HITACHI
Inspire the Next

ECHELON

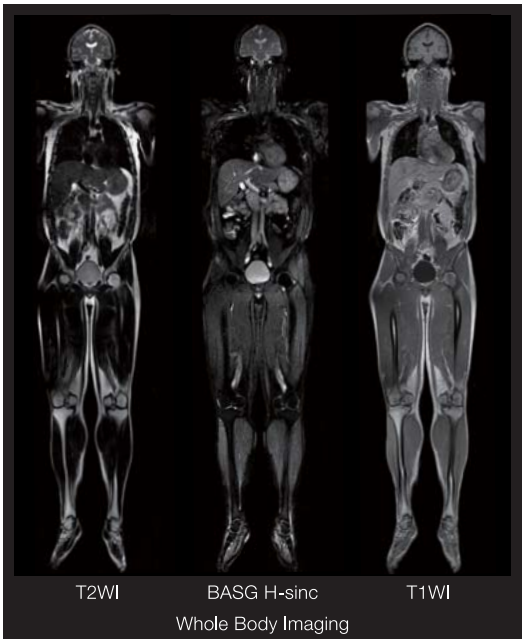
1.5T High-Field MRI

Whole Body Imaging*

Evaluate the whole body by stitching the images.

Since the Echelon patient table allows long strokes up to 2800mm, it is possible to scan head-to-toe. This feature will be advantageous in Whole Body Imaging, which is expected to be applied to the clinical field in the future. The Image Stitching function permits individually scanned images to be stitched to create an easy-to-see image with wide patient coverage being available.

*Optional

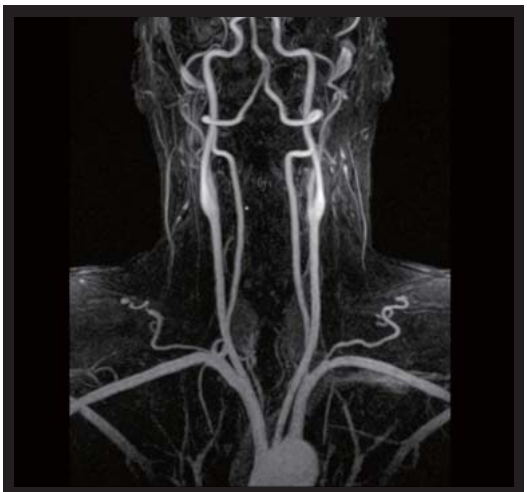


Whole Body Imaging

FLUTE

Evaluate the image at the best timing.

In contrast-enhanced MRA (CE-MRA), it is difficult to acquire excellent images if there is a time lag between the arrival of contrast agent and scan start time. FLUTE measures the timing of contrast agent arrival to the target region, and then starts filling the k-space sequentially from the center. The signal to fill the central part of the k-space (low-frequency components), which significantly influences the contrast deemed crucial in CE-MRA, is obtained first so as to acquire excellent images.


Head and neck area FLUTE image

TRAQ

From morphological information to dynamic information.

TRAQ is a function to conduct CE-MRA (2D or 3D measurements) continuously at high speed in a short time. With this continuous scan, the arteriovenous phase is separated and the images can be displayed in chronological order. By this procedure, it is possible to conduct a dynamic evaluation of each organ as well as a morphological evaluation of the blood flow.

Echelon further advances magnetic
by providing faster operation and

In response to the needs of the medical community, Echelon

Faster examination

The improved system specifications enable faster image acquisition, achieving a better total throughput capability in the whole scanning process.

Easier diagnosis

Along with a higher-resolution imaging ability, Image Stitching*1 provides a new optional function that stitches multiple images together which contributes to improved visibility in diagnosis. The sensitivity correction function, which is a standard feature, corrects sensitivity irregularity which occurs in multi receiver coil systems. This enables Echelon to be an easier-to-diagnose system.

Diagnosis support technology

For clinical cases hard to evaluate with MR images, MRS*1 is a technology that supports diagnosis with a one-button scan and one-button quantitative analysis, not interfering with the imaging process.

Compact and easy-to-use features

Ease of use is improved by adopting a large monitor, and the number of system units in the equipment room has been reduced*2. The reductions in power supply capacity and installation area have made Echelon an energy-efficient, space-saving imaging system.

*1 Optional *2 May vary depending on the requirements specified for installation.

ECHELON

resonance scanning technology
clearer imaging, making diagnosis easy.

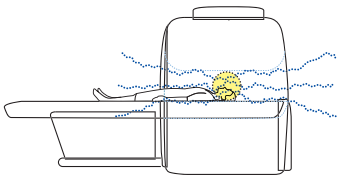
provides true practicality and ease of use.

High Order Shimming System

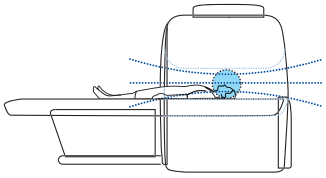
HOSS

Corrects any complex inhomogeneity of the magnetic field. Outstanding homogeneity of the magnetic field is the foundation of a prominent MRI system.

Magnetic field homogeneity is an important factor to determine the performance of an MRI system. Hitachi believes that the homogeneity of the magnetic field when a patient is inside the gantry is crucial. Echelon employs HOSS, a higher order shimming system applicable to a more complicated inhomogeneity of the magnetic field.
With the new Echelon, high-precision shimming on local regions such as joints and breasts is also possible, along with inhomogeneity correction on a large FOV. Thus, this technology can be applied to a variety of cases.

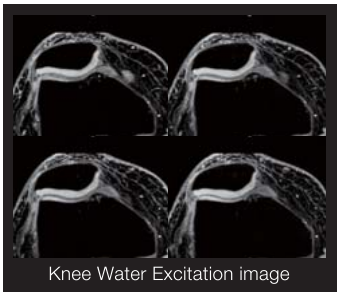


HOSS OFF a distorted magnetic field influenced by the human body



HOSS ON a homogeneous magnetic field under the effect of high order shimming

Wide area BASG CHESS MIP image



Knee Water Excitation image

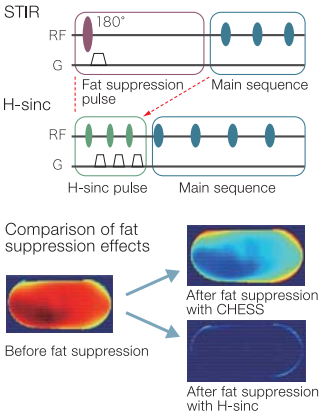
Since HOSS corrects inhomogeneity in a wide spectrum of the magnetic field, the regions remote from the body axis such as shoulder and knee joints can be scanned without keeping patients in uncomfortable positions.

H-sinc

An evolutionary fat suppression technique that mitigates B1 ununiformity.

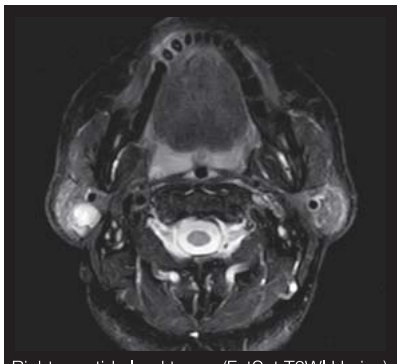
Fat suppression is critical for an accurate diagnosis with MRI systems. In order to obtain sufficient effect of fat suppression, the homogeneity of the magnetic field (B0 homogeneity) and the uniformity of RF transmission (B1 uniformity) are essential.

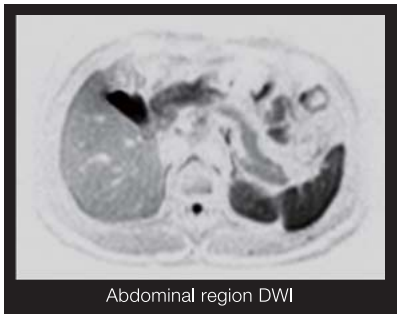
When a large FOV is required, it is difficult to use CHESS method of fat suppression, as it is sensitive to lack of B0 homogeneity and B1 uniformity. Hitachi has solved the B1 ununiformity problem by adopting its unique H-sinc method in which the fat signal is suppressed by the transmission of multiple RF pulses. In case STIR method is used for fat suppression, the prolonged scan time and the decreased number of slices induced by TI are problematic. Because the RF transmission process for fat suppression in H-sinc is remarkably shorter than TI of STIR, H-sinc helps mitigate such problems seen in STIR. (See the figure below.)



With H-sinc, the pulse sequence for fat suppression is short, and the operating constraints have been greatly alleviated compared to STIR. The figure above is a comparison of these two techniques using a water phantom. For H-sinc, the uniformity of RF transmission is higher compared to that of CHESS, because multiple pulses are applied. Also, the synergetic effect between HOSS and H-sinc produces excellent fat suppression effects.


MR Neurography (DWI)


Right parotid gland tumor (FatSat T2WI H-sinc)

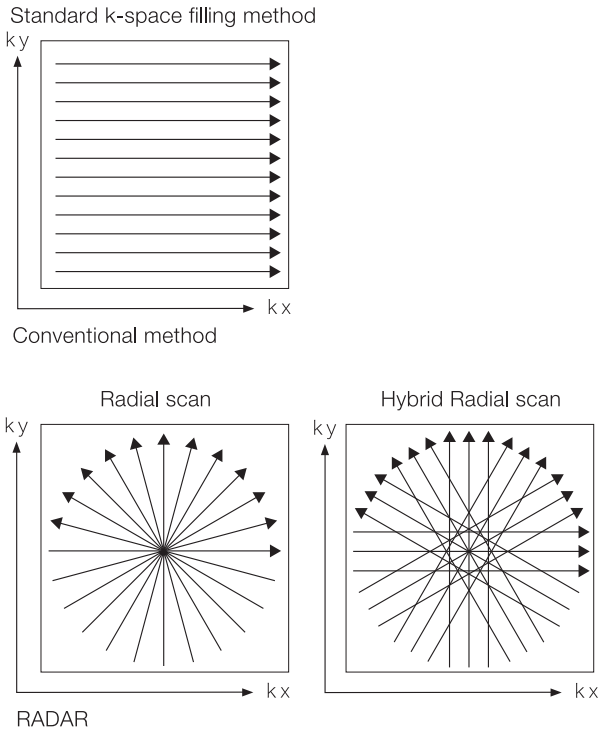

Abdominal region DWI

RADAR

An effective artifact reduction technology based on the idea of “rotation and intersection”.

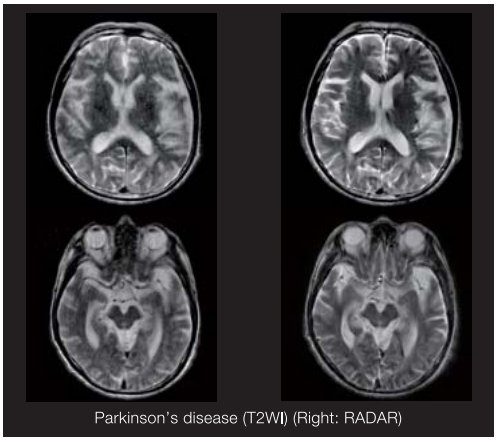
The problem of artifacts is inevitable with MRI imaging. In Hitachi’s RADAR, the k-space is filled radially with the center of the k-space as the axis. By this distinctive procedure, the motion artifacts generated in specific directions can be suppressed.

RADAR is effective for suppressing artifacts caused not only by the motion of patients, but also by involuntary body movements caused by heartbeats, respiration, and CSF (Cerebrospinal Fluid).

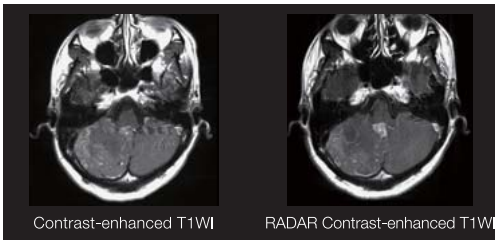


RADAR’s distinctive k-space filling procedure allows the arbitrary setting of oblique slices and the scanning of various body regions such as the body trunk and extremities as well as the head. It is also compatible with a variety of sequences such as FSE, FIR, DW-FSE, SE, and BASG.

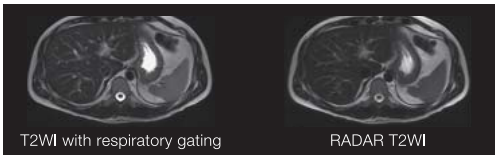
Other features of RADAR contribute to its ease of use. In Time mode, the imaging process is completed in the same length of time as by the conventional method, although this theoretically should take longer. In Res mode, the spatial resolution is prioritized. An aliasing artifact reduction function is incorporated as well.



Using RADAR, motion artifact can be reduced successfully.



Artifact is found on the conventional contrast-enhanced image on the left, however it is suppressed by RADAR, as seen on the right.



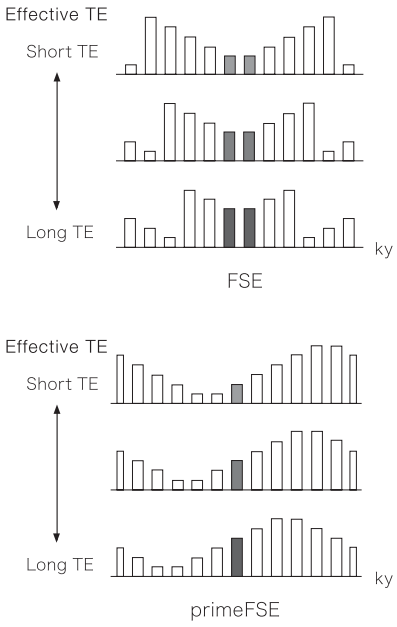
With the use of RADAR, images for which quality is equal to those with the respiratory gating can be acquired without taking extra time.

primeFSE*

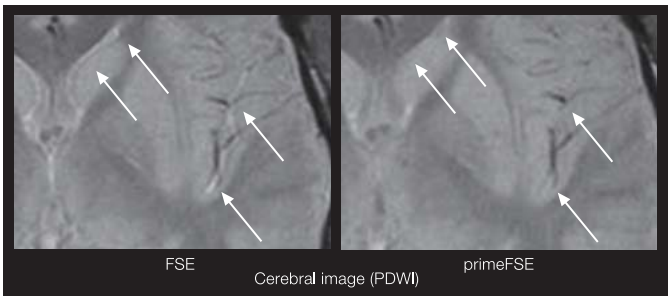
Automatically optimizes the echo allocation in the k-space.

The FSE sequence requires complicated settings for parameters, which were conventionally based on empirical rules. Also, artifacts are generated if the parameters have not been optimized. Hitachi's primeFSE is a sequence with parameter settings which are as easy as those for the conventional SE sequence. Moreover, optimized echo allocation results in the reduction of truncation artifacts in T2WI and STIR and the decrease of blurring artifacts in dual contrast imaging without any prolongation of acquisition time. Our primeFSE is a promising technique for improving image quality and shortening scan time.

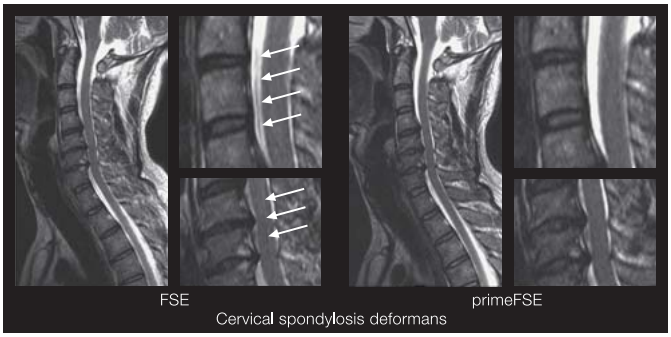
*Optional



Echo shift by conventional FSE produces large differences in signal intensity between neighboring echoes generating significant truncation artifacts. Echo shift by primeFSE maintains a minimum difference in signal intensity to suppress artifacts.



The reduction of Pseudo Edge Enhancement results in the diminution of artifacts in dual contrast imaging.



The gap between adjacent echoes has been decreased by the minimized IET, resulting in the reduction of artifact.

The concept of patient-friendliness in shape

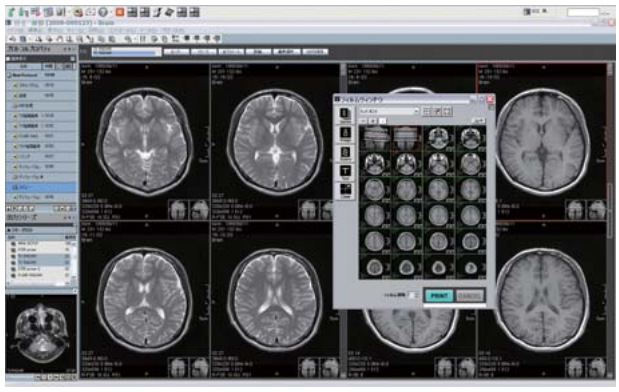
Features such as the height-adjustable patient table with the low height feature and LED illumination inside the gantry have been provided for patient comfort.

The patient table can be lowered down to 495mm above the floor. This feature reduces the burden for small children and elderly patients.

Dimmable LED illumination are placed inside the gantry, providing a bright environment during examination. Also, a power adjustable air blower is incorporated for patient comfort.

Large LCD Monitor

A 24-inch LCD monitor which can display large amounts of information simultaneously has been adopted. Workflow becomes more efficient since a variety of information such as filming and image processing can be managed on the same screen.



Interface

An intuitive GUI improves ease of use and is compatible with the DICOM MWM function*, which simplifies the input of patient information.

*Optional

DICOM function

Networking of computer systems within medical facilities has rapidly progressed. The DICOM interface has been adopted in order to facilitate networking within hospitals. Also, the compatibility with functions such as MWM*, CPI*, SWF* and PIR* allows for more advanced networking systems.

*Optional

IHE Key Image Note (KIN)*

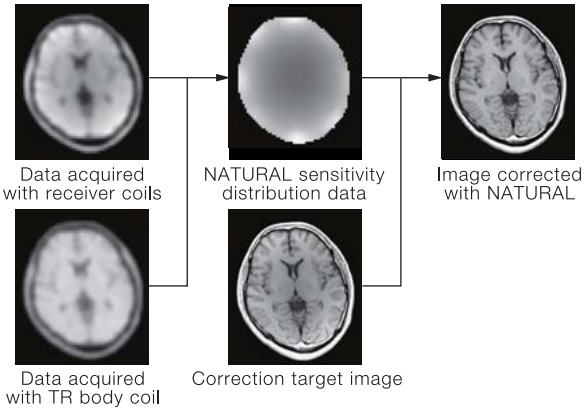
KIN function allows the image note (information attached to images) to be sent to workstations along with the images crucial for diagnosis.

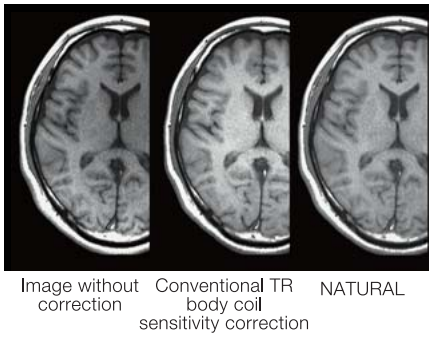
*Optional

NATURAL

Corrects the signal balance for an easier diagnosis.

The diameter of receiver coils has been reduced for higher sensitivity. Along with this trend, the scan time has been shortened using reduction techniques such as RAPID*. However, these advances have generated the problem of sensitivity irregularity for receiver coils. Hitachi has developed NATURAL which corrects such sensitivity irregularity to make images easier to diagnose.





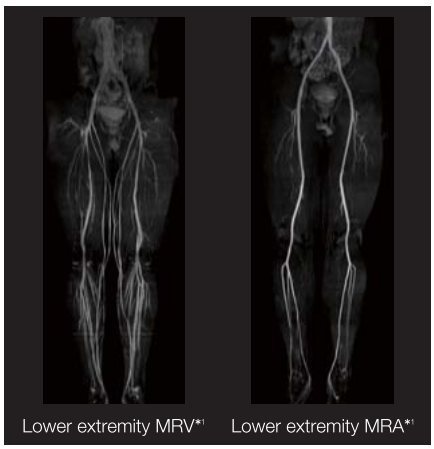
Since a whole-body coil is used in the conventional method for sensitivity correction, the central part of an image tends to be corrected more intensively than the peripheral parts. NATURAL accomplishes a more natural sensitivity distribution by controlling the signal balance of the central part.

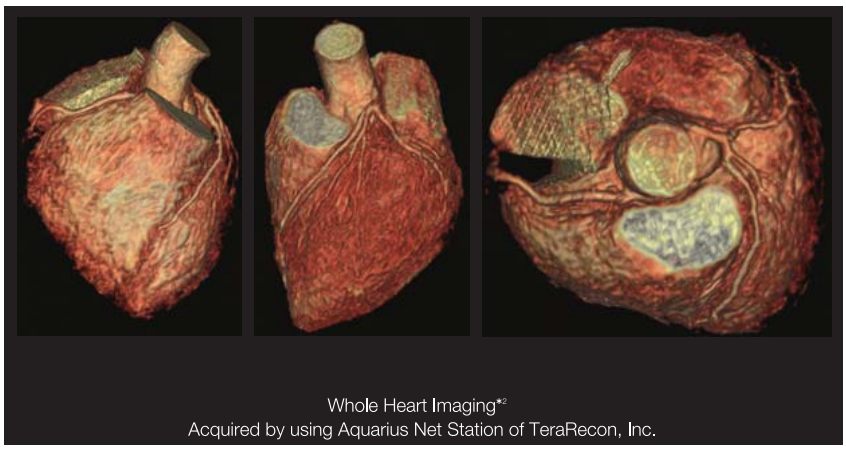
* RAPID (Rapid Acquisition through a Parallel Imaging Design)
RAPID is a function to shorten the scan time by reducing the number of phase encodes of an image, leveraging characteristics of the sensitivity distribution of receiver coils.

Non CE-MRA

Delineates blood flow images without using contrast agent.

For non CE-MRA measurements, Hitachi uses BASG method which is not subject to the influence of heartbeat and pulsation. Magnetic field homogeneity and stability are important elements for non CE-MRA, and by using HOSS, images with less influence of magnetic field inhomogeneity can be acquired. For Whole Heart Imaging, Echelon suppresses the signals from the regions of less concern in order to achieve a higher image quality.





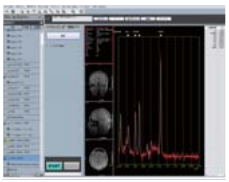
*1 The Whole Body Imaging and PV CE-MRA function (optional) are used to acquire the images.
*2 The Cardiac Imaging package (optional) is used to acquire the images.

MRS*

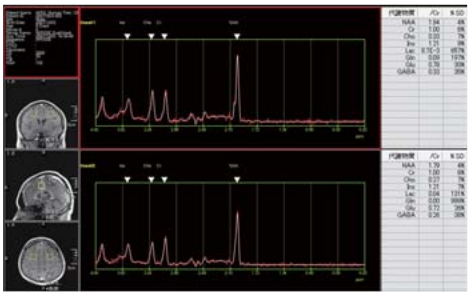
The simplest MRS aiming at the daily routine.

Aiming for higher user-friendliness and clarity, MRS system featuring a one-button measurement and one-button analysis has been developed. Transfer of the data to another computer for analysis is not necessary, since it is possible to commence analysis right after the measurement. After analysis, the obtained spectrograph and the list of components can be transferred to DICOM or be filmed.

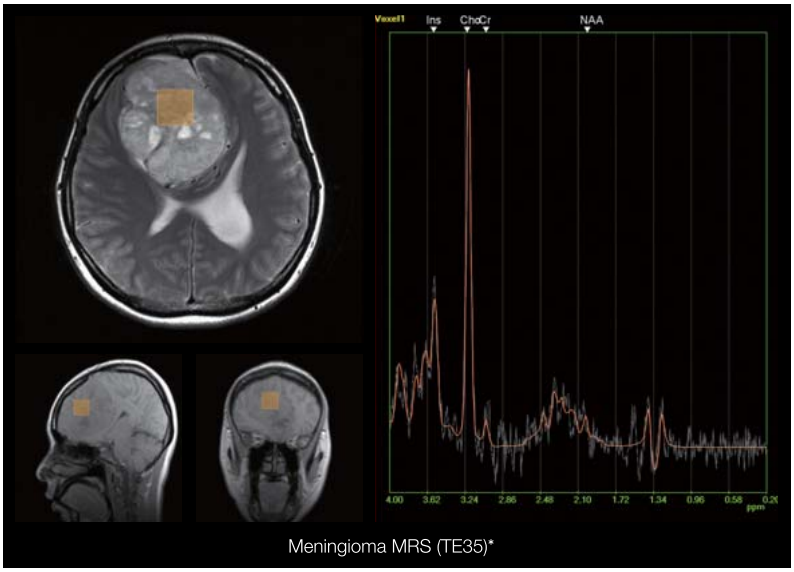
Automatic shimming function



One-button analysis



MRS (Dual Voxel Analysis)*



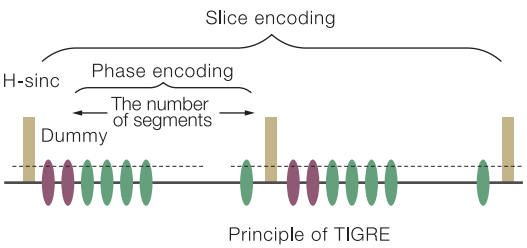
Meningioma MRS (TE35)*

*Optional

TIGRE*

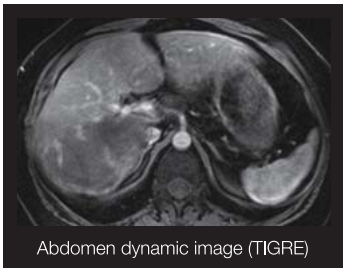
Faster and clearer image acquisition.

With the use of TIGRE, high-resolution dynamic imaging of abdominal and breast regions is possible. Since these regions contain a large amount of fat, high-precision fat suppression is necessary to acquire excellent images. The combined use of HOSS, which maintains the magnetic field homogeneity, and H-sinc, which corrects the RF ununiformity, enables excellent effects of fat suppression.



Principle of TIGRE

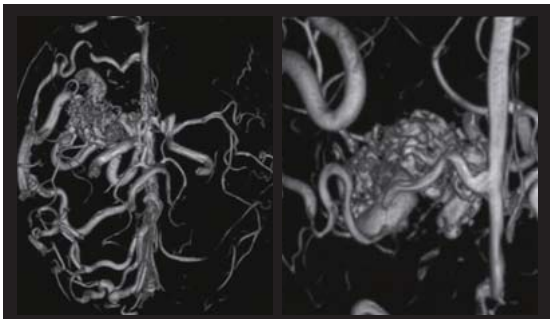
Breast TIGRE image



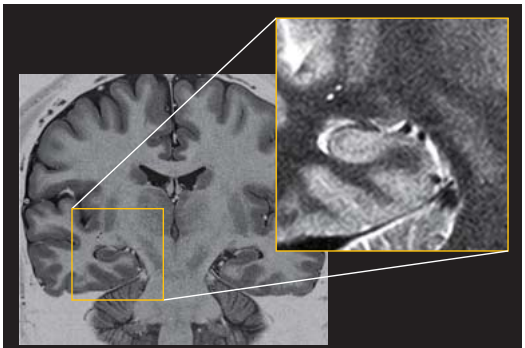
Abdomen dynamic image (TIGRE)

*Optional

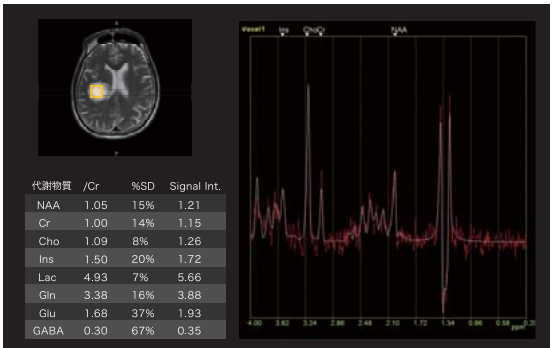
High-resolution MRA



AVM (VR image)



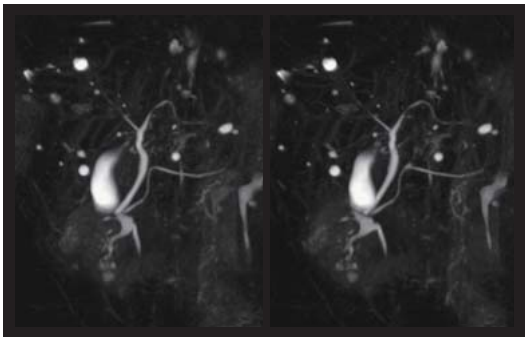
High-resolution cerebral image (primeFSE* · STIR)



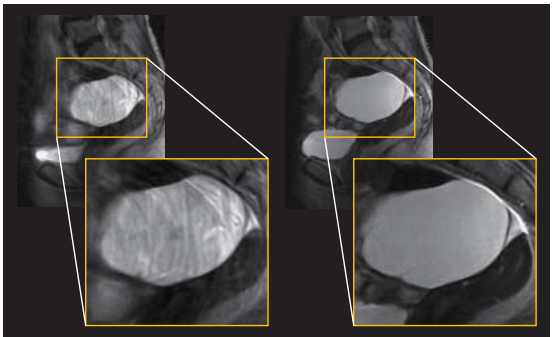
代謝物質	/Cr	%SD	Signal Int.
NAA	1.05	15%	1.21
Cr	1.00	14%	1.15
Cho	1.09	8%	1.26
Ins	1.50	20%	1.72
Lac	4.93	7%	5.66
Gln	3.38	16%	3.88
Glu	1.68	37%	1.93
GABA	0.30	67%	0.35

MRS*

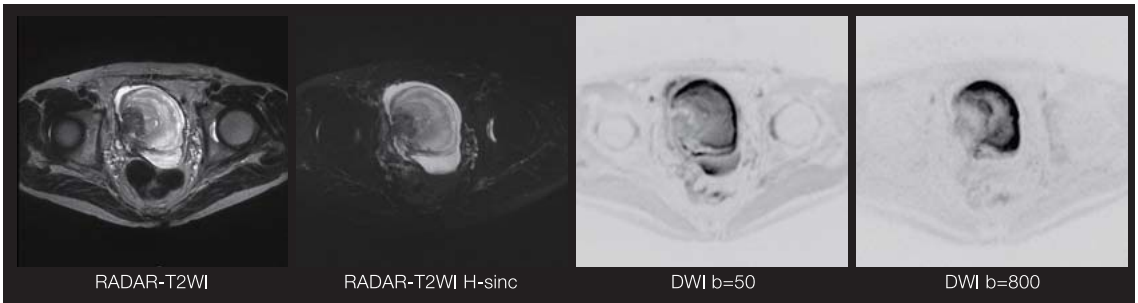
Tumor-forming multiple sclerosis (MRS TE=35ms)
Since the NAA value is higher than Cr and the increase of Cho is not shown, it could be diagnosed as a demyelinating lesion and not a brain tumor.



3D MRCP (primeFSE*)



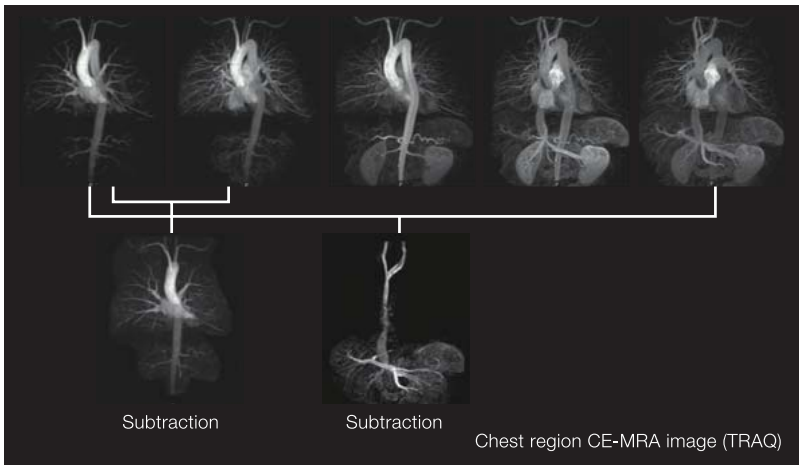
Ovarian cystoma (left: T2WI, right: RADAR-T2WI)



RADAR-T2WI　RADAR-T2WI H-sinc　DWI b=50　DWI b=800

Bladder cancer

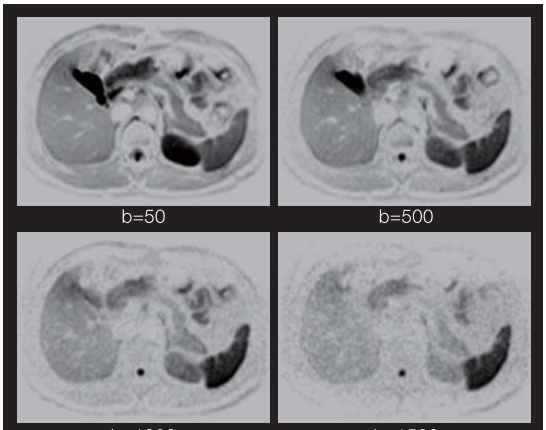
*Optional



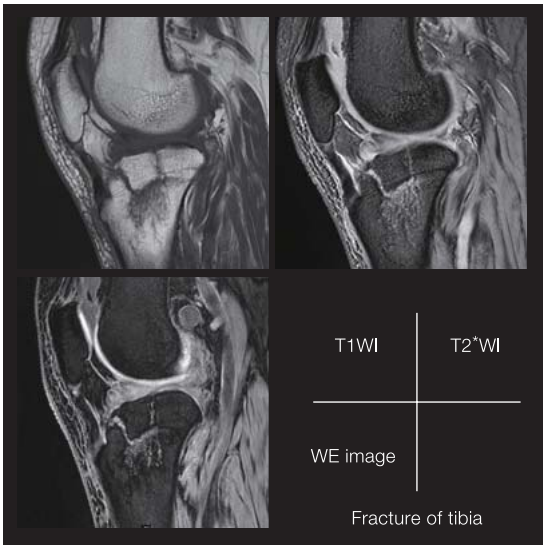
Chest region CE-MRA image (TRAQ)

Myelography (MIP image)

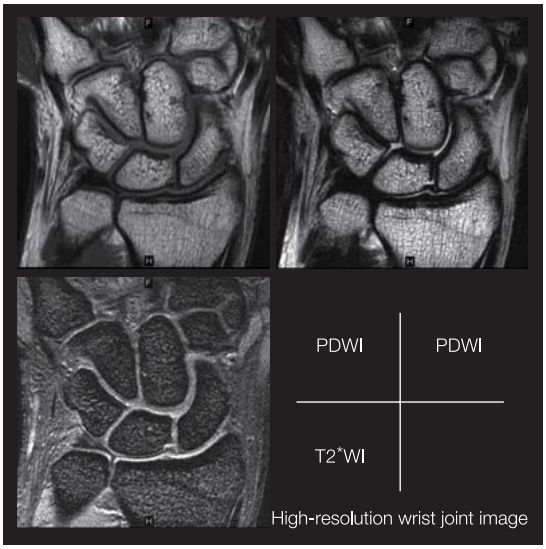
Cervical region MR Neurography (DWI)



Abdominal region DWI



Fracture of tibia

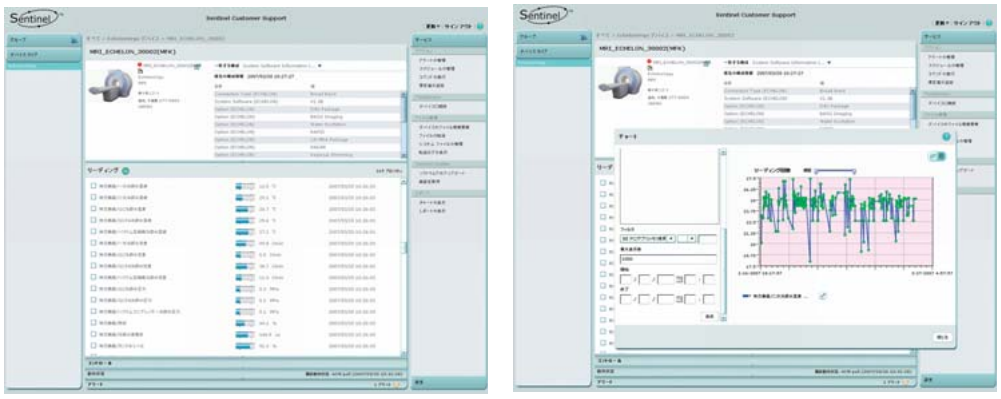


High-resolution wrist joint image

Sentinel*

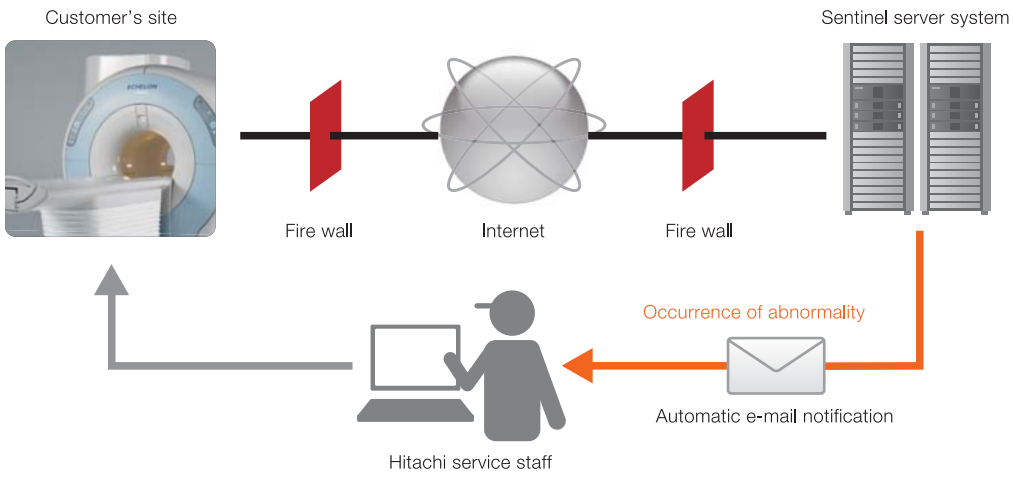
Echelon is compatible with Hitachi's customer support system, Sentinel*. Sentinel is a system which observes the operational status of your MRI system to support stable use. Echelon is able to acquire information about its operational status, and the information is sent to and archived in the Sentinel server at Hitachi. If abnormalities are detected, notifying e-mails are sent to the service staff to prompt appropriate action. Long-term operational status can be confirmed using accumulated information organized in a chronological order.

* Users are required to set up the network environment compatible with the service. The contents of the service may vary depending on the extent of contractual coverage.



System status screen

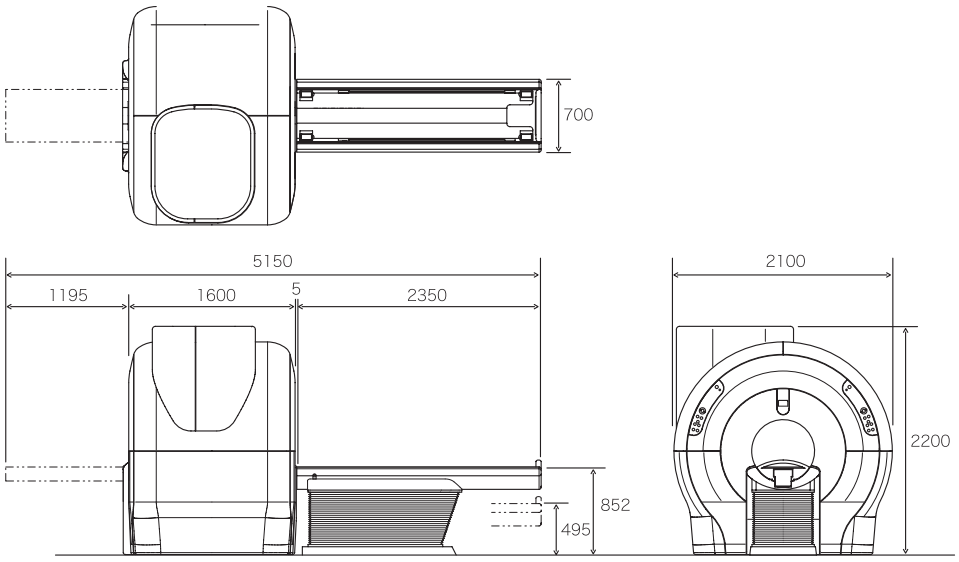
Conceptual diagram of Sentinel



Compact design*

When installing an MRI system, it is necessary to take into consideration the total cost of the peripheral equipment, the shield room, and the equipment room. Echelon has realized a compact design which reduces the number of MRI units brought into the equipment room. As a result, the size of the equipment room can be reduced compared to conventional MRI systems, and this leads to a reduction in total installation space. The running cost has also been reduced due to decreased consumption of electricity.

* The configuration and contents may vary depending on the requirements specified for installation.



Gantry

- Magnet type : Horizontal magnetic field superconductive magnet
- Static magnetic field strength : 1.5T
- Leakage Flux (0.5mT) : 2.5m×4.0m(Radially×Axially)

Patient table

- Patient table height : 495mm-852mm
- Patient table width : 700mm(Table top width506mm)
- The maximum load : 225kg(Under manual control)
- Longitudinal travel stroke : 2800mm

Imaging function

- Imaged region : Whole body
- Imaged nucleus : Hydrogen atom (Proton)
- Imaging method : (2DFT/3DFT) 2D/3D Fourier transformation
- Multi slice : 256 (Maximum)
- Slice thickness : 0.05mm(Minimum/3D)
- FOV (Field Of View) : 5~500mm

Image display/processing function

- Operation : Mouse / keyboard
- Image display matrix : 1024×1024

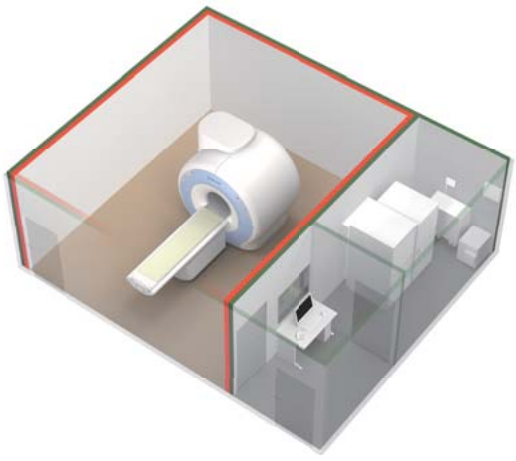
(a) MPR
(b) Volume Rendering
(c) Cine display

Equipment specification

- Power capacity : 75KVA *May vary depending on the requirements specified for installation.
- Power supply voltage : Three-phase AC,380,400,415V +-10%(50Hz)
- Power supply frequency : 50/60Hz +-1%
- Grounding : 10Ω or less (MRI exclusive use)

DICOM function

- DICOM : 3.0 compliant



ECHELON

1.5T High-Field MRI

Hitachi Medical Corporation Medical System Operations Group, Kashiwa has established and maintains a quality management system according to ISO 9001, ISO 13485.

Hitachi Medical Corporation, Kashiwa-site, is certified as complying with the International Environmental Management System (ISO 14001).

Hitachi Medical Corporation

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