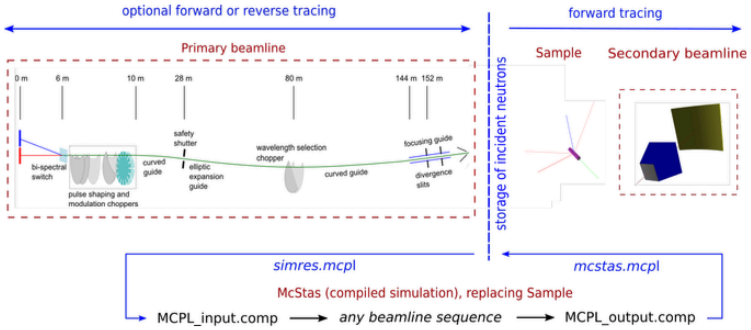
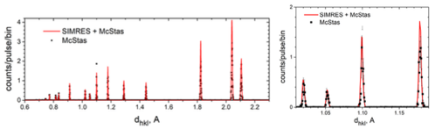
Student project at European Spallation Source
Data Management and Software Centre

Modify exitsting McStas optical component models to allow “reverse” ray-tracing from “sample” to “source”





	Rel. error (primary beam)	Computing time
SIMRES + McStas	1.1 %	56 s
McStas	1.8 %	1110 s

Supervisor	?	Code difficulty	★★★☆☆
Co supervisor	Peter Willendrup, peter.willendrup@ess.eu	Physics difficulty	★★★☆☆

DESCRIPTION

Neutron scattering is an investigative technique that examines matter at the atomic scale, particularly the distances between atoms in crystals. This process involves placing a sample in a neutron beam. By analysing the scattering patterns of these neutrons, researchers can infer the sample's properties. Instruments used in these experiments are highly specialized for various types of samples and scattering methods.

The European Spallation Source, nearing completion in Lund, Sweden, houses 15 such instruments. These instruments have all leveraged Monte-Carlo ray-tracing for their design, a method that predicts performance in terms of neutron intensity on the sample and the resolution of detected signals. McStas is a popular software tool for this purpose and mainly developed in Denmark.

The McStas algorithms generally transports neutrons from source to sample, which due to loss of statistics can be a time-consuming process. It is on the other hand known (see above figures) that by reversing the direction of the simulated neutron ray, i.e. from sample phase-space to source the simulations may in some cases be significantly sped up.

This project aims to work on adapting key McStas optical device component models for “sample to source” transport, validate against the “classic” approach and measure resulting simulation speed gains.

REQUIREMENTS

Practical knowledge of statistical methods interest in data analysis

Experience with the C programming language

LINKS

https://www.mcstas.org

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