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Horizontal testing of 648 MHz elliptical superconducting cavities for CSNS-II using dual-frequency signal method

Monday 22 September 2025 14:30 (3 hours)

This study presents high-precision Q_0 measurements for 648 MHz elliptical superconducting cavities in horizontal testing at CSNS-II, using the dual-frequency method to address errors in fixed-coupling systems ($\beta \approx 360$) under high-field (6 MV/m) operation. Dynamic phase calibration and reflection suppression algorithms minimized cavity deformation and electromagnetic interference effects. Results showed Q_0 measurement errors below 4.2 %, a linear field response up to 6.3 MV/m, and 98.5 % parameter confidence, surpassing traditional decay-time methods. The -70 dB coupler-based phase compensation suppressed 75 % of parasitic noise, proving the method's robustness in complex electromagnetic environments. This work provides a standardized solution for high-β cavity batch validation in large accelerators and offers insights for high-current proton accelerator stability.

I have read and accept the Privacy Policy Statement

Yes

Footnotes

Funding Agency

Session Classification: Monday Poster Session

Track Classification: MC3: Cavities