Technical Subject:

Development of Depth-of-Interaction Detector and Scanner Design for Brain PET

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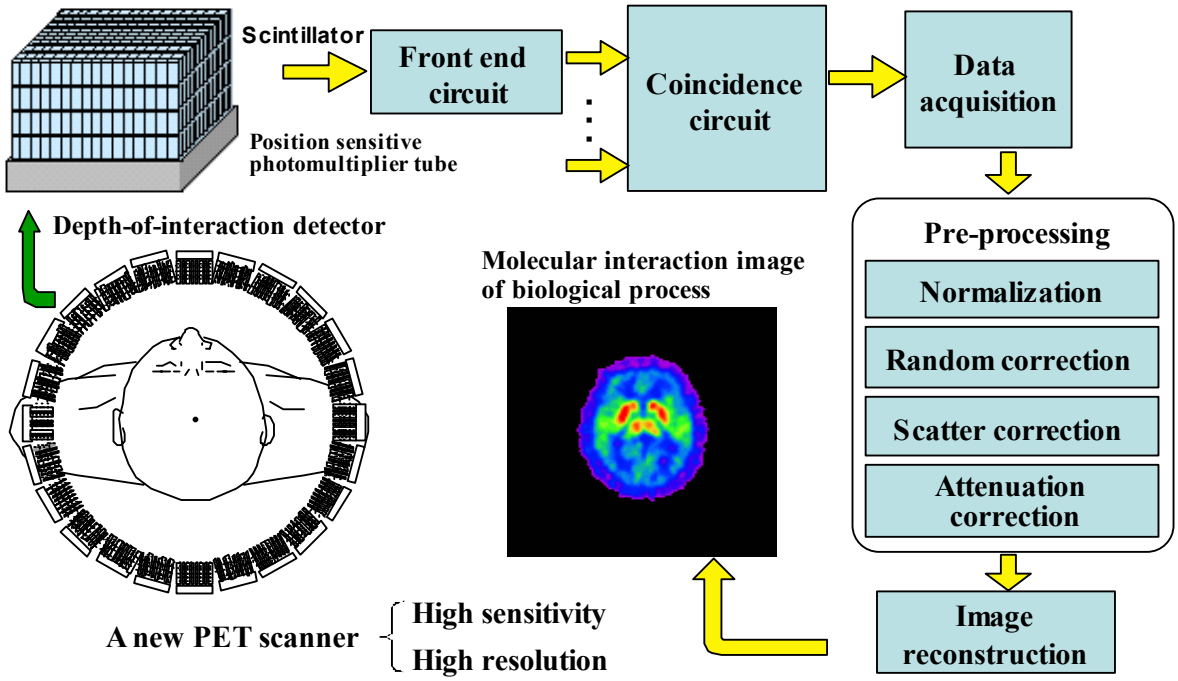

Goal & Contribution to well-being for all humanity:

A detector having a depth encoding scheme will be designed and prototype units will be constructed and evaluated. Using the practical depth-of-interaction detector, we will design a PET (positron emission tomography) scanner with high sensitivity and high resolution. Our PET scanner will improve quality and quantity of the PET image and at the same time to decrease radiation dose of persons to be examined their brain function on the basis of molecular imaging techniques that use radiolabeled molecules to image molecular interactions of biological processes in vivo. Our research project will provide a novel way to improve the rates of discovery and approval of pharmaceuticals on brain function and will contribute to study the integrative biology of nervous disease and to develop molecular therapies targeting the biological processes of mental disease.

Method/Approach:

The depth-of-interaction of gamma rays degrades the spatial resolution across the field-of-view for PET images. Especially, it is much important to proceed full 3D PET data acquisition with increasing sensitivity. The proposed detector unit consists of scintillation crystal blocks in a 2x2 array optically coupled at the bottom face to a position sensitive photomultiplier tube. Each scintillation event is mapped in a two dimensional distribution provided by the relative ratio of the output signals. Threedimensional location in the detector block projects into the two-dimensional map. We design and evaluate a PET scanner using the depth-of-interaction detectors towards its clinical application with coincidence measurement between the two detectors and the computer simulation in which new technologies on the coincidence handling, the data acquisition, the preprocessing and the image reconstruction are included.

Position in the session:

Since PET scanner is now recognized as an important tool for brain study of non-invasive imaging, radiation dose by injection of radiopharmaceuticals is one of the serious problems. Our proposed PET scanner will overcome this problem with the new detector and the relevant new technologies at no expense of spatial resolution.

Call for collaboration:

In order to improve performance of our detector, we would like to collaborate with the material scientist who is interested in the scintillator for PET.