AbstractID: 3884 Title: Dosimetric evaluation of the PEREGRINE IMRT MC treatment planning system at 6 MV for small fields in heterogeneous media

Purpose:
In a previous study Heath et al. reported good dosimetric accuracy between PEREGRINE and measurements in homogeneous and heterogeneous media, for 1x1 to 30x30 cm^2 fields. However, dosimetric accuracy for large field horns and inside the lung-equivalent phantom remained subject to further investigation. This work compares the effect of parameters directly related to the phantom with those related to linac beam modeling and discusses their effect on the calculated dose inside the heterogeneity.

Method and Materials:
To investigate the factors influencing the accuracy of 1x1 cm^2 depth dose profiles in lung, several dose calculations were performed and the effect of the following parameters were studied: the mathematical phantom's resolution, slice thickness, composition, density and dose collection voxel shape and size; and parameters influencing the PEREGRINE device file (which is the MC-derived correlated-histograms model of the beam) such as the width and shape of the electron beam (incident on the linac target) intensity distribution.

Results:
Our results show that modeling the lung component of the phantom as GAMMEX-RMI lung-equivalent material (ρ = 0.271 g/ cm^3) or as lung tissue (ρ = 0.26 g/ cm^3) results in less than 1% difference in dose to the lung, whereas using a device file with an optimized electron beam set of parameters to match the large field off-axis dose profiles results in 3% dose to lung difference. The agreement in dose to lung between this version of the device file and corresponding EGSnrc calculations is within 1%.

Conclusion:
When performing dosimetric verification calculations in heterogeneous media especially for small fields, attention must be paid to the effect of the details of the linac beam MC model (particularly the electron beam parameters) on the calculated dose in heterogeneities.

Conflict of Interest:
This work is supported by North American Scientific (Nomos Radiation Oncology Division).