MS38 X-Ray diffraction on the micro-s and ps time scale

Chairs: Dr. Gergely Katona, Dr. Ullrich Pietsch

MS38-O1

Commissioning experiments at FemtoMAX - An X-ray beamline for structural dynamics

Jörgen Larsson[1], Henrik Enquist[2], Andrius Jurgilaitis[2], Amelie Jarnac[3], Thai Van Pham[2], Åsa Bengtsson[1], Carl Ekström[1], Xiaocui Wang[1], David Kroon[2]

1. Department of Physics, Lund University, Lund, Sweden
2. MAX IV Laboratory, Lund University, Lund, Sweden
3. Synchrotron Soleil, Paris, France

email: jorgen.larsson@fysik.lth.se

The FemtoMAX beamline [1] is driven by the linear accelerator (LINAC) at MAX IV. The design of the LINAC allows for electron bunches shorter than 100 fs in duration. We will, describe the FemtoMAX beamline and show some of the early commissioning experiments. The MAX IV LINAC is operated at 3 GeV energy and 2 Hz repetition rate. An upgrade to 100 Hz is mainly limited by a lack of a radiation safety permit for higher repetition rates. The electron bunches have a duration of 100 fs for a bunch charge of 100 pC. The MAX IV LINAC is a stable electron source, as the pulse charge vary less than 10%, and the fluctuations of position and angle of the beam fall within 10% of the beam size and divergence. The FemtoMAX beamline is equipped with a 666 period undulator with 10 m active length. When the short electron pulses are sent through this insertion device they emit femtosecond X-ray pulses with photon energy from 1.8 keV and higher. We will describe the X-ray optics including focusing optics, monochromator options and X-ray beam position monitors. An ultrafast laser system provides femtosecond optical pulses for optical pump – X-ray probe experiments. The laser system is located in a laser laboratory directly above the beamline. The laser oscillator is synchronized to the 3 GHz RF signal originating from the master oscillator. The synchronization between laser and electrons are monitored by an optical cross-correlator and a RF filter-based jitter-monitor. The direct timing of the laser relative to X-rays can be measured by a UV-sensitive, X-ray streak camera. End stations for scattering and spectroscopy are built to be interchangeable, whereas a chamber for atomic and molecular physics is placed behind the scattering and spectroscopy end-station. We will present the first experiments demonstrating the beamline capabilities. These experiments include strain generated in an optoacoustic transducer [2] and non-thermal melting.

References:

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Journal of Synchrotron Radiation 25, 570 (2018) https://doi.org/10.1107/S1600577517017660

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Demonstration of a 20 ps X-ray switch based on a photo-acoustic transducer
Structural Dynamics 4, 051102 (2017) http://aca.scitation.org/doi/10.1063/1.4993730

Keywords: Time-resolved Diffraction, Beamline, Non-thermal melting