AbstractID: 9584 Title: Distal edge coverage movement for a protontherapy treatment in Lung tumor

**Purpose:** The objective of this work was to determine the optimal margin for proton therapy of lung cancer by investigating the effect of the lung density change on the coverage of the target volume. Discrepancies in the SOBP region for uniform water and heterogeneous patient anatomy were also studied.

**Method and Materials:**
Monte Carlo simulations were performed to investigate the distal edge shift for different phases of the respiratory cycle (e.g., inhale and exhale). Several Monte Carlo code systems were used in this study for dose comparison. Simulation geometries were built from patient CT data with proper materials and mass densities. Different positions of the tumor in the beam direction were set up to investigate the maximum effects.

**Results:**
Examination of the distal edges shows a shift induced by the density change in lung during the respiratory cycle. This motion has been quantified to a few millimeters (up to 1 cm) depending on the position of the tumor relative to the chest wall. A change in the shape of the SOBP (distal and proximal) has occurred and has been correlated to the thickness (and density) of the lung layer before the tumor. These results are consistent with previous Monte Carlo simulations. The margin required to account for the lung density change must be combined with the margin needed to account for respiratory motion to give an optimal margin for proton therapy in the thoracic region.

**Conclusion:**
This work indicates that extra margins have to be taken into account during the treatment of lung cancer with protons due to the lung density change. This study shows the importance of using a gating technique for lung tumor. Monte Carlo dose calculation plays an important role in accurate dose determination for proton therapy in the presence of heterogeneities.