AbstractID: 8881 Title: Using Dose Mass Histograms (DMH) for the Evaluation of Head and Neck IMRT plans Calculated by Monte Carlo

Purpose: Dose volume histograms (DVH) represent an important tool for the clinical evaluation of radiotherapy treatment plans. For head and neck regions, however, the presence of air cavities makes the DVH tool less adequate for Monte Carlo calculated IMRT plans. The air cavities may introduce high dose uncertainties in both air cavities and surrounding tissues (interface effects**)**. Since the dose to air is clinically irrelevant DVH becomes less clinically representative in the presence of large air cavities, and hence is no longer a good parameter for plan evaluation. In this work we assess the limitations of DVH for head and neck plan evaluation and investigate the dose mass histogram (DMH) as an alternative to overcome those limitations.

Method and Materials: Seven IMRT head and neck cases were included in this study. The Monte Carlo simulation geometry (2mm voxels) was built from patient CT data. Patient dose calculations were performed using the EGS4 based MCSIM code and photon source models for 6 and 10MV beams. Isodose distributions and DVH (including air) were generated for these plans. A new feature was created in order to calculate DMH for both the target (PTV) and critical structures. In addition, DVH excluding air were also generated.

Results: Our results for the 7 patients show significant differences (up to 10%) between the DVH calculated including and excluding air for the PTV and critical structures. DMH, on the other hand, eliminates the effect of large Monte Carlo statistical uncertainties in air cavities and is a better parameter than DVH for evaluating head and neck IMRT treatment plans.

Conclusion: DMH is a better parameter than DVH for evaluating treatment plans calculated by Monte Carlo simulations that may have large statistical uncertainties in low-density regions such as air cavities and lung tissues.