

1. Introduction

A novel Positron Emission Tomography (PET) detector consisting of strips of polymer scintillators is being developed in J-PET Collaboration. Despite other commercial PET scanners which are based on crystal scintillators. 24 Modular J-PET is the latest prototype of the J-PET collaboration which is using Silicon photomultipliers, Fig 1 shows perspective view of the 24 Modular J-PET. Each one of the modules in this prototype contain 13 strips of EJ-230 with 50 cm long plastic scintillator. Modules in this geometry are placed on the lateral area of a cylinder with 70 cm diameters. The axis of each detector is parallel to the axis of the cylinder. At each ends of the every modules

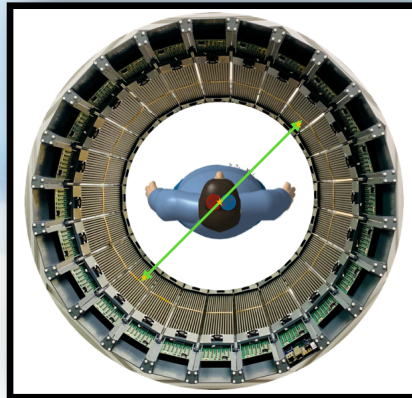


Fig1. Perspective view of the 24 Modular J-PET

Source Number	Positions (cm)
Number 1	(1,0,0)
Number 2	(1,0,18.75)
Number 3	(10,0,18.75)
Number 4	(10,0,0)
Number 5	(20,0,0)
Number 6	(20,0,18.75)

Table 1. Position of sources in GATE simulation

3. GOJA

Gate Output J-PET Analyzer (GOJA) is a software which developed by J-PET collaboration for GATE output analyzing. This software can preselect events and produce a List_Mode of each coincidences, which can use in image reconstruction.

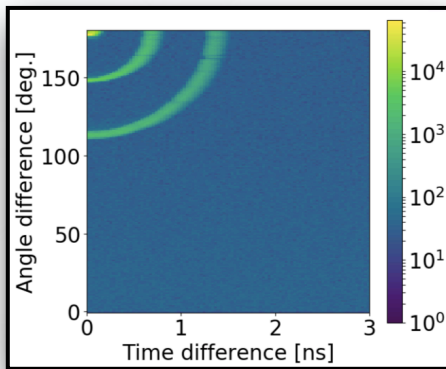


Fig 3. scatter plot of angle difference versus time differences for annihilation of the 6 point sources by GOJA software

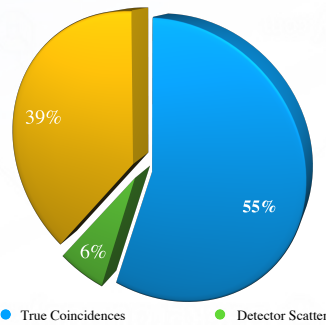


Fig 4. Percentage of each type of True, Scatter and Accidental coincidences for 6×10^4 activity.

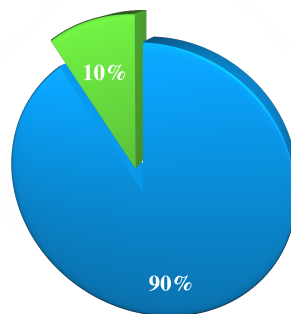


Fig 5. Percentage of each type of True and Scatter coincidences for 6×10^4 activity.

2. GATE simulation

GEANT4 Application for Tomographic Emission (GATE) is one of the most advanced specialized software packages for simulations of the Positron Emission Tomography scanners. For this simulation, 6 point sources have been used and just back to back events taken into account. Once The positions of these sources are according to the Table1. All of these 6 sources were active during simulation.

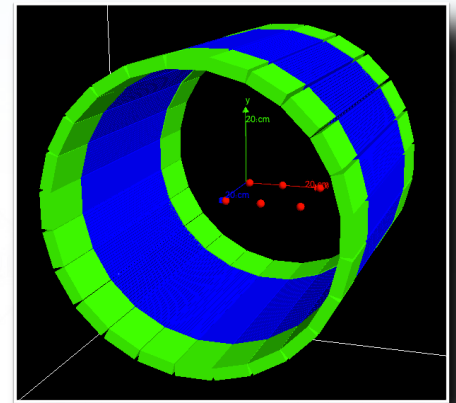


Fig 2. GATE simulation of the 24 Modular J-PET

4. Discussion

24 Modular J-PET is under construction, one of the aims of investigations is to find out all the NEMA characteristics of the tomography by GATE simulation. In parallel, GATE simulation and GOJA data analyzing have been implemented, to provide us with the reconstructed images of J-PET. For this goal, we are adapting Quantitative Emission Tomography Iterative Reconstruction (QETIR) software.

References

- [1] Jan S, et al. Phys in med and bio 49.19 (2004): 4543.
- [2] Kowalski, P. et al. Phys. Med. Biol. 63 (2018) 165008 (17pp)
- [3] Agostinelli S, et al. Nucl instru and meth in phy sec A: 506.3 (2003): 250-303
- [4] Kowalski, P. et al. Bio-Alg and Med-Syst, 10(2). doi:10.1515/b2014-0002.
- [5] Moskal, P. Et.al. Phys. Med. Biol. 61 (2016) 2025–2047
- [6] Vandenberghe, S, “ Ghent University Hospital, Co, Medisip” 2019.

Acknowledgment

The authors acknowledge the support by The Polish National Center for Research and Development through grant INNOTECHKI/INI/64/159174/NCBR/12, the Foundation for Polish Science through the MPD and TEAM/2017-4/39 programmes, the National Science Centre of Poland through grants no. 2016/21/B/ST2/01222