# MATTER IN EXTREME CONDITIONS ULTIMATE PROJECT will utilize control system platforms developed for LCLS-II Experiment Control Systems.

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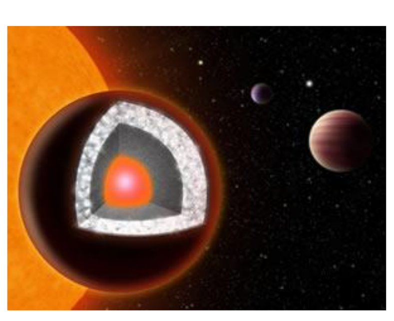
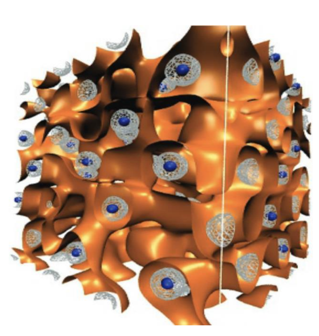
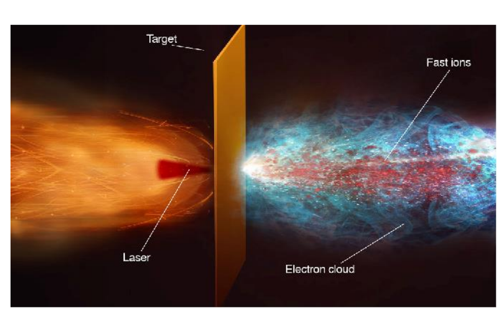
## MEC-U IS A CD-1 APPROVED, DOE 413.3B PROJECT TO BE BUILT AT SLAC

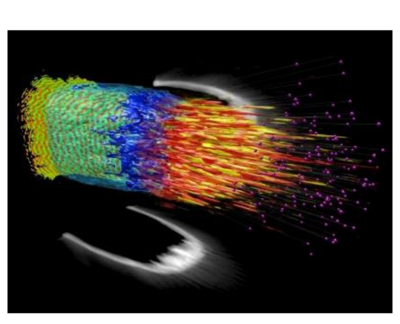
The facility will deliver the Linac Coherent Light Source (LCLS) XFEL in combination with a high energy long pulse (HE-LP) laser system and a rep-rated laser built by two other DOE labs, the Laser Lab for Energetics (LLE) and Lawrence Livermore National Laboratory (LLNL) respectively to experiment target chambers. This facility will be the first of its kind, combining the diagnostic power of the LCLS with the DOE's premier laser technology.

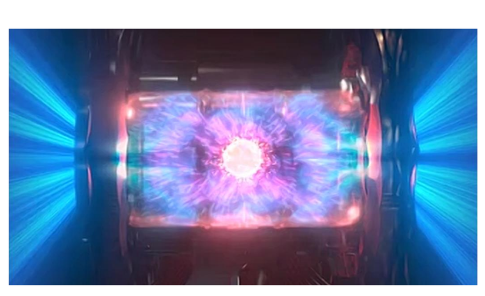

Planetary and stellar interior conditions

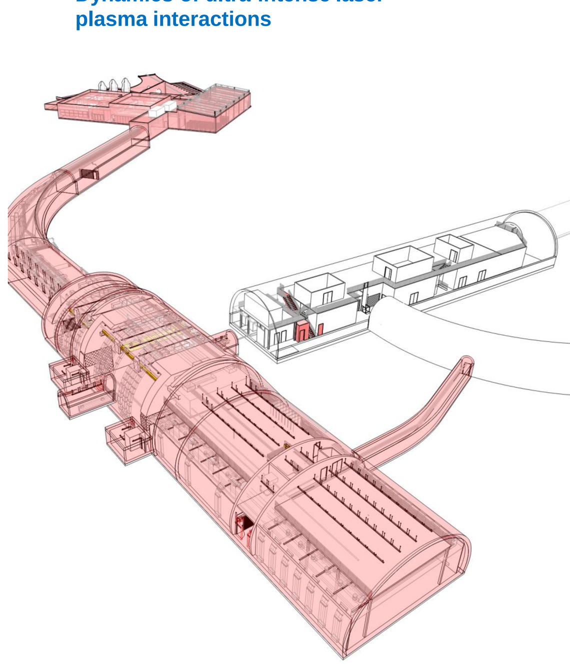

Properties of HED plasmas



Laser acceleration and plasma interactions with particle beams

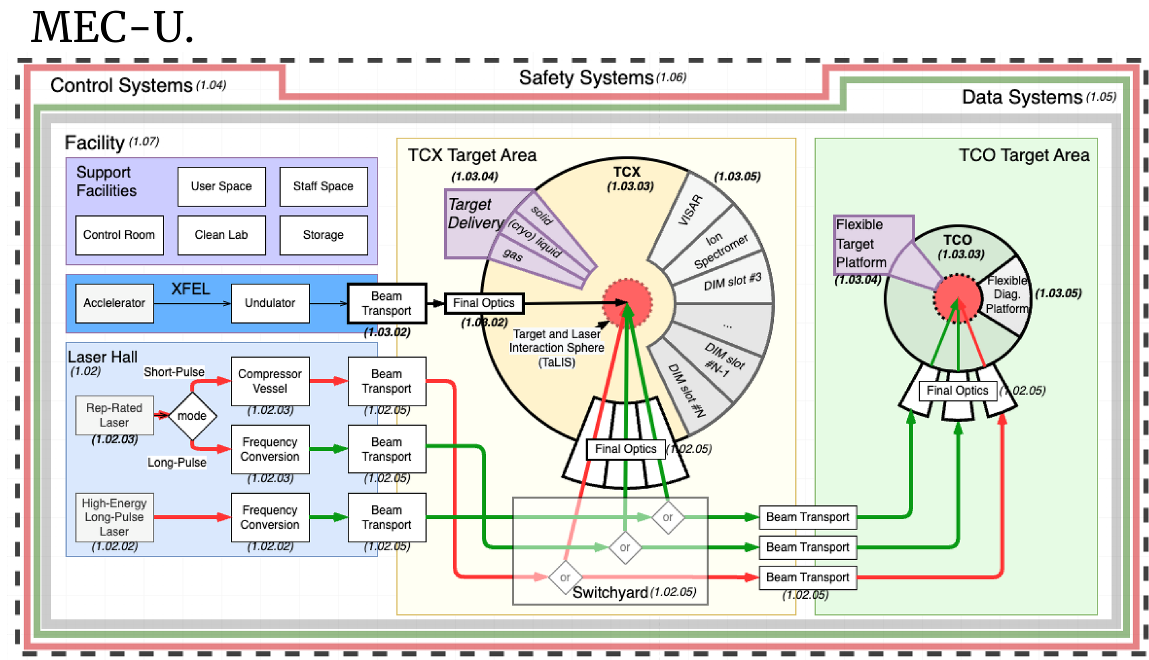

Dynamics of ultra-intense laser plasma interactions

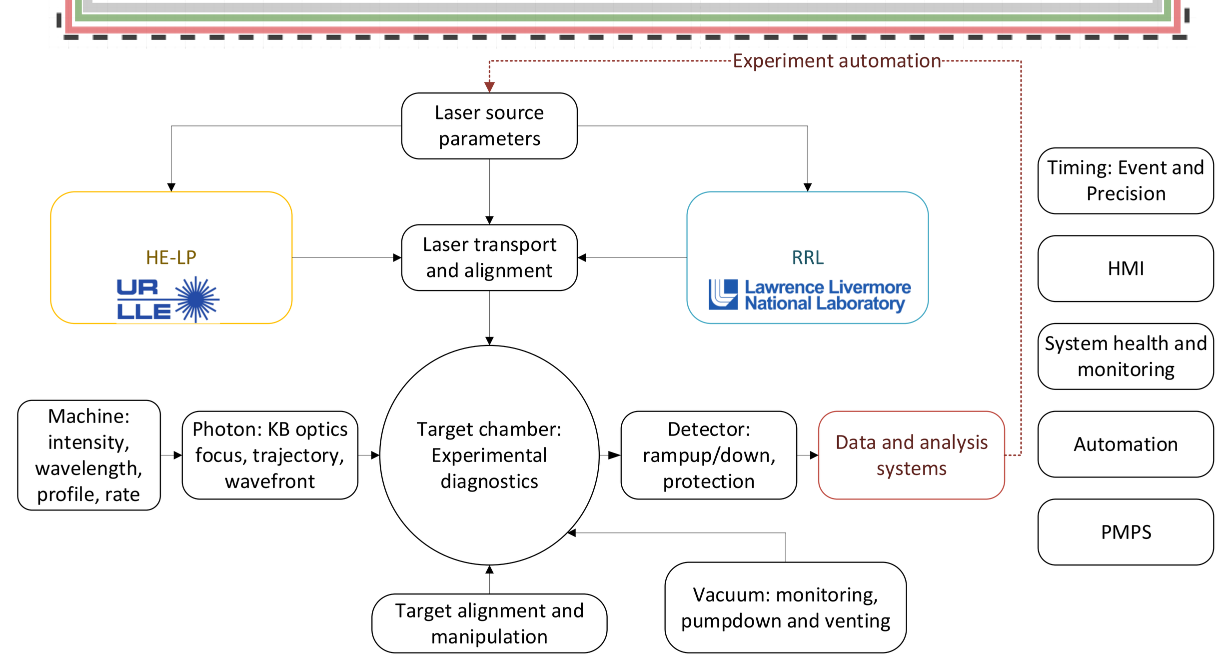

Inertial Fusion Energy




## A COORDINATED EFFORT ACROSS THREE LABS

The control system design for this facility will utilize EPICS throughout the SLAC, LLE and LLNL major subsystems, and to the extent possible a common hardware and software suite. The effort is a major undertaking in control system design and build via collaboration between the three partner labs of the project.
Thanks to the dedication of the LCLS ECS team, the commitment to a sustainable facility by project management, and the collaborative spirit of the LLNL and LLE control system teams, a common control system architecture has been selected as the basis for MEC-U.

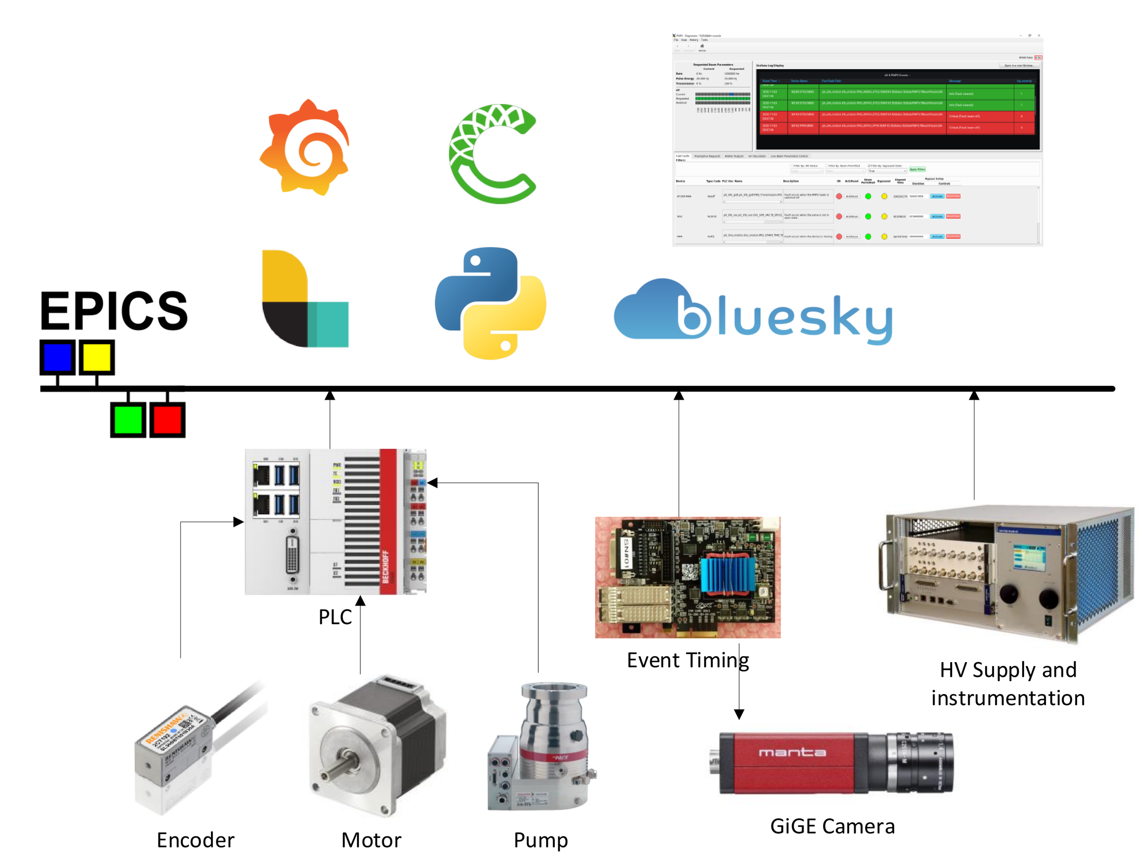


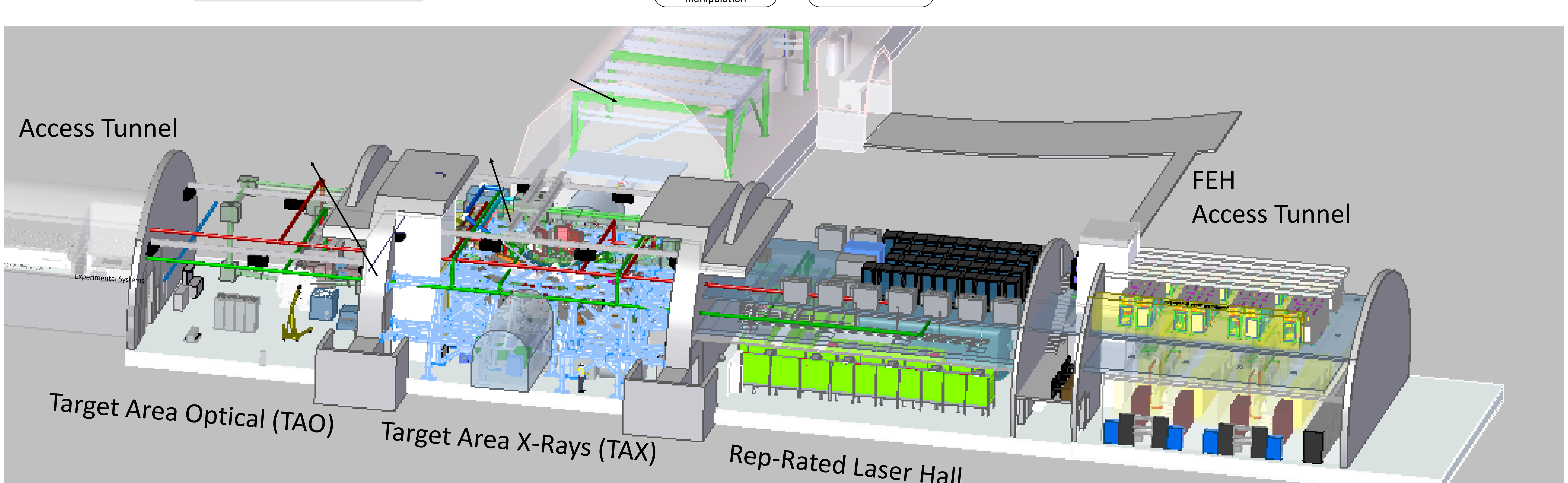




## COMMON CONTROL SYSTEM ARCHITECTURE AND IMPLEMENTATION

The LCLS-II Experiment Control System design is a SCADA type system consisting of Beckhoff PLCs, and serial port gateways tied together through a network and into an EPICS IOC middle layer hosted on local servers. A SLAC timing event stream is connected via fiber to select hosts (again conventional 1U servers) which are responsible for integrating beam-synchronous GigE cameras via a custom Timing Pattern Receiver FPGA PCIe card.

A large suite of Python frameworks, and modern IT solutions form the high-level controls supporting observability and automation.




## ACKNOWLEDGMENTS

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Mikael Martinez, for material from the FAC 2023 technical overview.
Corey Hardin for renderings of the MEC-U facility.
Kai LaFortune for diagram of the overall MEC-U Systems

## REFERENCES

MEC-U Conceptual Design Report: https://doi.org/10.2172/1866100