

General Comments – 10 June 2009 – Kem Robinson

**LCLS FACILITY ADVISORY COMMITTEE
CLOSE OUT**

IF IT WAS HARD LAST MEETING TO BE ORNERY...

- ✘ Commissioning, Lasing, saturation – **FANTASTIC**
- ✘ Milestones being met ahead of schedule
- ✘ Science program
 - + Organized
 - + Experiments lined up
 - + Schedule for early science
- ✘ CD-4 seems within reach
- ✘ Safety at LCLS is now used as a model within SLAC

HOWEVER, DON'T UNDERESTIMATE ME ...

... I CAN STILL BE A CURMUDGEON

- ✘ While we figured “2-Shot Paul” was right ...
 - + Get the impression many were *surprised* by the success
 - + Now others are in the *spotlight / heat lamp*
- ✘ At this point there are nothing but details
- ✘ *There is no float – it's gone – must avoid single point failures*
- ✘ Plans for optimizing laser performance still a bit thin
- ✘ Taking on more civil construction – drive everything to completion **EVERYTHING**
- ✘ We're an advisory not a review committee

ROBINSON FEL THEOREM STILL HOLDS

- ✘ Fantastic results with *just* YAG screens
- ✘ Good Beam Based Alignment results

However,

- ✘ Need to move towards optimization
 - + Develop clean set of operator metrics for specific needs
 - ✘ Power
 - ✘ Energy
 - ✘ Bandwidth
 - ✘ Pointing ...
- ✘ High-level applications for operations

MINI-CLOC

- ✘ This will be the *first-impression* and *front face* of the LCLS
- ✘ Think of *impressions* not just *holding capacity*

WELCOME TO THE LCLS



Welcome to the LCLS



EXPECTATION MANAGEMENT

- ✘ Last time concerned about unbounded expectations
- ✘ Now REALLY concerned about unbounded expectations
 - + Not everything will likely go as smoothly as laser turn on and saturation
- ✘ Need to allow users some flexibility in approach to ensure happy *testimonials*
- ✘ Using contingency wisely, but people will want more, more, more ...
- ✘ Details, details, details
(for example, procurements)

THINGS ARE IN TRANSITION

- ✘ SLAC is evolving
 - ✘ Congratulations and best wishes to Jo Stohr
- ✘ LCLS is evolving into an operational user facility
- ✘ The FAC must evolve to meet the needs of the LCLS facility

*A great project, a great team, a great opportunity to
watch and observe
– keep it up*

Electron Systems

Steve Marks & Kem Robinson

10 June 2009

Great Work

- The lasing and speed at which saturation and lasing was achieved is nothing short of phenomenal
 - The YAG screen measurements are very impressive
 - The commissioning has been spectacular
 - You can't quibble with success – but we will
 - The undulators are working properly
 - Measurements and systems meets needs
 - Motion control systems are functioning
 - The undulator commissioning results are very encouraging
 - Radiation doses are less than expected
 - Provides dividends from an operations standpoint
 - All systems seem to be functioning as required
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Opportunities

- Would have liked to see a bit more detail about what is coming up for commissioning
 - While tempting to declare success for e-beam commissioning, there is still a long ways to go for fully smoothly operating user facility
 - Understanding how to optimize the laser characteristics for a specific user experiment will be important
 - Didn't seem to have planned on success
 - Sense of not being able to capitalize on success
 - High-level applications: Need for clear prioritization and migration
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From the Previous Meeting

- Further work on the cathode? 😐
 - Work on the low charge operation mode 😊
 - Laser heater –
 - It's working well – improves the FEL gain 😊
 - But does it solve Coherent Optical Transition Radiation (COTR)? 😐
 - High-level applications: 😐/😞
 - They are functioning as needed
 - Require an attending physicist to properly execute
 - Adequate for commissioning, but migration to operations needs priority
 - Undulator: fully responsive 😊
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Report of the X-ray subgroup

Josef Feldhaus, Paul Fuoss, Peter
Takacs, Tom Rabedeau, Thomas
Tschentscher

General

- LCLS reached lasing and saturation at 800 & 8000 eV
- Now there is considerable expectation for early success of x-ray experiments
 - AMO commissioning will have to be efficient and successful
 - turn on of other instruments (in particular for hard x-rays) is awaited
- Start of FEE commissioning has been delayed
 - time to commission FEE and AMO gets shortened in order to not compromise the start of user experiments in Sep '09
- Former budget limitation is no longer valid due to stimulus funds
 - Speed up construction leads to high rate of procurements
 - Issues related to different types of funds (and specific spending)
- now 3 DOE projects for 6 instruments: LCLS, LUSI, MEC
- Overall the x-ray systems progress now rapidly towards realisation and designs have narrowed down in most cases
- The advanced date for providing instruments enabling early science is extremely good (5 by mid '11, 6 at end '12)

Findings (I)

- AMO
 - schedule was tight and is now even tighter (beam to Hutch 1 in Aug '09)
 - KB system mirror system is late and its commissioning schedule is now additionally challenged by HF incident at LBNL
 - hutch doors for laser safety now late
 - 6 week schedule for commissioning of entire instrument is demanding.
→ Two instrument scientists plus add. staff in shift work
- SXR
 - current schedule has no float : ready for beam end of Feb '10
 - again very short commissioning period to start user program I/'10
 - very tight procurement schedule
- XPP
 - seems to be well on track with expectation to have most components installed by Oct '09
 - efforts ongoing to assure delivery of diffractometer early '10
 - ask for commissioning time with x-rays in Oct '09
 - Raised floor in Hutch 3 to be looked at in order to avoid problems with search protocol

Findings (II)

- XCS
 - no discussion at this meeting
 - schedule has been considerably advanced → 2011
 - final detector delivery only end '11
- CXI
 - design of the instrument has implemented recommendations from the last FAC
 - set of refractive lenses has been added to refocus beam behind 0,1 μm focus → enhanced experiments capability
 - final design review in June '09, but the sample chamber design appears a little late
- MEC
 - fully funded by Office of Fusion Energy Science now (stimulus funds)
 - just passed CD0 (May '09) and foresees CD1 for fall '09
 - experiments using high-energy lasers will operate at very small repetition rates → scheme to switch beam for short periods

Findings (III)

- DCO components
 - many items (59) of 9 different objects
 - designs complete and procurement on-going for first elements
 - assembly and testing will start this summer for first elements
 - x-ray tests of profile/intensity/position monitors possible in fall '09
 - issue about purchasing items for 'prototypes' and small series
- Large offset monochromator
 - has been added to LUSI scope, but no discussion at this meeting
- Detectors
 - no discussion this time
- DAQ
 - the photon control data systems seem to be well on track
 - special attention is paid to turn on of AMO as first instrument
 - for specific user group (CAMP) special means for online monitoring are implemented
 - possible underestimate for computing in transition from start to operation of instruments
- RF cavity & laser timing system appears impressive

Findings (IV)

- Purchasing seems a big issue in the current situation
 - there is a lot of concern about delays (past & future) due to the administrative processes
 - small faults can lead to situation that items come on critical path which were not anticipated: need technical staff to monitor so many procurements
 - there is an assumption that beamline staff can be moved from the other instruments to the AMO program for commissioning. This will make the purchasing problem worse.

Other issues

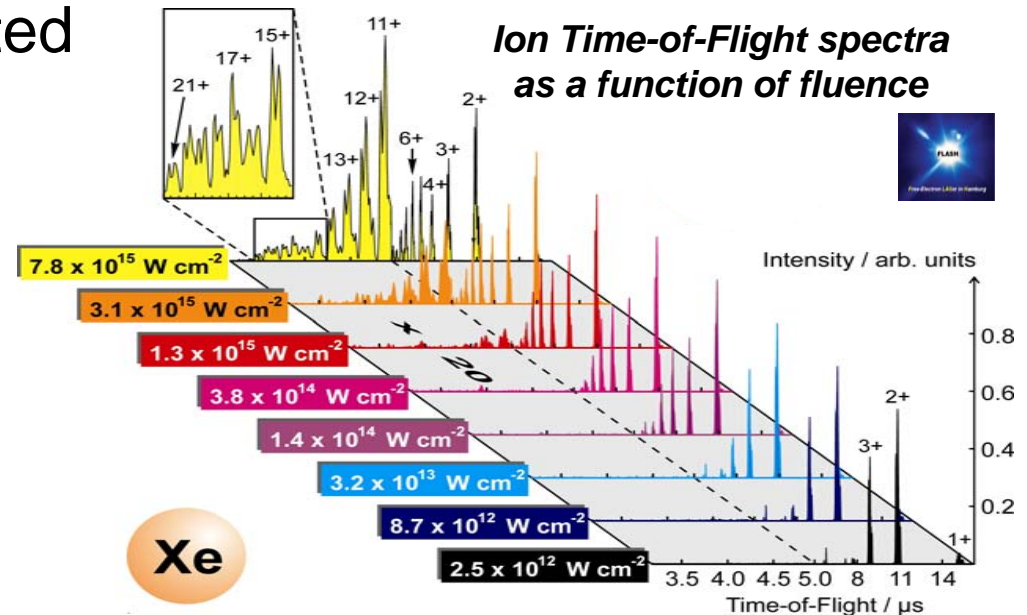
- Turn on of user program in fall '09
 - expect relatively large number of people for first years experiments
 - large collaborations
 - temporal overlap for preparation and wrap-up of experiments
 - high relevance of the experiments & science will attract more people
 - experiments at SPPS & FLASH show exactly this
 - where do you put them ???
 - assume control rooms, albeit being huge, should be for experimenters on the current experiment only
 - additional space is needed → ???
 - rooms for sample preparation or assembly of instruments
 - currently each one in NEH and FEH
 - will need more and more specialized (e.g. chemistry) → close-by provisions
- Additional 'external' staff coming for commissioning phase
 - work space : control room ?

Recommendations

- Early commissioning of DCO components using hard x-rays in the XPP hutch would be advantageous
 - gain confidence in performance and likely reduces the overall commissioning time
 - requirements to be fulfilled
 - HOMS mirrors & parts of instrumentation ready
 - requires 13.5 GeV operation → machine blocks & fast switching
- DAQ and instrument control software
 - this task will require permanent attention beyond initial installation and even beyond first experiments
 - foresee manpower for this task (per instrument?)
 - issue for LCLS operation
- Designate more space to user program
 - NEH & FEH are huge in principle
 - foresee dedicated space for instrument & sample preparation
 - foresee office space for users

What's next ?

- use x-ray beam and perform early science !!!!!!!!!!!!!!!!!!!!!!!!!!!!!
- user operation at AMO starts in about 3 month from now
- expect the unexpected



A.A. Sorokin et al., PRL 99 (2007) 213002

- construction of other instruments will continue for ~3 yrs
- there will be challenges on the way

Controls

Karen White, John Maclean

6/10/09

Control Progress

- Great progress has again been made since the last FAC
- 40 WBS accounts closed, most of ctls accts
- Controls deputy idea working well
- Impressed with talent & commitment of team

MPS

- Made Schedule, congratulations
- This has always been a schedule risk
- Some scope creep - but this was accommodated
 - Laser heater protection
 - Photoinjector maintenance activities

PPS

- A well documented, rigorous configuration control process is now becoming a standard way of working
- A culture change has occurred within the team, now working on changing customer culture
- Working on improving post PDR change request mechanism
- Paper based documentation and approval system. Nothing wrong with that!
- LCLS 1st software based PPS @ SLAC

PPS cont.

- FEE Checkout more rigorous than previous checkouts. People trained, will write reports following checkout
- IAT validation – test run before certification, tests procedure and system
- IAT - review of IAT process found no major concerns
- NEH critical path 5 enhanced qa/qc tasks .
- No float for problems found - should be ok we think

Timing system

- Reliability & maintenance issues to address
 - better rf diagnostic information - know how to do this
 - Diagnostics from fanout module - firmware change
 - Upgrade front end timing hardware
- Event generator – sever link with old system
- Phased approach to retiring old system is good

Beam diagnostics

- Stripline bpms
 - digitizer in successful operation, exceeded spec
 - Commissioned new LTU beamline this year
 - Will upgrade linac bpms to new lcls stripline
- RF cavity bpms
 - All specs met
- Undulator cavity bpm
 - Custom adc module successful
 - Met or exceeded specs

Undulators

- 30/33 installed
- Motion control in user terms
 - working ok
- Laser heater
 - successfully commissioned

Fast feedback

- Tight schedule
- Seems to adequately resourced
- We note that COTS solution not used for data exchange

LINAC Upgrade

- A substantial project
- Approach seems well thought out
- Will require commensurate resources
- Needs ~ \$5M AIP
- We encourage Tom to prepare a schedule... but make it flexible, we suspect it will see many changes

Photon Controls

- Phase 1 XTOD commissioning, tracking issues between LLNL – small issues
- Taking steps to ease accommodation of instruments from outside e.g. web docs
- Reusing systems from other projects

Photon Controls

- Increase in cooling needed in NEH server room – needed in ~1 yr
- 3 tables – danger to bellows. We encourage test stand work
- Integration with visiting instruments – 6 months lead time required for integrating, process being established
- ARRA money – longer lead time, but don't anticipate problems, few foreign components for controls ~ \$6M

Photon Controls

- MPS installation going well, interface well defined
- Laser safety system – LSO, laser group involved in reviewing design
- Laser timing – now 20fs drift, anticipate better performance next year
- Accelerator <-> experiment interface has been thought about - PV gateways

Photon Controls

- No plans for software simulator per-se. Don't understand what requirements are.
- Other preparations e.g.
 - Members of experiment assist in commissioning
 - Users send data, they wrap with metadata and send back with parser for them to develop their own code
- Invented own elog - carrying on a fine controls tradition

Photon Controls

- User AMO/CAMP workshop
 - Brought up issues, data transfer, run own analysis code
 - they have ways to address these
- Concerns
 - Run control calibration framework (data from accelerator) may not be ready by July but will be by Aug.
 - schedule squeeze, controls at end of the line!

Software

- Configuration control is getting more rigorous
- Test plans now routinely used for software installation
- Software installations now planned with stakeholder involvement
- Many good ideas still to implement
- Controls Program Deputy in MCC is a good thing
- Cyber security well managed, cooperation with SLAC cyber people - well done!

High Level Apps

- Availability of Matlab apps has been critical for the success of machine commissioning
- Matlab apps probably not robust enough for ops
- Plans to hire physicist /programmer to assist in Matlab maintenance. Could controls help?
- Converting Matlab to Java apps
- Make sure Controls/Physics/ops agree schedule and priorities
 - multi year effort, Consider adding staff
- Still some robustness/performance issues with Java apps

Facility Advisory Committee (FAC)

Conventional Facilities Closeout

Tony Chargin & Greg Herman

June 10, 2009

- Conventional Facilities overall has been a success
 - The total CF subsystem cost is \$142M (ETC) or 33.8% of the TPC
- EDIA percentage of 32% is a positive accomplishment of the team
- Design quality appears to have been good evidenced by limited construction change orders ~4%, which is less than had been held in contingency for the purpose
 - Planning another 3% of contingency for Potential Change Orders and Change Order Requests
 - Conservative initial planning provides part of contingency to build Office Space Alternative (OSA) aka miniCLOC

- Conventional Facilities completed to date valued at \$128M
 - Closeout effort underway
- \$14M construction work to go (includes approval of OSA BCR), a non-trivial amount considering the nearness of CD-4 date
- Facilities were available on time for the successful installation and commissioning of initial compliment of LCLS technical equipment

- The Office Space Alternative (OSA) is the face of LCLS
 - Building should reflect this in the internal and external functionality and appearance
- OSA completion should not affect CD-4
- Recommendations:
 - Review that resources are available and committed to complete OSA with other competing priorities at SLAC
 - Review Hutch system requirements for potential cost savings

- Need to obtain record drawings from Jacobs, incorporating red lines from Turner
- Need to obtain 23 of 26 trade subcontracts closeout binders from Turner

- Recommendation:
 - Identify expiration dates on Potential Change Orders (PCO)

- Tests performed as specified in commissioning plan provided by Jacobs,
 - Commissioning done by numerous contractors and supervised by Turner, CF staff and its commissioning agent
- High degree of confidence that commissioned CF equipment will perform as designed under future full load

- Continued attention to safety resulted in improved safety performance in the last 10 months
- LCLS provided leadership in enhancing the safety culture at SLAC
- SLAC ISMS Plan provides overarching direction with regard to safety expectations
- Developed Lessons Learned to distribute to LCLS Team

- Management should develop an organization that fruitfully employs the talent and experience developed on LCLS Conventional Facilities and project management
- This is of crucial importance to the successful execution of upcoming projects at SLAC over the next two to three years: MEC, PULSE center, SLI as well as completing LCLS and LUSI