AbstractID: 1067 Title: Compensator thickness verification using an a-Si EPID

This work examined the capability of an amorphous silicon EPID to determine compensator thickness profiles by relating measured transmission to thickness on a 2-D grid. First the total transmission at the EPID, T_T, was obtained as the ratio of EPID energy fluence readings with and without the compensator in place. These readings were corrected for (i) non-linearity of EPID response using a calibration curve to relate EPID pixel values to energy fluence for open and attenuated beams, and (ii) field size effects using EPID scatter factors determined by an iterative process. Then the primary transmission, T_P, was extracted from the total transmission by subtracting the scatter component, T_S, which was estimated using a single Compton scatter model,

$$T_P(FS, x, y) = T_T(FS, x, y) - T_S(FS, x, y),$$

with FS the field size and (x,y) the point of measurement in the EPID imaging plane. Primary transmission was subsequently related to thickness via an exponential relation involving beam hardening,

$$T_P(FS, x, y) = \alpha \cdot \exp[-\mu(FS, x, y) \cdot t(x, y)/(1 + \kappa \cdot t(x, y))],$$

where α is a constant, μ is an effective attenuation coefficient, and κ is a coefficient that accounts for beam hardening. Parameters α, μ, and κ were determined from fits to EPID transmission measurements for flat attenuators, for a range of field sizes. The thickness determination method was then verified by making measurements for several flat, test, and clinical compensators. After accounting for compensator fabrication uncertainties, the results indicate that thicknesses can be measured to an accuracy of ~ 0.5 mm in regions where steep gradients are absent. Consequently, the method appears suitable for routine compensator quality control in the clinic.