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Design and Development of Curved CCT Dipole Magnets for a Proton Therapy Gantry

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A proton therapy equipment named SC200 is developing in the Institute of Plasma Physics Chinese Academy of Sciences (IPP, CAS) and Heifei CAS Ion Medical and Technical Devices company. In order to develop a light weight gantry for proton therapy, the Canted Cosine theta (CCT) superconducting magnet technology was considered to apply in the superconducting gantry development. The designs of two curved CCT dipole magnets with the physical angles of 90 ° and 135 ° will be designed in this study. The formers of the two CCT magnets will be fabricated with different technical methods. Firstly, the magnetic fields and harmonic components of the curved CCT coils and the straight CCT coils were compared and analyzed. The effects of the curved CCT magnet design parameters on harmonic components were analyzed. Secondly, a harmonic optimized method for the curved CCT dipole magnets was approached. The designs of the two curved CCT dipole with a field quality requirement of 10-4 were presented. Finally, the mechanical structure of the magnet and error analysis on field quality were presented in this study.

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