AbstractID: 7237 Title: A Monte Carlo Study of the Out-of-Field Dose from IMRT

Purpose: To calculate the out-of-field dose resulting from intensity-modulated radiation therapy (IMRT) using Monte Carlo. Out-of-field radiation poses a health risk to the patient as it may induce late effects such as secondary malignancies. While this dose can be measured, measurements are time consuming and are specific to the irradiation conditions and patient examined. In contrast, Monte Carlo modeling can be flexible and applied to an arbitrary condition or patient, and may offer reasonable accuracy.

Method and Materials: MCNPX was used to create a Monte Carlo model of a Varian 2100 accelerator and treatment vault. Step-and-shoot IMRT of the prostate was simulated at 6 MV and 18 MV. The simulated patient was an anthropomorphic phantom, the CT of which was converted to MCNPX format using Scan2MCNP. The dose from photons and the dose equivalent from neutrons were calculated at various organ locations throughout the phantom. These calculated doses were compared to measured doses that were previously published, based on the same anthropomorphic phantom and IMRT treatments.

Results: The Monte Carlo model was able to accurately predict the out-of-field photon dose at both 6 MV and 18 MV. At 6 MV, the average absolute out-of-field photon dose was 14% different than measurement, while at 18 MV the average absolute out-of-field photon dose was 13% different than measurement. There have been a wide range of published neutron dose equivalents in phantom and our calculated neutron dose equivalents were consistent with these values.

Conclusion: Using Monte Carlo it was possible to calculate the out-of-field dose equivalent resulting from complex therapies incident on a complex phantom. Such a Monte Carlo model would therefore be a useful tool for evaluating the out-of-field dose received by patients undergoing radiotherapy.