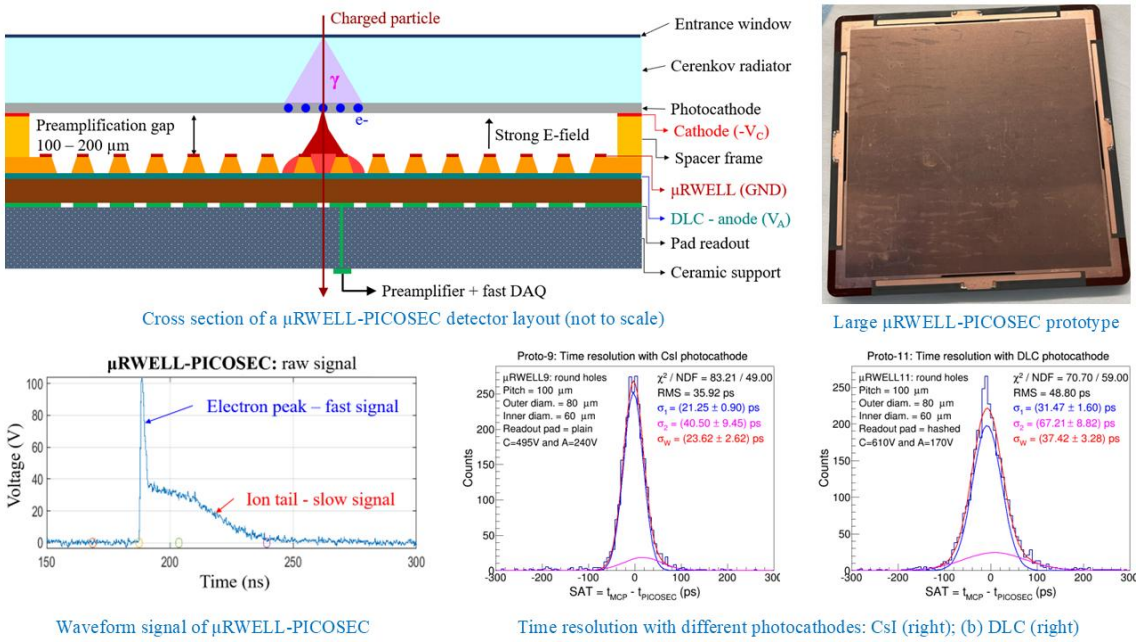
Fast timing with µRWELL-PICOSEC detector technology

Kondo Gnanvo

Thomas Jefferson National Accelerator Facility, Newport News, Virginia, USA

The µRWELL-PICOSEC detector, which is based on Resistive Micro-Well detector (µRWELL) technology, is a novel concept as part of Jefferson Lab LDRD program for fast and precision timing gaseous detectors that provide timing resolution in the tens of picosecond range, making it ideal candidate for time-of-flight (TOF) technology for particle identification (PID) in particle physics experiments as well as for future medical instrumentation. The µRWELL-PICOSEC concept is based on a Cerenkov radiator that produces Cerenkov photons from high energetic charged particles, a photocathode layer that converts the Cerenkov photons into primary electrons, a µRWELL amplification layer that multiply the electrons through amplification in a CF4-based gas mixture and a pad-segmentation anode readout coupled with fast timing electronics to provide fast signal (Figure 1). Beam tests were carried out at the CERN SPS H4 beamline in summer 2023 and 2024. Preliminary results show timing performance of the order of 23 ps achievable with µRWELL-PICOSEC prototype. and position scan of the 100-pads of a multi-channel prototype was performed to study response uniformity of large area detector [1].



Cross section of a µRWELL-PICOSEC detector layout (not to scale)

Large µRWELL-PICOSEC prototype

Waveform signal of µRWELL-PICOSEC

Time resolution with different photocathodes: CsI (right); (b) DLC (right)

Figure 1: Overview of the µRWELL-PICOSEC Detector concept and performances

References

[1] K. Gnanvo, "µRWELL-PICOSEC: Precision timing with resistive micro-well detector," *Nuclear Inst. and Methods in Physics Research, A,* p. 172001, 2027.