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T-REX, a bi-spectral chopper spectrometer for the ESS

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T-REX is a bispectral direct-geometry chopper spectrometer accepted for construction at the European Spallation Source (ESS). Currently the project is in the engineering design phase. We will discuss technical solutions for various instrument components.
The instrument will provide neutrons in the energy range 2 meV < Ei < 160 meV and therefore will allow detailed exploration of reciprocal space to study collective excitations of the nuclear or spin structure as well as localized excitations.
The chopper layout [1] is designed for polychromatic experiments using multiple incident neutron energy in Repetition Rate Multiplication. Moreover, the chopper configuration can be tuned to high energy resolution, i.e. achieving 20 micro-eV elastic energy resolution at 2 meV incident energy, or to relaxing the resolution and gain up to 5 times greater flux at the sample. By limiting the beam collimation, the Q resolution can be tailored to the experimental needs, as investigated in the study of the instrumental resolution function [2].
Many of the scientific questions to be addressed by the spectrometer will be tackled by means of neutron Polarization Analysis (PA) to probe not only the energy of spin excitations but also the eigenstates or to distinguish the spin-incoherent from the coherent scattering.
T-REX features XYZ neutron spin polarization analysis. Neutron polarization is achieved with the SEOP setup [3]. Neutron spin analysis in XYZ is performed with the magic PASTIS setup [4]. Specific investigations of high quality 3He cells are required [5], to achieve a long decay time of the polarization of the gas, which is crucial for long lasting inelastic scattering experiments.
In collaboration with the ESS detector group we are designing the PSD detectors based on the 10B multigrid technology [6] to cover the large area (20 m^2 in the full scope) with minimal gaps and a high detection efficiency for neutrons of energy up to 200 meV.

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