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Multi-Modal, Multi-Dimensional, Correlative Imaging: News from the GINIX

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The Göttingen Instrument for Nano-Imaging with X-rays is the nanofocus-setup at the coherence beamline P10 at PETRA III, DESY Hamburg. It features a 300 nm Kirkpatrick-Baez mirror system as a prefocus for X-ray waveguide (WG) optics; these WGs act as coherence filter and cleanup the X-ray beam from artefacts in the illumination. In holography mode, sub-50 nm resolution of biological / organic specimens becomes possible in three dimensions. In contrast, scanning nano-SAXS in the focused beam provides local access to physical quantities, e.g. orientations and sizes of collective scatterers such as sarcomeric structures.

A super-resolving optical fluorescence microscope has been combined into the X-ray micrscope. Using STimulated Emission Depletion (STED), the optical path of the setup allows for imaging of labelled molecules at a resolution scale of 100 nm; combined with the X-ray holography, the labelled functional components of biological cells (here: actin cytoskeleton in in cardiac tissue cells) can be correlated to the electron density. Then, the nano-SAXS measurements contribute spatially resolved scattering information.

We present a first correlative analysis combining STED and X-ray techniques on nenoatal cariac tissue cells. We can infer that the actin filaments, which are fluorescently labelled can be traced using STED, correlate to a significant extent with the filaments as segmented in the holographic X-ray image. From the nano-SAXS analysis, the filaments stand out by their anisotropic scattering, and the preferential orientation is quantified.

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