XtremeD: A new single crystal and powder diffractometer designed for measurements at extreme conditions of pressure and magnetic fields

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Neutron diffraction has unique capabilities for the research under extreme conditions, mainly in two large areas: crystallography/geosciences and magnetism/solid-state physics. The growing interest for these problems is attested by the quantity and quality of publications, by the number of experiments proposed at the different neutron sources and by the new instrumentation projects under development all around the world. Therefore, the project for the construction of a “\textit{Xtreme conditions Diffractometer (XtremeD)}” at Institut Laue-Langevin for both single crystals and powders, operating at high pressures (> 30 GPa) and high magnetic fields (up to 15-17 Tesla), is being considered and will be presented here.\textsuperscript{[1]} The scheme of the instrument is shown in figure 1.

The scientific areas in which the projected instrument can make significant contributions and the main technical characteristics of the project are discussed in this presentation. The main idea of XtremeD is to combine a large solid-angle detector with an optional highly-focused beam on the sample, thus providing high flux while maintaining low background. The principal features of XtremeD will be the following:

- Optimisation for small samples: optional and variable focusing optics (choice of the focusing point).
- Large 2D position-sensitive detector for powders and single crystals.
- Sample environment adapted for high pressure (variety of pressure cells, up to 30 GPa for the moment, but with a goal of 50 GPa after the envisaged developments) and high magnetic fields (up to 15 Tesla in continuous mode, with the possibility of higher pulsed fields).
- Radial oscillating collimator and neutron shielding to suppress background
- Choice of monochromators (Si, PG), take-off angles (40°-120°), and wavelengths (0.9–4 Å).

The scientific possibilities that this instrument will provide and the main technical characteristics of the instrument performance in different conditions will be the focus of this presentation.

\textbf{Figure 1.} Scheme of the XtremeD powder and single crystal diffractometer

\textsuperscript{[1]} J.A. Rodríguez-Velamazán et al, J. Phys. Conf. Ser. 325 (2011) 012010

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