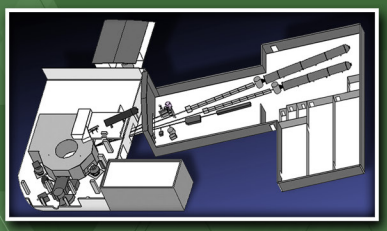
High Flux Isotope Reactor

Instrument

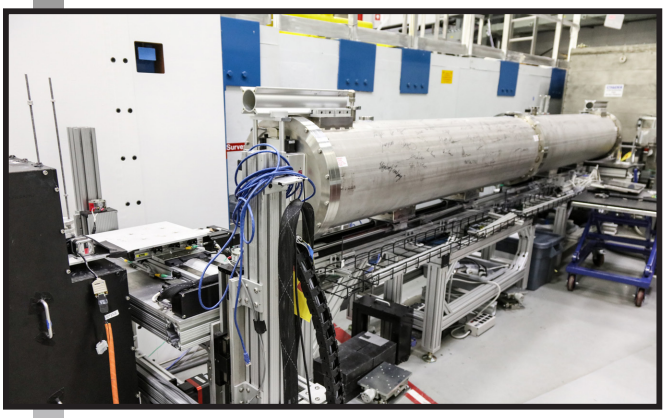
BEAM LINE

CG-1D



Cold Neutron Imaging Beam Line

The CG-1D neutron imaging facility provides a polychromatic beam of cold neutrons (peak wavelength 2.6 Å) to perform radiography and computed tomography. The facility provides a range of position-motorized apertures that can provide a collimation ratio L/D ranging from 400 to 2000 (where L is the distance from the aperture of diameter, D, and where the radiograph is formed). The sample area is equipped with a translation and multiple rotation stages, capable of performing automated tomography scans on two separate samples for each hands-on setup. This capability is enabled with the data acquisition system EPICS. Furthermore, the beam line is equipped with three detectors: a charge-couple device (CCD), a scientific complementary metal-oxide semiconductor (sCMOS) system and a micro-channel-plate (MCP) detector. While the CCD is optimized for static measurements and slow kinetic changes, the sCMOS and MCP detectors offer milli- and micro-second (for cycling motion), respectively, time resolution. Spatial resolution available at the beam line is 50 µm with the sCMOS, ~ 75–100 µm with the CCD and up to 25 µm with the MCP (radiographs require 4 hours acquisition time in this case). Recently, a double-bounce monochromator has been installed to allow polarized neutron imaging capabilities with in-house ^{3}He cells.



Specifications

Wavelength range (Å)	0.8 < λ < 6
L (m)	6.59
D (mm)	3.3, 4.1, 8.2, 11, 16
Wavelength resolution at 2.53 Å (with monochromator)	Δ λ/ λ ~ 0.5 %
Highest spatial resolution	CCD ~ 75 µm (FOV ~ 7.4 cm x 7.4 cm), MCP ~ 25 µm (FOV 2.8 cm x 28 cm), sCMOS ~ 50 µm (FOV ~ 1.5 cm x 2 cm)
Detectors	CCD (2k x 2k), MCP (512x512) and sCMOS (2.5k x 2k); LiF/ZnS scintillators for CCD and sCMOS (scintillator thickness from 25 to 200 µm)

Status: Available to users

Applications

Energy Storage
- Ion transport in energy storage materials; three-dimensional mapping of ions in electrodes

Nuclear Materials
- Molten salt diffusion at high temperatures, inhomogeneities in nuclear fuel material

Technologies
- Particulate deposition in vehicle parts; two-phase transport in heat pipes; multi-phase constrained jet flows; metal casting

Plant-Soil-Groundwater Systems
- Transport and interactions of fluids in porous media, water infiltration and aquifer recharge, plant-plant and plant-fungal interactions, change in pore structure and voids after repeated thawing and freezing of permafrost soil

Biological and Forensic Studies
- Structural, contrast agent, and cancer research; wood and biomass pyrolysis

Food Science and Archeology
- Water migration and degradation through time; examination of cultural artifacts

Detector housing for the CCD camera lens, mirror, and scintillator.

For more information, contact

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