

AbstractID: 9271 Title: Full 3D heterogeneous dose calculation for Total Body Irradiation: a comparison study between different treatment planning systems

Purpose: To realise a full 3D heterogeneous dose calculation for total body irradiation (TBI) cases treated with a translating couch technique and to compare different treatment planning tools.

Method and Materials: A retrospective study was performed on 7 patients. Dose distributions obtained with *Pinnacle³ v.7.9u* (Philips Medical Systems) were compared with those calculated with our actual TBI planning system *Theraplan Plus* (TPP) by MDS Nordion/Nucletron. Two different *Pinnacle³* models were studied: standard beam commissioning (*std_Pinnacle³*) and TBI commissioning (*TBI_Pinnacle³*). For the later case, the commissioning was adapted for TBI and its special conditions (extended SSD of 190cm, large field, acrylic beam spoiler, and out of field dose (OFD)).

Results: The retrospective study on 7 patients showed significant differences between *TPP*, *std_Pinnacle³* and *TBI_Pinnacle³* dose distributions. Relative homogeneous mid-line doses were compared. Differences up to 12% were obtained and a systematic overestimation of 5% was found in patients extremities (e.g.: head and legs) between *TPP* and *TBI_Pinnacle³*. Average dose underestimation of 3% was observed between *std_Pinnacle³* and *TBI_Pinnacle³*. Differences in patient extremities are attributed to the OFD contribution which is not correctly computed in *TPP* and *std_Pinnacle³*. Dose comparison outside the patient mid-line showed greater differences (up to 20%) between models. Because only *TBI_Pinnacle³* takes into account the beam spoiler effect, other models underestimate shallow doses. An accurate 3D heterogeneous dose calculation is possible with *TBI_Pinnacle³* model. Results showed major differences (homogeneous versus heterogeneous) in high and low density regions as bones and lungs. Dose overestimation of 5% was observed in bone regions and dose underestimation of 5% to 10% was observed in lung regions.

Conclusion: Those results are of major interest since, depending on the treatment planning system and its beam commissioning, it could lead to significant dose misevaluation. Heterogeneous dose calculation should be performed with TBI specific beam commissioning.