

A THGEM based low pressure gas detector for the detection of fission fragments



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Outline:

- Introduction: A THGEM based low pressure gas detector for the detection of fission fragments
- Design of the detector.
- Fabrication of the detector.
- Initial test results.
- Simulation results of the detector
- Conclusions and future scope.

Introduction:

Gas detectors (e.g. MWPC, PPAC, IC, etc.) are fundamental tools used in modern accelerator based experiments. Our studies are focused on experiments to study the fusion fission dynamics across the periodic table.

Requirements for the detector to detect the highly charged fission fragments in experiments:

Low operational gas pressure

Thin walled window for efficient transmission.

Large surface area.

Compact shape.

High gain.

Why THGEM ?

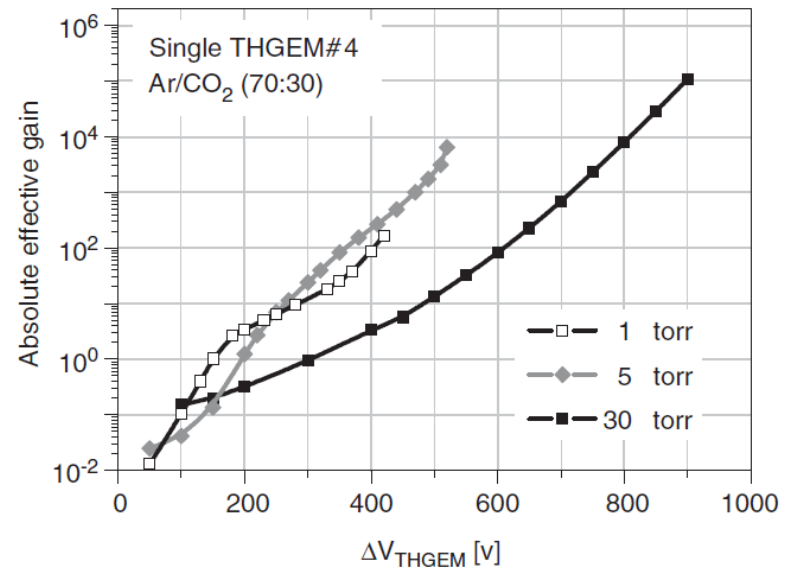
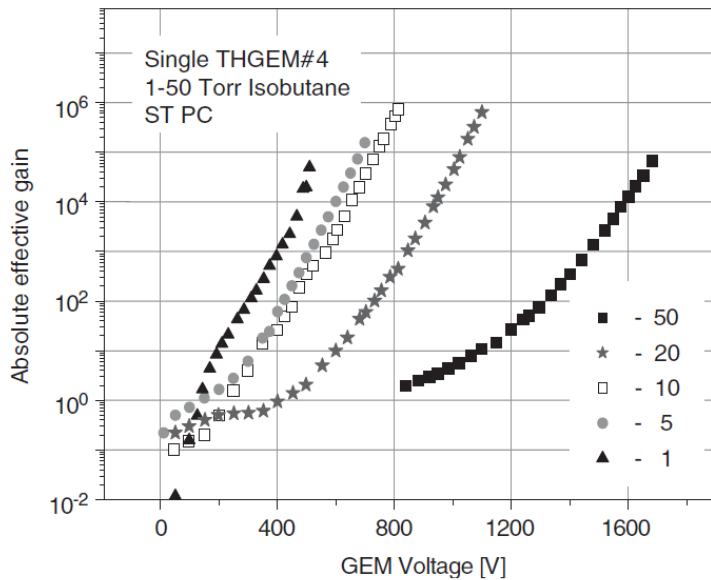
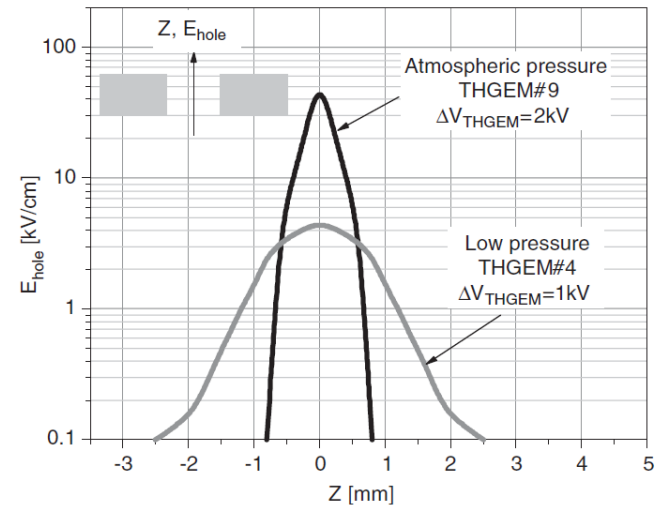
The central anode plane of MWPC detectors is the main charge multiplication region. Since the gain $\sim(\text{radius})^{-1}$, the usage of thin 10 micron wires suits best for MWPCs. However this makes the detectors highly fragile, and prone to tear. Replacement with THGEM shall provide an opportunity to make our detectors more mechanically robust, to increase the gain of the detector.

Required readouts from the detector:

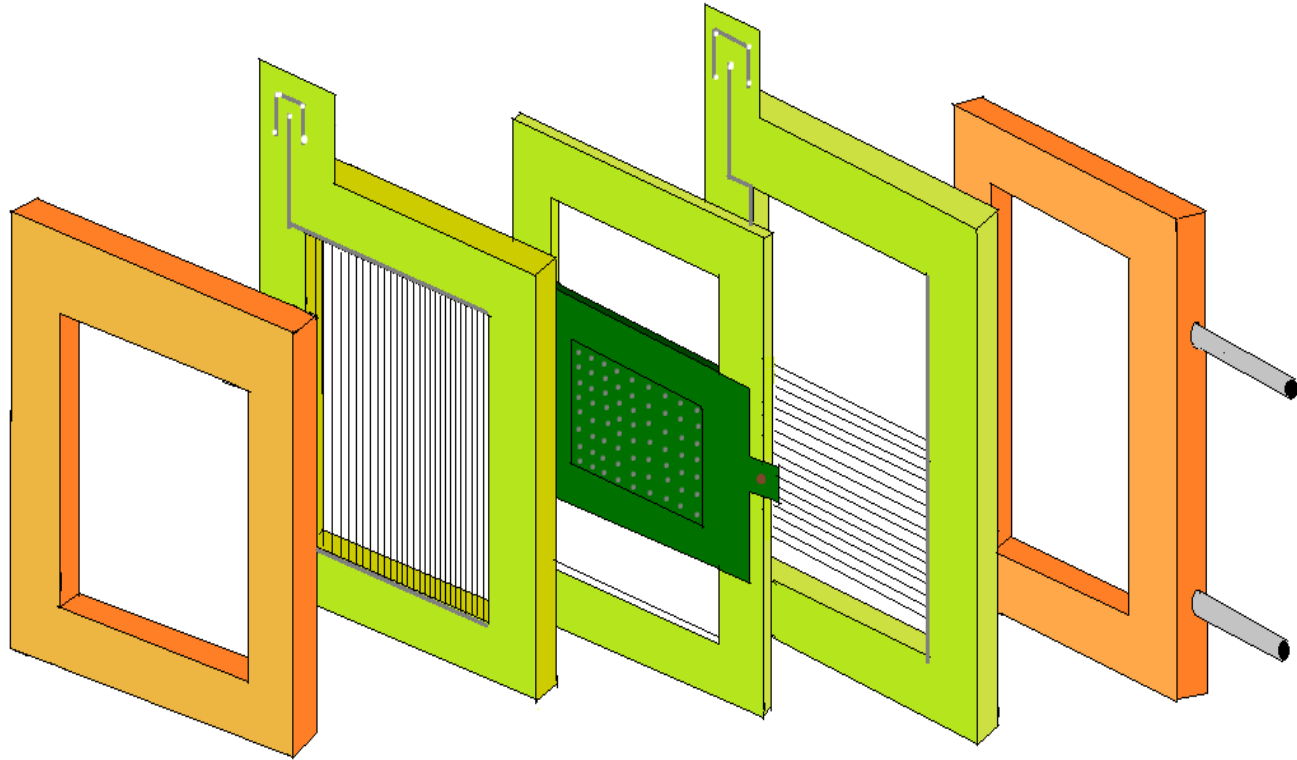
- Time of arrival of the fission fragment => Quick rise time of the anode signal.
- Position signals (X and Y co ordinates) of the point of impact of the fission fragment => Induced wired planes for the position signals (future plan)
- Energy loss of the fission fragment in the gas volume => readout from the pre amplifier.

Previous studies of THGEM based low pressure gas detectors:

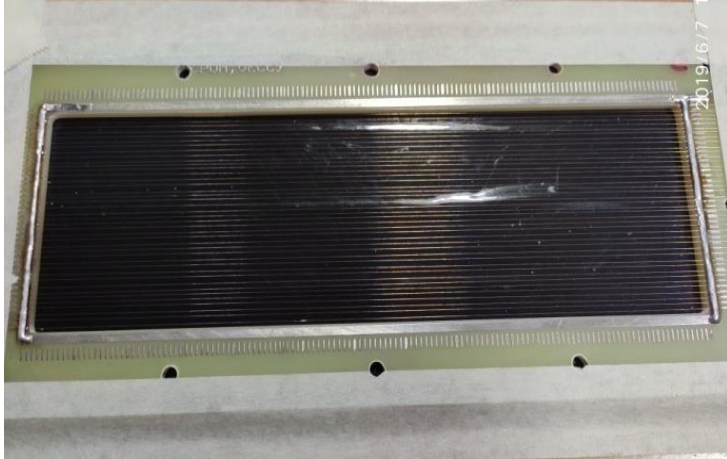
Previous studies by C.K. Shalem, *et al.*,
(Nucl. Instr. Meth. Phys. Res. A 558,
(2006) 468)



Design of the prototype test detector:



Fabrication of the detector:



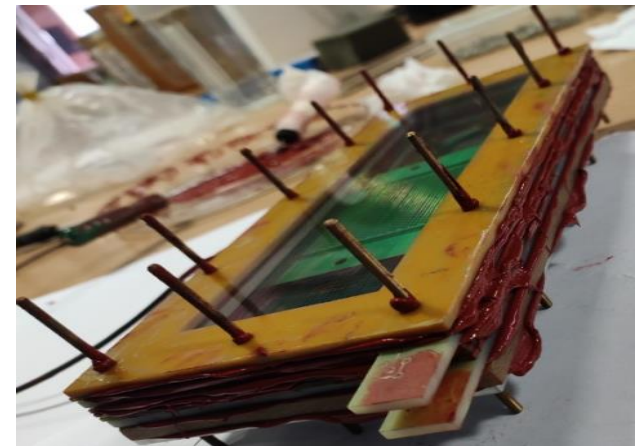
Cathode plane



GEM foil



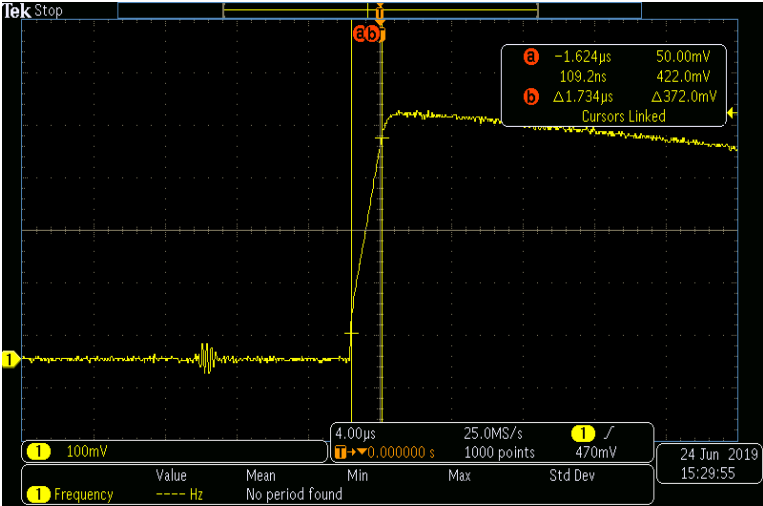
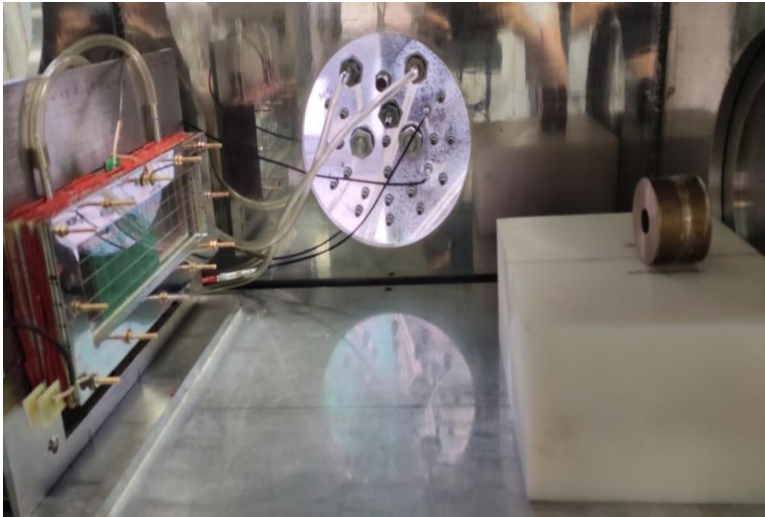
Gas inlet and outlet plane



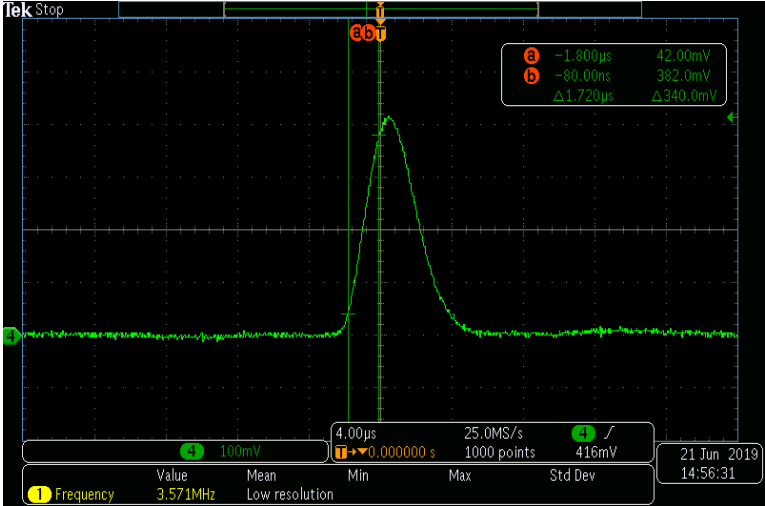
Fabricated detector

Testing of the Detector:

Testing setup

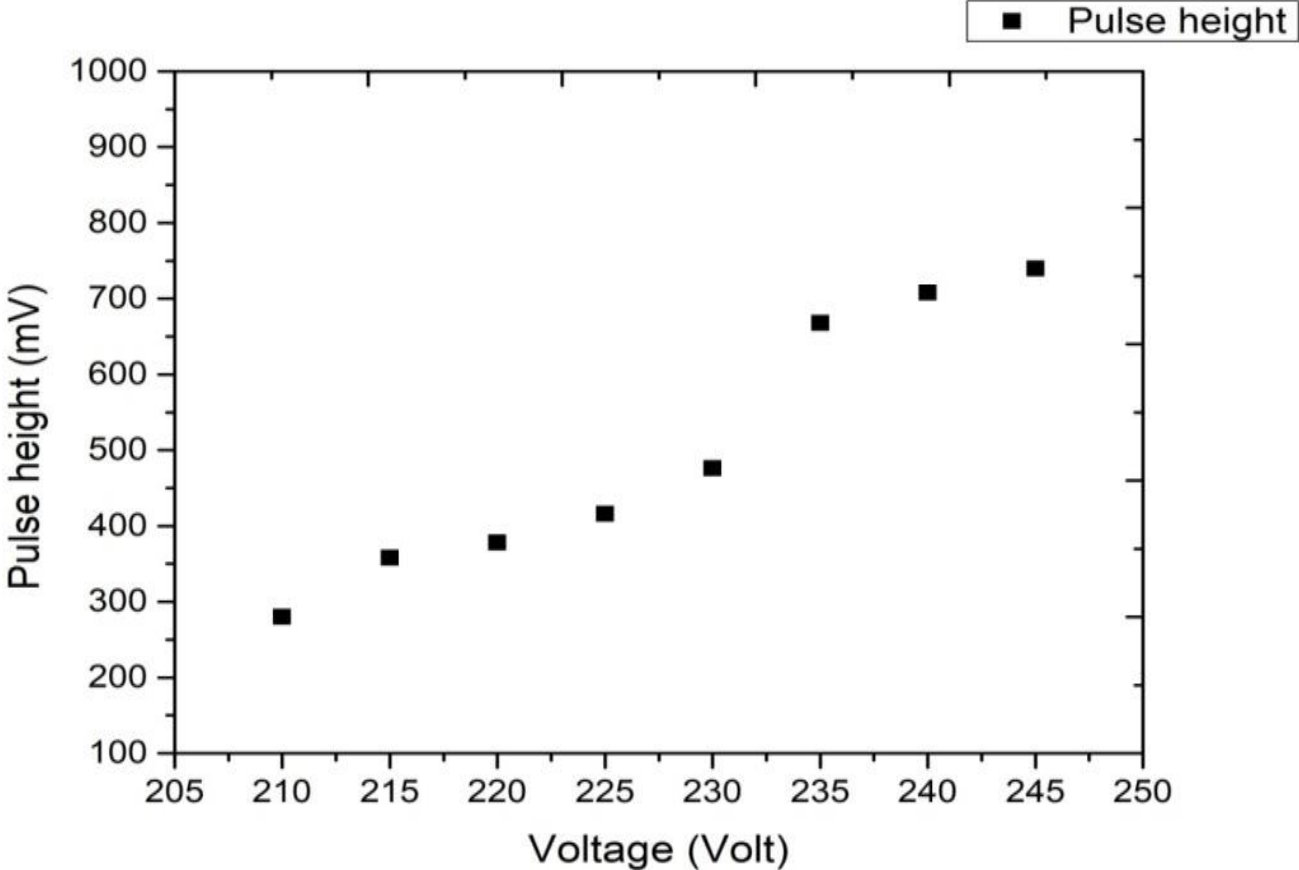


Pre amplifier ORTEC 142IH signal

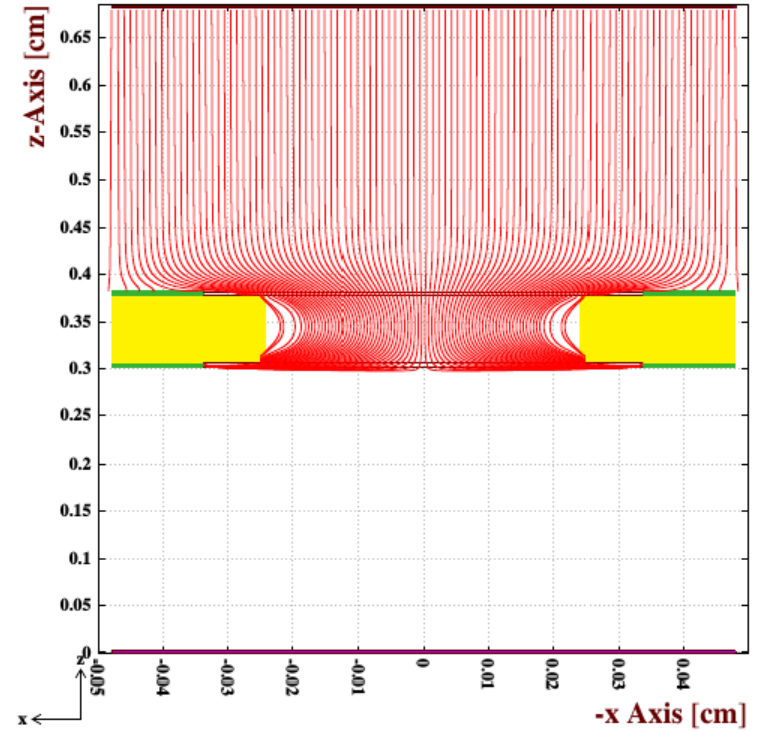
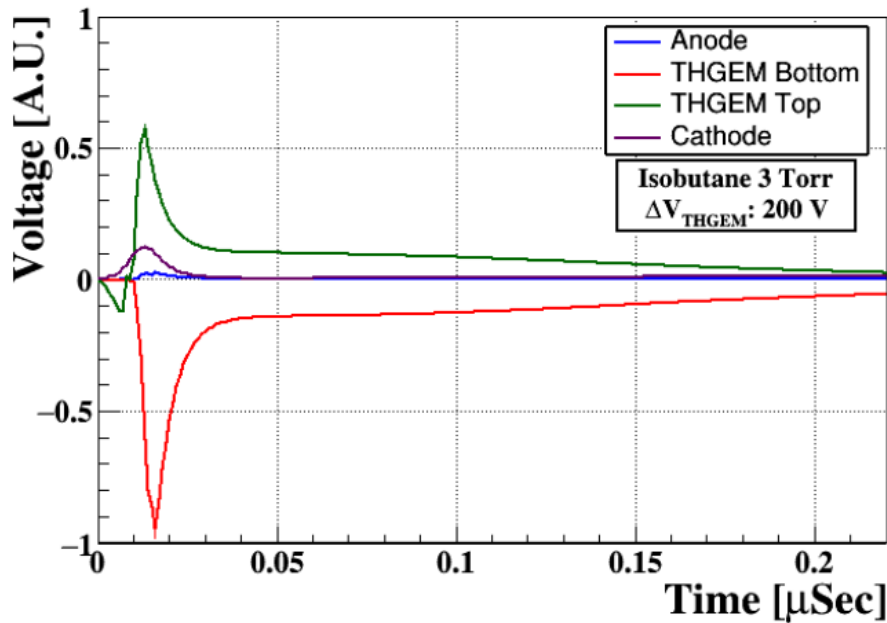
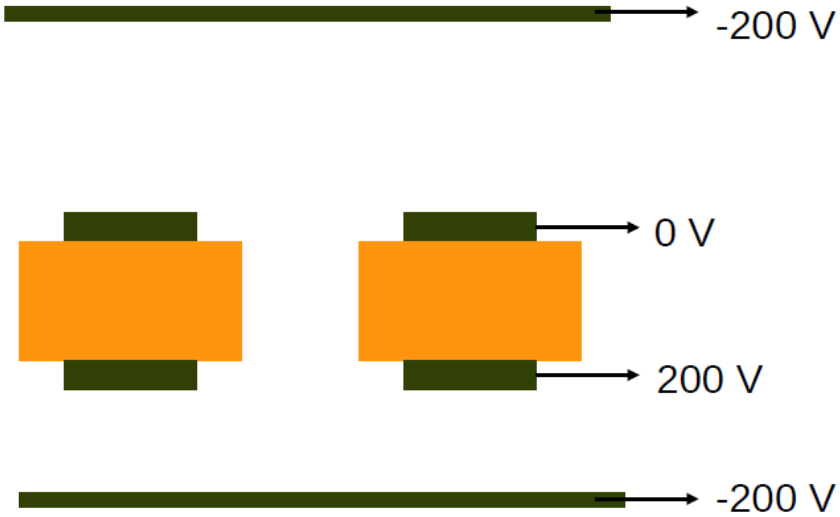


Amplifier signal

Pulse height trend:

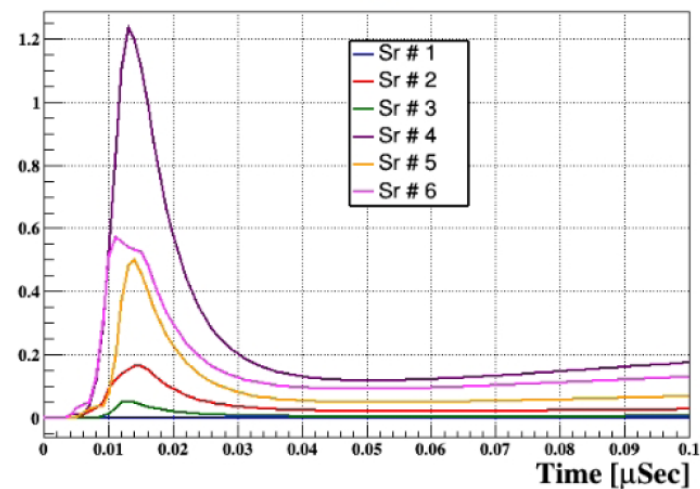
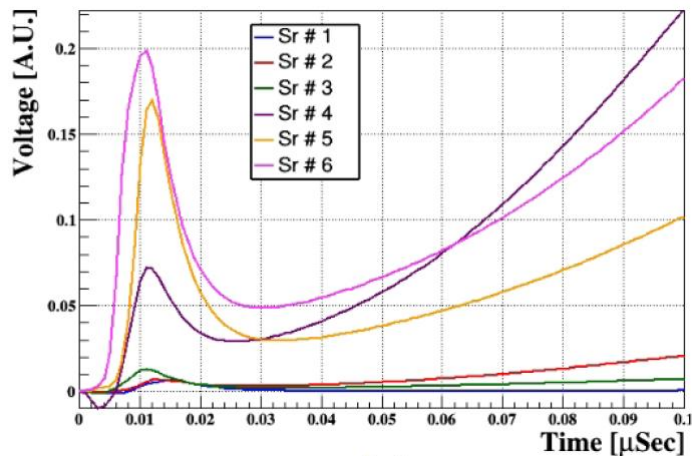
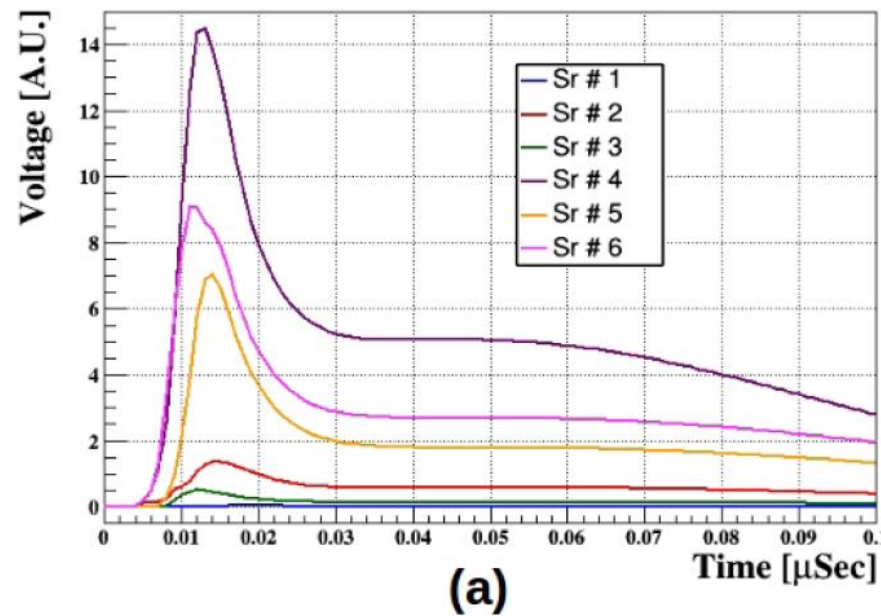
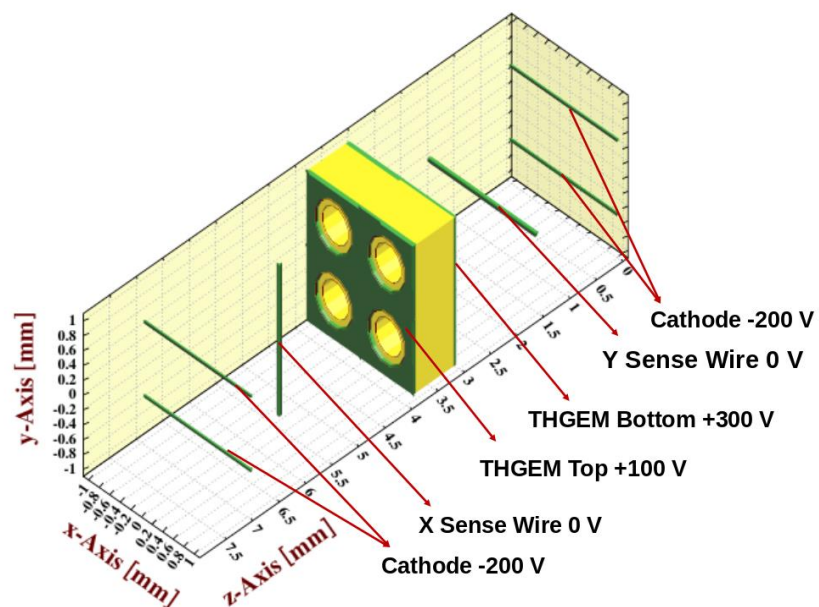


Simulation results 1:



Simulations done by: Dr. Purba Bhattacharya

Simulation results 2: With position planes



Conclusions:

- Preliminary testing of a GEM based low pressure gas detector has been tested with a ^{252}Cf source and signals obtained.
- Simulation results show induced X and Y signals from the designed detector can be obtained.
- Future testing with the X and Y plane shall be commenced shortly.