



TOPAZ – SINGLE-CRYSTAL DIFFRACTOMETER

TOPAZ is a high-resolution single-crystal diffractometer using wavelength-resolved Laue technique with an extensive array of neutron time-of-flight area detectors to address structural problems in diverse research areas: chemistry, earth sciences, materials science, engineering, and solid-state physics. Experiments can be conducted in ambient conditions or controlled



sample environments for parametric study (temperature and electric field). A nitrogen cold stream provides temperature control in the range of 90 to 450 K to collect data as a function of temperature. Variable and static electric field can be applied for stroboscopic study of ferroelectric materials. The wide neutron wavelength band is well suited for efficient 3D Q space mapping of Bragg and diffuse scattering originating from magnetic and nuclear interactions simultaneously.

TOPAZ samples can be oriented with high precision for volumetric sampling of Bragg peaks in specific directions. Currently, TOPAZ has 24 of 48 detector ports populated with Anger camera modules covering a scattering angle between 20 and 160° in 2θ, matching 3.0 sr in solid angle coverage. A full dataset for structure analysis can be collected with 4 to 25 settings with an exposure time of about 0.5–5 hours each, depending on the crystal symmetry, sample scattering strength, and crystal size.

APPLICATIONS

TOPAZ is well suited for determining atomic positions and displacement parameters of light elements (such as hydrogen) next to heavy metals. Moreover, the broad Q coverage makes TOPAZ ideal for studying magnetic structures, phase transitions, disorder, and local structure phenomena. Examples span a wide range of materials:

- Functional inorganic materials for studying of the interplay of nuclear and magnetic structures such as doping-driven structural distortion in iradates; Fe and Co site occupancies in a molecular precursor
- Hydrogen bonding, guest-host interaction, and guest mobility in hydride perovskites; uranyl nanoclusters; high-pressure synthesized mantle mineral and self-assembling tertiary amines
- Catalytic and dihydrogen activation or exchange materials for the study of metal-hydrogen bonding in electrocatalyst and nano-sized copper clusters
- Accurate atomic position and displacement parameters for charge density study of organic crystals containing a high percentage of hydrogen atoms

FOR MORE INFORMATION, CONTACT

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SPECIFICATIONS

Moderator	Decoupled poisoned hydrogen
Source-to-sample distance	18 m
Sample-to-detector distance	39–46 cm
Angular detector coverage	3.0 sr (24 detectors)
Detector size	15 × 15 cm ² with 256 by 256 pixels
Detector angular range	20–160° 2θ; +/- 54° out-of-plane
Wavelength bandwidth	3.1 Å
Frame 1	0.4–3.5 Å
d-spacing Q-range	0.25–14 Å 0.45–25 Å ⁻¹
Sample size	> 0.05 mm ³ in volume and > 0.1 mm on an edge
Average experiment time	4 days / 1 complete data set
Neutron beam sizes	2.0–4.0 mm diameter
Sample environment	Ambient goniometer: χ fixed at 135° ω: 0°–360° Φ: 0–360° LN2 flow: 90 – 450 K

Status: Available to users