

Abstract

The novel whole-body PET system is developed by the J-PET Collaboration. It is built of relatively cheap plastic scintillator strips arranged axially in the form of a cylinder. Usage of plastic scintillators opens perspective for the cost-effective construction of the total-body PET. In order to determine properties of the scanner prototype and optimize its geometry, advanced computer simulations using the GATE software were performed.

Firstly, simulations were verified with experimental results for laboratory prototype. After that, the simulations were used to calculate the NEMA characteristics and maps of efficiency. The spatial resolution, the sensitivity, the scatter fraction and the NECR were estimated according to the NEMA norm as a function of the length of the tomograph, number of the detection layers, diameter of the tomographic chamber and for various types of the applied readout.

Simulations results were used to optimize geometry and working parameters of the J-PET scanner. They were also used to compare the J-PET solution with current commercial technology.