AbstractID: 13702 Title: Monte Carlo investigation and measurements of distal edge degradation in lung phantoms with therapeutic proton beams

Purpose: To validate a computational lung model and investigate distal edge degradation of therapeutic proton beams.
Methods and Materials: We used the Monte Carlo code MCNPX to simulate therapeutic proton beams traversing a computational lung model. The computational lung model consisted of a slab constituted of randomly distributed voxels of air and plastic resin. Two computational lung slabs with different voxel resolutions were studied including: i) a high resolution slab (0.5 mm cubic voxels), which was assembled by randomly distributing the air and plastic resin voxels. This slab assembly reproduces the density gradient found in real lung-equivalent plastic slabs (realistic lung-equivalent slab); and ii) a low resolution slab (2 mm cubic voxels), which was generated by merging neighbor voxels and appropriately scaling the density and atomic fractions. This slab has a similar density distribution to a CT image (CT-equivalent slab). All simulations were done using a validated MCNPX model of the passive scattering beam line from the Proton Therapy Center at M.D. Anderson Cancer Center. Our simulations were compared to measured depth doses of a therapeutic proton beam traversing a lung-equivalent plastic slab.
Results: The distal edge degradation predicted by the simulations of the realistic lung-equivalent slab was in agreement with the experimental data. However simulations of proton doses from beams traversing the CT-equivalent lung slab did not show any distal edge degradation.
Conclusion: Our findings show that a computational lung phantom model with high resolution is needed to accurately predict the distal edge of proton dose distributions.
Conflict of Interest (only if applicable): none