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Calibration of MEBT Buncher Cavity Voltage and Validation of Phase-Sweep Fitting Method via Time-of-Flight Measurement

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Accurate setting and readback of radio frequency (RF) cavity voltage is critical for precise beam control in accelerator systems. To address potential discrepancies between set and actual voltages, this study presents an in-situ calibration of the MEBT Buncher1 cavity using a Time-of-Flight (ToF) method. The phase of the cavity was systematically swept while measuring the resulting energy change of a 16O⁶⁺ beam via two downstream beam position monitors (BPMs) and a high-speed oscilloscope. A least-squares fitting algorithm was applied to the phase-ToF curves acquired at three distinct nominal cavity voltage settings to determine the actual accelerating voltage and validate the phase-scan-based tuning procedure. The results provide a corrected calibration factor for the low-level RF system, ensuring more reliable beam tuning and future commissioning stages. This method highlights the importance of direct beam-based measurements for accelerator diagnostics and performance optimization.

Footnotes

Funding Agency

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