Flux Optimization of an Illinois Tech Bending Magnet Beamline

Brinden Carlson, Carlo Segre, and Ali Khounsary

Department of Physics, Illinois Institute of Technology, Chicago IL 606016

X-ray absorption spectroscopy is a powerful X-ray technique for local structural characterization of materials. Because of the relatively weak transactions involved, a high flux beam is instrumental in obtaining high quality results. This can be achieved by using more powerful X-ray sources and/or by collecting and focusing of the X-rays.

In this paper, we report on the results of our investigation of several beamline configurations and focusing optics options for upgrading the bending magnet beamline operated by Illinois Tech for the Materials Research Collaborative Access Team at Argonne National laboratory’s Advanced Photon Source. At present, only a small vertical and horizontal portion of this bending magnet X-ray beam is utilized in X-ray absorption spectroscopy experiments. We use ray tracing simulation software to study and compare the photon flux resulting from several optical systems which focus both horizontally and vertically without compromising energy resolution. These results along with the cost, complexity, and reliability of various options are used to select an optimized upgrade path.

Keywords: X-ray optics, focusing, bending magnet, beamline design, photon flux, simulation, ray tracing, mirror, monochromator