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A LOW BACKGROUND MAGNET FOR SPECTROSCOPY AT ESS

High magnetic fields, combined with low temperatures, are an essential tool for neutron spectroscopy. Together, these provide essential information about magnetic dynamics, which is invaluable for the understanding of phenomena such as spin liquids and frustrated magnetism, quantum criticality, excitations in multiferroics, and many other key problems in condensed matter physics.
CSPEC and TREX are direct-geometry spectrometers with large detector banks. The instruments are specifically designed to enable high field neutron experiments. A great deal of effort has been made to minimise the amount of magnetic material near the sample position to be able to use uncompensated magnets, building on the experience of other facilities where stray field has been a serious issue.
Spectroscopy deals with very small signals, so minimising background scattering from material in the beam and scattered neutron paths is important. This is in tension with the need to support the very high forces between the coils of a high field split-pair superconducting magnet. The time-of-flight technique however means that some angular obstructions of the scattered path is permitted. To this end ESS commissioned a design study to investigate possible configurations for a low background 14T magnet with radial coil supports.
As part of the design study, simulations were done of magnetic forces. These can arise both due to ferromagnetic material in the vicinity of the magnet, but also dynamic forces may occur because of eddy currents in highly conducting material nearby in the event of a quench. The latter gave some surprising results which will be presented in this poster.
A tender process for the full magnet system has just been concluded, due for delivery in late 2027.

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