AbstractID: 9390 Title: Evaluation of the Monte Carlo dose calculation engine of Eclipse treatment planning system for electron beams

Method and Materials: Eclipse©'s electron Monte Carlo (eMC) (Varian, Palo Alto, CA) engine is a fast implementation of Monte Carlo (MC) method for radiotherapy treatment planning with electron beams. Several types of phantoms, combining low and high density heterogeneities ranging from air through lung to cortical bone, are used to evaluate eMC by comparing its results with measurements and with full MC simulations using DOSXYZnrc (NRC, Canada). Measurements with physical phantoms are done using EBT Gafchromic© films, leading to absolute dose. The phantoms are reproduced virtually in order to exclude the effect of the CTscan (HU - density conversion curve, noise, artifacts, …) in DOSXYZnrc and in Eclipse© for full MC and eMC calculations, respectively.

Results: Absolute dose profiles obtained via the three methods (measurements, eMC and MC) are compared. As expected, MC simulations agree better with measurements. The three methods agree quite well in general, within 5% even in regions of high dose gradients, which is a great improvement compared over the previous algorithms. However, larger discrepancies (as high as 10%) between eMC and measurements are found under the small heterogeneities, as was already reported by Ding et al (Phys. Med. Biol. 51, 2781 (2006)). Our differences are smaller though probably due to the fact that that they use smaller heterogeneities which is harder to model due to scatter. This is still under investigation. The effect of the use of CT-defined phantoms instead of the virtual phantoms is also part of this study.

Conclusion: Our preliminary results using virtually designed phantoms show that eMC simulations give a good agreement with measurements within uncertainties. This study is very encouraging and shows that it should now be possible to treat the electron beams with the same kind of precision as is already done for photon beams.