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Development of an instrument for time activity curve measurements during Positron Emission Tomography imaging of rodents

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Molecular imaging using Positron Emission Tomography (PET) in small rodents commonly requires the knowledge of the input function of the tracer (development of new drugs or new tracers ...). In this paper, we report the status and the performances of a prototype of a counting system under development at DAPNIA(1) in collaboration with SHFJ(2). The detection device consists on six silicon diodes of 0.3 mm thickness used to detect the positrons emitted by the radiotracer contained in the arterial blood flowing in a thin wall catheter. Such diodes are poorly efficient for the detection of 511 keV gammas escaping from the rodent and thus require a thin lead shielding. The detectors, the front-end electronics (for signal preamplification, shaping, and discrimination), and the acquisition circuits are mounted on a single card. The device is connected directly to a portable computer via an USB port. Such a design provides a compact, rugged and portable device for working close to a small animal PET camera. Preliminary experimental measurements were performed using ^{18}F solutions with activity concentration close to that encountered during typical animal PET studies. The results show that the detector presents a good detection homogeneity, a good linearity and an efficiency of nearly 40 % close to that predicted using Monte Carlo simulations.

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