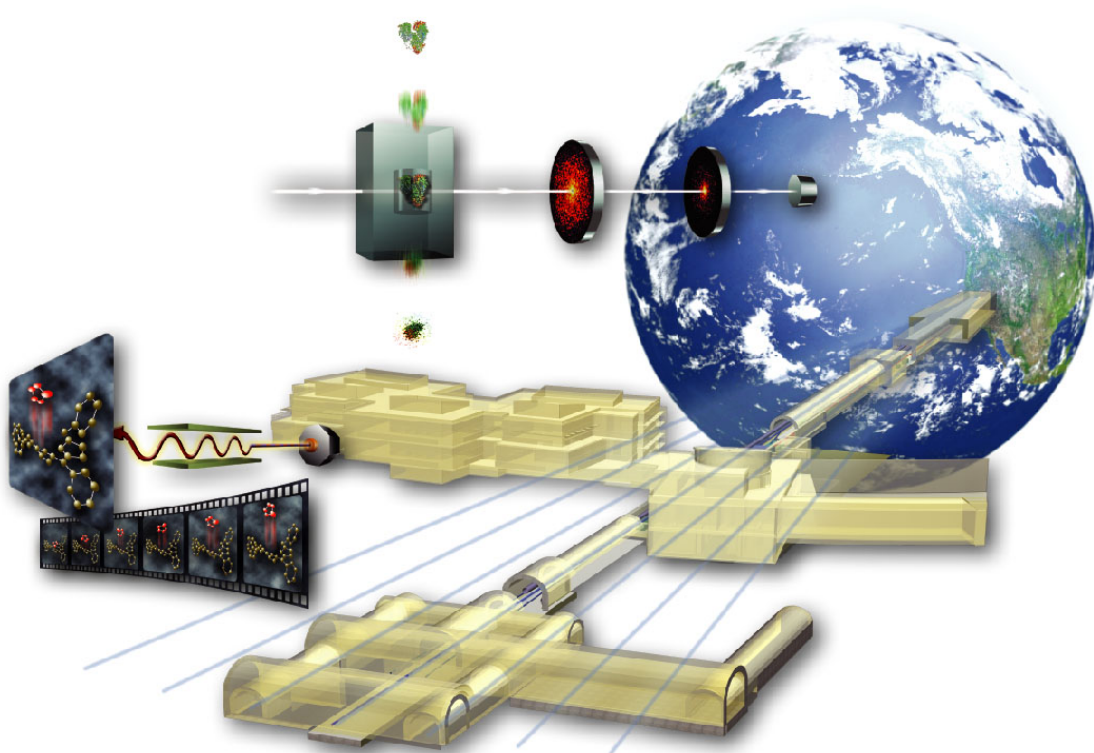


# Monthly Report

## February 2006



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## Project Overview and Assessment

### Highlights:

- A DOE Office of Science (Lehman) Review of the LCLS Project was conducted on February 7-9, 2006. The purpose of the review is to evaluate progress in all aspects of the project: technical, cost, schedule, management and environmental, safety and health (ES&H). The project received a recommendation to proceed with Critical Decision 3b (Approve Start of Full Construction), and this review serves to satisfy DOE O413.3 for an Independent Project Review prior to CD-3b. A full report on the DOE Review is expected in May 2006.
- Continued progress on the construction for the Sector 20 Injector Facility (S20) project. The project is 85% complete and is on schedule for a successful completion of the current Level 3 Milestone date of March 31, 06.
- Continued progress on the construction of the Magnetic Measurement Facility (MMF) project. The project is 90% complete and is on schedule for a successful completion of the current Level 3 Milestone date of April 3, 06.
- Title II 100% "Issue for Bid" set construction drawings and specifications were submitted by Jacobs Facilities (505 drawings). The Title II 100% LCLS review of the construction documents was held at the JE facility. A cost estimate based on 100% drawings and specifications has been provided by JE which showed an increase of 3% over the 60% cost estimate.

### Assessment and Issues:

- The February 2006 Cost Performance Reports (CPR) is the 24<sup>th</sup> month of reporting earned-value on the LCLS TPC. For February 2006, the LCLS cost and schedule indices are 1.01 and 0.93, respectively. Total obligations to date (actual costs + open commitments) are \$82,436K.
- The third partnering session was held on February 13 between SLAC, Jacobs and Turner to create a joint project mission statement and identify overarching project goals and how the SLAC-Jacobs-Turner project team can accomplish these goals.

## Project Office and Support

### WBS 1.1, 2.1 Project Planning, Management and Administration

#### Highlights:

- A web based system (SharePoint) that can be used to deposit requirements documentation (SOWs, Specifications (ESDs), and Drawings) and track documents used for Purchase Orders continued to be tested in February. Full use of the system will require significant effort to gather the needed data and enter it into the system, but will help with configuration control and record keeping.
- LCLS Environmental, Safety & Health Status – February 2006
  - Safety – The project has worked 186 days without a recordable injury incident through the end of February.
  - Oversight Walkthroughs – Walkthroughs continue at the Sector 20 and Magnetic Measurement Facility (MMF) construction sites. In addition, construction has started on the MMF Electrical Feeder project this month. The DOE Stanford Site Office (SSO) ES&H Group Leader, Construction Engineer and Operations Engineer performed a construction site walkthrough in addition to the weekly SSO Construction Engineer weekly walkthroughs. LCLS Project Office walkthroughs continue with multiple site visits per week.
  - Final Fire Hazards Analysis (FHA) – The FHA is being developed by Ralph Kerwin, the SLAC Assistant Fire Marshal. As part of the process of developing the FHA, Ralph has been in contact with the ORNL DOE Office of Science ES&H Group to assure that their concerns regarding life safety issues are being addressed to their satisfaction.
  - Safety Assessment Document (SAD) – Information for the LCLS project will be incorporated in the SLAC Linear Accelerator SAD. Steve Williams is coordinating the development of the SAD. The project goal is to have the SAD completed by July 1<sup>st</sup>.
  - Tunnel Rescue – Coordination meetings were held this month with participation from the University of Nevada, Reno Fire Science Academy, SLAC and local fire departments. The objective of the meetings have been to determine the scope of training required for Tunnel Rescue and the current training Fire Department personnel who will provide emergency response support have already. It appears that the difference between the Fire Department's current training levels and those required for Tunnel Rescue is not large. Discussions also addressed required hardware and equipment, which has been defined as is currently being proceed by LCLS Procurement.
  - Project Safety Reviews – The LCLS ESH group made presentations at two reviews in February:
    - Project Management Oversight Group

- DOE 'Lehman' Review
  - Review of Construction Safety
  - Integrated Safety Management (Status of Safety at LCLS)

The recommendation resulting from the DOE 'Lehman' review was for the project to implement an ES&H Corrective Action and Tracking System.
- LCLS Procurement Status – February 2006;
  - LCLS procurement activity continued to increase in February, mainly due to issues surrounding the Jacobs and Turner subcontracts and with Turner requiring significant oversight and support as they prepare for bidding.
  - A/E Design – A negotiation meeting was held on February 1 and a settlement was reached covering several outstanding issues. Subcontract modification number 12 was sent for signature, with modifications number 13 and 14 expected the second week in March.
  - CM/GC – Weekly Owner-Architect-Constructor (OAC) meetings are being held and are very productive. Meetings to work through sub-subcontracting details were held and will continue next month. Negotiations to clarify and incorporate RFP Addendum 3 into the subcontract continued, however further discussions are needed to agree on exact wording. The last scheduled senior management partnering session was held, with additional larger group meetings under consideration.
  - FFTB Equipment and Block Removal – IFB issued. Planned award date is April 4.
  - Research Yard Demo - APP approved with planned start of May 1 and complete by May 31.
  - Linac BC1 Chicane Dipole Magnets – Subcontract awarded. Due Jun 30.
  - Injector Laser Heater Chicane Dipole Magnets – Subcontract awarded. Due Aug. 18.
  - BC1 Tweaker Quadrupole Magnets – Proposals received, still under evaluation. Award date slipped but delivery is anticipated to be on schedule.
  - BC2 Chicane Dipole Magnets – RFP Addendum issued with 1 month extension provided.
  - BY Vertical Bend Dipole Magnets - RFP Addendum issued with 1 month extension provided.
  - BYD Vertical Bend Dump Magnets - RFP Addendum issued with 1 month extension provided.
  - LTU Quadrupole Magnets - RFP Addendum issued with 1 month extension provided.
  - Injector Quadrupole Magnets – 11 each shipped via ship, balance due by end of March.
  - Controls and Power Supply Racks – Awarded. Due Apr. 4.

- Undulator Coordinate Measurement Machine (CMM) – Due date slipped by approximately one month to early March.

**Assessment and Issues:**

- Response to the open Job Requisition for a Procurement/Subcontract Administrator has increased and an interview was held with an external applicant. An offer is under consideration. Business Services Division approved hiring a lower level position in addition to the senior level position that has been open for several months, and an internal applicant has expressed interest in filling the position. Office space continues to be a concern.
- Several meetings between SLAC and Turner Construction have been held to discuss legal and contractual issues without resolving all known issues. Additional meetings are necessary to work through sub-subcontracting details were held and will continue next month. Language to properly incorporate RFP.

## Electron Beam Systems

### WBS 1.1, 1.x.2 Controls System

#### Highlights:

- The Controls Manager has developed a list of engineering and technical staff from SLAC departments whose participation are considered essential for completing control system projects on time. The requested staff has been integrated with the LCLS controls group and is actively involved in system engineering.
- A draft control system installation and commissioning schedule was developed in collaboration with the physics commissioning and the mechanical systems installation groups. The details were discussed in the controls group meeting following a presentation on the control system requirements for injector commissioning. The control system project list was reprioritized to ensure the availability of critical systems by the injector commissioning time.
- Vacuum Controls: The engineering team finalized the decisions regarding controllers, ion pump power supply and the cold cathode gauge controllers. An ESD for vacuum controls is nearly done and a final design review has been scheduled. A sole source justification for the ion pump power supplies was prepared. This is the main long-lead item for the vacuum system and also the most expensive item.
- Magnet control: The design of the EPICS database was completed, additional resources were assigned to the team, and a schedule for the completion of the magnet software by the end of August was developed. Work continued on developing EPICS software for magnet control including field set, standardize and calibrate functions.
- LLRF: The phase and amplitude detector (PAD) support in EPICS is now functioning in a test set up and is taking REAL analog data. Noise measurements using Scilab on the raw data transferred by memory stick out of the standalone system are under test. A Windows program to read a PAD was developed for use by Thales. This creates a standalone system for data acquisition for the laser with a PAD and a laptop, with no external network and only a crossover cable in between the two devices.
- Timing System: A 3 day workshop was held with participants from LANL and the Swiss Light Source. The communication software between the EVG, EVR and the Pnet modules was successfully completed. A half-day meeting was held to discuss the high level and interface requirements for the timing system

including interfaces to the BPMs, MPS, LLRF, etc.. A requirements document is in preparation and a review will be scheduled shortly.

- PPS, MPS: Laser Safety System (LSS) Detailed schematics have been finished and all the parts required have been ordered to complete the system. The Final Design Review for the injector PPS is scheduled for the week of April 24. Trunk cables were identified and order has been placed. Robert Forestal from APS visited SLAC and reviewed and completed the PPS design in support of the upcoming formal design review.
  - After evaluation the decision was made to use the existing Linac MPS as an interim solution for injector commissioning. This is in place of developing a temporary PLC-based system. The Controls Manager met with the MPS team from the CPE department to identify hardware and software requirements.
- Laser System: Controls staff visited the camera manufacturer PULNiX to clarify details regarding syncing their cameras with the laser system. Since camera-link cable can only run 10 meters and some of our systems need much longer connections, we evaluated a camera-link to fiber interfacing and are working with the vendor to fix a few remaining issues. Orders for an additional 8 cameras have been placed. The building 407 laser camera test setup is running now. Work was completed on image processing, noise reduction, projection calculation, etc. Work continues on the algorithm to calculate cross-coupling matrix.
- Motion Control: The majority of hardware has arrived for our wire scanner motion prototype, including a manual hand-held controller, and has been assembled and tested. Apart from a few minor issues, the system is able to drive the motors well. Another motion control requirement has come to our attention, for adjustable gap between permanent magnets in the laser heater; although not needed for another 14 months, we need to understand cable requirements now.

#### **Assessments and Issues:**

- The Controls schedule for the 2006 installation in the Injector and Linac is very tight. A plan to meet the schedule has been made and resources have been allocated to address critical items. The Controls Manager is monitoring progress very closely.
- The cable plant installation above the drive laser interferes with the installation of the laser and so needs to be expedited. There is substantial effort going into this issue and there has been good progress, but it is still unfinished. Weekly meetings will continue to identify and address problems.



## **WBS 1.2, 2.2 Injector System**

### **Highlights:**

- LCLS Controls and Injector-Linac identified multi-disciplined design teams associated with required devices and systems. Progress was made in integration of diagnostics devices and controls hardware selection for wire scanners and toroids. A vendor's proposed toroid design, solicited by the Mechanical group, was found to be compatible with controls system hardware.
- An engineering specification for the Injector drive laser transport, conditioning and launch system was written. The final design review of the drive laser transport & launch optics was held.
- A venting procedure was written for Linac Sector 20 (which includes the Positron Vault.) It is desired to vent Sector 20 to remove existing waveguide connected to the klystrons which will be used to power components in the Injector Vault. Performing the gallery waveguide work prior to the 2006 shut-down will help to relieve manpower constraints. This work will be scheduled to occur following FFTB operations.

### **Assessments and Issues:**

- A consultant (Rudy Damm) visited the LCLS Injector-Linac team to conduct an independent analysis of readiness for August 2006 installation. Consistent with the DOE 'Lehman' committee's findings, the consultant found that the schedule is tight and progress towards the installation must be carefully monitored. Design manpower tracking has improved to assure mechanical designs will be completed in time to fabricate components for 2006 installation.
- A progress review was held for the OTR Optics. The current design was found not to fit in all desired locations, requiring custom optics designs. Standardization of design is being pursued as well as the possibility of using a design developed at ANL.
- Injector Drive Laser vendor (THALES) milestone 2, acquisition of components, was not completed by the vendor in February. The vendor will complete Milestone 2 by mid-March. Sufficient float exists to meet scheduled delivery of the drive laser.
- Laser commissioning is likely to be delayed by Injector Cable plant installation. The cable plant running over the laser bay has been largely completed and is being expedited. Placing the contract installation work is proceeding. The installation schedule is being coordinated. This effort is tracked in the weekly installation preparation meeting.

## **WBS 1.3, 2.3 Linac System**

### **Highlights:**

- A presentation was made on an alternate approach to bunch length measurement (BLM) for BC1 using a ceramic gap and RF diodes, similar to what was used in SLC. It was stated that both the gap and the CER/CSR techniques might be used to cover the full range of charge and bunch length in BC1. The gap method can be tested in End Station A.
- Fabrication was resumed on the BC1 chicane articulation vacuum chambers following modifications to flanges to accommodate Bunch Length Monitor and the X-Band section requirements. The delay will not affect installation.
- The 'Tweaker Quadrupole' magnet order for BC1 was placed as a 'build to specification'.
- The L1 BPM model was completed. The model will be integrated into the L1 assembly model prior to detail drawing release. The L1 BPM is a modification of the BPM designed for the Injector.

### **Assessments and Issues:**

- The development of the diagnostic section of BC1 now appears to be a critical path item for the Linac installation this autumn. Resources will be added to insure that the schedule is held.
- The development of the BLM system also needs to be advanced. Additional SLAC effort has been put on this project, and weekly team meetings with controls group are underway.

## **WBS 1.4, 2.4 Undulator System**

### **Highlights:**

- Undulator Magnets: The 1<sup>st</sup> Articles (1 each from 2 vendors) are in progress. The current delivery date is to ship the first undulator in the second week of March. This is still slightly ahead of the early finish date.
- Beam Position Monitors: A prototype RF beam position monitor was constructed and successfully operated on the bench in the laboratory with artificial beam signals. The group is now waiting for the 1<sup>st</sup> brazed assembly to be installed in the injector test stand for beam tests.
- Prototype undulator testing continued at SLAC. The undulator's magnetic field was measured with the undulator in the retracted position. Fields larger than expected were found near the vertical trajectory shims. The data was discussed with experts at ANL.
- Meetings at ANL were held to discuss assembly coordination and the system component delivery timetable to SLAC's MMF. The flow of production undulator magnets through the MMF will begin in August. The SLAC Undulator Assistant Manager is preparing a detailed schedule.

### **Assessments and Issues:**

- Last month the Undulator report identified a quality issue with the magnet block vendor. This issue continues to be monitored by working very closely with the magnet vendor. An improvement in the quality control of the vendor appears to have resulted in a significant improvement in the magnet block quality control. Additional quality control results will be needed to ensure that the issue is resolved.
- There have been delays in the RF BPM brazing, but it appears a vendor is now capable of meeting the quality and delivery specifications. However, the RF BPM delivery schedule is close to the critical path and could risk slowing down the assembly of the undulator systems in the magnet measurement facility.
- The assembly of the Single Undulator Test (SUT) was planned in mid-February but has been delayed due to a vendor's delivery of a support plate. The SUT is a crucial assembly to prove and validate our overall assembly and integration plan to ensure the work flow through the magnet measurement facility goes smoothly.

## Photon Beam Systems

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

#### Highlights:

- Management and Safety – BCR XT-09 was implemented primarily to reduce project TEC and increase project contingency related to the Conventional Facilities increase. In addition, the XTOD team prepared for the Slit Conceptual Design Review (CDR) to be held March 1.
- Tunnel – An updated Engineering Specification Document (ESD) for the tunnel vacuum system were received and approved. The vacuum system analysis for the single beam tunnel and pump-cart pump-down scheme has been completed. The final drawings for the tunnel were detailed and are ready for checking in preparation for the Final Design Review.
- Gas Attenuator – The XTOD group is preparing for an Attenuator CDR tentatively scheduled for early April 2006. The assembly of the prototype gas attenuator is making good progress. Testing will start in March.
- Beam Simulation – A full simulation of the (closed) slit has been run using the high-energy end ( $>1.2$  MeV) of the spontaneous radiation to check backgrounds in the detectors. No more than  $40 \pm 20$  high-energy photons (per 0.79 nC pulse) get through the closed slit and interact in the 100-micron-thick YAG scintillator detector. This result confirms that the slit has sufficient thickness to meet its absorption specification.
- FEL Offset Mirror System – the XTOD group is developing the Physics Requirements for the FEL offset mirror system. A model to predict the FEL beam parameters downstream of the mirror system has been developed and tested using theoretical surface Power Spectral Densities (PSD). The plan is to derive PSDs from vendor data on mirrors recently delivered to SSRL and run the model using these PSDs to determine what the FEL beam would look like after reflection from one of these standard mirrors.
- Controls – A cost/effort spreadsheet has been developed to track rack power consumption, and rack height/locations.

#### Issues:

- none

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

### **Highlights:**

- The XES group participated in the LCLS Detector Advisory Committee meeting on Feb. 9<sup>th</sup> at SLAC. Both the 2D x-ray Detector program at Cornell and the BNL detector program for LUSI were evaluated. A report from the review committee is expected soon. The Cornell project is going forward as planned. Niels van Bakel, as XES detector physicist, has started to take responsibility for these projects and has set up regular communications with the Cornell group.
- Controls: XES is coordinating controls needs and requirements with the LCLS Global Controls Group. An integrated plan for the scope of XES is under development.
- PPS: The XES group is meeting regularly with Mike Saleski (LCLS PPS Manager) for the Photon Systems and started to work on documenting the PPS layout for the Photon areas and possible access condition and requirements.
- The Atomic Physics instrument scientist John Bozek is having weekly teleconference meetings with the AMO Team Leaders. This is the beginning of the process to define the experimental program and requirements. Currently, two AMO instruments are envisioned (1) high field physics and (2) inorganic particle imaging. Initially the soft x-ray branch will be used but some experiments may require the hard x-ray line.

### **Assessment and Issues:**

- XES group is starting to develop a detailed schedule in all WBS areas. Modifications, detailing of our plans, resource and cost loading, and integration is expected to take at least through March and will then be presented as a BCR.
- The long-range staffing plan is continuing to be developed, particularly the necessary increase to a staffing level adequate for operating the LCLS.

## Conventional Facilities (CF)

### WBS 1.9, 2.9 Conventional Facilities (CF)

#### Highlights:

- Continued progress on the construction for the Sector 20 Injector Facility (S20) project. The project is 85% complete and is on schedule for a successful completion of the current Level 3 Milestone date of March 31, 06.
- Continued progress on the construction of the Magnetic Measurement Facility (MMF) project. The project is 90% complete and is on schedule for a successful completion of the current Level 3 Milestone date of April 3, 06.
- Title II 100% “Issue for Bid” set construction drawings and specifications were submitted by Jacobs Facilities (505 drawings). The Title II 100% LCLS review of the construction documents was held at the JE facility. A cost estimate based on 100% drawings and specifications has been provided by JE. (See Issues and Assessment below).
- The CF group participated in a training session provided by Turner for Turner-Talk; a web-based system to process data and correspondence between Owner-Architect-Contractor in a more efficient manner.
- LCLS CF will manage the demolition effort for three buildings within the Research Yard. This will result in a reduction of scope for the work of TC.

#### Issues and Assessments:

- The completed conventional facilities design was presented to the SLAC Earthquake Review Committee (ERC). An Independent Peer Reviewer participated in the presentation. The ERC approved above ground structures with the tunneling design scheduled for presentation at the next ERC meeting.
- A construction schedule was submitted by Turner Construction based on the 60% drawings and specifications for review and approval by LCLS. The construction schedule was returned to TC to more accurately reflect the required dates for various areas. In addition, several issues were unresolved and required further clarification.
- The 100% cost estimate provided by JE had increased by 3%. The areas with the most significant increases are tunneling, concrete, and site-work. A Variance Report will be provided by JE with clarification of the increases.



## LCLS Cost and Schedule Performance – February 2006

LCLS Cost/Schedule Status Report - Work Breakdown Structure										28-Feb-06
WBS	Cumulative to Date (\$K)							At Completion (\$K)		
	Budgeted Cost		Actual Cost Work Performed	Variance		Performance Indices		Budgeted	Management Estimate at Complete*	Variance
	Work Scheduled	Work Performed		Schedule	Cost	SPI	CPI			
1.1 Project Management	12,890	12,843	14,085	-47	-1,242	1.00	0.91	27,741	32,316	4,575
1.2 Injector	12,387	10,417	10,582	-1,970	-165	0.84	0.98	20,584	22,951	2,367
1.3 Linac	6,105	5,372	4,286	-733	1,085	0.88	1.25	25,312	22,915	-2,397
1.4 Undulator	13,388	11,837	11,737	-1,551	100	0.88	1.01	41,095	40,972	-123
1.5 X-ray Transport	6,939	6,831	6,487	-107	345	0.98	1.05	24,149	27,027	2,878
1.6 X-ray Endstations	914	907	876	-6	31	0.99	1.04	14,140	14,715	575
1.9 Conventional Facilities	15,178	14,690	14,192	-488	498	0.97	1.04	107,204	112,688	5,484
<b>1 LCLS Total Base Cost</b>	<b>67,800</b>	<b>62,898</b>	<b>62,245</b>	<b>-4,902</b>	<b>653</b>	<b>0.93</b>	<b>1.01</b>	<b>260,223</b>	<b>273,584</b>	<b>13,361</b>
<b>LCLS Total Estimated Cost</b>								<b>315,000</b>	<b>315,000</b>	
<b>Avail. Contingency</b>								<b>54,777</b>	<b>41,416</b>	
<b>% Contingency / ETC</b>								<b>27.8%</b>	<b>19.7%</b>	
<b>% Complete LCLS Base Cost</b>								<b>24.2%</b>	<b>23.0%</b>	
2.1 LCLS Project Mgmt, Planning & Admn (OPC)	5,076	5,152	5,094	76	58	1.01	1.01	33,425	33,582	-157
2.2 Injector (OPC)	733	667	669	-65	-2	0.91	1.00	5,754	5,805	-50
2.3 Linac (OPC)	1	1	31	0	-30	1.00	0.04	2,545	2,575	-29
2.4 Undulator (OPC)	1,050	747	794	-303	-47	0.71	0.94	5,502	5,502	0
2.5 X-ray Transport (OPC)	489	489	427	0	62	1.00	1.14	4,930	4,878	52
2.6 X-ray Endstations (OPC)	319	255	175	-64	80	0.80	1.45	5,246	5,164	82
2.9 Conventional Facilities (OPC)	0	0	0	0	0			621	621	0
<b>2 LCLS Total Other Project Cost</b>	<b>7,668</b>	<b>7,312</b>	<b>7,191</b>	<b>-356</b>	<b>121</b>	<b>0.95</b>	<b>1.02</b>	<b>58,024</b>	<b>58,126</b>	<b>-103</b>
<b>LCLS Other Project Cost</b>								<b>64,000</b>	<b>64,000</b>	
<b>Avail. Management Reserve</b>								<b>5,976</b>	<b>5,874</b>	
<b>% Management Reserve / ETC</b>								<b>11.8%</b>	<b>11.6%</b>	
<b>% Comp LCLS Other Project Cost</b>								<b>12.6%</b>	<b>12.6%</b>	
<b>LCLS Total Project Cost</b>	<b>75,468</b>	<b>70,210</b>	<b>69,436</b>	<b>-5,258</b>	<b>774</b>	<b>0.93</b>	<b>1.01</b>	<b>379,000</b>	<b>379,000</b>	
<b>% Complete LCLS TPC</b>								<b>22.1%</b>	<b>21.2%</b>	

\*Management Estimate at Complete includes the Budget at Complete, a weighted CPI and SPI, proposed Baseline Change Requests and known risk contingencies.



## **Cost and Schedule Narrative**

The LCLS cost and schedule estimate is consistent with a CD-4 milestone of March 31, 2009 and with a Total Estimated Cost (TEC) of \$315M and a Total Project Cost (TPC) of \$379M. All costs are in actual-year dollars and out-year costs are escalated using guidance provided by the Department of Energy's Office of Engineering and Construction Management (OECM).

The February 2006 Cost Performance Reports (CPR) is the 24<sup>th</sup> month of reporting earned-value on the LCLS TPC. For February 2006, the LCLS cost and schedule indices are 1.01 and 0.93, respectively. Total obligations to date (actual costs + open commitments) are \$82,436K. Approved Baseline Change Requests (BCR's) for February 2006 are shown in the table below. The project critical path runs through the beneficial occupancy of the Central Lab Office Complex (CLOC) and has a total float of 111 working days with respect to CD-4. An updated schedule is under review which intentionally delays the award of the CLOC to mitigate cost risk related to civil construction. The LCLS Project Office is working closely with Turner to optimize the award of the CLOC while maintaining adequate float on the project critical path. Early beam commissioning is critical to achieving the CD-4 goals of the LCLS. The controlling path for the LCLS beam commissioning runs through the Undulator Facility Beneficial Occupancy followed by the installation of the undulators followed by FEL beam commissioning. The total commissioning period with respect to CD-4 is 213 working days. LCLS management will aggressively work to maintain or improve this beam commissioning period.

### **Significant Cost/Schedule Variances**

**Injector System:**  $SPI = 0.84$  – The major driver of the schedule variance in the Injector System continues to be the laser system. For the drive laser, Laser vendor Thales is showing a delay in milestone #3 (final acceptance test at Thales), scheduled for March 29 is now expected to occur in May. This may delay the laser delivery date to SLAC on May 28, 2006. The delivery of the streak camera is another contributor to the schedule variance which is now due in April. The fabrication of the RF gun, another contributor to the schedule variance, is advancing. A detailed plan for the hot test of the gun is in hand which contains sufficient float prior to gun installation.

**Linac System:**  $SPI = 0.88$ ,  $CPI = 1.25$  – In the Controls Systems for both Linac and Injector the procurement of hardware for the upcoming installation is underway but behind schedule. There is a strong effort to recover schedule. The Linac System is running under budget in the RF subsystem. This is due to design synergies with the design effort for Injector RF which could lead to true savings, and due to there being no charges to LCLS yet for the SLAC-built X-band klystron which is under test.

**Undulator System:**  $SPI = 0.88$  – The delivery of the measurement test stand and the CMM remain the major drivers of the schedule variance in the Undulator system. The progress towards delivery of these devices is being closely watched. The measurement test





stand will be air-freighted to SLAC to recover lost time. The milestone for the establishment of an operational undulator tuning facility in the SLAC MMF has not slipped. Schedule variances for undulator system development at ANL have improved significantly since January.

All schedule variances are being addressed at this time, and as none of this planned work is on the project's critical path or shutdown schedules, these variances are seen as low risk. For the LCLS Other Project Costs (OPC), cost and schedule variances are negligible.



**Change Control Activity\***

**February 2006**

BCR #	WBS #	Signature Level	Approval Month	BCR Description	Originator	TEC Base Cost Estimate		
						Previous Estimate	Increase (Decrease)	New Estimate
CF45	1.09	4	1-Feb-06	Extend Sector 20 project completion from 2/28/06 to 4/12/06 and change order requests for Sector 20.	D. Saenz	66,248,050	89,981	66,338,031
LN-36	1.03.02	3	1-Feb-06	Renegotiate Level 3 milestone dates	Shoae	66,338,031	0	66,338,031
XE-11	1.06	3	1-Feb-06	Delete PC computers and servers for experiment control. Add travel budget.	J. Arthur-S. Moeller	66,338,031	(468,986)	65,869,045
XE-12	1.06	3	1-Feb-06	Replan completion dates for Level 3 milestones	J. Arthur-S. Moeller	65,869,045	0	65,869,045
January 2006 Total Base Cost Estimate						260,602,210		
Total Delta Base Cost Change			1-Feb-06				(379,005)	
February 2006 Total Base Cost Estimate								260,223,205

**\*All changes to the baseline are approved by the LCLS Change Control Board as per the approval thresholds defined in the LCLS Project Management Plan. Copies of Baseline Change Requests (BCRs) are available through the LCLS Project Office.**



### Milestone Report

<b>Milestone ID/Name</b>	MS3_XE110 –Hire Atomic Physicist
<b>Milestone Level</b>	ML3
Baseline Date	03/17/06
New Projected Date	01/03/06
Completed	Yes
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): This milestone is complete	

<b>Milestone ID/Name</b>	MS3_XE100 –Hire Detector Physicist
<b>Milestone Level</b>	ML3
Baseline Date	04/03/06
New Projected Date	01/17/06
Completed	Yes
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): This milestone is complete	

<b>Milestone ID/Name</b>	MS3_XE015 – 2D Pixel Detector Production Start
<b>Milestone Level</b>	ML3
Baseline Date	07/24/08
New Projected Date	12/03/07
Completed	No
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): Replanned the Level 3 milestone to the correct completion date.	



**Milestone Report (continued)**

<b>Milestone ID/Name</b>	MS3_XE085 – Complete Accept Tests for X-Ray Detectors
<b>Milestone Level</b>	ML3
Baseline Date	08/28/08
New Projected Date	1/20/09
Completed	No
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): Replanned the Level 3 milestone to the correct completion date.	

<b>Milestone ID/Name</b>	MS3_CF005, A&E Serv Title 2 Complete
<b>Milestone Level</b>	ML3
Baseline Date	02/28/06
New Projected Date	2/28/06
Completed	Yes
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): This milestone is complete	

<b>Milestone ID/Name</b>	MS3_CF005, A&E Serv (S20, MMF, MCC not incl) Title 2 Complete
<b>Milestone Level</b>	ML3
Baseline Date	02/28/06
New Projected Date	2/28/06
Completed	Yes
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): This milestone is complete	

**Milestone Report (continued)**

<b>Milestone ID/Name</b>	MS3_XT009 –Far Hall Mech/Vac Design Review Complete
<b>Milestone Level</b>	ML3
Baseline Date	12/10/07
New Projected Date	4/26/07
Completed	No
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): Revised schedule to prioritize instruments with beneficial occupancy and commissioning schedules.	

<b>Milestone ID/Name</b>	MS3_XT060 – Total Energy Measurement Installation Comp
<b>Milestone Level</b>	ML3
Baseline Date	5/28/08
New Projected Date	11/19/07
Completed	No
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): Revised schedule to prioritize instruments with beneficial occupancy and commissioning schedules.	

<b>Milestone ID/Name</b>	MS3_XT050 –Tunnel Mech/Vac Installation Complete
<b>Milestone Level</b>	ML3
Baseline Date	9/15/08
New Projected Date	12/16/07
Completed	No
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): Revised schedule to prioritize instruments with beneficial occupancy and commissioning schedules.	



**Milestone Report (continued)**

<b>Milestone ID/Name</b>	MS3_XT000 – FEE Mech/Vac Installation Complete
<b>Milestone Level</b>	ML3
Baseline Date	5/2/08
New Projected Date	2/12/08
Completed	No
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): Revised schedule to prioritize instruments with beneficial occupancy and commissioning schedules.	

## LCLS Glossary

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

**Actual Year Dollars (AY\$)** – Actual dollars in the year spent. Budgeted funds also reported in AY\$ to estimate of out-year expenditures and inflation. LCLS uses the escalation rate guidance as recommended by the Department of Energy for Energy Research projects.

**Budget Authority (BA)** – Cumulative budget 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 of the project at completion for a given 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 specific WBS#, subproject, or project physically accomplished to date.

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

**Commitments** – Budget allocated for approved work.

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

**Management Estimate at Completion** – Forecast of the final cost for a specific WBS#, subproject, or project based on the current BAC plus management’s assessment 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.  $\% \text{ Complete} = BCWP/BAC$ .

**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 costs.