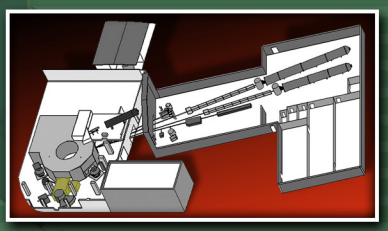
Instrument Fact Sheet

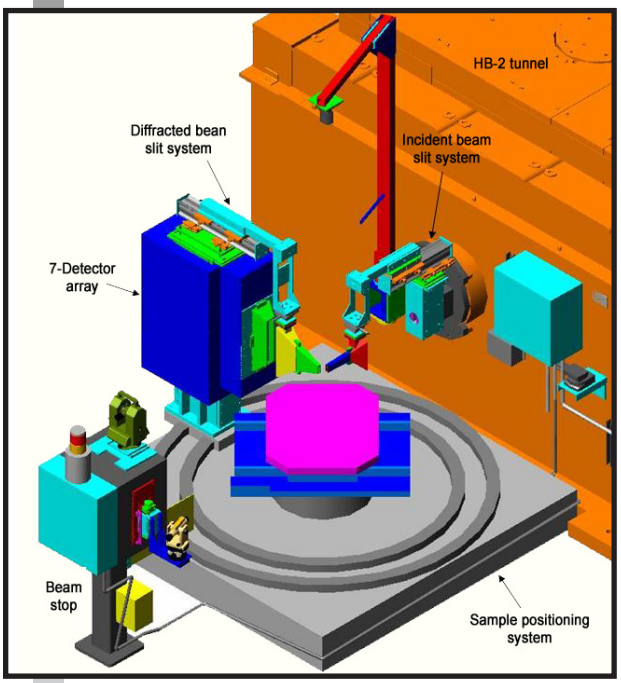
BEAM LINE **HB-2B**

High Flux Isotope Reactor



NRSF2 – Neutron Residual Stress Mapping Facility

NRSF2 at the HFIR HB-2B beam port is optimized for strain measurement and determination of residual stress in engineering materials. The large-specimen "XYZ" instrument is designed for spatial scanning of strains at depths from submillimeters to centimeters. The sample orienter can also be used for mapping strain in large-grained materials and within single crystals. The high flux and large detector coverage allow real-time, in situ studies or high-resolution mapping. Ancillary equipment available for use at NRSF2 includes a 2,267-kg uniaxial (tension or compression) load frame, a Huber Eulerian cradle, high-temperature furnaces (vacuum or air), and a 5-T superconducting magnet with an induction furnace insert. Custom-built sample environment systems can be installed on the XYZ sample positioning system. A laser-scanning metrology system is available to plan experiments and establish measurement locations in the sample coordinate system, reducing neuron beam time needed for alignment and increasing the accuracy of mapping measurements.



Specifications

Beam spectrum	Thermal
Monochromator takeoff angle	88° (fixed), λ= 1.452 Å (Si 511); 1.540 Å (Si 422); 1.731 Å (Si 331); 1.886 Å (Si 400); 2.275 Å (Si 311); 2.667 Å (Si 220)
Flux on sample	3 x 10^7 n/cm²/s (Si 331 and Si 400)
Detector angle range	70–110° optimal
Detection system	7 linear position-sensitive detectors
Position-sensitive detector coverage	5° 2Θ ±17° out of plane
Z elevator Z translation	Z ± 100 mm, 500 Kg Z ± 200 mm, 50 Kg
Nominal gage volume	Width: 0.3–5 mm; Height: 0.3–20 mm
Peak location precision	0.003° 2Θ
Sample environments	• Load frame for tension and compression (2,267-kg) • Huber Eulerian cradle for tensor and texture • Vacuum and environmental furnaces • 5-T superconducting magnet with induction heater
Detector	Fully operational

Status:
Program development use only

Applications

The penetrating power of neutrons is useful in mapping residual stresses in engineering materials. Examples of applications include residual stress maps of welds, heat-treated samples, forgings, extrusions, bearings and races, fasteners, and composites. Neutron diffraction studies of materials under applied stress reveal phase- and grain-level knowledge of deformation processes, which is fundamental for developing finite-element method and self-consistent field models of materials behavior. Systems of particular relevance for this instrument include functional materials in varied environments, such as piezoelectric materials in applied fields and shape-memory alloys under varying load and temperature conditions.

User Access

User access is currently limited to discretionary proposals through the program development process. Prospective users should contact the instrument team for further information.

For more information:

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HFIR

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