

Characterization of hybrid photodetector prototype based on microchannel plates and the Timepix4 ASIC

Monday, 27 May 2024 18:40 (20 minutes)

A novel single-photon detector based on a vacuum tube with transmission photocathode, microchannel plates and the Timepix4 CMOS ASIC used as read-out anode is presented. Timepix4, developed by the Medipix4 Collaboration, consists of a 512x448 pixel matrix with 55 microns pitch. Each pixel is equipped with amplifier and discriminator, and a TDC allows for precise measurement of the hit time-of-arrival and time-over-threshold. The ASIC features a data-driven architecture producing up to 160 Gb/s that are handled by FPGA-based external electronics with flexible design, used as well as control board. This device is expected to allow detection of up to 1 billion photons per second over an area of 7 cm², with simultaneous measurement of position and timing for each photon with resolutions of 5-10 microns and 50-100 ps respectively.

Initial characterisation of the Timepix4 ASIC using a 100-micron thick n-on-p Si sensor illuminated by an infrared pulsed picosecond laser have demonstrated a timing resolution of 110 ps per single pixel hit, after precise frequency mapping and calibration over the whole matrix. A timing resolution better than 50 ps was measured illuminating a cluster of multiple pixels exploiting oversampling.

The first hybrid photodetector prototypes have been recently produced. A first characterisation of their performance will be presented.

The DRD4 international Collaboration has been formed at the beginning of 2024 following the ECFA Detector R&D Roadmap. The scope of the Collaboration, which is anchored at CERN, is to bundle and boost R&D activities in photodetector technology and particle identification techniques for building future high-energy physics (HEP) experiments and facilities. DRD4 also covers scintillating fibre tracking as well as transition radiation detectors based on solid state X-ray detectors. A brief overview of the scientific scope and organisation of DRD4 will be presented, with a particular focus on the strategic role of the Collaboration for the future of HEP.

Collaboration

Role of Submitter

I am the presenter

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Session Classification: Photo Detectors and Particle ID - Oral session

Track Classification: T2 - Photo Detectors and Particle ID