AbstractID: 11578 Title: Evaluation of a novel heterogeneity inclusive pencil-beam-based dose calculation by Monte Carlo calculation and by measurement in anthropomorphic phantom

Purpose: The shortcomings of the pencil beam (PB) algorithm in regions of tissue inhomogeneity have been well documented, yet multiple commercially available treatment planning systems still employ versions of this algorithm (e.g. Varian® *Eclipse*®, Brainlab® *BrainScan-iPlan,* Best Nomos® *Corvus*®). The continuing value of the algorithm lies in its ability to quickly/efficiently calculate dose in the iterative inverse treatment planning environment. A novel heterogeneity inclusive PB dose calculation method capable of improving dose prediction in areas of lateral disequilibrium, such as lung, which does not compromise the time efficiency characteristics of the PB algorithm has been proposed. The new method is evaluated in anthropomorphic phantom in comparison to Monte Carlo (MC) calculation and measurement.

Method and Materials: Alderson Rando and CIRS anthropomorphic phantoms are used with multiple embedded target sizes to measure dose via MOSFET and film. Measured values are compared to the Corvus ’08 effective path length (EPL) correction method, to a prerelease version of the new heterogeneity inclusive dose calculation model which is capable of modeling lateral disequilibrium and to Peregrine® Monte Carlo.

Results: In the anthropomorphic lung scenarios, Corvus ’08 EPL calculation experienced errors ranging from 1.4% to 19%, depending on tumor size and beam configuration, while the new model agreed within 1.4% of measurement for all cases. The new model was seen to agree well with MC predicted dose, as well.

Conclusion: The novel heterogeneity inclusive, pencil-beam-based dose calculation method demonstrated excellent agreement with both Monte Carlo prediction and anthropomorphic phantom measured dose. The algorithm appears capable of providing accurate calculation of absorbed dose in lung without compromising the advantage of constant time computational complexity for each pencil-beam to each point of interest.

Conflict of Interest: Research support provided by Best NOMOS.