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High Flux Small Angle Neutron Scattering Instrument at Long Pulse Sources

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Abstract

The high flux SANS instrument is the instrument for future research of the ESS, because many interesting topics of the future are covered. The high flux serves highest scattering signals, which is desirable in many cases such as low contrasts, low concentrations, fast kinetics, or contrast variation experiments. Especially, the more complicated questions of tomorrow's research can be taggled. Topically, the field ranges from biology over soft matter and chemistry to materials research.

Within the ESS Design Update Programme we are studying various concepts for a time of flight small angle neutron scattering (TOF-SANS) instrument for a long puls source, i.e. The ESS in Lund. The favourite concept aims at samples of 1x1cm^2 area, which is directly connected to long SANS instruments of 10+10m or even longer. The parallel concept of small samples leads to shorter instruments, which might be needed for restricted sample material or strong external fields. One important result is that the high flux instrument will serve nearly all requirements (even that of a small sample SANS) and thus is the preferred instrumental concept.

The high flux instrument is optimized with respect to intensity for a considered wavelength band at a given high resolution, in order to resolve large particles. The practical low Q cutoff is not only determined by the used wavelength band and geometrical factors, but also by the counting statistics within the considered parameters. For a large spanned Q range we propose to use at least two detectors at different distances. So for one-shot kinetic experiments the classical SANS Q-range is covered. These initial considerations lead to a simple instrument with little compromises.

Extensions for this basic set-up are considered as add-ons. So focusing elements will extend the low Q limit by a factor of 10. Moving collimation elements might adapt the resolution for different wavelengths, such that even faster one-shot kinetic experiments might be carried out. The currently raising request for grazing incidence SANS experiments aims at lateral structures within thin layers. Polarizer and analyzer will allow to study magnetic structures or to separate coherent from incoherent scattering. The overall design will serve nearly all possible topics of tomorrow's reseach asked to a modern SANS instrument.