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Dose efficient, high resolution X-ray imaging applied to biological model organisms

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The main motivation of our work is to develop high-throughput as well as dose efficient X-ray imaging instrumentation and techniques for small animal imaging of vertebrate model organisms with high resolution and adjustable field of view (FOV) for multi-scale observations of whole organisms, organs, and cellular processes. High-resolution 3D and 4D X-ray imaging of model organisms and their developmental processes provides valuable insights and important information for life sciences without the need for dissecting the specimen, thus also allowing for *in vivo* studies. However, especially in the case of synchrotron *in vivo* experiments, the dose impinging on the specimen is crucial and has to be minimized.
Methodical routes for dose-efficient *in vivo* studies enclose in-line phase contrast imaging (PCI) and the use of Bragg Magnifier (BM) optics. By using asymmetric Bragg reflection, we achieve a magnification of up to 200 in 2D. By placing the BM downstream of the sample and combining it with a photon counting pixel detector, we obtain a highly resolving (sub-μm) and very dose efficient X-ray microscope. By placing the BM upstream of the sample, we can adjust the FOV up to several cm² and preserve or even enhance the coherence properties of synchrotron beamlines.
In this contribution we show exemplary results of high-throughput imaging of whole Medaka, *in vivo* PCI measurements of *Xenopus* embryos, as well as the design and first experimental results of the BM instrumentation.

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