ESRF	Two-dimensional x-ray waveguide gratings	**number:** 20-02-627
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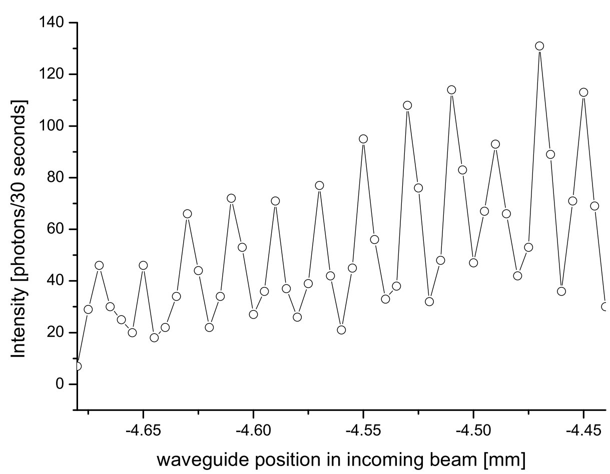
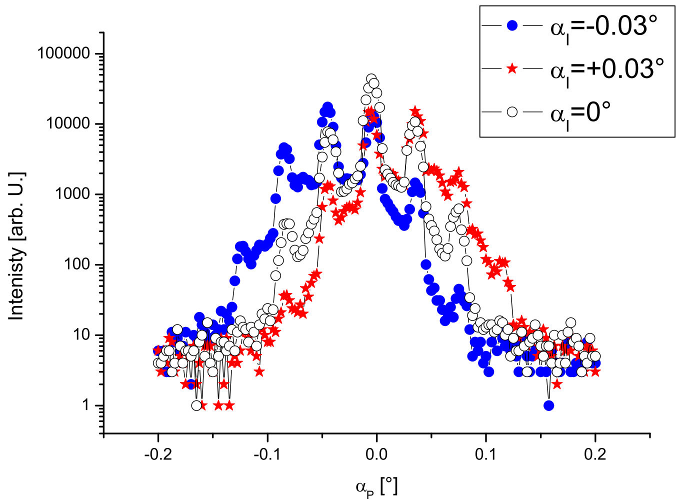
Report:

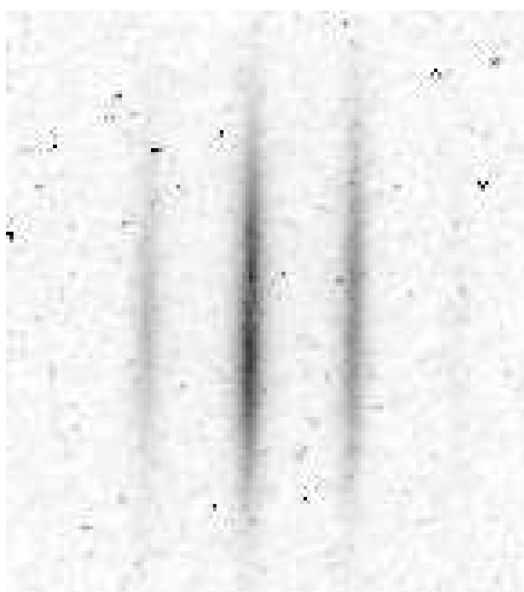
We have carried out measurements of the far-field pattern of two dimensional x-ray waveguides arranged on a lattice. These waveguide structures are prepared by spincoating a e-beam resist (e.g. Polymethylmethacrylate, PMMA) on a cleaned Silicon wafer. The resist is then structured in an e-beam lithography system (Lion LV1, Leica, Germany). After development of the structures a cladding material (here Silicon) is evaporated on top. As described in [1] these devices were recently used to produce a coherent and slightly divergent beam with a size of $25nm * 47nm$ at the exit of the waveguide.
Measurements of single two dimensional waveguides with a bending magnet beam are possible (see Figure 1, each peak corresponds to the illumination of a single two dimensional waveguide), but a detailed analysis of their properties is limited due the flux density at the entrance of such a waveguide. The photon energy was set to $E = 12keV$ with an integral flux of $5 * 10^5 photons/sec/mm^2$.



To overcome the demand of a high flux density at the entrance of such a two dimensional waveguide these structures can be arranged on a lattice with a period d_L. As described in [2] the field distribution behind such a structure is enveloped by the far field pattern of a single two dimensional waveguide (averaged over the lattice) and peaked at angles $\alpha_p = \arcsin \frac{n\lambda}{d_L}$. By changing the incidence angle α_I the center of the envelope of the far field pattern is shifted by $\alpha_{PC} = \alpha_I$ as is shown in figure 2:



A series of two dimensional CCD images of these waveguide lattice far fields were recorded. A typical pattern is shown in Figure 3. From these far field patterns it should be possible to reconstruct the E-field distribution at the exit of a single two dimensional waveguide and thus obtain information about efficiency of the optics. This work is currently in progress.



[1] A. Jarre *et al.* Physical Review Letters 94,(2005) 074801

[2] C. Ollinger *et al.* Physica B, 357 (2005) 53 - 56.