AbstractID: 5383 Title: Development of a Patient-Specific Lung Phantom using 3D Imaging and Rapid Prototyping

Purpose:
Physical human phantoms have been widely used in verification of external radiotherapy treatment plans, study of exposures outside of the target regions, and calibration of whole-body counter for nuclear medicine procedures and for radiation safety bioassays. Existing phantoms are mostly crude in anatomical representations, although realistic 3D images of patients are available. This paper presents a method of fabricating a physical phantom of the lung using patient-specific medical images and computer aided design (CAD) and manufacturing (CAM).

Methods:
Medical images have been used to construct the VIP-Man model from Visible Human images. The voxelized data from the lung of VIP-Man were translated into 3D polygon mesh models. The models were then corrected and scaled to the actual size of the organ. A 3D rapid prototyping machine (i.e., a 3D printer) was used to develop a physical mold of 3D polygon mesh lung. The mold was filled with lung tissue-equivalent foam, which matched the density and effective atomic number of the lung tissue.

Results:
Using the methods described above the lung of the VIP-Man model in STL format was used to fabricate an identical 3D tissue-equivalent phantom.

Conclusions:
A method has been developed to rapidly prototype physical lung phantoms using CAD and CAM capabilities. Currently, there is no method that automates this complicated process of creating 3D organ phantoms. A major research effort in this task is to develop an integrated software method that will streamline image processing and 3D printing.