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MAGNETOM Flash

An Applications Reference for Siemens MAGNETOM Users

From the Editor

Welcome to the new millennium! We hope you are already enjoying all the advantages of the new B33a software: they go beyond just Y2K safety. To provide you with even more useful information, this issue of MAGNETOM Flash includes an article describing the application highlights of this software.

And there's more. This MAGNETOM Flash presents the first clinical experiences with MAGNETOM Jazz. Product News provides information on our latest product developments, which were introduced at RSNA 1999.

US and Canada Application Helpline

Siemens Medical Systems is pleased to announce to our US and Canadian customers that the MR Applications Helpline is now available to answer calls from 8am to 8pm Eastern Time Monday-Friday (1-800-767-2313). Our West Coast customers are now covered through 5pm Pacific Time.

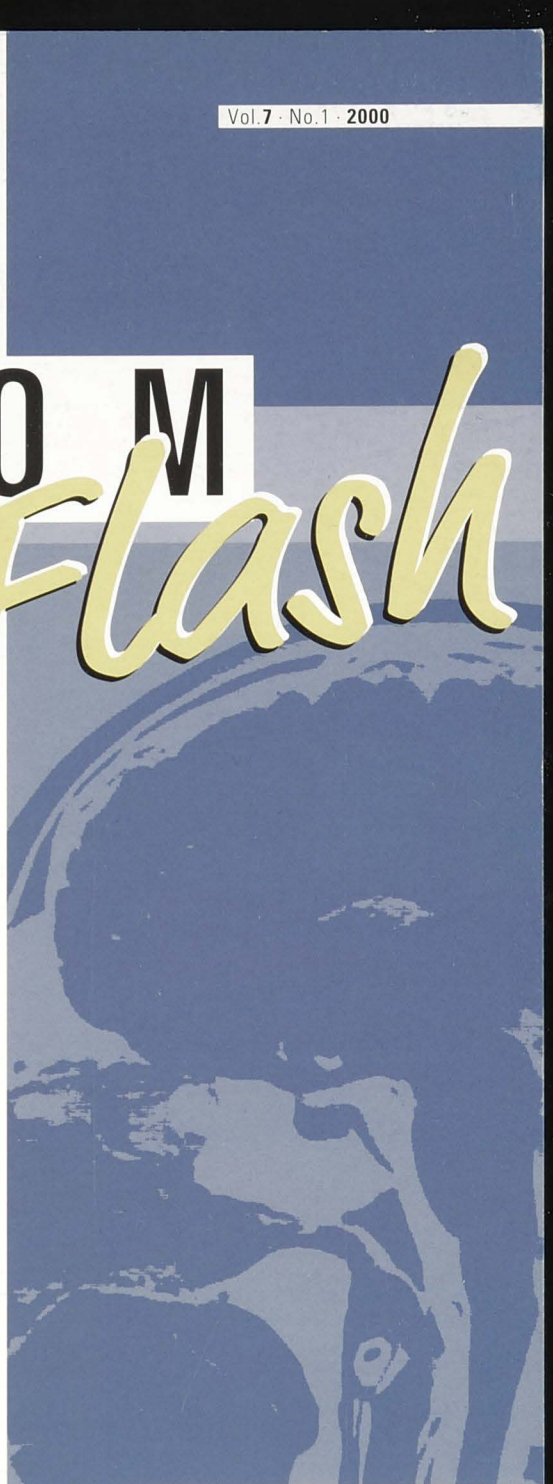
Change of address? Would you like to be added to our mailing list?

In the US, please contact the Applications Helpline (phone 800-767-2313 in the US) and give us your name and business address (no home addresses, please). MAGNETOM Flash is distributed outside the US by local Siemens offices. Please contact me and I will make sure that you are included on your local support office's distribution list.

Once again: remember that MAGNETOM Flash is an educational magazine for MAGNETOM users. Your experiences and your contributions bring it to life. Please share your experiences with others in the form of an article! All you have to do is contact me. You can write your article in your native language, and I will have it translated for publication.

And because we know that writing articles is hard work, we will show our gratitude to each author of a published article with a copy of "Sectional Scan Anatomy." I look forward to your tips, hints, and articles that will help others understand MR better and make it even easier to work with an MR system.

Dagmar Thomsik-Schroepfer, Editor



:In this issue:

Application Highlights of Vb33a Software

Judith L. Behrens and Margaret King, MRI Applications, Siemens Medical Engineering

In 1999 Siemens introduced the VB33A software, for our MAGNETOM Vision, Vision Plus, Impact, Impact Expert, Open and Open Viva customers. We hope that you have had an opportunity to review the Training Workbook and Video that came with this upgrade and that you are using the many new features such as the Virtual Filming, Freehand MIP, Multislice Curved Reformat within MPR, New 3D Shim Program and the new Dicom capabilities.

In addition there were many new and improved sequences for MAGNETOM Vision, Impact Expert and Open Viva. Below are some comments regarding just a few of the new sequences.

(Please refer to the Siemens Applications Guide for information on which sequences come with which specific packages)

Vision, Impact Expert and Open Viva

Interpolated MRA

With this upgrade Siemens introduced Interpolated MRA sequences. These sequences interpolate in the slice selection direction for improved resolution in less time. In addition, the TR and TE times have been reduced further in a number of sequences by taking advantage of the gradient performance.

You must have the Advanced Angio Package or the Peripheral MRA package to have access to any of these sequences.

For MRA of the ICV these improved 3D MRA sequences allow beautiful 3D Multislab MRA at 512 resolution for the Vision and Impact Expert, and at 256 for the Open (Fig. 1).

Contrast Enhanced MRA

With the new Interpolated 3D Contrast Enhanced MRA you will get improved resolution as well as shorter TR and TE times.

For the 3D Contrast Enhanced sequences the center of k-space is reached at 3/8 of k-space.

Center of k-space =
3D CE Scan Time • 0.375

These new Turbo Angio protocols can be found on the Siemens Protocol page under Turbo MRA (Fig. 2).

There is also a new Test Bolus Sequence for Vision and Impact Expert customer. With this sequence the number of acquisitions is actually the number of measurements and each image is labeled with the actual time after injection that the image was taken.

Impact Expert:	tfl_t1_3b279.wfc
Vision/Vision Plus	tfl_t1_2b355.ykc

Please refer to the Vb33a workbook or the Applications Guide for more information on the interpolated MRA sequences.

Gradient Echo Imaging

For MAGNETOM Vision and Impact Expert, "In" and "Opposed" Phase imaging (Fig. 3) is now available with a single breath hold. "In-Phase" and an "Opposed Phase" images are obtained simultaneously. This sequence is interpolated for exceptional in-plane resolution. The most common application for this imaging technique will be abdominal liver and adrenal imaging as both exams require both "In" and "Opposed" Phase imaging.

Vision:	fl2d_3b488_5b488.ykc
Impact Expert:	fl2d 4b390_7b390.wfc

Fat Sat T1 Weighted Gradient Echo

With this sequence, fat sat T1 weighted images of the abdomen can be obtained in a breath hold. This is an excellent sequence for abdominal imaging where fat signal is suppressed, therefore maximizing the signal from enhancement in conjunction with the utilization of gadolinium. There is a total of 20 slices with a fat saturation pulse prior to each 10 slices netting a total of 2 fat sat pulses (2s10 = 2 sat pulses per 10 slices). There is also a 16 slice gradient echo sequence with one fat sat pulse per 8 slices (2s8 = 2 sat pulses per 8 slices).

You must have the Ultrafast Imaging package to have access to these sequences.

Vision:	fl2d_2s8_2b488.ykc
Vision:	fl2d_2s10_2b488.ykc

There are many applications for utilization of this fat sat T1 weighted gradient echo within the abdomen (Fig. 4-7).

As well as imaging the liver, pancreas, kidneys and pelvis, the prostate is beautifully imaged with this sequence as well.

Fig. 1

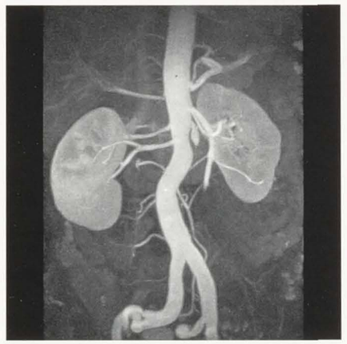


Fig. 2

Fig. 3a: "In Phase" Liver

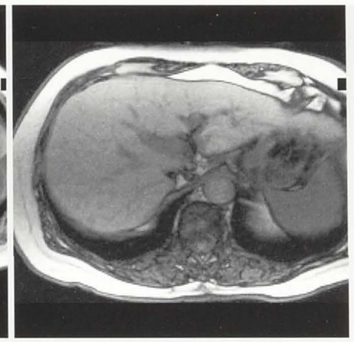


Fig. 3b: "Opposed Phase" Liver

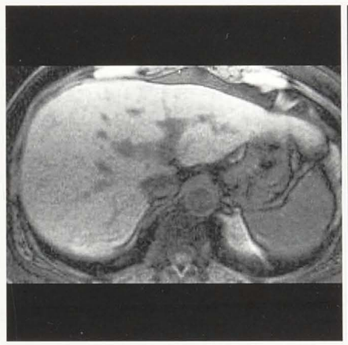


Fig. 4a: Fat Sat Pre Contrast Liver

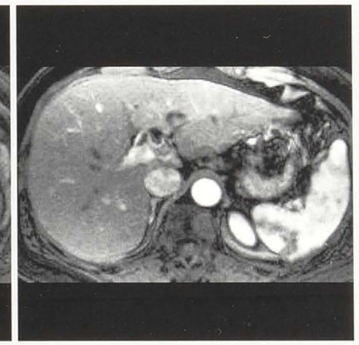


Fig. 4b: Fat Sat Post Contrast Liver

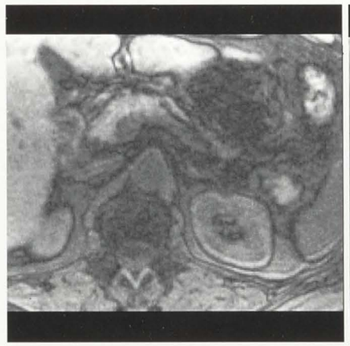


Fig. 5a: Fat Sat Pre Contrast Pancreas

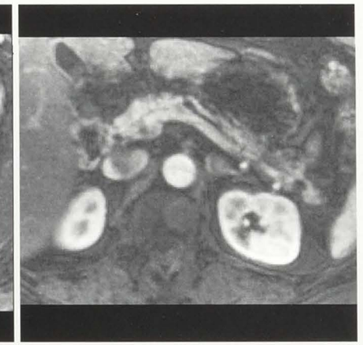


Fig. 5b: Fat Sat Post Contrast Pancreas

Fig. 6a: Fat Sat Pre Contrast Kidney

Fig. 6b: Fat Sat Post Contrast Kidney

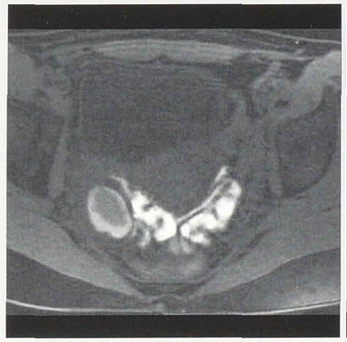


Fig. 7a: Fat Sat Pre Contrast Pelvis

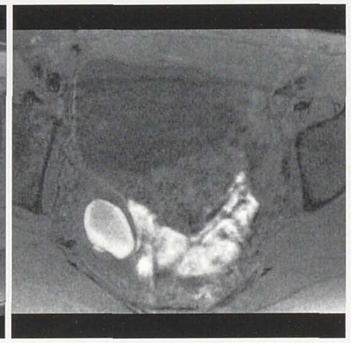


Fig. 7b: Fat Sat Post Contrast Pelvis

Fig. 7c: Fat Sat Post Contrast Pelvis

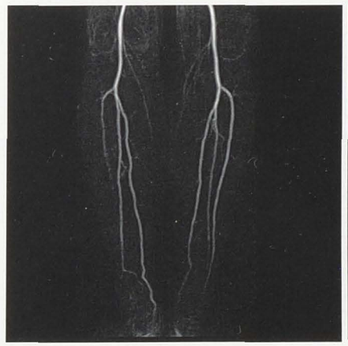


Fig. 8: Peripheral MRA

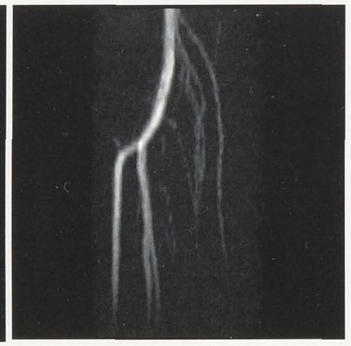


Fig. 9: Peripheral MRA

Peripheral MRA

For MAGNETOM Vision, Vision Plus, Impact Expert and Open Viva there are new Segmented Triggered Peripheral sequences with overlapping sats. The advantage here is that you will get better background suppression.

In studies done without contrast some customers like the suppression of the background tissue (fat) created by the overlapping sat pulses. Quickly flowing blood replaces partially saturated blood in the slice and gives nearly its full signal. It was for this background suppression that the sequences were originally designed.

Open Viva

fl2d13_sdo_9rb78.vhc
fl2d13_suo_9rb78.vhc
fl2d19_sdo_9rb78.vhc
fl2d19_suo_9rb78.vhc

Impact Expert

fl2d13_sdo_10rb108.wfc
fl2d13_suo_10rb108.wfc
fl2d19_sdo_10rb108.wfc
fl2d19_suo_10rb108.wfc

Vision/Vision Plus

fl2d13_sdo_7rb108.yfc
fl2d13_suo_7rb108.yfc
fl2d19_sdo_7rb108.yfc
fl2d19_suo_7rb108.yfc

For the MAGNETOM Vision customers: in addition to the above mentioned Peripheral MRA sequences we added a new Triggered Peripheral MRA sequence which acquires information in both systole and diastole (Fig. 8).

This produces a set of images which subtract the diastole from the systole images, with the result being a complete subtraction of the fat signal and better enhancement of the vessels.

fl2d11_sd_d_6rb195.ykc
fl2d11_su_d_6rb195.ykc

The "d" stands for "difference".

This triggered sequence collects 11 lines in systole and then 11 lines in diastole during each heart cycle. The results are subtracted to eliminate nearly all of the stationary tissue signal.

Patients with uniform flow will have about the same signal during systole and diastole, and the subtraction will yield just noise. Therefore, a set of systolic images is also provided. The technologist should determine the image numbers for the two sets, and MIP them both.

This sequence works nicely with the spine phased-array coil.

It is always triggered. It should never be used with contrast. Contrast would increase the diastolic blood signal, and ruin the subtraction (Fig. 9).

MAGNETOM Vision Diffusion and Perfusion

With this upgrade, if you have the diffusion package, you received many new diffusion/perfusion sequences.

The following new diffusion sequences are available which include a trace and/or ADC Map image.

An ADC map (Apparent Diffusion Coefficient):

The ADC map is a measure of the mobility of the water hydrogen protons for the tissues in a direction.

This is a calculated image of the actual diffusion coefficient in the tissue. The values of the ADC map will depend upon how the diffusion sensitizing gradients are applied. If the images are generated with diffusion sensitization in three orthogonal directions (read, slice and phase directions) then the anisotropy of the tissues results in different diffusion weighted images and ADC maps for each direction.

The calculated trace image:

The differences due to anisotropy can be "averaged" by adding the results of each of the diffusion directions (read, phase and slice) and then averaging the 3 together, this results in a trace image.

Diffusion with a trace image

A trace image is 3 diffusion images combined into one image.
Example: ep2d_d2t_139b833_11.ykc
d2t = 2 b-values and a trace image
Application: Brain

Diffusion with an ADC map

ADC image is a map of intensities over time.
Example: p2d_d33a_110b833_11.ykc
d33a = 3 b-values in 3 directions and an ADC map
Application: Brain

ep2d_d2t_137b1250_11.ekc **Diffusion Package**

- d2t = 2 b-values and trace image
- Trace image is 3 diffusion images combined into one image
- Generates a diffusion tract with strong weighting
- b = 1000 s/mm² plus reference T2 image

ep2d_d2t_139b833_11.ykc **Diffusion Package**

- d2t = 2 b-values and a trace image
- Trace image is 3 diffusion images combined into one image
- Generates a diffusion tract with strong weighting
- b = 1000 s/mm² plus reference T2 image

ep2d_d3ta_137b1250_11.ekc **Diffusion Package**

- d3ta = 3 b-values, trace image and ADC map image
- Trace image is 3 diffusion images combined into one image
- ADC is the Apparent Diffusion Coefficient = this is a map of intensities over time
- b = 0; 500; 1000s/mm² plus ADC map plus pure diffusion image

ep2d_d3ta_139b833_11.ykc **Diffusion Package**

- d3ta = 3 b-values, trace image and ADC map image
- Trace image is 3 diffusion images combined into one image
- ADC is the Apparent Diffusion Coefficient = this maps intensities over time
- b = 0; 500; 1000 s/mm² plus ADC map plus pure diffusion image

ep2d_d33a_100b1250_11.ekc **Diffusion Package**

- d33a = 3 b-values in 3 directions; and a ADC map image
- b = 0; b = 500; b = 1000

ep2d_d33a_110b833_11.ykc **Diffusion Package**

- d33a = 3 b-values in 3 directions; and a ADC map image
- b = 0; b= 500; b = 1000

Diffusion without Trace or ADC Map:

ep2d_d23_100b1250_11.ekc **Diffusion Package**

- d23 = 2 b-values in 3 directions
- b-value= 0; b-value= 1000
- 4 images at each slice position: 3 diffusion-weighted images plus reference T2 image.
- Application: Head, strong weighting, b = 1000s/mm², in all three directions

ep2d_d23_128b833_11.ekc **Diffusion Package**

- d23 = 2 b-values in 3 directions
- b-value = 0; b-value = 1000
- Strong diffusion weighting
- b = 1000 s/mm², in all three directions
- 4 images at each slice position: 3 diffusion weighted images plus reference T2 image

ep2d_d23_110b833_11.ykc **Diffusion Package**

- d23 = 2 b-values in 3 directions
- b-value = 0; b-value = 1000
- Strong diffusion weighting
- b = 1000s/mm², in all three directions
- 4 images at each slice position: 3 diffusion weighted images plus reference T2 image

Perfusion:

These pulse sequences are intended for use following the first pass of Gd-based contrast agent as it passes through the brain.

These pulse sequences are susceptibility weighted EPI based sequences.

Number of acquisitions, as specified within the NUMARIS interface, should be equal to the number of time points that are to be sampled during the bolus passage.

TR is the interval between the time points.

To ensure the acquisition of data both before and after the arrival of contrast, you should sample at least 10 time points before the arrival of contrast.

Images acquired:

a. Global Intensity Curve

This is a plot of the average signal in the head as a function of time during the acquisition.

b. Time to Peak map (TTP) of each slice

The intensity of each pixel in the map is related to the relative position of the peak of the bolus-passage curve.

Labeled TTP in lower right hand corner of image

c. Percentage of baseline at peak (PBP) of each slice

The image intensity at any pixel is proportional to the ratio of the signal at the bolus peak to the baseline signal before the bolus arrival, with the baseline level assigned a value of 1000.

For example, an intensity of 700 indicates that the signal dropped by 30% at the bolus peak.

These images are labeled PBP in the lower right hand corner.

The rest of the images are the "raw" susceptibility weighted images, organized so that each slice is saved with consecutive image numbers.

Each image is labeled in the lower right with the acquisition number and the time since the beginning of the measurement.

Perfusion sequences:

ep2d_fidp_54b1470_62.ekc **Diffusion Package**

- Susceptibility weighted perfusion sequence with time to peak map (TTP)

ep2d_fidp_64b780.ykc **Diffusion Package**

- Susceptibility weighted perfusion sequence with time to peak map (TTP) (Fig. 10)

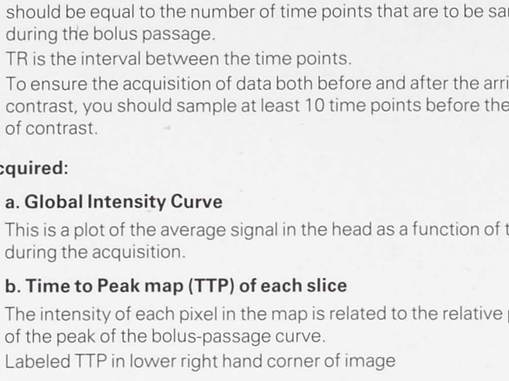


Fig. 10

MAGNETOM Vision Breast Imaging

Water Excitation FLASH 3D:

fl3d_we_5b260.ykc
Advanced 3D Imaging
(we = water excitation)

- Fat saturation through excitation pulse for hydrogen protons only
- Allows for shorter TR compared to a sequence with fat saturation pulse
- Use SHIM 3D
- Application: Breast imaging

fl3d_we_9b108.ykc
Advanced 3D Imaging
(we = water excitation)

- Fat saturation through excitation pulse for hydrogen protons only
- High spatial resolution
- Use SHIM 3D
- Application: Orthopedics

MAGNETOM Vision Functional Imaging

One of these new techniques includes Bold Imaging, if you have purchased the Functional Package.

Bold Imaging provides a dedicated acquisition and reconstruction technique which offers the possibility of visualization of small susceptibility changes, due to increased levels of oxygen, by parametric images. These parametric images can be overlaid on the anatomical images to optimize the presentation of information to support the diagnostic process. These BOLD images when interpreted by a trained physician, yield information that may assist in diagnosis.

MAGNETOM Impact Expert and Vision

Long Term Averaging

Long Term Averaging (LOTA) sequences reduce motion artifacts in orthopedics, spinal column imaging, and in the upper abdominal region. These will be labeled with a (a) in the sequence name. Example: se_15b130_a_wkc.

Medic

These strong T2* weighted sequences measure multiple echoes with a single excitation and possess a very high signal-to-noise ratio. Especially useful for orthopedics, abdominal imaging, and axial spinal column imaging.

MAGNETOM Open Viva

New 3D CISS for Cervical Spine Imaging and IAC (Fig. 11, 12).

New Dark Fluid with better slice coverage (Fig. 13).

Fig. 11: 3D CISS C-Spine

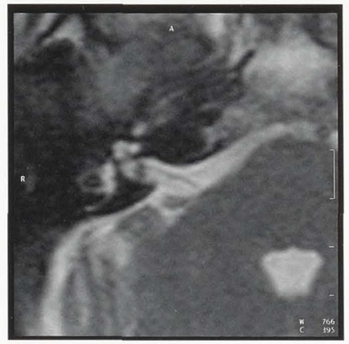


Fig. 12: 3D CISS inner ear

Fig. 13: Dark Fluid imaging

Initial Clinical Experiences with a Dedicated Low-Field MR System for Acute Diagnosis of Traumatized Joints

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Introduction

The prominence of magnetic resonance tomography (MRT) is based on the technique's sensitivity in the identification of both bone and tissue lesions. There are disadvantages, though, that prevent this method from being used even more extensively:

- higher costs in comparison to X-ray and CT
- lengthy examinations
- low patient throughput
- long wait times
- claustrophobic reactions.

Because of its ability to provide important information, the availability of MRT is a desideratum not only for radiologists, but also for clinical physicians active in acute traumatological diagnostics. Up until now, however, this has been difficult for a number of reasons: The MRT system is often not located in the department where primary X-ray diagnosis is performed. Even if the system is on-site, scheduling and staffing considerations often make it impossible to perform an acute examination. Another apparently insurmountable obstacle is the need for round-the-clock availability; this would mean that the entire emergency-shift technical examination staff (MTAR), working nights, holidays, and weekends, would have to be able to operate the system. The standard procedure for acute diagnosis is typically as follows: After the clinical examination, X-ray exposures are made. If they do not reveal any pathology, in many cases additional exposures in different planes or stress exposures are made (for example, held exposures for diagnosis of ligaments in the ankle). If the findings are negative, a CT examination might follow, although this tends in most cases to take place selectively on the following day.
If soft-tissue injury is suspected (for example, a tear in the muscle fiber), an ultrasound examination is indicated first. If the imaging procedures used up to this point have not resulted in a reliable diagnosis, the patient is scheduled for MRT. Depending on the infrastructure available, this can take days. For this reason, some clinicians tend to perform an invasive diagnostic procedure such as arthroscopy, which can often be done sooner.

Motivation and Requirements

These problems can be solved by using an appropriately configured MRT system. Ideally, the system should be relatively light-weight and take up little space so that it can be installed in a department without extensive construction. Operation should be easy enough that all of the department's MTAR's (emergency-shift technical personnel) can be trained in a short time regardless of previous experience with MR. The most open design possible is important for the unproblematic examination of traumatized patients, particularly those with children or those who exhibit claustrophobic reactions. Finally, such a system should be as inexpensive as possible, since it will typically be acquired in addition to an existing high-field MRT system.

Description of the System

The MAGNETOM Jazz (Siemens AG, Medical Engineering Group, Erlangen, Germany) is a dedicated system that satisfies the requirements described (Figure 1a). This is a low-field system with a field strength of 0.2T (permanent magnet). The magnet is open on three sides; the table can be swiveled over 180 degrees. The maximum gradient field strength is 20 mT/m, the minimum rise time 800 s. Including the evaluation console, the system weighs 2.260 kg. The magnet is surrounded by a modular RF pavilion (Figure 1b) with an area of 3.85 x 3.67 m. Examinations of the elbow, wrist, and hand, the knee and ankle, and the shoulder can be performed here. Dual phased array coils are available for examinations of the elbow, wrist, knee, and ankle; the shoulder coil is an LP coil. The following sequences can be used:

- Spin Echo
- Gradient echo
- Turbo Spin Echo
- STIR (short-tau inversion recovery)

Preliminary Results

System installation and training

Installing the system in our department took only three days. There were no difficulties in training the technical examination staff: each MTAR needed one day of instruction in order to be able to operate the system without assistance.

Patient examinations

Optimized protocols were prepared for operation for clinical examinations. Typically, we use gradient echo STIR sequences (TR 1080-1790 ms, TE 16 ms, TI 75 ms) in two planes and a T1-weighted spin echo sequence (TR 450-600 ms, TE 22 ms) in a third orientation. Slice thickness is 2-4 mm. To identify meniscus lesions, we are currently still using a proton-density and T2-weighted Turbo spin echo double-echo sequence (TR 2500 ms, TE 38/90 ms). The average examination time per patient is approximately 30 minutes.

The first 50 patients examined with the dedicated system exhibited fractures (Figure 2), ligament injuries (Figures 3-4), meniscus lesions (Figure 5), lesions of the Discus triangularis, osteochondritis dissecans (Figure 6), osteonecroses, impingement syndromes (Figure 7), and cystic bone lesions (Figure 8). Figure 9 shows the distribution of the examined regions. The low-field diagnoses were correlated with the results from other procedures (x-ray, ultrasound, computed tomography, high-field MRT, arthroscopy). The comparison demonstrated the good diagnostic reliability of the low-field system, a conclusion that matches the results from other studies in which low-field systems have been found to possess high sensitivity, specificity, and accuracy in the identification of musculoskeletal lesions [1-7].

Resolution

Phantom examinations have verified a maximum image-plane resolution of 0.4 mm for a T1-weighted spin echo sequence with a field of view of 100 x 100 mm and a 256^2 matrix.

Patient comfort

The open magnet design makes the MRT examination relatively comfortable for the patient; there have been no problems with claustrophobic reactions so far. The positioning accessories enable largely painless examinations without motion artifacts even for acutely traumatized patients. The open configuration of the modular RF pavilion permits direct spoken and visual contact with the patient during the entire examination; as a result, there is no need for monitoring systems. The noise caused by switching the gradients on and off is extremely low in comparison to that of high-field systems, and no patient has found it disturbing. Thanks to the systems' high level of patient acceptance, all examinations—even those performed on children – have been successfully concluded.

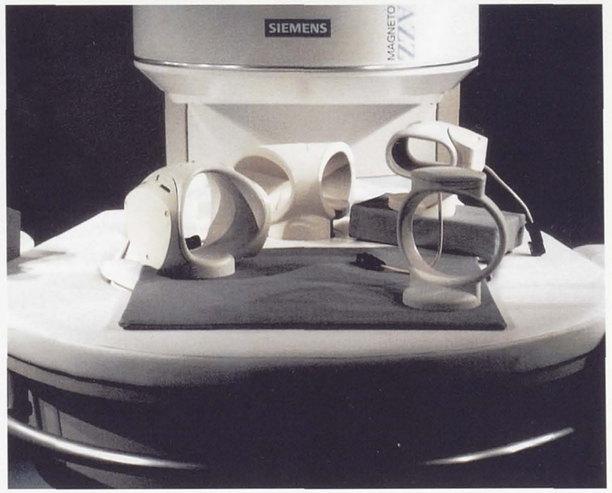
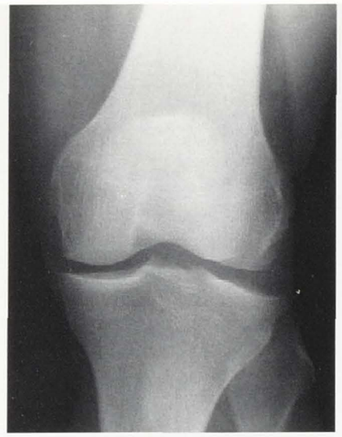
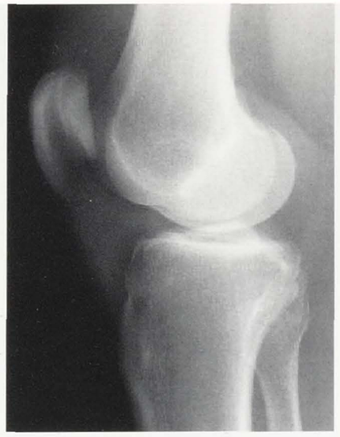


Fig. 1a:
Dedicated low-field system with coils

Fig. 1b:
Modular RF pavilion



2a



2b

Fig. 2:
Lateral fracture of the head of the tibia (radiologically occult, ascertained arthroscopically during operation)

a+b: X-ray exposures in two planes on the day of the accident: no identification of the fracture.

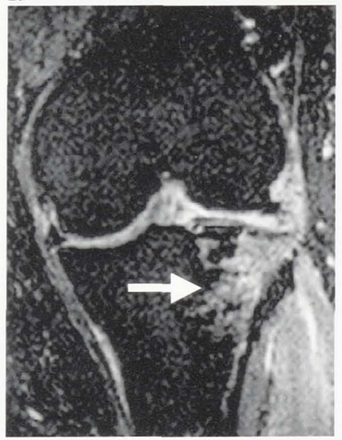
c: GRE-STIR coronal

d: SE T1 coronal

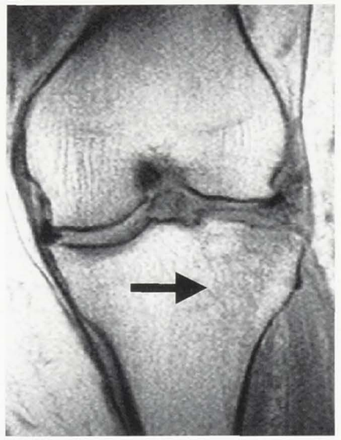
e: GRE-STIR sagittal

f: SET 1 sagittal: clear identification of the lateral fracture of the head of the tibia

g+h: X-ray exposures in two planes, subsequent to operation and insertion of screws into head of tibia



2c



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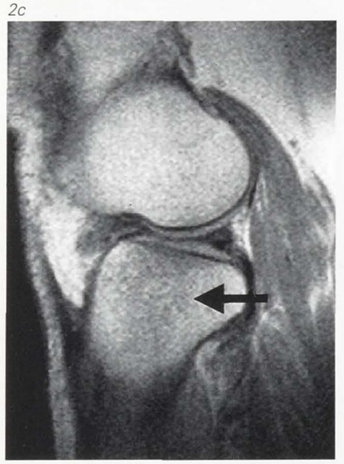

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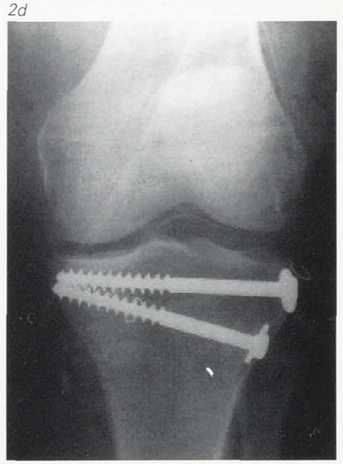

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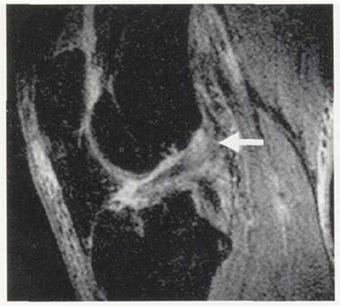


3a

3b

Fig. 3:
Osseous tear of the cruciate ligament in the vicinity of the femur

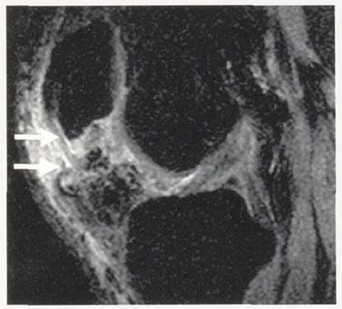
a: GRE-STIR sagittal

b: SE T1 sagittal

Fig. 4:
Rupture of the patellar tendon at the lower patellar pole

a: GRE-STIR sagittal

b: SE T1 sagittal



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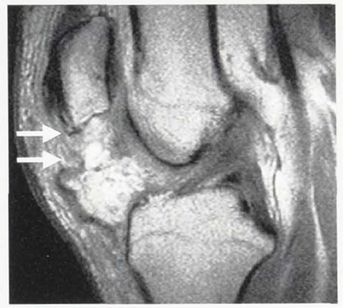


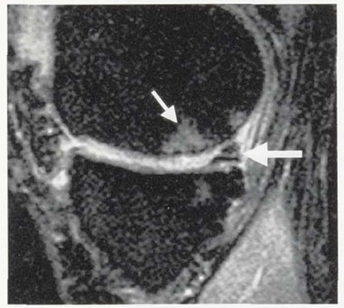
4b

Fig. 5:
Tear in the inner posterior horn of the meniscus (large arrow) and femoral marrow edema (small arrow)

a: GRE-STIR sagittal

b: SE T1 sagittal

c: SE T1 coronal



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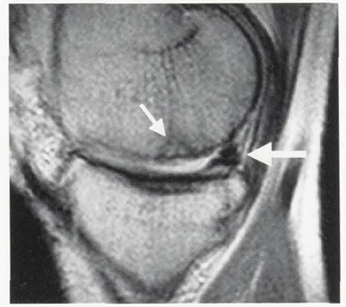

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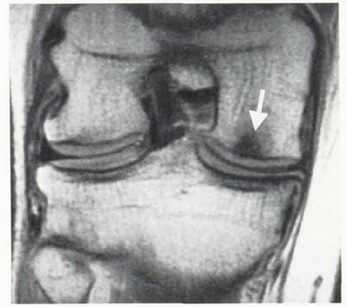

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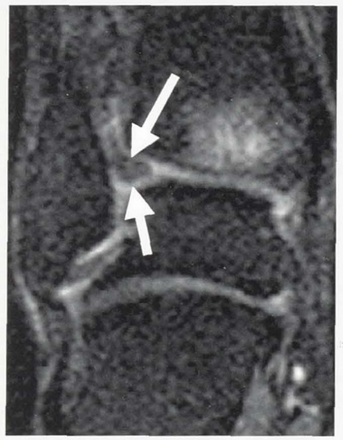

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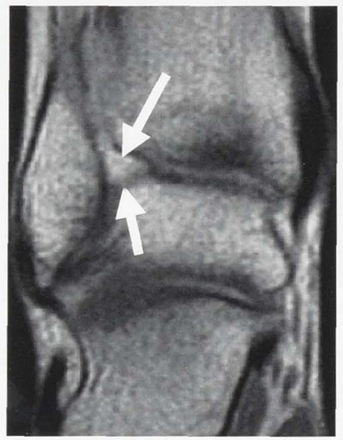

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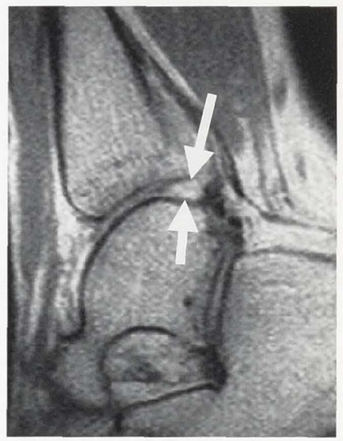

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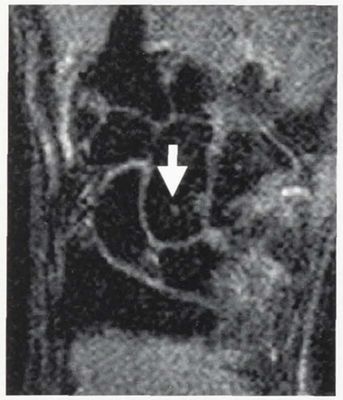

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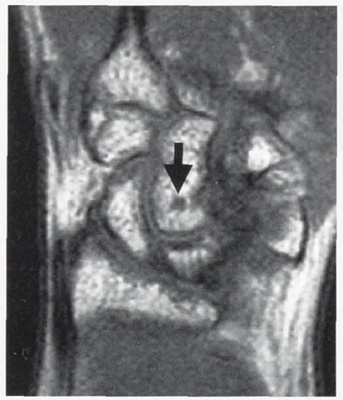

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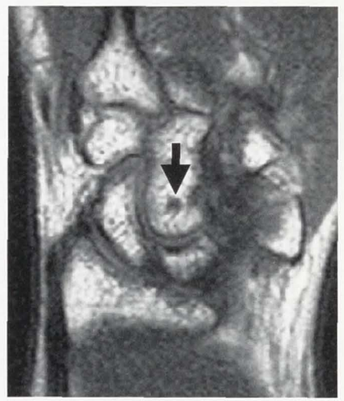

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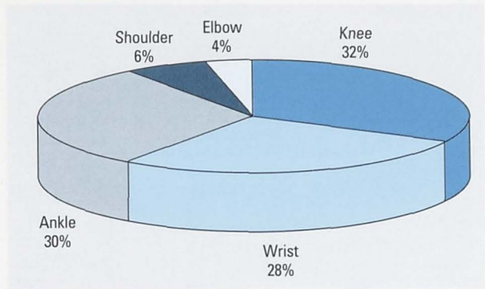

Fig. 9:
Distribution of the regions examined in 50 patients

Fig. 6:
Osteochondritis dissecans of the talus

a: GRE-STIR coronal

b: SE T1 coronal

c: SE T1 sagittal

Fig. 7:
Impingement of the ankle: impaction of fatty tissue in the joint cavity

a: GRE-STIR coronal

b: SE T1 coronal

c: SE T1 sagittal

Fig. 8:
Bone cyst

a: GRE-STIR coronal

b: SE T1 coronal (TR 510 ms/TE 22 ms)

c: SE T1 coronal (TR 300 ms/TE 22 ms)

Summary

A dedicated low-field system for joint diagnosis is useful for the acute diagnosis of traumatized joints and juxta-articular segments of the extremities, thus closing an important gap in diagnostic practice. Correct diagnosis in the acute phase makes it possible to begin suitable treatment at the earliest possible point.

Acknowledgments

We offer our warmest thanks to the following colleagues in the Department of Traumatology for their outstanding collegiality and cooperation: Dr. W. Franck, Priv. Doz. Dr. H. Richter, Priv. Doz. Dr. R. Stangl, Dr. W. Summa, and Department Head Professor Dr. F.F. Hennig.

Literature

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MAGNETOM Harmony/Symphony/Sonata

Peripheral CP Angio Array Coil* and "Floating Table"

- Automatic table movement to extend the FoV from above the level of the renal artery down to the vessels of the foot.
- Faster 3D CE MRA sequences to follow the bolus in the arterial phase.
- CP Peripheral Angio Array Coil to visualize the femoral and distal vessels in detail (voxel volume of 1µl).

Arteriosclerosis is a major concern for elderly populations in the developed countries, with a prevalence of 3% in individuals younger than 60 years and 20% in those 75 years or older.

Recent advances in fast sequences for gadolinium-enhanced three-dimensional (3D) magnetic resonance (MR) angiography have made it possible to acquire high-definition images of the arterial tree during the arterial phase using a gadolinium chelate bolus. These techniques have proved to be robust, accurate, and reproducible in clinical practice.

Siemens Panoramic Table contrast-enhanced (ce) MR Angiography combines the inherent advantages of ce 3D image acquisition and table movement, thus extending the scope of the examination beyond a single field of view; this enables rapid and comprehensive evaluation of the aorta and the vessels of the lower extremity. The automatic table motion is programmable for 32 different positions, thus allowing more flexibility in applications.

Siemens Medical Systems has also launched a new development in peripheral MR angiography, the CP Peripheral Angio array coil. The anatomically designed Peripheral Angio Array, with 8 CP elements, increases the S/N and spatial resolution in visualizing the femoral and distal vessels; it comes very close to the "gold standard" set by standard Digital Subtraction Angiography.

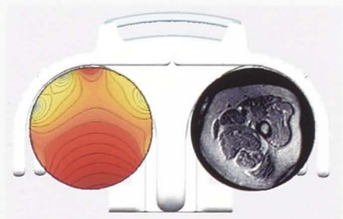
The upper elements are designed to increase the signal from femoral vessels, while the lower elements, with a smaller diameter and special design, increase the signal from popliteal and crural vessels. This coil can be combined with a body array coil (IPATM) to extend the FoV covering the abdominal aorta and peripheral vessels.

The examination is performed sequentially, with three unenhanced steps without contrast medium followed by three identical sequences subsequent to bolus injection. The table moves automatically between sequences to cover the anatomy from above the level of the renal artery to the vessels of the foot. To perform the sequence after bolus injection no additional shim is necessary. Thus reducing the total exam time. Online subtraction and automatic MIP almost completely eliminate the need for the operator to intervene in post-processing.

Versatility and Technique Peripheral CP Angio Array Coil:

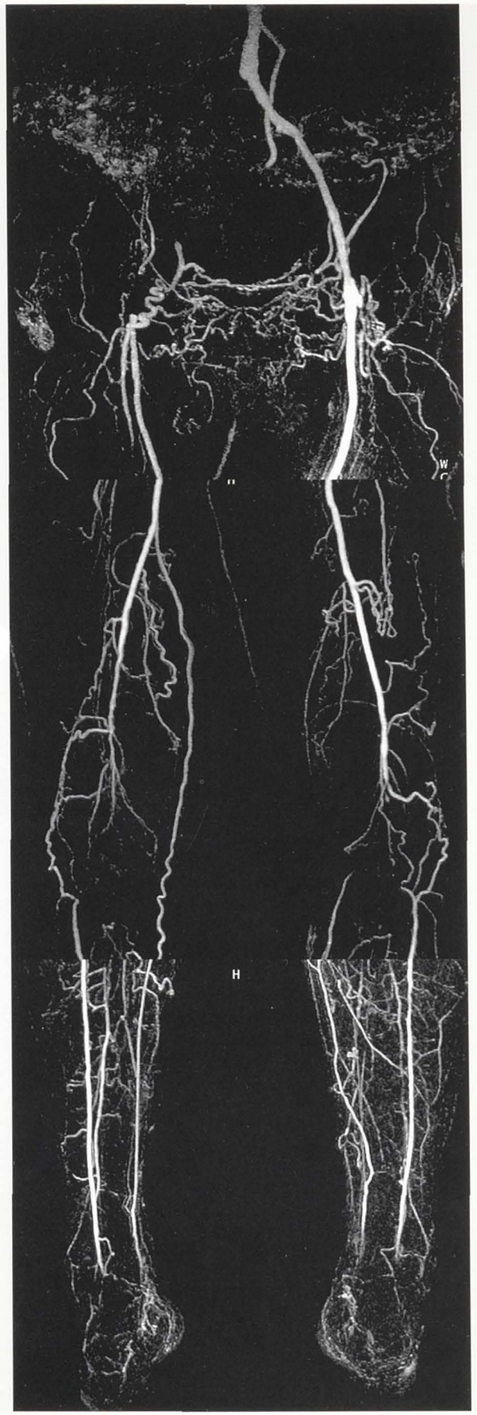
- Anatomically designed coil to increase signal from femoral and crural vessels
- Operates in conjunction with CP Spine Array and CP Body Array Coil (IPATM)
- CP no-tune receive coil to provide high SNR and allow high resolution (voxel volume of 1 µl)
- 4 CP pairs and 16 extremely low-noise integrated preamplifiers
- Intelligent combination of CP and Array technology to cover large FOV with high SNR (from above the level of the renal artery to the vessels of the foot)
- Integrated preamplifiers increase image quality and signal-to-noise ratio and eliminate degradation of the signal during transfer
- The no-tune coil saves even more time (no need for patient-specific tuning)
- High patient comfort
- Total length 970 mm
  Height 210 mm for thigh
  160 mm for lower leg
  Weight 6 kg

CP Peripheral Angio Array + CP Body Array (+ CP Spine Array Coil)



Upper level: Anterior & medial CP array elements cover the thigh vessels

Lower level: Smaller CP array elements are closer to the crural vessels and the vessels of the foot



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Contrast enhanced MRA of peripheral arteries with the automatic "floating table"; R. Janka, F. Fellner, M. Requardt, C. Fellner, H. Greess, W. Lang, W. Bautz; Röntgenpraxis 52 (1999), 15 – 18

MR Angiography in the Evaluation of Atherosclerotic Peripheral Vascular Disease; N. Rofsky; M. Adelman; Radiology 2000; 214: 325 - 338

** Currently the Peripheral CP Angio Array Coil is only available for the MAGNETOM Symphony*

Ralph Gritzbach, Product Manager MRease, Erlangen, Siemens Medical Engineering

:Standards simplify life MRease – MR Acquisition Console and Software:

At Siemens, we believe that users of medical technology should benefit from a uniform way of communicating with their systems.

That's why we developed our new viewing and filming software, *syngo*. *syngo* is more than just software; it is like an entire language, consisting of a few basic elements that can be mastered quickly and applied to all systems that speak *syngo*. *syngo* means that the workflow support with task cards and icons, can now be used for different acquisition consoles and modality-specific second consoles, thus creating a new, far-reaching standard.

How does MR fit into this new common language?

The new MR acquisition console, MRease, is one of these *syngo*-speaking systems. MR professionals have been involved from the very conception of MRease. The experience of our clinical users, coupled with our expertise in MR technology, enabled us to develop the unique combination of hardware and software. MRease optimizes clinical workflow by combining the advantages of standardized software with the flexible, custom-oriented solutions.

The result: increased throughput, with up to 55% fewer mouse clicks, and a reduction in exam time of up to 20%.

MRease Performance

The computer system includes:

- an industry-standard PC platform optimized for medical imaging – 512 MB RAM (expandable), 9 GB system hard-disk drive, separate hard-disk drive with 18 GB for image data
- 10 ms reconstruction time (256 matrix)
- online display of 10 images/s (512 matrix)
- 3D reconstruction with 2 online FFT at once
- high-resolution color 18" LCD flat screen monitor with 1280 x 1024 pixels
- image processor with 512 MB RAM with up to four 9 GB HD

Operation by just one click

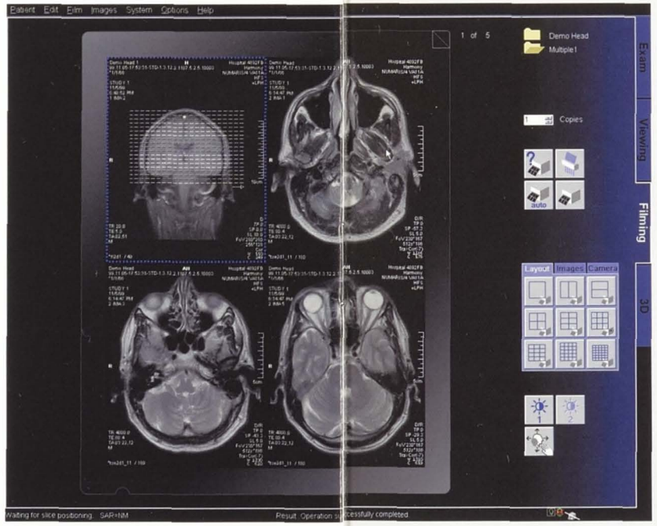
MRease extends the benefits of the unique Integrated Panoramic Array™ (IPA) coil concept with the functionality of Integrated Panoramic Positioning™ (IPP). Once the patient is positioned on the table and all necessary coils have been plugged in, both the appropriate coil elements and the graphically manipulated slices can be interactively selected using IPP. All it takes is a mouse click to change such frequently used parameters as slice thickness, number of slices, distance factor, and even phase oversampling.

One click to another world

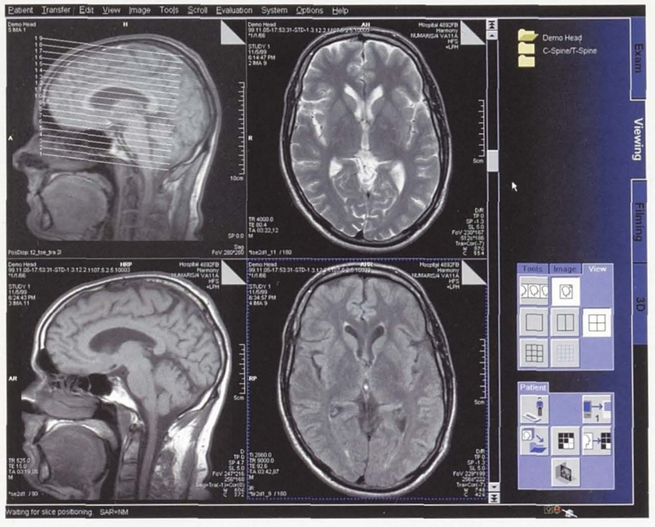
The new user interface is structured into five main task cards: examination, viewing, filming, 3D, and MR-specific post-processing. This concept allows parallel workflow and let you handle 9 patient datasets in different tasks—all of them just one click away.

Individualized Operation

The new ScanProgram concept realized with MRease can be customized to fit individual clinical requirements. Predefined ScanPrograms with an optimized set of parameters for daily routine are included.



Filming task card showing virtual film sheet



Viewing task card

Examination task card showing ScanProgram concept

MAGNETOM OPEN 1 Tesla* – A Vision is Born

Most people would agree that an open high-field system has been the ultimate goal of MR technology since its inception. While bore systems deliver the highest performance, it is clear that optimal patient comfort requires open systems. Openness allows for clearly better handling of orthopedic and pediatric patients, not to mention those with claustrophobia. Ultimately, greater patient comfort means higher patient throughput. And that is to everyone's advantage.

But it is no easy matter to equip an open system with a high-field-strength magnet. Given the increased mass of stronger magnets and the additional cooling and active shielding they require, it might have been easier to concentrate on an open middle-field system first. But we knew right from the start that the advantages a middle-field system might offer would not be convincing enough to justify development. As Robert Krieg from Siemens Product Planning Department says: "0.5 Tesla is a dead field strength." With the jump from 0.5 to 1.0 Tesla, though, you see performance double. It's no wonder everyone agrees: high-field MR really starts at 1 Tesla. 1 Tesla produces a significantly higher signal-to-noise ratio than middle-field systems.

Thanks to our close cooperation with Oxford Magnets, we have been able to optimize an open magnet arrangement that meets the specifications of our popular 1 Tesla short-bore system, MAGNETOM Harmony. The larger space created by an open system poses real challenges. But by pooling our resources and our collective know-how, we were able to merge the advantages of an open system with the high performance of a conventional 1 Tesla system. The result: the same high imaging quality of a MAGNETOM Harmony, but with all the advantages of an open system.

Siemens has conducted considerable research in ways to improve openness. For instance, to enhance the subjective experience of openness, short gradient coils are used in bore-type systems so that the outer edges of the magnet cover can be rounded off. In the Open High-Field magnet, patients can spread their arms out to the side and not touch anything. Depending on the application, the table can even be positioned diagonally, creating a feeling of even greater openness on one side.

As always, extensive customer focus groups have guided the development of our new open high-field system. Along with a clear desire for 1 Tesla field strength, high-field applications were at the top of the wish list (for example, peripheral MRA, diffusion, perfusion, BOLD Imaging). Customers also showed interest in the many other benefits they have come to expect and appreciate from the Siemens MAGNETOM family: from innovative software solutions like MRease and *syngo* to 3D simulations, IPA accessories, and cutting edge gradient technology – and our free-floating patient table, with software control, movable in two horizontal directions, in and out, left and right (thus permitting a variety of examinations on a single patient with no need to go into the system room for re-positioning). Siemens has gone to great lengths to integrate everything a radiologist's heart could desire. All the MAGNETOM family advantages at their optimized best!

Siemens knows its stuff when it comes to high-field MR systems. We continue to push our limits, not only surpassing our own already high engineering standards, but exceeding your expectations as well. In its time, MAGNETOM Vision was a revolutionary advance in MR technology; and the official introduction of our open high-field MR system at the end of this year is sure to change the course of MR history as well. Like all revolutionary visions, the 1 Tesla open system will make an unforgettable mark. It will set new standards and lead the way to a whole new field of possibilities.

Siemens 1 Tesla
WIP Open High-Field
Preliminary Specifications

Magnet	High Field
Manufacturer	Oxford Magnet Technology
Field Strength	1 Tesla
Type	Superconducting, actively shielded
Homogeneity	2 ppm Vrms @ 40 cm 1 ppm Vrms @ 30 cm
Weight	13 tons (30.000 lbs)
Fringe field (without shielding)	5m x 6m (16' x 19') (vertical x horizontal)
Patient opening	44 cm
Max. FoV	40 cm
Gradients	
Strength	> = 20 mT/m
Slew rate	> = 25
Rise time	< = 800 µsec
Table	
Width	80 cm wide
Movement?	Automatic table movement, controlled from console Horizontal Floating table
Applications	**MAGNETOM Harmony Performance**
Packages	MR Angiography, Peripheral MRA and moving table, BOLD Imaging, Perfusion, Diffusion, breath-hold abdominal imaging, Single-Shot EPI, Spectral Fat Sat, ...
RF Coils	**Equivalent to MAGNETOM Harmony**
Integrated Panoramic Array™ coil concept	CP Head, Neck, Spine, Body, Peripheral Array Coil,
Software	
	MRease Acquisition Console and Software, *syngo*-speaking

** The information about this product is being provided for planning purposes. The product requires 510 (k) review and is not commercially available in the U.S..*

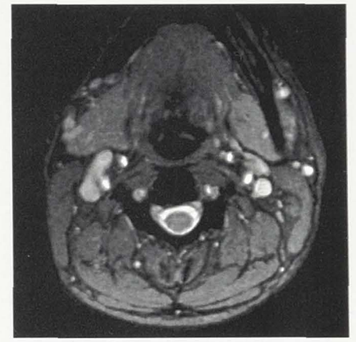


Fig. 1: Neck Coil
TR 900, TE 30, SL 3 mm

Fig. 2: Knee Coil
TR 1800, TE 18, SL 4 mm

Fig. 3: Head & Neck Coils
TR 450, TE 15, SL 4 mm

MAGNETOM Flash

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