

MARS

Multimodal Advanced Radiography Station

The MARS neutron imaging instrument, HFIR beamline CG-1D, 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 beamline is equipped with two main detector systems: a charge-couple device (CCD) and a scientific complementary metal-oxide semiconductor (sCMOS) system. While the CCD is optimized for static measurements and slow kinetic changes, the sCMOS detector offers milli- and micro-second (for cycling motion), respectively,

time resolution. Spatial resolution available at the beamline is 25–30 μm with the sCMOS, 75–100 μm with the CCD. A micro-channel-plate (MCP) Timepix3 detector is currently under development.



SPECIFICATIONS

Wavelength range (Å)	$0.8 < \lambda < 6$
L (m)	6.59
D (mm)	3.3, 4.1, 8.2, 11, 16
Wavelength resolution at 2.53 Å (with monochromator)	$\Delta\lambda/\lambda \sim 0.5\%$
Highest spatial resolution	CCD ~ 75 μm (FOV ~ 8.6 x 8.6 cm ²), sCMOS ~ 25 μm (FOV ~ 3.6 x 2.4 cm ²)
Detectors	CCD, and sCMOS; coupled with scintillators (various thickness from 25 to 200 μm)

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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

Transportation 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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