

Status of the Front Tracker GEM and INFN Electronics

2013 –May– 15
SBS Weekly Meeting

INFN – Catania, Genova, Bari and Rome

GEM Test @ DESY

Production

Test @ DESY

From Apr/22 to May/5

Overall test in experimental area of:

- First GEM modules

- Electronics (new MPD, ...)

- Gas Mixing System

- HV

Measure in magnetic field (up to 1000 G)

- at different impact angles w.r.t. field and chamber

- scan HV and position (centre/border)

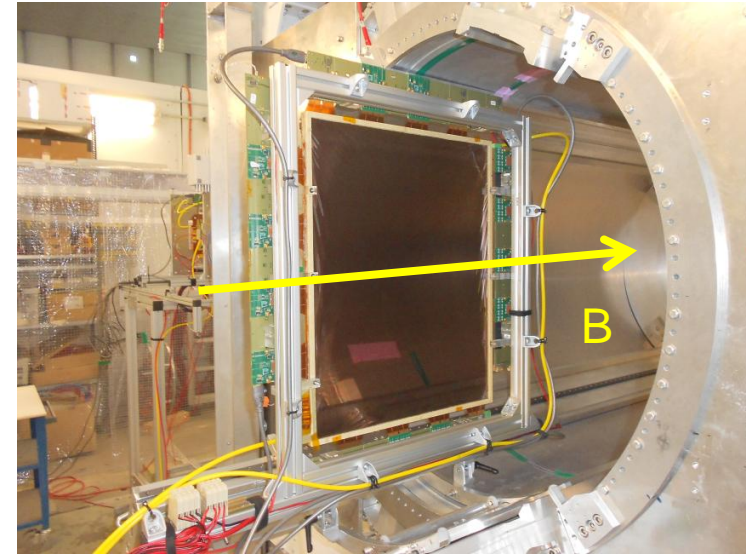
Setup @ DESY / First Period

2x2 small scintillators as telescope for trigger

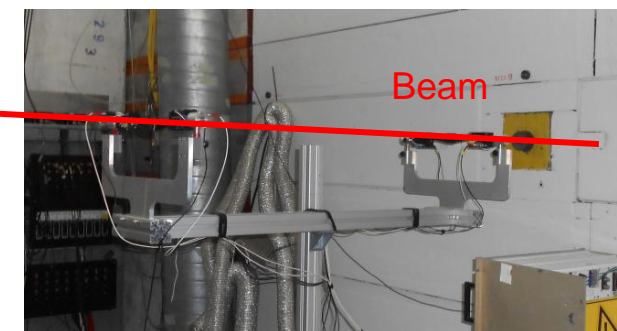
One big GEM in solenoid open space

Two small GEM chambers behind the magnet as reference tracking

New and old electronics / long HDMI cables > 20 m total length from FE to VME



Big GEM + Solenoid



Scintillators

Setup @ DESY / Second Period

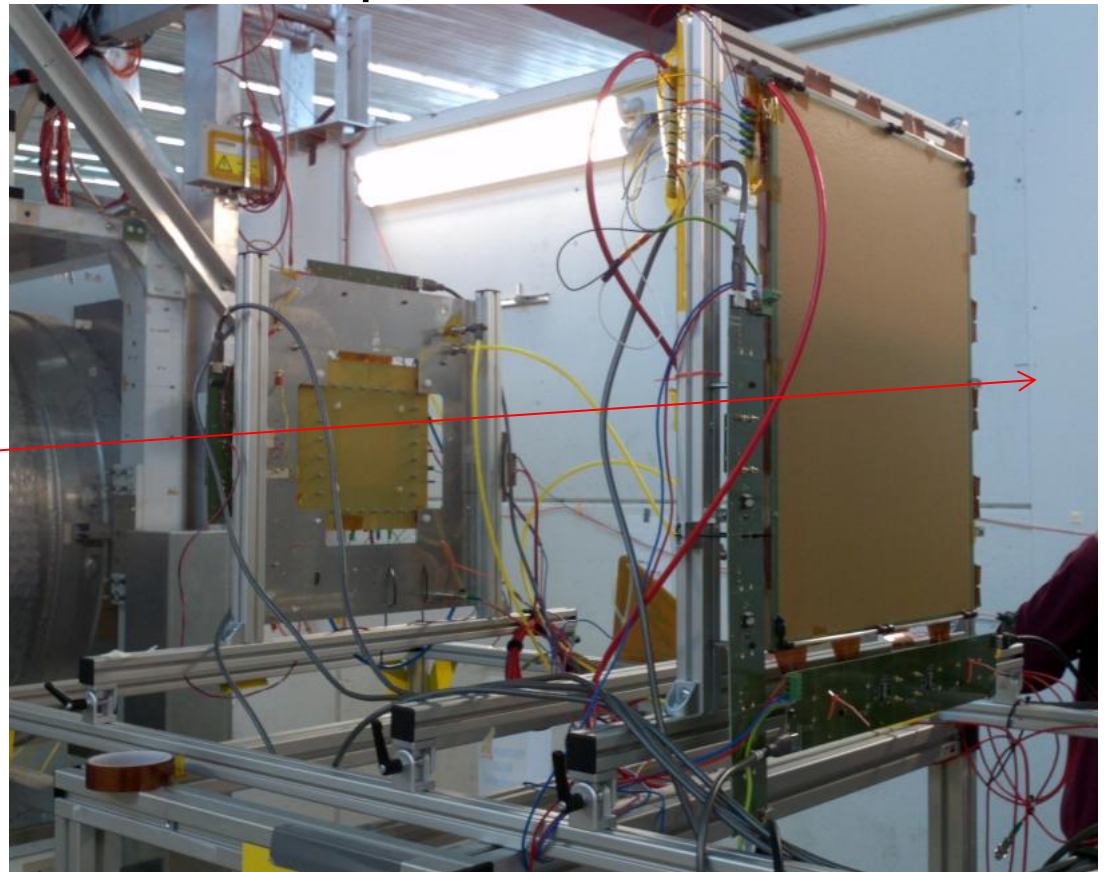
2x2 small scintillators as telescope for trigger

One big GEM in solenoid open space

One small GEM chamber behind the magnet as reference tracking

Second big GEM behind the small GEM operated as 2xGEM

Same electronics



Test @ DESY / Very short summary

Spent 5 days for installation and «commissioning»

First «good» data Apr/27 afternoon (fixed couple of DAQ bugs)

During HV scan in Apr/28 we notice *drop* in gain/efficiency of all chambers (almost) simultaneously – this was the main intriguing issue of the whole experiment

Got back *large gain* on May/2 for few hours than back to «sub-normal» gain for the rest of the test

Magnetic field scan from 50 G to 1000 G, HV scan, position scan, beam momentum scan, gas mixture scan (70/30 to 90/10)

Noise level down to 15 ADC unit (better than in Lab)

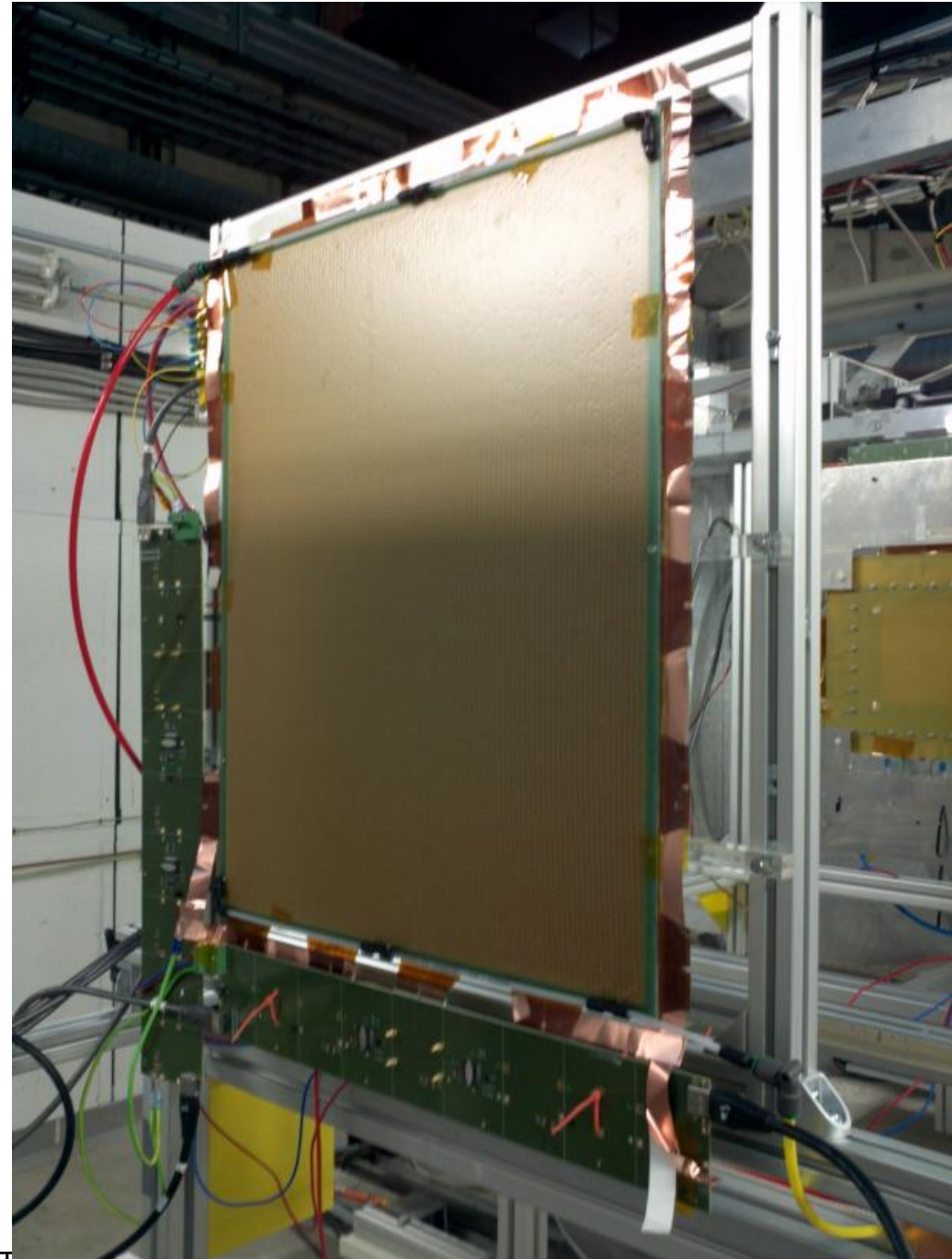
We took about 300 runs (50000 events each)

Noise improvement

All unused strips (not enough electronics) have been connected to ground by mean of copper adesive tape

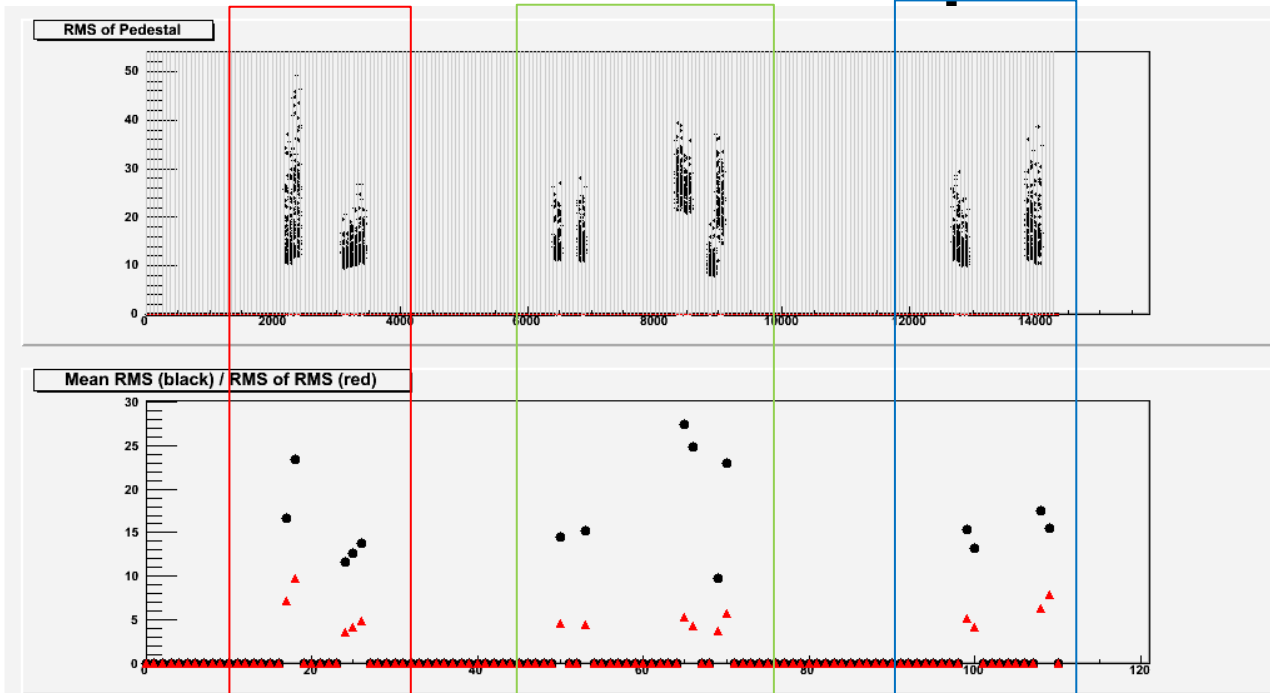
New GEM modules appear much more stable in terms of noise (no flex adapters and ground lines in connectors)

Each backplane connected to common ground by existing connectors: NO EXTRA grounding

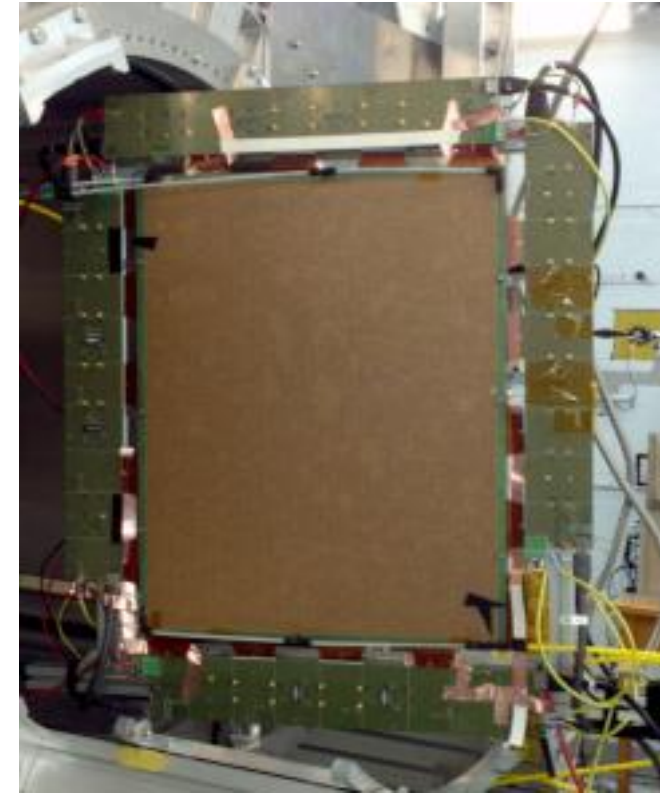
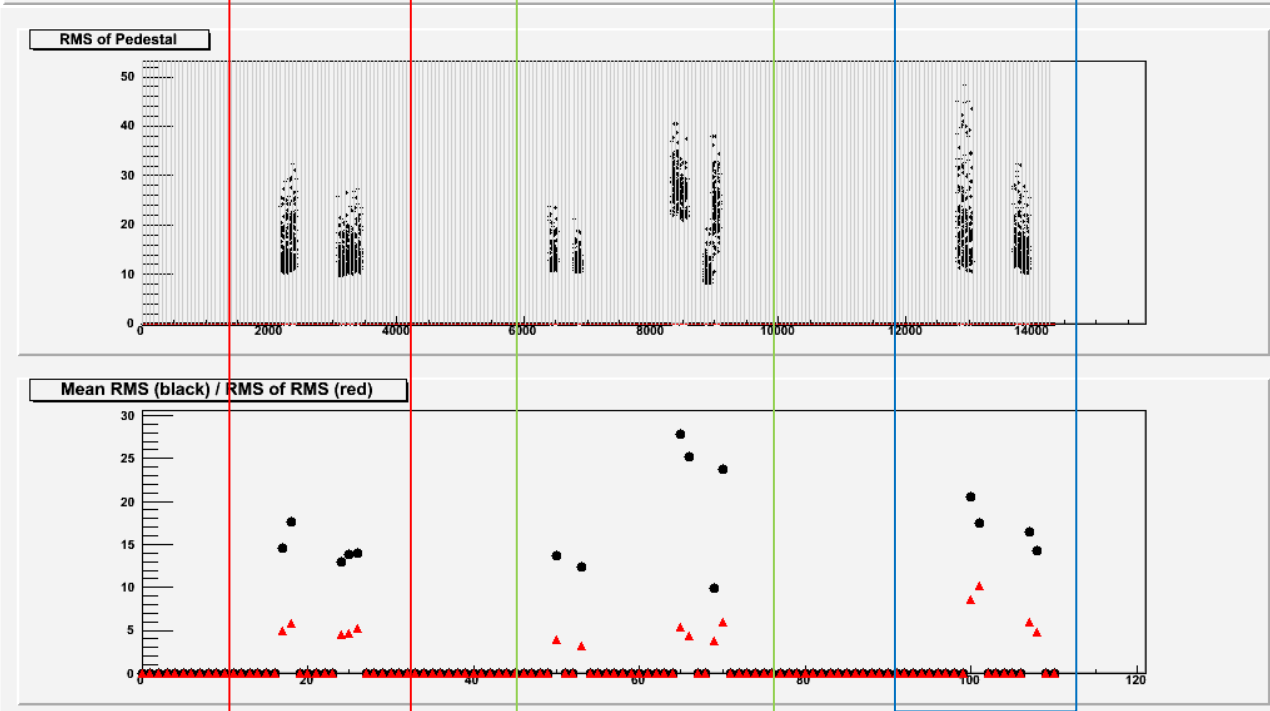


Noise Improvement

Before strip grounding



After strip grounding

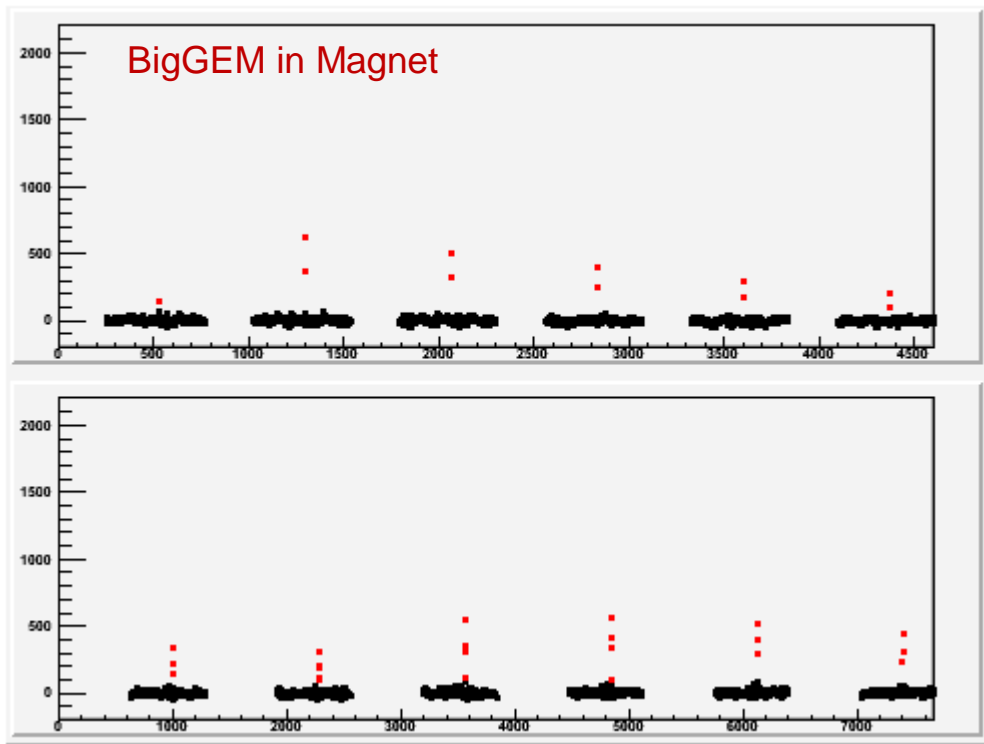


Red – big Chamber – new MPD
 Blue – big Chamber – old MPD
 Green – two small GEMs

4 different MPD/Front End card
 Combinations

Average RMS_ADC down to 15

Event Display / Run 3080 / High Gain



6 samples

Gas Mixture 80/20 Ar/CO₂

BigGEM in Magnet : 4100 V

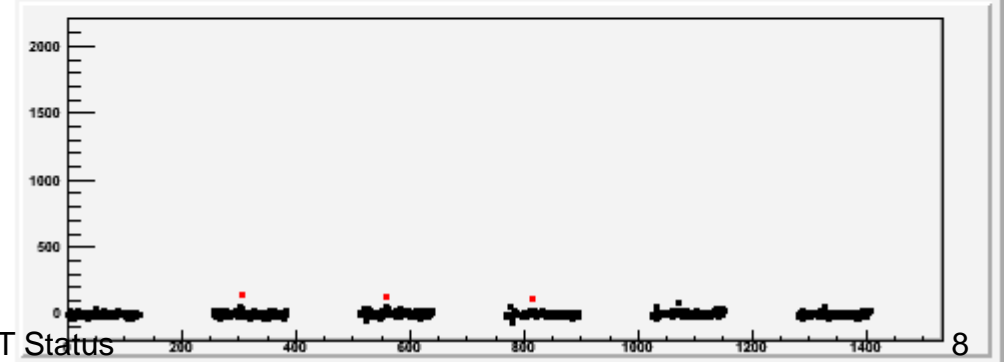
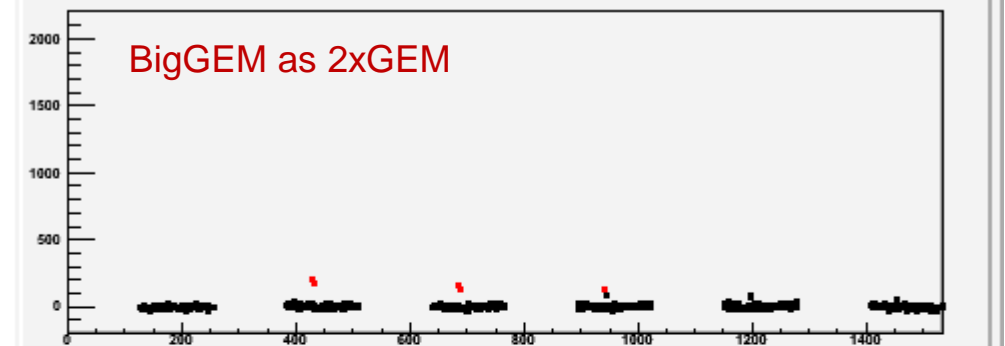
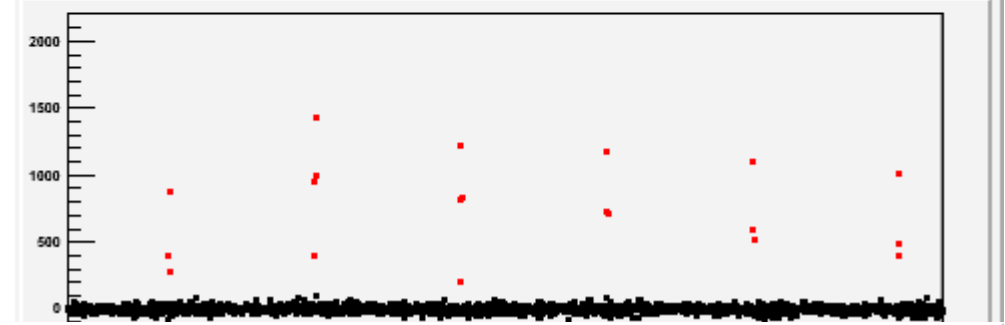
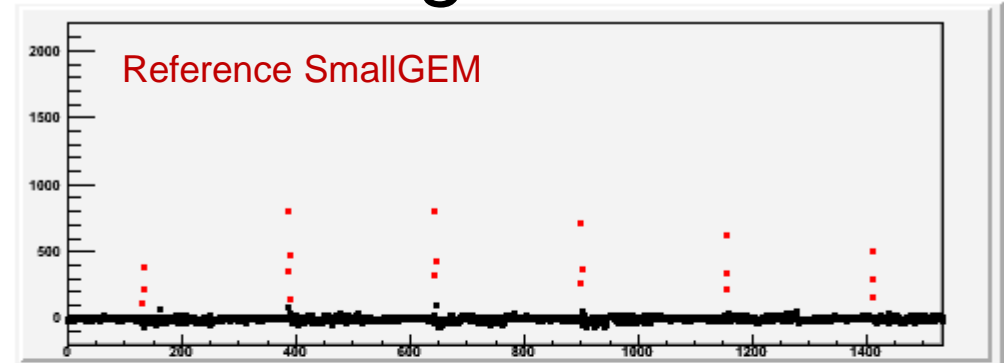
Reference SmallGEM : 4050 V

BigGEM as 2xGEM : 4300 V

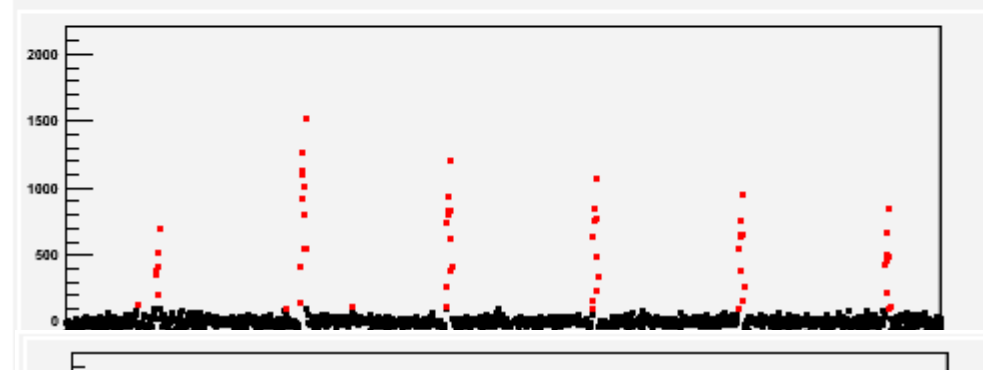
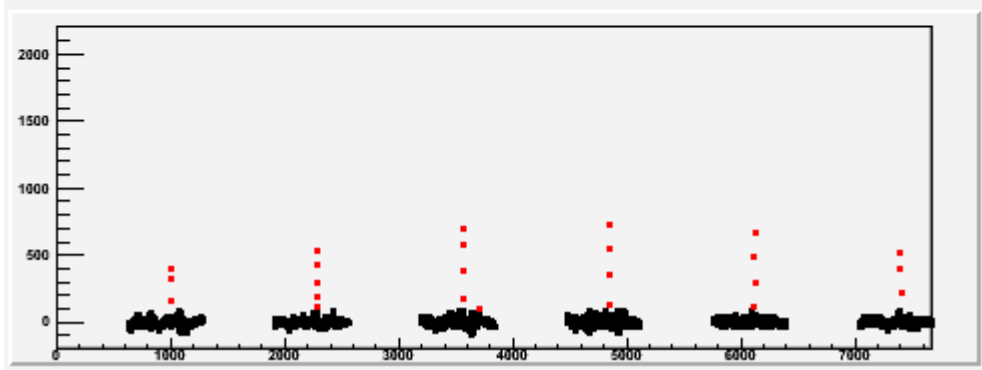
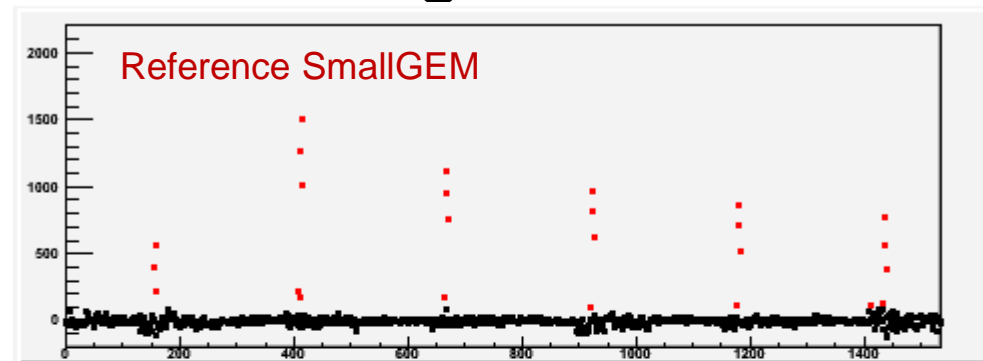
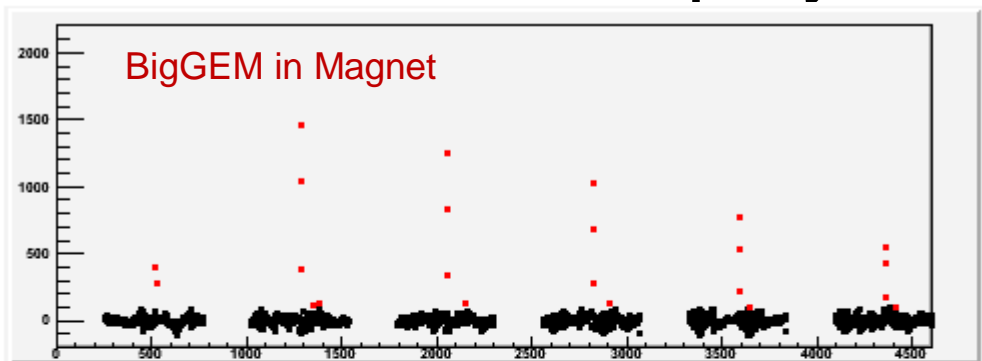
«Normal event»

Efficiency x/y:

0.85/0.75 – 0.85/0.90 – 0.60/0.40



Event Display / Run 3080 / High Gain



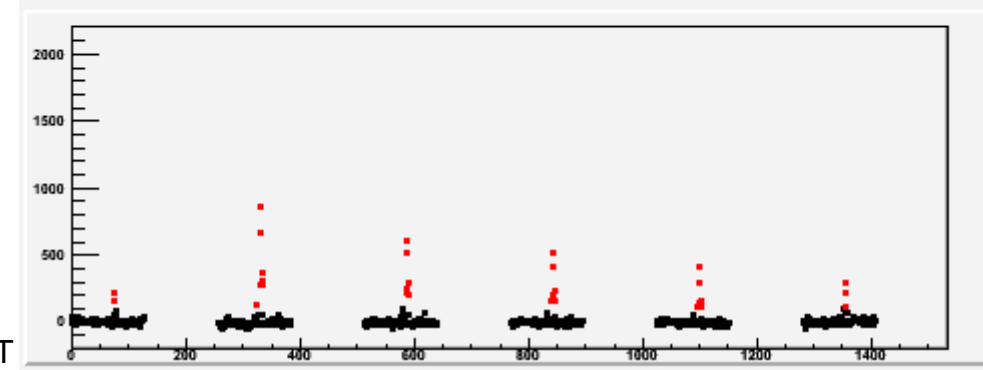
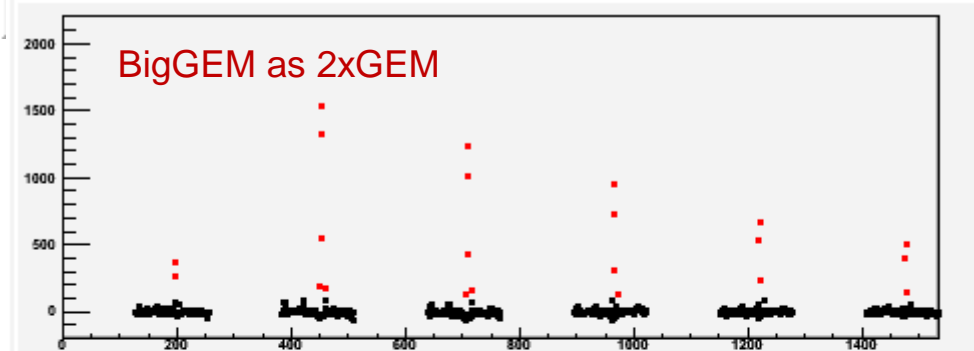
Gas Mixture 80/20 Ar/CO₂

BigGEM in Magnet : 4100 V

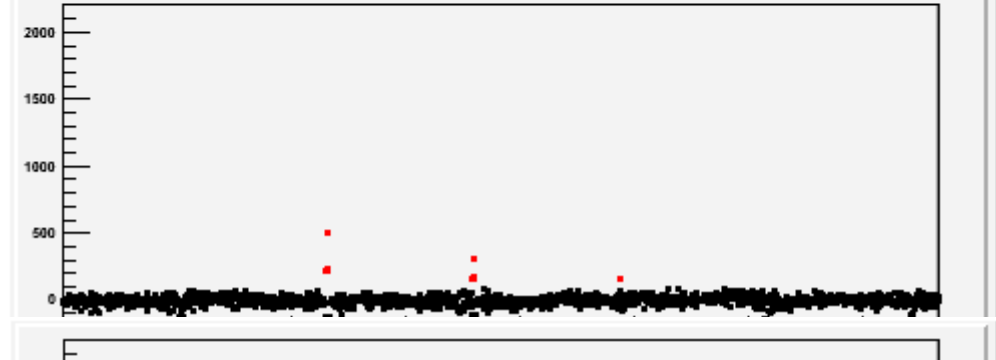
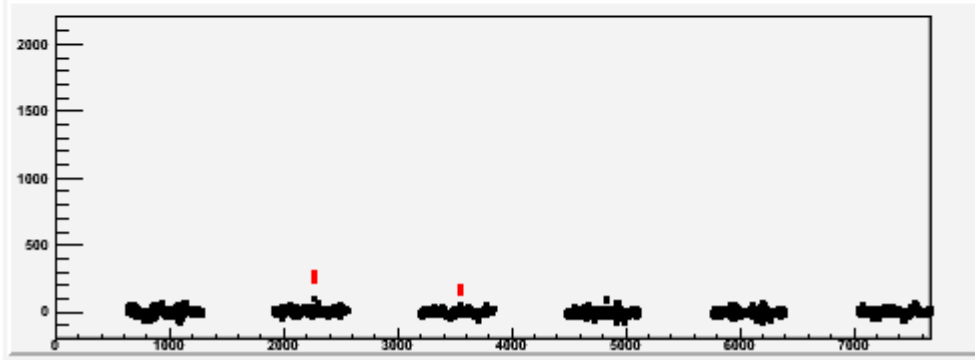
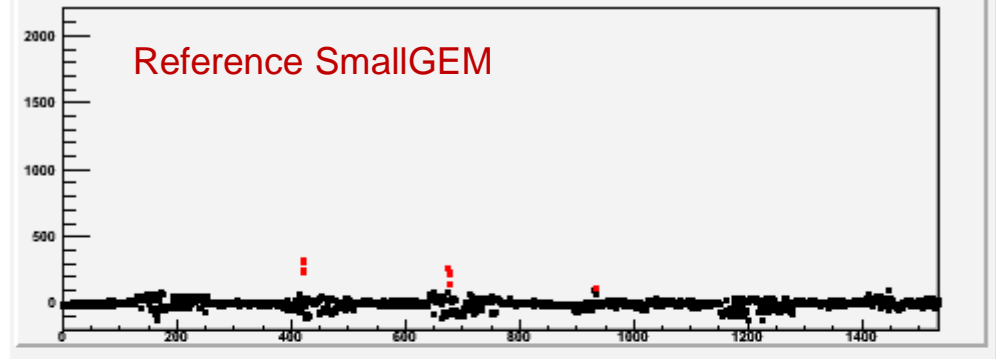
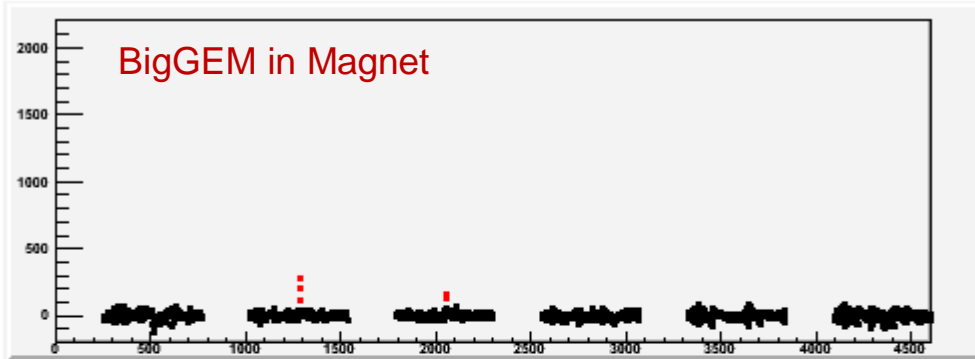
Reference SmallGEM : 4050 V

BigGEM as 2xGEM : 4300 V

«Large gain event»



Event Display / Run 3134 / *SubNormal Gain*



Gas Mixture 80/20 Ar/CO₂

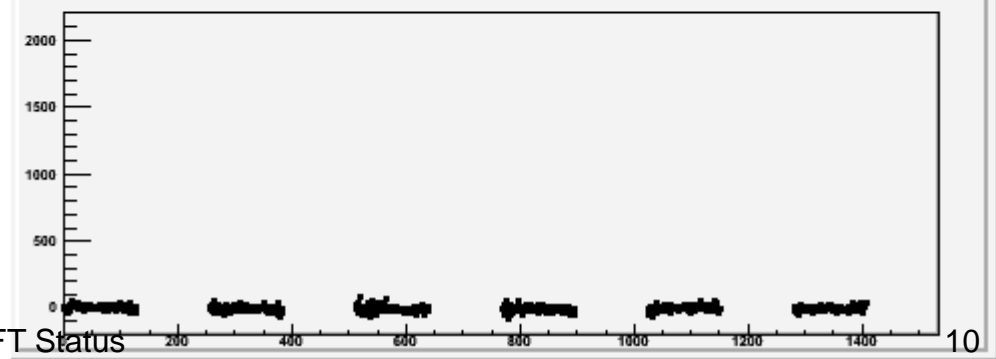
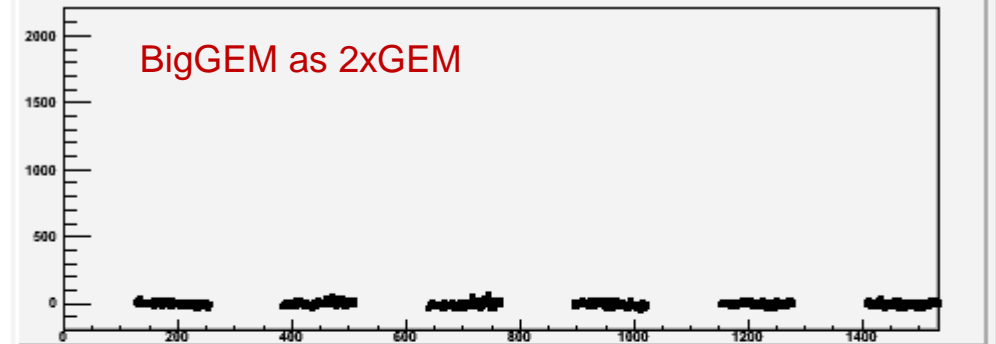
BigGEM in Magnet : 4200 V

Reference SmallGEM : 4100 V

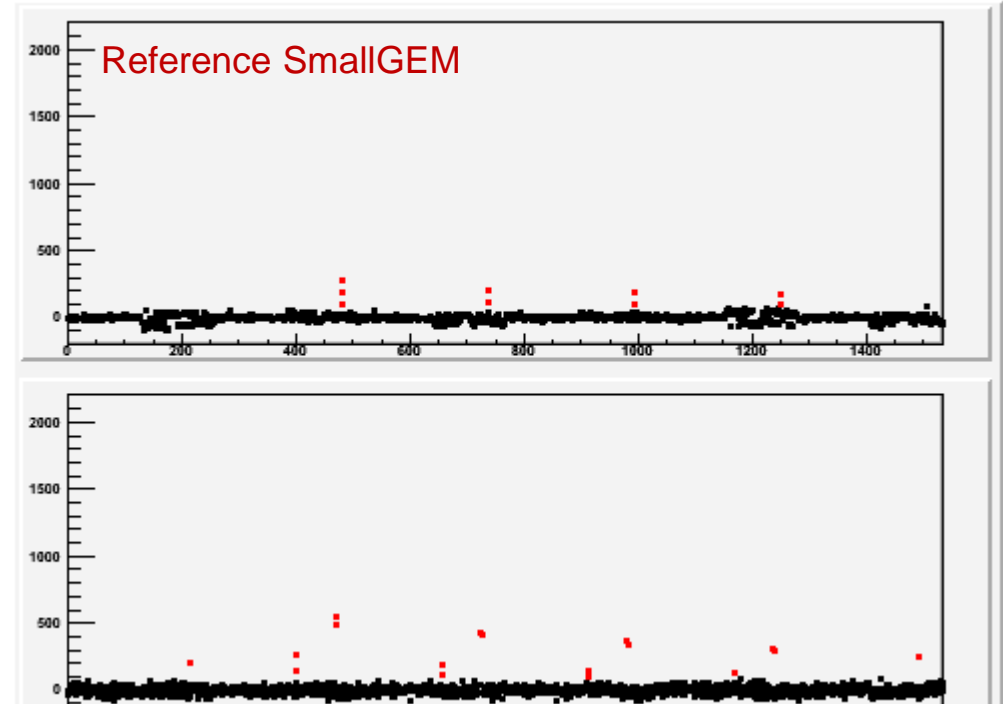
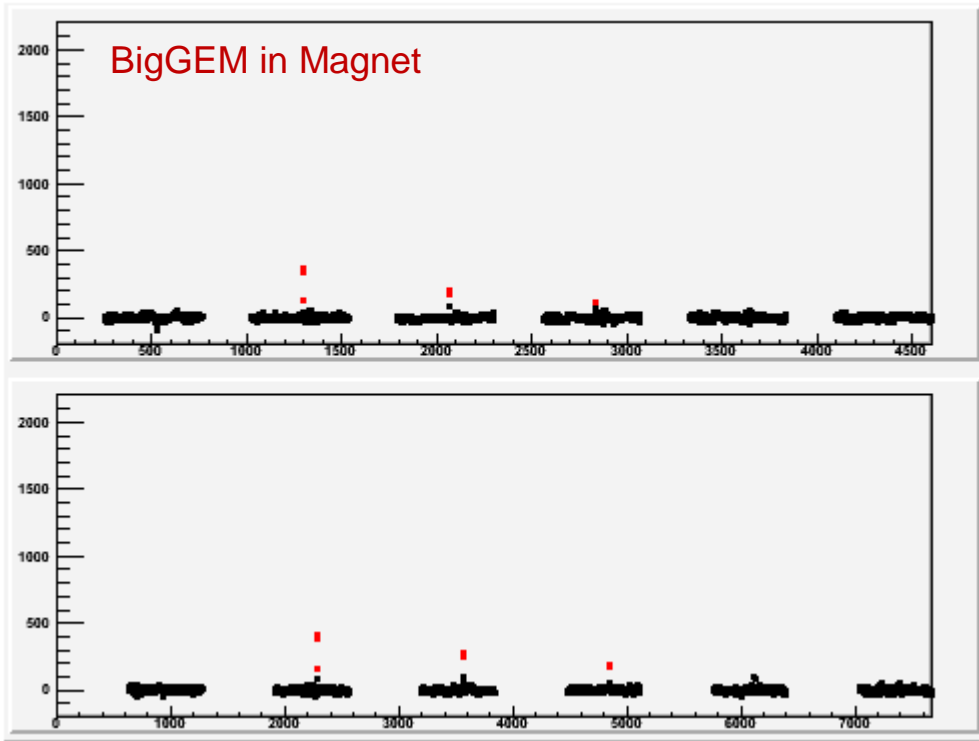
BigGEM as 2xGEM : 4400 V

Efficiency x/y:

0.65/0.62 – 0.80/0.85 – 0.20/0.10



Event Display / Run 3134 / *SubNormal Gain*

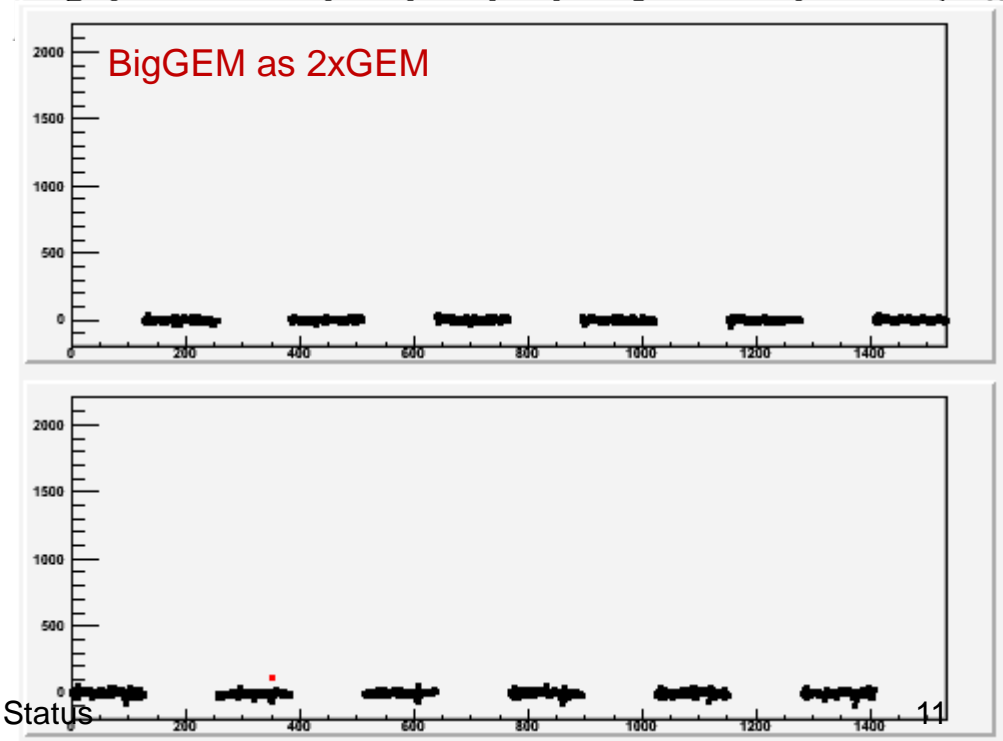


Gas Mixture 80/20 Ar/CO₂

BigGEM in Magnet : 4200 V
Reference SmallGEM : 4100 V
BigGEM as 2xGEM : 4400 V

Efficiency x/y:
0.65/0.62 – 0.80/0.85 – 0.20/0.10

Analysis just started ...



GEM production

1. No apparent significant issue in gas flow in both big modules: small leaks easely cured (can flow at 20 ml/m with 2 mm bubbler)
2. One GEM sector likely compromised by dust during assembling; we can/must test the HV right after assembling before/after gluing (still possibility to recover the foil). However not sure the HV GEM test rubust enough
3. Going to slightly modify GEM foil design:
 1. make protection resistors mor eaccessible
 2. Increase HV path width (although no isse experienced up to now)
4. HV distribution/divider design (outside the GEM) to be improved
5. 3rd GEM module under assembling in Catania with material already ordered.
6. New MPD revision looks stable and working as expected