

LCLS PARS

DOE Project ID:	03-SC-002
DOE Project Name:	Linac Coherent Light Source
Managing Office Code:	SC
Site Code:	SLAC
Project Status:	Active
Project Size:	Other
Project Start Date:	6/13/2001
Project Completion Date:	3/31/2009
Project Acronym:	LCLS
Total Area - sq ft:	60,000
City:	Menlo Park
State:	CA
Zip Code:	94025
Prime Contractor:	Stanford University
Project Start at CD2:	6/13/2001
Project Completion at CD2:	3/31/2009
Project Location:	Stanford Linear Accelerator Center, Menlo Park, CA

Project Description Short: The LCLS project leverages capital investments in the existing SLAC linear accelerator (linac) as well as technologies developed for linear colliders and for the production of intense electron beams with radio-frequency photocathode guns. The LCLS requires an injector to be built at Sector 20 of the 30-sector SLAC linac to create the electron beam required for the x-ray Free Electron Laser. The last one-third of the linac will be modified and most of the linac and its infrastructure will remain unchanged. The existing components in the Final Focus Test Beam tunnel will be removed and replaced by a new undulator and associated equipment. Two new experimental buildings, the Near Hall and the Far Hall, will be constructed and connected by the beam line tunnel. A Central Laboratory Office Building will be constructed to provide laboratory and office space for LCLS users and serve as a center of excellence for basic research in x-ray physics and ultrafast science.

Project Description Long: The LCLS is based on the existing SLAC linac. The SLAC linac can accelerate electrons or positrons to 50 GeV for colliding beam experiments and for nuclear and high-energy physics experiments on fixed targets. At present, the first two-thirds of the linac is being used to inject electrons and positrons into PEP-II, and the entire linac is used for fixed target experiments. When the LCLS is completed, the latter activity will be limited to 25 percent of the available beam time and the last one-third of the linac will be available for the LCLS a minimum of 75 percent of the available beam time.

For the LCLS, the linac will produce high-brightness 4 - 14 GeV electron bunches at a 120 Hertz repetition rate. When traveling through the new 120 meter long LCLS undulator, these electron bunches will amplify the emitted x-ray radiation to produce an intense, coherent x-ray beam for scientific research. The LCLS makes use of technologies developed for SLAC and the next generation of linear colliders, as well as the progress in the production of intense electron beams with radiofrequency photocathode guns. These advances in the creation, compression, transport, and monitoring of bright electron beams make it possible to base this next generation of x-ray synchrotron radiation sources on linear accelerators rather than on storage rings.

The LCLS will have properties vastly exceeding those of current x-ray sources (both synchrotron radiation light sources and so-called "table-top" x-ray lasers) in three key areas: peak brightness, coherence (i.e., laser-like properties), and ultrashort pulses. The peak brightness of the LCLS is 10 billion times greater than current synchrotrons, providing x-ray photons in a pulse with duration of 230 femtoseconds or less. These characteristics of the LCLS will open new realms of scientific application in the chemical, material, and biological sciences.

The proposed LCLS Project requires a 135 MeV injector to be built at Sector 20 of the 30-sector SLAC linac to create the electron beam required for the x-ray FEL. The last one-third of the linac will be modified by adding two magnetic bunch compressors. Most of the linac and its infrastructure will remain unchanged. The existing components in the Final Focus Test Beam tunnel will be removed and replaced by a new undulator and associated equipment. Two new experimental buildings, the Near Hall and the Far Hall, will be constructed and connected by the beam line tunnel. A Central Laboratory Office Building will be constructed to provide laboratory and office space for LCLS users and serve as a center of excellence for basic research in x-ray physics and ultrafast science.

LCLS PARS

Project Mission Need Short: The purpose of the LCLS Project is to provide laser-like radiation in the x-ray region of the spectrum that is 10 billion times greater in peak brightness than any existing coherent x-ray light source. This advance in brightness is similar to that of a synchrotron over a 1960's laboratory x-ray tube. Synchrotrons revolutionized science across disciplines ranging from atomic physics to structural biology. Advances from the LCLS are expected to be equally dramatic.

The characteristics of the light from the LCLS will open new realms of scientific applications in the chemical, material, and biological sciences including fundamental studies of the interaction of intense x-ray pulses with simple atomic systems, structural studies on single nanoscale particles and biomolecules, ultrafast dynamics in chemistry and solid-state physics, studies of nanoscale structure and dynamics in condensed matter, and use of the LCLS to create plasmas.

Project Objectives: The LCLS Project will provide the first demonstration of an x-ray FEL in the 1.5 - 15 Angstrom range and will apply these extraordinary, high-brightness x-rays to an initial set of scientific problems. This will be the world's first such facility.

Name	Planned Date	Baseline	Actual Date	Narrative	Approval
CD-0 Approve Mission Need	6/30/2001	6/2/2003 15:08	6/13/2001		
CD-1 Approve Preliminary Baseline	10/30/2002	6/2/2003 15:08	10/16/2002		
CD-2 Approve Performance Baseline	5/31/2003	6/2/2003 15:08	7/1/2003	This critical decision is CD-2a, Long Lead Procurement Baseline, as defined in the Preliminary Project Execution Plan.	
CD-2 Approve Performance Baseline	10/31/2004	6/2/2003 15:08	4/11/2005	This critical decision is CD-2b, Approve Performance Baseline, as defined in the Project Execution Plan.	
CD-3 Approve Start of Construction	12/31/2004	6/2/2003 15:08	12/10/2004	This critical decision is CD-3A, Start Long Lead Procurements. This is defined in the Preliminary Project Execution Plan.	
CD-3 Approve Start of Construction	2/28/2006		3/10/2006	This critical decision is CD-3b, Approve Start of Construction, as defined in the Project Execution Plan.	
CD-4 Acceptance/Completion	3/31/2009			This critical decision is defined in the Project Execution Plan.	

LCLS PARS

Month	Fiscal Year	Project Assessment	Narrative Type	Narrative
April	2007	Yellow	Progress	The LCLS cost and schedule indices are 0.92 and 0.88, respectively. The SPI of 0.88 ('Yellow') is primarily driven by CR impacts including hold on procurements affecting future activities, 6 months of uncertainty about FY'07 funding level, as well as delays in civil construction. In April, percent contingency on EAC was reduced, primarily due to ongoing compounding effects. The delays and shortfall in FY2007 funding require a Directed Change to re-baseline the project. High level of effort is being spent on re-baselining and preparing for the upcoming Office of Science IPR for baseline validation and OECM limited EIR of CR impacts, scheduled for July 10-12, 2007.
March	2007	Yellow	Progress	Overall schedule performance index is 0.89 and the cost performance index is 0.92. Decline in SPI is primarily due to delays in civil construction and delayed procurements due to FY2007 CR and budget reduction.
February	2007	Yellow	Progress	CR concluded in mid February; FY07 funding is less than the requested level. Currently the impact is being assessed and a July '07 DOE re-baseline review is scheduled.
January	2007	Yellow	Progress	The FY07 continuing resolution (CR) is impacting the project's schedule as planned procurements are on hold until the final resolution of the CR. LCLS management is evaluating impacts on the project cost and schedule due to the CR, the potential for a year long CR and reduced budget authority.
December	2007	Yellow	Progress	Due to higher than expected civil construction bids, the project has developed a functional alternative to constructing new office and lab space by renovating existing and under utilized space for the operational staff of the LCLS facility. This alternative continues to support all of the mission requirements as a scientific user facility and has no impact on key technical operating parameters. This alternative requires a baseline change and the Acquisition Executive's approval.

LCLS PARS

November	2007	Yellow	Progress	The remaining civil construction bids received were higher than the project estimate. On average, the bids for the construction of the office building were as high as the first group of bids for the construction of the tunnel and experimental halls. Construction of the tunnel and experimental halls continues. However, the project proposed an alternative to provide office space to support LCLS operations. This alternative has no impact on the scientific capabilities of the LCLS facility. The October 2006 Office of Science IPR reviewed the proposed alternative and provided their recommendations to the SC Program Office. The Program Office is considering the IPR recommendations.
October	2007	Yellow	Progress	An Office of Science Independent Project Review was conducted in October to evaluate the status of the project and to evaluate options due to the high bid prices for civil construction. SC is considering revising the conventional facilities scope while maintaining the project's capability to meet all its mission requirements as a scientific user facility.
September	2006	Yellow	Progress	The construction phase for the major civil activities began this month. The project is contiuing to evaluate the second bid group contracts for civil construction to determine price growth areas. The increase in construction bids continue to be an issue for the project and they are evaluating options to reduce the impact. These options will be evaluated by the SC Independent Project Review next month.
August	2006	Yellow	Progress	The project issued the notice to proceed to the Construction Manager (CM) to award the first group of bids for civil construction. The project and CM are evaluating the group 2 bids currently.
July	2006		Progress	The project SPI and CPI are 0.93 and 0.95 respectively. The first group of civil construction contracts were awarded. The project worked with the construction manager (CM) to reduce bid prices and develop bid alternatives. The overall bids were much higher than estimated. The CM is preparing to mobilize in September to begin construction activities.

LCLS PARS

June	2006		Progress	The project is working with the Construction Manager (CM) to determine the cause for the high bids for civil construction. The project and CM are developing options to identify areas for cost savings. The first group of bids accounts for approximately 67% of all civil construction.
May	2006		Progress	The group 1 bids for civil construction came in higher than expected. The project is currently pursuing mitigation strategies with its Construction Management contractor.
April	2006		Progress	The project is receiving bids for civil construction and will be evaluating the bids with the Construction Management firm.
March	2006		Progress	The project continues on track with the schedule and cost performance indices at 0.93 and 1.01, respectively. OECM conducted an earned value management system certification review on March 27-31, 2006. The project will prepare a corrective action plan to address the finding.
February	2006		Progress	The project cost and schedule performance indices are 1.01 and 0.93. An Office of Science Independent Project Review was conducted February 7-9, 2006. The review committee recommended the project proceed with requesting CD-3b approval to start construction.
January	2006		Progress	Project SPI and CPI are 0.95 and 1.03, respectively.

LCLS PARS

December	2006		Progress	The project remains on track. Major activities include preparation of the construction schedule and reviewing cost estimates for conventional facilities. Project activities ceased during the planned winter shutdown of the entire laboratory.
November	2006		Progress	The project continues on track. The construction manager is in place and meeting regularly with project staff to develop the conventional construction schedule and reviewing the design packages.
October	2006		Progress	The CM/GC contract was awarded this month. The construction manager will begin meetings to prepare construction schedule and review design for the conventional facilities. Preparations for the installation activities during the October downtime was completed and work is proceeding. The project remains on track for cost and schedule.
September	2005		Progress	The project cost and schedule performance remains on track. Negotiations continue on finalizing the subcontract for the construction management procurement. Subcontract award is expected in October.

Funds Type	Budget Fiscal Year	TPC Current (\$K)	TPC at CD2 (\$K)	TEC Current (\$K)	TEC at CD2 (\$K)	BAC Current (\$K)	BAC at CD2 (\$K)	Total Contingency Current (\$K)	Total Contingency at CD2 (\$K)	Total Schedule Contingency Current (Days)	Total Schedule Contingency at CD2 (Days)	Total PED Current (\$K)	Total PED at CD2 (\$K)
Capital	2005	379,000	379,000	315,000	315,000	175,067							