Press Release

For immediate release

SPADnet, a New Concept for Biomedical Imaging, reaches its main intermediate milestone

SPADnet presents a comprehensive overview of its advances at London Image Sensors 2013

Lausanne, Switzerland/London, United Kingdom – March 21, 2013. SPADnet – "Fully Networked, Digital Components for Photon-starved Biomedical Imaging Systems" – is a collaborative research project funded by the European Union within the Information and Communication Technologies (ICT) Theme of its Seventh Research Framework Programme (FP7). The project, launched on July 1st, 2010, is coordinated by EPFL and it includes seven leading European experts in image sensors, medical imaging, and photonics. SPADnet was granted 3,700,000 EUR of funding over a 42 month period.

The first results from the SPADnet project (www.spadnet.eu) are scheduled to be presented at the London Image Sensors conference on Mar 21st, 2013 (www.image-sensors.com).

SPADnet aims to innovate in several areas of the Positron Emission Tomography (PET) system: primarily in optical coupling techniques, single-photon sensor architectures, and intelligent ring networks. The SPADnet system design is based on the first computational model enabling to study the full chain from gamma photons to network coincidence detection through scintillation events, optical coupling, etc.

The first version of the SPADnet photosensor, a fully digital CMOS SiPM (Silicon PhotoMultiplier) with 8×16 pixels individually capable of photon time stamping and energy accumulation, has recently been fabricated. The sensor also provides a real-time output of the total detected energy at up to 100Msamples/s and on-chip discrimination of gamma events. These events can then be routed to the SPADnet ring network, a 2 Gbps network that provides real-time processing and coincidence determination. This architecture simplifies the construction of the overall system and allows the scaling of the system to larger arrays of detectors, thus prompting for potentially better and faster image reconstruction.

In the IS 2013 talk we will show the first experimental results from the SPADnet sensor, along with the main project achievements in optimization of scintillation coupling, fill factor recovery through nano-imprinted optical concentrators, Gbps network, and reconstruction issues. A novel characterization technique based on single point ultraviolet excitation of the scintillator provides new insight into the sensor's capabilities.

The impact of SPADnet is not only on PET scalability, performance and cost, but also on the capability of being compatible with magnetic resonance imaging (MRI). The combination of these two powerful techniques will give the medical community new and more effective tools for medical diagnostics.

About SPADnet and PET (Positron Emission Tomography):

SPADnet aims to develop a new generation of smart, CMOS-based large area networked image sensors for photon-starved biomedical applications, build ring-assembly modules for Positron Emission Tomography (PET) imaging, and carry out performance tests in a PET evaluation system. While suited to applications offering repetitive measurement techniques, existing sensors are not well adapted to single-shot, rare events often occurring in diagnostic tools based on specific radiation detection, PET, SPECT, gamma cameras, and other minimally-invasive point of care tools. In addition, the relatively small field-of-view of existing sensors is a limiting factor.

PET itself provides functional three-dimensional images of the human body, its key application being in clinical oncology and brain function analyses. To obtain metabolic information, PET scanners detect gamma ray pairs arising from the nuclear decay of radiotracers that are injected in patients and accumulate in certain areas of the body. A typical PET scanner is composed of a ring of scintillator crystals, which absorb gamma rays and emit photons as a result, coupled to photon-sensing devices. The photons hit the sensors with a certain spread in space and time, depending on the material and geometry of the crystals. The sensors must then estimate the energy, the time-of-arrival (ToA), and the axial position of incoming gamma rays. With this information, the system can then determine if any two detected photons form a pair – achieved through a coincidence timing window – and establish a line of response (LOR) along which the gamma pair was generated. After several LORs are acquired, a 3D image of the body can finally be reconstructed.

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