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Simulations of background scattering from a 15 T magnet

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Neutron scattering allows for quite complicated sample environments with control over the sample conditions, such as controlled temperature, as well as the presence of strong magnetic fields.

The presence of magnets in scattering experiments necessitates a significant amount of materials in the structure. The coils of the magnets, which are not in the direct beam, add more material into the structure and could influence the experiments, since neutrons would scatter multiple times before reaching the detector. Additionally, they exert large forces on the structure that need to be withstood, requiring more material to safeguard the structural integrity of the system.

In an attempt to investigate the effect of the sample environment on the resulting background scattering, simulations of inelastic neutron scattering data in the presence of multiple scattering from the sample environment are carried out with the Union tool in McStas, a neutron ray-trace simulation package.

A model of the 15 T magnet for the BIFROST spectrometer at ESS is constructed and incorporated into models of existing spectrometers, such as triple-axis, direct TOF and indirect TOF. Optimisation of the sample environment is pursued in such a way as to minimize background scattering within a variety of particular instruments and structures.

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