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Automatic Cryomodule Characterization with LLRF controller

The JLab 12GeV upgrade project has 10 new cryomodules with RF stations to be installed and commissioned on the framework of the existing CEBAF accelerator. Each cryomodule has 5 superconducting radio-frequency (SRF) cavities to be integrated and controlled with digital LLRF controllers. This paper demonstrates an automatic characterization method for commissioning processes using LLRF sampled waveforms, including cavity gradient calibration by reflected RF power falling edge analysis, and cavity detune & phase offset measurement by chirp signal response analysis. Online test results shows <3% precision for loaded Q and cavity gradient measurements, and <0.5% precision for cavity detune and phase offset measurements.

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