

Linac Coherent Light Source Monthly Report January 2010



CONTENTS

PROJECT OVERVIEW AND ASSESSMENT	3
TECHNICAL AND PROGRAMMATIC PROGRESS	
<u>LCLS Project Office & Support</u>	
WBS 1.1, 2.1	Project Management and Administration 3
<u>Photon Beam Systems</u>	
WBS 1.5, 2.5	X-Ray Transport, Optics & Diagnostics 5
WBS 1.6, 2.6	X-Ray Endstations 6
<u>Conventional Facilities</u>	
WBS 1.9, 2.9	Conventional Facilities 7
COST PERFORMANCE REPORT	
-Cost/Schedule Performance	8
-Cost/Schedule Assessment	
-Milestone Performance	
GLOSSARY	11

Project Overview and Assessment

Highlights:

- Cover page (X-ray Tunnel): The X-Ray Tunnel is a 200 meter long section of the LCLS that transports x-rays from the Near Experimental Hall to the Far Experimental Hall. It will eventually contain optics that will redirect the x-ray beam to the three hutches located in the Fall Hall that will house the LUSI and MEC experiments. This installation is now a complete vacuum system, having already been evacuated. Remaining work consists of cabling, finishing the photon beam stoppers, and installing the camera and beam dump which will detect x-rays in the Far Experimental Hall and satisfy one of the stated CD-4 goals that will complete the LCLS Project.

Assessment and Issues:

- The January 2010 Cost Performance Report is the 71st month of reported earned-value on the LCLS. TPC cumulative obligations to date (actual costs + open commitments) are \$406,743K. Cost and schedule indices are 1.00 and 0.99, respectively.

Project Office and Support

WBS 1.1, 2.1 Project Planning, Management and Administration

Highlights:

- LCLS Environmental, Safety & Health Status –
 - The project has worked 466 days without a restricted or lost time injury and 383 days without a recordable injury. Total project hours are 2.39M comprised of 1,717K collaboration hours and 672K subcontracted hours.
 - The project DART rate for construction is currently 2.7¹, as compared to the general industry rate of 3.2. The total project DART rate is 0.9; this includes construction and collaboration hours.
- LCLS Project Closeout Status –
 - Management: The Project is on track to complete all construction, commissioning and closeout activities in May 2010.
 - The Lessons Learned document underwent review and is in final stages of editing.
 - Detectors for first observation of x-rays in the Far Experiment Hall have been placed at the end of the x-ray transport tunnel.

¹ The number of injuries sustained by an average work crew of 100 individuals over a year.

- The first draft of the project closeout report is in preparation.
- A draft memorandum is being prepared to mark the completion of commissioning of x-ray systems to the far hall.
- The Project is working to the following timetable for closeout:
 - 28 February – Lessons Learned Document complete
 - 15 March – XRT Readiness Review
 - 17 March – Closeout document final draft complete
 - 30 May – LCLS Project charge numbers inactivated
- Status of CD-4 Performance Goals:
 - Detection of x-rays in the Far Hall – Projection date: 30 April 2010
 - Finishing FEE: All vacuum beam path parts are out the shop and being installed.
 - Beam transport to FEH: The beamline is complete from Hutch 1 to the FEH. Most of the beamline is now under EPICS vacuum control.
 - B901 Beneficial Occupancy – Projection date: May 2010 (see CF p.10)
 - Building 901 is 70% complete.
 - Outer shell 100% complete.
 - LCLS Accelerator Conventional Facilities B910 – B999:
 - Final punch list for FEH Hutches 98% complete.
 - Red-lines received from the general contractor and are under review by SLAC.
- Finance: Areas of focus that are in progress:
 - Control account status: As of the end of January, 573 Project accounts have been closed out, and 45 accounts remain open.
 - Review open project control accounts and accounting charge numbers and close as appropriate
 - Review accruals for accuracy and expedite invoice vouchering from vendors
 - Capitalize the relevant property record units as appropriate in the DOE system
 - Maintain the transition to operations budget model to ensure resources are appropriately managed
 - Coordinate closeout activities with collaborating labs to ensure their records are adequate and complete
 - Complete spares transfers and ensure records for future withdrawals are submitted to the Budget Office
 - Participate in assessing unresolved contingent liabilities in accordance with GAAP
 - Review and organize project documentation, policies, reports, etc for records retention
- Status of Closeout Deliverables: For January 2010, final Conventional Facilities (CF) related lessons learned and best practices were compiled.

A validation review of the CF lessons learned was performed to ensure clarity and consistency of CF input. Final edits will be initiated to the CF lessons learned based on comments from the validation review and then incorporated in the LCLS Lessons Learned Report. Work commenced on the LCLS Transition to Operations and Closeout Plan. The Transition to Operations and Closeout Plan is now approximately 40% complete.

28 February	Transition to Operations and Closeout Plan – First Draft Complete
28 February	Lessons Learned Report Complete
17 March	Transition to Operations and Closeout Plan Complete
24 March	LCLS Closeout Report – First Draft Complete
28 April	LCLS Closeout Report – Final Draft Complete (Prior to CD-4)

Assessment and Issues:

- None.

Photon Beam Systems

WBS 1.5, 2.5 X-ray Transport, Optics and Diagnostics (XTOD)

Highlights:

- Status of Activities Leading to CD-4 –
 - Finishing FEE – All vacuum beam path parts are out of the shop and being installed. About 75% of the new installed parts are leak-tested and under vacuum. Utilities for the system (cooling water, air) are being completed.
 - Beam transport to FEH – The beamline is complete from Hutch 1 to the FEH. Most of the beamline is now under EPICS vacuum control.
- Commissioning and Installation Progress –
 - The modified pop-in monitors are being completed. All will be installed by the end of February.
 - All vacuum hardware loaned to SLAC from LLNL has been returned.
 - Only one fabrication account is still open.

Assessment and Issues:

- None.

WBS 1.6, 2.6 X-Ray Endstation Systems (XES)

Highlights:

- Soft X-Ray Material (SXR) Instrument –
 - The mirrors for the focusing system have been coated at LLNL and are now at LBNL for assembly. The fabrication of the tank has been slightly delayed but is expected to be complete by mid February.
 - The monochromator tank has been delivered to SLAC from the German vendor and is undergoing vacuum qualification. The grating is on schedule to be coated in the beginning of February.
 - The M1 mirror was inspected by the vendor, and the damaged areas were ground out. The repaired mirror is available for coating for early next month just slightly delayed and on schedule for keeping the installation dates.
 - All SXR cable specifications were entered into the SLAC KAPTAR database (lengths, connectors, terminations). Most cables have been assembled and installation is in progress.

- LCLS Detector at Cornell University –
 - The remaining tasks to complete the detector will take place at SLAC, and the contract with Cornell ended on December 31, 2009 as planned. The new bump-bonded modules for the final detector have been delivered to SLAC and will be tested with x-rays at SSRL in February.
 - Some of the detector modules that have recently been assembled at SLAC display unexpected behavior during electrical testing. The problem seems to be associated with a particular batch of ASIC chips, but at this time it is not clear whether the problem is associated with mounting or with the chips. Modules built with chips from a different batch seem to work fine. Efforts to identify the problem are underway at SLAC, with consultation from Cornell.
 - The mechanical assembly of the detector including the movable quadrants will be completed by the end of February.
 - Cornell will participate in commissioning and preparing the detector for the first experiments later this year.

Assessment and Issues:

- As the assembly issues for the Cornell detector modules have been resolved, further problems have been discovered with some modules during the electrical testing phase. The exact cause of the problems is not clear yet. This is being aggressively investigated, in order to determine how many good modules can be completed, and whether the problem modules can be fixed.

Conventional Facilities (CF)

WBS 1.9, 2.9 Conventional Facilities (CF)



B901 exterior window installation



FEH Hutch #4



FEH Hutch #5

Highlights:

- Far Experimental Hall (FEH) Hutches –
 - Hutches 4-6 are roughly 98% complete.
 - Utilities including Process Cooling Water (PCW) and Compressed Air (CA) are 100% complete.
 - Mechanical HVAC is nearly 100% complete.
 - All work on mezzanine level is 100% complete.
- LCLS Office Space Project –
 - The 12kV tie-in at MH48 has been successfully completed.
 - The B901 project is at 70% completion.
 - The first layer of A/C paving installed in parking areas.

Assessment and Issues:

- The current contract completion date for B901 is April 27, 2010. However there have been several delays related to severe weather (2 days), buried concrete/AC in parking area (2 days), inability to use nuclear density gauge (4 days), and SLAC power outage (3 days).
- 12kV tie-in was completed as scheduled. The work involved splicing cable for the new unit substation/transformer into existing cable at MH48.
- A FEH walk-thru for the final punch list was conducted this month. The walk-thru included the general contractor, SLAC Facilities, SLAC Fire Marshal, Users, and the remaining Project team. Nearly 100 items were developed and identified to be corrected. To date, the list is over 80 % complete. Remaining issues pertain to electrical and are scheduled to be completed during the next reporting period.

LCLS Cost and Schedule Performance – January 2010

LCLS Cost/Schedule Status Report								31-Jan-10		
WBS	Cumulative to Date (\$K)							Budget At Complete (\$K)	Estimate At Complete (\$K)	Variance At Complete (\$K)
	Budgeted Cost		Actual Cost Work Performed	Variance		Performance Indices				
	Work Scheduled	Work Performed		Schedule	Cost	SPI	CPI			
1.1 Project Management	21,532	21,532	20,847	0	685	1.00	1.03	21,592	20,912	679
1.2 Injector	20,239	20,239	20,240	0	-1	1.00	1.00	20,239	20,240	-1
1.3 Linac	27,948	27,948	27,921	0	26	1.00	1.00	27,948	27,921	26
1.4 Undulator	45,830	45,830	45,936	0	-106	1.00	1.00	45,830	45,936	-106
1.5 X-ray Transport	29,255	28,837	32,119	-418	-3,282	0.99	0.90	29,316	32,829	-3,513
1.6 X-ray Endstations	10,709	10,428	10,332	-281	96	0.97	1.01	10,876	11,014	-138
1.9 Conventional Facilities	141,202	140,083	140,806	-1,119	-723	0.99	0.99	144,793	145,892	-1,098
1.X LCLS Controls	40,831	40,728	42,012	-103	-1,283	1.00	0.97	40,831	42,511	-1,680
1 LCLS Total Base Cost	337,545	335,625	340,212	-1,920	-4,588	0.99	0.99	341,424	347,255	-5,831
LCLS Total Estimated Cost								352,000		
Contingency								10,576		
2.1 LCLS Project Mgmt, Planning & Admn (OPC)	23,274	23,274	21,274	0	2,000	1.00	1.09	24,855	22,993	1,862
2.2 Injector (OPC)	6,392	6,392	6,648	0	-256	1.00	0.96	6,392	6,648	-256
2.3 Linac (OPC)	2,311	2,334	2,330	23	5	1.01	1.00	2,334	2,330	5
2.4 Undulator (OPC)	10,327	10,094	10,109	-233	-15	0.98	1.00	10,380	10,396	-16
2.5 X-ray Transport (OPC)	3,805	3,594	3,622	-211	-27	0.94	0.99	3,815	3,715	101
2.6 X-ray Endstations (OPC)	10,614	9,998	9,142	-616	856	0.94	1.09	11,232	10,237	995
2.9 Conventional Facilities (OPC)	2,953	3,048	2,332	95	716	1.03	1.31	3,459	2,733	726
2.X LCLS Controls (OPC)	4,157	4,073	4,763	-84	-690	0.98	0.86	4,555	5,262	-707
2 LCLS Total Other Project Cost	63,833	62,807	60,220	-1,026	2,587	0.98	1.04	67,022	64,313	2,709
LCLS Other Project Cost								68,000		
Management Reserve								978		
LCLS Total Project Cost	401,378	398,432	400,432	-2,946	-2,000	0.99	1.00	420,000	98%	

Cost and Schedule Performance (con't)

Overall Cost and Schedule Assessment

<u>January 2010 Project Performance</u>	AYK\$
Total Project Cost (TPC)	\$420,000
Planned % Complete	98.3%
Actual % Complete	97.5%
Total Estimated Cost (TEC)	\$352,000
Cost and Commitments to Date	\$344,539
Estimate at Complete	\$347,255
Work Remaining	\$7,043
Outstanding Phase-Funded Awards	\$3,268
Remaining Contingency (Based on EAC)	\$4,745
% Contingency on uncommitted work remaining	117.4%

The LCLS cost and schedule are consistent with the approved baseline with a Total Estimated Cost (TEC) of \$352M and a Total Project Cost (TPC) of \$420M. The CD-4 milestone is July 2010. All costs are in actual-year dollars and out-year costs are escalated.

The January 2010 Cost Performance Report is the 71st month of reported earned-value on the LCLS. TPC cumulative obligations to date (actual costs + open commitments) are \$406,743K. Cost and schedule indices are 1.00 and 0.99, respectively.

The critical path to meet CD-4 technical performance runs through the scheduled Linac shutdown, then FEL commissioning and has ~4 months of float. The critical path to meet CD-4 overall performance runs through the LCLS space renovation has ~3 months of float.

The Estimate at Complete (EAC) provides the most current estimate of the TEC projected final cost. Contingency on EAC is considered adequate for this stage of the project.

DOE (Level 2) Milestones

Activity Description	Base Date	Base vs Curr	Current Date	Fiscal Year							
				FY04	FY05	FY06	FY07	FY08	FY09	FY10	
DOE Milestone - Level 2											
Preliminary Safety Assessment (PSAD) Doc Comp	04/30/04	0	04/30/04A	●							
DOE External Independent Review (EIR) Complete	06/15/04	0	06/15/04A	●							
Fire Hazard Analysis Approved	06/30/05	-31	08/15/05A	●							
Preliminary Safety Assessment (PSAD) Doc Appvd	02/28/06	0	02/28/06A			●					
Delivery of Undulator 1st Articles to MMF	07/03/06	12	06/15/06A			●					
Sector 20 Alcove Beneficial Occupancy	07/21/06	68	04/14/06A			◆					
MMF Qualified & Ready to Measure Prod Undulators	08/28/06	0	08/28/06A			●					
Research Yards Mods Beneficial Occupancy	10/20/06	36	08/30/06A			●					
Start Injector Commissioning (Drive Laser)	01/29/07	19	12/15/06A			●					
Injector Laser Commissioning Review Complete	01/31/07	31	12/01/06A			●					
Injector Accelerator Readiness Review (ARR) Comp	01/31/07	-41	03/30/07A			●					
Start Injector Commissioning(UV Beam to Cathode)	04/09/07	2	04/05/07A			●					
Linac Water/Power Available	07/11/07	72	03/29/07A			◆					
Linac (Li20-Li30) Ready for Commissioning	12/01/07	0	12/01/07A			●					
Start Installation of Undulator Facility	05/16/08	-62	08/14/08A			●					
Beam Transport Hall Beneficial Occupancy	07/21/08	-18	08/14/08A			●					
Undulator Facility Beneficial Occupancy	07/21/08	-18	08/14/08A			●					
Front End Enclosure Beneficial Occupancy	07/21/08	-21	08/19/08A			●					
Near Experimental Hall Beneficial Occupancy	07/21/08	-19	08/15/08A					●			
Central Utility Plant Beneficial Occupancy	07/21/08	-19	08/15/08A					●			
Linac (Li20-Li30) Commissioning Complete	07/30/08	84	04/01/08A					◆			
Safety Analysis Document (SAD) Approved	08/29/08	-19	09/28/08A					●			
Start Installation of Beam Transport Hall	09/26/08	-2	09/30/08A					●			
X-Ray Transport Beneficial Occupancy	10/22/08	-18	11/17/08A					●			
Far Experimental Hall Beneficial Occupancy	10/22/08	-17	11/16/08A					●			
XT Start FEE Installation	01/13/09	-40	03/12/09A					●			
Beam Path Project Close Out	02/13/09	53	11/17/08A					◆			
LCLS ARR Complete (BTH thru FEH)	04/17/09	13	03/31/09A					●			
Start Linac-to-Undulator (LTU) Commissioning	04/20/09	82	12/12/08A					●			
XT Start Tunnel Installation	05/27/09	7	05/15/09A					●			
Start Undulator Commissioning (1st Light)	07/06/09	59	04/13/09A					●			
XE Start Installation in NEH	07/24/09	39	05/29/09A					●			
Start FEE Commissioning with Beam	08/06/09	26	06/30/09A					●			
First X-Rays into NEH, ready to start Expt'l Ops	09/10/09	19	08/14/09A					●			
XE Start Installation in FEH	02/22/10	0	02/22/10*					●			
2-D Detector Shipped to SLAC	02/26/10	20	01/29/10A					●			
LCLS Integration of SXR	03/31/10	0	03/31/10*					●			
First X-Rays into FEH	05/05/10	13	04/16/10					●			
LCLS Office Space Alternative Ben Occup	06/30/10	44	04/29/10					●			

Start Date: 07/19/06
 Finish Date: 08/04/10
 Data Date: 02/01/10

FBF_Level 2 Milestones
LCLS PROJECT Milestone Level 2
 PL-F2

Glossary

Actual Cost of Work Performed (ACWP) – Actual cost reported through the LCLS cost accounting systems, plus any accruals, for a specific WBS#, subproject, or project.

Budget Authority (BA) – Cumulative funds currently allocated and authorized by the Department of Energy that may be committed and spent by LCLS for project-related activities.

Budget at Completion (BAC) – The total budgeted cost at completion for a given WBS, subproject, or project. BAC is the budgeted cost of the project excluding contingency.

Budgeted Cost of Work Performed (BCWP) – Budgeted value of planned work for a WBS#, subproject, or project physically accomplished.

Budgeted Cost of Work Scheduled (BCWS) – Budgeted value of planned work time-phased to the schedule for a specific WBS#, subproject, or project.

Commitments – Funds allocated to subcontractors where work has been authorized but not yet expensed.

Cost Performance Index (CPI) – The ratio of the value of the work performed to actual cost; $CPI = BCWP/ACWP$. Values less than 1.0 represent “cost overrun” condition, and values greater than 1.0 represent “cost under run” condition.

Cost Variance (CV) – Difference between the estimated value of the physical work performed and the actual cost expended for a specific WBS#, subproject, or project. $CV = BCWP - ACWP$. A negative result is unfavorable and indicates the potential for a cost overrun.

Estimate at Completion – Forecast of the final cost for a specific WBS#, subproject, or project based on the current ACWP plus a management assessment of the cost to complete the remaining scope of work.

Estimate to Complete (ETC) – A realistic appraisal of the cost to complete the remaining scope of work.

Other Project Cost (OPC) – LCLS “supporting” costs not directly contributing to the construction project. OPC costs generally include research and development and pre-operation (start-up) activities.

Percent Complete – The ratio of the work accomplished (earned-value) to the Budget at Completion for any WBS#, subproject, or project. $\% \text{ Complete} = BCWP/BAC$.

Percent Contingency Remaining – The ratio of remaining contingency dollars to remaining line item (TEC) work calculated as follows: the numerator is equal to the contingency available (after consideration of the EAC) less 5% of outstanding technical phase-funded awards and less 10% of outstanding conventional facilities phase-funded awards. The denominator is the EAC less ACWP less outstanding phase-funded awards.

Percent Planned – The ratio of the current plan to the Budget at Completion. $\% \text{ Planned} = BCWS/BAC$.

Project Engineering and Design (PED) – Funding used to support the engineering and design effort for the LCLS.

Schedule Performance Index (SPI) – The ratio of the value of work performed to work scheduled, $SPI = BCWP/BCWS$. Values less than 1.0 represent a “behind schedule” condition, and values greater than 1.0 represent “ahead of schedule” condition.

Schedule Variance (SV) – Difference between the value of the physical work performed and the value of the work planned (scheduled). $SV = BCWP - BCWS$. A negative result is unfavorable and indicates a behind schedule condition.

Total Estimated Cost (TEC) – The total capital budget authorized for the LCLS project for the construction phase of the project. TEC includes contingency but does not include OPC.

Total Project Cost (TPC) – The total capital budget authorized for the LCLS project, including TEC and OPC.

WBS (Work Breakdown Structure) – A method of hierarchically numbering tasks in a traditional outline numbering format. The WBS provides a basis for the LCLS work plan which is used to track all resources, schedules, and cost.