LoMaX EDS Optic: Low Energy Gain

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The LoMaX EDS optic is a non-focusing and non-collimating optic designed to increase the performance of industry standard EDS detectors in the soft X-ray region below 1 keV. The placement of the EDS optic within 4 mm of the source allows for the efficient collection of low energy X-rays into a standard 10 mm^2 EDS detector. The result is a unity gain for X-ray energies above 1 keV which are passed directly through the optic without reflection, and a gain as high as 8 to 10 (C K_α) for low energy X-rays for which the optic has a significant effective total solid angle.

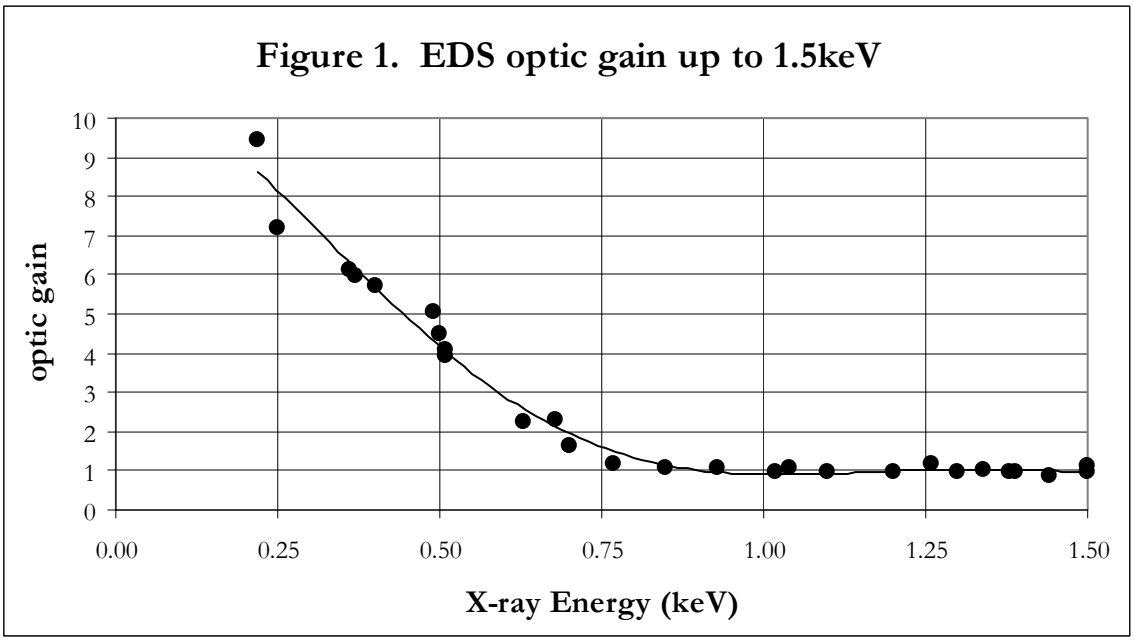

Figure 1 above shows the gain of the LoMaX EDS optic-- the ratio of gross peak intensity using the LoMaX to the gross peak intensity without it-- for all of the K, L and M lines available up to 1.5 keV. Two performance features are of interest. Despite the low effective total solid angle of the LoMaX about 1keV due to the decreased reflectivity at the grazing angles encountered, there is no loss of higher energy performance. Also, below approximately 750 eV there is a nearly linear relationship between the LoMaX gain and the X-ray energy.

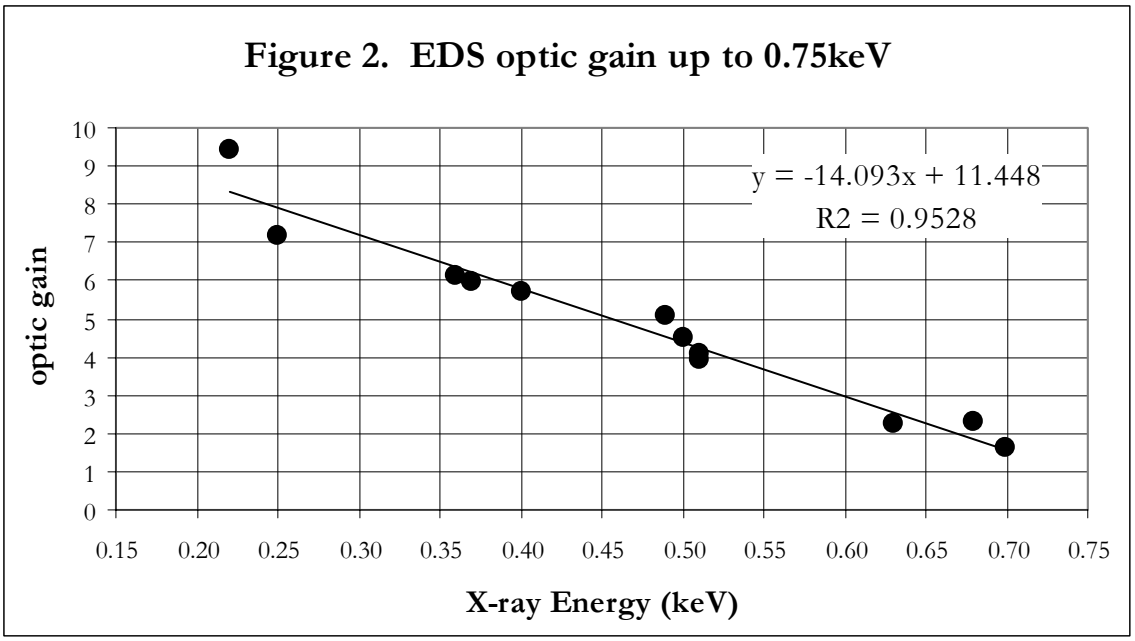

Figure 2 above shows the gain of the LoMaX EDS optic in the low-energy region. The linearity of the gain should be noted, and is fit to $\beta = 11.4 - 14.1*E$. This linearity is a useful feature, as it allows for the easy scaling of this data for the purposes of quantitation without standards, though it is assumed that use of the LoMaX in quantitative applications will involve the accepted use of standards.

The LoMaX requires some initial alignment to maximize its low-energy gain. It should be noted that larger low-energy gains can be obtained at the expense of sub-unity gain above 1 keV by moving the optic closer than 4 mm to the source. The LoMaX includes its own electron trap, and the design of the LoMaX allows for the quick replacement of the EDS optic with an electron trap for traditional EDS without low-energy gain. An indexed alignment slot allows the re-installment of LoMaX EDS optic without a need for additional alignment given a fixed SEM working distance and EDS detector insertion distance.

Applications of the LoMaX include: the enhanced detection limit of transition metal L-lines in low energy applications; better counting statistics in quantitation using low-energy lines; less uncertainty in background subtraction of low-energy lines; applications involving B K_α, C K_α and O K_α lines which are highly attenuated even in "light element" EDS systems.