MS39-P06 | Recent developments towards high-flux time-resolved and THz - SAXS-experiments at the EMBL P12 BioSAXS beamline

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The high-brilliance beamline P12 of the EMBL at PETRA III (DESY) is dedicated to biological small-angle X-ray scattering (SAXS) and is optimized for scattering experiments on macromolecular solutions. P12 offers automated sample delivery with on-line data processing capabilities but also tailored sample environments. In addition, the recent developments aim at exploiting the high flux for time-resolved SAXS experiments to study kinetics of proteins.

In the standard mode SAXS data are collected within 30-50 ms allowing one to study kinetics using e.g. a stopped flow device. For faster kinetics, a double multilayer monochromator (MLM) provides a flux of $5*10^{14}$ photons/second. With the MLM, the exposure times of about 1 ms on standard protein samples yield data of sufficient quality for further analysis and subsequent structural modelling. A fast rotating beam chopper was built to provide X-ray pulses for stroboscopic or pump-probe experiments with a tunable pulse length. A nanosecond laser was installed covering a spectral range from 335 to 2300 nm to trigger reactions through temperature-jump, release of caged compound or by perturbing photo-sensitive protein.

An additional setup utilizes terahertz (THz) radiation, which is expected to excite collective motions of protein domains, detectable by SAXS. As this non-equilibrium effect is assumed to be extremely weak and highly dynamic, a number of new developments in hardware, sample handling and software are necessary for such experiments. We present developments on the THz setup employing newly-developed microfluidic cells dedicated for combined SAXS-THz measurements.

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