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BIFROST - An extreme environment cold neutron spectrometer at the European Spallation Source

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Inelastic neutron scattering is instrumental in making key discoveries in a broad range of materials, such as superconductors, multiferroic materials and quantum magnets. However, the applicability of the technique is limited by inherently weak signals, leaving parametric studies as a function of sample environment parameters relatively inaccessible.

BIFROST, currently under construction at the European Spallation Source (ESS), aims to drastically shift those limits of feasibility by combining a multiplexing crystal analyzer backend with an indirect geometry time-of-flight front end. Due to the peak brilliance and long pulse of the ESS source, the primary spectrometer enables an unprecedented polychromatic sample flux exceeding 10^10 n/s/cm2 at 5 MW accelerator power, with a primary spectrometer resolution ΔEi/Ei of 4 %, common in cold neutron spectroscopy. The multiplexing backend consists of 9 Q-channels with continuous angular sensitivity, each containing 5 fixed analyzers probing neutron energies below 5.0 meV. The analyser backend utilize position sensitive detectors to significantly improve energy resolution as compared to a normal triple-axis backend. By shaping the source pulse, an energy resolution well below 0.1 meV is obtainable even far from the elastic line while retaining a respectable flux on the sample.

Instrument construction is making significant progress, with major components installed, and the instrument slated for completion by the end of 2023.

Primary author: TOFT-PETERSEN, Rasmus (European Spallation Source)

Co-authors: HAUBACK, Bjørn (IFE); NIEDERMAYER, Christof (Laboratory for Neutron Scattering and Imaging, Paul Scherrer Institute); Prof. RØNNOW, Henrik (EPFL); LASS, Jakob (Paul Scherrer Institut); BIRK, Jonas (Niels Bohr Institute, University of Copenhagen); LEFMANN, Kim (Niels Bohr Institute, University of Copenhagen); KRIGHAAR, Kristine (Niels Bohr Institute, University of Copenhagen); MARKO, Marton (Paul Scherrer Institute); CHRISTENSEN, Niels Bech (Technical University of Denmark); WILLENDRUP, Peter (DTU Physics); Dr BOURGES, Philippe (LLB)

Presenter: TOFT-PETERSEN, Rasmus (European Spallation Source)

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