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Design considerations of a superconducting gantry with alternating-gradient combined-function magnets

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A proton therapy facility based on the superconducting cyclotron is under development in HUST (Huazhong University of Science and Technology), which uses warm magnets for beam transport lines and gantries. For future upgrade, a lightweight superconducting gantry is under consideration. This paper describes the design of a superconducting gantry with alternating-gradient combined-function magnets and downstream scanning. $\pm 15\%$ momentum acceptance is achieved from demonstration of beam optics including high order aberrations and realistic fringe field effect. From the viewpoint of systematic design for this superconducting gantry, an integrated fast degrader and a compact scanner to perform fast 3D pencil beam scanning will also be introduced.

Primary authors: Dr QIN, Bin (Huazhong University of Science and Technology); Mr ZHAO, Runxiao (Huazhong University of Science and Technology); LIU, Xu (Huazhong University of Science and Technology); Mr CHEN, Heming (Huazhong University of Science and Technology); Dr CHEN, Qushan (Huazhong University of Science and Technology); Dr LIU, Kaifeng (Huazhong University of Science and Technology)

Presenter: Dr QIN, Bin (Huazhong University of Science and Technology)