AbstractID: 9633 Title: Influence of Fluorescent Reabsorption on Detector Parallax Resolution Effects in Pinhole SPECT

Pinhole collimators are often used for ultra-high resolution SPECT systems for small animal imaging. Pinhole systems have a favorable tradeoff between spatial resolution and sensitivity at small distances, and can use magnification to reduce the contribution of detector resolution to total system resolution. Detection systems considered for small animal pinhole SPECT include clinical SPECT systems, with 40 cm x 22 cm sodium iodide detectors 9.5 mm thick, CCD-based systems, with 3 cm x 2 cm gadolinium oxysulfide detectors 0.5 mm thick, and pixellated sodium iodide detectors and cadmium zinc telluride detectors of intermediate size. Contributing factors to spatial resolution have been studied to optimize resolution, and also so that resolution effects can be included in the reconstruction algorithm. Inherent detector resolution effects are well known, and pinhole edge penetration has also been studied. Detector parallax effects have not been as extensively studied. Parallax effects are complicated by the fact that k-fluorescent photons produced in the detection medium can escape, reducing detected energy and causing the incident photon to be rejected. K-escape is enhanced near the detector surface. This reduces the point spread suffered by beams entering the detector at low angles. Greater pinhole acceptance angles can thus be used without undue blurring, increasing options for system geometry. This study uses Monte Carlo simulation to examine the influence of k-escape on parallax-induced blurring for NaI, Gd_2O_2S, and CdZnTe detectors for a variety of incident angles and detector thicknesses, for photon energies ranging from 27 keV (I-125) to 140 keV (^{99m}Tc).