Contribution ID: **16** Type: **not specified**

Development of Large Area µRWELL Detectors for CLAS12 High Luminosity Upgrade at Jefferson Lab

Monday 12 December 2022 10:30 (20 minutes)

The high-luminosity upgrade of the CEBAF Large Acceptance Spectrometer (CLAS12) will significantly enhance the physics reach of experiments in Hall B at JLab. However, at the current luminosity of L = 1 × 1035 cm-2 s-1, the reconstruction efficiency of charged particles in the forward region of the CEBAF Large Acceptance Spectrometer (CLAS12) is at the level of 85% and limited in part by the drift chambers inability to handle high occupancy, in the first tracking region (DC- R1) of the Forward Detector. The reconstruction efficiency is expected to drop even lower at higher luminosities with the current tracking technology. Various options under consideration to achieve the desired performance at a higher luminosity of L = 2 × 1035 cm-2 s-1 include the addition of fast tracking layers to complement DC-R1 or the replacement of DC-R1 with a different tracking detector technology altogether. In either case, a novel generation of compact, simple and robust Micro-Pattern Gaseous Detector (MPGD) known as the Resistive Micro-Well detector (µRWELL) is the ideal candidate to satisfy the requirements in terms of timing O (10 ns) and position O (100 µm) resolutions. A large µRWELL prototype, combined with a two-dimensional U-V strip readout layer based on the novel concept of capacitive-sharing approach has been developed as a proof of principle for fast tracking capabilities in the forward region of CLAS12 high-luminosity upgrade. In this talk, we will present the technical aspects of the design choices of the large µRWELL prototype under development and report on the detector assembly process and preliminary performance characteristic tests. We will also discuss the plans for the test and characterization of the prototype in beam during spring 2023 CEBAF run. Finally, we will report on ongoing R&D efforts on small prototypes with the goal to improve rate capability, spatial resolution performance and minimize material thickness.

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Session Classification: Session 1