Design of a Neutron Diffractometer at SINQ using Monte Carlo Simulations

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Monte Carlo simulations have become an essential tool for the investigation and improvement of the performance of neutron scattering instruments. For the cold neutron powder diffractometer DMC at the Swiss spallation neutron source SINQ, the Monte Carlo program McStas [1] was chosen to investigate a detector upgrade. The simulations included all components from neutron source to the position sensitive detector, including neutron guide, monochromator, beam reduction and sample. By means of these simulations the ideal detector geometry was determined.

Monte Carlo ray-tracing simulations have been proven that the optimization of a neutron scattering instrument or the describing of the performance of such an instrument can be done in a reliable and effective way. But such simulations have a much larger potential. Another field of application is to use Monte Carlo simulations to analyze data during and after an experiment. Such a 'virtual experiment' is a full simulation of a real measurement. By means of the cold neutron powder diffractometer DMC we show that the Monte Carlo packages are in a state where virtual experiments can easily be performed.

[1] http://neutron.risoe.dk/