



# High precision RF control at LBNL

Gang Huang  
Oct. 16, 2017



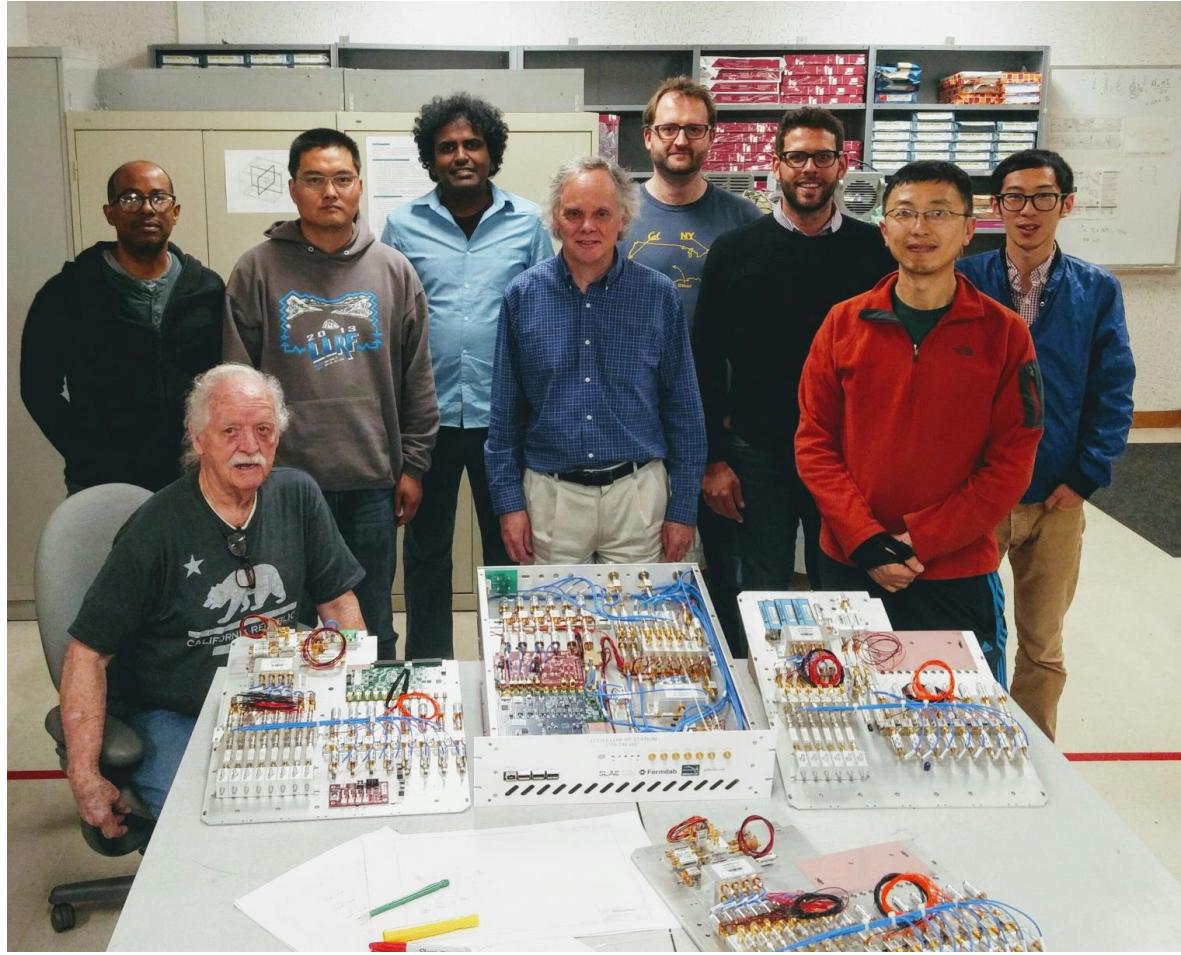
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**ATAP**

# The team



K. Campbell  
J. Greer  
Q. Du  
V. Vytla  
L. Doolittle  
J. Jones  
C. Serrano  
G. Huang  
Y. Xu  
Q.Chen\*

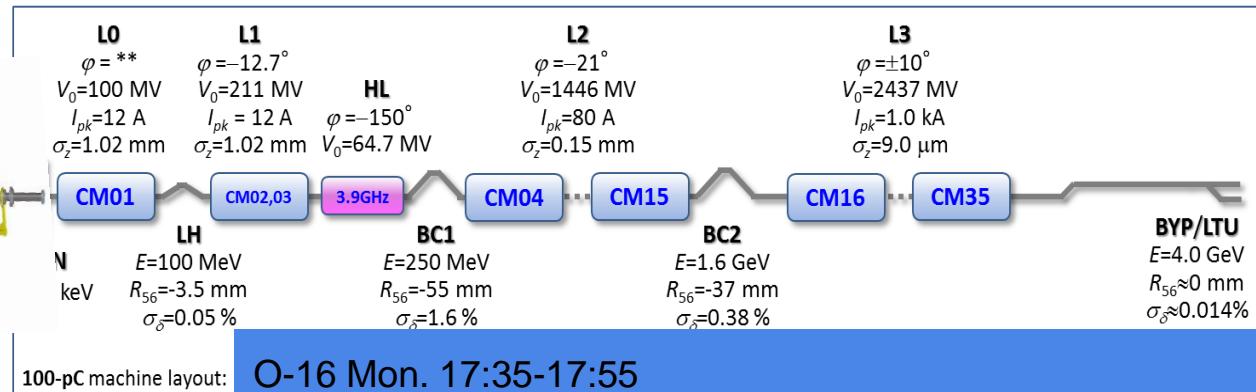
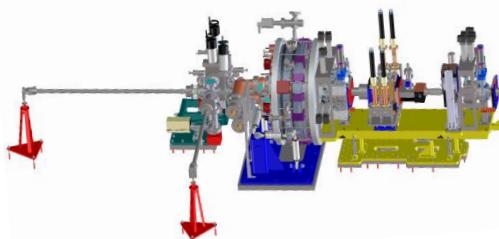
\* Not Shown

# LCLS-II LLRF



**Fermilab**

**Jefferson Lab**



Preliminary testing result: Field out-of-loop

O-16 Mon. 17:35-17:55

LCLS-II LLRF prototype testing and characterization  
Lawrence Doolittle



P-79 Baseband board set for LCLS-II LLRF  
Lawrence Doolittle etc.



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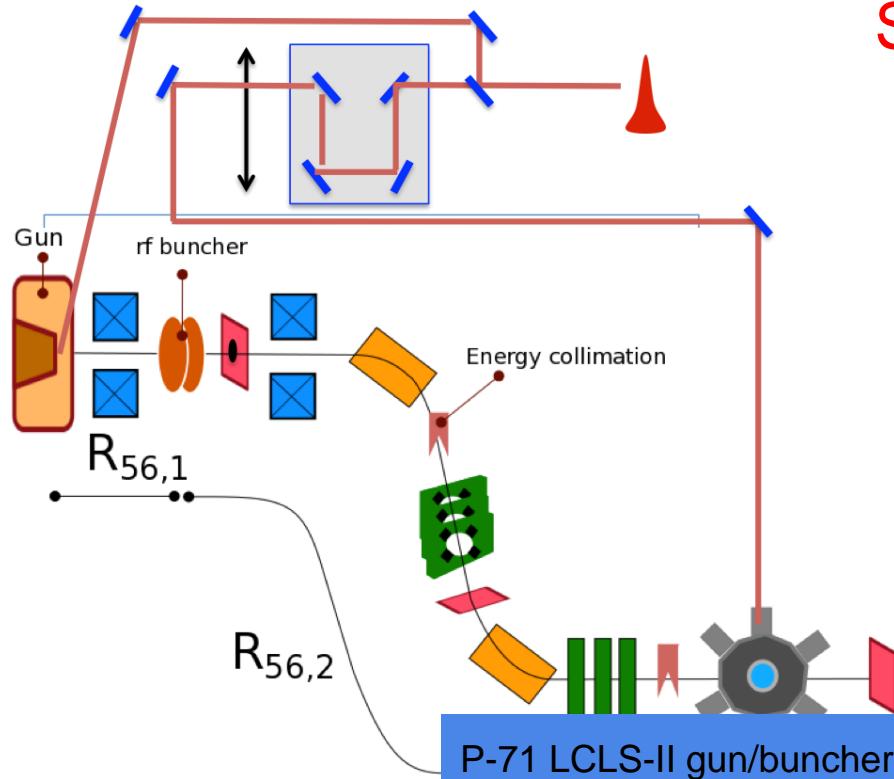
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# APEX/HiRES LLRF

High repetition Rate Electron Scattering beamline

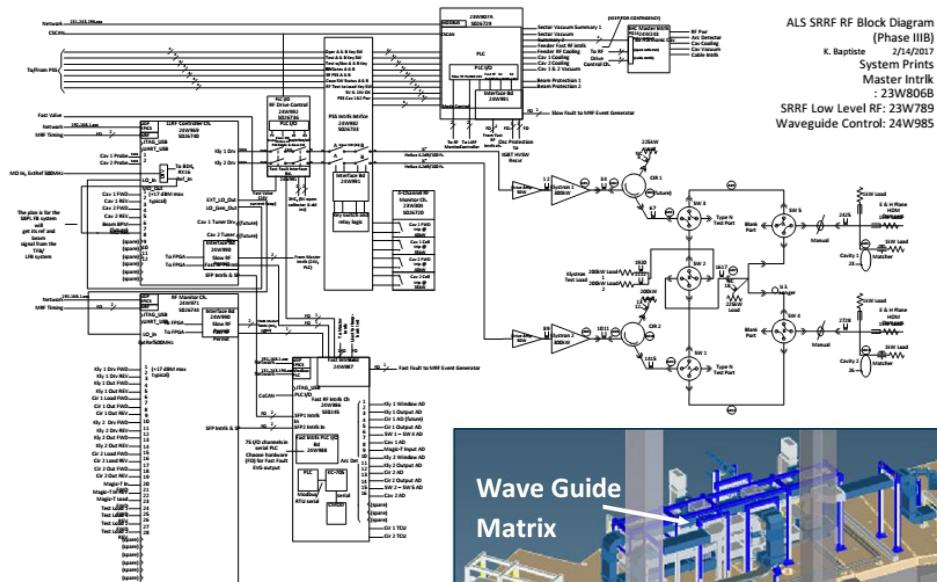


D. Filippetto and H. Qian, JPB: At

P-71 LCLS-II gun/buncher and APEX LLRF development  
Gang Huang, Lawrence Doolittle, etc.



# Digital LLRF for ALS Storage Ring RF System Upgrade



- Original SRRF system from 1993
- Upgrade to configurable two klystrons driving two cavities operation,
- Preliminary test result shows RF field stability of 0.01% in amplitude and 0.01° in phase at 499.654 MHz for the band above 1 Hz (no beam)



P-46 Digital Low Level RF control for Advanced Light Source  
Qiang Du, Lawrence Doolittle etc.



Courtesy of Ken Baptiste



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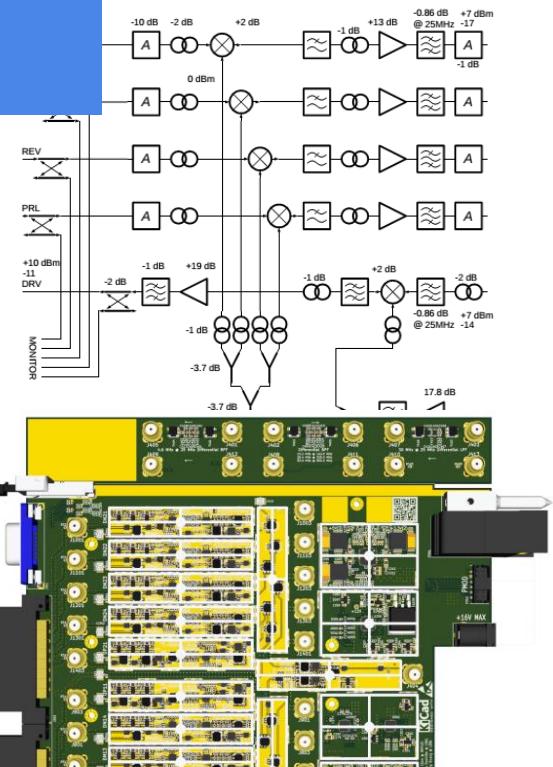
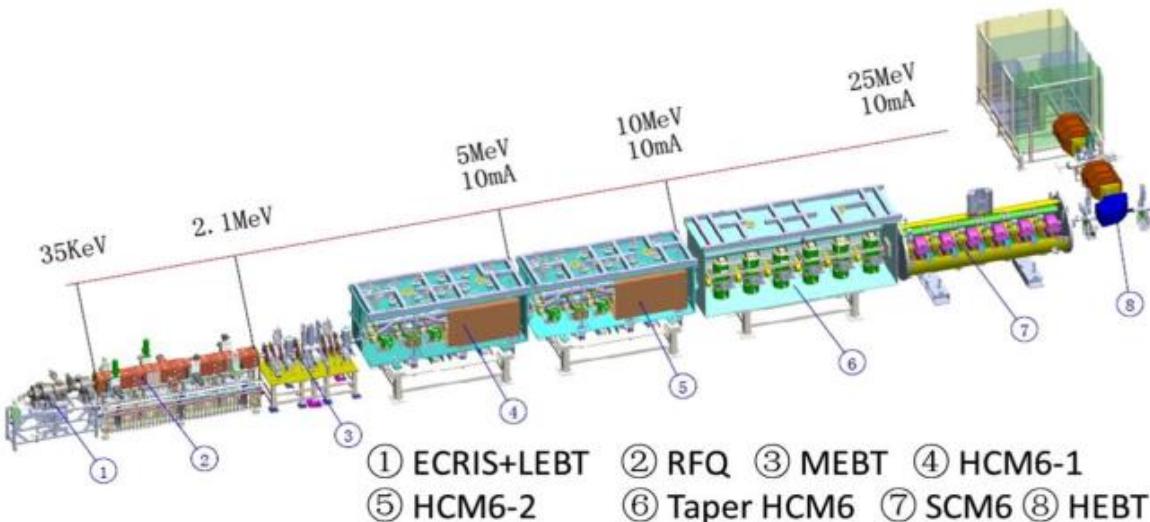


# RF Front End processing

Tutorial: Analogue and Signal processing for Low Noise LLRF Front Ends

Lawrence Doolittle, LBNL, United States of America

Wed. 09:00-09:50



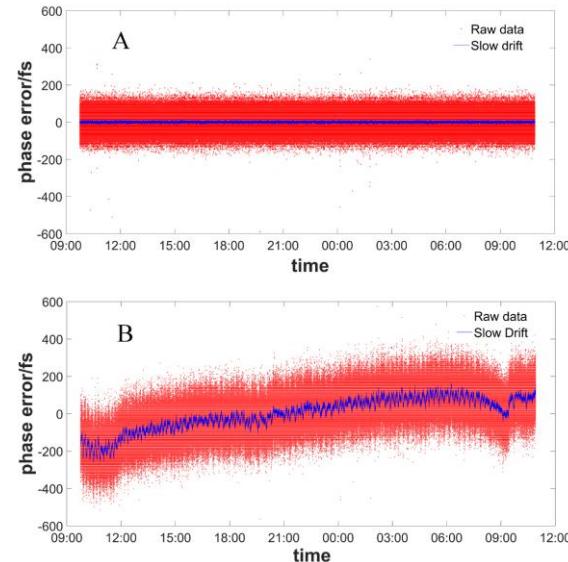
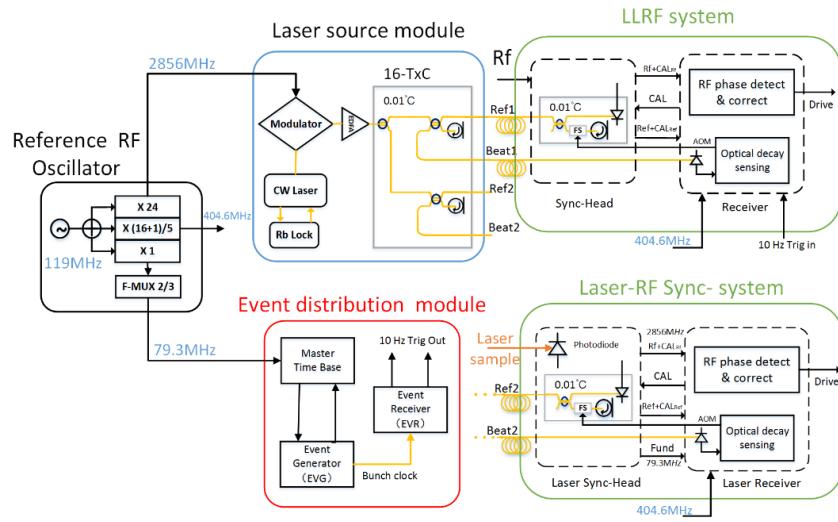
中国科学院大学  
University of Chinese Academy of Sciences



中国科学院近代物理研究所  
Institute of Modern Physics, Chinese Academy of Sciences

P-72 Multi-frequency Supported LLRF Front-end  
Qi Chen, Lawrence Doolittle etc.

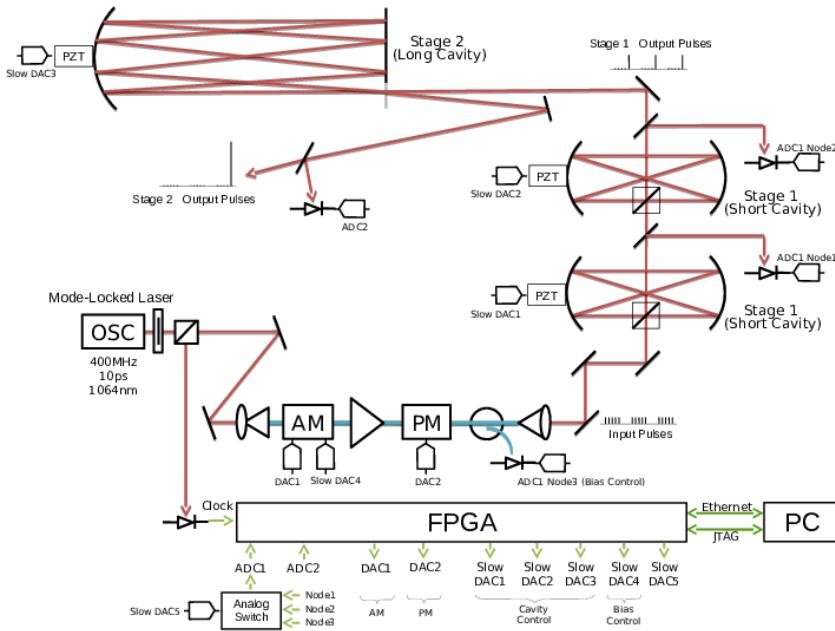
# Femto-second timing and LLRF for TXGLS



Development of Sub-100 Femtosecond Timing and Synchronization System at Tsinghua University  
Zhenyang Lin, etc. IPAC 2017

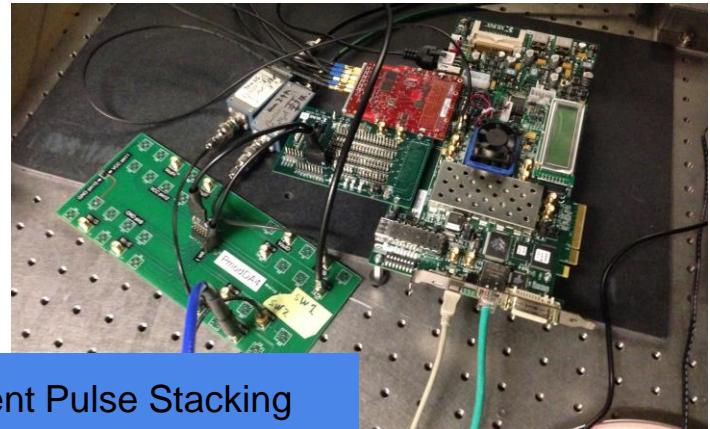
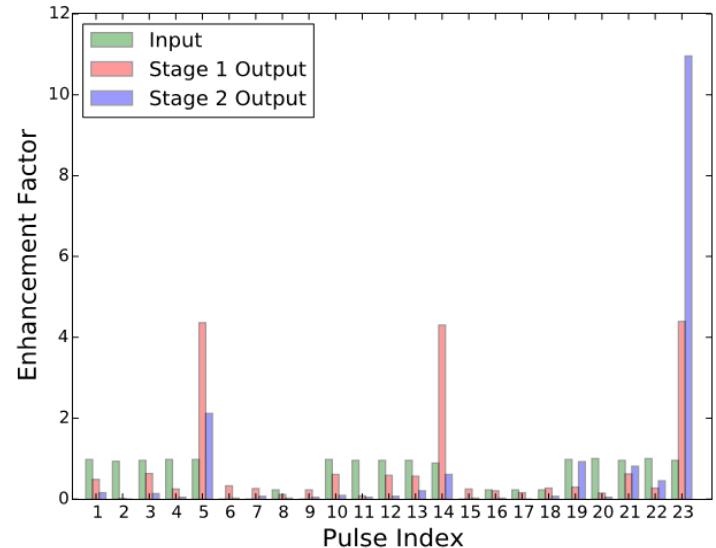


# Coherent Laser Pulse Stacking



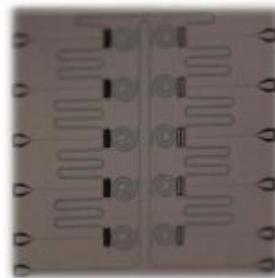
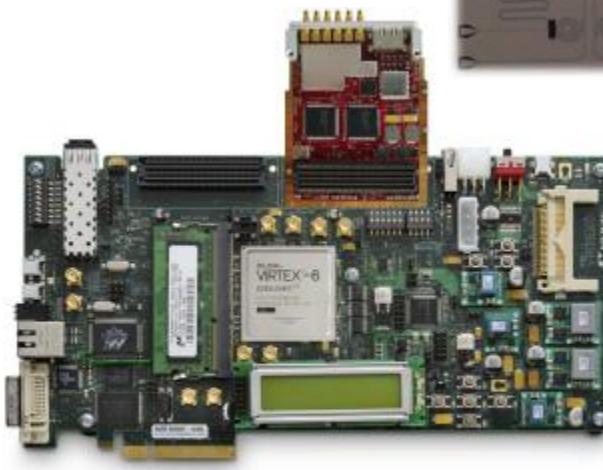
Two stage (2+1) cavities, 15 pulse stacking system  
Theoretical peak-power enhancement factor : 12.0  
Measurement result: 11.0

P-84 FPGA-Based Cavity Phase Stabilization for Coherent Pulse Stacking  
Yilun Xu, Gang Huang etc.

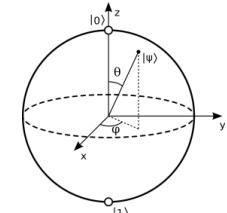
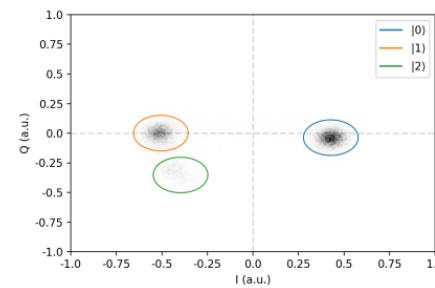
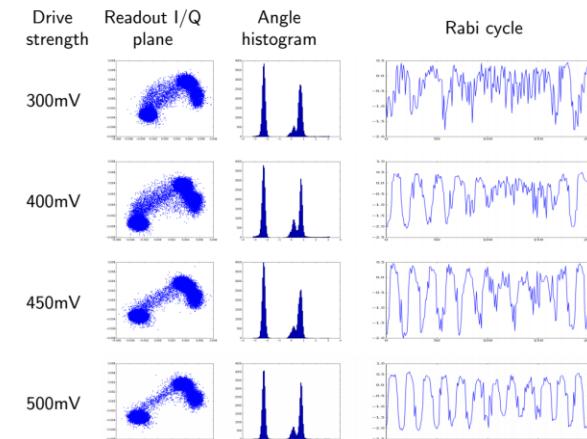


# Quantum bit control

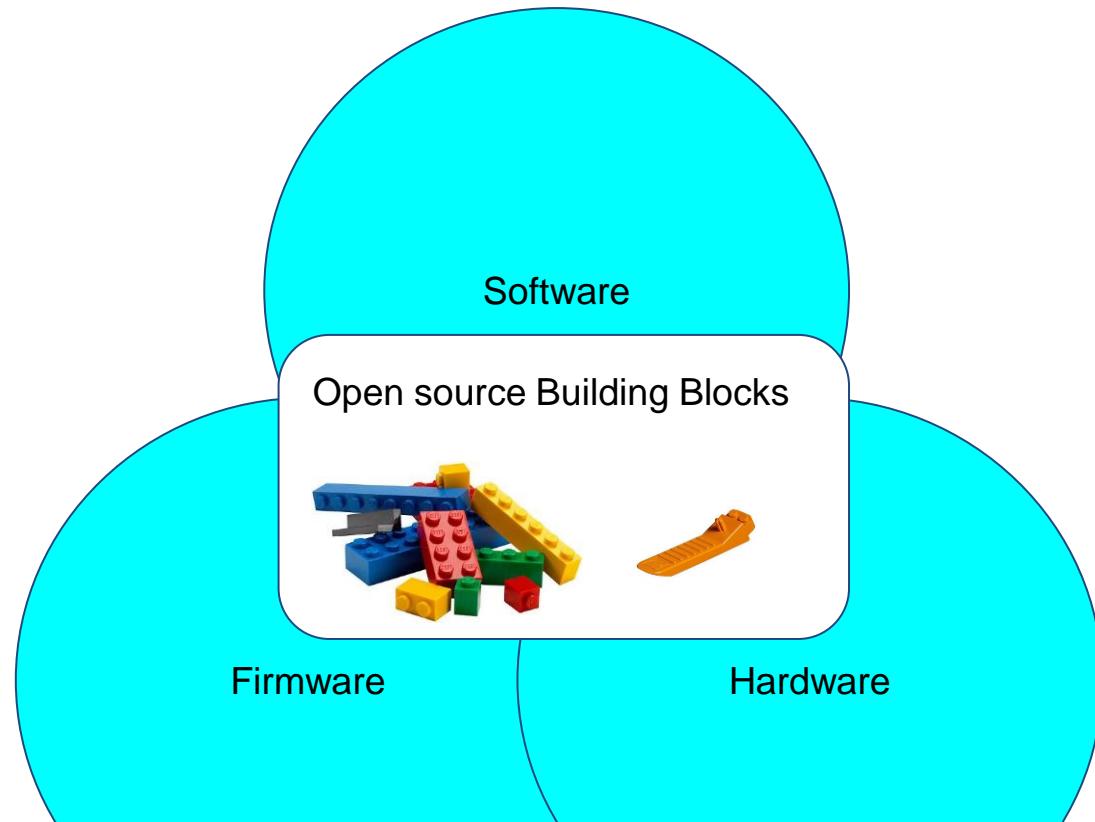
Superconducting circuit  
Josephson junction  
Coupling RF cavities



Qubit 4 Rabi cycle test result



# Beam Instrumentation Development System



P-47 BIDS, the open source building blocks for a high precision RF control system  
Gang Huang, Lawrence Doolittle, Qiang Du, Carlos Serrano

# Summary

Monday 17:35-17:55

O-16 LCLS-II LLRF prototype testing and characterization

Lawrence Doolittle, LBNL, United States of America

Wednesday 09:00-09:50

Tutorial: Analogue and Signal processing for Low Noise LLRF Front Ends

Lawrence Doolittle, LBNL, United States of America

Tuesday Poster Session

P-46 Digital Low Level RF control for Advanced Light Source

Qiang Du, Kenneth Baptiste, Michael Betz, Massimiliano Vinco, Lawrence Doolittle, Gang Huang

P-47 BIDS, the open source building blocks for a high precision RF control system

Gang Huang, Lawrence Doolittle, Qiang Du, Carlos Serrano

P-71 LCLS-II gun/buncher and APEX LLRF development

Gang Huang, Lawrence Doolittle etc.

P-72 Multi-frequency Supported LLRF Front-end

QI Chen, Lawrence Doolittle, Gang Huang, Yuan He, Xianwu Wang

P-79 Baseband board set for LCLS-II LLRF

Lawrence Doolittle, Gang Huang, John Jones, Carlos Serrano

P-84 FPGA-Based Cavity Phase Stabilization for Coherent Pulse Stacking

Yilun Xu, Russell Wilcox, John Byrd, Lawrence Doolittle, Qiang Du, Gang Huang, Yawei Yang, Chuanxiang Tang, Wenhui Huang



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