

Developments for automatic sample changing at the EMBL Hamburg structural biology beamlines

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In macromolecular crystallography basically two instrumental approaches for automatic sample changing systems exist: custom-made Cartesian robotic systems based on linear translations or systems constructed around multi-axis industry robots. Whereas the first approach can offer high speed and compact solutions, the second one may have advantages in the integration in different diffractometer environments and flexibility in performing the assigned task(s).

The EMBL Hamburg Unit has developed a sample changing system based on an ADEPT™ six-axis industry robot serving an existing diffractometer on the fixed wavelength BW7b beamline at DORIS storage ring. The main design considerations have been simplicity (e.g. all sample movements are performed by the robot, in particular those in liquid nitrogen), compatibility (e.g. compatible with the EMBL/ESRF baskets for SPINE sample holders), flexibility (e.g. the system can automatically load baskets into its main dewar) and reliability (e.g. robot grippers are heated to reduce problems related to ice formation).

The use of an industry robot requires also the application of industrial safety standards even when installed in a scientific environment. We have implemented a safety system in conformity with the European regulations.

The progress in automating the sample changing, sample centering and data acquisition process makes remote access to the instruments even more attractive. We have integrated the sample changing robot into the TINE control system developed by DESY (German Electron Synchrotron Center).

Until recently, the repeated change of samples on a diffractometer was one of the bottlenecks in the macromolecular crystallography pipeline. However, it is only a small step in the whole process of high throughput MX. Its integration into a wider concept for the planned structural biology beamlines at the future PETRA-III synchrotron will be described.