

DL DAQ / SlowCtrl status

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DL CM, SBU, May 2026



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Status SlowCtrl

- » Seems to be working
- » Small snafu during data taking – slow ctrl not streamed to root files initially. Reconstructed from database.
- » ToDo item: Upgrade run database to include more info, annotate existing runs.
- » Anything missing?

Status DAQ

- » Worked OKish
- » Small bug in GEM writing: Some border channels not written correctly (structure packing issue). These might be unused channels anyway. (Fixed now)
- » Misfeatures of the firmware we used:
 - » “Bubble” (short readout) in the first 20 events that kills fast readout. Unclear why this happens.
 - » Hacked around it: Read out 20 events in slow mode, reset, then fast mode works 100%
 - » Somehow, event and event time reported by MPD is offset by 1.
 - » This is taken care of in the analysis. Annoying
 - » Intermediate buffers are shallow. Can overload on-fpga event builder. Frames lost / sync broken.
 - » Avoid by limiting events in flight.

Upgraded firmware

- » Major rewrite:
 - » Stripped out histogramming. Buld in better raw data streaming. Can histogram on host side, but raw traces give more info!
 - » More buffer space. Faster event building. Bigger readout buffer.
 - » No bubbles
- » Tested, but not employed during beam time.

Upgraded frontend

- » Also upgraded frontend. Multi-threaded to hide data transport latency.
- » More online data consistency checks (but no issues seen in short test)
- » Speed: 2.4kHz, 80-90 MByte/s.
 - » This might be network bottlenecked
 - » Could bond network interface to get 2x (max). But CPU might hit limit before

Next steps

- » Close to limit what MPD4 + APV + VMECPU can do
- » Other readout system? I can write drivers only if hardware in hand.
- » (I will not learn JLAB DAQ)

GEM readout

- » Data from GEM seems “suboptimal”
- » Unclear if this happens during recording or readout
- » Question: Does the pedestal depend on the CCD column nr inside the APV?
- » I asked Ethan to look at 100 consecutive events in two runs

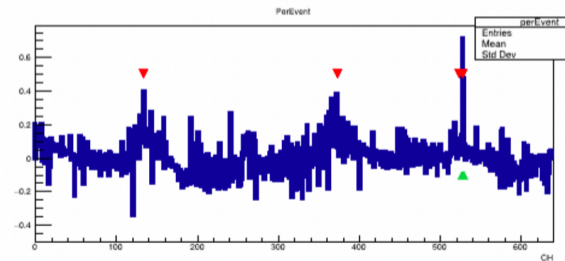
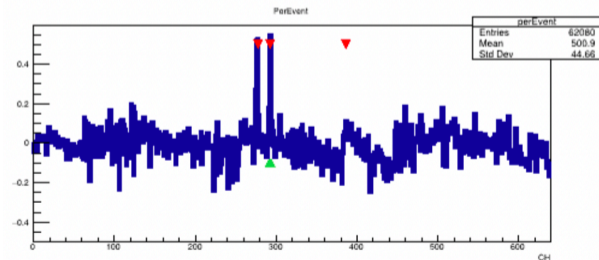
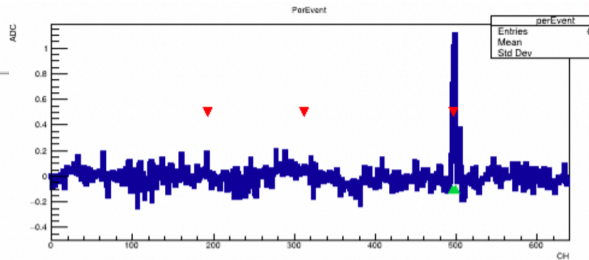
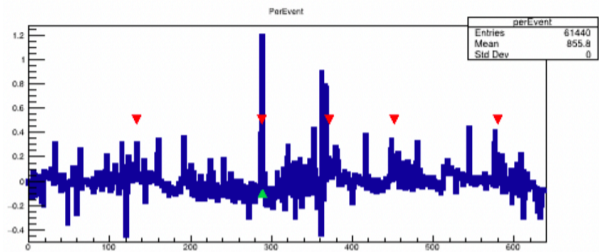
Some remarks first

- » Remember: all APV capture 6 consecutive frames over all channels
- » All APVs are read out in parallel, with channels in consecutive order (APV order), and then looping over the frames.
- » Hit finding is not perfect. Ignore the red/green triangles.
- » Data is 6-sample averaged, pedestal (approximate) and CM mode corrected, scaled by $1/1400$

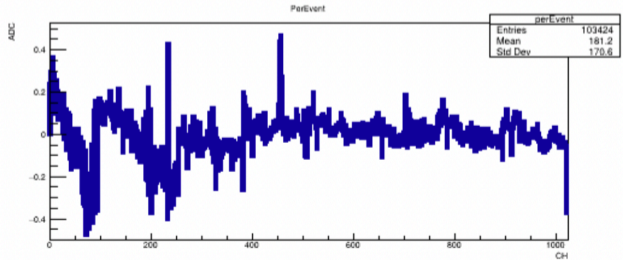
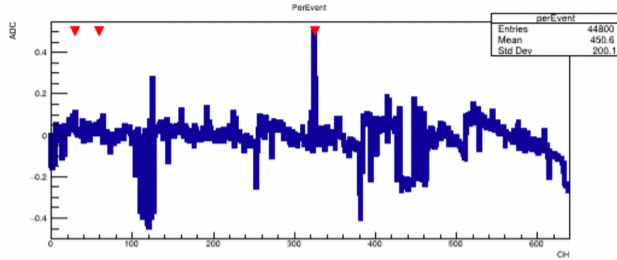


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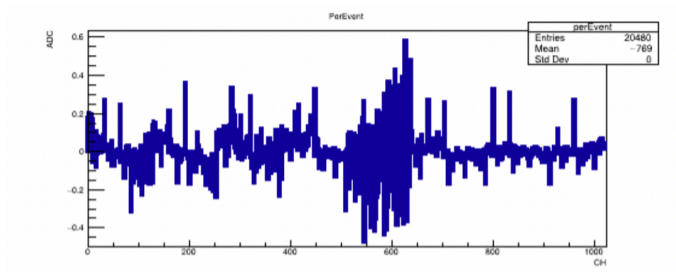
Good Clusters



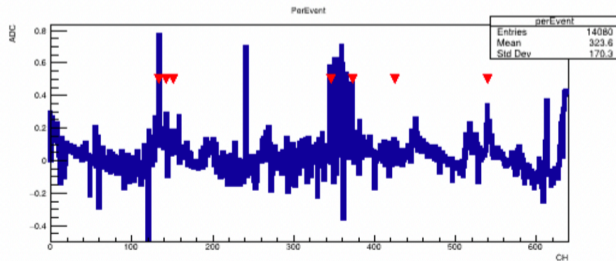
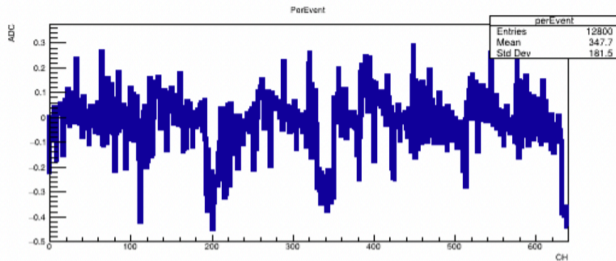
Sometimes miss a cluster. Note vertical scale.
This is in the “noise” that we show next.



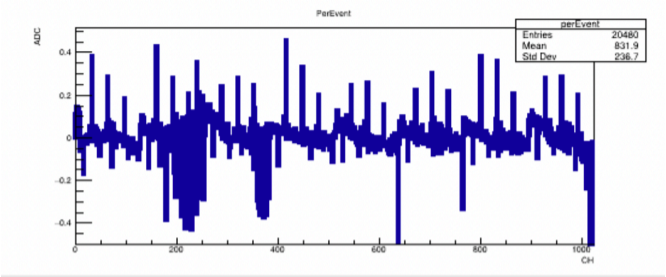
APV ringing



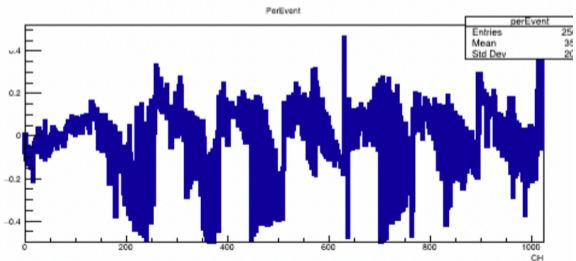
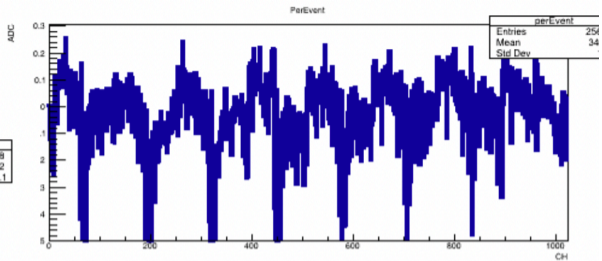
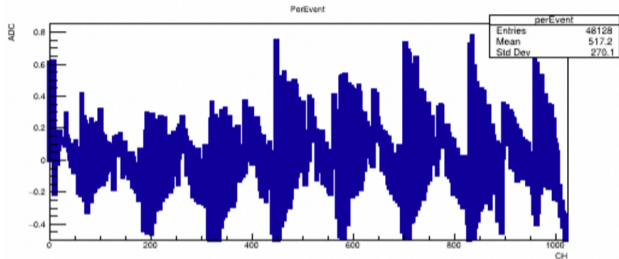
Negative/positive pulse



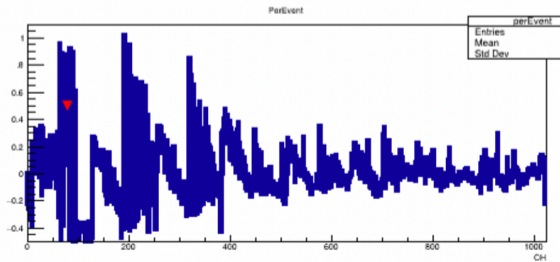
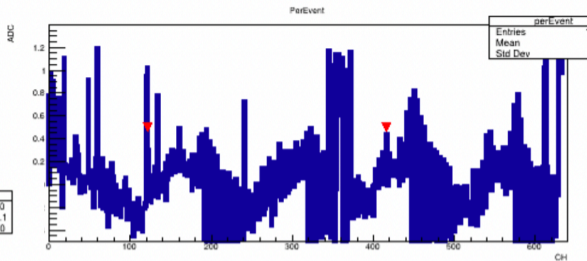
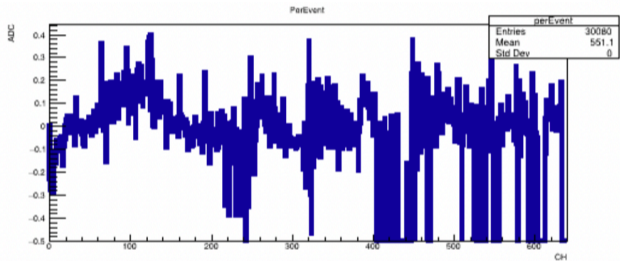
Comb



Periodic Garbage



???



Stats for Run 3815, Friday, Jan 9

Left Arm: Elastic, Right Arm: Moller

# events with behavior in 100 events	APV Ringing	Negative/ Positive Pulse	Comb	Periodic	????
GEM Left Bottom		37	100	6	7
GEM Left Top	100	28	20	2	4
GEM Right Bottom	1	25	49	13	6
GEM Right Top		82	27	6	6

Stats for Run 3815, Friday, Jan 9

Left Arm: Elastic, Right Arm: Moller

Highly correlated but not 100 %

# events with behavior in 100 events	APV Ringing	Negative/ Positive Pulse	Comb	Periodic	????
GEM Left Bottom		37	100	6	7
GEM Left Top	100	28	20	2	4
GEM Right Bottom	1	25	49	13	6
GEM Right Top		82	27	6	6

Stats for Run 4070, Thursday, Jan 22 Cosmic Both Arms

# events with behavior in 100 events	APV Ringing	Negative/ Positive Pulse	Comb	Periodic	????
GEM Left Bottom		26	100		
GEM Left Top	100	20	3		22
GEM Right Bottom		37	35	2	
GEM Right Top		100	5		

This GEM was dead

More findings