Abstract
A superconducting CW RF linear accelerator is being built at the SLAC National Accelerator Laboratory to provide 4 GeV short bunch length electrons to LCLS II at a repetition rate. LCLS II requirements have driven the need for a high precision RF control system (Emma et al., 2014). A digital LRF system was designed by a multi-laboratory collaboration to meet the LRF needs of the II (C. Hovater et al., 2011). Results from initial testing have demonstrated that the system meets and exceeds critical performance requirements (Douglas et al., 2017) enabling low phase noise control of superconducting cryomodules as well as the possibility of active compensation for microphonic effects. The modern, high-performance LRF system will be distributed in the first kilometer of the SLAC klystron gallery, a non-air conditioned structure with well documented ambient temperature stability limitations (Ake et al., 1997); the klystron gallery can vary 50 degrees F in a single day. To overcome the thermal stability limitations of the klystron gallery, a rack system has been carefully designed, size efficiently designed to house the distributed LRF system. The LRF racks have been strategically placed close to accelerator penetrations to minimize effects from temperature drift on high band RF cables. Careful attention has also been paid to the internal design of the rack to keep temperature sensitive LRF chassis thermally stable and microphonic sensitive chassis acoustically stable. The LRF rack design considerations will be presented with test results demonstrating a variety of metrics including temperature, acoustic, and RF stability.

II. The Two Mile Shed

Temperature Stability

- Red = outside gallery deg F – 50 to 105 deg F
- Blue = inside gallery deg F – 60 to 110 deg F

Variations on the temperature profile are minimized through short enclosed routing paths and a dedicated PRC fan assembly. Temperature in the PRC area is temperature controlled to +/- 5C. PRC Area Temperature Maximum and Tolerance: 35 Degree C Max

Measured Performance

- Rack fan assembly recently optimized for improved air flow ~ 90%
- Study made to determine if lower fan speed (less audible noise) is preferable to increased air flow
- Variac used to adjust fan speed to affect audible noise and air speed

Fan setting  | Chassis  | Air speed (cfm) | Audible noise (dB) | Phase stability (mdeg)
--- | --- | --- | --- | ---
High 130 VDC  | PRC  | 830 | 90 | 0.477
| RFS  | 830 | 89 |
Low 70 VDC  | PRC  | 480 | 72 | 0.407
| RFS  | 450 | 71 |

- **PRC Area Temperature Maximum and Tolerance:** 35 Degree C Max with stability of +/- 2 Degree C
- **RF Station/Resonance/Interlocks**/ Area Max Temperature with Tolerance: 35 Degree C Max +/- 5 Degree C (note can have temperature gradient from bottom to top of 10C max)
- **Rack heat load from LLRF:** Total 250 Watts (PRC area 35 Watts)
- **350 W total with running stepper motors and fan assembly (large Helixview)**
- **Acoustic Noise:** 60 dBA max
- **Electrical Service:** Two 20A breakers each with power strips
- **AC outlet at the bottom of the rack (front and rear) for test equipment**
- **Fiber Patch Panel Near the top of the rack**
- **Max cable length for quantity 6, 3/8 inch heliax from penetration opening to inside of LLRF rack is approximately 30 feet. The cables should enter the rack from sides near the back of the rack.**

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