AbstractID: 10281 Title: A study on the dosimetric accuracy of lung cancer treatment plan using Average and Maximum Intensity Projection images in stereotactic body radiation therapy

Purpose: To verify how conformal treatments and plans are developed for lung Stereotactic Body Radiation Therapy treatment when targets are defined by images generated from Maximum Intensity Projection (MIP) and Average Intensity (AVG) of four-dimensional computed tomography (4DCT).
Methods: A custom built programmable lung phantom was used to simulate tumor motions that follows various breathing patterns, including regular periodic motions and irregular motions measured for actual patients at treatment. After scanning, the phantom with moving target in 4DCT, reconstructed images, including AVG and MIP, were imported into Pinnacle treatment planning system. The PTV targets have been defined from these images according to protocols used in 3D SBRT. Phantom with the target in motion was exposed to radiation according to plan. Dosimetric measurements within the target were performed with radiochromic film.
Results: The analysis of film dosimetry allowed us to find that targets moving regularly or with irregular small range (with average range less than 5mm) reproduced at treatment dose distributions closely to dose distributions computed at planning. However, for targets moving irregularly, and with larger than 1 cm motion amplitude, the measured isolines on film were found to be noticeably shifted relative to dose isolines as computed by the plan. In particular, this shift of isolines demonstrated that parts of PTV were underdosed relative to prescription.
Conclusions: We should be cautious when using the 4DCT images for the definition of targets for lung treatment, particularly when targets do experience irregular and large amplitude motions. The geometric domains defined by 4D CT that intend to contain tissue of the target at all times, irrespective of its motion, may not provide accurate geometrical and temporal representation of these domains as anticipated. Our results indicate that abdominal compression, together with image guidance assures precise delivery of SBRT in lung.