

Submicron Stabilization of the X-Ray Beam Position on Long Beamlines

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The stability of the particle beam position and angle on third generation synchrotron sources such as the Advanced Photon Source (APS) at Argonne National Laboratory is extremely good. However, because of the long length of beamlines (50 to 70 meters) at such sources, small perturbations of the particle beam angle can result in undesirable beam movement in the experimental end station. Additionally, instabilities in the beamline optics may also result in beam movement.

At the BioCAT undulator source beamline at the APS, we have employed an X-ray beam position monitor (BPM) [1] in the experimental station at 61 m from the source to record the real time beam position in both the horizontal and vertical directions. A comparison of the RF-BPM in the storage ring and the X-ray BPM in the beamline confirm that positional changes of ± 20 microns in the experimental end station can be traced to angular changes of ± 0.3 microradians in the particle beam angle. Motion on this scale is particularly undesirable for small angle and solution scattering experiments that require small focal sizes on the order of 50 microns and positional stability on the order of 5 microns.

In this paper we demonstrate that the vertical beam position can be stabilized to better than ± 1 micron at distances of 60 to 70 m from the source. This was accomplished by using the position output in a closed loop feedback system to drive a piezo translator effecting the Bragg angle of the second crystal of the double crystal monochromator.

References

- [1] R. Alkire, G. Rosenbaum, G. Evans, Design of a vacuum-compatible high precision monochromatic beam-position monitor for use with synchrotron radiation from 5 to 25 keV. *J. Synchrotron Rad.* 7, (2000), 61-68.

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