AbstractID: 12807 Title: Image Noise and Radiation Dose Reduction in Spectral CT

Purpose: Spectral (multiple energy) CT can characterize material composition using the x-ray spectral information. However, image noise and radiation dose is a concern as photons are distributed into multiple energy bins. Therefore, the intrinsic trade-off between number of energy bins and photon numbers in each bin results in either too noisy images, or too high radiation dose. The purpose of this study is to break this trade-off and to reduce noise and/or radiation dose in spectral CT.

Method and Materials: A semi-anthropomorphic thoracic phantom was scanned with multiple energies (80,100, 120 and 140 kVps) on a dual source CT scanner. Images were reconstructed at each beam-energy separately using commercial software. The reconstructed images were processed wtih the Highly Constrained Back-Projection (HYPR) algorithm using the averaged image of all 4 kVp scans as the composite image. CT numbers and noise were measured inside three circular ROIs representing calcium, water, and soft tissue. Noise and dose reduction using HYPR compared with commercial software was calculated.

Results: The same CT numbers were obtained using both algorithms while approximately 50% of noise reduction was achieved using HYPR. Based upon the relationship between noise and radiation dose, this was equivalent to 4 times dose reduction given the same image noise. These results could be interpreted as noise reduction given the same radiation dose, dose reduction given the same image noise, or a combination of these two.

Conclusion: We have presented a method to reduce image noise and/or radiation dose in spectral CT. Using HYPR, images at each individual energy bin have SNR similar as the composite image which uses all x-ray photons. This breaks the tradeoff between number of energy bins and number of photons in each bin. Therefore, the intrinsic problem of excessive noise and/or radiation dose in spectral CT has been addressed.