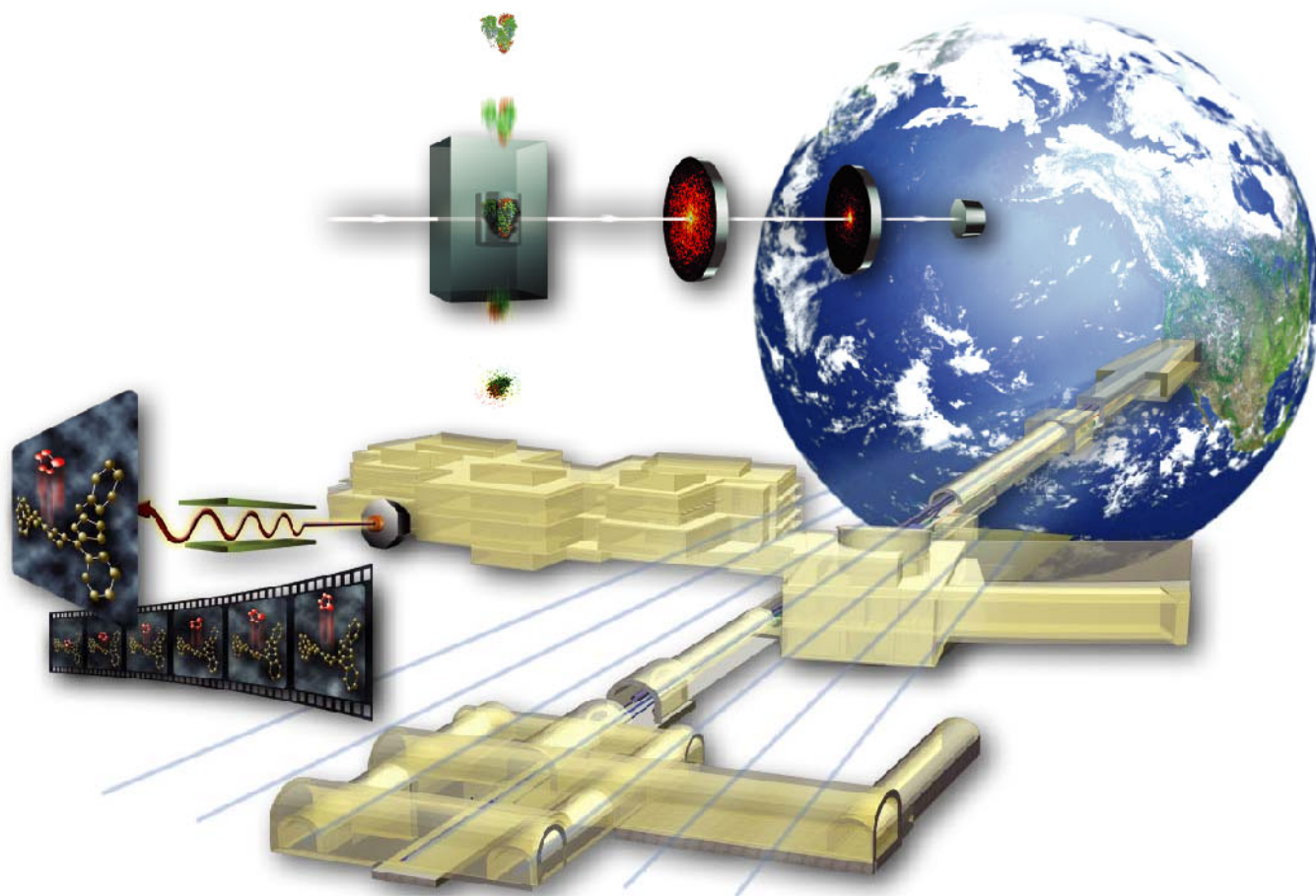


# MONTHLY REPORT

March 2005





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## **Project Overview and Assessment**

### **Highlights:**

- On December 10, 2004, Critical Decision 3a milestone, “Approve Start of Long-Lead Procurement”, was approved by Dr. James Decker as delegated Acquisition Executive. This approval authorizes the project to begin long lead procurements for the LCLS within the FY2005 budget authority.
- The LCLS procurement group has been assembled with David McGiven hired to fill the Procurement Manager position. David will report to SLAC’s Associate Director for Business Services. He and his group are fully dedicated to the LCLS Project, with independent signature authority for LCLS procurements.
- The Title II Kick-Off meeting for the LCLS Conventional Facilities design was held on March 29-30, 2005. This meeting included a review of the Title I design basis and SLAC ES&H requirements. There was also a requested modification of key personnel to the Jacobs Engineering design team, which is being evaluated by LCLS.
- A meeting of the LCLS Collaboration (“LCLS Week”) is planned for April 4-7, 2005 at SLAC. The main focus of this project-wide collaboration meeting will be preparation for the upcoming FAC and DOE reviews, along with overall project status, and integration of the LCLS technical and conventional systems.

### **Assessment and Issues:**

- The March 2005 Cost Performance Report (CPR) is the 13<sup>th</sup> month of reporting earned-value on the LCLS TPC. All LCLS TEC and OPC actual costs for the project are captured in the LCLS CPR. For February 2005, cost and schedule indices for the LCLS are 0.98 and 1.02, respectively, indicating that LCLS is tracking well with the current cost and schedule estimate.
- The CD-2b (Approve Performance Baseline) milestone for LCLS, scheduled for October 2004 has been delayed. The CD-2b decision is partially dependent upon DOE’s Office of Engineering and Construction Management (OECM) validation of the project’s scope, cost, schedule and contingency, which was presented to an External Independent Review in June 2004. The LCLS team is now working directly with BREI to resolve these latest issues, however the validation process is not well defined which may result in further delays to CD-2b.
- The CM/GC procurement continues to be the highest priority for the LCLS CF and Procurement teams. The status of the procurement is;

- SLAC Purchasing has signed off on the CM/GC package and submitted it to the DOE Site Office for approval. The package was returned requesting several modifications before resubmitting the CM/GC package, which will result in a delay from our original schedule.
- The CM/GC APP will be revised to reflect these changes and a new plan to bring on a CM around the 30% Title II complete is under development.

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

### **Highlights:**

- For LCLS Project Staffing;
  - System Accelerator Physicist Group Leader - Interviews are in process for this position to lead the project physics and commissioning. A decision is expected in April.
  - Procurement Manager – The LCLS procurement group has been assembled with David McGiven hired to fill the Procurement Manager position. David will report to SLAC’s Associate Director for Business Services. He and his group are fully dedicated to the LCLS Project, with independent signature authority for LCLS procurements.
  - Quality Assurance (QA) Manager – Interviews are in process for this position to lead the LCLS QA effort. A decision is expected in April.
  - Information Technology Manager – Applications are being sought for this position. A decision is expected in late April or May.
  - E-Beam System Manager - The E-Beam Systems Manager interviews are underway and a decision is expected in April. This person will manage the Injector-Linac, Undulator and Controls Systems with particular emphasis on integration and coordination.
  - Laser Group Leader – Interviews are in process for this position to lead the LCLS Laser Group. A decision is expected in April.
  
- For the LCLS Global Controls;
  - The SLC-aware IOC is 70% complete. All of the basic message tasks are completed. The design work for the synchronous acquisition, motion control and power supply control is progressing well. All of the data conversions for the VAX data in the UNIX environment are being tested.
  - The Swiss Light Source Power Supply Controller is installed and operating, with the replacement hardware in hand. The stability is being tested.
  - A list of all power supplies is being compiled and verified that the mapping from magnets to power supplies are well understood and that the power supplies specifications are correct..
  - The PNET board driver is in test for reliability and timing. All information from the PNET is being received. The next steps are to perform timing tests and to test the reliability of the PNET interface over a long period of time.
  - The PPS design is under way for the laser area, and a primary review was held. The feedback was encouraging on the use of the PLC in PPS, and a citizen review is scheduled for April 2005.

- Conventional Facilities will be integrated into the LCLS control system, and rack, AC, and cable tray requirements for the injector, linac, and LTU hall are complete.
- The LLRF design is complete – one CPU, one crate per klystron. Some boards have been identified for use in LLRF; however there is a concern that commercial boards may not meet the accuracy specifications. In parallel, we are watching the development of a board for a PEP upgrade.
- Responses for hiring two junior programmers are in and the jobs are closed. Job ads for two junior operators are open. Interviews are being set up for the EE job. A PO for a contractor to work on wire scanner, toroids and other diagnostics is complete.
- For the LCLS Procurements;
  - The LCLS procurement group has been assembled with David McGiven hired to fill the Procurement Manager position. Chris Jamison moved back to SLAC Purchasing will be phasing out of the LCLS procurement team. Bruce Patten has accepted the LCLS Conventional Facility Procurement Lead position and co-located with the technical team. Beverly Freeman has joined the LCLS procurement team and has relocated to building 280B. Vince Villanueva will transition to the LCLS procurement team and move to 280B when space becomes available.
  - The Request for Proposal (RFP) and Statement of Work (SOW) for the LCLS CM/GC procurement was submitted to DOE for review. LCLS received comments and recommendations for improvement, which are now being addressed by both technical and procurement staff members.
  - The Injector Drive Laser proposal evaluations have been completed with selection of the foreign subcontractor. A waiver to the Buy America Act has been requested from DOE. No delay is anticipated since the subcontract can deliver on a shorter than estimated schedule.
  - The market survey for the Streak Camera has been completed with several potential sources located. An Advance Procurement Plan is under development with a final approval expected by mid-April.
  - The proposals for the Titanium Strongbacks, the Magnet Poles, and the Magnet Blocks are being managed by ANL have been received and are under evaluation. Awards are scheduled for early April.
  - The Sector 20 Injector Facility RFP was released to industry on March 18. Proposals are due April 14, with award following in mid May.
  - The requisition package for the Magnetic Measurement Facility has been approved and forwarded to procurement for release of the RFP the first week in April. A site visit will be scheduled with proposals due early May. Evaluations will follow with award scheduled for the end of May.

### **Assessment and Issues:**

- See Project Overview Assessments and Issues



## WBS 1.2, 2.2 Injector System

### **Highlights:**

- A “make” decision to design and fabricate the RF Gun in-house has been approved to reduce schedule and technical risk. A Baseline Change Request was issued to reflect this decision, and the RF Gun design has been started.
- Injector beamline design work continued, concentrating on the region from the shield wall to the connection to the SLAC accelerator, the RF waveguide runs that penetrate the Injector shield wall, the laser heater region, and common beamline supports. A 20% Design Review of the Injector system has been called by the Project Office for April 12, 2005.
- Implementation of the February baseline change request has improved performance tracking of the Injector planned work.
- Two hires were made to add engineering to diagnostics and management of the magnet procurement.
- Installation activities for October were defined as installation of the wall region and installation of the RF waveguide down the penetration and through the shielding wall.

### **Assessment and Issues:**

- The injector drive laser proposals were evaluated and a vendor was selected and approved by LCLS management. Swift approval of the drive laser purchase is required to maintain LCLS schedule.
- A transverse accelerating cavity was removed from SLAC Linac Sector 11. The removal exercised SLAC’s Integrated Safety Management System (ISMS) and the interface between the LCLS specifying the work and SLAC Technical Division performing the work. The ISMS model will be further refined and developed for the larger scope of LCLS installation activities.

## WBS 1.3, 2.3 Linac System

### **Highlights:**

- A joint Linac-Undulator discussion was held on the cavity BPM's to be deployed in the Linac LTU and Undulator beamlines. The operating frequency may be X-Band or L-Band and will be determined based on undulator vacuum chamber requirements. The LTU cavity BPMs will duplicate the Undulator BPM design.
- The number of racks required for the LTU and E-Dump was given to Conventional Facilities for the commencement of Title II.
- X-Band Klystron fabrication has begun at SLAC.

### **Assessment and Issues:**

- Engineering and design effort in the Linac was replanned to increase engineering effort in the Injector. This will help to advance the Injector effort which has a higher schedule pressure than the Linac. No schedule impact is foreseen for the Linac system.
- Fabrication BC1 bunch compressor articulation and L1 will start in FY05 as Long Lead Procurement.



## WBS 1.4, 2.4 Undulator System

### **Highlights:**

- The long-lead procurement award for the magnet poles was made and the award for the titanium strongback is pending some final negotiations with the vendors. The procurement package for the magnet blocks was completed and released for proposal from vendors.
- Geoff Pile has accepted the role of ANL LCLS Chief Engineer. Geoff has been with the APS for many years most recently as the Group Leader for the RF Group.
- A meeting was held at ANL to discuss the full needs of the undulator system in the undulator hall and the associated equipment halls. All room data sheets required for the Title II kickoff meeting were completed for the undulator system and submitted to David Saenz, the LCLS Conventional Facilities manager.
- Sushil Sharma, the Group Leader for mechanical system in the Accelerator Systems Division at ANL has agreed to take over the design and engineering of the undulator fixed support system. Sushil has extensive experience on the engineering and construction of stable support systems used for synchrotron light sources.

### **Assessments and Issues:**

- Richard Hislop and Yuelin Li have been approved to perform LCLS work above the approved scope of work described in the MOU and Technical Addendum-D between ANL and SLAC. This newly added scope has been added to the approved P3 data through a BCR and a transmittal memo from SLAC to ANL directs the LCLS-ANL team to set up proper accounts for this effort. An amendment to Addendum-D shall be generated to cover all FY05 changes to the ANL scope later in the fiscal year.
- A new idea to counter the residual earth field in the undulator tunnel was developed using additional trajectory shims on the undulator which can be adjusted in the tunnel if we find out that the tunnel field is different than that found in the magnet measurement facility.

## **WBS 1.5, 2.5 X-ray Transport, Optics & Diagnostics System**

### **Highlights:**

- Preparations were made for participation in LCLS Week (April 4-6) and the meeting of the LCLS Facility Advisory Committee (April 7-8). Several presentations on aspects of XTOD will be given.
- Discussions were held with XES and SLAC Radiation Physics regarding possible layouts for x-ray filter mirrors located in the FEE. Several possible variations on a new FEE layout were discussed. With the addition of new optical elements in the FEE, the allocation of space in that region will need to be carefully considered. At this point, it is not certain that all components will fit easily.

### **Assessment and Issues**

- Space allocation in the FEE needs to be considered carefully. This may require a discussion with the LCLS electron groups regarding repositioning of the electron dump by a few meters.

## **WBS 1.6, 2.6 X-Ray Endstations System (XES)**

### **Highlights:**

- SLAC Radiation Physics has made additional calculations concerning shielding calculations for x-ray mirrors for the new FEE configuration. The results confirm that the mirror system can be incorporated safely and reduces the required hutch shielding significantly.
- The first safety meeting concerning the LCLS experimental areas with safety experts participating from SLAC, LCLS, SSRL and LLNL was conducted in March. These meetings will be scheduled on a regular basis to allow us to include safety analysis in our designs of all aspects of the XES work.

### **Assessment and Issues:**

- WBS refinement aimed at building a more complete Atomic Physics Station is progressing. However, due to general planning deadlines the changes will not be able to be included for the Lehman review. We will continue this pending BCR and submit the changes for approval after the review.
- The official documents (MOU and Technical Addendum) for the 2-d x-ray detector development have been submitted to all parties for signing, and approval by SLAC and Cornell is expected soon. We have made an adjustment in our schedule to account for the slight but non-critical delay of this R&D program.
- The Title II Conventional Facilities meeting incorporated recent changes to the Far Experimental Hall (FEH) layout which will provide greater functionality for the users. However, two similar layouts are now being considered for the final version which will require additional funding to complete the Title I FEH design.
- The long-range staffing plan is continuing to be developed, particularly the necessary increase to a staffing level adequate for operating the LCLS.

## WBS 1.9, 2.9 Conventional Facilities (CF)

### Highlights:

- The Title II Kick-Off meeting for the LCLS Conventional Facilities design was held on March 29-30, 2005. This meeting included a review of the Title I design basis and SLAC ES&H requirements. There was also a requested modification of key personnel to the Jacobs Engineering design team, which is being evaluated by LCLS.
- LCLS management met with Stanford University personnel to discuss potential LCLS project impact (traffic, site disruptions, and public relations) to the site both during construction and after commissioning. LCLS agreed to develop a traffic management plan during construction and operations phases of LCLS.
- The LCLS Sector 20 Conventional Facility project was submitted by Jacobs Engineering as 100% for Title II. LCLS management is now reviewing the details of the design package for quality and accuracy.
- SLAC's Conventional Experimental Facilities (CEF) Department held a design review for Substation #521 to provide the electrical feeder for the LCLS Magnetic Measurement Facility (MMF) in Building #081. The feeder work is scheduled for completion in July.
- Javier Sevilla has joined the LCLS Conventional Facilities staff as a Mechanical Engineer to oversee the LCLS HVAC projects. Javier is shifting off of the International Linear Collider (ILC) at SLAC, and will bring significant design and construction expertise to HVAC and construction projects in LCLS.

### Issues and Assessments

- The Far Experimental Hall (FEH) Title I layout has been modified which improves the functionally, but may have cost and schedule implications. LCLS management has approved the new FEH design and Jacobs Engineering will commence on a FEH Title I design immediately. LCLS management plans to present this new design to the Scientific Advisory Committee (SAC) in May 2005 for feedback before proceeding into Title II.
- SLAC Purchasing has signed off on the CM/GC package and submitted it to the DOE Site Office for approval. The package was returned requesting several modifications before resubmitting the CM/GC package, which will result in a delay from our original schedule. The CM/GC APP will be revised to reflect these changes and a new plan to bring on a CM around the 30% Title II complete is under development.



## LCLS Cost and Schedule Performance – Mar05

LCLS Cost Performance Report - Work Breakdown Structure													31-Mar-05			
WBS	Current Period (\$K)					Cumulative to Date (\$K)							At Completion (\$K)			
	Budgeted Cost		Actual Cost Work Performed	Variance		Budgeted Cost		Actual Cost Work Performed	Variance		Performance Indices		Budgeted	Latest Revised Estimate	Variance	
	Work Scheduled	Work Performed		Schedule	Cost	Work Scheduled	Work Performed		Schedule	Cost	SPI	CPI				
1.1 Project Management	670	760	452	89	308	6,326	6,194	5,379	-132	815	0.98	1.15	29,295			
1.2 Injector	249	89	330	-161	-241	3,213	3,265	3,533	53	-268	1.02	0.92	18,456			
1.3 Linac	-10	-9	104	1	-113	2,040	1,889	1,931	-152	-42	0.93	0.98	26,764			
1.4 Undulator	299	257	281	-43	-25	3,450	3,227	3,247	-223	-20	0.94	0.99	48,586			
1.5 X-ray Transport	354	187	313	-166	-126	2,282	2,156	2,283	-126	-127	0.94	0.94	26,595			
1.6 X-ray Endstations	22	13	66	-9	-53	473	468	473	-5	-6	0.99	0.99	14,883			
1.9 Conventional Facilities	-4	62	118	66	-57	2,756	2,721	2,432	-35	289	0.99	1.12	76,783			
<b>1 LCLS Total Base Cost</b>	<b>1,580</b>	<b>1,359</b>	<b>1,664</b>	<b>-222</b>	<b>-305</b>	<b>20,540</b>	<b>19,918</b>	<b>19,277</b>	<b>-621</b>	<b>641</b>	<b>0.97</b>	<b>1.03</b>	<b>241,362</b>			
												<b>LCLS Total Estimated Cost</b>		<b>315,000</b>		
												<b>Avail. Contingency</b>		<b>73,638</b>		
												<b>% Contingency / Rem. Work</b>		<b>33.3%</b>		
												<b>% Complete LCLS Base Cost</b>		<b>8.3%</b>		
2.1 LCLS Project Mgmt, Planning & Admn (OPC)	175	169	176	-6	-7	3,636	3,633	3,902	-3	-269	1.00	0.93	33,201			
2.2 Injector (OPC)	80	1,759	69	1,679	1,690	487	479	511	-8	-31	0.98	0.94	6,090			
2.3 Linac (OPC)	0	0	0	0	0	1	1	1	0	0	1.00	1.00	2,545			
2.4 Undulator (OPC)	33	25	15	-8	10	564	552	492	-12	60	0.98	1.12	7,101			
2.5 X-ray Transport (OPC)	88	63	68	-25	-5	431	561	404	130	157	1.30	1.39	4,395			
2.6 X-ray Endstations (OPC)	-29	0	0	29	0	15	7	5	-7	3	0.51		5,208			
2.9 Conventional Facilities (OPC)	0	0	-41	0	41	0	0	0	0	0	0.00		0			
<b>2 LCLS Total Other Project Cost</b>	<b>346</b>	<b>2,016</b>	<b>287</b>	<b>1,670</b>	<b>1,729</b>	<b>5,135</b>	<b>5,234</b>	<b>5,315</b>	<b>99</b>	<b>-81</b>	<b>1.02</b>	<b>0.98</b>	<b>58,539</b>			
												<b>LCLS Other Project Cost</b>		<b>64,000</b>		
												<b>Avail. Management Reserve</b>		<b>5,461</b>		
												<b>% Contingency / Rem. Work</b>		<b>10.2%</b>		
												<b>% Comp LCLS Other Project Cost</b>		<b>8.9%</b>		
<b>LCLS Total Project Cost</b>	<b>1,926</b>	<b>3,375</b>	<b>1,951</b>	<b>1,449</b>	<b>1,424</b>	<b>25,674</b>	<b>25,152</b>	<b>24,592</b>	<b>-522</b>	<b>560</b>	<b>0.98</b>	<b>1.02</b>	<b>379,000</b>			
												<b>% Complete LCLS TPC</b>		<b>6.6%</b>		



## 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 March 2005 Cost Performance Report (CPR) represents 13 months of reporting earned-value on the LCLS TPC. All LCLS TEC and OPC actual costs for the project are captured in the LCLS CPR. For March 2005, cost and schedule indices for the LCLS are 0.98 and 1.02, respectively, indicating that LCLS is tracking well with the current cost and schedule estimate.

For cost variances (CV), a positive CV in 1.1 and negative CV in 2.1 are due to global controls mischarges to be corrected in next months report (similarly in 1.5 and 2.5). In 1.2, a negative CV is driven by overcharges in Injector's Vacuum and Diagnostics cost accounts, which is being investigated. The positive CV in 1.9 is due to good performance for the CM/GC advertisement and environmental protection effort. For schedule variances (SV), there is a delay in writing interface documentation in 1.3, the overall magnet and support design for the undulator in 1.4, and in the diagnostic specifications for 1.5.

### Change Control Activity\*

SYSTEM	WBS #	BCR #	BCR Level	Approval Date	BCR Description	Originator	WBS System Base Cost Estimate			Contingency		New LCLS Project Base Cost Estimate
							Previous Estimate	Increase (Decrease)	New Estimate	Increase (Decrease)	Balance	
				Feb-05	Prior Balance						\$73,973,396	\$241,026,604
LN	Multiple	LN-07	4	Mar-05	Modifications to Linac Schedule to smooth BCWS near term	E. Bong	26,751,209	\$3,721	\$26,754,930	(\$3,721)	\$73,969,675	\$241,030,325
IJ	Multiple	IJ-09	4	Mar-05	Modifications to Injector Schedule to smooth BCWS near term	E. Bong	18,434,824	(\$3,635)	\$18,431,190	\$3,635	\$73,973,310	\$241,026,690
PM	Multiple	CT-04	4	Mar-05	Modifications to Injector Schedule to smooth BCWS near term	E. Bong	29,293,557	\$1,908	\$29,295,465	(\$1,908)	\$73,971,402	\$241,028,598
LN	Multiple						26,754,930	\$9,142	\$26,764,072	(\$9,142)	\$73,962,260	\$241,037,740
IJ	Multiple						18,431,190	\$24,544	\$18,455,734	(\$24,544)	\$73,937,716	\$241,062,284
UN	1.04	UN-09	3	Mar-05	Modifications to Undulator Schedule to smooth commitment profile and BCWS near term	S.Milton	48,241,654	\$139,777	\$48,381,431	(\$139,777)	\$73,797,939	\$241,202,061
PM	N/A	PM-12	2	Mar-05	Modify PSAD Level 2 Milestones	M.Reichanadter	0	\$0	0	\$0	\$73,797,939	\$241,202,061
XE	1.06.01.01	XE-04	2	Mar-05	Remove Mgt. hours, increase contract funds, correct error on 2.06.05.02	J. Arthur	14,956,141	(\$73,252)	\$14,882,889	\$73,252	\$73,871,191	\$241,128,809
CF	Multiple	CF-12	4	Mar-05	Moved fund from C to P for T1 & T2 MCC and Linac, add Student RA in FY05, add \$10k for CM/GC advertisement, and revised schedule based on latest plan.	D. Saenz	76,754,200	\$28,527	\$76,782,727	(\$28,527)	\$73,842,664	\$241,157,336
PM	2.01.03.03	PM-11	3	Mar-05	Re-profile Spares budget and Linac Lagacy Upgrades to gain more OPC management Reserve in FY08	M.Reichanadter	241,026,610	\$204,530	\$241,231,140	(\$204,530)	\$73,638,134	\$241,361,866

\*Copies of Baseline Change Requests (BCRs) are available through the LCLS Project

### DOE (Level 1 - 2) Milestones

System	Level?	P3 ID	Milestone	Baseline	Updated	Variance	'03		'04		'05		'06		'07		'08		'09	
							Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr	Oct	Apr
			<b>Level 1 DOE (SC1) Milestones</b>	<b>8/29/08</b>	<b>3/31/09</b>	<b>N/A</b>														
DOE	ML1	MS1_PM000	CD0 - Approve Mission Need	6/17/01	6/17/01	0 days														
DOE	ML1	MS1_PM005	CD1 - Approve Preliminary Baseline Range	10/16/02	10/16/02	0 days														
DOE	ML1	MS1_PM015	CD2a - Approve Long-Lead Procurement Budget	7/30/04	7/30/04	0 days														
DOE	ML1	MS1_PM020	CD2b - Approve Performance Baseline	3/31/05	3/31/05	0 days														
DOE	ML1	MS1_PM025	CD3a - Approve Start of Long Lead Procurement	10/29/04	10/29/04	0 days														
DOE	ML1	MS1_PM030	CD3b - Approve Start of Construction	2/28/06	2/28/06	0 days														
DOE	ML1	MS1_PM035	CD4 - Approve Start of Operations	3/31/09	3/31/09	0 days														
			<b>Level 2 DOE (SSO) Milestones</b>	<b>8/29/08</b>	<b>3/31/09</b>	<b>N/A</b>														
PM	ML2	MS2_PM045	Prelim Safety Assessment (PSAD) Doc Complete	4/30/04	4/30/04	0 days														
PM	ML2	MS2_PM035	DOE External Independent Review (EIR) Complete	6/15/04	6/15/04	0 days														
PM	ML2	MS2_PM040	Fire Hazard Analysis Approved	5/31/05	5/31/05	0 days														
PM	ML2		Prelim Safety Assessment (PSAD) Doc Approved	2/28/06	2/28/06	0 days														
UN	ML2	MS2_UN010	Delivery of Undulator 1st Articles to MMF	7/3/06	7/3/06	0 days														
CF	ML2	MS2BO_005	CRIT: Rel RFP T3 Const. Pkg. RF Hut & S20/Alcove	7/21/06	7/21/06	0 days														
UN	ML2	MS2_UN005	MMF Qualified & Ready to Measure Prod Undulators	8/28/06	8/28/06	0 days														
IJ	ML2	MS2_IJ0027	Injector Laser Commissioning Review Complete	9/18/06	9/18/06	0 days														
CF	ML2	MS2BO_025	Research Yards Mods Beneficial Occupancy	10/20/06	10/20/06	0 days														
IJ	ML2	MS2_IJ0010	Start Injector Commissioning (Drive Laser)	11/20/06	11/20/06	0 days														
IJ	ML2	MS2_IJ0030	Injector Accelerator Readiness Review (ARR) Comp	5/18/07	5/18/07	0 days														
CF	ML2	MS2BO_050	Near Experimental Hall Beneficial Occupancy	6/18/07	6/18/07	0 days														
CF	ML2	MS2BO_035	Undulator Facility Beneficial Occupancy	7/2/07	7/2/07	0 days														
CF	ML2	MS2BO_020	Linac Facility Beneficial Occupancy	7/11/07	7/11/07	0 days														
IJ	ML2	MS2_IJ0020	Start Injector Commissioning(UV Beam to Cathode)	7/20/07	7/20/07	0 days														
CF	ML2	MS2BO_060	Far Experimental Hall Beneficial Occupancy	9/4/07	9/4/07	0 days														
CF	ML2	MS2BO_040	Front End Enclosure Beneficial Occupancy	10/5/07	10/5/07	0 days														
CF	ML2	MS2BO_055	X-Ray Transport Beneficial Occupancy	10/12/07	10/12/07	0 days														
LN	ML2	MS2_LN020	Linac ARR (Li20-Li30) Complete	1/3/08	1/3/08	0 days														
XE	ML2	MS2_XE015	2-D Pixel Detector Production Start	1/3/08	1/3/08	0 days														
CF	ML2	MS2BO_030	Beam Transport Hall Beneficial Occupancy	1/3/08	1/3/08	0 days														
LN	ML2	MS2_LN025	Start Linac (Li20-Li30) Commissioning	3/4/08	3/4/08	0 days														
PM	ML2	MS2_PM005	Final Safety Analysis Document (FSAD) Approved	3/31/08	3/31/08	0 days														
PM	ML2	MS2_PM030	LCLS ARR Complete (BTH thru FEH)	6/9/08	6/9/08	0 days														
UN	ML2	MS2_UN025	Start Undulator Commissioning (1st Light)	8/18/08	8/18/08	0 days														
XTOD	ML2	MS2_XT005	Start XTOD Commissioning	8/18/08	8/18/08	0 days														
XE	ML2	MS2_XE005	Start XES Commissioning	8/18/08	8/18/08	0 days														
CF	ML2	MS2BO_065	Central Lab Office Ctr Beneficial Occupancy	11/10/08	11/10/08	0 days														
		<b>Notes</b>	<b>Baseline Milestone Symbol</b>	3/31/09	3/31/09															
			<b>Projected Milestone Symbol</b>	3/31/09	3/31/09															
			<b>Achieved Milestone Symbol</b>	3/31/09	3/31/09															



## 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 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 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** – Funds 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 at Completion (EAC)** – Forecast of the final cost for a specific WBS#, subproject, or project based on the current ACWP plus a management assessment (ETC) 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 available contingency dollars ( $TPC - EAC$ ) to remaining work ( $EAC - BCWP$ ).

**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 funds 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 funds 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.