

Aging study of HRPD

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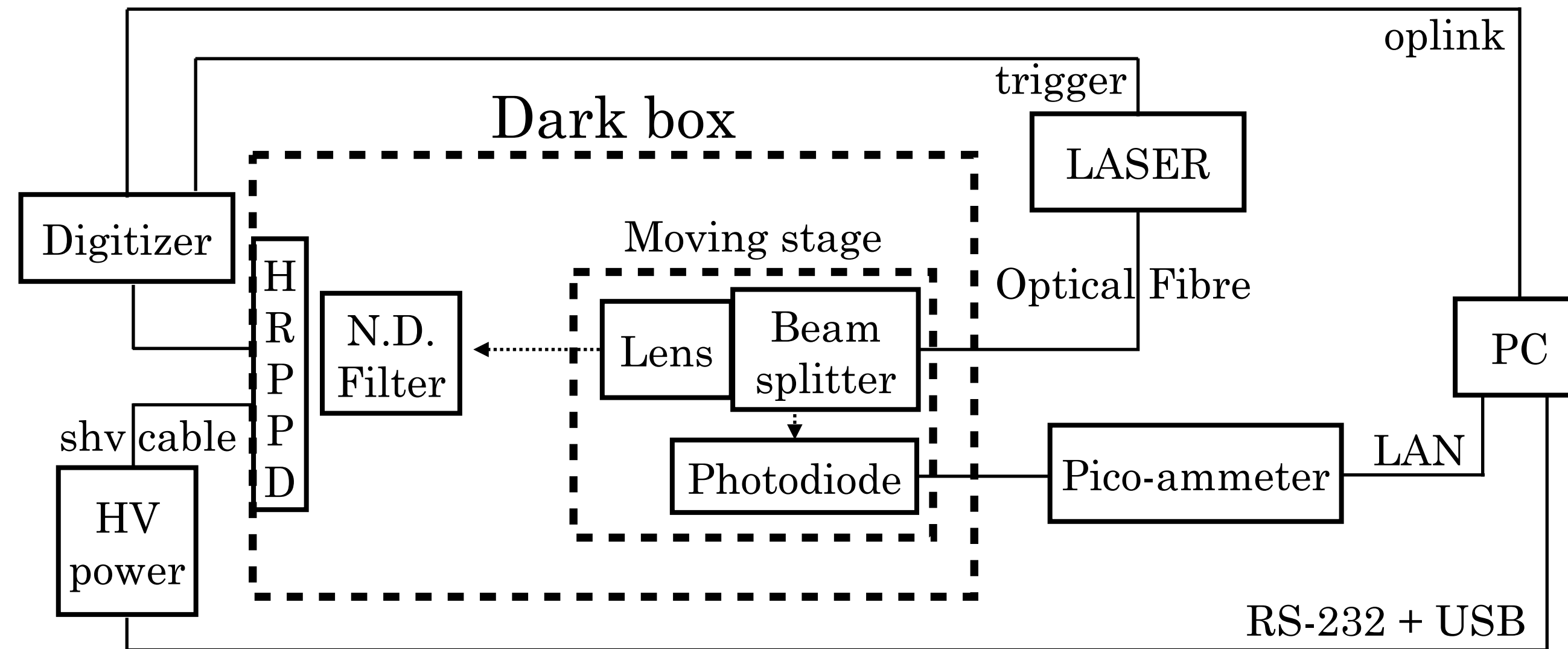
Brookhaven National Lab

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Outline

- Experimental test-stand
- Variables of interest

Setup



HV power: LeCroy 1458/1461

Digitizer: CAEN V1742

Photodiode: S1227-1010BQ

Pico-ammeter: Keithley 6485

LASER: NKT Photonics PIL1-040-40FC

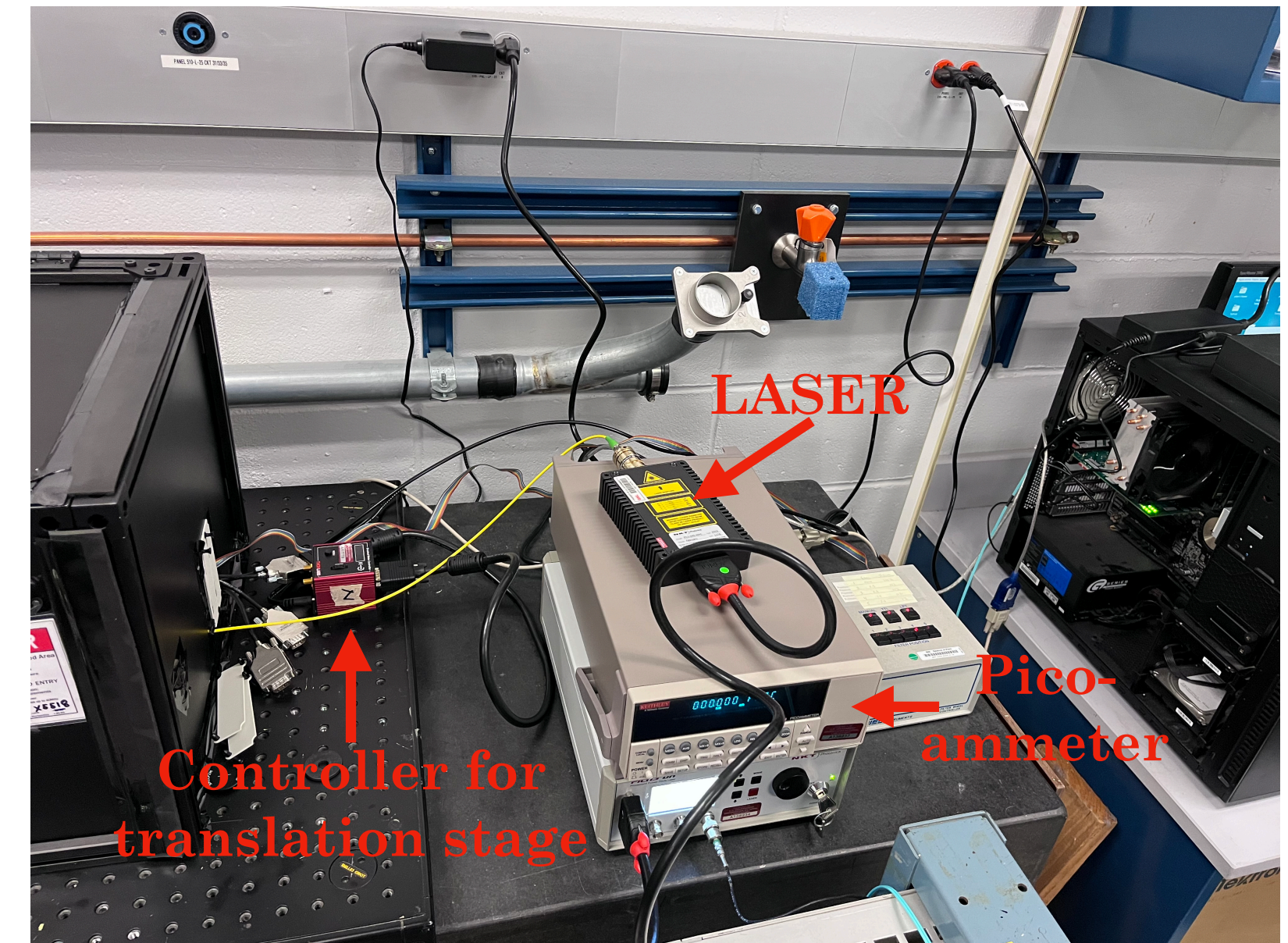
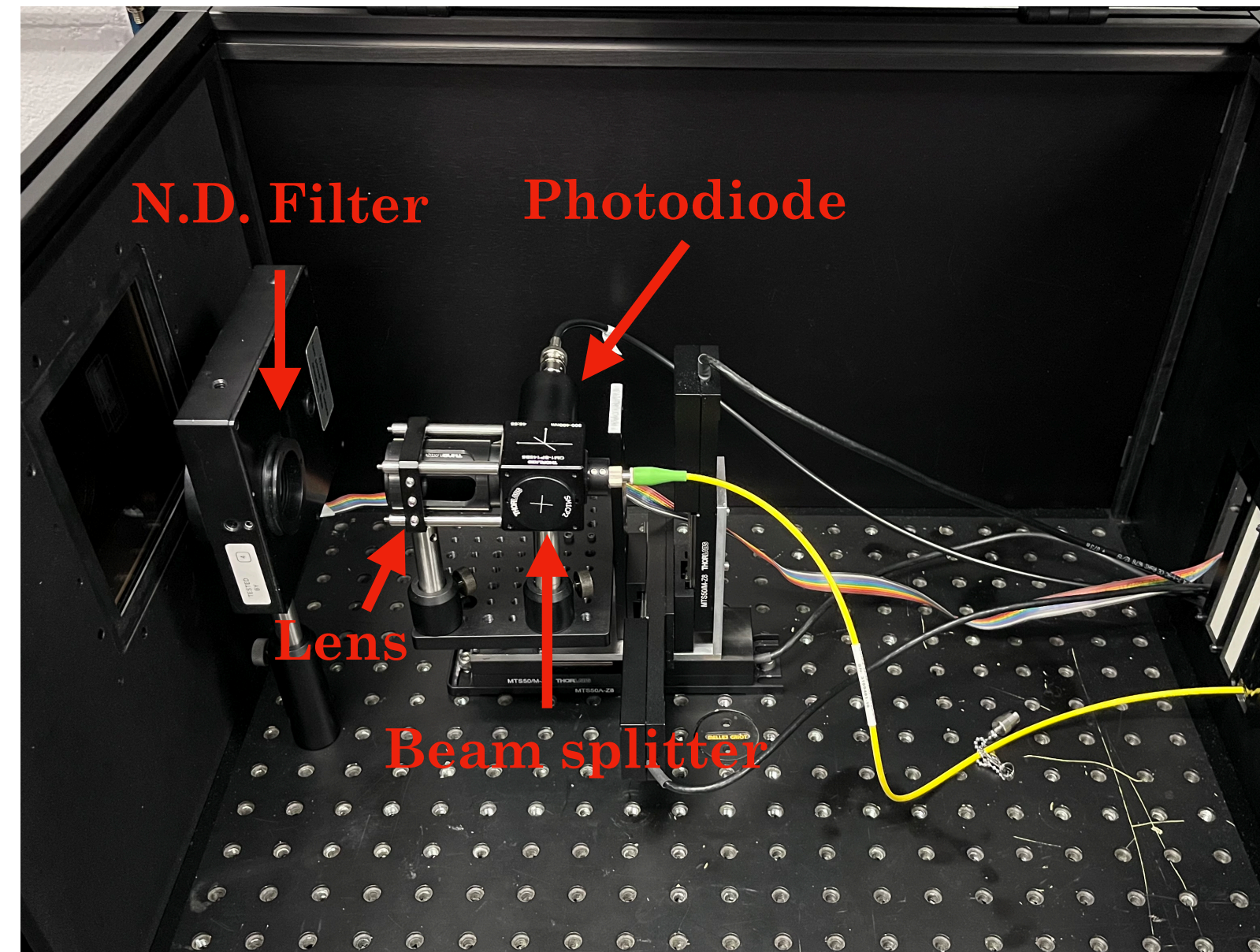
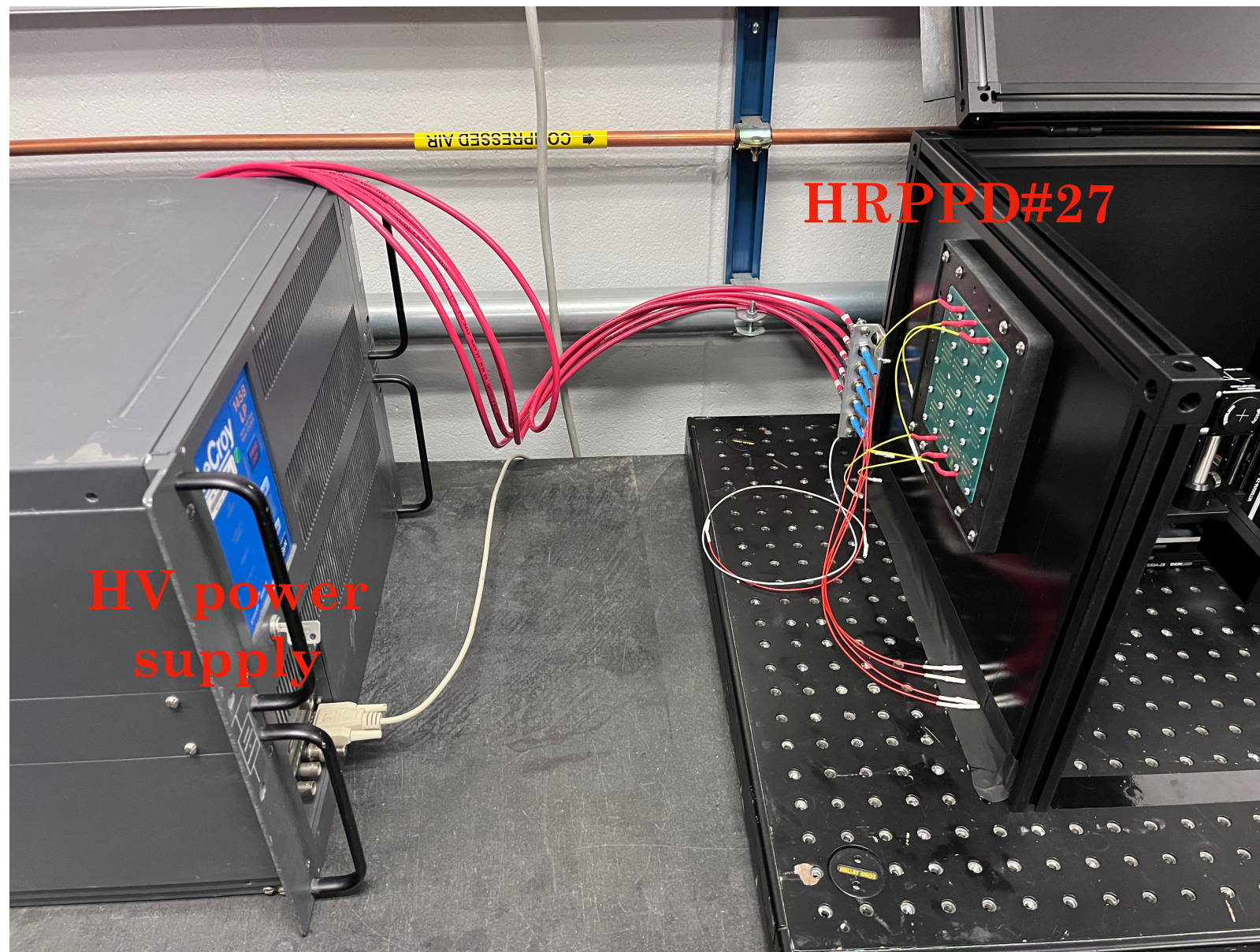
Beam splitter: Thorlabs CM1-BP14585

Lens: N-BK7, focal length 50 mm.

N.D. filter: ???

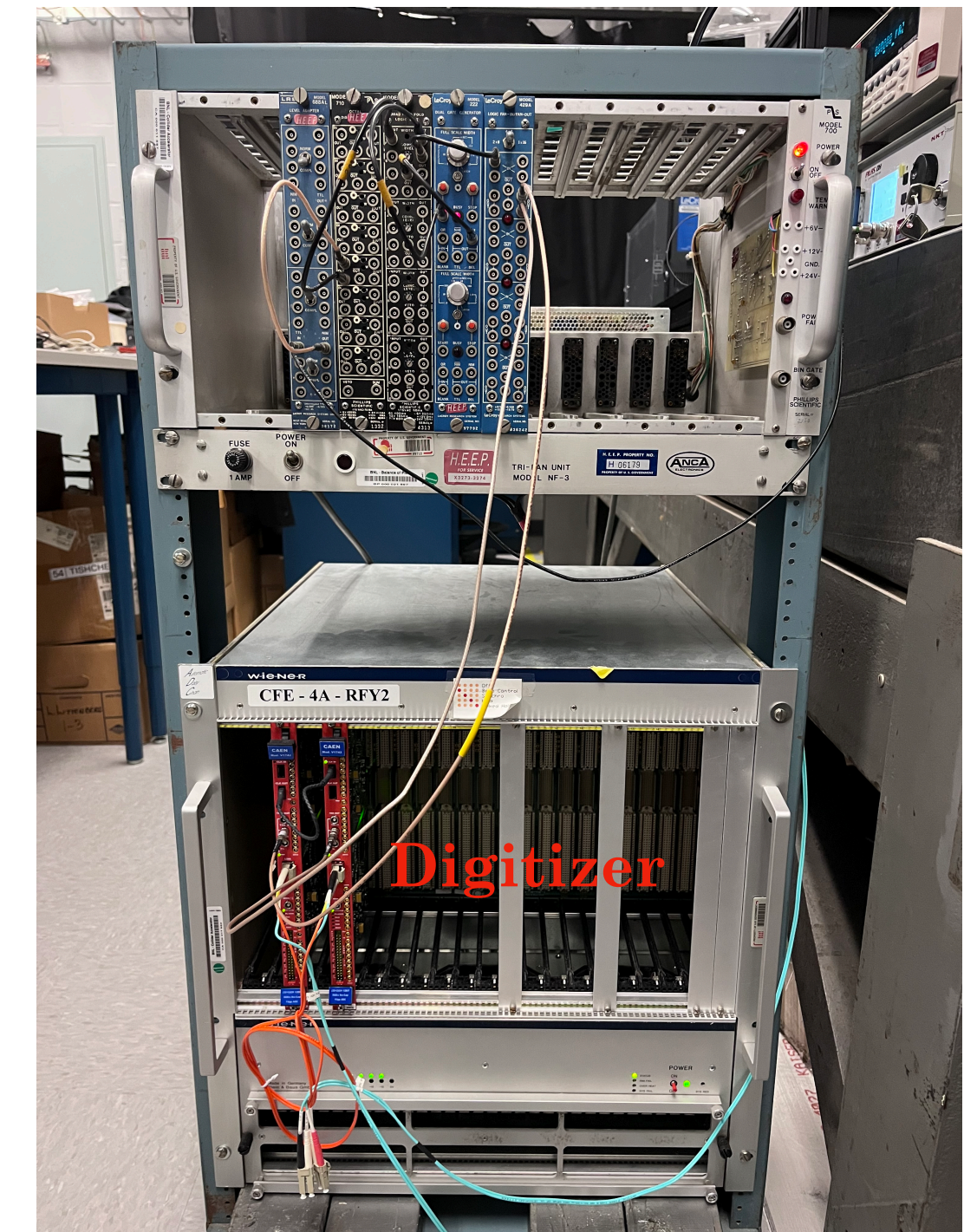
DAQ: rc_daq

Slow control: Alexander's library



Test-stand

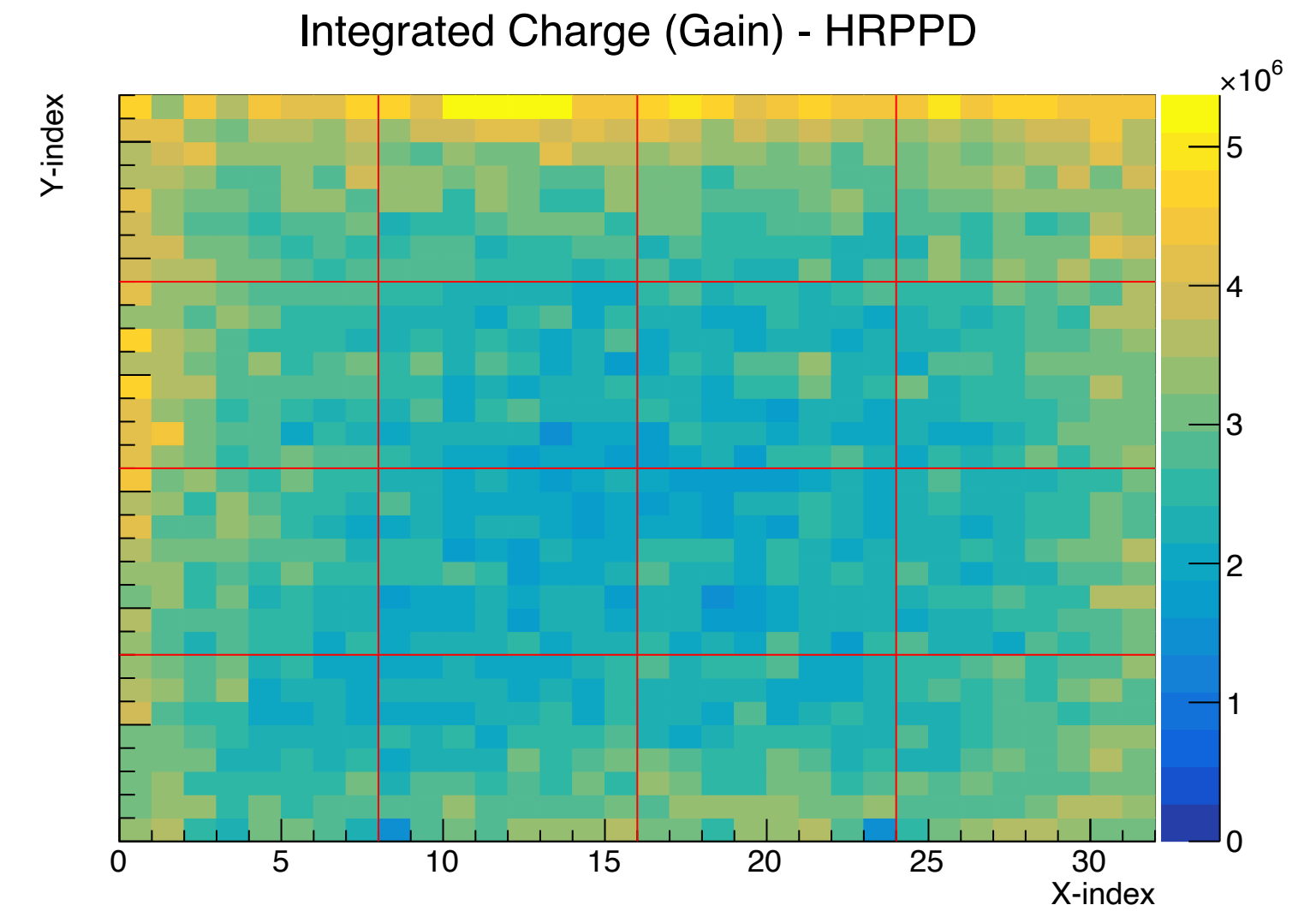
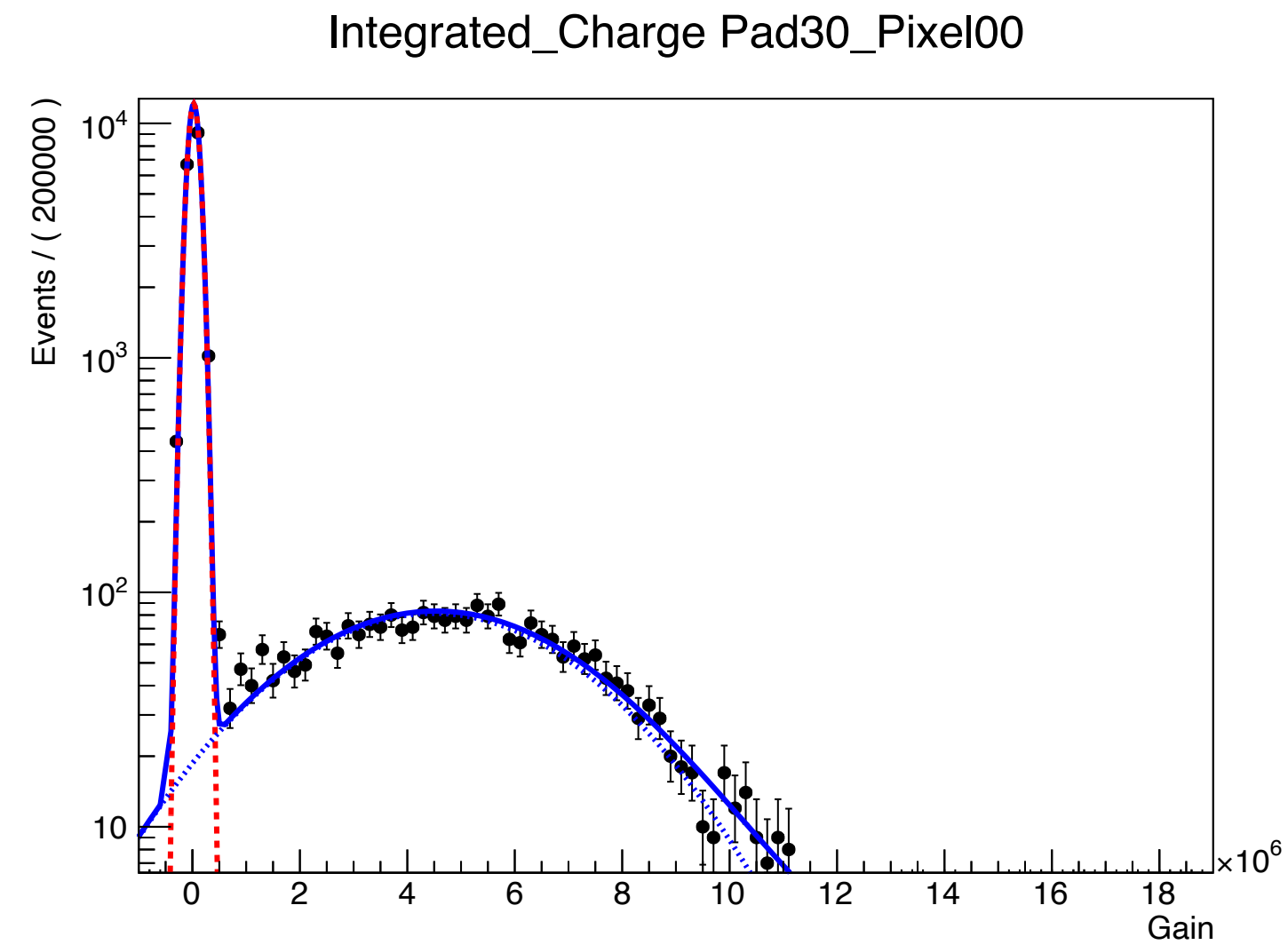
- Assembling has been completed.
- Data taking is ready.



Variables of interest

- After a period of illumination, the characterization of the HRPPD in **single photon detection** mode will be investigated regularly.
- Gain,
- Photon Detection Efficiency (PDE),
- dark count rate (DCR),
- timing, etc.
- Methodology of measuring them are in the following pages.

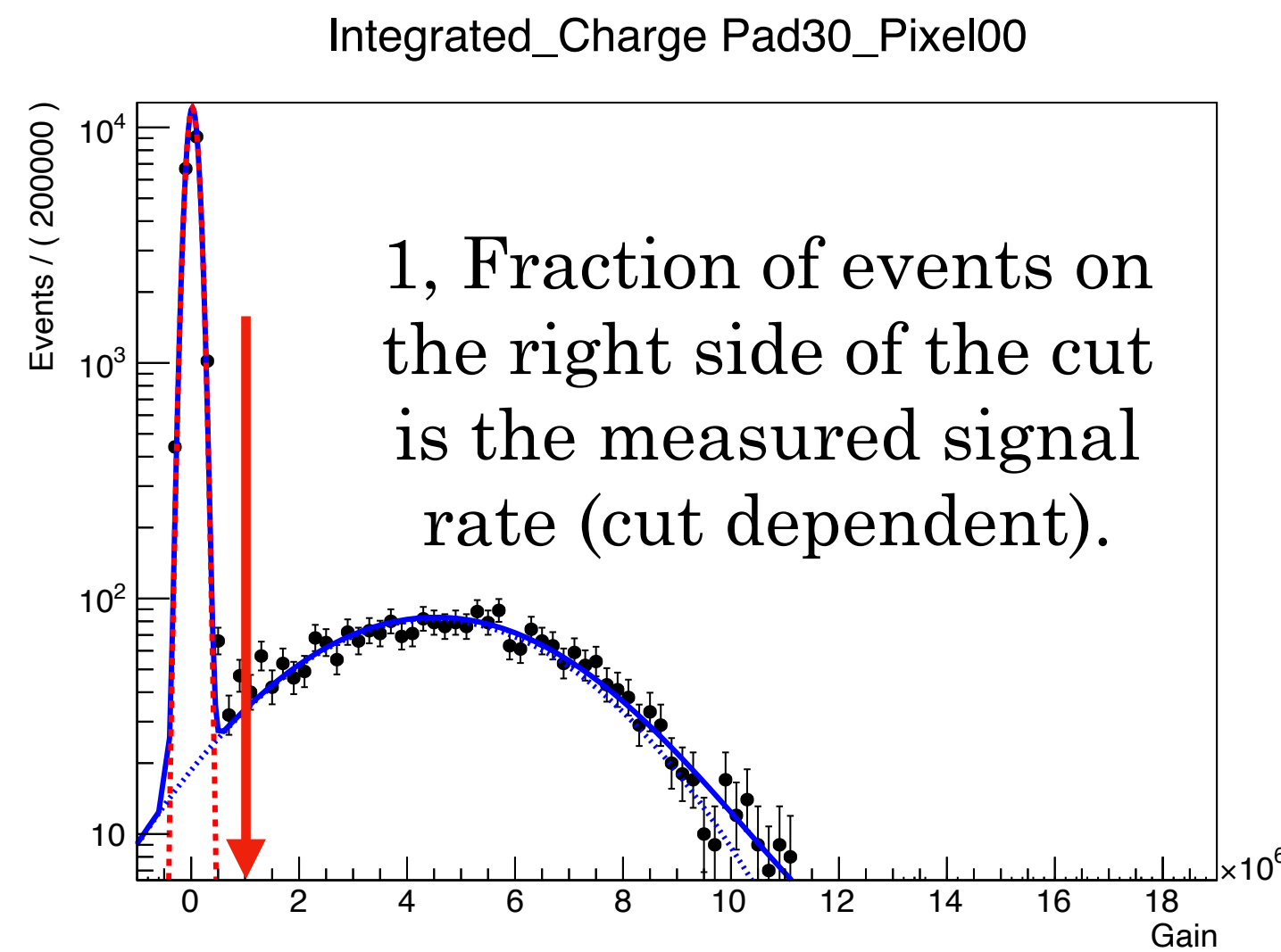
Gain



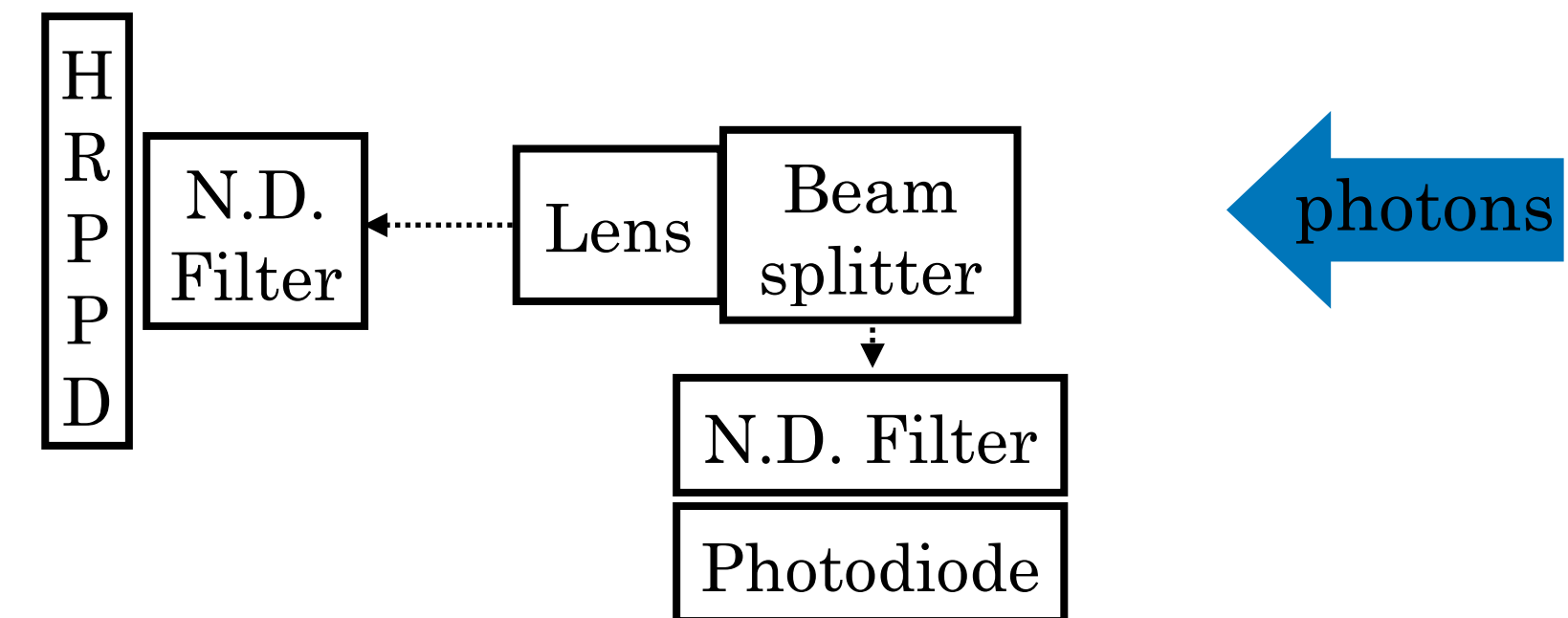
- Analysis codes are ready.
- Only assess the performance of a small cluster of pixels, e.g., 7x7, rather a complete surface scan.
- Investigation of the HV setting is still ongoing.

PDE

- Assuming Poisson probability for the process of photon hitting photo-cathode, no-photon rate is $P(\lambda,0)$, photon rate = $1 - P(\lambda,0)$. (n.b. signal rate = photon rate * PDE)
- If the mean value (λ) of photon number is well known, $PDE = \text{measured signal rate} / (1 - P(\lambda,0))$.
- Initially a large number of photon from a laser pulse thus is favored, i.e., high OD N.D. filters are needed.



2, Fitted value for fraction of single photon peak is the measured signal rate (cut-independent)



Dark count rate

- Configure the DRS4 to read data but not to write data, checking how many noise pulses in one channel cross the custom-set threshold in a few seconds.

Timing

- Using timing information between the trigger and signal pulse recorded by DRS4.
- Note that our LASER has non-ideal timing (FWHM ~ 30 ps).

To-do

- Laser setting.
- Illumination time duration.
- Data size.