AbstractID: 5201 Title: Investigation of respiratory motion effect on lung tumor radiotherapy using 4D Monte Carlo treatment planning and 4D CT

Purpose: To investigate the respiratory motion effect on lung tumor radiotherapy using 4D Monte Carlo treatment planning and 4D CT.

Method and Materials: 4D CT images for four lung patients (two upper lung tumors and two lower ones, with different volumes) were acquired by using a GE LightSpeed-QX/I scanner. Ten phase bins were used in the 4D-data acquisition. A 4D Monte Carlo treatment planning system based on the EGS4/MCDOSE code was developed to calculate the 3D dose and map the 3D dose of the CT at each phase to the inhale CT (as reference). CT images at different phases were registered with the inhale CT image using a BSpline deformable registration model. Isodose lines and the DVHs of tumor and normal lung were used to compare the 4D plan (3D dose mapped from the CT at 10 selected phases to the inhale CT) and the 3D reference plan (3D dose for the inhale CT) for each patient. Respiratory motion effect was investigated for the different tumor volumes and locations.

Results: In our study, for the upper lung tumors, the respiratory motion effect on target dose coverage was insignificant (<2% difference between the 4D plan and the 3D reference plan). However, for the lower lung tumors, the motion effect was clinically significant (>3% difference between the 4D and 3D plans). For the same PTV margin, less motion effect was observed for larger tumor volumes. The motion effect for the normal lung volume receiving dose was not correlated with the tumor volume or the location.

Conclusion: Respiration motion may significantly influence the tumor dose in lung radiotherapy and 4D dose calculation may be necessary when treating tumors in the lower lung or when the tumor volume is small