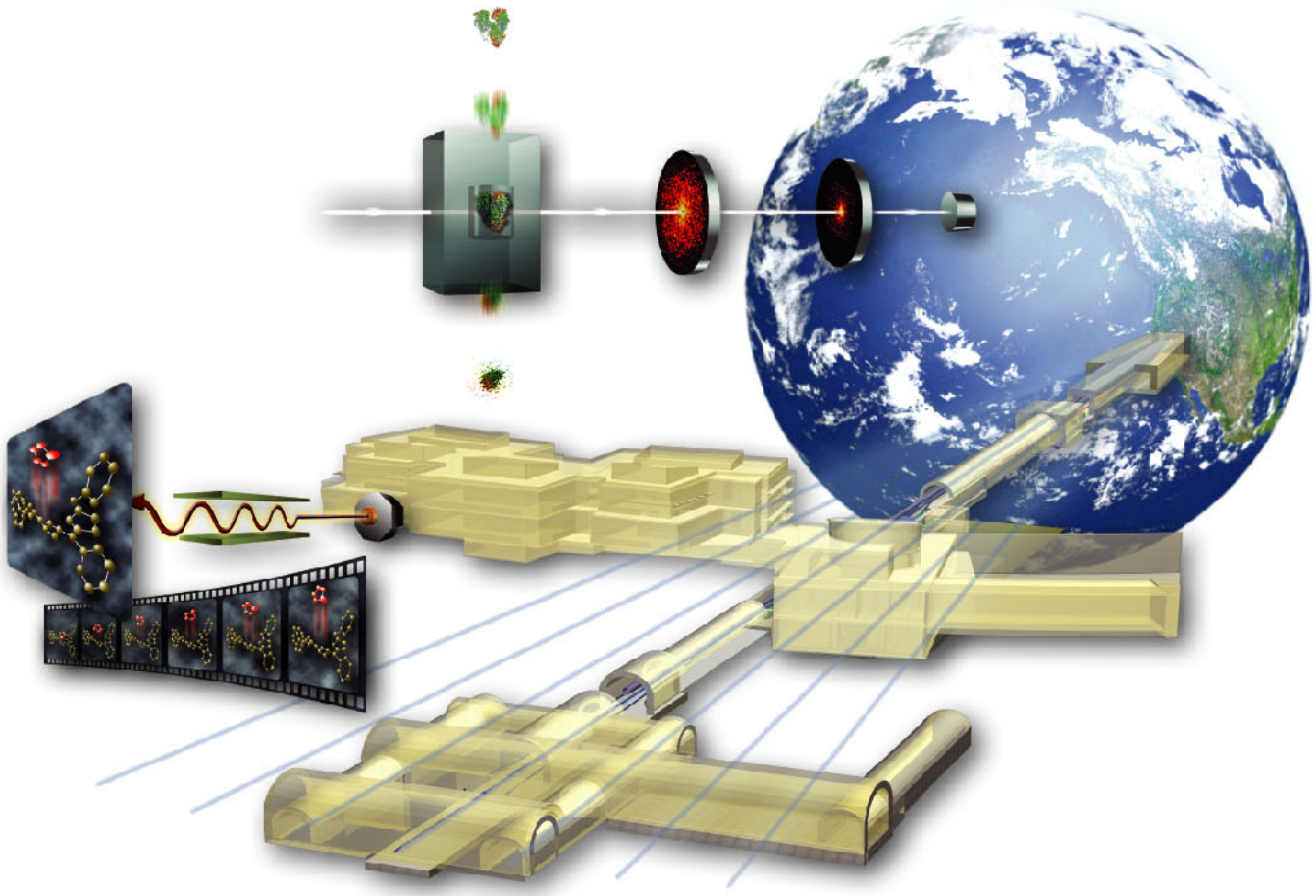
LCLS Linac Coherent Light Source

MONTHLY REPORT

January 2006



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SLAC Stanford Linear Accelerator Center – Stanford Synchrotron Radiation Laboratory SSRL

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Project Overview and Assessment

Highlights:

- The LCLS project team is preparing for an Office of Science semi-annual status review of the LCLS 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 is seeking 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.

- The 100% Title II submittal of drawings and specifications by Jacobs Facilities was submitted as scheduled on January 30, 2006. An in-house review was conducted to provide final comments to Jacobs on an expedited basis to recover schedule. Final comments/corrections will be incorporated into the design package on February 17, 2006 and an Issue for Bid (IFB) package will be submitted to the CM/GC (Turner).

- A cost reconciliation report (60% design package) provided by Turner Construction was ~10% higher than the Jacobs Facilities. Both estimates matched very well on quantities. The 10% variance is considered to be within a reasonable range for the maturity of the package. If necessary, a follow-up reconciliation will be made with the 100% cost estimates.

- A construction schedule was submitted by Turner Construction for review and approval by LCLS. The schedule was found to be consistent with the beneficial occupancy dates of individual facilities as well as the overall completion date. Minor revisions are anticipated.

Assessment and Issues:

- The January 2006 Cost Performance Reports (CPR) is the 23rd month of reporting earned-value on the LCLS TPC. For January 2006, the LCLS cost and schedule indices are 1.03 and 0.95, respectively. Total obligations to date (actual costs + open commitments) are $78,720K.

- The second partnering session was held on January 6 between SLAC, Jacobs and Turner to review and agree on: review processes (RFI's, Submittals, change management) and to create a joint project mission statement or overarching project goal and how the SLAC-Jacobs-Turner project team will accomplish this goal.

Project Office and Support

WBS 1.1, 2.1 Project Planning, Management and Administration

Highlights:

- The LCLS IT Manager (Andrea Chan) is developing a web-based system that can be used to deposit requirements documentation (SOWs, Specifications (ESDs), and Drawings) and track documents used for Purchase Orders. Rollout was delayed due to other priorities. The system will be tested in February, but will require the support of requesters and operators to accomplish.

- LCLS Environmental, Safety & Health Status – January 2006
  - Project safety has been receiving good attention in both technical design and in the field. Attention to detail in system design has been demonstrated in the design reviews where in addition to technical considerations, safety is also addressed. Work planning has been very thorough, including detailed consideration for safety on field projects such as the FFTB Shield Wall, Sector 20 and MMF projects. The project has worked 165 days without a recordable injury incident through January.
  - One Lessons Learned was raised this month relating to good practices in material movement and handling. A delivery truck driver un-strapped a very heavy load and then backed his semi-trailer over a curb en route to the delivery point potentially tipping his load. This incident was investigated and brought to the attention of the rest of the project engineers and the Laboratory as whole. The next day an identical situation began to evolve, which the project engineer in attendance observed and corrected immediately.
  - Several of the project ESH documents which had been revised to reflect accumulated project changes over the pervious two years received DOE-SSO approval this month.
    - Environmental Assessment (Affirmation of FONSI)
    - Preliminary Safety Assessment Document
  - The Laboratory will include LCLS information in the Linear Accelerator Safety Assessment Document (SAD) that they are in the progress of updating. This approach will save substantial project effort of having to write an entire SAD and subsequently keeping it up-to-date.
  - Turner Construction Company construction safety program was received and reviewed during January. A first set of project comments were provided to Turner with a second round anticipated in February. Areas of major focus in the document are Tunnel Rescue and Emergency Management.
  - The LCLS received several visits in January from the BES ESH Subcommittee chair in anticipation of the February review.

- LCLS Procurement Status – January 2006;
  - LCLS procurement activity increased in January, mainly due to issues surrounding the Jacobs and Turner subcontracts and with Turner requiring significant oversight and support as they prepare for bidding.
  - The LCLS ES&H Plan was updated and is being used for all construction procurements. LCLS safety personnel have indicated a willingness to consider exceptions to the 30-hour OSHA training requirement.
  - A/E Design – A negotiation meeting is scheduled for February 1 to settle several outstanding issues. Pending Subcontract modifications were delayed due to submission of incomplete data by Jacobs.
  - CM/GC – Weekly OAC meetings are being held and are very productive.
  - S20/K10B/MMF – Weekly status meetings are held for S20/K10B and MMF with minutes distributed by XL. Several change orders have been authorized with PO modifications issued or pending. Sector 20 Controls Equip. and Installation change order was issued.
  - MMF Electrical Feeder Upgrade - Subcontract awarded to Atlas/Pellizzari Electric for $555,000 on Jan. 20 after completion date had to be pushed out.
  - FFTB Equipment and Block Removal – Scope determined, APP approved. SOW under development. Planned award date April 5, 2006.

Assessment and Issues:

- Response to the open Job Requisition for a Procurement/Subcontract Administrator has increased and an interview was held with an internal applicant. An offer is under consideration. There is a serious need for additional procurement staff to stay up with the procurement requests, particularly in civil construction procurements. LCLS is working closely with SLAC's BSD to acquire additional staff.

- 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:

- On January 23rd Hamid Shoaee joined LCLS in the role of Head of the Controls Group. Hamid, who was at SLAC for many years, joins us from Los Alamos where he has been the Group Leader of the Instrumentation & Controls Group at LANSCE.

- On January 1st Mike Saleski joined LCLS to lead the development and integration of the PPS and BCS systems. He will be responsible for seeing that the safety systems are adequately designed, reviewed and accepted.

- The interface for the emittance application has been started to verify that the requirements are all handled. The Matlab interface is able to acquire configuration information. It is not yet accessing channel access variables. The GUI for the LCLS Query Manager has basic editing functionality, however it needs menus and to be packaged and installed as a stand alone application.

- Additions were made to the power supply application on the SLC-aware IOC. This is the chief application needed. It continues to be operated in test mode.

- The cable plant for the steering laser, heating laser and alignment laser, and the cable plant for OTR/YAG were worked on. The camera driver is nearing completion. Newport motor control is operational. A test stand is in place and waiting for some mechanical pieces.

- The PPS cable plant is being completed. Four trunk cables that must be installed for PPS and LSS have been identified. Locations of PPS terminal cabinets need to be finalized. John Forrestal from APS will join the effort to review and complete the PLC PPS design in support of the upcoming design reviews.

- The MPS ESD has been reviewed internally and is being updated. The purchase order for the PLC hardware to be used in the 2006 installation is ready. Wiring and rack space for the MPS in the Injector section is being completed. Pockels cell control signals are defined.

- EVG and EVR 200 driver and device support changes for data passing (using EPICS R3.14.8.1 with RTEMS 4.7) are in progress. A timing meeting will be held with experts from PSI, LANL and SNS who are interested in the use of this board.

- The loaner hardware for the Wire Scanner has arrived. Carrier card, motor controller, HV Power Supplies for PMTs, and ADC are being checked. The wire scanner EDM screen proposal is near completion.

- Good progress to complete the signal lists and routing for the cable plant for the 2006 installation has been made. Racks are identified for the Controls equipment.

Assessments and Issues:

- The Controls schedule for the 2006 installation in the Injector and Linac is in jeopardy. A rescheduling needs to be done to reconcile the schedule with installation needs. The new Controls manager is restructuring the manpower groups to address the installation schedule needs. The controls deliverables (hardware and software) do not require access to the Linac to install so the impact to the overall schedule is expected to be small.

- The cable plant which is to be installed above the drive laser may delay the installation of the laser and so needs to be expedited. There is extensive effort going into this issue and there has been good progress, but it is still unfinished. This is a near-term critical path item.

WBS 1.2, 2.2 Injector System

Highlights:

- A meeting was held to review infrastructure requirements for the Injector vault. The proposed water system modifications were discussed. Detail placement of water system and cable tray was started in order to establish installation contracts. Cable plant definition for the Injector Vault was completed. Tray installation in the injector vault can start in mid-April.

- Work was started on improving detailed design status reporting to assure components will be ready for the 2006 installation. Component fabrication status will be compared to installation task date. The SLAC manufacturing department is increasing its technician manpower to support LCLS component assembly and installation. The increase in personnel will also serve to decrease the shop rate.

- The design of the beam phase monitor cavity was completed. The completion of the cavity design finalized the position of L0a and L0b for the region integration effort. Beam Phase Monitor Cavity drawings were released to fabrication.

- The specification was generated for the in-vacuum mirror required to launch the drive laser on-axis to the gun cathode. Vendors were contacted to provide quotes.

Assessments and Issues:

- Laser commissioning is likely to be delayed by Injector Cable plant installation. The cable plant procurement is being expedited and a detailed schedule leading up to commissioning is being developed. Currently the commissioning is expected in mid June 2006 which will meet the L2 and L3 milestones.

- The Injector Vault water system requires SLAC laboratory review for tie-in to the existing SLAC facility. LCLS is working with SLAC CEF for a sign-off approval and details of how this new system will be maintained.

- Cathode launch system final design review will be held in mid-February. An alignment procedure must be written for the in-vault optics.

- The Injector Drive Laser vendor (THALES) did not meet their contractual milestone “Milestone 2: acquisition of components” in January which led to a schedule variance. The vendor will complete Milestone 2 by mid-March. Sufficient float exists to meet scheduled delivery date of the drive laser.

WBS 1.3, 2.3 Linac System

Highlights:

- The date for shutdown of the FFTB and removal of equipment has been set to April 10. Meetings are being held to organize effort to re-use FFTB components, some for LCLS. All equipment in FFTB required for LCLS was tagged. An outside contractor will remove the equipment and take down the FFTB enclosure shielding.

- Work was started on improving detailed design status reporting to assure components will be ready for the 2006 installation. Component fabrication status will be compared to installation task date. The SLAC manufacturing department is increasing its technician manpower to support LCLS component assembly and installation. The increase in personnel will also serve to decrease the shop rate.

- A meeting was held to approve adding three feet of radiation shielding steel in the down-beam end of the dump pit. The dump design will have to be revised from the baseline concept.

- Tune-up dumps TD23 North and South were removed from the North and South SLC Final Focus beamlines. One of the tune-up dumps will be used as the BC1 stopper.

- The gallery location of the X-Band klystron has been finalized and will be used to complete detailing of the last X-Band waveguide components.

- It was decided to perform the engineering and design of the BC1 and BC2 bunch length monitors at SLAC. An estimate for building the BC1 and BC2 bunch length monitors in house was prepared. A proposal will be submitted to test a detector in the NLCTA for use in the BC1 bunch length monitor.

Assessments and Issues:

- The 100% Conventional Facilities drawings from Jacobs were reviewed and comments were submitted for correction. Water distribution and shielding are top concerns of the Linac group within the CF scope.

- Work was halted on the BC1 chicane articulation vacuum chambers to modify flanges for the Bunch Length Monitor and the X-Band section. The modification to the design was performed, drawings were released to the vendor and fabrication resumed. The delay will not affect installation and was limited to the vacuum chambers and not the articulation mechanism.

WBS 1.4, 2.4 Undulator System

Highlights:

- Rodd Pope has joined LCLS to serve as the Undulator Group Assistant Manager. Rodd has the responsibility for Integration, Assembly and Installation for the LCLS Undulator systems at SLAC. Rodd has already visited the APS for nearly 2 weeks in January.

- Undulator Magnets
    - Titanium Strongbacks
        - 9 of 40 completed and
        - Vendors are ahead of schedule
    - Magnet Poles
        - 13,000 total machined out of 19,200
        - Vendor ahead of schedule
    - Magnet Blocks
        - Lots 3 and 4 shipped to the assembly vendors
    - 1st Articles (1 each from 2 vendors)
        - Start of assembly at both vendors imminent.

- The first prototype RF beam position monitor has been received and waveguides have been brazed to it. The initial RF measurements look very good despite some initial worries about a low Q measurement due to the vacuum beam pipe not being.
- Metrology and MMF Preparation
    - Several meetings were begun with SLAC's Assistant Undulator Manager (Rodd Pope) ranging from the MMF set-up to the integration of the monitoring systems.
    - Measurements of the prototype undulator which arrived last month from ANL have started. The software to automate shim placement was refined and there were very fruitful discussions with Isaac Wasserman during his visit.
    - A list of all necessary cabinets, hand tools and standards for the MMF was begun.
    - The last steps for the CMM procurement were finalized. Eric Lundhal will be in Germany for the runoff tests the week of March 6th. The machine will be crated for shipment the week of March 13th and is expected to be arriving at SLAC the week of April 24th.

Assessments and Issues:

- There is concern about the level of quality coming from our magnet block vendor and a representative was sent to Japan to visit their factory. Some of the

magnet blocks were found to be out of specification and this should have been caught at the factory. The vendor is working with us to resolve this issue.

- The delivery plan for the RF BPMs needs to be improved. Currently, they are close to the critical path and could risk a slow down in the assembly of the undulator systems in the magnet measurement facility.

- The flow of production undulator through the MMF will begin in a few months, and there is concern that the facility and the operators will not be ready for the rapid increase in pace. The current tests with the prototype undulator from APS have been useful to increase experience with the process. The schedule for this work needs to be integrated with the Undulator assembly and installation schedule. The new SLAC Undulator Manager is preparing this.

- A complete rework of the undulator installation process needs to occur as the existing plan no longer reflects the best approach to installing the undulators. This will be done over the next month.

Photon Beam Systems

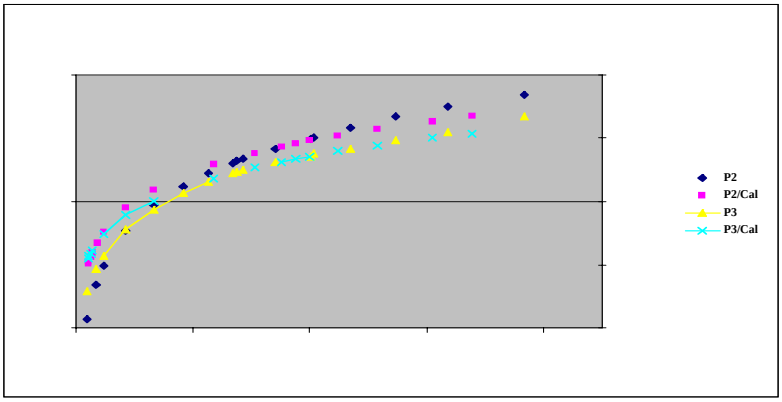
WBS 1.5, 2.5 X-ray Transport, Optics & Diagnostics (XTOD)

Highlights:

- Management and Safety – The XTOD group completed a BCR for the addition of the offset mirror system to the project and a schedule for the slit, gas and solid attenuator, total energy measurement system, and the controls. Also, the XTOD group completed a BCR to remove the Flipper Mirror and the side arms in the tunnel.

- Tunnel - The draft ESD for the tunnel vacuum system has been submitted for review. Work has begun on the Final Design Review, which is tentatively scheduled for mid-April. The Final Design will be a single-beam configuration consistent with the current LCLS baseline. The new stand design has been incorporated into the seismic review report for the tunnel, ERD05-500141-AA "LCLS X-Ray Tunnel Review Seismic Safety", a draft of which has been completed, has passed first review, and is now awaiting concurrence.

- Gas Attenuator – The design effort for the gas and the solid systems are underway, and currently are preparing a System Concept Review (SCR /CDR) report for the Attenuator project. As discussed and recommended in LCLS-TN-06-1 "The Physics Analysis of a Gas Attenuator with Argon as a Working Gas", the use of Argon gas to extend the gas attenuation for photon energies up to 8 keV is being explored. A "prototype" has been constructed with 3 small chambers, orifices, and data acquisition system to experimentally verify the pressure calculations. The figure below shows the pre-prototype station differential pumping data results.



Differential pumping data from the gas attenuator pre-prototype station and our model calculations.

- Solid Attenuator - A test has been designed and is being set-up to determine the repeatability of the pneumatic actuators with regard to tip and tilt of the attenuator blocks. All components have been ordered and the test stand has been constructed. A test block has been made to simulate the real attenuator block. The actuator has been received, but had the wrong solenoid attached and that is being remedied. Arrangements have been made with the precision measurement shop to measure the repeatability on their CMM. This test should be completed in February.

- Slit – A conceptual design of the x-ray slit sub-system has been developed. It is more compact than the previous design and has very few parts in the vacuum. Investigation into the feasibility of making the slit blocks as desired has begun. Thus far, they appear to be feasible to manufacture as conceived. Preparations are being made for a Conceptual Design Review in a few weeks, as scheduled.

- TTF Damage Experiment – The XTOD group has examined each shot position on the samples in our Zygo system for damage measuring the depths of any craters observed. The gas detector data from TTF gives the measured fluence for each shot on our samples during the damage experiment. There is a clear correlation between the crater depths measured on the SiC sample with the gas detector fluences, but the exact value of the damage threshold is masked by the errors at the low fluences around the damage threshold. To overcome this limitation, a statistical model of the pulse-to-pulse variations in beam fluence has been developed based on high fluence measurements. The pulse-to-pulse fluence was found to vary by 200% (lowest to highest). Appling this model to our single shot data taken at lower fluences, show a damage threshold for SiC at about the melt dose. This is consistent with expectations and indicates that these materials will perform under design conditions in the LCLS beam.

Assessment and Issues:

- None

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

Highlights:

- XES has participated in the review of the Jacobs Engineering 100% complete submittal of the drawings and has been involved in resolving remaining issues.

- Staffing: Atomic Physicist John Bozek has joined SLAC working for the LCLS-XES group. Mike Saleski has started as the Endstation PPS Manager and has been given the additional initial task of coordinating all LCLS PPS Systems. Niels van Bakel from SLAC (BaBar) will be starting in February as the Detector Physicist.

- The XES group participated in the LCLS Team Leaders' Meeting coordinating activities with the LUSI project.

- Detectors: The Technical Addendum for the second year for 2-D X-ray Detector Project has been completed and funding has been awarded. The technical review with the LCLS Detector Advisory Committee has been scheduled for February. The streak camera project has been affected by descoping and is in the process of being modified to the new funding levels. Developing the specifications is ongoing.

Assessment and Issues:

- The XES group executed a BCR removing several WBS elements (Imaging Detector, Intensity Detector, and most of the X-ray Streak Camera) as requested by the Project office. Another BCR will be processed in February.

- The long-range staffing plan is continuing to be developed, particularly the necessary increase to a staffing level adequate for operating the LCLS. This now becomes more important as the XES group is staffing up.

Conventional Facilities (CF)

WBS 1.9, 2.9 Conventional Facilities (CF)

Highlights:

- Progress continued on the construction for the Sector 20 Injector Facility (S20) project and the Magnetic Measurement Facility (MMF). The projects are 80% and 85% complete, respectively with zero accidents. Both are on schedule to be complete prior to their Level 3 milestone date. Change orders to date for the S20 project remain unchanged from last months report.

- Title II 100% submittal of drawings and specifications by Jacobs Facilities was submitted as scheduled. An in-house review was conducted to provide final comments to Jacobs on an expedited basis to recover schedule.

- TC has mobilized a portion of their pre-construction staff on site into the existing SLAC building #211 located in the Research Yard. Minor building improvements were provided in preparation for their occupancy.

- A cost reconciliation report provided by Turner Construction was ~10% higher than Jacobs Facilities. This is considered to be within a reasonable and acceptable range of comparable estimates.

- A construction schedule was submitted by Turner Construction for review and approval by LCLS. The schedule was found to be consistent with the beneficial occupancy dates of individual facilities as well as the overall completion date. Minor revisions are anticipated.

Issues and Assessments

- The MMF and S20 construction projects have experienced delays with internal processing of field orders to the General Contractor, which resulted in a delay in contract modifications to the base contract. For MMF and S20, these issues are small in scale, however similar delays on the main construction effort (Turner) will have a significant negative impact to the cost and schedule of the LCLS CF.

- An independent cost estimate was received from Davis Langdon Assoc (DLA) for the cost of all construction (less tunneling activities). The initial review of the cost estimate revealed a variety of inconsistencies in quantities and unit prices. A reconciliation of the cost estimate will be provided during February.

LCLS Cost and Schedule Performance – January 2006

LCLS Cost/Schedule Status Report - Work Breakdown Structure											31-Jan-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	12,148	12,320	13,170	172	-850	1.01	0.94	27,741	31,401	3,660	
1.2 Injector	11,282	9,841	9,895	-1,441	-55	0.87	0.99	20,584	20,014	-570	
1.3 Linac	5,081	4,985	3,946	-96	1,039	0.98	1.26	25,312	25,025	-287	
1.4 Undulator	12,274	10,563	10,458	-1,711	105	0.86	1.01	41,095	40,856	-239	
1.5 X-ray Transport	6,423	6,533	6,062	110	471	1.02	1.08	24,147	26,602	2,455	
1.6 X-ray Endstations	844	844	825	0	19	1.00	1.02	14,609	14,598	-11	
1.9 Conventional Facilities	14,282	13,795	12,914	-487	881	0.97	1.07	107,114	109,780	2,666	
1 LCLS Total Base Cost	**62,333**	**58,880**	**57,271**	**-3,453**	**1,610**	**0.94**	**1.03**	**260,600**	**268,276**	**7,676**	
					LCLS Total Estimated Cost			**315,000**	**315,000**		
					Avail. Contingency			**54,400**	**46,724**		
					% Contingency / ETC			**27.0%**	**22.3%**		
					% Complete LCLS Base Cost			**22.6%**	**21.9%**		
2.1 LCLS Project Mgmt, Planning & Admn (OPC)	4,962	5,043	5,051	81	-8	1.02	1.00	33,425	33,539	-114	
2.2 Injector (OPC)	711	652	648	-59	4	0.92	1.01	5,754	5,783	-29	
2.3 Linac (OPC)	1	1	1	0	0	1.05	1.00	2,545	2,545	0	
2.4 Undulator (OPC)	747	747	795	0	-48	1.00	0.94	5,502	5,551	-49	
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)	249	255	162	6	93	1.02	1.57	5,246	5,151	95	
2.9 Conventional Facilities (OPC)	0	0	0	0	0			621	621	0	
2 LCLS Total Other Project Cost	**7,159**	**7,187**	**7,085**	**28**	**103**	**1.00**	**1.01**	**58,024**	**58,068**	**-44**	
					LCLS Other Project Cost			**64,000**	**64,000**		
LCLS Total Obligations = $78,719.6K					**Avail. Management Reserve**			**5,976**	**5,932**		
					% Management Reserve / ETC			**11.8%**	**11.7%**		
					% Comp LCLS Other Project Cost			**12.4%**	**12.4%**		
LCLS Total Project Cost	**69,492**	**66,068**	**64,355**	**-3,425**	**1,712**	**0.95**	**1.03**	**379,000**	**379,000**		
					% Complete LCLS TPC			**20.7%**	**20.2%**		

*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 January 2006 Cost Performance Reports (CPR) is the 23rd month of reporting earned-value on the LCLS TPC. For January 2006, the LCLS cost and schedule indices are 1.03 and 0.95, respectively. Total obligations to date (actual costs + open commitments) are $78,720K. Approved Baseline Change Requests (BCR's) for January 2006 are shown in the tables 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.

The unfavorable cost variance is WBS 1.1 is due to larger than anticipated start-up costs in office and infrastructure support for the LCLS team. This variance is expected to improve slowly over time.

For schedule variances, the largest contributors to the Injector variance are: (1) A laser progress payment scheduled in January will not be made to Thales in March. There is no impact on the overall laser delivery schedule. When the payment is made the variance will correct, (2) The Injector RF Gun is behind schedule. There is some float and the Hot Test of the gun (the next step) should proceed as planned, (3) The Injector quads were shipped to SLAC by ship, and so have not yet all arrived. The final lot is expected to arrive very soon, and no impact is anticipated to the installation schedule. The largest contributors to the Undulator variance are: (1) Equipment for the measurement of undulators in the MMF needs to be purchased. The newly hired Undulator Project Engineer is planning the logistics of this work and will bring this effort back on track. (2) Payments for magnet poles are behind schedule, even though the vendor is ahead of schedule with their fabrication. This variance will correct when the vendor delivers the parts already fabricated. (3) The Single Undulator Test SUT is behind schedule. ANL is pushing very hard to recover and get back on schedule.

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*

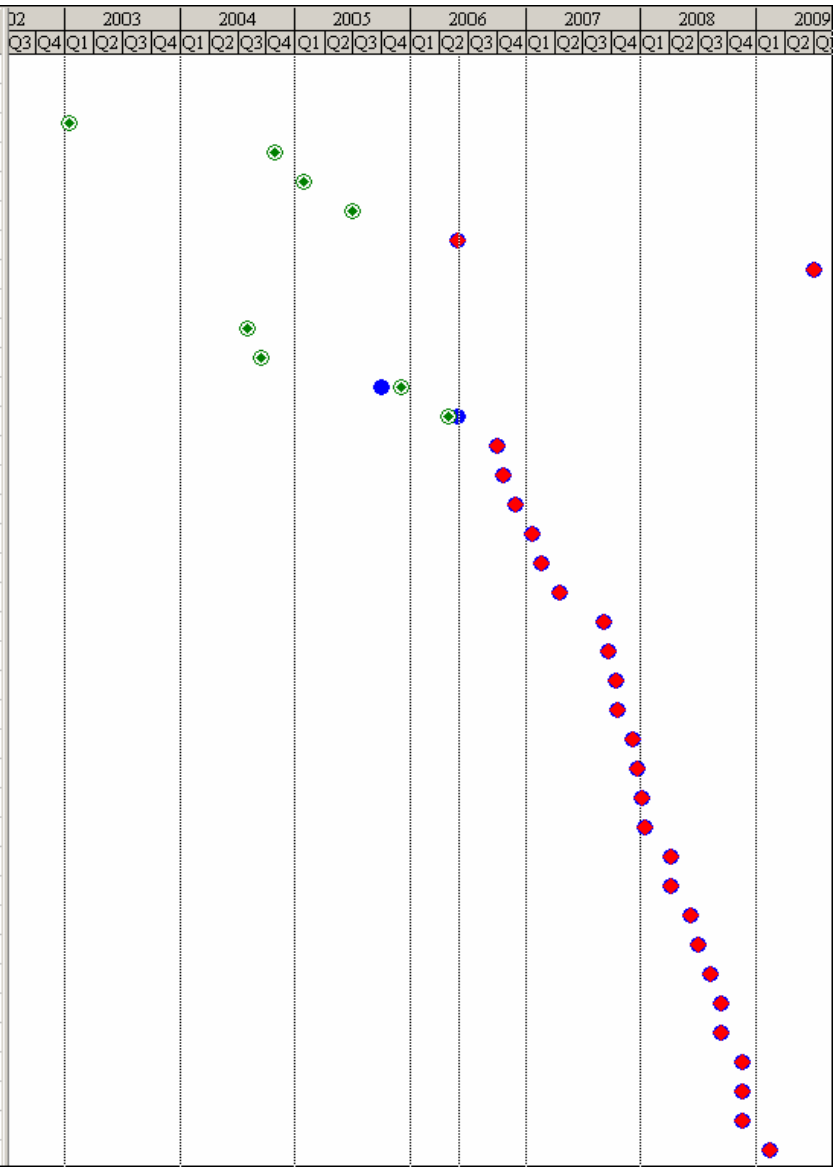
January 2006

BCR #	WBS #	Signature Level	DCN #	Approval Month	BCR Description	Originator	TEC Base Cost Estimate		
							Previous Estimate	Increase (Decrease)	New Estimate
LN-33	1.03.02.04	3		01/01/06	LINAC SYSTEM - Additional Power Supplies due to increased magnet count.	B. Dalesio	$262,659,783	$451,475	$263,111,258
LN35	1.03.07.06	3		01/01/06	Transfer scope to CF WBS 1.09.03.05 for FFTB Removal and Preservation	Schultz/Bong	$263,111,258	($340,098)	$262,771,160
UN-36	NA	4		01/01/06	WBS Dictionary Title and Description Changes	D. Schultz/S.Milton	$262,771,160	$0	$262,771,160
UN-38	1.04.05.04.02	3		01/01/06	Remove End-of undulator Streak Camera Station	D. Schultz/S.Milton	$262,771,160	($411,550)	$262,359,610
UN-42	1.04.02.04.03	3		01/01/06	Remove Observation Station Video	D. Schultz/S.Milton	$262,359,610	($129,716)	$262,229,894
UN-39	1.04.05.02, 1.04.06.05	2		01/01/06	Remove Undulator diagnostics design and prototyping budget.	D. Schultz/S.Milton	$262,229,894	($1,102,637)	$261,127,257
UN-40	1.04.03.06, 2.04.03.06	3		01/01/06	Update Alignment Diagnostic System	D. Schultz/S.Milton	$261,127,257	($313,627)	$260,813,630
XT-09	1.05	3		01/01/06	Move Modeling and simulation effort to R&D. Add funding for FEL Offset mirrors. Delete effort to measure spatial coherence of the FEL beam using slit diffraction.	J Arthur, R Bionta	$260,813,630	($648,552)	$260,165,078
XE-10	1.06	3		01/01/06	Beam imaging and intensity detectors: Delete for use in the x-ray hutches for experiment alignment, normalizaton. Transfer X-Ray Streak Camera Scope to LUSI Program.	J. Arthur-S. Moeller	$260,165,078	($744,442)	$259,420,636
CF38	1.09	3		01/01/06	Add $100k for "Hard Cost" to Remove concrete Pad (this scope was missing from approved Dec 05 CF34). Transfer fund within WBS 1.09.03.05, 1.09.03.08, 1.09.03.12, and 1.09.03.19 to correctly assigned activities in current WBS.	D. Saenz	$259,420,636	$109,550	$259,530,186
CF39	1.09	4		01/01/06	Add new scope for Arc flash Calculation ($75 base cost) and increase cost for Monte Carlo Analysis ($2k base cost)	D. Saenz	$259,530,186	$81,620	$259,611,806
CF41	1.09	3		01/01/06	Transfer scope from WBS Linac 1.03.07.06 to WBS Conventional Facility 1.09.03.05 for FFTB Removal and Preservation	D. Saenz	$259,611,806	$340,790	$259,952,596
CF42	1.09	2		01/01/06	WBS 1.09.02.02 A&E Jacobs DCNs and Post 100% negotiation	D. Saenz	$259,952,596	$730,000	$260,682,596
CF43	1.09	4		01/01/06	Descope Building 102B in WBS 1.09.03.05 (SLAC will fund this scope and work will be managed by LCLS CF group	D. Saenz	$260,682,596	($80,386)	$260,602,210
December 2005 Total Base Cost Estimate							$262,659,783		
Total Delta Base Cost Change				01/01/06				($2,057,573)	
January 2006 Total Base Cost Estimate									$260,602,210

***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

	System	Level?	Milestone	Baseline	Current	Variance
1			**Level 1 DOE (SC1) Milestones**	**8/29/08**	**3/31/09**	**140 days**
2	DOE	ML1	CD0 - Approve Mission Need	6/17/01	6/17/01	0 days
3	DOE	ML1	CD1 - Approve Preliminary Baseline Range	10/16/02	10/16/02	0 days
4	DOE	ML1	CD2a - Approve Long-Lead Procurement Budget	7/30/04	7/30/04	0 days
5	DOE	ML1	CD3a - Approve Start of Long Lead Procurement	10/29/04	10/29/04	0 days
6	DOE	ML1	CD2b - Approve Performance Baseline	3/31/05	3/31/05	0 days
7	DOE	ML1	CD3b - Approve Start of Construction	2/28/06	2/28/06	0 days
8	DOE	ML1	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	Prelim Safety Assessment (PSAD) Doc Complete	4/30/04	4/30/04	0 days
11	PM	ML2	DOE External Independent Review (EIR) Complete	6/15/04	6/15/04	0 days
12	PM	ML2	Fire Hazard Analysis Approved	6/30/05	8/31/05	44 days
13	PM	ML2	Prelim Safety Assessment (PSAD) Doc Approved	2/28/06	1/26/06	-23 days
14	UN	ML2	Delivery of Undulator 1st Articles to MMF	7/3/06	7/3/06	0 days
15	CF	ML2	Sector 20/Alcove Beneficial Occupancy	7/21/06	7/21/06	0 days
16	UN	ML2	MMF Qualified & Ready to Measure Prod Undulators	8/28/06	8/28/06	0 days
17	CF	ML2	Research Yards Mods Beneficial Occupancy	10/20/06	10/20/06	0 days
18	IJ	ML2	Start Injector Commissioning (Drive Laser)	11/20/06	11/20/06	0 days
19	IJ	ML2	Injector Laser Commissioning Review Complete	1/16/07	1/16/07	0 days
20	CF	ML2	Undulator Facility Beneficial Occupancy	6/4/07	6/4/07	0 days
21	CF	ML2	Near Experimental Hall Beneficial Occupancy	6/18/07	6/18/07	0 days
22	CF	ML2	Linac Facility Beneficial Occupancy	7/11/07	7/11/07	0 days
23	IJ	ML2	Start Injector Commissioning(UV Beam to Cathode)	7/20/07	7/20/07	0 days
24	CF	ML2	Far Experimental Hall Beneficial Occupancy	9/4/07	9/4/07	0 days
25	IJ	ML2	Injector Accelerator Readiness Review (ARR) Comp	9/20/07	9/20/07	0 days
26	CF	ML2	Front End Enclosure Beneficial Occupancy	10/5/07	10/5/07	0 days
27	CF	ML2	X-Ray Transport Beneficial Occupancy	10/12/07	10/12/07	0 days
30	CF	ML2	Beam Transport Hall Beneficial Occupancy	1/3/08	1/3/08	0 days
31	XE	ML2	2-D Pixel Detector Production Start	1/3/08	1/3/08	0 days
28	LN	ML2	Linac ARR (Li20-Li30) Complete	3/7/08	3/7/08	0 days
29	PM	ML2	Final Safety Analysis Document (FSAD) Approved	3/31/08	3/31/08	0 days
32	LN	ML2	Start Linac (Li20-Li30) Commissioning	5/8/08	5/8/08	0 days
33	PM	ML2	LCLS ARR Complete (BTH thru FEH)	6/9/08	6/9/08	0 days
34	LN	ML2	Start Linac-to-Undulator (LTU) Commissioning	6/12/08	6/12/08	0 days
35	UN	ML2	Start Undulator Commissioning (1st Light)	8/18/08	8/18/08	0 days
36	XTOD	ML2	Start XTOD Commissioning	8/18/08	8/18/08	0 days
37	XE	ML2	Start XES Commissioning	8/18/08	8/18/08	0 days
38	CF	ML2	Central Lab Office Ctr Beneficial Occupancy	11/10/08	11/10/08	0 days



Milestone Report

Milestone ID/Name	MS2_PM055 "Prelim Safety Assessment (PSAD) Doc Approved"
Milestone Level	ML2
Baseline Date	2/28/06
New Projected Date	1/26/06
Completed	Yes
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): The DOE Federal Project Director approved the LCLS PSAD on January 26, 2006.	

Milestone ID/Name	MS3_UN040 –Hydrostatic Level System Complete
Milestone Level	ML3
Baseline Date	03/02/07
New Projected Date	07/18/08
Completed	No
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): This milestone was incorrectly scheduled, as the wire system cannot be completed until the Undulator Installation is complete. The new projected date is now in agreement with the undulator installation.	

Milestone ID/Name	MS3_UN042 – Wire Monitoring System Complete
Milestone Level	ML3
Baseline Date	01/25/08
New Projected Date	07/18/08
Completed	No
Impacts:	Cost: No L1 Schedule: No Other: No
Comments (Reason for Change): This milestone was incorrectly scheduled, as the wire system cannot be completed until the Undulator Installation is complete. The new projected date is now in agreement with the undulator installation.	

Milestone Report (continued)

Milestone ID/Name	MS3_XT009 –Far Hall Mech/Vac Design Review Complete
Milestone Level	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.	

Milestone ID/Name	MS3_XT060 – Total Energy Measurement Installation Comp
Milestone Level	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.	

Milestone ID/Name	MS3_XT050 –Tunnel Mech/Vac Installation Complete
Milestone Level	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)

Milestone ID/Name	MS3_XT000 – FEE Mech/Vac Installation Complete
Milestone Level	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. % 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.