**ABSTRACT**

Crosstalk (XT) characteristics such as pulse amplitude and shape are studied with a simple SPICE model of the capacitive couplings within an MPGD. The crosstalk pulse shape can be understood as due to a CR-differentiator. Crosstalk can occur simultaneously through more than one capacitive coupling path. The crosstalk signals on these paths add differently if the signal is induced via a current source as in normal detector operation or via a voltage source as is often done in benchtop tests with an external voltage pulse generator. A few means for reducing the crosstalk are investigated with the model. It shows that a low-impedance AC path from the amplification electrode that faces the readout structure to ground is important for achieving low crosstalk, which implies a need for a sufficiently large capacitance of that amplification electrode to ground. This result has consequences for how much an amplification electrode can be segmented.

**CAPACITANCES IN MPGDs**

Numerous capacitances among MPGD electrodes, which can be substantial (tens of pF) due to the small gaps in MPGDs, as well as parasitic capacitances between MPGD electrodes and detector ground play a role in the generation of crosstalk between readout structures via capacitive coupling.

**CIRCUIT MODELS**

**A)** Bench test with external voltage pulser modeled as voltage source:

- **Signal strips**: Capacitance of 128-ganged signal strips connected to ground.
- **Face electrode**: 150 μs risetime and full time.
- **XT strips**: Parasitic capacitance of facing electrode to ground.

**B)** Normal avalanche operation modeled as pulse current source:

- **Input impedance of analog amplifier**: Producing a pulse with 560 mV amplitude, 10 us risetime and fall time.
- **XT strips**: Parasitic capacitance of 128 XT strips connected to ground.

**SIMULATION RESULTS WITH PSPICE**

**Observations:**

- The simulation reproduces measured XT amplitude (1.3 %) and pulse shape very well.
- The HT pulse has the same polarity as the input pulse on the leading edge and opposite polarity on the trailing edge.
- The HT pulse is diminished when clipping the HT signal pulse by a CR filter circuit component of the CR-C filter circuit components.

**OBSERVATIONS & CONCLUSIONS**

This work is a result from the SPICE model:

- Replicate experimental HT results obtained for a Triple-GEM with a voltage pulser.
- Simulated effects of different input pulse rise time on the actual HT pulse during tests with a GEM in normal operation produce different responses to HT pulses due to the differences between an internal voltage source and an external current source.
- Simulate an additional parasitic component to the readout structure to ground in the HT pulse generator circuit.
- Simulate a different pulser circuit on the amplifier's output.
- Demonstrate that the HT signal amplitude is limited by the input impedance of the amplifier on the XT strip.
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The motivation for this study is an experimental observation that a segmentation of the bottom of the third GEM foil (facing electrode) in a Triple-GEM intended to reduce discharge propagation causes substantial opposite polarity crosstalk.