Purpose: To evaluate the use of multiple projections in spectroscopic x-ray tomography techniques for electron density reconstruction using backprojection over isogonic curves at realistic energy resolutions.
Method and Materials: Matlab was used to simulate a clinical breast CT geometry and 55 keV fan-beam. The system design includes a point source producing an x-ray fan-beam, which passes through the object to be imaged, before interacting with the primary detector. The scattered x-rays, are measured using energy sensitive photon counting detectors aligned with the source and placed outside of the periphery of the primary fan beam. We consider a 2D case where reconstructions are carried out in the fan-beam plane. We assume no multiple scatter or attenuation of the scattered photons. Image reconstruction was performed using backprojection over isogonic curves passing through the source and detector points. Single projection reconstruction results in an image that varies in resolution and noise throughout the image. The image reconstructed at realistic energy resolutions is not of sufficient quality. For a given energy resolution, images obtained from different projection angles were fused.
Results: Results demonstrate the improvement in electron density image quality of a modified Shepp-Logan phantom as a function of projection number and the energy resolution of the detector.
Conclusions: This work has shown that it is possible to improve the image quality in a spectroscopic approach for electron density image reconstruction by combining multiple projections. It appears that it may be feasible to create clinical quality images with current detector technology.