DOCTORATS INDUSTRIALS

EL PLA DE DOCTORATS INDUSTRIALS

PROJECTE DE DOCTORAT INDUSTRIAL EXPEDIENT 2016 DI 014

DADES DE L'EMPRESA I DE L'ENTORN ACADÈMIC

Títol del projecte
Optimized monolithic PET moduled using MPPCs and HRFlexToT
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Hamamatsu Photonics France Sucursal en España.
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BREU DESCRIPCIÓ DEL PROJECTE DE RECERCA

There is a lot of research in medical imaging focused on improving the time resolution that is related with the spatial resolution, it means the minimum part of the organ under study that could be resolved. In this Ph. D the work will be focused in the construction of a Possitron Emission Tomography (PET) module with the best timing performance as possible with 25x25x20mm crystals. The specific task to be done during this work are:
- Monte Carlo simulation of the monolithic scintillator crystal to obtain the best surface configuration.
- Produce an optimized design of a monolithic demostrator PET module.
- Implementation of the monolithic demostrator using 3x3mm SiPM in a 64 channel configuration with 25x25x20mm scintillator crystals attached.
- Laboratory evaluation of the demostrator and comparison with expected from the simulation .

The candidate should have a strog background in solid state devices such as PMTs and SiPMs, experience in the use of laboratory equipment like voltage source, oscilloscopes, LASERs, a knowledge of Monte Carlo simulations software, specialy PENELOPE, which is focused in radiation-matter interaction.

The work will be organized in few sequential steps:
- Initial evaluation of key crystal features necessary to achieve the desired goals: light yield, reflectivity on its surfaces, rise and decay time, transparency, uniformity. Basic version of monolithic crystal simulation. Selection of 1-2 scintillator material candidates.

- Measurement of crystal samples, including aspects like size, purity and surface treatment and tuning of the Monte Carlo simulation to allow description of all the measurements. It will be desirable to include in the evaluation one or more solutions for the coupling of the crystal to the MPPC.
- Design and construction of a demonstrator module (or modules if the budget allows it) optimized for 3D position and time resolution as well as for detection efficiency for 511 keV photons. The necessary electronics for the readout will be provided by UB/HPKK independently of this work.
- Development of a basic data acquisition and processing algorithms and software.
- Design and construction of the evaluation setup allowing to take data in coincidence with a reference high resolution module, for instance a 2x2x3 mm3 LSO or LFS crystal coupled to a single channel MPPC.
- Evaluation of the demonstrator module on the lab under standard conditions allowing extrapolation of the results to a complete device based on this module under normalized conditions like NEMA NU 2-2012 or NEMA NU 4-2008.