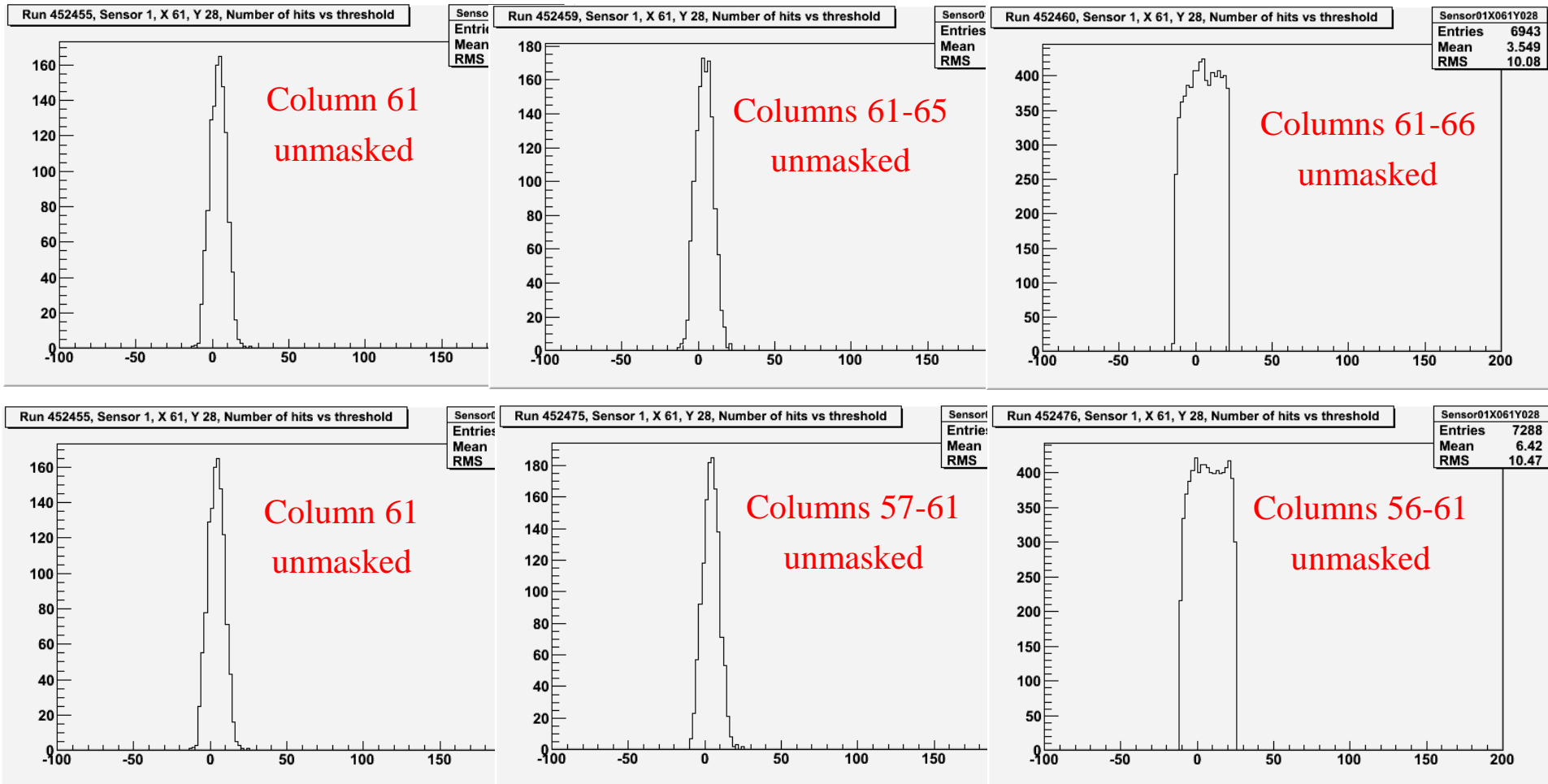


Crosstalk and laser results

Paul Dauncey, Anne-Marie Magnan, Matt Noy

Crosstalk

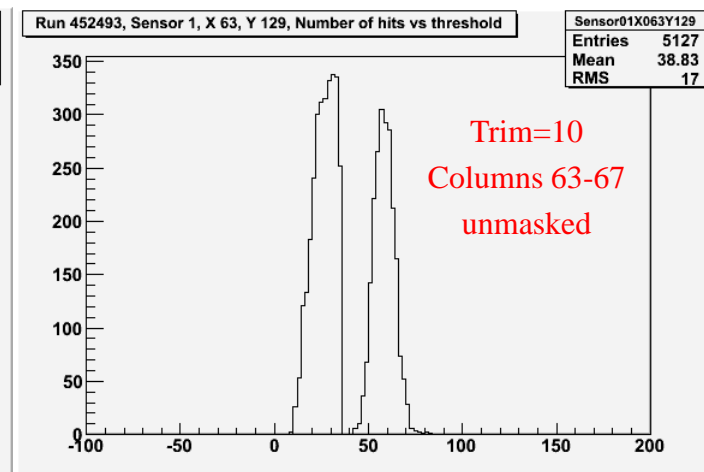
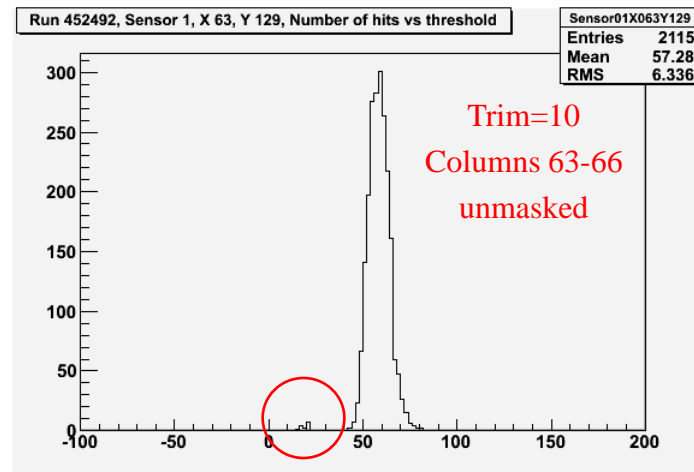
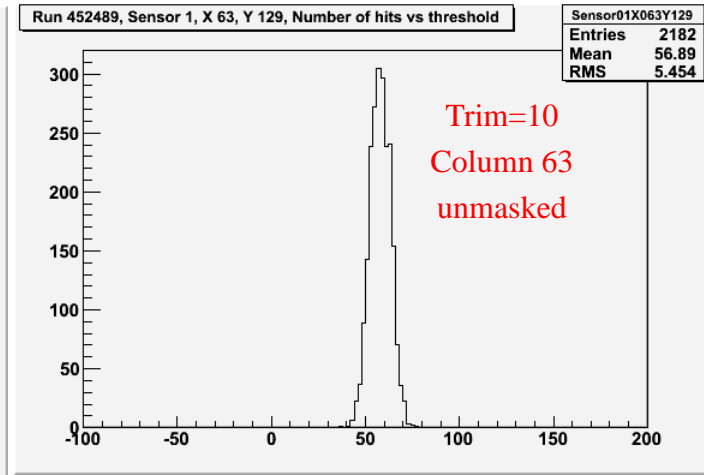
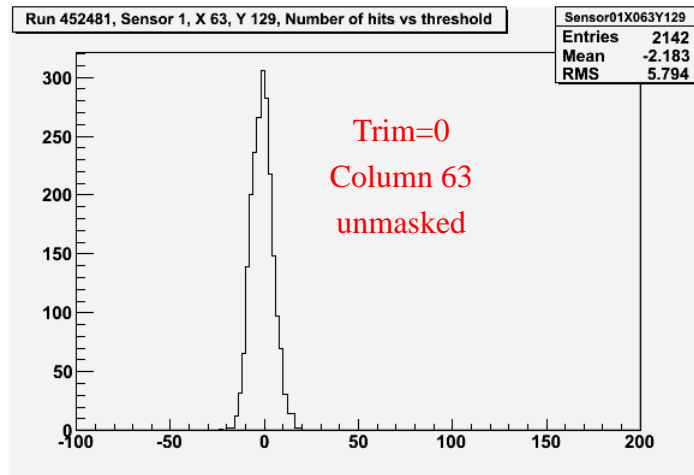
- Trying to find a repeatable pattern...
- Study Sensor #1, pixel 61, 28; mask quads 1-3, 10 bunch crossings/bunch train



Crosstalk source

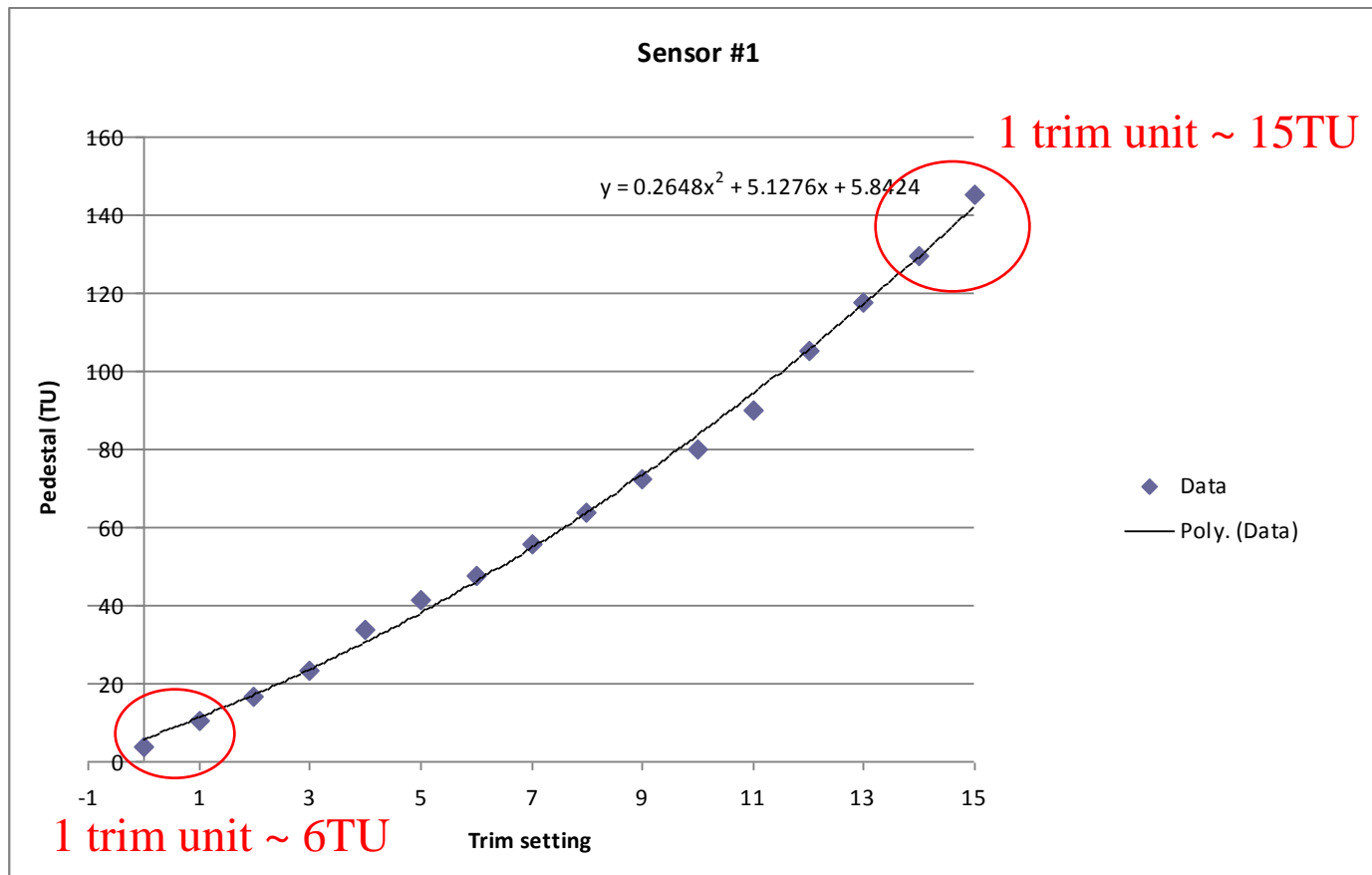
- Check if in analogue or digital part of circuit
 - Move pixel 63,129 up by trim=10 to move away from other pedestals

- Effect is not quite a step function
- Pedestal position and width are unaffected by extra noise from other pixels
- Crosstalk appears not to affect analogue circuit



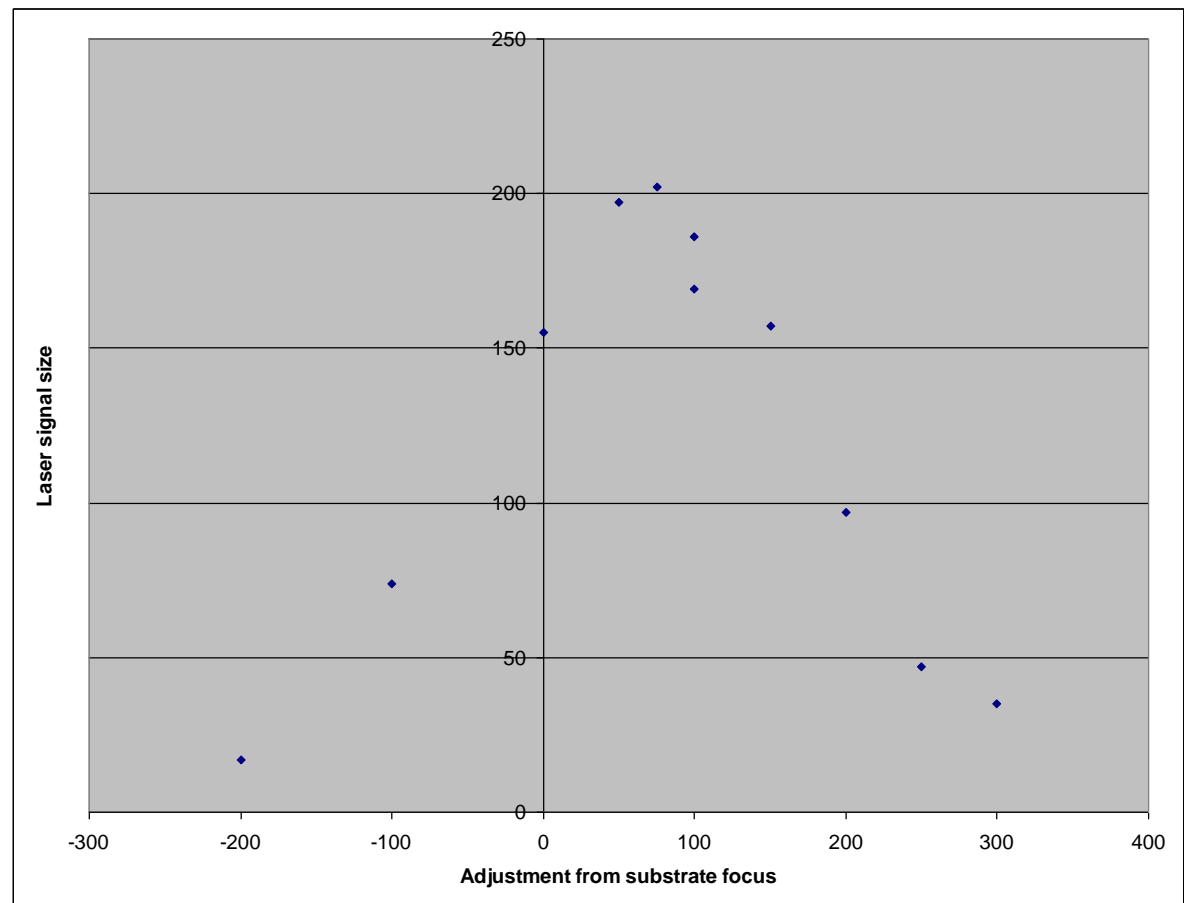
Trim units

- Can measure pedestal peak accurately with short bunch trains
- Scan trim setting and measure pedestal position for single channel
 - Pixel 61, 28



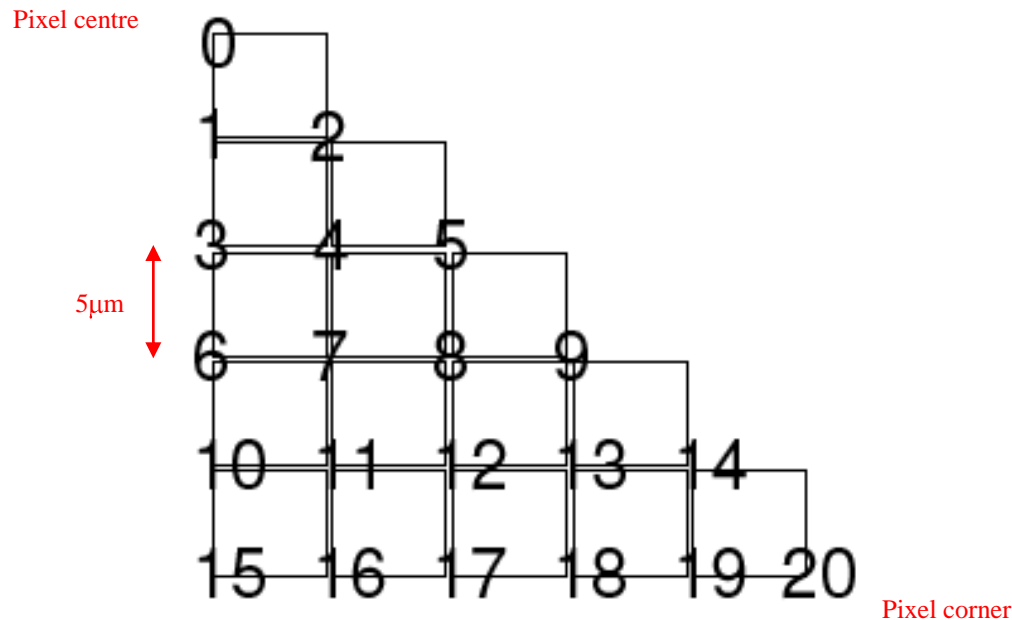
Laser focus

- Easy to focus optically on substrate surface, but...
 - Epitaxial layer $\sim 300\mu\text{m}$ below this
 - Laser wavelength will have different focal point
- Focus on substrate and adjust by focus dial gradations
 - We think these are in units of μm
 - Positive value moves focus down towards epitaxial layer
- Measure laser signal above pedestal at each setting
 - Work with $+60\mu\text{m}$



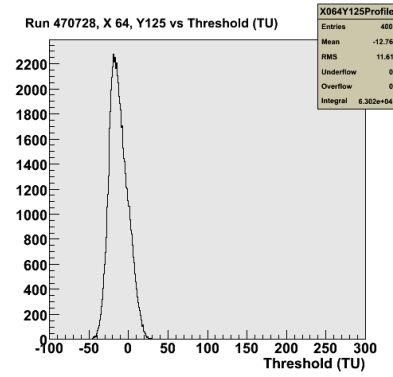
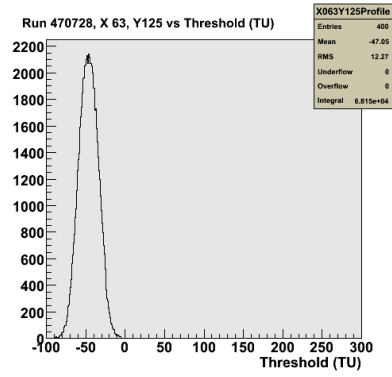
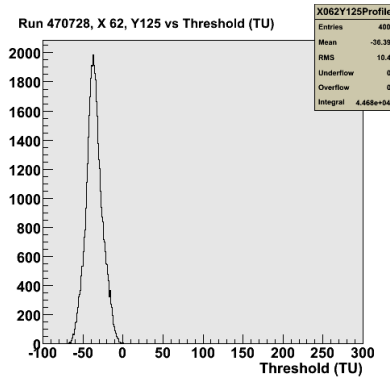
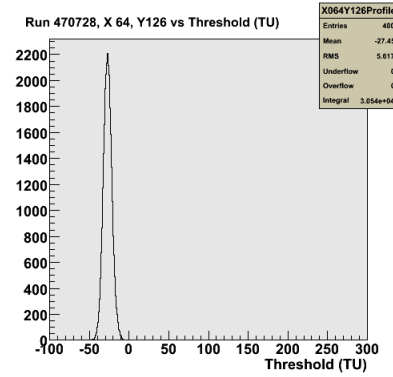
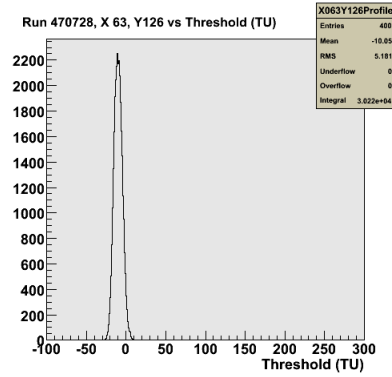
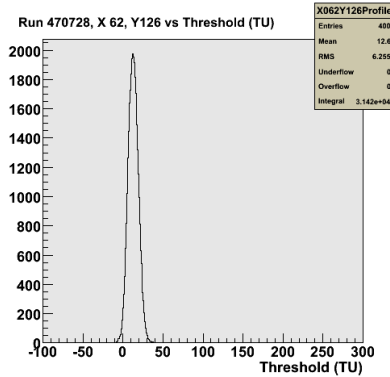
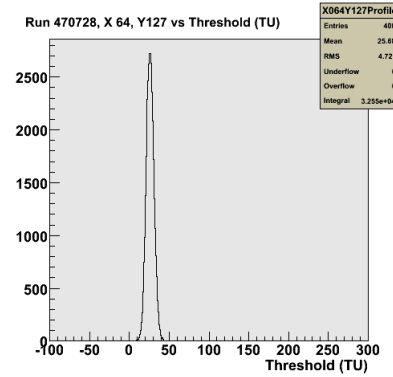
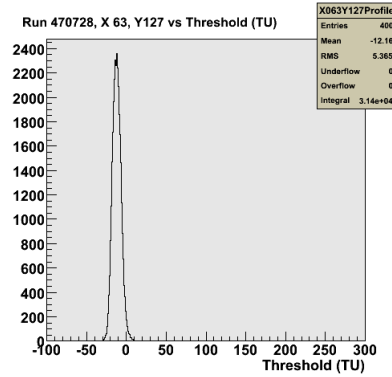
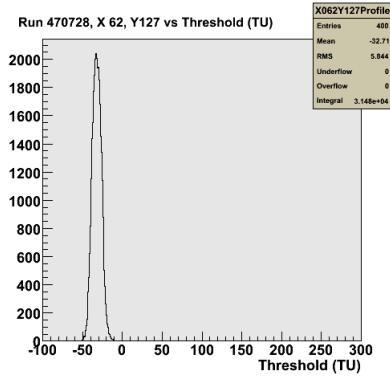
Charge sharing

- Unmask 3x3 array of pixels in bulk
 - Take a threshold scan with laser disabled
 - Take threshold scans at each of the 21 “Giulio” simulation points
- Use upper edge of threshold scan to define signal
 - Analogue measurement of signal size in 3x3 array



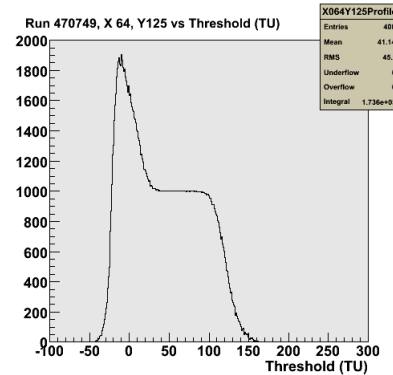
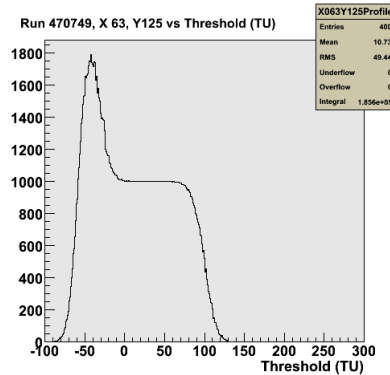
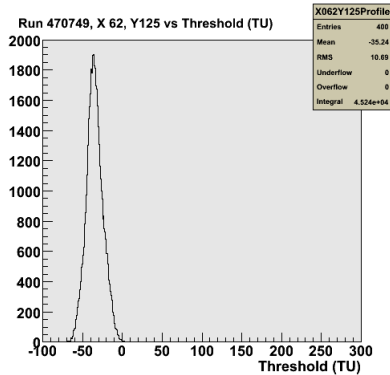
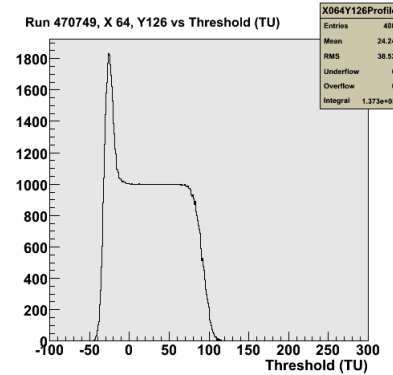
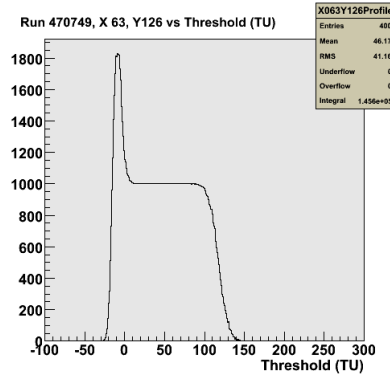
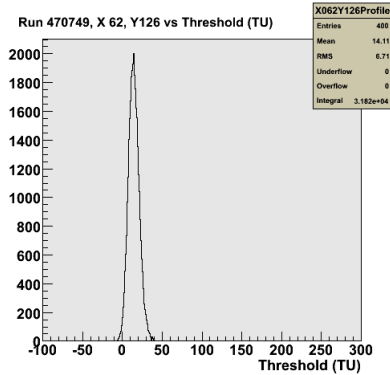
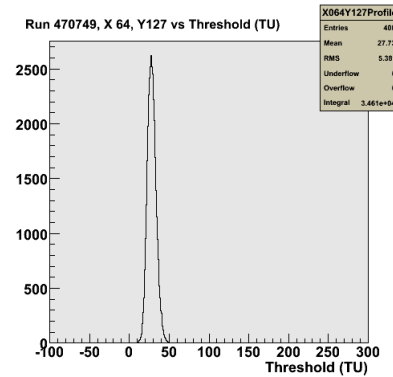
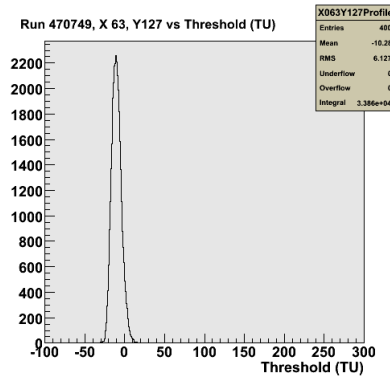
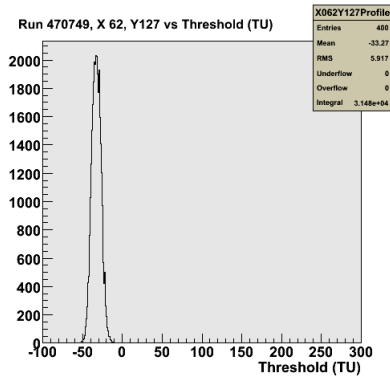
Pedestals

Laser disabled



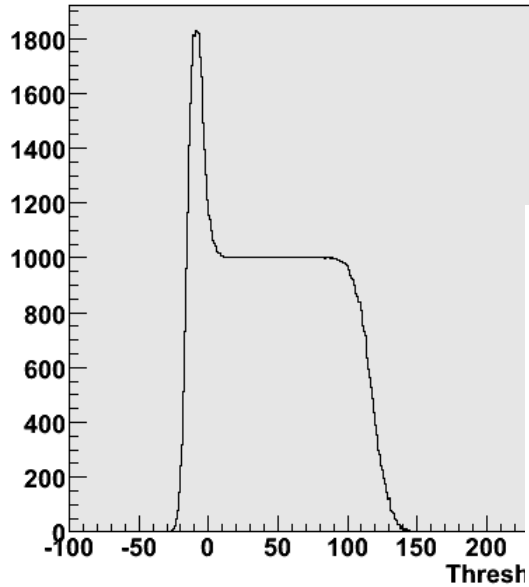
Laser signals

Laser in corner
of four pixels
= point 20



Fitting for upper edge

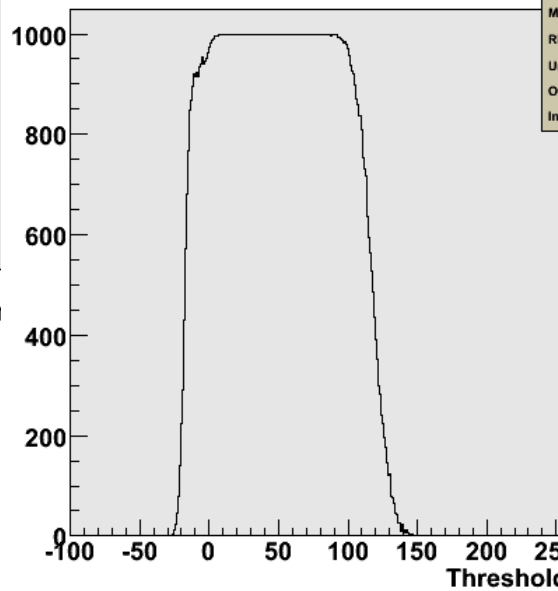
Run 470749, X 63, Y126 vs Threshold (TU)



| X063Y126Profile | |
|-----------------|-----------|
| Entries | 400 |
| Mean | 46.17 |
| RMS | 41.16 |
| Underflow | 0 |
| Overflow | 0 |
| Integral | 1.456e+05 |

Count events with hit,
not number of hits

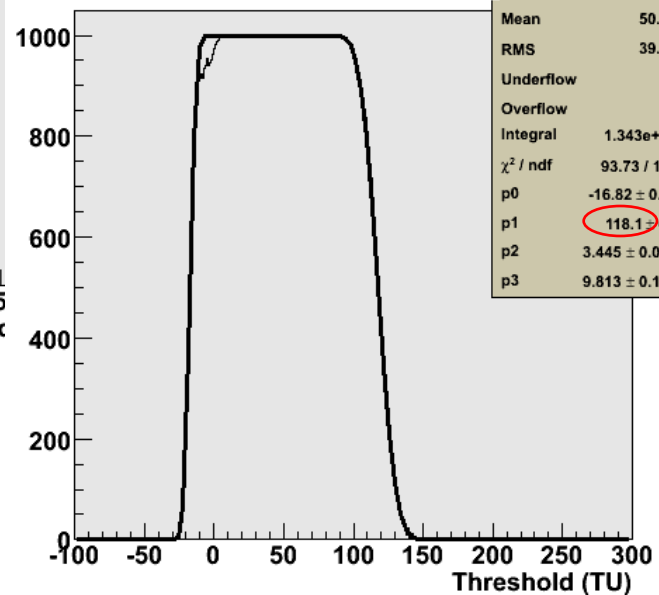
Run 470749, X 63, Y126, Bool vs Threshold (TU)



| X063Y126BProfile | |
|------------------|-----------|
| Entries | 400 |
| Mean | 50.77 |
| RMS | 39.55 |
| Underflow | 0 |
| Overflow | 0 |
| Integral | 1.343e+05 |

Fit to rising and falling erfs

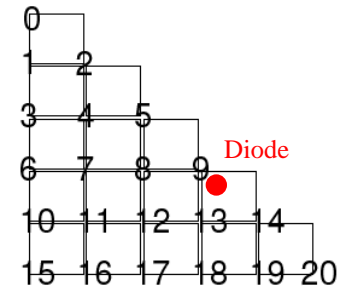
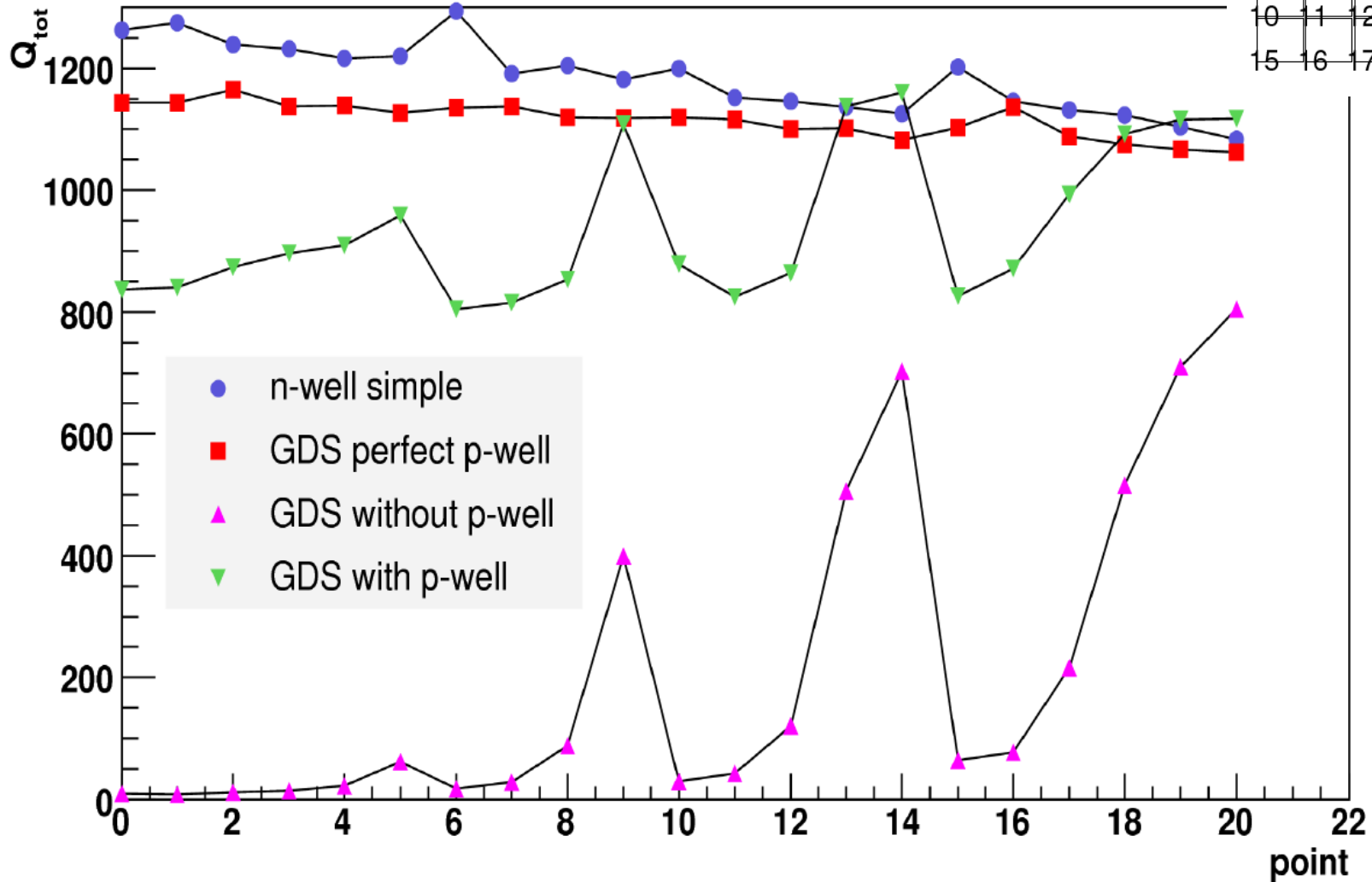
Run 470749, X 63, Y126, Bool vs Threshold (TU)



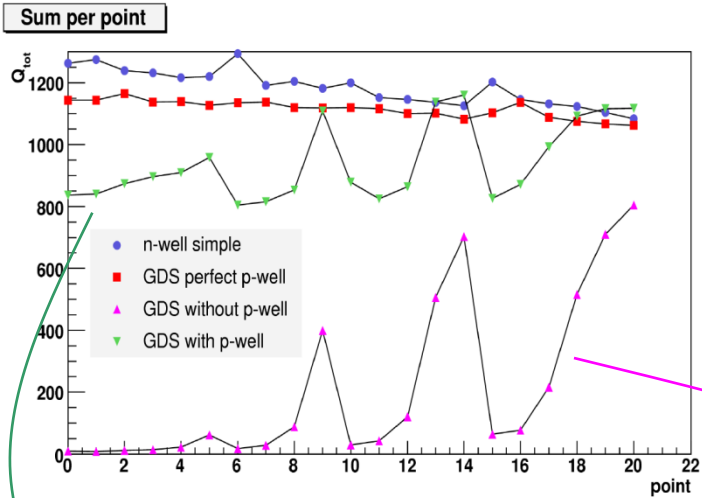
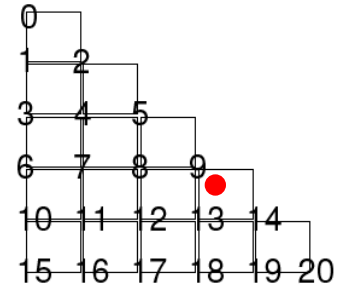
| X063Y126BProfile | |
|-----------------------|---------------|
| Entries | 400 |
| Mean | 50.77 |
| RMS | 39.55 |
| Underflow | 0 |
| Overflow | 0 |
| Integral | 1.343e+05 |
| χ^2 / ndf | 93.73 / 175 |
| p0 | -16.82 ± 0.08 |
| p1 | 118.1 ± 0.1 |
| p2 | 3.445 ± 0.079 |
| p3 | 9.813 ± 0.122 |

Expected total sum of signal

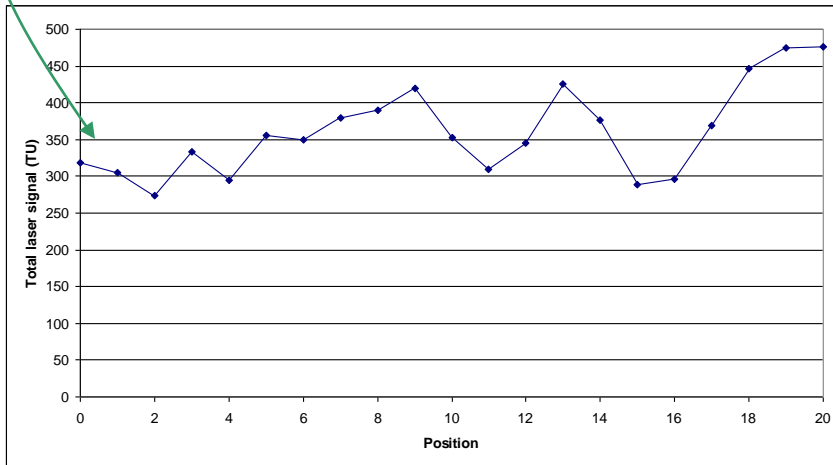
Sum per point



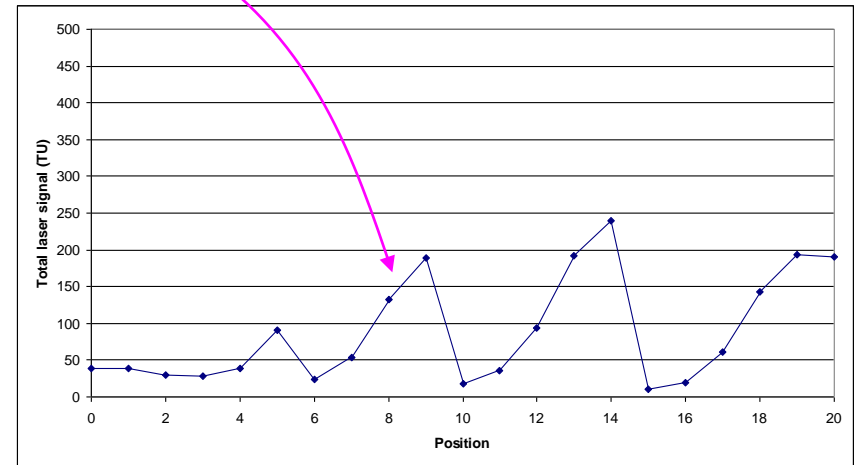
Measured total sum of signal



Total simulation signal $\sim 1300e^-$
 Guess "total" signal $\sim 530TU$



With deep p-well

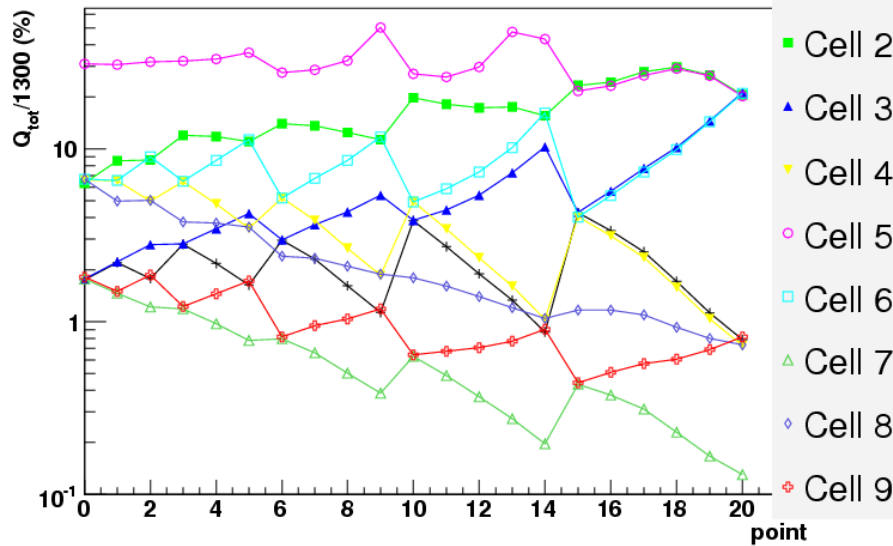


Without deep p-well

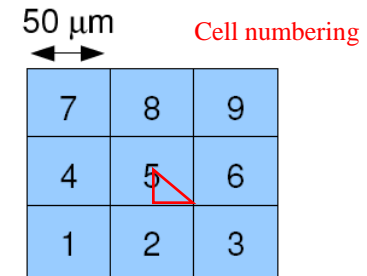
Deep p-well signal per pixel

Giulio simulation

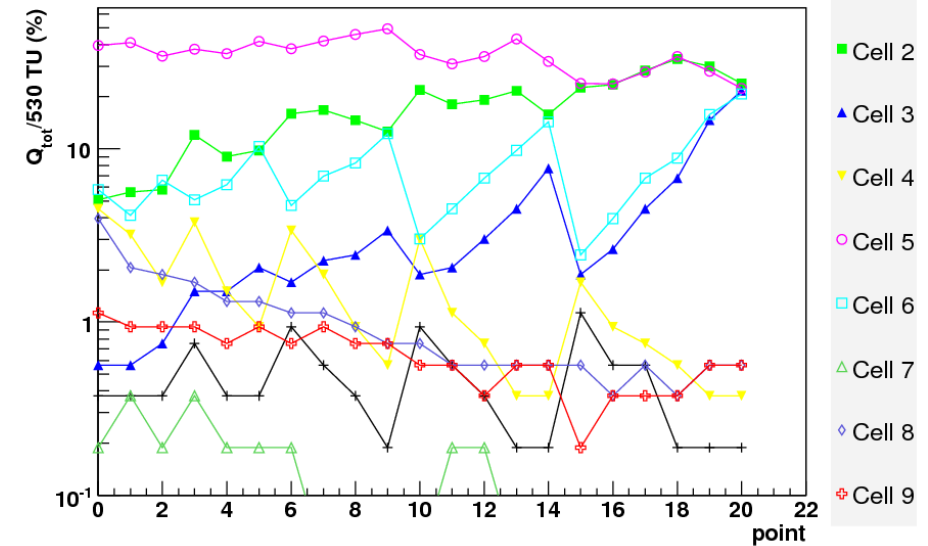
GDS deep p-well



Data



Real data DPW



Non-deep p-well signal per pixel

50 μm Cell numbering

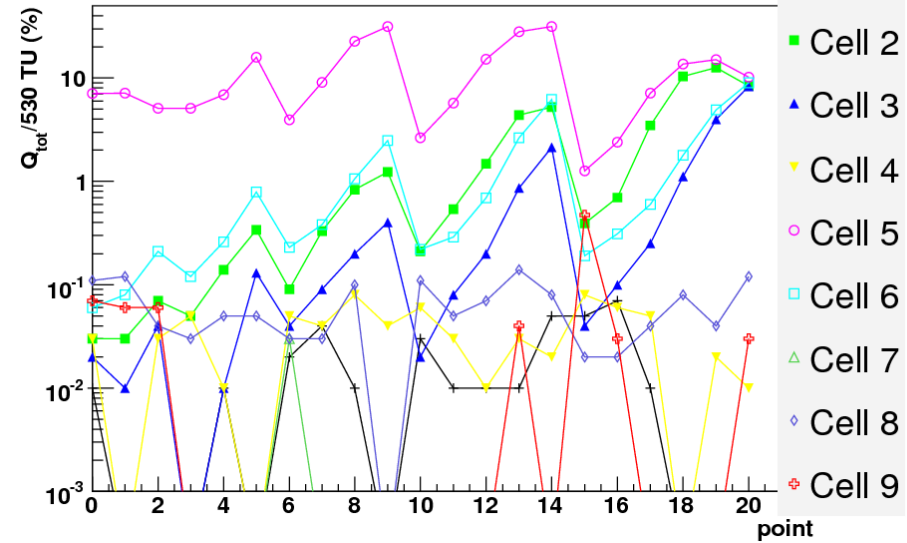
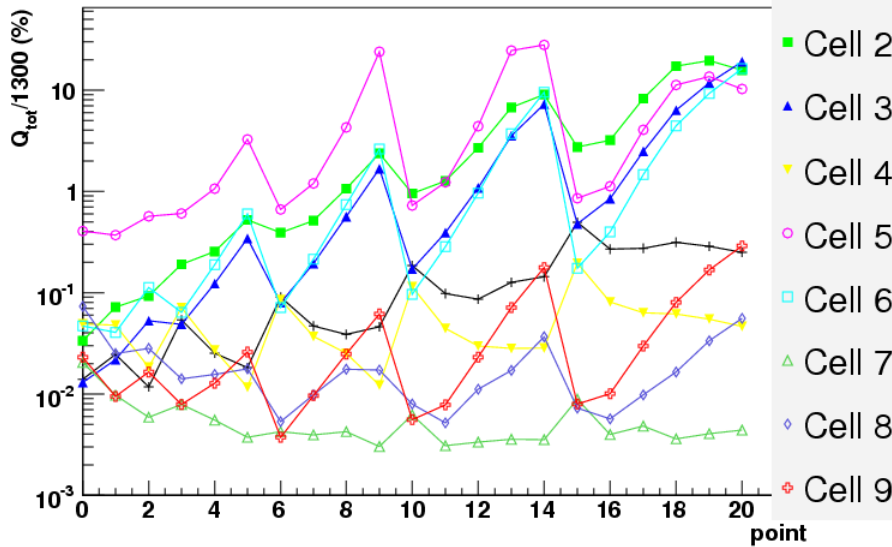
| | | |
|---|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |

Giulio simulation

Data

GDS no deep p-well

Real data NDPW



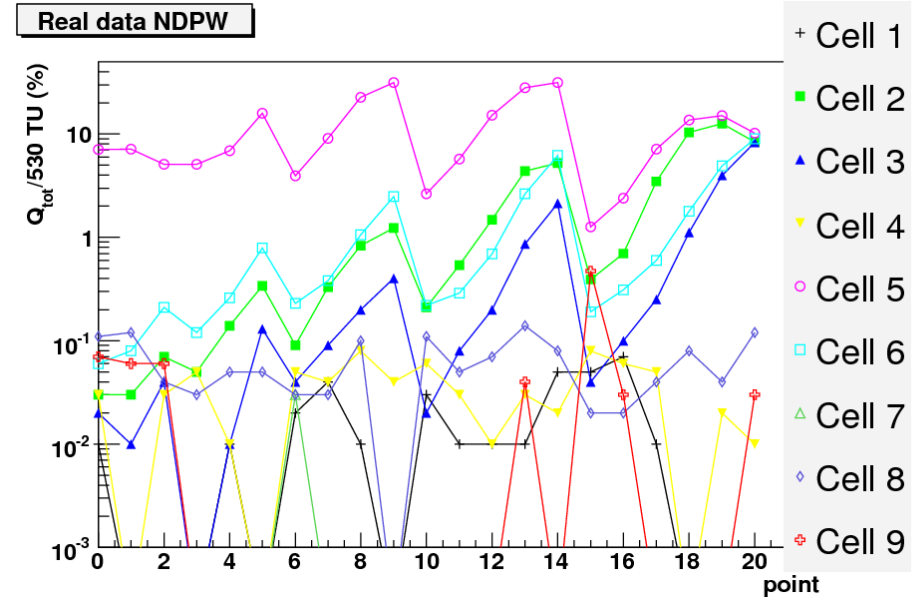
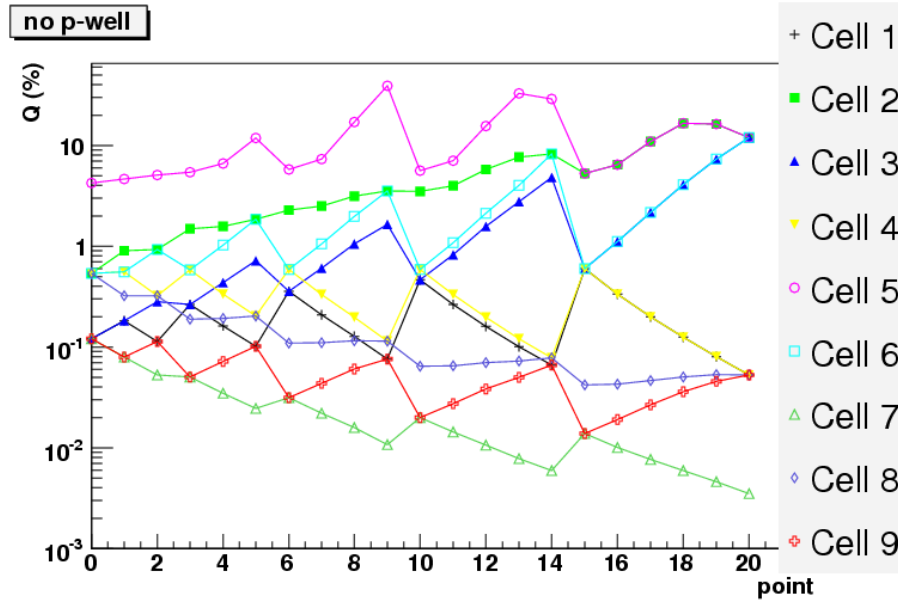
Non-deep p-well signal per pixel (cont)

50 μm Cell numbering

| | | |
|---|---|---|
| 7 | 8 | 9 |
| 4 | 5 | 6 |
| 1 | 2 | 3 |

Diffusion simulation

Data



Conclusions

- Crosstalk is pickup from other pixels firing
 - Seems to be quite pixel dependent
 - No obvious pattern seen yet
 - No effect on analogue circuit performance
- Trim is not exactly linear
 - Trim unit in TU depends on trim setting
- Laser focus makes a big difference to signal size
- Charge spread can be measured in the bulk
 - The spread is qualitatively similar to the simulation...
 - ...but does not agree quantitatively
- Must check laser uniformity in time and alignment
 - Not yet at precision level