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The Munich Compact Light Source (MuCLS) –a laboratory-size laser-undulator X-ray source for biomedical applications

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The Munich Compact Light Source (MuCLS) is a tuneable, brilliant and compact hard X-ray synchrotron source. Electrons are accelerated in a classical RF-accelerator and injected into a small storage ring (4.6 m circumference). X-rays are generated via a laser-undulator, realised as a short laser pulse circulating in an enhancement cavity. Thus, the MuCLS provides incoherently-produced brilliant quasi-monochromatic X-rays in the energy range 15 keV –35 keV. The MuCLS‘s radiation has been exploited for biomedical research focussing on this source’s particular advantages: partial spatial coherence, quasi-monochromaticity, milli-radian divergence angle and availability for longitudinal studies.
First, we present the MuCLS and its recent upgrades [1] before we highlight the value of compact synchrotron sources for biomedical applications, e.g. [2]. Results from phase-contrast imaging are shown, like improved detection of tumorous lesions in mammography and in vivo lung imaging in mice for the assessment of airway health or drug development. Furthermore, we demonstrate the benefit of K-edge subtraction imaging, e.g., for angiography and display the performance of the MuCLS for X-ray absorption spectroscopy.
[1] Günther, PhD-Thesis, Springer Cham, DOI: 10.1007/978-3-031-17742-2 (2023)
[2] Günther et al., J. Synch. Rad. 27, 1395-1414 (2020)

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