The SLS Optics Beamline - Performance Measurements and Status

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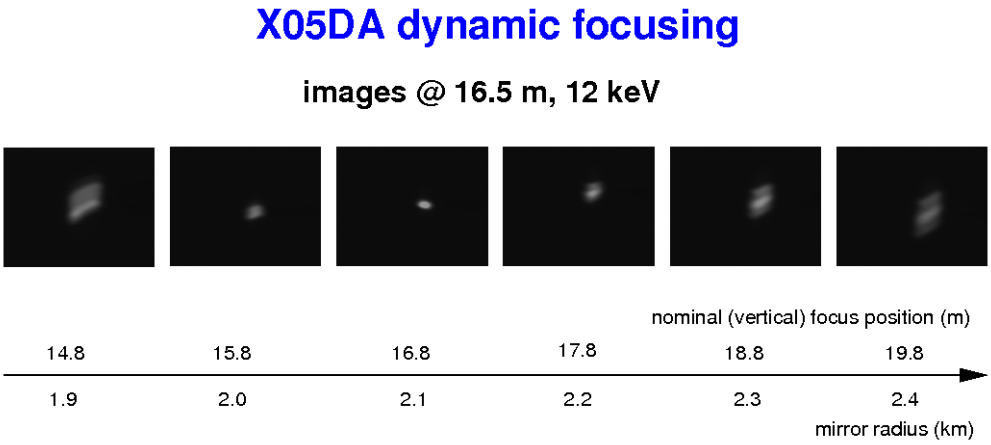
A beamline for experiments and developments in the field of X-ray optics and synchrotron radiation instrumentation in general has been installed and commissioned at the Swiss Light Source (SLS) bending magnet X05DA.

The beamline covers a photon energy range of about 5.5 to 22 keV with a cryogenically cooled channel cut Si(111) monochromator and a bendable 1:1 toroidal focusing mirror. The basic principle of the beamline has been taken over from the x-ray diffraction beamline at the Advanced Light Source (ALS BL 11.3.1) [1]. The details of the design and the hardware can be found in [2]. The monochromator and focusing mirror can be individually retracted to allow focused and unfocused monochromatic and pink beam respectively.

Since the first light in fall 2006 a basic experimental infrastructure has been installed and the beamline has been extensively characterized. Some characteristic measurements with focused monochromatic light are: a photon flux of 1.7 x 10^{11} photons/s at 10 keV with a resolving power E/ΔE of about 3000, a higher order contamination of 3% at 18 keV and a focus of (70 x 140) μm (v x h) @ 12 keV. The bender allows to shift the vertical focus along the beam path, alternatively one can collimate the light or defocus as shown in the figure. The mirror radius has been varied while the screen remained at a fixed position. Out of focus we see a not uniform intensity distribution which indicates residual slope errors of the focusing mirror.

In the unfocused pink beam mode we measured the power directly with a thermopile sensor. We received 10.6 W which is in very good agreement with the expectation. The horizontal opening of the beamline was 1 mrad and matched to the sensor acceptance (10 mm in diameter).



The focused pink beam mode has not been further investigated so far. The expected power density is 1.6 kW/mm^2. Tests showed- the 50 μm thick Kapton window which terminates the beamline melts within a few seconds i.e. to use this mode the experiments have to be inside vacuum.

The results of the performance measurements will be presented for the fist time. Possible applications of the beamline for "at wavelength" metrology and detector calibration will be discussed.

References

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