Press Release | September 2023 | Magdeburg

Neoscan Solutions receives the order for providing the world's strongest human whole-body MRI magnet.

Neoscan Solutions announced today that it has been assigned to build the world's first 14T MRI magnet, using a transformational magnet technology based on a high temperature superconductor (HTS). This national lighthouse project of the Netherlands will be installed at the Radboud University of Nijmegen.

- Neoscan Solutions builds the worldwide first 14 Tesla MRI magnet using an innovative technology on the basis of high temperature superconductors (HTS)
- The client is the DYNAMIC consortium, formed by seven Dutch institutions engaged in neurological research and medical imaging, and led by the Radboud University of Nijmegen. The national lighthouse project is funded with 19 million euros by the science community of the Netherlands (NWO).
- This is the first high field magnet which is cooled conductively without using a liquid Helium. The magnet is not sealed but bolted, with a closed product cycle. It weighs less and is more compact than conventional magnets.
- All other high field magnets to date are based on low temperature superconductors. Currently only systems up to 7 Tesla are released for medical application. A 10.5T research system is run in Minneapolis, an 11.7 Tesla system in Paris; two more 11.7 Tesla are currently being installed in the U.S: and in South Korea.

Magdeburg, 19th September 2023 – Neoscan Solutions GmbH, an emerging medical device manufacturer specializing in magnetic resonance imaging (MRI), announced today that it has received the order for building the 14 Tesla magnet of the world's strongest MRI system for human use.

MRI is a diagnostic method which solely uses magnetic fields and radio-waves, both of which are considered not harmful. It allows to acquire high quality 3D images of organs, functional contrasts, angiographs, and dynamical measurement especially of soft tissue. The image quality increases with the increasing strength of the main magnetic field. In the early 90s, the first 1.5 Tesla systems set today's clinical standard, in the early 2000 years 3 Tesla system became available, later 7 Tesla system first for research, today also for clinical use. History shows that the field strength has been at least doubled, to achieve significant progress in the results. At the same time the realization of a new field strength is an effortful undertaking, due to extremely high requirements of MRI regarding the homogeneity and stability of the field. With this in mind, it is not a given that with Neoscan Solutions a young company is tasked to develop the first 14 Tesla MRI magnet.

Neoscan Solution has pioneered a transformational MRI magnet technology based on high temperature superconductors (HTS). HTS wires are fragile and require novel production processes. Once the technology is mastered however, HTS magnets show significant advantages compared to today's traditional 1.5 to 7 Tesla magnets that use low temperature superconductors (LTS), which operate below the evaporation point of liquid Helium at ~ 4 Kelvin. HTS magnets can be run dry i.e. without using any liquid Helium, can be built in a more compact fashion and are lighter, and can generate and tolerate a much higher ambient magnetic field. The last factor became decisive for taking the next step: Since unknown technical risks are associated with doubling the field strength in LTS technology, Neoscan Solutions has been tasked to build the 14 Tesla magnet in HTS technology. The 14 Tesla HTS magnet remains compact despite its strong field, of similar size as a 3 Tesla clinical magnet.

In the Netherlands, seven leading institutions in the fields of medical imaging and cognitive research have joined forces by forming the DYNAMIC consortium. David Norris, the principle investigator of DYNAMIC, and Professor at the Donders Centre for Cognitive Imaging of Radboud University in Nijmegen explains his view on the magnet technology: "It appears that HTS magnet technology, which is used already in small bore research magnets at fields of 25 Tesla and above, avoids some of the risks of LTS technology. Further, in my perception it became a critical element of our grant proposal not to push an existing technology to its extreme limit, but to also invest into new technology, to overcome some of the principle limits of MRI as we know it."

Stefan Roell, executive director of Neoscan Solutions, adds his view on the project: "Within four years, our R&D team has established a new magnet technology. Now we are ready to take the next step. It is a large step, but I am confident that we will complete the project according to plan, mainly for two reasons: one, we know the superconductor has what it takes; two, we are pursuing a modular and reversible approach for building the magnet, interleaved with test cycles of-sub-components under realistic conditions. By building the magnet iteratively, we will find potential errors early on, and will correct them. If we had to build the magnet in a single go instead, as it is mostly done in conventional magnet technology, I would not be sleeping as quietly as I am."

The DYNAMIC 14T MRI will be an exceptional research platform, from which we will gain knowledge e.g. by resolving even finer structures of the brain even better, by depicting dynamic processes such as thinking in a time-resolved fashion, and by visualizing even molecules beyond water such as neurotransmitters. Further, through this project, we will learn also a lot about HTS magnet technology, which also has the potential to make MRI more accessible to all patients, and to run MRI systems more climate friendly.

About the DYNAMIC consortium:

The academic members of the DYNAMIC consortium are the Amsterdam UMC, the Spinoza Centre, the Leiden University Medical Centre, the University Medical Centre Utrecht, the Radboud University Nijmegen, the Radboud University Medical Centre, and the University of Maastricht. In 2023, the consortium has won funding of 19 million Euros by the National Roadmap Large-Scale Research Infrastructure initiative of the Netherlands Research Council (NWO), for building the world's strongest 14T MRI at Radboud University in Nijmegen, NL.

For more information, please visit:

[Strongest MRI scanner in the world will be built in the Netherlands | Radboud University (ru.nl)]

About Neoscan Solutions:

Neoscan Solutions is a young MedTech company focused on developing, manufacturing, distributing, and servicing breakthrough innovations in the field of MRI. The company has recently been certified as a medical device manufacturer according to ISO 13485. In addition to a clinical pediatric MRI system, it offers preclinical MRI solutions, as well as components such as HTS MRI magnets, digital consoles and MRI Software.

Professor Rose, the director of the Research Campus STIMULATE, and Dr. Gerhold, the founder of the GETEC group of companies, took the initiative that Neoscan Solutions was established in 2017: Karl Gerhold has provided a frame of funding and won Klemens Gutman, shareholder of regiocom, to invest as well, thus enabling Stefan Röll to found and build Neoscan Solutions in Magdeburg, Saxony-Anhalt. The Otto-von-Guericke University and the Research Campus STIMULATE who are engaging in joint research projects have been key for the vibrant development of the company. Neoscan Solutions is grateful for support by the state of Saxony-Anhalt, and for support of the program "KMU innovativ Medizintechnik" by the Federal Ministry of Education and Research.

Neoscan Solutions strongly believes in collaborating with non-academic and academic partners. Together we can reach so much more than each party on its own, and we keep looking for partners who share our vision and are going to revolutionize the field of MRI together with us.

For further information, please visit our website:
https://www.neoscan-solutions.com/

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Keywords: MRI, UHF-MRI, 14T-MRI, HTS-Magnet, MedTech, Disruptive-Innovation

The architect’s view on the new 14 Tesla MRI system

Ultra High Field MRI Magnet Technology

magnet technology	LTS Low temperature superconductor	HTS High temperature superconductor
superconducting material	alloys such as niobium-tin	chemical compounds such as rare-earth barium copper oxides
strongest adult-size magnet	11.7 Tesla	14 Tesla
typical maximum operating temperature	4 Kelvin	20 Kelvin
typical cooling technology	^{2}He liquid helium	dry conductive cooling
typical size of an adult-size >= 11.7 T magnet length x height x warm bore	11.7T: 370 x 270 x 68 cm	14T: 200 x 150 x 82 cm
typical mass of an adult-size >= 11.7 T magnet	10t 10t 10t 10t 10t 10t	10t 5t
product cycle		

The term “ultra high field” (UHF) refers to magnets of 7 Tesla or higher in the field of MRI
Literature used; LTS: R. Warner (2016), Supercond. Sci. Technol., vol. 29, no. 9, p. 094006; HTS: Yi Li (2021), Supercond. Sci. Technol., vol. 34, no. 12, p. 125005
Such an HTS magnet is under construction for the DYNAMIC consortium

Features of the new HTS magnet technology in comparison to the conventional LTS technology

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