Standard Acquisition and Reconstruction Techniques

Standard techniques

- 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)
- 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
- MTC (Magnetization Transfer Contrast). Off-resonance RF pulses to suppress signal from certain tissues, thus enhancing the contrast. Used e.g. in MRA
- 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
- Flexible film formats and paper print
- Data storage of images and cine AVI files on CD/DVD with DICOM viewer as the viewing tool
- Selectable centric elliptical phase reordering via the user interface
- Inversion Recovery to nullify the signal of fat, fluid or any other tissue
- Multiple Direction Diffusion Weighting (MDDW) – diffusion tensor imaging measurements can be done with multiple diffusion-weightings and up to 12 directions for generating data sets for diffusion tensor imaging.
- syngo® WARP – 2D TSE sequence combining optimized high-bandwidth pulse sequences and View Angle Tilting (VAT), tailored to reduce susceptibility artifacts caused by orthopedic MR-Conditional[1] metal implants.

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 TSE with multiple average – it is possible to acquire T2-weighted TSE images during shallow breathing, in a time efficient manner
	- 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
	- 2D/Optimized high bandwidth TSE (T1, T2, and PD weighted and STIR) with WARP for the reduction of susceptibility artifacts caused by MR-Conditional metal[1] implants.

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[1] MR Imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.

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Gradient Echo family of sequences	• 2D/3D FLASH (spoiled GRE) – dual echo for in-/opposed phase imaging 3D VIBE (Volume Interpolated Breathhold 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) • ce-MRA sequence with Inline subtraction and Inline MIP • 2D/3D Time-of-Flight (ToF) Angiography – single slab and multi slab; triggered and segmented • 2D/3D Phase Contrast Angiography • BEAT Tool – TrueFISP segmented; 2D FLASH segmented; Magnetization-prepared TrueFISP (IR, SR, FS); IR TI scout; Retrogating
Turbo Gradient Spin Echo (TGSE)	Hybrid Turbo Spin Echo / Gradient Echo used primarily for T2-weighted imaging • Shorter measurement time • Decreased RF power deposition • High resolution imaging of brain and spine

Standard Fat/Water Imaging

• Fat and Water Saturation. Additional frequency selective RF pulses used to suppress bright signal from fatty tissue. Two selectable modes: weak, strong
• Quick FatSat
• SPAIR: robust fat suppression for body imaging using a frequency selective inversion pulse
• Fat/Water Excitation. Spectral selective RF pulses for exclusive fat/water excitation
• Dixon technique for fat and water separation – available on VIBE and Turbo Spin Echo sequences

Standard Flow Artifact Reduction

• LOTA (Long Term Data Averaging) technique to reduce motion and flow artifact
• Pre-saturation technique. RF saturation pulses to suppress flow and motion artifacts
• Tracking SAT bands maintain constant saturation of venous and/or arterial blood flow, e.g. for 2D/3D sequential 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

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Standard Scan Time Reduction	
Elliptical scanning reduces scan time for 3D imaging	
iPAT – integrated Parallel Acquisition Technique high-performance and flexible Parallel Imaging with integrated AutoCalibration	Two algorithms – mSENSE and GRAPPA – for maximum quality for all applications
	iPAT is compatible with all relevant sequence techniques (e.g. SE, TSE, SPACE, MEDIC, TIRM DarkFluid, HASTE, EPI, MPRAGE, 3D VIBE, FLASH, TrueFISP, TurboFLASH, FLASH Phase Contrast, etc)
	iPAT is compatible with all multi-element 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
	T-PAT with mSENSE and GRAPPA for advanced parallel imaging provides fast high-resolution dynamic imaging
	3 different calibration techniques can be used: • AutoCalibration with an integrated 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. • T-PAT and PAT averaging for motion artifact suppression using Self-Calibration
iPAT^2	More slices and coverage in the same breathhold by applying PAT in 2 directions simultaneously (phase-encoding direction and 3D direction for 3D sequences)
	The effective PAT factor can be maximized, and PAT applications are extended. Typical clinical applications are MR Angiography or ultrafast isotropic T1-weighted 3D imaging of the head
	A new iPAT^2 sequence technique named CAIPIRINHA (Controlled Aliasing In Parallel Imaging Results IN Higher Acceleration) has been added. It can be applied to volumetric 3D imaging e.g. in the abdominal region.

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Standard Motion Correction

BLADE	• Improves image quality by minimizing and correcting for the effects of motion during an MR sequence acquisition. e.g. head, spine, orthopedic imaging and the abdomen • Motion insensitive Turbo Spin Echo sequence • Can be used with all coils and in all planes • Supports T2-weighted, T1-weighted, STIR, and DarkFluid pulse sequences • Simultaneous in-plane motion correction for arbitrary slice orientations • Versatile sequence e.g. supporting iPAT with GRAPPA, Restore pulses and supports respiratory triggered imaging of the abdomen using 2D PACE
1D PACE (Prospective Acquisition CorrEction)	Quick and easy acquisition control for free breathing examinations, e.g. for cardiac imaging
2D PACE Precise Motion Correction	• Detects and corrects respiratory motion of the heart, liver, etc. for free breathing high resolution 2D and 3D examinations • Significantly increased image quality • Improved security in the diagnosis of diseases in moving organs and precise slice registration for multi breathhold studies • Eliminates the need for respiratory belt • PAT averaging for motion artifact suppression using Self-Calibration

Standard Susceptibility Artifact Reduction

WARP	• 2D TSE sequence combining optimized high-bandwidth pulse sequences and View Angle Tilting (VAT), tailored to reduce susceptibility artifacts caused by orthopedic MR-Conditional[1] metal implants. • This helps in evaluation of soft tissue in proximity of the implant. • Available pulse sequences include T1-weighted, T2-weighted, proton density and STIR contrast.

Standard Workflow Enhancements

AutoCoilDetect	Detects the position and orientation of coils automatically. Shows coils in the user interface right within the graphical slice positioning.
AutoCoilSelect	Automatic detection and selection of all coil elements in the active Field-of-View.
syngo Scan Assistant	Shows parameter constraints and provides possible solutions.
scan@center	Automated movement of table so that the scan is performed in the magnet isocenter -- can be activated or deactivated by the user.

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AutoVoiceCommands	These multi-language automatic voice commands during the scaning to help synchronize timing of breathing, scanning, and contrast media injection.
Phoenix and PhoenixZIP	Exchange of pulse sequence data (e.g. via Internet) by drag & drop clinical images. PhoenixZIP allows transfer of whole measurement programs.
Online Help Functions	Context sensitive and quick resource for questions about software operation or MR physics.
DirectConnect	Cable-less direct connection for Head/Neck 16, Head/Neck 20, Spine 24, Spine 32, Foot/Ankle 16[1], Pediatric 16[1].
SlideConnect	SlideConnect® cable connectors can be securely plugged-in with one hand only.
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. Inline functionality is user-configurable. Examples: • Automatic subtraction of images, e.g. pre- and post-contrast enhancements • MIP on-the-fly, e.g. MR Angiography with automatic image subtraction and following MIP in three orthogonal planes • Prospective motion correction (1D and 2D PACE) on-the-fly • Automatic perfusion[1] and diffusion maps • Automatic composing of multi-step images[1] • Automatic on-the-fly calculation of standard deviation, for better differentiation of arterial and venous phases • Inline Display automatically shows reconstructed images. It offers immediate access to the results and opens automatically for e.g. interactive real-time scanning or CareBolus examinations • Inline Movie automatically starts the cine image display

TimCT FastView

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.

• 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.
• TimCT FastView runs without laser light positioning to further streamline the workflow for several indications

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Tim Application Suite

3.8.1

The Tim Application Suite offers a complete range of clinically optimized examinations for all regions. The Tim Application Suite – allowing excellent head-to-toe imaging – is provided standard on MAGNETOM Aera.

- Neuro Suite
- Angio Suite
- Cardiac Suite
- Body Suite
- Onco Suite
- Ortho Suite
- Breast Suite
- Scientific Suite
- Pediatric Suite[1]

Neuro Suite

Comprehensive head and spine examinations can be performed with dedicated programs. High resolution pulse sequences and fast pulse sequences for uncooperative patients are provided. The Neuro Suite also includes pulse sequences for diffusion imaging, perfusion imaging, and fMRI.

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[1] MR scanning has not been established as safe for imaging fetuses and infants under two years of age. The responsible physician must evaluate the benefit of the MRI examination in comparison to other imaging procedures.

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General features	• Fast 2D imaging with SE, TSE, GRE pulse sequences for high-resolution imaging in all orientations and all contrasts
	• BLADE motion correction for TSE imaging in all orientations and contrasts
	• EPI pulse sequences 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
	• 3D TOF for non-contrast-enhanced angiography
	• 3D isotropic resolution volume imaging using T1 3D MPRAGE/ 3D FLASH, SPACE DarkFluid, T1 SPACE, T2 SPACE, and 3D TSE T2-weighted high resolution 3D Restore pulse sequences optimized for inner ear examinations
	• Double Inversion Recovery 3D pulse sequences (DIR SPACE) with two user-selectable inversion pulses for the simultaneous suppression of e.g. cerebro-spinal fluid and white matter
	• MP2RAGE (Magnetization Prepared 2 Rapid Acquisition Gradient Echoes) provides homogeneous tissue contrast for segmentation and applications such as voxel-based morphometry. In combination with MapIt[1], it also provides T1 mapping functionality.
	• Whole-spine pulse sequences in multiple steps with software controlled table movement

[1] Option

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General features	• 2D and 3D MEDIC pulse sequences 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 and 3D MEDIC pulse sequences 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
• PSIF sequence for diffusion-weighted imaging of the spine
• Precision filter for high spatial accuracy e.g. for neuro intra-operative imaging and stereotactic planning
• 3D CISS (Constructive Interference in Steady State) for excellent visualization of fine structures such as cranial nerves. High resolution imaging of inner ear and spine
• TGSE sequence used primarily for T2-weighted imaging for shorter measurement time, decreased RF power deposition and high resolution imaging of brain and spine
• AutoAlign Head LS providing a fast, easy, standardized, and reproducible patient scanning supporting reading by delivering a higher and more standardized image quality
• GOBrain[1] is a set of optimized pulse sequences for diagnostic neuroimaging developed by the board-certified neuroradiologists at Massachusetts General Hospital, USA. These protocols aim to achieve a diagnostic brain examination and are optimized for short acquisition times. The following contrast and orientations are provided with this protocol:
  • sagittal T1-weighted GRE
  • axial T2-weighted TSE
  • axial T2 TSE FLAIR
  • axial Diffusion-weighted single-shot EPI
  • axial T2*-weighted EPI-GRE

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Angio Suite
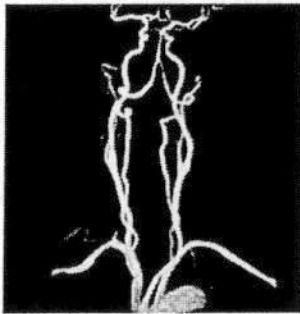
Excellent MR Angiography can be performed to visualize arteries and veins.
- 3D MRA protocols for e.g. single step, dynamic, peripheral, whole body MRA with short TR and TE. The strong gradients make it possible to separate the arterial phase from the venous phase
- Dynamic MRA for 3D imaging over time

Contrast-enhanced MRA	• 3D contrast-enhanced MRA protocols for e.g. single step, dynamic, peripheral, whole body MRA with the shortest TR and TE. The strong gradients make it possible to separate the arterial phase from the venous phase • TestBolus workflow for optimal bolus timing and excellent image quality • CareBolus functionality for accurate determination of the bolus arrival time and the "Stop and Continue" of the 3D ce-MRA protocol after the 2D bolus control scan • Dynamic ce-MRA for 3D imaging over time
Non-contrast MRA and venography	• 2D or 3D Time-of-Flight (ToF) protocols for MRA for the Circle of Willis, carotids, neck vessels, and breathhold protocols for abdominal vessels • Triggered 2D 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 • TONE (Tilted optimized non-saturating excitation) and MTC (Magnetization Transfer Contrast) techniques for improved Contrast-to-Noise Ratio (CNR)
Image processing tools	• MPR, 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

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Cardiac Suite

The cardiac suite covers comprehensive 2D routine cardiac applications, ranging from morphology and ventricular function to tissue characterization. Featuring BEAT 2D in conjunction with IPAT and T-PAT techniques

Cardiac views	· Fast acquisition of the basic cardiac orientations 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
BEAT	· Unique tool for fast and easy cardiovascular MR imaging · E.g. 1 click change from FLASH to TrueFISP for easy contrast optimization · · 1-click to switch arrhythmia rejection on/off · 1-click change from Cartesian to radial sampling to increase effective image resolution (e.g. in pediatric patients)[1] and avoid folding artifacts in large patients
Visualization of structural cardiovascular pathologies with CMR – BEAT	· Breathhold and free breathing techniques for strong contrast between the blood and vascular structures. Dark Blood TSE and HASTE imaging are available for the structural evaluation of the cardiothoracic anatomy, including vessels or heart valves. Cine techniques (FLASH & TrueFISP) for high-resolution valve evaluation · Multiple contrasts such as T1- and T2-weighted imaging for use in diseases such as myocarditis (inflammation/hyperaemia), ARVD (fibrous-fatty degeneration) or acute myocardial infarction (edema) · Dark-blood TSE with motion compensation for high-quality vessel wall imaging in small or large vessels

[1] MR scanning has not been established as safe for imaging fetuses and infants under two years of age. The responsible physician must evaluate the benefit of the MR examination in comparison to other imaging procedures.

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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 whole-heart coverage • iPAT integration for highest temporal and spatial resolution • Real-time imaging in case the patient is not able to hold his breath
Dynamic imaging and tissue characterization with BEAT Protocols for high-contrast and high-resolution tissue characterization	• Protocols for stress and rest imaging with TrueFISP or TurboFLASH contrast support the acquisition of multiple slices with high resolution and arbitrarily adjustable slice orientation for each slice • T-PAT with mSENSE and GRAPPA for advanced parallel imaging provides fast high-resolution dynamic imaging • Segmented IR TrueFISP/FLASH with TI scout for optimization of tissue contrast • Advanced tissue characterization with 2D phase-sensitive IR (PSIR) sequences TrueFISP and FLASH contrast. Magnitude and phase-sensitive images with one acquisition • Simple: no adjustment of inversion time (TI) necessary with PSIR technique

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๑.ลงชื่อ..ประธานกรรมการ ²¹

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Body Suite

The Body Suite is dedicated to 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. The 2D PACE technique makes body imaging easy, allowing multi-breathhold examinations as well as free breathing during the scans. Motion artifacts are greatly reduced with 2D PACE Inline technology. This package includes:

- Free breathing 2D PACE applications with 2D/3D HASTE (RESTORE) and 2D/3D TSE (RESTORE)
- It is possible to use a phase navigator, which measures respiratory induced off-resonance effects. The positioning can be done automatically for most protocols.
- Optimized fast single shot HASTE protocols and high-resolution 3D RESTORE protocols based on SPACE and TSE for MRCP and MR Urography examinations
- REVEAL: diffusion imaging for abdomen and whole body exams. In protocols with multiple b-values individual numbers of averages may be specified per b-value. Inline calculation of ADC maps, exponential ADC maps and inverted b-value images can be selected. Inline calculation (extrapolation) of high b-values (up to b=1600 s/mm^2) is possible.

Abdomen	2D: • T1 (FLASH) breathhold scans with and without FatSat (SPAIR, Quick FatSat, in-/opp-phase) • T2 (HASTE, TSE/BLADE, EPI) breathhold scans with and without FatSat (SPAIR, FatSat, STIR) • 2D TSE with multiple averages – it is possible to acquire T2-weighted TSE images during shallow breathing, in a time efficient manner • T1 (TFL) triggered scans (2D PACE free breathing) in-/opp-phase • T2 (HASTE, TSE/BLADE, EPI) triggered scans (2D PACE free breathing) with and without FatSat (SPAIR, FatSat, STIR) as well as HASTE- and TSE-multi-echo • Optimized fast single-shot HASTE protocols and high-resolution 3D RESTORE protocols based on SPACE and TSE for MRCP and MR urography examinations

Abdomen	3D: • Dixon (VIBE 2pt-Dixon) breathhold scans; the following contrasts can be obtained: in-phase, opposed phase, fat and water image • Dynamic (VIBE Dixon and VIBE Quick-FatSat) protocols with inline motion correction for visualization of focal lesions with high spatial and temporal resolution • Colonography bright lumen with T2 TrueFISP and dark lumen with T1-weighted VIBE • CAIPIRINHA (Controlled Aliasing In Parallel Imaging Results IN Higher Acceleration) – reduces breath-hold times for 3D VIBE FS and 3D DIXON (in, opposed, water, fat)
Pelvis	• High-resolution T1, T2 pelvic imaging (prostate, cervix) • Isotropic T2 SPACE 3D protocols • Dynamic volume examinations with 3D VIBE • REVEAL: Diffusion-weighted imaging of the prostate, cervix, rectum and other organs with multiple b-values. Inline calculation of ADC maps, exponential ADC maps and inverted b-value images can be selected. Inline calculation (extrapolation) of high b-values (up to b=1600 s/mm²) is possible.

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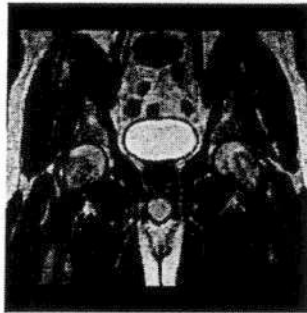
Onco Suite

MR imaging provides excellent soft tissue contrast, multi-planar capabilities, and the possibility of selectively suppressing specific tissue, e.g. fat or water. The Onco Suite features a collection of sequences as well as protocols and evaluation tools that may be used for a detailed assessment of a variety of oncological conditions.

General features	· STIR TSE, HASTE, and FLASH in-phase and opposed-phase protocols for highly sensitive visualization of focal lesions · Dynamic imaging protocols for visualizing the kinetic behavior of tissue · Quantitative evaluation and fast analysis of the data with colorized Wash-in, Wash-out, Time-To-Peak, Positive-Enhancement-Integral, MIPtime 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 postprocessing 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 imaging for liver and whole body exams. In protocols with multiple b-values individual numbers of averages may be specified for each b-value.
Prostate protocols	· Dedicated prostate protocols for a variety of clinical scenarios · REVEAL: Diffusion-weighted imaging of the prostate with multiple b-values. Inline calculation of ADC maps, exponential ADC maps and inverted b-value images can be selected. Inline calculation (extrapolation) of high b-values (up to b=1600 s/mm^2) is possible. · Protocols with high temporal resolution (VIBE, TWIST[1] and TWIST-VIBE[1]) allow time course evaluation of contrast wash-in and wash-out behavior. · Prostate spectroscopy (3D CSI[1] volume scan) with up to 8 sat bands (suppression of water and fat signal) · RESOLVE[1]: Diffusion-weighted, readout-segmented (multi-shot) EPI sequence for high-resolution susceptibility-insensitive DWI of the prostate

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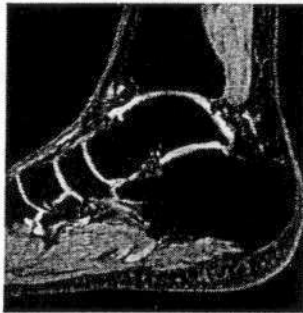
Ortho Suite

The Ortho Suite is a comprehensive collection of protocols for joint imaging including the spine.

General features

- 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
- T1, T2, 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 off-center 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
- Multi Echo SE sequence with up to 32 echoes for T2 mapping
- High resolution 3D DESS (Double Echo Steady State): T2/T1-weighted imaging for excellent fluid-cartilage differentiation
- 2 point Dixon technique for fat and water separation – Turbo Spin Echo sequence
- WARP – 2D TSE sequence combining optimized high-bandwidth protocols and View Angle Tilting (VAT), tailored to reduce susceptibility artifacts caused by orthopedic MR-Conditional[1] metal implants. This helps in evaluation of soft tissue in proximity of the implants. Available protocols include T1-weighted, T2-weighted, proton density and STIR contrast.

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[1] MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.
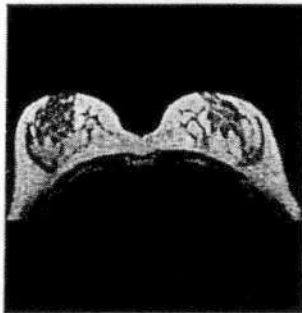
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Breast Suite

MR imaging provides excellent tissue contrast that may be useful in the evaluation of the breasts. Extremely high spatial and temporal resolution can be achieved in very short acquisition times by using iPAT with GRAPPA and CAIPIRINHA.

Customized protocols (e.g. with fat saturation, or water or silicone excitation), as well as flexible multiplanar visualization allow a fast, simple and reproducible evaluation of MR breast examinations.

General features	This package includes: • High-resolution 2D protocols for morphology evaluation • High-resolution 3D protocols covering both breasts simultaneously • Protocols to support interventions (fine needle and vacuum biopsies, wire localization) • Protocols for evaluating breasts with silicone implants • Automatic and manual frequency adjustment, taking into account the silicone signal • Detection of the silicone signal either to suppress the silicone signal, if the surrounding tissue is to be evaluated, or to suppress the tissue signal in order to detect an implant leakage • SPAIR – robust fat sat (robust fat suppression using an adiabatic 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 with GRAPPA for maximum resolution in short time • iPAT² with CAIPIRINHA allows state-of-the-art sagittal breast imaging and further improvement of the temporal resolution in dynamic scans while maintaining spatial resolution • Inline subtraction and MIP display • Offline subtraction, MPR and MIP display • REVEAL: diffusion imaging for breast exams. In protocols with multiple b-values individual numbers of averages may be specified per b-value • RESOLVE[1]: Diffusion-weighted, readout-segmented (multi shot) EPI sequence for high-resolution susceptibility-insensitive DWI of the breast
RADIANT	Ultra-sound like reconstruction around the nipple
VIEWS (Volume Imaging with Enhanced Water Signal)	• Bilateral – both breasts are examined simultaneously • Axial – the milk ducts are directly displayed • Fat-saturated or water-excited – fat complicates clinical evaluation and is suppressed • Near-isotropic 3D measurement – the same voxel size in all three directions for reconstruction in any slice direction • Submillimeter voxel – high resolution for precise evaluation

[1] Optional

Scientific Suite

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

General features
- 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

Pediatric Suite[1]

Tissue relaxation times in pediatrics are very different compared to those of adults. The reasons for these differences are: developing tissues, body size, faster heart rates, and compliance with breathhold commands. Protocols can be easily adapted for imaging infants.
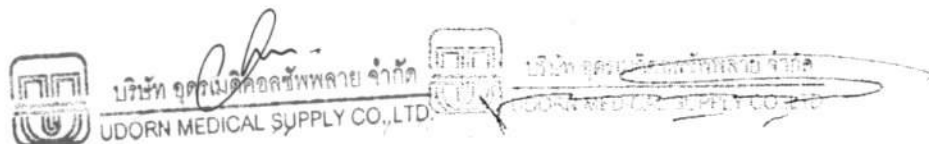
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[1] MR scanning has not been established as safe for imaging fetuses and infants under two years of age. The responsible physician must evaluate the benefit of the MRI examination in comparison to other imaging procedures.

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DotGO. Go for consistent results, efficiently

In 2009, Siemens set the benchmark in MR scanning and productivity by introducing Dot. Easily adapt to the patient's condition or clinical question, consistently achieve reproducible, high-quality results, and consequently reduce exam times and the number of rescans. From 2014 on, the newest generation of Dot – DotGO – is also setting the standard in protocol configuration. For true flexibility, consistency and efficiency in every aspect of MRI.

Flexibility. Intuitive protocol management.

One central user-interface for easy and flexible configuration and maintenance of all protocols and Dot Engines. Intuitive, fast functionality results in 80%[1] improved usability in exam configuration. DotGO empowers you to provide your MRI expertise for the entire department and to define a higher standard of care for more patients and referrers.

Consistency. Quality results for each exam.

Every patient is different. Every referrer's and radiologist's requirement is different. Imaging results need to be consistent and of high quality. Your daily schedule has to be met. DotGO partners you in meeting all of these different needs with dedicated functionality for the clinical question at hand.

Efficiency. Stay on time with less than 1 minute exam-time variation.[2]

Time, quality and costs define the efficiency of your MRI exams. DotGO enables scheduling to be more predictable through reducing time-consuming software interaction by up to 46%[3], thus resulting in reduction of exam-time variations to less than a minute[2]. Standardized procedures support quality results for each exam and help to reduce rescans. All in all the diagnostic turnaround time to the referrer is quicker, higher image quality is maintained, and MRI services are more efficient.

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[1] Compared to MR protocol configuration without Dot Cockpit, Usability Study, 2013
[2] Zhongshang Hospital Fudan University, Fudan, CN, Abdomen Dot Engine Workflow Study
[3] University Hospital Essen, GER, Brain Dot Engine Workflow Study

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๑.ลงชื่อ.................... ....ประธานกรรมการ

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Dot Cockpit

Intuitive protocol management

by providing unprecedented flexibility in MRI configuration.

At the heart of this new flexibility is the Dot Cockpit. It is the central protocol management platform enabling highly flexible and intuitive configuration, manipulation, organisation and updating of all protocols. Whether you are using a Dot engine or not, the Dot Cockpit is the new starting point for every exam.

MRI flexibility from the start:

- One central user-interface for every protocol
- Fast and intuitive protocol configuration
- User-friendly functionalities like drag&drop, Dynamic Search
- Exam strategies created with one click
- Multiple strategies in one protocol
- Change protocols on the fly
- Update parameter changes to all or a selection of identically configured protocols anywhere in the Dot Cockpit. (Identical Configurations)

Take the lead in defining the standard of MRI in your institution!

Dot Cockpit

Designed to realize the full potential of the Dot engines. The new Dot Cockpit is your central interface for all protocol management tasks. This includes flexible configuration of all Dot engines, according to your standards of care. In the following, we introduce the most important features of the new Dot Cockpit.

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Configure all protocols from one central interface	The Dot Cockpit enables you to configure and save all of your MRI protocols and Dot engines.
Dot Explorer and Program Editor on one page	The Dot Cockpit offers two tasks: Dot Explorer and Program Editor. In the Dot Explorer, you browse through and organize your protocols. In the Program Editor, you modify them.
A new program overview	With the Dot Cockpit, you can see the whole exam workflow, the different strategies, decisions, sequences and AddIns are visualised together on one page.
Dynamic search delivers highlighted results	In the Dot Explorer, searching for protocols is very quick. Just type in your search query, and results are highlighted instantly.
Editing protocols instantly	In order to modify a protocol opened in the Dot Explorer, you can immediately switch to the Program Editor with one click.
Adding a new Exam Strategy	In the Program Editor, just drag & drop or click on the strategy button in the sidebar, and a new Exam strategy is added to your exam workflow. This step automatically creates a new Dot engine.
Drag & drop from the sidebar	In the Program Editor, you can add protocols to a strategy by drag & drop from the sidebar.
User-friendly toolbar	Use the toolbar for opening and saving of programs, for copy, paste, undo, redo – in the same way as you are used to in Office programs.

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Brain Dot Engine

The Brain Dot Engine optimizes brain examinations with guided and automated workflows customized to your standards of care. The Brain Dot Engine supports the user in achieving reproducible image quality using automation tools and functionalities incorporated into the program.

Patient View	Within the Patient View the user can easily tailor examinations to an individual patient. Dot Exam Strategies allow you to choose the most appropriate strategy with one mouse click, the complete scan setup is then automatically prepared.
Guidance View	Step-by-step user guidance is seamlessly integrated. Example images and guidance text are displayed for each individual step of the scanning workflow to ensure perfect scanning even by the non-expert operators. Both images and text are easily configurable by the user.
Parameter View	The new streamlined Parameter View displays a user-defined subset of parameters which are available for manual protocol optimization. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
AutoPosition	Accurate positioning of the anatomy in the isocenter without need for laser light positioning.
AutoAlign Head LS	Automated, positioning and alignment of slice groups to the anatomy, relying on multiple anatomical landmarks. Provides fast, easy, and reproducible patient scanning and facilitates the reading by consistently delivering high image quality with a standardized slice orientation, both for follow-ups and across patients. AutoAlign Head LS computes the central positioning for many routine brain structures such as AC-PC, Midbrain & Temporal Lobes. The inner ear, the orbits and the optic nerve are also standard positioning orientations with the AutoAlign Head LS. It delivers robust and consistent results independently of patient age, head position, disease or existing lesions.
AutoCoverage	Maximizes the speed of the examination by automatically setting the number of slices and the FoV to fully cover the brain. This is performed based on the information delivered by AutoAlign, eliminating manual setting and the scanning of unnecessary slices.