



MAGNETOM Trio, A Tim System

I-class

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Order No.
A91MR-700-G9-51-7600
Printed in Germany
MC.MR-00700 PA 0308 POD

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MAGNETOM Trio

A Tim System

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Tim

is changing MRI forever.

Around the world, Tim (Total imaging matrix) technology has become the new standard in MRI. With more than 2000 installations, Tim is proving it every day, with excellent flexibility, accuracy and speed. Let Tim prove it to you, too.

Select exams not coils

[102×32]. Up to 102 seamlessly integrated matrix coil elements and up to 32 independent RF channels combined to create one Total imaging matrix. A matrix scalable to both the anatomy under examination and the individual patient size. This is how Tim redefines flexibility.

Local and total

Matrix coils unleash the high SNR only local coils provide. Extreme precision for single-organ exams up to whole-body exams. From 5 mm to 181 cm (6') FoV. Without coil or patient repositioning. For all applications. With up to 100% more SNR. This is how Tim redefines accuracy.

Parallel in all directions

Head to toe, front to back, and side to side for unlimited Parallel Imaging. Up to PAT 16. Even for double oblique slice orientation. Without restrictions in coverage. With the high SNR of standard matrix coils. This is how Tim redefines speed.



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- Tim – Total imaging matrix
- Industry's leading 3T magnet
- TQ-engine
- Workflow automation



Get ready for the next level of excellence: **MAGNETOM Trio meets T-class.**

Everything we do is focused on how to best meet the needs of clinicians, administrators and patients.

MAGNETOM Trio with T-class is based on Tim, the most innovative RF-technology integrated with a radically different Matrix coil concept. Truly, the world's leading advance in MRI.

MAGNETOM Trio with T-class is the only 3T with the power of Tim®, Total imaging matrix technology. For 3T that works hard and works fast. Tim makes 3T simple to use for all clinical applications and all body parts. It's available with up to 102 seamlessly integrated coils and up to 32 RF channels for ultra-fast scan times and high image resolution.

So, while MAGNETOM Trio with T-Class combines the industry's leading 3T magnet with a revolutionary matrix coil design, the real benefit is that clinicians can perform any MRI – from the most routine to the most challenging – quickly, easily and without compromise.

MAGNETOM Trio gives you:

- Strongest gradients for ultrafast scan times and high image resolution
- Significantly improved workflow by eliminating the need for patient repositioning and manual coil changes
- 32-channel 3T system for accelerations up to PAT 16
- Coverage up to 50cm FoV
- AudioComfort to reduce acoustic noise by up to 90%.

MAGNETOM Trio is helping leading institutions around the world develop new approaches to clinical care. MAGNETOM Trio with T-class is where the future is headed.

12-Channel Head Matrix Coil

MAGNETOM Trio delivers stunning resolution for imaging the deep brain structures in clinically relevant acquisition times thanks to the industry's leading 3T head coil and unique parallel imaging with GRAPPA.

50cm FoV

MAGNETOM Trio with 50cm FoV and Tim's unique flexible coil combination show you all you need to see at once. Because pathology does not stop at the end of the coil.

syngo TimCT

MAGNETOM Trio is ready for *syngo TimCT*. Run-offs become easier than ever. The patient is getting scanned while moving in the magnet. And you scan always at the center.

Functional MRI

MAGNETOM Trio brings you inline 3D fMRI. Technology leadership for your daily routine. Easy to perform, easier to interpret.



Tim – Total imaging matrix



Total imaging matrix technology. It's a whole new way to think about MR. Tim goes beyond incremental enhancements in magnet technology and gradient power to something radically different. A transforming technology that shifts the spotlight to a new and tremendously innovative RF system and matrix coil technology. A unique combination of features that enable a quantum leap forward with 102 coil elements and up to 32 RF channels. For pristine image quality. Acquisition speed that breaks new records. True whole-body coverage. Highest signal-to-noise ratio. Dramatically streamlined workflow. And flexibility that's virtually unlimited. Tim will open up new worlds of possibility.

Up to 102 seamlessly integrated coil elements with 8, 18 or 32 RF channels¹⁾

This unique combination of 102 coil elements can be connected to a large number of channels allowing for highest flexibility in the choice of examinations covering all clinical questions, without the need for coil changes or patient repositioning.

Customer's advantage:
Revolutionary flexibility –
Selects exams, not coils.



181 cm FoV. Whole Body at the highest quality

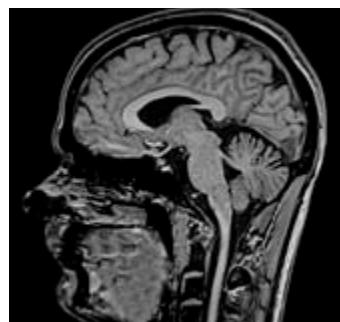
Tim puts it all together, for the very first time. It allows to exploit maximum SNR while enabling seamless, head-to-toe imaging with a total FoV of up to 181 cm²) at full surface coil quality. And all that without the need to reposition the patient, or to change a single coil, not even once. Tim or Total imaging matrix revolutionizes MRI and resolves typical limitations of local anatomy MR imaging.

Customer's advantage:
Revolutionary accuracy –
Local becomes total.

PAT. Unlimited

Tim provides total iPAT (integrated Parallel Acquisition Techniques) functionality, in all directions, throughout the entire FoV of 181 cm²). Siemens iPAT with Tim has highest signal-to-noise, provides two different PAT algorithms (mSENSE and GRAPPA) for Parallel Imaging, and integrates the time-saving AutoCalibration into a single scan. The new iPAT² enables extreme speed with acceleration factors up to 16 for Tim [102×32] and Tim [102×18], and acceleration factors up to 8 for Tim [102×8]³.

Customer's advantage:
Revolutionary speed –
Parallel in all directions



- 1) Tim [102×32] systems are equipped with 32 independent receiver channels, Tim [102×18] systems are equipped with 18 independent receiver channels and Tim [102×8] systems are equipped with 8 independent receiver channels.
- 2) Whole body coverage of 181 cm is optional and included in the Tim Whole Body Suite.
- 3) iPAT² is optional and included in the iPAT Extensions option.



3T Matrix coils

The new multi-element Matrix coil technology is an essential part supplementing the most innovative Total imaging matrix.

Matrix coils have multiple receive coil elements that are grouped in clusters. Each receive coil element is equipped with a low noise preamplifier to maximize signal-to-noise ratio. The Matrix coil technology includes an intelligent logic combining signals into various permutations and combinations to yield best SNR from the numerous coil elements.

The Head Matrix, Neck Matrix, Spine Matrix, and Body Matrix are examples of the new revolutionary multi-element Matrix coils. The Head Matrix, for example, has 12 receive coil elements. The receive coil elements are grouped in 4 clusters with 3 coil elements per cluster. Since clusters are working in the left-right direction, they do not compromise image quality. The signals from the receive coil elements within a cluster can be chosen from three different Matrix Coil Modes. Depending on the Matrix Coil Mode selected, the Head Matrix can be operated as a 4, 8 or 12 channel array.

Matrix Coil Mode

The Matrix Coil Mode is a user-selectable parameter determining the mode extracted from a cluster of receive coil elements.

There are three Matrix Coil Modes available:

- CP (Circularly Polarized)
- Dual
- Triple

The CP Mode is optimized to obtain maximum signal-to-noise (SNR) at the center of the region of interest. The Dual and Triple modes contain additional information which can be used to improve SNR in the periphery of the image and/or enable higher PAT factors.

The Matrix Coil Modes, which are automatically pre-selected by the system, can be best compared with the mono, stereo and quattro-reception known from audio receiver systems: While the mono signal already contains the audio information, the stereo or quattro signal adds spatial information.

CP Mode

With the CP Mode selected, the Head Matrix can be operated as a 4-element CP head array. There are 4 virtual CP elements. Each virtual CP element is generated from a cluster of 3 receive coil elements. This is the standard mode for non-parallel imaging. However, parallel imaging acceleration can be applied and is only limited by the number of virtual coil elements. As in conventional CP array coils, the CP Mode guarantees optimum SNR at the center of the image.

Dual Mode

With the Dual Mode selected, the Head Matrix can be operated as an 8-element CP head array. There are 8 virtual coil elements. The Dual Mode improves SNR and CNR (contrast-to-noise ratio), particularly in the periphery, as more coil elements receive signal. Higher PAT factors are available for speed, resolution, more slices or coverage, and image quality.

Triple Mode

With the Triple Mode selected, the Head Matrix can be operated as a 12-element head array. The Triple Mode further improves SNR and CNR, particularly in the periphery of the image, as more coil elements receive signal and are available for post-processing. In addition, higher PAT factors are available for speed, resolution, more slices or coverage, and image quality. This is the standard mode for parallel imaging and provides maximum ultra-fast acquisition as well as high resolution iPAT imaging.



In the past, the signals from independent receiver coils within an array were directly connected to independent receiver channels. The Matrix coil technology allows an unprecedented flexible and efficient use of receiver channels. The higher the Matrix Coil Mode, the more independent receiver channels per Matrix coil are

utilized, resulting in higher SNR and CNR, particularly in the periphery of the image. On one hand, it allows for a higher flexibility of iPAT as well as higher acceleration factors. On the other hand, even with the CP or Dual Mode selected, the SNR at the center of the region of interest is always optimal.

Superior Tim technology, revolutionary multi-element Matrix coils, excellent experience with iPAT and the intelligent logic available with the Coil Mode are collectively triggering a revolution in MR imaging.



Tim Application Suite

The Tim Application Suite has a complete range of clinically optimized examinations for all regions. Excellent head-to-toe imaging can be accomplished with the sequences and features included in this Application Suite. The Tim Application Suite – which exploits fully the benefits of Tim – is provided in standard on the MAGNETOM Trio, A Tim System.

There are nine dedicated application packages – all of them have been included as standard applications. All of them are based on the revolutionary Tim technology:

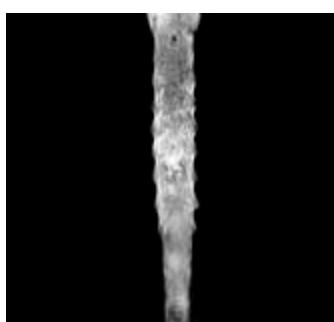
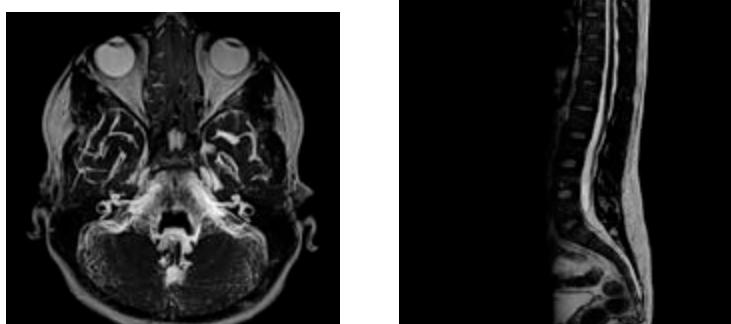
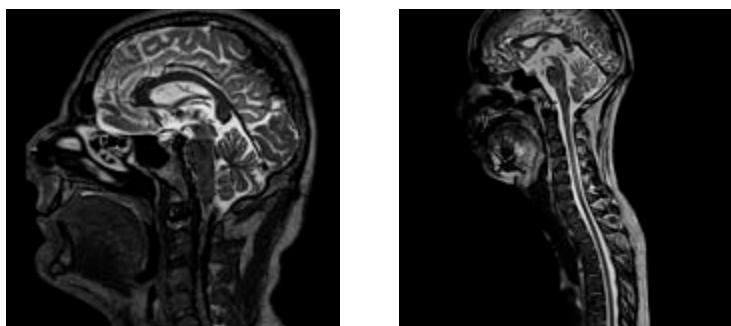
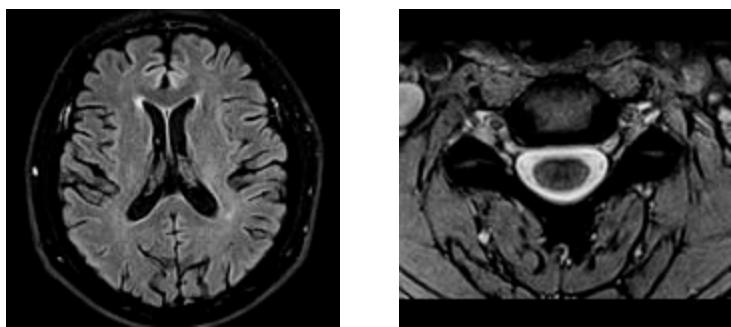
- Neuro Suite
- Angio Suite
- Cardiac Suite
- Body Suite
- Onco Suite
- Breast Suite
- Ortho Suite
- Pediatric Suite and
- Scientific Suite

Neuro Suite

The Neuro Suite is a part of the Tim Application Suite. Comprehensive head and spine examinations can be performed with dedicated programs that are optimized for clinical examinations. High resolution protocols and fast protocols for uncooperative patients are provided, as well as protocols optimized for pediatric applications. Neuro Suite also includes protocols for diffusion imaging, perfusion imaging, and fMRI.

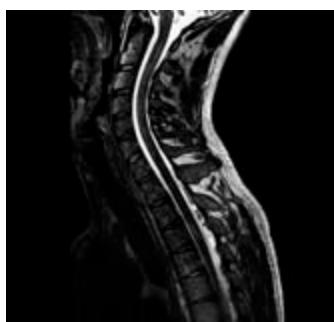
This package includes, for example:

- EPI sequences and protocols for diffusion imaging, perfusion imaging, and fMRI for advanced neuro applications. Diffusion weighted imaging is possible with up to 16 b-values in the orthogonal directions. In addition diffusion tensor imaging measurements can be done with multiple diffusion weightings and up to 12 directions
- 3D isotropic resolution volume imaging using T1 3D MPRAGE/3D FLASH, SPACE DarkFluid, T2 SPACE and 3D TSE
- T2-weighted high resolution 3D Restore protocols optimized for inner ear examinations
- Whole-spine protocols in multiple steps with softwarecontrolled table movement
- 2D and 3D MEDIC protocols for T2-weighted imaging, particularly for C-spine examinations in axial orientation where reproducibility is difficult due to CSF pulsations and blood flow artifacts
- 3D Myelo with 3D HASTE and 3D True-FISP for anatomical details
- Dynamic sacro-iliac joint imaging after contrast administration using a fast T1-weighted FLASH 2D sequence
- Spine diffusion protocols to differentiate osteoporosis versus tumor infiltration and post-radiotherapy changes versus residual tumor with PSIF sequence
- Precision filter for high spatial accuracy e.g. for neuro intra-operative imaging and stereotactic planning



Dedicated workflow and ease-of-use features

- Spine Matrix coil conveniently integrated in the patient table
- Examination of the whole spine or the whole central nervous system possible without patient or coil repositioning using Tim's Spine and Head Matrix coil flexible combination
- Software-controlled table movement



Angio Suite

The Angio Suite¹⁾ is also a part of the Tim Application Suite. Excellent MR Angiography can be performed to visualize arteries and veins with or without contrast agent.

This package includes, for example:

Contrast-enhanced MRA

- 3D contrast-enhanced MRA protocols with or without iPAT for head, neck, thorax, abdomen, peripheral regions with the shortest TR and TE. The strong gradients make it possible to separate the arterial phase from the venous phase. No venous contamination is seen due to the ultra-fast ce-MRA protocols.
- CareBolus functionality for excellent results. It supports accurate determination of the bolus arrival time and the "Stop and Continue" of the 3D ce-MRA protocol after the 2D bolus control scan.
- Excellent peripheral ce-MRA can be acquired with Tim's flexible coil combinations.



Non-contrast MRA and venography

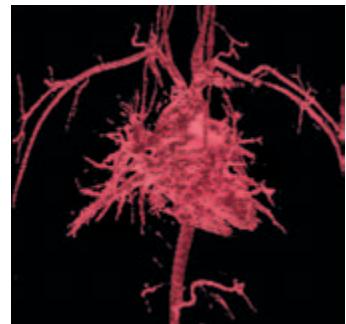
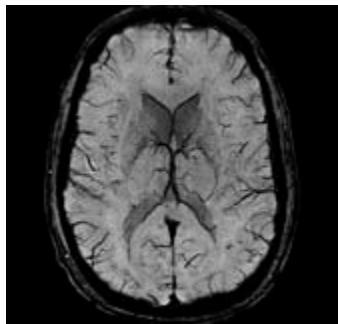
- 2D and 3D Time-of-Flight (ToF) protocols for MRA for the Circle of Willis, carotids, neck vessels, and breath-hold protocols for abdominal vessels
- Triggered 2D/3D ToF sequences for non-contrast MRA, particularly in the abdomen and the extremities
- 2D/3D Phase-Contrast
- MR venography with 2D/3D Time-of-Flight (ToF) and Phase-Contrast
- Tilted optimized non-saturating excitation (TONE) and MTC techniques for improved Contrast-to-Noise Ratio (CNR)
- Water-excitation 3D ToF protocol for better suppression of orbital fat



1) For triggering the PMU Wireless Physio Control option is required

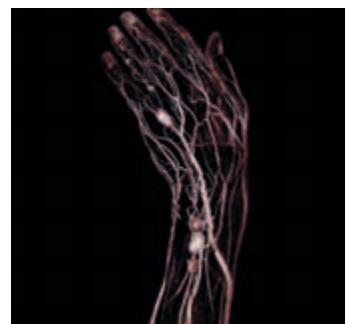
Image processing tools

- MIP, MinIP, and 3D SSD
- Inline MIP for immediate results
- Inline subtraction of pre- and post-contrast measurements
- Inline standard deviation maps of Phase-Contrast measurements for delineation of arteries and veins



Dedicated workflow and ease-of-use features

- Matrix coils provide flexibility to combine coil elements and have a large anatomical coverage
- Software-controlled table movement
- Inline Technology for immediate results without the need of an extra post-processing step



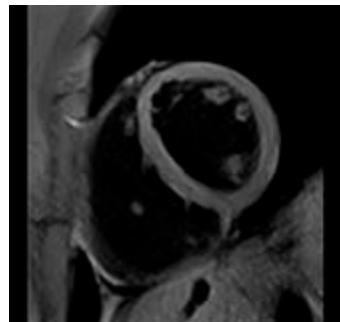
Cardiac Suite

The Cardiac Suite covers the complete application range from morphology, ventricular and valvular functions to tissue characterization, coronary imaging and angiography. Featuring *syngo BEAT* 2D. The utilization of triggering requires the optional PMU Bluetooth Physio Control.

This package includes, for example:

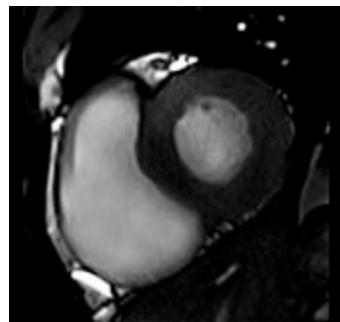
Cardiac view creation

- Fast acquisition of the basic cardiac views for further examination planning
- Cardiac scouting provides users with a step-by-step procedure for the visualization and planning of typical cardiac views, e.g. based on TrueFISP or Dark Blood TurboFLASH: short-axis, 4-chamber and 2-chamber views



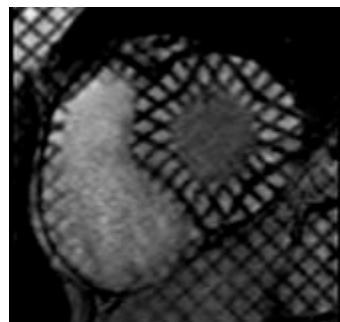
syngo BEAT

- Unique tool for optimization of cardiac acquisitions with a single mouse click
- E.g. 1 click change from FLASH to TrueFISP for easy contrast optimization



Morphology – heart and vessel structure and valve function with *syngo BEAT*

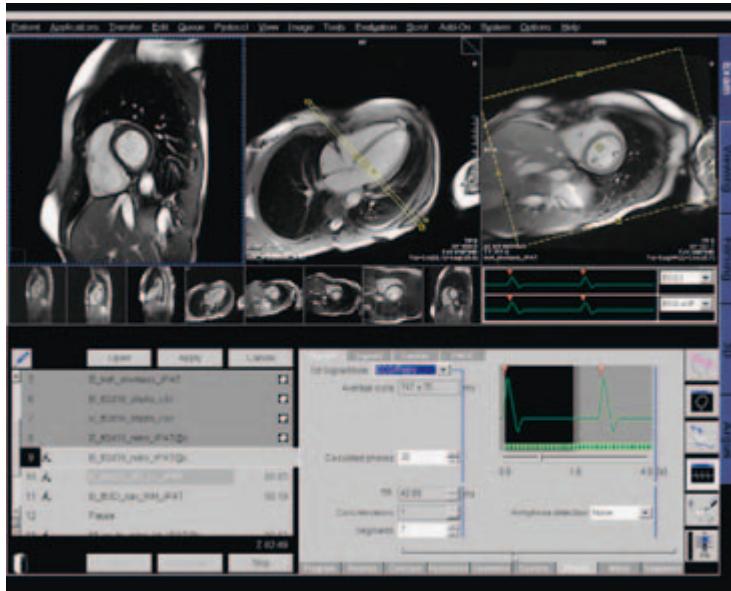
- Various breath-hold techniques for strong contrast between the blood and vascular structures. Dark Blood TSE and HASTE imaging are available for the structural evaluation of the cardio-thoracic anatomy, including vessels or heart valves. Standard cine techniques (FLASH) can also be used to visualize functions of the heart valves
- Optimized workflow with Drag & Drop recall (Phoenix), Scan Button and Copy Position



Ventricular function and wall motion with *syngo BEAT*

Tools for rapid evaluation of left or right ventricular function:

- Acquisition of a stack of short-axis slices (standard segmented FLASH, or advanced segmented TrueFISP)
- Automatic adjustment of the acquisition window to the current heart rate
- Use of the Inline ECG for graphical ECG triggering setup
- Retrospective gating with cine sequences (TrueFISP, FLASH)
- Protocols for coverage of the whole heart
- iPAT integration for highest temporal/spatial resolution



Tissue characterization with *syngo BEAT*

Protocols for high contrast and high resolution tissue characterization:

- Ultra-fast protocols for dynamic imaging, e.g. for 8 arbitrarily oriented slices per heart beat. These protocols provide multi-slice information for the assessment of coronary heart disease (TurboFLASH)
- Segmented IR TrueFISP/FLASH
- TI scout for optimization of contrast between tissues
- Protocols for pediatric examinations, stress imaging and plaque characterization

Body Suite

The Body Suite is dedicated for clinical body applications. Ultra-fast high resolution 2D and 3D protocols are provided for abdomen, pelvis, MR Colonography, MRCP, dynamic kidney, and MR Urography applications. Siemens-unique 2D PACE technique makes body imaging simple, allowing for multi-breath-hold examinations as well as free breathing during the scans. Motion artifacts are mostly reduced with the 2D PACE Inline Technology.

This package includes, for example:

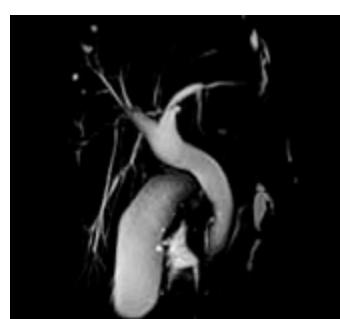
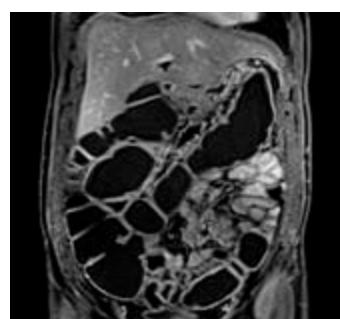
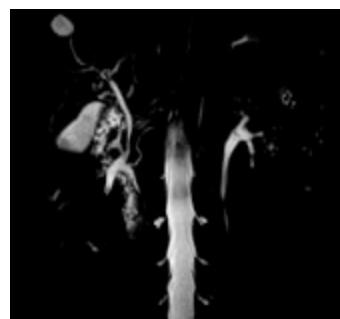
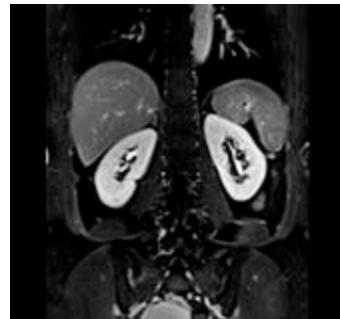
- Free breathing 2D PACE applications with 2D/3D HASTE (Restore) and 2D/3D TSE (Restore)
- Optimized fast single-shot HASTE protocols and high resolution 3D Restore protocols for MRCP and MR Urography examinations
- Excellent fat suppression protocols with Quick FatSat, STIR, HASTE, FLASH, SPAIR and 3D VIBE (in-phase/opposed-phase) protocols and multi-echo TSE
- DIXON – 2 point Dixon with 3D VIBE. The following contrasts can be obtained: in-phase, opposed phase, fat and water image
- Dynamic 3D VIBE protocols for best visualization of focal lesions with high spatial and temporal resolution

- dynaVIBE – Inline motion correction of multi-phase VIBE data sets of the abdomen for increased conspicuity of small lesions
- High resolution pelvic imaging (prostate, cervix) for tumor visualization with T2 SPACE
- Colonography bright lumen with T2-weighted TrueFISP and dark lumen with T1-weighted VIBE
- Dynamic volume examinations with 3D VIBE with high spatial and temporal resolution, available with 2D PACE (Prospective acquisition motion under control), beneficial for patients unable to hold their breath
- REVEAL (diffusion-weighted imaging for liver and whole body), prerequisite: Inline Diffusion
- REVEAL with 2D PACE for respiratory synchronized measurements

Dedicated workflow and ease-of-use features

- Matrix coils provide flexibility to combine coil elements and have a large anatomical coverage for both tall or large patients. Up to 3 Body Matrix* coils can be connected
- Inline Technology reduce post-processing steps
- 2D PACE eliminates the need for respiratory belt

* separate option



Onco Suite

MR imaging has the advantage of excellent soft tissue contrast, multi-planar capabilities and the possibility of selectively suppressing specific tissue e.g. fat or water. This helps in the detection of pathologies, particularly metastases. The Onco Suite features a collection of sequences as well as protocols and evaluation tools that guide through a detailed screening of clinical questions.

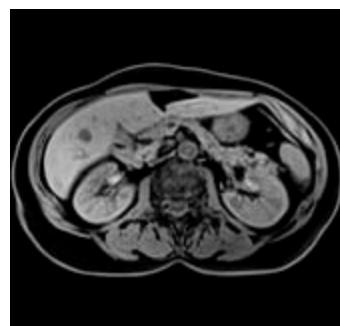
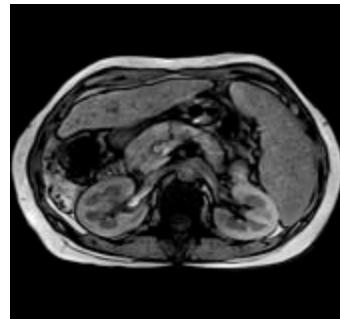
This package includes, for example:

- 3D VIBE, FLASH and STIR-TSE in-phase/opposed-phase protocols with a high sensitivity to metastases detection
- Dynamic imaging protocols for assessment of the kinetic behavior for lesion visualization and characterization, including dynaVIBE, a dynamic 3D VIBE with inline motion correction of multi phase data sets of the abdomen
- Quantitative evaluation and fast analysis of the data with colorized Wash-in, Wash-out, Time-To-Peak, Positive-Enhancement-Integral, MIP-time, and combination maps with Inline Technology or for offline calculation
- Display and analysis of the temporal behavior in selected regions of interest with the included MeanCurve post-processing application. This includes the capability of using additional datasets as a guide for defining regions of interest even faster and easier than before
- REVEAL (diffusion-weighted imaging for liver and whole body), prerequisite: Inline Diffusion
- Precision filter for high 3D spatial accuracy e.g. for radiotherapy planning

Dedicated workflow and ease-of-use features

- Matrix coils provide flexibility to combine coil elements and have a large anatomical coverage for both tall or large patients. Up to 3 Body Matrix* coils can be connected
- Inline Technology reduce post-processing steps
- 2D PACE eliminates the need for respiratory cushion

* separate option



Breast Suite

MRI has shown to be extremely sensitive for the visualization of breast lesions and MR can be a definitive exam for implant assessment.

High spatial and temporal resolution can be obtained in extremely short acquisition times (e.g. 1 minute) supported by iPAT (GRAPPA and SENSE) techniques.

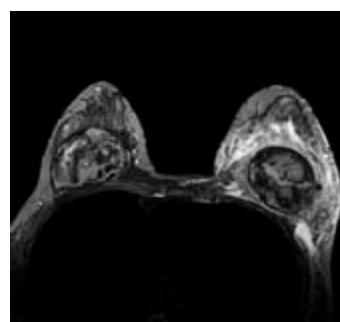
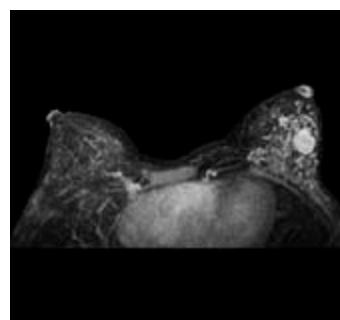
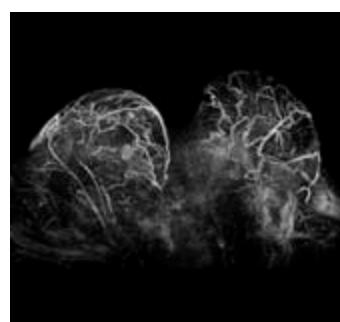
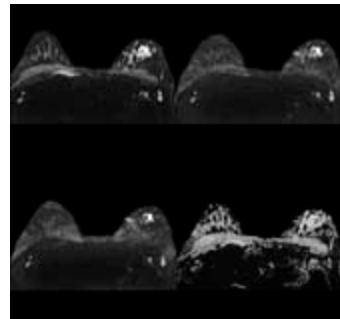
Excellent soft tissue characterization, multi-planar viewing capabilities and tailored techniques (e.g. fat suppression and water excitation) allow fast, easy and reproducible evaluation of breast MR examinations.

This package includes, for example:

- High resolution 2D protocols for morphology
- High resolution 3D protocols for contiguous coverage of both breasts simultaneously
- REVEAL (diffusion weighted imaging for the breast) with 2D PACE for respiratory synchronized measurements, prerequisite: Inline Diffusion
- Interventional procedure protocols (needle/vacuum/wire localization)
- Implant assessment protocols
- Silicone detection used to suppress the silicone signal if the tissue is examined, or used to enhance it if leakage of implants shall be detected
- Automated and manual frequency adjustment
- SPAIR – robust fat sat (robust fat suppression using a frequency selective inversion pulse)
- DIXON – 2 point Dixon with 3D VIBE. The following contrasts can be obtained: in-phase, opposed phase, fat and water image
- iPAT for increased speed and resolution

Siemens Technique: VIEWS (Volume Imaging with Enhanced Water Signal)

- Bilateral – both breasts are scanned simultaneously
- Axial – ductal paths can be directly visualized
- Fat-saturated or water stimulated – fat impedes clinical analysis and requires suppression
- 3D – utilizing the full potential of MRI
- Near isotropic – same dimensions in all directions
- Sub-millimeter voxels – high resolution for great morphological analyses
- Excellent reconstruction in any plane including RADIANT (ultra-sound like reconstruction around the nipple)

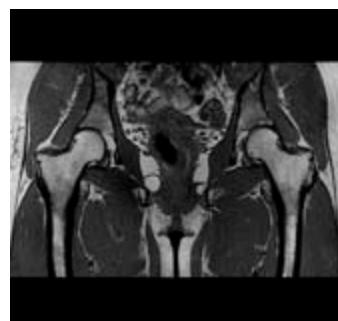
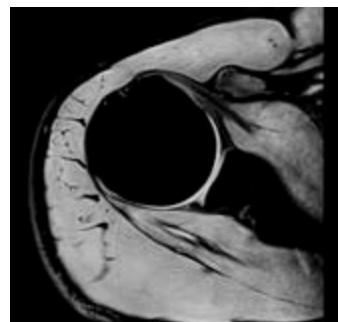


Ortho Suite

The Ortho Suite is a comprehensive collection of protocols for joint imaging including the spine. Avascular necrosis and internal derangements may benefit from MR. Also in case of tumors and infections, a large amount of additional information can be acquired using the protocols provided as standard in this suite.

This package includes, for example:

- 2D TSE protocols for PD, T1, and T2-weighted contrast with high in-plane resolution and thin slices
- 3D MEDIC, 3D TrueFISP protocols with water excitation for T2-weighted imaging with high in-plane resolution and thin slices
- High resolution 3D VIBE protocols for MR Arthrography (knee, shoulder and hip)
- 3D MEDIC, 3D TrueFISP, 3D VIBE protocols with Water Excitation having high isotropic resolution optimized for 3D post-processing
- T2 SPACE and PD SPACE, 3D imaging with high isotropic resolution optimized for post-processing
- Whole-spine, single-step and multi-step protocols
- Excellent fat suppression in offcenter positions, e.g. in the shoulder due to high magnet homogeneity
- Dynamic TMJ protocol (different joint positions)
- Dynamic ilio-sacral joint protocol for contrast dynamics
- Susceptibility-insensitive protocols
- Multi Echo SE sequence with up to 32 echoes for T2 time mapping



Pediatric Suite

Tissue relaxation times in pediatrics¹⁾ are very different compared to those of adults. The reasons for these differences are: developing tissues, body size, faster heart rates and compliance with breath-hold commands. The Pediatric Suite provides dedicated protocols with optimized contrasts for pediatric imaging by age groups, e.g. available for tumors, malformations and epilepsy in the brain, cardiac morphology as well as functional imaging and contrast-enhanced MR Angiography.

This package includes, for example:



Neuro

- Head protocols divided according to age groups and providing best contrast-to-noise ratio with optimized parameters, e.g. protocols for under 6 months old infants¹⁾, protocols for infants¹⁾ between 6 months and one year, protocols for toddlers between one and two years of age
- Excellent practice protocols from leading pediatric imaging centers for brain and spine
- Excellent T1-weighted contrast with optimized TR, TE and flip angles
- Protocols with MTC pulse for post-contrast T1-weighted imaging that provides excellent contrast-to-noise ratio resulting in improved conspicuity of lesions/pathologies

Cardiovascular

- Cardiac morphology protocols according to age groups, optimized for a small FoV and faster heart rates in congenital heart diseases (CHD)
- Imaging protocols for ventricular function as well as valvular and septal defects
- ce-MRA as an adjuvant in the assessment of CHD and vasculature

1) The safety of imaging infants has not been established

Scientific Suite

The Scientific Suite supports scientific users by providing easy access to application-specific data for further processing and advanced image calculus.

This package includes, for example:

- Support of USB Memory sticks
- Access to file system via a secure and comfortable File Browser
- Anonymization of patient data
- Easy creation of AVIs and screen snapshots to include in presentations or teaching videos
- Export of tables, statistics and signal time courses to communal exchange formats like e.g. tabulated text files (MeanCurve, Spectroscopy evaluation, DTI evaluation)
- Advanced image calculus including T2 and T1 time calculation, addition, subtraction, multiplication, division, log and integration of images

Sequences

Spin Echo family of sequences

- Spin Echo (SE) – Single, Double and Multi Echo (up to 32 echoes); Inversion Recovery (IR)
- 2D/3D Turbo Spin Echo (TSE) – Restore technique for shorter TR times while maintaining excellent T2 contrast; TurboIR: Inversion Recovery for STIR, DarkFluid T1 and T2, TrueIR; Echo Sharing for dual-contrast TSE
- 2D/3D HASTE (Half-Fourier Acquisition with Single Shot Turbo Spin Echo) – Inversion Recovery for STIR and DarkFluid contrast;
- SPACE for 3D imaging with high isotropic resolution with T1, T2, PD, and DarkFluid contrast

Gradient Echo family of sequences

- 2D/3D FLASH (spoiled GRE) – dual echo for in-/opposed phase imaging
- 3D VIBE (Volume Interpolated Breath-hold Examination) – quick fat saturation; double echo for in-phase/opposed phase 3D imaging; DynaVIBE: Inline 3D elastic motion correction for multi phase data sets of the abdomen; Inline Breast Evaluation

- 2D/3D MEDIC (Multi Echo Data Image Combination) for high resolution T2 weighted orthopedic imaging and excellent contrast
- 2D/3D TurboFLASH – 3D MPRAGE; single shot T1 weighted imaging e.g. for abdominal imaging during free breathing
- 3D GRE for field mapping
- 2D/3D FISP (Fast Imaging with Steady State Precession)
- 2D/3D PSIF – PSIF Diffusion
- Echo Planar Imaging (EPI) – diffusion weighted; single shot SE and FID e.g. for BOLD imaging and Perfusion weighted imaging; 2D/3D Segmented EPI (SE and FID)
- 2D/3D TrueFISP – Shared Phases Real-time TrueFISP (w/o ECG gating)
- ce-MRA sequence with Inline subtraction and Inline MIP
- 2D/3D Time-of-Flight (ToF) Angiography – single slab and multi slab; triggered and segmented¹⁾
- 2D/3D Phase Contrast Angiography – multiple velocity encoding; triggered¹⁾
- syngo BEAT Tool¹⁾ – TrueFISP segmented; 2D/3D FLASH segmented; Magnetization-prepared TrueFISP (IR, SR, FS); IR TI scout; Retrogating

1) For triggering the PMU wireless Physio Control option is required



Tim Application Suite: Acquisition and Reconstruction Techniques

- 1D/2D PACE (Prospective Acquisition CorrEction)
- Whisper Mode for scanning with reduced noise; beneficial for children, non-cooperative, or anxious patients
- LOTA (Long Term Data Averaging) technique for motion and flow artifact reduction without increasing scan time
- Elliptical scanning reduces scan time for 3D imaging
- Selectable centric elliptical phase reordering via the user interface
- Inversion Recovery to nullify the signal of fat, fluid or any other tissue
- True Inversion Recovery to obtain strong T1-weighted contrast
- Dark Blood inversion recovery technique that nulls fluid blood signal

- Saturation Recovery for 2D TurboFLASH, gradient echo, and T1-weighted 3D TurboFLASH with short scan time (e.g. MPRAGE)
- Presaturation Technique. RF saturation pulses to suppress flow and motion artifacts. Up to six saturation bands may be positioned in any orientation
- Tracking SAT Bands maintain constant saturation of venous and/or arterial blood flow, e.g. for 2D/3D sequential MRA
- Fat Saturation. Additional frequency selective RF pulses, used to suppress bright signal from fatty tissue. Two selectable modes: weak, strong
- Water Saturation. All sequences used for fat saturation can also be used to suppress the water signal
- Quick FatSat
- SPAIR: robust fat suppression for body imaging using a frequency selective inversion pulse
- Fat Excitation. Spectral selective RF pulses for exclusive fat excitation
- Water Excitation. Spectral selective RF pulses for exclusive water excitation
- Silicone detection for breast examinations
- MTC (Magnetization Transfer Contrast). Off-resonance RF pulses to suppress signal from certain tissues, thus enhancing the contrast. Used e.g. in MRA
- TONE (Tilted Optimized Non-saturating Excitation). Variable excitation flip angle to compensate inflow saturation effects in 3D MRA. TONE pulse selectable depending on the desired flow direction and speed
- GMR (Gradient Motion Rephasing). Sequences with additional bipolar gradient pulses, permitting effective reduction of flow artifacts
- Freely adjustable receiver bandwidth, permitting studies with increased signal-to-noise ratio
- Freely adjustable flip angle. Optimized RF pulses for image contrast enhancement and increased signal-to-noise ratio
- PAT averaging for motion artifact suppression using Self-Calibration

Highlights

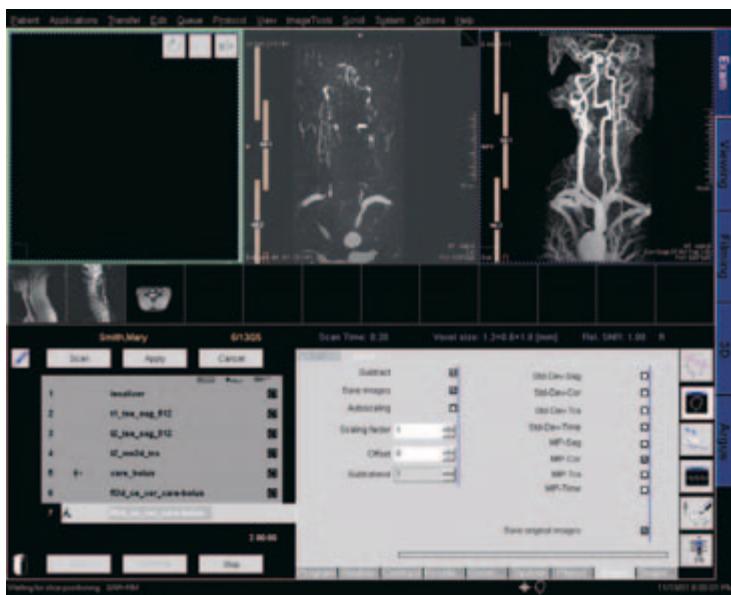
- syngo MR – the cross-modality intuitive user interface
- syngo Scan Assistant
- Inline Technology
- 1D/2D PACE Inline motion correction
- Advanced workflow features such as image stamps, Inline display, Inline movie functionality
- iPAT – high-performance and flexible Parallel Imaging. Tim and its Matrix coils are combined with the most innovative implementation of PAT for highest speed and resolution
- The Tim Assistant and the Intelligent Coil Control help maximize PAT factors according to the selected coils to achieve exemplary image quality in the shortest time
- Phoenix functionality for reproducible image quality and for benefiting from other MAGNETOM users sharing their protocols
- scan@center enables maximum image quality by automatically moving the table into the magnet isocenter with every scan
- Argus viewer for reviewing cine studies
- Report Viewer for DICOM structured reports including report editing
- Dynamic Analysis for addition, subtraction, division, standard deviation, calculations of ADC maps, T1 and T2 values, TTP, t-Test etc.
- Image Filter
- 3D post-processing MPR, MIP, MinIP, SSD
- Software-controlled patient table movement for a total coverage of 154 cm (standard)
- Flexible film formats and paper print
- Data storage of images and cine avi files on CD/DVD with DICOM viewer as the viewing tool

Inline Technology – Processing Instead of Post-processing

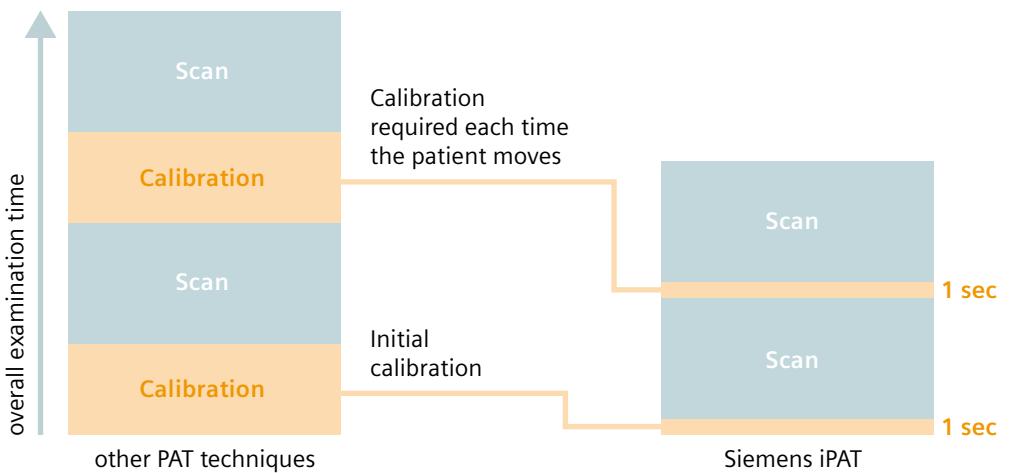
Inline Technology helps to streamline the clinical workflow by automating mundane post-processing steps before image viewing. See the clinical results immediately.

Examples are:

- Automatic subtraction of images, e.g. pre- and postcontrast enhancements
- Automatic on-the-fly calculation of standard deviation, for better differentiation of arterial and venous phases
- MIP on-the-fly, i.e. MR Angiography with



- automatic image subtraction and following MIP in three orthogonal planes, stored as a separate study
- Prospective motion correction (1D and 2D PACE) on-the-fly
 - Automatic diffusion and perfusion imaging
 - Automatic soft tissue evaluation



iPAT (Integrated Parallel Acquisition Techniques)

- iPAT is the Siemens Parallel Imaging solution. It is fully integrated.
- PAT factors up to 4 are implemented in the Tim Application Suite
- Two algorithms – mSENSE and GRAPPA – included for maximum quality for all applications
- Integrated AutoCalibration includes an immediate reference (calibration) scan to additionally save on total scan time
- TurboCalibration uses a separate measurement directly before the actual measurement. Images measured using TurboCalibration are characterized by reduced PAT artifacts. TurboCalibration is only used in conjunction with GRAPPA
- PAT averaging for motion artifact suppression using Self-Calibration
- iPAT is compatible with all relevant sequence techniques (e.g. SE, TSE, Restore, SPACE, MEDIC, TIRM DarkFluid, HASTE, EPI, MPRAGE, 3D VIBE, FLASH, TrueFISP, TurboFLASH, FLASH Phase Contrast, etc)
- iPAT is compatible with all Matrix coils, all array coils, as well as coil combinations
- Tim Assistant facilitates optimized iPAT settings

Higher speed and temporal resolution can be used for:

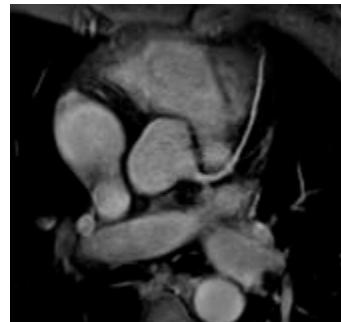
- Improved image resolution
- Improved image quality due to reduced artifacts
- More slices and coverage in the same breath-hold

1D PACE Fast Navigator

Prospective Acquisition CorrEction

Quick and easy acquisition control,
e.g. for cardiac imaging

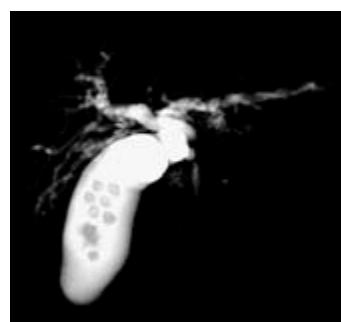
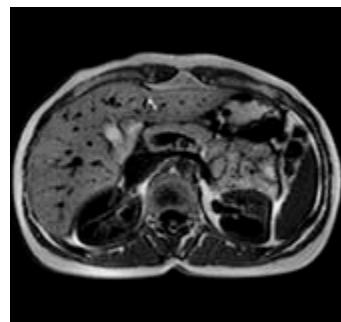
- Allows examination of patients
with free breathing



2D PACE Precise Motion Correction

New robust pattern matching to detect
and correct respiratory motion of the
heart, liver, etc.

- Significantly increased image quality
- Improved security in the diagnosis of
diseases in moving organs and precise
slice registration for multi breath-hold
studies
- Data acquisition during free breathing
for high resolution 2D and 3D examina-
tions



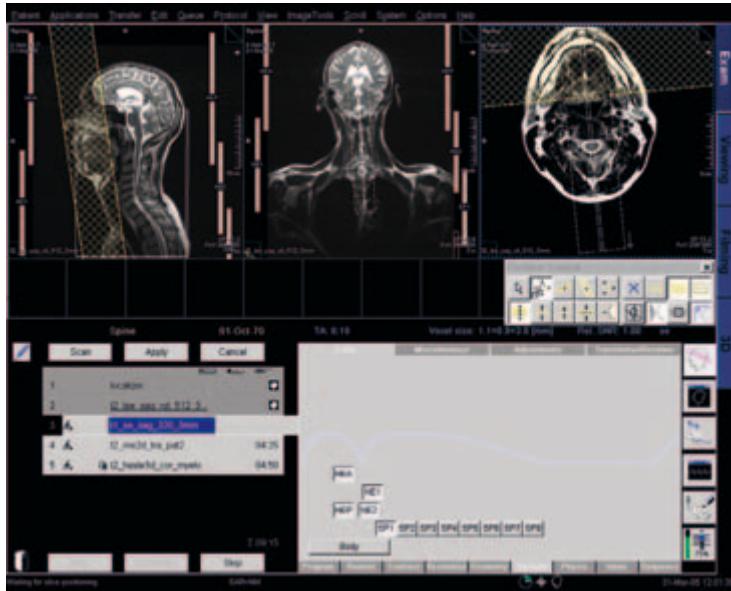
Tim – Matrix Coils and RF Technology

One of the major benefits of the revolutionary Total imaging matrix is that it optimizes coil positioning and virtually eliminates coil changing times.

RF Receiver Technology

The MAGNETOM Trio, A Tim System equipped with Tim facilitates the integration of 102 coil elements¹⁾ within one examination.

Nine coil connectors integrated in the patient table enable the simultaneous use of a large number of coils. All coil elements of all connected coils can be flexibly selected for each scan.



Intelligent Coil Control

- Automatic detection of the exact coil position on the patient table
- What you see is what you get: graphical visualization of coils at their current position within the user interface
- Choice of coil setting via software buttons at the *syngo* Acquisition Workplace
- Storage of coil settings within the protocols and adaptation when the protocol is recalled
- AutoCoil Select for dynamic, automatic or interactive selection of the coil elements within the Field of View

Additional benefits

- No coil changing with multi-exam studies
- All coils are time-saving "no-tune" coils
- Low-noise preamplifiers

1) depending on system configuration

3T Matrix coils

The multi-element Matrix coil technology is an essential part supplementing the Total imaging matrix.

It is the next generation IPA (Integrated Panoramic Array) technology from Siemens. With new advances in MR imaging, the IPA coil technology evolved into the Matrix coil technology. The Matrix coil design has an intelligent logic that combines signals in various permutations and combinations to yield best SNR from the numerous coil elements.

The following 3T Matrix coils are standard:

- Head Matrix coil 4-channel CP Mode, 8-channel Dual Mode, 12-channel Triple Mode
- Neck Matrix coil 2-channel CP Mode, 4-channel Dual Mode, 4-channel Triple Mode
- Spine Matrix coil 8-channel CP Mode, 16-channel Dual Mode, 24-channel Triple Mode



The following 3T Matrix coils are optional:

- Body Matrix coil 2-channel CP Mode, 4-channel Dual Mode, 6-channel Triple Mode (up to 4 Body Matrix coils can be utilized simultaneously)
- PA Matrix coil (Peripheral Angio Matrix) 12-channel CP Mode, 24-channel Dual Mode, 24-channel Triple Mode



> For further information refer to the coil appendices.



Integrated CP Body Coil

Integrated whole-body coil system

- No tune transmit/receive coil with 16 rungs
- Circularly polarized (CP)
- Optimized RF efficiency and signal-to-noise-ratio (SNR)

Additional RF Coils

The following **additional** RF coils are available:

- 4-Channel Breast Array coil
- 7-Channel Breast coil
- 4-Channel Shoulder Array coil
- 8-Channel Knee Array coil
- 8-Channel Wrist Coil
- 8-Channel Foot – Ankle coil
- Endorectal coil
- CP Extremity coil
- CP Wrist coil
- CP Head coil
- 4-Channel Large Flex coil
- 4-Channel Small Flex coil
- Large Loop coil
- Medium Loop coil
- Small Loop coil

> For further information refer to the coil appendices.



Digital Signal Processing System

- Compact air cooled amplifier
- Digital quadrature demodulation
- Digital filtering
- Receiver with high dynamic range without adjustments

Transmitter path	Frequency stability (5 min)	$\pm 2 \times 10^{-10}$
	Frequency control	32 bits (0.03 Hz)
	Phase control	16 bits (0.006 degrees)
Transmit amplifier	Transmit amplitude	16 bit control 50 ns resolution
	Gain stability (5 min)	≤ 0.1 dB (low signal path) ≤ 0.15 dB (power amplifier)
Receive path	Extremely compact water-cooled	
	Transmit amplifier bandwidth	800 kHz
	Peak power	35 kW
	Receiver bandwidth	500 – 1 MHz (for each channel)
	Receiver signal resolution	32 bits
	Number of independent receiver channels	8/18/32
	Sampling rate (Sampling resolution)	10 MHz (100 ns)
	Preamplifier noise figure	≤ 0.5 dB
	Total gain	31 dB / 46 dB with automatic control
	Dynamic range	135 dB instantaneous at receiver 142 dB with automatic control



Tim – Workflow and Patient Handling

Tim ensures increased patient comfort and optimized workflow efficiency.

- Only one patient setup, no repositioning, no changing of coils
- Ultra-light weight coils
- Imaging with optimized surface coil quality
- Remote table move
- Feet-first examinations for many applications

The majority of applications can be performed in the feet first position, e.g. cardiac, liver, upper abdomen, pelvis, colonography, body angio, reducing the level of anxiety experienced by highly claustrophobic patients.

The scan range of 181 cm¹⁾ allows for whole body examinations with full usage of the surface coils, however, without the need for patient repositioning. This saves time without compromising image quality.

Patient Table

Free-floating table: Free foot room for the attending staff and better access to the patient (cantilevered table design)

Table extends approx 50 cm beyond the back of the system for additional patient access¹⁾

Removable tabletop and trolley (optional)

Patient Positioning Aids

Standard set of cushions for comfortable and stable patient positioning together with safety straps.

Additional positioning supports (optional)

- Set of vacuum cushions (large, medium, small) with vacuum pump
- Cushions filled with gel for improved fat saturation

Patient Comfort Facilities

Facilities at the tableside control unit and at the *syngo Acquisition Workplace*

- In-bore lighting (3 levels)
- In-bore ventilation (3 levels)
- In-bore intercom via loudspeaker, microphone and earphones
- Look-out mirror 90°

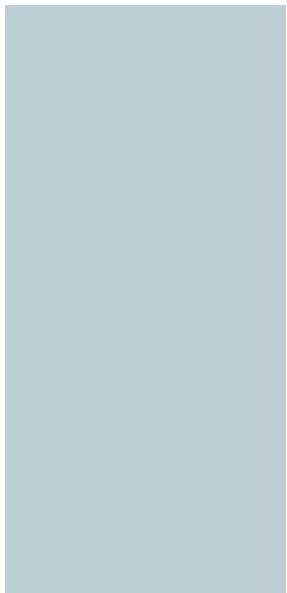
Patient Table

Max. patient weight (including vertical movement)	250 kg	
Max. scan range	140 cm, opt. 181 cm ¹	
Vertical table movement	Range	57 – 100 cm
	Max. speed	10 cm/s
Longitudinal table movement	Max. range	268.0 cm
	Max. speed	20 cm/s

1) With Tim Whole Body Suite option.

Tableside Control Units

Two ergonomically designed units integrated into the front covers (one on each side of the patient tunnel)



Controls

- Table up/down
 - Table in/out in 2 speed levels
 - Table stop
 - Laser light localizer
-
- Automatic transfer to isocenter
 - Home position (auto transfer)
 - Ventilation within the patient tunnel (adjustable in 3 levels)
 - Lighting within the patient tunnel (adjustable in 3 levels)
 - Scan start, scan stop
 - Volume of speaker and headphones in examination room for external audio system

Table functions can also be controlled via software from the *syngo* Acquisition Workplace

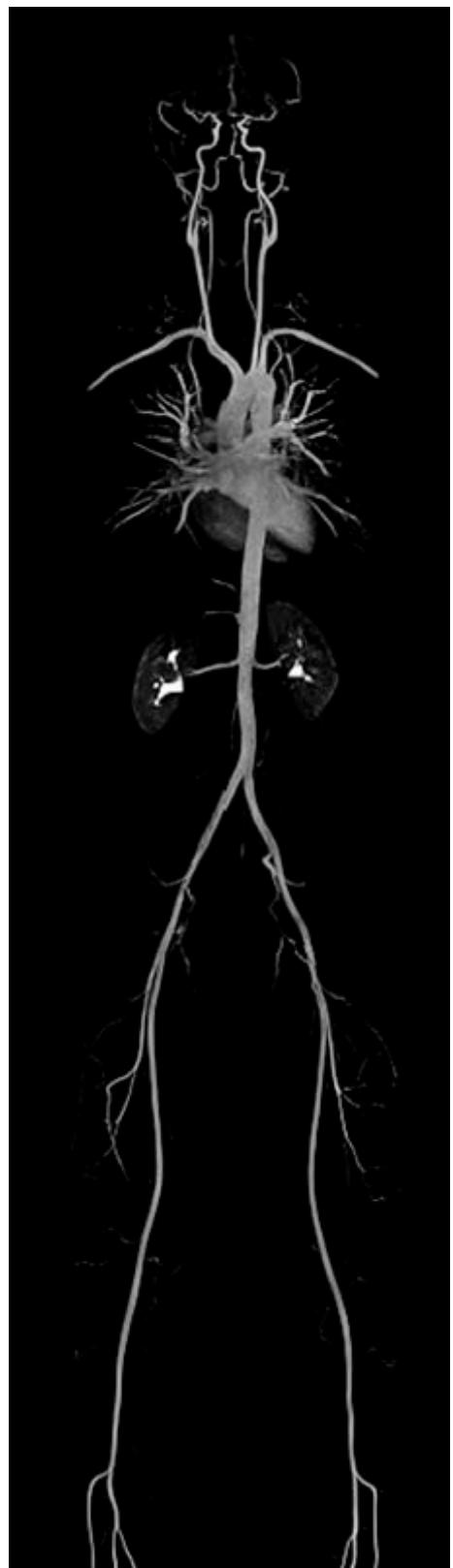
Patient Communication

Assistance call via squeeze-bulb for the patient

Ergonomically designed patient communication unit – may be placed at any convenient location on the Workplace table

- Intercom communication with the patient
- Response to the patient's activation of the squeeze-bulb
- Table stop
- Volume of speaker in control room
- Volume of speaker and headphones in examination room for voice commands
- Connection to external audio system
- Independent volume control of voice and music
- Pneumatic system of headphones
- Loudspeaker
- Microphone

Automatic and freely programmable voice commands for breath-hold examinations.



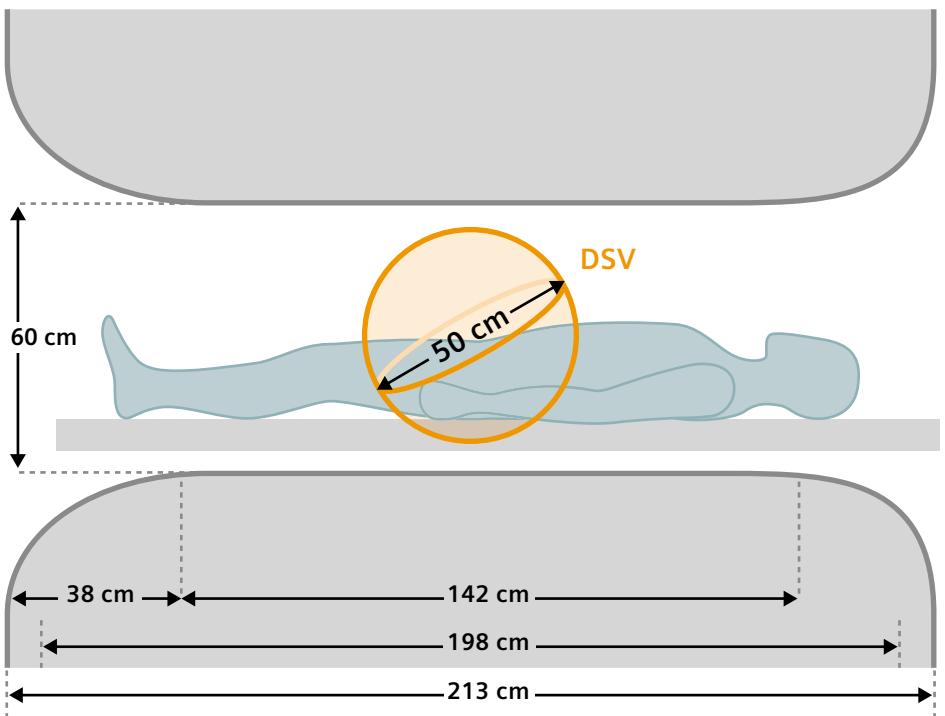
Magnet System

Superconducting Magnet

Short bore, patient-friendly design with large flared opening

Large DSV (diameter spherical volume), high homogeneity

Easy siting due to AS (Active Shielding) and E.I.S. (External Interference Shielding) magnet technology



Magnet Bore

Magnet length	198 cm
Magnet bore diameter¹	90 cm
Inner tunnel length	142 cm
Length of flared opening	38 cm
Inner diameter²	60 cm
System length	213 cm

1) w/o shim coils, gradient coil, RF body coil

2) incl. shim coils, gradient coil, RF body coil

Magnet Parameters

Operating field strength	3 Tesla
Superconductor	Niobium-Titanium
Field stability over time	<0.1 ppm/h
Number of field-generating coils	6

Homogeneity	DSV	Guaranteed	Typical
(based on highly accurate 24 plane plot)			
	50 cm	<1.5 ppm	1.2 ppm
	45 cm	<0.5 ppm	0.325 ppm
	40 cm	<0.2 ppm	0.1 ppm
	30 cm	<0.1 ppm	0.045 ppm
	20 cm	<0.02 ppm	0.01 ppm
	10 cm	<0.002 ppm	0.0008 ppm
	DSV=Diameter spherical volume (x, y, and z direction)	Standard deviation Vrms (volume root-mean square) measured with highly accurate 24 plane plot method (20 points per plane) Standard active shim with 3 linear and 5 non-linear channels	
3D Shim			
	Patient-specific automated shim		
	For optimization of the magnetic field homogeneity		
	Time to shim	approx. 20 s	
Active Shielding (AS)			
	5th generation active shielding (AS) technology with counter coils		
	Fringe field (axial x radial)	0.5 mT* 0.1 mT	5.9 m × 3.4 m 9.2 m × 5.9 m
		* pacemaker safety limit	
External Interference Shield (E.I.S.)			
	Patented shielding system integrated into the magnet		
	Continuous compensation and automatic suppression of external magnetic field interferences during measurement (caused by moving ferromagnetic objects)		
Magnet Cooling System			
	Refill interval (typical)	6 – 9 month*	
	Boil-off rate (typical)	0.12 l/h*	
	Helium capacity	1,200 liters	
		* depending on used sequences and number of examinations	



Gradient System

The combination of our worldclass gradients together with Tim (Total imaging matrix) enables the most demanding applications.

General Features

- Actively shielded (AS), super-compact whole-body gradient coil system
- Extremely low eddy currents
- Water-cooled coil and amplifier for maximum performance
- Gradient coil length 122 cm, optimized for gradient linearity

Excellent spatial and temporal resolution

Shortest TE and TR for high image contrast and best signal-to-noise ratio

Patient-specific shimming

Active shim via 3 linear channels with 20 coils

Combined with 5 additional non-linear 2nd order channels with 32 coils for advanced high order shim (standard)

Features and Technical Data

> Refer to appendices:

Tim [102x8] with TQ-engine

Tim [102x18] with TQ-engine

Tim [102x32] with TQ-engine
for the different system options

AudioComfort

The integrated design of the MAGNETOM Trio, A Tim System as well as the hardware and software measures included reduce the acoustic noise to a minimum without compromising gradient performance.

AudioComfort incorporates aspects of the gradient coil, body coil and magnet as well as the sequence design.

Gradient

- Special epoxy resin and casting technology for damping vibrations.
- Reduction of gradient stray field to decrease eddy currents which generate acoustic noise.
- Noise-optimization of the MR system with an acoustically soft but mechanically rigid mounting of the gradient coil inside the magnet
- This reduces vibration amplitudes without the drawbacks of supporting the gradient coil directly on the floor.

Body Coil

- The supporting tube of the body coil is built using filament winding and optimized for internal damping and minimum vibration amplitudes
- In order to achieve maximum noise reduction, the body coil tube was extended beyond the gradient coil
- This is an extremely efficient method for reducing noise, since most of the noise is generated at the ends of the gradient coil
- Copper structures are slotted and glued to the GRP tube to reduce high frequency noise
- The Body coil is acoustically decoupled by special suspensions

Magnet

- Encapsulation of the entire magnet
- Efficient floor decoupling for reduction of noise transferred to the building
- Noise-optimized cold head

Sequence Design

- Optimized sequence timing
- Sequences automatically avoid parameter settings that cause the gradient coil to resonate
- No relevant application drawbacks – no increase in sequence parameters, i.e. full performance

"Whisper Mode"

The "Whisper Mode" is a userselectable mode that reduces the max. slew rate and max. amplitude of the gradients. It is compatible with nearly all sequence techniques.

Acoustic Noise

Max. acoustic noise level¹⁾:
102 dB(A)

- With AudioComfort, acoustic noise is reduced by up to 20 dB as compared to conventional 3T systems. This is a reduction of 90% in sound pressure.



Clinical Benefits

- High performance combined with quietness. All gradient demanding protocols using e.g. EPI techniques such as diffusion, perfusion or fMRI examinations show a significant acoustic noise reduction, thanks to Siemens-unique AudioComfort.
- AudioComfort makes MR examinations a comfortable experience even for children.
- AudioComfort prevents the necessity of implementing noise-absorbing measures to gain a comfortable noise level for technologists and neighbors.

1) According to NEMA specifications with max. gradient amplitude and max. gradient slew rate.

Acquisition Parameters*

2D Slices	Number of slices	
	per single slice stack	1 – 128 (steps of 1)
	per series (total number of slices in one dynamic measurement)	up to 262,144 (depending on matrix size)
	Slice order	ascending, descending or interleaved
3D Slabs/Partitions	Number of 3D partitions per single slab	4 – 512
	Number of 3D slabs (3D volumes)	1 – 128 (steps of 1)
Acquisition Matrix	Frequency encoding (true imaging matrix without interpolation or oversampling)	64 – 1024 (in steps of 64)
	Phase encoding	32 – 1024 (in steps of 1)
Partial Fourier Imaging	Phase partial Fourier (1/2 = Half Fourier)	4/8 – 1 (steps of 1/8)
	Read partial Fourier (asymmetric echo)	selectable
	Slice partial Fourier (3D volumes)	6/8 – 1 (steps of 1/8)
Rectangular Field of View	Rectangular Field of View (in phase-encoding direction)	3 % – 100 %
Averaging	Number of data acquisitions	1 – 32 (steps of 1)
	Averaging mode	short term, long term (LOTA)

*Combinations of the parameters stated are not always possible; some parameters may depend on optional application packages

Oversampling	Read oversampling	100% standard
	Phase oversampling	0 – 100% (steps of 12.5%)
	Slice oversampling (3D volumes)	0 – 100% (steps of 12.5%)
Interpolation	In-plane interpolation in frequency-encoding and phase-encoding direction	selectable (factor of 2)
	3D interpolation (3D volumes)	selectable (up to factor of 2)
Slice Orientation	Slice orientations for 2D scans and 3D scans	transverse, sagittal, coronal, oblique, double oblique (steps of 0.1°)
	Multi-slice multi-angle (simultaneously)	yes
Off-center Shift	Longitudinal direction (head-feet)	–250 mm to +250 mm
	Horizontal direction (left-right)	–250 mm to +250 mm
	Vertical direction (anterior-posterior)	–250 mm to +250 mm
Serial Acquisitions	Number of repeat scans	with constant delay times 1 – 4096
		with different delay times 1 – 65
Swap	Exchange of read-out and phase-encoding direction	yes

syngo MR Software

syngo[®], the unique software platform for medical applications and systems integrates all patient related information, physiological and imaging data across your entire clinical workflow. In every workplace syngo's innovative user interface allows you to know intuitively what to do.

Its intelligent automation features accelerate your examination, enabling smooth efficient workflow, across modalities, departments and people. With syngo, your workplace is uniquely customized to the way you work. The "program" concept in syngo MR enables scanning patients with a minimum of mouse clicks. This speeds up the total examination time.



Intelligent Features

The syngo MR user interface is the cockpit for dynamic MRI.

The ergonomic and easy-to-use interface supports the clinical workflow.

Tim Assistant

Helps to make Parallel Imaging easy by automatically recommending the appropriate PAT factor for the selected application. Tim Assistant always knows the selected coil elements and the MR protocol, ensuring the optimal iPAT configuration for each application.

scan@center

Easy planning – best position scanning. scan@center automatically moves the table so that the scan is performed in the magnet isocenter. This enables best image quality especially for fat saturation techniques. Extended Field of View examinations benefit from this functionality as well as multi-stage examinations.

Intelligent Coil Control

Detects the position and orientation of coils automatically. Shows coils in the user interface right within the graphical slice positioning.

AutoCoil Select

Dynamic, automatic and interactively selects the coil elements within the Field of View.

Image Filter

The Image Filter Software uses adaptive filtering and adjusts to the local image content automatically. The Image Filter is available “inline” and “offline” on the *syngo* Acquisition Workplace and “offline” on the *syngo* MR Workplace. Default and freely definable image filter values are provided.

Inline Applications Card

Programming of Inline processes for the current protocol

- Subtraction
- Standard deviation
- MIP
- Soft tissue evaluation

syngo Scan Assistant

Shows parameter constraints and offers possible solutions.

Inline Display

Automatically shows reconstructed images. It offers real-time control of the results and opens automatically for e.g. real-time interactive scanning or CareBolus examinations.

Inline Movie

Inline technology automatically starts the cine image display.

Scan Open Protocol

Allows faster workflow for breath-hold exam.

Table Positioning Interface

Remote software control of table move and patient comfort facilities, such as in-bore ventilation and lighting.

Physiological Display

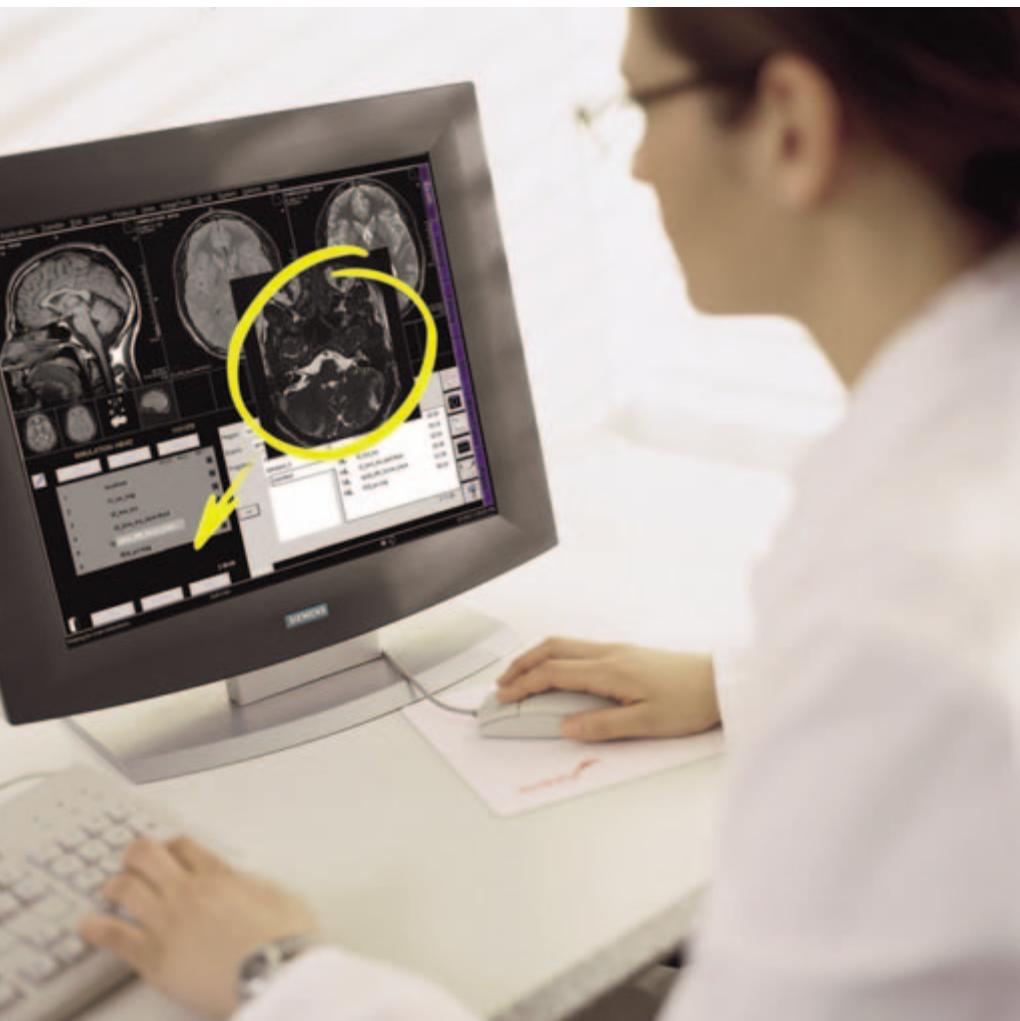
Displays the pulse, ECG or respiration signal, combined with a graphical indication of the acquisition window (requires PMU option).

Automatic Voice Command

Records and plays freely programmable language-independent voice commands, e.g. for breath-hold instructions to the patient.

Online Help

Functions as a context-sensitive and quick resource for questions about software operation or MR physics.



Phoenix – What you see is what you get

The unique Phoenix technique from Siemens is the easiest way to exchange protocol data. It supports intelligent extraction of sequence parameters from images acquired worldwide with MAGNETOM systems via network, CD exchange, or the Internet.

By simply dragging the desired image into the measurement queue, Phoenix extracts the protocol from the DICOM header in the images, and instantly duplicates the protocol – TR, TE, bandwidth, number of slices, echo spacing, etc. The same parameters can be applied for subsequent scans.

Phoenix is standard on all MAGNETOM systems

- Supports multi-center protocol standardization
- Improves reproducibility of studies, e.g. in case of follow-up or research
- Helps to establish new applications quickly. Expertise from other sites is available in seconds
- Shares optimized protocols on the different MAGNETOM systems
- Is an effective tool for monitoring and assessing quality and can help to maintain the highest possible performance level
- Is a tool for the visual selection of applications that are either new to a facility or for facilities that are in the start-up phase
- Enables MAGNETOM users around the world to exchange protocols and benefit from the experience of other experts, e.g. by downloading images from the internet

PhoenixZIP

PhoenixZIP allows the transfer of whole measurement programs in an easy and simple way. Once measured examinations can be restored from the PACS, data sets can be exchanged between MAGNETOM systems via Internet or storage media like CD or DVD. The data sets for PhoenixZIP contain the protocol data of all protocols of the measurement as well as the order and conjunctions of these. Therefore PhoenixZIP offers an effective and time-efficient way to exactly reproduce once measured examinations.



syngo MR Examination

Integrated Exam Programs

- Executable with just one mouse click
- Selects automated examinations with less interaction
- Enables automated scanning
- Allows queuing of multiple protocols as program steps during an examination
- Pending program steps can be rearranged or removed from the queue, as required
- Allows for predefined pauses between program steps, e.g. for the administration of contrast agent
- Allows for the appending and deleting of program steps
- Parameters can be copied either manually or automatically
- Programs can be saved to the exam explorer
- Enables easy exchange of program steps between queue area and exam explorer
- Both program steps and the whole queue can be repeated, as required

Exam Explorer

- Allows free and flexible programming of customized integrated exam programs
- Simple change of exam programs via drag & drop

Scan Preparation

- Automatic adjustment of frequency, transmitter power and 3D Shim
- Eliminates the need for receive adjustments through dynamic receiver gain control, significantly reducing scan time
- Allows for individual interactive adjustments
- No coil tuning necessary, also saving examination time

Autoscout

- Allows for automatic start of localizer scan with very short acquisition time
- Allows for arbitrary orientations (multi-slice multi-angle)
- Automatically loads images into Graphical Slice Positioning

Graphical Slice Positioning

Simultaneous use of three arbitrary localizer images from possibly different measurements for graphically positioning slices and sat regions.

Interactive modification of measurement parameters (slice thickness, distance factor, oversampling etc.):

- Automatic selection of relevant coil elements
- Graphical selection of coil elements
- Off-center positioning (shift of FoV within the selected slice position)
- True multi-slice multi-angle, i.e. simultaneous measurement of multiple images (stacks with different orientation)
- Recall of previous slice and/or sat region positioning
- Paging through all images during graphical positioning
- Inline Movie, allowing positioning of slices on e.g. the beating heart
- Loads images immediately when they are available, i.e. during image reconstruction
- Allows quick overview via image stamps. Loads entire series of planning images with drag & drop
- Slice positioning (GSP) on 3D reconstructed images
- Slice positioning (GSP) on 2D and 3D distortion corrected images
- Slice positioning (GSP) on composed images



syngo MR Image Viewing and Filming

Image Recall

Images are stored in DICOM format, allowing fast image access and recall

- Combines images in a new series, e.g. post-processed images
- Loads images automatically
- Inline Display

Image Display

- Various display layouts selectable
- Up to 3 patients can be simultaneously active in the viewer
- Image annotation and labeling
- Non-interpolated display
- Fast paging through up to 500 images with 15 images/s for full screen display

Windowing

- Freely selectable window width and center
- Windowing on succeeding images
- Auto-windowing for optimized contrast
- Saves and sends window values

Automatic Movie for cine display

Interactive movie paging by dragging the mouse or Automatic Movie mode by clicking the icon

Evaluation

Parallel evaluation of up to 40 regions of interest

- Circle
- Rectangle
- Freehand ROI
- Pixel lens with position marker
- Statistical evaluation
- Area
- Standard deviation
- Mean value
- Min/max values
- Image scrolling
- Magnification
- Distance
- Angle

2D Post-processing

Image manipulations

- Reversal of gray-scale values
- Image rotation by 90° or by user-defined angle
- Flip horizontally/vertically
- Image zoom and pan
- Shutter
- Annotation

Position display

Displays measured slice positions on localizer image and selected series.

Argus Viewer

Viewing software for cardiac MR studies and large data sets

- Efficient cine review of cardiac and other dynamic data sets
- Multiple sorting options
- Single movie as well as 2, 4, or 8 simultaneous slices together in movie mode
- Rapid avi creation of 1 to 8 slices simultaneously
- Creates and edits DICOM structured reports



Mean Curve

Time-intensity analysis for contrast-enhanced examinations

- Creates and edits DICOM structured reports

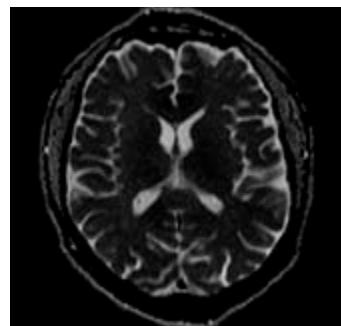
Filming

- Connection via DICOM Basic Print
- Interactive filming
- Filming parallel to other activities
- Independent scanning and documentation – no wait time due to camera delays
- Freely selectable positioning of images onto virtual film sheet
- Selectable various film layouts
- Mother-in-Child display
- Windowing, image zoom and pan on film sheet
- Configurable image text
- Simultaneous handling of multiple film jobs
- Up to 100 virtual film sheets

Dynamic Analysis

Arithmetic operations on images and series (e.g. for evaluation of contrast media studies)

- Addition, subtraction, multiplication, division of single images and whole series
- Arithmetic mean and standard deviation across a range of selected images
- Calculation of T1 and T2, and logarithmic images
- Differentiation/integration of selected images
- Calculation of a mean slope image from a range of selected images
- Calculation of z-score (t-test) images for evaluation of BOLD imaging data (Blood Oxygenation Level Dependent)
- Time-to-peak evaluation (TTP)
- ADC maps



Several evaluation functions may be started consecutively in the background

Printing on Paper

Interface and software for printing images on paper (laser printer not included)

Grey levels and color printing supported

Data format Postscript Level 2

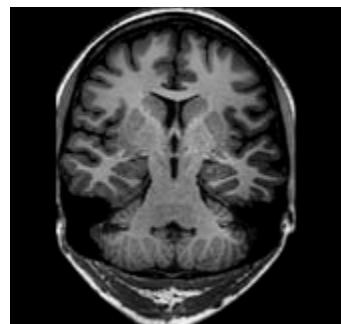
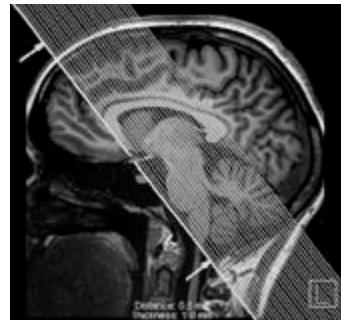


syngo MR 3D Post-processing

MPR – Multiplanar Reconstruction

Real-time multiplanar reformatting of secondary views

- Viewing perspectives: sagittal; coronal; axial; oblique; double oblique; curved (freehand)
- Reconstruction along polygon and/or curved (freehand) cut lines
- Reconstruction based on reconstructed planes possible
- Reconstruction of user-defined ranges of parallel, radial or freehand cuts
- Selectable slice thickness and slice increment of reconstructed images
- Storing of post-processing protocols
- Annotations and 2D evaluations such as distance and ROI



MIP – Maximum Intensity Projection

3D reconstructions of vessels from a 3D data set, or a 2D sequential slice data set (acquired with dedicated MR Angiography sequences)

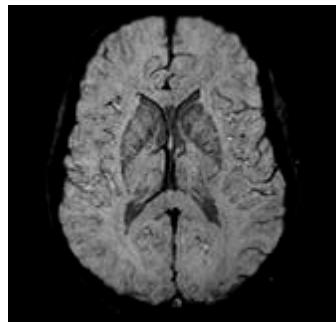


- Volume of Interest (Vol) defined to increase reconstruction speed and to improve image quality
- Freehand MIP: virtually eliminating interfering overlays by manually drawn, irregular contours in all dimensions
- Arbitrary views along any direction can be defined interactively with mouse-driven virtual trackball
- Multiple view angles around any orthogonal axis
- Projections displayed as single images, as interactive movie or by fast paging
- MIP thin/MIP thick

MinIP – Minimum Intensity Projection

Similar to MIP but reconstructs the minimum intensity (e.g. for Dark Blood techniques)

- Volume of Interest (Vol) defined to increase reconstruction speed and to improve image quality
- Freehand minMIP: virtually eliminating interfering overlays by manually drawn, irregular contours in all dimensions
- Arbitrary views along any direction can be defined interactively with mouse-driven virtual trackball
- Multiple view angles around any orthogonal axis
- Projections displayed as single images, as interactive movie or by fast paging
- MinIP thin/MinIP thick

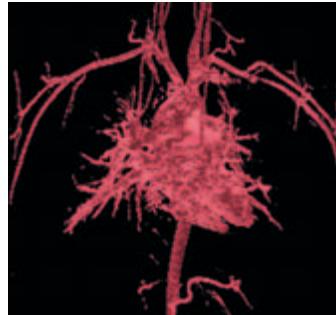


SSD – Shaded Surface Display

Three-dimensional display of surfaces, such as contrast-enhanced vessels

- Selectable variable threshold values
- Multiple view angles around any orthogonal axis

Rectangular and irregular Volumes of Interest (Vol) can be defined to improve image quality



syngo MR Network Communication

DICOM Services (Digital Imaging and Communications in Medicine)

Interface for transmitting medical images and information in the DICOM 3.0 industrial standard

Allows for communication between devices from different manufacturers

- DICOM Send/Receive
- DICOM Query/Retrieve
- DICOM SC Storage commitment
- DICOM Basic Print
- DICOM Modality Worklist
- DICOM MPPS Modality performed procedure steps; communication back to information system
- DICOM Structured Reports

DICOM Conformance Statements can be found on the Internet:

www.siemens.com/healthcare

> Services
> DICOM
> Magnetic Resonance

DICOM Study Split

DICOM Study Split provides the mapping of one study acquired based on multiple requests to multiple studies directly at the scanner. For example, two requests for head and neck acquisition can be registered once, scanned once and immediately mapped to two separate studies for individual reading.

Multiple requested procedures can be combined in a time saving manner by scanning a larger body region and then splitting them to individual billing relevant studies for separate reading.

This package allows:

- Time saving simple mapping of multiple requested procedures to multiple acquired series with one scan
- Simple creation of studies with individual billing based on one scan workflow
- Improvement for departmental workflow by eliminating need to load/change and to request/execute splitting on a separate workstation after the scan
- Immediate visual selection, check and correction of images to study assignments.
- Overlapping region images can be copied to both studies

Exchange Media

Storage of images and additional data (e.g. avi files) on CD/DVD.

A viewing tool (DICOM Viewer) can be stored together with images on a DICOM CD/DVD to be handed out to the patient.

Remote Diagnostics

Direct computer link to the local Siemens service department or the Siemens service centers (via router with telephone connection)

Image transfer for further evaluation

- Image and file transfer in batch mode
- Reading of entries in the error logbook
- Remote trouble shooting
- Remote access to service manuals written in easy-to-use HTML format
- Remote access to Service Site Database
- Start of preventive maintenance and quality assurance routines

Provided in conjunction with a service contract with Siemens (UPTIME Services)

- Remote access granted only with permission of the institution. Data security is ensured by secure access

Virus Protection

Permanent scanning for malicious software in the background to provide maximum security

Via Remote Access over secure network connection the latest virus scanner updates and operating system hotfixes are installed automatically

Provided in conjunction with a service contract with Siemens (UPTIME Services)

MPPS

DICOM Modality Performed Procedure Steps (MPPS) allows communication of information about the examinations from the MR system to an information system (such as RIS systems). MPPS enables provision of data for billing, documentation and planning purposes to an information system.

Image Transfer

Local network	Ethernet
Data transfer rate	max. 1 Gbit/s
Transfer rate (256 x 256 image)	approx. 20 images/s



Computer System

syngo Acquisition Workplace

Full multi-tasking for simultaneous functionality, e.g.:

- Patient registration and pre-registration
- Scanning
- Reconstruction
- Viewing
- Post-processing
- Filming
- Data storage

Color LCD Monitor

High resolution flicker-free flat-screen monitor

Horizontally tilttable, forward and backward

Automatic backlight control for long-term brightness stability

Host Computer and MCPRO Multi2 Image Processor: Technical Data

> Refer to appendix
"Computer System"

Color LCD Monitor

Screen size (diagonal)	19"
Horizontal frequency	30 – 97 kHz
Vertical frequency	50 – 120 Hz
Screen matrix	1280 × 1024

Installation

Radio Frequency Shielding	For shielding the examination room from external RF sources	
RF attenuation factor	> 90 dB	
Frequency range	15 – 128 MHz	
Magnetic Shielding		
Room shielding	For additional reduction of the magnetic fringe field, suitable iron shielding can be installed in the walls of the examination room. The room shielding can be used to create a magnetic shielding enclosure	
One-Floor Installation	A combination of active shielding and a special shielding installed on the ceiling of the magnet room or below it will keep the 0.5 mT line within the same floor as the MAGNETOM Trio, A Tim System, even in case of very low room heights	



System Electronics Cabinets	<p>2 cabinets which may be placed directly against the wall or even in a corner</p> <p>1 RF power amplifier, air cooled</p> <p>Require service access only from the front, saving considerable space</p> <p>Integrated water cooling cabinet may eliminate the need for a dedicated computer room</p>
Power Requirements	<p>Line voltage 380, 400, 420, 440, 460, 480 V</p> <p>Stability tolerances $\pm 10\%$</p> <p>Line frequency 50/60 Hz, ± 1 Hz</p> <p>Connection value 110 kVA for TQ-engine gradients</p>
Cooling Water Requirement	<p>Water consumption $> 90 \text{ l/min}^1$</p> <p>Heat dissipation to water $\leq 63 \text{ kW}$ for TQ-engine gradients</p> <p>1) water temperature: $6^\circ\text{C} - 12^\circ\text{C}$ ($43^\circ\text{F} - 54^\circ\text{F}$)</p>
Power Consumption	<p>System off¹ $\leq 6.5 \text{ kW}$</p> <p>Stand-by $\leq 10 \text{ kW}$</p> <p>Ready for measurement $\leq 20 \text{ kW}$</p> <p>Typical measurement $\leq 33 \text{ kW}$</p> <p>Highest average power $\leq 50 \text{ kW}$</p> <p>1) refrigerator only, 24 h/d</p>
Space Requirements	<p>Min. total space requirement (for magnet, electronics and console room) $\leq 33 \text{ m}^2$</p>

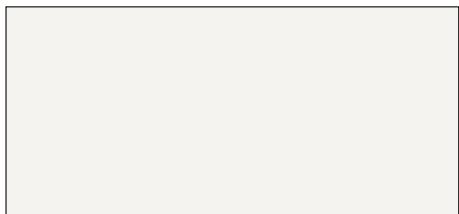
Dimensions	Component	Width [cm]	Depth [cm]	Height [cm]	Weight [kg]	Heat dissipa- tion [kW]
Examination Room						
	Magnet 3 Tesla AS (incl. Helium)	215	198	253	10,500	
	Magnet in operation, incl. gradient coil, body coil, patient table, and covers	255	459	267	13,000	2
	Patient table	54 (top)	243	57–100	350	0.2
	Required min. room height clearance			273		
	Min. transport dimensions	240*	358*	242*		
Control Room						
	syngo Acquisition Workplace (table + monitor)	120	80	117 (72 + 45)		
	Host computer	22	46	47		
	syngo MR Workplace (optional) (table + monitor)	120	80	117 (72 + 45)		
Equipment Room						
	Electronics cabinet, incl. system control, RF system, gradient power system, image processor	160	65	198**	1,500	≤ 10
	Cooling system	65	65	189*	500	

* Without covers

** Without attachments

System Cover

The system is available in two individual design variants:



Satin White



Zebra





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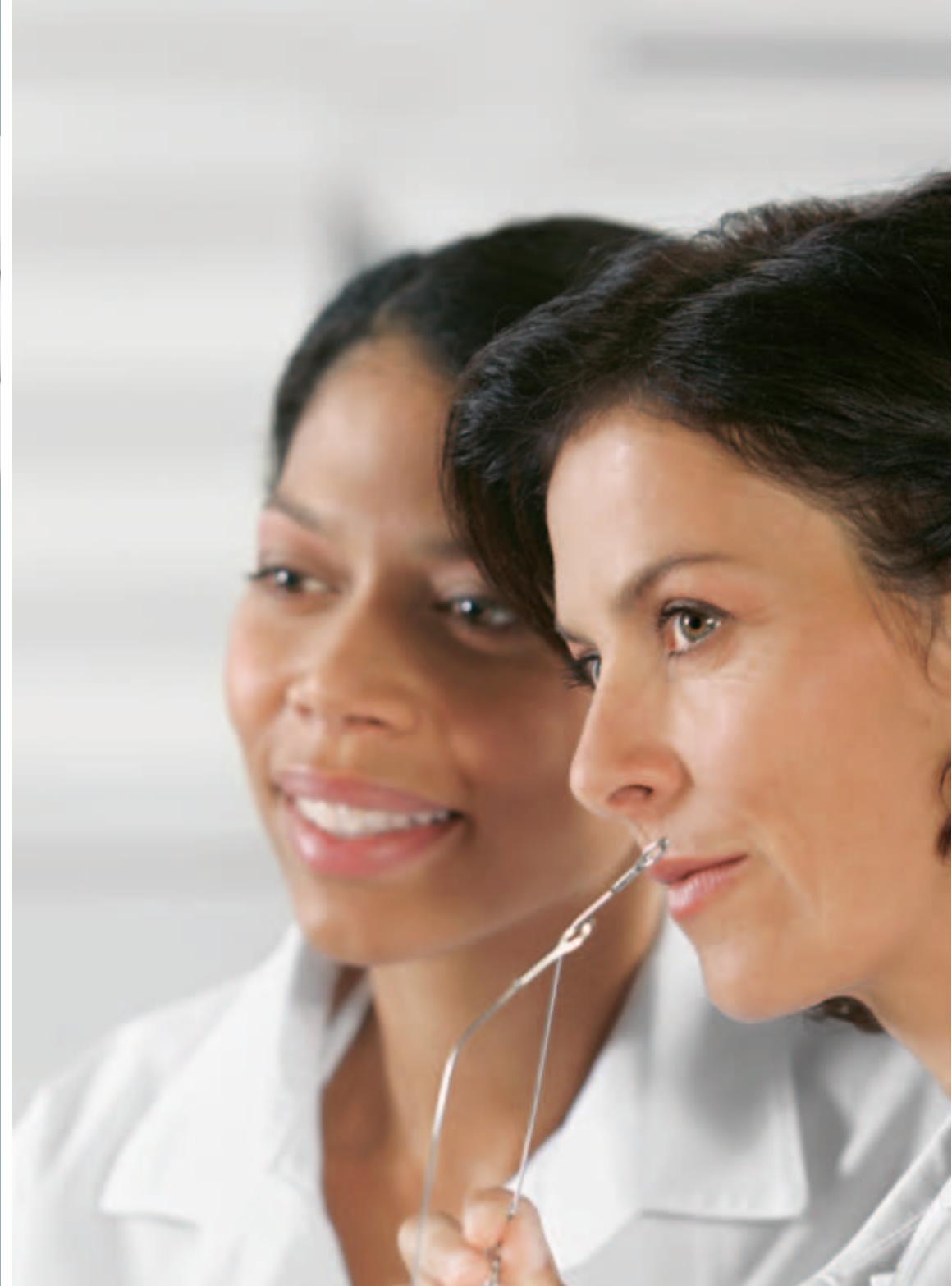
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Order No.
A91MR-700-G9-53-7600
Printed in Germany
MC.MR-00700 PA 0308 POD

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MAGNETOM Trio

T-class. Get ready for a new kind of workflow

www.siemens.com/healthcare

SIEMENS

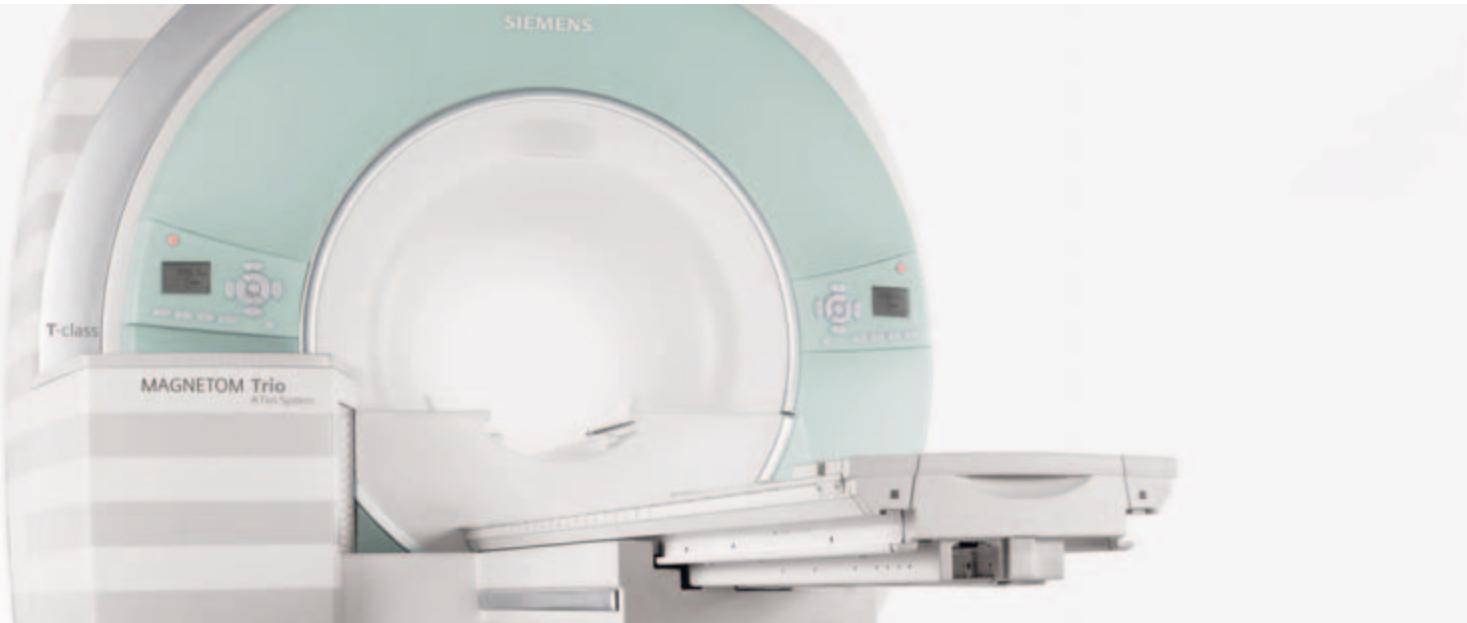


T-class is the next generation of trend-setting Tim-based MRI scanners. The new T-class systems enable for the first time in MRI, Continuous Table move examinations, *syngo TimCT*, and support workflow both At the scanner and Beyond the scanner through a unique departmental integration of the MR and the Siemens RIS (*syngo Workflow*).

syngo TimCT

The trendsetting TimCT – Continuous Table move powered by Tim – opens the door to a revolutionary way of scanning – namely from stepping to continuous movement measurements, a world first from Siemens.

With “MR as simple as CT”, *syngo TimCT* on MAGNETOM T-class systems provides a smooth workflow and the most homogeneous image quality. The image quality profits from continuously scanning at the iso-center, the most homogeneous region of the magnet. The seamless scanning of large FoVs removes boundary artifacts inherent to stepping techniques.



With **syngo TimCT** no time is lost for table moves between stations.

syngo TimCT builds on the Siemens unique Tim Technology that provides:

- Connection of multiple coils for full anatomical coverage with the highest SNR. Matrix coils provide high resolution imaging as well as speed with integrated Parallel Acquisition Techniques (iPAT)
- Flexible coil combination for seamless anatomical coverage
- Automatic coil position detection and selection of coils (AutoCoil Select)

syngo TimCT is built on the highly advanced T-class patient table:

- High positioning accuracy
- RF shielded table drive

MAGNETOM Tim Systems with T-class feature **syngo TimCT FastView**. The fast and efficient Continuous Table move localizer for large body regions.

- Inline reconstruction of the localizer images during the scan
- Localizing images in the three planes over the maximum Field of View available for subsequent planning in all orientations.
- **syngo TimCT FastView** can be run without laser light positioning to further streamline the workflow

syngo TimCT FastView

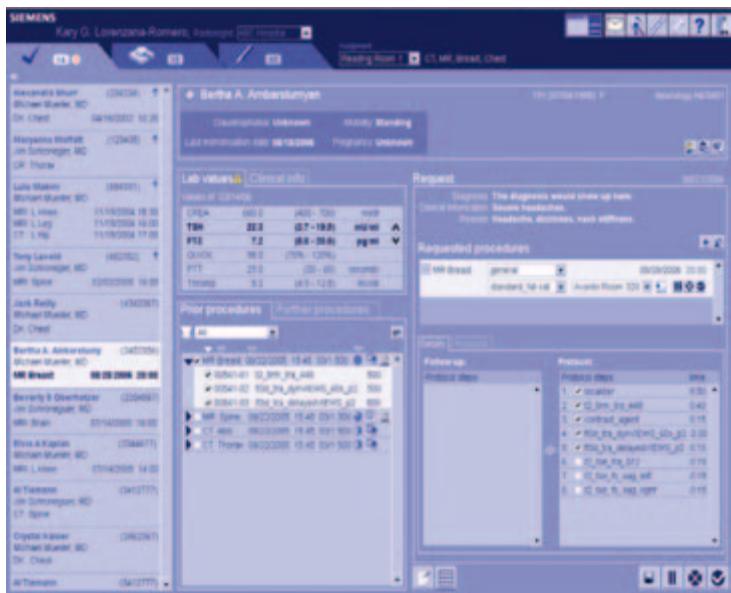
syngo TimCT FastView is the “one go” localizer for the whole body or large body regions such as the whole spine or the whole abdomen. It acquires the complete extended Field of View in one volume with isotropic resolution. Transverse, coronal and sagittal reformats of the volume are calculated Inline and displayed for planning subsequent exams.

Tim Workflow Suite

The Tim Workflow Suite provides a comprehensive workflow solution for MR measurement, processing and reading focused on extended Field of View and whole body exams.

Most efficient planning and reading with the Tim Planning Suite and Inline Composing

Planning can be done in an efficient way using Set-n-Go protocols. This allows planning of several stations at once e.g. on inline composed localizer images. The overlap of slice groups can be adjusted. All stations can have independent parameter settings although they are displayed together. A special coupling mode allows easy positioning of all stations at once according to the patients anatomy. Fully supports scan@center and Phoenix functionality.



Ready to use "Set-n-Go" protocols for different clinical questions

- Tim Planning Suite User Interface with optimized layout for slice positioning
- Integrated toolbar for fast advanced slice planning : FoV-Plus, FoV-Minus, Align Parallel, Align Field Of Views

Images resulting from extended Field of View multi step exams can be composed inline with fully automated anatomical or angiographic composing algorithms. Adjacent coronal or sagittal images are registered and fused into one image with full coverage of the extended Field of View. This way the direct result of a Set-n-Go protocol is the composed image showing the complete anatomy of e.g. a whole spine exam or a whole body angiography.

- Images can also be composed offline either fully automated or manually.
- Composed images can be automatically loaded into Graphical Slice Positioning for planning purposes.

Imaging of Fields of View exceeding the intrinsic scanners Field of View becomes as easy and straight forward as imaging of regular Fields of View.



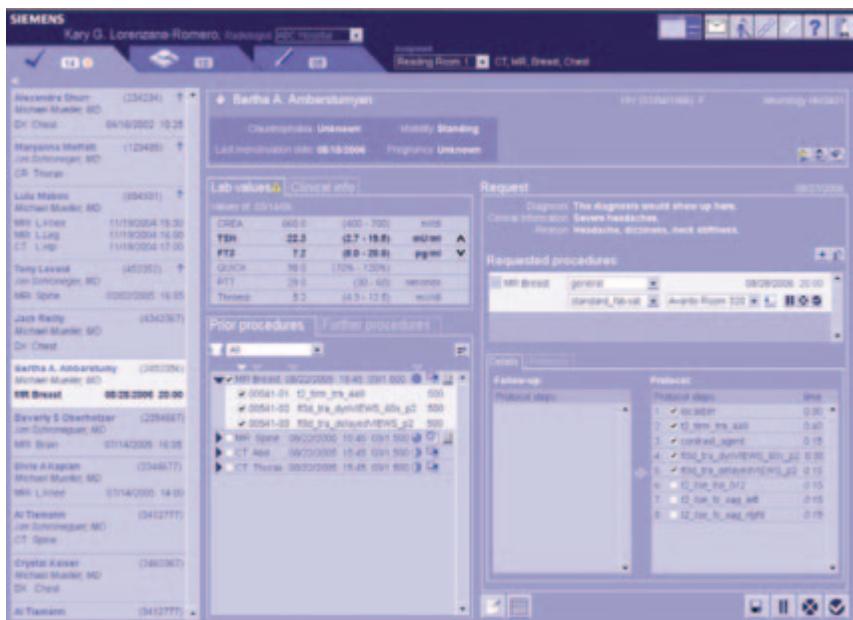
Inline evaluation of diffusion weighted images:

The Tim Workflow Suite also allows for the automatic real-time calculation of trace-weighted images and ADC maps with Inline Technology.

syngo Chorus MR

The workflow in radiology requires the connectivity and interoperability of different systems. In order to reach a smooth and integrated workflow of these systems, Siemens Medical Solutions provides a solution for setting up MRI examinations at the Radiology Information System (RIS), thus eliminating exam planning efforts at the scanner.

The follow-up examination workflow is systematically supported to reproduce examination results for comparison. Centralized services for protocol update and protocol distribution ensure defined high-quality scanning results across MR scanners.



Protocol Planning

For patient centric efficient and consistent protocol planning, the RIS system acts as a planning tool for the MR modalities connected. Scheduling examinations can be performed at the RIS. The information exchange is based on DICOM Modality Worklists, Modality Performed Procedure Steps and PhoenixZIP Documents.

Benefits include an easy and convenient MR planning for the physician – avoiding unnecessary phone calls or walking to the MRI suite – as well as an insurance that the desired protocol will be ran on the patient.

Inline-Follow up

To ease the setup of follow-up examinations the modality scan protocols and PhoenixZIP documents of the previous examinations can be used at the RIS to schedule a scan with the same scanning protocol(s), sequence(s) and parameters. Thus best comparable follow up results will be created at the MR modality.

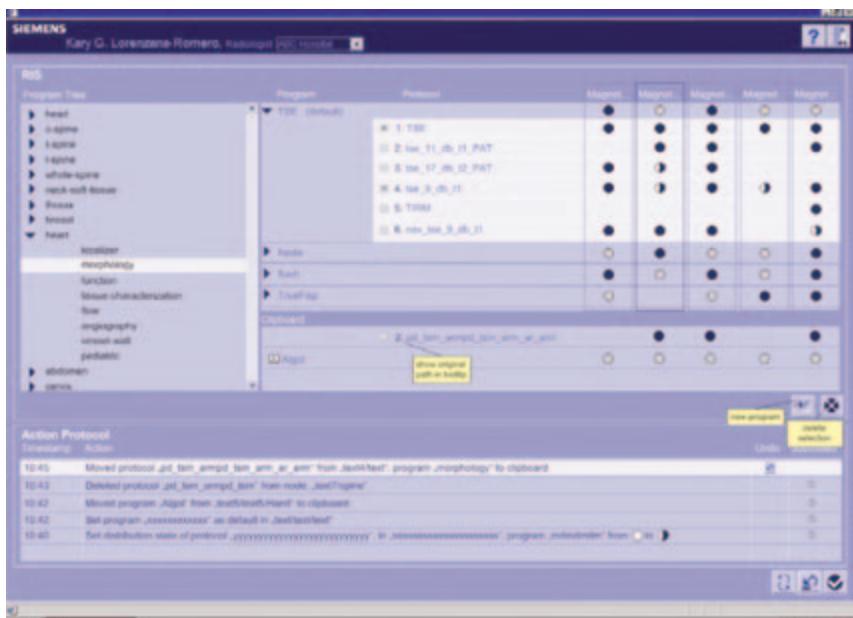
Protocol Distribution

Protocol Distribution ensures an easy and efficient standardization of examinations across the MR scanners of your Radiology department. With this web based technique, protocols can be distributed between RIS and multiple MR modalities with the RIS acting as a central protocol repository.

Inline Billing/MPPS

Via the same mechanism used for Protocol Distribution, accounting information is exchanged between the RIS and the MR modality with a centralized supply catalog. Inline Billing eliminates the need to enter billing codes after the examination and thereby streamlines the billing process. The automatic process eliminates possible manual errors and reduces the order-to-billing time in your department.

syngo Chorus MR can be installed stand-alone on MAGNETOM Tim Systems with I-class or syngo MR B15. The functionality within *syngo* Chorus MR currently requires the Siemens Radiology Information System *syngo* Workflow with the software version V30.



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Order No.
A91MR-700-G9-54-7600
Printed in Germany
MC.MR-00700 PA 0308 POD

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MAGNETOM Trio, A Tim System

Tim [102x8]
TQ-engine

www.siemens.com/healthcare

SIEMENS



Tim – Total imaging matrix

[102x8]. 102 seamlessly integrated coil elements.
8 RF channels.

- 102 simultaneously connected coil elements which can be seamlessly integrated into one examination
- 8 independent receiver channels (Analog/Digital Converters, ADCs)

Almost all receiving coils with 102 coil elements in total can be connected simultaneously. They can be seamlessly integrated into the examination without repositioning the patient or even changing a single coil.

iPAT – Advanced iPAT capabilities

- Full iPAT throughout the whole body – without patient repositioning or changing the coil setup
- Multi-directional, i.e. three dimensional, high-speed, high resolution iPAT
- Flexible iPAT through use of multiple coils and Matrix Coil Mode
- iPAT with acceleration factors up to 4 (one direction) or 16 (with iPAT², optional)¹⁾
- Tim Assistant ensures ease-of-use and optimized iPAT settings

1) With iPAT Extension Option

Gradients

General

Gradient duty cycle	100%
Gradient performance for each axis	
Max. amplitude	45 mT/m ²⁾
Min. rise time	200 µs from 0 to 40 mT/m
Max. slew rate	200 T/m/s
Vector gradient performance (vector summation of all 3 gradient axes)	
Max. eff. amplitude	72 mT/m
Max. eff. slew rate	346 T/m/s

2) Value is valid for longitudinal direction. Max. amplitude for horizontal and vertical direction:
40 mT/m

Gradient Amplifier

Water-cooled, highly compact, modular design Ultra-fast solid-state technology with very low switching losses
Max. output voltage³⁾
Max. output current³⁾

3) Values for each of the 3 gradient axes

Resolution Parameters			
Min. FoV	5 mm		
Max. FoV	500 mm		
Min. slice thickness 2D	0.1 mm		
Max. slice thickness 2D	200 mm		
Min. partition thickness 3D	0.05 mm		
Max. partition thickness 3D	20 mm		
Min. slab thickness 3D	5.4 mm		
Max. slab thickness 3D	500 mm		
Max. matrix	1024		
Highest in-plane resolution	10 µm		
Spin Echo			
Matrix	128	256	
Min. TR	7.5 ms	8.2 ms	
Min. TE	4.5 ms	5.0 ms	
Inversion Recovery			
Matrix	128	256	
Min. TR	29 ms	30 ms	
Min. TE	4.5 ms	5.0 ms	
Min. TI	42 ms	49 ms	
2D GRE (TurboFLASH)			
Matrix	128	256	
Min. TR	1.4 ms	1.5 ms	
Min. TE	0.50 ms	0.63 ms	
Min. measurement time	42 ms	49 ms	
3D GRE (ceMRA)			
Matrix	128	256	
Min. TR	1.4 ms	1.5 ms	
Min. TE	0.50 ms	0.63 ms	
TrueFISP			
Matrix	128	256	
Min. TR	2.1 ms	2.6 ms	
Min. TE	0.94 ms	1.1 ms	
Min. measurement time	84 ms	110 ms	
TSE (HASTE)			
Matrix	128	256	
Min. echo spacing	3.6 ms	3.9 ms	
Min. TR	7.5 ms	8.2 ms	
Min. TE	4.5 ms	5.0 ms	
Min. measurement time	132 ms	158 ms	
Max. Turbo factor	512		

TurboGSE	Matrix	128	256	
	Min. echo spacing	0.9 ms	1.1 ms	
	Min. TR	7.5 ms	8.2 ms	
	Min. TE	4.5 ms	5.0 ms	
	Max. Turbo factor	65		
	Max. EPI factor	21		
EPI (single-shot and multi-shot)	Matrix	64	128	256
	Min. echo spacing	0.29 ms	0.41 ms	0.69 ms
	Min. TR	10 ms	10 ms	10 ms
	Min. TE	2.1 ms	2.2 ms	2.5 ms
	Min. measurement time	12 ms	15 ms	24 ms
	Max. EPI factor	256		
Diffusion Imaging	Matrix	64	128	256
	Max. b-value [s/mm²]	10,000	10,000	10,000
	Min. TE with b=1,000 [s/mm²]	56 ms	58 ms	62 ms

All matrices without interpolation.

Combinations of the stated parameters are not always possible; some parameters may require optional application packages.

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MAGNETOM Trio, A Tim System

Tim [102x18]
TQ-engine

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Tim – Total imaging matrix

[102x18]. 102 seamlessly integrated coil elements.
18 RF channels.

- 102 simultaneously connected coil elements which can be seamlessly integrated into one examination
- 18 independent receiver channels (Analog/Digital Converters, ADCs)

Almost all receiving coils with 102 coil elements in total can be connected simultaneously. They can be seamlessly integrated into the examination without repositioning the patient or even changing a single coil.

iPAT – Advanced iPAT capabilities

- Full iPAT throughout the whole body – without patient repositioning or changing the coil setup
- Multi-directional, i.e. three dimensional, high-speed, high resolution iPAT
- Flexible iPAT through use of multiple coils and Matrix Coil Mode
- iPAT with acceleration factors up to 4 (one direction) or 16 (with iPAT², optional)¹⁾
- Tim Assistant ensures ease-of-use and optimized iPAT settings

1) With iPAT Extension Option

Gradients

General

Gradient duty cycle	100%
Gradient performance for each axis	
Max. amplitude	45 mT/m ²⁾
Min. rise time	200 µs from 0 to 40 mT/m
Max. slew rate	200 T/m/s
Vector gradient performance (vector summation of all 3 gradient axes)	
Max. eff. amplitude	72 mT/m
Max. eff. slew rate	346 T/m/s

2) Value is valid for longitudinal direction. Max. amplitude for horizontal and vertical direction:
40 mT/m

Gradient Amplifier

Water-cooled, highly compact, modular design	
Ultra-fast solid-state technology with very low switching losses	
Max. output voltage³⁾	2000 V
Max. output current³⁾	625 A

3) Values for each of the 3 gradient axes

Resolution Parameters			
Min. FoV	5 mm		
Max. FoV	500 mm		
Min. slice thickness 2D	0.1 mm		
Max. slice thickness 2D	200 mm		
Min. partition thickness 3D	0.05 mm		
Max. partition thickness 3D	20 mm		
Min. slab thickness 3D	5.4 mm		
Max. slab thickness 3D	500 mm		
Max. matrix	1024		
Highest in-plane resolution	10 µm		
Spin Echo			
Matrix	128	256	
Min. TR	7.5 ms	8.2 ms	
Min. TE	4.5 ms	5.0 ms	
Inversion Recovery			
Matrix	128	256	
Min. TR	29 ms	30 ms	
Min. TE	4.5 ms	5.0 ms	
Min. TI	22 ms	22 ms	
2D GRE (TurboFLASH)			
Matrix	128	256	
Min. TR	1.4 ms	1.5 ms	
Min. TE	0.50 ms	0.63 ms	
Min. measurement time	42 ms	49 ms	
3D GRE (ceMRA)			
Matrix	128	256	
Min. TR	1.4 ms	1.5 ms	
Min. TE	0.50 ms	0.63 ms	
TrueFISP			
Matrix	128	256	
Min. TR	2.1 ms	2.6 ms	
Min. TE	0.94 ms	1.1 ms	
Min. measurement time	84 ms	110 ms	
TSE (HASTE)			
Matrix	128	256	
Min. echo spacing	3.6 ms	3.9 ms	
Min. TR	7.5 ms	8.2 ms	
Min. TE	4.5 ms	5.0 ms	
Min. measurement time	132 ms	158 ms	
Max. Turbo factor	512		

TurboGSE	Matrix	128	256	
	Min. echo spacing	0.9 ms	1.1 ms	
	Min. TR	7.5 ms	8.2 ms	
	Min. TE	4.5 ms	5.0 ms	
	Max. Turbo factor	65		
	Max. EPI factor	21		
EPI (single-shot and multi-shot)	Matrix	64	128	256
	Min. echo spacing	0.29 ms	0.41 ms	0.69 ms
	Min. TR	10 ms	10 ms	10 ms
	Min. TE	2.1 ms	2.2 ms	2.5 ms
	Min. measurement time	12 ms	15 ms	24 ms
	Max. EPI factor	256		
Diffusion Imaging	Matrix	64	128	256
	Max. b-value [s/mm²]	10,000	10,000	10,000
	Min. TE with b=1,000 [s/mm²]	56 ms	58 ms	62 ms

All matrices without interpolation.

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MAGNETOM Trio, A Tim System

Tim [102x32]
TQ-engine

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Tim – Total imaging matrix

[102x32]. 102 seamlessly integrated coil elements.
32 RF channels.

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Max. Turbo factor	512		

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	Min. echo spacing	0.9 ms	1.1 ms	
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	Min. TE	4.5 ms	5.0 ms	
	Max. Turbo factor	65		
	Max. EPI factor	21		
EPI (single-shot and multi-shot)	Matrix	64	128	256
	Min. echo spacing	0.29 ms	0.41 ms	0.69 ms
	Min. TR	10 ms	10 ms	10 ms
	Min. TE	2.1 ms	2.2 ms	2.5 ms
	Min. measurement time	12 ms	15 ms	24 ms
	Max. EPI factor	256		
Diffusion Imaging	Matrix	64	128	256
	Max. b-value [s/mm²]	10,000	10,000	10,000
	Min. TE with b = 1,000 [s/mm²]	56 ms	58 ms	62 ms

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MAGNETOM Trio, A Tim System

Head Matrix Coil

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Head Matrix Coil

General

The Head Matrix coil is part of the standard system configuration.

- 12-element design with 12 integrated preamplifiers, one ring of 12 elements each (4 clusters of 3 elements each)
- Upper coil part removable
- Lower coil part usable without upper part for highly claustrophobic patients
- Lower coil part may stay on the patient table for most of the examinations
- Smoothly integrated into the patient table with Neck Matrix coil and Spine Matrix coil
- Open patient-friendly design
- Cushioned head stabilizers (removable)
- No coil tuning
- iPAT-compatible
- Detachable double mirror

Applications

- Head examination
- MR Angiography
- Combined head/neck examination
- TMJ (temporo mandibular joints)

Can be combined with

- Neck Matrix coil
- Spine Matrix coil
- Body Matrix coils (up to 4; optional)
- PA Matrix coil (optional)
- All flexible coils (e.g. CP Flex coil, small, CP Flex coil, large)



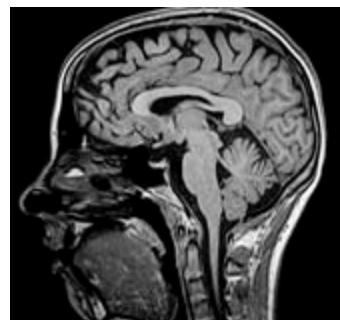
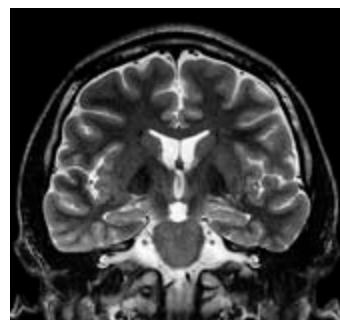
Matrix Coil Mode

- 4-channel CP Mode
- 8-channel Dual Mode
- 12-channel Triple Mode



Technical Data

- Weight: 5 kg
- Dimensions:
300 mm x 300 mm x 330 mm
(LxWxH)



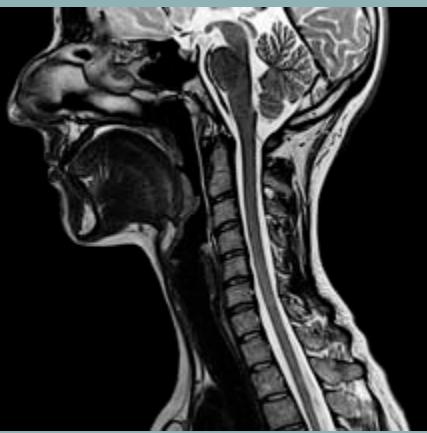
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MAGNETOM Trio, A Tim System

Neck Matrix Coil

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Neck Matrix Coil

General

The Neck Matrix coil is part of the standard system configuration.

- 4-element design with 4 integrated preamplifiers, 2 clusters of 2 elements each
- Upper coil part removable
- Lower coil part may stay on the patient table for most of the examinations
- Operates in an integrated fashion with the Head Matrix coil and Spine Matrix coil, for coverage of the posterior and anterior neck region
- No coil tuning
- iPAT-compatible

Applications

- Cervical Spine
- Neck
- Larynx/Esophagus
- MR Angiography
- Mediastinum
- Combined head/neck examination



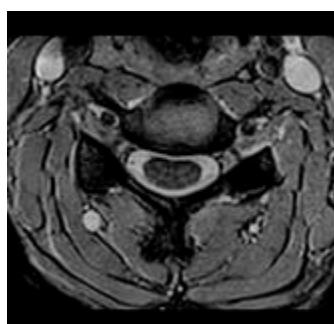
Can be combined with

- Head Matrix coil
- Spine Matrix coil
- Body Matrix coils (up to 4; optional)
- PA Matrix coil (optional)
- All flexible coils (e.g. Flex coil, small, Flex coil, large; optional)



Matrix Coil Mode

- 2-channel CP Mode
- 4-channel Dual or Triple Mode



Technical Data

- Weight: 2.6 kg
- Dimensions:
190 mm x 330 mm x 332 mm
(L x W x H)

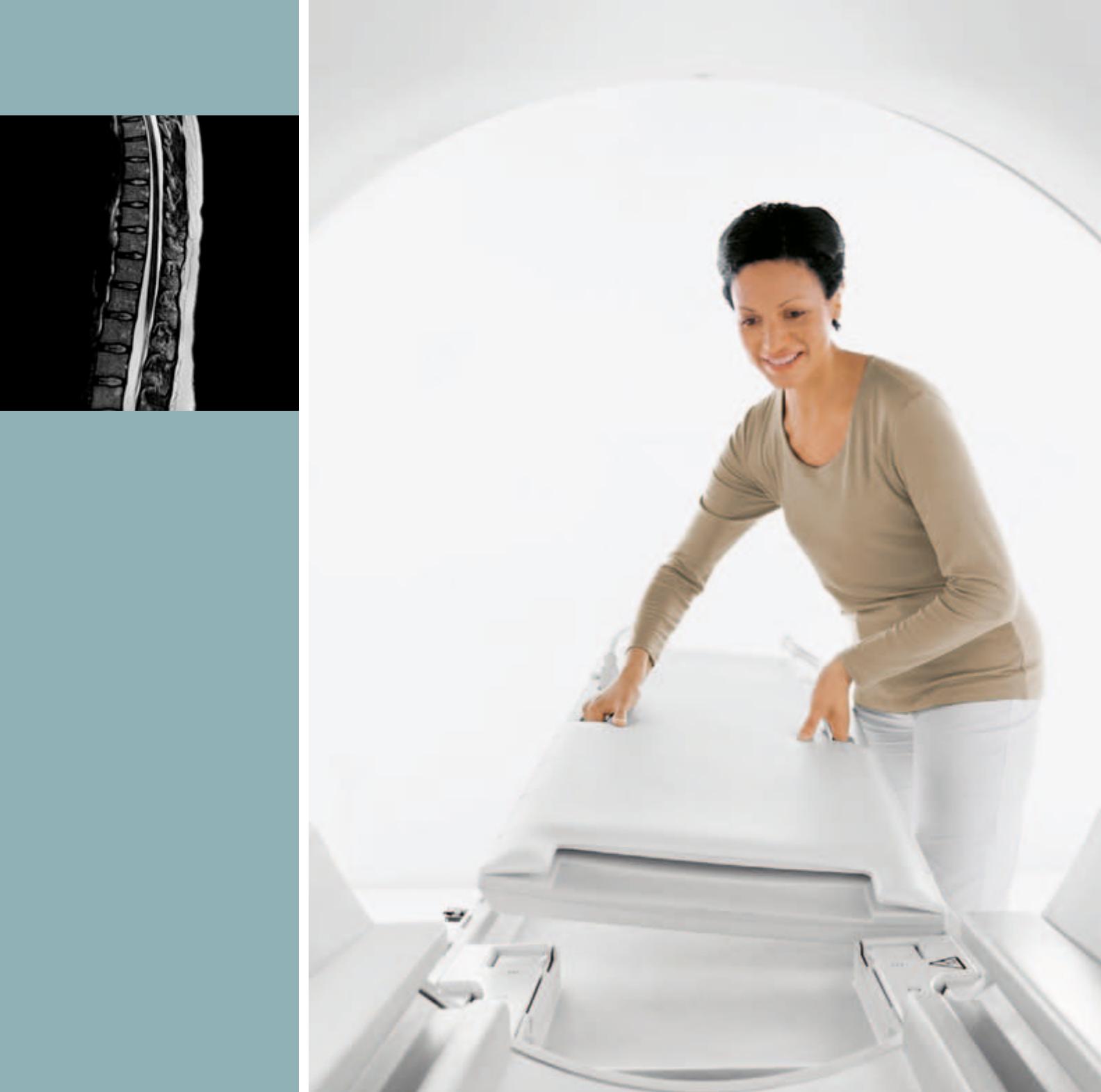


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MAGNETOM Trio, A Tim System

Spine Matrix Coil

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Spine Matrix Coil

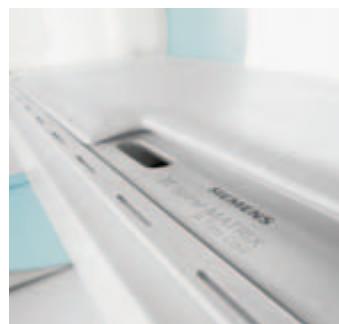
General

The Spine Matrix coil is part of the standard system configuration.

- 24-element design with 24 integrated preamplifiers, 8 clusters of 3 elements each
- Smoothly integrated into the patient table and streamlined with Head Matrix coil and Neck Matrix coil
- May remain on the patient table for almost all exams
- No coil tuning
- iPAT-compatible

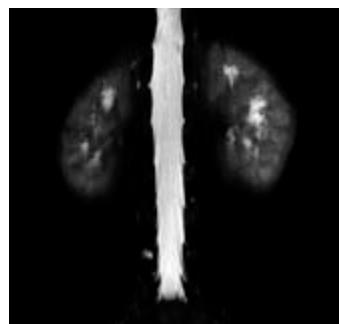
Applications

- High resolution imaging of the whole spine
- Various applications in combination with additional coils



Can be combined with

- Head Matrix coil
- Neck Matrix coil
- Body Matrix coils (up to 4; optional)
- PA Matrix coil (optional)
- All flexible coils (e.g. Flex coil, small, Flex coil, large; optional)



Matrix Coil Mode

- 8-channel CP Mode
- 16-channel Dual Mode
- 24-channel Triple Mode



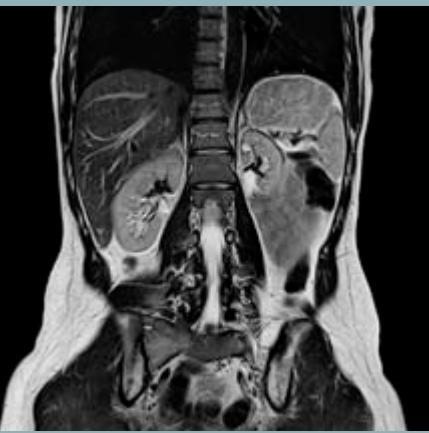
Technical Data

- Weight: 11 kg; may remain on the patient table for almost all exams
- Dimensions: 1185 mm × 485 mm × 33 mm (L×W×H)

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MAGNETOM Trio, A Tim System

Body Matrix Coil

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Body Matrix Coil

General

- 6-element design with 6 integrated preamplifiers, with 2 clusters of 3 elements each
- Operates in an integrated fashion with the Spine Matrix coil (2 rings of 6 elements each = 12-element design)
- Can be combined with further Body Matrix coils for larger coverage
- No coil tuning
- iPAT-compatible

Applications

- Thorax (incl. heart)
- Abdomen
- Pelvis
- Hip



Can be combined with

- Head Matrix coil
- Neck Matrix coil
- Spine Matrix coil
- Additional Body Matrix coils (typically 2–3 in total)
- PA Matrix coil (optional)
- All flexible coils (e.g. Flex coil, small, Flex coil, large; optional)
- Endorectal coil



Matrix Coil Mode

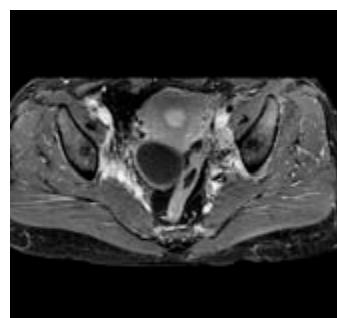
- 2-channel CP Mode
- 4-channel Dual Mode
- 6-channel Triple Mode

which results in 4-, 8-, or 12-channel body imaging in combination with the Spine Matrix.



Technical Data

- Weight: 1.5 kg; “patient-felt” weight of coil only 950 g
- Dimensions: 322 mm × 520 mm × 70 mm (L×W×H)



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MAGNETOM Trio, A Tim System

Peripheral Angio Matrix Coil

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Peripheral Angio Matrix Coil

General

- 36-element design with 36 integrated preamplifiers, distributed over 6 planes with 6 elements each
- Operates in an integrated fashion with the Body Matrix coils and Spine Matrix coil and for Whole-Body examinations also with the Head and Neck Matrix coil
- Automatic table feed and active coil switch
- Can be utilized head and feet first
- Both legs are independently covered with coil elements, maximizing the coil filling factor and the signal-to-noise ratio
- No coil tuning
- iPAT-compatible

Applications

- High resolution angiography of both legs incl. pelvis with highest signal-to-noise ratio
- Visualization of the iliac arteries and aorta
- Bilateral examinations of long bones of the legs



Can be combined with

- Head Matrix coil
- Neck Matrix coil
- Spine Matrix coil
- Body Matrix coils (up to 3)
- All flexible coils (e.g. Flex coil, small, Flex coil, large; optional)



Technical Data

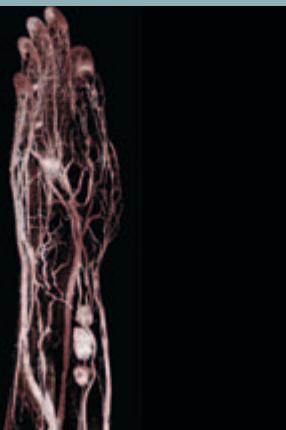
- Weight: 8 kg
- Dimensions:
860 mm x 300 – 640 mm x 280 mm
(L x W x H)

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MAGNETOM Trio, A Tim System

Flex Coils

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Flex Coils

Flex Coil Interface

- Four integrated low-noise preamplifiers
- Allows flexible coil positioning
- Only one interface necessary for all Flex coils
- Several Flex Coil Interfaces can be used simultaneously

Flex Coil, large

- Wrap-around coil made from soft and flexible material
- 4-element design with 4 integrated preamplifiers
- iPAT-compatible
- No coil tuning

Applications:

- Imaging of large regions such as medium to large shoulders, hip and knee

Can be combined with:

- All matrix coils
- All flexible coils
(second Flex Coil Interface required)
- Endorectal Coil
- Weight: 550 g
- Dimensions: 516 mm x 224 mm

Flex Coil, small

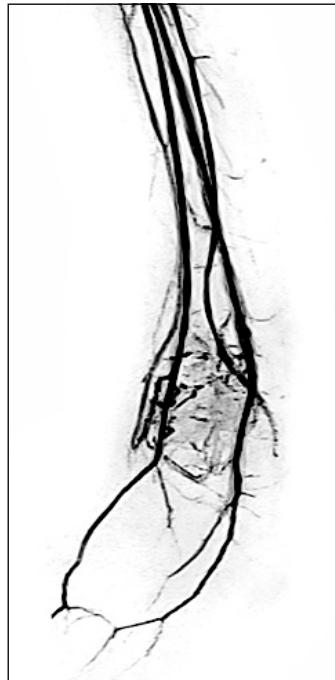
- Wrap-around coil made from soft and flexible material
- 4-element design with 4 integrated preamplifiers
- iPAT-compatible
- No coil tuning

Applications:

- Imaging of small regions such as small to medium shoulders, wrist, elbow and ankle

Can be combined with:

- All matrix coils
- All flexible coils
(second Flex Coil Interface required)
- Endorectal Coil
- Weight: 450 g
- Dimensions: 366 mm x 174 mm



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MAGNETOM Trio, A Tim System

Endorectal Coil

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Endorectal Coil

General

- Interface device for connecting either the prostate, colon, or cervix receive coil
- The endo coil is plugged into the endo interface which can be directly connected to the patient table connector
- No coil tuning
- Disposable

Applications

- Excellent visualization of the prostate, colon, rectum and cervix without the risk of invasive procedures
- Non-invasive preoperative diagnostic evaluation and treatment planning



Can be combined with

- Body Matrix coil
- All additional flexible coils (second Flex Coil Interface required)

Technical Data

- Weight: 200 g

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MAGNETOM Trio, A Tim System

Breast Array Coil

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Breast Array Coil

General

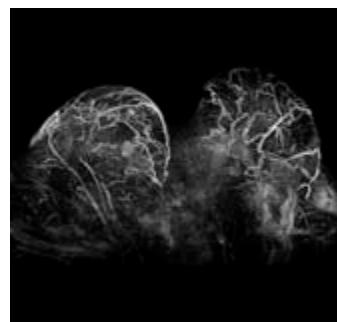
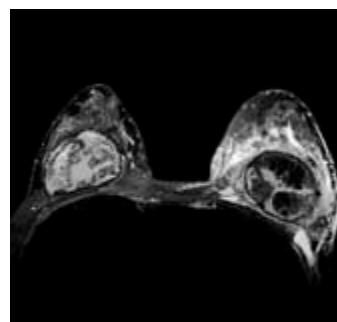
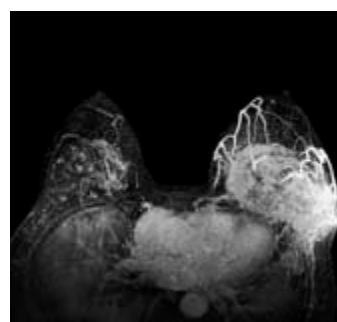
- 4-element design with 4 integrated preamplifiers
- Padded for imaging in prone position
- Stabilizing pads for wide anatomical variations
- Mediолateral compression capability
- No coil tuning
- iPAT-compatible

Applications

- Simultaneous high resolution imaging of both breasts in all directions
- Imaging of one or both breasts in sagittal direction

Technical Data

- Weight: 7.1 kg
- Dimensions:
500 mm x 530 mm x 145 mm
(L x W x H)

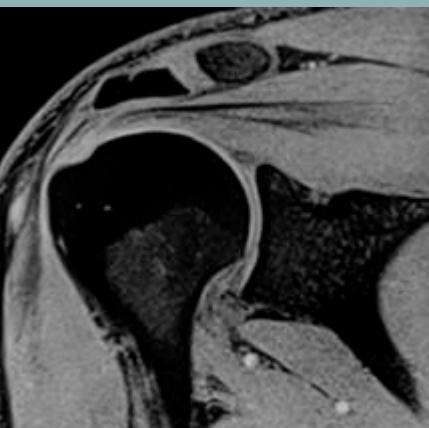


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MAGNETOM Trio, A Tim System

Shoulder Array Coil

Shoulder Array Coil

General

- 4-coil design with 4 integrated preamplifiers
- Two coils are included, one for small and one for large shoulders
- For narrow or wide shoulders the coil can be attached at different positions on the base plate
- Includes one base plate pad and one head rest for high patient comfort
- No coil tuning
- iPAT-compatible

Applications

- Best visualization of small anatomical structures (e.g. labrum)
- Higher SNR and better field homogeneity
- Reduced slice thickness and measurement times



Technical Data

Small Shoulder Array Coil

- Opening: 165 mm
- Weight: 1.3 kg



Large Shoulder Array Coil

- Opening: 200 mm
- Weight: 1.6 kg



Base plate

- Dimensions:
445 mm x 490 mm (LxW)
- Weight: approx. 5 kg

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MAGNETOM Trio, A Tim System

CP Extremity Coil

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CP Extremity Coil

General

- Transmit/receive coil
- CP coil with integrated preamplifier
- Upper coil part removable
- Holder allows off-center positioning to keep knee or foot which is not under examination in a comfortable position
- No coil tuning

Applications

- Knee
- Ankle
- Peripheral MR Angiography

Technical Data

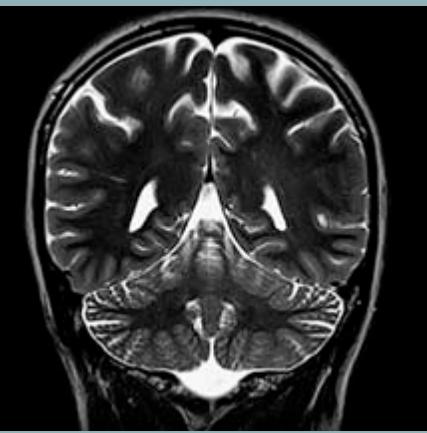
- Weight: 5.3 kg
- Dimensions:
370 mm × 440 mm × 280 mm
(L×W×H)



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MAGNETOM Trio, A Tim System

CP Head Coil

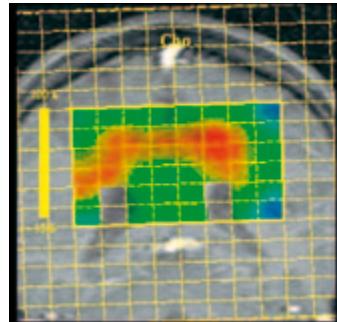
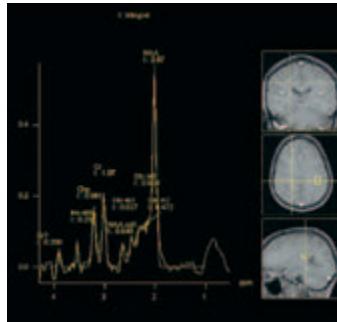
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CP Head Coil

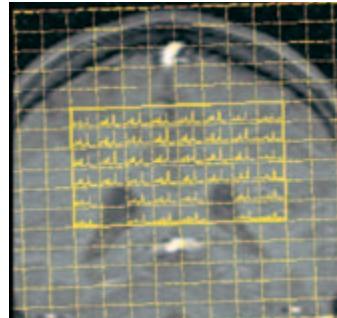
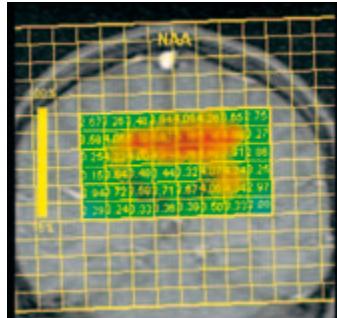
General

- CP Transmit/receive head coil with integrated preamplifier and 16 rungs
 - Upper coil part removable
 - Open patient-friendly design
 - No coil tuning
 - Cushioned head stabilizers (removable)
 - Detachable double mirror (optional)



Applications

- Head examinations
 - Pediatric imaging
 - High resolution brain spectroscopy



Technical Data

- Weight: 7 kg
 - Dimensions:
430 mm x 370 mm x 370 mm
(L x W x H)



Headquarter

Contact



MAGNETOM Trio, A Tim System

CP Wrist Coil

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CP Wrist Coil

General

- Transmit/receive coil
- CP coil with integrated preamplifier
- Stabilization pads for comfortable positioning
- No coil tuning



Applications

- High resolution wrist imaging

Technical Data

- Weight: 2 kg
- Dimensions:
150 mm x 180 mm x 160 mm
(L x W x H)

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MAGNETOM Trio, A Tim System

8-Channel Knee Coil

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8-Channel Knee Coil

General

- 8 element transmit/receive coil with 8 integrated preamplifiers
- iPAT compatible
- Upper coil part removable
- Holder allows off-center positioning to ensure a comfortable position for the patient
- No coil tuning

Applications

- High resolution knee or elbow imaging

Technical Data

- Weight: 5 kg
- Dimensions:
400 mm x 420 mm x 310 mm
(LxWxH)



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MAGNETOM Trio, A Tim System

8-Channel Wrist Coil

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8-Channel Wrist Coil

General

- 8 elements coil with 8 integrated preamplifiers; true 8 channel phase array coil
- iPAT compatible
- Hinged design of the upper part for quick and easy patient positioning
- Stabilization pads for comfortable positioning
- Holder allows off-center positioning to ensure a comfortable position for the patient
- No coil tuning

Applications

- High resolution wrist imaging

Technical Data

- Weight: 4.3 kg
- Dimensions:
400 mm × 400 mm × 300 mm
(L × W × H)



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MAGNETOM Trio, A Tim System

8-Channel Foot-Ankle Coil

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8-Channel Foot-Ankle Coil

General

- 8-element coil with 8 integrated preamplifiers
- iPAT compatible
- Boot-like coil design
- Fast patient setup with user-friendly slide mechanism
- Stabilization pads for comfortable patient positioning
- No coil tuning

Applications

- High resolution foot and ankle imaging

Technical Data

- Weight: 6.4 kg
- Dimensions:
410 mm × 330 mm × 390 mm
(L × W × H)



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MAGNETOM Trio, A Tim System

Loop Coils

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Loop Coils

Flex Coil Interface

- Integrated four low-noise preamplifiers
- Allows flexible coil positioning
- Only one interface necessary for all Loop coils
- Several Flex Coil Interfaces can be used simultaneously

Applications:

- Examination of inner ear, structure of wrist and fingers, pediatrics examinations

Can be combined with

- All matrix coils
- All flexible coils (second Flex Coil Interface required)
- CP Head Coil



Technical Data

- Weight: 175 g
- Diameter: 70 mm

Loop Coil, large

- No coil tuning
- iPAT-compatible in combination with other coils

Applications:

- Examination of upper or lower extremities (e.g. shoulder, axilla)

Can be combined with

- All matrix coils
- All flexible coils (second Flex Coil Interface required)
- CP Head Coil

Applications:

- Examination of small structures near the surface (e.g. joints of fingers and toes, wrist, skin, temporo mandibular joints (TMJ))



Technical Data

- Weight: 225 g
- Diameter: 110 mm

Can be combined with

- All matrix coils
- All flexible coils (second Flex Coil Interface required)
- CP Head Coil

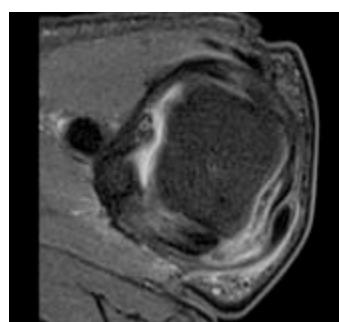


Loop Coil, medium

- No coil tuning
- iPAT-compatible in combination with other coils

Technical Data

- Weight: 200 g
- Diameter: 40 mm



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MAGNETOM Trio, A Tim System

7-Channel Breast Coil

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7-Channel Breast Coil

General

- 7-element design with 7 integrated preamplifiers
- Padded for imaging in prone position
- Stabilizing pads for wide anatomical variations
- Mediolateral compression capability
- Increased aperture volume
- No coil tuning
- iPAT-compatible

Applications

- Simultaneous high resolution imaging of both breasts in all directions
- Uni- or bi-lateral imaging of the breasts in sagittal direction
- Visualization of axilla region and chest wall



Technical Data

- Weight: 7.0 kg
- Dimensions:
700 mm x 440 mm x 230 mm
(L x W x H)

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MAGNETOM Trio, A Tim System

32-Channel Body Coil

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32-Channel Body Coil

General

- 32-element coil with integrated 32 preamplifiers
- Coil designed in 16 element anterior part and 16 element posterior part
- Pads for comfortable patient positioning
- No coil tuning
- iPAT compatible

Applications

- Thorax (incl. heart)
- Abdomen
- Pelvis
- Hip

Can be combined with

- Spine Matrix coil
(anterior part of the coil)

Technical Data

- Weight, anterior/posterior coil:
1,8 kg each (without cable)
- Dimensions:
300 mm x 400 mm
(L x W)

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MAGNETOM Trio, A Tim System

32-Channel Head Coil

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32-Channel Head Coil

General

- 32-element design with 32 integrated preamplifiers
- Upper coil part removable, designed with 12 elements
- Lower coil part usable without upper part (e.g. for highly claustrophobic patients), designed with 20 elements
- Coil design with comfortable open view for visual stimulation experiments and reduction of claustrophobic response
- Cushions (removable) for head stabilization
- No coil tuning
- iPAT-compatible
- Detachable mirror assembly

Applications

- High resolution head proton imaging
- MR angiography of the head
- Functional imaging of the brain

Lower coil part can be combined with:

- Loop Coils
- Spine Matrix coil
- Body Matrix coils
- All flexible coils
(e.g. CP Flex coil, small, CP Flex coil, large)



Technical Data

- Weight: 5.4 kg
- Dimensions:
300 mm x 309 mm x 290 mm
(L x W x H)

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MAGNETOM Trio, A Tim System

Application Packages
I-class. It's all about Innovations.

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Tim Whole Body Suite

MAGNETOM Trio, A Tim System features a unique telescopic patient table which enables a full Field of View of 181 cm, without increasing total system length. No additional table extension is required.

The table top has standard length. Table movement to its full extent can be controlled from the *syngo* Acquisition Workplace.

The large FoV helps in imaging metastases with sequences such as TIRM (Turbo Inversion Recovery). Whole-Body MR Angiography is possible on the entire volume with iPAT.

- Max. scan range of 181 cm
- Protocols and programs for Whole-Body MR Angiography and metastases detection

Tim Planning Suite

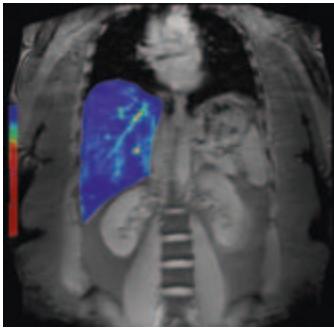
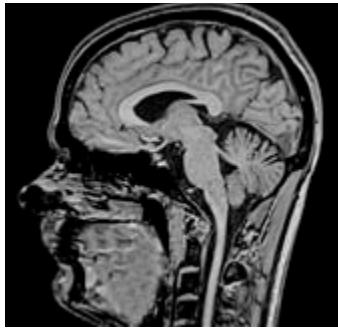
Easy planning of extended Field of View examinations in an efficient way using Set-n-Go protocols.

It allows planning of several stations at once e.g. on composed localizer images. The overlap of slice groups can be adjusted. All stations can have independent parameter settings although they are displayed together.

A special coupling mode allows easy positioning of all stations at once according to the patient's anatomy.

Fully supports scan@center and Phoenix functionality.

- Tim Planning UI with optimized layout for slice positioning
- Ready to use Set-n-Go protocols for different clinical questions
- Integrated toolbar for fast advanced slice planning: FoV-Plus, FoV-Minus, AlignParallel, AlignFieldOfViews



iPAT Extensions (integrated Parallel Acquisition Techniques)

iPAT² allows iPAT in 2 directions simultaneously (phase-encoding direction and 3D direction for 3D sequences)

By applying PAT in 2 directions simultaneously, the effective PAT factor can be maximized, and PAT applications are extended.

Typical clinical applications are MR Angiography or ultra-fast isotropic T1-weighted 3D imaging of the head.

syngo MapIt

syngo MapIt allows the early detection of osteo arthritic pathology based on the T1 and T2 and T2* properties of the cartilage. As well the assessment of T1, T2 and T2* properties of tissues in other body regions is possible.

syngo MapIt provides the Inline calculation of parametric maps for the T1, T2 and T2* properties of the imaged tissue and the necessary measurements.

- 3D VIBE sequence for Inline T1 mapping
- Multiecho spin echo sequence for Inline T2 mapping
- Multiecho gradient echo sequence for Inline T2* mapping
- Protocols for fully automated Inline parametric mapping

CISS & DESS

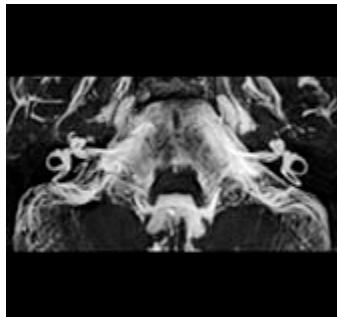
Unique Siemens sequences and protocols

3D DESS (Double Echo Steady State):

- T2/T1-weighted
- Excellent fluid-cartilage differentiation in orthopedic imaging

3D CISS (Constructive Interference in Steady State):

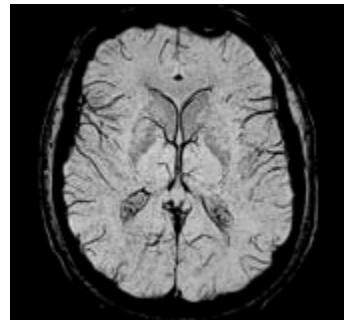
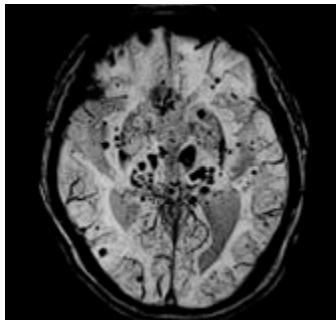
- Excellent visualization of fine structures such as cranial nerves
- High resolution imaging of inner ear and spine



syngo SWI (Susceptibility Weighted Imaging)

Siemens-unique sequence technique for Susceptibility Weighted Imaging

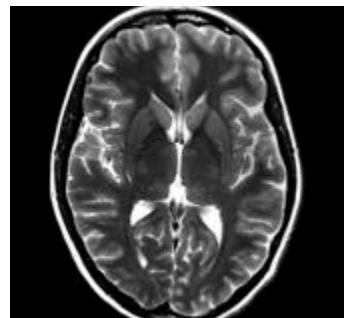
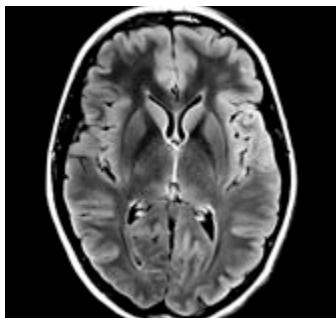
- Visualization of local changes of the magnetic field due to tissue properties in general and due to the presence of deoxygenated blood or blood decomposition products
- 3D GRE sequence with full flow compensation to support venous angiography
- Enhanced susceptibility weighting of the magnitude images by phase images to increase sensitivity to intracerebral hemorrhage



syngo BLADE

Motion insensitive Turbo Spin Echo sequence optimized for head exams

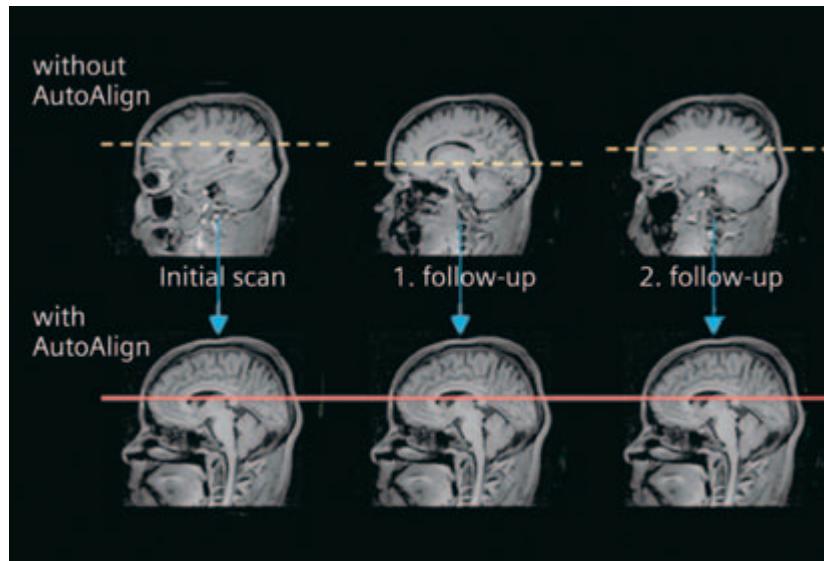
- Supports T2-weighted, T1-weighted, STIR and DarkFluid protocols
- Simultaneous in-plane motion correction for arbitrary slice orientations
- Versatile sequence e.g. supporting iPAT with GRAPPA, Restore pulses and 2D PACE
- Supports respiratory triggered imaging of the abdomen using 2D PACE
- Improves image quality for uncooperative patients e.g. children in head, spine, orthopedic imaging and the abdomen



AutoAlign Head

Automated alignment of slice positioning for head examinations. This option enables easy and accurate patient follow-up. AutoAlign Head references the 3D MR brain atlas and automatically aligns the slice positions in a standard reproducible way.

- Automatic slice planning : no manual adjustments of slice positioning necessary
- Reproducibility : reviews all head images in the same position and orientation
- Follow-up : reapply exactly the same image position as in previous examinations (supported by the Phoenix technique)



AutoAlign Spine

Single mouse click double oblique positioning of transverse slice packages in spine imaging. AutoAlign Spine localizes the intervertebral disk on sagittal images and positions the transverse slice packages parallel to the disk in a standardized way. This allows for a faster and easier exam and supports reading by delivering a higher and more standardized image quality.

syngo Security

Security package for general regulatory security rules

The option supports customers to achieve compliance with HIPAA (Health Insurance and Accountability Act).

- User authentication
- Restricts access to functions and data through privileges and permissions
- Logs relevant data security information in audit trail

Advanced Cardiac

This package contains special sequences and protocols for advanced cardiac exams including enhanced 3D and 4D *syngo BEAT* functionalities. It allows comprehensive exams covering morphology, function, tissue characterization, coronary imaging, plaque characterization and more.

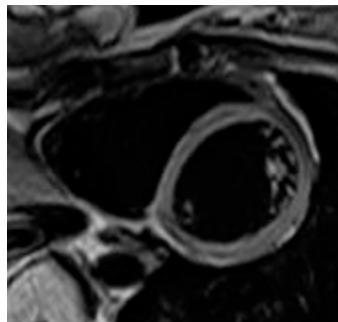
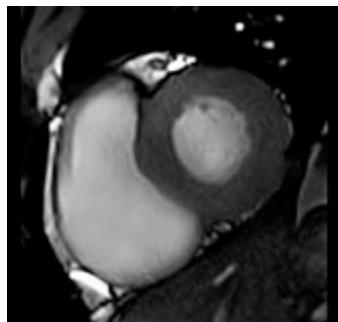
This package includes, for example:

Morphology – heart and vessel structure and valve function with *syngo BEAT*

- High resolution morphological imaging using Dark Blood sequences with free breathing

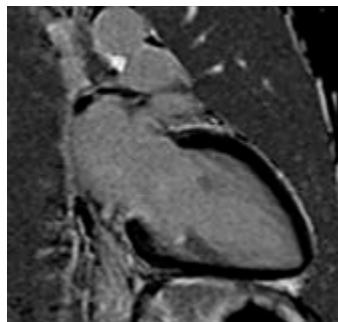
syngo BEAT

- Unique tool that enables with one click to optimize cardiac acquisitions
- 1 click to switch arrhythmia rejection on/off
- 1 click change from FLASH to TrueFISP for easy contrast optimization
- 1 click change from Cartesian to radial sampling to avoid folding artifacts in large patients
- 1 click switch from cine imaging to tagging for wall motion evaluation
- 1 click switch from 2D to 3D imaging



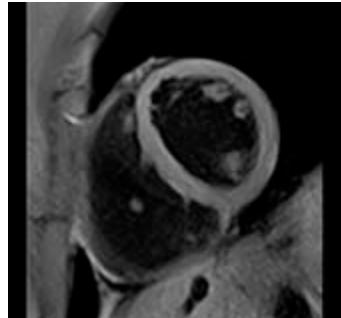
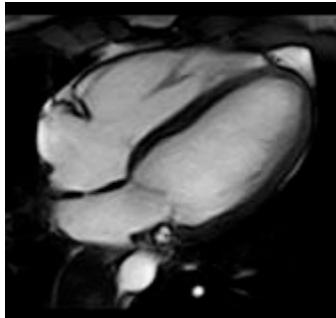
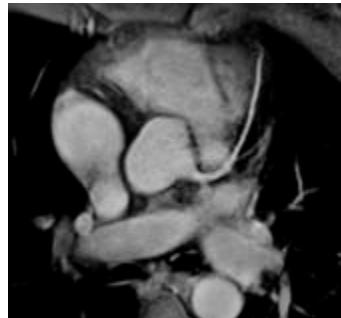
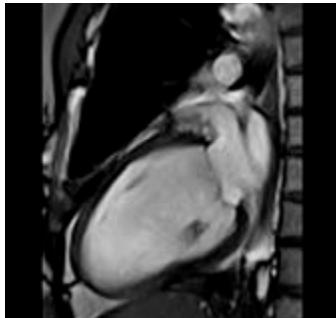
Ventricular function and wall motion with *syngo BEAT*

- Arrhythmia rejection for retrospectively triggered TrueFISP imaging, iPAT supported. No compromise in image quality for arrhythmic patients
- 3D cine imaging, complete coverage of the heart using a single sequence
- Real-time radial imaging for high speed and high resolution cine studies
- Real-time cine TrueFISP imaging without need for ECG triggering or breath-hold commands, supports iPAT
- Visualization of myocardial contractility using various tagging techniques



Tissue characterization with *syngo BEAT*

- Ultra-fast, high SNR sequences for dynamic imaging using TurboFLASH iPAT or TrueFISP iPAT for the assessment of coronary heart disease. These protocols allow the acquisition of multiple slices with high resolution, even under stress, with arbitrary slice orientation for each slice.
- Robust and reproducible contrast between tissues with phase-sensitive Inversion Recovery (2D FLASH and 2D TrueFISP). Adjustment of TI is no longer necessary with this technique
- Complete coverage of the myocardium with 3D FLASH and TrueFISP



Coronary Imaging with *syngo BEAT*

- Dedicated 2D and 3D sequences for high resolution coronary artery imaging, providing free breathing navigator (1D PACE with motion-adaptive gating) and breath-hold techniques
- Whole Heart Coronary MRA with CT-like results. 3D representation of the whole coronary tree in a single exam

Plaque characterization

- High resolution sequences and protocols for plaque characterization

syngo Inline Ventricular Function

syngo Inline VF performs volumetric evaluation of cardiac cine data fully automatically right after image reconstruction. There is no user input necessary. *syngo Inline VF*, a new member of the *Inline* family, brings intelligent image analysis on the fly directly to the scanner. *Inline* results are displayed and stored to the data base. If desired, *inline* calculated segmentation results can be loaded to Argus Ventricular Function for further review or processing.

syngo TWIST

This package contains a Siemens unique sequence and protocols for time-resolved 3D MR angiographic imaging with high spatial and temporal resolution. TWIST supports comprehensive dynamic MR angi exams. TWIST offers temporal information of vessel filling in addition to conventional static MR angiography. In case of very high spatial resolution TWIST may even replace conventional static MR angi. Moreover, TWIST does not require any bolus timing – just inject and go.

Visualization of contrast agent dynamics in the vessel system of interest

Needs only low amount of contrast agent

Imaging of all body regions, e.g. carotids, pulmonary and other peripheral vessels with brilliant spatial and temporal resolution

Clear separation of the arterial and venous phase

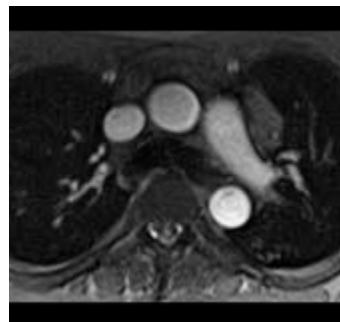
High speed acquisition by intelligent k-space strategies and use of iPAT, powered by Tim

Flow Quantification

Special sequences for quantitative flow determination studies

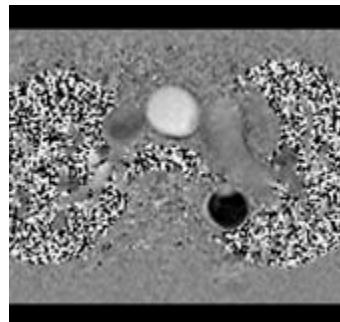
Measuring blood/CSF flow non-invasively

Requires Physiological Measurement Unit (PMU) option



RetroGated Flow

- Dynamic representation of temporally changing flow



Interactive Realtime

Sequences and hardware for interactive real-time scanning

Uses ultra-fast TrueFISP and other Gradient Echo sequences for high image contrast

Real-time reconstruction of the acquired data

The user can navigate in all planes on-the-fly during data acquisition

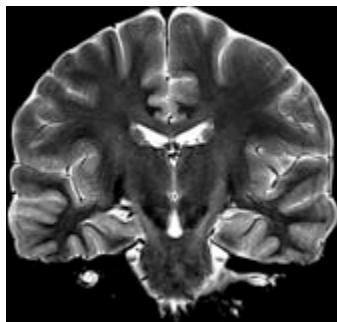
- Real-time cardiac examinations
- Real-time interactive slice positioning and slice angulation

TGSE (Turbo Gradient Spin Echo)

Ultra-fast sequence providing high resolution imaging or extremely short acquisition times

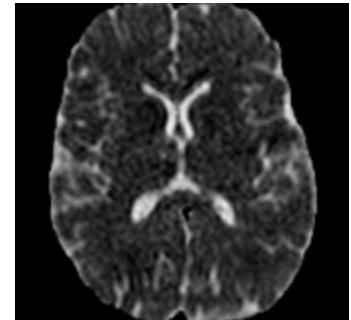
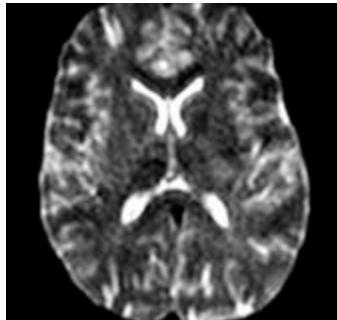
Hybrid Turbo Spin Echo/Gradient Echo used primarily for T2-weighted imaging

- Shorter measurement time
- Decreased RF power deposition
- Improved visualization of hemorrhage, due to magnetic susceptibility differences
- High resolution imaging of brain and spine



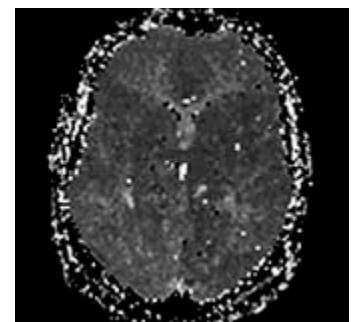
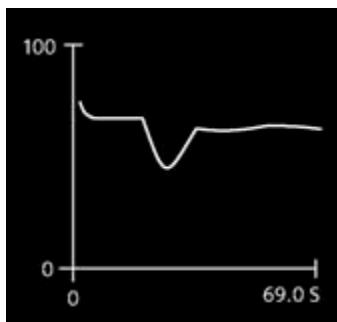
Inline Diffusion

Automatic real-time calculation of trace-weighted images and ADC maps with Inline Technology. Compatible with single-shot diffusion weighted EPI. Inline Diffusion enables syngo REVEAL body diffusion applications



Inline Perfusion

Automatic real-time calculation of Global Bolus Plot (GBP), Percentage of Baseline at Peak map (PBP) and Time-to-Peak map (TTP) with Inline technology

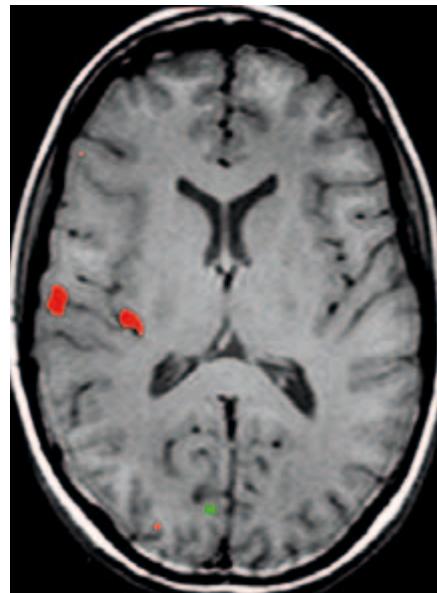
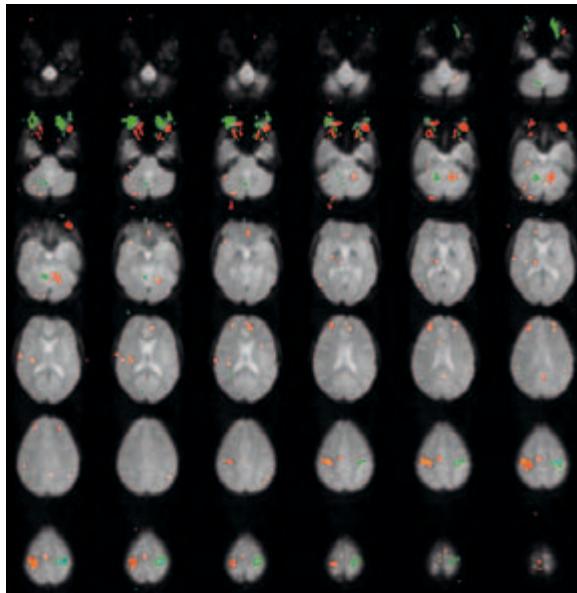


Inline BOLD Imaging (Blood Oxygen Level Dependent)

Examination of intrinsic susceptibility changes in different areas of the brain, induced by external stimulation (e.g. motor or visual)

Automatic real-time calculation of z-score (t-test) maps with Inline Technology, for variable paradigms

- Compatible with single-shot EPI with high susceptibility contrast for fast multi-slice imaging
- ART (Advanced Retrospective Technique) for fully automatic 3D retrospective motion correction, for 6 degrees of freedom (3 translations and 3 rotations)
- Mosaic images for efficient storage and transfer of large data sets
- 3D spatial filtering
- Inline calculation of t-statistics (t-maps) based on a general linear model (GLM) including the hemodynamic response function and correcting for slow drifts
- Overlay of inline calculated statistical results on the EPI images



Inline Composing

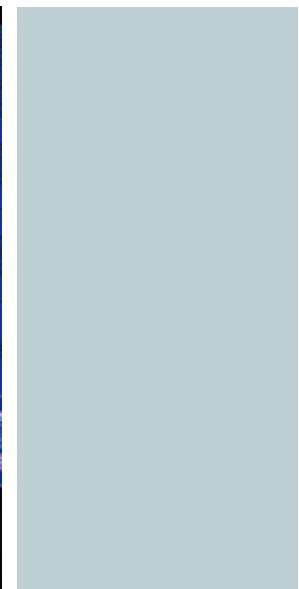
Automatic anatomical or angiographic composing of multiple adjacent coronal or sagittal images for presentation and further evaluation

Composed images can be automatically loaded into Graphical Slice Positioning for planning purposes. Composing is a pre-requisite

3D PACE

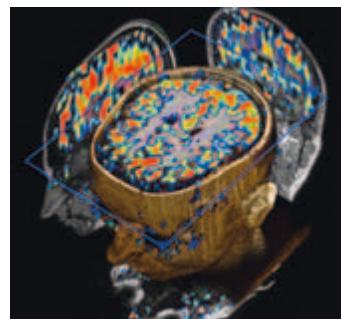
3D PACE (Prospective Acquisition CorreCtion) enhances inline BOLD imaging with motion correction during the acquisition of a BOLD exam. In contrast to a retrospective motion correction that corrects previously acquired data, the unique 3D PACE tracks the head of the patient, correcting for motion in real time during the acquisition. This increases the data quality beyond what can be achieved with a retrospective motion correction. As a result the sensitivity and specificity of BOLD experiments are increased.

- Fully automatic 3D prospective motion correction during data acquisition, for 6 degrees of freedom (3 translations and 3 rotations)
- Motion correction covering the complete 3D volume
- Provides high accuracy
- Substantially reduced motion-related artifacts in t-test calculations
- Significantly increased signal changes in the activated neuronal volume
- Increased functional MRI (fMRI) sensitivity and specificity



syngo ASL (Arterial Spin Labeling)

Arterial Spin Labeling (ASL) is an MR technique using the water in arterial blood as an endogenous contrast agent to evaluate perfusion non-invasively. syngo ASL provides unique insight into human brain perfusion and function physiology by evaluating cerebral blood flow. syngo ASL is capable of high spatial resolution perfusion imaging, making the technique very appealing in the evaluation of stroke, tumors, degenerative diseases, epilepsy but also in basic neuroscience, e.g. for studies of functional CBF changes.

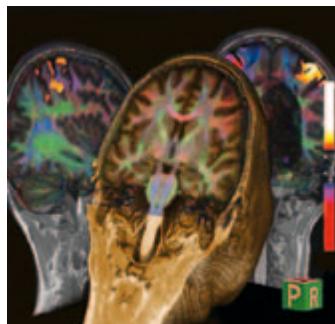


- Fully compatible with iPAT
- Includes 3D PACE motion correction for increased reliability
- Fully automated Inline calculation of regional blood flow color maps
- Supports the "Pulsed Arterial Spin Labeling" – technique (PASL).

Diffusion Tensor Imaging (DTI)

Acquisition of data sets with multi-directional diffusion weighting to assess anisotropic diffusion properties of brain tissue

- Measurement of up to 256 directions of diffusion weighting with up to 16 different b-values
- Inline calculation of the diffusion tensor
- Inline calculation of Fractional Anisotropy (FA) maps (grey-value as well as color-coded for principle diffusion direction), Apparent Diffusion Coefficient (ADC) maps and trace-weighted images based on the tensor

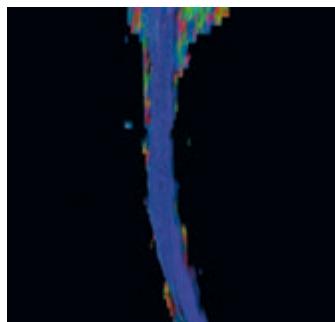


Multinuclear Support

Integrated hardware and system software package to prepare the MAGNETOM system for imaging and spectroscopy with nuclei other than ^1H .

Coils, pre-amplifiers and optimized pulse sequences are not included.

- Supports the generation of RF pulses for ^3He , ^7Li , ^{13}C , ^{19}F , ^{23}Na , ^{31}P , ^{129}Xe and ^{17}O and allows to receive signals at the respective frequencies
- Supports mono and double resonant send/receive coils ($^1\text{H}/x$ -nucleus)
- Imaging with the nuclei ^3He , ^7Li , ^{13}C , ^{19}F , ^{23}Na , ^{31}P and ^{129}Xe and spectroscopy with the nuclei ^7Li , ^{13}C , ^{19}F , and ^{31}P
- Spectroscopic and imaging experiments using the ^1H Nuclear Overhauser Effect (NOE) and using ^1H decoupling
- A basic pulse sequence serves as a starting point for flexible design of x-nucleus sequences using the development environment IDEA (see below)



syngo DTI Tractography

syngo DTI Tractography allows the visualization of multiple white matter tracts based on diffusion tensor imaging data. DTI Tractography is optimized to support the presurgical planning and to allow for neuro physiological research with respect to connectivity and white matter pathology.

- Advanced 3D visualization of white matter tracts in the context of 2D or 3D anatomical and DTI datasets
- Texture Diffusion, a highly versatile in-plane visualization of white matter tracts, allows to display and read DTI Tractography results on PACS reading stations and in the OR.
- Seed points for tracking with single ROI and with multiple ROIs to assess connectivity
- Tract and seeding ROI statistics (mean/max FA value, min/mean/max ADC value, and more)
- DICOM export of views, HTML export of Tract and seeding ROI statistics
- Interactive QuickTracking displays the tract originating from the mouse pointer position while moving over the DTI data set.

Single Voxel Spectroscopy

Integrated software package with sequences and protocols for proton spectroscopy. Streamlined for easy push-button operation

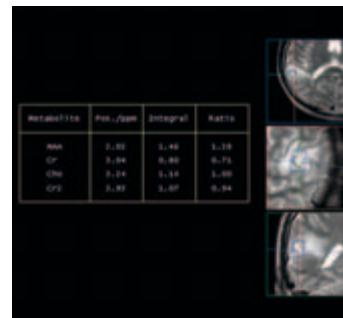
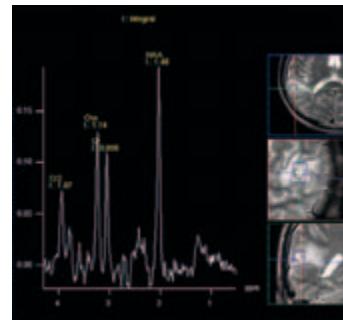
- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR based on the head matrix coil
- Spectral suppression (user definable parameter) to avoid lipid superposition in order to reliably detect e.g. choline in the breast
- Up to 8 regional saturation (RSat) bands for outer volume suppression can be defined by the user.
- Physiological triggering (ECG, pulse, respiratory or external trigger) in order to avoid e.g. breathing artefacts.

Clinical application:

- Brain, liver, neck soft tissue, spine

SVS techniques SE and STEAM

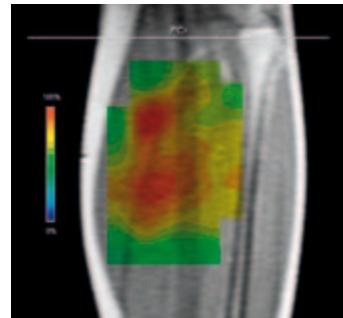
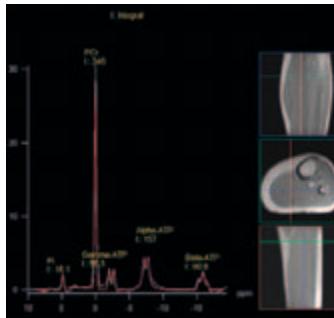
- Short TEs available
- Fully automated adjustments including localized shimming and adjustment of water suppression pulses
- Also available: Interactive adjustments and control of adjustments
- Optimized protocols for brain applications



M multinuclear Spectroscopy

CSI spectroscopy sequence and protocols for x-nuclei

- The CSI sequence supports measurements with all frequencies supported by the hardware
 - Basic measurement and post-processing protocols for ^7Li , ^{13}C , ^{19}F and ^{31}P
 - The sequence supports NOE (Nuclear Overhauser Effect) and ^1H decoupling
 - ECG triggering available
 - Weighted acquisition available

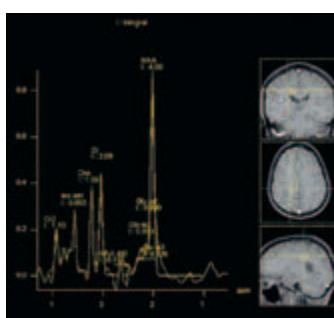
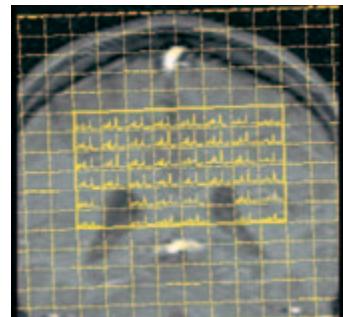
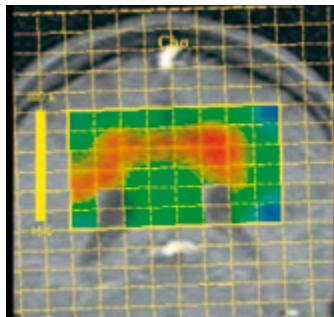


Chemical Shift Imaging

Integrated software package with sequences and protocols for Chemical Shift Imaging (CSI)

Extension of the SVS package, offering the same level of user-friendliness and automation

- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR with configurable prescan-based normalization for optimal homogeneity
 - 2D and 3D Chemical Shift Imaging
 - Hybrid CSI with combined Volume selection and Field of View (FoV) encoding
 - Short TEs available (30 ms for SE, 20 ms for STEAM)
 - Automized shimming of the higher order shimming channels for optimal homogeneity of the larger CSI volumes
 - Weighted acquisition, leading to a reduced examination time compared to full k-space coverage while keeping SNR and spatial resolution
 - Outer Volume Suppression
 - Spectral Suppression
 - Protocols for prostate spectroscopy



Measurement	Age (yr)	Weight (kg)	Height (cm)
100	1.00	3.00	4.00
200	2.00	3.00	4.00
300	3.00	3.00	4.00
400	4.00	3.00	3.00
500	5.00	3.00	3.00
600	6.00	3.00	3.00
700	7.00	3.00	3.00
800	8.00	3.00	3.00
900	9.00	3.00	3.00
1000	10.00	3.00	3.00

Advanced High Order Shim Option required

syngo Expert-i

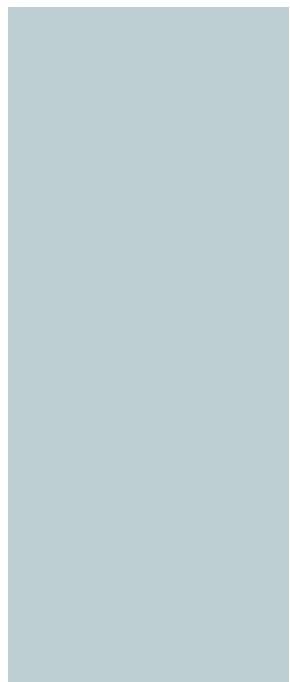
Interactive remote assistance during the MR exam. Get real-time access to imaging data and exam information from any networked PC within the hospital network.

Until now, radiologists or other experts had to stop what they were doing and go to the MR scanner when complex clinical questions arose.

Now, questions can be addressed quickly and efficiently via networked PC.

Some of the benefits of syngo Expert-i are:

- Excellent results right from the first examination
- Streamlined workflow & faster patient throughput
- Reduces repeat rates with a check on images while the patient is still in the examination room
- Reduces training effort by enabling expert assistance for specialized procedure



IDEA Integrated Development Environment for Applications

Extensive programming environment used to create and modify pulse sequences, offering a maximum of flexibility

Based on C++ for Windows XP

Sequences and RF pulses are displayed in a visual interface

- Allows direct access to the Image Calculation Environment (ICE), and to all protocols
- Testing the generated code is extensively supported by the debugger and the simulation program
- IDEA is also usable on any standard PC with operating system Windows XP making developments independent of the MR system

Processing Plug-ins

For development or modification of user-defined image processing steps which may be integrated into the measurement protocols

- Individual processing is secured by a number of functions (e.g. TTP and MTT), useful for neuro or perfusion imaging

Prerequisite:
IDEA training course

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Order No.
A91MR-700-G9-B5-7600
Printed in Germany
MC.MR-00700 PA 0308 POD

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MAGNETOM Trio, A Tim System

Application Packages

T-class. Trendsetting applications. Powered by Tim.

www.siemens.com/healthcare

SIEMENS

T-class is the next generation of trendsetting Tim-based MRI scanners. The new T-class systems enable for the first time in MRI, Continuous Table move examinations, *syngo TimCT*, and support workflow both at the scanner and beyond the scanner through a unique departmental integration of the MR and the Siemens RIS (*syngo Workflow*).

Tim Whole Body Suite

MAGNETOM Trio, A Tim System features a unique telescopic patient table which enables a full Field of View of 181 cm, without increasing total system length. No additional table extension is required.

The table top has standard length. Table movement to its full extent can be controlled from the *syngo Acquisition Workplace*.

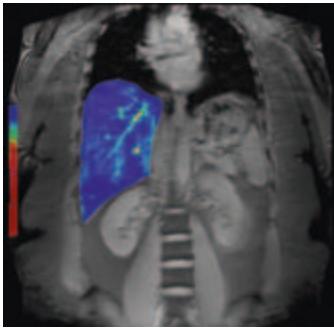
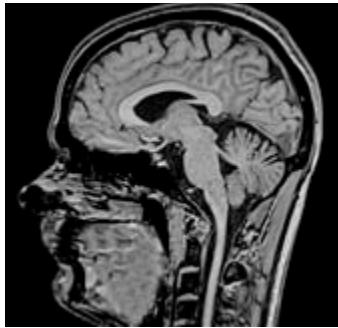
The large FoV helps in imaging metastases with sequences such as TIRM (Turbo Inversion Recovery). Whole-Body MR Angiography is possible on the entire volume with iPAT.

- Max. scan range of 181 cm
- Protocols and programs for Whole-Body MR Angiography and metastases detection

syngo Inline Ventricular Function

syngo Inline VF performs volumetric evaluation of cardiac cine data fully automatically right after image reconstruction. There is no user input necessary. *syngo Inline VF*, a new member of the Inline family, brings intelligent image analysis on the fly directly to the scanner. Inline results are displayed and stored to the data base. If desired, inline calculated segmentation results can be loaded to Argus Ventricular Function for further review or processing.





iPAT Extensions (integrated Parallel Acquisition Techniques)

iPAT² allows iPAT in 2 directions simultaneously (phase-encoding direction and 3D direction for 3D sequences)

By applying PAT in 2 directions simultaneously, the effective PAT factor can be maximized, and PAT applications are extended.

Typical clinical applications are MR Angiography or ultra-fast isotropic T1-weighted 3D imaging of the head.

syngo MapIt

syngo MapIt allows the early detection of osteo arthritic pathology based on the T1 and T2 and T2* properties of the cartilage. As well the assessment of T1, T2 and T2* properties of tissues in other body regions is possible.

syngo MapIt provides the Inline calculation of parametric maps for the T1, T2 and T2* properties of the imaged tissue and the necessary measurements.

- 3D VIBE sequence for Inline T1 mapping
- Multiecho spin echo sequence for Inline T2 mapping
- Multiecho gradient echo sequence for Inline T2* mapping
- Protocols for fully automated Inline parametric mapping

CISS & DESS

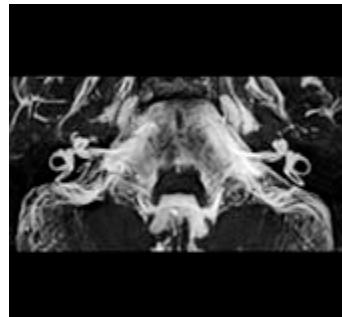
Unique Siemens sequences and protocols

3D DESS (Double Echo Steady State):

- T2/T1-weighted
- Excellent fluid-cartilage differentiation in orthopedic imaging

3D CISS (Constructive Interference in Steady State):

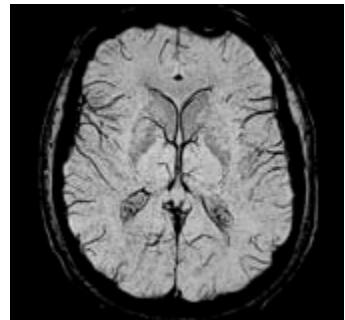
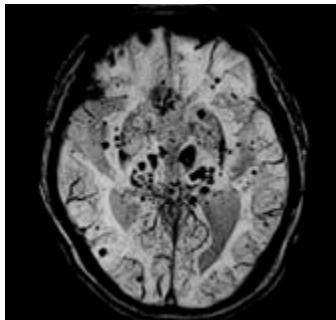
- Excellent visualization of fine structures such as cranial nerves
- High resolution imaging of inner ear and spine



syngo SWI (Susceptibility Weighted Imaging)

Siemens-unique sequence technique for Susceptibility Weighted Imaging

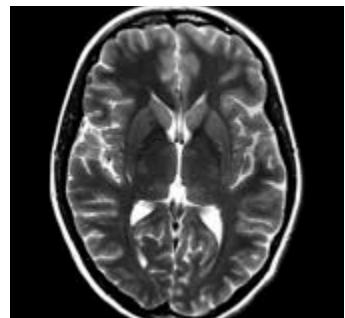
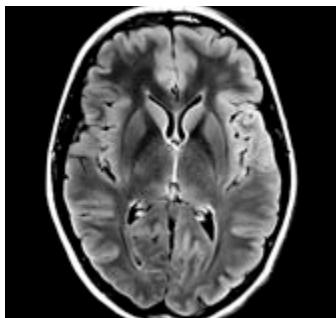
- Visualization of local changes of the magnetic field due to tissue properties in general and due to the presence of deoxygenated blood or blood decomposition products
- 3D GRE sequence with full flow compensation to support venous angiography
- Enhanced susceptibility weighting of the magnitude images by phase images to increase sensitivity to intracerebral hemorrhage



syngo BLADE

Motion insensitive Turbo Spin Echo sequence optimized for head exams

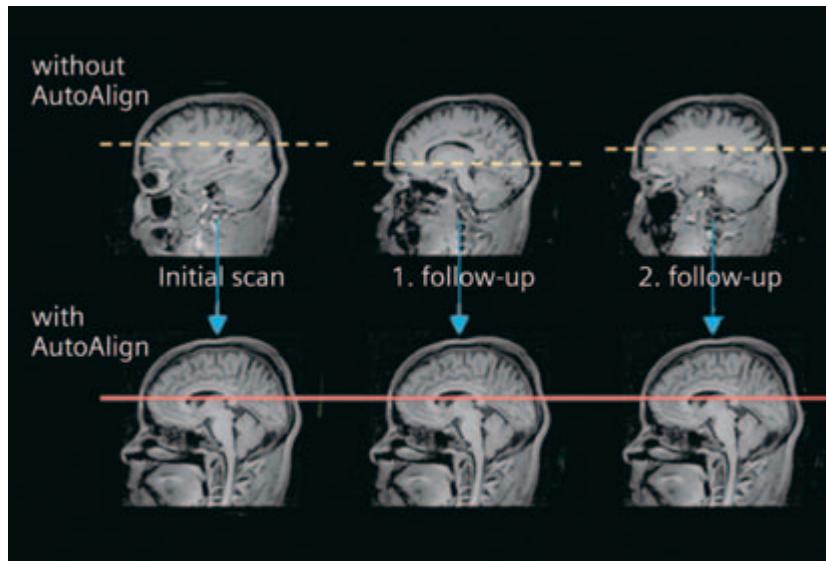
- Supports T2-weighted, T1-weighted, STIR and DarkFluid protocols
- Simultaneous in-plane motion correction for arbitrary slice orientations
- Versatile sequence e.g. supporting iPAT with GRAPPA, Restore pulses and 2D PACE
- Supports respiratory triggered imaging of the abdomen using 2D PACE
- Improves image quality for uncooperative patients e.g. children in head, spine, orthopedic imaging and the abdomen



AutoAlign Head

Automated alignment of slice positioning for head examinations. This option enables easy and accurate patient follow-up. AutoAlign Head references the 3D MR brain atlas and automatically aligns the slice positions in a standard reproducible way.

- Automatic slice planning : no manual adjustments of slice positioning necessary
- Reproducibility : reviews all head images in the same position and orientation
- Follow-up : reapply exactly the same image position as in previous examinations (supported by the Phoenix technique)



AutoAlign Spine

Single mouse click double oblique positioning of transverse slice packages in spine imaging. AutoAlign Spine localizes the intervertebral disk on sagittal images and positions the transverse slice packages parallel to the disk in a standardized way. This allows for a faster and easier exam and supports reading by delivering a higher and more standardized image quality.

syngo Security

Security package for general regulatory security rules

The option supports customers to achieve compliance with HIPAA (Health Insurance and Accountability Act).

- User authentication
- Restricts access to functions and data through privileges and permissions
- Logs relevant data security information in audit trail

Advanced Cardiac

This package contains special sequences and protocols for advanced cardiac exams including enhanced 3D and 4D *syngo BEAT* functionalities. It allows comprehensive exams covering morphology, function, tissue characterization, coronary imaging, plaque characterization and more.

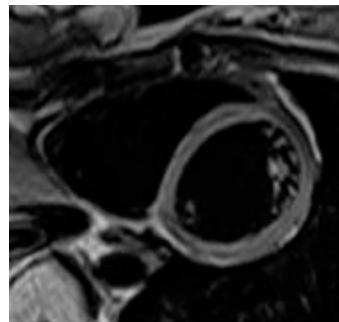
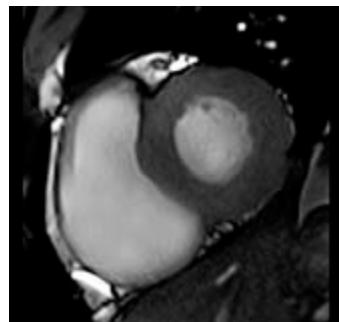
This package includes, for example:

Morphology – heart and vessel structure and valve function with *syngo BEAT*

- High resolution morphological imaging using Dark Blood sequences with free breathing

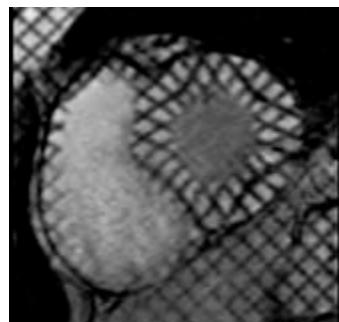
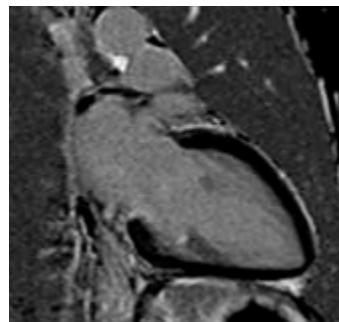
syngo BEAT

- Unique tool that enables with one click to optimize cardiac acquisitions
- 1 click to switch arrhythmia rejection on/off
- 1 click change from FLASH to TrueFISP for easy contrast optimization
- 1 click change from Cartesian to radial sampling to avoid folding artifacts in large patients
- 1 click switch from cine imaging to tagging for wall motion evaluation
- 1 click switch from 2D to 3D imaging



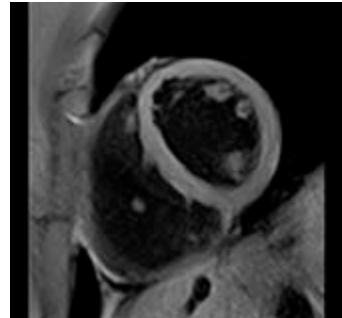
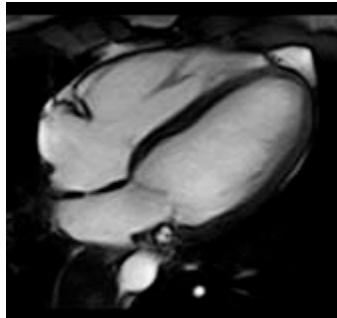
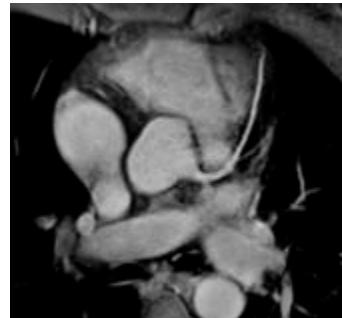
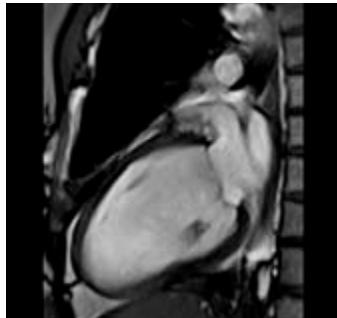
Ventricular function and wall motion with *syngo BEAT*

- Arrhythmia rejection for retrospectively triggered TrueFISP imaging, iPAT supported. No compromise in image quality for arrhythmic patients
- 3D cine imaging, complete coverage of the heart in just one go
- Real-time radial imaging for high speed and high resolution cine studies
- Real-time cine TrueFISP imaging without need for ECG triggering or breath-hold commands, supports iPAT
- Visualization of myocardial contractility using various tagging techniques



Tissue characterization with *syngo BEAT*

- Ultra-fast, high SNR sequences for dynamic imaging using TurboFLASH iPAT or TrueFISP iPAT for the assessment of coronary heart disease. These protocols allow the acquisition of multiple slices with high resolution, even under stress, with arbitrary slice orientation for each slice.
- Robust and reproducible contrast between tissues with phase-sensitive Inversion Recovery (2D FLASH and 2D TrueFISP). Adjustment of TI is no longer necessary with this technique
- Complete coverage of the myocardium with 3D FLASH and TrueFISP



Coronary Imaging with *syngo BEAT*

- Dedicated 2D and 3D sequences for high resolution coronary artery imaging, providing free breathing navigator (1D PACE with motion-adaptive gating) and breath-hold techniques
- Whole Heart Coronary MRA with CT-like results. 3D representation of the whole coronary tree in a single exam

Plaque characterization

- High resolution sequences and protocols for plaque characterization

syngo TWIST

This package contains a Siemens unique sequence and protocols for time-resolved 3D MR angiographic imaging with high spatial and temporal resolution. TWIST supports comprehensive dynamic MR angi exams. TWIST offers temporal information of vessel filling in addition to conventional static MR angiography. In case of very high spatial resolution TWIST may even replace conventional static MR angi. Moreover, TWIST does not require any bolus timing – just inject and go.

Visualization of contrast agent dynamics in the vessel system of interest

Needs only low amount of contrast agent

Imaging of all body regions, e.g. carotids, pulmonary and other peripheral vessels with brilliant spatial and temporal resolution

Clear separation of the arterial and venous phase

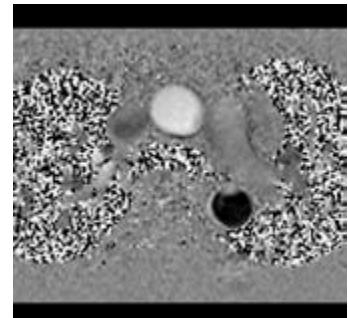
High speed acquisition by intelligent k-space strategies and use of iPAT, powered by Tim

Flow Quantification

Special sequences for quantitative flow determination studies

Measuring blood/CSF flow non-invasively

Requires Physiological Measurement Unit (PMU) option



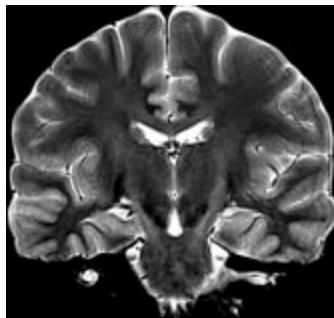
RetroGated Flow

- Dynamic representation of temporally changing flow

TGSE (Turbo Gradient Spin Echo)

Ultra-fast sequence providing high resolution imaging or extremely short acquisition times

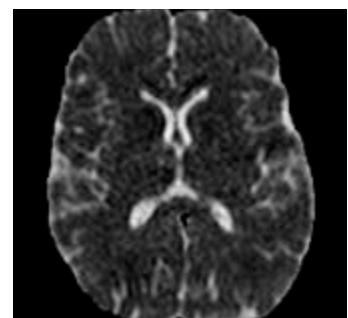
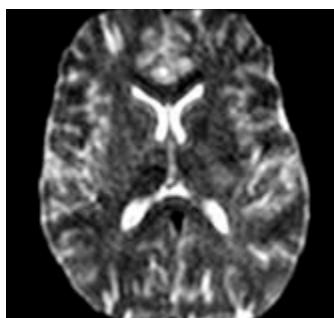
Hybrid Turbo Spin Echo/Gradient Echo used primarily for T2-weighted imaging



- Shorter measurement time
- Decreased RF power deposition
- Improved visualization of hemorrhage, due to magnetic susceptibility differences
- High resolution imaging of brain and spine

Inline Diffusion

Automatic real-time calculation of trace-weighted images and ADC maps with Inline Technology. Compatible with single-shot diffusion weighted EPI. Inline Diffusion enables syngo REVEAL body diffusion applications

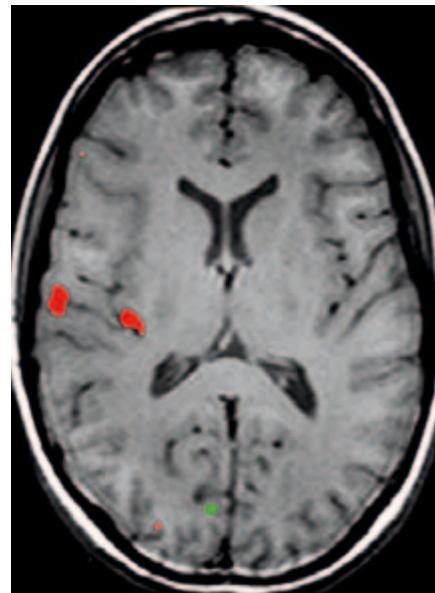
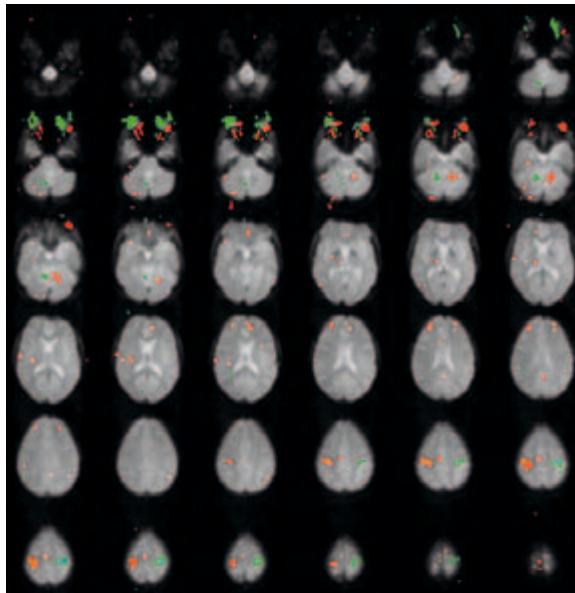


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Inline Composing

Automatic anatomical or angiographic composing of multiple adjacent coronal or sagittal images for presentation and further evaluation

Composed images can be automatically loaded into Graphical Slice Positioning for planning purposes. Composing is a pre-requisite

3D PACE

3D PACE (Prospective Acquisition CorreCtion) enhances inline BOLD imaging with motion correction during the acquisition of a BOLD exam. In contrast to a retrospective motion correction that corrects previously acquired data, the unique 3D PACE tracks the head of the patient, correcting for motion in real time during the acquisition. This increases the data quality beyond what can be achieved with a retrospective motion correction. As a result the sensitivity and specificity of BOLD experiments are increased.

- Fully automatic 3D prospective motion correction during data acquisition, for 6 degrees of freedom (3 translations and 3 rotations)
- Motion correction covering the complete 3D volume
- Provides high accuracy
- Substantially reduced motion-related artifacts in t-test calculations
- Significantly increased signal changes in the activated neuronal volume
- Increased functional MRI (fMRI) sensitivity and specificity



Interactive Realtime

Sequences and hardware for interactive real-time scanning

Uses ultra-fast TrueFISP and other Gradient Echo sequences for high image contrast

Real-time reconstruction of the acquired data

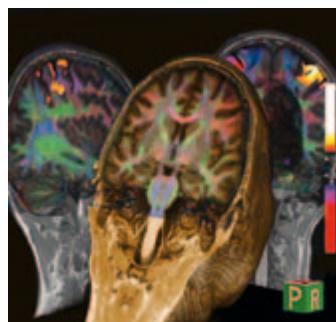
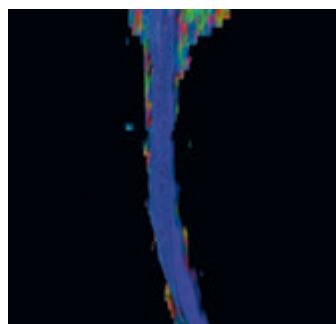
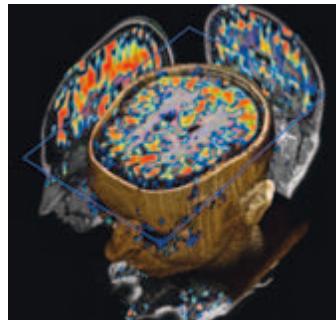
The user can navigate in all planes on-the-fly during data acquisition

- Real-time cardiac examinations
- Real-time interactive slice positioning and slice angulation

syngo ASL (Arterial Spin Labeling)

Arterial Spin Labeling (ASL) is an MR technique using the water in arterial blood as an endogenous contrast agent to evaluate perfusion non-invasively. syngo ASL provides unique insight into human brain perfusion and function physiology by evaluating cerebral blood flow. syngo ASL is capable of high spatial resolution perfusion imaging, making the technique very appealing in the evaluation of stroke, tumors, degenerative diseases, epilepsy but also in basic neuroscience, e.g. for studies of functional CBF changes.

- Fully compatible with iPAT
- Includes 3D PACE motion correction for increased reliability
- Fully automated Inline calculation of regional blood flow color maps
- Supports the "Pulsed Arterial Spin Labeling" – technique (PASL).



Diffusion Tensor Imaging (DTI)

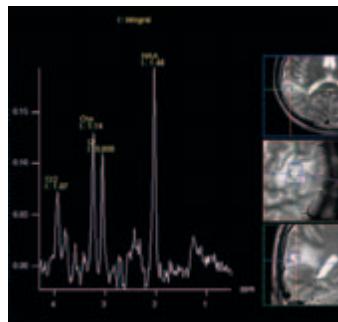
Acquisition of data sets with multi-directional diffusion weighting to assess anisotropic diffusion properties of brain tissue

- Measurement of up to 256 directions of diffusion weighting with up to 16 different b-values
- Inline calculation of the diffusion tensor
- Inline calculation of Fractional Anisotropy (FA) maps (grey-value as well as color-coded for principle diffusion direction), Apparent Diffusion Coefficient (ADC) maps and trace-weighted images based on the tensor

syngo DTI Tractography

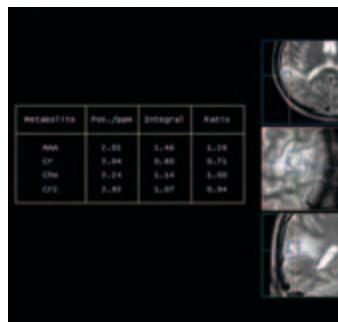
syngo DTI Tractography allows the visualization of multiple white matter tracts based on diffusion tensor imaging data. DTI Tractography is optimized to support the presurgical planning and to allow for neuro physiological research with respect to connectivity and white matter pathology.

- Advanced 3D visualization of white matter tracts in the context of 2D or 3D anatomical and DTI datasets
- Texture Diffusion, a highly versatile in-plane visualization of white matter tracts, allows to display and read DTI Tractography results on PACS reading stations and in the OR.
- Seed points for tracking with single ROI and with multiple ROIs to assess connectivity
- Tract and seeding ROI statistics (mean/max FA value, min/mean/max ADC value, and more)
- DICOM export of views, HTML export of Tract and seeding ROI statistics
- Interactive QuickTracking displays the tract originating from the mouse pointer position while moving over the DTI data set.



Single Voxel Spectroscopy

Integrated software package with sequences and protocols for proton spectroscopy. Streamlined for easy push-button operation



- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR based on the head matrix coil
- Spectral suppression (user definable parameter) to avoid lipid superposition in order to reliably detect e.g. choline in the breast
- Up to 8 regional saturation (RSat) bands for outer volume suppression can be defined by the user.
- Physiological triggering (ECG, pulse, respiratory or external trigger) in order to avoid e.g. breathing artefacts.

Clinical application:

- Brain, liver, neck soft tissue, spine

SVS techniques SE and STEAM

- Short TEs available
- Fully automated adjustments including localized shimming and adjustment of water suppression pulses
- Also available: Interactive adjustments and control of adjustments
- Optimized protocols for brain applications

Multinuclear Support

Integrated hardware and system software package to prepare the MAGNETOM system for imaging and spectroscopy with nuclei other than ^1H .

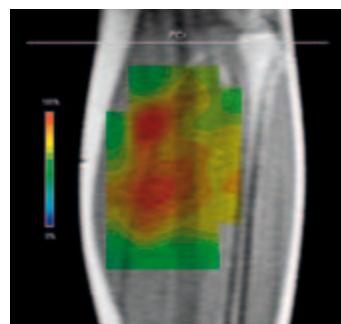
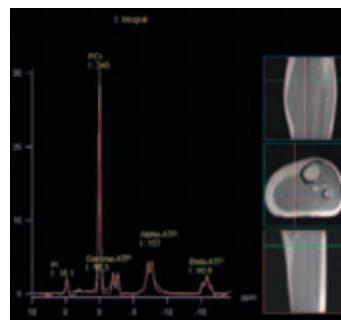
Coils, pre-amplifiers and optimized pulse sequences are not included.

- Supports the generation of RF pulses for ^3He , ^7Li , ^{13}C , ^{19}F , ^{23}Na , ^{31}P , ^{129}Xe and ^{17}O and allows to receive signals at the respective frequencies
- Supports mono and double resonant send/receive coils ($^1\text{H}/x$ -nucleus)
- Imaging with the nuclei ^3He , ^7Li , ^{13}C , ^{19}F , ^{23}Na , ^{31}P and ^{129}Xe and spectroscopy with the nuclei ^7Li , ^{13}C , ^{19}F , and ^{31}P
- Spectroscopic and imaging experiments using the ^1H Nuclear Overhauser Effect (NOE) and using ^1H decoupling
- A basic pulse sequence serves as a starting point for flexible design of x-nucleus sequences using the development environment IDEA (see below)

Multinuclear Spectroscopy

CSI spectroscopy sequence and protocols for x-nuclei

- The CSI sequence supports measurements with all frequencies supported by the hardware
- Basic measurement and post-processing protocols for ^7Li , ^{13}C , ^{19}F and ^{31}P
- The sequence supports NOE (Nuclear Overhauser Effect) and ^1H decoupling
- ECG triggering available
- Weighted acquisition available

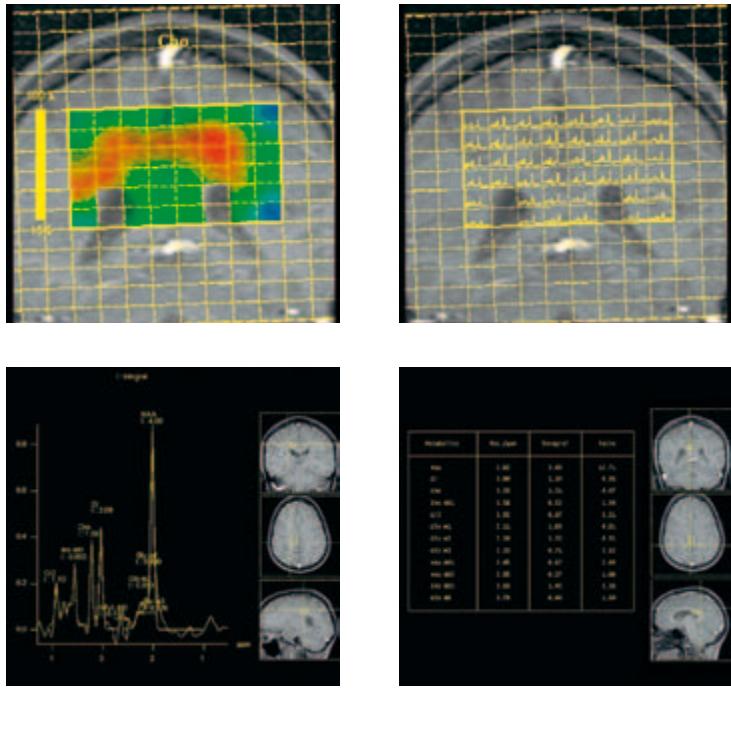


Chemical Shift Imaging

Integrated software package with sequences and protocols for Chemical Shift Imaging (CSI)

Extension of the SVS package, offering the same level of user-friendliness and automation

- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR with configurable prescan-based normalization for optimal homogeneity
- 2D and 3D Chemical Shift Imaging
- Hybrid CSI with combined Volume selection and Field of View (FoV) encoding
- Short TEs available (30 ms for SE, 20 ms for STEAM)
- Automated shimming of the higher order shimming channels for optimal homogeneity of the larger CSI volumes
- Weighted acquisition, leading to a reduced examination time compared to full k-space coverage while keeping SNR and spatial resolution
- Outer Volume Suppression
- Spectral Suppression
- Protocols for prostate spectroscopy



Advanced High Order Shim Option required

syngo Expert-i

Interactive remote assistance during the MR exam. Get real-time access to imaging data and exam information from any networked PC within the hospital network.

Until now, radiologists or other experts had to stop what they were doing and go to the MR scanner when complex clinical questions arose.

Now, questions can be addressed quickly and efficiently via networked PC.

Some of the benefits of syngo Expert-i are:

- Excellent results right from the first examination
- Streamlined workflow & faster patient throughput
- Reduces repeat rates with a check on images while the patient is still in the examination room
- Reduces training effort by enabling expert assistance for specialized procedure



IDEA Integrated Development Environment for Applications

Extensive programming environment used to create and modify pulse sequences, offering a maximum of flexibility

Based on C++ for Windows XP

Sequences and RF pulses are displayed in a visual interface

- Allows direct access to the Image Calculation Environment (ICE), and to all protocols
- Testing the generated code is extensively supported by the debugger and the simulation program
- IDEA is also usable on any standard PC with operating system Windows XP making developments independent of the MR system

Processing Plug-ins

For development or modification of user-defined image processing steps which may be integrated into the measurement protocols

- Individual processing is secured by a number of functions (e.g. TTP and MTT), useful for neuro or perfusion imaging

Prerequisite:
IDEA training course

syngo TimCT Angiography

syngo TimCT Angiography employs the revolutionary TimCT Continuous Table move technology for large Field of View angiographies with the smoothest workflow and the most homogeneous image quality.

syngo TimCT Angiography is built on the Tim technology as well as on a highly advanced patient table with high positioning accuracy and a RF shielded table drive.

syngo TimCT Angiography uses a coronal 3D gradient echo TimCT sequence with strong T1-weighting and high SNR. Optimized protocols for peripheral vessel run off exams allow for CT-like scanning with MR: Just define start & end of the scan range. No need to plan multiple steps. No need to plan overlapping sections. No lost time due to inter station table move. No need to compose images.

- iPAT compatibility utilizing Tim's Matrix coils capabilities
- Inline subtraction and Inline MIP of complete peripheral run off images
- Highest image homogeneity and no boundary artifacts thanks to seamless TimCT scanning
- Maximum FoV of syngo TimCT Angiography: 181 cm/140 cm (with/without Tim Whole Body Suite)

- Fast table speed during angiographic measurements up to 50 mm/s
- Fast examination time (typically below 1 minute) for TimCT peripheral angiographic exam e. (40–70 s depending on resolution)

Thanks to the streamlined and automated workflow and the fast acquisition time with syngo TimCT, a peripheral vessel run off exam can be performed in less than 10 minutes with the most homogeneous image quality.

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Order No.
A91MR-700-G9-C5-7600
Printed in Germany
MC.MR-00700 PA 0308 POD

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Medical images courtesy of:
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Hong Kong Sanatorium & Hospital, Hong Kong,
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S.Y.U.M., Guangzhou, P.R. China
CGMH, Taoyuan, Taiwan

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MAGNETOM Trio, A Tim System

syngo Chorus MR

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syngo Chorus MR

The workflow in radiology requires the connectivity and interoperability of different systems. In order to reach a smooth and integrated workflow of these systems, Siemens Medical Solutions provides a solution for setting up MRI examina-

tions at the Radiology Information System (RIS), thus eliminating exam planning efforts at the scanner.

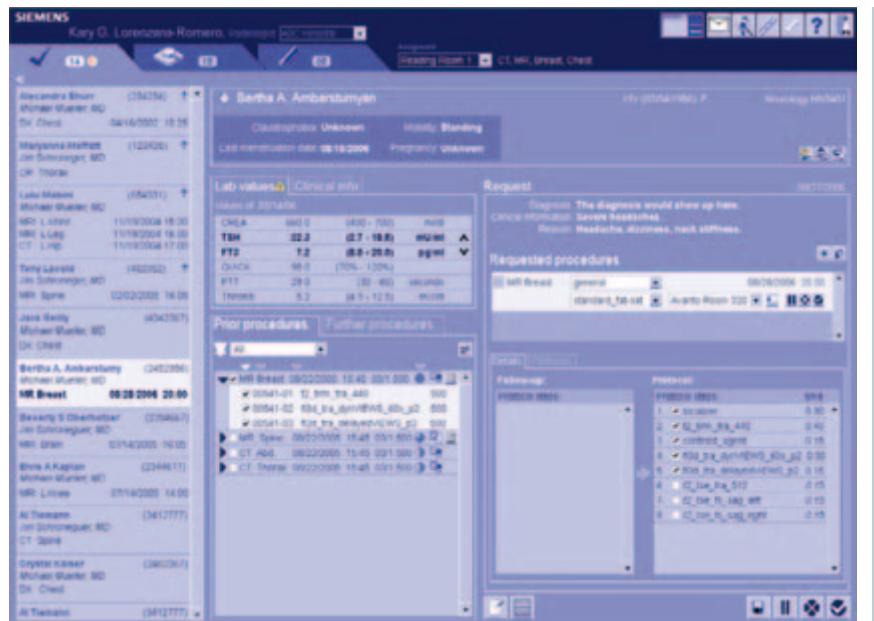
The follow-up examination workflow is systematically supported to reproduce examination results for comparison.

Centralized services for protocol update and protocol distribution ensure defined high-quality scanning results across MR scanners.

Protocol Planning

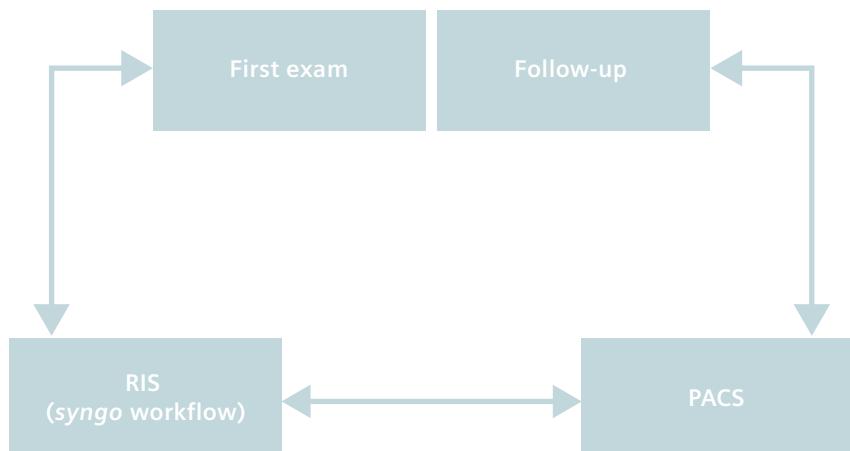
For patient centric efficient and consistent protocol planning, the RIS system acts as a planning tool for the MR modalities connected. Scheduling examinations can be performed at the RIS. The information exchange is based on DICOM Modality Worklists, Modality Performed Procedure Steps and PhoenixZIP Documents.

Benefits include an easy and convenient MR planning for the physician – avoiding unnecessary phone calls or walking to the MRI suite – as well as an insurance that the desired protocol will be ran on the patient.



Inline-Follow up

To ease the setup of follow-up examinations the modality scan protocols and PhoenixZIP documents of the previous examinations can be used at the RIS to schedule a scan with the same scanning protocol(s), sequence(s) and parameters. Thus best comparable follow up results will be created at the MR modality.



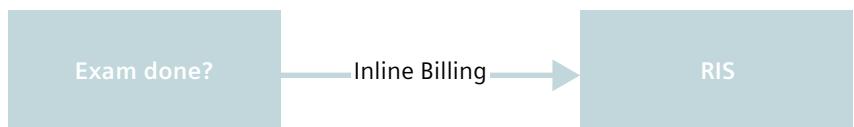
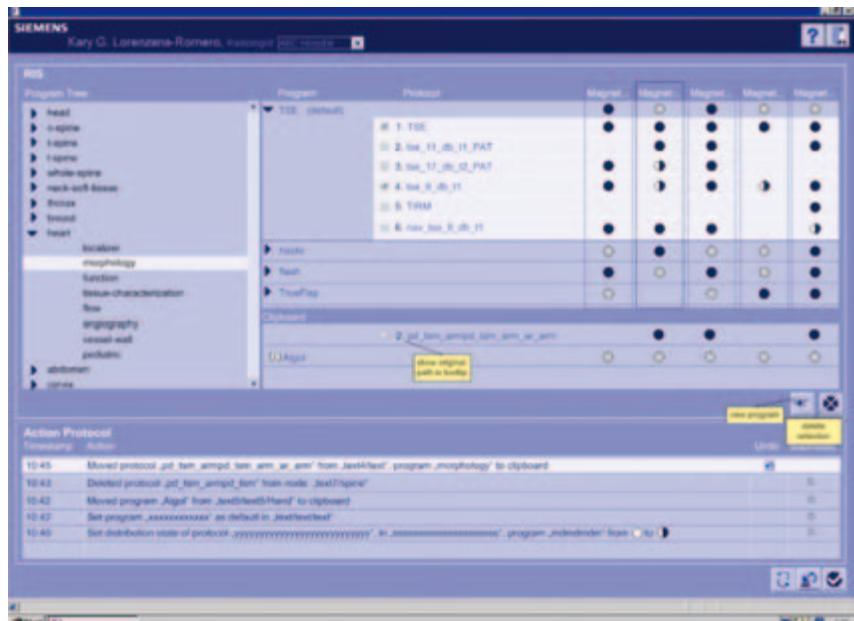
Protocol Distribution

Protocol Distribution ensures an easy and efficient standardization of examinations across the MR scanners of your Radiology department. With this web based technique, protocols can be distributed between RIS and multiple MR modalities with the RIS acting as a central protocol repository.

Inline Billing/MPPS

Via the same mechanism used for Protocol Distribution, accounting information is exchanged between the RIS and the MR modality with a centralized supply catalog. Inline Billing eliminates the need to enter billing codes after the examination and thereby streamlines the billing process. The automatic process eliminates possible manual errors and reduces the order-to-billing time in your department.

syngo Chorus MR can be installed stand-alone on MAGNETOM Tim Systems with I-class or syngo MR B15. The functionality within *syngo* Chorus MR currently requires the Siemens Radiology Information System *syngo* Workflow with the software version V30.



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MAGNETOM Trio, A Tim System

Post-processing Packages

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All post-processing packages are separately available for the *syngo* Acquisition Workplace or the *syngo* MR Workplace

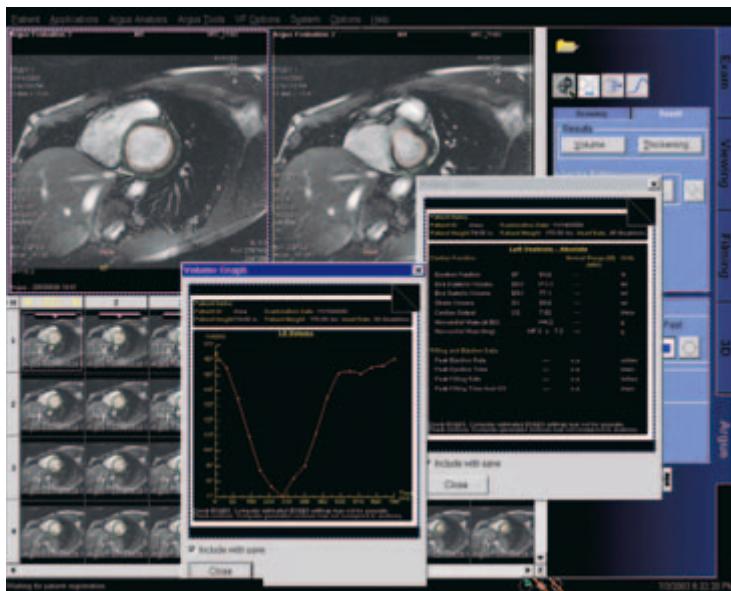
***syngo* Argus 4D Ventricular Function**

syngo Argus 4D VF software processes MR cine images of the heart and generates quantitative results for physicians in the diagnostic process. This new Argus protocol provides volumetric cardiac data of a given patient very quickly and easily. Parametric results and volume-time curves are being calculated upon automatic creation and adaptation of a 4D model of the left ventricle. The resulting 4D model of the patient's heart can be visualized superimposed to anatomical images as reference.

Argus Function

Automated tool for cardiac function evaluation

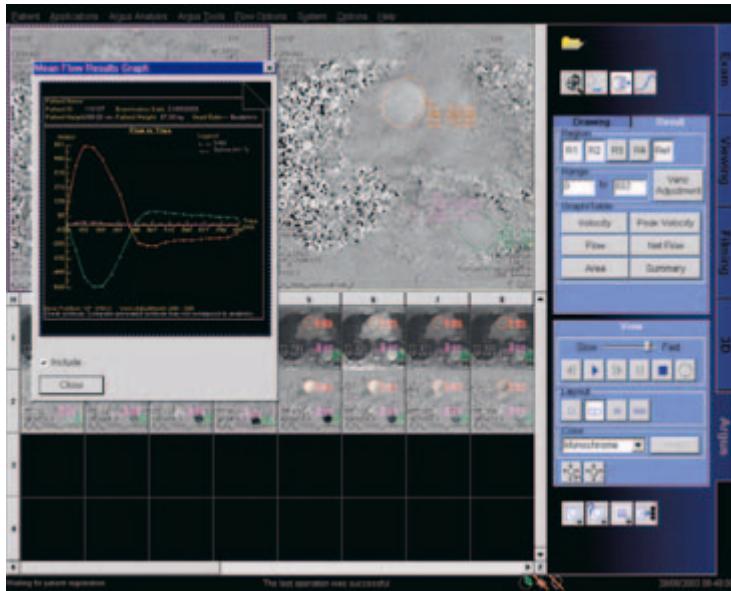
- Fully automatic left ventricle segmentation
- Easy user guidance with graphical selection of ED, ES, basal and apical slices
- Volumetric and regional wall motion analysis (e.g. stroke volume and bull's-eye plots)



Argus Flow

Automated tool for analysis of blood and CSF flow

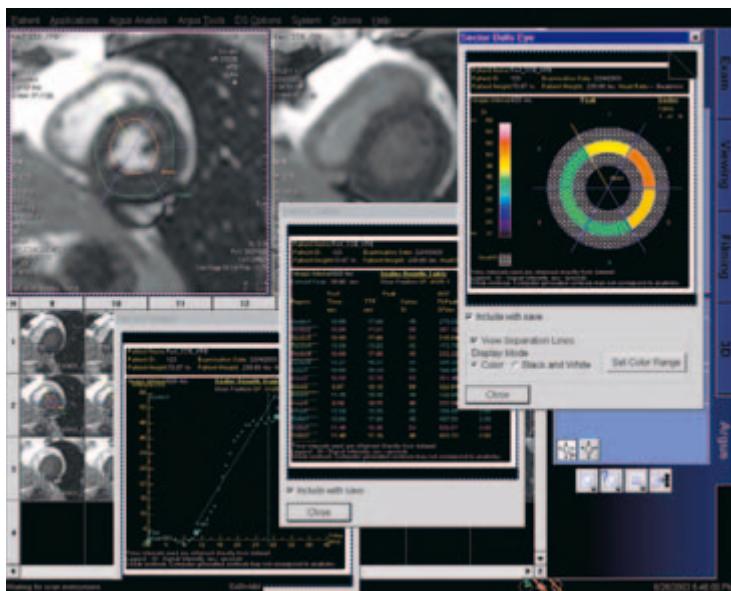
- Semi-automatic detection of regions of interest over time
- Color-coded display of velocity values
- Calculation of flow and velocity parameters with color results (e.g. peak velocity, average velocity)



Argus Dynamic Signal

Automated tool for dynamic data analysis

- Manual or automatic segmentation
- Automatic compensation of contours in regard to translation or deformation of organs over time
- Sector-based or ROI-based evaluation
- Evaluation of Time-to-Peak, Peak Value, Uptake Slope, Area under the Curve
- Graphical display of results in parameterized bull's eye plots

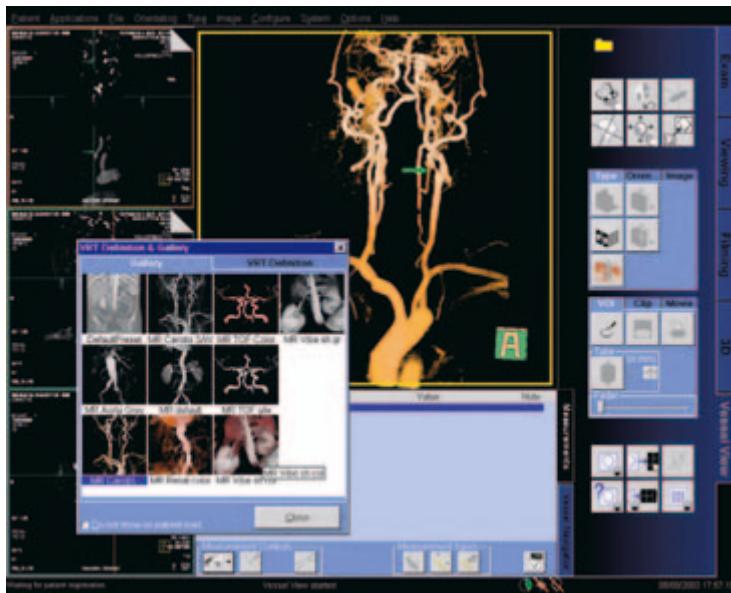


Vessel View

Interactive analysis of vessel disease using MR or CT angiography data

Viewing with VRT, MPR or MIP mode

- Semi-automatic detection of vessel segments
- Quantification of changes in vessel size (e.g. stenosis graduation, aneurysm volume measurement)
- Protocol-based software for workflow support
- Artery vein separation
- Creates and edits DICOM structured reports

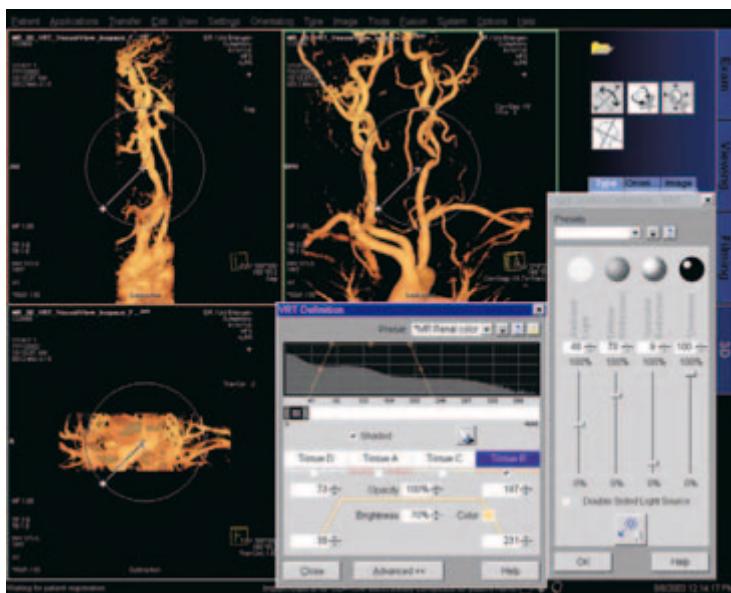


3D VRT Volume Rendering Technique

3D visualization for clearer depiction of complex anatomy and relationship of anatomy in 3D for contrast MR Angiography and VIBE imaging

More productive surgical planning and discussion with referring physicians

- Integrated with other 3D functionality
- Color image creation
- Color gallery of icon presets
- Additional threshold-based segmentation of 3D objects
- Volume measurements

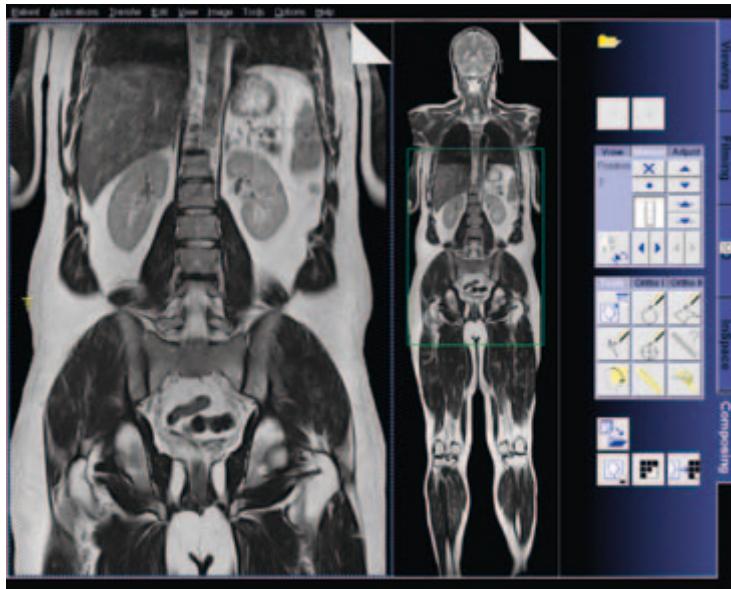


Composing*

Composing of images from different table positions

- Automatic and manual composing of sagittal and coronal images
- Dedicated algorithms for spine and angio examinations
- Measurement on composed images (angle, distance)

* Composing on the syngo Acquisition Workplace is standard with T-class.



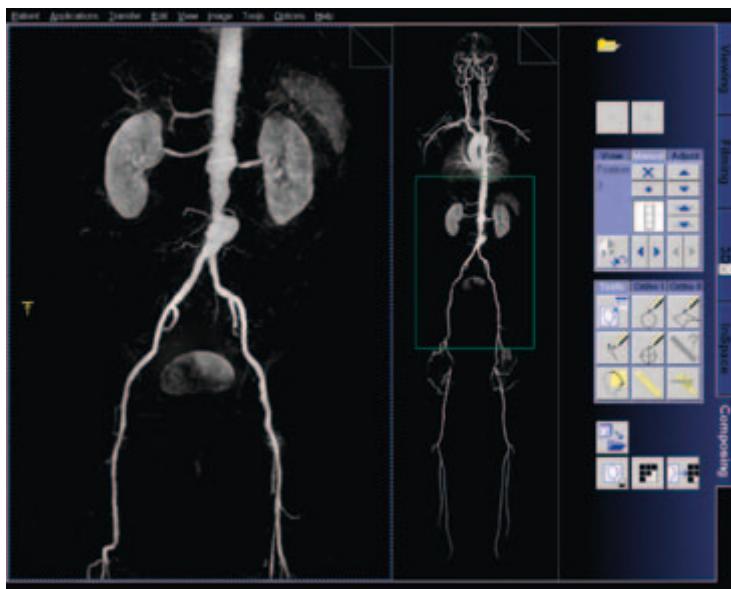
Fly Through

Simulated endoscopic views of the inside of bronchi, vessels, colon and any other hollow structures

Multi-modality application for CT, MR and 3D AX data

Fully integrated into the familiar 3D workflow and user interface

- Ready-to-use from day one
- One click to action

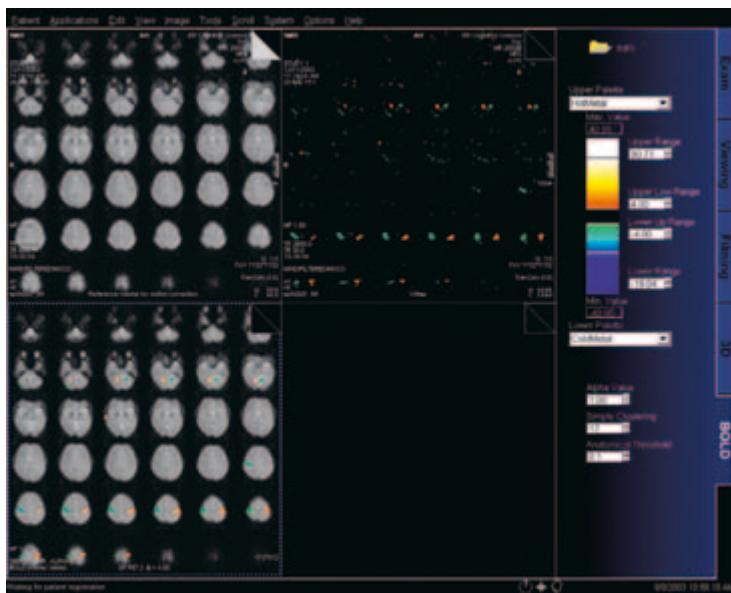


syngo BOLD 3D Evaluation

syngo BOLD 3D Evaluation is the comprehensive processing and visualization package for BOLD fMRI. It provides a full set of features for clinical fMRI, as well as advanced features for more research oriented applications.

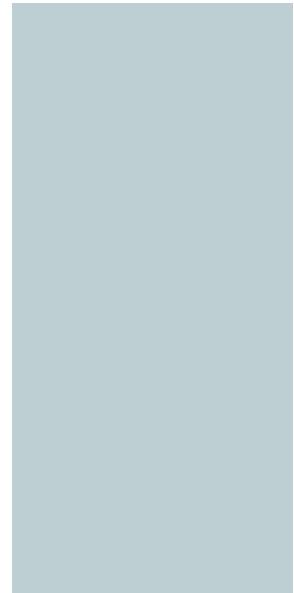
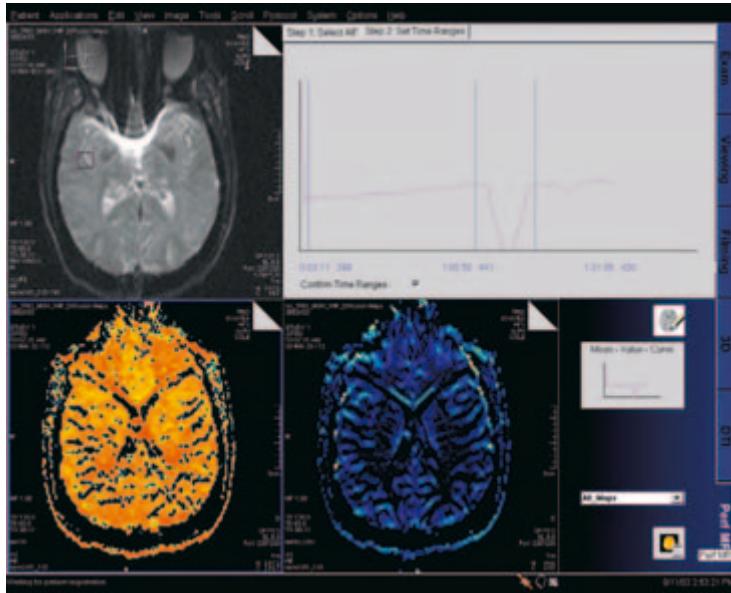
This package provides statistical map calculations from BOLD datasets and enables the visualization of task-related areas of activation with 2D or 3D anatomical data. This allows the visualization of the spatial relation of eloquent cortices with cortical landmarks or brain lesions.

On the syngo Acquisition Workplace the unique Inline function of BOLD 3D Evaluation merges, in real time, the results of ongoing BOLD imaging measurements with 3D anatomical data. Additionally, evolving signal time courses in task-related areas of activation can be displayed and monitored.



Functional and anatomical image data can be exported for surgical planning as DICOM datasets, additionally all color fused images and results can be stored or printed

- Statistical map generation: paradigm definition, calculation of t-value map with General Linear Model or t-test
- 3D Visualization : fused display of fMRI results, color t-value maps on anatomical datasets
- Inline 3D real time monitoring of the fMRI acquisition
- On-the-Fly Adjustment for t-value thresholding, 3D clustering, and opacity control
- Data export to neurosurgical planning software
- Fly Through the Volume: Zoom, pan, rotate, cut planes
- Analysis of Signal Time Curves
- Data Quality Monitoring: B0 field map, Cine display of the BOLD time series
- Archiving & Distribution of results and views as colored DICOM images and bit maps
- If the respective options are available, results from Diffusion Tensor Imaging and DTI Tractography can be displayed together with fMRI results and anatomy.



Neuro Perfusion Evaluation

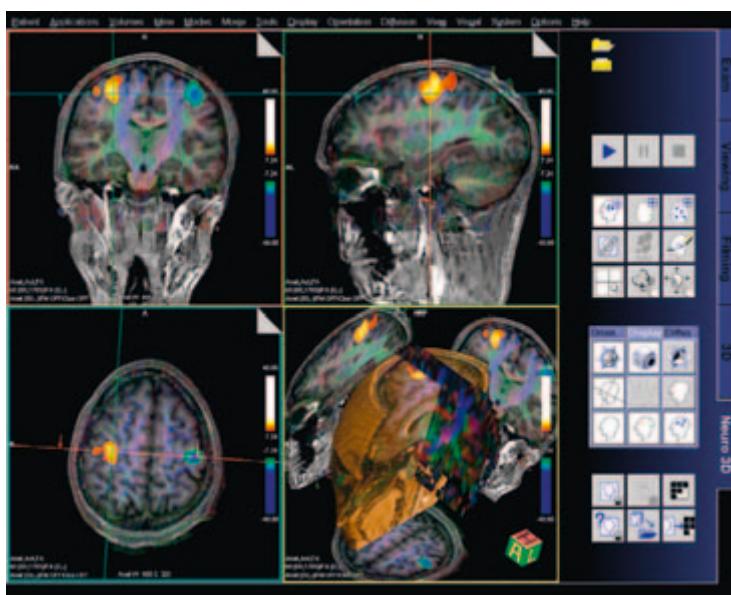
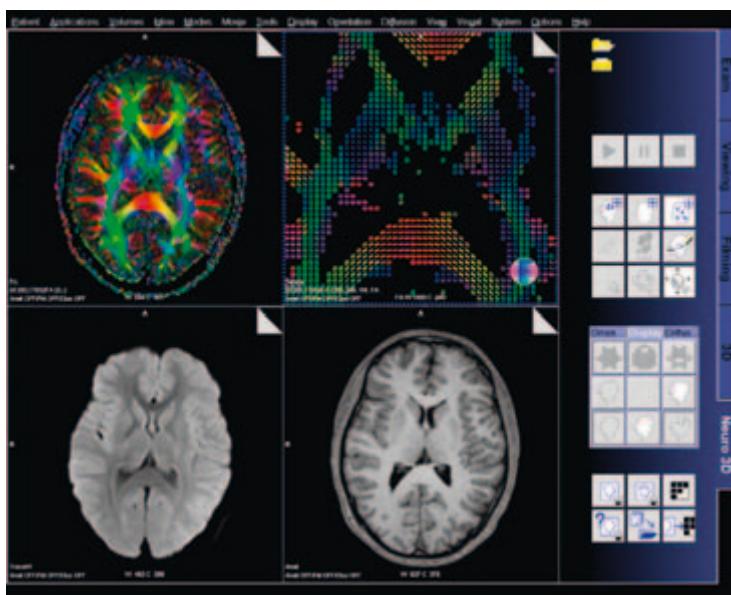
Dedicated task card for quantitative processing of neuro perfusion data

- Color display of relative Mean Transit Time (relMTT), relative Cerebral Blood Volume (relCBV), and relative Cerebral Blood Flow (relCBF)
- Flexible selection of Arterial Input Function (AIF) for reliable analysis. This function takes into account the dynamics over time of the contrast agent enhancement

DTI Evaluation

Offline post-processing to generate and visualize parametric maps derived from the diffusion tensor in order to assess anisotropic diffusion properties of brain tissue

- Generation of diffusion maps based on tensor including : Fractional Anisotropy (FA), Volume Ratio (VR), trace-weighted, ADC, E1-E3, E1, linear, planar, tensor maps
- Display of maps in scalar mode (grey scale), vectorized mode (directions color coded) and tensorized mode (using tensor graphics like ellipsoid or cuboids); overlay of maps onto anatomical images
- Side by side display of several maps (e.g. ADC, FA and trace-weighted) and anatomy for simultaneous ROI based evaluation; generation of a results table in order to support the assessment of diseases of the white matter
- Integrated into Neuro 3D taskcard: display of DTI maps in the context of an anatomical 3D data set; arbitrary oriented clip planes allow to explore the 3D volume
- Fused display with white matter tracts if the “DTI Tractography” option is present.
- Export of reformatted images for neuro navigation
- Together with the “BOLD 3D Evaluation” option: simultaneous display of anatomical, fMRI, and DTI data



syngo DTI Tractography

syngo DTI Tractography allows the visualization of multiple white matter tracts based on diffusion tensor imaging data. DTI Tractography is optimized to support the presurgical planning and to allow for neuro physiological research with respect to connectivity and white matter pathology.

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- Texture Diffusion, a highly versatile in-plane visualization of white matter tracts, allows to display and read DTI Tractography results on PACS reading stations and in the OR.
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- Tract and seeding ROI statistics (mean/max FA value, min/mean/max ADC value, and more)
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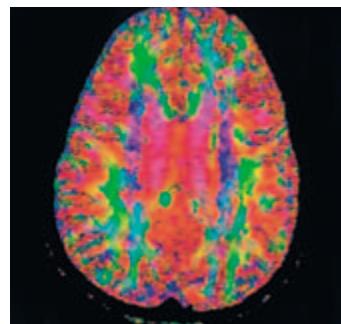
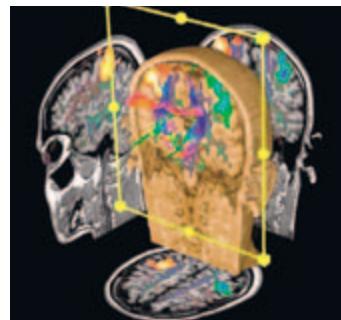
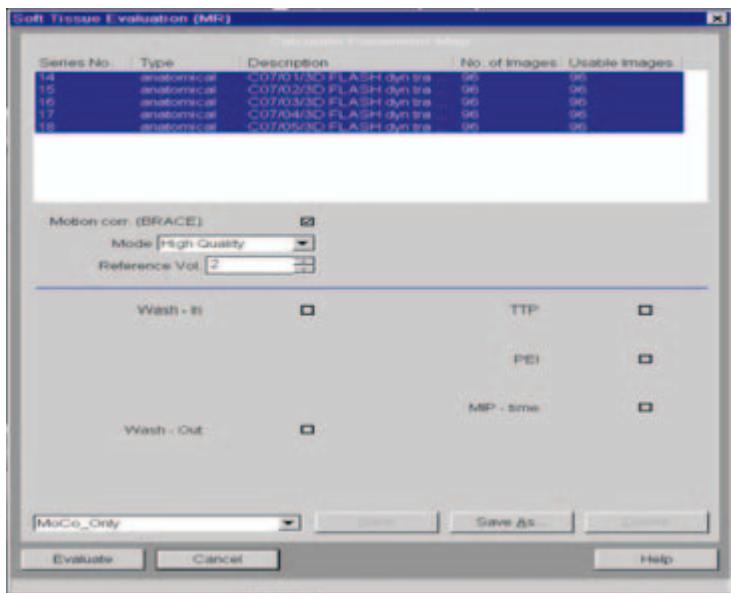


Image Fusion

Image fusion of multiple 3D data sets with alpha blending, i.e. overlay of two images with manual setting of the opacity

- Multiple 3D data sets from different modalities (MR, CT, Nuclear Medicine, PET)
- Visual alignment, automatic registration, or landmark based registration



Spectroscopy Evaluation

Integrated software package with extensive graphical display functionality

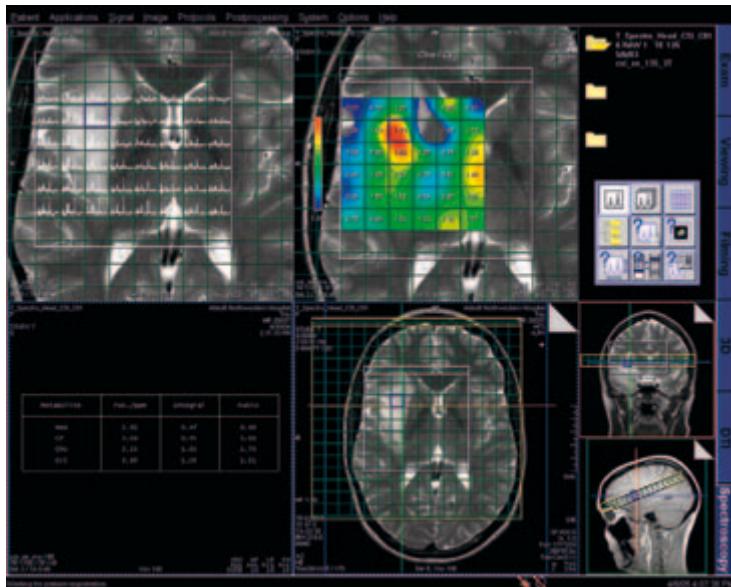
Comprehensive and user-friendly evaluation of spectroscopy data

Display of CSI data as colored metabolite images or spectral overview maps, overlaid on anatomical images

- Export of spectroscopy data to a user-accessible file format
- Relative quantification of spectra, compilation of the data to result table

Automated peak normalization tissue, water or reference

New dedicated SVS breast evaluation protocols



Soft Tissue Motion Correction

3D elastic motion correction, for offline
3D correction in all directions over entire
2D and 3D data sets suitable for breast
MR exams.

Allows higher conspicuity and accuracy
especially for multi-focal lesion detection
in the breast.

Two different registration algorithms
(fast and high quality) are now available
to compensate for patient motion of the
breast. Both correction possibilities can be
applied offline for 2D and 3D MR data
sets.

New image data is reconstructed and
saved in a separate series within the
patient browser. It can be combined with
the original non-corrected image data.



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MAGNETOM Trio, A Tim System

Parts & Accessories

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SIEMENS



Physiological Measurement Unit (PMU) – Wireless Physio Control

Synchronizes the measurement with the physiological cycles (triggering to minimize motion artifacts caused by cardiac and respiratory movements)

Wireless Sensors

Wireless Vector ECG/respiration and pulse sensors for physiologically synchronized imaging, rechargeable battery-powered – for optimized patient handling

- VCG acquires ECG signal from two projection directions, for easy identification of the R-wave
- ECG – disposable electrodes
- Pneumatic cushion to be placed on the chest or abdomen
- The signals can be transmitted to an external MRI-compatible Patient Monitoring System (option) via a respective receiver interface in the Patient Monitoring System

Physiological Signals Display

- ECG (2 channels I and/or aVF)
- Pulse
- Respiration

External Trigger Input Display

ECG Triggering

Acquisition of multiple slices, e.g. of the heart, at different phases of the cardiac cycle.

Excellent image quality by synchronizing data acquisition with the heart motion

Peripheral Pulse Triggering

Reduces flow artifacts caused by pulsatile blood flow

Excellent image quality by synchronizing data acquisition to the pulsatile blood flow

Respiratory Triggering

Excellent image quality by synchronizing data acquisition with the respiratory motion

External Triggering

Interface for trigger input from external sources (e.g. pulse generator)

Optical trigger output for fMRI

Retrospective gating for ECG, peripheral pulse and external trigger input

PMU Examination Room Display

LCD monitor mounted on the magnet cover for display of physiological signals in the examination room

- Provides for the display of the 2 ECG-channels I and aVF, for optimal signal quality, pulse signal, respiratory signal and external trigger input



Patient Video Monitoring

Special video camera integrated in the back magnet cover for observing the patient

Color 640×480 pixel LCD monitor may be positioned at the *syngo* Acquisition Workplace or at a convenient wall location

Remote Viewing Monitor

Color LCD monitor (1280×1024) to be connected in parallel to the Workplace monitor

Data transfer via fiber optic cables for high signal quality over a long distance

Max. distance from Workplace – 150 m (492 feet)

syngo MR Workplace

Additional integrated Workplace with host computer for post-processing and image evaluation

Same user interface as the *syngo* Acquisition Workplace, except for scan control

Shared database with *syngo* Acquisition Workplace, therefore eliminating image copy time

Host Computer
(*syngo* MR Workplace)
Technical Data:

> Refer to appendix
“Computer System”

In-Room *syngo* Acquisition Workplace

Operation and evaluation Workplace, placed in the examination room close to the patient. Operates in parallel to the *syngo* Acquisition Workplace.

- MR-compatible trackball as input device
- Moveable, height-adjustable Workplace trolley with connection cable

High resolution LCD monitor:

- Screen size (diagonal) – 46 cm (18")
- Screen matrix – 1280×1024

Workplace Table

Ergonomically designed table for:

- Color monitor
- Keyboard
- Mouse
- Patient communication unit
- Patient supervision display



Removable Patient Table and Trolley

Enables patient positioning and preparation outside the examination room

Max. patient weight – 200 kg (440 lbs)

Precise docking mechanism with automatic electronic interlock

The trolley is adjustable for height and has integrated controls for the table movement of the system

Second Removable Tabletop and Trolley

Enables preparation and positioning of the next patient on the trolley outside the examination room while the current patient is being scanned

Prerequisite:

- Removable patient table and trolley

Max. patient weight – 200 kg (440 lbs)

Patient Transport Stretcher

MR-compatible design on wheels for transporting a patient into the examination room

Useful when the removable tabletop and trolley option are not purchased

- Non-ferromagnetic, height-adjustable design
- Trendelenburg positioning possible

Max. patient weight – 160 kg (350 lbs)

Comfort Kit

Vacuum cushions for stable and comfortable positioning of the patient during the examination

Vacuum pump integrated in the table

3 anatomically shaped cushions of different size for patient stabilization and comfort (spine, head, multi-purpose)

May significantly reduce patient set-up times and improve image quality by minimizing the occurrence of motion artifacts



Coil Storage Cart

Specially designed non-ferromagnetic cart for easy storage of some of the most commonly used coils and accessories

May be rolled to convenient locations in the examination room

Additional storage space on the inside of the doors when doors are opened

Additional optional accessories and consumables for MR

www.siemens.com/healthcare-accessories

Coil Storage Cart

	Closed	Opened
Width	140 cm (4'7")	280 cm (9'2")
Depth	54 cm (1'9")	54 cm (1'9")
Height	121 cm (3'12")	121 cm (3'12")

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Order No.
A91MR-700-G9-F5-7600
Printed in Germany
MC.MR-00700 PA 0308 POD

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MAGNETOM Trio, A Tim System

Computer System

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SIEMENS



Host Computer

(syngo Acquisition Workplace)

Double processor	2 x Dual Core Intel Xeon™
Clock rate	≥ 2.66 GHz
Main memory (RAM)	4 GB
1st hard disk (system SW)	73 GB
2nd hard disk (data base)	73 GB
3rd hard disk (images)	73 GB (approx. 110,000 images, square matrix 256 ² and 512 ² uncompressed)
CD-R writer	approx. 4,000 images 256 ² ; DICOM Standard, ISO 9660
DVD-R writer	approx. 25,000 images 256 ² ; DICOM Standard, ISO 9660
Media drives	CD/DVD drive

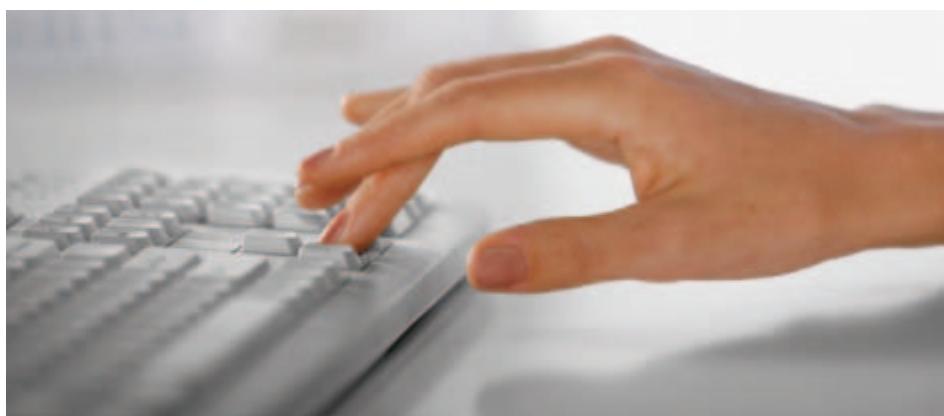
MCP Multi2 Image Processor

Double processor	2 x AMD Opteron 252 CPU (Linux 64bit)
Clock rate	≥ 2.6 GHz
Main memory (RAM)	≥ 8 GB
1 hard disk (system SW)	36 GB
4 hard disks (raw data)	4 x 36 GB
Reconstruction speed	1,252 recons per second (256 ² FFT, full FoV) 8,694 recons per second (256 ² FFT, 25% recFoV)
Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 8 data sets
Media drives	CD/DVD drive

syngo MR Workplace

(optional)

Double processor	2 x Pentium 4™/Intel Xeon™
Clock rate	≥ 3.6 GHz
Main memory (RAM)	3 GB
1st hard disk (system SW)	73 GB
2nd hard disk (images)	73 GB
CD-R writer	approx. 4,000 images 256 ² ; DICOM Standard, ISO 9660
DVD-R writer	approx. 25,000 images 256 ² ; DICOM Standard, ISO 9660
Media drives	CD/DVD drive



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MC.MR-00700 PA 0308 POD

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