# Investigation of a novel small field of view hybrid compact gamma camera (HCGC) for scintigraphic imaging

| | |
|---|---|
| **Poster No.:** | B-0033 |
| **Congress:** | ECR 2016 |
| **Type:** | Scientific Paper |
| | |
|---|---|
| **Authors:** | M. Alqahtani[1], J. Lees[1], S. Bugby[1], L. Jambi[1], B. Bhatia[1], N. Dawood[1], W. McKnight[1], A. Ng[2], A. Perkins[2]; [1]Leicester/UK, [2]Nottingham/UK |
| | |
|---|---|
| **Keywords:** | Lymph nodes, Molecular imaging, Nuclear medicine, Lymphography, Experimental, Nuclear medicine conventional, Diagnostic procedure, Biopsy, Cancer |

## Purpose

The need to improve patient management in the surgical theatre has led to the development of many new medical imaging systems [1,2]. The Hybrid Compact Gamma Camera (HCGC) has been developed to provide additional localisation information during procedures such as sentinel lymph node (SLN) biopsies [3,4]. In this study, a lymph-node contrast (LNC) phantom was fabricated and idealised medical scenarios were modelled to study the HCGC detectability for varying radioactivity concentration and sentinel lymph node size.

## Methods and materials

The LNC phantom is made of Perspex plates, with simulated SLNs of diameters ranging between 10mm and 2.5mm (16 SLNs in total). These simulated SLNs were positioned beneath thicknesses of scattering material ranging between 5mm and 40mm. The LNC phantom has four different background wells to simulate the activity uptake surrounding the SLNs (Figure 1). The simulated activities ranged between 4MBq and 25kBq for the SLNs following their sizes [5]. Modelled background activity was 1/10 of the simulated activity in the SLN. The HCGC was fitted with a 1500µm thick CsI(Tl) scintillator and a 1mm diameter pinhole collimator.

**Images for this section:**

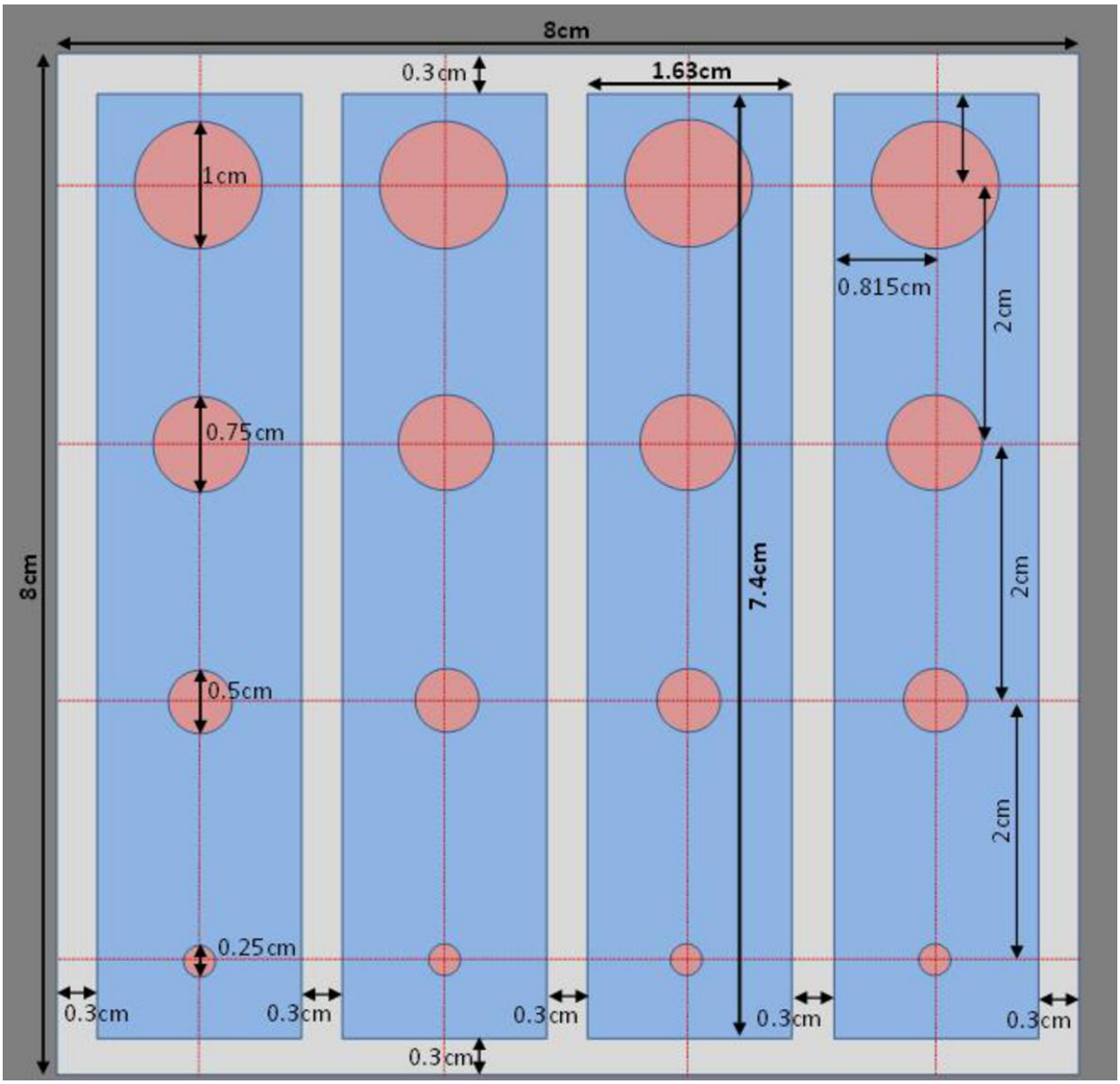


**Fig. 1:** A diagram of the a lymph-node contrast (LNC) phantom's dimensions

# Results

Spatial resolution measurements and Signal to Noise Ratio (SNR) analysis of the SLN were used as the main criteria to compare imaging sets produced by the HCGC with acquisition times ranging between 60s and 240s. The HCGC can successfully detect 87.5% to 100% (depending on the acquisition time) and 75% to 93.75% of the SLNs that are positioned underneath 20mm and 40mm thicknesses of Perspex respectively (Figure 2). The HCGC provides good spatial resolution images; the detected SLNs were ranging between 9.43mm and 12.2mm in diameter (Figure 3). The ability of the CGC to detect a small simulated SLN with a 2.5mm diameter that contains a small amount of radioactive material 25kBq in a maximum acquisition time of 240s and at 130mm collimator-to-source distance indicates its usefulness for critical surgical procedures.

This study shows the capability of the HCGC to fulfil the majority of the requirements that are needed in a small field of view imaging device to be used for pre-, intra- and post-operative investigations. The CGC has the ability to resolve small simulated SLNs in the presence of adjacent active structures.

**Images for this section:**

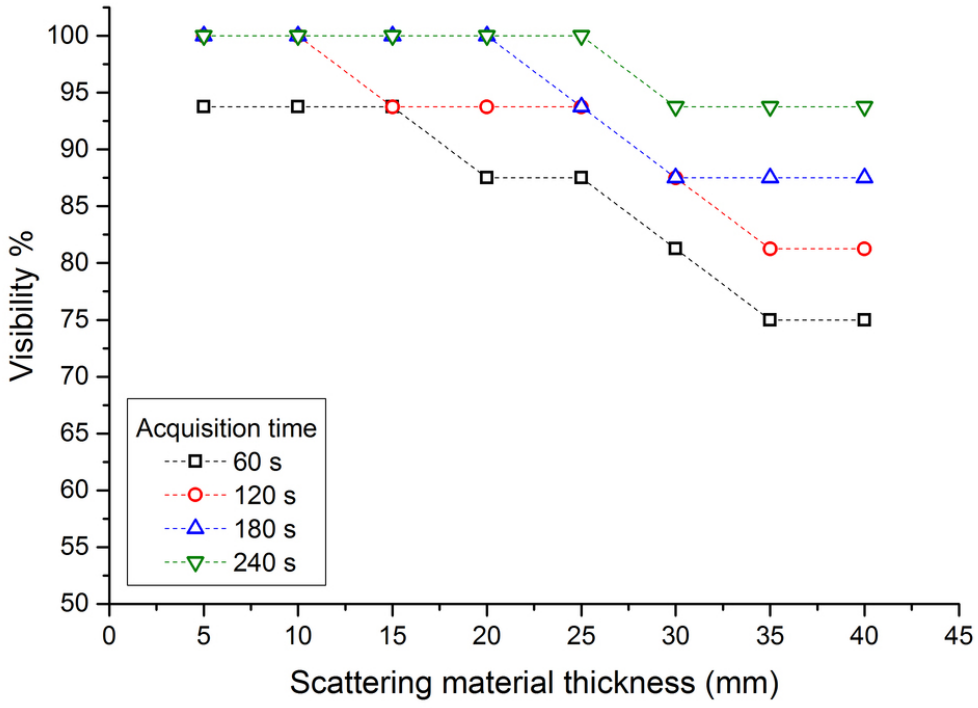

**Fig. 2:** A graph shows the relationship between the simulated SLN depths and the visibility (i.e. detection rate).



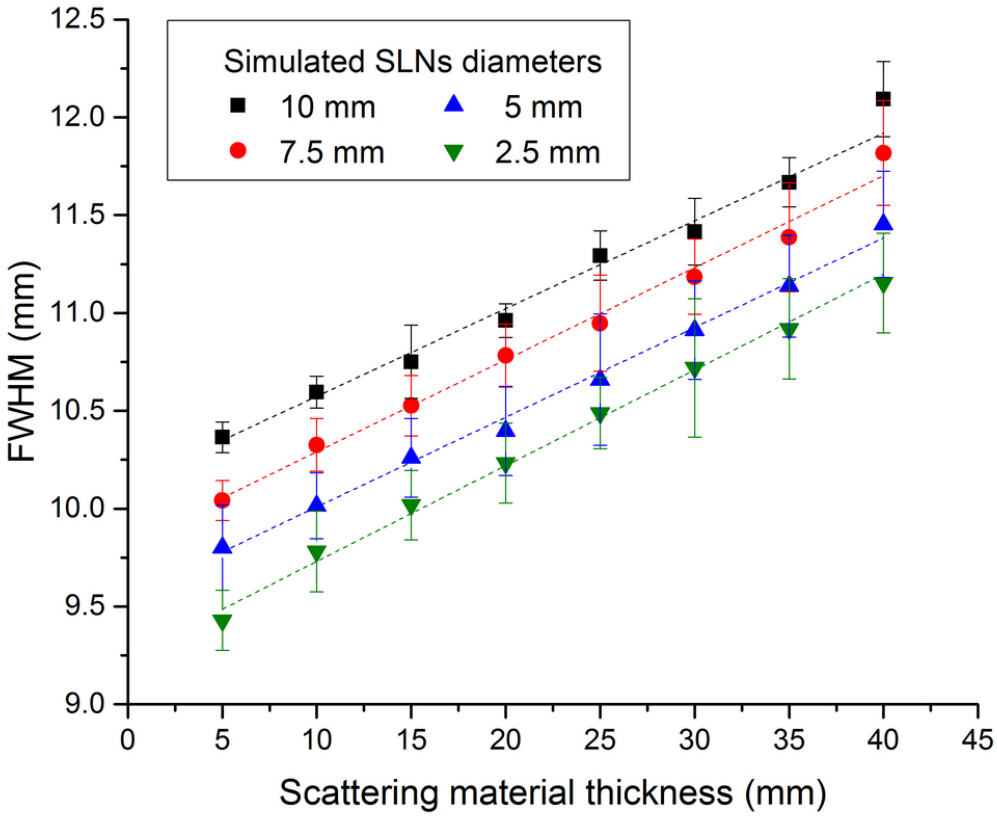


**Fig. 3:** Full width at half maximum (FWHM) measured values of various sizes of the simulated SLNs ranging between 2.5 mm and 10 mm in diameter.

## Conclusion

A simulation technique and a scintigraphic phantom have been designed and utilised to validate the capability of the HCGC in SLN detection imaging. The evaluation of the HCGC in this study shows that it is well suited for SLN imaging. The HCGC capability to detect low activity uptake in a small SLN indicates its usefulness as an intraoperative imaging system during critical surgical SLN procedures. The procedures described could be of use to evaluate any gamma camera system.

## Personal information

Mohammed Alqahtani

Postgraduate Researcher

BioImaging Unit

University of Leicester

Leicester

LE1 7RH

UK

Email: msma7@le.ac.uk

Tel: +44 (116) 229 7717

## References

1. Fass, L., Imaging and cancer: a review. Mol Oncol, 2008. 2(2): p. 115-52.

2. Evans, J.W. and A.M. Peters, Gamma camera imaging in malignancy. Eur J Cancer, 2002. 38(16): p. 2157-72.

3. Lees, J.E., et al., A high resolution Small Field Of View (SFOV) gamma camera: a columnar scintillator coated CCD imager for medical applications. Journal of Instrumentation, 2011. 6(12): p. C12033-C12033.

4. Bugby, S.L., et al., Characterisation of a high resolution small field of view portable gamma camera. Physica Medica-European Journal of Medical Physics, 2014. 30(3): p. 331-339.

5. Alqahtani, M.S., et al., Lymphoscintigraphic imaging study for quantitative evaluation of a small field of view (SFOV) gamma camera. Journal of Instrumentation, 2015. 10(07): p. P07011-P07011.