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How not to become a ghost writer

Accelerator-based photon sources have improved in brilliance, stability, and coherence over the last decades. To transfer those properties to photon-hungry and high-resolution-demanding users and experiments in the VUV-, soft- and tender X-ray photon energy range, high-quality blazed profile gratings are mandatory. In addition, such gratings are of interest e.g. for spectroscopic applications at laboratory sources or as master gratings for the production of replica gratings. Currently, their availability is critical due to technological challenges and limited manufacturing resources. To counterbalance this bottleneck, grey-tone e-beam lithography has been investigated for the production of blazed profile gratings. E-beam lithography (EBL) allows patterning of arbitrary shapes over relatively large areas in a short time. However, in order to achieve a high-quality grating and a stable manufacturing process and precise metrology is essential. We report on the ongoing investigation of blazed profile gratings to track the lithography process and on challenges that EBL poses to structure characterization. Measurements performed by atomic force microscopy as well as at-wavelengths at the Optics Beamline at BESSY II will be presented. We focus on the investigation of the imperfections and their causes. Ghosts are additional peaks that appear on the dispersion plane, which ultimately reduce the resolution and performance of the grating. At EBL they are caused by stitching of the fields while writing and reducing its impact on the scattering plane is sought.

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yes

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