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Superconducting quadrupole magnets in the interaction region of BEPCII-U and CEPC

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This presentation will present the superconducting quadrupole magnets in the interaction region that have been manufactured for the BEPCII Upgrade (BEPCII-U) project and then describe the superconducting quadrupole magnets in the interaction region that are being designed for the Circular Electron Positron Collider (CEPC).

The BEPCII-U project is an upgrade and renovation project based on BEPCII. The aim is to increase the highest beam energy from the current 2.47 GeV to 2.8 GeV. Based on this requirement, the existing combined superconducting magnets in the collision area of BEPCII cannot meet the design requirements, so a new magnet has to be developed to increase the magnetic field strength. The aim of the development of these magnets is to increase the magnetic field gradient of the SCQ from 18.7 T/m to 25 T/m, while maintaining other coil performance indicators, with the overall size of the magnet remaining unchanged. We have successfully wound several superconducting quadrupole magnets which have been shown by magnetic field measurements to meet the design requirements and will be used in the BEPCII-U project.

As the study of superconducting quadrupole magnets in the interaction region of the CEPC at the Higgs factory enters the CEPC engineering design report (EDR) phase, the design of superconducting quadrupole magnets in the interaction region has become one of the key challenges. The CEPC Technical Design Report (TDR) proposed a basic design scheme utilizing Cos2θ coils with iron core shielding, which meets the physical requirements. However, the iron core increases the magnet ' s weight, imposing a substantial burden on the mechanical support system. To address this issue, this study investigates the design of ironless core magnets. Two primary schemes are considered: a Cos2θ coil magnet design equipped with an external correction coil, and a Canted Cosine Theta (CCT) magnet coil design that can be modified by the parametric equations.

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