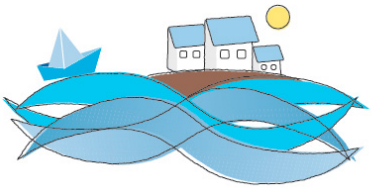

Mediterranean Thematic Workshops in Advanced Molecular Imaging

Contribution ID: **4** Type: **Oral**

Low dose small animal 3γ imaging with the XEMIS2 liquid xenon Compton telescope

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The goal of the innovative 3γ medical imaging modality is to reduce significantly the dose administered to the patient. Based both on new detection technologies involving liquid xenon and on a specific 3γ emitter radionuclide, ^{44}Sc produced by the ARRONAX cyclotron, the 3γ imaging has a very high potential from small animal imaging acceptances to whole body clinical applications.
Following a conclusive R&D program around the XEMIS1 prototype (XEnon Medical Imaging System), a second phase dedicated to small animal imaging, XEMIS2, is now under qualification. This new prototype is a monolithic liquid xenon cylindrical camera, which totally surrounds the small animal thanks to its 24 cm axial field of view.
XEMIS2 hold around 200kg of liquid xenon. The active volume of the detector is covered by Hamamatsu PMTs to detect VUV scintillation photons generated by liquid xenon, and the ionization signals are collected by two end plates with segmented anodes and a total number of 20000 pixels. XEMIS2 has been designed for preclinical applications in hospital centers; it includes a very compact liquid xenon cryogenics workshop and a fast DAQ with new electronics.
In parallel, a full simulation of the camera has been performed and a complete reconstruction algorithm has been developed to triangulate the position of the source from the interactions of the 3 γ. Absolute sensitivity of 7% should be reached for a small animal. An image of the whole field of view is obtained using an ML-EM iterative deconvolution algorithm. Detectability and contrast are very promising with 20 kBq of injected activity in the phantom with only 20 mn of exposure time. This is typically 100 times less activity than that used for conventional PET small animal imaging.
The XEMIS2 camera should be completely qualified this year. From 2017, it would be operational and available for preclinical research at the CIMA center of the Nantes Hospital.

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