Contribution ID: **56** Type: **not specified**

Optimizing Structure and Operating of Gas Electron Multiplier (GEM) Detectors for High Particle Rate at Jefferson Lab

Friday 16 December 2022 09:20 (20 minutes)

The Gas Electron Multiplier (GEM) detectors built at the University of Virginia are used for both front and rear tracking systems in the Super Bigbite Spectrometer (SBS) experiments at Jefferson Lab (JLab). These GEM detectors include some of the largest area GEM detectors to be used in an experiment. Furthermore, with over 50 large area GEM modules, this is one of the largest ever sets of GEMs in the world. Many new techniques were developed for the fabrication and operation of these GEMs. They meet all critical requirements of the SBS program, including being able to handle rates as high as 500 kHz/cm2 while providing an excellent spatial resolution of 70 μm. However, a higher than expected background resulting from the intense low-energy photon environment in SBS leads to reduced efficiency and increased difficulty in track reconstruction using the GEM detectors. To rectify these issues, our research focuses on optimizing the structure of GEM detectors to reduce the background hits, as well as modifying the high voltage distribution of the detector to improve efficiency. A GEANT4 simulation of a 10cm x 10cm GEM module has been developed to optimize the cathode foil structure by varying its material, thickness, and effective area to lower the background rates. Prototype 10cm x 10cm GEM modules are constructed with different cathode foil structures and data is taken while the prototypes are exposed to an X-ray beam to validate the simulated results. Modifications of the high voltage distribution in the GEM detector were tested using a 50 cm x 60 cm GEM chamber exposed to an X-ray beam and then tested during the upcoming GEn experiment at JLab. Preliminary results on the detector efficiency measured at the GEn experiment and in the simulated high-rate environment using an X-Ray beam will be presented.

Presenter: NGUYEN, Huong (University of Virginia)

Session Classification: Session 12