ECNS 2023
Garching

EUROPEAN
CONFERENCE
ON NEUTRON
SCATTERING

Contribution ID: **202**   Type: **Talk (17 + 3 min)**

SHERPA: a backscattering instrument with polarisation analysis

Monday 20 March 2023 15:40 (20 minutes)

Polarisation analysis (PA) has been growing in popularity to separate the coherent and incoherent scattering contributions in complex systems. For quasielastic spectroscopy, PA has been used with neutron spin-echo, triple axis, and direct geometry time of flight spectrometers. However, crystal analyser backscattering instruments are the workhorses of quasielastic neutron scattering (QENS), due to high signal, high resolution and low cost. PA has not been implemented on backscattering instruments to date.

SHERPA (Spectrometer for High Energy Resolution Polarisation Analysis) is proposed as a near-backscattering instrument with single axis polarisation analysis for the ISIS neutron source. It will be well-suited to study diffusion and molecular dynamics in aqueous systems, proteins, polymers, MOFs, proton conductors and adsorbed phases, amongst others. Initial simulations suggest that SHERPA would out-perform LET at the equivalent resolution by a factor of 130 in detected intensity.

The design uses pyrolytic graphite crystal analysers exploiting the prismatic effect (FARO design[1]). Polarisation and analysis are proposed with supermirror cavities. The factors influencing these decisions will be presented with McStas simulations of the preliminary instrument.

1:Rev. Sci. Instrum. 90, 075106 (2019); https://doi.org/10.1063/1.5089642

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Session Classification: Spectroscopy

Track Classification: Neutron Instrumentation, Optics, Sample Environment, Detectors, and Software