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Anomalous frequency shifts near Tc of fundamental and higher-order modes in medium-velocity 644 MHz superconducting elliptical cavities

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Recent studies indicate the magnitude of an anomalous decrease in the resonant frequency, so-called frequency dip, near critical temperature of superconducting niobium cavities, Tc, correlates to the cavity quality factor, Q0, and impurities introduced into the superconducting niobium surfaces, such as nitrogen or oxygen. We measured frequency dips in both 644 MHz fundamental mode (FM) and 1.45 GHz higher-order mode (HOM) of single-cell elliptical cavities for FRIB energy upgrade (FRIB400) R&D. These measurements were performed in cavities with the following surface treatments: 1) electropolished (EP) only, 2) nitrogen-doped (N-doping), 3) medium-temperature (mid-T) baked and then hydrofluoric (HF) acid rinsed. We will present measured frequency dips and compare them to cavity Q0 performance in the FM. Frequency-dependent behavior of frequency dips with various surface treatments will also be discussed as our experimental setup has a unique feature compared to previous studies, which allows for measurement of frequency dips in different modes within the same cavity, in other word, on the same surfaces.

Footnotes

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