

## The High-Throughput Macromolecular Crystallography Beamline P11

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Beamline P11 at PETRA III in Hamburg is a versatile instrument for macromolecular crystallography (1). During the passed two years the beamline has proven very adaptable and has changed its mode of operation from fully onsite to almost exclusively remote operations. Many renovations were required to achieve this and some are still ongoing. These changes have allowed P11 to operate at full pace throughout the pandemic and the future developments aim to further improve the user experience and prepare the beamline towards PETRA IV.

During 2020 we enabled user operations via remote connection using FastX -access via a dedicated remote machine. Users were supported via VC, scientific accounts were taken in use for manual data processing and a user wiki was established. In 2021 we employed the Eiger2 X 16M as the stationary detector and migrated our autoproccessing from the beamline to the dedicated P11 nodes at the central computing facility, Maxwell. Additionally MXCuBE installation advanced to include the control of all hardware objects and our user lab received an OLT Shifter for semi-automated crystal mounting.

Serial Synchrotron Crystallography (SSX) with tapedrive has been developed at P11 within an LTP (2) and this has stabilised into a setup that is bookable via Door to all of the P11 user community. Experiments with external users took place in 2021 first as mail-in by staff and finally in December 2021 with users onsite. Currently another LTP is ongoing to develop real-time autoproccessing for serial data with CrystFEL (3).

In 2022 we aim to employ MXCuBE as our default control software and start the ISPyB integration. ISPyB will track shipments and communicate the sample details to MXCuBE, as well as act as a data archive. We also aim to establish parallel autoproccessing pipelines in addition to the currently used, xdsapp-based (4) autoproccessing and implement strategy calculation that includes dose estimate. Many of the above software developments are also harmonising the P11 interfaces with the EMBL PETRA III beamlines, paving the way to a uniform structural biology village at PETRA IV.

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