# AbstractID: 1648 Title: Simulation and evaluation of free breathing planning target volumes in the lung in the presence of respiratory tumor motion using 4D-CT data

We evaluated the probability of geographic miss due to respiration-induced tumor motion when planning target volumes (PTV's) are based on 'free breathing' images ($PTV_{FB}$). Respiration-correlated 4D-CT data, which yields multiple CT studies correlated to breathing phase, were obtained for 6 lung carcinoima patients. A physicist delineated the gross tumor volume ($GTV_0$) at 10% breathing phase intervals using treatment planning CT contours drawn by the radiation oncologist as a guide. A set of "free breathing" GTV's ($GTV_{FB}$) was constructed from the $GTV_0$'s in which successive slices corresponded to different phases, thus simulating standard CT acquisition. Ten such $GTV_{FB}$'s were created per patient, each subsequently expanded by 1cm (3D) to give 10 simulated free-breathing planning target volumes ($PTV_{FB}$). Each $PTV_{FB}$ was then tested to determine if it enclosed the 10 $GTV_0$'s from the same data set. Of the 6 patients examined, the 10 $GTV_0$'s of one patient (tumor was attached to the chest wall) were adequately enclosed by all simulated $PTV_{FB}$'s. Another patient (tumor was attached to the diaphragm) showed poor coverage at end inspiration with as much as 47% of $GTV_0$ outside $PTV_{FB}$. The remaining patients (lung tumors not attached to either chest wall or diaphragm)showed < 6.5% of $GTV_0$ missed during any phase. We conclude that free breathing CT scans can result in inadequate tumor coverage, especially near the diaphragm. 4D-CT scans can help alleviate this problem by imaging the tumor over the entire breathing cycle.