Synchrotron-based radioscopy with spatio-temporal micro-resolution using hard X-rays

A. Rack [a, b], F. García-Moreno[c], O. Betz[d], S. Zabler[e], J. Banhart[c], T. Baumbach[b]
[a] European Synchrotron Radiation Facility, Grenoble, France
[b] Forschungszentrum Karlsruhe GmbH – ANKA, Karlsruhe, Germany
[c] Helmholtz Centre Berlin (Hahn-Meitner-Institut Berlin), Germany
[d] Zoologisches Institut, Universität Tübingen, Germany
[e] Technische Universität Berlin, Germany

The outstanding scientific value of time resolved imaging is known since the famous high-speed movies of living insects by Lucien Bull [1]. The use of synchrotron light sources allows the next step in the fast imaging development: the use of hard X-rays. Micro-radiography as an established method to image the internal structure of an object with micrometer resolution can be extended to study its temporal evolution as well. While direct converting pixel detectors are known which can acquire images with high frame rates [2] here detectors are needed with higher spatial resolution which can stand the highly intense synchrotron photon flux. Our approach is based on indirect pixel detectors which are already known for micro-imaging at synchrotron light sources [3, 4]. We combine those with CMOS cameras in order to achieve frame rates of 10.000 images per second or more, thus progressing to micro-radioscopy [5]. Applications are studies of living insects with moderate frame rates up to 250 images/s (ANKA, TopoTomo) and ruptures of individual cell walls in a liquid metal foam with 40 000 images/s (ESRF, ID15a).

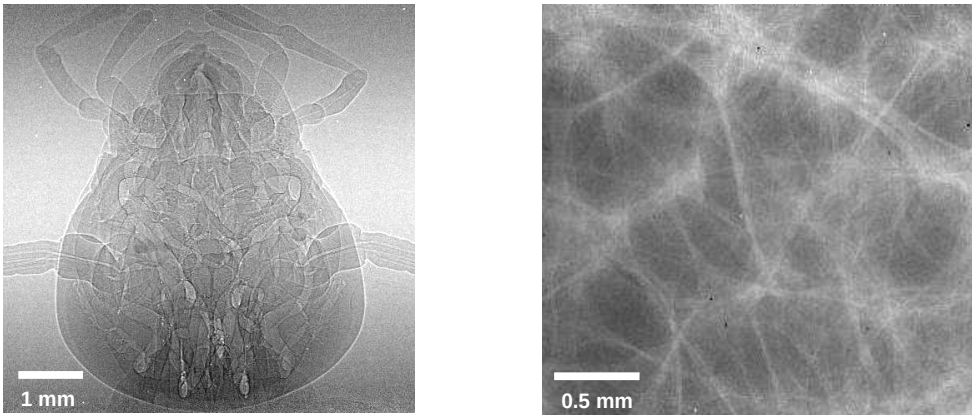

Figure 1. Left: radiograph of a living cockroach Periplaneta americana (250 FPS), right: Aluminum foam imaged with 10 000 FPS.

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