Aberrations of Bragg-case Diffractive-refractive Optics (Sagittal focusing)

Jaromir Hrdý[a], Alan Kuběna[b], Petr Mikulík[b], [a] *Institute of Physics, Academy of Sciences of the Czech Republic.* [b]*Institute of Condensed Matter Physics, Faculty of Science of the Masaryk University, Brno, Czech Republic.* E-mail: hrdy@fzu.cz

The diffractive-refractive optical device consisting of four crystals in (+,–,–,+) setting with longitudinal parabolic grooves has a geometrical aberration which influences the achievable focus size. This aberration is discussed analytically by using the improved formula for the calculation of focusing distance, which respects the finite distance between optical elements. The calculation of the intensity distribution surrounding the focus is illustrated by a ray-tracing method based on the dynamical theory of diffraction. It demonstrates an achievable focus size. Finally we discuss that this aberration may be suppressed by the slight narrowing of the groove profile. In particular, the parameter a in the equation of parabola has to slightly grow with x. A practical application may require an ultra-precise manufacturing of the grooves.

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