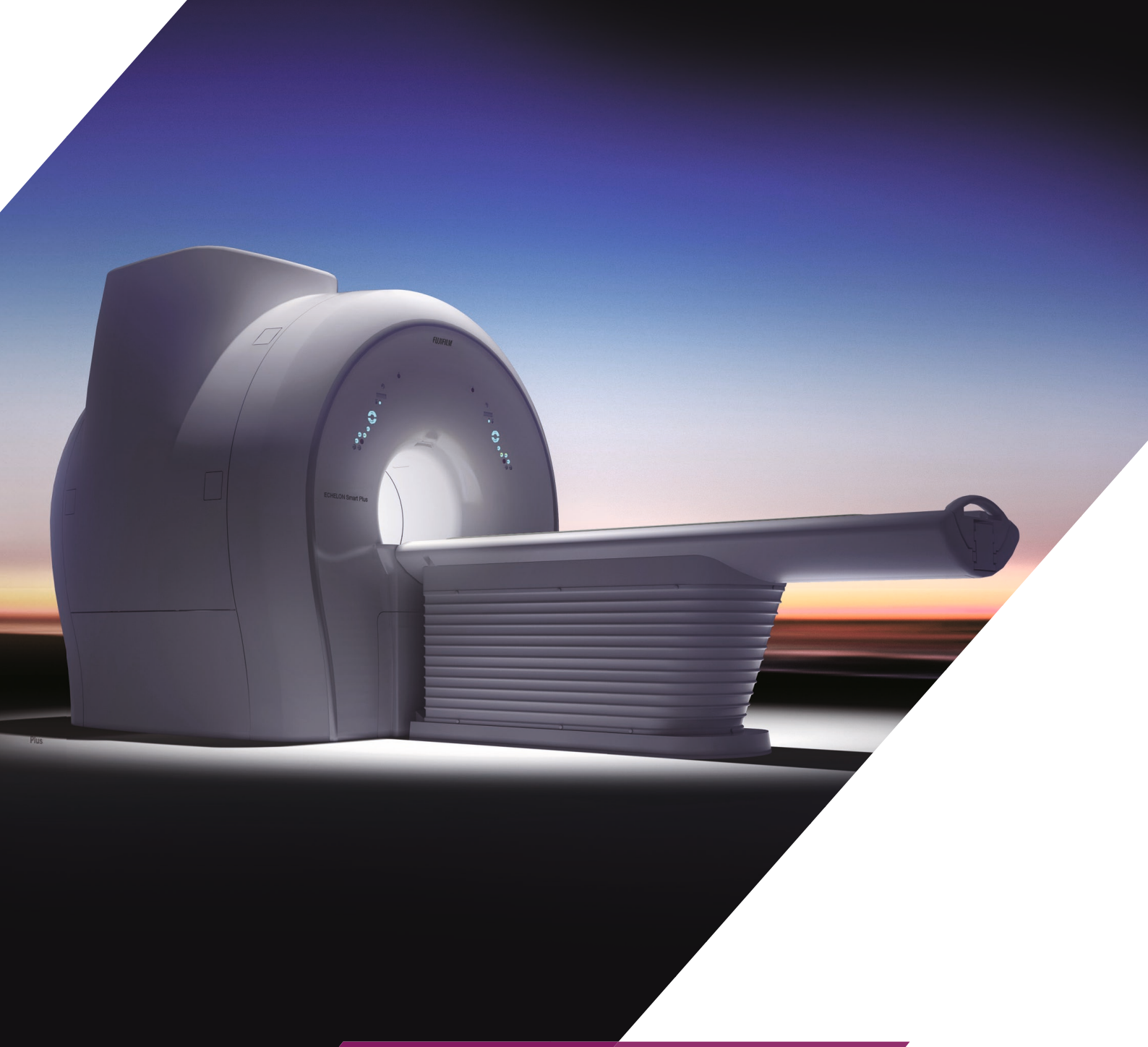
FUJIFILM
Value from Innovation

ECHELON Smart Plus

THE ENLIGHTENED CHOICE FOR HIGH PRODUCTIVITY AND DIAGNOSTIC POWER

the next level in magnetic resonance imaging

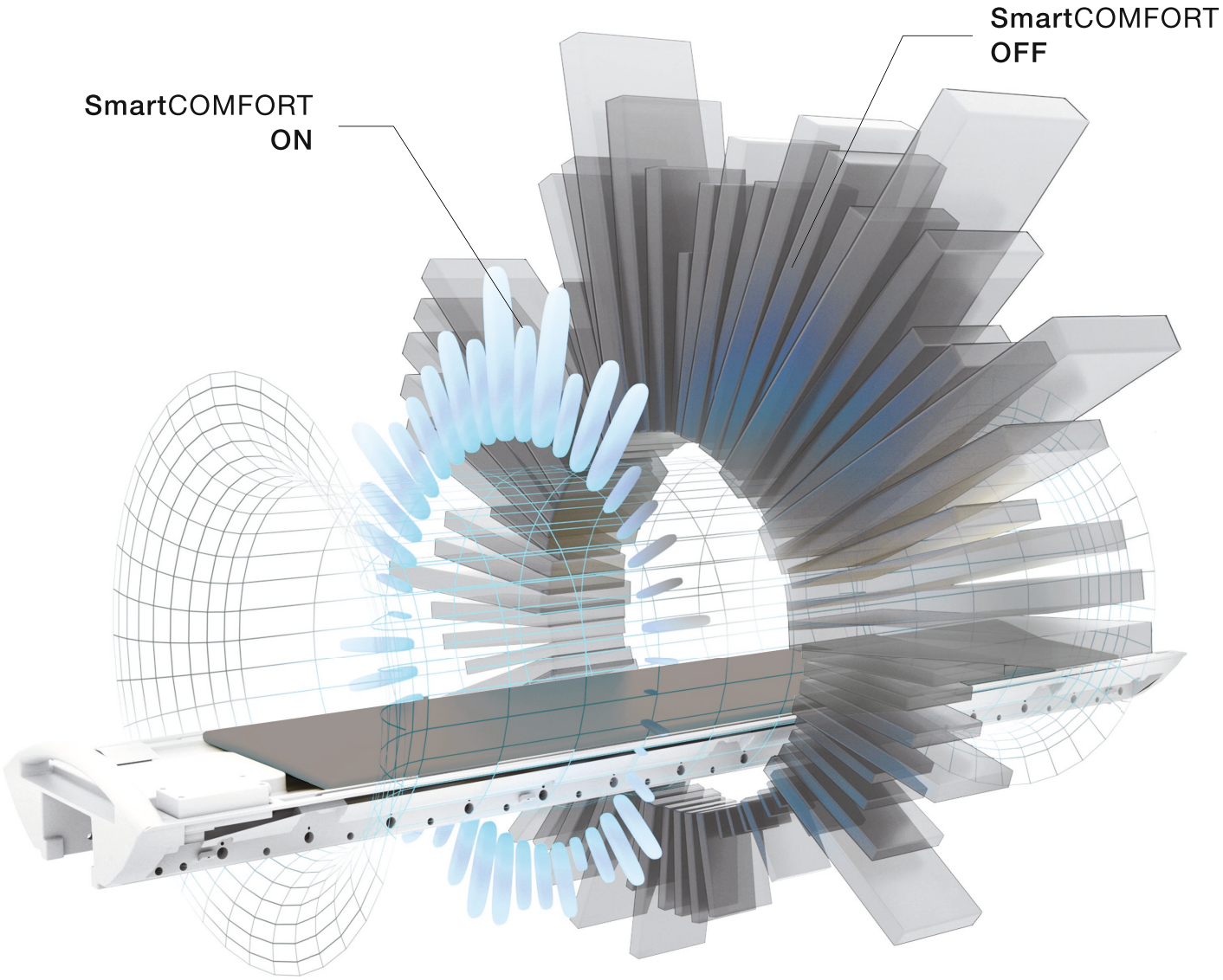


KEY FEATURES

- **Smart**COMFORT
- **Smart**SPEED
- **Smart**ECO
- **Smart**SPACE

ECHELON Smart Plus heralds the dawn of a new standard for 1.5T superconductive MRI

The ECHELON Smart Plus features a small footprint with economics that do not compromise diagnostic quality and speed.
Based on FUJIFILM's proprietary technology, this system has opened up the potential for 1.5T systems, providing superb image quality and superior install flexibility inherited from permanent-magnet MRI systems.
ECHELON Smart Plus offers new options for superconductive MRI.



96% REDUCTION*

SmartCOMFORT

Patient-friendly quiet examinations

Quiet examinations with SoftSound

Various technologies exist to reduce MRI acoustic noise. However, reducing acoustic noise often compromises image quality and may extend scan time, making it unsuitable for routine examination. Other approaches need dedicated hardware. FUJIFILM's SoftSound noise reduction technology reduces the acoustic noise by up to 96%* maintaining image quality and scan time, and without any dedicated hardware.

* Compared to ECHELON Smart without SmartCOMFORT and in dependence of the sequence parameters

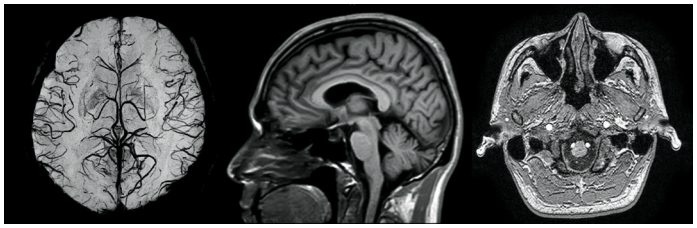
+ Plus

IP-RAPID can be used along with SoftSound

SoftSound + IP-RAPID

+ Plus

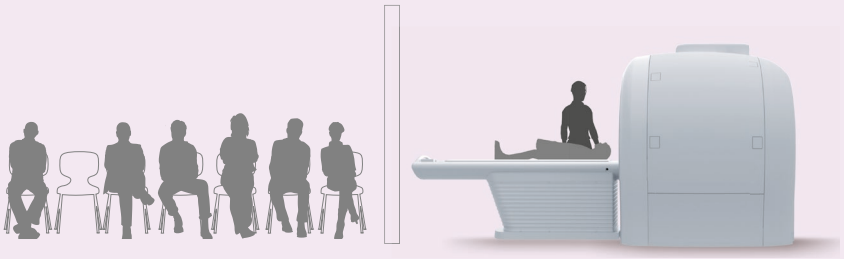
SoftSound can also be used with the "BSI" high-speed 3DT2* weighted images and "3D GEIR"/"3D RSSG" high-speed 3DT1 weighted images.

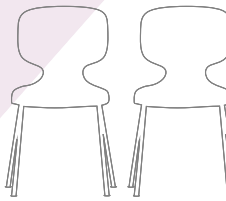


BSI 3D GEIR 3D RSSG

Experience enhanced SPEED with FUJIFILM's SynergyDrive

Conventional equipment





Conventional equipment: Enter MRI room → Patient setting

Workflow coil system

Positioning, imaging and post-processing

ECHELON Smart Plus: Enter MRI room → Patient setting → Patient positioning

■ AutoPose

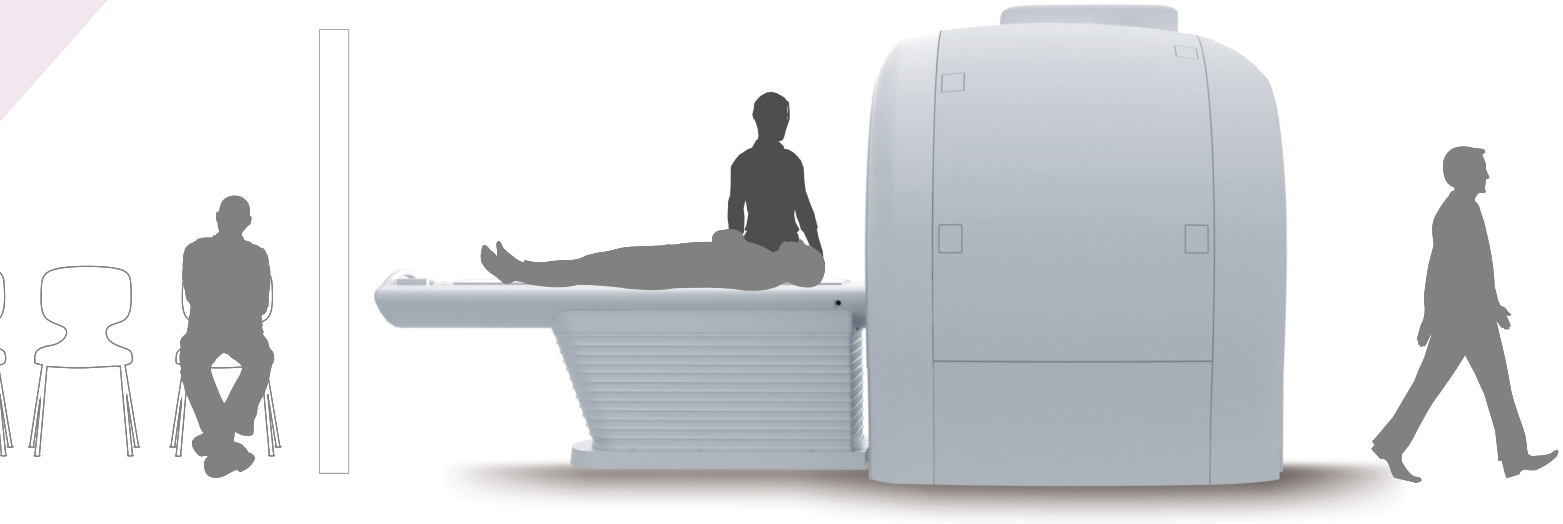
The new Scanogram function allows information to be displayed rapidly on cross-sectional areas of regions for operators.

FUJIFILM's SynergyDrive offers enhanced speed during MRI examinations without reducing image quality or increasing acoustic noise.

FUJIFILM's SynergyDrive offers efficient workflow

"SynergyDrive" offers various functions and applications to simplify the series of operation procedures from entering and leaving the examination room to shortening examination time. This is also expected to improve management efficiency.

ECHELON Smart Plus



Patient positioning | Scanning

AutoExam

are all completed in one step. The examination time is shortened by simplifying operations.

Scanning | Post-processing | Exit MRI room

■ IP-RAPID

■ AutoClip

Digital image processing function that automatically creates clipping images of head MRA images.

■ DICOM transfer

Automated image transfer by DICOM

■ High speed Prescan

Prescan, which is performed as a preparatory procedure, is also enhanced by reducing the time before the main scan.

IP-RAPID A cutting-edge high-speed imaging technology

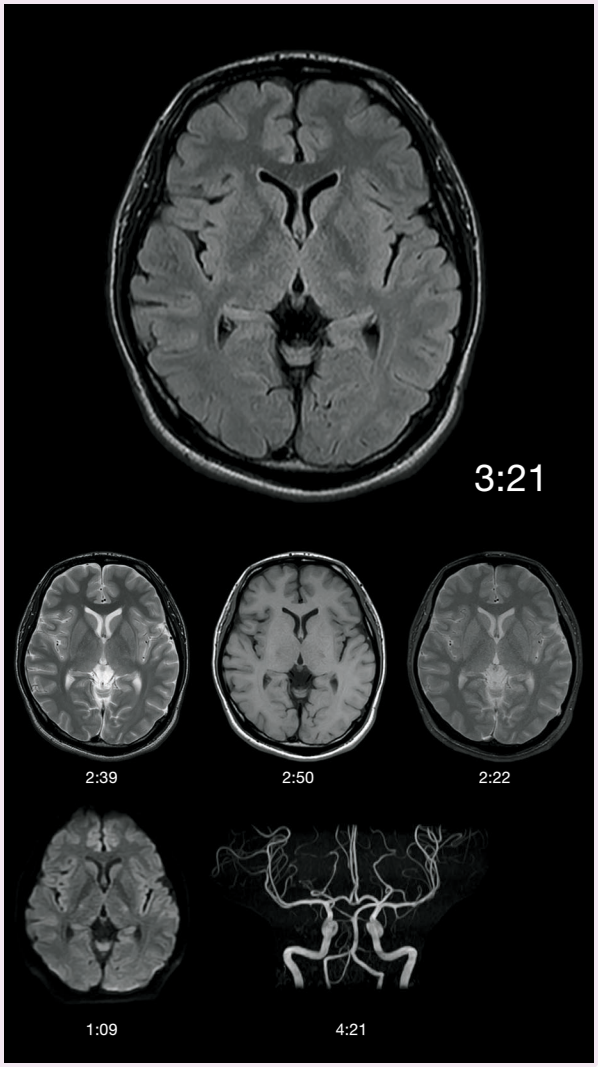
IP-RAPID is high-speed imaging using iterative processing, reducing scan times by up to 60%* while maintaining image quality comparable to conventional imaging methods.

Up to **60%** REDUCTION*

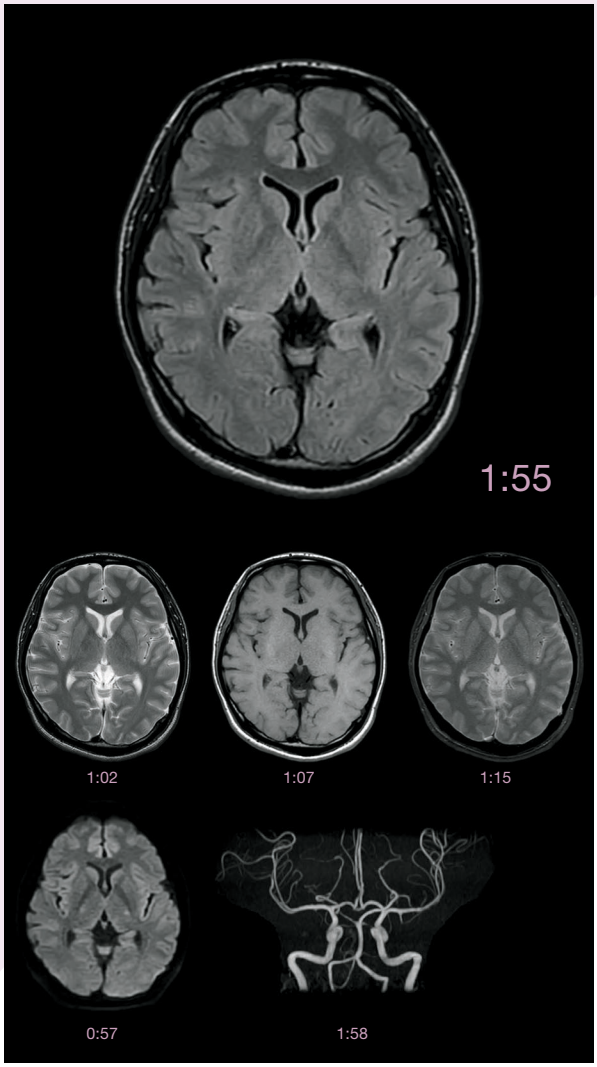
* Compared to ECHELON Smart without SynergyDrive

Experience newly enhanced SPEED with FUJIFILM's IP-RAPID

Normal scan Total 16:42



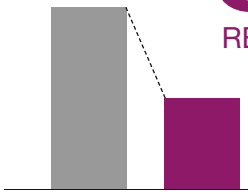
With IP-RAPID Total 8:14



IP-RAPID enables both high image quality and reduced scan time

IP-RAPID is a new technology that can reduce scan time while maintaining image quality. By optimizing and combining undersampling and iterative reconstruction, it can be combined with various regions and functions. SNR and spatial resolution can also be improved while maintaining the scan time.

Total scan time **50%** REDUCTION*



* Value is compared between the following examples, base on the left is ECHELON Smart without IP-RAPID

SynergyDrive

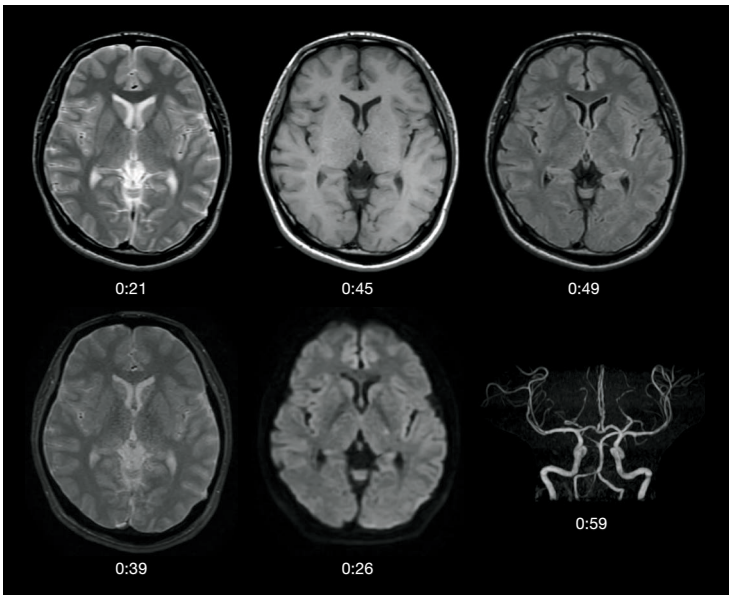
Workflow coil system　AutoExam
■ AutoPose　■ AutoClip　■ DICOM transfer

Enter MRI room → Patient setting → Patient positioning → **Scanning** → Post-processing → Exit MRI room

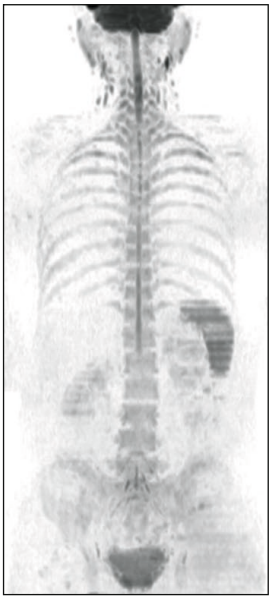
IP-RAPID

IP-RAPID covers a variety of pulse sequences for all anatomical regions.

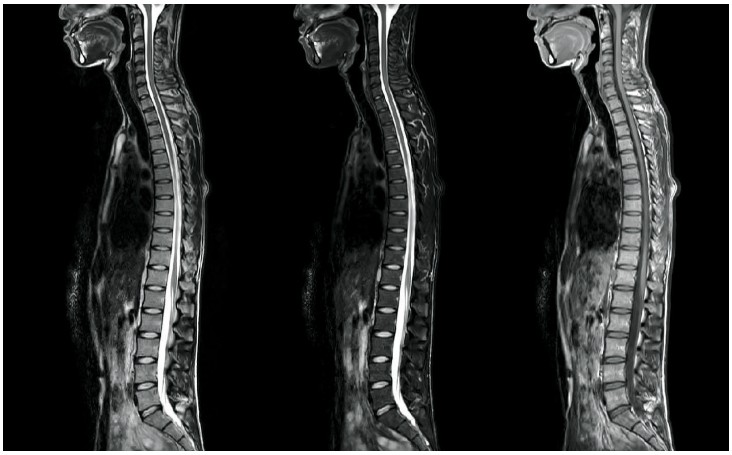
Emergency imaging Total 3:59



DWI Total 4:00

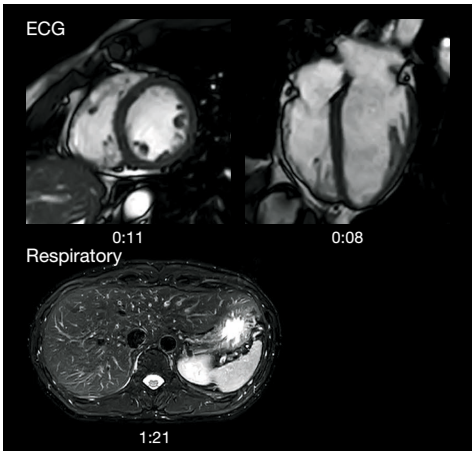


Multi-contrast imaging Total 5:54

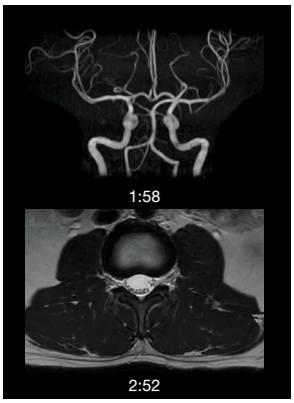


T2WI-InPhase (Original image)　T2WI-Water image (Fat suppression image)　T1WI
FatSep 1:28×2　1:29×2

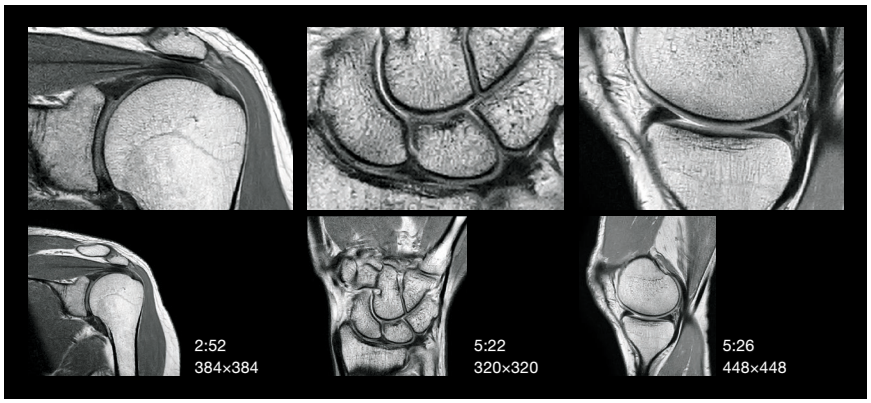
Gated imaging (ECG, respiratory)



Combined with SoftSound



High-resolution imaging



Experience enhanced SPEED with FUJIFILM's AutoExam

Auto operation

Main scan with IP-RAPID

Scanogram
AutoPose brain

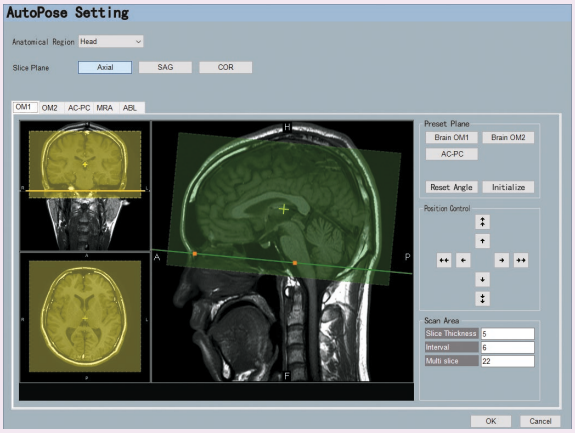
DWI | FLAIR | T2WI | T2*WI

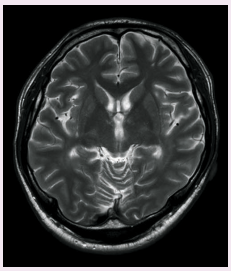
■ AutoPose brain

AutoPose is a slice line setting support function. When the Scanogram imaging ends, the slices are automatically positioned and allow to register up to five types of presets. Below you see two different examples.

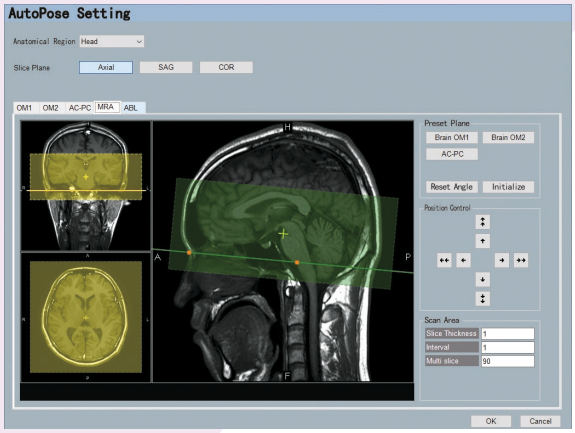
■ Examples of preset screens

Preset 1





Preset 2



Fully automatic function of MRI examination with simplified operations

AutoExam enables setting of imaging conditions, positioning, image processing, image display, image storage, and image transfer functions to be carried out in one step during examination.
The operator can choose to perform semi-automated examinations and may stop, correct and restart imaging.

SynergyDrive

Workflow coil system — AutoExam (■ AutoPose, ■ AutoClip, ■ DICOM transfer)

Enter MRI room → Patient setting → Patient positioning → Scanning → Post-processing → Exit MRI room

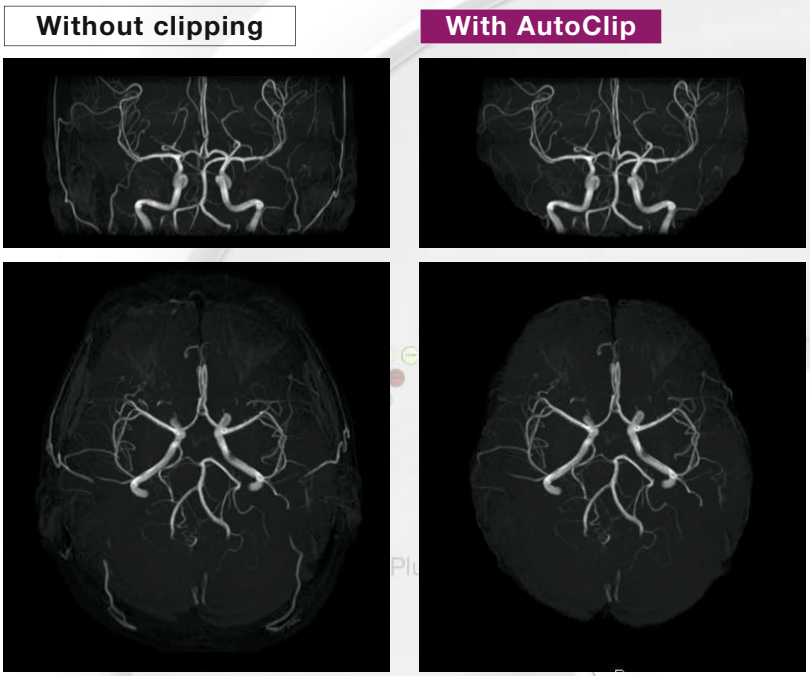
IP-RAPID

Post-processing

MRA | T1WI | DWI analysis | AutoClip | DICOM transfer | Image diagnosis

■ AutoClip

When AutoExam is executed, clipping is performed automatically after MRA imaging.
It is possible to perform additional clipping on images after automatic clipping.



SmartECO

Ecological and economical running costs

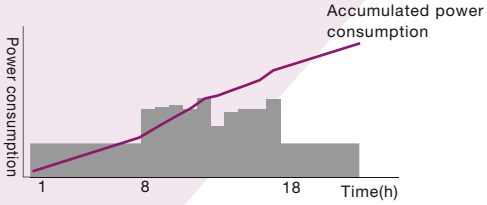
17 % LESS RUNNING COSTS*

*Compared to ECHELON Smart

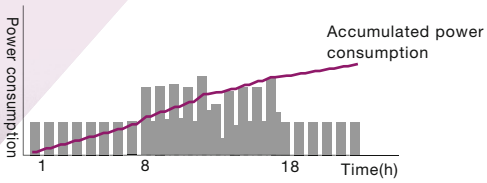
FUJIFILM's SmartECO effectively reduces power consumption

A compact scan room with an MRI unit with less heat discharge also reduces the air conditioning requirements of the examination and equipment rooms. The energy saving function together with the reduction of heat discharge can reduce running costs by 17%*.
*Depending on operating conditions and other factors.

without SmartECO



with SmartECO

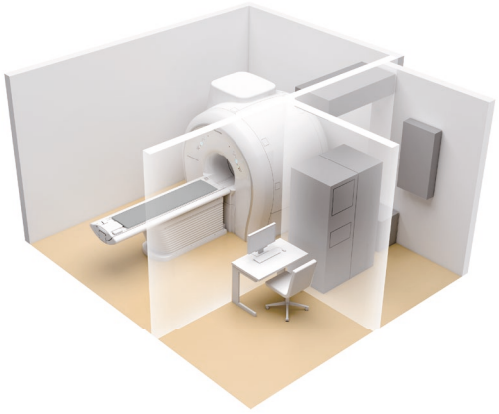


Minimize unnecessary power consumption

Superconductive MRI systems generally command high running costs. These costs are mainly related to the high power consumption of the cooling system necessary to maintain superconductivity. ECHELON Smart Plus is equipped with an energy saving function that can stop the cooling system for a certain length of time during periods of non-use or on non-consultation days. This function effectively reduces the power consumption whilst maintaining zero helium boil-off. Furthermore, as the heat emission from the cooling system itself also decreases during these periods, the power consumption of its heat-dissipating unit is also cut.

SmartSPACE

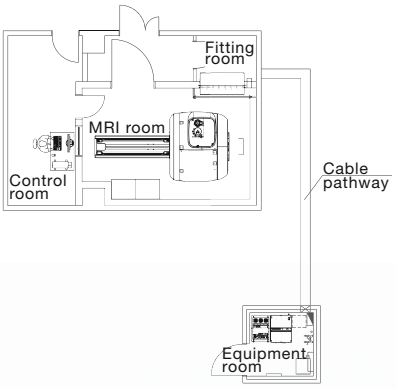
Small footprint
flexible layout



Flexible layout even in limited space

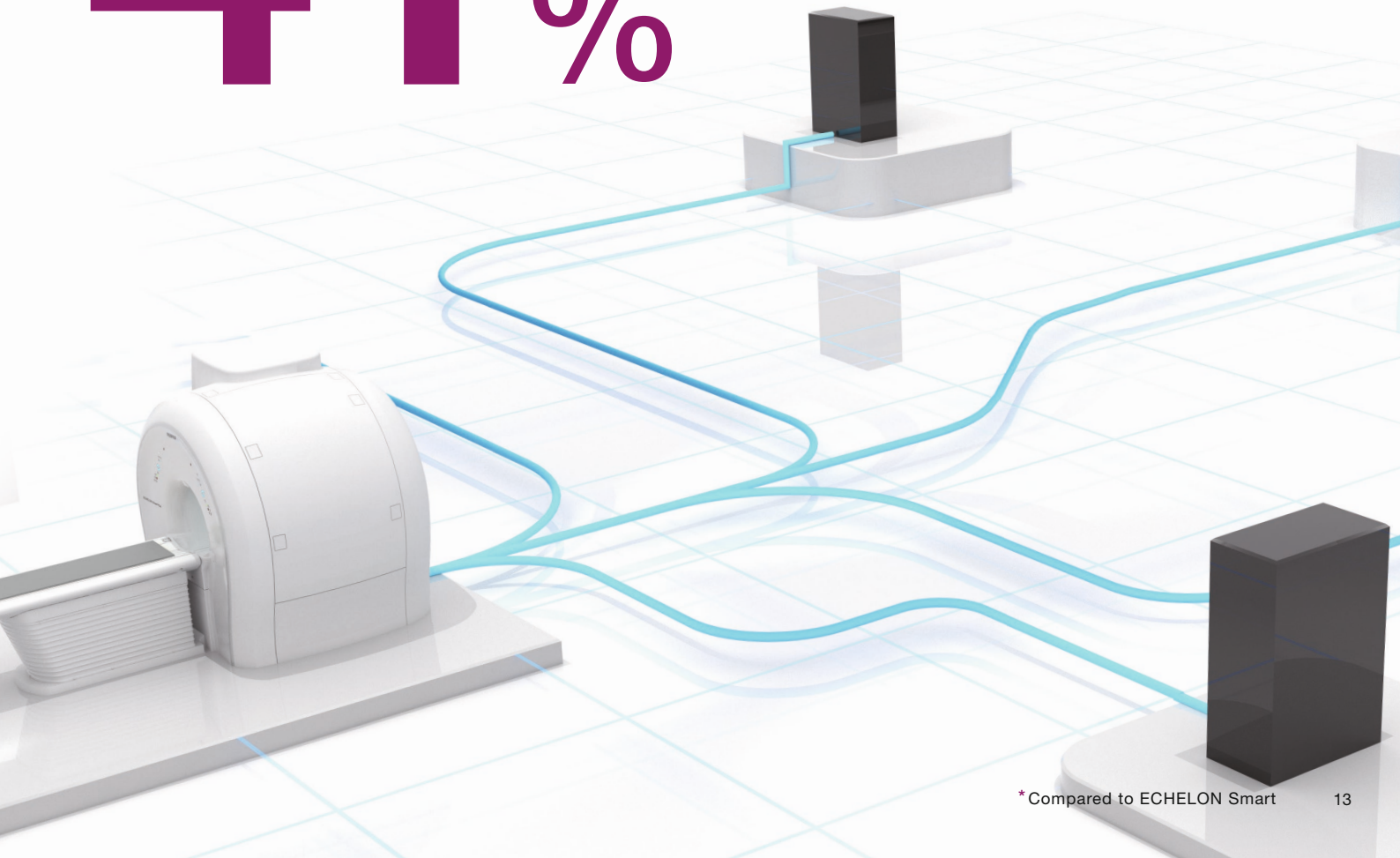
It is often a matter of concern whether there is sufficient space in the equipment room for a superconductive MRI system installation.
ECHELON Smart Plus can remove such obstacles during installation.

ECHELON Smart Plus saves 41% of the installation space in the equipment room



Example of installation
Example of equipment room layout
An equipment room can be built using an open plan

41 SPACE SAVING* **%**



*Compared to ECHELON Smart

ECHELON Smart Plus CAPABILITIES

Attain high image speed in clinical practice with the combination of FUJIFILM's applications, operations, and hardware.

SmartAPPLICATION

All Around RADAR

Plaque imaging

FatSep

AutoPose spine

BeamSat TOF

SmartIMAGE GALLERY

SmartHARDWARE

Work coil system

High performance
RF system

16ch receiver system

High performance
gradient system

Sentinel Analytics

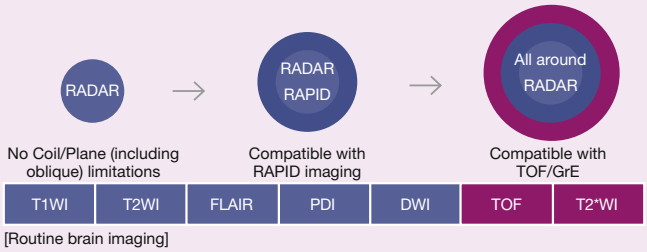
SmartAPPLICATION

Efficient applications for enhancing MR imaging

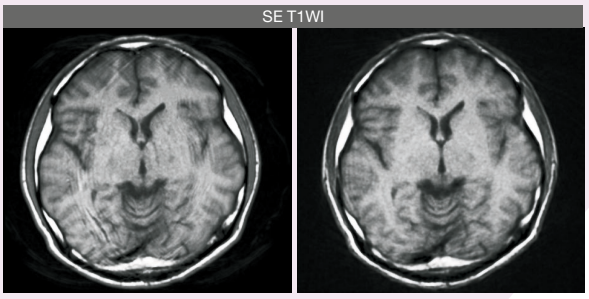
All around RADAR

RADAR is applicable for routine head examinations

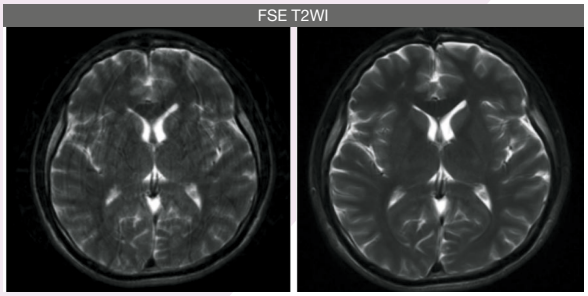
RADAR reduces motion artefacts and increases the ease of use by making it compatible with multiple sequences, all receiver coils and arbitrary cross sections. RADAR can be used in combination with high-speed imaging as well. ECHELON Smart Plus's "All Around RADAR" is compatible with TOF sequences, GrE sequences and most of the sequences required for routine brain examinations.



[Routine brain imaging]



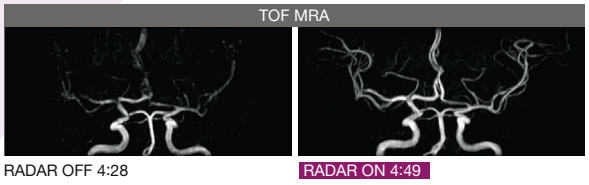
RADAR OFF 2:24 RADAR ON 2:39



RADAR OFF 2:32 RADAR ON 2:42

Effects of RADAR on TOF MRA and GrE T2*WI

RADAR has been applied to GrE sequences using a high-precision signal correction technology.
This has enabled the combined use with RADAR for all sequences required in routine brain examinations.

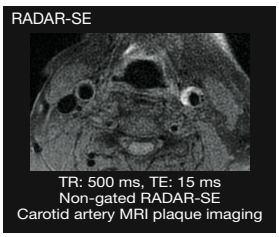


RADAR OFF 4:28 RADAR ON 4:49

Plaque imaging

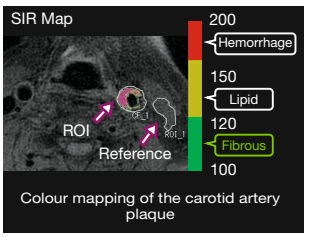
Diagnosis of plaque characterization

Diagnosis of carotid artery plaque characterization requires a high T1 contrast MRI image.



TR: 500 ms, TE: 15 ms
Non-gated RADAR-SE
Carotid artery MRI plaque imaging

The non-gated RADAR-SE method (also known as Radial Scan), maintains a constant TR without being affected by pulsation and can conduct scanning with a high T1 contrast appropriate for diagnosis of plaque characteristics.



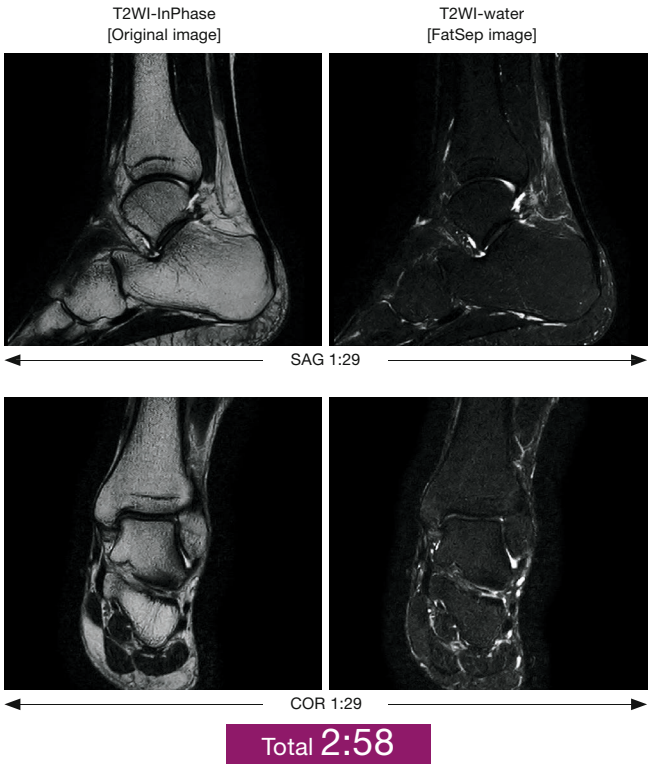
Colour mapping of the carotid artery plaque

SIR Map shows the colour map depending on the signal strength ratio after normalizing the ROI signal strength using reference signal strength.

FatSep

FatSep is a type of suppression method and is less influenced by changes in magnetic susceptibility

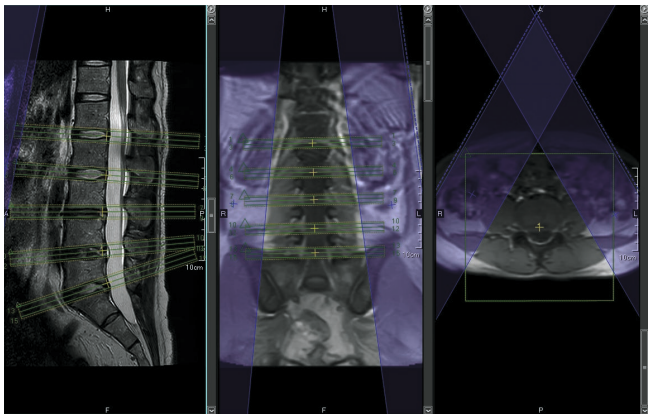
Multiple images can be obtained with one scan, using the difference in resonance frequency (chemical shifts of water protons and fat protons).



AutoPose spine

Assistance with imaging plane setting allows reduced in operation time

AutoPose spine is a support function for quick and accurate slice setting. AutoPose processing is executed at the end of the Scanogram, and the scanning positions of the AX / SAG / COR cross-sections are calculated simultaneously. The scanning position of the AX slices are set automatically parallel to the intervertebral disc.



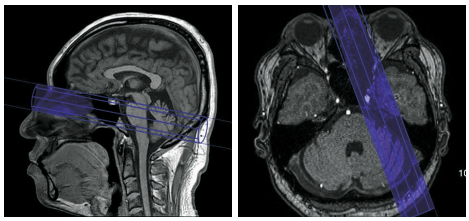
AutoPose spine (AX)

BeamSat TOF

Improving visibility in haemodynamic changes
Selective MRA - Addition of haemodynamic information added to TOF

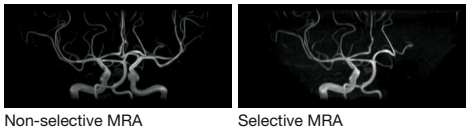
Pencil-beam type pre-saturation (BeamSat) pulses based on the application of local excitation are used in TOF imaging to selectively suppress some of the blood flow signals required for identification of the haemodynamics.

Selective MRA scans with BeamSat pulses, which targets a specified blood flow allow signals to be suppressed and the dominant regions to be clearly identified. BeamSat pulses can be set to arbitrary positions and angles using a dedicated GUI.



Dedicated GUI for BeamSat

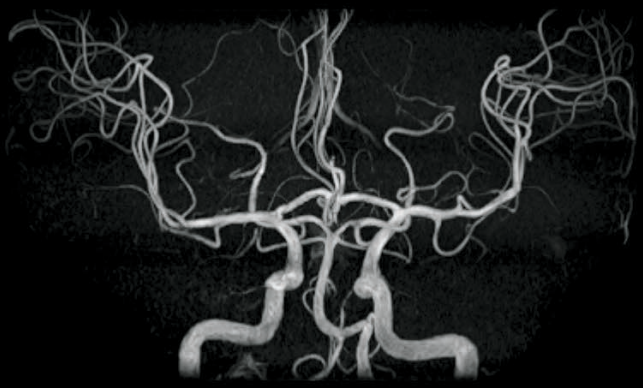
Example of BeamSat pulse setting on the left ICA
SAG : Position contacting the nasal root and sella turcica
AX : Position contacting the pyramid and clivus

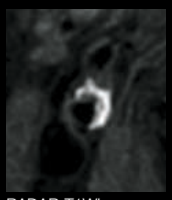


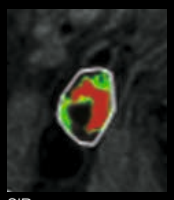
Non-selective MRA | Selective MRA

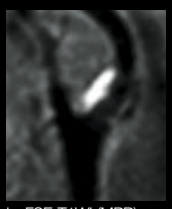
SmartIMAGE GALLERY

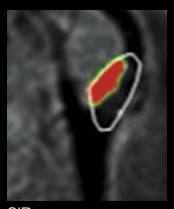
Neuro Vascular

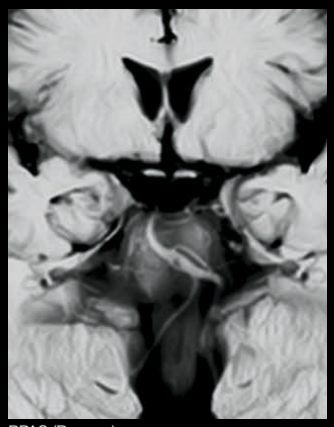

3D-TOF MRA (MIP)

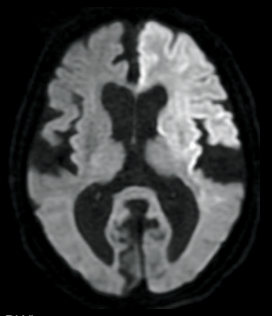

RADAR-T1WI

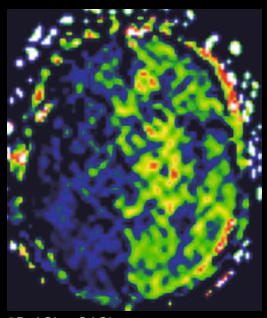

SIR-map

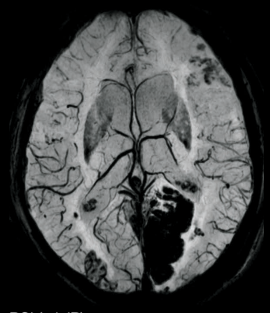

isoFSE-T1WI (MPR)

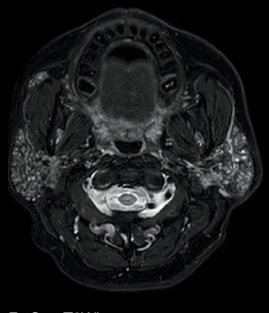

SIR-map

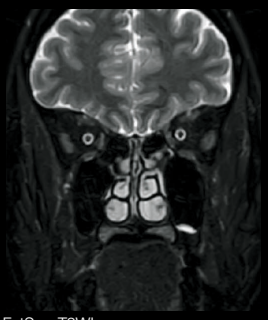

BPAS (Reverse)


DWI

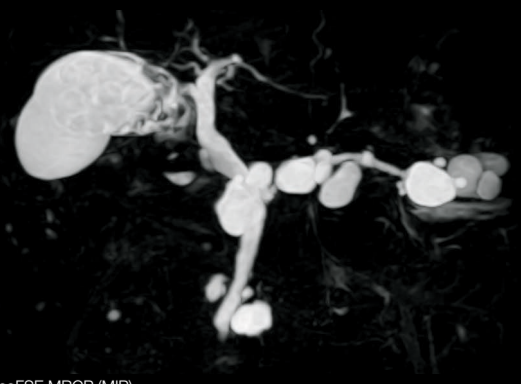

3D-ASL-pCASL

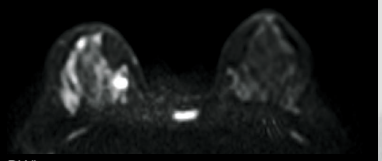

BSI (minIP)

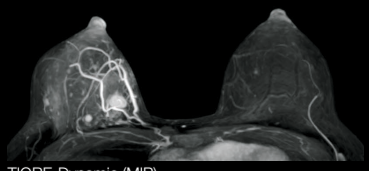

FatSep-T2WI

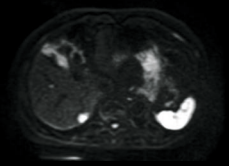

FatSep-T2WI

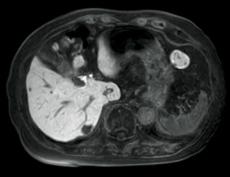
Body

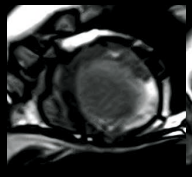
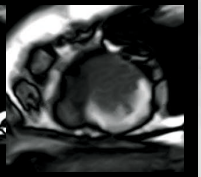

3D-isoFSE MRCP (MIP)


DWI


TIGRE-Dynamic (MIP)


DWI


TIGRE (EOB)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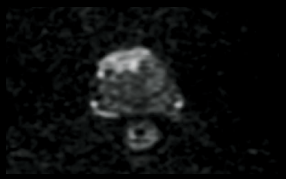
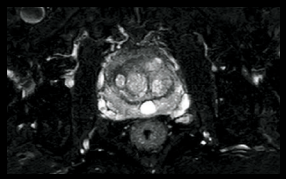
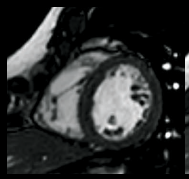
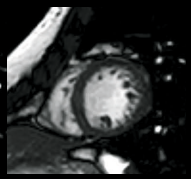
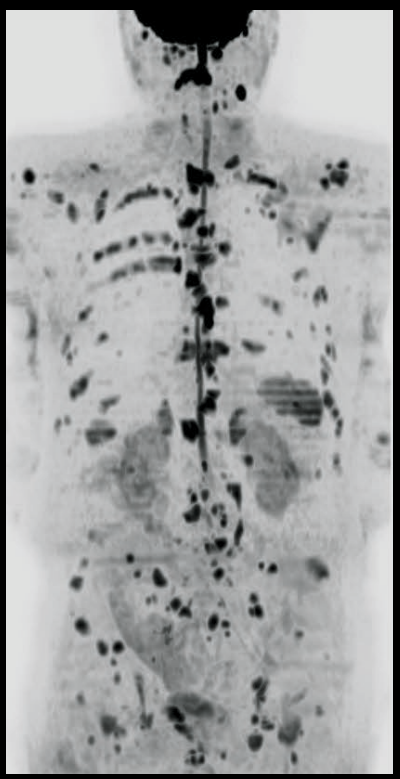
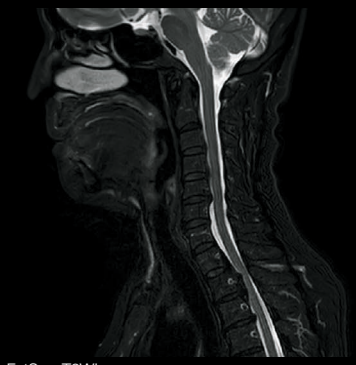

DWI


FatSep-T2WI



BASG-Cine

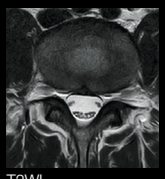

WholeBody-DWI (MIP-Reverse)

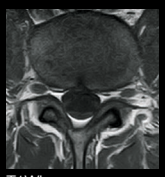
Spine

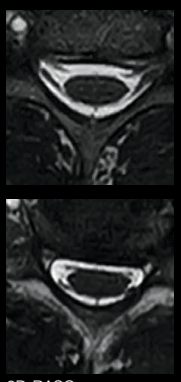

FatSep-T2WI

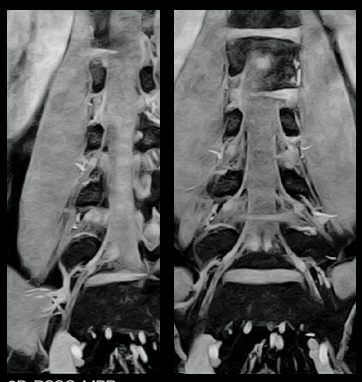

T2WI


FatSep-T2WI


T2WI


T1WI


3D-BASG

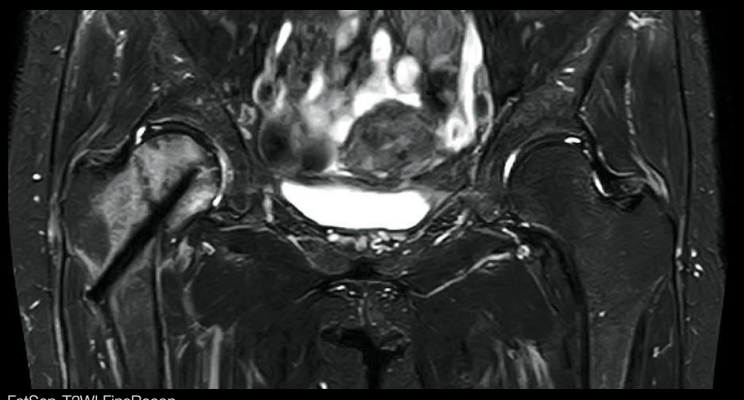

3D-RSSG-MPR

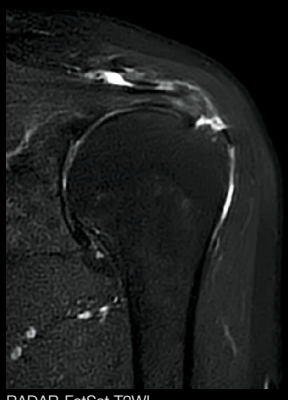

T1WI (2station)

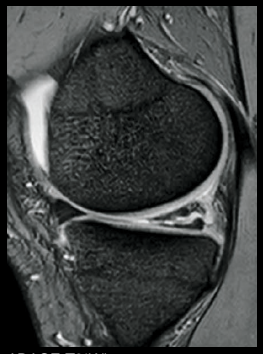

CE-FatSep-T1WI (2station)

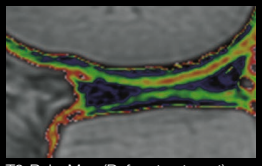
MSK

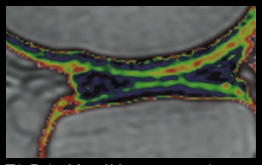

BASG-MRA (MIP)

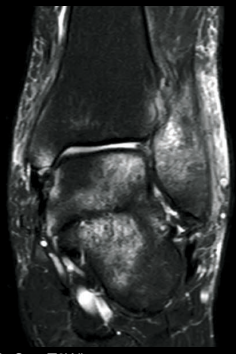

FatSep-T2WI FineRecon


RADAR-FatSat T2WI


ADAGE-T2*WI


T2-RelaxMap (Before treatment)


T2-RelaxMap (After treatment)


FatSep-T2WI


3D-T2*WI (MPR)

SmartHARDWARE

FUJIFILM's hardware technologies for enhancing image quality

Workflow coil system

Receiver coils support ease of patient setting and offer superb image quality

The number of receiver coils that must be set prior to the examination is minimized to reduce replacement time and effort. With a system designed for ease of use and with the adoption of special receiver coils for individual regions, significant reduction in examination time is attained whilst maintaining high image quality.

Workflow coil system

for head & neck

for spine

for abdomen

for joints

Workflow coil system Setting examples

Spine examination
- Head and neck coil (posterior side) + WIT spine coil

Head and neck examination
- Head and neck coil + WIT spine coil

Abdomen examination
-Head and neck coil [posterior side] + WIT spine coil + Flex body upper coil

Extremity examination
-Head and neck coil [posterior side] + WIT spine coil + GP flex coil

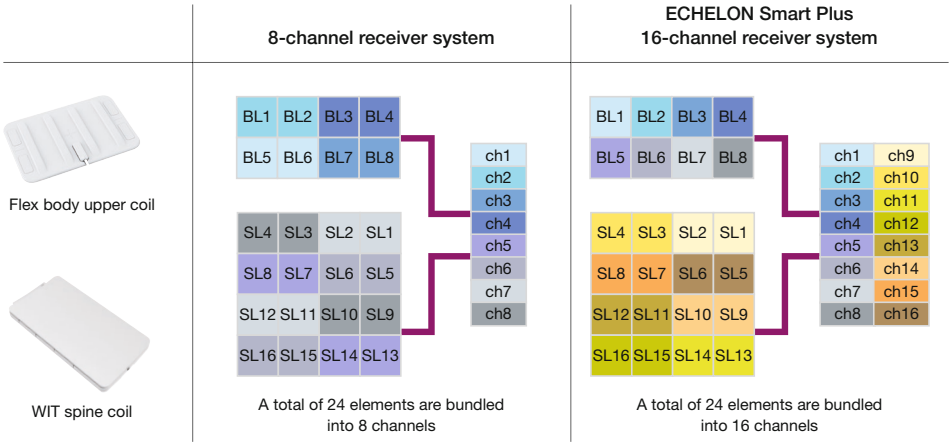
High performance RF system

Powerful RF output contributes to stable RF transmission

ECHELON Smart Plus is equipped with an RF power output of 18 kW. This is sufficient to provide clear images without deterioration of image quality even in the FSE sequence that applies refocus pulses continuously.

16ch receiver system

Increasing receiver coil channels improves sensitivity and stability



Major hardware specifications

ECHELON Smart Plus is equipped with a high performance hardware system which is essential for creating high quality images.

High performance hardware

Gradient system

Maximum gradient strength	33mT/m
Maximum slew rate	130T/m/s

RF system

Maximum RF output 18kW

High Order Shimming System

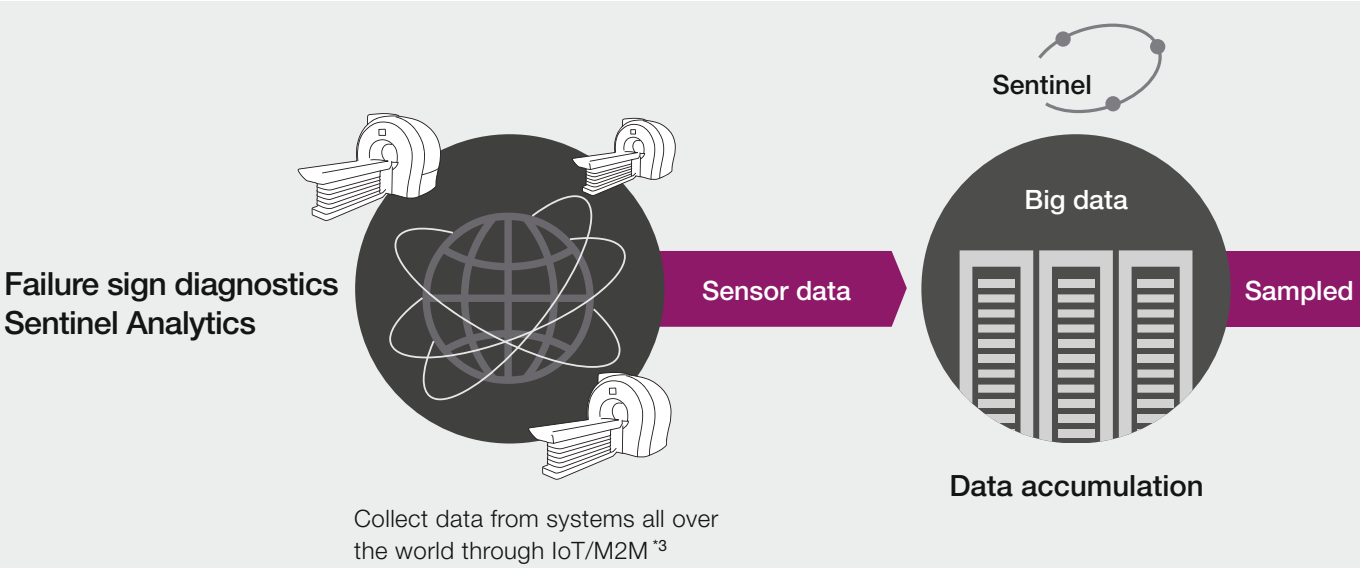
HOSS

Sentinel Analytics[*1]

Improving the uptime through failure sign diagnosis

Achieving higher uninterrupted system availability and optimizing maintenance costs remain challenges for conventional remote support services for medical devices. FUJIFILM has accumulated and analyzed big data to develop a new system that utilizes its "Failure sign diagnosis service" to launch "Sentinel Analytics", a failure sign diagnostic service for superconductive MRI systems.

With the failure sign diagnosis based on IoT[*2], the inspection and parts replacement cycles can be optimized and the system availability can be improved.



Major features and advantages

Constant system monitoring

The Sentinel server monitors the system state 24 hours a day.

Automatic notification feature

When the Sentinel server detects either a malfunction or a lowered performance of the system, an alert is automatically reported to the FUJIFILM service site. This helps prevent the occurrence of a malfunction. Furthermore, a corrective measure is quickly taken in the case of a malfunction.

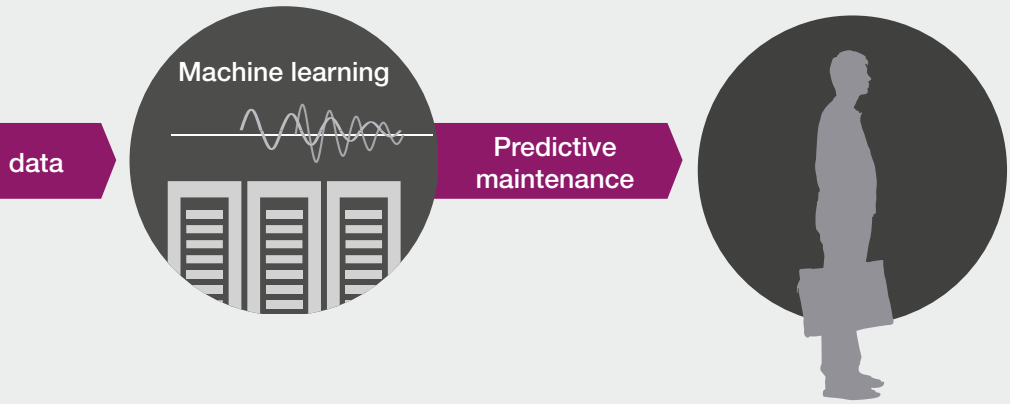
Direct connection feature

This feature provides service via direct connection of the service site and your system. To track down the causes of a malfunction, we check artefacts and abnormal images, check image data before reconstruction (raw data) and run test programs on the system.

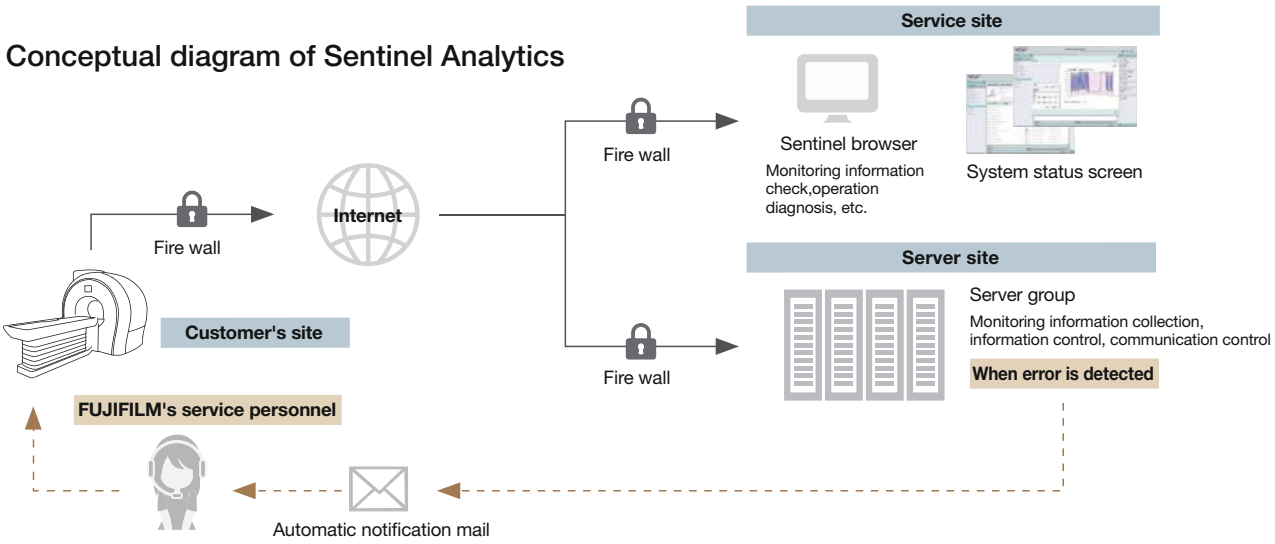
Data security

Features such as encryption of communication data and communication based on mutual authentication are available to protect patient information. Furthermore, the specification does not allow recognition of personal information included in patient lists and images (such as a patient's name, sex, weight, age, and date of birth) on the Sentinel server and the service site.

Highly accurate failure sign diagnostics



Conceptual diagram of Sentinel Analytics



*1 Service contract is required.
*2 IoT (Internet of Things) : A system in which various devices with communication functions exchange information via the Internet to realize identification, monitoring, and control of such devices.
*3 M2M (Machine-to-Machine) : A system of direct exchange of information between machines via a network without human intervention.

ECHELON Smart Plus

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