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Conceptual design of supermirror polarizers at the European Spallation Source

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The use of polarized neutrons is very important to cover new science cases and polarized neutrons. Polarized neutrons will be made available on many European Spallation Source (ESS) instruments. There are a number of technologies available for polarizers and polarization analyzers, among them polarizing supermirror and polarized ^3He , which will both be used at the ESS. The selection of the technology for an instrument is based on the performance and the constraints of the instrument.

Supermirror polarizer has been selected as the polarizer for instruments BIFROST (indirect geometry spectrometer), MIRACLES (backscattering spectrometer) and ODIN (imaging). BIFROST AND MIRACLES are long baseline instruments where the polarizer is placed in the neutron guide system upstream from the instrument cave. In ODIN, the polarizer needs to be placed after the guide system, imposing a stricter constraint.

Careful design studies need to be done for the polarizer. At ESS, Monte Carlo ray-tracing simulation of neutron trajectories is an integral part of instrument design process. To search for the appropriate parameters for the polarizer, we have developed the module for simulating multi-channel v-cavity polarizer and incorporated it into the respective instrument model. Subsequently systematic simulation studies of the polarizer parameters have been carried out. In all these three cases we will analyze how the polarizers can be designed to obtain an outstanding performance.

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