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PTB's new microfocus beamline for Tender X-ray dipole radiation at BESSY II with a monochromator combining a multilayer-based PGM and a DCM

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In PTB's laboratory at BESSY II, we have set up a new beamline at a bending magnet. It provides monochromatized radiation in the tender X-rays range from 1.5 keV to 10 keV focused typically to a 20 µm x 20 µm spot. A new concept has been developed and implemented for the monochromator. It consists of a plane grating monochromator (PGM) with a multilayer-coated blazed grating and plane mirror on the one hand and an integrated double crystal monochromator (DCM) module with two Si(111) crystals on the other hand. Either the PGM (below 3.5 keV) or the DCM module (above 2.45 keV) can be used. Other components of the beamline are a toroidal and a cylindrical mirror for the collimated PGM, a slit system with a horizontal and a vertical slit at the intermediate focus and a Kirkpatrick-Baez optical system with plane-elliptical mirrors. The toroid has a Pt- and a C-coating, while the other mirrors only have a Pt-coating.
The new beamline is intended to increase our beamtime capacity in the tender X-rays range, where the requirements increased significantly and cannot be met anymore with the existing four-crystal monochromator (FCM) beamline. Providing a microfocus will simplify and improve X-ray spectrometric measurements such as µ-XRF (X-ray fluorescence) and XES (X-ray emission spectroscopy) with a von Hamos spectrometer.
Currently, the beamline is in the commissioning phase and will be available for full user operation from August 2024. We will present the concept of the monochromator and the optical design of the beamline. We will discuss the advantages and disadvantages of the concept and the present first results about the performance of the beamline concerning e.g. the available photon flux, the obtained spot size and the spectral purity including the higher order contributions.

Figure: The figure shows the photon flux provided by the new microfocus beamline in PGM and DCM mode at 300 mA ring current. Different coatings of the toroidal mirror and thin metal filters have been used to improve the spectral purity.

I plan to submit also conference proceedings

Yes

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