Purpose: To investigate the feasibility of tissue composition measurement with dual energy computed tomography as compositional information may help to better characterize suspicious lesions.

Method and Materials: Simulations and experimental studies were performed for a flat panel dual energy dual kVp CT system. Simulations were performed to identify optimal beam energy combinations. A figure of merit (FOM) was used to determine the optimal dual energy signal to noise ratio with respect to mean glandular dose. Beam energies ranging from 40 to 140 kVp were simulated in 1 kVp increments. The distribution of dose between low and high energy images was simulated at intervals of 10%. An experimental calibration phantom of 3.175 cm in diameter was constructed from a polyoxymethylene plastic with cylindrical holes filled with water and oil. Similar size samples of pure adipose and lean bovine tissues were also prepared. The phantom and tissue samples were imaged with the dual energy CT system. The calibration phantom was used to estimate the water, lipid and protein contents of each tissue sample. Tissue composition results computed from images were compared to data from chemical analysis of prior tissue samples.

Results: The predicted spectra from simulation which optimized the FOM were at beam energies of 40 kVp and 140 kVp with the mean glandular dose divided equally between each exposure. Given tube loading and system constraints, experimental beam energies for the dual kVp CT system were selected to be 50 kVp and 120 kVp. The percentage RMS errors of water, lipid and protein contents as compared to data from chemical analysis were 10.9% for the dual kVp technique.

Conclusion: The results of this study suggest that the water, lipid, and protein content may be measured with dual energy CT with relatively good agreement. This might potentially be useful for characterizing suspicious lesions.