Poster Presentation

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Status of the EMBL BioSAXS beamline P12 at PETRA III.

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The high-brilliance synchrotron beamline P12 of the EMBL located at the PETRA III storage ring (DESY, Hamburg) is dedicated to biological small-angle X-ray scattering (SAXS) and has been designed and optimized for scattering experiments on macromolecular solutions [1]. P12 offers both automated sample delivery and data processing capabilities plus tailored sample environments to cater for a diverse user community, spanning novices to experts. During the 2016 beam year, P12 had 240 user visits from across the world.

The undulator and double crystal monochromator deliver a beam of energy tunable between 4 and 20 keV with up 1*10^13 photons per seconds focused by bimorph mirrors down to the size of 200µmx100 µm. Recently, a multilayer monochromator has been commissioned increasing the total flux by a factor of 40.

High throughput solution SAXS measurements are performed in an in vacuum flow through capillary. The samples are automatically loaded by a robotic sample changer, which also cleans and dries the capillary between measurements. The typical exposure time is one second and the full loading/cleaning cycle finished within 1 minute. The flexible sample-detector-distance offers the option for wide angle scattering. Alternatively, an on-line size exclusion chromatography mode is available with additional spectrometers (UV/Vis, refractive index and MALS) attached for online purification and characterization.

For these experiments, particular care was taken to automate the measurements such that they can be performed with a minimal input from the user. Fully automated data collection by the sample changer robot is followed by the computation of the overall parameters of the solute (Rg, p(r), MW and 3D low resolution shape) by the data analysis pipeline SASFLOW within minutes after data collection. This high level of automation allows one to conduct and analyze over 1000 measurements per day and also allows for permit remote and mail-in operation.

The sample environment can be rapidly exchanged to conduct "non-standard" SAXS experiments such as scanning SAXS, microfluidic chips, etc. The beamline is further being developed to allow for fast time resolved measurements. With the multilayer monochromator and using the newly installed EIGER 4M detector, data can be collected at 750 Hz frame rate. A stopped flow device, already available at the beamline, allows time resolved data collection with a dead time of a few ms. Continuous flow chip and laser triggering devices are developed to further reduce the dead time and allow sub-ms time resolved SAXS experiments.

1. Blanchet, C. E., Spilotros, A., Schwemmer, F., Graewert, M. A., Kikhney, A., Jeffries, C. M., … Svergun, D. I. (2015). Versatile sample environments and automation for biological solution X-ray scattering experiments at the P12 beamline (PETRA III, DESY). Journal of Applied Crystallography, 48, 431–443.

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