Purpose: To evaluate the advantages of Compton backscatter radiography system as a medical imaging tool by comparing images obtained to traditional transmission radiography methods.

Methods: Five phantoms were scanned with a scatter x-ray imaging (SXI) system and state of the art transmission imaging systems. Four phantoms contained biological tissue equivalent samples used to exemplify objects found in medical imaging scenarios. For a complex biological setting a euthanized 60 lb pig was scanned. Parameters such as the x-ray tube voltage, x-ray tube current, pixel integration time, stand-off distance, detector type and detector collimation were varied. Images acquired with the scatter and transmission modalities were compared by observing the differences between the mean pixel value and standard deviation of regions within the images. Visual comparisons between images were also used.

Results: The contrast differences between SXI and transmission images varied based on phantom composition and placement of objects within them. As a result, neither system showed better overall object contrast across all phantom scans. SXI images of bone at 1.6 cm depth and 7.8 cm depth revealed a 30.3% change in contrast while transmission images showed a 0.1% difference in contrast. Standard deviation of the mean pixel values (noise) in the SXI images ranged from 13.7% to 21.1% whereas the standard deviation for the transmission images ranged from 3.1% to 6.6%. Detector collimation prevented the detection of surface scatter and better represented objects deeper within a phantom.

Conclusions: Clinical applicability of an industrial SXI system for medical applications was demonstrated. Exposures with the SXI system required access from only one side of a patient, giving it a smaller form factor and eliminating the spatial constraints imposed by traditional transmission x-ray imaging systems. Additionally, depth information was observed in SXI images, potentially reducing the number views necessary to properly diagnose patients.