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Simulation of a neuroimaging experiment with MAPSSIC, a β+ sensitive intracerebral microprobe

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The correlation of molecular neuroimaging and behavior studies in the preclinical field is of major interestto unlock progress in the understanding of brain processes and assess the validity of preclinical studies in drug development. However, fully achieving such ambition requires being able to perform molecular images of awake and freely moving animals whereas currently, most of the preclinical imaging procedures are performed on anesthetized animals. To achieve such a combination, we propose MAPSSIC, a pixelated intracerebral probe based on the CMOS technology implantable in rat brains. This probe provides real time images of β+ radioisotopes concentrations along its axis. Thanks to its in situ position, the probe is able to directly detect positrons. We present the simulations
with GATE of a typical animal experiment using a widely used β+ radiotracer with a fully voxelized rat phantom to assess the capacities expected with the probe.
We show that, at the optimal radiotracer distribution time point, 99.52 % ±0.10 % of the events recorded in the specific probe come from the skull area. Moreover, nearly 90 % of the events are from a direct detection of positrons which ensures the recording of local information.

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