AbstractID: 12857 Title: Effect of treatment and beam parameters on surface dose in proton beam therapy

Purpose: The advantage of lower skin dose in proton beam therapy may result in less radiation-related side effects which are typically seen in hypo-fractionated conventional external beam therapies. In this study, we evaluate the surface dose (SD) in proton therapy as a function of various beam parameters.

Materials & Methods: SD is defined as the ratio of absorbed dose on CAX at surface to that at the middle of the Spread-Out Bragg Peak (SOBP). SD in proton therapy is affected by several parameters: energy (***E***), ***SOBP***, source-to-surface distance (***SSD***), air gap (***g***), field radius (***r***), material thickness upstream of surface besides air (***t***), atomic number of medium (***Z***), beam angle relative to surface (***θ***), and nozzle type (***N***). The parameters, t, Z and ***θ*** are not included in this study.

Results: Giving a proton range in water of 27 cm, SD rises from 30 to 90% with SOBP increasing from 0 to17cm. At high energy, SD is 5% higher in the uniform scanning (US) nozzle than in double scattering (DS) nozzle. This can be explained by the large difference in source-to-axis distances in US and DS nozzles (250 cm vs 320 cm). SSD and ***g*** have minimal impact on SD for ***r*** > 2.5cm. For small fields (***r*** < 2.5cm), SD increases significantly with field size decreases. Within 15mm of the surface there is a small but pronounced 2% buildup in proton beam at high energies, which may be partially due to secondary electrons, secondary protons and heavy charged particles.

Conclusions: In a clinical setting, , SD is most significantly affected by SOBP extent, followed by field size, SAD, and beam energy. In general, SD ranges from 50 to 95%. It is important to clearly understand and minimize SD in Proton therapy, especially in hypo-fractioned treatments.