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Stitching Fizeau interferometry for X-ray optics metrology at MAX IV

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Precise metrology of synchrotron optics is essential for maintaining the performance of X-ray beamlines at diffraction-limited storage rings. We are developing a stitching Fizeau interferometer system designed to measure large synchrotron X-ray mirrors and gratings. Using a stitching approach, the system will provide full-aperture measurements of curved and flat surfaces, with sub-nanometre accuracy over lengths up to 0.75 m. The system will integrate a stable Fizeau interferometer with a motorized, multi-axis positioning platform, enabling automated scanning and acquisition across large optical surfaces presented sideways. Surface maps will be reconstructed from individual sub-aperture measurements using advanced algorithms, including using the PyLost software developed at ESRF. The design focuses on minimizing environmental noise, optical aberrations, and mechanical drift to ensure repeatable and reliable measurements. At MAX IV, the system will strengthen in-house capabilities in optical metrology. It will support the inspection of new mirror substrates before installation, the monitoring of ageing optics already in operation, and the optimization of mounting strategies.

Footnotes

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