

Next generation asymmetric horizontal SANS magnet for quantum phenomena in nanostructures and correlated electron systems

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The main goal of the project “Next generation asymmetric horizontal SANS magnet for quantum phenomena in nanostructures and correlated electron systems” is the development of a high performance compensated asymmetric horizontal magnet optimized for small angle neutron scattering (SANS), reflectometry and the resonance spin echo technique MIEZE [1] (Modulation of Intensity with Zero Effort). With an asymmetric coil geometry allowing for the use of polarized neutrons and polarization analysis, this superconducting magnet is dedicated for research on quantum phenomena in nanostructures, strongly correlated electron systems and superconductivity [2]. NSHM will provide a central magnetic field of ~10T with stray fields down to 10G at 1m distance, and parallel and perpendicular access with $\pm 10^\circ$ scattering cones.

The magnet will be optimized for lowest possible parasitic background scattering with the least possible amount of material in the beam. Together with a dedicated integrated cryostat, it will offer a wide temperature range of 50 mK to 350 K. Only the use of modern high-temperature superconducting (HTS) technology will allow the fringe field compensation of a split coil magnet as large as NHSM at reasonable weight (~750 kg) and size (~75 cm x 75 cm) enabling the use on a large number of beamlines at MLZ with minimized interference and stray fields. The magnet will be a pioneering project using HTS technology without cryogenic liquids (dry system).

This project proposal is based on the results achieved by two feasibility studies performed in collaboration with the companies Bilfinger-Noell (Germany) and HTS-110 (New Zealand), funded by BMBF.

[1] J. Jochum, A. Wendl, T. Keller and C. Franz, Measurement Science and Technology 31, 3 (2020) 035902, DOI: 10.1088/1361-6501/ab5358

[2] S. Mühlbauer et al., Reviews of Modern Physics 91 (2019) 015004, DOI: DOI: 10.1103/RevModPhys.91.015004

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