Focus characterization of the NanoMAX Kirkpatrick–Baez mirror system

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The focusing and coherence properties of the NanoMAX Kirkpatrick-Baez mirror system at the fourth-generation MAX IV synchrotron have been characterized. The direct measurement of nano-focused X-ray beams is possible by scanning of an X-ray waveguide, serving basically as an ultra-thin slit. In quasi-coherent operation, beam sizes of down to 56 nm (FWHM, horizontal direction) can be achieved. Comparing measured Airy-like fringe patterns with simulations, the degree of coherence $|\gamma|$ has been quantified as a function of the secondary source aperture (SSA); the coherence is larger than 50% for SSA sizes below 11 µm at hard X-ray energies of 14 keV. For an SSA size of 5 µm, the degree of coherence has been determined to be 87%.

The thick green line in the left figure shows the simulated intensity profile for a finite SSA size of 15 µm convolved with the WG channel. The right figure shows the experimental contrast values as orange circles at different SSA sizes between 5 µm (quasicoherent) and 50 µm (full flux). The thick red curve shows the corresponding WG-convolved simulated data. Experimental and simulated values agree within 2σ, and the experimental values reflect the oscillating behaviour of the contrast with minima at 18 µm and 36 µm.

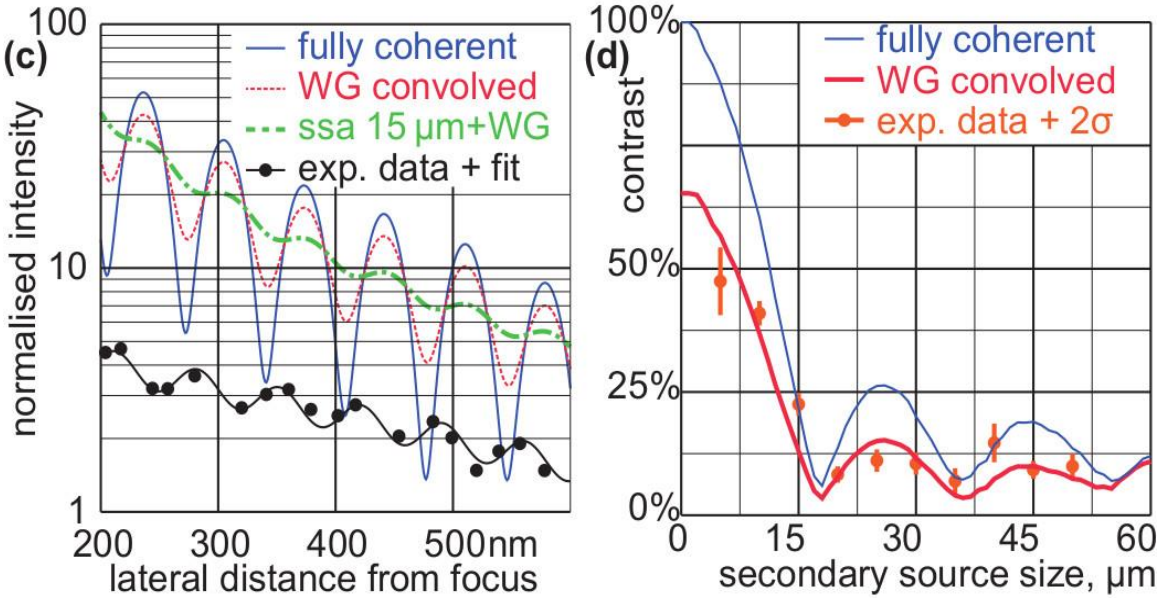

Figure 1: Simulated and measured fringe contrast to determine the coherence properties of the NanoMAX focussing system. Left: Fringe visibility at a fixed secondary source aperture; right: degree of coherence as a functino of secondary source aperture.