

## Access modes to the highly automated BioSAXS beamline P12 of EMBL Hamburg

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The last decades saw a sharp increase in the use of small angle X-ray scattering (SAXS) for the characterisation of biological macromolecules in solution [1]. SAXS became an important part of the structural biologist's toolbox and dedicated instruments are essential to provide high quality beams and to support the rapidly growing requests to access SAXS beamlines. Here, we present the development of EMBL's BioSAXS beamline (PETRA III ring, Hamburg, Germany) [2]. The reported advances allow for a reliable collection of the weak SAXS signal from biological macromolecules in solution, and for the proper handling and online characterisation/purification of the sample. The high brilliance and low background beamline is equipped with a robotic sample changer [3] and an on-line size exclusion chromatography setup [4]. Data collection and analysis are highly automated, such that the first results can be obtained within a minute after data take. More than 100 user projects (for more than 300 user visits) are measured each year on this instrument. Beyond "standard" bioSAXS measurements, P12 exploits the high flux of the X-ray beam delivered by the PETRA III undulator for fast time resolved measurements. A recently commissioned multilayer monochromator, a EIGER 4M detector as well as a stopped flow device allow time resolved data collection with a dead time of a few ms. A beam chopper and laser triggering devices are now developed to further reduce the dead time of the reaction triggering to perform sub-ms time resolved SAXS experiments at the beamline. Various modes of user access to the beamline will be discussed. The automation at P12 allows mail-in/remote measurements and the user operation is further supported through European funded translational activities such as iNEXT-Discovery. Rapid access is available for urgent (e.g. Covid-19 related) proposals, the BioSAXS group supports service groups and is always open for new collaborations. Recently, a spin-off company, BIOSAXS GmbH ([www.biosaxs.com](http://www.biosaxs.com)), was founded utilizing the achievements made at EMBL Hamburg to streamline industrial access to synchrotron SAXS. BIOSAXS GmbH presently provides services for numerous pharmaceutical and biotechnological companies ranging from advanced SAXS measurements at the P12 beamline to complete projects involving sample handling, measurements, data analysis and reporting to answer the relevant medical, biological and structural questions. References [1] – Tuukkanen et al., *IUCrJ* 4(Pt 5):518-528 (2017). [1] – Graewert et al., *Current opinion in structural biology* 23(5) (2013). [2] – Blanchet et al., *Journal of applied crystallography*, 48(2) (2015). [3] – Round et al., *Acta Crystallographica Section D*. 71(1) (2015). [4] – Graewert et al., *Scientific reports* 5 (2015).