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Supporting information for article:

The TES Beamline (8-BM) at NSLS-II: tender-energy spatially-resolved X-ray absorption spectroscopy and X-ray fluorescence imaging

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S1. NSLS-II BM source characteristics

Accessible radiation from the NSLS-II dipole Bend Magnet is centered at only 3.25 mrad into the bend. This falls within the “nose” or ramping-up portion of the magnetic field (Figure S1). Calculations courtesy of O. Chubar.

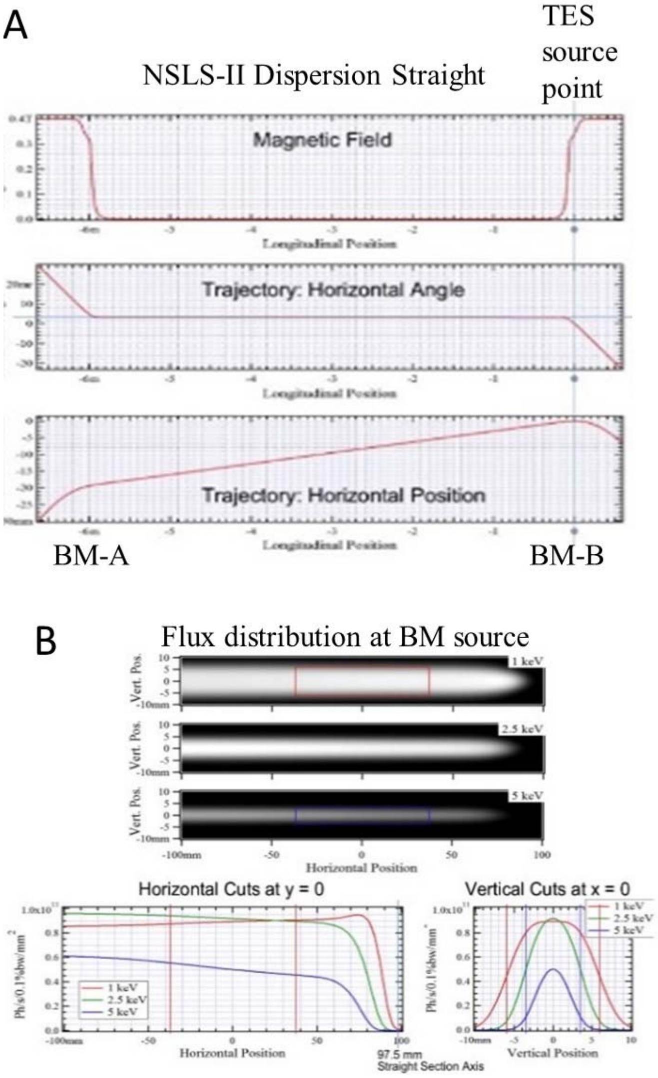

Figure S1 **A**) Magnetic field at the NSLS-II TES Beamline source point, indicated as vertical blue line. **B**) Photon flux distribution, viewed at 30 m projection, showing uniformity within about 10% at <5 keV across the beam footprint used for TES. Beamline optics acceptance is indicated by the red outline (at <2 keV) and the blue outline (at >5 keV). Note that the extent of vertical fan is energy dependent, which is well matched to beamline optics. The vertical acceptance of Mirror 1 is greater at the steeper pitch settings required for harmonic rejection at lower energies.

S2. Measurement of flux to sample

Optical configuration is set up differently for specific applications, to balance flux with energy range and harmonic rejection needs for a given experiment. Pitch of Mirror 1, Mirror 2 and the KB mirrors control high energy cut-off, and their angular acceptance defines flux throughput, so no single flux curve is applicable for all configurations. One example is given in Figure S2.

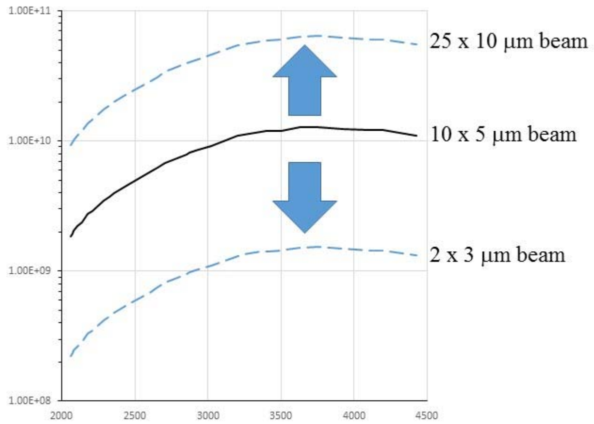

Figure S2 Representative example of flux curve for one general-purpose optical configuration, measured as a single continuous on-the-fly scan with no adjustment to optics. Values shown are photons/s, normalized to 500 mA ring current. The upper and lower curves are calculated for different beam sizes, as flux scales linearly with beam size within the range from 2 x 3 to 25 x 10 µm (H x V).

S3. Modifications to monochromator second crystal for fine roll adjustment

Commissioning of the monochromator confirmed the need for an additional fine roll adjustment to control horizontal beam trajectory and to compensate for small residual mechanical roll as a function of theta. While this was expected, it was first necessary to experimentally determine the total range and minimum increment needed to provide the necessary adjustments and feedback to maintain horizontal position of beam at the SSA. This new design was implemented for the second crystal (Figure S2). It uses a compound lever geometry with picomotor actuation to control of horizontal beam trajectory within 100 nrad. It replaced a simple block supporting the crystal.

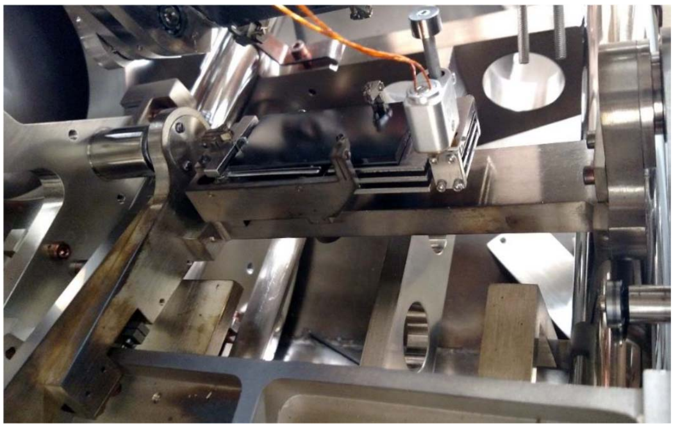

Figure S3 Modification of second crystal holder to introduce fine roll adjustment. Note picomotor at the inboard (right) end, and three plates providing leverage. The top plate supports the crystal. The picomotor moves the middle plate, which pivots to raise/lower the outboard end of the crystal with a 5.6:1 reduction of picomotor travel. In this arrangement, the crystal is held against firm contact points so as to avoid introducing new vibration modes. Crystal is 28 x 65 x 3 mm.