PIP-II 650 MHz Cryomodule Test Stand LLRF System

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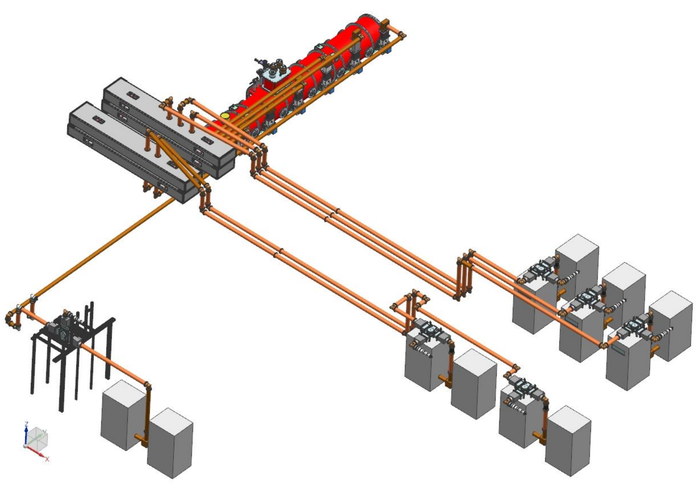
ID 50

Introduction

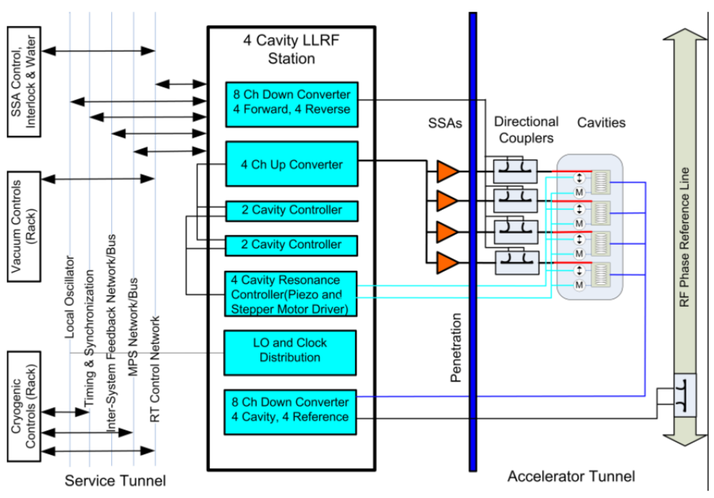
The Fermilab 650 MHz Cryomodule Test Stand is a facility for independently testing HB/LB 650 MHz and SSR2 (325 MHz) cryomodules without beam. The first cryomodule tested will be the HB 650 which consists of six cavities. Cavity bandwidth and loaded Q measurement, SSA linearity, Cavity resonance finding, Piezo transfer function and capacitance measurements, Detune frequency are some of the test features available with the LLRF system.

HPRF Distribution for HB650

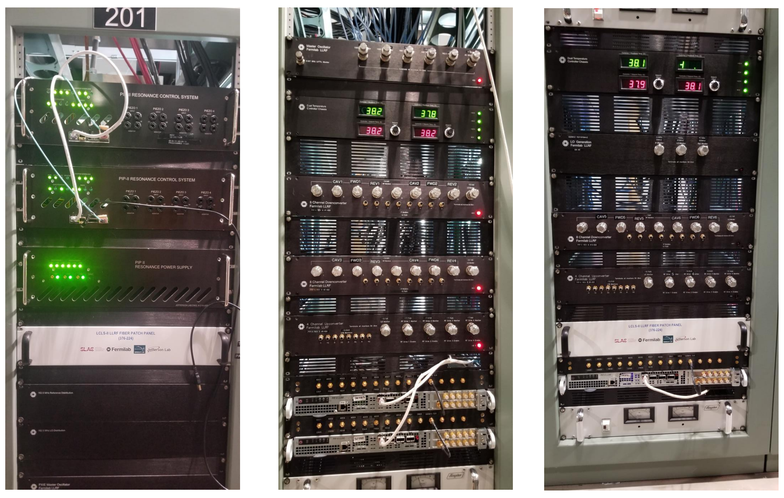


70 KW RF Amplifier

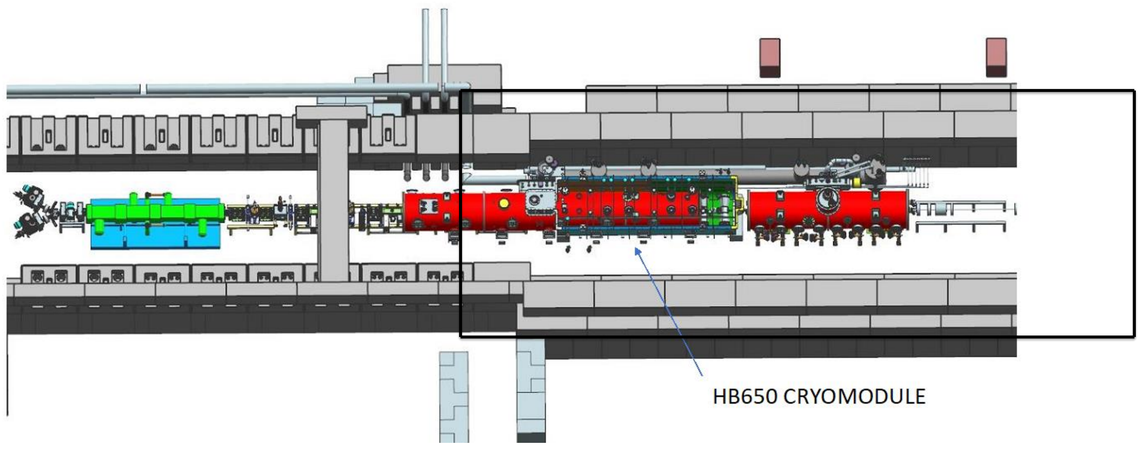
PIP-II 4-Cavity LLRF Station



6-Cavity LLRF System Hardware



650 MHz Cryomodule Test Stand

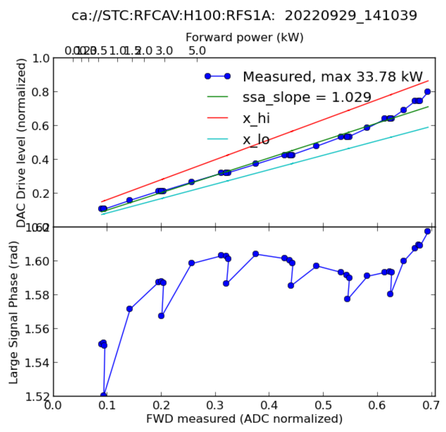


Test Stand Features

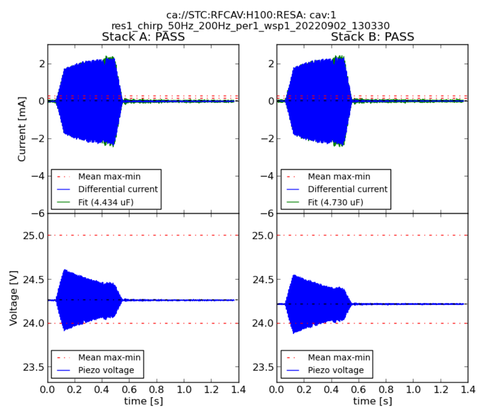
1. Cavity Conditioning
2. Cavity Field and Resonance Control
3. Bring cavities on resonance and lock amplitude and phase
4. Run CW at nominal gradient, in GDR mode (SELAP)
5. Synchronize to phase reference line
6. Capture RF and frequency detune waveforms
7. Microphonics suppression algorithm development
8. Measurements –

   Bandwidth, Loaded Q, Detune frequency, Coupling coefficients, Plant gain, SEL phase offset, Probe calibration based on emitted energy, Circulator S_22, SSA response, Piezo transfer function and capacitance measurements

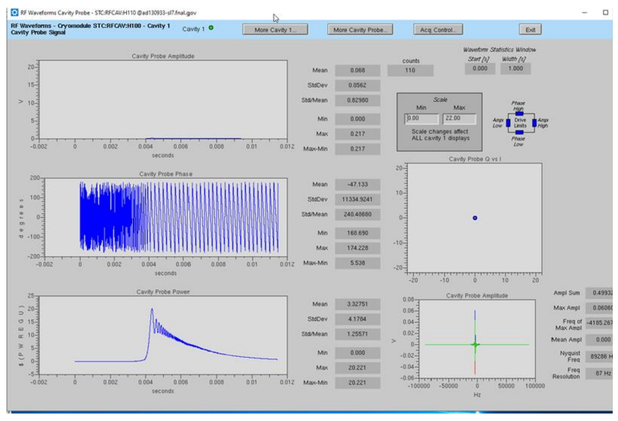
SSA Characterization



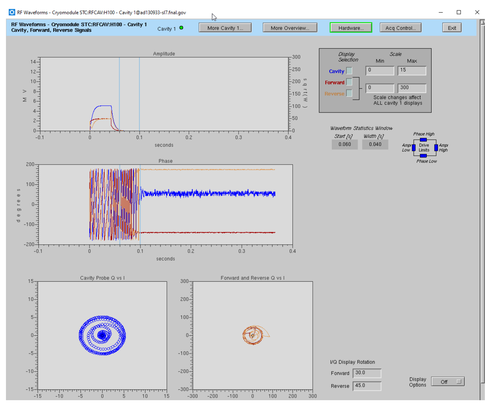
Piezo Capacitance



Cavity Resonance with Chirp



Pulsed SEL Calibration



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