

XR MRI, VAMC SALT LAKE CITY, UT

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## Description

MAGNETOM Aera - the first 1.5T Tim+Dot system - integrates the next generation Tim (Total imaging matrix) - Tim 4G and the Siemens unique Dot (Day optimizing throughput) engines enabling workflow efficiency combined with higher diagnostic confidence due to consistent results.

The system includes:

### Tim 4G+Dot

Tim 4G provides increased patient comfort and optimized workflow efficiency. Only one patient setup, no repositioning, no changing of coils. Ultra-light-weighted coils with high density of coil elements for maximized patient comfort and increased SNR. Feet-first positioning for almost all examinations possible reduces claustrophobia.

Tim 4G with its 4G flexibility, 4G accuracy and 4G speed brings image quality and acquisition speed to a new level.

Dot offers a customizable framework for patient personalization, user guidance and exam automation. Optimized scan strategies are provided and can be selected based on patient condition, which allow for high quality exams even when conditions change. Integrated decision points allow the user to easily add or remove one or a group of protocols with one click. Step by step image and text guidance guides novice users even through the most complicated exams. Exam automation allows optimal timing for breathing, scanning, planning or contrast arrival. Dot can be easily customized to follow the individual standards of care.

Dot is personalized, guided and automated and designed to improve workflow efficiency and image consistency.

MAGNETOM Aera with its 70 cm Open Bore design and a system length of only 145 cm gives a patient friendly appearance that can significantly help patients with anxiety or claustrophobia.

### Magnet:

- Ultra-short 137 cm long (145 cm with covers), whole-body superconductive 1.5T magnet with active shielding (AS) technology with counter coils
- External Interference Shielding (E.I.S.)
- Excellent homogeneity enabled by TrueForm magnet design which allows for a cylindrically optimized homogeneity volume resulting in higher image quality (50 × 50 × 45 cm<sup>3</sup> DEV, typ. 3.1 ppm based on the 24-plane plot method)
- The magnet has a helium capacity of approximately 1,280 liters and a typical Helium boil-off rate of 0 l/yr during typical, undisturbed clinical operation depending on the sequences used and examination time, and provided the system is serviced in regular intervals.
- It has an integrated magnet cooling system.

### Gradient system :

- Actively shielded water-cooled world-class gradient system
- True Form Gradient Design
- All axes force compensated

### DirectRF - RF Transmit/Receive System:

- Fully integrated Transmit and Receive path in the magnet housing including extremely compact water-cooled solid state amplifier with 26.1 kW peak power
- High dynamic range
- Immediate feedback loop for real-time sequence adaptation
- Integrated no tune transmit/receive Body Coil
- The revolutionary Tim 4G technology allows connecting up to 204 coil elements simultaneously enabling higher SNR and iPAT in all directions. No repositioning of patients is needed even for large Field of View

examinations.

- Dual-Density Signal Transfer enables ultra-high density coil design by integrating key RF components into the local coil.

#### **Tim 4G Coils:**

The new Tim 4G coil technology with Dual-Density Signal Transfer, DirectConnect and SlideConnect technology combines key imaging benefits:

Excellent image quality, high patient comfort, and unmatched flexibility.

The Tim 4G coils are designed for highest image quality combined with easy handling. The high coil element density increases SNR and reduces examination times. DirectConnect and SlideConnect™ technology reduce patient set up time significantly. The coils are designed with the patient in mind. Light weighted coils and open design ensure highest patient comfort which results in better patient cooperation and image quality. No coil changing with multi-exam studies saves patient setup- and table time.

AutoCoilSelect enables dynamic, automatic, or interactive selection of the coil elements within the Field of View and speeding the exam preparation at the host.

All coils are time-saving "no-tune" coils.

A comprehensive set of pads for comfortable and stable patient positioning together with safety straps are included.

- Head/Neck 20

The 20-channel coil with its 20 integrated pre-amplifiers ensures excellent signal-to-noise ratio. The unique DirectConnect technology allows users connecting the 20 coil elements of the Head/Neck20 without cables. The patient friendly open design allows for maximum patient comfort which is supported in addition by a look-out mirror for claustrophobic patients. The high channel coil is iPAT compatible in all directions.

The open and light design of the upper coil part increases patient comfort and is removable for easy patient handling. The lower coil part may remain on the table for most of the examinations can be used without the upper part. The Head/Neck 20 and Spine 32 are smoothly integrated into the patient table, thus enabling high flexibility in imaging and fewer coil changes and easy handling when switching patients. The Head /Neck 20 coil is equipped with two removable cushioned head stabilizers for stable and comfortable patient positioning.

The Head/ Neck 20 can be used for applications like head examinations, neck examinations, MR Angiography, combined head/neck examinations or for imaging of the TMJ (temporomandibular joints).

Typically combined with the Spine 32 and Body 18 or Peripheral Angio 36 but also other combinations eg with flexible coils like the Flex Large 4 are possible.

- Body 18

The 18-channel coil with its 18 integrated pre-amplifiers ensures maximum signal-to-noise ratio. The 18 coil elements of the Body 18 with only one SlideConnect Plug allows for fast and easy patient preparation resulting in less table time. Fast acquisition times enabled by iPAT in all directions. The light-weighted coil ensures highest patient comfort.

Body 18 operates in an integrated fashion with the Spine 32 as an 30 channel body coil

Body 18 can be combined with further Body 18 coils for larger coverage and positioned in different orientations (0°, 90°, 180°, 270°) for patient specific adaptations

The Body 18 is typically used in combination with the Spine 32 for examinations of the thorax, abdomen, pelvis or hip and operates as a 30 channel body coil (3 rings 10 elements). The Body 18 can also be used for cardiac or vascular applications. Through its perfect combinability with the Spine 32, further Body 18 (optional), the Peripheral Angio 36 (optional), but also the Head/Neck 20 and all flexible coils (e.g. Flex Large 4, Flex Small 4) it contributes for a broad range of indications up to whole-body imaging.

- Spine 32

The 32-channel coil with its 32 integrated pre-amplifiers ensures maximum signal-to-noise ratio. The unique DirectConnect technology allows connecting the 32 coil elements of the Spine 32 without the need to plug in any cable. The patient friendly ergonomic design allows for maximum patient comfort. The high element coil is iPAT compatible in all directions.

Smoothly integrated into the patient table the Spine 32 may remain on the patient table for nearly all exams.

## Description

The Spine 32 is typically combined with Body 18, Head/Neck 20, Peripheral Angio 36 (optional) or Flex Large 4, Flex Small 4.

- Flex Large 4/ Flex Small 4  
Light-weighted, very flexible, iPAT compatible, 4-element no-tune receiver coils which are made of soft and smooth material. The coils can be wrapped around or used flat.

Both coils can be connected via Flex Coil interface. One Flex Coil interface is already delivered as standard.

The coils can be used for different examinations ranging from examinations of the extremities to abdominal examinations.

### Tim Table

- The maximum scan range of the Tim Table is 140 cm. A scan range of 205 cm can be achieved with the Tim Whole Body Suite (optional)
- The maximum patient weight of 250 kg (550 lbs) is valid for horizontal and vertical movements, which ensures maximized patient comfort for obese patients.
- The patient table can be lowered to a minimum height of 52 cm from the floor, for easier patient positioning and better accessibility for geriatric, pediatric or immobile patients. An infusion stand is integrated to ensure fast patient set up also for critical patients.
- Multiple Tim4G coils can be connected at once for efficient and patient friendly examinations.
- The Tim Table can be moved with two clicks into the isocenter - one click to the upmost position and one click into the isocenter.

### Dot (Day Optimizing Throughput) engine

Dot multiplies the power of Tim resulting in greater image consistency and diagnostic confidence

### Dot Control Centers and Dot Display

- The ergonomically designed Dot Control Centers are integrated left and right into the front covers for controlling table movement and interaction with the Dot Display. The Dot Control Centers are well illuminated for easy visual recognition.
- Automated table move up to upmost position, to center position or Home position facilitate smooth patient preparation and will reduce table time
- Variable (6 levels) ventilation and lighting inside the magnet bore or volume adjustments are possible for increased patient comfort
- The Dot Display provides on board guidance for patient set up where it's needed - directly at the scanner. Information such as patient name or exam type or required patient position, guidance for ECG set up and immediate visualization of physiological curves will be provided for convenient operation.
- Almost all table control functions, including ventilation and illumination of the magnet bore, can be also controlled from the operator console for convenient operation.

### Dot Technology

Dot gives uniquely tailored, optimized scans configurable to patient condition or clinical question.

Dot provides patient personalization, user guidance and exam automation and is of course configurable by the user to adapt to the different clinical needs and standards of care.

### Brain Dot Engine

The Brain Dot Engine provides guided and automated workflows customizable to the site specific standards of care for general brain examinations. The Brain Dot Engine supports the user in achieving reproducible image quality with increased ease of use and time efficient exams.

The brain workflow can be personalized to the individual patient condition and clinical need. Several predefined strategies are included, which can be easily selected with one click. They can be changed at any time during the brain workflow.

Protocols tailored for use of contrast media are integrated.

- 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
- Motion insensitive: Examination with *syngo* BLADE protocols
- to minimize and correct for the effects of motion automatically

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.

Easy positioning of the patient with AutoPosition. The patient is automatically placed at the isocenter without any laser marking required.

AutoAlign Head provides automated, positioning and alignment of slice groups to the anatomy, relying on multiple anatomical landmarks. Besides basic brain positioning, AutoAlign Head computes reference position for several other brain structures such as the inner ear, the orbits and the optic nerve.

Automatic real-time calculation of trace-weighted images and ADC maps with Inline DiffusionTechnology.

Easy rerun or repeat with functionality allows for reduced table time. Alternatively an exam can be repeated with a changed strategy.

The Brain Dot Engine as all Dot engines can be modified by the user to their individual standard of care.

#### **Tim Application Suite**

The Tim Application Suite offers a complete range of clinically optimized sequences, protocols and workflow functionalities for all body regions. Excellent head-to-toe imaging can be accomplished with the sequences and features included in this application suite. To enable this comprehensive application range, ten dedicated application packages have been included.

- *syngo* TimCT FastView
- Neuro Suite
- Angio Suite
- Cardiac Suite
- Body Suite
- Onco Suite
- Breast Suite
- Ortho Suite
- Pediatric Suite
- Scientific Suite

#### ***syngo* TimCT FastView**

*syngo* TimCT FastView is a “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. Transversal, coronal and sagittal reformats of the volume are calculated inline and displayed for planning subsequent exams. Moreover, while planning is underway, adjustments are acquired automatically for further time savings in subsequent measurements.

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

#### **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. It includes for example:

- EPI sequences and protocols for diffusion, perfusion and fMRI for advanced neurological applications. Diffusion weighted imaging is possible with up to 16 b-values in the orthogonal directions. Dynamic Analysis software (included in standard configuration) enables calculation of:
  - ADC maps
  - t-test maps from the EPI images for fMRI
  - Time-to-Peak maps for perfusion analysis.
- Whole spine protocols acquire in multiple steps via software controlled table movement in a single click.

## Description

- 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 Myelograms 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 optimized 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 and 3D Time-of-Flight (ToF) protocols for MRA for the Circle of Willis, carotids, neck vessels, and breath-hold protocols for abdominal vessels
- Triggered 2D ToF sequences for non-contrast MRA, particularly of 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-saturation Excitation) and MTC (Magnetization Transfer Contrast) techniques for improved Contrast-to-Noise Ratio (CNR)

#### *Image processing tools*

- MPR, MIP, MinIP, and 3D SSD (Multiplanar Reconstruction, Maximum Intensity Projection, Minimum Intensity Projection, Shaded Surface Display)
- 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

*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 T1 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

Physiological Measurement Unit (PMU) - Wireless Physio Control

- Synchronizes the measurement with the physiological cycles (triggering to minimize motion artifacts caused by cardiac and respiratory movements)
- Wireless Sensors
- Wireless Vector ECG / respiration and pulse sensors for physiologically synchronized imaging, rechargeable battery-powered - for optimized patient handling
- Physiological Signals Display
- ECG (3 channels)
- Pulse
- Respiration
- External Trigger Input Display

ECG Triggering:

- Acquisition of multiple slices, e.g. of the heart, at different phases of the cardiac cycle
- Excellent image quality by synchronizing data acquisition with cardiac motion
- Peripheral Pulse Triggering: Reduces flow artifacts caused by pulsatile blood flow
- Excellent image quality by synchronizing data acquisition to the pulsatile blood flow
- Respiratory Triggering: Excellent image quality by synchronizing data acquisition with the respiratory motion
- External Triggering: Interface for trigger input from external sources (e.g. 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

## Description

### Breast Suite

MR imaging has proven a very high sensitivity for breast lesions and is the gold standard for the examination of silicone implants. 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.

This package includes:

- 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
- 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
- Inline subtraction and MIP display
- Offline subtraction, MPR and MIP display
- *syngo* REVEAL: diffusion imaging for breast exams
- iPAT Extension allows bilateral 3D sagittal breast imaging with Fat Sat or Water excitation

The Breast Suite also includes:

#### ***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

### Body Suite

Body Suite covers your needs for clinical body applications. Ultrafast high resolution 2D and 3D protocols are provided for abdomen, pelvis, MR Colonography, MRCP, dynamic kidney, and MR Urography applications. Siemens unique 2D PACE technique makes body imaging 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:

- T1w (FLASH) breath-hold scans +/- Fat Sat (SPAIR, Q-FatSat, in-/opp-phase)
- T2w (HASTE, TSE/BLADE, EPI ) breath-hold scans +/- Fat Sat (SPAIR, FatSat, STIR)
- T1w (TFL) triggered scans (2D PACE free breathing) in-/opp-phase
- T2w (HASTE, TSE/BLADE, EPI) triggered scans (2D PACE free breathing) +/- Fat Sat (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

## Description

### 3D:

- Dixon (VIBE 2pt-Dixon) breath-hold scans, following contrasts can be obtained: in-phase, opposed phase, fat and water image.
- Dynamic (VIBE + Q-FatSat) protocols for best visualization of focal lesions with high spatial and temporal resolution
- Colonography bright lumen with T2-weighted TrueFISP and dark lumen with T1-weighted VIBE
- CAIPIRINHA enables VIBE sequence with improved iPAT2 algorithm to improved abdominal dynamic scans as well as SNR. Reduced patient stress can be achieved through reduced acquisition (and breathhold) times.

### PELVIS:

- High-resolution T1w, T2w pelvic imaging (prostate, cervix)
- Isotropic T2w 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

### 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. This helps visualize pathologies, particularly metastases. The Onco Suite features a collection of sequences as well as protocols and evaluation tools that guide through a detailed screening of clinical indications, such as in hepatic neoplasms.

This package includes:

- STIR TSE and HASTE, 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

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

### OrthoSuite

Ortho Suite is a comprehensive collection of protocols for joint and spine imaging. MR imaging is especially suitable for avascular necrosis and internal derangements. The protocols included in this Suite can also be applied for imaging of tumors and infections.

This package includes:

- 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 protocol 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
- PD SPACE with fat saturation and T2 SPACE with high isotropic resolution optimized for 3D post-processing
- Whole spine single-step or multi-step protocols
- Excellent fat suppression in off-center positions, e.g. in the shoulder due to high magnet homogeneity
- Dynamic TMJ and ilio-sacral joint protocol
- Susceptibility-insensitive protocols for imaging in the presence of a prosthesis
- Multi-Echo SE sequence with up to 32 echoes for the calculation of T2 time maps (calculation included in the Scientific Suite)
- High resolution 3D DESS (Double Echo Steady State): T2 / T1-weighted imaging for excellent fluid-cartilage



differentiation

*syngo WARP Susceptibility Artifact Reduction*

- 2D TSE sequences with high bandwidth protocols tailored to reduce susceptibility artifacts. Available protocols include T1-weighted, T2-weighted, proton density and STIR contrast.

### **Pediatric Suite**

The parameters for pediatric imaging vary significantly in comparison to the parameters for adults. The reasons are developing tissues, body size, faster heart rates and restricted compliance with breath-hold commands. Protocols can be adapted for imaging infants.

### **Scientific Suite**

Scientific Suite supports the scientifically oriented user with an easy access to application-specific data for further processing and advanced image computation methods.

- Support of USB memory sticks
- Access to the file system by means of a secure and convenient browser
- Anonymization of patient data
- Easy generation of AVIs and screenshots for integration into presentations and training videos
- Export function for tables, statistics and signal-time-courses in a communal format (MeanCurve, Spectroscopy, DTI evaluation)
- Advanced image computation methods such as T2 and T1 time calculation, addition, subtraction, multiplication, division, and integration of images

The sequences, features and techniques for acquisition and reconstruction included in the Tim Application Suite are described in detail below.

### **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 T1 scout; Retrogating

Standard Fat/Water Imaging

- Fat and Water Saturation. Additional frequency selective RF pulses used to suppress bright signal from fatty tissue. Two selectable modes: weak, strong
- Quick FatSat
- SPAIR: robust fat suppression for body imaging using a frequency selective inversion pulse
- Fat / Water Excitation. Spectral selective RF pulses for exclusive fat / water excitation
- Dixon technique for fat and water separation - available both based on VIBE (2 point Dixon)

#### 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 for hand out to the patients or referrals
- Selectable centric elliptical phase reordering via the user interface
- Inversion Recovery to nullify the signal of fat, fluid or any other tissue
- Multiple Direction Diffusion Weighting (MDDW) - perform diffusion tensor imaging with multiple diffusion weightings and up to 12 directions for generating data sets.

#### Standard techniques for Flow Artifact reductions

- LOTA (LongTerm Data Averaging) technique to reduce motion and flow artifacts
- Pre-saturation techniques using RF saturation pulses to suppress flow and motion artifacts
- Tracking SAT bands maintain constant saturation of venous and/or arterial blood flow eg. for 2D/3D sequential MRA
- TONE (Tilted Optimized Non-saturating Excitation - variable excitation flip angle to compensate inflow saturation effects in 3D MRA - selectable on desired flow direction and speed
- Gradient Motion rephasing permitting effective reduction of flow artifacts

#### 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
- 1D PACE (Prospective Acquisition CorrEction) allows examination of patients with free breathing
- 2D PACE (Precise Motion Correction) detects and corrects respiratory motion eg of the heart or liver

MAGNETOM Aera runs *syngo* MR software. *syngo*® is the unique software platform for medical applications. Parallel working and one-click exams are efficiently supported and increase productivity. Parallel scanning and reconstruction are standard.

The unique Phoenix technique is the easiest way to exchange protocol data. It supports intelligent extraction of sequence parameters from images acquired on a MAGNETOM Aera system.

Inline technologies, scan@center or AutoVoiceCommands speed up the workflow further.

The context-sensitive "Online Help" function and *syngo* Scan Assistant offer support and propose solutions to MR-specific questions and parameter conflicts.

## Description

Studies can be easily networked and managed using the standard DICOM 3.0 protocol for efficient support of workflow. The following standard functions are supported: Send/Receive, Query/Retrieve, Basic Print for DICOM-compatible laser cameras (Camera is not included in the basic unit. Verify if existing camera is compatible or order separately.), DICOM Worklist, DICOM Storage Commitment (SC) DICOM Modality Perform Procedure Step (MPPS), DICOM Structured Report (SR), DICOM Study Split.

### Patient Communication

- The intercom system includes an ergonomically designed patient communication unit for desktop positioning on the *syngo* Acquisition Workplace and pneumatic headphones for the patient.
- It controls emergency table stop, volume control of speaker and headphones in the examination room, volume control of speaker in the control room, response to the patient's activation of the assistance-call button and provides a connection to an external audio system (external audio system is not included in the basic unit) for music playback.

### Computer system

The high performance measurement and reconstruction system and the high performance host computer are ideally suited for even the most demanding applications. The PC-based computer system uses the intuitive *syngo* MR user interface. The computer system includes the following components:

High-performance measurement and reconstruction system

- Two Intel Quadcore Processor  $\geq$  E5620
- Clock rate of  $\geq 2 \times 2.4$  GHz, or comparable
- Main memory (RAM) of 48 GB
- Hard disk for raw data  $\geq 300$  GB
- Hard disk for system software  $\geq 100$  GB
- Parallel Scanning and Reconstruction of up to 8 data sets
- Reconstruction speed
  - 12,195 recons per second (256 x 256 FFT, full FoV)
  - 37,914 recons per second (256 x 256 FFT, 25 % recFoV)

High-performance host computer

- Intel Xeon processor  $\geq$  E5-1620 QuadCore
- Clock rate 3.6 GHz, or comparable
- Main Memory (RAM) 16 GB
- Three hard disks
  - system SW  $\geq 300$  GB SAS
  - data base  $\geq 300$  GB SAS
  - images  $\geq 300$  GB SAS
- DVD-R writer for CD-R (approx. 4000 images 256<sup>2</sup> DICOM Standard, ISO 9660 ) and DVD-R (approx. 25 000 images 256<sup>2</sup> DICOM Standard, ISO 9660) storage of DICOM data or other data like AVI files
  - DVD-ROM drive
  - Electronic mouse.
- The combination of host computer and the measurement and reconstruction system offers a truly powerful imaging system designed for large image matrix sizes of up to 1024 x 1024. The unrestricted multitasking capability allows time-saving parallel scanning and reconstruction.
- High-resolution 19" color LCD flatscreen monitor with 1280 x 1024 pixel display, integrated gamma correction for optimum display of radiographic grayscale images and automatic backlight control for longterm brightness stability.

### Installation:

- The relatively lightweight design of the MAGNETOM Aera in most cases eliminates the need for structural building reinforcements and thus facilitates installation in upper floors.
- The compact integrated design allows for short installation times and reduces the required space to less than 30 sqm (323 sq. ft.) for the entire installation. The minimum room height clearance is only 2.40 m (7' 10").
- MAGNETOM Aera allows siting of the system without a dedicated computer room - no additional cooling or

floor requirements.

- MAGNETOM Aera combines state-of-the-art performance with peace of mind. High system availability is ensured by the expert, highly trained Siemens MR service engineers;
- Your Siemens service contract (not included in the basic unit) offers a comprehensive range of benefits such as Uptime Remote Diagnostics for improved productivity

#### **Tim [204x48] performance level**

Tim 4G offers DirectRF a completely redesigned RF architecture. This new all digital-in/ digital-out design integrates all RF transmit and receive components at the magnet, eliminating analog cables for true signal purity. This compact and efficient design enables a dynamic feedback control for temporal stability and power linearity. The all-new innovative coil architecture packs more coil elements in a smaller space. Therefore up to 204 coil elements can be simultaneously connected. The newly designed ultra high density array is an essential part supplementing Tim4G. Combined with the 48 independent RF channels advanced iPAT capabilities and SNR are enabled.

An additional benefit of multiple coil elements and receiver channels is improved performance in multi-directional, i.e. three dimensional, high-speed, high-resolution iPAT in the head-feet, anterior-posterior or left-right directions.

This option includes also Advanced High Order Shim.

#### **XQ gradients**

Siemens XQ gradients provide actively shielded, water cooled world-class gradients. All axes are force-compensated.

The XQ gradients have:

- Maximum gradient amplitude of 45 mT/m, per axis, i.e. 78 mT/m vector summation gradient performance,
- max. slew rate 200 T/m/s per axis, i.e. 346 T/m/s vector summation,
- minimal rise time 225  $\mu$ s, from 0 to 45 mT/m amplitude
- Max. output voltage for each of the gradient axes 2250 V
- Max. output current for each of the gradient axes 900 A
- Separate cooling channels that simultaneously cool primary and secondary coils allow the application of extremely gradient intensive techniques in a new class of performance.
- 100% duty cycle for fast and demanding techniques such as ultra-short TE MRA in continuous operation, thin slice single breath-hold liver studies and EPI imaging techniques (all optional in appropriate clinical packages).
- Variable Field-of-View selection from 0.5 cm to 50 cm (up to 45 cm in z direction) for optimal coverage and highest spatial resolution in diagnostic. The minimum slice thickness in 2D and 3D is 0.1 mm and 0.05 mm, respectively.
- Acquisition of sagittal, transverse, coronal, single oblique and double oblique slices with highest resolution.
- The extremely compact water-cooled gradient amplifier features a modular expandable design with excellent linearity and pulse reproducibility. It is digitally controlled and has very low switching losses due to ultrafast solid state technology.

The keys of the numerical key panel are assigned to syngo-specific functions and labeled with the corresponding syngo icons. The keyboard supports the country specific special characters.

The unique color and material selection enhances the visual appeal of the new system design, thereby creating an enticing, patient-friendly impression.

The Dot Control Centers and the unique Dot Display are neatly integrated into this main face plate. The aesthetically pleasing and ergonomically designed control elements of the Dot Control Centers are well illuminated for easy visual recognition.

In particular, the table cover and the asymmetric left deco area cover have also been designed to promote a modern visual appearance. This combination of ingenuity and practical design as presented with "Pure White" design with its brilliant white and the silver trim simply makes the MAGNETOM an overall visually appealing system and creates a patient-friendly environment.

## Description

The Tim Dockable Table with its light appealing design allows for a fast patient preparation and maximized patient comfort.

It provides unobstructed foot space for attending staff and direct access to the patient. The patient table can be lowered to a minimum height of 56 cm (18.5") from the floor, for easier moving of immobile patients and better access for geriatric, pediatric patients or immobile patients. The Tim Dockable Table can be moved with two clicks into the isocenter - one click to the upmost position and one click into the isocenter. The tabletop travels beyond the rear end of the system, enabling additional patient access.

Multiple Tim4G coils can be connected at once for efficient patient set up and patient friendly examinations. The seamless integration of multiple Tim 4G coils is possible via 4 SlideConnect and 4 DirectConnect connector slots, which are embedded in the table. This allows for comprehensive examinations without the need of repositioning.

The Tim Dockable Table is easily adjustable for height even in the undocked state. A minimum height of 61 cm allows for easy wheelchair access or easy patient movement to the hospital bed.

The integrated infusion stand and arm rests allow for fast patient set up anywhere and also for critical patients

*syngo* MR E11C provides several workflow and performance enhancements, and an extended IT security configuration.

There are new options (with separate licenses) available with the *syngo* MR E11C software:

- Simultaneous Multi-Slice EPI (for brain diffusion and BOLD imaging)
- Advanced Diffusion (RESOLVE and QuietX Diffusion for brain)
- *syngo* System Security Enhanced

GOBrain comes standard for MAGNETOM Aera and Skyra with Tim [204x48] or higher configurations with E11C.

GOBrain is a set of optimized protocols for diagnostic neuroimaging developed by the board-certified neuroradiologists at Massachusetts General Hospital, USA. These protocols aim to achieve a diagnostic brain examination and are optimized for short acquisition times.

The following contrast and orientations are provided with this protocol:

- sagittal T1-weighted GRE
- axial T2-weighted TSE
- axial T2 TSE FLAIR
- axial Diffusion-weighted single-shot EPI
- axial T2\*-weighted EPI-GRE

*syngo* System Security Basic comes standard for all system configurations with *syngo* MR E11C. *syngo* System Security Basic features provide security settings to protect the scanner against known security threats. It uses an embedded Windows® version that adjusts user rights to the required minimum and restricts network communication to the clinically relevant. It also protects the protocol trees against unauthorized modifications.

Effective noise reduction is achieved through Quiet Suite by targeting the main source of MRI noise - rapid switching in the gradient coils. Quiet Suite consists of QuietX, an intelligent algorithm which effectively reduces noise through summation of gradients and reduction of slew rates while keeping timing parameters within the same range. QuietX has been enabled for TSE, SE and GRE sequences for T1, T2 and DarkFluid contrasts. Within the TSE-sequence, the parameter "Echo-spacing" allows the user to further lower the gradient slew-rates. QuietX has also been enabled for susceptibility and diffusion-weighted imaging and these sequences are available with the SWI and Advanced Diffusion licenses, respectively. The automated algorithm runs in parallel to normal protocol handling. All features and contrasts of the TSE, SE, and GRE sequences remain available.

In addition, Quiet Suite contains PETRA, a 3D T1 UTE sequence. The PETRA sequence allows for even lower gradient switching. With its unique gradient trajectories, no acoustic noise associated with gradient switching is generated during a PETRA scan. Residual noise may arise due to radio frequency switching.

With Quiet Suite, optimized quiet protocols for imaging the brain and large joints are also provided.

## Description

The high-end computing option brings the high-end image reconstruction performance to the 48 rf channel configuration of the MAGNETOM Aera and Skyra. The high-end image reconstruction computer offers faster processing power for intensive algorithms, high amount of data storage for large data sets acquired over long-term measurements, a large amount of main memory for fast processing of measurement data, and a general purpose graphic processing unit for highly intensive computational calculations.

The high-end image reconstruction computer has the following specifications:

- ≥ Intel Xeon (2 x 8-core) processor 2.1 GHz
- ≥ 64 GB Main Memory (RAM)
- ≥ 400 GB Hard disk for raw data
- ≥ 100 GB Hard disk for system software
- ≥ 1x Tesla K10 GPGPU

### Spine Dot Engine:

The Spine Dot Engine provides optimized cervical, thoracic and lumbar spine imaging for patients of all conditions. Spine Dot Engine provides the functionality to simplify your spine workflow by providing tools to reduce examination times, achieve optimal image quality, and assist you during reading.

- User guidance step-by-step
- AutoPosition
- AutoAlign Spine with intervertebral disc detection
- AutoCoverage
- AutoSatPosition
- Initial and interactive snapping
- AutoLabeling of vertebrae
- Automatic curved multiplanar reconstructions of 3D datasets

The Spine Dot Engine includes:

- Tim Planning Suite
- Inline Composing
- *syngo* WARP Susceptibility Artifact Reduction  
*syngo* WARP integrates different techniques tailored to reduce susceptibility artifacts caused by orthopedic MR-Conditional metal\* implants. 2D TSE sequence combining optimized high-bandwidth protocols and View Angle Tilting (VAT) technique, tailored to reduce susceptibility artifacts caused by orthopedic MR-Conditional metal\* implants. This helps in evaluation of soft tissue in proximity of the implant. Available protocols include T1- weighted, T2-weighted, proton density and STIR contrast.

### LargeJoint Dot Engine:

LargeJoint Dot Engine optimizes image quality of knee, hip and shoulder scans by proposing the most appropriate protocols according to the examination strategy chosen for the specific patient. It ensures reproducible image quality and streamlines large joint examinations to the greatest extent.

#### *Dot Exam Strategies*

The workflow can be personalized to the individual patient condition and clinical need. The LargeJoint Dot Engine comes with the following predefined strategies, which the user can select according to patient conditions or change at any time during the workflow, when conditions change:

- Image quality: Achieve highest image quality in a reasonable scan time with 2D and 3D protocols.
- Speed focus: Examine patients in the shortest possible time with protocols being accelerated to the maximal extent.
- Motion artifact reduction: Compensate for the effects of motion, e.g. with motion insensitive *syngo* BLADE protocols.
- Artifacts reduction: Reduce susceptibility artifacts, using *syngo* WARP.

#### *AutoAlign*

- 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 high image quality with a standardized slice orientation.

## Description

### *Inline MPRs - Automatic multiplanar reconstruction for 3D datasets*

- The Multi Planar Reconstruction (MPR) tool uses the position information from the AutoAlign algorithm and can be easily configured to automatically generate any required 2D images from high resolution 3D acquisitions.

### *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

### *syngo WARP - Susceptibility Artifact Reduction*

- syngo WARP integrates different techniques tailored to reduce susceptibility artifacts caused by orthopedic MR-Conditional metal\* implants. 2D TSE sequence combining optimized high-bandwidth protocols and View Angle Tilting (VAT) technique, tailored to reduce susceptibility artifacts caused by orthopedic MR-Conditional metal\* implants. This helps in evaluation of soft tissue in proximity of the implant. Available protocols include T1- weighted, T2-weighted, proton density and STIR contrast.

### *Advanced WARP:*

- Advanced WARP application consists of SEMAC, a technique to reduce gross metal\* artifacts (i.e. through-plane artifacts) caused by big orthopedic implants. The main clinical applications are in hip and knee joint replacements. Available protocols include T1-weighted, T2-weighted, proton density and STIR contrast.

### *Customization*

The LargeJoint Dot Engine 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
- Add clinical decision points
- Add/remove parameters in the parameter viewing card
- \*MR imaging of patients with metallic implants brings specific risks. However, certain implants are approved by the governing regulatory bodies to be MR conditionally safe. For such implants, the previously mentioned warning may not be applicable. Please contact the implant manufacturer for the specific conditional information. The conditions for MR safety are the responsibility of the implant manufacturer, not of Siemens.

## Angio Dot Engine

### *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

### *Test bolus*

- Automatic detection of arterial / venous timing window

### *Feedback of bolus timing information*

- Timing information is fed back into planning steps and parameters are adapted automatically

### *Auto Voice Commands*

- 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

## Description

### *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

### Application Packages:

#### *syngo* Inline Composing

- Automatic anatomical or angiographic composing of multiple adjacent coronal or sagittal images
- Composed images can be automatically loaded into Graphical Slice Positioning for scan planning purposes

### Tim Planning Suite

With the Tim Planning Suite, multiple regions in the entire body can be examined in a minimum of time through measurement planning on a single FoV of any desired size.

### Abdomen Dot Engine

#### *Patient View*

- Within the Patient View the user can easily tailor the exam to each individual patient.
- 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. Furthermore protocols tailored for use of contrast media are integrated.

Dot Exam Strategies allows personalizing the workflow to the individual patient condition and clinical need. The following predefined strategies are included:

- Standard with breath-hold
- Standard with PACE triggering
- Limited patient capabilities using *syngo* BLADE and PACE triggering.

#### *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*

- This new view displays the parameters that are really needed for this scan set-up.
- This reduced set of protocol parameters allows the user to concentrate on the essentials.
- The Parameter View can be opened at any time during an examination

### Additional functionalities:

Automatic sequence scaling according to physiological characteristic. (Auto FoV, AutoNavigator, breath-hold adaptations).

Auto Navigator based automatic breathing pattern detection and scaling of triggered scans.

Automatic FoV: the optimal FoV is automatically estimated based on the localizer images.

### *Dot Decisions*

Decisions are seamlessly integrated into the scanning workflow. The user just selects the queue and the appropriate pulse sequences are added automatically. For the abdomen MRCP and Diffusion decision points are offered.

Timeline setup and monitoring for best overview of multi-phase breath-hold examinations and CM enhancement curve visualization.

### *Auto Voice Commands*



## Description

The system plays them automatically at the right time point. 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.

Auto Bolus Detection initiates automatically the dynamic upper abdomen examination based on bolus detection. The user can override this function.

### *Inline radial range calculation for MRCP*

MRCP is measured and Inline Radial Ranges are automatically generated.

### *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 automatically performs 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

### *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

### *Auto Voice Commands*

- Integrated into the scanning workflow.
- The system plays them automatically at the right time point.
- 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.

### *Test bolus*

- Automatic detection of arterial / venous timing window

### *Feedback of bolus timing information*

- Timing information is fed back into planning steps and parameters are adapted automatically

### *General*

- iPAT compatibility utilizing Tim's 4G coils capabilities
- Inline subtraction and Inline MIP of complete peripheral run off images
- Highest image homogeneity and no boundary artifacts thanks to seamless TimCT scanning
- Max. FoV of syngo TimCT (depending on the resolution): 205 cm (with Tim Whole Body Suite), 140 cm (without Tim Whole Body Suite)
- Table speed during angiographic measurements: Up to 5 cm / s
- 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.

## Description

- Add/remove protocol steps
- Change guidance content (images and text)
- Change or add Dot Exam Strategies and Decision Points
- Modify the Parameter View

The option features:

- Display and storage of full-format images, e.g. of the spine, the central nervous system or the vessel tree (starting from *syngo* MR B13), combined from multiple overlapping stages.
- Dedicated composing algorithms, optimized for the generation of anatomical or angiographic (starting from *syngo* MR B13) full-format images.
- Data sets with different FoV, resolution, matrix and slice thickness can be combined (starting from *syngo* MR B13).
- Generation of full-format images from inline MIPs (starting from *syngo* MR B13).
- Original, detail and reconstructed images can be displayed in different layouts.
- Comparison of two reconstructed images for evaluation and diagnosis is thus made possible.
- Filming in different layouts is supported.
- Measurements of basic functions via reconstructed images is then possible.
- Measurements of extended orthopedic functions:  
scoliotic angle, kyphotic angle, vertical distance measurement and differences in width of the intervertebral spaces.

*Prerequisite: SW syngo MR B13.*

*syngo* NATIVE offers:

- Non-contrast enhanced 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

QISS offers:

- Non-contrast enhanced peripheral MRA
- Higher robustness when compared to other non-contrast enhanced peripheral MRA methods
- Improved usability provided by the Dot AddIn which enables easier multi-stage planning

The QISS package comprises:

- QISS sequence
- QISS Dot AddIn
- Non contrast-enhanced peripheral vessels protocols

Main Features:

- The inline screening Dixon sequence gives the user a first overview of possible fat and/or iron overload in the whole liver.
- Based on the result images, liver segmentation runs without user interaction.
- If further evaluation is needed, the user can choose from two methods:
  1. HISTO is a pushbutton single breath-hold single voxel spectroscopy method to calculate fat fraction as well as water R2.
  2. Multi-echo Dixon is an image based method to calculate maps such as water, fat, fat signal percentage, and R2\*.

## Description

Main Features:

- TWIST VIBE is a VIBE sequence with CAIPIRINHA capability providing high spatial resolution. The view-sharing mode provides temporal information to ensure the right contrast timing for different lesions. Dixon is used for fat-water separation.
- StarVIBE allows body imaging in free breathing mode, providing a solution for patients without breath hold capabilities.

The spectroscopy evaluation software is fully integrated in *syngo* MR.

Evaluation protocols adapted to the scan protocols carry out a complete and automatic evaluation of the measured data.

Optimized protocols for 3D CSI in the prostate are included.

The following functions are included:

- Subsequent water suppression with optional phase correction
- Apodization
- Zero filling
- Fourier transformation
- Base line correction
- Automatic or manual phase correction
- Curve fitting and peak labeling
- Summaries in tabular form of the essential results specifying the metabolites, their position, integrals and signal ratios in relation to a selectable reference.

Tissue 4D provides the tissue visualization features:

- 4D visualization (3D and over time)
- Color display of parametric cards (Ktrans, Kep, Ve, Vp, iAUC)
- Additional visualization of 2D or 3D morphological dataset

Post-processing features:

- Elastic 3D motion correction
- Fully automatic calculation of subtracted images

Standard curve evaluation:

- Calculation and display of enrichment curves

Pharmacokinetic model:

- Pharmacokinetic calculation on a pixel-by-pixel basis using a 2-compartment model
- Calculation is based on the Toft model. Various model functions are available.
- Manual segmentation and calculation on the result images.

The following result images can be saved as DICOM images:

- 3D motion-corrected, dynamic images
- Colored images
- Possibility for exporting results in the relevant layout format.

### Cardiac Dot Engine

#### **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

#### **Patient View**

## Description

- Within the Patient View the user can easily tailor the exam to each individual patient (e.g. patient with arrhythmia, breath hold capability).
- 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

### ***AutoFoV (automatic Field of View calculation)***

- Based on the localizer images the optimal FoV is automatically estimated.
- If 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 (e.g. heart rate)

### ***Novel heart localization method***

- On-board guidance visually facilitates anatomic landmark settings which are used for calculation
- Automated localization
- Automated localization of short-axis views

### ***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.
- If desired, inline calculated segmentation results can be loaded to 4D Ventricular Function Analysis for further review or processing

### ***Cardiac specific layout for the Exam task***

- layouts show the new physio display and are configured for every step of the exam

### ***Automated Naming***

- Automated naming of series depending on cardiac views and sequence type

### ***Auto Voice Commands***

- Seamlessly integrated into scanning workflow.
- Played automatically
- The user controls breath-hold or pauses are actually played
- Ability to add pauses between automatic breath-holds

### ***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 techniques
- **Limited patient capabilities:** switch to real-time 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

Flow Quantification enables the acquisition of flow encoded images and the evaluation of blood as well as of cerebro-spinal fluid (CSF).

## Description

Sequences include:

- ECG triggered 2D phase contrast with iPAT support
- Retrospective reconstruction algorithms for full R-R interval coverage
- Maxwell Term Compensation

The combination of automated contouring and easy-to-use editing tools, provides users with a rapid way to quantify flow parameters.

Argus Flow includes:

- Calculation of flow and velocity parameters( e.g. mean and max velocity, mean, cumulative, prograde, retrograde flow) for large and small vessels.
- 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)
- Graphical and tabular display of the results (e.g. flow-time curves)
- Integration of the results in Argus structured report and storage in DICOM format for documentation.

Combining the unique advantages of Tim and *syngo* BEAT with iPAT and powerful gradients, it allows performing cardiac MR examinations without compromise in image resolution or acquisition speed.

*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 for e.g. thalassemia assessment (only for 1.5T systems)
- 3D aortopathy imaging with free breathing (SPACE)

### Global or Regional 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)

The MyoMaps package enables the calculation of quantitative T1, T2 and T2\* parametric maps at the heart. The calculation is available shortly after the measurement is finished without the need of post-processing.

### T1 Parametric Map

- Acquisition based on ECG triggered modified look-locker inversion recovery (MOLLI)
- T1 parametric maps could be used to enhance the characterization of both ischemic and non-ischemic heart disease.

### T2 Parametric Map

## Description

- Acquisition based on T2-prepared TrueFISP sequence
- T2 parametric maps could be used to enhance the evaluation of myocarditis and heart transplant rejection.

### T2\* Parametric Map

- Acquisition based on multi-echo GRE sequence
- T2\* parametric maps could be used in the evaluation of iron overload for hemochromatosis patients.

This package includes Argus Function as well as Argus 4D Ventricular Function.

Argus Function:

- Automatic, semi-automatic, or manual segmentation of the left and semi-automatic or manual segmentation of the right ventricle.
- Volumetric analysis and wall thickness analysis.
- Output of parametric results, volume-time curves and bull's-eye plots.
- DICOM Structured Reporting.

Argus 4D Ventricular Function:

- Calculation of volumetric cardiac data of a given patient very quickly and easily.
- Parametric results and volume-time curves are 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 a reference.

Features:

- 3D VIBE sequence for Inline T1 mapping
- Multiecho spin echo sequence for Inline T2 mapping
- 3D Multiecho gradient echo sequence for Inline T2\* mapping
- iPAT compatibility
- Protocols for Inline parametric mapping

Using iPAT the 3D sequences provide isotropic imaging extremely high resolution while maintaining clinical measurement times. These data sets allow for the multi planar reconstruction of all planes. 3D is necessary to properly visualize the whole articular cartilage since it typically has a complex shape. In addition the accuracy of isotropic high resolution 3D data sets is superior because partial volume effects between e.g. synovial fluid and cartilage are minimized.

For the visualization of the parametric maps in the anatomical context the maps can be displayed as a colored overlay onto anatomical images using the optional package "syngo Image Fusion"

**CT, MR, NM, or PET images** are accepted as input for image fusion. Studies can be done with the same modality or with different modalities.

### Registration Algorithms:

- Easy-to-use visual alignment with 6 degrees of freedom (3x translation, 3x rotation)
- Landmark based registration with convenient landmark editor for point-based registration using anatomical landmarks
- Automatic registration
- Storage of transformation matrix after registration for later retrieval with datasets

### Visualization Techniques:

- Side by side visualization of both datasets with correlated pointer and correlated scrolling with dog ears
- 2D alpha-blending in monochrome or pseudo-color with adjustable balance between the two superimposed

data sets.

Storage of fused results as secondary capture images.

Neuro Perfusion Package provides a modified sequence and image reconstruction for motion correction and post-processing in dynamic susceptibility contrast (DSC) based perfusion imaging.

Depending on whether motion correction is switched on, the following uncorrected or motion corrected perfusion maps can be calculated: time-to-peak (TTP), relative cerebral blood volume (relCBV), relative cerebral blood flow (relCBF), relative mean transit time (MTT), relative corrected cerebral blood volume (relCCBV) and bolus plots. Perfusion parameter maps are calculated based on a Local Arterial Input Function. The algorithm selects many AIFs per slice and volume based on a number of built-in criteria. This removes the need for manual selection of AIF voxels to calculate the cerebral perfusion parameters and allows the calculation to be performed in-line at the end of the measurement. It also minimizes deconvolution errors due to the effects of delay and dispersion of the contrast agent bolus. Additionally, in cases of contrast extravasations due to a disrupted blood-brain barrier, the postprocessing allows a correction to be applied during calculation of the relCBV maps.

Post-processing features:

- Flexible selection of the Arterial Input Function (AIF) by the user.
- Pixelwise calculation of the hemodynamic parameters relative Mean Transit Time (relMTT), relative Cerebral Blood Volume (relCBV), relative Cerebral Blood Flow (relCBF), corrected relative Cerebral and Blood Flow (relCBF) for compensation of blood brain barrier leakage.
- Pixelwise calculation of maximum signal loss due to contrast agent enhancement (Percentage of Baseline at Peak, PBP) and of the time to the maximum signal loss (Time-To-Peak, TTP).
- Display of the global signal time course (averaged over all slices) to assess the quality of the exam.
- Predefined post-processing protocols available, user definable post-processing protocol are possible.

Visualization features:

- Colored display of relMTT-, relCBV-, relCBF-, relCBFcor, PBP- and TTP-maps.
- Zoom, pan, annotate.
- Colored images can be saved as DICOM images.

### Diffusion Tensor Imaging

Diffusion Tensor Imaging allows for a complete description of the diffusion properties of the brain within the scope of the tensor diffusion model, both for anisotropic and isotropic diffusion. Efficient diffusion direction schemes are pre-defined to allow for optimal diffusion directional resolution. Schemes with up to 256 directions can be selected. Inline technology enables automatic and immediate calculation of the diffusion tensor, including grey-scale and colored "fractional anisotropy" (FA) map derived from it.

Details:

- Measurements with up to 256 different directions and with up to 16 different b-values
- Inline calculation of tensor, grey-scale and colored FA map, ADC map and trace-weighted image
- Support of parallel imaging (iPAT)
- Clinical protocols with full head coverage, incl. inline calculation of tensor, FA, ADC and trace-weighted images in 4 minutes.

### DTI Tractography *syngo*

*syngo* DTI Tractography is optimized for the clinical use by providing advanced 3D visualization of white matter tracts in the context of 2D or 3D anatomical datasets and DTI datasets. DTI data sets can be explored fast and intuitively using the interactive QuickTracking. QuickTracking instantaneously displays the tract originating from the mouse pointer position while moving over the DTI data set. This also allows identifying qualified regions to place seeding ROIs. Seed points can be set to assess connectivity by tracking with single ROI and with multiple ROIs. Furthermore they can be placed in fused views displaying the anatomical reference and e.g. the colored FA map simultaneously.

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.

At the same time the package provides the scientific user with the flexibility to configure the tracking algorithm and to change display settings for the tracts. Tract and seeding ROI statistics are included to support publications (e.g.

mean/max FA value, min/mean/max ADC value).

All views can be exported as DICOM images or bitmaps. Tract and seeding ROI statistics can be exported as html files.

#### **DTI Evaluation**

Clinical applications are supported by a dedicated DTI evaluation mode to support diagnostics of white matter diseases (e.g. multiple sclerosis and brain maturation disorders). Based on the tensor, in addition to the already inline-calculated parameter maps, further maps characterizing the anisotropy of diffusion properties can be calculated and stored. Multiple diffusion parameter maps (e.g. Fractional Anisotropy, ADC,  $b=0$ ) and an anatomical image are displayed next to each other in the same slice position for comparison. The images can be evaluated together based on ROIs and the results can be documented in a table. The display options include 2D and 3D tensor graphics, colour-coded images and overlay images on the anatomical images.

In addition, the package offers the scientific user full flexibility of 2- and 3-dimensional visualization of the diffusion tensor with measures of isotropic and anisotropic (fractional and relative) diffusion, Eigen vectors (E1, E2, E3) of the diffusion tensor and shape-descriptive measures of the diffusion tensor (linear, planar, spherical).

RESOLVE is a diffusion-weighted, readout-segmented EPI sequence optimized towards high resolution imaging with reduced distortions.

The sequence uses a very short echo-spacing compared to single-shot EPI, substantially reducing susceptibility effects. A 2D-navigator correction is applied to avoid artefacts due to motion-induced phase errors. This combination allows diffusion weighted imaging of the breast, prostate (SEEit sequence for prostate DWI), brain and spine with a high level of detail and spatial precision.

Additionally, an automatic reacquisition of data with large phase errors can be used to ensure that diffusion-weighted images of the brain are not affected by CSF pulsation.

QuietX DWI protocols for the brain utilize QuietX, an intelligent algorithm which effectively reduces noise through summation of gradients and reduction of slew rates while keeping timing parameters within the same range. All features and contrasts of DWI remain available, delivering image quality comparable to a conventional single shot diffusion sequence, while providing at least 70% sound pressure reduction for increased patient comfort.

Simultaneous Multi-Slice (SMS) EPI provides slice accelerated BOLD and Diffusion protocols for the brain.

The slice acceleration factor can be selected on the protocol parameter card and can be utilized by the user in various ways:

- For diffusion weighted imaging, the user can choose to invest the benefits into scan time reductions or into more spatial or diffusion resolution.
- For BOLD, the user can utilize the slice acceleration to increase temporal sampling of BOLD data, for higher sensitivity to BOLD signal changes, and/or to increase the slice coverage and resolution (Inline BOLD Imaging required).

3D acquisition of non-contrast enhanced brain perfusion with a TGSE sequence for minimal susceptibility and full brain coverage. Higher SNR, optimized contrast uniformity and reduced motion sensitivity. Inline calculation of PWI (perfusion weighted images) for a qualitative assessment of brain perfusion.

Despite a strong sensitivity for local magnetic field inhomogeneities Susceptibility Weighted Imaging (SWI) as a 3D technology keeps up the signal near large susceptibility leaps due to very thin slices and high resolution in the slice (high image quality e.g. in the area of the forebrain near the frontal sinus).

Moreover, the phase information of the MR signal is integrated in the image display. In order to further increase sensitivity for localized microscopic magnetic field inhomogeneities, large-area magnetic field inhomogeneities (e.g. caused by susceptibility leaps near the sinus) are specifically suppressed in the phase images.

This allows even small amounts of deoxygenated hemoglobin (e.g. in cerebral veins) or from products of hemoglobin decomposition (e.g. from hemorrhages) to be displayed.

Interesting measuring times for the ultra-high-resolution 3D protocols are achieved through parallel imaging with iPAT (GRAPPA).

The Susceptibility Weighted Imaging package includes:

- SWI measuring sequence, iPAT compatible
- optimized measuring protocols for the head



## Description

- inline-postprocessing for automatic calculation of relevant images within the scope of image reconstruction:
  - calculation of susceptibility-weighted images
  - venous angiography: MIP of a thin slice block

SWI has been optimized for clinical use to support diagnostics with cerebrovascular diseases (e.g. cerebral insult), venous malformation, brain trauma and tumors.

*Prerequisite: Software syngo MR B13*

Tim and the Tim Whole Body Suite enable for true whole body MR scanning for head-to-toe imaging. Whole body imaging with highest image quality without patient repositioning and without the need to change a single coil, not even once, this means whole body imaging without compromise.

The Tim Whole Body Suite features:

- The all-new Tim Table or Tim Dockable Table enable a full Field-of-View with coverage up to 205 cm (6' 9"). The table top has the same length as the standard system without whole body capabilities. Additional free space is required at the rear part of the magnet to ensure, that the table movement is not limited by the rear wall.
- Table movement to its full extent can be remotely controlled from the operator console either by the operator or by sequence protocols.
- Protocols and programs for whole body MR angiography and morphology e.g. for metastasis visualization and preventive care examinations.
- Whole body MR Angiography is possible with high speed, high resolution and high image contrast on the entire volume combining high speed gradients and iPAT.
- The large FoV of 205 cm supports the assessment of metastases distribution in the body with sequences such as TIRM (Turbo Inversion Recovery).

*syngo TWIST* provides:

- Visualization of contrast agent dynamics in the vessel system of interest with maximum flexibility.
- Needs only a low amount of contrast agent.
- Imaging in all body regions, e.g. carotids, pulmonary and peripheral vessels with brilliant spatial and temporal resolution.
- Clear separation of the arterial and venous phase.
- High speed acquisition by intelligent k-space strategies and use of iPAT, powered by Tim.
- *syngo TWIST* provides fat suppression using water selective excitation.
- Inline technologies, such as subtraction and MIP are provided for optimal workflow.
- In case of very high spatial resolution *syngo TWIST* may even replace conventional static MR angio. Moreover, *syngo TWIST* does not require any bolus timing - just inject and go.

The Peripheral Angio 36 has a 36-element design with 36 integrated preamplifiers distributed over 6 planes with 6 elements each.

A uniquely designed non-ferromagnetic coil cart for safe coil storage is included. The PA Matrix Coil is also shipped with a set of positioning cushions for proper handling.

No tuning of the fully iPAT-compatible Peripheral Angio 36 is required.

With a length of about 1m both legs are covered from the iliac artery level down to the foot arch vessels using multiple, flexible wings. For the visualization of the abdominal aorta and the iliac bifurcation it can be combined with the Body 18 and Spine 32. For larger body coverage eg whole body with up to 205 cm possible coverage, it can be combined with Head/Neck20 or a further Body18 to allow for large Field of View examinations with high patient comfort. Patient set up is done once and no repositioning is necessary

For peripheral Angiography the PA Matrix coil will be typically used in feet-first position, but also head-first positioning for whole-body examinations is possible (optional Tim Whole Body Suite required).

The dimensions of the Peripheral Angio 36 are:  
860 mm x 300 - 640 mm x 280 mm

The iPAT compatible Shoulder 16 Large and Shoulder 16 Small are ergonomically designed and adapted to the shape of the shoulder.

The different sizes obtain maximum image quality for different body sizes:

- 165 mm (6.5 in) diameter for small and medium sized shoulders
- 200 mm (7.9 in) diameter for large shoulders

The coils can be used either for left or right shoulders. It features sliding attachments to the base plate and can easily be adjusted for comfortable positioning. The coils excel in highest resolution imaging with exceptional signal/noise ratio.

The 16-element coil with 16 integrated pre-amplifiers excels in highest resolution imaging with exceptional signal/noise ratio, while taking full advantage of iPAT in all directions.

Hand/Wrist 16 is ergonomically designed and adapted to the shape of the hand/wrist region. The coil features a hinged design of the upper part and slidable attachment to the base plate. Together with the included stabilization pads the coil allows easy, fast and comfortable patient positioning.

The 16-element coil with 16 integrated pre-amplifiers excels in highest resolution imaging with exceptional signal/noise ratio, while taking full advantage of iPAT in all directions.

Foot/Ankle 16 is ergonomically designed and features a boot-like coil design. Together with the included stabilization pads the coil allows easy, fast and comfortable patient positioning.

Thanks to its 15-channel design this coil is perfectly suited for high-resolution images with excellent SNR. With the arrangement of the antennas in three rings of 5 elements each, the coil is specially designed for parallel imaging with high acceleration factors.

The coil is positioned on a laterally movable support and therefore allows for comfortable patient positioning of both legs for off-center examinations. SlideConnect Technology allows for fast and easy patient preparation, resulting in less table time. Furthermore, the upper part can be removed for easier patient positioning. Additional cushions allow for optimum patient immobilization.

The integrated transmission function makes volume-sensitive excitation with greatly reduced RF power possible on the one hand and, on the other, prevents aliasing artifacts (e.g. due to the other knee).

The Body 18 has a 18-element design with 18 integrated preamplifiers that are arranged in 3 clusters of 6 coil elements each. The Body 18 will be typically used together with the Spine 32 with which it operates in an integrated fashion as a 30-element coil, resulting in 3 rings of 10 elements each for highest SNR and fast imaging. It can be positioned in different orientations and addresses the requirement range for the examinations of obese patient to pediatric patients. The light weight coil improves patient comfort and can be easily connected via SlideConnect technology. No tuning of the fully iPAT-compatible Body 18 is necessary allowing for efficient and patient friendly set-up.

For examinations where larger anatomical coverage is required, several Body 18 coils can be used simultaneously. Up to four Body 18 can be used simultaneously, but typically two Body 18 will be used for coverage of the entire abdomen or in the case of large patients.

The Body 18 is typically used in combination with the Spine 32 for examinations of the thorax, abdomen, pelvis or hip and is also well suited for cardiac or vascular applications. In addition, the Body 18 can be combined with the Spine 32, further Body 18 (optional), the Peripheral Angio 36 (optional), but also the Head/Neck20 and the 4-channel flex coils (e.g. Flex Large 4, Flex Small 4) it contributes for all large-Field-of-View applications up to whole-body imaging.

The dimensions of the Body 18 are 385 mm x 590 mm x 65 mm (L x W x H). Its weight is about 2 kg (4.5 lbs), whereas the patient feels as little weight as 1 kg (2,25 lbs).

This enables studies with very high spatial resolution and very short scan time. The upper part of the coil is detachable and can be fitted with a mirror allowing the patient a rear view out of the magnet. Displaceable cushions are provided with the coil for positioning. The coil is suited for head proton imaging and brain spectroscopy.

Included Features for individual configuration:

- User management with authentication to prohibit unauthorized access
- User switch during patient examination between measurement steps
- Password strength according to configured policy
- PHI protection including restricted permission to access defined patient groups (.e.g. VIP patients)
- Screensaver with password protection and adjustable idle time
- Privileges to grant rights and define functionality based on user/role/group
- Permissions to control data access
- Audit trail to log system and data access by the defined users and service

Special video camera for monitoring the patient during an MR examination.  
Color 640 x 480 pixel LCD monitor may be positioned at the *syngo* Acquisition Workplace or at a convenient wall location (wall support not included in scope of delivery) in the control room.

Function:

- Interface between the on-site water chiller (of any brand/type) or
- Interface to the central hospital chilled water supply.

Delivery volume:

- Separator
- Two 3.0 m hoses (forward and return) for connecting the SEP to the local cooling water supply system
- Separation cabinet
- With the SEP configuration, the helium compressor is built into the SEP cabinet and connected internal
- Regional specific adapter for connection to the hospital installation

Power cable to connect the 3 KVA Powerware 9125 small UPS system (pn PWR9125H3000) to the ACC cabinet of the MAGNETOM Avanto/ Espree/ Tim Trio for backing up the host computer and imager.

Configuration includes connection box.

The standard cable length is 9 m.

Voltage range: 180 - 276 V  
Input frequency: 50 / 60 Hz  
Output voltage: 230 VAC  
Dimensions (H x W x D): UPS 346 x 214 x 412 mm  
incl. UPS bracket set  
Weight: approx. 36 kg

An MR-compatible arm rest that supports the patient's arm on the magnet patient table when starting intravenous lines. The board is removed after the IV is inserted.

This product has been tested and verified for compatibility with the following Siemens' products: MAGNETOM Trio, Verio, Espree, Essenza, Avanto, Symphony, Area Skyra and Biograph mMR. Compatibility with other products cannot be assured and may void service contracts and/or system warranties.