AbstractID: 11399 Title: Impact of D_m vs. D_w in electron beam Monte Carlo based treatment planning for breast

Purpose: One of the issues arising when using Monte Carlo based treatment planning systems is "dose-to-water (D_w)" vs. "dose-to-medium (D_m)" calculations. The two are conceptually different and the method used has an impact on the reported doses to tumor and different organs. A systematic analysis of clinical data is needed to help understand the differences between the D_m and D_w approaches and for more accurate evaluation of treatment outcomes. **Method and Materials:** The analysis included plans for phantoms containing soft bone and lung heterogeneities as well as 54 breast cancer patients treated with electron beams. Comparisons between D_m and D_w plans were performed by means of dose volume histograms and isodose distributions. **Results:** The plans for phantoms show very small differences between the D_m and D_w approaches, consistent with medium/water stopping power ratios (lung/water=0.985, soft bone/ water=0.980). Differences between D_m and D_w were also observed in clinical plans, with magnitudes depending not only on the beam energy but also on the location of the tumor and organs at risk. The largest difference was found for a treatment of the chest wall with 13 MeV electrons following a complete mastectomy. The dose to the sternum was 49.9 Gy and 50.7 Gy for D_m and D_w approach, respectively. This amounts to 1.52% difference in the maximum dose delivered to that volume. For the same patient, the dose received by the internal mammary nodes was 46.9 Gy and 46.2.4 Gy for D_m and D_w plans, respectively, corresponding to a 1.27% difference. **Conclusion:** For breast patients, the plans calculated for D_m and D_w showed only small differences consistent with the ratios of medium/water stopping powers and depended on beam energy, location of the tumor and organs at risk.