

Electronics validation analysis

Updates from Genoa

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GRAIN Meeting

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Our goals

- **Simulated data:** we simulated photon scintillation emission events in both LAr and in Xenon-doped Argon. Each ROOT output file contains 120 spill events

(/storage/gpfs_data/neutrino/users/ldn/Samples/Spill_Xe/Spill_opt3_STT1_*/output/sensor_all_*.root)

(/storage/gpfs_data/neutrino/users/ldn/Samples/Spill_Ar/Spill_opt3_STT1_*/output/sensor_all_*.root)

- **Goal:** we want to select most critical and significative samples and validate the architecture on those samples

Work in progress

- We are writing three different Python codes (https://baltig.infn.it/dune/sand-optical/electronics_validation):
 1. **Selection.py**: Selects the event accordingly to the chosen criteria ($O(100)$ samples)
 2. **Ele_run.py**: Runs the architecture simulation provided by the Torino group on the samples and saves in a pickle file the information from MC-truth and from Torino's architecture simulation
 3. **Analysis.py**: It analyzes the output pickle file of Ele_run

Selected samples

Electronics validation

1. Events that need a high number of integration windows for some channels



1. For validating the architecture with 2 Wilkinson and conversion time of 40-50 ns

2. Events with the highest number of photons within an integration window



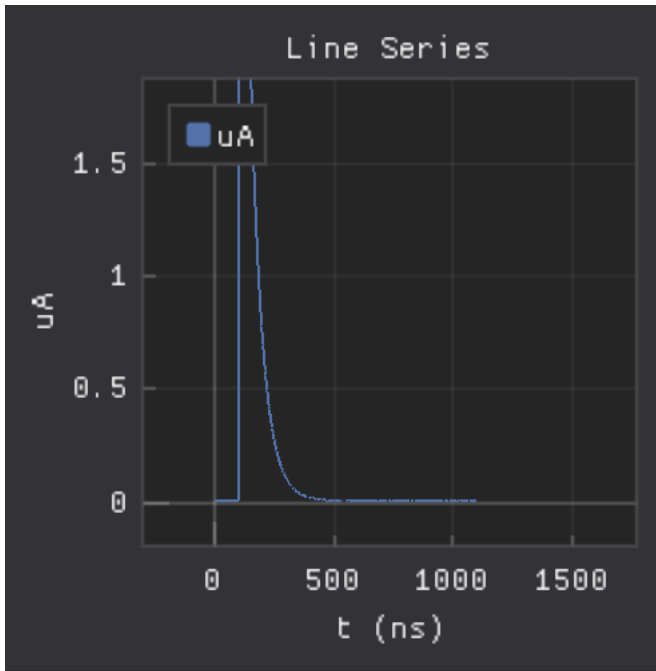
2. For optimizing/validating the dynamic range



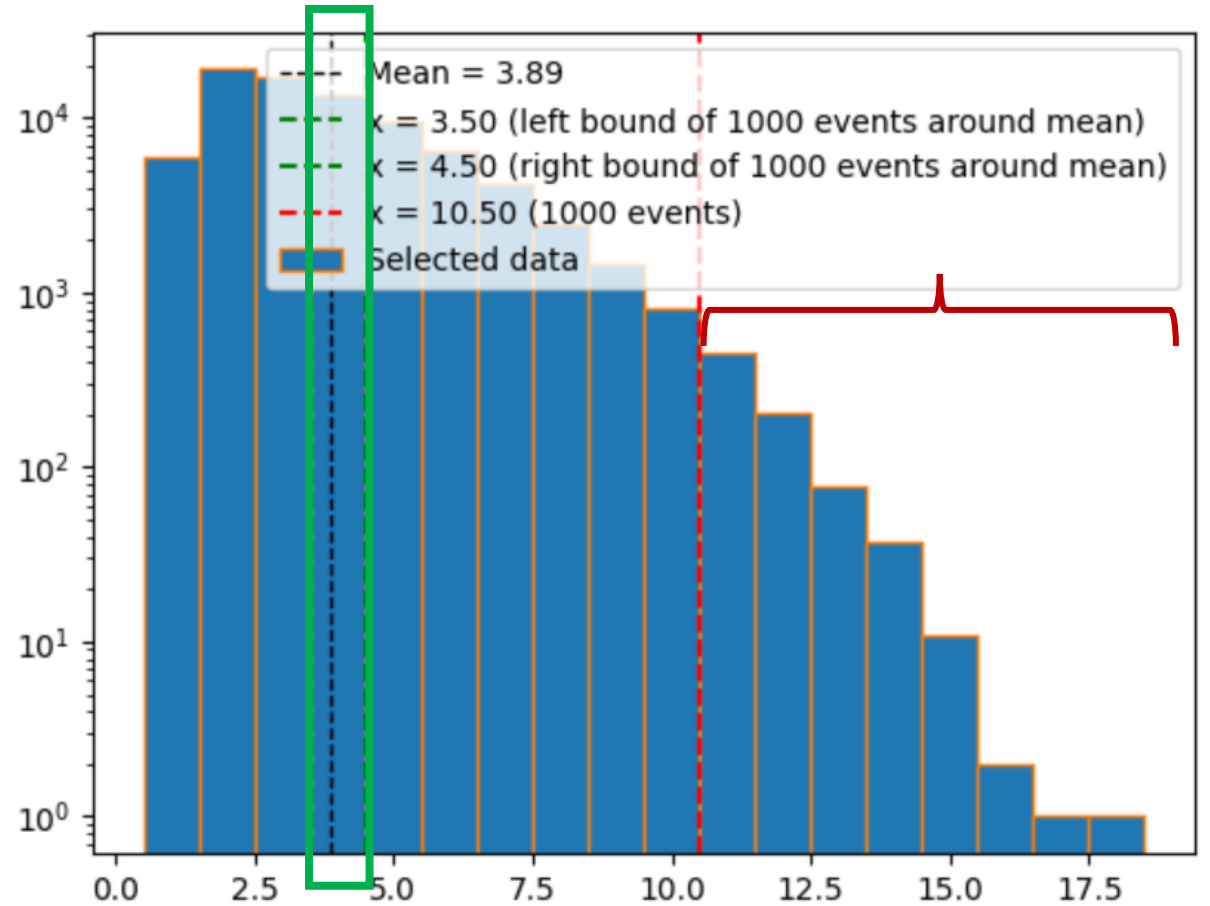
Selected samples: Events that need a high number of integration windows for some channels

Rq for 2x2 SiPM: 300 kOhm (info from HAMAMATSU)

We use single PE waveform: 2x2_I2in_interactive5489.csv
Rq = 500 kOhm



Imax=9 uA



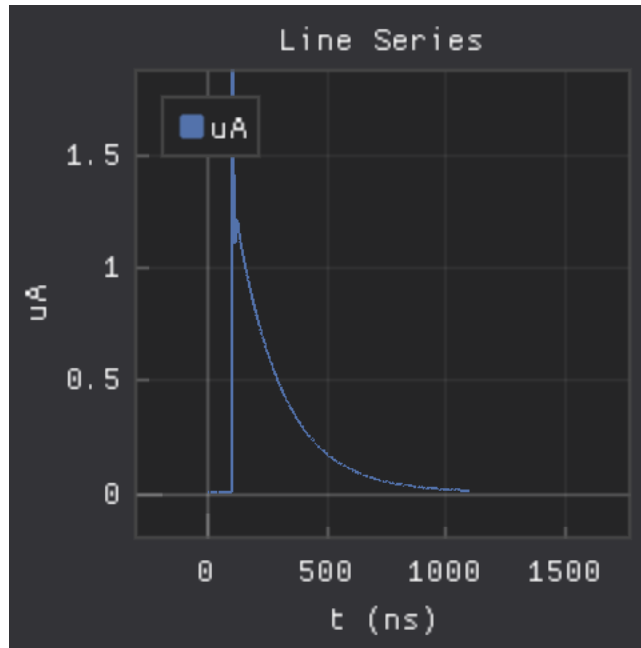
720 spill

Selected samples: Events that need a high number of integration windows for some channels

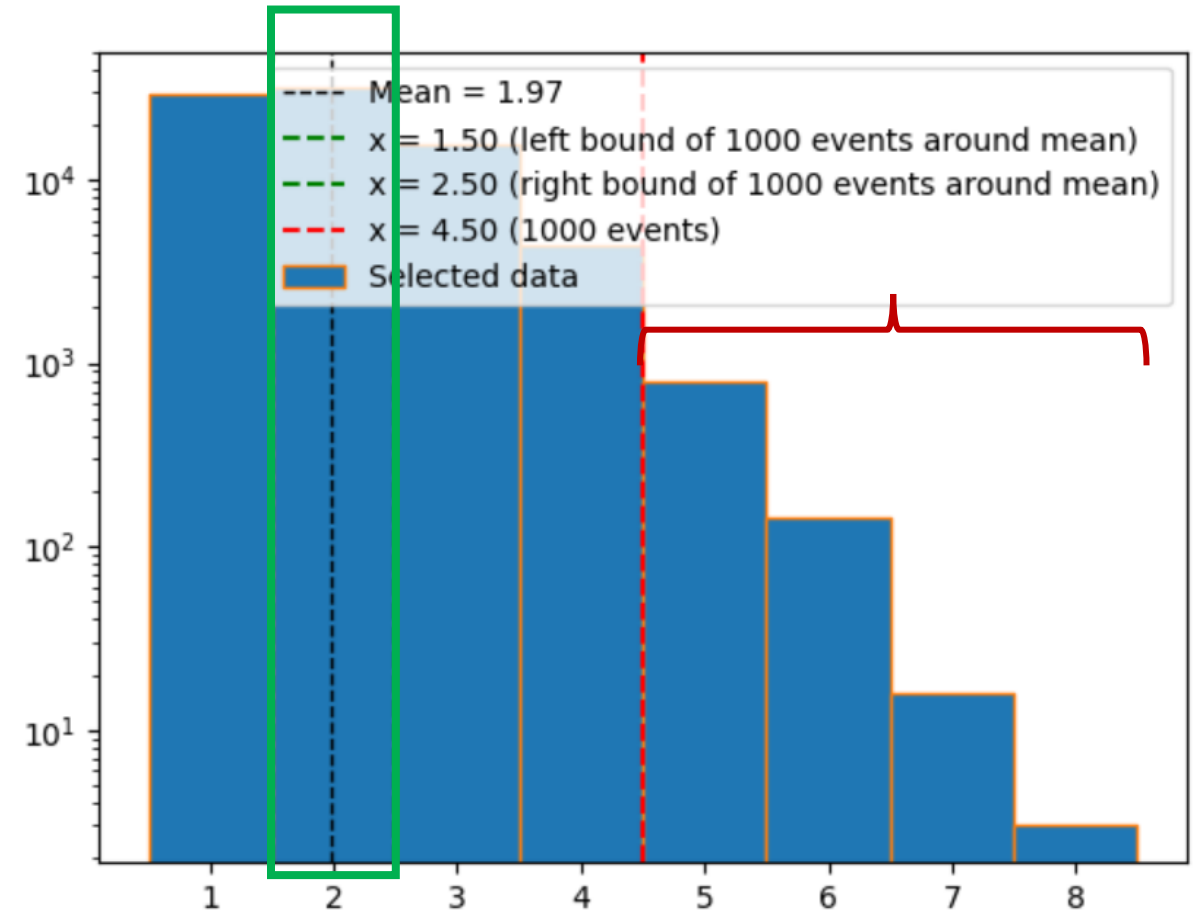
Just for comparison:

$R_q = 2000 \text{ k}\Omega$

We use single PE waveform: 2x2_I2in_interactive5489.csv



$I_{max} = 26 \text{ uA}$



720 spill

Selected samples

1. Channels with the highest number of photons within one τ (signal decay constant) from the interaction time *



2. Events with the lowest time between the interaction time* and the previous detected photon



Electronics validation

1. Is the electronics capable of detecting such a high number of photons in a small time window?

2. Which amount of channels per interactions have not the right t_0 , due to previous photons

WORK IN PROGRESS



*The interaction time is given by true information from MonteCarlo, if a peak of at least 3 photons is detected in the channel

Open questions and next steps

- Check how to convert from charge to number photons with the two Integrator gains
- Check that the time of the photons is reconstructed correctly with respect to the time of the photons given by MC-truth
- Implement the comparison between the interaction time MC-truth and the reconstructed one
- Implement the comparison between the MC-truth number of photons and the reconstructed number of photons

A problematic case

Conf: conf1.json

1PE: 2x2_I2in_interactive5489.csv

$R_q = 500 \text{ k}\Omega$

Nintegrator = 13

