

HTS-110 Ships World-First 12 Tesla All-HTS Magnet for Neutron Science to Institut Laue-Langevin

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A state-of-the-art 12 Tesla (12 T) asymmetric magnet, the world's highest field all-High-Temperature-Superconducting (HTS) magnet for neutron scattering, has successfully passed factory acceptance testing and is now in France, en route to the Institut Laue-Langevin (ILL) in Grenoble, the world's flagship centre for neutron science.

This project was funded by the French Alternative Energies and Atomic Energy Commission (CEA), and the magnet was designed in close collaboration with teams from both the ILL and CEA. Developed by a team led by HTS-110's principal magnet designer Dr. Taotao Huang, this powerful new magnet represents a significant technological achievement. Once installed, it will offer researchers ultra-long liquid helium autonomy and unprecedented ease of use to switch, control and discover the properties of materials.

The successful factory acceptance test confirms that the magnet meets the stringent performance and safety criteria required for operation at a leading international research facility like the ILL.

"We are incredibly proud to have reached this critical milestone," said Dr. Taotao Huang. "This is a world first for this class of neutron scattering magnet using HTS conductor, and it represents a significant leap beyond the liquid-helium based LTS magnets."

Magnetic fields are an essential tool for materials research, allowing scientists to influence the magnetic moments, or 'spins', of atoms and electrons within a sample. By combining a powerful 12 T field in conjunction with the ILL's intense neutron beams, researchers can gain deeper insights into the fundamental properties of matter, accelerating the development in fields such as computing, energy, and medicine.

A key feature of the magnet is its compatibility with a dilution refrigerator (DR) insert, allowing for experiments at milli-Kelvin temperatures. The magnet will be integrated into the ILL's world-class diffractometers and three-axis spectrometers, where it will be available to researchers from 65 countries who visit the facility each year.



Key Magnet Specifications

Peak Central Field	> 12 T
Sample volume	Φ10 X 30 mm
Field homogeneity over the sample volume	<3%
Cold bore	Ø60 mm
Horizontal scattering angle	2 X 130°
Vertical scattering angle	-11° /+2°
Zero field nodes	Outside of the neutron beams
Energy	1.3 MJ
Ramping time to a full field	70 min
Cool-down time	3 days (Approx.)
Dimensions	780 x 780 x 1529 mm
Mass magnet and cryocooler	800 kg (Approx.)



The ILL is an international research centre at the leading edge of neutron science and technology. The ILL provides scientists from its member countries and around the world with a very high flux of neutrons feeding some 40 state-of-the-art instruments, which are constantly being developed and upgraded. The ILL is funded and managed by France, Germany and the United Kingdom, with scientific partnership from 10 other countries.



The French Alternative Energies and Atomic Energy Commission (CEA) is France's state-funded R&D leader, advancing defence, low-carbon energy, industrial tech and fundamental science through nine research centres and a 20 000-strong workforce. A top European patent filer, its support for the new 12 T all-HTS magnet highlights the CEA's drive to turn bold science into real-world innovation.



HTS-110, a New Zealand-based company founded in 2004, is a world leader in the design and manufacture of high-temperature superconducting (HTS) magnets and cryogen-free magnetic systems.