Detector Needs for Imaging with High Spatial and Temporal Resolution

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The large depth of focus, the element and chemistry specific interaction near absorption edges and the simple analytical description of the wave-matter interaction make hard X-rays an invaluable imaging tool. They are particularly suited for quantitative three-dimensional imaging in absorption, phase contrast and fluorescence mode. Taking benefit of the high brilliance of modern synchrotron sources a large range of applications can be covered today.

However, while parallel beam illumination is extremely flexible for imaging, it puts stringent requirements on the high spatial resolution detector. Improvement of the detector efficiency, combined with the sensitivity of phase contrast imaging, will offer new possibilities in the imaging of biological and other radiation sensitive samples. Fast, real-time tomography allows characterising in-situ systems with an evolution time of the order of seconds in the best case. New experimental schemes and detectors have to be proposed to access much faster time scales.

Deep sub-micron X-ray imaging is an active field of research. Using a mirror device (Kirkpatrick-Baez) a focused spot size smaller than 100 nm was obtained with a very high photon flux. Such a point source can be used in a single setup for full-field projection microscopy and fluorescence mapping. The successful development of X-ray nano-imaging will strongly depend on adequate new detector technology.