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Feasibility study of positronium imaging with Biograph Vision Quadra and Modular J-PET

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On behalf of the J-PET Collaboration

Abstract

Positronium Imaging is gaining interest as a new promising method that may improve the diagnostic specificity of Positron Emission Tomography. Recently, the first ex-vivo and in-vivo positronium lifetime images were demonstrated by means of the dedicated multi-photon J-PET system. The latest upgrades of the Biograph Vision Quadra (Siemens Healthineers) to the singles mode acquisition open the possibility of multi-photon imaging. In this simulation-based work, sensitivity of both systems has been assessed as a function of the energy window applied for registration of the prompt photon. The research was conducted using four radioisotopes: ^{124}I, ^{68}Ga, ^{44}Sc, ^{22}Na, which were chosen due to their medical or laboratory utilization. Simulations were performed with the GATE software. The result indicates that Biograph Vision Quadra provides about 400 times higher sensitivity with respect to the modular J-PET prototype used to demonstrate the first positronium images, assuming full energy acquisition of the prompt photon.

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