# Gem Tracking Code Progress

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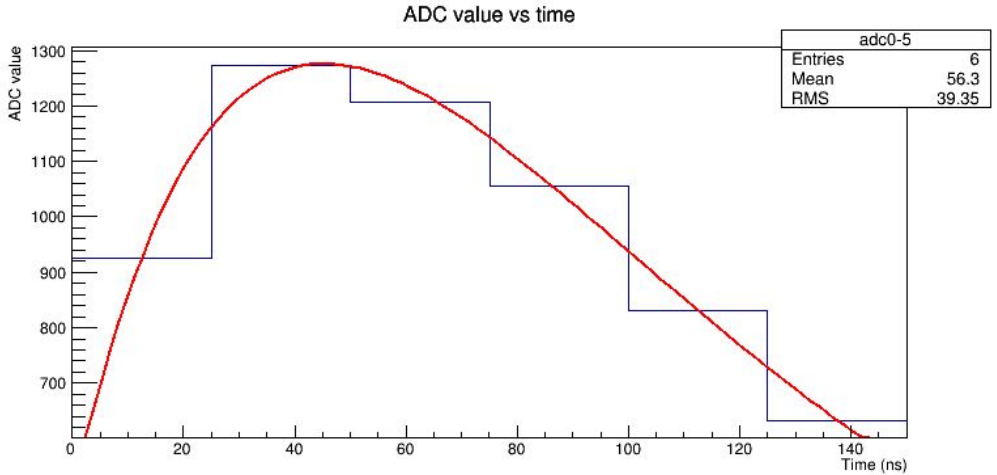
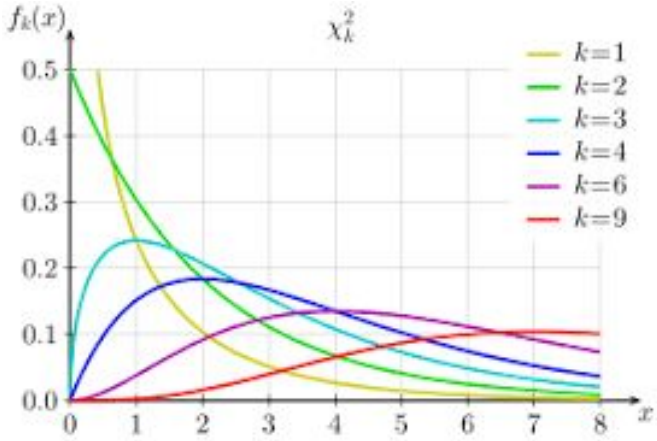
# Background

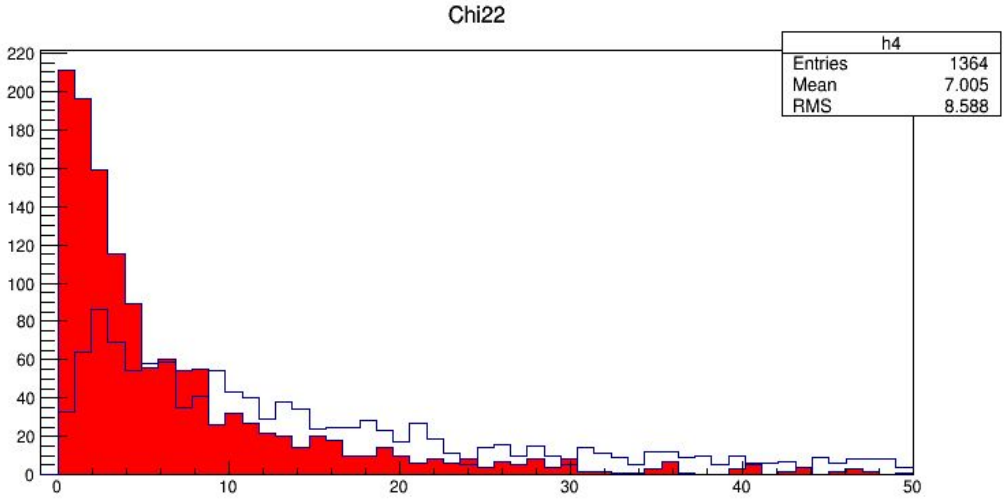
- Analyzing one plane data (one x plane and one y plane)
- The readout is taken in 6 intervals of 25 nanoseconds each, we are looking for the largest values at 50 ns (ADC2)
- Abigail defined a function to fit graphs of ADC value vs time (ELOG post 47 in Group Meetings section)
- Made graphs of all events with an adc2val of > 500 (example below)

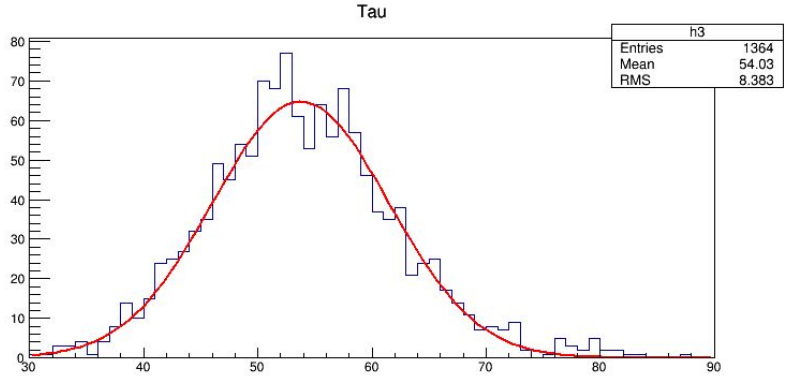


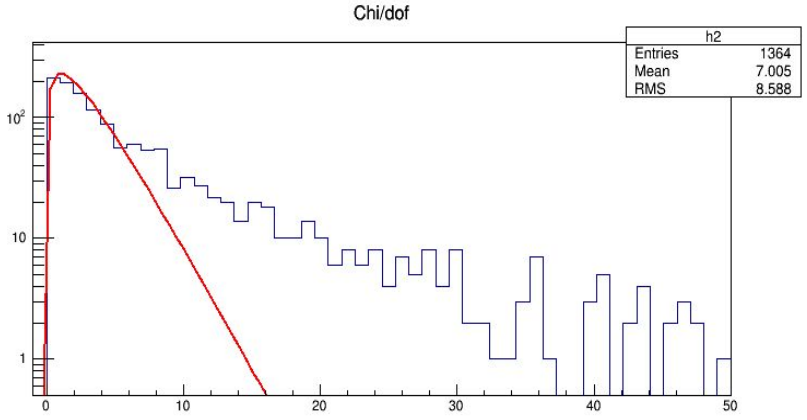
# Chi2/dof plots

- For all high adc2 value events mentioned in the previous slide, I plotted chi2/dof as a measure of testing goodness of these fits
- Using 3 degrees of freedom, our distribution matched the theoretical distribution
- I then attempted to fix one of the parameters, tau, by plotting all values from the fit and fitting it to a gaussian
    - Tau should be fixed since it is a function of the electronics
- The new chi2/dof distribution did not match the theoretical distribution, so next I tried to reject common mode noise


$f_k(x)$
$\chi^2_k$
$k=1$
$k=2$
$k=3$
$k=4$
$k=6$
$k=9$
0.5
0.4
0.3
0.2
0.1
0.0
0
1
2
3
4
5
6
7
8
$x$


Chi22
h4
Entries 1364
Mean 7.005
RMS 8.588
220
200
180
160
140
120
100
80
60
40
20
0
0
10
20
30
40
50

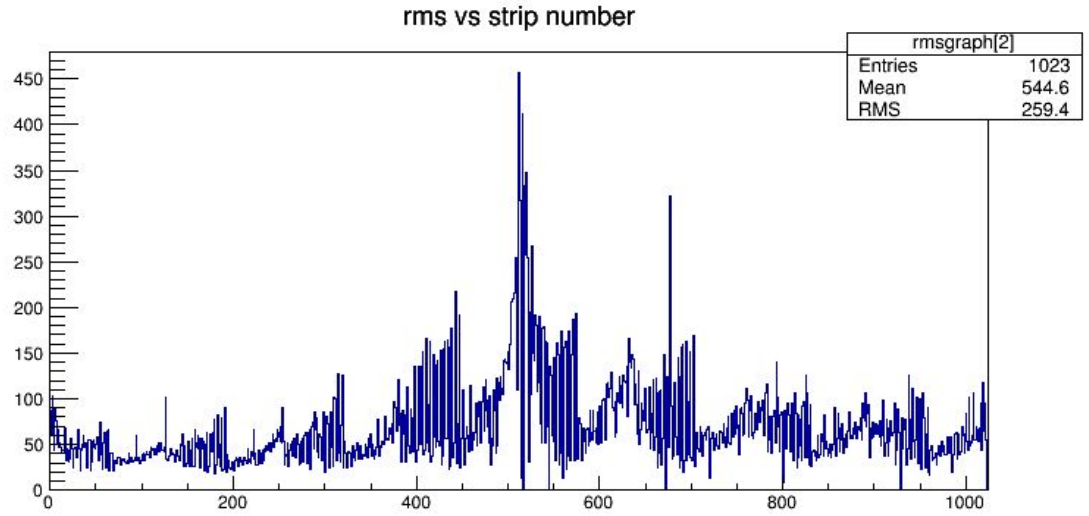

Tau
h3
Entries 1364
Mean 54.03
RMS 8.383
80
70
60
50
40
30
20
10
0
30
40
50
60
70
80
90

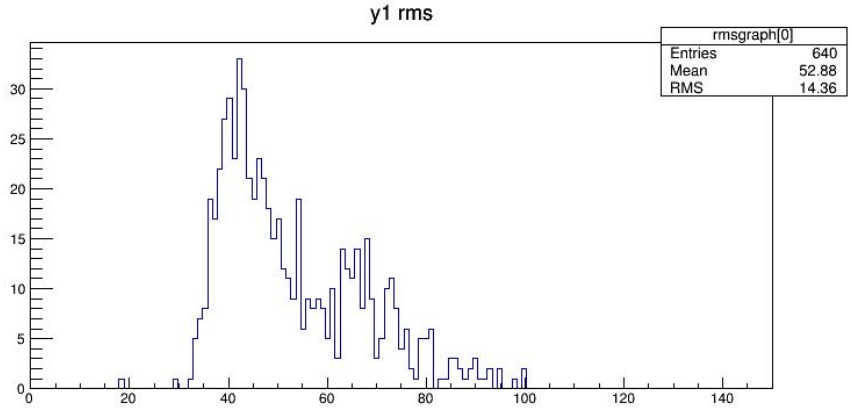

Chi/dof
h2
Entries 1364
Mean 7.005
RMS 8.588
$10^2$
10
1
0
10
20
30
40
50

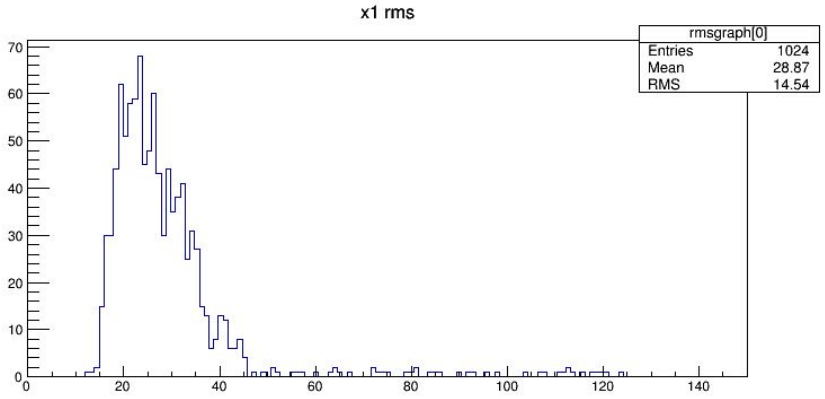
# Common mode noise/RMS

- To calculate common mode noise we plotted all of the adc2 values for each event, and fitted the data to a gaussian to find the average signal for that event
- During these calculations, we discovered that the RMS of the fits looked strange: the values were on a wider range than expected
- I changed the default implementation of the script that calculates the pedestal and RMS (was using a simple root “GetRMS” function)
    - This immediately made the RMS worse, after which point we then subtracted common mode noise to improve it

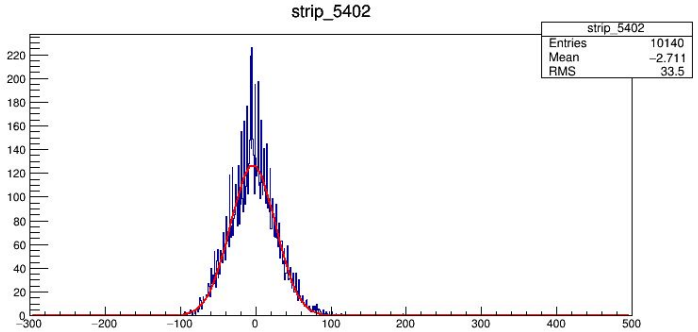
# Before changes

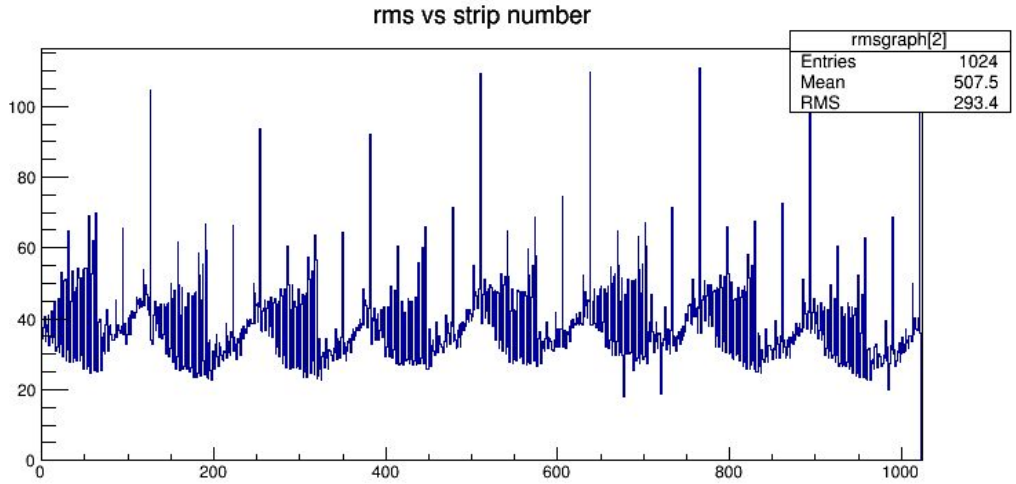


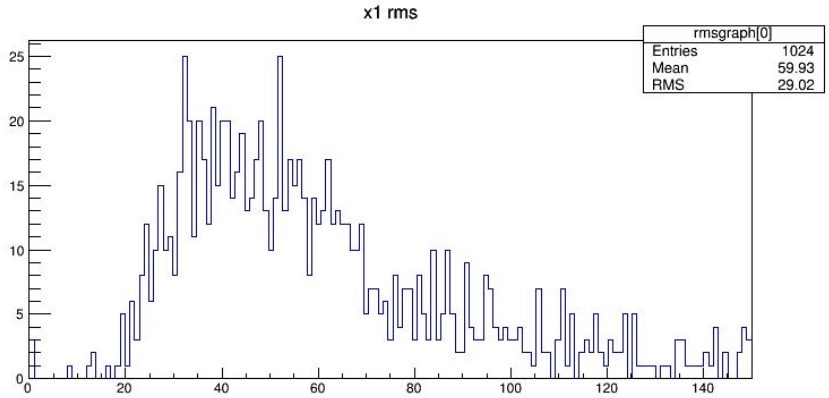



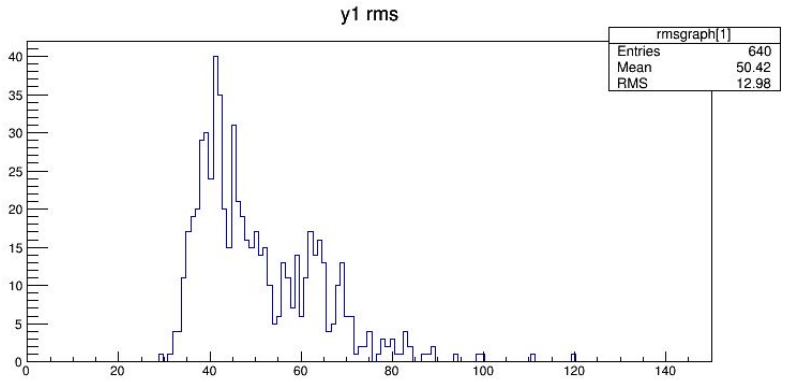



# After RMS change

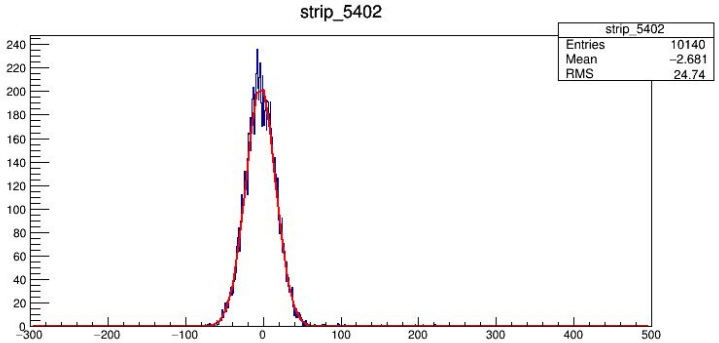


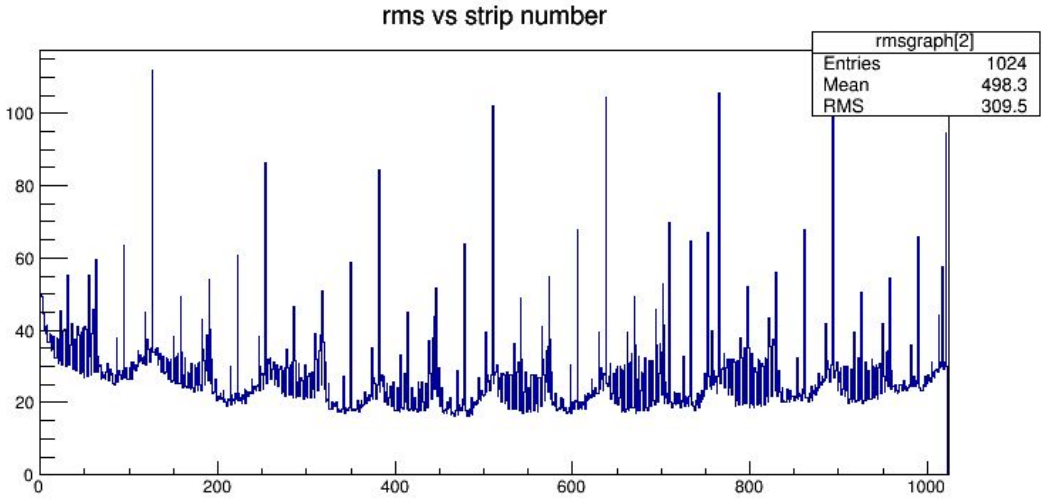



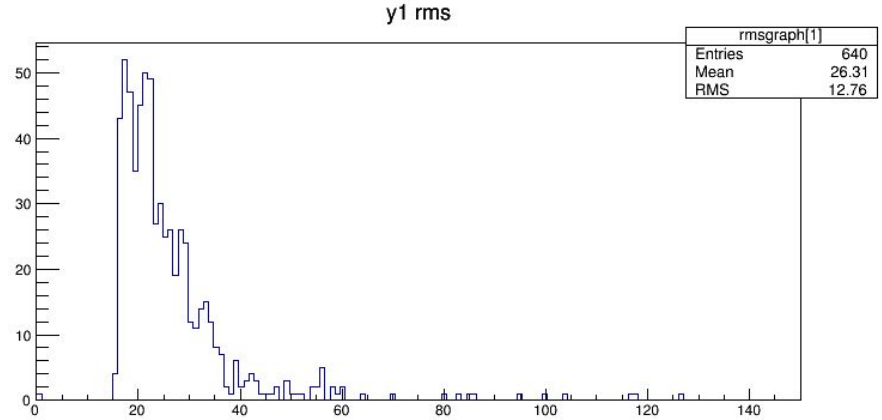



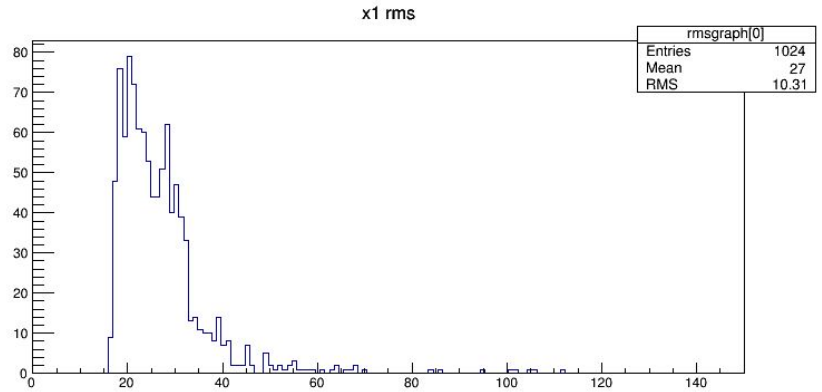



# After common mode



# Next Steps

- Now that we have an accurate measure of RMS, we can determine a threshold for a hit (etc. something 5x its RMS is significant)
- We can then use the set of hits to determine clusters, and then, when working with data with multiple planes, be able to draw straight lines through the planes
- Tao’s script is to correct for shifting of individual gem planes to the lab frame, which will be important later, but not yet