Purpose: Evaluate and determine the feasibility of using thoracic phantoms in the credentialing of proton therapy facilities, by using irradiations, treatment planning calculations and Monte Carlo simulations.

Methods: The Radiological Physics Center (RPC, Houston, TX) has developed an anthropomorphic lung phantom to be used for credentialing of lung trials in proton therapy. The phantom has structures like heart, spinal cord, right and left lungs and a cylindrical target located in the middle of the left lung. EBT2 films were placed cutting the target on the axial, coronal and sagittal planes for relative dosimetry. The absolute dose was measured with LiF TLDs located in the center of the target. The proton stopping power ratio of each material used in the phantom as well the respective CT number was also evaluated for this work. Based on a CT image of the phantom we created a plan in ECLIPSE with two fields delivering 6 Gy RBE to the target. A customized table was used to translate the phantom CT numbers into stopping power ratio for the ECLIPSE plan. The treatment plan was also simulated in Monte Carlo using a customized version of MCNPX. The phantom was irradiated at University of Texas MD Anderson Proton Therapy Center, Houston, Texas. Profiles and the Gamma tool were used to compare the film measurements to ECLIPSE and MCNPX calculations.

Results: The gamma agreement of the Monte Carlo and ECLIPSE calculations was above 85% in the GTV region for all planes. The profiles of the Monte Carlo showed a better agreement with film measurements than ECLIPSE calculations. We also identified LET dependence on film measurements.

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