

Updates on HRPPD #25 activities

Noise and Signals

Weekly Meet

Chandra, Fulvio, Jinky

04/03/2025

Outline

- Signals from Anode
 - Dark signal / light signal / with bread board / without bread board
- Noise and dark signals (single pads)
- Light signals from single pads

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Signals from Anode

Recap

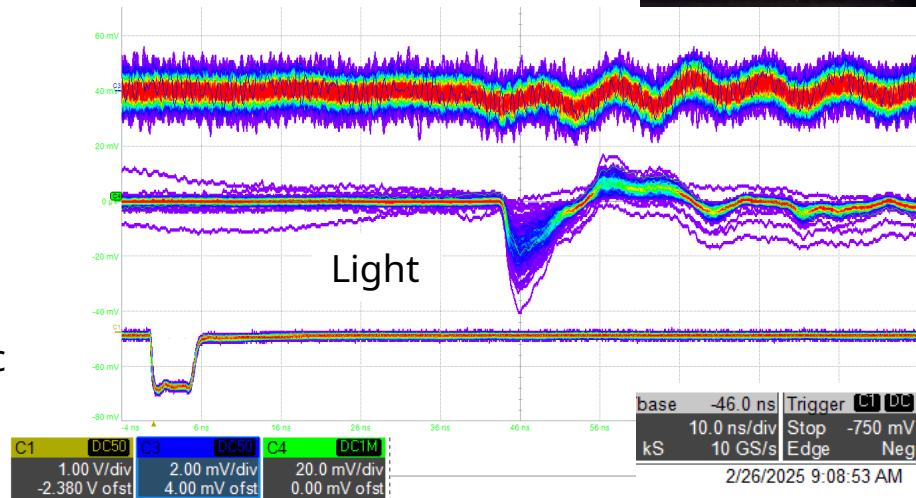
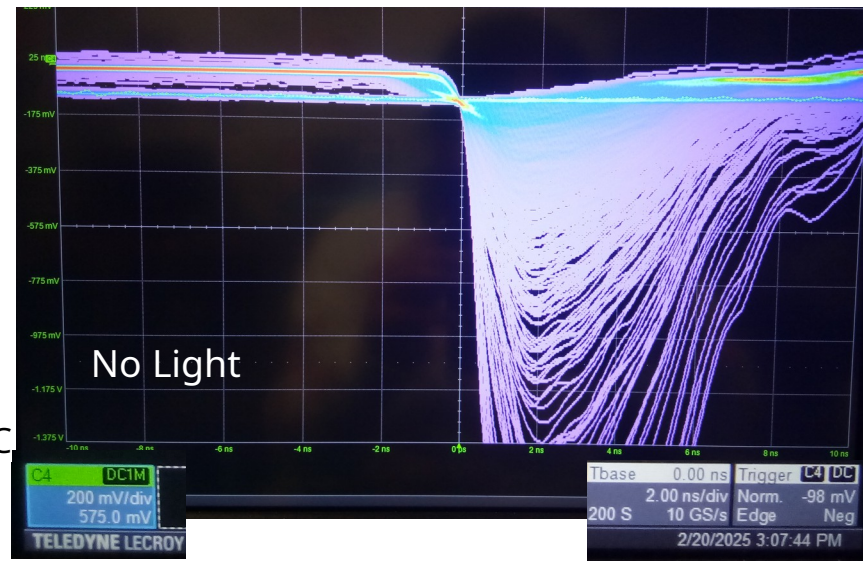
With Bread Board (15 Grounding caps)

Anode HV electrode is a common output of:

- (1024 – 32) Anode and RO pads, Guard rings, Samtec connector pins
- Floating (HRPPD Internal Grounding via grounding caps)
- Put together in the oscilloscope via 50 Ω

HV configuration: -200_-675_-200_-675_-30 V @ XoX_NoX_XoN_NoN_PC

- Reasonable signals (standard shape, fast rising edge ~ 1 ns)
- Large amplitudes (> -100 mV) observed (due to large noise)
- Low rate ($\sim$ Hz)
- Both dark and light signals are observed
- Light signals ($\sim$ few tens of mV) synchronised with Laser sync after ~ 45 ns

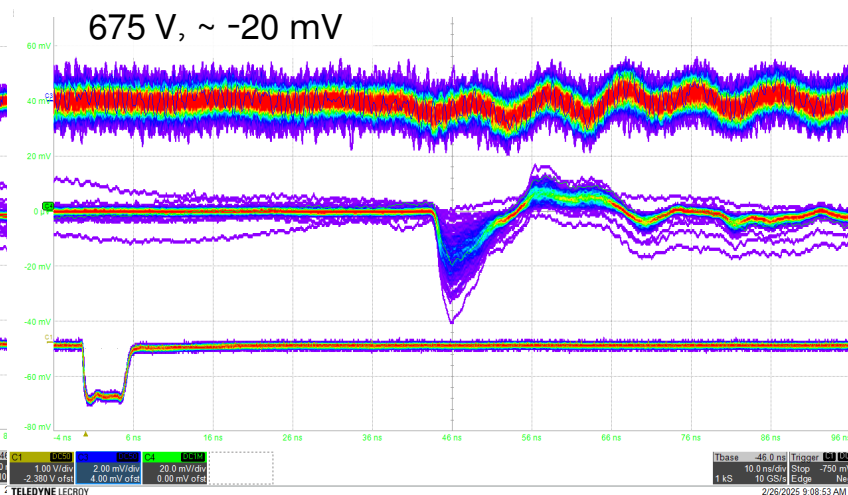
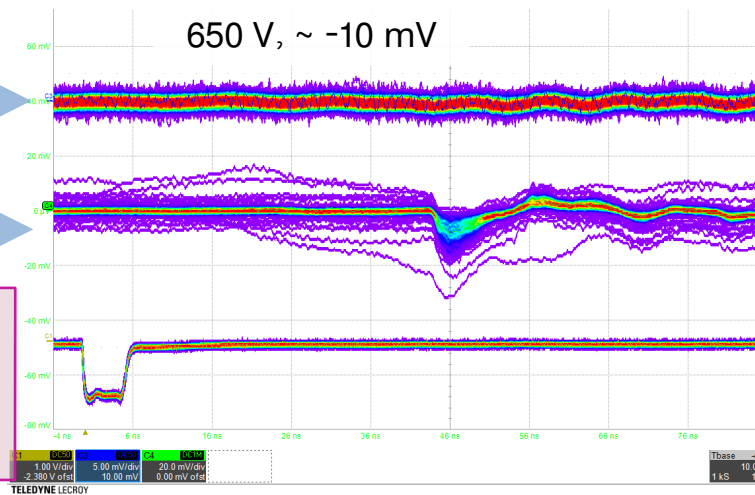


Signals from Anode - amplitude vs. ΔV_{MCPs}

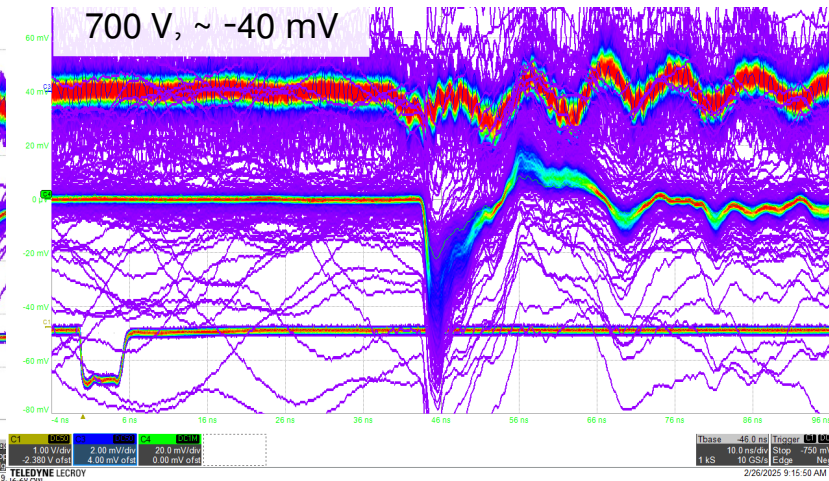
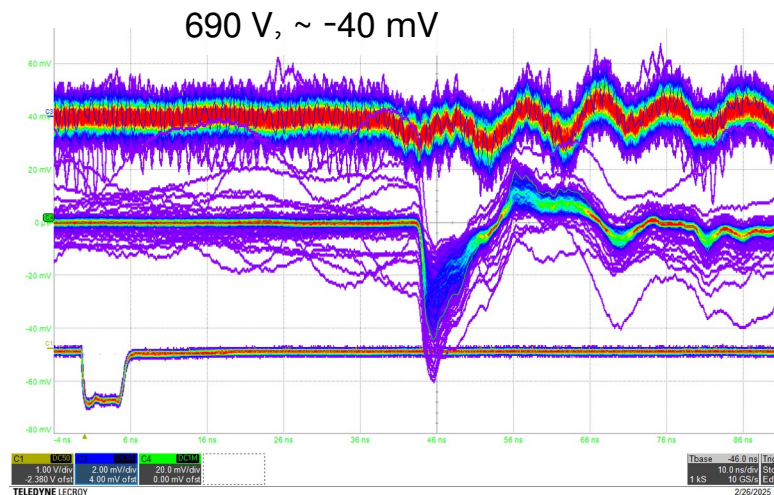
Channel #33

Anode

- Triggering at the Sync from the Laser Head
- Laser intensity 2.1
- -200_ ΔV _200_ ΔV _30 V

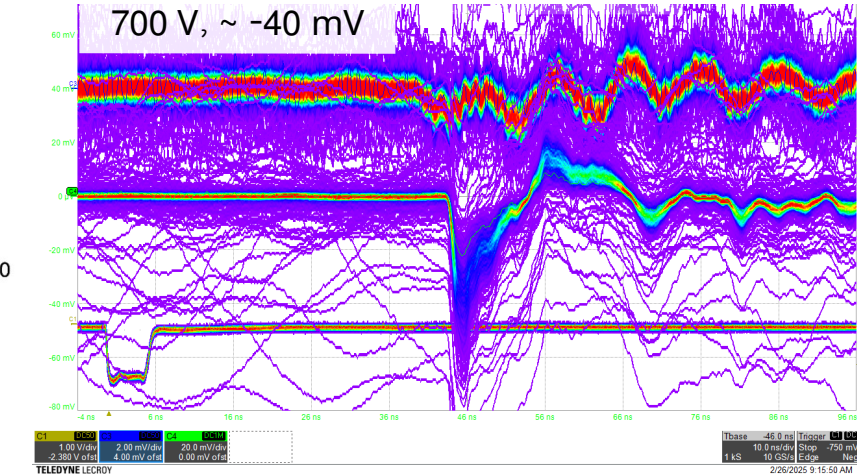
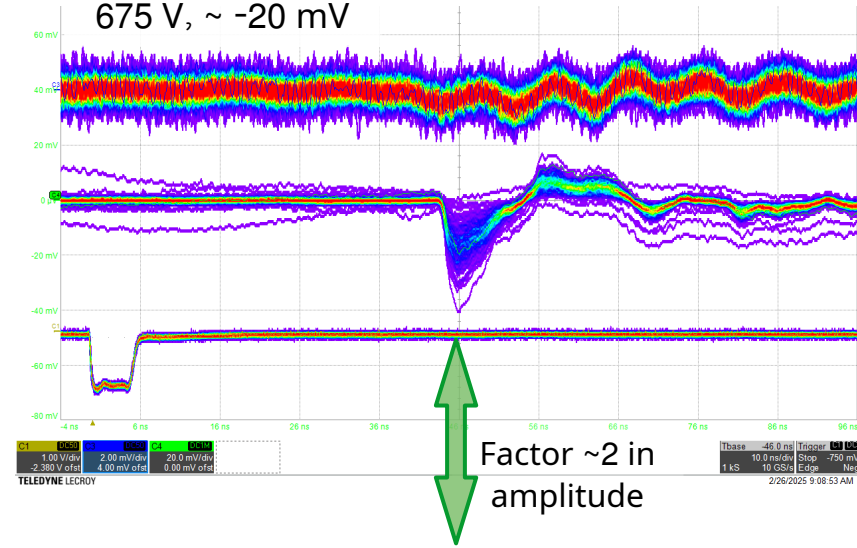
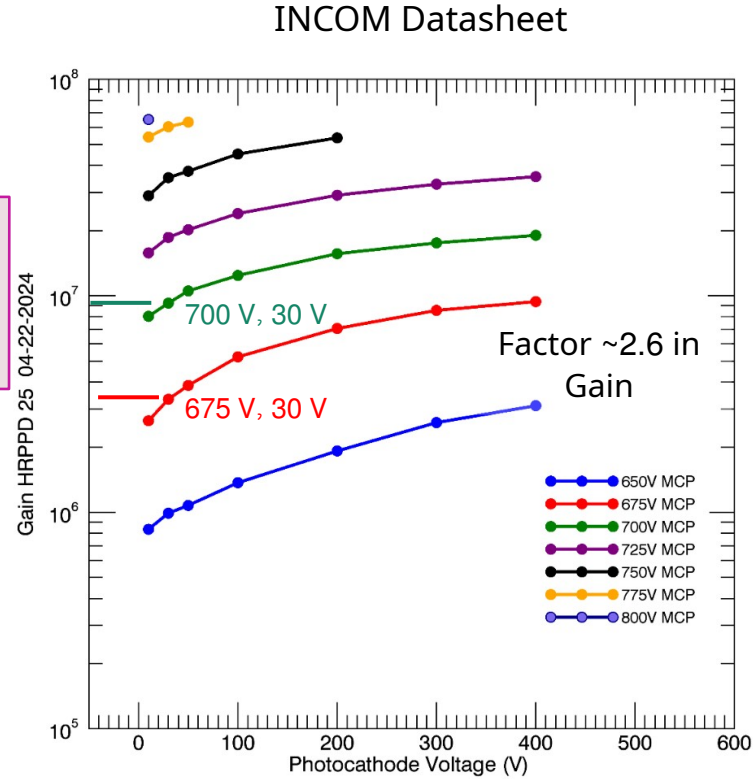


ΔV_{MCPs} [V]	I_{Anode} [nA]	I_{PC} [nA]
- 630	- 186	- 119.0
- 650	- 188	- 119.6
- 670	- 194	- 119.7
- 690	- 204	- 119.9
- 700	- 211	- 120.0



Anode signal amplitude varies with ΔV_{MCPs}

- Triggering at the Sync from the Laser Head
- Laser intensity 2.1
- -200_- ΔV _-200_- ΔV _-30 V



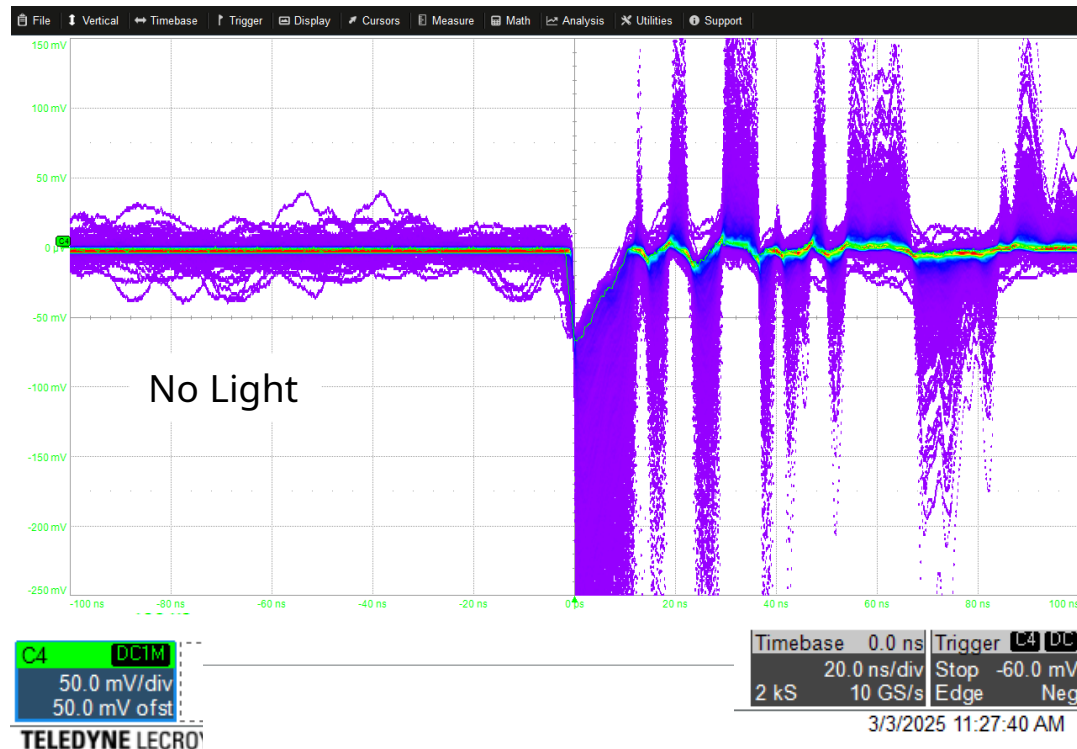
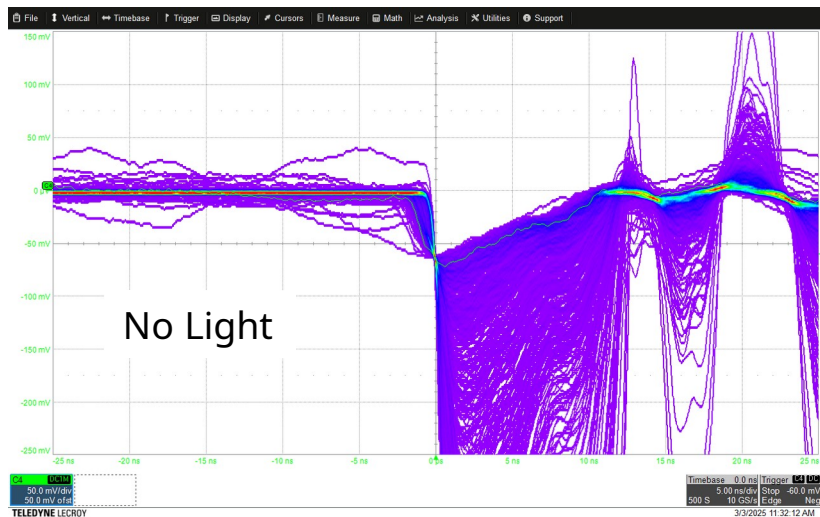
Clear evidence of light signals after multiplication in HRPPD MCPs

Signals from Anode

Without Bread Board (16 Grounding caps)

HV configuration: -200_-675_-200_-675_-30 V @ XoX_NoX_XoN_NoN_PC

- Noise level decreased to ~60 mV
- Signals of amplitude $< |100|$ mV observed
- Rate ~ 10 Hz

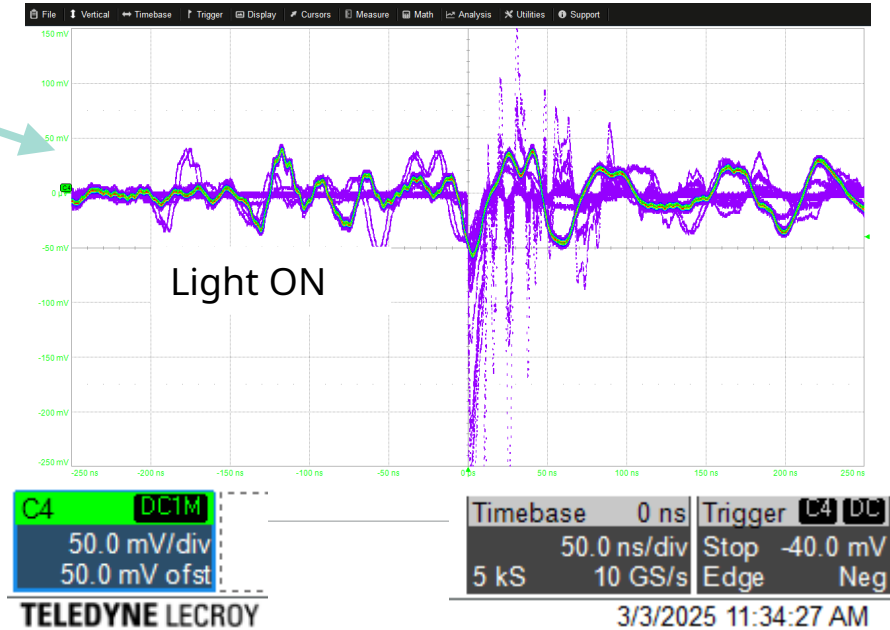
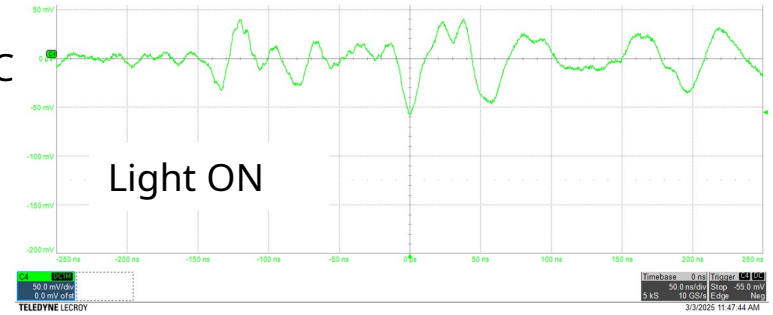


Signals from Anode

Without Bread Board (16 Grounding caps)

HV configuration: -200_-675_-200_-675_-30 V @ XoX_NoX_XoN_NoN_PC

- Laser On, ext. trigger (600 Hz), Int. 2.0
- Triggering on the Anode channel
- Periodic pattern at 25 μ s; pattern at 0 ns is different from Oscillating shape
- Larger light signal starts to appear at ~ -40 mV



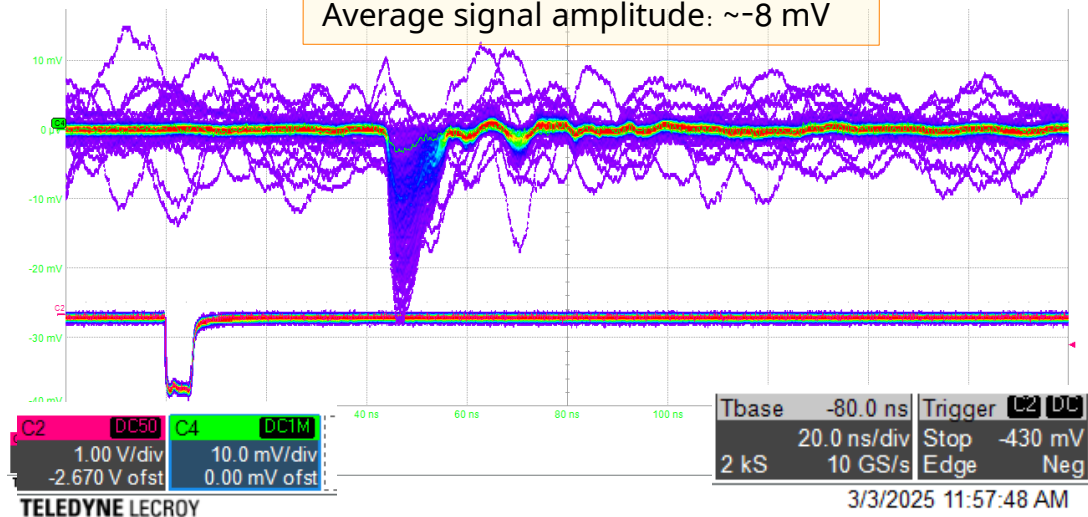
Signals from Anode

Without Bread Board (16 Grounding caps)

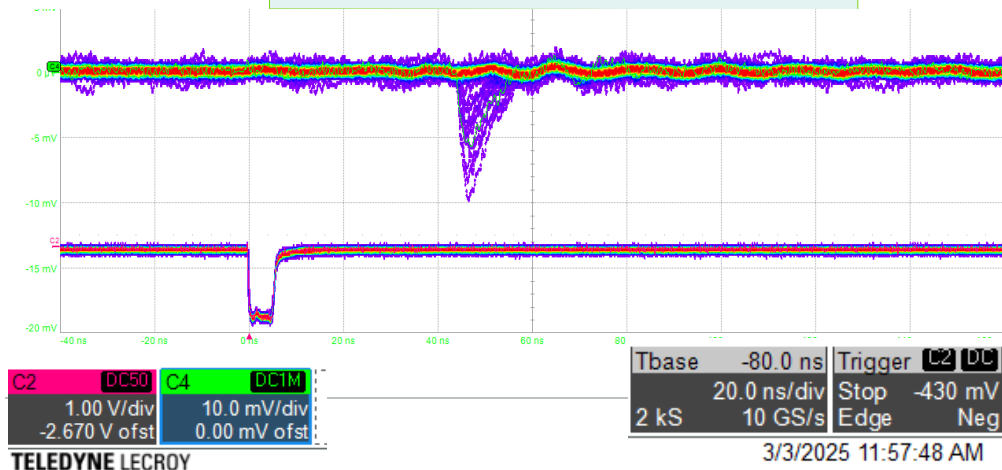
HV configuration: -200_-675_-200_-675_-30 V @ XoX_NoX_XoN_NoN_PC

- Laser On, ext. trigger (600 Hz)
- Triggering on the laser sync pulse
- Light signal appears at ~ 45 ns

Int. 2.0
Efficiency ~90 % (multi-photon)
Average signal amplitude: ~-8 mV



Int. 1.5
Efficiency ~5-8 % (SPE)
Average signal amplitude: ~-3 mV



Intervention

External electrodes of all (32+8) μ -coaxial cables are soldered with the robust ground of the bread board

Outline

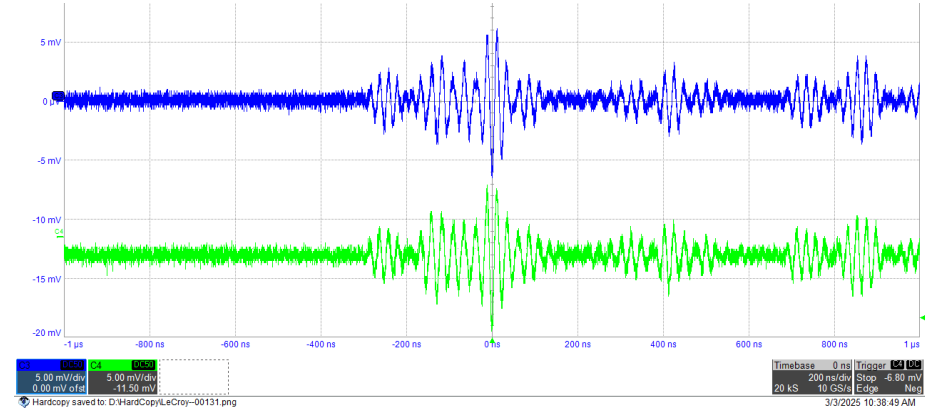
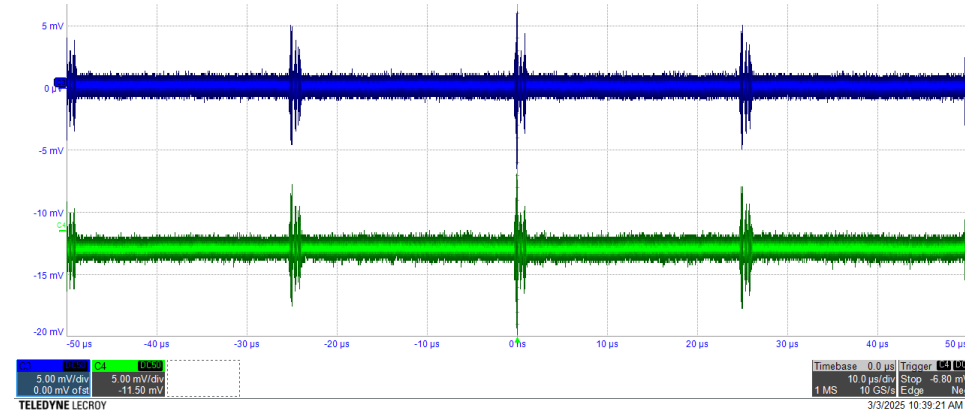
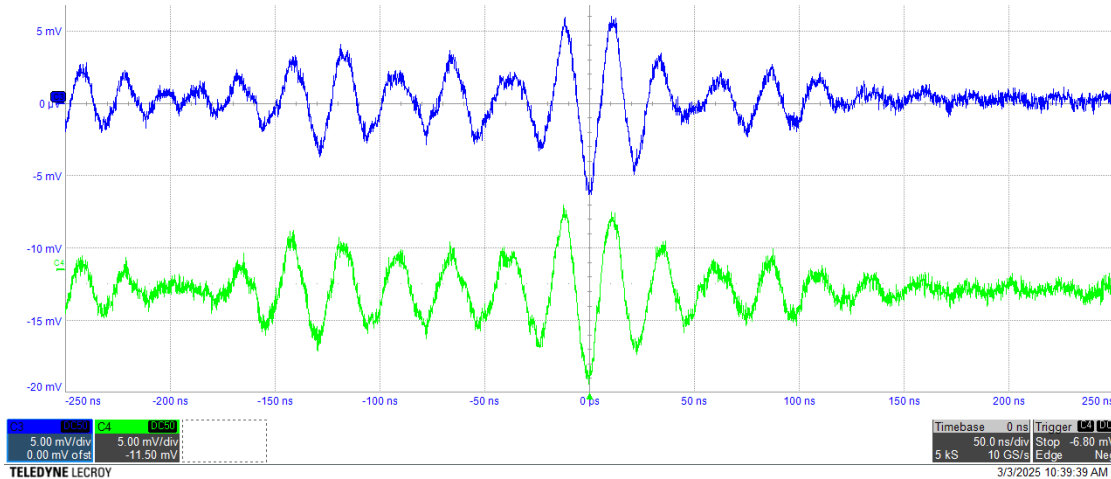
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Noise

Single channels from bread board
NO connection with HRPPD

Ch #19, Ch #31

- Noise level -7.0 mV
- Periodic pattern at $25\ \mu\text{s}$
- Oscillation of a period ~ 25 ns, amplitude (PP) ~ 12 mV



We could not get rid of noise with ringing pattern

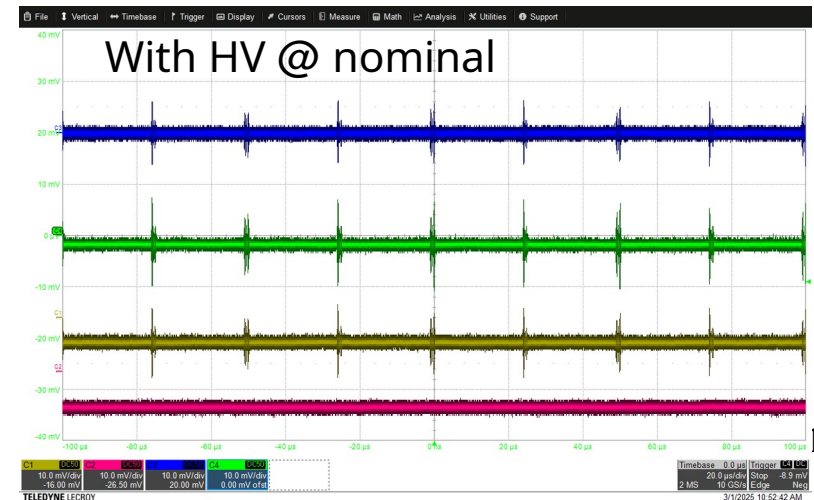
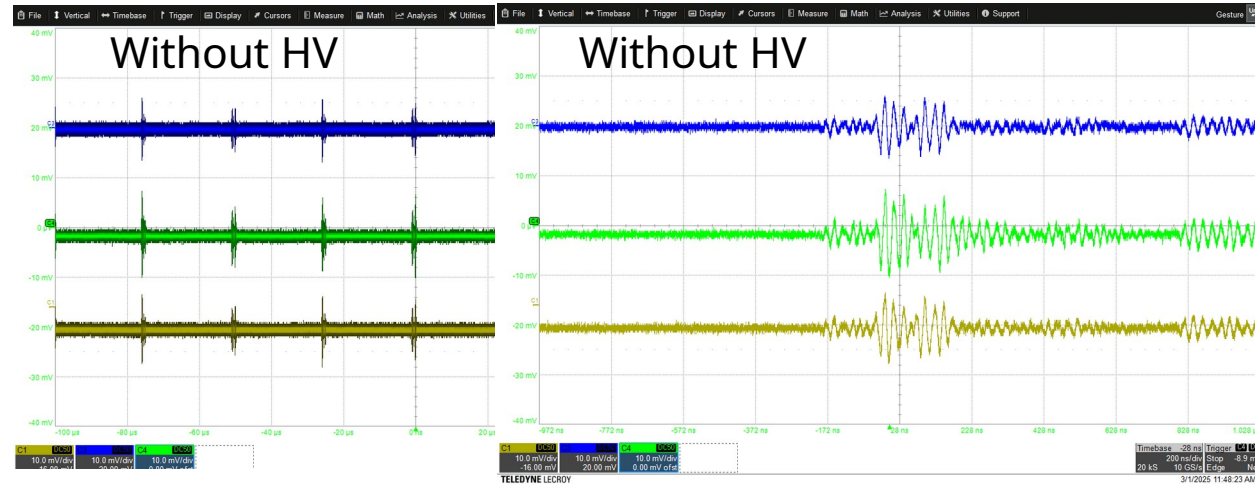
Noise

Single channels from bread board

Connected to HRPPD
With and Without HV

Ch #24, Ch #9, Ch #22

- Trigger at ~ -9 mV (Channel #9)
- Periodic pattern appears at $25\ \mu\text{s}$
- Oscillation of a period ~ 25 ns, amplitude (PP) ~ 13 mV
- Same noise level with and without HV
- Dark signals can not be observed



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Light signals from single pads

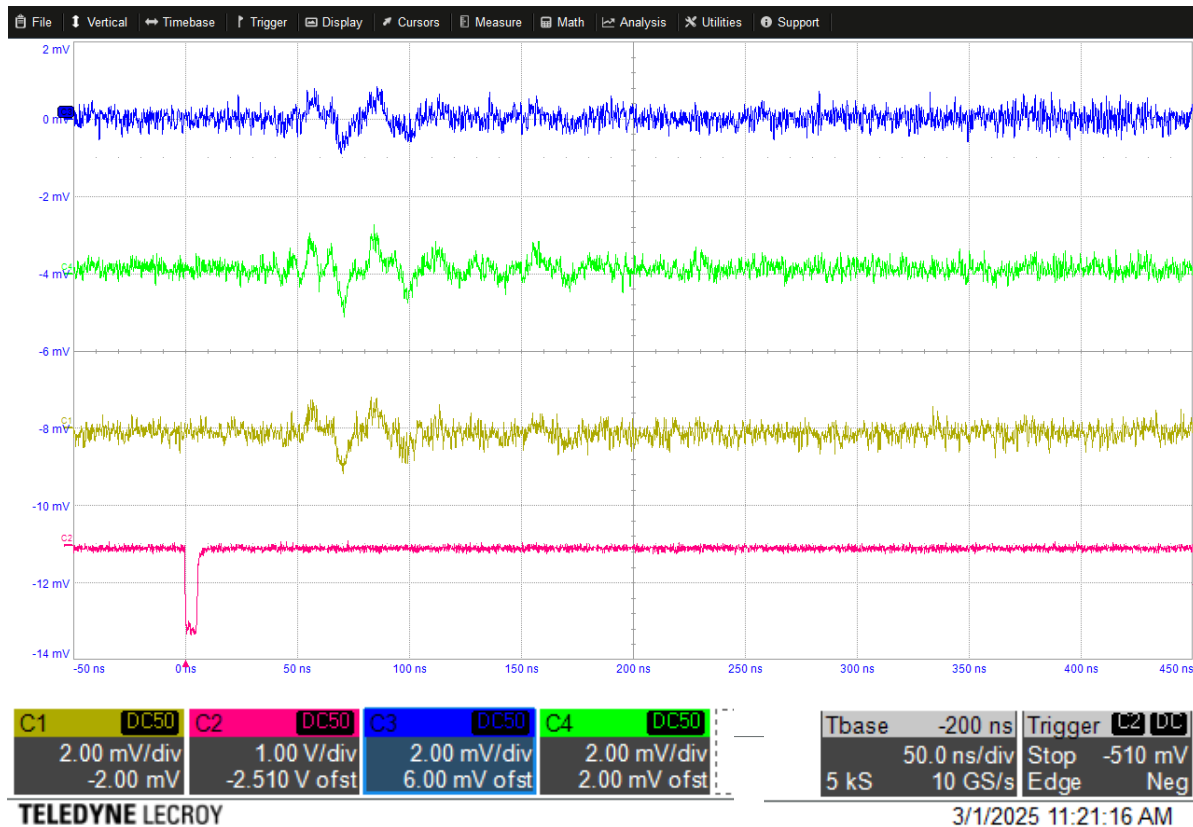
HV configuration: -200_-650_-200_-650_-30 V @ XoX_NoX_XoN_NoN_PC

Ch #24, Ch #9, Ch #22

- Laser ext. trigger (600.0 Hz), intensity: 2.5
- Signal at ~ 70 ns (the first dip)
- Amplitude (distance between highest and lowest points) 2 mV (Channel #9)

Are these signals/shapes coming from
Light and/or the MCPs/HRPPD?

- ➔ Amplitude vs. ΔV_{MCPs}
- ➔ Amplitude vs. Laser intensity



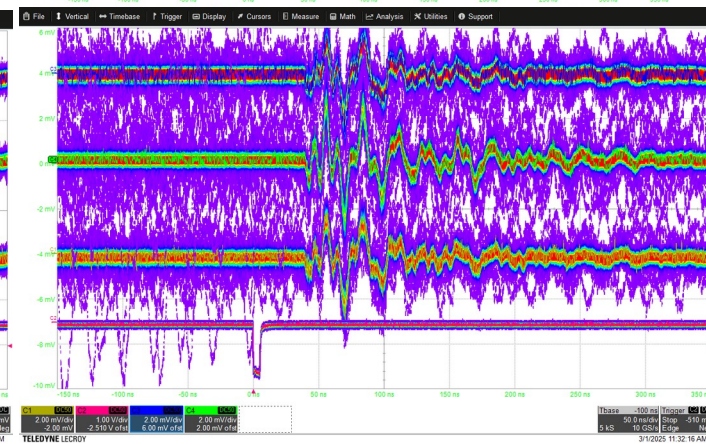
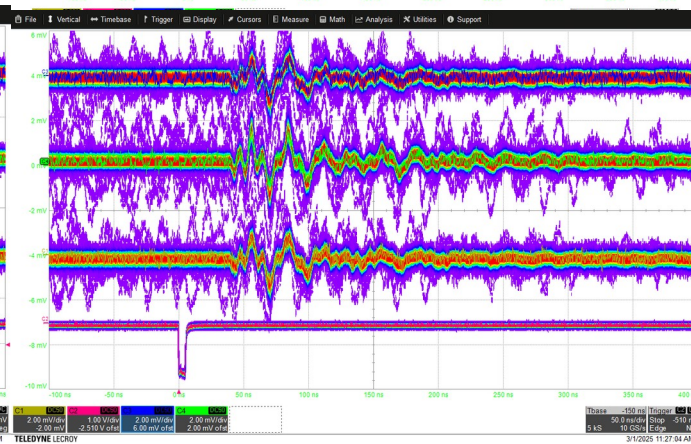
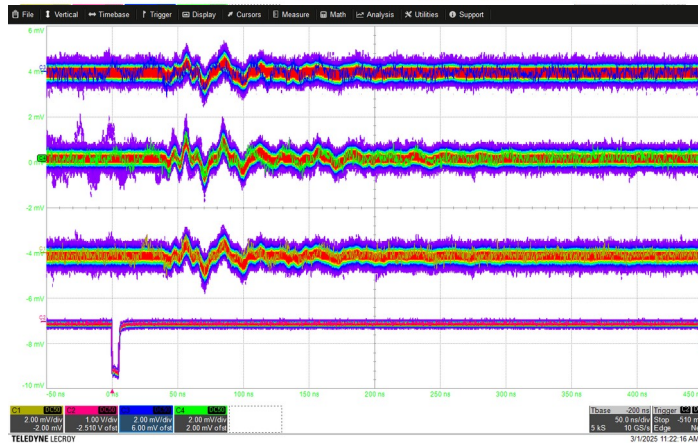
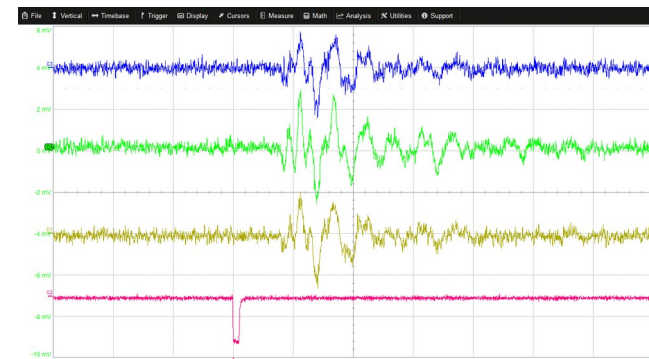
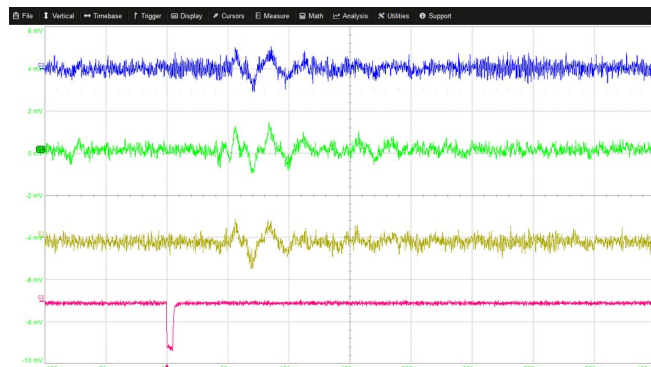
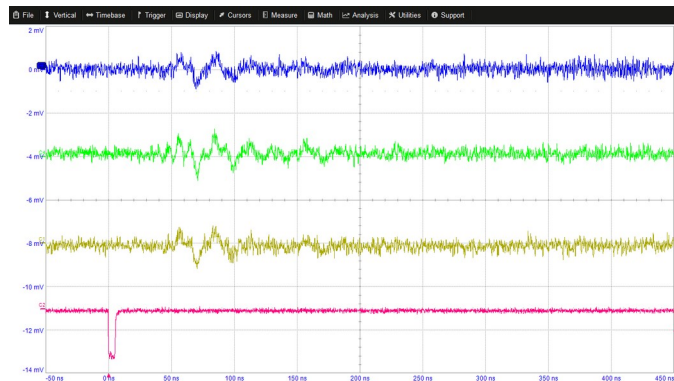
Light signals from single pads

Fixed Intensity 2.5

$\Delta V_{\text{MCPs}} = 650 \text{ V}$
Amplitude: $\sim 2 \text{ mV}$

$\Delta V_{\text{MCPs}} = 675 \text{ V}$
Amplitude: $\sim 3 \text{ mV}$

$\Delta V_{\text{MCPs}} = 700 \text{ V}$
Amplitude: $\sim 5 \text{ mV}$



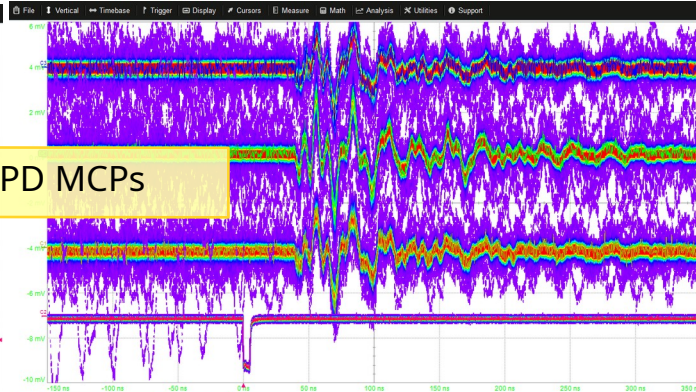
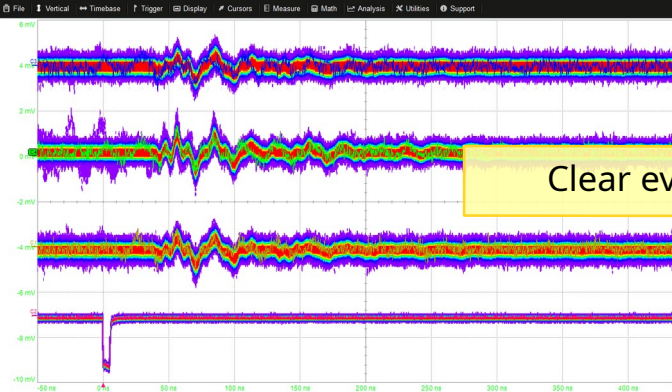
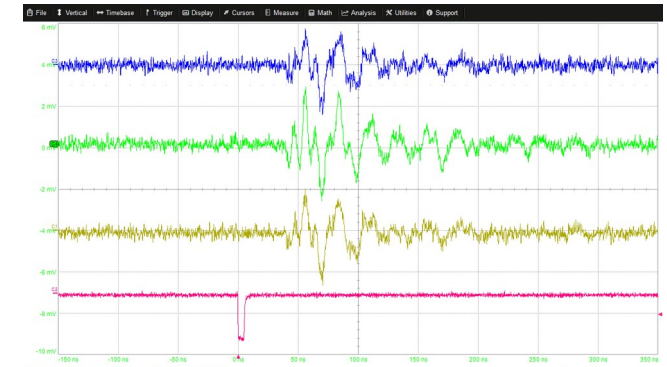
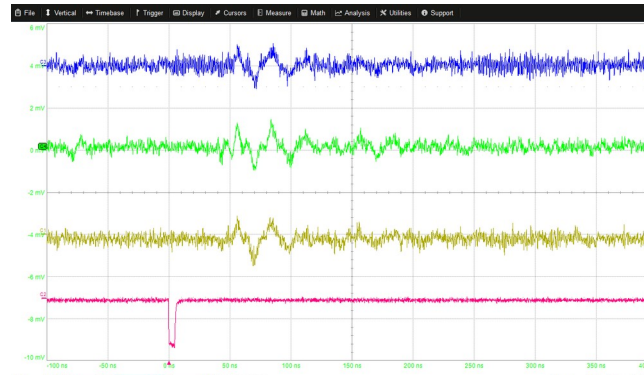
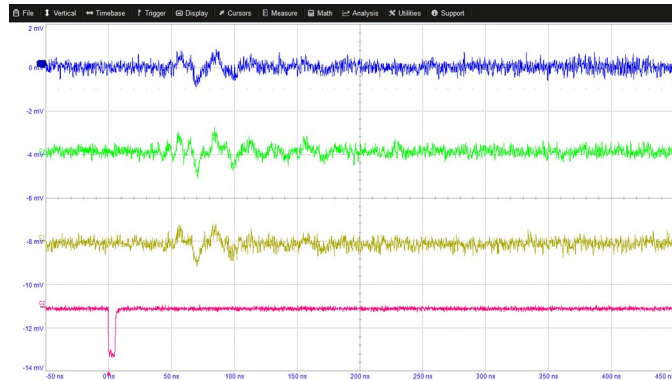
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Clear evidence of signals after multiplication in HRPPD MCPs

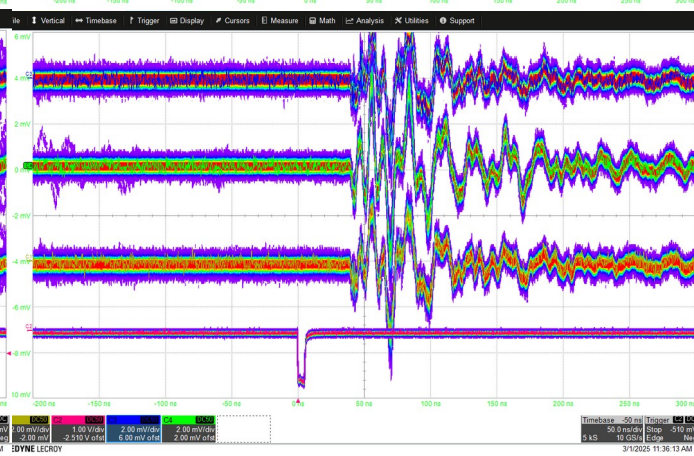
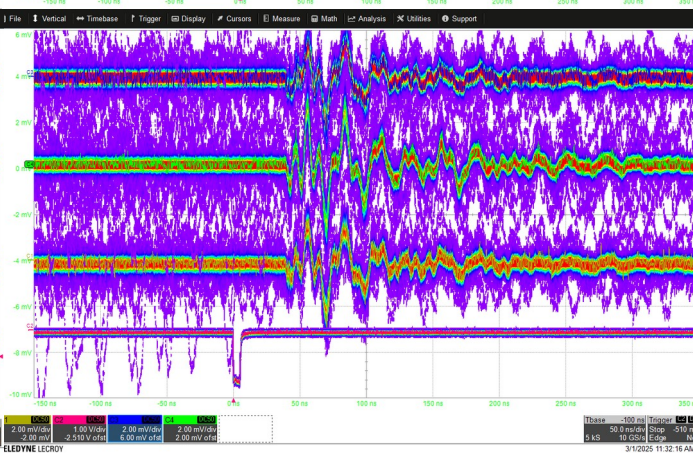
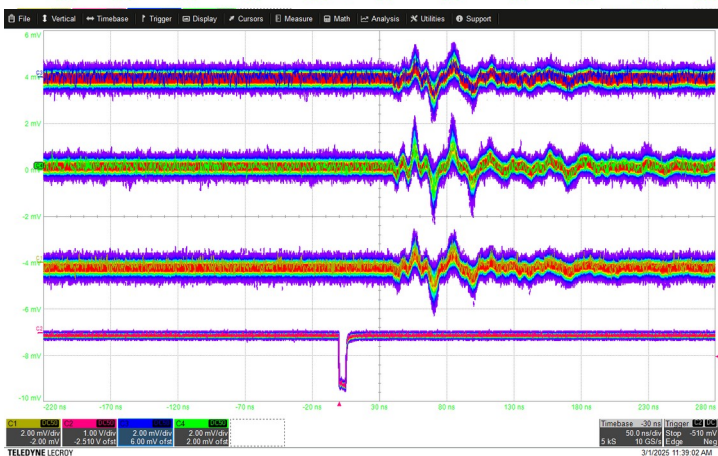
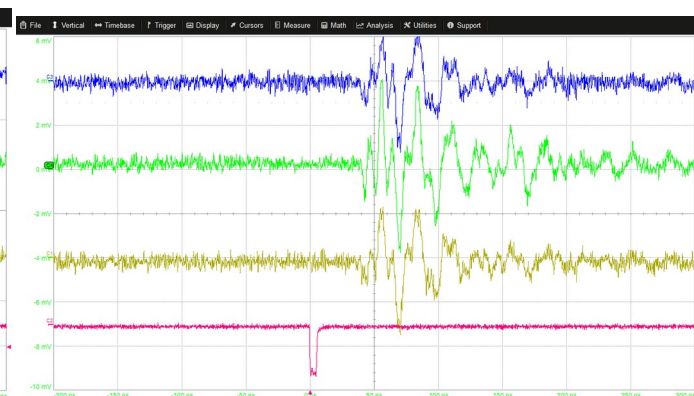
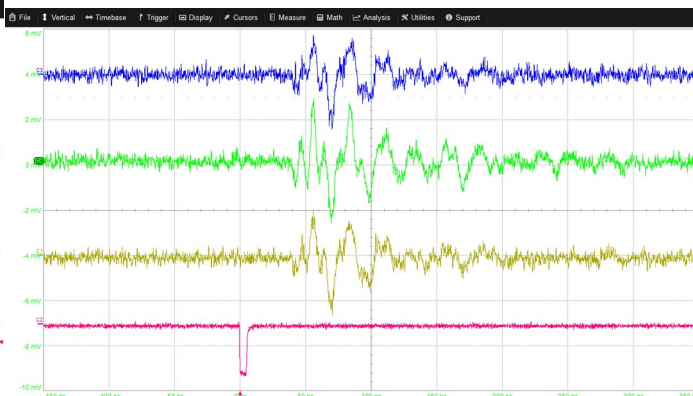
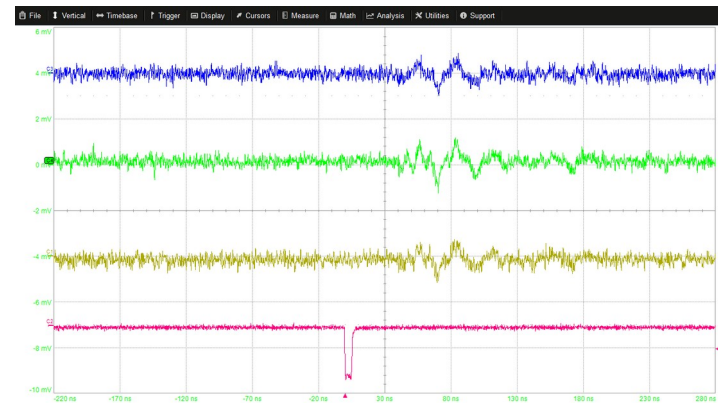
Light signals from single pads

Fixed $\Delta V_{\text{MCPs}} = 700 \text{ V}$

Int. 2.0
Amplitude: $\sim 2 \text{ mV}$

Int. 2.5
Amplitude: $\sim 5 \text{ mV}$

Int. 2.8
Amplitude: $\sim 8 \text{ mV}$



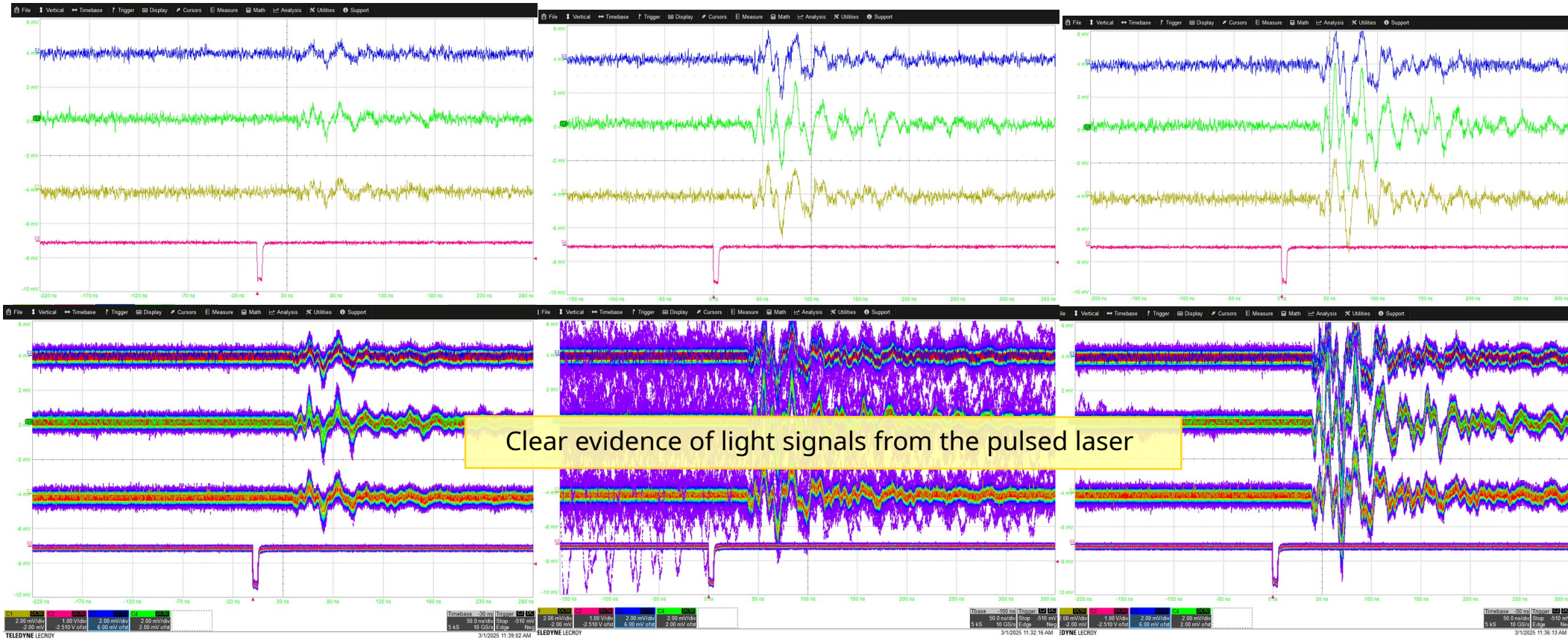
Light signals from single pads

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Int. 2.8
Amplitude: $\sim 8 \text{ mV}$

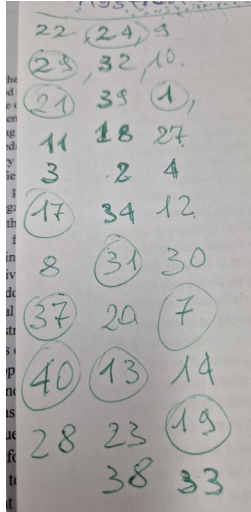


Light signals from single pads

- We looked at light signals from all 32 pads
- “Light on which pad” is not found. Almost same signal amplitude in 32 pads

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

Some pads with slightly larger Amplitudes



A3t39	A3t33	A3t29	A3t23	A3t19	A3t13	A3t9	A3t3
A3t37	A3t31	A3t27	A3t21	A3t17	A3t11	A3t7	A3t1
A3t40	A3t34	A3t30	A3t24	A3t20	A3t14	A3t10	A3t4
A3t38	A3t32	A3t28	A3t22	A3t18	A3t12	A3t8	A3t2
A3b2	A3b8	A3b12	A3b18	A3b22	A3b28	A3b32	A3b38
A3b4	A3b10	A3b14	A3b20	A3b24	A3b30	A3b34	A3b40
A3b1	A3b7	A3b11	A3b17	A3b21	A3b27	A3b31	A3b37
A3b3	A3b9	A3b13	A3b19	A3b23	A3b29	A3b33	A3b39

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

Signal not bouncing at scope

10 ns delay included in the green channel

