Research Techniques Seminar

PET Developments at i3M

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Curia II (WH2SW)

Clinical and organ-dedicated PET ('Positron Emission Tomography') systems typically require a high efficiency, imposing the use of thick scintillators, normally through crystal arrays. When depth of interaction (DOI) information is required, 2 layers in the staggered or phoswich approach are mounted, resulting in a higher material cost. An alternative we are proposing in our projects is the use of thick and large monolithic crystals. In order to return accurate 3D photon impact coordinates, both planar and DOI ('depth of interaction'), but also good energy resolution is required. In our systems SiPM ('Silicon PhotoMultiplier') arrays are being used, each array is directly connected to a readout circuit that provides outputs for each row and column of the array. Each detector module provides information for both X and Y projections of the scintillation light distribution. The centroids of these distributions are calculated through a modified version of the center of gravity algorithm. The photon impact DOI is estimated by the ratio of the sum of all signals (photon energy) to the maximum data point (E/Imax). Accurate DOI information is used to properly calculate the true Line of Response ('LOR'), correcting for the parallax error, in order to obtain a homogenous spatial resolution of the reconstructed image. Through the present seminar one small animal PET system and three different human dedicated PET systems (2 for the brain and one for the prostate) are going to be described, making an overview of their capabilities, showing their spatial, energy and DOI resolution values.