AbstractID: 10992 Title: Deformable computational breast phantoms for Monte Carlo based calibrations of detector systems used for assessing internal radioactivity burden in the lungs

Purpose: To demonstrate the feasibility of deformable patient modeling for the virtual calibration of detectors used to measure inhaled radioactivity in a female patient's lungs for internal dose assessment. **Materials and Methods:** We have developed the ability to deform a mesh-based phantom that consists of 140 highly detailed organs or tissues. The phantom can be adjusted to match a desired patient. A software was developed to deform the breasts of this phantom to create new models representing female patients with different breast cup sizes (ranging from AA to G) and breast glandularities. The geometries of these phantoms and a Phoswhich detector system were defined in a Monte Carlo code for virtual in-vivo lung counting simulations involving various photon emitting radionuclides. The counting efficiencies for each of the virtual patients were calculated and compared. **Results:** The counting efficiency was found to decrease with increasing breast size and mass because of greater attenuation in the patient. For low energy emitting radionuclides such as Am-241, roughly a 50% drop in counting efficiency was observed for the model with G cup size as compared to the smaller breasted AA model. Higher breast glandularities resulted in lower counting efficiencies; however, this effect was small. For the E breast cup size model, the counting efficiency for low energy emitters decreased by roughly 2% as the glandularity increased from 7% to 40%. **Conclusions:** In order to obtain accurate internal dosimetry estimates for female patients, the in-vivo measurements of the activity in the lungs should account for breast size. The effect of breast glandularity can be ignored because it is negligibly small compared to other sources of experimental uncertainty.