# Introducing the easyPET/CT: a Novel Multimodal Preclinical Imaging Scanner

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## Abstract

easyPET.3D is a micro-Positron Emission Tomography (micro-PET) scanner, patented and developed by Aveiro University, that can map the β+ emitter radiotracer biodistribution within a living organism. This scanner employs an innovative acquisition method characterized by a synchronous rotation of two sets of detectors with high granularity, using fewer detectors compared to other micro-PETs.

Incorporating Computed Tomography (CT) in PET scanners allows precise anatomical structure identification and the creation of attenuation coefficient maps, crucial for enhancing PET image quality through attenuation correction. The main goal of this work is to incorporate the CT modality in the easyPET.3D, offering a modern and cost-effective hybrid micro-PET/CT solution for the preclinical market.

Our CT approach relies on using radioactive sources, such as Americium-241 (241-Am), as the radiation source. This is an optimal solution for integrating the CT imaging modality into the easyPET.3D system, which also benefits from its unique acquisition method. In the easyPET/CT geometry, the radioactive source is positioned tangentially above and axially centered with one of the easyPET's detector modules, while the other module is dedicated to transmission imaging.

Simulation studies conducted using GATE v9.2 will be presented . Results show the system's capability to detect objects with reduced dimensions (> 0.125 mm). Additionally, experimental tests with the system were performed showing the electronics' capability to detect characteristic peaks of 241-Am (30 keV and 60 keV), opening the door for dual-energy CT imaging applications.

Ongoing efforts include further simulation studies to assess spatial resolution and real-world testing to validate simulation findings, including the studies of the optimal electronic gain and detectors bias supply to increase the SNR from the $^{241}$Am detected signals.

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