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Fast timing with μ RWELL-PICOSEC detector technology

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The μ RWELL-PICOSEC detector, which is based on Resistive Micro-Well (μ RWELL) technology, is a novel concept for fast timing gaseous detectors that can 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 μ RWELL-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 μ RWELL 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. 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 μ RWELL-PICOSEC prototype. and position scan of the 100-pads of a multi-channel prototype was also performed to study time response uniformity of large area detector. In this talk, after a brief overview of the PICOSEC technology, we will present recent results with different single channel μ RWELL-PICOSEC prototype designs and also the position scan results of the 100-pads large prototype to study timing response uniformity for large area μ RWELL-PICOSEC detector. Finally, we will discuss the ongoing R&D effort to further improve the timing resolution and allow good position capabilities through charge sharing for large area.

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