Low Level RF Workshop 2022

9-13 Oct 2022, Brugg-Windisch, Switzerland

Contribution ID: **86** Type: **Oral**

Mitigating instabilities in SRF resonance control loops

Thursday, October 13, 2022 10:40 AM (20 minutes)

LLRF systems usually include a resonance control loop, in which an actuator adjusts the frequency of the cavity's electrical resonance. Electrical measurement of the cavity detune frequency and a control algorithm complete the feedback loop. In SRF cavities with a piezoelectric actuator, this loop is responsible for compensating cavity Lorentz forces and drifts in helium pressure (in some cases an elaborate controller attempts to cancel narrow-band microphonics terms). Having the mechanical linkage between actuator and cavity in a cryogenic environment introduces a non-obvious complication: high-Q mechanical resonances in the audio band, sometimes with Q over 1000. These resonances can push a simple integrator-based controller into instability, unless the gain-bandwidth-product is made unreasonably low. This presentation shows theory and experiment for a better mitigation of these instabilities, which is general and needs no tuning. Operational success has been demonstrated with LCLS-II cryomodules.

Primary author: DOOLITTLE, Larry (LBNL)

Presenter: DOOLITTLE, Larry (LBNL)

Session Classification: Superconducting RF

Track Classification: Low Level RF Workshop 2022