A Variable-Focus X-ray Compound Lens*

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Abstract

Design and fabrication of an x-ray lens assembly for focusing x-ray beams is described. The assembly consists of a number of precisely stacked and aligned aluminum parts. These parts are cut from a long extruded section having sixteen parabolic cavities along its length. The thickness of the wall between adjacent cavities is 0.2 mm. By cutting the assembled parts diagonally as shown below, a variable-focus lens system can be made. Moving the lens horizontally allows the incident beam to pass through fewer or more cavities collimating or focusing the emerging beam at a desired distance downstream.

The variable-focus aluminum lens has been used at the Advanced Photon Source to collimate a monochromatic, 81-keV undulator beam to increase downstream crystal monochromator throughput. Results indicate collimation consistent with theoretical expectations.

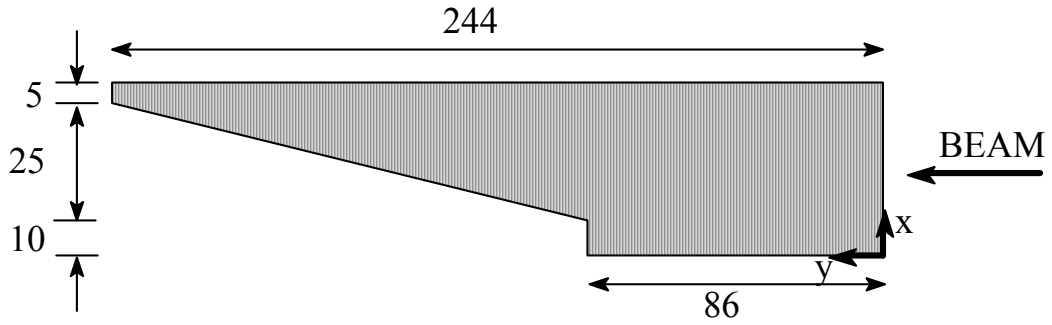

Figure: Cross-section of a typical variable-focus x-ray lens: the assembly focuses the beam in the z-direction (into the paper). Moving the assembly horizontally along the x-axis will vary the focal distance. Dimensions are in mm.

Keywords: x-ray, optics, lens, compound lens, variable focus, aluminum extrusion

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