SEQUOIA: A Newly Operating Chopper Spectrometer at the SNS

NEUTRON SCIENCES

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Abstract
A new fine resolution chopper spectrometer (SEQUOIA) received first neutrons from the SNS on October 7, 2008. The commissioning phase of the instrument is underway. SEQUOIA is designed to utilize neutrons of an incident energy (E_i) between 10-1000 meV. A monochromatic beam is provided on a sample, 20 m from the decoupled ambient temperature H_2O moderator, by filtering the white beam with a Fermi chopper located 18 m from the source. Two Fermi chopper choices are available: one with 2 mm slits and a channel curvature of 0.58 m and another with 3.6 mm spacing and a channel curvature of 1.53 m. After interacting with the sample, neutrons are detected by an array of 1.2 m long by 25 mm wide, ^{3}He linear position sensitive tubes located on a vertical cylinder with a radius of 5.5 m. This detector array covers -30º and 60º in the horizontal plane and ± 18º in the vertical plane. This contribution presents current results from the commissioning experiments and compares SEQUOIA's actual and predicted performance. These commissioning experiments include characterization of the beam by monitors and image plates, determination of the chopper phase offsets, and runs with various well known samples such as V and Si powder. The predicted performance is provided by full instrument Monte Carlo simulations. As a specific example characterization of the neutron beam with the monitors has shown, using the 2mm slit package Fermi chopper running at 600 Hz and phased for E_i = 100 meV, a flux of $1x10^5$ n/cm^2/s is observed for an energy resolution of 1.4% and a source power of 700 kW. This result is consistent with the Monte Carlo predictions.

Figure 1. A view of the competed SEQUOIA, showing the detector vessel, sample enclosure, control hutch and equipment mezzanines.

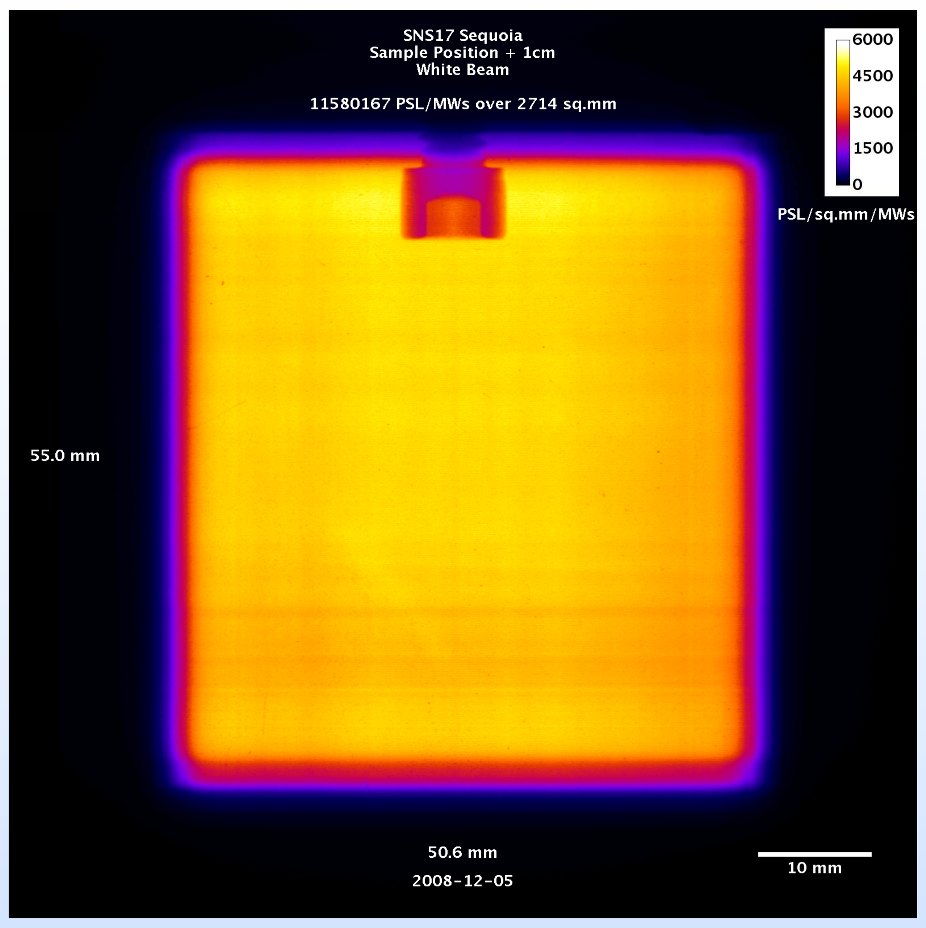

Figure 2. White beam measurements with an image plate have confirmed a 5cm x5cm beam size at the sample position.

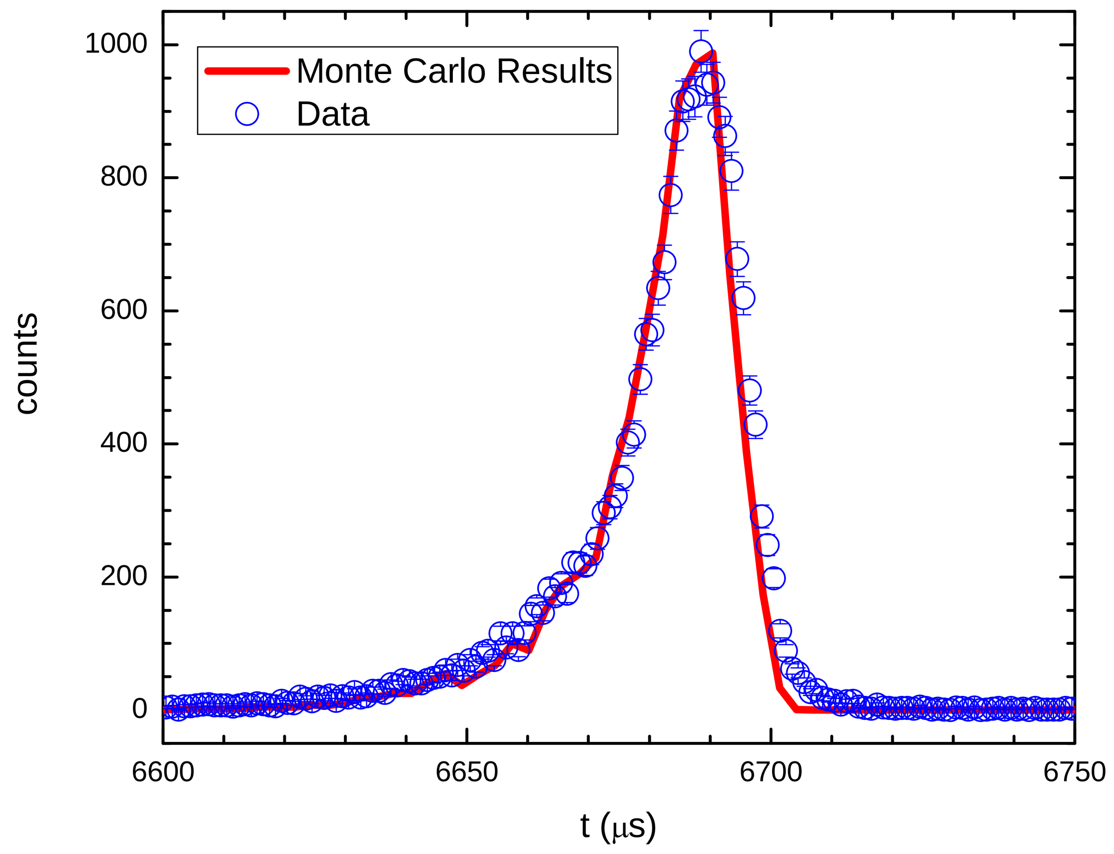

Figure 3. The blue points show the signal measured at the downstream monitor (29.003 m from the moderator) with no sample in place, with source power 700kW, the 2mm slit package spinning at 600Hz, and E_i = 98 meV. The red curve is a Monte Carlo simulation for the same conditions. The differences in the two curves are believed to be a consequence of neglecting the monitor width.

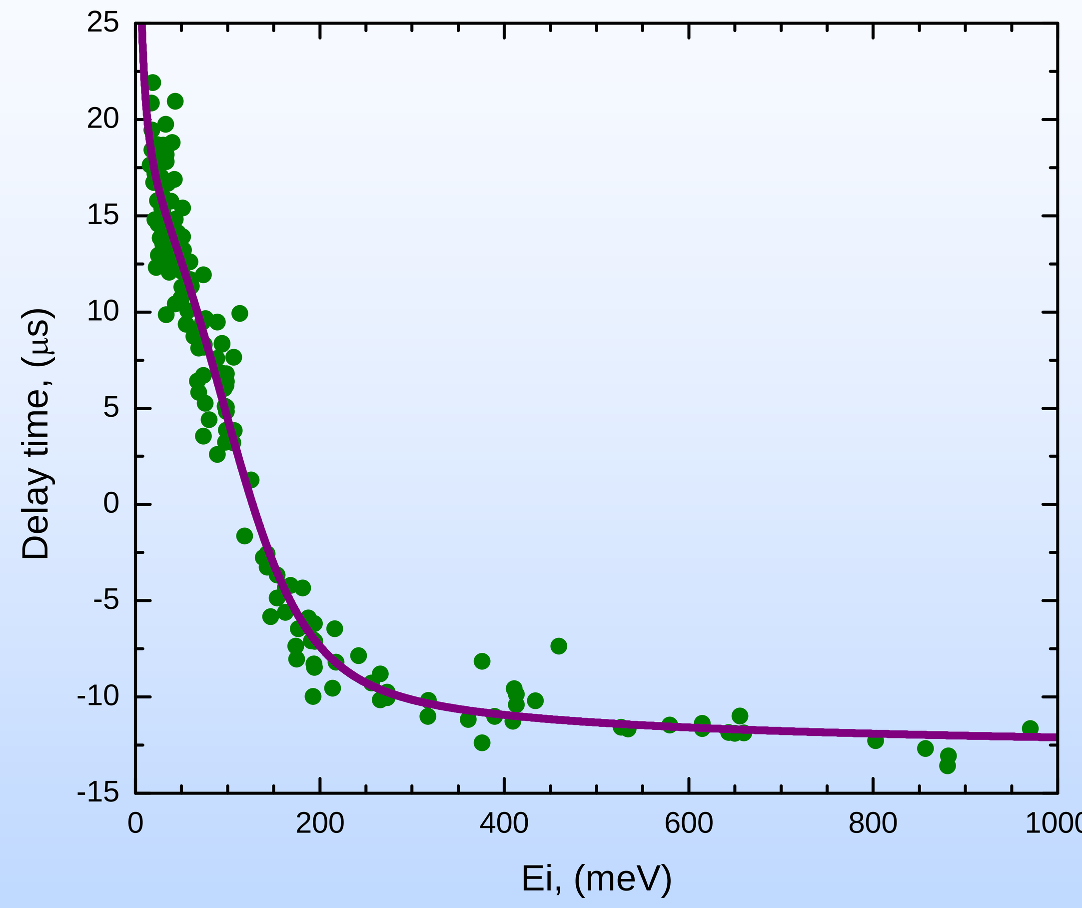

Figure 4. The delay time between the instance protons strike the target and neutrons of a given energy are emitted from the moderator. There apparent negative delay time is consequence of an offset in the electronics.

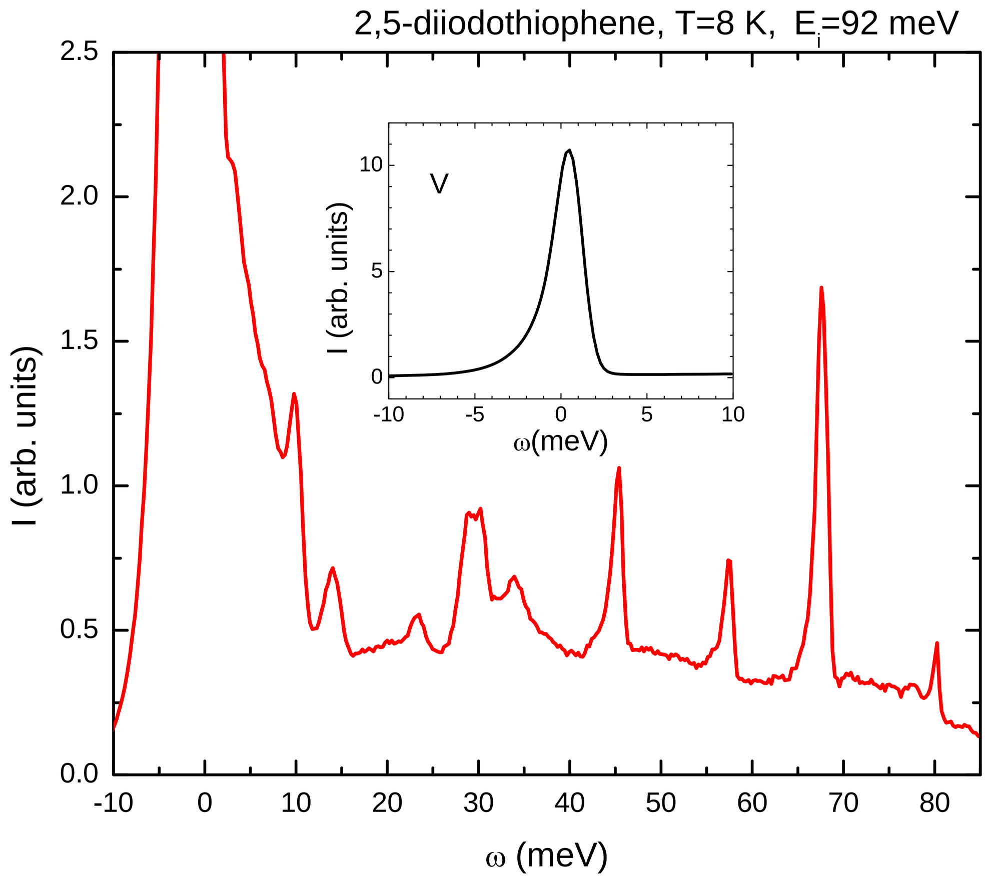

Figure 5. The Q integrated spectrum for $C_4H_2I_2S$ with the T_0 chopper running at 90 Hz. Inset: Q integrated spectra for V under the same conditions.

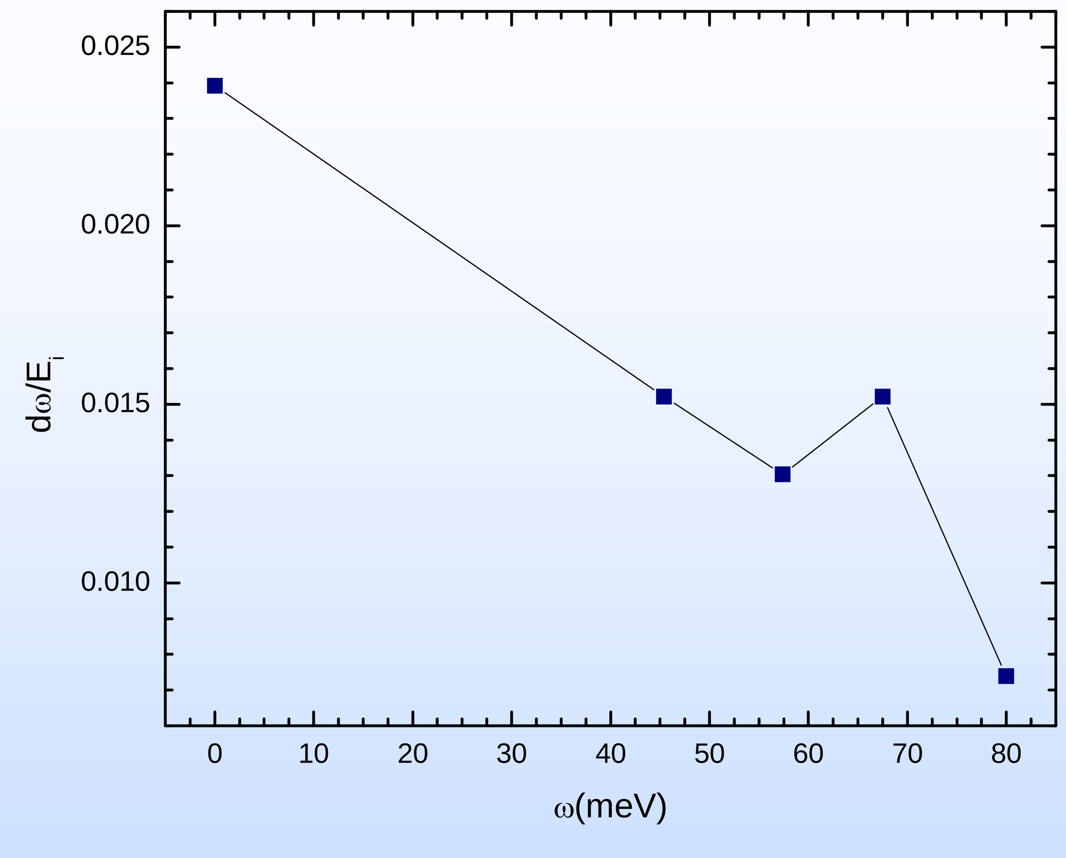

Figure 6. The ratio of the FWHM of the peaks in Fig. 5 to E_i as a function of energy transfer. More detailed analysis is under way.

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