

Status of the Front Tracker GEM

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2013 –June– 5
SBS Collaboration Meeting

INFN – Catania, Genova, Bari and Rome/Sanità

Production Status

DESY Test

Electronics update (Paolo Musico)

Front Chamber reqs and design

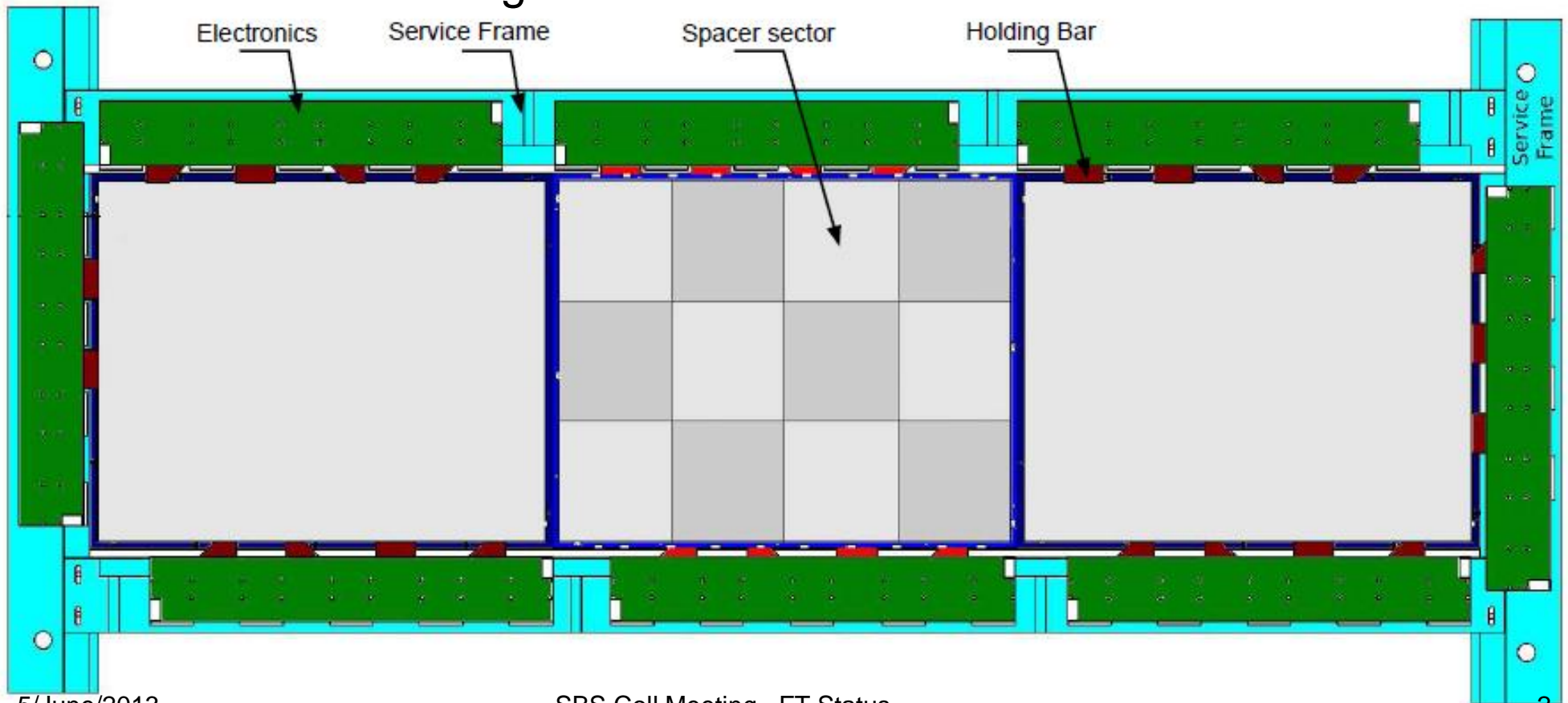
Hit spatial resolution $\sim 70 \mu\text{m}$

Stand large background ($\gamma \sim 250 \text{ MHz/cm}^2$, $e/\pi \sim 160 \text{ kHz/cm}^2$)

Transverse area at least $40 \times 120 \text{ cm}^2$

Event rate at the level of 20 kevents/s

Reuse in different configurations



GEM (pre)production

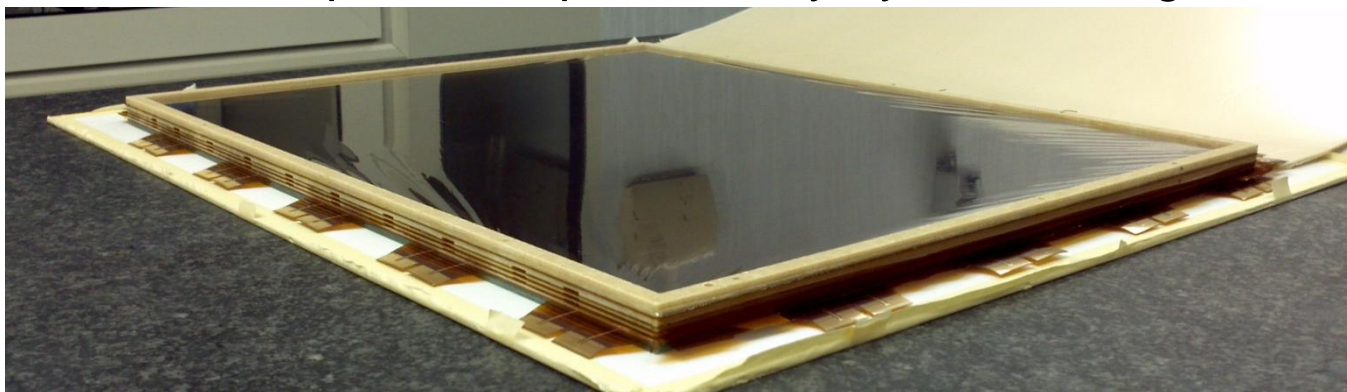
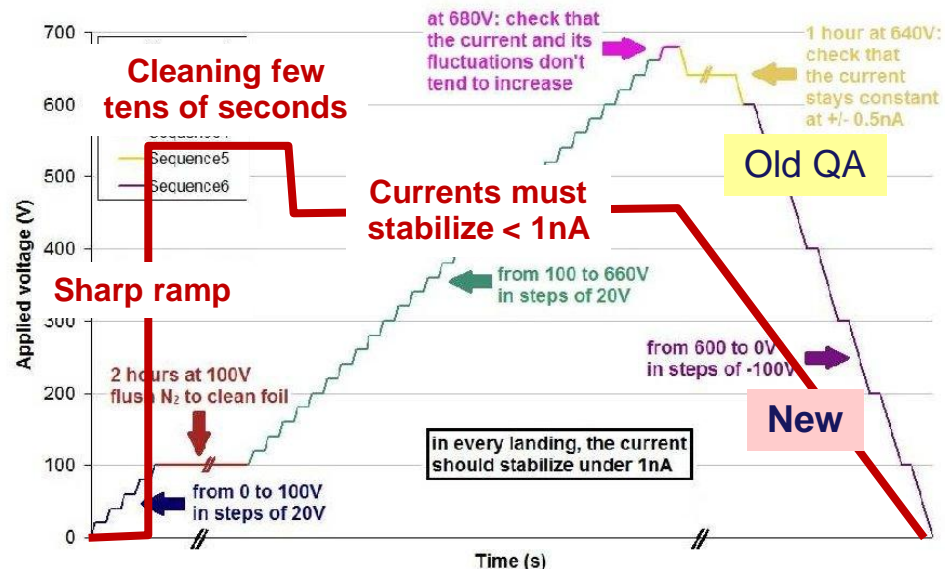
1. Nov-Dec 2012: «Standard» Quality Controls on first bunch of Single Mask GEM foils was completely negative: 4 foils damaged

2. Jan-Feb 2013: New «cleaning and check» procedure defined with CERN/Rui and UVa support.

The new procedure strongly suggest to have access to the GEM sectors HV directly to clean the foils also during/after assembling

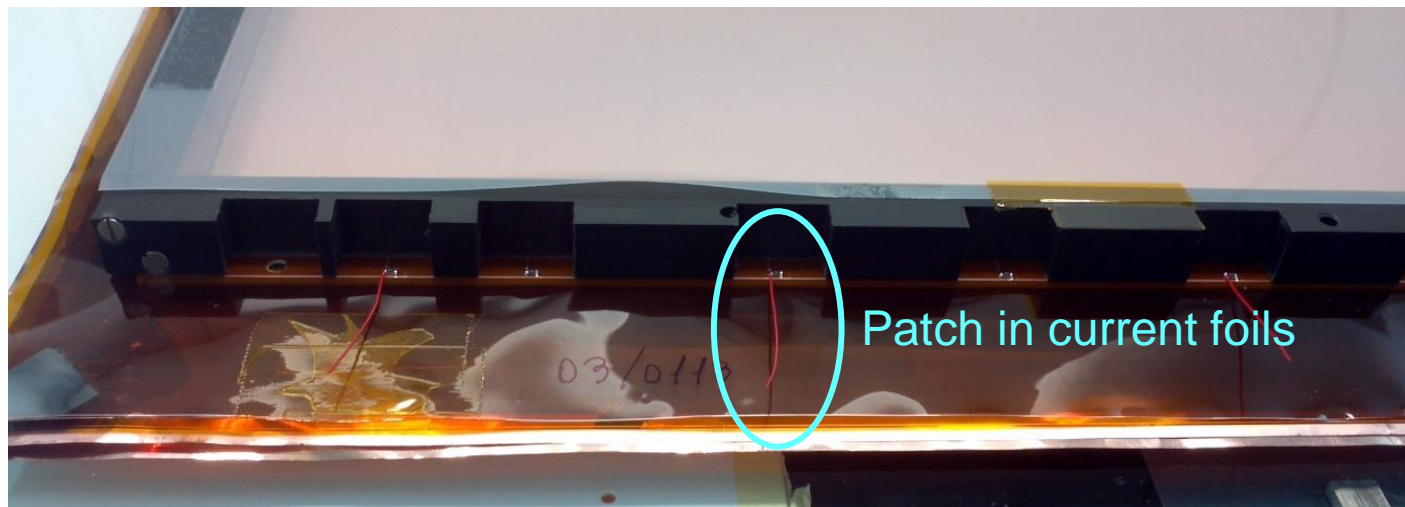
3. Since then 2 GEM modules assembled with no significant issues*; small improvements adopted during assembling

4. One GEM sector compromised presumably by dust during assembling;



First GEM module

Move Protection resistors outside the frame



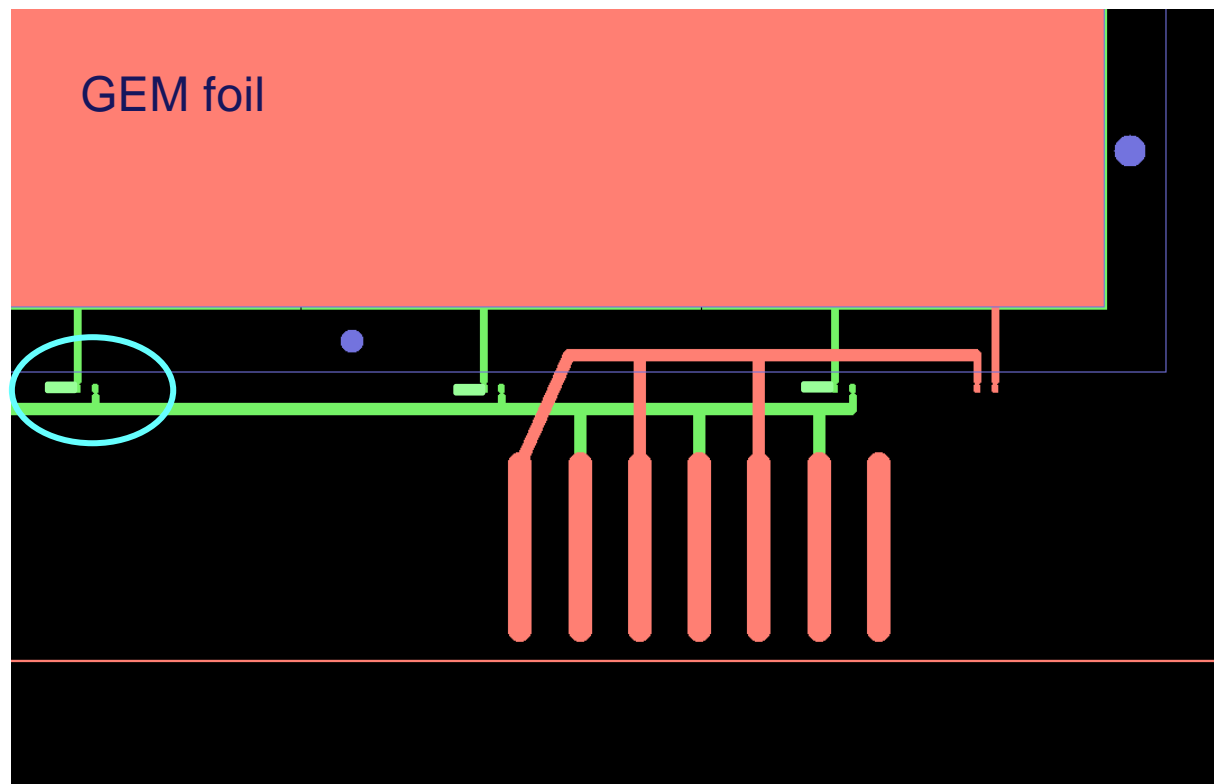
Detail of resistors in the GEM foil during assembling

Small revision of GEM foil:

- Resistor pads moved 2 mm out of the GEM frame.
- Larger HV paths

Pros: Access GEM sector HV directly for «cleaning» protocol proposed by Rui

Cons: Resistors are no longer protected by the frames



Test @ DESY 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)



First Test: ~ 2000 km traveling on Van



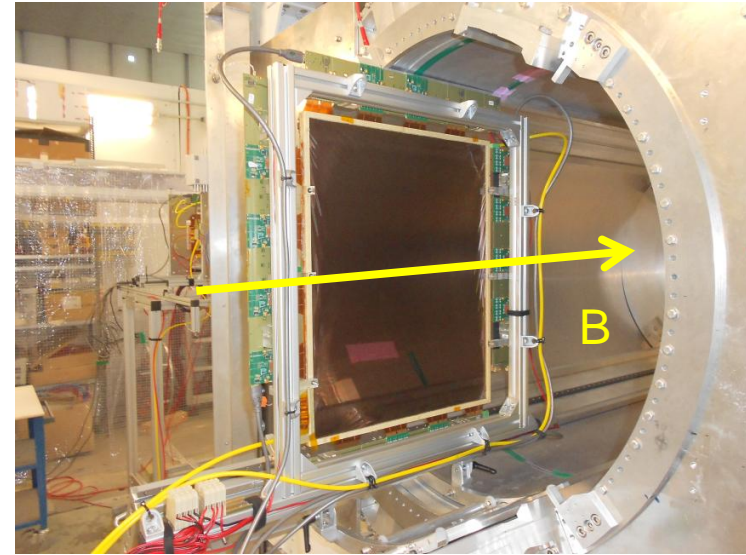
Setup @ DESY

2x2 small scintillators as telescope for trigger

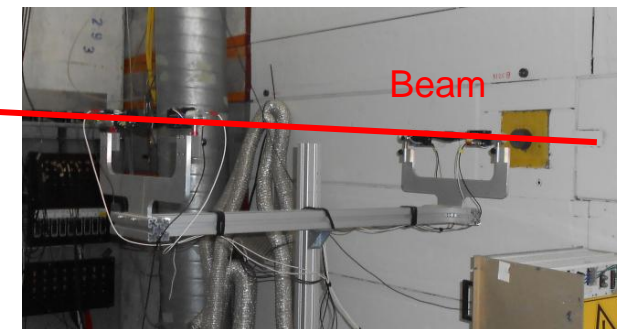
One big GEM in solenoid open space

Either 2 small GEM chambers or 1 small GEM + 1 big GEM beyond the magnet as reference tracking

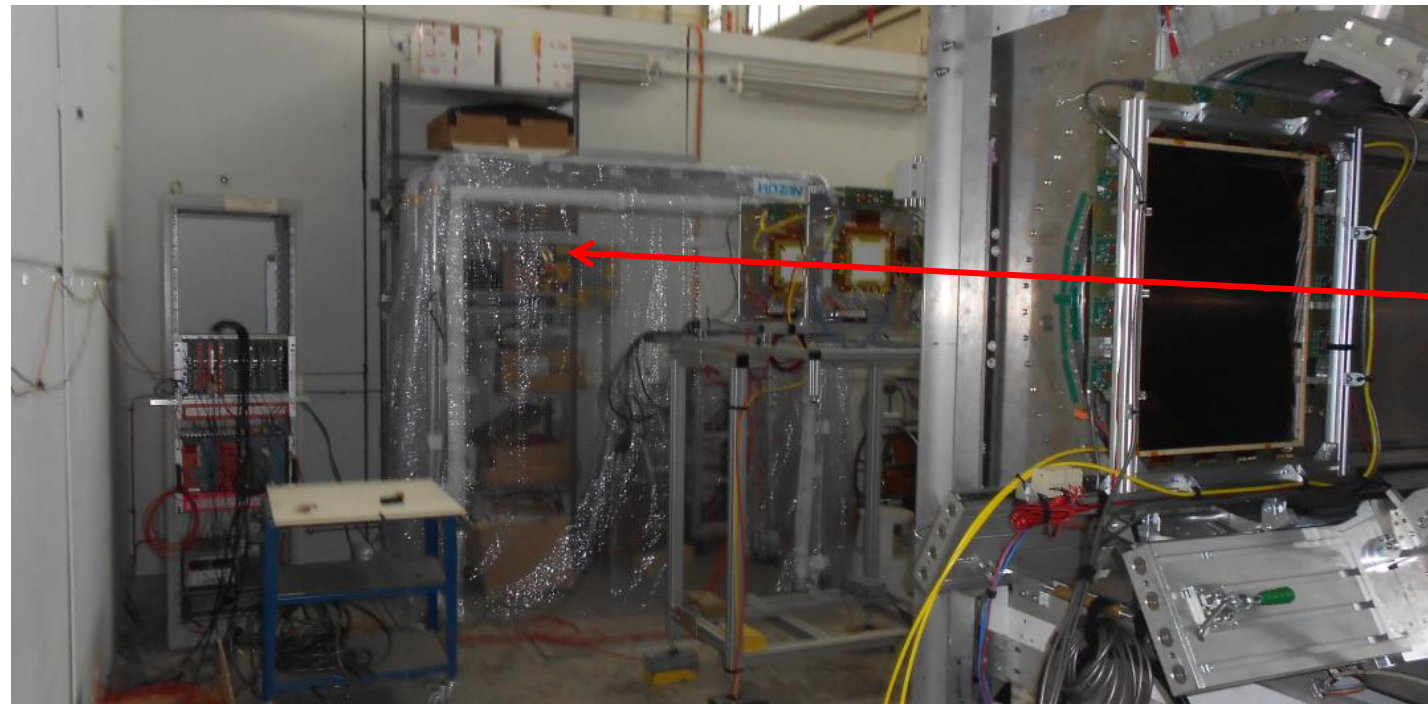
New and old electronics / long HDMI cables > 20 m total length from FE to VME



Big GEM + Solenoid



Scintillators



Test @ DESY / Very short summary

Spent 5 days for installation and «commissioning»

Apr/27: first «good»

Apr/28: During HV scan we notice *drop* in gain/efficiency of all chambers (almost) simultaneously

Apr/29-May/1: Try to fix this gain drop – everything has been rechecked (Gas, HV, electronics ...) ... No apparent explanation

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

May/2-May/5: Magnetic field scan from 50 G to 1000 G, HV scan, position scan, beam momentum scan, gas mixture scan (70/30 to 90/10)

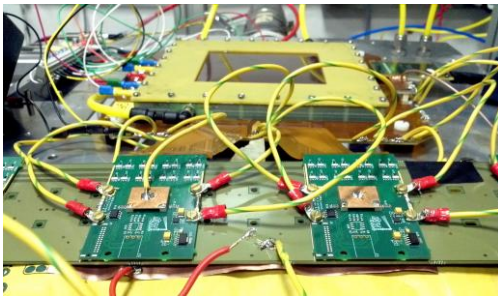
Noise level down to 15 ADC unit (better than in Lab)

We took about 300 runs (50000 events each)

Noise improvement

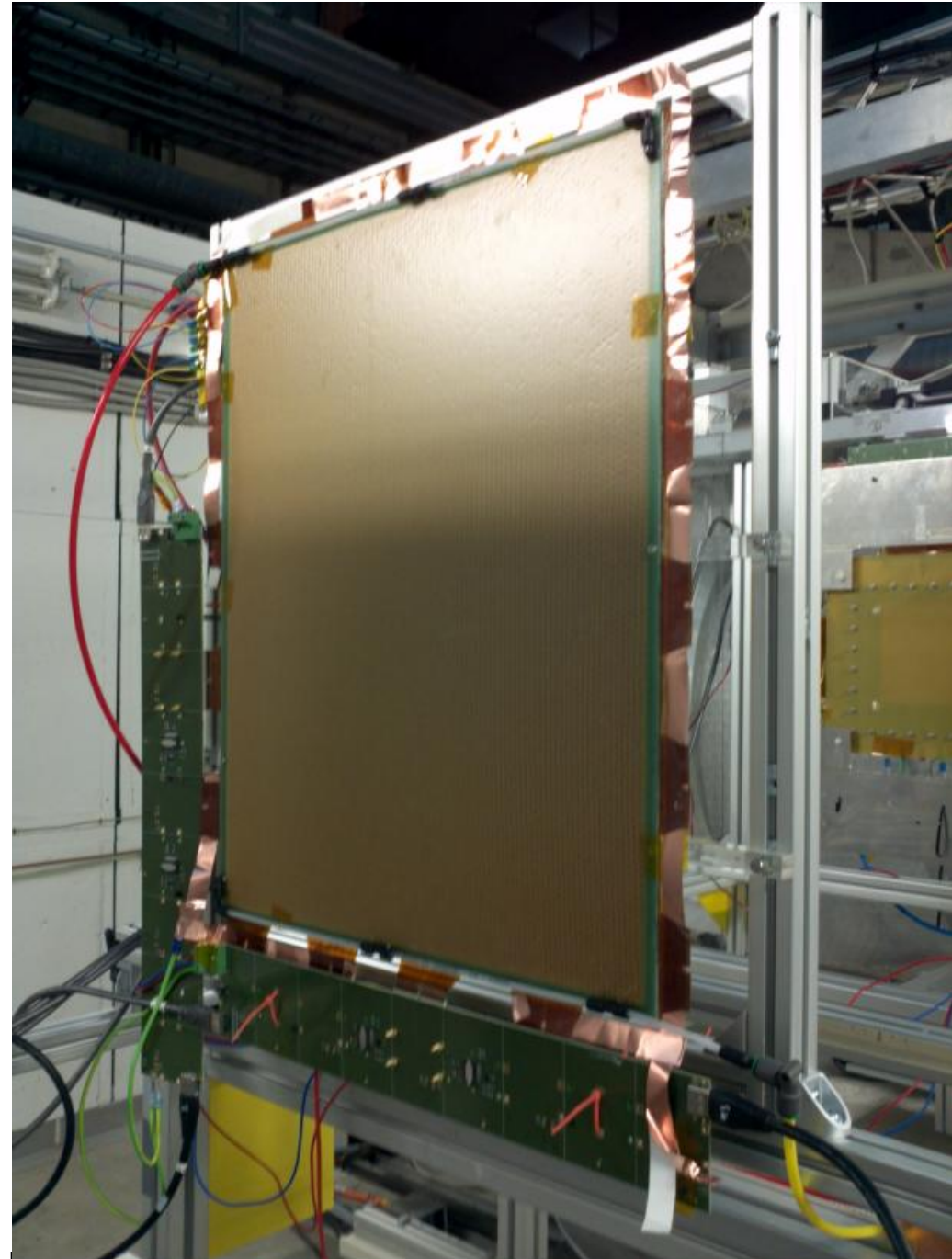
The new modules connect directly to the FE cards (no special adapters) and provide common grounding to them.

New modules noise is smaller and much more stable respect to 10x10 GEM (no «special» ground lines soldered)



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

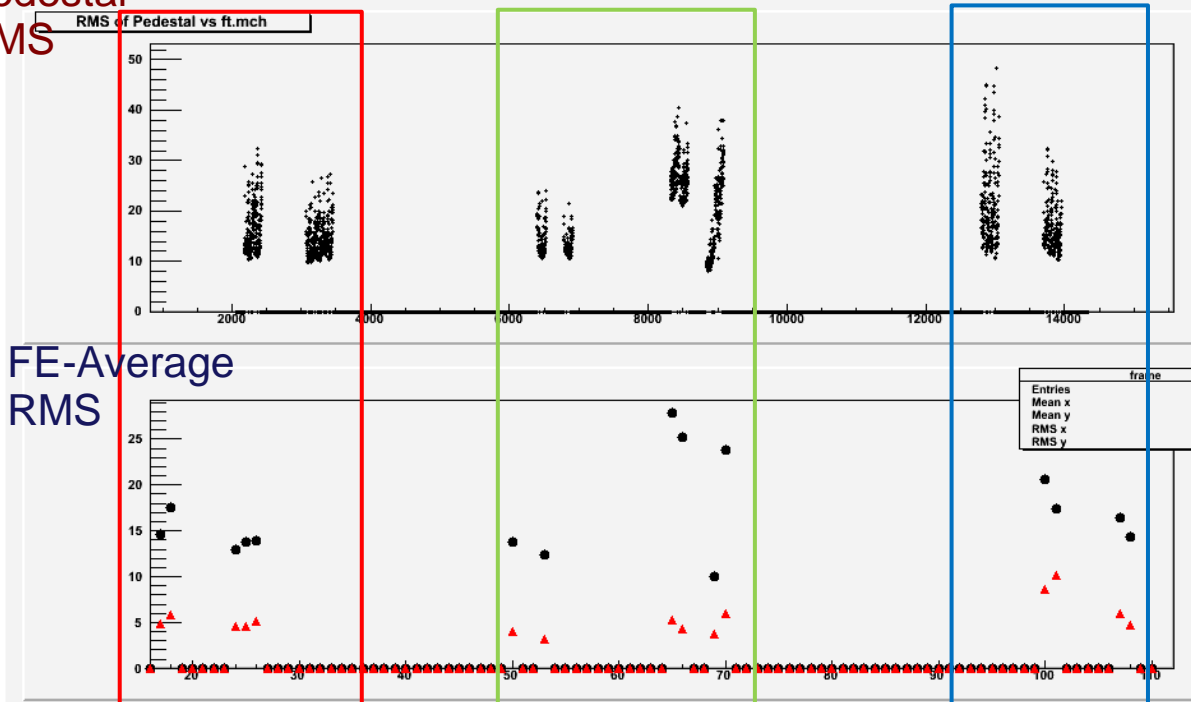
Each backplane connected to common ground by existing connectors: NO EXTRA grounding



Noise

Pedestal
RMS

Single Sample



Red – big Chamber – new MPD

Blue – big Chamber – old MPD

Green – two small GEMs

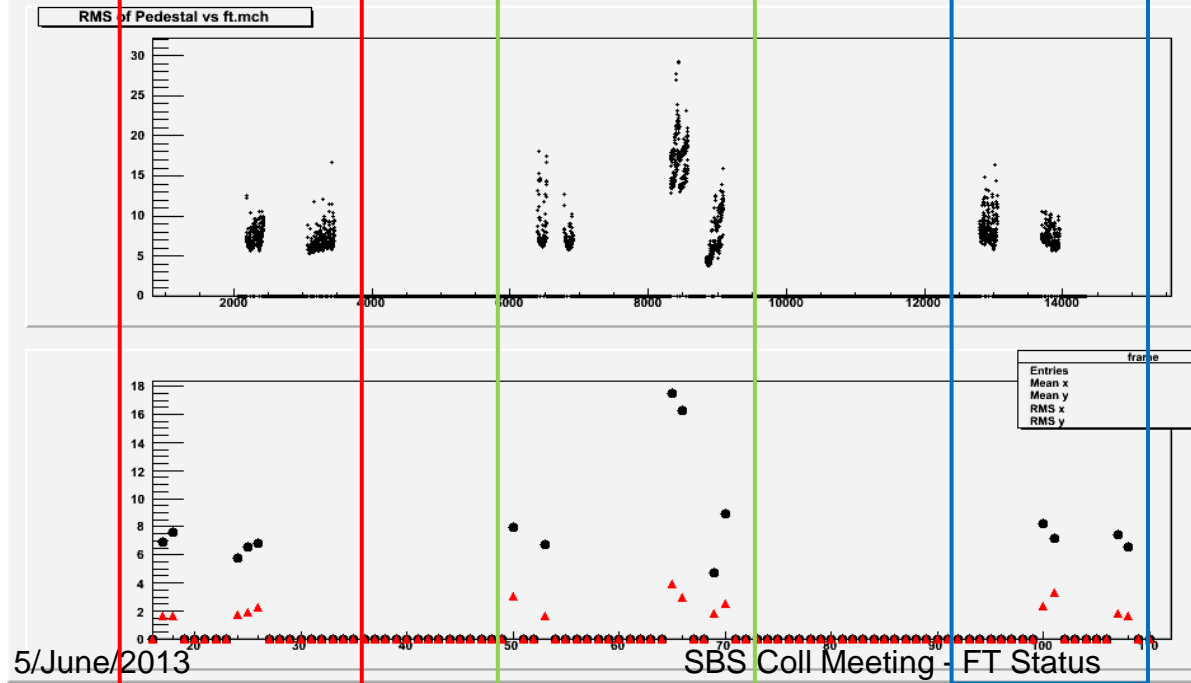
4 different MPD/Front End card

Combinations + HDMI-Patch-panels

Up to 23 m long cables tested

Average RMS down to 14-15 ADC
(compare SRS: 13-14 ADC on
small chamber SBS/Feb/13)

6 Sample Average

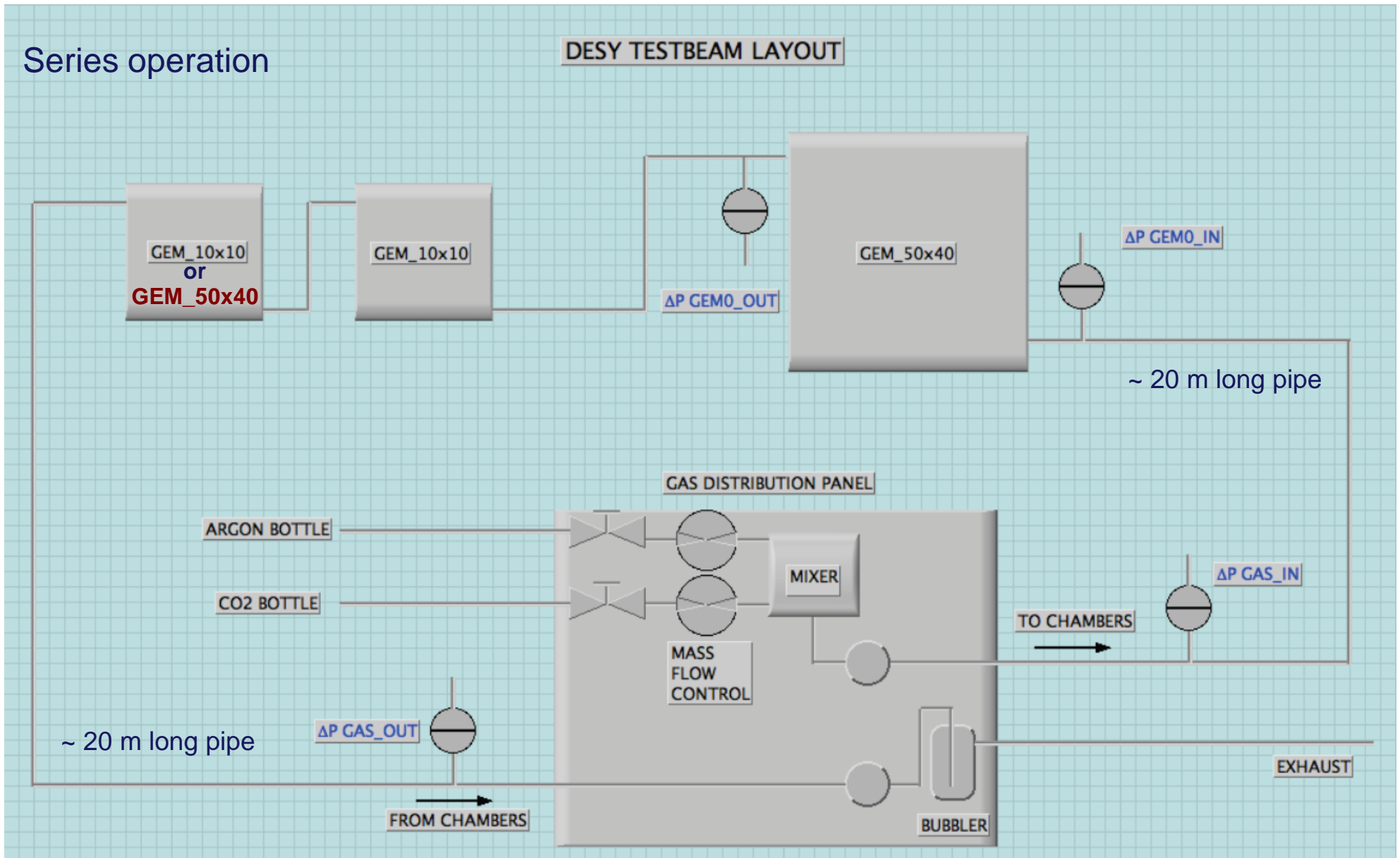


5/June/2013

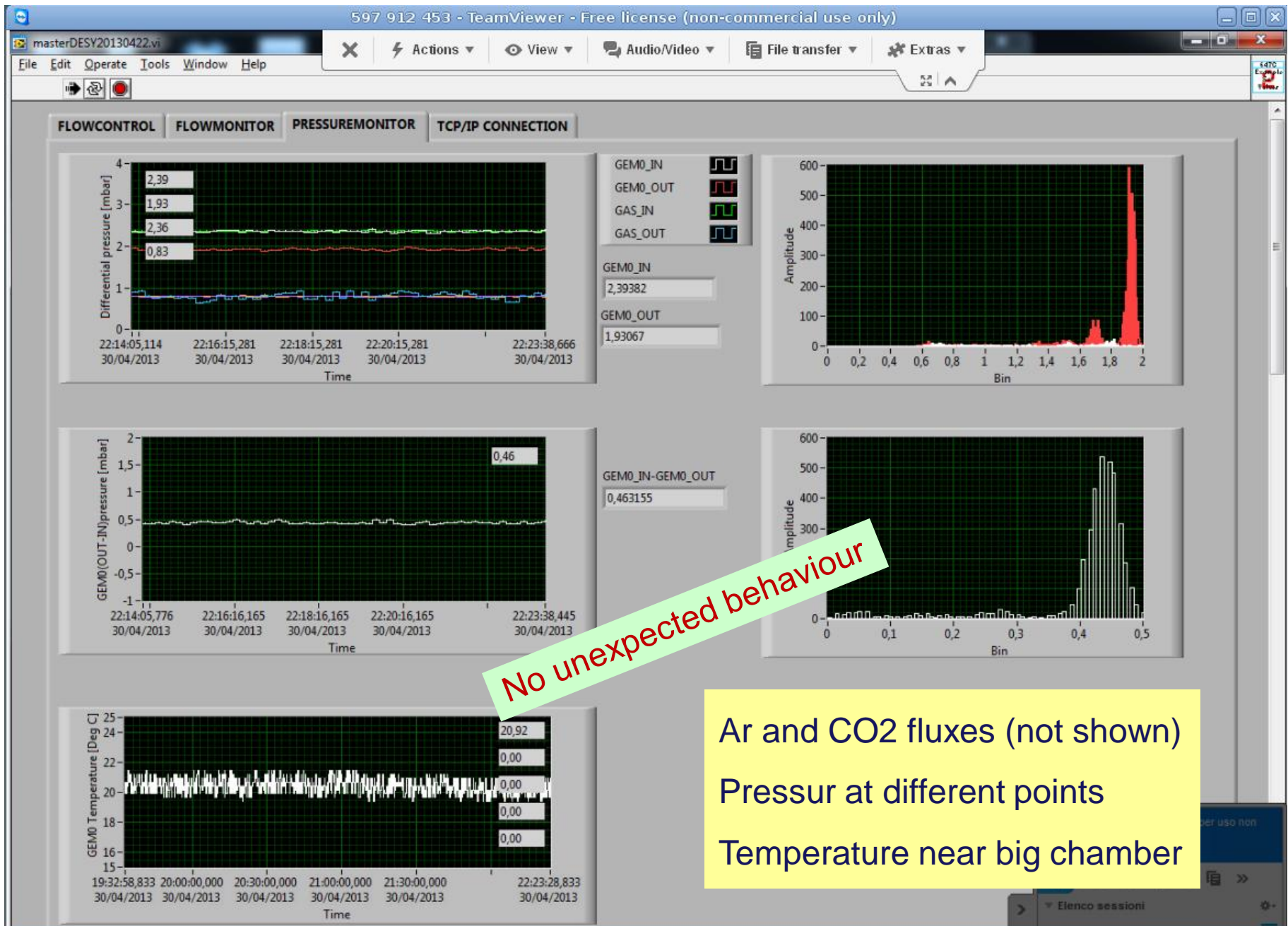
SBS Coll Meeting - FT Status

DESY Test: Gas system

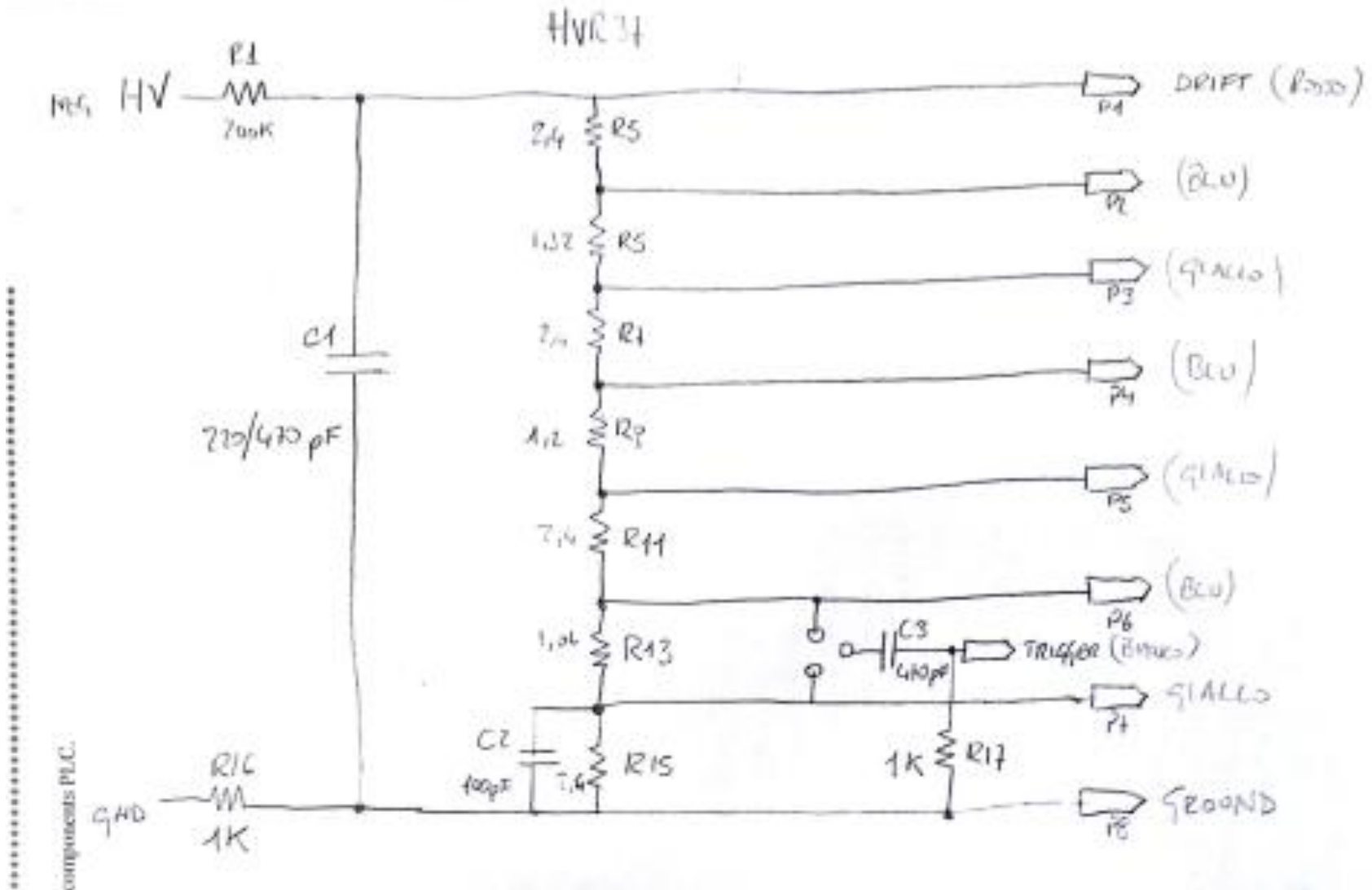
Series operation



DESY Test: Gas system monitor

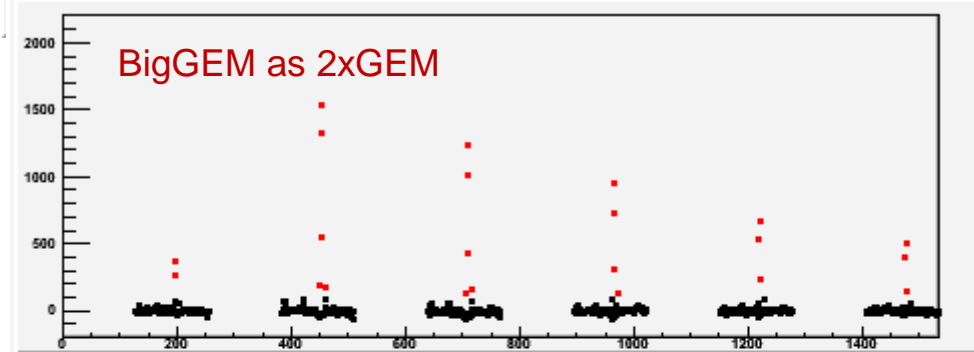
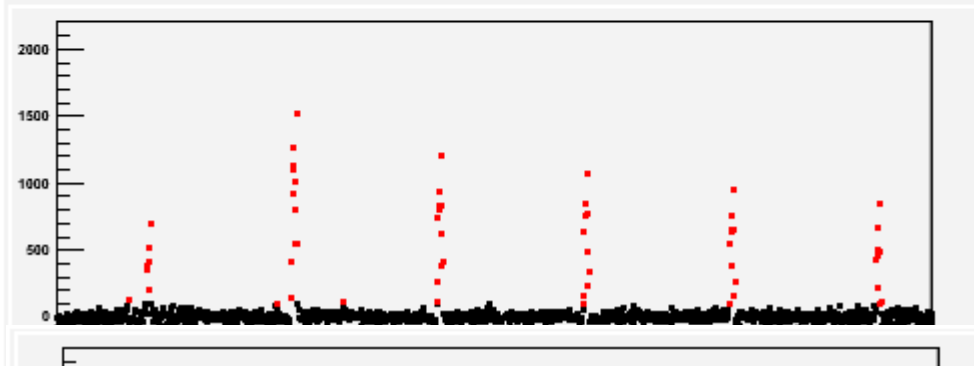
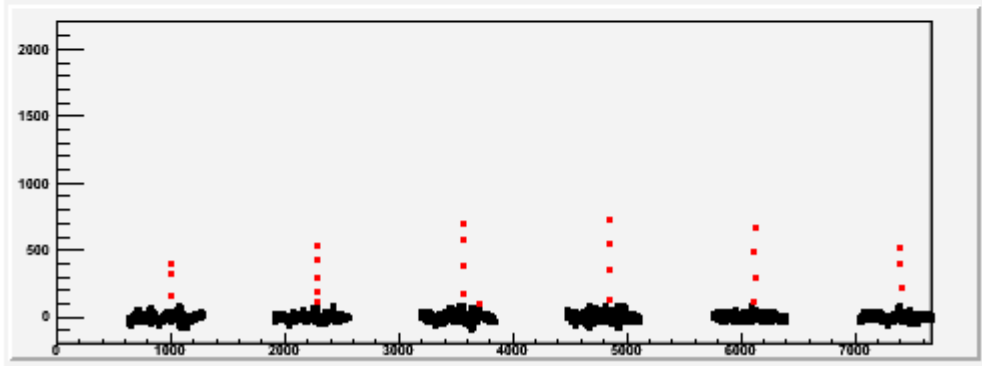
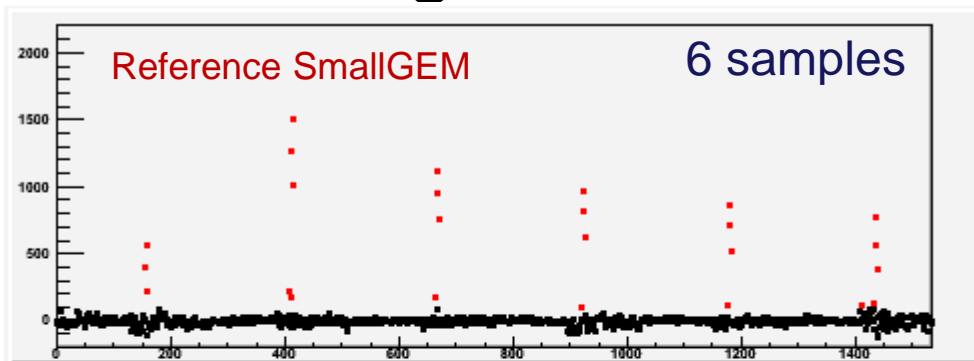
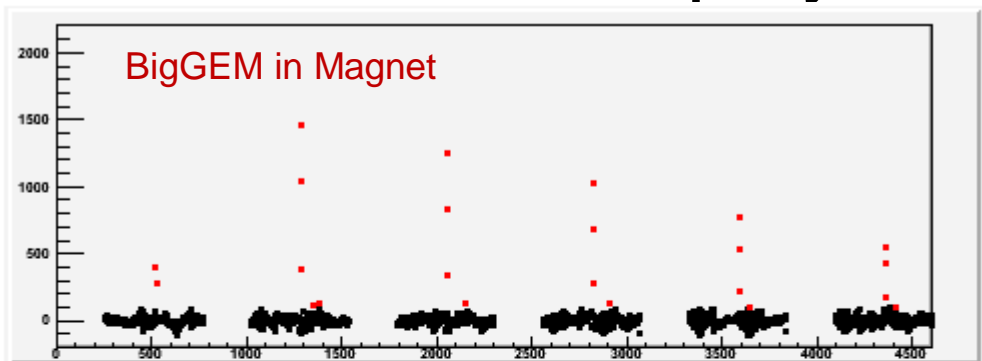


HV divider



Derived from OLYMPUS

Event Display / Run 3080 / High Gain



Gas Mixture 80/20 Ar/CO₂

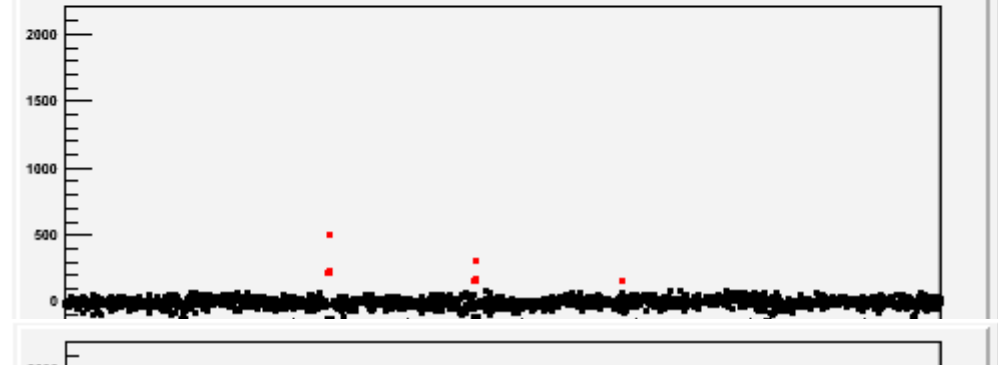
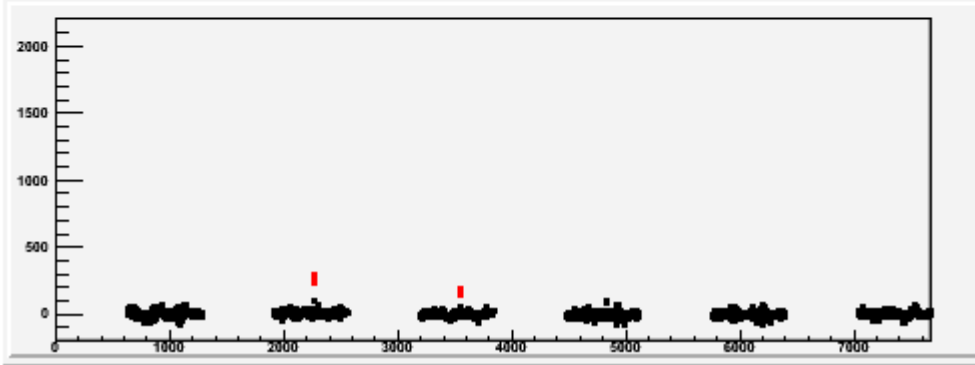
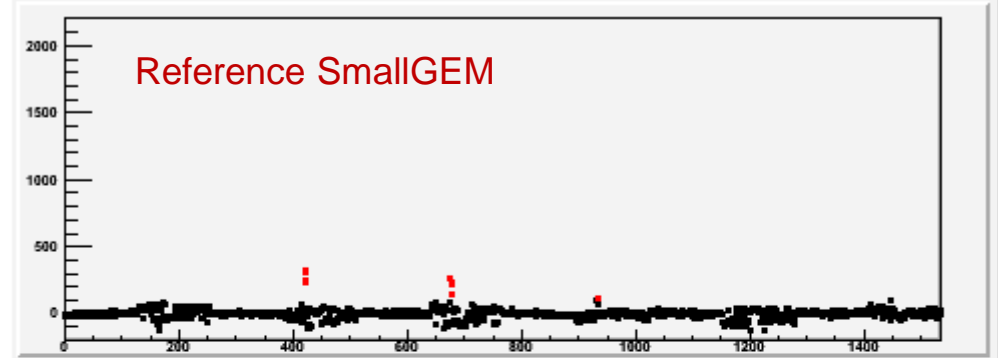
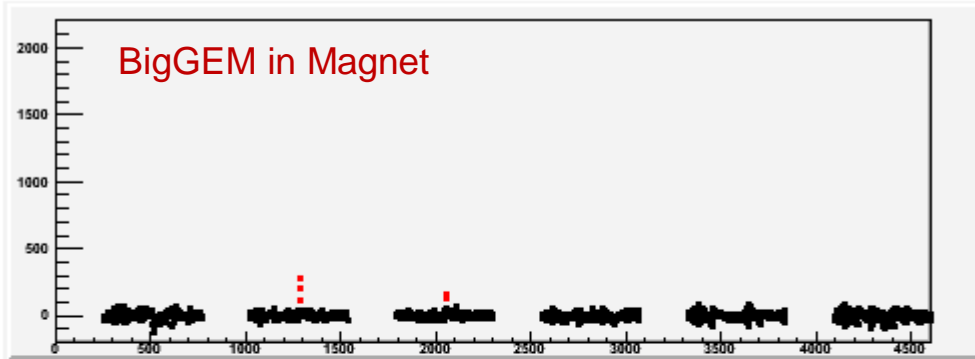
BigGEM in Magnet : 4100 V

Reference SmallGEM : 4050 V

BigGEM as 2xGEM : 4300 V

«Large gain event»

Event Display / Run 3134 / *SubNormal Gain*



Gas Mixture 80/20 Ar/CO₂

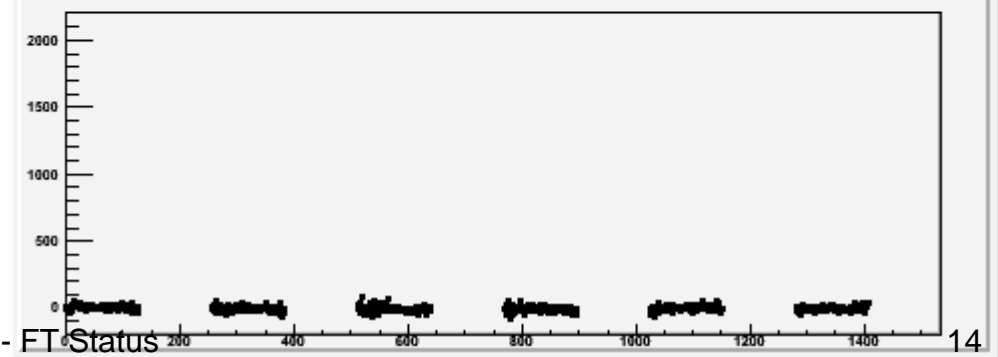
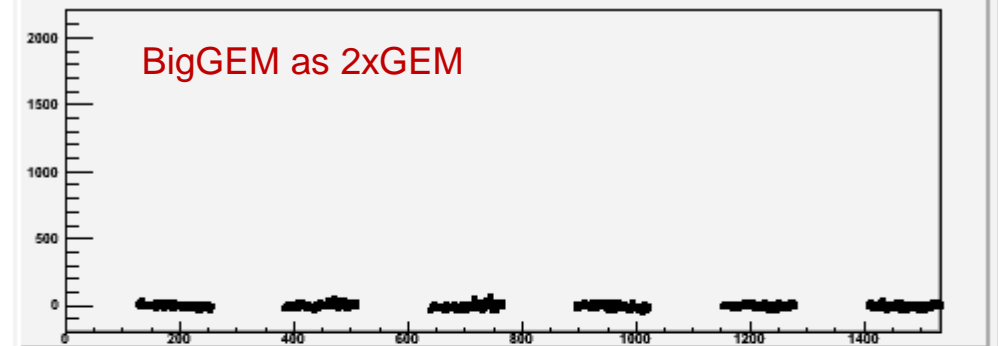
BigGEM in Magnet : 4200 V

Reference SmallGEM : 4100 V

BigGEM as 2xGEM : 4400 V

Efficiency x/y:

0.65/0.62 – 0.80/0.85 – 0.20/0.10



DESY Test, first raw plots

Raw Data

⇒ Subtract Pedestal

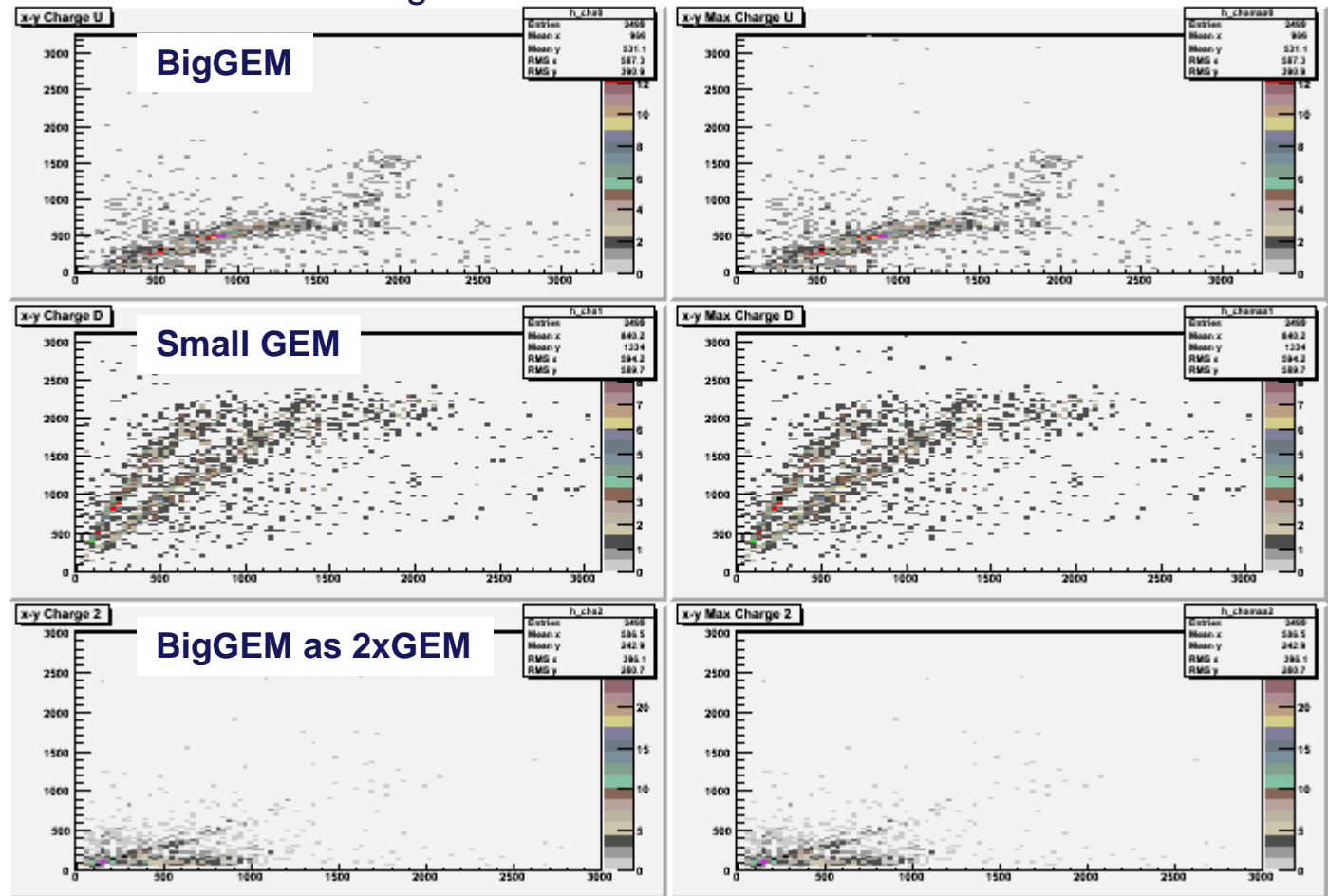
⇒ Detect Hits (ROOT TSpectrum)

⇒ Gaussian Fit

Charge Sharing (no cuts applied!), run 3080

Gaussian Integral

Peak Maximum



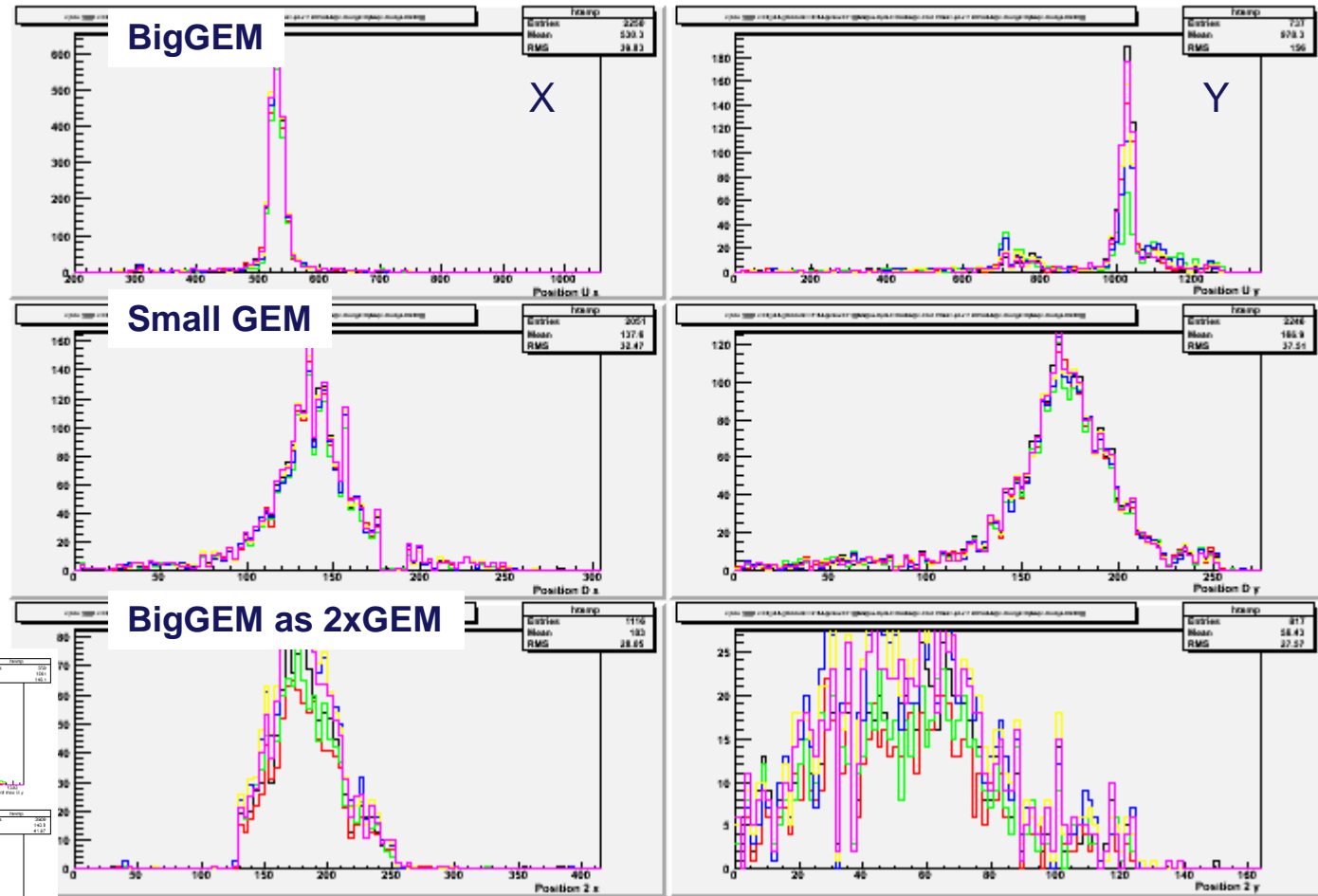
Artefacts from hit reconstruction procedure

DESY Test, first raw plots

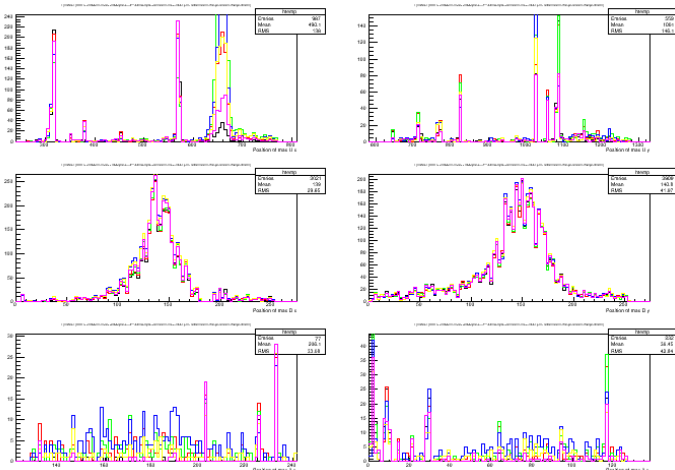
Raw Data

- ⇒ Subtract Pedestal
- ⇒ Detect Hits (ROOT TSpectrum)
- ⇒ Gaussian Fit

Peak Profile (no cuts applied!), run 3080



«Low gain» run



Colors for different samples

... à suivre

Current Status

1. Material:
 1. Procured and available:
 1. All PERMAGLAS frames procured and available
 2. Almost all drifts foils procured and available
 3. 10 readout foils + 3 honeycomb planes
 2. Ordered:
 1. 30 GEM foils (new design revision)
 2. Outer frame prototype (support 3 modules + electronics + gas pipes ...)
2. Electronics/Firmware ... (⇒Paolo Musico)
3. Gas system main functionalities ready
4. HV system ... Optimization to be done, spark detection (?)
5. DAQ Software ... stable versions/development
6. Analysis Tools ... slow development
7. Characterization stand ... in progress