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Construction of a helix-based test bench for low- β BPM

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Beam Position Monitors (BPMs) are crucial in particle accelerators for accurately measuring beam trajectories. Given the inaccuracies in their manufacturing and assembly, stringent offline calibration procedures are imperative to ensure the accuracy of beam position measurements. The prevalent calibration method, notably the wire test method, is designed for relativistic beams and is unsuitable for low- β beams. This paper presents a novel approach using a helical slow-wave structure to simulate the electromagnetic fields of low-energy beams, thereby enabling the calibration of BPMs for low- β applications. Utilizing a helix-based calibration platform, we calibrated the nonlinear response of BPMs at the Xi'an Proton Application Facility to a 7 MeV proton beam, thereby expanding the BPM's measurement range from about 20% to 50% of its aperture through polynomial fitting. This enhancement broadens the precision and scope of beam position measurements, significantly benefiting the operation and optimization of particle accelerators.

Footnotes

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Yes

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