

Mirror Systems for SwissFEL, from concept to commissioning with X-rays

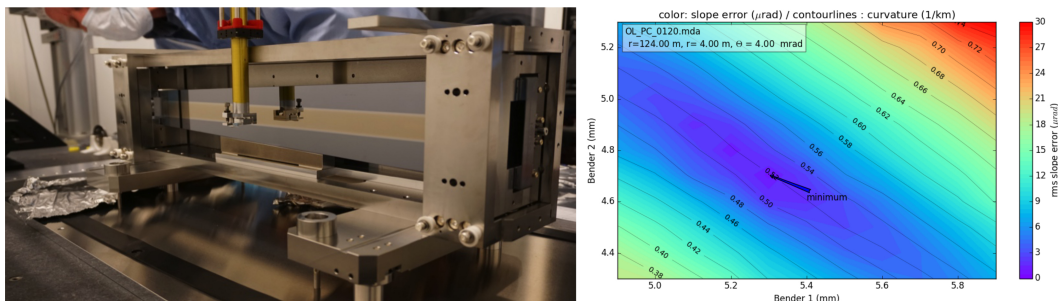
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The Aramis beamlines [1] at SwissFEL are currently under commissioning, first pilot experiments have already been carried out. This contribution will focus on the mirror systems. In total we have 10 mirror systems, 6 offset mirrors and 4 mirrors in KB configuration. Starting from the tolerable wavefront distortions we end up with single nm figure error specifications over 600 mm usable optical surface. We opted for flat mirrors from Jetec and Zeiss in 2-element mechanical bender systems built at PSI for the offset mirrors and bender systems from Toyama for the KBs respectively.

In the talk we will present the bender mechanics and optics in more detail. As central part we will describe our extensive test and calibration procedure. The mirrors have been mounted in the mechanics in our metrology lab. First we checked for possible twist errors introduced by the clamping with a Fizeau interferometer, then the complete bender mechanics with the mounted mirror has been placed in the final orientation under the LTP and 2d curvature maps have been recorded for calibration. Technically we did 3d scans- the local slope as function of mirror position and the two settings of the bender actuators. For the data evaluation we put in the nominal grazing angle and focusing distance and can extract figure error maps. The measurements were done fully automatised, unattended with the EPICS software used for the operation. In the last part of the talk we will present first commissioning results with X-rays. The benders are routinely used by the beamline operators and pilot users to adjust the focusing dynamically, the reproducibility and accuracy of the calibration settings appears to be very good- almost no fine tuning is required so far.



Horizontally deflecting KB mirror in mechanical bender. Left: Calibration measurement with LTP. Right: Curvature map and figure error for 4 m focusing distance, 4 mrad grazing angle.

References

- [1] Milne Christopher et al., "SwissFEL: The Swiss X-ray Free Electron Laser", APPLIED SCIENCES-BASEL 7, 720 (2017). DOI: 10.3390/app7070720