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## **Wed-Af-Po3.20-01 [54]: CCT Type Twin aperture Superconducting Quadrupole Design for CEPC Interaction Region**

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Iron free twin aperture superconducting quadrupole in the interaction region is a key technology to increase the luminosity for the high energy particle collider. The Circular Electron Positron Collider (CEPC) that China plan to build in the next 10 years, has the center-of-mass energy of 240 GeV and 33 mrad cross angle at the interaction regions. The beam separation distance at the front end of the final focusing quadrupoles QD0 (2.2m away from the interaction point) is only 72 mm, whereas the diameter of the beam pipe is 40 mm which left the useful space for the coils is very tight. Build QD0 quadrupole by using the Rutherford cable is not in practice, which needs large space and special collar to confine coil to prevent quench. In recent years, with the rapid development of the Machine tool CNC, machine precision for spatial curves is greatly improvement. A bundle of thin superconducting wires can be wound into the pre-machined slot in coil former. The coil has a Canted Cosine Theta (CCT) type, the winding direction is in a fix angle with respect to the former. The coils can also be designed with the combination of the several function magnets, or can be used to cancel out the unwanted harmonics. For QD0 magnet in CEPC, the coils in the two apertures are nearly contacted, high order harmonics will be produced from the magnetic field crosstalk, which can be calculated in precision previously. This paper will present the CCT type for the QD0 magnet, where the shape at the coil end is optimized by added several opposite harmonics to cancel out the unwanted harmonics. The axial solenoidal field compensation scheme is also present for beam dynamic requirement. Two single CCT quadrupole prototypes with each has the 500mm long will be built to testify the design idea, they will be test in the vertical Dewar at the similar fixed position as that of the QD0 quadrupole.

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