AbstractID: 13605 Title: An RBE Rescaling Method for the Comparison of Intensity Modulated Neutron Radiotherapy Plans to Conventional Photon Intensity Modulated Radiotherapy Plans

Purpose: At our institution we have developed the ability to deliver intensity modulated neutron radiotherapy (IMNRT). Our goal now is to determine which clinical sites may benefit from the increased conformality and biological effectiveness that IMNRT provides, particularly with respect to conventional photon IMRT therapy. Here we present a method for comparing IMNRT treatment plans to conventional photon IMRT treatment plans.

Method and Materials: A patient treated previously with a combination of 3D neutron radiotherapy and photon IMRT for prostate cancer was re-planned for IMNRT and current standard of care photon IMRT. The IMNRT plans were created using an in-house treatment planning system, while the photon IMRT plans were created using Varian's Eclipse treatment planning system. Plan comparisons are made by converting all IMNRT cDVHs into *effective photon* cDVHs by applying a dose-dependent relative biological effectiveness (RBE) function point by point along the curves. Generalized equivalent uniform doses (gEUD) are then calculated for each structure and normalized to the prostate-GTV.

Results: The biological advantages of IMNRT given by the neutron RBE differences between structures are shown explicitly through the rescaling of each cDVH curve. For the IMNRT plans the bladder and rectum gEUDs are 39% and 53% of the prostate-GTV gEUD. The photon IMRT plans, while more conformal than our best IMNRT plans, deliver a higher dose to the bladder and rectum — 53% and 77% of the prostate-GTV gEUD — due to lack of RBE differentiation.

Conclusion: Including RBE and other biological considerations into plan comparison allows for a direct comparison between current photon IMRT treatments and possible IMNRT treatments at a given clinical site. This type of analysis should allow the design of IMNRT treatments that maintain normal tissue toxicities equivalent to those of standard photon IMRT treatments while exploiting the high LET nature of neutron radiotherapy.