Abstract Submitted
for the APR20 Meeting of
The American Physical Society

Studies of Ion Backflow and Space Charge Build-up in Triple and Quadruple GEM Detectors MICHAEL REYNOLDS, SOURAV TARAFDAR, Vanderbilt University — A Gas Electron Multiplier (GEM) is a charged particle detector that in recent years has supplanted the multi-wire proportional chamber (MWPC) as the standard in many particle physics experiments. GEM detectors operate on the principle of gas ionization thereby amplifying a small incident charge into a larger readout pulse. These freed electrons rush towards the GEM foil, which is perforated with thousands of microscopic holes. These holes contain a very strong electric field and further ionize the gas thus amplifying the number of electrons. These electrons are transferred to more GEM foils to be further amplified, reaching gains as high as 104. A byproduct of this process is ion backflow (IBF). Each freed electron leaves behind a positively charged gas molecule that drifts slowly towards the cathode as the lighter electrons rush to the anode for readout. Over time these heavier, slower moving ions build up in the gas volume creating an imbalance of charge that will distort the uniformity of the electric field. These effects need to be minimized in order to preserve accurate data. This project is testing 3 and 4 stage GEM detectors with an Ar:CO2 gas mixture, in either 70:30 or 80:20 ratio for these IBF studies, and using cosmic rays, x-rays, and Fe55 radiation sources.

Michael Reynolds
Vanderbilt Univ

Date submitted: 10 Jan 2020 Electronic form version 1.4