

MS16-1-2 CFEL TapeDrive 2.0: a conveyor belt-based sample-delivery system for multi-dimensional serial crystallography
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A. Henkel ¹, J. Maracke ¹, A. Munke ¹, M. Galchenkova ¹, A. Rahmani Mashhour ¹, P. Reinke ¹, M. Domaracky ¹, H. Fleckenstein ¹, J. Hakanpää ², J. Meyer ², A. Tolstikova ², J. Carnis ¹, P. Middendorf ¹, L. Gelisio ¹, O. Yefanov ¹, H.N. Chapman ¹, D. Oberthür ¹

¹Center for Free-Electron Laser Science, DESY - Hamburg (Germany), ²Deutsches Elektronen-Synchrotron DESY - Hamburg (Germany)

Abstract

Serial crystallography (SX) at both X-ray free-electron lasers (XFELs) and synchrotrons offers the possibility to collect data at non-cryogenic temperature almost radiation damage free and enables time-resolved crystallography of irreversible reactions. The necessary steady delivery of new micron-sized crystals of biological macromolecules sets it apart from traditional single crystal macromolecular crystallography (MX). For this, many new means of sample delivery have been developed [1]. Described here is a novel conveyor belt-based sample delivery system, the completely re-designed and re-engineered second generation of the CFEL TapeDrive. It is optimized for fast installation at beamlines, ease of use, low sample consumption and precise adjustment of several sample delivery parameters, like ligand concentration, pH and sample temperature. Through combination of these parameters and the additional possibility for time-resolved experiments (delay times of 50 ms – 180 s), CFEL TapeDrive 2.0 enables multidimensional serial crystallography experiments. It can now be used as standard instrumentation at beamline P11 at PETRA III (DESY, Germany) and is suitable for serial Laue crystallography with polychromatic X-rays. Additionally, it can be used at XFELs in air (e.g. at SwissFEL and LCLS), offering the possibility to combine the advantages of jet-based injection with those of fixed target-based systems. In the future, parts of the system will be automated to achieve rapid ligand screening with micron-sized crystals in various sample environments.

By introducing the CFEL TapeDrive 2.0, a platform for user-friendly multi-dimensional serial crystallography, we provide a novel approach for structural biology to further reveal details about how macromolecules keep our biological world turning.

References

[1] Sierra R.G. et al. (2018) Sample Delivery Techniques for Serial Crystallography. In: Boutet S., Fromme P., Hunter M. (eds) X-ray Free Electron Lasers. Springer, Cham. https://doi.org/10.1007/978-3-030-00551-1_5

Detailed drawing of the CFEL TapeDrive 2.0

