Noise test on planar GEMs in Ferrara Lab

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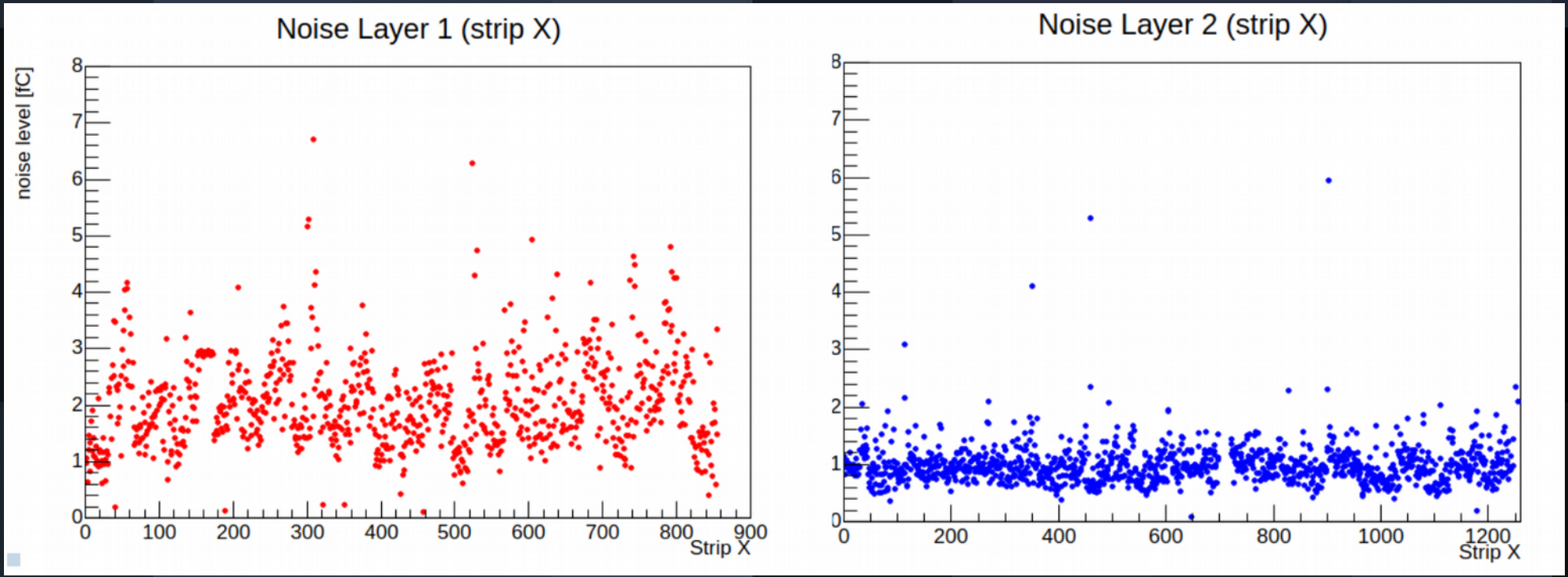
On behalf of integration group

BESIII Italia – ONLINE – 06/10/20

Motivation

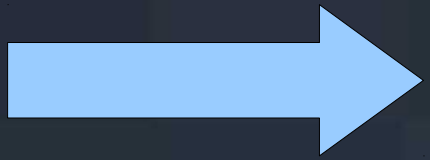
- Noise level in IHEP clean room good, trying to understand wheter it can be furtherly improved



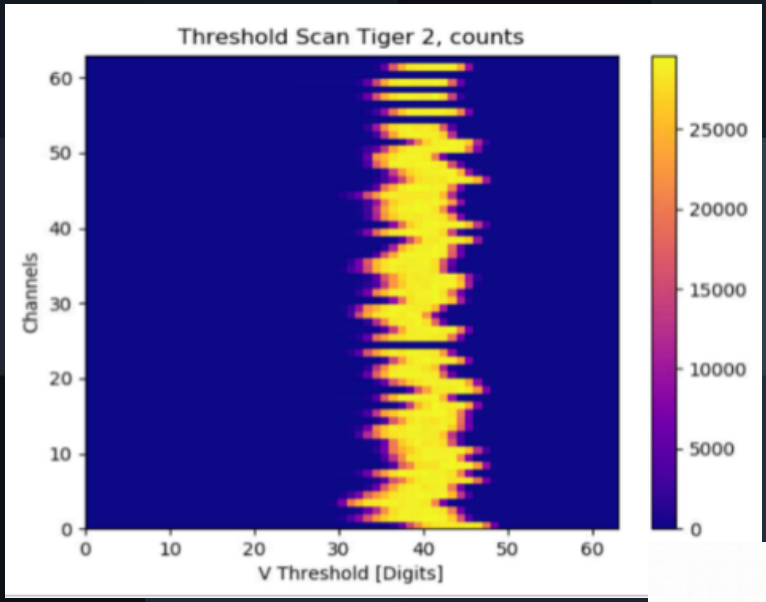
From A. Bortone report @ last CGEM meeting

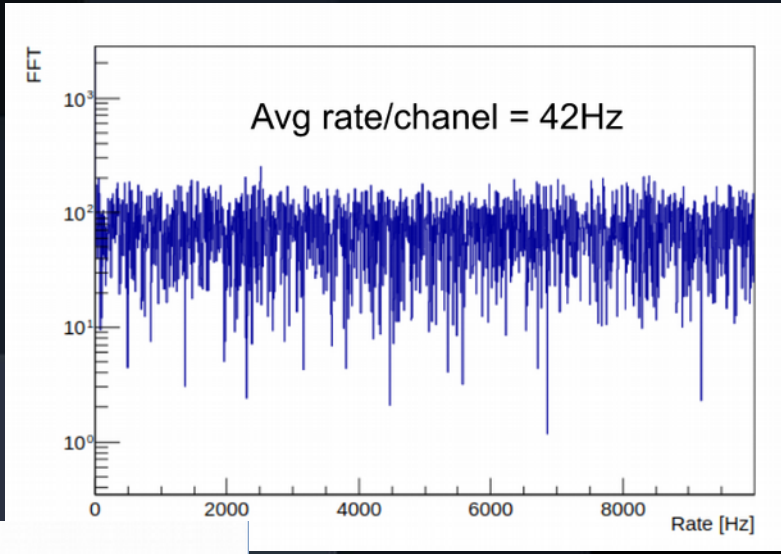
https://docs.google.com/presentation/d/e/2PACX-1vRBVU30ycT_ri2g9m2jUKcsr_zSCamAzyh3cmNSB0BK5eCUDME6tBjYJ_lZKZFnJCTYfjEa1ovAIICP/pub?start=false&loop=false&delayms=3000#slide=id.g97b53bdf5f_2_9

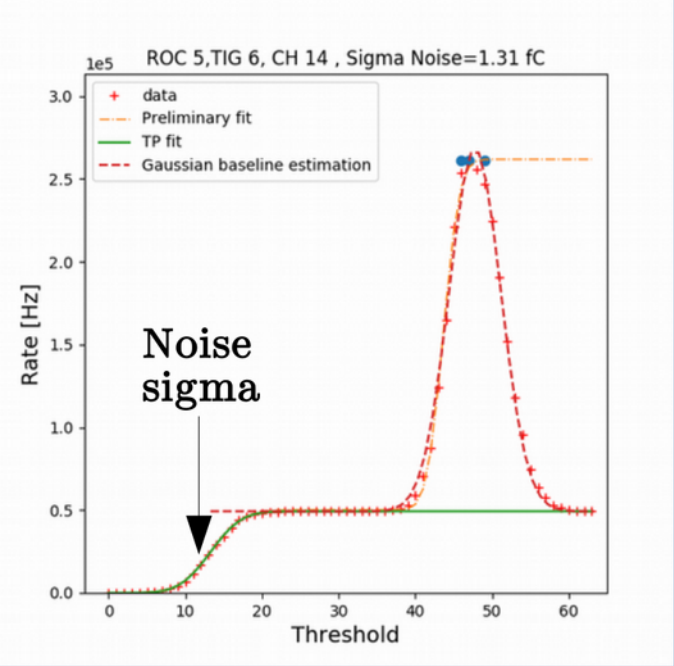
Crono-Story



How we can access to noise information – a reminder

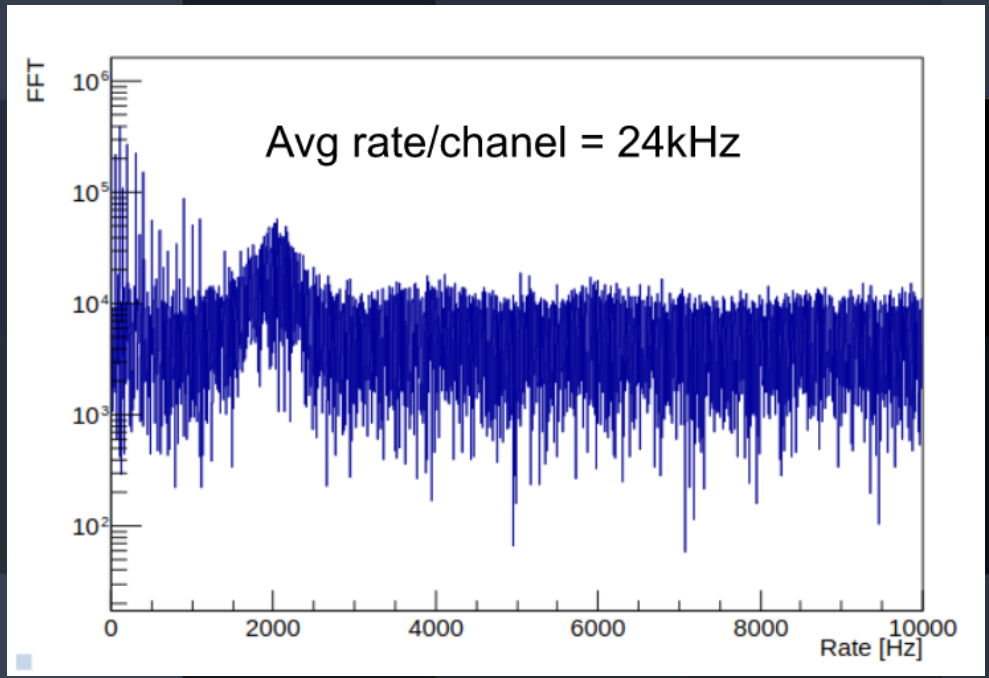






Shielding on HV cables

- We noticed an increase in the rate by the presence of un-shielded HV cable on planar GEM



Shielding on HV cables

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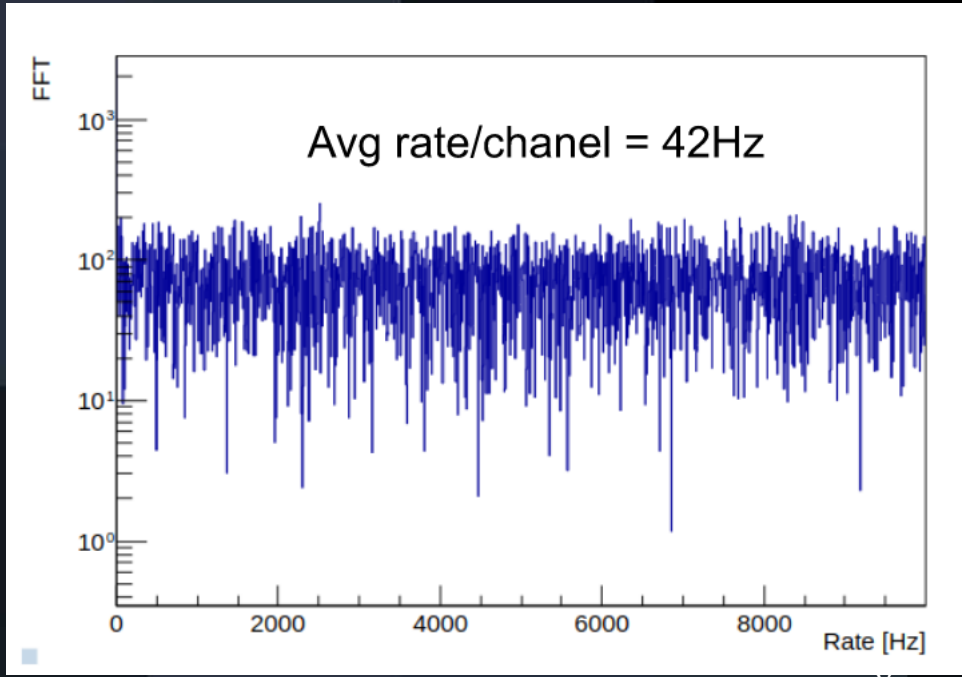
- By applying shielding



Tests

Is

reduction of rate == reduction of effective threshold

true?

- Strategy: set the same autotune value in both configuration and readout the digit value

FEB temperature

- In Ferrara we do not have cooling, so FEB temperature is not stable as in IHEP
- The effect can result in a small variation of the position of the baseline, thus the numerical value can shift to different values

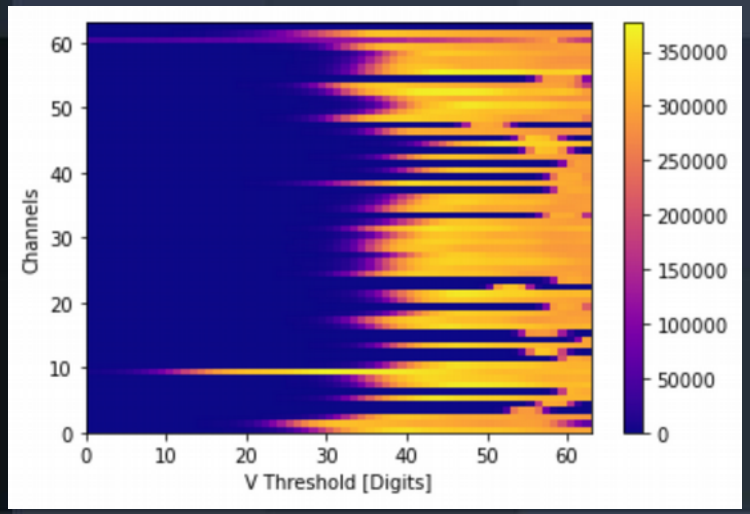
```
THR T52, THR E54  rate: 303700.0
THR T53, THR E50  rate: 305020.0
THR T53, THR E51  rate: 304990.0
THR T53, THR E52  rate: 304990.0
THR T53, THR E53  rate: 305030.0
THR T53, THR E54  rate: 305000.0
```

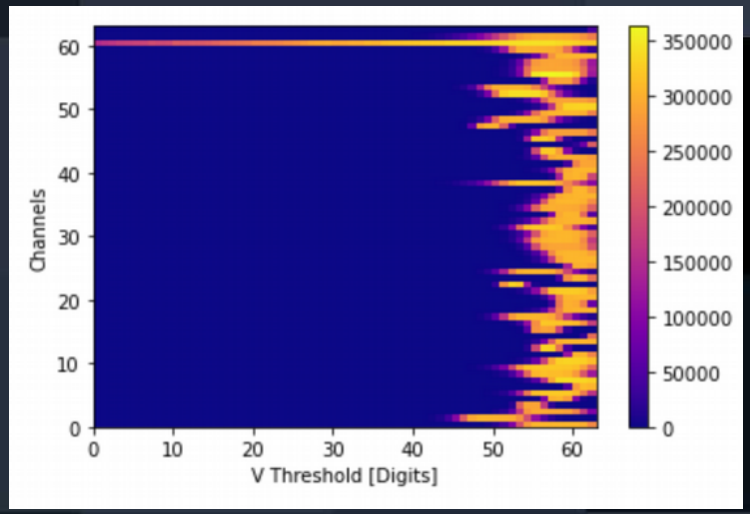
```
THR T52, THR E53  rate: 122920.0
THR T52, THR E54  rate: 116400.0
THR T53, THR E50  rate: 8560.0
THR T53, THR E51  rate: 36670.0
THR T53, THR E52  rate: 92480.0
THR T53, THR E53  rate: 125870.0
THR T53, THR E54  rate: 125980.0
```

During the subsequent test we have waited > 10 minutes after power on to mitigate this effect

First results

- Tested only one chip: in planar GEMs all the strips are equal, no geometrical effects

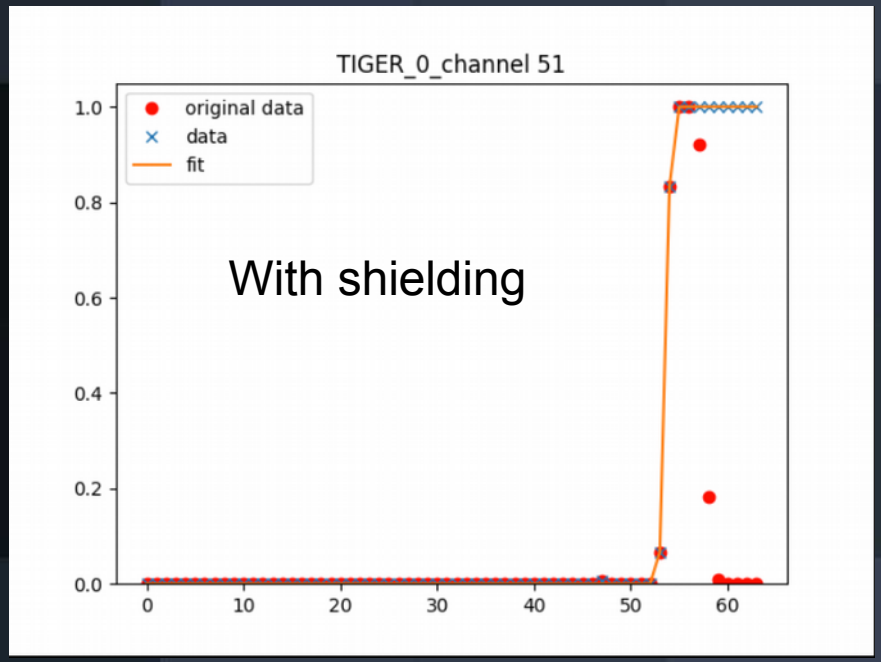


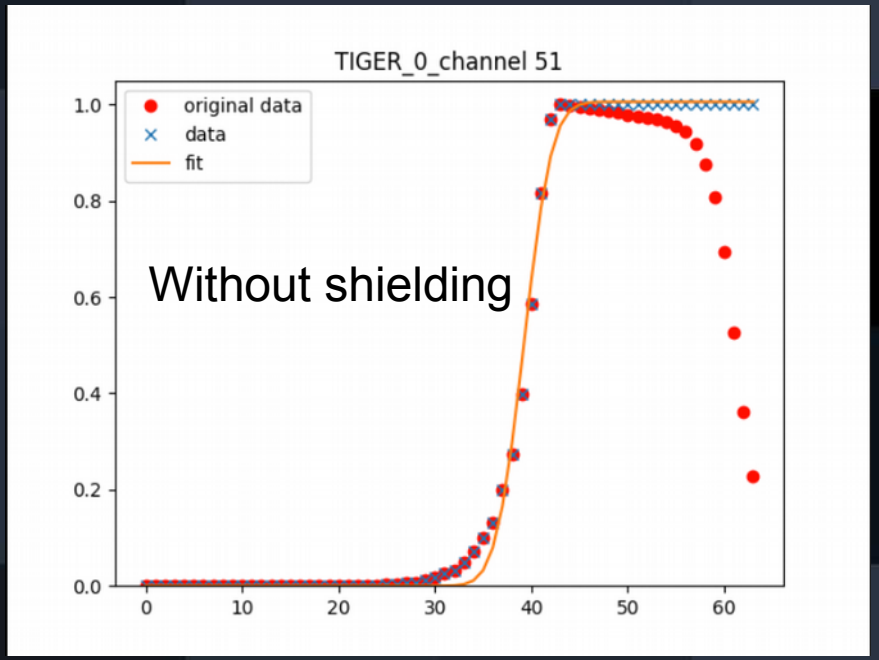


In all the channel, the digit doublet is found closer to the baseline → Reduction of the effective threshold that can be applied

First results - II

First check – verify with single threshold scan

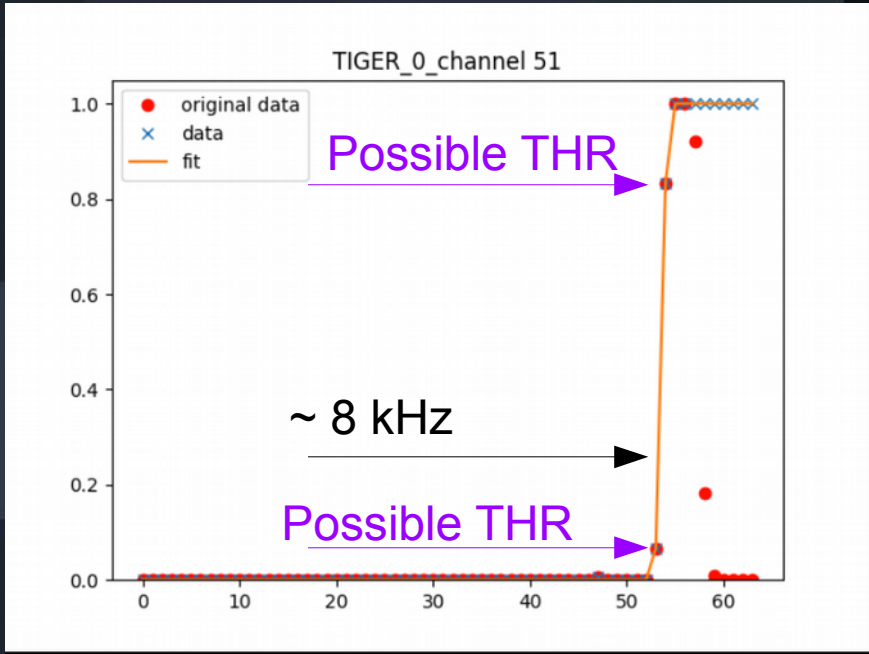




In all the channel it is possible to see the improvements!

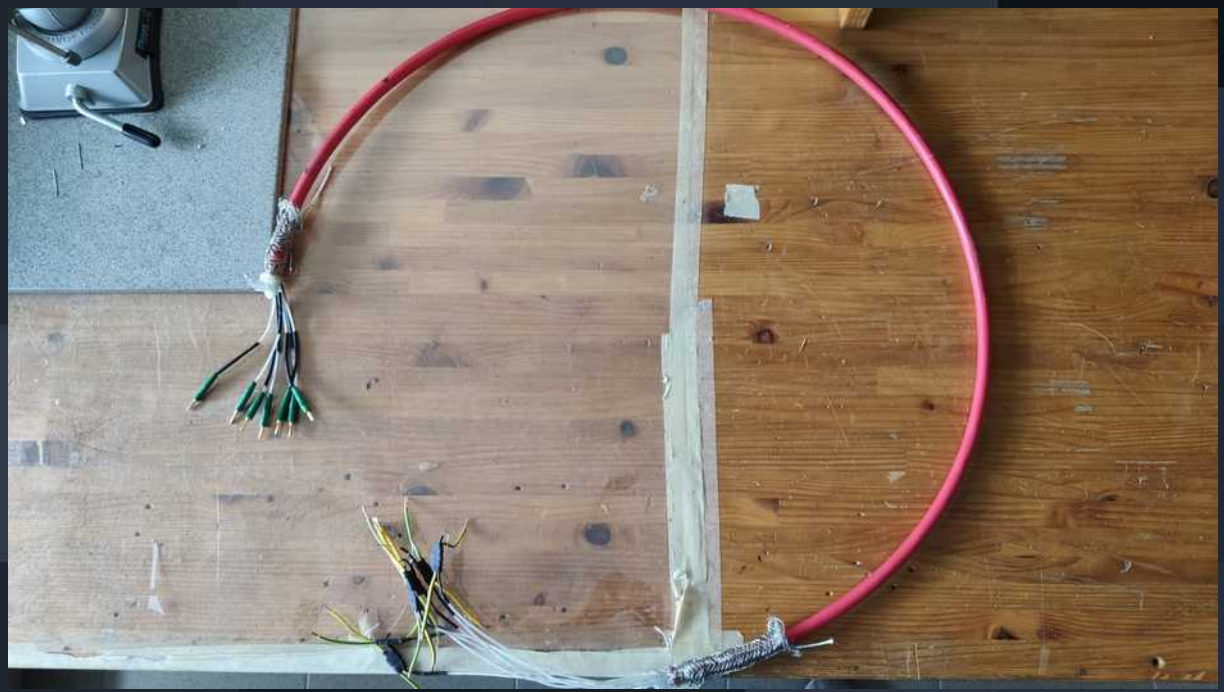
First considerations

- Step forward into understanding our setup → improvement of in operation threshold (CAVEAT: in IHEP the situation IS DIFFERENT from the planar, but we have found a possible way to redyce the noise)
- With shielding the present rate cannot be properly tuned, since the threshold steps are not fine enough



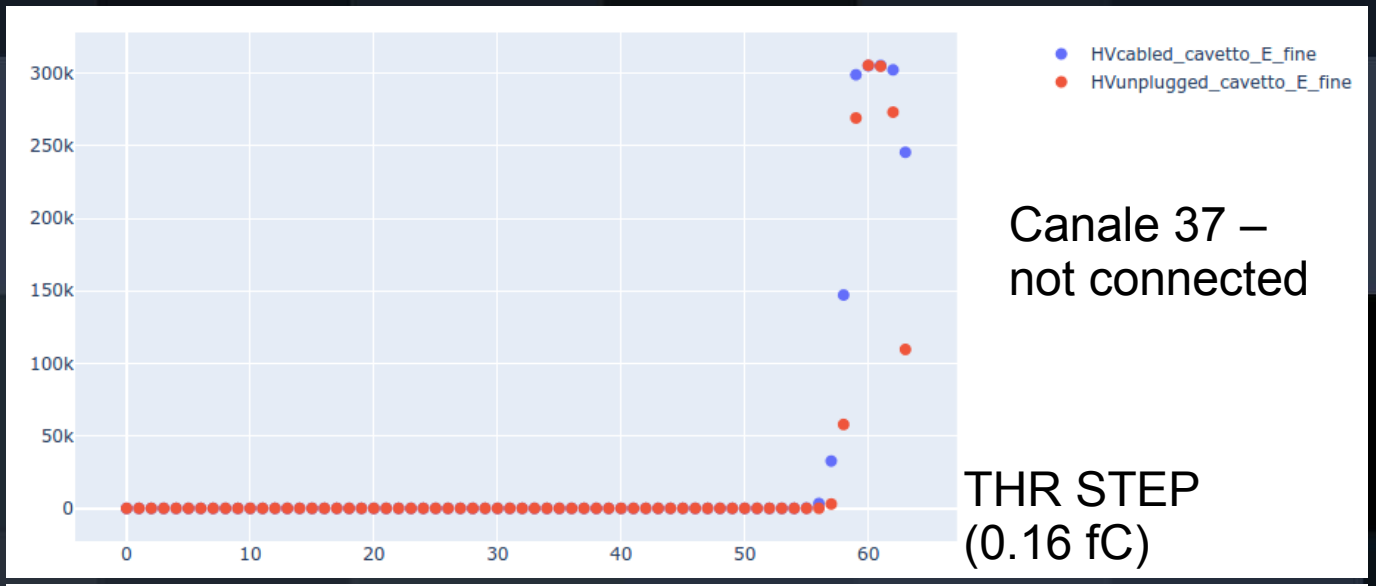
Some additional tests on-going

- With the preparation of the cosmic setup we are performing some tests:
  - Finer step of the threshold (Vcasp 55 → 60)
  - Improved shielding cable + filters on HV



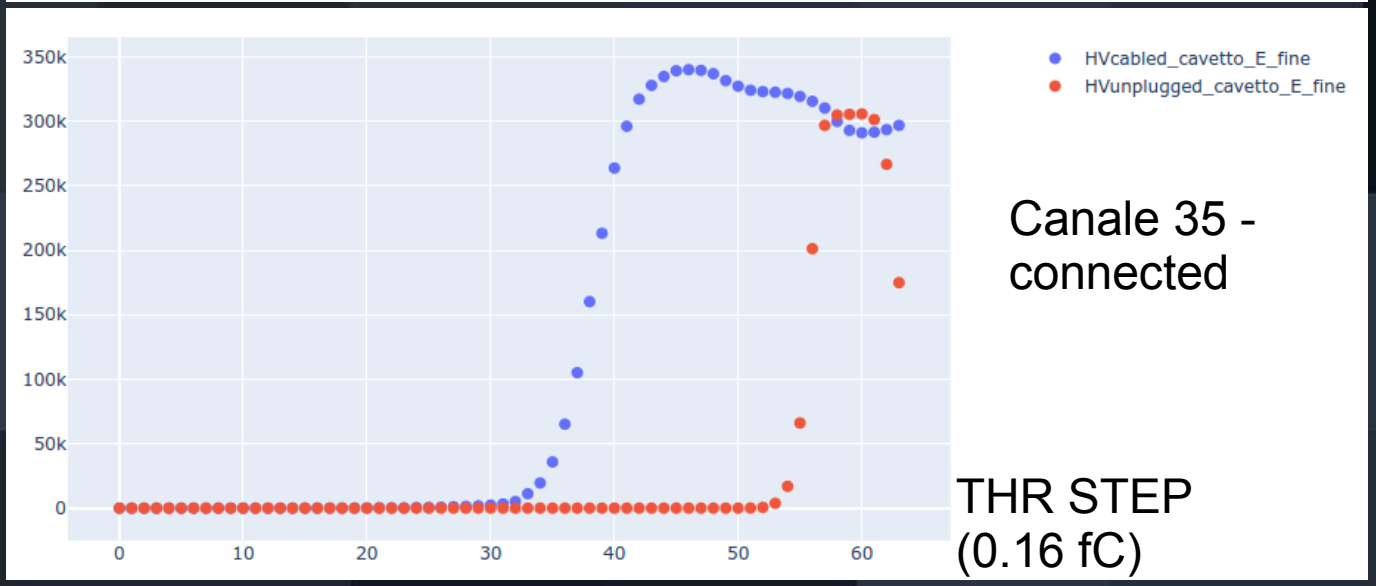
Effect of the finer steps

Rate



Canale 37 – not connected

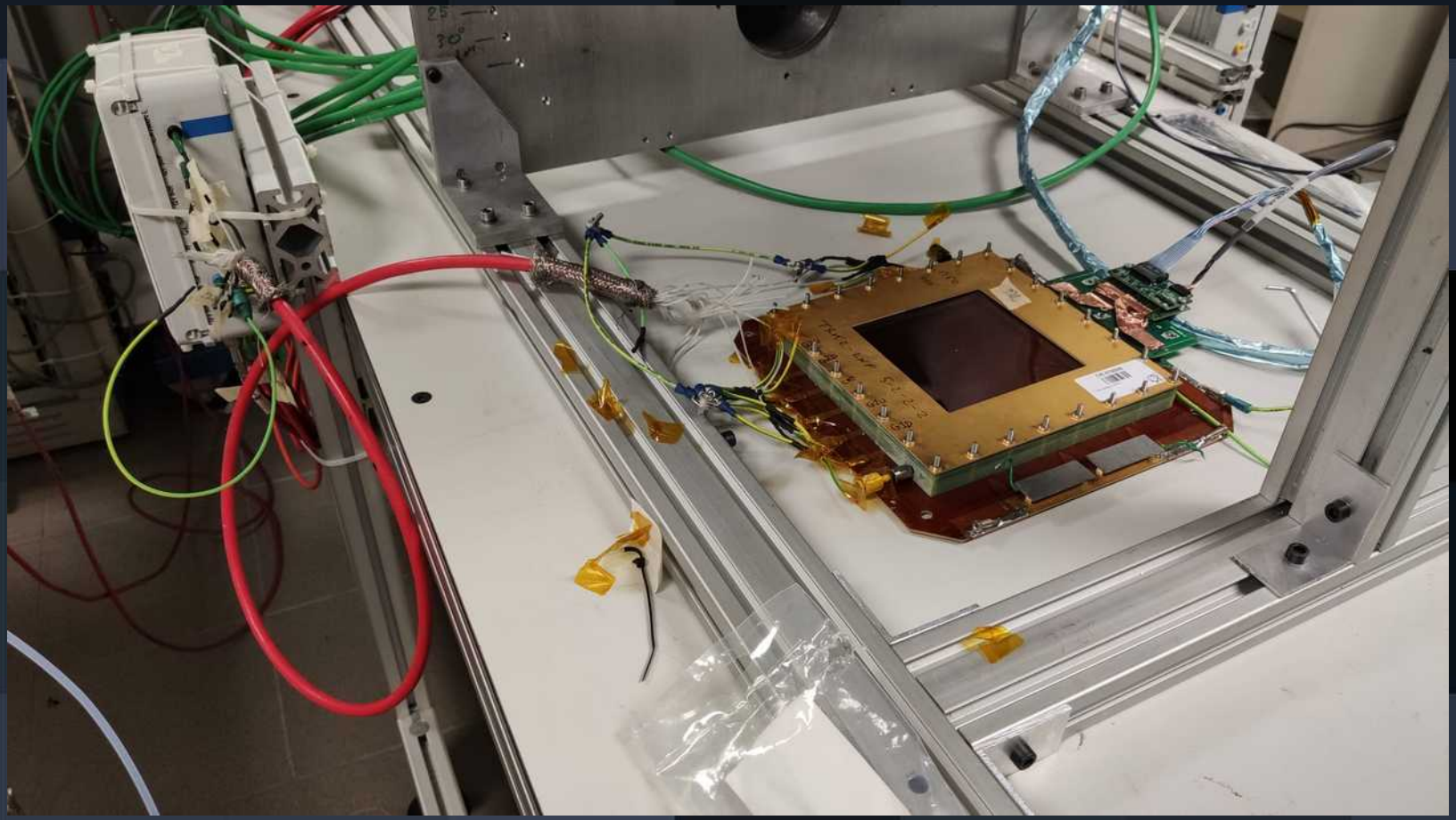
THR STEP (0.16 fC)



Canale 35 - connected

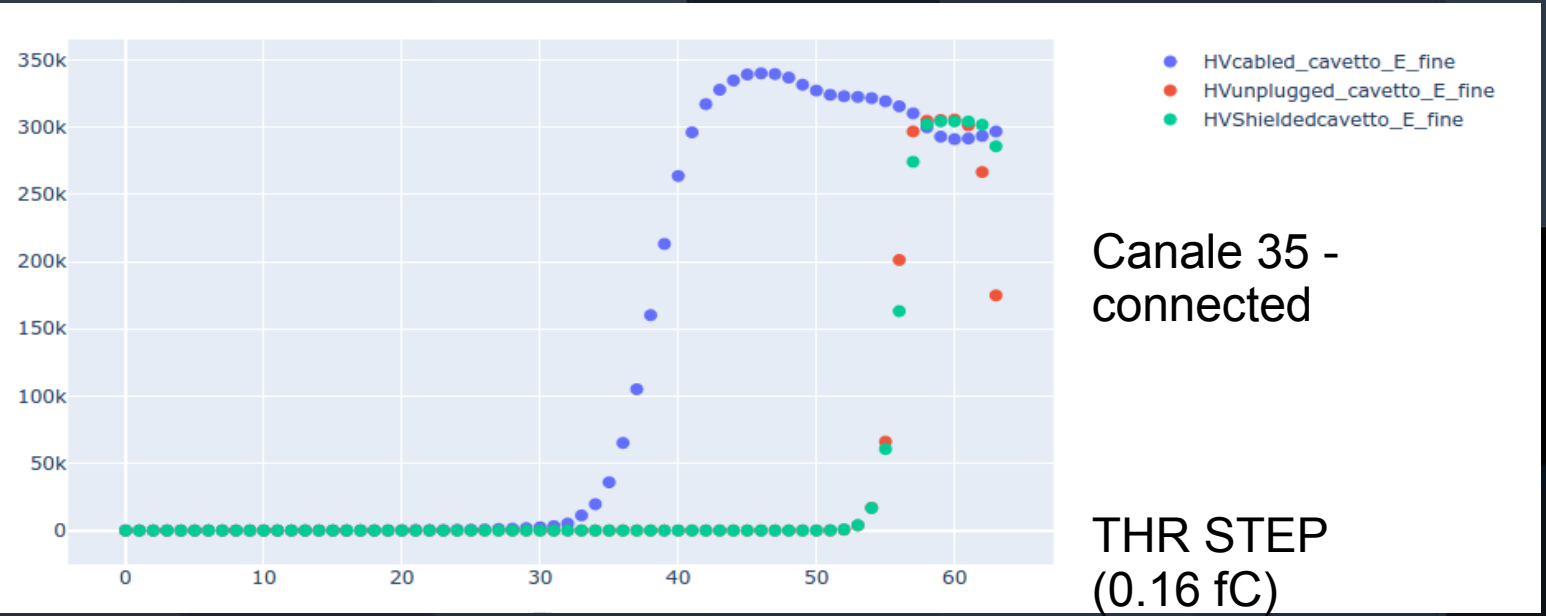
THR STEP (0.16 fC)

Effect of an improved shielding



Effect of an improved shielding

Rate



Canale 35 - connected

THR STEP (0.16 fC)

Summary

- On planar GEMs, shielding of the HV short-haul cable improve the general noise level
- Test on planar GEMs will continue in the following weeks during the cosmic data taking in Ferrara and in Mainz
- As soon as we are going to be able to go to IHEP, study of the effect of the full HV distribution shielding
  - System is much different, we can foresee an improvement, but test have to be completed

Thanks to everyone involved in the work, each result is the effect of a cumulative effort

Thanks everybody for your attention

Additional material

Reminder of autotune

- Automatic procedure to scan both T and E branches
  - Creates a 5x5 cell around the start T and E, investigate which is the best value
  - Find the doublet (T,E) closest to the set value (e.g. 8 kHz)
- Output is saved into a log file and can be retrived and analysed