Contribution ID: **4** Type: **not specified**

Picosecond timing resolution with scintillators

The future generation of radiation detectors is more and more demanding on timing performance for a wide range of applications, such as particle identification in nuclear physics and high energy physics detectors, high resolution hadronic calorimetry in finely segmented detectors, precise event time tagging in high luminosity accelerators, time of flight (TOF) techniques for PET cameras and a number of photonic applications based on single photon detection.

There is in particular a consensus for gathering the multidisciplinary academic and industrial excellence around the ambitious challenge to develop a 10ps TOF PET scanner (TOFPET). The goal is to reduce the radiation dose (currently 5-25 mSv for whole-body PET/CT), scan time (currently > 10 minutes), and costs per patient (currently > 1000 € per scan), all by an order of magnitude.

To achieve this very ambitious goal it is essential to significantly improve the performance of each component of the detection chain: light production, light transport, photodetection, readout electronics. Speeding up progress in this direction is the goal of the challenge and will have an important impact on the development of a new generation of ionization radiation detectors.

It will be shown that the possibility to reach 10ps time-of-flight resolution at small energies, as required in finely granulated calorimeters and PET scanners, although extremely challenging, is not limited by physical barriers and that a number of disruptive technologies, such as multifunctional heterostructures, combining the high stopping power of well know scintillators with the ultrafast photon emission resulting from the 1D, 2D or 3D quantum confinement of the excitons in nanocrystals, photonic crystals, photonic fibers, as well as new concepts of 3D digital SiPM structures, open the way to new radiation detector concepts with unprecedented performance.

Primary author: Prof. LECOQ, Paul

Presenter: Prof. LECOQ, Paul