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New polarized neutron diffraction setup with 8 T magnet on POLI

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The polarized single-crystal diffractometer POLI offers two types of polarized neutron diffraction experiments: spherical neutron polarimetry (SNP), also known as full three-dimensional polarization analysis in zero magnetic field, and classical polarized neutron diffraction, also called flipping-ratio (FR) method, in high applied magnetic fields. Recently, the available sample environment of POLI has been extended by an asymmetric field magnet of 8 T. Although this new magnet is actively shielded, its stray fields are still too large to be used with the sensitive ^3He polarizer of the original SNP setup. To overcome this issue, a new, large-beam-cross-section solid-state supermirror (SM) bender polarizer has been developed for POLI. An existing shielded Mezei-type flipper is used between the magnet and SM polarizer. A dedicated guide field construction was numerically simulated, optimized and built to link the magnetic field of the polarizer to the flipper and to the stray field of the magnet. An almost loss-free spin transport within the instrument in the complete field range of the new magnet was achieved. The new setup was successfully implemented and tested. A high polarization efficiency of above 99% for short wavelength neutrons could be experimentally reached with the new solid-state bender. The new high-field FR setup is now available for POLI's user community.

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