STATUS OF THE LCLS-II-HE PROJECT AT JEFFERSON LAB*

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Abstract

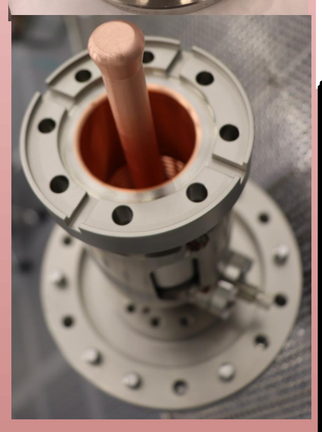
The Linac Coherent Light Source II High Energy (LCLS-II-HE) upgrade at the SLAC National Accelerator Laboratory is being constructed in partnership with the Thomas Jefferson National Accelerator Facility (JLab) and the Fermi National Accelerator Laboratory (FNAL). The cryomodule production scope consists of the design, procurement, construction, and acceptance testing of 24 eight-cavity, 1.3 GHz cryomodules, as well as R&D activities necessary to develop the required technology. To achieve this, JLab and FNAL are also contributing to SLAC's effort to develop the cavity recipe and production processes necessary to meet the LCLS-II-HE goal of 20.8 MV/m and average Q_0 of 2.7x10^{10}. This paper details the JLab scope, focusing on the project initiation phase, in particular technology development and prototyping, project development and planning, and implementation of lessons learned from LCLS-II.

JLab Scope of Work

- Collaborate on cavity R&D to support HE requirements of 20.8 MV/m and average Q_0 of 2.7x10^{10}.
- Procure copper-plated beamline bellows, gate valves, tuners, and FPCs.
- Assemble and test 11 cryomodules.
- Project management for JLab activities.

Component	JLab	FNAL	SLAC
Dressed Cavities			
HOM/FP Feedthroughs			
Cavity Flanges/Hardware			
FPCs			
Cavity String Bellows			
Cavity String Hardware			
SC Magnet Assembly			
Beam Position Monitor (BPM)			
HOM Absorber			
Gate Valves			
Two-phase Pipe Bellows			
End Lever Tuners			
Magnetic Shielding			
Cold Mass			
Vacuum Vessel			
Instrumentation			
Cryogenic Valves			
Vacuum Equipment			
Beamline Interconnect Parts			

Procurement responsibilities, bellows, FPC

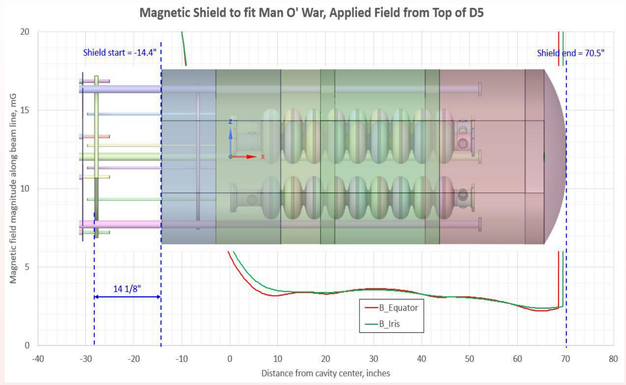


Lessons Learned Improvements

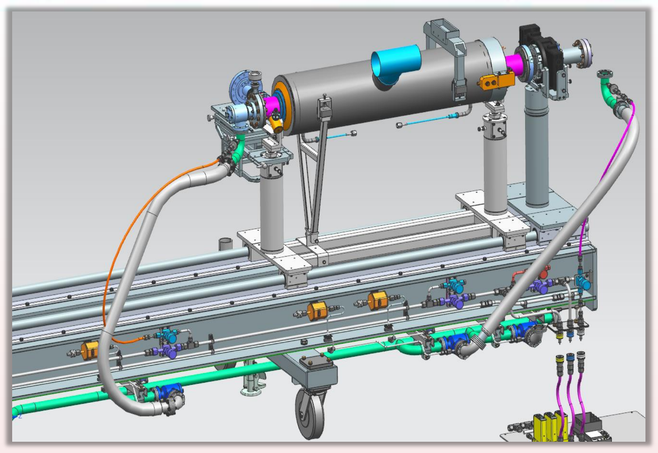
- Continuous improvements made throughout LCLS-II (such as improvements to magnetic hygiene) carry over to HE.
- Designs for HE were reviewed with subject-matter experts and corrections/updates made (mostly to reflect as-builts and address interferences/tolerances).
- All procedures being reviewed for application of lessons learned.
- Extended warranty periods for procurements.

Cavity R&D

- JLab, SLAC and FNAL partnered in a Cavity Technical Board to develop techniques to improve cavity performance.
- Notable developments include new cavity doping recipe, cold EP, and nitric soak after furnace treatment.
- See talks by A. Palczewski and M. Martinello, poster TUPFDV003 by D. Gonnella.



Analysis by G. Cheng



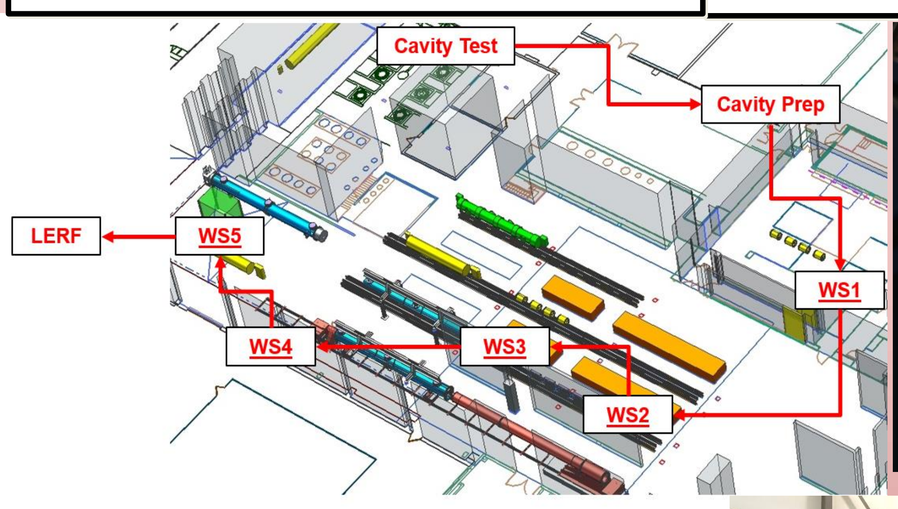
Infrastructure Upgrades for HE

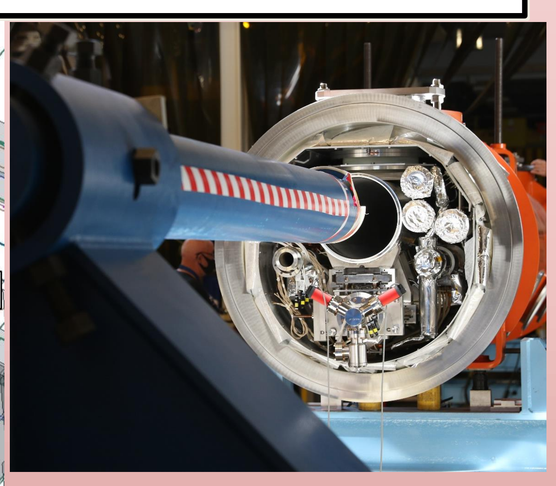
New magnetic shielding for dewar

- Largest dewar, allows 3 HE cavities to be tested at once.
- Will reduce the fields at the cavity from around 20 mG to 5 mG, in order to meet the requirements for HE.
- Nitrogen-doped cavities are particularly sensitive to magnetic fields, and thus maintaining low magnetic fields in the dewars is essential to achieving high Q_0 in vertical test.

Nitrogen purge system for string assembly

- Aligns the assembly procedures between JLab and FNAL.
- Allows the replacement of parts, if necessary, without full string disassembly.
- Reduces moisture and oxidation of copper parts in the string.
- Should reduce field emission due to particulate generation during assembly, thus improving cryomodule performance.





Assembly and Test

- JLab's Test Lab houses facilities for inspection of parts, cavity test, string assembly & cryomodule assembly.
- Testing will be conducted for HE at LERF (constructed and used for LCLS-II CM) which provides vertical slice of SLAC CM operation.
- LERF will be upgraded for HE requirements (new, higher-power SSAs).
- Clean room and CM tooling is still in place from LCLS-II.
- Five workstations allow separate areas for cavity string assembly, cold mass assembly, vacuum vessel assembly & final assembly.
- Production layout & schedule allow parallel assembly of CMs for HE and for other projects at JLab.

Conclusion

Building on experience from LCLS-II and application of lessons learned, JLab is well positioned to successfully complete its scope for LCLS-II-HE.

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