New furnace a step towards future collider development

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The new furnace is currently being installed and tested. Credit: Friedrich Lackner/CERN

A new furnace arrived at CERN's Large Magnet Facility last month and is currently being installed and tested.

The furnace completes the equipment required for the production of

superconducting coils, which are needed for the High-Luminosity LHC (HL-LHC) upgrade and future circular colliders.

Superconducting accelerator magnets are key for reaching higher energies and luminosities in particle accelerators.

The HL-LHC upgrade aims for magnetic fields up to 11T for the dipole magnets while the Future Circular Collider study explores using magnets with a field of 16 Tesla, almost double the 8.3 Tesla of the superconducting magnets used in the LHC.

To reach these goals new superconducting materials are needed.

"Nb3Sn has been chosen for the next generation of superconducting magnets. The field achieved with this material can reach up to 16T. The production of such coils is complex as we must first wind the coils and then perform the heat treatment that allows the tin and niobium to react and turn into the superconducting Nb3Sn compound." explains Friedrich Lackner, a project engineer who supervises the coil production for HL-LHC.

Once the material has undergone this heat treatment it becomes very brittle, which is why this process is performed after the winding process—the opposite to magnets in the LHC.

The new 32-metre-long furnace, called GL010000, will allow the heat treatment of coils with a length up to 11m and can reach temperatures up to 900°C providing a sufficient margin for future challenges.

This treatment involves a two week long process during which the coils are raised to different temperature plateaus up to 665°C. A special feature of this oven is that it is able to raise the coils to such high temperatures completely uniformly throughout the entire oven, making

sure one part doesn't heat more or less than another.

The installation of the new furnace at CERN's Large Magnet Facility (LMF) will help scientists researching and developing the new materials needed for future colliders to understand the superconductor development based on this Nb3Sn alloy, and will allow CERN to lead the production of superconducting coils and the development of high-field magnets.

Provided by CERN