AbstractID: 8883 Title: An Efficient Technique for Commissioning a Tissue Heterogeneity Correction Algorithm for Treatment Planning for Lung Cancer

Purpose: To establish a measurement protocol for commissioning lung heterogeneity correction using the Pinnacle^{3TM} convolution/superposition algorithm based treatment planning system (TPS).

Method and Materials: A phantom with lung density material was constructed to investigate differences between dose calculated using the Pinnacle^{3TM} TPS and dose delivered using an Elekta^{TM} Synergy^{TM} linear accelerator. The phantom set-up was 4cm solid water then 4cm lung phantom material (Gammex), then either no bolus, 1cm bolus, or 2cm bolus; then 4cm solid water. Point doses were calculated by placing points of interest (POIs) along the beam central axis at various depths. All dose distributions were calculated using the Pinnacle^{3TM} adaptive convolve (AC) algorithm, for a 10x10cm^2 AP beam (6MV and/or 15MV) @ 100 SSD and 200MU prescription. Ion chamber and/or MOSFET measurements were performed between bolus slabs for the bolus containing phantoms and POIs were generated to obtain calculated dose for each dosimeter position. In addition, a MapCheck device was placed under each phantom to measure 2D dose distributions for comparison against the calculated 2D planar dose map.

Results: Agreement between calculated and measured dose using ion chamber was within ±1% for 19/23 measurements with a maximum difference of 3.23%. MOSFET measurements showed good agreement, as all measurements were within 3%. Evaluation of planar dose distribution with the MapCheck yielded a pass rate ranging from 93.2% to 98.5% based on 2% difference and 2mm distance to agreement.

Conclusions: Pinnacle^{3TM} TPS dose calculations using tissue heterogeneity showed excellent agreement with dose measured in a heterogeneous phantom using 3 different dosimeters. The measurement plan presented represents a simple, efficient, and accurate means for commissioning heterogeneous dose calculation algorithms for clinical use.