LCLS Call for Proposals

Experiments at the AMO, SXR, XPP, CXI, MFX, XCS, and MEC Experimental Stations for the period November, 2017 – June, 2018 ("Run 16").

DEADLINE: 4pm PACIFIC on May 4, 2017

For full details of the call, see:
http://www-ssrl.slac.stanford.edu/lcls-resources/proposal-submission

Please note the following important information specific to this call:

1. Since Run 13, LCLS has been running in a new mode of operation, called ***Standard Configuration Beam Time***. Selected areas will operate for ~25% of Run 16 (possibly more if user demand is high) in a contiguous block of time during which the instrument will be in a Standard Configuration. The intent is to reduce the amount of time that is taken each run tearing down, setting up, and testing the same configurations at different times throughout the run. The reduced amount of setup and test time has resulted in significantly more users and experiments being allocated beam time. *If you feel your experiment is able to operate in a Standard Configuration for one of the instruments, please indicate this in your proposal and follow the directions provided.* See further details.

2. **SSRL Beam Time.** User feedback has suggested that for some LCLS proposals, the science case can be significantly enhanced by having access to SSRL beam time in addition to proposed LCLS time. For this run 16 proposal call, LCLS will consider a limited number of proposals that make a strong scientific case for beamtime access to SSRL. These proposals should indicate how much time is requested, when the time would be needed relative to the LCLS time, as well as which SSRL beamline would be needed. If Users have questions about which SSRL beamlines would be appropriate for the proposed scientific goals, please contact Piero Pianetta (pianetta@slac.stanford.edu). Scheduling of time across facilities is complicated and availability depends strongly on which of the SSRL beamlines is requested.

3. **New capabilities offered for Run 16**
   a) **Sub-Femtosecond Operation**: During Run 16 we expect to be able to deliver sub-fs soft-X-ray pulses with a new XFEL configuration known as **XLEAP**. This will use a high-power infrared laser to compress a short fraction of the electron bunch to very high current. The setup is anticipated to be able to deliver ~0.5 fs pulses with a large coherent bandwidth, which is controllable using the space-charge boost given by the long LCLS undulator. XLEAP is predicted to be able to deliver a single sub-fs pulse or a train of pulses separated by ~ 6.8 fs

   The expected XLEAP performance is as follows. Please note however that testing of this system will occur during Run 15, and so actual performance is not yet known. The system is thus being offered "at risk".
   - ~ 30-50 uJ per pulse
   - ~ 0.5 fs FWHM pulse duration
   - 4 to 8 eV FWHM bandwidth

Expected setup times are on the order of 3-4 hours. Submitted proposals shouldn't rely solely on XLEAP's performance & robust operation, but preparing experiments/proposals that would work without XLEAP, but could benefit from it when it becomes available is strongly advised. For more information, please contact Mike Minitti (minitti@slac.stanford.edu).

b) **Split-and-Delay for XCS**: A crystal-based split-and-delay system will be commissioned during Run 15 and is planned to be available for user experiments in Run 16. It consists of two four-bounce monochromator branches delayed relative to each other. It will be available exclusively on the XCS instrument. It will operate in a range of 7-12 keV with a delay range from roughly -5 to 350 ps at 8 keV, with varying ranges as a function of energy. Up to 1 ns delay is possible if one branch is bypassed. Contact Diling Zhu (dlzhu@slac.stanford.edu) for more details.

c) **New modes of beam operation**: For up-to-date information on LCLS performance, please contact the respective instrument e-mail address listed below, and see the FAQ at: https://portal.slac.stanford.edu/sites/lcls_public/Lists/machine_faq/FAQ.aspx

A number of 2-pulse modes of operation are under constant development. See LCLS for up-to-date information. For a summary of some key options, see: https://portal.slac.stanford.edu/sites/lcls_public/machinefaqpix/MultiColorModes-8-22-16.pdf

Experimental stations available to users:

- **Atomic, molecular and optical science (AMO)** - contact srd-sxd@slac.stanford.edu
- **Soft X-ray Material Science (SXR)** - contact srd-sxd@slac.stanford.edu
- **X-ray Pump Probe (XPP)** - contact srd-hxr@slac.stanford.edu
- **Coherent X-ray Imaging (CXI)** - contact srd-hxr@slac.stanford.edu
- **Macromolecular Femtosecond Crystallography (MFX)** - contact srd-hxr@slac.stanford.edu
- **X-ray Correlation Spectroscopy (XCS)** - contact srd-hxr@slac.stanford.edu
- **Matter in Extreme Conditions (MEC)** - contact srd-mec@slac.stanford.edu

LCLS has demonstrated **routine FEL operations** over the energy range 250 eV to 11.2 keV using the fundamental, with pulse energies of at least 1-3 mJ depending on the pulse duration and photon energy. For some configurations, the pulse energy can now be extended up to 5 mJ. In addition, the photon energy may be extendable up to 12.8 keV. If high pulse energy or high photon energy is required, please contact the appropriate station at the emails above.

Third harmonic radiation is available up to 25 keV at about 1% of the fundamental pulse energy. The pulse length can be varied from 40 fs to 300 fs for hard Xrays, while for soft X-rays the range is extended to 500 fs. Shorter pulses, ranging down to <10 fs, with a reduced number of photons per pulse can also be provided. The maximum repetition rate of the LCLS is 120 Hz (please note that this may be reduced to 115 Hz at certain time periods).

Self-seeding systems are available for both hard x-ray and soft-x-ray regions. Seeded beams can provide up to 50-fold higher brightness. For hard x-rays (5.5 keV to 9.5 keV), the narrow seeded line, 0.4 to 1.1 eV FWHM, for 50 fs pulse duration typically contains an average pulse energy of 0.3 mJ, with occasional shots up to 1 mJ. Set up time from a SASE beam is about 30 minutes. Soft x-ray self-seeding has been successfully demonstrated across the range of 400-1000 eV with a resolving power of 2000-5000. Recent work has shortened the

set up time, which is now typically 2 hours. Note that a SASE pedestal of comparable total energy may be present. Contact LCLS for further details of performance.

The recently installed **Delta Undulator** has demonstrated variable polarization output including left/right circular on the order of 100 microjoules per pulse across an X-ray energy range of 530 to 1200 eV. The degree of circularly polarization can reach 95-100%. Users are expected to provide experimentally necessary polarization diagnostics and include details in their proposal. For more information please contact srd-sxd@slac.stanford.edu.

LCLS is currently offering a wide range of **two-pulse and two-color operating modes**, where pairs of FEL pulses are produced with variable temporal separation, and/or up to 1% photon energy separation, in both the hard and soft X-ray regimes. We encourage proposals utilizing two-pulse and two-color operation. See FAQ for further details, and the following summary table:
https://portal.slac.stanford.edu/sites/lcls_public/machinefaqpix/MultiColorModes-8-22-16.pdf

Preparing your Proposal

The Linac Coherent Light Source (LCLS) encourages scientists from diverse fields to propose experiments utilizing the LCLS's unique capabilities for the period November, 2017–June, 2018.

Access to LCLS is open to the international community. There is no cost to submit proposals or conduct experiments at LCLS. However, users are responsible for their own travel expenses and (in rare cases) for any extraordinary consumables required by the experiment.

Register as a user and submit LCLS proposals through the User Portal.

Read the proposal preparation guidelines, along with information on the new standard configurations, and the proposal review process prior to writing your proposal. Users are encouraged to contact LCLS instrument scientists to discuss technical capabilities and proposed experiments

Submit your proposal early to avoid a last-minute crisis at the proposal cutoff time. The proposal deadline is strictly enforced: 4 PM Pacific Time on May 4, 2017.

We recommend that scientists describe well-posed experiments that can be accomplished in ~12-60 hours of beam time. Proposals must include brief discussions of the expected scientific or technological impact and anticipated feasibility and probability of success of experiments. Proposals that include a clear description of the expected shift-by-shift schedule indicating the scope within each 12-hour shift have a better chance of fitting into a tightly constrained Run.

Each proposal is for one specific experiment. Proposals can be re-submitted at each call, but this will not happen automatically and a re-submission will not receive preference during the review process. There is no limit to the number of proposals that can be submitted by a scientist or team, but multiple similar proposals from the same team members may not be reviewed favorably by the Proposal Review Panel (PRP).

Proposals may be made in the context of a larger scope than can be covered in a single experiment. All proposals, even these broader proposals that address important problems, must be resubmitted each cycle in order to be peer reviewed and considered for beam time.

However, in the absence of sufficient information to evaluate progress (data disseminated from previous beam time, publications, etc.), the PRP may recommend or LCLS may decide that some proposal(s) be postponed for consideration until a future review cycle.

The PRP will pay particular attention to the applicants' publication record from prior LCLS beamtimes. Failure to publish in a timely manner will impact the chances of a successful application in a similar area.

Required Content for Your Proposal:

Provide a descriptive title of your proposed experiment that you would be willing to be made public if awarded beam time.

Provide an abstract that concisely (less than 1,950 characters) summarizes the proposed experiment, quantities to be measured, samples to be studied, expected scientific results and impact. The more detailed proposal text is limited to 6 pages in PDF format, not including the additional one page for the standard configuration table, or a one page progress report of previous beam time which can be uploaded separately. Proposals should include the following information (include the spokesperson's name in the upper right hand corner of each page):

1. **Experimental Team**: In a table, list the names, institution, email address of PIs and collaborators who would participate in the proposed experiment (e.g., sample prep, theory, data collection, data analysis). This section could also briefly mention directly-relevant previous work done by the team members.

2. **Scientific Case**: Briefly explain the background and significance of your experiment. In particular, why is LCLS required for this experiment? Itemize the specific aims and particular questions you want to answer. Focus on the specific experiment and avoid broad discussions in general terms.

3. **Experimental Procedure**: Provide specific information so that the feasibility of this experiment at the requested LCLS instrument can be evaluated. Tell us if you plan or have carried out supporting experiments at other facilities. Have simulations of the experiment been performed? What are the anticipated data rates? Provide a beam time plan, indicating what could be accomplished shift by shift. Describe any additional equipment you plan to bring to LCLS for the experiment (see policy on end-stations).

   We strongly recommend that you contact LCLS instrument scientist(s) before proposal submission to discuss capabilities, to identify possible problems in integrating external equipment with the LCLS facility and to determine possible solutions.

4. **Technical Feasibility**: Proposals must contain sufficient information for the LCLS to review the proposal for technical feasibility. This information should include:
   - Equipment
     Which elements of the proposed instrument do you require for the proposal?
     What additional equipment is needed, including laser, detector, sample delivery/environment, temperature, pressure, etc?
     How do you plan to provide/organize the additional equipment?
   - Parameters
     Describe X-ray wavelength, pulse energy, bandwidth, beam size, repetition rate, pulse duration

If laser is required, describe laser wavelength, pulse energy, bandwidth, beam size, repetition rate, pulse duration, timing, geometry.

- Experimental protocol
  Describe the experimental geometry.
  Calculate the expected signal rate/background.
  Describe samples and concentrations, sample preparation and storage.
  Describe local facilities that may be required.

  As part of the proposal process, we will contact the Spokesperson for proposals that have the potential of being awarded beamtime. The Spokesperson will be asked to provide specific experimental parameters to help inform the viability and schedule.

5. **Progress Report**: When submitting a new proposal, also upload a brief progress report summarizing proposals that have previously received LCLS beam time; include proposal number(s), date(s) of experiment, instrument(s) used, a brief summary of how experiment time was used and results disseminated (list major invited talks, papers published or in press, awards or special recognition). **NOTE: User publications are extremely important in demonstrating the scientific impact of LCLS.**

   Proposal teams must inform and acknowledge LCLS and the DOE Office of Science in presentations and publications using this template: "*Use of the Linac Coherent Light Source (LCLS), SLAC National Accelerator Laboratory, is supported by the U.S. Department of Energy, Office of Science, Office of Basic Energy Sciences under Contract No. DE-AC02-76SF00515.*"

6. **Addenda:** New information that becomes available after the proposal was submitted may be submitted up to two weeks before the scheduled Proposal Review Panel (PRP). Addenda are limited to one page and must be consistent with the original scope of the proposal. LCLS management will determine if the supplemental information meets the criteria to forward such material to the PRP. Forward addenda to the LCLS User Office (lcls-user-office@slac.stanford.edu).

Safety related documents must be submitted during the safety management portion of the LCLS proposal submission process in the user portal. List and describe any safety concerns that may arise with samples you will examine, equipment you will use, or techniques you will perform (including any physical, chemical or biological hazards) and how these issues will be addressed.

Proposal Evaluation Criteria:

Proposals must provide sufficient information to evaluate the impact, originality, need for LCLS, scientific risk, prior results, as well as technical feasibility. Proposal evaluation criteria include:

- **Scientific Impact:** Does proposal address a question that, if successfully answered by the proposed experiment, will have a strong impact either on the scientific field or technological area addressed by the research?

- **Originality/New Scientific Field:** If successful, does the proposal open a new field?

- **Need for LCLS/Experimental Plans:** To what extent is the LCLS critical for the success of this proposal? Can other techniques or facilities provide similar information about the

scientific question?

- **Scientific Risk:** Evaluate the probability that the proposed research will yield significant new results.

- **Prior Results:** Evaluate success or progress of prior experiments.

- **Feasibility:** LCLS scientists conduct a preliminary technical feasibility review of submitted proposals.

- **Compatibility:** Can the experiment be performed simultaneously with another experiment (i.e. can it be performed with monochromatic, hard X-ray beam)? Does the experiment require significant modifications to a LCLS instrument setup? We specifically encourage proposals that use monochromatic, hard X-ray beam and proposals that minimize instrument modifications.