INFN GEM Update:

Hardware Troubleshooting and Cosmic Data

11/04/20-11/11/20

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Recent Activities at JLab:

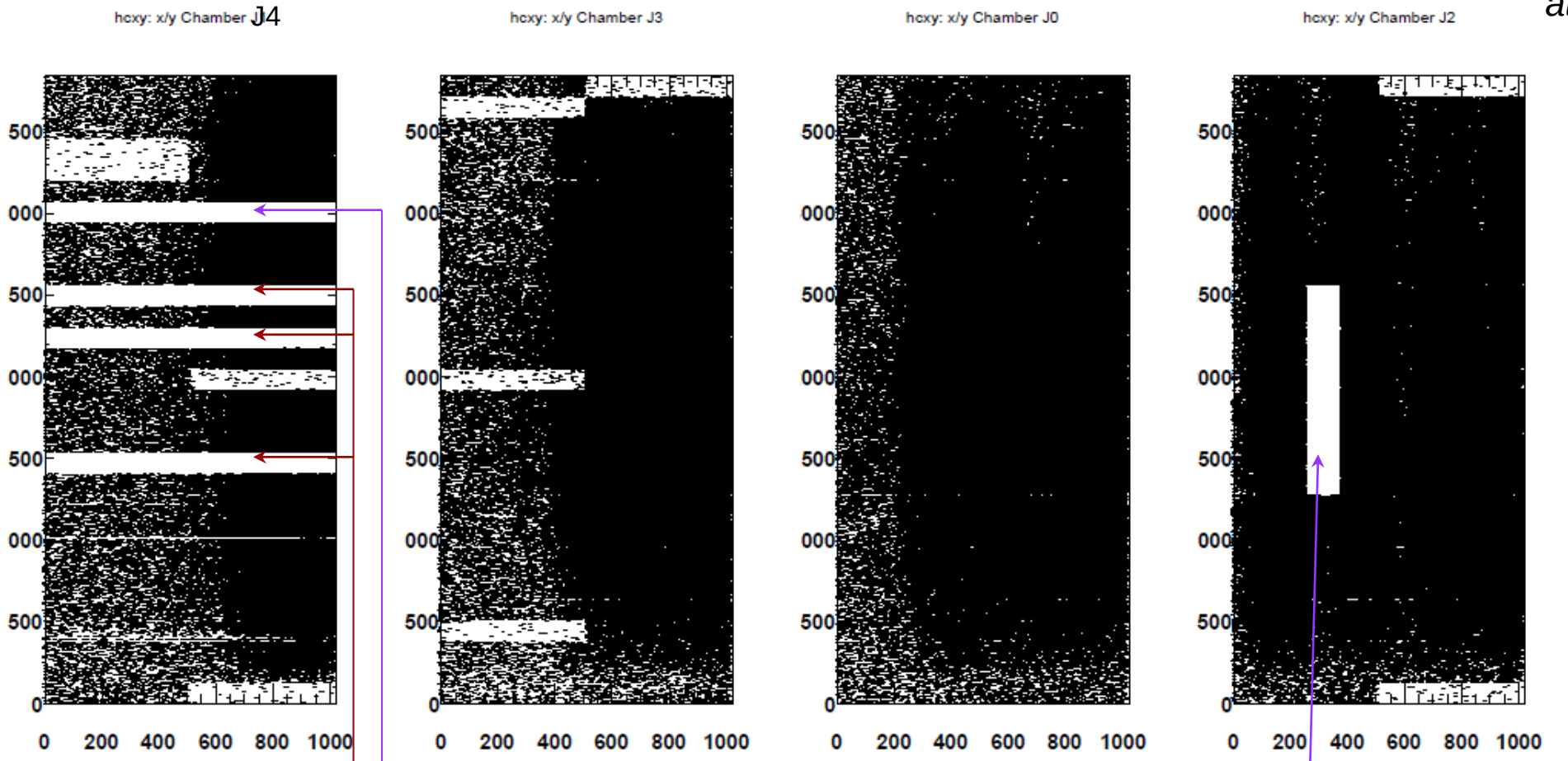
- Data (Nov. 3,4)
  - Pedestal and cosmic data on CODA 2 with AR/CO2 and HV = 3850, 4000V, Runs 4651-4654
  - Switched to CODA 3
  - Pedestal and cosmic data with AR/CO2 and HV = 4000V, Runs 135, 141, 142
  - Decoded and made some plots for runs 4651-4654
- Data (Nov. 5)
  - Pedestal and cosmic data with AR/CO2 and HV = 3900 V, Runs 145, 146
  - Decoded and made some plots for runs 135, 141, 142, 146
  - Started working with INFN config file for offline analysis software (Andrew's Code)
- Data (Nov. 6-10)
  - HV scan (cosmic data) with AR/CO2 and HV = 3800V-4150 V, by 50 V increments; Runs 147-156 or ~ 3,200,000 events
  - Pedestal runs with AR/CO2 and varied HV = 3800V-4150V ;Runs 142, 145, 157-159.
  - GEM HV was stable until run 156, when module on J4 trips HV.
- Hardware (Nov. 10, 11)
  - GEM HV on lowest module of chamber J4 trips off when going to 4150 V. Most likely a sector of the module shorted.
  - Begin work on replacing cable trays (from plastic to metal) for at least chambers J2 and J0, best overall chambers, maybe chamber J3 just to be safe.

Before: Hit Map (Cosmic run 4605) Oct 7-8

(statistics: files _0-101 or 320000 events)
gas flow ~ ½ of “nominal” values
HV = 4000V

MPD18 returned in Hit

NOTE: use pedestal 4603 at HV=4000 V



Card on MPD 14

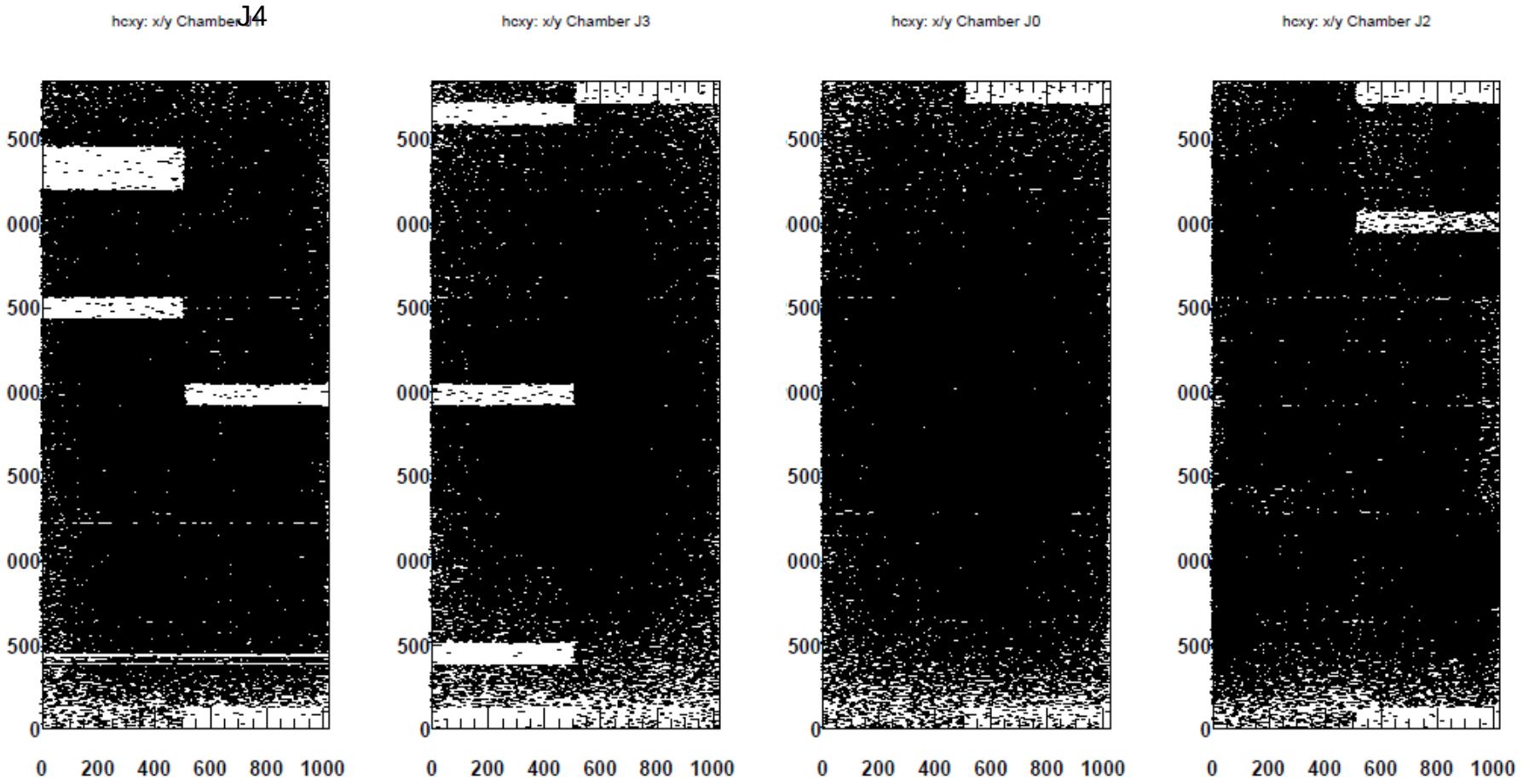
disabled cards in MPD7
bad histos, gives timeout when enabled

“missing” / not detected cards

Hit Map (Cosmic run 4654) Nov 4

(statistics: files _0-78 or ~ 241000 events)
AR/CO2 gas flow ~ ½ of “nominal” values
HV = 4000V

NOTE: use pedestal 4651 at HV=4000 V



Conclusions:

- 4 APV cards on MPD 7 of J4 are now good
- Increase in 0.1 V of LV makes MPD 17 stable on J3
- 1 APV card on MPD 14 of J2 is good
- Run 4653 is HV = 3850 V and run 4652 is HV = 4000 V. Hit Map looks similar to 4654.
- All plots for run 4654 and before are with CODA 2 DAQ.

Pedestal RMS vs Channel #, Run 142 Nov 5, HV=4000 V, AR/CO2 gas, CODA3

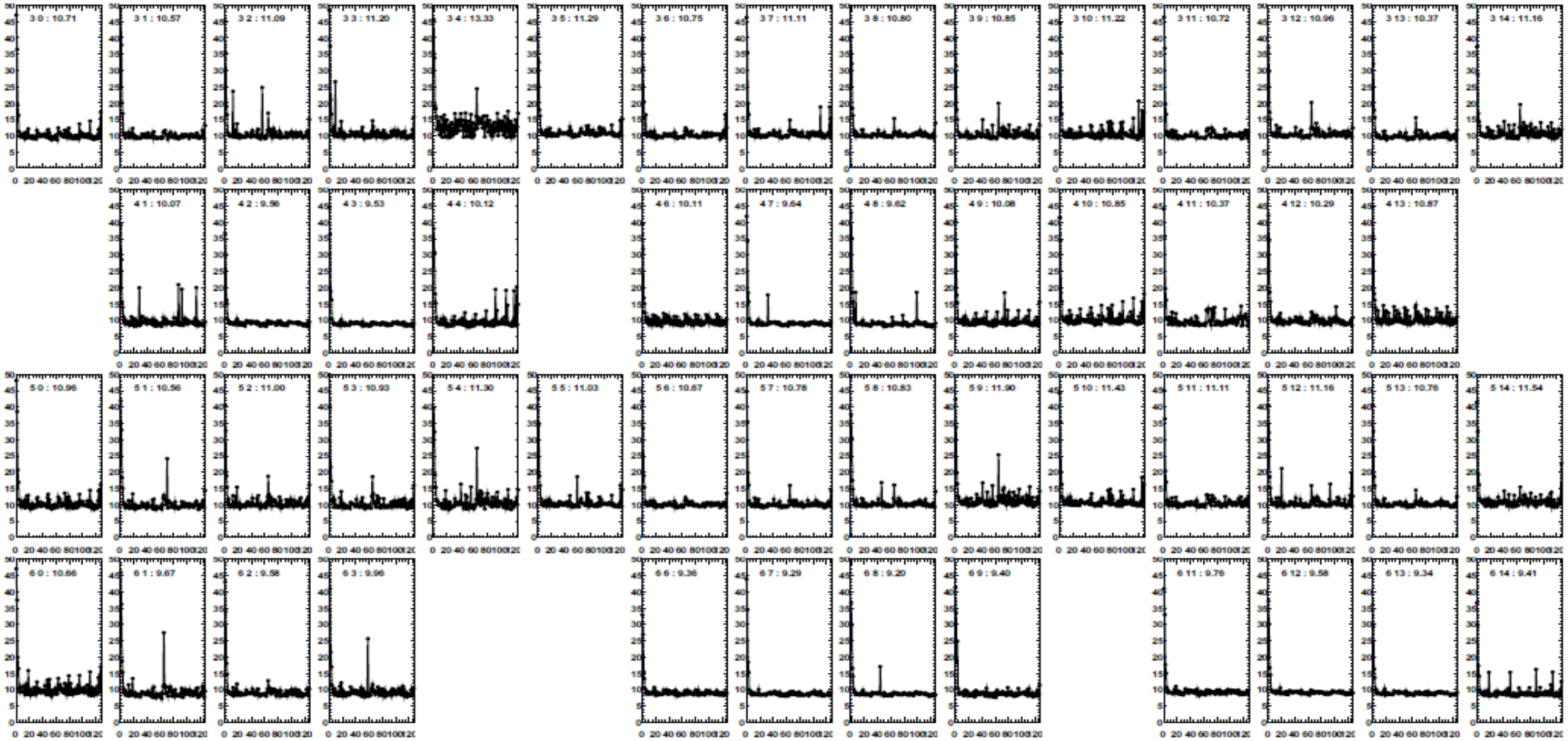
- Plots for each APV card by MPD on Chamber J0.

MPD 3

MPD 4

MPD 5

MPD 6



Pedestal RMS vs Channel #, Run 142 Nov 5, HV=4000 V, AR/CO2 gas, CODA 3

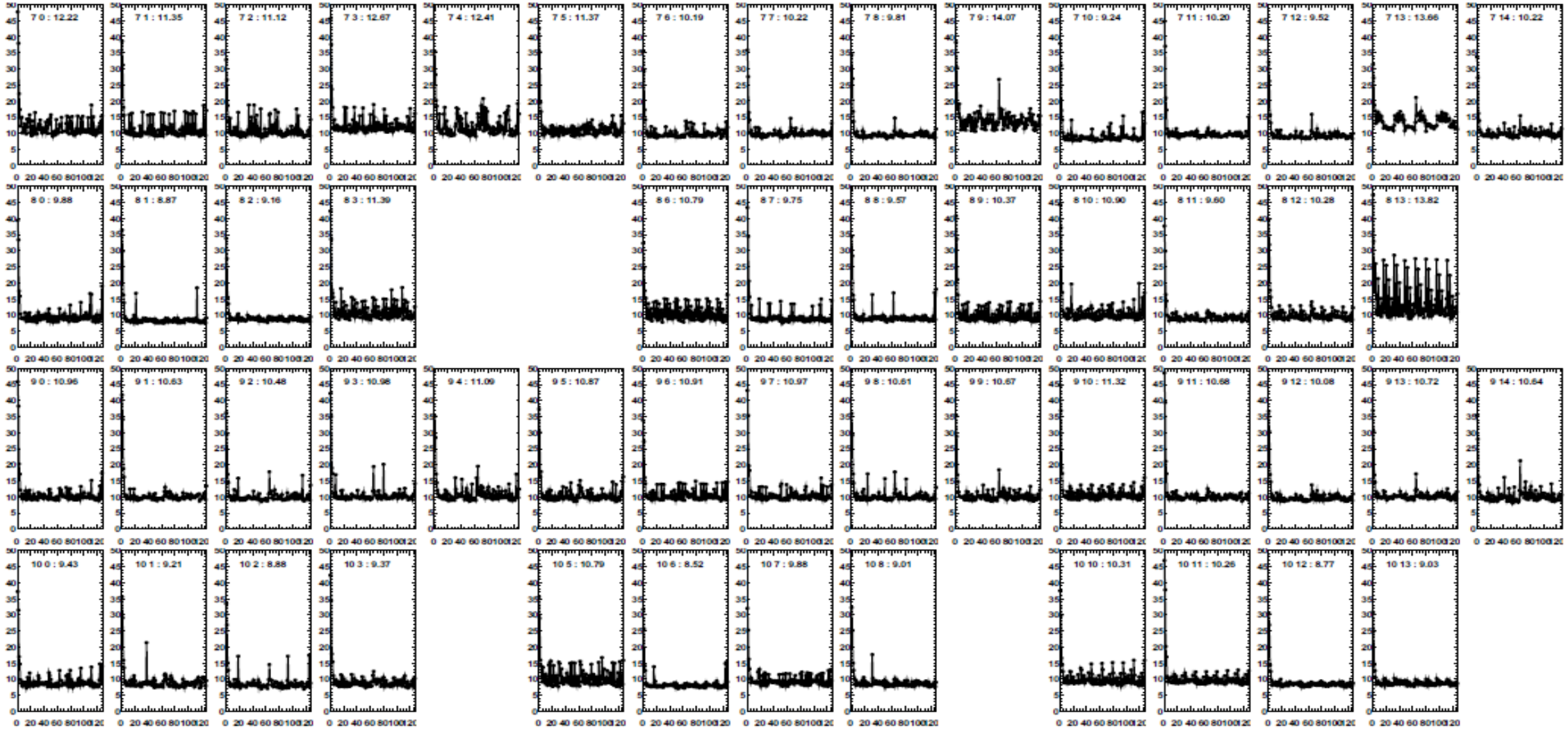
- Plots for each APV card by MPD on Chamber J4.

MPD 7

MPD 8

MPD 9

MPD 10



Pedestal RMS vs Channel #, Run 142 Nov 5, HV=4000 V, AR/CO2 gas, CODA 3

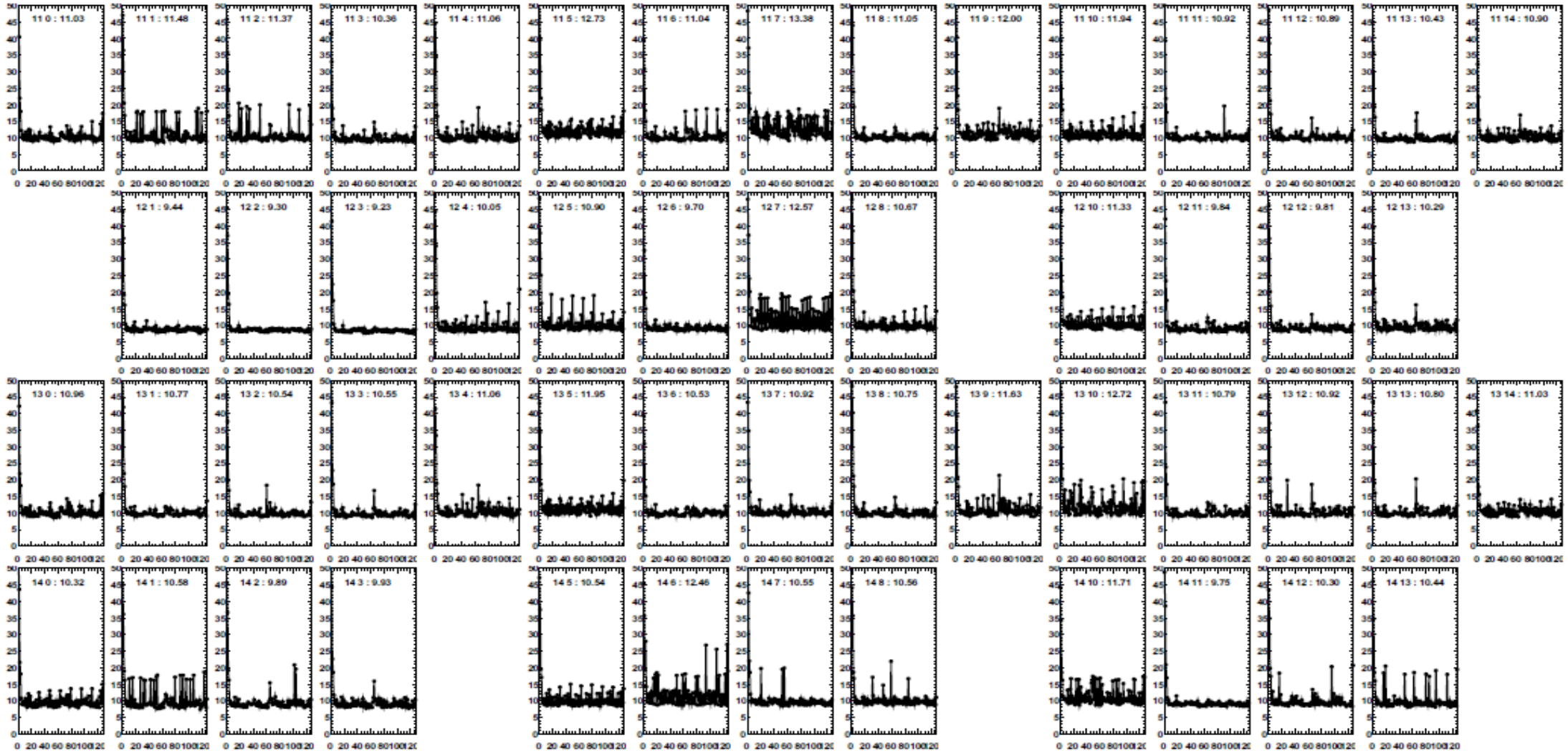
- Plots for each APV card by MPD on Chamber J2.

MPD 11

MPD 12

MPD 13

MPD 14



Pedestal RMS vs Channel #, Run 142 Nov 5, HV=4000 V, AR/CO2 gas, CODA 3

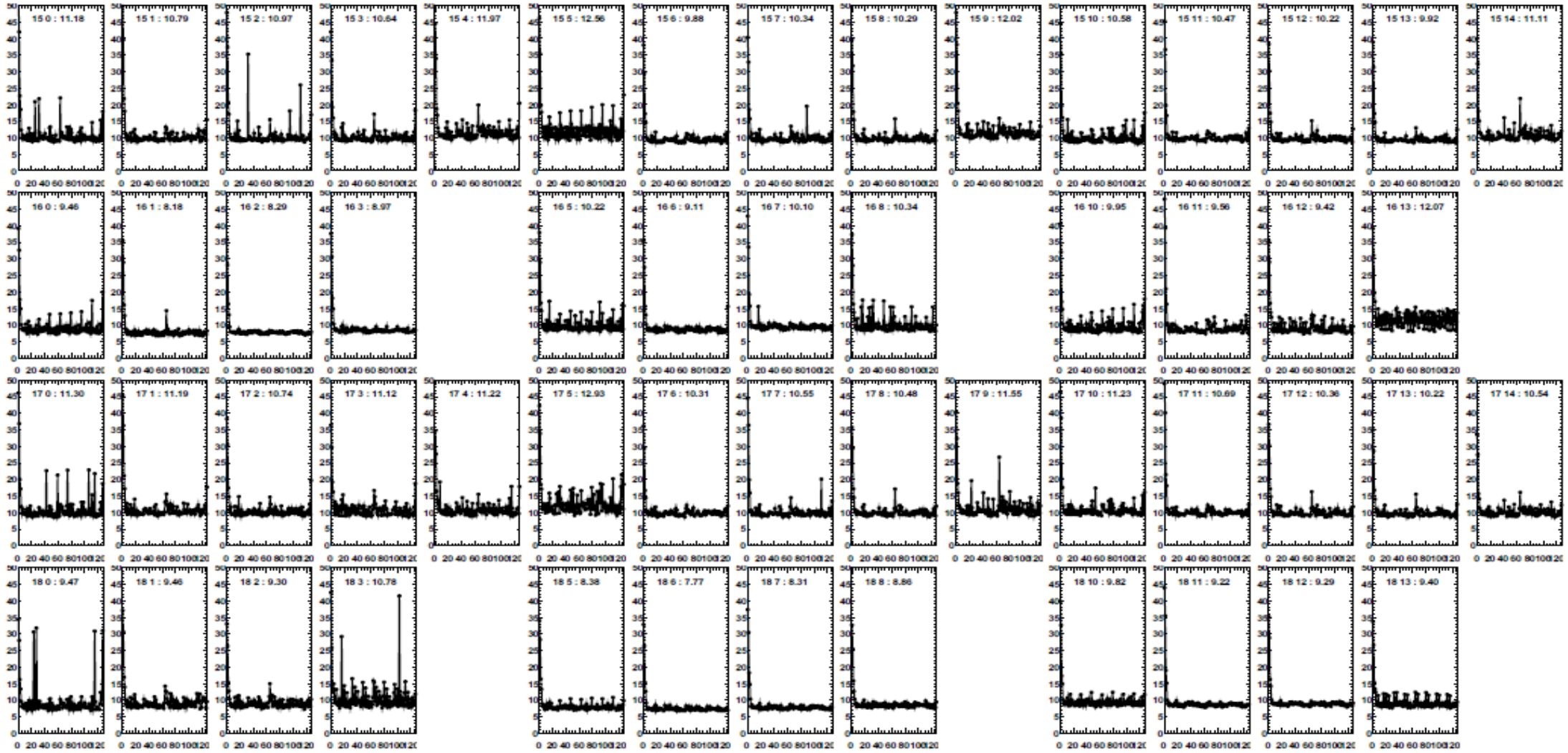
- Plots for each APV card by MPD on Chamber J3.

MPD 15

MPD 16

MPD 17

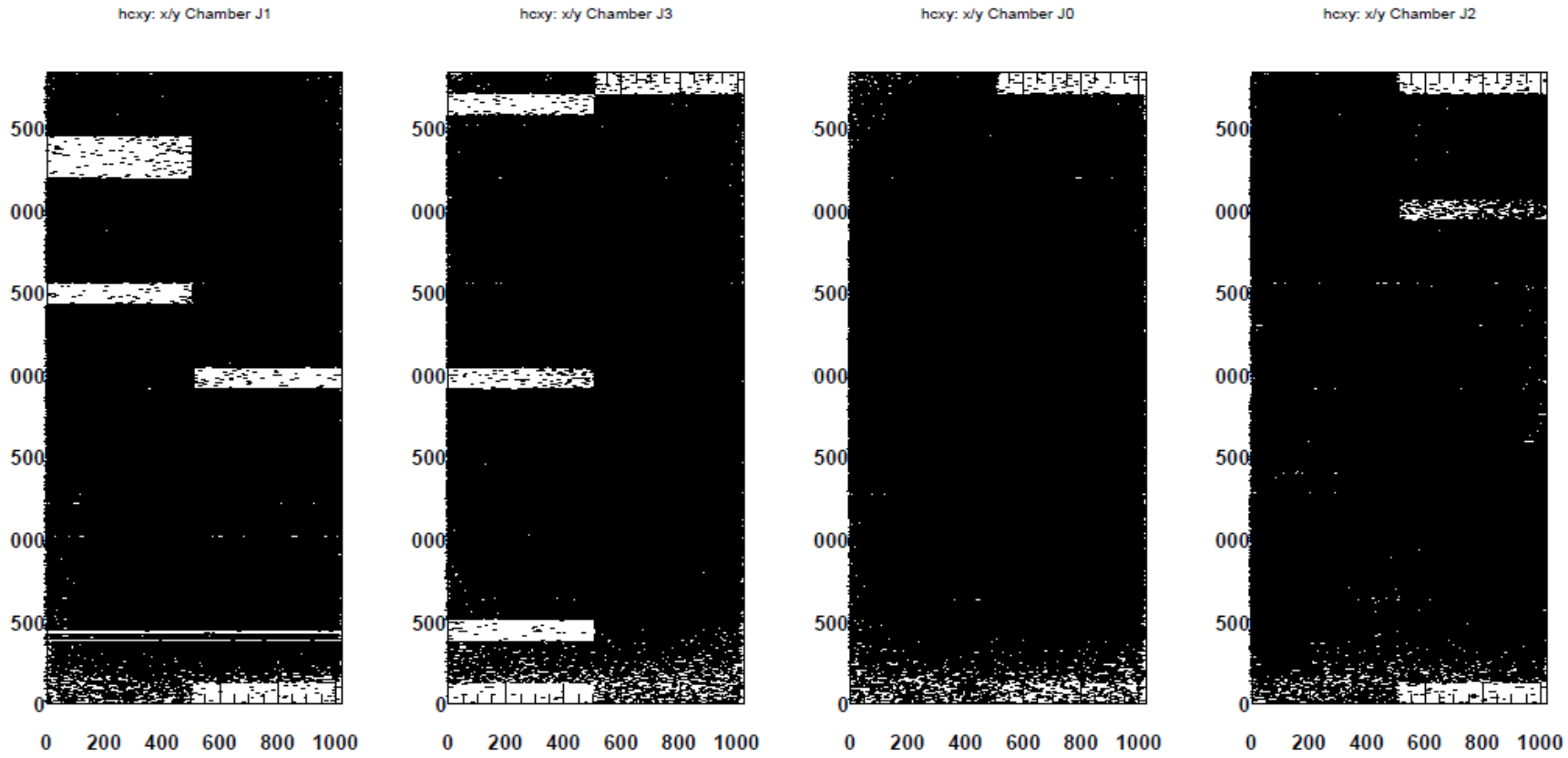
MPD 18



Hit Map (Cosmic run 141) Nov 4-5

(statistics: ~ 514000 events)
AR/CO2 gas flow ~ ½ of “nominal” values
HV = 4000V

NOTE: use pedestal 142 at HV=4000 V



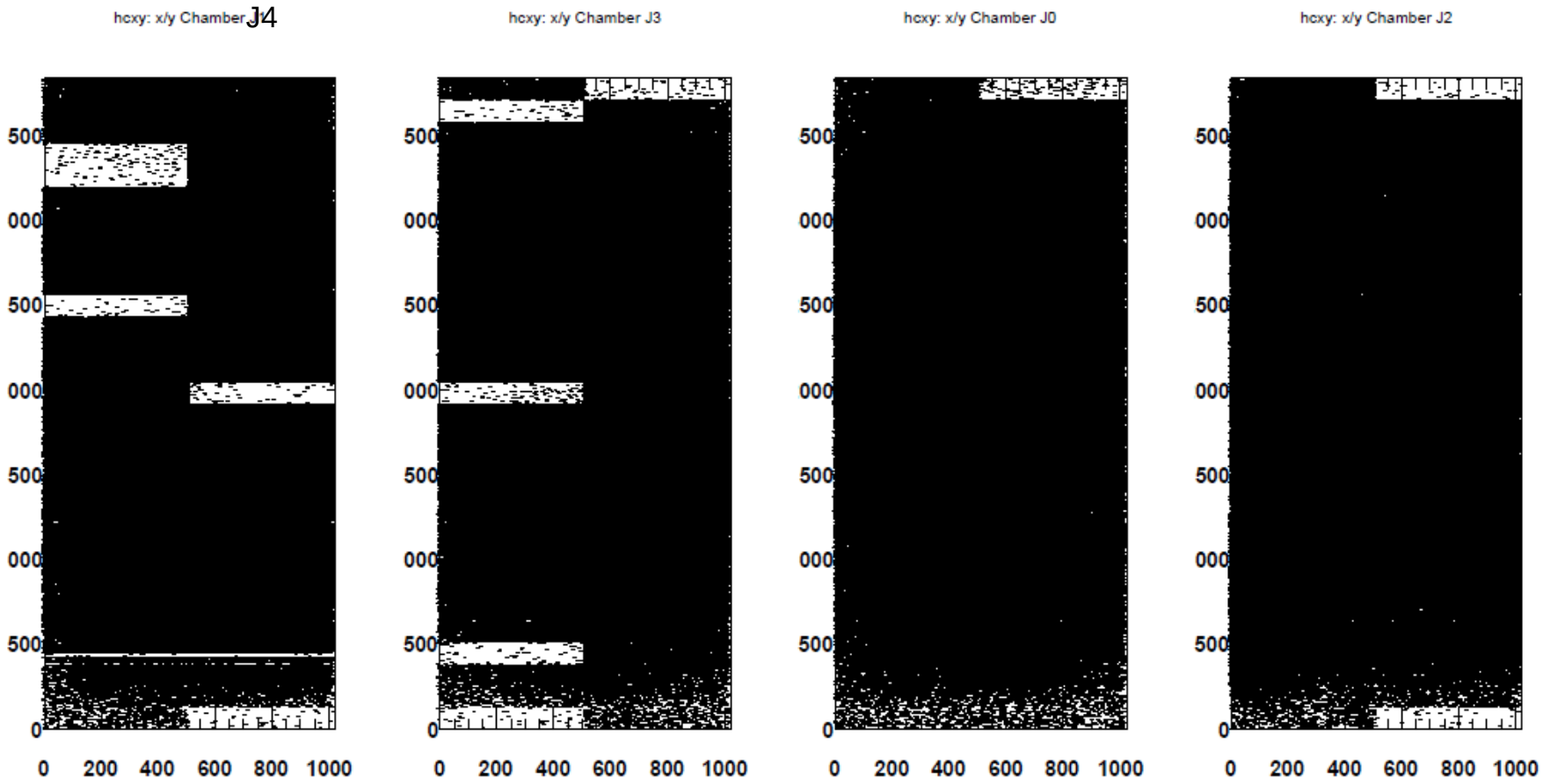
Conclusions:

- Uses CODA 3 and is similar if not the same as CODA 2
- Faulty HV contact on upper part of J2 corresponds to MPD 14. Most likely a poorly soldered resistor.

Hit Map (Cosmic run 147) Nov 6

(statistics: ~ 504000 events)
AR/CO2 gas flow ~ ½ of “nominal” values
HV = 4100V

NOTE: use pedestal 142 at HV=4000 V

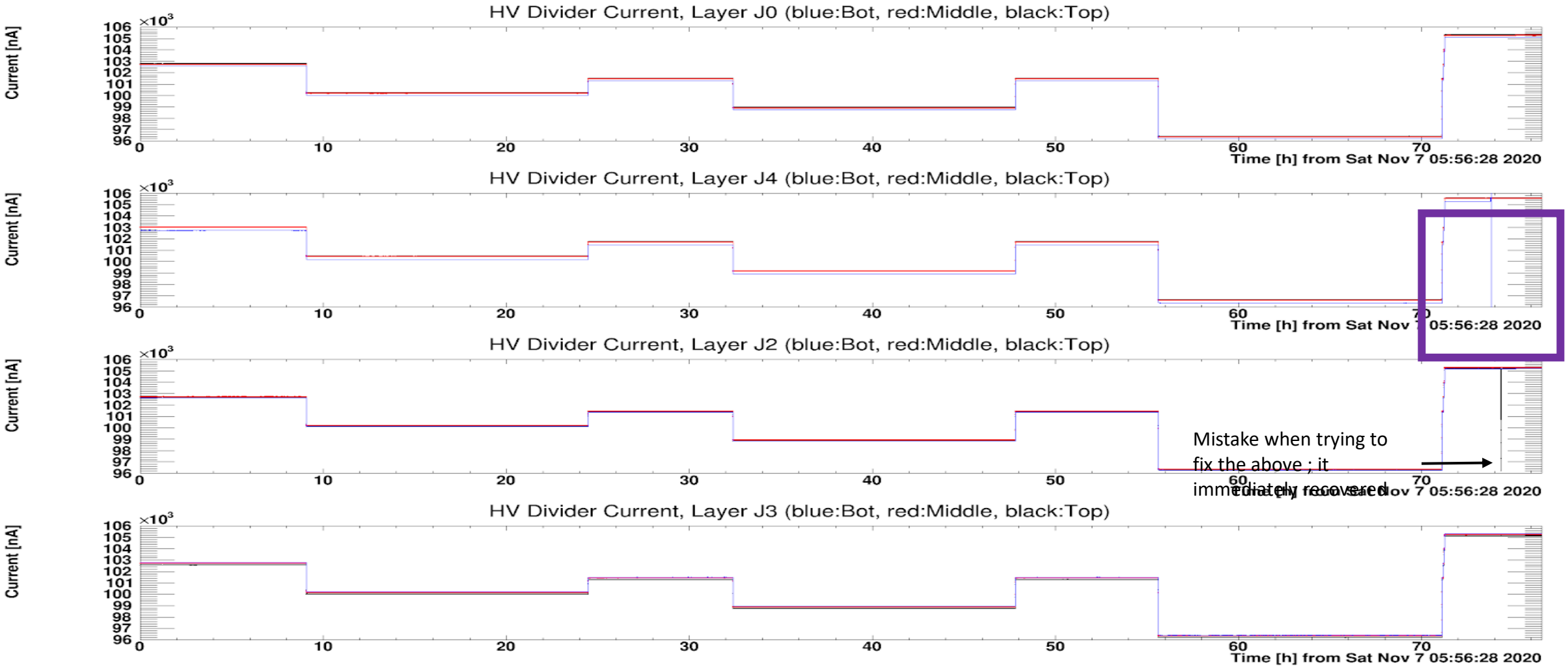


Conclusions:

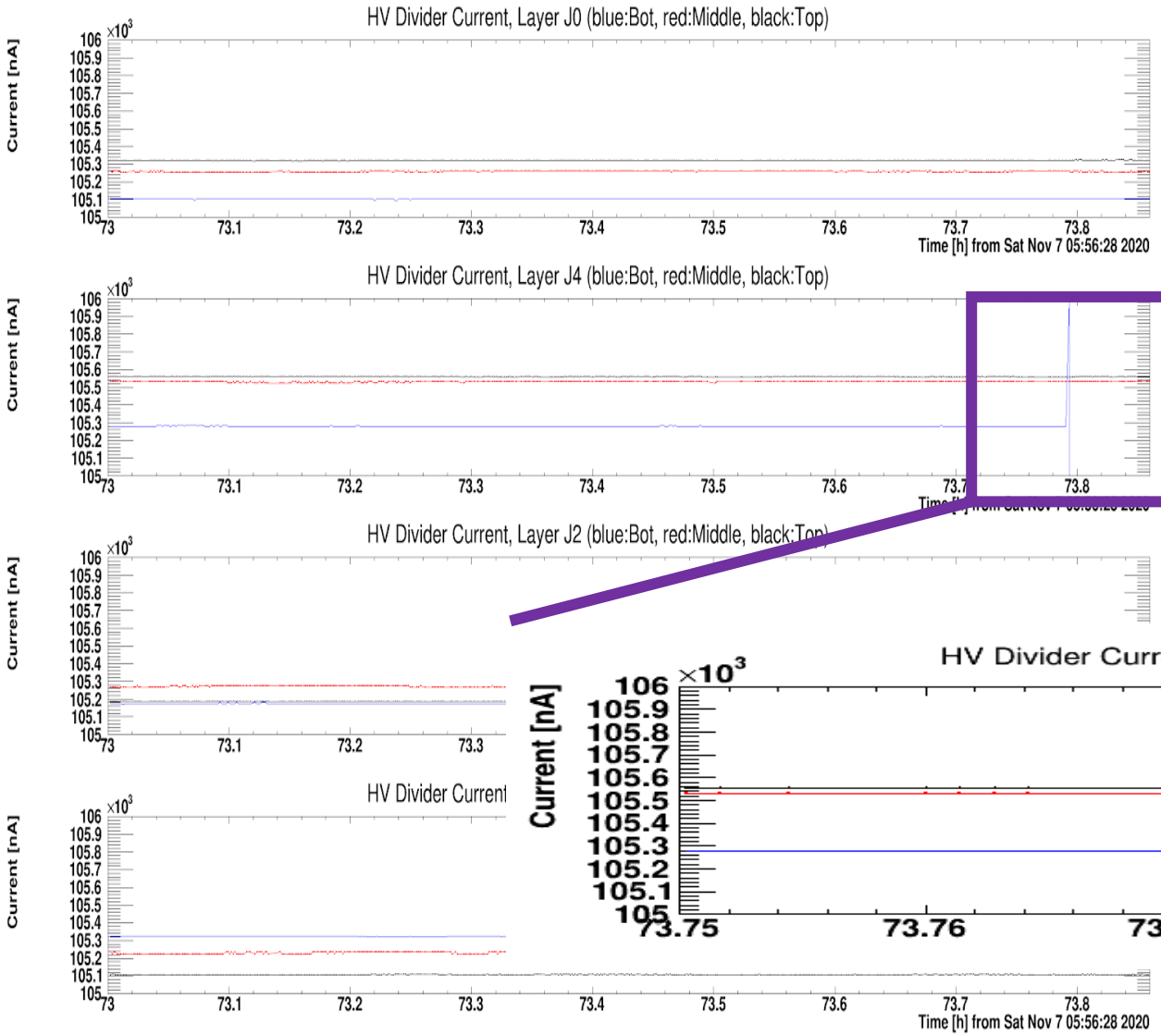
- Either increase in LV of 0.1 V or CODA 3 makes the 3 APV cards on MPD 17 stable.
- Increase HV recovers faulty sector of MPD 14 on J2

HV Currents Nov. 7-10

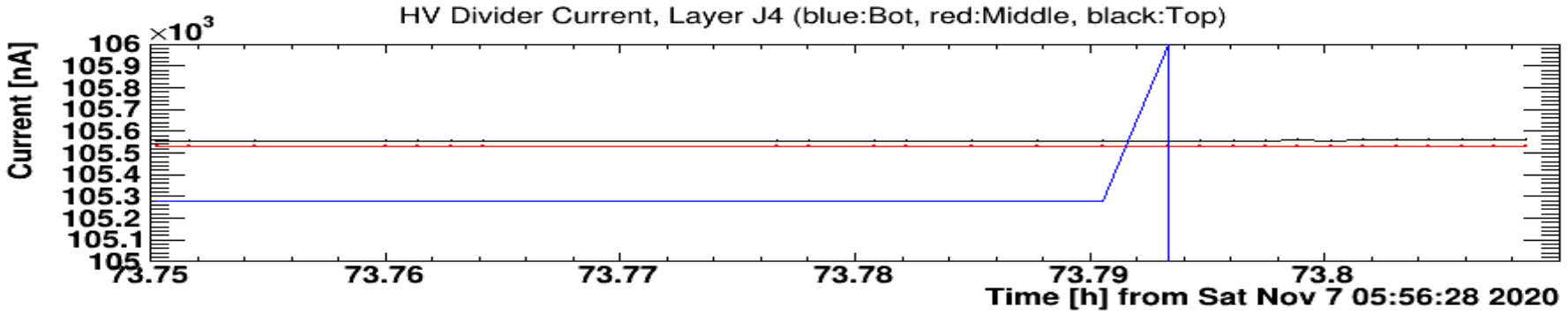
4050 V 3950 V 4000 V 3900 V 4000 V 3800 V 4150 V



Zoom-In on HV Ch 5 Nov. 10



- Trip time was 500 millisecs
- Get data point every 5 secs
- No unusual behavior before the trip, it actually was a very stable channel.



What to do next?

- Hardware:
  - Finish changing plastic cable trays to metal cable trays for at least chambers J2 and J0. Maybe J3. Once change is complete verify Low Level Histograms and Pedestal RMS plots.
  - Reconnect one noisy card on MPD 8
  - Start building the GEM frame in the next few weeks
  - If necessary, remove the lowest module on J4 from the chamber and move to the single chamber setup. Apply a small amount of HV (~100 V) and use a thermal camera to determine where the shorted sector is on the module.
- Data Analysis:
  - Decode and make corresponding plots for runs 147-159
  - Use the HV scan data to make a plot of Efficiency vs HV
  - Optimize alignment parameters for INFN config in SBS offline analyzer (Andrew's Code).
  - Once properly aligned, reanalyze recent data with SBS offline analyzer.

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- Data (Nov. 6-10)
  - HV scan (cosmic data) on CODA 3 with AR/CO2 and HV = 4100 V, 4050 V, 3950 V, 4000 V, 3900 V, 3800 V, 4150 V ; Runs 147, 148 & 150, 151, 152 & 154, 153, 155, 156 respectively. Or ~ 3,200,000 events
  - Pedestal runs on CODA 3 with AR/CO2 and HV = 4150 V, 4100 V, 4000 V, 3900 V, 3800 V ; Runs 157, 158, 142, 145, 159 respectively.
  - Decoded and made some plots for runs
  - GEM HV was stable until run 156
- Hardware (Nov. 10, 11)
  - GEM HV on lowest module of chamber J4 trips off when going to 4150 V. Most likely a sector of the module shorted.
  - Begin work on replacing cable trays (from plastic to metal) for at least chambers J2 and J0, best overall chambers, maybe chamber J3 just to be safe.