

Background sources in Advanced High-Pressure Neutron Scattering Experiments

For condensed matter physics neutron scattering experiments at high pressures are an ideal combination of microscopic probe and tuning parameter to investigate magnetic properties and phenomena. However, they require a high neutron flux and a robust signal-to-noise ratio, especially for small samples. This work focusses on the background noise within high-pressure neutron scattering experiments. It provides a comprehensive assessment for specific pressure cells and neutron scattering instruments through a combination of simulations and benchmark experiments with the aim to devise more generally applicable background analysis and reduction strategy. We employed McStas 3.2 package with the Union component framework to simulate different origins of background contributions and their contribution in high-pressure experimental settings. The experimental benchmark was performed at CAMEA, SINQ, where we used a Ho₂Ti₂O₇ powder sample enclosed within a CuBe clamp cell inside orange cryostat. Our analysis concludes with technical solutions to improve the signal-to-noise ratio in state-of-the-art neutron experiments.

Primary authors: MA, Zhanwen (PSI); MAZZONE, Daniel (Paul Scherrer Institute); LASS, Jakob (Paul Scherrer Institute); SIMUTIS, Gediminas (Paul Scherrer Institute); THÜRSAM, Sascha (Paul Scherrer Institute); BARTKOWIAK, Marek (Paul Scherrer Institute); NIKITIN, Stanislav (Paul Scherrer Institute); FENNELL, Tom (Paul Scherrer Institute); POMJAKUSHINA, Ekaterina (Paul Scherrer Institute); BERTELSEN, Mads (European Spallation Source); WIL-LENDRUP, Peter (European Spallation Source;5. Technical University of Denmark); FILGES, Uwe (Paul Scherrer Institute); KLAUSER, Christine (Paul Scherrer Institute)

Presenter: MA, Zhanwen (PSI)

Session Classification: Instruments