TaichuPix1 Measurement

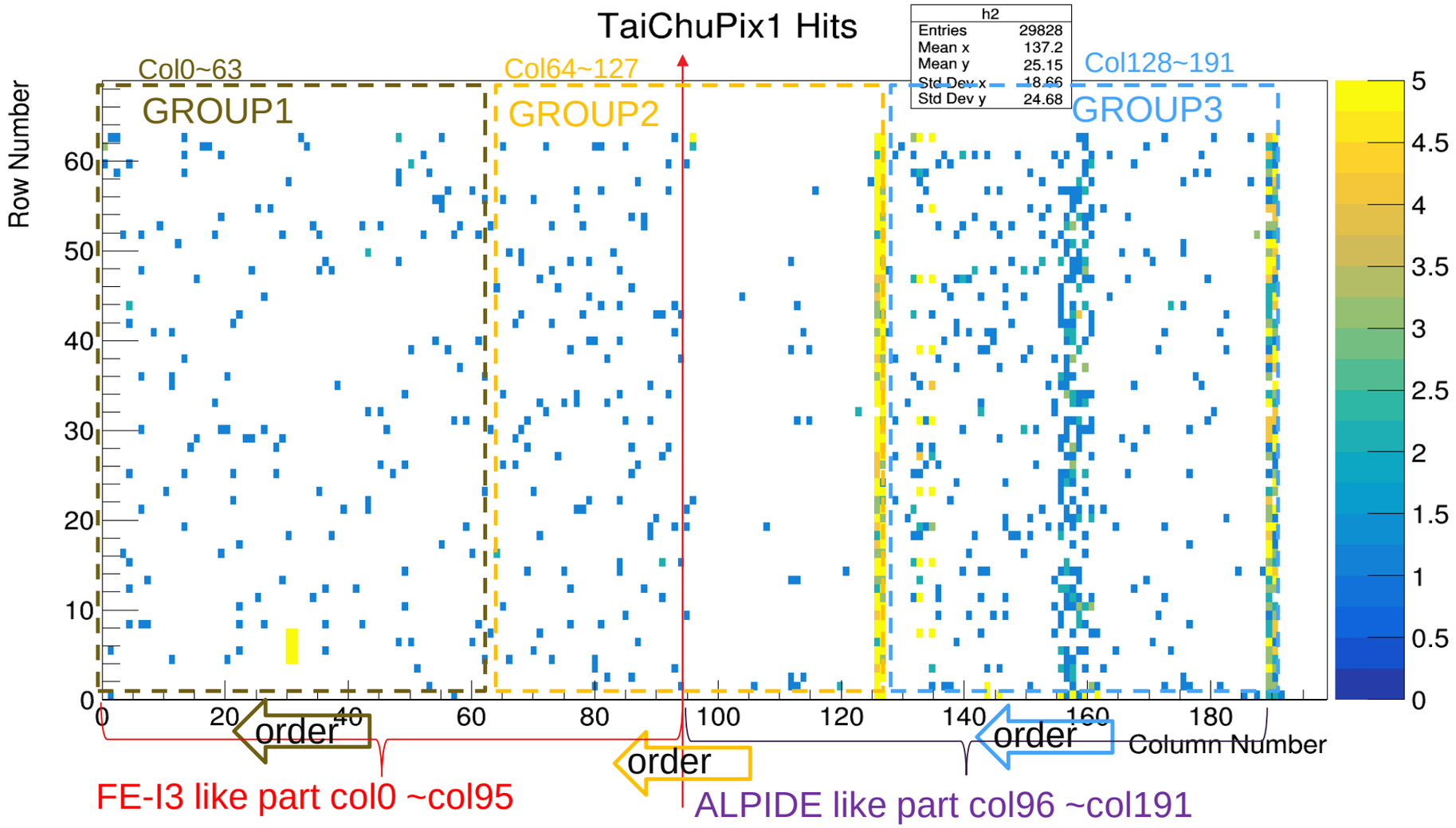
Tianya Wu

CEPC Meeting

twu@ifae.es

28-12-2020

Readout priority order for digital periphery



- The whole matrix could divide into 3 parallel groups, periphery would scan the group one by one.
- Inside each group, the priority order is from right to left, col191、col127 and col63 are the top priority. And GROUP2 is a mixture group.
- Timestamp is added at the end of column, so when many injection hits arrive at the same time , only higher priority position could be recorded.
- FE-I3 part data density in GROUP2 will be higher than GROUP1.

LVDS DATA Results

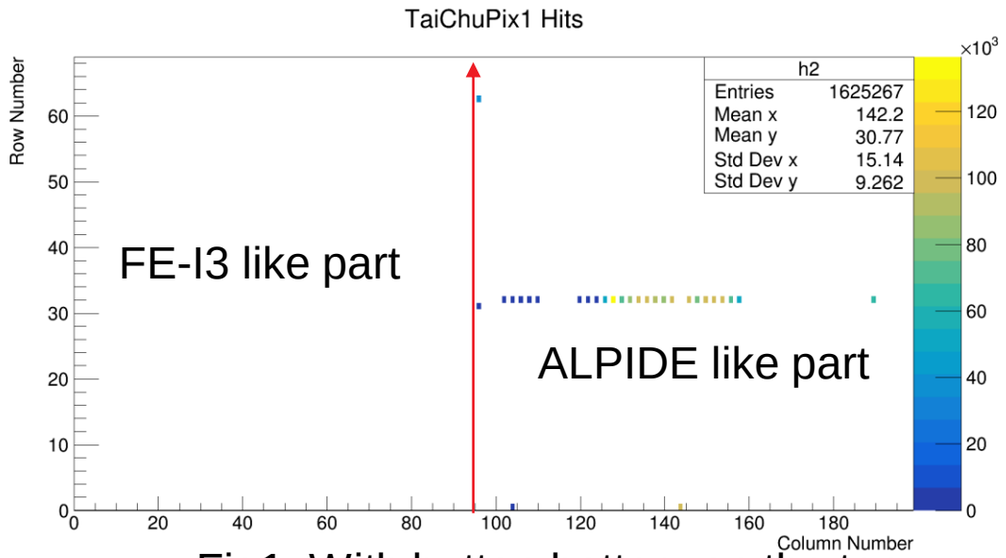


Fig1 With button battery on the top

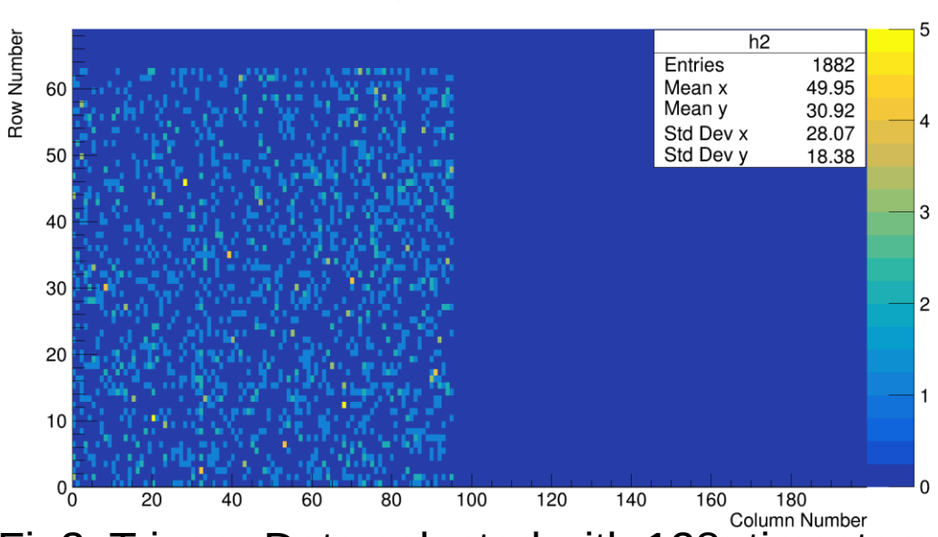


Fig3 Trigger Data selected with 128>timestamp>47

- I selected the data from a 120MB files.
- Process all of the data, I will find a lot of errors inside.
- I picked the data with timestamp range [47,128]

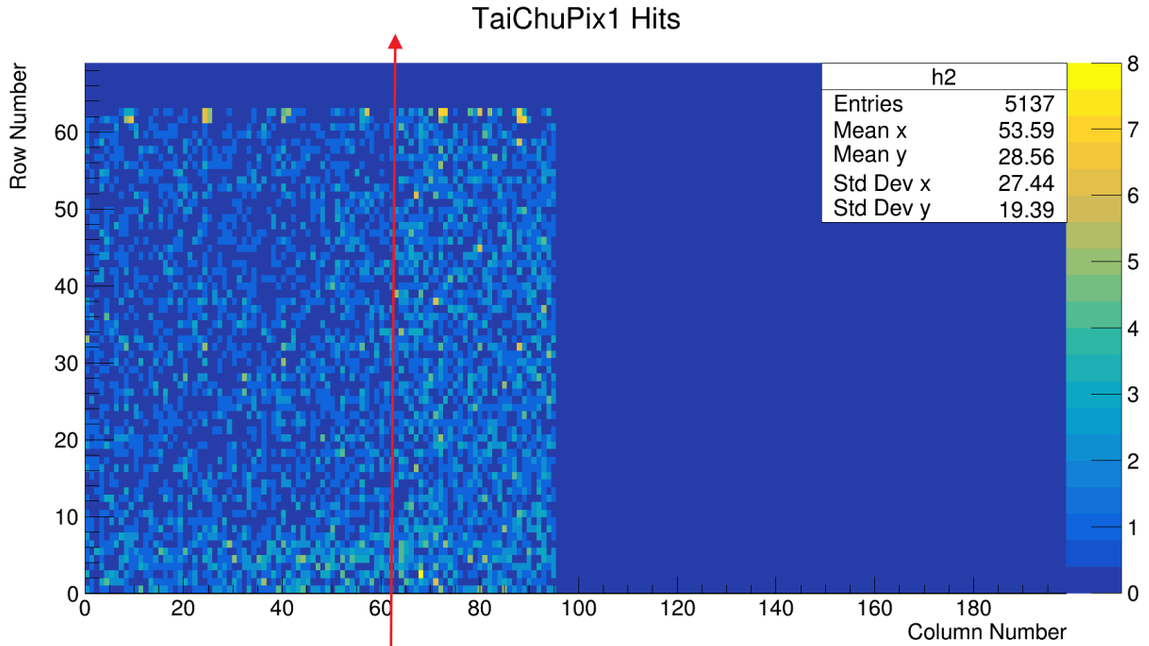


Fig2 Triggerless Data selected with 128>timestamp>47

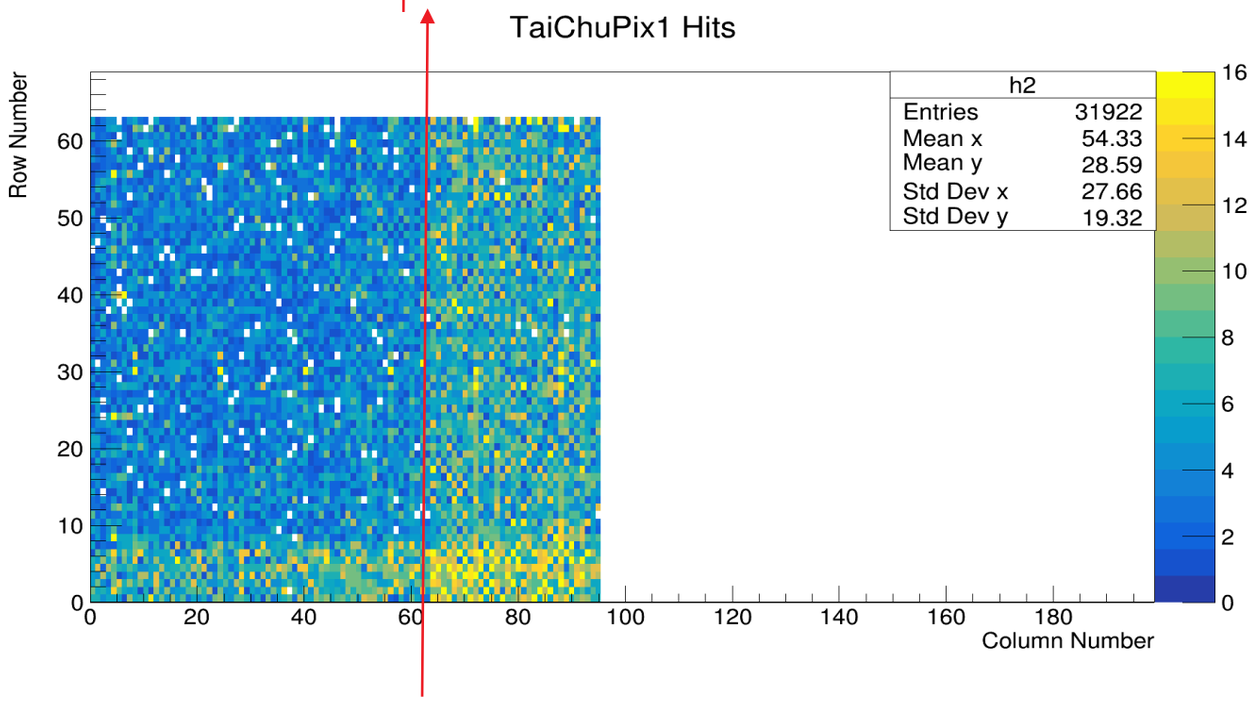


Fig4 More Triggerless data integration

Principle of Analog Front End

Here are schematics of Analog front end with the design parameters and the waveform result.

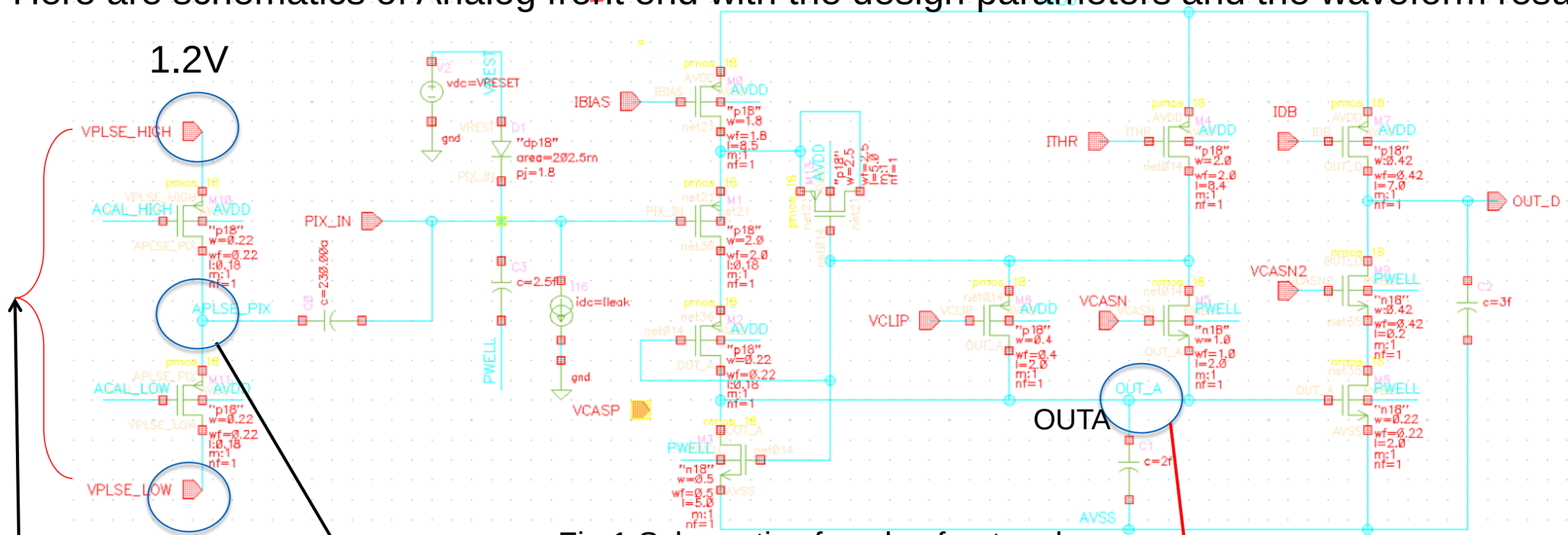


Fig 1 Schematic of analog front end

Electrons simulation:
0.88mV/e-

1.2V-0.5V=0.7V is around 800e-

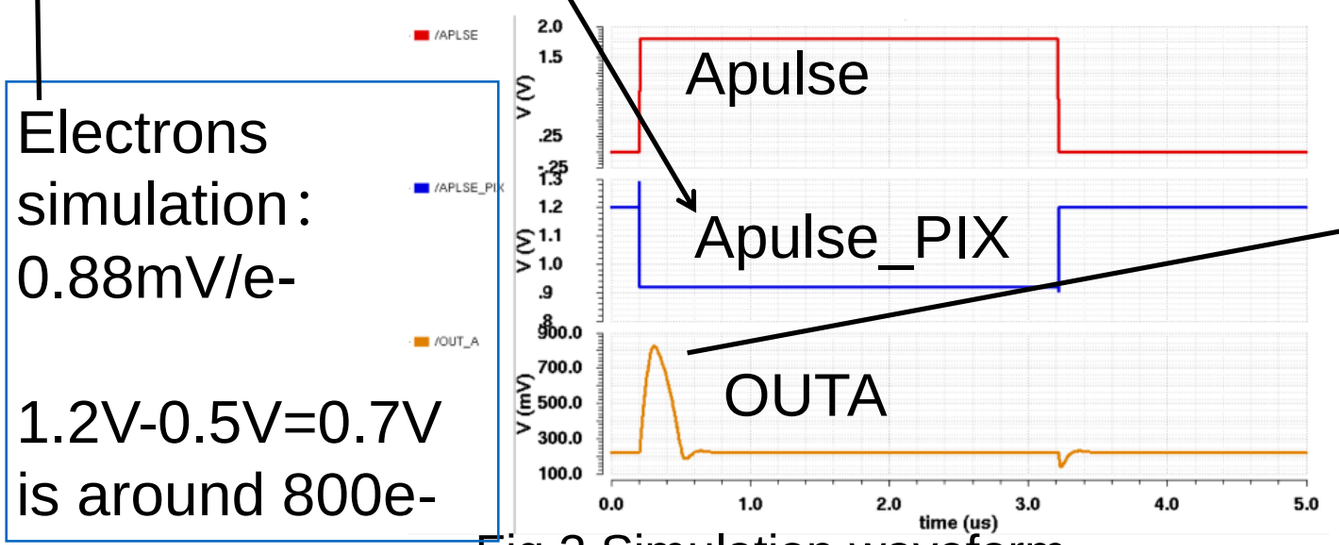


Fig 3 Simulation waveform

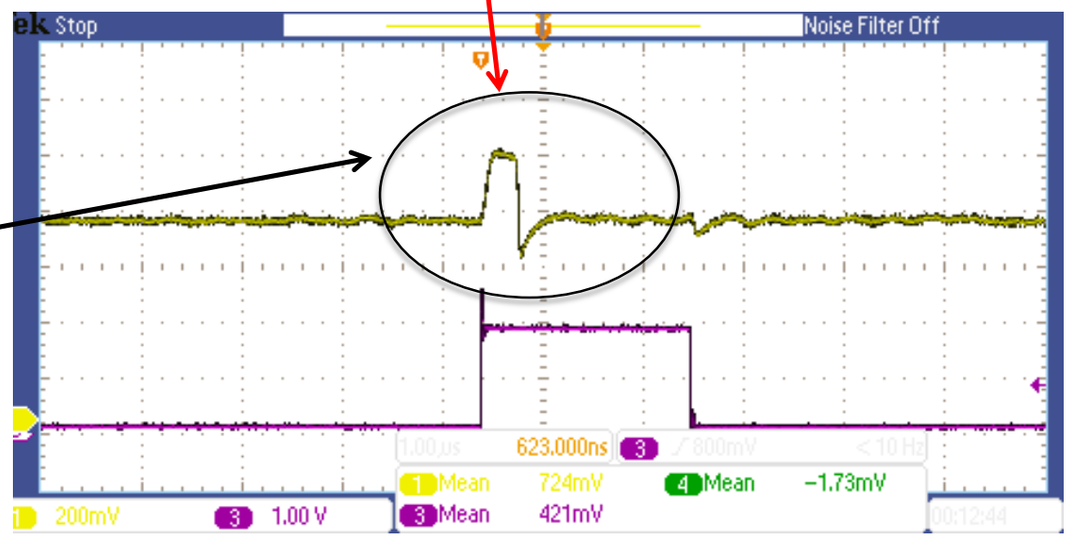


Fig 4 Test waveform

Analog signal probe results

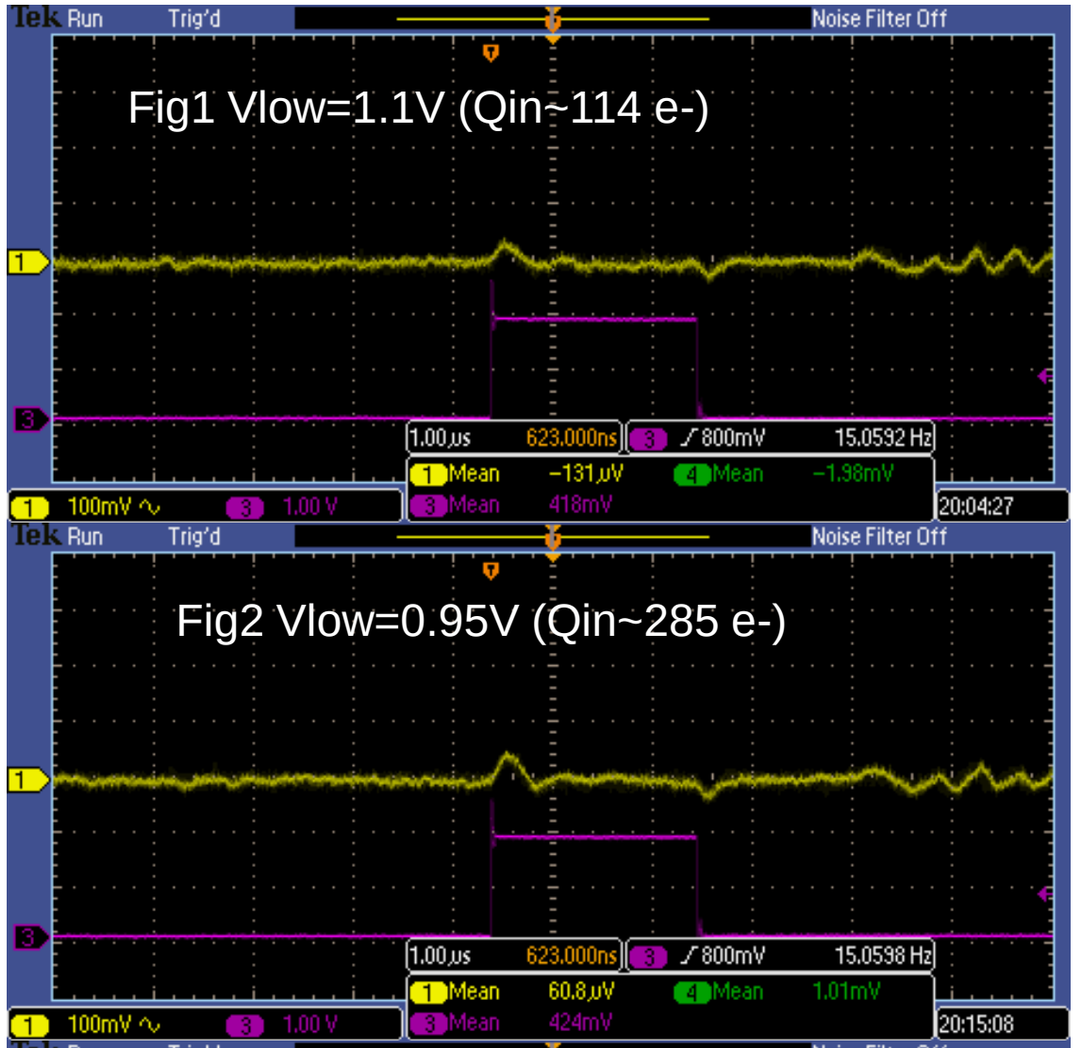


Fig1 Vlow=1.1V (Qin~114 e-)

Fig2 Vlow=0.95V (Qin~285 e-)

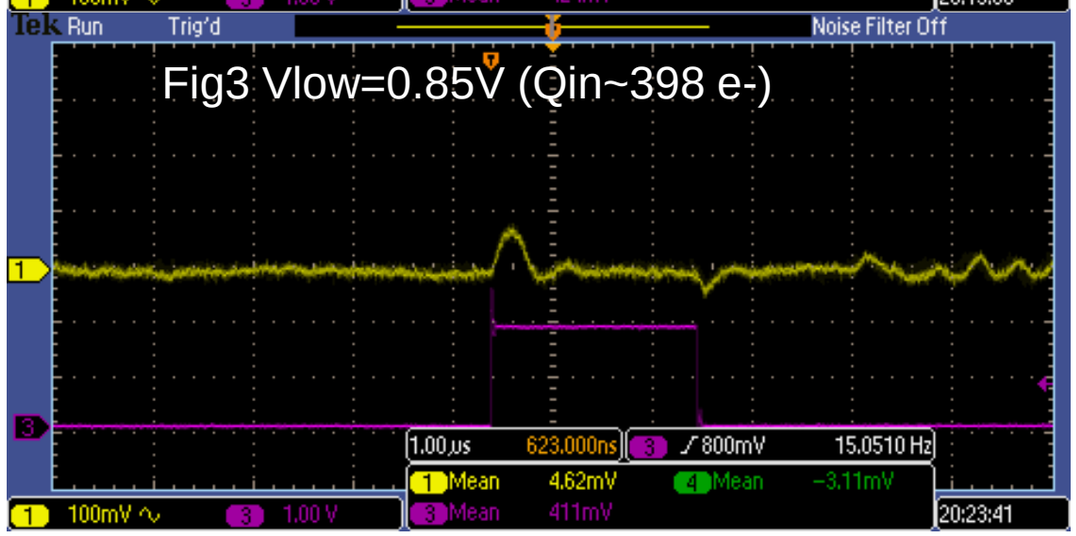


Fig3 Vlow=0.85V (Qin~398 e-)

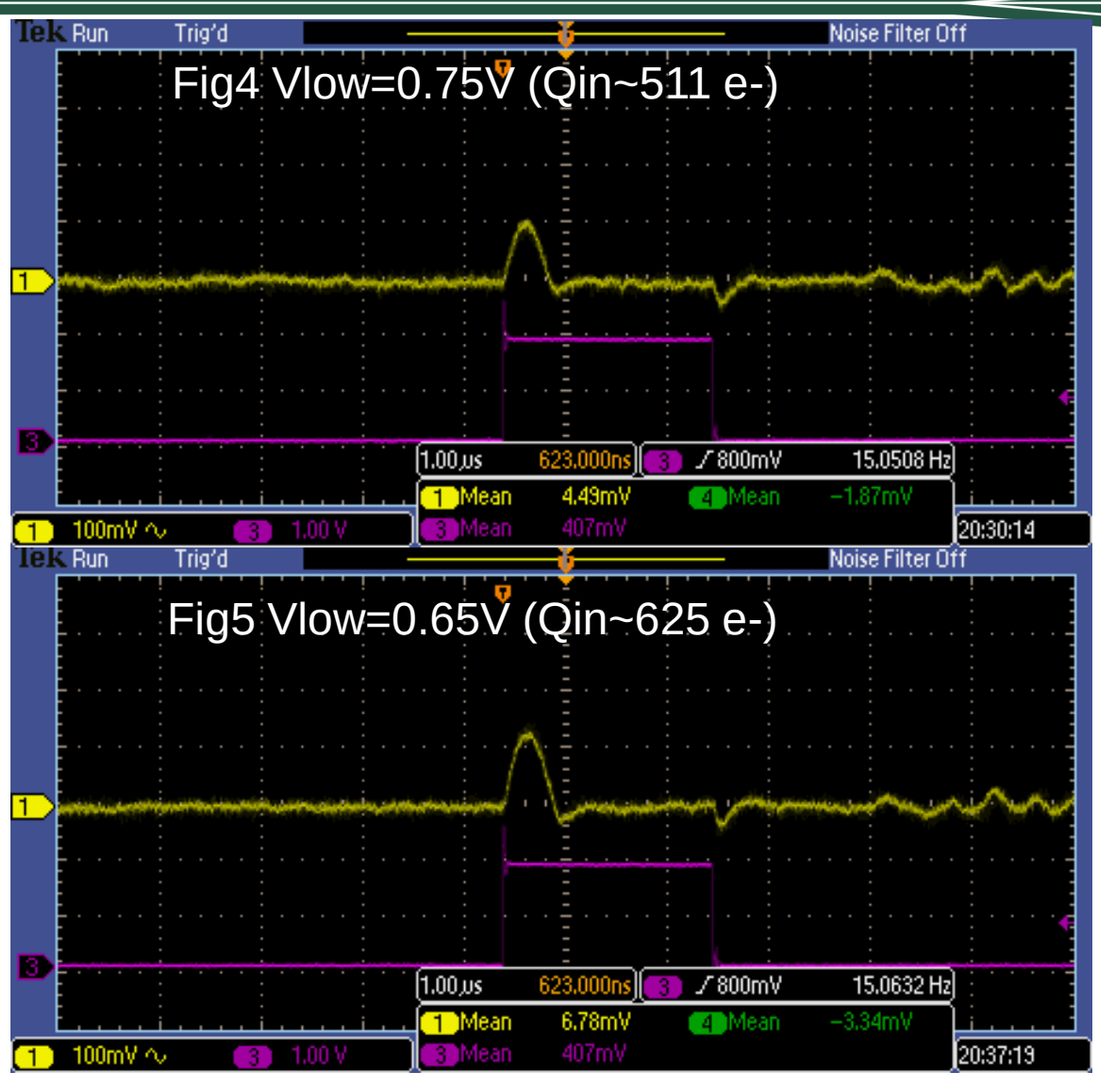


Fig4 Vlow=0.75V (Qin~511 e-)

Fig5 Vlow=0.65V (Qin~625 e-)

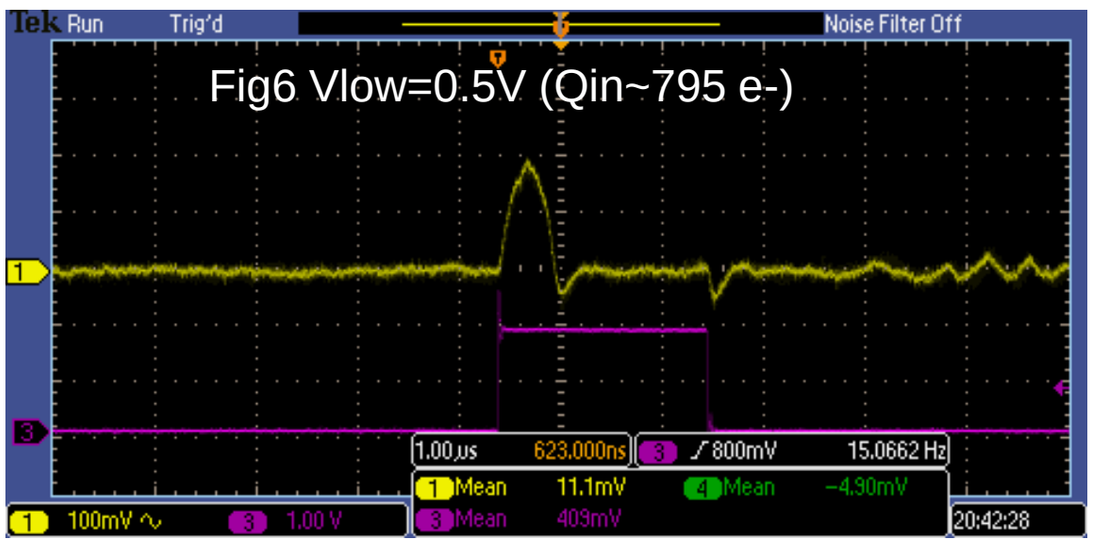


Fig6 Vlow=0.5V (Qin~795 e-)

Turn on one column to do analog calibration

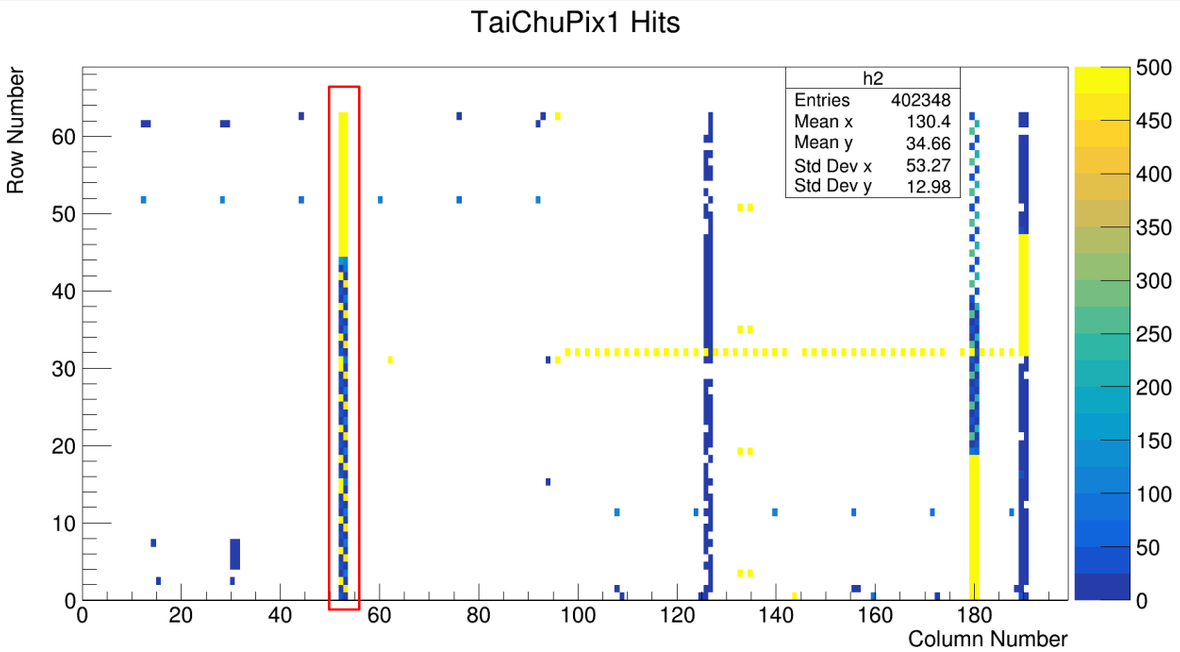


Fig1 Turn on DBCol26 with Vlow= 0.5V(Qin~795e-)

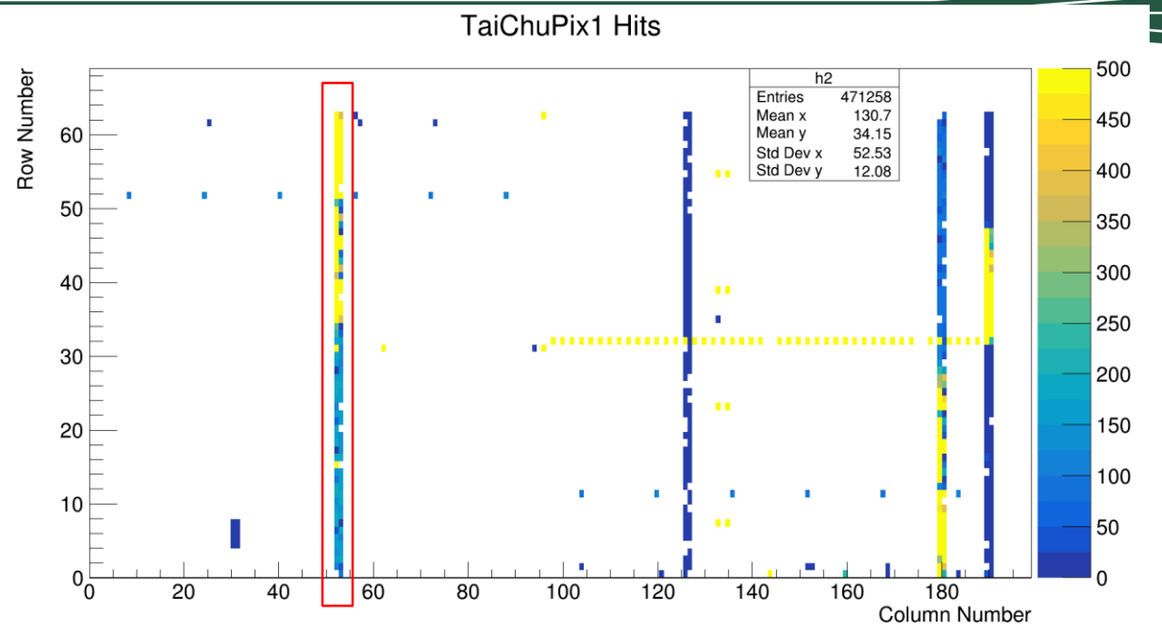


Fig2 Turn on DBCol26 with Vlow= 0.75V(Qin~511e-)

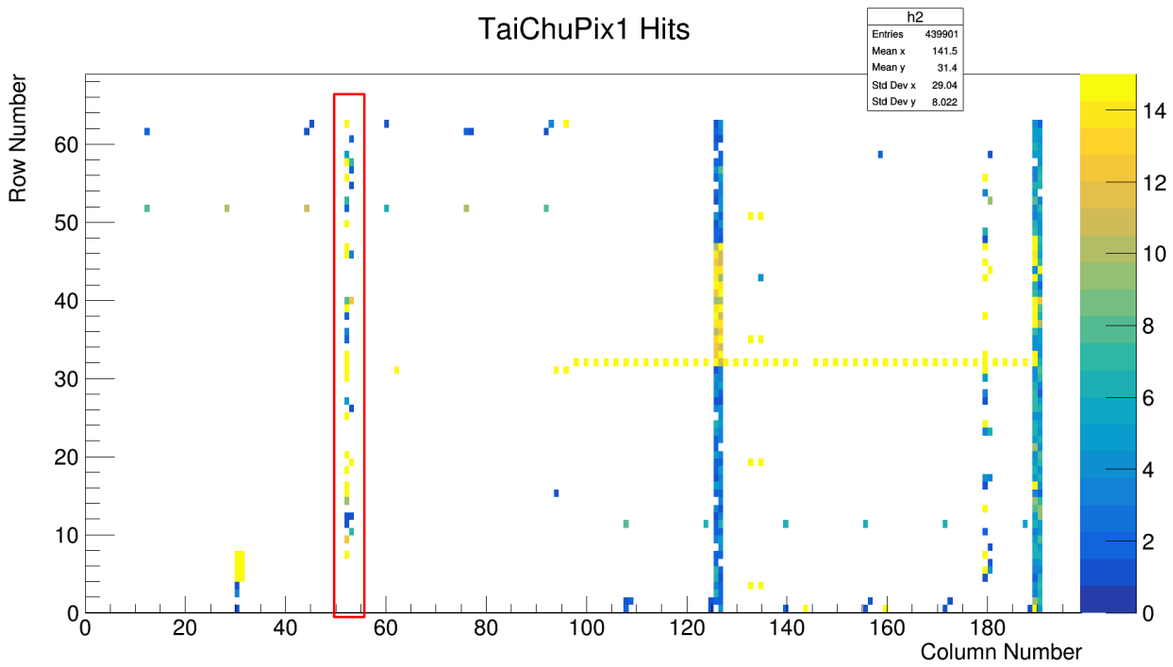


Fig3 Turn on DBCol26 with Vlow= 0.85V(Qin~398e-)

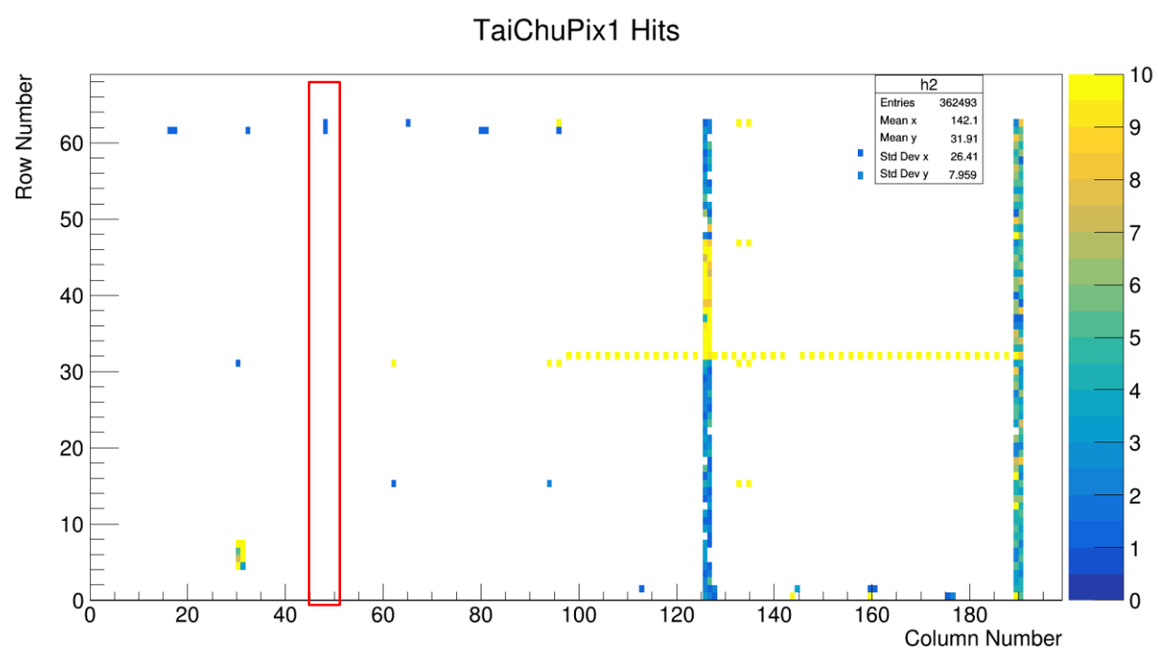


Fig4 Turn on DBCol26 with Vlow= 1.0V(Qin~227e-)

I select the COL52 /ROW63 to calculate the probability due to its top priority.

Fit curve of test result

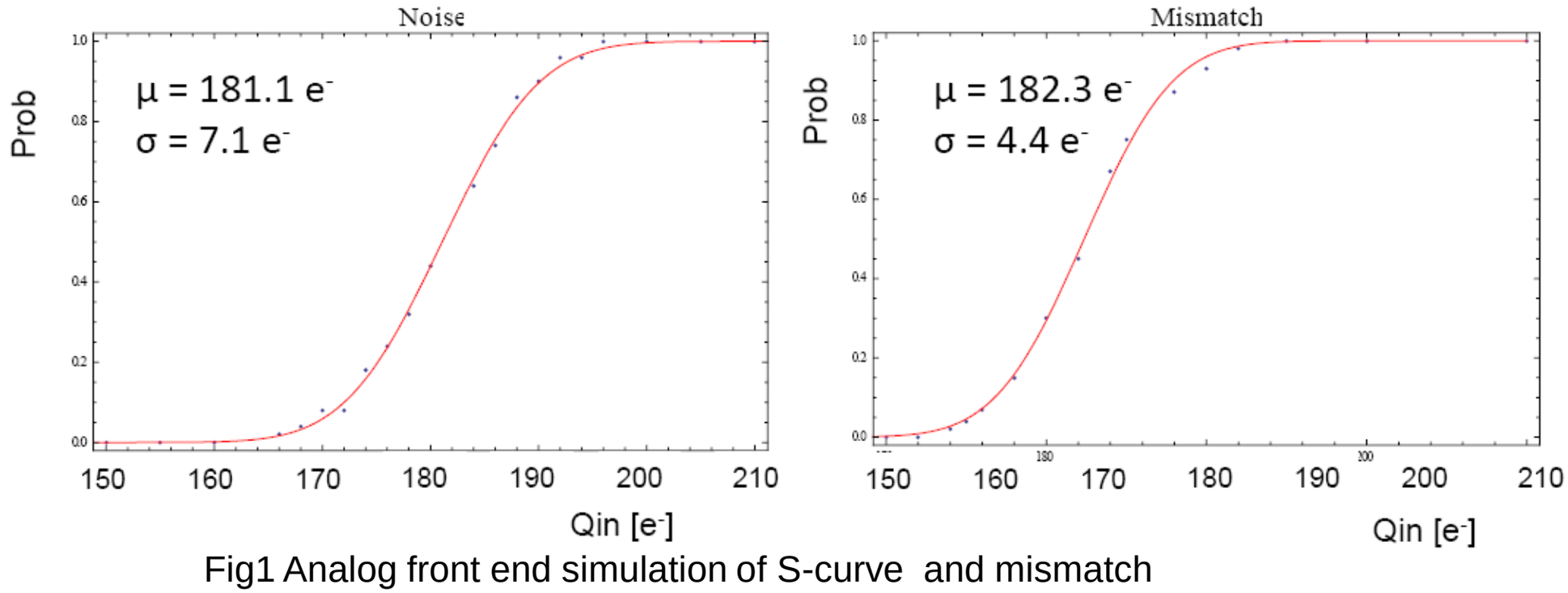


Fig1 Analog front end simulation of S-curve and mismatch

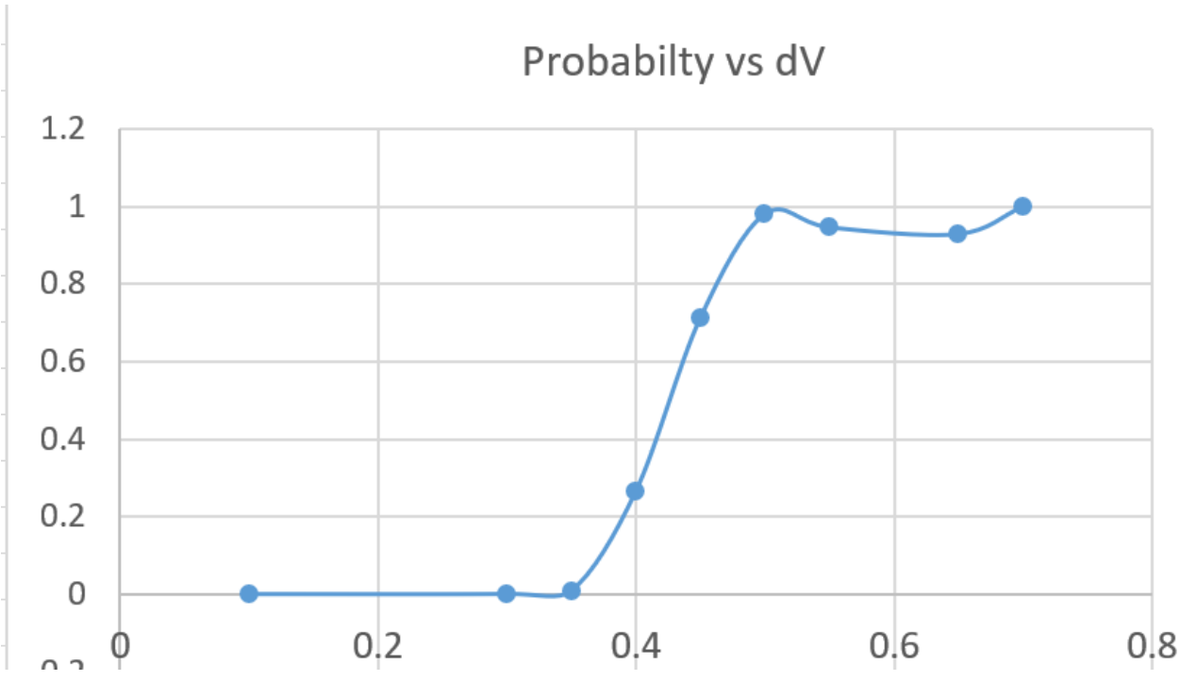


Fig2 Test results of S-curve

- I select the COL52 /ROW63 to calculate the probability due to its top priority.
- Scan the dV=Vhigh-Vlow from 0.1V to 0.7V with step of 0.05V
- Acquire around 400K data at every dV point.
- The ratio of valid data is around 20K/400K=0.05.
- Set the prob to 1 at the dV of 0.7V, and normalized the rest of data.

Apulse injection for 100 times

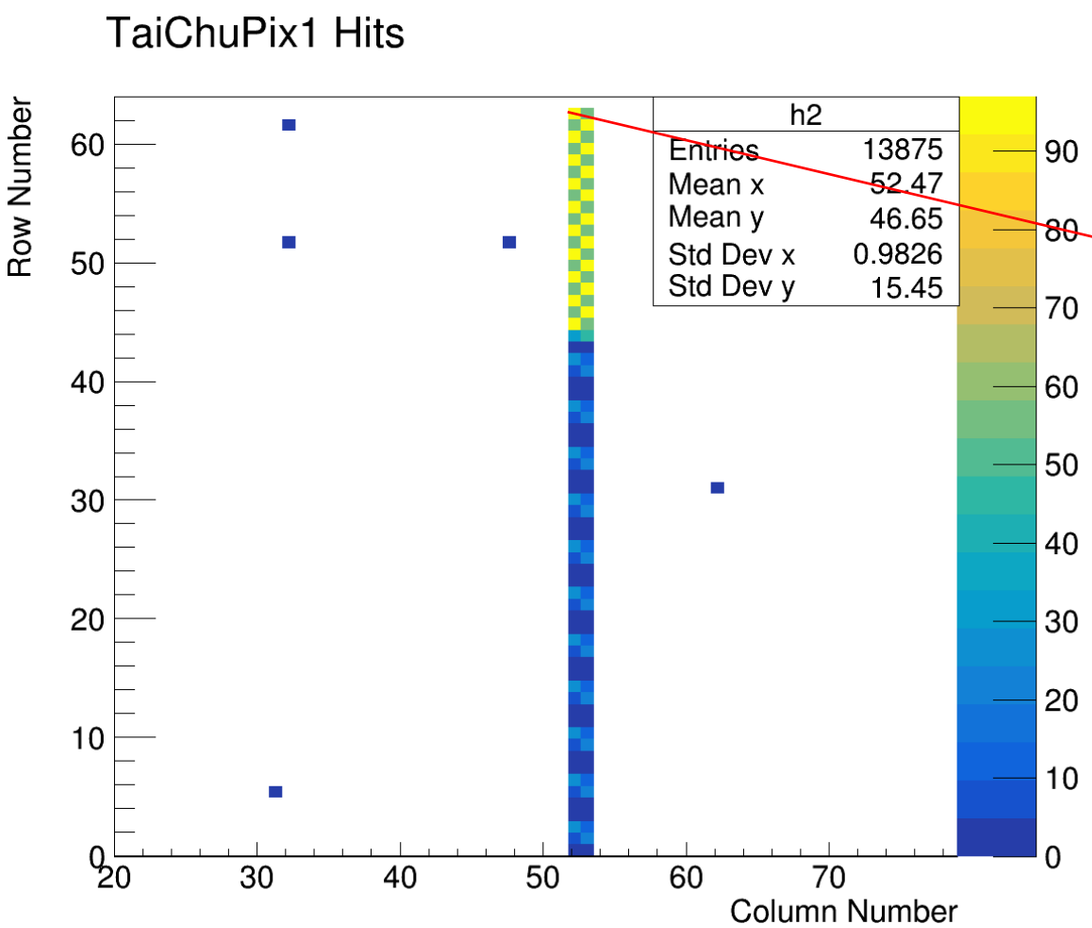


Fig1 Inject 100 times Apulse while Vlow= 0.55V(Qin~738e-)

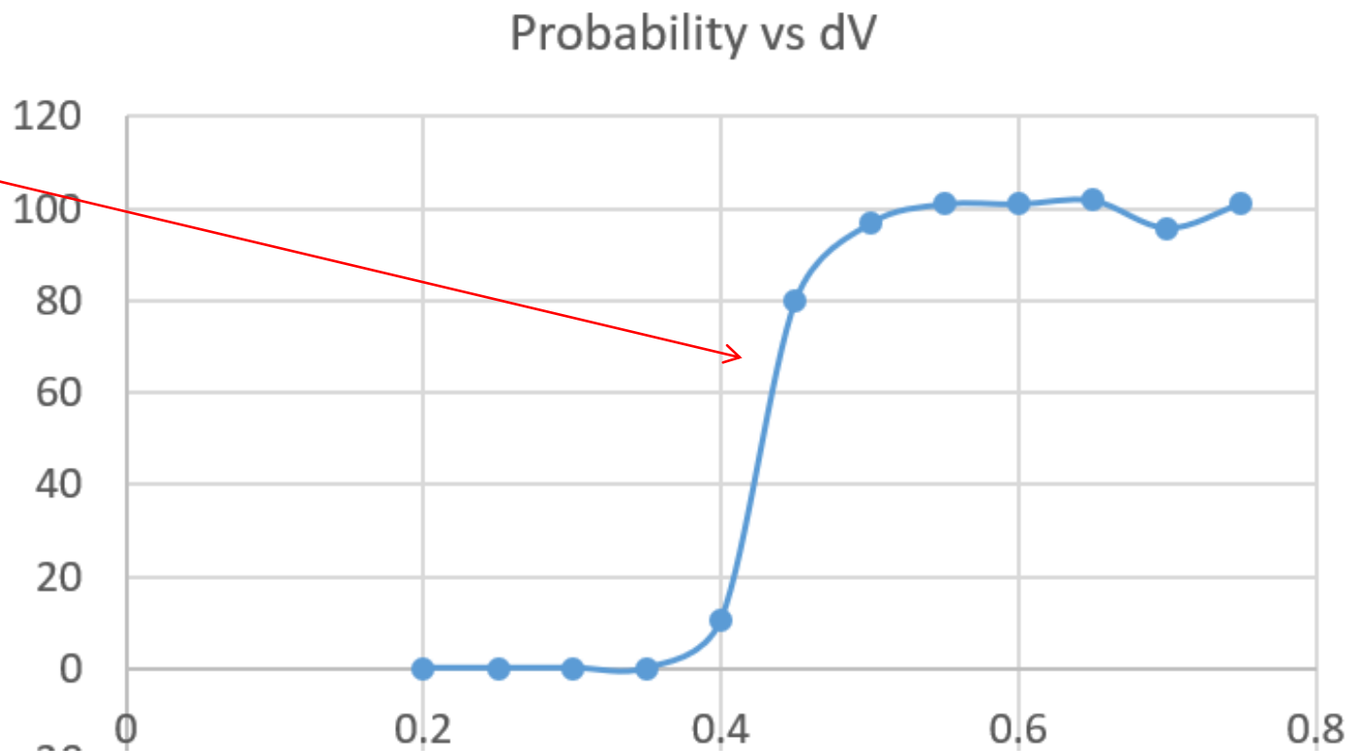


Fig2 Fit curve of COL52 /ROW63

- I select the COL52 /ROW63 to calculate the probability due to its top priority.
- Scan the dV=Vhigh-Vlow from 0.2V to 0.7V with step of 0.05V
- Sometimes the LVDS output count rate would be over 100. It might be error from noise?
- The trend of the fit curve meets what I expect but not always be 100% when dV is over 0.6V, it exists some small jitter.
- The threshold of dV is around 450mV (Qin~511e-)

Turn on 4 Pixels for analog calibration

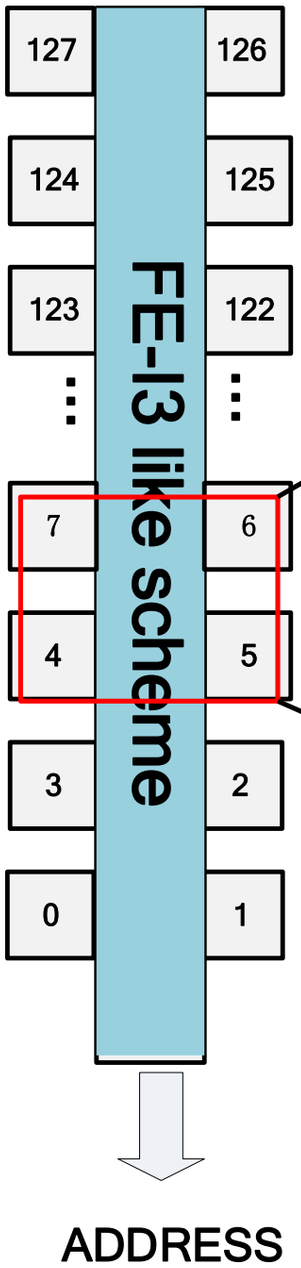
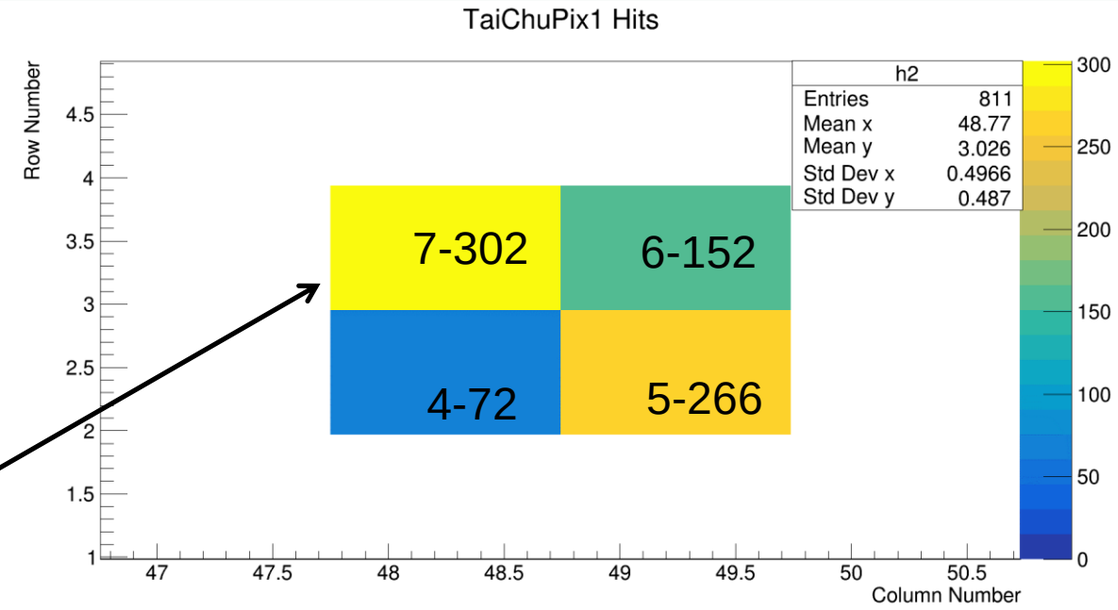


Fig1. Double Column24 turn on 4 adjacent Pixels(4/5/6/7)



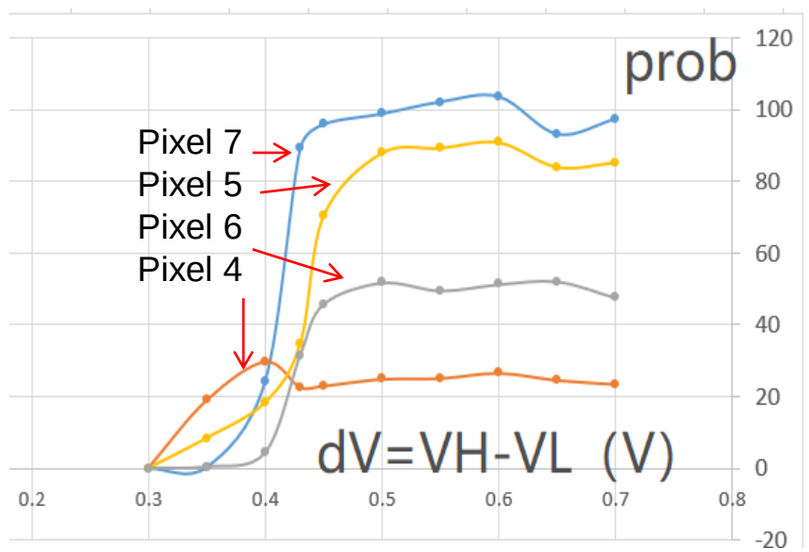


Fig2 Inject 300 times Apluse while Vlow= 0.55V(Qin~738e-)

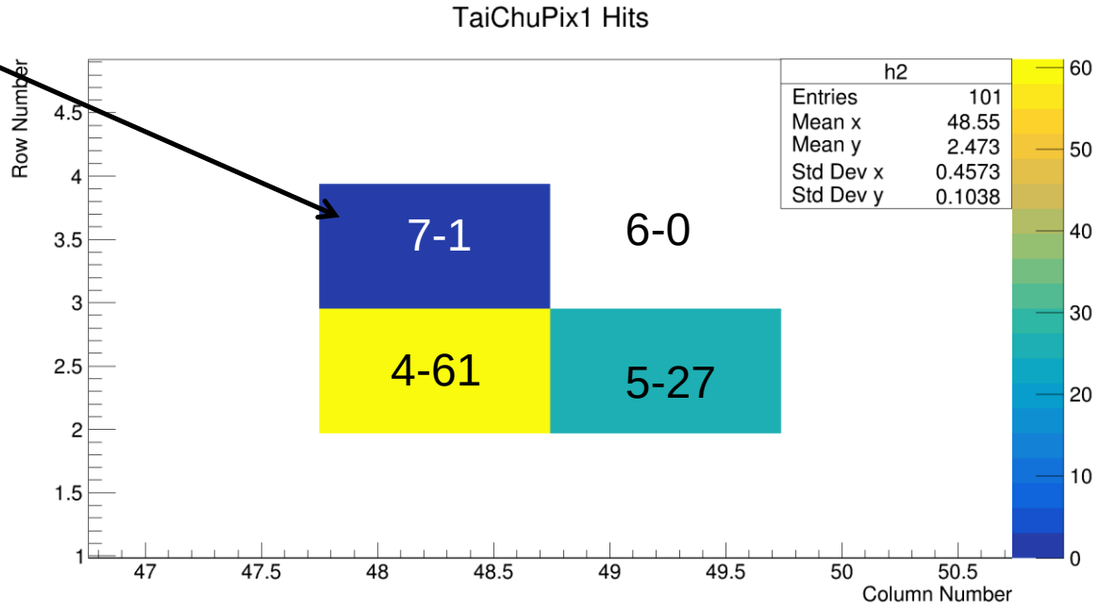


Fig3 Inject 300 times Apluse while Vlow= 0.85V(Qin~400e-)

- The probability of 4 adjacent pixels has a big difference.
- Pixel7 & Pixel5 has a higher probability than Pixel 6 & Pixel4.
- It seems the consistency is very bad of 4 adjacent pixels.

Thanks for your attention.