Status of the Front Tracker GEM and INFN Electronics

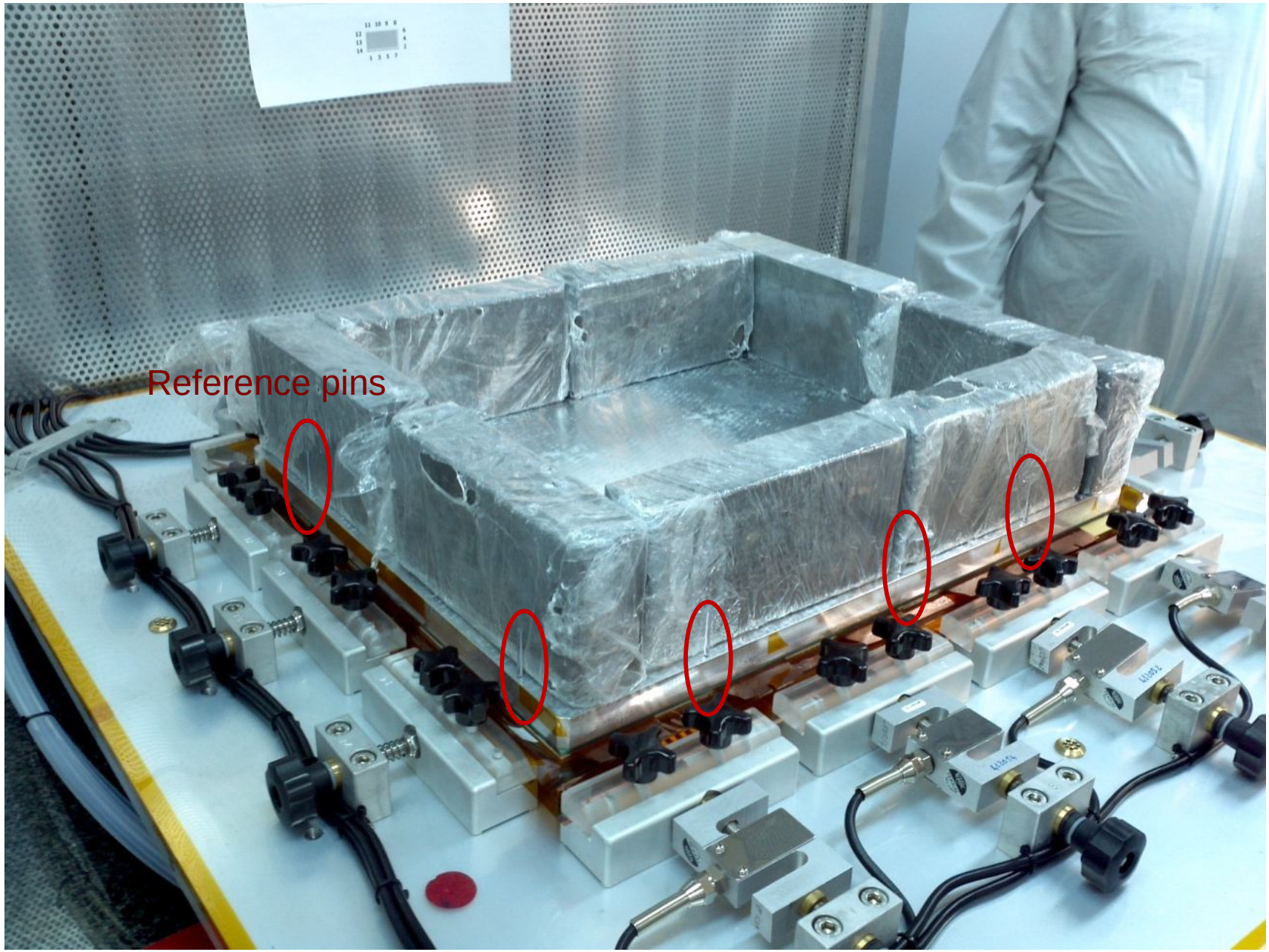
2013 – Apr – 10
SBS Weekly Meeting

INFN – Catania, Genova, Bari and Rome

GEM Production
- First Tests on module 0
- Improvements in design

Electronics
- Continue SRS ⇔ INFN comparison
- New MPD revision 4

Stretching and gluing



Reference pins inserted during compression

GEM preProduction

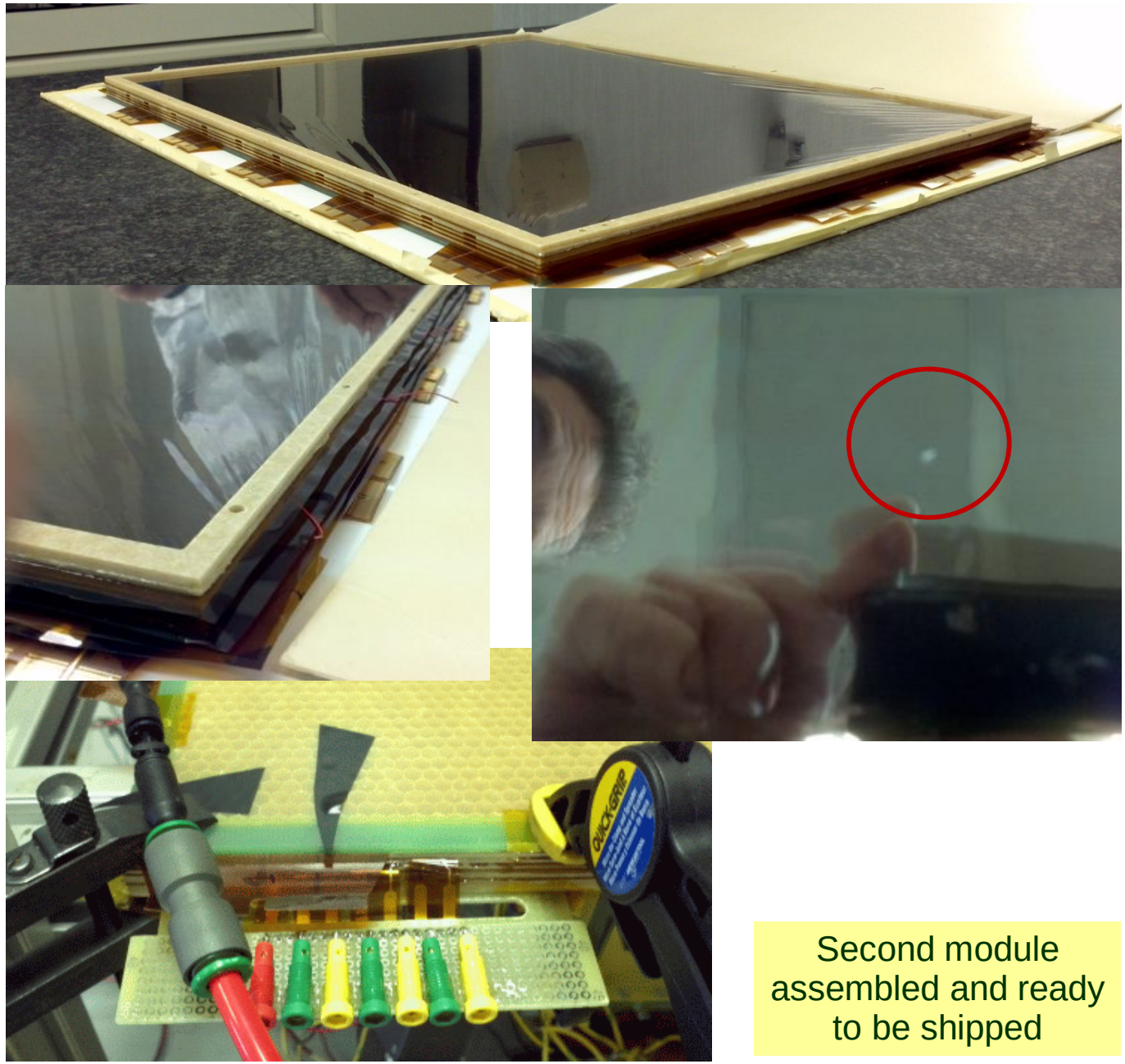
Frst module assembled beginnig of March

Shipping to Rome (from Sicily/Catania) second half of March

HV and gas (temporary setup) completed the first days of April

Major issues:

1. Some dust in the mylar (6 μm) gas window hard to clean -> move to 12 μm and sligtly different gluing procedure; also stretch of 6 μm difficult
2. Gas leak inside the reference holes and in 3 point near edges (black arrow in picture)
3. Noticeable pressure drop (~0.5 mm deformation of honeycomb plane)



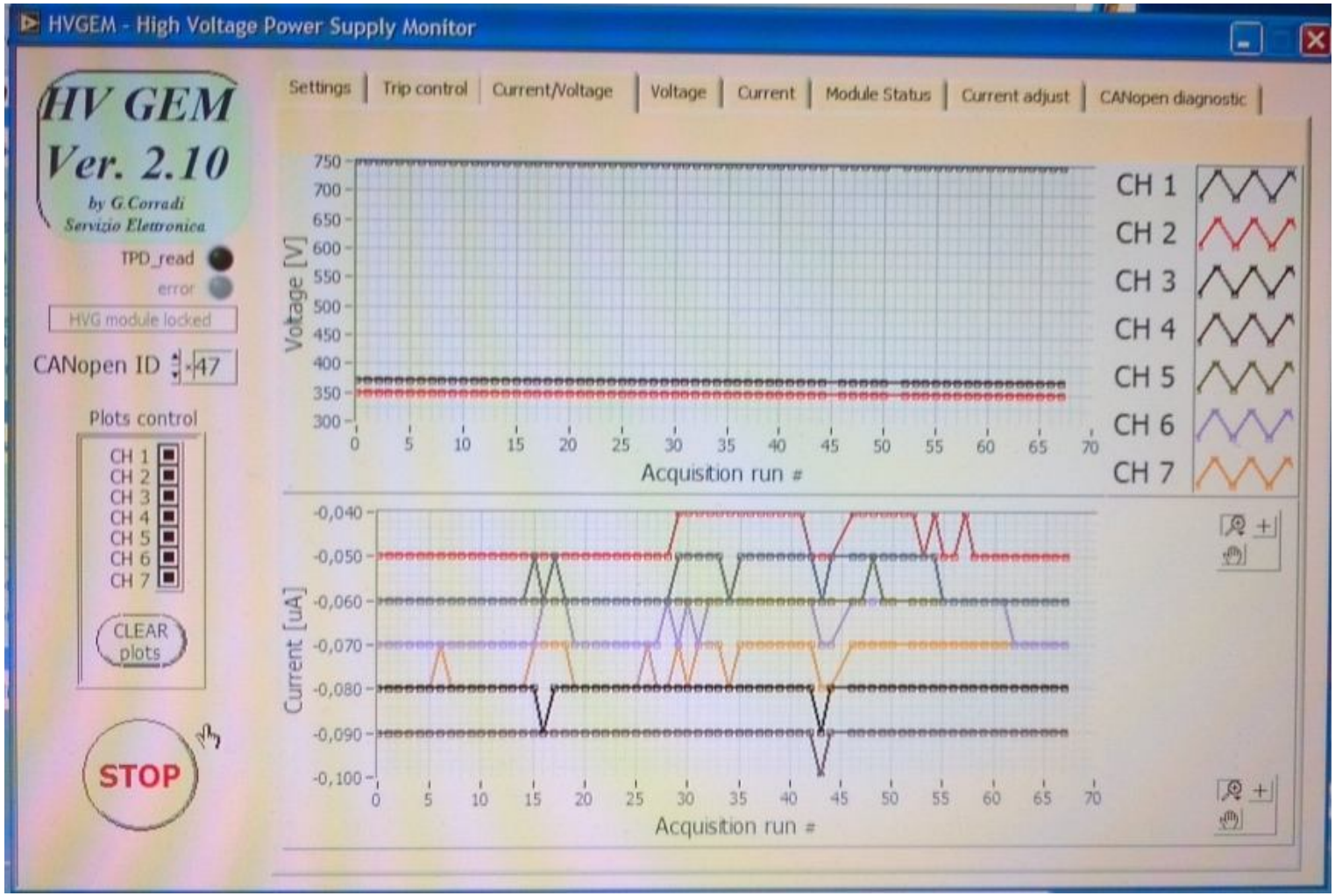
Second module assembled and ready to be shipped

HV Test up to

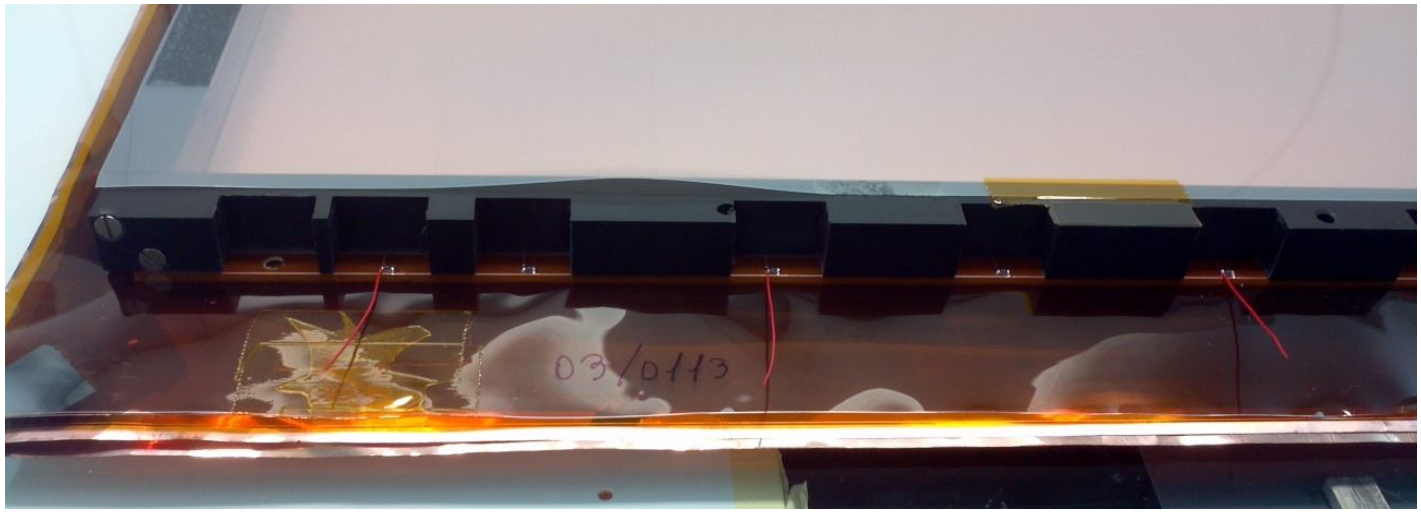
ΔHV:
750
350
750
370
750
370
750

4090

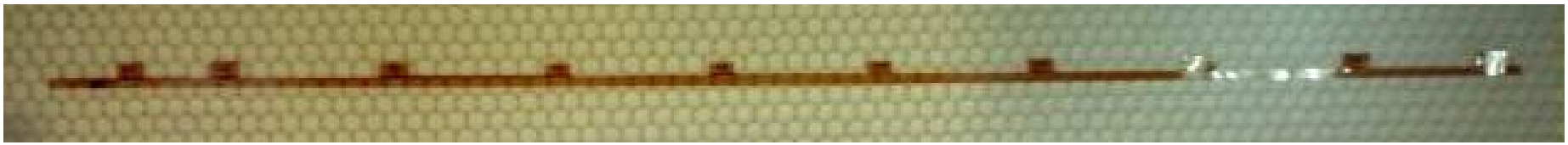
Currents < 10 nA



Move Protection resistors outside the frame



Detail of resistors in the GEM foil during assembling



a) Use simple kapton circuit, soldered on the resistors pads; it «extents» the GEM foil; the resistors soldered on the kapton

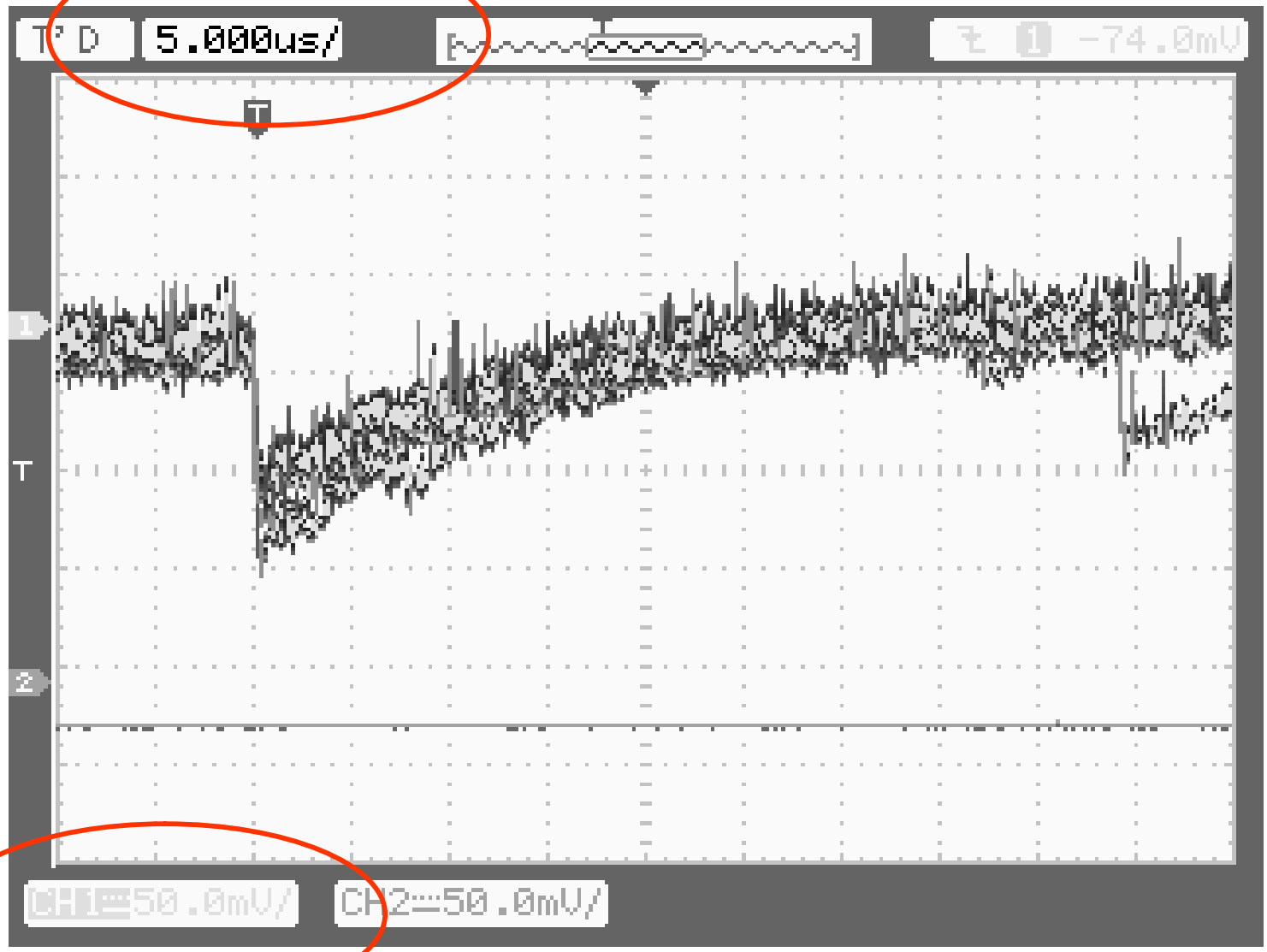
b) Modify the GEM foil in the next production

Pros: Both solutions will permit the «cleaning» protocol proposed by Rui

Cons: Resistors are not protected by the frames; additional soldering ...

Signal from last GEM

- Finally got a good signal from GEM plane (small chamber)... Better grounding (expecially between HV and output connector)
- Work in progress on timing (suspended for work on large chamber ...)



Signal from 90Sr, similar for 55Fe

Current Setup

Large chamber with 4 + 4 INFN cards

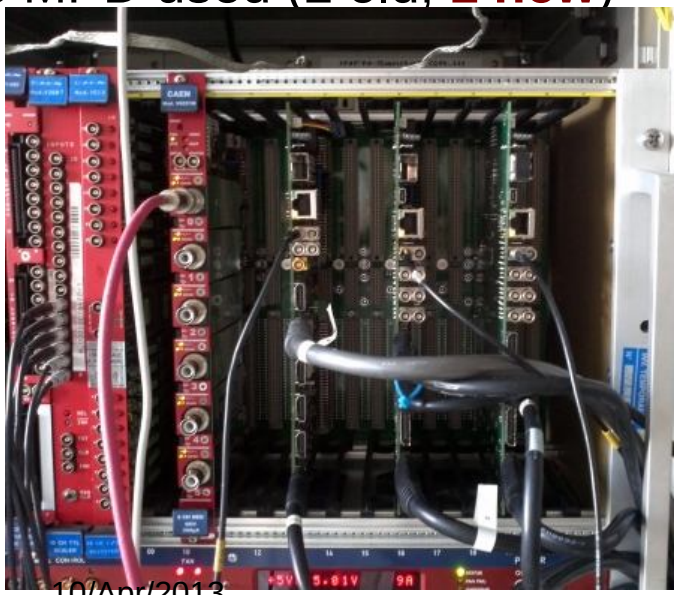
Small Chamber with SRS + 2 INFN cards

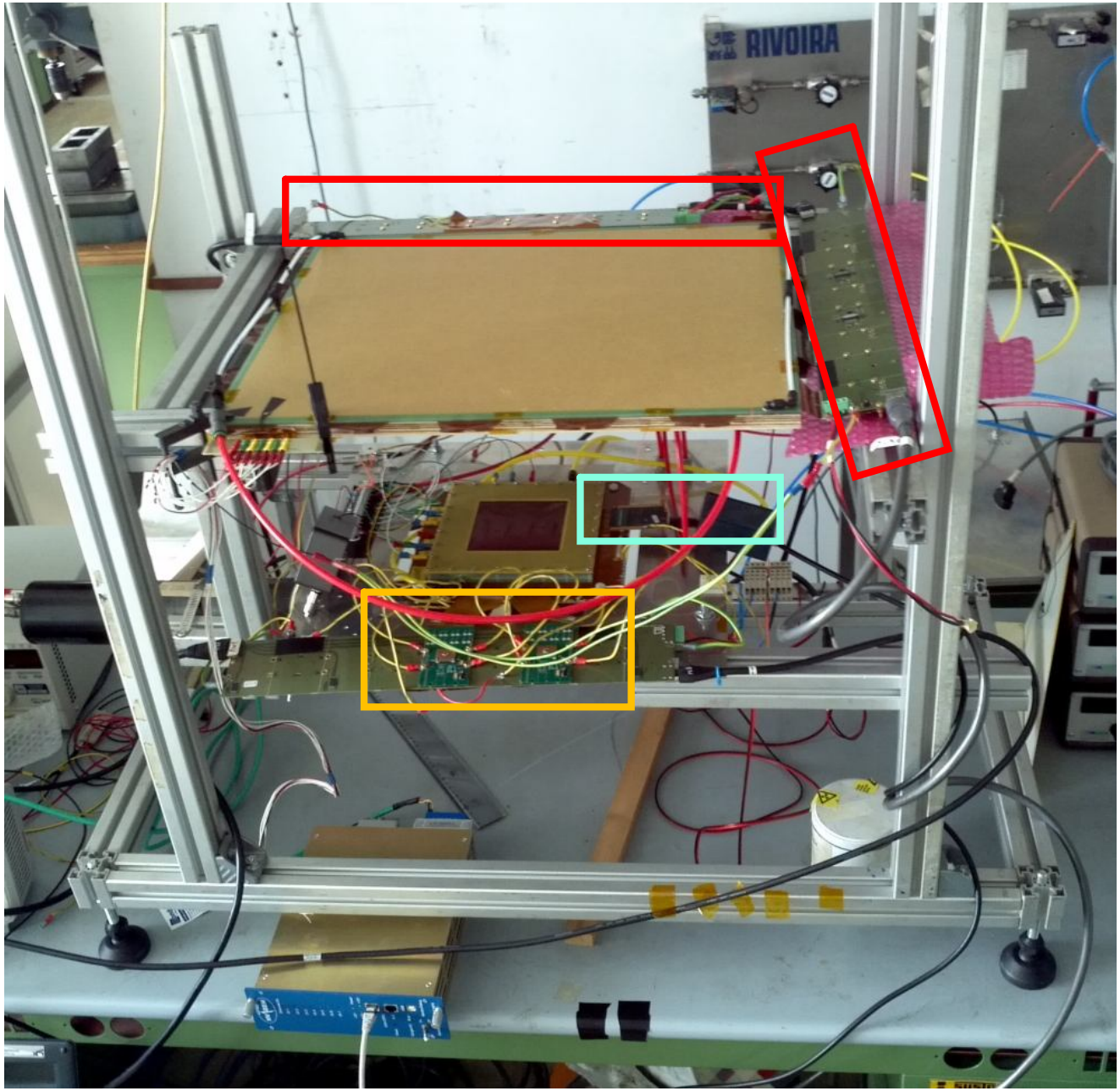
Independent HV modules

Same LV modules (common ground at this level)

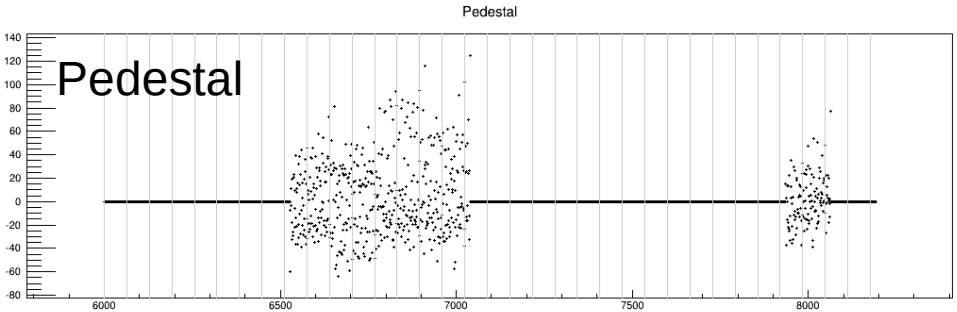
No common ground near detector (?)

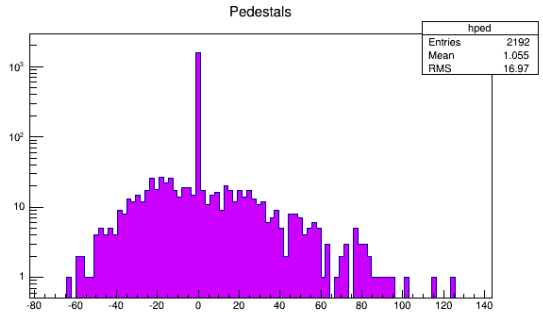
3 MPD used (2 old, **1 new**)

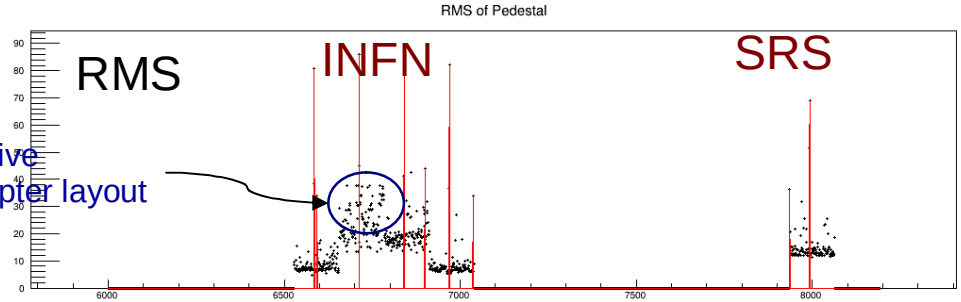




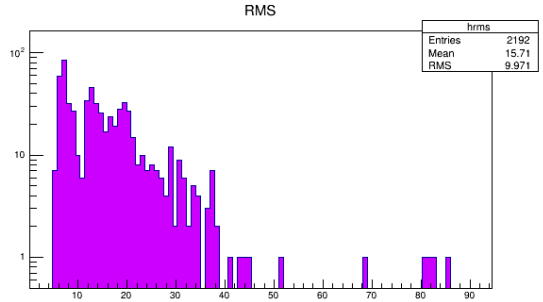
Pedestal and Noise, cards connected



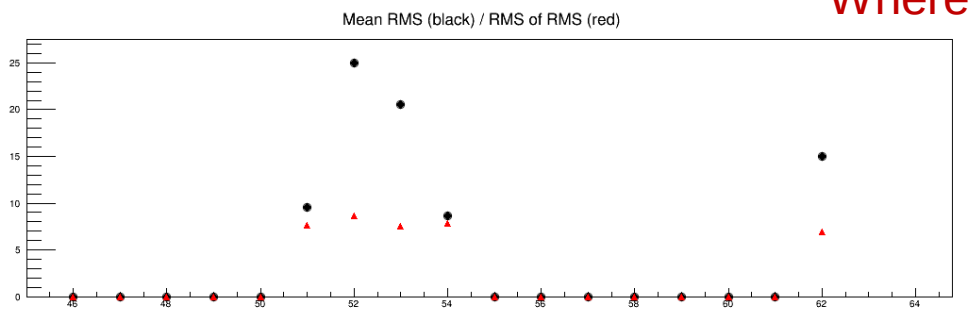


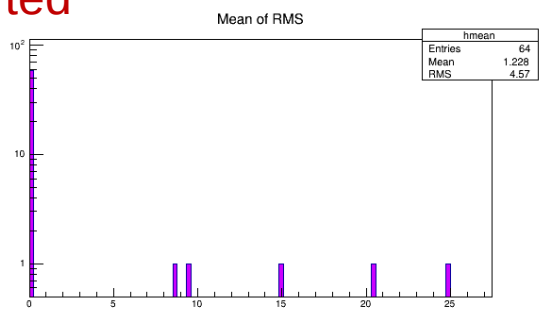


Sensitive to adapter layout



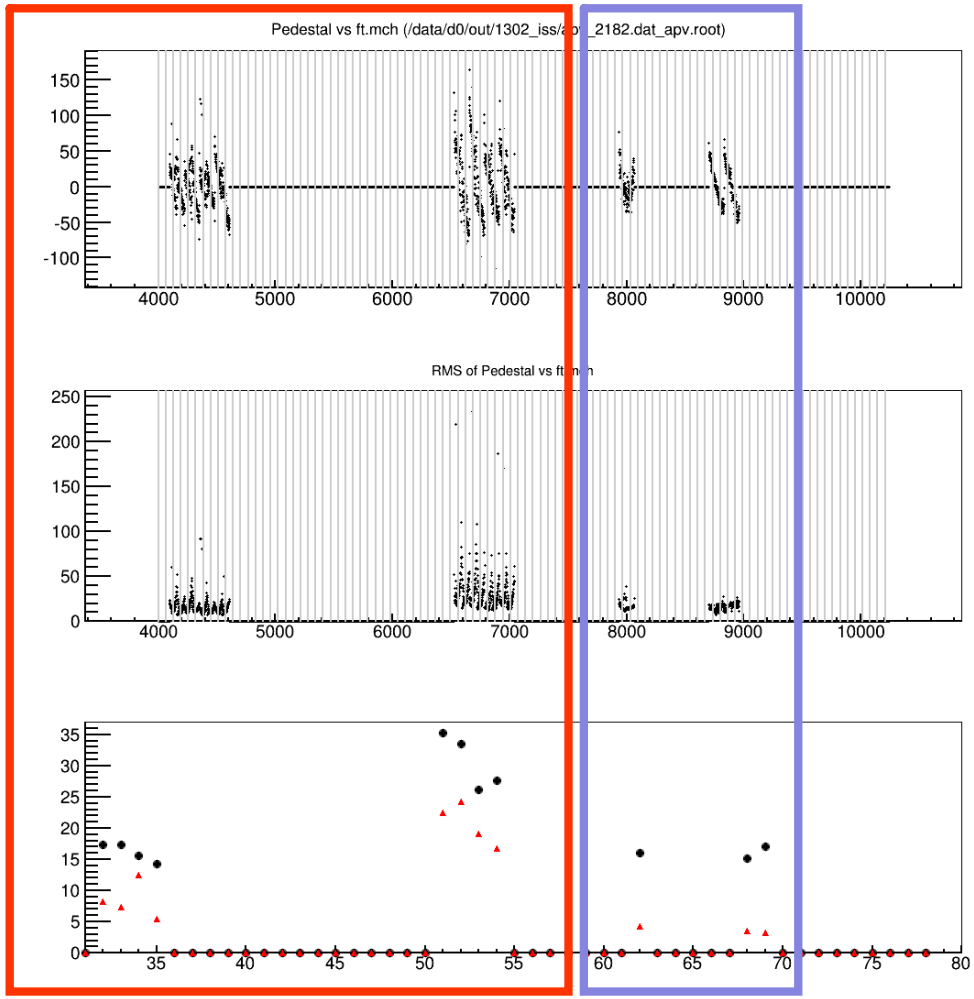
Where we started

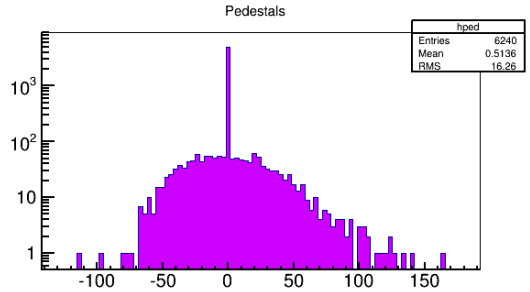


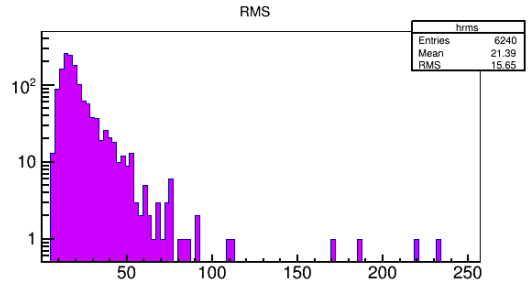


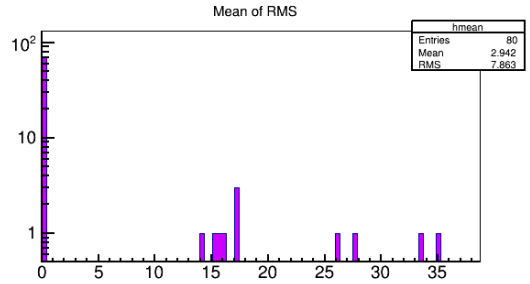
Larger noise when INFN cards are connected respect to SRS

Same noise level in small GEM









Improved ground between SRS and INFN

Same HDMI cable lengths

HV – Electronics same ground

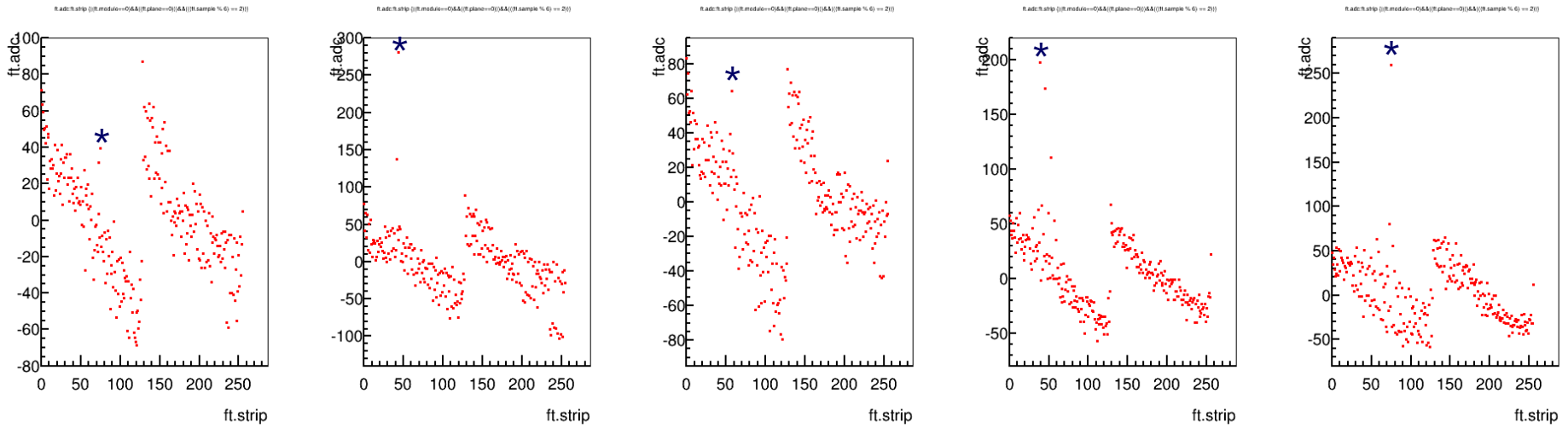
Removed unconnected cards

RED: Large Chamber (INFN only
BLUE: Small Chamber (SRS+INFN)

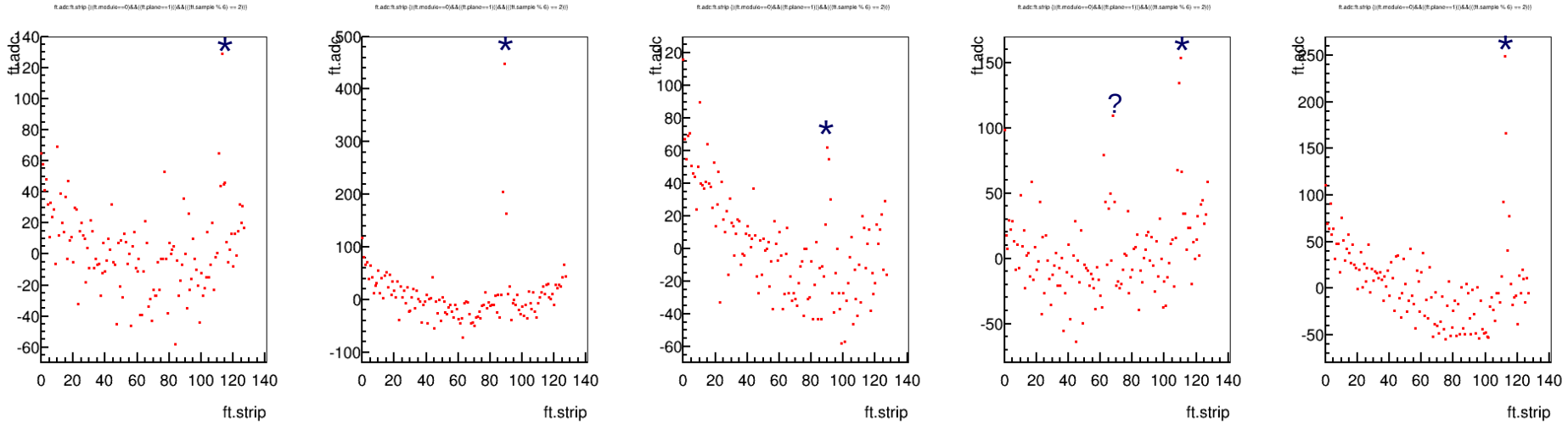
Noise level in small chamber ~ 15 ADC chs

90Sr source on small GEM (no ped subtr.)

INFN

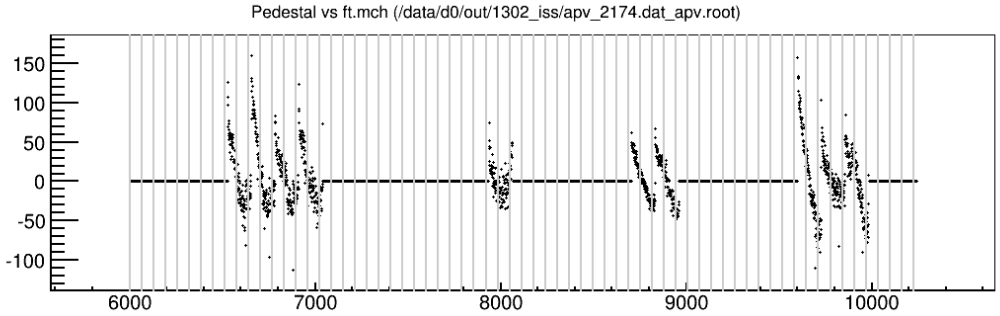


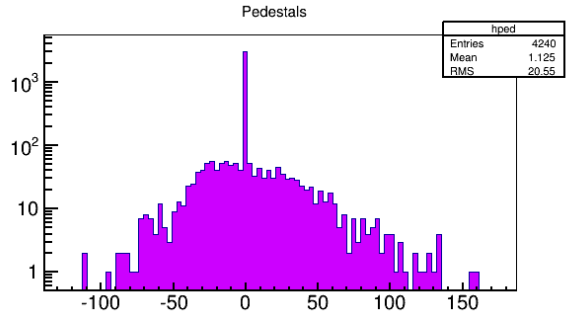
SRS

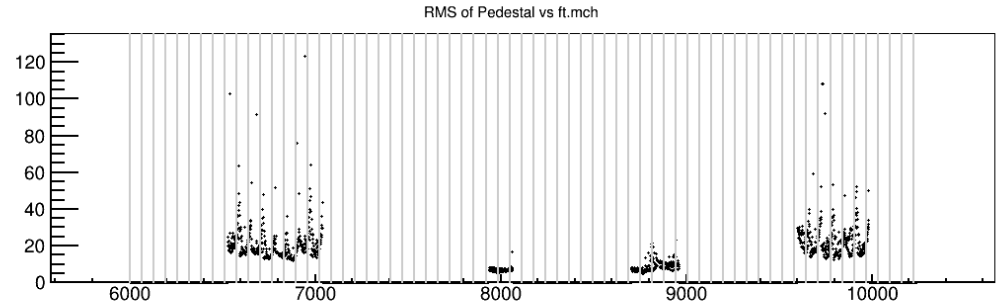


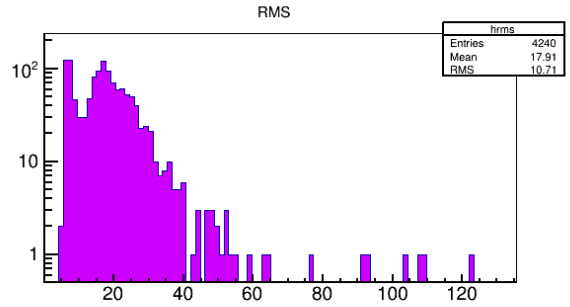
Sligtly better SRS sensitivity (?)
Nominal GEM gain ~ 4800 (HV=3940)

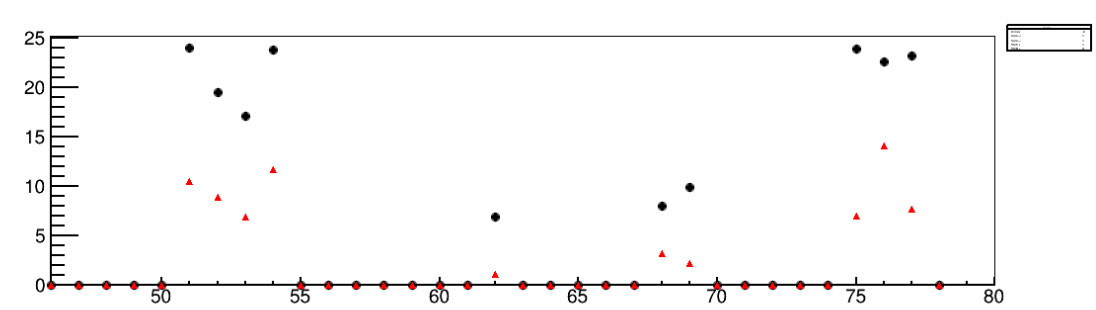
SRS disconnected from GEM

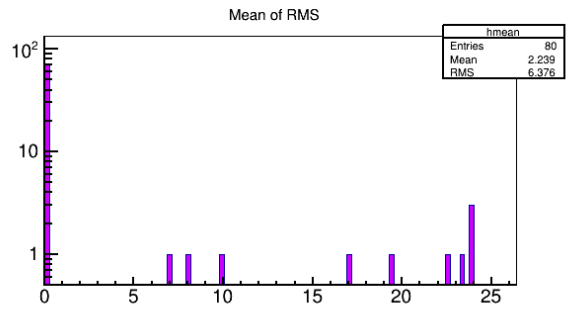






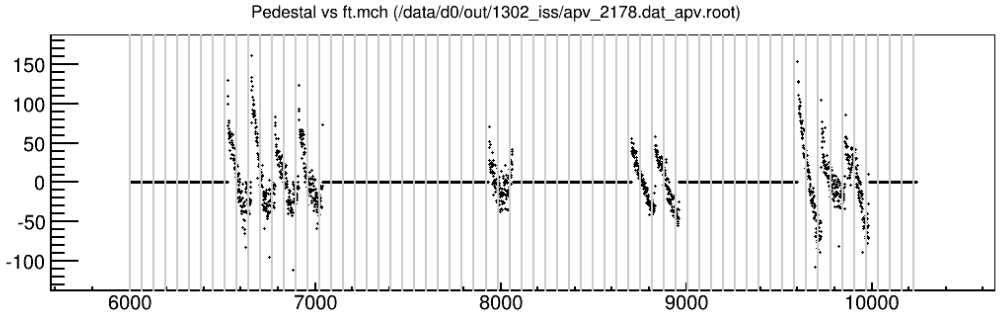


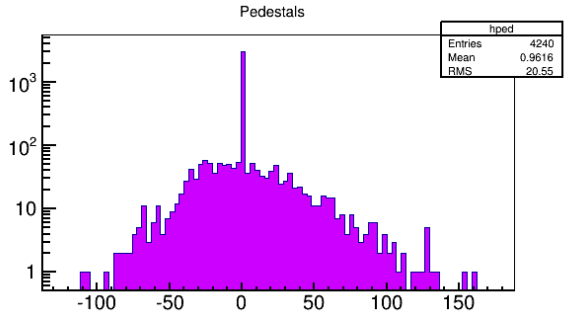


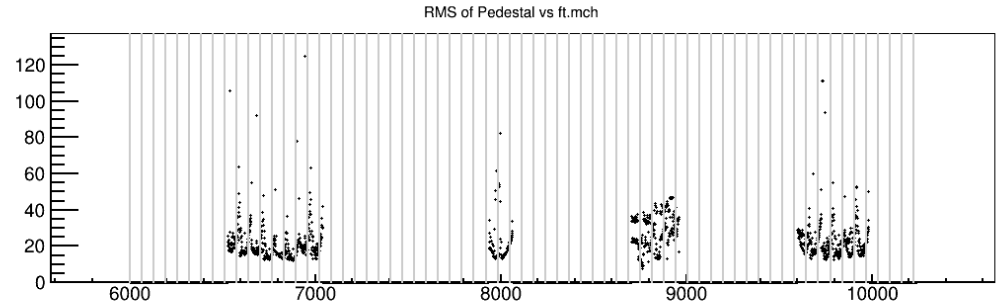


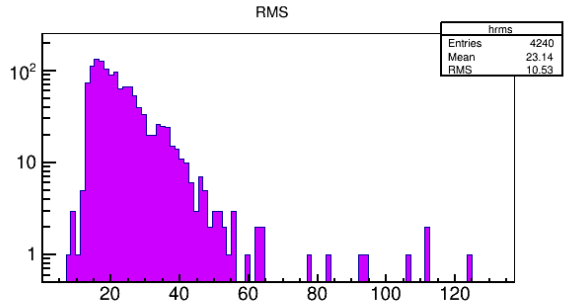
INFN noise pretty low! Sensitive to SRS card

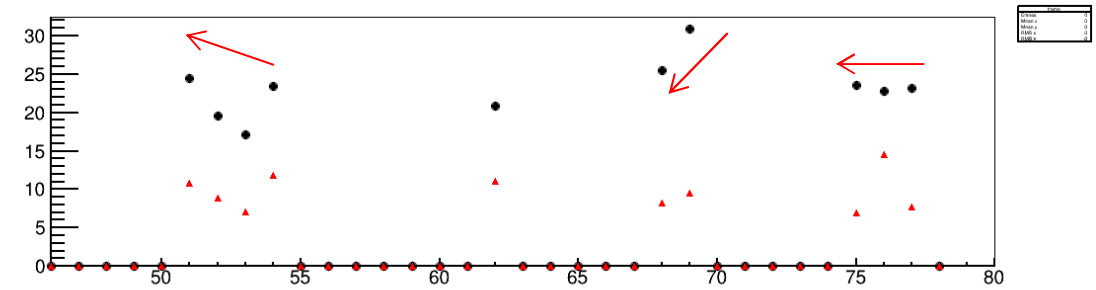
SRS connected to GEM

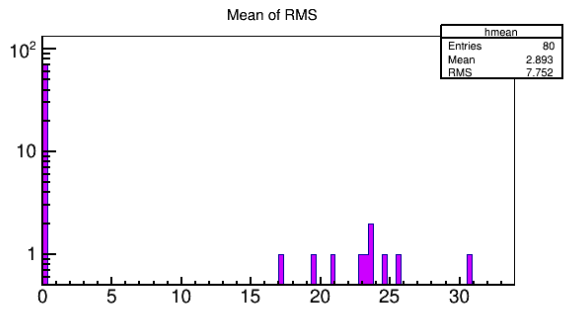








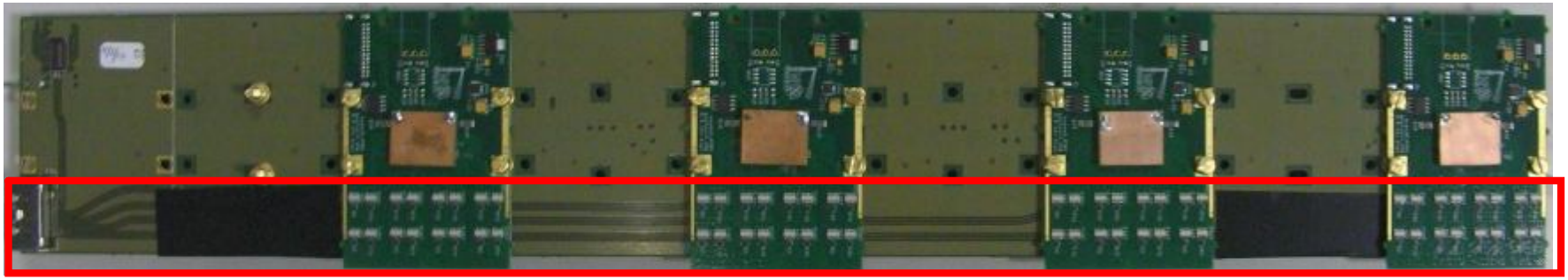




SRS sensitive to other cards (no grounding or shielding)

No unique effects from order of the cards in backplane (next)

Analog lines below cards inputs

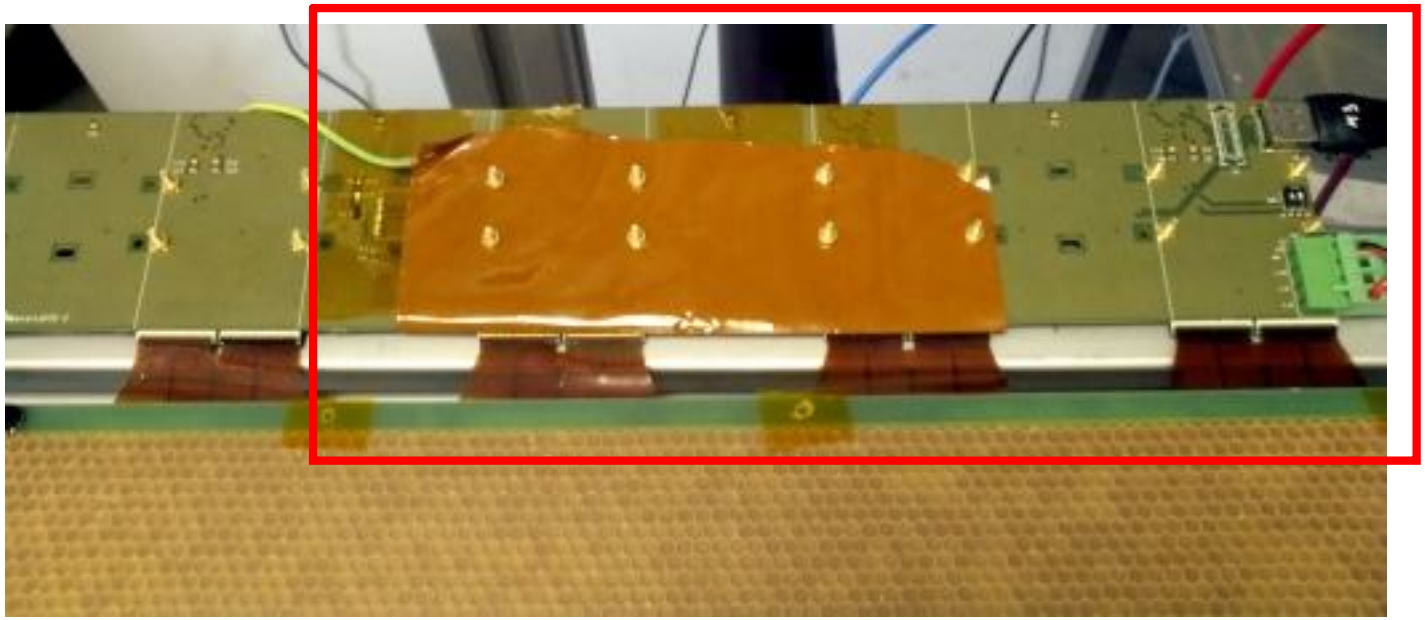


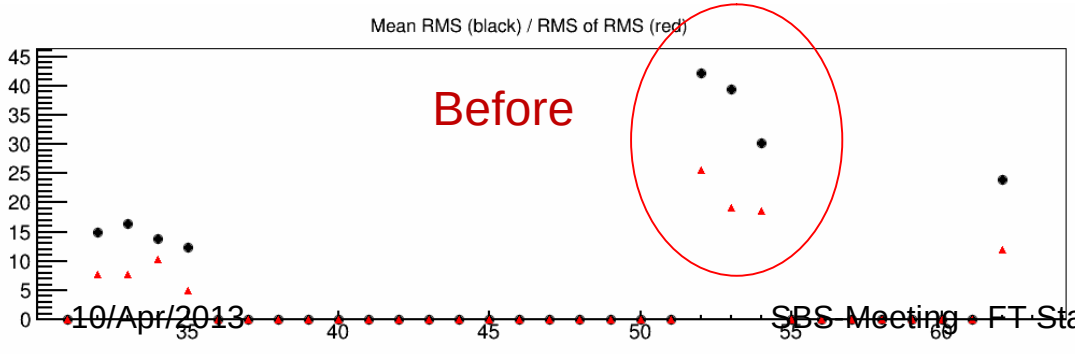
⇦ Noise should increase from right to left ⇦

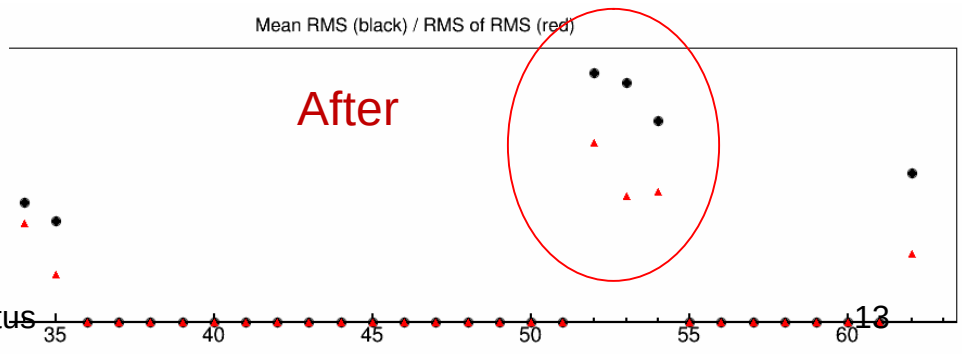
Shielding the middle cards slightly improves noise

(but could be a sligtly different grounding due to the work to insert the shielding kapton foil)

NOTE: the analog signals are on differential lines



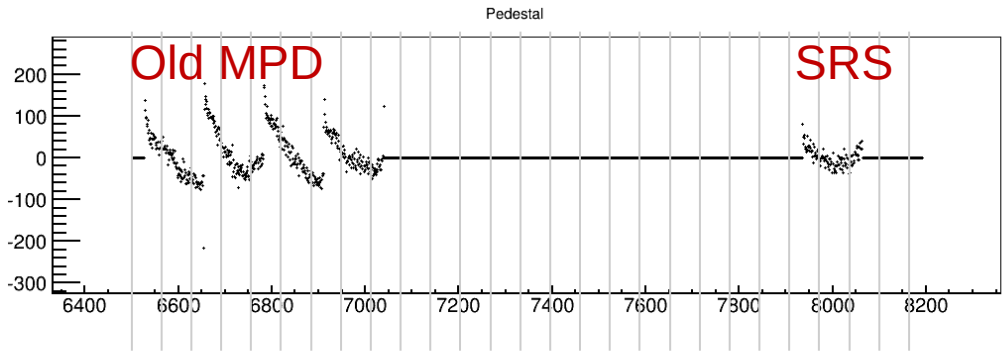


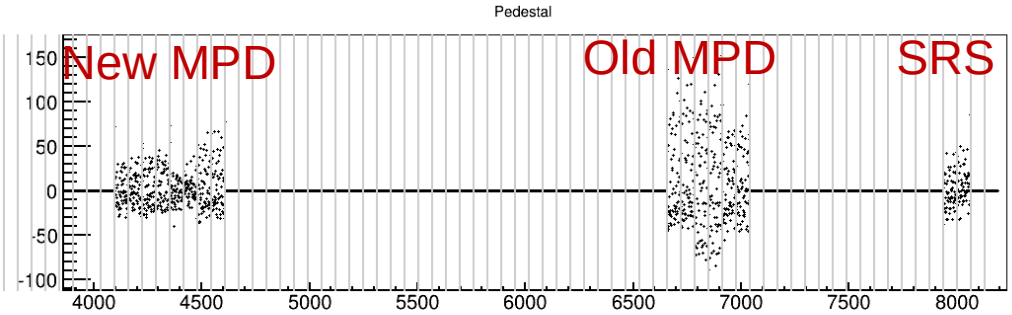


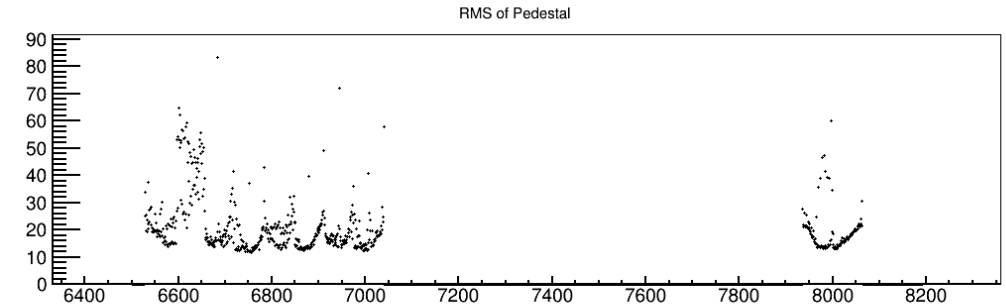
Noise on large chamber

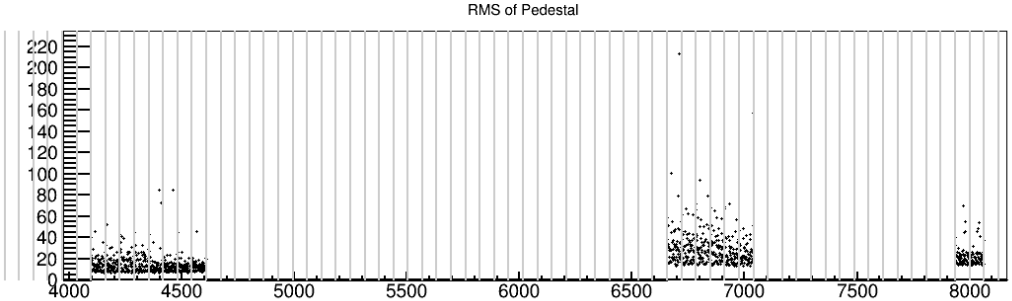
Left: 1 backplane on x

Right: 2 backplanes (7 cards) on x and y



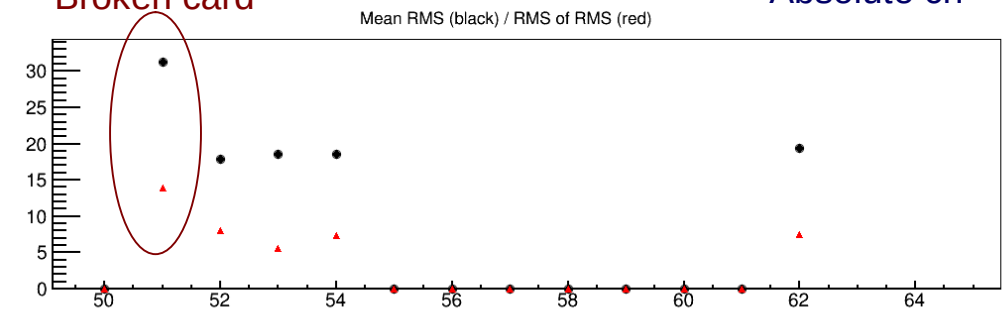




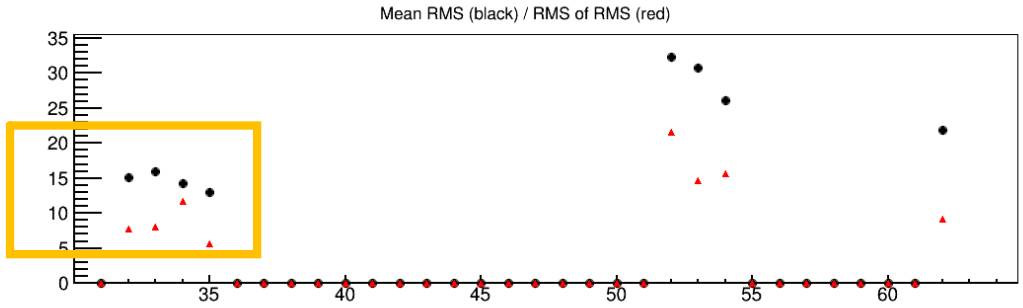


Broken card

Absolute ch



APV ch

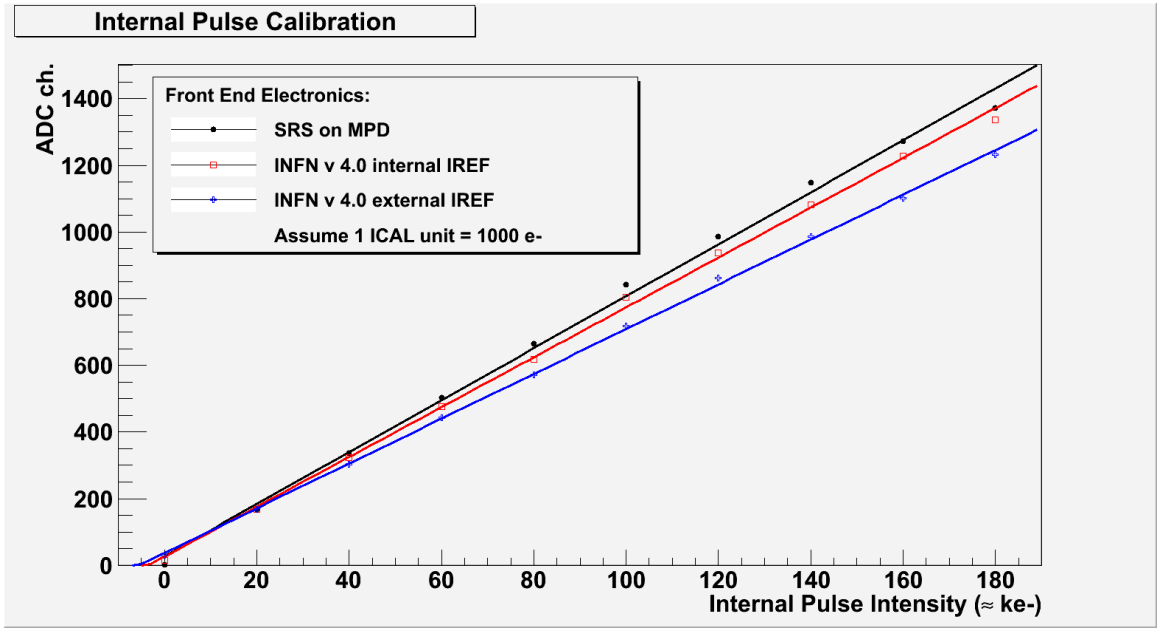


New MPD has lower gain!

Confirm noise depends on cards connected on perp. Strips

Note: pattern of Noise very similar between SRS and INFN (different in small GEM)

Internal and External Signal Test ...

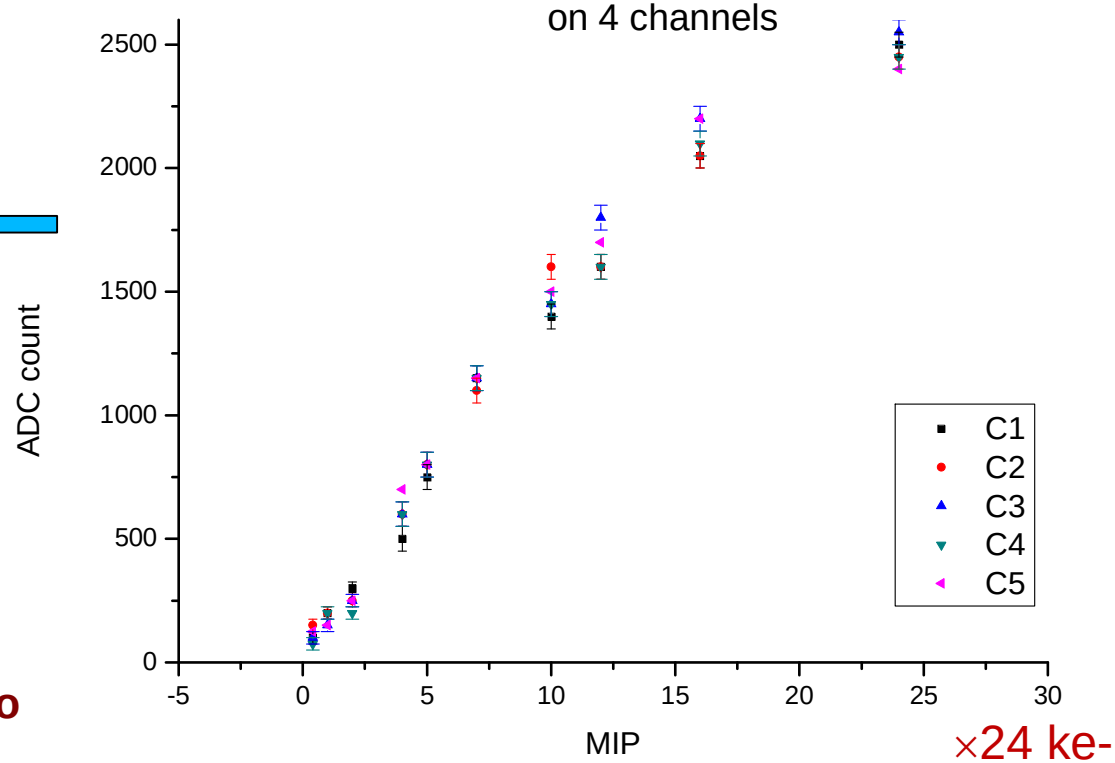


Signal through ~3 pF capacitor soldered on 4 channels

ADC ~ 6.5*Charge_int +30

ADC ~ 4.6*Charge_ext +110

Internal and external test signal provide similar gain



From Fulvio De Persio

Summary of comparison (up to now)

Results are still preliminary, (hopefully converging):

1. No significant difference in noise and sensitivity with internal and external pulse (one more test required with SRS)
2. SRS more stable versus setup and grounding
3. INFN need «strong» grounding in small GEM (with flex adapters); if well done, noise similar to SRS (14 ADC ch), lower if only one side connected (7-8)
4. Very preliminary sensitivity/gain test on small GEM shows SRS sligtly better than INFN cards
5. Noise on large chamber (only INFN, direct connection), looks much more stable: <20 (only one side connected) or 25-35 (two side connected). No grounding study done till now.
6. Large chamber electronics affect noise level in SRS (maybe via MPDs)

Work in progress

- Second GEM mudule ready to be shipped to Rome
- First GEM module is under test in Rome

- MPD v4, 2 boards under test
- DAQ improvements (delayed analysis !!)
- Electronics further tests