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MAPSSIC: Development of a miniaturized CMOS telemetric probe for deep brain imaging of radiotracers in awake and freely moving animals

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The purpose of MAPSSIC project is to provide an innovative tool for imaging beta+ radiopharmaceuticals in rodents brain, in order to assess brain functional processes. Complementary to others imaging modalities (such as Positron Emission Tomography), MAPSSIC distinguishes itself by performing real time images on awake and fully freely-moving animals, a requirement for concomitant behavioral studies.

Although previous intracerebral probes development showed promising results for behavioral neuroimaging [1,2], limits were reached in sensitivity, noise and mechanical properties. The CMOS sensor technology is an opportunity to provide several advantages for direct detection of beta+ particles.
Thus, the MAPSSIC collaboration aims to produce this solution on the basis of a wide range of expertises, from micro-electronics to behavioral neurosciences. The ambition of the project is to investigate the potential of CMOS active pixels and to develop within a period of 3 years an improved beta+ intracerebral probe surgically implantable in brain tissues.

In order to produce optimal detection technology, three different CMOS sensor prototypes have been designed at Institut Pluridisciplinaire Hubert Curien, probe performance have been studied using Monte-Carlo simulations at Imagerie et Modelisation en Neurobiologie et Cancérologie laboratory, data acquisition and transmission technologies have been studied at Centre de physique des particules de Marseille.

[1]: Märk, J., Benoît, D., Balasse, L., et al. *A wireless beta-microprobe based on pixelated silicon for in vivo brain studies in freely moving rats.* Physics in medicine and biology, 2013, vol. 58, no 13, p. 4483.

[2]: Balasse, L. et al. *PIXSIC: A Wireless Intracerebral Radiosensitive Probe in Freely Moving Rats* Molecular Imaging, Vol 14 (September 2015): pp 484-489.

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