

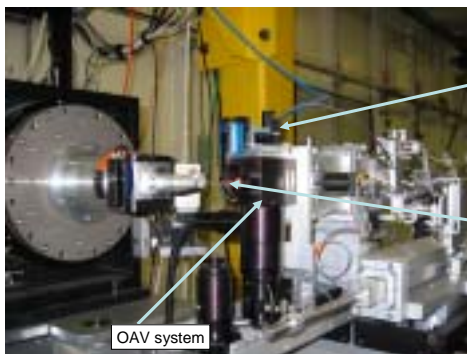
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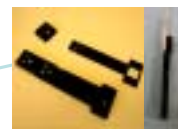
Abstract

Kinematic mounting principles are extensively applied to the mechanical structure design for high-precision instruments. The kinematic design is deterministic and does not rely on probabilistic approach. Kinematic mounting can provide repeatable relocation capability with high accuracy, which is very important for many synchrotron radiation experimental applications, such as x-ray crystallography and x-ray microscopy. In this paper, we present a series of compact magnetic-based kinematic mounting structures developed for sample holders, optics holders and tools for x-ray beam diagnostics at the Advanced Photon Source. Test results of positioning repeatability few microns performance for these kinematic mounting structures are also discussed in this paper.

Collimator and I₀ monitor on GMCA experimental station of macromolecular crystallography



OAV system



Kinematic mount for the I₀ monitor (photodiode) and aluminum filter. The diode in line downstream of fast shutter to monitor incident beam intensity

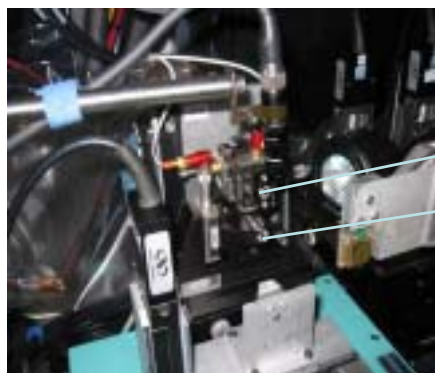


Collimator

Kinematic mount for collimator allows quick change of different aperture diameters (25 - 600 microns) according to sample size and for alignment beamline

The On-Axis-Visualization (OAV) system provides a parallax-free image of the direct beam at the sample position. This is accomplished by mounting a front-surface mirror at an angle of 45 degrees to reflect the image of the beam from a YAG scintillator at the sample position down to a 16:1 zoom optics and digital color CCD camera. Both the mirror and the objective lens nearest the sample have a 1.2 mm hole to allow passage of the x-ray beam.

Compact, stable, modular optics mounts for soft x-ray microprobe



Zone plate (ZP) and order-sorting aperture (OSA) mounted in the 2-ID-B soft x-ray microprobe



A

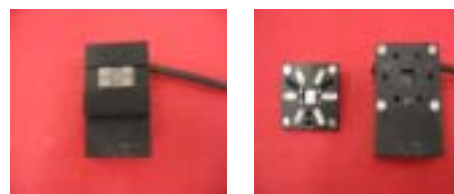


B

ZP
OSA

- interchangeable optics
- 2- μ m reproducibility
- recovers well from "crashes"

The soft x-ray nanoprobes (fig. A) is the heart of the scanning x-ray microscope. This modular assembly supports the ZP and OSA on magnetic kinematic mounts with 2 μ m reproducibility (fig. B). The ZP is aligned to the x-ray beam with a manual two-axis stage. Alignment of the OSA to the ZP is performed remotely with a three-axis stage driven by picomotors. The three magnets and three $\text{\O}1.0$ mm ruby spherical balls on the $\text{\O}10$ mm circle.



10 micron slit mounting allow quick 90 deg rotation to measure horizontal and vertical beam size. The mounting base used 4 magnets, 3 ruby balls.

Many shapes and sizes of kinematic mount were developed for various applications



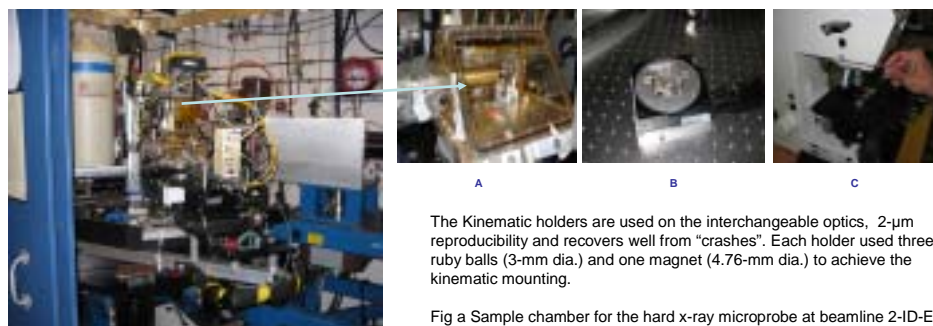
Summary

1. Implementation of automated sample centering
2. High repeatability
3. Easy and quick to change samples
4. Compact
5. Allow quick transport between instruments for different characterization

References

1. S Xu, Z. Cai and B. Lai "Mechanical design for an x-ray diffraction microprobe at the Advanced Photon Source" 2004 MEDSI meeting in ESRF (May 24-27).
2. Ian McNulty, S.Xu "The 2-ID-B intermediate - energy scanning x-ray microscope at the APS" International conference on X-ray Microscopy, Grenoble, France. July 28 - Aug.02, 2002
3. J. Maser, B. Lai, W. Yun, Z. Cai, S. Xu, E. Trackhtenberg "Near-field stacking of zone plates in the x-ray range" 2002 SPIE conference, July 7-11 Seattle, USA

Sample holder using on X-ray spectromicroscopy



A

B

C

The hard x-ray microprobe at beamline 2-ID-E at APS

The Kinematic holders are used on the interchangeable optics, 2- μ m reproducibility and recovers well from "crashes". Each holder used three ruby balls (3-mm dia.) and one magnet (4.76-mm dia.) to achieve the kinematic mounting.

Fig a Sample chamber for the hard x-ray microprobe at beamline 2-ID-E
Fig b Sample holder at beamline 2-ID-D
Fig c Identical sample holder used at a Leica optical microscope