

Development of SiPM DOI detector for high resolution PET system

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I. Background

Silicon photomultipliers (SiPMs) are silicon based semiconductor photodetectors that are of great interest for positron emission tomography (PET) because of their faster response and higher gain. In this work we will present a concept scheme of a high resolution positron emission tomography system based on 0.5 mm pixel Ce:GAGG scintillator and newly developed 16-channels silicon photomultiplier array prototype. This system will be constructed in order to measure dynamics of blood cells.

II. Materials and Experiment Results

A new 16-channel SiPM device prototype has been designed and fabricated. The array of the 16-channels SiPM has 500 μm pitch. A single pixel, sized 390 x 390 μm^2 , consists of 676 APD-Geiger mode cells. To get the best possible spatial resolution the individual readout system is used. The layout of the 16-channels SiPM is shown in Fig. 1, which shares one cathode for bias and has 16 anode outputs. The measured breakdown voltage of the detector is 22.77 V and the operational voltage range is in between 24 V and 30 V. The basic performance of 16-channels SiPM array with a picosecond light pulser is shown in Fig. 2, where the maximum amplitude reaches 290 mV by the full excitation of all the cells.

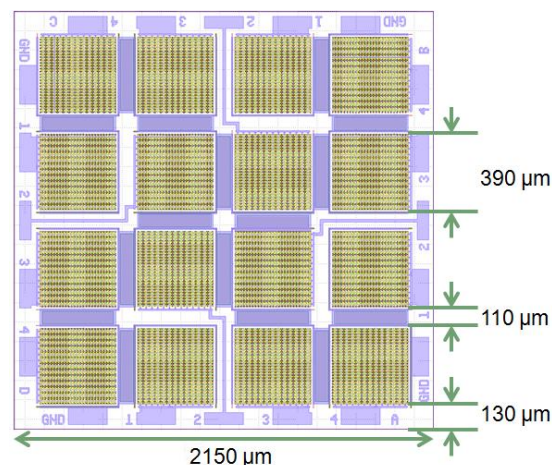


Fig. 1. 2150 x 2150 μm^2 size 16-channels SiPM array with individual readout system

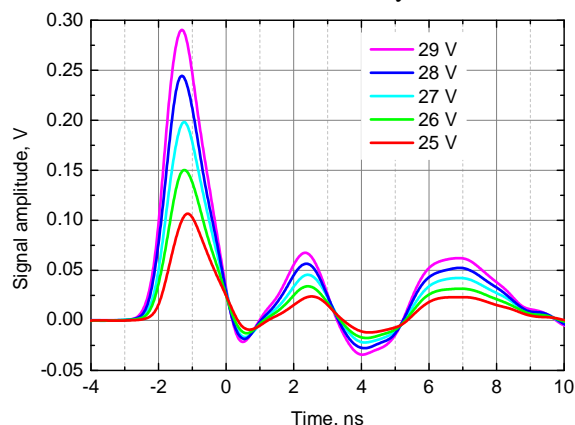


Fig. 2. Performance of 16-channels SiPM array with a picosecond light pulser using different input high voltage

III. Conclusions and Future work

The new 16-channel SiPMs have been designed and developed for the purpose of high resolution PET detector. The amplification in the Geiger-mode cells is confirmed and signals are observed. The coupling of the pixelated Ce:GAGG crystals to the SiPM will be tested next.