Motivation

- Micro Pattern Gaseous Detectors (MPGDs) are being used widely in particle physics experiments all over the world for their good position resolution, timing resolution and high rate capabilities.
- The time-dependent variation of avalanche gain in these micro pattern gaseous detectors, is one of the challenging problems in high-rate experiments.
- Charging up and charging down are two such phenomena which significantly affect gain-stabilization and thus the optimum working range.
- These phenomenon are very pronounced in THGEMs, due to thick dielectric (PCB material) used in their construction.
- THGEMs are robust detectors and their manufacturing is cost effective.

Charging Up

- Out of all the charges created in the multiplication region, a significant amount of them end up on the exposed dielectric surfaces, leading to charge accumulation during the detector operation.
- This accumulation of charge gives rise to an additional electric field, which distorts the originally applied field.
- The electrons lost on the top rim of the holes can charge up the dielectric and introduce a charging up process in THGEMs.

Electron transmission study

- Electron transfer efficiency (ETE) has been studied varying drift field at constant AVGEM and induction field
- AVGEM is kept at 2000V and induction field is 3kV/cm
- It is found that electron transfer efficiency is found to increase with drift voltage, attains a maximum value, then it decreases.

Results and discussions

- Two different irradiation rates were used to study the evolution of gain.
- Low rate source: 52.77 Hz/mm²
- High rate source: 686 Hz/mm²
- Drift field was 0.5 kV/cm and induction field was 1kV/cm

Gain evolution with irradiation rate

- On increasing VGEM from initial value

Gain evolution with applied THGEM voltage

- Voltage across the dielectric is changed to get the gain evolution curve
- Drift field was again 0.5 kV/cm and induction field was 1kV/cm
- High rate source (686 Hz/mm²) was used

Future studies

- Numerical and experimental study of effect of “Rim” on gain evolution with different irradiation rates and rim sizes.
- Use of other gas mixtures in experiments, and get an optimum working range.
- Study micro-discharges and see whether charging up is the driving factor.

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