PHILIPS

SmartSpeed Precise

Ultimate precision at maximum speed with **Dual AI**

MR Clinical application

Our vision

For more than 130 years, we have been creating meaningful innovations to improve people's lives and make the world more sustainable. We are inspired to continously advance the state of precision diagnosis with customer- and patient-centric solutions that deliver clear care pathways and predicable outcomes.
In MR, our mission is to achieve a fast, fully automated, and personalized exam for every patient, while acting responsibly towards our planet and society. With Artificial Intelligence (AI)-driven, smart, connected imaging; smart workflows; and integrated clinical solutions, we improve your MR department's productivity, enhance patient and staff experience, and deliver high-quality diagnostic imaging. This vision inspired Philips SmartSpeed Precise, our breakthrough new MRI application that delivers ultimate precision at maximum speed with Dual AI.

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Addressing your most urgent priorities

According to a recent study,[1] most MRI departments share three priorities: increasing productivity, patient satisfaction and referring physician satisfaction.

Productivity | Patient satisfaction | Referring physician satisfaction

These priorities are directly related to two trends. First, the rising clinical utility of MR is increasing the pressure to efficiently scan more patients and to shorten the path from initial scan to final diagnosis. Second, to maintain profit margins in the face of declining reimbursement[2], MR departments are looking for ways reduce the cost per scan, as well as to reduce rescans, 20% of which are necessitated by motion artifacts.[3]

Solutions that increase productivity address all these challenges. And when productivity rises while preserving diagnostic confidence, both patient satisfaction and referring physician satisfaction increase as well.

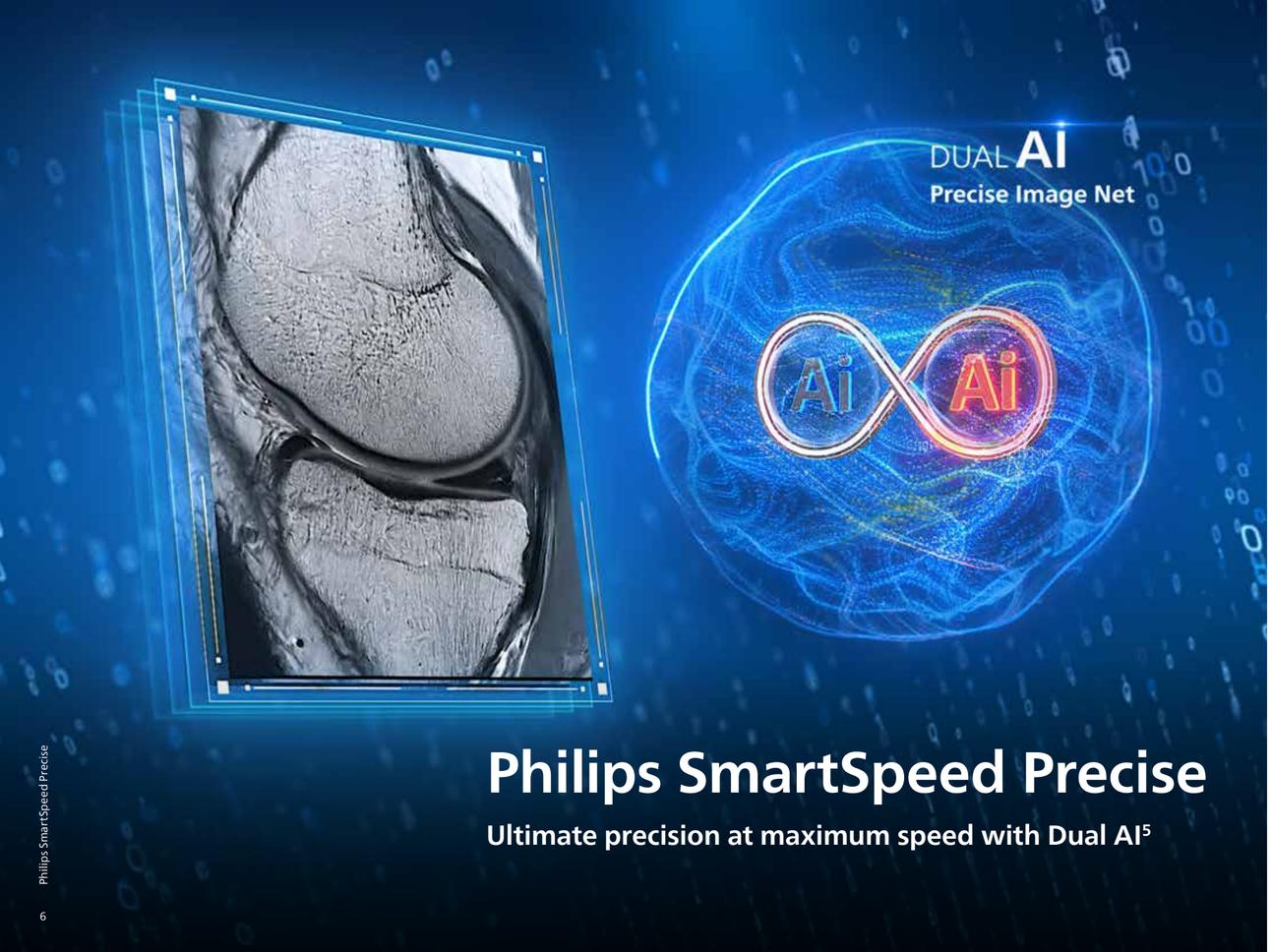
Ultimate precision at maximum speed is the answer

We have long recognized that speed combined with higher image quality is a significant answer to the challenges facing MR departments.

- Speed – particularly when available for a broad range of patients – enables more exams per day, increasing productivity
- Speed shortens exam length, helping to increase patient satisfaction
- Speed can improve image quality, increasing referring physician satisfaction

Understanding the primacy of speed that increases image quality is what drove us to pioneer SENSE, ds SENSE, Multiband SENSE, Compressed SENSE and more recently our state-of-the-art speed engine, SmartSpeed.

And now, we are building on our proven technology and leveraging two AI engines deeply integrated in the MR system to take fast MRI technology to the next level.



Philips SmartSpeed Precise

Ultimate precision at maximum speed with Dual AI[5]

Fast and high-quality imaging

Philips SmartSpeed Precise is our next generation acceleration technique that expands the proven Compressed SENSE and SmartSpeed[4] technologies with a unique integrated Dual AI[5] innovation. SmartSpeed Precise takes the leap towards ultimate precision at maximum speed by maximizing image quality with better signal-to-noise ratio and **up to 80% higher sharpness[6]** and increasing your imaging speed by up to a **factor of 3.[7]**

Be confident with unmatched sharpness

- SmartSpeed Precise enables an **increase in sharpness by up to 80%** compared to conventional[6] imaging and increases SNR

Get ahead with maximum acceleration

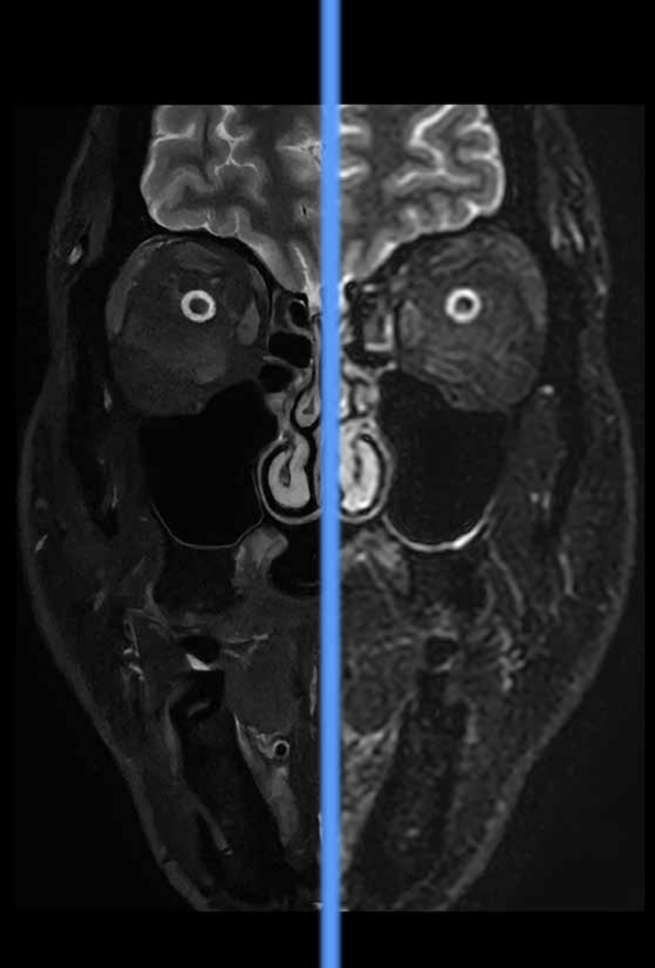
- With SmartSpeed Precise you can **scan up to three times faster[7]** with no loss in image quality

Get ahead with maximum accessibility

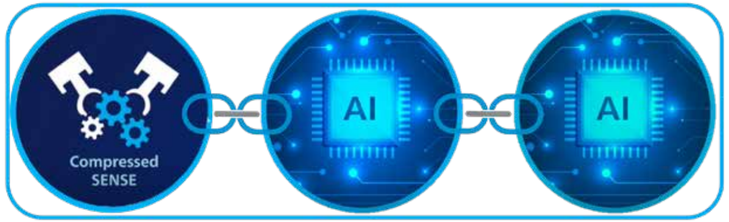
- SmartQuant Precise made faster[7] and efficient with **Dual AI[5] reconstruction**
- SmartSpeed Precise is available not just for new systems, but across Philips' entire installed base of 1.5T and 3.0T MR systems[8]

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**



A unique technology based on a leading speed engine and a unique integrated Dual AI[5] innovation



Compressed SENSE

1st AI engine at source of MR signal[9]

2nd AI engine at raw complex image domain

Philips SmartSpeed Precise enabling technologies

Philips SmartSpeed builds on three key technologies:

- **Compressed SENSE:** A state-of-the-art speed engine that uses a unique, balanced k-space sampling approach to achieve maximum speed while preserving details so that there is no compromise in image quality
- **Adaptive-CS-Net:** An award-winning[9], deep-learning Artificial Intelligence (AI) reconstruction that has been trained with Compressed SENSE data as input, which is applied at the source of the MR signal to remove noise and preserve details
- **Precise Net:** AI engine applied on the raw complex imaging data to deliver a boost in image quality and sharpness

Together, these technologies can be used to speed up scan time and boost image quality significantly on all anatomical areas and contrasts[10]. In fact, the Adaptive-C-SENSE technology used by Philips SmartSpeed Precise so outpaces other acceleration solutions that it won the Fast MRI Challenge hosted by Facebook and New York University.

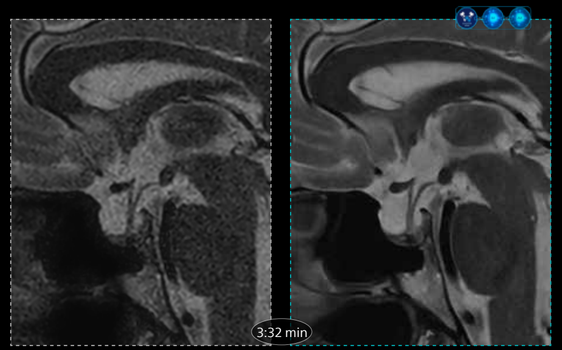
Be confident with unmatched sharpness

Enhance diagnostic confidence

SmartSpeed Precise enables an **increase in sharpness by up to 80%** compared to conventional[6] imaging and delivers MR images with reduced ringing. Because Philips SmartSpeed Precise applies deep learning AI reconstruction at the source – as close as possible to the beginning of the image acquisition process enabling k-space data consistency check for trustworthy AI and minimizing data loss. And less data lost means more information in the reconstructed image. This allows you to boost your image quality for higher confidence when diagnosing your patients.

Up to **80% sharper images**[6]

Improve your diagnostic confidence for all anatomies

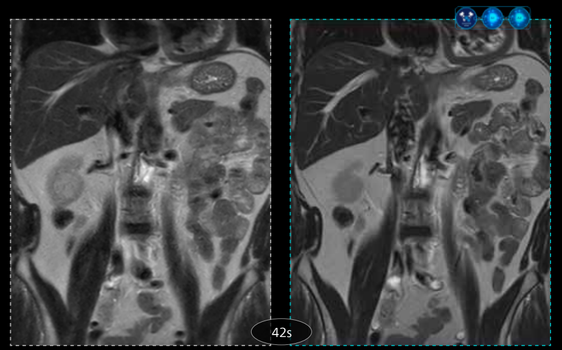


Non-AI (SENSE)
Recon 0.31x0.31x 1mm

Pituitary Sag T2 TSE

SmartSpeed Precise
Dual AI Recon 0.32x0.32x 1mm

MR 7700, 3.0T

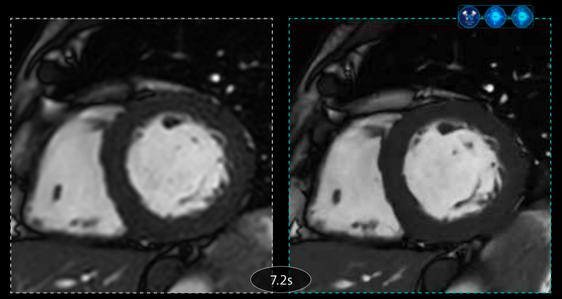


Non-AI
Recon 0.7x0.7x 5mm

Abdomen Ssh T2

SmartSpeed Precise
Dual AI Recon 0.7x0.7x 5mm

BlueSeal XE, 1.5T

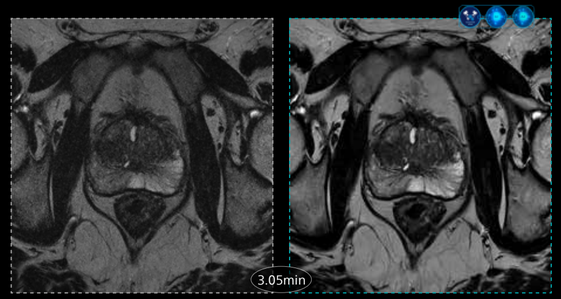


Non-AI
Recon 0.95x0.95x 8mm

Cardiac BTFE

SmartSpeed Precise
Dual AI Recon 0.8x0.8x 8mm

BlueSeal XE, 1.5T

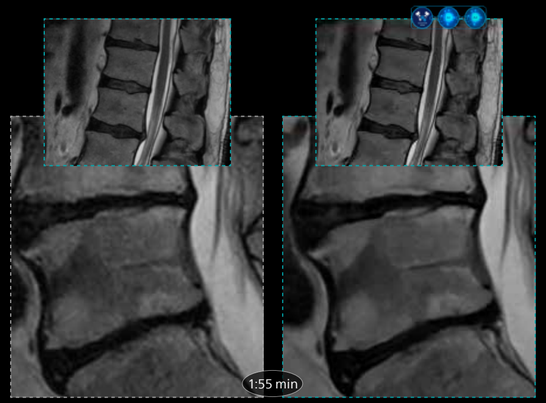


Non-AI
Recon 0.5x0.5x2mm

Prostate T2 TSE

SmartSpeed Precise
Dual AI Recon 0.5x0.5x2mm

MR 7700, 3.0T

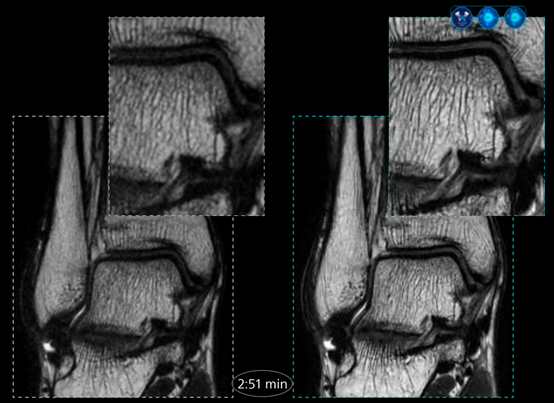


Non-AI
Recon 0.35x0.35x 3.5mm

L Spine T2 TSE

SmartSpeed Precise
Dual AI Recon 0.35x0.35x 3.5mm

Ingenia CX, 3.0T



Non-AI
Recon 0.1x0.1x 2mm

Ankle Cor T2 TSE

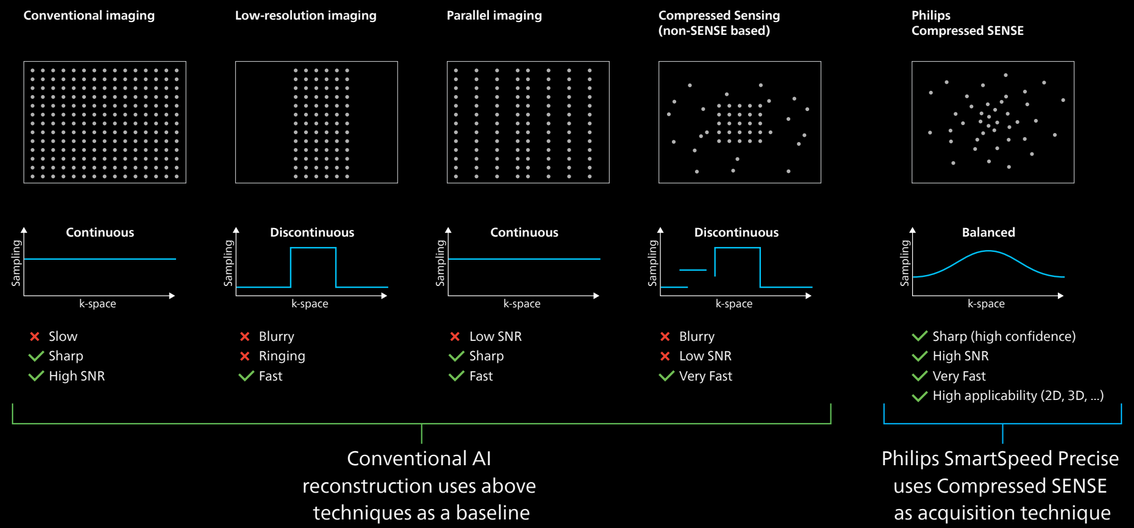
SmartSpeed Precise
Dual AI Recon 0.1x0.1x 2mm

Ingenia Elition X, 3.0T

Maximize information, remove noise, preserve details

In contrast to other industry speed solutions that combine AI with conventional acceleration techniques and apply AI much later in the reconstruction chain, Philips SmartSpeed Precise utilizes Compressed SENSE as a speed engine and applies AI early, to collect just the right amount of data in the shortest amount of time, ensuring fast imaging without compromising image quality.

Why do we use AI reconstruction with Compressed SENSE?



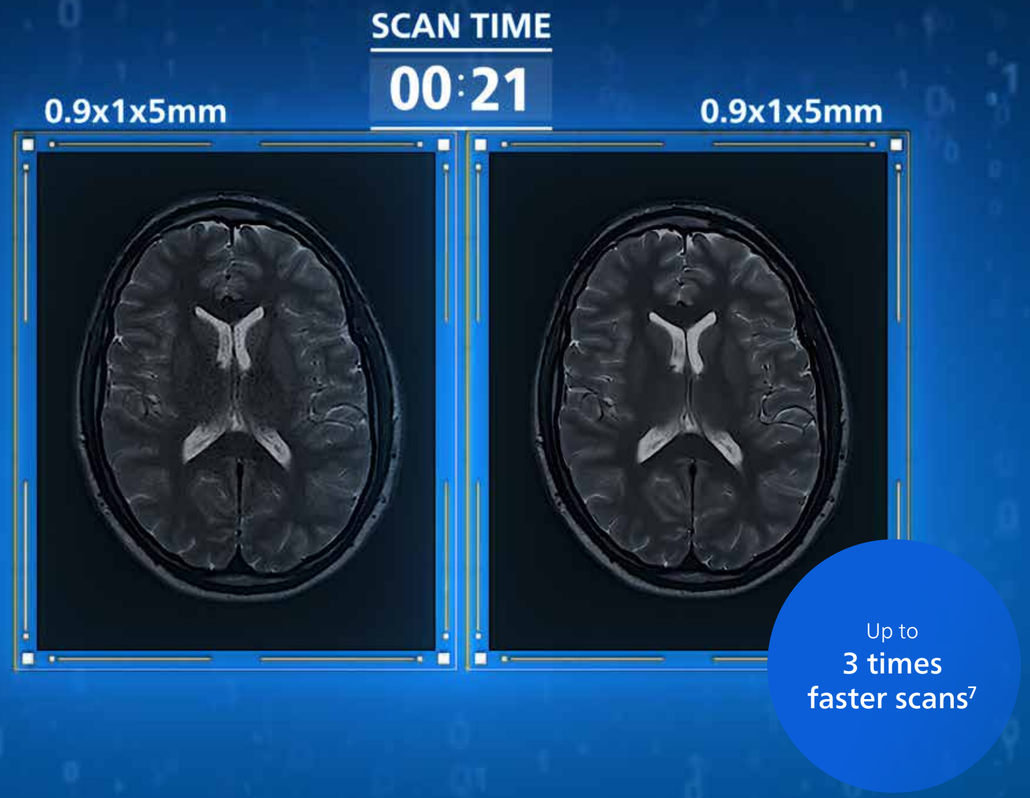
1) IEEE Access, Oct. 2020, An Adaptive Intelligence Algorithm for Undersampled Knee MRI Reconstruction
2) MLMIR, MICCAI, Oct. 2021, Evaluation of the Robustness of Learned MR Image Reconstruction to Systematic Deviations Between Training and Test Data for the Models from the MRI Challenge

Get ahead with maximum acceleration

Increase productivity

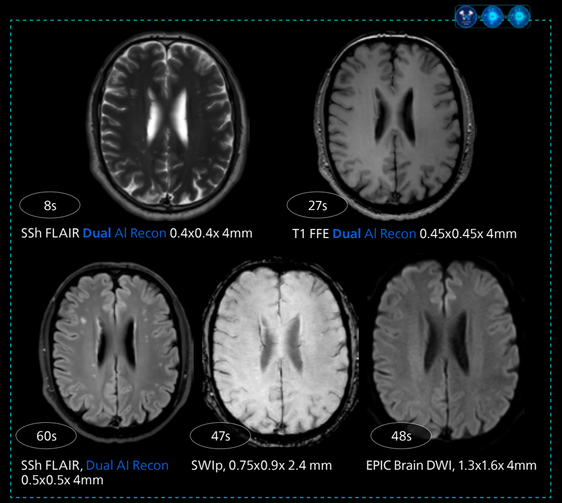
By scanning up to three times faster[7] and helping to reduce the total exam time, SmartSpeed Precise can help increase MRI department productivity. You can use the time gained to scan more patients and reduce the cost per scan, to add unplanned patients to the schedule or to reduce staff overtime.

Philips SmartSpeed Precise's speed increases MR accessibility for patients who are stressed, anxious or in pain. Because it shortens exams and provides first-time-right scans regardless of patient condition, patients spend less time in the scanner. It also helps to reduce breath holds and supports free-breathing exams to create a more comfortable exam experience. In addition, technologists can free up more time for patient interaction, ultimately making the MRI exam experience better for patients.



Up to **3 times faster**[7] scans with similar image quality

Increased productivity via ultra fast imaging



SSh FLAIR **Dual** AI Recon 0.4x0.4x 4mm

T1 FFE **Dual** AI Recon 0.45x0.45x 4mm

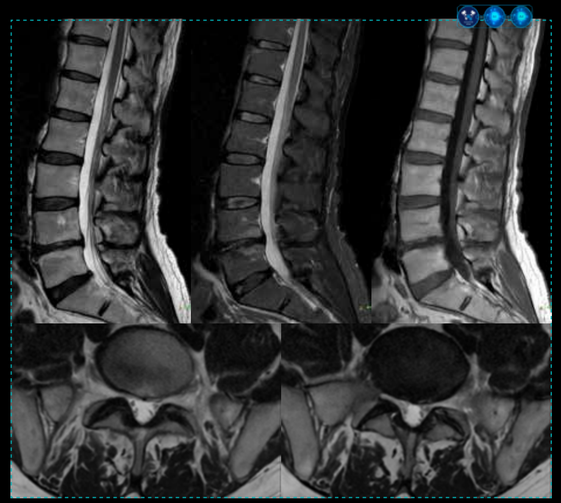
SSh FLAIR, Dual AI Recon 0.5x0.5x 4mm

SWIp, 0.75x0.9x 2.4 mm

EPIC Brain DWI, 1.3x1.6x 4mm

Brain
SmartSpeed Precise

MR 7700, 3.0T

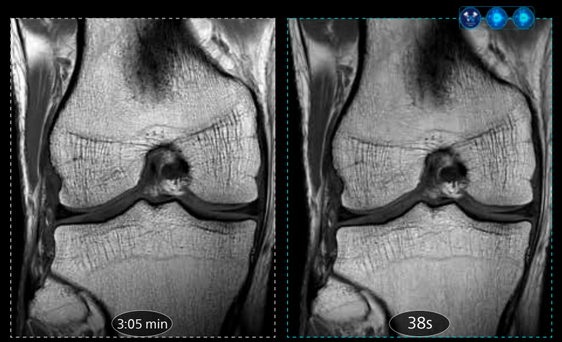


SmartSpeed Precise
Dual AI Recon Sag T2; 0.4x0.4x 4mm, 58s
Sag T1; 0.45x0.45x 4mm, 78s

SmartSpeed Precise
Dual AI Recon Sag STIR; 0.5x0.5x 4mm, 74s
Tra T2; 0.45x0.45x 3.5mm, 86s

BlueSeal XE, 1.5T

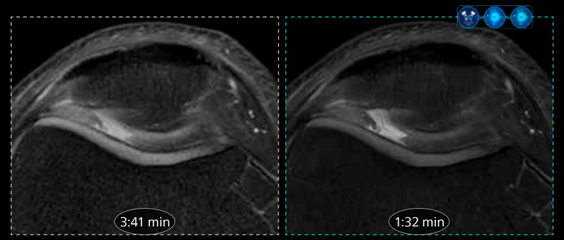
Improve your productivity with reduced exam time without losing image quality



Non-AI
Recon 0.2x0.2x 3mm

Knee T1 TSE

SmartSpeed Precise
Dual AI Recon 0.2x0.2x 3mm

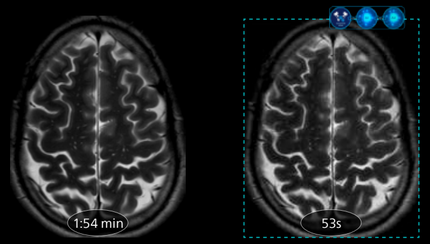


Non-AI
Recon 0.19x0.19x 3mm

Knee PD FS

SmartSpeed Precise
Dual AI Recon 0.19x0.19x 3mm

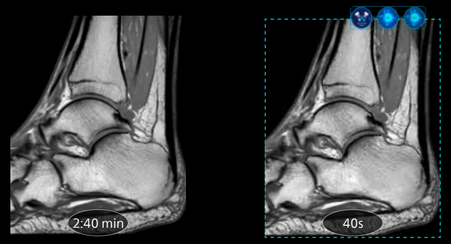
Ingenia Elition X, 3.0T



Standard of care
Recon 0.3x0.45x 4mm

Brain Tra T2

SmartSpeed Precise
Dual AI Recon
0.3x0.3x 4mm



Standard of care
Recon 0.23x0.23x 3mm

Ankle T1

SmartSpeed Precise
Dual AI Recon[1]
0.23x0.23x 3mm

Ingenia Elition X, 3.0T

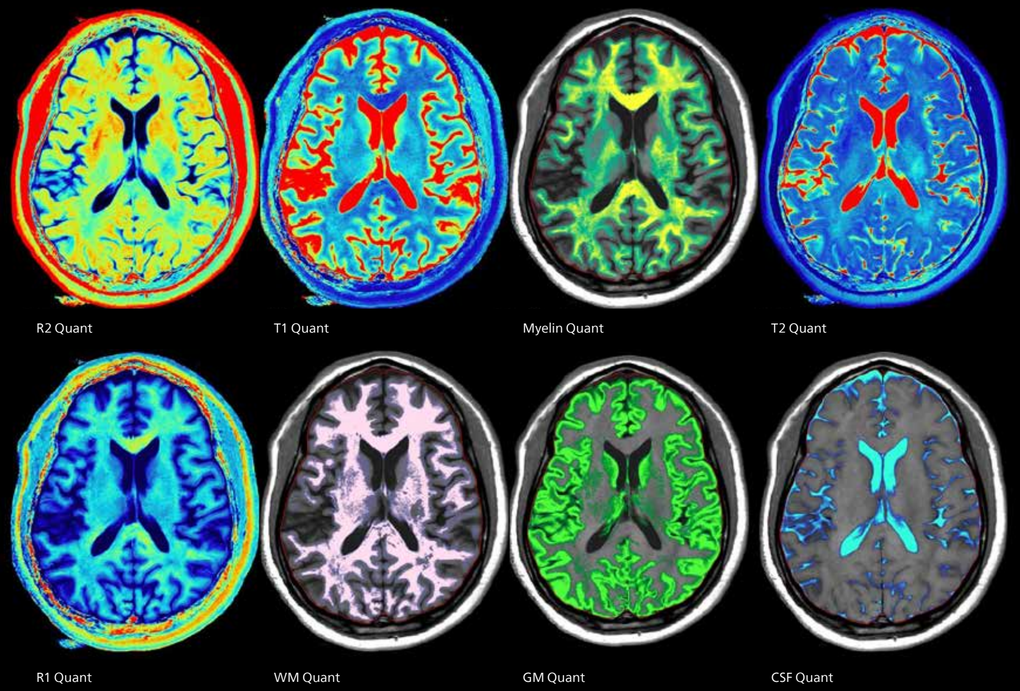
Get ahead with maximum accessibility

Include fast quantitative MR imaging in your daily practice

Wide application of SmartSpeed Precise helps MR departments to perform quantitative imaging techniques like T1- or T2-mapping faster[7] by decreasing acquisition time, helping to bring this technique to mainstream clinical practice.

Smart Quant, combination of SmartSpeed Precise technology and quantitative MR, is designed to allow you to perform fast and high-quality MR quantitative imaging and increase your diagnostic confidence with extra diagnostic information. It gives you access to exciting advanced applications for brain, MSK, body[11] and cardiac.

SmartQuant Neuro uses single quantification scan as an input for advanced third-party processing software[12] to synthesize MR images with different contrasts, produce brain parenchyma fraction maps and brain segmentation maps, such as Myelin, aiming at efficient assessment and triage. Smart Quant MSK facilitates the advanced visualization of cartilage structures and provides tools to support determination of the degradation of the cartilage. Smart Quant Cardiac can help in the non-invasive assessment of myocardial tissue characteristics by providing comprehensive graphs and pixel based, quantitative information in different regions of the myocardium to guide early decisions for therapy. SmartQuant Body aid your diagnostic assessment by providing 3D fat fraction maps of the whole liver in one single breathhold.[11]



2:34 min

Brain **SmartQuant Precise,**
Dual AI Recon 0.38x0.38x 4mm

Scalable Impact Across the Installed Base

SmartSpeed Precise is available not just for new systems, but across Philips' entire installed base of 1.5T and 3.0T MR systems[8]—offering healthcare systems a scalable, cost-effective upgrade path that boosts clinical performance without requiring new hardware. SmartSpeed Precise is also available across all anatomies.

Philips SmartSpeed Precise packages

SmartSpeed Precise Plus		
Neuro	Spine	MSK
SmartSpeed Precise 2D		
SmartSpeed AI 3D		
SmartSpeed MotionFree, DWI, Implant		
C-SENSE		

SmartSpeed Precise Premium				
Neuro	Spine	MSK	Body	Cardiac
SmartSpeed Precise 2D				
SmartSpeed AI 3D				
SmartSpeed MotionFree, DWI, Implant, 3D Free Breathing				
C-SENSE				

AI throughout MR workflow – from pre-scanning to reconstruction

Philips SmartSpeed Precise is available via MR Workspace, our industry-unique control room solution that empowers your team to drive departmental efficiency and predictability while improving their experience. It helps to simplify the path from image acquisition to diagnosis by providing the technologist with integrated AI protocol selection. With the combination of Philips SmartSpeed and MR Workspace, VitalEye touchless patient sensing and SmartExam exam planning you can utilize AI throughout the MR workflow– from pre-scanning to reconstruction – to increase productivity and enable staff to focus more on their patients.

AI throughout MR workflow – from pre-scanning to reconstruction

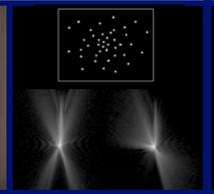
Pre-scan

VitalEye
Touchless patient sensing

Acquisition

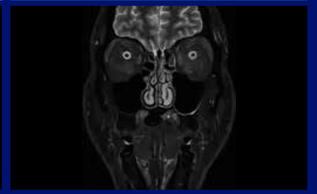
MR Workspace
AI protocol selection

SmartExam
AI exam planning



Philips SmartSpeed Precise
Compressed SENSE acceleration

Reconstruction pipeline



Philips SmartSpeed Precise
Dual AI reconstruction

Philips SmartSpeed Precise
Integrated Dual AI

1. MI&A Insights Report MR. Q1. 2021.
2. https://coder.aapc.com/cpt-codes/76498. Accessed October 11, 2019.
3. JACR, July 2015, Vol. 12:7, pp. 689-605
4. SmartSpeed is compatible with 97% of clinical protocols on average, measured across a sample of sites from Philips MR installed base.
5. 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 Net).
6. Compared to Philips SENSE/ C-SENSE imaging.
7. Compared to Philips SENSE imaging.
8. dStream based systems, , not available for Prodiva and Multiva systems
9. Adaptive-C-SENSE-Net technology is the winner of Fast MRI Challenge hosted by Facebook AI research and New York Langone Health.
10. All anatomical areas and contrasts with SmartSpeed and SmartSpeed Precise combination
11. Compatible with SmartSpeed
12. SyMRI NEURO, Synthetic MR, AB, Sweden.

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