AbstractID: 4641 Title: Accuracy of CT based volume measurements performed by four different treatment-planning systems

Purpose: To investigate the accuracy of volume measurements in phantoms with known volumes calculated by four radiation therapy treatment-planning systems from routine-clinic CT images and evaluate their overall performances. The methodology to improve the accuracy is proposed.

Method and Materials: An ellipsoid mammosite was used as a phantom injected with 35, 45, 55, and 65cc of saline separately, and scanned by a multi-detector CT (GE, 4-Slice helical Scan, 1.25mm thickness, 512x512). The images were transferred to 4 treatment-planning systems: GE simulation workstation, ADAC Pinnacle, BrainLab and Varian VariSeed. Image windows & levels were adjusted to see the wall of the phantom and kept same in each system. ROIs of the phantom and central catheter were segmented in CT slices by automatic contour tool (unavailable in VarianSeed, manually contoured by a physicist). The total volume of each phantom was generated from 3D ROI stack by volume-calculating toolkits. The actual saline volume in each phantom was calculated by subtracting the catheter volume from the total phantom volume. To approach the true injected volume, dilation or erosion of phantom's ROIs was performed.

Results: The average measured and the true volumes varied by -9.86%, -10.24%, -11.748%, -13.02% for the GE, Pinnacle, BrainLab, and VariSeed systems respectively. For 35cc phantom, if phantom ROIs were dilated by two pixels, the measured volume was approaching its true value. The difference between average measured and the true volumes decreased from -11.74% to -10.15 when phantom volumes increased from 35cc to 65cc

Conclusions: Image **w**indows & levels have the greatest impact on calculating accurate volumes. All planning systems underestimated the true volume of the phantoms by about 11%. This underestimation should be factored in the clinical settings when calculating Dose Volume Histograms especially for IMRT plans. Furthermore, two-pixel dilation could fill the gap between measurements and true volumes.