

# LCLS UEC Meeting Minutes

September 6<sup>th</sup>, 2024

**Present:** U. Bergmann, M. Centurion, L. Conradson, M. Doyle, M. Dunne, G. Dyer, J. Evans, A. Fry, P. Jones, N. Hartley, M. Mitrano, D. Oberthür, B. Ofori-Okai, S. Pandolfi, N. Powers-Riggs, C. Rajendran, A. Rudenko, B. Tam, S. Teitelbaum, A. Zong

## **LCLS Management update, M. Dunne:**

- Run 22 is now underway, summer downtime ended mid-August for the NC-Linac, including first experiment delivering attosecond hard x-ray pulses to users
- SC-LINAC starts at the end of September, ramping up to users middle of October.
- Starting at 8 kHz, hopefully move to 16 kHz, and then up to 33 kHz for next year
- Going to MRCO (TMO) and ChemRIXS initially, alongside early commissioning of qRIXS
- DREAM endstation largely installed. Will have optical laser commissioning first.
- Run 23 deadline is coming up (11 Sept), using the universal proposal system for proposals
- Extended operational run for SC-LINAC to the end of 2025 – future meeting will discuss how Run 25 will look.
- Note: Next meeting will be an in person at the users meeting, on Tuesday evening

## **Users meeting updates, C. Rajendran**

- Around 350 registrants (expected to climb as the deadline approaches), 17 exhibitors, 34 workshops,
- Awards are organized
- SSRL/LCLS UEC reception is happening on Thursday night.
- Let Chitra know if there is anything missing
- Nominees for UEC have been sent out and some people have replied
- Poster judges needed
- LCLS and SSRL UECs will have a meeting with BES management Dava Keavney
  - Round table meeting starting with slides and then move on to general discussion.
  - Slides in preparation by Nick. Will circulate to UEC for feedback.
  - Key emphasis point – how can LCLS utilize the lessons learned from the soft x-ray upgrade to avoid delays/downtime

## **MEC-U project – Guest speaker Alan Fry, project lead for MEC-U**

- LCLS is a transformative tool for dense plasma science
- MEC is the first instrument to combine high power/intensity lasers with X-rays
  - Short pulse laser for producing plasmas (~100TW/5Hz)
  - Long pulse laser system for driving shocks into materials (~100J)
  - Relatively modest high energy/intensity lasers compared with other facilities, but MEC is still very productive

- X-ray from LCLS have properties that can be taken advantage of for studying dense plasmas
- Studies and workshops over the last few years from the community have called for increased federal funding
  - Goal: combine LCLS X-rays with petawatt scale intensity and kJ class energy lasers
- Scientific needs were identified by defining flagship experiments in different scientific areas, developed with the help of the MEC-U User Advisory Panel
  - Relativistic HED plasmas
  - Laser based secondary sources (e.g. ion beams)
  - Dynamic compression
  - Warm dense matter
  - Also, strong resurgence in interest of fusion energy technologies
- MEC-U is well-suited for solving problems in different fusion technologies, in particular inertial fusion energy (IFE) being studied at the NIF at LLNL, especially in studies of the microphysics that are enabled using X-rays
  - Inertial Confinement Fusion (ICF) capsule physics
  - Ion stopping power
  - Radiation Damage
- MEC-U will operate at 10 Hz, will require the development of diagnostic, target tracking, etc. at much higher repetition rate than typical for MEC experiments
- MEC-U Experimental facility will be placed in the XEH (eXtreme Experimental Hall)
  - 10 Hz Petawatt laser (150 J, 150 fs,  $10^{15}$  W), or 10 Hz 200 J nanosecond pulse
  - 1 kJ 3-30 nanosecond laser
- Current design removes the optical only target area, reconfigures laser bays, but still leaves room for upgrades
- Two project plans developed to deliver MEC-U
  - Case 1: Early finish in 2030, yields earliest science. Requires higher funding per year (more than what is currently allocated), but shorter timeline would result in a lower total project cost
  - Case 2: Two sub projects ending in 2031 and 2035. Delays science output and will require stop and start of scientific activities.

**Design will be based on LLE Target chamber, will target and diagnostics will be different?**

- Yes, many diagnostic will be held by SLIMs, similar to DIMs and TIMs. Will potentially allow for borrowing DIMs/TIMs from, e.g., LLE. Other diagnostics will be on dedicated lines of sight.
- There will be a partial breadboard in the chamber for ad hoc diagnostics, particularly in the early operations phase. Still want to minimize the amount of time people need to get into the chamber.

**Has there been a check of compatibility of currently developed diagnostics to see if they can be translated into MEC-U?**

- Ideally current setups could be placed onto the breadboard in the chamber. Ideal placement might be different because of the high energy laser-target interactions.

**How much of the funding will rely on fusion funding?**

- Project was initiated without a fusion program. Currently it is a line item from congress, so gets negotiated year-by-year and then ends up in president's budget request

- Office of Science assessment of large facility options over the next decade are now with Harriet Kung (acting Director, Office of Science) and being used to figure out how funding will be allocated going forward
- Advocacy can really help push the needle on this

**Do you have a sense of how the staffing will need to change?**

- Currently have a model with a mock schedule with how many experiments could be fielded. Possibly getting 3x as many shifts.
- Approximate staffing model requires about 2x the current number of staff, would be supported by appropriations budgets

**When would switchover happen?**

- Need to consider activities in the FEH for LCLS-II-HE.
- Plan is being put together and analyzed currently. Want to keep MEC running for as long as possible.
- Will be limited by the installation of parts into the XEH

**Is there a required gap given that parts will need to move things into MEC-U?**

- The intent is to minimize the operations gap between MEC and MEC-U. Details will be determined over the next year.

**Also note: Eu-XFEL has started to already plan an MEC-U equivalent facility**

- Existing resources and space at Eu-XFEL sets their facility timetable differently than SLAC
- Currently there is open collaboration between LCLS and Eu-XFEL leadership to ensure commonality of experience for users wherever possible
- Also note that advocacy from the UEC can help here as well