# A single W:B$_4$C transmission multilayer for polarization analysis of soft x-rays up to 1keV

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**Abstract ---** Modern undulator beamlines can produce light in an arbitrary polarisation state. Of particular interest are experiments probing magnetic circular dicroism from the 2p absorption edges of first row transition metals (500 eV to 1000 eV). Polarimeters designed to determine the four Stokes parameters of a source rely on a phase retarder followed by a (linear) polarisation analyser. A transmission Bragg (W:B$_4$C) multilayer capable of acting as a non resonant phase retarder over this energy range has been reported previously at PXRMS '08 [1]. However, with a phase retardance of ~8°, theoretical modelling was required in the data analysis. For a new multilayer the number of layers and their thickness was increased so that the ratio of roughness to d spacing was improved by working at more grazing Bragg angles. This is at the cost of increased absorption and an increased mechanical precision requirement on the polarimeter, but, the phase retardance of this new multilayer is greater than 25°, allowing a self calibrating measurement of the Stokes parameters, without the need for theoretical modelling.
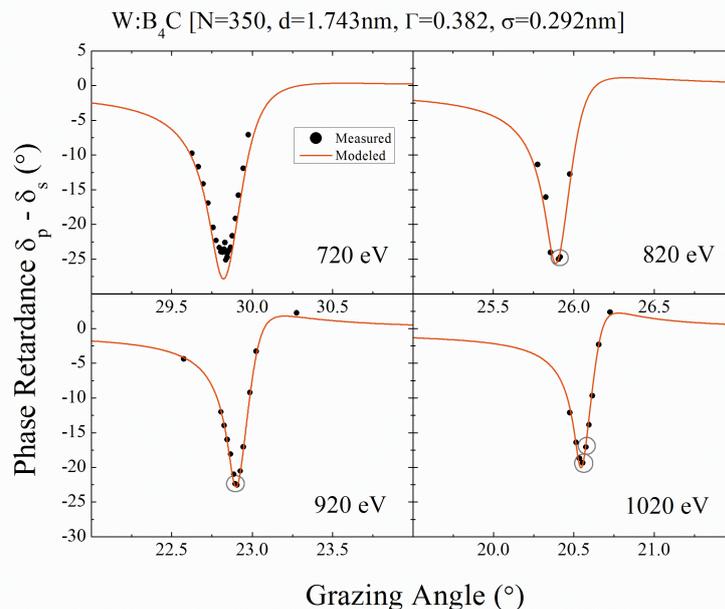
Figure 1    The phase retardance ($\delta_p$ - $\delta_s$) of the multilayer polarizer as modeled and as measured at a) 720 eV, b) 820 eV, c) 920 eV and d) 1020 eV photon energies. The points marked in circles are where the data was cross-calibrated with linear polarized radiation

**REFERENCES**
1. M.A. MacDonald, F. Schaefers, R. Pohl, I.B. Poole, A. Gaupp, F.M. Quinn, "A W/B$_4$C multilayer phase retarder for broad-band polarisation analysis of soft x-ray radiation," Rev. Sci. Instrum. **79**, 1025108, 1-4 (2008) and PXRMS '08.