Purpose:Analyze and contrast the thorax phantom irradiation results as compared to the planning system dose calculations using a Monte Carlo heterogeneity correction algorithm as compared to a superposition convolution/anisotropic analytical heterogeneity correction algorithm.

Methods:Institutions wishing to be credentialed for clinical trials delivered clinically relevant treatment plans to the Radiological Physics Center's anthropomorphic thorax phantom. Various treatment planning systems with different heterogeneity correction algorithms including Monte Carlo (MC), Superposition convolution (SC) and Anisotropy Analytical Algorithm (AAA) were used. The phantom contained radiochromic film in the three major planes and TLDs in the center of the tumor target to measure the delivered dose. Point doses and planar dose distributions were extracted from the treatment planning system and compared to TLD and film measurements. Dose profiles were compared point by point using criteria of 5% and 3mm distance to agreement.

Results:The overall ratio of the measured lung target dose to the calculated heterogeneity corrected dose for all algorithms is 0.966±0.026. The RPC uses an acceptance criterion of ±5% about a ratio of 0.97 in order to maintain consistency among clinical trial participants. The measured to calculated dose ratios for the Tomotherapy TomoPlan (n=21), CMS XiO (n=21), Eclipse AAA (n=81) and Pinnacle SC (n=84) were 0.973±0.025, 0.956±0.024, 0.958±0.028 and 0.969±0.026, respectively. However, the measured to the Accuray MultiPlan (n=22) and BrainLab iplan (n=4) MC calculated average dose ratio was 0.996±0.026. Dose profiles between the above mentioned algorithms were all consistent and comparable.

Conclusions:The MC heterogeneity corrected dose calculations are in better agreement with measurements than other modern advance heterogeneity corrected dose calculation algorithms. The RPC will use a different acceptance criterion of ±5% about a ratio of 1.00 for MC calculated lung target doses.