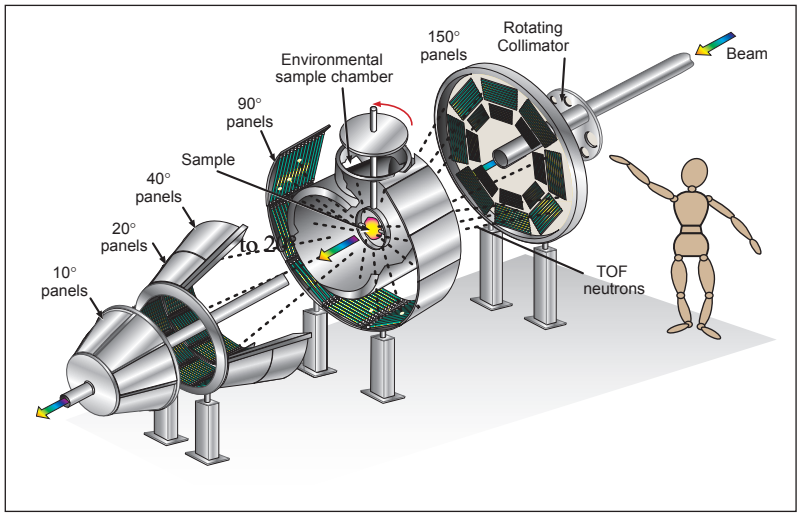
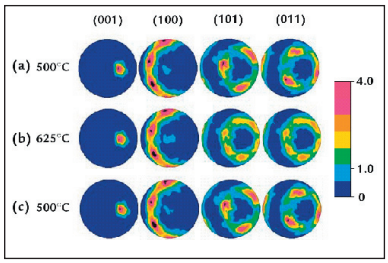
Sven Vogel
(505) 667-7016
sven@lanl.gov

Darrick Williams
(505) 665-2081
darrick@lanl.gov

High-Pressure Preferred Orientation Neutron Diffractometer (HIPPO)

HIPPO is the first third-generation neutron time-of-flight powder diffractometer constructed in the United States. It achieves very high neutron count rates by virtue of a short (9 m) initial flight path on a high-intensity water moderator and 1,360 ^{3}He detector tubes covering 4.8 m^2 of detector area from 10° to 150° in scattering angles. HIPPO was designed and manufactured as a joint effort between LANSCE and the University of California with the goal of doing world-class science by making neutron powder diffractometry an accessible tool to the national user community. D-spacing ranges from 0.12-4.80 Å (1.31-52.4 Å^{-1}) to 1.2-47.5 Å (0.13-5.3 Å^{-1}) are available to support studies of crystal orientation distribution (texture), amorphous solids, liquids, magnetic diffraction, small crystalline samples, and samples subjected to non-ambient environments such as temperature, pressure, or uni-axial stress. The exceptionally high data rates of HIPPO also make it useful for time-resolved studies. In addition to the standard ancillary equipment (100-specimen sample changer, closed-cycle He refrigerator, furnace), HIPPO has unique high-pressure anvil cells capable of achieving pressures of 30 GPa at ambient and high (2000 K) temperatures with samples up to 100 mm^3 in volume. A low-temperature gas cell allows studies in the pressure range up to 5 kbar and temperatures between 10K and ambient for instance, to study clathrates. The uni-axial stress-rig CRATES, built by the Technical University Hamburg-Harburg, Germany, allows the study of crystal lattice strains and texture changes *in situ* during deformation. HIPPO's sample chamber also accomodates user-provided sample environments.





Texture of a quartzite rock before and after the trigonal↔hexagonal phase transformation. This investigation utilized HIPPO's unique capability to measure texture at high temperatures. The results show that texture exhibits a memory effect.

Specifications	
Performance	
Moderator	Chilled water, high intensity/low resolution
Resolution and range at 150°	~0.4% and 0.12 Å < d < 4.8 Å (1.31 Å^{-1} < Q < 52.4 Å^{-1})
Resolution and range at 90°	~0.7% and 0.17 Å < d < 6.9 Å (0.91 Å^{-1} < Q < 37.0 Å^{-1})
Resolution and range at 40°	~1.8% and 0.35 Å < d < 13.9 Å (0.45 Å^{-1} < Q < 18.0 Å^{-1})
Resolution and range at 20°	~4.6% and 0.65 Å < d < 26.1 Å (0.24 Å^{-1} < Q < 9.7 Å^{-1})
Resolution and range at 10°	~9.2% and 1.19 Å < d < 47.5 Å (0.13 Å^{-1} < Q < 5.3 Å^{-1})
Primary Flight Path	
Moderator to sample	~9.0 m
Incident collimation (at sample)	.3 to 20 mm diameter (round beam)
Secondary Flight Path	
Sample to 150° tube and detector area	~1.0 m and 1.1 m^2 coverage
Sample to 90° tube and detector area	~0.7 m and 1.1 m^2 coverage
Sample to 40° tube and detector area	~1.0 m and 1.1 m^2 coverage
Sample to 20° tube and detector area	~1.5 m and 1.0 m^2 coverage
Sample to 10° tube and detector area	~2.0 m and 0.5 m^2 coverage
Sample Changer	
Number of samples (non-texture)	100
Number of samples (texture)	32
Texture tilt angle	-5°to 20°
Texture rotation	0° to 270°
Sample size (texture)	25 mm diameter
Sample size (non-texture)	9.5 and 6.3 mm diameter