



Contribution ID: 108

Type: Poster

The new Chemical Crystallography Beamline P24 at Petra III (PEX-E), Desy

Monday, 17 September 2018 17:45 (15 minutes)

The shutdown of DORIS III discontinued some successful beamlines which served as main stations for a wide field of crystallographic applications ranging from diffuse scattering studies, charge density analysis, phase transitions, disordered and modulated structures all at ambient and non-ambient conditions.

A collaboration of a joint research BMBF project and Desy build up a new beamline at Petra III dedicated to all fields of crystallographic research. The beamline is in full user operation since spring 2018 and consists of two experimental hutches housing a refurbished Eulerian diffractometer (EH2) and a new heavy-load Kappa-diffractometer (EH2). Both instruments offer a compatible range of detectors (eg. Pilatus 1M CdTe, MarCCD, Ketek drift detector) and sample environments (10K-1300K, electrical fields, DACs).

The diffractometers are installed at a standard PETRA III undulator (2m, U29) using a CEMO-type water-cooled DCM (Si111/Si311) with preceding water-cooled mirrors for higher harmonic rejection (Rh/Pt-coated, 1.5 –3.0 mrad). Due to heat-load restrictions of the CEMO-DCM, additional Cu-coated diamond windows will reduce the low-energy range providing an optimised continuous range between 15keV –44keV and a smaller range around 8keV. The calculated horizontal and vertical beam profiles at 80m source distance and 17.7keV are 1.5 x 0.7 mm² and 0.6 x 0.3 mm² FWHM and FW90%M, respectively. Additional Be-CRLs are foreseen for further beam-focusing down to 6µm.

The Kappa-diffractometer (ca. 3.5 tons) offers two independent detector circles able to take loads of 30 kg each equipped with motorized counter-weights to balance a detector travel of 500 mm. The sphere of confusion (SOC) of the main circles (incl. Omega) for multi axis movements is below 10 µm and repeatability below 2x10⁻⁴ degrees. The inner circles (Kappa, Phi) provide a SOC below 25 µm for loads up to 5 kg with a maximum load of 10 kg. The Phi circle includes a motorized xyz-stage offering an accuracy in the micrometer range. The available space for sample environments is 190 mm, extendable to 250 mm by removing the stage. In combination with a modular mounting system, an easy exchange of different detectors or sample environments is possible.

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Presenter: PAULMANN, Carsten

Session Classification: Poster session 1

Track Classification: P1 Instrumentation and methods