AbstractID: 3704 Title: A Dosimetric Comparison between Laser-Proton Therapy and Photon IMRT

Purpose: Advanced treatment modalities are being developed for radiation oncology to improve local control and normal tissue sparing. The goal of this study was to perform patient dose calculations for laser-accelerated proton beams and to compare treatment advantages using laser-proton therapy with conventional photon IMRT.

Method and Materials: Laser-accelerated proton beams have broad energy and angular distributions. Small proton beams (beamlets) with limited energy spread were selected by a magnet system, and superimposed to generate spread out Bragg peaks (SOBPs) for proton therapy. The weights of the beamlets for the superposition were derived based on the Boltzmann transport equation and parameterization together with a gradient-search algorithm for plan optimization through intensity modulation. Monte Carlo simulations were performed for laser-proton treatment planning that used the same dose prescription and beam arrangement as those used in IMRT planning.

Results: Twenty prostate patients previously treated with IMRT have been included in this study. The comparison is made between IMRT planned on Corvus and laser-proton therapy on a home-grown Monte Carlo based inverse planning system. Our results show that better target coverage is achieved by proton therapy. Compared with IMRT, the target dose inhomogeneity ($(D_{5\%} - D_{95\%})/D_{95\%}$) can be reduced by 20-30%. The bladder dose can be reduced by up to 55% with proton therapy. Up to 40% of the rectum dose can be reduced using intensity modulated proton therapy.

Conclusion: Significant improvement in target dose uniformity and normal tissue sparing can be achieved using laser-accelerated proton beams. Intensity modulation can further improve the dose distributions for proton therapy of prostate cancer.