

October 2006 LCLS DOE Review

Response to Recommendations July 2007



Accelerator Physics

Recommendation #1: Implement start-to-end modeling from the Gun to the FEL in a manner useful in the control room to interpret diagnostics data and to optimize total system performance. Start evaluation of this task by initiating collaboration between physics and controls groups by January 31, 2007.

Response: Greg White and Chris Larrieu (SLAC) have been tasked with the job of developing a computer system to implement a modeling framework for pipelining the results of one tracking code into the inputs of the next, so that LCLS can be modeled from "start-to-end" in one computer run. They have been interfacing with the physicists to better understand the manual tracking process that has been used to date. In addition to streamlining the interconnected tracking software, they will provide an interface to the LCLS control system to include on-line LCLS accelerator data and device operating parameters in the tracking process. The output of the tracking system will also be made available online in a format that resembles actual LCLS beam parameter measurements, to allow convenient comparisons of simulations and beam measurements. They have started with the IMPACT code, developed at LANL/LBNL, for the injector simulations, working with Cecile Limborg, the injector physicist. In the next phase we plan to connect the injector code IMPACT (and eventually PARMELA and/or ASTRA) to the linac code ELEGANT, and finally to the FEL codes GINGER and/or GENESIS.

Injector / Linac Systems

Recommendation #1: Establish method and priority to ensure sufficient access to the linac will be provided to allow commissioning to proceed per the required schedule (March 2007).

Response: LCLS maintains a list of work requiring access to the linac. The list has been used to efficiently schedule work during periods of tunnel access. Fifteen such periods have been completed.

Recommendation #2: Establish detailed integration plan to identify schedule impacts early enough to ameliorate potential issues (May 2007).

Response:

See response to Recommendation 1 above. A comprehensive punch-list of work requiring tunnel entry is maintained by LCLS personnel, and updated to reflect progress after each entry as well as newly identified needs. In addition, a Bill of Material (BOM) was implemented to plan and track designs, fabrication and installation schedules. Richard M. Boyce also implemented integrated schedule for all installation groups. In 2006 downtime installation, there were some components assembled and installed incorrectly. We have instituted a more stringent quality assurance checking system which requires alignment, mechanical engineer, control engineer and physicist to inspect before and after installation.

Undulator Systems

Recommendation #1: Within two weeks of the selection of a backup chamber concept, explicitly add the cost of the backup vacuum chamber design and development work to the LCLS project plan.

Response: Cost estimate for the backup design is contingent on results of prototyping. A plan for production of the aluminum extrusion option has been developed which fits within the budget and schedule allocation for the original stainless steel design.

Recommendation #2: Advance the development of the backup chamber design sufficiently that it could become a viable production option if the baseline chamber design is not successful by January 31, 2007.

Response: Please see response to Recommendation #3.

Recommendation #3: Advance the development of the baseline vacuum chamber as much as possible and convene an independent set of third-party experts to recommend the selection of a design (baseline or back-up) to move into production before February 15, 2007.

Response: LCLS has followed this recommendation. A review was held on February, 22, 2007 to evaluate the results of the work done to date on the two competing designs. The designs considered were the then current baseline four-weld stainless steel vacuum chamber and an alternate two-weld aluminum clamshell design. The review committee did not specify the preferred design approach, but felt that the stainless steel chamber design was more advanced. With this in mind, the project decided to go ahead with stainless steel chamber design as

the primary vacuum chamber design. An excerpt from the decision memorandum follows:

“Based on the results of the Undulator Vacuum Chamber Review on 2/22/07, the LCLS Project Office has determined that it is in the best interest of the LCLS Project to continue with the development and full production of the Stainless Steel, “4-weld design” Undulator vacuum chambers.

While this effort remains the primary path, other designs may continue to be pursued.

Outstanding technical issues with the “4-weld design” are 1) the vacuum pump-down of the chambers and the measurement of pump-down time and ultimate vacuum pressures, and 2) the measurement of surface roughness of the Al coated polished SS surfaces. Both of these items should be complete by March 23rd. The magnetic permeability also remains a concern, and the production team needs to include, as a part of final QA of the production chambers, magnetic permeability measurements made on all welds on all chambers.”

The magnetic permeability concern has become a critical issue for the project. Magnetic field measurements taken within the last month have indicated that the use of a stainless steel vacuum chamber will introduce uncontrollable and unacceptable errors in the undulator magnetic field. On-going field tests indicate the stainless steel vacuum chamber design should not be continued. The path forward will be presented during this review.

Recommendation #4: To broaden the exposure and involvement of SLAC personnel in the undulator installation planning, consider installing or duplicating the Long-Term Test Setup (LTS) at SLAC. A plan for this transition should be prepared before the next DOE review, April 2007.

Response: Rodd Pope and Geoff Pile are planning to get first article support/girders to SLAC for experience with assembly, installation and testing. The Long Term Test Setup at SLAC will be populated with the first article deliveries of each procured/fabricated sub-assembly.

Photon Beam Handling Systems and Endstations

Recommendation #1: Finalize the orientation (vertical vs horizontal deflection) of the high-energy mirrors by January 2007 so that the procurement packages for both the low-energy and high-energy mirror substrates can be released no later than May 2007 (early start date on the current schedule).

Response: After careful consideration of all aspects of this choice, the decision has been made to deflect the high-energy beam in the horizontal direction. In fact, either a horizontal or a vertical deflection would probably work well. The decision to deflect horizontally was made primarily because the metrology measurements done by vendors while fabricating the mirrors are always done in a horizontal geometry. Using the mirror in the same horizontal geometry should in principle reduce the chance of systematic errors creeping in.

One argument for horizontal deflection (a consideration raised during the October DOE Review) is to avoid the necessity of bending the mirror to compensate for gravity sag. However, due to the length of the x-ray beamline, it will still be necessary to include a capability of slightly bending the mirror, to remove any intrinsic very-long-radius bend (too slight to be measured using standard mirror metrology). This required bending could be in either direction, but will be very small. The XTOD group has begun working on a scheme to effect such a small, controlled bending.

Control Systems

Recommendation #1: Starting January 31, 2007, identify and specify the high-level applications required for those systems for which application do not yet exist, and by April 1, 2007, mobilize the forces necessary to begin the design and implementation of those applications.

Response: As mentioned above, start-to-end simulation work is proceeding. Basic high-level applications for injector commissioning include existing linac applications (updated to include LCLS hardware and modifications) as well as an extensive suite of MATLAB applications for fully automated collection and analysis of diagnostics data such as laser-to-RF phase adjustment, projected emittance measurement, slice emittance measurement, bunch length measurement and digital image management, as well as MATLAB-based feedback algorithms for several key parameters such as laser pulse energy and bunch charge.

We have also developed plans for a suite of applications software including model based high level applications based on the XAL framework from SNS. The development team includes seven software engineers and physicists.

Conventional Facilities

Recommendation #1: Obtain from Turner a current resource-loaded project schedule. Discuss the schedule with DOE by Thursday, November 2, 2006.

Response: New milestone dates were provided by Turner at the end of November. The resource-loaded schedule was delivered earlier in January. A recovery plan was implemented in May 2007 to mitigate a slow start to the tunneling activities. The recovery plan consists of re-sequencing work and concentrating manpower on schedule-critical activities and essentially restores the Baseline milestones for early occupancy.

Recommendation #2: Reevaluate cost and schedule contingency after accepting the Turner resource-loaded schedule and completing contract negotiations.

Response: Done. Results will be shown in the Mini-Review. Change orders and contract modifications to date are between 4-6% allowing an adjustment to the contingency assigned to on-going as well as remaining work.

Recommendation #3: Obtain DOE approval of the award of the Bid Group 2 contract before the November 15 price expirations.

Response: All issues with the Turner contract relevant to Bid Group 2 have been resolved. There are no issues which require review or approval at Chicago or Oak Ridge.

Recommendation #4: Define what the elimination of the CLOC includes, and fix any secondary impacts.

Response: Effect of CLOC removal on construction of "beam path" buildings has been assessed. Appropriate changes to plan have been implemented for construction in progress now. Finalization of modifications will keep pace with construction activities. Credit proposals received are presently in negotiations.

Recommendation #5: Finalize and complete renegotiation of the Turner contract. If possible include more powerful incentive methods. Complete all value engineering changes, including the CLOC deletion, as quickly as possible, no later than the end of November.

Response: Renegotiation of the Turner contract has not been completed to the satisfaction of both parties. SLAC proposed increase of incentives to \$1.5M. DOE-SSO reviewed the proposed incentives and has found them acceptable. An agreement on increased incentives was not consummated because the parties have not agreed on the credit due SLAC for deletion of the Central Lab Office Complex (CLOC). SLAC has received a \$4.5M claim from Turner. LCLS implemented some contingency plans including withholding of CM/GC fees proportionate to the deleted scope. Incentives are evaluated quarterly and paid according to the existing contract language. The claim was referred to arbitration by the CM/GC and negotiations between LCLS and the CM/GC have been suspended while the issue is addressed by the legal department.

Recommendation #6: Adjust the Turner schedule to eliminate any false indicators of delay.

Response: Level-2 milestones incorporate prudent "float". Level 3 and 4 milestones are "early finish" dates.

Recommendation #7: Prepare an obligations profile for the Turner contract work. This might be necessary to work around the effects of possible ongoing continuing resolutions in FY 2007

Response: The Turner Obligation schedule will be presented. The obligation profile has been adjusted to reflect the current Project Schedule. The impacts of the continuing resolution have been mitigated for conventional facilities and limited to extension of key staff due to delays in installation of the Far Experiment Hall hutches.

Recommendation #8: Complete the technical designs and consider LUSI impacts as quickly as possible and evaluate these designs for additional impact on CF work under contract.

Response: The LCLS baseline includes two Far Experiment Hall hutches, consistent with LUSI planning. LCLS will provide a soft x-ray branch line in the Near Hall, while LUSI provides a 2nd hard x-ray transport line to the Far Hall.

Construction of the hutches in the far hall will include a mezzanine level. This additional construction will require a change order to the Turner contract, or a separate civil construction contract to install. In the near experimental hall, the two floors are to be reconfigured to provide office space and modifications to the hutch lead walls will be required to allow installation of oversize experiment components.

Cost, Schedule and Funding

Recommendation #1: Update the EAC monthly based on a management assessment of variances, key risks and upcoming changes (especially those in CF).

Response: Estimate-at-Complete (EAC) is calculated monthly and reported in the LCLS Monthly Report. The LCLS EAC provides a realistic cost estimate for the overall project and includes all remaining work, any overruns / underruns, potential Baseline Change Requests, corrections for mischarges and a reserve for high risk items. High risk items are identified in the LCLS Risk Registry. The % contingency on EAC is calculated on commitments-to-go by reserving a specific portion of contingency for all awarded contracts with the remainder reserved for uncommitted work (commitments to go).

Recommendation #2: The SLAC Financial office needs to support the project with timely financial/accounting actions to ensure accurate reporting of earned value data (by the next SC review).

Response: The LCLS spares mischarges have now been addressed by creating a DOE Budget and Reporting (B&R) code for Special Process Spares. This allowed spares expenditures to be properly applied to LCLS Other Project Costs (OPC). LCLS project management and SLAC budget controller meet biweekly to ensure good coordination on financial matters.

Recommendation #3: Integrate the re-negotiated Turner resource-loaded schedule into project plans, and determine the impact to the project cost estimate, schedule, contingency assessment and FY2007 obligation plan (by November 30, 2006).

Response: The Turner resource-loaded schedule (schedule of values) has been updated and is fully integrated into the LCLS resource-loaded schedule.

Project Management

Recommendation #1: Resolve the office/laboratory issue to develop a plan that maintains the required functionality by November 30, 2006.

Response: BCR CF-58 describes the decision to upgrade existing laboratory space in support of LCLS operations. BCR-58 has been approved at L3 (Project Office) and L2 (DOE SSO).

Recommendation #2: Resolve the Turner contract approval issue as soon as possible (i.e., October 26, 2006).

Response: The Turner contract schedule was approved in October 2006 with the submission of an acceptable resource-loaded schedule. Since this time, a revised schedule has been submitted by Turner to remediate schedule delays by re-sequencing work. This also has been approved by LCLS project management and incorporated into the LCLS resource-loaded schedule.

Recommendation #3: Update the Integrated Project Schedule (IPS) to reflect actual status and current plans, particularly with respect to conventional facilities, by December 15, 2006.

Response: As stated in recommendation PM-#2, the LCLS resource-loaded schedule has been updated and approved by LCLS project management. Milestones at levels 2, 3 and 4 (early-occupancy) have been revised as necessary.

Environmental, Safety and Health

Recommendations: None

Laboratory Space

Recommendation #1: Generate a detailed plan accomplishing Phase 1 scope (space required for LCLS operations), including detailed scope, engineering estimate and schedule, to be presented to the Federal Project Director by the end of December 2006, to determine appropriate funding sources.

Response: A detailed plan of the Phase 1 scope for space renovation to support LCLS operations was prepared and presented to the LCLS Federal Project Director. A review of this plan, including the cost and schedule for the design and construction was presented to an independent review team in February 2007. The committee endorsed the plan and provided recommendations to ensure the cost and schedule was consistent with recent market trends. Since the February 2007 review, the Continuing Resolution has made it necessary to reschedule the renovation activity to start in FY2009.