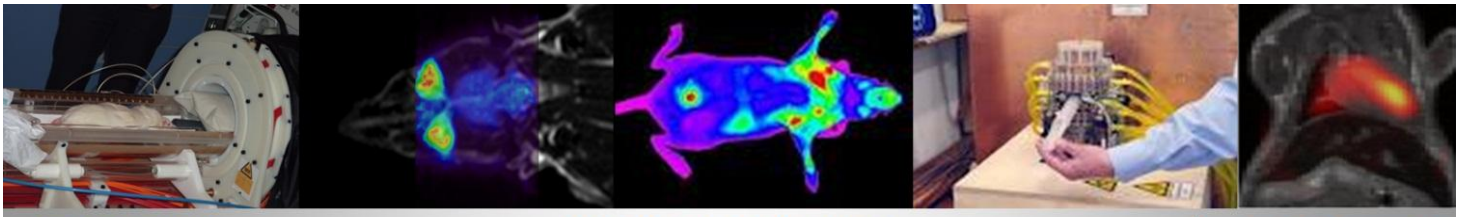


PMI Physics of Molecular Imaging Systems

HELMHOLTZ-INSTITUT FÜR BIOMEDIZINISCHE TECHNIK

RWTH

Research focus of the department of “Physics of Molecular Imaging Systems” (**PMI**) is on exploring the physical limits of current and future molecular imaging technologies. These areas range from simulations of new detector concepts, hardware prototypes, high speed data processing, image reconstruction algorithms and applications using our research imaging prototypes. Our group consists of students and researchers from different disciplines: physics, engineering, computer science and medicine. PMI is part of a large international network with a close link to industry, especially Philips Research.

Data Processing for and Characterization for a Monolithic PET Detector Stack

Positron Emission Tomography

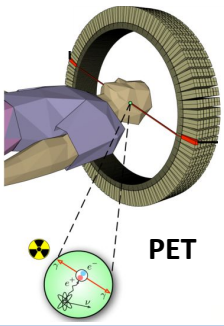
In Positron Emission Tomography (PET) imaging, a patient or animal is injected with a radioactive substance emitting positrons during decay. The positron annihilates with an electron from the patient’s body, thus producing two gammas which propagate through the body in opposite directions. These gammas are detected outside the body using a ring of PET detectors. From the detection points a line of response can be assumed along which the annihilation took place.

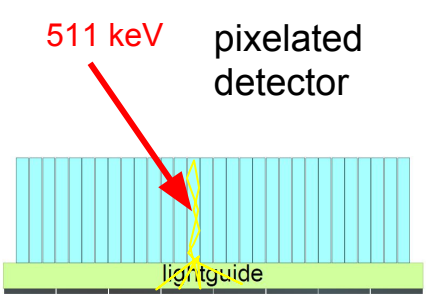
Monolithic Scintillation Detector

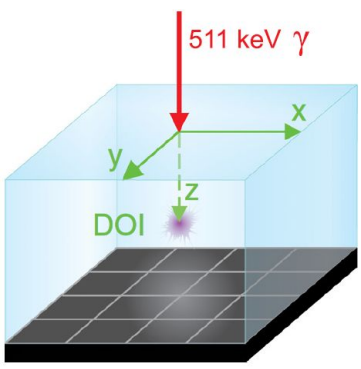
PET detectors mostly use scintillators which are readout by photosensors. A PET detector has to measure the the position, energy and timing information with high precision. Besides the classical approach to segment the scintillator and identify the crystal element that has been hit by the gamma, novelle detectors use a larger monolithic crystal which is read out by multiple photosensor channels. From the measured light distribution on the photosensors the 3D position of the scintillation event position inside the crystal volume can be deduced.

Your Thesis

In this master’s thesis the candidate shall use a pinhole collimator setup that allows to produce a gamma beam with a width of about 0.5mm to calibrate a monolithic LYSO scintillator read out by digital silicon photomultipliers. From the gathered calibration data a positioning algorithm shall be developed (eg. kNN or MLE). The positioning accuracy in all three dimension will be tested and compared to pixelated scintillator geometries. The candidate will work with a processing and calibration environment, which is implemented in a multi-threaded C++/Qt/ROOT environment. Good programming skills are preferred as well as a good understanding of statistical data analysis.







Van Dam, H. T. et al. (2011). “A practical method for depth of interaction determination in monolithic scintillator PET detectors”. Phys. Med. Biol., 56 (13), 4135–4145. doi:10.1088 /0031-9155/56/13/025

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