MAGNETOM Skyra

A Tim+Dot System

SIEMENS

MAGNETOM Skyra

Transforming 3T productivity.

MAGNETOM Skyra delivers **true day-changing performance**. Through the groundbreaking integration of Tim 4G and Dot, MAGNETOM Skyra sets a new standard of efficiency and care which will help you **harness a new level of productivity**. Tim 4G gives you the power you need for superb image quality. And Dot takes away the complexity inherent in MR scanning that can slow you down. With MAGNETOM Skyra you'll significantly **optimize your clinical and business processes**. Reduce staff workload. Radically improve your return-on-investment (ROI). And, most importantly, deliver excellent quality of care to your patients – regardless of patient condition or experience level of staff. Today, when healthcare is under pressure from all sides, MAGNETOM Skyra delivers. Clinically. Economically. Easily. It will literally **transform the way you work** with MR.

Tim (Total imaging matrix) Technology

Tim advances MR imaging – again – with 4G flexibility, accuracy, and speed. It's Siemens ultimate innovation technology that unlocks imaging power like never before. Tim's newly designed ultra high-density coils are combined with the highest channel configurations ever offered. And, with Tim's new patient adaptive technology, image quality and acquisition speed go to a whole new level. Think more exams per day. Every day.

Tim is 4G Flexibility

- Now up to 204 coil elements deliver more signal than ever before
- Now up to 128 channels [204×128] – never wonder if you have enough channels to support ultra-high density coils
- The Tim Dockable Table is mobility done right

Tim is 4G Accuracy

- From meters to microns – The result is high resolution imaging that holds up even when zooming in on multistation images. Scan everywhere, zoom anywhere
- DirectRF – Tim's new all digital-in/digital-out design integrates all RF transmit and receive components at the magnet, eliminating analog cables for true signal purity
- TimTX – Providing excellent B1 homogeneity and scalability to higher transmission channel configurations with the potential to unlock new applications

Tim is 4G Speed

- New DirectConnect™ coils eliminate the hassle of cables – speed exam setup, and improve SNR
- New Tim Dockable Table supports faster patient preparation
- iPAT² technology – Enabling simultaneous parallel acquisition in two directions for fast 3D data
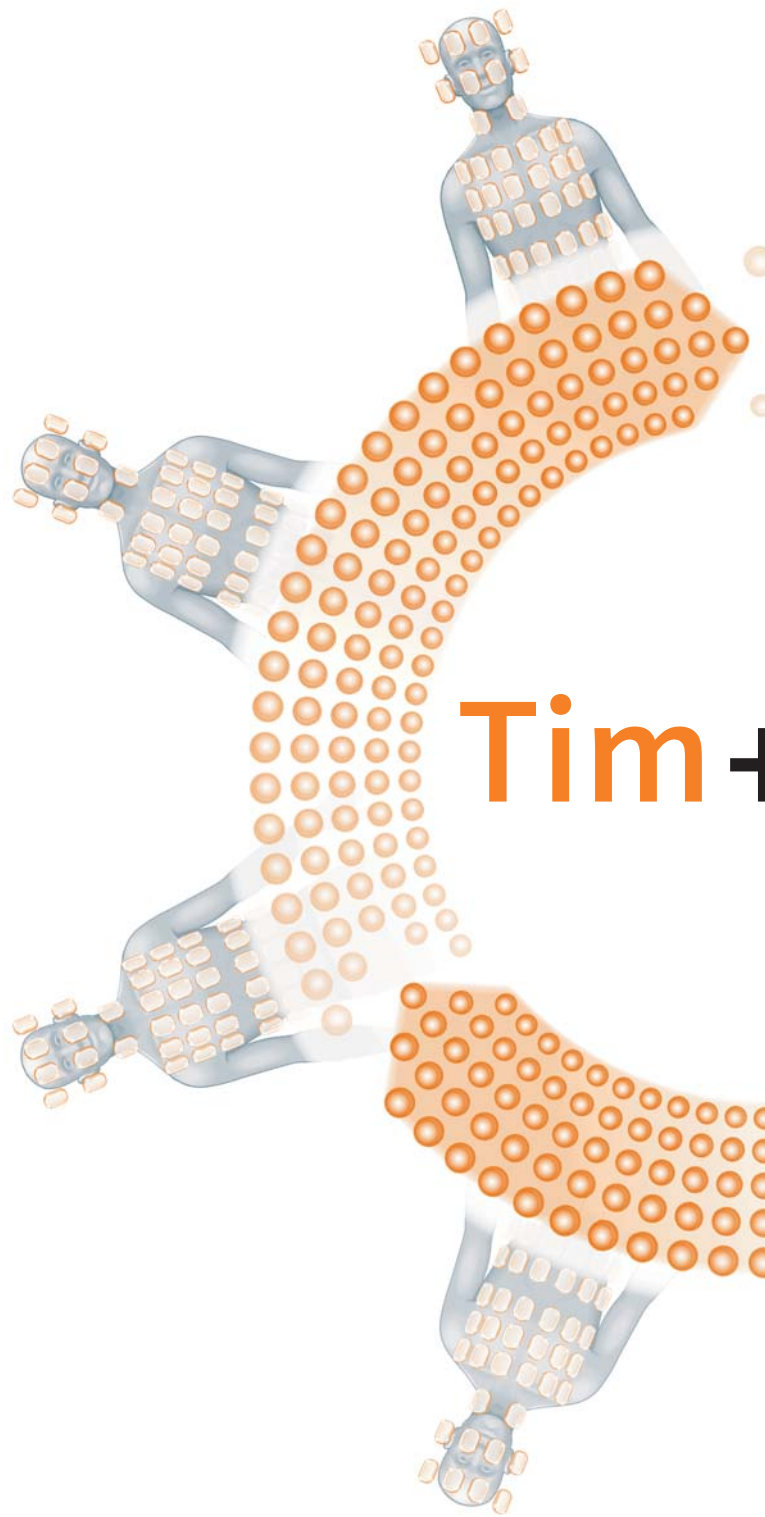
Siemens brought together a unique combination of our groundbreaking technologies Tim and Dot in our new 70 cm Open Bore 3T scanner MAGNETOM Skyra.

+Dot
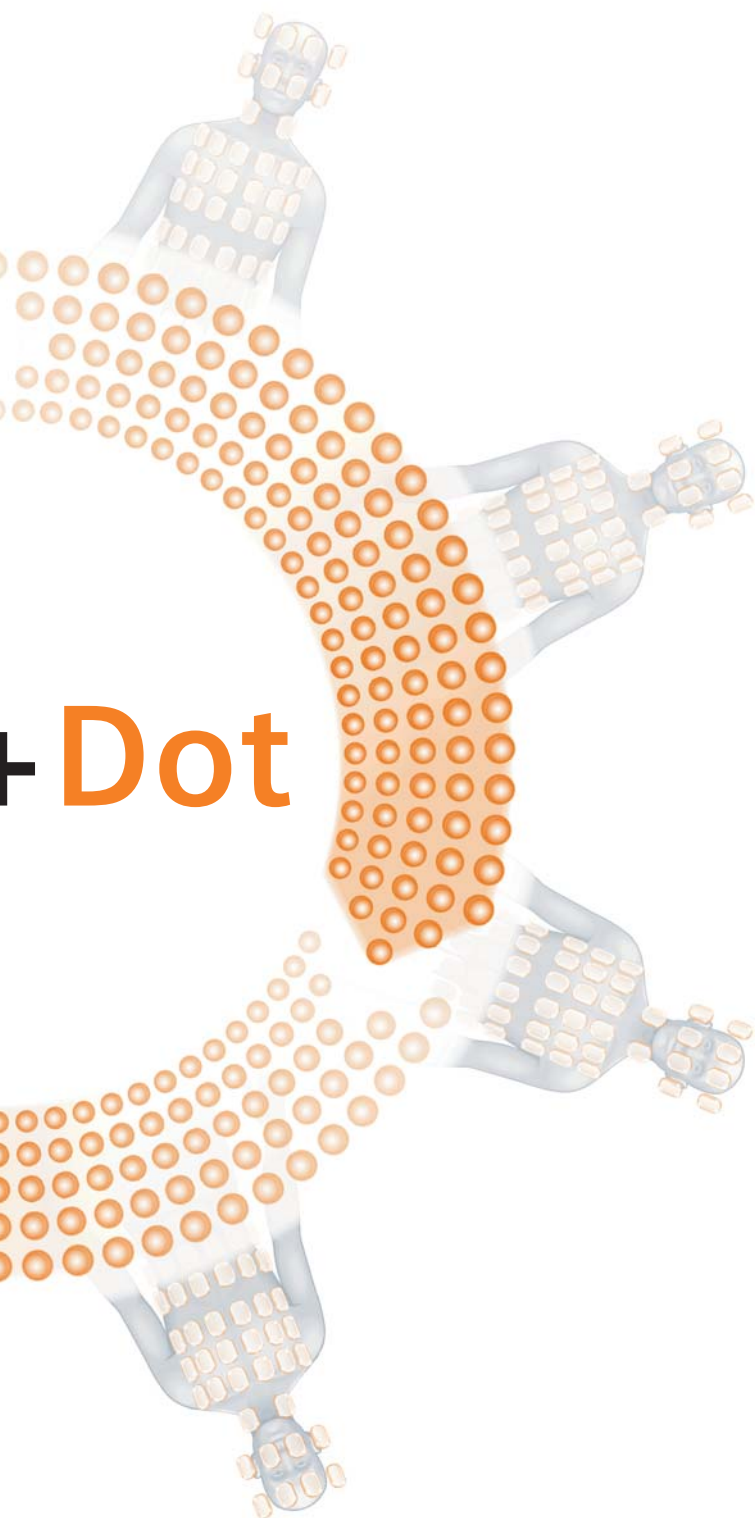
Dot (Day optimizing throughput) Engine

The imaging world's first MRI "throughput engine", offers a customizable framework for patient personalization, user guidance, and process automation to help optimize every part of your MR workflow. From reduction in your exam times and improved clinical workflows to enhanced staff efficiencies. Exam by exam, patient by patient, Dot takes away the complexity of MR scanning. Dot multiplies the power of Tim resulting in greater image consistency and diagnostic confidence, greater ease of use, and a day that's more productive than ever before.

Dot is personalized

- Optimized exam strategies – Your customized protocols are automatically selected based on the patient's condition or clinical indication
- Consistent, high quality exams even when conditions change
- Dot speaks your clinical language – create your own strategies tailored to your clinical practice

Dot is guided

- Real-time on-board guidance – Dot guides you, intuitively, through even the most complicated exams
- Integrated decision points – The user can add or eliminate protocols or groups of protocols with the click of a button
- Customizable to your standards – to follow your standards of care
- Dot Display – Patient data and positioning information is provided at the scanner
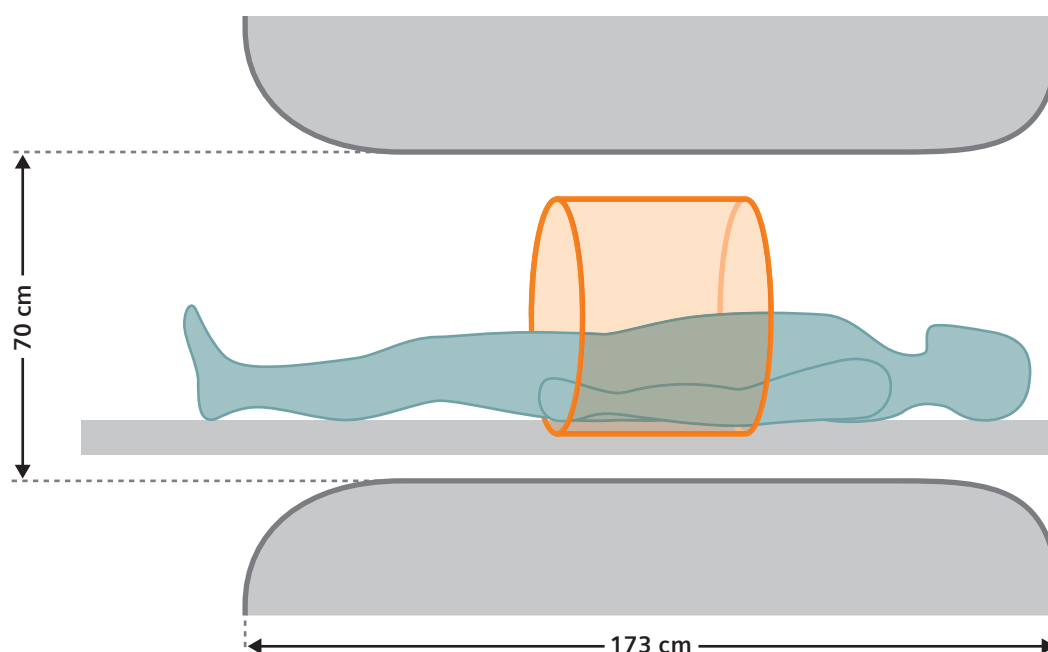
Dot is automated

- Intelligent, automated workflows – Dot Engines can be tailored to your clinical needs
- Effortless set-up – Dot links your protocols and procedures
- Timing is never off – Dot integrates AutoVoiceCommands ensuring the synchronized timing of breathing, scanning, and contrast arrival

Magnet System

General	
Superconducting Magnet	Short bore, patient-friendly design, high homogeneity 3 Tesla with 70 cm Open Bore design
	Easy siting due to AS (Active Shielding) and E.I.S. (External Interference Shielding) magnet technology
TrueForm Magnet Design	TrueForm magnet design produces a cylindrically optimized homogeneity volume that corresponds better to the true form of the human body. This results in better image quality as well as better fat saturation for the whole area covered in a scan. TrueForm reduces the overlap needed between steps for large virtual FoV exams and thus reduces the number of steps needed for a given scanning range

Magnet Parameters	
Operating field strength	3 Tesla
Magnet type	Superconductor
Field stability over time	<0.1 ppm/h
Weight (with cryogens)	5768 kg
Magnet length	1.63 m
Open Bore design[1]	70 cm
System length cover to cover	1.73 m

[1] Incl. shim coils, gradient coil, RF body coil

Homogeneity
(based on highly accurate 24 plane plot)

TrueForm magnet design with a cylindrically optimized homogeneity volume for higher image quality

10 cm DSV	Guaranteed	0.01 ppm
	Typical	0.003 ppm
20 cm DSV	Guaranteed	0.05 ppm
	Typical	0.03 ppm
30 cm DSV	Guaranteed	0.3 ppm
	Typical	0.2 ppm
40 cm DSV	Guaranteed	1.4 ppm
	Typical	1.2 ppm
$50 \times 50 \times 45$ cm³ DEV	Guaranteed	4.0 ppm
	Typical	3.6 ppm

In compliance with the German "Qualifikationsvereinbarung".

Standard deviation Vrms (volume root-mean square) measured with highly accurate 24 plane plot method (20 points per plane).

Standard active shim with 3 linear and 5 non-linear channels (2nd order).

DSV = Diameter spherical volume (x, y, and z direction);
DEV = Diameter elliptical volume.

Shimming

Both: passive and active shimming.
Passive shimming during installation

Standard active shim with 3 linear channels (1st order) and 5 non linear channels (2nd order)

| 3D Shim | Patient-specific automated shim | |
| | Time to shim | Approx. 30 s |

Shielding

Active Shielding (AS)	5th generation active shielding (AS) technology with counter coils
Fringe field (axial × radial)	0.5 mT[1] 4.6×2.6 m
	0.1 mT 6.8×3.9 m
External Interference Shield (E.I.S.)	Patented shielding system integrated into the magnet
	Continuous compensation and automatic suppression of external magnetic field interferences during measurement (caused by moving ferromagnetic objects or nearby power lines)

Magnet Cooling System

Zero Helium boil-off technology

Refill interval (typical)[2]	Not applicable
Boil-off rate (typical)[2]	0.0 l/year
Max. helium capacity	Approx. 1200 liters

[1] Pacemaker safety limit
[2] For typical clinical use, depending on sequences and operating time with running helium compressor. The system needs to be serviced at regular interval. Undisturbed magnet cooling for 24 hours and 7 days a week.

Gradient System

XQ Gradients: General Features
• Actively shielded (AS) whole-body gradient coil system
• Extremely low eddy currents
• Water-cooled coil and amplifier for maximum performance
• All axes force compensated

Gradient Performance For Each Axis	
Max. amplitude	45 mT/m
Min. rise time	225 µs
Max. slew rate	200 T/m/sec

Vector Gradient Performance (vector addition of all 3 gradient axes)	
Max. eff. amplitude	78 mT/m
Max. eff. slew rate	346 T/m/s
Gradient duty cycle	100%

XQ Gradients: Amplifier	
Water-cooled, highly compact, modular design	
Ultra-fast solid-state technology with very low switching losses	
Max. output voltage[1]	2250 V
Max. output current[1]	750 A

XQ Gradients: Resolution Parameters	
Min. FoV	5 mm
Max. FoV[2]	500 mm
Slice thickness 2D	min. 0.1 mm max. 200 mm
Partition thickness 3D	min. 0.05 mm max. 20 mm
Slab thickness 3D	min. 5 mm max. 500 mm
Max. matrix	1024
Highest in-plane resolution	12 µm

[1] Values for each of the 3 gradient axes
[2] Depending on the application, the maximum FoV in the z-direction can be up to 45 cm

Sequences		Matrix		
		64	128	256
Spin Echo	min. TR [ms]	5.7	6.3	6.4
	min. TE [ms]	3	3.3	3.5
Inversion Recovery	min. TR [ms]	27	28	28
	min. TE [ms]	3	3.3	3.5
	min. TI [ms]	22	22	22
2D GRE	min. TR [ms]	0.54	0.67	1
	min. TE [ms]	0.22	0.22	0.22
3D GRE	min. TR [ms]	0.54	0.67	1
	min. TE [ms]	0.22	0.22	0.22
TrueFISP	min. TR [ms]	2.03	2.22	2.7
	min. TE [ms]	0.94	0.98	1.19
TSE (HASTE)	min. Echo Spacing [ms]	1.92	2.12	2.5
	min. TR [ms]	5.7	6.3	6.4
	min. TE [ms]	3	3.3	3.5
	max. Turbo Factor = 512			
Turbo GSE	min. Echo Spacing [ms]	0.7	0.82	0.86
	min. TR [ms]	5.7	6.3	6.4
	min. TE [ms]	3	3.5	3.5
	max. Turbo Factor	65	65	65
	max. EPI Factor = 21			
EPI (single-shot and multi-shot)	min. Echo Spacing [ms]	0.28	0.4	0.66
	min. TR [ms]	10	10	10
	min. TE [ms]	2.1	2.2	2.7
	min. Measurement time	12	17	25
	max. EPI Factor = 256			
Diffusion Imaging	Max. b-value [s/mm^2]	10 000	10 000	10 000
	Min. TE [ms] with b = 1000 [s/mm^2]	42	43	47

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

DirectRF™ Technology

General

Tim's new all digital-in/digital-out design integrates all RF transmit and receive components at the magnet
- Optical RF system improves SNR by reducing electrical noise and increasing signal detection
- Optical links between magnet and equipment room to achieve highest RF stability
- Transmit path is integrated in the magnet housing
- Receive path is integrated in the magnet housing
- Dual-Density Signal Transfer technology enables ultra-high density coil designs by integrating key RF components into the local coil.
- Receiver with high dynamic range without adjustments

Direct Transmit Technology

Frequency stability (5 min)	$\pm 2 \times 10^{-10}$	
Frequency control	32 bits (0.03 Hz)	
Phase control	16 bits (0.006 degrees)	
Body coil	Integrated whole body no tune transmit/receive coil with 32 rungs	
	Optimized RF efficiency and signal-to-noise ratio (SNR)	
Transmitter path	Real-time Feedback loop for unmatched RF stabilization	
	Transmit amplitude	16 bit control 25 ns resolution
	Gain stability (after first minute)	<0.05 dB (1 s) <0.2 dB (5 min)
Transmit amplifier	Extremely compact, water-cooled solid state amplifier, fully integrated at the magnet as part of DirectRF technology	
	Transmit amplifier bandwidth	800 kHz
	Peak power	37.5 kW

TimTX TrueForm

TimTX TrueForm includes innovative techniques in the RF excitation hardware as well as new application- tion and processing features enabling uniform RF distribution in all body regions. TimTX TrueForm for MAGNETOM Skyra consists of TrueForm excitation, which uses amplitude and phase transmission settings optimized for dedicated body regions. Feeding the 2 ports of the integrated body coil with an optimized weighting yields a homogeneous B1 distribution

TimTX TrueForm is supported by:
- a-SPACE, which is a version of the SPACE sequence. a-SPACE uses composite adiabatic excitation pulses, which are insensitive to B1 spatial variations.
- B1 Filter, which is an adaptive inline image filter that reduces any remnant B1 effects without affecting image contrast.

RF Receiver Technology

The revolutionary Total imaging matrix optimizes coil positioning and virtually eliminates coil changing times. It also features Dual-Density Signal Transfer technology in the local receive coils, which enables the high density design. All local coils are no tune coils. Further Tim4G features are AutoCoilSelect for dynamic, automatic, or interactive selection of the coil elements within the FoV.

Receive path	Number of coil elements	Up to 204
	Number of independent receiver channels	48, 64[1], 128[1]
	Quadrature demodulation and filtering	Digital
	Receiver bandwidth	500 Hz −1 MHz (for each channel)
	Receiver signal resolution	32 bit
	ADC sampling rate	80 MHz
	Preamplifier noise figure	<0.5 dB
	Dynamic range at coil connector (referred to 1 Hz resolution bandwidth)	164 dB instantaneous at receiver 169 dB with automatic gain control at local coil connector

[1] Optional

Coils

Standard Integrated Whole-Body Coil

- No tune transmit/receive coil with 32 rungs
- Enabling TimTX TrueForm technology

3T Tim Matrix Coils

The Tim Matrix coils are designed for highest image quality in combination with easy handling. High element coils increase SNR and reduce examination times. DirectConnect™ and SlideConnect™ technology reduce patient set up time. Light weight, ergonomically designed coils enable highest patient comfort.

- No coil changing with multi-exam studies saves patient setup time
- All coils are time-saving "no-tune" coils
- Low-noise preamplifiers
- AutoCoilSelect for dynamic, automatic, or interactive selection of the coil elements within the Field of View

Standard Coils

Head/Neck 20 (DirectConnect)	Application area	Head and neck
	Dimensions with look out mirror (L×W×H)	440 mm × 330 mm × 370 mm
	Weight	4.7 kg
Spine 32 (DirectConnect)	Application area	Spine
	Dimensions (L×W×H)	1200 mm × 489 mm × 63 mm
	Weight	9.8 kg
Body 18 (SlideConnect)	Application area	Thorax, Heart, Abdomen, Pelvis, Hip
	Dimensions (L×W×H)	385 mm × 590 mm × 65 mm
	Weight	1.6 kg
Flex Large 4	Application area	Multi purpose
	Dimensions (L×W)	516 mm × 224 mm
	Weight	550 g
Flex Small 4	Application area	Multi purpose
	Dimensions (L×W)	366 mm × 174 mm
	Weight	450 g
Accessories	• Flex Coil Interface 3T • Tim Coil Interface 3T	

Combination of all coils possible for large Field of View exams.

Patient Handling

General

Tim and Dot help increase patient comfort and improve workflow efficiency.

- Set up the patient once, no repositioning, no changing of coils needed
- Scan range of 205 cm[1] allows for whole body examinations with full usage of the surface coils, without the need for patient repositioning. Ultra-light weight coils
- Imaging with optimized high element surface coil
- Remote table move
- Feet-first examinations for many applications (e.g. cardiac, liver, upper abdomen, pelvis, colonography, body angio) reduces the level of anxiety experienced by highly claustrophobic patients
- AutoPosition for selected exams
- In-room Dot Display: Patient preparation is smooth with all patient data displayed right at the scanner. Dot gives the user advice during the positioning process – very helpful in the case of ECG, for example

Patient Positioning Aids

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

Additional positioning supports (optional): Set of vacuum cushions (large, medium, small) with vacuum pump

Tim Table

Comfortable patient table solution which fits the needs for patients up to 250 kg supporting full weight capacity in vertical and horizontal movement. Integrated coils for fast patient preparation and enhanced user comfort. Examinations of patients up to 205 cm[1]. Integrated infusion stand.

Max. patient weight for vertical and horizontal table movement	250 kg (550 lbs)
Max. scan range	140 cm, opt. 205 cm[1]

User can adjust the table speed with two pre-defined speed mode buttons or accelerate continuously with the wheel on the Dot Control Centers

Vertical table movement	Range	52–104 cm
	Speed	60 mm/s; one click table up
Horizontal table movement	Max. range	2750 mm
	Max. speed	200 mm/s
	Position accuracy	±0.5 mm

Continuous table movement during scan capable

[1] Optional with Tim Whole Body Suite

Dot Control Centers

Two ergonomically designed control units integrated into the front cover on each side of the patient tunnel. Optional 3rd Dot Control Center including a Dot Display is available at the rear-end of the system.
• Continuous table movement or two speed predefined levels
• Automatic transfer from any vertical position to home position
• Automatic transfer to isocenter
• Automatic transfer from any horizontal position to home position
• In bore ventilation (6-step regulation)
• In bore lighting (6-step regulation)
• Headphone volume adjustment (6-step regulation)
• In room loudspeaker adjustment (6-step regulation)
• Laser light localization
• Start scan
• Alarm off
• Horizontal table movement, lighting adjustments, and ventilation are also possible from the console

Dot Display

Dot Display with user guidance for fast and efficient exam preparation and start of measurement at the scanner. Display of physiological curves and guidance for patient set up of triggering device.

Color LCD Monitor	13.3"; 16 : 10
Horizontal frequency	15.0−80.0 kHz
Vertical frequency	50.0−85.1 kHz
Screen Matrix	1280×800 pixels

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). The physiological curves are visualized at the Dot Display.	
Wireless Sensors	Wireless Vector ECG/respiration and pulse sensors for physiologically synchronized imaging, rechargeable battery-powered – for optimized patient handling
Physiological Signals	• ECG (3 channels) • Pulse • Respiration
	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 cardiac motion
	Peripheral PulseTriggering: • 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. Patient Monitoring System) inside the examination room • Interface for trigger input from external sources (e.g. pulse generator, trigger sources for fMRI) outside the examination room • Optical trigger output for fMRI
	Retrospective gating for ECG, peripheral pulse and external trigger input

Patient Communication

Ergonomically designed patient communication unit – may be placed at any convenient location on the workplace table.
• Intercom system incorporating active noise cancellation for improved patient communication
• Assistance call via squeeze-bulb for the patient
• Response to the patient's activation of the squeeze-bulb via communication unit
• Table stop
• Sequence stop
• Volume of speaker in control room
• Volume of speaker and headphones in examination room for voice commands
• Connection to external audio system
• Independent volume control of voice and music
• Pneumatic system of ergonomically designed headphones
• Loudspeaker
• Microphone
• Automatic and freely programmable voice commands for breath-hold examinations

Noise Reduction Features

General Features

- Acoustically optimized mountings for all components including gradient coil and body coil
- Minimized structure borne noise transfer to building
- Noise attenuating foam between gradient coil and cover, and between magnet and cover
- Encapsulation of noise producing components

Gradient

- Special epoxy resin and casting technology for damping vibrations
- Reduction of gradient stray field to decrease eddy currents
- Noise-optimization of the MR system with an acoustically soft but mechanically rigid mounting of the gradient coil inside the magnet
- Force compensation for all axes

Magnet

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

Body Coil

Material of supporting tube of the body coil is optimized for low vibration and noise

- In order to achieve maximum noise reduction, the body coil tube was extended beyond the gradient coil
- Copper structures are slotted and glued to the tube to reduce high frequency noise
- The Body coil is acoustically decoupled by special suspensions

Sequence Design

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

"Whisper Mode"

The "Whisper Mode" is a user selectable mode that reduces the max. slew rate and max. amplitude of the gradients and enables very quiet imaging techniques.

Acquisition Parameters

Acquisition Parameters[1]		
2D	Number of slices	1−128 (steps of 1)
	Slice order	Sequential or interleaved
3D Slabs/Partitions	Number of 3D partitions for matrix 256×256	4−512
	Number of 3D Slabs (3D volumes)	1−128 (steps of 1)
Acquisition Matrix	Frequency encoding (true imaging matrix without interpolation or oversampling)	64−1024 (in steps of 2; sequence dependent)
	Phase encoding	32−1024 (in steps of 1)
Reduced Matrix	Phase resolution (rectangular matrix)	32×n ... n×n (steps of 1)
	Slice resolution (3D volumes)	50−100%
Partial Fourier Imaging	Phase partial Fourier (Half Fourier)	4/8−1 (steps of 1/8)
	Read partial Fourier (asymmetric echo)	Selectable
	Slice partial Fourier (3D volumes)	5/8−1 (steps of 1/8)
Rectangular Field of View	In phase encoding direction	3−100%
Averaging	Number of data acquisitions	1−32 (steps of 1)
	Averaging mode	Short term, Long term (LOTA)
Oversampling	Read oversampling	100% standard
	Phase oversampling	0−100% (steps of 12.5%)
	Slice oversampling (3D volumes)	0−100% (steps of 12.5%)
Interpolation	In plane interpolation	Selectable (factor of 2)
	3D interpolation (3D volumes)	Selectable (up to factor of 2)
Serial Acquisitions	Number of repeated scans	With constant delay times 1−4096
		With different delay times 1−65
Swap	Exchange of read-out and phase-encoding direction	Yes
Slice orientation	Slice orientation for 2D and 3D scans	Transverse, sagittal, coronal, oblique, double oblique (steps of 0.1°)
	Multi-slice multi-angle (simultaneously)	Yes

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

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

Sequences	
Spin Echo family of sequences	• Spin Echo (SE) – Single, Double, and Multi Echo (up to 32 echoes); Inversion Recovery (IR) • 2D/3D Turbo Spin Echo (TSE) – Restore technique for shorter TR times while maintaining excellent T2 contrast; TurboIR: Inversion Recovery for STIR, DarkFluid T1 and T2, TrueIR; Echo Sharing for dual-contrast TSE • 2D/3D HASTE (Half-Fourier Acquisition with Single Shot Turbo Spin Echo) – Inversion Recovery for STIR and DarkFluid contrast • SPACE for 3D imaging with high isotropic resolution with T1, T2, PD, and DarkFluid Contrast
Gradient Echo family of sequences	• 2D/3D FLASH (spoiled GRE) – dual echo for in-/opposed phase imaging 3D VIBE (Volume Interpolated 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 • *syngo* BEAT Tool – TrueFISP segmented; 2D FLASH segmented; Magnetization-prepared TrueFISP (IR, SR, FS); IR TI scout; Retrogating

Standard Fat/Water Imaging

• Fat and Water Saturation. Additional frequency selective RF pulses
• 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 both based on VIBE (2 point Dixon) and Turbo Spin Echo (3 point Dixon) sequence

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		

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	
iPAT²	More slices and coverage in the same breath-hold 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	

Standard Motion Correction	
syngo 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 • Supports T2-weighted, T1-weighted, STIR, and DarkFluid protocols • Simultaneous in-plane motion correction for arbitrary slice orientations • Versatile sequence e.g. supporting iPAT with GRAPPA, Restore pulses and supports respiratory triggered imaging of the abdomen using 2D PACE
1D PACE (Prospective Acquisition CorrEction)	• Quick and easy acquisition control, e.g. for cardiac imaging • Allows examination of patients with free breathing
2D PACE Precise Motion Correction	• New robust pattern matching to detect and correct respiratory motion of the heart, liver, etc. • Significantly increased image quality • Improved security in the diagnosis of diseases in moving organs and precise slice registration for multi breath-hold studies • Data acquisition during free breathing for high resolution 2D and 3D examinations • Eliminates the need for respiratory belt • PAT averaging for motion artifact suppression using Self-Calibration

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.
AutoVoiceCommands	These multi-language automatic voice commands during the scan assist the user in providing optimal timing of breathing, scanning, and contrast media injection.
Phoenix and PhoenixZIP	Exchange of protocol 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 20, Spine 32, Foot/Ankle 16.
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 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

syngo TimCT FastView

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

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

[1] Optional

Tim Application Suite

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 the MAGNETOM Skyra.

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

Neuro Suite

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

General features

- EPI sequences and protocols for diffusion imaging, perfusion imaging, and fMRI for advanced neuro applications. Diffusion-weighted imaging is possible with up to 16 b-values in the orthogonal directions
- 3D isotropic resolution volume imaging using T1 3D MPRAGE/3D FLASH, SPACE DarkFluid, T2 SPACE, and 3D TSE T2-weighted high resolution 3D Restore protocols optimized for inner ear examinations
- Whole-spine protocols in multiple steps with software controlled table movement
- 2D and 3D MEDIC protocols for T2-weighted imaging, particularly for C-spine examinations in axial orientation where reproducibility is difficult due to CSF pulsations and blood flow artifacts
- 3D Myelo with 3D HASTE and 3D True-FISP for anatomical details
- Dynamic sacro-iliac joint imaging after contrast administration using a fast T1-weighted FLASH 2D sequence
- Spine diffusion protocols to differentiate osteoporosis versus tumor infiltration and post-radiotherapy changes versus residual tumor with PSIF sequence
- Precision filter for high spatial accuracy e.g. for neuro intra-operative imaging and stereotactic planning
- 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
- AutoAlign Head LS providing a fast, easy, standardized, and reproducible patient scanning supporting reading by delivering a higher and more standardized image quality

Angio Suite	
	Excellent MR Angiography can be performed to visualize arteries and veins with or without contrast agent
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 superb 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 breath-hold 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

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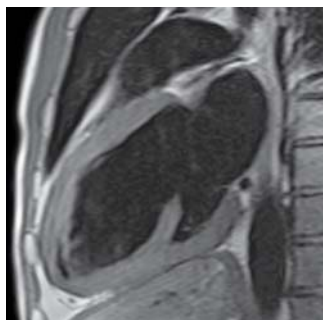
The cardiac suite covers comprehensive 2D routine cardiac applications, ranging from morphology and ventricular function to tissue characterization. Featuring *syngo* BEAT 2D in conjunction with iPAT and T-PAT techniques

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
syngo 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) and avoid folding artifacts in large patients
Visualization of structural cardiovascular pathologies with CMR – *syngo* BEAT	• Breath-hold 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

Cardiac Suite *(Continued)*	
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 *syngo* 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 • Ungated single-shot PSIR imaging for tissue characterization under difficult conditions: free-breathing technique that can be applied even in case of arrhythmia

Body Suite
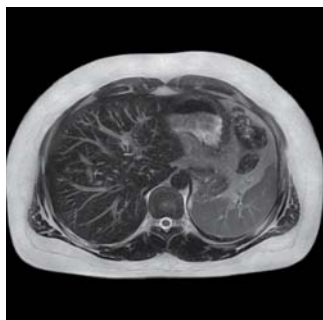
The Body Suite is dedicated for clinical body applications. Ultra-fast high resolution 2D and 3D protocols are provided for abdomen, pelvis, MR Colonography, MRCP, dynamic kidney, and MR Urography applications. 2D PACE technique makes body imaging easy allowing for multi-breath-hold examinations as well 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)
- Optimized fast single shot HASTE protocols and high-resolution 3D RESTORE protocols based on SPACE and TSE for MRCP and MR Urography examinations

Abdomen	2D:
	• T1 (FLASH) breath-hold scans with and without FatSat (SPAIR, Quick FatSat, in-/opp-phase)
	• T2 (HASTE, TSE/BLADE, EPI) breath-hold scans with and without FatSat (SPAIR, FatSat, STIR)
	• 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
	3D:
	• Dixon (VIBE 2pt-Dixon) breath-hold scans, following contrasts can be obtained: in-phase, opposed phase, fat and water image
	• Dynamic (VIBE and Quick-FatSat) protocols with Inline motion correction for best visualization of focal lesions with high spatial and temporal resolution
	• Colonography dark lumen with T1-weighted VIBE
Pelvis	• High-resolution T1, T2 pelvic imaging (prostate, cervix)
	• Isotropic T2 SPACE 3D protocols for tumor search in the pelvis
	• Dynamic volume examinations with 3D VIBE
	• *syngo* REVEAL: diffusion imaging for liver and whole body exams with 2D PACE for respiratory synchronized measurements

Onco Suite
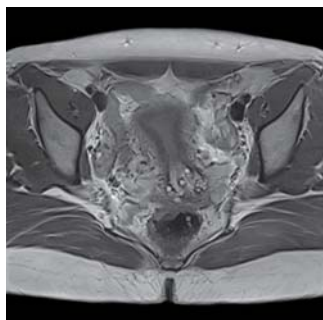
MR imaging has an excellent advantage of soft tissue contrast, multi-planar capabilities and the possibility of selectively suppressing specific tissue e.g. fat or water. The Onco Suite features a collection of sequences as well as protocols and evaluation tools that may be used in a detailed screening of clinical indications, such as in hepatic neoplasms.

General features	• STIR TSE, HASTE, and FLASH in-phase and opposed-phase protocols with a high sensitivity to metastases visualization • Dynamic imaging protocols for assessment of the kinetic behavior for lesion visualization and characterization • 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 • *syngo* REVEAL: diffusion imaging for liver and whole body exams
Prostate protocols	• Dedicated prostate protocols for detection, localization, and staging of tumors and recurrences • *syngo* REVEAL (diffusion-weighted imaging) • Protocols with high temporal resolution allow time course evaluation based on pharmacokinetic modeling • Prostate spectroscopy (3D CSI) with up to 8 sat bands supports tumor diagnosis[1]

[1] Option

Ortho Suite

The Ortho Suite is a comprehensive collection of protocols for joint imaging including the spine. Also in case of tumors, infections, or vascular necrosis, a large amount of additional information can be acquired using the protocols provided as standard in this suite.

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 time mapping
- High resolution 3D DESS (Double Echo Steady State): T2/T1-weighted imaging for excellent fluid-cartilage differentiation
- 3 point Dixon technique for fat and water separation – Turbo Spin Echo sequence

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 measuring times by using iPAT with GRAPPA. Excellent soft tissue differentiation, customized protocols (e.g. with fat saturation or water excitation or silicone excitation), as well as flexible multiplanar visualization allow for 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 • iPAT Extension that allows state-of-the-art sagittal breast imaging • Inline subtraction and MIP display • Offline subtraction, MPR and MIP display • *syngo* REVEAL: diffusion imaging for breast exams
Including RADIANT (ultra-sound like reconstruction around the nipple)	
Siemens Technique: *syngo* 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 – highest resolution for precise evaluation

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

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 breath-hold commands. Protocols can be easily adapted for imaging infants.

Dot Engines

Dot is personalized.

Dot makes it easy to get the best possible results for virtually any type of patient. Dot gives you uniquely tailored, optimized scans configurable to patient condition or clinical question.

- **Optimized exam strategies.** Dot provides scan strategies based on the patient's condition and clinical indication. Your protocols are automatically selected. Just confirm and start scanning.
- **Optimized to patient condition.** Dot adapts to each patient's breath-hold capacity and then links to your best scanning protocol to match.
- **Consistent, high quality exams.** High quality exams are easily reproduced, even when conditions change. Now every patient gets the same consistent exam every time.
- **Dot speaks your clinical language.** Customize Dot to create your own strategies tailored to your clinical practice. Display only the parameters you need.

Dot is guided.

Dot helps you truly optimize staff resources from every perspective. By allowing you to add critical decision points along the way, Dot guides the novice user, helping them to scan more expertly. Highly experienced staff is then freed up for more complicated studies. The result is greater efficiency at all levels and a dramatic improvement in image consistency.

- **Real-time onboard guidance.** Dot guides you, intuitively, through even the most complicated exams, step by step. Instant help, how-to descriptions, and example images are readily within view.
- **Integrated decision points.** At critical steps in the scanning process, your decision points are presented. The user can add or eliminate protocols or groups of protocols with the click of a button.
- **Customizable to your standards.** Dot can be easily customized to your steps, images, text, and protocols to follow your standards of care.
- **Dot Display.** Patient data and positioning information is provided at the scanner for accurate and fast patient set-up.

Dot is automated.

With intelligent automated workflows customized to your standards, Dot takes efficiency to a whole new level. Scans are completed faster and more easily, with less chance of errors or repeats.

- **Intelligent, automated workflows.** Dot Engines can be tailored to your clinical needs with simplified workflows that literally take the complexity out of MRI exams – even for cardiac and abdomen.
- **Effortless set-up.** Dot links your protocols and procedures. Optimal Field of View (FoV) is instantly estimated. And automated positioning and alignment of slices ensure fast and robust image quality across all patients.
- **Timing is never off.** Dot integrates AutoVoiceCommands into the scan process, ensuring the synchronized timing of breathing and scanning. In addition, contrast timing is more accurate due to AutoBolusDetection.

Brain Dot Engine

The Brain Dot Engine simplifies general 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 with increased ease of use and time efficient exams.

Patient View	The user simply easily tailors the exam to each individual patient. Several customizable Dot Exam Strategies can be easily selected with one click and the measurement program automatically updates. Your protocols tailored for use of contrast media can be integrated.
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. Both images and text are easily configurable by the user.
Parameter View	The new streamlined Parameter View displays the parameters that are really needed for the scan set-up. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
AutoPosition	The head of the patient is automatically placed at the isocenter without any laser marking required.
AutoAlign Head LS	All following protocols automatically position and align on the anatomically derived sagittal, coronal, and axial slices of the localizer. The alignment anatomical marking is independent of patient age, head position, or disease. AutoAlign Head LS provides a fast, easy, and reproducible patient scanning by delivering standardized image quality.

Brain Dot Engine *(Continued)*	
Dot Exam Strategies	The brain workflow can be personalized to the individual patient con-dition and clinical need. The following customizable strategies are included. They can be changed at any time during the brain workflow: • Standard: Standard examination with 2D protocols • Resolution focus: Examination with 3D protocols (with e.g. SPACE) for detailed views • Speed focus: Examination with fast 2D protocols (with e.g. HASTE) for further speeding up the exam • Limited patient capabilities: Examination with *syngo* BLADE protocols to minimize and correct for the effects of motion automatically
syngo BLADE	Motion insensitive Turbo Spin Echo sequence. Improves image quality by correcting for the effects of motion during an MR acquisition. (Can be used in head, spine, and other body regions).
Inline Diffusion	Automatic calculation of trace-weighted images and ADC maps with Inline Technology.
Rerun	An image inside the examination UI can be selected and a rerun of the corresponding series can be triggered with identical sequences or parameters.
Customization	Existing Dot Engines can be modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot Exam Strategies and Decision Points • Modify the Parameter View

Knee Dot Engine[1]

With Knee Dot Engine the user can adapt the scan strategy by a single mouse-click, even during the scan in case patient conditions change – e.g. speeding up the scan if the patient starts to move.

Knee Dot Engine includes AutoAlign to assist the user in the process of slice orientation, based on a 3D-localizer. Dot guides through the workflow step-by-step with image and text information. And in most routine cases, user interaction is only required for the very first scan after which the user needs only to confirm the selection.

With its new 3D functionality, Dot assists the user to dramatically speed up scan time and generate 3D datasets for interactive 3D reading, while at the same time providing Inline MPR's for conventional 2D reading.

Patient View	Within the Patient View the user can easily tailor the exam to an individual patient. Dot Exam Strategies can be integrated. With one mouse-click you simply choose the most appropriate scan strategy, then the queue is automatically loaded and filled with the complete scan setup.
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. Both images and text are easily configurable by the user
Parameter View	The new streamlined Parameter View displays the parameters that are really needed for the scan set-up. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
AutoPosition	Positions the knee automatically into the optimal scanning position
AutoAlign Knee	Automated, localizer based positioning and alignment of slice groups to the anatomy, relying on anatomical landmarks. Providing fast, easy, and reproducible patient scanning and supporting the reading by consistently delivering the highest possible image quality with a standardized and customizable slice orientation.

[1] Optional

Knee Dot Engine[1] *(Continued)*	
Dot Exam Strategies	The workflow can be personalized to the individual patient condition and clinical need. Dot comes with the following predefined strategies, which the user can select or change at any time during the workflow: • Standard: Achieve highest image quality in a reasonable scan time with 2D protocols. • Speed focus: Examine e.g. claustrophobic patients or children in the shortest possible time with protocols being accelerated to maximal extend • Limited patient capabilities: Compensate for the effects of motion, e.g. with *syngo* BLADE protocols. • Metal: Reduce artifacts with protocols being tailored to patients carrying metal implants.
New 3D workflow	Fast SPACE program together with Inline MPR calculation for highly reproducible and fast workflow. Easy to understand user guidance. E.g. the user can acquire 3D datasets and reconstructed conventional 2D slices simultaneously in one step and in TSE contrast. Supported with easy to follow guidance information, the planning of required 2D MPR orientations is done simultaneously when the 3D scan is running.
Customization	Existing Dot Engines can be modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot Exam Strategies and Decision Points • Modify the Parameter View

[1] Optional

Abdomen Dot Engine[1]

The Abdomen Dot Engine offers a comprehensive and customizable workflow so that robust image quality can be achieved.
The Abdomen Dot covers workflows for the upper abdomen. Imaging for lesion detection and for lesion characterization can be configured. All oncologic examinations in this anatomical region including grading and staging of liver tumors plus metastasis screening are covered, as well as other upper abdomen indications.

Patient View	Within the Patient View the user can easily tailor the exam to each individual patient. Several pre-defined Dot Exam Strategies can be integrated. The user just selects the appropriate strategy with one click and the queue and the complete scan set-up are automatically updated. Furthermore protocols tailored for use of contrast media can be integrated
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. Both images and text are easily configurable by the user
Parameter View	The new streamlined Parameter View displays the parameters that are really needed for the scan set-up. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
AutoPosition	After registration the patient is positioned automatically into the optimal scanning position.
Automatic sequence scaling	According to physiological characteristic (AutoFoV, AutoNavigator, breath-hold adaptations)
AutoNavigator	Automatic breathing pattern detection and scaling of triggered scans
AutoFoV (automatic Field of View calculation)	Based on the localizer images the optimal FoV is automatically estimated. In case the patient moves during the examination, this step can be repeated at any time
Dot Exam Strategies	The workflow can be personalized to the individual patient condition and clinical need. The following predefined strategies are included. They can be changed at any time during the workflow: • Standard with breath-hold • Standard with PACE triggering • Limited patient capabilities using *syngo* BLADE and PACE triggering

[1] Optional

Abdomen Dot Engine *(Continued)*	
Dot Decisions	Your decisions can be seamlessly integrated into the scanning workflow. The user just selects the queue and the appropriate protocol or set of protocols are automatically added. For the abdomen MRCP and Diffusion decision points are offered.
MRCP decision point	Dot provides comprehensive guidance, including positioning help. MRCP is measured and Inline Radial Ranges are generated in-line.
Timeline setup and monitoring	For best overview of multi-phase breath-hold examinations, CM enhancement curve visualization
Automatic timing	For different phases
AutoBolusDetection	With override function to initiate the dynamic upper abdomen examination
AutoVoiceCommands	Seamlessly integrated into the scanning workflow. The system plays them automatically at the desired time point. This assists the user in providing the optimal timing of scanning, breathing and contrast media. The user can monitor which breath hold or pauses are actually played, and could add pauses between the automatic breath hold commands if necessary
Inline Subtraction	Within the contrast-enhanced abdomen exam, multiple phases are acquired: native, arterial phase, portal-venous phase and late-phase. The scanner automatically subtracts the native measurement from the arterial, portal-venous and late phase
Inline Registration	For best visualization of lesions the system can be set to automatically perform a registration/alignment of the anatomy for the different dynamic phases. The importance of registration/correction can be seen when examining nodular enhancing pathologies.
Customization	Existing Dot Engines can be modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot Exam Strategies and Decision Points • Modify the Parameter View

TimCT Onco Dot Engine[1]
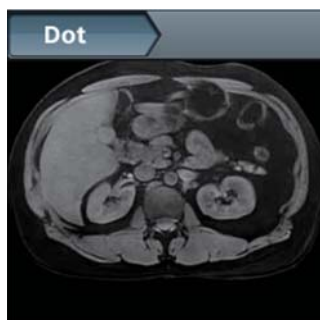
syngo TimCT Oncology employs the revolutionary TimCT Continuous Table move technology for large Field of View applications with smooth workflow and superb image quality. *syngo* TimCT Oncology is built on the Tim technology as well as on a highly advanced patient table with high positioning accuracy and an RF shielded table drive. Simultaneous coverage of a large Field of View using local coils with a high signal-to-noise ratio enables excellent image quality and extremely fast imaging with iPAT.

syngo TimCT Oncology allows a CT-like MR examination:
• Definition of start point and end point of scan area only
• No need to plan in multiple steps
• No need to plan overlapping areas
• No delay, no measurement pauses during table move
• No need for composing

TimCT Onco Dot Engine makes the easy workflow of *syngo* TimCT even easier by customizable guidance throughout the exam

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. Both images and text are easily configurable by the user.
Parameter View	The new streamlined Parameter View displays the parameters that are really needed for the scan set-up. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
iPAT compatibility	Enabled by Tim 4G
Seamless scanning	Enables high image homogeneity and suppression of boundary artifacts
Special features	The possibility of shorter examination times, the BLADE technique and the suppression of boundary artifacts.
Techniques	Based on axial 2D multi-slice sequences for T1-weighted (with FatSat or Dixon technique) and T2-weighted imaging (with STIR or FatSat) with the TimCT sequence variants of the FLASH, TSE, HASTE, and *syngo* BLADE technique acquired with continuous table moving. Therefore it suits best as a complement to the primary tumor diagnosis done in stationary mode (ex. for upper-abdomen) by providing comprehensive metastasis and lymph node evaluation in thorax-abdomen-pelvis.
Customization	Existing Dot Engines can be modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot Exam Strategies and Decision Points • Modify the Parameter View

[1] Optional; Prerequisite: Abdomen Dot Engine

Angio Dot Engine[1]
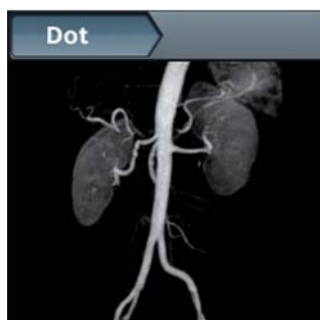
The timing of contrast injection and scan is commonly stated the most challenging part of an angiographic exam. The Angio Dot Engine guides the user through angiographic single or multi station examinations by providing visualization arterial and venous timing windows using a test bolus technique. This information is fed back into the next planning steps so scan parameters can be adapted to the individual patient and patient's condition. Where needed, automatic voice commands support the communication with the patient

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. Both images and text are easily configurable by the user
Parameter View	The new streamlined Parameter View displays the parameters that are really needed for the scan set-up. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
Test bolus	Visual display of of arterial/venous timing window
Feedback of bolus timing information	Timing information is fed back into planning steps and parameters can be adapted automatically
AutoVoiceCommands	Integrated into the scanning workflow. The system plays them automatically at the right point in time. This ensures optimal timing of scanning, breathing and contrast media. The user can monitor which breath hold or pauses are actually played, and could add pauses between the automatic breath hold commands if necessary
Customization	Existing Dot Engines can be modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot Exam Strategies and Decision Points • Modify the Parameter View

[1] Optional

TimCT Angio Dot Engine[1]
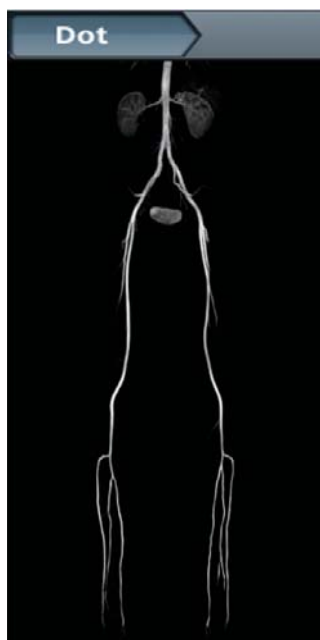
syngo TimCT Angiography employs the revolutionary TimCT Continuous Table move technology for large Field of View angiographies with a smooth workflow and homogeneous image quality. *syngo* TimCT Angiography is built on the Tim technology as well as on a highly advanced patient table with high positioning accuracy and an RF shielded table drive.

Dot TimCT Angio makes TimCT even easier with guidance throughout the exam and by providing a visual display of arterial and venous timing windows using a test bolus technique. This information is fed back into the next planning steps so scan parameters can be adapted to the individual patient and patient's condition. Where needed, automatic voice commands support the communication with the patient.

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. Both images and text are easily configurable by the user
Parameter View	The new streamlined Parameter View displays the parameters that are really needed for the scan set-up. If desired, the user can switch to the conventional – fully loaded – parameter view at any time.
AutoVoiceCommands	Integrated into the scanning workflow. The system plays them automatically at the right time point. This supports the synchronized timing of scanning, breathing and contrast media. The user can monitor which breath hold or pauses are actually played, and can add pauses between the automatic breath hold commands if necessary.
Test bolus	Automatic detection of arterial/venous timing window
Feedback of bolus timing information	Timing information is fed back into planning steps so parameters can be adapted automatically

[1] Optional; Prerequisite: Angio Dot Engine

TimCT Angio Dot Engine *(Continued)*	
iPAT compatibility utilizing Tim's Matrix coils capabilities	
Inline subtraction and Inline MIP of complete peripheral run off images	
High image homogeneity and no boundary artifacts thanks to seamless TimCT scanning	
Max. FoV of *syngo* TimCT (depending on the resolution)	205 cm (with Tim Whole Body Suite[1]) 140 cm (without Tim Whole Body Suite)
Table speed during angiographic measurements	Up to 5 cm/s with patient weight up to 250 kg (550 lbs)
Fast examination time for TimCT peripheral angiographic exam	40–70 s depending on resolution
Customization	Existing Dot Engines can be modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot Exam Strategies and Decision Points • Modify the Parameter View

[1] Optional

Cardiac Dot Engine[1]

Cardiac examinations used to be the most complex exams in MR. Now The Cardiac Dot Engine supports the user in many ways. Using anatomical landmarks, standard views of the heart, such as dedicated long axis and short-axis views are easily generated and can easily be reproduced using different scanning techniques. Scan parameters are adjusted to the patient's heart rate and automatic voice commands are given. All of this takes most of the complexity out of a cardiac exam and supports customized workflows that are easy to repeat.

Patient View	Within the Patient View the user can easily tailor the exam to each individual patient (e.g. patient with arrhythmia, breath hold capability). Several pre-defined Dot Exam Strategies are integrated. The user just selects the appropriate strategy with one click and the queue and the complete scan set-up are automatically updated to the users pre-defined standard of care.
Guidance View	Step-by-step user guidance is seamlessly integrated. Example images and guidance text are displayed for the individual steps of the scanning workflow. Both images and text are easily configurable by the user
AutoFoV (automatic Field of View calculation)	Based on the localizer images the optimal FoV is automatically estimated. In case the patient moves during the examination, this step can be repeated at any time
Automated parameter adaptation	Scan parameters are automatically adapted to the patient's condition (heart rate etc.)
Novel heart localization method	On-board guidance visually facilitates anatomic landmark settings which are used for calculation of standard long-axis views
Automated localization	Automated localization of short-axis views
Guided slice positioning	Easy way to match slice positions (short-axis) between cine, dynamic imaging, tissue characterization
Cardiac Views	Easy selection of cardiac views (e.g. 3 chamber view) during scan planning
Inline Ventricular Function Evaluation	*syngo* Inline VF performs volumetric evaluation of cardiac cine data fully automatically right after image reconstruction. There is no user input necessary. If desired, inline calculated segmentation results can be loaded to 4D Ventricular Function Analysis for further review or processing
Inline Time Course Evaluation	Automatic, real-time and motion corrected calculation of parametric maps with inline technology
Cardiac specific layout for the Exam task	Automatically chosen layouts show the new physio display and are configured for every step of the exam

[1] Optional

Cardiac Dot Engine *(Continued)*	
Automatic display of images	Automatic display of image in dedicated cardiac image orientations instead of the standard DICOM orientations.
Adaptive triggering	Acquisition adapts in realtime to heart rate variations for non-cine applications.
Automated Naming	Automated naming of series depending on cardiac views and contrast.
AutoVoiceCommands	AutoVoiceCommands are seamlessly integrated into the scanning work-flow. The system plays them automatically at the desired time point. This ensures synchronized timing of scanning, breathing and contrast media. The user can monitor which breath-hold or pauses are actually played, and could add pauses between the automatic breath hold commands if necessary.
Dot Exam Strategies	The workflow can be personalized to the individual patient condition and clinical need. The following predefined strategies are included. They can be changed at any time during the workflow: • Standard: Segmented acquisition • Limited patient capabilities: switch to realtime and single shot imaging if breath-hold is not possible or arrhythmias occur
Customization	Existing Dot Engines can be modified by the user to their individual standard of care. • Add/remove protocol steps • Change guidance content (images and text) • Change or add Dot Exam Strategies and Decision Points • Modify the Parameter View

syngo MR Software

syngo MR Examination	
Exam Explorer	• Free and flexible programming of customized integrated exam programs • Simple change of exam programs via drag & drop • Allows configuration of Dot: e.g. customization of image and text guidance, definition of strategies and decision points and to add sequences • 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	• Automatic start of localizer scan with very short acquisition time • Allows for arbitrary orientations (multi-slice multi-angle) • Automatically loads images into Graphical Slice Positioning
Graphical Slice Positioning	Simultaneous use of three arbitrary localizer images from possibly different measurements for graphically positioning slices and sat regions. Interactive modification of measurement parameters (slice thickness, distance factor, oversampling etc.): • Automatic selection of relevant coil elements • Graphical selection of coil elements • Off-center positioning (shift of FoV within the selected slice position) • True multi-slice multi-angle, e.g. simultaneous measurement of multiple images (stacks with different orientation) • Recall of previous slice and/or sat region positioning • Paging through all images during graphical positioning • Inline Movie, allowing positioning of slices on e.g. the beating heart • Loads images immediately when they are available, e.g. during image reconstruction • Allows quick overview via image stamps. Loads entire series of planning images with drag-and-drop • Slice positioning (GSP) on 3D reconstructed images • Slice positioning (GSP) on 2D and 3D distortion corrected images • Slice positioning (GSP) on composed images

syngo MR Image Viewing and Filming	
Image 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.

syngo MR Image Viewing and Filming *(Continued)*		
Argus Viewer	Viewing software for cardiac MR studies and large data sets • Efficient cine review of cardiac and other dynamic data sets • Multiple sorting options • Single movie as well as 2, 4, or 8 simultaneous slices together in movie mode • Rapid avi creation of 1 to 8 slices simultaneously • Creates and edits DICOM structured reports	
Mean Curve	Time-intensity analysis for contrast-enhanced examinations • Creates and edits DICOM structured reports	
Filming	• Connection via DICOM Basic Print • Interactive filming • Filming parallel to other activities • Independent scanning and documentation – no wait time due to camera delays • Freely selectable positioning of images onto virtual film sheet • Selectable various film layouts • Mother-in-Child display • Windowing, image zoom and pan on film sheet • Configurable image text • Simultaneous handling of multiple film jobs • Up to 100 virtual film sheets	
Dynamic Analysis	Arithmetic operations on images and series (e.g. for evaluation of contrast media studies) • Addition, subtraction, multiplication, division of single images and whole series • Arithmetic mean and standard deviation across a range of selected images • Calculation of T1 and T2, and logarithmic images • Differentiation/integration of selected images • Calculation of a mean slope image from a range of selected images • Calculation of z-score (t-test) images for evaluation of BOLD imaging data (Blood Oxygenation Level Dependent) • Time-to-peak evaluation (TTP) • ADC maps Several evaluation functions may be started consecutively in the background	
Printing on Paper	Interface and software for printing images on paper (laser printer not included)	
	Supported printing	Grey levels and color
	Data format	PostScript Level 2

syngo MR 3D Post-processing	
MPR – Multi-Planar Reconstruction	Real-time multi-planar 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 (VoI) defined to increase reconstruction speed and to improve image quality • Freehand MIP • Arbitrary views along any direction can be defined interactively with mouse-driven virtual trackball • Multiple view angles around any orthogonal axis • Projections displayed as single images, as interactive movie or by fast paging • MIP thin/MIP thick
MinIP – Minimum Intensity Projection	Similar to MIP but reconstructs the minimum intensity (e.g. for Dark Blood techniques)
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
Volumes of Interest (VoI)	Rectangular and irregular VoI can be defined to improve image quality

syngo MR Network Communication	
DICOM Services (Digital Imaging and Communications in Medicine)	Interface for transmitting medical images and information in the DICOM 3.0 industrial standard. Allows for communication between devices from different manufacturers • DICOM Send/Receive • DICOM Query/Retrieve • DICOM SC Storage commitment • DICOM Basic Print • DICOM Modality Worklist • DICOM MPPS Modality performed procedure steps. Communication back to information system • DICOM Structured Reports • DICOM Study Split
DICOM Study Split	DICOM Study Split provides the mapping of one study acquired based on multiple requests to multiple studies directly at the scanner. For example, two requests for head and neck acquisition can be registered once, scanned once and immediately mapped to two separate studies for individual reading.
	Multiple requested procedures can be combined in a time saving manner by scanning a larger body region and then splitting them to individual billing relevant studies for separate reading.
	This package allows: • Time saving simple mapping of multiple requested procedures to multiple acquired series with one scan • Simple creation of studies with individual billing based on one scan workflow • Improvement for departmental workflow by eliminating need to load/change and to request/execute splitting on a separate workstation after the scan • Immediate visual selection, check and correction of images to study assignments. • Overlapping region images can be copied to both studies
syngo MR Network Communication	Exchange Media Storage of images and additional data (e.g. avi files) on CD/DVD
DICOM Viewer	A viewing tool which can be stored together with images on a DICOM CD/DVD to be handed out to the patient
Virus Protection	• Permanent scanning for malicious software in the background to provide maximum security • Via Remote Access over secure network connection the latest virus scanner updates and operating system hotfixes are installed automatically • Provided in conjunction with a service contract with Siemens (UPTIME Services)
Image Transfer	Local network	Ethernet
	Data transfer rate	Max. 1 Gbit/s
	Transfer rate (256×256 image)	Approx. 60 images/s

Computer System

syngo Acquisition Workplace		
General	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 Optional second monitor	
	Screen size (diagonal)	19"
	Horizontal frequency	30–100 kHz
	Vertical frequency	50–75 Hz
	Screen matrix	1280×1024
Host computer	Processor	Intel Xeon ≥ W3520 QuadCore
	Clock rate	≥2.66 GHz
	RAM	≥4 GB
	1st hard disk (system SW)	≥146 GB SAS
	2nd hard disk (data base)	≥146 GB SAS
	3rd hard disk (images)	≥146 GB SAS
	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/DVD drive

syngo Acquisition Workplace *(Continued)*		
Measurement and reconstruction system	Processor	Intel ≥ E5540 2.53 GHz (Quadcore)
	Clock rate	≥2×2.53 GHz
	Main memory (RAM)	48 GB
	Hard disk for raw data	≥300 GB
	Hard disk for system software	≥100 GB
	Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 8 data sets
	Reconstruction speed	12195 recons per second (256^2 FFT, full FoV) 37914 recons per second (256^2 FFT, 25% recFoV)
Measurement and reconstruction system (optional system configuration with 64 receiver channels)	Processor	Intel ≥ W5580 3.2 GHz (Quadcore)
	Clock Rate	≥2×3.2 GHz
	Main memory (RAM)	≥64 GB
	Hard disk for raw data	≥400 GB
	Hard disk for system software	≥100 GB
	Reconstruction speed	14800 recons per second (256^2 FFT, full FoV) 56338 recons per second (256^2 FFT, 25% recFoV)
	Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 8 data sets
Measurement and reconstruction system (optional system configuration with 128 receiver channels)	Processor	Intel ≥ W5580 3.2 GHz (Quadcore)
	Clock rate	≥2×3.2 GHz
	Main memory (RAM)	≥96 GB
	Hard disk for raw data	≥750 GB
	Hard disk for system software	≥100 GB
	Reconstruction speed	14800 recons per second (256^2 FFT, full FoV) 56338 recons per second (256^2 FFT, 25% recFoV)
	Parallel Scan & Recon	Simultaneous scan and reconstruction of up to 8 data sets

syngo MR Workplace[1]		
Color LCD Monitor and host computer as for *syngo* Acquistion Workplace		

[1] Optional

Installation

Siting and Installation	
Short installation time due to integrated digital DirectRF technology	
Typical installation time	Less than 7 working days

Radio Frequency Shielding	
For shielding the examination room from external RF sources	
RF attenuation factor	>90 dB
Frequency range	15–128 MHz

Magnetic Shielding	
Room shielding	For additional reduction of the magnetic fringe field, suitable iron shielding can be installed in the walls of the examination room. The room shielding can be used to create a magnetic shielding enclosure
One-Floor Installation	A combination of active shielding and a special shielding (installed on the ceiling of the magnet room or below it) will keep the 0.5 mT line within the same floor as the MRI scanner installation, even in case of very low room heights

System Electronics Cabinets	
Two cabinets which may be placed directly against the wall or even in a corner	
Require service access only from the front, saving considerable space	
Integrated water cooling cabinet may eliminate the need for a dedicated computer room	

Power Requirements	
Line voltage	380, 400, 420, 440, 460, 480 V
Stability tolerances	±10%
Line frequency	50/60 Hz, ±1 Hz
Connection value	110 kVA

Cooling		
Two different customer specific cooling alternatives (Separator or Eco Chiller) available.		
Separator option for connection to available cooling system	Water consumption	90 l/min[1]
	Heat dissipation to water	60 kW
Eco Chiller option with automatic adaptation to the required cooling demands (e.g. different night/day mode) to decrease energy cost	GREEN Cooling Package[2]: The Free Cooling Unit reduces energy consumption by up to 50%. It automatically starts if the surrounding temperature is 18 °C (64 °F) or less and reduces the chiller energy consumption. If the temperature is less than −10 °C (14 °F) the chiller is switched off[3]	

[1] Water temperature 12 °C/45 °F
[2] Optional
[3] In case of clinical routine measurement conditions

Power Consumption	
System off[1]	6.0 kW
Stand-by[1]	6.7 kW
Ready for measurement[1]	13 kW
Typical examination[2]	25 kW
Space Requirements	
Min. total space requirement (for magnet, electronics, and console room)	$< 31\ m^2$
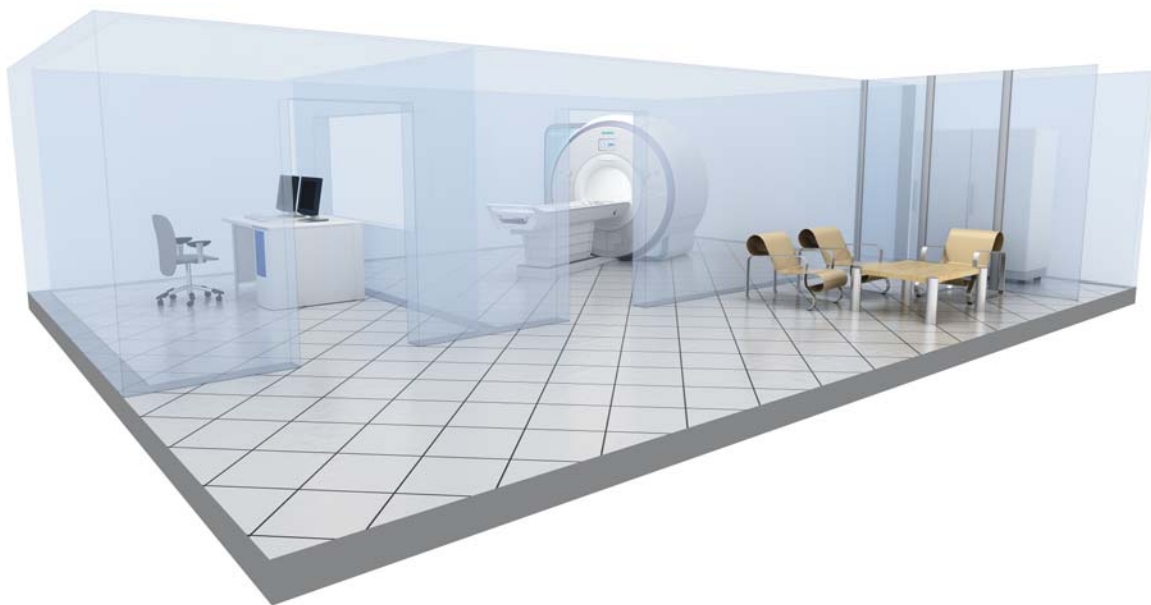
Dimensions		Width [cm]	Depth [cm]	Height [cm]	Weight [kg]
Examination Room	Magnet 3 Tesla AS (incl. Helium)	205	163	215	5768
	Magnet in operation, incl. gradient coil, body coil, patient table and covers	231	433[1] 461[2]	219	7168
	Patient table	76	249	52–104[1]	
	Required min. room height clearance			240[3]	
	Min. transport dimensions	231	182	227	
Control Room	syngo Acquisition Workplace (table + monitor)	120	80	117 (72+45)	
	Host computer	22	46	47	
	syngo MR Workplace (optional)	120	80	117 (72+45)	
Equipment Room	Electronics cabinet, incl. system control, RF system, gradient power system, image processor	160	65	198[4]	1500
	Heat dissipation	≤5 kW, only ventilation might be required			
	Cooling system	65	65	189	500

[1] With fixed Tim Table
[2] With whole body option
[3] Finished floor to finished ceiling
[4] Without attachments

System Cover

Different design variants are available for customer specific needs

Standard variant:
Pure White Design with
brilliant front ring

Optional wood, color,
and Illumination MoodLight™
variants with brilliant or
satined front rings are
available

Illumination MoodLight
with or without Customized
Logo with brilliant front ring

Light Green Design
with brilliant front ring

Water Blue Design
with brilliant front ring

Walnut Wood Design
with satined front ring

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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

MAGNETOM Skyra

Tim Dockable Table

SIEMENS

General

Comfortable patient table fitting the needs for patients up to 250 kg / 550 lb.
- Integrated coils for fast patient preparation and enhanced user comfort
- Integrated arm boards for IV injection
- Integrated infusion stand
- 360° maneuverability with integrated navigation wheel
- Fast dock/undock functionality
- Integrated safety rails
- Compatible with *syngo* TimCT
- Compatible with available Tim 4G coils

Technical Data

Max. patient weight for vertical and horizontal table movement		250 kg (550 lbs)
Max. scan range		140 cm 205 cm[1]
User can adjust the table speed with two predefined speed mode buttons or accelerate continuously with the wheel on the Dot Control Centers		
Vertical table movement	Range	56–108 cm
	Speed	60 mm/s; one click table up
Horizontal table movement	Max. range	2750 mm
	Max. speed	200 mm/s
Position accuracy		±0.5 mm
Continuous table movement during scan capable		

[1] With Tim Whole Body option

MAGNETOM Skyra

Body 18

SIEMENS

Body 18

General	The Body 18 is part of the standard system configuration.
	• 18-channel design with 18 integrated pre-amplifiers, with 3 rows of 6 elements each
	• Operates in an integrated fashion with the Spine 32 (8 rows of 4 elements each)
	• Can be combined with further Body 18 coils for larger coverage
	• No coil tuning
	• iPAT-compatible in all directions
	• Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil.
	• SlideConnect™ technology for easy coil set up
Applications	• Thorax
	• Heart
	• Abdomen
	• Pelvis
	• Hip
	• Vascular
Typically combined with	• Head/Neck 20
	• Spine 32
	• Additional Body 18 coils
	• Peripheral Angio 36 (optional)
	• Flex Large 4
	• Flex Small 4
	• Loop 3T coils (optional)
	• Endorectal coil (optional)
Weight	1.6 kg
	"patient-felt" weight of coil only – 1.1 kg
Dimensions (L × W × H)	385 mm × 590 mm × 65 mm

MAGNETOM Skyra

Head/Neck 20

SIEMENS

Head/Neck 20

General	The Head/Neck 20 is part of the standard system configuration • 20-channel design with 20 integrated pre-amplifiers, two rings of 8 elements each and one ring with 4 elements • Cable-less coil with DirectConnect™ technology • Combined coil for head and neck examination for optimized workflow • Upper coil part removable • Lower coil part usable without upper part for highly claustrophobic patients • Lower coil part may stay on the patient table for most of the examinations • Smoothly integrated into the patient table with Spine 32 • Open patient-friendly design • Cushioned head stabilizers (removable) • No coil tuning • iPAT-compatible in all directions • Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil • Detachable double mirror
Applications	• Head examination • Neck examination • MR Head/Neck Angiography • Combined head/neck examination • TMJ (temporomandibular joints)
Typically combined with	• Spine 32 • Body 18 • Peripheral Angio 36 (optional) • Flex Large 4 • Flex Small 4 • Loop 3T coils (optional)
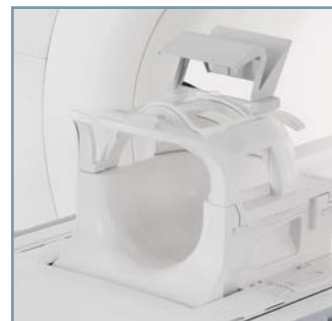
Weight	Total	4.7 kg
	Anterior part	1.7 kg
Dimensions (L × W × H)	440 mm × 330 mm × 370 mm	

MAGNETOM Skyra

Spine 32

SIEMENS

Spine 32

General	The Spine 32 is part of the standard system configuration. • 32-channel design with 32 integrated pre-amplifiers, 8 rows of 4 elements each • Cable-less coil with DirectConnect™ technology • Smoothly integrated into the patient table and streamlined with Head/Neck 20 • May remain on the patient table for nearly all exams • No coil tuning • iPAT-compatible in all directions • Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil
Applications	• High resolution imaging of the whole spine • Various applications in combination with additional coils
Typically combined with	• Head/Neck 20 • Body 18 • Peripheral Angio 36 (optional) • Flex Large 4 • Flex Small 4 • Loop 3T coils (optional)
Weight	11 kg
Dimensions (L × W × H)	1200 mm × 489 mm × 63 mm

MAGNETOM Skyra

Flex Large 4
Flex Small 4

SIEMENS

Flex Large 4 and Flex Small 4		
	Flex Large 4	**Flex Small 4**
General	The Flex Large 4 and Flex Small 4 are part of the standard system configuration. • Four integrated low-noise preamplifiers • Allows flexible coil positioning • Only one interface necessary for all Flex coils • Several Flex Coil Interfaces can be used simultaneously • Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil • Connection via Flex Coil Interface	
Features	• Wrap-around coil made from soft and flexible material • 4-channel design • iPAT-compatible • No coil tuning	
Applications	Imaging of large regions such as medium to large shoulder, hip, and knee	Imaging of small regions such as small to medium shoulder, wrist, elbow, and ankle
Typically combined with	• Head/Neck 20 • Body 18 • Peripheral Angio 36 (optional) • Flex Small 4[1] • Loop 3T coils[1] • Endorectal coil (optional)	• Head/Neck 20 • Body 18 • Peripheral Angio 36 (optional) • Flex Large 4[1] • Loop 3T coils[1] • Endorectal coil (optional)
Weight	550 g	450 g
Dimensions	516 mm × 224 mm	366 mm × 174 mm

[1] Second Flex Coil Interface 3T required (option)

MAGNETOM Skyra

Peripheral Angio 36

SIEMENS

Peripheral Angio 36

General	• 36-channel design with 36 integrated pre-amplifiers, distributed over 6 planes with 6 elements each • Operates in an integrated fashion with Body 18 coils and with the Spine 32 and for whole-body examinations also with the Head/Neck 20 • Can be utilized head and feet first • Both legs are independently covered with coil elements, maximizing the coil filling factor and the signal-to-noise ratio • No coil tuning • iPAT-compatible in all directions • Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil • SlideConnect™ technology for easy coil set up • One cable only for easy handling
Applications	• High resolution angiography of both legs with highest signal-to-noise ratio • Bilateral examinations of long bones of the legs
Typically combined with	• Head/Neck 20 • Body 18 • Spine 32 • Flex Large 4 • Flex Small 4
Weight	8 kg
Dimensions (L × W × H)	860 mm × 300–640 mm × 280 mm

MAGNETOM Skyra

Hand/Wrist 16

SIEMENS

Hand/Wrist 16		
General	• 16-channel coil with 16 integrated preamplifiers • iPAT-compatible in all directions • Hinged design of the upper part for quick and easy patient positioning • Stabilization pads for comfortable positioning • Holder allows off-center positioning to ensure a comfortable position for the patient • No coil tuning • Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil • SlideConnect™ technology for easy coil set up	
Applications	High resolution hand and wrist imaging	
Typically combined with	• Body 18 • Flex Large 4 • Flex Small 4 • Loop 3T coils (optional)	
Weight	Coil	approx. 2.8 kg
	Base plate	approx. 1.6 kg
Dimensions (L × W × H)	Coil	approx. 332 mm × 215 mm × 115 mm
	Base plate	approx. 524 mm × 313 mm × 30.5 mm

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MAGNETOM Skyra

Foot/Ankle 16

SIEMENS

Foot/Ankle 16

General	• 16-channel coil with 16 integrated preamplifiers • iPAT-compatible in all directions • Boot-like coil design • Cable-less coil with DirectConnect™ technology • Stabilization pads for comfortable patient positioning • No coil tuning • Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil	
Applications	High resolution foot and ankle imaging	
Weight	Coil	3.2 kg
	Base plate	7.1 kg
Dimensions (L × W × H)	Coil	410 mm × 330 mm × 390 mm
	Base plate	427 mm × 333 mm × 383 mm

MAGNETOM Skyra

Shoulder Large 16
Shoulder Small 16

SIEMENS

Shoulder Large 16 and Shoulder Small 16

General	• Two 16-channel coils to cover small and large shoulder anatomy, – each with 16-channel coil design with 16 integrated preamplifiers • For narrow or wide shoulders the coil can be attached at different positions on the base plate • Includes one base plate pad and one head rest for high patient comfort • No coil tuning • iPAT-compatible in all directions • Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil • SlideConnect™ technology for easy coil set up
Applications	• Best visualization of small anatomical structures (e.g. labrum) • Higher SNR and better field homogeneity • Reduced slice thickness and measurement times

Technical Data	Shoulder Large 16	Opening	200 mm
		Weight	2.3 kg
	Shoulder Small 16	Opening	165 mm
		Weight	2.2 kg
	Base plate	Dimensions (L × W)	445 mm × 490 mm
		Weight	Approx. 5 kg

MAGNETOM Skyra

CP Extremity Coil

SIEMENS

CP Extremity Coil

General	• Transmit/receive coil • Upper coil part removable • Holder allows off-center positioning to keep knee or foot which is not under examination in a comfortable position • No coil tuning • Connection via Tim Coil Interface 3T
Applications	• Knee • Ankle • Peripheral MR Angiography • Pediatric imaging
Weight	5.7 kg
Dimensions (L × W × H)	265 mm × 360 mm × 310 mm
Minimum inner dimension	154 mm

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MAGNETOM Skyra

Tx/Rx 15-Channel Knee Coil

SIEMENS

Tx/Rx 15-Channel Knee Coil

General	• 15 channel transmit/receive coil • 15-channel coil with 15 integrated preamplifiers, elements arranged in 3 rungs by 5 elements • iPAT-compatible in all directions • Upper coil part removable • Holder allows off-center positioning to ensure a comfortable position for the patient • Cushions for patient comfort and stabilization of the anatomy • No coil tuning • Connection via two Tim Coil Interfaces 3T[1]
Applications	• Examinations of joints in the area of the lower extremities • High resolution knee or elbow imaging
Weight	6.6 kg
Dimensions (L × W × H)	256 mm × 360 mm × 310 mm
Minimum inner diameter	154 mm

[1] One Tim Coil Interface is part of the standard configuration, the second is optional.

MAGNETOM Skyra

4-Channel BI Breast Coil

SIEMENS

4-Channel BI Breast Coil

General	• Frame • 2-channel insert plate coil • 2-channel patient pad coil • Positioning cushion • Head rest • Biopsy plate • Biopsy set: biopsy box; 2 fixation units (grid and post/pillar); positioning system including 2 needle adapter tubes and oil marker • Tim Coil Interface 3T needed to connect coil with scanner • Spine 32 can remain on the table
Applications	• Simultaneous basic imaging of both breasts in all directions • Uni- or bi-lateral basic imaging of the breasts in sagittal direction • Uni-lateral biopsy imaging for lateral, medial, and cranio-caudal access
Typically combined with	• Flex Large 4 • Flex Small 4 • Loop 3T coils (optional)
Weight (coil and frame)	10 kg
Dimensions (L × W × H)	880 mm × 470 mm × 210 mm
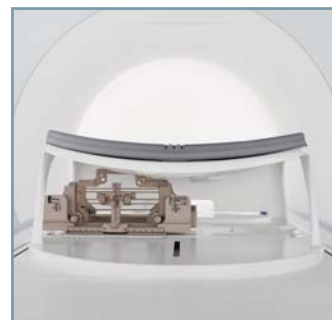
MAGNETOM Skyra

16-Channel AI Breast Coil

SIEMENS

16-Channel AI Breast Coil

General	• The coil consists of a 16-channel design with 16 integrated preamplifiers. The coil elements are arranged in arrays of 6 elements, plus an axilla element and a cup design element on each side. • Frame • Positioning cushion • Head rest • iPAT compatible • Two Tim Coil Interfaces 3T needed to connect coil with scanner (one optional) • Spine 32 can remain on the table
Applications	• Simultaneous imaging of both breasts in all directions • Uni- or bi-lateral imaging of the breasts in sagittal direction • High-resolution 2D and 3D MR breast imaging • Unmatched iPAT capabilities, iPAT factors up to 4
Weight (coil and frame)	11 kg
Dimensions (L × W × H)	710 mm × 470 mm × 200 mm

MAGNETOM Skyra

Sentinelle Vanguard for Siemens

SIEMENS

Sentinelle Vanguard for Siemens

General	• Patient frame • Immobilization plate • Slider • Two 3-channel diagnostic insert coils, two 1-channel biopsy insert coils, one 2-channel medial coil • The coil can be used in the following configurations: 8-channel diagnostic imaging, 4-channel biopsy (bilateral), 2-channel biopsy (unilateral) • Breast cushion set • Height adjustable head rest • Contra-lateral support plate for use in unilateral biopsy • Tim Coil Interface 3T needed to connect coil with scanner • Biopsy set for training purposes (grid, marker and training needle kit)
Applications	• Simultaneous imaging of both breasts in all directions • Uni- or bi-lateral imaging of the breasts in sagittal direction • Uni-lateral biopsy imaging for lateral and medial access • High-resolution 2D and 3D imaging • iPAT factors up to 4 • For quantitative spectroscopy (*syngo* GRACE) a reference bottle can be inserted.
Typically combined with	• Flex Large 4 • Flex Small 4 • Loop 3T coils (optional)
Weight	16 kg without riser 22 kg with riser
Dimensions (L × W × H)	1097 mm × 582 mm × 279 mm

www.siemens.com/healthcare

MAGNETOM Skyra

Loop Coils

SIEMENS

4-Channel Flex Coil Interface

General	• 4 integrated low-noise preamplifiers • Allows flexible coil positioning • Only one interface necessary for all Loop coils • Several Flex Coil Interfaces can be used simultaneously • Flex Coil Interface 3T needed to connect coil with scanner (optional) • Dual-Density Signal Transfer enables ultra-high density coil designs by integrating key RF components into the local coil

Loop Coils

	Loop Coil, large	Loop Coil, medium	Loop Coil, small
General	• No coil tuning • iPAT-compatible in combination with other coils		
Applications	Examination of upper or lower extremities (e.g. shoulder, axilla)	Examination of inner ear, structure of wrist and fingers, pediatrics examinations	Examination of small structures near the surface (e.g. joints of fingers and toes, wrist, skin, temporo mandibular joints (TMJ)
Typically combined with	• Head/Neck 20 • Body 18 • Spine 32 • All flexible coils[1] • Endorectal coil	• Head/Neck 20 • Body 18 • Spine 32 • All flexible coils[1] • Endorectal coil	• Head/Neck 20 • Body 18 • Spine 32 • All flexible coils[1] • Endorectal coil
Weight	225 g	200 g	175 g
Diameter	110 mm	70 mm	40 mm

[1] Second Flex Coil Interface 3T required

MAGNETOM Skyra

Endorectal

SIEMENS

Endorectal	
General	• The endorectal coil kit is connected via adapter with Tim Coil Interface • Interface device for connecting either the prostate receive coil • No coil tuning • Disposable
Applications	• Excellent visualization of the prostate, colon, rectum and cervix without the risk of invasive procedures • Non-invasive preoperative diagnostic evaluation and treatment planning
Typically combined with	• Body 18 • Spine 32 • All flexible coils
Weight	200 g

MAGNETOM Skyra

Application Packages

SIEMENS

Application Packages

Tim Planning Suite

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

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

Tim Whole Body Suite

MAGNETOM Skyra features a full effective Field of View of 205 cm.
Table movement to its full extent can be controlled from the *syngo* Acquisition Workplace.
The large FoV helps in imaging metastases with sequences such as TIRM (Turbo Inversion Recovery Magnitude). Whole body MR Angiography is possible on the entire volume with iPAT.

- Max. scan range of 205 cm
- Protocols and programs for whole body MR Angiography and metastases detection

syngo MapIt

syngo MapIt provides the protocols and Inline calculation of parametric maps of T1, T2, and T2* properties of the imaged tissue. The application range includes cartilage evaluation of joints, liver, kidney, prostate, and more.

In particular, *syngo* MapIt supports the user in detecting osteo arthritis of the joint based on the T1, T2, and T2* properties of the cartilage.

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

syngo SWI (Susceptibility Weighted Imaging)

Siemens-unique sequence technique for Susceptibility Weighted Imaging

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

Inline BOLD Imaging (Blood Oxygen Level Dependent)

Examination of intrinsic susceptibility changes in different areas of the brain, induced by external stimulation (e.g. motor or visual). Automatic real-time calculation of z-score (t-test) maps with Inline Technology, for variable paradigms.

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

Neuro Perfusion

Inline Perfusion helps to streamline the clinical workflow by automating post-processing perfusion data during data acquisition. This makes it possible to see the clinical results immediately and facilitates instantaneous image quality assurance. Inline perfusion functionality is user-configurable. Neuro Perfusion measures perfusion deficits and assist in the diagnosis and grading of e.g. vascular deficiencies and brain tumors.
Neuro Perfusion provides the inline calculation of relative Cerebral Blood Volume (rel CBV), corrected relative CBV, relative Cerebral Blood Flow (rel CBF), relative Mean Transit Time (MTT), Global Bolus Plot, Percentage of Baseline at Peak and a task card for detailed post-processing of brain perfusion data sets. It also features retrospective motion correction of the time series. Color display of the relMTT, relCBV, and relCBF is supported. Flexible selection of the Arterial Input Function (AIF) for more reliable analysis taking into account the dynamics over time of the contrast agent enrichment, as well as the use of automated local AIFs are available.

3D PACE

3D PACE (Prospective Acquisition CorrEction) enhances Inline BOLD imaging with motion correction during the acquisition of a BOLD exam.

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

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

syngo DTI (Diffusion Tensor Imaging)

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

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

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.

AutoAlign Spine

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

Inline Composing

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

Composed images can be automatically loaded into Graphical Slice Positioning for planning purposes.

syngo TWIST

This package contains a Siemens-unique sequence and protocols for advanced time-resolved (4D) MR angiography and dynamic imaging in general with high spatial and temporal resolution. *syngo* TWIST supports comprehensive dynamic MR angio exams in all body regions. It offers temporal information of vessel filling in addition to conventional static MR angiography, which can be beneficial in detecting or evaluating malformations such as shunts. *syngo* TWIST can be combined with water excitation.

syngo NATIVE

Integrated software package with sequences and protocols for non-contrast enhanced 3D MRA with high spatial resolution. NATIVE particularly enables imaging of abdominal and peripheral vessel

NATIVE offers:
- Non-contrast MRA
- Separate imaging of arteries and veins
- Visualization of – e.g. – renal arteries or peripheral vessels

The *syngo* NATIVE package comprises:
- *syngo* NATIVE TrueFISP
- *syngo* NATIVE SPACE

syngo ASL (Arterial Spin Labeling) 2D

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

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

syngo ASL (Arterial Spin Labeling) 3D

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

- Fully compatible with iPAT
- Includes 3D PACE motion correction for increased reliability
- Fully automated Inline calculation of relative blood flow color maps
- Supports the "Pulsed Arterial Spin Labeling" – technique (PASL)
- 3D-GRASE ASL sequence: A 3D volume acquisition with echo planar imaging and multiple refocusing pulses to increase signal-to-noise and to speed-up scan times. Multi-phase and multislice acquisition is supported

Advanced Cardiac

This package contains special sequences and protocols for advanced cardiac imaging including 3D and 4D *syngo* BEAT functionalities. It supports advanced techniques for ventricular function imaging, dynamic imaging, tissue characterization, coronary imaging, and more.

syngo BEAT is a unique tool for fast and easy cardiovascular MR imaging. It provides 1-click switch from cine imaging to tagging for wall motion evaluation and 1-click switch from 2D to 3D imaging. *syngo* BEAT automatically adjusts all parameters associated with the changes.

Cardiac and vessel morphology	• Multi echo technique thalassemia assessment
	• 3D aortopathy imaging with free breathing (SPACE)
Morphology and global or regional ventricular wall motion analysis with *syngo* BEAT	• 3D cine acquisition for full CT-like heart coverage
	• 2D segmented FLASH for visualization of the regional wall motion using various tagging techniques (grid or stripes)
Dynamic myocardial imaging with *syngo* BEAT	• Ultra-fast, high-SNR sequence for dynamic imaging with GRE EPI contrast for stress and rest exams
Tissue characterization with *syngo* BEAT	• Robust myocardial tissue characterization with 3D PSIR (phase-sensitive inversion recovery), e.g. after myocardial infarction or for differentiation of cardiomyopathies.
	• Fast and complete coverage of the myocardium with IR 3D FLASH and TrueFISP
Coronary imaging with *syngo* BEAT	• 3D whole heart non-contrast coronary MRA
	• 3D whole heart MRA with advanced free-breathing navigator compensating diaphragm shifts during the acquisition (motion-adaptive respiratory gating)

TGSE (Turbo Gradient Spin Echo)

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

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

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

Flow Quantification

Special sequences for quantitative flow determination studies

- Non-invasive blood/CSF flow quantification
- ECG Triggered 2D phase contrast with iPAT support
- Retrospective reconstruction algorithms for full R-R interval coverage

Interactive Realtime

Sequences and hardware for interactive real-time scanning

Uses ultra-fast Gradient Echo sequences for high image contrast

Real-time reconstruction of the acquired data

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

- Real-time cardiac examinations
- Real-time interactive slice positioning and slice angulation for scan planning

Single Voxel Spectroscopy

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

- Matrix Spectroscopy – phase-coherent signal combination from several coil elements for maximum SNR based on the Head/Neck 20
- Spectral suppression (user definable parameter) to avoid lipid superposition in order to reliably detect e.g. choline in the breast
- Up to 8 regional saturation (RSat) bands for outer volume suppression can be defined by the user.
- Physiological triggering (ECG, pulse, respiratory or external trigger) in order to avoid e.g. breathing artifacts. Clinical application: brain, liver, neck soft tissue, spine

SVS Techniques SE and STEAM

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

syngo CSI 2D: Chemical Shift Imaging

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

Extension of the Single Voxel Spectroscopy (SVS) package, offering the same level of user-friendliness and automation

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

syngo CSI 3D: Chemical Shift Imaging

Integrated software package with sequences and protocols for Chemical Shift Imaging (CSI) Extension of the SVS package, offering the same level of user-friendliness and automation

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

syngo GRACE (GeneRAlized breast speCtroscopy Exam)

SVS technique (spin echo sequence) optimized for breast spectroscopy.
The technique contains a special spectral lipid suppression pulse (user definable) for lipid signal reduction.

Siemens unique water reference detection to visualize the normalized choline ratio.

Online frequency shift correction for reduction of breathing related artifacts, Inline implementation – no additional user interaction is required.

Clinical applications:	• Differentiating benign from malignant breast lesions • Predicting clinical response to neoadjuvant chemotherapy in an early stage (24hours after receiving the first dose)

syngo Security

Security package for general regulatory security rules

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

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

syngo Expert-i[1]

Interactive real-time access to imaging data and exam information from any PC within the hospital net-work during the MR exam.

Until now, radiologists or other experts had to stop what they were doing and go to the MR scanner to see the acquired images, help with the scan set-up, or answer an open question.
Now, questions can be addressed quickly and efficiently via remote PC.

Benefits of *syngo* Expert-i	• Excellent results right from the first examination • Streamlined workflow and faster patient throughput • Reduced repeat rates with a check on images while the patient is still in the examination room • Reduced training effort by enabling expert assistance for specialized procedure

syngo Remote Assist

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

1) within hospital enterprise

IDEA Integrated Development Environment for Applications	
Extensive programming environment used to create and modify pulse sequences, offering a maximum of flexibility	
Based on C++ for Windows XP. Sequences and RF pulses are displayed in a visual interface	
Features	• Allows direct access to the Image Calculation Environment (ICE), and to all protocols • Testing the generated code is extensively supported by the debugger and the simulation program • IDEA is also usable on any standard PC with operating system Windows XP making developments independent of the MR system
Processing plug-ins	For development or modification of user-defined image processing steps which may be integrated into the measurement protocols • Individual processing is secured by a number of functions (e.g. TTP and MTT), useful for neuro or perfusion imaging
Prerequisite	IDEA training course

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MAGNETOM Skyra

Post-processing Packages

SIEMENS

Post-processing Packages

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

syngo Argus 4D Ventricular Function

syngo Argus 4D VF software processes MR cine images of the heart and generates quantitative results for physicians in the diagnostic process. It 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.

syngo Argus 4D VF includes the well-known functionalities of Argus Function, the automated tool for cardiac function evaluation.

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

Argus Flow

Automated tool for analysis of blood and CSF flow.

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

Argus Dynamic Signal

Automated tool for dynamic data analysis.

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

Vessel View

Interactive analysis of vessel disease using MR or CT angiography data.

Viewing with VRT, MPR, or MIP mode.

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

Vessel View Artery-Vein-Separation

This package allows for semi-automated segmentation and separation of arteries and veins, as well as suppression of surrounding tissue. Supports modes allowing the display of only arteries or only veins, or arteries and veins together in different colors. (Prerequisite: Vessel View)

3D VRT Volume Rendering Technique

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

More productive surgical planning and discussion with referring physicians.

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

syngo BOLD 3D Evaluation

Comprehensive processing and visualization package for BOLD fMRI. It provides a full set of features for clinical fMRI, as well as advanced features for more research oriented applications.

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

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

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

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

DTI Evaluation

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

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

syngo DTI Tractography

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

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

Neuro Perfusion Evaluation

Dedicated task card for quantitative processing of neuro perfusion data.

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

Composing

Composing of images from different table positions.

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

Fly Through

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

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

Fully integrated into the familiar 3D workflow and user interface.

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

syngo Tissue 4D

syngo Tissue 4D facilitates the detection of tumor tissues in organs such as the prostate or the liver.
It is an application card for visualizing and post-processing dynamic contrast-enhanced 3D datasets.

Evaluation options	• Standard curve evaluation • Curve evaluation according to a pharmacokinetic model
Visualization features	4D visualization (3D and over time)
	Color display of parametric maps describing the contrast media kinetics such as: • Transfer constant (Ktrans) • Reflux constant (Kep) • Extra vascular extra cellular volume fraction (Ve) • Plasma volume fraction (Vp) • Initial Area-Under-Curve (iAUC) for the first 60 seconds
	Additional visualization of 2D or 3D morphological dataset
Post-processing features	Elastic 3D motion correction
	Fully automatic calculation of subtracted images
Pharmacokinetic model	Pharmacokinetic calculation on a pixel-by-pixel basis using a 2-compartment model.
	Calculation is based on the Tofts model. Various model functions are available.
	Manual segmentation and calculation on the resulting images.
	The following resulting images can be saved as DICOM images: • 3D motion-corrected, dynamic images • Colored images • Storage of calculated results • Export of results in the relevant layout format

Spectroscopy Evaluation

Integrated software package with extensive graphical display functionality

Comprehensive and user-friendly evaluation of spectroscopy data

Display of CSI data as colored metabolite images or spectral overview maps, overlayed on ana-tomical images

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

Automated peak normalization tissue, water or reference

New dedicated Single Voxel Spectroscopy breast evaluation protocols

Image Fusion

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

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

syngo Breast Biopsy Software

Easy to use *syngo*-based post-processing software helps finding the coordinates for needle insertion for biopsy or localization of breast lesions detected by MR

Allows calculation of the coordinates after clicking the center of the lesion and the 0 marker of the breast biopsy device

- Printout of working sheet
- Multi-lesion calculation

| Prerequisites | • Breast Biopsy Device |
| | • Loop Flex coil, large |

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MAGNETOM Skyra

syngo.via and MAGNETOM Skyra networked

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syngo.via and MAGNETOM Skyra networked

syngo.via is the new imaging software, creating an exciting experience in efficiency and ease of use – anywhere[1]. *syngo*.via is your agent for productivity throughout your radiology workflow. No other solution supports and integrates all MR tasks in a comparable way – from planning and scanning to result sharing.

Integrated Engine concept	
The Engine concept integrates the scanning and reading processes into one holistic workflow and enables you to maximize your scanner and application investment.	
Key features	The Dot (Day optimizing throughput) Engines optimize the performance of MAGNETOM Aera and MAGNETOM Skyra and offer patient personalization, user guidance, and exam automation.
	syngo.via offers reading workflows, which are optimally adjusted to the Dot Engines for the best reading outcomes
	The scanning and reading workflows are easily customizable to the user's standards of care.
	Results from the scanner are optimally displayed in the reading workflows.
Key benefits	Guidance, standardization and flexibility is offered for every step of the workflow, reducing the need for further inquiry
	Increasing throughput, minimizing recalls, and enhancing quality of care.

Networked MR scanner – the scanner workplace for optimized productivity	
syngo.via handles images from any MR system. With MAGNETOM scanners, the integration is perfect. The networking capabilities of the MAGNETOM scanners and *syngo*.via will transform the technologist workplace of today. One consistent workflow is offered, from planning, to scanning to viewing, and processing.	
Key features	Host computer of the MAGNETOM Skyra is rich-thin-client enabled. The *syngo*.via client can be run with only one keyboard and one mouse – no cumbersome change of devices necessary.
	syngo.via offers unique workflows to support the technologist: • Check Protocol: pre-defined protocols are automatically displayed • Initiate Scan: get guidance by additional text info for the optimal scan and patient set-up. Start patient registration directly out of *syngo*.via • Check images: immediate availability of images, easy quality check of images
	Automatic transfer of the patient data and planned protocols from *syngo*.via to the scanner. No need for double entry of information.
	Automatic selection of the appropriate *syngo*.via reading workflow
	syngo.via and MAGNETOM Skyra UI – both based on the proven *syngo* UI concept.
Key benefits	Work with different patients side-by-side without any screen overlays and possible confusions. E.g. begin with patient registration of one patient, while other patient is still scanned.
	Automatic transfer of information – reduced need for clarifications
	Higher throughput, reliable results, and reduced costs.
Pre-requisites	Additional monitor and one *syngo*.via license

[1] Prerequisites include: internet connection to clinical network, DICOM compliance, meeting of minimum hardware requirements and adherence to local data security regulations

Direct Protocol Transfer (DPT)

syngo.via redefines protocol management – providing remote protocol planning, and automated selection of the right protocols at the scanner. *syngo*.via offers a dedicated workflow for protocol planning and distribution. The radiologist can plan the protocols from anywhere in the institutional network.

Key features	Remote protocol planning from any *syngo*.via client to select or modify a planned protocol (and perhaps add further explanations) for a patient examination before the patient is registered at the MR system. The planed protocol will be automatically transferred to the scanner via DICOM Modality Worklist.
	The technologist works with the same syngo.x view directly at the scanner – accessing the same information, without any further handwritten notes or need for clarifications.
	Automatic transfer of the patient data and planned protocols from *syngo*.via to the scanner. No need for double entry of information.
	In addition: Remote Protocol distribution: • upload, change and/or delete any protocol from your MAGNETOM scanners (available for all Tim Systems) • send examination protocols to every other connected scanner
Key benefits	Define standards of care and easily distribute the related protocols among your Tim systems.
	Save time for clarifications – while minimizing re-scans
	Easy, automated, and efficient protocol handling – from anywhere
	DPT works with MAGNETOM Skyra and any other Tim system.

Direct Image Transfer (DIT)

After completion of a series of images, they are transferred automatically to *syngo*.via. Easily view the images with any *syngo*.via client immediately after they were acquired.

Key features	This data will be automatically transferred to the *syngo*.via data base and loaded into the related workflow. Enhanced DICOM MR enables to transfer fMRI data and spectroscopy raw data in new DICOM standard format. In *syngo*.via and any PACS supporting this standard, these data can be handled.
Key benefits	Images are immediately available throughout the institution. This enables fast and convenient feedback from everywhere.
Direct Image Transfer Pro	A direct cable connection is build between the MAGNETOM scanner and the *syngo*.via server. This ensures a guarantied performance for image transfer.

Seamless workstation integration

syngo.via. integrates smoothly with *syngo* MultiModality Workstation (MMWP). Open MMWP directly out of *syngo*.via, and vice versa.

Key features	Remotely open the same patient at the MMWP easily with *syngo* Expert-i
	The MMWP results can then be easily integrated into the *syngo*.via report
	syngo.via client can be opened from any MMWP with one click
Key benefits	Remote and easy access of all MMWP applications
	Smooth integration of results into *syngo*.via

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MAGNETOM Skyra

Parts & Accessories

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Parts & Accessories

Patient Video Monitoring

Dedicated MAGNETOM Skyra video camera for comprehensive patient observation in the examination room and waiting room observation.

- Up to two in-room cameras for optimized patient observation from front end and rear-end
- Up to two waiting room cameras for observing the situation in the waiting room
- Color 640×480 pixel LCD monitor may be positioned at the *syngo* Acquisition Workplace or at a convenient wall location
- Possibility to switch between 4 camera layout and single camera layout

Remote Viewing Monitor

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

Data transfer via ethernet for high signal quality over a long distance allows the computer and user to be located anywhere on the 100 or 1000 Mbps network with full routing of data across routers, switches and subnets (1 Gbit/s recommended).

Data encryption to provide secure access (128 bit AES)

Additional Dot Control Center Rear

Additional Dot Display and Dot Control Center Rear, e.g. for interventional procedures. Located at the rear end of the system.

Foot Switch

In-room foot switch with two pneumatic buttons for start and stop of a preset MR sequence. The foot switch is MR compatible and is positioned near the patient table on the examination room floor.

syngo MR Workplace

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

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

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

> Host Computer and LCD Monitor
> technical data:
> refer to "Computer System" section
> of the main data sheet.

In-Room *syngo* Acquisition Workplace

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

- MR-compatible trackball as input device
- Moveable, height-adjustable Workplace trolley with connection cable. Alternatively the monitor can be mounted via overhead boom.

> Host Computer, LCD Monitor
> technical data:
> refer to "Computer System" section
> of the main data sheet.

Workplace Table

Ergonomically designed table for:
• Color monitor
• Keyboard
• Mouse
• Patient communication unit
• Patient supervision display

Patient Transport Stretcher

MR-compatible design on wheels for transporting a patient into the examination room.
Useful when the removable tabletop and trolley option are not purchased

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

Max. patient weight	160 kg (350 lbs)

Comfort Kit

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

Vacuum pump connection at the Tim Table

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

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

Coil Storage Cart

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

May be rolled to convenient locations in the examination room

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

Coil storage	Width, cart closed	140 cm (4'7")
	Width, cart opened	280 cm (9'2")
	Depth	54 cm (1'9")
	Height	121 cm (3'12")

> **Additional optional accessories
> and consumables for MR:
> www.siemens.com/healthcare-accessories**

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Please find fitting accessories:
www.siemens.com/healthcare-accessories

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