



## THE HYSPEC POLARIZED BEAM SPECTROMETER AT THE SNS

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### Abstract

The HYSPEC instrument, currently under construction at the SNS is a direct geometry time of flight spectrometer that utilizes Bragg focusing optics to obtain a high intensity at the sample position for neutron energies in the range  $3.6 < E_f < 90$  meV. It's primary mission is to study the magnetic and lattice vibrational excitations in small single crystal specimens. In order to separate magnetic and lattice vibrational scattering HYSPEC will have the capability to perform full polarization analysis in inelastic mode if needed. The layout of the HYSPEC beamline and the concepts for implementing polarization analysis on HYSPEC are outlined on this poster.

### DESCRIPTION OF THE BEAMLINE ELEMENTS

The Hybrid Spectrometer (HYSPEC) is currently under construction at the Spallation Neutron Source, Oak Ridge National Laboratory, U.S.A. It is a direct geometry spectrometer intended for the measurement of excitations in small single crystal specimens. A rendering of the beamline layout is shown to the left. Neutrons are carried from the bottom downstream cryogenic coupled H<sub>2</sub> moderator of the SNS out to the experimental area, located in a building external adjacent to the SNS target hall, via supermirror neutron guides. The neutrons are conditioned by various choppers and focused onto the sample position by Bragg scattering from an array of crystals.

#### CVI and Shutter

The neutrons exit from the face of the 100mm wide x 120mm tall moderator through the Core Vessel Insert (CVI) which does not contain guide but is tapered to allow the beam to expand vertically. In the shutter and target monolith wall the neutrons are transported by m=3 supermirror guide, which continues to vertically expand up to a height of 150mm tall at 6.4m from the moderator. Beyond this the guide is constant at 150mm tall and 40mm wide.

#### Chopper box A

In the region known as chopper box A two neutron choppers are located. A vertical axis T0 chopper of the same design as used for the ARCS and SEQUOIA beamlines at SNS operating at 30 or 60Hz is located at 8.5m. This chopper reduces the high energy component of the neutron beam. The second chopper is a 60Hz frame overlap disk chopper located at 9.33m which removes the very low energy component of the beam.

#### Curved guide

Following chopper box A there is a 24m long curved guide, with a radius of curvature of 2.56km, with m=3 supermirror on the top, bottom and outer curved surface and m=2 supermirror on the inner curved surface. At the end of the curved guide is the secondary shutter and then chopper box B. The curved guide, the disk chopper in chopper box A, the secondary shutter and the two choppers in chopper box B share a common (windowless) vacuum.

#### Chopper box B

In chopper box B there are two choppers, a 60Hz disk chopper that is used for order suppression and frame overlap, and a short straight bladed Fermi chopper. The Fermi chopper can operate between 60Hz and 540Hz in 30Hz intervals and is used to monochromate the neutron beam. After the Fermi chopper the neutrons continue up to the drum shield where the guide ends.

#### Focusing crystals (Non-polarizing and Polarizing)

The neutron beam from the Fermi chopper is vertically focused onto the sample using one of two arrays of crystals. One such array consists of Highly Oriented Pyrolytic Graphite (HOPG) crystals with a mosaic spread of ~48' (ZYB). The other is an array of Heusler crystals, which can be used to polarize the neutron beam, as described in the box to the right.

#### Detector vessel

The sample is mounted on a goniometer for orientation and around the sample axis the detector vessel can be rotated. The detector vessel is filled with Ar gas and contains 160 vertically oriented LPSD tubes at a distance of 4.5m from the sample.

#### Polarization Analyzer

As an option a <sup>3</sup>He wide angle polarization analyzer will be available to be installed on the front of the detector vessel in order to analyze the polarization of the neutrons scattered by the sample. Our concept for this analyzer is described on the right.

### HYSPEC BEAMLINE LAYOUT

