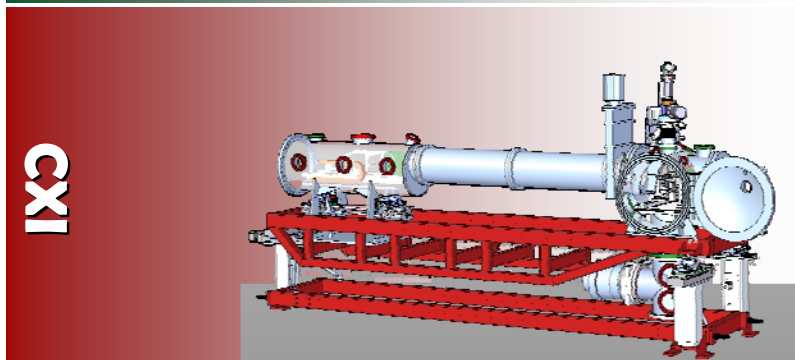
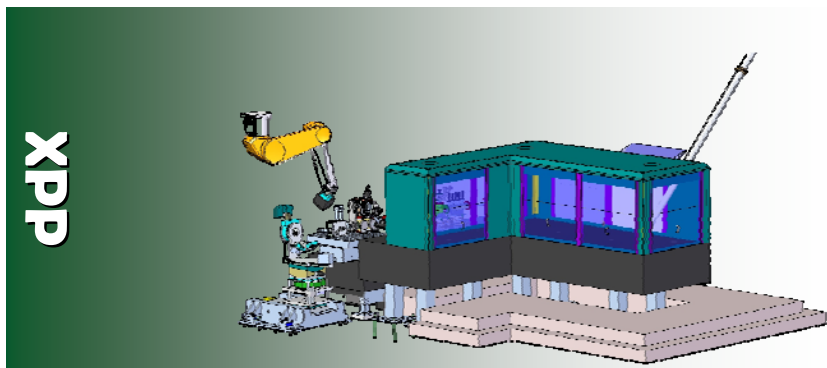


## LCLS Ultrafast Science Instruments Monthly Report February 2009



# Contents

WBS 1.1 and 2.1 Project Management.....	3
WBS 1.2 X-ray Pump Probe (XPP) Instrument.....	4
WBS 1.3 Coherent X-ray Imaging (CXI) Instrument.....	5
WBS 1.4 X-ray Correlation Spectroscopy (XCS) Instrument.....	7
WBS 1.5 Diagnostics and Common Optics (DCO).....	9
WBS 1.6 Controls and Data Acquisition (CDA).....	11
LUSI Cost and Schedule Performance- December 2008.....	12
LEVEL 1 & 2 MILESTONES.....	14
GLOSSARY.....	15

## **WBS 1.1 and 2.1 Project Management**

- Management and Safety

LUSI staff has started draft planning for the possibility of additional early funds which would be used to accelerate the LUSI project. In addition, we are starting to act on advanced engineering plans and staffing plans to enable us to advance the schedule. This is somewhat of a risk because if full funding of \$15M for this FY isn't received we might have to find other work outside of LUSI for the staff.

LUSI staff continues to participate in the FEH Hutch 4 and 5 design reviews and coordination. This is an on-going effort and will continue through construction of the hutches.

- Assessment and Issues:

The February 2009 Cost Performance Report is the 5<sup>th</sup> month of reported earned-value on LUSI. MIE cumulative obligations to date (actual costs + open commitments) are \$6,606K. Schedule and cost indices for the MIE are 0.98 and 1.03 respectively.

WBS 1.1 cumulative obligations to date (actual costs + open commitments) are \$2,155K. Schedule and cost indices for WBS 1.1 are 1.00 and 0.97, respectively.

All planned OPC (WBS 2) work has been completed. OPC cumulative actual costs to date are \$4,852K.

## WBS 1.2 X-ray Pump Probe (XPP) Instrument

- Management and Safety

The XPP Final Instrument Design Review was successfully held on February 24th and 25th.

WBS 1.2 cumulative obligations to date (actual costs + open commitments) are \$1,758K. Schedule and cost indices for WBS 1.2 are 0.98 and 1.02, respectively.

- General

Two interviews were conducted for the XPP Second Scientist (Feb 20th, 26th). Additional interviews are scheduled for March 2<sup>nd</sup> and 3<sup>rd</sup>.

- Design

Work continued the conceptual design effort for the robot base. This effort will be accelerated to mount the robot in Hutch 3 and test the robot as soon as possible. This was suggested by the FIDR review members.

We reviewed and finalized the procurement documents for the optics support tables, laser table, laser enclosure and Hutch 3 raised floor system (detailed drawings, procurements specifications, etc...). The purchasing process for these items is expected to begin next month.

- Detector

The XPP design team traveled to Brookhaven National Lab to discuss the mechanical packaging and interface with the detector development team. The XPP team explained the design considerations that must be taken onto account to be compatible with the XPP detector mover and the BNL team discussed various packaging considerations. The meeting was extremely fruitful and a draft interface control document has since been created. This document is now out for review.

In addition, the option of placing a hole in the detector was explored since the XAMPS detector is now being constructed with four 512 x 512 sensors. The XPP team leaders were consulted about this option and all agreed that it would be extremely valuable to have a hole. A 2 x 2 mm hole will now be built into the XAMPS design.

- Procurement

Bid proposals for the XPP sample goniometer were received at the end of the month. The proposals will be evaluated and a vendor will be selected the first week in March.

The solicitation for the XPP detector-positioning robot was posted on the FedBizOp web page (ROBOT04FEB09) and closed at the end of the month. A RFP package is now being prepared.

- Component Status

There are currently no manufactured components at this time.

- Assessment and Issues:

None.

## WBS 1.3 Coherent X-ray Imaging (CXI) Instrument

- Management and Safety

The MOU with LLNL for the Particle Injector was signed by both parties and the Memorandum Purchase Order was placed. LLNL will now transfer drawings, documentation and the equipment to SLAC as described in the MOU. The CXI team now requires additional engineering resources to begin work on the injector.

The LUSI management is still pursuing options for increasing the CXI engineering and design staff to bring the level consistent with the schedule. There is an offer out to one engineer and a response is expected in March. In addition, one LCLS engineer will begin working on LUSI-CXI in March. This will be part-time in March ramping up to full-time over two months.

WBS 1.3 cumulative obligations to date (actual costs + open commitments) are \$858K. Schedule and cost indices for WBS 1.3 are 0.95 and 1.11, respectively.

- General

The CXI team reviewed the 90% drawings for the Far Experimental Hall and identified issues to be communicated with the architectural firm.

- Design

The design efforts were primarily concentrated on the Reference Laser and the 1 micron Sample Chamber in order to prepare the Preliminary Design Reviews.

Work continued on the CXI layout to optimize the use of space while allowing flexibility. The components in the X-ray Transport Tunnel have been coordinated with the LCLS group building the transport line in order to minimize the effort required to install the CXI devices.

- Detector

The CXI detector, which falls under the LCLS construction project, is progressing as planned. Communication is ongoing between the CXI team and the group working on the mechanical design of the detector. Specifically, both groups are pushing forward to finalize the interface between the detector and the CXI Detector Stage.

- Procurement

The deadline for submission of the 1 micron KB proposals was extended in order to allow vendors to provide a cost proposal for the second CXI KB system to produce a 100 nm focus. An option was added to the Request for Proposals which will allow the same vendor to be selected for the 0.1 micron KB System to be procured at a later date. Extra time was given to the vendors to respond to this option.

- Component Status

- **Sample Chambers**

Preliminary design work was completed. A Preliminary Design Review was scheduled for March 4 2009.

- **Precision Stands**  
No update due to the lack of engineering staff.
  - **Detector Stage**  
No update due to lack of staff. We are processing a procurement requisition for design services to work on the Detector Stage. We expect to have this in place in March.
  - **Particle Injector**  
The MOU with LLNL was signed. Work will begin once staffing issues have been addressed.
  - **KB Mirrors**  
We are awaiting the proposals from the potential vendors. A proposal review meeting has been scheduled for April 9 2009, at which point the selected vendor will be identified.
  - **Ion Time-Of-Flight**  
No update.
  - **Reference Laser**  
Preliminary Design was completed. A Preliminary Design Review was scheduled for March 3 2009.
- Assessment and Issues:  
None.

## WBS 1.4 X-ray Correlation Spectroscopy (XCS) Instrument

- Management and Safety

WBS 1.4 cumulative obligations to date (actual costs + open commitments) are \$580K. Schedule and cost indices for WBS 1.4 are **0.99** and **1.06**, respectively.

BNL started working on the XCS detector, since the Technical Addendum was signed in January by SLAC and BNL.

The MOU between SLAC National Accelerator Laboratory and the Deutsches Elektronen Synchrotron laboratory (DESY, Hamburg, Germany) related to the Split and Delay prototype (built by the group of Dr. Gerhard Grübel) is under discussion by the management of each laboratory. The Split and Delay unit will provide the unique scientific opportunity to probe ultrafast dynamics of condensed matter systems on the XCS instrument.

- General

The XCS Instrument team presented the new monochromatization scheme on February 20th to the Technical Configuration Control Committee (TCCC). It involves the relocation of the Large Offset Monochromator to a location nearer to the XCS sample position and the addition of a post-monochromator. The TCCC favorably received the proposed change and supported the BCR. The BCR was presented at the Change Control Board on February 25<sup>th</sup> and is now implemented in the WBS structure and P3.

A. Robert, the XCS Instrument scientist, travelled to BNL on February 10<sup>th</sup> together with Niels van Bakel (LUSI Detector Physicist) to discuss in details the specification of the XCS detector. The summary of the discussion is detailed in the detector section.

G. Grübel visited SLAC on February 27-28 in the frame of the Free Electron Laser 3-way meeting organized at SLAC. During that time we discussed the plan for the upcoming commissioning time of the Split and Delay at the European Synchrotron Radiation Facility, scheduled end of May. Both A. Robert and S. Lee will be involved in the commissioning. We also started to discuss the procedure to be followed in order to properly integrate the Split and Delay Unit at SLAC, once the MoU concerning it will be signed by all parties. It was agreed that Soo-Heyong Lee will be in charge of the integration of the DESY device at SLAC.

- Design

The XCS Instrument team continued to interact intensively with LCLS Conventional Facility staff regarding the design effort for the hutches located in the Far Experimental Hall. The XCS Instrument team received the “90% design complete drawings” in February 2009. A Meeting with the various coordinators of the project took place where all the comments/concerns from the XCS Instrument team were addressed. The “100% design complete drawings” are expected to be available for review end- March 2009.

The specifications of the Large Offset Monochromator have been worked out. This will lead to the update of the Physics Requirement Document related to the component. The Engineering Specification Document should be expected in March.

The detailed design of the vacuum transport line, delivering the beam to the CXI instrument located in hutch 5, and which travels within Hutch 4 where the XCS instrument resides, is worked out by the engineering team. Also the XCS engineering team monitored the LCLS design work on the vacuum section in the X-ray Transport Tunnel (especially the stands locations) in order to make sure that it does not interfere with any instrumentation to be installed in the XRT for the XCS Instrument.

- Detector

A. Robert visited BNL to discuss the specifications of the XCS Detector. It turns out that the current and original specifications state a pixel size of 35 microns, but also accept a charge-leaking effect up to one neighboring pixel. This would result in an effective pixel size of the order of 70-100 microns. This is not favorable for many XPCS experiment to be performed on the XCS instrument. The small pixel size requirement should be understood as small “effective” pixel size. During the discussion with the BNL detector team, we agreed that a physical AND effective pixel size of 50-60 microns would be acceptable (still maintaining the other XCS detector specifications: 120Hz readout, very low noise, 100% DQE at 8keV). We also emphasized that the XCS Instrument integrated team is extremely favorable to a detector design allowing tilability for future detector upgrade. The suggested changes in the pixel size specifications will be presented at the next LDAC Review Committee for approval in May.

- Procurement

There are no ongoing procurements for the XCS instrument.

- Component Status

There is no specific status to report on any XCS component.

- Assessment and Issues:

None.



## WBS 1.5 Diagnostics and Common Optics (DCO)

- Management and Safety

WBS 1.5 cumulative obligations to date (actual costs + open commitments) are \$928K. Schedule and cost indices for WBS 1.5 are 0.98 and 1.00, respectively.

- General

2/26/09 Generated BCR 2009-02-005 to make corrections to the Profile Monitor/Wavefront Monitor work package.

- Design

The report for the preliminary design review of the Monitors was received. No major items of concern were reported. Items to consider included selecting a feed through connector for the diode assembly and the procurement of the beryllium target for the IPM. This might become a long lead item since there are only a limited number of companies that can process beryllium.

Pulse Picker test program is under way. A few problems with the design have been uncovered that lead to the generation of particles. Issues were communicated to the vendor.

Further detail follows:

- **Monitors:**

Report for the PDR was received early February. Report and response to the recommendations were filed in share point.

Continued detailing work on the alignment stages, chamber, target and diode assemblies for the IPM and PM.

- **X-Ray Lenses:**

Since the vendor is expecting a six to eight week assessment before they can propose a solution to our needs, we are pursuing the house solution based on the IPM design.

- **Slits:**

A solicitation for the Slits was placed in FedBizOpps

- Received response documentation from ADC. No other company responded.
- Released Statement of Work and Purchase Specification documents
- The request for proposal documentation has been started RFP will be sent to ADC and JJ X-ray.

- **Attenuator/Pulse Picker:**

Pulse Picker test program is still in progress. Housing modifications were made to constraint bearings and minimize particle generation. Testing done with modified housing looks promising. However, it is recommended that the

body be made out of stainless steel or that the aluminum body be plated with nickel.

- **Harmonic Rejection Mirrors:**

Engineering efforts on the HRM system have resumed at the end of the month. Designer activity expected to start at the end of February or early March was stopped. No designer will be available until April. This has impacted the schedule on the HRMs.

- Procurement

- Ordered slides for IPM prototype
- Ordered additional bearings and another Aluminum body from AZSOL
- Ordered one SS body
- Ordered one attenuator linear actuator

- Component Status

None.

- Assessment and Issues:

None.

## WBS 1.6 Controls and Data Acquisition (CDA)

- Management and Safety

WBS 1.6 cumulative obligations to date (actual costs + open commitments) are \$327K. Schedule and cost indices for WBS 1.6 are 0.96 and 1.28, respectively.

- General

We are currently updating the status for primavera.

- Design

The XPP Controls and Data Systems Preliminary Design Review was conducted on February 7. Material and the review report are posted at <http://confluence.slac.stanford.edu/display/PCDS/XPP+Preliminary+Design+Review>. Included with this review were the Diagnostics and Common Optics Controls required for XPP.

We also began preparing for the XCS and CXI Controls Preliminary Design Reviews to be held in May. This also involves iterating and reviewing the ESD and ICD documents with the respective instrument scientists and updating the controls item lists of items to be ordered and configured.

In regards to offline data management, work continued on defining the data-format translator to convert online data formats to HDF5 data formats.

We are continuing the discussions with LUSI scientists regarding data processing. A drafted ESD was prepared for the common portion of the data processing system for the three instruments.

- Detector

Noise measurements on XPP detector readout integrated circuit are continuing. We are also interacting with BNL to bring up their test setup which also has one of the circuits. We continue to work in parallel working to modify schematics and lay-outs of integrated circuit. This will take another month.

- Procurement

We are starting to prepare order lists and requisitions in anticipation of receiving approval for XPP controls procurements

- Status

We are fabricating and loading printed circuit boards for the intensity-position and position monitors for diagnostics and beginning functionality testing. The VHDL has been prepared for the on-board FPGA.

- Assessment and Issues:

None.

## LUSI Cost and Schedule Performance- February 2009

SLAC Linear Accelerator Center Menlo Park, California	LUSI Cost/Schedule Status Report (February 2009)							Date:	3/22/2009	
Performance Data										
WBS[2]	Cumulative to Date					At Completion			Indices	
	Budgeted Cost		Actual Cost Work Performed	Variance		Budgeted	Latest Revised Estimate	Variance	SPI	CPI
	Work Scheduled	Work Performed		Schedule	Cost					
1.1 PROJECT MANAGEMENT	2,099,005	2,099,005	2,155,188	0	-56,183	5,355,823	5,412,066	-56,243	1.00	0.97
1.2 X-RAY PUMP PROBE (XPP)	1,816,368	1,787,813	1,757,522	-28,555	30,291	5,784,211	5,753,920	30,291	0.98	1.02
1.3 COHERENT X-RAY IMAGING (CXI)	999,274	947,838	857,530	-51,436	90,308	10,022,246	9,931,939	90,307	0.95	1.11
1.4 X-RAY CORRELATION SPECTROSCOPY (XCS)	620,693	615,031	580,415	-5,662	34,616	7,227,371	7,192,755	34,616	0.99	1.06
1.5 DIAGNOSTICS & COMMON OPTICS	970,381	930,314	928,430	-40,067	1,884	6,786,963	6,785,079	1,884	0.96	1.00
1.6 CONTROLS AND DATA ACQUISITION	434,106	417,319	327,278	-16,787	90,041	7,380,671	7,290,630	90,041	0.96	1.28
Gen. and Admin.	0	0	0	0	0	0	0	0		
Undist. Budget						0	0	0		
Sub Total	6,939,827	6,797,320	6,606,363	-142,507	190,957	42,557,285	42,366,389	190,896		
Management Resrv. (MIE)						12,542,715	12,733,611	-190,896		
Total MIE	6,939,827	6,797,320	6,606,363	-142,507	190,957	55,100,000	55,100,000	0	0.98	1.03
2.0 Other Project Costs (OPC)	4,851,861	4,851,861	4,851,861	0	0	4,851,861	4,851,861	0		
Management Resrv. (OPC)						48,139	48,139	0		
Total OPC	4,851,861	4,851,861	4,851,861	0	0	4,900,000	4,900,000	0		
Sub Total (MIE+OPC)	11,791,688	11,649,181	11,458,224	-142,507	190,957	47,409,146	47,218,250	190,896		
Total Management Reserve						12,590,854	12,781,750	-190,896		
Total Project Cost (TPC)	11,791,688	11,649,181	11,458,224	-142,507	190,957	60,000,000	60,000,000	0		

<b>February 2009 Performance</b>	<b>AYK\$</b>
Total Project Cost (TPC)	\$60,000
Planned % Complete (MIE)	16.4%
Actual % Complete (MIE)	16.0%
Total Estimated Cost (MIE)	\$42,557
Cost and Commitments to Date (MIE)	\$6,606
Estimate at Complete (MIE)	\$42,366
Work Remaining (MIE)	\$35,569
MIE Remaining Management Reserve (Based on EAC)	\$12,734
% Contingency on Uncommitted Work Remaining (MIE)	35.8%

The LUSI cost and schedule are consistent with the approved baseline with a Total Estimated Cost (TEC) of \$42.7M and a Total Project Cost (TPC) of \$60M. The CD-4 milestone is August 2012. All costs are in actual-year dollars and out-year costs are escalated.

The January 2009 Cost Performance Report is the fourth month of reported earned-value on LUSI. Schedule and cost indices are 0.98 and 1.00, respectively.

The projected Estimate at Complete (EAC) provides the most current estimate of the TEC final cost. Contingency on EAC is considered adequate for this stage of the project. LUSI is evaluating possible scope changes to the approved baseline. Scope changes will be presented to the LUSI Technical Configuration Control Committee (TCCC) and the LCLS Change Control Board for approval prior to being added to the baseline.

## LEVEL 1 & 2 MILESTONES

MILESTONE DESCRIPTION	Baseline	Projected	Variance		CY 2008	CY 2009	CY 2010	CY 2011	CY 2012
<b>LUSI - Project Management</b>									
<b>Level 1 DOE HQ Milestones</b>									
CD-0 MISSION NEED APPROVAL	08/10/05A	08/10/05A	0 days						
APPROVED: CD-1 COST RANGE	09/27/07A	09/27/07A	0 days	▼					
APPROVED: CD-2 PERFORMANCE BASELINE	10/22/08A	10/22/08A	0 days		▼				
APPROVED: CD-3 FABRICATION START	4/12/10	4/12/10	0 days				▼		
APPROVED: CD-4 START OF OPERATIONS	8/31/12	8/31/12	0 days						▼
<b>Level 2 - DOE Local Milestones</b>									
COMPLETE: CD-2 REQUIREMENTS - XPP / CXI / XCS	08/18/08A	08/18/08A	0 days		▼				
APPROVED: ADVANCE PROCUREMENT-XPP&CXI	01/30/09	12/19/08A	-20 days			▼			
APPROVED: FAB START - XPP	05/07/09	03/16/09	-37 days			▼			
APPROVED: ADVANCE PROCUREMENT-XCS&DCO	08/03/09	06/03/09	-40 days			▼			
COMPLETE: CD-3 REQUIREMENTS	01/15/10	01/15/10	0 days				▼		
COMPLETE: XPP PHASE 1 INSTL-START EARLY SCIENCE	10/20/10	10/20/10	0 days				▼		
COMPLETE: CXI PHASE 1 INSTL-START EARLY SCIENCE	08/05/11	08/05/11	0 days					▼	
APPROVED: FINAL INSTRUMENT READINESS REVIEW	07/06/12	07/06/12	0 days						▼

BASELINE - ▼  
 PROJECTED (Early) - ▼  
 PROJECTED (Late) - ▼  
 ACTUAL - ▼

## GLOSSARY

**Cost of Work Performed (ACWP)** – Actual cost reported through the LCLS cost accounting systems, plus any accruals, for a specific WBS#, subproject, or project.

**Budget Authority (BA)** – Cumulative funds currently allocated and authorized by the Department of Energy that may be committed and spent by LUSI for project-related activities.

**Budget at Completion (BAC)** – The total budgeted cost at completion for a given WBS, 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 WBS#, subproject, or project physically accomplished.

**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 to subcontractors where work has been authorized but not yet expensed.

**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** – Forecast of the final cost for a specific WBS#, subproject, or project based on the current ACWP plus a management assessment 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.

**Major Item of Equipment (MIE)** - Capital equipment or automated information system components with a total estimated purchase value of \$2,000,000 or more, including costs that are capitalized and not related to construction.

**Other Project Cost (OPC)** – LUSI “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 remaining contingency dollars to remaining line item (TEC) work calculated as follows: the numerator is equal to the contingency available (after consideration of the EAC) less 5% of outstanding technical phase-funded awards and less 10% of outstanding conventional facilities phase-funded awards. The denominator is the EAC less ACWP less outstanding phase-funded awards.

**Percent Planned** – The ratio of the current plan to the Budget at Completion.  $\% \text{ Planned} = BCWS/BAC$ .

**Project Engineering and Design (PED)** – Funding used to support the engineering and design effort for LUSI.

**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 MIE budget authorized for the LUSI project for the construction phase of the project. TEC includes contingency but does not include OPC.

**Total Project Cost (TPC)** – The total budget authorized for the LUSI project, including MIE 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 LUSI work plan which is used to track all resources, schedules, and cost.