SLAC
Lab Status

Andy Benwell on behalf of SLAC team

LLRF 2019

9/30/2019

U.S. DEPARTMENT OF ENERGY | Stanford University

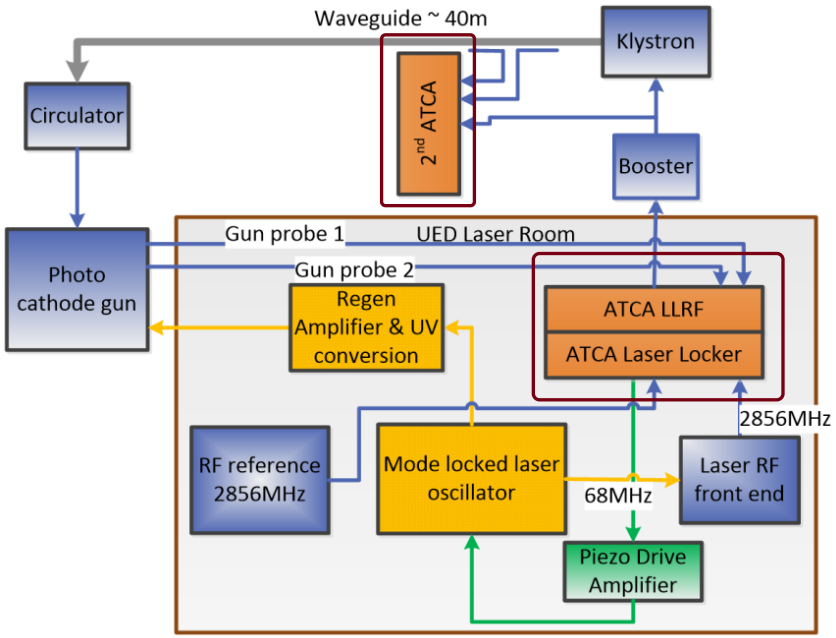
SLAC NATIONAL ACCELERATOR LABORATORY

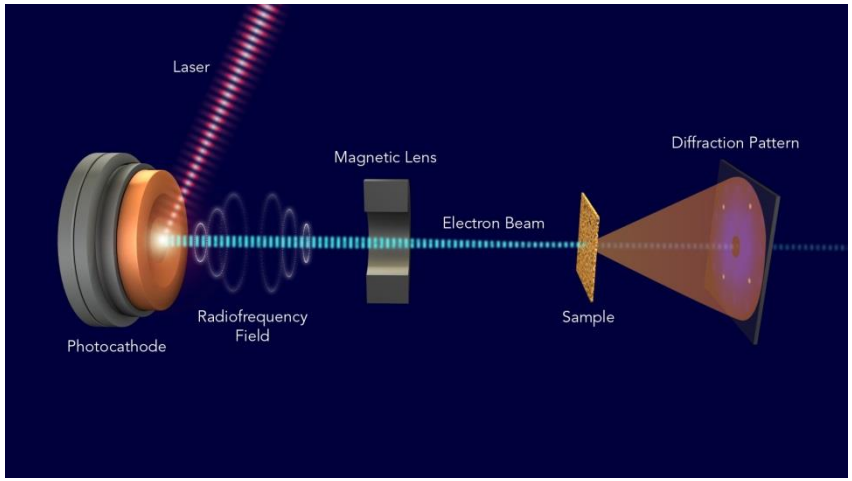
LLRF development for Accelerator Complex

- Common Platform
  - ATCA based high performance controller
  - Ultrafast Electron Injector (UED)
  - Global timing system
  - FACET Injector
- LCLS-II Precision Controller
  - LCLS-II high Q SRF cavities
  - LCLS-II Injector RF
  - Average beam Current Monitoring (ACM)

SLAC Ultra-Fast Electron Diffraction

- UED user facility uses electron diffraction for imaging
- 2 – 4 MeV RF accelerator
- New ATCA based RF control system
  - Improve laser jitter
  - Improve RF jitter
  - Increased repetition rate





L. Ma, Wednesday, Advanced Topics

ATCA LLRF SYSTEM for ASU COMPACT FEL a Strategic Planning Proposal

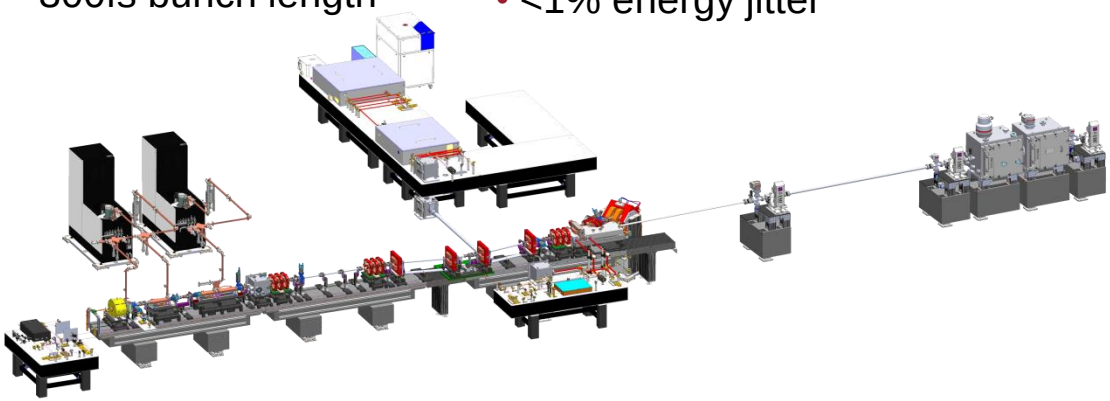
SLAC

Electron Linac

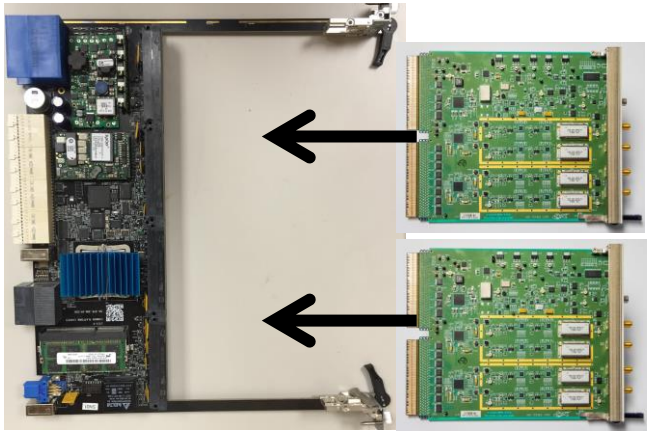
- 9.3GHz RF Frequency
- 1kHz repetition rate
- 300pC/bunch
- 300fs bunch length

IR Laser

- Yb:YAG thin disk regen amplifier
- 200mJ/pulse
- 1ps pulse length
- <1% energy jitter



SLAC hardware and software application on ATCA platform



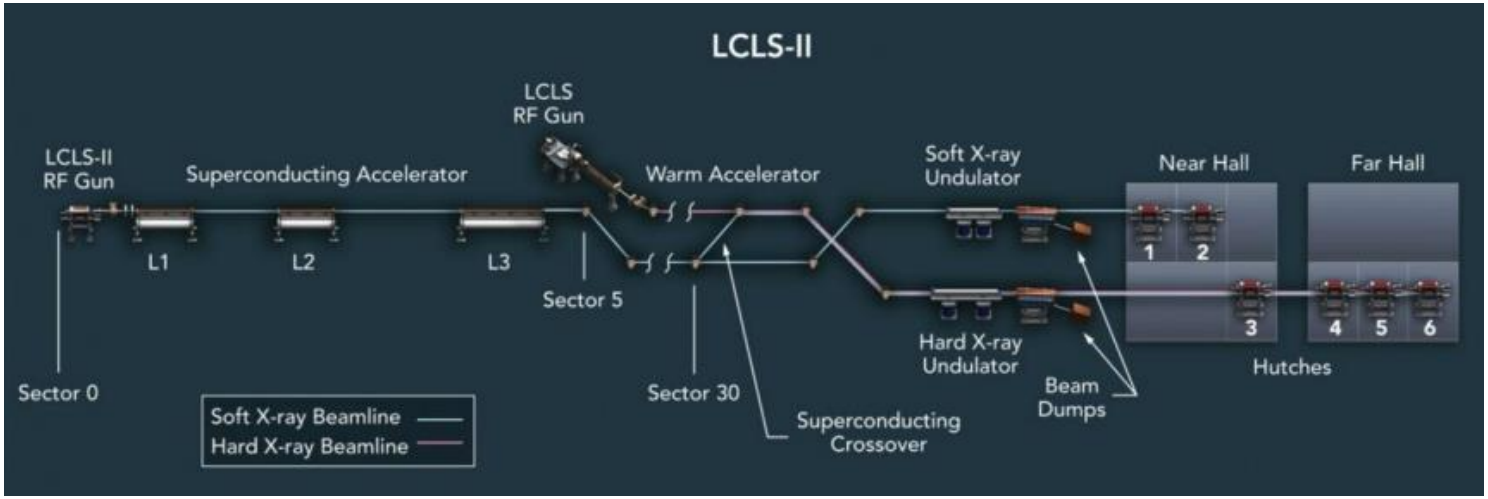
1: Carrier Card
2: Crate
3: RTM
Each carrier supports 2 AMC application cards

A. Young, et al., Poster Session Tuesday

Precision Timing for LCLS complex

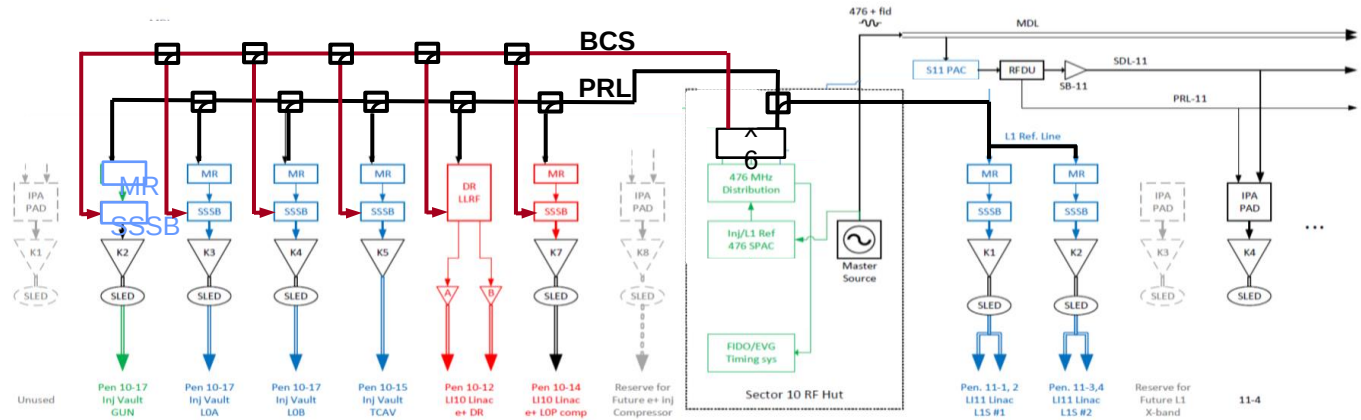
Precision timing integration of the LCLS complex will enhance performance and add flexibility for LCLS experimental users

- 120 Hz Copper based beamline
- 928 kHz SRF beamline
- Near Experimental Hall
- Far Experimental Hall



J. May, Poster Session Tuesday

Common Platform LLRF, FACET-II Injector



- Digital LLRF will be installed at 6 stations in the FACET-II Injector
- This will provide improved monitoring and control including precision independent phase adjustments.
  - A major improvement over existing legacy RF control system

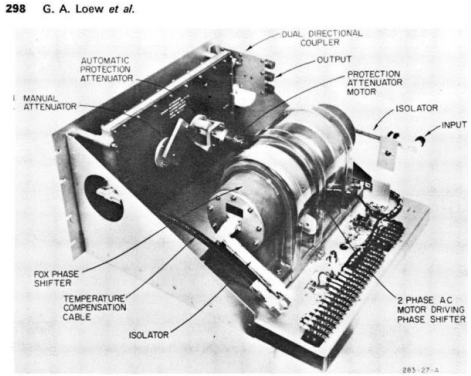
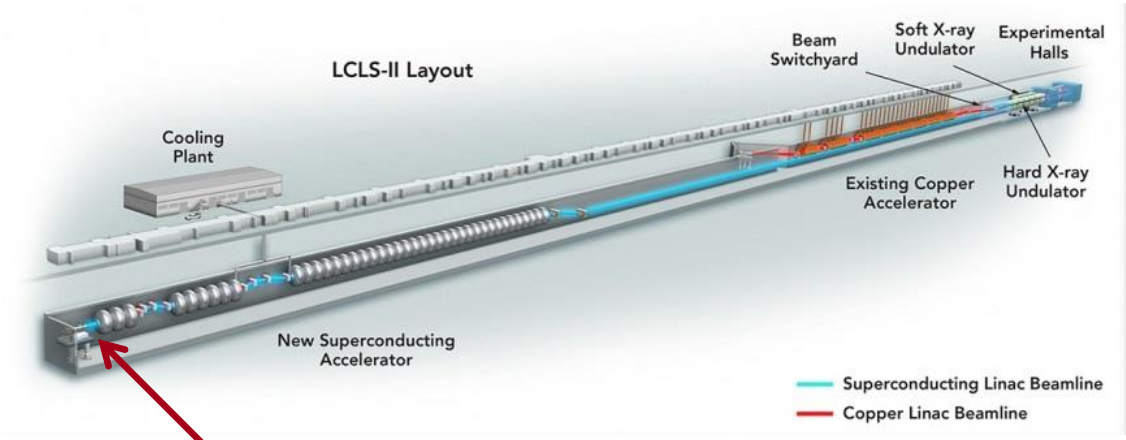
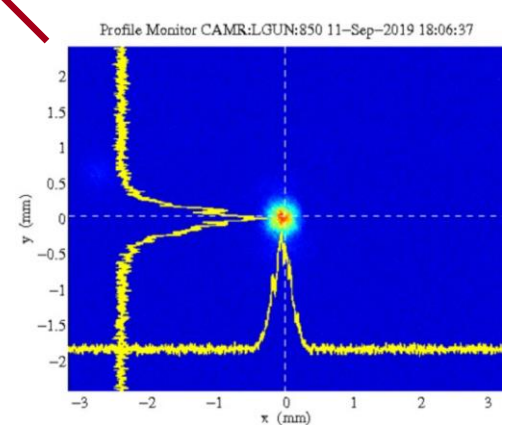


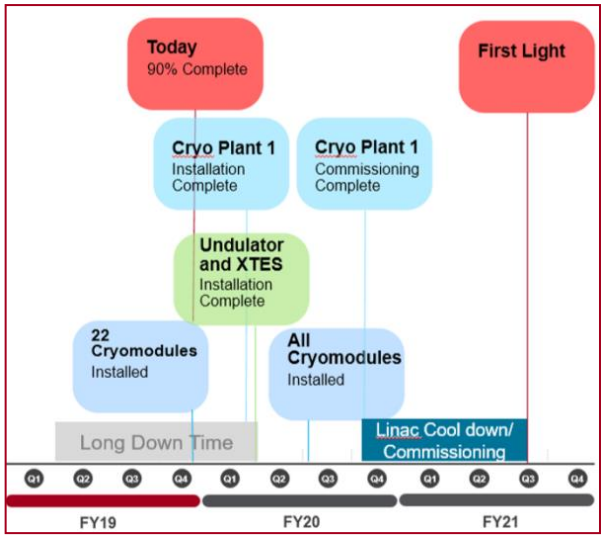
Figure 9-11 Isolator, phase shifter, and attenuator unit.

LCLS–II LLRF updates

- LCLS-II SRF accelerator project is heading steadily toward cooldown & commissioning
- Much work at both SLAC and within our partner laboratories to ensure the RF control system is ready

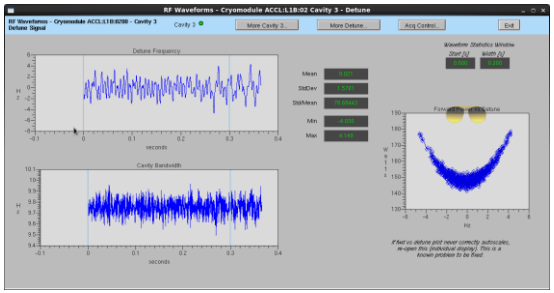






LCLS – II LLRF updates

The LLRF collaboration has worked toward ensuring we are as ready for commissioning as possible.

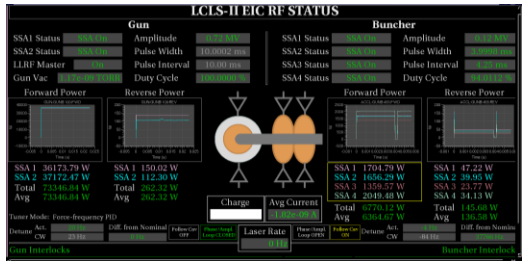


- Recent efforts have focused on expanding functionality and improving user interfaces for controlling cryomodules.

LLRF system development update
Thursday in SRF
Presented by SLAC on behalf of LLRF collaboration

- Ensuring hardware is ready to meet checkout and commissioning schedule

LCLS LLRF Hardware Production Update
A. Benwell, Poster Session Tuesday



- Some LCLS-II commissioning has begun
  - CM practice at LERF with experts at Jlab
    - LCLS-II injector with help from LBNL

LCLS-II Test Results from LERF Jlab
and the LCLS-II Injector at SLAC
Presented by our collaboration partners!

Machine Learning for LCLS-II SRF linac performance

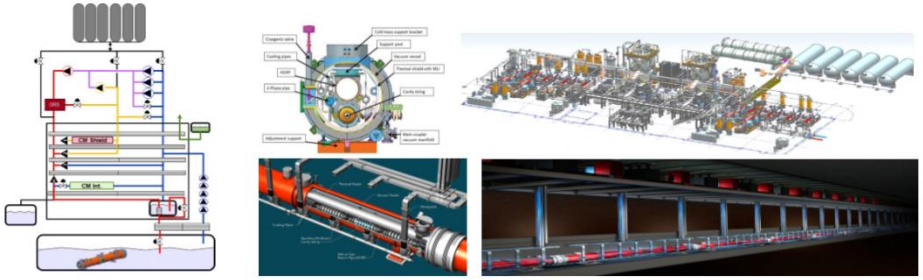
Due to the size and complexity of SRF linacs, control systems are designed to optimize individual unit or single system performance.

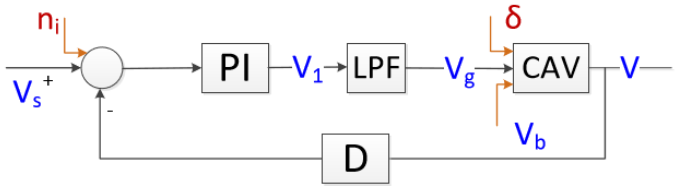
- RF

  or

- Cryogenic

Machine Learning based control can handle many interaction timescales and make decisions across systems to achieve global goals





F. Wang, Wednesday, Advanced Topics

J. Diaz-Cruz, Tuesday, Student poster & presentation