

ECHELON Smart *with SynergyDrive*



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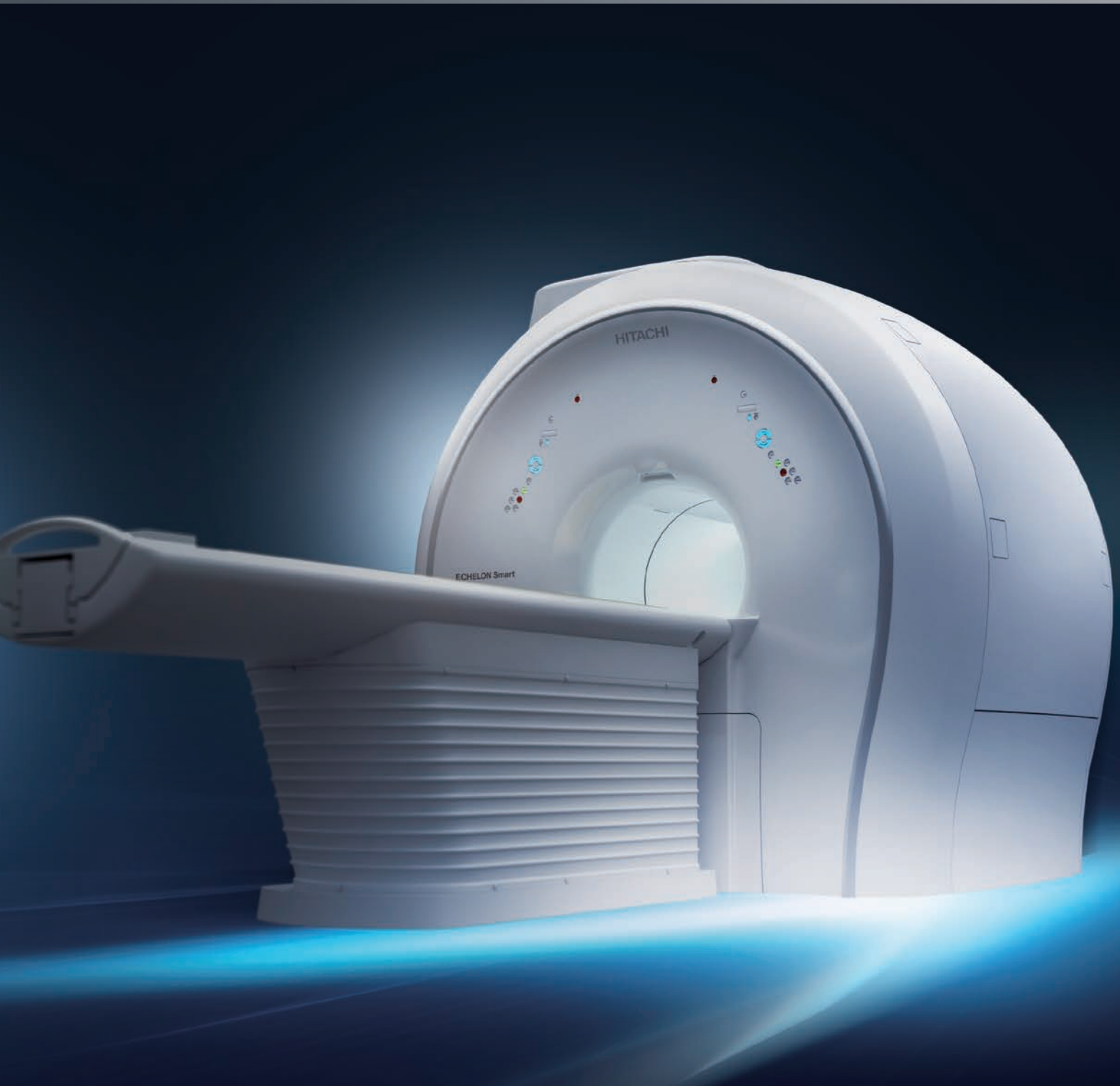
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Experience enhanced SPEED with Hitachi's SynergyDrive

Hitachi's "SynergyDrive" offers enhanced speed during MRI examination without reducing image quality while maintaining quietness.

SynergyDrive

ECHELON Smart with SynergyDrive

Conventional equipment



Conventional equipment

Enter MRI room

Patient Setting

Patient Positioning

Scanning

Workflow Coil System

AutoExam^(†1)

Positioning, imaging and post-processing are all completed in one step. The examination time is shortened by simplifying operations.

ECHELON Smart with SynergyDrive

Enter MRI room

Patient Setting

Patient Positioning

Scanning

Post-processing

Exit MRI room

Hitachi'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 shorten examination time. This is also expected to improve management efficiency.

■ AutoPose

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

■ IP-RAPID^(†1)

■ High speed Prescan

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



IP-RAPID^(†1) A Cutting-edge HighSpeed 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.

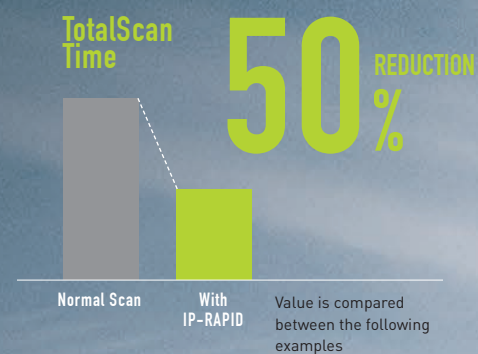


Up to
60%
REDUCTION^(†2)

Experience newly enhanced SPEED with Hitachi's IP-RAPID⁽⁺¹⁾

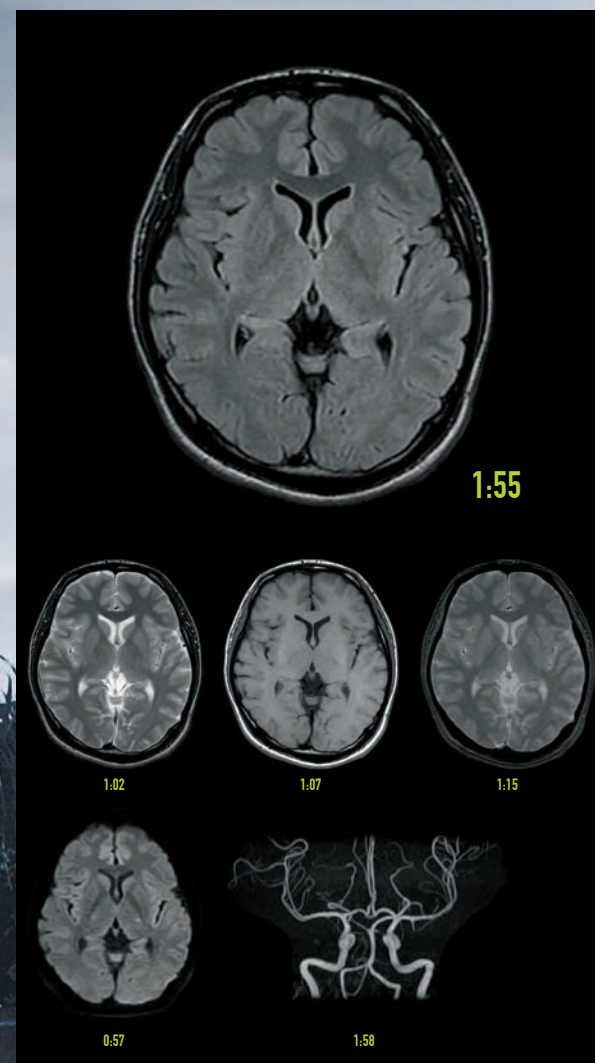
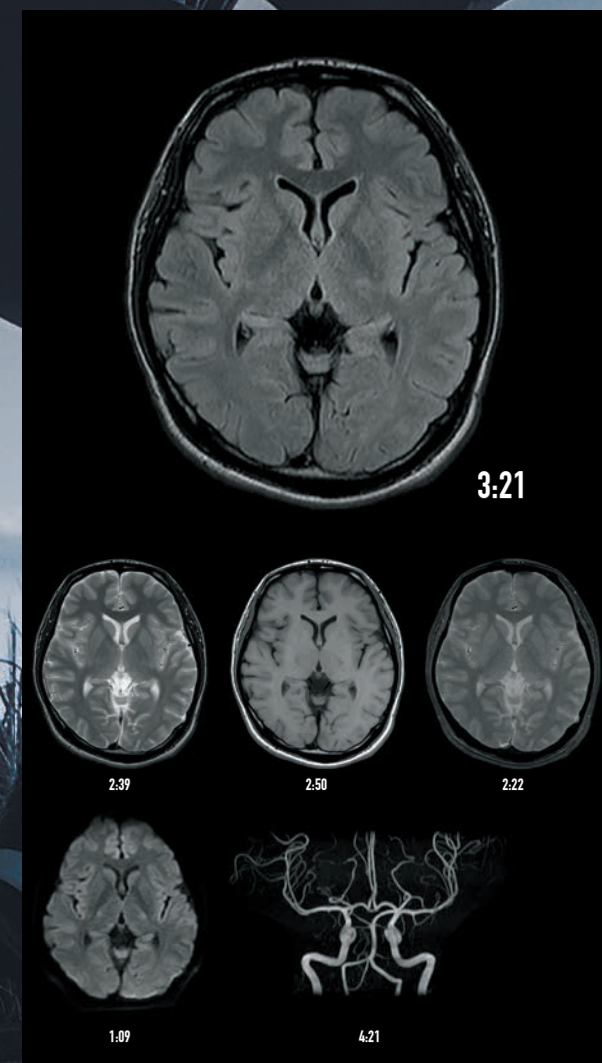
IP-RAPID enables both high image quality and reduced scanning time

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.



Normal Scan Total 16:42

With IP-RAPID Total 8:14



SynergyDrive

Workflow Coil System

AutoExam
AutoPose

AutoClip

DICOM Transfer

Enter MRI room

Patient Setting

Patient Positioning

Scanning

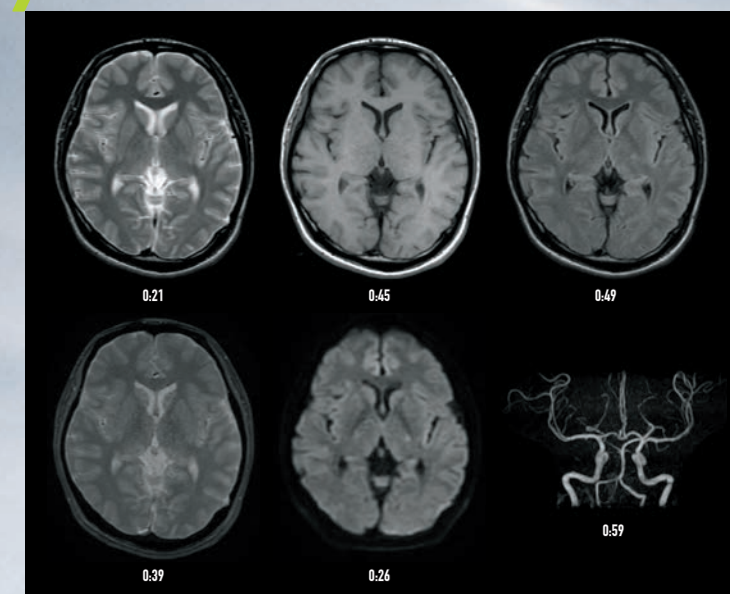
Post-processing

Exit MRI room

IP-RAPID

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

Emergency imaging Total 3:59



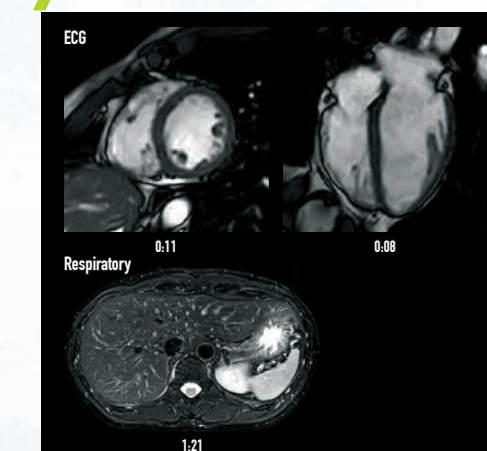
DWI Total 4:00



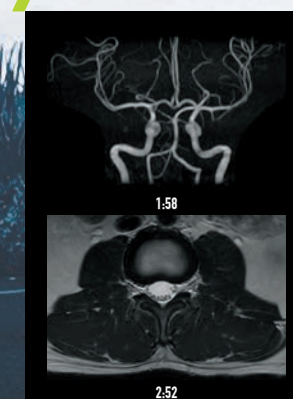
Multi-contrast imaging Total 5:54



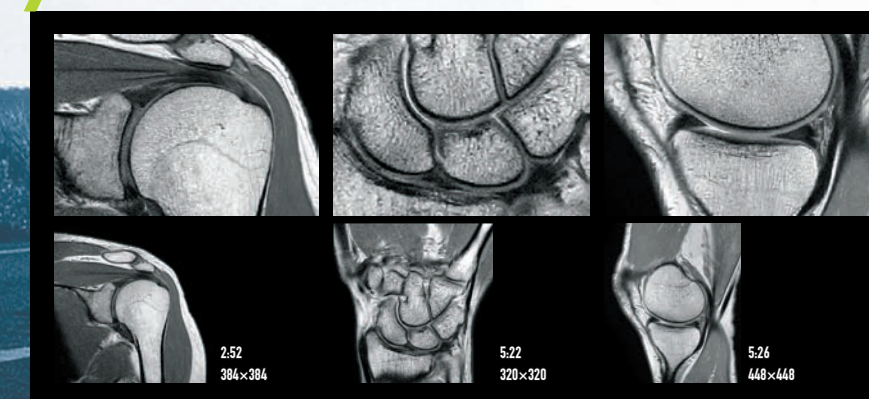
Gated imaging (ECG, Respiratory)



Combined with SoftSound



High resolution imaging



Experience enhanced SPEED with Hitachi's AutoExam.^(†1)

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.

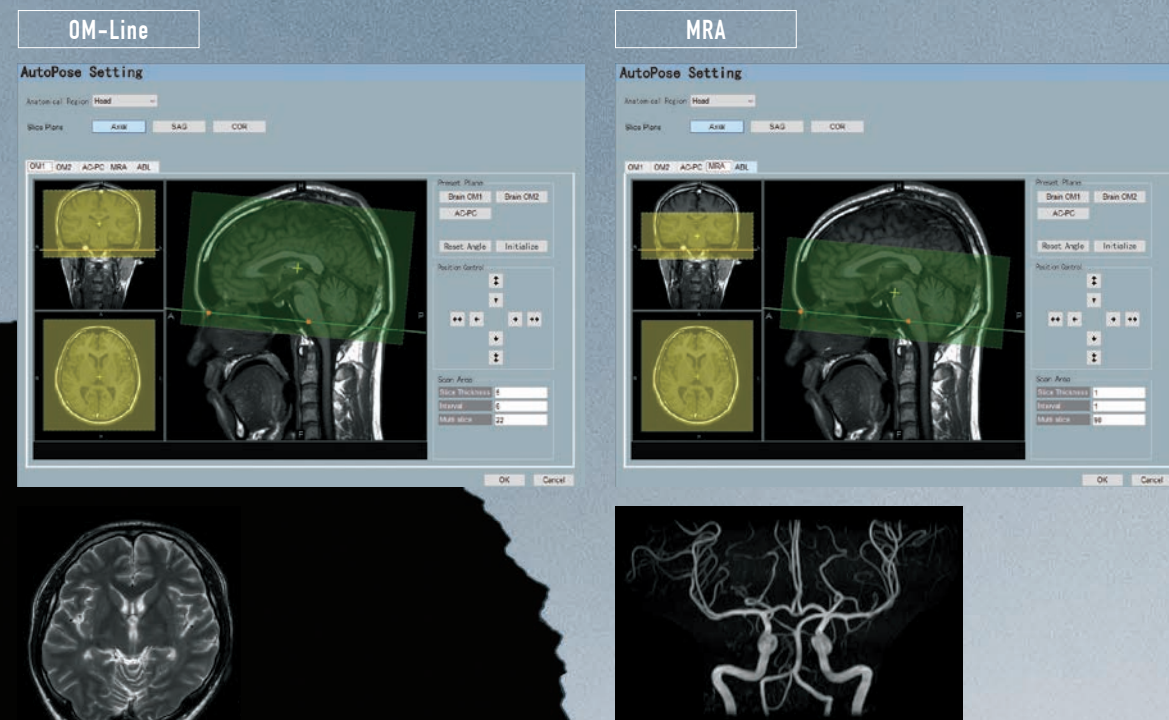
Auto Operation



- **AutoPose Brain**

AutoPose is a slice line setting support function.
When the Scanogram imaging ends, the preset section is automatically set and can be registered up to five types of preset sections.

■ Example of Preset screen



SynergyDrive

Workflow Coil System

■ AutoPose

■ **AutoClip**

Patient Setting

Patient Positioning

Scanning

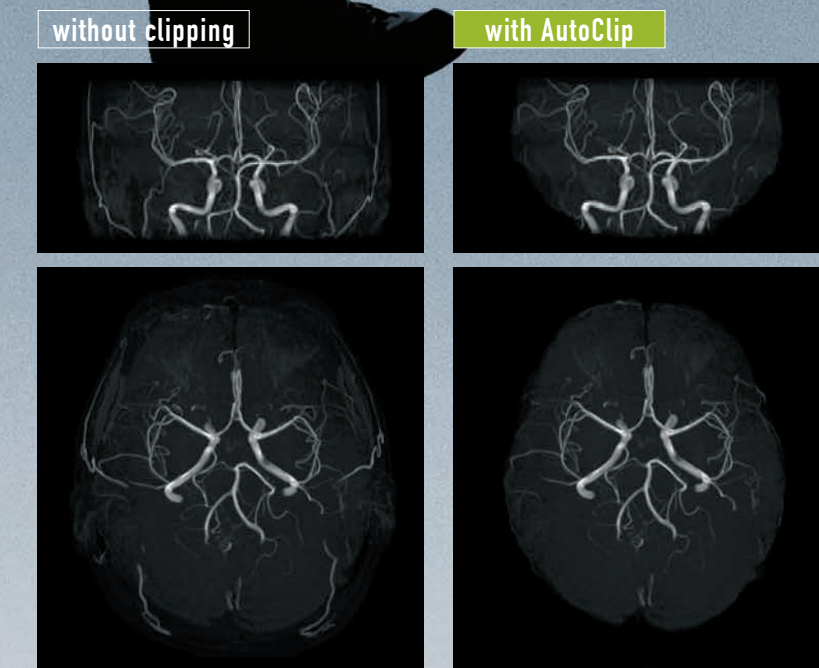
Post-processing

Exit MRI room

IP-RAPID

- AutoClip⁽⁺¹⁾

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



SmartCOMFORT

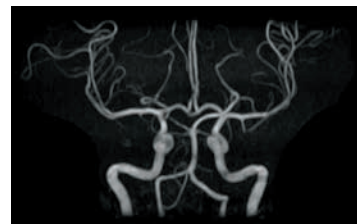
Patient-friendly Quiet Examination

Quiet examination with SoftSound

Various technologies exist to reduce MRI acoustic noise. However, reducing acoustic noise often compromise on image quality and may extend scan time, making it unsuitable for routine examination. Other approaches need dedicated hardware. Hitachi's SoftSound noise reduction technology reduces the acoustic noise by up to 96%^[+1] maintaining image quality and scan time, and without any dedicated hardware.

Plus

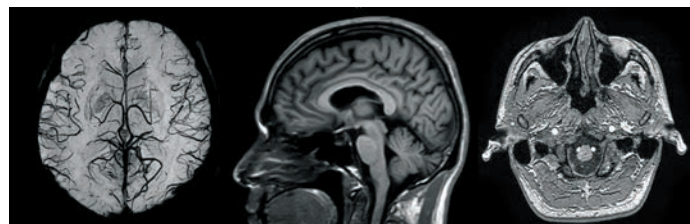
IP-RAPID can be used along with SoftSound



SoftSound + IP-RAPID

Plus

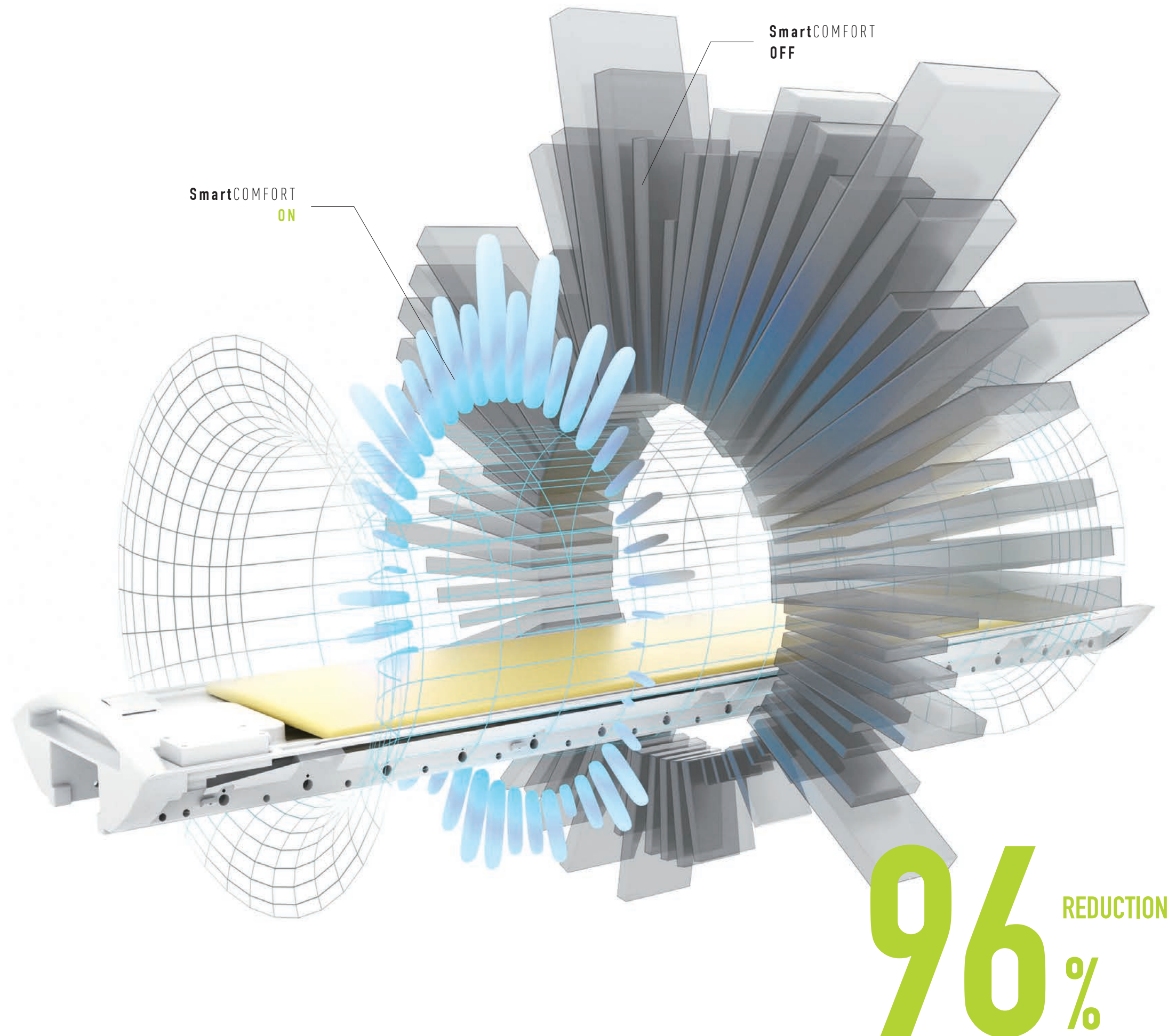
The SoftSound can also be used with the "BSI" high-speed 3DT2* enhanced images and "3D GEIR"/"3D RSSG" high-speed 3DT1 enhanced images.^[+2]



BSI

3D GEIR

3D RSSG



⁺¹ Depending on imaging conditions
⁺² Option

Minimizing unnecessary power consumption

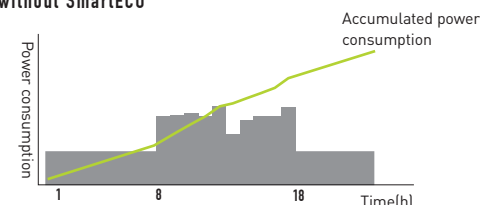
Generally, superconductive MRI system is known with its high running cost. This cost is mainly due to the high power consumption of the cooling system necessary to maintain superconductivity. ECHELON Smart is equipped with SmartECO, an energy saving function that can stop the cooling system for a certain length of time during periods of non-use. This function effectively reduces the power consumption while maintaining zero boiling off of the helium. Moreover, as the heat emission from the cooling system decreases during these periods, the power consumption of its heat-dissipating unit is also reduced.

Hitachi's SmartECO effectively reduces power consumption

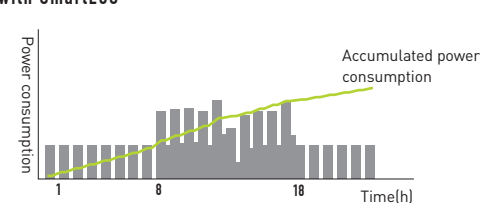
A compact scan room with an MRI unit with less heat discharge also reduces the air conditioning requirements of the examination and equipment rooms. The energy saving function together with the reduction of heat discharge can reduce running costs by 17%†.

† Depending on operating conditions and other factors.

without SmartECO



with SmartECO



SmartECO

Ecological and
Economical Running Cost

17%
LESS

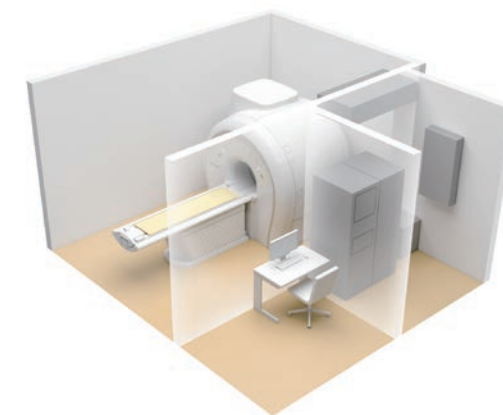


SmartSPACE

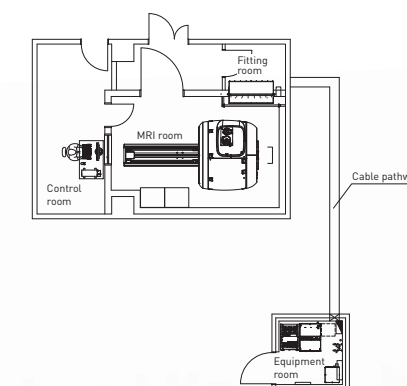
Small Footprint
Flexible Layout

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 can remove such obstacles during installation.



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

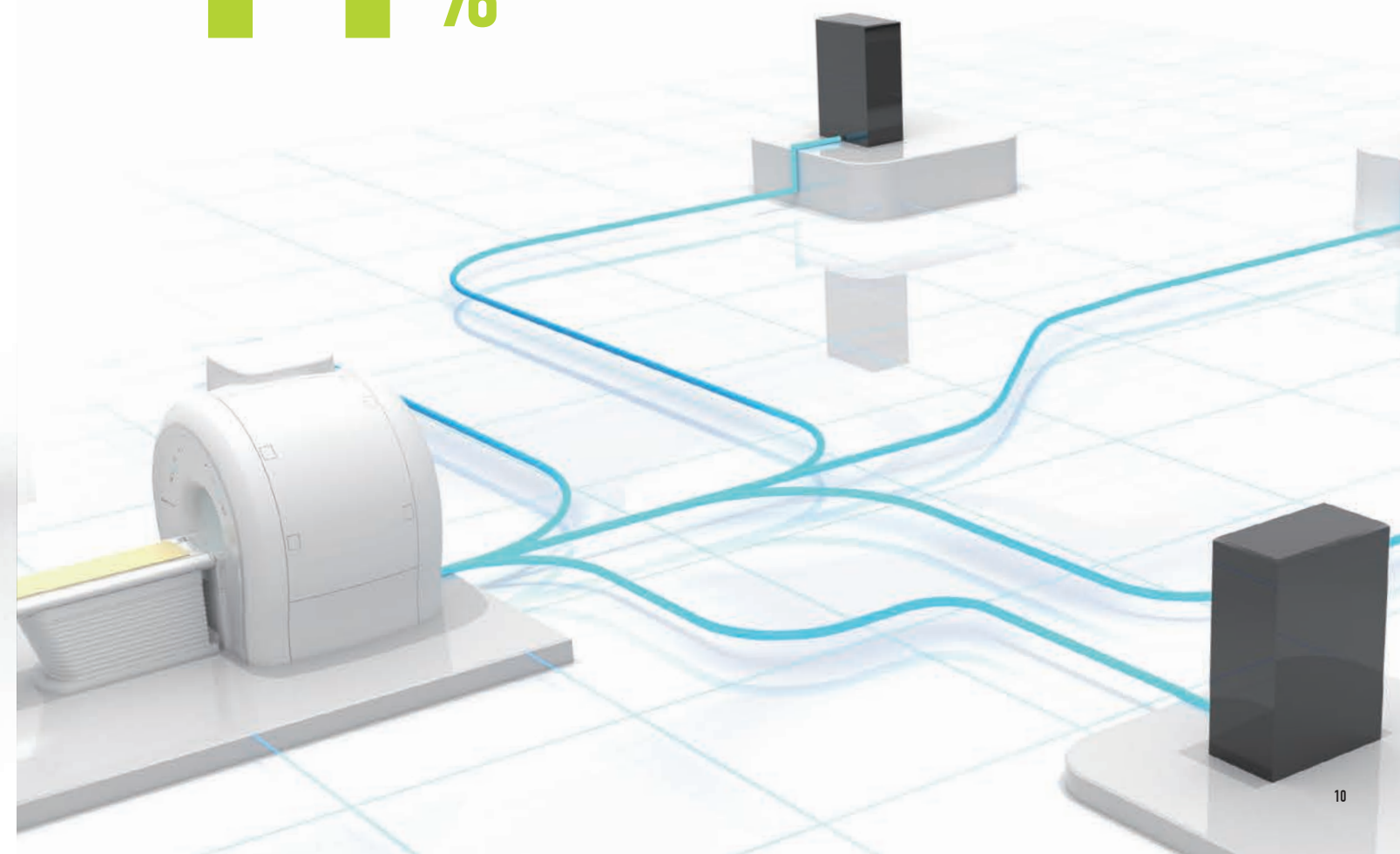


[Example of installation]

Example of equipment room layout

An equipment room can be built using an open area

41%
SPACE
SAVING



Smart HARDWARE

Hitachi's hardware technologies for enhancing image quality

Workflow Coil System

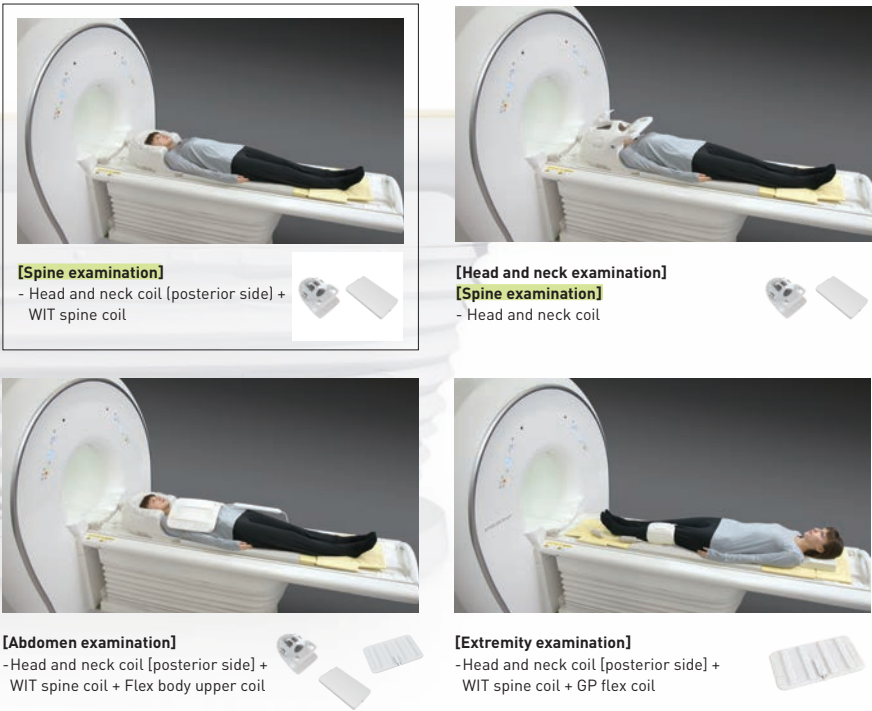
Receiver coils support ease of patient setting and offer superb image quality

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



Workflow coil system Setting examples



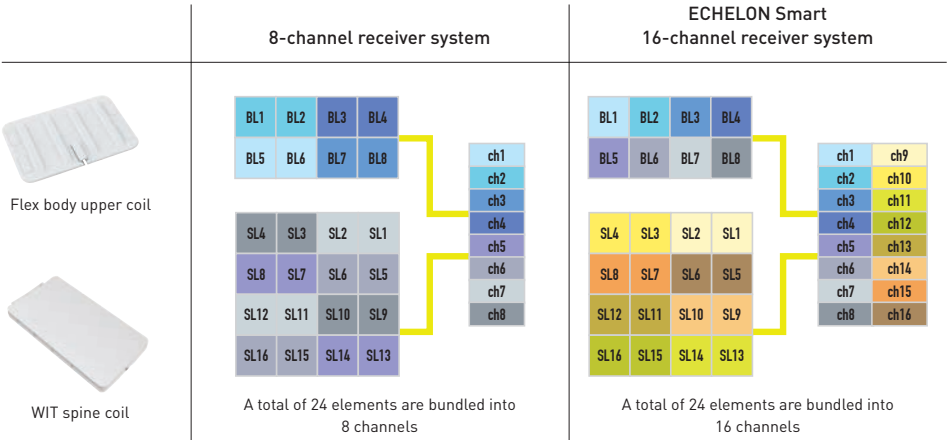
High Performance RF System

Powerful RF output contributes to stable RF transmission

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

High Performance Hardware

Gradient System		RF System
Maximum Gradient Strength	33mT/m	Maximum RF Output 18kW
Maximum Slew Rate	130T/m/s	High Order Shimming System HOSS

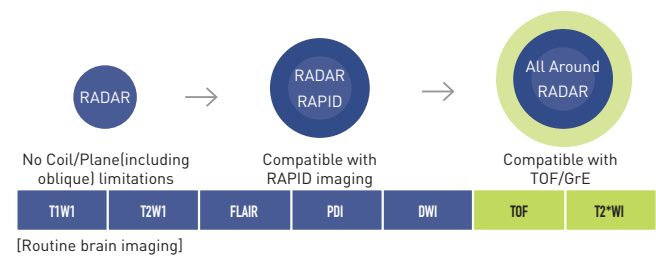
Smart APPLICATION

Efficient applications for enhancing MR imaging

All Around RADAR

RADAR is applicable for routine head examinations

RADAR reduces motion artifacts 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's "All Around RADAR" is compatible with TOF sequences, GrE sequences and most of the sequences required for routine brain examinations.



Effects of RADAR on TOF MRA and GrE T2*WI

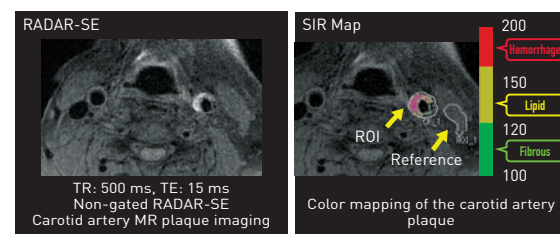
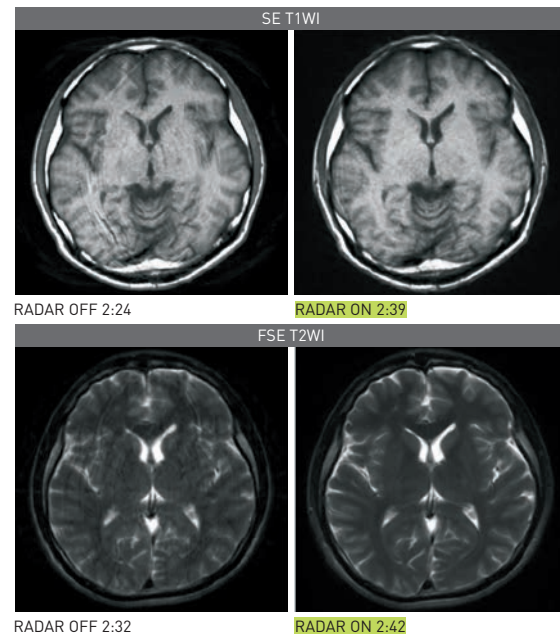
RADAR has been applied to GrE sequences using a high-precision signal correction technology.

This has enabled the combined use with RADAR for all sequences required in routine brain examinations.

Plaque Imaging^(†1)

Diagnosis of plaque characterization

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



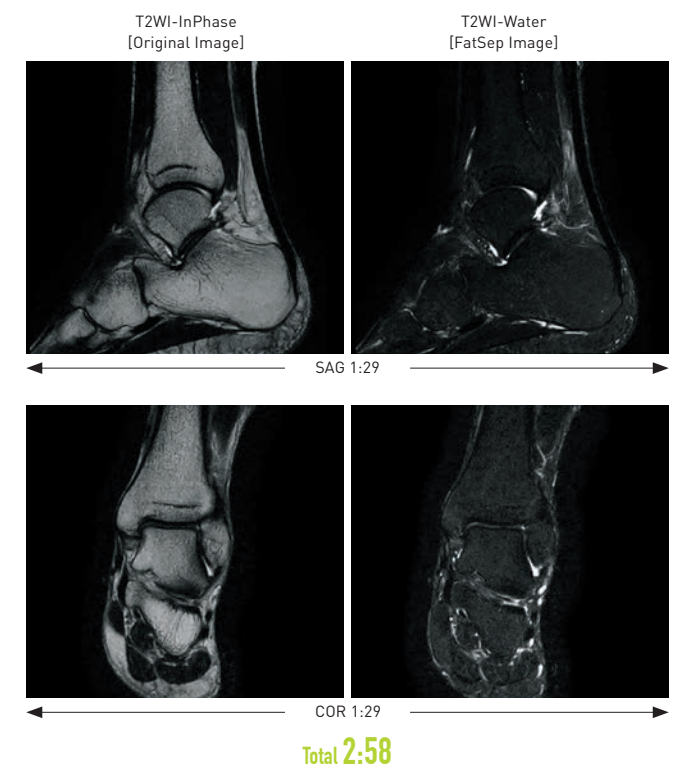
The non-gated RADAR-SE method (also known as Radial Scan), maintains a constant TR without being affected by pulsation and can conduct scanning with a high T1 contrast appropriate for diagnosis of plaque characteristics.

SIR Map shows the color 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.

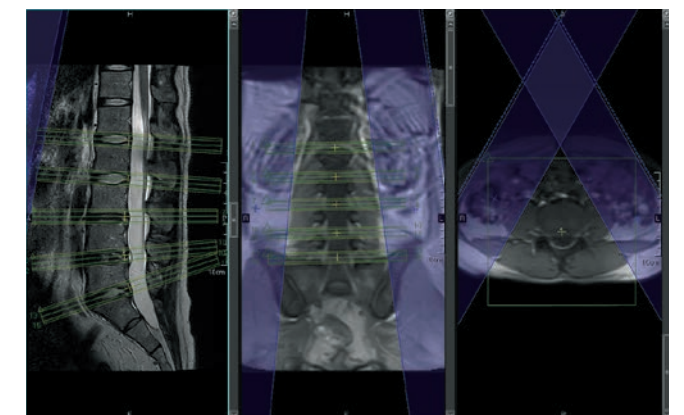
Multiple images can be obtained with one scan, using the difference in resonance frequency. (chemical shifts of water protons and fat protons)



AutoPose Spine^(†1)

Assistance of imaging plane setting allows reduction 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 cross section can be selected from intervertebral disc, vertebral body and intervertebral disc / vertebral body.



AutoPose Spine[AX]

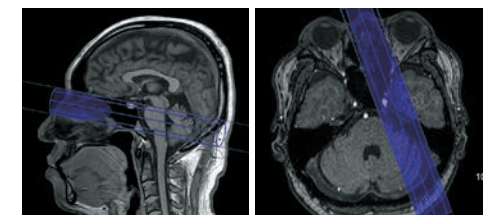
BeamSat TOF^(†1)

Improving visibility in hemodynamic changes

Selective MRA - Addition of hemodynamic 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 hemodynamics.

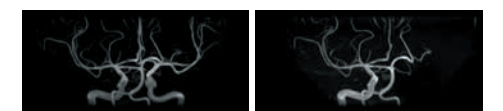
Selective MRA scans with BeamSat pulses which targets a specified blood flow allowing signals to be suppressed and the dominant regions to be clearly identified. BeamSat pulses can be set to arbitrary positions and angles using a dedicated GUI.



[Dedicated GUI for BeamSat]

In the BeamSat display, the continuous line represents the nearer part while the broken line represents the farther part than the scanogram; the hatched part is a cross-section between the BeamSat and the scanogram.

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

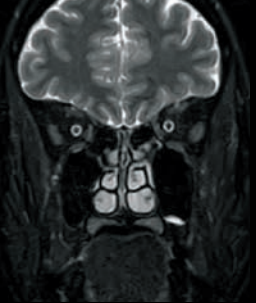
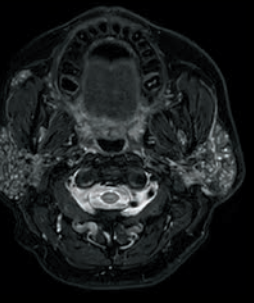
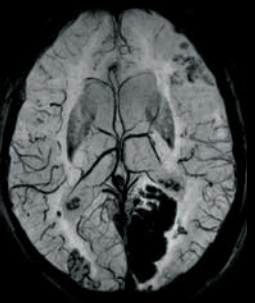
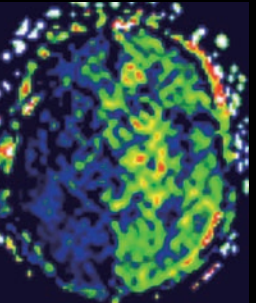
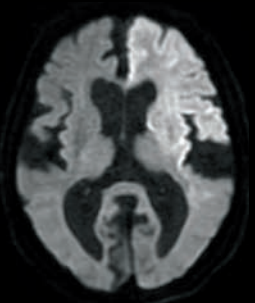
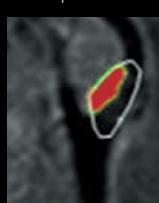
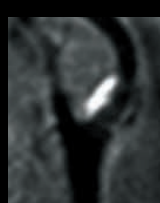
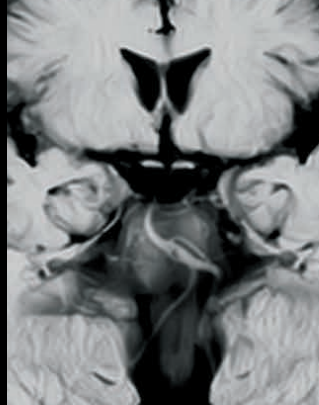
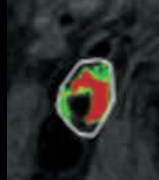

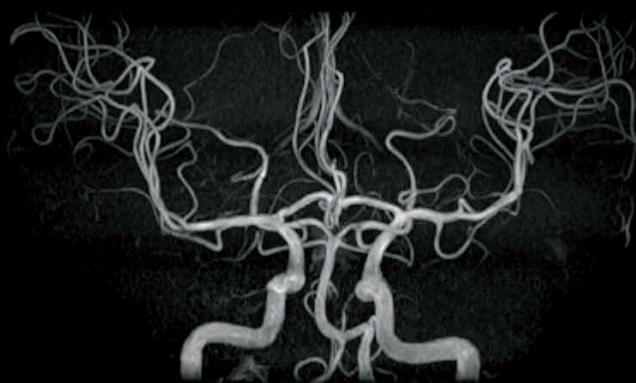


Non-selective MRA

Selective MRA

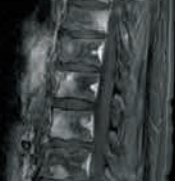
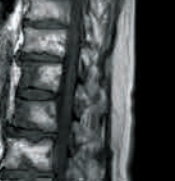

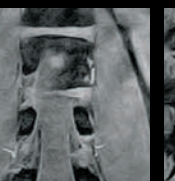
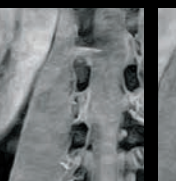




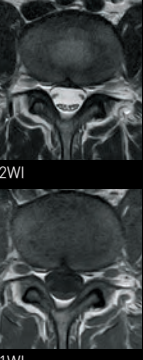


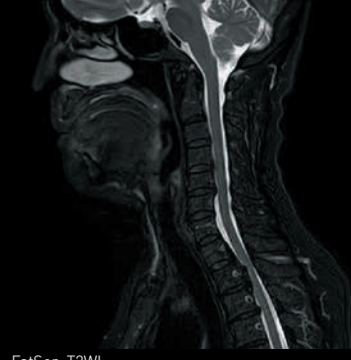
Smart IMAGE GALLERY

NueroVascular-Image



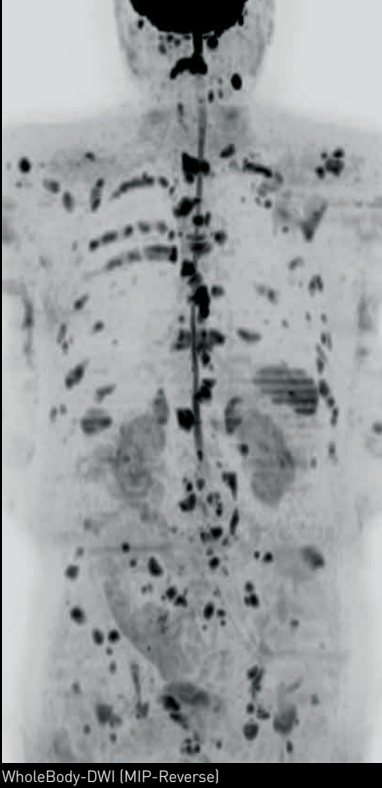
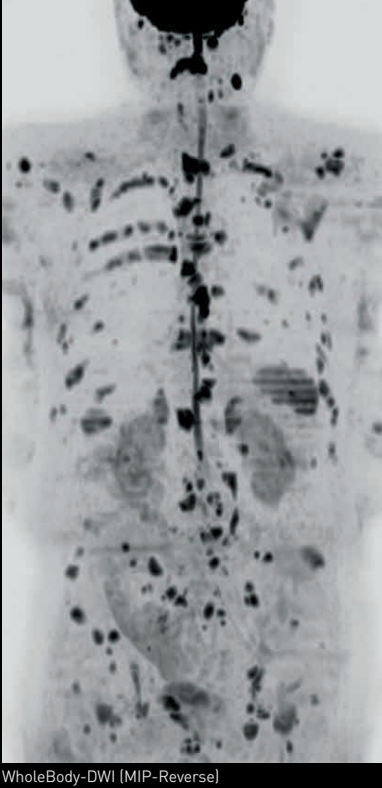
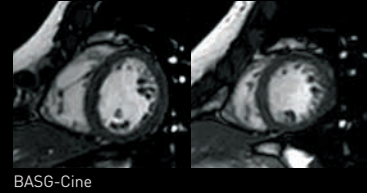
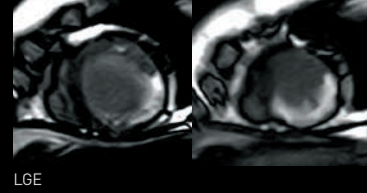
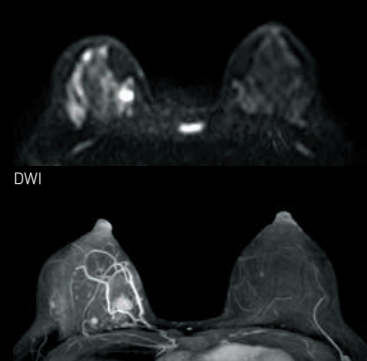
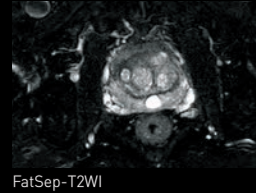

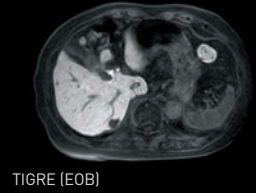
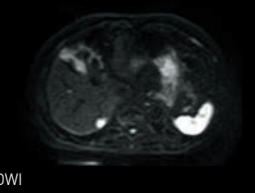
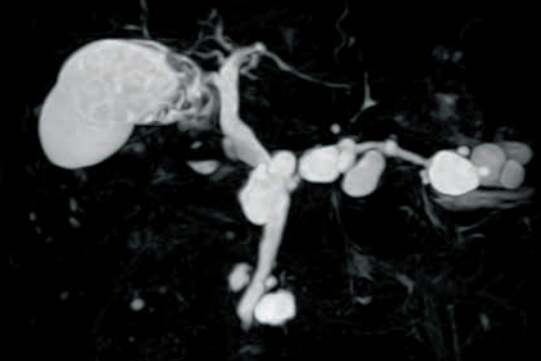
3D-TOF MRA (MIP)RADAR-T1WISIR-mapBPAS (Reverse)isoFSE-T1WI (MPR)SIR-mapDWI3D-ASL-pCASLBSI (miniP)FatSep-T2WIFatSep-T2WI

Spine-Image



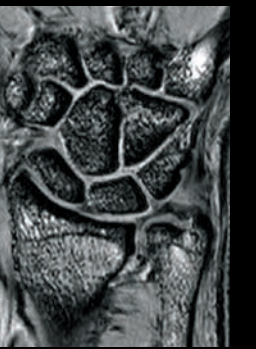
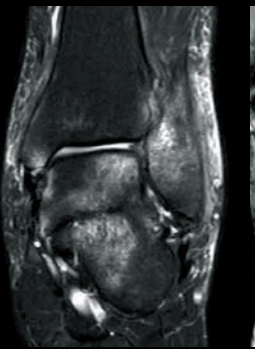
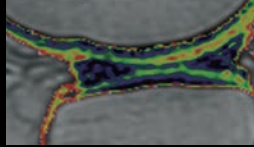
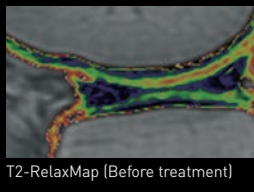
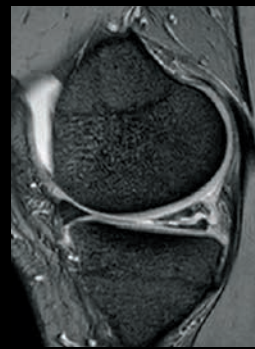
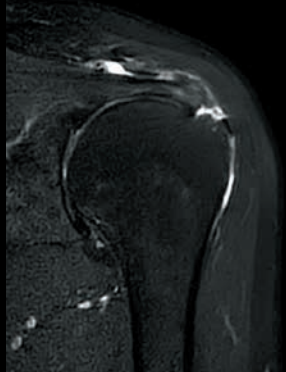
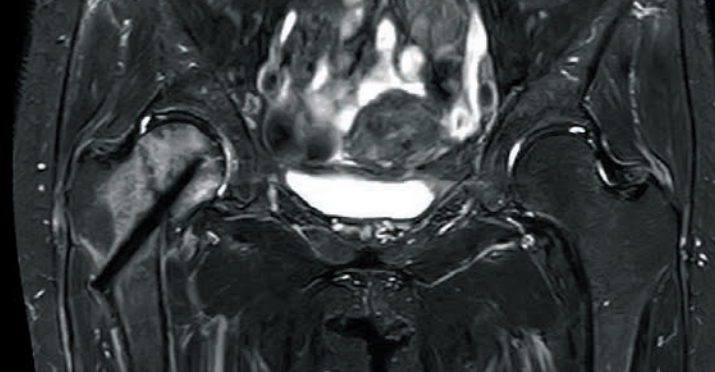
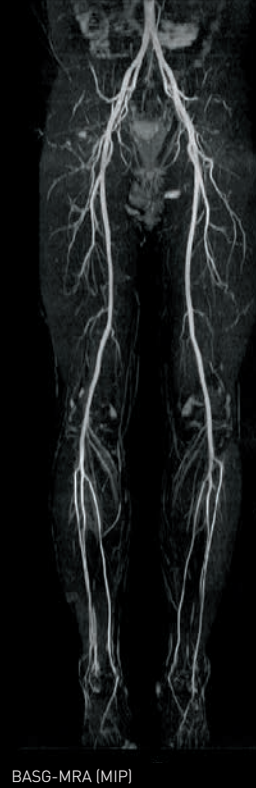
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Body-Image



3D-isoFSE MRCP (MIP)DWITIGRE (EOB)DWIFatSep-T2WITIGRE-Dynamic (MIP)LGELGEBASG-CineWholeBody-DWI (MIP-Reverse)

MSK-Image



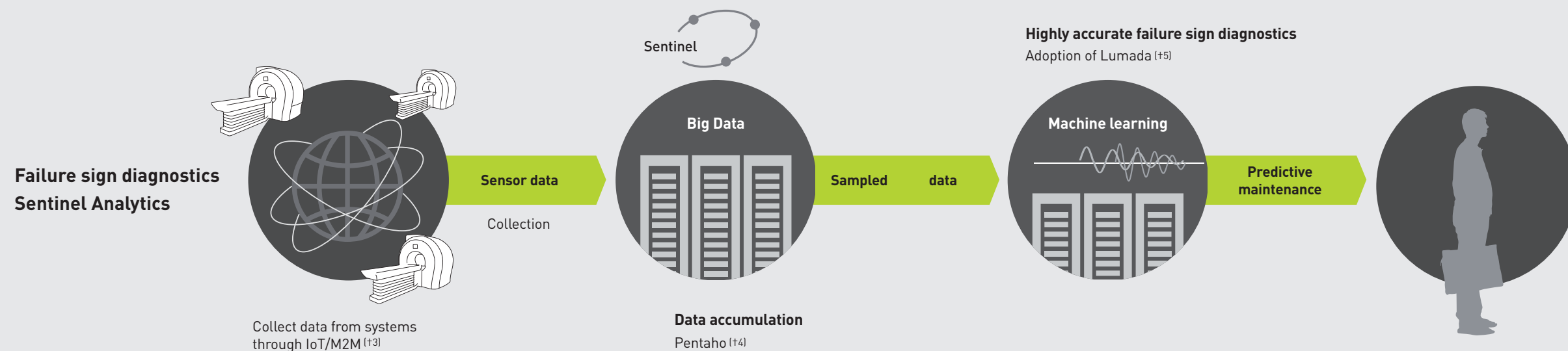
BASG-MRA (MIP)FatSep-T2WI FineReconRADAR-FatSat T2WIIDAGE-T2*WIT2-RelaxMap (Before treatment)T2-RelaxMap (After treatment)FatSep-T2WI3D-T2*WI (MPR)

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. Hitachi 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's up time can be improved.



Major features and advantages

Constant system monitoring

The Sentinel server monitors the system status 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 Hitachi service site. This helps to prevent the occurrence of a malfunction. Furthermore, a corrective measure is quickly taken in case of malfunction.

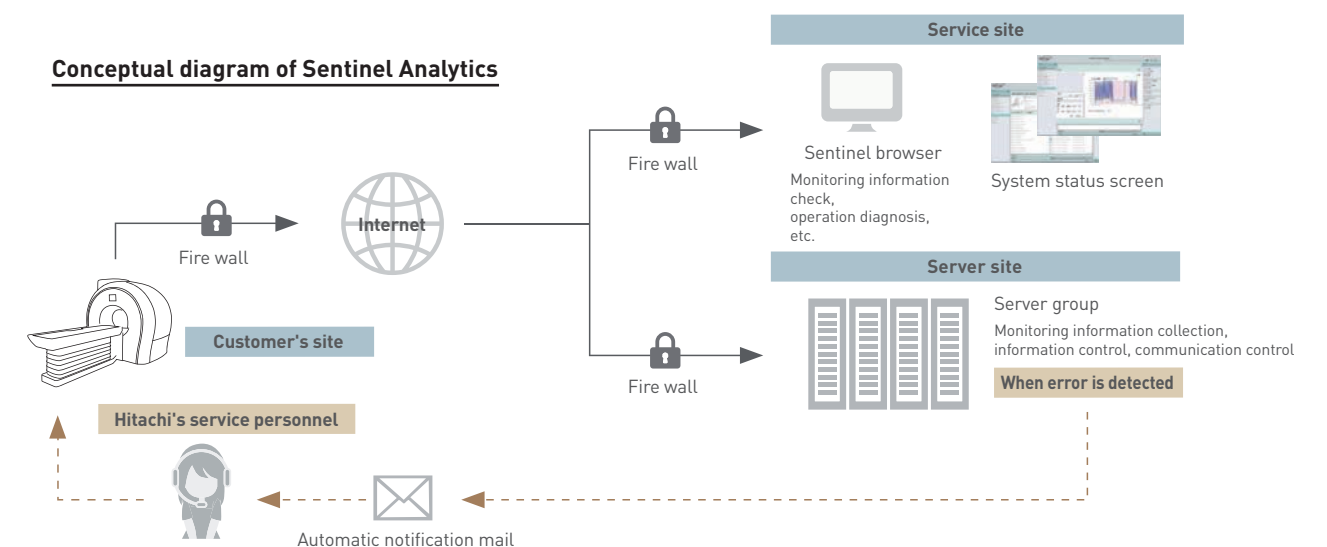
Direct connection feature

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

Security

Such features 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.

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.

†4 Pentaho : Big Data analysis software available from Pentaho Corporation, a subsidiary of Hitachi Data Systems Corporation of the U.S.

†5 Lumada : Lumada is Hitachi's IoT Core Platform.