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Phase Constrast X-Ray tomography of biological tissues: methods and applications

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X-rays imaging can provide information about the functional (interior) architecture of complex biological organisms and tissues down to the sub-cellular level. Until recently, however, this potential of hard x-rays in view of penetration, spatial resolution, contrast, and compatibility with environmental conditions was significantly limited by the lack in suitable in x-ray optics. With the development of lens-less diffractive imaging and coherent focusing, the situation has changed. We now have nano-focused coherent x-ray synchrotron beams at hand to probe nanoscale structures both in scanning and in full field imaging and tomography. We explain how the central challenge of inverting the coherent diffraction pattern can be mastered by different reconstruction algorithms in the optical far and near-field. In particular, we present full field projection imaging at high magnification, recorded by illumination with advanced x-ray waveguide optics [1], and show how imaging and diffraction can be combined to investigate biomolecular structures within biological cells.

In this talk we present examples of biophysical and biomedical applications [2,3], with a focud on 3d virtual histology of human brain tissue [4], and discuss the novel opportunities offered by PETRAIV.

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