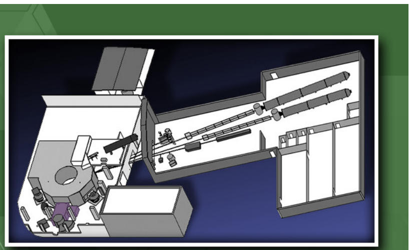
HIGH FLUX ISOTOPE REACTOR

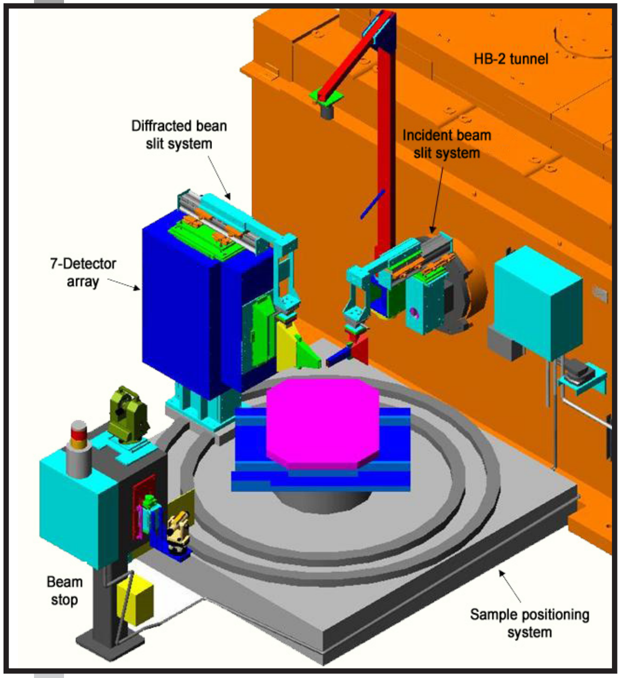
INSTRUMENT

BEAM LINE

HB-2B



NRSF2 – NEUTRON RESIDUAL STRESS MAPPING FACILITY



The 2nd Generation Neutron Residual Stress Mapping Facility (NRSF2), located at beam port HB-2B, is a high-flux engineering diffractometer ideal for spatial characterization of residual stress in large-scale engineering components. The instrument is flexible, meaning its configuration is defined by the sample material and geometry. The large-specimen "XYZ" sample translation stage is designed for spatial scanning of strains at depths from sub-millimeters to centimeters. 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 multiaxial load frame (with UTK collaboration), a Huber Eulerian cradle, and high-temperature furnaces (vacuum or air). Load frame experiments are currently discouraged on NRSF2 given the superior load frame capabilities at VULCAN. 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.

APPLICATIONS

The penetrating power of neutrons is useful in mapping residual stresses in engineering materials. NRSF2 is used for strain mapping of welds (thermal and friction stir), heat-treated samples, forgings, extrusions, bearings and races, fasteners, components for transportation and aerospace, pressure vessels and piping, nuclear engineering components, and increasing numbers of parts made through additive manufacturing. Neutron diffraction studies of materials under applied stress reveal phase- and grain-level knowledge of deformation processes, which are fundamental for developing finite-element and self-consistent field models of materials behavior. More complex experiments have included functional materials such as piezoelectric materials in applied fields, and shape-memory alloys under varying load and temperature conditions.

SPECIFICATIONS

Beam spectrum	Thermal
Monochromator takeoff angle	88° (fixed), λ= 1.452 Å (Si 511); 1.452 Å (Si 333); 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	3×10^7 n/cm^2/s (Si 331 and Si 400)
Detector angle range	70–110° optimal
Detection system	7 linear position-sensitive detectors
Position-sensitive detector coverage	4° 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	• Huber Eulerian cradle and/or phi-chi stage for tensor and texture • Vacuum and environmental furnaces • Integration with flexible specialized sample environments
Detector	Fully operational

Status: Available to users

FOR MORE INFORMATION:

Instrument Scientist: Jeffrey Bunn, bunnjr@ornl.gov, 865.574.6332
neutrons.ornl.gov/hb2b

OAK RIDGE
National Laboratory
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