In Vacuum HighResolutionMono with sub micro-radian resolution for IXS experiments at P01.

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At Petra III Beamline P01 a High Resolution Monochromator for energies down to 2.5 keV was installed in June 2017.

High Precision Goniometer

Description of the concept

A high interpolating Encoder with 1nm resolution in combination with a long piezo driven rod is chosen to cover an angular range of 40 degrees with a resolution of better than 0.5 micro-rad (theoretically 10 nanorad is possible). The maximal load of the high precision spindle ball bearing is 6 kg. All components must be compatible with a clean vacuum of 5x10⁻⁷ mbar.

Motivation

Due to high absorption of 2.5 keV photons in air (more than 99.9% at 100 mm) our high precision goniometers (three independent stages) for the high resolution monochromator had to be put into high vacuum (5x10⁻⁷ mbar). To our knowledge there is no vacuum compatible high precision goniometer at the market for this range of vacuum and for a load of 6kg.

High precision spindle ball bearing for 10⁻⁷ mbar

Resolution and stability of the 3 goniometers (500 nanorad steps required)

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Angular speed

From 0 to 10 millirad in 100 sec

The Dynamics Beamline P01 is dedicated to Nuclear Resonant and Inelastic X-ray scattering experiments.