

Approach to Calibrate Beam Phase Using Steady-State RF Forward Signal under Closed-Loop Operation

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We propose a new algorithm for calibrating the beam phase that utilizes the steady-state RF forward signal (V_f) in closed-loop operation, which overcomes the difficulties associated with measuring the beam phase using RF transients in open-loop operation in high-intensity proton accelerators. The new algorithm calibrates the beam phase by comparing the steady-state V_f vector before and after the beam. We validated the calibration results of this algorithm against BPM measurements in two different experimental setups (the CAFe facility at the Institute of Modern Physics and the European Spallation Neutron Source), finding excellent agreement between the two methods in both facilities. Additionally, we investigated the feasibility of using beam-induced RF transient signals in closed-loop operation to obtain the beam phase. Our paper offers a more accessible and practical method for calibrating beam phases in high-intensity proton accelerators.

Keyword

On-line beam phase measurement, Cross-talk calibration, Beam-loading

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