

RHIC 56 MHz Storage Cavity

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LLRF Control Requirements

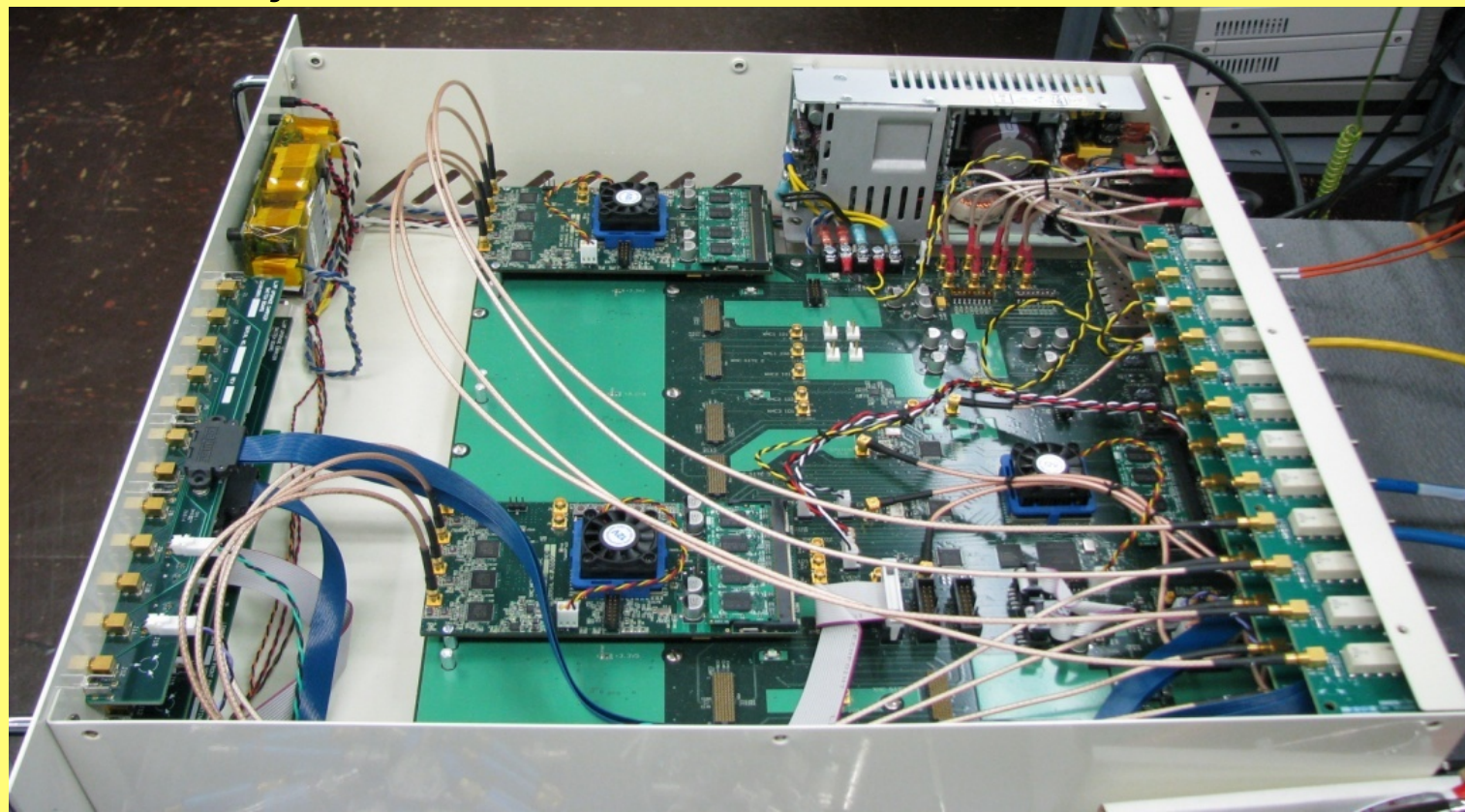
56 MHz Project Review

- The 56 MHz SRF cavity is a beam driven cavity.
- Operating goal is 2.0 MV gap voltage
 - Q_0 = 3E9
 - Q_{ext} = 4E7 (300 with FMD inserted)
 - R/Q = 80 ohms (accel), 40 ohms (circuit)
 - Coarse Tuner Range = 25.5 kHz at 0.1 Hz / step (mech)
 - Fine Tuner Range = 60 Hz at 0.06 Hz / volt (piezo)
 - Lorentz Detuning = -37 Hz / MV² 32 Hz = -148 Hz
 - Beam Current = ~ 200mA at 1E9/bunch Au, 2 x 110 bunches
 - Nominal Detuning = ~ 225 Hz
- Cavity Field Control Objectives
 - Amplitude and Phase: 1E-4 rms (“AC” variation only, absolute “DC” voltage and phase determined by beam and cavity detuning.)

BNL Generic LLRF Controller

56 MHz Project Review

- The LLRF Controller is a front-end configuration developed by the Brookhaven National Laboratory for the High Energy Superconducting Linear Collider (HLCS) project. It is a complete turnkey system built up.



LLRF System Control Requirements *56 MHz Project Review*

- Adiabatic turn on under control of state machine slowly pushing cavity frequency toward beam frequency, via stepper tuner.
 - “Slow” feedback via piezo tuner for control of cavity impedance to maintain nominal 2.0 MV on the gap.
 - “Fast” feedback via LLRF drive and 1kW PA to compensate microphonic detuning, i.e. “AC” variations about the nominal 2.0MV setpoint within a few hundred Hz modulation bandwidth.
 - Cavity and machine protection.
 - Currently under study.
 - Cavity quench requires dumping RHIC beam.
 - Standard RHIC Permit system functionality via 56 MHz MPS.
 - SRF cavity control is new to C-AD, but we don’t see any show stoppers for this project.
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