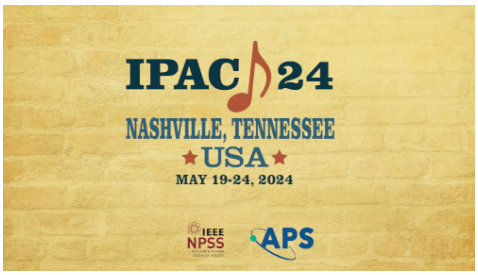

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Importance of quadrupole magnet fringing fields in low energy beam transport: example in the LIPAc 5 MeV D+ beamline

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

The hard-edge model for a quad field distribution is widely assumed in particle simulations at the early design phase of beam transport lines or circular accelerator rings to quickly evaluate their beam optics. However, the model assuming a rectangular field distribution even with an effective length is not an appropriate approximation for low-energy beams (<50 MeV). This approximation is known not to necessarily lead to the correct beam optics. The evaluated beam size based on this hard-edge model has tended to be different from measured ones and simulation results employing the exact field distribution fully implementing fringing fields. We try to study the magnetic field gradients of single quads installed in the Linear IFMIF Prototype Accelerator beamline. We define a characteristic magnetic field gradient gc [T/m] of the quad, which is determined only by the distance relations for the target quad, steerer, and BPM. Simulation results, where the hard-edge and file-map models are assumed, are compared with those measured using a 5 MeV deuteron beam. The details of the comparison of the results and the effect of the fringe fields on the beam optics are discussed in this paper.

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