Comparison of any imaging systems requires evaluation tools that relate to the imaging task. Gamma cameras that perform coincidence imaging are often used in oncology work to detect small hot lesions. We have designed a test protocol that uses hot spheres (OD = 38, 32, 25, 18, 16, 13 mm) in a standard elliptical body-sized phantom with sphere/background concentrations ratios similar to that in oncology (8:1). Regions-of-interest, appropriately sized to the known sphere sizes, together with background regions are used to measure contrast, noise and a derived parameter, detectability index (DI) = (Contrast * Mean Bkg)/ stddev (Bkg). Various conditions (attenuation correction, randoms correction, Compton photons, scatter correction, total activity) can be studied and quantitative information obtained about instrument performance.

Using these tools it was found that a measured attenuation correction and randoms correction improved contrast by 5% and improved the DI by 250% (averaged over all visible spheres) when compared to a scan with no corrections. Randoms correction, by the delayed window method, improved contrast by 19% but reduced the DI by 13%. A model-based method of randoms correction increased contrast by 32% but decreased DI by 30% for the visible spheres. Compton photons can be shown, quantitatively, to slightly improve detectability under low count conditions. The detrimental effect of high count rates and low count rates was quantified in relation to the clinical task.

This test protocol and the quantitative information it provides is very useful for determining the optimum imaging conditions and for comparing instruments.