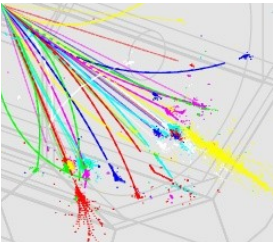
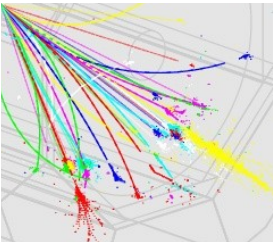


^{55}Fe Studies

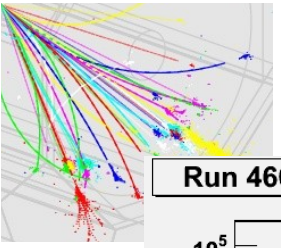
RAL 08.12.2008

J.P. Crooks, M. Stanitzki, M. Tyndel

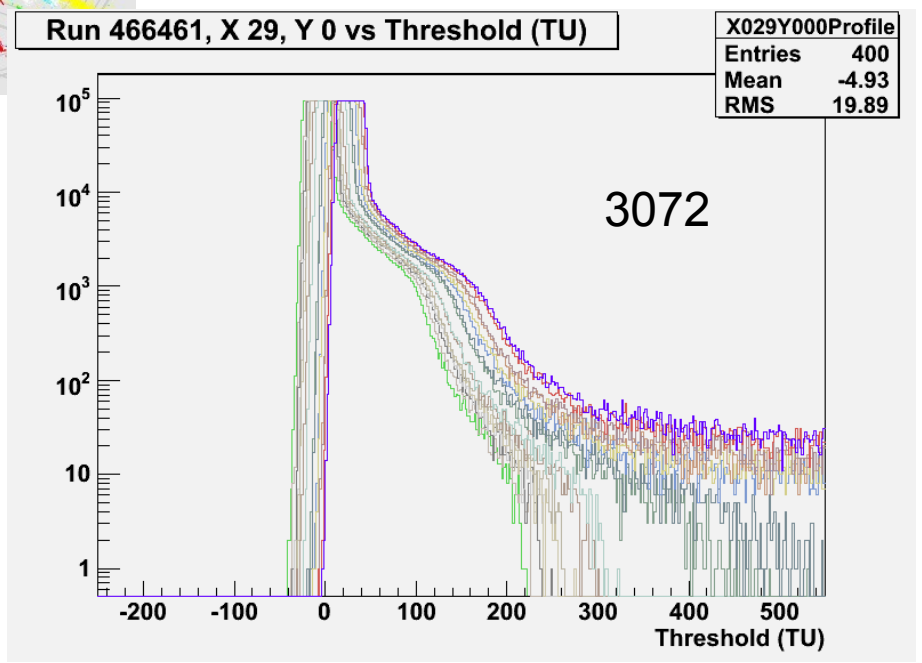


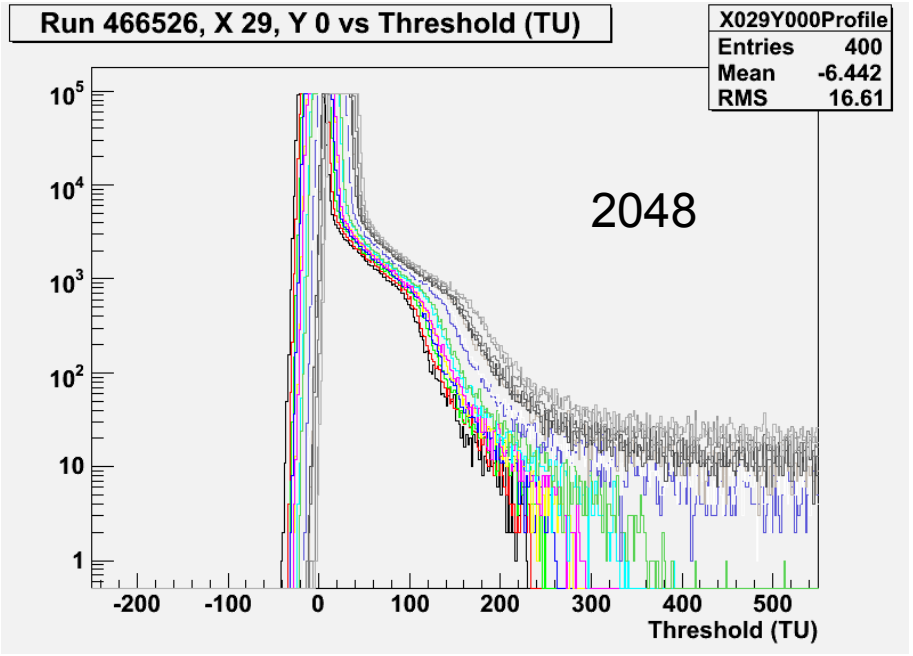
Trim studies

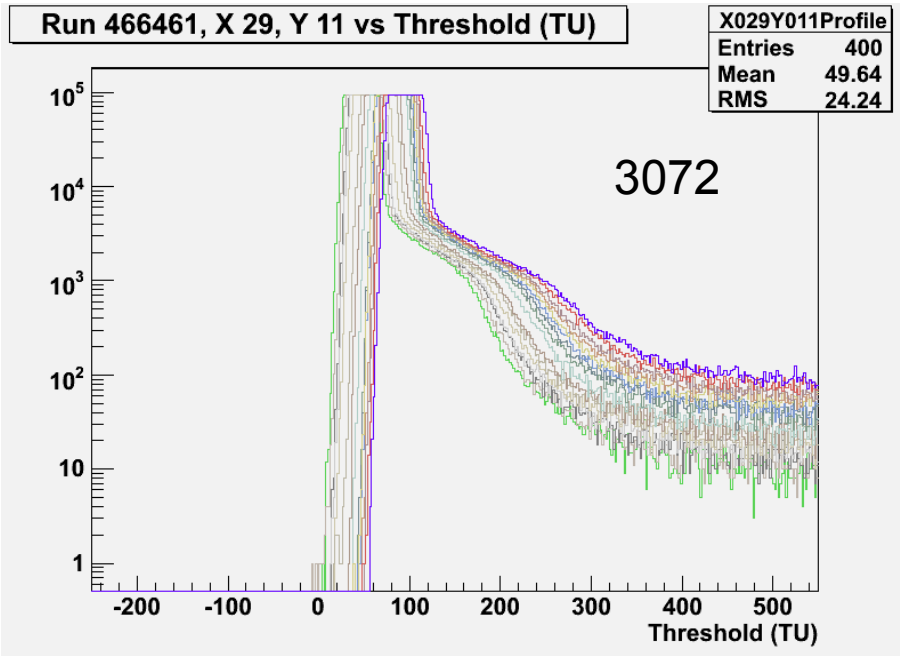
- Run 84 pixel
  - in quad0 and quad1
- Scan trims from 0 to 15
  - measure trim linearity with signal
  - study after glow
- Repeated Study with different setting
  - Changed from Common mode of 3072 (old study)
  - Common mode 2048 new study

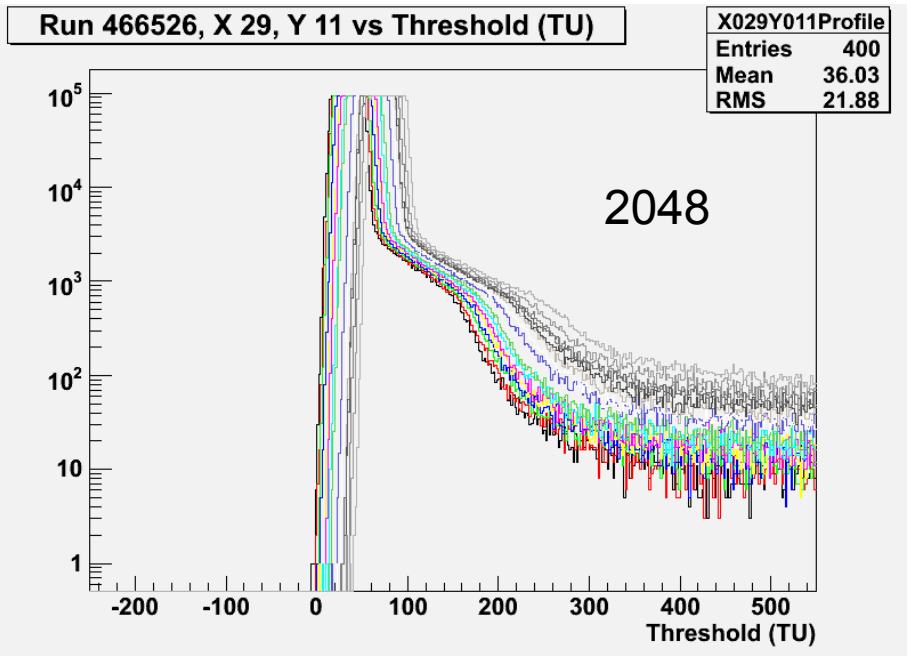


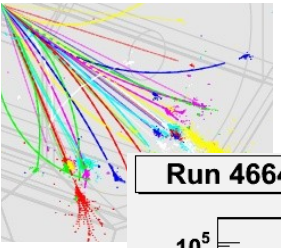
individual pixels quad 0



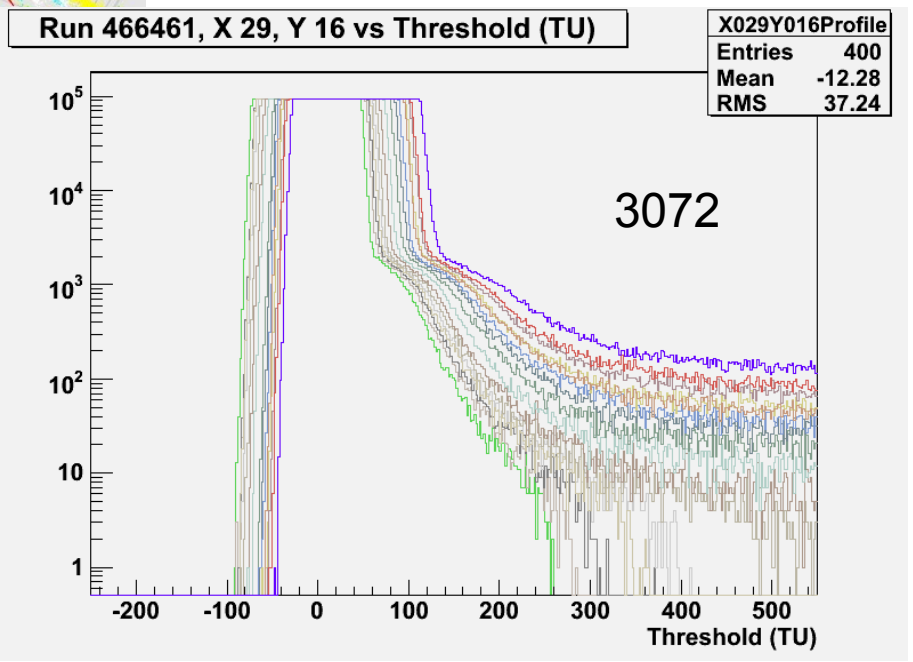


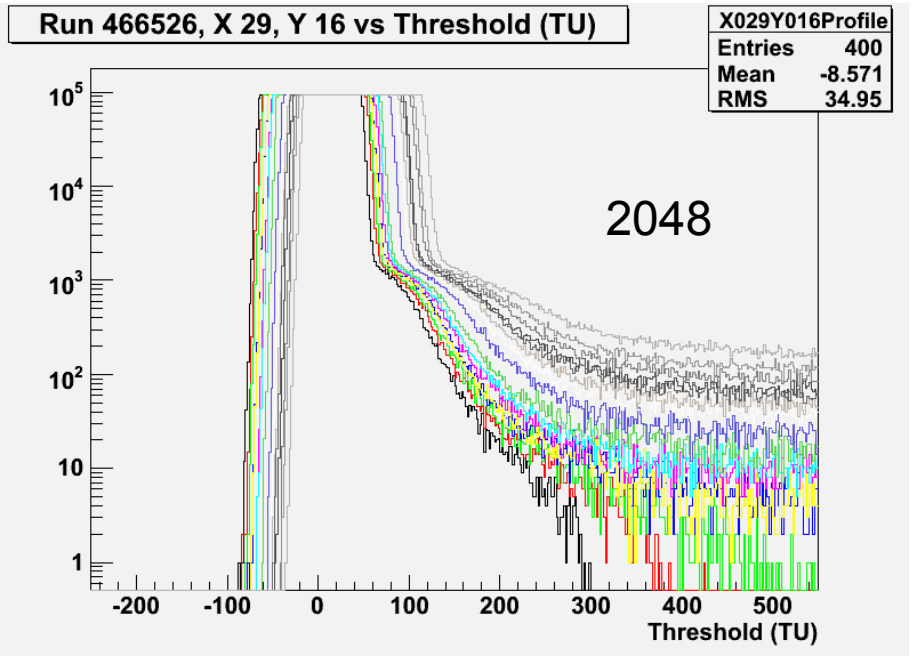


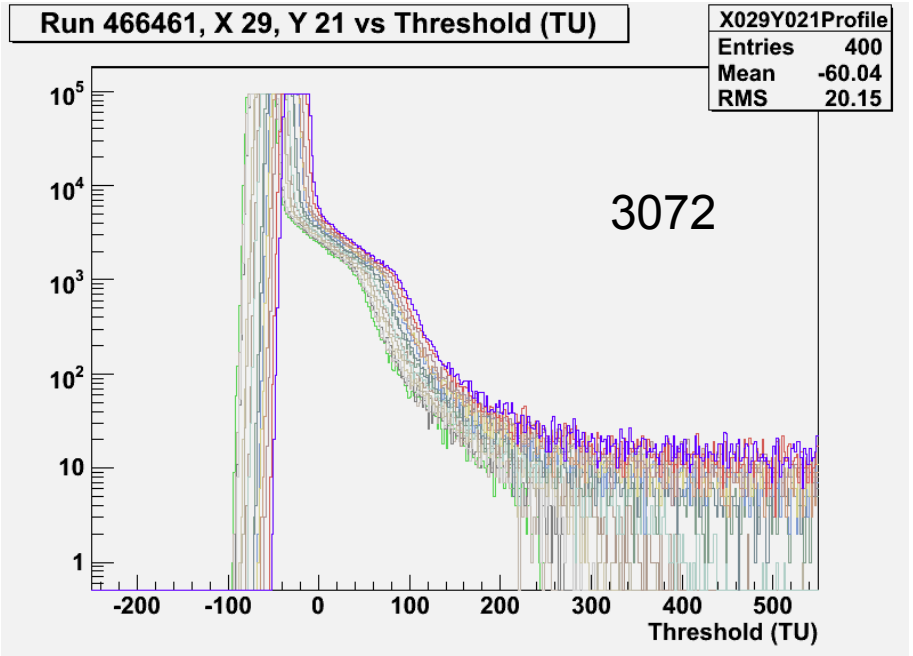


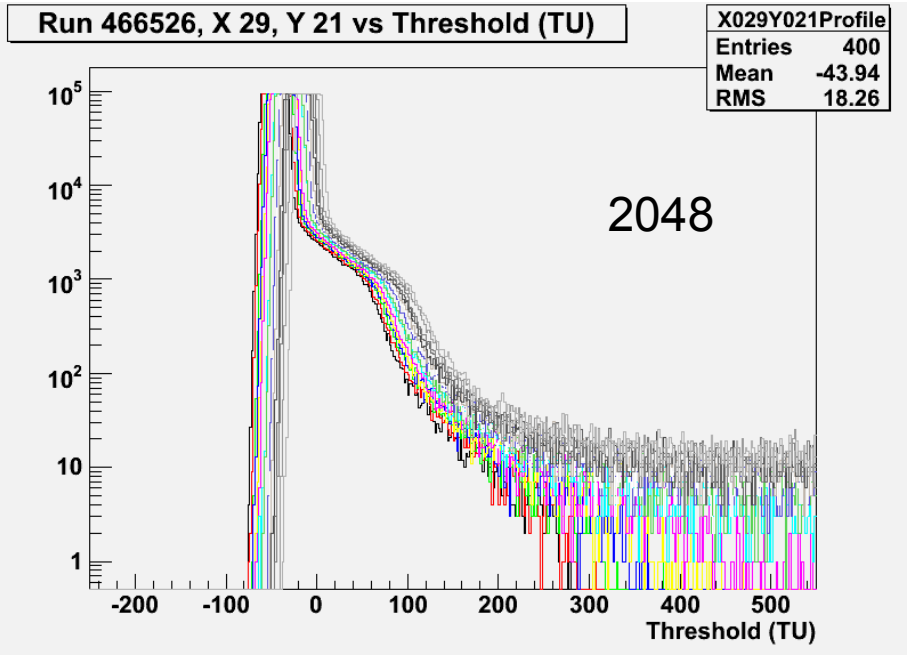


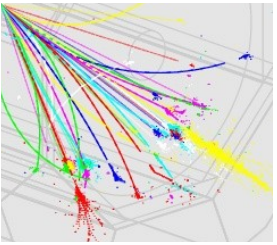
individual pixels quad 0



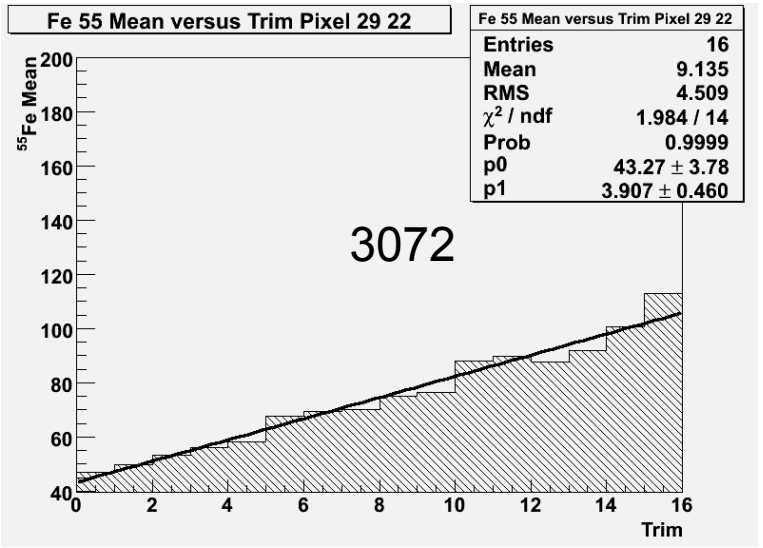


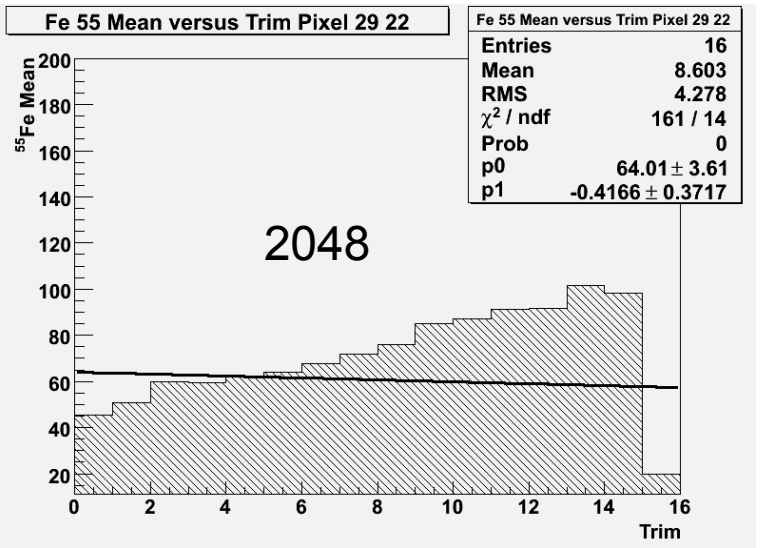


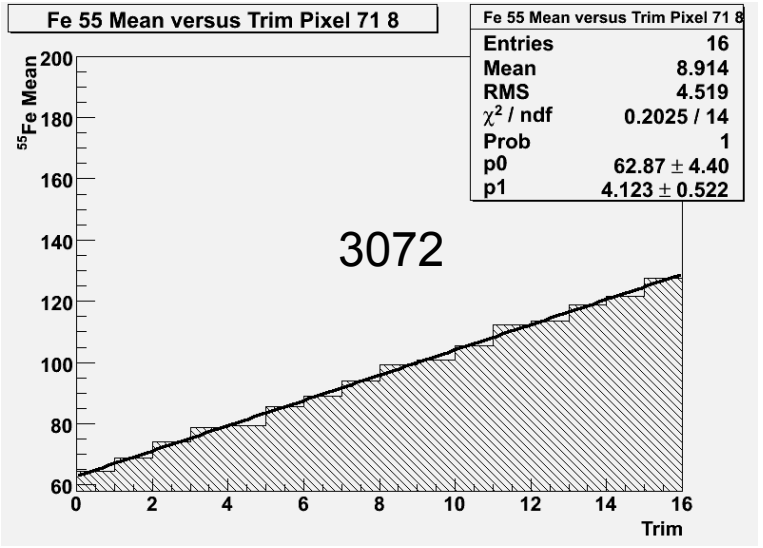


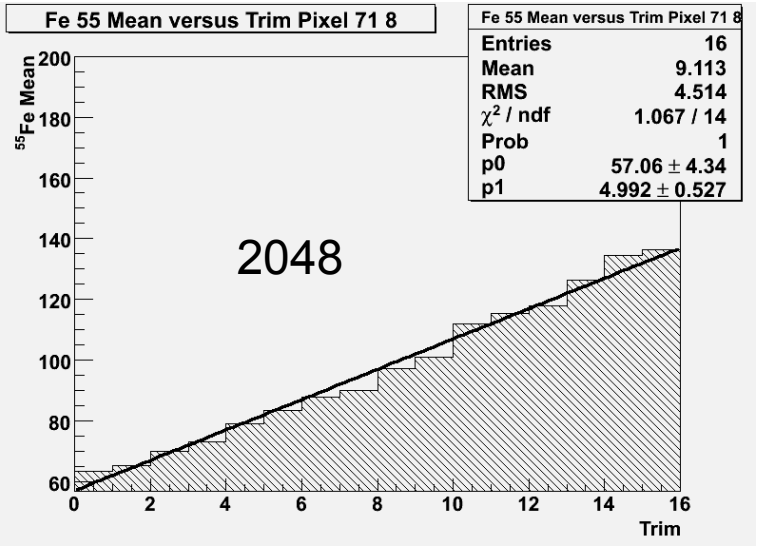


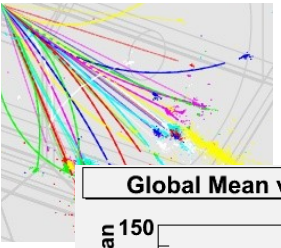
trim linearity in quad 0



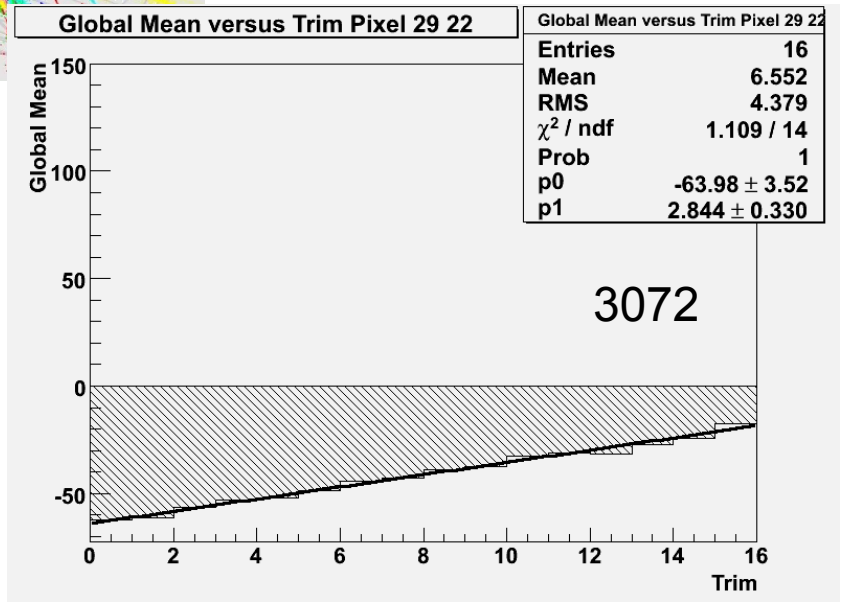


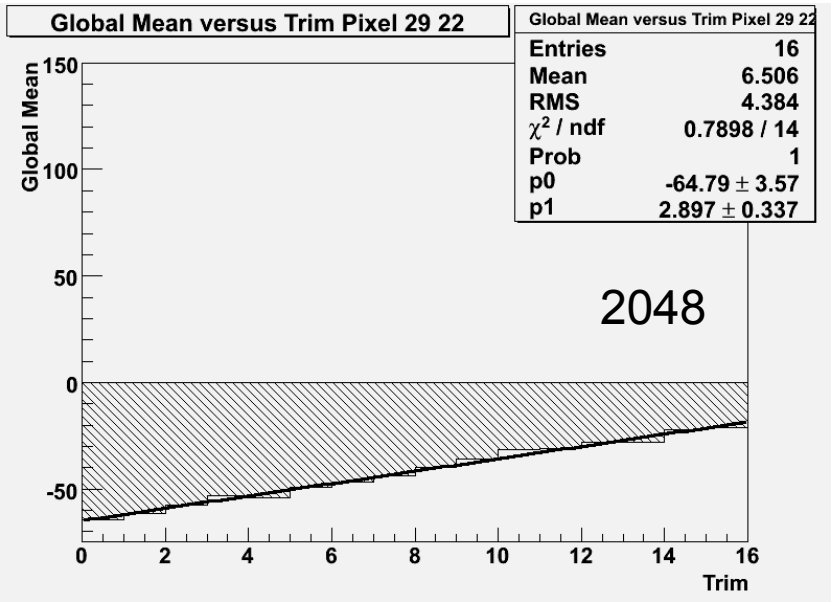


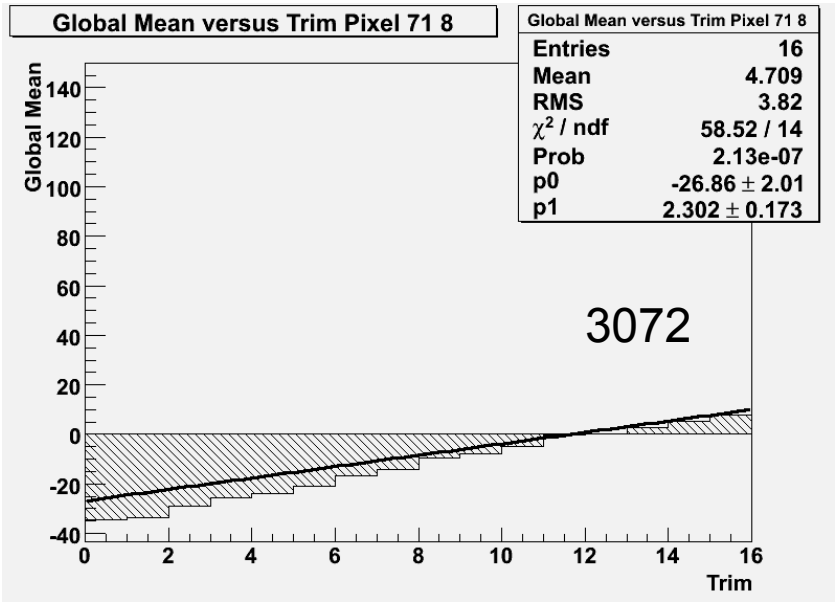


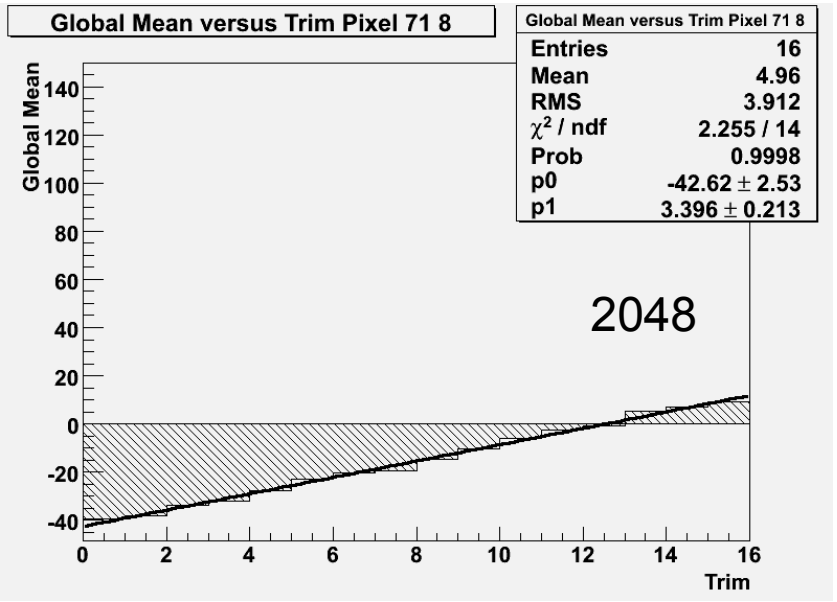


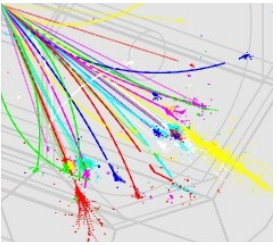
Cross-check


Global Mean versus Trim Pixel 29 22
Global Mean versus Trim Pixel 29 22
Entries 16
Mean 6.552
RMS 4.379
χ² / ndf 1.109 / 14
Prob 1
p0 -63.98 ± 3.52
p1 2.844 ± 0.330
3072
Global Mean
Trim

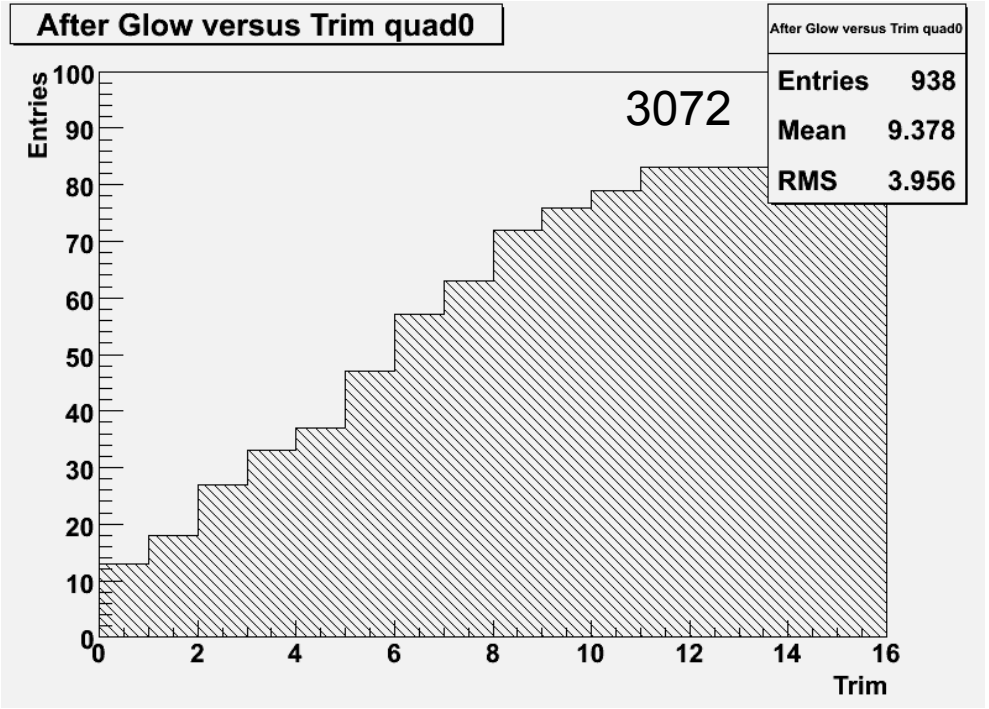

Global Mean versus Trim Pixel 29 22
Global Mean versus Trim Pixel 29 22
Entries 16
Mean 6.506
RMS 4.384
χ² / ndf 0.7898 / 14
Prob 1
p0 -64.79 ± 3.57
p1 2.897 ± 0.337
2048
Global Mean
Trim

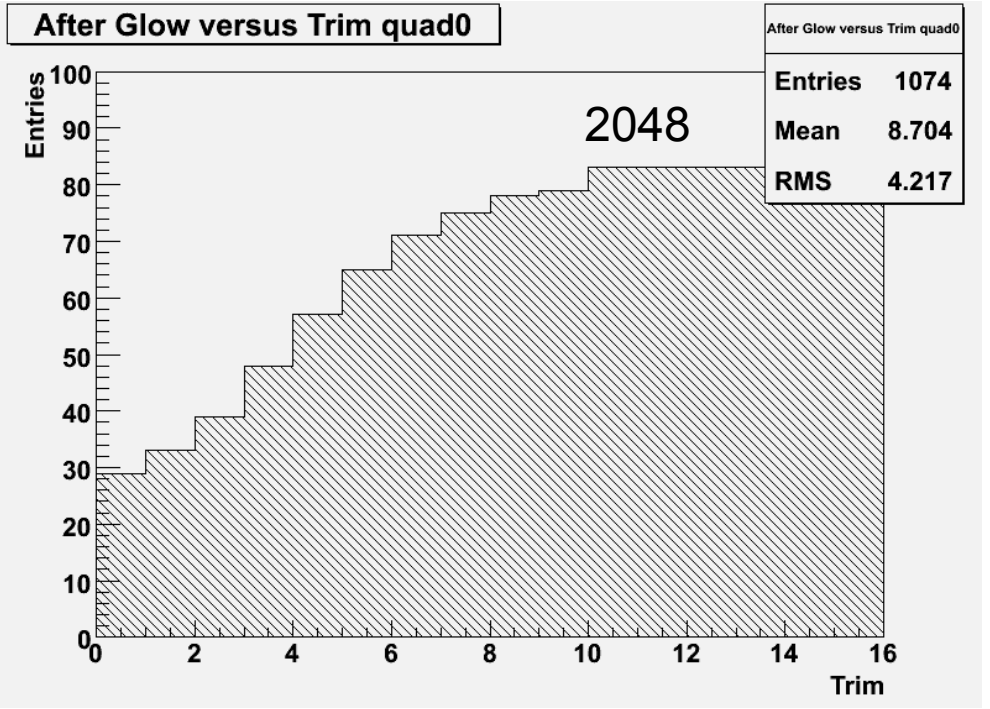

Global Mean versus Trim Pixel 71 8
Global Mean versus Trim Pixel 71 8
Entries 16
Mean 4.709
RMS 3.82
χ² / ndf 58.52 / 14
Prob 2.13e-07
p0 -26.86 ± 2.01
p1 2.302 ± 0.173
3072
Global Mean
Trim

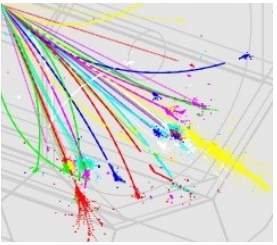

Global Mean versus Trim Pixel 71 8
Global Mean versus Trim Pixel 71 8
Entries 16
Mean 4.96
RMS 3.912
χ² / ndf 2.255 / 14
Prob 0.9998
p0 -42.62 ± 2.53
p1 3.396 ± 0.213
2048
Global Mean
Trim



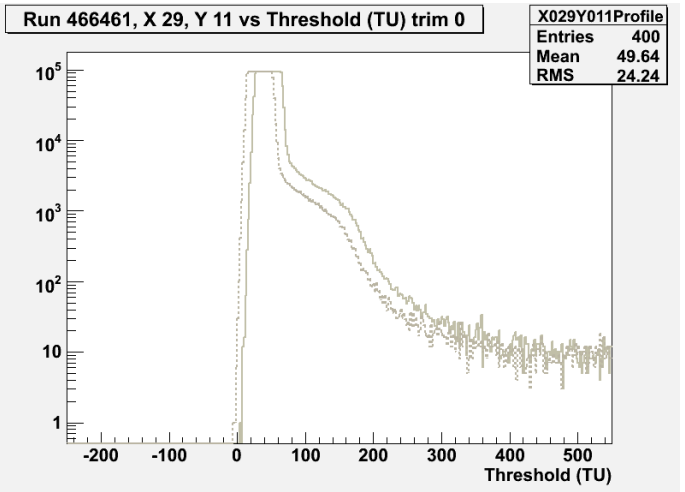
Afterglow

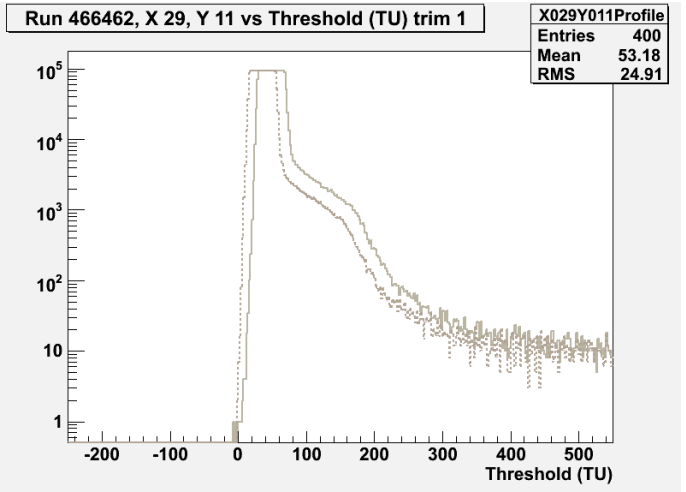

After Glow versus Trim quad0
After Glow versus Trim quad0
Entries 938
Mean 9.378
RMS 3.956
3072
Entries
Trim

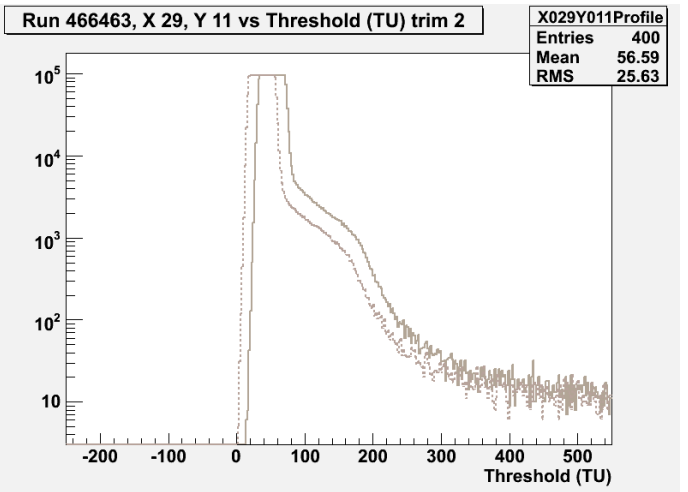

After Glow versus Trim quad0
After Glow versus Trim quad0
Entries 1074
Mean 8.704
RMS 4.217
2048
Entries
Trim

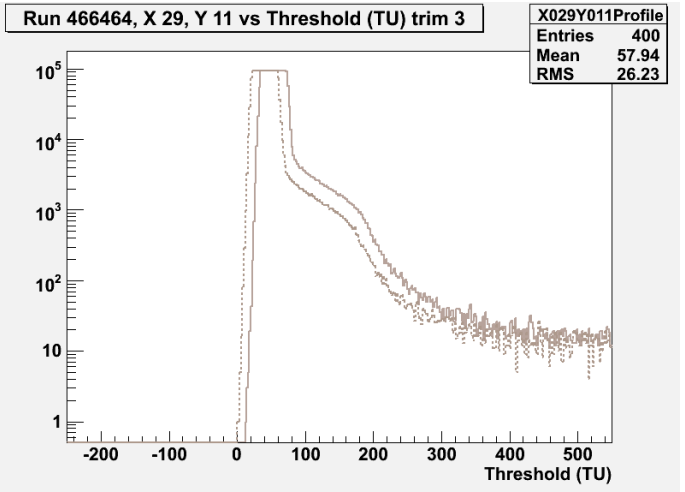


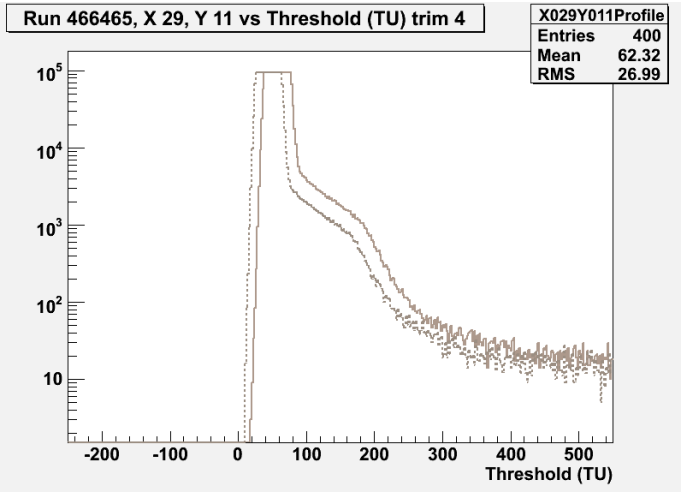
A more detailed look

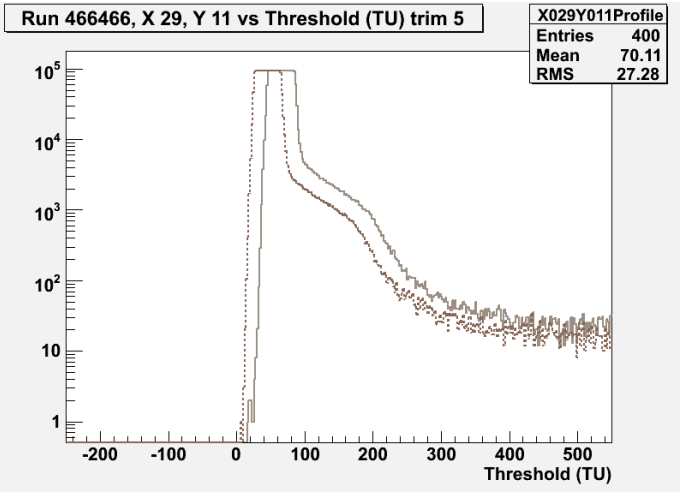


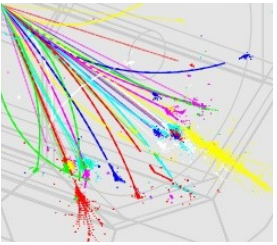




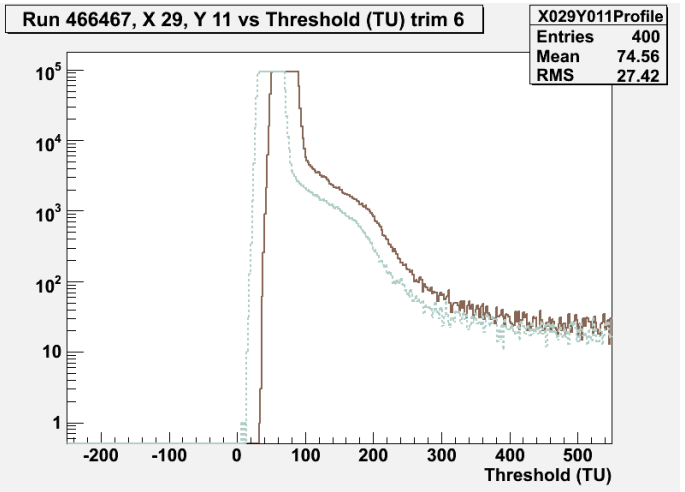


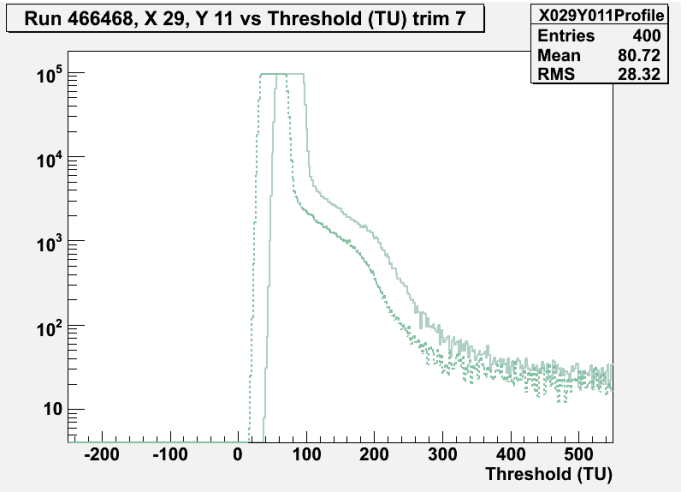


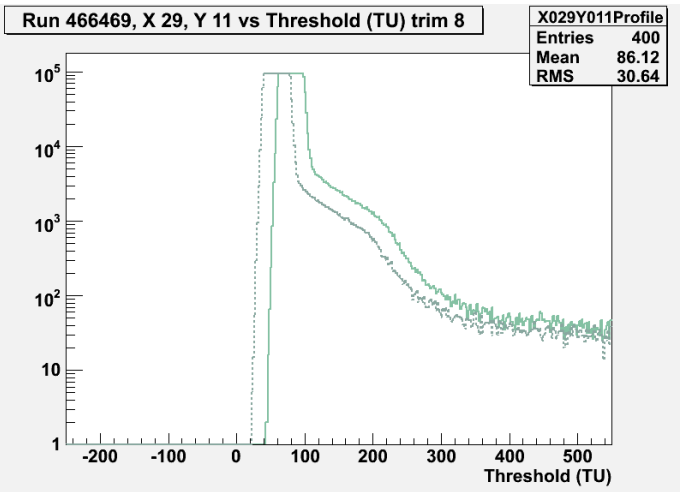


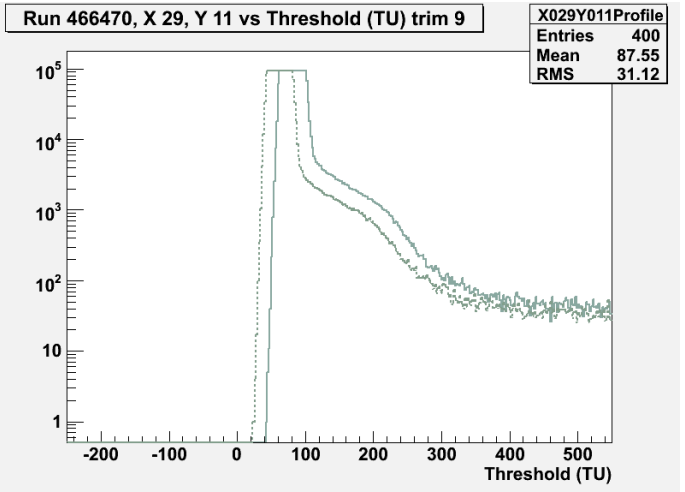


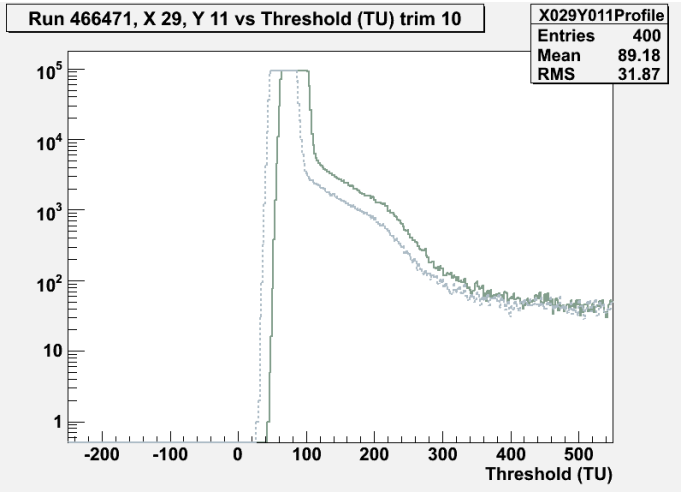
A more detailed look

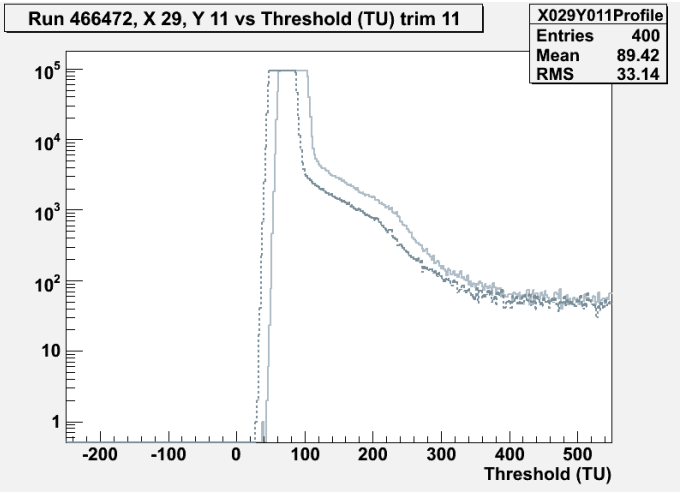


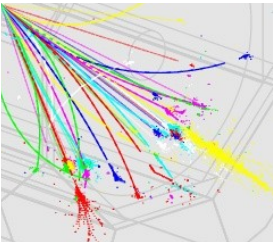




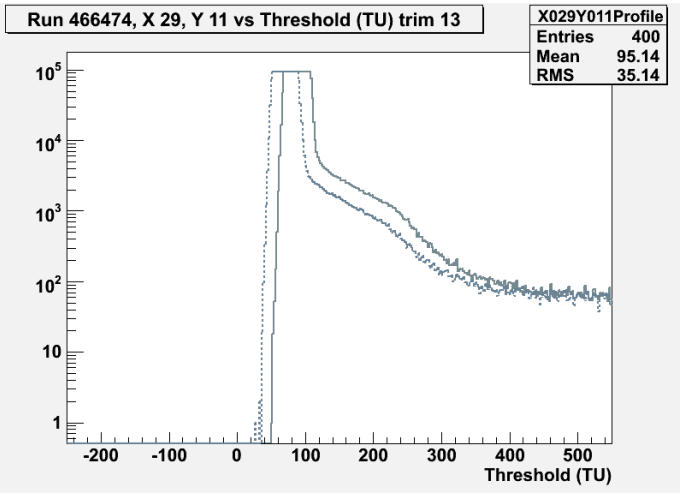


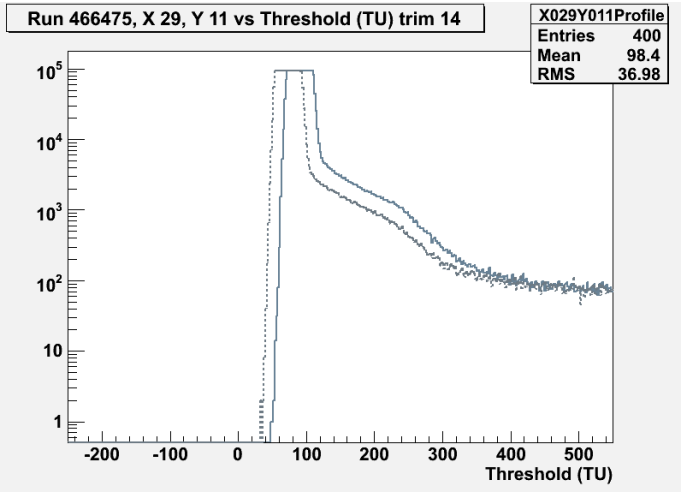


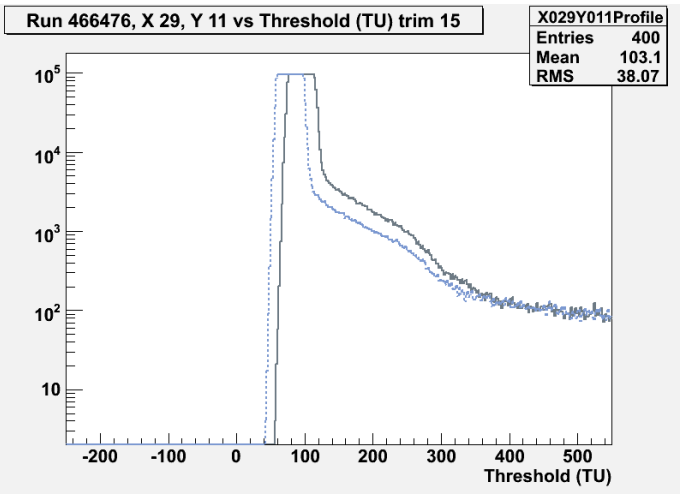


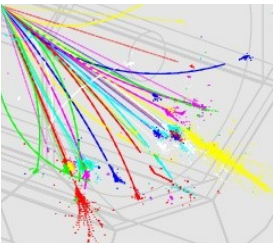


A more detailed look





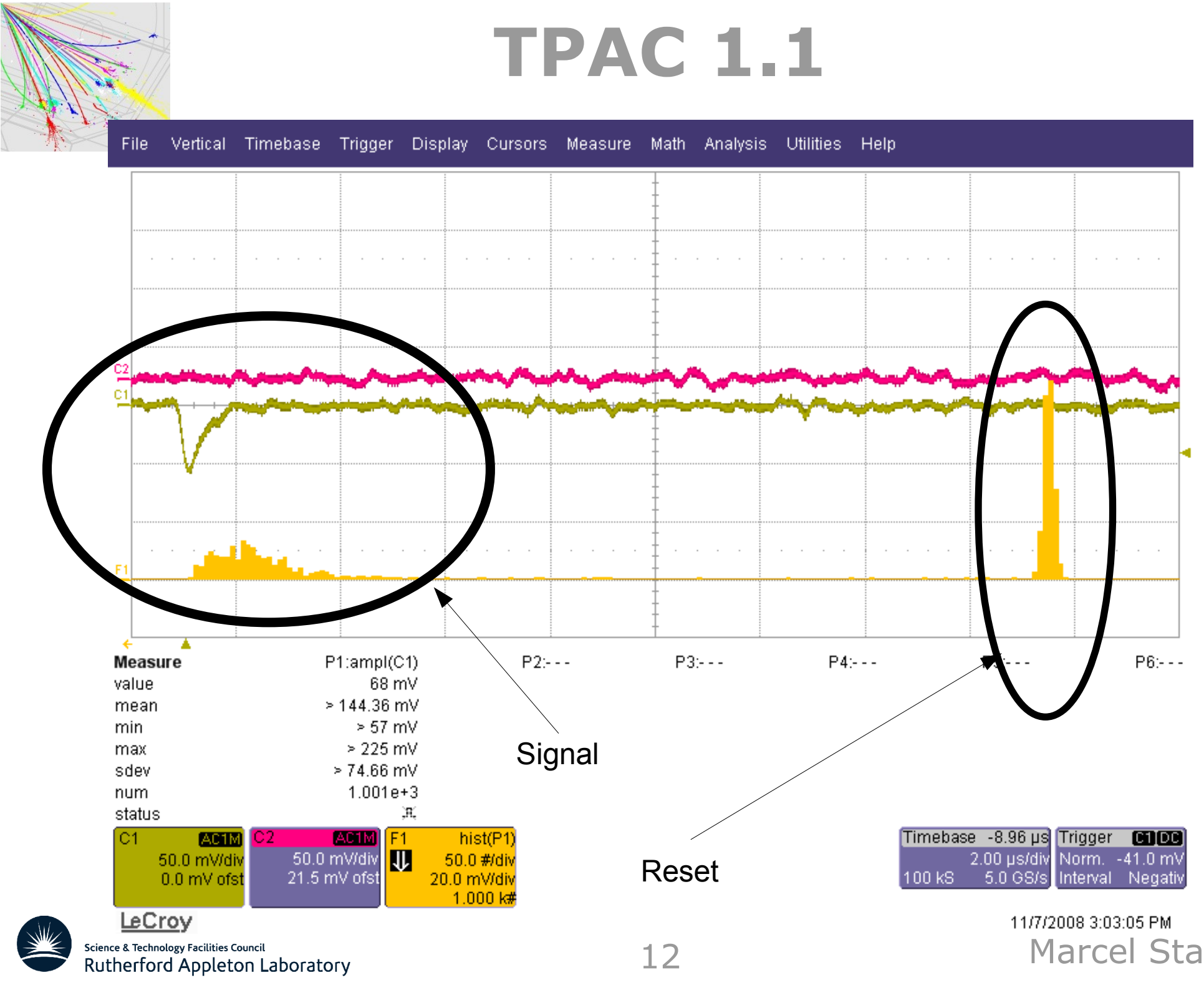


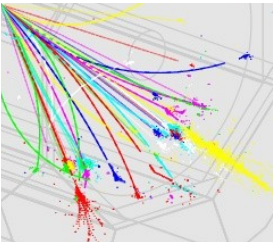


First look at TPAC 1.1

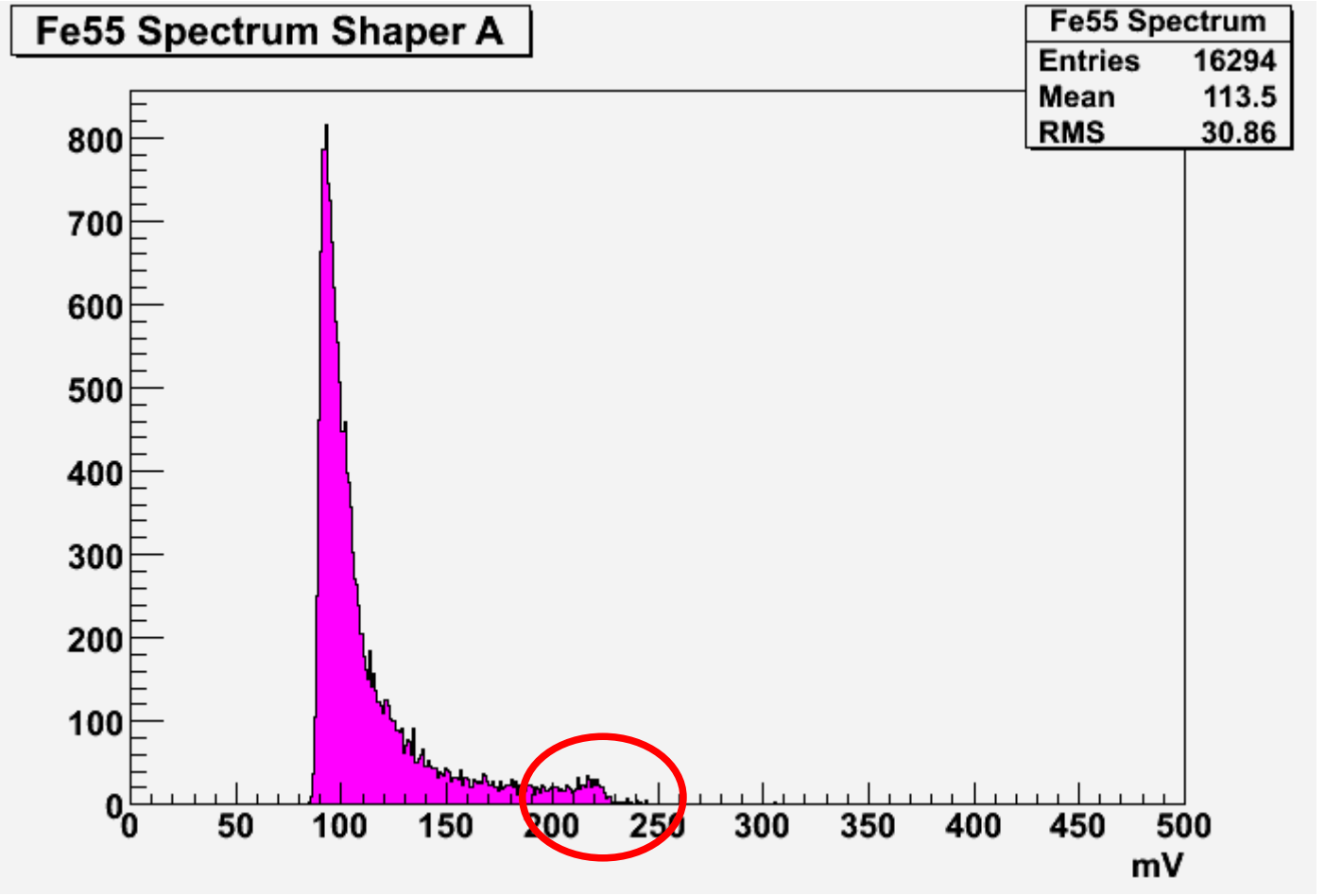
- Irradiated the testpixels with Gary's ^{55}Fe source
  - Readout done using scope
- Several problems
  - much harder to trigger on ^{55}Fe pulse
  - We can only store 16384 samples
  - talked to LeCroy and got a lot of feedback
    - and some ideas how to fix or work around
- anyway, we took some data
- Cross checked with DC coupling
  - no hidden factors of two found

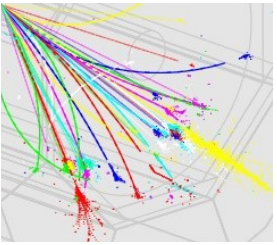
TPAC 1.1


File Vertical Timebase Trigger Display Cursors Measure Math Analysis Utilities Help
C2
C1
F1
Measure P1:ampl(C1) P2:- - - P3:- - - P4:- - - P6:- - -
value 68 mV
mean > 144.36 mV
min > 57 mV
max > 225 mV
sdev > 74.66 mV
num 1.001e+3
status
C1 AC1M 50.0 mV/div 0.0 mV ofst
C2 AC1M 50.0 mV/div 21.5 mV ofst
F1 hist(P1) 50.0 #/div 20.0 mV/div 1.000 k#
Timebase -8.96 µs 2.00 µs/div 100 kS 5.0 GS/s
Trigger C1 DC Norm. -41.0 mV Interval Negativ
LeCroy
11/7/2008 3:03:05 PM
Signal
Reset

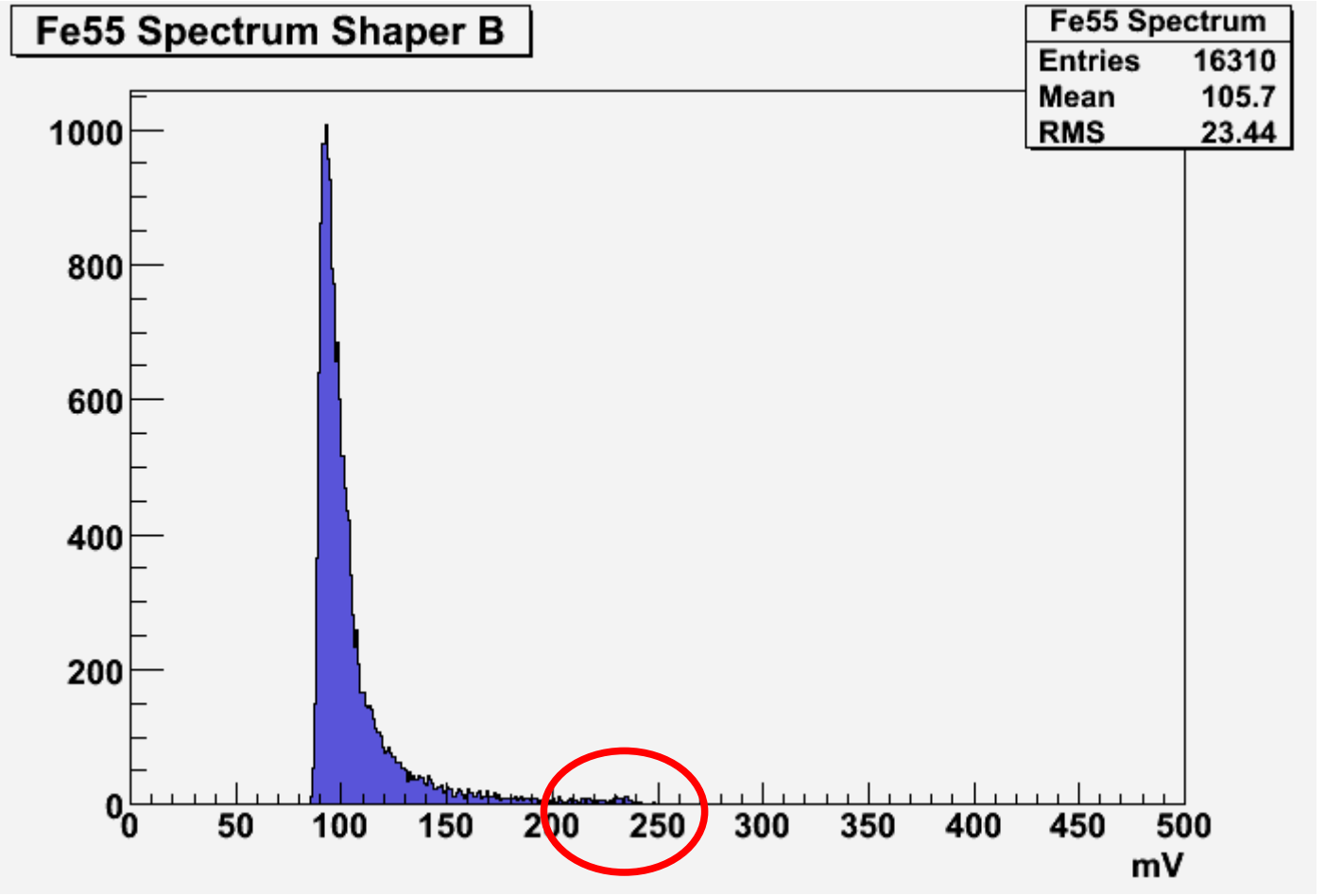


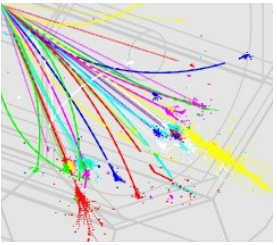
The spectra – Shaper A



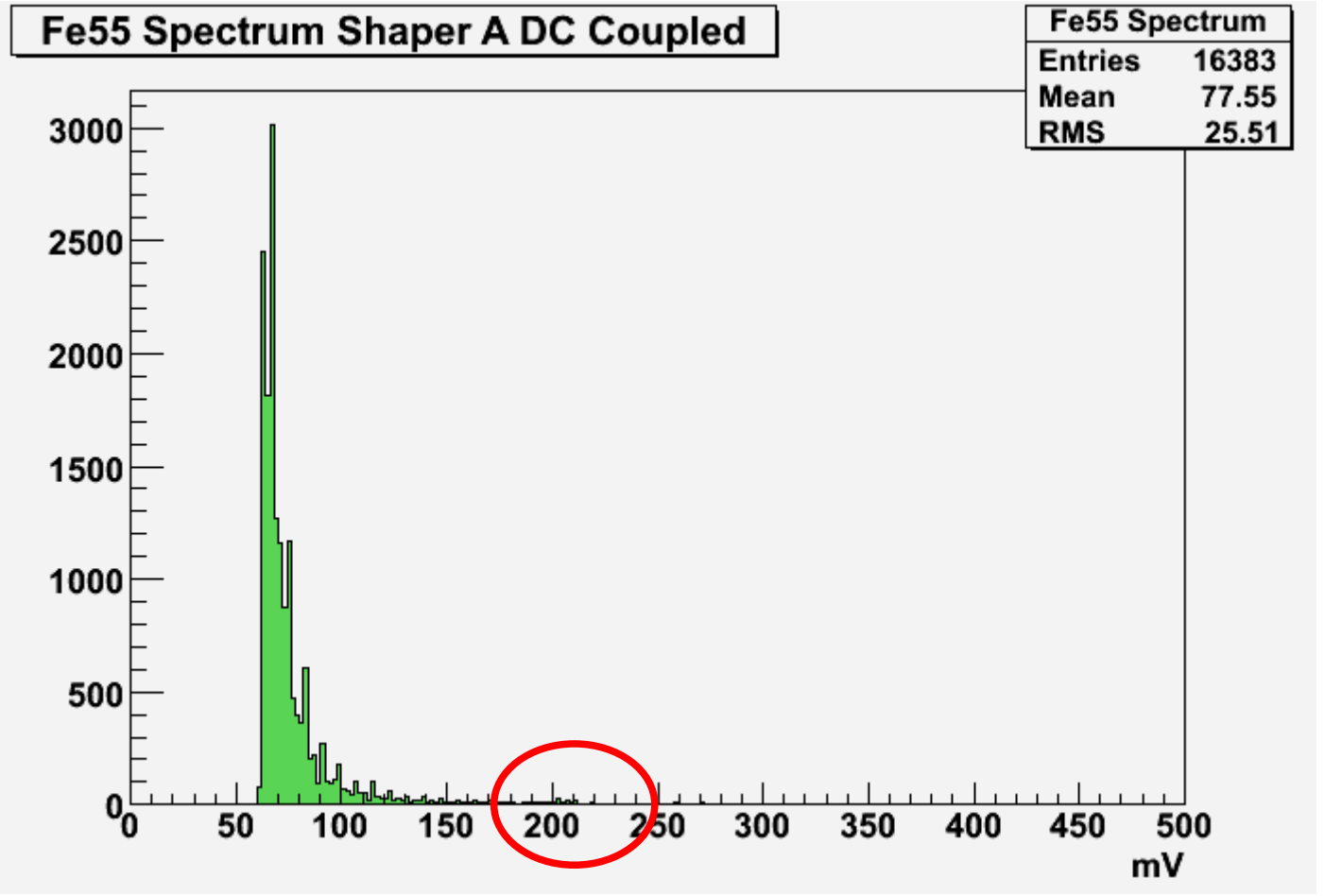


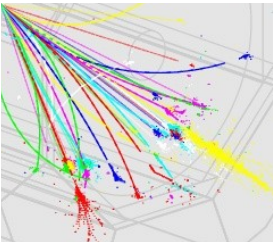
The spectra – shaper B





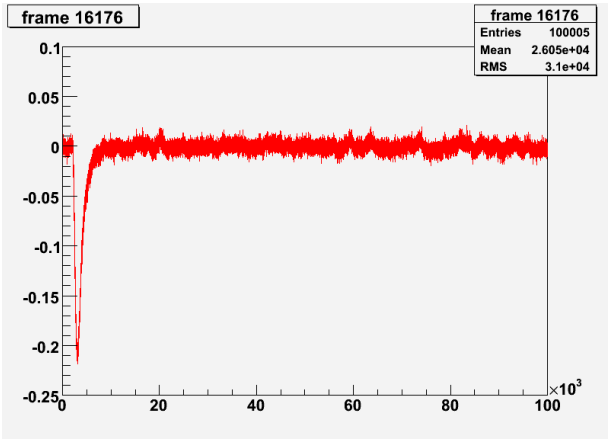
Shaper A DC coupled

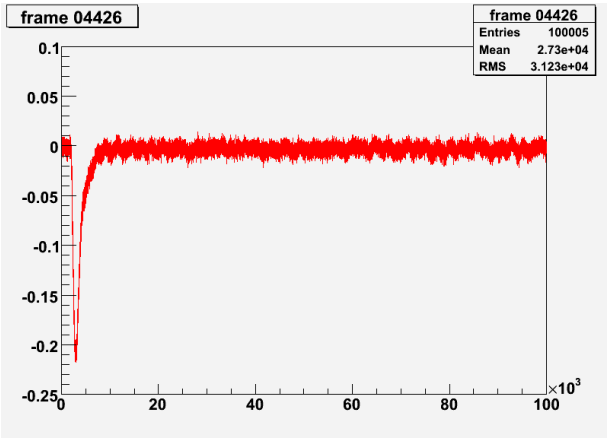


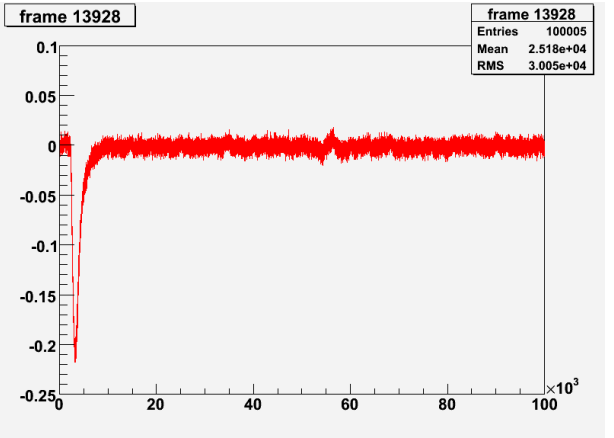


Some individual pulses

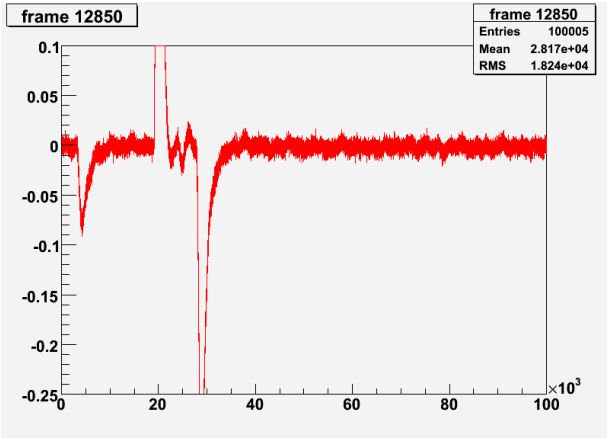
Real pulses



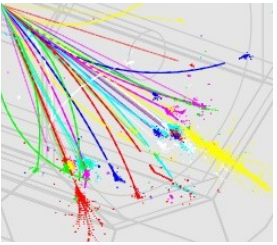




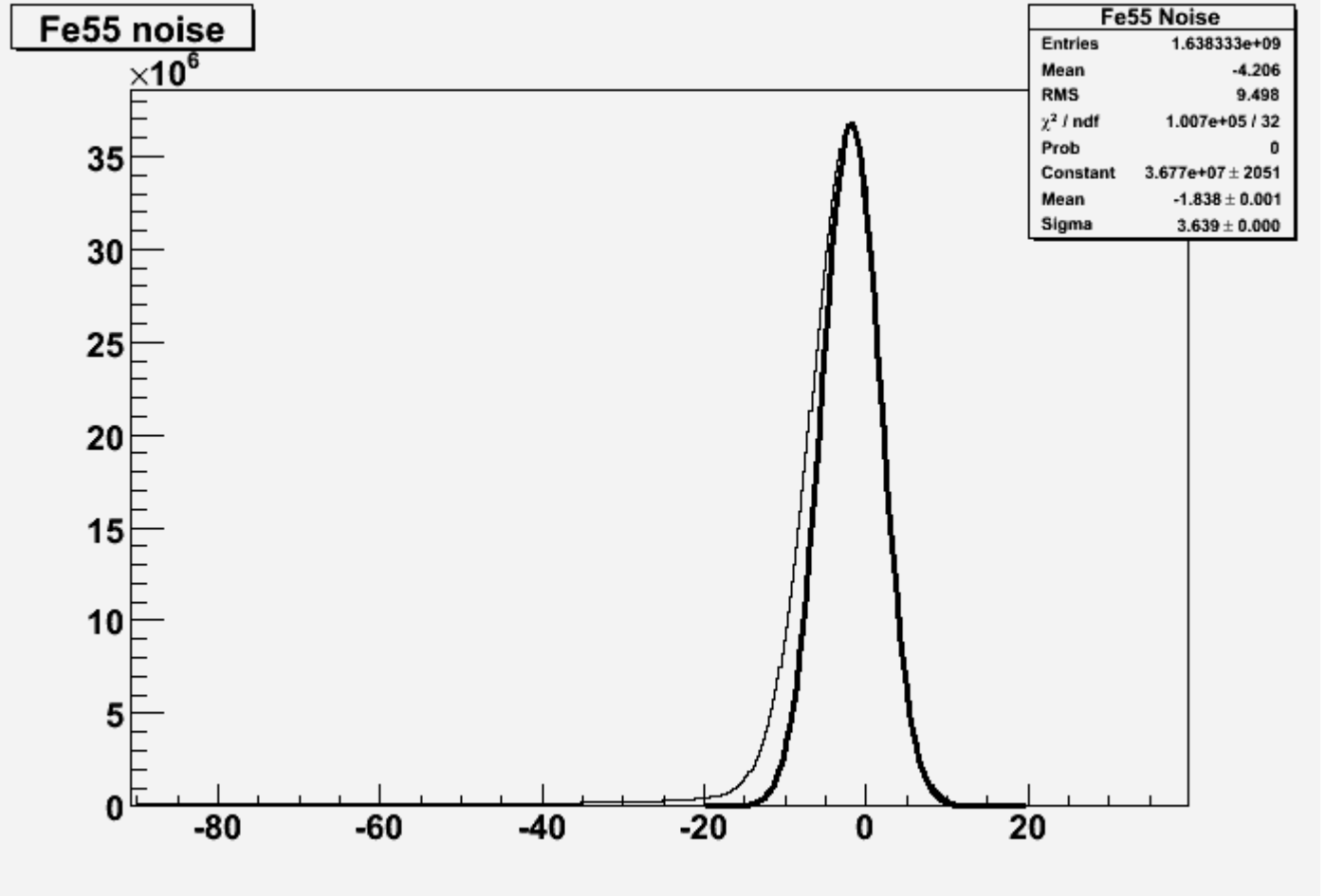
Fake pulses



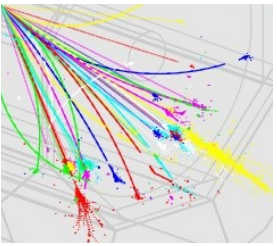
Includes Reset Pulses
Automatically filtered during analysis



Noise

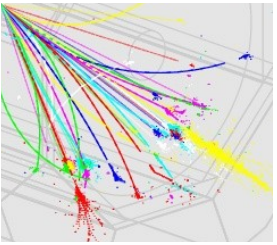


Noise of 3.64 mV measured

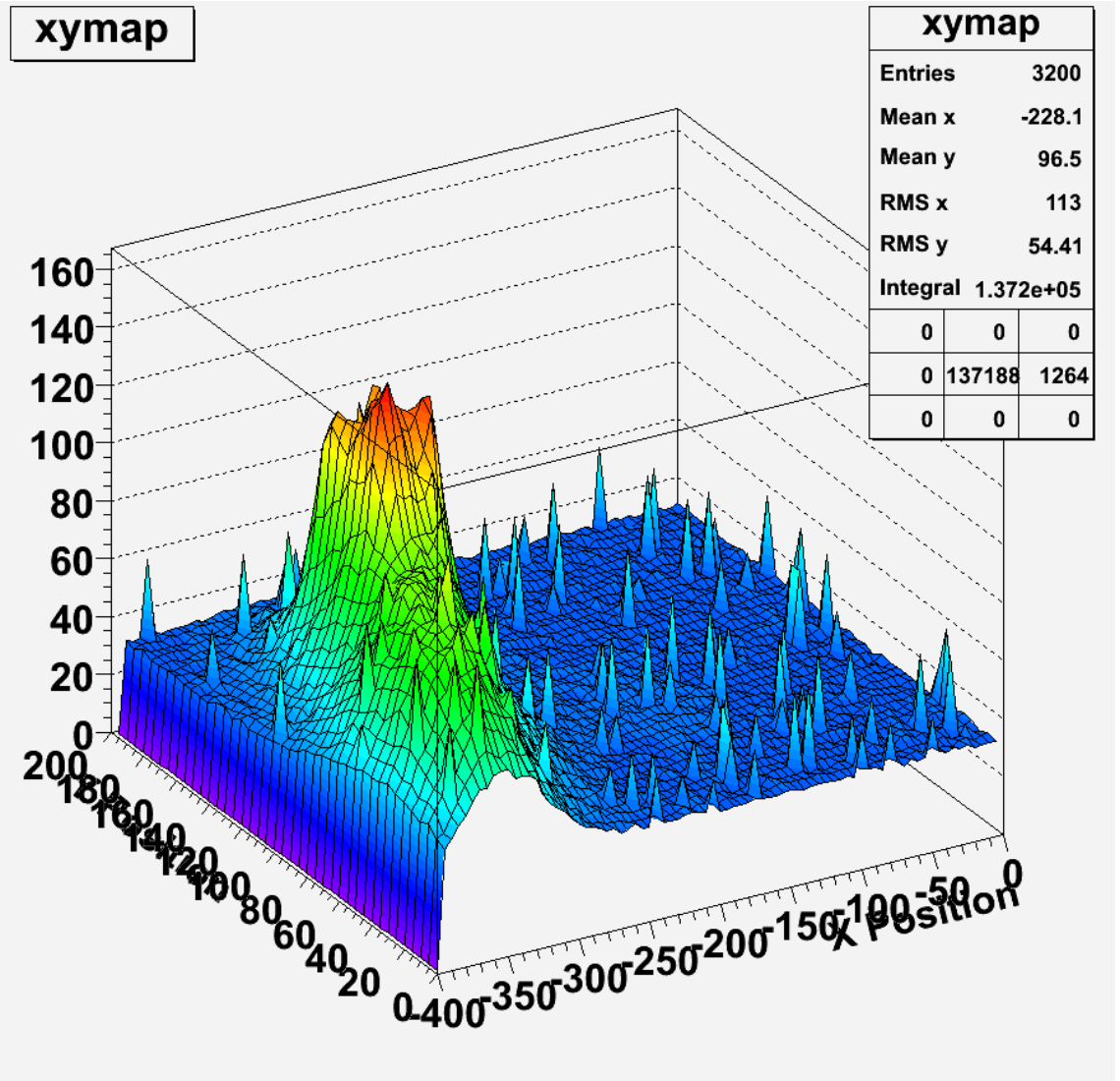


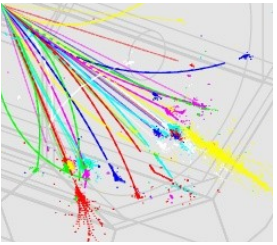
TPAC 1.1 Simulation

- Triggered by Mike
  - Do we understand the ^{55}Fe spectra ?
- Taking the Laser Scan done by Jamie
  - Apply pedestal correction
  - Interpolate it
  - Transform in a probability map
  - do the simulation

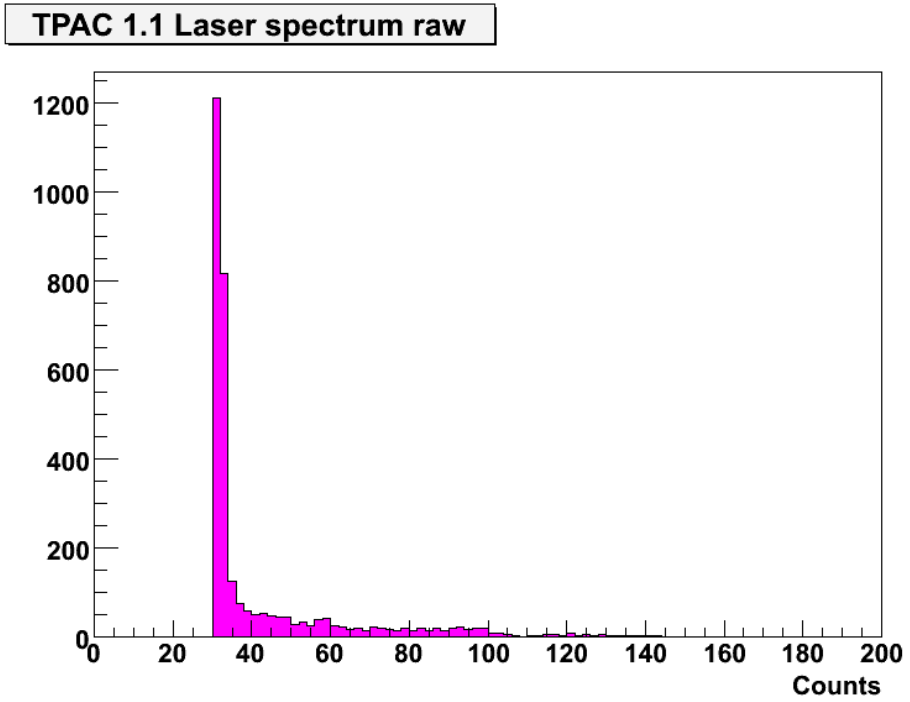


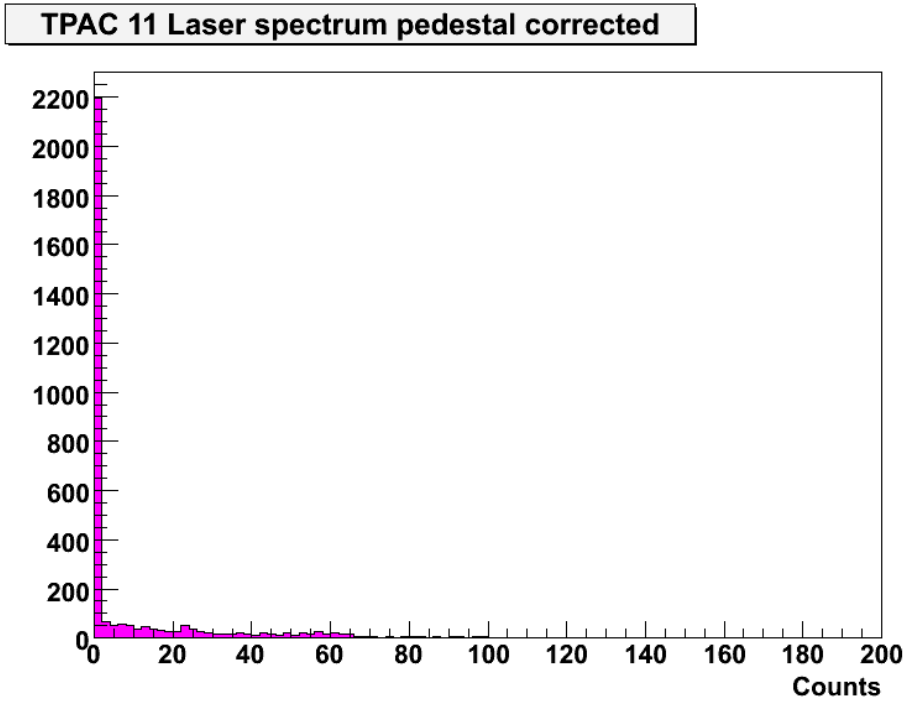
The Data

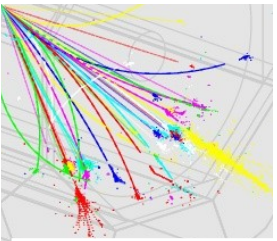

xymap
xymap
Entries 3200
Mean x -228.1
Mean y 96.5
RMS x 113
RMS y 54.41
Integral 1.372e+05
0 0 0
0 137188 1264
0 0 0
160
140
120
100
80
60
40
20
0
200
180
160
140
120
100
80
60
40
20
0
-400
-350
-300
-250
-200
-150
-100
-50
0
X Position



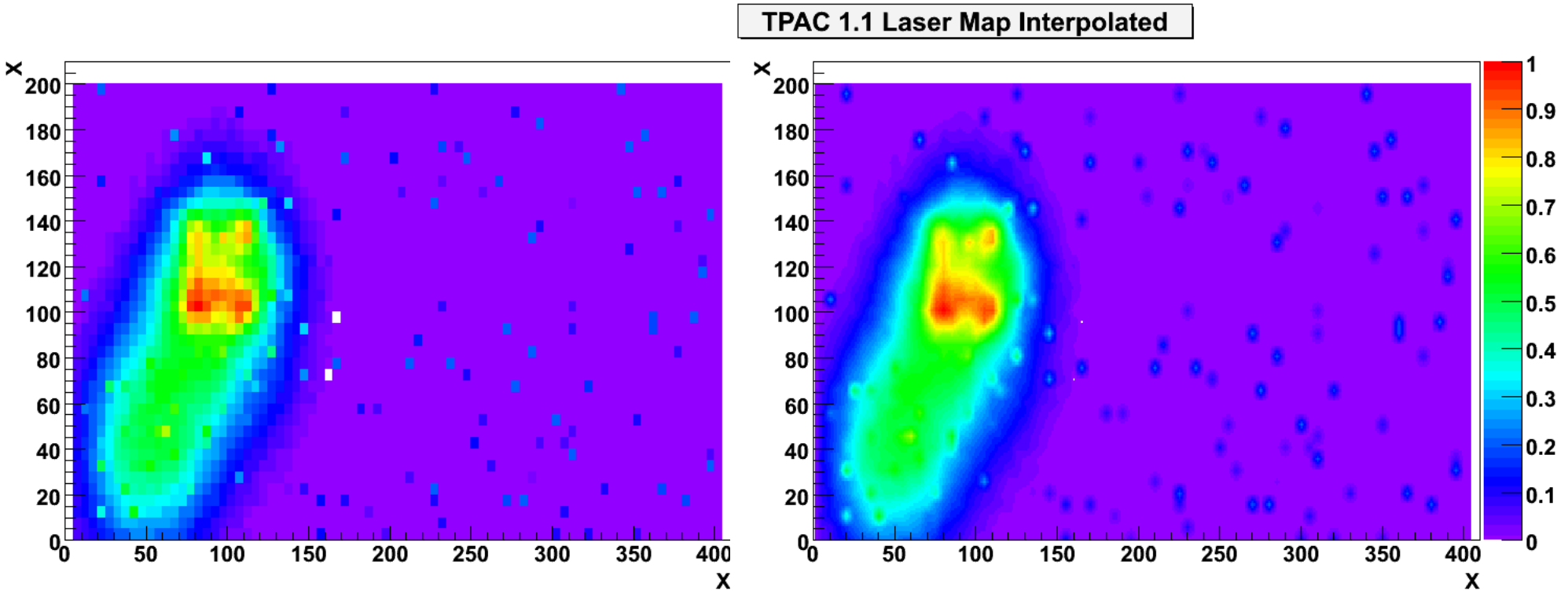
Pedestal subtraction



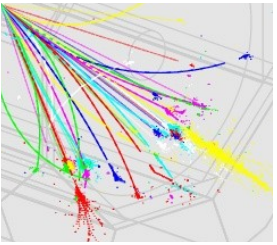




Interpolation

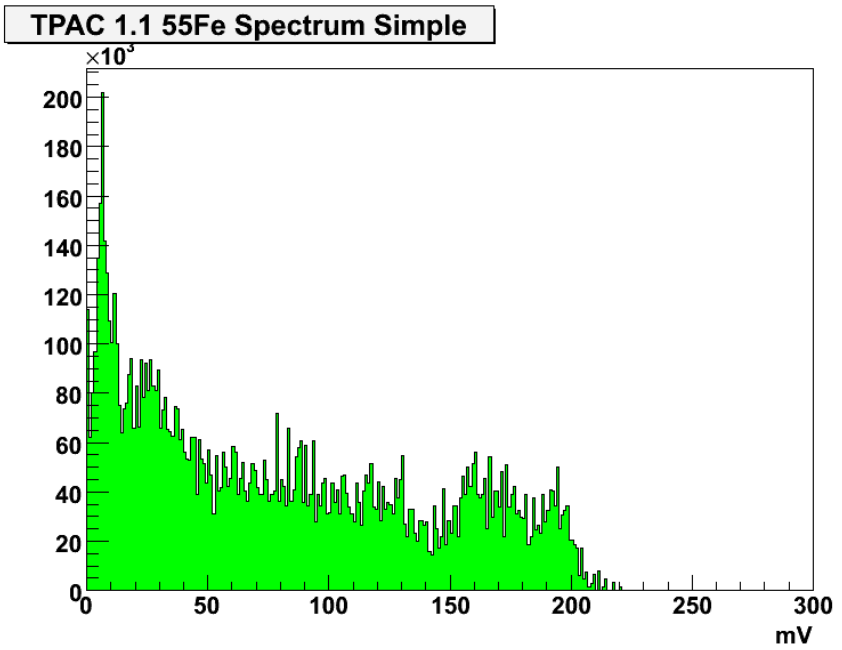


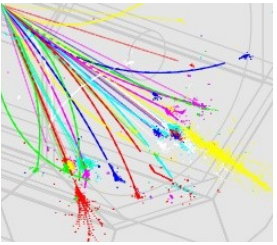
- Interpolate from 5 steps to 1 micron steps
- Linear interpolation so far
- Certainly not optimal
- normalized to have a collection efficiency from 0 to 1



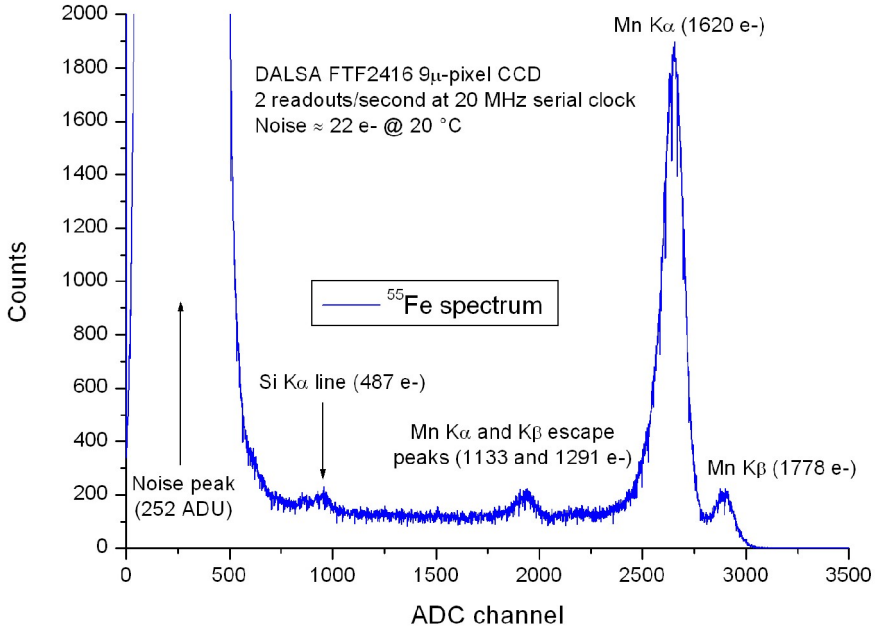
First attempt

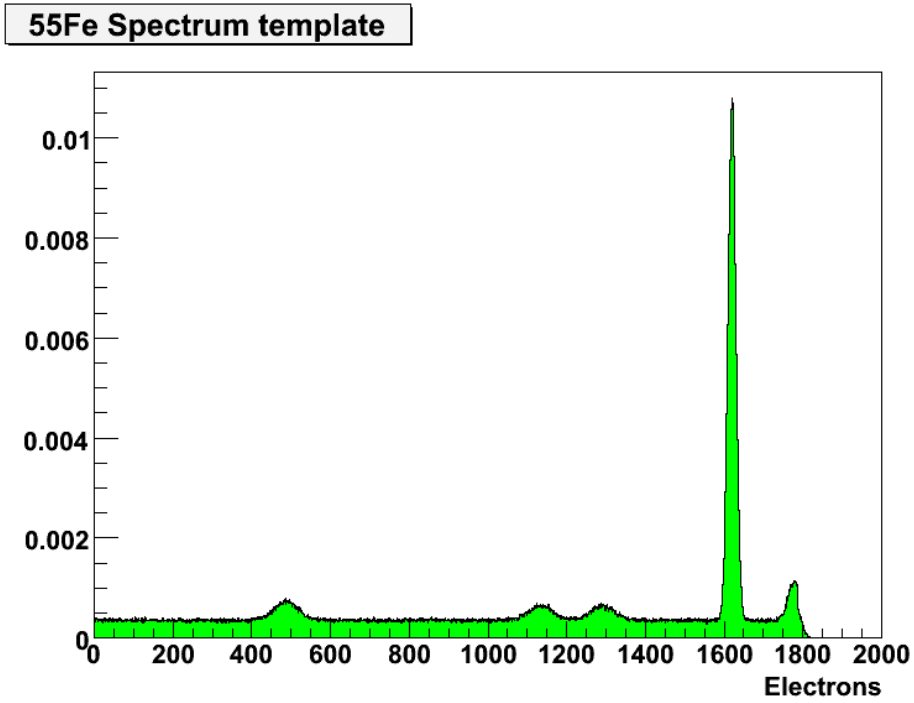
- Inject delta peak of 1620 electrons
- Randomly in 80x80 mu window with pixel in center
- Gives an idea, but no so great
- mV conversion is “educated guess”

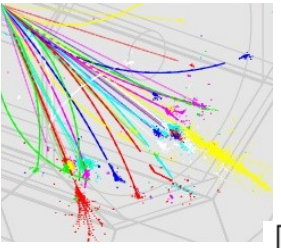




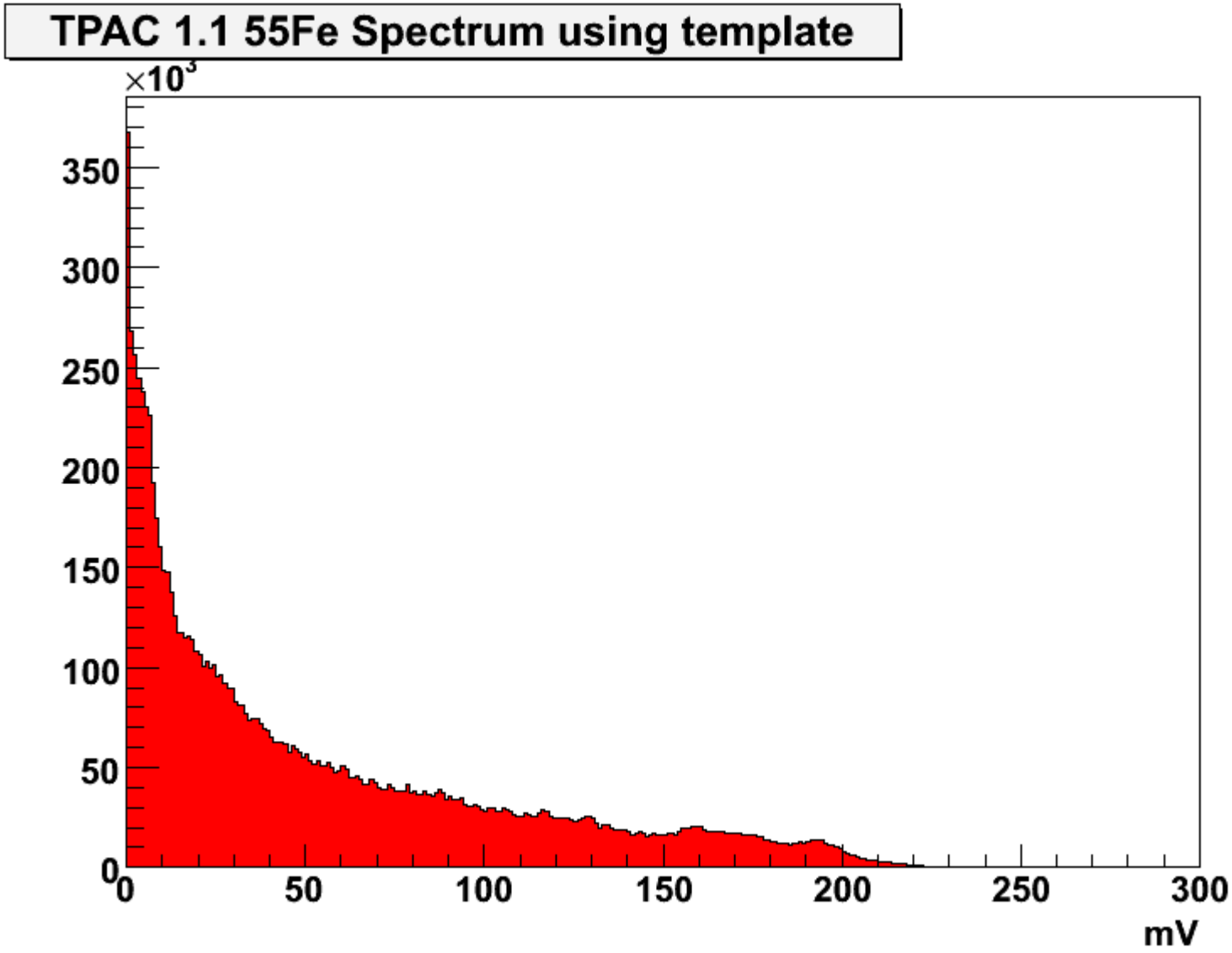
Model spectra

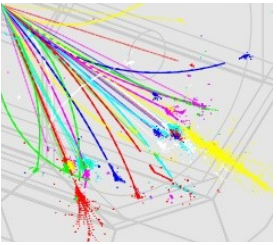






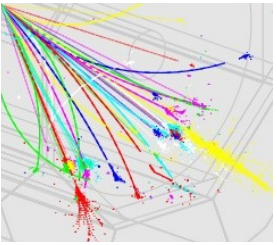
Go again


TPAC 1.1 55Fe Spectrum using template
×10³
350
300
250
200
150
100
50
0
0
50
100
150
200
250
300
mV



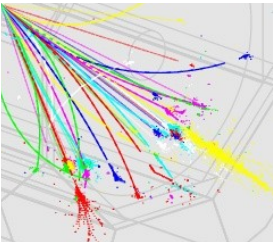
Comments

- Shapes are modeled reasonably
- The pedestal subtraction is not a straight forward thing to do
  - Could have an impact on the description at small values
  - could be the wrong way of doing things
- Went on with some cross-checks

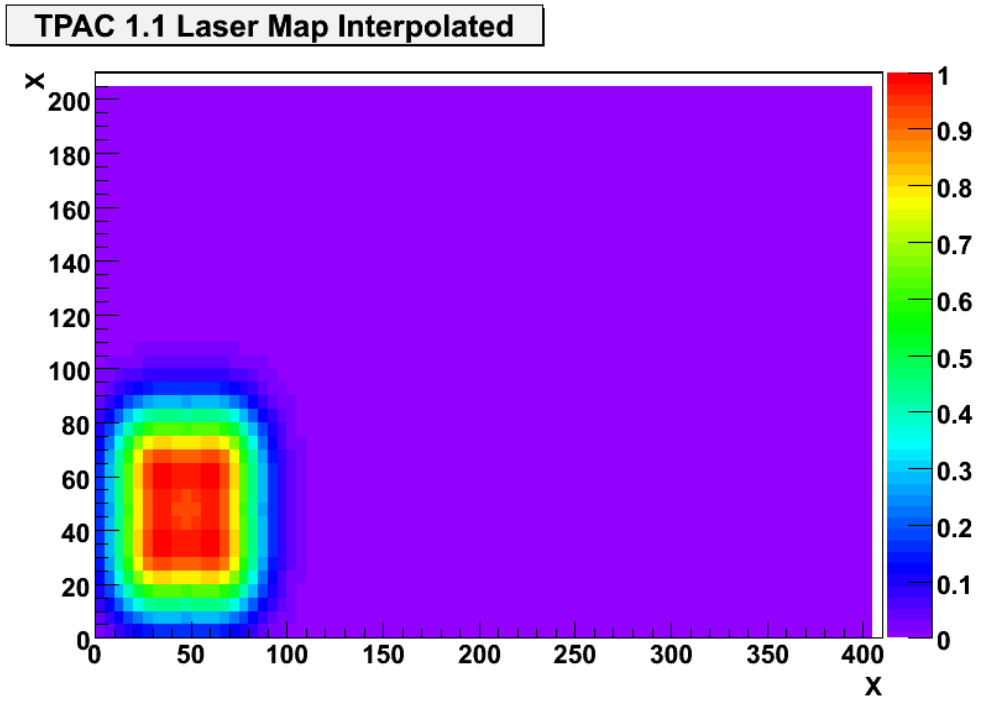


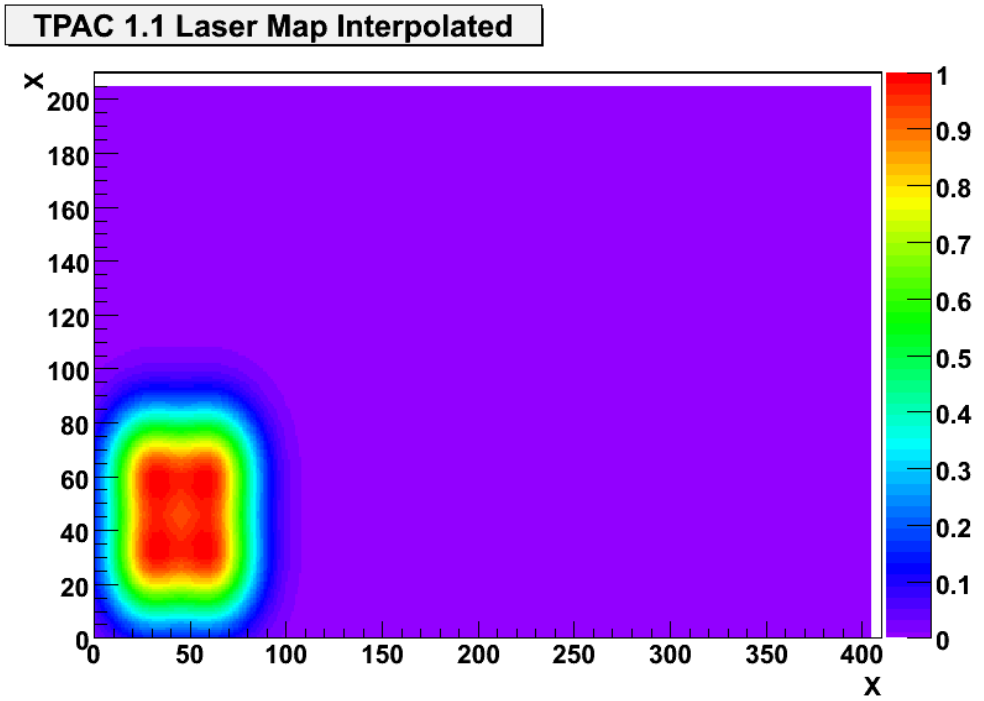
Start with a toy model

- 50 x50 mu pixel
- 4 diodes
- modelled as 2d-Gaussian
- 5 x5 charge collection map

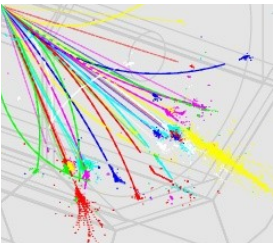


Testing interpolation



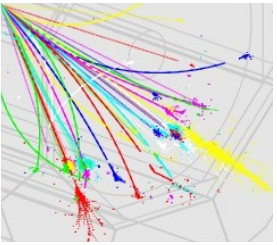


Interpolation does not introduce any craziness !

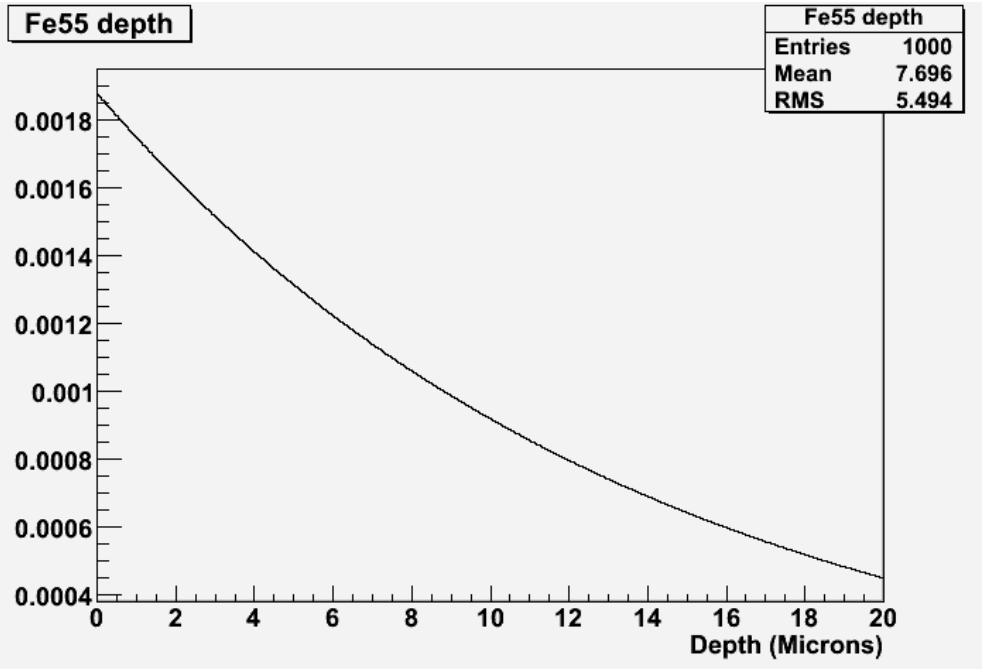


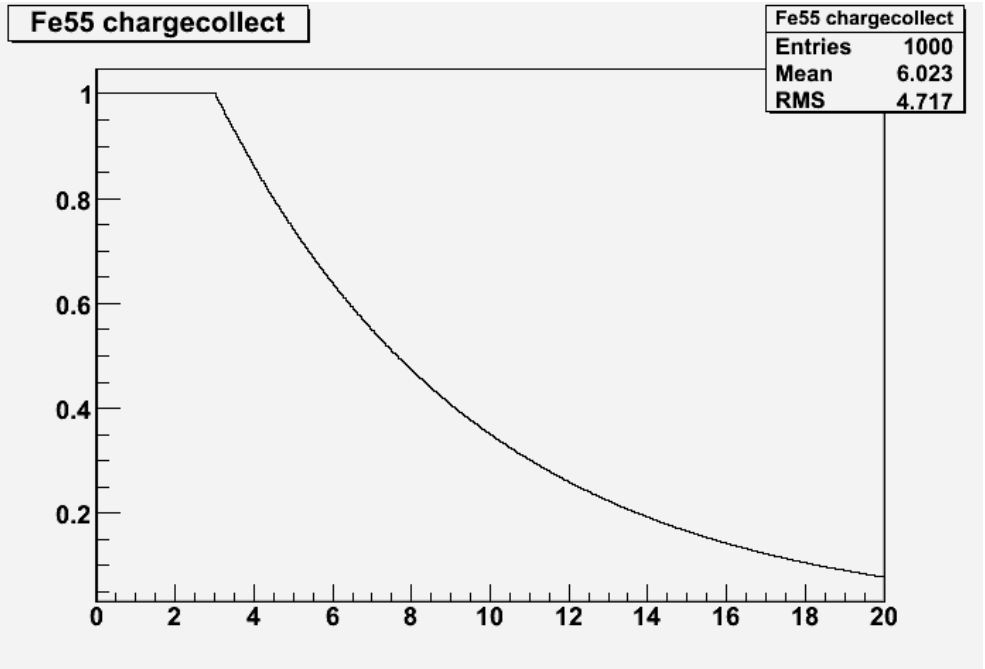
Advanced modelling

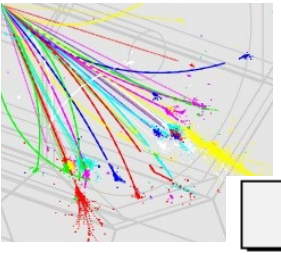
- did not include so far
- Absorption effect of ^{55}Fe
  - from Mike Absorption length is 14 microns
- collection is dependent on depth
  - need to model that as well
- So for each photon
  - randomize depth using exponential
  - include charge collection efficiency at this point



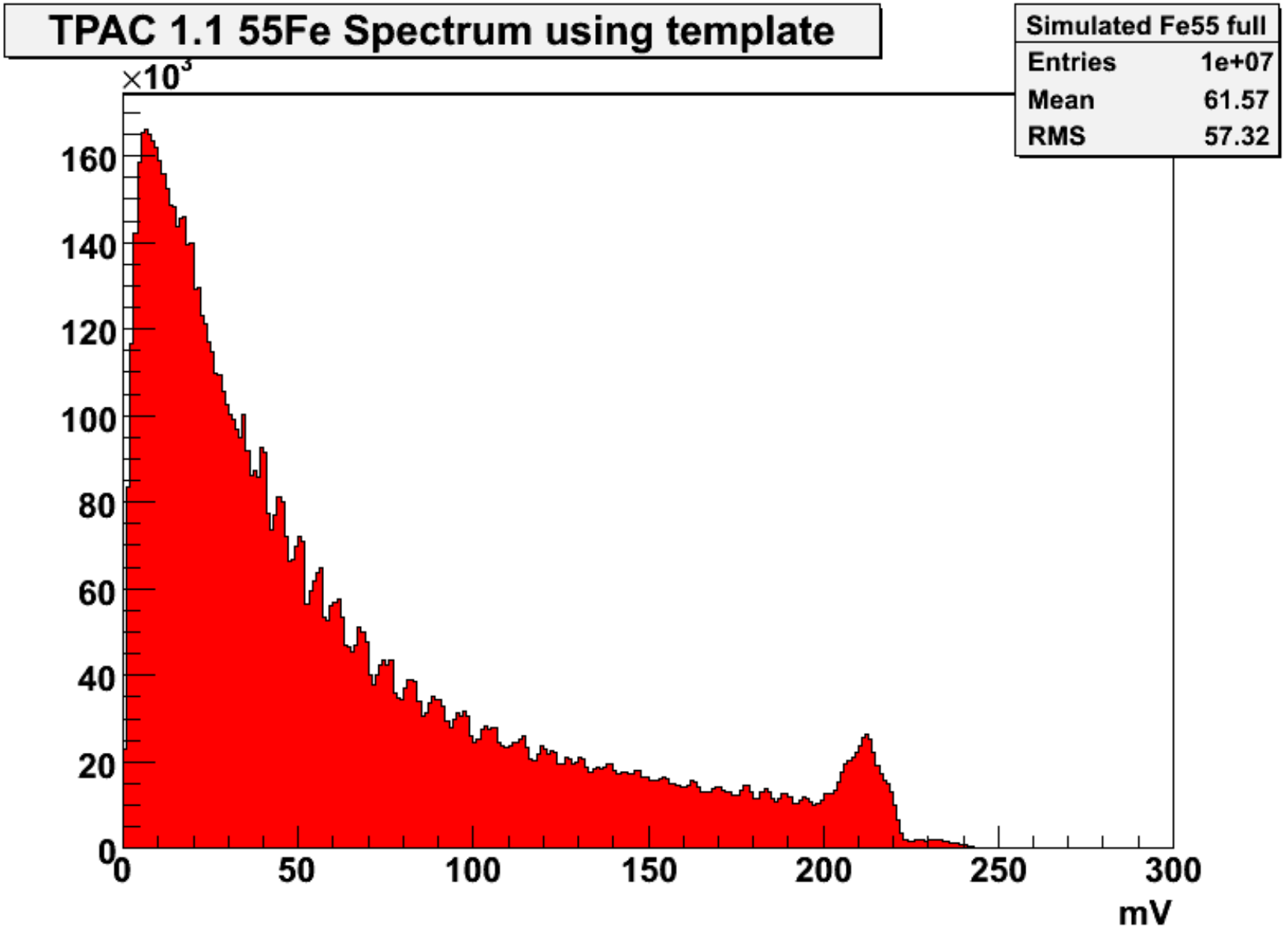
Plots

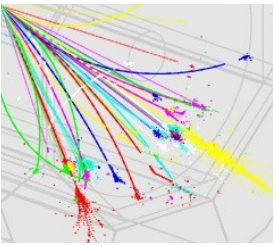

Fe55 depth
Fe55 depth
Entries 1000
Mean 7.696
RMS 5.494
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0 2 4 6 8 10 12 14 16 18 20
Depth (Microns)


Fe55 chargecollect
Fe55 chargecollect
Entries 1000
Mean 6.023
RMS 4.717
1
0.8
0.6
0.4
0.2
0 2 4 6 8 10 12 14 16 18 20



Results


TPAC 1.1 55Fe Spectrum using template
Simulated Fe55 full
Entries 1e+07
Mean 61.57
RMS 57.32
×10³
160
140
120
100
80
60
40
20
0
0
50
100
150
200
250
300
mV



Summary

- Our simple assumptions of ^{55}Fe are wrong
- To get decent simulation
  - Depth effects
  - Collection effects in 3D !
  - a lot of CPU
- Have a rough model in place
  - fully flexible
- Crazy thought
  - can we fit it to the data ?