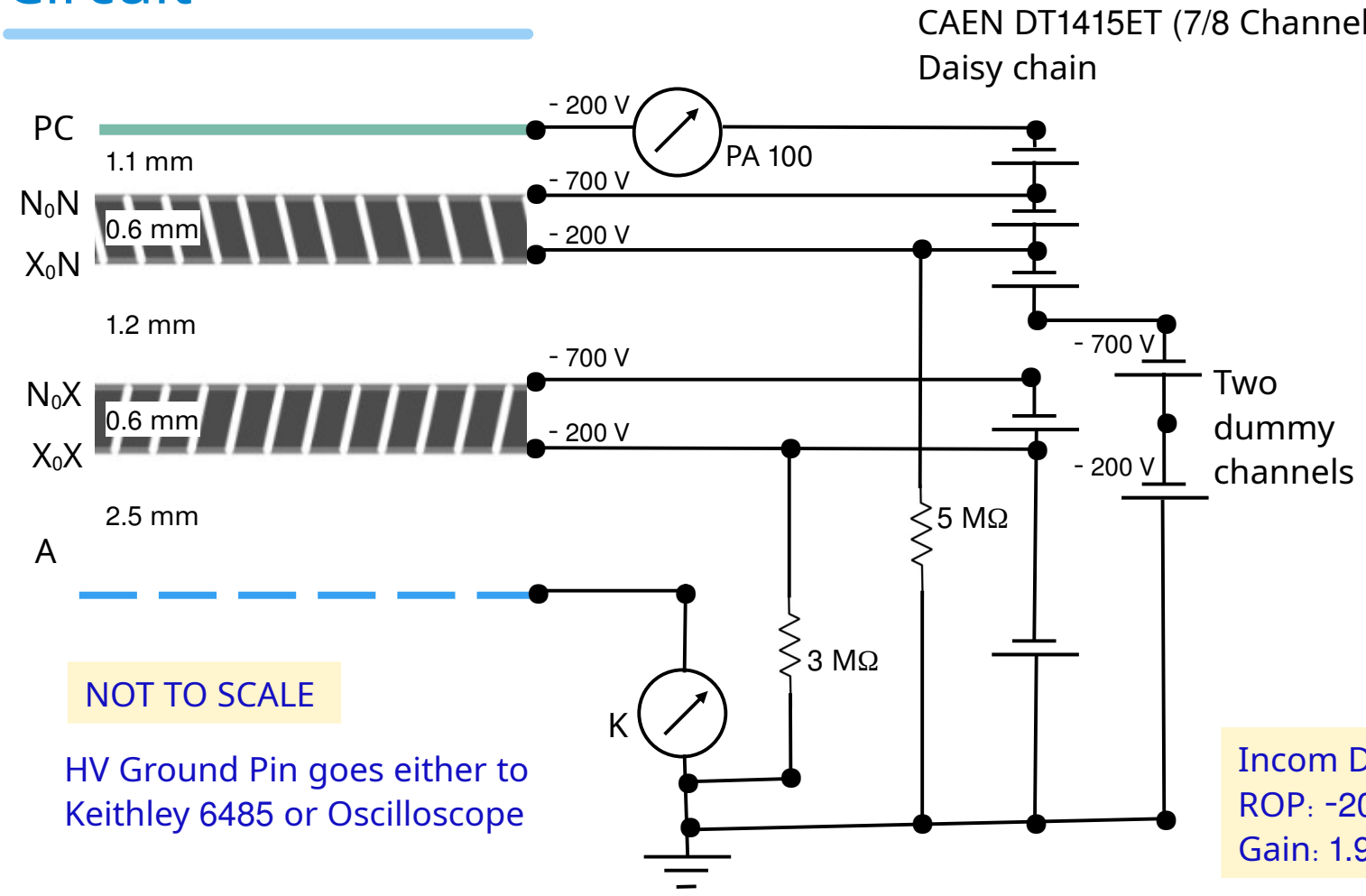
Updates on HRPPD #25 activities
Turning On HVs and Looking at signals

Weekly Meet

Chandra, Fulvio, Jinky

25/02/2025

Circuit



- CAEN DT1415ET
- Protection resistors
- Keithley 6485
- Custom-designed PicoAmmeters
- 2.5 GHz Oscilloscope (waverunner 9254)

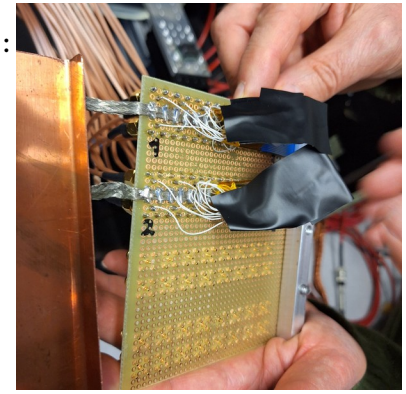
NOT TO SCALE

HV Ground Pin goes either to Keithley 6485 or Oscilloscope

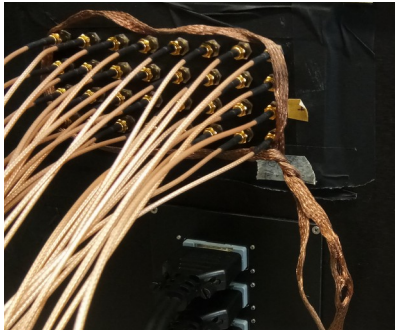
Incom Datasheet:
ROP: -200_-700_-200_-700_-200V
Gain: 1.90 x 10^7

Noise and Grounding

- 8/40 pins on Samtec connectors are internally grounded and NOT connected to Anode pads. These pins were connected to the bread board ground – **this was bridging internal HRPPD ground to the external ground of the SMA coaxial cables**. Mauro removed this connection:
  - **Anode pads, Guard rings, etc. are floating**
  - Lower noise level on single pads <~1 mV on scope for NO HV connections



- HV cabling + HV hw ON ~ 5 mV noise and 1 nA on Keithley
  - Grounding provided and 15 pA on Keithley



- After dark covering, HV sw "OFF", noise on channel #13 ~ 3 mV
- HV On: -200_-670_-200_-670_-30 V @ XoX_NoX_XoN_NoN_PC → noise level increase upto ~10 mV

Dark signals

2 ways of looking at signals

- Single channels (any of the 32 channels from the bread board) – directly to Scope
- Multiple electrodes (~1000 pads, Guard rings, Ground pins of Samtec connectors etc.) - via Anode Ground Pin

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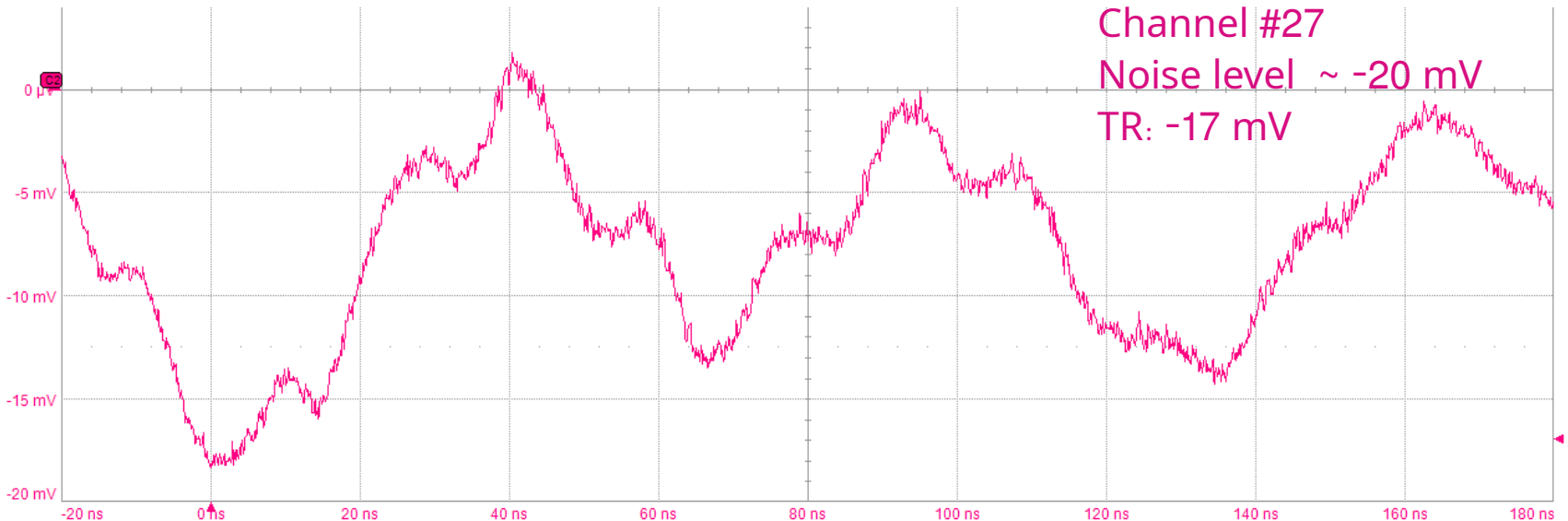

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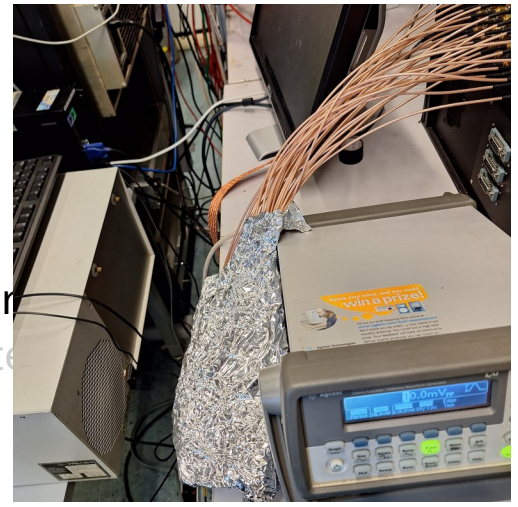
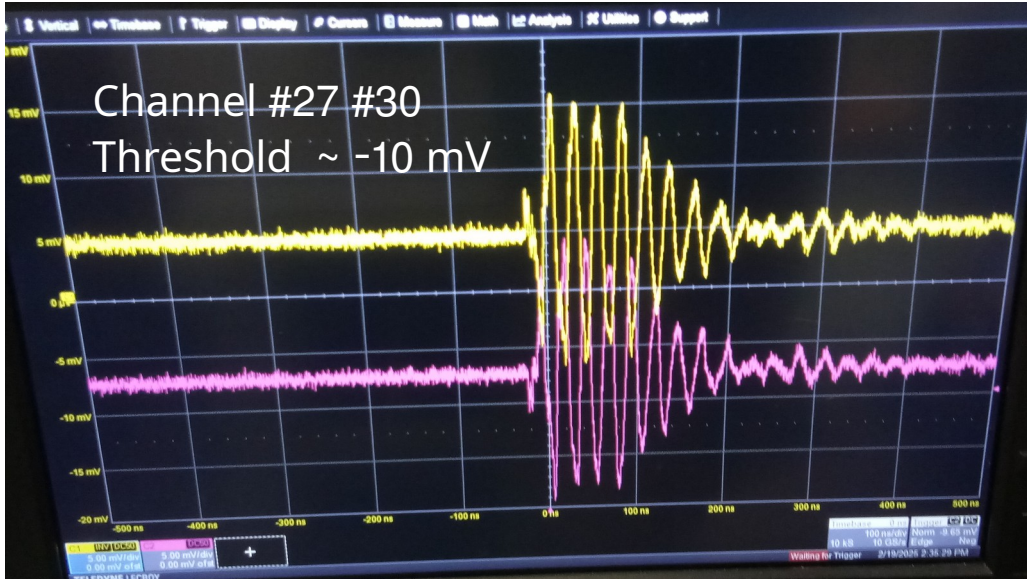
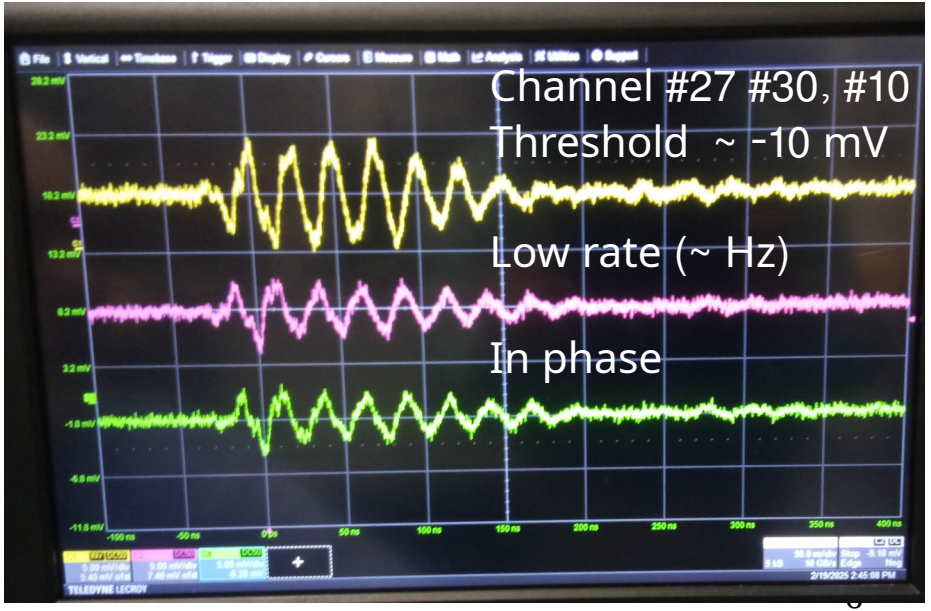




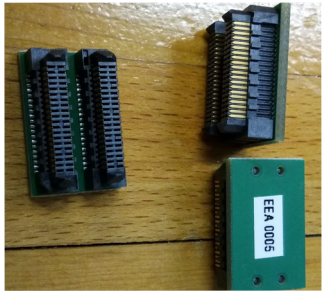


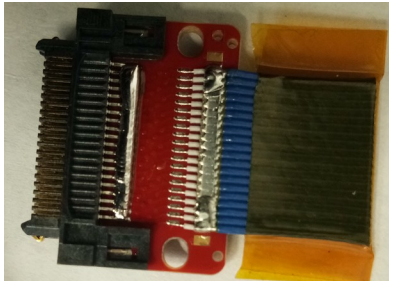
Dark signal from multi-electrodes

Anode Groud Pin is connected to a number of electrodes which are inter-connected

- 1024 – 32 = 992 Anode and RO pads
- Guard ring (vacuum side)
- 16 small Guard rings (RO side)
- 16 pins out of 80 Pins in Samtec connectors (total 240 pins)
  Grounded internally on the grounding cap PCBs and on the Samtec connector prepared by Mauro

Internal HRPPD Ground



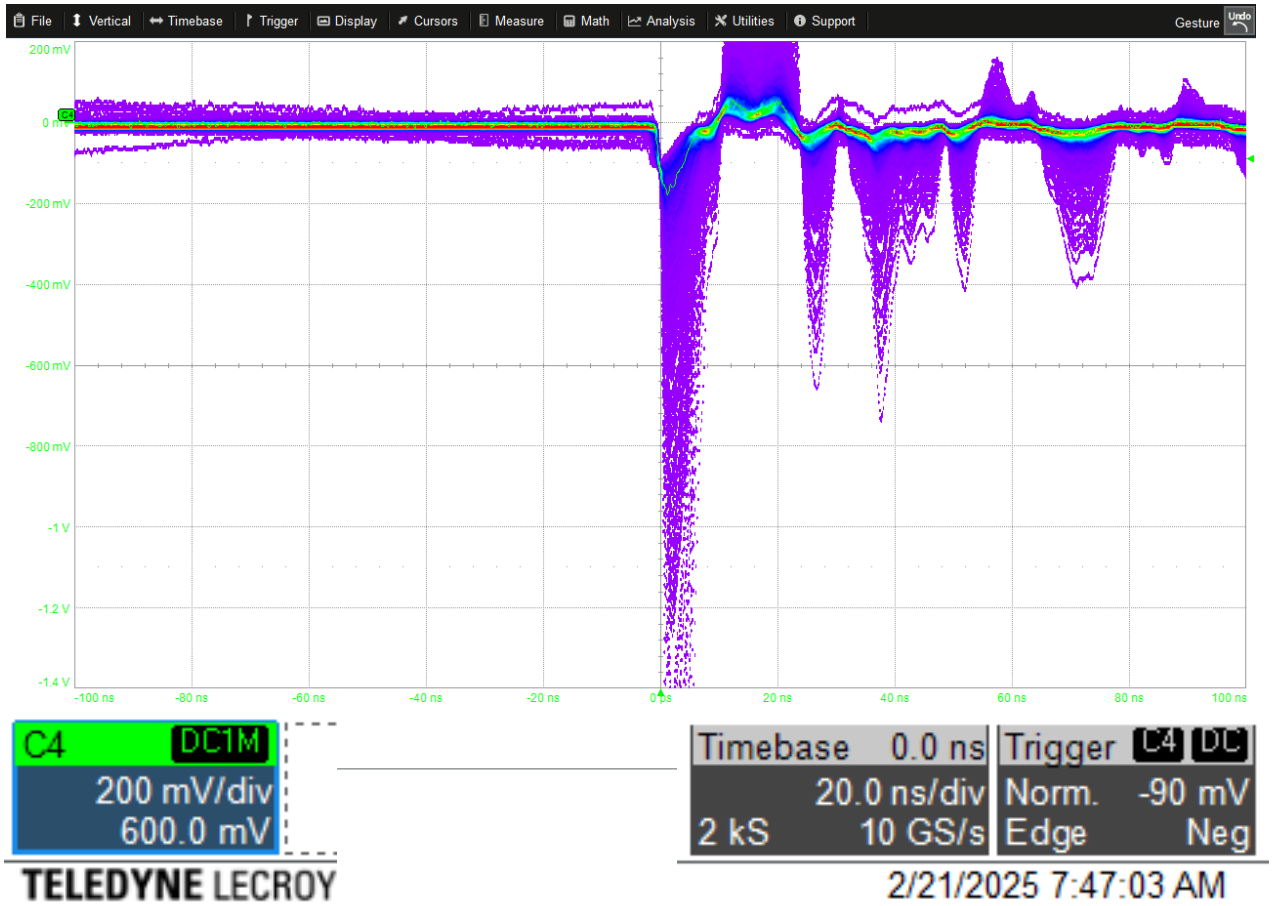


Anode Ground Pin is a common output to all these electrodes

- Signals are distributed in all these inter-connected electrodes
- These (big) signals are observed

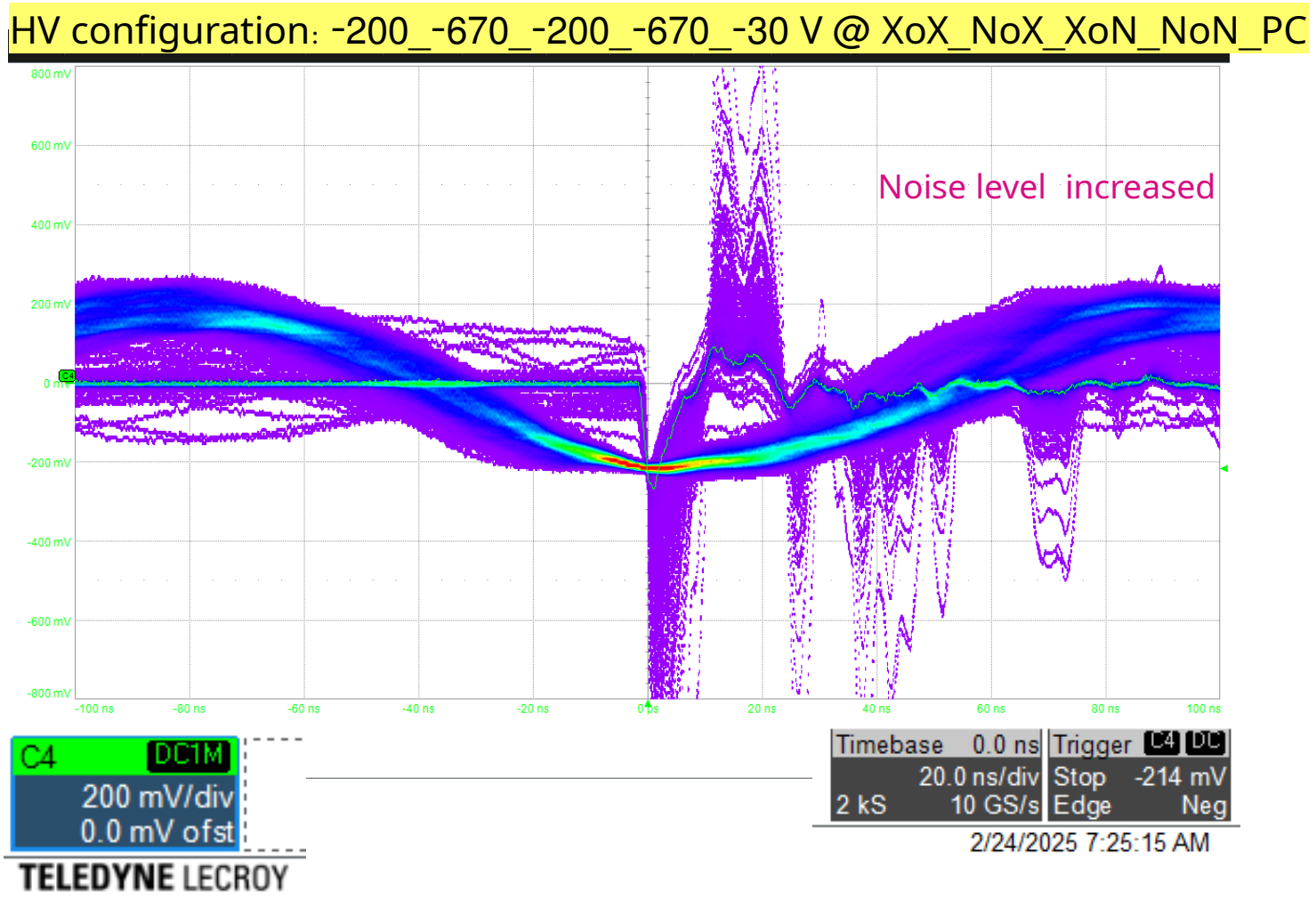
Dark signal from multi-electrodes

HV configuration: -200_-670_-200_-670_-30 V @ XoX_NoX_XoN_NoN_PC

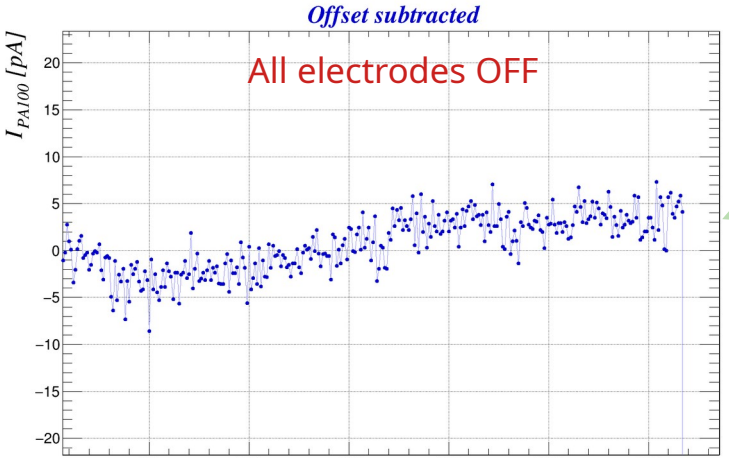


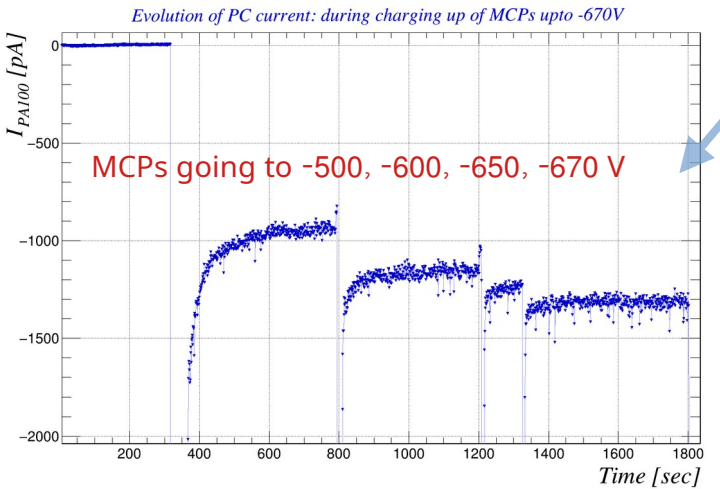
- Threshold -90 mV; neg. edge
- Rise time ~1 ns; Fall time ~4 ns
- Average amplitude: between -100 to -200 mV
- Rate: 1-2 Hz
- Amplitude > 800 mV with a rate of 0.05 Hz
- I_K ~ -186 nA (nominal leak 165 nA)
- I_PA100 ~ -115 nA (as expected, leak 0.26 GΩ)

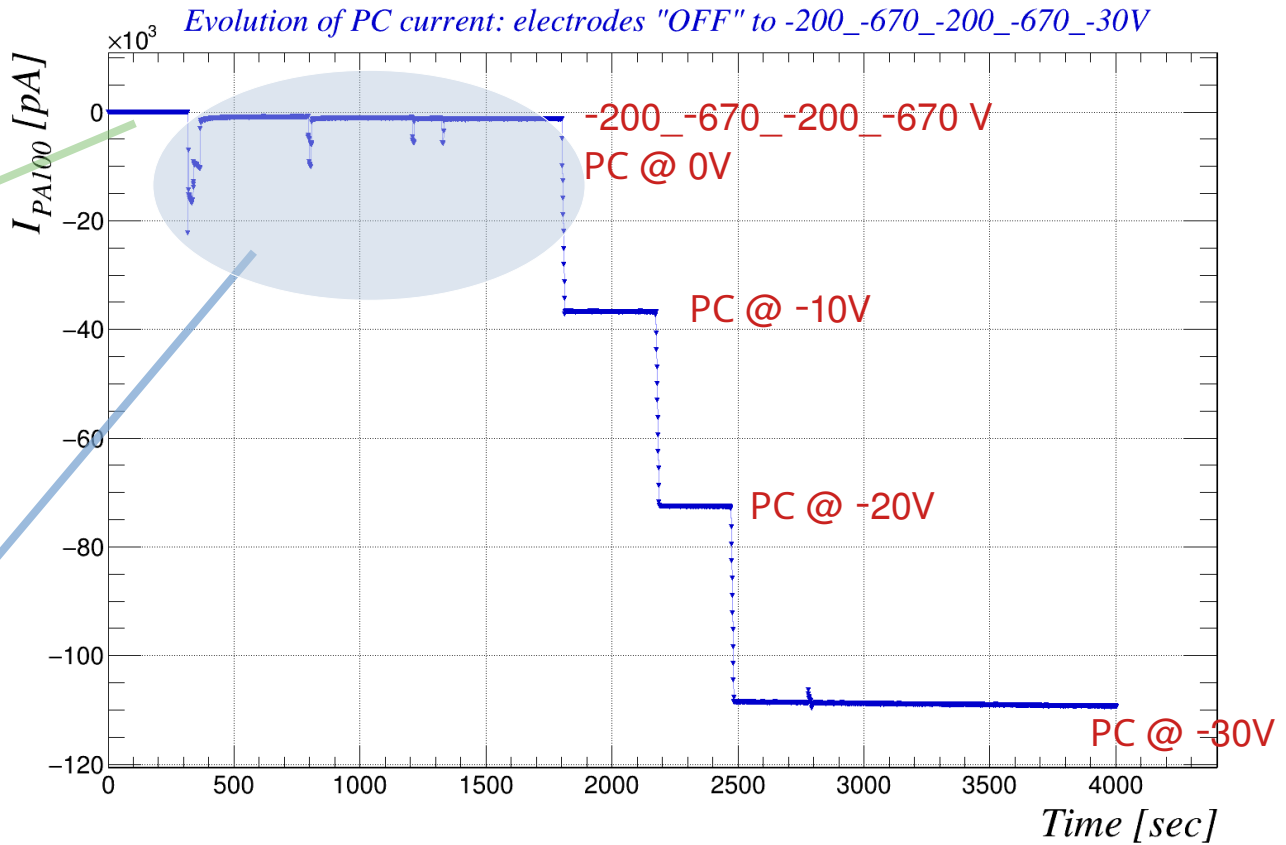
Dark signal from multi-electrodes



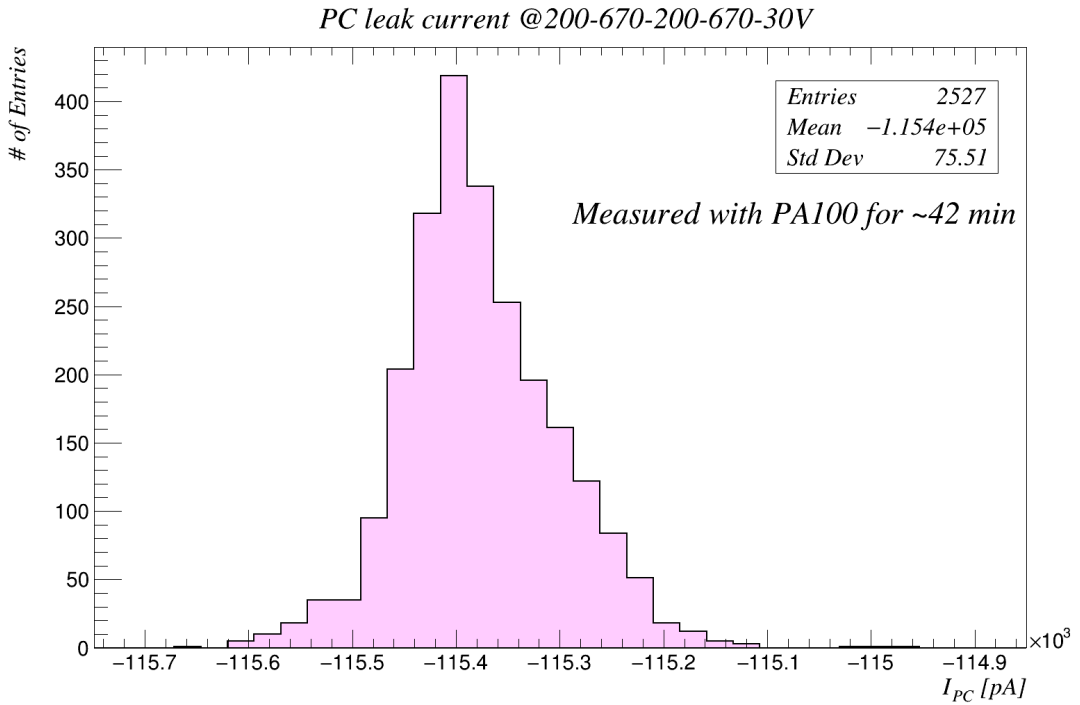
PC leak during charging up electrodes

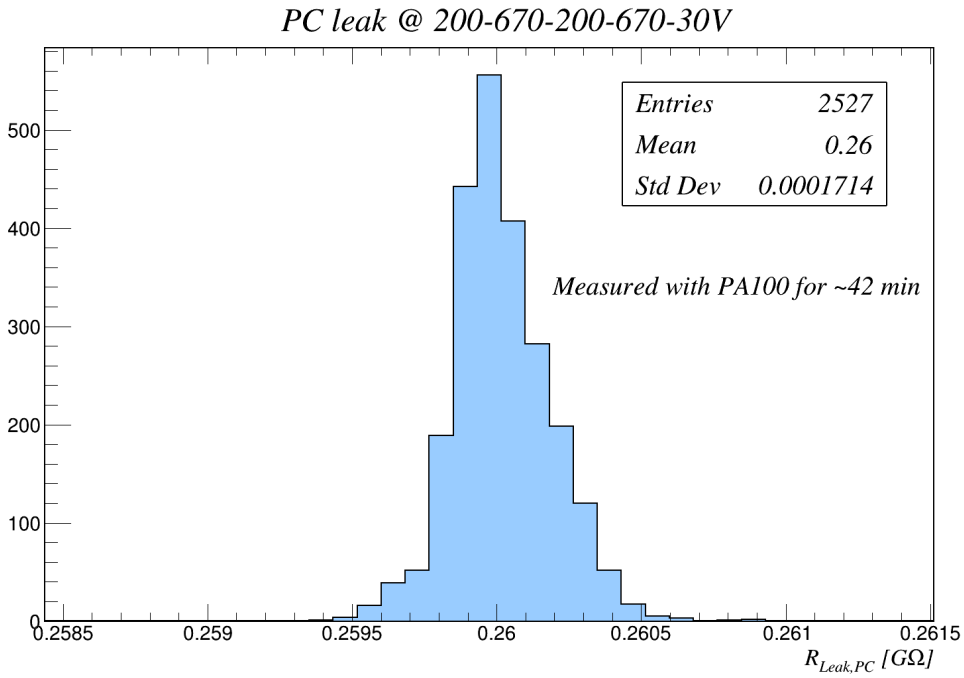






PC leak during HV On

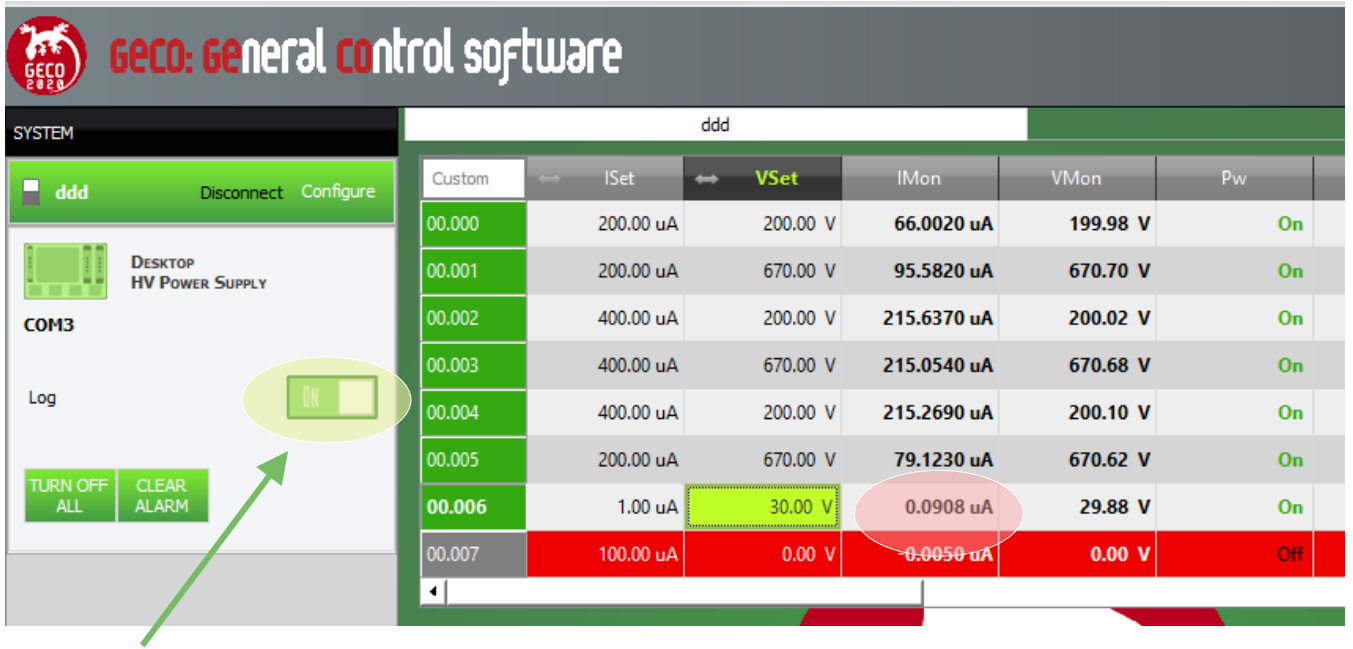




Some outliers are cut off

CAEN currents

GECO2020 updated: Now, Version 1.13.1



Recording ON

All CAEN currents are reasonable when > 1 µA

200V/66.0 µA = 3.03 MΩ

670 V/95.58 µA = 7.01 MΩ

1070 V/215 µA = 4.98 MΩ

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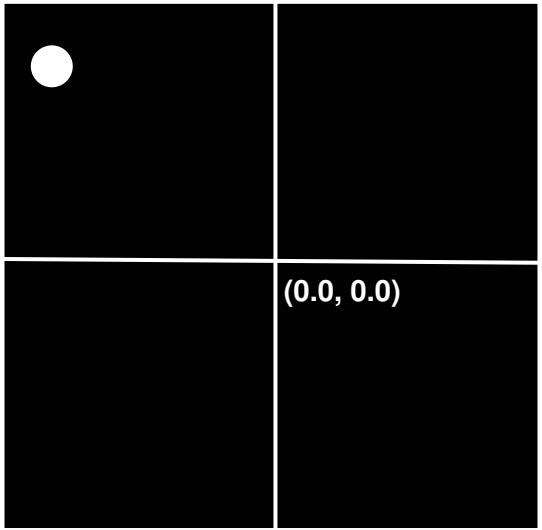
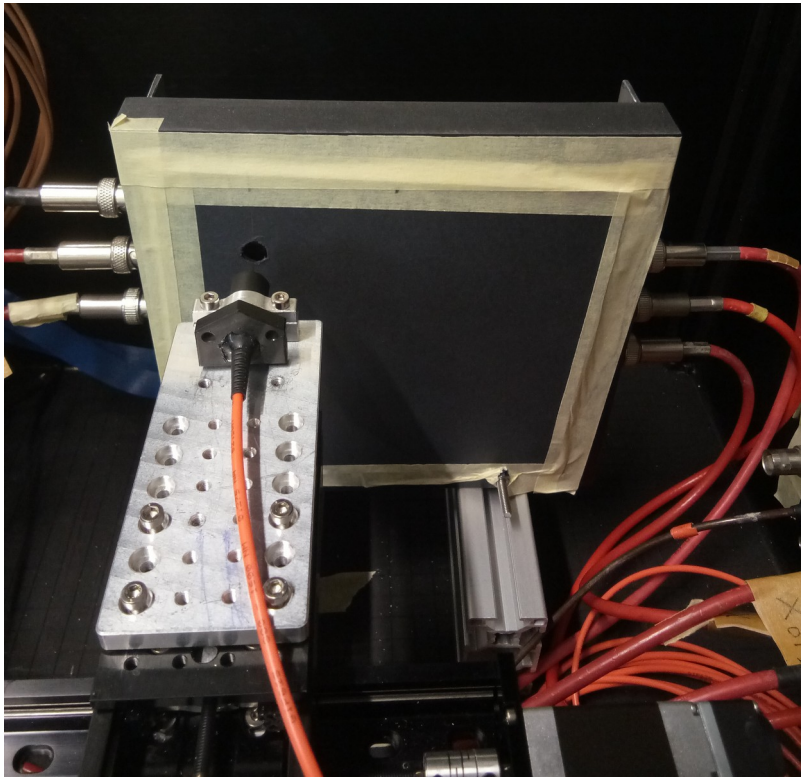
670 V/79.12 µA = 8.5 MΩ

PC current Not correct.
We read PA100.

Turning On the laser





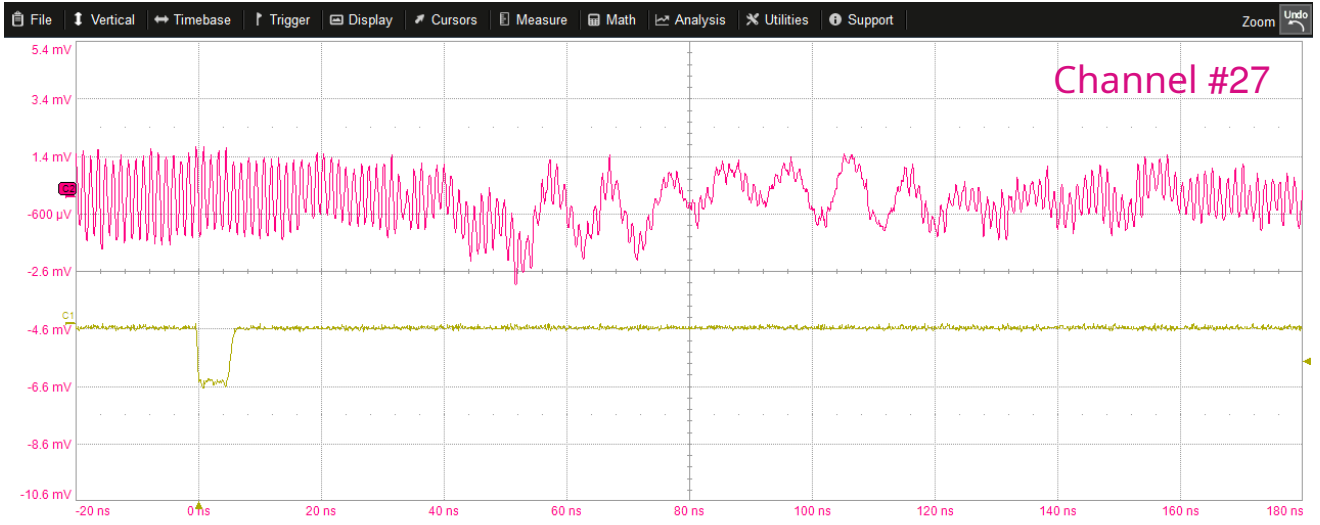
- Hole diameter: ~8 mm
- Hole Centre: X= -39.0 mm, Y= -45.5 mm
- Position of fibre on moving arm:
  (96.8, 45.0001, 41) [mm]
  (up-down, back-forth, left-right)

- Double protection card
- Fibre tip ~ 1 cm away from window

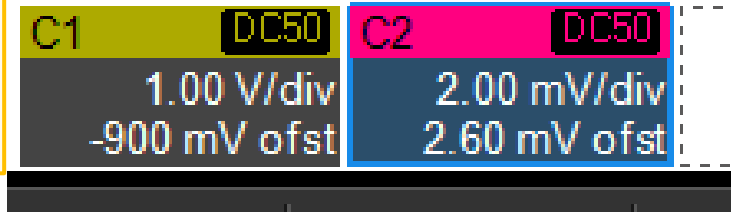
Light signals

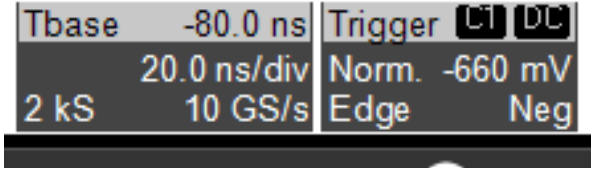
HV configuration: -200_-670_-200_-670_-20 V @ XoX_NoX_XoN_NoN_PC

- Waveform Generator Output to trigger the laser head
  - 1.2 V_{RMS}, 600 Hz, 100 µs width
- Laser Intensity: 2.8

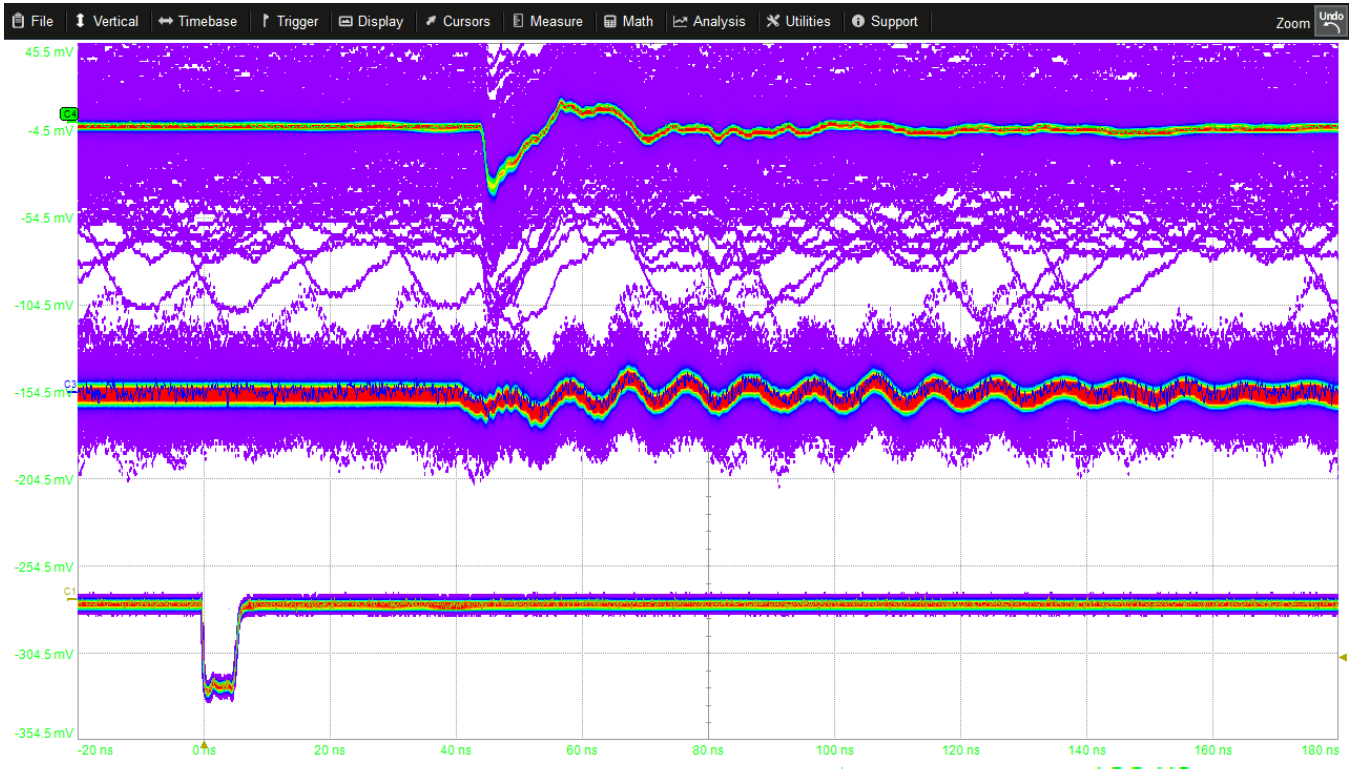


- Triggering on the pulse (-660 mV)
- Signal Amplitude: ~ 4 mV
- I_K ~ -184 nA
- I_PA100 ~ -78 nA





Light signals



C4, Anode G. Pin
~ 50 mV amplitude
In 45 ns after TR

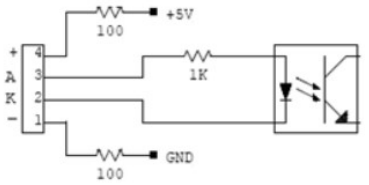
C3, single pad

C1, Trigger

Interlock flag

- The HV system went to INTERLOCK MODE when we were looking at dark signals.
- We were not doing anything on the HV (neither hardware level nor software level), so we did't understand what went wrong.
- We followed instructions from the User Manual: KILL the channels and then turned them OFF (hardware level)

Interlock signal



A schematic diagram of the Interlock input is shown in the figure on the left, where the diode is part of opto-coupler stage.
Interlock means that channels are hardware disabled. The following table explains the interlock operation:

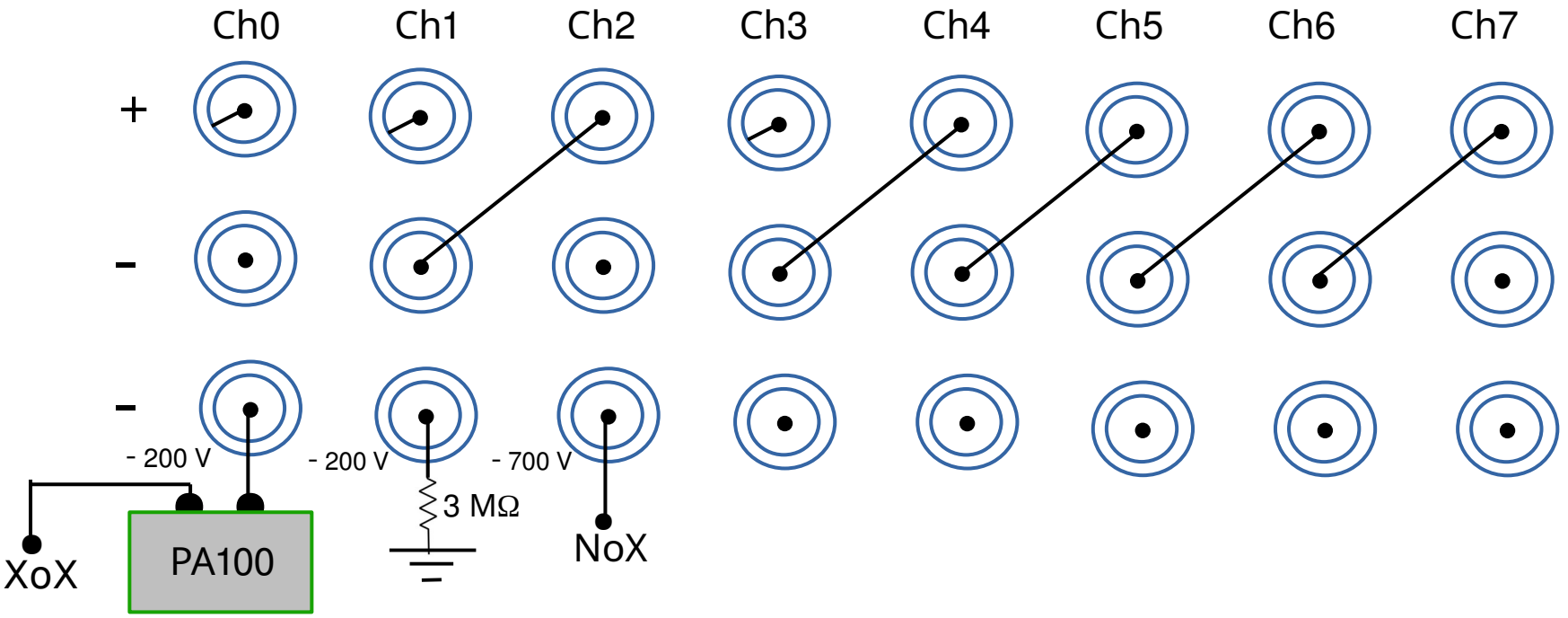
CONFIGURATION ↓ INTERLOCK MODE →	*UNDRIVEN*	*DRIVEN*
leave contact open	INTERLOCK	ENABLED
voltage level (0÷1V, ~5mA current) between pin 2 (high) and pin 3 (low)	INTERLOCK	ENABLED
short circuit pin 1 with pin 2, and pin 3 with pin 4	ENABLED	INTERLOCK
voltage level (4÷6V, ~5mA current) between pin 2 (high) and pin 3 (low)	ENABLED	INTERLOCK

The front panel Interlock LED is ON when the INTERLOCK is active; as INTERLOCK is active, channels are turned off at the fastest available rate, regardless the RAMP DOWN setting. To reset the Interlock flag, all switches must be placed on KILL and then on OFF.

"Driven" is Green in operating mode

A different Daisy Chain – another dummy

A proposal from Fulvio



Benefits:

- Measure XoX currents using a Pico-Ammeter (< 1 µA).
- Separating generators for XoX and NoX, -200 V stable at XoX.
- – 200 V stable at Dummy_0, ensuring stable V at NoX.


File
Vertical
Timebase
Trigger
Display
Cursors
Measure
Math
Analysis
Utilities
Support
Zoom
Undo
20 mV
15 mV
10 mV
5 mV
0 mV
-5 mV
-10 mV
-15 mV
-20 mV
C2
C1
-20 ns
0 ns
20 ns
40 ns
60 ns
80 ns
100 ns
120 ns
140 ns
160 ns
180 ns
C1 DC50
1.00 V/div
-2.380 V ofst
C3 DC50
5.00 mV/div
0.00 mV ofst
C4 DC1M
10.0 mV/div
20.00 mV
Tbase -80.0 ns
20.0 ns/div
2 kS 10 GS/s
Trigger C1 DC
Norm. -660 mV
Edge Neg
TELEDYNE LECROY
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Thank you!