

Frequently Asked Questions (FAQ)

Aspect Imaging M-Series™ Compact MRI

This Frequently Asked Questions document has been created to help answer some of the most asked questions by people newer to MRI imaging and address some M-Series™ Compact MRI-specific questions.

Q 1. What is MRI?

MRI stands for magnetic resonance imaging that uses magnetic fields and radiofrequency waves to generate images. MRI is non-invasive, produces three-dimensional anatomical images and is often considered the gold standard in soft tissue imaging. It is often used for disease detection, diagnosis, and a wide variety of anatomical targets including the brain, tumors in all tissue types, the heart, abdominal organs, adipose tissue, and muscle.

Q 2. How does MRI work?

MRI is based on the protons within water molecules, which are randomly oriented. The magnetic field temporarily realigns the protons within water and tissue. A radiofrequency pulse is applied which excites the proton out of alignment with the magnetic field. As the protons return to their previous state, energy is emitted which is the source of the MR signal used to create an image.

Q 3. What is the M-Series compact MRI?

The M-Series is a compact self-shielded MRI manufactured by Aspect Imaging. It operates at 1T and is a permanent magnet. The M-Series produce high-resolution 3D whole body, anatomical, functional, and molecular images of small animals. The M-Series product line includes the M3, M5, M7, and M12. The difference between the systems is the bore size, which affects the overall size of the system. The M3, is a mouse-only system; the M5 can image mice and small rats, the M7 can image animals ranging in size from mice to 700g rats, and the M12 can image non-human primates.

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Q 4. What is a permanent magnet?

A permanent magnet is composed of magnetic materials, like a strong fridge magnet. Once the magnet is charged, it maintains its magnetic field without any input of electricity or other external components. The Aspect M-Series is an example of a system using a permanent magnet.

Q 5. What is the difference between a permanent magnet and a superconducting magnet?

Permanent magnets are composed of magnetic materials, which typically create a lower field strength (i.e., 1 Tesla); this field is maintained without any additional external resources. Superconducting magnets use magnetic materials and electricity to create the magnetic field, typically 3 Tesla or higher. This field needs to be ramped up over time and requires a continuous supply of electricity to maintain the magnetic field. As a result, a large amount of heat is produced by superconducting magnets, and this heat needs to be dissipated which is often done with water or cryogenes.

Q 6. What are the infrastructure requirements for a superconducting magnet system vs the M-Series permanent magnet system?

Superconducting magnets, when they are not self-shielded, require a specialized room to shield the magnetic field from the surrounding areas, and this room must be devoid of metal objects. Therefore, the user workstation is often outside the magnet room.

A form of cooling is also required for superconducting systems, often using water or cryogenes. As a result, there needs to be a continuous cold-water source or cryogen storage within the MRI suite; and if water is used then a means of draining away the wastewater is needed. Along with the cooling source, are the considerations for the ongoing maintenance of the cooling mechanism, as the superconducting magnets are “always on” and therefore heat is being produced which must be dissipated to avoid catastrophic failure of the magnet.

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On the other hand, the M-Series is self-shielded so it does not need a dedicated space and can be placed in a room with other equipment. The M-Series is a permanent magnet, and as described previously does not require any cooling. The only infrastructure required to operate the M-Series system is a single 220V electrical plug. Electricity is required to run the electronics cabinet, which is only turned on during an active imaging session.

Q 7. Where can the M-Series system be placed within a lab?

The M-Series system can be placed anywhere within an existing lab, including next to other equipment, next to metal objects, and can even be placed within sensitive areas such as an animal facility. The system is composed of 3 components: the magnet, the user workstation, and the electronics cabinet. The magnet and the user workstation should be placed nearby to one another so that the operator can initiate the scans quickly after placing the imaging subject within the system. However, the electronics cabinet has a 7-meter-long cord, which allows the electronics to be placed in a different part of the room or in another room or floor if space is constrained.

Q 8. What kind of calibration and optimization is required for imaging sessions on the M-series?

The calibrations and the tuning/matching of the coils are all automated and performed by the system for each imaging subject. Initial protocol sets are provided as factory defaults on the M-series, these are a starting point to provide quality images without the need to change parameters. However, optimization of the sequence protocols is reviewed during applications training and there is a quick access tab containing the parameters that are often optimized or changed. Sequence protocols can be saved, and a protocol list can be assembled for consistency across studies.

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Q 9. Do you need an MRI technician to run the M-Series?

An MRI technician is not required to operate the M-Series. The software interface is very user-friendly, and the workflow is streamlined. As protocol lists can be saved, multiple labs or users will be able to load their protocols, establish their geometry (region of interest), and the system will acquire images. By using the protocol lists the images are acquired in the same way every time, allowing for more reproducible data across a longitudinal study.

Q 10. Can you incorporate PET or other modalities for multimodal imaging?

The M-Series has multimodal imaging options. The M7 can be paired with the SimPET insert which allows for simultaneous PET and MR imaging. The SimPET can also be used for standalone operations to acquire PET only data. Adding PET for multimodal imaging adds functional data to the anatomical data of the MRI. The M-Series can easily be incorporated with other imaging modalities like optical imaging and ultrasound.

Q 11. Do you need to have prior experience with MRI to incorporate the M-Series into your research?

You do **not** need to have prior experience or knowledge of MRI to incorporate the M-Series. The M-Series is extremely user-friendly and is designed to reduce the cost, complexity, and technical burden of conventional MRI. Users typically acquire images within the first day of training and do **not** need a background in MR physics. However, the software has full flexibility to tailor parameters for users who have a background in MRI.

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M-Series™

Compact MRI instrumentation
for small animals.

