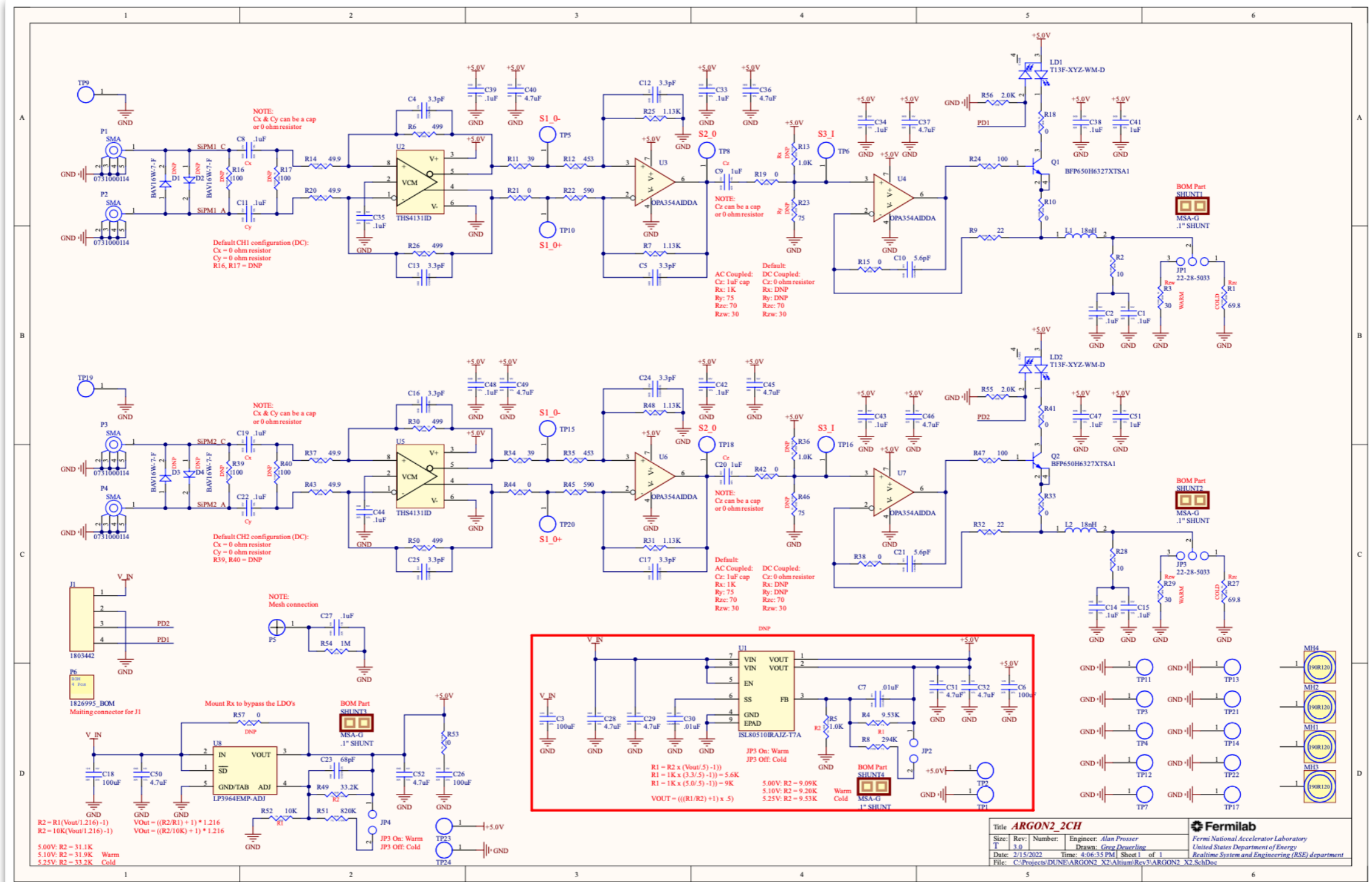


Argon2x2 rev.3 characterization

Ajib Paudel
Alan Prosser
Alex Kish

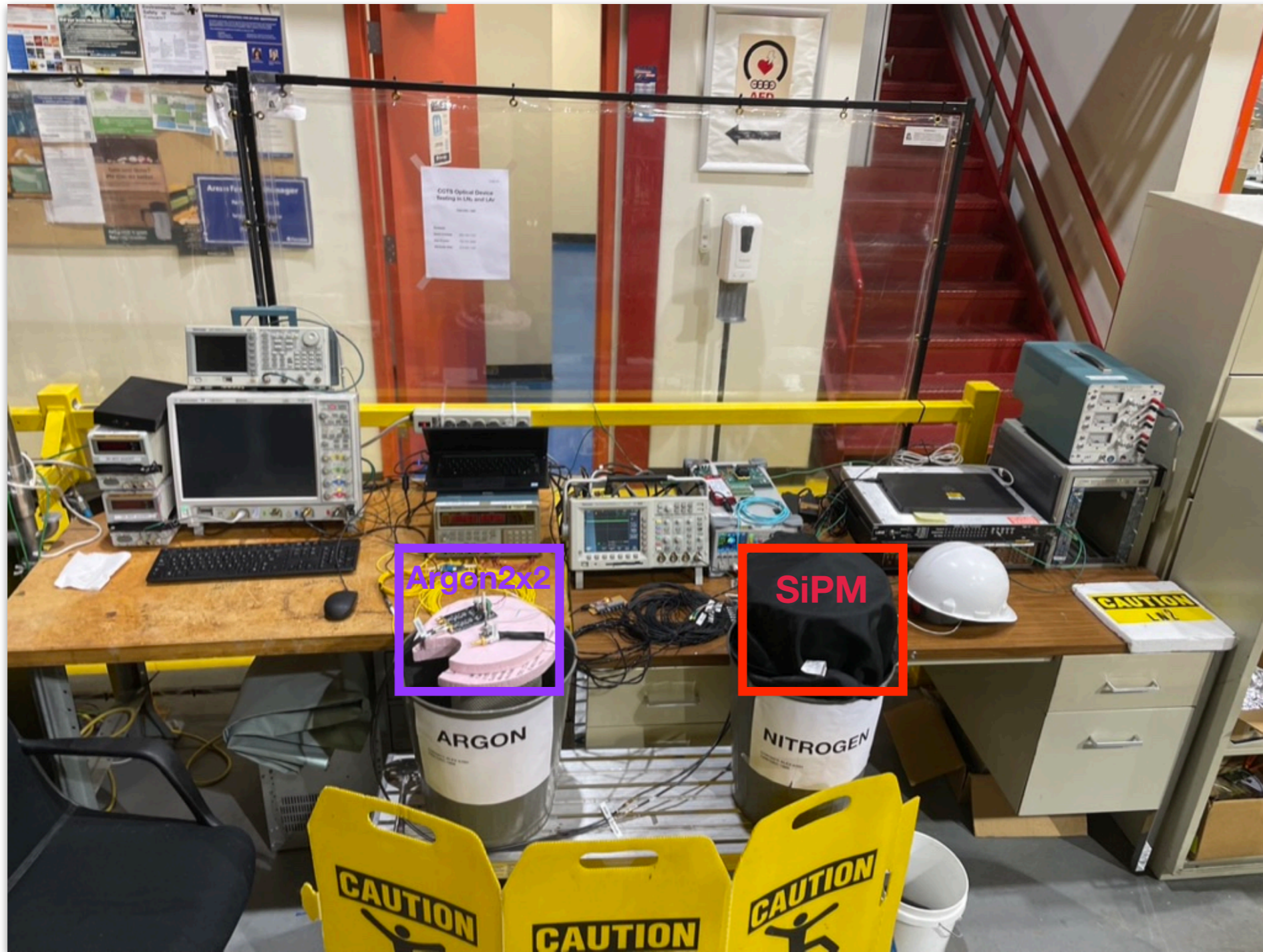
Fermilab
240420

Argon2x2, Rev.3, "Board 8" Schematic



1. Replace R24 and R47 each with 10 ohms (tested at FNAL) to address instability.
2. Replace C1, C2, C14, and C15 each with 1 uF (tested at FNAL) to reduce "droop" in signals after the onset of fast edges.
3. Replace R10 and R33 each with 10 ohms
4. Replace 0 ohm resistors with 0.1uF capacitors on the input of excitation signal C8, C11, C19, C22

Test stand, DAQ



Argon2x2 board at room temperature (**BOARD_8**)

SiPM test card in LN2 ('mini-Arapuca' tile)

Data acquisition with oscilloscope

Trigger from the LED pulser, ~300 Hz

Sampling at ~1GHz

5 μ s trace length (2/3 μ s pre/post-trigger)

2000 events collected in each setting

Data of 220408

Argon2x2 \rightarrow MMF \rightarrow 3dB attenuator \rightarrow SMF

220408 AK

Data I took this day is with a new mini-Arapuca tile that was under urgent test

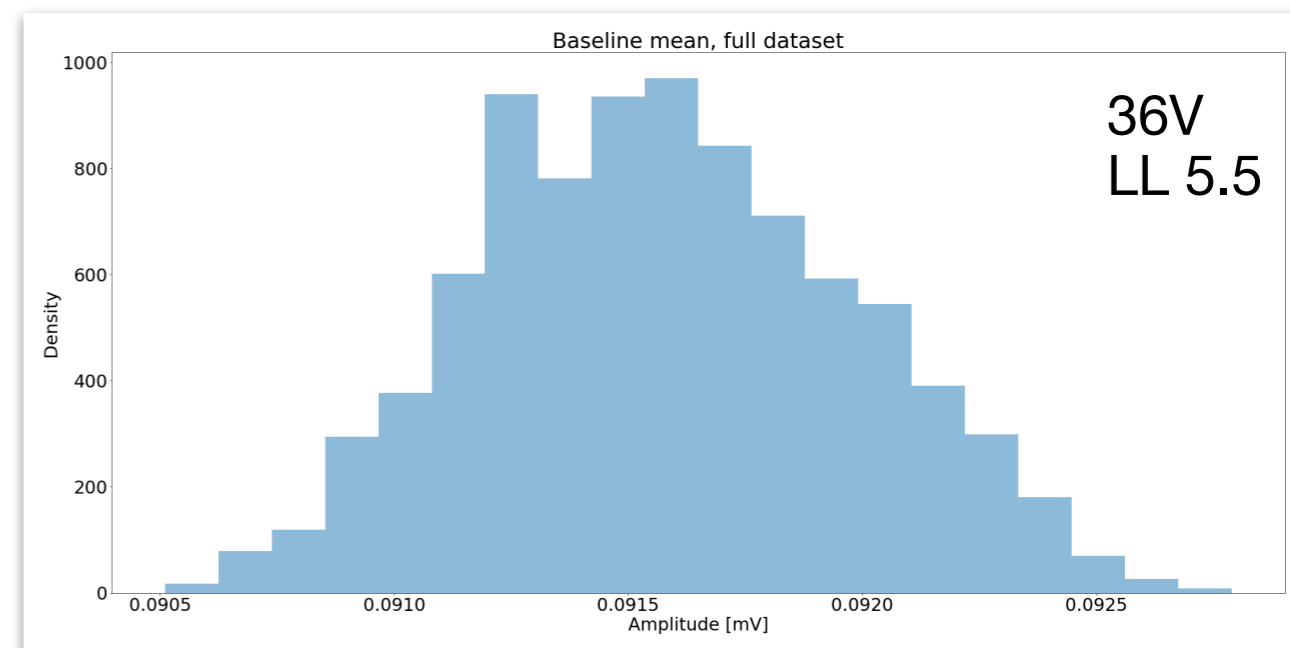
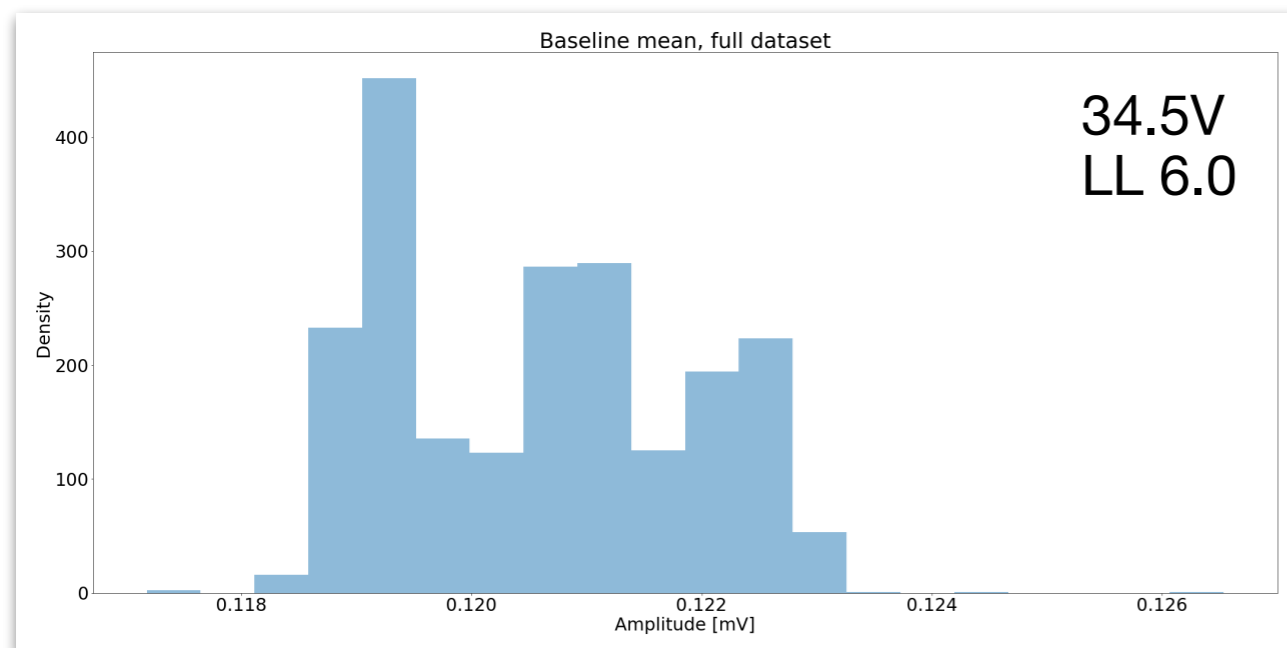
The Argon 2x2 board that I used had only one mounting post per laser diode, and optical coupling with single mode fiber was not ok the other day, so I switched to 50 μ m fiber that solved my coupling problem

Observed noise, looking to be mostly below the baseline and containing superimposed different frequencies, that depended on how I handled the parts

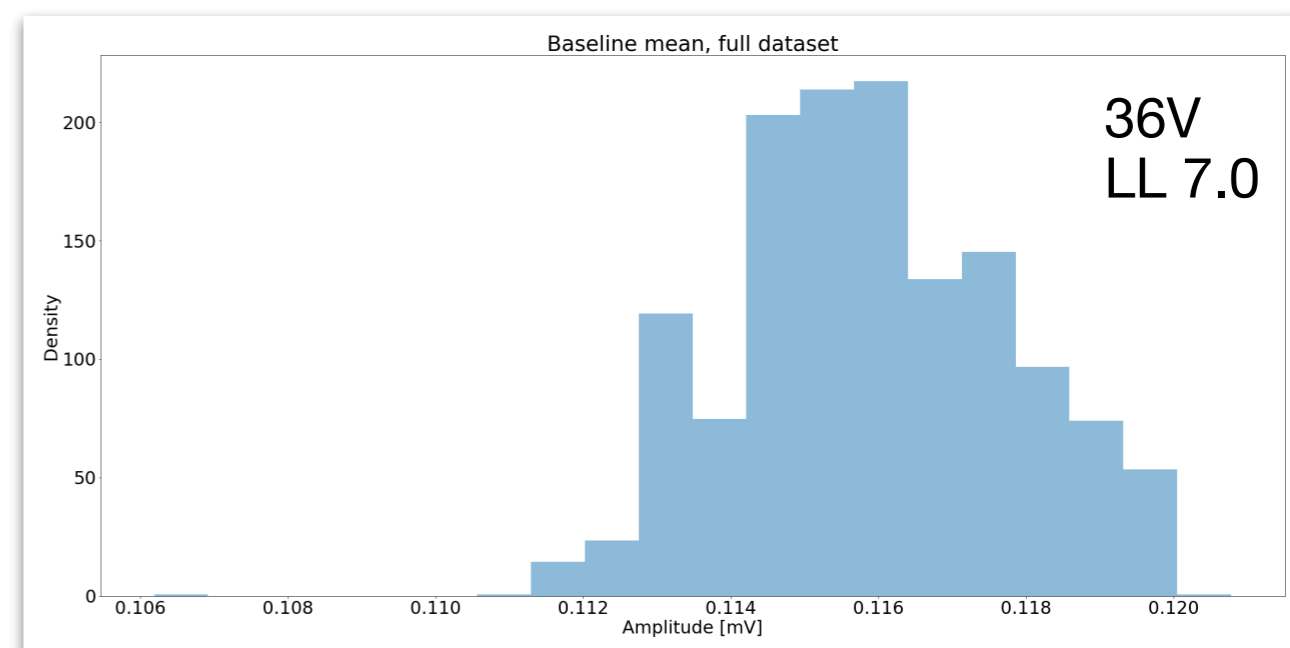
SiPM in LN2 | Argon2x2 in LAr | AC-coupled channel | light level 6.0

Baseline is calculated on the first ~1.5 μm in the pre-trigger

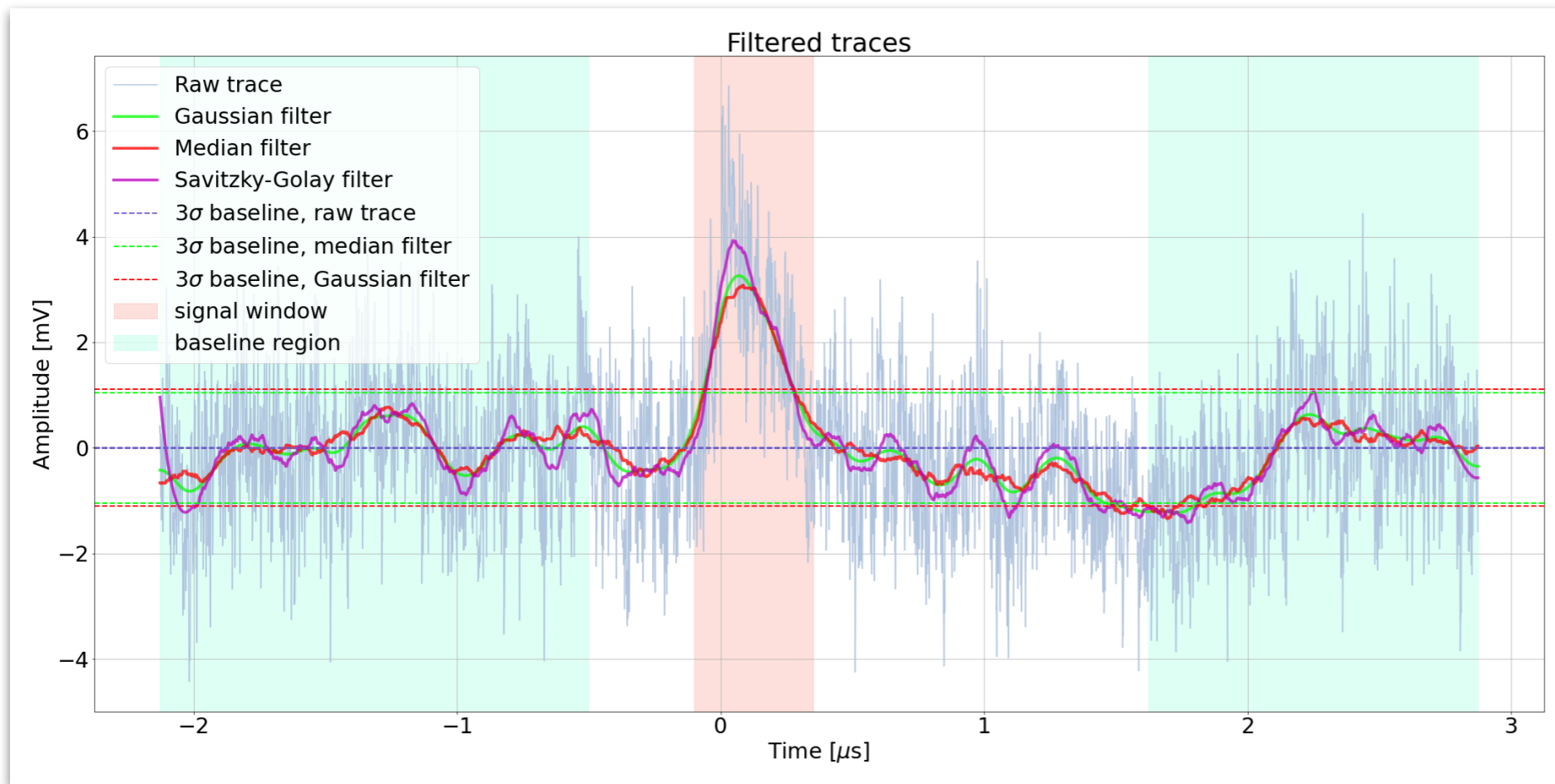
Distribution for all 2000 events:



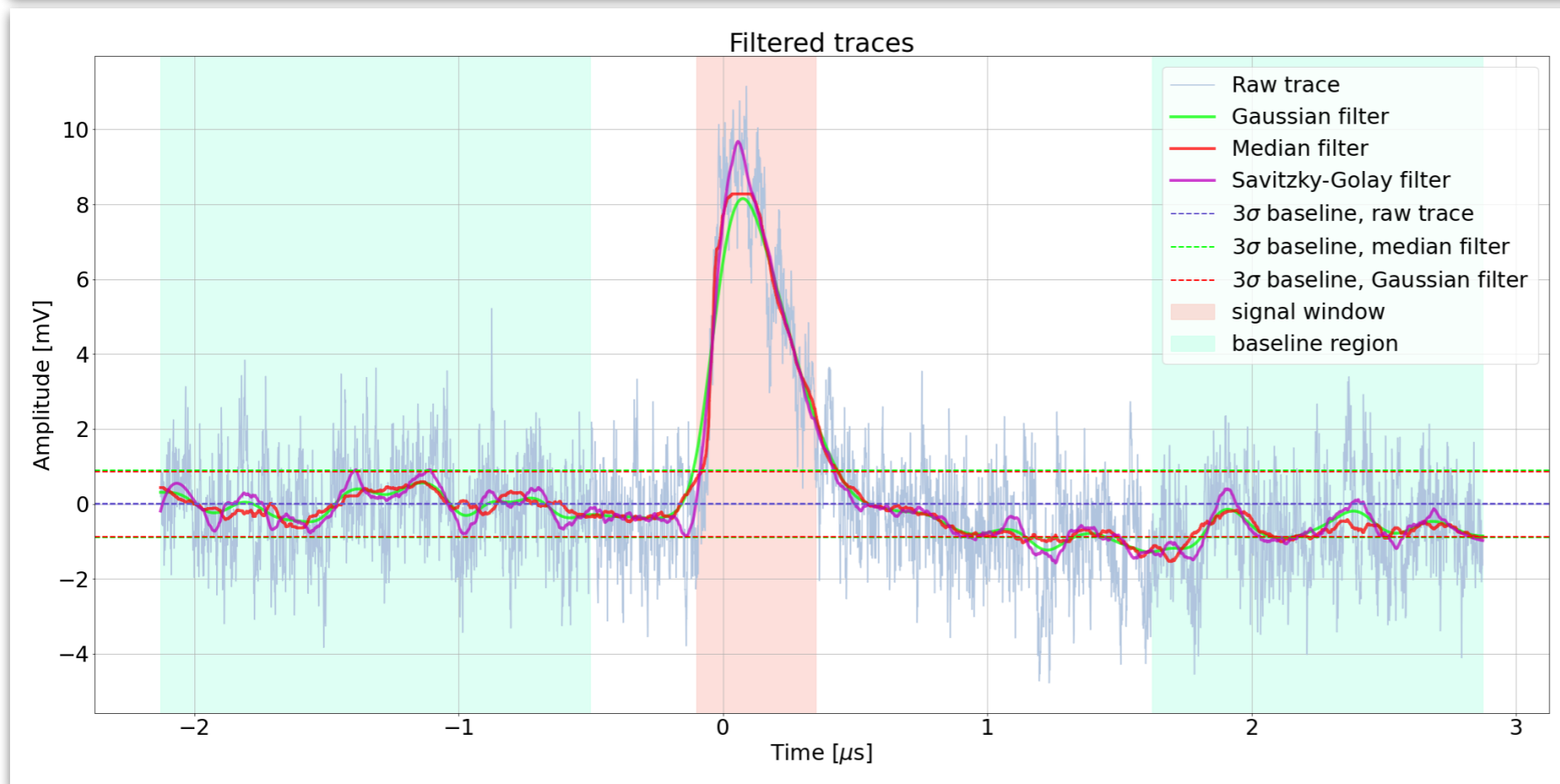
Non-Gaussian shape. The distinct shift is likely caused by the multi-mode fiber



SiPM @34.5V in LN2 | Argon2x2 in LAr | AC-coupled channel | light level 6.0



SPE candidate



Filter window size:

median 1000

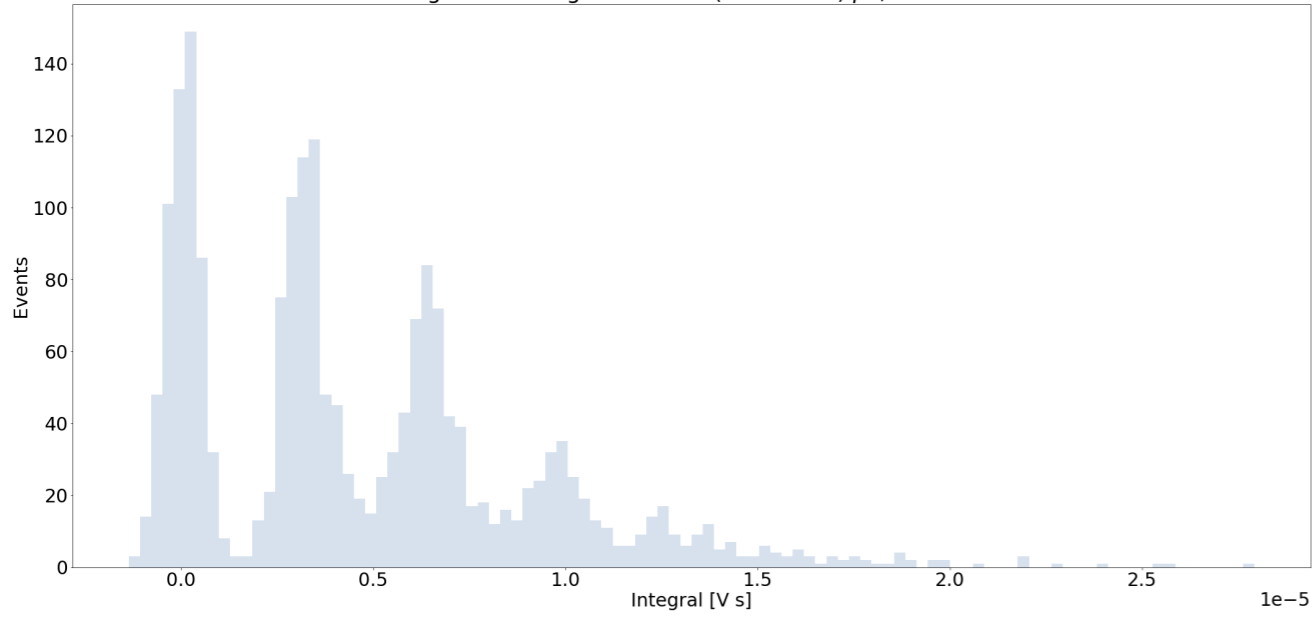
Gaussian (σ) 250

Savitzky-Golay 1001

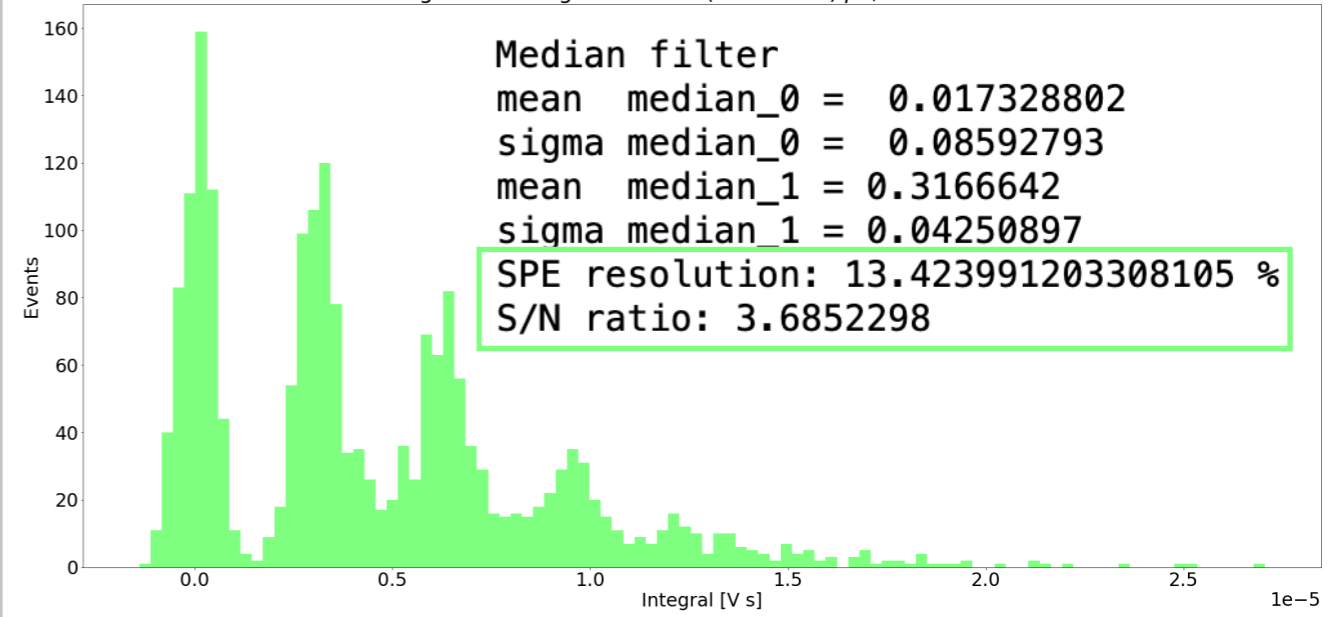
*sampling rate 1Gs/s

SiPM @34.5V in LN2 | Argon2x2 in LAr | AC-coupled channel | light level 6.0

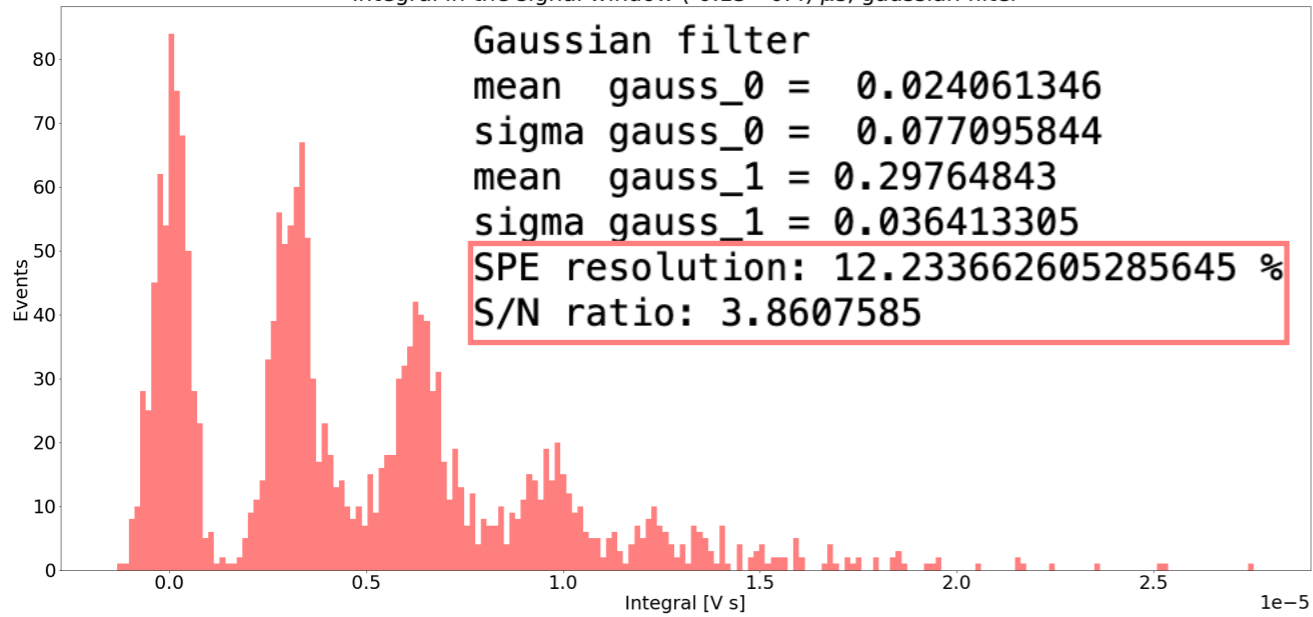
Integral in the signal window (-0.15 - 0.4) μ s, raw trace



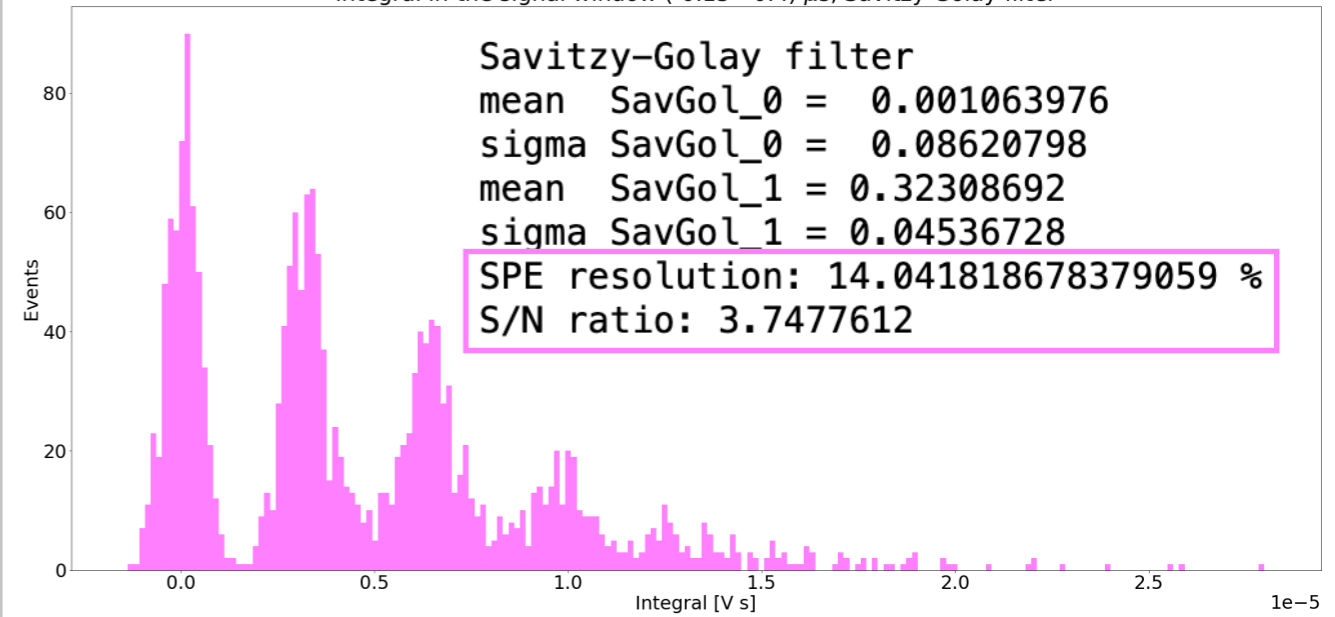
Integral in the signal window (-0.15 - 0.4) μ s, median filter



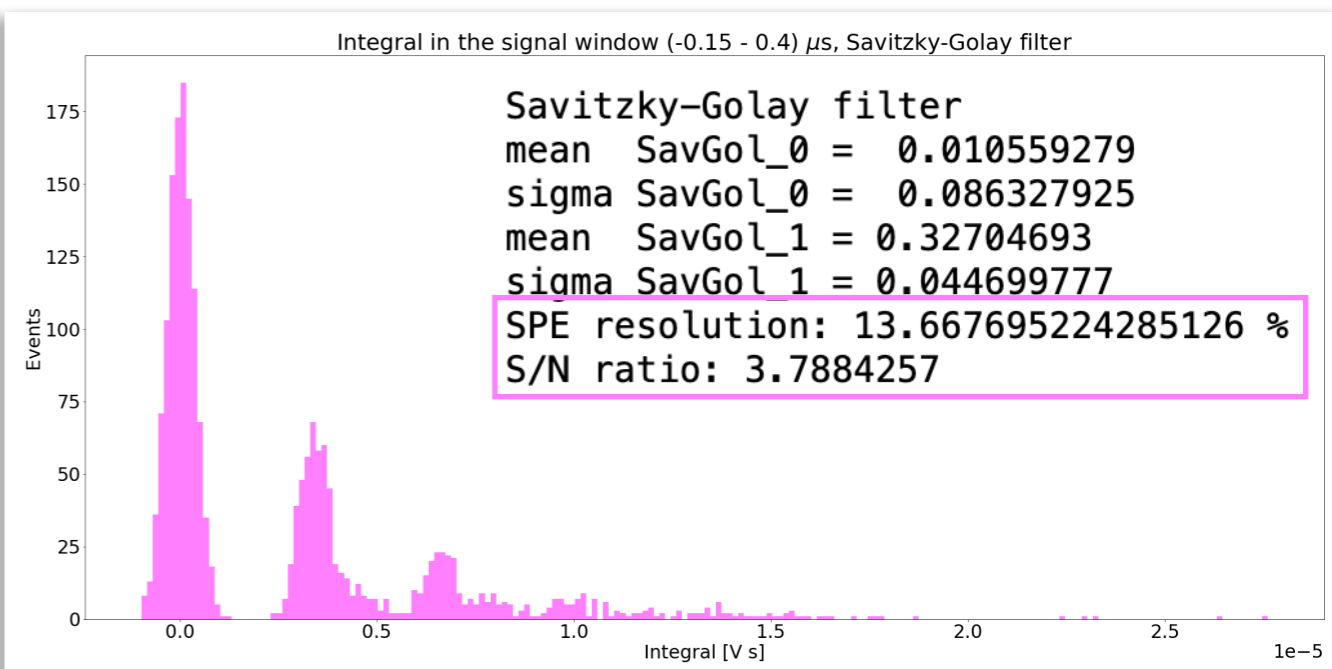
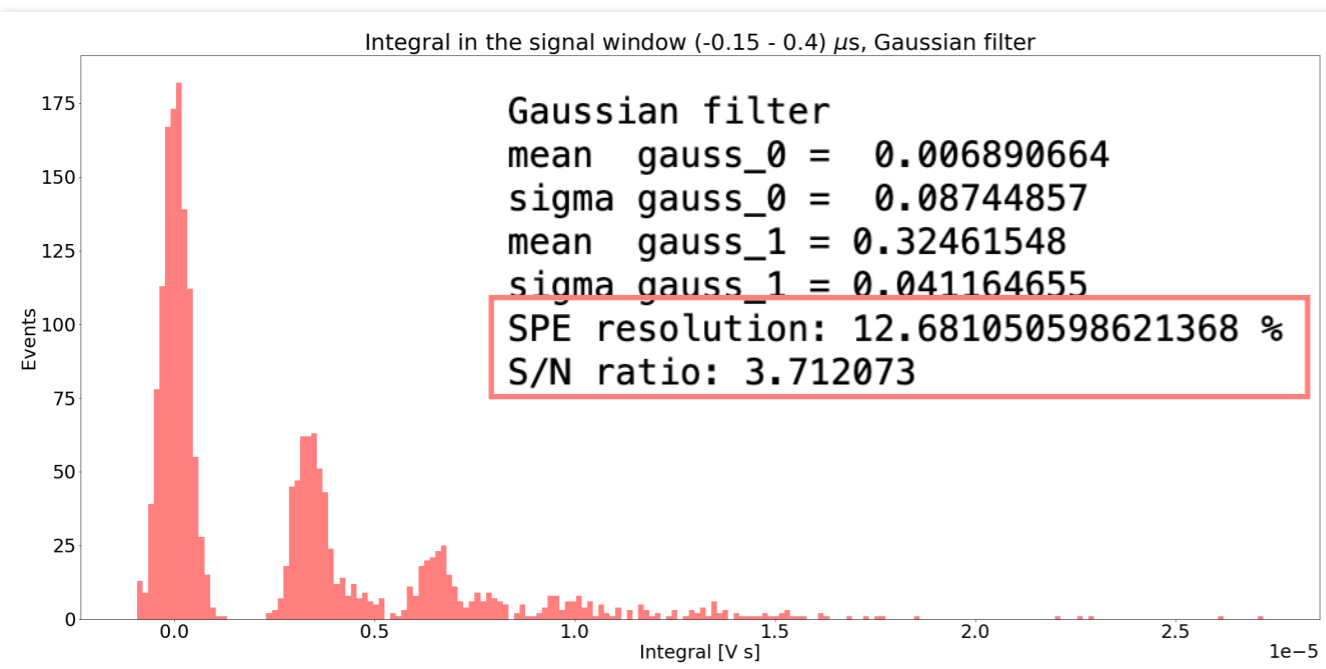
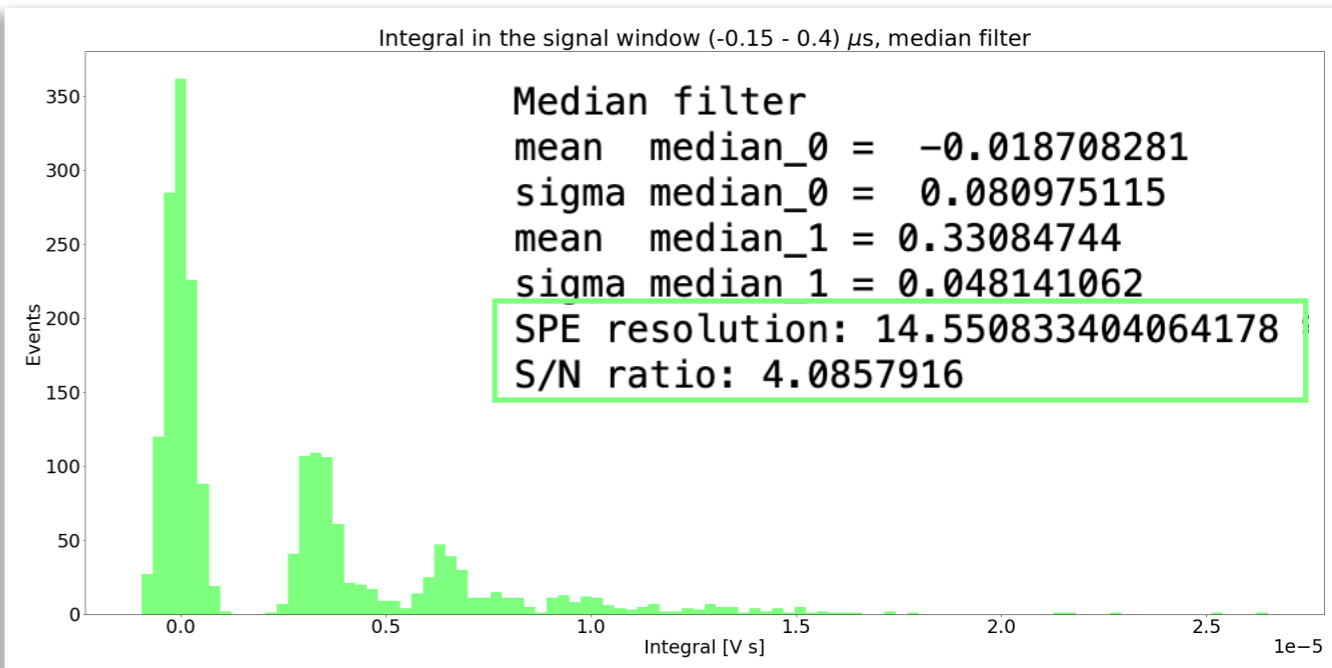
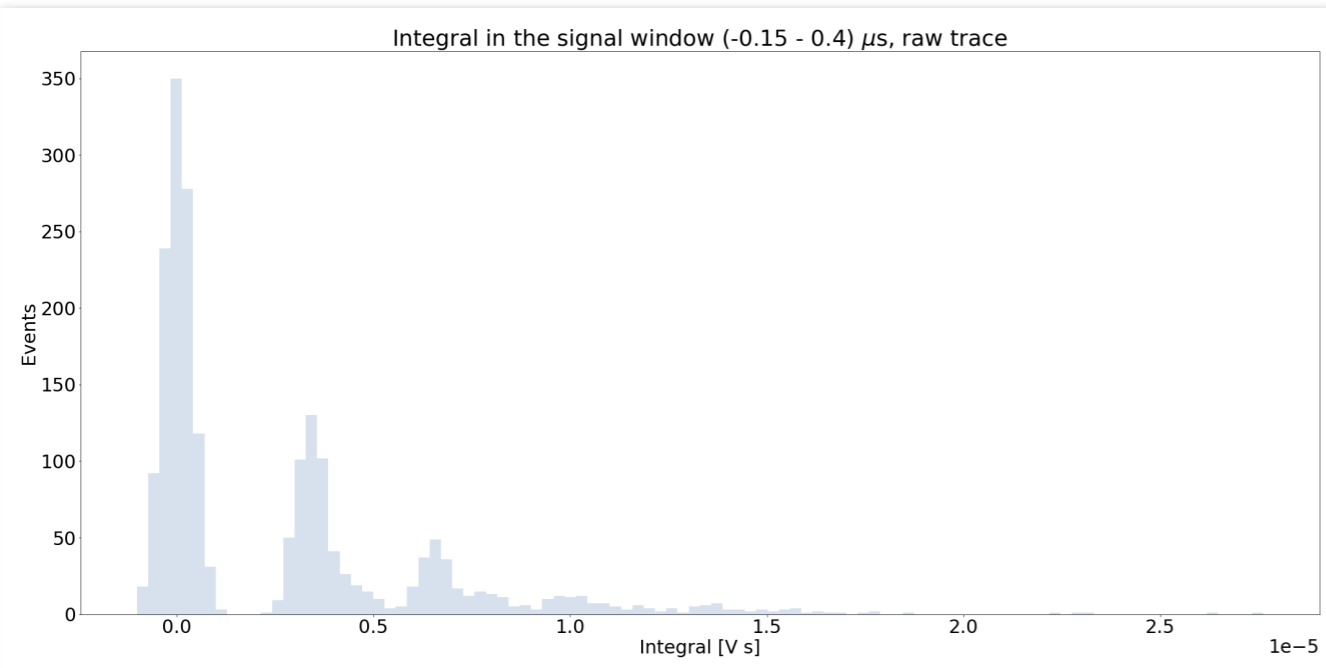
Integral in the signal window (-0.15 - 0.4) μ s, gaussian filter



Integral in the signal window (-0.15 - 0.4) μ s, Savitzky-Golay filter

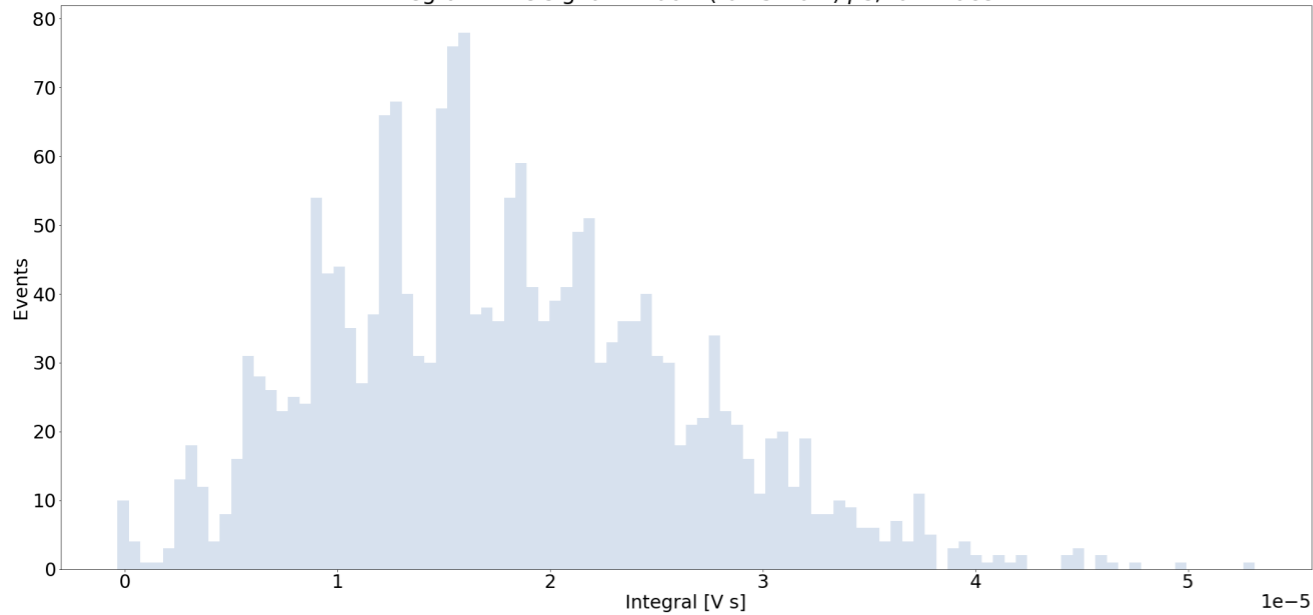


SiPM @36.0V in LN2 | Argon2x2 in LAr | AC-coupled channel | light level 5.5

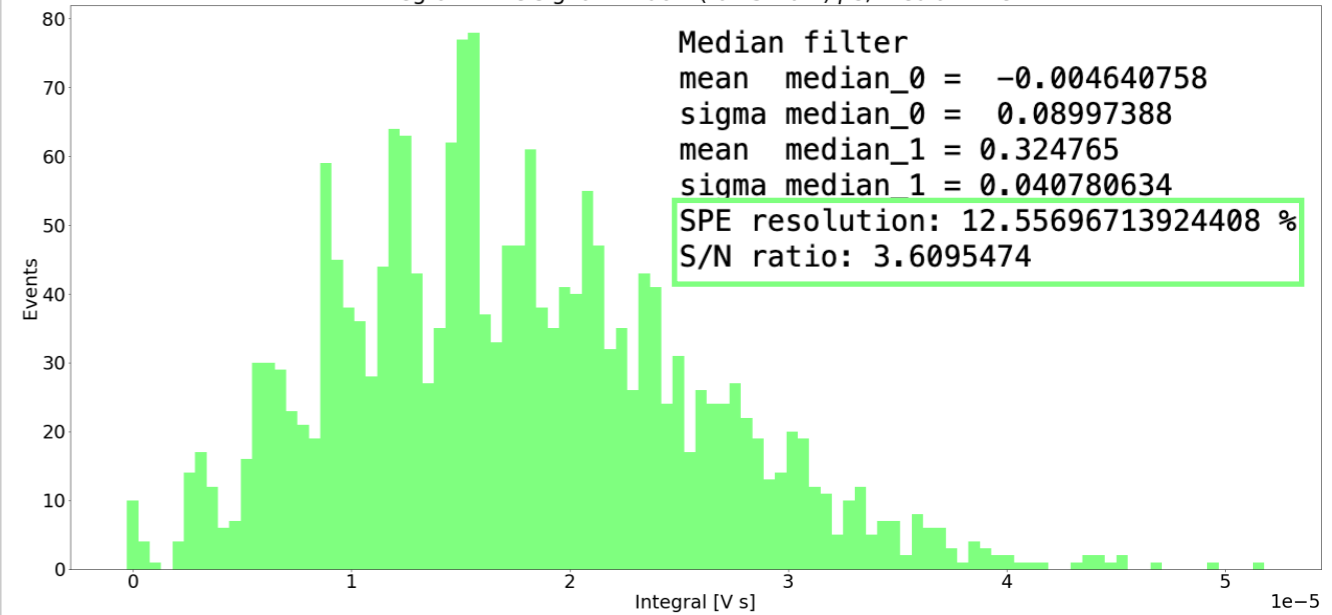


SiPM @36.0V in LN2 | Argon2x2 in LAr | AC-coupled channel | light level 7.0

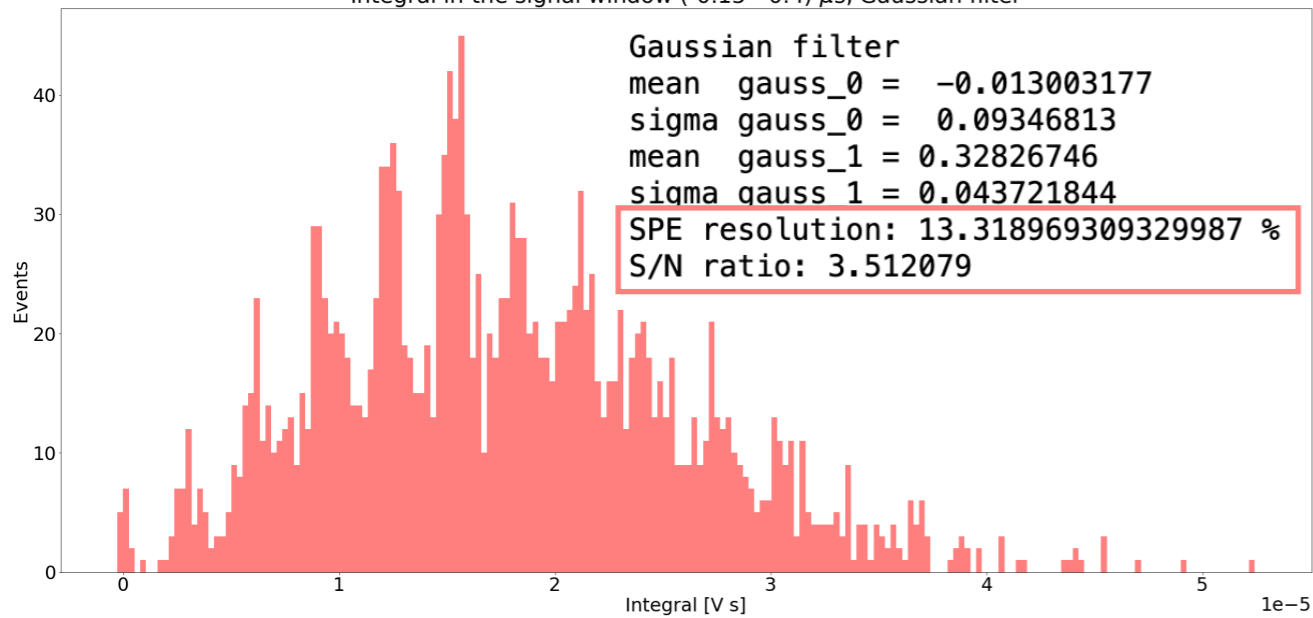
Integral in the signal window (-0.15 - 0.4) μ s, raw trace



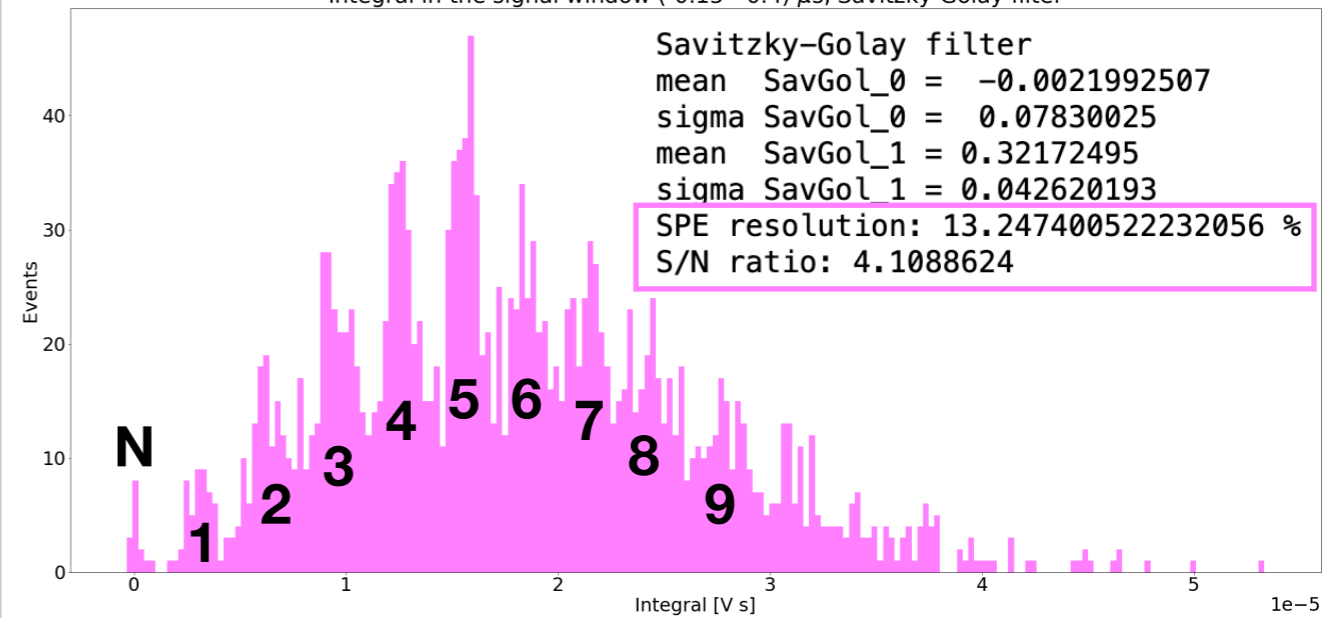
Integral in the signal window (-0.15 - 0.4) μ s, median filter



Integral in the signal window (-0.15 - 0.4) μ s, Gaussian filter



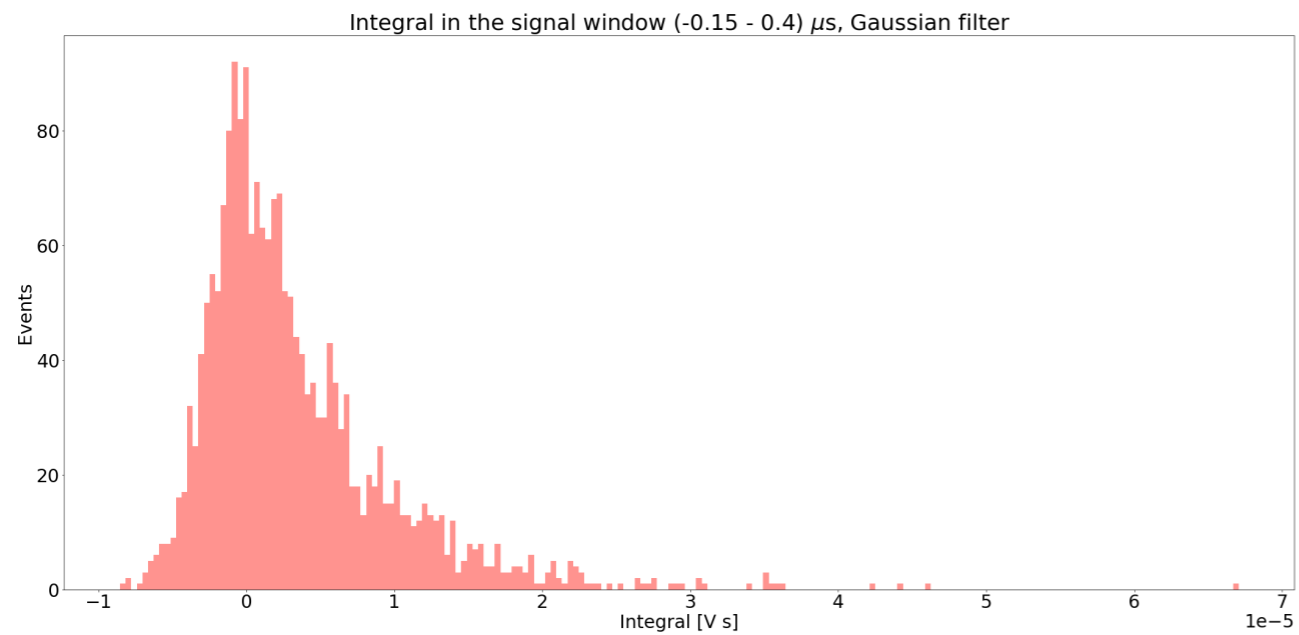
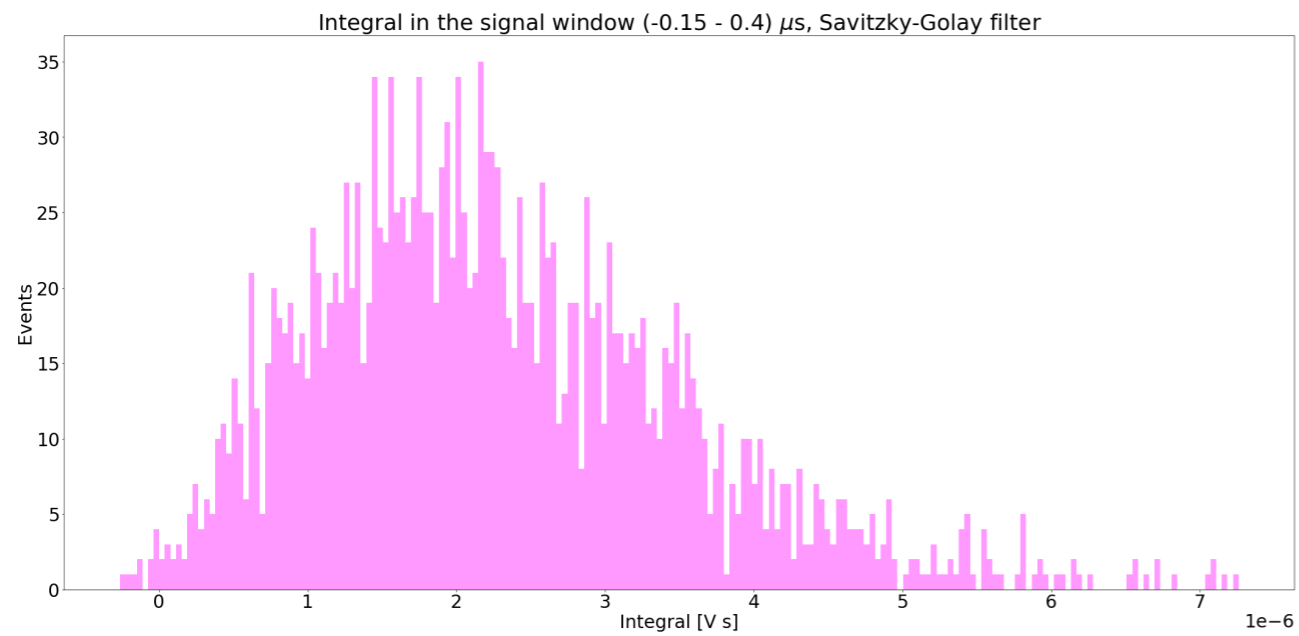
Integral in the signal window (-0.15 - 0.4) μ s, Savitzky-Golay filter



DC-coupled channel

Bad data, likely due to multi-mode fiber and introduced optical noise

Noise level increased with SiPM gain



Next tests

- Data with single mode fiber (FC and pigtail)
- board with/without input capacitors
- circuit removing 10 Ohm resistor and capacitors (simulation shows faster response in both rise and decay time and less undershoot)

Example traces

