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High-precision RF-voltage measurements using longitudinal phase-space tomography in the CERN PSB and SPS.

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Precisely determining the gap voltage and phase in an RF cavity is essential for the calibration of the LLRF feedbacks. Following the conventional approach, measured RF power is converted into gap voltage, assuming a given shunt impedance. However, power and impedance evaluations can both have large uncertainties. Alternatively, the voltage can be obtained precisely with a complementary technique based on longitudinal phase-space tomography. From a set of bunch profiles, tomography reconstructs the bunch distribution in the longitudinal phase-space. The quality of the reconstruction strongly depends on the RF voltage and therefore allows to derive its absolute value. In this paper we describe the tomography-based voltage measurements performed in the CERN PSB and SPS, where this method allowed to detect significant voltage errors for the main RF systems. After applying the correction factors in the LLRF, 1% accuracies were reached. We report here also the remarkable results achieved by using this technique to calibrate the voltage of the SPS higher-harmonic cavities at 800 MHz, as well as their relative phases with respect to the 200 MHz cavities.

Keyword

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