Rate Dependency Study on Gas Electron Multiplier Gain

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Background

- This summer, I worked in the Gas Detectors Development lab at CERN

- Gas electron multiplier (GEM) detectors are a type of detector used to detect charged particles or radiation, for example near the collision points of the LHC at CERN

- One important property of a detector is its gain, which means how much the incoming signal is amplified at a certain input voltage

- The detectors were tested with x-ray radiation

Background

- A doctoral thesis from 2006 by Pieter Everaerts showed that the gain started fluctuating when the rate of the source was increased (rate = x-ray photons/sec)
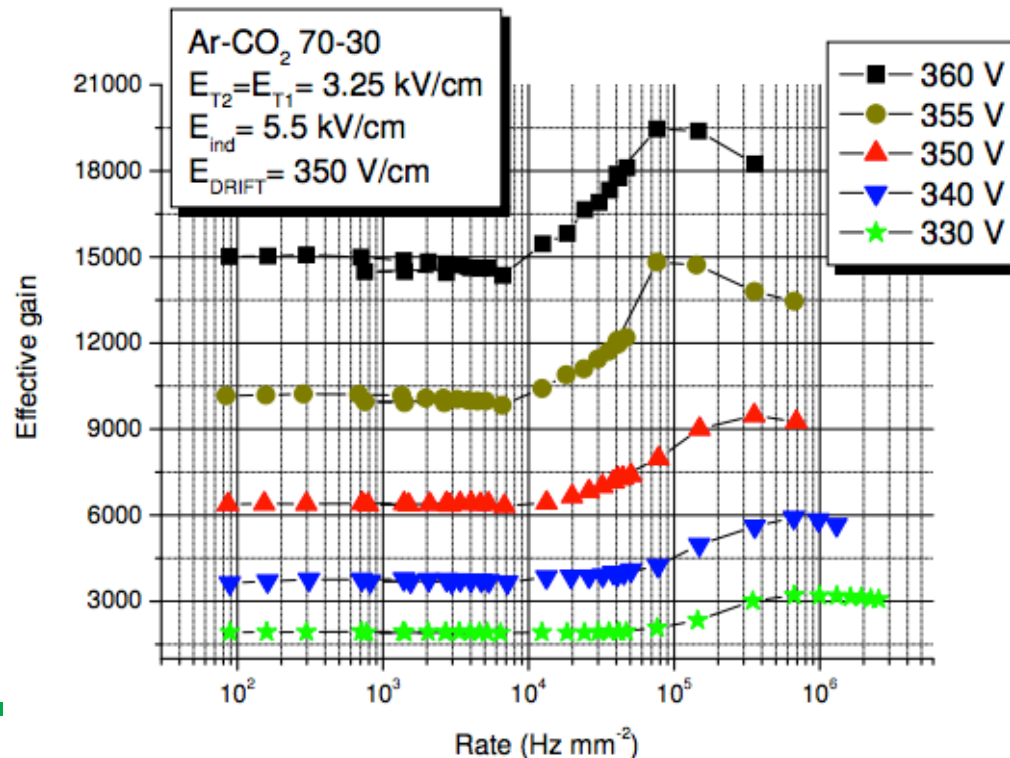
Objectives and Scope

- Providing a comprehensible introduction to GEM detectors

- Performing gain calibration at higher and lower voltages, investigating causes of possible irregularities

- Investigating the effects of high rate on the GEM detector gain

Information Sources

- Doctoral Thesis by Pieter Everaerts (2006): Rate Capability and Ion Feedback in GEM-detectors

- Gas Electron Multiplier (GEM) Detectors: Principles of Operation and Applications, Fabio Sauli (2012)

- (Other papers on GEM detectors)

- All the material I have from the measurements I did this summer

Methods and Tools

- MS Excel for managing and analyzing the data

- Matlab for plotting, calculating different parameters

- Repeated measurements many times while varying parameters (e.g. the electric field inside the detector, the distance from the window to the first GEM) and electronics (preamplifier, power supply)

  - To rule out other causes for irregularities in the results

Schedule

- 06-08/2014: Learning about detectors, taking measurements in the lab
- 10/2014: Presenting topic
- 11/2014 - 01/2015: Studying related articles, writing
- 02/2015: Thesis ready, presenting final work