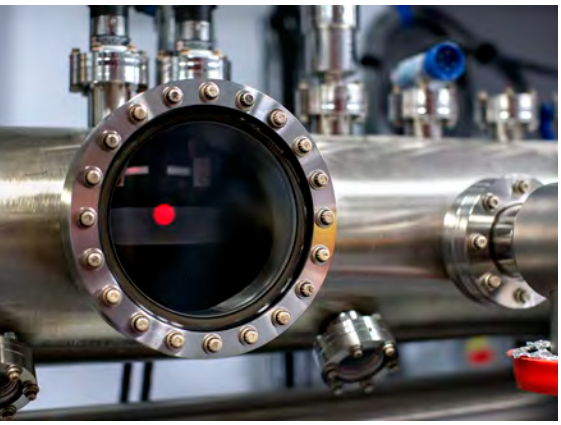
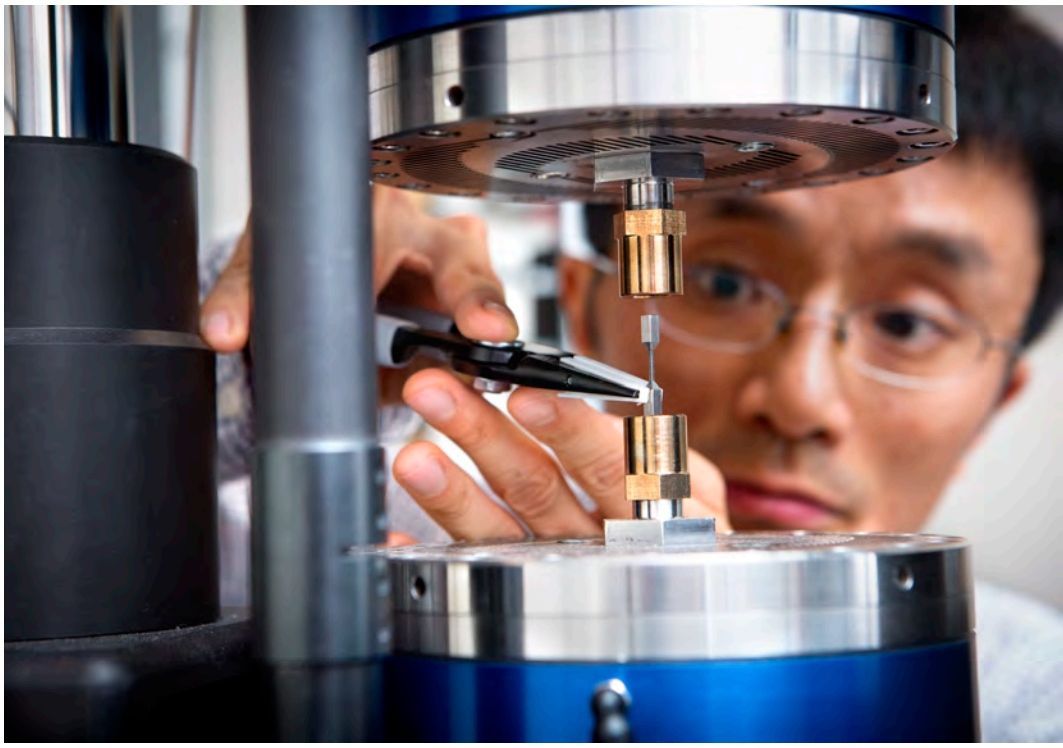
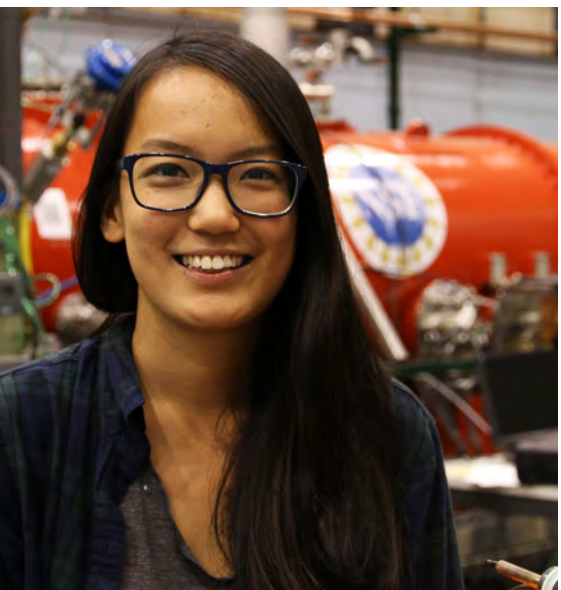
CHESS

Cornell High Energy Synchrotron Source





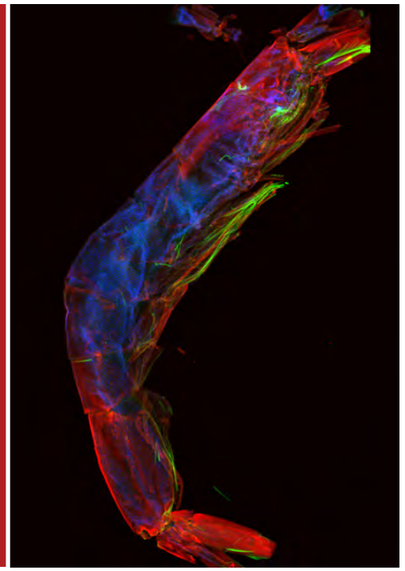


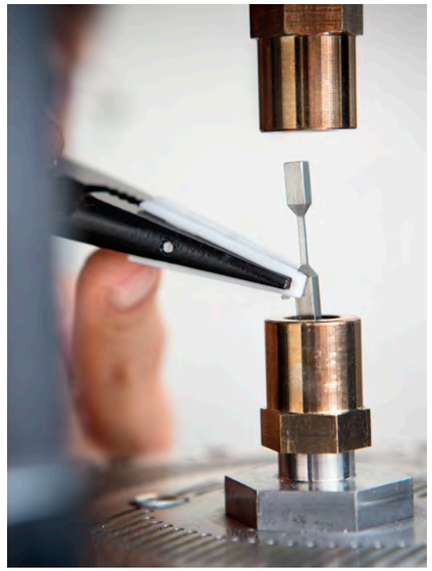
A state-of-the-art x-ray facility for research in physics, chemistry, biology, engineering, and environmental and materials sciences.

ENGAGE

RESEARCH

CHESS undergraduate summer student Cooper Hanley, right, from Fort Lewis College in Colorado, adjusts the slits used to define the X-ray beam. Cooper participated in a research program exploring "white beam" x-ray diffraction, where the x-ray beam has an energy spectrum of 40-100 keV. These high energies allow the x-rays to penetrate through thick industrial samples.





CHESS is a key training ground for both x-ray scientists and accelerator scientists, and provides critical x-ray tools for scientists across disciplines from materials science, biology, chemistry, and engineering to art, archeology, and environmental science. Serving as a science incubator for students to design beamlines, develop and implement experiments, and to analyze and present their results, CHESS is the most productive training center in the U.S. for new x-ray beamline scientists. CHESS is also a pipeline for future graduate students by supporting 60 undergraduate researchers each year. Nationally, Cornell awards 20 percent of all the nation's PhDs trained in accelerator science.

During summers CHESS offers ten-week research opportunities to 2 and 4-year college undergraduate students who want to work side-by-side with scientists and engineers developing cutting-edge technologies. In addition to participation in research, the program includes informal seminars, formal lectures, tours of research facilities, social and recreational events, and a forum at summer's end in which participants present the results of their research.

Synchrotron x-ray sources are a key tool in the investigation of the structure and function of biomaterials and living systems. Advanced x-ray detectors can now map the elemental composition of diverse samples, such as the shrimp shown above. Here, researchers were testing for toxic pathogens in our food supply, where different colors represent specific elements.

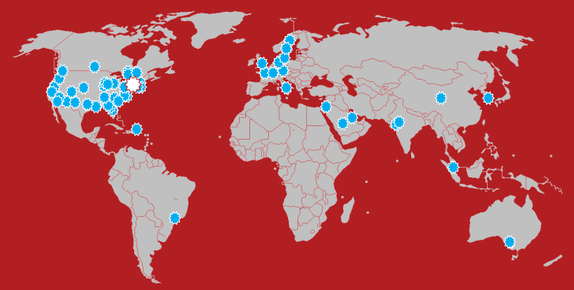
Working side-by-side at the InSitμ beamline, CHESS scientists empower corporate users like Caterpillar and Alcoa to understand and model crystal-scale behavior of engineering alloys. InSitμ provides enhanced support for industrial users working on the most important structural, additive manufacturing, and lightweighting problems.

Arthur Woll, staff scientist at CHESS, and Elizabeth Steele, head of conservation at the Phillips Collection, prepare Pablo Picasso's "The Blue Room" for scanning. The X-ray Fluorescence image revealed another painting of a bearded, bow-tied man buried beneath the masterpiece.

Shina Okunoye from Hudson Valley Community College presents his findings on the structure and motion of biomolecules.

Dilmurod Saliev, from SUNY Broome Community College spent his summer working on Image Enhancement for the Visible-Light Electron Beam Monitor.

Middle School students investigate the wonders of light at the eXploration Station, the home of Xraise, CHESS's K-12 outreach program.

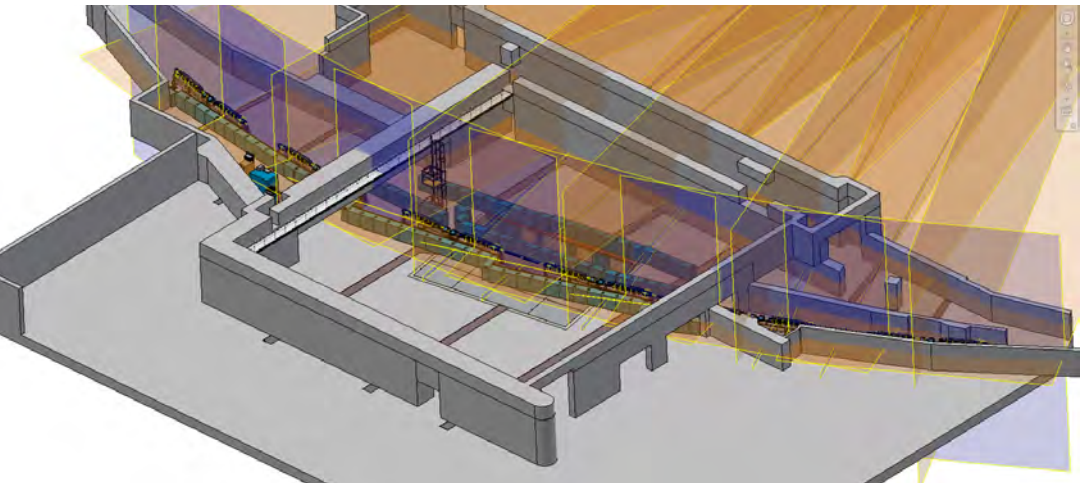


CHESS users come from around the world and represent both academic and corporate communities. X-ray beam time is granted to users through a competitive, peer-review process. Scientists and researchers use x-ray beams to engineer new materials, study structural materials under real-time working conditions, and analyze macromolecules. Their discoveries not only broaden our knowledge of materials but also improve business processes and products.

CHESS-U

CHESS-U is a three-year, $15M upgrade project that will dramatically extend CHESS's capabilities for cutting-edge, innovative science and technology. At the completion of CHESS-U, CHESS will be the premier synchrotron source in the world for high-energy, high-flux x-ray studies.

CHESS-U will replace one-sixth of the Cornell Electron Storage Ring (CESR) with a modern multi-bend achromat structure, increasing the energy and current of the electron beam while shrinking its size. The new CESR structure will enable CHESS to install state of the art undulator sources on all of the x-ray beamlines, and to instrument these beamlines with advanced x-ray optics, sample environments and x-ray detectors.



CHESS FACILITY FAST FACTS

- 5.3 GeV storage ring, one of two high-energy synchrotron sources in the US
- Circumference of the storage ring is 768 m. (~.5 mile) and it is located 12 meters (40 ft.) below the ground.
- 11 experimental stations; 3,600 hours per year of x-ray operations
- 243 unique experimental projects in FY16 involving 1071 researchers
- 1,753 tours given in FY16
- High demand for use of the facility where only half of beam time requests can be granted

The Cornell High Energy Synchrotron Source (CHESS), a national user facility, is supported by the National Science Foundation under NSF award DMR-1332208.

www.chess.cornell.edu