SUPPRESSION OF INCOHERENT, INELASTIC SCATTERING IN A CHOPPED SANS INSTRUMENT

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Introduction

Lise or Joachim provides first draft

Understanding the inelastic incoherent scattering

Main input to this section incl. subsections will come from Gergely and Joachim

Theoretical background

Preliminary experimental results

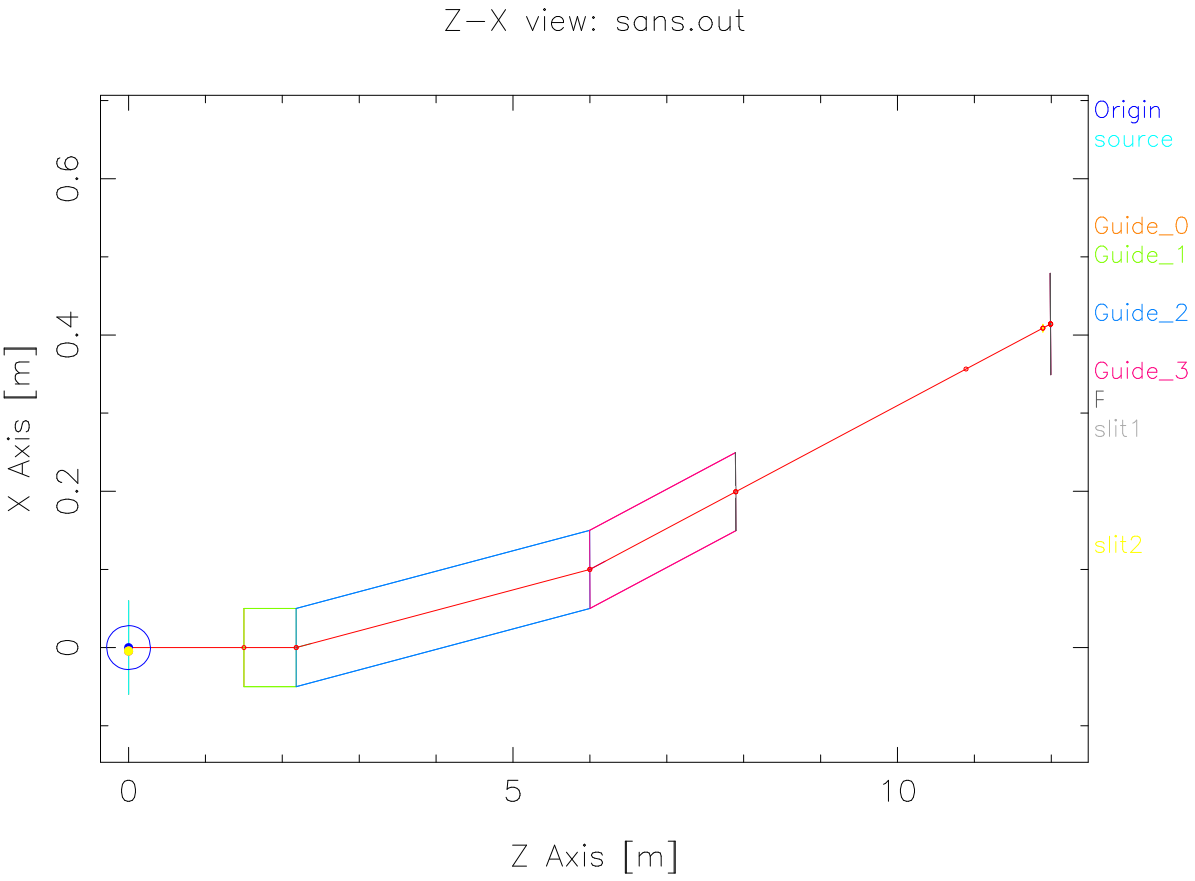
Simulation of a chopped SANS instrument for suppression of the inelastic incoherent scattering

The virtual instrument described in earlier reports is now being modified to include disc-choppers to make the instrument Time of Flight (ToF) resolved. This consists of seperating the beam into clearly defined monochromatic pulses just before the sample, in order to allow a time resolved discrimination at the detector position between elastic and inelastic scattering in the sample. To make full use of the long repetition rate of the ESS source, the chopper system will utilize wavelength multiplication as described in "Simulation of a multiple-wavelength time-of-flight neutron spectrometer for a long-pulsed spallation source" by Lefmann et. al.

Proposed Instrument layout

The instrument assumes a uniform 12x12 cm cold-spectrum moderator face, using a pulse length of 2.86 ms and a repetition rate of 14 Hz. The guide starts 2 m from the moderator face, as we have been informed by Ken Andersen that this is the closest possible. The guide is square with a 4x4 cm cross-section, and features a double kink to eliminate the direct line of sight from source to sample. The kink is designed to successfully transmit neutrons with a wavelength above 3 Å. The kink has similar transport performance to a traditionally bend guide, and has been chosen in anticipation of a source with a "hot spot", which a kink would transport better than a bend guide.

Figure 1: *Top down view of the instrument from source to sample, showing the guide with a kink and a 4 m collimation distance. Note that this is an old figure and does not completely fit the guide as described in the text. Due to server downtime, this cannot be changed before the deadline.*

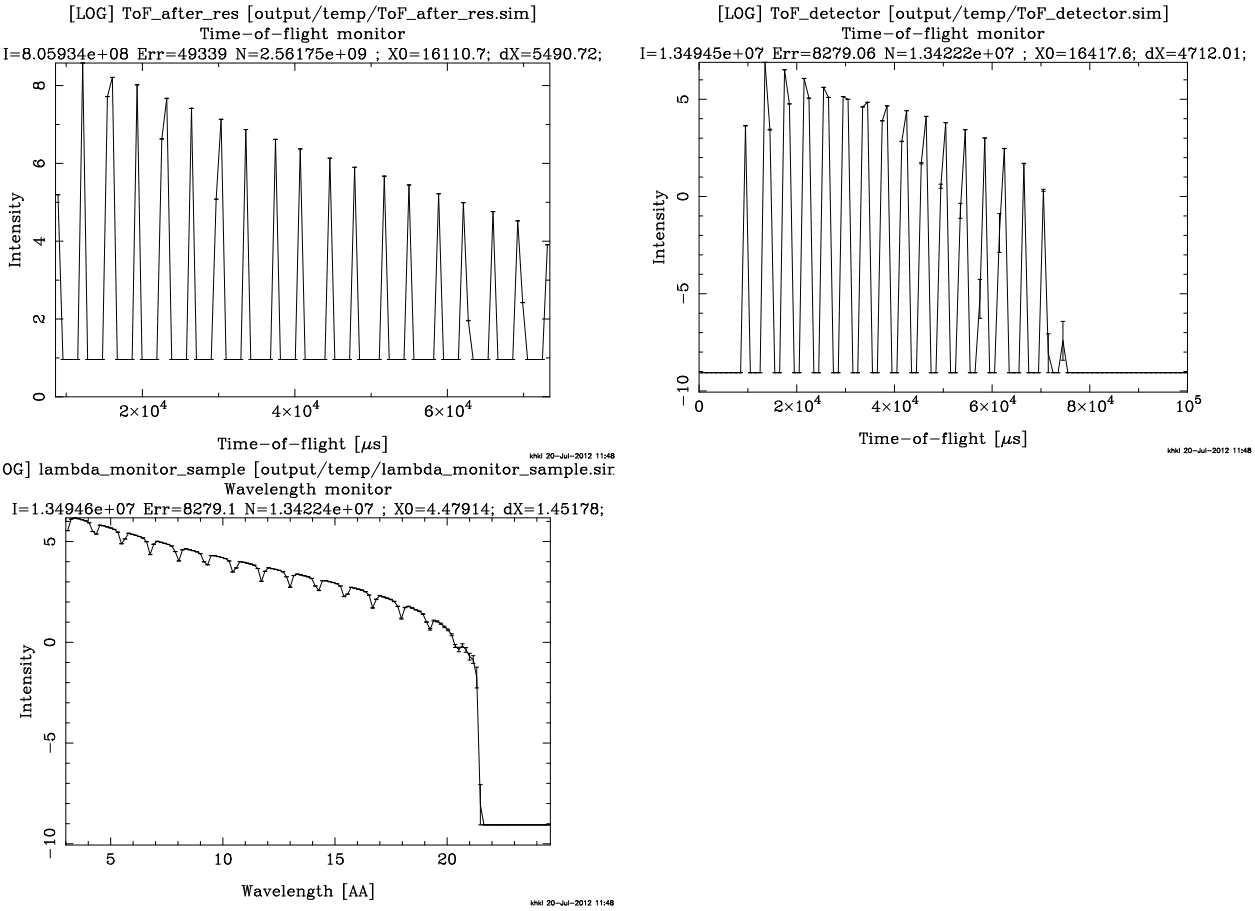


The guide system continues until 7.9 m from the moderator, where the collimation section begins. The collimation section is restricted to a maximum length of 4 m, so that the last slit is placed 11.9 m from the sample position. With the sample position at 12 m, this leaves room for a sample environment of 10 cm in radius.

The Chopper system is positioned so that there is 50 cm space from the sample to the nearest chopper, and a 5 cm spacing between choppers. The chopper system is still early in the design phase, but currently consist of a double high-speed chopper with a radius of 30 cm and two windows, and running at a multiple of the repetition rate. There is also a pulse selection chopper that can optionally run at a factor less that the double chopper, to this out the pulses.

The detector is assumed to be 1x1 m and is positioned 1-4 meters from the end of the collimation section.

Figure 2: *Effect of the chopper system, with intensity shown on a logarithmic scale. Left: Time distribution of the beam immediately after the choppers. Right: Time distribution of the beam at the detector position. Bottom: Wavelength distribution of the beam at the sample position.*



Simulation of the instrument perfomance

Previous reports have detailed the performance of the 'classic' instrument, i.e. without the inelastic suppression. Here we show the preliminary simulations of the chopped SANS-instrument. Figure 2 shows the effect of double chopper running at 140 Hz and the pulse selection chopper off. It can be seen that the time seperated pulses generated are still well seperated at the detector position.

Concluding remarks and upcoming work

Main input from Lise and Joachim