

A Monte Carlo study for system development in low dose Molecular Breast Imaging (MBI)

Wednesday, 15 September 2021 13:06 (1 minute)

Molecular Breast Imaging (MBI) is a diagnostic technique which uses the radioisotope Technetium-99m to identify lesions within the breast. Cadmium Zinc Telluride (CZT) is a desirable detector material for use in MBI primarily due to its good position resolution. This property makes the detector highly sensitive to 141 keV gamma rays and therefore allows for an isotope of lower activity to be administered to patients without compromising the image quality. The DMatrix Nuclear Imager is a pixelated CZT detector which has been developed by Kromek for applications including Medical Imaging. The detector has previously been characterised at the University of Liverpool for high activity application in Molecular Therapy. We are currently investigating the application of the system towards low activity measurements in MBI.

One of the primary aims of MBI is to optimise a detector system that minimises the dose delivered to the patient. The system consists of both a CZT detector and an imaging collimator, whose properties both contribute to the overall system performance. The collimator is required in order to reconstruct the path of the detected gamma-rays. It is desired that the collimator is optimised such that it complements the sub mm3 resolution achieved (through PSA) within the CZT. The desired imaging properties of good position resolution and high sensitivity are conflicting requirements in terms of collimator design and hence the collimator must be designed such that this trade-off is surmounted.

A Geant4 simulation has been developed to model Kromek's DMatrix system and explore its response to irradiation of 141 keV gamma rays. The simulation has also been used to model and compare the imaging performance of various collimator designs. The Monte-Carlo study is complemented by a suite of ongoing experimental work. In this talk, the results of the Monte-Carlo study will be presented.

Title

Ms

Your name

Hannah Brown

Institute

University of Liverpool

email

sghbrow2@liverpool.ac.uk

Nationality

British

Primary author: BROWN, Hannah (University of Liverpool)

Presenter: BROWN, Hannah (University of Liverpool)

Session Classification: Poster Session 2 (X-ray and Gamma Ray Detectors; Applications in Nuclear Physics and Nuclear Industry; Detectors for FELS, Synchrotrons and Other Advanced Light Sources; Detectors for Neutron Facilities; Novel Ionising Radiation Detection Systems)

Track Classification: Applications in Nuclear Physics and Nuclear Industry