AbstractID: 9445 Title: Methods to calculate organ doses due to scattered radiation from external beam radiation treatment using various patient phantoms and Monte Carlo simulations

Purpose: It has been long known that patients treated with radiation carry a risk of developing second cancers in their lifetimes as a result of their treatments. In addition to hosting a symposium on "Secondary Cancer Risks for Emerging Radiation Treatments," the AAPM has recently formed Task Group 158 that will provide recommendations on the dosimetry protocols for quantifying scattered radiation dose outside the treatment volume. Measurements are useful in providing a relative comparison of different treatment modalities or beam characteristics. On the other hand, more precise organ dose equivalent values need to be calculated from Monte Carlo simulations and anatomically realistic computational phantoms. This study outlines a computational platform that integrates anatomically-refined virtual patient models with a detailed model of a medical accelerator head to calculate scattered doses to patients treated with radiation.

Method and Materials: A detailed model of a 6-MV Varian Clinac 2100C was developed in MCNPX. Several virtual patient models have been integrated with the accelerator head model in MCNPX. Various conventional and IMRT treatment plans have been considered.

Results: Average organ doses are significantly different than point-wise measurement values. The differences can be attributed to various sources of scattered radiation that deposits dose in the organ. Large dose gradients will be present throughout organs at short and intermediate distances from the tumor volume, while organs at longer distances will have a more uniform dose distribution.

Conclusion: A computational platform to calculate organ dose from scattered radiation during radiation treatments has been demonstrated. Results indicate that average organ/tissue doses are significantly different than point-wise measurements. Organ doses calculated in this manner will likely provide more accurate organ dose information for epidemiologic studies and for assessing the risk during the treatment planning.