

Gas Electron Multiplier (GEM) Technology

The GEM electrode is a thin polymer foil, metal-coated on both sides and perforated with a high density of holes. A large potential difference provides electrons with enough energy to generate an avalanche through ionization collisions in the gaps.

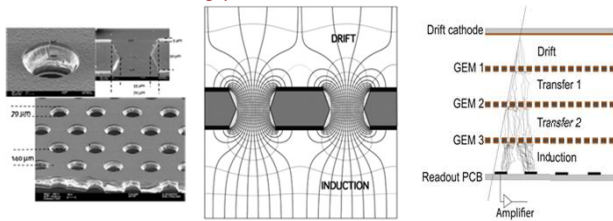


Figure 1: Left - Electron microscope picture of a section of typical GEM electrode. Middle - Electric field in the region of the holes of a GEM electrode. Right - Schematics of Triple GEM detector.

GEM Trackers in GEN-Recoil Polarimeter (RP)

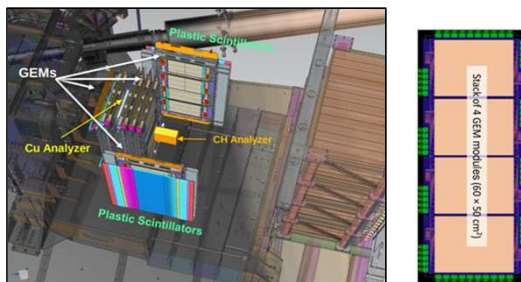
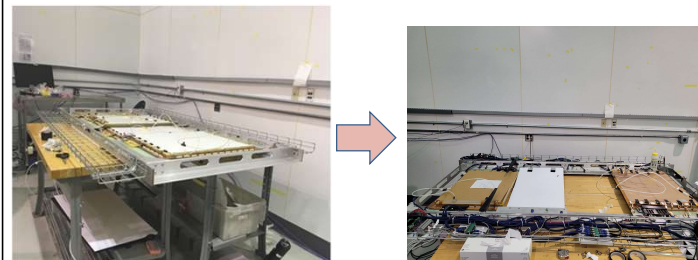


Figure 4: Left - GEN-RP arm. Right - A schematic 200 x 60 cm² UVA GEM layer.

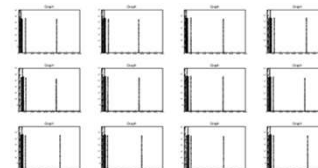
- Uses 10 UVA GEM layers + 2 INFN GEM layers.

Assembly of the UVA GEM Layers in EEL clean room

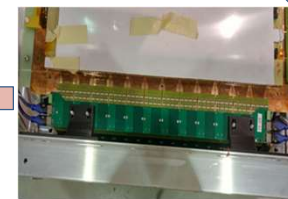


GEM modules placed on the frame.

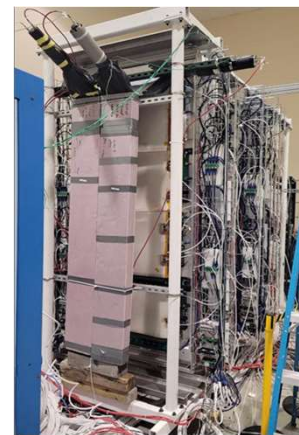
Cabling of the HDMI, high voltage and low voltage cables plus gas tubes.



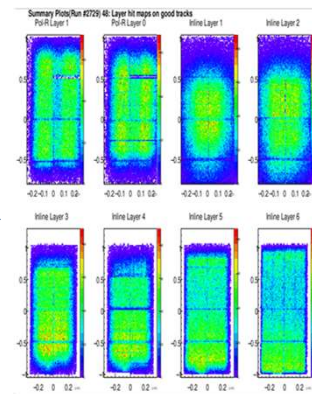
Testing of the DAQ electronics (The APV histogram test. The X-axes are the ADC value)



Attaching DAQ electronics (APV cards) to the GEM modules.



Completed layers moved into the cosmic stand for testing



2D hit (cluster) distributions of the layer 1 GEM modules taken from cosmic runs.

Figure 6: A flowchart of making and testing of GEM layers inside the GEN-rp cosmic stand

- 10 XY layers and 4 UV GEM layers have been completed so far with four already being used for GMn experiment in Hall A
- The cosmic tests for multiple layers on the GEN-RP cosmic stands are showing promising results

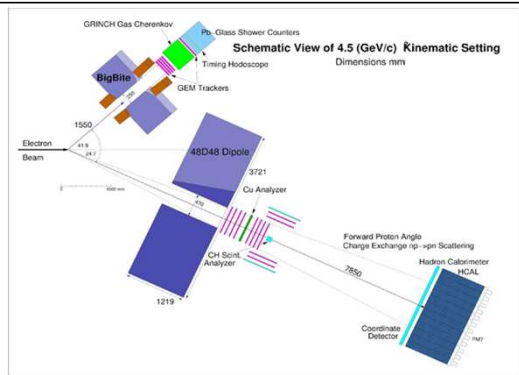


Figure 2: Schematic Experimental Layout.

GEM Trackers in Bigbite

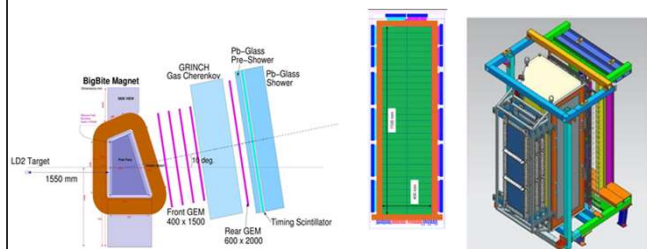
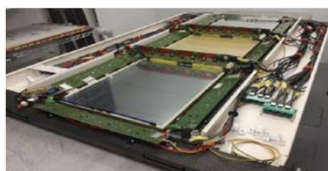


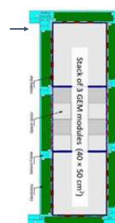
Figure 3: Left - Schematic Big bite arm. Middle - A schematic Schematic Experimental Layout 150 x 40 cm² UV front tracker GEM layer. Right - The Bigbite frame.

- Uses 4 UVA UV front tracker GEM layers + 1 UVA back tracker GEM layer.

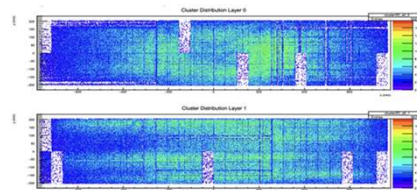
A schematic Schematic Experimental Layout 150 x 40 cm² INFN front tracker GEM layer



A layer with three 40 X 50 cm² GEM modules



4 GEM layers in the cosmic stand



2D hit (cluster) distributions of layers

Figure 5: A flowchart of making and testing of the INFN GEM layers inside the test lab clean room.