

Latency Scan for DarkLight GEMs

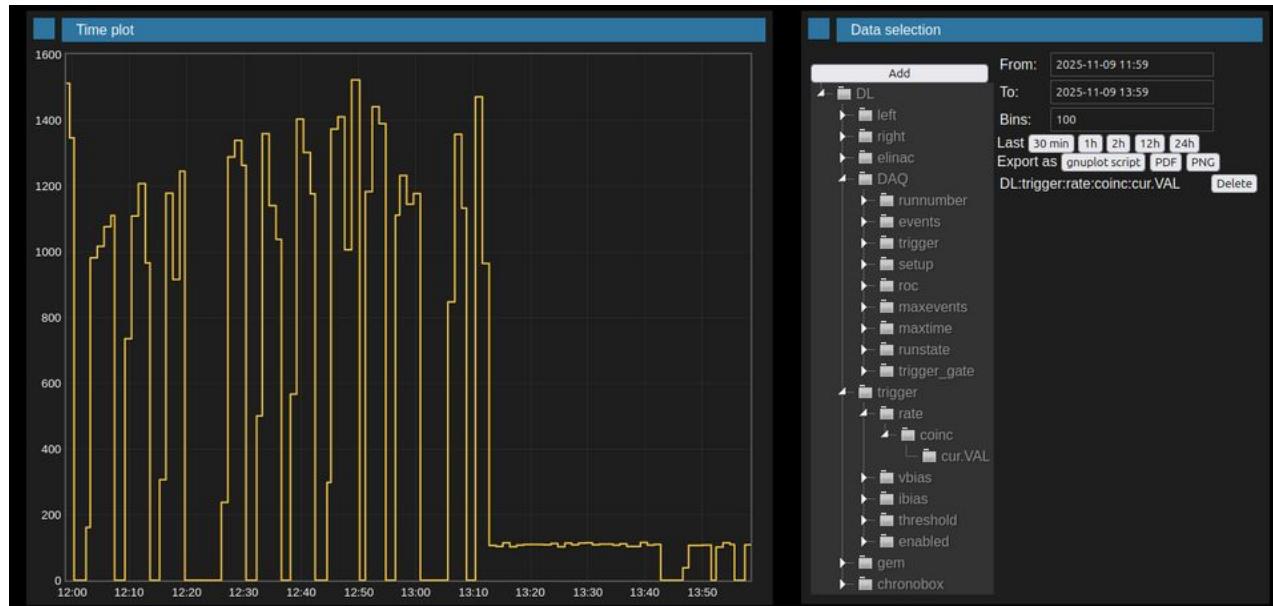
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Nov 13, 2025

Latency

- Latency is a configurable parameter in our software
- It controls the timing of the signal digitization process relative to the trigger
- Recently, we added extra cable length to the GEM readout, so the latency needs to be adjusted accordingly
- Test Lab (50 m cables) → Latency = 9
- Hall (50 + 25 m cables) → Latency = ??

Latency Scan (left arm)

- Latency values: 8, 11, 14, 17, 20, 23, 26; HV values: 3500, 3600, 3700 V
- ~ 5 min runs at each setting; Left arm only
- cavities are on -> 500k events cavities are off -> 35k events



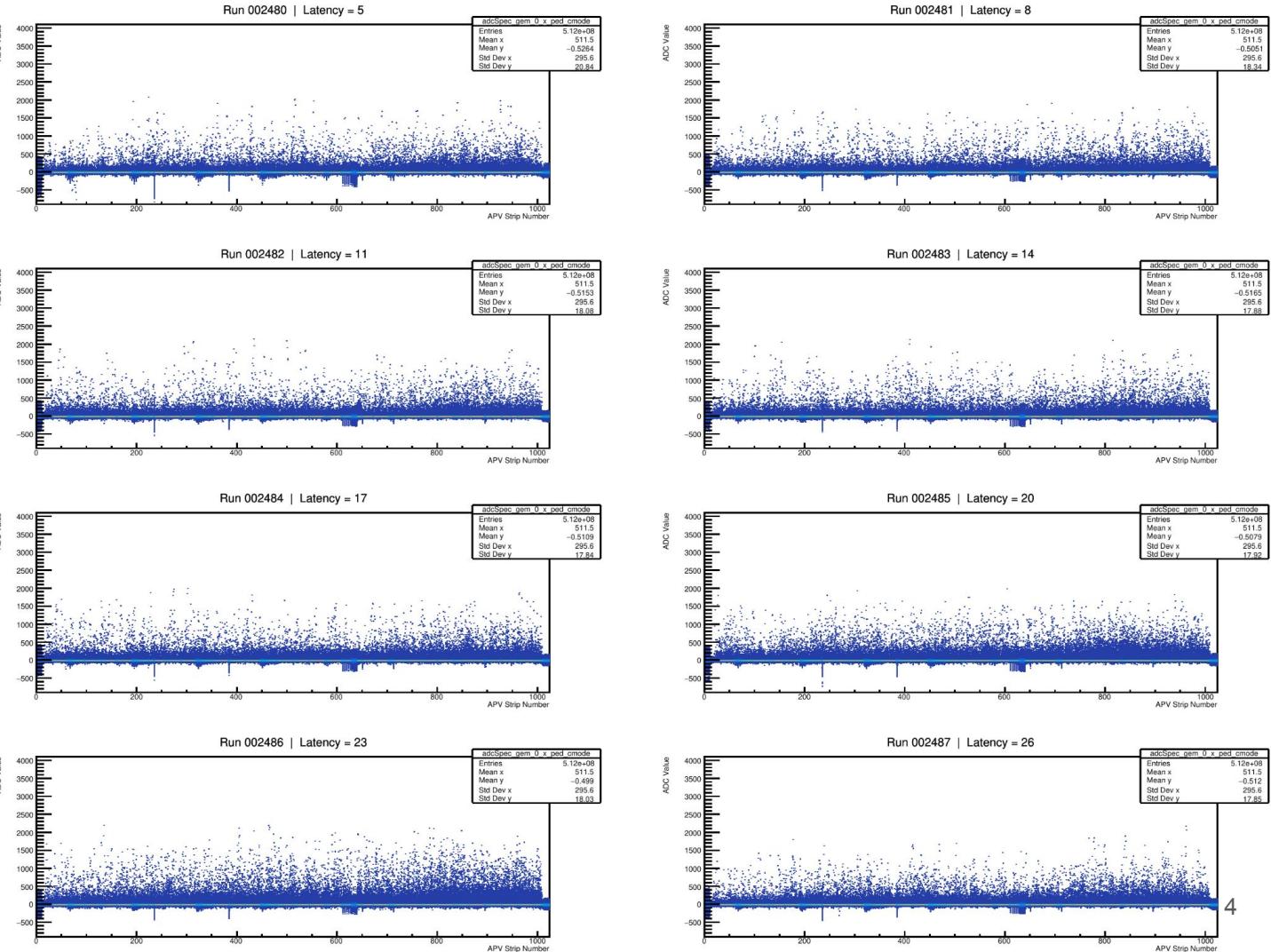
↳ adc plots after pedestal and common mode subtracted

↳ Left bottom x axis

↳ Cavities ON

↳ 500k events

↳ HV=3700 V



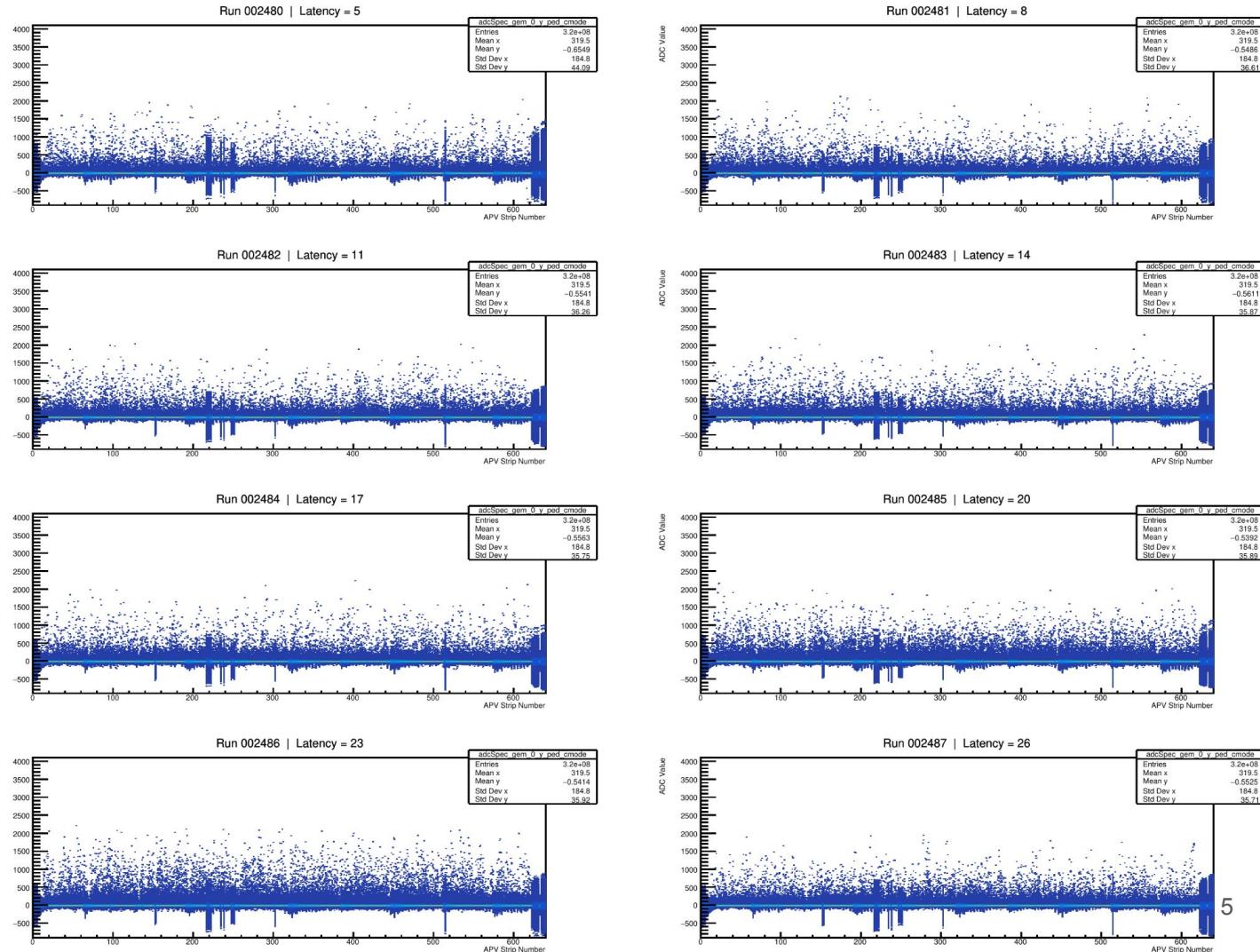
⚡ adc plots after pedestal and common mode subtracted

⚡ Left bottom y axis

⚡ Cavities ON

⚡ 500k events

⚡ HV=3700 V



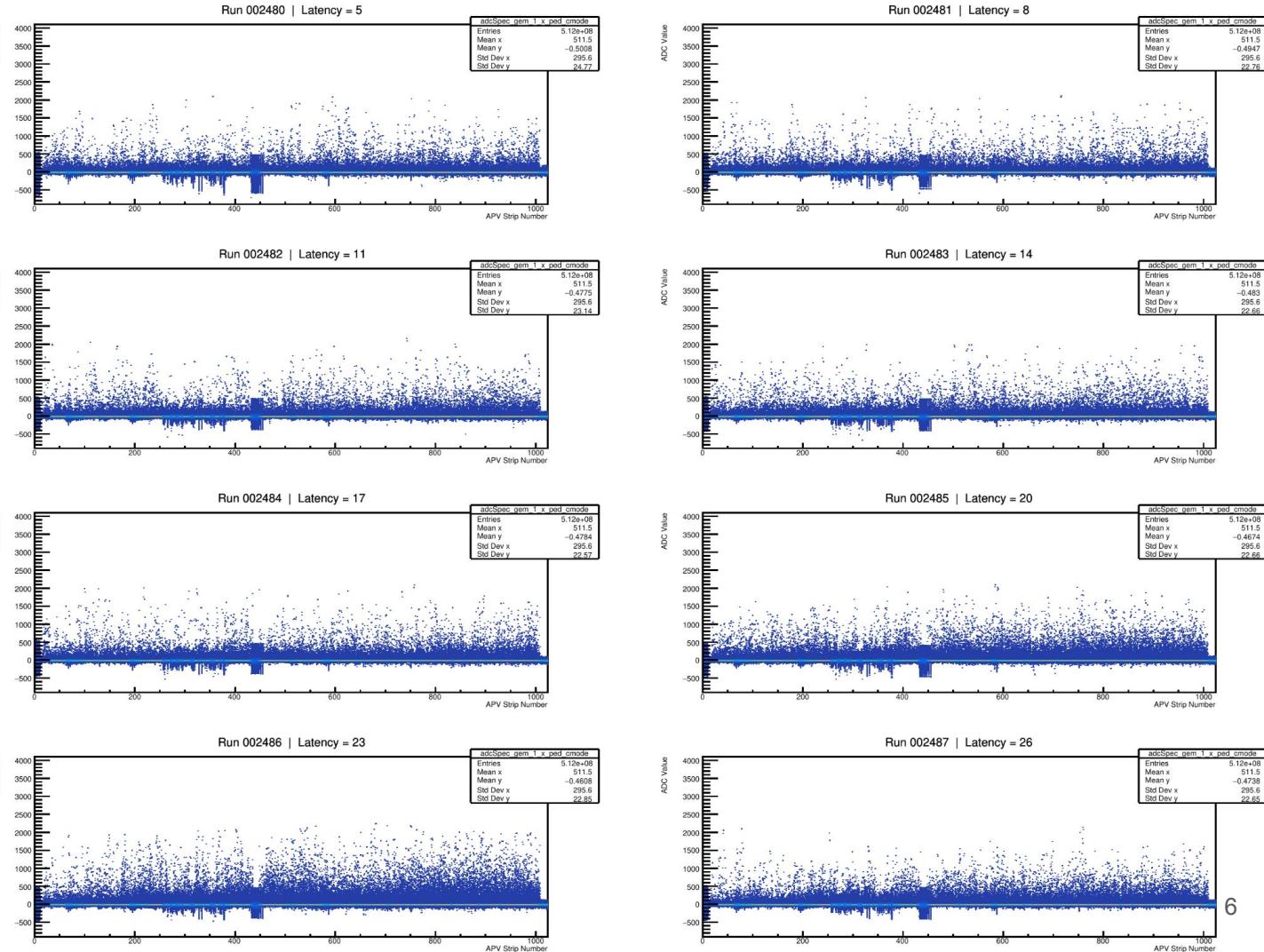
⚡ adc plots after pedestal and common mode subtracted

⚡ Left top x axis

⚡ Cavities ON

⚡ 500k events

⚡ HV=3700 V



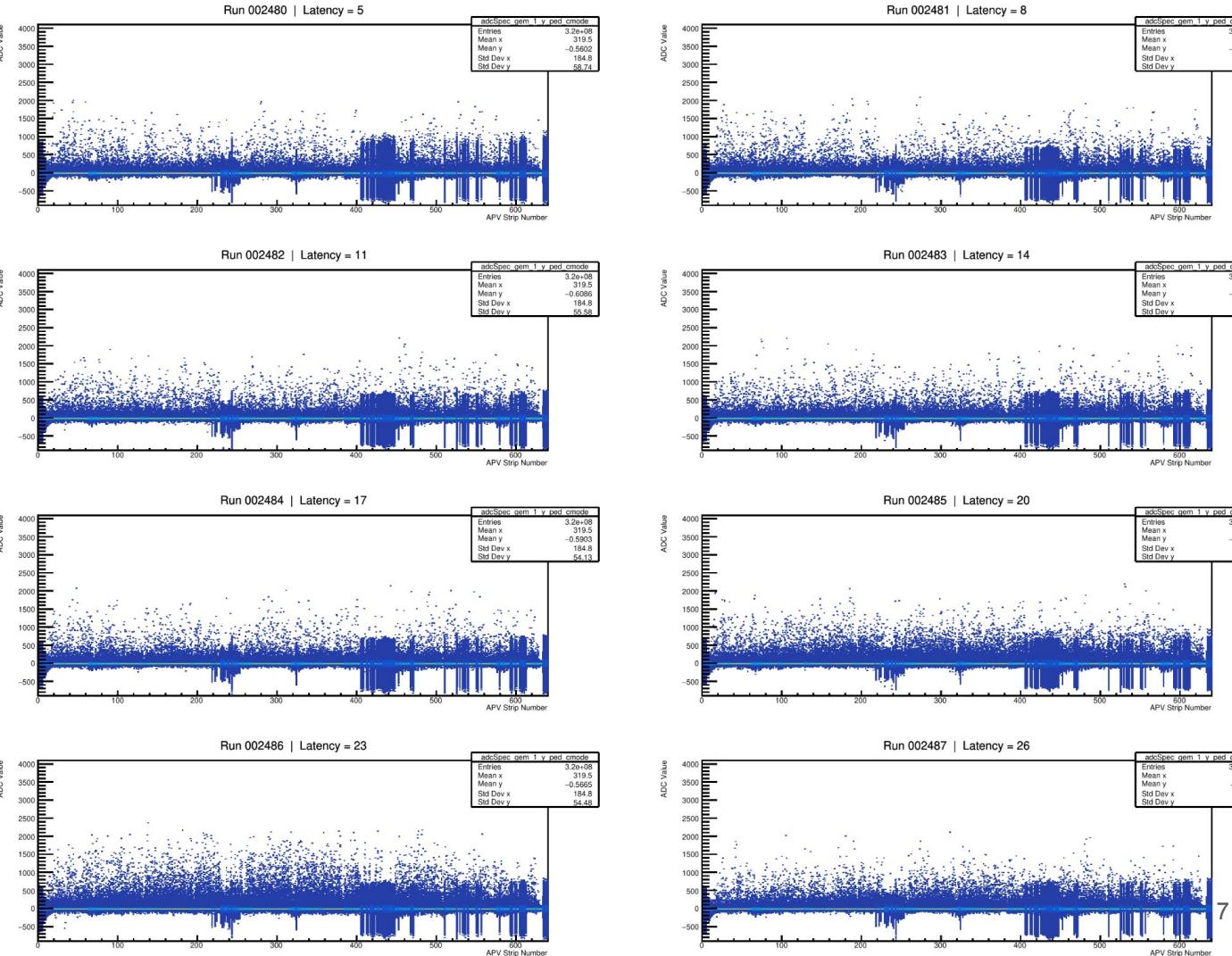
⚡ adc plots after pedestal and common mode subtracted

⚡ Left top y axis

⚡ Cavities ON

⚡ 500k events

⚡ HV=3700 V



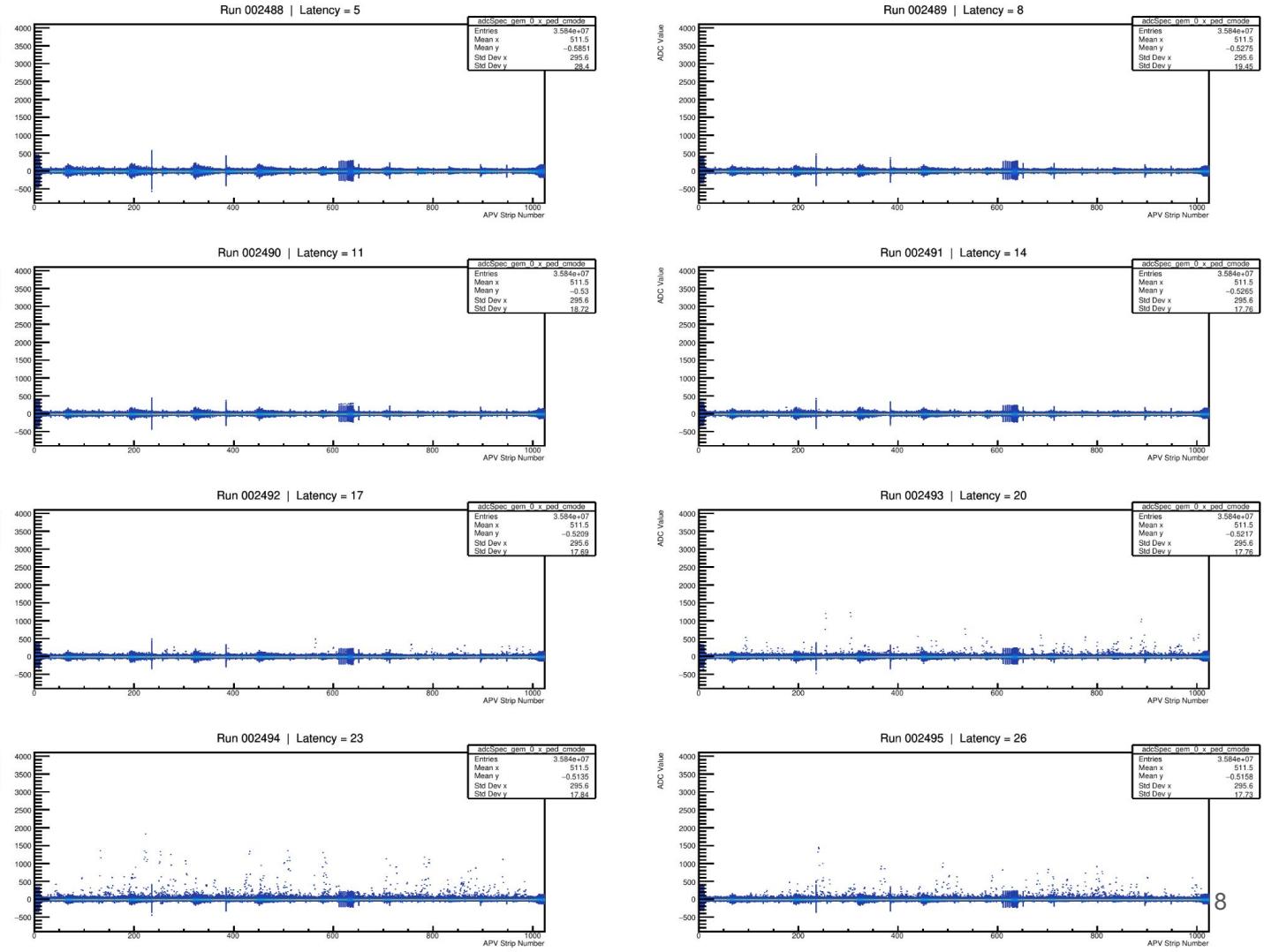
↳ adc plots after pedestal and common mode subtracted

↳ Left bottom x axis

↳ Cavities OFF

↳ 35k events

↳ HV=3700 V



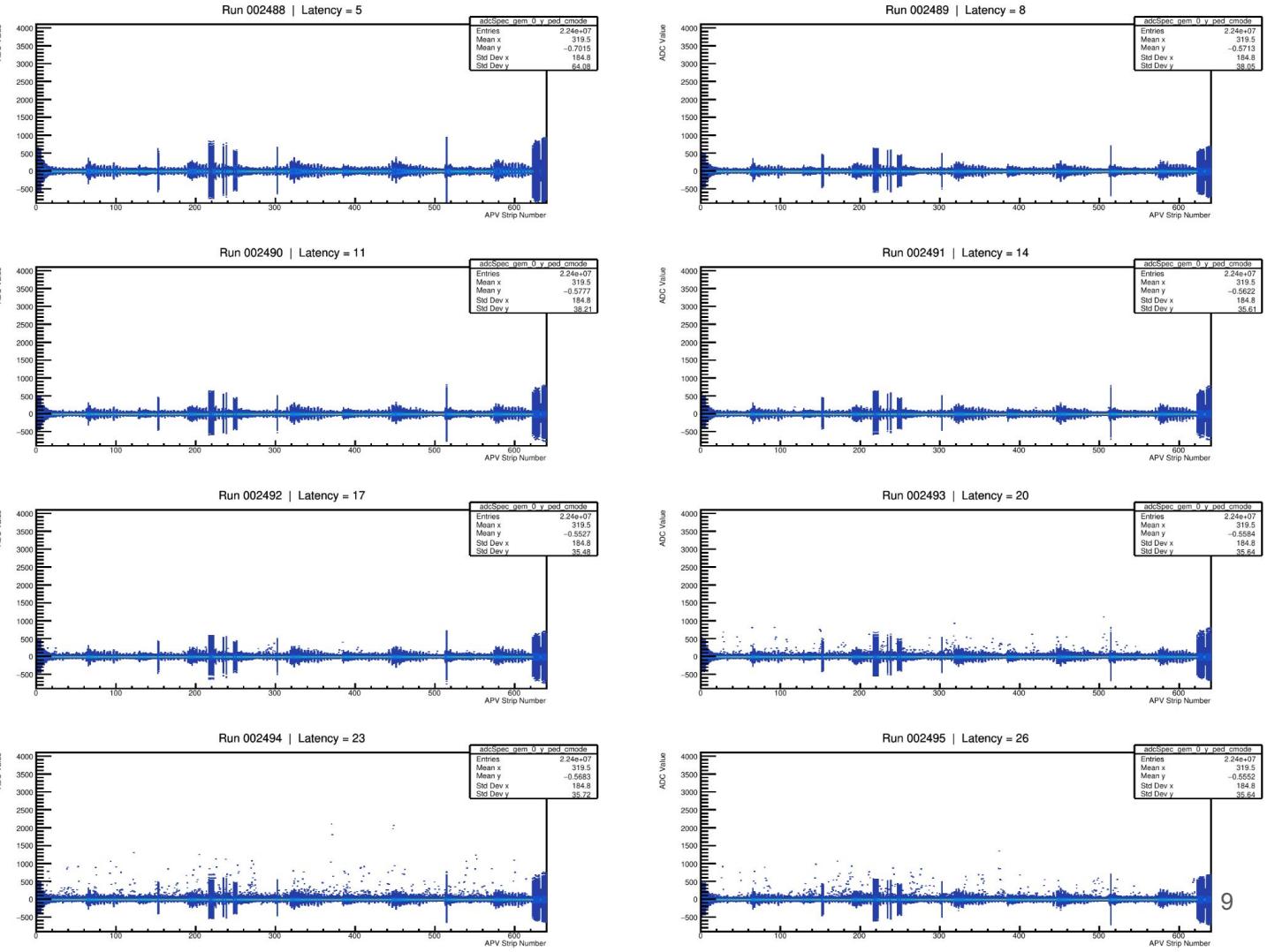
- adc plots after pedestal and common mode subtracted

- Left bottom y axis

- Cavities OFF

- 35k events

- HV=3700 V



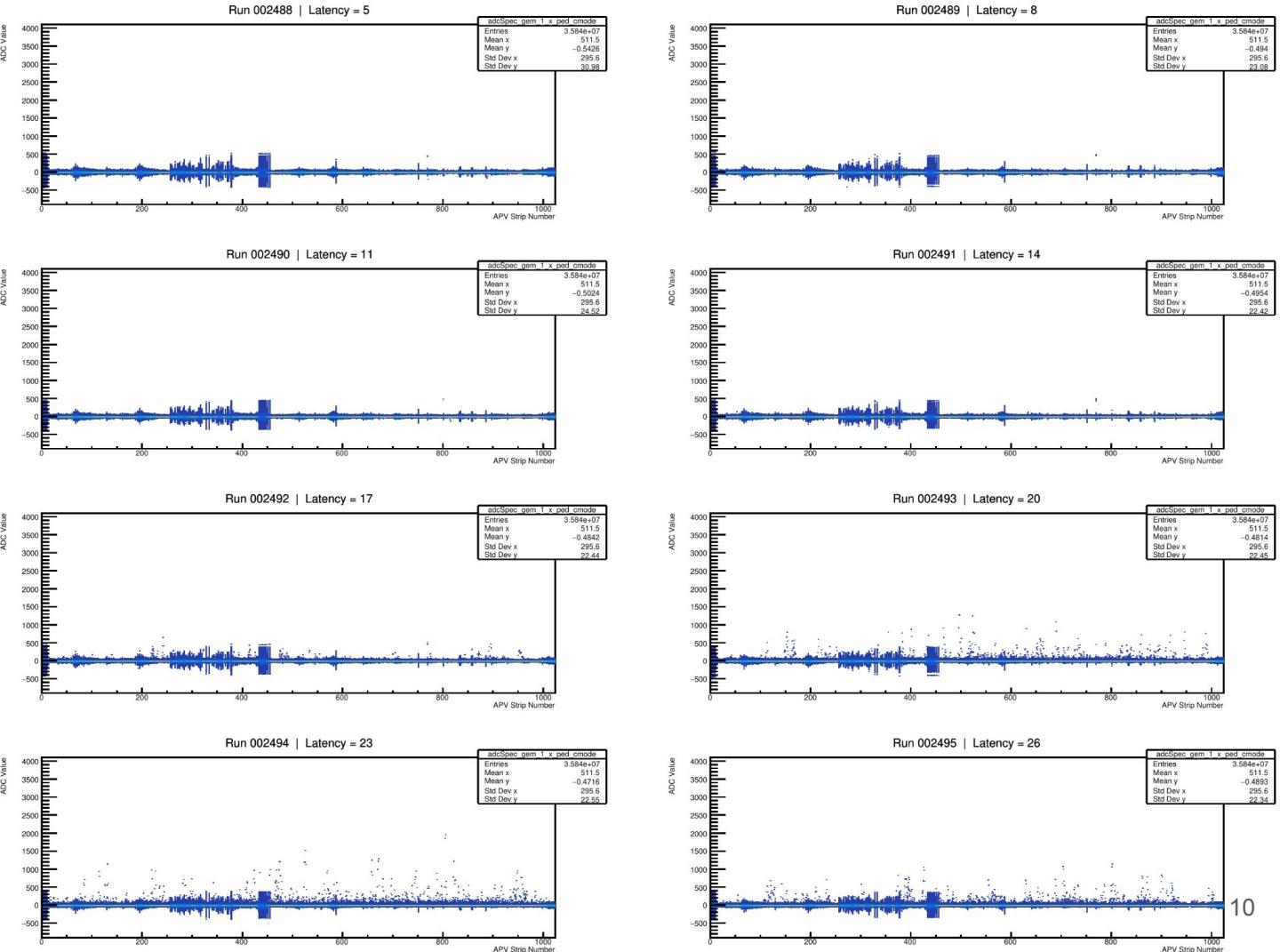
↳ adc plots after pedestal and common mode subtracted

↳ Left top x axis

↳ Cavities OFF

↳ 35k events

↳ HV=3700 V



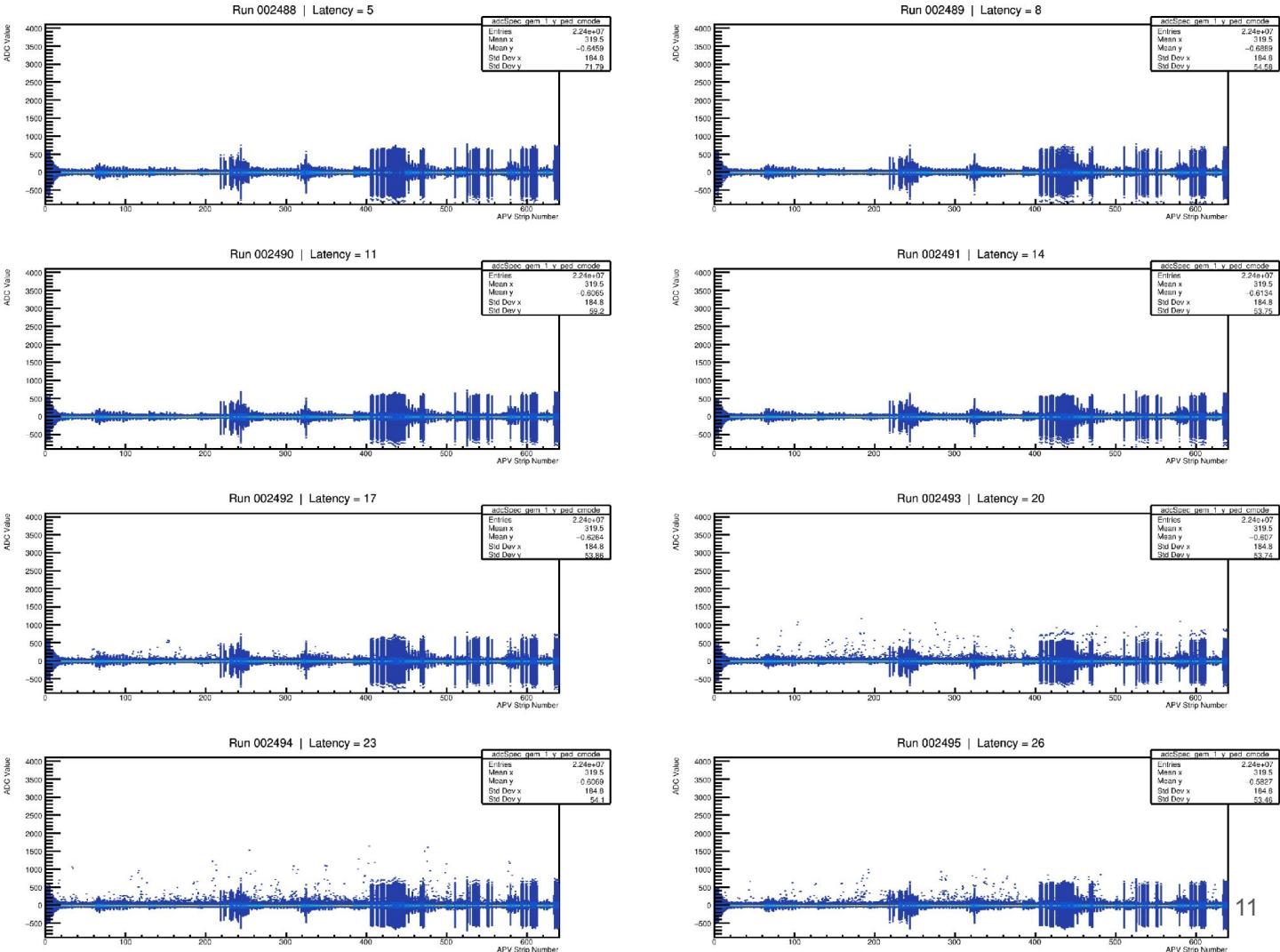
adc plots after pedestal and common mode subtracted

Left top y axis

Cavities OFF

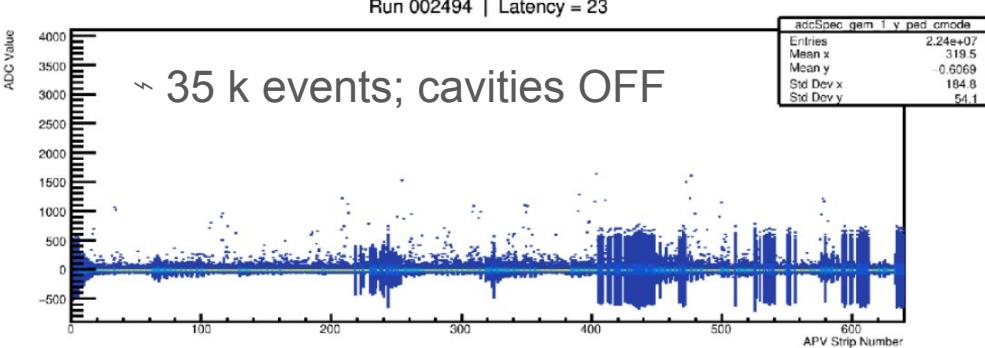
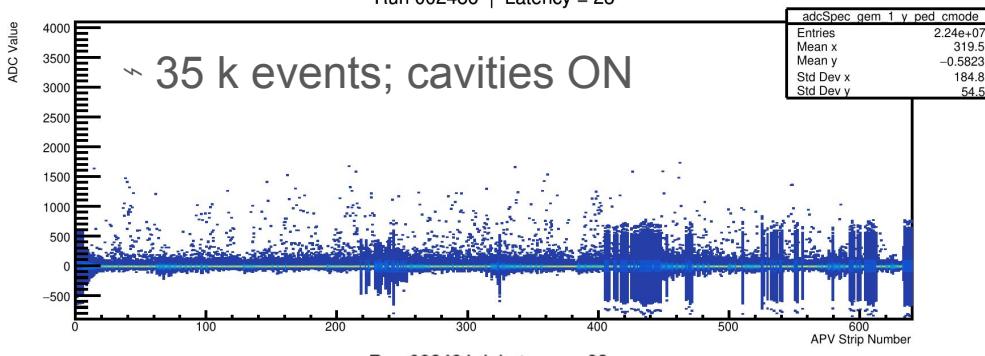
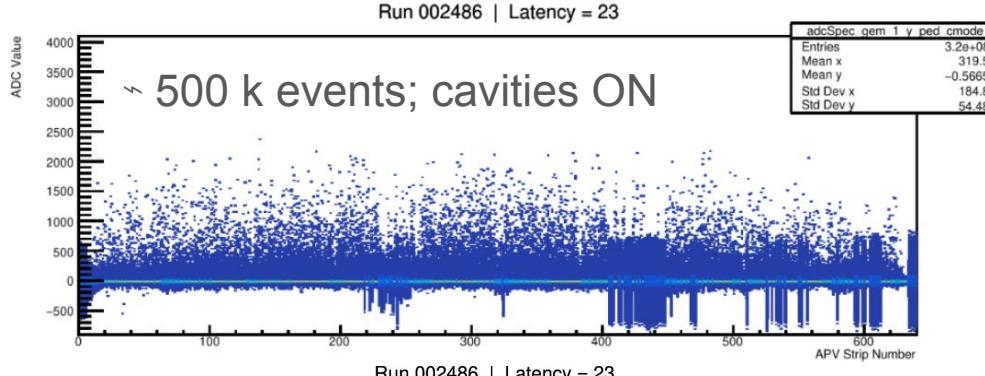
35k events

HV=3700 V

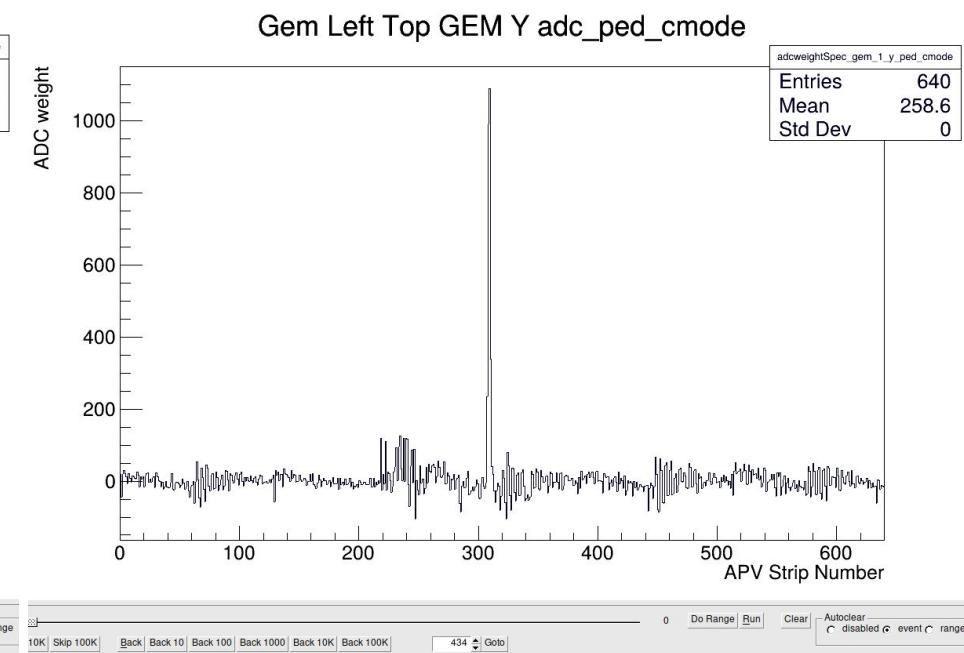
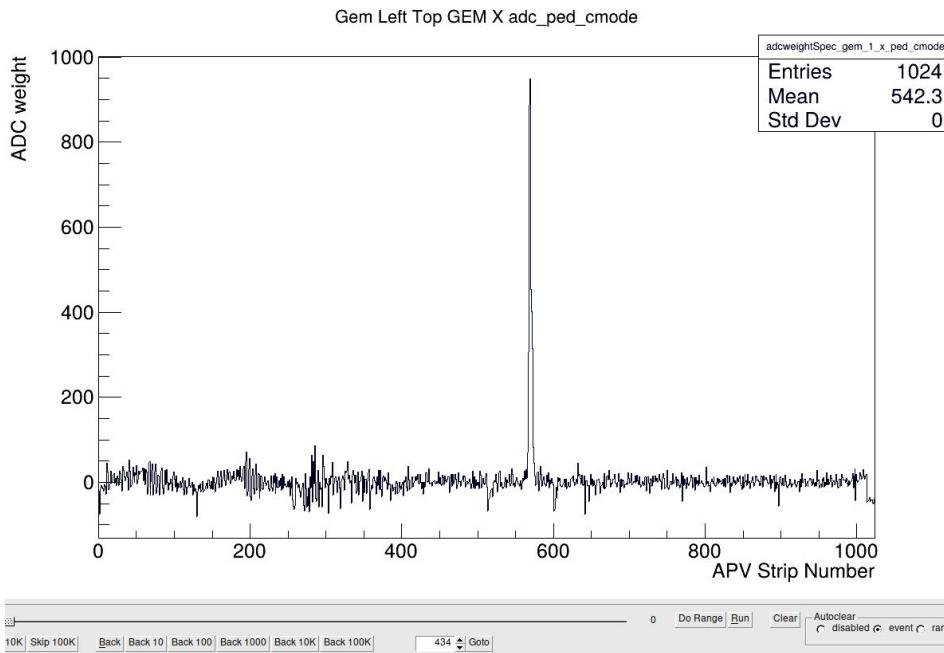


Cavities ON vs OFF

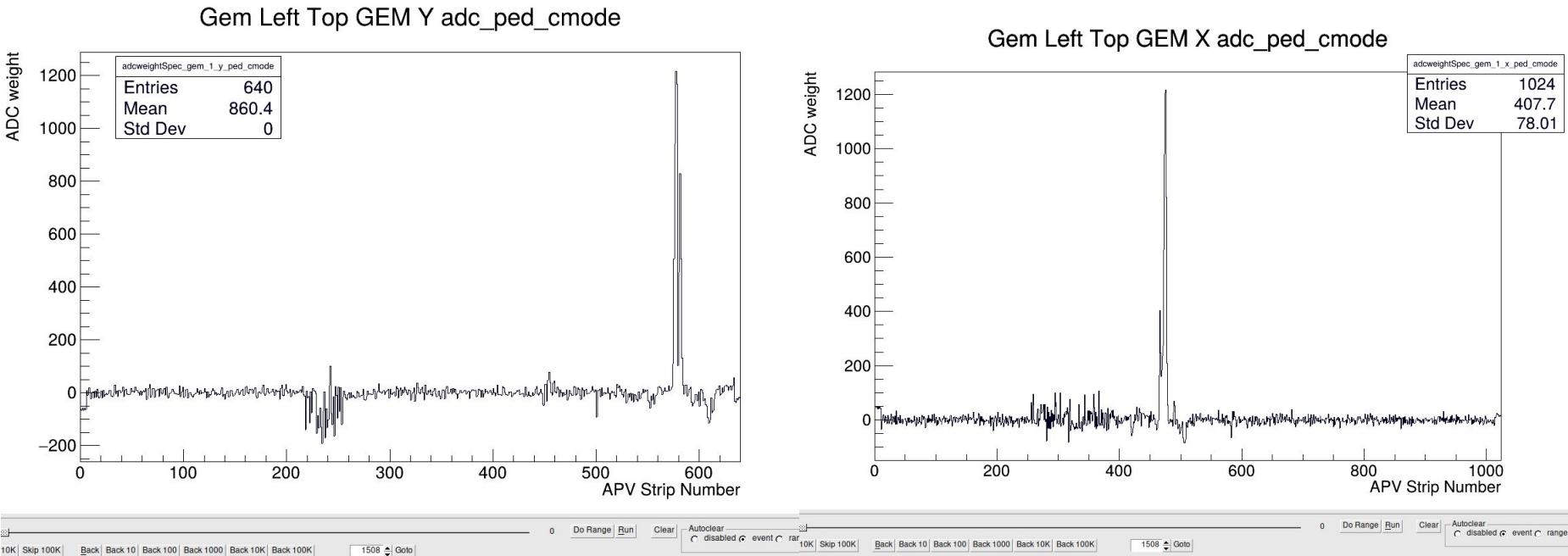
- adc plots after pedestal and common mode subtracted
- Left top y axis
- HV=3700 V



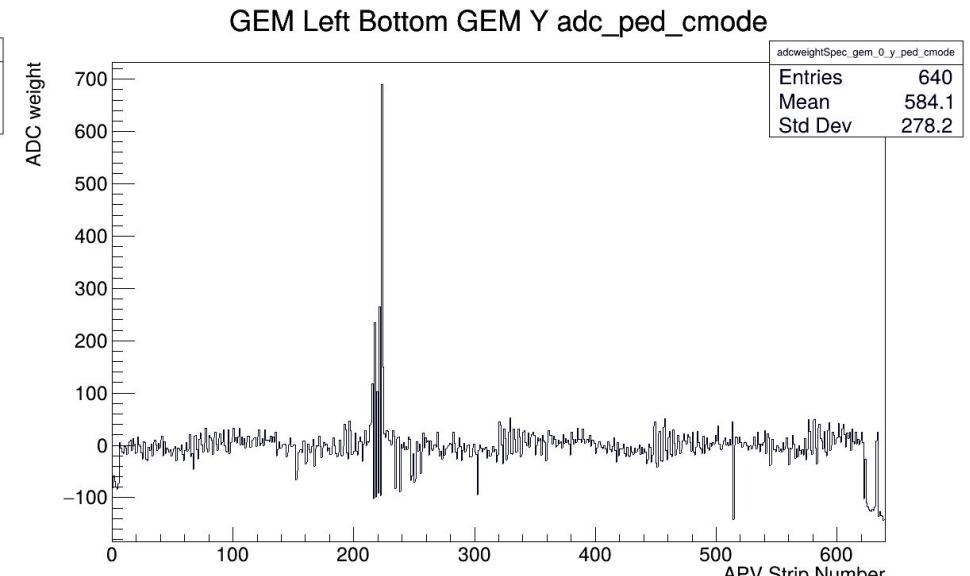
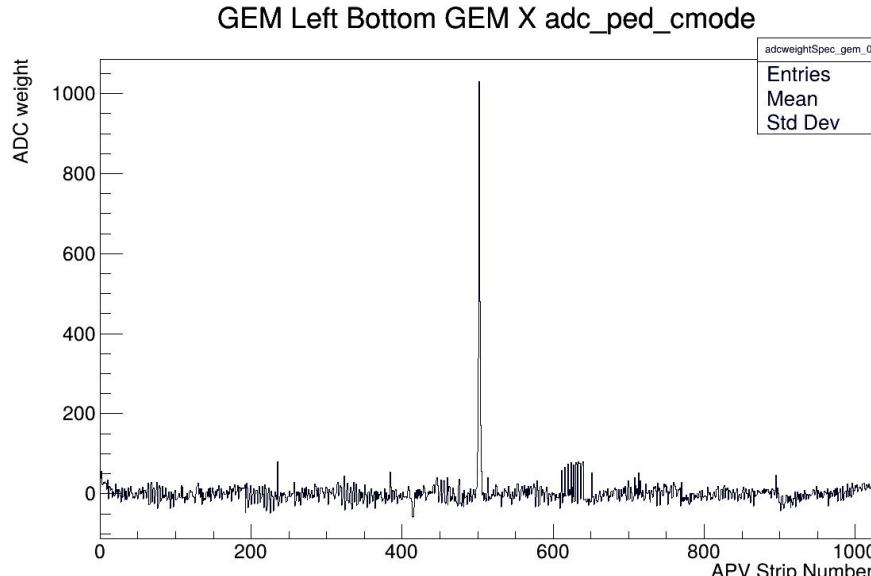
Single event views (run2494; Latency=23, cavities OFF, HV=3700)



Single event views (run2494; Latency=23, cavities OFF, HV=3700)



Single event views (run2494; Latency=23, cavities OFF, HV=3700)

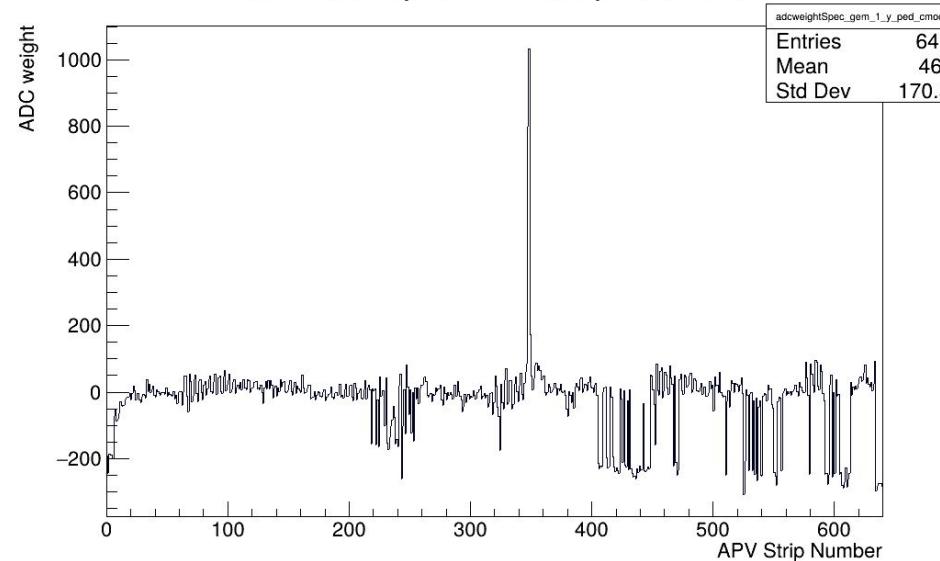


0 Do Range Run Clear Autoclear
10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K | 2186 Goto

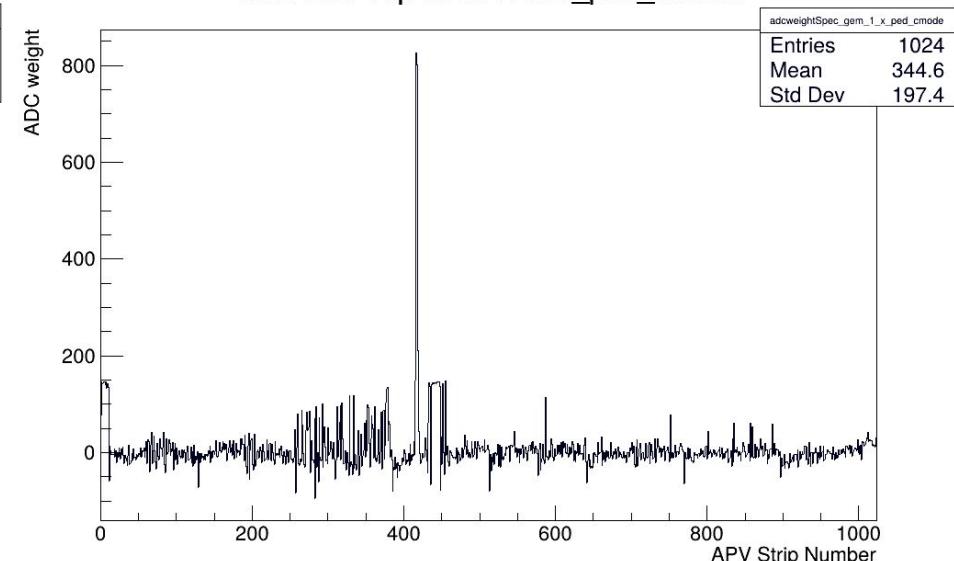
0 Do Range Run Clear Autoclear
10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K | 2186 Goto

Single event views (run2486; Latency=23, cavities ON, HV=3700)

Gem Left Top GEM Y adc_ped_cmode



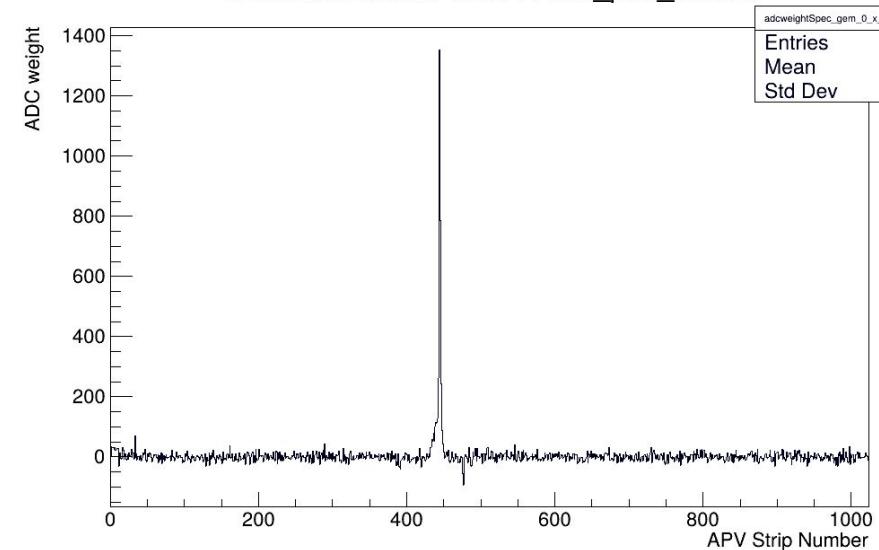
Gem Left Top GEM X adc_ped_cmode



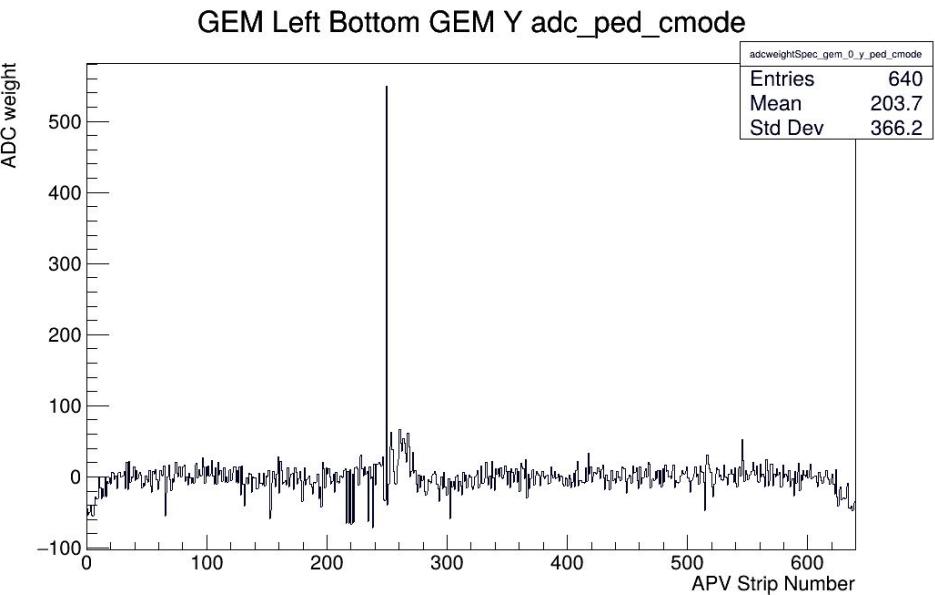
0 Do Range Run Clear Autoclear
10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K 445 Goto 10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K 445 Goto

Single event views (run2486; Latency=23, cavities ON, HV=3700)

GEM Left Bottom GEM X adc_ped_cmode



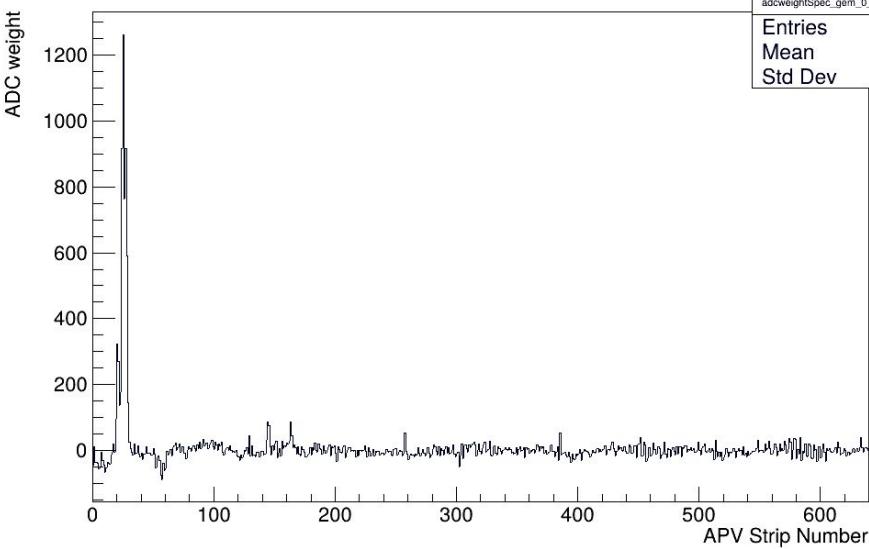
GEM Left Bottom GEM Y adc_ped_cmode



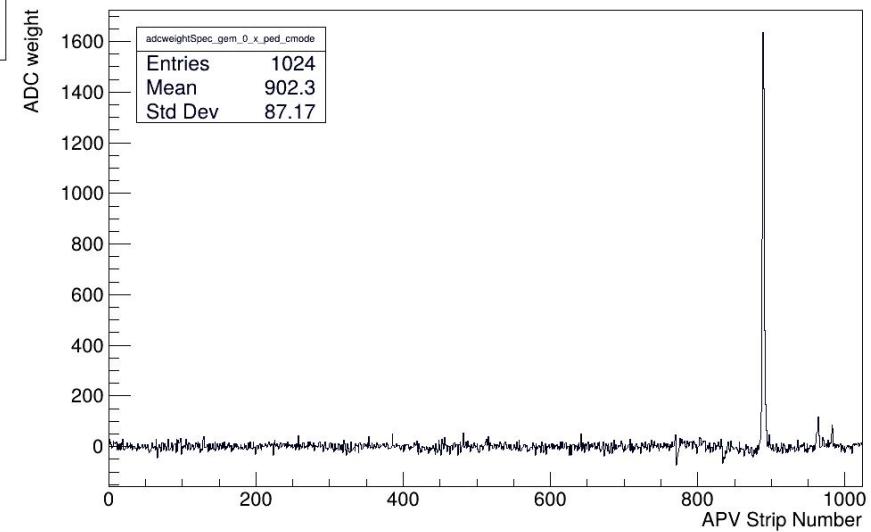
0 Do Range Run Clear Autoclear
C disabled C event C range
10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K 574 Goto
10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K 574 Goto

Single event views (run2486; Latency=23, cavities ON, HV=3700)

GEM Left Bottom GEM Y adc_ped_cmode



GEM Left Bottom GEM X adc_ped_cmode

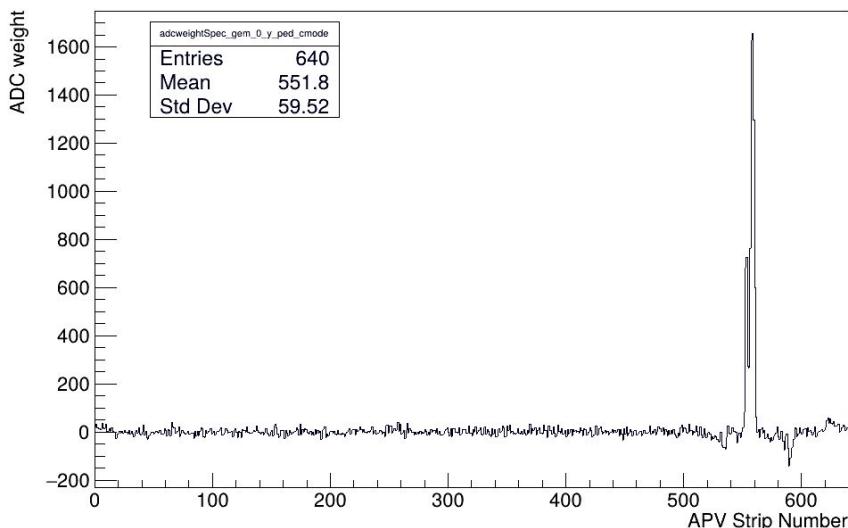


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C disabled C event C range
10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K 1774 Goto

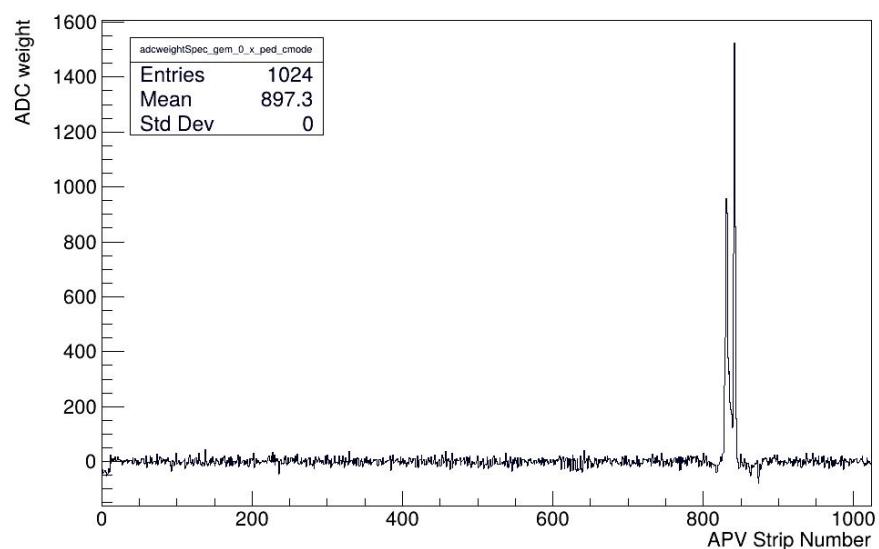
0 Do Range Run Clear Autoclear
C disabled C event C range
10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K 1774 Goto

Single event views (run2486; Latency=23, cavities ON, HV=3700)

GEM Left Bottom GEM Y adc_ped_cmode

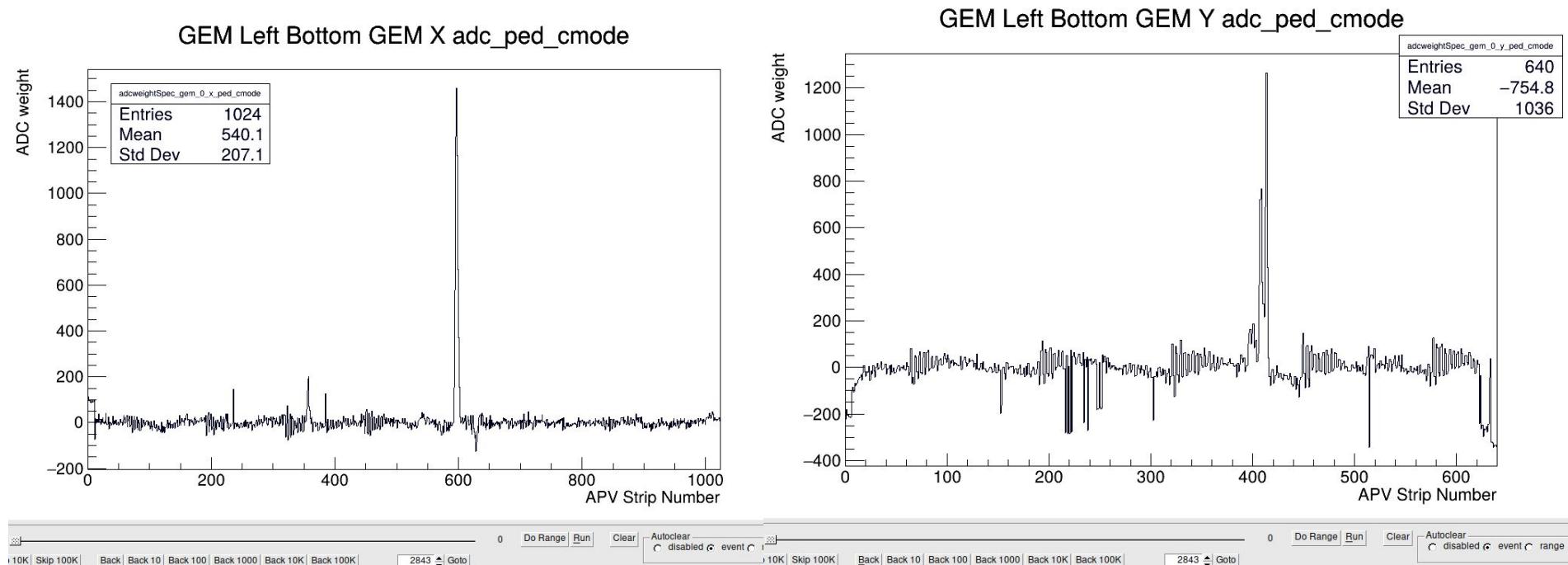


GEM Left Bottom GEM X adc_ped_cmode



0 Do Range Run Clear Autoclear
10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K 10142 Goto
10K Skip 100K Back Back 10 Back 100 Back 1000 Back 10K Back 100K 10142 Goto

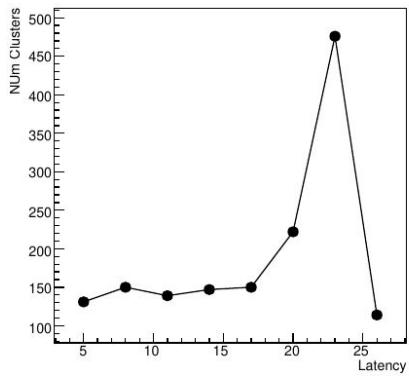
Single event views (run2486; Latency=23, cavities ON, HV=3700)



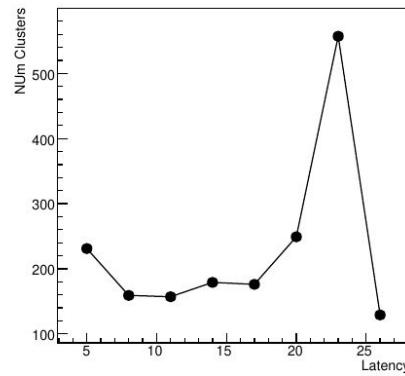
Number of clusters (amplitudes > 1000)

Cavities ON; 500k events; HV=3700

Axis 0: Number of clusters vs Latency

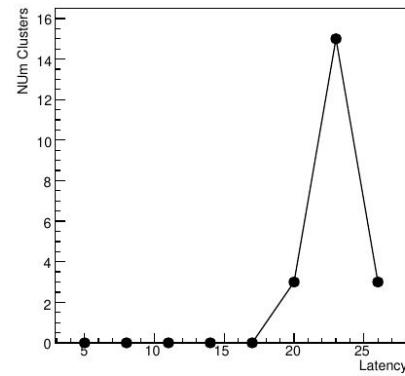


Axis 1: Number of clusters vs Latency

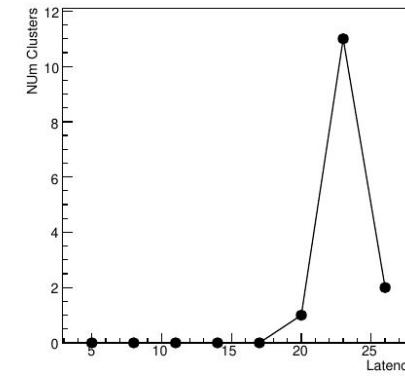


Cavities OFF; 35k events; HV=3700

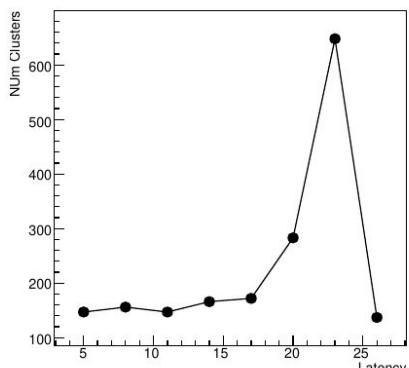
Axis 0: Number of clusters vs Latency



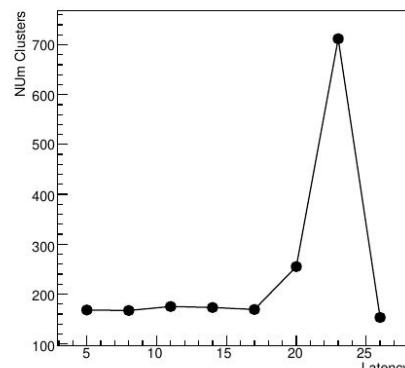
Axis 1: Number of clusters vs Latency



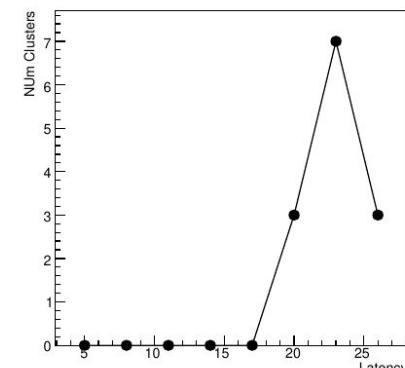
Axis 2: Number of clusters vs Latency



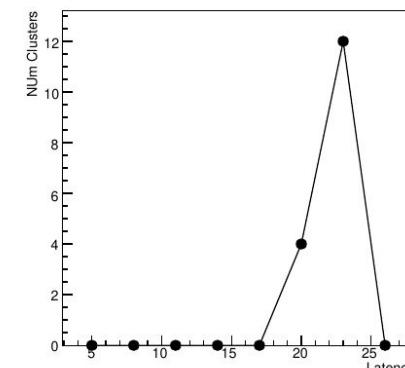
Axis 3: Number of clusters vs Latency



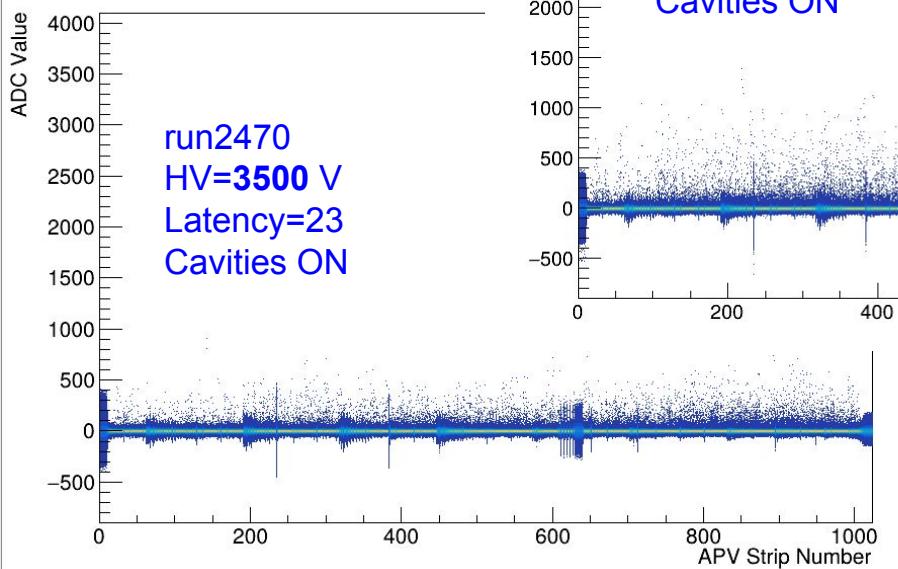
Axis 2: Number of clusters vs Latency



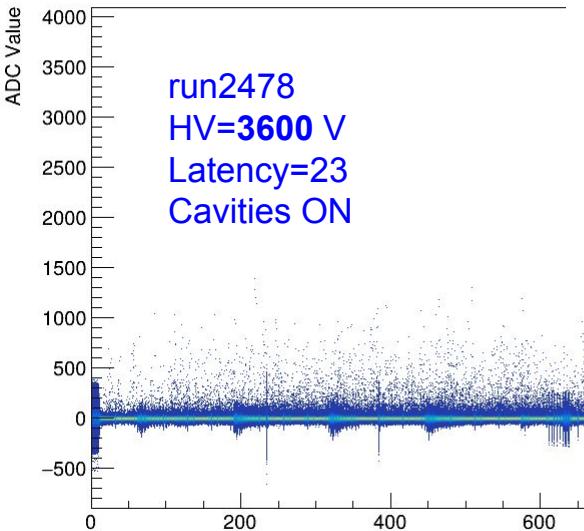
Axis 3: Number of clusters vs Latency



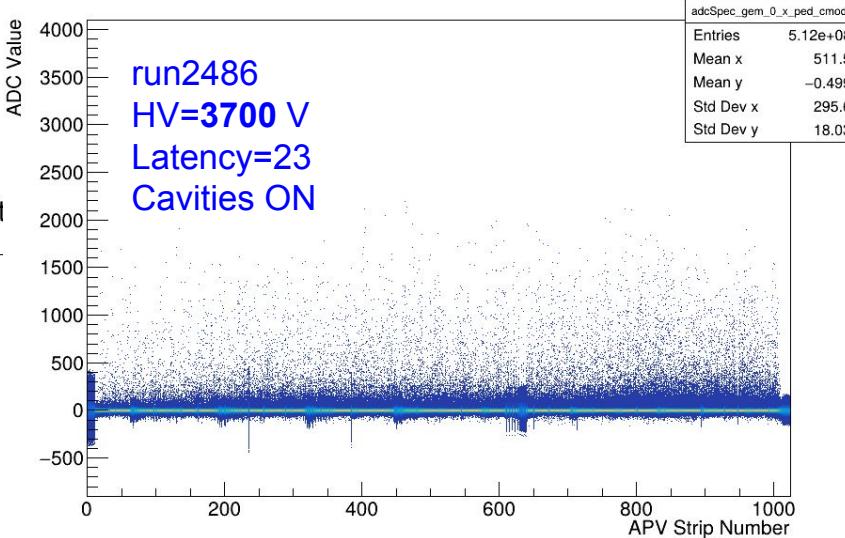
HV dependence



GEM Left Bottom GEM X spect



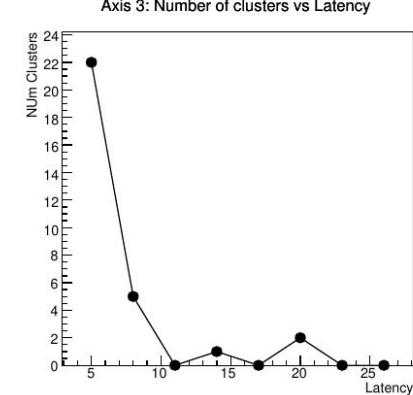
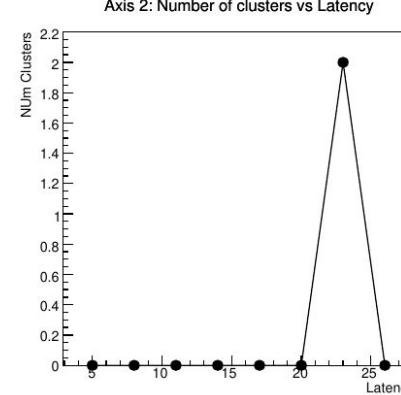
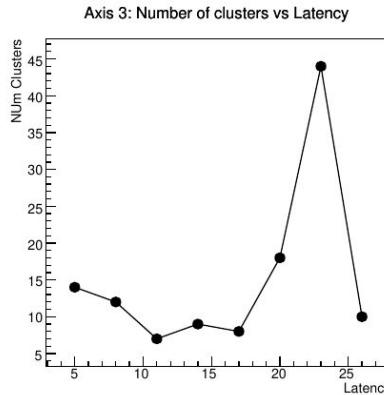
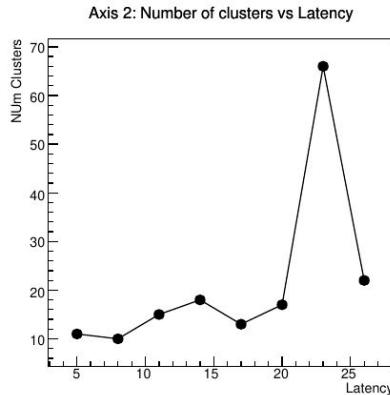
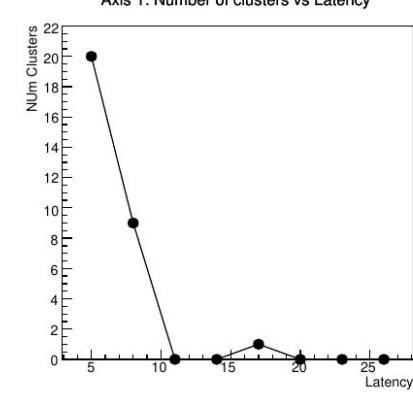
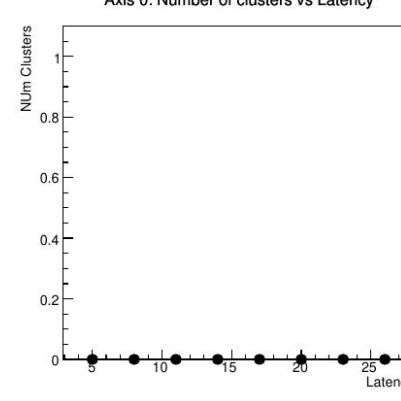
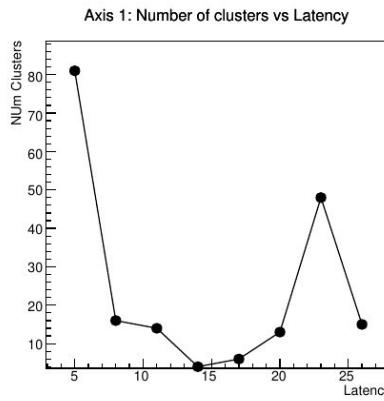
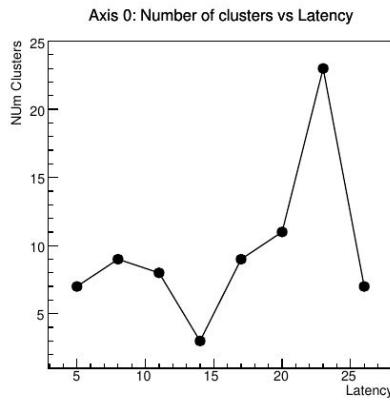
GEM Left Bottom GEM X spectrum ped+cmode



adcSpec_gem_0_x_ped_cmode
Entries 5.12e+08
Mean x 511.5
Mean y -0.499
Std Dev x 295.6
Std Dev y 18.03

Number of clusters (amplitudes > 1000)

Cavities ON; 500k events; HV=3600



Summary

- Latency = 23 is good
- Need a finer Latency scan
 - Latency values: 20, 21, 22, 23, 24, 26, 27, 28
 - HV values: 3800, 3900 V ?
 - Both left arm and right arm independently
 - ~ 5 min runs at each setting
 - ~ 4 hours of total data taking