Realtime 4D tomographic microscopy: the SLS experience.

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Abstract

The TOMCAT beamline of the Swiss Light Source operates multiple imaging end-stations, covering three orders of magnitude in spatial resolution (0.1-10 um) and enabling dynamical 3D acquisitions within a fraction of a second. The talk presents the latest achievements obtained in terms of instrumentation development and results, with particular emphasis on material science and biomedical applications. I will review some of the technical challenges which have been addressed in the recent past enabling dynamical, tomographic microscopy of flying insects and the alveolar visualization of the breathing mouse lung. I will further discuss the limitations of present setups and propose options to improve spatio-temporal resolution. Our future work will focus on the optimization of the acquisition protocols for ultrafast imaging (introducing the GigaFROST detector to users). I will present a few examples from material science applications (foaming processes) and geo-science (bubbling in volcanic rocks) where the ability of collecting 3D data within a short time (subseconds) over a longer period (a few minutes) is demonstrated. Consequently, real-time data interrogation becomes the next hurdle in modern, synchrotron-based tomographic imaging and calls for new, paradigm-shifting approaches. Examples from bone research will be illustrated and discussed.

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