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Tue-Mo-Po2.08-07 [60]: Consideration of misalignment and fringe field of beamline elements in a proton therapy facility

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Proton therapy is regarded as one of the most advanced radiotherapy methods for its unique Bragg Peak. As a medical apparatus, the proton therapy facility must deliver stable and accurate dose or proton beams to patients. Huazhong University of Science and Technology (HUST) was funded in 2016 to build such a machine, known as HUST-PTF. The HUST-PTF uses a superconducting cyclotron to produce 250 MeV proton beams with highest current of 500 nA. The facility will be equipped with two 360-degree gantries and one fixed treating room. The transport beamline needs to accurately adjust the beam energy and deliver proton beams from the cyclotron to each treating room according to the treating plan. For consideration of compactness and economy, the beam pipe is designed to twice of the beam RMS size, which sets rigorous requirements on the beam orbit and optical design. So, fringe field and misalignment are the two main factors needed to be considered during the design phase. We studied the effects of fringe field of the bends and interference between the quadrupoles and steering magnets on beam optics, based on which optimized working points were proposed. We also analyzed the influence of misalignment of the bends and quadrupoles on beam orbit, based on which a global correction scheme was designed.

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