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Reconstruction of the NEMA IEC body phantom from J-PET total-body scanner simulation using STIR.

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Current total-body PET scans are time consuming, expensive, and require high-activity radiopharmaceuticals. In available clinical PET scanners, the cost of detectors introduces restrictions to the field of view. The J-PET project of a total-body scanner based on polymer detectors is expected to increase geometric efficiency without increasing the production costs. The results of reconstruction of the NEMA IEC phantom simulation for a long J-PET scanner will be presented. The simulations and reconstruction is carried out using two recognized open source packages. For simulations of the phantom and the scanner the GATE (Geant4 Application for Tomographic Emission) is used, while the basis for the 3D image reconstruction is the STIR (Software for Tomographic Image Reconstruction). Huge number of registered coincidences in a total-body scan poses a challenge for data acquisition and image reconstruction. Additionally, for long cylindrical PET detectors, the axial resolution can be degraded by the parallax effect between detected pairs with a large axial difference. A more oblique line of response (LOR) penetrates more scintillating material than a LOR of less axial difference, which coupled with unknown depth of interaction increases uncertainty on axial position of detection pair. One possible solution to this problem is to limit the maximal LOR angle with regards to the transverse plane. The effect on the image quality of LOR angle is discussed.

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