MS50-05 **E9 upgraded: the fine-resolution neutron powder diffractometer at BER II.** Daniel M. Többens,[a] Michael Tovar,[a] Christiane Stephan,[a] Paul F. Henry,[a,b] [a]*Helmholtz-Zentrum Berlin für Materialien und Energie, Germany,* [b]*now European Spallation Source ESS AB, Sweden*
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The fine-resolution neutron powder diffractometer E9 at the BER II reactor at the Helmholtz-Zentrum Berlin für Materialien und Energie [1] has undergone major alterations, which improved both the performance and the flexibility of the instrument. The layout between source and sample remained unchanged [2], with the monochromator - reactor core distance of 11 m allowing a large take-off angle, reduced number of epithermal neutrons in the primary beam from a sapphire single crystal filter, and a vertically focussing Ge-monochromator of 300 mm height allowing flexible optimization of the focus of the secondary beam. The original 64 channel linear wire detector (old D2B type) [2] has been replaced by eight area detectors of 300 x 300 mm active area, with a radial collimator to reduce background scattering. The individual detectors are arranged at varying distances from the sample, thus optimizing resolution and intensity to the different requirements at different diffraction angles. With this novel setup, complete diffraction patterns of the whole diffraction range of 2-142° are now accumulated in only three steps. Position-sensitive data integration results in a strongly reduced asymmetry of the peaks, allowing for wide axial detector angles. In combination, these changes result in a manifold increase of pattern intensity, without compromising the resolution function. In this mode, the instrument is dedicated to collect diffractograms suited for crystal structure determinations and Rietveld refinements with unit cell volumes up to 1000 $Å^3$. This is equivalent to the original dedication, but with increased data collection speed. Additionally, four of the individual detectors can be placed at variable distances from the sample, in a new high intensity, low resolution conformation of the instrument. This mode is suitable for atomic and magnetic structures with small unit cells and high symmetry. Also, this configuration results in a large angular range being covered by a single detector. This is useful for data collection with fixed detector position, allowing for rapid parameterized scans, e.g. temperature or field strength dependency of magnetic structures, cavity fillings or phase compositions. Combining different distance selections is also possible. The 2D-data are directly accessible, e.g. to perform texture analysis. Of course, the upgraded instrument still allows the use of the usual suit of sample environments, covering a wide range of low and high temperatures, pressure, variable magnetic fields, and controlled gas atmosphere. With BER II back in operation, E9 is now once again open to applications [1] from external users.

[1] Helmholtz-Zentrum Berlin für Materialien und Energie, http://www.helmholtz-berlin.de [2] Többens, D. M. *et al.* (2001) *Mat. Sci. Forum.* **378-381**, 288-93.

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