AbstractID: 13868 Title: The effect of Smoothing on the Uncertainty in the Dose Distributions for a Commercial Electron Monte Carlo Algorithm

Purpose:
Commercial Electron Monte Carlo treatment planning algorithms such as the Eclipse algorithm (EEMC) are relatively new. The random variation inherent in these algorithms introduces new elements to their commissioning and use. For example, using these algorithms in a clinical setting requires a compromise between calculation time and resulting accuracy. The goal of this study is to explore the effect of the "Accuracy" and "Smoothing" settings in the EEMC algorithm on the uncertainty in the resulting dose distribution, and the calculation time.
Method and Materials:
Electron plans were calculated for a homogeneous medium and for a skin lesion located on the ear. The plans were first calculated to achieve an estimated uncertainty of < 0.1% without smoothing. This calculated dose distribution was treated as the true values. The same plan was then re-calculated multiple times with accuracy settings of 1, 3 and 5% using all of the different smoothing options available. Every calculation was performed with a unique random number seed to ensure that it was independent. The distributions were compared by calculating the percentage of voxels within the field which had a discrepancy of more than 3% from the "true values".
Results:
The inhomogeneous phantom shows a higher degree of uncertainty than the homogeneous phantom. The smoothing option which gives the lowest uncertainty depends on the accuracy setting but not on the phantoms used. Gaussian Smoothing performs better than Median Smoothing at higher "Accuracy". At "1% Accuracy" "No Smoothing" has a lower uncertainty than most smoothing settings.
Conclusion:
The trade off between speed and accuracy is not straight forward; significant gains in speed can be obtained without sacrificing accuracy by selecting the optimal smoothing parameters. Selection of the optimal accuracy should be based on the level of inhomogeneity. Selection of optimal smoothing should then be based on accuracy setting.