AbstractID: 7517 Title: A Study of the Impact of X-ray Energy and Angular Distributions Produced from 6- and 18-MV Medical Linear Accelerators on Non-target Exposures

Purpose: Recently two AAPM task groups have identified the need for more detailed data on the energy and angular distribution of bremsstrahlung X-ray photons produced from the target of medical linear accelerators. Previous studies had focused on primary photon beam toward the patient. On the other hand, X-ray photons produced at large angles are responsible for neutron activations in the surrounding of the accelerator head and for the secondary radiation dose to the patient outside the treatment volume. This paper presents our effort to create a database on angular X-ray energy and fluence distributions from a medical linear accelerator outside the primary beam direction.

Method and Materials: Parameters for a Varian Clinac 2100C operated in 6- and 18-MV were modeled using the MCNPX code. Energy and 360^{o} angular distributions of photons and electrons emanating from radiotherapy targets were determined using MCNPX. A tally sphere was placed around the target in order to characterize the full 4π emittance of these particles from the target. The tallies were binned according to energy and the directional cosine from a fixed vector pointing perpendicular to the target face.

Results: Both the 6- and 18-MV photon beams are mostly emitted in forward direction and are predominately in low energies. A low energy peak in the backward direction is also seen in the 6-MV distribution. The electron distribution emanating from the target for the 6-MV platform is highly backward directed, while the electron distribution from the 18-MV platform is mostly low energy and has a forward and backward directed contribution.

Conclusion: The results in these studies are consistent with data from previous studies. A detailed database on angular X-ray energy and fluence distributions from medical linear accelerator outside the primary beam direction will allow the sources of the secondary photonuclear interactions to be located and mapped.