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Cost-Effective Whole-Body Low-Field MRI Scanner Unveiled

At its Shape 22 press conference, Siemens Healthineers (Erlangen, Germany) presented its digital whole-body MRI scanner, Magnetom Free.Star. Like the preceding Magnetom Free.Max, the Magnetom Free.Star achieves its image quality, digitally. The two scanners are based on Siemens's 'High-V MRI' platform, which combines advances in digitisation and artificial intelligence with the compactness of low-field MRIs. The Magnetom Free.Max and Magnetom Free.Star, respectively, have patient bores of 80 and 60 cm.

Both feature Siemens's proprietary magnet technology, which heavily factors into making these scanners compact. MRI scanners generate magnetic fields using helium-cooled superconducting magnets. The ultracold temperatures reduce electrical resistance to enable superconducting phenomena upon which the scanner's magnetic field generation depends. Liquid helium is required to maintain stable magnetic fields because temperature increases quench the magnetic field. Conventional MRIs require hundreds of litres of liquid helium for cooling. Refrigeration requirements and the need for maintaining large helium inventories influence the space needed for imaging facilities to operate MRIs. The technology focuses on minimising the mass of the cold parts so that less liquid helium is needed. The system is designed to be cooled by thermal conduction, eliminating the need for liquid helium immersion. The structure is also designed to minimise heating by interaction with the gradient coil. Thus, only 0.7 litres of liquid helium are needed for cooling.

Both scanners can also be considered low-field MRIs (< 1.5 T). Image resolution and quality increase with greater magnetic field strength, but so, unfortunately, does cost. The performance cost equation favoured larger magnetic fields over the last 30 years. The MRI standard is 1.5 T. Siemens's image processing technology increases image sharpness and reduces scan time due to reconstruction based on deep learning algorithms and targeted denoising. Since both scanners feature the technology, they use 0.55 T to achieve practical medical imaging.

These innovations make the scanner (Magnetom Free.Star) compact and lightweight enough to roll through hospital corridors. The comparatively lower cost of low-field MRI scanners, along with the reduced operational requirements and smaller footprint, make this whole-body scanner more accessible where MRI scanners are not widely available. This is important given that MR imaging is commonly used to diagnose soft tissue injuries and helps in the early diagnosis and treatment of cancer, neurological diseases, and orthopaedic problems. Arthur Kaindl, Head of Magnetic Resonance Imaging at Siemens Healthineers, adds: 'Right now, more than half of the world's population has no access to MRI examinations. The limiting factors include installation and operating costs as well as the lack of qualified personnel.'

Source:

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