

B36

Asymmetric channel cut monochromator with quasi-fixed offset

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In many monochromatic X-ray applications it is important to maintain a constant direction of the monochromatized beam, preferably parallel to the direction of the original beam. For the most exacting applications independent-crystal two-bounce monochromators can be used. These however, are costly and cumbersome. Therefore, in less demanding situations or when space is at premium, two bounce channel-cut monochromators are commonly used.

Unfortunately, while the direction of the beam emerging from a channel cut monochromator is fixed, the beam offset varies with the angle of incidence, i.e., with the energy of the monochromatic beam. This complicates experiments in which it is important to maintain the beam on a fixed spot of the sample.

We show however, that the variation of beam offset in channel-cut monochromators can be greatly reduced by introducing a small amount of asymmetry into the cut. The exact amount of asymmetry (typically few degrees) depends, of course, on the crystal d-spacing and the energy tunability range. We will present a full mathematical analysis and a design of a working monochromator based on this scheme.