LEXI_MCP_Notes_Unit1

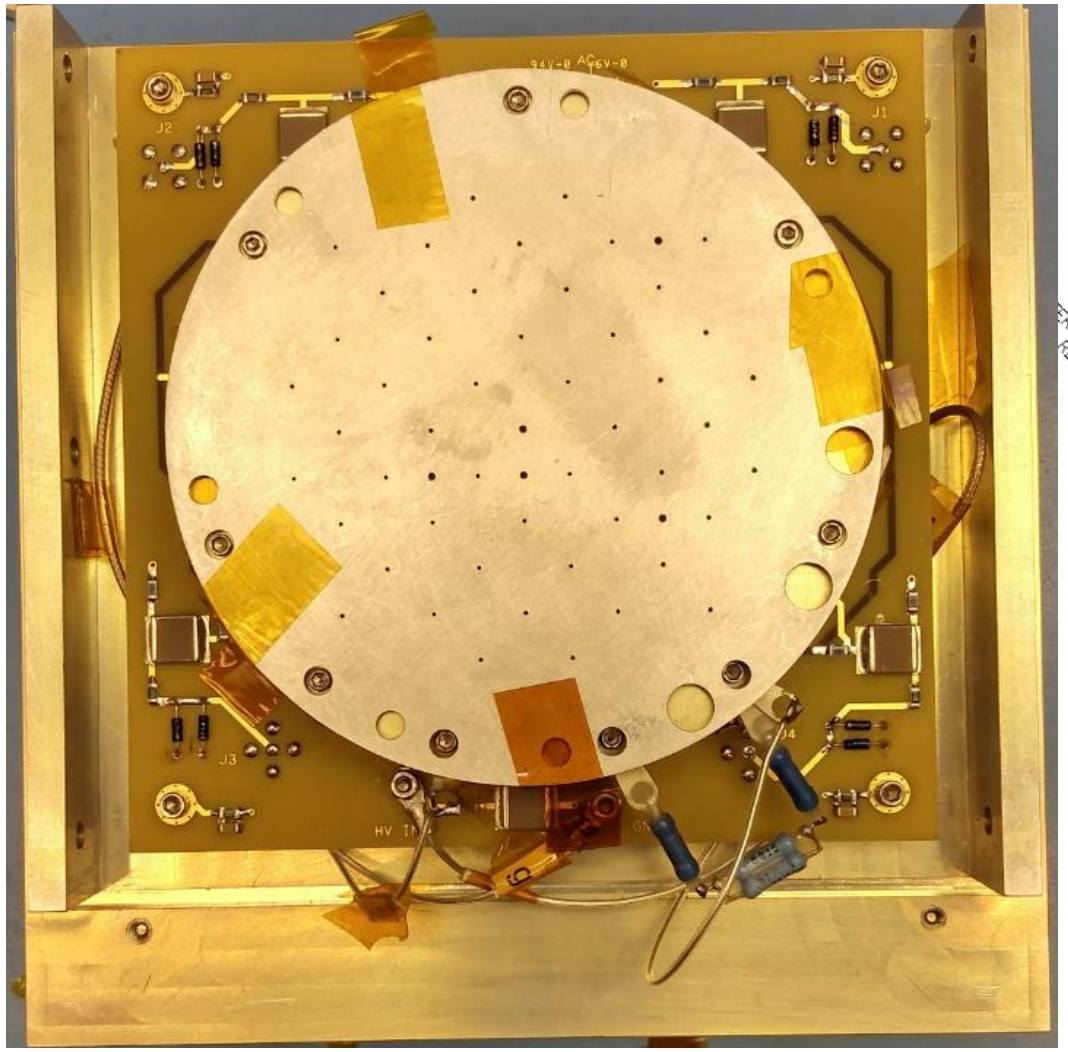
5/9/2022

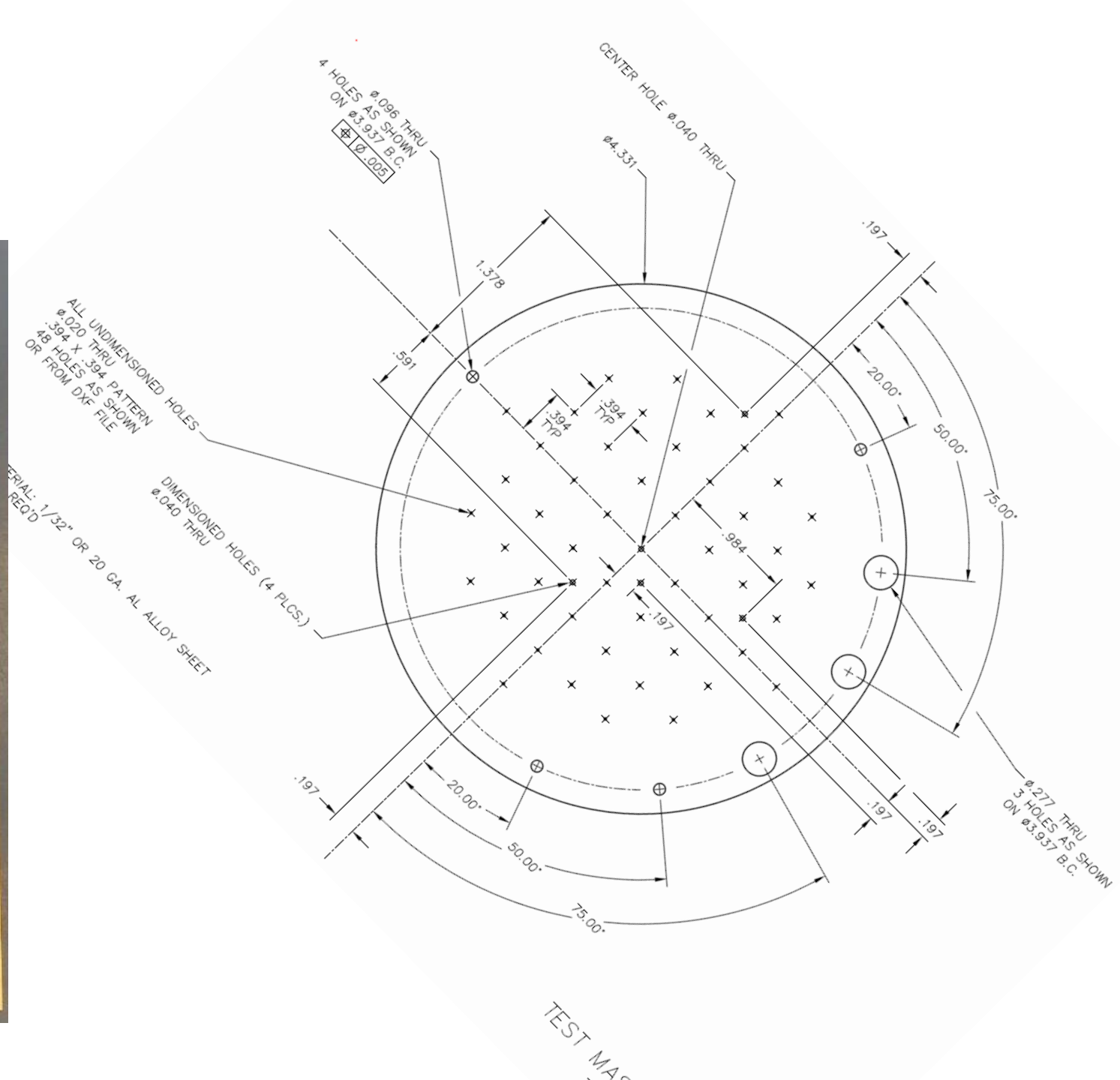
D. Chornay/Norm Dobson/Ken Simms

- Following plots are for LEXI Unit1
- Note these MCP's were not matched, so a series resistor was added to be able to use the HVPS that requires matched MCPs.
- This unit currently has an old version of the ultem spacer with Copper tape.

Test Mask Orientation

Electronics Box “Top” has no connectors, aligned with a mark on Optics housing.
Plotted images match the mask pattern as shown here.





To generate plots…

Read channel voltages from CSV data files generated by Norm's Labview program,

Actual Channel Voltage = (Raw ADC count * 6.8817x10e-5) (ADC is 16 bit with our voltage range 4.51volts)

format below

Timestamp,Channel1,Channel2,Channel3,Channel4

11999,1.0771E+0,1.1128E+0,1.1508E+0,1.1419E+0,

12999,1.0771E+0,1.1128E+0,1.1508E+0,1.1417E+0,

13999,1.0772E+0,1.1127E+0,1.1507E+0,1.1416E+0,

14999,1.0771E+0,1.1127E+0,1.1505E+0,1.1414E+0,
etc...

Determine # lines in file, then create arrays Tm(#lines) and D(0:3, #lines)

read the data into arrays, Tm(*) and D(0:3,*)

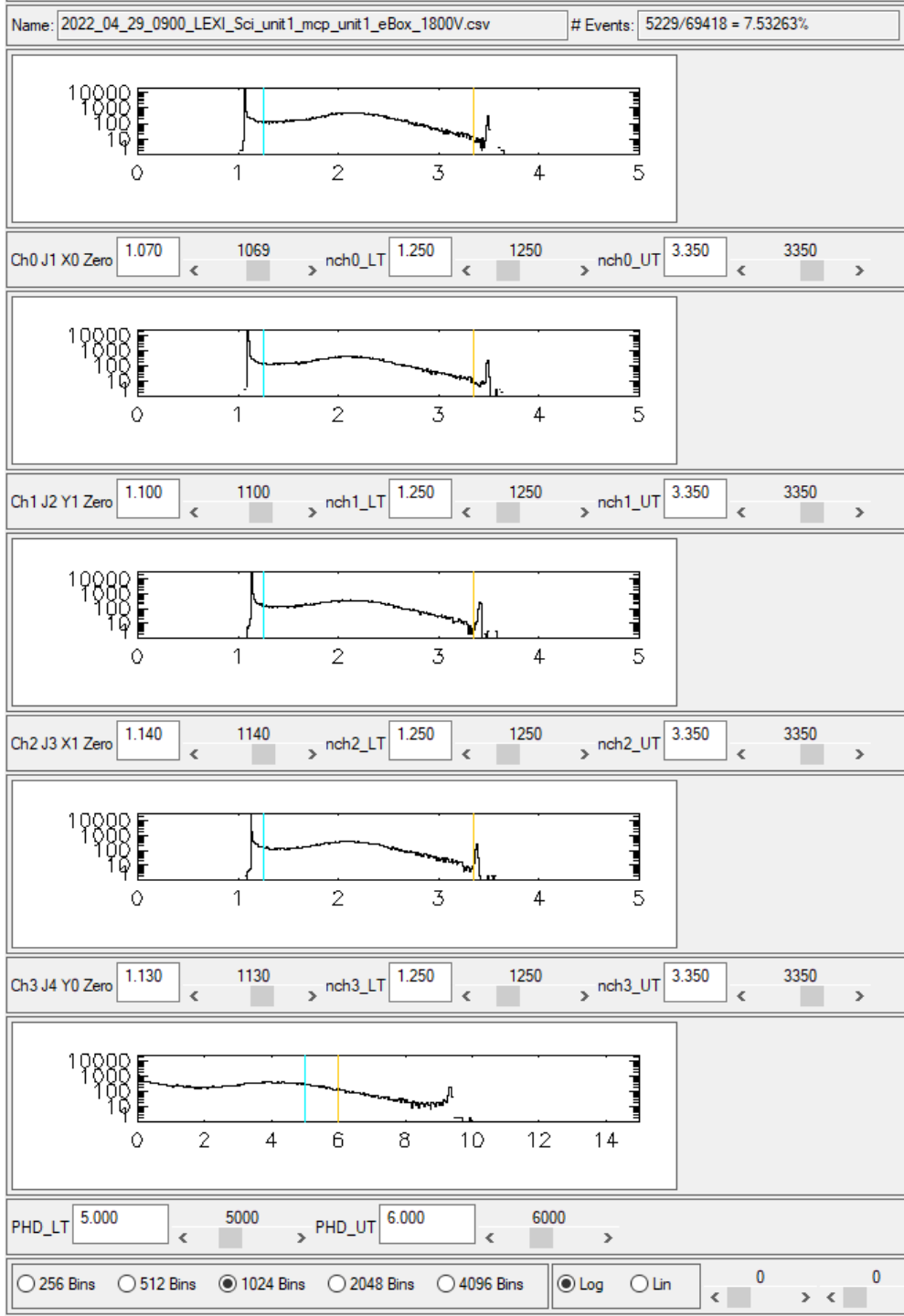
Tm is in msec so convert to seconds Tm(*)/1000.0

- Generate Histogram plots for each of the Raw channels.
- Bin size here = 0.01
- Determine the location/value where the Low Noise peak occurs.
- Will assume this corresponds to the “Zero” point for the A111 charge sensitive amplifiers.
- Note: these values may vary from device to device so may be different for Unit#2

```
X0_raw = D(0,*) ; Wide Strip LHS      Ver 5 Anode Board J1
X1_raw = D(2,*) ; Wide Strip RHS      Ver 5 Anode Board J3
Y0_raw = D(3,*) ; Wedge Pointing Up   Ver 5 Anode Board J4
Y1_raw = D(1,*) ; Wedge Pointing Down Ver 5 Anode Board J2
X0 = X0_raw -n0Z    ; LEXI Remove offsets..
X1 = X1_raw -n2Z    ;
Y0 = Y0_raw -n3Z
Y1 = Y1_raw -n1Z
PHD = (X0 + X1 + Y0 + Y1)
```

- Equation to determine position of event.

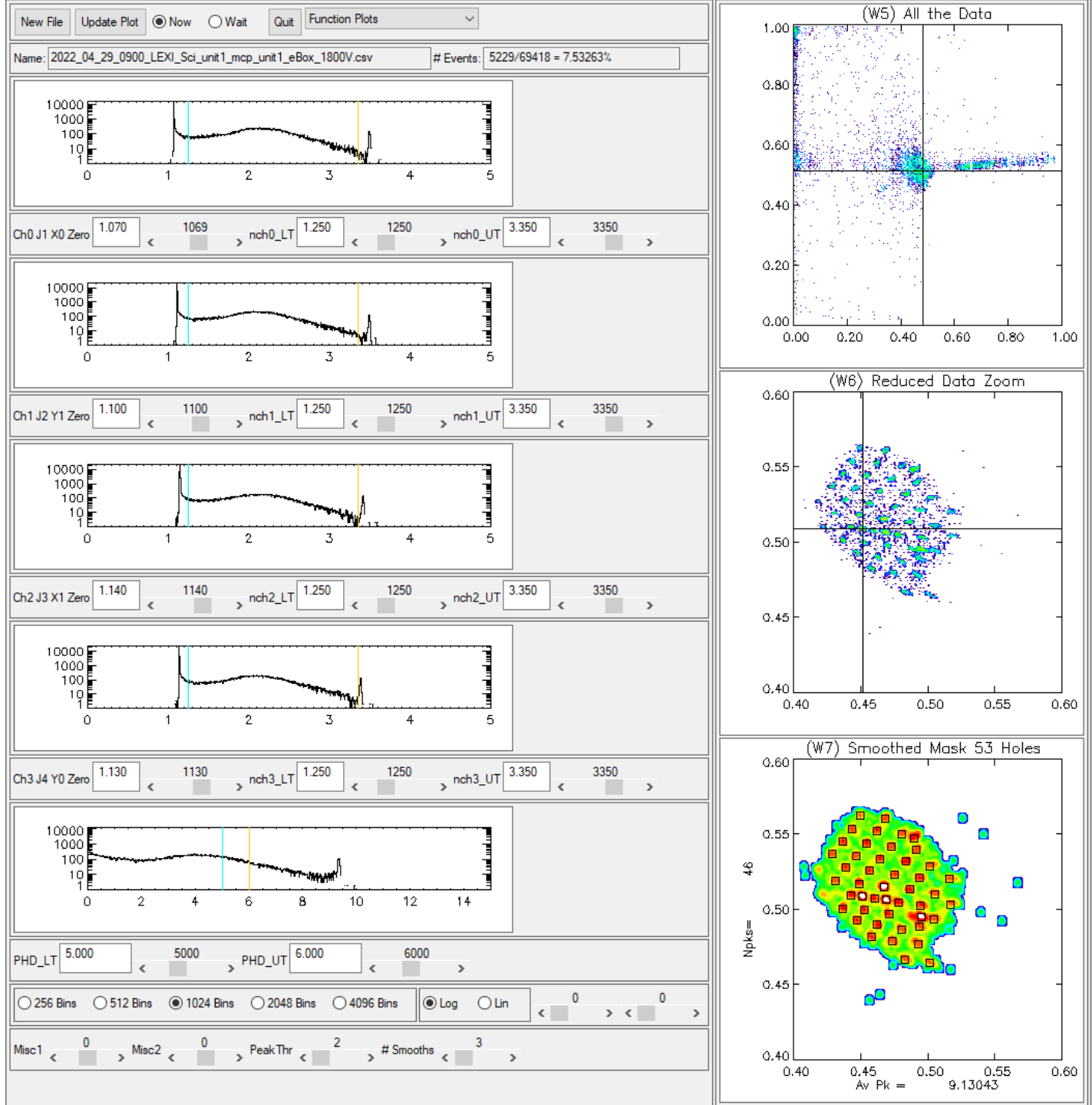
```
XP =  X1/(X0+X1)  ; eqn for X Pos, Strips = J3/(J1+J3)
YP =  Y1/(Y0+Y1)  ; eqn for Y Pos, Wedges = J2/(J4+J2)
```



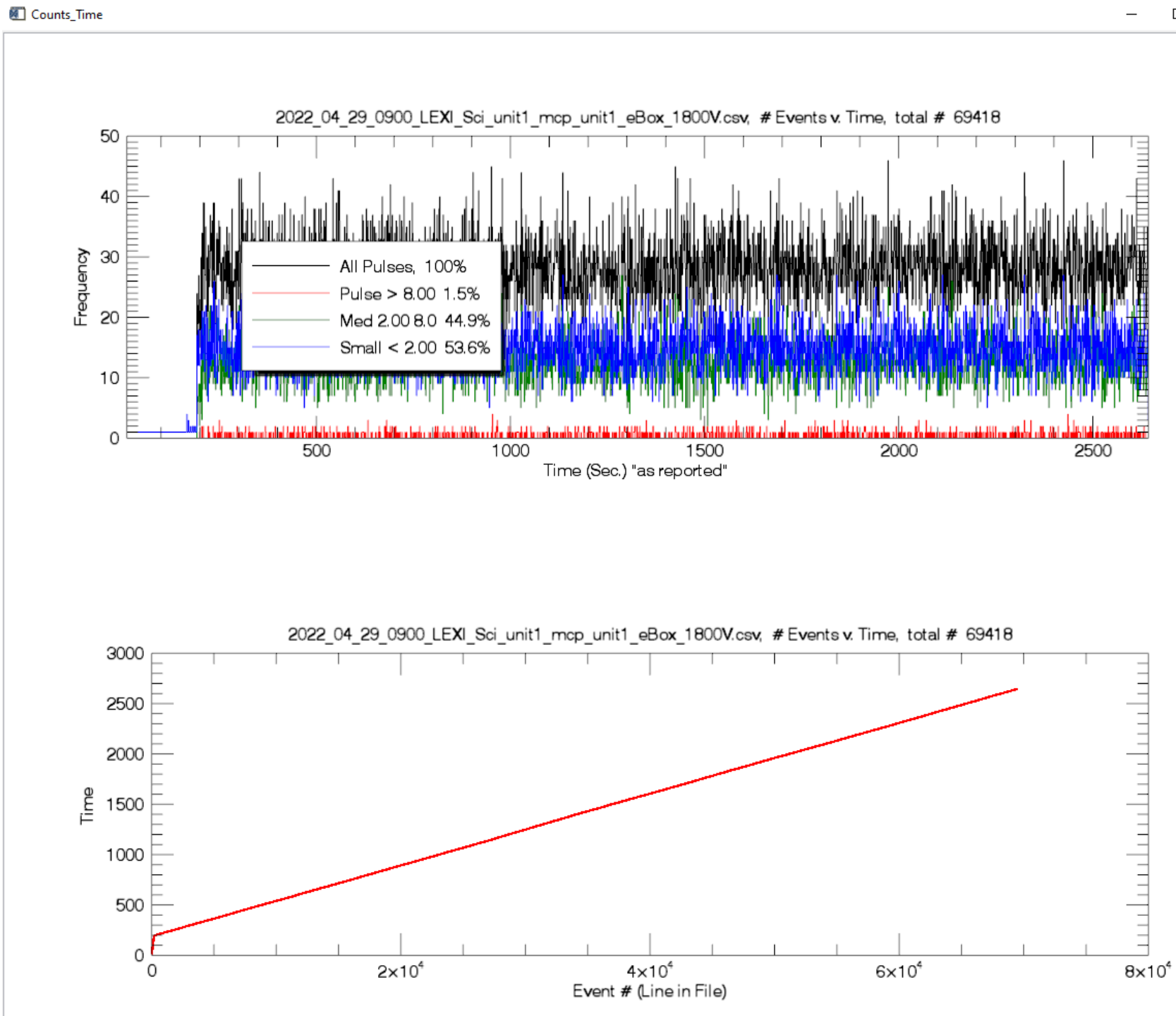
Location of Low and High noise Peaks

- @1800V
- Max_Subscript L/H 0:- 107 1.07000 349 3.49000
- Max_Subscript L/H 1:- 110 1.10000 349 3.49000
- Max_Subscript L/H 2:- 114 1.14000 341 3.41000
- Max_Subscript L/H 3:- 113 1.13000 338 3.38000
- @1900V
- Max_Subscript L/H 0:- 106 1.06000 351 3.51000
- Max_Subscript L/H 1:- 109 1.09000 351 3.51000
- Max_Subscript L/H 2:- 113 1.13000 343 3.43000
- Max_Subscript L/H 3:- 112 1.12000 340 3.40000
- @2000V
- Max_Subscript L/H 0:- 106 1.06000 350 3.50000
- Max_Subscript L/H 1:- 109 1.09000 350 3.50000
- Max_Subscript L/H 2:- 113 1.13000 342 3.42000
- Max_Subscript L/H 3:- 112 1.12000 339 3.39000
- @2100V
- Max_Subscript L/H 0:- 105 1.05000 352 3.52000
- Max_Subscript L/H 1:- 109 1.09000 351 3.51000
- Max_Subscript L/H 2:- 112 1.12000 343 3.43000
- Max_Subscript L/H 3:- 112 1.12000 340 3.40000
- @2200V
- Max_Subscript L/H 0:- 106 1.06000 349 3.49000
- Max_Subscript L/H 1:- 110 1.10000 349 3.49000
- Max_Subscript L/H 2:- 114 1.14000 341 3.41000
- Max_Subscript L/H 3:- 113 1.13000 338 3.38000
- @2300V
- Max_Subscript L/H 0:- 106 1.06000 350 3.50000
- Max_Subscript L/H 1:- 109 1.09000 350 3.50000
- Max_Subscript L/H 2:- 113 1.13000 342 3.42000
- Max_Subscript L/H 3:- 112 1.12000 339 3.39000
- @2325V
- Max_Subscript L/H 0:- 106 1.06000 350 3.50000
- Max_Subscript L/H 1:- 110 1.10000 349 3.49000
- Max_Subscript L/H 2:- 113 1.13000 342 3.42000
- Max_Subscript L/H 3:- 113 1.13000 338 3.38000

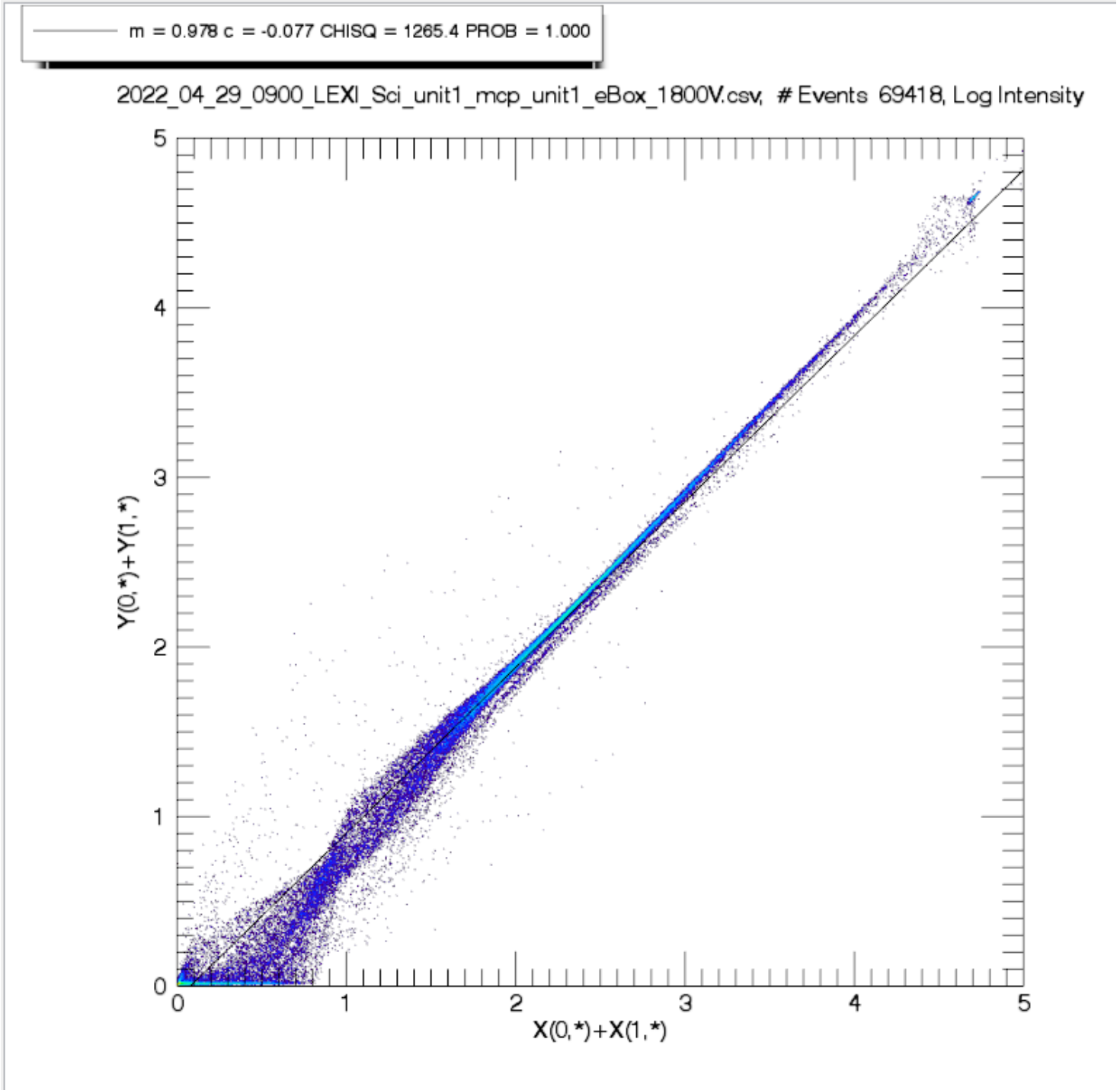
- @1800V
- (W6) “Reduced Data” 2D histogram plots, only including events where the PHD is between 5.0 and 6.0



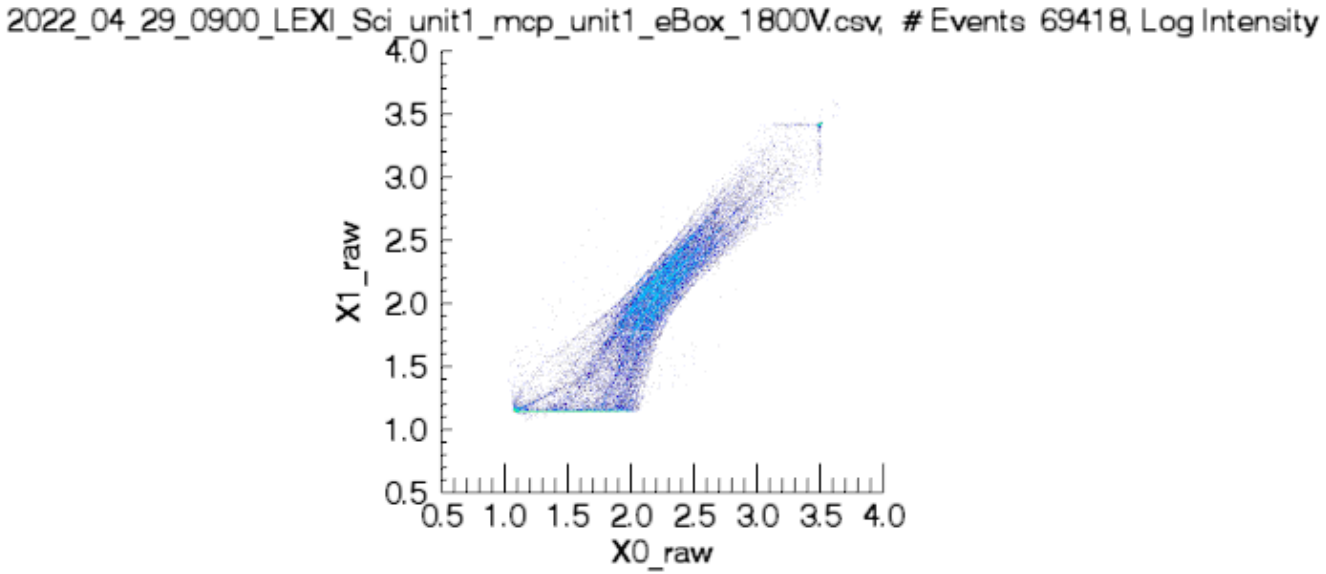
- @1800V
- Plotting events as fn time

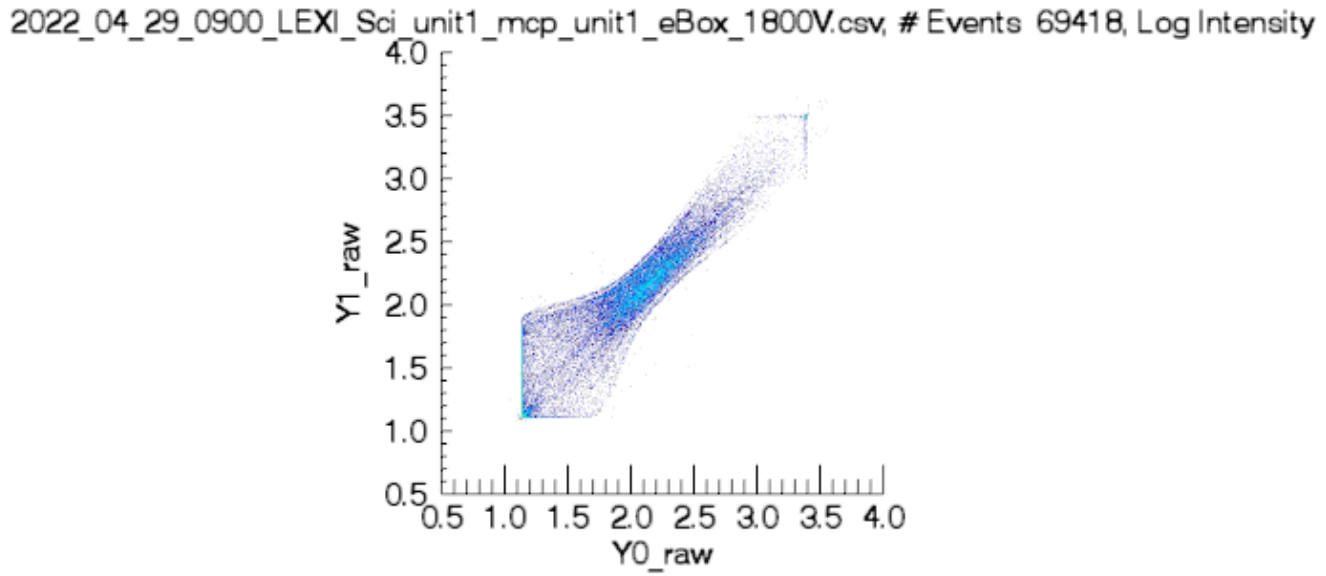


- @1800V

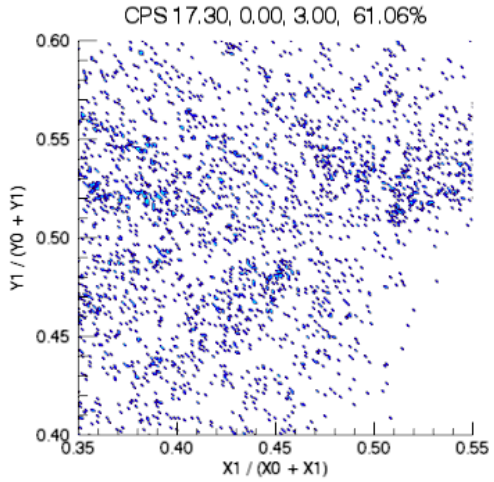

m = 0.978 c = -0.077 CHISQ = 1265.4 PROB = 1.000
2022_04_29_0900_LEXI_Sci_unit1_mcp_unit1_eBox_1800V.csv, # Events 69418, Log Intensity
Y(0,*)+Y(1,*)
X(0,*)+X(1,*)
0
1
2
3
4
5

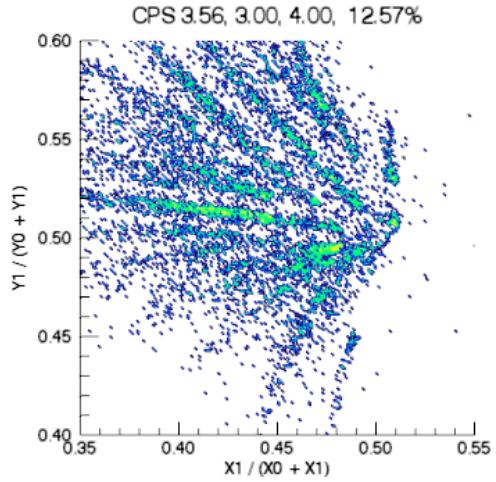
- @1800V

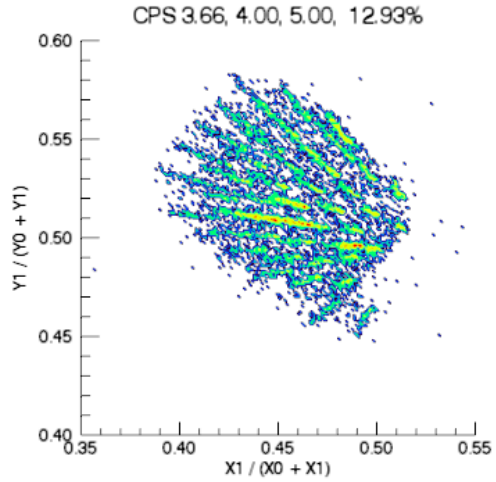

2022_04_29_0900_LEXI_Sci_unit1_mcp_unit1_eBox_1800V.csv, # Events 69418, Log Intensity
X1_raw
X0_raw
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

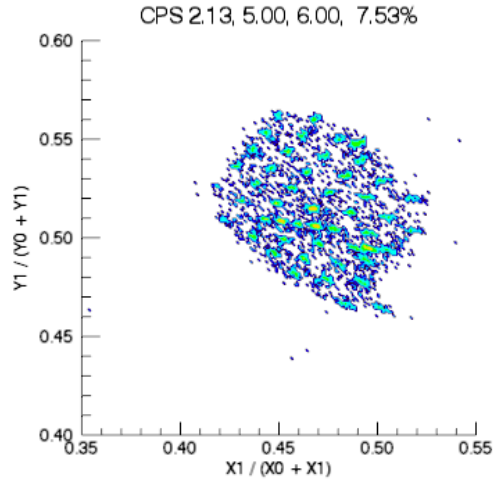

2022_04_29_0900_LEXI_Sci_unit1_mcp_unit1_eBox_1800V.csv, # Events 69418, Log Intensity
Y1_raw
Y0_raw
0.5
1.0
1.5
2.0
2.5
3.0
3.5
4.0

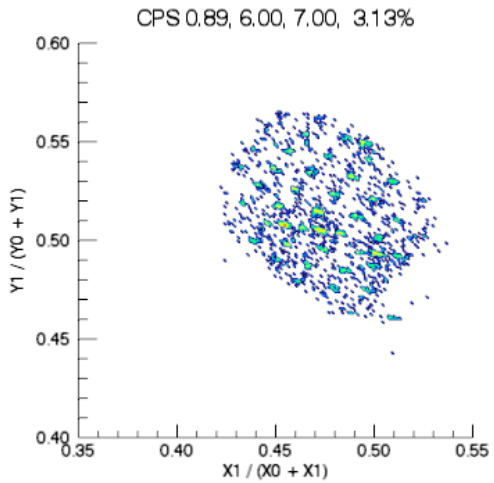
- @1800V, Plots as a fn of Pulse Height Range, Range 5-8 gives best results

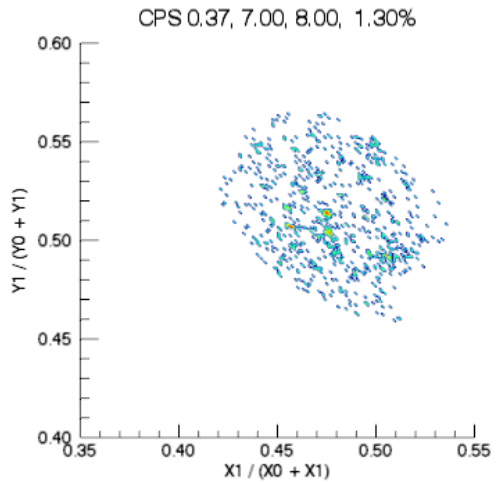


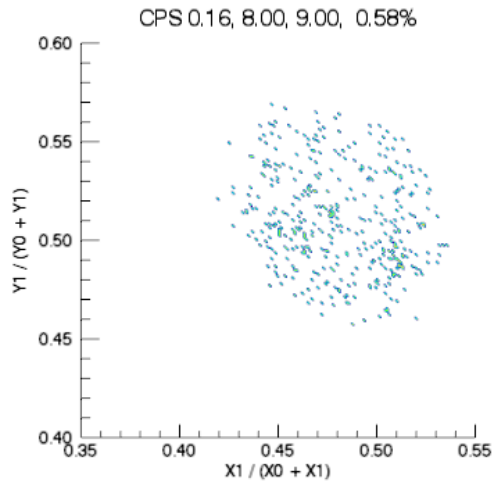


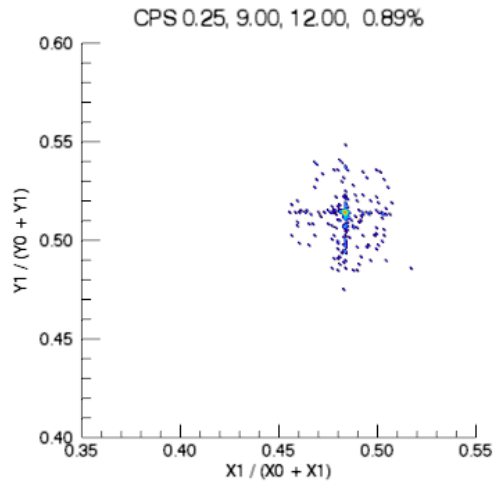




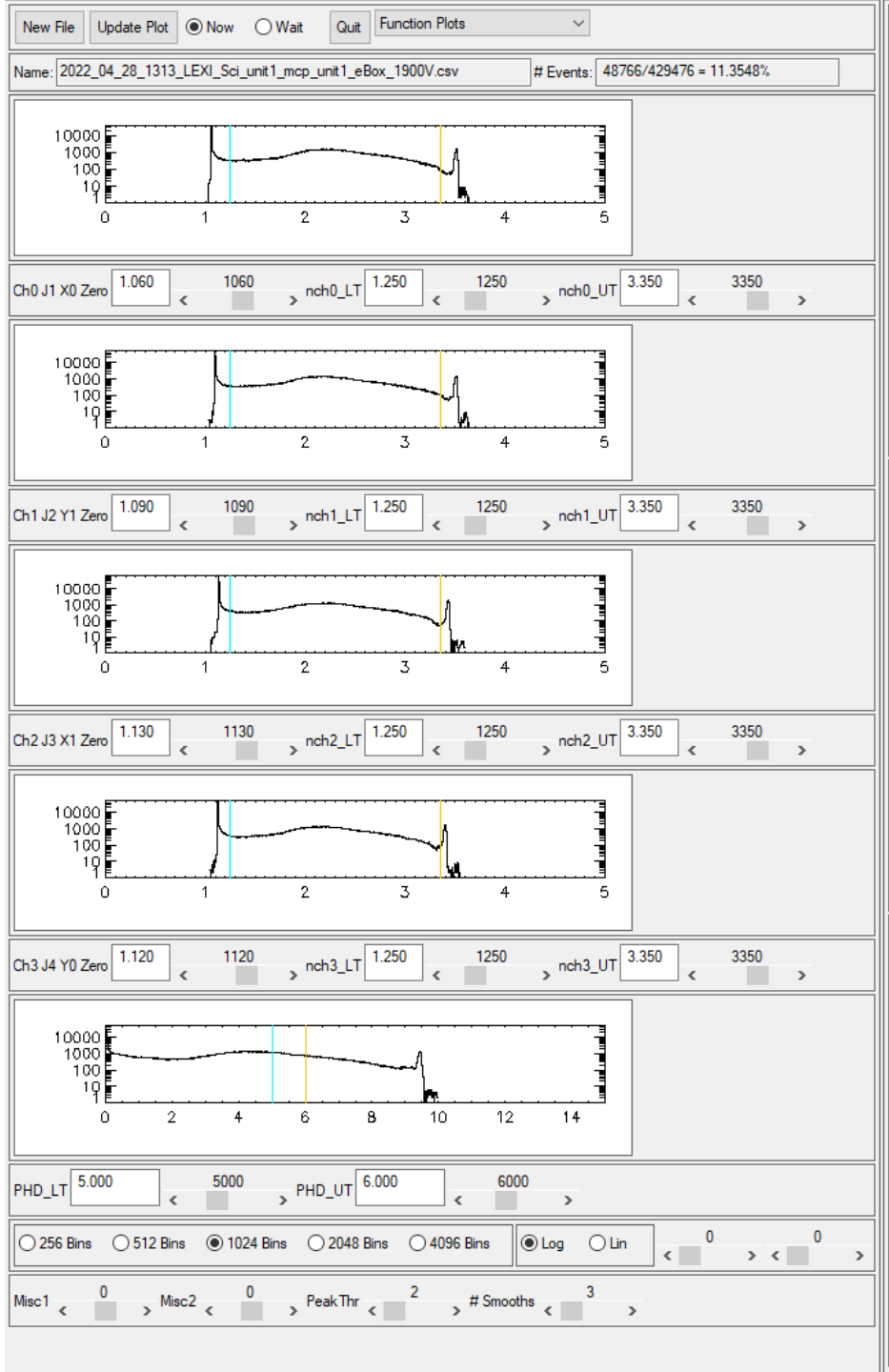


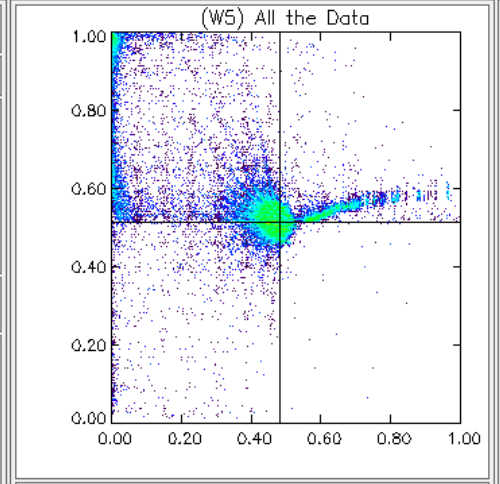


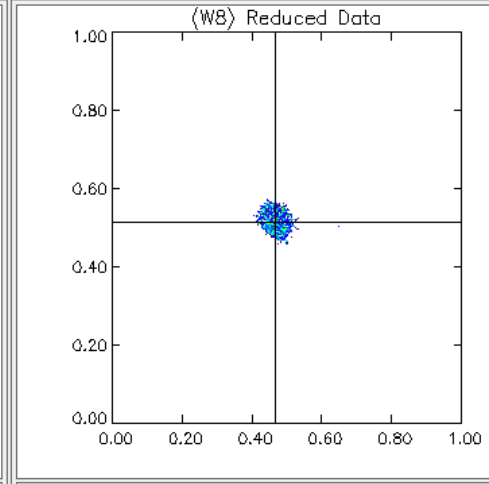


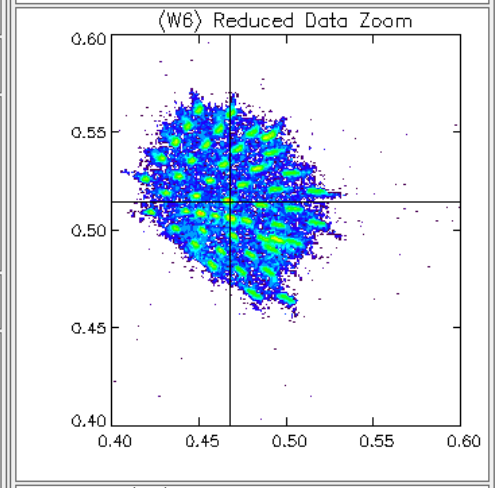


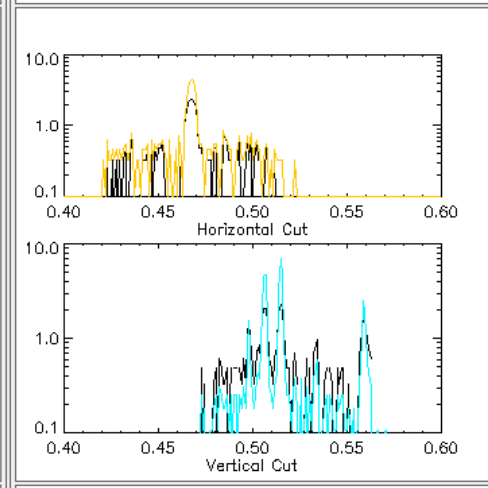
- @1900V
- (W6) “Reduced Data” 2D histogram plots, only including events where the PHD is between 5.0 and 6.0

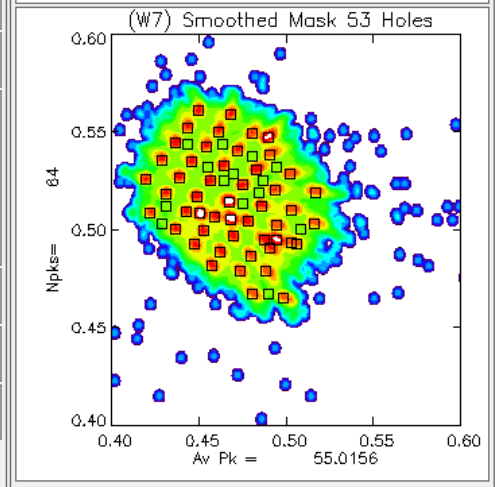


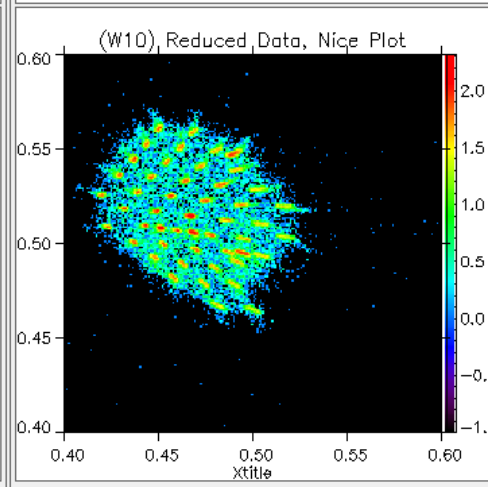




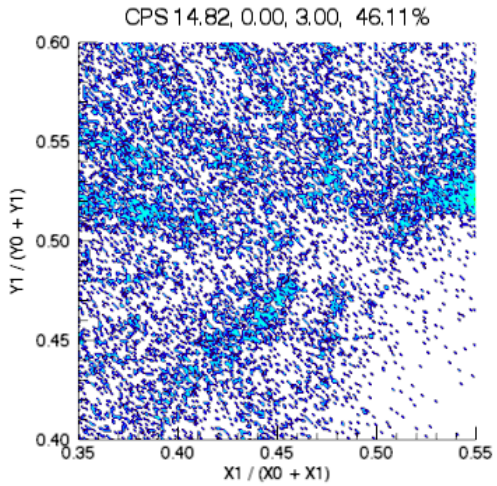


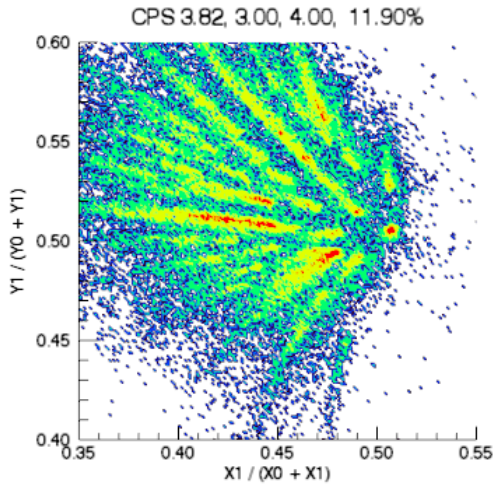


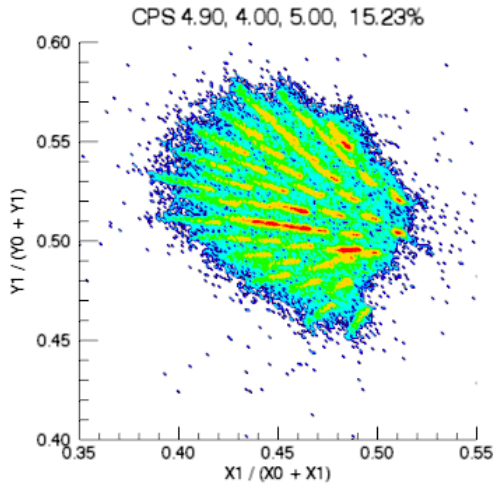


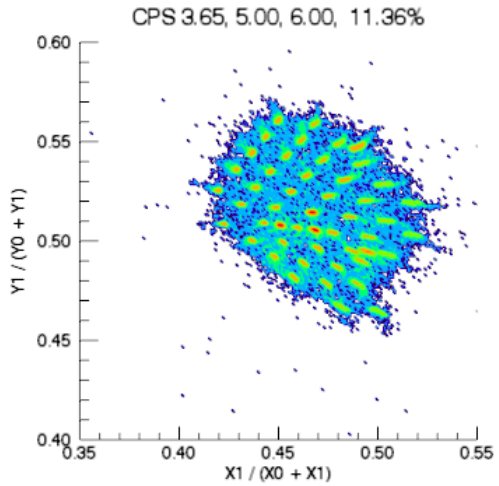


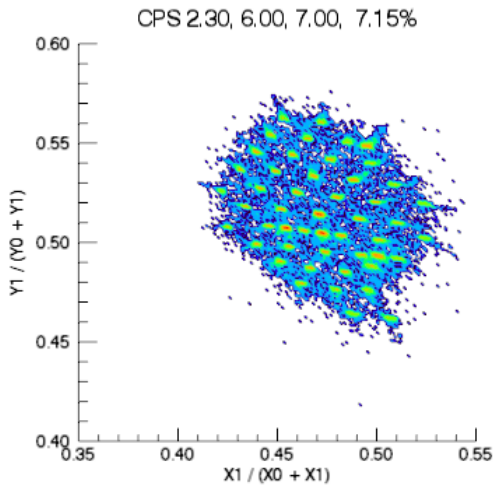
- @1900V

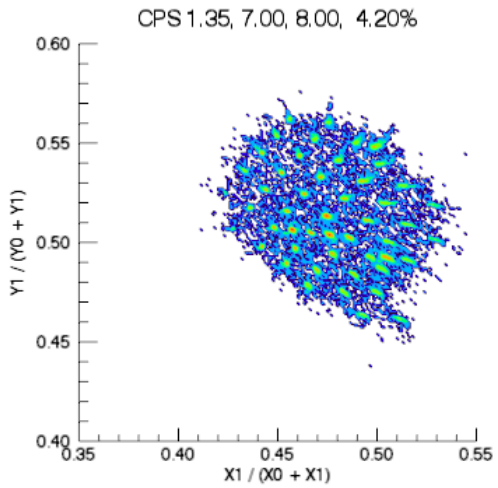

CPS 14.82, 0.00, 3.00, 46.11%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

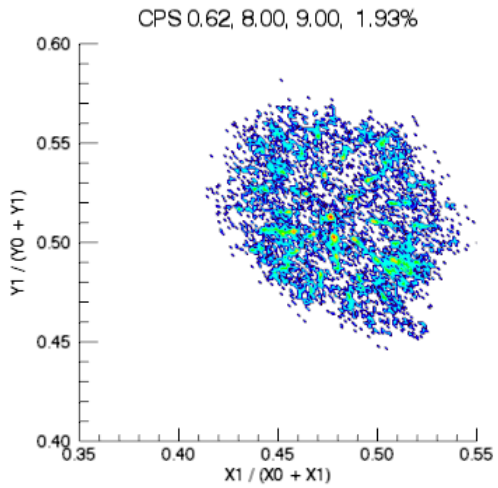

CPS 3.82, 3.00, 4.00, 11.90%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

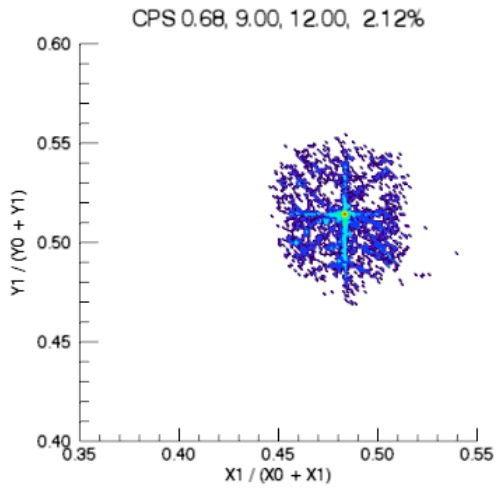

CPS 4.90, 4.00, 5.00, 15.23%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)


CPS 3.65, 5.00, 6.00, 11.36%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

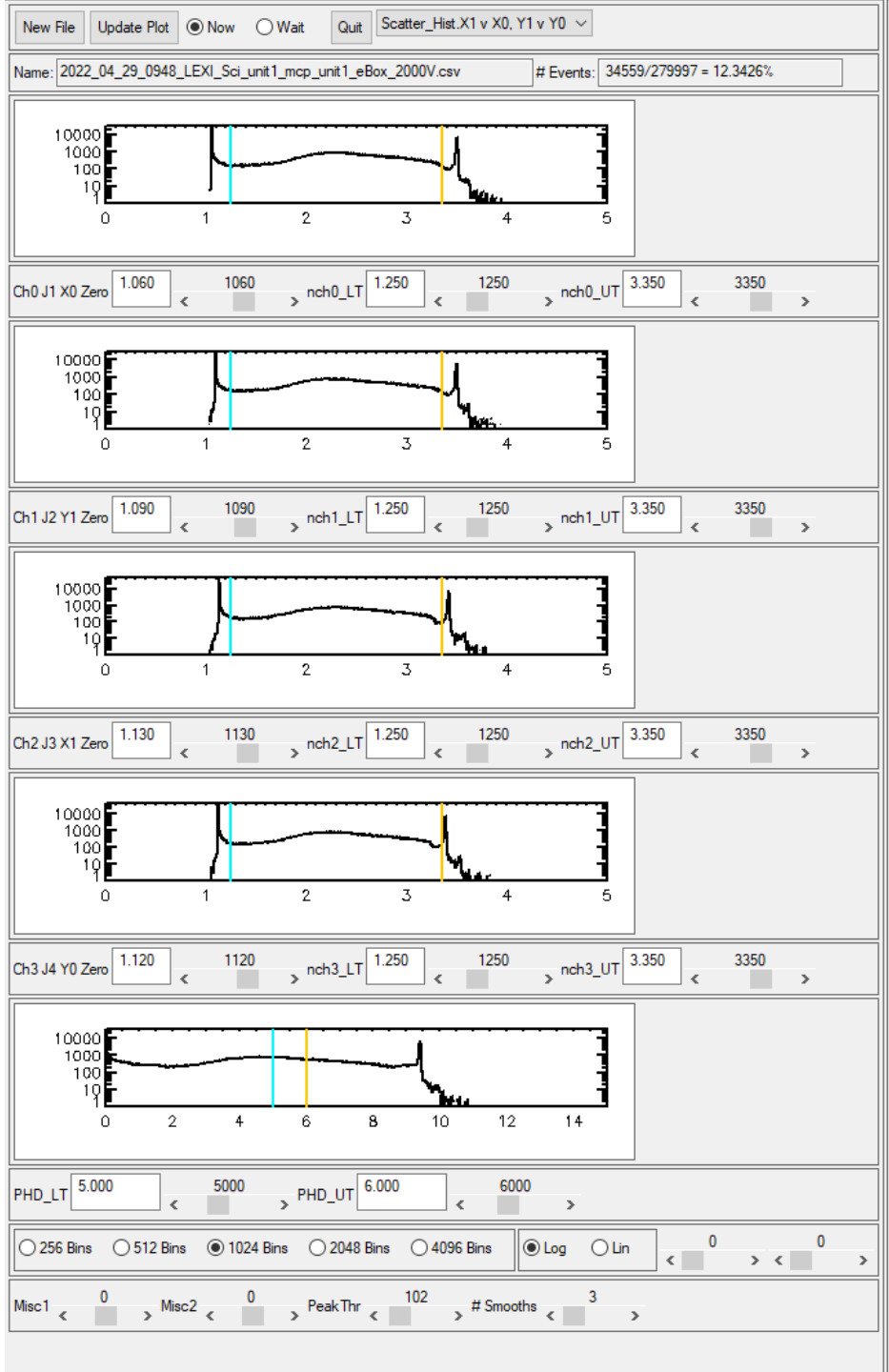

CPS 2.30, 6.00, 7.00, 7.15%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

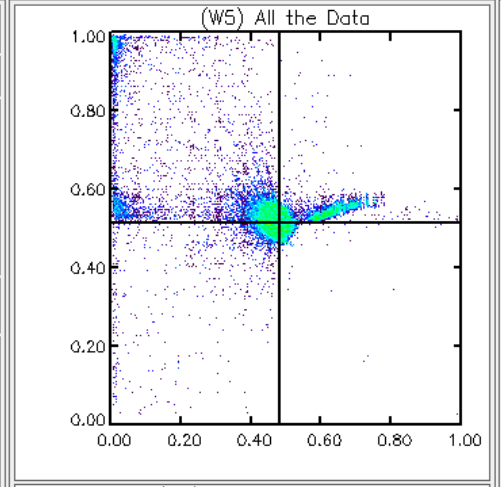

CPS 1.35, 7.00, 8.00, 4.20%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

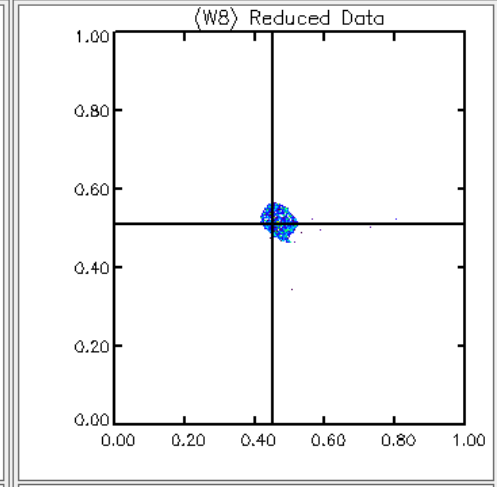

CPS 0.62, 8.00, 9.00, 1.93%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

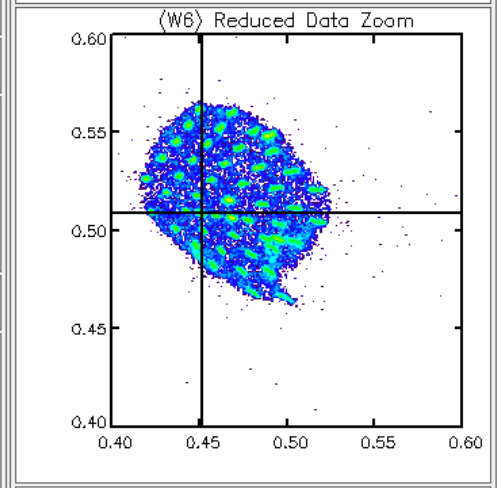

CPS 0.68, 9.00, 12.00, 2.12%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

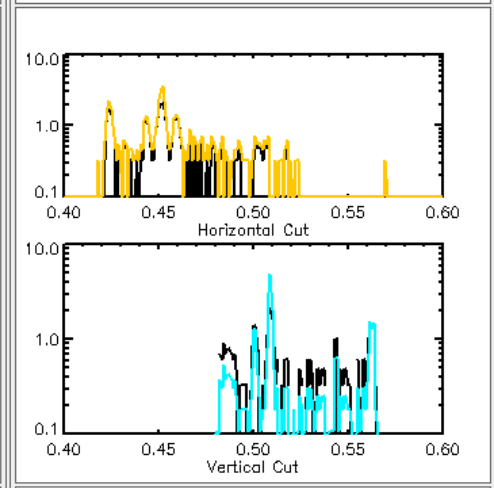
- @2000V
- (W6) “Reduced Data” 2D histogram plots, only including events where the PHD is between 5.0 and 6.0

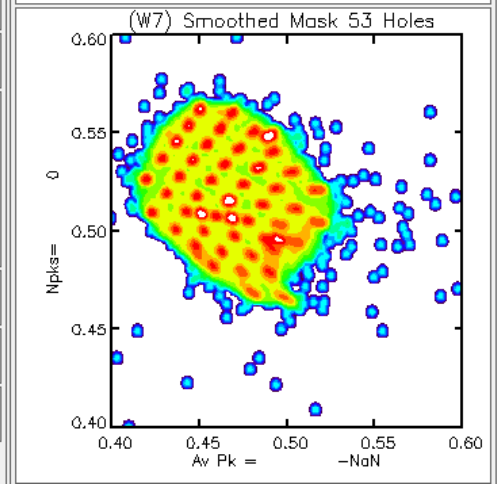


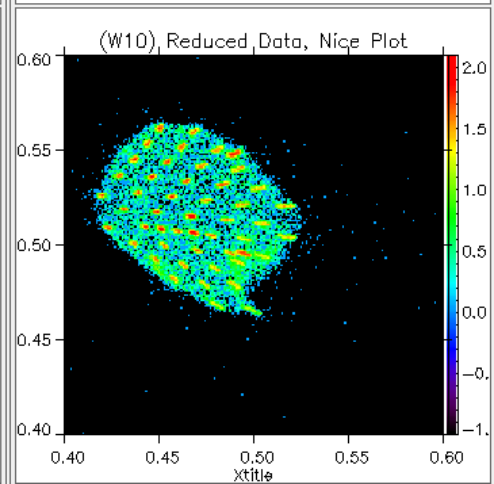




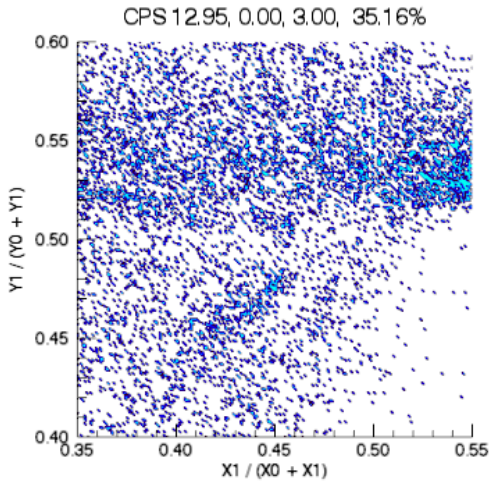


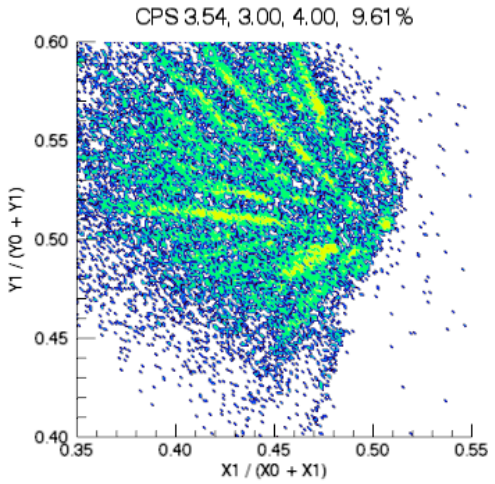


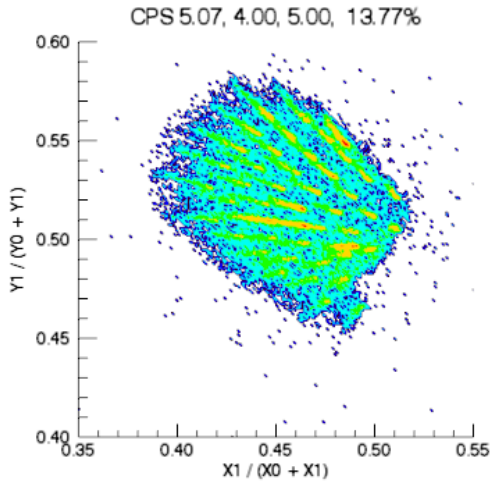


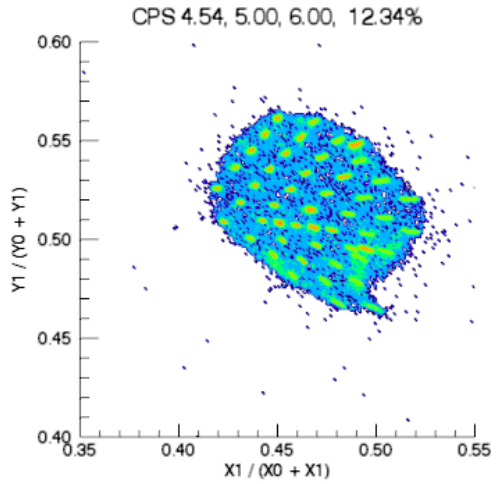


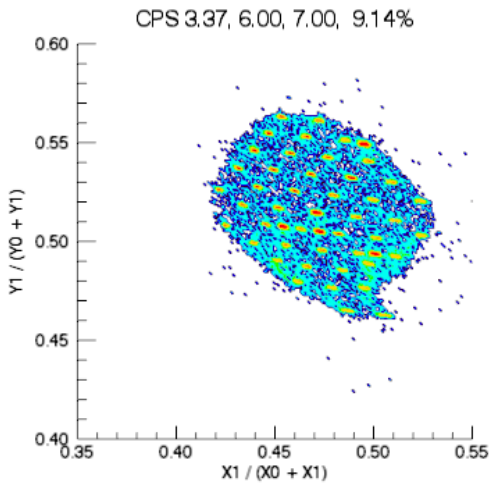
- @2000V

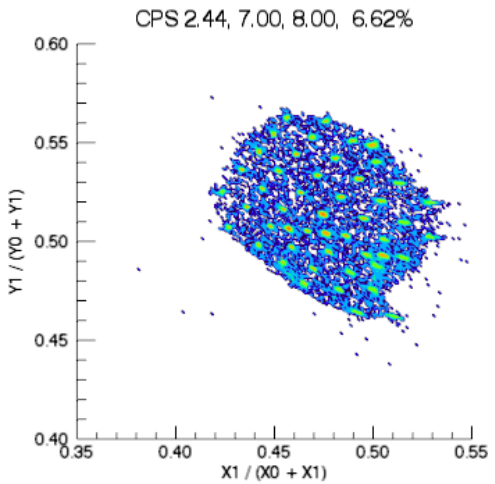

CPS 12.95, 0.00, 3.00, 35.16%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

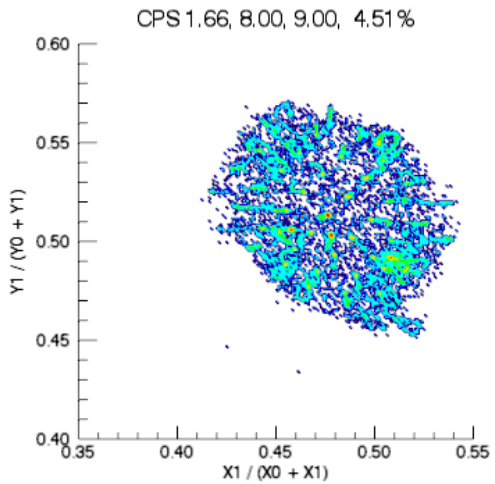

CPS 3.54, 3.00, 4.00, 9.61%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

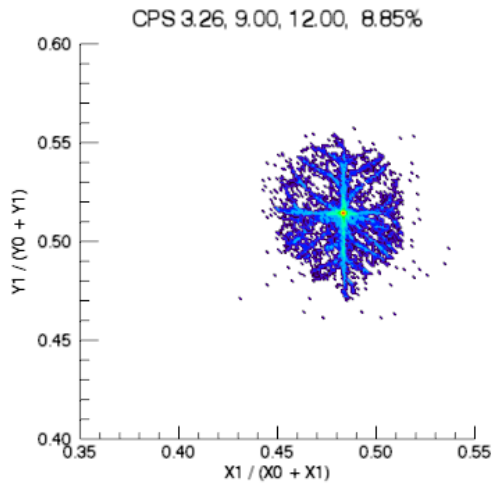

CPS 5.07, 4.00, 5.00, 13.77%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)


CPS 4.54, 5.00, 6.00, 12.34%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

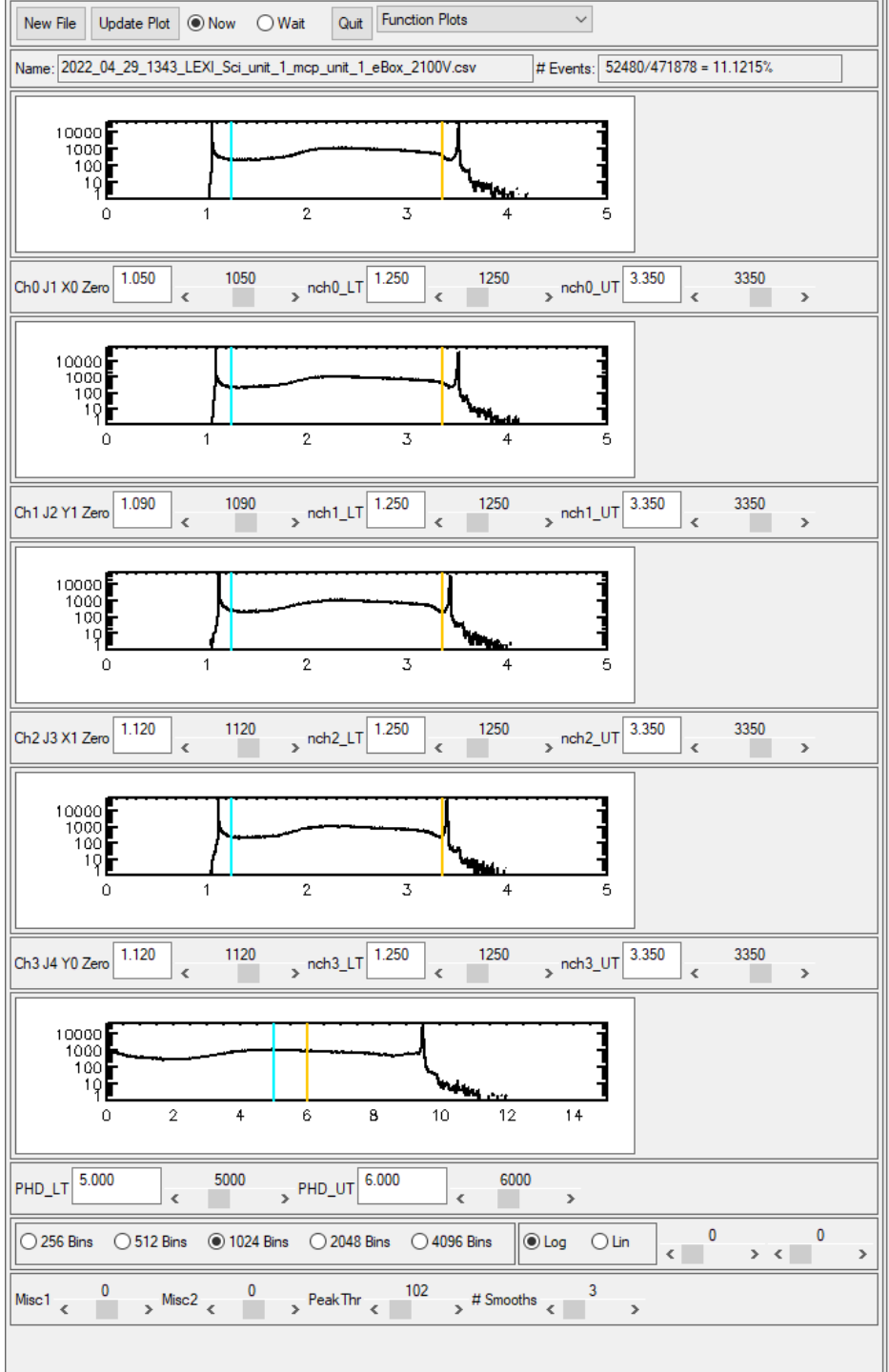

CPS 3.37, 6.00, 7.00, 9.14%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

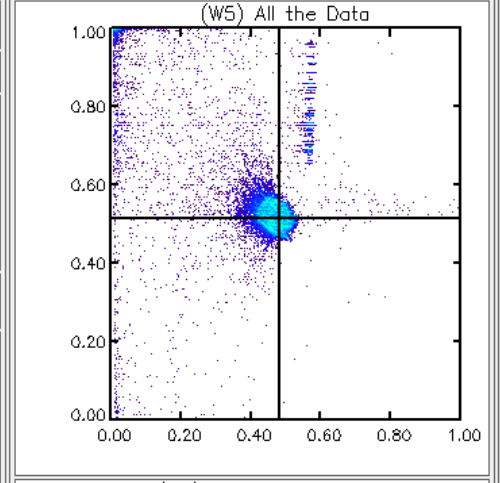

CPS 2.44, 7.00, 8.00, 6.62%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

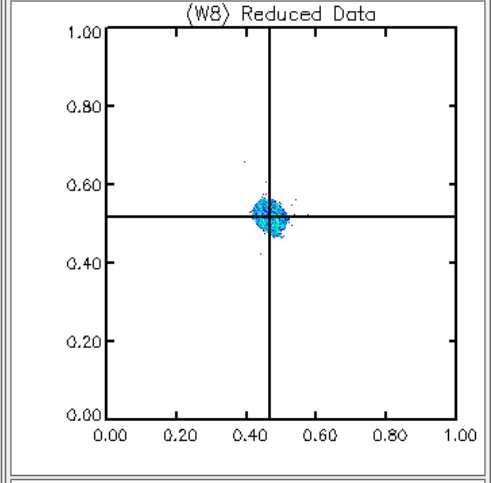

CPS 1.66, 8.00, 9.00, 4.51%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

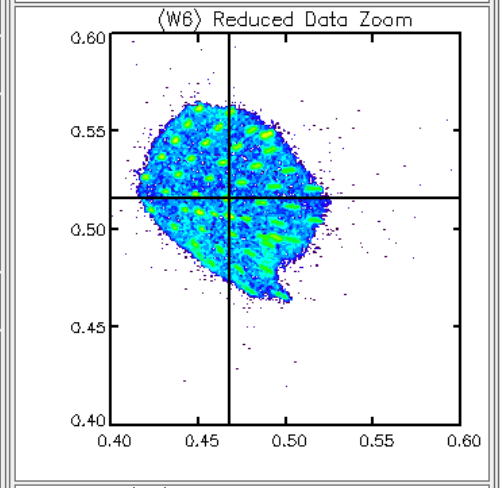

CPS 3.26, 9.00, 12.00, 8.85%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

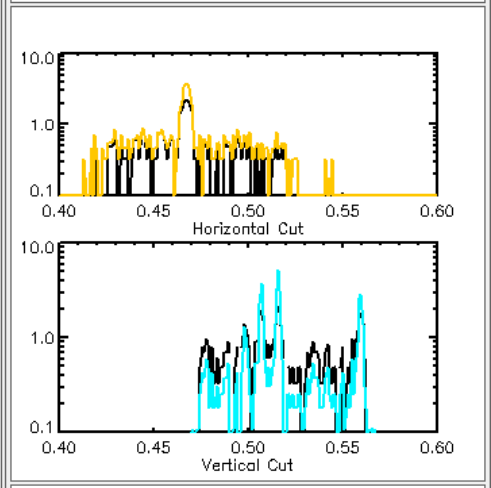
- @2100V
- (W6) “Reduced Data” 2D histogram plots, only including events where the PHD is between 5.0 and 6.0

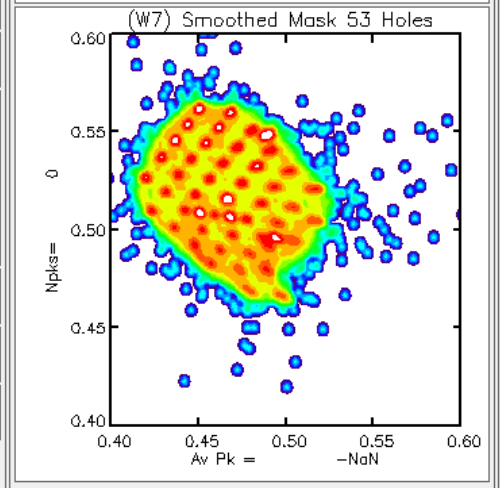


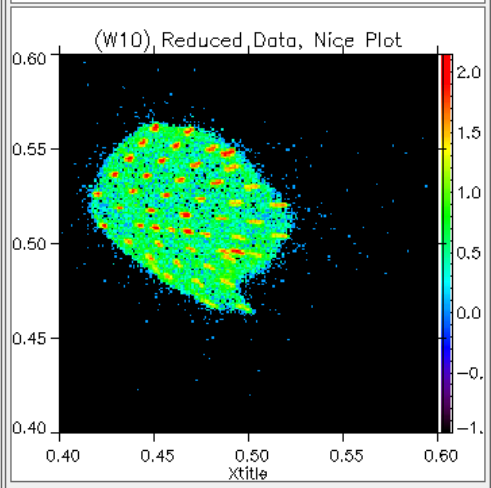




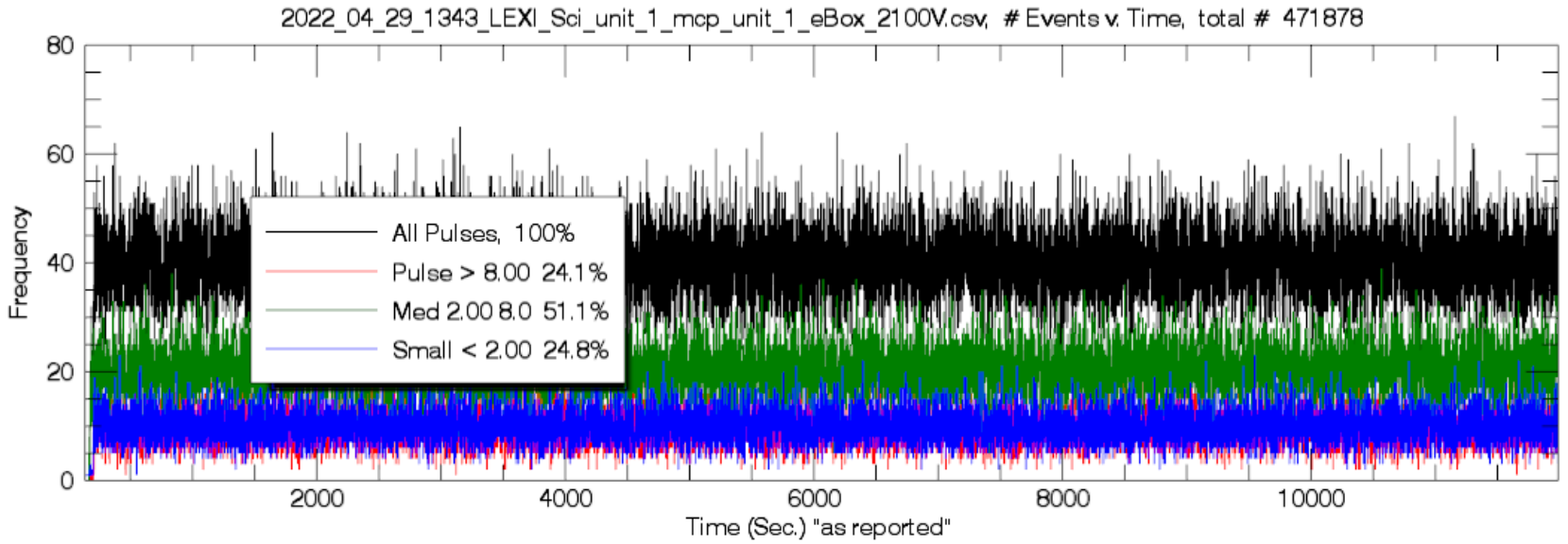


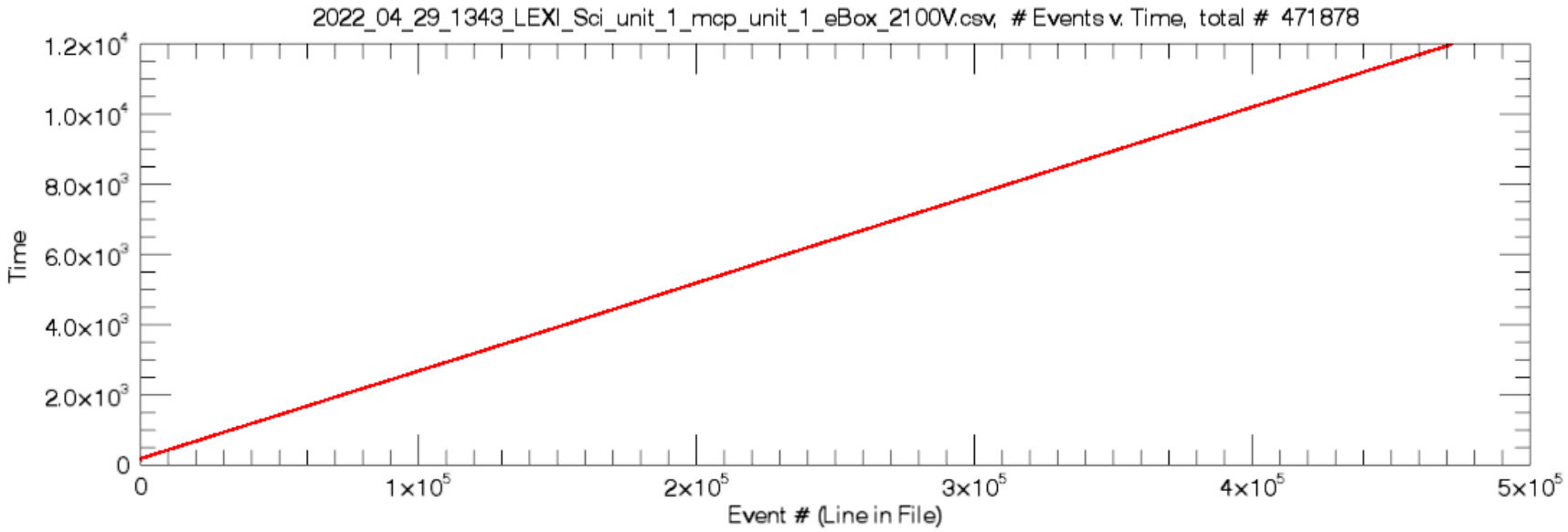




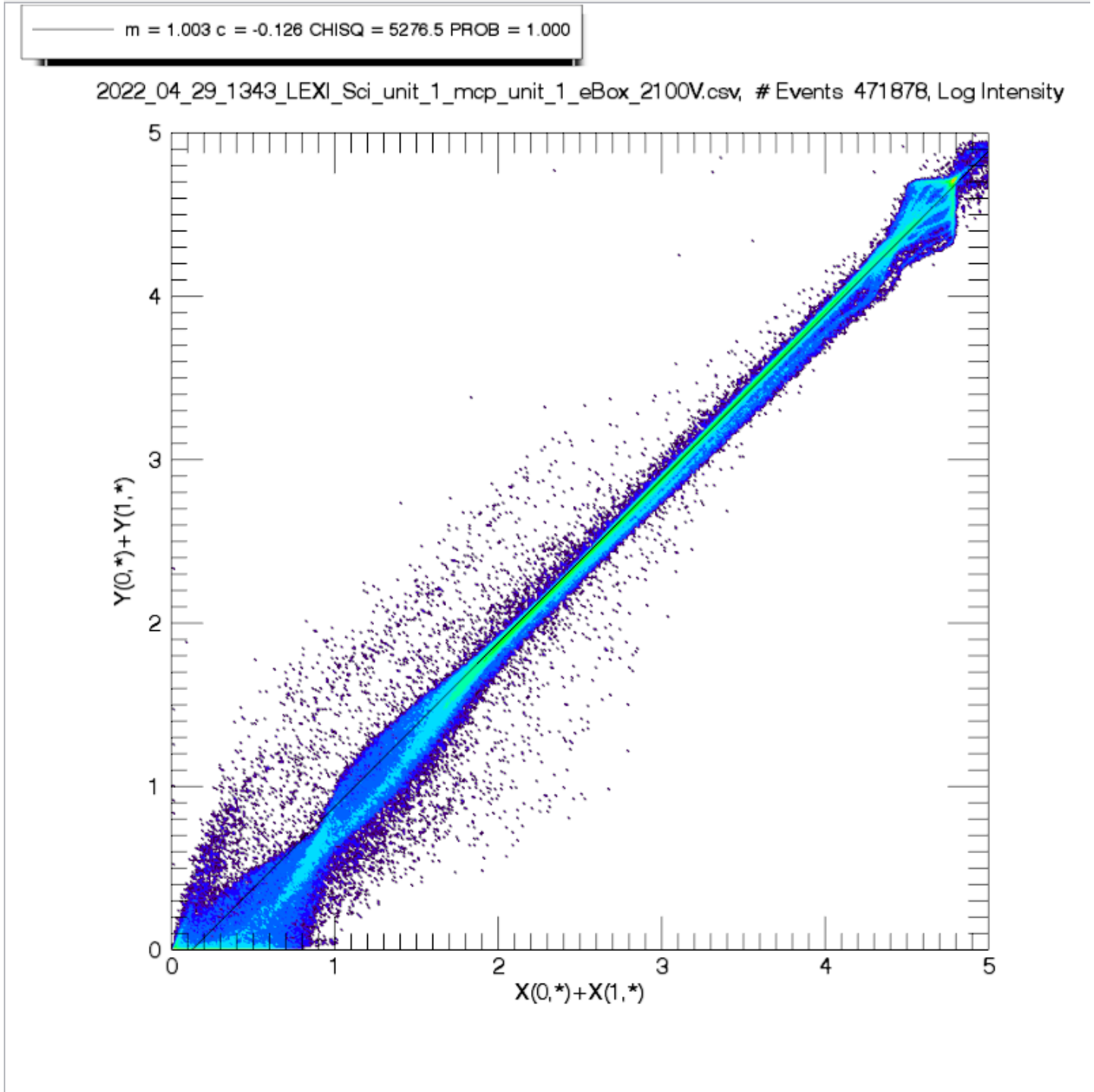


- @2100V
- Plotting events as fn time

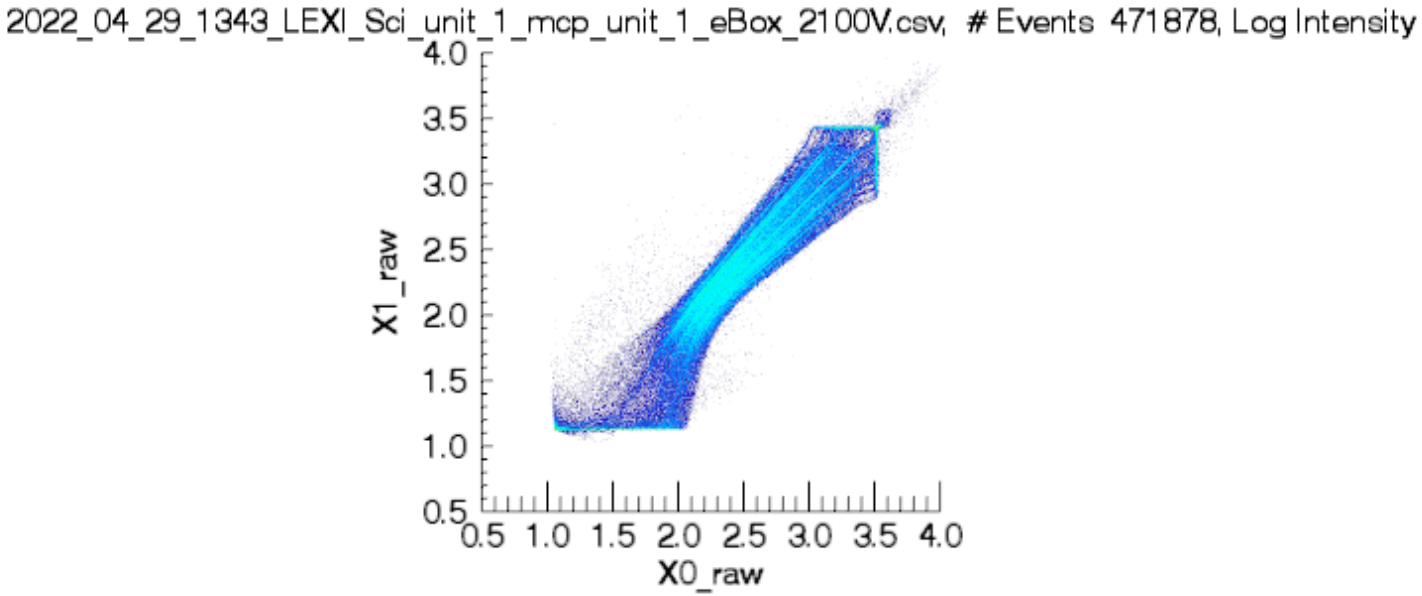


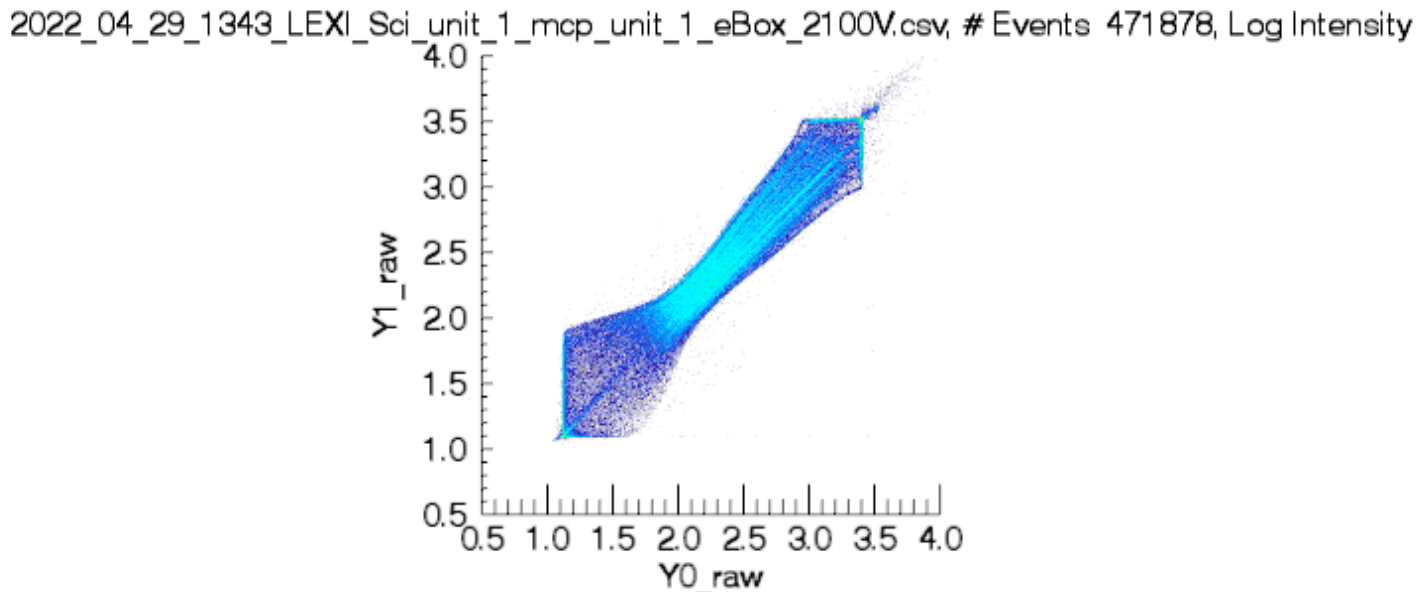


- @2100V

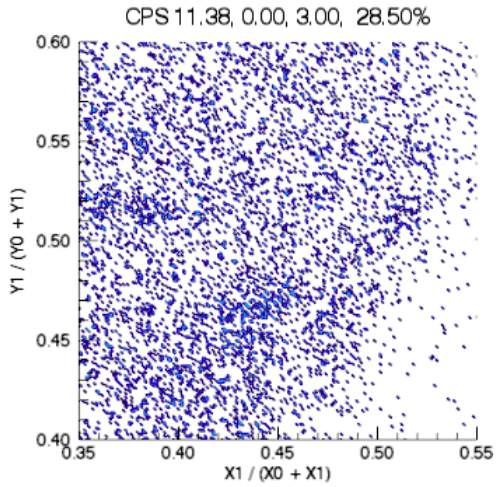

m = 1.003 c = -0.126 CHISQ = 5276.5 PROB = 1.000
2022_04_29_1343_LEXI_Sci_unit_1_mcp_unit_1_eBox_2100V.csv, # Events 471878, Log Intensity
Y(0,*)+Y(1,*)
X(0,*)+X(1,*)
0
1
2
3
4
5

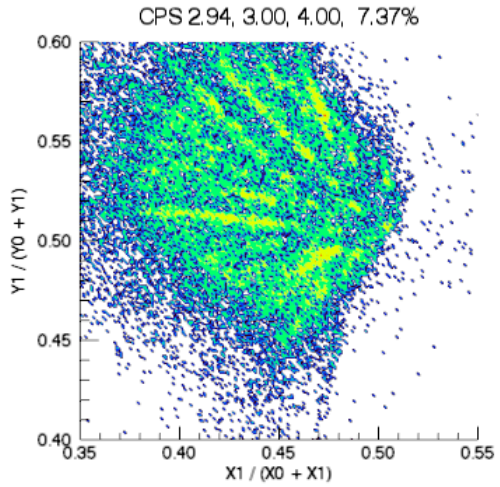
- @2100V

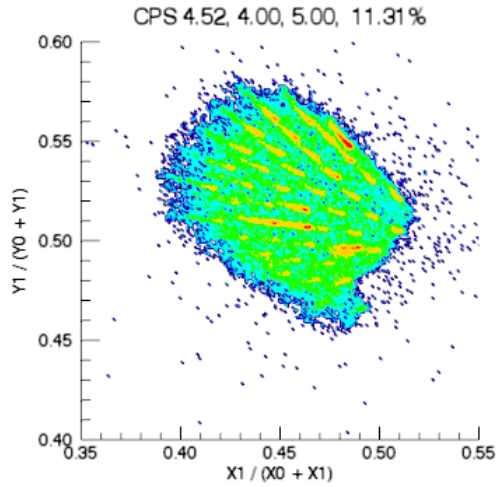

2022_04_29_1343_LEXI_Sci_unit_1_mcp_unit_1_eBox_2100V.csv, # Events 471878, Log Intensity
X1_raw
X0_raw
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0

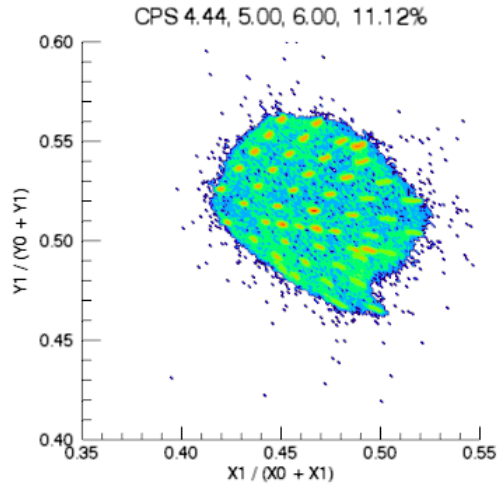

2022_04_29_1343_LEXI_Sci_unit_1_mcp_unit_1_eBox_2100V.csv, # Events 471878, Log Intensity
Y1_raw
Y0_raw
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0

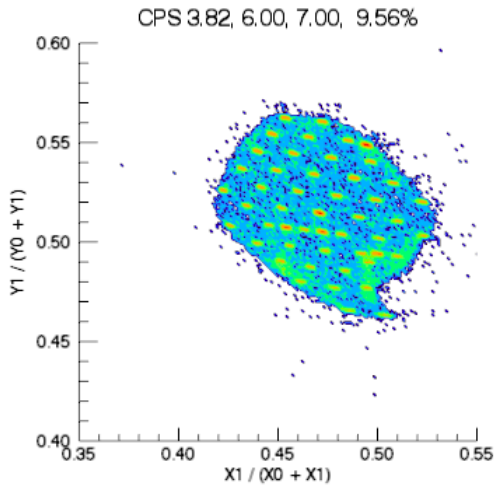
- @2100V

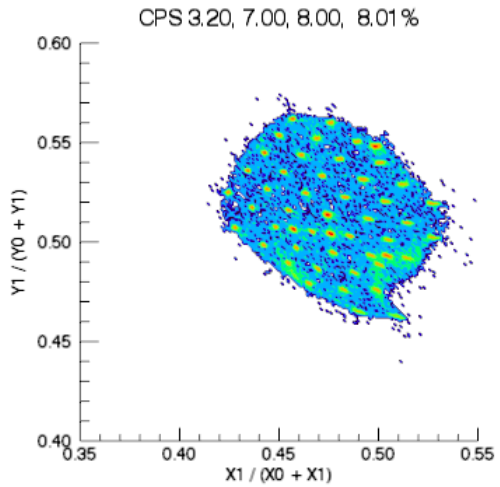

CPS 11.38, 0.00, 3.00, 28.50%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

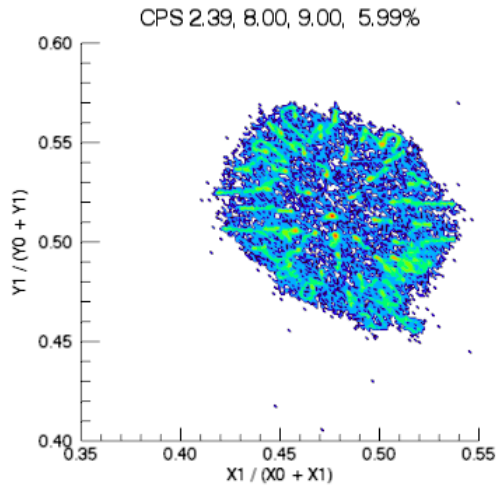

CPS 2.94, 3.00, 4.00, 7.37%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

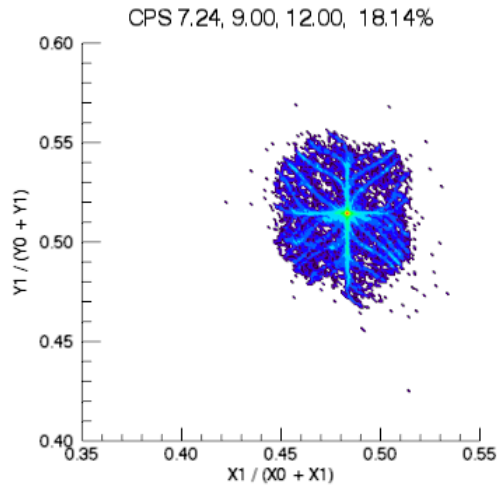

CPS 4.52, 4.00, 5.00, 11.31%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)


CPS 4.44, 5.00, 6.00, 11.12%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

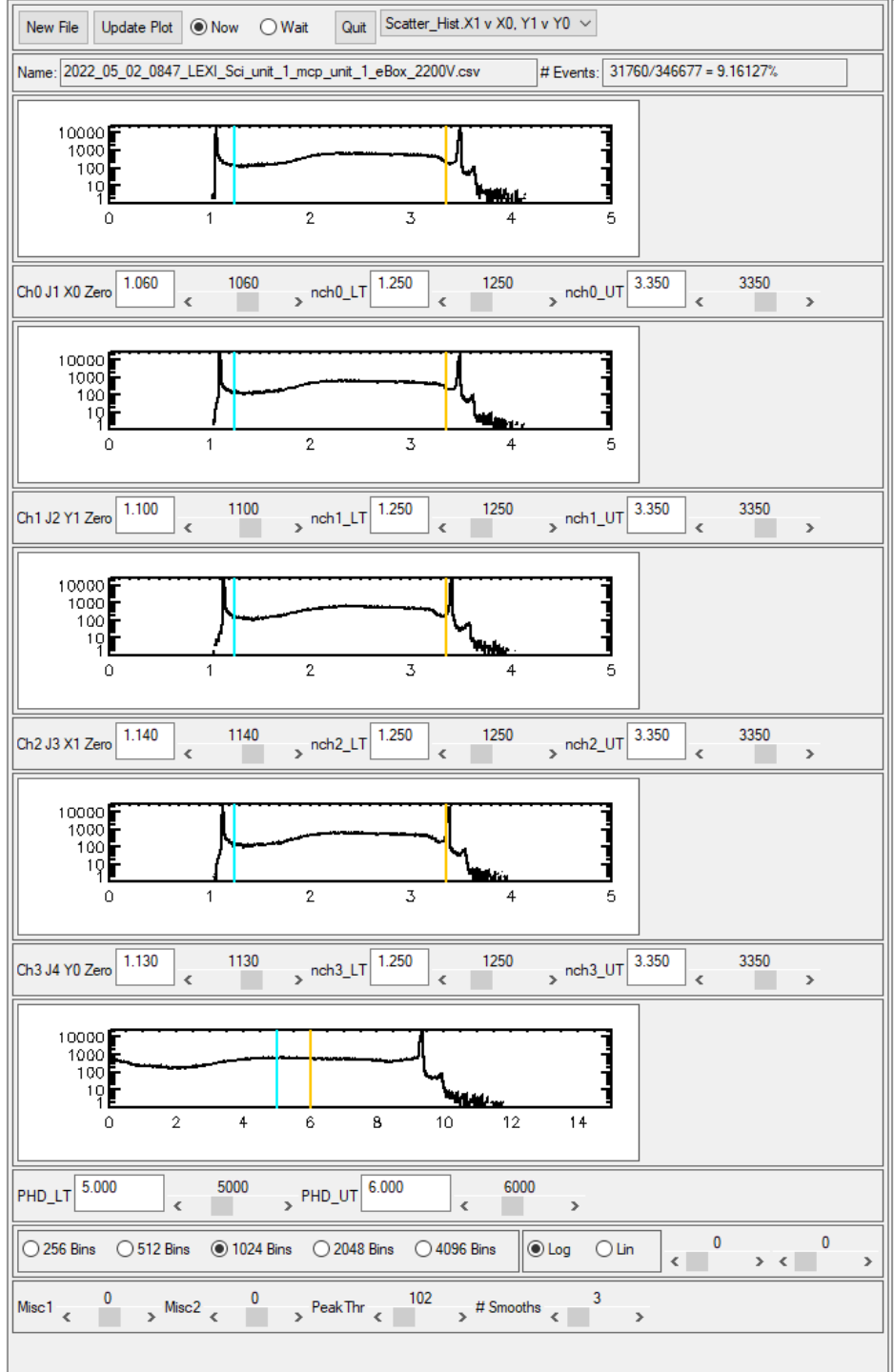

CPS 3.82, 6.00, 7.00, 9.56%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

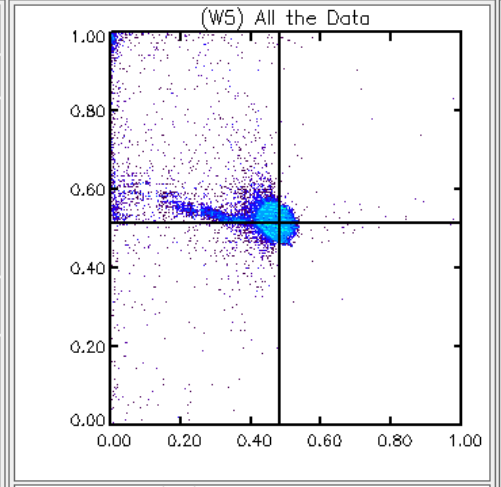

CPS 3.20, 7.00, 8.00, 8.01%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

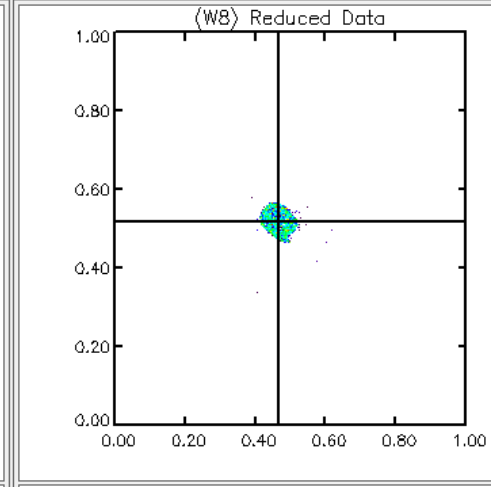

CPS 2.39, 8.00, 9.00, 5.99%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

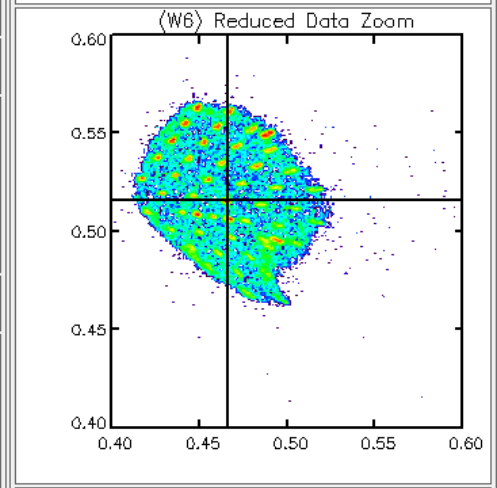

CPS 7.24, 9.00, 12.00, 18.14%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

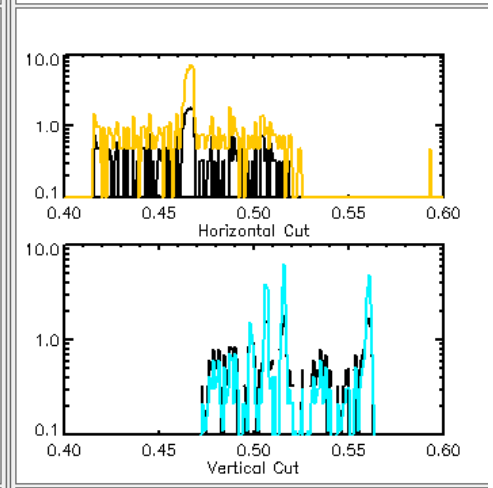
- @2200V
- (W6) “Reduced Data” 2D histogram plots, only including events where the PHD is between 5.0 and 6.0

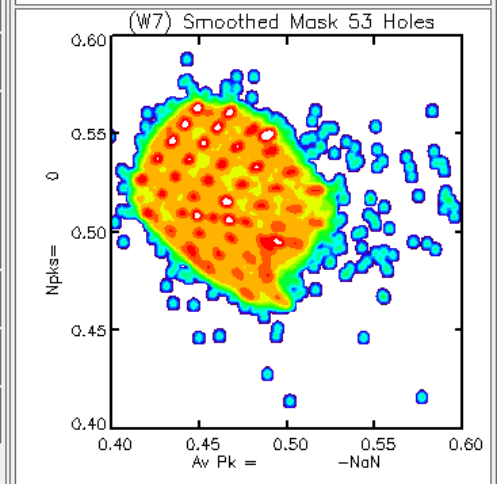


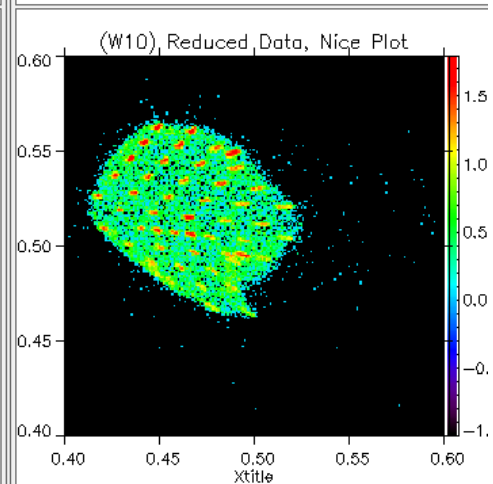




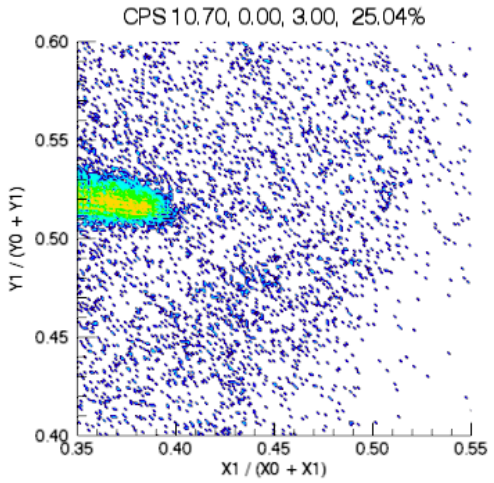


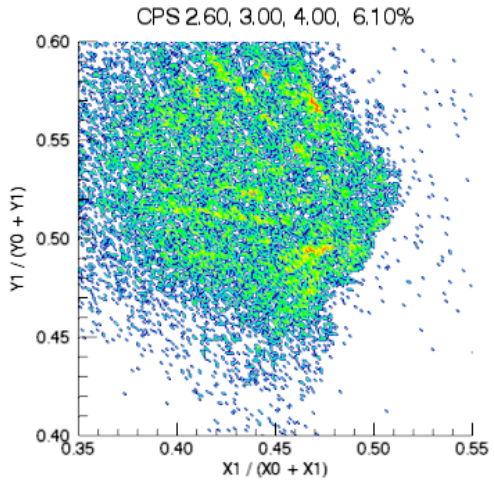


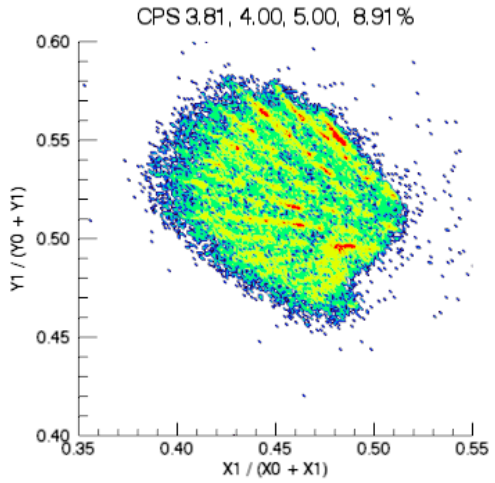


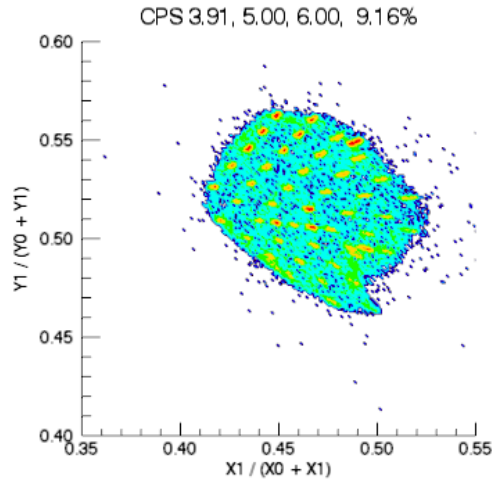


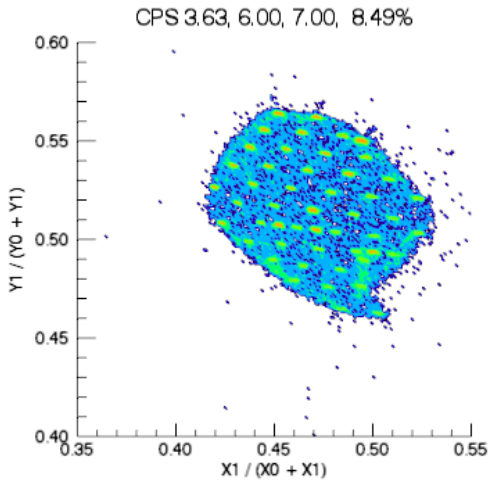
- @2200V

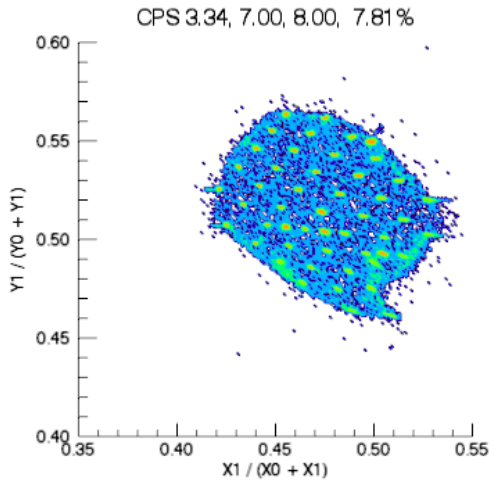

CPS 10.70, 0.00, 3.00, 25.04%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

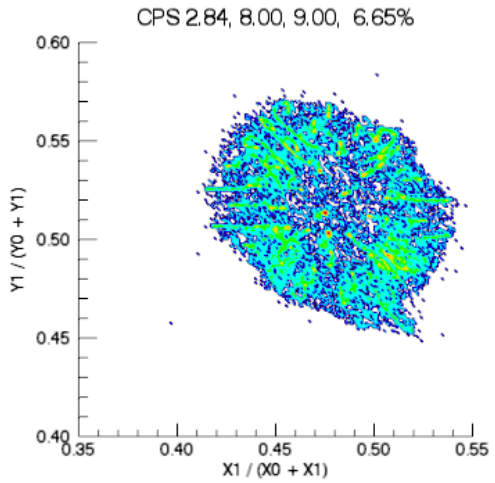

CPS 2.60, 3.00, 4.00, 6.10%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

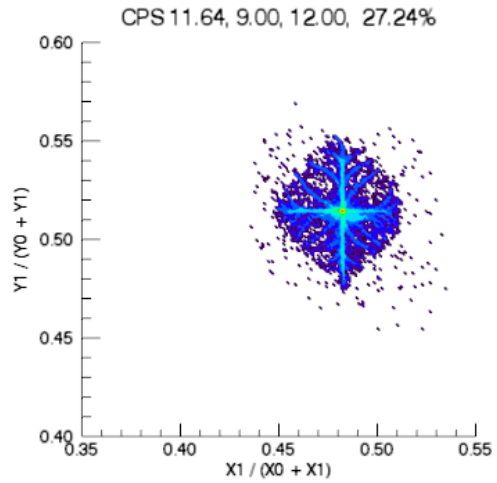

CPS 3.81, 4.00, 5.00, 8.91%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)


CPS 3.91, 5.00, 6.00, 9.16%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

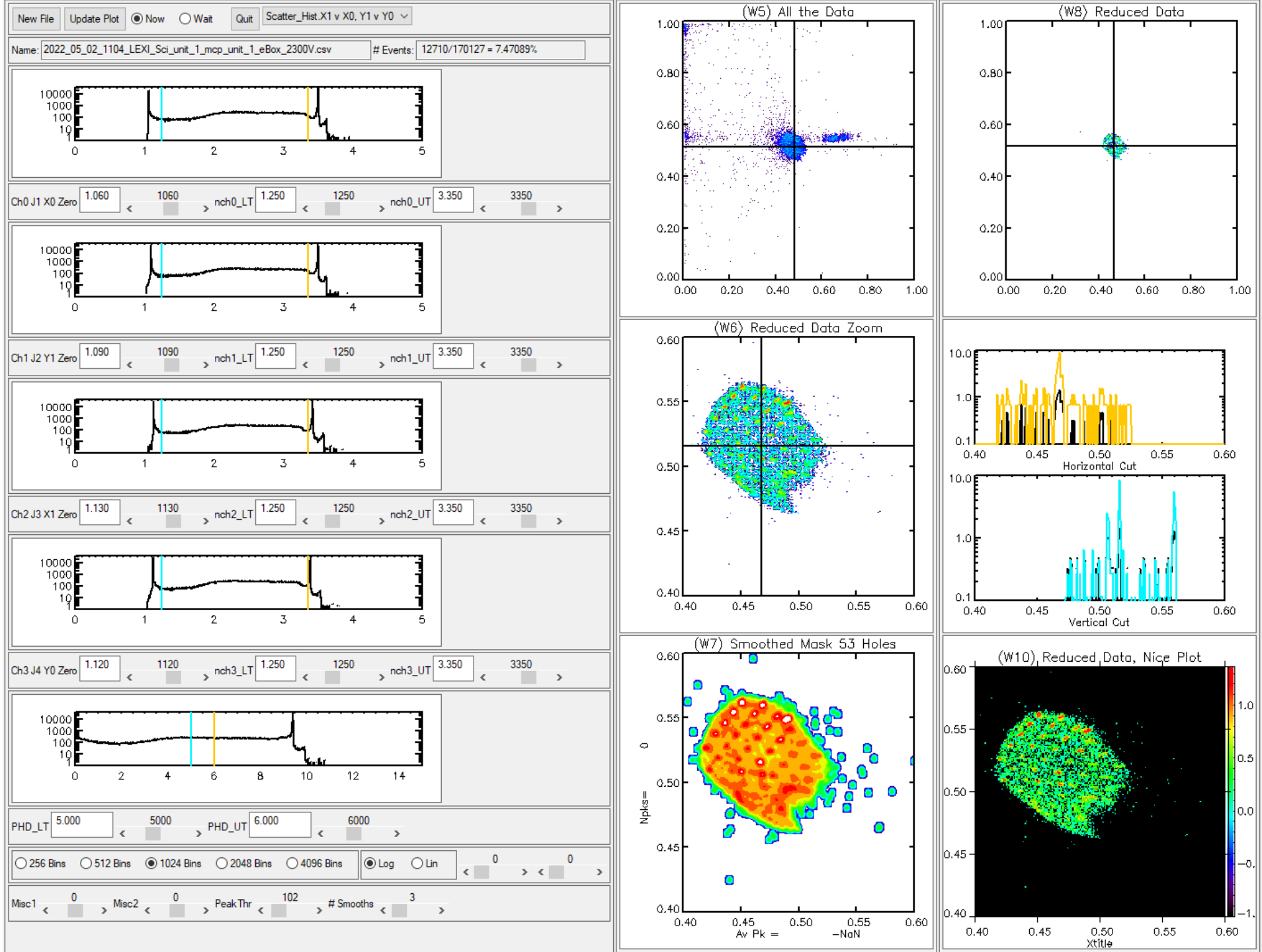

CPS 3.63, 6.00, 7.00, 8.49%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)


CPS 3.34, 7.00, 8.00, 7.81%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

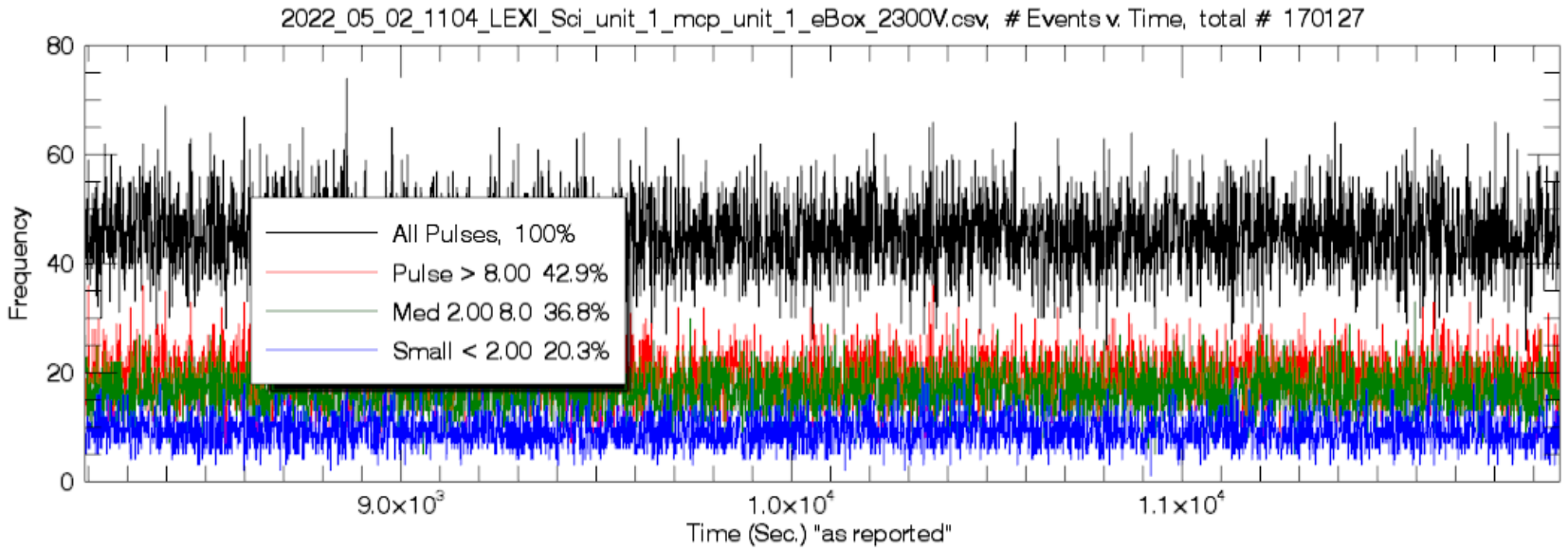

CPS 2.84, 8.00, 9.00, 6.65%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

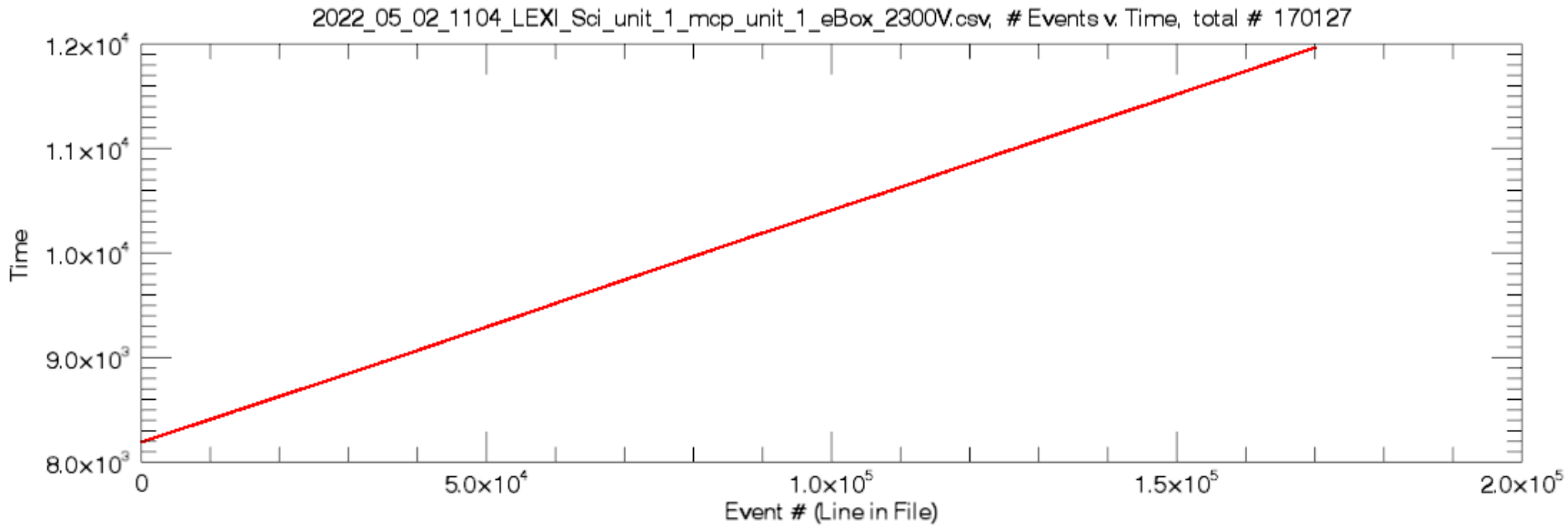

CPS 11.64, 9.00, 12.00, 27.24%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)

- @2300V
- (W6) “Reduced Data” 2D histogram plots, only including events where the PHD is between 5.0 and 6.0

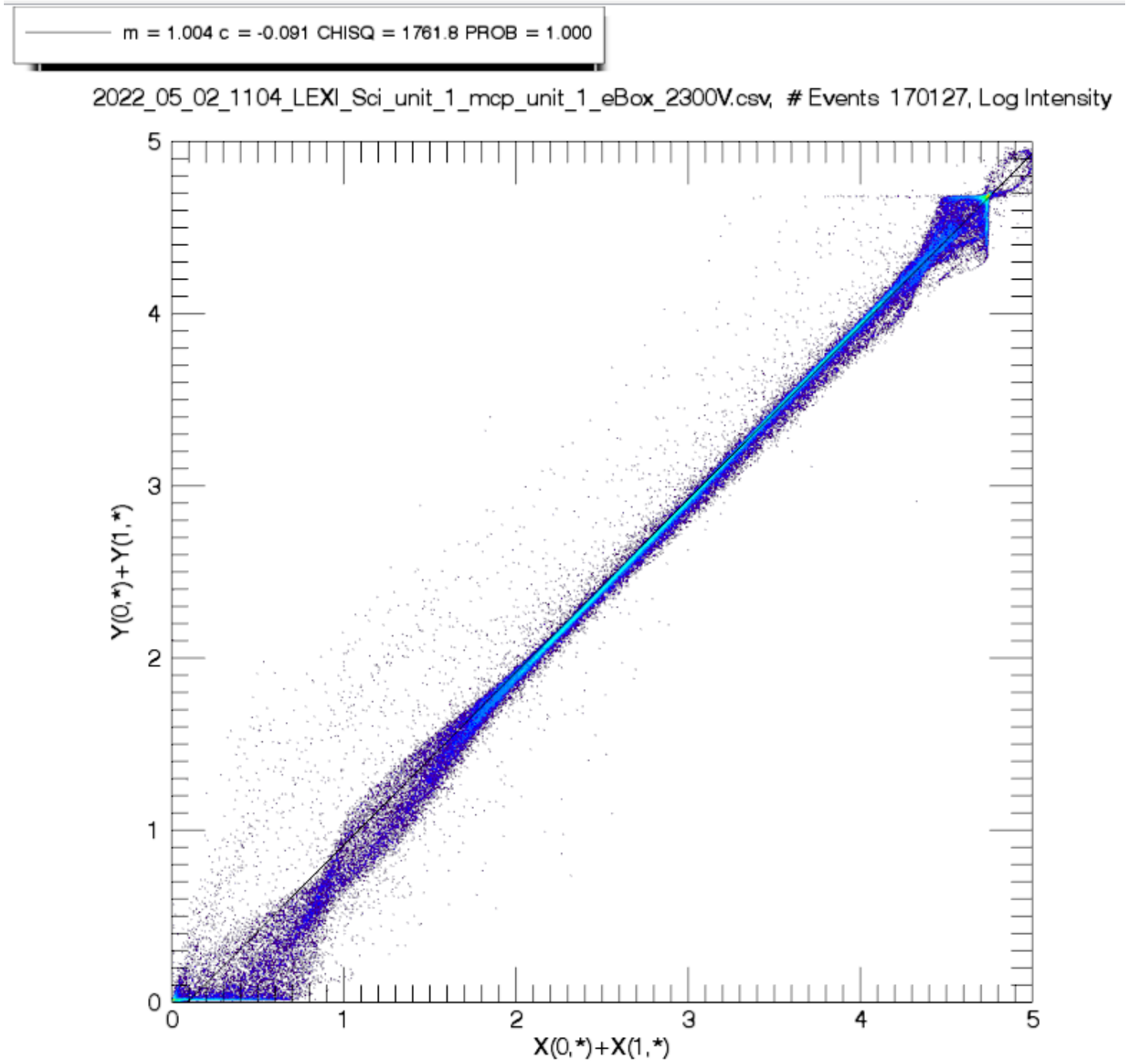


- @2300V
- Plotting events as fn time

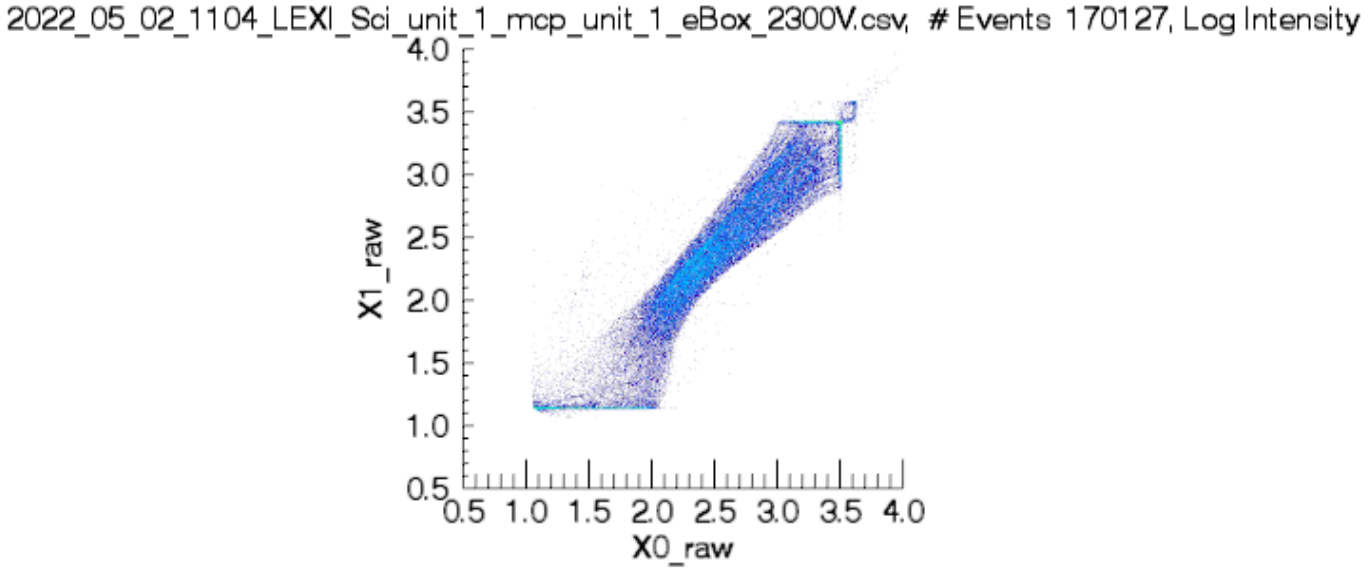


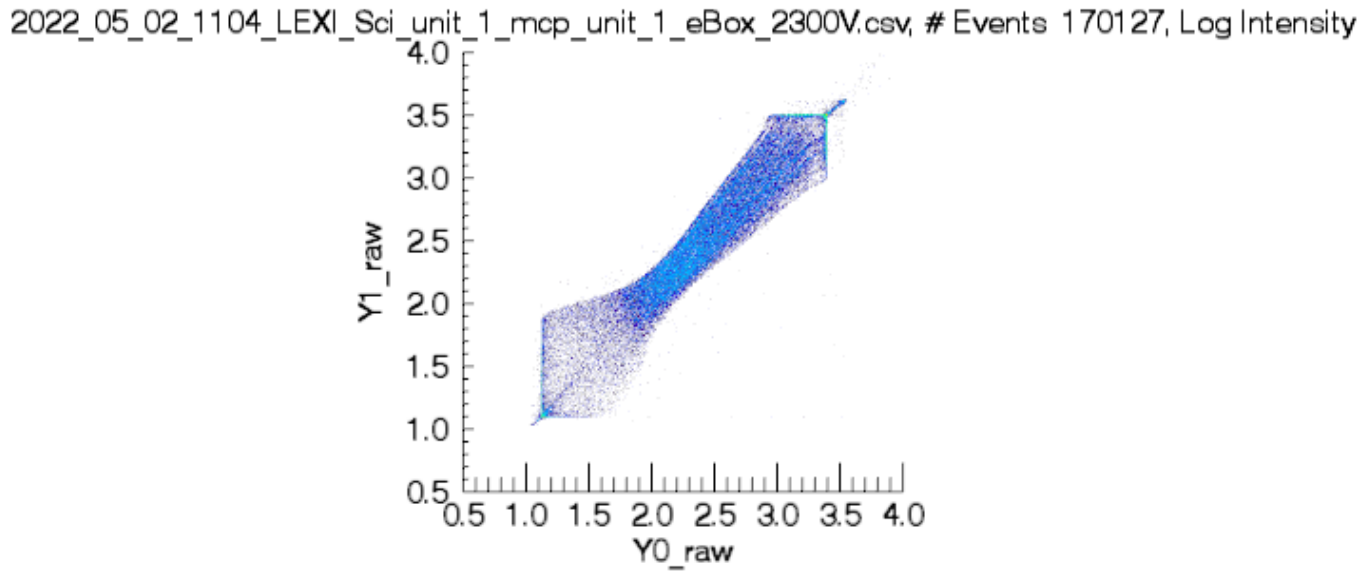


- @2300V

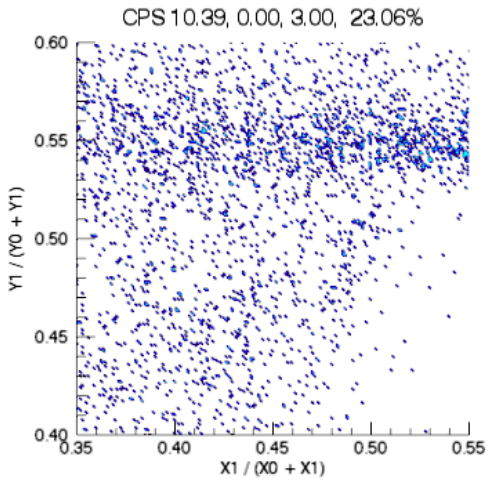

m = 1.004 c = -0.091 CHISQ = 1761.8 PROB = 1.000
2022_05_02_1104_LEXI_Sci_unit_1_mcp_unit_1_eBox_2300V.csv, # Events 170127, Log Intensity
Y(0,*)+Y(1,*)
X(0,*)+X(1,*)
0
1
2
3
4
5

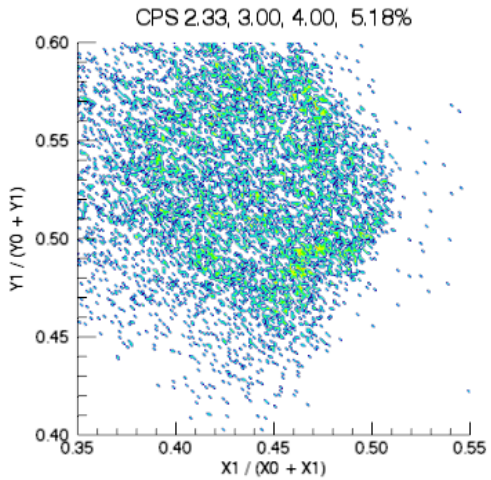
- @2300V

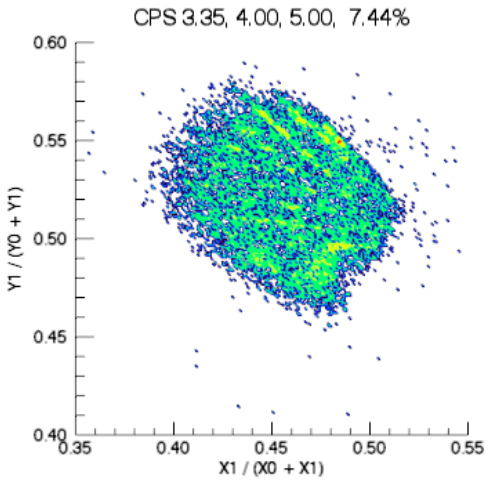

2022_05_02_1104_LEXI_Sci_unit_1_mcp_unit_1_eBox_2300V.csv, # Events 170127, Log Intensity
X1_raw
X0_raw
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0

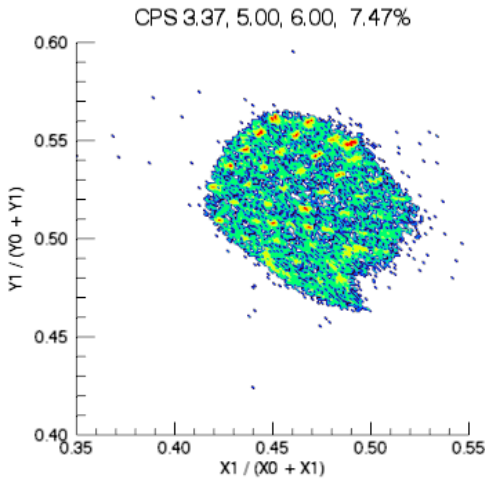

2022_05_02_1104_LEXI_Sci_unit_1_mcp_unit_1_eBox_2300V.csv, # Events 170127, Log Intensity
Y1_raw
Y0_raw
4.0
3.5
3.0
2.5
2.0
1.5
1.0
0.5
0.5 1.0 1.5 2.0 2.5 3.0 3.5 4.0

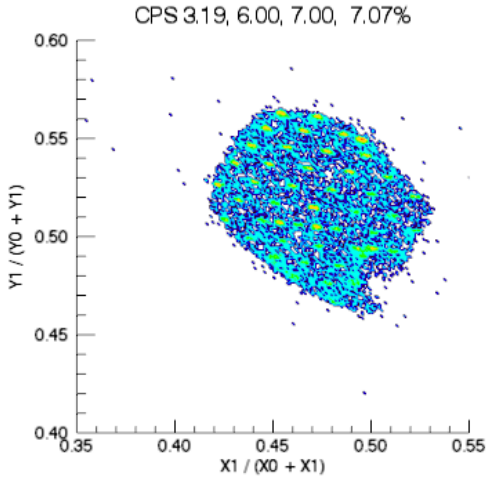
- @2300V

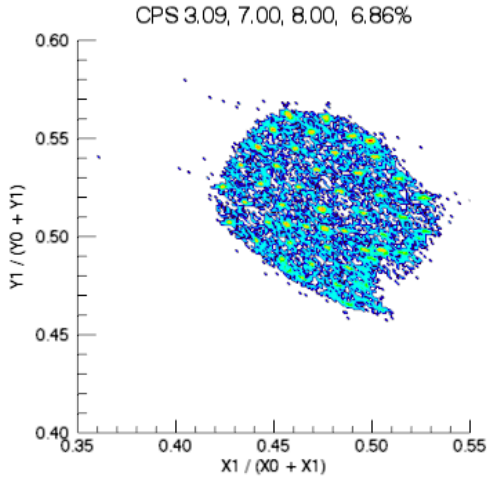

CPS 10.39, 0.00, 3.00, 23.06%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)
0.60
0.55
0.50
0.45
0.40
0.35
0.40
0.45
0.50
0.55

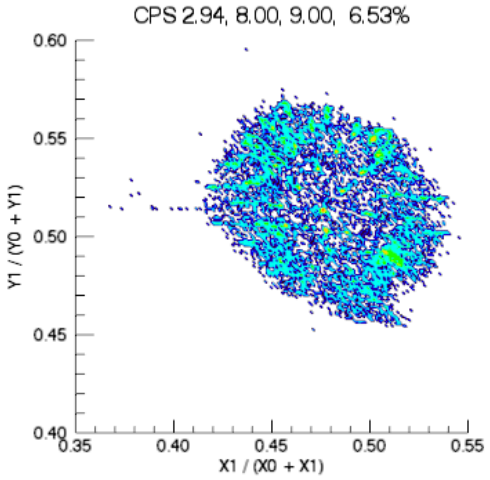

CPS 2.33, 3.00, 4.00, 5.18%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)
0.60
0.55
0.50
0.45
0.40
0.35
0.40
0.45
0.50
0.55

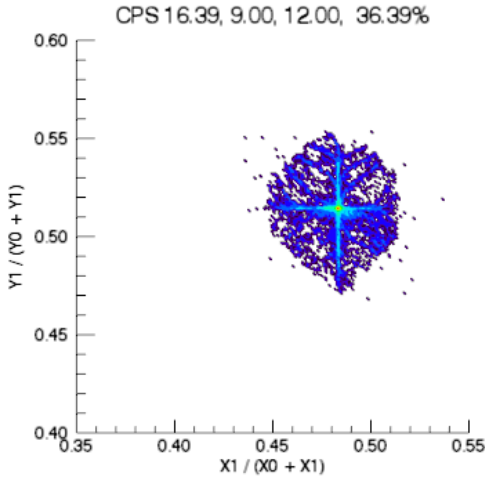

CPS 3.35, 4.00, 5.00, 7.44%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)
0.60
0.55
0.50
0.45
0.40
0.35
0.40
0.45
0.50
0.55


CPS 3.37, 5.00, 6.00, 7.47%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)
0.60
0.55
0.50
0.45
0.40
0.35
0.40
0.45
0.50
0.55


CPS 3.19, 6.00, 7.00, 7.07%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)
0.60
0.55
0.50
0.45
0.40
0.35
0.40
0.45
0.50
0.55

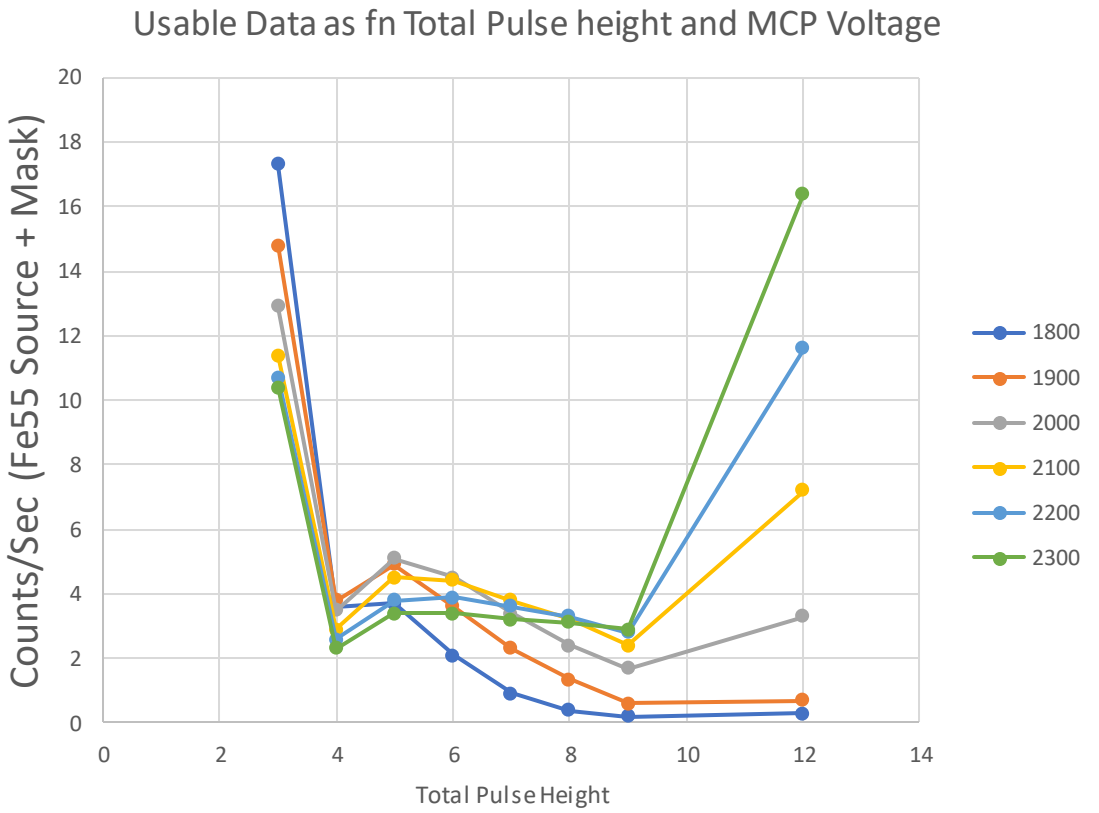

CPS 3.09, 7.00, 8.00, 6.86%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)
0.60
0.55
0.50
0.45
0.40
0.35
0.40
0.45
0.50
0.55


CPS 2.94, 8.00, 9.00, 6.53%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)
0.60
0.55
0.50
0.45
0.40
0.35
0.40
0.45
0.50
0.55


CPS 16.39, 9.00, 12.00, 36.39%
Y1 / (Y0 + Y1)
X1 / (X0 + X1)
0.60
0.55
0.50
0.45
0.40
0.35
0.40
0.45
0.50
0.55

- Summary
- From the previous plots
- The A111 Charge Sensitive PreAmps have a limited usable dynamic range.
- Charge Cloud output from MCP ideally form a gaussian distribution.
- The amplitude is a function of the MCP, applied HV and countrate.
- This is shared among the 4 anodes.
- Often there is a large exponential decaying contribution.
- Increasing the MCP voltage moves the distribution upwards.
- Choosing the appropriate voltage is a balance between the voltage being too small so that there are a large number of events in the "noise" or the voltage being too high such that the A111's o/p saturate, and pulse heights are meaningless.
- To get usable data the sum on the pulse heights must lie between 5 and 8 Volts.
- The max # usable Counts/sec occurs when we have Unit 1 MCP set to 2100V

Thr_Low	Thr_Hi	MCP Voltage						
		1800	**1900**	**2000**	**2100**	**2200**	**2300**	
0	3	17.3	14.8	12.9	11.4	10.7	10.4	
3	4	3.6	3.8	3.5	2.9	2.6	2.3	
4	5	3.7	4.9	5.1	4.5	3.8	3.4	
5	6	2.1	3.6	4.5	4.4	3.9	3.4	Usable data
6	7	0.9	2.3	3.4	3.8	3.6	3.2	Usable data
7	8	0.4	1.35	2.4	3.2	3.3	3.1	Usable data
8	9	0.2	0.6	1.7	2.4	2.8	2.9	
9	12	0.3	0.7	3.3	7.2	11.6	16.4	
		3.4	7.25	10.3	11.4	10.8	9.7	



Test Mask Orientation

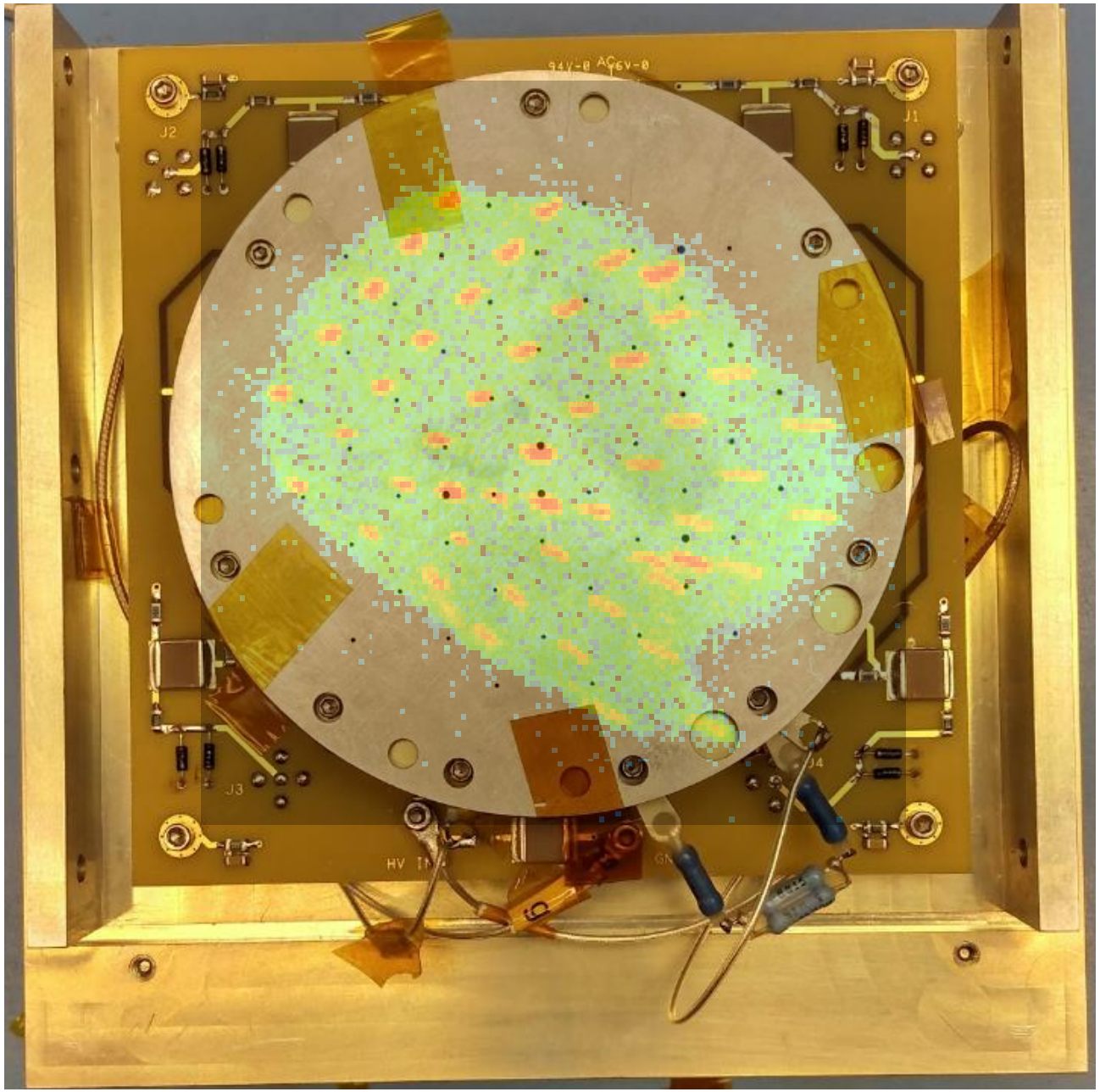
Attempt to overlay the plot on to the MASK..

This id for MCP = 2100V case
Sum Pulse Heights of Events from 5-6

There is a coupling between the X and Y axis
(Image is rotated CW a little)

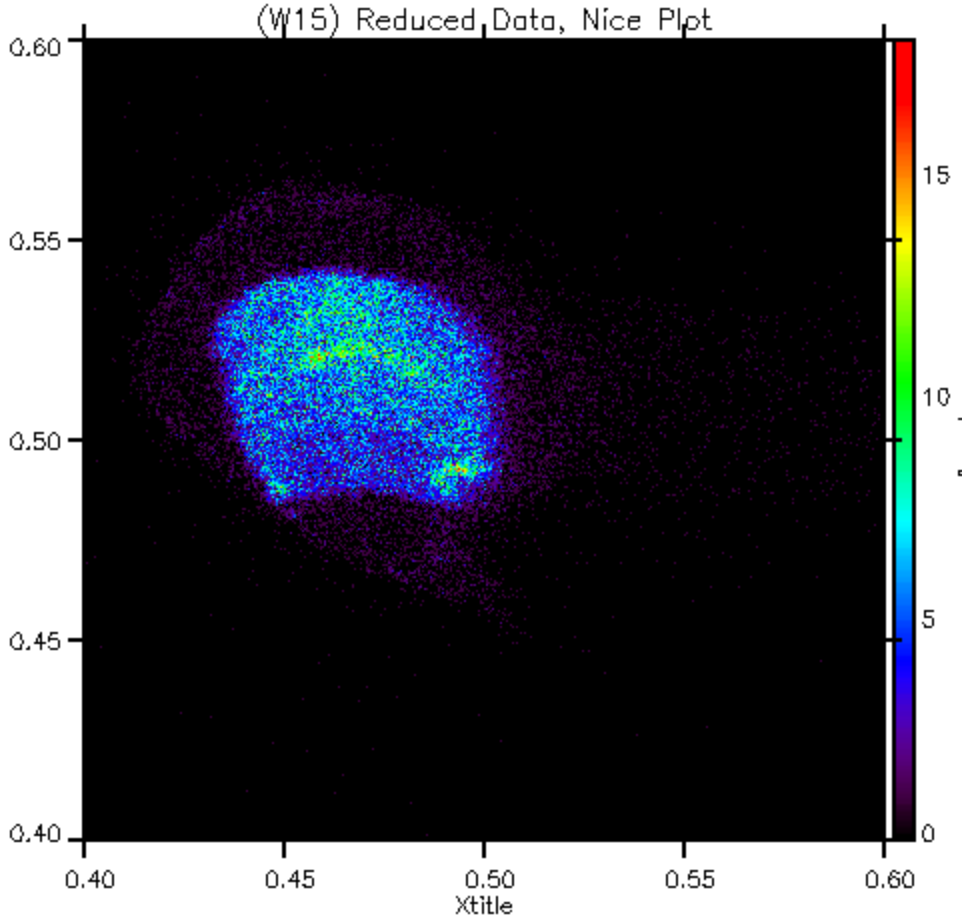
Also the pixel to mm is not linear along either axis.

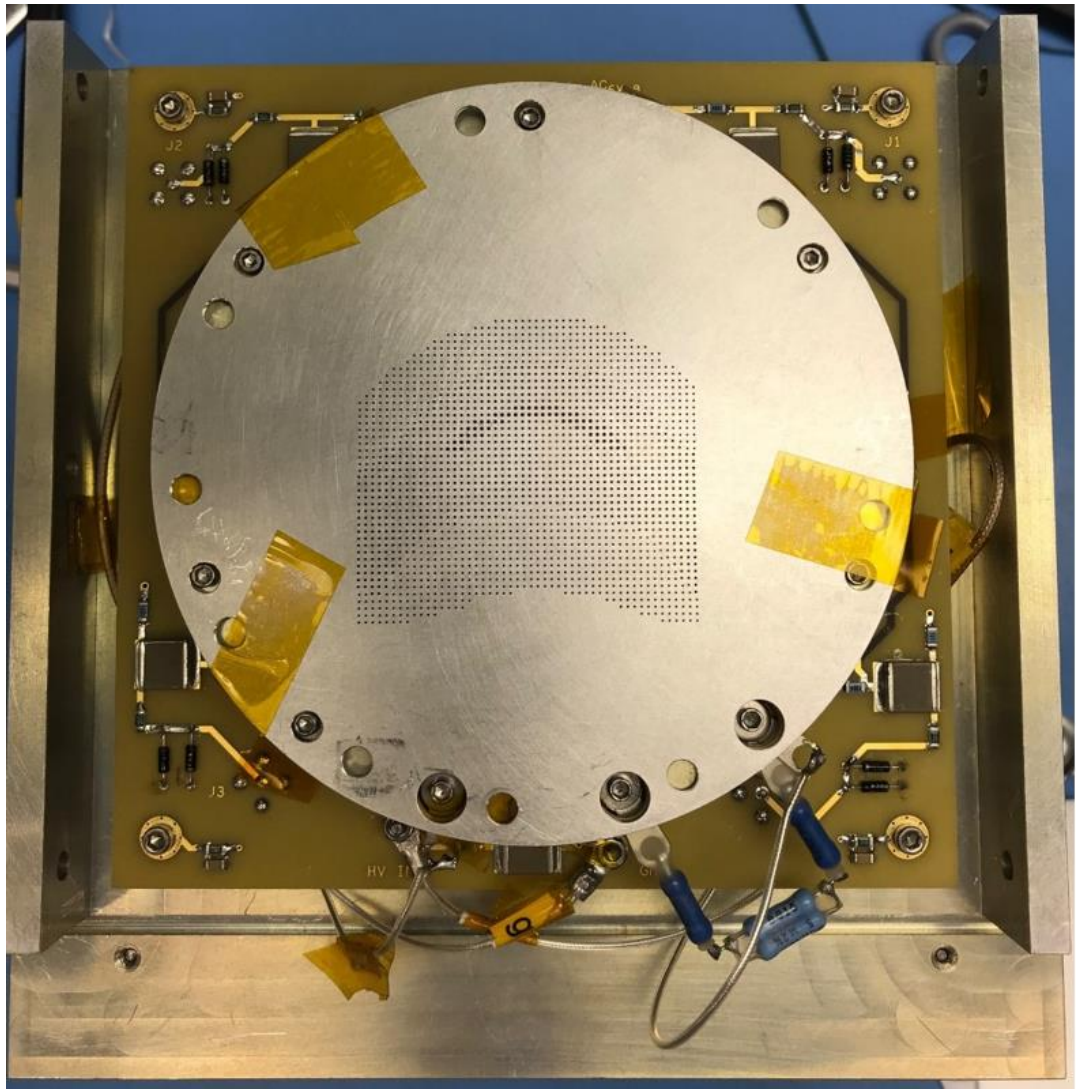
It should be possible to come up with a pixel to mm method to



Mask #2, Simulates Magnetopause?

- Linear Intensity
- 2048 Channels





@2225V

- Using Manetopause Mask