The aim of the CaLIPSO project is to develop a new, high sensitivity, high spatial resolution PET-scan technology. The project focus on the development of an innovative calorimetric detector. Beyond the measurement of Gamma photon energies, this detector must allow locating photon interactions in the detector in three dimensions, with accuracy of the order of 1 mm3. The steering committee of the CEA Technosanté program has qualified this project as a *technological breakthrough*. A patent has been accepted (WO2011/117158), and is being extended to international.

#### The CaLIPSO detector

The detector uses a “heavy” organometallic liquid (TriMethyl Bismuth, 70% by weight of Bismuth), to convert photons with energies of the order of 1 MeV. We intend to develop an ionisation chamber filled with ultra-pure TMBi: the detection of electrons allows the interactions to be located, in the plane of charge collection. The collected charge also codes the energy deposited in the detector. In addition, a common physical property of materials subjected to ionising radiation is light production, generally with a poor efficiency. We will use the detection of optical photons, to “trigger” the detector, and to provide accurate dating of the interaction time. The drift time of the electrons measures the distance covered through the thickness of the detector.

The expected performances, were until now unattainable. For a 511 keV photon, we compute: a photoelectric efficiency of 57%; an energy resolution of ~ 10%; a temporal resolution of few 100 ps, allowing Time Of Flight reconstruction, an interaction localisation in the detector accurate to within 1 mm.

The research program proposed to P2IO started as soon as we learned the project approval. Ceramic sample holders have been designed, bought and recieved. Thin film titanium deposition has been done in IPN labs. CSNSM/SEMIRAMIS team have implanted Ni beam at 3 doses. CEA/IRFU labs have tested Titanium wet eching procedure, and high resistivity surface measurement methods. Technology has yet to be optimised. We are working on it.

Best regards

Dominique Yvon, for the CaLIPSO collaboration team.