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Characterization of Non-Gaussian beam profiles of polycapillary lenses

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Polycapillary x-ray optics are a powerful tool to focus x-ray radiation in order to achieve small spot sizes of about ~10 µm. Especially the capability to focus radiation in a broad energy range (5-30 keV) shows polycapillary x-ray optics to be without an alternative for compact table-top EDXRF spectrometers. Since their invention in the early 1990s, a lot of developments were made and many characterization studies were carried out. A good qualitative and quantitative description of the beam profile is achieved in most cases by means of Gaussian intensity distribution functions. Severe deviations from this simple case can occur in the high energy regime of about ~20 keV, where photons can penetrate glass walls on straight paths creating a corona-like intensity distribution around the primary spot ('halo-effect'). As a consequence, the radiation transmitted by the polycapillary optics consists of a focused and an unfocused part. In this work, the experimental characterization of the beam profile is carried out with a modified knife-edge method using thin pure element foils. Afterwards, a suitable Inverse Radon-transformation is performed to gain the 2D-Intensity distribution from the 1D-Integral line scans, which can then be used as a model function to calculate fluorescence intensities from small microstructures. Finally, a comparison between calculated and experimental intensities will be shown.

Primary author: Mr BREMEKAMP, Marcel (Helmut Fischer GmbH Intitut fuer Elektronik und Messtechnik)

Co-authors: Dr LESKE, Jörg (Helmut Fischer GmbH Institut fuer Elektronik und Messtechnik); Dr BERNHARD, Nensel (Helmut Fischer GmbH Institut fuer Elektronik und Messtechnik)

Presenter: Mr BREMEKAMP, Marcel (Helmut Fischer GmbH Intitut fuer Elektronik und Messtechnik)

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