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Study of Background Noise in High-Pressure Neutron Scattering Experiments

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Advanced high-pressure neutron scattering experiments demand a high neutron flux and precise phase space at small sample volumes, while maintaining a high signal-to-noise ratio. This work is dedicated to a comprehensive evaluation of background noise in high-pressure neutron scattering experiments, employing simulations and benchmark experiments. McStas 3.2 with the Union component is used to simulate the sources of background noise and its effects on high-pressure experiments. Validation experiments are conducted at the CAMEA (Cold Neutron Triple-Axis Spectrometer) at SINQ (Swiss Spallation Neutron Source), utilizing $\text{Ho}_2\text{Ti}_2\text{O}_7$ powder samples placed in a 5 mm diameter \times 19 mm height container. The container is then housed within a CuBe clamp cell, which is subsequently placed in orange cryostats. Simulations and tests are compared to understand the sources of background noise and assess its impact on high-pressure experiments. Furthermore, the potential solutions to reduce background noise from pressure cells are discussed.

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