Contribution ID: **121**   Type: **Oral Presentations**

Innovative hybrid photodetector based on the Timepix4 ASIC as pixelated anode

Monday, 4 September 2023 17:30 (20 minutes)

An innovative single-photon detector based on a vacuum tube with transmission photocathode, a microchannel plate and the Timepix4 CMOS ASIC [[1]] as read-out anode is presented. This photodetector will allow to detect up to 1 billion photons per second over an area of 7 cm^2, allowing to simultaneously achieve a position resolution of $5-10$ μm and a timing resolution better than 100 ps. The detector is based on about 230 thousand channels with analog and digital front-end electronics. 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. These performances will enable significant advances in particle physics, life sciences, quantum optics or other emerging fields where the detection of single photons with excellent timing and position resolutions are simultaneously required.

Recent timing resolution measurements of the Timepix4 ASIC will be presented, obtained using a 100 μm thick n-on-p Si sensor illuminated by an infrared pulsed picosecond laser. The measured timing resolution shows a non-negligible dependence on the Voltage-Control-Oscillator frequency, requiring a frequency mapping and calibration over the whole matrix. A timing resolution of about 60 ps for the Time-to-Digital Converter itself has been measured, and of 110 ps when also considering the contributions from signal generation in the silicon sensor and the electronics front-end.

Primary authors: BOLZONELLA, Riccardo (University and INFN Ferrara); ALOZY, Jerome Alexandre (CERN); BALLABRIGA, Rafael (CERN); BIESUZ, Nicolò Vladi (INFN Ferrara (IT)); CAMPBELL, Michael (CERN); CAVALLINI, Viola (INFN and University of Ferrara (IT)); COTTA RAMUSINO, Angelo (INFN Ferrara (IT)); FIORINI, Massimiliano (INFN and University of Ferrara (IT)); GUARISE, Marco (INFN and University of Ferrara (IT)); LLOPART CUDIE, Xavier (CERN); OKAMURA, Shinichi (INFN and University of Ferrara (IT)); ROMOLINI, Gabriele (INFN and University of Ferrara (IT)); SAPUTI, Alessandro (INFN Ferrara (IT))

Presenter: BOLZONELLA, Riccardo (University and INFN Ferrara)

Session Classification: A5