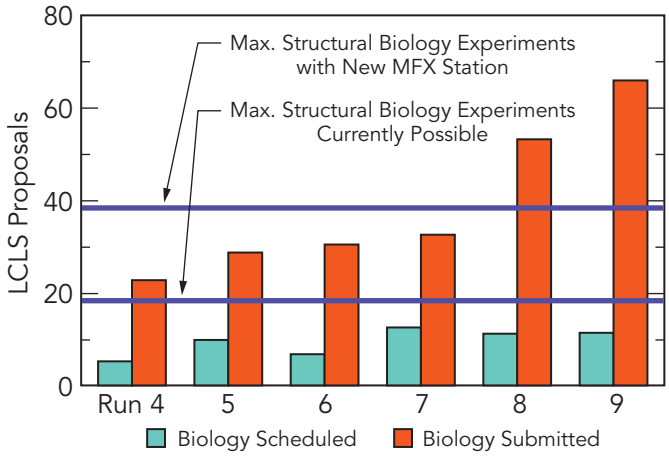
SLAC NATIONAL ACCELERATOR LABORATORY

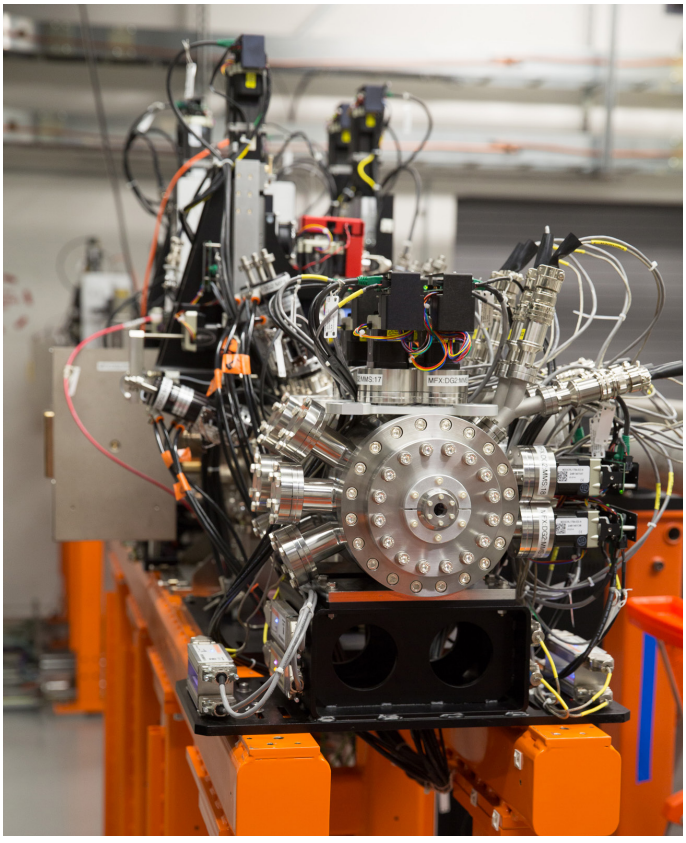
MFX – Facility Update (January 2016)

The Macromolecular Femtosecond Crystallography Instrument at LCLS

The Linac Coherent Light Source is adding a seventh X-ray instrument to its suite of cutting-edge scientific capabilities. The MFX instrument is primarily designed for structural biology experiments that will expand the use of LCLS for novel ideas that are revolutionizing the life sciences. The MFX instrument will make full use of the unique capabilities of the LCLS X-ray laser to produce sharp pictures of the molecules of life, as well as movies of those molecules in action.



Photograph of the MFX experimental hutch.



Responding to a Scientific Need

The first six years of LCLS have seen groundbreaking results in many fields of science. In particular, the life sciences have been greatly impacted, with results showing the ability to achieve unprecedented spatial resolution of important biomolecules and watch biological systems evolve on sub-picosecond timescales. Demand for beamtime has grown out of these successes with an increasing need for access by scientists interested in understanding and controlling disease and studying how plants harness solar energy via photosynthesis. The construction of the MFX instrument addresses this need and signals a new era of LCLS in which a specific scientific need is targeted with dedicated instrumentation for enhanced access and productivity.

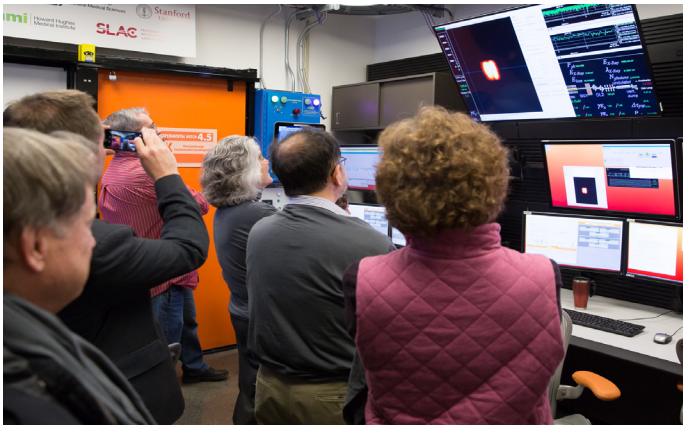
More Beamtime

By gathering many life science experiments together at MFX, it will be possible to share the LCLS beam more easily and more often – alleviating the problem that forces the great majority of proposals to be rejected. MFX will immediately create more beamtime access to LCLS for life scientists and for all fields of science by allowing the single LCLS beam to be divided between multiple instruments simultaneously – a process called multiplexing.

SLAC National Accelerator Laboratory
2575 Sand Hill Road
Menlo Park, CA 94025–7015

slac.stanford.edu

U.S. DEPARTMENT OF ENERGY
Office of Science



Picture of the first light event (1-12-2016).

A Collaborative Endeavor

MFX is the result of multiple funding agencies coming together to make it a reality. The U.S. Department of Energy provided the seed funding via two separate programs in the Office of Science: Biological and Environmental Research (BER) and Basic Energy Sciences (BES). This allowed the new experimental area (X-ray hutch) and beamline to take shape. Major contributions from the National Institute of General Medical Sciences (NIGMS) are creating the foundation for the experimental station that will use the X-ray laser for scientific discovery, while funding from Stanford University and the Howard Hughes Medical Institute are providing enabling technology.

MFX is possible only due to the unique combination of capabilities and expertise that exist at SLAC. A close collaboration between LCLS and the Stanford Synchrotron Radiation Lightsource (SSRL) has been central to the rapid development of MFX and will be critical to a future where SLAC as a whole provides life scientists a unique combination of integrated and complementary tools.

A New LCLS Hutch is Born

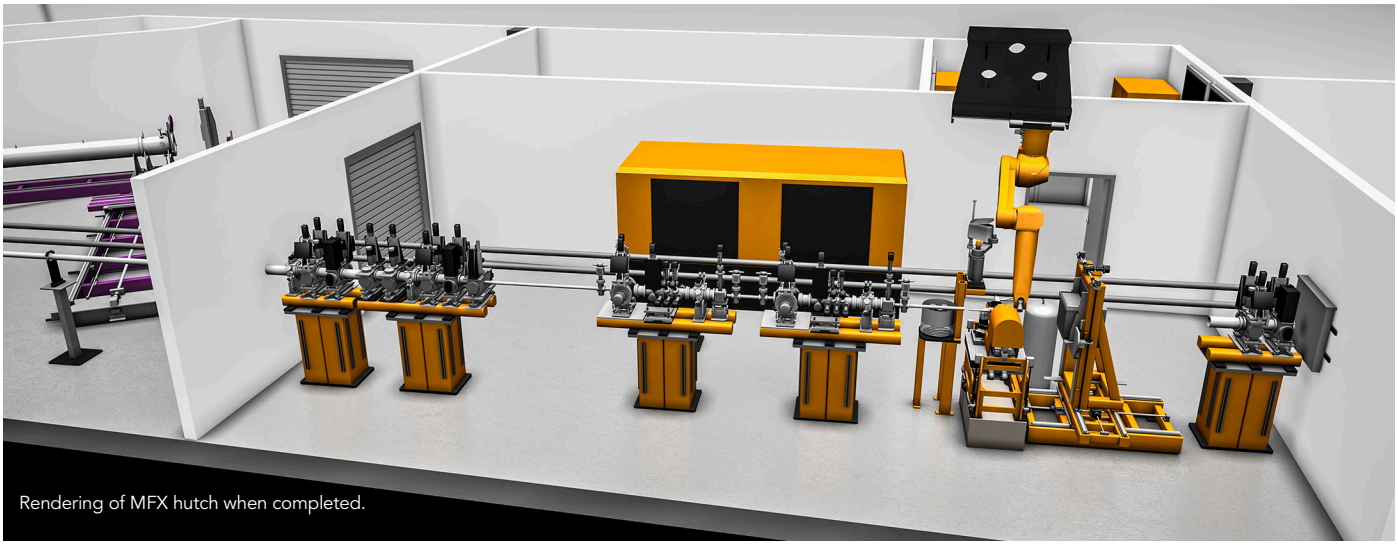
Space in the Far Experimental Hall of LCLS was re-purposed to build a new LCLS experimental hutch. Over the summer of 2015, major construction drastically changed the face of LCLS with the creation of a home for the MFX instrument.

First Light in January 2016

LCLS celebrated the official start of the MFX instrument on January 12, 2016. The occasion, called “first Light,” in which the LCLS X-ray laser beam was sent into the new experimental hutch for the first time, took place less than two years after the start of the project. The event was marked by a small celebration involving the project staff and leaders from SLAC and Stanford University.

Next Steps

Beam commissioning activities will take place over the first few months of 2016, and end station capabilities will be fabricated and installed to allow the start of scientific exploitation of MFX by the international user community. User experiments are scheduled to begin on July 1, 2016. Subsequently, the permanent installation of a system capable of rapid and automated use of the beam will make MFX a highly optimized system that will greatly increase the scientific productivity of the LCLS facility. Ideas for future development of this system are already being identified by staff and users, ensuring that the scientific vitality of this area will continue to grow.



Rendering of MFX hutch when completed.

SLAC is operated by Stanford University for the U.S. Department of Energy Office of Science.

INC0075249-01-2016