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 polarised neutrons and polarisation 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 $\approx 10\,\mathrm{T}$ with stray fields down to $10\,\mathrm{G}$ at $1\,\mathrm{m}$ distance, and parallel and perpendicular access with $\pm 10^{\circ}$ scattering cones.

The magnet will be optimised 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 ($\approx 750\,\mathrm{kg}$) and size ($\approx 75\,\mathrm{cm} \times 75\,\mathrm{cm}$) enabling the use on a large number of beamlines at MLZ with minimised 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.

References

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