New Capabilities at CHESS Beamline C1

K.D. Finkelstein, P. Abbamonte, V. Kostroun, M. Collins, W. Protas
Cornell University

At station C1 we are exploring applications for a novel monochrometer that can focus an intense beam of bend magnet radiation, and scan energy at high resolution. So far, it has been used for: inelastic x-ray scattering, high resolution fluorescence spectroscopy, & anomalous (resonant elastic) scattering and diffraction.

Improved energy resolution, up to 10 times better than a conventional double bounce mono, is obtained by inserting a channel-cut (2-bounce) crystal in so-called “dispersive orientation” between the first and last crystals of the standard CHESS design.

Increased resolution comes at the expense of monochrometer throughput. To maximize beam intensity a wide horizontal swath of radiation is collected, passed by the channel cut, and focused to 1mm by the CHESS microfabricated sagittally bent crystal [1,2].

We discuss the monochrometer, some recent improvements and extensions to the concept, and show experimental results to illustrate how it can be used.

References:

1 “Inelastic X-ray Scattering at Modest Energy resolution”, K.D. Finkelstein, J.Z. Tischler, and B.C. Larson, AIP Conference Proceedings CP417, 80-87 (1997).
2 “X-ray Optics Fabricated by Deep reactive Ion Etching”, K.D. Finkelstein, Sami Rosenblatt, Paul Cottle, Rev. Sci. Instrum. 73, 1464-1468 (2002).

This reduction in bandwidth can yield a number of benefits for macromolecular crystallography including the following:

- enhanced anomalous signal
- better control of the energy and resolution
- significant improvement in signal to noise ratio (more photons contribute to Bijvoet and dispersive differences)
- a reduced background in scattering from mosaic crystals
- directly address the *Radiation Damage Issue* by using a reduced number of photons (lowering the total dose) in a more efficient manner
- can lead to *new local structure information via near-edge diffraction spectroscopy*.