

02/Nov/2020

# INFN GEM Status

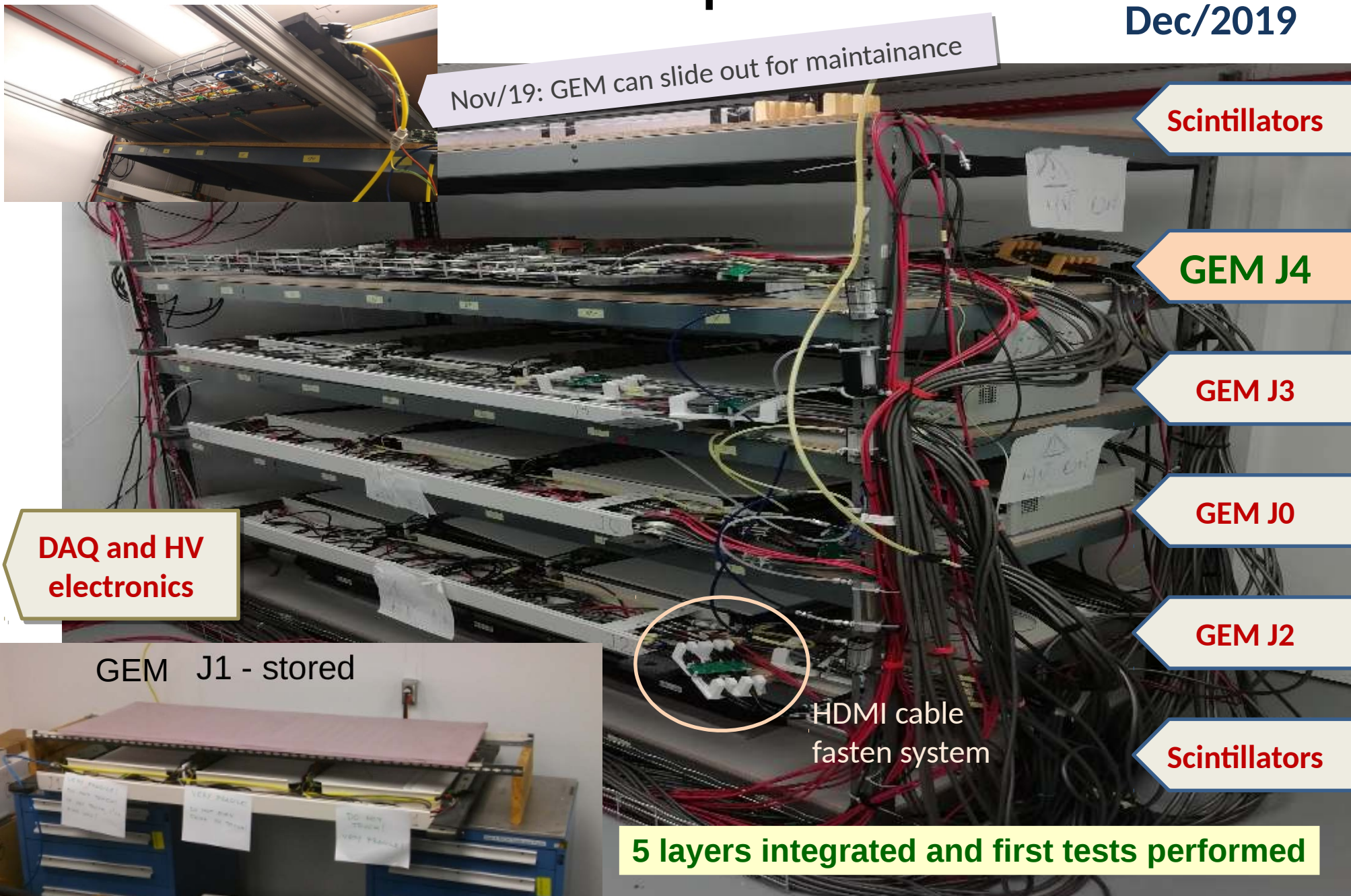
E. Wertz, R. Perrino, P. Musico, E. Cisbani, ...

SBS-weekly meeting

- Ezekiel Wertz is working onsite since end of September; Roberto and Evaristo support from remote, Chuck, Alexandre, Brian ... help locally
  - Taken cosmic tests (at different HVs)
  - Fixed most of cabling/electronics/DAQ issues and working on the remaining
  - ... while Ezekiel is quickly familiarizing with the complex GEM hardware and software (thanks also to Andrew)
- Electronics: Paolo is updating the MPD firmware to account Ben advices
- Last GEM module production: we are *paused* due to in progress maintenance of the clean room (custom) air conditioning system

# GEM setup at JLab

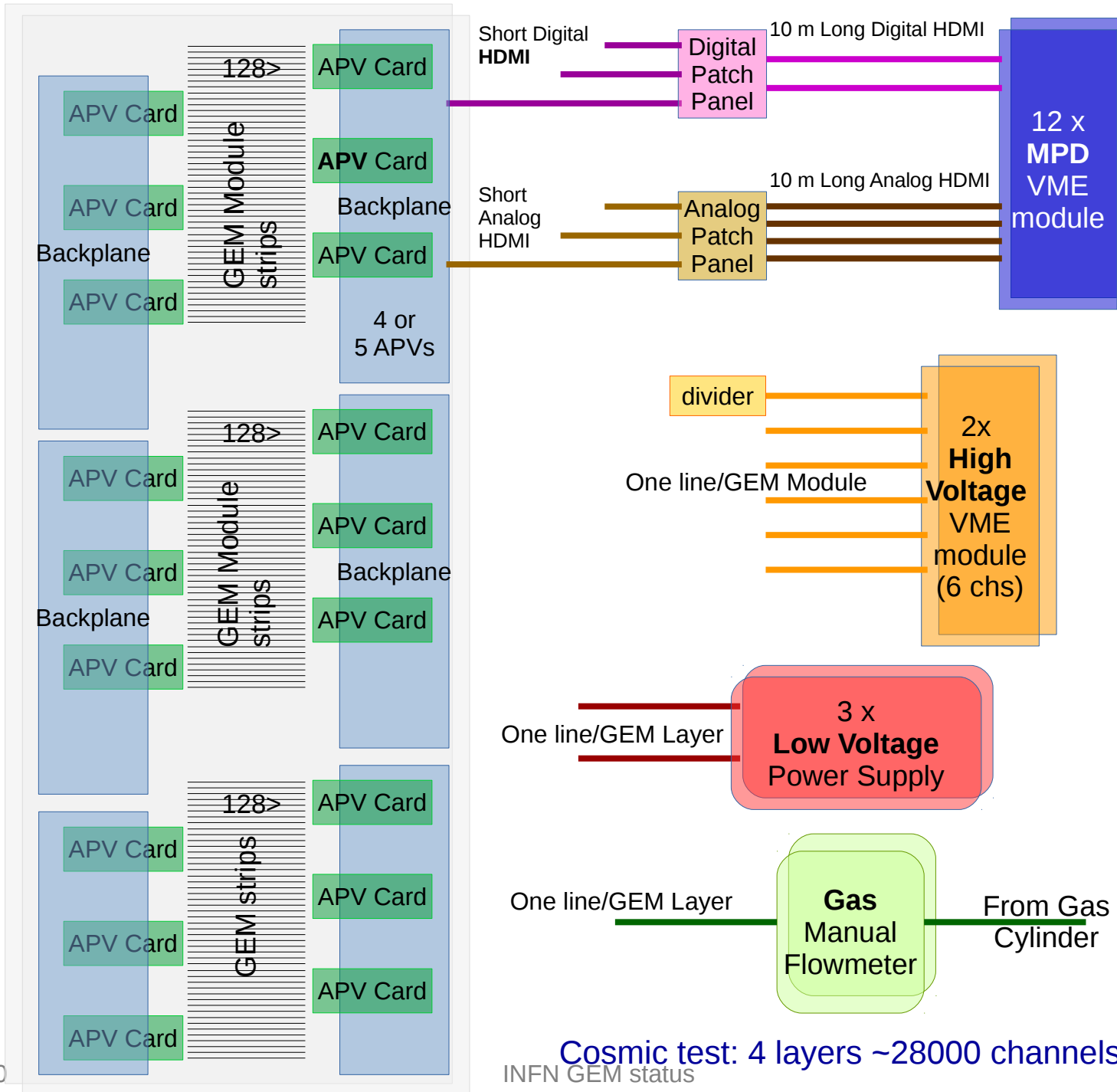
Largely unchanged since Dec/2019



# GEM Schematic View

One layer is made of 3 GEM modules

(y strips shown, similar for x strips)



# HV on

- From 5<sup>th</sup> of Aug N<sub>2</sub> gas is flowing in 4 GEM layers (chambers) in the cosmic tower → thanks to Chuck!
- HV first ramp up on Sep/30 (and other few times next weeks to work on electronics)
- HV ran for more than 2 weeks very smoothly (different from past experience)

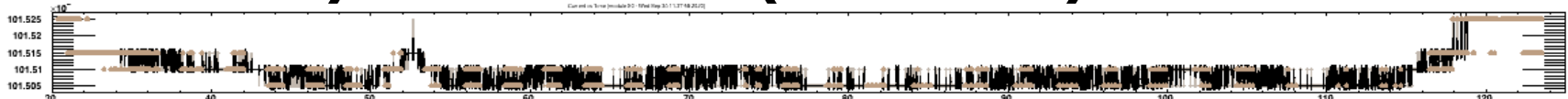
*The anticipated and continuous gas flowing keep low humidity in the GEM and prevent entrance of dust*

# HV (4000 V) current (~90 h)

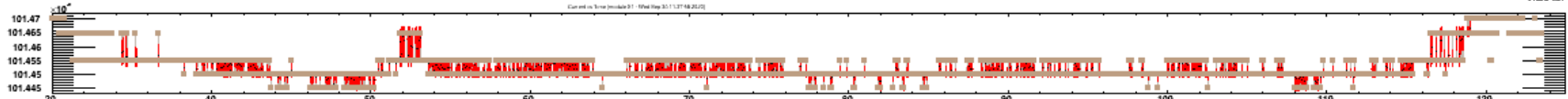
N2 and then ArCO2  
~half nominal flow

nA

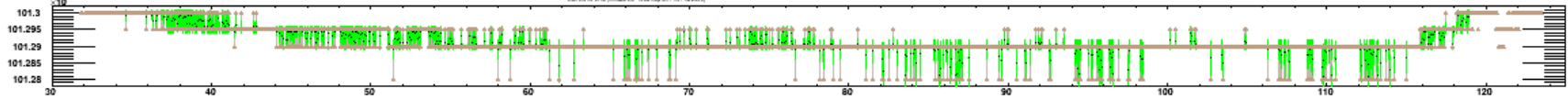
101507.9 +/- 3.2



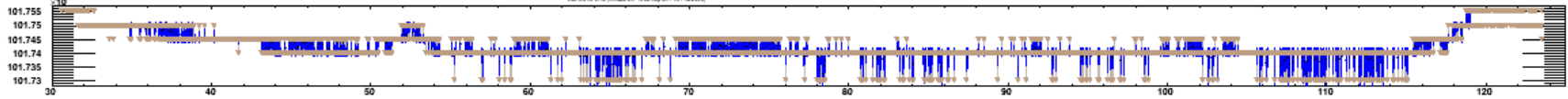
101451.5 +/- 3.1



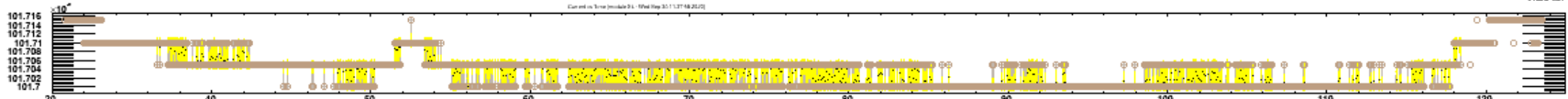
101291.4 +/- 3.2



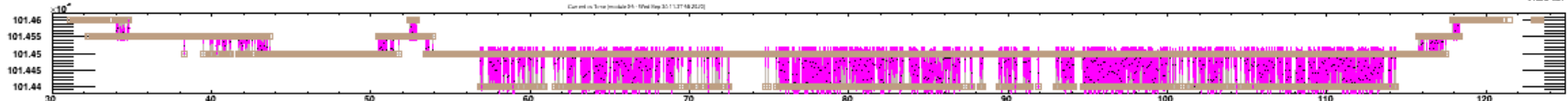
101741.4 +/- 3.3



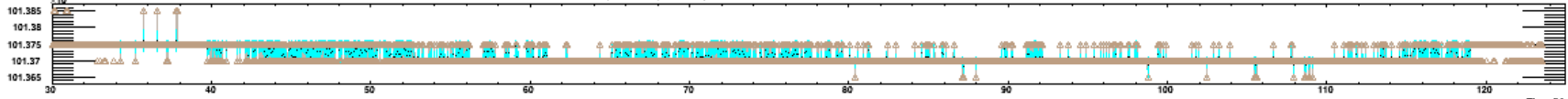
101703.2 +/- 3.2



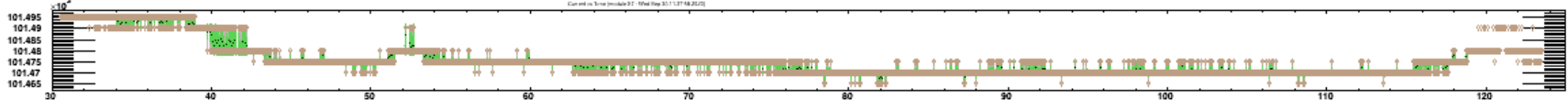
101449.3 +/- 4.5



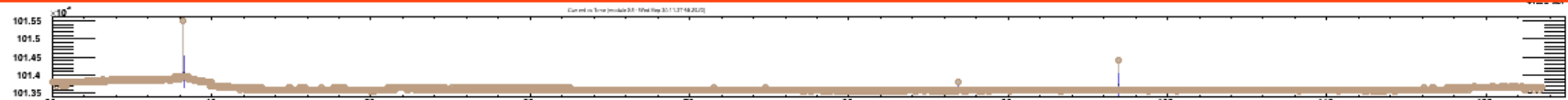
101371.3 +/- 2.2



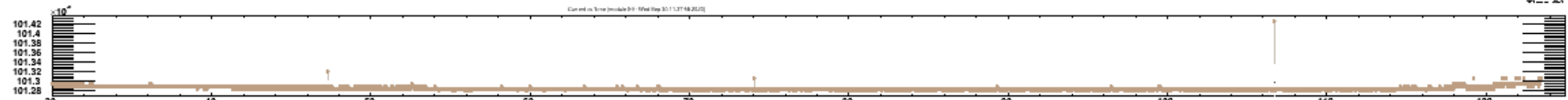
101474.5 +/- 6.0



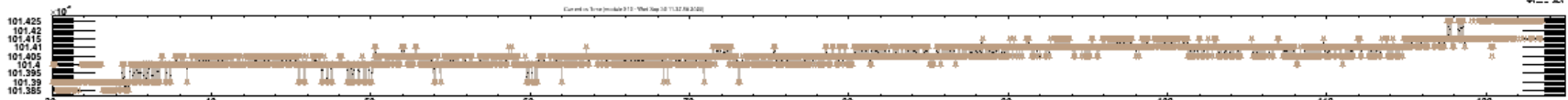
101362.3 +/- 7.1



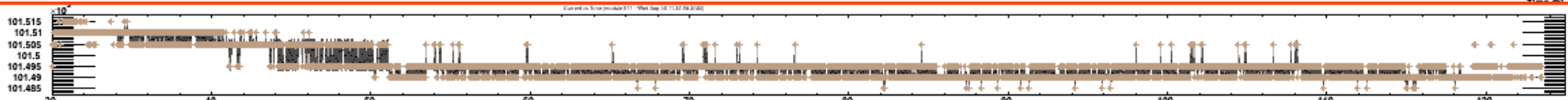
101285.4 +/- 2.6



101405.1 +/- 5.3



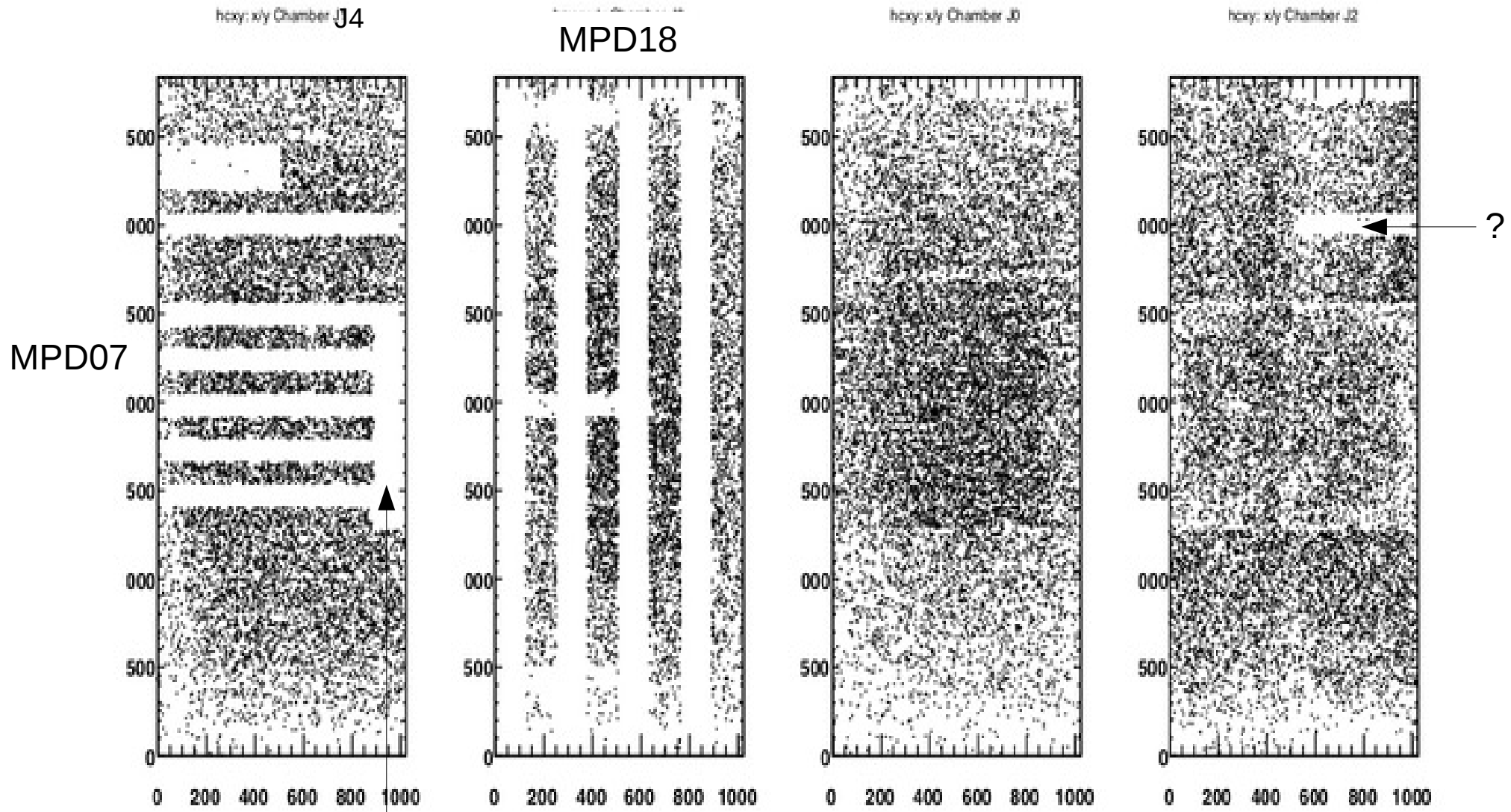
101494.9 +/- 5.5



02/Nov/2020

Situation we left last year

# Cosmic Hit Map - Dec/2019



NOTE: most of the missing hits are electronics issue!

mapping in the decoder

# Cosmic Hit Map (run 4558)

04/Oct/2020

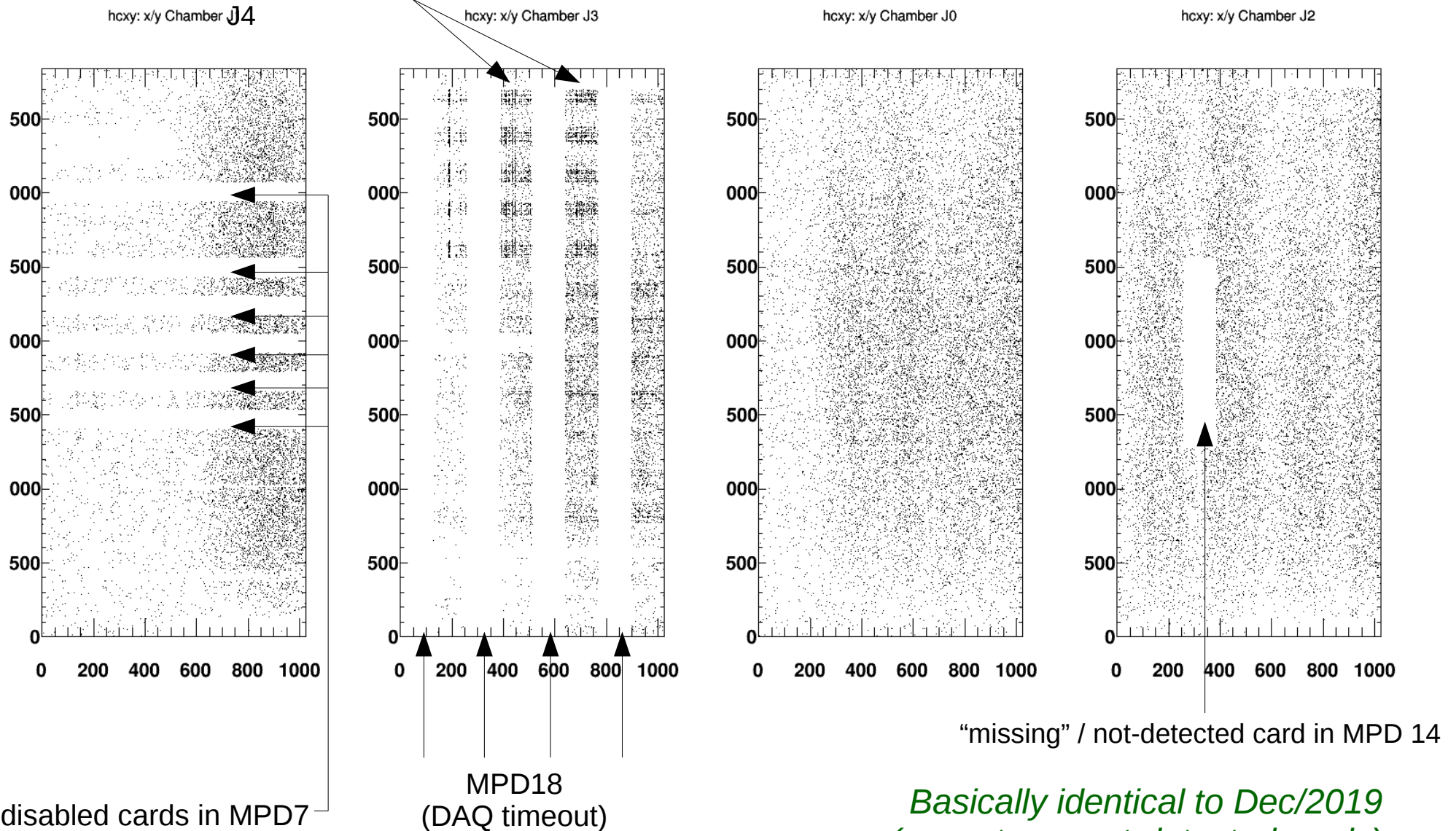
Starting conditions

(about 1 day statistics)

~5 Hz Trigger Rate

Use pedestal 4553 at HV=3000 V

Noisy hits ?



disabled cards in MPD7

MPD18  
(DAQ timeout)

"missing" / not-detected card in MPD 14

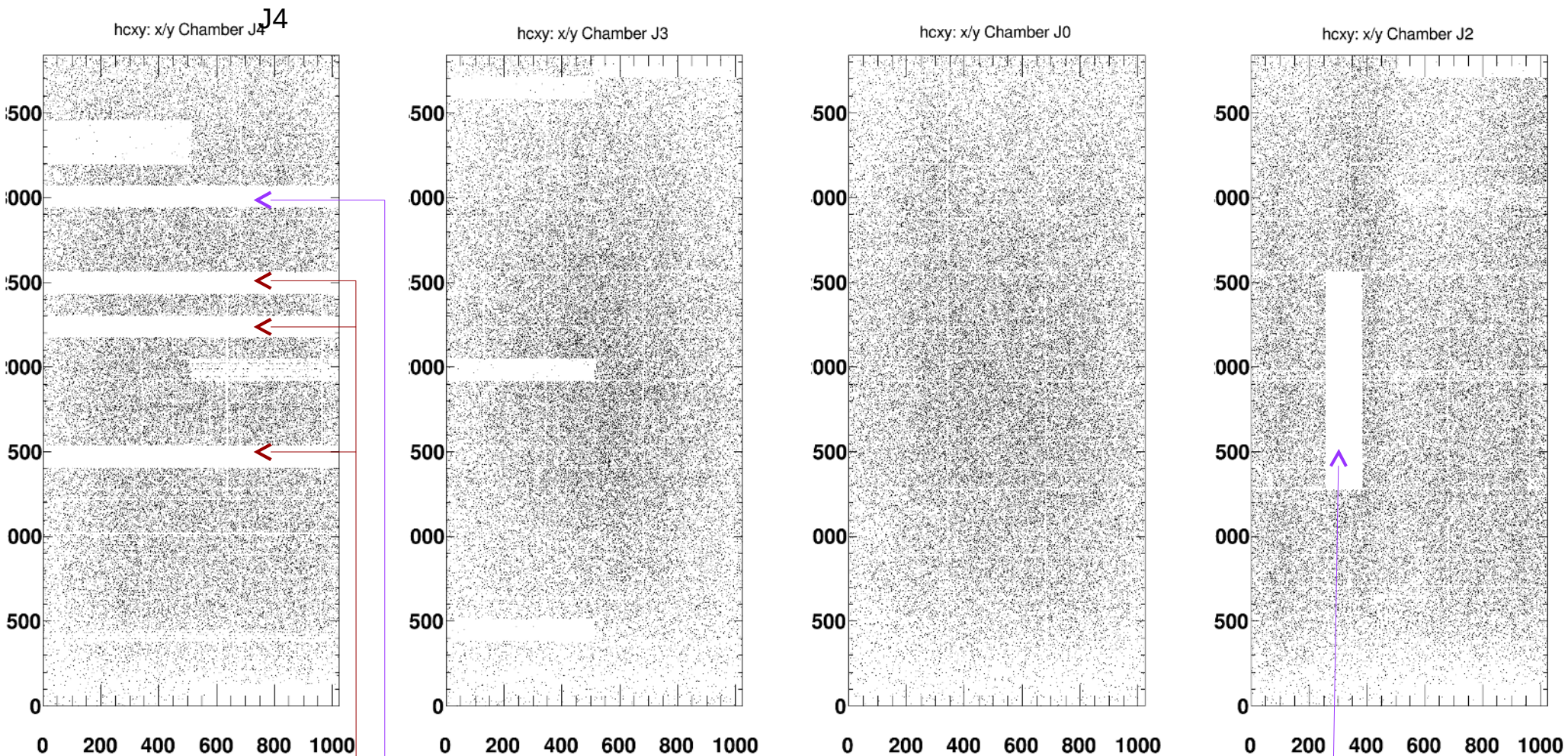
*Basically identical to Dec/2019  
(except one not-detected cards)*

# Cosmic Hit Map (run 4617)

~one week later  
Improved conditions

HV = 4000V (statistics: files \_0-40)  
gas flow ~ 1/2 of "nominal" values

also Cosmic Trigger  
scintillators fixed; rate ~ 10 Hz



disabled cards in MPD7  
bad histos, gives timeout  
when enabled

"missing" / not detected cards

*Trying to fix them has been the work of the last couple of weeks*



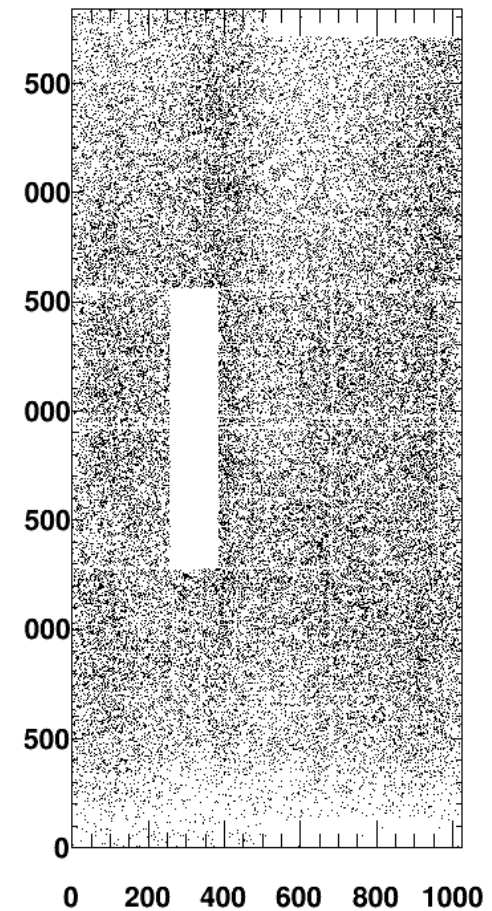
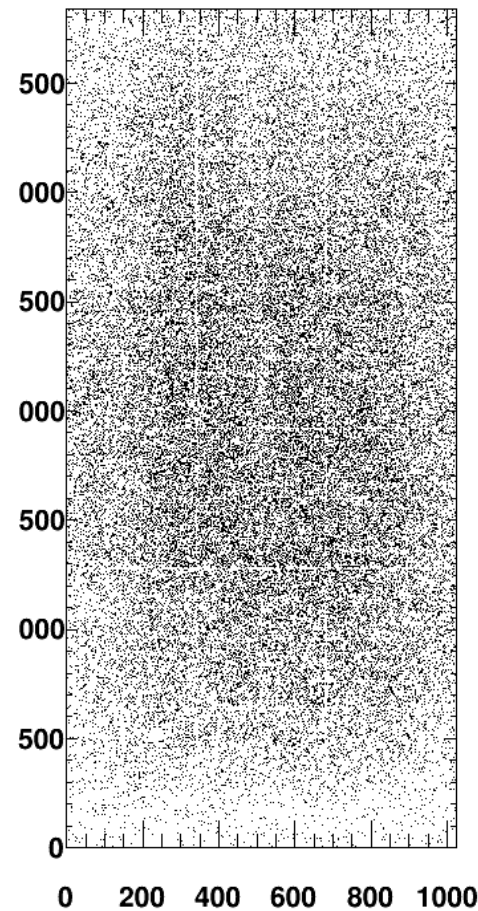
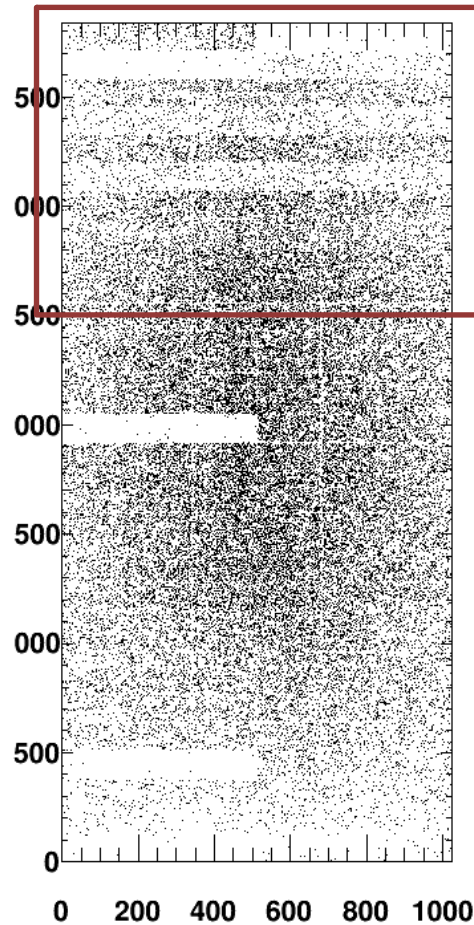
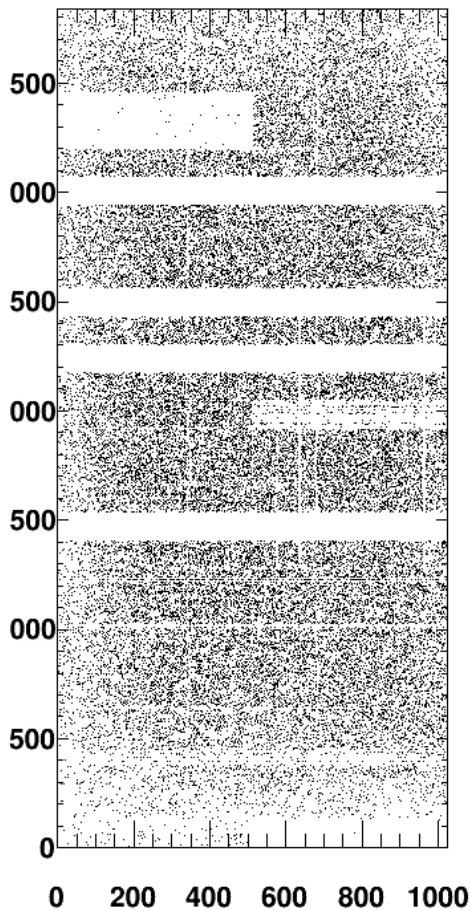
# Cards Readout instabilities on MPD17

hcxy: x/y Chamber J4

hcxy: x/y Chamber J3

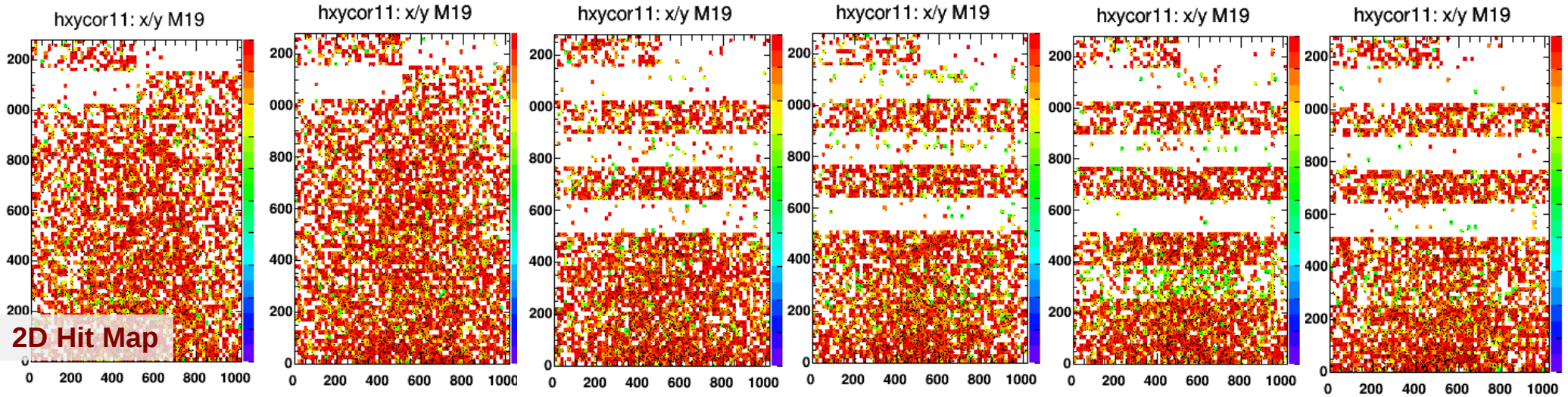
hcxy: x/y Chamber J0

hcxy: x/y Chamber J2



Three-Four consecutive cards in **3<sup>rd</sup> backplane of MPD17 stop giving cosmic hits** during the run, with **no apparent DAQ errors** (similar behavior experienced in some UVA cards)  
 With a new run the cards initially recover then they may return to get unstable  
 → *they likely loose (part of) their configuration*

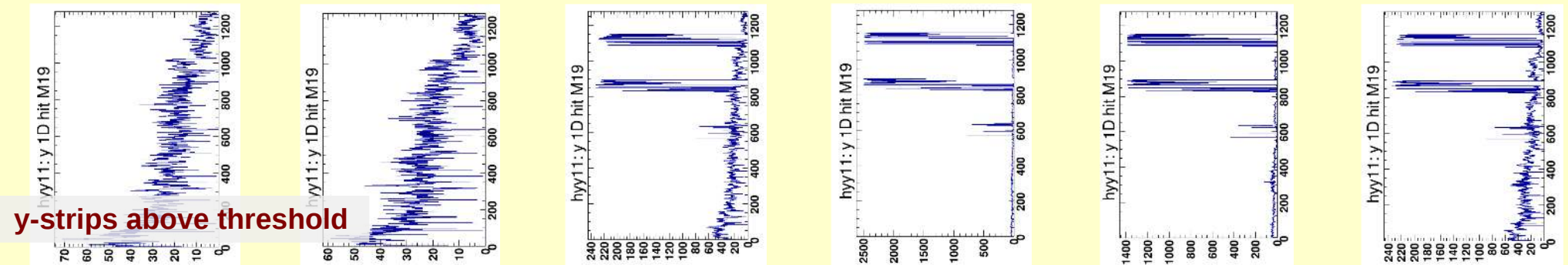
# Details on "MPD17 instability"



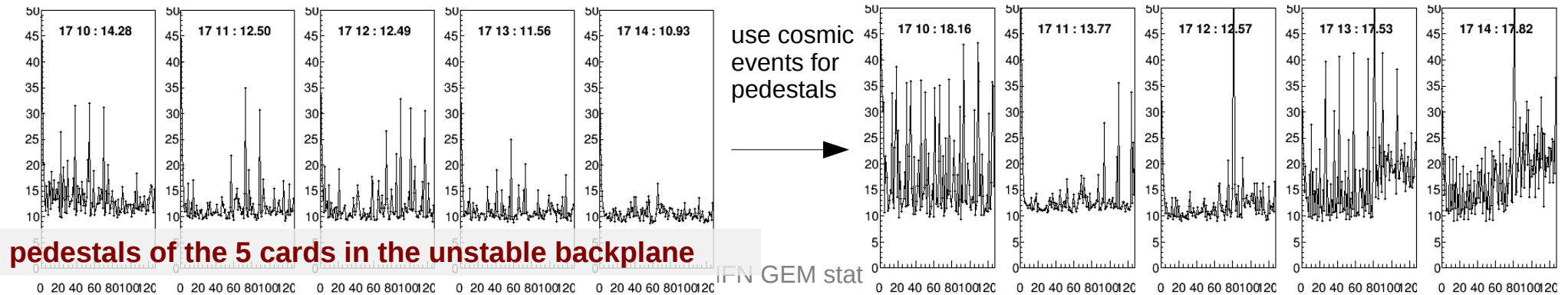
start of run

time evolution (~30 kevt each)

end of run



y-strips above threshold



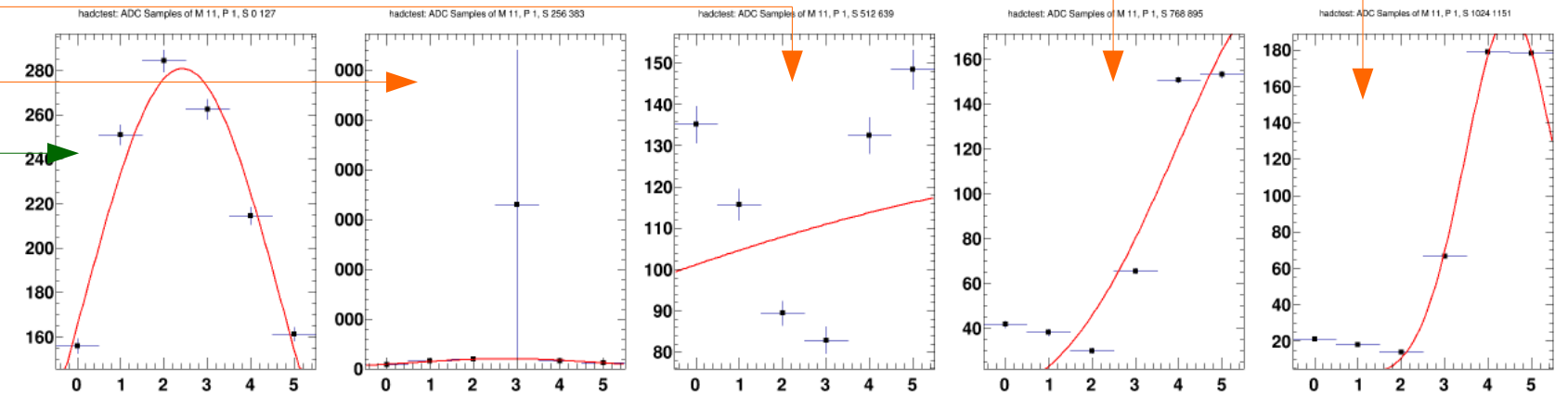
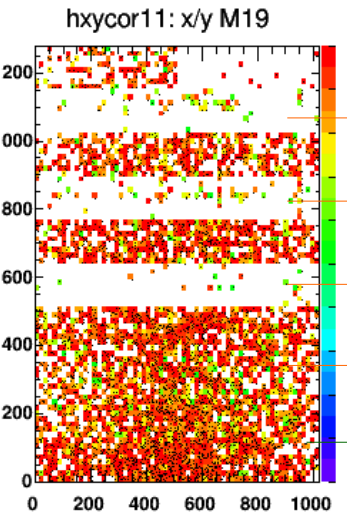
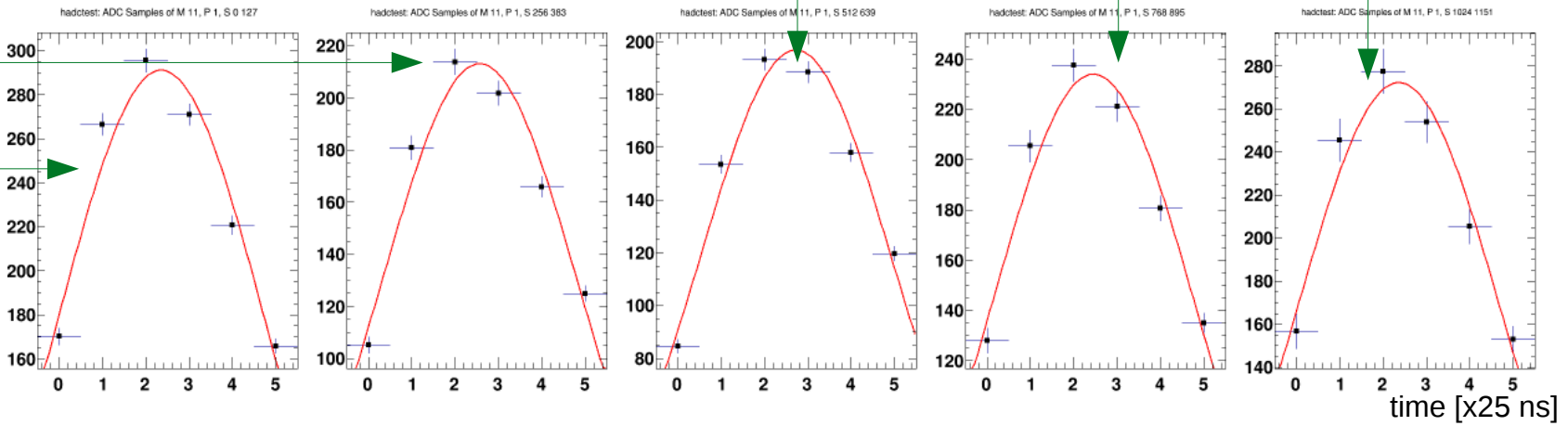
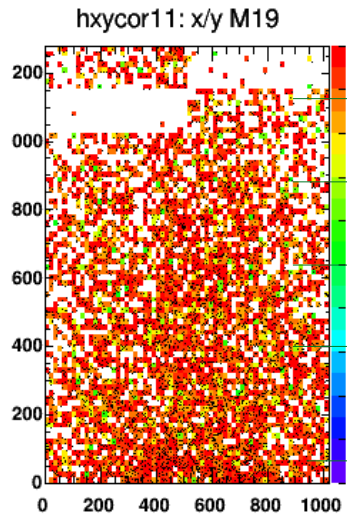
pedestals of the 5 cards in the unstable backplane

use cosmic events for pedestals

FN GEM stat

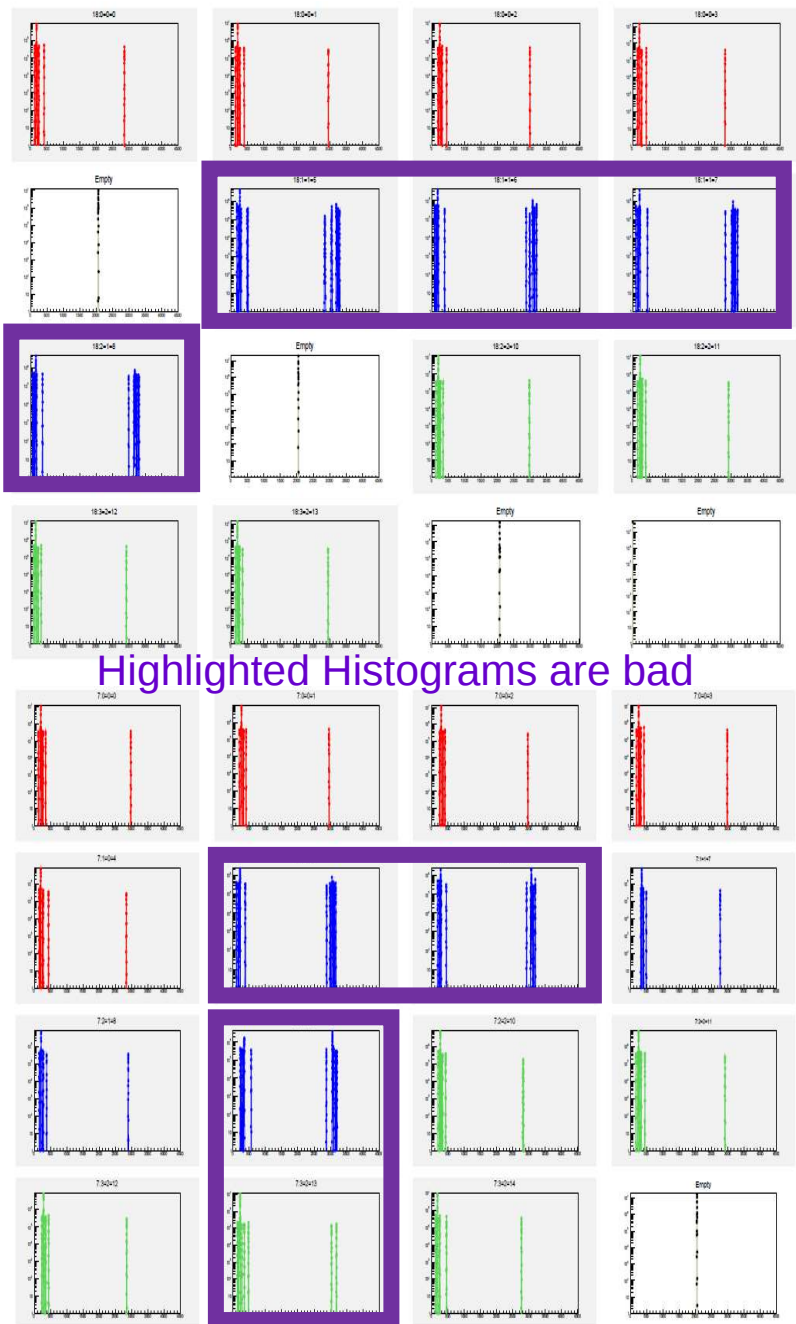
# “MPD17 instability” - recorded pulses

Average GEM pulse evolution (ADC samples of the collected charge)



Likely “latency” (distance between cosmic track and trigger arrival times) gets wrong in APV

# Lots of work fixing cabling/electronics issues



Highlighted Histograms are bad

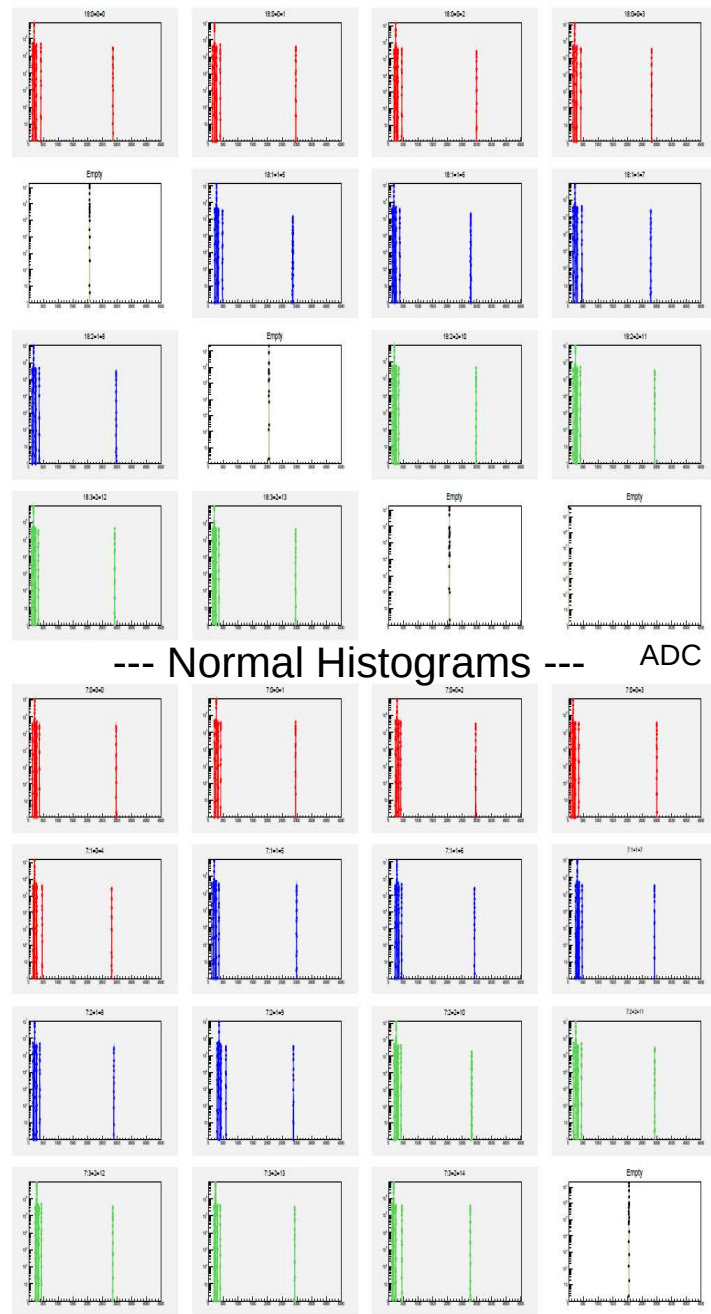
**MPD18**  
 Unplug/replug  
 of short digital  
 HDMI cables at  
 patch panel

Histo: distribution of  
 APV transmitted  
 dataframe (pedestals +  
 logic levels)

Each histo represents  
 one card/MPD-ADC  
 channel

Different colors  
 represent different  
 backplanes

**MPD7**  
 replaced two  
 backplanes (and  
 one card)



--- Normal Histograms --- ADC →

# Coming days activities (mainly onsite, thanks to Ezekiel)

- Preliminarily test latests DAQ/Electronics fixing
- Analyze taken data (using Andrew code) and integrate run start-stop auto logging
- Take additional cosmic tests to verify latest fixing and complete HV scan (3800 V, 3850 V, repeat ref. 4000 V)
- Replace plastic cable trays (one chamber has the new metallic tray and can be used as reference)
- Test again new setup
- Finalize GEM BigBite Frame and ancillary components and then start assembling GEM frame
- Finalize procedure for moving GEM chambers to TED then inserting/removing in/from the BigBite Frame and build tools (hanging, sliding ...)

*Keep continuous gas flushing into the GEM chambers (Chuck support)*

# GEM Activity in Italy till end 2020

- test of the last GEM foil in Catania - completed
- setup a drying oven (sort of) for ultrasound cleaning test - completed
- assemble last GEM module; upgrade air conditioning in clean room is **delayed**
- test assembled module and likely send to JLab together with one or two modules we are trying to cure in Rome. They can be used to integrate the last layer (6<sup>th</sup>); **delayed**
- continue remote support onsite activities and analysis
- Improve readout electronics (MPD firmware) and coordinate new production of some components (Paolo)
- support U/V chambers production; **finalized CERN order**

## Links to main GEM documentation

- GEM user manual (sort of): <https://docs.google.com/document/d/1QWbZPQZJ9sGWcWRkJDHlxRwA0eFlcie8kyNKTMDKzTs/edit?usp=sharing>
- Cosmic and installation test Run Log: <https://pandora.infn.it/public/cd5c37>
- Electronics MPD Firmware: [https://github.com/music964/Fpga\\_4\\_Fiber](https://github.com/music964/Fpga_4_Fiber)
- Also some entries in the SBS wiki: <https://hallaweb.jlab.org/dvcslog/SBS/>
- BigBite installation procedure (version 1): <https://pandora.infn.it/public/143c29>