

CMOS SiPM design and signal compression

Friday 24 May 2013 09:00 (1h 30m)

This lecture reviews several design solutions adopted in both analog and digital SiPMs to improve their characteristics, with particular focus on timing and spatial resolution.

A brief overview of SiPM technology developed at Fondazione Bruno Kessler (FBK) is given. The problem of optimum timing pickoff is analyzed and the solutions adopted at FBK are described. The main limitations to optimum timing resolution are addressed, indicating the directions of future SiPM design improvements. Position encoding approach, which was proposed to reduce the complexity of high-spatial resolution detector modules for preclinical PET systems, is also reviewed.

The architecture of a CMOS digital SiPM developed inside the EU project SPADnet is then presented. In this design, signal compression is used to reduce the complexity and area occupation of focal plane processing electronics. Each pixel, composed by 720 SPADs, provides the total counts and timestamp of detected gamma events. SiPM total counts, used to discriminate gamma event detection, are sampled at up to 100MS/s by an adder tree overlaid on top of the pixel array. Experimental results validating the approach are presented and critically discussed.

Brief biography of the speaker

Lucio Pancheri received the Laurea degree in Materials Engineering from the University of Trento, Italy, in 2002, and the Ph.D. in Information and Communication Technologies from the same university in 2006. From 2006 to 2012 he has been a research scientist at Fondazione Bruno Kessler (FBK), Trento, Italy, where he has been involved in the development of optical and radiation sensors in CMOS technology for advanced imaging and biomedical applications. From May 2012 he is a researcher at the University of Trento. In the last years, his research activity has been mainly focused on the development of CMOS Single Photon Avalanche Diodes and readout circuits for time-resolved light detection and of electro-optical demodulating detectors for ToF 3D image sensors.

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Session Classification: SiPM Architecture and time-processing (4th Module)