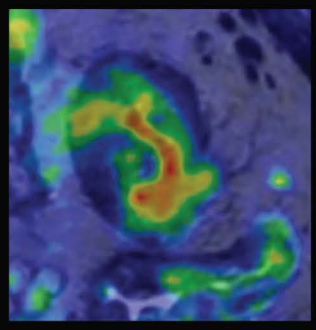
2D T2WI
0.7 x 0.9 x 4 mm



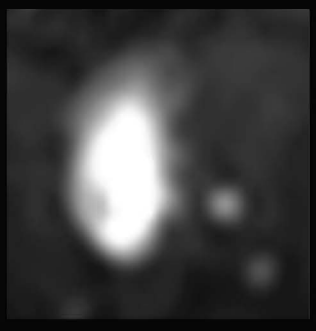
HR 3D VISTA T2WI
0.75 mm isotropic AI factor 12



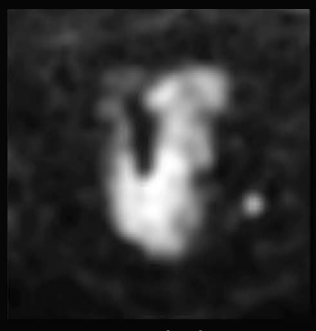
MPR oblique



Fusion image oblique

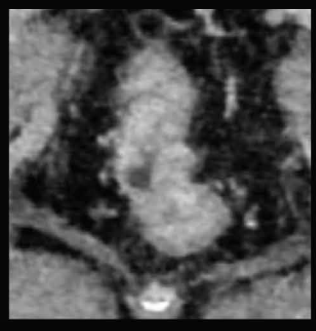


DWI
3.6 x 4.7 x 6 mm



EPICS (2.5)
2 mm isotropic

MPR oblique



Contrast CT

The MRI team performs well over 20 prostate MRI exams per week. "In T2-weighted images we can get higher resolution," says Dr. Katahira. "And while previously we were used to seeing blurred images due to rectal movements, introduction of the MotionFree SmartSpeed application allows us to obtain beautiful motion-compensated images, that are very useful for diagnosing, which was previously often impossible."

"In the diffusion-weighted images, we can use Compressed SENSE to obtain high quality images, and AI can be added to further improve image quality," Dr. Katahira says.

"SmartSpeed MotionFree allows us to obtain beautiful motion-compensated images, that are very useful for diagnosing, which was previously often impossibles."

Dr. Kazuhiro Katahira

"For patients having difficulty holding their breath, a direct benefit is the shorter scan time possible."

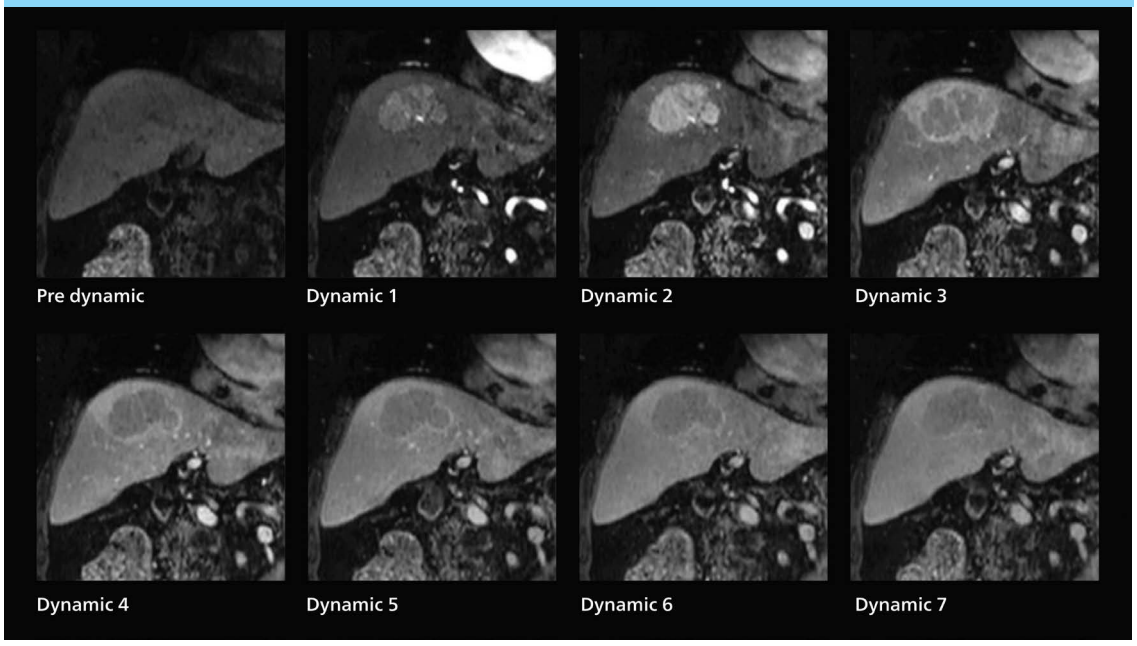
Dr. Kazuhiro Katahira

MotionFree abdominal scans

SmartSpeed helps achieve imaging that used to be problematic before. "When patients have difficulty holding their breath, for example in upper abdominal examinations, it is often not possible to perform an MRI examination," says Dr Katahira. "However, with SmartSpeed we now have various ways to accomplish it. A direct benefit to these patients is the shorter scan time possible. The motion-free techniques allow us to now acquire clean single shot images. We have seen that this helps many such patients complete the examination."

Dynamic MRI of liver using SmartSpeed

A patient was referred for MR imaging of HCC. A double arterial volume dynamic study was performed. Since it is a volume dynamic study, it can also be evaluated using MPR images. Performed on Elition X. The hospital's routine ExamCard for dynamic MRI of the liver uses total scan duration 1:05 min, dynamic scan time 9.2 sec, 1.6 x 1.8 x 2.0 mm, 200 slices, acceleration factor 8.



Images of the upper abdomen can easily get blurred due to the patient's breathing. Before SmartSpeed a viable alternative method was lacking. "We like to use single shot T2-weighted images but in the past these would look like heavy T2-weighted images, which is why we added halfscan, but this often introduced blurring," says Dr. Katahira. "So there was a limit to what could be done. Now, with SmartSpeed, the reduction factor can be increased, so halfscan can be turned off, and sharp images can be obtained.

A single-shot T2-weighted image can be taken in about 10 seconds. Because of their high resistance to movement, acquiring multiple of these images can be a substitute, even if there is some patient motion. So, thanks to SmartSpeed, we can now obtain sharp single shot images without halfscan, making single shot a good alternative to multishot."

Rapid clarity for stroke and liver

For patients with acute cerebral infarction, who cannot endure long examinations, some clear benefits of SmartSpeed emerge. "We have a fast MR scan protocol that quickly completes the scanning. It allows us to acquire all the images we need in about 3 to 5 minutes," says Dr. Katahira. "And it is often possible to acquire more images at that level, which is an advantage because the exam is complete even if the patient moves in the middle of the exam."

Also in dynamic MRI of the liver Dr. Katahira sees important improvements. While previously his scan used 9 seconds for a 5 mm slice, SmartSpeed now allows him to achieve a thin slice volume scan (1.6 x 2.1 x 2mm) with double arterial phase using acceleration factor 8. He indicates this is very useful for the radiologist when diagnosing, especially because it can provide a high temporal resolution. ■

"For patients with acute cerebral infarction, we have a fast protocol that allows us to acquire all the images we need in about 3 to 5 minutes."

Dr. Kazuhiro Katahira

Increased MRI throughput and exceptional image quality at Potsdam

At an MRI practice in Potsdam Philips SmartSpeed helped increase patient throughput by about 20% and obtain high resolution.

Dr. Tobias Schröter
Radiologist, MRT-Praxis
Potsdam, Germany

After acquiring SmartSpeed on his BlueSeal MRI system, Dr. Tobias Schröter was astonished at the great potential of this technology. It sets the stage for rapid, high quality MRI exams in his practice. He points out that across all anatomies, he discovers that shorter scan times and exceptional detail means faster, more confident diagnoses. Patient throughput has improved by about 20 percent.

"SmartSpeed is a real game changer. The decisive factor is that we can now achieve this speed and this high resolution."

Dr. Tobias Schröter

> **"I am astonished at the great potential of SmartSpeed."**
>
> Dr. Tobias Schröter

Making a difference with fast, powerful technology

Dr. Tobias Schröter, MD, has been a radiologist since 2000. After running a 24/7 radiology practice for 16 years, he took over MRT-Praxis Potsdam, specializing in MRI diagnostics. "After the takeover, I completely redesigned the premises and exchanged the older MRI machine for a 1.5T Philips Ingenia Ambition S with sealed magnet."

Recently, the MRI Practice in Potsdam acquired AI-based Philips SmartSpeed of which Dr. Schröter has found that it makes a significant difference. "We had already been using Compressed SENSE from Philips to accelerate our cartesian scans and increase throughput. SmartSpeed now allows us to further reduce scan times and artificial intelligence (AI) makes the image quality even better compared to images we acquired using Compressed SENSE."

Dr. Schröter now uses SmartSpeed for 2D and 3D sequences in all anatomies. "I am astonished at the great potential of SmartSpeed, especially because 3D imaging in MSK is becoming feasible now. I can get very good image quality in very short scan time." He also uses SmartSpeed for patients that cannot hold still, without worrying about needing re-scans. And it can also be used for patients with implants.

Besides the fast scanning, we now have the advantage of fast image reconstruction, so that we can already look at images while the scanning is still ongoing."

Higher patient throughput

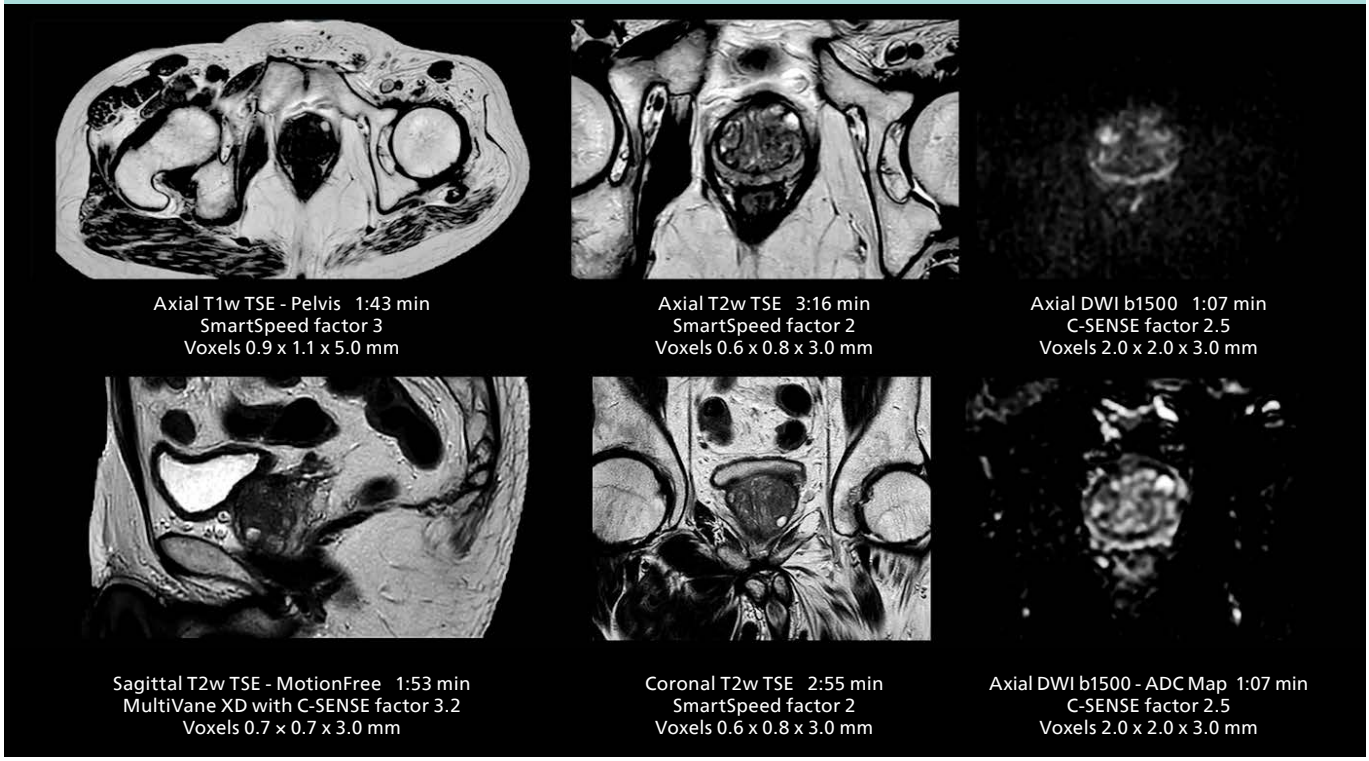
MRT-Praxis Potsdam mostly focuses on neuro imaging and musculoskeletal examinations. They also perform prostate examinations, and occasionally some abdominal MRI.

"Philips SmartSpeed really helps us scan more patients per day," Dr. Schröter says. "We achieve higher throughput and better productivity without compromising on image quality. We used to scan 32 to 35 patients per day, but now with SmartSpeed we can perform significantly more examinations in less time. We went from 160 to 170 exams per week before SmartSpeed to up to 200 per week, or about 40 patients per day. ▶

> **"In our prostate exams we have saved almost 50 percent of time and obtain significantly higher resolution."**
>
> Dr. Tobias Schröter

Prostate

With SmartSpeed also scan times for diffusion imaging and motion-free imaging can be reduced. Scanned without contrast agent. Performed with 1.5T Ambition S, dS Torso coil.



Axial T1w TSE - Pelvis 1:43 min
SmartSpeed factor 3
Voxels 0.9 x 1.1 x 5.0 mm

Axial T2w TSE 3:16 min
SmartSpeed factor 2
Voxels 0.6 x 0.8 x 3.0 mm

Axial DWI b1500 1:07 min
C-SENSE factor 2.5
Voxels 2.0 x 2.0 x 3.0 mm

Sagittal T2w TSE - MotionFree 1:53 min
MultiVane XD with C-SENSE factor 3.2
Voxels 0.7 x 0.7 x 3.0 mm

Coronal T2w TSE 2:55 min
SmartSpeed factor 2
Voxels 0.6 x 0.8 x 3.0 mm

Axial DWI b1500 - ADC Map 1:07 min
C-SENSE factor 2.5
Voxels 2.0 x 2.0 x 3.0 mm

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

"Better productivity is important in a private imaging center like ours. And it is essential that we achieve this higher throughput without compromising image quality."

Dr. Tobias Schröter

"The short MRI scan times that we realize with SmartSpeed also provide better comfort for all our patients. Not everyone is comfortable lying in the scanner. Even normal, healthy individuals often cannot lie still for that long, which may lead to motion artifacts. So, being able to image faster is an obvious benefit. Our average examination time is now about 10 minutes. Only a few of our exams need more than 20 minutes."

Faster scans, faster diagnoses[1], high productivity

"Thanks to SmartSpeed, we are able to perform examinations extremely quickly. We can carry out most examinations in under ten minutes. Our MRI exam of the knee only takes six minutes. The shorter time makes it easier for patients to lay still, which helps prevent motion artifacts.

Then, because the computing capacity is so large, we have the images immediately available on the large screen. Higher resolution is very valuable. From the high-resolution 3D sequences, excellent multiplanar reconstruction can be obtained. This makes it easier and faster for us to diagnose and create reports. And while the patient is still lying in the magnet, we can already view the images and make a diagnosis. When the patient comes out, I can immediately ask whether what I see corresponds to the symptoms."

Dr. Schröter also highlights their step forward in MRI of the prostate. "In prostate exams we have saved almost 50 percent of time. We used to need about 35 minutes for an MRI exam of the prostate and now we can do it in just 18 minutes with a significantly higher resolution and higher image quality."

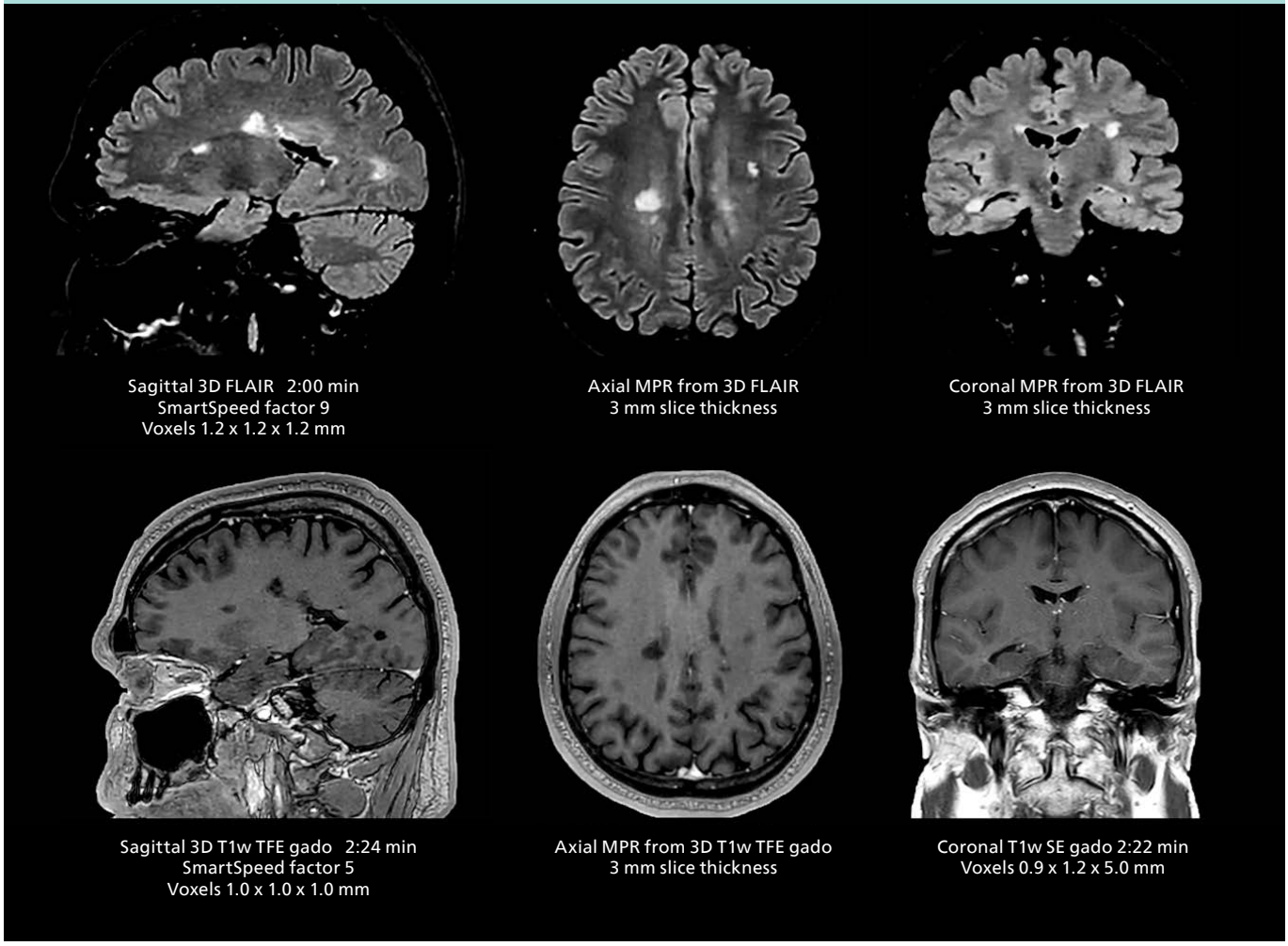
According to Dr. Schröter the advances that come with SmartSpeed enable them to more frequently use metal artifact suppression sequences, such as O-MAR, for imaging joints with prostheses. This sequence can now be acquired in the relatively short time of three minutes and Dr. Schröter observes significant progress in recognizing anatomy in the vicinity of the prostheses.

SmartSpeed brought options for motion-free imaging, so motion artifacts no longer play a major role like before. Dr. Schröter says the team sees fewer repeat scans when using SmartSpeed, "Firstly, because patients' time in the magnet is shorter, and secondly because SmartSpeed MotionFree reduces motion artifacts better than before."

> **"Motion artifacts no longer play a major role because patients' time in the magnet is shorter and SmartSpeed reduces motion artifacts better than before."**
>
> Dr. Tobias Schröter

White matter lesions in brain

In this examination SmartSpeed is used to reduce scan times. All three FLAIR orientations were obtained with only one 3D sequence using SmartSpeed. Performed with 1.5T Ambition S, dS Head coil.



Sagittal 3D FLAIR 2:00 min
SmartSpeed factor 9
Voxels 1.2 x 1.2 x 1.2 mm

Axial MPR from 3D FLAIR
3 mm slice thickness

Coronal MPR from 3D FLAIR
3 mm slice thickness

Sagittal 3D T1w TFE gado 2:24 min
SmartSpeed factor 5
Voxels 1.0 x 1.0 x 1.0 mm

Axial MPR from 3D T1w TFE gado
3 mm slice thickness

Coronal T1w SE gado 2:22 min
Voxels 0.9 x 1.2 x 5.0 mm

How SmartSpeed helps

According to Dr. Schröter MR is a powerful imaging modality, but for producing images with high resolution and excellent detail, a long scan time is often required. In addition, motion artifacts can be a problem, as remaining motionless throughout the exam is difficult for many patients.

"Now, with SmartSpeed, we can achieve better results – high image resolution and razor-sharp images – in the shortest possible time. That is an advantage both for the patient and for us: the patient gets out of the scanner faster and diagnosing and reporting is easier for us."

"I can use SmartSpeed on patients with implants and for patients that cannot hold still, without worrying about re-scans due to motion. I am astonished by the great potential of SmartSpeed. I can get very good image quality in very short scan time, and 3D imaging in MSK is now feasible for us." ►

"With SmartSpeed, we can achieve high image resolution and razor-sharp images in the shortest possible time. We hardly have any examinations that last longer than ten minutes."

Dr. Tobias Schröter

> **"SmartSpeed really surprised me – I didn't expect that images would be so impressive, that such speed and such high resolution are possible."**
>
> Dr. Tobias Schröter

A leap in MSK imaging thanks to SmartSpeed

Previously, the practice wasn't able to use 3D imaging on all joints, because the time required was too long, and on some joints it was simply not possible to achieve a good quality image, Dr. Schröter says. "Now, with SmartSpeed we consistently use 3D imaging for all joints and can thus discover the smallest changes, for example in the cartilage. And that, of course, helps us in making a detailed diagnosis."

Dr. Schröter says their MSK images show high contrast and extremely high quality. He mentions the menisci as an example. "We use a 3D proton density weighted fatsat sequence, thickness is 0.3 mm and scan time 3 minutes. The MPRs show an unbelievable resolution. Very small tears and even fraying of the tip of the meniscus become visible, which is normally only possible in arthroscopic surgery.

When imaging the small joints of the fingers and the thumb we achieve extraordinary quality. Using SmartSpeed we succeed in displaying even very small structures anatomically correct, enabling us to see the extent of possible injuries. Tendons and ligaments appear with higher resolution so we can better see the injury pattern and describe and delimit it.

Our referring physicians are fascinated by the extraordinary quality and high level of detail of the images. Patients are happy that the examination does not take too long. We hear from patients that it took a lot less time than they expected. This is especially important when scanning patients who are very uncomfortable in the MRI environment."

Traumatic knee injury

SmartSpeed is used to reduce scan times. All three PDw orientations were obtained with only one 3D sequence using SmartSpeed. Performed with 1.5T Ambition S, 16ch dS Knee coil.

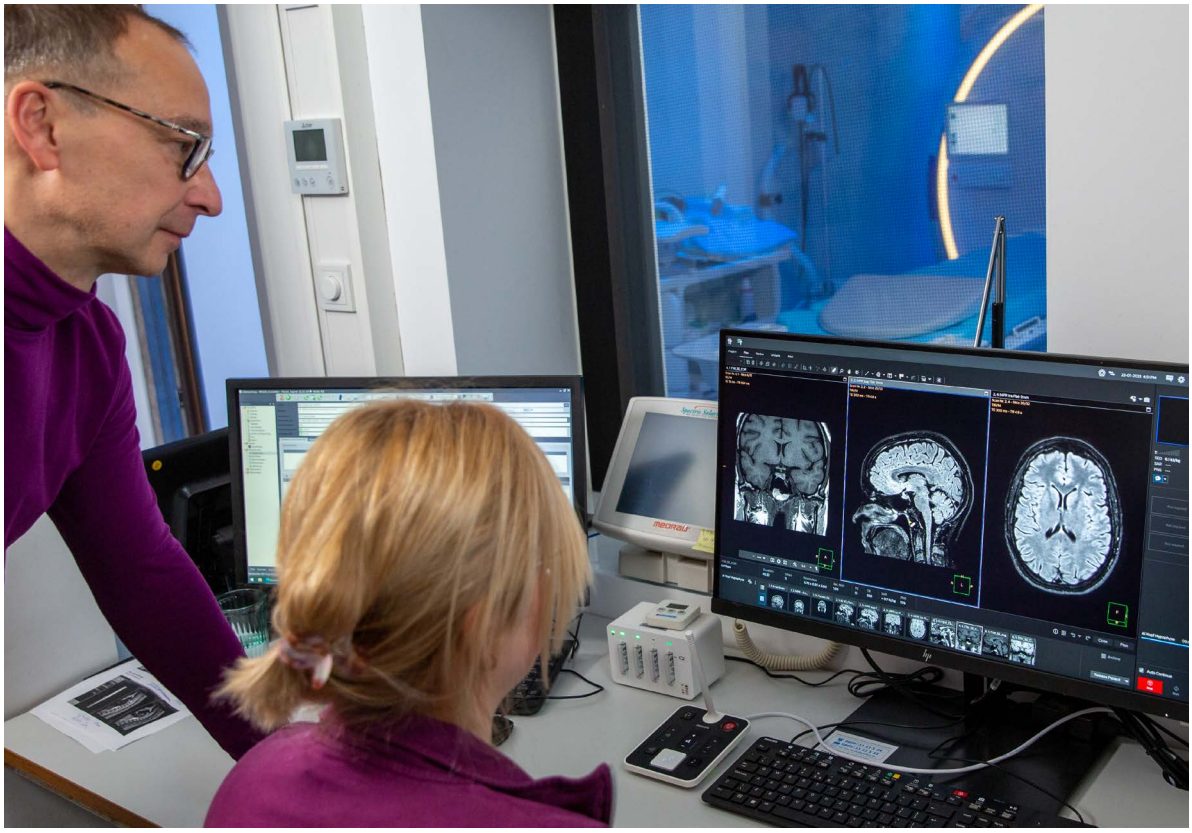
Sagittal 3D PDw FatSat 3:35 min
SmartSpeed factor 10
Voxels 0.75 x 0.75 x 0.75 mm

Axial MPR from
sagittal 3D PDw FatSat
1 mm slice thickness

Coronal MPR from
sagittal 3D PDw FatSat
1 mm slice thickness

Sagittal T2w TSE 1:18 min
SmartSpeed factor 2.2
Voxels 0.45 x 0.5 x 3.0 mm

Coronal T1w TSE 1:02 min
SmartSpeed factor 3
Voxels 0.65 x 0.85 x 3.0 mm



"With these 3D scans we can create freely selectable MPRs that are pin-sharp, allowing us to easily see pathological changes."

Dr. Tobias Schröter

Improving diagnostic confidence across the board at MRT-Praxis Potsdam

Dr. Schröter points out that a more confident diagnosis requires high-quality images with more diagnostic information. "Philips SmartSpeed provided that to us. AI denoises the clinical images without losing any important data, resulting in high-resolution images. It keeps all the information we need and makes the images better.

We can apply SmartSpeed to almost all sequences. That is a big step forward! We use it for example in 3D imaging and in diffusion-weighted imaging, to dramatically reduce scan time or increase image resolution, which is quite useful.

There are small lesions that we would certainly have seen without SmartSpeed, however it would have taken us longer to properly diagnose. In 3D MSK images with extremely high resolution, we uncover the finest anatomical structures and can thus report very detailed findings."

Helium-free operation helps saving costs

When Dr. Schröter initially planned to replace the old MRI system, he learned that safety requirements for the quench system had become so strict that the existing vent pipe could no longer be used and costs for updating it in the heritage-protected building were excessive.

Choosing the Philips Ambition S with its BlueSeal magnet allowed Dr. Schröter to avoid the expensive conversion, as this magnet does not require a vent pipe, because the helium is permanently enclosed within the sealed magnet. The seven-liter helium content of the BlueSeal magnet is also significantly lower than the roughly 1500 liters of other Philips magnets.

"With the BlueSeal magnet we don't need to concern ourselves with helium anymore. Refills are not needed, so there's no time or cost wasted with that. Sustainability was also an important aspect for me when deciding for BlueSeal. Helium is a resource that is not infinitely available on earth, that's why I think it's good that we have a closed system that only includes seven liters. ▶

"As a radiologist I can't see any difference between images from a sealed system and a system that requires regular helium refill. The image quality and the handling are virtually the same."

Dr. Tobias Schröter

Effects of a patient-friendly atmosphere

"In our MRI room we have the Ambient Experience lighting and In-bore experience, which enable us to create a feel-good atmosphere for our patients," says Dr. Schröter. "They feel more comfortable with this experience than in MRI machines without. Our patients love it. It helps many to successfully tolerate the examination. When inside the bore, patients can see the remaining scan time and breath hold guidance on the display. This is very popular. It improves patient engagement and ultimately image quality.

Many patients tell us that if they had known how nice it was in our device, they wouldn't have been afraid of the exam. Patients often say that they will recommend us to others if they ever need an MRI.

Thanks to image quality and a relaxing environment we have been able to scan a higher number of patients. I can emphasize that with the Ambition system, our patient throughput and exam scope have grown."

Large screen and easy operation

Philips SmartSpeed is available via MR Workspace, the large-screen operator console that empowers the technologist with integrated AI protocol selection.

"The big 27-inch 4K high resolution screen makes a total difference. It shows the large planning images with much higher resolution than we were used to. Anatomic landmarks can be more easily identified, which advances the process. Now it is much easier and faster to plan the new sequences and it's easier for us to find lesions," says Dr. Schröter.

"MR Workspace is a tool to operate the system more seamlessly. The user interface is designed in a very advanced way. Operation is intuitive. Many actions can be executed via drag and drop. It is really easy to use and self-explanatory. There are small features and tools that improve the work significantly. For example, being able to copy the geometry of one sequence to the next, without having to make any major adjustments.

We also use the new Day manager. During an ongoing examination it allows us to load and adjust the planned examinations for upcoming patients at the same time."

Powerful GPU rapidly provides images and reconstruction on large screen

Another important part of MR Workspace is the graphics processing unit (GPU), which allows on-the-fly reconstruction times for images acquired with SmartSpeed. "In addition to seeing razor-sharp images on the large 4K monitor, we also have better and faster reconstruction of the images. Using this extremely high resolution, we sometimes have sequences with up to 800 individual images. The GPU then manages to convert them in a matter of seconds into multiplanar reconstructions. Very impressive."

Staff learning curve

"We've received great application training from Phillips", Dr. Schröter says. "My highly motivated technologists were able to recognize the advantages of SmartSpeed in a very short time. Simultaneously they were also getting used to the new MR Workspace, which is completely different from the previous operating console. However, the new workspace is modern and very easy to use. We can simply select SmartSpeed from the menu.

When Compressed SENSE protocols are available, only one click is needed to convert to a SmartSpeed sequence. And we can adjust the denoising levels depending on our needs: strong, medium or weak and achieve the best level for our practice. It makes work easier overall."

Everybody wins

Dr. Schröter believes SmartSpeed is really a step forward. "It is almost incomprehensible that scanning can be so fast. And the images are brilliant. I'm excited. For all of our examinations the scanning time was drastically shortened – particularly the switch to 3D sequences makes a difference. Our practice is now able to use some sequences that were hardly used before because of their long scan time.

SmartSpeed is a real game changer. The decisive factor is that we can now achieve this speed and this high resolution. And I can only say yes to the question on consistency of the picture quality. We can always produce brilliant images with SmartSpeed, so it is not necessary to repeat sequences.

Faster scanning means less possibility for motion artifacts, less rescans, and a much better result. We gain more confidence during reporting, so patients are getting a much better diagnosis. Everybody wins." ■

1. Compared to the way of working at MRT-Praxis Potsdam before having SmartSpeed.
Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Crowded city, tall building, remote location, hurricane-prone area or urban power outages?

Discover the advantages of BlueSeal

The numerous benefits of BlueSeal MRI systems

BlueSeal systems use only seven liters of helium that is sealed in the magnet. This innovation eliminates the need for helium refills, reducing costs and downtime.

BlueSeal magnets are typically around 900 kg lighter than traditional MRI machines[1] and don't need a vent pipe[2]. This offers greater ease and flexibility for installation.

In contrast, traditional MRI machines typically contain around 1,500 liters of helium and require regular refills. Unfortunately, helium is an increasingly scarce, non-renewable resource, its cost is rising[3], and its availability is becoming less obvious.

BlueSeal systems provide excellent clinical performance with a large bore and stable field of view. Using AI-based SmartSpeed, scans are up to three times faster, and resolution improves by up to 65%[4]. Patients benefit from a wide bore opening, quicker scan times, and a calming environment that reduces stress.

BlueSeal magnets allow you to easily turn the magnet off and on from the console. This reduces downtime during emergencies, allowing a quick shutdown when a disaster or power outage is expected, and fast restarts afterward.

And even mobile BlueSeal MRI systems are available, offering flexibility to provide quick and patient-friendly MRI services wherever and whenever needed. ■

Use QR code or click link to read more:
Helium-free MRI BlueSeal technology - Philips

1. Compared to the Ingenia 1.5T zero boil-off magnet
2. Due to closed magnet system
3. 2022 onwards, https://www.innovationnewsnetwork.com/helium-shortage-4-0- January what-caused-it-andwhen-will-it-end/29255/
4. Compared to Philips SENSE imaging

Cost savings and operational simplicity

A winning combination for University Hospital Marburg

BlueSeal

Uncovering the benefits of BlueSeal

In 2020, UKGM chose to install a Philips BlueSeal Ambition X MRI into the University Hospital Marburg. "We needed an MRI system to provide us with outstanding image quality and optimized workflows," says Prof. Mahnken, Director of the Clinic for Diagnostic and Interventional Radiology. "The benefits of BlueSeal technology were obvious. The magnet is lighter than traditional MRIs and fits into small spaces. This has saved us money, both during installation because it doesn't require a vent pipe[1] and operationally because it does not require helium refill. And obviously, I want to ensure high clinical quality for every patient. The Philips BlueSeal Ambition X does just that."

Easy siting at a lower cost

Philips BlueSeal technology uses micro-cooling which requires only a negligible amount (less than 0.5% (in liters) of previous systems[2]) of liquid helium for cooling, which is placed in the magnet during manufacturing and then fully sealed. Because no helium can escape[2], BlueSeal magnets do not need a vent pipe[1], thus reducing construction costs. It has also been designed to be lightweight, requiring a minimum siting capacity of only 3,700 kg.

"The fact that a vent pipe is unnecessary has really simplified installation, as our radiology department is located in the middle of the university hospital building," says Alexandra Rausch, Head of Medical Technology. "Another advantage is the reduced weight of this BlueSeal magnet, which is about 900 kilograms lighter than conventional Philips MRI magnets[2]. This reduced weight simplified the location selection and minimized the reconstructions needed in the building, which was particularly important to us since the MRI room is on the floor directly above the ORs. And this BlueSeal system requires less space, which allowed for a flexible integration into our existing infrastructure. The installation of the Philips MRI with BlueSeal technology has proven beneficial not only in planning and execution but also in ongoing operation and service."

Prof. Mahnken concurs, "It was not only the lower installation costs, but also the long-term operating costs which were key considerations we made beforehand. These cost savings, along with the fact that no quench pipe needs to be installed for a BlueSeal system, were the arguments we used to convince UKGM management to choose an equipment provider different from our usual vendor."

The importance of managing a scarce resource

Helium prices have increased in recent years due to its scarcity[4]. This non-renewable resource is used in roughly 50,000 mostly conventional MRI scanners around the world, which need regular refills of helium. A conventional MRI system can also quickly and unexpectedly lose its helium during a quench.

"The European Commission classified helium as a critical raw material in 2023," notes Ms. Rausch. "We anticipate that acquiring helium will become even more challenging and more expensive over the next 10–15 years. This underscores the importance of BlueSeal technology for us."

Compelling real-life events demonstrate cost saving advantages

"The BlueSeal magnet contains very little helium, that is fully sealed so that none can escape[3]. We've experienced two incidents that demonstrate the advantages this has brought. Two years ago, a cleaning staff member accidentally triggered the emergency magnet off button while cleaning all contact surfaces. The BlueSeal system was back in operation within two days and at a cost of only around 8,000 euros, thanks to Philips' quick response.

"Then just a few weeks ago we experienced an urban power outage. Remarkably, the BlueSeal Ambition X remained on field for 24 hours without power before it autonomously shut down in a controlled manner. Philips responded promptly, and the system was back in service after a short downtime, again with very manageable costs.

Prof. Dr. Med. Andreas H. Mahnken
MBA, MME, EBIR
Director of the Clinic for Diagnostic and Interventional Radiology UKGM, University Hospital Marburg, Rhoen-Clinics as part of Asklepios-Clinics Marburg, Germany

Alexandra Rausch
Head of Medical Technology UKGM, University Hospital Marburg, Rhoen-Clinics as part of Asklepios-Clinics Marburg, Germany

University Hospital of Giessen and Marburg (UKGM) is the third largest university hospital in Germany, offering top-class medicine to more than 460,000 patients annually. To meet its goal of offering top-quality medicine at an affordable price for everyone, UKGM needs state-of-the-art medical imaging equipment that is efficient and effective.

"With a conventional MRI, these two incidents would have cost us significantly more."

Alexandra Rausch

"With a conventional MRI, these two incidents would have cost us significantly more. Given current helium prices, lead times, and service costs, we would have faced economic losses exceeding €100,000 in both cases, not to mention equipment downtime and the need to reschedule many patient appointments. These experiences affirm our decision to go with the BlueSeal magnet—it offers tremendous advantages."

Exceptional image quality

Apart from the physical advantages of BlueSeal, it is image quality that of course remains top priority. "With this system, we get exceptionally good image quality," says Prof. Mahnken. "I love the system's T2 sequences – the quality is simply wonderful. And with Philips Compressed SENSE, we achieve drastically improved speed without any loss of quality."

The Compressed SENSE speed engine meaningfully speeds up scans while delivering virtually equal image quality. By intelligently compressing data, it accelerates existing MR scans up to 50%[5] and can provide up to 60% higher resolution[6] to enhance diagnostic confidence.

Ease-of-use workflow features support a streamlined procedure

For Prof. Mahnken, easy operation is important and helps radiographers get up to speed and work easier and faster. "The BlueSeal system includes several workflow features that influenced our decision to purchase. For example, VitalEye allows for a continuous and robust respiratory trigger signal without the need to position a respiratory belt. This touchless workflow feature is very important for our radiographers." The quality of the physiology signal detected by VitalEye is better than a belt-based approach providing superior image quality, for a broad range of patient sizes. It shifts the operator's focus from the technology to the patient.

"What I personally appreciate are the features that help patients lie comfortably in the scanner. The system uses audio and visuals to create an engaging environment where they can remain calm and compliant. It offers entertainment while also informing them with a progress bar, breath-hold guidance, and AutoVoice. "This definitely helps patients. And AutoVoice adds a new level of communication without requiring the operator to manage it, which simplifies workflow even further. We use these automated smart features every day with every patient."

"Apart from the physical advantages of BlueSeal, it is image quality that of course remains top priority."

Prof. Andreas H. Mahnken

A cost-conscious solution without compromise

Healthcare providers today must do more with less. Imaging systems must be more efficient in their operational and material costs. Philips uses cutting-edge BlueSeal technology to reduce the environmental footprint, while meeting clinical demands of quality and performance. At UKGM, the ability to easily site a new system, reduce operational costs, and still maintain the level of service their patients have come to expect, addresses the hospital's goal to offer top-quality medicine at an affordable price for everyone. ■

1. Due to closed magnet system
2. Compared to the Ingenia 1.5T ZBO magnet
3. Even in the rare case of the magnet becoming unsealed, the negligible amount of helium escaping would not materially affect the oxygen level within the room
4. January 2022 onwards https://www.innovationnewsnetwork.com/helium-shortage-4-0-what-caused-it-andwhen-will-it-end/29255/
5. Compared to Philips scans without Compressed SENSE

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

BlueSeal

MRI speed, quality, and ease-of-use at an attractive total-cost-of-ownership with Philips BlueSeal technology

For Barking, Havering and Redbridge University Hospitals NHS Trust (BHRUT) in the UK, reducing wait times and providing quick access to exceptional care is paramount. In February 2023, plans for a new Community Diagnostic Centre (CDC) at Barking Community Hospital were announced to help meet growing demand for diagnostic testing and to reduce healthcare inequalities. The CDC, opened in March 2024, provides scans away from the hospital for northeast London residents.

Christiane Zelenyanszki, PhD
Programme and Service Development Lead, Community Diagnostics for BHRUT Barking, Havering and Redbridge University Hospitals NHS Trust (BHRUT), Community Diagnostic Centre (CDC) at Barking Community Hospital, UK

Zivio Mascarenhas
Procurement and Programme Specialist for BHRUT, Barking, Havering and Redbridge University Hospitals NHS Trust (BHRUT) Community Diagnostic Centre (CDC) at Barking Community Hospital, UK

Ronnie Hernandez
Cross Site MRI Lead Radiographer for BHRUT, Barking, Havering and Redbridge University Hospitals NHS Trust (BHRUT), Community Diagnostic Centre (CDC) at Barking Community Hospital, UK

According to Christiane Zelenyanszki PhD, Programme and Service Development Lead Community Diagnostics for BHRUT, "In order to increase the capacity, all non-urgent diagnostics need to move out of the acute departments into the community. The whole idea is to try to address inequality and bring diagnostic services directly into the community, making it easier for our patients."

Crucial to the decision making process was finding the proper MRI system to meet BHRUT's strategic requirements. After careful, competitive analysis, the Trust selected a system powered by Philips exclusive BlueSeal magnet technology for helium-free operations. A BlueSeal magnet eliminates the need for liquid helium refill. There's no helium loss, no refills, and no unexpected costs. The lightweight system sites easily and incorporates AI-driven technology to simplify and automate complex clinical tasks. Most importantly it offers a total-cost-of-ownership that reflects positively for a publicly funded institution such as BHRUT.

> **"A BlueSeal magnet eliminates the need for liquid helium refill. There's no helium loss, no refills, and no unexpected costs."**

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Procurement and Programme Specialist for BHRUT, Zivio Mascarenhas, recalls the search effort, "Not only did we look at the total-cost-of-ownership of the equipment, but also at longevity associated benefits and efficiency, in terms of equipment maintenance, and supplier responsiveness. We considered design innovation, image quality, maintenance needs, and the footprint of the system. We looked at whether the system was patient friendly, and its ease-of-use for our clinicians. Taking all this into consideration, we chose the Philips BlueSeal MR 5300 system."

Simplified placement with the unique characteristics of a BlueSeal system

The BlueSeal magnet can dramatically reduce installation costs. Because no liquid helium can escape, a BlueSeal magnet does not need a vent pipe[1], along with the associated expenses and installation limitations it involves. Thanks to this unique advantage, the BlueSeal magnet can be installed in locations where it was previously very difficult.

Additionally, the system is very light. With a minimum siting limitation of 3,700 kg, the magnet is around 900 kg lighter than its predecessor[2] a decrease in weight that can potentially facilitate easier siting, reduce floor adaptations and further lower construction costs.

At BHRUT, this was of critical importance. "Ease of installation was key to us," says Mascarenhas. "The Barking CDC was going to be of modular design, constructed off site and then brought to the permanent location. Collaboration between the equipment supplier and the modular building company was essential to integrate the BlueSeal system seamlessly into the building design. Not needing a vent pipe was a key factor in this regard. And with a much lighter system, final siting was considerably simplified."

Increased operational efficiency makes for a more sustainable future

At Philips, a clear focus is placed on asset lifecycle management as key to reducing the environmental impact of technological development. Use less, use longer and use again is the philosophy that guides this approach. Every BlueSeal magnet at the heart of a Philips MRI system is designed for increased energy efficiency and continued peak performance through upgrades that can be easily applied to extend its life.

"BlueSeal demonstrates the convenience of a modern solution – it is truly plug-and-play," says Mascarenhas. "Once powered on, the BlueSeal MRI runs seamlessly and consumes significantly less energy compared to Philips systems without PowerSave functionality. By procuring this permanent, energy-efficient solution, we've been able to reduce associated expenses substantially, providing both a financial and operational benefit."

Ronnie Hernandez, Cross Site MRI Lead Radiographer for BHRUT, adds, "The system is in line with BHRUT's green plan 2022-25, to play an active and leading role in the greener NHS agenda. That's one of the major factors that attracted us to the Philips BlueSeal MR 5300." ►

BHRUT realizes tangible cost benefits through innovative system design

System downtime negatively affects operations, clinical efficiency, and patient throughput. This is a situation staff at BHRUT is all too familiar with. As Christiane Zelenyanszki explains, "We have five MR scanners throughout the Trust that require a regular helium refill or 'topping up'. It costs a lot of money and the scanner needs to be down at least a day or two. That puts a lot of pressure on us. In comparison, BlueSeal's helium-free operations offers a significant reduction in our planned downtime which adds to our improvement in both efficiency and capacity."

> **"The patient is well supported with various functionalities to help us complete the scan. As an example, AutoVoice technology comforts our anxious patients and supports exam compliance."**

"BlueSeal's helium-free operations offers a significant reduction in our planned downtime which adds to our improvement in both efficiency and capacity."

Christiane Zelenyanszki

To further mitigate unwanted downtime issues, Philips BlueSeal qualifies as the first magnet driven by an adaptive intelligence functionality called EasySwitch. This technology offers a quick and easy way to power down the system from behind the MRI console. Ronnie Hernandez describes the benefits, "With the EasySwitch, a radiographer can temporarily ramp down the magnet and then put it back on field again. In comparison, traditional MRI scanners need a full set of engineers, a helium-refill and a lot of system down time."

Meeting the NHS KPI with faster throughput and outstanding image quality

Barking CDC patient throughput is driven by adherence to the NHS Diagnostic Waiting Times and Activity (DM01[3]) KPI. This goal is exactly what the Trust was planning to address with the implementation of the new Centre. According to Hernandez, "We're meeting our target and smashing it. We used to scan 2 patients per hour, or even 45 minutes for each. Now it's easily 3 per hour. We are overperforming because the scanner can do it. I think we're the only Trust within Northeast London that achieved DMO1 compliance."

How is this accomplished? The BlueSeal system employs SmartSpeed acceleration technology where images can be acquired up to 3 times faster with no loss in quality[4], providing up to 65% greater resolution[4], and is compatible with 97% of clinical protocols[5].

"This high throughput is really excellent," says Mascarenhas. "There's been a huge backlog since COVID-19 and this BlueSeal system has helped us reduce the number of patients who are waiting for scans."

Ease-of-operation benefits staff and patients alike

Ronnie Hernandez and his team enjoy working with the new system. "We chose the BlueSeal system because it's so easy to use – particularly when you transition from traditional MRIs as we have."

"What I'm seeing," adds Zelenyanszki. "is that the patient is well supported with various functionalities to help us complete the scan. As an example, AutoVoice technology comforts our anxious patients and supports exam compliance."

AutoVoice ensures that patients are receiving consistent instructions by telling them what to expect and what is expected of them. It announces scan duration and table movements, and provides breath hold guidance. Another feature, VitalEye, is highly appreciated by Barking CDC staff. This AI-based touchless patient sensing provides fast detection of patient's breathing without any operator interaction.

Meeting BHRUT's required criteria brings satisfaction and intent to expand

Zivio Mascarenhas sums up BHRUT's perspective on their new Philips BlueSeal MR system. "We were looking for an efficient system to save us money in the long run. When we take sustainability, clinical quality, ease-of-use, and lack of downtime interruptions into consideration and add an excellent total-cost of-ownership – not just up front, but over the next 10 years – we know we made the right decision."

Both the clinical and non-clinical teams on the decision panel were so satisfied that they have purchased a second Philips BlueSeal MR system to be placed in their latest Community Diagnostic Centre slated to open in 2025 at BHRUT's St. George location. ■

1. Due to closed magnet system
2. Ingenia 1.5T ZBO magnet
3. https://digital.nhs.uk/data-and-information/data-collections-and-data-sets/data-collections/diagnostics-waiting-times-and-activity-dm01
4. Compared to SENSE imaging
5. On average, measured across a sample of sites from Philips MR installed base

Efficient MRI workflow at FUESMEN with help of MR Workspace

> **MR Workspace helps save a lot of time in the daily MR schedule and also allows us to spend less time in front of the console."**
>
> Dr. Maximiliano Noceti, radiologist at FUESMEN

Offering a 24/7 MRI service with long shifts and a large share of complex cases, FUESMEN staff members quickly recognized the benefits of MR Workspace. They appreciate the time-saving features and value the two large screens. Thanks to the ease of use, training times at FUESMEN are reduced. It helped technologists and radiologists improve their efficiency, benefiting the department as a whole.

Maximiliano Noceti, MD
Radiologist and coordinator of MR Services at FUESMEN, where he has worked since 2009. He has 15 years of experience in MRI and specializes in medical research.

Bruno Javier Lima
Has a degree in bioimaging and a broad experience in MRI gained during more than 15 years of working as a technologist at FUESMEN.

Daniel Fino Villamil
Physicist and leading the MR technologists and MR projects at FUESMEN where he has worked since 2008. He oversees quality control for the radiology department's CT and MRI services and conducts MRI research.

Verónica Natalia Romero
MR technologist at FUESMEN for 15 years, the last 10 of which she has been involved with MRI and CT.

Dual monitor benefits both clinicians and technologists

When MR Workspace was installed at FUESMEN (Fundación Escuela Medicina Nuclear, Mendoza, Argentina) to replace their Ingenia's previous operator's console, the MRI technologists quickly adapted, discovering its many benefits. It facilitates various MR exam steps, including preparing exams in advance, selecting the right protocol, planning sequences, viewing and post-processing. The FUESMEN team is driving productivity, quality and predictability in image acquisition and diagnosis, and feels that MR Workspace features are helping them.

MRI technologist Bruno Javier Lima says: "The dual monitor setup is what impressed me most. It helps me streamline the workflow by processing an exam on one monitor, while simultaneously using the other monitor to set up the exam of the patient in the scanner."

"This relieves me of much of the daily stress," he adds. "Before, if a cardiologist or radiologist needed to see or post-process something on the console, we had to give them the mouse and the monitor. Now, I can still watch the setup on one monitor when I leave the mouse and the other monitor to the doctor who wants to review or process the images."

According to FUESMEN radiologist Maximiliano Noceti, the dual-monitor configuration makes it easier for radiologists to guide examinations. "I am more often present with less experienced technologists who might not be as well versed with the anatomy I am studying," he says. "For instance, in oncological pelvis and gynecological studies that need to be well-directed toward the pathology, I can help the technologist plan the high-resolution sequences so that these studies are successful. This helps save a lot of time in the daily MR schedule and also allows us to spend less time in front of the console and continue with our daily tasks."

Scan planning made easy

MR Workspace is designed to simplify image acquisition by limiting the number of interactions users have with the interface. "In brain studies, for example, the scans are positioned and angulated automatically, because through AI the system recognizes the structures," Dr. Noceti says. "We have seen the benefits of this, for example, when new technologists working on the weekends make very few mistakes. As a radiologist with no official training on MR Workspace, I found the interface easy to use and I became accustomed to it very quickly."

This is an improvement over the previous interface, especially for newer team members, according to Dr. Noceti, who has observed that technologists rapidly learn how to use MR Workspace and can begin contributing their skills in the department quickly.

"I think speed is the main benefit that MR Workspace has given us," Mr. Lima adds. "Setting up has become much more enjoyable, having it on the large monitor with the three very large quadrants for planning."

> "I think speed is the main benefit that MR Workspace has given us. Setting up has become much more enjoyable, having it on the large monitor with the three very large quadrants for planning."
>
> Bruno Lima, MRI technologist at FUESMEN

"Post-processing is faster. I can visualize the active areas in the brain during live scanning. It almost feels like a live procedure."

Dr. Maximiliano Noceti, radiologist at FUESMEN

Fast and easy post-processing

The MR Workspace has proven agile in processing and post-processing, according to Dr. Noceti. "What amazes me when using the post-processing packages for angiography and spectroscopy is how fast I have the processed images on the second screen," he says. "I can visualize the active areas in the brain during live scanning. It almost feels like a live procedure. This was slower with the previous interface. Bottom line, the speed and post-processing are better and the advanced visualization tools are handier."

FUESMEN bioengineer and head of medical physics, Daniel Fino Villamil notes that: "When implementing a volumetric sequence with MR Workspace, I can very quickly change the processing of MIP/MPR. Other interfaces require multiple mouse clicks to obtain the same results."

He highlights the interface's ease of use and says the advanced visualization toolkits are exceptional. "I can very easily compare the different sequences or create different maps, such as K-trans maps and those for diffusion and ADC quantification. In neuro studies, the tractography toolkit is very intuitive and gives me the ability to manipulate images in 3D – it's fast and the interaction with the morphological sequences is rapid as well."

"With the perfusion and diffusion toolkits it's very easy to copy the same region-of-interest in the various maps or to acquire a different geometry. In oncology and neuro studies, I like the correlation that I can perform with the volumetric sequences, functional imaging and tractography, and the diffusion and perfusion maps," Mr. Villamil adds.

More patients per day with a new way of working

Dr. Noceti notes that being able to almost immediately view the images on the second monitor allows him to considerably reduce scan time in some cases. "On several occasions, the concurrent post-processing has already shown me the relevant information, so that we could skip subsequent sequences," he says. "Suspending the exam in this way shortens overall exam time, particularly for complex studies."

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Dr. Maximiliano Noceti, radiologist at FUESMEN

"Since we can save a lot of time between patients, there have been days that we can examine four or five additional patients on top of the usual patient volume."

Dr. Maximiliano Noceti, radiologist at FUESMEN

Dr. Noceti says MR Workspace has allowed them to elevate their use of the Ingenia MR system by scanning more patients than they were able to do before, in a way they wouldn't do with the hospital's other MR systems. "Since we can save a lot of time between patients, there have been days that we can examine four or five additional patients on top of the usual patient volume. For example, on one day we were able to process 17 patients in a six-hour shift," he says.

Streamlining the schedule with MR Day Manager

MR Day Manager allows technologists to see the patient schedule on their MR Workspace monitor and indicates which patients have arrived. Patient and schedule data from the RIS can be integrated in MR Day Manager and made accessible on the monitor via a single mouse click. Before patient arrival the technologist can already assign ExamCards and prepare for special situations by entering MR Conditional implant information, pregnancy status and other information. This helps save time when the patient arrives.

"With MR Day Manager, two or three upcoming studies already are uploaded and ready to go," Dr. Noceti says. "If the patient is in the dressing room on time, the technologist workflow is not interrupted. When we can save five minutes per patient, at the end of the day that adds up to impressive time-savings." ▶

Screen showing MR Day Manager

FUESMEN technologists appreciate the ability to enter the patient's weight and height and even select protocols for successive patients in the queue. "During my normal routine, the ability to load patient data with MR Day Manager makes the workflow much more streamlined," says technologist Verónica Natalia Romero.

Mr. Lima explains: "If I see four patients on the schedule that have already arrived, I can go ahead and preload them. So, when the patient is being positioned in the scanner, I already have all safety data and I even have the protocol I will use. That's a big advantage."

High quality screens assist FUESMEN physicians in diagnosing

According to FUESMEN staff, the two 27-inch monitors also stand out because of their size, the 4K HD resolution and deep dark screens. "The large monitors and the resolution they provide are fantastic," Dr. Noceti says. "The MR Workspace screens are also darker than the previous interface, which is friendlier to my eyes after a long shift."

In prostate studies with small pathology, Dr. Noceti appreciates the screen quality and high resolution. "The better the resolution and contrast on the monitors, the easier it is for us to see that small black region of pathology," he says. "Studies employing the microscopy coil are another example where I can appreciate that the resolution is now better."

Mr. Lima adds: "The contrast resolution on those monitors looks great, they are amazing for many high-resolution sequences. Our microscopy coil sequences have very fine slice thickness and voxels of 0.2 or 0.1 millimeters – seeing that high resolution on those monitors is spectacular."

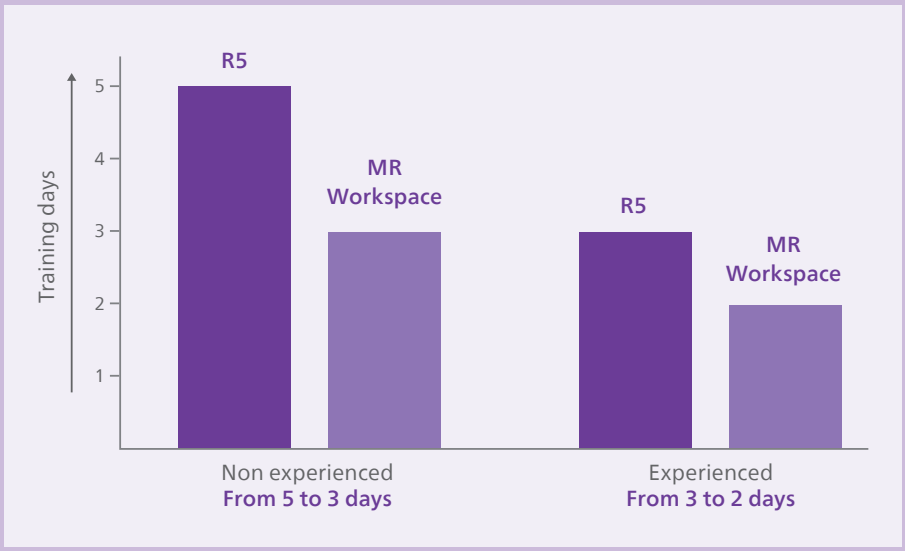
Mr. Villamil cites the utility of the monitors for confirming details that may be missed on standard screens and for conducting quality assurance. "When I check images on my home computer, I sometimes can't see a lesion that I had seen on the MR Workspace monitor, so for pathology it's a spectacular interface," he says. "And for quality assurance and quality control, I think it's very easy to check the spatial resolution on the second screen. On some monitors you may think the spatial resolution is good, until you see that same image on MR Workspace."

"I feel that the large screens help me reduce the visual fatigue that I sometimes experience," Mr. Lima adds. "The matte black color of the monitors, combined with the monitors' size, helps me to not focus so intently on the structure to get the slice just where I want it to pass, which is an improvement over the smaller single monitor we had before. It helps me ease some daily stress. The bottom line is that the MR Workspace screens are more user-friendly for us as technologists."

> **"The bottom line is that the MR Workspace screens are more user-friendly for us as technologists."**
>
> Bruno Lima, MRI technologist at FUESMEN

Technologist training days reduced at FUESMEN

Imaging professionals ramp up quickly with MR Workspace. In a study, Daniel Fino Villamil and his team of biomedical engineers compared training differences between the previous Ingenia user interface and MR Workspace. The study involved 20 individuals from the MRI service, 10 of whom were inexperienced or experienced MR technologists. The team found that training of both experienced and inexperienced technologists took fewer days on Release 10 versus Release 5.



Switching from the previous MR user interface to MR Workspace reduced training times from 5 days to 3 days (-40%) for inexperienced technologists and from 3 days to 2 days (- 33%) for experienced technologists.

"It is much easier to learn and use because it is more intuitive."

Bruno Lima, MRI technologist at FUESMEN

Easy to learn and use

Learning how to use MR Workspace is straightforward. "It is much easier to learn and use because it is more intuitive," Mr. Lima says. "MR Workspace does not show the large range of parameters to manipulate but provides only the basic parameters in a section at the bottom. Technologists who only occasionally operate the Philips MR system can feel more relaxed thanks to this."

As experienced MR technologists, Mr. Lima and Mrs. Romero both began using the interface immediately, requiring only a general introduction. They familiarized themselves with the concepts promptly.

However, even for imaging technologists with little MRI experience, learning MR Workspace has been simple. FUESMEN runs MR courses and technologists who have never done MRI are often rotated through the MR department. Mr. Lima says: "I had taught one of these students how to do a spine study and after only three days I left him alone with MR Workspace. He described it as a very intuitive, useful platform. It doesn't take weeks or months to train technologists on it."

Value added for the MR service

Driving an efficient high-quality service, the FUESMEN MRI team is unanimous in their satisfaction with MR Workspace supporting their service. "On a day-to-day basis, when doing an exam, it is much more streamlined," Mrs. Romero says.

Regarding productivity, Dr. Noceti says: "I can confirm that even on days when we had to overload the system with more patients than originally planned, our quality has not been negatively impacted. In addition, when we can skip unneeded sequences – because I've already seen in post-processing that we acquired the necessary images for diagnosis – our efficiency increases without compromising study quality."

Dr. Noceti also values the ease of use and short training time. "In general, MR technologists are hard to find and train and there is a lot of turnover. So, for a technologist to be trained and ramped up to competency quickly is a very important factor," he says.

When asked if he would like a solution such as MR Workspace to be available for all of FUESMEN's MRI systems, Dr. Noceti firmly states: "Yes, without a doubt!" ■

Results from case studies are not predictive of results in other cases. Results in other cases may vary.

To a modern MRI without a change of magnet

Opting for the SmartPath to Evolution upgrade for their Ingenia 1.5T instead of purchasing a new system, has brought the latest technology and modern look to the MRI system at Toyonaka Municipal Hospital. Choosing this upgrade helped the hospital in cutting costs, reducing downtime, and enhancing their patient-centered environment. The MRI team now experiences remarkable improvements in workflow, benefiting patients and staff. Excellent diagnostic images are acquired, while efficiency in handling patients and performing scanning are achieved.

Hideto Miyano
is Chief Technologist (Engineer) of Toyonaka Municipal Hospital Central Medical Bureau Radiology Department.

> **"SmartPath to Evolution 1.5T has helped us realize the importance of improving patient-centered workflows and has allowed us to focus on acquiring high-quality diagnostic images, which is a priority in our hospital."**
>
> Dr. Hideto Miyano

Choosing SmartPath to Evolution 1.5T upgrade instead of a new MRI system

Toyonaka Municipal Hospital in Japan performs approximately 6500 MRI examinations per year with a main focus on head, vertebral bodies, limb joints, upper abdomen and lower abdomen, mainly on pediatric patients. It is a designated secondary emergency hospital, and its MRI room accepts stroke patients 24 hours a day.

The hospital used to operate two 1.5T MRI machines until it was decided to replace the Achieva 1.5T with a Philips Elition 3.0T system. The recent upgrade of the hospital's Ingenia 1.5T with SmartPath to Evolution has brought latest technology and appearance to that system and the MRI team experiences remarkable improvements in workflow and clinical usefulness.

When the Ingenia 1.5T had been in operation for approximately nine years, the hospital was considering options for updating or replacement. "At the perfect time, we received a proposal for SmartPath to Evolution 1.5T," says Hideto Myano. This upgrade brings both technology and appearance to the latest systems' level, while making use of the existing magnet.

"Benefits of this approach include reduced installation costs and limited downtime. Being able continue use of our existing magnet, but with an updated technology level, was an important reason why we chose SmartPath to Evolution 1.5T. And operating two MR systems having the same modern user interface, will make it easier for operators to work alternately on both systems."

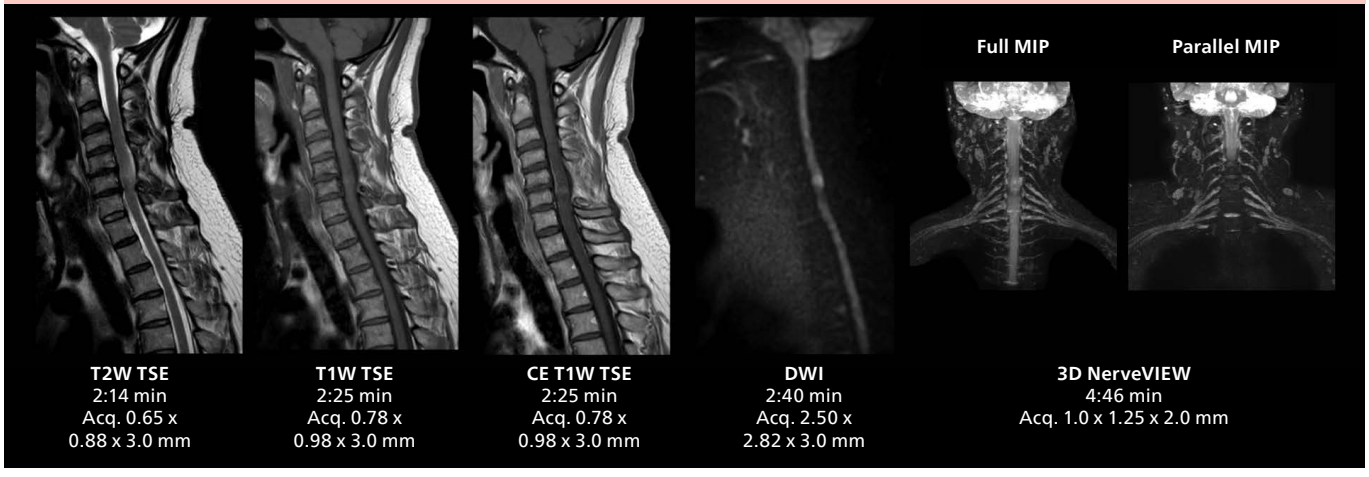
SmartPath to Evolution 1.5T

Workflow improvements help patients and technologists

Emphasis often seems to be on obtaining high-quality images in a short time using Philips top-quality, high-speed technology, observes Hideto Miyano. "However, SmartPath to Evolution 1.5T also comes with the concept of 'improving the examination environment by putting the patient at the center'. I see it has many technologies that help improve the workflow, which is what clinical sites have been looking for."

During the scan, patients automatically receive spoken and visual guidance, which often helps alleviate patients' anxiety. It provides breath holding instructions, allows the patient to see the examination's progress and remaining scan time, and get prompts when the table will move. All of this contributes to patients feeling at ease during the examination. ►

Routine Cervical spine imaging (DWI, 3D NerveVIEW) in a case of postoperative edema for cervical myelopathy.



Results from case studies are not predictive of results in other cases. Results in other cases may vary.

Toyonaka Municipal Hospital (Toyonaka City, Osaka Prefecture) is a general hospital and designated as a regional base hospital for cancer treatment cooperation. It provides safe, high-quality medical care and strives to be a warm-hearted hospital that takes the patient's perspective into account.

The comfortable, extra-thick mattress is designed to reduce the effects of pain and distress even during long examinations. It also helps reduce patient motion that causes motion artifacts, which in turn reduces the risk of needing to redo scans.

Hideto Miyano appreciates how workflow for technologists can be considerably improved, for instance with the interactive touchscreen's features like automatic patient centering (SmartTouch) during patient setup and automatic start of scanning when the examination room door (SmartStart) is closed. The touchless breathing synchronization device VitalEye is always on, so setting up a breathing sensor is no longer needed, which improves workflow and saves time. Some of these relatively simple innovations can help shorten examination time slots, which is exactly what users have been looking for for years.

"SmartPath to Evolution came with AutoVoice, which was not available on our Ingenia. AutoVoice not only gives breathholding instructions, but also announces table movements and informs the patient of the remaining scan time, which used to be done manually by the MR technologists," says Hideto Miyano. "So, these features not only help many patients feel more comfortable during the examination, but also relieves the technologists."

"SmartPath to Evolution has many technologies that help improve the workflow, which is what clinical sites have been looking for."

Dr. Hideto Miyano

Getting excellent diagnostic images while improving examination efficiency

"SmartPath to Evolution 1.5T has helped us realize the importance of improving patient-centered workflows and has allowed us to focus on acquiring high-quality diagnostic images, which is a priority in our hospital," says Hideto Miyano.

Patients can undergo examinations with peace of mind and comfort, and the introduction of the SmartWorkflow solution has shortened the time it takes to set up patients, allowing the Toyonaka technologists to focus on patient care more than ever before and perform examinations with more time to spare.

"These improvements have allowed us to add sequences tailored to initial clinical findings, without exceeding the examination time," says Hideto Miyano. "Adding sequences like NerveVIEW, FRACTURE, and DWI TSE XD enhance our clinical confidence, helping obtain diagnostic examinations without compromise. In terms of image quality, beautiful images with high SNR, high resolution and stable fat suppression have been obtained. SmartPath to Evolution 1.5T has improved our patient-centered examination environment and provides high-quality, clinically useful images."

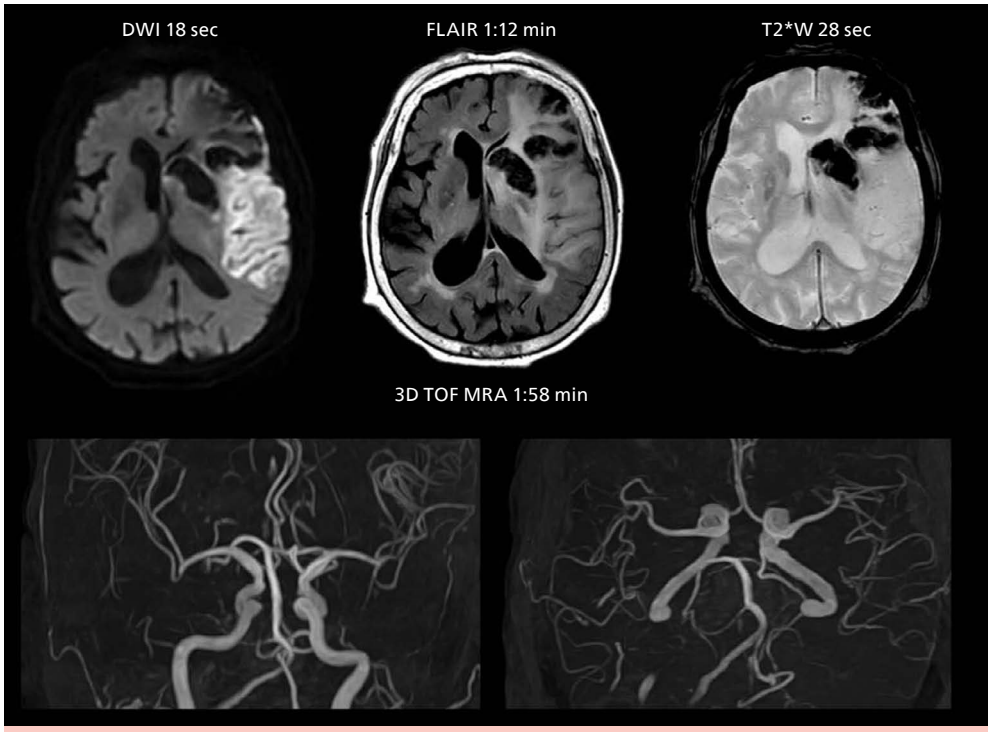
VitalEye's touchless breathing synchronization enhances workflow and image quality

The touchless breathing synchronization device VitalEye uses an infrared camera and removes the need for setting up a breathing sensor, which improves workflow and saves time.

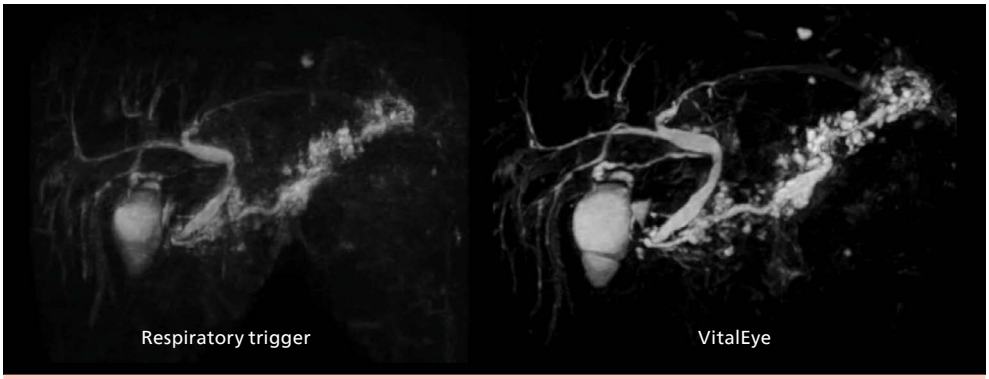
Previously, when a respiratory sensor or navigator echo was used, sudden movements such as coughing or irregular breathing cycles affected respiratory gated imaging. Use of VitalEye removes such sudden breathing and its AI-based respiratory waveform recognition provides highly accurate respiratory-gated imaging,

"For routine head imaging in emergency patients, the total imaging time has been considerably shortened to less than a minute, and our way of working for emergency examinations has been improved."

Dr. Hideto Miyano



Acute head imaging using SmartSpeed. Total imaging time was 3:56 min.



This comparison shows that image quality of 3D MRCP with respiratory gated imaging using VitalEye is better than obtained through respiratory synchronization with traditional breathing sensor set up, which results in poor image quality due to irregular breathing cycles (left). With VitalEye the effects of irregular movements are reduced (right).

surpassing conventional methods. "We see improvements in the accuracy of our respiratory gated imaging and a reduced risk of re-imaging," says Hideto Miyano. VitalEye can also be applied when imaging the lower abdomen and shoulder joints, expanding the range of imaging methods in those areas.

Improving image quality and efficiency of examinations using SmartSpeed AI

Dr. Hideto Miyano's first observation about SmartSpeed AI was that high-quality images can be obtained in short scan times. This is particularly advantageous in single shot sequences with low SNR, and he is actively applying it, mainly in abdominal imaging. "We can now obtain images with high SNR at around four times the speed, while reducing the effects of blurring."

Many head and abdominal examinations are performed at our hospital, and our examination times have now been reduced by about four to five minutes. Specifically for routine head imaging in emergency patients, the total imaging time has been considerably shortened to less than a minute, and our way of working for emergency examinations has been improved. ▶

"Since the introduction of SmartSpeed AI, we can now perform examinations faster and with more flexibility."

Dr. Hideto Miyano

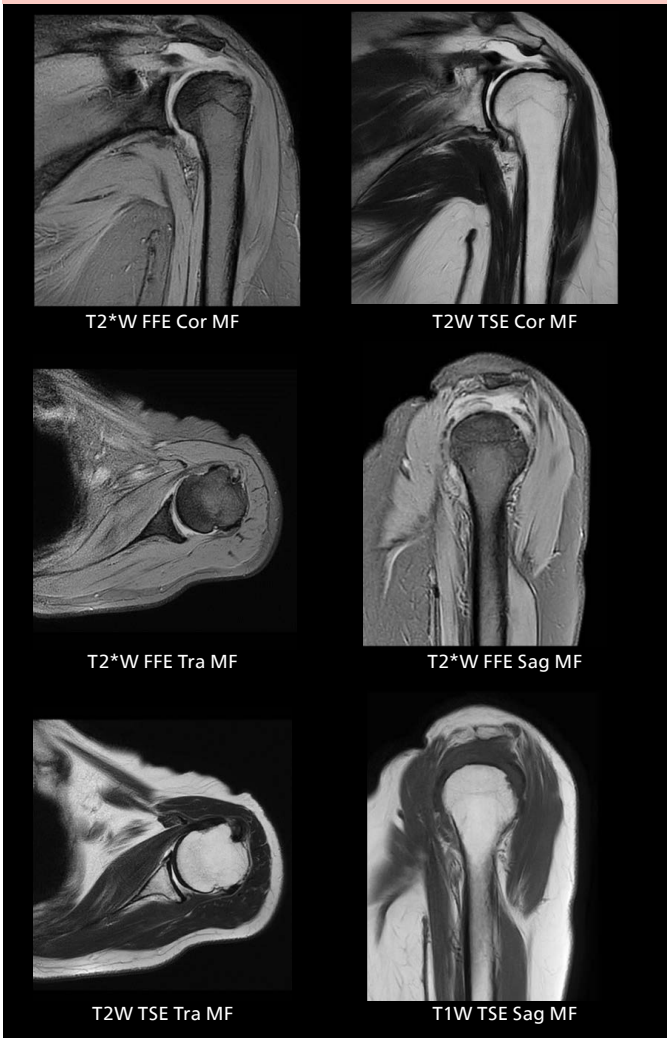
Previously, the MR team was often swamped with examinations, Dr. Hideto Miyano explains. "However, since the introduction of SmartSpeed AI, we can now perform examinations faster and with more flexibility. For instance, when our 3.0T system was unavailable for half a day, we managed to complete all examinations by using the 1.5T system. Thanks to SmartSpeed's capability to shorten scan times while providing high image quality.

Motion reduction benefits image quality and helps reduce need for re-scans

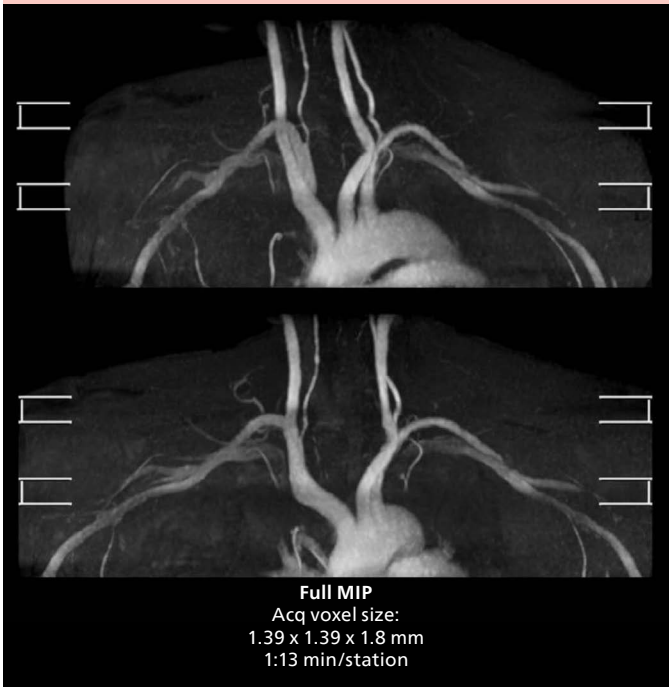
In areas that are often affected by body movements, like the shoulder joints and the pelvic cavity, Dr. Hideto Miyano uses SmartSpeed MotionFree. It leads to reproducible examinations and helps him reduce the need for re-imaging because of motion artifacts.

He values that SmartSpeed MotionFree images provide a natural appearance in body imaging, without contrast loss, and chemical shift resembling Cartesian imaging. Furthermore, the FOV change from circular to rectangular benefits the body motion correction technology for him. ►

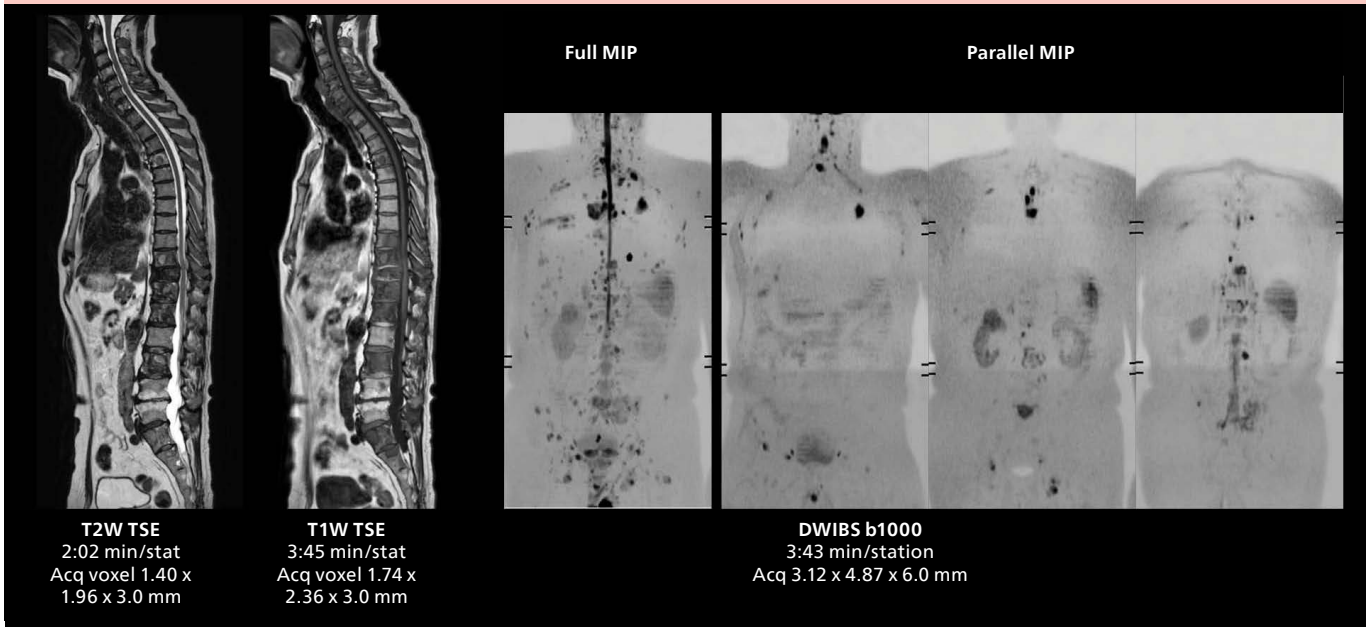
Routine MRI of shoulder with SmartSpeed MotionFree.



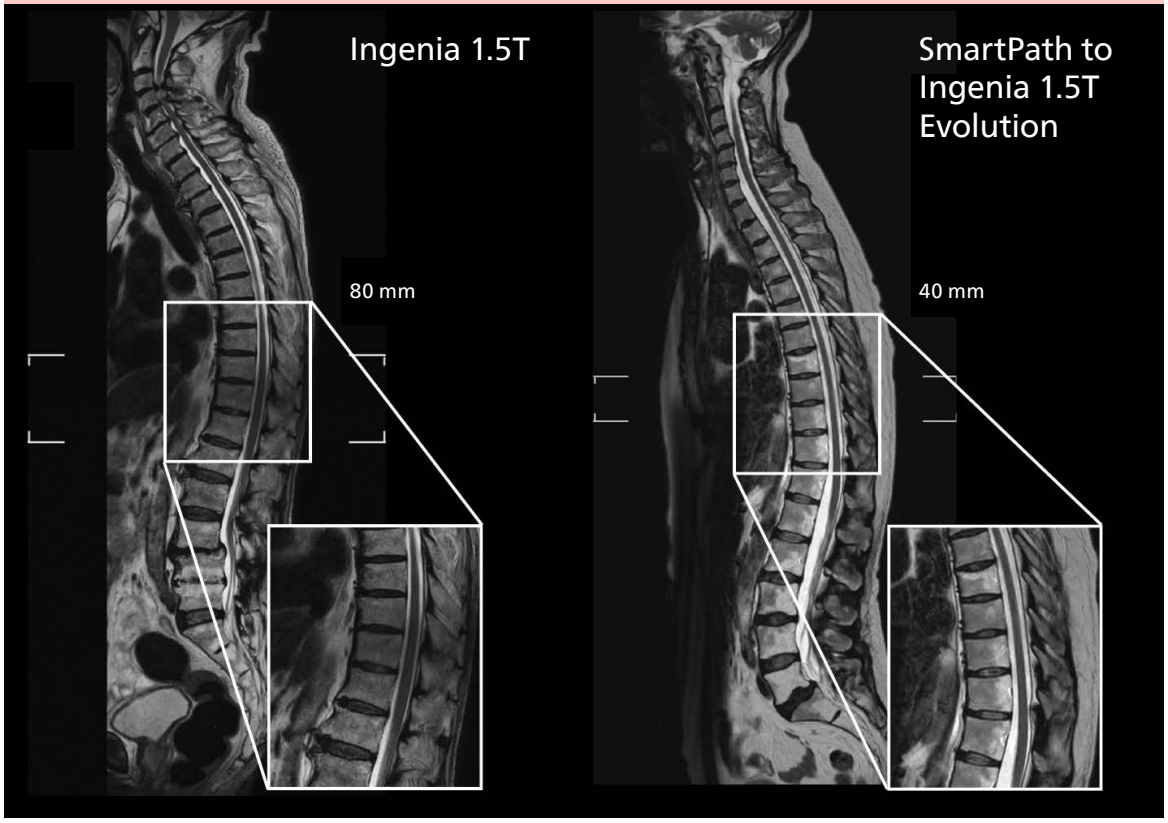
mDIXON XD FFE and 3D VANE XD MRA. By combining the DIXON method and body motion correction technology, the three branches from Aorta are clearly visualized. Acquired voxels are 1.39 x 1.39 x 1.8 mm, scan time is 1:13 min per station.



Total spine and DWIBS imaging showing multiple bone metastases in a lung cancer patient.

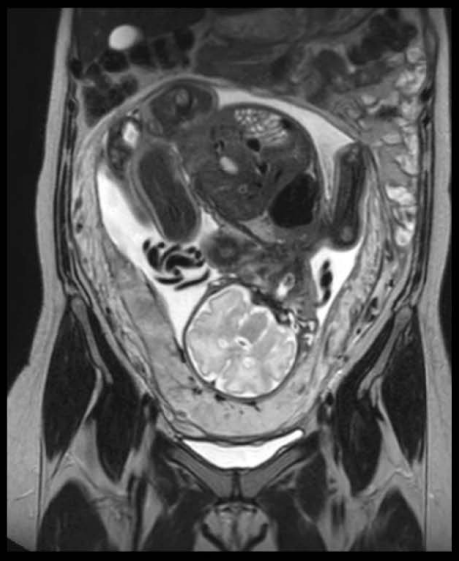


Comparison of total spine multi-station imaging. No effects of unevenness or blurring at seams are observed with SmartPath to Evolution 1.5T. Moreover, the overlap of stations was reduced from 80 mm to 40 mm.

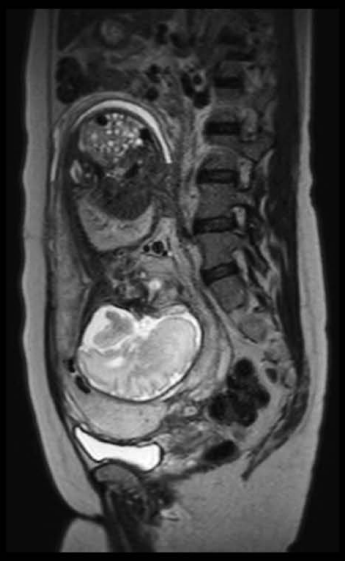


Results from case studies are not predictive of results in other cases. Results in other cases may vary.

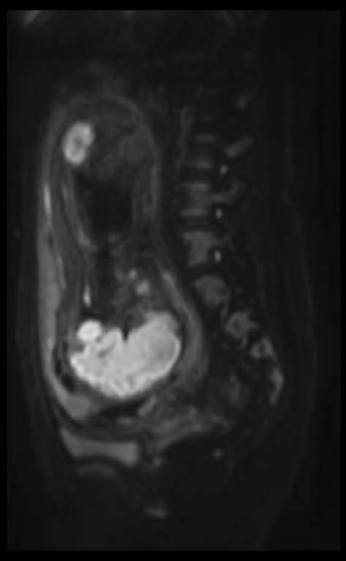
Routine fetal imaging using single shot TSE, SmartSpeed AI and SmartSpeed DWI. Single shot TSE does not use halfscan and produces sharp images with high SNR.



sSh T2W TSE Cor
Acq. 1.30 x 1.40 x
3.0 mm
1:25 min



SSh T2W TSE Sag
Acq. 1.13 x 1.67 x
3.0 mm
1:10 min



DWI
Acq. 2.75 x 2.81 x
3.0 mm
2:25 min

Improving image uniformity in large field-of-view imaging

Dr. Hideto Miyano observed improved image uniformity in large FOV imaging, thanks to improvements in static magnetic field uniformity and uniformity correction since SmartPath to Evolution 1.5T. He notes that joint unevenness and blurring in multi-station imaging, such as total spine and DWIBS, are notably reduced compared to their imaging before SmartPath to Evolution.

In the past, additional stations were sometimes scanned when inhomogeneity and blurring arose near the overlap, particularly in total spine imaging. However, with SmartPath to Evolution, excellent quality is obtained in all stations and the overlap has been reduced, allowing for a wider imaging coverage than previously in their Ingenia 1.5T. This has improved their workflow and efficiency. ■

Summary

- Toyonaka Municipal Hospital upgraded their nine-year-old MRI – instead of buying a new magnet – to reduce costs and improve their patient-centered environment.
- The upgrade facilitates high-quality imaging, reductions in examination time, less motion artifacts and workflow efficiency.
- Technologists benefit from improved workflow with automated steps in patient setup and scanning.
- Patient-centered improvements include a comfortable thick mattress, faster scans, seeing remaining scan time, automatic breathhold instructions.

Researchers at VUIIS unlock the diagnostic potential of sodium MRI

At Vanderbilt University Institute of Imaging Science (VUIIS, Nashville, Tennessee, USA) Rachelle Crescenzi, PhD is using multinuclear MRI to study lipedema and lymphedema. She found that sodium MRI displays salt retention in the adipose tissue of these patients, which distinguishes their disease from obesity. Her studies aim to support the development of more targeted therapeutic treatments. The ability to combine sodium and proton MRI into one single exam helps develop a fast procedure.

Rachelle Crescenzi
PhD, Assistant Professor Clinical Radiology & Radiological Sciences, Vanderbilt University Institute of Imaging Science, USA

> **"When patients with lymphatic disease undergo conventional MRI only, the increased sodium in their edema and adipose tissue deposition will stay unnoticed."**
>
> Dr. Rachelle Crescenzi , PhD

Multi-nuclei imaging provides vital information for studying lymphatic disease

At Vanderbilt University Institute of Imaging Science, Rachelle Crescenzi, PhD, is using sodium and proton MRI to study lipedema and lymphedema, two medical disorders that are often difficult to distinguish from, or wrongly mistaken for, obesity. She believes the future of research in MRI is related to the imaging of these multiple nuclei. "Not only can we image the structure at the excellent high resolution that MRI provides, but I think really the functional and molecular composition of tissue is where we should be imaging in the future," says Dr. Crescenzi.

Studies of lipedema and lymphedema in the SALT Lab

Dr. Crescenzi leads the Sodium, Adipose & Lymphatics Translational Imaging Lab, or "SALT Lab" at VUIIS. Her studies in lipedema and lymphedema started a few years ago with a key observation.

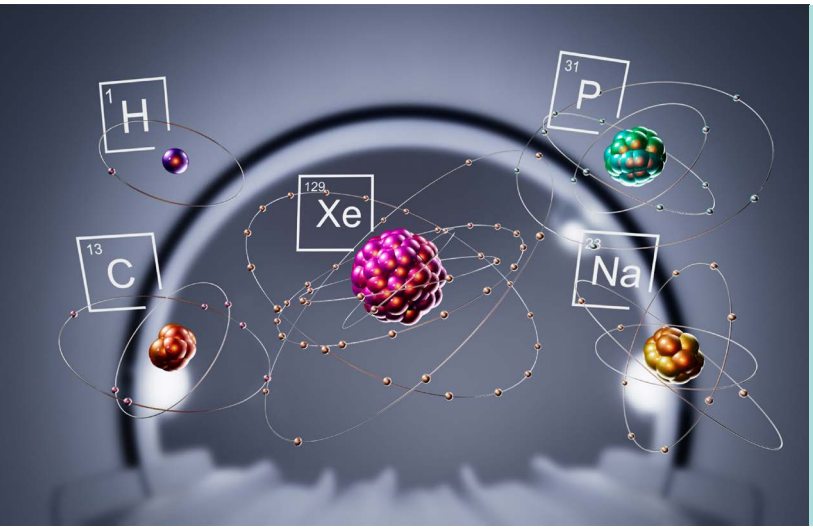
"These patients develop limb swelling which is visible externally as a large volume of their legs or arms, for instance," says Dr. Crescenzi. "But with sodium MRI at 3T, we observe that they not only retain a lot of water, but also a lot of salt. That was an interesting finding and we wanted to follow up on this and understand what salt is doing in the body of patients with lipedema and lymphedema. Could it potentially be a precursor to their later stages of advanced disease?"

"We're interested in applying sodium imaging in long term clinical trials of lipedema and lymphedema to understand the development of advanced disease severity, and if sodium, early in the disease process, could be a marker of risk for lymphatic dysfunction," she says. "Also fascinating are the features of lymphedema with lymph stasis in the body, that we observed with some vascular imaging techniques that we've worked on over the years with our collaborators in radiology and vascular medicine."

Sodium MRI in studies of upcoming therapies

The SALT Lab's research includes studies of therapies that have been applied to patients with lymphedema and lipedema. A pilot study looked at reductions in tissue sodium following compression therapy. "That was exciting because we learned that therapy could mobilize sodium and that MRI was also sensitive to that sodium mobilization," Dr. Crescenzi says. This was a study performed in collaboration with Dr. Paula Donahue, a certified lymphedema physical therapist at Vanderbilt University Medical Center.

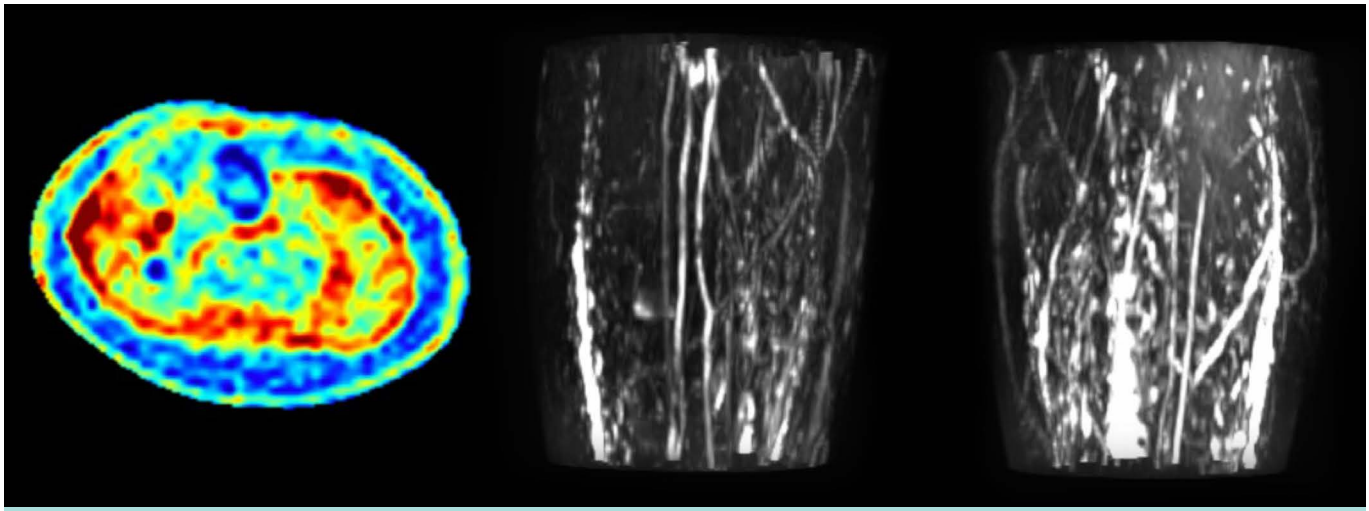
Dr. Crescenzi highlights some exciting therapies that are being developed, such as pharmaceuticals and microvascular surgeries, aiming to clear the lymph and this inflammatory fluid. "We want to follow patients before and after these therapies, so that we can see if there is any connection between improving the patients' lymphatic function and reducing their tissue sodium content.



Most MRI examinations use signals from protons in water molecules to generate images, because these are the most abundant magnetic nuclei in the body.

However, other magnetic nuclei can be used for MRI as well, including carbon-13, sodium-23 and phosphorus-31. These substances play different roles in the body, allowing MRI the opportunity to diversify its capabilities with non-invasive exploration of a wide range of biological processes and pathologies beyond the information derived from hydrogen proton imaging.

In order to use these molecular imaging capabilities, an MRI scanner needs to have a wide array of sensitivities to the different magnetic nuclei.



Example of standardized tissue sodium content map (left) and example of MR lymphangiography and maximum intensity projection (MIP) reconstruction (right).

We can measure all of those together with MRI, and we are eager to use these multimodal imaging exams. We hope to make these MRI exams faster, with a comfortable patient scan time, so that we can apply them in longitudinal clinical trials."

"In our ongoing observational clinical trial, we see examples of lymphatic disease every day with our radiologists, as well as limbs of similar size without changes due to lymphatic disease," says Dr. Crescenzi. "When patients with lymphatic disease undergo conventional MRI only, the increased sodium in their edema and adipose tissue deposition will stay unnoticed. In lymphatic disease, it's thought that the adipose results from vascular dysfunction and is different than common adipose due to obesity. Lymphatics disease mechanisms and therapies are still being discovered, and sodium and vascular imaging could play a key part in vital discoveries."

More information is welcomed by radiologists

Dr. Crescenzi notes that radiologists are interested in the additional information that the molecular imaging method can provide, by 3T sodium MRI. "They are hoping that pairing these measures of tissue sodium content with vascular functional imaging, can add new understanding of lymphedema risk factors, and how therapies might modify these."

Although fairly similar to everyday radiology, Dr. Crescenzi's approach for these patients takes it even further. "We are looking at the vascular networks, how they develop, how they change the disease and how that impacts tissue sodium and tissue fat deposition in diseases like lipedema and lymphedema."

"I don't think that advanced training is needed for radiologists, when they start looking at sodium images," says Dr. Crescenzi. "The standardized protocol allows us to present the sodium signal intensity acquired with MRI in a clinically meaningful metric – millimoles per liter – which radiologists are already familiar with, as it is used for measuring blood sodium concentration.

Very few tools are available to non-invasively measure tissue sodium, and investigators at VUIIS found sodium MRI can help objectively distinguish lymphatic disease from co-morbidities like obesity, which can be highly impactful to patients. "Once these patients have a diagnosis and learn that their adipose deposition is indeed different from obesity, and that it might be related to vascular dysfunction, that opens up a new range of therapies that they may want to choose," says Dr. Crescenzi.

Adding sodium imaging in a proton MRI exam

While common MR imaging is sensitive to the protons of water in the body, imaging of other magnetic nuclei requires different detection hardware, including a radiofrequency coil that is tuned to the resonance of the specific nuclei. Sodium MRI is possible because sodium (23Na) is also magnetic and naturally abundant in the body.

Previously, adding sodium imaging required a separate and time-consuming examination procedure. The current process used in the SALT Lab is much more efficient. "We perform sodium and proton imaging in one series: both protocols are included in a single ExamCard," says Dr. Crescenzi. "And to overcome the inherently low SNR of sodium MRI, we aim to develop protocols that can sense sodium faster and acquire the scan with higher resolution. These developments, including ultra short echo time (UTE) imaging, are highly relevant to our current clinical trials and to what we think will be important future clinical developments." ▶

“We perform sodium imaging in series with other vascular and anatomical MRI scanning – it can be done in the same ExamCard and runs just like any other lower extremity scan.“

Rachelle Crescenzi, PhD

Sodium and proton MRI in one examination

Performing leg sodium MRI starts with the technologist positioning the patient feet-first into the 3-tesla magnet. “No specialized training is required – a technologist who can run other lower extremity MRI exams is perfectly capable of running the multi-nuclei exam,” says Dr. Crescenzi. “In fact, we perform sodium imaging in series with other vascular and anatomical MRI scanning: it can be done in the same ExamCard and is run just like any other lower extremity scan.”

Sodium MR imaging in the lower extremities is performed first, using a dedicated sodium coil. “We use multi-nuclei MR spectroscopy and imaging to perform sodium MRI in series with other scans like mDIXON MRI and MR lymphangiography,” says Dr. Crescenzi. “Once the sodium MRI is acquired, the subsequent scans can acquire proton imaging just like any other ExamCard. And all of this can be performed by the MRI technologists.”

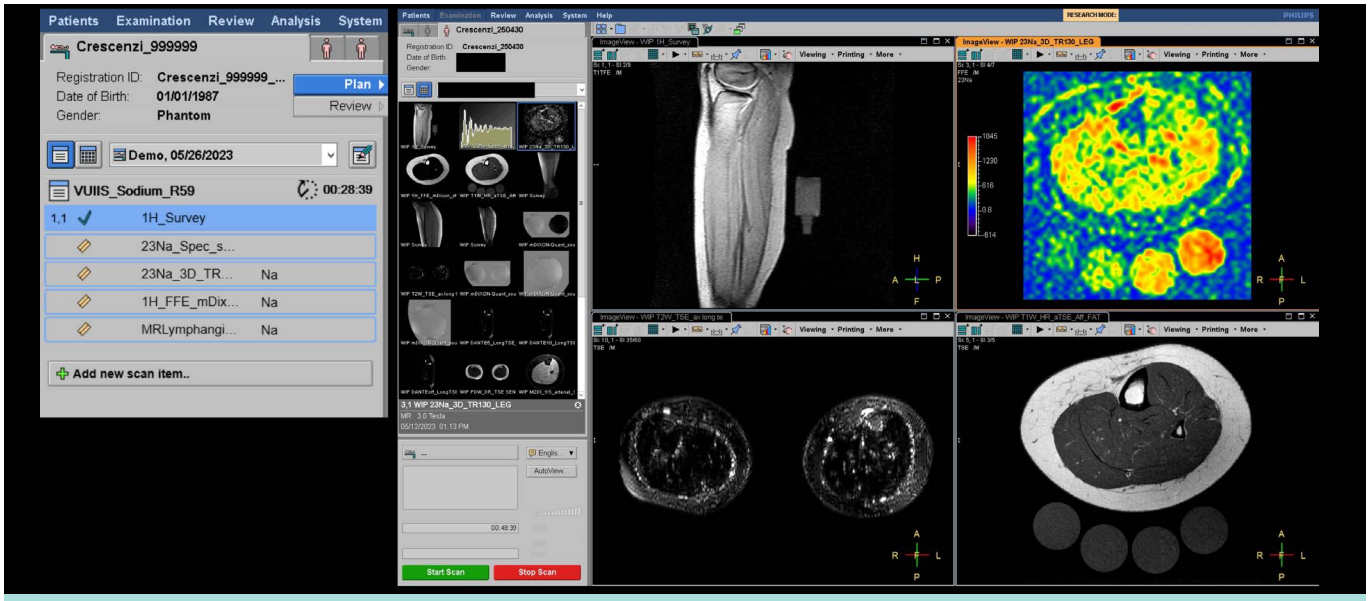
“Our MRI technologists all learned the standardized sodium protocol, which is used in multiple clinical trials at the imaging institute. We have optimized and modified the ExamCard parameters with our imaging trainees and translated this back to the technologists who operate the scanner day in and day out. Integration of sodium and proton MRI capabilities has increased our scan time efficiency which aims to improve the adoption of non-invasive molecular imaging by sodium MRI.”

Multi-nuclei MRI poised for broader application

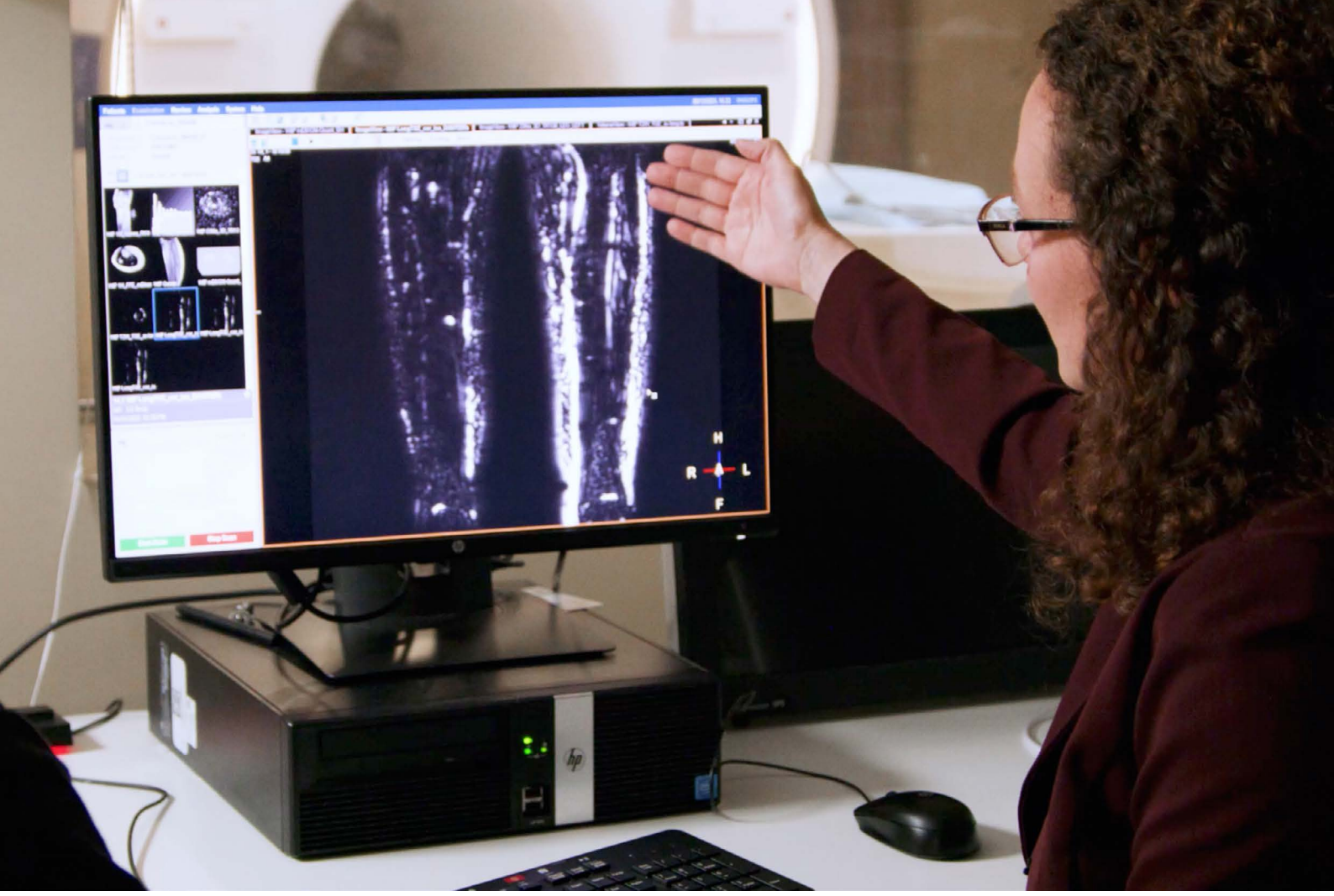
According to Dr. Crescenzi, it is not only the small niche of lymphatic diseases where sodium imaging could have an impact. There are also renal, cardiovascular and metabolic diseases that affect sodium in the body.

Pediatric vascular medicine specialists currently have very few technologies for differentiating a venous from a lymphatic malformation. “The ability to perform MR lymphangiography with the capabilities now available on our three-tesla clinical scanners is very attractive to the radiologists and the vascular medicine specialists in the hospital here,” says Dr. Crescenzi. “I believe that if we had sodium MRI on top of vascular functional imaging in the hospital setting, it could really transform how some rare vascular diseases are being treated and diagnosed in the clinic. Being able to perform multi-nuclei imaging at clinical field strength 3T will be critical to getting these technologies into the hospital.”

Dr. Crescenzi appreciates the collaboration with the vendor and their onsite clinical scientist. They worked jointly on improving technologies for proton imaging and multi-nuclei sodium imaging, and are driving standardization of sodium imaging technology across different sites in the network.



Multi-nuclear MRI ExamCard and review.



Patient needs are what motivates researchers

According to Dr. Crescenzi, hearing from patients about their most troublesome symptoms is what really motivates her team's research. "These patients are often told that they have common obesity, when they actually have something very different from obesity, that involves together sodium, adipose and lymphatics. We want to develop sodium imaging together with MR lymphangiography in a short, clinically feasible scan time."

"I think that finding a cure for lymphatic diseases is a real possibility. Consider how treatment development has often started with better technologies to evaluate therapies in clinical trials. We want to make the sodium imaging faster and acquire higher resolution images to better test the impact of therapies on lymphatic disease and monitor long term outcomes," she concludes. ■

Summary

- The SALT Lab uses sodium MRI and proton MRI to study lipedema and lymphedema, that are often difficult to distinguish from obesity.
- In clinical trials, sodium MRI shows salt retention in patients with lipedema and lymphedema and allows measurement of tissue sodium non-invasively.
- Radiologists are interested in the additional information that sodium MRI provides when pairing it with vascular functional imaging.
- Sodium MRI can be seamlessly integrated in a series with other vascular and anatomical MRI scans, all in the same ExamCard.

Continuous access to latest MRI software

MR Subscription helps Royal Darwin Hospital enhance throughput and diagnostic capabilities

Two years ago, Jack Feeney, MRI manager at Royal Darwin Hospital, started using MR Subscription to improve capabilities of their Ingenia 1.5T MRI system – in place since 2019. MR subscription gives access to all software that is available for Philips 1.5T[1], allowing to enhance and optimize the hospital's scanning. Feeney reports a 20% increase in patient scans since adopting MR Subscription.

The main clinical benefits come from SmartSpeed and MotionFree. "SmartSpeed has made our scans faster or provides higher resolution," says Feeney. MotionFree has improved scanning for patients with head and neck cancers or tongue tumors, making images clearer for radiologists and scanning easier for radiographers.

Radiologist Dr. Filipe Vilas Boas notes that their MRI scanner is one of the few available in the Northern Territory (NT) and optimizing its use is a day-to-day challenge. He highlights that MR subscription has expanded their diagnostic capabilities in neuro-oncology. Some advanced sequences have been successfully implemented, including spectroscopy and perfusion, which were previously unavailable in the NT. This has led to engagement with services such as neurosurgery, that can now refer patients to them that before needed to go down to Adelaide for imaging." ■

Dr. Filipe Vilas Boas (left) and Jack Feeney (right)

Having MR Subscription means that for the next 5 years we'll have access to latest software that comes out and anything exciting that's developed in the MRI world."

Jack Feeney, MRI manager at Royal Darwin Hospital, Australia.

Philips MR Subscription is a future-focused business model providing continuous access to all the most up-to-date software on a continuous basis, helping you realize the full potential of your MRI systems. Benefits of the MR Subscription model:

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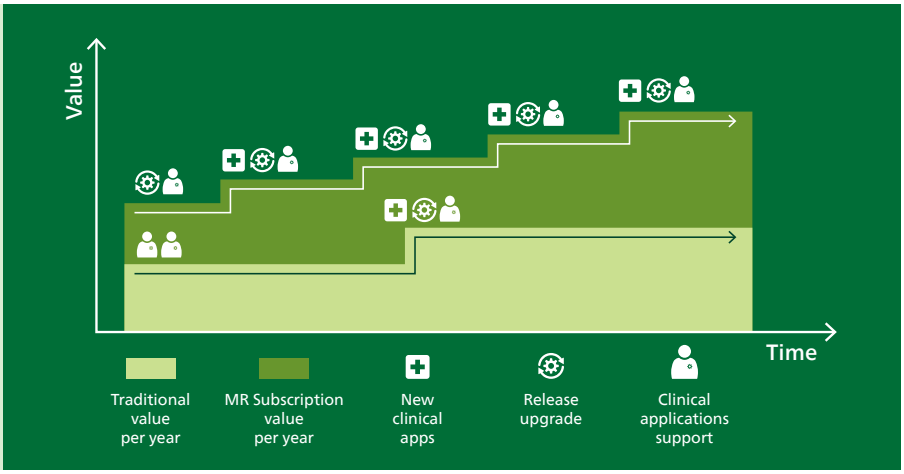

1. Subject to terms and conditions of sale. To access the most current Speed module applications, your system should have the DDAS operating system and MR Workspace.

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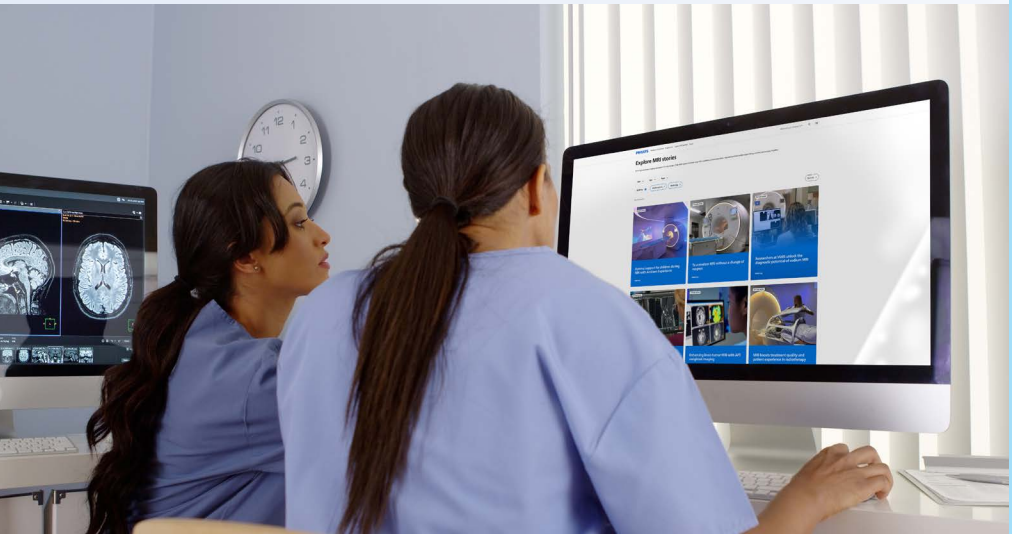

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