Simulation of multi-layer GEM from single to triple GEMs

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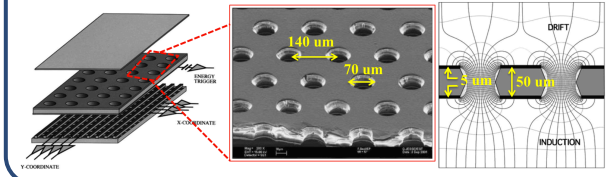
GEM (Gas Electron Multiplier)

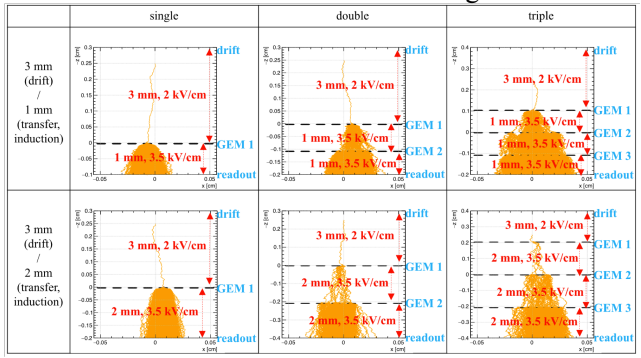
- Introduced by F. Sauli in 1997 (CERN)
- The foil (e.g. 50 um thick kapton) is metalized on both sides (e.g. 5 um copper) and has a pattern of holes (e.g. 70 um diameter with a 140 um pitch).

- Schematics of single GEM detector
- Microscope view of GEM foil
- Electric field of GEM holes



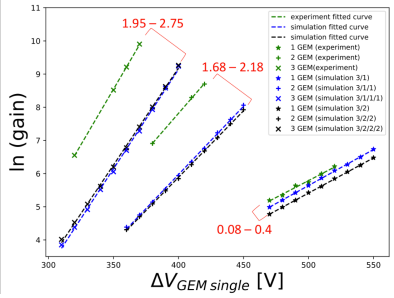
Simulation of multi-layer GEM

- Stacks of several GEM foils can reach a gain of 10^6

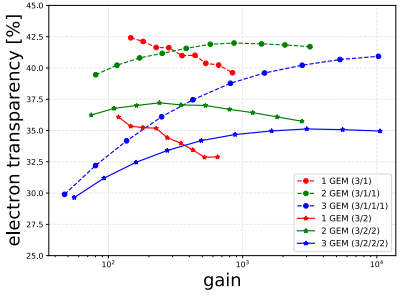


Results

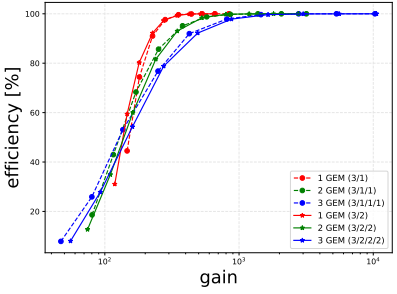
- Gain



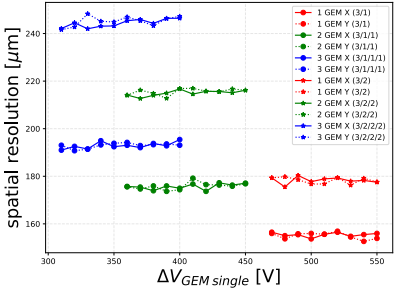
- Transparency



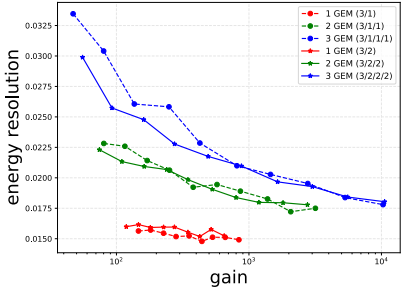
- Efficiency



- Spatial resolution



- Energy resolution



As the number of GEM layers is increased, the gain increases by using a small delta GEM voltage. On the other hand, energy resolution deteriorates as the number of GEM layers is increased while maintaining the system at a constant gain. The spatial resolution becomes poorer as the distance between the last GEM and the anode is increased. However, this difference is ~15 μm/mm. Lastly, there are some differences in transparency and efficiency, but both single, double, and triple GEMs are pretty much the same.