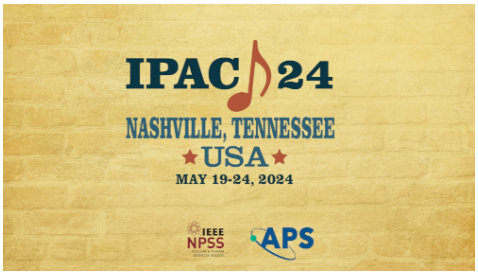

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A large momentum acceptance gantry for light-weight proton therapy facility: its beam lattice, magnets design and clinical advantages

Thursday, 23 May 2024 16:00 (2 hours)

As one of the state-of-the-art radiotherapy approaches, proton therapy possesses conformal dose profiles yet expensive cost. Designing a facility with a small footprint and a high treatment efficiency is the main goal for researchers to fulfill the potential of proton therapy and make it more affordable both for vendors and patients. In this contribution, the design of a light-weight proton therapy gantry based on the alternating-gradient canted-cosine-theta (AG-CCT) super-conducting (SC) magnet is presented. The AG-CCT magnets adopt large bores and combined function design. With fine field harmonic control and fringe field shape optimization of the magnets, the multi-particle tracking results prove that the gantry achieves a momentum acceptance of ±8%. So that the full energy range from 70 to 230 MeV can be covered with merely 3 field switch points. Combined with a fast degrader component, whose switch time is below 50 ms, the energy modulation speed can be greatly fastened. To fully utilize the advantages of the large momentum acceptance gantry, the energy spread of the proton beam is expanded and a reduced treatment plan is proposed. Compared with the standard treatment plan, the energy layers number of a prostate case is reduced by 61.3% with comparable plan quality. In summary, the proposed gantry has significant superiority both in manufacture and clinical aspects.

Footnotes

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