



Instrumentation for high-resolution 3D imaging via X-ray ptychography at the SLS

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For nearly 15 years, the Swiss Light Source (SLS) has developed dedicated instrumentation for high-resolution 3D X-ray ptychography. In this presentation, I will provide an overview of the microscopes and show instrumentation concepts shared between these setups. I will discuss the current fIOMNI (flexible tOMography Nano Imaging) endstation, highlighting its integrated sample-environment module [1] and its sample position metrology / sample positioning architecture. The latter recently enabled 4 nm 3D imaging resolution in a semiconductor device using burst ptychography [2], demonstrating the impact of instrument design, but also pointing to limitations on ultimate imaging performance. Following the upgrade of the SLS to a fourth-generation storage ring, the cSAXS beamline has been equipped with an entirely new optics concept optimized for coherent imaging. I will present the new beamline layout as well as a related in-house-developed fast shutter system designed to cope with the expected high X-ray power.

References:

- [1] Holler M, Aidukas T, Heller L, Appel C, Phillips NW, Müller-Gubler E, et al. Environmental control for X-ray nanotomography *Journal of Synchrotron Radiation*. 2022; 29: 1223-1231. <https://doi.org/10.1107/S1600577522006968>
- [2] Aidukas T, Phillips NW, Diaz A, Poghosyan E, Müller E, Levi AFJ, et al. High-performance 4-nm-resolution X-ray tomography using burst ptychography *Nature*. 2024; 632(8023): 81-88. <https://doi.org/10.1038/s41586-024-07615-6>