EEE MRPC response to cosmic muons simulation with GEMC (GEANT4)

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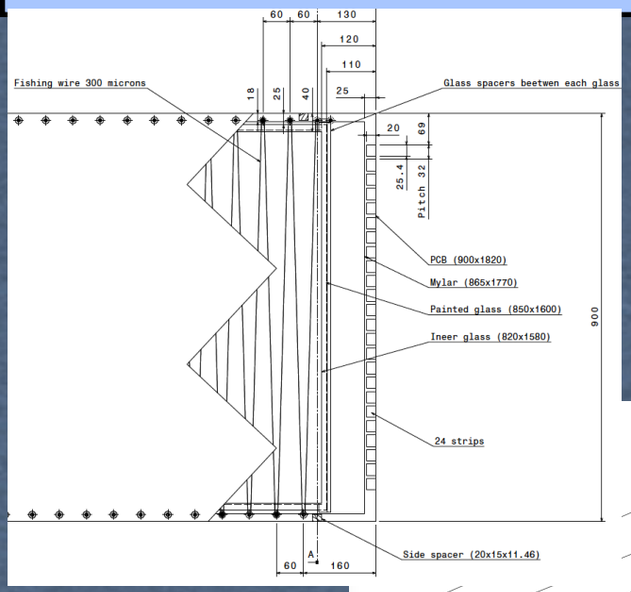
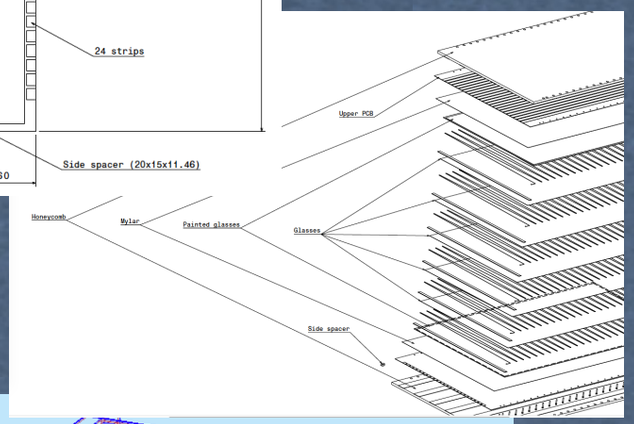
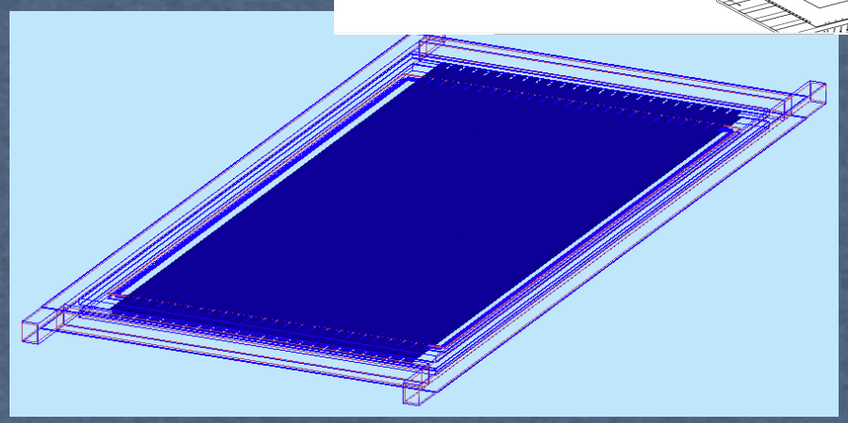
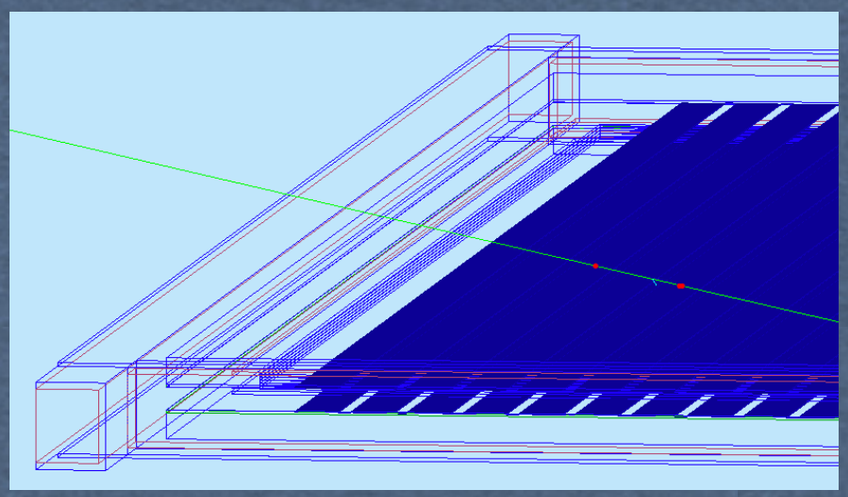
MRPC single chamber in GEMC

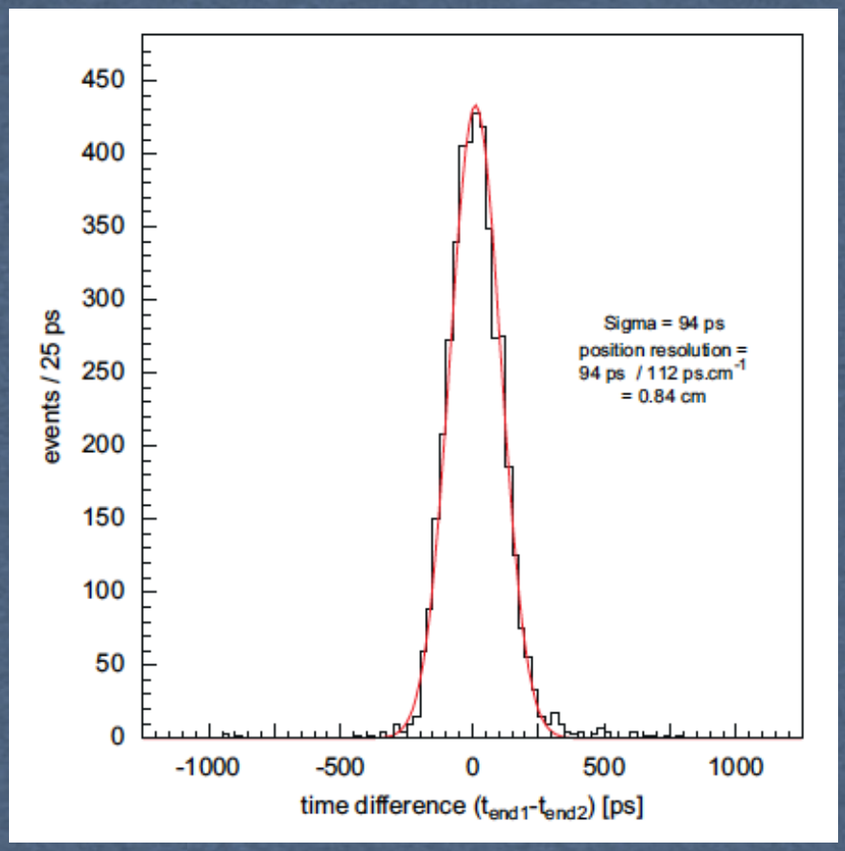






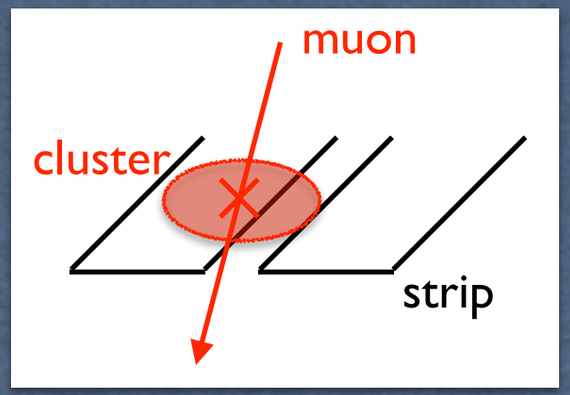


- ✳Realistic geometry implemented
  - materials (Al, Vetronite-G10, Cu, glass, Al-honeycomb, Gas
  - geometry
  - active layers (so far only bottom strips + gaps)
- ✳No avalanche simulated in details
- ✳Effective hit process:
  - Sample XY (and Z) muon hit on on bottom strip plane
  - Assume both strips and gaps as active
  - Apply a spread of σ=8.4mm (2σ) to account for multiple hits and spread position resolution both in X and Y
  - Apply a time spread (constant) σ=94ps



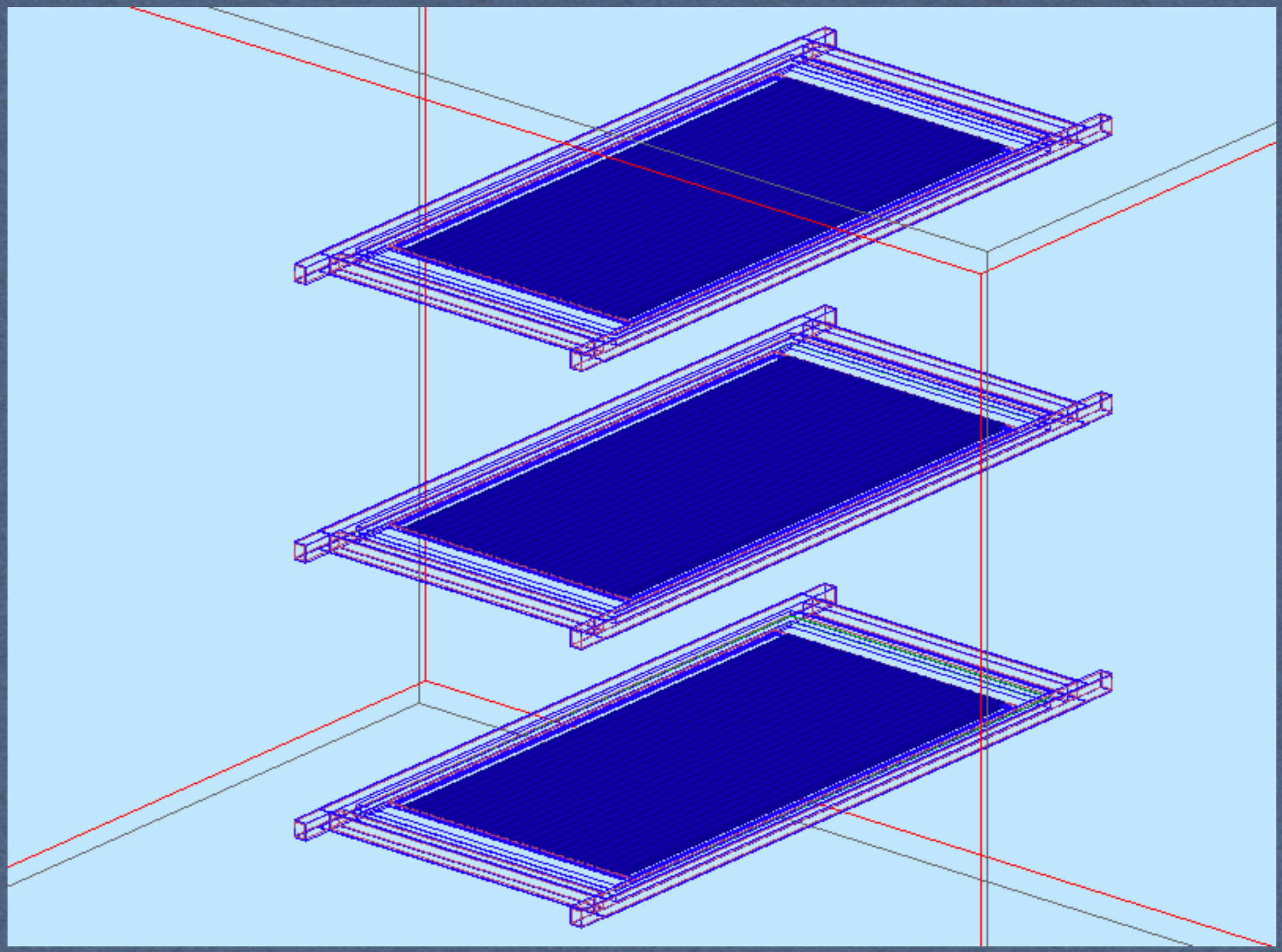
✳MRPC parameters

- 90x160 active area
- Active: 2.5cm x 24 strips + 0.7cm x (24-1) gaps
- Time spread: σ = 75ps
- Cluster size: σ_X = 8.4 mm
- Cluster size: σ_Y = 8.4 mm
- HIT_{XY} is gaussian-spread and projected on the sensitive area to derive strip multiplicity



✳Telescope Parameters

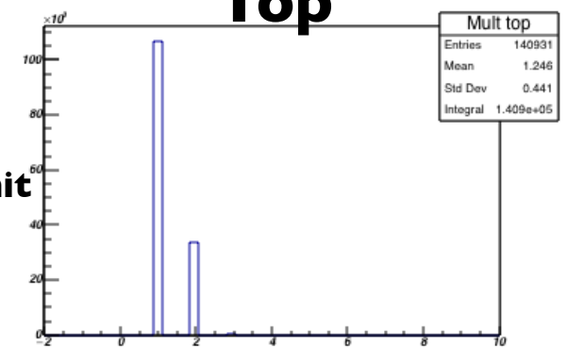
- 3 chambers
- -80/0/+80 cm apart
- placed in a concrete box wall on all sides (30cm concrete)

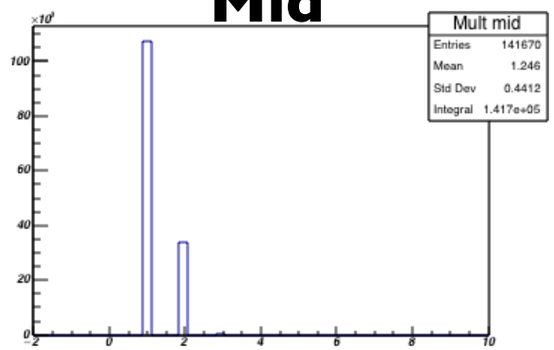


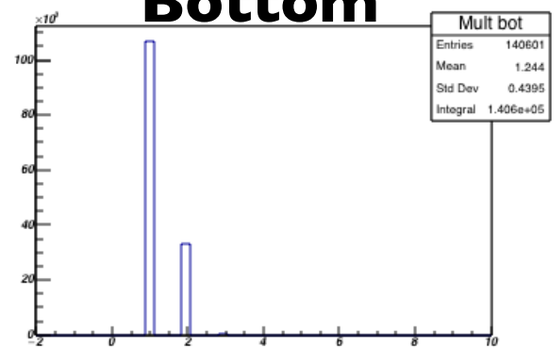
- Response of the three chambers (indipendently) to cosmic muons (2-10 GeV)

Top **Mid** **Bottom**

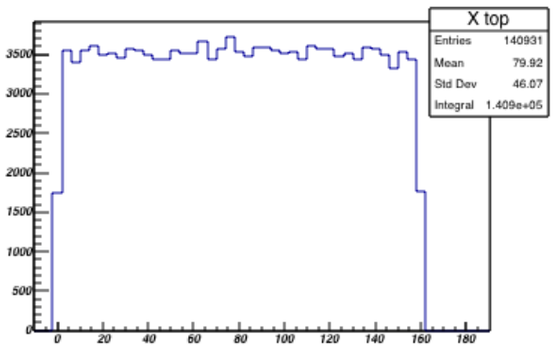
$Mult_{hit}$

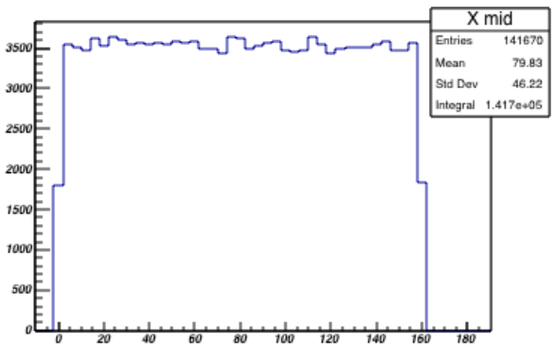


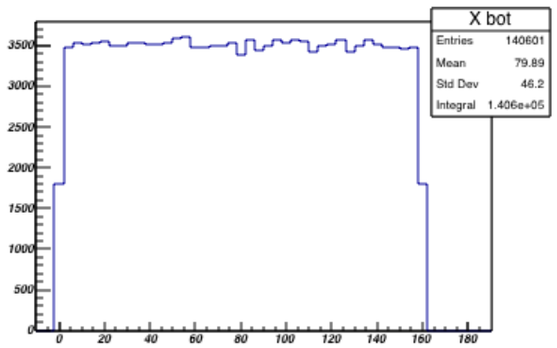




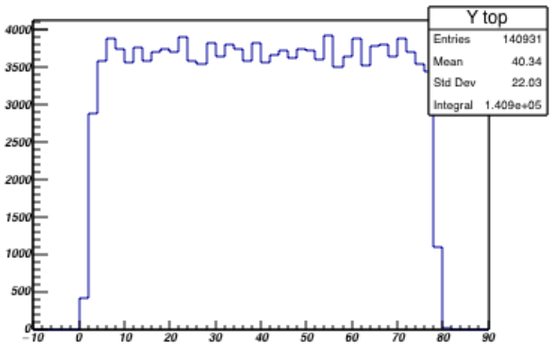
X_{hit}

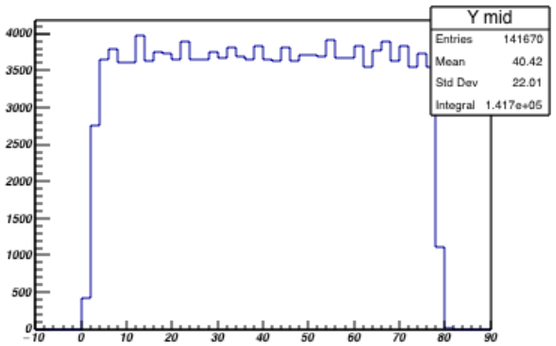


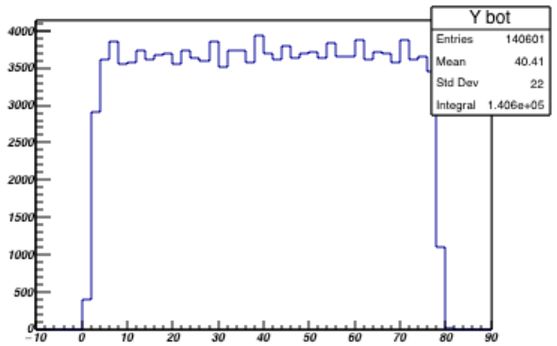




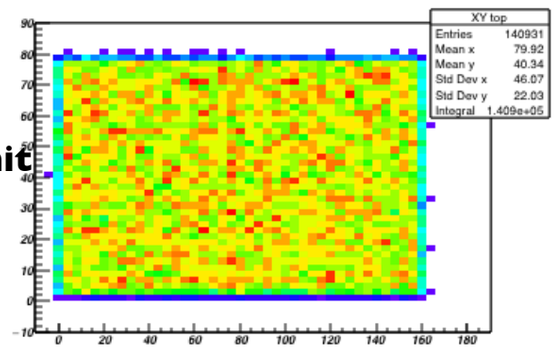
Y_{hit}

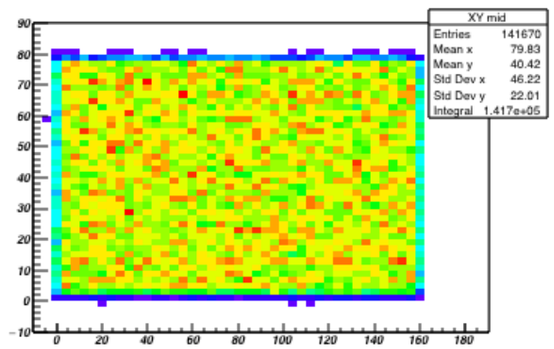


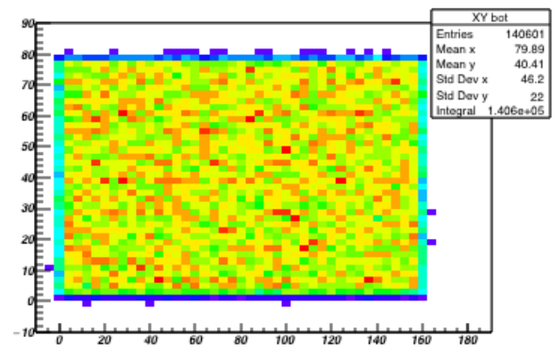




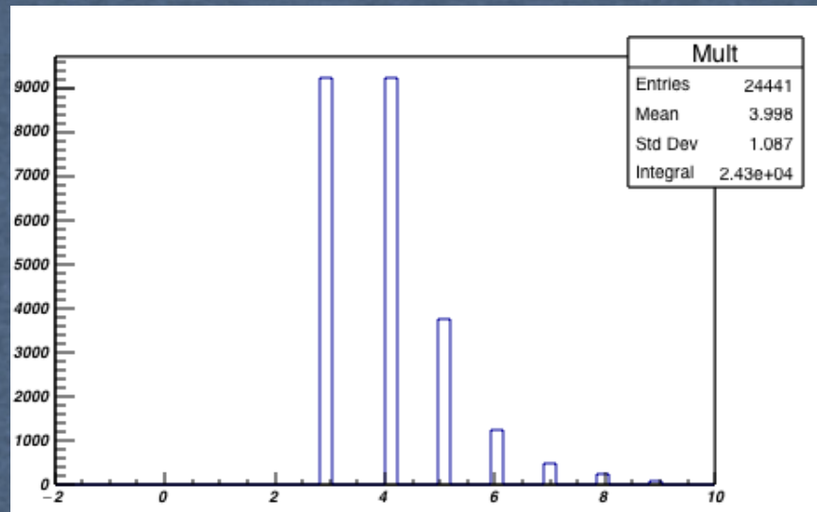
$XvsY_{hit}$

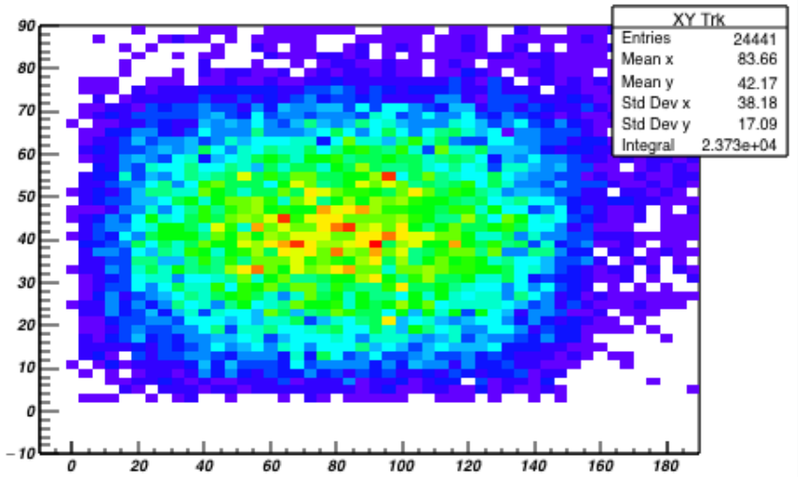


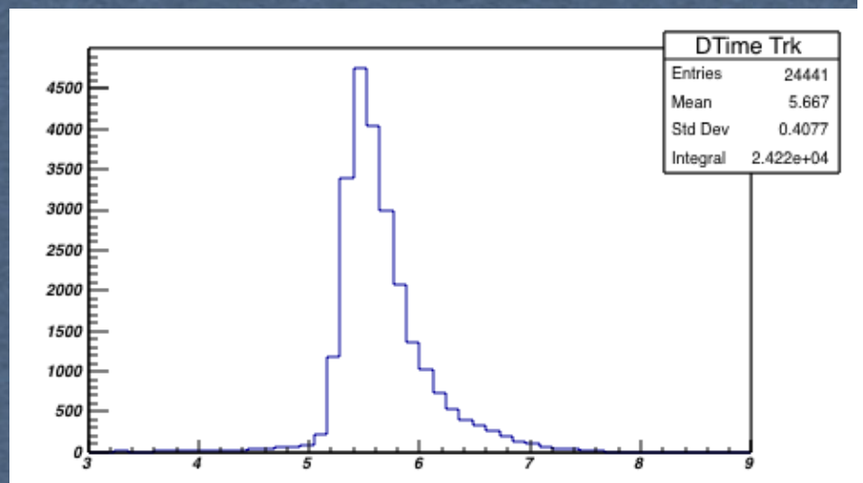


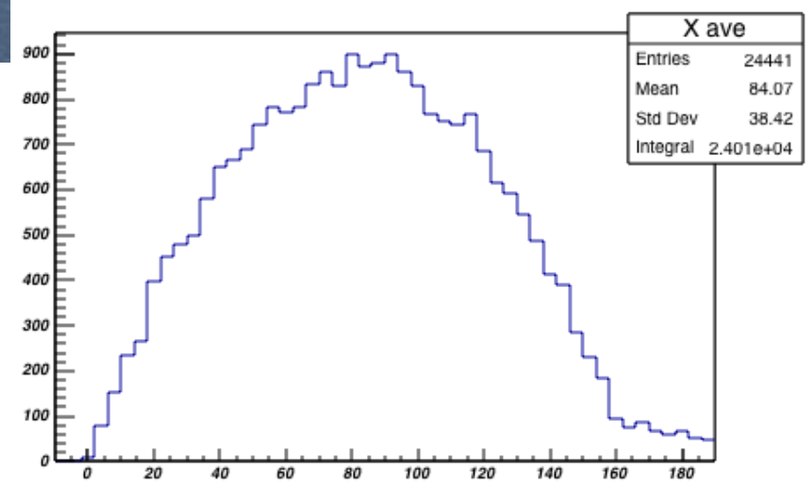


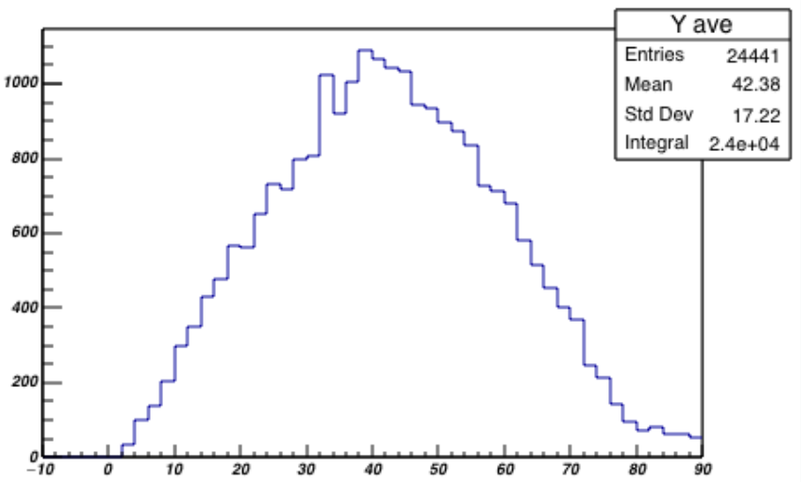
- Response to cosmic muons (2-10 GeV)
- To match data, sim needs to go trough the same analysis chain

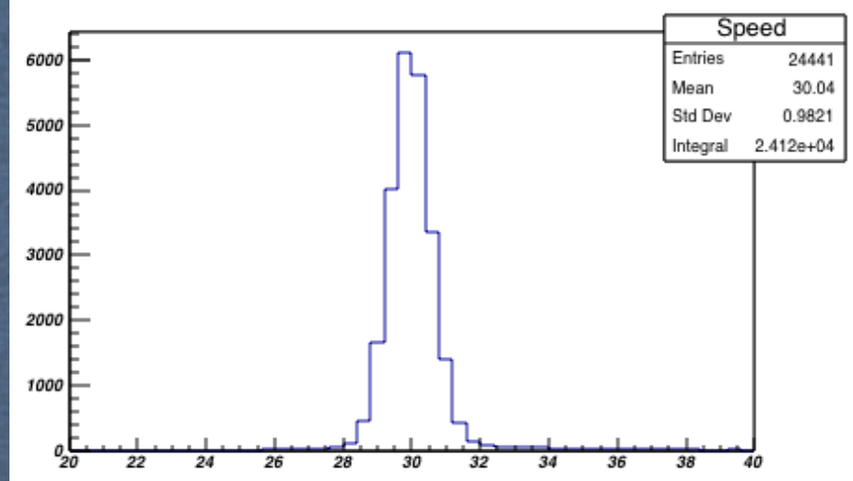


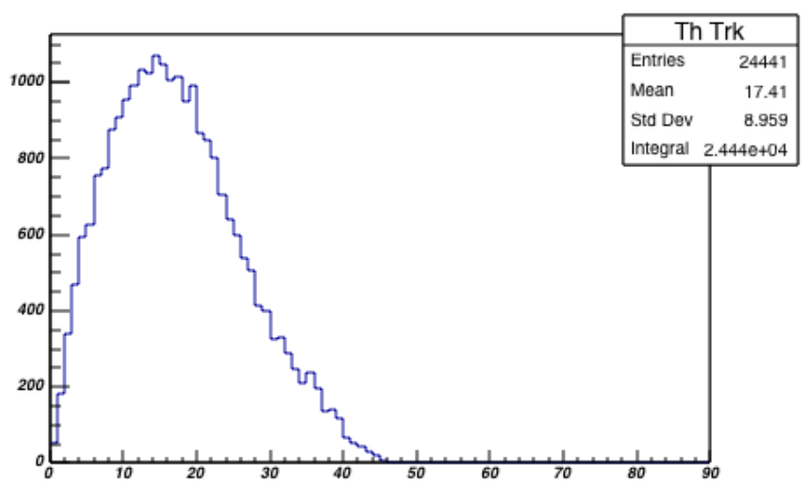


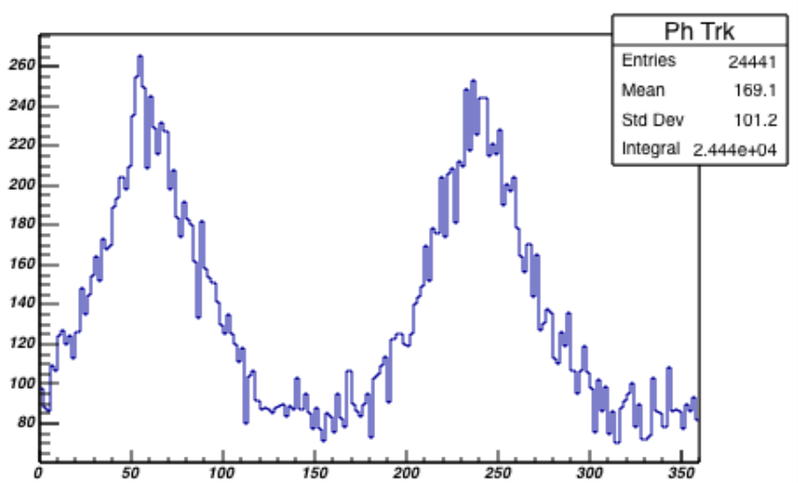


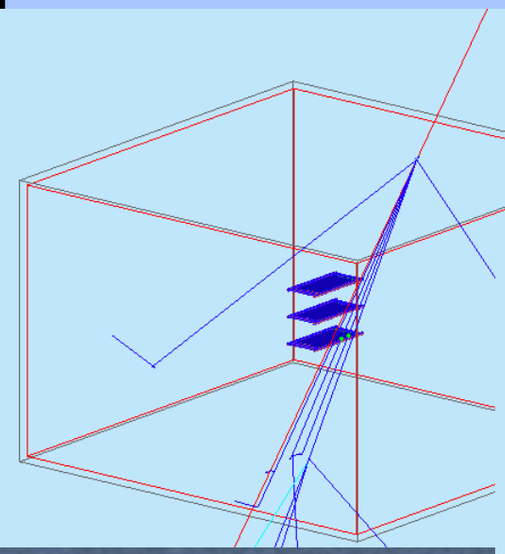


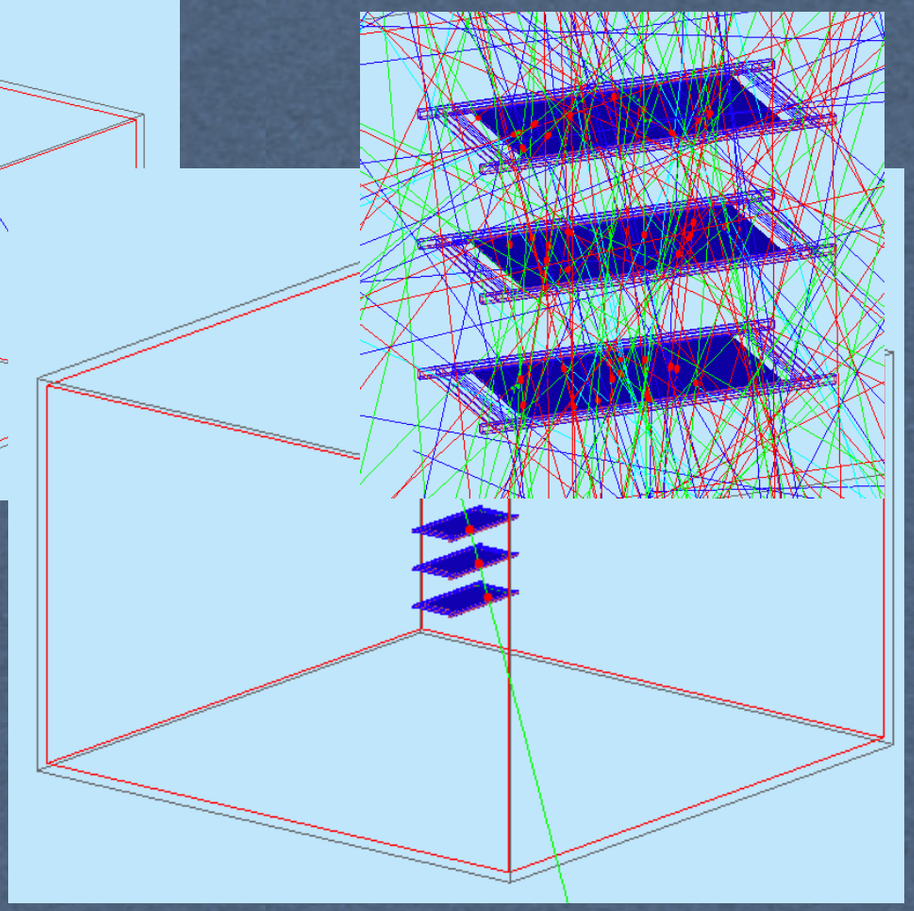


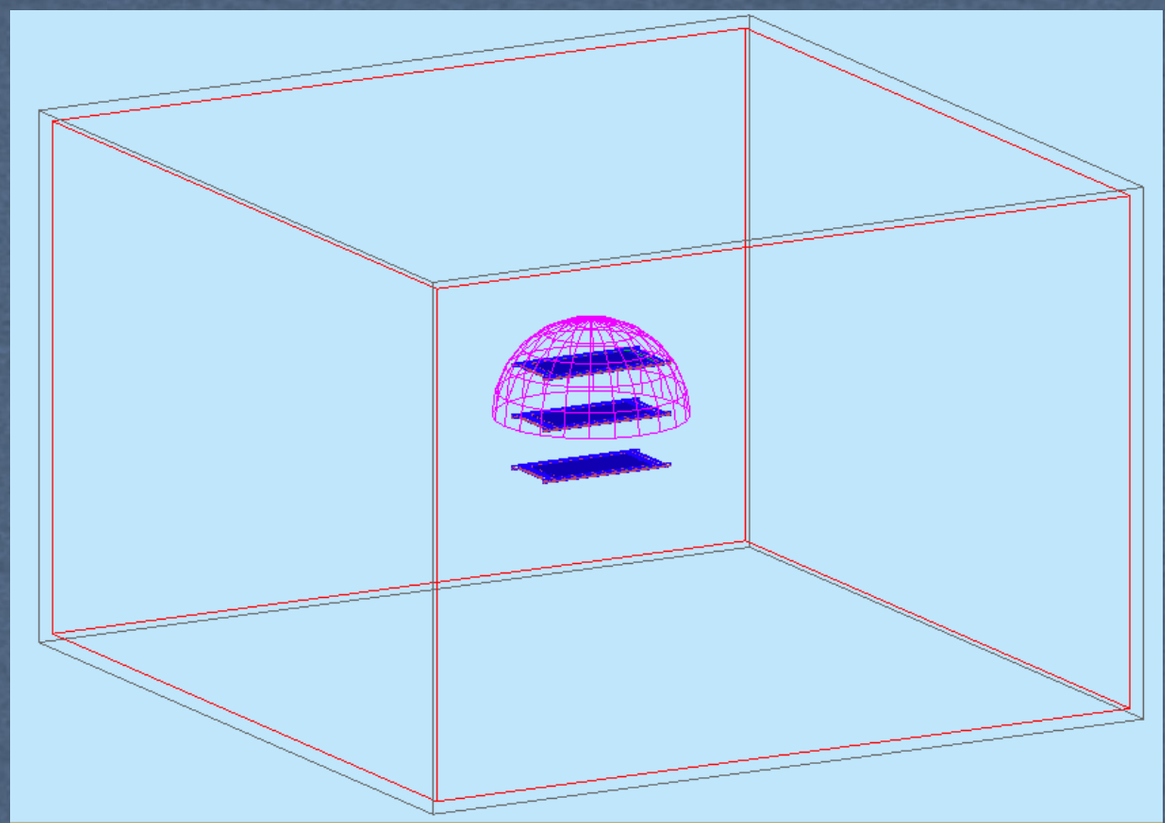












Energy	fraction of the spectrum (%)	Rate 1248.8Hz * Rec/Gen	Rate
0.2 - 2 GeV	44.5	36.6Hz	16.3Hz
2- 10 GeV	41	30.2Hz	12.4Hz
10- 100 GeV	14.2	20.4Hz	3Hz
100 - 500 GeV	0.3		
Tot	**100**		**31.7Hz**

Rate for single chambers: 62+73+23 = 160 Hz

- Work program
  - ✓ implement 3 chambers (easy, just copy the geometry)
  - ✓ generate cosmics (full spectrum), derive absolute single-hit rate and compare to data
  - study effect of surrounding material (rate ratios, geometrical effects)
  - compile and run the giant4 model at CNAF and make it public
  - more realistic response from data (same time/space resolution)
  - avalanche model (?) requires electric fields to be implemented in GEMC
  - more realistic output format to feed the rec program (?)