Contribution ID: **242** Type: **Poster**

Sat-Mo-Po.04-07: Design and performance evaluation of a 9.0 T frameless conduction-cooled superconducting magnet

Saturday 5 July 2025 09:30 (1h 45m)

A 9.0 T frameless conduction-cooled superconducting magnet has been successfully developed in our laboratory. The electromagnetic design was accomplished using a hybrid global optimization method. The magnet features a cold clear bore of 95 mm. Leveraging the frameless design, the consumption of superconducting wire is reduced by approximately 20% compared to conventional designs with an equivalent bore size and central field. Cooling is achieved using one GM cryocooler, enabling the magnet to reach temperatures below 4 K from room temperature. The magnet comprises five coaxial NbTi superconducting coils connected in series, operating at a current of 79.73 A, with a total magnetic energy storage of 0.14 MJ. A passive quench protection system is implemented through coil subdivision, ensuring self-protection by propagating the quench to all coils in the event of an overcurrent. The frameless design eliminates sliding interfaces between the coils and structural frames, preventing friction-induced joule heating during excitation and significantly reducing the occurrence of training quenches. This novel design demonstrates improved efficiency and reliability for conduction-cooled superconducting magnet systems.

Authors: CHENG, Zhiwen; LI, Jianglan; SONG, Yunxing (Wuhan National High Magnetic Field Center)

Presenter: CHENG, Zhiwen

Session Classification: Sat-Mo-Po.04 - Protection and Stability