TOMORROW TODAY

SIGNA™ Premier

System Specs

gehealthcare.com/mr

Introduction

Tomorrow Today

SIGNA™ Premier is an ultra high-performance, 70cm 3.0T system. Designed for research and beyond, SIGNA™ Premier delivers a new imaging experience that helps differentiate your services through technology, clinical capability and patient comfort.

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Magnet

The Foundation of Quality

When it comes to delivering on the promise of 3.0T image quality while enhancing the openness and patient experience, no other MR component has greater impact than the magnet. The SIGNA™ Premier system features a compact, lightweight, superconducting magnet designed to provide excellent homogeneity ensuring uniform signal and fat-suppression over a larger FOV. While improving the patient experience with a 70 cm bore size, the SIGNA™ Premier magnet supports a large 50 cm FOV and may reduce exam time since fewer acquisitions are needed to cover a large anatomy.

Magnet Specifications	
Operating field strength	3.0 Tesla
Magnet shielding	Active
EMI shielding factor	97.5% 0.6 hertz excitation and 94.5% dc step
Size (without enclosures) (L x W x H)	1.74 x 2.12 x 2.40 meters
Size (with enclosures) (L x W x H)	2.09 x 2.52 x 2.50 meters
Magnet weight with cryogens	14,060 lbs (6,378 kg)
Magnet cooling	Cryogenic
Long-term stability	< 0.1 ppm per hour over a 24 hour period
Cryogen refill period	Zero Boil-Off[‡]
He Boil-off rate	Zero Boil-Off[‡]
Fringe field – (axial x radial)	7.8 m x 4.8 m at 1 Gauss 5.2 m x 2.8 m at 5 Gauss
Manufacturer	GE Healthcare

Patient Focused Design	
Patient Bore (L x W x H)	163 cm x 70 cm x 70 cm
Patient Aperture	74 cm at magnet flare 70 cm at isocenter
Patient comfort module	Head or feet-first imaging Dual-flared patient bore 2-way in-bore intercom system Adjustable in-bore lighting system Adjustable in-bore patient ventilation system

LV-vrms Homogeneity Specifications*		
Diameter of Spherical Volume – DSV	Guaranteed ppm	Typical ppm
10 cm		0.02
20 cm	< 0.050	0.03
30 cm	< 0.150	0.08
40 cm	< 0.500	0.27
45 cm	< 1.500	0.7
40 (z) x 50 cm	< 3.000	1.8
50 (z) x 50 cm	< 4.000	2.5

[‡]Normal Operating Conditions

*measured on the magnet, after passive shimming.

Gradients

The SuperG gradients introduce exceptional performance and superb stability, delivering a new way of thinking about wide bore platforms. The SuperG gradient coil uses a hollow conductor, water-cooled design for all axes and a force balanced layout to maximize overall gradient performance and minimize vibro-acoustic effects on the patient. The SuperG Gradient Amplifier outputs 2.4MW* of power to maximize outcomes in high demanding cases.

Gradient Performance	
Peak amplitude	80 mT/m
Peak slew-rate	200 T/m/s
Maximum FOV (x,y,z)	50 cm x 50 cm x 50 cm
Duty Cycle	100%

Gradient Amplifier & Coil	
Peak amplifier current and voltage	1034A/2324V
Control	Optimized-digital control
Intelligent Gradient Control with load-optimized feed forward and feedback control algorithms that deliver accurate and repeatable output performance	
Dedicated active feedback control loop to regulate current errors	
Gradient current accuracy	300 uAs
Shot-to-shot repeatability[‡]	100 uAs
Symmetry[‡]	200 uAs

Gradient Waveform Optimization

User selectable mode to further reduce acoustic noise.

High Order Shim

The SIGNA™ Premier gradient coil comes with 5 second order shim coils integrated into the gradient coil structure.

- Linear terms: X, Y, Z
- 2nd order terms: XY, ZX, ZY, Z2, X2-Y2

*Product of peak output current and peak output voltage

[‡]Typical gradient fit expressed in terms of the absolute integrated errors in micro-Amperes-second (μAs). Gradient integral precision is the maximum integrated current error over a full-scale, echo-planar gradient waveform. Shot-to-shot repeatability is the largest difference between integrated errors across waveforms. Symmetry is the largest difference in integrated current error when comparing positive and negative gradient waveforms.

RF

The RF acquisition technology of the SIGNA™ Premier enables greater clinical performance and higher image quality especially for data-intensive applications and provides an improvement in SNR versus previous generation based on GE's Total Digital Imaging (TDI) RF architecture.

Direct Digital Interface (DDI) which employs an independent analog-to-digital converter to digitize inputs from 146 RF channels, eliminating unnecessary noise enhancement. In other words, every element translates to a digitized signal. The result? Not only does DDI technology improve SNR of our images but it also works with legacy GE coils for unmatched flexibility.

Digital Surround Technology (DST), SIGNA™ Premier comes prepared for DST, and combines signals from every coil element. The exceptional SNR and sensitivity of the high-density surface coils are combined with the superior homogeneity and deeper signal penetration of the integrated RF body coil.

Digital Micro Switching (DMS) technology represents a revolutionary advance in RF coil design by replacing analog blocking circuits with intelligent Micro Electro-Mechanical Switches (MEMS). The result? Coil design supports ultrafast coil switching times for further expansion of zero TE imaging capabilities and reduced power consumption.

TDI RF Architecture	
Simultaneous RF Receivers (A/D Converters)	146
Receiver sampling per channel	80 Mhz
Quadrature demodulation	Digital
Receiver dynamic range at 1 Hz BW	> 165 dB
Receiver resolution	Up to 32 bits

RF (continued)

MultiDrive

At 3.0T, precise control over the RF environment in a 70 cm patient bore has been challenging until now. The SIGNA™ Premier RF transmit architecture consists of two liquid-cooled 15 kW solid-state RF power amplifiers. By optimizing the phase and amplitude of each RF amplifier output channel that is applied to GE's 70 cm whole-body RF transmit coil, the RF uniformity and signal homogeneity improves regardless of the patient's shape, size, and/or body habitus.

RF Transmit Architecture	
RF amplifier	Multiple output Small footprint Water cooled
Maximum output power	15 kW body per channel (30 kW peak total) 4.5 kW Head
Maximum B_1 field with whole body RF coil	19 uT at 75 kg (> 25 uT at 20 kg)
Transmit gain	40 db coarse, > 84 dB instantaneous
RF exciter frequency range	127.72 +/- 0.625 MHz
Receiver resolution	< 0.6 Hz/step
Frequency stability	14 parts per billion (0 to 50 C)
Phase resolution	0.005 deg/step
Amplitude control	16 bit with 12.5 ns resolution
Amplitude stability	< 0.1 dB over one minute at rated power
Digital RF pulse control	2 amplitude modulators 2 frequency/phase modulators
Transmit/Receive Body Coil	Fully integrated 16 rung quadrature Birdcage 70 cm inner diameter 50 cm FOV

Scan Parameters

Sequences	Parameters	Matrix 64	Matrix 128	Matrix 256	Matrix 512
2D Spin Echo	Min. TR (ms)	N/A	2.8 ms	3.193 ms	4.39 ms
	Min. TE (ms)	N/A	1.52 ms	1.848 ms	2.64 ms
2D Fast Spin Echo	Min. TR (ms)	N/A	3.3 ms	3.7 ms	5 ms
	Min. TE (ms)	N/A	1.564 ms	1.832 ms	2.64 ms
	Min. slice thickness	0.1 mm			
	Min. ESP (ms)	N/A	1.564 ms	1.832 ms	2.64 ms
	Max. ETL	480			
3D Fast Spin Echo	Min. TR (ms)	N/A	41 ms	52 ms	70 ms
	Min. TE (ms)	N/A	5.0 ms	6.0 ms	10.0 ms
	Min. slice thickness	0.3 mm			
	Min. ESP (ms)	N/A	1.56 ms	2.16 ms	3.504 ms
	Max. ETL	400			
2D Fast Gradient Echo	Min. TR (ms)	0.532 ms	0.66 ms	0.916 ms	1.2 ms
	Min. TE (ms)	0.184 ms	0.184 ms	0.188 ms	0.192 ms
3D Fast Gradient Echo	Min. TR (ms)	0.53 ms	0.67 ms	0.84 ms	1.21 ms
	Min. TE (ms)	0.176 ms	0.176 ms	0.18 ms	0.188 ms
Inversion Recovery	Min. TR (ms)	N/A	58 ms	58.5 ms	60.5 ms
	Min. TE (ms)	N/A	1.536 ms	1.832 ms	2.64 ms
	Min. TI (ms)	N/A	50 ms	50 ms	50 ms

Scan Parameters (continued)

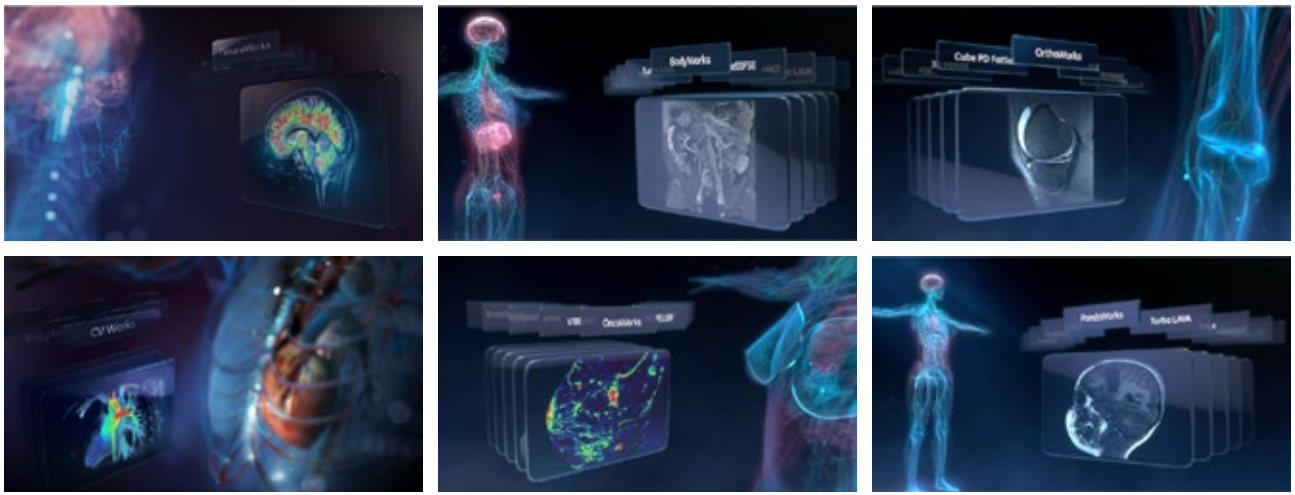
Sequences	Parameters	Matrix 64	Matrix 128	Matrix 256	Matrix 512
3D FIESTA	Min. TR (ms)	0.92 ms	1.19 ms	1.66 ms	2.2 ms
	Min. TE (ms)	0.224 ms	0.288 ms	0.38 ms	0.544 ms
Echo Planar Imaging	Min. TR (ms)	4.0 ms	5.0 ms	6.0 ms	N/A
	Min. TE (ms)	1 ms	1.2 ms	1.6 ms	N/A
	Min. FOV	4 cm			
	ESP at 25 cm	0.404 ms	0.572 ms	0.908 ms	N/A
	ESP at 48 cm	0.28 ms	0.396 ms	0.58 ms	N/A
	ESP at 99 cm	0.196 ms	0.296 ms	0.56 ms	N/A
	Images per second	157	93	36	N/A
	b value	Maximum(s/mm^2): 10.000 Max # for ADC: 40			
	Diffusion tensor directions	Max: 150			
Minimum slice thickness in 2D					0.1 mm
Minimum slice thickness in 3D					0.1 mm
Min/Max FOV					10 mm / 500 mm
Min/Max Matrix					32-1024
Highest in-plane resolution					5 µm

SIGNA™Works

SIGNA™Works is the latest software platform that includes base pulse sequences, workflow enhancements and visualization tools that enable high productivity with exceptional quality and outcomes. Each of the six optimized Works categories delivers preset protocols for the most demanding neuro, musculoskeletal, cardiovascular, body, oncology and paediatric areas. In addition to enabling the routine imaging, SIGNA™Works provides the user with a streamlined and efficient operating environment with in-line processing through single-click outcomes for even the most demanding processes.

SIGNA™ Works provides:

- Software platform with a wider range of assets for image acquisition, display and post processing.
- Strategically packaged to deliver speed, high quality diagnostic images and reliable post processing to each clinical area.
- An intelligent combination of MR pulse sequences and advanced techniques, designed to bring solutions for enhanced care and productivity.
- From SE, FSE, frFSE, Inversion Recovery, SSFSE, SSFSE-IR, GRE, FGRE, SPGR, FSPGR to Volumetric imaging, Motion Correction, Diffusion Weighted, Vascular imaging and beyond.



Comfort Plus Patient Table

The Comfort Plus patient table was designed for safety, comfort and efficiency. The SIGNA™ Premier offers a fully integrated Comfort Plus patient table (also known as TDI patient table), which features the embedded Posterior Array and helps improve exam efficiency and patient comfort. The Comfort Plus patient table can be lowered to very low heights for easy and fast transfer of wheelchair patients. The cradle width has also been increased by 30% from previous generations to enable a more comfortable patient experience.

Comfort Plus Patient Table

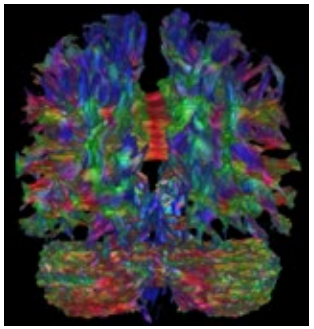
Patient Table	
Configuration	Fixed
Minimum & Maximum Height	53.5 cm to 93 cm continuous
Table Drive	Automated power-driven vertical and longitudinal
Longitudinal Speed	25 cm/sec (fast), 1.9 cm/sec (slow), 15 cm/sec (patient positioning)
Total Scanable Range	168 cm
Cradle length and width	245 cm x 56 cm (L x W)
Maximum Patient Weight Detached and Mobile	250 kgs (550 lbs)
Maximum Lift Capacity	250 kgs (550 lbs)
Patient Transport Accessories	Drawers
Landmarking	Laser alignment with S/I and R/L alignment IntelliTouch touch sensors
Total Cradle Travel	264 cm
Coil connection ports	Five ports. Four high density auto-coil sensing connection ports, fifth port for embedded PA coil

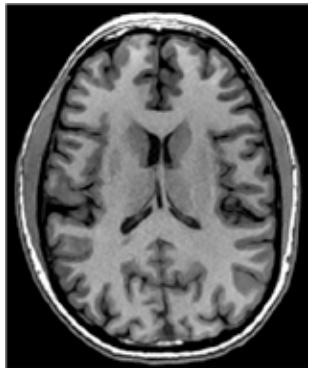
48 channel Head Coil

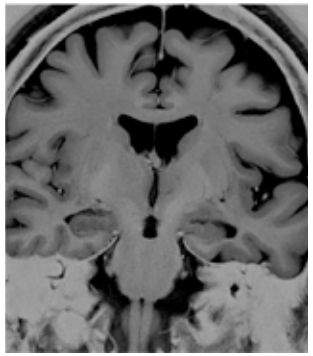
Benefits

- Designed for inner dimension adjustments for larger head sizes
- Designed for forward and back projection mirror system
- Compatible with Goggle systems and MR Compatible EEG devices
- Compatible with Comfort Tilt and TDI PA Array

The Phased Array 48 channel Head Coil is designed for high SNR brain imaging and high patient population compatibility. The coil topology is designed for optimum parallel imaging and Hyperband acceleration performance.



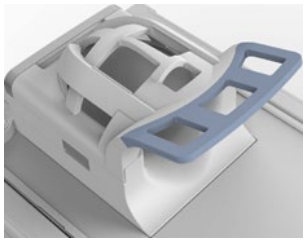




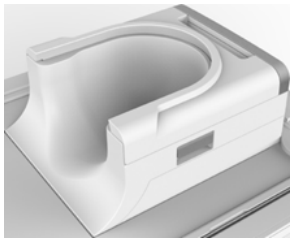
48ch Head Coil	
Elements	48
Dimensions (W x H x L)	35 cm x 33 cm x 45 cm
Weight	7.5 kg (16.46 lb)

Optional

Head-neck Array

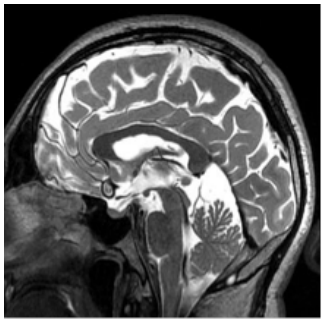


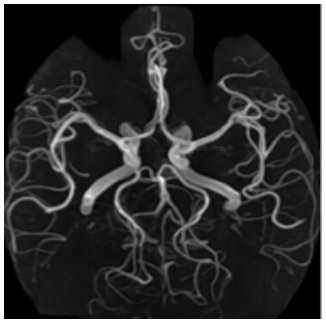
Head-neck Array with NV adapter

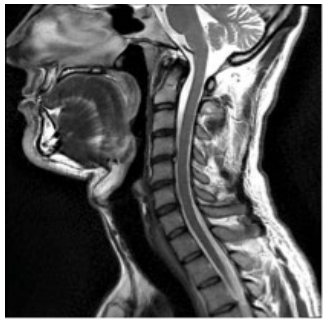


Head-neck Array with Open Face adapter

Comfort Tilt







Head-neck Array with NV Adapt	
Elements	21
Dimensions	53 cm x 35 cm x 35 cm
Weight of HNA base & NV Adapter	6.5 kg (14.3 lb)
S/I Coverage	45 cm (17.7 in), when combined with the PA
R/L Coverage	32 cm (12.6 in)
Patient orientation	Head first

Head-neck Array with Open Face Adapt	
Elements	10
Dimensions	53 cm x 35 cm x 21 cm
Weight of HNA base & Open Face Adapter	5 kg (11 lbs)
S/I Coverage	45 cm (17.7 in) when combined with the TDI PA
R/L Coverage	24 cm (9.4 in)
Patient orientation	Head first

TDI Spine Posterior Array

TDI Spine Posterior Array
The TDI Spine Posterior Array (PA) is a 32 channel array that is embedded in the patient table. It includes the Digital Micro Switch technology which enables it to achieve ultrafast coil switching for “zero-TE” imaging capabilities and further expansion of SilentScan.

The TDI PA is indicated for use for spine, pelvis, hips, prostate, abdominal, cardiac, lower extremities, blood vessels, long bone, and whole body imaging. It has also been designed to become transparent when additional surface coils are placed directly on top of the table.

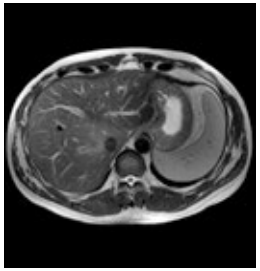
TDI Spine Posterior Array specifications	
Elements	32
R/L Coverage	48.6 cm (19.1 in)
S/I Coverage	113 cm (44.4 in)

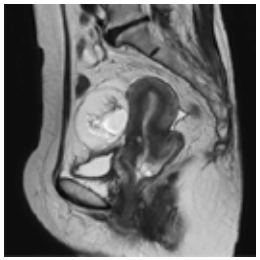
TDI Body Anterior Array

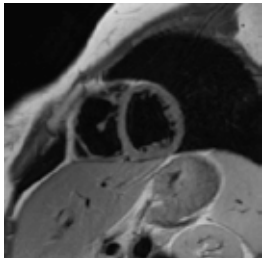
TDI Body Anterior Array

The TDI Body Anterior Array (AA) is a 16ch array coil that can be combined with the TDI Spine Posterior Array for pelvis, hips, prostate, abdominal, cardiac, lower extremities, blood vessels, long bone, and whole body imaging. The coil can be combined with an optional second Anterior Array for whole body or peripheral vascular imaging.

TDI Body Anterior Array Specifications	
Elements	16
Dimensions	55.6 cm x 67.4 cm x 3.3 cm
Weight	2.8 kg (6.16 lb) resting on patient 3.9 kg (8.6 lb) with cable
S/I Coverage	54 cm (21.3 in)
R/L Coverage	Full 50 cm (19.7 in) FOV of the system
Patient orientation	Head-first or feet-first

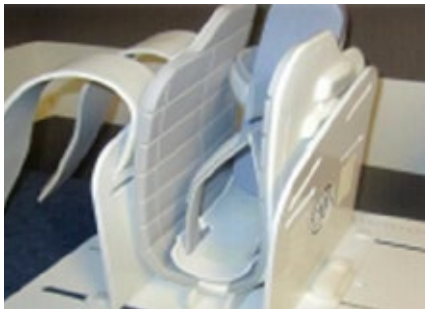




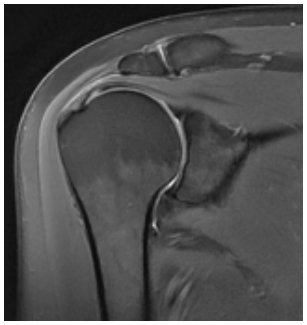


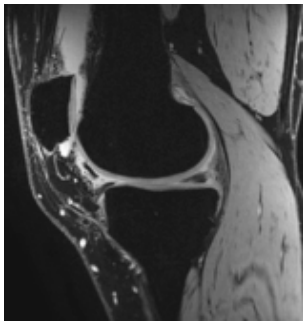
16 channel Flex Coils

The GEM Flex Suite is a versatile set of high density 16ch coils designed to give high quality images in a wide range of applications. The high degree of flexibility is particularly advantageous when imaging patients that do not fit the constraints of rigid coils, improving the patient and technologist experience, and enabling most exams to be completed with the same level of image quality expected from dedicated coils. The coils are available in small, medium, and large. The full Flex Suite is intended to cover a broad range of musculoskeletal applications, including upper and lower extremities of the hand, wrist, elbow, shoulder, knee, ankle, and foot.



Knee and foot ankle positioner





GEM Flex Specifications

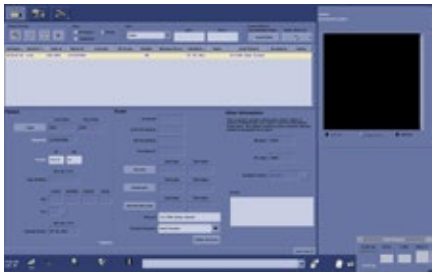
Coil	Dimensions (W x L x H)	Wrap Diameter	Elements	Weight
GEM Flex Large	23 cm x 71 cm x 5 cm	15.5 cm – 21.5 cm	16	1.2 kg
GEM Flex Medium	23 cm x 57 cm x 4 cm	11.5 cm – 15.5 cm	16	0.9 kg
GEM Flex Small	23 cm x 44 cm x 4 cm	9 cm – 12.5 cm	16	0.9 kg

Optional

SIGNA™ Flow

SIGNA™Flow is designed to standardize and accelerate workflows for patient setup, exam prescription, scanning and post-processing. SIGNA™ Flow can begin before the patient enters the magnet room and exams can be completed within a few mouse clicks – delivering quality and consistency for all patients and from all technologists. At the same time, SIGNA™ Flow maintains the flexibility needed to rapidly adapt and optimize exams for patient specific situations.

Exam Setup



Modality Worklist

Automated and standardized rapid set up

- Allows the MR protocol to be selected and linked to the patient record in advance of the patient's arrival
- For sites with full DICOM connectivity, select the patient from the Modality Worklist, start a new session and view the relevant exam details on the in-room operator console
- Add critical patient information such as allergies, pre-medication, pregnancy status and history

Protocol Tools

Search, select and one click to share

- Protocol Libraries: GE Optimized (preloaded protocols) and Site Authored (customized and saved)
- Protocols can be saved based on patient demographics, anatomy, scan type, or identification number for rapid search
- Commonly used protocols can be flagged for quick selection from the modality worklist
- One-click to share protoCopy – enables a complete exam protocol to be shared with the click of a mouse and provides a process for managing protocols across multiple systems as well as saving protocols for back up
- Step-by-step protocol notes – guide the user through the entire clinical routine procedure via expert inputs, can be edited by the user for site specific instructions
- Step-by-step video guides – provide simplified video instructions on-console

Reconstruction Engine & Host Computer

Reconstruction System Gen6	ADVANCED
Operating system	Scientific Linux
Processor	Intel® Xeon® E5-2967 (2 x 14 core)
Clock rate	2.6 GHz
Memory	≥ 192 GB
Network	10 GbE
Hard disk storage	3 x 400 GB SSD
2D FFT/second (256 x 256 full FOV)	75,000 2D FFTs/second

Host Computer	
Operating system	Scientific Linux (RT)
Processor	Intel® Xeon® E5-1620 v3 (4 core, 8 threads)
Clock rate	3.5 GHz
Memory	≥ 32 GB
Network	Gigabit (10/100/1000) Ethernet
Hard disk storage	1024 GB SSD
Graphics subsytem	PCI-Express x16 2GB Single DVI-I 3D
Media drives	CD/DVD drive
Cabinets	Single, tower configuration

Orchestra Reconstruction Platform

Orchestra is a high performance computing software library toolbox that enables new possibilities for integration of advanced reconstruction elements. Delivering enhanced productivity gains by increased image reconstruction speed and minimizing workflow disruptions. A powerful platform not only built to support the most demanding application such as HyperSense, but also to provide our collaborators with easy access to the product reconstruction algorithms.

In-line Processing & In-line Viewing

In-line Processing

Automated post-processing

- Automated post-processing of specific applications
- Automatic opening and loading to advanced visualization tools when appropriate
- Automated in-line processing can be stored within the protocol

3D ASL series	Automatic compute and save
Diffusion Weighted series	Automatic compute and save
Diffusion tensor series	Automatic compute and save
eDWI series	Automatic compute and save
Image filtering: A-E, SCIC, deFINE	Automatic compute and save
Maximum/Minimum Intensity Projection	Automatic compute and save
Reformat to orthogonal plane	Automatic compute and save
T2 map for cartilage evaluation	Automatic compute and save
3D Volume Viewer	Automatic load
BrainStat	Automatic load
FiberTrak	Automatic load
Image Fusion	Automatic load
Interactive Vascular Imaging	Automatic load
Pasting	Automatic load

In-line Viewing

Enhanced Visualization

In-line viewing allows the user to seamlessly and conveniently view, compare, and analyze images (during scan progress). The user simply selects the series, or multiple series, to view from the workflow manager, and the images are displayed along with the image display tools.

Siting

Siting and Other Specifications

Typical Room Layouts	
	System configuration minimum values
Magnet Room	21.2 sq.m (228.3 sq ft)
Minimum Ceiling Height	2.5 m (8 ft 2.4 in) min ceiling height
Equipment Room	7.8 sq m (84.3 sq ft)
Control Room	3.2 sq m (34.4 sq ft)

Fringe Field		
	Axial	Radial
0.5 mT (5 Gauss)	5.2 m	2.8 m
0.1 mT (1 Gauss)	7.8 m	4.8 m

Altitude Requirements	
Upper limit	2600 m
Lower limit	-30 m

Siting (continued)

Siting and Other Specifications

Power Consumption	
Power consumption depends on actual usage. They exclude consumption by the shield cooler compressor (9 kVA). The following values are approximate:	
Standby (no scan)	<17 kVA
Maximum continuous sustained power (> 5 secs)	181 kVA
Peak instantaneous power (< 5 secs)	349 kVA

RF Shielding
100 db. for 10 - 100 MHz plane wave

Workspace Monitor Positions	
	Maximum field strength
LCD flat panel monitor	5 mT (50 Gauss)

Water Requirements	
Maximum heat removal to customer-supplied water	94 kW
Water flow	114 liters/min (30 gpm) minimum at a maximum temperature of 15 degrees C

Imagination at work

DOC1948285