APVs Calibration

PARTIAL CONCLUSIONS

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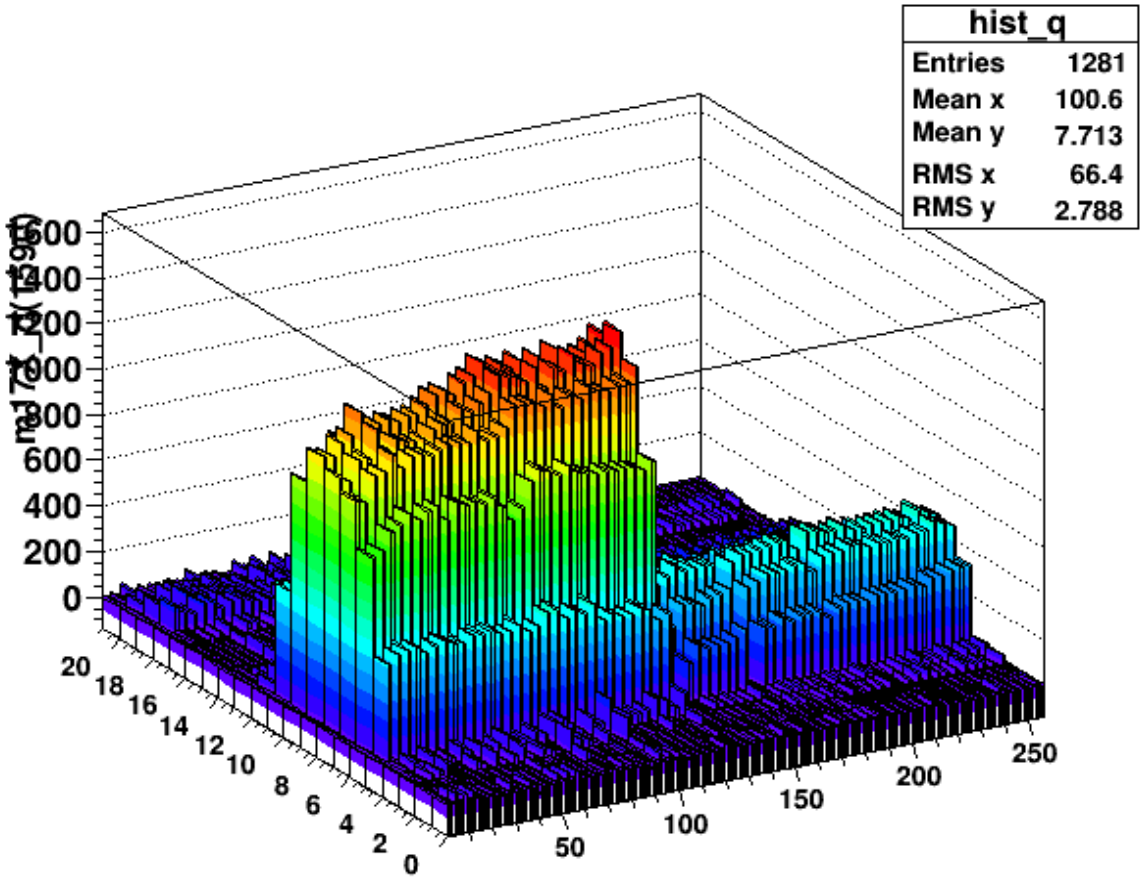
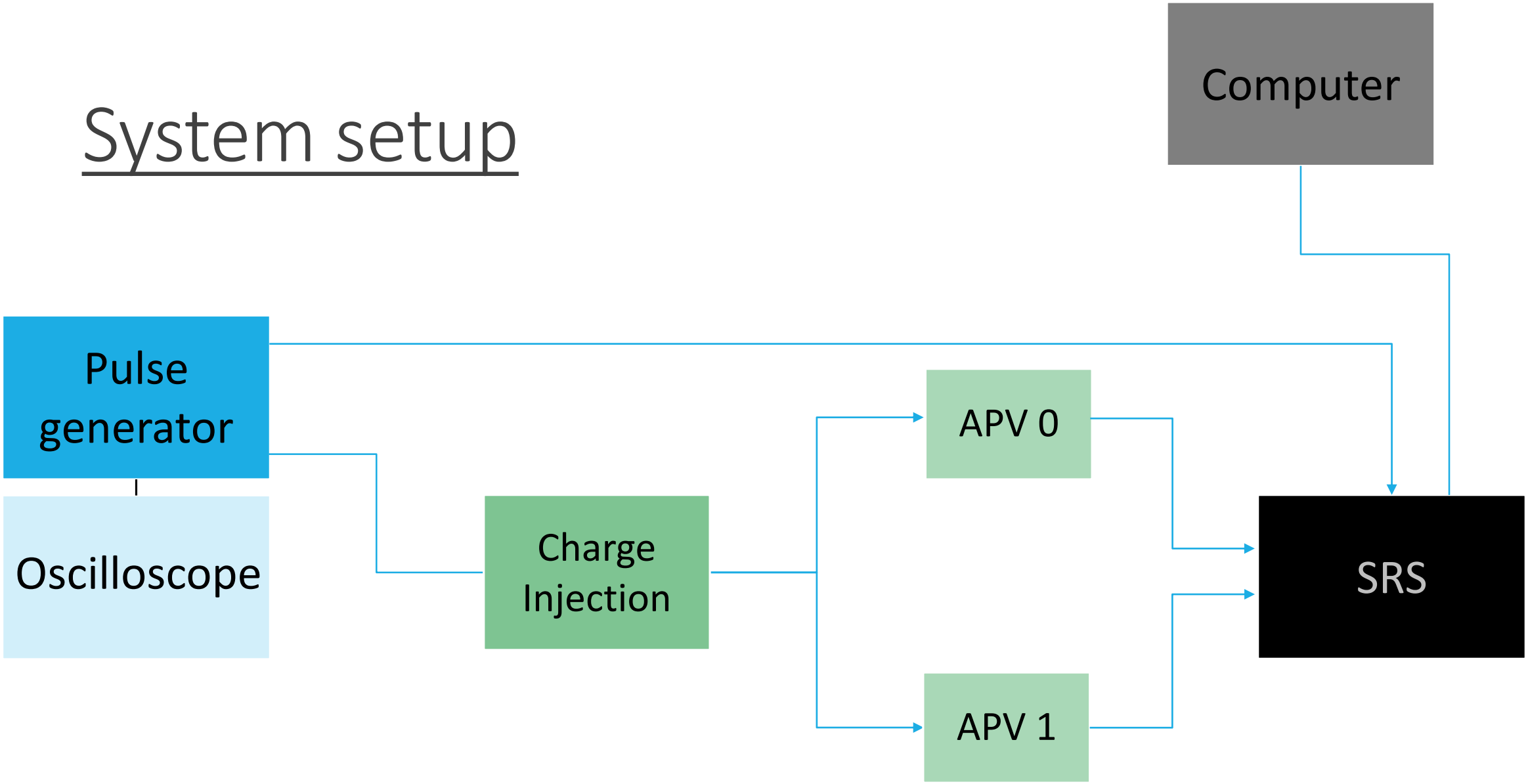
The APVs

- Each measurement is done using two APVs
- “APV 0” – divides the signal by ≈ 1
- “APV 1” – divides the signal by ≈ 4



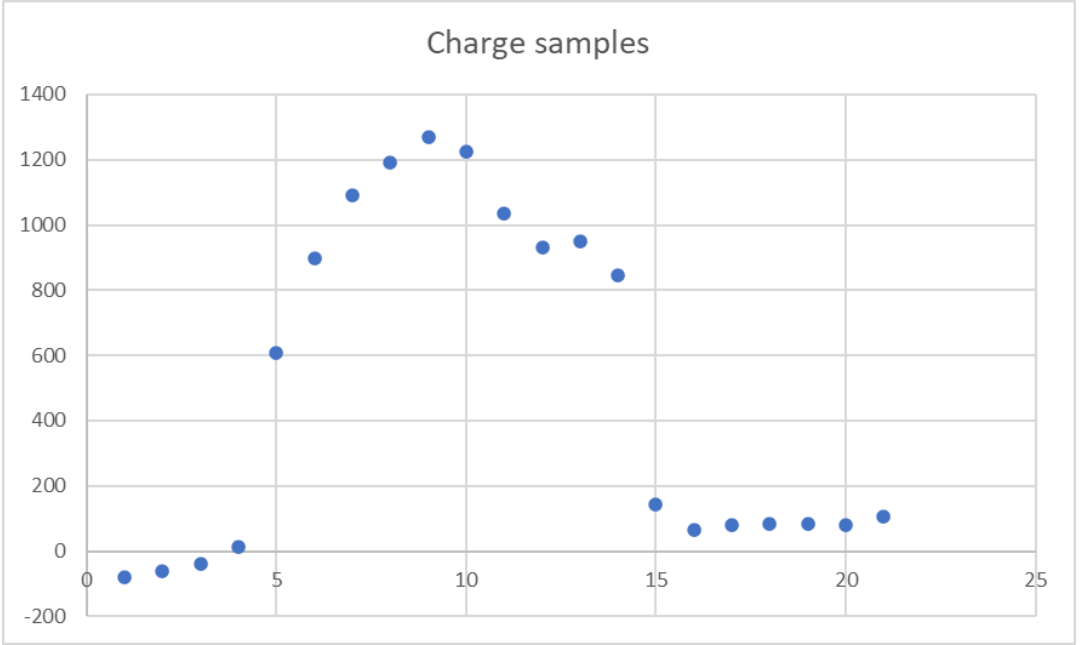
System setup



System setup – cont.

- A Pulse generator sends a known signal and triggers a measurement
- Signal is injected to the APVs
- For each APV
  - And for each channel within it
    - Charge is sampled 21 times (every 25 ns)
    - Pedestals subtracted

- Procedure occurs repeatedly



Example of the 21 time samples

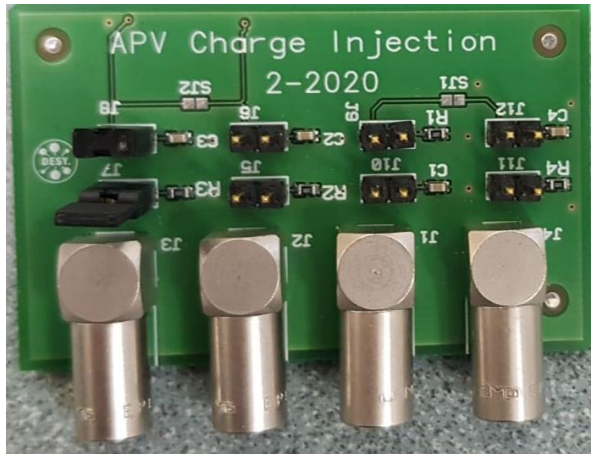
Charge Injection

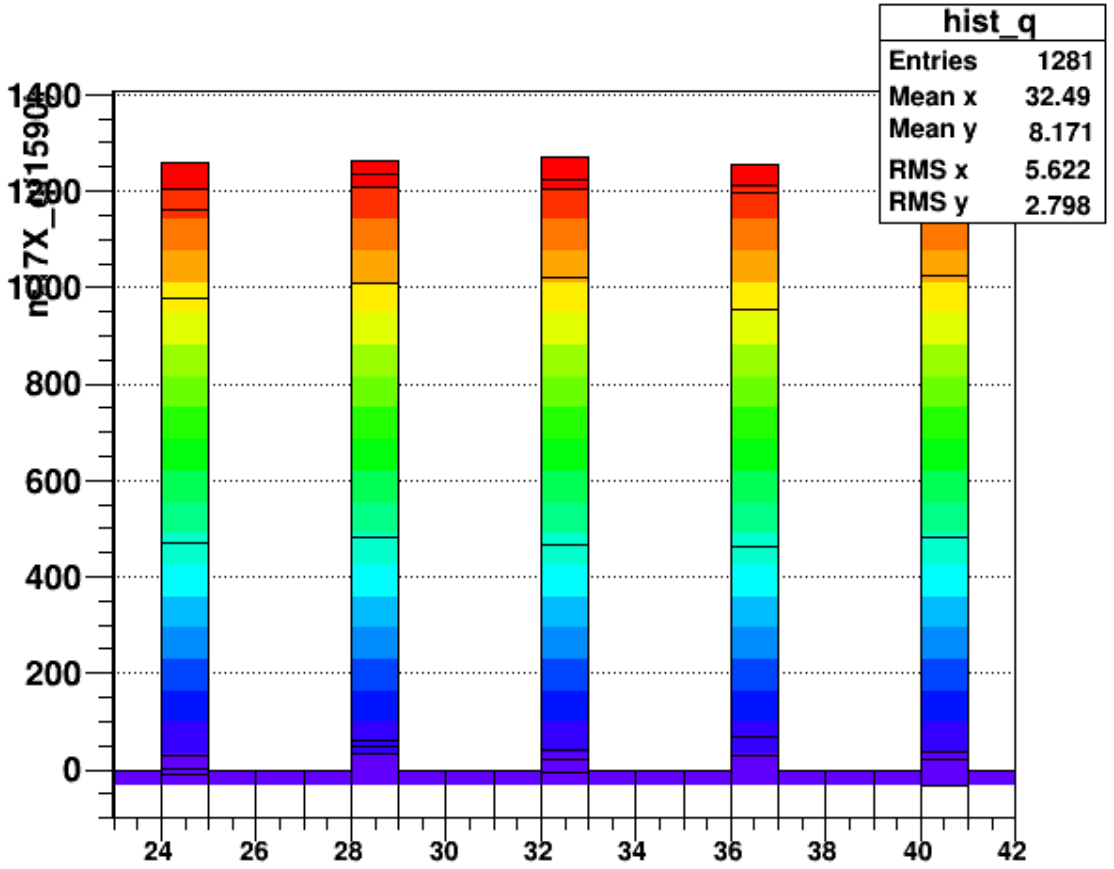
- Four possible “sockets” for a charge injection
- Each one injects fourth of the channels, alternately
- For example:

  Second entrance

  APV 0 – channels 0, 4, 8 etc.

  APV 1 – channels 3, 7, 11 etc.

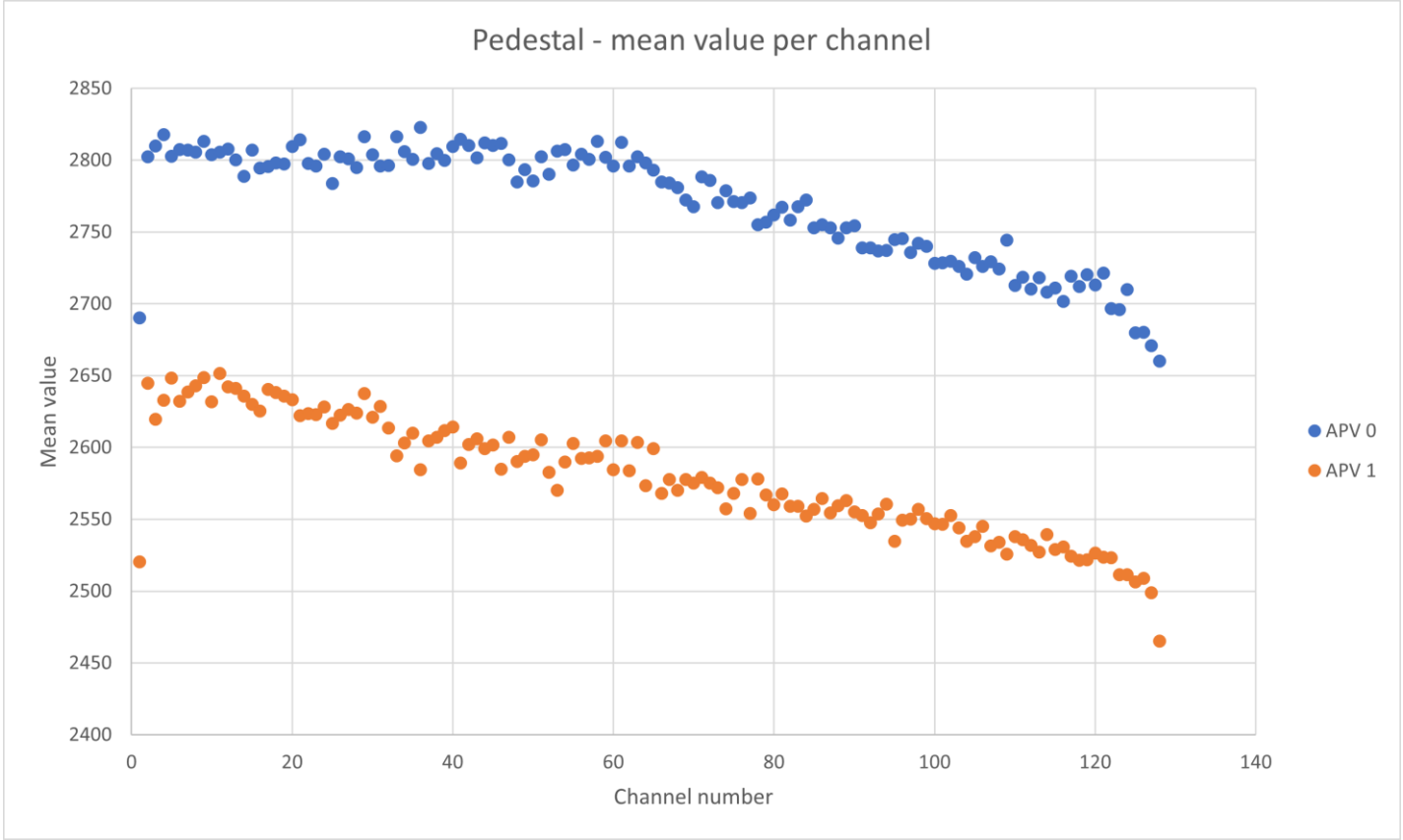


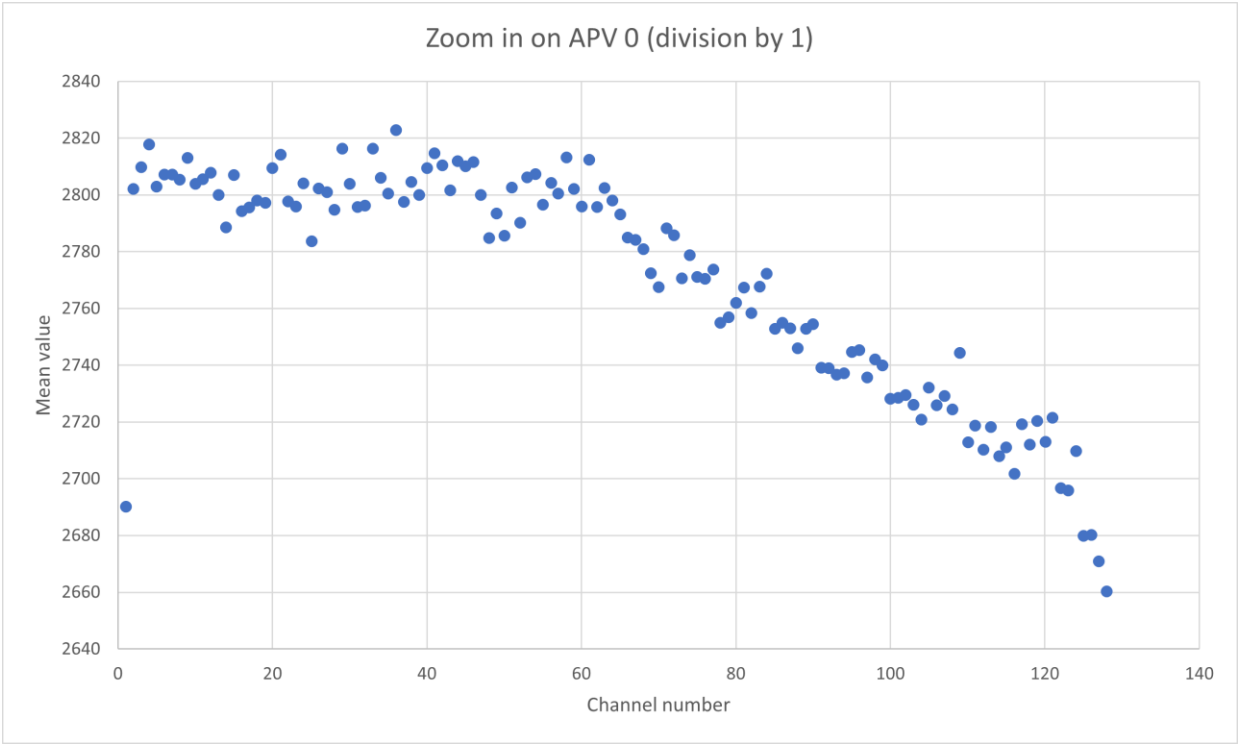


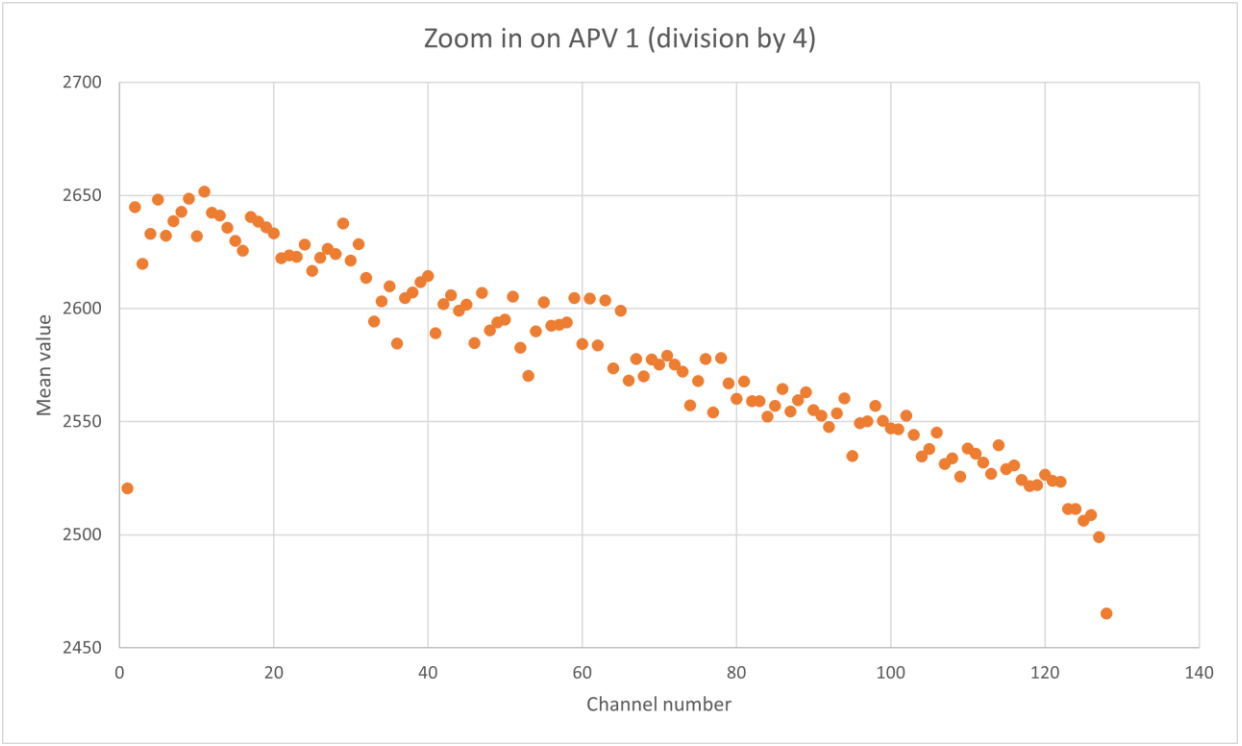
Second entrance, APV 0

Pedestals – mean value

- Overall descendent orientation
- Edge channels (# 0, 127) seem problematic throughout measurements



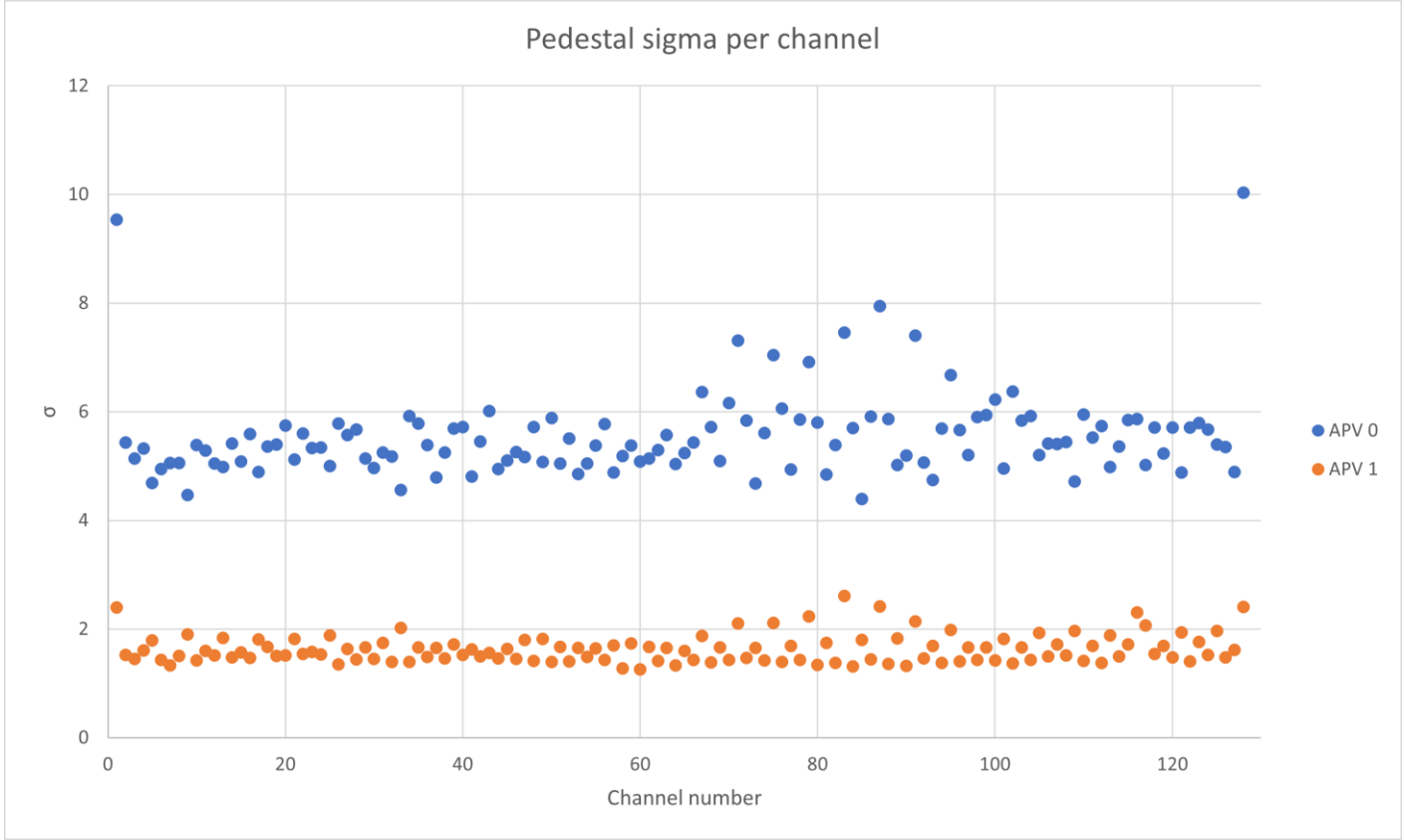

Zoom in on APV 0 (division by 1)
Mean value
Channel number
2840
2820
2800
2780
2760
2740
2720
2700
2680
2660
2640
0
20
40
60
80
100
120
140

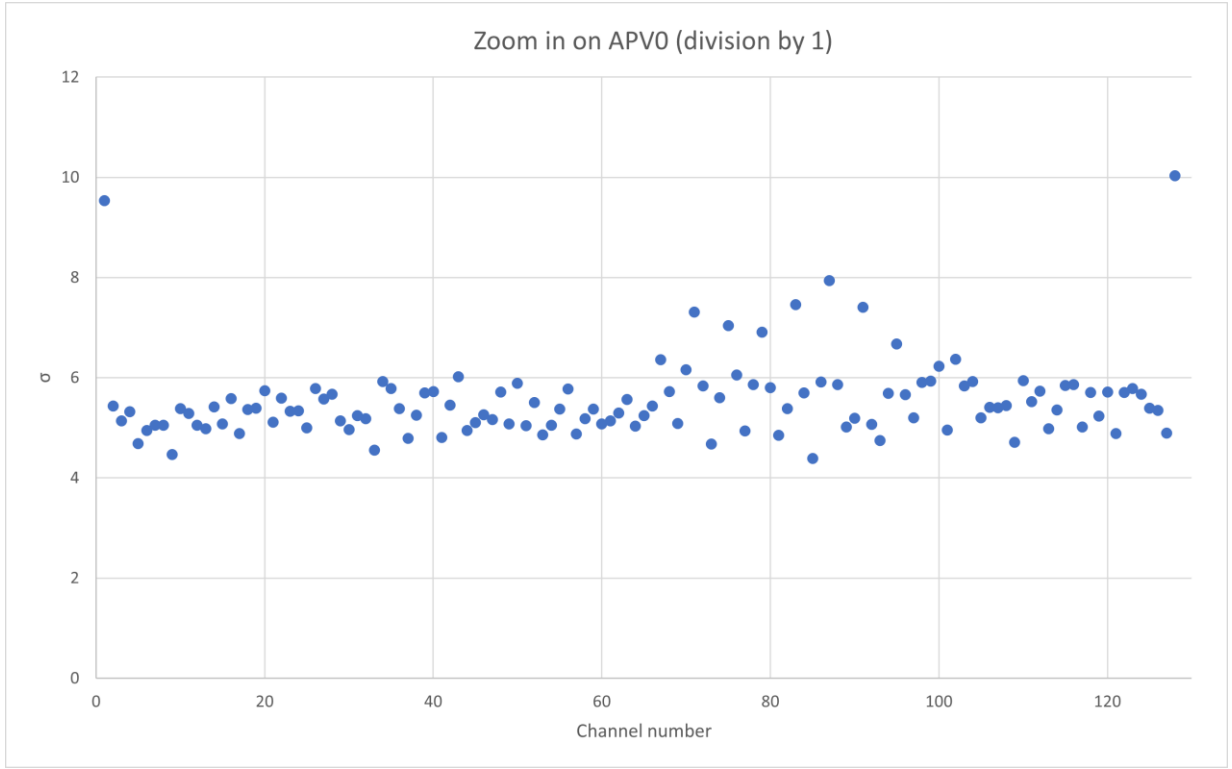

Zoom in on APV 1 (division by 4)
Mean value
Channel number
2700
2650
2600
2550
2500
2450
0
20
40
60
80
100
120
140

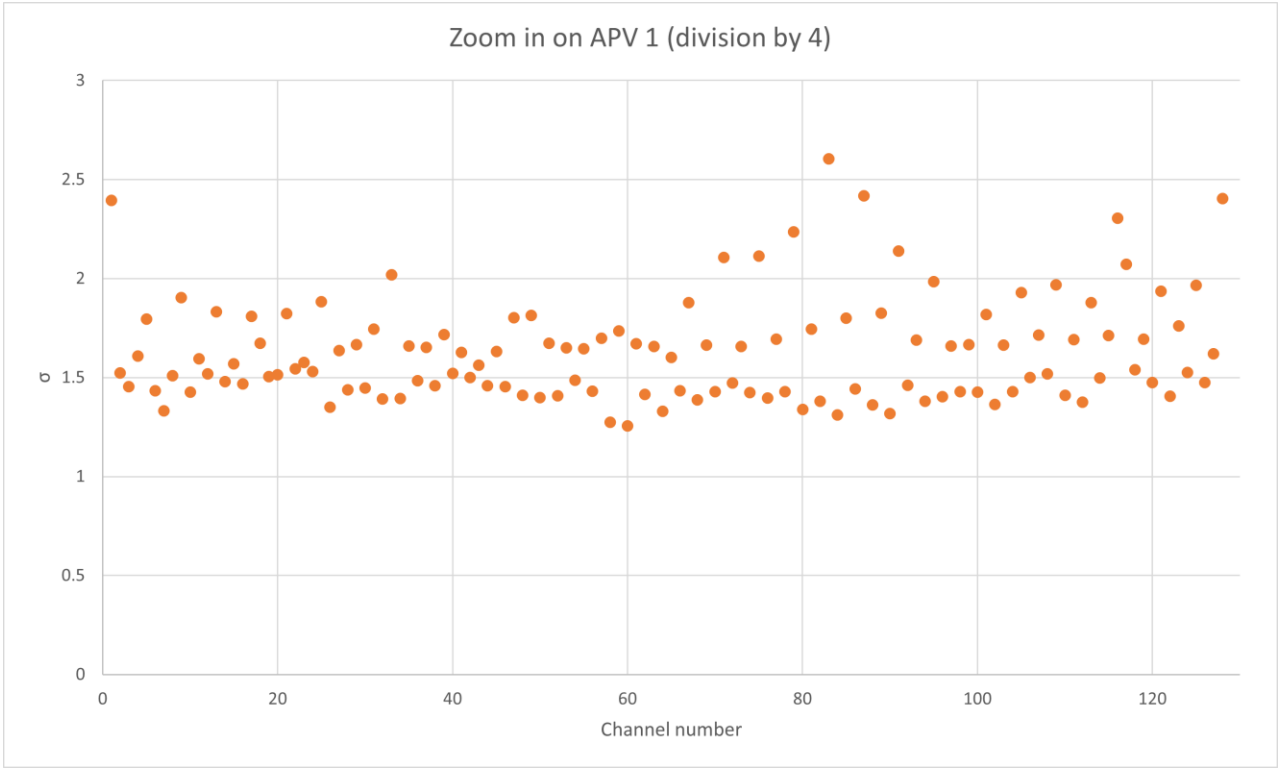
Pedestals – sigma

- A bit noisy
- Mostly varies around the same value

- APV 0 ≈ 5.5
- APV 1 ≈ 1.6

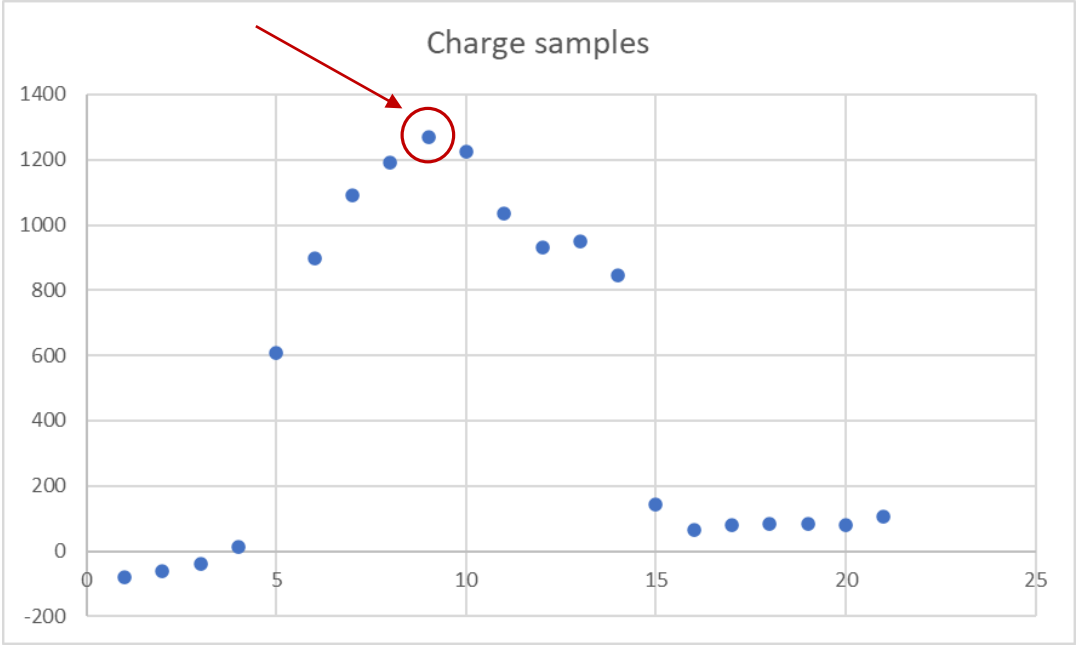



Zoom in on APV0 (division by 1)
12
10
8
6
4
2
0
σ
0
20
40
60
80
100
120
Channel number


Zoom in on APV 1 (division by 4)
3
2.5
2
1.5
1
0.5
0
σ
0
20
40
60
80
100
120
Channel number

Experimenting with APVs

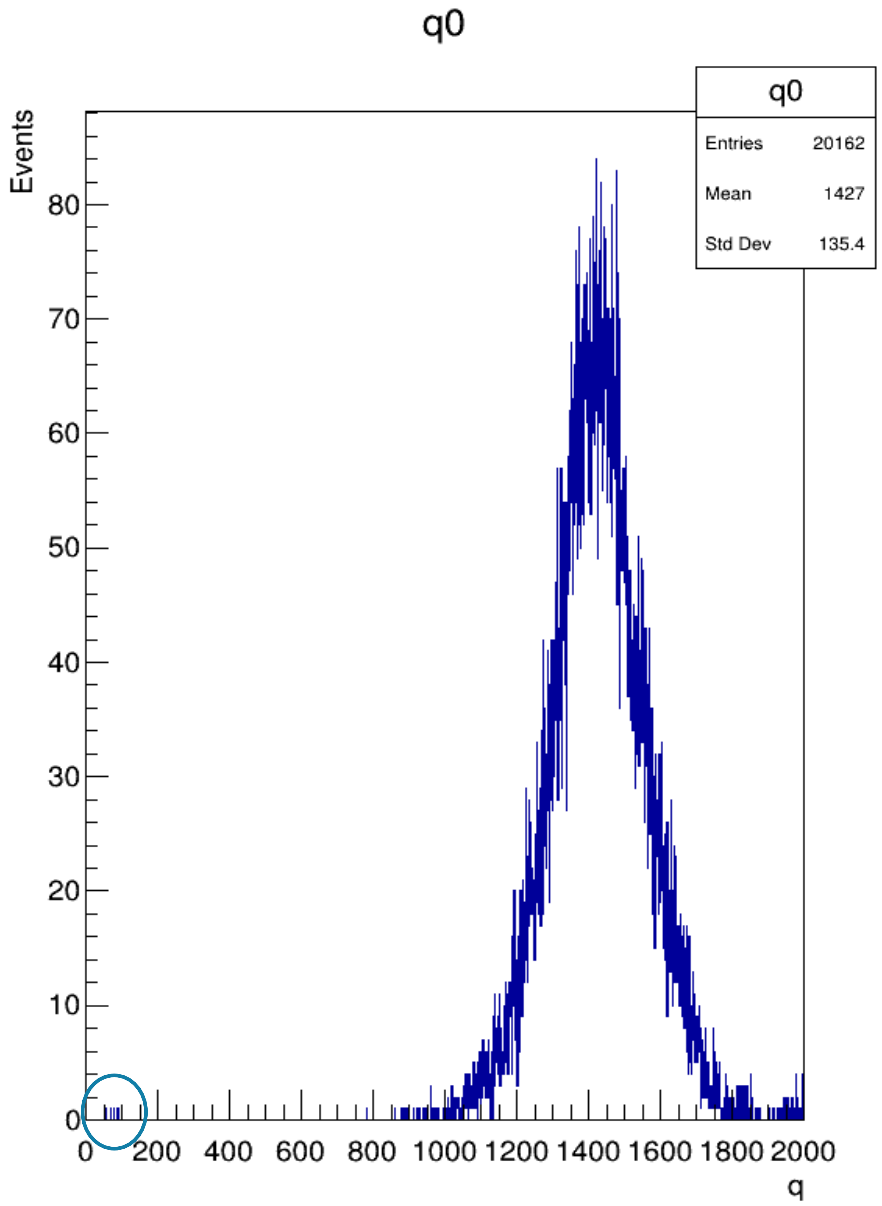
- 1000 such measurements were taken
- The max value per channel was extracted from each

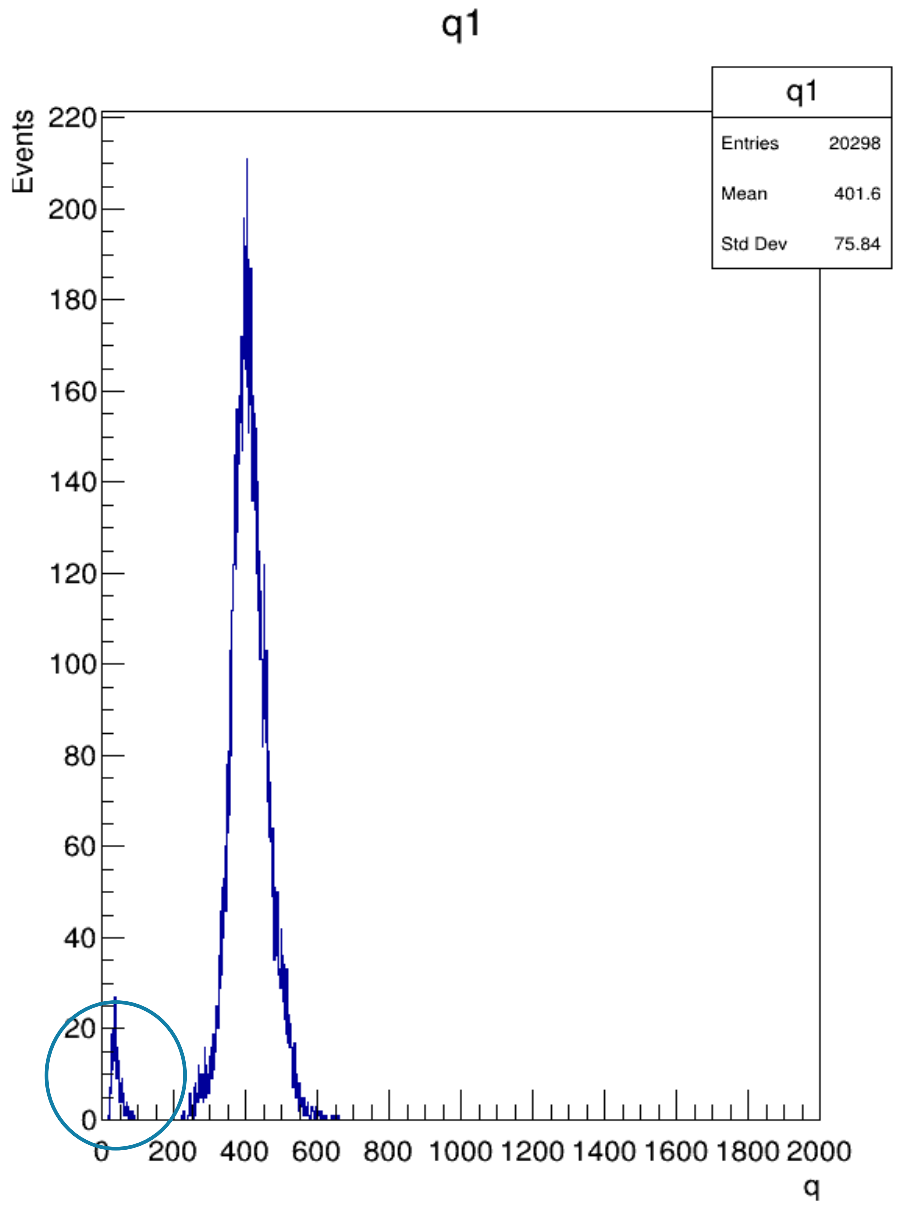


Example of the 21 time samples

Results – all channels

- Irregular events are circled
- Without exception, all are from channels which shouldn’t show activity whatsoever
- Assumed to be caused by environmental conditions

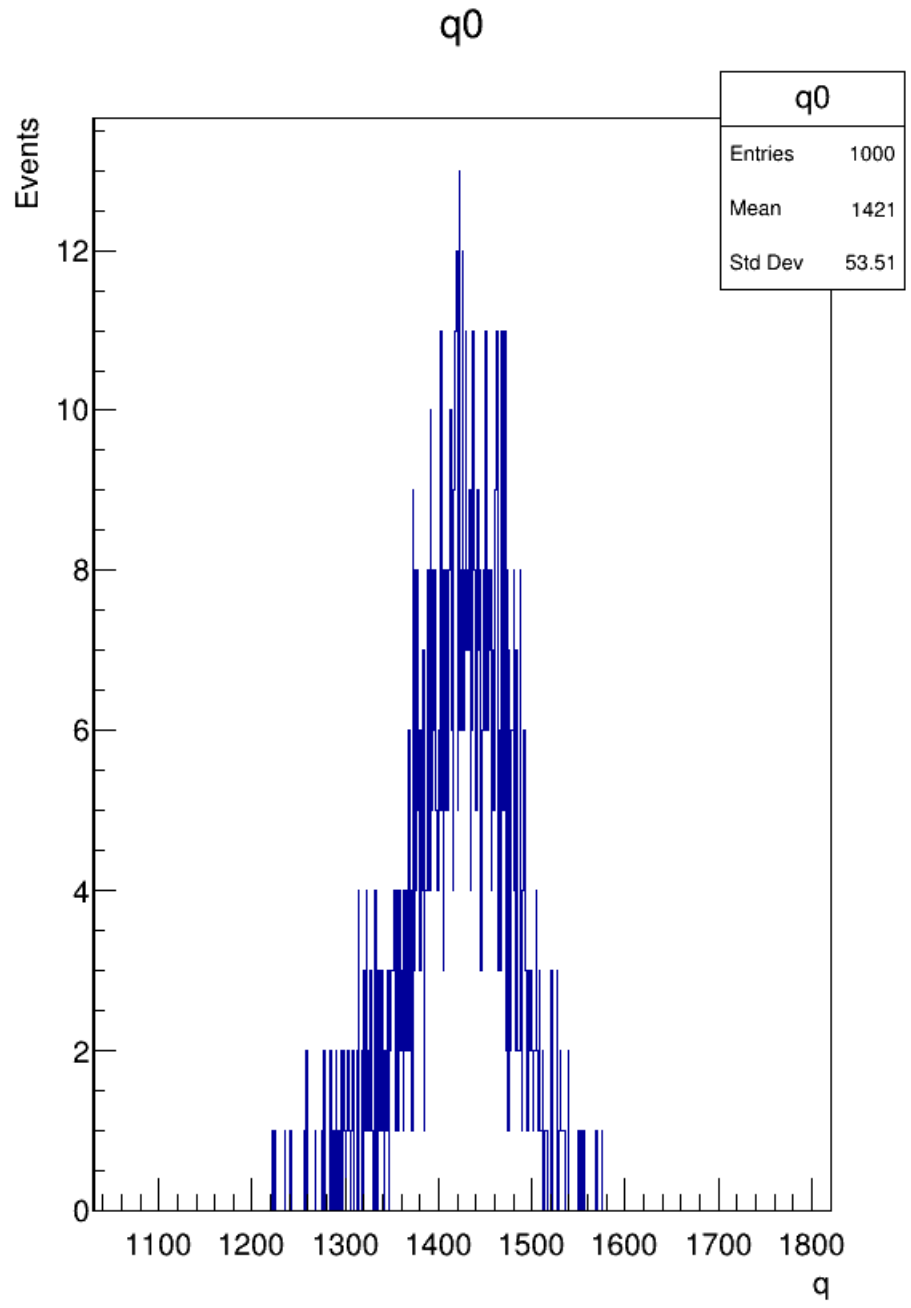


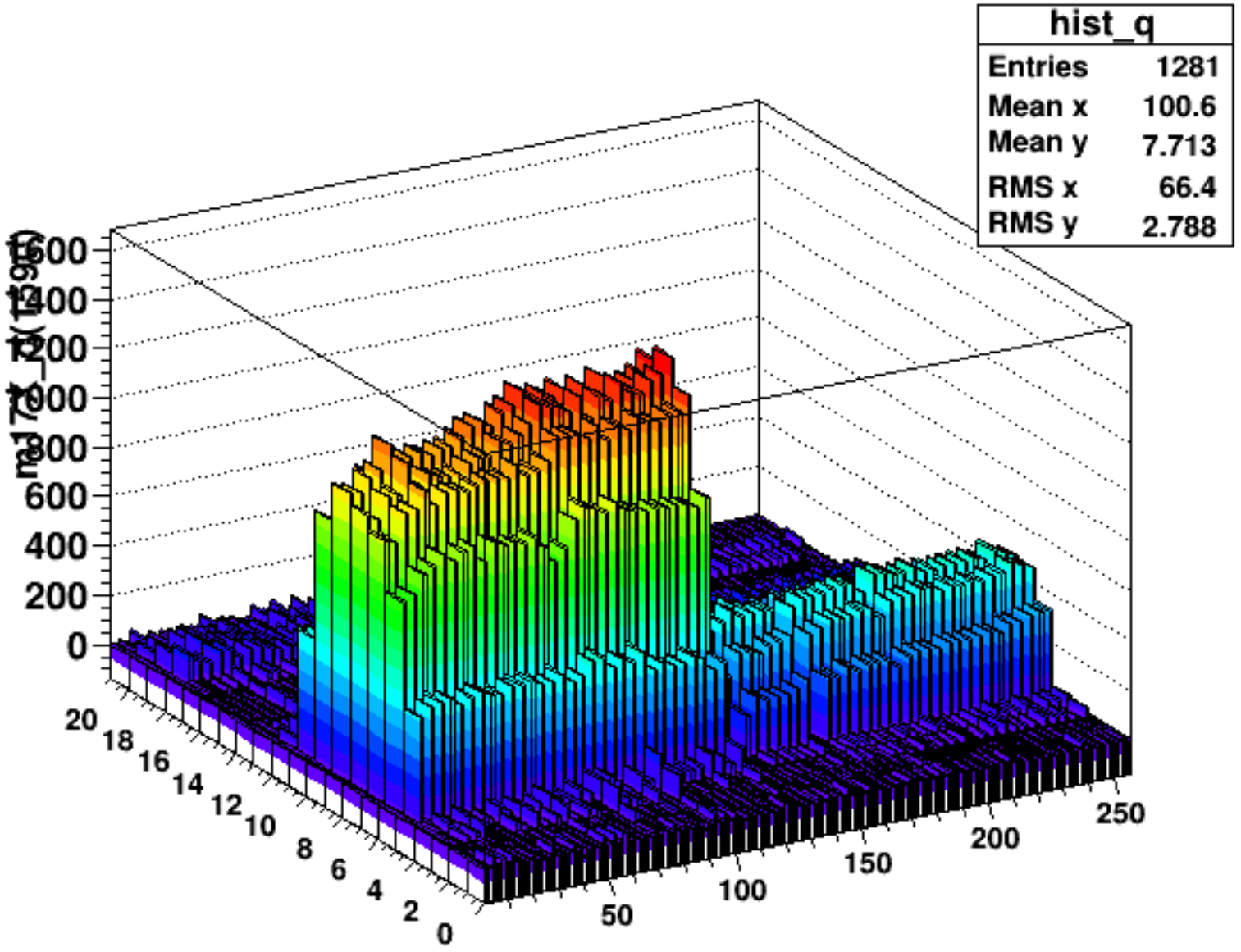


Results – one channels

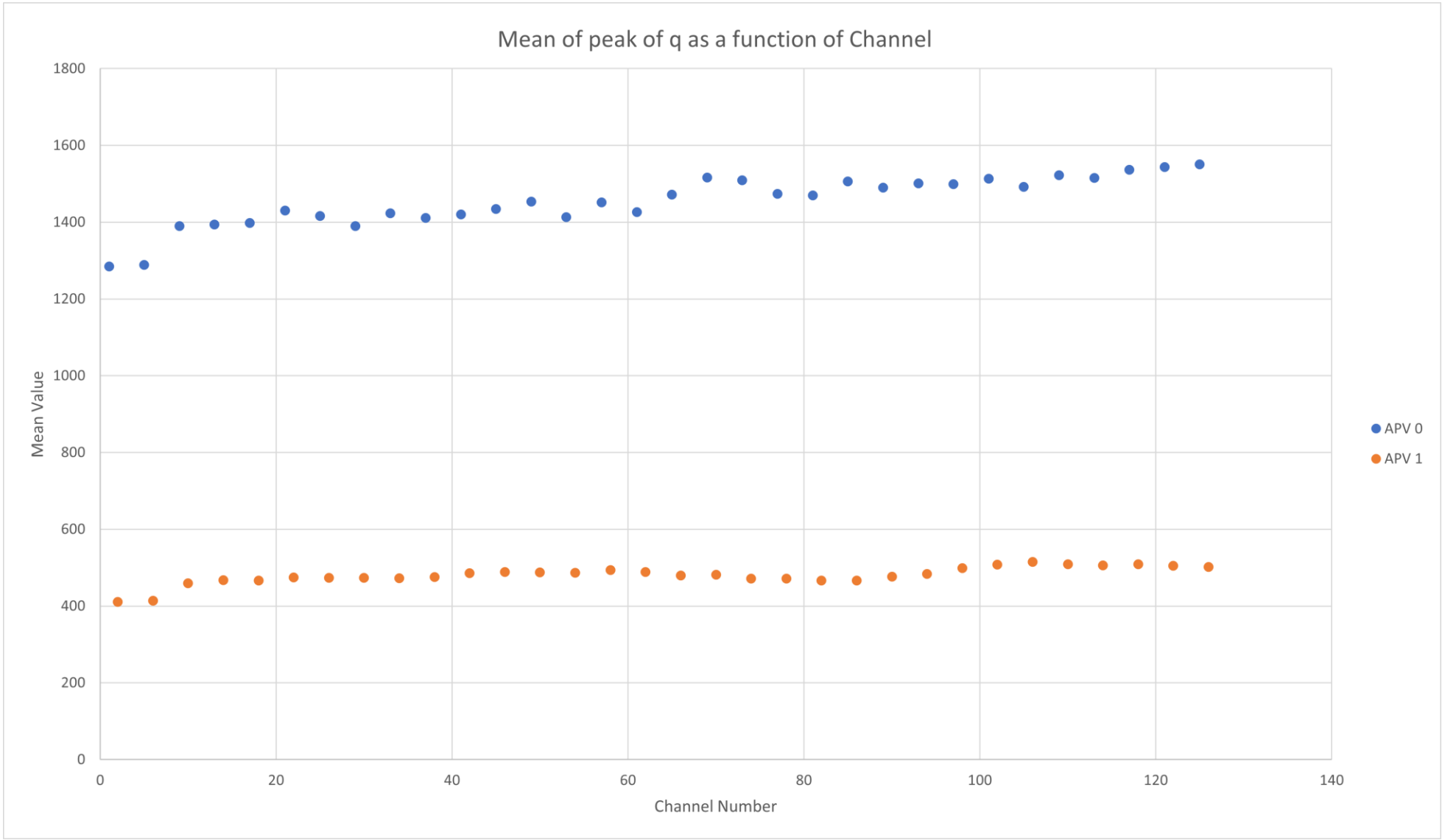
APV 0 – channel 83

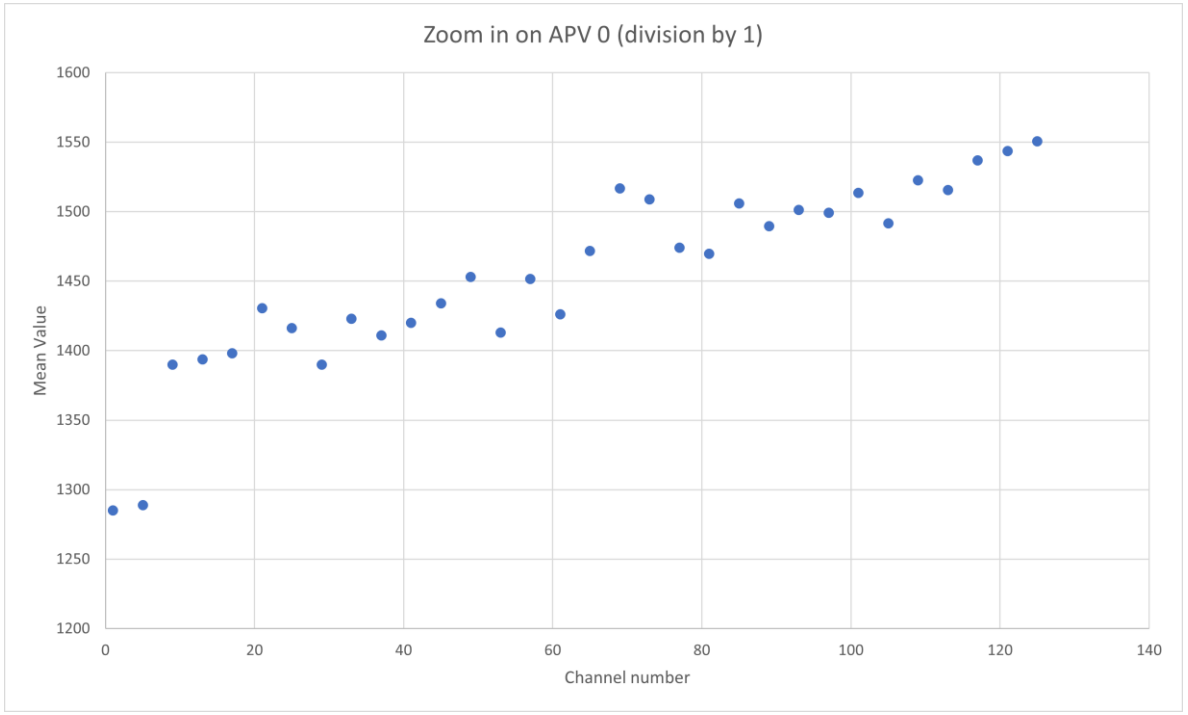
- Digging into each channel separately shows no issues
- However, the mean value of such histogram per channel differs between channels

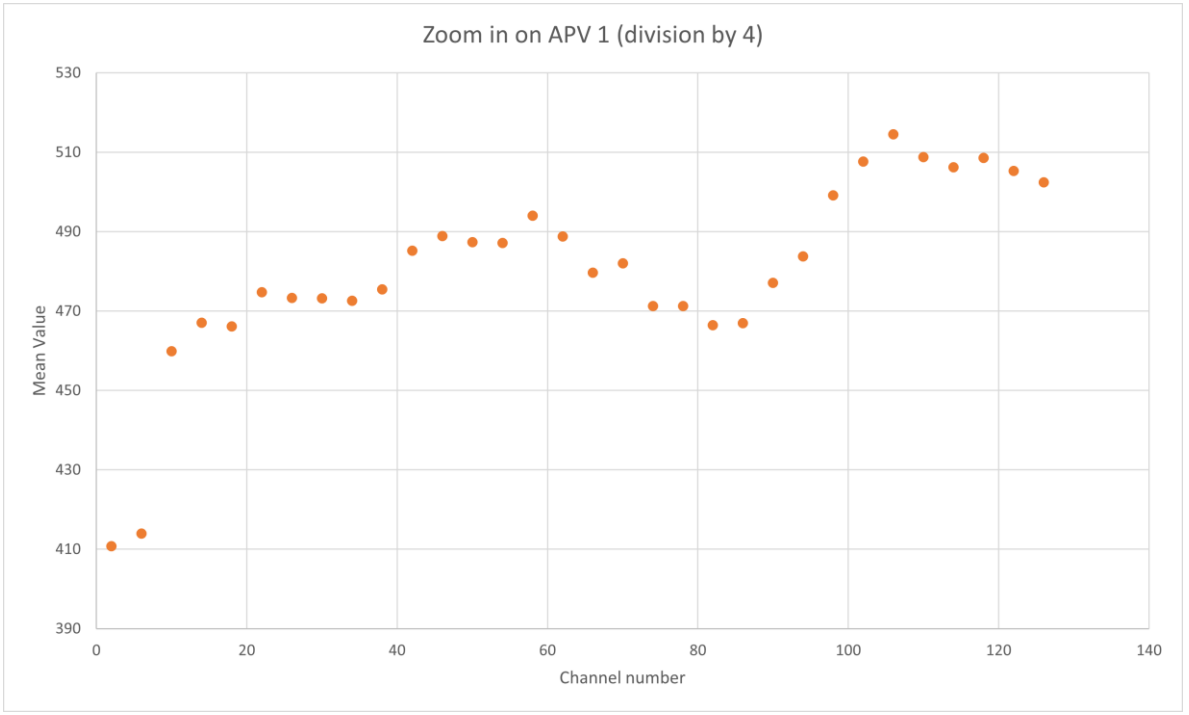



hist_q
Entries 1281
Mean x 100.6
Mean y 7.713
RMS x 66.4
RMS y 2.788
600
400
200
0
20
18
16
14
12
10
8
6
4
2
0
50
100
150
200
250

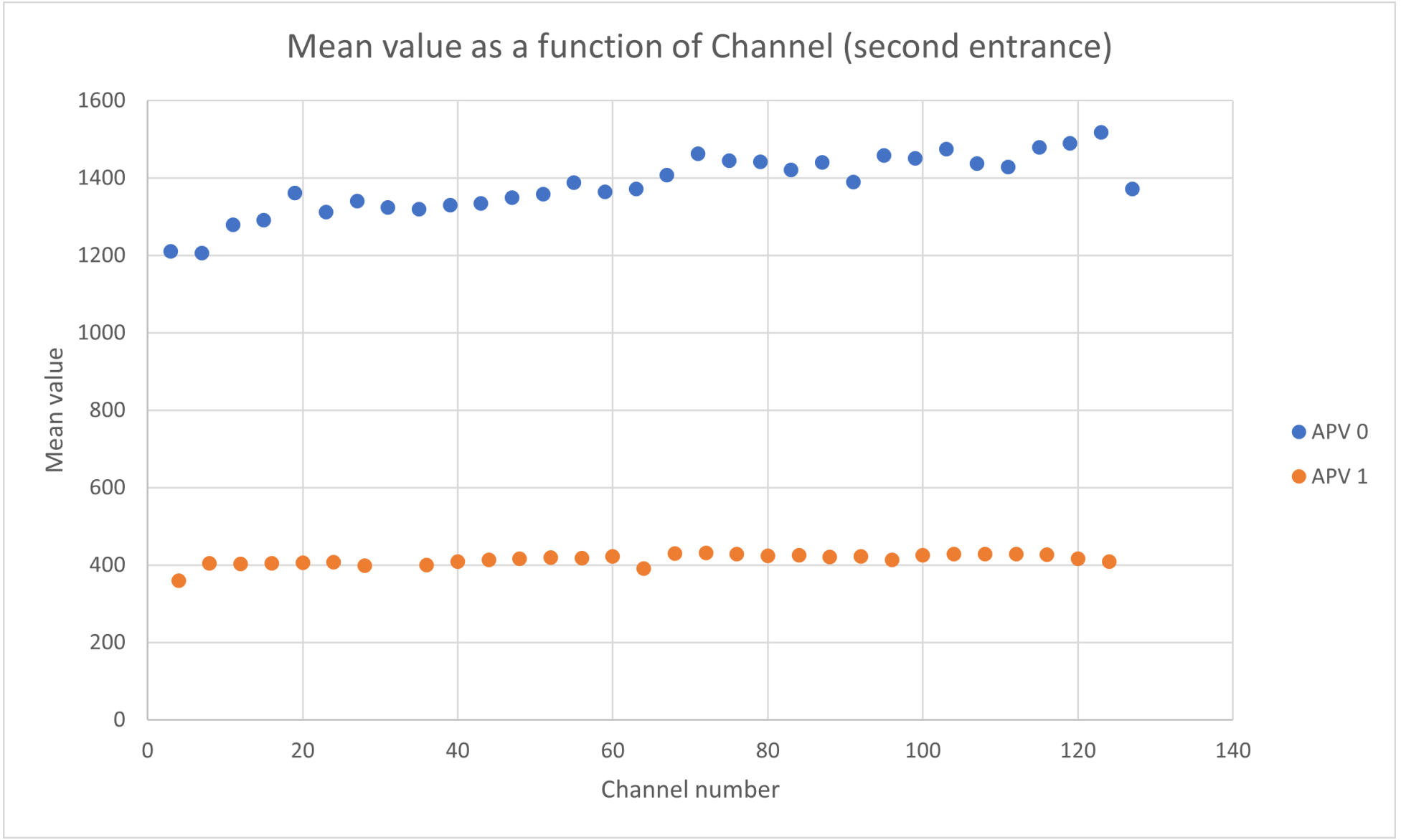
- Clearly, mean value increases with increase of the channel number

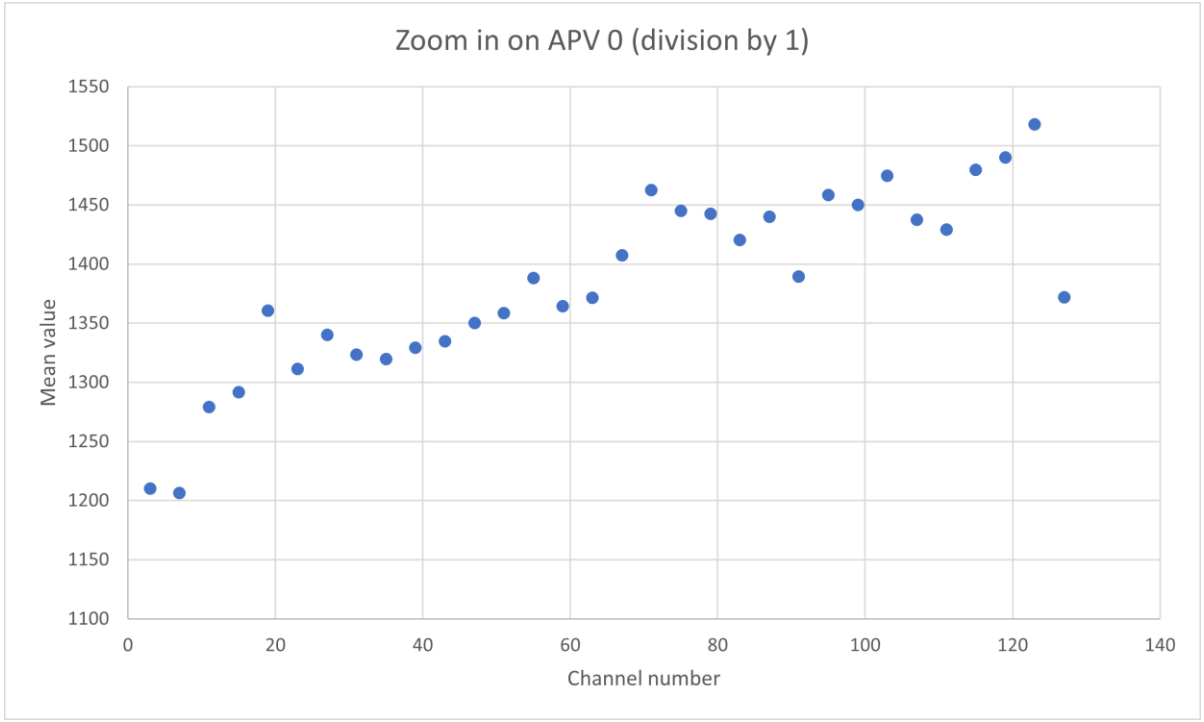


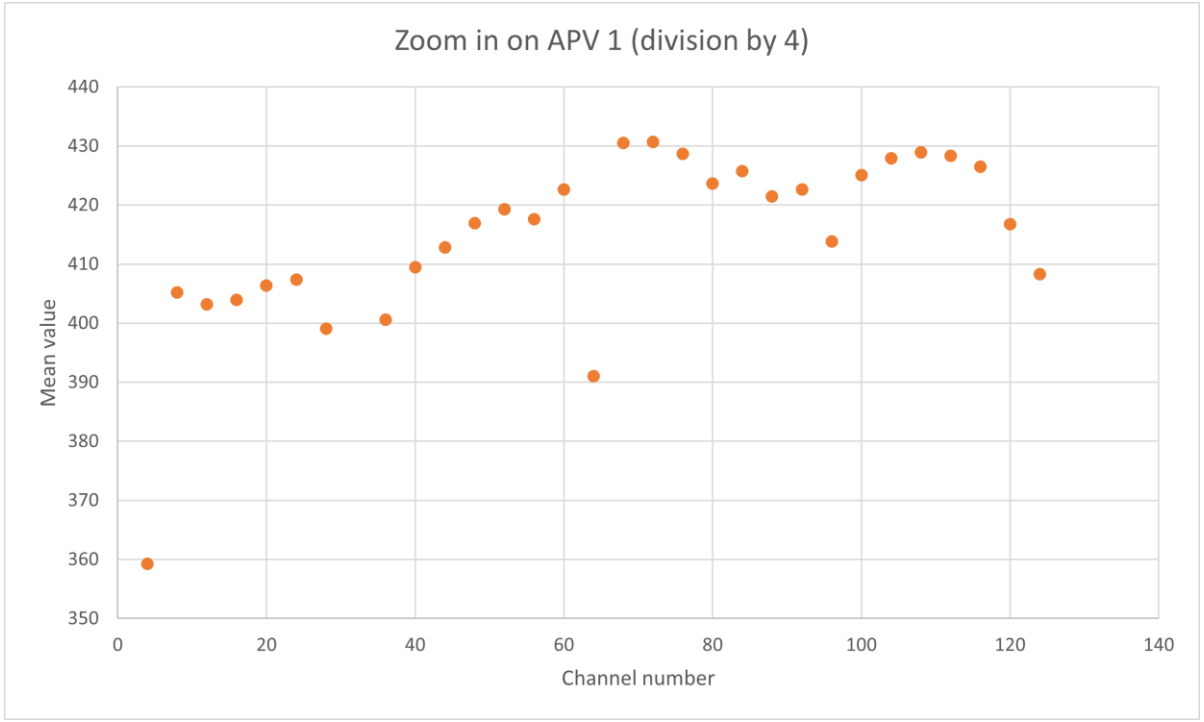

Zoom in on APV 0 (division by 1)
Mean Value
Channel number
1600
1550
1500
1450
1400
1350
1300
1250
1200
0
20
40
60
80
100
120
140


Zoom in on APV 1 (division by 4)
Mean Value
Channel number
530
510
490
470
450
430
410
390
0
20
40
60
80
100
120
140

- To confirm the first injection entrance isn’t defected, another was tested
- Same results appear here too

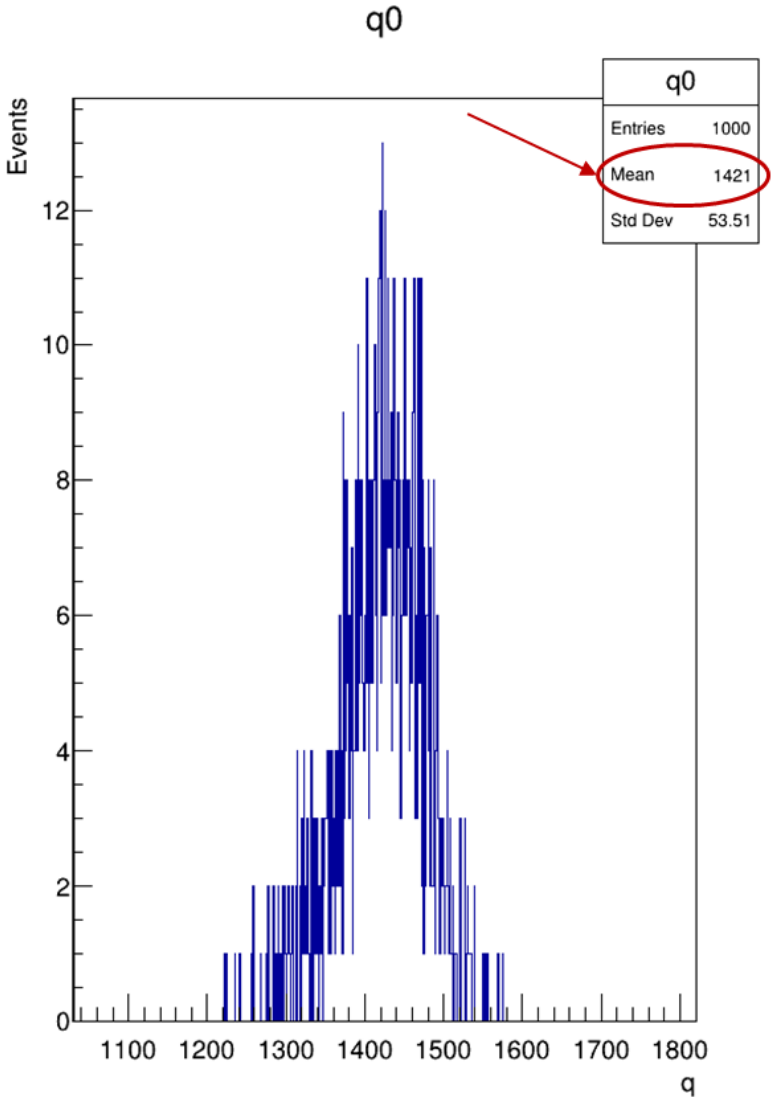



Zoom in on APV 0 (division by 1)
Mean value
Channel number
1550
1500
1450
1400
1350
1300
1250
1200
1150
1100
0
20
40
60
80
100
120
140


Zoom in on APV 1 (division by 4)
Mean value
Channel number
440
430
420
410
400
390
380
370
360
350
0
20
40
60
80
100
120
140

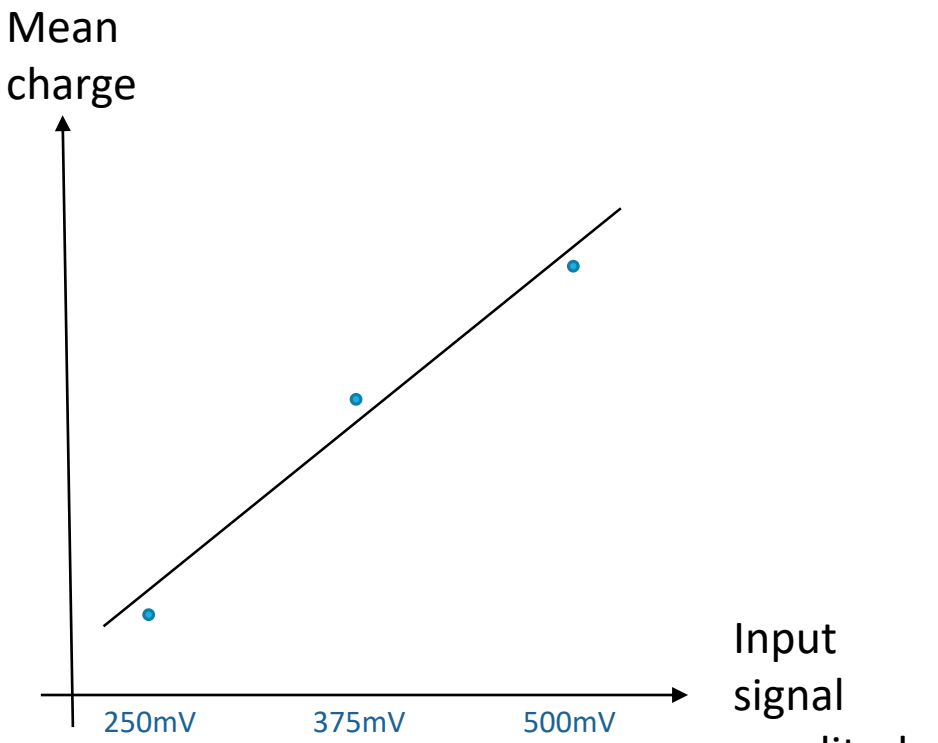
Mean value of charge

- Mean value varies between channels
  - What happens if we change the input signal?
  - Will all channels be affected equally?



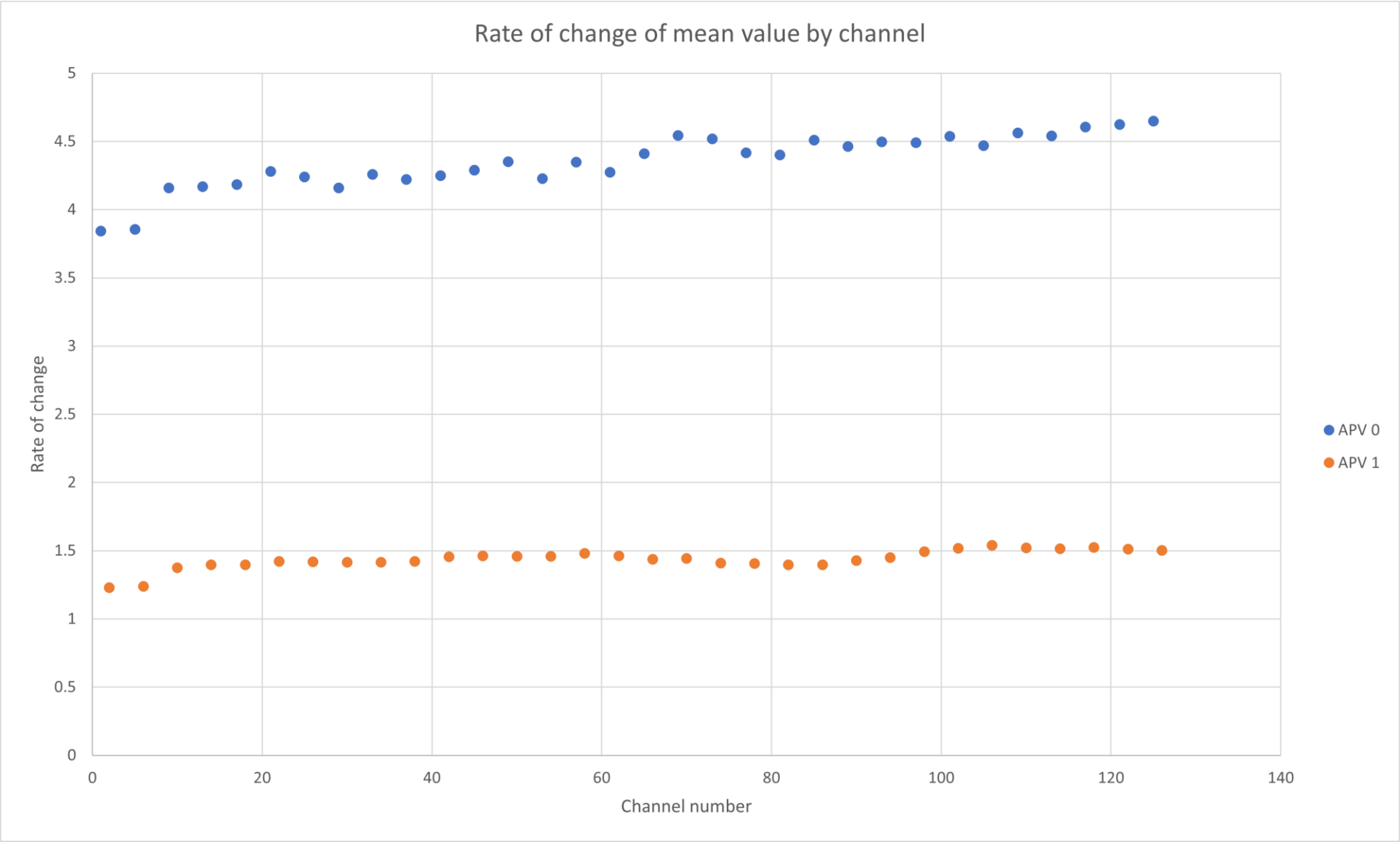
Mean value of charge – cont.

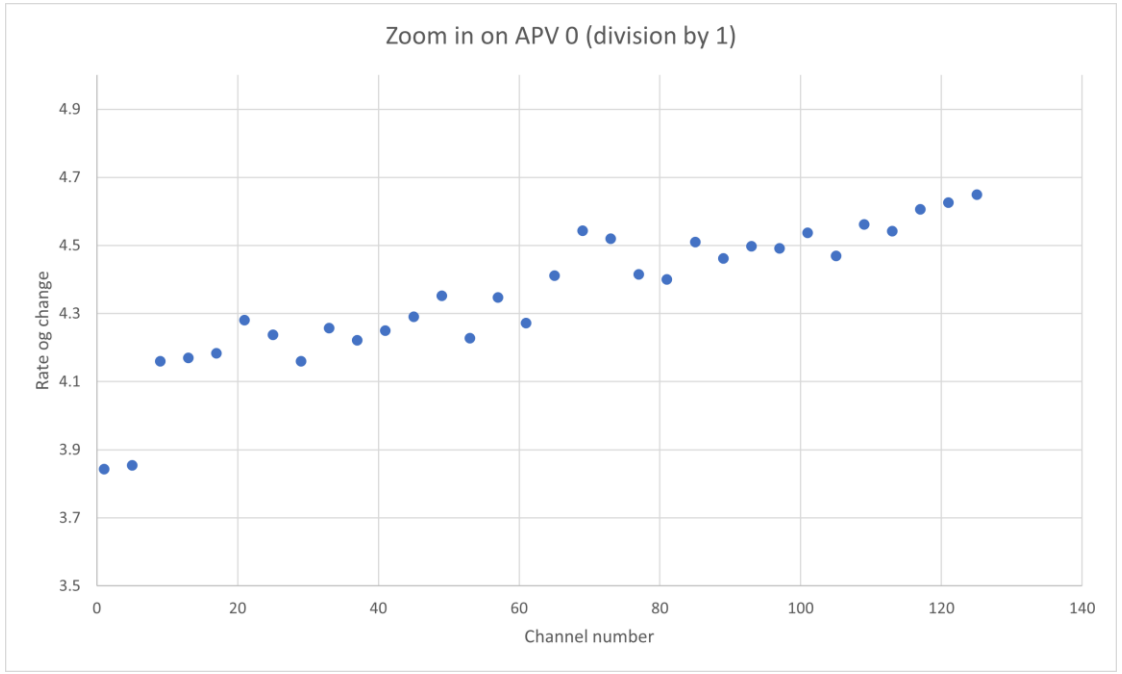
- Linear dependency was assumed between the mean value and the amplitude of the input signal
- Three different signals were used: 250mV, 375mV and 500mV
- For each APV and channel, the mean value of the charge was extracted
- Using linear regression we calculated the slope of the fit, let it be ***m***

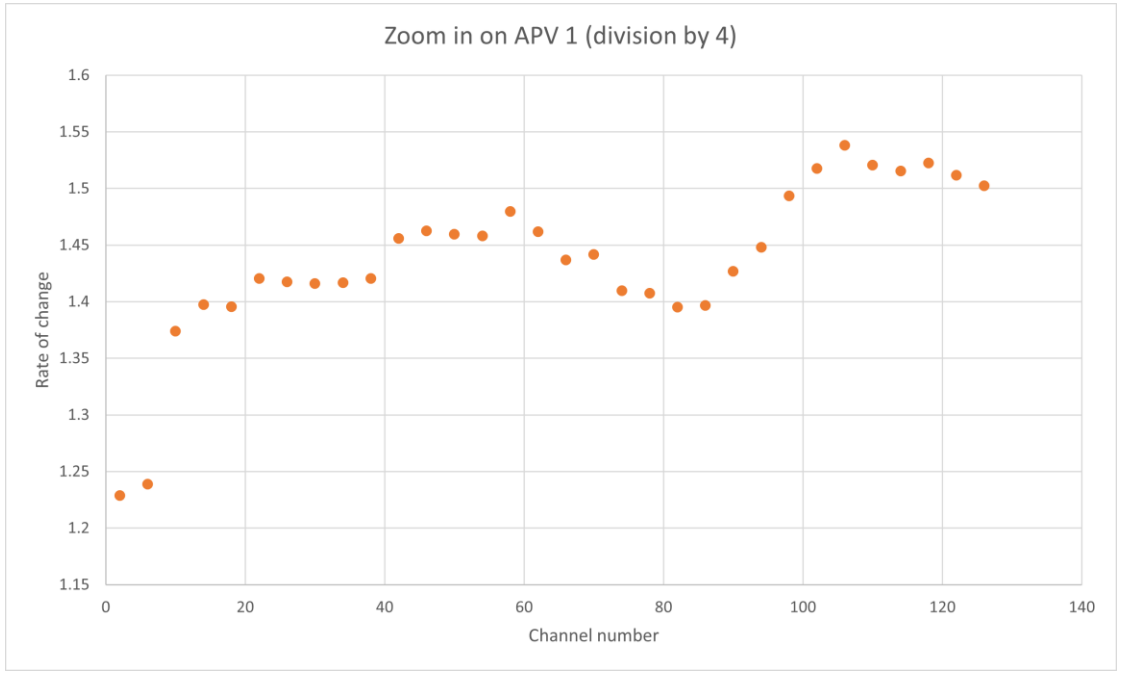


For a specific channel and APV

- Unfortunately, ***m*** increases as well – contrary to our expectations
- Moreover, it looks almost identical to the mean value as a function of channel number




Zoom in on APV 0 (division by 1)
Rate og change
4.9
4.7
4.5
4.3
4.1
3.9
3.7
3.5
0
20
40
60
80
100
120
140
Channel number


Zoom in on APV 1 (division by 4)
Rate of change
1.6
1.55
1.5
1.45
1.4
1.35
1.3
1.25
1.2
1.15
0
20
40
60
80
100
120
140
Channel number

The End.

THANK YOU