AbstractID: 7761 Title: Modeling to Characterize Neutron Activation Products in a Medical Linear Accelerator

Purpose: Estimate production of prompt and delayed activation products for 18 MV source in Varian Clinac 2100C. The work supports AAPM task group TG-136 on assessing hazards to therapy staff due to activation.

Method and Materials: A detailed model of the Varian Clinac 2100C was developed in MCNPX. An 18 MV photon beam was produced by impinging double Gaussian-shaped electron parallel beam on a tungsten target with average energy of 18.3 MeV. The relative neutron yields from photonuclear interactions in the major components were calculated. In addition, several neutron fluence tallies were generated around the accelerator head. Another calculation was done in order to map the neutron fluence throughout the entire accelerator geometry. Two activation libraries ACTL and JEFF were considered in the simulations.

Results: The majority of the neutrons were produced in the primary collimator and jaws as a result of these components high-z composition (W). Also, more than 98% of the neutrons were produced in primary components. The neutron fluence tallies calculated at various locations around the accelerator are consistent with previous studies.

Conclusion: The neutron yield in primary accelerator components and neutron fluence map across the entire accelerator geometry were calculated. The origins of photonuclear products inside the accelerator allow the determine activation rates to be determined. Once the activation rates are determined, subsequent calculations can be performed using detailed anatomical human models to assess the unwanted activation dose to therapy staff, physics staff, engineering staff, patients, and patient's family members.