A fixed-exit high-efficiency Kirkpatrick-Baez micro-focusing optics for XAS and XRF microspectroscopy in the 6-13 keV X-ray energy range.

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Producing a microbeam is one way of getting spatially resolved X-ray images of large specimens (with respect to the size of the probe beam) via raster scanning methods. To perform spectro-microscopy imaging, additional constraints on the optics, such as achromaticity and ability to reach many absorption edges while preserving a high flux, can greatly simplify the experimental setup.

For this purpose, we have developed a special Kirkpatrick-Baez multilayer-coated optics. Prior to the experiment the shape of each individual mirror is optimized on-line according to the Bragg angle corresponding to the mean X-ray energy of the XAS spectrum or to the excitation energy (XRF). The multilayer coatings have been designed to produce an energy bandpass $\Delta E/E$ of 15% for any X-ray energy set within the 6-13 keV range, so that both focus size and throughput can be preserved while scanning the energy.

The setup is presently installed on the ESRF bending-magnet beamline BM5. It is combined with either a double-reflection Si(111) monochromator (XAS mode) or a low-pass double-reflection multilayer monochromator (XRF mode). Both are mounted upstream the KB with additional slits to further define the incident beam direction and position. In the focal plane, the smallest beam size achieved is presently of the order of 1 micrometer (40 m from the source) with a flux of 2 10^8 ph/s per mA of ring current when using the multilayer monochromator. In light of few examples we will present the performance and the limits of the system and emphasize the conditions for beam stability, in position and in size, over time.