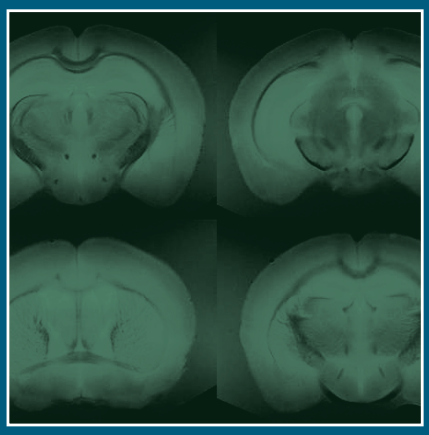
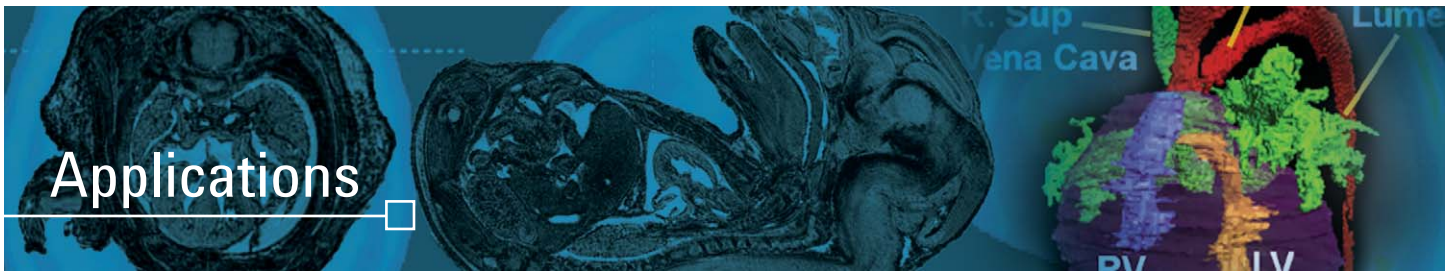


Magnetic Resonance Imaging

for Pre-clinical Applications

The Measure of Confidence

Agilent Technologies

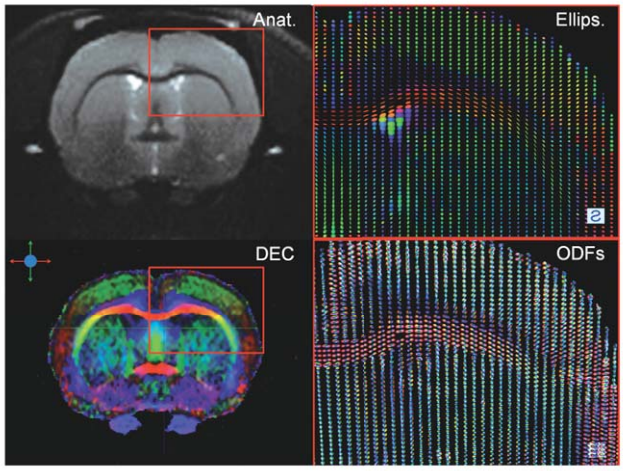


Applications

Agilent's range of MRI systems are used in a variety of applications. Each system is carefully configured to meet your requirements and your demands, while offering the best performance of that system.

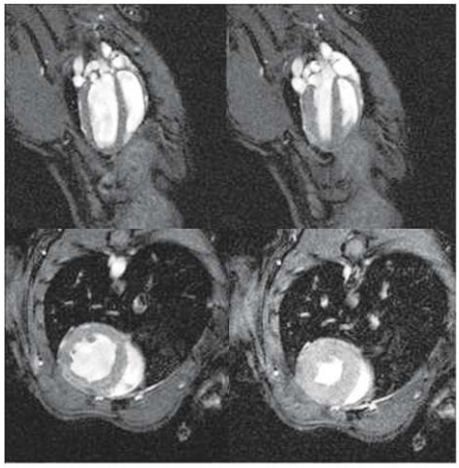
Some of the pre-clinical applications include:

- Brain and organ imaging
- Cardiac investigation
- Tumour assessment
- Investigation of contrast agents
- Magnetic resonance spectroscopy

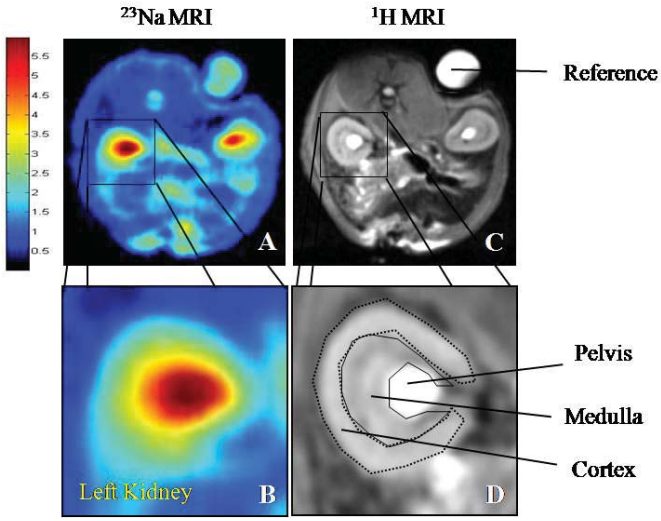


Brain Diffusion Tensor Imaging at 9.4T
Data courtesy: Laboratory of Functional and Metabolic Imaging, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland.

We understand that data and image acquisition can be time consuming and labor intensive. Therefore, our systems are designed to improve throughput, increase efficiency and improve accuracy, allowing you to collect high quality data.



k-t SENSE Cardiac Imaging at 9.4T
Data Courtesy: CABI, University College London, and BIC Imperial College London, UK

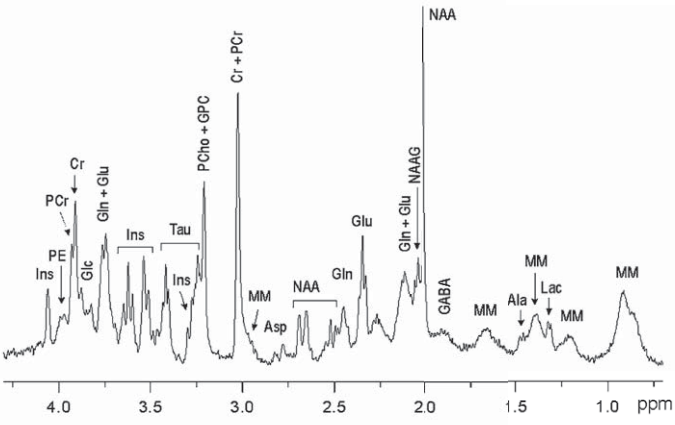


Sodium MRI of Kidney at 9.4T
Data Courtesy: Indiana University School of Medicine

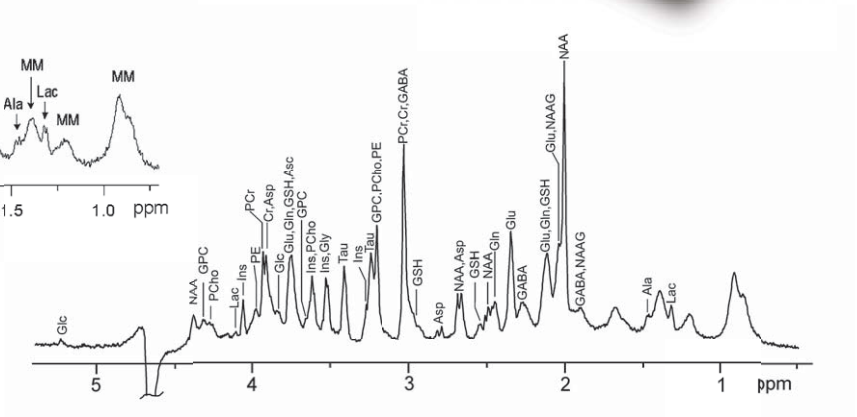
Complete, Flexible MRI Systems

Agilent offers a complete range of pre-clinical MRI systems. Each Agilent MRI system includes the DD2 console, a high field or ultra-high field magnet, gradient and RF coils, VnmrJ 3.1 software, and a selection of sample handling options to meet your specific needs.

Working together with a range of clients, Agilent is able to produce high field magnetic systems exhibiting very high stability and consistency. The architecture of the Agilent DD2 console allows superior performance on multiple channels. Our VnmrJ 3.1 Software supports an extensive library of 2D, 3D and advanced MRI pulse sequences.



9.4T (above) and 14.1T (right) Brain Spectroscopy Data courtesy: Laboratory of Functional and Metabolic Imaging, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland.



Data courtesy: Center for Magnetic Resonance Research, University of Minnesota, Minneapolis, MN, USA.

High Field MRS

4.7-9.4T Horizontal Bore Magnet Systems

Pre-Clinical MRI at its Best

High Field MRI Systems

Available in a range of bore sizes from 160-900mm and in field strengths from 4.7-9.4T, Agilent's high field magnets are renowned for their market leading performance. Most systems are available with active shielding technology. The proton operating frequency of each system is dependent upon field strength.

The core products in the range comprise two MRI systems.

The Agilent MRI System is an adaptable MR imaging platform that can be utilized in many MRI applications well as in the development of novel research processes.

The Discovery MR901 System is a complete pre-clinical MRI system operating on a clinical environment interface facilitated by GE Healthcare.

9.4T/310mm

7T/210mm

Specifications for Horizontal Bore Magnet									
	MRBR	MRBR	MRBR	MRBR	MRBR	MRBR	MRBR	MRBR	MRBR
Product	4.7T/310	7.0T/160	7.0T/210	7.0T/310	7.0T/400	9.4T/160	9.4T/210	9.4T/310	9.4T/400
	ASR	ASR	ASR	ASR	ASR	ASR	ASR	ASR	ASR
Operating field (T)	4.7	7	7	7	7	9.4	9.4	9.4	9.4
Bore Size excl RT shim and Gradients (mm)	310	160	210	310	400	160	210	310	400
Homogeneity volume (mm DSV)	150	80	80	140	200	80	80	140	200
Homogeneity: fully shimmed peak to peak (ppm) / (mm) DSV	<±5ppm / 150mm	±2ppm / 80mm	±2ppm / 80mm	±2.5ppm / 150mm	±2.5ppm / 200mm	±2ppm / 80mm	±2ppm / 80mm	±2.5ppm / 140mm	±2.5ppm / 200mm
Homogeneity: superconducting only peak to peak (ppm) / mm DSV		±5ppm / 80mm	±4ppm / 80mm	±10ppm / 150mm	±10ppm / 200mm	±4ppm / 80mm	±4ppm / 80mm	±10ppm / 140mm	<10ppm / 200mm
System length (mm)	1280	1012	1280	1636	1998	1224	1420	1704	2286
Minimum ceiling height (mm)	3150	3130	2485	3030	3033	3300	3030	2990	3530
System diameter (mm)	1360	1350	1250	1655	2171	1500	1655	1740	2708
Zero boil-off	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Fringe field (5 Gauss) (Axial x Radial) (m)	2.3 x 1.5	2.1 x 1.1	1.5 x 1.4	2.6 x 1.2	4.2 x 2.3	2.4 x 2.0	3 x 2	3.6 x 2.2	5 x 3.6

Ultra High Field MRI

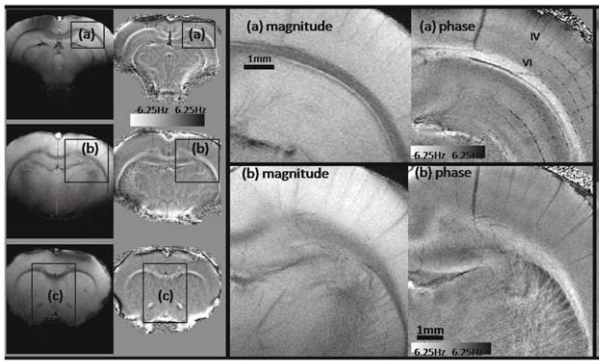
11.7-18.8T Horizontal Bore Magnet Systems

Meeting our Customers' Needs

Agilent's Ultra High Field MRI magnets adopt the same high standards and practices as the high field magnets. In field strengths of 11.7T to 18.8T, and with bore sizes 160-400mm, these cutting-edge designs take into account every aspect of a client's needs, including ease of use, running cost and space constraints.

We incorporate market-leading superconducting technology to meet even the most demanding requirements and technological specifications.

And with each one being built for individual purposes and customer requirements, you can be confident of superb MRI performance every time.



In vivo brain phase imaging at 14.1T
Data courtesy: Laboratory of Functional and Metabolic Imaging, Ecole Polytechnique Fédérale de Lausanne, Lausanne, Switzerland.

11.74T/160mm

16.4T/260mm

Specifications for UHF Horizontal Bore Magnet Systems

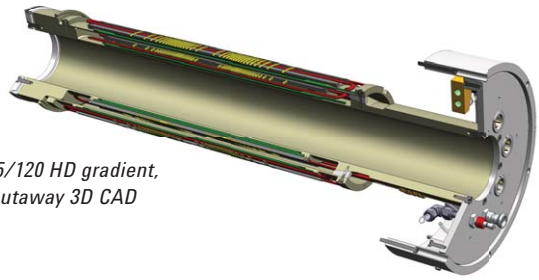
	MRBR	MRBR	MRBR	MRBR	MRBR	MRBR	MRBR	MRBR
Product	11.7/160	11.7/210	11.7/310	11.7/400	14.1/260	16.4/260	17.6/210	18.8/210
	Active	Active	Passive	Passive	Passive	Passive	Passive	Passive
Operating field (T)	11.7	11.7	11.7	11.7	14.1	16.4	17.6	18.8
Operating temperature (K)	4.2	2.3	2.3	2.3	2.3	2.3	2.3	2.3
Bore Size excl RT shim and Gradients (mm)	160	210	310	400	260	260	210	210
Homogeneity volume (mm DSV)	80	100	150	200	130	100	100	100
Homogeneity fully shimmed peak to peak (ppm /mm DSV)	±2.5ppm / 80mm	±2.5ppm / 100mm	±2.5ppm / 150mm	±2.5ppm / 200mm	±2.5ppm / 130mm	±4ppm / 100mm	±2.5ppm / 100mm	±2.5ppm / 100mm
Homogeneity super conducting only peak to peak (ppm /mm DSV)	±10ppm / 80mm	±10ppm / 100mm	±5ppm / 100mm	±5ppm / 100mm	±10ppm / 130mm	±10ppm / 100mm	±5ppm / 100mm	±5ppm / 100mm
Minimum Hold Time between Helium refills (days)	365	365	50	50	50	50	32	32
Minimum Hold Time between Nitrogen refills (days)	N/A	N/A	8	8	14	14	14	14
System length (mm)	1400	1680	2240	2600	2132	2572	2572	2920
Minimum ceiling height (mm)	2950	3030						
System diameter (mm)	1840	1690	2100	2380	1820	2100	2100	2380

Gradient Coils

High Duty Cycle Gradient Coils

Agilent's latest generation of high performance gradients has been designed and developed by MR scientists to address the most challenging techniques and applications at the highest magnetic fields.

Nested Gradients



Agilent 205/120 HD gradient, including cutaway 3D CAD

Features include:

- Excellent heat extraction, providing industry-leading high duty cycle performance
- Improved peak strength with short rise times
- Microgroove technology for superior magnetic shielding
- High slew-rates
- Superior gradient linearity
- High strength room-temperature shims
- HD 305/210 and HD 205/210 now rated to 300A peak current providing increased gradient strength performance

Specifications for Gradients						
Outside diameter:	395mm	305mm	205mm	156mm	156mm	115mm
Inside diameter:	290mm	210mm	120mm	100mm	90mm	60mm
Peak Current:	300A	300A	300A	200A	200A	200A
Peak Voltage:	500V	500V	500V	300V	300V	300V
Gradient sensitivity:	0.333mT/m/A	1.0mT/m/A	2.0mT/m/A	2mT/m/A	3.75mT/m/A	5.0mT/m/A
Maximum gradient strength:	100mT/m	300mT/m	600mT/m*	400mT/m	750mT/m*	1000mT/m*
Maximum slew rate:	>380T/m/s	>700T/m/s	>4444T/m/s	>3000T/m/s	>5770T/m/s	>7690T/m/s
Maximum DC current in all 3 axes simultaneously, $I_{DC\ Max}$	100A	75A	75A	55A	45A	50A
Duty cycle @ I_{Max}:	11.1%	6.25%	6.25%	7.6%	5.1%	6.25%
Minimum inductive rise time:	162µsec	229µsec	38µsec	50µsec	54µsec	16µsec
Gradient sub-system rise time:	260µsec	425µsec	135µsec	130µsec	130µsec	130µsec
Linearity (% over DSV):	<5 %/200mm	<5 %/120mm	<5 %/80mm	<5 %/75mm	<5 %/60mm	<5 %/40mm
Number of shims:	9 (including gradient shims)					
Shim strengths:						
Z^0	348mG/A	380mG/A	530mG/A	470mG/A	505mG/A	510mG/A
Z^2	16.6mG/cm²/A	29.7mG/cm²/A	87mG/cm²/A	89.7mG/cm²/A	127mG/cm²/A	157mG/cm²/A
ZX, ZY	5.1mG/cm²/A	12.2mG/cm²/A	41mG/cm²/A	62mG/cm²/A	73.5mG/cm²/A	124mG/cm²/A
2XY, X2-Y2	2.5mG/cm²/A	5.6mG/cm²/A	12.7mG/cm²/A	16.8mG/cm²/A	23.5mG/cm²/A	40mG/cm²/A
Shim algorithm	3D Automatic					
Shim algorithm	Manual Interactive					

RF Coils

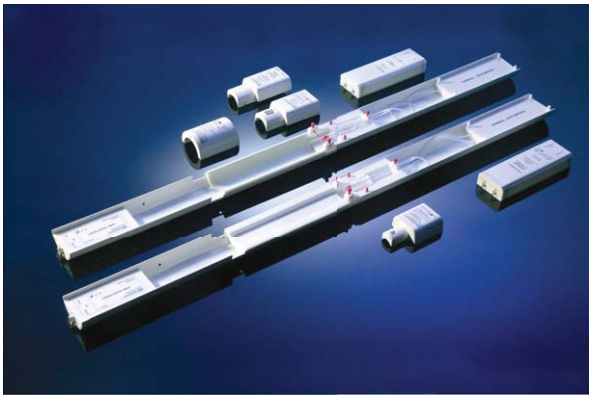
For Every Application

A key feature of Agilent's complete range of RF coils is the high level of RF homogeneity and stability, which is vital to effective imaging, whether in the transmit or receive phase, while maintaining excellent signal to noise ratios.

We have an extensive catalogue of RF coils, which fall into five key categories central to MRI applications. These are:

- Millipede: Suitable for whole body scanning and micro-imaging, these coils produce consistent imaging with reduced potential systematic errors
- Volume: suitable for all pre-clinical applications, the sample fits fully inside the coil, minimizing the distance between the coil body and the sample surface.
- Surface: ideal for oncology, surface coils enable increased signal-to-noise ratios.
- Phased Array: ideal for neurological, spinal and cardiac imaging, these coils are available in a variety of anatomical spatial arrangements.
- Dual-tuned: these can increase your productivity by a significant amount, because they capture data at two different frequencies at the same time. Volume and surface coils are available in dual-tuned format.

Millipede RF Coil



Selection of Phased Array RF Coils and support devices.

Sample Handling

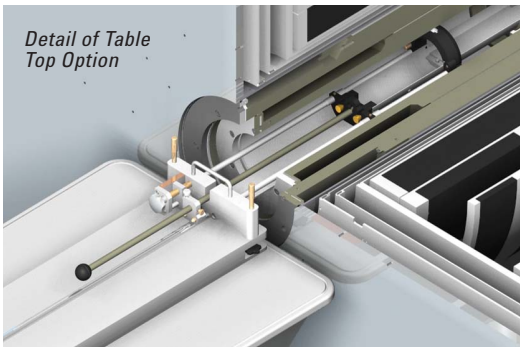
Sample Positioning System

Designed for Ease-of-use

Agilent's sample handling products are able to meet customer demands, whatever the specifications. Each is made to a very high standard, and greatly improve ease of sample handling and image quality.

We offer two options: the LITE system for unscreened rooms, and either the table top or cart system for screened rooms. .

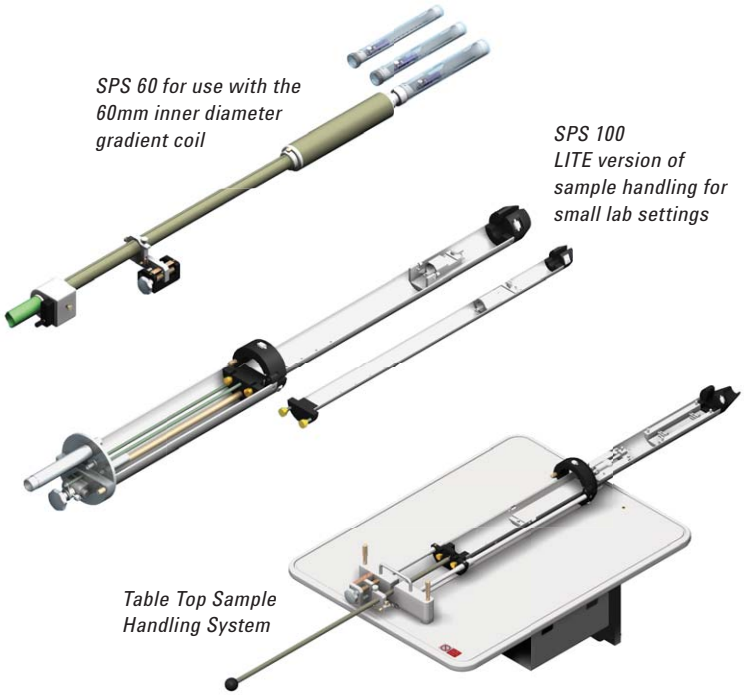
Cart Option



Detail of Table Top Option

Features and Benefits

- Fine adjustment from the end of the positioner ensures repeatable placement of your sample in the iso-centre.
- Positioners and sample cradles are available across our entire range of gradients.
- Easy adjustment of the table height seamlessly accomodates sample preparation and insertion.
- The large flat surfaces of the table and cart allow convenient access to additional equipment.



SPS 60 for use with the 60mm inner diameter gradient coil

SPS 100 LITE version of sample handling for small lab settings

Table Top Sample Handling System

Cradle OD	Nominal Sample weight	RF coil					Positioner configuration				Magnet bore size for 4.7T – 11.7T			
mm	Up to gm	Volume/ phased array	Millipede	Brain	Cardiac	Surface	LITE	Table	Cart	RF shielding Option	160mm	210mm	310mm	400mm
29	25	•	•				•			•	•	•	•	
33	25	•	•				•			•	•	•	•	
38/39	30	•	•				•	•		•	•	•	•	
62	30	•		•	•	•	•	•		•	•	•	•	
71	300	•		•	•	•	•	•	•	•	•	•	•	•
138	300	•		•	•	•		•	•	•			•	•
148	300	•		•	•	•		•	•	•			•	•

Software

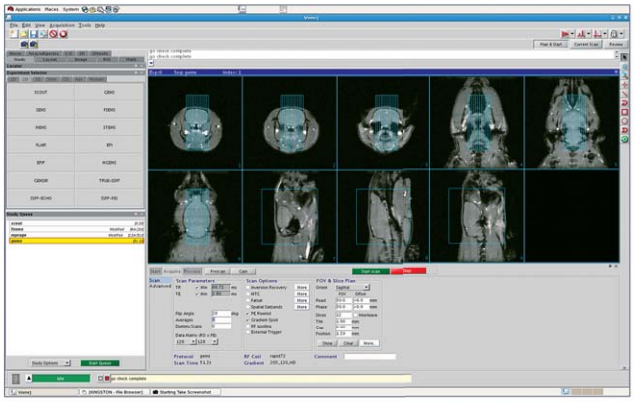
Pulse Sequence Library

Agilent Pulse Sequence Library

The Agilent MRI sequence library is constantly being revised, updated, and enhanced. The sequences are fully parameterized for maximum flexibility.

- VnmrJ 3.1 Software
- Standard 2D Imaging Sequences
- Diffusion-weighted 2D Imaging Sequences
- Standard 3D Sequences
- Advanced MRI Sequences
- Magnetic Resonance Spectroscopy (MRS) Sequences
- Shimming

FSEMS protocol



GEMS protocol

Standard 2D Imaging Sequences

All standard 2D sequences described below are designed for ease of use.

- SEMS – A 2D spin-echo MRI
- MEMS – A 2D multi-echo MRI
- GEMS – A 2D gradient-echo MRI
- MGEMS – A 2D gradient-echo MRI with multi-echo acquisition
- GEMSIR – An inversion recovery MRI with 2D gradient-echo - can be used for T1map
- FSEMS - A 2D Fast Spin Echo MRI
- FLAIR – Fluid-attenuated inversion recovery MRI
- Echo Planar 2D Imaging Sequence - Designed for use by a non-MRI expert using a simple setup pre-scan for routine EPI imaging

Advanced MRI Sequences

- Cardiac MRI – for looking at phases of the cardiac cycle and reconstruction of the images for creating CINE views of the beating heart
- Arterial spin labeling MRI – for measuring perfusion
- EPI-FAIR – slice-selective inversion recovery pulse on the imaging slice. The control is a non-selective inversion recovery pulse.
- EPI-STAR – slab-selective inversion recovery pulse applied below the imaging slice. The control is above the imaging slice.
- EPI-PICORE – slice-selective inversion recovery pulse applied below the imaging slice. The control is a non-selective inversion recovery pulse.
- SSFP – A steady-state free precession MRI
- Localized Spectroscopy - LASER, SPECIAL, Short Echo STEAM

Site Planning

Your Partner in Planning

Evaluating and deciding on the right MRI system takes time, but it is just the beginning of our relationship with you the customer.

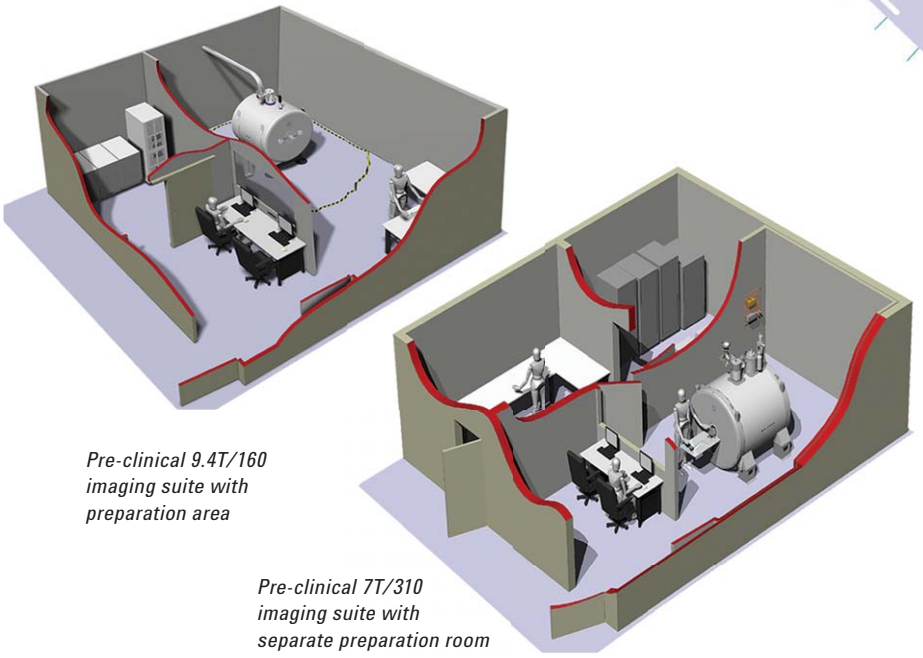
Here at Agilent, we know that our role doesn't stop when your system is ready. Site planning, and ensuring the correct pre-requisites are in place, are just as important as helping you select which system meets your research needs.

We will be on hand to help you plan and prepare the location for the installation of your new imaging equipment. This includes an additional site survey to identify and eliminate potential issues that could impact operation of the magnet once it is energized.

Maximum Capability, Minimum Footprint

All of our systems are designed to have the smallest physical footprint possible, while providing you with maximum imaging capability.

We recommend you have 3-4 rooms dedicated to your new MRI system, but we will work with you to find a solution to whatever space constraints you may have.



Pre-clinical 9.4T/160 imaging suite with preparation area

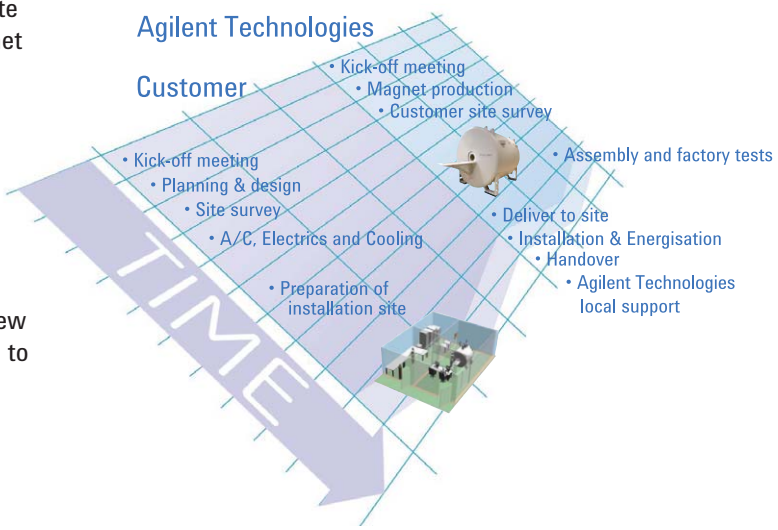
Pre-clinical 7T/310 imaging suite with separate preparation room

Implementation Timeline

The implementation of our system is designed to be as efficient as possible, allowing you to continue with your research quickly.

The four key dates of the system implementation timeline are:

- Start of the project
- Build of the installation environment
- Delivery and installation of magnet system
- Commission and hand-over to the customer



Protecting Your Assets

RF shielding is an available option with all of our systems, giving you peace of mind that your installation will provide a safe working environment for all personnel who come into contact with the equipment.

The RF room is a custom, insulated, turn-key magnet room, which includes effective sound proofing designed to shield the room's exterior, while an oxygen monitor gives you clear indication of the working conditions inside.

The Measure of Confidence

Agilent is a name that is synonymous with measurement. With expertise that spans electronic measurement, chemical analysis and the life sciences, you can be sure that our products will meet your toughest requirements.

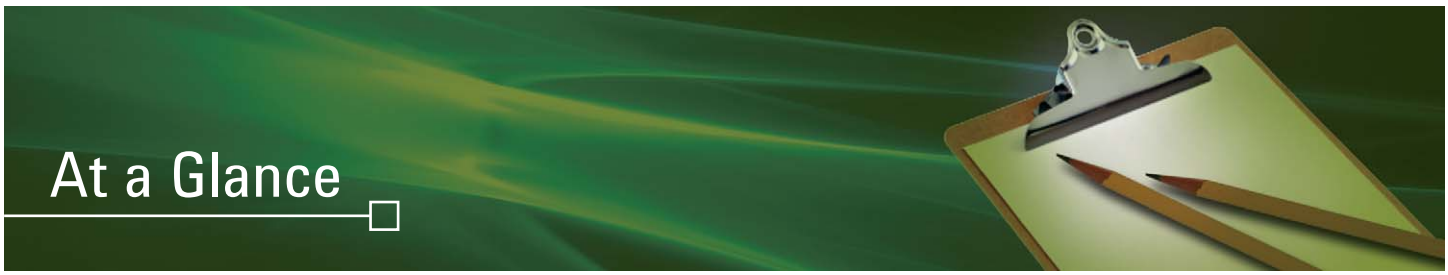
We pride ourselves on providing the world's most complete, most reliable laboratory productivity solutions, optimized for your applications and workflows. Through a combination of industry-leading instruments, accessible scientific expertise, easy-to-use software and a full range of global support services, we are committed to delivering better results, faster than ever.

Our MRI systems are no different. Our extensive expertise dates back to the founding of Magnex Scientific in 1982. As a result, our customers have benefitted from the experience and knowledge of our design teams and scientists, who bring a wealth of information into the design of each and every system we build.

Discovery MR901 (7T/310)

9.4T/310mm magnet

Agilent's magnet facility in Yarnton, UK.



At a Glance

We have provided this table so that you can compare our best selling systems at a glance. Further information can be found inside this brochure, or by contacting us using the information on this page.

Magnet System	7T (300MHz)		9.4T (400MHz)	
Bore size	210	310	210	310
Length	1280mm	1636mm	1420mm	1719mm
Width	1200mm	1690mm	1690mm	1740mm
Min. ceiling height	3125mm	3030mm	3030mm	2990mm
Homogeneity (ppm/DSV)				
Fully shimmed	< ±2 / 8cm	< ±2.5 / 15cm	< ±2 / 8cm	< ±2.5 / 14cm
Superconducting only	< ±4 / 8cm	< ±10 / 15cm	< ±4 / 8cm	< ±10 / 14cm
Fringe Field (5 Gauss line)				
Radial	1.5m	2.1m	2m	2.2m
Axial	1.4m	2.6m	3m	3.6m

Main Gradient				
Outside diameter	205mm	305mm	205mm	305mm
Inside diameter	120mm	210mm	120mm	210mm
Peak current	300A	300A	300A	300A
Max. gradient strength	600mT/m	300mT/m	600mT/m	300mT/m

Sample Positioning (optional)				
Trolley				
OD of optional positioners available	N/A	210mm	N/A	210mm
	120mm	120mm	120mm	120mm
	60mm	60mm	60mm	60mm
Table				
OD of optional positioners available	N/A	210mm	N/A	210mm
	120mm	120mm	120mm	120mm
	60mm	60mm	60mm	60mm
LITE				
OD of optional positioners available	N/A	210mm	N/A	210mm
	120mm	120mm	120mm	120mm
	100mm	100mm	100mm	100mm
	90mm	90mm	90mm	90mm
	60mm*	60mm*	60mm*	60mm*

* No additional cradles are required for use with this positioner

Applications of RF Coils	Surface	Dual-Tuned	Volume	Phased Array	Millipede
Oncology	✓	✓	✓		
Spectroscopy	✓	✓	✓		
Neurology (Brain and Spinal)	✓	✓	✓	✓	
Cardiac Scanning			✓	✓	
Micro-Imaging			✓		✓
Whole Body Anatomic Scanning				✓	✓

For more information

Learn more:
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