AbstractID: 11302 Title: Investigation of dosimetric effect of repiratory lung density variation

**Purpose:** To investigate the dosimetric effect of respiratory lung density variation in proton and conventional x-ray beam delivery

**Method and Materials:** 2D dose for proton and x-ray beams have been calculated for homogenous slab water medium and for that with lung heterogeneity. The central-axis depth-dose curves were generated at different depths (4, 8, 10 cm) of lung heterogeneity as well as those with lung heterogeneity at fixed depth (3 cm) with various lung densities (0.3, 0.45, 0.6 $g/cm^3$) for both proton and x-ray beams. We used PLM (Lee and Sandison 2004a, b), analytic proton loss model, and DPM (Sempau et al 2000), Monte Carlo dose calculation model, for proton and x-ray, respectively.

**Results:** We found that protons spread more and penetrate deeper with lung heterogeneity introduced. We also found that x-ray dose values at depth and lateral spread are affected significantly by lung heterogeneity. Central-axis depth-dose calculation shows that proton dose is more radically affected by the location of lung heterogeneity compared to that for x-ray dose. However, the lung density change with fixed depth of lung heterogeneity shows that both beams are largely affected by the lung density changes. Specifically, the proton range is significantly affected by lung density variation while the maximum dose was affected similarly to that for x-ray.

**Conclusion:** It was found that the depth of lung heterogeneity and its density variations are challenging for proton therapy because the dose spread, range, and maximum dose are radically affected by them while for x-ray beams, only maximum dose and doses at depths are significantly affected. The results suggest that the respiratory lung density variations during proton therapy need to be considered in addition to the lung target motion to avoid healthy lung tissue from receiving high dose.