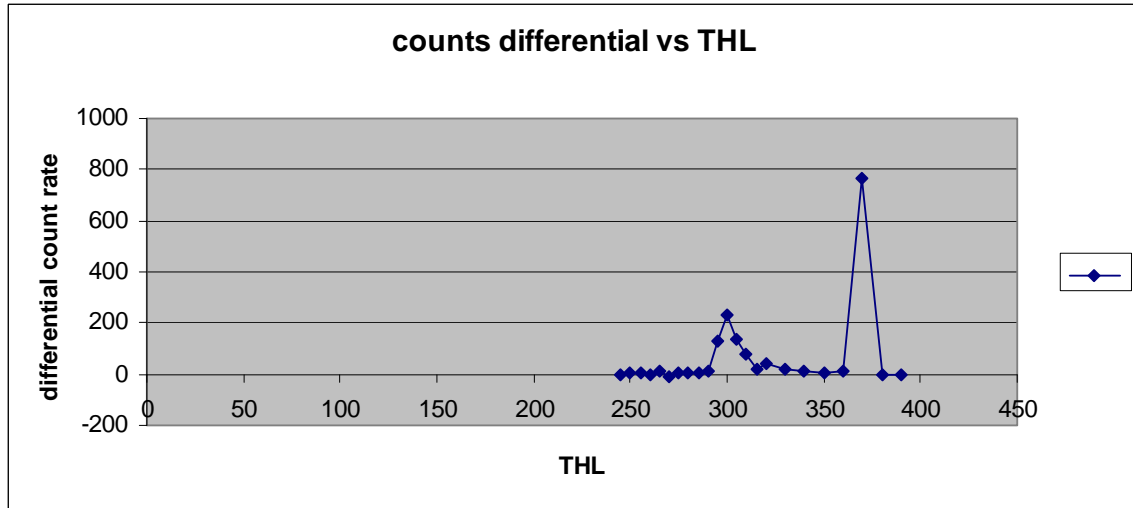01:13
Dima & Celeste & Chris & (Eva in lab)

Make threshold scan by hand again, using total counts with beam on.
We are doing this by hand as the DAC scans didn't make any sense !
This is in the excel file labeled Threshold Scan n-bulk 3D.xls
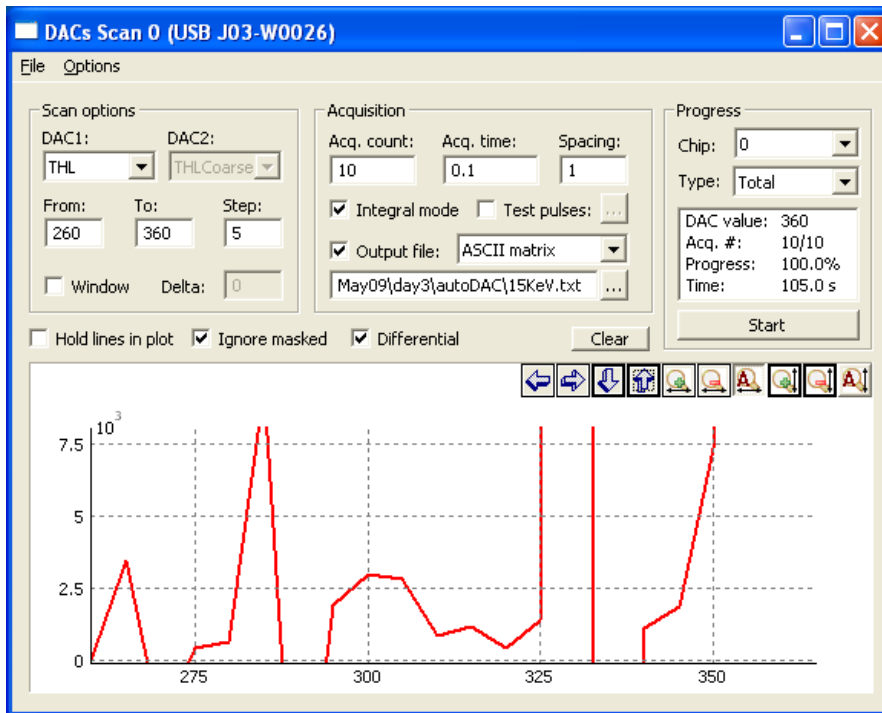
Bias voltage is 5V

counts differential vs THL

Fig, 1

The final peak corresponds to the counts being saturated in the noise.
The signal peak is clearly visible around 300 counts.

01:48
Automated DAC scan.

DACs Scan 0 (USB J03-W0026)

File   Options

Scan options
DAC1:   DAC2:
THL   THLCoarse
From: To: Step:
260   360   5
Window   Delta: 0

Acquisition
Acq. count: Acq. time: Spacing:
10   0.1   1
☑ Integral mode   ☐ Test pulses: ...
☑ Output file: ASCII matrix
May09\day3\autoDAC\15KeV.txt ...

Progress
Chip: 0
Type: Total
DAC value: 360
Acq. #:   10/10
Progress: 100.0%
Time: 105.0 s
Start

☐ Hold lines in plot ☑ Ignore masked ☑ Differential   Clear

The peak around 300 is probably the signal (15KeV). Data is to be reanalyzed off-line.

Data is here C:\3DMedipixMay09\day3\autoDAC.

02:03

Plan – make re-check of alignment of 3D Medipix n-bulk detector.

Measurements in Day 3 n-bulk 3D Record of Positions.xls
Measurement 1 Phi / Measurement 1 Theta are measurements from Day 2.
New measurements are labeled Measurement 2

Check of Phi alignment misalignment is -0.753 degrees. Good !
Check of Theta Alignment misalignment 0.003 degress. Amazing !

3:21
Dismounting of n-bulk detector (J03)
Check of voltage communicated (sliding out of holder, without disconnecting). Voltage definitely fine.
5V on power supply = 4.8 V on pins on Medipix board
20V on power supply =19.7V

Mounting of p-bulk 3D Medipix detector (J06)

3:26
Rough Plan for next days

Saturday night -Sunday morning = Dima & chris mount p-type and align it
Sunday morning-evening = take p-type detector data
Sunday night-Monday morning = mount planar & align
Monday morning = take planar data at 100V.
Monday afternoon – detailed beam scan. 1) Ask Kawal to produce image of beam profile in x and y directions, keep data, as we may want this for publication/presentations. 2) Can Kawal also measure the 2nd larger scattering component of the beam ? Measurement of this would also be useful.

Data – before leaving
1) Ensure all current data and current analysis pictures from Matlab are saved on PC.
2) Make backup copy of all data from PC onto network.
3) If Aaron/Dima has suitable drive – make copy of all data for Glasgow also.
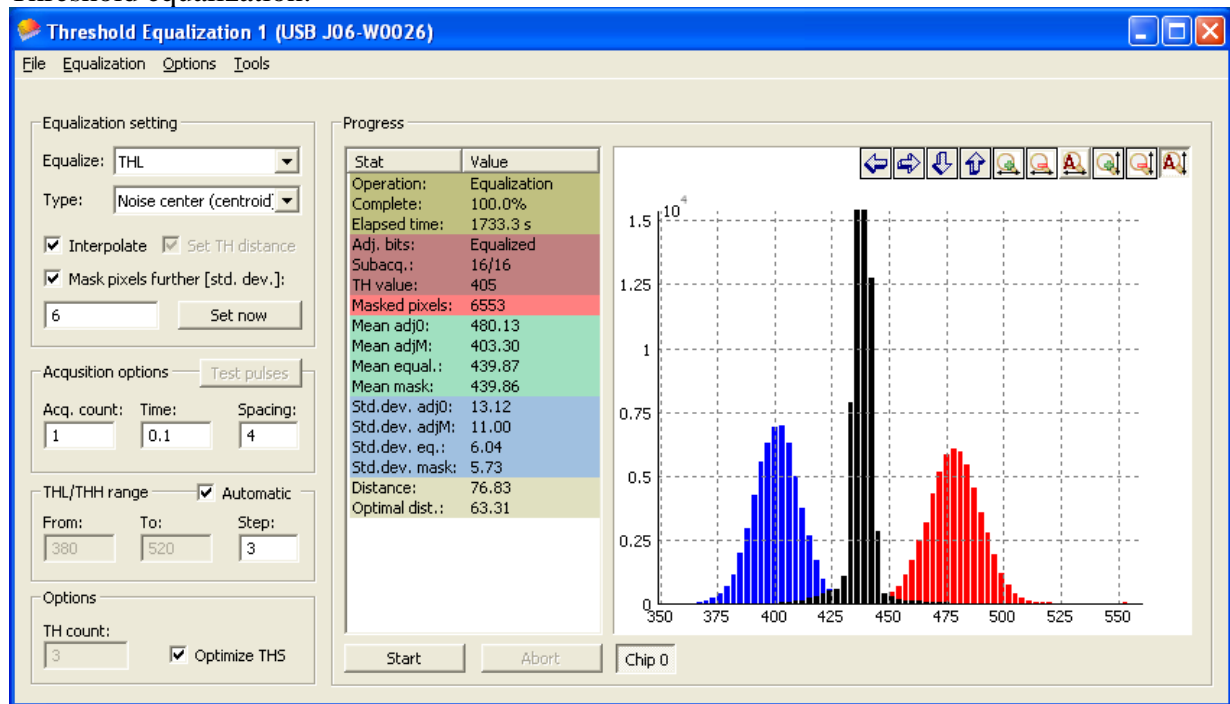

3:34
Mounted p-bulk
Applied 5V on power supply.
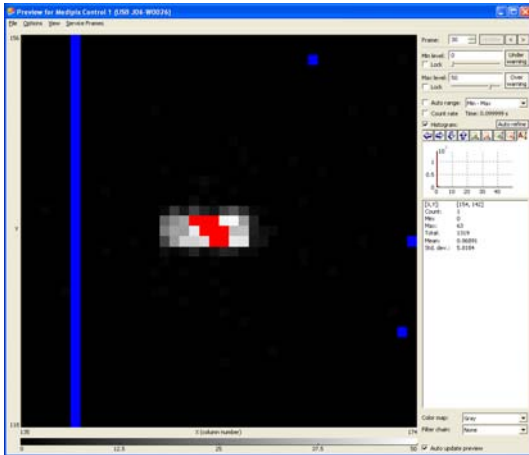Acquisition polarity – negative.

Threshold equalization:

Set threshold to 530 THL (0.0623 THL-FBK). We assumed that according to the previous MPX the 15KeV was 50 THLs above the noise. In this case noise is ~ 480-THL.

4:40
When we turned the beam on, we saw that the beam size is rather large (10 x 5 pixels). We went inside and checked setup, everything looked fine.
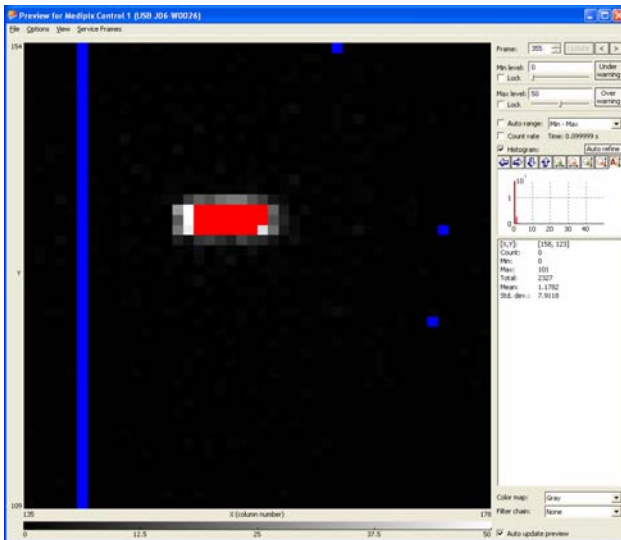
Example of da is here: C:\3DMedipixMay09\day3\J06-W0026\spot

4:57
We realized that it is P-type detector and we had not switched the polarity on the power supply in order to get the right electric field.
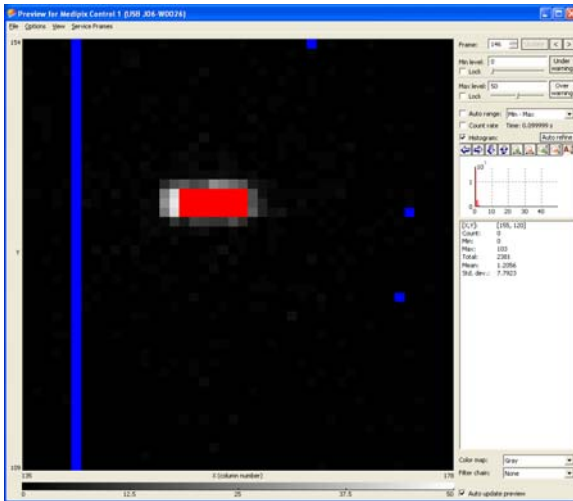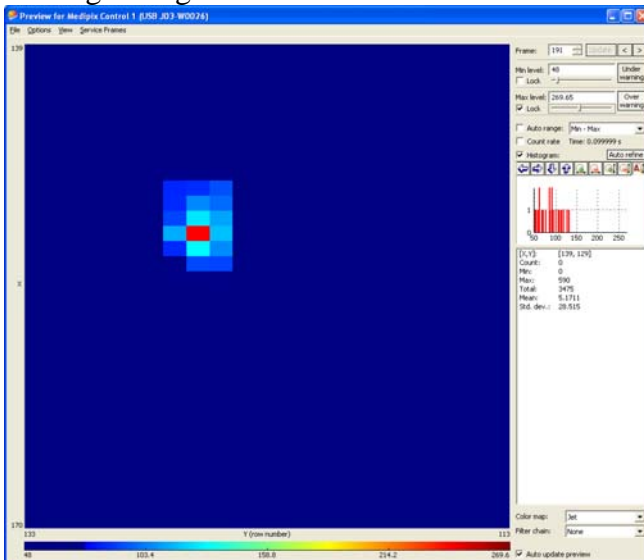Applied -5V.
Still same beam size

Increase to -20V.

Spot size is reduced by ~2 pixels height and 1 pixel wide:

5:34
We have mounted the previous device again to check the consistency and that there is nothing wrong with the beam itself

The beam looks OK and the spot consistent with previous results.

5:36
We are mounting p-type MPX again and checking that the bias voltage is getting through to the detector.

5:47
Voltage on the detector is OK.
Mount and ready to restart.

5:52
Cannot apply voltage – we have a short.
Unmount and check.

Medipix was shorted to box, remounted.
Beam restarted, still see same large beam size

Theory – the n-type columns are connected by an electron layer when only depleting between the 3d columns, so would need to fully deplete device in order to get small spot size.

Cannot test this as we measured on day 0 that this device breaksdown at 24V.
So, try with Timepix p-bulk device F09 W0015, which can be biased to higher voltages.
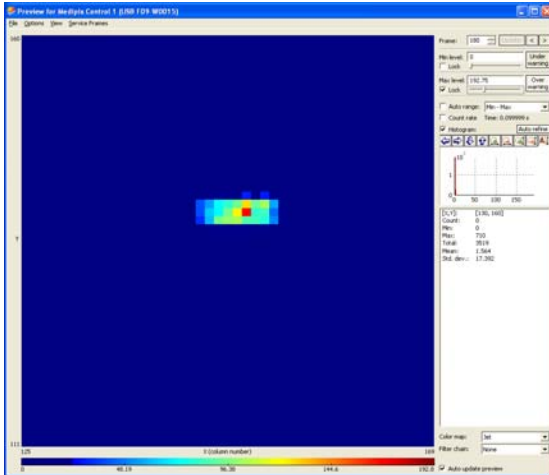We measured on day 0 the IV up to 50V.

Mount device F09 W0015 Timepix p-bulk, and use in Medipix mode.
Apply -5V.

6:28
Performing Threshold scan for F09 W0015
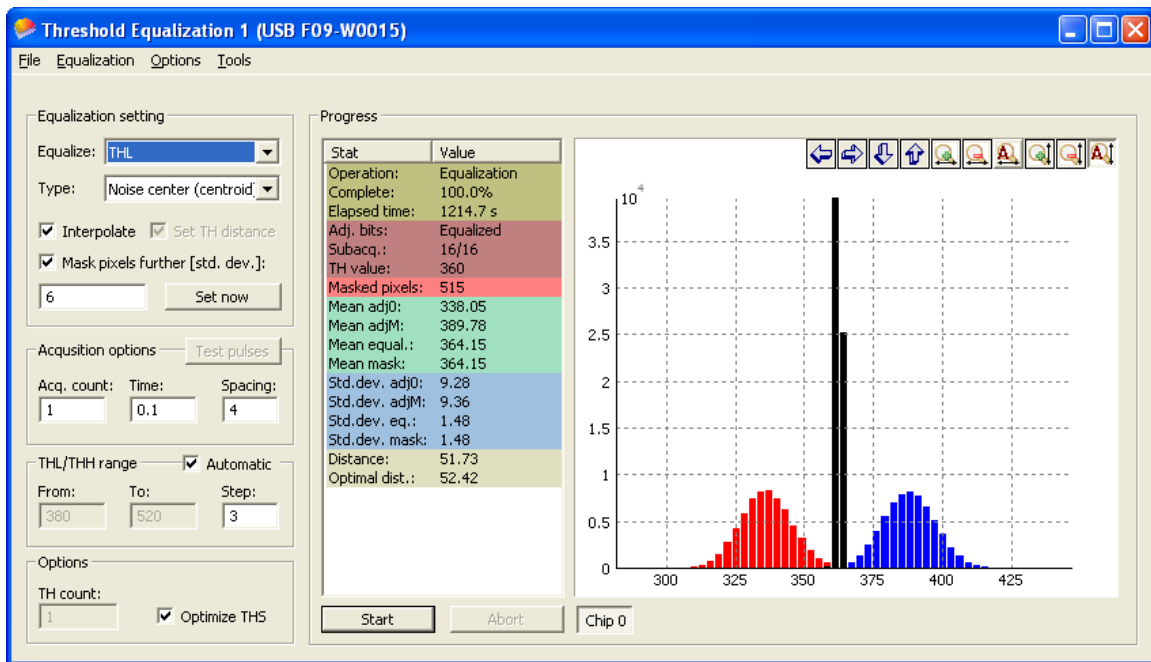
Files saved to C:\3DMedipixMay09\day3\F09-W0015\eq

An image of the beam:

The spread of the beam has the similar size to one on MPX p-type (9x3 pixels). However, one pixel has significantly more counts than the surrounding area (710 counts centre, next highest 127).
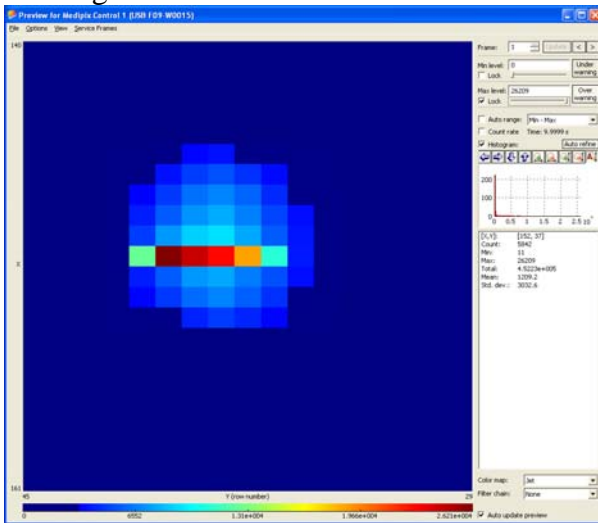
This is still a much wider distribution than for the n-type detector, where the central pixel very strongly dominated the fraction of counts.

However, this is easily good enough to align with. Will be interesting to see if it gets narrower at higher voltages, but currently stay at 5V.
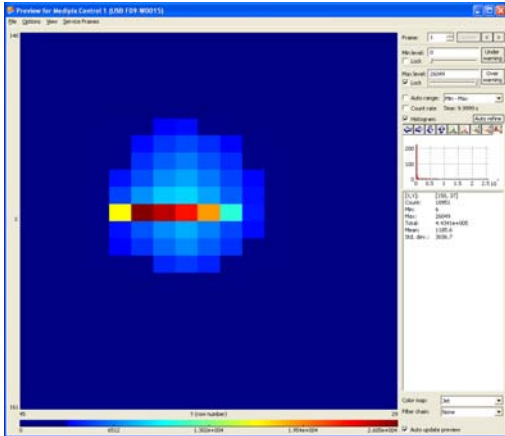
7:17
Mount Trigger box.
Do Alignment.

Not, so easy to align.
After 45 degree rotation get image above. Pixels on the central row have similar counts so not easy to select best pixel.

Increase voltage to -20V.

Looks much the same.
Stick at 20V.

Ok, understood – the box tends to have a shielding effect when rotated.
So when the pixels are shielded the highest pixel on the central row can change.
Need to be a long way clear of the edge to ensure it is always the same pixel lit.

8:34
Making alignment.
In Theta, well aligned, off by 0.384. apply correction to give theta=5.703
In Phi, slightly worse, off by 0.733, apply correction to give phi-0.7974, and cross-check
again. This time can't rotate by 9.9, would exceed maximum, so rotate by 9 degrees only.

Cross-check suggests we are further away – now 1.636 degrees off.
Try applying correction in opposite direction.
Need to apply correction negatively !
We are now spot on in Phi – accurate to 0.009 degrees
And spot on in Theta – accurate to 0.000 deg !

10.00

Aaron and Nicola are in charge. We start with a manual scan of the threshold. The pixel
considered is (158, 135). The peak for 15 keV is estimated at THL = 505, the centroid of
the noise is estimated at THL =375. THL is then set to 440 that is theoretically half the
energy (7.5 keV) this point in fact is in the plateau of the scan. This is the setting that will
be used for the pixel area scan.
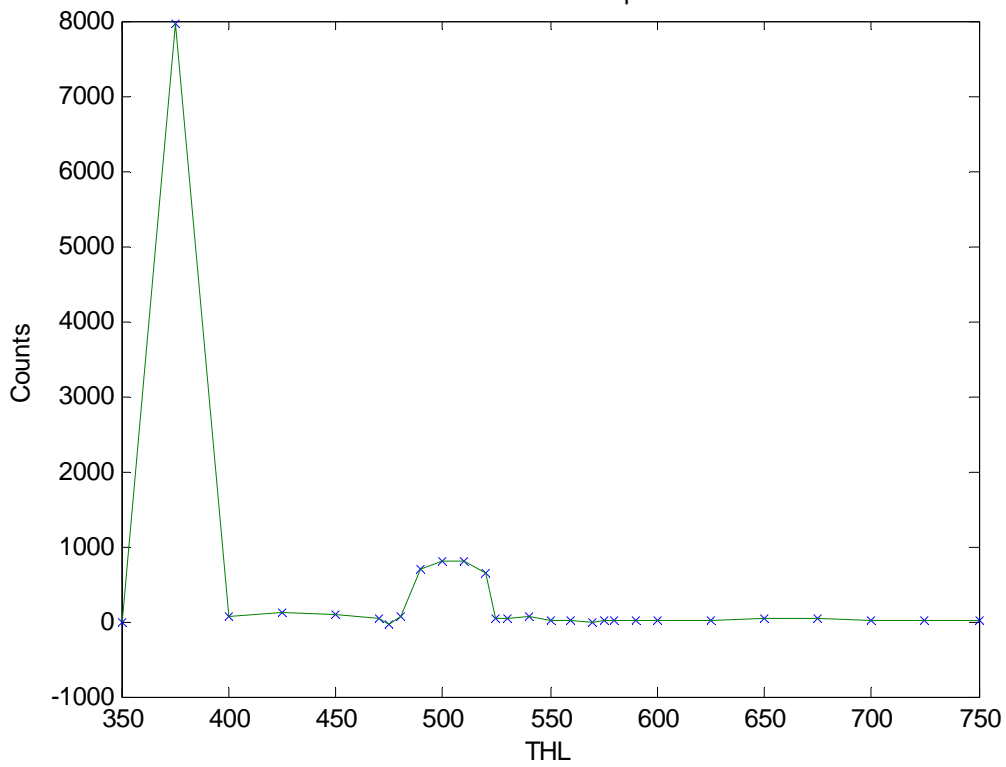The other two thesholds that will be used, as for the 3d-N, will be 25% of the energy (low
THL = 407) and 75% of the energy (high THL) = 472

Manual DAC scan for Timepix detector

THL-FBK
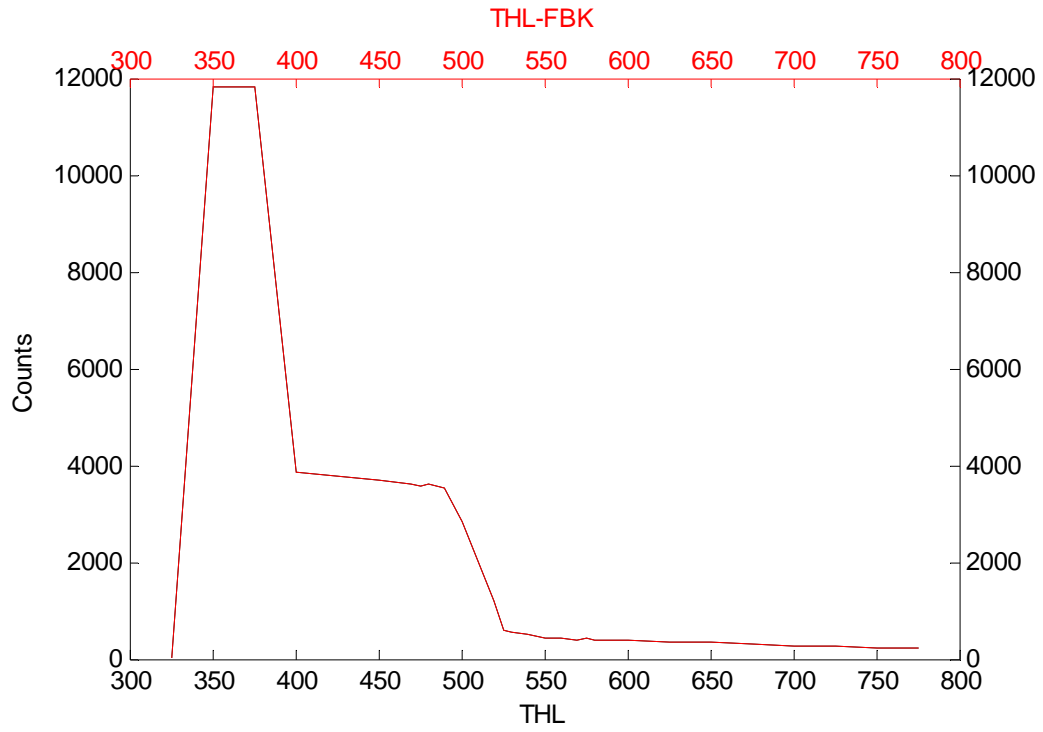
Differential for Manual Timepix DAC scan

We'll do two bias voltages for each THL: 20V (laterally depleted but not fully depleted) and 40V (fully depleted as VFD is 30V) (this detector has been tested only up to 50V. At this bias the detector is still ok but we think that using 50V might not be safe, as we don't know how close we are to breakdown)

Motor position:

tboptX = -4.990 tbpotY = 16.1075 tboptXcoarse = 552.0 tboptZcoarse = 4.50

tboptChi = 0.0 tboptPhi = -0.8389 tboptTheta = 4.935

tbbaseY1 = -8.0 tbbaseY2 = -8.0

We double checked the data of the threshold scan with Matlab (plots above) and we confirmed the value of 440 for THL (50%)

The data acquisition time is set to 0.7 s. The maximum number of counts is over 5,000 and it is considered acceptable. We look for the coordinates to scan the area of the pixel (158,135). We start the scan recording 5 images per pixel.

GDA command: scan tboptX -5.01 -4.9350 0.0025 tboptY 16.0675 16.1425 0.0025 tbdiagX 8.0 8.21 0.2 w 0.2 pcotrig 1 rc t

Scan over full pixel, **V=20V (under full depletion), THL=440 (50%)**
Data file: C:\3DMedipixMay09\day3\PixelScans\1stPixelScan_5aq_70ms_20V
Logfile: 12437.dat

V= 40V (over full depletion), THL= 440 (50%)

Logfile file: 12438.dat
Data file: C:\3DMedipixMay09\day3\PixelScans\2ndPixelScan_5aq_70ms_40V

Something wrong with the number of frames. Mismatch between number of acquisitions and steps in optical table. Stop acquisition at 15:45.

15:49
V= 40V, THL= 440 (50%) (repeat)
Logfile file: 12439.dat
Datafile C:\3DMedipixMay09\day3\PixelScans\3ndPixelScan_5aq_70ms_40V_repeat

16:10
Beam was stopped due to unknown reasons by diamond facility.

The last good frame was the 504 at the Datafile:
C:\3DMedipixMay09\day3\PixelScans\3ndPixelScan_5aq_70ms_40V_repeat

Repeat again the former measurement when beam comes back.

16:55 The beam is back. Illuminated pixel moved to (158,136) (one to the right) Move the optical table to have the same pixel as before, (158,135)
Hope we didn't lost the focus

Eva and Celeste in charge.

17:08
Repeat scan
V= 40V, THL= 440 (50%) (repeatX2)

Changed the scanning parameters to get a square frame and correct the starting point to get the pixel (158,135)

New GDA command: scan tboptX -5.01 -4.9350 0.0025 tboptY **16.0725 16.1475** 0.0025 tbdiagX 8.0 8.21 0.2 w 0.2 pcotrig 1 rc t

Datafile:
C:\3DMedipixMay09\day3\PixelScans\4thPixelScan_5aq_70ms_40V_repeatX2\4thPixel Scan.txt
Logfile file: 12440.dat
(Celeste) Made a mistake and used automatic trigger, not HW. Stopped acquisition at 17.55

Start again 17:56
Erased previous datafiles and started again. Datafile is same as before:
C:\3DMedipixMay09\day3\PixelScans\4thPixelScan_5aq_70ms_40V_repeatX2\4thPixel Scan.txt
Logfile file: 12441.dat
End of scan 21:06, 4803 acquisitions, 2 missing !

Add two dummy files in folder
C:\3DMedipixMay09\day3\PixelScans\4thPixelScan_5aq_70ms_40V_repeatX2
(two last files) so we can use matlab. Pixel map looks OK. (Actually it looks great! Collection efficiency better than in Ntype!)

21:42 Start new scan at low threshold, quarter of a pixel
V= 40V, THL= 407 (25%)
Change THL to low THL=407. THL-FBK =0.0232
Scan over ¼ of a pixel: New scan parameters:

>*Y0 = 16.075 (1 position more than before to start closer to hole)*
>*17 positions instead of 31*
>*Step 2.5um*
>*Yend = 16.115*
>
>*X0 = -5.0075 (1 position more than before to start closer to hole)*
>*17 positions instead of 31*
>*Step 2.5um*
>*Xend = -4.9675*
>
>*As before, take 5 acquisitions in each position*

New GDA command: scan tboptX -5.0075 -4.96750.0025 tboptY 16.075 16.115 0.0025 tbdiagX 8.0 8.21 0.2 w 0.2 pcotrig 1 rc t

C:\3DMedipixMay09\day3\PixelScans\5thPixelScan_5aq_70ms_40V_THL407_quarter_3DP\5thPixelScan.txt
Logfile 12443.dat
Have ~ 5000 acq in central pixel (158,135)

22:40
Scan ends. 1445 datafiles, as expected.

22:50 Start new scan at HIGH threshold, quarter of a pixel
V= 40V, THL= 472 (75%)
Change THL to high THL=472. THL-FBK =.0513

C:\3DMedipixMay09\day3\PixelScans\6thPixelScan_5aq_70ms_40V_THL472_quarter_3DP\6thPixelScan.txt
Logfile 12444.dat

23:47 Scan ends

23:55 Start new scan at LOW threshold, quarter of a pixel, 20V
V= 20V, THL= 407 (25%)
Change THL to low THL=407. THL-FBK =.0195

Nearby pixels (156,133) (162,137) (160,133) and (162,133) very noisy, saturated most of the time.
Counts in central pixel look ok, ~3000
Weird behavior.

Stop scan. Check Vbias is OK. Run without beam: (162,137) (160,137) very noisy but our pixel seems OK.

00:12 Start scan again

C:\3DMedipixMay09\day3\PixelScans\7thPixelScan_5aq_70ms_20V_THL407_quarter_3DP\7thPixelScan.txt
Logfile 12447.dat

01:13 Scan ends

01:17
V= 20V, THL= 472 (75%)
Set THL to 472 (high, 75% of the energy) THL-FBK=.0507
C:\3DMedipixMay09\day3\PixelScans\8thPixelScan_5aq_70ms_20V_THL472_quarter_3DP\8thPixelScan.txt
Logfile is 12448.dat