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Technological, computational and methodological aspects of High Dynamic Range Imaging

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Synchrotron and Free Electron Laser sources have enabled powerful imaging techniques with high impact research applications. Techniques like Computed Tomography (CT), X-ray Ptychography, and Coherent Diffraction Imaging (CDI) have a strong computational component due to their reconstruction algorithms [1] but also have high requirements from their detectors and electronics [2]. Those detector requirements regard energy sensitivity, QE, speed, resolution and dynamic range. This work reviews various characteristics of detectors applied on specific imaging techniques but focuses on that of dynamic range. In particular, it highlights the importance of high dynamic range on modern techniques like Ptychography and CDI (Figure 1). It presents technological issues related to detectors and electronics, computational aspects of HDR during reconstruction and processing, and finally outlines recent methodological research aiming at extending dynamic range [3].

Simulated data and actual acquisitions during beamtime experiments in an X-ray spectromicroscopy beamline (TwinMic @ Elettra Sincrotrone Trieste [4]) are presented.

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