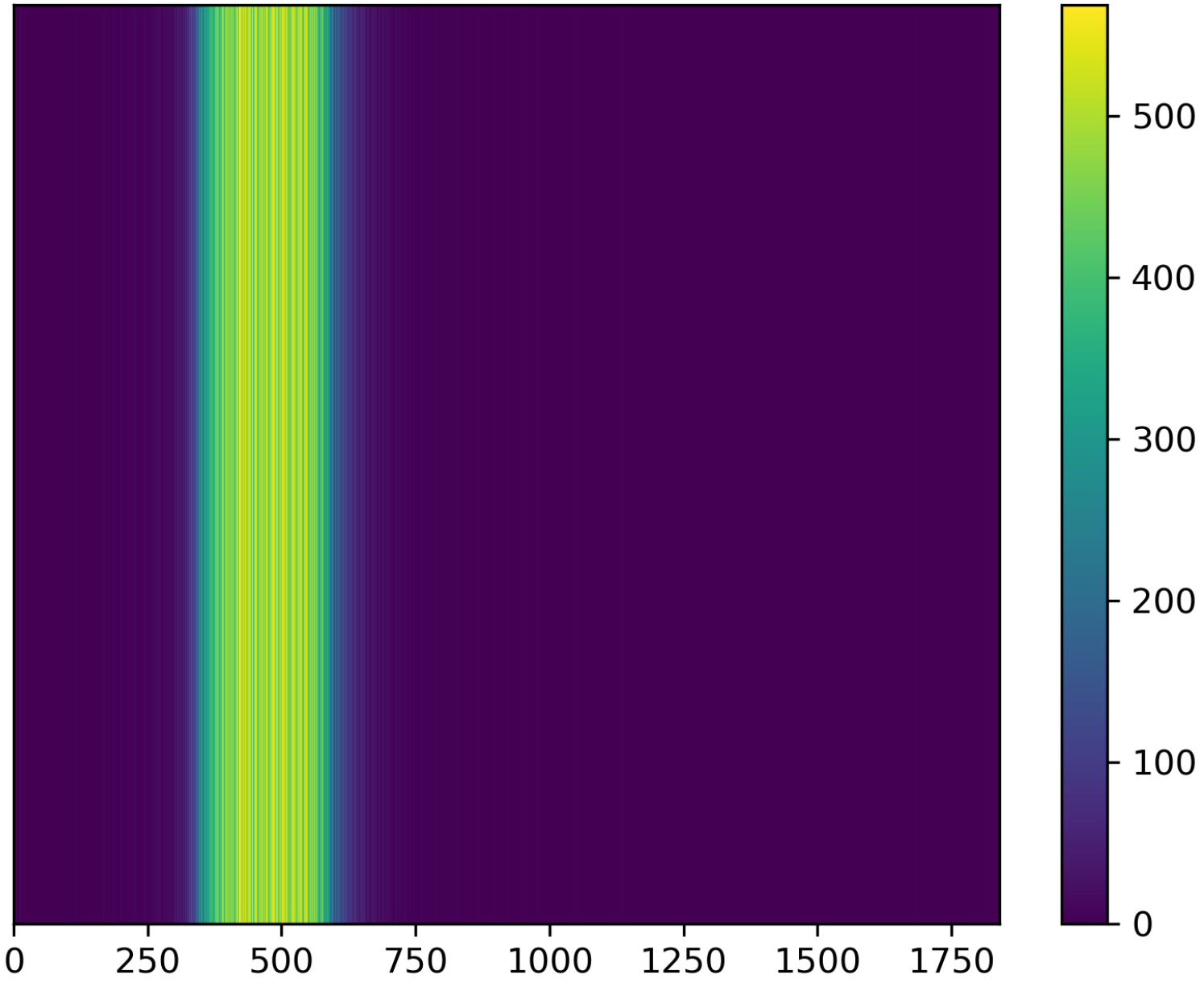
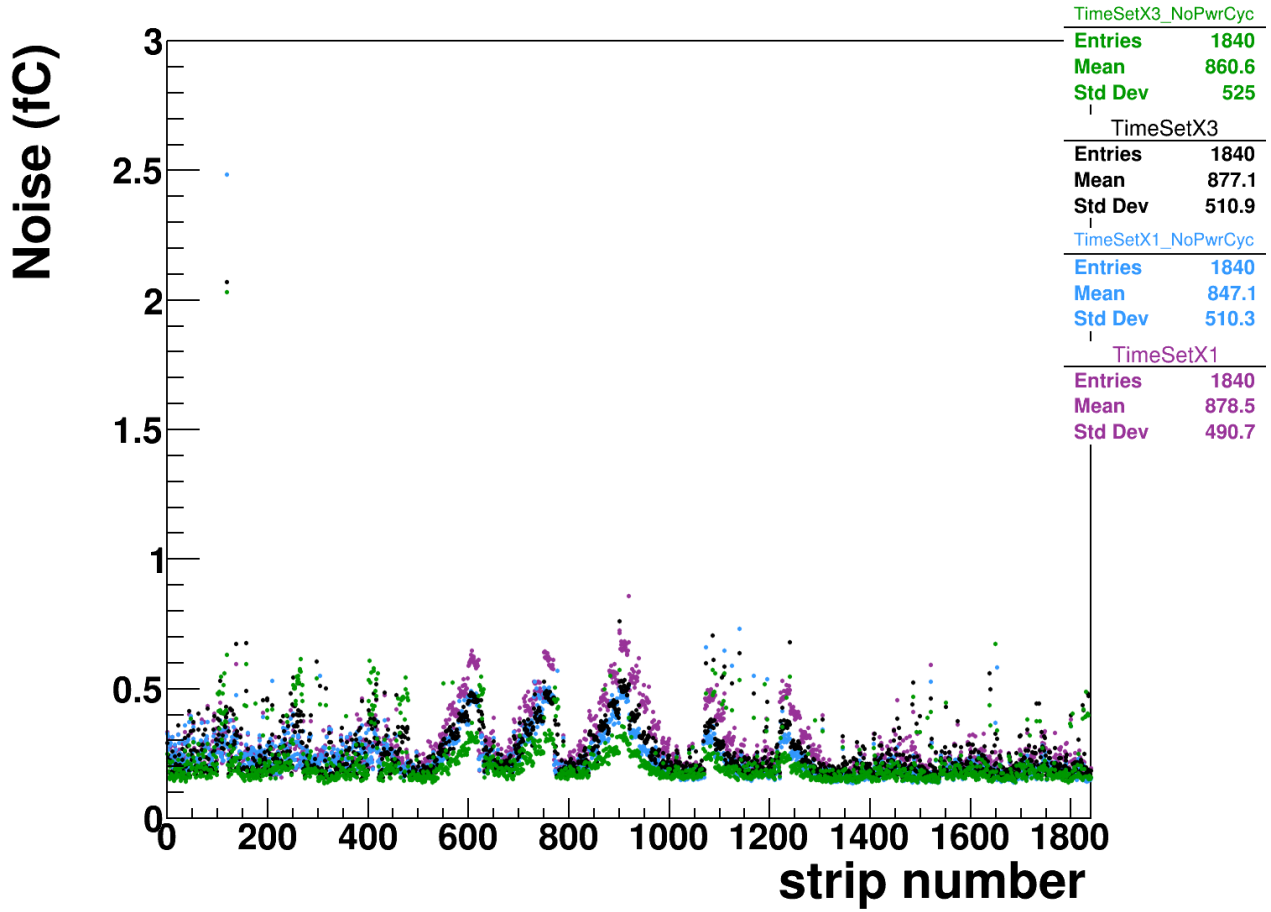


Heatmap showing location on the sensor where I recorded hits that are on track

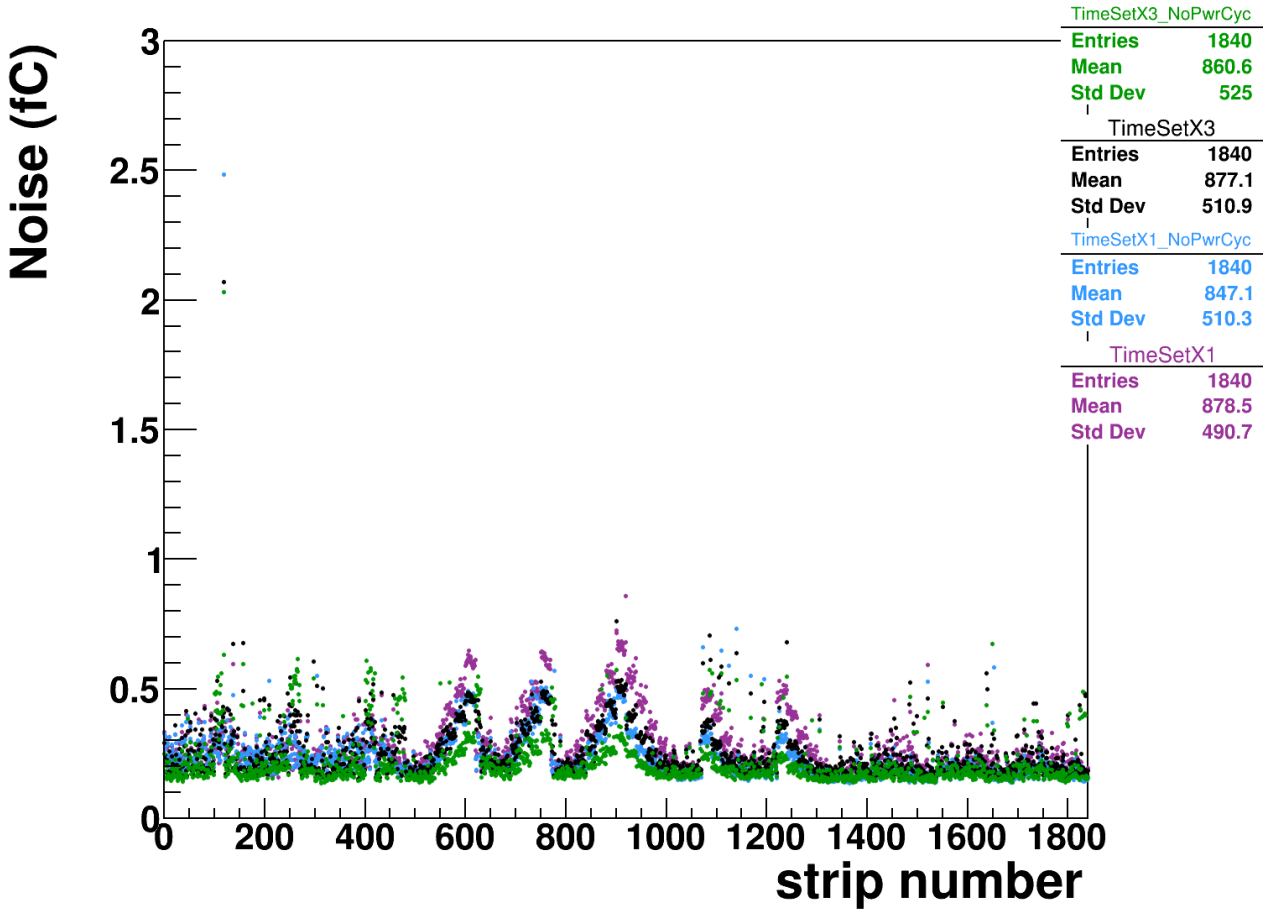
Investigating power pulsing (Noise vs strip number)

- Last week I sent around some slides concerning the impact of the power pulsing on the system noise. (Should also be in the same indico)
- Below is are two distributions for noise vs strip number for 4 different configuration
  - Standard start up time
  - Standard start up time
    + No power pulsing
  - Start up time stretched by a factor 3
  - Start up time stretched by a factor 3
    + no Power pulsing



Investigating power pulsing (Noise vs strip number)

- As Dieter already noted, the spikes in the center of the sensor are still present event without power pulsing as such the power pulsing cannot be the reason for the spikes.
- Question from my side: Why though is the entire noise distribution pressed down?
- All 6 sensors show that a stretched start up time improves the noise and running without power pulsing further improves it.
- The fact that there is still a difference between TimeSetX3 and TimeSetX1 without power pulsing proves that there are other things that impact the noise
- It was glanced over by Dieter but is this expected?

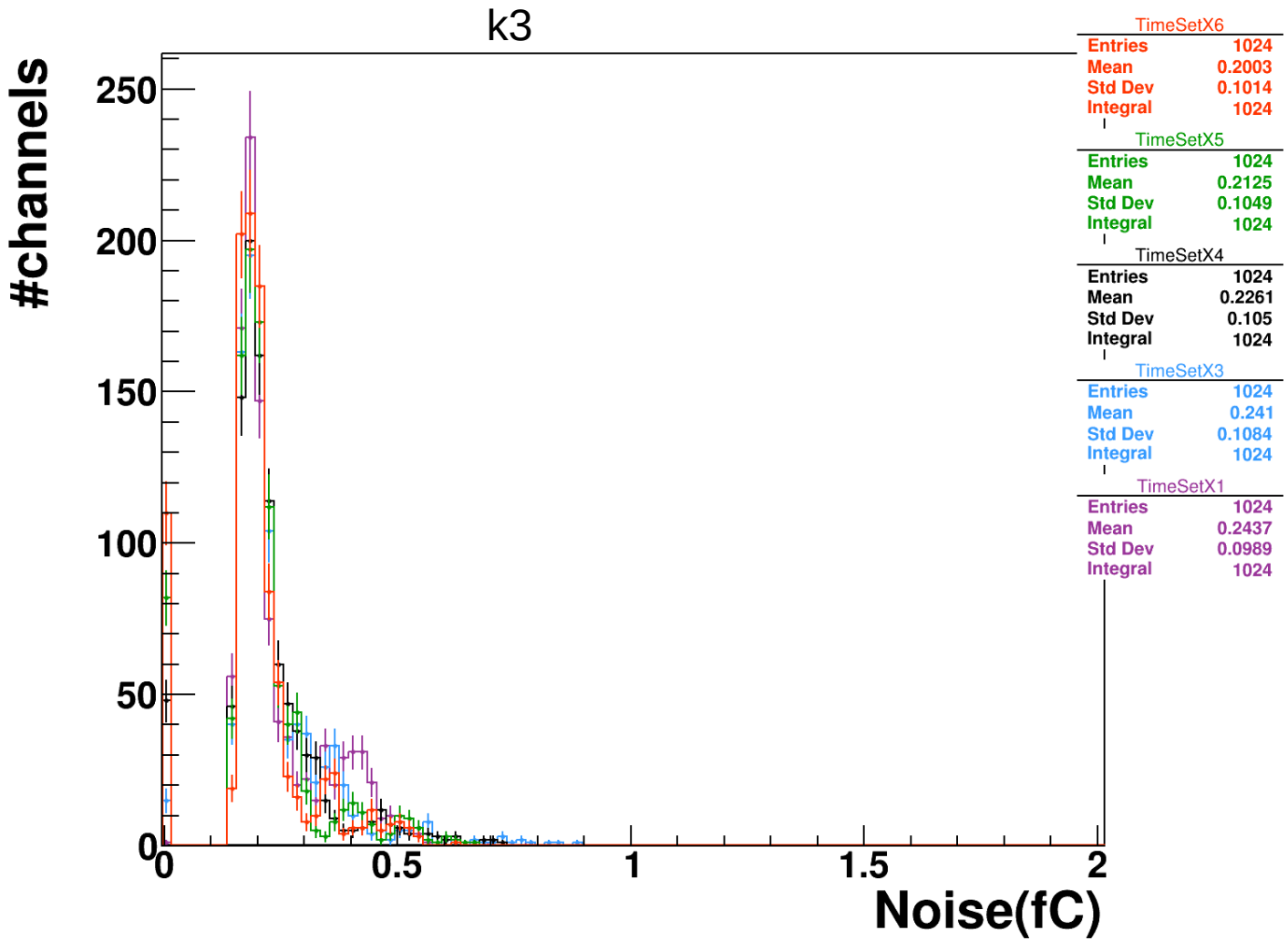


Stretching start up

- The next question was then, what if I further increase the start up time?
- Do I at some point reach some asymptotic value?
- As such I did measurements with the start up time further stretched
- TimeSetX4, X5, X6 means that every value that performs an operation in the start up (TimeResetOn/Off, TimeBunchClockDelay, TimePowerUpOn etc.) is multiplied by the value after X

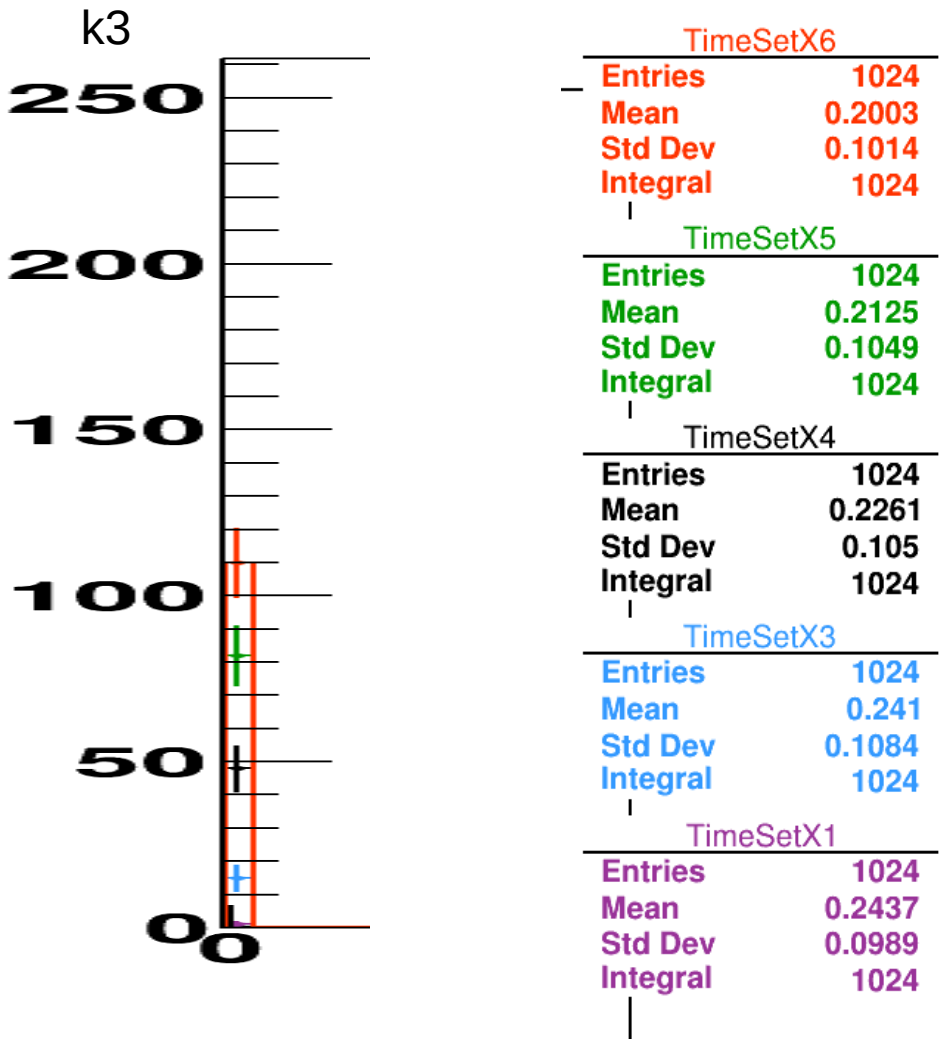
Stretching start up

- In essence once could maybe see a slight improvement in the the noise distribution when further increasing the start up phase
- This improvement is not massive but there is also something negative



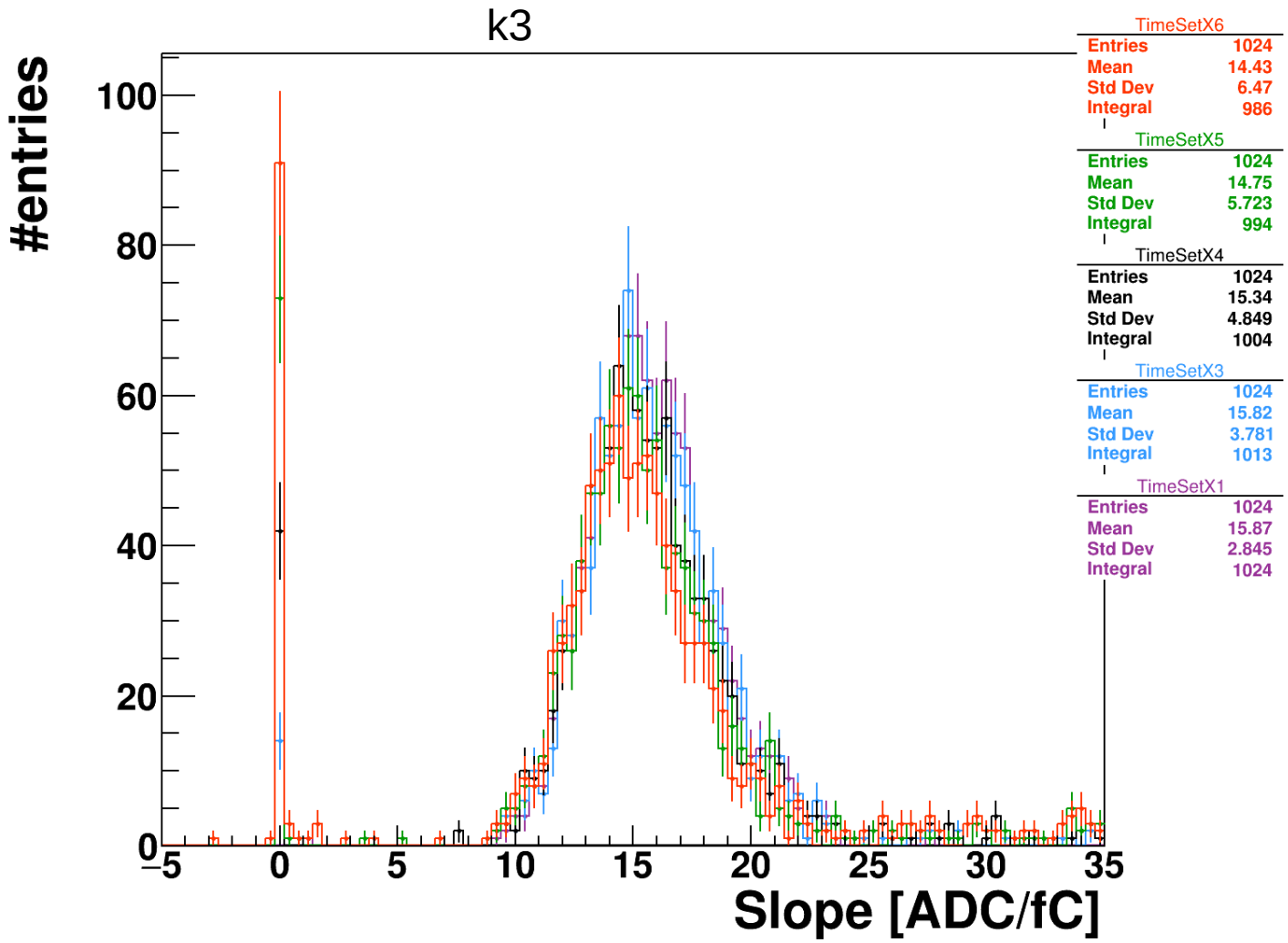
Stretching start up

- In essence once could maybe see a slight improvement in the the noise distribution when further increasing the start up phase
- This improvement is not massive but there is also something negative
- The number of channels that show a noise value of 0 (which is highly unphysical) increases with increased stretching time



Stretching start up

- The reason for this increase in unphysical channels is simple. It is an increase in number of faulty calibration channels.
- Question1: Why does the number of channels with faulty calibration increase?
- Question2: Why is this consistently the case for all KpiX EXCEPT for k4



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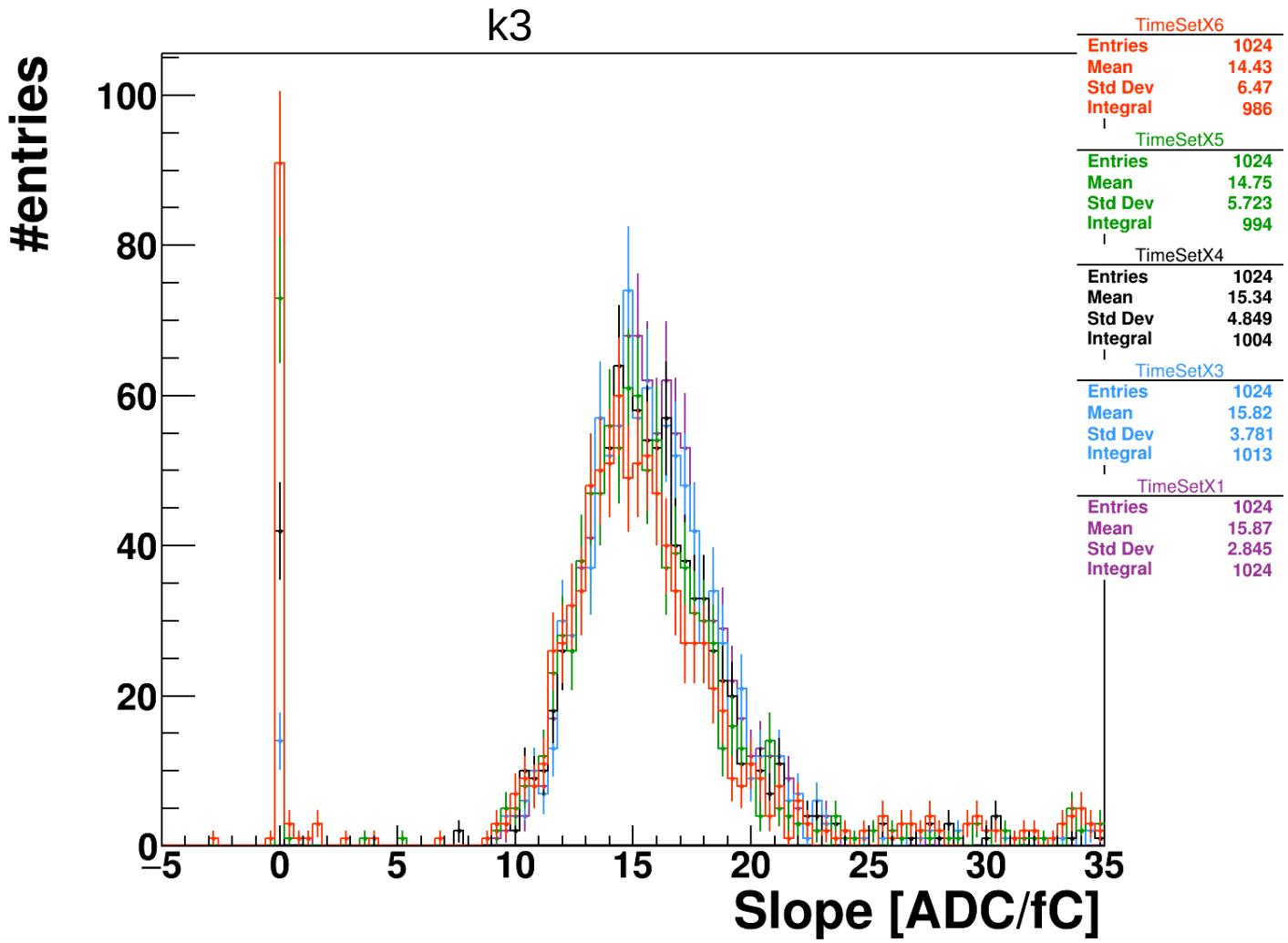
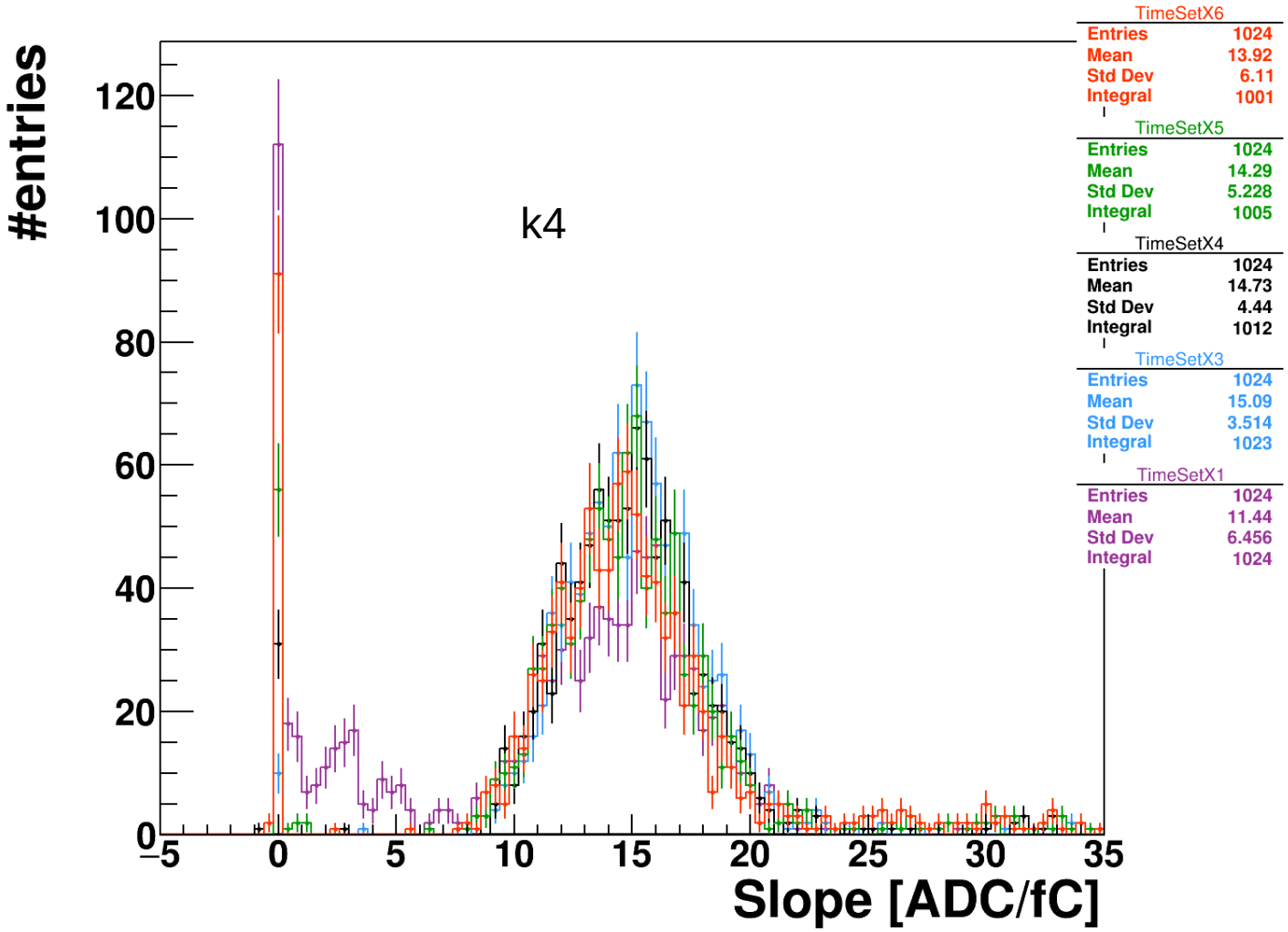


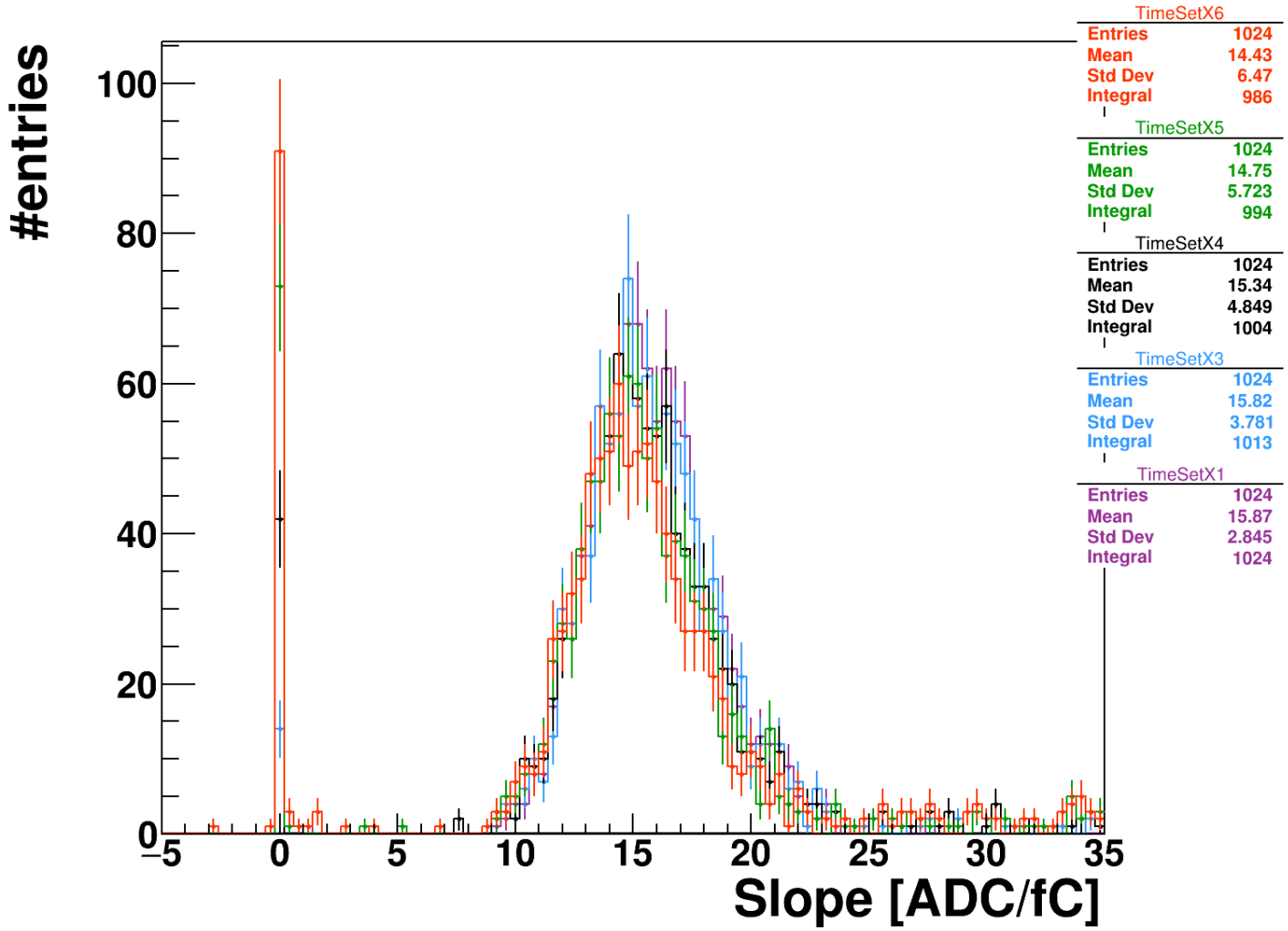
Stretching start up

- Question2: Why is this consistently the case for all KpiX EXCEPT for k4
- K4 calibration improves by about 400 channels when stretching the start up phase by a factor of 3. And afterwards starts getting worse like the other 11 KPiX



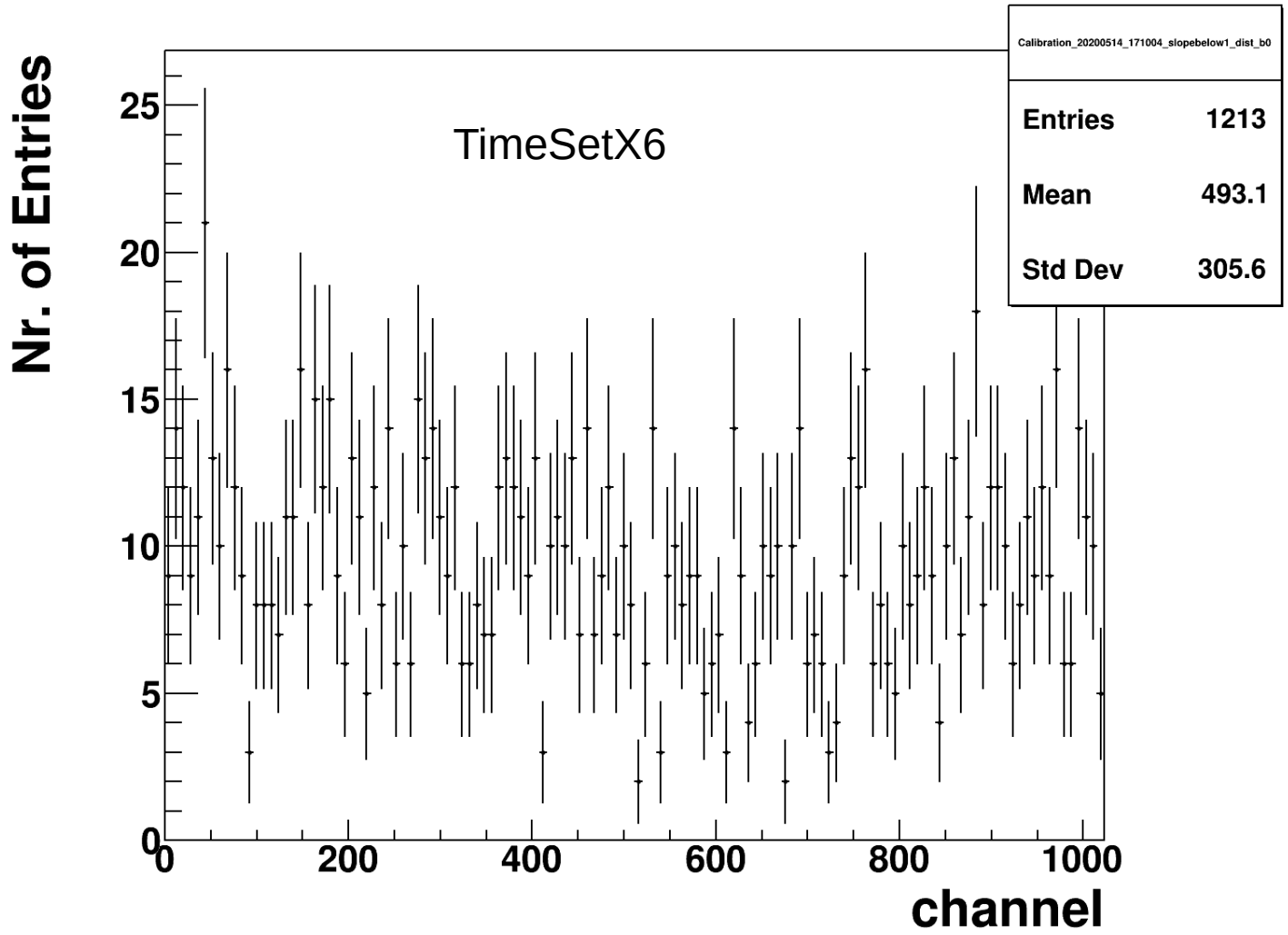
Stretching start up

- The reason for this increase in non sensical channels is simple. It is an increase in number of faulty calibration channels.
- Is there some leakage which results in faulty calibration when increasing start up?
- Is this normal or even expected?



Stretching start up

- The plot to the right shows for all 12 KpiX with times 6 stretched start up the location of the faulty channels with slope below 1
- There is no clear correlation between which channels show faulty calibrations and their position.

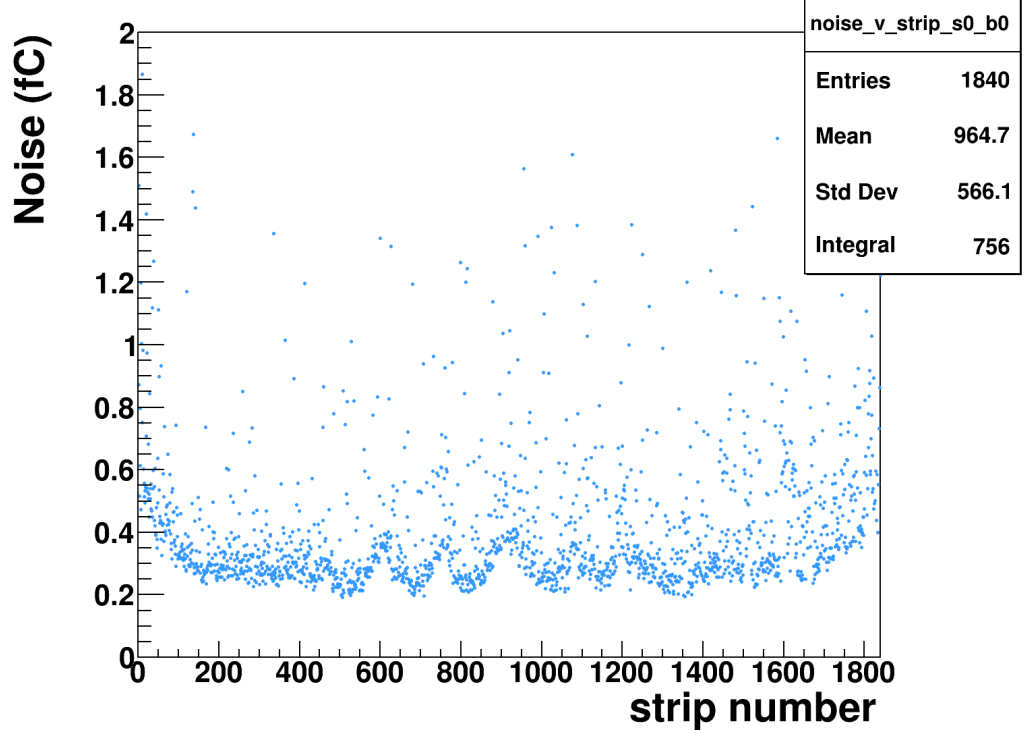


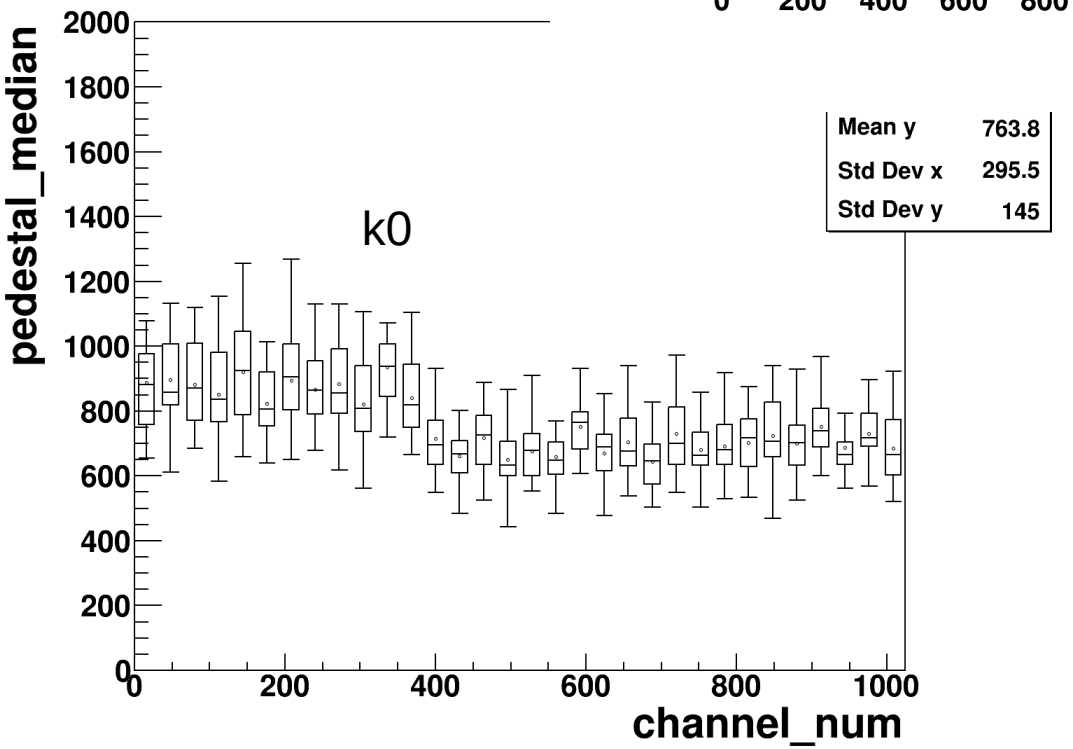
Stretching start up

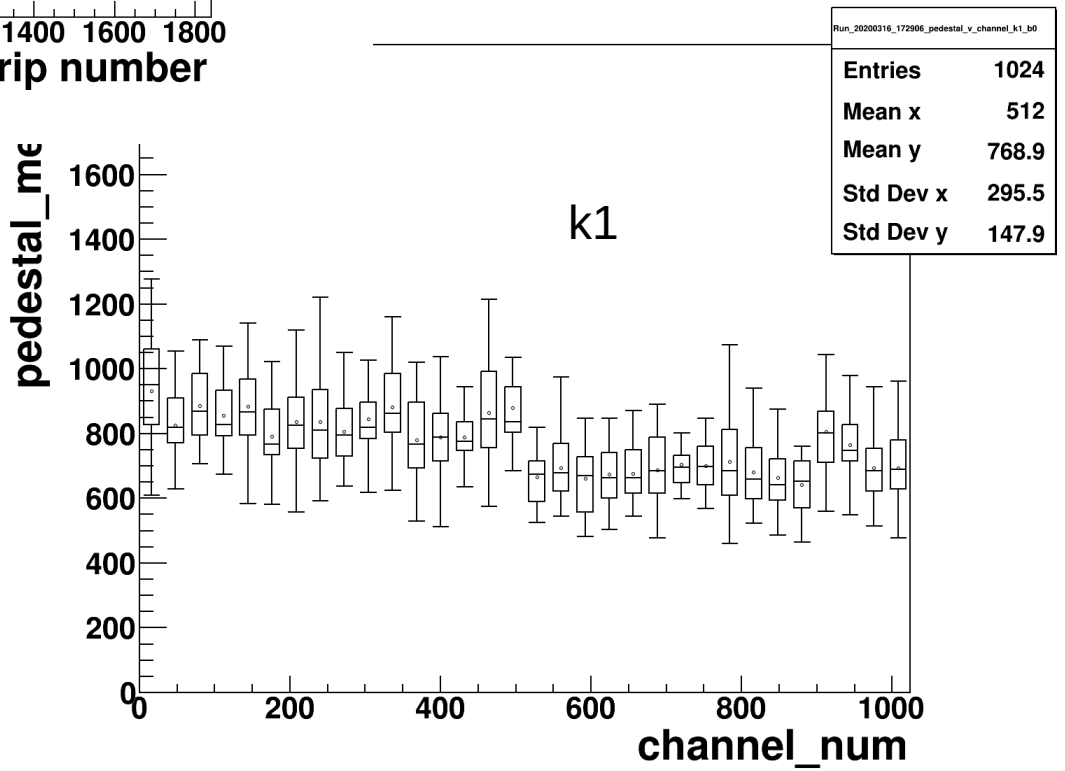
- We need an explanation for why the noise improves with increased start up.
- We also need an explanation for why k4 improves in calibrations when stretching start up
- And finally we need an explanation for why, with further stretching, all kpix start getting worse again in their calibration.

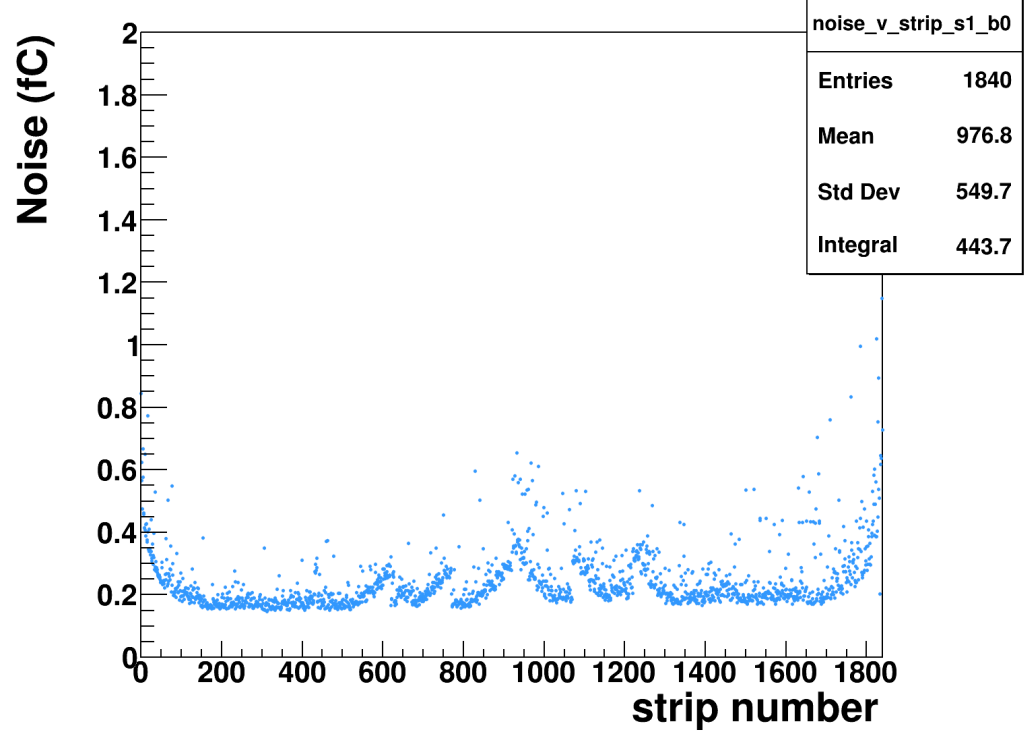
Early channel leakage?

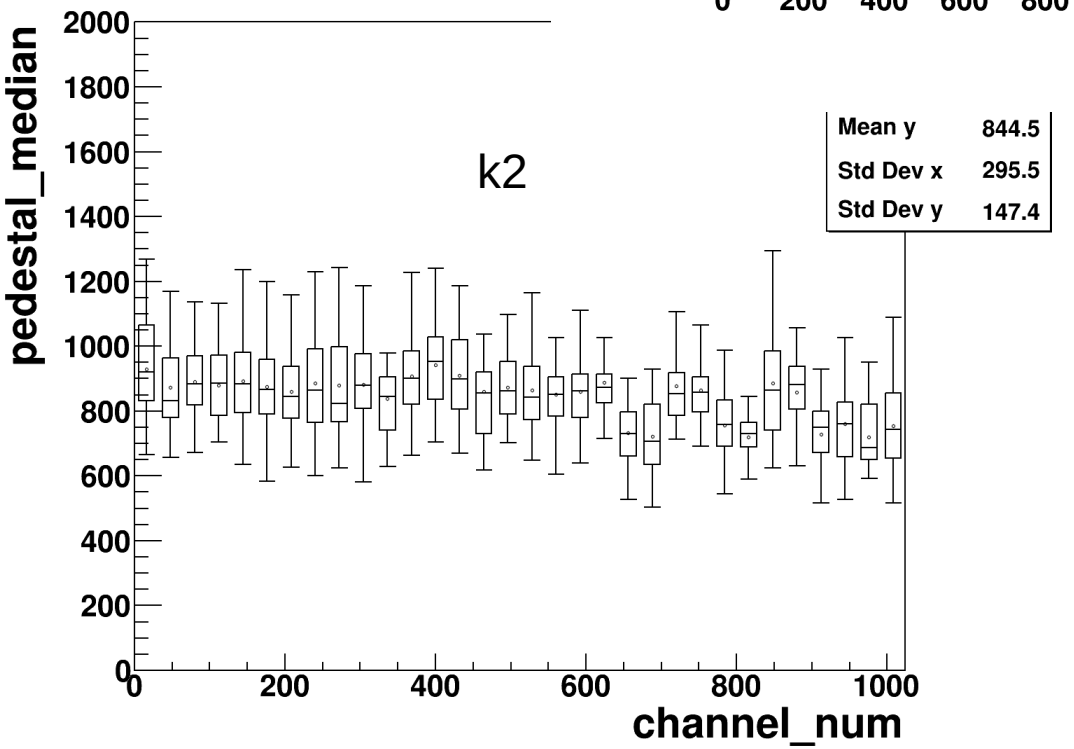
- Dieter has put forth that he saw for the KpiX that in the early channels he sees increased pedestals which would indicate leakage through the coupling capacitor.
- I cross checked this in my data set and can confirm that there are KpiX that show this behavior. But not all of them do.
- And I see basically no correlation between the size of the spikes and average pedestal height.
- In some cases the pedestal heights are basically equal but they still show these spikes.

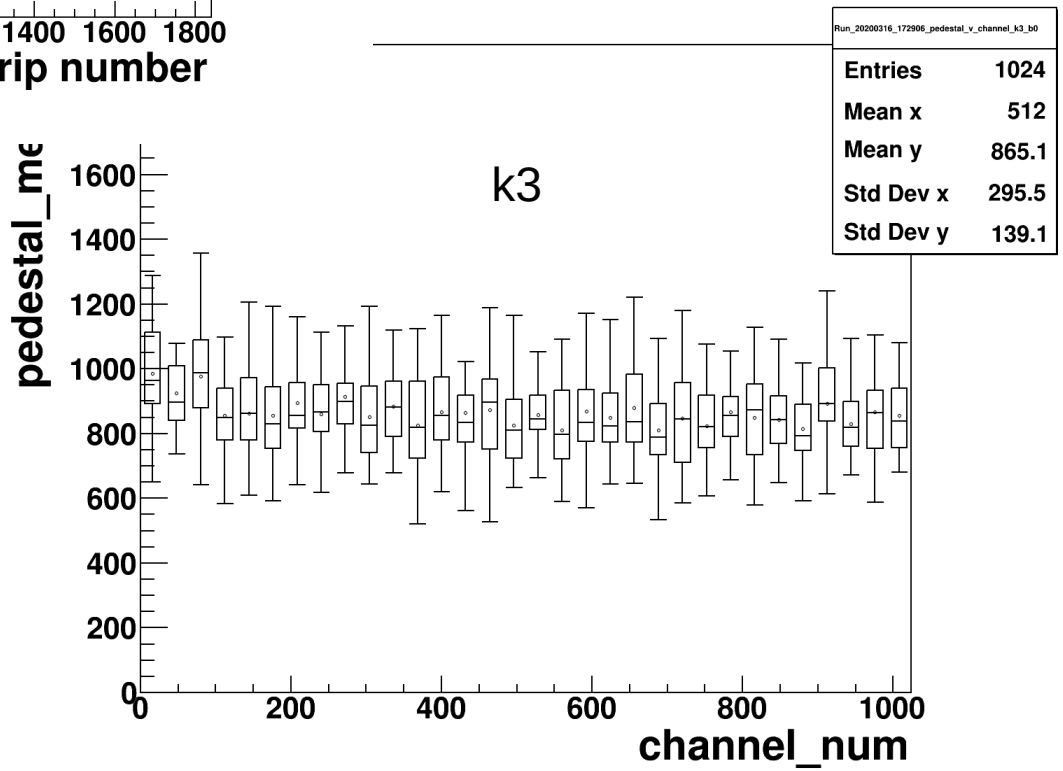

noise_v_strip_s0_b0
Entries 1840
Mean 964.7
Std Dev 566.1
Integral 756
Noise (fC)
strip number

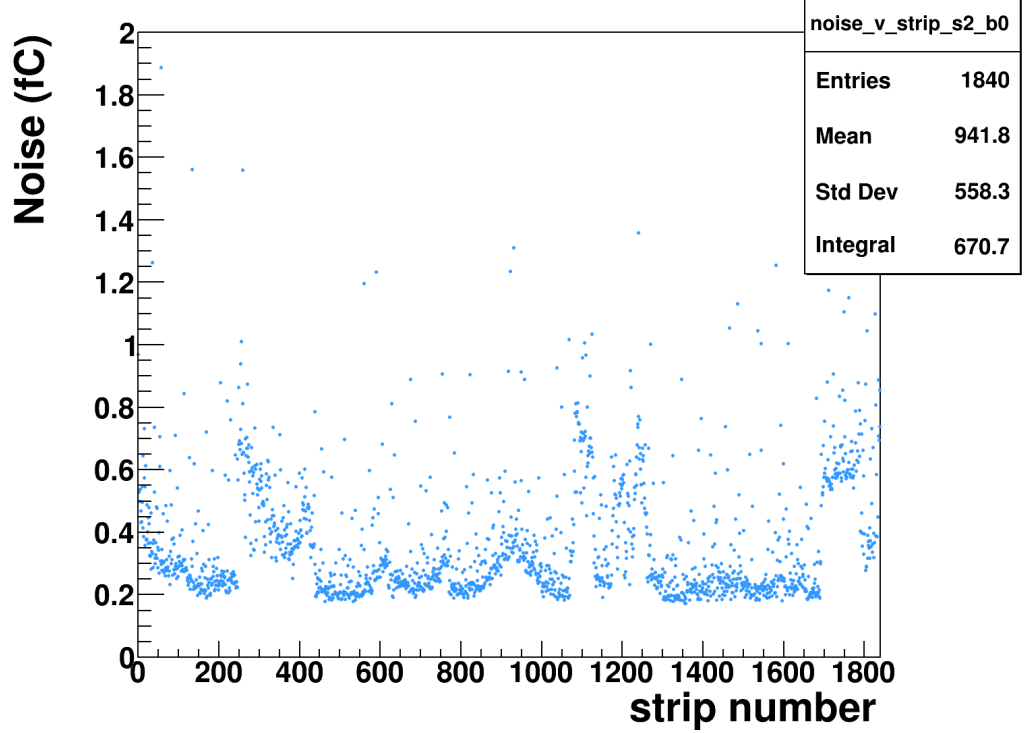

k0
Mean y 763.8
Std Dev x 295.5
Std Dev y 145
pedestal_median
channel_num

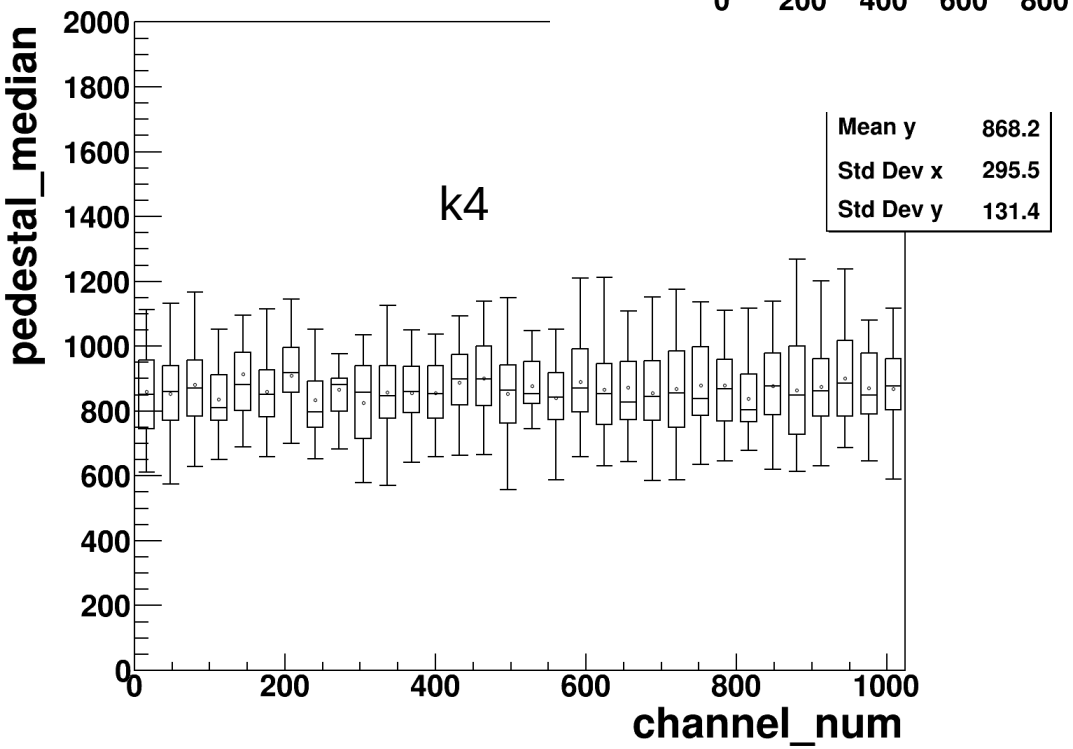

Run_20200316_172906_pedestal_v_channel_k1_b0
Entries 1024
Mean x 512
Mean y 768.9
Std Dev x 295.5
Std Dev y 147.9
k1
channel_num

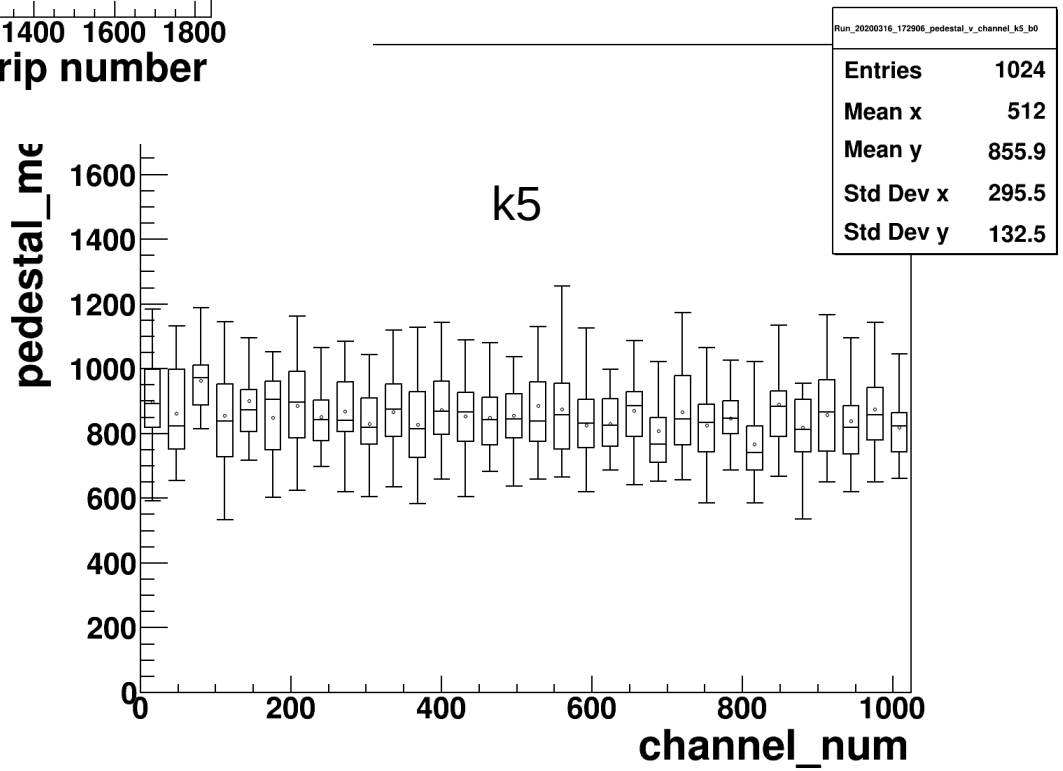

noise_v_strip_s1_b0
Entries 1840
Mean 976.8
Std Dev 549.7
Integral 443.7
Noise (fC)
strip number

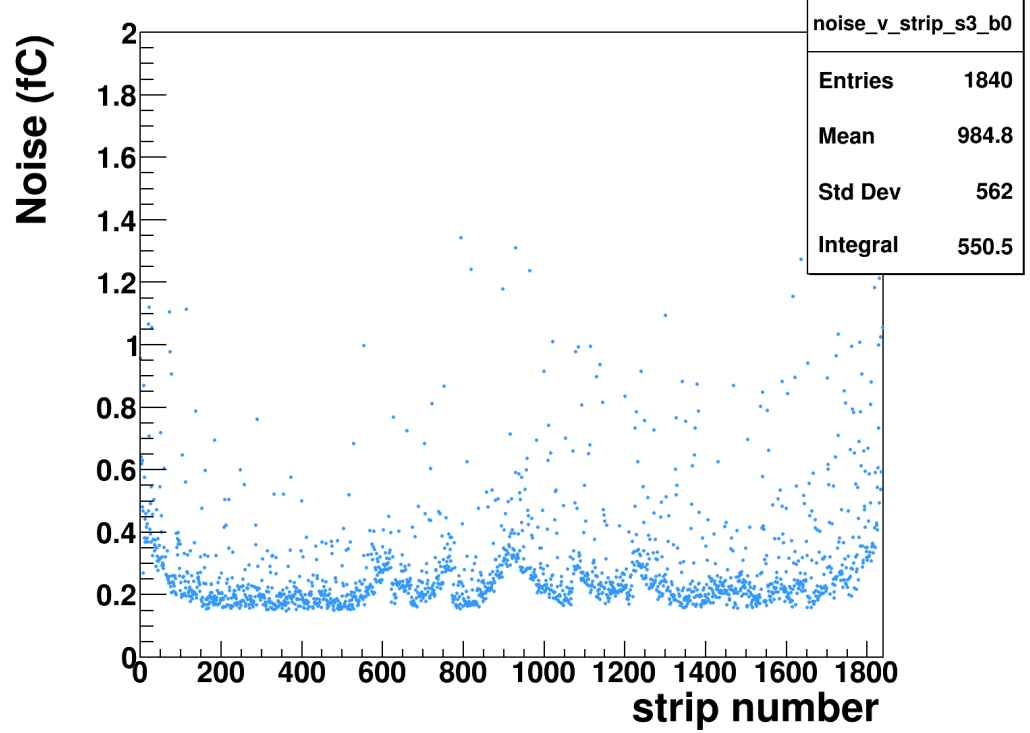

k2
Mean y 844.5
Std Dev x 295.5
Std Dev y 147.4
pedestal_median
channel_num

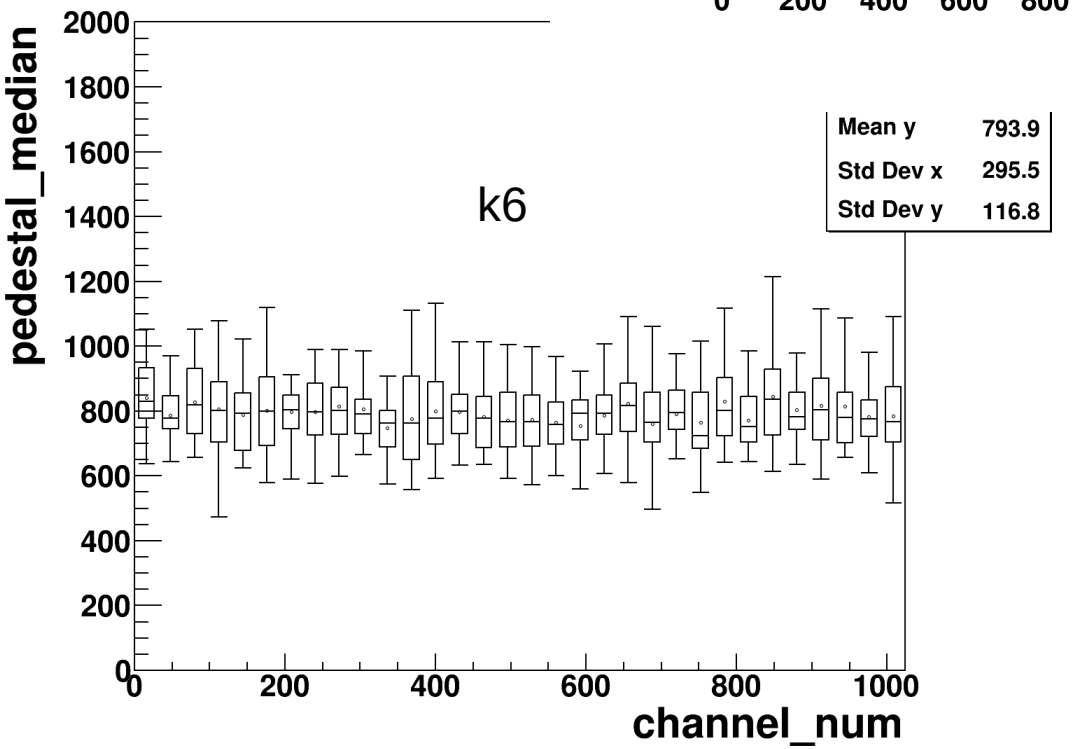

Run_20200316_172906_pedestal_v_channel_k3_b0
Entries 1024
Mean x 512
Mean y 865.1
Std Dev x 295.5
Std Dev y 139.1
k3
channel_num

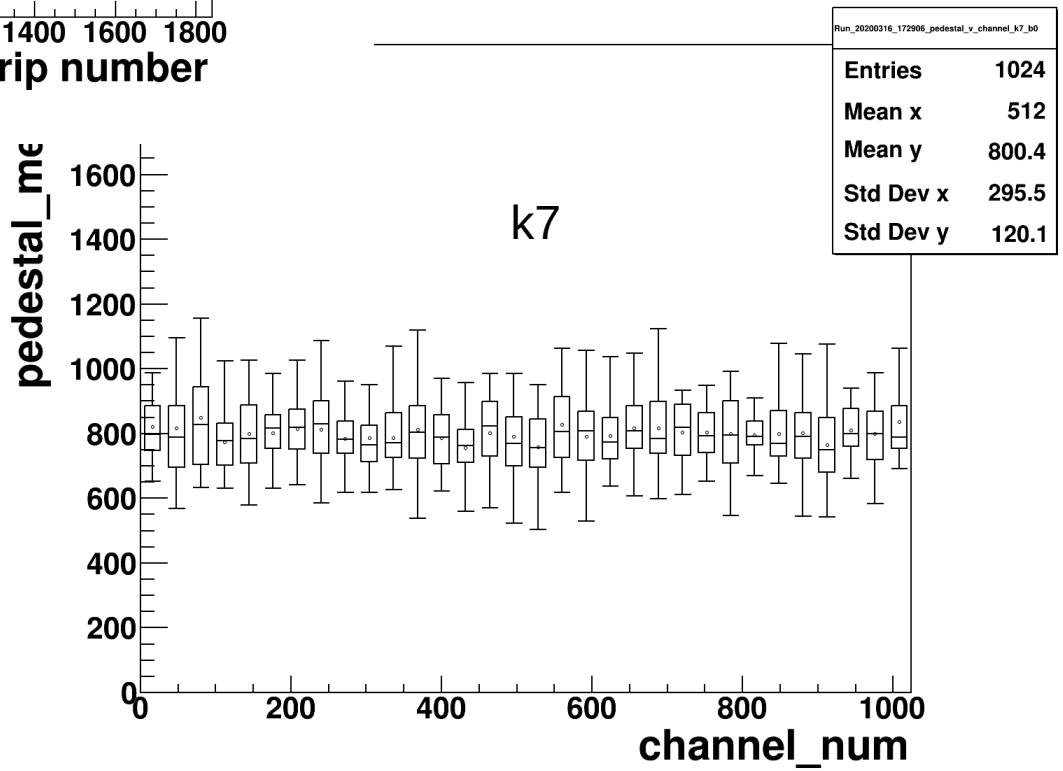

noise_v_strip_s2_b0
Entries 1840
Mean 941.8
Std Dev 558.3
Integral 670.7
Noise (fC)
strip number

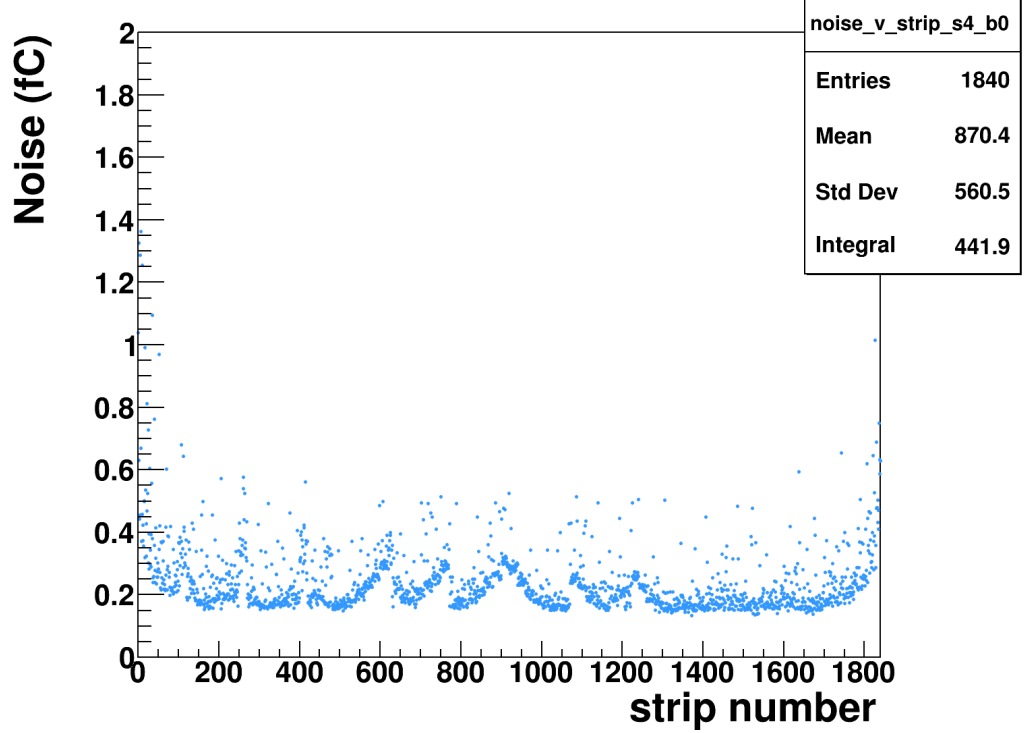

k4
Mean y 868.2
Std Dev x 295.5
Std Dev y 131.4
pedestal_median
channel_num

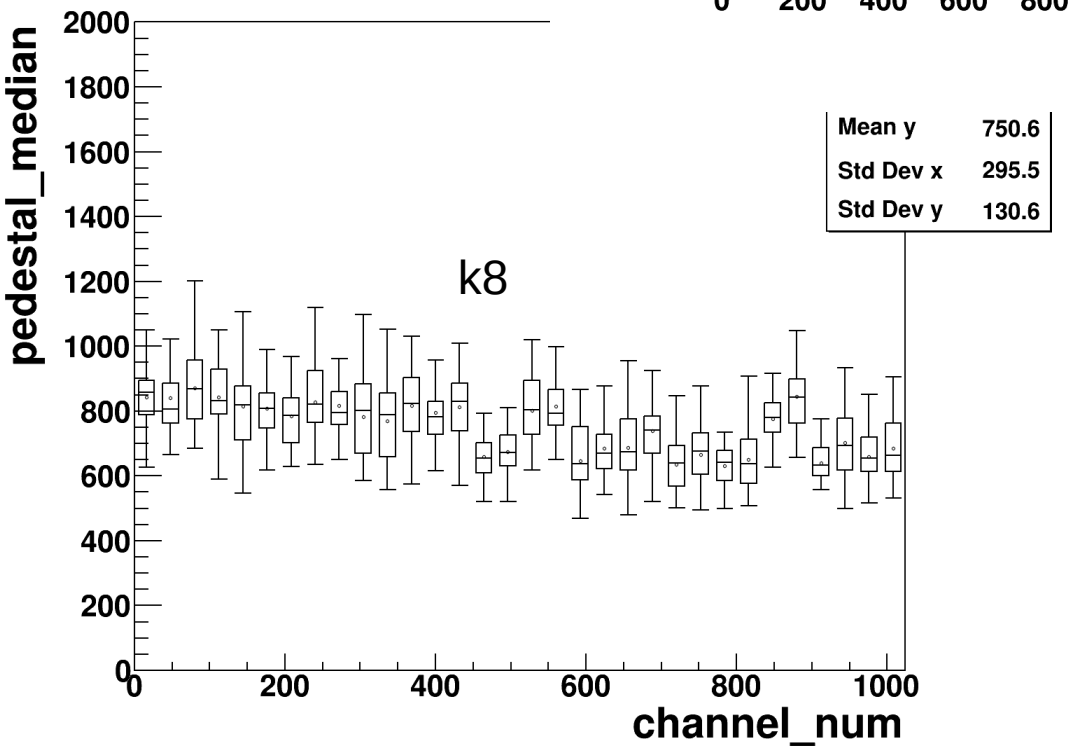

Run_20200316_172906_pedestal_v_channel_k5_b0
Entries 1024
Mean x 512
Mean y 855.9
Std Dev x 295.5
Std Dev y 132.5
k5
channel_num

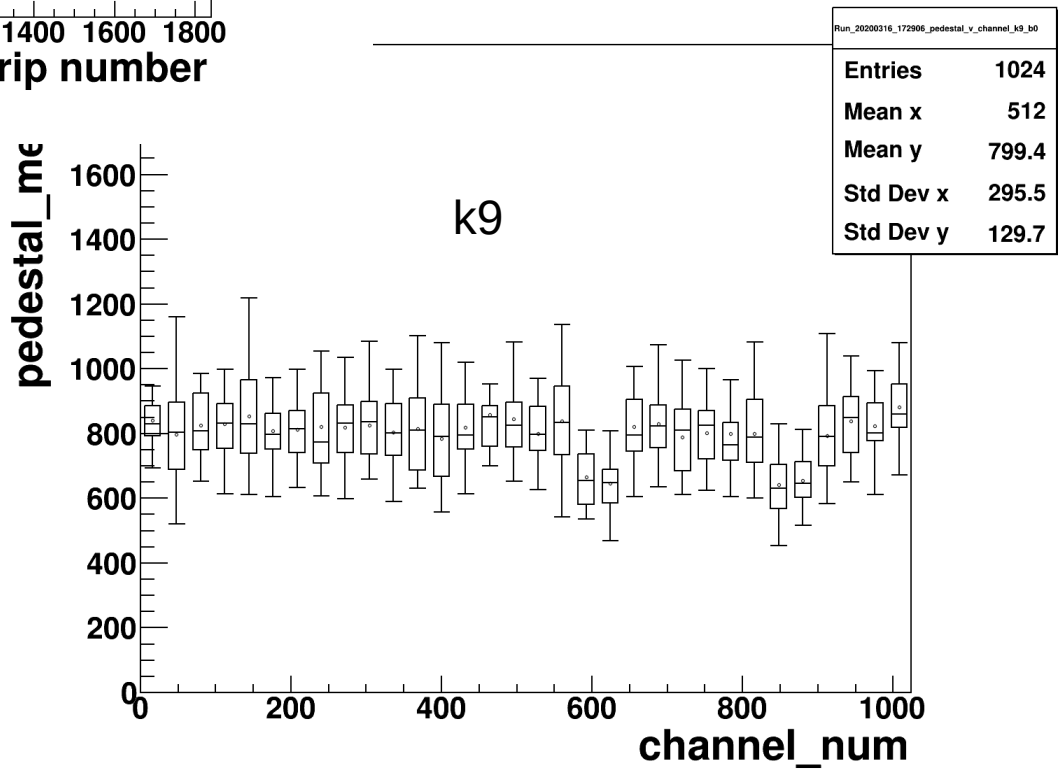

noise_v_strip_s3_b0
Entries 1840
Mean 984.8
Std Dev 562
Integral 550.5
Noise (fC)
strip number

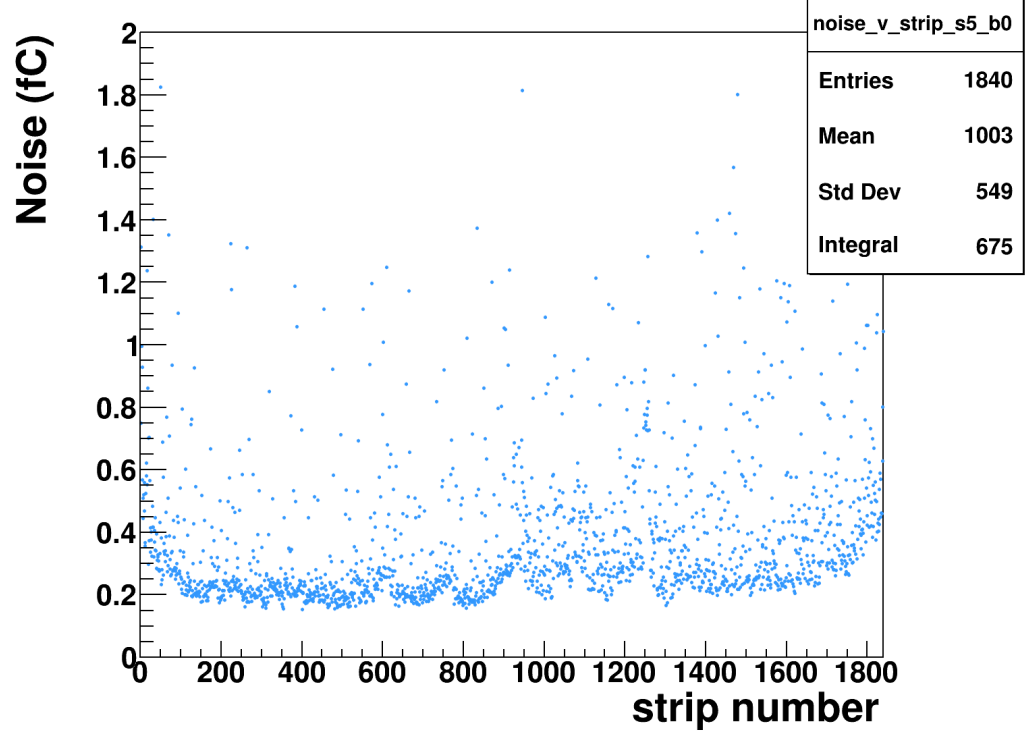

k6
Mean y 793.9
Std Dev x 295.5
Std Dev y 116.8
pedestal_median
channel_num

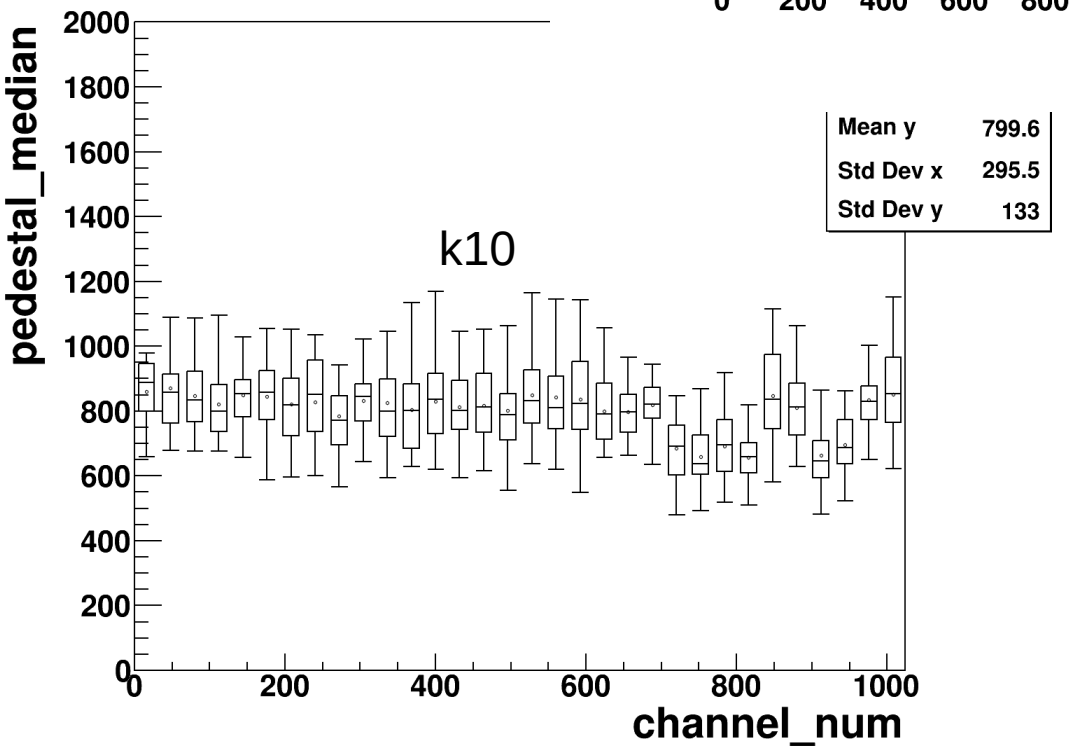

Run_20200316_172906_pedestal_v_channel_k7_b0
Entries 1024
Mean x 512
Mean y 800.4
Std Dev x 295.5
Std Dev y 120.1
k7
channel_num

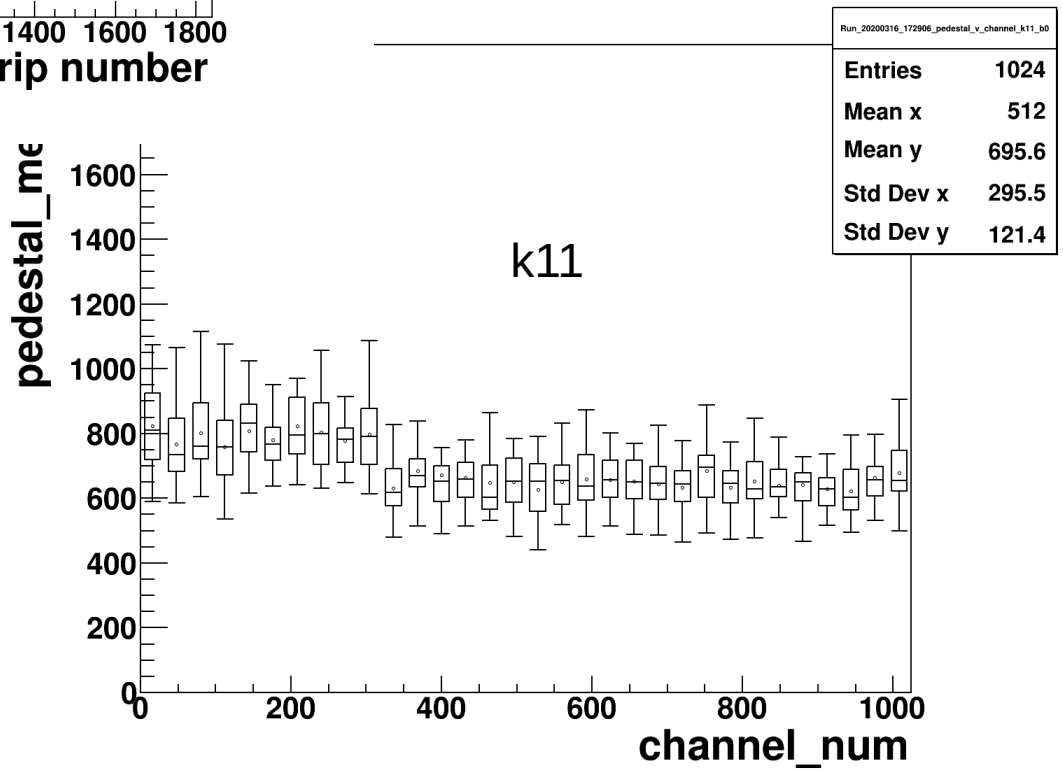

noise_v_strip_s4_b0
Entries 1840
Mean 870.4
Std Dev 560.5
Integral 441.9
Noise (fC)
strip number


Mean y 750.6
Std Dev x 295.5
Std Dev y 130.6
k8
pedestal_median
channel_num


Run_20200316_172906_pedestal_v_channel_k9_b0
Entries 1024
Mean x 512
Mean y 799.4
Std Dev x 295.5
Std Dev y 129.7
k9
channel_num


noise_v_strip_s5_b0
Entries 1840
Mean 1003
Std Dev 549
Integral 675
Noise (fC)
strip number


Mean y 799.6
Std Dev x 295.5
Std Dev y 133
k10
pedestal_median
channel_num


Run_20200316_172906_pedestal_v_channel_k11_b0
Entries 1024
Mean x 512
Mean y 695.6
Std Dev x 295.5
Std Dev y 121.4
k11
channel_num