

Implementation of the On-line RF Amplitude and Phase Calibration for Vector Sum Control

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The RF field's quality in particle acceleration significantly affects beam properties. Controlling and measuring the field as observed by the beam is crucial, but only indirect measurements are usually available. In many RF accelerators, a single RF source drives multiple cavities to reduce costs. The individual cavity fields are probed and combined to regulate the vector sum. Errors in gradient and phase calibration create a discrepancy between the observed vector sum and the measured vector sum stabilized by the RF control system, leading to energy spread, especially with microphonics. The standard calibration method measures small beam-induced transients in the cavity, requiring RF field stability, particularly forward power. Active cavity field regulation during measurements is excluded, limiting normal operation. This paper presents a new method that calibrates the RF field to the beam under normal conditions, especially in feedback mode, by fitting the beam to the cavity equation for accurate calibration estimation.

Keyword

Vector sum calibration

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