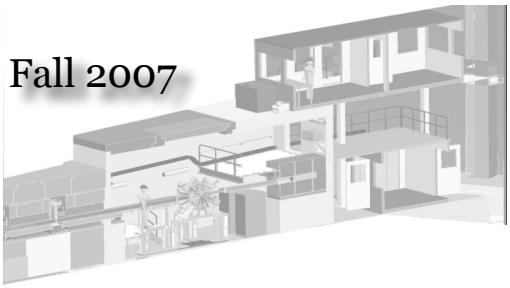
Highlights:

➔ Topaz will be a time-of-flight Laue single crystal neutron diffractometer with polarized neutron option. It will be optimized to collect data on X-ray size crystals of moderately complex atomic and molecular structures. The layout allows maximum detector coverage in the horizontal plane and +/- 60 degrees out of plane.

Fall 2007



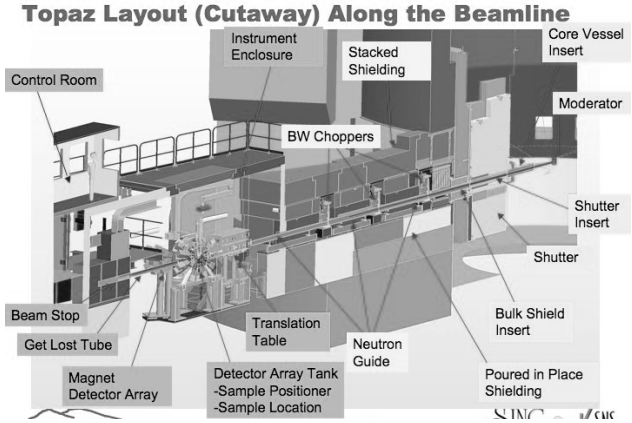
Order of Magnitude Smaller Crystals for Neutron Diffraction. ***TOPAZ,*** *The Next Generation Neutron Single-Crystal Diffractometer,* Instrument Progress and Science Update, Fall 2007

Send comments and suggestions to Christina Hoffmann, *NSSD, Oak Ridge National Laboratory, P.O.BOX 2008, Oak Ridge, TN 37831-6475.*
email: hoffmanncm@ornl.gov
http://www.sns.gov/instrument_systems/fs_Instrument_12_TOPAZ_06_G00805.pdf
http://www.sns.gov/instrument_systems/beamline_12_topaz/index.shtml

The unique advantages of neutron diffraction in structure analysis include its sensitivity to 'light' elements including hydrogen in proximity to metals and other 'heavy' elements, absence of radiation damage to samples, and sensitivity to magnetic structures. However, single-crystal applications have been limited by the requirement for large samples, in the mm range, and by long data collection times.
The single crystal diffractometer currently under construction at the Spallation Neutron Source (SNS),TOPAZ, will make extensive use of beam focusing optics in order to increase the flux on sample, thus reducing the required sample size by 1-2 orders of magnitude.

Topaz Construction is continuing to move forward on cost and on schedule. The first beam guide section will be installed during the October construction outage, along with poured-in-place shielding and shutter interface components. Three more beam guide sections will be installed and aligned after the outage along with sample cave construction, all of which to be completed in May 2008. In addition to facilities construction, detector and sample environment implementation will begin, to be complete by April 2009.

Topaz Layout (Cutaway) Along the Beamline



Day One Experiments for TOPAZ: As SNS is developing into an active user facility it is of paramount importance to consider the science program for the future TOPAZ instrument. Much of the new science will build on previous science from IPNS and other facilities. Nevertheless, input from the IDT members with novel ideas is highly encouraged.

Neutron diffraction results

$Yb_{14}MnSb_{11}$

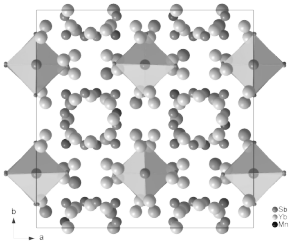
- Tetragonal with space group $I4_1/acd$

1 Mn atom
4 inequivalent Sb atoms
Sb (2) involved in Mn-Sb tetrahedra

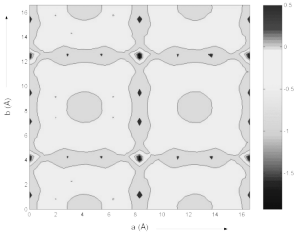
- Ferromagnet regarded as a rare example of an underscreened Kondo lattice. (T_C = 53 K)

Polarized neutron diffraction data (47 reflections)
→ MaxEnt reconstructions of spin density distribution

selection rules :
Mn (8a): 2h + l = 4n
Sb (32g): h + k + l = 2n



Projection of the spin density in $Yb_{14}MnSb_{11}$ along the *c*-axis.



→ maximum entropy magnetization density reconstruction reveals the presence of a magnetic moment on the Sb site with opposite sign with respect to the Mn moment.

Nov 2007	May 2008	Apr 2009	Nov 2009
Facilities Construction		Friendly User Access	
Detector and Sample Environment Implimentation			

Full User Access

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