LERF as Cryomodule Testing Facility Set-Up and Installation Logistics

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U.S. DEPARTMENT OF ENERGY
Office of Science

Outline

- Scope
- Contacts
- Rules of Engagement
- LCLS II Review & other reviews
- Lessons Learned from Dark Light
- Schedule
- Cryomodule Layout
- Questions/Concerns/Comments

Scope

- Install 16 SSAs & LLRF in LERF Gallery
- Connect to SSAs to existing waveguide that routes to tunnel
- Connect 2 CMs to tunnel waveguide
- Install new cables in existing penetrations
- Duplicate (2) AC distribution/PSS/VVU from Test Lab facility
- Remove 2 existing CMs in LERF vault and relocate the third CM
- Design & build new supply/return ‘U-Tubes’ for both 2K & shield
- Install & commission 16 sets of LCLS LLRF hardware & software
- Develop EPICS based CM testing & commissioning tools
- Install & commission LCLS based cryo, vacuum & interlock systems
- Restore LERF once CM commissioning is complete

Contacts

Project Lead – Kevin Jordan Lead on SLAC Equip – Curt Hovater

- Lead Engineer – Joe Gubeli
- Work Coordinator – Jim Coleman

Neil Wilson Installation	Chris Curtis Survey & Alignment	Omar Garza EE Support	Rick Nelson High Power RF
Vashek Vylet Radiation Safety	Matt Bickley EPICS Software	Ernest Stallworth Electrical Installation	Mike McCaughan Operations POC
Curt Hovater LLRF	Jonathan Creel Cryogenics	Jim Henry CM End Can design	John Fisher CM Production POC
Wesley Moore Software/Access	Rusty Sprouse Facilities	Paul Collins EHS&Q	

Rules of Engagement

- All work will require ATLis
  - Ensures all efforts are review by safety professionals
  - Safety is integrated into all processes
- LERF logbook should be used to record efforts & issues
  - Easy to track progress in single location
- Daily ‘Tool Box’ meeting immediately after 8:00 AM meeting
  - PD in the loop for work going on in LERF
- Weekly tag-up scheduling meeting 11:00 AM Wednesday in LERF break room

LERF LCLS II Testing Review

- A review was held Aug. 3, 2017, slides available
  - Review of LERF as Cryomodule Testing Facility for LCLS-II
  - https://www.jlab.org/indico/event/233/
- A Final Design Review will be held in November for new hardware
- A Testing Readiness Review will be held prior to testing
- Other reviews will be held as needed
  - Waveguide layout review will held in early October
  - Software ‘mini’- review will be scheduled for October
  - Radiation ‘mini’- shielding review will be scheduled for November
  - Others as needed to document design choices

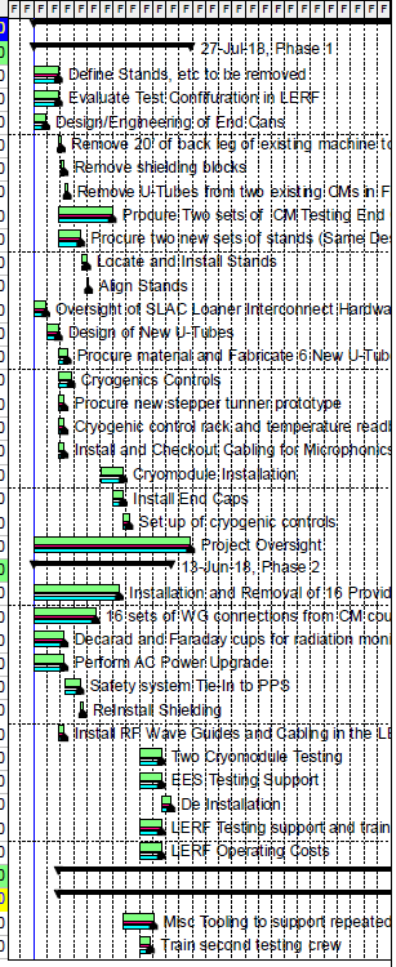
Lessons Learned from Dark Light

- We will take advantage of Dark Light experience
- Lessons Learned from Dark Light
  - Treat "non-routine endeavors" more as a project with a designated and empowered leader, a clearly defined management structure, resource loaded schedule, and directorate-level monitoring of progress/issues
  - Funding for the project should be available sufficiently ahead of time (start of fiscal year?) to apply planning resources/effort that will result in an adequately planned and executable project that has a high probability of success.
  - Identify an Overall Point-of-Contact for the Project
  - Manage Change
  - Develop a Schedule/Calendar of Work

P6 Schedule (1/2)

LERF | LERF | 19-Jul-17 10:25

WBS Path	Activity ID	Activity Name	Start	Finish	Total Float	Original Duration
LERF			01-Aug-17	22-Nov-19	88.00	578.00
Phase 1			01-Aug-17	27-Jul-18	419.00	247.00
1	Phase 1-010	Define Stands, etc to be removed	01-Aug-17	26-Sep-17	147.00	40.00
1	Phase 1-012	Evaluate Test Confifuration in LERF	01-Aug-17	26-Sep-17	147.00	40.00
1	Phase 1-015	Design/Engineering of End Cans	01-Aug-17	28-Aug-17	167.00	20.00
1	Phase 1-020	Remove 20' of back leg of existing machine to install/position CMs	27-Sep-17	03-Oct-17	229.00	5.00
1	Phase 1-030	Remove shielding blocks	04-Oct-17	10-Oct-17	229.00	5.00
1	Phase 1-040	Remove U-Tubes from two existing CMs in FEL Vault	11-Oct-17	17-Oct-17	229.00	5.00
1	Phase 1-050	Procure Two sets of CM Testing End Caps (Same Design as CMTF)	27-Sep-17	29-Jan-18	147.00	80.00
1	Phase 1-060	Procure two new sets of stands (Same Design as CMTF)	27-Sep-17	17-Nov-17	161.00	38.00
1	Phase 1-070	Locate and Install Stands	20-Nov-17	30-Nov-17	161.00	7.00
1	Phase 1-080	Align Stands	01-Dec-17	05-Dec-17	161.00	3.00
1	Phase 1-090	Oversight of SLAC Loaner Interconnect Hardware	01-Aug-17	28-Aug-17	229.00	20.00
1	Phase 1-100	Design of New U-Tubes	29-Aug-17	26-Sep-17	229.00	20.00
1	Phase 1-110	Procure material and Fabricate 6 New U-Tubes to connect CMs to Existing Cryogenic tra	27-Sep-17	17-Oct-17	229.00	15.00
1	Phase 1-120	Cryogenics Controls	27-Sep-17	24-Oct-17	199.00	20.00
1	Phase 1-125	Procure new stepper tunner prototype	27-Sep-17	10-Oct-17	199.00	10.00
1	Phase 1-127	Cryogenic control rack and temperature readback	27-Sep-17	10-Oct-17	199.00	10.00
1	Phase 1-130	Install and Checkout Cabling for Microphonics Testing	27-Sep-17	10-Oct-17	199.00	10.00
1	Phase 1-140	Cryomodule Installation	03-Jan-18	21-Feb-18	147.00	35.00
1	Phase 1-150	Install End Caps	30-Jan-18	21-Feb-18	147.00	17.00
1	Phase 1-180	Set up of cryogenic controls	22-Feb-18	07-Mar-18	520.00	10.00
1	Phase 1-190	Project Oversight	01-Aug-17	27-Jul-18	420.00	247.00
Phase 2			01-Aug-17	13-Jun-18	450.00	216.00
2	Phase 2-010	Installation and Removal of 16 Provided SSAs 16 Channels of SLAC LLRF and 16 sets	01-Aug-17	12-Feb-18	204.00	130.00
2	Phase 2-020	16 sets of WG connections from CM couplers to existing WG runs	01-Aug-17	21-Dec-17	254.00	100.00
2	Phase 2-025	Decarad and Faraday cups for radiation monitoring	01-Aug-17	10-Oct-17	617.00	50.00
2	Phase 2-030	Perform AC Power Upgrade	01-Aug-17	10-Oct-17	204.00	50.00
2	Phase 2-040	Safety system Tie-In to PPS	11-Oct-17	14-Nov-17	204.00	25.00
2	Phase 2-050	ReInstall Shielding	15-Nov-17	21-Nov-17	204.00	5.00
2	Phase 2-055	Install RF Wave Guides and Cabling in the LERF Vault	27-Sep-17	10-Oct-17	199.00	10.00
2	Phase 2-060	Two Cryomodule Testing	02-Apr-18	22-May-18	120.00	37.00
2	Phase 2-065	EES Testing Support	02-Apr-18	22-May-18	120.00	37.00
2	Phase 2-070	De Installation	23-May-18	13-Jun-18	120.00	15.00
2	Phase 2-075	LERF Testing support and training	02-Apr-18	22-May-18	135.00	37.00
2	Phase 2-080	LERF Operating Costs	02-Apr-18	22-May-18	160.00	37.00
Phase 3			27-Sep-17	22-Nov-19	88.00	538.00
Phase 3 Non Recurring			27-Sep-17	22-Nov-19	88.00	538.00
3.1	Phase 3-015	Misc Tooling to support repeated tests	22-Feb-18	02-May-18	480.00	50.00
3.1	Phase 3-020	Train second testing crew	02-Apr-18	27-Apr-18	483.00	20.00



Primary Baseline Milestone | Primary Baseline | Remaining Work
Project Baseline Bar | Actual Work | Critical Remaining ...

Page 1 of 2

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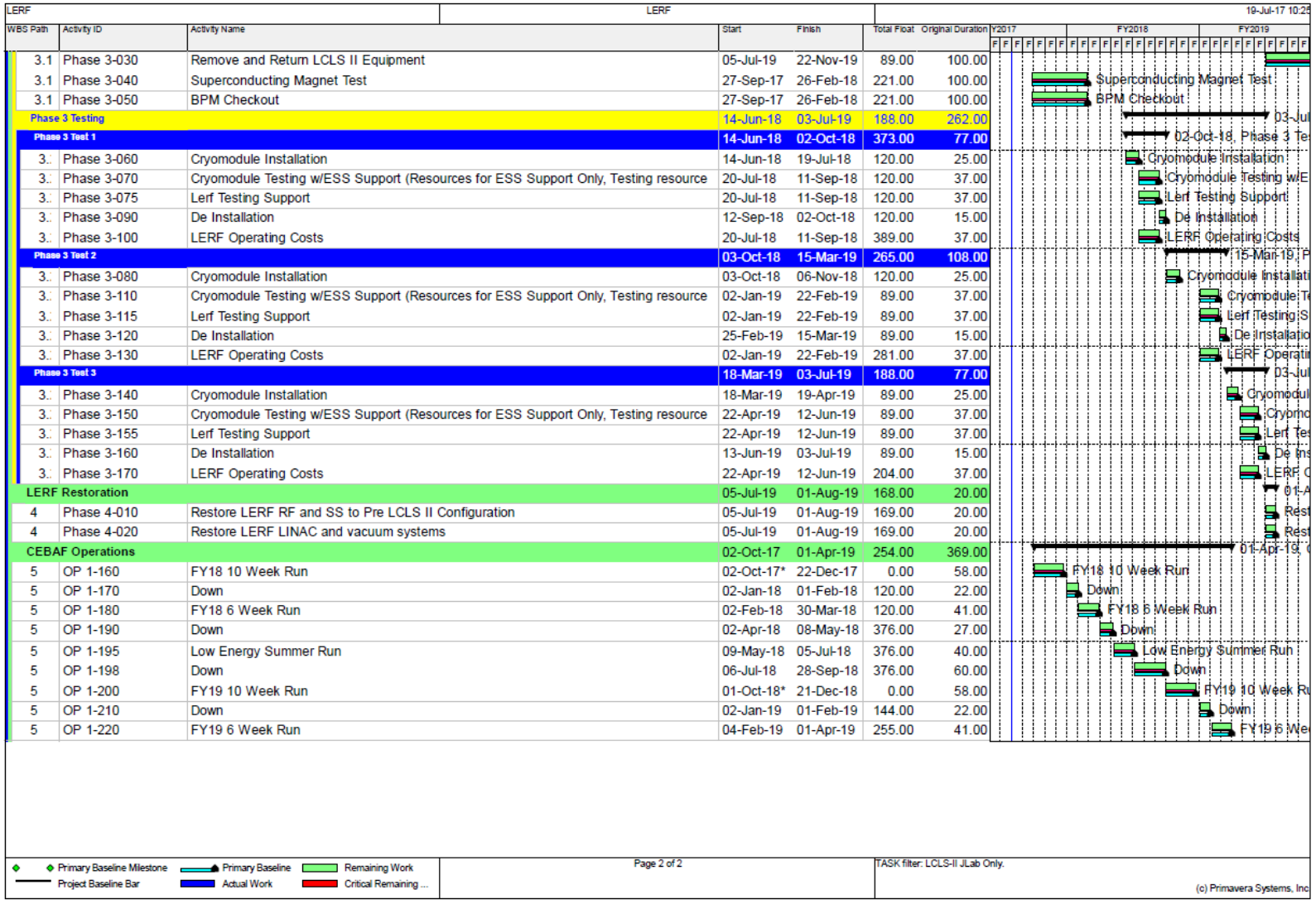
P6 Schedule (2/2)



LERF | LERF | 19-Jul-17 10:25

WBS Path	Activity ID	Activity Name	Start	Finish	Total Float	Original Duration
3.1	Phase 3-030	Remove and Return LCLS II Equipment	05-Jul-19	22-Nov-19	89.00	100.00
3.1	Phase 3-040	Superconducting Magnet Test	27-Sep-17	26-Feb-18	221.00	100.00
3.1	Phase 3-050	BPM Checkout	27-Sep-17	26-Feb-18	221.00	100.00
Phase 3 Testing			14-Jun-18	03-Jul-19	188.00	262.00
Phase 3 Test 1			14-Jun-18	02-Oct-18	373.00	77.00
3..	Phase 3-060	Cryomodule Installation	14-Jun-18	19-Jul-18	120.00	25.00
3..	Phase 3-070	Cryomodule Testing w/ESS Support (Resources for ESS Support Only, Testing resource	20-Jul-18	11-Sep-18	120.00	37.00
3..	Phase 3-075	Lerf Testing Support	20-Jul-18	11-Sep-18	120.00	37.00
3..	Phase 3-090	De Installation	12-Sep-18	02-Oct-18	120.00	15.00
3..	Phase 3-100	LERF Operating Costs	20-Jul-18	11-Sep-18	389.00	37.00
Phase 3 Test 2			03-Oct-18	15-Mar-19	265.00	108.00
3..	Phase 3-080	Cryomodule Installation	03-Oct-18	06-Nov-18	120.00	25.00
3..	Phase 3-110	Cryomodule Testing w/ESS Support (Resources for ESS Support Only, Testing resource	02-Jan-19	22-Feb-19	89.00	37.00
3..	Phase 3-115	Lerf Testing Support	02-Jan-19	22-Feb-19	89.00	37.00
3..	Phase 3-120	De Installation	25-Feb-19	15-Mar-19	89.00	15.00
3..	Phase 3-130	LERF Operating Costs	02-Jan-19	22-Feb-19	281.00	37.00
Phase 3 Test 3			18-Mar-19	03-Jul-19	188.00	77.00
3..	Phase 3-140	Cryomodule Installation	18-Mar-19	19-Apr-19	89.00	25.00
3..	Phase 3-150	Cryomodule Testing w/ESS Support (Resources for ESS Support Only, Testing resource	22-Apr-19	12-Jun-19	89.00	37.00
3..	Phase 3-155	Lerf Testing Support	22-Apr-19	12-Jun-19	89.00	37.00
3..	Phase 3-160	De Installation	13-Jun-19	03-Jul-19	89.00	15.00
3..	Phase 3-170	LERF Operating Costs	22-Apr-19	12-Jun-19	204.00	37.00
LERF Restoration			05-Jul-19	01-Aug-19	168.00	20.00
4	Phase 4-010	Restore LERF RF and SS to Pre LCLS II Configuration	05-Jul-19	01-Aug-19	169.00	20.00
4	Phase 4-020	Restore LERF LINAC and vacuum systems	05-Jul-19	01-Aug-19	169.00	20.00
CEBAF Operations			02-Oct-17	01-Apr-19	254.00	369.00
5	OP 1-160	FY18 10 Week Run	02-Oct-17*	22-Dec-17	0.00	58.00
5	OP 1-170	Down	02-Jan-18	01-Feb-18	120.00	22.00
5	OP 1-180	FY18 6 Week Run	02-Feb-18	30-Mar-18	120.00	41.00
5	OP 1-190	Down	02-Apr-18	08-May-18	376.00	27.00
5	OP 1-195	Low Energy Summer Run	09-May-18	05-Jul-18	376.00	40.00
5	OP 1-198	Down	06-Jul-18	28-Sep-18	376.00	60.00
5	OP 1-200	FY19 10 Week Run	01-Oct-18*	21-Dec-18	0.00	58.00
5	OP 1-210	Down	02-Jan-19	01-Feb-19	144.00	22.00
5	OP 1-220	FY19 6 Week Run	04-Feb-19	01-Apr-19	255.00	41.00

FY2017 | FY2018 | FY2019

Primary Baseline Milestone | Primary Baseline | Remaining Work
Project Baseline Bar | Actual Work | Critical Remaining ...

Page 2 of 2

TASK filter: LCLS-II JLab Only.

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Schedule Integrated with CEBAF Operations

- Testing cycles could occur three times per FY at the conclusion of planned CEBAF runs
- First testing cycle most likely in Jul-2018 contingent upon actual FY2018 run schedule and staffing availability

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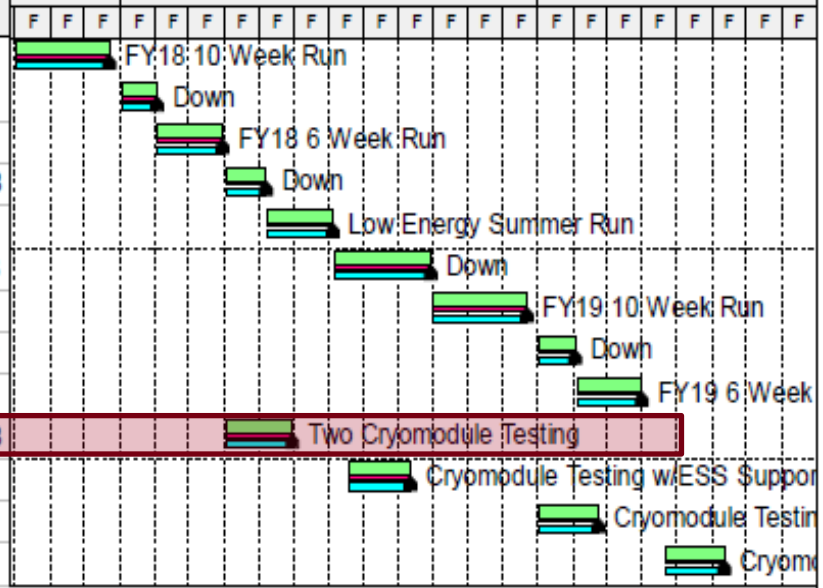
Activity ID	Activity Name	Start	Finish
OP 1-160	FY18 10 Week Run	02-Oct-17*	22-Dec-17
OP 1-170	Down	02-Jan-18	01-Feb-18
OP 1-180	FY18 6 Week Run	02-Feb-18	30-Mar-18
OP 1-190	Down	02-Apr-18	08-May-18
OP 1-195	Low Energy Summer Run	09-May-18	05-Jul-18
OP 1-198	Down	06-Jul-18	28-Sep-18
OP 1-200	FY19 10 Week Run	01-Oct-18*	21-Dec-18
OP 1-210	Down	02-Jan-19	01-Feb-19
OP 1-220	FY19 6 Week Run	04-Feb-19	01-Apr-19
Phase 2-060	Two Cryomodule Testing	02-Apr-18	30-May-18
Phase 3-070	Cryomodule Testing w/ESS Sup(	20-Jul-18	11-Sep-18
Phase 3-110	Cryomodule Testing w/ESS Sup(	02-Jan-19	22-Feb-19
Phase 3-150	Cryomodule Testing w/ESS Sup(	22-Apr-19	12-Jun-19



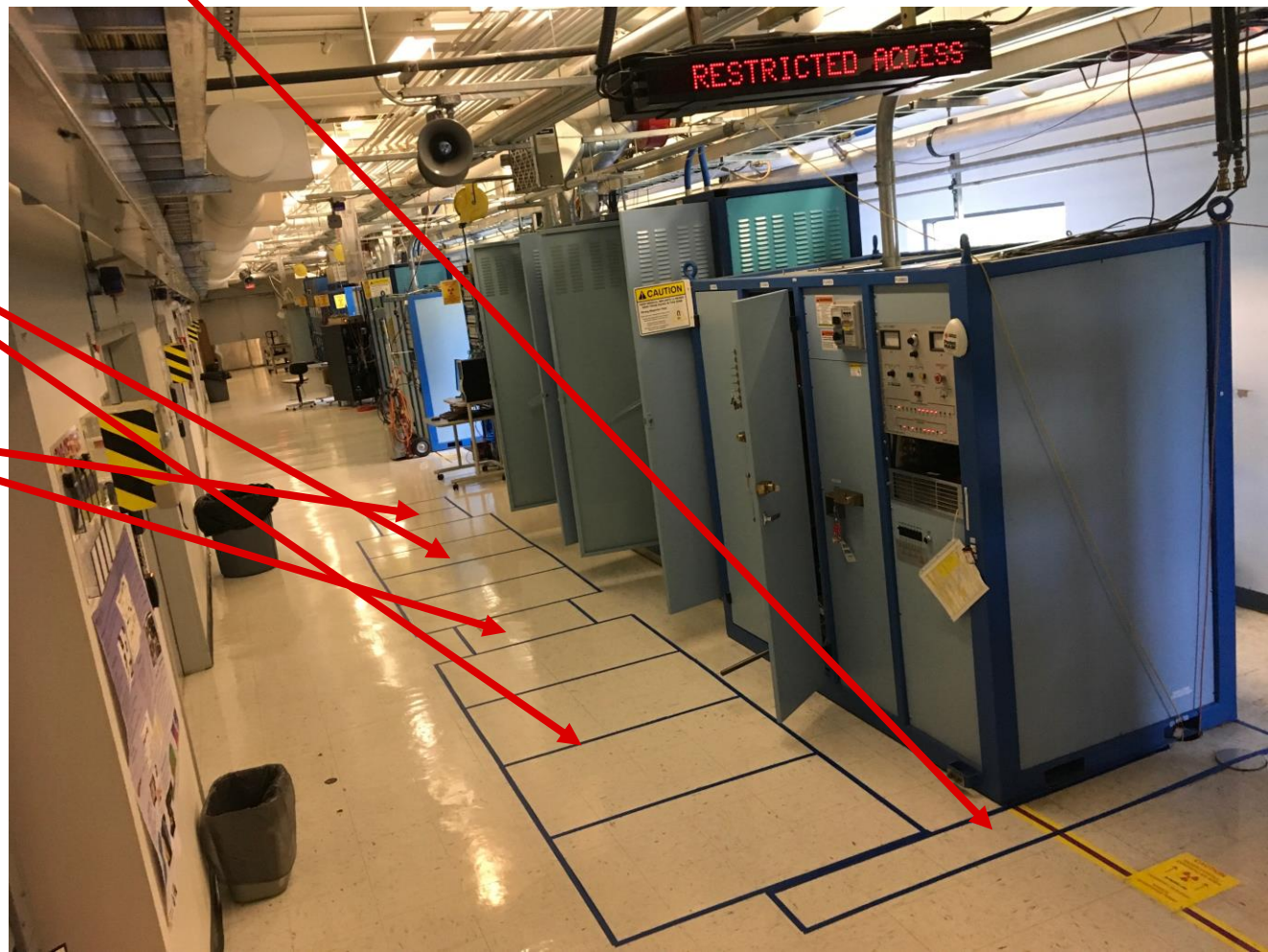
REV3, 03-AUG-2017

Gallery Layout for 1 of 2 Zones

Voltage Verification Unit (VVU)
480 VAC Breaker panel
Personnel Safety System (PSS)

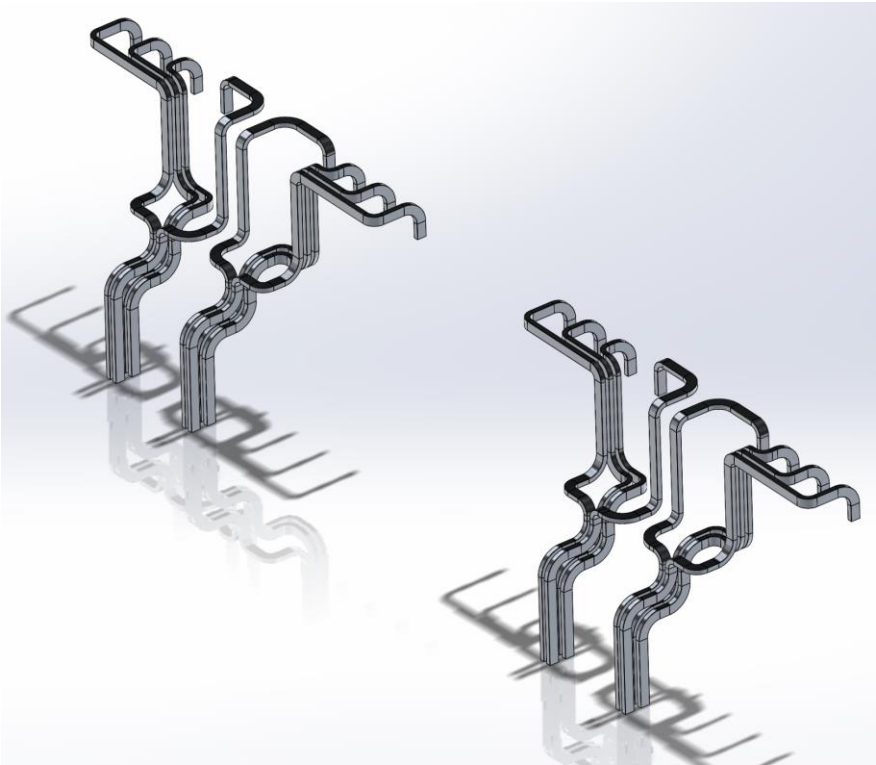
Solid State Amps

Equipment Racks



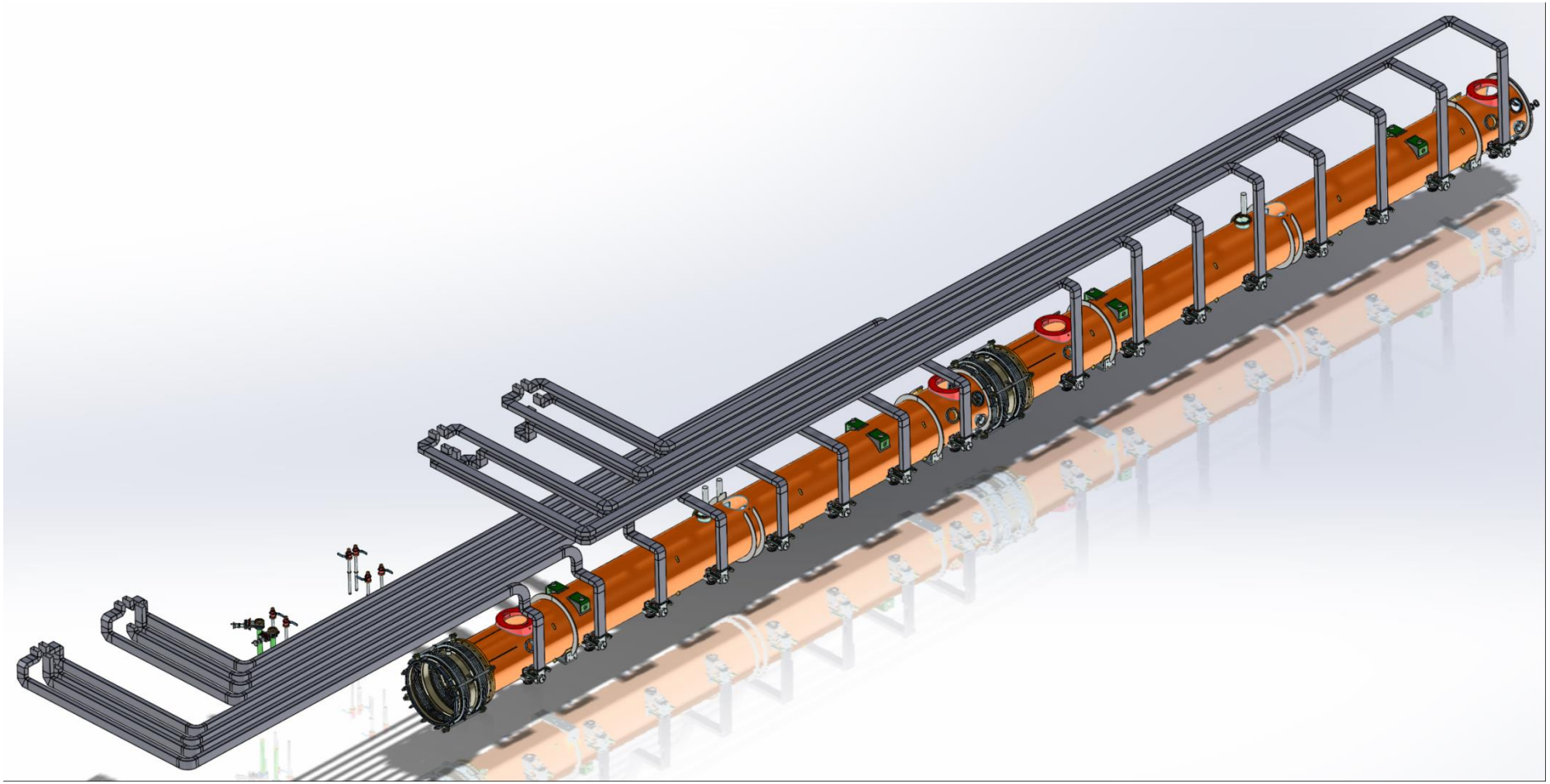
Waveguide Layout Upstairs

- Waveguides will route out the top of the existing rack to the SSA
- All connections will be done using waveguide



Waveguide Layout Tunnel

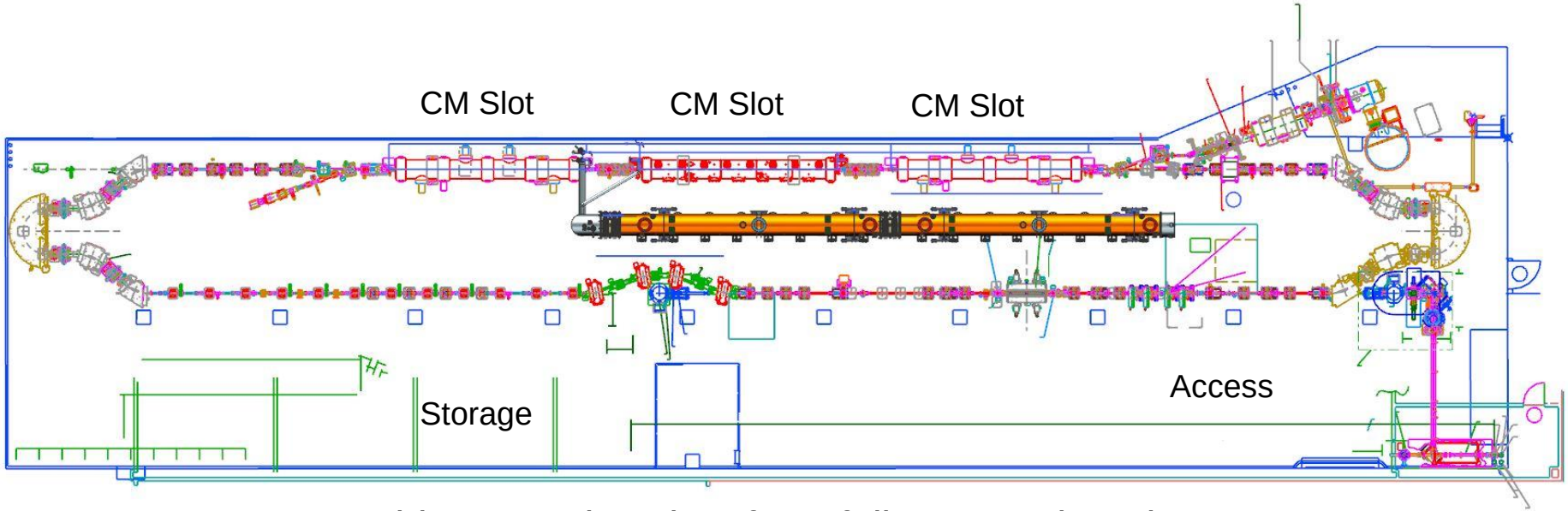
- Initial waveguide layout for tunnel



Cryomodule Instrumentation

- As much as possible, instrumentation will be LCLS II standard
  - Software
  - Temperature diodes
  - Magnetic Field monitoring
  - Vacuum controls (insulating, coupler beam line)
  - Decarad system for radiation monitoring
  - Faraday cups – ADC channel readout
  - SC Magnet Test
    - Duplicate existing magnet test stand
  - BPM cables and monitor (Vector Network Analyzer).

LCLS-II CM Layout in LERF – Testing 2 CMs per Cycle

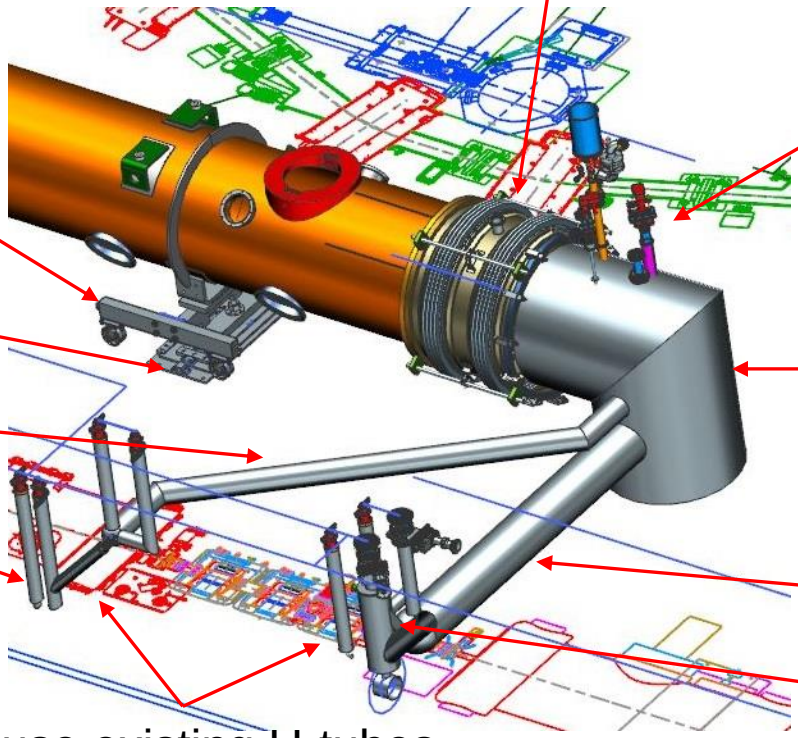


- Current machine contains slots for 3 full CMs and 1 Injector CM
- Shielded vault
- Existing PSS including radiation and ODH monitoring
- Utilities include cryo, water, electrical

Re-Use Existing U-Tubes

- New “end can” designed for LCLS II cryomodules
  - Two CMs are fed both supply & return 40K & 2K from same end

End Can & U-tubes – Conceptual Design



Move Cryomodule from Zone 4 to Zone 2

- The C50 module in Zone 4, which is at 4K needs to be relocated to Zone 2
- Gary Chen want to get a baseline Q_o measurement @ 2K then warmup & degauss then cool down again to see if there is an improvement
- Jonathan does not really care when this is done
- I would prefer that this is done sooner than later
  - Activity needs to be scheduled & ATLis submitted
  - Connections need to re-established (waveguide & interlocks)

Summary

- **Questions/Concerns/Comments**

Thanks for your attention