

High resolution SFOV gamma camera systems

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XMM-Newton: EPIC

Technologies and Expertise

Optical, UV, X-rays, gamma rays

Charge Coupled Devices: CCD



Gamma Cameras and Probes



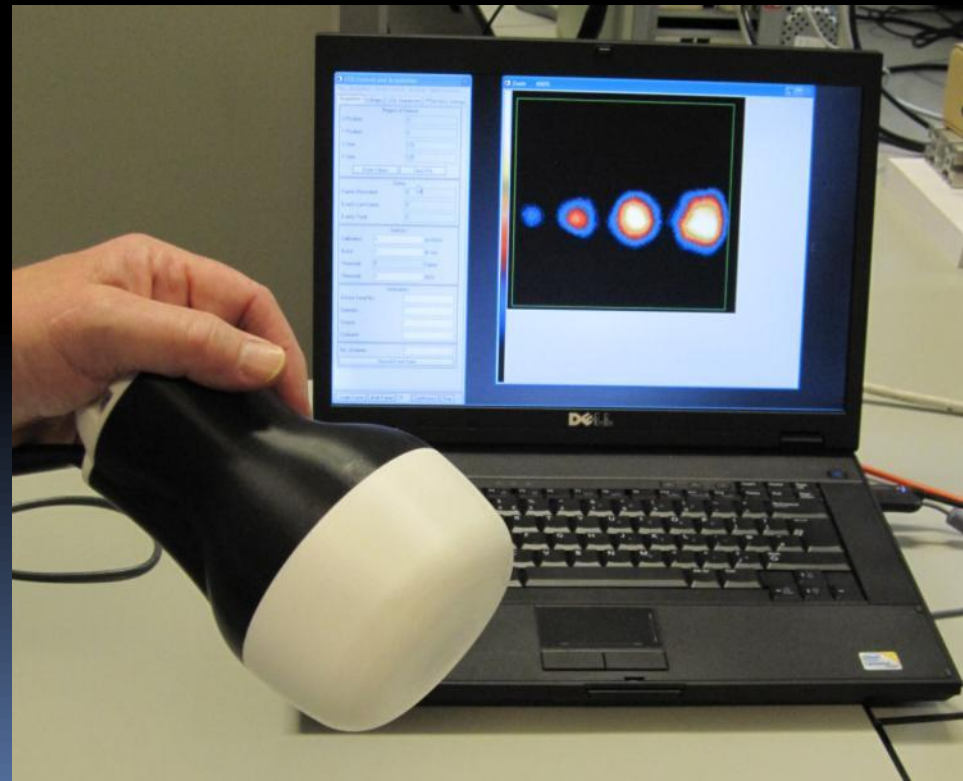
A dual head gamma camera



A nuclear probe detector

Mini Gamma Ray Camera (MGRC)

- Scintillator coated CCD
- Complementary to “standard” Gamma Camera
- High spatial resolution (<1mm)
- Energy range 30-160 keV.
- International Patents
- Hand held potential
- Point of care testing



Mini Gamma Ray Camera (MGRC)

- e2v CCD 97 BI
- 16 μm pixels
- 512 x 512 pixels
- 8 mm x 8 mm

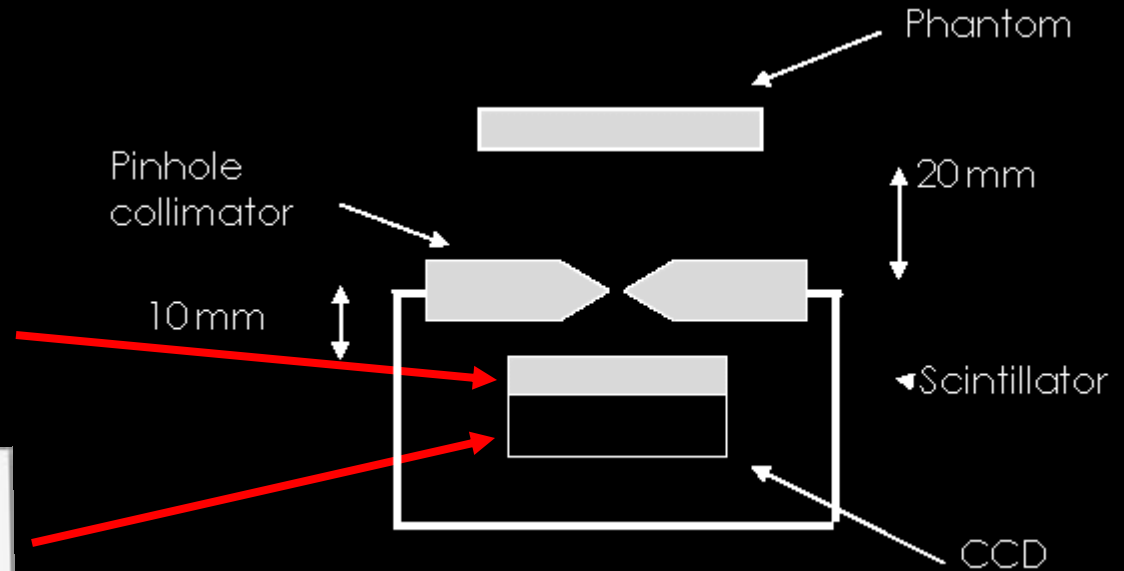
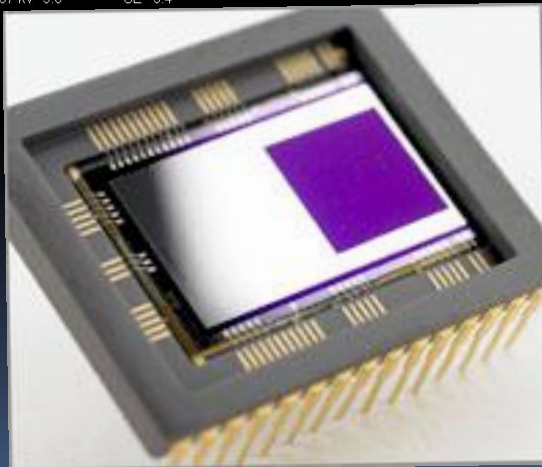
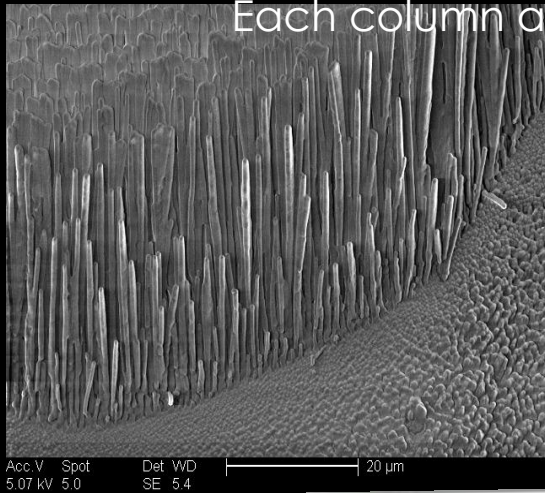
Pinhole collimators:
FOV 40mm x 40mm



Camera Schematic

Columnar CsI

Each column acts as a "light pipe"



The mini gamma camera



Phantoms

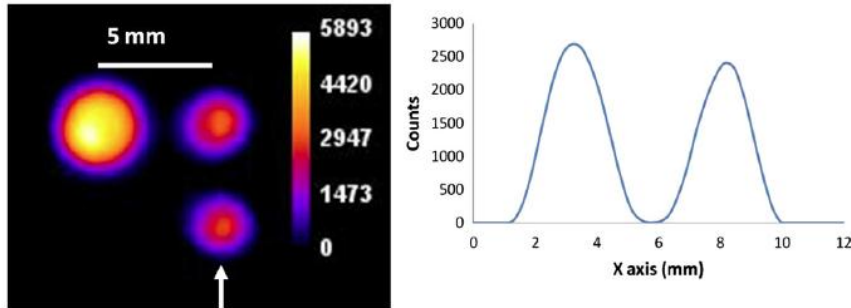


Fig. 4. Left: MGRC image of three-hole phantom filled with ^{99m}Tc . Right: profile of counts taken vertically through the two small holes as indicated by the arrow (profile width 2.15 mm).

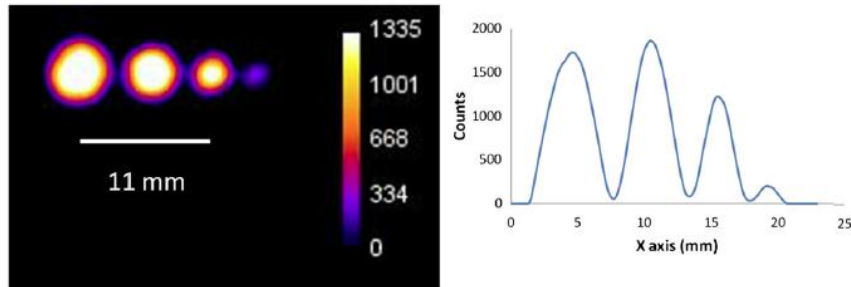


Fig. 5. Right: MGRC image of four ^{99m}Tc filled holes of the "hot-spot" mini-phantom. Exposure

Applied Radiation and Isotopes 68 (2010) 2448–2451



Contents lists available at ScienceDirect

Applied Radiation and Isotopes

journal homepage: www.elsevier.com/locate/apradiso



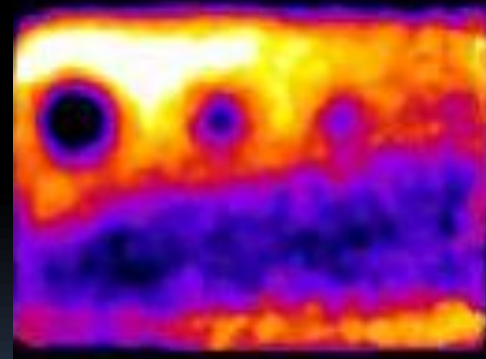
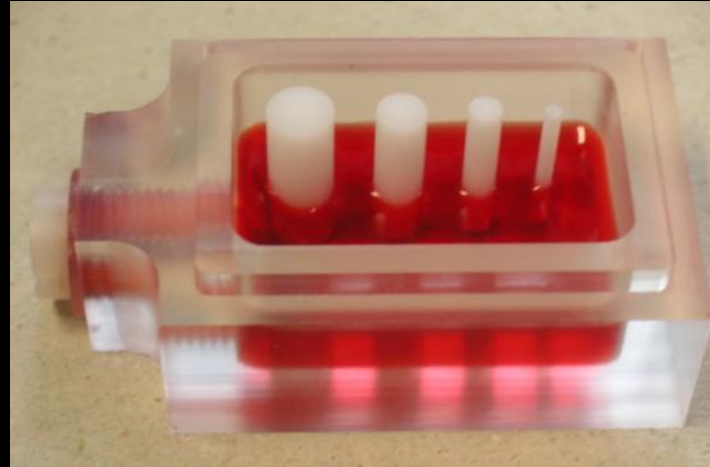
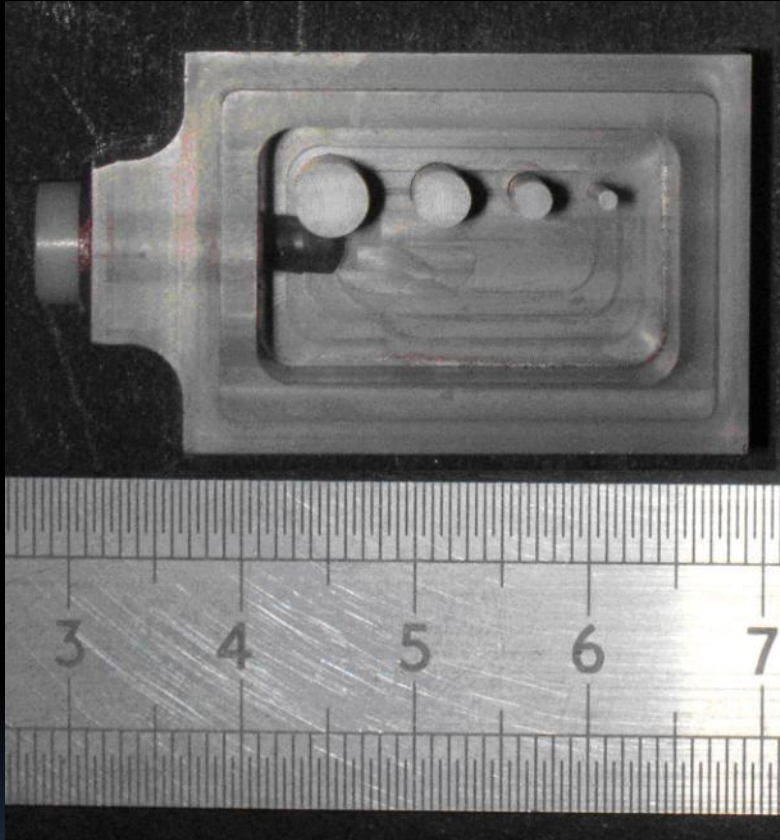
Design and use of mini-phantoms for high resolution planar gamma cameras

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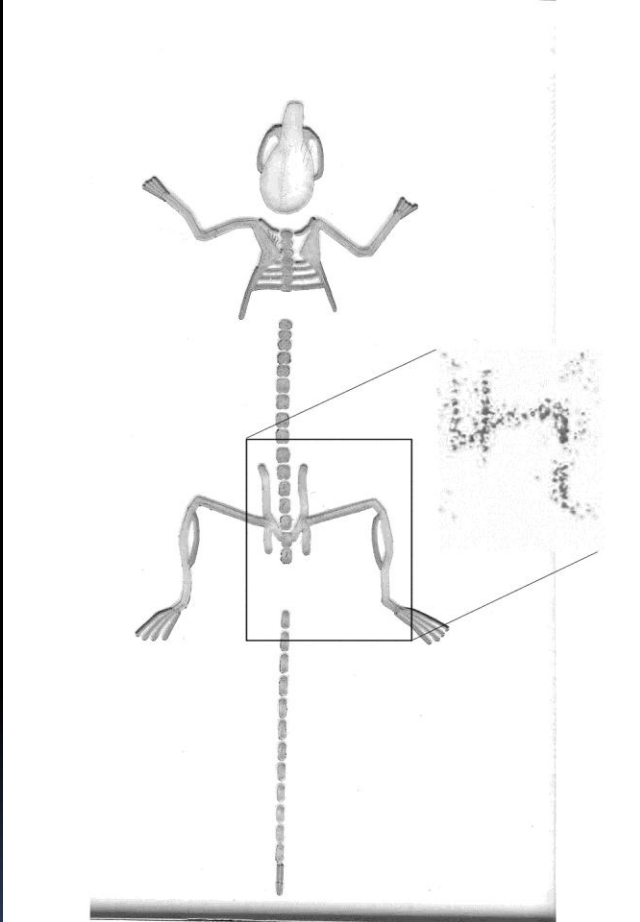
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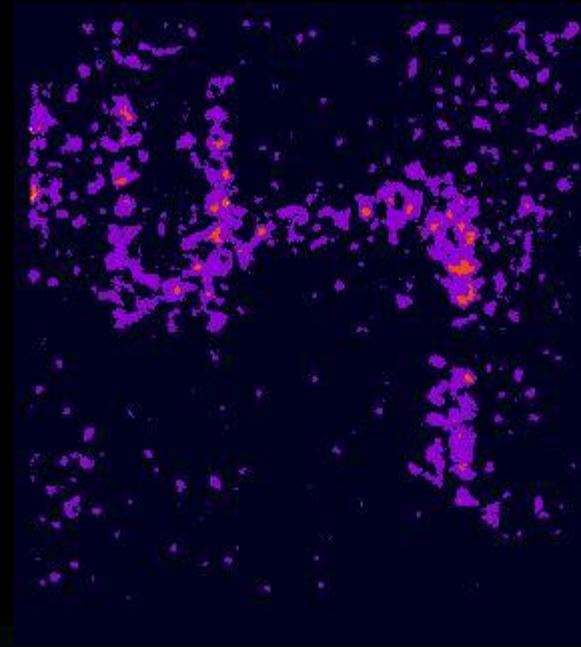
Mini-Phantom



Phantoms



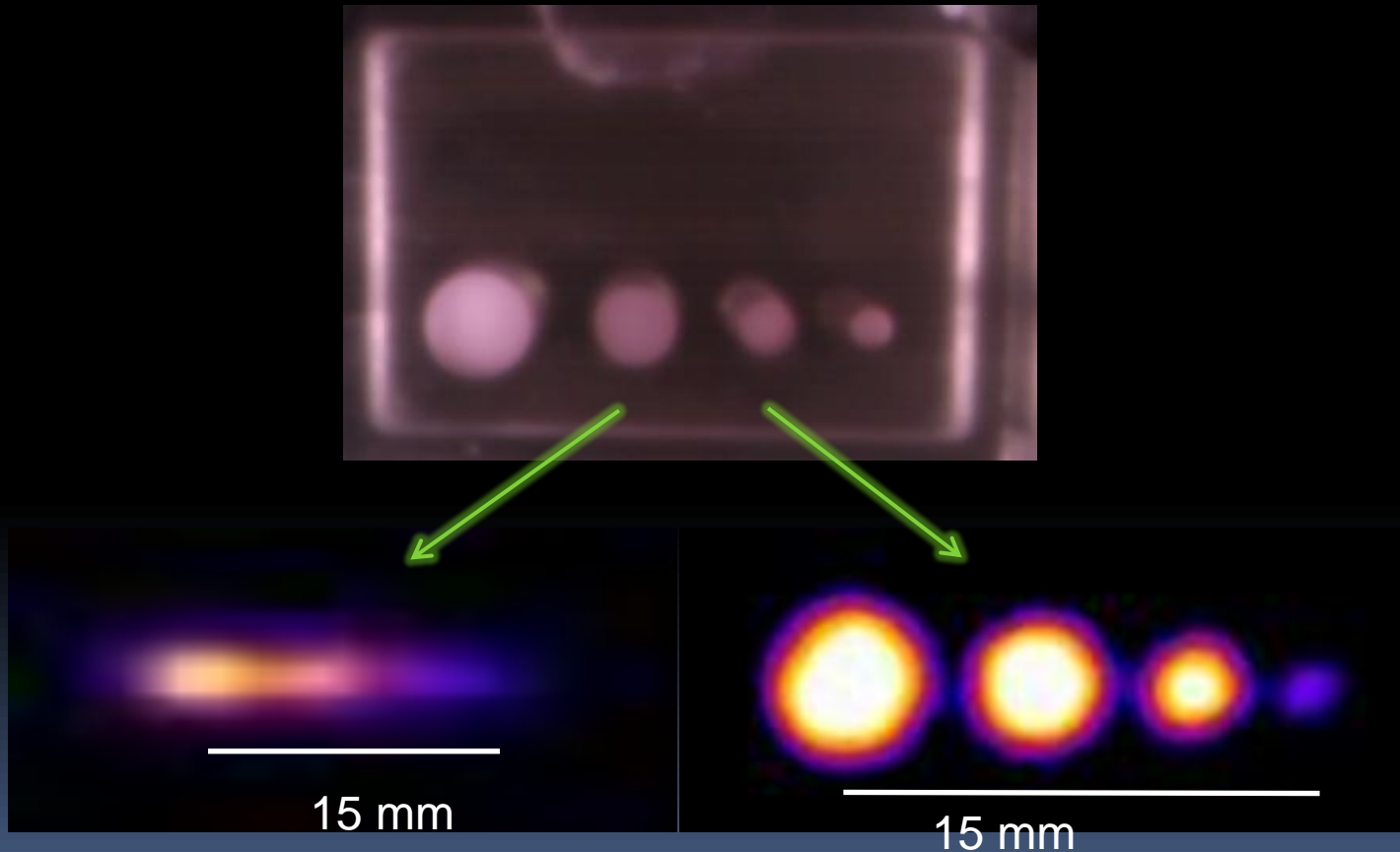
Mouse phantom



^{99m}Tc image of leg and hips

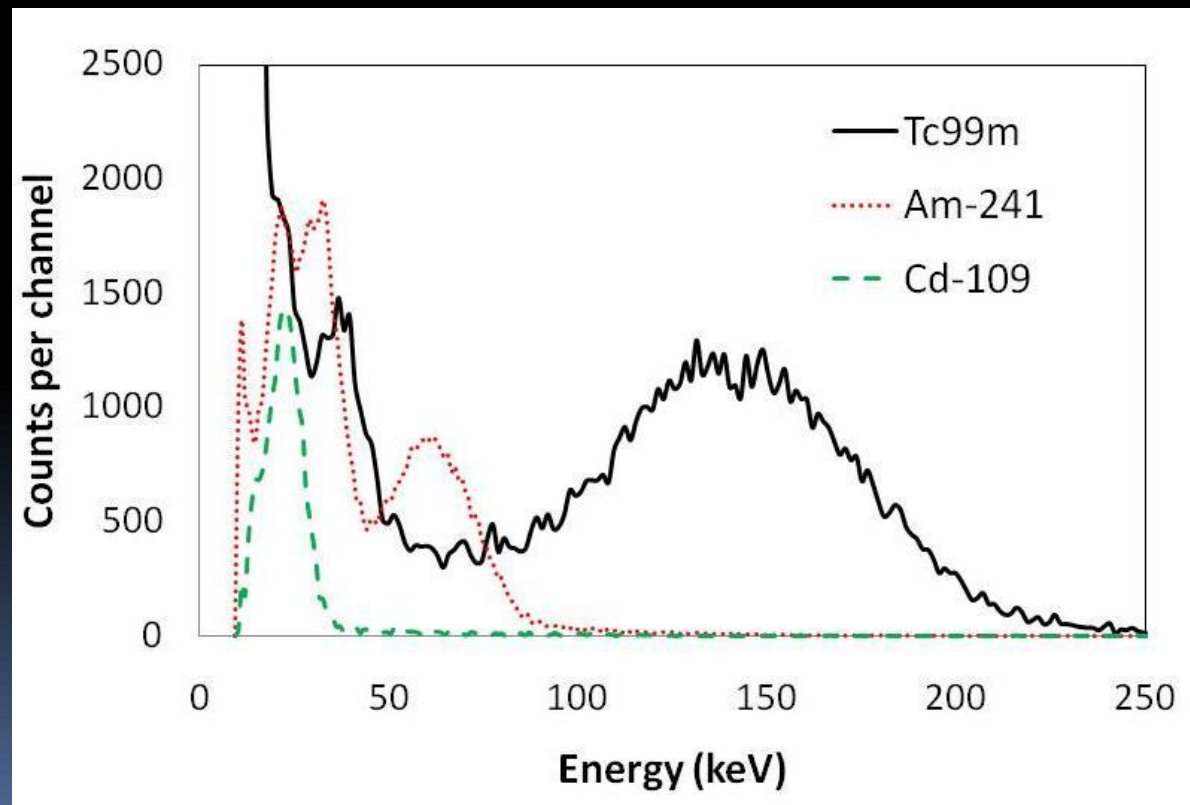
Comparison with WBGC

- Hot spot Phantom ^{99m}Tc

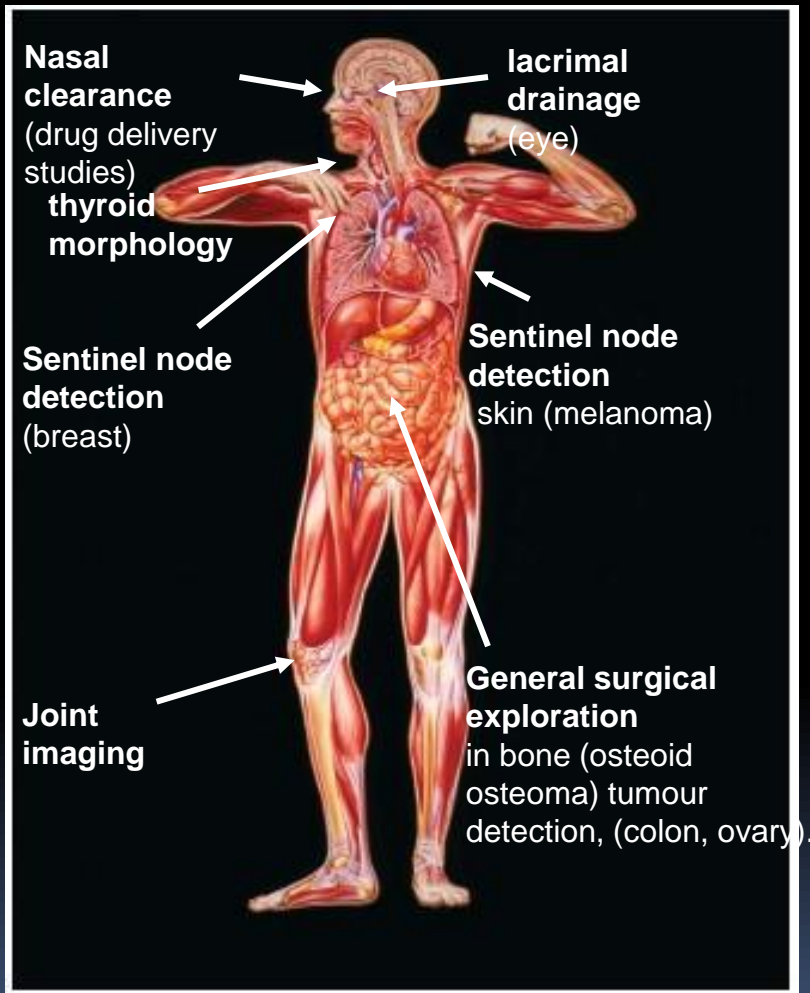


MGRC performance

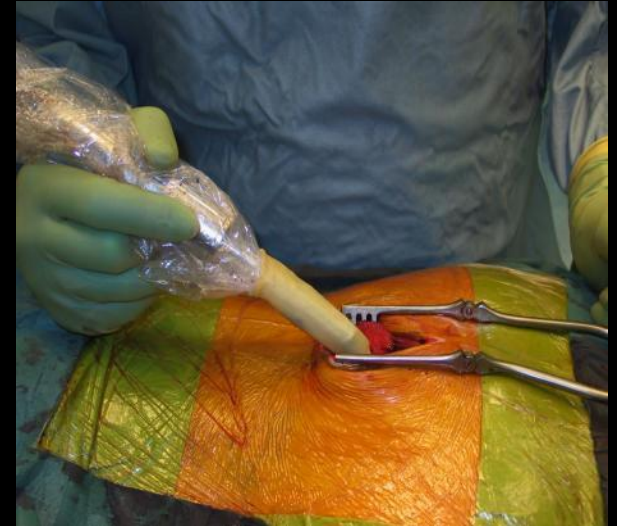
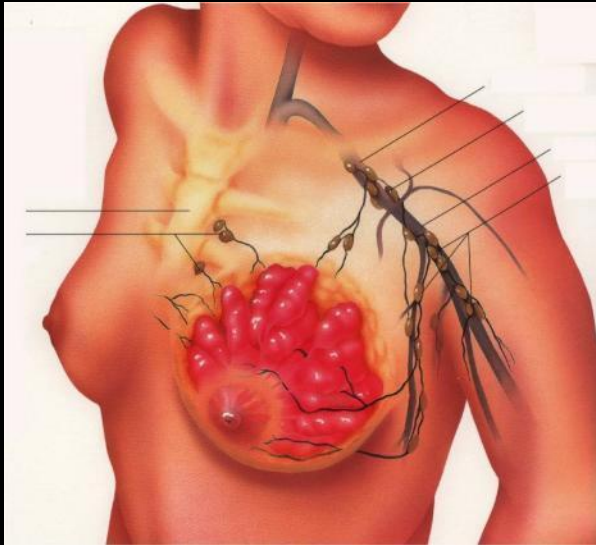
- Sub-mm spatial resolution $\sim 0.9\text{mm}$ @ 25mm
- Interesting Energy Resolution



Clinical Applications & Evaluation



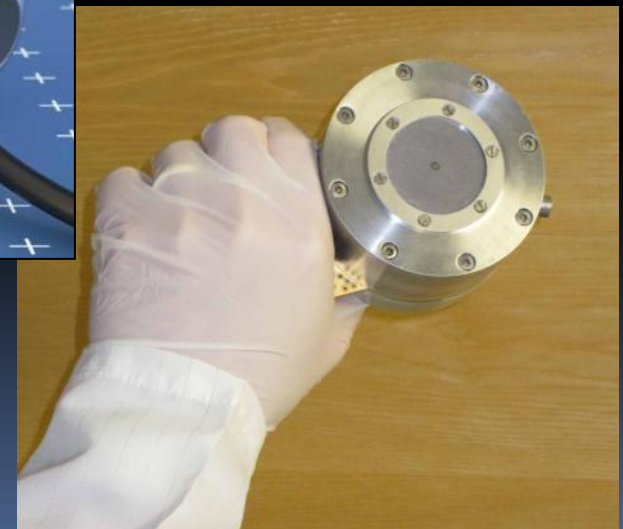
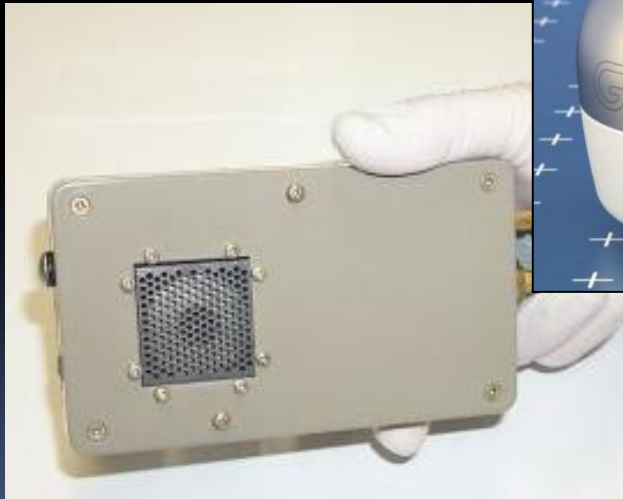
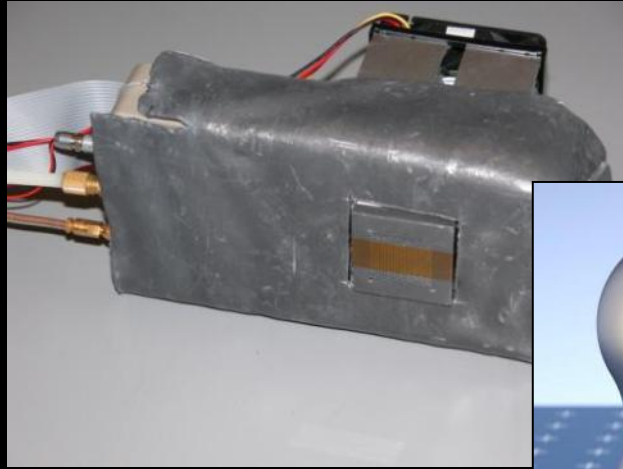
Sentinel Node Detection



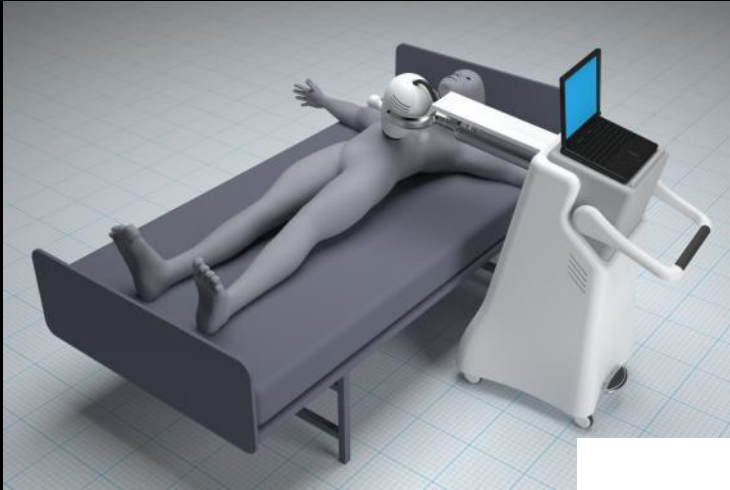
**RCS New Start Programme 2007-2008:
Sentinel Lymph Node Biopsy Training Programme**

Regionally run programme aimed at all members of the breast care team.

Design evolution - MGRC



Clinical prototype design



Clinical prototype design

MGRC in clinical setting

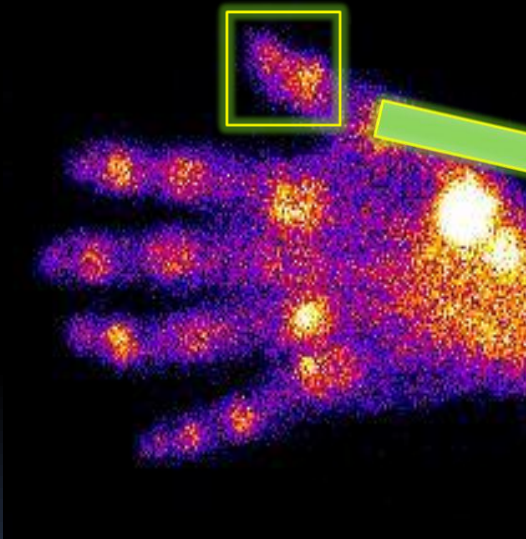


MGRC prototype

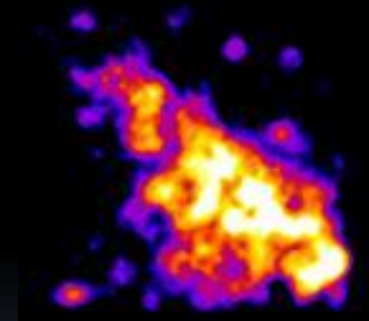


Clinical trial, QMC Nottingham

Tc-99m-HDP bone imaging in patient

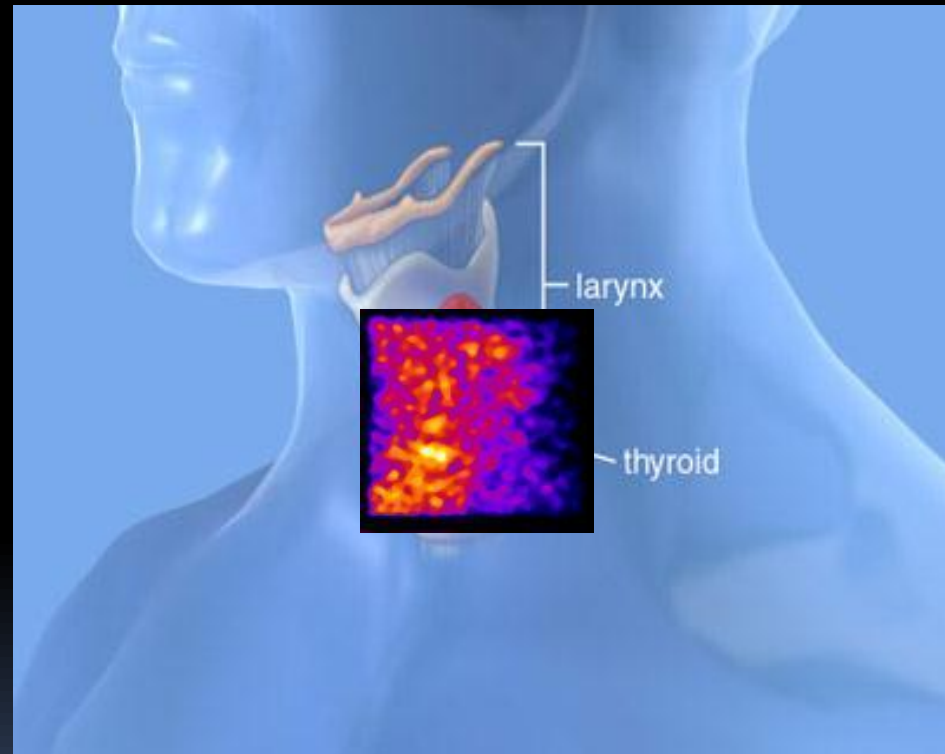


Conventional gamma camera



HR Mini gamma camera

Tc-99m-MIBI Parathyroid Study

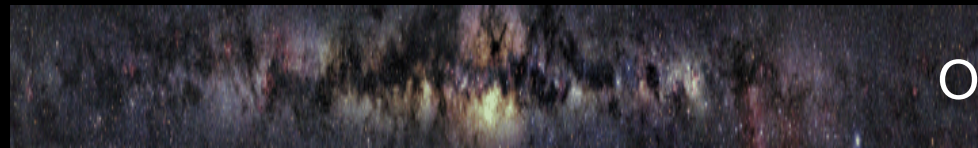


Multi-wavelength approach

The Milky Way



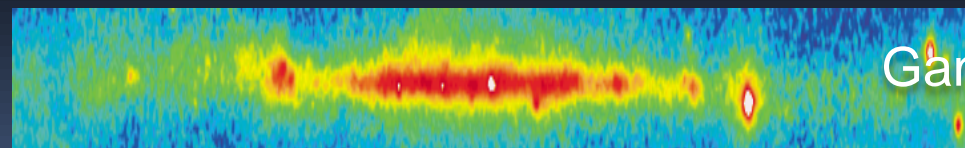
Near-Infrared



Optical

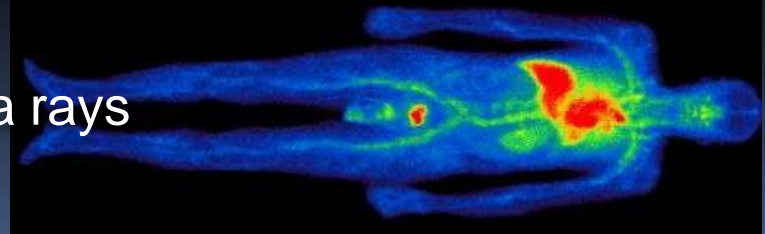
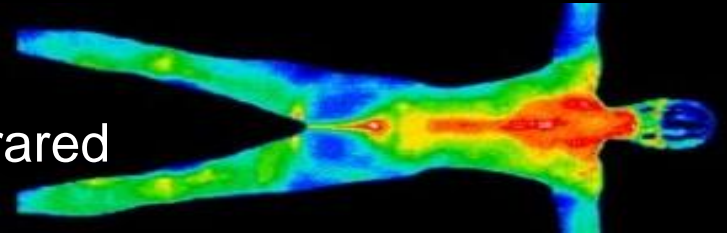


X - rays



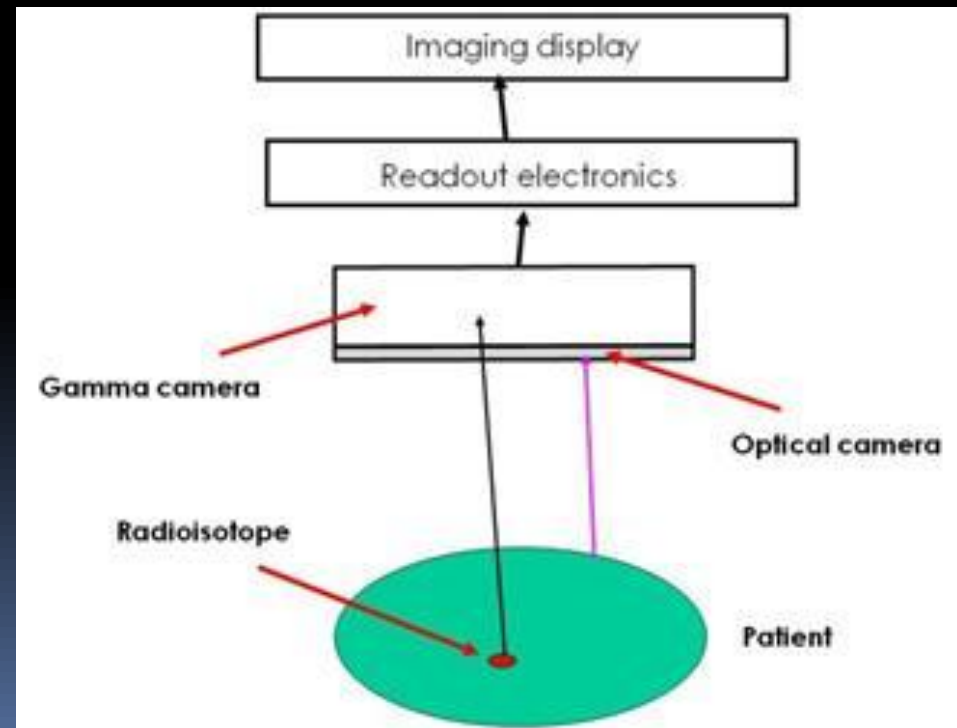
Gamma rays

Man

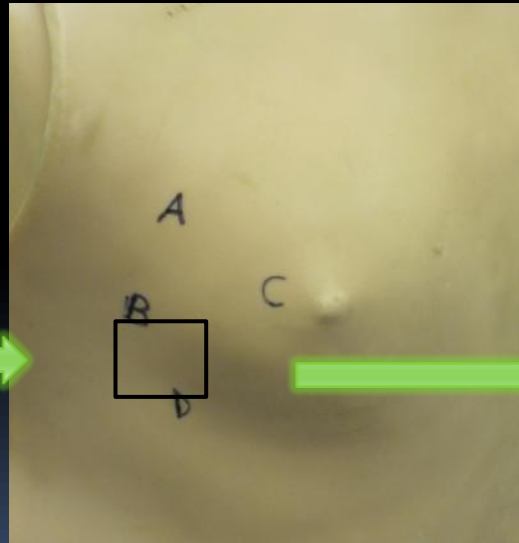
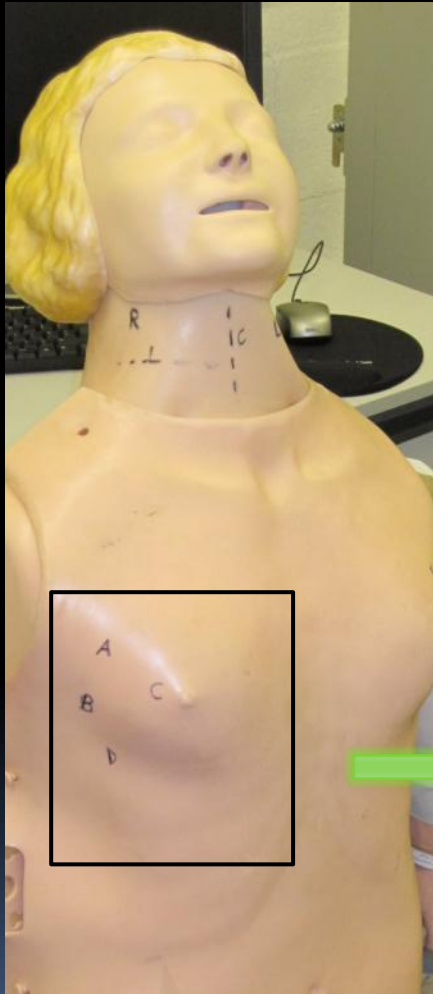


Hybrid camera

- A combined optical and gamma camera system
- Co-aligned optical and gamma camera
- Minimises parallax
- Minimises image registration problems



Lymph node phantom



Hybrid Imaging



Benefits of SFOV Cameras

- High spatial resolution (<1mm)
- Energy range 30-160 keV.
- Hand held potential
- Point of care imaging

Intra-operative imaging will

- Improve patient management
- Increase surgical confidence
- Reduce surgery time
- Reduce cost of treatment

Acknowledgements

- Space Research Centre, Leicester
David Bassford, Oliver Blake, Tony Abbey,
George Fraser, Duncan Ross, Chris Bicknell
Massimiliano Canali
- University of Nottingham
Alan Perkins and Elaine Blackshaw
- De Montfort University
Peter Ford and Lee Cottrell