Montel Optics for Synchrotron Applications in Different Sizes

Montel optics consist of two mirrors mounted side-by-side in an L-shape arrangement enabling a 2-dimensional beam shaping. A Montel optics with two elliptically shaped mirrors is point focusing, whereas two parabolic mirrors enable a collimated beam. A line focus is created with a hybrid optics, a combination of an elliptical and a parabolic mirror. High quality multilayer optics are essential for an excellent beam shaping with homogeneous beam properties. The Montel optics accumulate a lot of flux within a well-defined, pin-hole-like spot of expected size measured by 2D detectors or pin diodes. Nowadays, Montel optics are also used at synchrotrons, where they substitute the KB (Kirkpatrick-Baez) mirrors enabling a more compact design.

Multi-stripe Multilayer Optics

At imaging beamlines multilayer optics are often used as double crystal monochromator in synchrotron radiation. For example, tomography needs a homogeneous and stable beam profile, in order to perform optimal background corrections. Because of the high coherence of the radiation, the optical components must be designed with particular care in order to avoid a deterioration of the beam quality. Multilayer coatings with up to 5 stripes were produced with films homogeneities ≤ 0.2% as well as with lateral gradients.

Collimating Montel mirror as part of a multi-crystal analyzer system for resonant inelastic X-ray scattering

2D parallel beam multilayer optic for 11215 eV
Monteport: 150 x 7 x 10 mm ± 0.1 mm (L x W x H)
Acceptance angle: > 14 mrad x 14 mrad
Meridional slope error: ≤ 2 arcsec (10 μrad) rms
Microroughness: ≤ 2.0 nm (rms) HSFR
Coating: W/C Multilayer

Montel Optics for Synchrotron Applications in Different Sizes

Monteport: 100 x 4 x 6 mm: 0.1 mm (L x W x H)
Acceptance angle: > 10 mrad x 10 mrad
Meridional slope error: ≤ 2 arcsec (10 μrad) rms
Microroughness: ≤ 0.2 nm (rms) HSFR
Coating: W/C Multilayer

Montel Optics - 100-250 mm in length
Different cross sections from 40 x 40 mm to 10 x 10 mm: First optics, with slope errors < 2 arcsec, were sold to NSLS, DLS, APS and ESRF. They are used in inelastic scattering beamlines.

Diamond Light Source Ltd
Beamline: 816 at DLS, 34-ID at APS
Contact: John Shutter, John.Shutter@Diamond.ac.uk
Monteport: 40 x 40 mm x 20 mm ± 0.1 mm (L x W x H)
Acceptance angle: > 20 mrad x 20 mrad
Meridional slope error: ≤ 2 arcsec (10 μrad) rms
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Performance of a collimating L-shaped laterally graded multilayer mirror for the IXS analyzer system at NSLS-II

2D parallel beam multilayer optic for 9130 eV
Monteport: 100 x 4 x 6 mm: 0.1 mm (L x W x H)
Acceptance angle: > 10 mrad x 10 mrad
Meridional slope error: ≤ 2 arcsec (10 μrad) rms
Microroughness: ≤ 0.2 nm (rms) HSFR
Coating: W/C Multilayer


Comparison of Scatterless Pinholes SCATEX and Scatterless Slits 2.0

The measurements were performed by C. Golzow at the PTB four-crystal monochromator beamline on BESSY II at 8 keV with typical photon fluxes of ~10^{10} ph/s.

SCATEX pinhole

Scatterless Slits 2.0

Detector images of the parasitic aperture scattering at 8 keV with the new apertures being the beam defining element. No scatter guard inserted. The downstream photon flux was the same measured with the same number of summed up pixels. The data is normalized to the number of summed up pixel.

Deduced scattering intensity vs. q-plots (360°-integration) for the various tested apertures.

Comparison of SCATEX-Ta Pinholes and tungsten slits

The measurements were performed at 13 keV at the hard X-ray Diffractometer PO3 beamline at PETRA III with typical photon fluxes of ~10^{10}–10^{11} ph/s by C. Krywka.

SCATEX pinhole

Scatterless Slits 2.0

Deduced scattering intensity vs. q-plots (360°-integration) for the various tested apertures.

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