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60-T pulsed magnet for x-ray scattering experiments at the European XFEL

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High magnetic fields allow for the stabilization of otherwise inaccessible new quantum states of matter. A scattering technique is imperative for a deep and thorough microscopic understanding of these exotic high field phases in correlated electron systems. We report pulsed magnetic field installation for x-ray scattering experiments, aiming up to 60 T, within an international user consortium called HiBEF (Helmholtz International Beamline for Extreme Fields). The pulsed-field setup will be combined with the High Energy Density instruments at the European X-ray Free Electron Laser (XFEL) facility, covered x-ray energies from 5-25 keV. The European XFEL provides a unique time structure with bunch trains consisting of up to 2700 bunches separated by 220 ns. The pulse length of our high field magnet matches the length of the X-ray bunch train, 0.6 ms. This offers the opportunity to measure the field dependence of fundamental and/or superlattice diffraction intensities in a single magnetic-field pulse. We have developed a 750 kJ/24 kV capacitor bank with the peak current of 100 kA for energizing a horizontal bi-conical solenoid with 60 (20) degree opening at the outgoing (incoming) side of the XFEL pulses. This coil system integrates an eddy-current shield in order to minimize stray fields and vibrations due to interactions with the environment. We present the status of the project, including the coil design, magnet and sample cryo environment, as well as the X-ray goniometer.

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