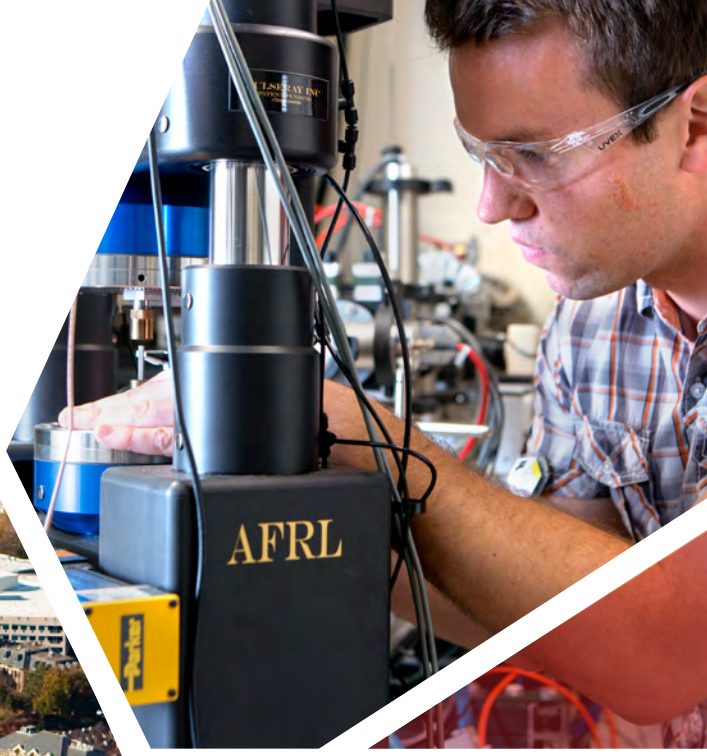
CHESS

CORNELL HIGH ENERGY
SYNCHROTRON SOURCE



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

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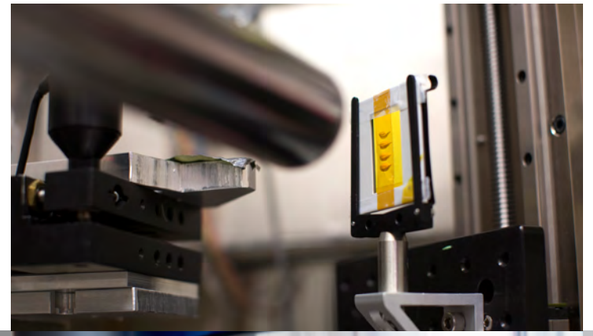
Shedding new light on science

Researchers use CHESS's X-rays to explore everything from the annealing of titanium alloys, to the atomic structure of a virus, to how a grape bud survives subzero temperatures.

Each year, over 1,200 researchers travel from all over the world to conduct research at CHESS.

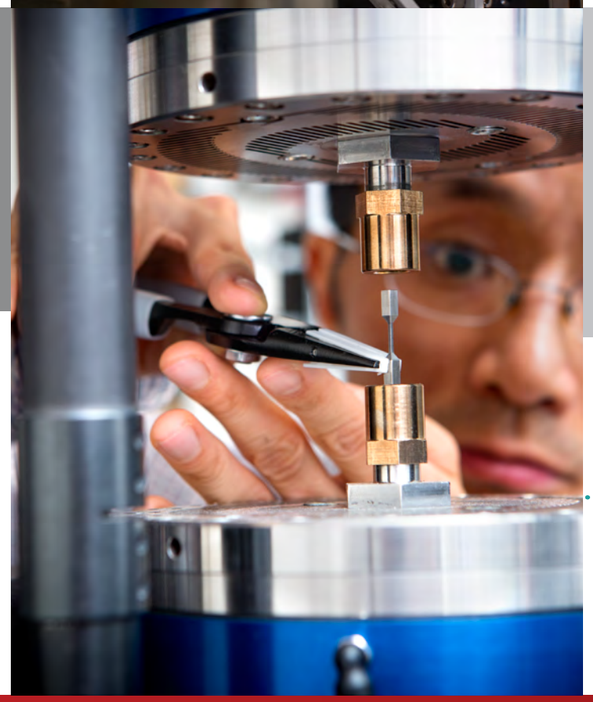
BIOLOGY

Scientists study mineral distribution and molecular environment, genetic and environmentally-induced structural changes, and the interplay between structural changes and mineral distribution, all at organ, tissue, and cellular scales.



ENGINEERING

Scientists use the high energy synchrotron x-rays to pass through bulk thicknesses of most engineering alloys and interrogate every crystal within a multi-grain sample.



MATERIALS

Scientists use techniques such as high-energy X-ray diffraction, diffuse scattering, and computed tomography to examine the positions of atoms in macroscopic materials under real engineering conditions.

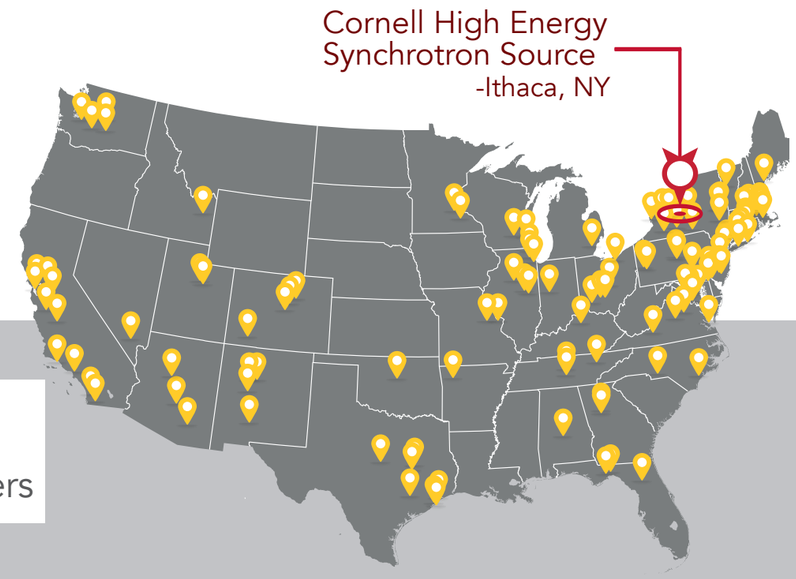
1,200 Users

Due to high demand for use of CHESS, **less than half** of beam time requests can be granted.

~30% New users

350 Grad Student Users

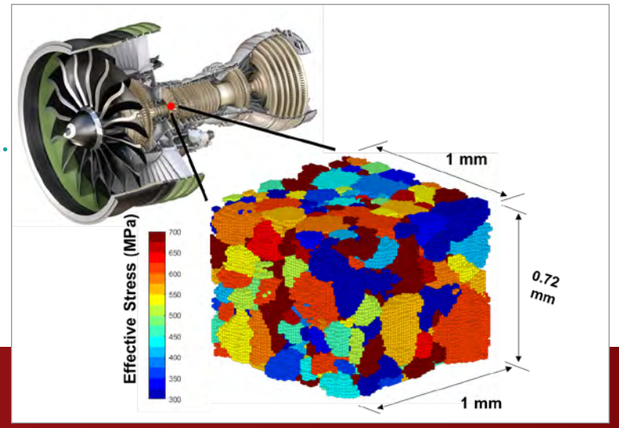
Training future synchrotron scientists!



One-of-two High Energy Synchrotron Sources in US

Working side-by-side at the MSN-C beamlines, CHESS scientists work with industrial users to understand and model crystal-scale behavior of engineering alloys. The program also provides enhanced support for a new generation of industrial users working on the most important structural and light weighting problems.

Understanding Stress & Metal Fatigue



We don't really know how fatigue cracks start, and in materials like airplane wings, breaking is not an option. In practice, we build components thicker and heavier than they need to be and we remove them from service long before they might fail. The high energy X-rays at CHESS are helping users to build a better understanding of the physical processes that drive fracture, allowing manufacturers to create parts that are stronger and more efficient.

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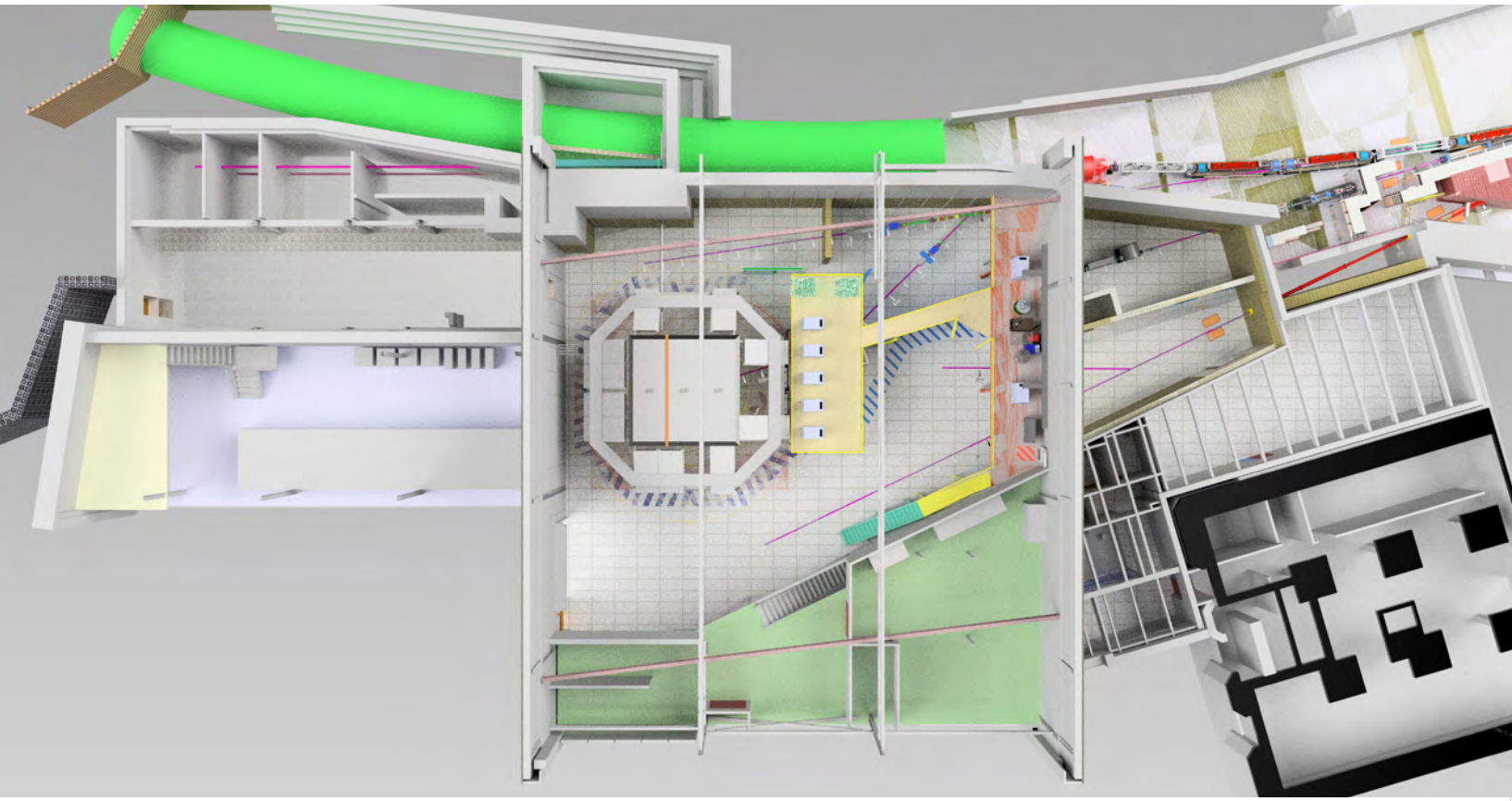
High Magnetic Field Beamline

Coming to CHESS in 2026



400,000 times stronger than Earth's magnetic field

CHESS is currently building a $32 million High Magnetic Field Beamline, funded by the National Science Foundation. Like the recent NYS-funded CHESS-U project, the New Experimental Hall will be transformative for the research landscape of the United States and have a direct positive impact on creating jobs in the region. Upon completion of this project, CHESS will become the world-leader in structural studies of materials in high magnetic fields, and will have "beam-ready" sites for future beamlines and capabilities.

The HMF beamline will enable precision x-ray studies of materials in persistent magnetic fields that vastly exceed those available at any other synchrotron. New capabilities for x-ray scattering in high magnetic fields are an established priority of several overlapping research communities. High field magnets at synchrotrons are essential to address urgent questions in quantum materials research. Additional science impact is anticipated in chemistry, engineering, and biology.

User operations to begin in 2026.