EVALUATION OF A SMALL FIELD OF VIEW SIPM ARRAY DETECTOR BASED ON A LGSO:Ce PIXELLATED SCINTILLATOR

Stratos David, Eleftherios Fysikopoulos and Nektarios Kalyvas

Department of Biomedical Engineering, Technological Educational Institute of Athens, 122 10 Athens, Greece

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Purpose

- The aim of this study is to investigate the behavior of the ArraySL-4 (4x4 array) silicon photomultiplier array coupled to a 6x6 LGSO:Ce pixellated scintillator, for possible applications in small field of view PET imaging detectors.
- Evaluation was carried out with ^{137}Cs radioactive source and results regarding energy resolution and peak to valley ratio are presented.

Introduction

- Silicon photomultipliers are used in dedicated small field of view animal imaging detectors (i.e in those used to head PET/MR studies in mice) due to their small size and flexibility.

- LGSO:Ce scintillator crystal is based on a mixture of LSO:Ce and GSO:Ce orthosilicates and has high density of 7 g/cm^3, high light output (~32000 ph/MeV) and fast scintillation decay time (~40 ns).

Materials and Methods I

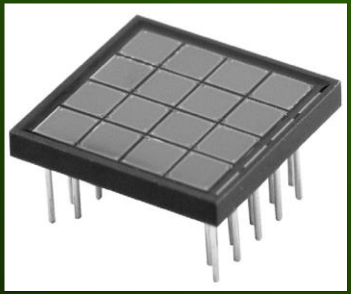

Fig 1. SensL's Sipm array

- ArraySL-4 (4x4 element array of $3x3mm^2$ silicon photomultipliers) purchased by SensL company, Ireland.

Fig 2. LGSO:Ce scintillator array

- LGSO:Ce 6x6 scintillator array, with $1.9x1.9x5mm^3$ crystal size elements purchased by Amcrys company, Ukraine.

Materials and Methods II

- We have developed a symmetric resistive charge division circuit to read out the signal outputs of 4x4 pixel SiPM array reducing the 16 pixel outputs to 4 position signals.

- The 4 position signals were acquired using a free running sampling technique.

- An FPGA (Spartan 6 LX150T) was used for triggering and signal processing of the pulses acquired using free running Analog to Digital Converters.

Results

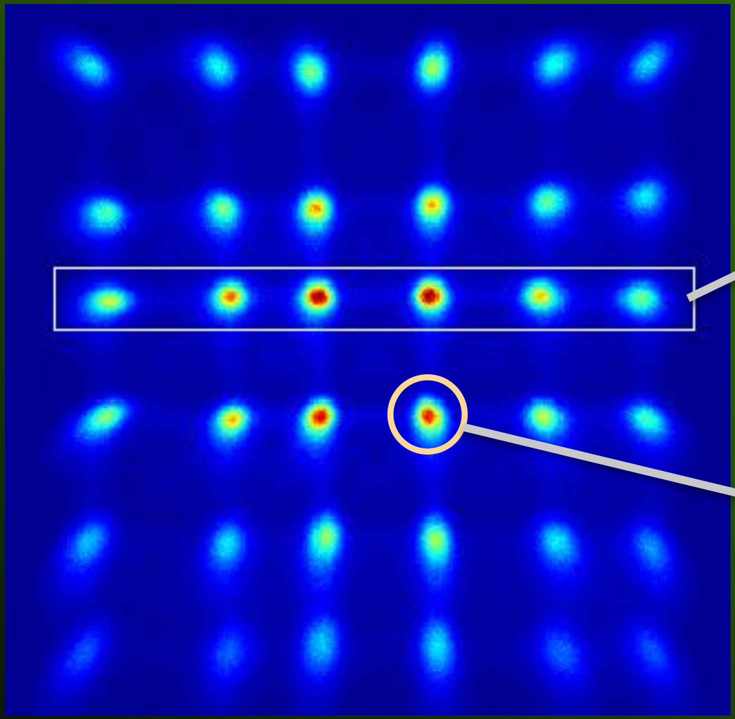

Fig 3. Raw image produced under 662 keV excitation at room temperature.

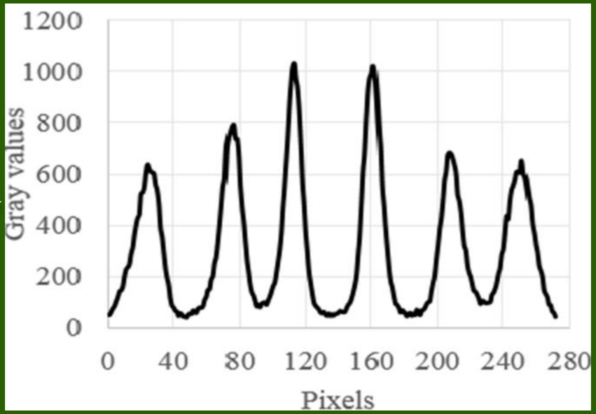

Fig 4. Horizontal profile of the pixel elements

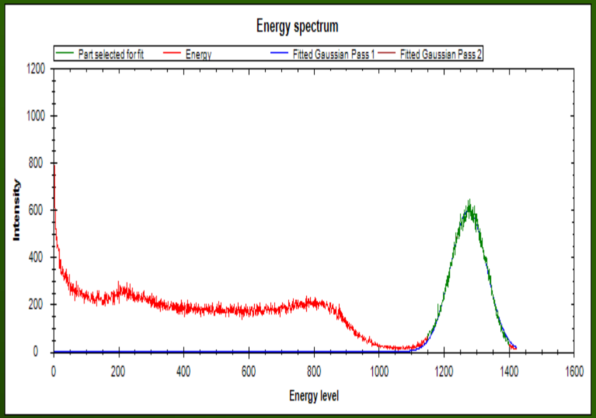

Fig 5. Energy spectrum of the central scintillator element.

Conclusions

- Evaluation shows a clear visualization of all (64) discrete scintillator elements.

- The mean peak to valley ratio of the profiles on the image was measured equal to 13.

- The mean energy resolution was measured equal to 18%.

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