AbstractID: 10996 Title: Experimental determination of central- and off-axis Scerma using scatter primary ratio

Purpose:

The absorbed dose for a clinical megavoltage photon beam can be separated into primary and scatter doses expressed as a convolution of the point spread kernels with Terma (*T*). This expression requires an additional beam hardening function to account for the difference of photon attenuation vs. energy for the photon energy spectrum. It has been established that the beam hardening function can be eliminated if one rewrite the convolution as modified polyenergetic energy deposition kernels with primary collision Kerma K_c, and S_c, Scerma, equal to T- K_c. Both K_c and S_c include beam-hardening effects but are with different depth dependence. However, no experimental method has been established to determine the depth dependence of S_c. In this study, we focused on developing a method to experimentally determine S_c/K_c at central- and off-axis.

Methods:

We use an empirical expression for scatter-to-primary ratio (*SPR*) as a function of photon energy to determine Scerma at infinite field size and depth. There are three parameters, a_0, w_0 and d_0, related to SPR, which need to be determined experimentally, and they can be directly correlated with attenuation coefficient μ. Therefore, one can determine central- and off-axis scerma, if μ is known. To confirm the off-axis Scerma we obtained from the off-axis μ(x), we propose an independent experiment to extract off-axis SPR. The SPR will be determined by fitting experimentally-measured TPR*S_p.

Results:

We have extracted the parameters from Monte Carlo simulated data at central axis in a wide clinical energy range. We find that a_0/w_0 is proportional to the beam energy at central axis, and this is the slope of the depth dependence of S_c/K_c. Our results also show that the ratio of primary Scerma-to-collision Kerma has linear depth dependence.

Conclusion:

Experimental method is developed to determine the off-axis Scerma, which is critical in convolution-based scatter dose calculation.