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PtyNAMi: Ptychographic Nano-Analytical Microscope at PETRA III -How to achieve sample stability in the nanometer range

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In recent years, ptychography has been established as a method in X-ray microscopy to achieve a spatial resolution even below the diffraction limit of x-ray optics, down to a few nm. This requires, among other things, an extremely high degree of mechanical stability, a low background signal from the x-ray microscope and highest demands on the beam guiding and focusing optics.
PtyNAMi is the new generation hard x-ray scanning microscope at beamline P06 of PETRA III at DESY combining a sample scanner designed for maximal stability, a new detector system designed to reduce background signals, and an interferometric position control of sample and X-ray optics.
The interferometer system enables tracking the sample position relative to the optics in scanning microscopy and tomography on all relevant time scales. This is crucial for high-resolution scanning x-ray microscopy to track vibrations and long-term drifts in the noisy environment of a synchrotron radiation source in user operation.
We present the design concept in detail with a special focus on real-time metrology of the sample position during 3D x-ray scanning microscopy using a ball-lens retroreflector.

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