



Contribution ID: 105

Type: Poster

C2Po3A-04: Cryogenic Cooldown Performance of the GE (HTIC) Compact 7 T MRI Magnet

Tuesday 20 May 2025 14:00 (2 hours)

A Compact 7 T ultra-high field and fully sealed low cryogen Magnetic Resonance Imaging (MRI) system has been developed at the GE HealthCare Technology & Innovation Center, Niskayuna, USA. The cold mass (magnet) has been cooled down to 4 K using only 12 liters of liquid helium liquified with three SHI GM type RDE-412 two-stage cryocoolers. A gas tank has been charged to 150 bar with pure helium at room temperature. Helium vapor is liquefied with several recondensing cups in contact with the cryocooler second stage. Recondensing liquid helium is collected in a liquid tank from where liquid helium flows into a closed loop thermosiphon system in thermal contact with the cold mass. The first stage of the cryocooler cools the thermal shield down to 40 K. Several pre-cooling lines are wrapped around the cold mass externally connected to an open-loop Bluefors/Cryomech MPC600 fast Cold Helium Circulation System (CHCS). All three cryocoolers and the CHCS operate in tandem to cool the cold mass down to 50 K within two weeks. Upon reaching 50 K, the CHCS is turned off and cooldown continues with all three system cryocoolers, reaching a base temperature of 4 K within 5 days. This research explains the cryogenic cooling technique adapted for a Compact 7 T MRI magnet. The cryogenic system performance during the magnet ramp to the designed magnetic field will be discussed as well.

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Session Classification: C2Po3A - Magnet and Cryomodule Heat Load Management