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Detection Sensitivity and Light Collection Studies of an APD-based High Packing-Fraction LYSO:Ce Matrix for PET Applications

The ClearPEM is a dedicated APD-based PET detector for high-resolution breast cancer imaging. The basic detector module is composed of 12 LYSO:Ce crystal matrices, each with 4x8 individual crystals (2x2x20mm3) optically coupled on both ends to S8550 Hamamatsu APD arrays for the scintillation light readout.

In the present design, the sensitive area corresponding to the LYSO:Ce crystals is ~46%, being the dead space due the existing gaps between the detector modules, encapsulation and BaSO4 reflective walls.

To improve the overall sensitivity of the system, a new compact crystal matrix geometry was designed aiming to minimize the existing dead spaces. From geometrical considerations the active area will increase up to 76%. However, and due to the different cross-section matching factors between the APD pixels active area and each individual crystals, a study on the effects on the energy and time resolution, optical crosstalk and on the depth-of-interaction capability is required.

In this conference we present an experimental study on the improvement of the sensitivity with this new compact matrix, and a characterization of its effects on the overall detector performance.

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ClearPEM

Primary author: Dr NEVES, Jorge (LIP - Laboratory of Instrumentation and Experimental Particle Physics)

Co-authors: Dr ORTIGÃO, Catarina (LIP - Laboratory of Instrumentation and Experimental Particle Physics); Mr SILVA, José C. (LIP - Laboratory of Instrumentation and Experimental Particle Physics); Prof. VARELA, João (LIP - Laboratory of Instrumentation and Experimental Particle Physics); Mr BUGALHO, Ricardo (LIP - Laboratory of Instrumentation and Experimental Particle Physics); Mr VECKALNS, Viesturs (LIP - Laboratory of Instrumentation and Experimental Particle Physics)

Presenter: Mr VECKALNS, Viesturs (LIP - Laboratory of Instrumentation and Experimental Particle Physics)

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