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Approach to calibrate cavity forward and reflected signals using LLRF system for continuous wave-operated cavities

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Precise measurements of the cavity forward (Vf) and reflected signals (Vr) are essential for characterizing other key parameters such as the cavity detuning and forward power. In practice, the accuracy of these measurements is impacted by the crosstalk between the forward and reflected channels. DESY proposed an algorithm for calibrating Vf and Vr based on the cavity differential equation for pulsed RF system, and we verified the validity and pract*emphasized text*icability of this approach for the Chinese ADS front-end demo superconducting linac (CAFe) facility. This approach requires cavity voltage (Vc) changing over time to establish a complete differential equation. However, for a CW operated RF system, Vc signal is almost constant over time thanks to the LLRF system's high gain feedback control. As a result, it is difficult to locate the optimal calibration factors using DESY's algorithm. Therefore, we offer an alternative algorithm to determine the calibration factors using the CW waveforms during a nominal RF shutdown event. The effectiveness of the proposed algorithm was demonstrated on the CAFe facility that operated in CW mode.

Keyword

Forward and reflected signals; Measurement; Calibration; Continuous wave

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