Purpose: Ongoing advancements in SPECT-CT hardware and software raise important questions regarding the relative performances of various cameras and their respective image-processing software. This phantom study compares images produced from three state-of-the-art cameras using four figures-of-merit (FOM) to assess image quality.

Methods: A thorax phantom modeling the spine, lungs, a healthy heart and 2 tumours (cylindrical bottles) was scanned with the following SPECT-CT systems: Philips' Precedence (PP), GE's Infinia-Hawkeye (GH), and Siemens' Symbia-T6 (SS). For each scan, Tc-99m solutions were injected into the heart (120mL), two bottles (33mL) and thorax (7000mL) to yield activity concentration ratios of roughly 6:1 and 8:1 for heart:thorax and tumour:thorax, respectively. The processing was performed using the reconstruction software available on the cameras; namely, Evolution, Astonish and Flash3D for GH, PP, and SS, respectively. Additionally, all sets of data were reconstructed using our in-house (MIRG) software. Mean values of activity error, uniformity, signal to noise ratio (SNR) and image contrast were used as FOM for the three objects of interest in each image (heart and 2 bottles). Two-tailed paired t-tests were used to test significance between means, considering $p<0.05$ as significant.

Results: No significant differences were observed for all FOM between MIRG reconstructions using PP, GH and SS acquisition data. Mean activity errors for the PP reconstructions were significantly closer to the truth relative to GH and SS reconstructions and contrast measurements were significantly better for PP relative to SS. However, PP uniformity was significantly lower than GH and SS. No significant differences were found between GH and SS for all FOM.

Conclusions: When reconstructing the data with the same algorithm, no significant differences were observed for any FOM; however, when using the respective vendor algorithms, PP yielded more accurate activity and contrast measurements, yet lower uniformity relative to GH and SS images.