Updates on HRPPD #25 activities

Mapping, position scans, etc.

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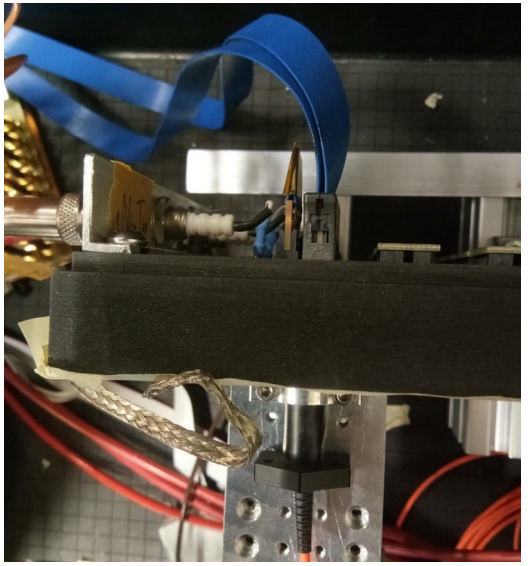
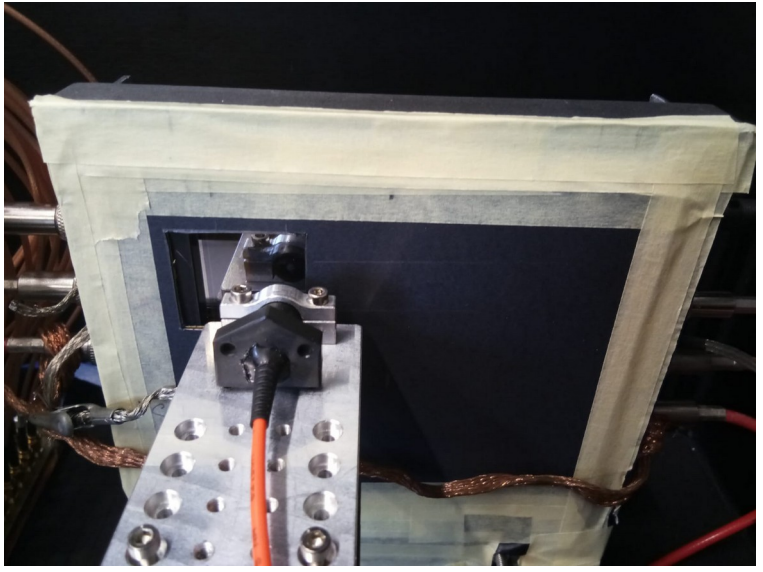
01/04/2025

Outline

- Mapping – Pixels to Samtec Pins
- Position scans of pixels
- Amplitude vs light intensity
- Preparation of adapter card



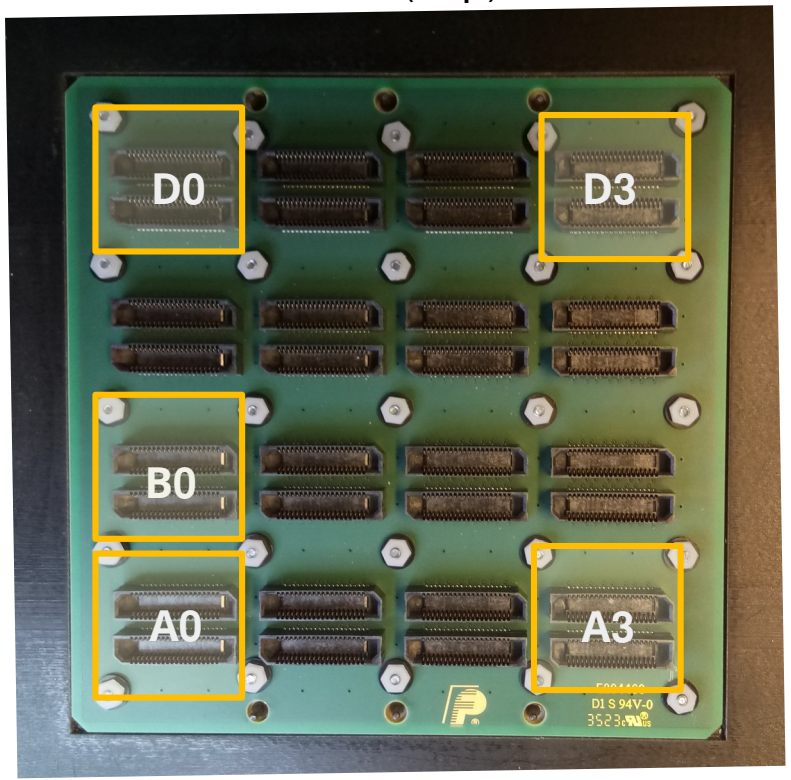
32 Single pads read by bread board arrangement



Modified hole: 35 mm hor. X 30 mm vert.

Mapping

PC (Top)



G (bottom)

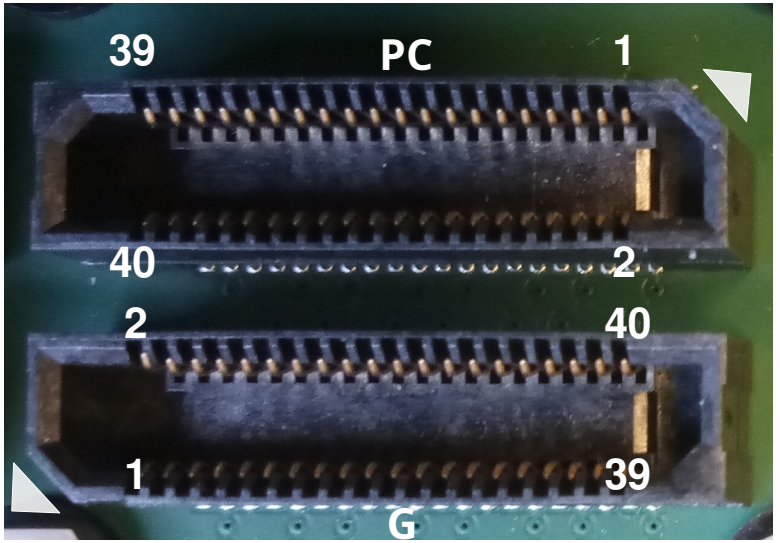
Light spot of ~ 2 mm diameter falls on the HRPPD window

↓

A **pixel** fires

↓

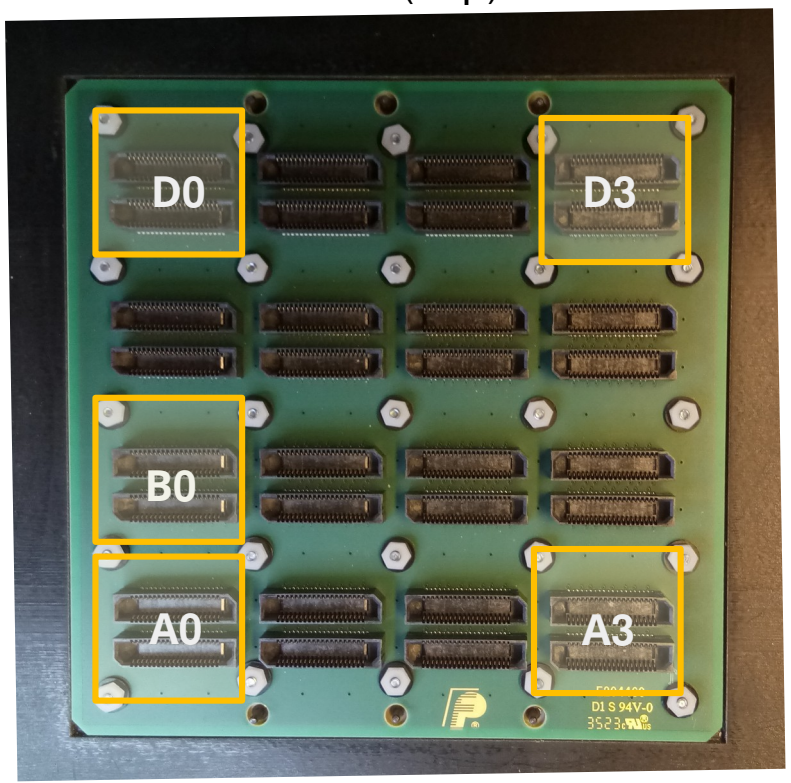
The corresponding **Samtec Pin** detects the signal



Standard naming convention of Samtec Pins

Mapping

PC (Top)



G (bottom)

Light spot of ~ 2 mm diameter falls on the HRPPD window

↓

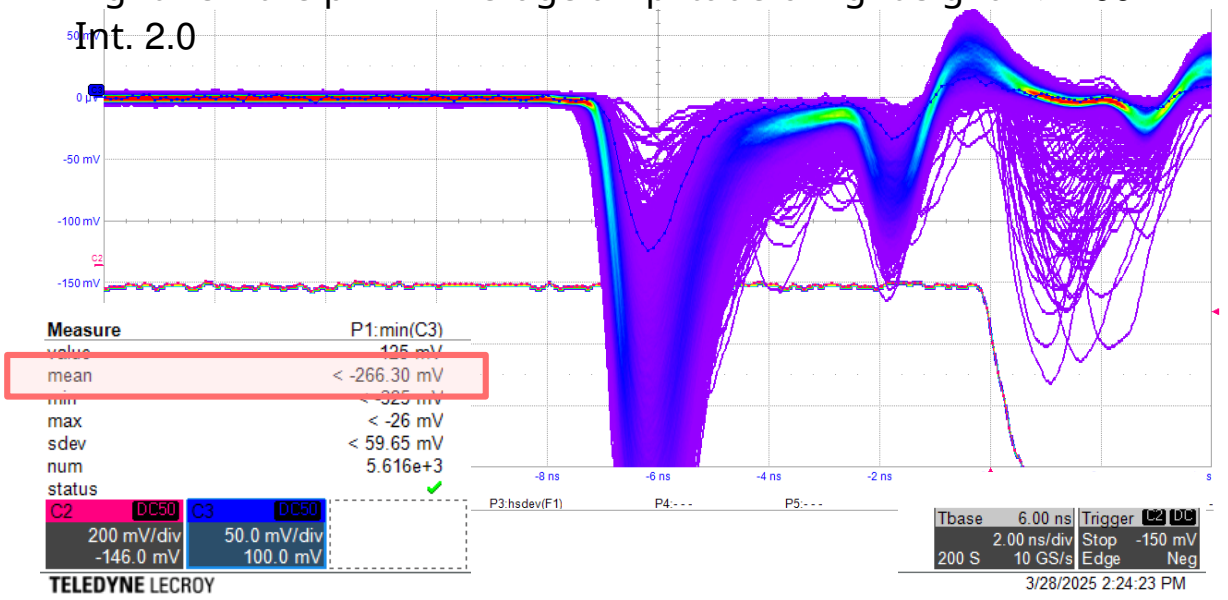
A **pixel** fires

↓

The corresponding **Samtec Pin** detects the signal

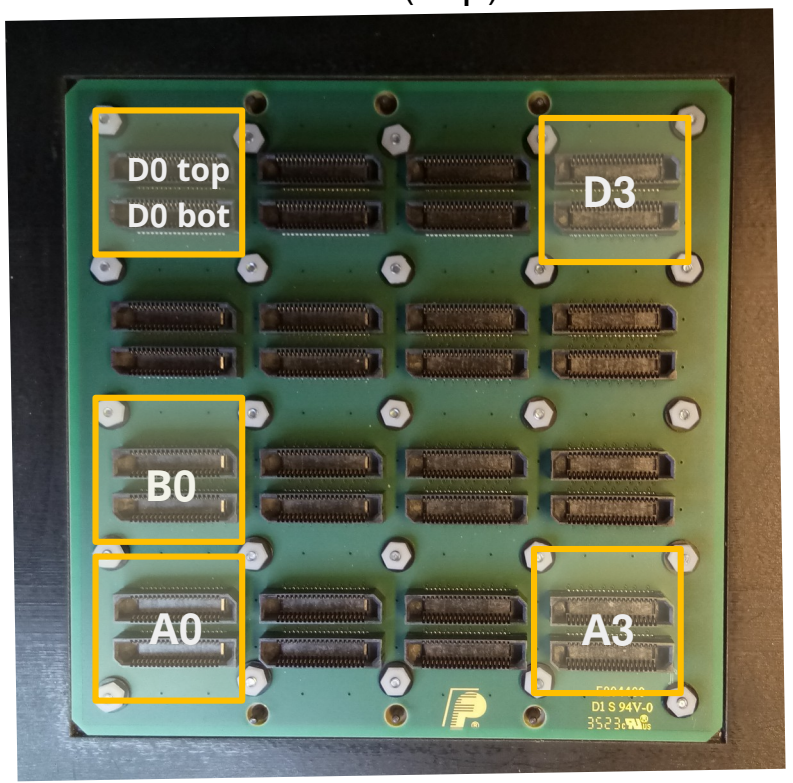
Light “On the pin” - Average amplitude of light signal > 200 mV

Int. 2.0



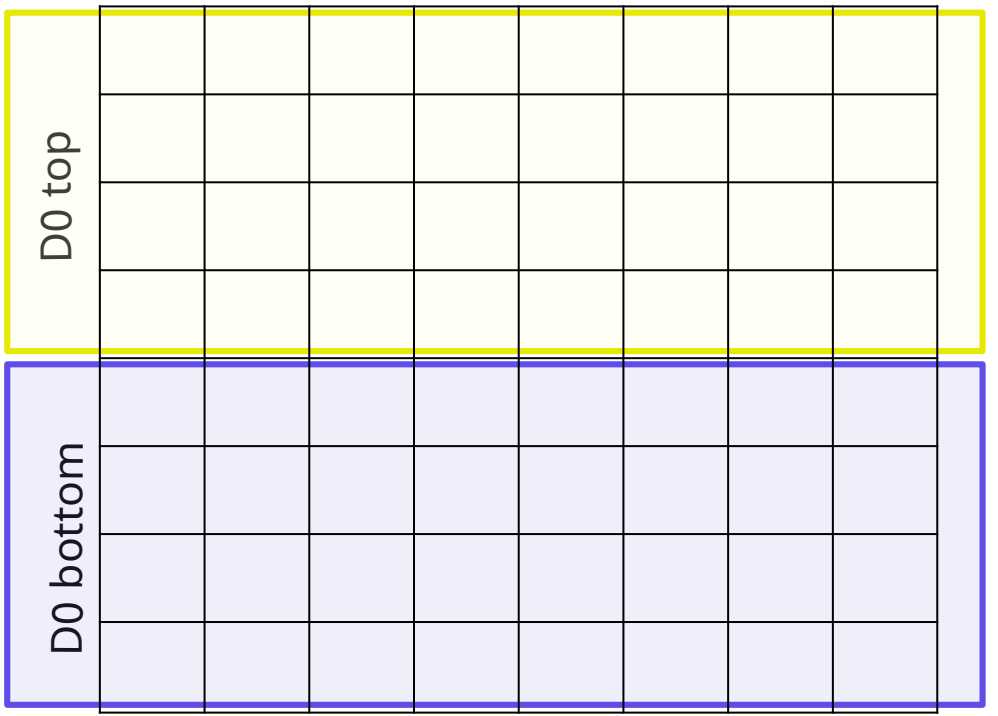
Mapping – group D0

PC (Top)



G (bottom)

PC (Top)

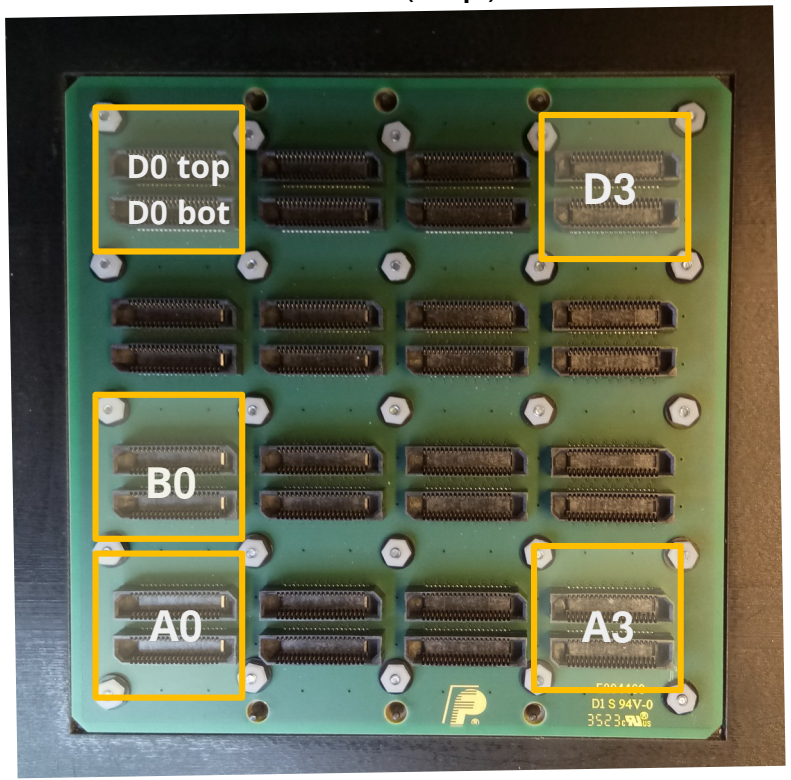


G (bottom)

Mapping – group D0

Rear End View

PC (Top)



G (bottom)

PC (Top)

D0 top	37?	27	33	23	19	14	11	9
	34	39?	29	24	20	13	3	10
	30	40?	31	21	17	7	4	1?
	38	28	32	22	18	8	12	2?
D0 bottom	2	12	8	18	22	32	28	38
	1	4	7	17	21	31?	40	37
	10	3	13	20	24	29	39?	34
	9	11	14	19	23	30	27	33

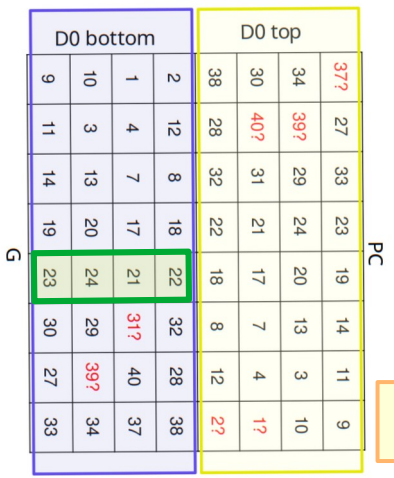
G (bottom)

Pin numbers on Anode pads

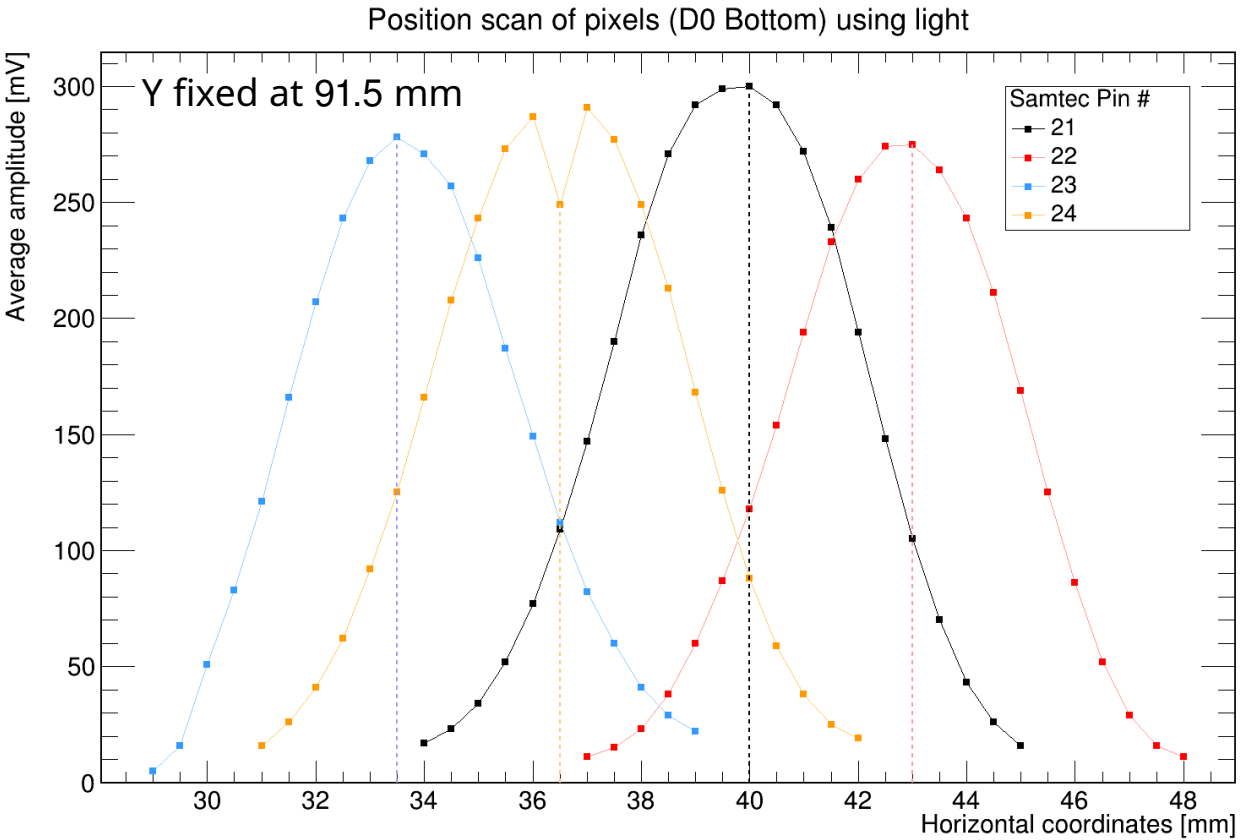
In Red – seems connection broken

Horizontal scan of pixels

- Average amplitude of ~ 2k events as a function of position
- In a step of 0.5 mm
- -200_-700_-200-700_-30 V
- Light intensity 2.0
- Trigger at -150 mV on Laser sync pulse (1.2 V_{RMS}) of rate 1.0 kHz



Rear End View



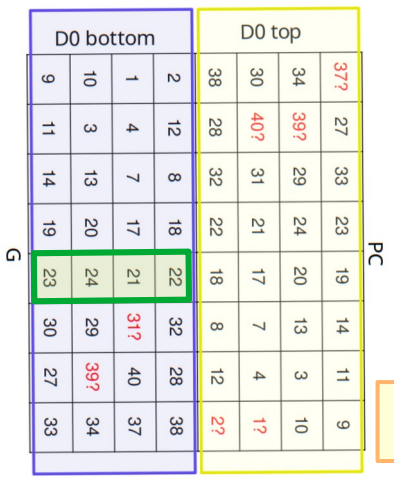
X_{centre} [mm] 33.5 36.5 40 43

Observed Pitch 3-3.50 mm

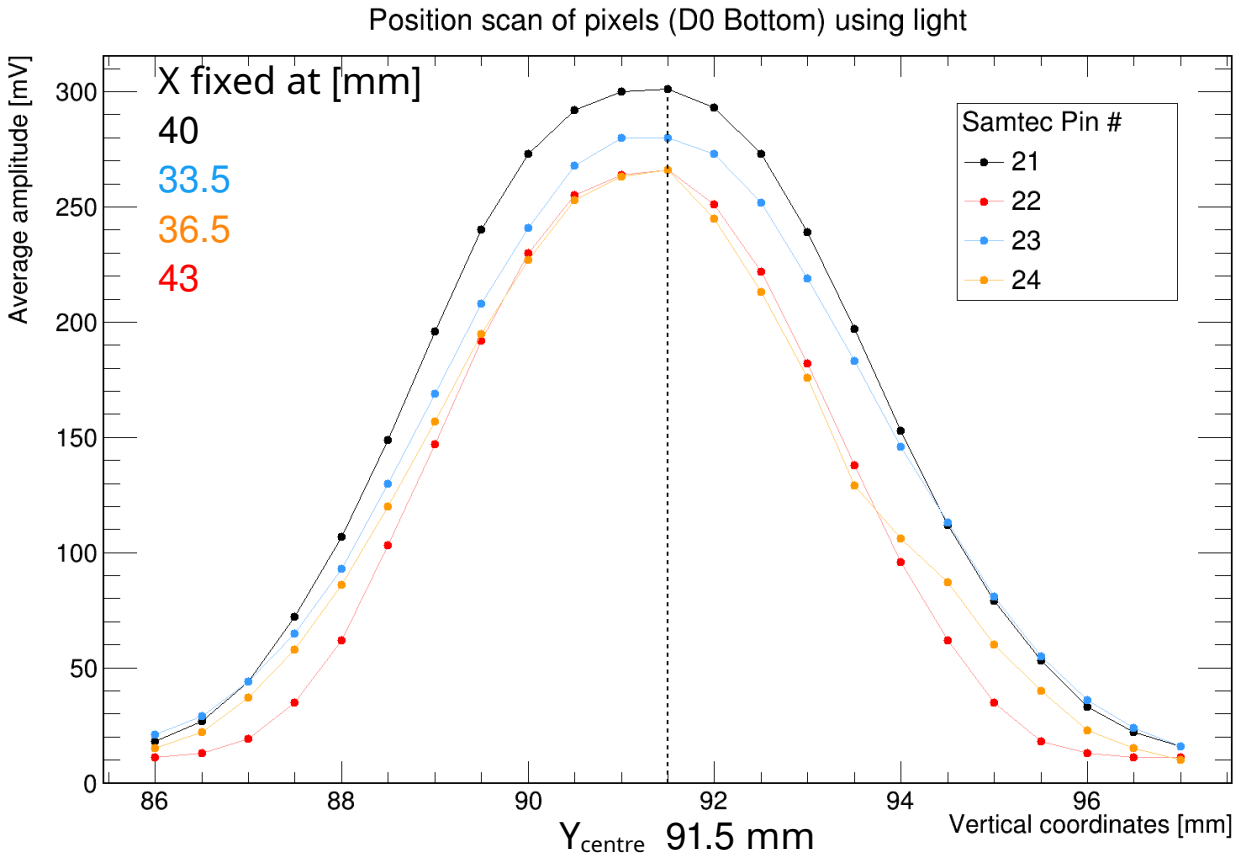
Expected pitch 3.25 mm

Vertical scan of pixels

- Average amplitude of ~ 2k events as a function of position
- In a step of 0.5 mm
- -200_-700_-200-700_-30 V
- Light intensity 2.0
- Trigger at -150 mV on Laser sync pulse (1.2 V_{RMS}) of rate 1.0 kHz

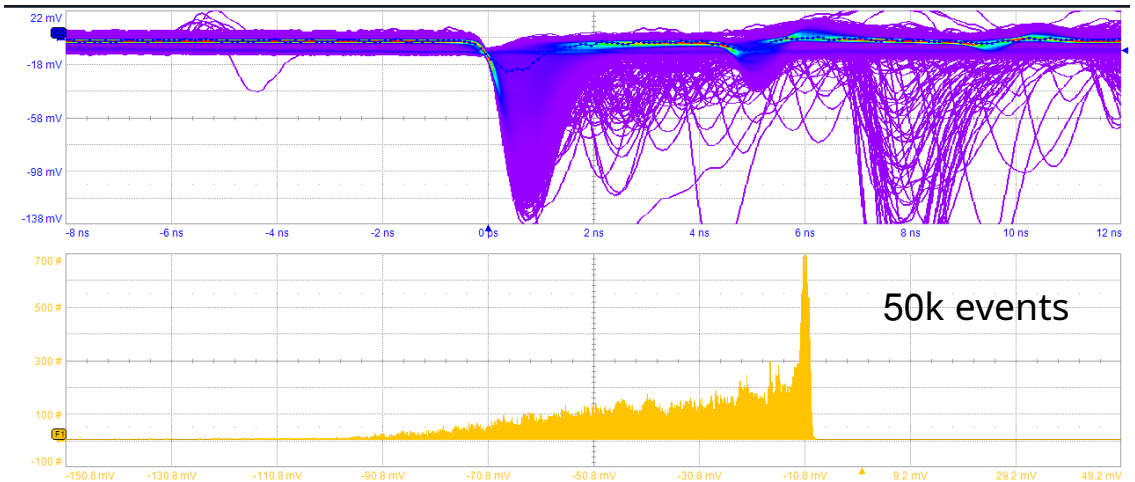


Rear End View



Pulse height distribution

Pin #29 D0 bottom



Measure	P1:min(C3)	P2:hmean(F1)
value	-23.5 mV	< -36.9 mV
mean	< -36.85 mV	< -36.9 mV
min	< -148.0 mV	< -36.9 mV
max	< -8.5 mV	< -36.9 mV
sdev	< 22.60 mV	---
num	51.012e+3	1
status	✔	

C3 DC50 20.0 mV/div 58.00 mV | F1 hist(P1) 100 #/div 20.0 mV/div 50.000 k#

TELEDYNE LECROY

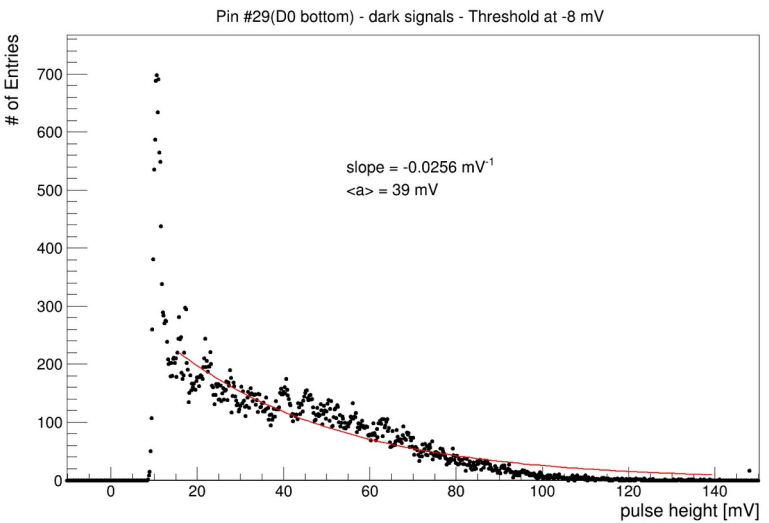
Tbase -2.00 ns | 2.00 ns/div | 200 S | 10 GS/s

Trigger C3 DC | Stop -8.0 mV | Edge Neg

3/31/2025 11:51:39 AM

- Dark signals
- Trigger at -8 mV
- Plot the histogram of the minimum of the waveform (signal amplitude of the event)
- Save the histogram and analyse and find the average pulse height

- Repeat for light signal of different intensities

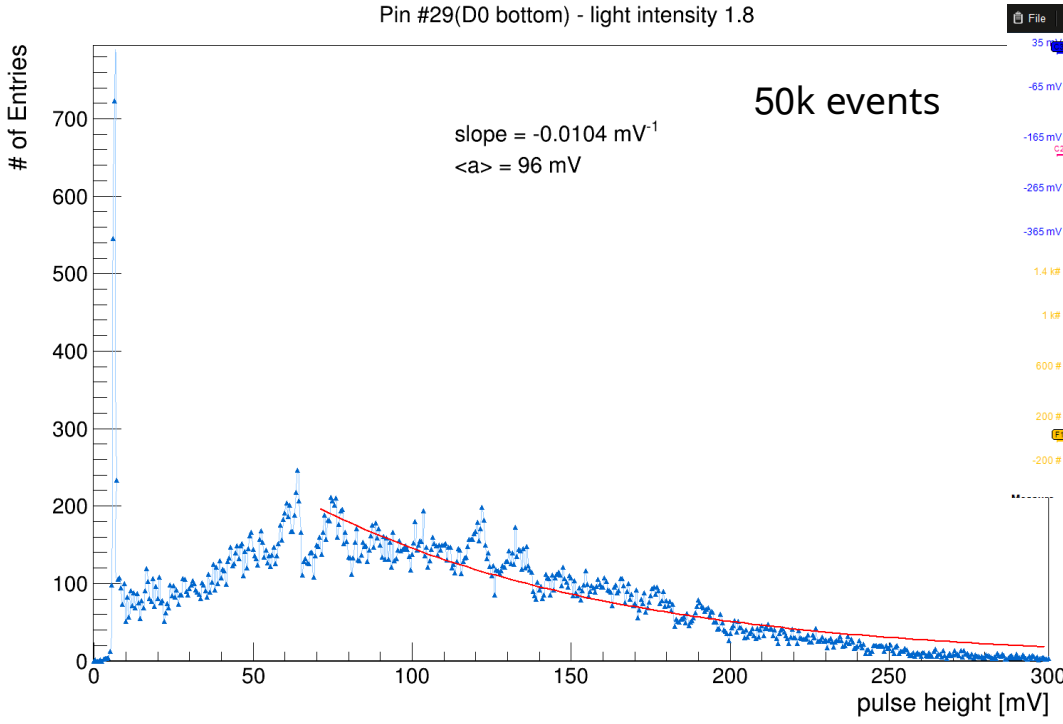


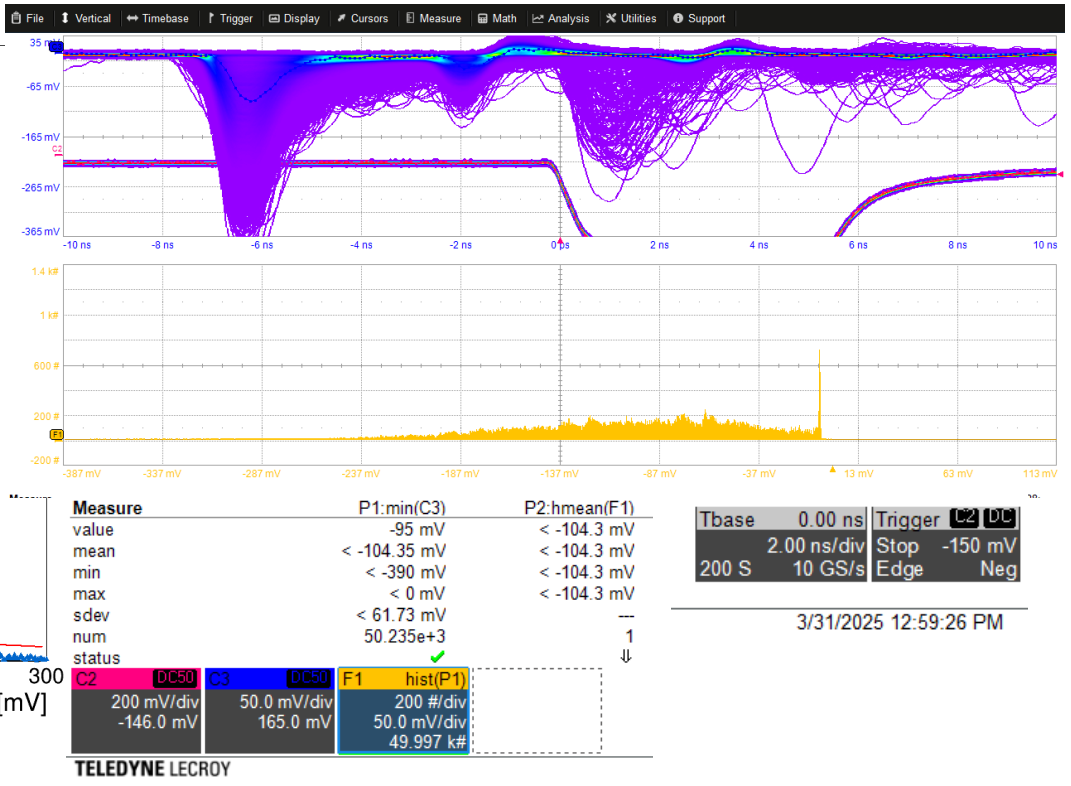
y=exp(p0+p1*x)

<a> = 1/-p1

Pulse height distribution

Pin #29 D0 bottom





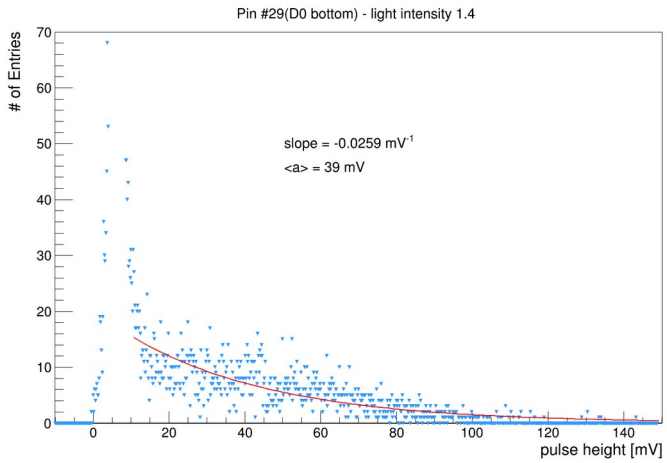
y=exp(p0+p1*x)

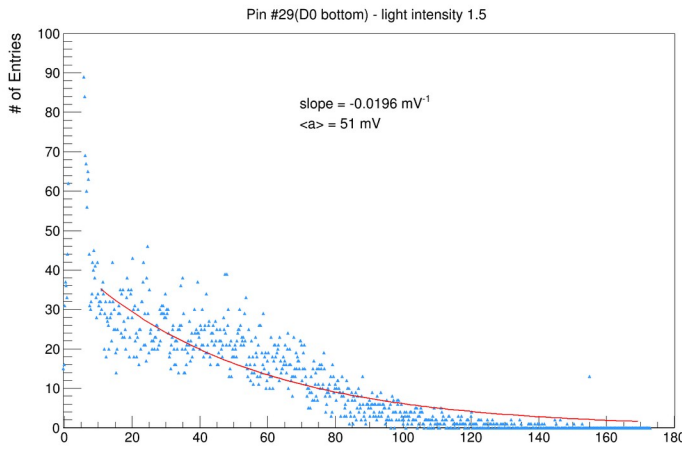
<a> = 1/-p1

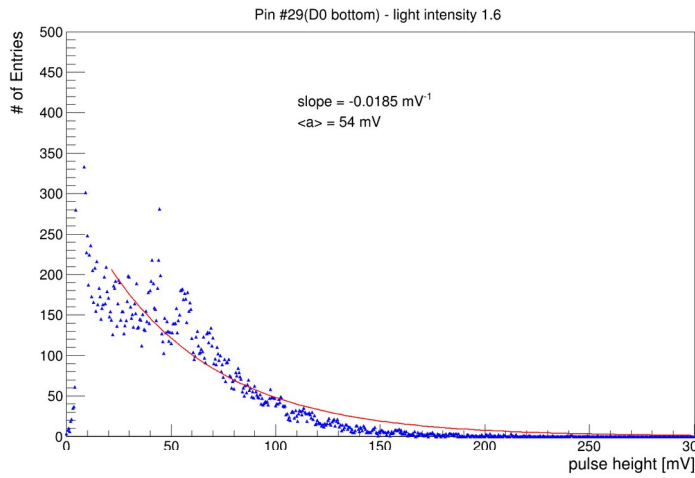
Pulse height distribution

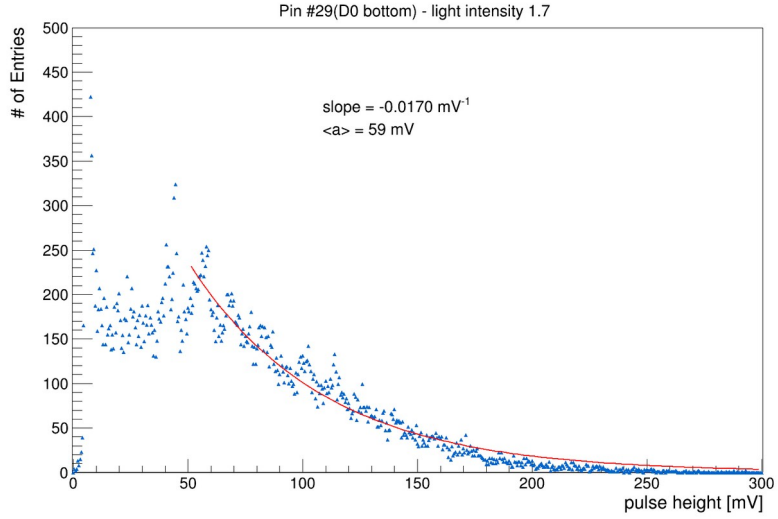
50k events

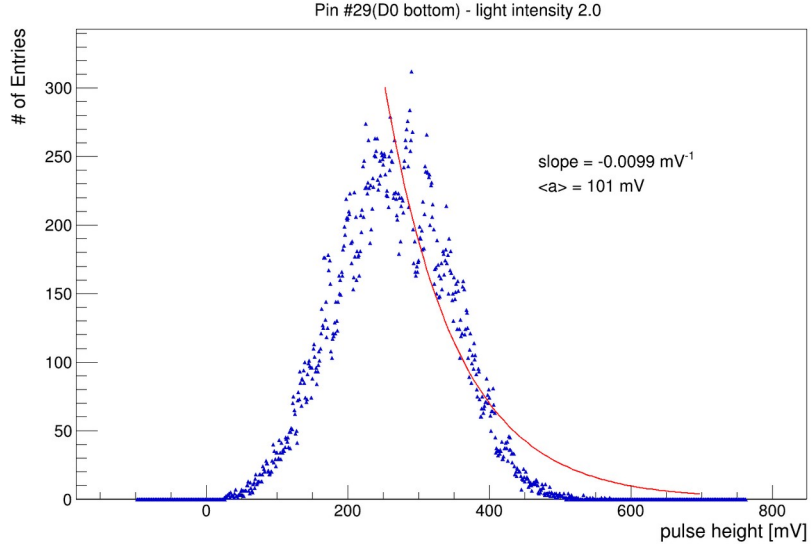
Pin #29 D0 bottom









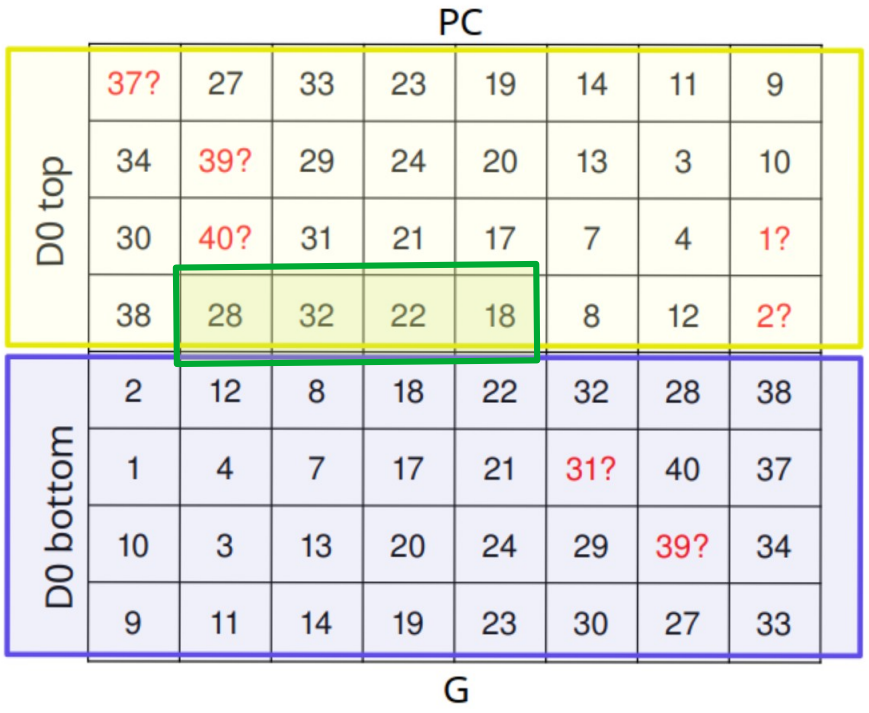


Pulse height distribution

Pin #29 D0 bottom

Light Intensity	Average pulse height [mV] (#ofPh)	
	Root	Scope Analysis
2.0	101 (3)	263 (7)
1.8	96 (2.5)	104
1.7	59 (1.5)	61
1.6	54 (1.4)	30
1.5	51 (1.3)	10
1.4	39 SPE	8
1.3	x	x
Dark signals -8 mV	39 SPE	37

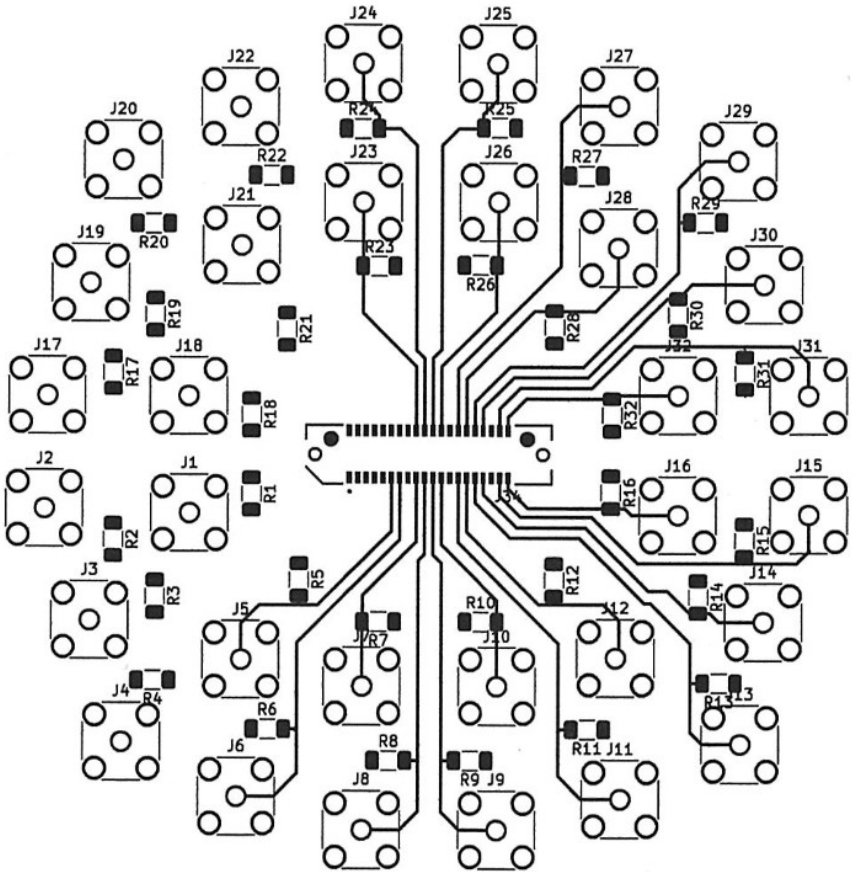
Dark count rates



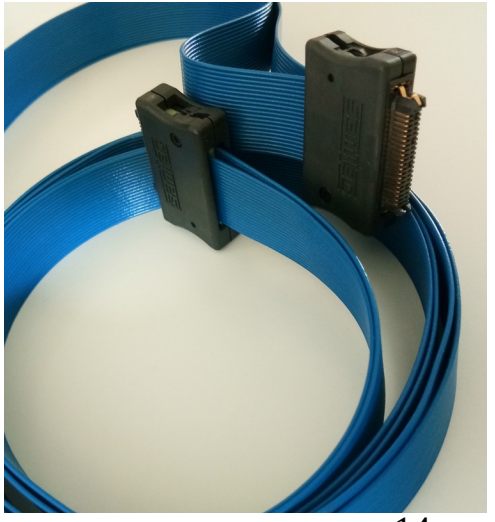
Using discriminator (Th -7 mV) and Scalar module

Pin #	28	32	22	18
Counts [Hz/9 mm^2]	20	180	900	500
DCR [Hz/cm^2]	0.2k	2k	10k	5.5k

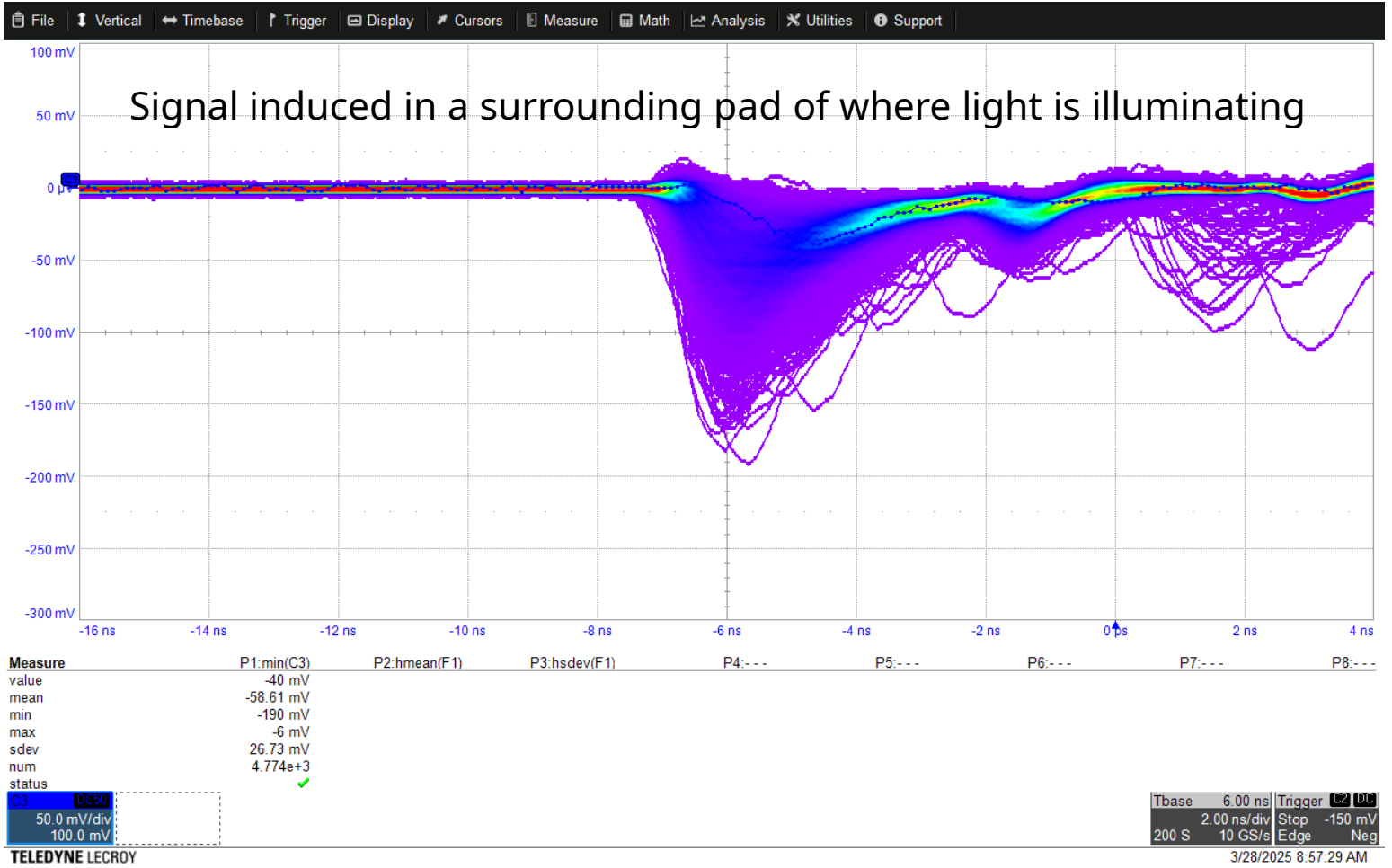
PCB preparation



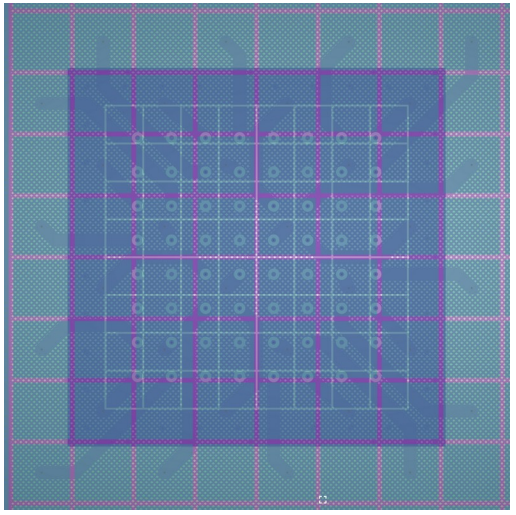
- Substitute for the bread board with SMA connectors
- Read 32 pads individually
- Connection between backplane and PCB – μ Coax with Samtec male connectors on both sides



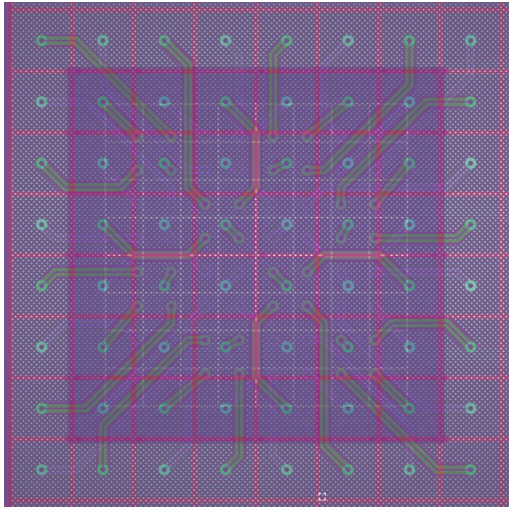
- Each Pixel connected to resistors (~ 1 kΩ)


File
Vertical
Timebase
Trigger
Display
Cursors
Measure
Math
Analysis
Utilities
Support
Signal induced in a surrounding pad of where light is illuminating
100 mV
50 mV
0 µV
-50 mV
-100 mV
-150 mV
-200 mV
-250 mV
-300 mV
-16 ns
-14 ns
-12 ns
-10 ns
-8 ns
-6 ns
-4 ns
-2 ns
0 ps
2 ns
4 ns
Measure
P1:min(C3)
P2:hmean(F1)
P3:hsdev(F1)
P4:- - -
P5:- - -
P6:- - -
P7:- - -
P8:- - -
value -40 mV
mean -58.61 mV
min -190 mV
max -6 mV
sdev 26.73 mV
num 4.774e+3
status
C3 DC50
50.0 mV/div
100.0 mV
Tbase 6.00 ns
2.00 ns/div
200 S 10 GS/s
Trigger C2 DC
Stop -150 mV
Edge Neg
TELEDYNE LECROY
3/28/2025 8:57:29 AM

Complex routing



Layer 1



Layer 2

56	57	58	59	60	61	62	63
48	49	50	51	52	53	54	55
40	41	42	43	44	45	46	47
32	33	34	35	36	37	38	39
24	25	26	27	28	29	30	31
16	17	18	19	20	21	22	23
8	9	10	11	12	13	14	15
0	1	2	3	4	5	6	7

32 - 63

0 - 31

Anode pad numbering (Vacuum side)

Mapping

49	56	43	59	60	53	61	45
40	42	57	50	44	62	54	63
34	48	58	51	52	36	55	46
32	41	33	35	47	38	37	39
24	26	25	2	28	30	22	31
17	8	27	11	12	5	15	29
16	18	1	19	13	6	21	23
9	0	10	3	4	20	7	14

Layer1 /Layer2

# of Anode pads written on RO pads

- Cells represent Air side pads
- Numbers represent vacuum side pads

Complex routing

Alexander's

33	27	30	23	19	9	11	1
34	39	21	24	20	13	7	10
37	32	31	29	17	3	4	18
38	28	40	22	14	8	12	2
2	12	8	14	22	40	28	38
1	4	7	17	29	31	32	37
10	3	13	20	24	21	39	34
9	11	18	19	23	30	27	33

Correct one is in the next slide

Do NOT match with ours
36% does not match

Measured (D0)

?	27	33	23	19	14	11	9
34	?	29	24	20	13	3	10
30	?	31	21	17	7	4	?
38	28	32	22	18	8	12	?
2	12	8	18	22	32	28	38
1	4	7	17	21	?	40	37
10	3	13	20	24	29	?	34
9	11	14	19	23	30	27	33

Signal / induced signal NOT found in any pad

Complex routing – Corrected/Latest (2 April)

Alexander's

33	27	30	23	19	9	11	1
34	39	29	24	20	13	3	10
37	40	31	21	17	7	4	14
38	28	32	22	18	8	12	2
2	12	8	18	22	32	28	38
1	4	7	17	21	31	40	37
10	3	13	20	24	29	39	34
9	11	14	19	23	30	27	33

Do NOT match with ours
Corrected

Measured (A0)

37	27	33	?	19	14	11	9
34	39	29	24	20	13	3	10
30	40	31	21	17	7	4	1
38	28	32	22	?	8	12	2
2	12	8	18	22	32	28	38
1	4	7	17	21	31	40	37
10	3	13	20	24	29	39	34
9	11	14	19	23	30	27	33

Signal / induced signal NOT found in any pad