AbstractID: 14053 Title: K-edge imaging using a gold nanoparticle contrast agent and a CT system with photon counting detectors

Purpose: To investigate the feasibility of imaging a gold nanoparticle (GNP) contrast agent for detection of vulnerable plaque using a CT with photon counting detectors and energy resolution. **Materials and Methods:** Simulation was performed for material decomposition based on the likelihood maximization method. The simulations were based on single-slice parallel beam geometry. The beam energy was set to 120 kVp in order to provide high enough photon flux for energies above the k-edge of the gold (80.7 keV). A CdZnTe detector with 5 different energy bins was used. Both ideal and more realistic detectors were used in the simulation. The phantom used for the simulation contained polymethyl-methacrylate (PMMA), calcium, and GNP. The concentration of calcium in plaque was adjusted in such a way that the linear attenuation coefficients of GNP and calcium were approximately equal. It is expected in patients with an unstable plaque that gold nanoparticles would occupy portions of calcified tissue. Thus, the simulation of these three materials allows the simulation of the situations which are clinically relevant. **Results:** In reconstructed images after decomposition only gold was visualized without any traces of PMMA or calcium. The minimum detectable gold density for ideal detector was found to be ~300 $\mu g/cm^3$. The minimum detectable density increased by a factor of two as imperfections were added to the detector during simulation. However, the minimum detectable GNP density was far less than the amount of GNP that is accumulated in the plaque. The effect of dose, beam energy, and gold concentration on the image quality was also studied. **Conclusions:** These studies show the feasibility of using GNP as a contrast agent to detect vulnerable plaque.