THE

Dynamic Compression Sector

AT THE ADVANCED PHOTON SOURCE,
ARGONNE NATIONAL LABORATORY

A DOE/NNSA Sponsored Capability

THE FRONTIER OF DYNAMIC COMPRESSION SCIENCE

DCS DEDICATION CEREMONY - AUGUST 4, 2016

The Dynamic Compression Sector (DCS), designed and developed by Washington State University in partnership with the Advanced Photon Source, national laboratories, and academic institutions, is an exciting and visionary scientific undertaking. The DCS integrates expertise across the U.S. Department of Energy (National Nuclear Security Administration and the Office of Science) to address both basic research and national security challenges.

DCS Location

The Dynamic Compression Sector

The Dynamic Compression Sector (DCS) is a Department of Energy (DOE) National Nuclear Security Administration (NNSA) sponsored capability dedicated to understanding the dynamic compression of materials. NNSA's Defense Programs selected Washington State University (WSU) to design, build and operate this facility at the Advanced Photon Source (APS) at Argonne National Laboratory, a DOE Office of Science National Laboratory. The APS produces the brightest, high-energy x-rays in the U.S.

This is a first-of-its-kind (worldwide), multidisciplinary scientific capability. In addition to NNSA's interest in dynamic compression science for national security, there is strong interest and participation in this experimental capability by the Department of Defense. This capability is also an outstanding venue for research interactions and collaborations across the DOE National Laboratories, universities, Department of Defense Laboratories, and graduate students. It is an ideal platform to educate and train the next generation of researchers.

DCS Partners

National Laboratories: Argonne National Laboratory, Los Alamos National Laboratory, Lawrence Livermore National Laboratory, Sandia National Laboratories, Army Research Laboratory, Naval Research Laboratory, Air Force Research Laboratory

Academic Institutions: Washington State University, Johns Hopkins University, Princeton University, California Institute of Technology, Case Western Reserve University

DCS Dedication Ceremony
August 4, 2016

11:00 AM - Ribbon Cutting Ceremony and Tour

12:00 PM - Luncheon

Program

Christopher Keane
Vice President for Research
Washington State University

Peter Littlewood
Director
Argonne National Laboratory

Congressman Bill Foster
11th Congressional District of Illinois
U.S. House of Representatives

Daryll DeWald
Dean, College of Arts and Sciences
Washington State University

Thomas Russell
Deputy Assistant Secretary for Research & Technology
Department of the Army

Dimitri Kusnezov
Chief Scientist and Senior Advisor to the Secretary
U.S. Department of Energy / National Nuclear Security Administration

Kathleen Alexander
Assistant Deputy Administrator for
Research, Development, Test, and Evaluation
U.S. Department of Energy / National Nuclear Security Administration

Stephen Streiffer
Associate Laboratory Director, Photon Sciences and
Director, Advanced Photon Source
Argonne National Laboratory

Yogendra Gupta
DCS Principal Investigator
Washington State University

1:30 PM - General Tour

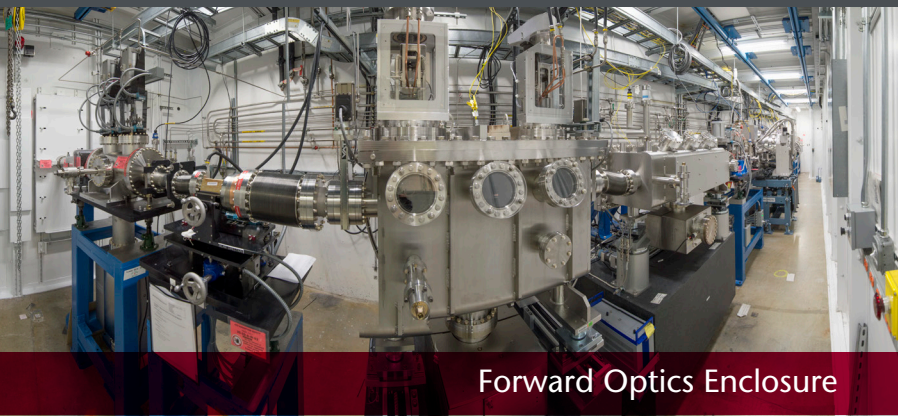
Impact Facilities - Station E

DCS Project Highlights

- The DCS project is an excellent example of a successful collaboration between a university, the U.S. Department of Energy (DOE) National Nuclear Security Administration (NNSA) and the DOE Office of Science.
- The project was completed on time and on budget.
- DCS adds an extremely versatile experimental capability to the APS, a DOE Office of Science Basic Energy Sciences scientific user facility. The APS provides ultra-bright, high-energy x-ray beams to more than 5,000 scientists conducting research in nearly every scientific discipline.
- DCS is an important element in understanding the key dynamic compression phenomena for the stockpile stewardship mission and maintaining and training a highly skilled workforce.
- There is significant interest by the Department of Defense to use this capability for national security research needs.
- DCS is a necessary first step to determine how more powerful and specialized facilities will be utilized in the future.

Representative Scientific Applications

Multidisciplinary research at the DCS will address challenges related to our nation's security and energy needs, to understanding the structure of planetary interiors, and developing novel lightweight materials for industrial, aerospace and automotive applications.



Forward Optics Enclosure

Significant Achievements

First results have already demonstrated that long standing scientific challenges can be addressed by the DCS. Three representative examples below highlight the different types of x-ray measurements that have been made and are a precursor to a very bright scientific future:

X-ray Scattering
A team from LLNL and LANL addressed a long standing problem regarding the nature of carbon condensation behind a detonation front. Until now, a universal description of carbon condensation reactions and kinetics has proven elusive. The DCS measurements meet an acute need in predicting explosive energy release behavior. *Journal of Applied Physics 117, 245902 (2015).*

X-ray Imaging
A team from LLNL and LANL demonstrated the first ever measurements on additively manufactured structural materials subjected to shock wave loading. This capability opens up the possibility of designing and engineering material properties precisely to meet application demands. *Scientific Reports 6, 28094 (2016).*

X-ray Diffraction
A team from WSU directly determined the structure of silicon at 19 GPa in impact experiments for the first time. Until now, researchers have relied on computer simulations to follow atomic-level changes of compression induced structural transformations. The DCS provides a powerful new method for examining atomistic mechanisms during compression-induced structural changes. *Physical Review Letters 117, 045502 (2016).*

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