

Non-standard configuration of SANS instruments: Multiple beam techniques for VSANS, scanning and magnified neutron imaging methods

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Small-angle neutron scattering (SANS) instruments offer a unique toy-box of neutron optical devices combined with the high flux of an end-of-neutron-guide beam position. The appropriate combination of optical components such neutron guides, apertures, time-of-flight or monochromatic modes of operation, polarisation and analysis techniques allow a typical SANS instrument to be imaginatively configured for other purposes. Here, we demonstrate how the D33 SANS instrument at ILL can be configured to produce multiple highly collimated beams for measurements in the VSANS regime at the smallest scattering angles. The multiple beam configuration uses the intrinsic properties of the neutron guide system, source and sample apertures with no additional optical devices or precise aperture array alignments. This is particularly useful for the study of small samples, or small regions of a sample, at the smallest scattering angles while retaining sufficient neutron flux due to the use of multiple beams. We also demonstrate how the instrument can be configured to perform magnified neutron imaging and scanning imaging measurements or 'scanning SANS microscopy' using single or multiple beams. Both techniques provide spatial resolution down to $\sim 50\mu\text{m}$ without the need for high resolution cameras, using only the regular low resolution (5mm x 5mm pixel) SANS detector. Neutron imaging in this way profits from, and allows separation of, both absorption and scattering contrast mechanisms. Examples of multiple beam 'VSANS' and imaging measurements made on D33 will be presented.