

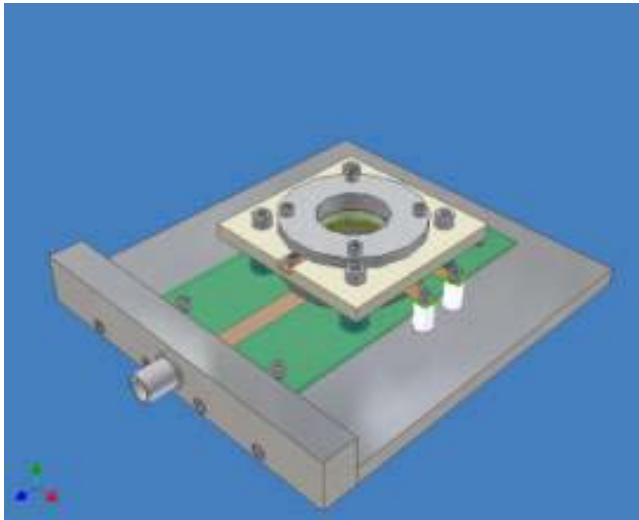
High Energy Particle Detection through prototype Gas Electron Multiplier Systems

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What Is a Gas Electron Multiplier (GEM)?



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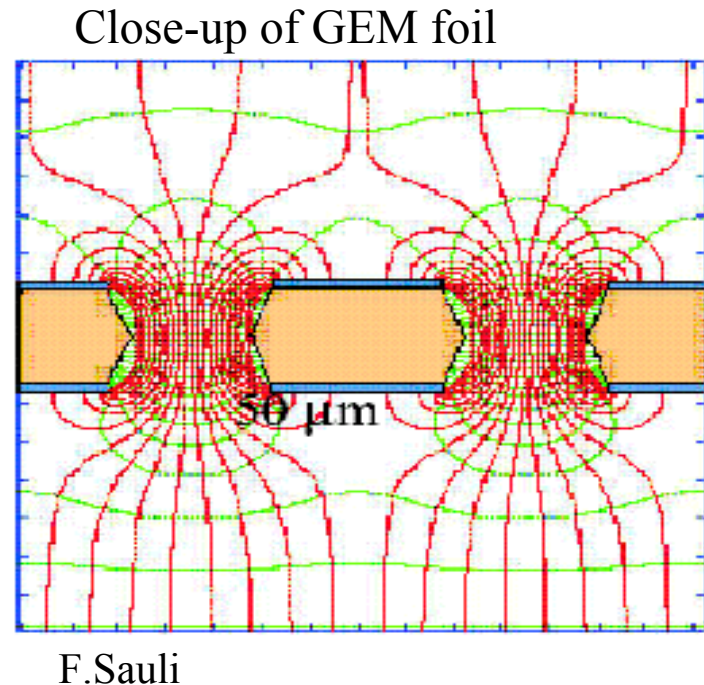
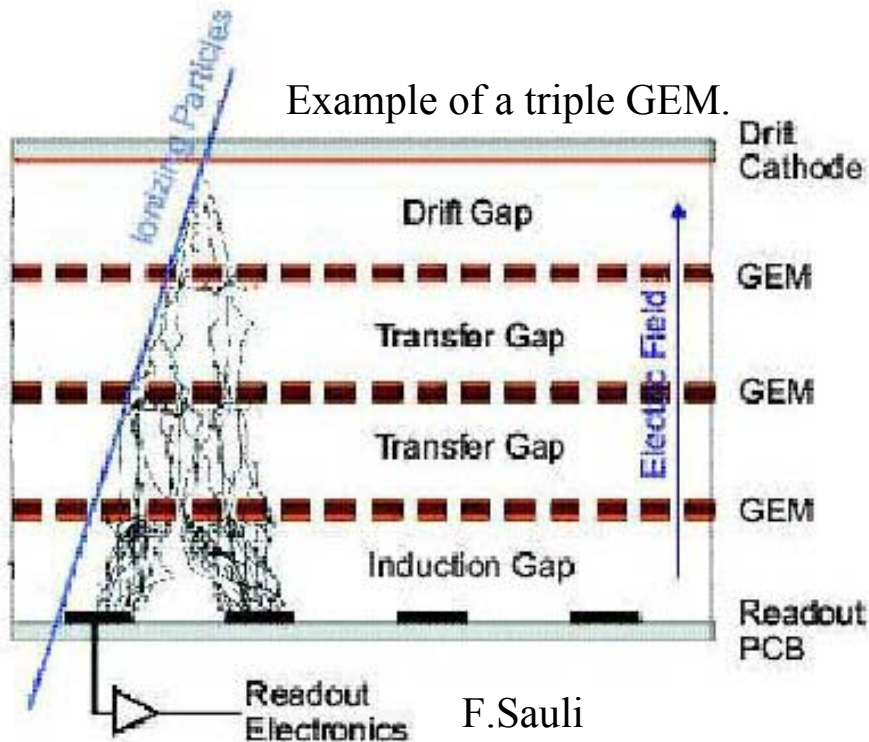
- Applications:
- particle tracking at accelerators
 - X-ray imaging for space-based high-energy astrophysics
 - applications/designs for Homeland Security
 - aging of substances
 - medical imaging

The GEM

- Our purpose to serve as a detector for high energy ionizing particles (usually gamma rays), and to image the substances that emit the radiation.

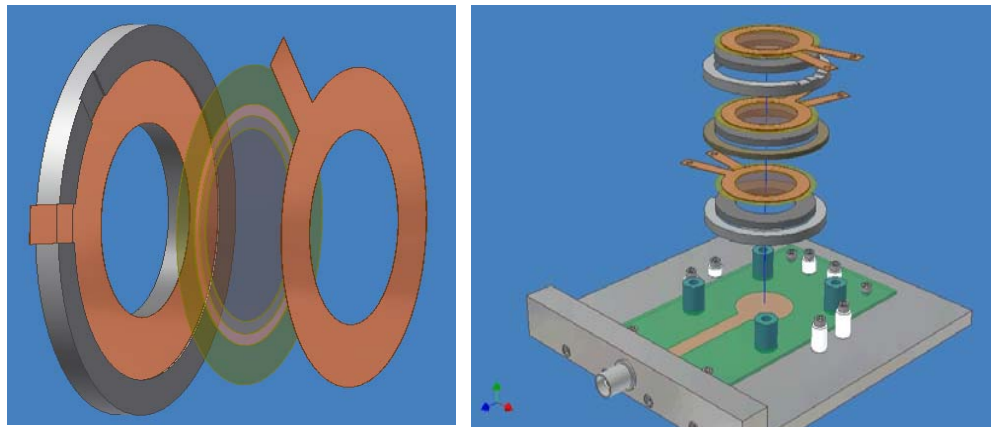
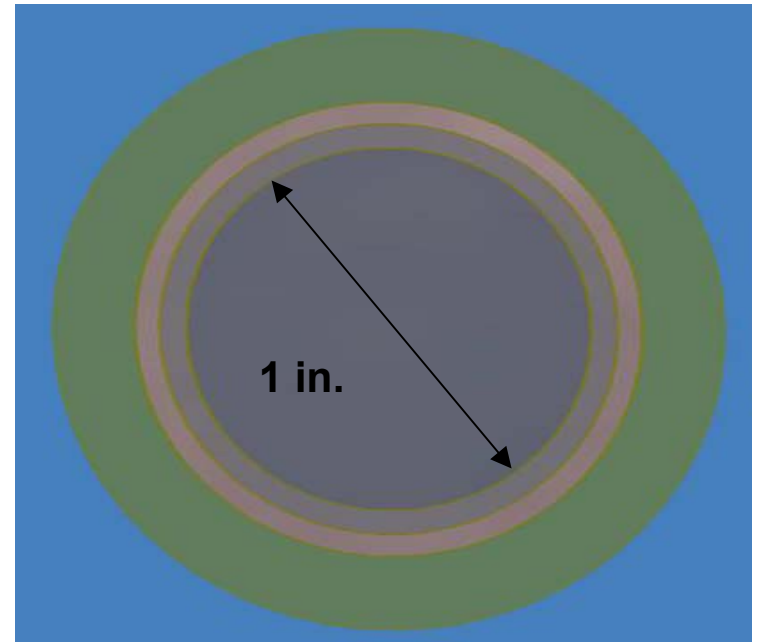
How It Works

- Incident ionizing particle
- ArCO₂ (70% Ar, 30% CO₂) mixture
- Photoelectric Effect and Compton Scattering
- relectons are accelerated towards the induction plane
- large electric potentials created by the GEM foils around 300V to 500V.
- “cascade”
- gain



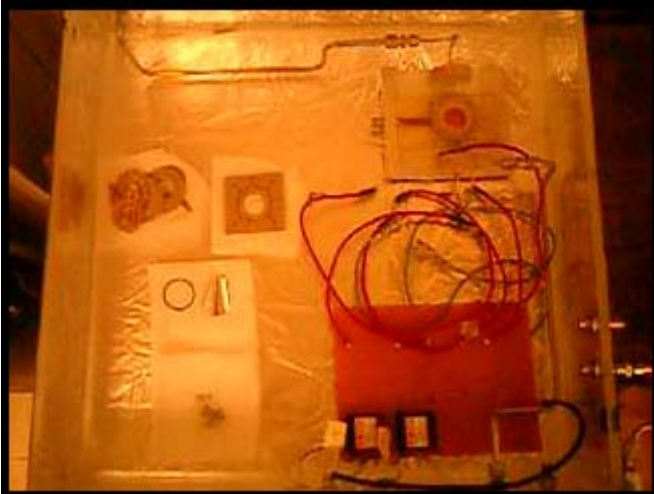
GEM Foils

- 3M Worldwide
- Copper coated Kapton foil
- 1-inch effective area

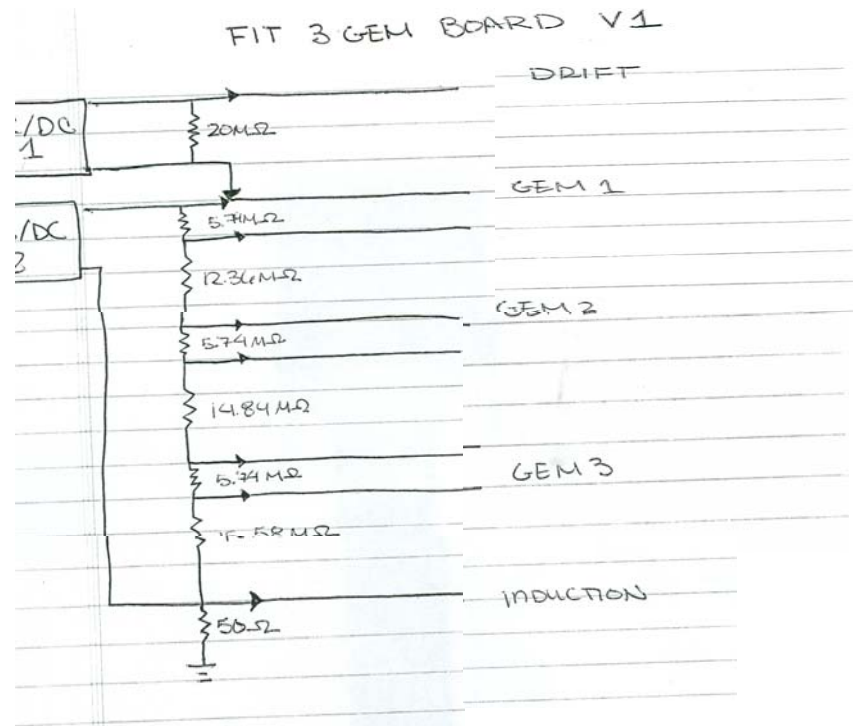
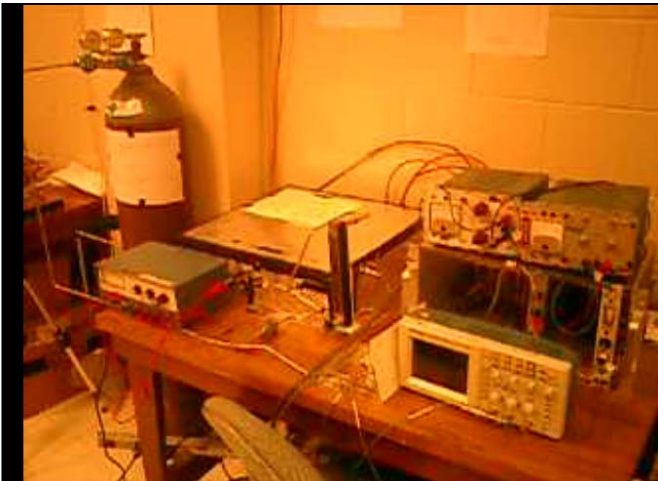


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System

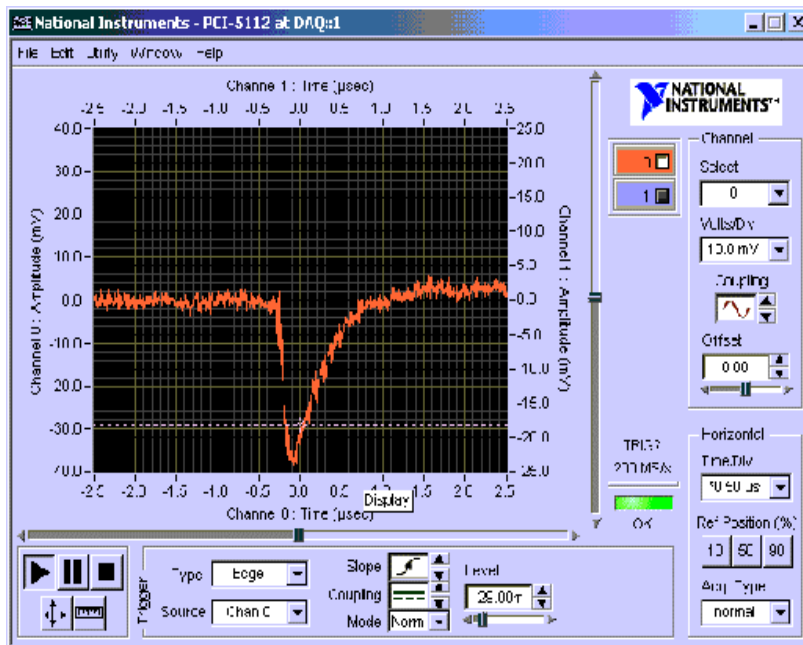


- A) Voltage Source for HV board
- B) HV board provides voltage for GEM foils.
- C) Radioactive Source provides impetus for cascade.
- D) Output signal amplified by linear amplifier.
- E) Signal interpreted by oscilloscope or Labview programs.



Results of Experimentation

- Results for experimentation proved inconclusive.
- Signal seen from triple GEM may have incorporated the desired signal.



Results seen from Single GEM detector

Problems To Overcome

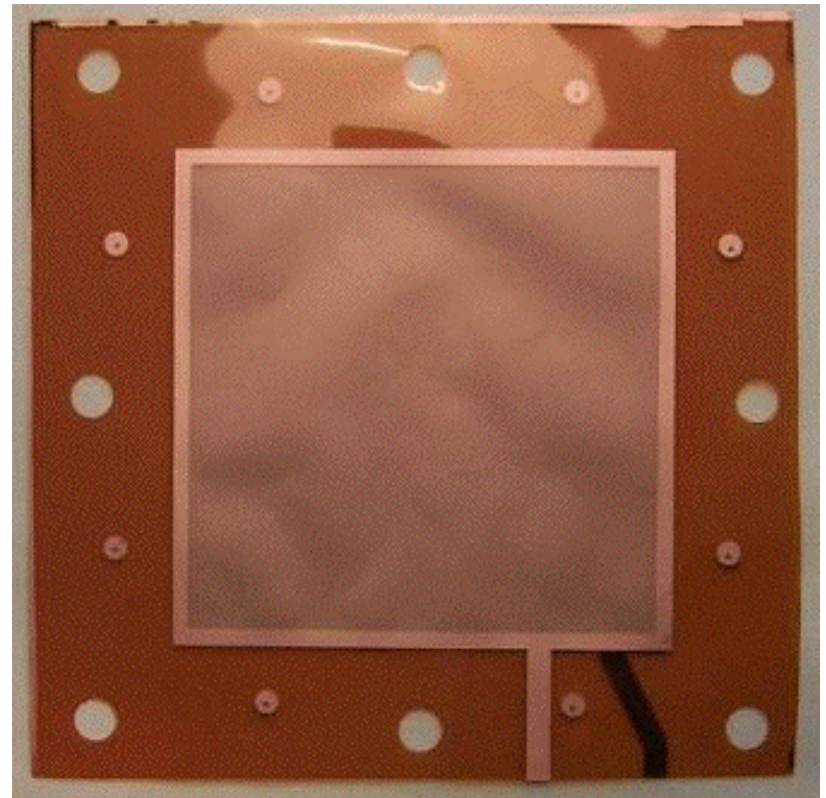
Problems with the triple GEM:

- Sparking inside GEM, most likely due to humidity.
- Keeping out out-gassing substances/substances which interfere with operations as well as unwanted electromagnetic interference.
- Keeping GEM foils clean.

Subsequent

The 10x10 GEM

Plans are currently being made for the next generation of GEM using a “10x10 triple GEM” to accomplish what we set out to do in the first two GEM detectors.



F. Sauli

Conclusion

The GEM

Use

What was done

Outcome of trials

Acknowledgements

Outgassing Information:

<http://outgassing.nasa.gov/>

Good sources for GEM information:

http://chall.ifj.edu.pl/~lesiak/detectors_yr02.pdf

http://www-hep.uta.edu/hep_notes/lc/lc_0001.pdf

<http://www-flc.desy.de/thesis/diplom.2004.voigt.pdf>

GEM Graphics: (in order of appearance)

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<http://gdd.web.cern.ch/GDD/using.htm>

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