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The LLRF related superconducting elliptical cavities characterization for ESS project

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The installation phase of the European Spallation Source (ESS) linear accelerator is nearly complete. As with other superconducting linacs operating in pulse mode, LLRF systems play a crucial role in controlling accelerating beam parameters.
Modern LLRF systems go beyond providing fast and reliable feedback for RF signal regulation; they also ensure precise, dynamic cavity tuning. Additionally, they enhance machine availability by monitoring various signals to identify potential issues and implementing fast and slow algorithms to optimize cavity performance within safety limits, tailored to specific accelerator conditions.
Preparation for these tasks begins during cryomodule and cavity testing, prior to tunnel installation. Key parameters such as Lorentz force detuning coefficients, piezotuner range and polarity, main mechanical cavity modes, Pi-mode frequencies, slow tuner sensitivity, and backlash must be accurately determined to enable peak LLRF performance.
This paper outlines the development, implementation, and application of software tools designed to determine these parameters for cavities tested at ESS Test Stand 2 (TS2) and those installed in the accelerator tunnel.

Footnotes

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