AbstractID: 13162 Title: 3D heterogeneous dose distributions for Total Body Irradiation Patients

Purpose: One major objective of Total Body Irradiation (TBI) treatments is to deliver a uniform dose in the entire body of the patient. Looking at 3D dose distributions for constant speed (*CteSpeed*) and variable speed (*VarSpeed*) translating couch TBI treatments, dose uniformity and the effect of body heterogeneities were evaluated.

Method and Materials: This study was based on retrospective dose calculations of 10 patients treated with a translating couch TBI technique. Dose distributions for *CteSpeed* and *VarSpeed* TBI treatments have been computed with *Pinnacle*^{3} *t*reatment planning system in homogeneous (*Homo*) and heterogeneous (*Hetero*) dose calculation modes. A specific beam model was implemented in Pinnacle^3 to allow an accurate dose calculation adapted for TBI special aspects.

Results: Better dose coverages were obtained with *Homo/VarSpeed* treatments compared to *Homo/CteSpeed* cases including smaller overdosage areas. Large differences between *CteSpeed* and *VarSpeed* dose calculations were observed in the brain, spleen, arms, legs, and lateral parts of the abdomen (differences between V100% mean values up to 57.5%). Results also showed that dose distributions for patients treated with *CteSpeed* TBI greatly depend on the patient morphology, especially for pediatric and overweight cases. Looking at heterogeneous dose calculations, underdosages (2-5%) were found in high density regions (i.e. bones), while overdosages (5-15%) were found in low density regions (i.e lungs). Overall, *Homo/CteSpeed* and *Hetero/VarSpeed* dose distributions showed more hot spots than *Homo/VarSpeed* and they were greatly dependent on the patient anatomy.

Conclusion: *CteSpeed* TBI treatments allow a simple optimization process but lead to less dose uniformity due to the patient anatomy. *VarSpeed* TBI treatments require more complex dose optimization, but lead to a better dose uniformity independent of the patient morphology. Finally, this study showed that heterogeneities should be considered in dose calculations in order to obtain a better optimization and therefore, to improve dose uniformity.