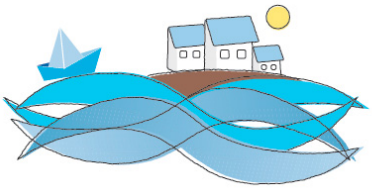

Mediterranean Thematic Workshops in Advanced Molecular Imaging

Contribution ID: **25** Type: **Oral**

Fast SiPM readout for PET

Wednesday 4 May 2016 11:00 (20 minutes)

Medical imaging devices have historically been based on scintillator crystals coupled to photomultipliers tubes, PMTs. The problems to combine PMTs with high electromagnetic fields and the relatively high cost per unit surface, opens new opportunities on the field for a different type of photodetector named silicon photomultiplier.

SiPM or Multipixel Photon Counter, MPPCs, offer an alternative combining the high gain of the photomultipliers tubes, and the insensitiveness to the magnetic field, high quantum efficiency and compact structure of the avalanche photodiodes. This allows an increasing quality of medical imaging technics, such as positron emission tomography, allowing a better and early detection of different diseases.

A front end application specific integrated circuit (ASIC) for the readout of common cathode Silicon Photo-Multipliers arrays is presented with the following features: less than 10 ps RMS of timing resolution, wide dynamic range, high speed, multi-channel, low input impedance current amplifier, low power (≈10mW per channel), common cathode connection, directly coupled input with common mode voltage control and separated timing and charge signal output.
The low jitter current mode processing together with a configurable differential current mode logic (CML) output provides a timing signal suitable for Time of Flight (ToF) measurements. This low jitter allows coincidence time resolution (CTR) measurements close to 100 ps using 2x2x5 mmˆ3 LYSO crystals. Each channel delivers a digital output of a Time over Threshold (ToT) type with a pulse width proportional to peak current (charge) input.

The results show that the FlexToT v2 ASIC is a flexible solution for the front-end readout of different designs of SiPM-based scintillator detectors in TOF-PET applications.

A new version of the ASIC is under development in a 180 nm CMOS technology, with 3.5 mW/ch power consumption and similar or better timing performances. Inclusion of digitization and back-end and implementation of individual time-stamps per channel will be considered as well.

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