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Recent achievements in advanced diffractive optics for neutron monochromators at ILL

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Within the Endurance Phase 1 projects, several new monochromators have been developed, covering the complete process from crystal growth to device integration, with first results already obtained on ILL instruments. Major achievements include large double-focusing HOPG monochromators for the D007 diffuse scattering spectrometer and the SHARPER time-of-flight spectrometer, as well as a new HOPG monochromator for D10+. Mosaic CaF_2 crystals, produced at the ILL, have been successfully applied in a temperature-gradient monochromator for the thermal neutron backscattering spectrometer IN13. Large single crystals grown in-house provide copper crystals with controlled mosaic distribution, enabling highly efficient monochromators such as those for the PANTHER spectrometer and the upgraded D10+ diffractometer.

In parallel, new fabrication techniques for advanced neutron optics using perfect Si single crystals have been established. These methods allow the production of high-quality bent Si(111) crystals, without mechanical support, thereby enabling the development of innovative optical designs. A key application is the MARMOT analyzer system for the ThALES spectrometer, currently under construction, which employs a unique focusing geometry to provide simultaneous analysis over a quasi-continuous energy range (3.5–7 meV) and a wide 75° angular coverage, representing a major step forward in multiplexed neutron spectroscopy.

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