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Investigation of the DOI capable configuration in dealing with the parallax error in the Total-Body J-PET tomograph

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There is an ongoing interest in the development of Total-Body PET scanners. J-PET Collaboration from Jagiellonian University, as one of the groups focused on development of such tomograph, investigate the possibility of PET scanner construction based on the novel geometrical configuration and unique utilization of organic scintillators. Despite many advantages of Total-Body PETs, they create new challenges. The impact of parallax error decreases the system resolution and as a result, the image quality. Solution for that may be introduced by creation of a PET system with depth of interaction (DOI) capability, which can provide more accurate information about the location of gamma photon interaction with the scintillator material. In this simulation-based work a new DOI capable Total-Body PET tomograph designed with the J-PET technology has been inspected. Its feasibility was assessed by comparing to the standard Total-Body J-PET tomograph as a dependence of characteristics such as sensitivity, scatter fraction and coincidences share. Both scanners were simulated using GATE simulation software. Additionally, impact of the 45° acceptance angle has been assessed. As expected, the DOI capable solution does not have influence on investigated characteristics, which suggest its applicability for the parallax error correction. As a next step, the effect of this human-grade Total-Body J-PET configuration on the imaging will be investigated.

Primary authors: DADGAR, Meysam (Jagiellonian University); Prof. MOSKAL, Pawel (1-Marian Smoluchowski Institute of Physics, Jagiellonian University, Poland. 2- Total-Body Jagiellonian-PET Laboratory, Jagiellonian University,Poland); Mr PARZYCH, Szymon (1-Marian Smoluchowski Institute of Physics, Jagiellonian University, Poland. 2- Total-Body Jagiellonian-PET Laboratory, Jagiellonian University,Poland)

Presenter: DADGAR, Meysam (Jagiellonian University)

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