# AbstractID: 11781 Title: A new method for calculating the half-value layer of x-ray beams

**Purpose:** Traditionally, half-value layer (HVL) of an x-ray beam has been calculated through either linear (Eq. 2) or semi-logarithmic (Eq. 3) interpolation under the assumption that attenuation varies linearly or monochromatically over a small range of attenuator thicknesses. Our aim is to evaluate the accuracy of HVL calculation using Lambert W interpolation (Eq. 4-6) and compare it to the traditional methods. **Method and Materials:** X-ray exposure was measured over a wide range of attenuator thicknesses on a CT scanner (range: 0.49 mm Al – 33.03 mm Al), a mammography system (range: 0.1 mm Al – 1.08 mm Al), and a general radiography system (range: 0.5 mm Al – 10 mm Al; range: 0.1 mm Cu – 0.45 mm Cu). Exposure was measured using a RadCal exposure meter connected to a 10-cm pencil ionization chamber for the CT scanner, a mammography chamber for the mammography system, and a 6 cc chamber for the general radiography system. Exposure values were measured at two different techniques for each system. **Results:** The percent transmission of the measured data was calculated and plotted versus measured attenuator thickness. The three interpolation methods used two measured data points that bracketed the HVL to construct percent transmission versus material thickness curves. Using data measured on a CT scanner for120 kVp, Lambert W interpolation yielded less than 5% error in the calculated HVL for approximately 89% of all possible interpolation and extrapolation point combinations. Using the same data, semi-logarithmic and linear interpolation yielded less than 5% error in the calculated HVL for approximately 38% and 5.6% of all possible interpolation and extrapolation point combinations, respectively. **Conclusion:** Lambert W interpolation is more accurate and less sensitive to the choice of interpolation points compared to traditional methods.