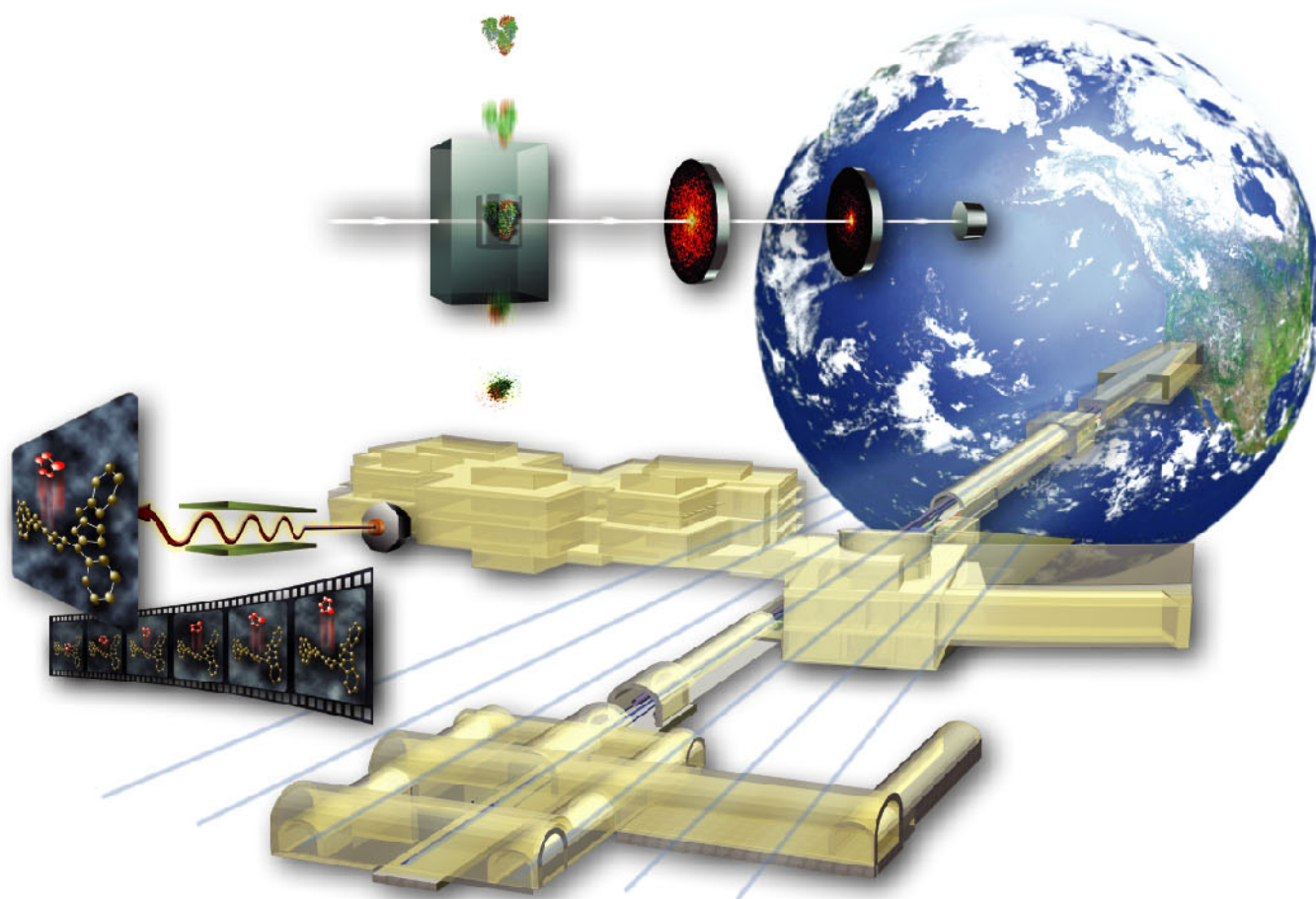


MONTHLY REPORT

May 2006



CONTENTS

PROJECT OVERVIEW AND ASSESSMENT	3
TECHNICAL AND PROGRAMMATIC PROGRESS	
<u>LCLS Project Office & Support</u>	
WBS 1.1, 2.1 Project Planning, Management & Administration	4
<u>Electron Beam Systems</u>	
WBS 1.1.3, 1.X.3 Global Controls	6
WBS 1.2, 2.2 Injector	7
WBS 1.3, 2.3 Linac	8
WBS 1.4, 2.4 Undulator	9
<u>Photon Beam Systems</u>	
WBS 1.5, 2.5 X-Ray Transport & Diagnostics	10
WBS 1.6, 2.6 X-Ray Endstations	12
<u>Conventional Facilities</u>	
WBS 1.9, 2.9 Conventional Facilities	13
COST PERFORMANCE REPORT	
-Cost/Schedule Variance Narrative	14
-Change Control Activity	
-Milestone Performance	
GLOSSARY	19

Project Overview and Assessment

Highlights:

- The Injector team reviewed its Estimate-to-Complete (ETC) for the Injector Performance Measurement Baseline (PMB). Overall, WBS 1.2 was in line with the original PMB with some changes to its internal schedule logic. WBS 2.2, which includes commissioning of the Injector added manpower for laser commissioning.
- LCLS has begun to identify candidates for strengthening its senior staff in the Project Office. These are:
 - Procurements, LCLS has brought on Mr. Barry Miller, formerly of ORNL and the SNS project to assist the Project Office.
 - Civil Construction, LCLS has a requisition in place and is actively recruiting for this position.
 - Engineering, LCLS has a requisition in place and is beginning to actively recruit for this position.
- Phase one of the FFTB deconstruction (de-energizing energy sources and removal of key components) was completed on schedule. Phase two is now underway (removal of all accelerator components and supports, cabling and cable trays and concrete enclosure blocks).

Assessment and Issues:

- The May 2006 Cost Performance Reports (CPR) is the 27th month of reporting earned-value on the LCLS TPC. For this month the LCLS cost and schedule indices are 0.98 and 0.93, respectively. Total obligations to date (actual costs + open commitments) are \$102,334K.
- SLAC ceased electrical work activities for 3 days to review its processes and procedures deactivation of energy sources prior to removal of cabling fed by such sources. By shifting its FFTB subcontractors to different activities during the electrical activity shutdown, LCLS construction activities were not impacted.
- Bids were received for the first major LCLS construction packages. Many packages are in-line with the estimate however four of the bids were much higher. To understand the reasons for these high bids, LCLS has requested that Turner provide full visibility into the cost variance between estimates and bids for these four packages.
- Contractual issues continue to remain unresolved to the existing CMGC contract. This potentially can cause a delay to the commencement of the Phase II option and start of construction.

Project Office and Support

WBS 1.1, 2.1 Project Planning, Management and Administration

Highlights:

- The SharePoint web based system has been tested and will be used for depositing requirements documents that are used in conjunction with purchase orders including SOWs, Specifications (ESDs), and drawings. 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 – May 2006
 - Through the end of May, the project has worked 15 days without a recordable injury incident. On May 10th a technician experience a muscle strain during the course of performing assigned duties (details below). Previously the project had worked 235 days without a recordable injury incident. The LCLS project recordable incident rate is currently 0.72¹. This compares favorably to general industry rates of 6.8 and that of the Department of Energy which is 2.1 for similar work.
 - Identified Incidents and Opportunities for Improvement
 - Electrical cord cut: A subcontractor at the FFTB unexpectedly cut through the exterior insulation of an energized power cord. The worker's foreman had routed the power cord in close proximity to cables to be cut and did not inform the worker of the energized cord. The worker inadvertently bundled the de-energized cables with the power cord and began cutting using a manually operated ratchet cutter that pierced the insulating jacket of the power cord.
 - Muscle strain: On May 10th an ANL technician experienced a muscle strain while moving an electronics rack. There had been pre-task planning including discussion on proper material management. Review of the incident indicated a pre-existing condition and previous overexertion contributed to this incident.
 - Fire sprinkler line cut: A subcontractor at the FFTB cut a fire sprinkler riser on the incorrect (upstream) side of the isolation valve that had been closed to permit removal of the sprinkler line. The worker failed to confirm that the riser was isolated; in addition the project manager was to confirm isolation before allowing work to proceed but did not.
- LCLS Procurement Status – May 2006;
 - Procurement activity continued with heavy activity in May, mainly due to issues surrounding the Jacobs and Turner subcontracts. The Turner

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

contract requires significant oversight and support to make progress on contractual issues and higher than anticipated bid package costs.

- With increasing procurement activity, SLAC's BIS Head Jerry Jobe, authorized assistance from other SLAC resources on an as needed basis.
- A/E Design – Planning for additional Title III support was performed although not finalized.
- FFTB Equipment and Block Removal – Work is progressing well ahead of schedule. Completion is expected in early June.
- BC1 Tweaker Quadrupole Magnets – Subcontract awarded. The preliminary design review was and final review of the drawings has been completed. SLAC instructed supplier to purchase an additional mod to help maintain schedule. Current due date is July 7.
- Award was made for the Research Yard demolition activities. Work is scheduled to commence during the month of June.
- BC2 Chicane Dipole Magnets – RFP Addendum issued with 1 month extension provided. Bids were received on March 20 and a technical evaluation was completed on April 21. Award was made in May to Everson Tesla with a due date of Jan 12, 2007.
- Injector Quadrupole Magnets – Subcontract awarded. All critical items have been received. One remaining item (non-critical) will ship in December.
- CMM – Subcontract awarded. The Coordinate Measuring Machine has shipped and was received in late May. The installation began shortly thereafter and is expected to complete in June.

Assessment and Issues:

- None

Electron Beam Systems

WBS 1.1, 1.x.2 Controls System

Highlights:

- Cable Plant, I&C Infrastructure
 - Awarded contract for phase I (injector) cable plant installation; schedule calls for completion by the end of June.
 - Expedited rack delivery for I&C systems; all required racks will be delivered by the end of June.
- Low-Level RF
 - Test on the Phase and Amplitude Controller show very low distortion. Suppression of fundamental, opposite side band and harmonics are better than 60dB below signal.
 - Tests on Phase and Amplitude Detector control board have begun and results look good. Signal/Noise meets CLS requirements at 63dBc.
- PPS, LSS – The PPS PLC hardware is running the field (final prototype) software. Testing has revealed no major deficiencies in the hardware.
- Beam Instrumentation and Diagnostics
 - Reviewed BL11 bunch length monitor vacuum hardware. All electronic components from vendor are in hand as well as driver software.
 - Reviewed BC1 chicane stripline BPM design. The analysis suggested moving the striplines closer together for better matching of calibration coupling and symmetric beam coupling.
- Applications Software
 - Completed the MATLAB Feedback application framework. This allows the development of specific feedback loops such as bunch length control.
 - Work continues on developing a feedback simulation IOC for testing orbit, energy and bunch length feedback loops.

Assessments and Issues:

- The schedule for the delivery of electronics racks is now set, but delivery is later than desired. There should be no impact to laser delivery. This is being expedited by purchasing.

WBS 1.2, 2.2 Injector System

Highlights:

- The Injector team reviewed its Estimate-to-Complete (ETC) for the Injector Performance Measurement Baseline (PMB). The updated Injector ETC is captured in BCR# IJ-37, reevaluated the baseline in terms of scope, cost, schedule and resources for WBS 1.2 and 2.2 (excluding controls). Overall, WBS 1.2 was in line with the original PMB with some changes to the schedule logic. WBS 2.2, added manpower for laser commissioning.
- Design of the shielding plug for the unused S20 penetration above the RF Gun was completed and informal approval of the shielding was received. The shielding design has yet to undergo formal review and approval by SLAC's Radiation Safety. Final shielding installation must be completed prior to laser table installation, which is scheduled for end of June. A contract is in place with a vendor to install both the plug and laser tables.
- LCLS personnel visited THALES to inspect the drive laser for approval of Milestone 3; 'Acceptance of laser at vendor site'. All tests were successful and the milestone was met. At the THALES site, the LCLS drive laser system performed at the repetition rate 120Hz. THALES has been requested to develop an option to run the system at 30Hz (which will increase the lifetime of the pump lasers during the first commissioning run).
- The RF Gun Solenoid, Linac Solenoid, BX01, BX02 and ETA Quads all entered SLAC's Magnetic Measurement Facility for calibration and testing.

Assessment and Issues:

- Following installation of the vault floor, Sector-20 cable installation is now underway. This activity is critical path for laser installation and commissioning, and is projected to finish ~mid-June, just in time for laser installation.
- The BXG magnet steel was short ordered, with a second order placed later for remaining components. All personnel responsible for ordering components have been reminded to carefully check vendor quotes against requests for price, delivery and parts count.
- The S20 Vault water ESD was approved and a PDR on vault water was held. An action item was to develop a plan for vibration mitigation. LCLS will need continued support from CEF on water issues throughout construction.

WBS 1.3, 2.3 Linac System

Highlights:

- Three QE magnets were precisely measured to qualify for placement in the low energy end of the LCLS. Paul Emma directed which QE will be installed in which location.
- BC1 final vendor magnet drawings were furnished to Leif Eriksson to incorporate into the final BC1 installation drawing.
- Removal of FFTB components for use in LCLS was started. Plans were made to refurbish several of the used magnets prior to installation in the LCLS LTU.
- The Linac Housing cable tray location was discussed with the SLAC Acc. Dept. to check for compatibility with SABER.
- The BC1 Articulation assembly was delivered to SLAC. The articulation will be assembled for a drive test.
- The design of toroids by the vendor was completed and reviewed; approval to fabricate was granted.
- Linac and Injector Wire Scanners entered final assembly.
- An FDR for Bunch Compressor 1 diagnostics was held.
- A PDR was held for the BC1-out region. Good progress is being made on the design of the region, including the bunch length monitor.

Assessment and Issues:

- A proposal was made to install a cryo-trap in the LTU beamline to isolate the LCLS experimental area vacuum from possible contamination from the Beam Switchyard vacuum, which is diffusion pumped. Size, cost and location of the cryo-trap are being explored.

WBS 1.4, 2.4 Undulator System

Highlights:

- Work progresses on the Single Undulator Test (SUT) setup. The SUT is an essential element in allowing us to test fit and work out all integration issues in the full undulator assembly.
- The first fully brazed RF Beam Position Monitor (BPM) prototype has been tested on the bench and is now being readied for installation into the Argonne's APS Injector test stand where it will undergo testing with electron beams.
- Undulator Assembly and Installation
 - The Kugler Magnetic Measurement bench was delivered and installed at SLAC Magnetic Measurement Facility (MMF).
 - The Leitz Coordinate Measurement Machine (CMM) was delivered to SLAC's MMF and is stabilizing in temperature prior to commissioning.
 - Shipment of S/N 2 Undulator Magnet to SLAC is planned for June 9th.
 - Shipment of S/N 3 Undulator Magnet to SLAC is planned for the last week of June. The SLAC LCLS Magnetic Measurement Group will be prepared to perform acceptance testing on the magnet by July 1st.
 - Two prototype pedestals and one girder are due at SLAC on June 23rd.
 - The SLAC Undulator System Assembly and Installation Supervisor started with the Project on May 16th.

Assessments and Issues:

- The 1st article undulator was accidentally dropped at during a move at the APS MMF. The damage appears minor; however the undulator will require remeasurement on the test bench prior to shipping to SLAC. During a review of the accident, the review committee found poor lifting practices led to the undulator damage. As a result, the ANL team is reviewing/rethinking all undulator lifts/moves and specifying more stringent procedures for critical lifts.
- The ANL team is pursuing a 4-weld alternative design for the vacuum chamber assembly, as recommended by the LCLS FAC. The original two-weld design is still the preferred method however, given the risk to performance and schedule; the 4-weld design will provide a risk mitigating option.
- The Kugler Magnetic Measurement Bench must be commissioned and ready to make production measurements by July 28th to meet the level 3 milestone.

Photon Beam Systems

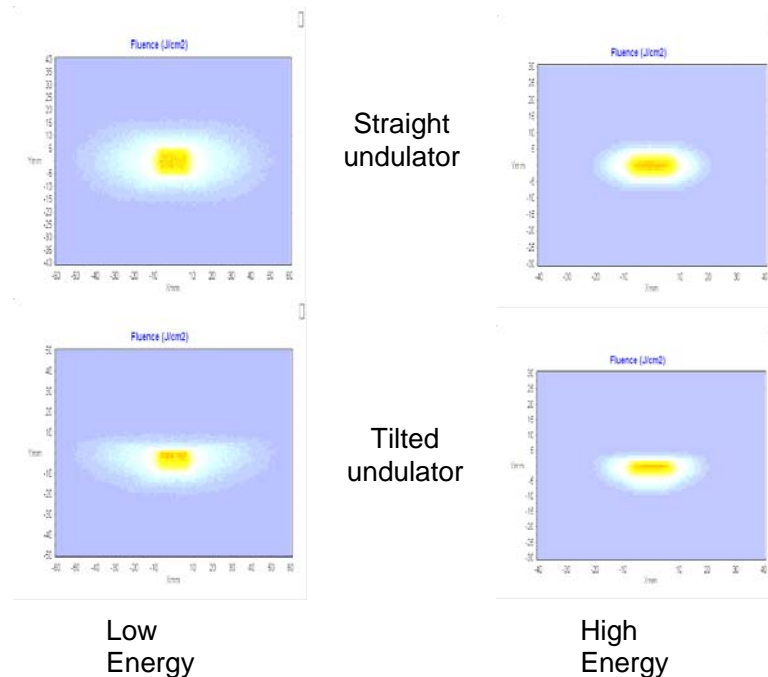
WBS 1.5, 2.5 X-ray Transport, Optics & Diagnostics (XTOD)

Highlights:

- Management and Safety - The Integration Work Sheet (IWS) describing the implementation of Integrated Safety Management to the proposed activities in the new XTOD laboratory facility in B141 at LLNL has been approved. Activities proposed for the laboratory can begin immediately, and include assembly and testing of the Fast Valve, Fixed Mask, Slit, and electronics racks.
- Mech/Vac Design — A new XTOD configuration drawing reflecting the changes to the Front-End Enclosure (FEE) has been released. It can be found on the Project Office SharePoint directory.
- Slit / Fixed Mask / Fast Valve – The second slit System Concept Review (SCR) was held on May 4. No major issues were identified although the vertical size of the fixed mask had not been finalized. The preliminary design of the slit has begun with the goal of having a Preliminary Design Review (PDR) of the Fixed Mask / Fast Valve and Slit systems by the end of June 2006.
- Attenuator – The prototype gas attenuator met the design goal of 20 Torr operation for both nitrogen and argon gases. The measured pressure distributions and the required amount of gas flow are in good agreement with the model calculations. The Programmable Logic Controller (PLC) that contains the “Ladder Logic” that controls the components of the vacuum system was programmed and used to control the operation of the prototype gas attenuator. The PLC system is functioning as designed.
- Gas Detector – Considerable progress on the conceptual design of the Gas Detectors has been made. A draft Physics Requirements Document (PRD) has been written and circulated around the Photon Group for comment. When the PRD is approved, a System Concept Review of the photo-luminescent concept will be held. The current schedule calls for a PRD by the end of June.
- FEL Offset Mirror System – The calculations of the predicted FEL characteristics, based on vendor-supplied smoothness data, were checked and found to be accurate. A draft PRD for the mirror systems and a Request For (vendor) Quote for the mirrors have been written consistent with the above performance, but will not be approved until the users accept the calculated performance specs.

- **Beam Simulation** – Simulations of the expected spontaneous radiation patterns at the imager location have been completed (see figure below). The simulations include the effects of the reflections off of a rough undulator vacuum chamber. This analysis includes the possibility that the FEL might be miss-steered into the tunnel vacuum chamber which will be presented at the XVTS Final Design Review.

Spontaneous radiation at FEE diagnostics station



- **Tunnel** – The final design review of the X-ray Vacuum Tunnel System (XVTS) will be held sometime during the last two weeks of July.

Assessment and Issues:

- As a result of discussions with LCLS and LUSI physicists, the attenuation requirements for the gas attenuator are being revised so that the maximum attenuation required at 2 keV will give transmission of 10^{-3} . At the nominal pressure of 20 Torr, this will reduce the length of the central high-pressure section from 6 meters to 4 meters. The attenuator will still achieve 10^{-4} transmission at 826eV.

WBS 1.6, 2.6 X-Ray Endstation Systems

Highlights:

- A detailed update of the XES work plan was completed for all areas except controls. Several baseline change requests (BCRs) reflecting this updated plan were presented during May, all of which were approved. The XES group is now developing the XES portion of the controls schedule in coordination with the LCLS Controls group, and completing the remaining integration.
- A detector controls and data acquisition workshop was held at SLAC on May 24-26. Requirements for data rates, data acquisition and integration to the EPICS control system were discussed. This will serve as input for a common design approach for all the experimental stations.
- The schedule of the Cornell 2D detector project was discussed and finalized with the Cornell group. Milestones were set and updated according to technical review and chip fabrication dates. The detector delivery date remained unchanged for the end of 2008. A second small-scale prototype (16x16array with 110 μ m pixel size) was submitted to MOSIS. Cornell group members attended EPICS training and presented a high level plan for the detector support electronics at the Detector Workshop at SLAC.
- The Atomic Physics Instrument's project plan was finalized to reflect the latest instrumentation concept. Budget and resource plans were established and implemented into an integrated schedule. Arrangements were made with the LUSI project to allocate engineering resources to the AMOS effort beginning in June 2006.
- A meeting of the larger Atomic, Molecular and Optical Science (AMOS) user community was held at the annual meeting of the American Physical Society's Division of Atomic, Molecular and Optical Physics (DAMOP) to update them on the plans for the AMOS instrumentation at LCLS.

Assessment and Issues:

- None.

Conventional Facilities (CF)

WBS 1.9, 2.9 Conventional Facilities (CF)

Highlights:

- A SLAC acoustical engineering study was conducted by evaluating samples of anticipated construction activities and measuring their potential impact to surrounding neighborhoods. No significant mitigation plans to the LCLS construction plan appear necessary to address noise.
- Bid Group #2 bidder conference was held on May 17, 2006 at SLAC. Group #2 bid scope contains the remainder of the beam path procurements and is ~10% of the total construction costs.
- The 12KV feeder installation project supplying power to the MMF project was completed. This project was delayed due to inclement weather during March and April. Dry weather in May allowed this work to be completed.
- Phase one of the FFTB deconstruction (de-energizing energy sources and removal of key components) was completed on schedule on May. Phase two is now underway (removal of all accelerator components and supports, cabling and cable trays and concrete enclosure blocks). Phase two (see picture on right) is scheduled to be completed in late July.



Issues and Assessments

- Bid Group #1 bid packages have been received by Turner Construction. Overall the bid costs appear to be significantly higher than estimated. The project is working closely with Turner, Jacobs Facilities and potential low subcontractor bidders to understand the nature of the variance and any impacts to the project.
- SLAC Radiation Physics (RP) has determined that the soil below the FFTB housing has become activated. This area was previously tested by RP over the past three years and was determined to not contain any activated soil. This new finding may result in greater excavation, transportation and disposal costs not currently budgeted in the CF WBS schedule or budget.



LCLS Cost and Schedule Performance – May 2006

LCLS Cost/Schedule Status Report - Work Breakdown Structure										31-May-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	15,292	15,058	16,813	-234	-1,754	0.98	0.90	27,887	31,372	3,485
1.2 Injector	14,023	13,811	14,043	-213	-232	0.98	0.98	20,858	20,791	-67
1.3 Linac	9,037	6,734	5,893	-2,303	842	0.75	1.14	24,248	23,637	-611
1.4 Undulator	16,960	15,022	16,239	-1,938	-1,217	0.89	0.93	41,095	43,532	2,437
1.5 X-ray Transport	8,658	8,056	7,905	-601	152	0.93	1.02	24,149	26,932	2,783
1.6 X-ray Endstations	1,501	1,141	1,053	-361	88	0.76	1.08	14,425	15,667	1,242
1.9 Conventional Facilities	18,054	17,435	18,128	-619	-693	0.97	0.96	107,711	120,496	12,785
1 LCLS Total Base Cost	83,525	77,258	80,073	-6,268	-2,815	0.92	0.96	260,372	282,427	22,055
								LCLS Total Estimated Cost	315,000	315,000
								Avail. Contingency	54,628	32,573
								% Contingency / ETC	29.8%	15.9%
								% Complete LCLS Base Cost	29.7%	27.4%
2.1 LCLS Project Mgmt, Planning & Admn (OPC)	5,541	5,601	5,551	60	50	1.01	1.01	34,008	34,018	10
2.2 Injector (OPC)	828	781	780	-48	0	0.94	1.00	7,148	7,248	100
2.3 Linac (OPC)	1	1	31	0	-30	1.00	0.04	2,555	2,577	22
2.4 Undulator (OPC)	798	1,035	826	236	209	1.30	1.25	4,634	4,410	-224
2.5 X-ray Transport (OPC)	489	489	427	0	62	1.00	1.14	4,971	4,878	-93
2.6 X-ray Endstations (OPC)	539	540	198	1	342	1.00	2.73	5,415	5,059	-356
2.9 Conventional Facilities (OPC)	2	0	0	0	0			621	621	0
2 LCLS Total Other Project Cost	8,199	8,446	7,813	250	633	1.03	1.08	59,353	58,812	-541
								LCLS Other Project Cost	64,000	64,000
								Avail. Management Reserve	4,647	5,188
								% Management Reserve / ETC	9.1%	10.3%
								% Comp LCLS Other Project Cost	14.2%	14.4%
LCLS Total Project Cost	91,724	85,704	87,886	-6,018	-2,182	0.93	0.98	379,000	379,000	
								% Complete LCLS TPC	26.8%	25.1%
*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 May 2006 Cost Performance Reports (CPR) is the 27th month of reporting earned-value on the LCLS TPC. For this month the LCLS cost and schedule indices are 0.98 and 0.93, respectively. Total obligations to date (actual costs + open commitments) are \$102,334K. Approved Baseline Change Requests (BCR's) 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. The LCLS schedule intentionally delays the award of the CLOC to mitigate cost risk related to civil construction. 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 214 working days. LCLS management will aggressively work to maintain or improve this beam commissioning period.

Significant Cost/Schedule Variances

Linac System: SPI = 0.75, CPI = 1.144

The Controls effort for both Linac and Injector has been focused on preparations for the upcoming installation and commissioning period. Linac Controls work for future installations is now scheduled to begin, but is being deferred to support immediate needs. This is also true for some Linac hardware items needed for 2007 installation. The design and fabrication of these items is scheduled to begin but is being deferred as effort is concentrated on the current installation and commissioning period. Sufficient float exists that this delay for 2007 Linac controls and hardware will not impact the 2007 schedule.

Undulator System: SPI = 0.89, CPI = 0.93

The Single Undulator Test (SUT) is progressing well at ANL, but is behind schedule. The SUT is now scheduled to be complete in June with a closeout meeting of the collaboration in July. The completion of the SUT is driving the specification and purchase of several of the controls in the Undulator system. These devices were scheduled to have been purchased in May. Upon the completion of the SUT these devices will be specified and placed on order.



XES Controls System: SPI = 0.76, CPI = 1.08

The schedule variance for the XES is driven entirely by the Controls Systems, 1.6.2., where PPS and MPS design effort had been planned. As stated above, the Controls effort has been focused on preparations for the upcoming Injector installation and commissioning period. The XES Controls will require replanning and is now underway.

Change Control Activity (May 2006)*

BCR #	WBS #	Signature Level	Approval Month	BCR Description	Originator	TEC Base Cost Estimate		
						Previous Estimate	Increase (Decrease)	New Estimate
PM-29	1.01,2.01	3	01-May-06	Add Procurement consulting services, EVM Training support, Physics support	M. Reichanadter	27,478,925	240,000	27,718,925
PM-30	All	4	01-May-06	Correction to TEC and OPC rate and calculation tables	P. Mast	27,718,925	(93,338)	27,625,587
PM-30	All	4	01-May-06	Correction to TEC and OPC rate and calculation tables	P. Mast	27,625,587	0	27,625,587
IJ-37	1.02	2	01-May-06	INJECTOR SYSTEM - ETC	Schultz/Bong	27,625,587	(170,103)	27,455,484
PM-30	All	4	01-May-06	Correction to TEC and OPC rate and calculation tables	P. Mast	27,455,484	0	27,455,484
PM-30	All	4	01-May-06	Correction to TEC and OPC rate and calculation tables	P. Mast	27,455,484	0	27,455,484
PM-30	All	4	01-May-06	Correction to TEC and OPC rate and calculation tables	P. Mast	27,455,484	0	27,455,484
XE-13	1.06	3	01-May-06	K Measurement Spectrometer	S. Moeller	27,455,484	119,450	27,574,934
XE-14	1.06	3	01-May-06	XE system management extension thru Mar 31, 2009	S. Moeller	27,574,934	0	27,574,934
XE-15	1.06	3	01-May-06	Replan Atomic Physics Exp. (AMOS)	S. Moeller	27,574,934	180,794	27,755,728
XE-16	1.06	3	01-May-06	Replan 2D X-Ray Detector R&D (Cornell) & deletion of Streak Camera	S. Moeller	27,755,728	(95,637)	27,660,091
PM-30	All	4	01-May-06	Correction to TEC and OPC rate and calculation tables	P. Mast	27,660,091	0	27,660,091
PM-30	All	4	01-May-06	Correction to TEC and OPC rate and calculation tables	P. Mast	27,660,091	22,233	27,682,324
Previous Month Total Base Cost Estimate						260,169,063		
Total Delta Base Cost Change			1-May-06				203,399	
Current Month Total Base Cost Estimate								260,372,462

***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.**



DOE (Level 1 - 2) Milestones

ID	System	Level?	P3 ID	Milestone	Baseline	Updated	Variance	2002		2003		2004		2005		2006		2007		2008		2009	
								Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct
1				Level 1 DOE (SC1) Milestones	8/29/08	3/31/09	140 days																
2	DOE	ML1	MS1_PM000	CD0 - Approve Mission Need	6/17/01	6/17/01	0 days																
3	DOE	ML1	MS1_PM005	CD1 - Approve Preliminary Baseline Range	10/16/02	10/16/02	0 days																
4	DOE	ML1	MS1_PM015	CD2a - Approve Long-Lead Procurement Budget	7/30/04	7/30/04	0 days																
5	DOE	ML1	MS1_PM025	CD3a - Approve Start of Long Lead Procurement	10/29/04	10/29/04	0 days																
6	DOE	ML1	MS1_PM020	CD2b - Approve Performance Baseline	3/31/05	3/31/05	0 days																
7	DOE	ML1	MS1_PM030	CD3b - Approve Start of Construction	2/28/06	3/21/06	15 days																
8	DOE	ML1	MS1_PM035	CD4 - Approve Start of Operations	3/31/09	3/31/09	0 days																
9				Level 2 DOE (SSO) Milestones	8/29/08	11/10/08	51 days																
10	PM	ML2	MS2_PM045	Prelim Safety Assessment (PSAD) Doc Complete	4/30/04	4/30/04	0 days																
11	PM	ML2	MS2_PM035	DOE External Independent Review (EIR) Complete	6/15/04	6/15/04	0 days																
12	PM	ML2	MS2_PM040	Fire Hazard Analysis Approved	6/30/05	8/31/05	44 days																
13	PM	ML2	MS2_PM055	Prelim Safety Assessment (PSAD) Doc Approved	2/28/06	1/26/06	-23 days																
14	UN	ML2	MS2_UN010	Delivery of Undulator 1st Articles to MMF	7/3/06	7/3/06	0 days																
15	CF	ML2	MS2BO_005	Sector 20/Aicove Beneficial Occupancy	7/21/06	4/14/06	-70 days																
16	UN	ML2	MS2_UN005	MMF Qualified & Ready to Measure Prod Undulators	8/28/06	8/28/06	0 days																
17	CF	ML2	MS2BO_025	Research Yards Mods Beneficial Occupancy	10/20/06	10/20/06	0 days																
18	IJ	ML2	MS2_IJ0010	Start Injector Commissioning (Drive Laser)	11/20/06	11/20/06	0 days																
19	IJ	ML2	MS2_IJ0027	Injector Laser Commissioning Review Complete	1/16/07	1/16/07	0 days																
20	CF	ML2	MS2BO_035	Undulator Facility Beneficial Occupancy	6/4/07	6/4/07	0 days																
21	CF	ML2	MS2BO_050	Near Experimental Hall Beneficial Occupancy	6/18/07	6/18/07	0 days																
22	CF	ML2	MS2BO_020	Linac Facility Beneficial Occupancy	7/11/07	7/11/07	0 days																
23	IJ	ML2	MS2_IJ0020	Start Injector Commissioning (UV Beam to Cathode)	7/20/07	7/20/07	0 days																
24	CF	ML2	MS2BO_060	Far Experimental Hall Beneficial Occupancy	9/4/07	9/4/07	0 days																
25	IJ	ML2	MS2_IJ0030	Injector Accelerator Readiness Review (ARR) Comp	9/20/07	9/20/07	0 days																
26	CF	ML2	MS2BO_040	Front End Enclosure Beneficial Occupancy	10/5/07	10/5/07	0 days																
27	CF	ML2	MS2BO_055	X-Ray Transport Beneficial Occupancy	10/12/07	10/12/07	0 days																
28	CF	ML2	MS2BO_030	Beam Transport Hall Beneficial Occupancy	1/3/08	1/3/08	0 days																
29	XE	ML2	MS2_XE015	2-D Pixel Detector Production Start	1/3/08	1/3/08	0 days																
30	LN	ML2	MS2_LN020	Linac ARR (Li20-Li30) Complete	3/7/08	3/7/08	0 days																
31	PM	ML2	MS2_PM005	Final Safety Analysis Document (FSAD) Approved	3/31/08	3/31/08	0 days																
32	LN	ML2	MS2_LN025	Start Linac (Li20-Li30) Commissioning	5/8/08	5/8/08	0 days																
33	PM	ML2	MS2_PM030	LCLS ARR Complete (BTH thru FEH)	6/9/08	6/9/08	0 days																
34	LN	ML2	MS2_LN015	Start Linac-to-Undulator (LTU) Commissioning	6/12/08	6/12/08	0 days																
35	UN	ML2	MS2_UN025	Start Undulator Commissioning (1st Light)	8/18/08	8/18/08	0 days																
38	XE	ML2	MS2_XE005	Start XES Commissioning	8/18/08	8/18/08	0 days																
36	XTOD	ML2	MS2_XT005	Start XTOD Commissioning	8/18/08	8/18/08	0 days																
37	CF	ML2	MS2BO_065	Central Lab Office Ctr Beneficial Occupancy	11/10/08	11/10/08	0 days																

KEY: CD-2B Baseline Date (Blue Circle) – Established in April 2005
 Updated Date (Red Diamond – Current Projection
 Actual Date (Green Diamond) – Actual Date Accomplished



Milestone Report

Approve Date	Milestone ID	Milestone Name	Level	May-05 (CD 2) Date	New (Projected) Date	Variance (days)	Impacts			Complete (Yes / No)	Comments (Reason for Change)
							Cost	L1 Schedule (Critical Path)	Other		
May-06	MSBS_125	FY06 Shutdown: HW Req'd for Installation	L3	8/1/2006	8/21/2006		No	No	No	No	Laboratory Management changed start of 2006 downtime to begin on 8/21/06; therefore, hardware is not required for installation prior to the start of the down.
May-06	MSBS_130	FY06 Shutdown Over	L3	11/30/2006	1/5/2007		No	No	No	No	Laboratory management changed end of 2006 shutdown to January 5, 2007.
May-06	MS3_IJ005	Drive Laser Available for Integration	L3	7/10/2006	10/18/2006		No	No	No	No	Delays in the S20 cable plant installation impacted the Drive Laser installation start.
May-06	MS3_IJ020	Heater Region Installation Complete	L3	5/31/2006	10/31/2006		No	No	No	No	The Heater installation was delay due to certification of the S20 crane.
May-06	MS3_IJ0010	Start Injector Commissioning (Drive Laser)	L3	10/18/2006	11/15/2006		No	No	No	No	The delivery of the Drive Laser was delayed to accommodate the S20 cable plant installation.
May-06	MS3_IJ032	Laser Tables & Optical Paths Installation Comp	L3	8/21/2006	11/30/2006		No	No	No	No	The installation of the Laser Tables and Optical Paths was delayed to accommodate the S20 cable plant installation.
May-06	MS3_IJ085	Accelerator Region Installation Complete	L3	8/2/2006	11/30/2006		No	No	No	No	The Accelerator region installation was delayed due to certification of the S20 crane.
May-06	MS3_IJ125	RF Gun Ready for Installation	L3	10/2/2006	11/30/2006		No	No	No	No	The Gun installation schedule logic was rescheduled as part of the updated Injector ETC
May-06	MS3_IJ0030	Injector Accelerator Readiness Review (ARR) Comp	L3	8/20/2007	1/2/2007		No	No	No	No	The Injector ARR schedule logic was rescheduled as part of the updated Injector ETC
May-06	MS3_IJ080	Gun Region Installation Complete	L3	10/9/2006	1/2/2007		No	No	No	No	Gun region installation completion schedule logic was rescheduled as part of the updated Injector ETC. New projected date allows completion of gun hot test prior to completion of installation.
May-06	MS3_IJ100	Insertion Region Installation Complete	L3	10/27/2006	1/31/2007		No	No	No	No	Insertion region schedule logic was updated as part of the updated Injector ETC. Insertion region installation is complete prior to or concurrent to the end of the 2006 downtime.
May-06	MS3_IJ105	Spectrometer Installation Complete	L3	10/27/2006	1/31/2007		No	No	No	No	Spectrometer installation schedule logic was updated as part of the updated Injector ETC. Spectrometer region installation is complete prior to or concurrent to the end of the 2006 downtime.
May-06	MS3_IJ110	Injector RF Subsystem Installation Complete	L3	3/28/2007	1/31/2007		No	No	No	No	Insertion region schedule logic was updated as part of the updated Injector ETC. RF Subsystem Installation is complete when Gallery components are tested following the completion of the 2006 downtime.
May-06	MS3_IJ0020	Start Injector Commissioning(UV Beam to Cathode)	L3	6/20/2007	3/8/2007		No	No	No	No	Injector beam commissioning schedule logic was updated as part of the updated Injector ETC. UV Beam to cathode starts at the beginning of Injector commissioning following the 2006 shutdown.
May-06	MS3_XE040	LDAC Review (2D Detector)	L3	11/20/2006	4/16/2007		No	No	No	No	LCLS Detector Advisory Committee (LDAC) which meets bi-annually, was updated as part of the updated Injector ETC. The name was changed for clarity.
May-06	MS3_XE090	COMP: Specification for Streak Camera	L3	5/30/2006	None		No	No	No	No	This milestone has been deleted since the budget for building the streak camera has been removed from WBS 1.6.

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.