What Life Scientists Should Know About Molecular Imaging

MR Fundamentals for Life Scientists

Magnets for Magnetic Resonance Imaging Systems

Michael Parizh
MRI Technology and Systems, General Electric Global Research, Niskayuna, New York, USA

Learning Objectives:

- New applications of MRI
- Customer requirements to MRI scanners: critical and desirable requirements
- Magnets and gradient coils

Magnetic Resonance Imaging (MRI) is a powerful diagnostic tool that the medical community considers as a procedure of choice for visualization of soft tissues. More than 30,000 MRI systems are installed in hospitals worldwide. Magnet is the largest and most expensive component of an MRI system. MRI was introduced in late 1970s with resistive magnets. Today, customer may choose between superconducting, permanent and electric magnets. Superconducting magnets are used in more than 75% of MRI system making MRI the largest commercial application of superconductivity. Recent decade has marked substantial progress in MRI magnets and systems. The 3.0 tesla horizontal field and high-field vertical field open whole-body MRI systems have become commercially available. Increased bore size improved patient comfort. Newer superconducting magnets typically require helium refill once in more than three years if ever. The magnet configuration is determined by numerous competing requirements including optimized functional performance, patient comfort, ease of siting in a hospital environment, minimum acquisition and lifecycle cost. The factors that drive the magnet requirements are increased center field, maximized uniformity volume, minimized stray field, magnet compactness, long helium refill period, and more. Advances in the cryogenic technology and magnet design practice provide means for improvements in magnet performance while meeting the market requirement for continuous system cost reduction.

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