



MAGNETOM C!

www.siemens.com/healthcare

SIEMENS

MAGNETOM C!

Small footprint – giant steps

A new, powerful, compact player in MRI. For both, patients and health care professionals, the mid-field has realized a giant step to cost efficient quality care.

Smallest pole diameter in mid-field permits side loading and easy 270° accessibility with the most compact C-shaped magnet.

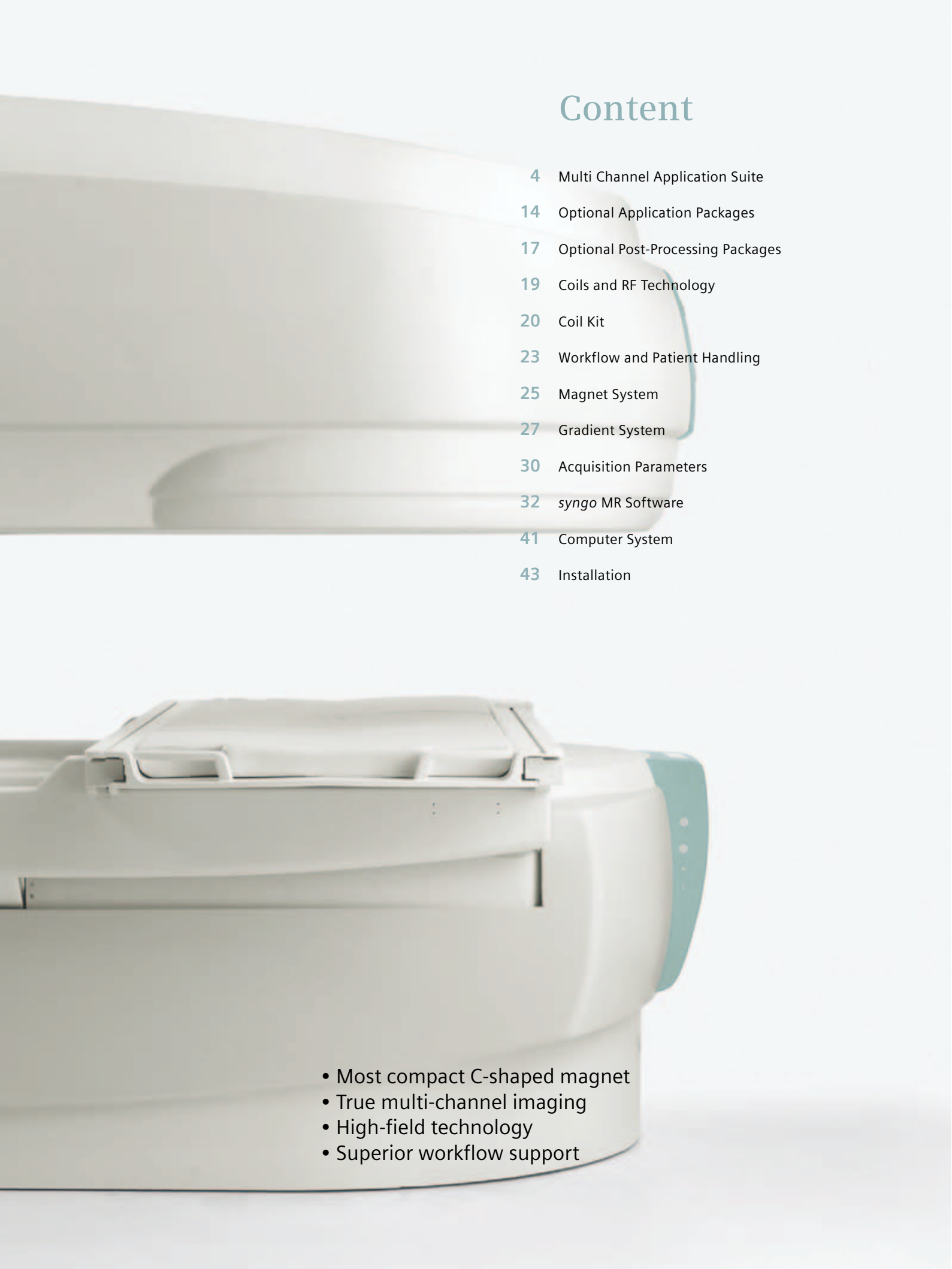
True multi-channel imaging, up to 4 coils can be placed simultaneously, facilitating up to 100 cm seamless field-of-view.

High-field technology and superior workflow support deliver excellent image quality in a matter of minutes, assuring highest diagnostic confidence.

The friendly appearance and open feeling contribute to maximum patient comfort and acceptance. Increased health care quality, efficient workflow and low operating costs will promote an excellent return-on-investment.

Discover the changing face of mid-field MRI.





Content

4	Multi Channel Application Suite
14	Optional Application Packages
17	Optional Post-Processing Packages
19	Coils and RF Technology
20	Coil Kit
23	Workflow and Patient Handling
25	Magnet System
27	Gradient System
30	Acquisition Parameters
32	<i>syngo</i> MR Software
41	Computer System
43	Installation

- Most compact C-shaped magnet
- True multi-channel imaging
- High-field technology
- Superior workflow support

Multi Channel Application Suite

The Multi Channel 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.

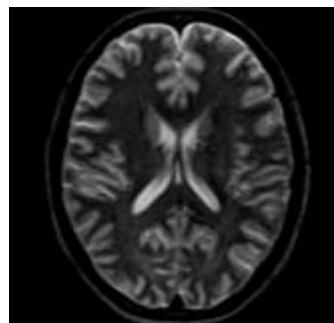
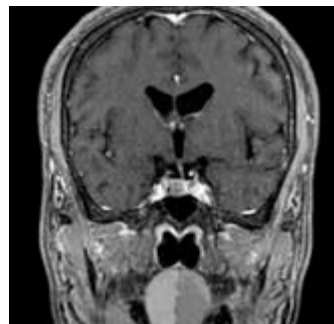
There are seven dedicated application packages: Neuro Suite, Angio Suite, Cardiac Suite, Body Suite, Onco Suite, Ortho Suite and Pediatric Suite have been included as standard applications.

Neuro Suite

The Neuro Suite is a part of the Multi Channel 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.

This package includes, for example :

- 3D isotropic resolution volume imaging using T1 3D MPRAGE/3D FLASH and T2 dark fluid 3D TSE
- T2-weighted high resolution 3D Restore protocols optimized for inner ear examinations
- 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
- 2D segmented EPI
- 2D EPI sequences for perfusion and diffusion imaging
- 3D SPACE for isotropic 3D acquisition in various contrasts



Angio Suite

The Angio Suite is also a part of the Multi Channel Application Suite. Excellent MR Angiography can be performed to visualize arteries and veins without contrast agent.

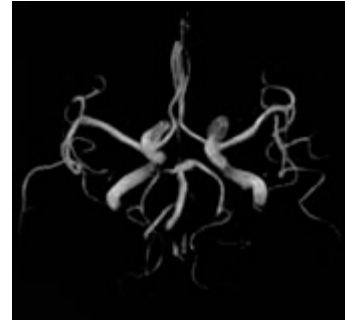
This package includes, for example:

Non-contrast MRA and venography

- 2D and 3D Time-of-Flight (ToF) protocols for MRA of Circle of Willis, carotids, neck vessels, and breathhold protocols for abdominal vessels
- Triggered 2D/3D ToF sequences for non-contrast MRA, particularly in the abdomen and the extremities
- 2D/3D Phase Contrast
- 3D Time-of-Flight (ToF) with overlap-free combination of slabs with SLINKY (SLiding INterleaved KY acquisition)
- MR venography with 2D/3D Time-of-Flight (ToF) and Phase Contrast
- Tilted optimized non-saturating excitation (TONE) and MTC techniques for improved CNR

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



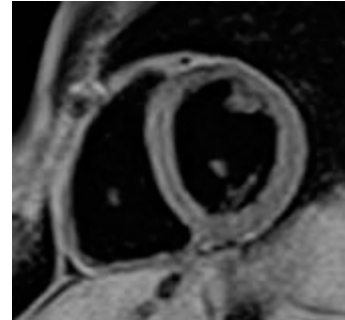
Cardiac Suite

The Cardiac Suite* covers the complete application range from morphology, ventricular and valvular functions to cardiac imaging and angiography.

This package includes, for example:

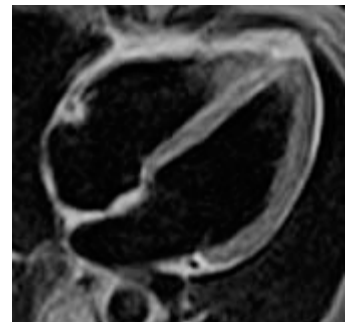
Cardiac view creation

- 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 dark blood TurboFLASH: short-axis, 4-Chamber and 2-Chamber views



Morphology – Heart and vessel structure and valve function

- Various breathhold techniques for strong contrast between the blood and vascular structures (dark blood TSE) 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 valvular function
- Optimized workflow with Drag & Drop recall (Phoenix), Scan button and Copy Position



Ventricular function and wall motion

Tools for rapid evaluation of left or right ventricular function:

- Acquisition of a stack of short-axis slices (standard FLASH)
- Automatic adjustment of the acquisition window to the current heart rate
- Use of the Inline ECG for graphical ECG triggering setup

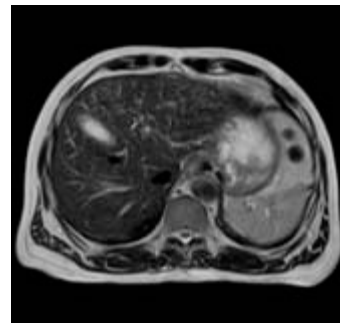
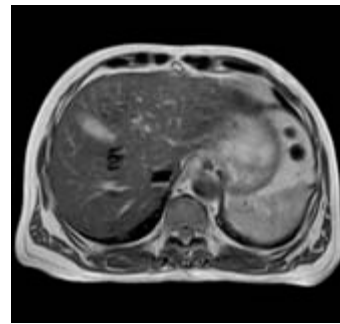
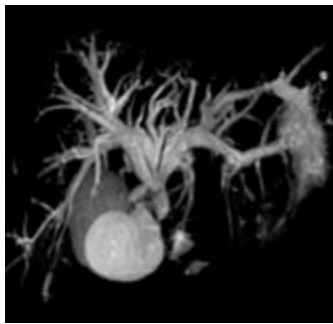
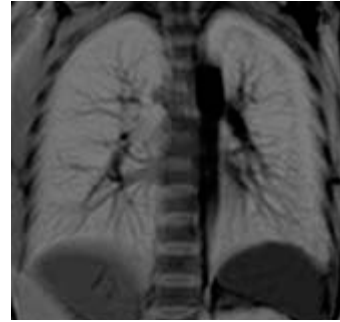
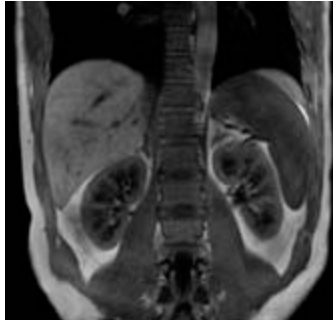
* PMU Wireless Physio Control option required

Body Suite

The Body Suite is dedicated for clinical body applications. Ultrafast high resolution 2D and 3D protocols are provided for abdomen, pelvis, MRCP, kidney, and MR Urography applications. Siemens-unique 2D PACE technique makes body imaging simple, allowing for multi-breathhold 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 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 FatSat, STIR, FLASH and multi-echo TSE
- High resolution pelvic imaging (prostate, cervix) for tumor visualization

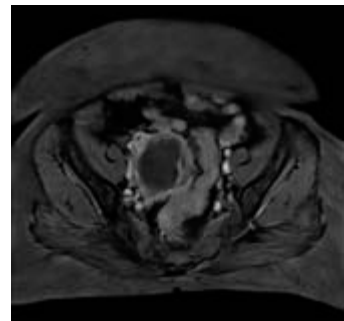
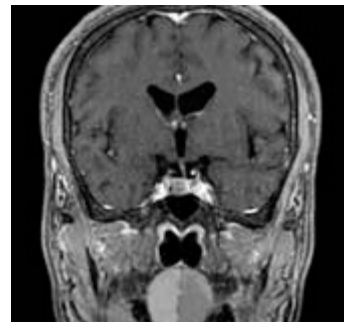
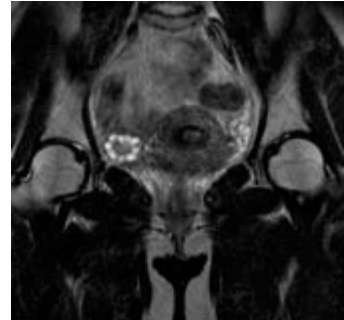


Onco Suite

MR imaging has the biggest advantage of excellent soft tissue contrast, multi-planar capabilities and the possibility of selectively suppressing specific tissue, e.g. fat. This helps in the visualization 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:

- STIR, TSE and FLASH 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
- 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.
- Four different fat saturation techniques (Spectral, Water Excitation, Dixon and Inversion Recovery) make fat saturation available for a broad range of oncological applications for which T1 and T2 contrast with fat saturation is desired.

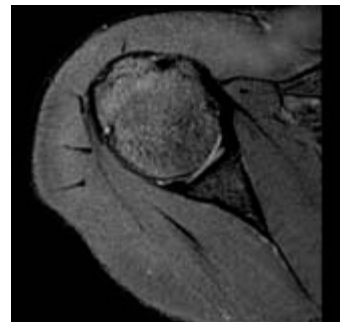
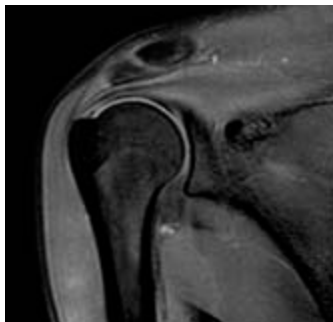
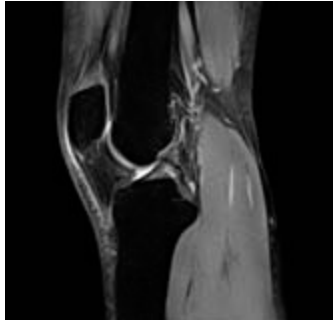


Ortho Suite

The Ortho Suite is a comprehensive collection of protocols for joint imaging including the spine. MR is beneficial to visualize avascular necrosis and internal derangements. Also in case of tumors and infections, a large amount of additional information can be acquired using the protocols provided as standard material 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 protocols for T2-weighted imaging with high in-plane resolution and thin slices
- 3D protocols with water excitation having high isotropic resolution optimized for 3D post-processing
- 3D TSE with variable flip angle and high isotropic resolution optimized for 3D post-processing
- T2 protocols with fat saturation for visualization of water infiltration.



Pediatric Suite

The parameters for pediatric imaging vary significantly in comparison to the parameters for adults. The reasons for the difference in parameters are: developing tissues, body size, faster heart rates and compliance with breathhold commands. The Pediatric Suite provides dedicated protocols for pediatric imaging, e.g. for tumors, malformations and epilepsy in the brain.

This package includes, for example:

Neuro

- Head protocols providing best contrast-to-noise ratio with optimized parameters
- Excellent T1-weighted contrast with optimized TR, TE and flip angles



Sequences

- Spin Echo (SE): Single, Double and Multi Echo (up to 32 echoes)
- Inversion Recovery (IR)
- 2D/3D FLASH (spoiled GRE)
- 2D/3D FISP
- 2D/3D PSIF
- 2D FLASH shared phases
- 2D TrueFISP realtime shared phases
- 2D/3D MEDIC (Multi Echo Data Image Combination)
- 2D/3D TurboFLASH (MPRAGE)
- 2D/3D TSE
- Echo Sharing technique for dual contrast TSE enhancing speed by using acquired echoes in both proton density and T2 images simultaneously. Speeds up dual contrast TSE by almost a factor of 2
- 2D/3D Restore TSE
- Single slab 3D TSE with ultrahigh turbo factors for T2 and dark fluid applications with isotropic resolution
- 2D/3D TurboIR (TrueIR, STIR, Dark Fluid T1 and T2)
- 2D/3D HASTE (Half-Fourier Acquisition with Single-Shot Turbo Spin Echo)
- 2D/3D HASTE IR for fat or fluid suppression
- 2D/3D Single-Shot TSE for heavy T2-weighting
- 2D/3D Time-of-Flight (ToF) angiography, single and multi slab
- 2D/3D Time-of-Flight (ToF), triggered
- 2D/3D Phase Contrast, triggered
- Variable 3D TSE sequence method: optimized tissue contrast through a flip angle amplitude modulation; protocols with isotropic submillimeter resolution can be created

- Echo Planar Imaging (EPI) – diffusion weighted; single shot FID; e.g. for Perfusion weighted imaging, 2D/3D Segmented EPI (SE)
- 3D VIBE (Volume Interpolated Breathhold Examination) – quick fat saturation; double echo for in-phase/opposed-phase 3D imaging; inline breast evaluation

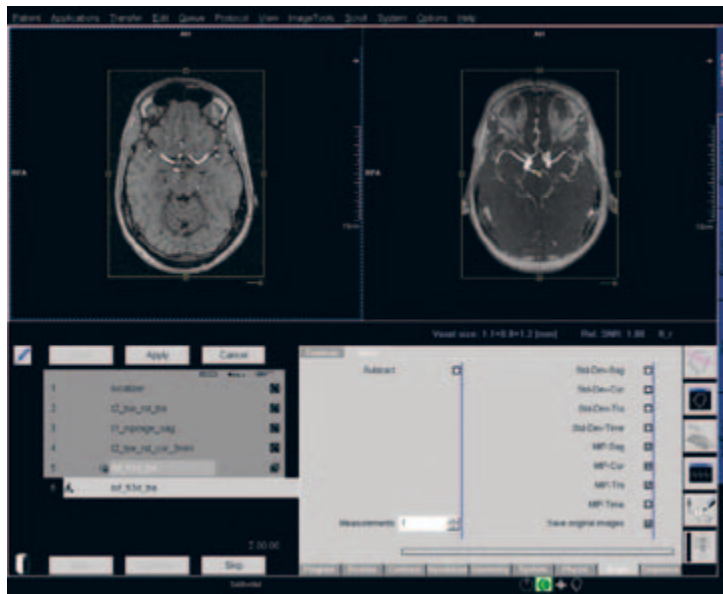
Multi Channel Application Suite: Acquisition and Reconstruction Techniques

- 2D PACE (Prospective Acquisition Correction)
- 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

- Water Excitation. Spectral selective RF pulses for exclusive water excitation
- Dixon for fat and water separation
- RF Fat Saturation. Spectral selective RF pulses for saturation of fat
- 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
- Simultaneous Excitation. Doubles the number of slices per TR for 2D GRE
- Integrated Parallel Acquisition Technique (iPAT)
- PAT averaging for motion artifact suppression using Self-Calibration

Highlights

- syngo MR – the intuitive user interface
- syngo Scan Assistant
- Inline Technology
- 2D PACE Inline motion correction
- Advanced workflow features such as image stamps, Inline display, Inline movie functionality
- Phoenix functionality for reproducible image quality and for benefitting from other MAGNETOM users sharing their protocols
- Dynamic Analysis for addition, subtraction, division, standard deviation, calculations of ADC maps, T1 and T2
- 3D post-processing MPR, MIP, MinIP, SSD
- Flexible film formats and paper print
- Data storage of images and cine avi files on CD ROM/DVD-R with DICOM viewer as viewing tool
- Annotations and 2D evaluations in 3D
- Structured Report Viewer and Editor
- Printing of Protocols
- Position of Marker in Viewer
- DICOM Viewer on CD/DVD-R
- In-plane rotation of slices
- Export files to CD/DVD-R



Inline Technology – Processing Instead of Post-processing

Inline Technology helps to streamline the clinical workflow by automating mundane postprocessing 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 (2D PACE) on-the-fly
- Diffusion imaging

iPAT (Integrated Parallel Acquisition Techniques)

- iPAT is the Siemens Parallel Imaging solution
- Siemens iPAT increases the acquisition speed
- Higher speed and temporal resolution (up to factor 4)
- Better image resolution
- Better image quality due to reduced artifacts
- More slices
- Integrated Auto-Calibration: immediate reference scan saves time
- mSENSE and GRAPPA algorithms included
- PAT averaging for motion artifact suppression using Self-Calibration

SPACE

- Variable 3D TSE sequence method
- Optimized tissue contrast through flip angle amplitude modulation

2D PACE Motion Correction

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

- Significantly increased image quality
- Facilitates evaluation of diseases in moving organs and precise slice registration for multi-breathhold studies
- Data acquisition during free breathing for high resolution 2D and 3D examinations

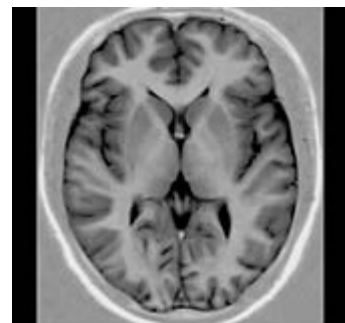
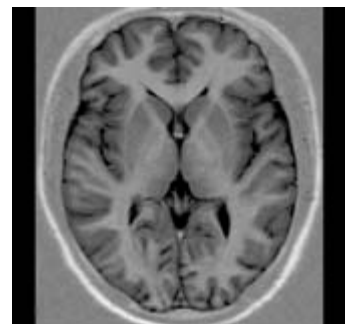
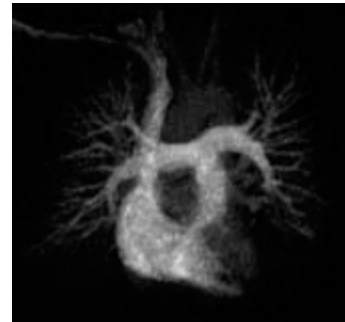
Image Filter

For noise reduction in the MR images and better edge definition

- Uses high-pass and low-pass filtering
- Automatically adjusts to the local image content (adaptive filtering)
- Inline image filter and off-line image filter

GRAPPA

- iPAT factor of 4 for maximum resolution in short time





Optional Application Packages

CISS & DESS

Unique Siemens sequences and protocols

- 3D DESS: used for orthopedic imaging providing excellent T1/T2 contrast
- 3D CISS: best suited for high resolution studies, e.g. inner-ear examinations

Advanced Diffusion

Selection of advanced fast imaging techniques optimized for ultrafast imaging

- Diffusion weighted imaging based on HASTE
- *syngo* REVEAL: diffusion imaging for liver, ortho and spine exams. Pre-requisite for abdominal applications (e.g. liver diffusion) is the option "PMU Wireless Physio Control".

syngo BLADE

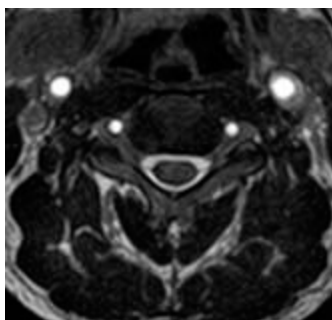
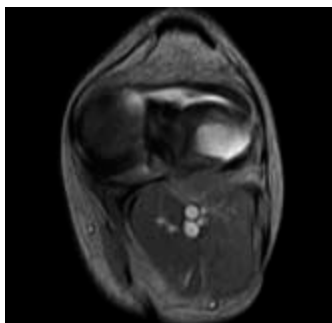
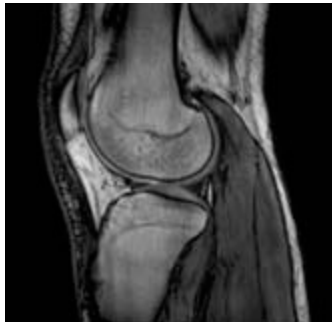
Motion and flow insensitive Turbo Spin Echo sequence

- Supports T2-weighted, T1-weighted, STIR and DarkFluid protocols
- Optional in-plane motion correction for head applications
- Versatile sequence, e.g., supporting iPAT with GRAPPA and Restore pulses
- Improves image quality for uncooperative patients, e.g., children in head, spine and orthopedic imaging

Advanced Angio

Sequences and protocols optimized for the head/neck, body and peripheral region

- Turbo contrast-enhanced MRA technique for up to 50% faster studies than conventional MRA
- 2D Time-of-Flight (TOF) triggered and segmented
- 2D Bolus Timing Protocols



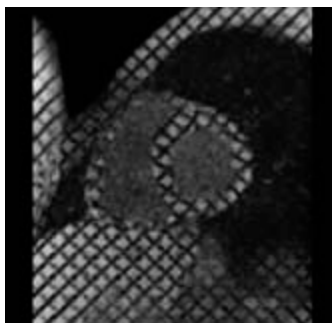
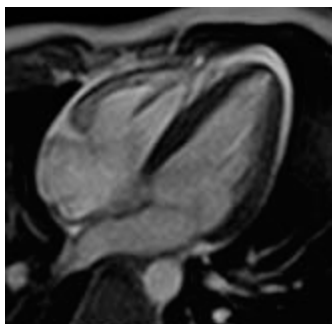
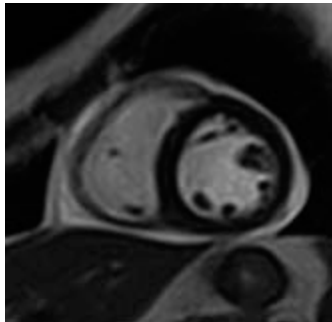
CARE Bolus

Online-visualization of contrast enhancement for exact timing of ceMRA

- CARE Bolus protocols and program
- Switching from 2D to 3D MRA on-the-fly
- Stop and Continue in Exam Taskcard
- Centric, elliptical phase reordering

Advanced Cardiac Package

Visualization of myocardial contractility using various tagging techniques.



syngo Expert-i

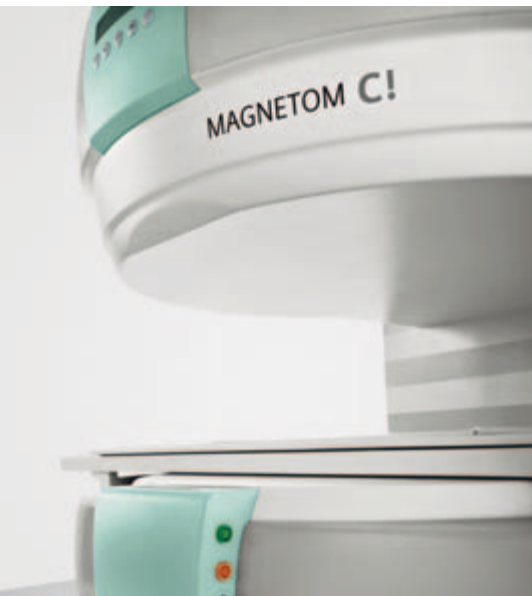
Interactive remote assistance during the MR exam. Get real-time access to imaging data and exam information from any networked PC within the hospital network.

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

Optional Post-Processing Packages



syngo Security Package

- HIPAA related functionality
- User authentication
- Privileges and permissions
- Audit trail

Fly Through

3D post-processing fly functionality.

Spine composing

Image composing task card for seamless composition of images acquired in multiple stages (e.g. whole CNS studies).

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.



Neuro Perfusion Evaluation

Calculation of TTP, MTT, rCBF and rCBV maps.

Vessel View

Interactive analysis of vessel disease using MR or CT angiography data

- Viewing with Volume Rendering Technique (VRT), Multi Planar Reconstruction (MPR) or Maximum Intensity Projection (MIP) mode
- Automatic or semi-automatic visualization of vessel segments
- Quantification of changes in vessel size
- Protocol-based software for workflow support
- Artery and vein separation (optional)

3D VRT (Volume Rendering Technique)

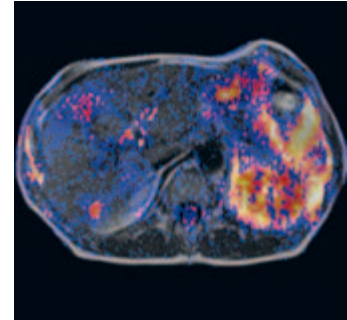
3D visualization for clearer depiction of complex anatomy and relationship of anatomy in 3D for contrast MR Angiography and VIBE imaging

- 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
- 3D post-processing
- VRT and Editor
- Volume Measurement
- Interactive Light Source
- 3D Interpolation and other Quality Improvements

Image Fusion

Image fusion of multiple 3D data sets with alpha blending

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



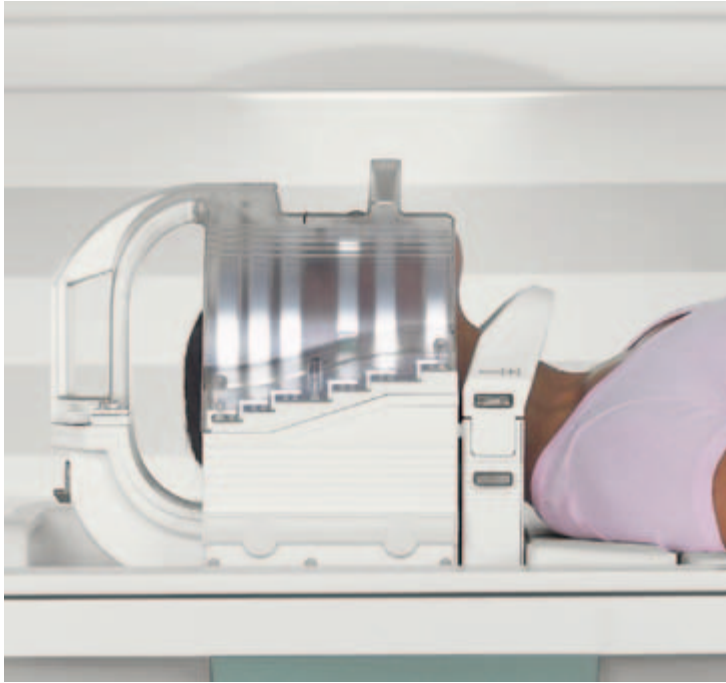
Coils and RF Technology

Our revolutionary coil concept optimizes coil positioning and reduces coil changing times. The lower part of the Body/Spine Array Coil and the CP Head/Neck Array Coil are integrated within the patient tabletop.

Both remain on the table, while you simply plug in the upper coil parts thus saving your time and increasing your productivity.

Up to four coil elements can be used for image acquisition simultaneously

- Reduced coil changing with multi exam studies
- All coils are automatically tuned



Coil Kit

CP Head/Neck Array Coil

General

- 4 channel head array receive coil
- Neck coil, large (diameter of 20 cm/7.8 in)
- Neck coil, medium (diameter of 16 cm/6.3 in)
- iPAT-compatible (integrated Parallel Acquisition Technique)
- Upper coil part removable for easy patient positioning
- Patient-friendly design using translucent material for maximum patient comfort
- Lower part integrated in patient table
- Cushions for head stabilization
- Look out mirror

Applications

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

Body/Spine Array Coil, large

General

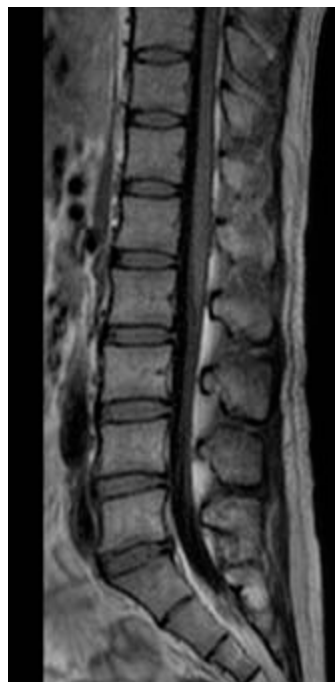
- 4 channel imaging standard
- 43.5×30.5 cm (17.1×12 in) (internal W×H) (For patients with a circumference of approx. 116.8 cm/46 in)
- iPAT-compatible (integrated Parallel Acquisition Technique)
- Common lower coil part smoothly integrated in patient table
- The common lower coil part can be left in position for consecutive examinations
- Upper coil part removable for easy patient positioning
- Patient-friendly design for maximum patient comfort

Applications

- Imaging of the thoracic region, the abdomen, pelvis and thighs
- MR Angiography
- Spine imaging

Transmit Coil

- Flat circularly polarized (CP) transmit coil integrated inside magnet enclosure



Digital Signal Processing System

Digital transmit and receive signal processing for fast and flexible modulation and demodulation of the radio frequency signals

- Single sideband modulation with suppressed carrier
- Computer-controlled pulse shape and phase
- Quadrature demodulation
- Highly linear transfer characteristics via software correction

Operating frequency	14.6 MHz
Frequency instability (15 min)	$\leq 9 \times 10^{-9}$
Frequency control	32 bits (0.015 Hz)
Phase control	16 bits (0.006 degrees)

Transmit Path

Transmit application bandwidth	250 kHz
Transmit amplitude	16 bit control 50 ns resolution
Gain stability (5 min)	<0.1 dB (low signal path) <0.3 dB (power amplifier)

Transmitter Amplifier

Peak power	2.5 kW
Bandwidth	800 kHz
Gain instability	0.15 dB

Receiver Path

Double preamplifier system for simultaneous connection of two receiving coils

- Digital quadrature demodulation
- Digital filtering
- Receiver adjustment no longer required

Receiver Path			
	Preamplifier	ADC sampling rate	10 MHz
		Gain	29 dB/53 dB (automatic control)
		Noise figure	<0.8 dB
	Dynamic range	128 dB (automatic control)	
	Max. output sampling rate (complex)	1 MHz	
	Receiver signal dynamic	up to 24 bits	
	Receiver signal resolution	32 bits	
	Number of independent receiver channels	4	

Workflow and Patient Handling



Patient Table

- Allows fast and flexible patient positioning outside the magnet gap

Patient Positioning Aids

Standard set of cushions, sandbags and restraining straps for comfortable and stable patient positioning

Arm rest for comfortable positioning of the arms

- Optional set of vacuum cushions, 'Comfort Kit' (three sizes)

Patient Positioning Tools

Laser light localizer for positioning of center slice

Manual transfer to center of imaging volume

Positioning tools for comfortable and stable positioning of the patient

Patient Communication

Assistance call squeeze-bulb for patient

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

- Intercom communication with the patient
- Response to the patient's activation of the squeeze-bulb
- Volume of speaker in control room
- Connection to hi-fi stereo system
- Independent volume control of voice
- Loudspeaker
- Microphone

Automatic voice command for breathhold examinations (see page 29)

Patient Table

Table dimensions (LxW)	210×79 cm (82.7×31.1 in)
Table height (fixed)	81.5 cm (32.1 in)
Longitudinal travel (manual)	±83 cm (±32.6 in)
Lateral travel (manual)	–81.8/+21.2 cm (–32.2/+8.3 in)
Position accuracy	±1 mm
Max. patient weight	200 kg (440 lbs)



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).

Retrospective gating for ECG, peripheral pulse and external trigger input.

Magnet System

Magnet Parameters

C-shaped permanent magnet with vertical magnetic field

Operating field strength:
0.35 Tesla

Hybrid Shim System

Provides maximum homogeneity of the magnetic field

Preshim

Factory preshim for short installation time

Passive shim

Computer based passive shim to adapt to environmental static interferences

Active shim

The 3 gradient coils are used for shimming the linear terms

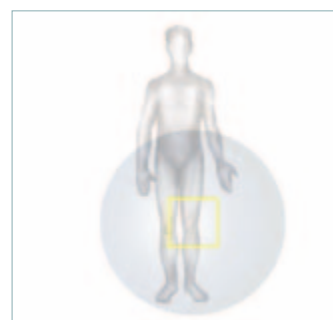
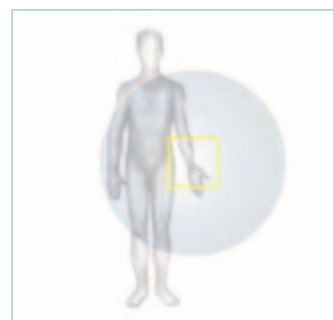
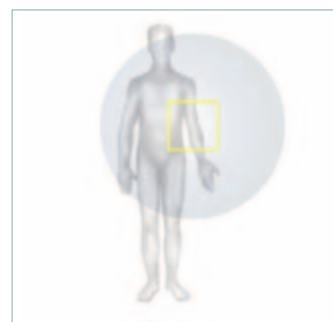
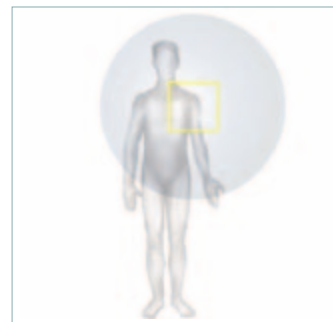
Volume Selective 3D Shim

Patient-specific automated online shim, for optimization of the magnetic field homogeneity within the imaging volume

Time to shim:
approx. 20 s

Isocenter Imaging

All extremity joints are scanned in the magnet isocenter for optimum results



Patient Aperture				
The open design provides free patient access from three sides				
Upper magnet width		137 cm (54 in)		
Vertical gap distance (cover)		41 cm (16.1 in)		
Table top to upper pole cover		38.5 cm (15.2 in)		
Homogeneity ¹⁾		DSV	Typical	Guaranteed
36 cm			±2.5 ppm	±4 ppm (FWHM)
20 cm			±1.2 ppm	±2.5 ppm (FWHM)
1) DSV=Diameter spherical volume (x, y, and z direction) FWHM =Full Width Half Maximum of the proton spectrum measured in 15 planes with 24 points per plane				
Fringe Field ¹⁾				
X-axis: horizontal		in front of the magnet	2.2 m (7 ft 2.6 in)	
		behind the magnet	2.9 m (9 ft 6.1 in)	
Z-axis: horizontal		left/right	2.2 m (7 ft 2.6 in)	
Y-axis: vertical		top of the magnet	3.1 m (10 ft 2 in)	
		bottom of the magnet	2.7 m (8 ft 10.2 in)	
1) Distances of the 0.5 mT line (pacemaker safety limit) from the magnet isocenter				



Gradient System*

One of the most powerful gradient systems in the low-field segment.

Actively shielded flat gradient coil system

Integrated into the magnet pole shoes

Gradient Amplifier		
Ultrafast solid-state technology with very low switching losses		
Max. gradient field strength		24 mT/m
Max. slew rate		55 T/m/s
Duty cycle		100%
Effective Performance	Max. eff. gradient field strength	39.4 mT/m
	Max. eff. slew rate	92.5 T/m/s
Gradient Cooling System	Gradient coils	closed loop water cooling
	Power electronics	water cooled

* All matrices without interpolation. Combinations of the stated parameters are not always possible; some parameters may need optional application packages.

Resolution Parameters			
	Min. FoV	5 mm	
	Max. FoV	400 mm	
	Min. Slice Thickness 2D	1.6 mm	
	Max. Slice Thickness 2D	250.0 mm	
	Min. Slice Thickness 3D	0.05 mm	
	Max. Slice Thickness 3D	20.0 mm	
	Max. Matrix	512 Max Matrix 1024i	
	Highest In-Plane Resolution	26 µm	
Spin Echo	Matrix	128	256
	Min. TR	11 ms	12 ms
	Min. TE	4.8 ms	5.9 ms
2D GRE (TurboFLASH)	Matrix	128	256
	Min. TR (Echo Spacing)	2.65 ms	2.99 ms
	Min. TE	0.89 ms	1.21 ms
	Min. Measurement Time	59 ms	81 ms
3D GRE (ceMRA)	Matrix	128	256
	Min. TR	2.65 ms	2.99 ms
	Min. TE	0.89 ms	1.21 ms
TrueFISP	Matrix	128	256
	Min. TR	3.48 ms	4.3 ms
	Min. TE	1.45 ms	1.8 ms
	Min. Measurement Time	118 ms	165 ms

TSE (HASTE)	Matrix	128	256
	Min. Echo Spacing	3.48 ms	4.42 ms
	Min. TR	21 ms	24 ms
	Min. TE	5.5 ms	6.9 ms
	Min. Measurement Time	120 ms	120 ms
	Max. Turbo Factor	129	256
Diffusion Imaging	Matrix	128	
	Max. b-value	10 000 s/mm ² for EPI Diffusion	
	Min. TE (with b = 700)	97 ms	

Acquisition Parameters*

Acquisition Matrix		
	In steps of 64 (true imaging matrix without interpolation and oversampling)	64×64, 128×128, 256×256, 512×512
Reduced Matrix		
	Phase resolution (rectangular matrix)	32×n ... n×n (steps of 1%)
	Slice resolution (3D volumes)	50%–200%
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)	6.3%–100%
Averaging		
	Number of data acquisitions	1–32 (steps of 1)
	Averaging mode	short term, long term (LOTA)
Oversampling		
	Read oversampling	100% standard
	Phase oversampling	0%–100% (steps of 12.5%)
	Slice oversampling (3D volumes)	0%–100% (steps of 12.5%)

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

Interpolation			
	In-plane interpolation	selectable (factor of 2)	
	3D interpolation (3D volumes)	selectable (up to factor of 2)	
Orientation			
	Slice orientations (2D and 3D)	transverse, sagittal, coronal, oblique, double oblique (steps of 0.1°)	
	Multi-slice multi-angle	yes, simultaneously	
Serial Acquisitions			
	Number of repeat scans	with constant delay times	1 – 512
		with different delay times	1 – 65
2D Slices			
	Number of slices	1 – 128 (steps of 1)	
	Slice Gap	freely selectable	
	Slice Overlap	freely selectable (up to 100%)	
	Slice Order	sequential or interleaved	
3D Slabs/Partitions			
	Number of 3D partitions	for matrix 256×256×m	4 – 512
		for matrix 512×512×m	4 – 512
	Number of 3D slabs (3D volumes)	1 – 128 (steps of 1 %)	

syngo MR Software

syngo[®], the unique software platform for medical applications and systems, integrates virtually 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 can 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.

Inline Applications Card

Programming of Inline processes for the current protocol

- Subtraction
- Standard deviation
- MIP
- Breast evaluation

syngo Scan Assistant

Shows parameter constraints and offers possible solutions.

Inline Display

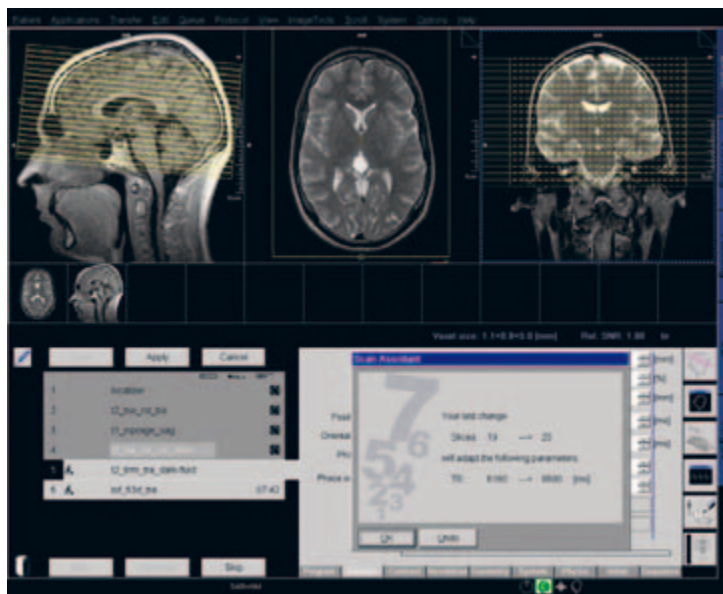
Automatically shows reconstructed images. It offers real-time control of the results and opens automatically for e.g. real-time interactive scanning or CareBolus examinations.

Inline Movie

Inline technology automatically starts the cine image display.

Scan Open Protocol

Allows faster workflow for breath-hold exam



Physiological Display

Displays the pulse, ECG or respiration signal, combined with a graphical indication of the acquisition window (requires PMU Wireless Physio Control 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



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.):

- 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 orientations)
- 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



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

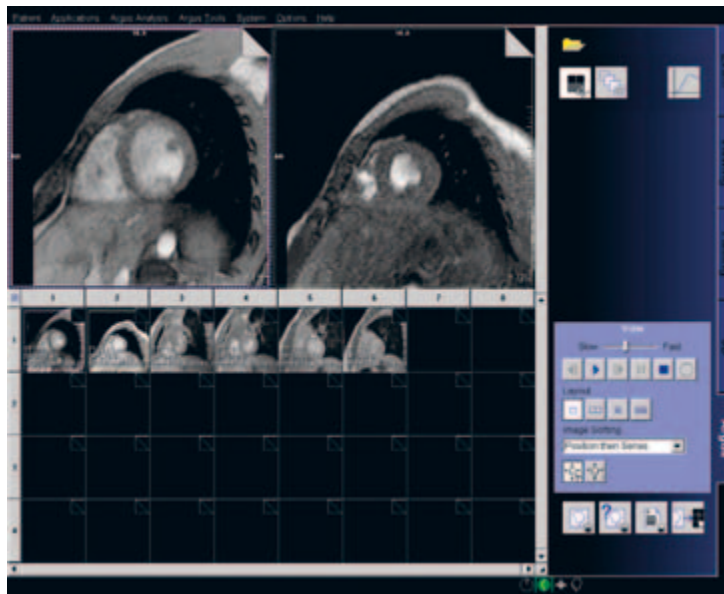
- Efficient cine review of cardiac and other dynamic imaging data sets
- Dynamic imaging data sets
- Single movie as well as 2, 4, or 8 simultaneous slices together in movie mode
- Rapid avi creation of 1 or 8 simultaneous slices
- Creates and edits reports

Mean Curve

Time-intensity analysis for contrast-enhanced examinations, e.g. for post-contrast studies

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
- Mean Transit Time (MTT)
- Cerebral Blood Volume (CBV), Cerebral Blood Flow (CBF) and Time to Peak (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

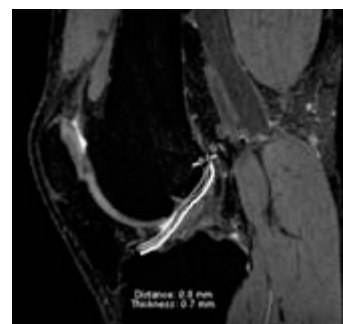
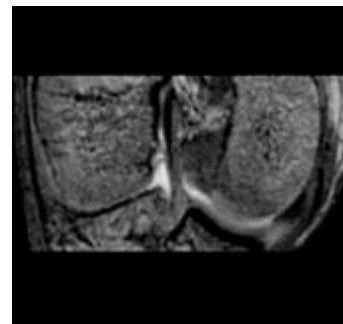


syngo MR 3D Post-processing

MPR – Multiplanar Reconstruction

Real-time multiplanar reformatting of secondary views

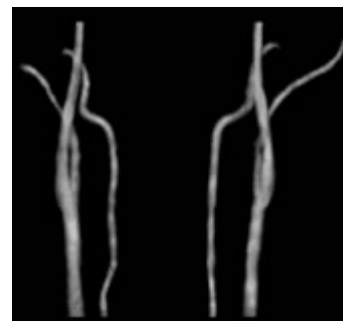
- Viewing perspectives: sagittal; coronal; axial; oblique; double oblique; curved (freehand)
- Reconstruction along polygon and/or curved (freehand) cut lines
- Reconstruction based on reconstructed planes possible
- Reconstruction of user-defined ranges of parallel, radial or freehand cuts
- Selectable 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: eliminating interfering overlays by manually drawn, irregular contours in all dimensions
- Arbitrary views along any direction defined interactively with mouse-driven virtual trackball
- Multiple view angles around any orthogonal axis
- Projections displayed as single images, as interactive movie or through fast paging
- MIP thin/MIP thick



MinIP – Minimum Intensity Projection

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

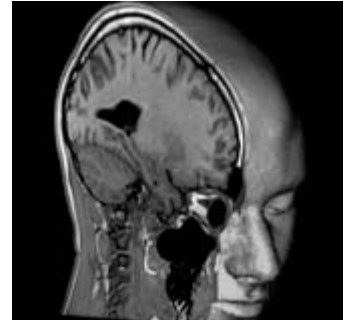
- Volume of Interest (Vol) defined to increase reconstruction speed and to improve image quality
- Freehand minMIP: eliminating interfering overlays by manually drawn, irregular contours in all dimensions
- Arbitrary views along any direction defined interactively with mouse-driven virtual trackball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

DICOM Conformance Statements can be found on the Internet:

www.siemens.com/healthcare

- > Services
- > DICOM
- > Magnetic Resonance

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

Image Transfer	
Local network	Ethernet
Data transfer rate	max. 100 MBit/s
Transfer rate (256 x 256 image)	approx. 4 images/s



Computer System

MR Main Console (MRC)

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 tiltable, forward and backward

Automatic backlight control for long-term brightness stability

Color LCD Monitor

Screen size (diagonal)	19"
Horizontal frequency	30–82 kHz
Vertical frequency	56–76 Hz
Screen matrix	1280 × 1024

Host Computer	
Double processor	Intel Xeon CPU
Clock rate	≥ 2.6 GHz
Main memory (RAM)	4 GB
1 st hard disk (system SW)	146 GB
2 nd hard disk (data base)	146 GB
3 rd hard disk (images)	146 GB (220 000 images for both matrixes 256^2 and 512^2)
CD-R writer	approx. 4000 images 256^2 ; DICOM Standard, ISO 9660
DVD-R writer	approx. 25 000 images 256^2 ; DICOM Standard, ISO 9660
Media drives	CD-ROM drive, DVD drive
Measurement and Reconstruction System (MARS)	
CPU	Quad Core Xeon™
Clock rate	≥ 2.33 GHz
Main memory (RAM)	8 GB
1 hard disk	500 GB
Reconstruction speed	≥ 1859 recons per second (256^2 FFT, full FoV) ≥ 9840 recons per second (256^2 FFT, 25% recFoV)
Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 4 data sets

Installation

Radio Frequency Shielding	For shielding the examination room from external RF sources	
	RF attenuation factor	>90 dB
	Frequency range	10 – 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. Can be used to create a magnetic shielding enclosure



44

Dimensions	Component	Width [cm]	Depth [cm]	Height [cm]	Weight [kg]	Heat Dissipa- tion [kW]*
Examination Room						
	Magnet (incl. covers)	137 (54 in)	209 (82.3 in)	189 (74.4 in)	16 000 (35 320 lbs)	1.0
	Patient table	79 (31.1 in)	210 (82.7 in)	82 ** (32.3 in)		
	Required min. room height			225 (88.6 in)		
Control Room						
	MR console (table + monitor)	120 (47.2 in)	80 (32 in)	117 (72+45) (46 in (28+18))		
	Host computer	22 (8 in)	80 (32 in)	49 (19 in)		
Equipment Area						
	Electronics cabinet (incl. MARS and system control, RF system, gradient power system)	95.4 (37.6 in)	64.8 (25.5 in)	197.5 (77.8 in)	602.5 (1 328 lbs)	total 10
	ICS (integrated cooling system)	80 (31.5 in)	64.8 (25.5 in)	193 (76 in)	310 (683 lbs)	

* Heat dissipation into air

** Above floor level





On account of certain regional limitations of sales rights and service availability, we cannot guarantee that all products included in this brochure are available through the Siemens sales organization worldwide. Availability and packaging may vary by country and is subject to change without prior notice.

The information in this document contains general technical descriptions of specifications and options as well as standard and optional features which do not always have to be present in individual cases.

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Please find fitting accessories:

www.siemens.com/healthcare-accessories

Medical images courtesy of:
Salamaniya Medical Complex, Manama, Bahrain

Aarhus MR-Klinik, Aarhus, Denmark
Horsens Regionalhospital, Horsens, Denmark
Eduardus Hospital, Cologne, Germany
Radiology of Jung-Stilling-Hospital, Siegen, Germany

Mamata General Hospital, Khamman, India

Rainbow Open MRI, Nagpur, India
KLSC Sports Imaging, Kuala Lumpur, Malaysia

Airforce General Hospital, Beijing, P.R. China

Sir Run Run Shaw Hospital, Hangzhou, P.R. China

SMMR, Shenzhen, P.R. China

IMADIA, Lucenec, Slovakia

AGM, Ankara, Turkey

Cleveland Community Hospital, Cleveland, USA

Medical Center, Franklin, USA

Contact

Germany

Siemens Healthcare Sector
Magnetic Resonance
Henkestr. 127, D-91052 Erlangen
Telephone: +49 9131 84-0

USA

Siemens Medical Solutions USA, Inc.
51 Valley Stream Parkway
Malvern, PA 19355
Telephone: +1 888-826-9702
Telephone: +1 610-448-4500
Telefax: +1 610-448-2254

Japan

Siemens-Asahi
Medical Technologies Ltd.
Takanawa Park Tower 14F
20-14, Higashi-Gotanda 3-chome
Shinagawa-ku
Tokyo 141-8644
Telephone: +81 3 5423 8411

Asia

Siemens Healthcare Sector
Asia Pacific Headquarters
The Siemens Center
60 MacPherson Road
Singapore 348615
Telephone: +65 6490 6000
Telefax: +65 6490 6001

Global Siemens Headquarter

Siemens AG
Wittelsbacherplatz 2
D-80333 Muenchen
Germany

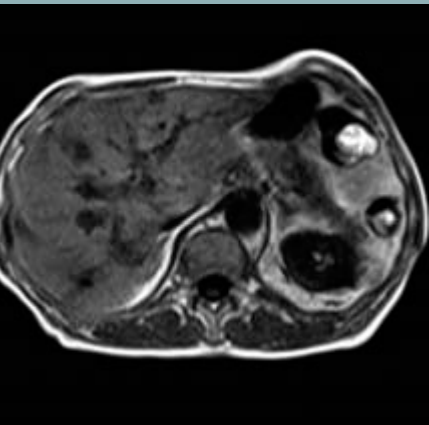
Global Siemens Healthcare Headquarters

Siemens AG
Healthcare Sector
Henkestrasse 127
D-91052 Erlangen
Germany
Telephone: +49 9131 84-0
www.siemens.com/healthcare

Legal manufacturer

Siemens Mindit Magnetic
Resonance Ltd. (SMMR)
Siemens MRI Center, Gaoxin C. Ave.
2nd, Hi-Tech Industrial Park
Shenzhen 518057, P.R. China
Telephone: +86 755-26525421
Telefax: +86 755-26549253

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MAGNETOM C!

Body/Spine Array Coil small, medium and XL

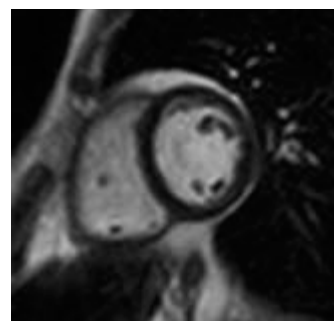
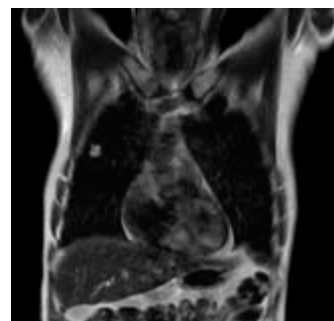
www.siemens.com/healthcare

SIEMENS

Body/Spine Array Coil small, medium and XL

General

- Phased array receive coils with four coil elements each
- Three different coil sizes, additional to standard Body/Spine Array Coil, large, suitable for most patients
- iPAT-compatible (integrated Parallel Acquisition Technique)
- 4 channel imaging standard
- Small coil:
30×20.5 cm (11.8×8.1 in)
(internal W×H)
(For patients with a circumference of approx. 78.7 cm/31 in)
- Medium coil:
36×25.5 cm (14.2×10 in)
(internal W×H)
(For patients with a circumference of approx. 96.5 cm/38 in)
- XL coil:
50×30.5 cm (19.7×12 in)
(internal W×H)
(For patients with a circumference of approx. 127 cm/50 in)
- Upper coil parts removable for easy patient positioning
- Patient-friendly design for maximum patient comfort



Applications:

- Imaging of the thoracic region, the abdomen, pelvis and thighs
- MR Angiography
- Spine imaging

Global Siemens Headquarter

Siemens AG
Wittelsbacherplatz 2
D-80333 Muenchen
Germany

Global Siemens Healthcare Headquarters

Siemens AG
Healthcare Sector
Henkestrasse 127
D-91052 Erlangen
Germany
Telephone: +49 9131 84-0
www.siemens.com/healthcare

Legal manufacturer

Siemens Mindit Magnetic
Resonance Ltd. (SMMR)
Siemens MRI Center, Gaoxin C. Ave.
2nd, Hi-Tech Industrial Park
Shenzhen 518057, P.R. China
Telephone: +86 755-26525421
Telefax: +86 755-26549253

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MAGNETOM C!

Body/Spine Array Coil XXL

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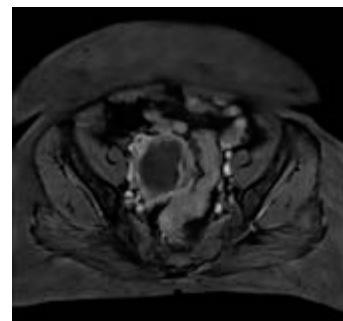
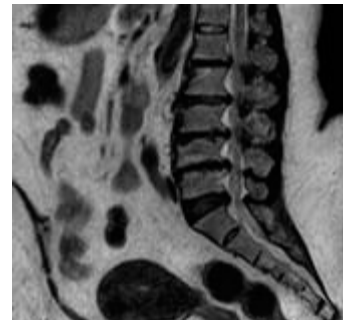
Body/Spine Array Coil XXL

General

- Flexible 2 channel array receive coil
- Circumference 175 cm (69 in) to fit most obese patients
- Patient-friendly design with velcro straps for positioning and for maximum patient comfort

Applications:

- Imaging of the thoracic region, the abdomen, pelvis and thighs
- MR Angiography
- Spine imaging



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D-80333 Muenchen
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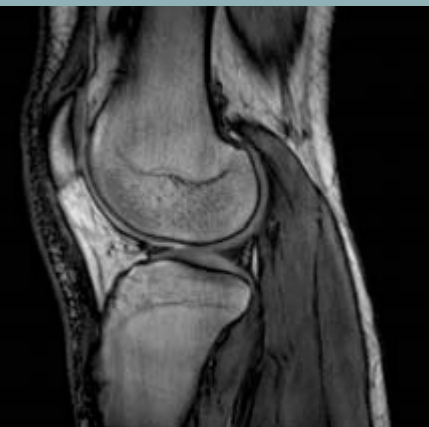
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Extremity Array Coil small, large and XL

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Extremity Array Coil small, large and XL

General

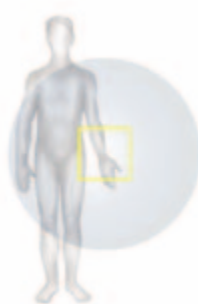
- Phased array receive coils with four coil elements each
- 4 channel imaging standard
- iPAT-compatible (integrated Parallel Acquisition Technique)
- Upper coil part removable for easy patient positioning
- Coils integrated in base shaped as knee support
- Cushions for extremity stabilization
- Small coil:
15×23×17 cm
(5.9×9×6.6 in)
(internal W×H×D)
- Large coil:
20×28×20 cm
(7.8×11×7.8 in)
(internal W×H×D)
- XL coil:
25×33×22 cm
(9.8×13×8.7 in)
(internal W×H×D)

Isocenter Imaging

- All extremity joints are scanned in the magnet isocenter for optimum results

Applications:

- High resolution imaging of the knee and ankle



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Wrist Array Coil

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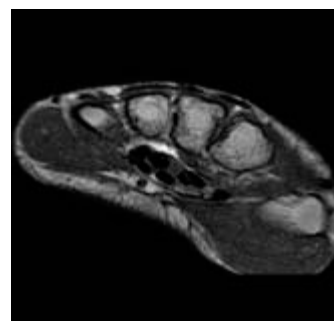
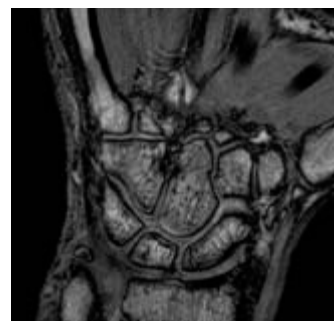
Wrist Array Coil

General

- Phased array receive coil with four coil elements
- 4 channel imaging standard
- iPAT-compatible (integrated Parallel Acquisition Technique)
- Inner oval dimensions:
12×7 cm (4.7×2.7 in)
Length: 20 cm (7.9 in)
- For stable positioning

Applications:

- High resolution imaging of the wrist and adjacent region with excellent visualization of small anatomical structures



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D-80333 Muenchen
Germany

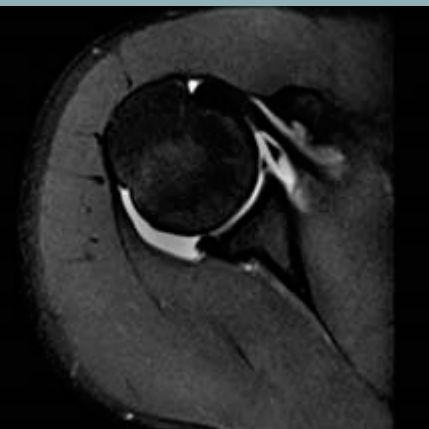
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Siemens AG
Healthcare Sector
Henkestrasse 127
D-91052 Erlangen
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Resonance Ltd. (SMMR)
Siemens MRI Center, Gaoxin C. Ave.
2nd, Hi-Tech Industrial Park
Shenzhen 518057, P.R. China
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Shoulder Array Coil

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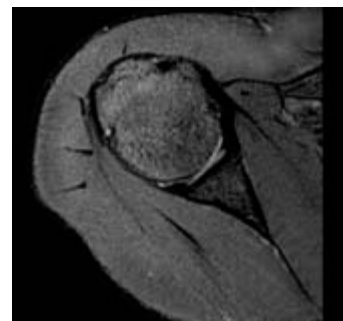
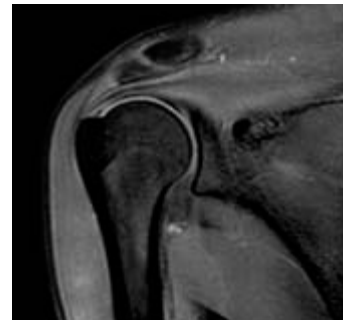
Shoulder Array Coil

General

- Phased array receive coil with two coil elements
- Anatomically shaped coil to best fit various patient sizes. Inner vertical opening 19.5 cm (7.6 in)
- Coil smoothly integrated in foam base for easy positioning

Applications:

- High resolution imaging of the right or left shoulder with excellent visualization of small anatomical structures



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Wittelsbacherplatz 2
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Siemens MRI Center, Gaoxin C. Ave.
2nd, Hi-Tech Industrial Park
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MAGNETOM C!

MP2 Coil Set

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MP2 Coil Set

General

- Set of two flexible ring coils with circumferences of 51 cm (20 in) and 66 cm (26 in)
- Positioning aids for comfortable and safe patient positioning



Applications:

- Especially suitable for imaging of the extremities, the neck and interventional procedures
- Enables imaging of c-spine, shoulder, knee and other anatomies in various angles of motion e.g. for kinematic studies or shoulder imaging in the ABER position.



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Wittelsbacherplatz 2
D-80333 Muenchen
Germany

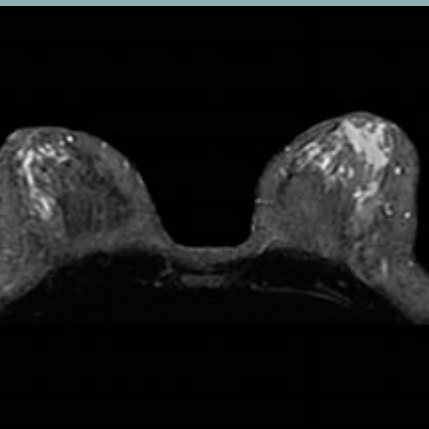
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Siemens AG
Healthcare Sector
Henkestrasse 127
D-91052 Erlangen
Germany
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Siemens Mindit Magnetic
Resonance Ltd. (SMMR)
Siemens MRI Center, Gaoxin C. Ave.
2nd, Hi-Tech Industrial Park
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Telefax: +86 755-26549253

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Breast Array Coil

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Breast Array Coil

General

- Four coil elements design
- iPAT-compatible (integrated Parallel Acquisition Technique)
- Padded for imaging in prone position
- Stabilizing pads for wide anatomical variations
- Mediolateral compression capability

Applications:

- Simultaneous high-resolution imaging of both breasts in coronal and transverse directions
- Imaging of one or both breasts in sagittal direction



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Siemens AG
Wittelsbacherplatz 2
D-80333 Muenchen
Germany

Global Siemens Healthcare Headquarters

Siemens AG
Healthcare Sector
Henkestrasse 127
D-91052 Erlangen
Germany
Telephone: +49 9131 84-0
www.siemens.com/healthcare

Legal manufacturer

Siemens Mindit Magnetic
Resonance Ltd. (SMMR)
Siemens MRI Center, Gaoxin C. Ave.
2nd, Hi-Tech Industrial Park
Shenzhen 518057, P.R. China
Telephone: +86 755-26525421
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MAGNETOM C!

Accessories

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In-Room MRC syngo

General

- Mobile operator console to be used close to the patient in the examination room
- RF shielded 18 inch LCD color display for selection of scan parameters, start of measurement, evaluation and documentation
- Trackball driven operation using an MR compatible trackball built into the operator console



MR Guided Procedure Kit

- MR-compatible surgical light for sterile handling, on a flexible arm attached to the magnet
- Ergonomic chair for the interventionalist
- Sterile covers for the magnet
- Protocols for interventional procedures

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Contact

Germany

Siemens Healthcare Sector
Magnetic Resonance
Henkestr. 127, D-91052 Erlangen
Telephone: +49 9131 84-0

USA

Siemens Medical Solutions USA, Inc.
51 Valley Stream Parkway
Malvern, PA 19355
Telephone: +1 888-826-9702
Telephone: +1 610-448-4500
Telefax: +1 610-448-2254

Japan

Siemens-Asahi
Medical Technologies Ltd.
Takanawa Park Tower 14F
20-14, Higashi-Gotanda 3-chome
Shinagawa-ku
Tokyo 141-8644
Telephone: +81 3 5423 8411

Asia

Siemens Healthcare Sector
Asia Pacific Headquarters
The Siemens Center
60 MacPherson Road
Singapore 348615
Telephone: +65 6490 6000
Telefax: +65 6490 6001

Global Siemens Headquarter

Siemens AG
Wittelsbacherplatz 2
D-80333 Muenchen
Germany

Global Siemens Healthcare Headquarters

Siemens AG
Healthcare Sector
Henkestrasse 127
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