AbstractID: 11113 Title: Improved Dose Characteristics from Proton Arc Therapy

Purpose: IMRT is common for x-ray treatment, but proton treatment is still only performed at a few angles. Expanding proton radiation therapy to many angles may reduce dose to surrounding tissue. Beam technologies are moving forward (e.g., dielectric wall accelerator) making this practicable. This study seeks to quantify the reduction in dose to surrounding healthy tissue using proton arc therapy.

Materials and Methods: Monte Carlo simulations were performed using Geant4. Proton beams impinged on a 100mm radius cylindrical water phantom with a 10mm radius treatment region. Protons were delivered equally over all angles with -***r*** initial direction, producing kernals of rings of dose for each of several energies.

Results: Reduction in dose outside of the treatment region is dramatic for the high dose regions. Single beam therapy PDD is presented, the entrance dose is a large portion of the total dose, with a >50% of peak dose from 60mm from peak. The entrance dose may be spread through the typical clinical use of 2 or 3 angles, but this still leaves significant entrance dose. The lateral drop off can be sharp though.

The PDD is presented for proton arc therapy. The difference from the large entrance dose is significant. The distance to 50% dose is similar to the lateral drop-off with traditional beams, and drops to 10% within 25mm of peak, leading to a much lower average dose to irradiated tissue outside the prescription area. Proton arc therapy has the conformity of the lateral dose - without similar entrance dose - of traditional proton therapy.

Calculations are ongoing for avoidance regions and comparison with few angle treatments.

Conclusions: Proton arc therapy shows great potential for reduction of high dose to tissues outside the treatment region compared with traditional proton treatment.