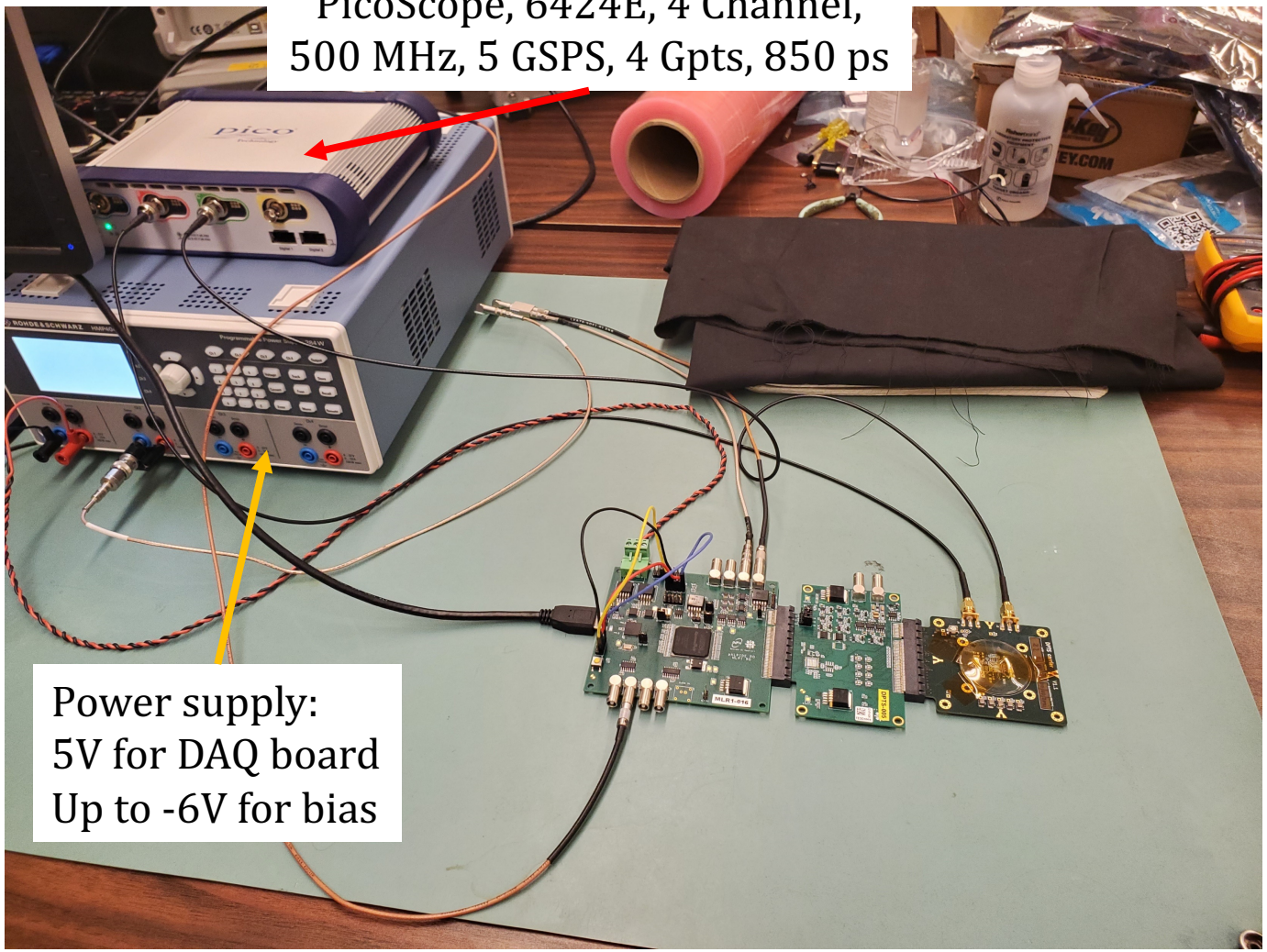
LBNL eRD113 update: DPTS testing

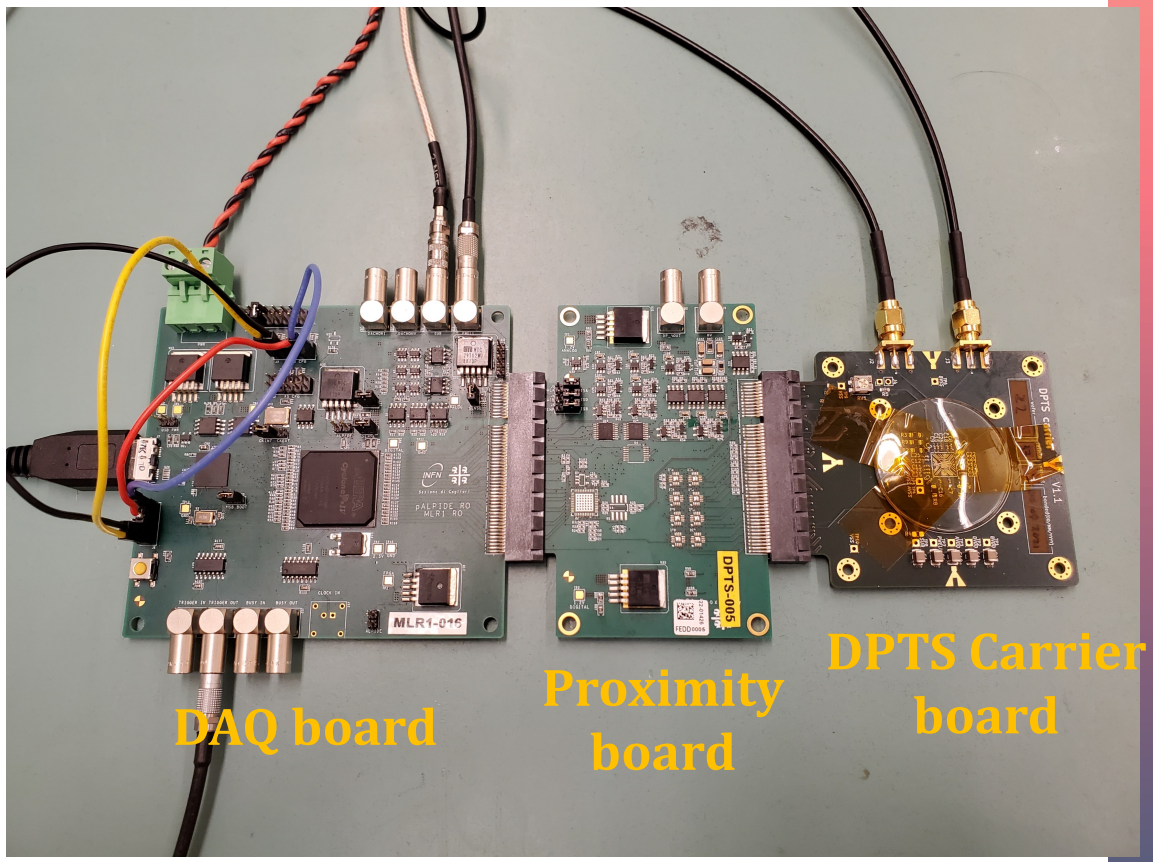
Nikki Apadula, Ezra Lesser, Yuan Mei, Peng Miao, Barak Schmookler

EICSC Meeting

May 9, 2023

Bench Setup

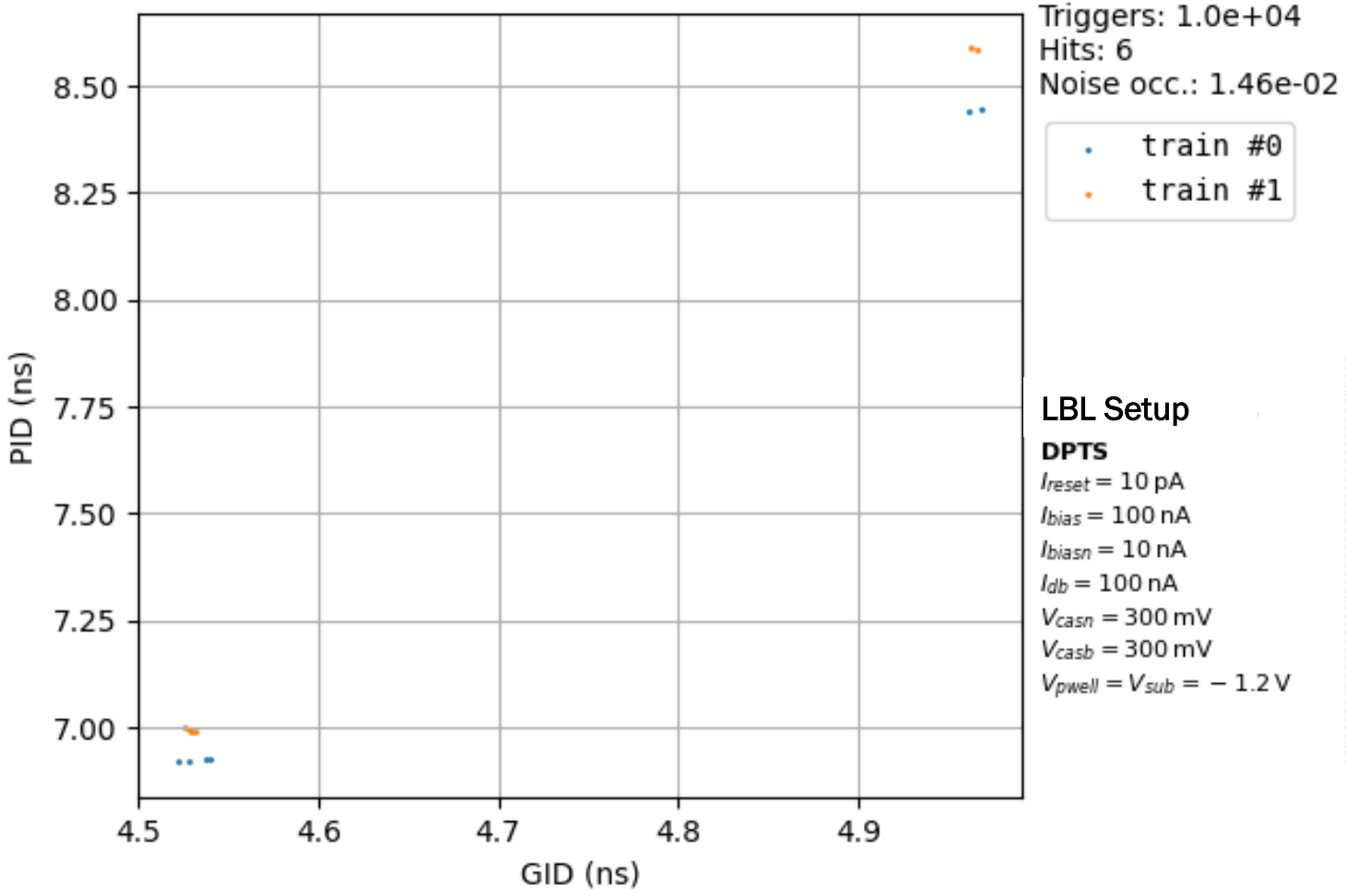

PicoScope, 6424E, 4 Channel,
500 MHz, 5 GSPS, 4 Gpts, 850 ps
Power supply:
5V for DAQ board
Up to -6V for bias


DAQ board
Proximity board
DPTS Carrier board

First checks

- Checked required resistances on DPTS before powering on
- With chip powered ON, bias voltage adjusted from 0 to -3V in 0.3V steps. Confirmed readback current remained <1 mA
- Confirmed voltage across R5 on DPTS was set correctly to 400 mV. Otherwise, requires tuning with a small screwdriver.
- Tested the shift register using DAQ software

Fake Hit Rate Scan

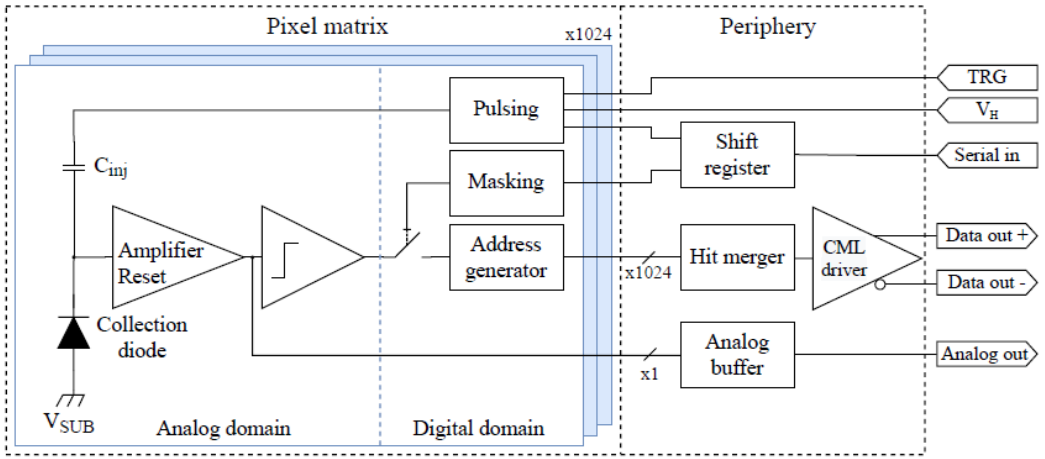


LBL Setup

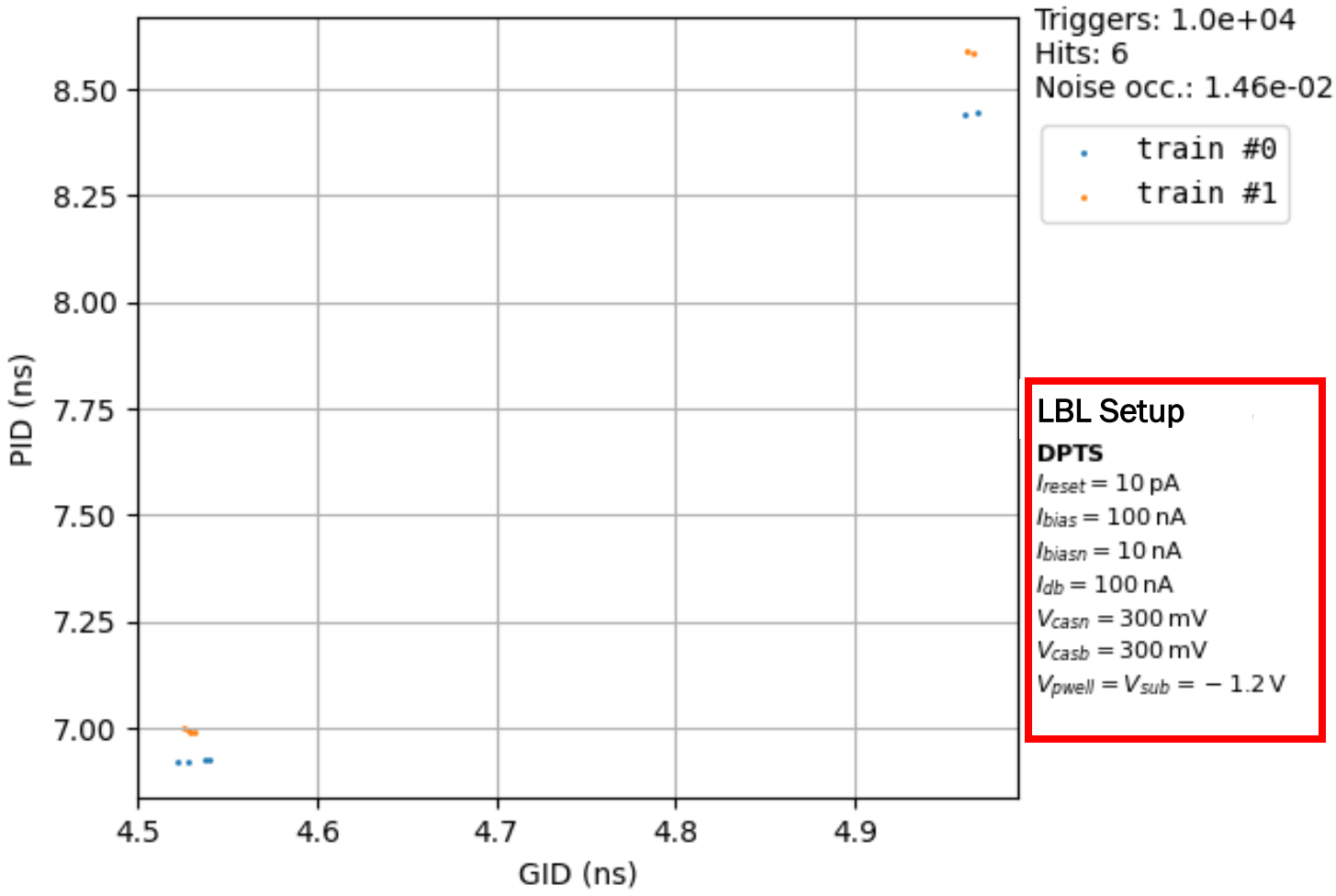
DPTS

$I_{reset} = 10\,pA$
$I_{bias} = 100\,nA$
$I_{biasn} = 10\,nA$
$I_{db} = 100\,nA$
$V_{casn} = 300\,mV$
$V_{casb} = 300\,mV$
$V_{pwell} = V_{sub} = -1.2\,V$

Measures number of hits seen in absence of external stimuli. That is, no charge injected into pixel circuitry by the trigger pulse.



Fake Hit Rate Scan



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We use 'nominal' settings here.

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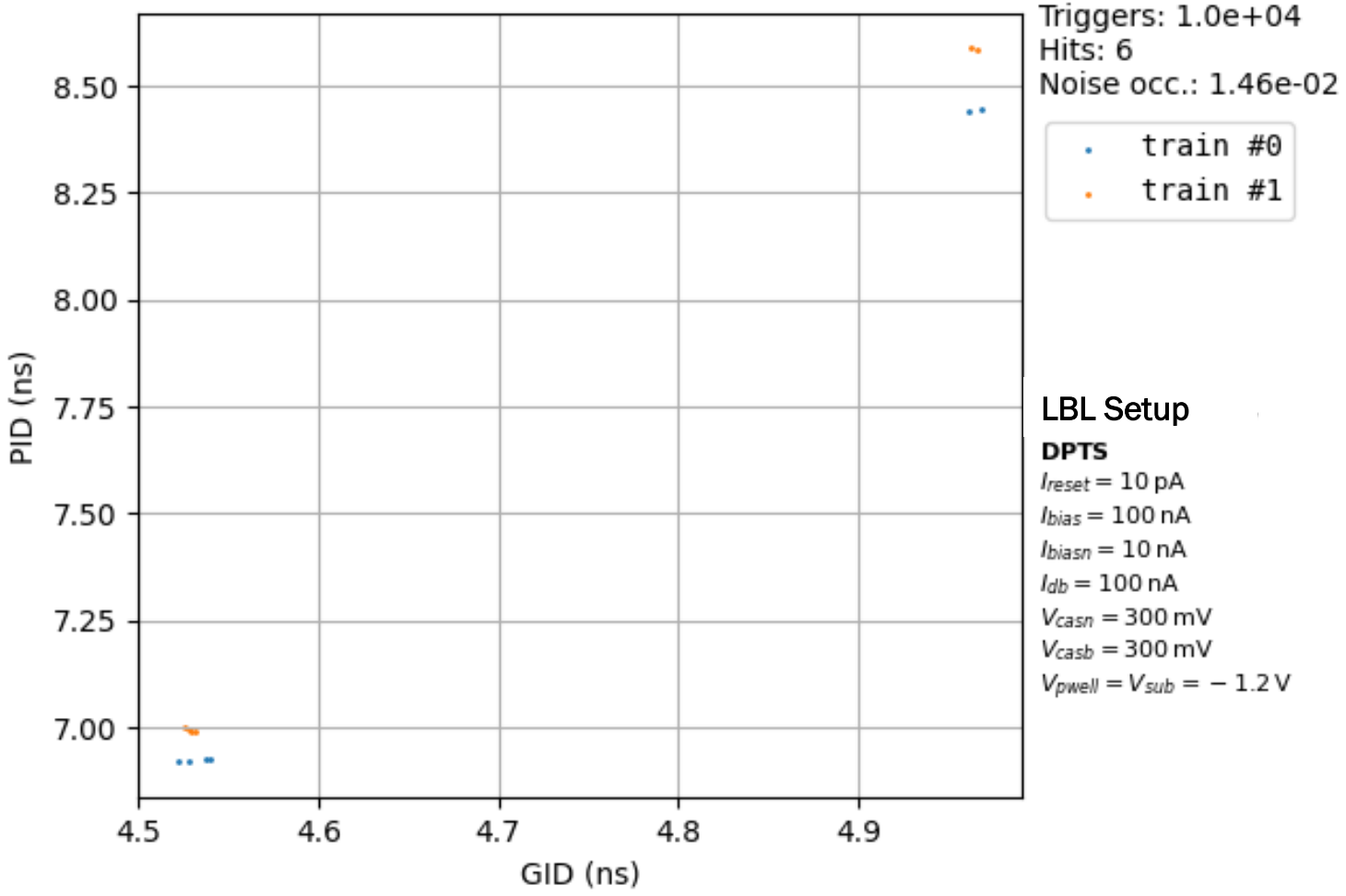

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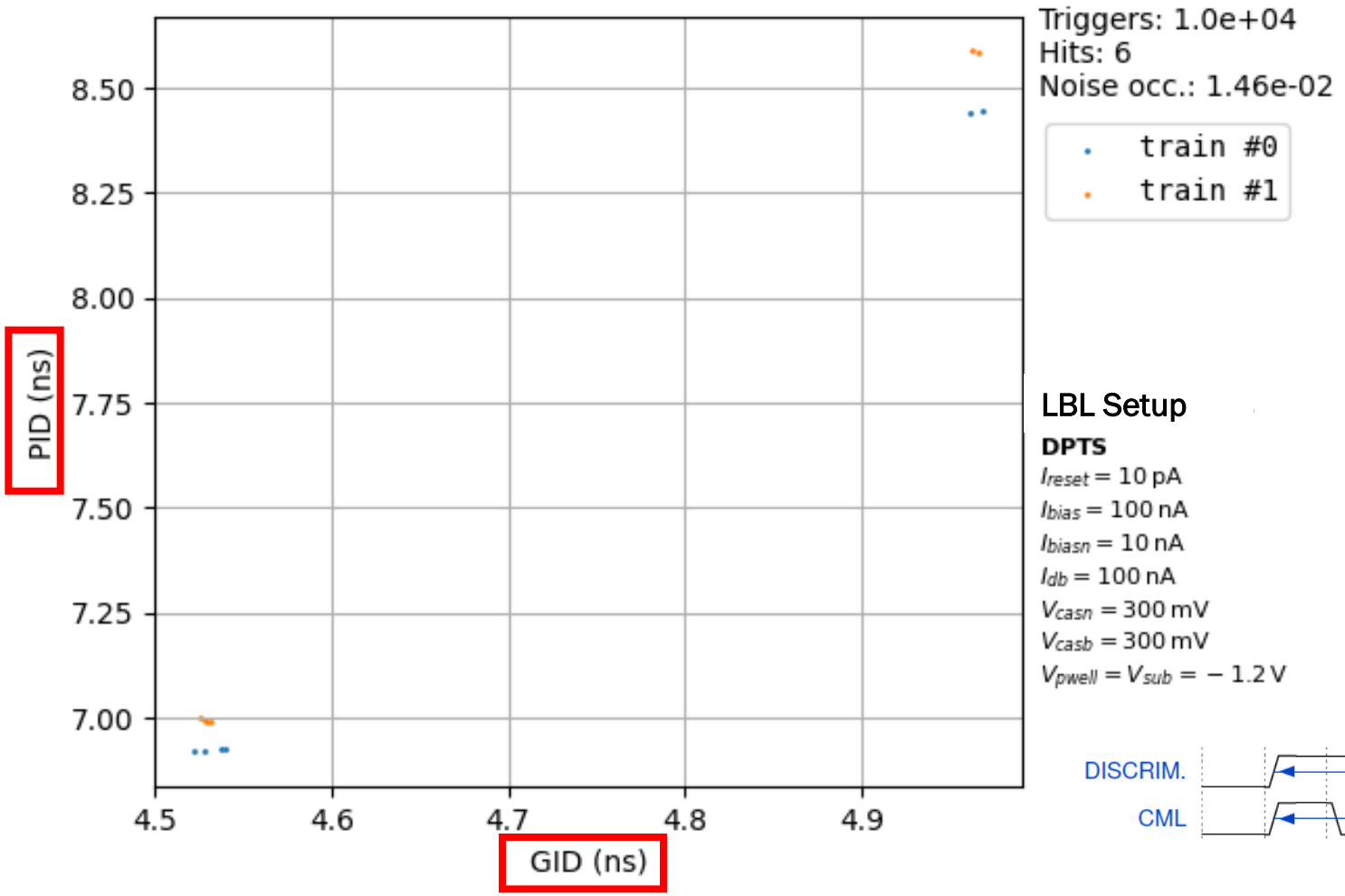
$$Noise\ Occ. =$$

$$\frac{Hits}{(Triggers \times Pixels \times scope\ capture\ time)} =$$

$$\frac{6}{(10{,}000 \times 1024 \times 40\ us)} =$$

$$0.0146\ per\ pixel\ per\ s$$

Fake Hit Rate Scan



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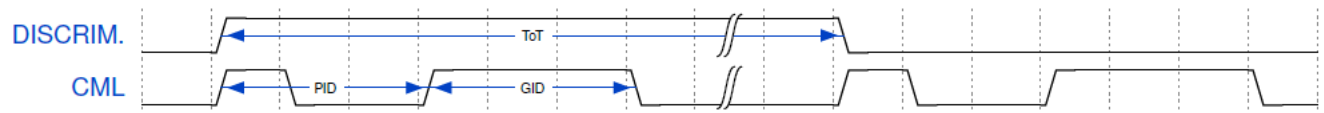
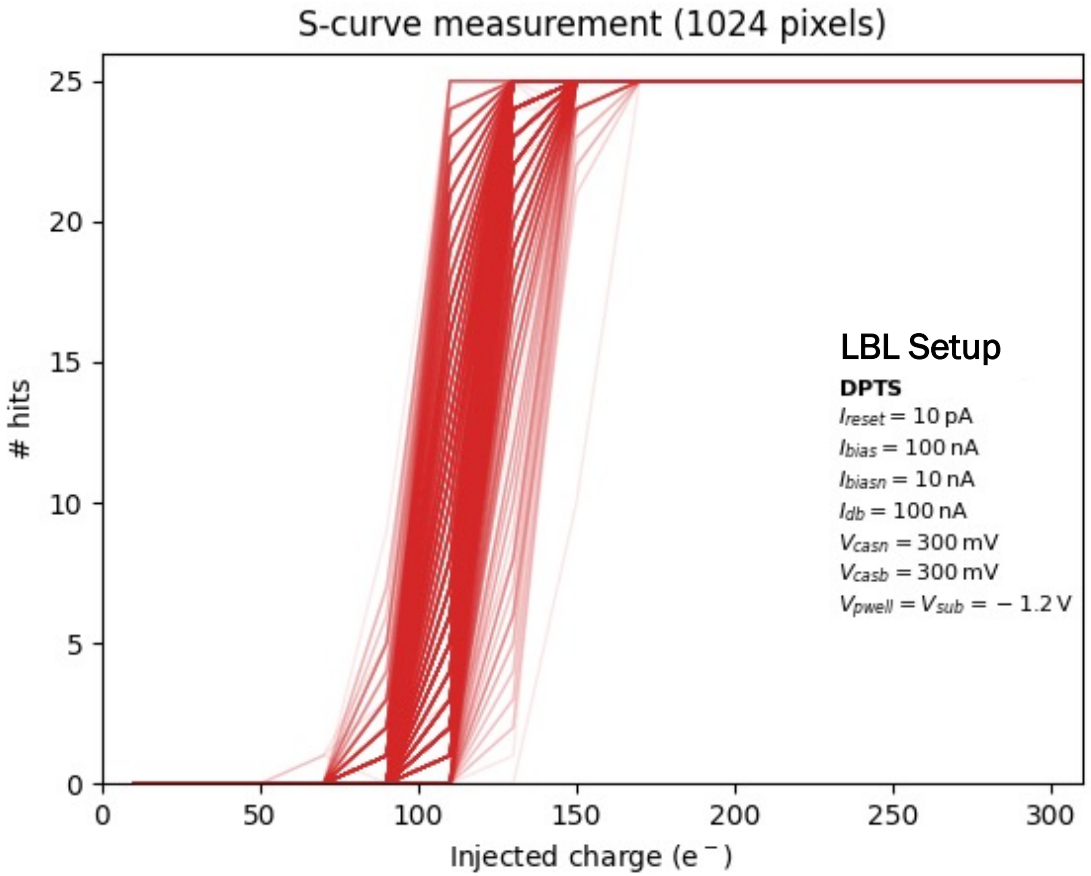
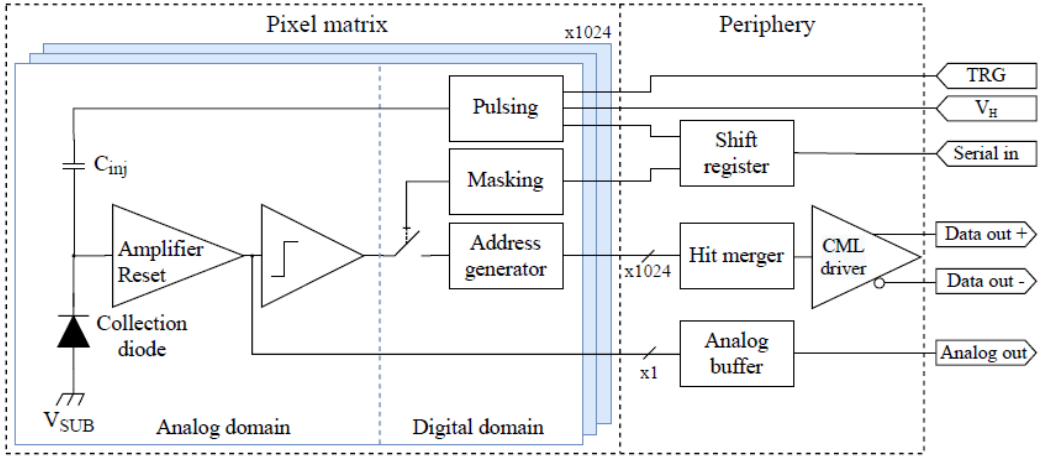
These PID and GID times identify the pixel.



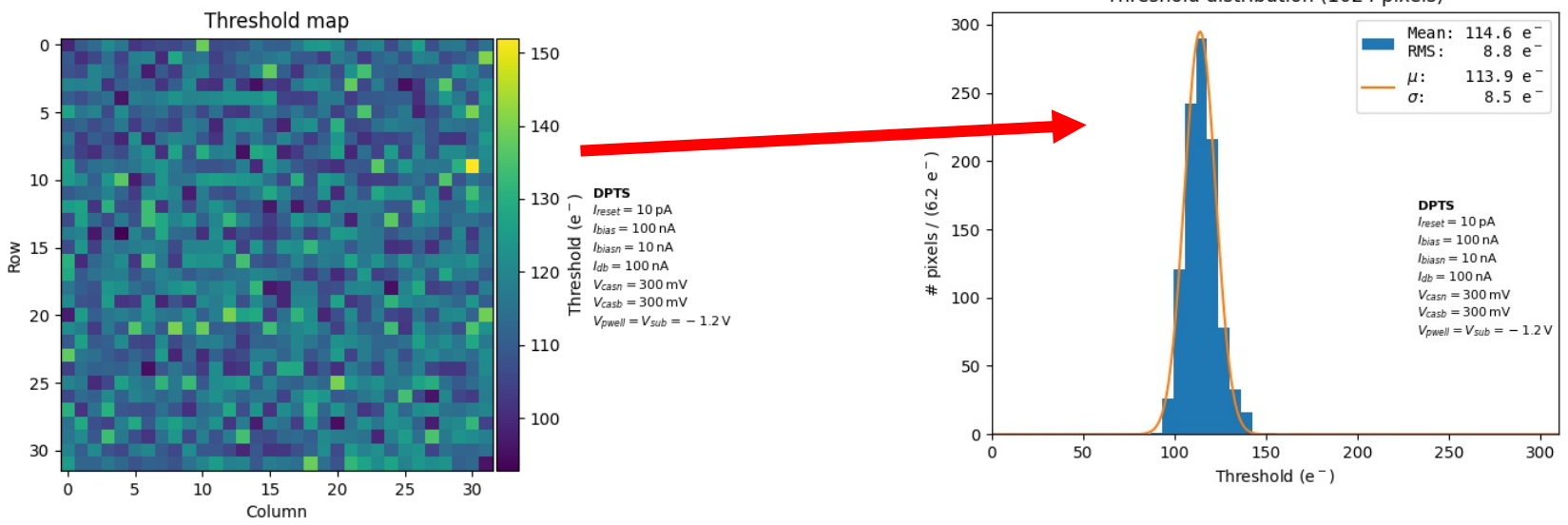
Threshold scan

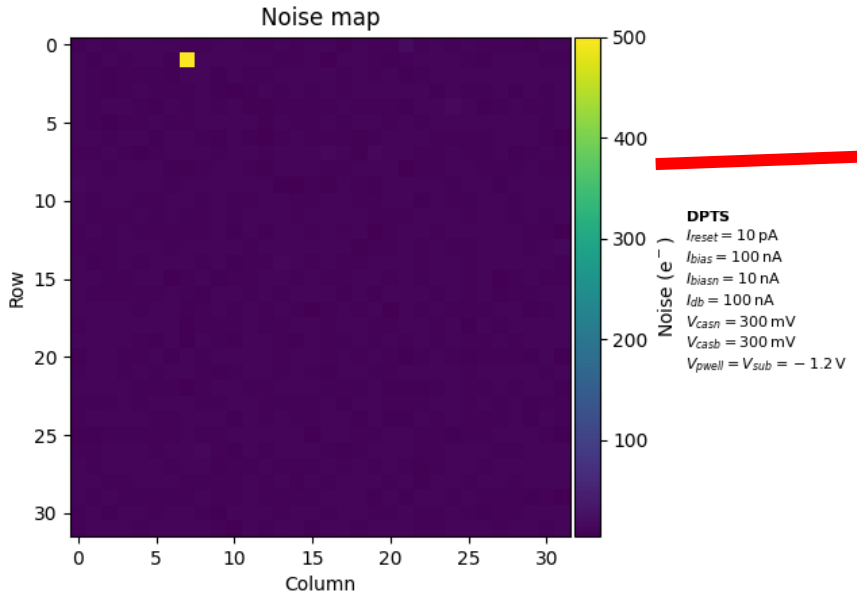


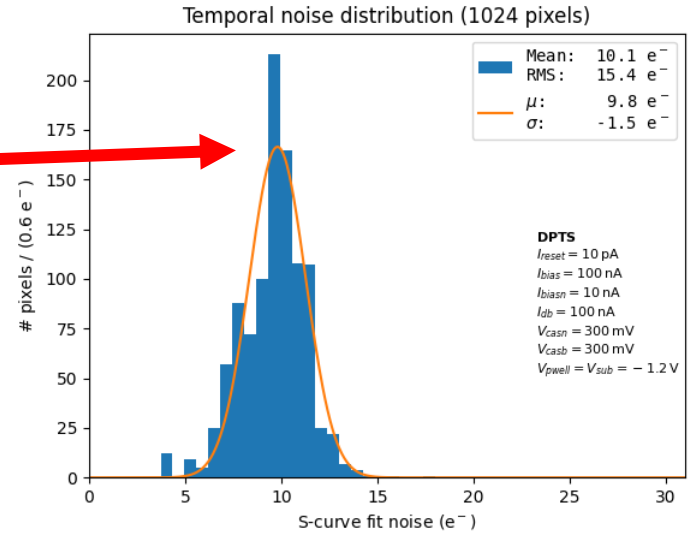
At a given V_H (i.e. input charge), each pixel is pulsed 25 times and the number of hits is recorded. A hit requires two pulses to be captured by the scope – indicating the assertion and de-assertion of the discriminator pulse.



Threshold & noise map







The threshold and noise are determined from the mean and standard deviation of the derivative of the S-Curve.

Summary

- LBNL has a working DPTS bench set up
- Verified with fake hit rate and threshold scan
- Next step is time-over-threshold study