

Update on dark-noise/gain measurements @ IFIC, Valencia

Results from tray 62

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Photosensors WG - 07 May 2024

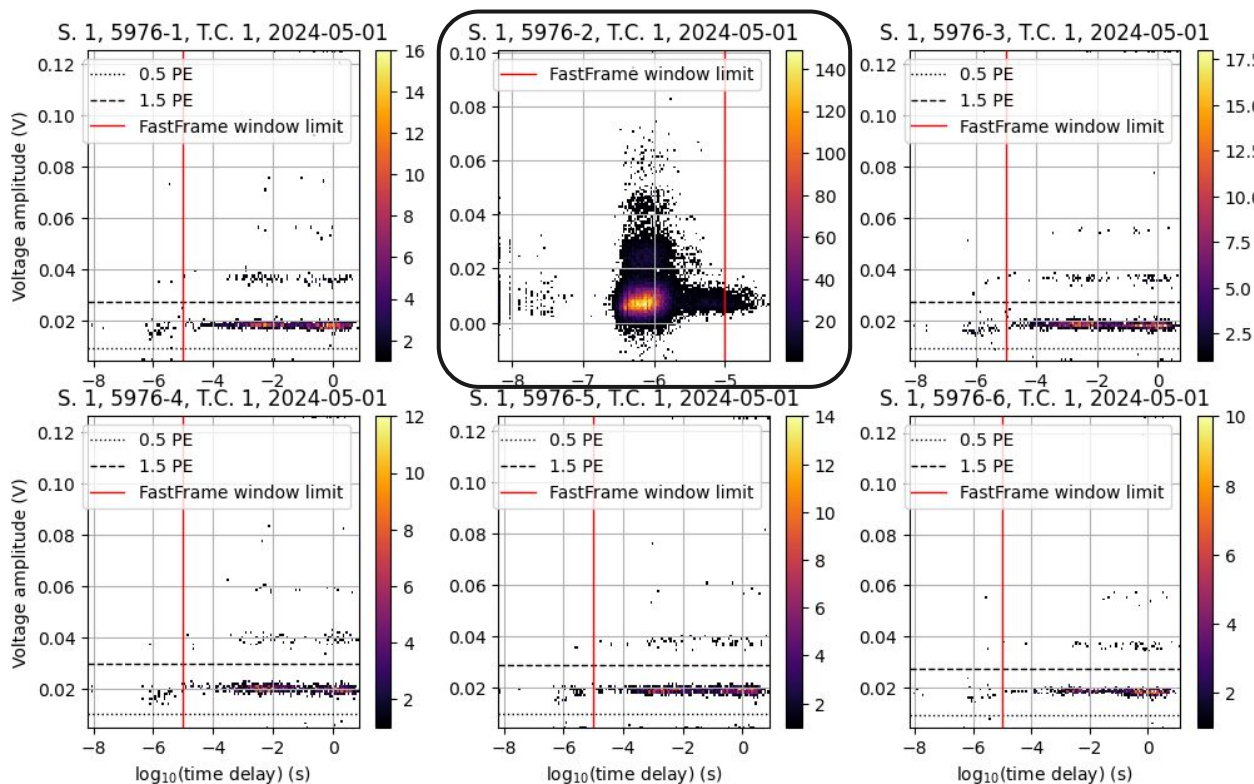


Trays measured in Valencia so far: **68, 115, 62, XX, XX**

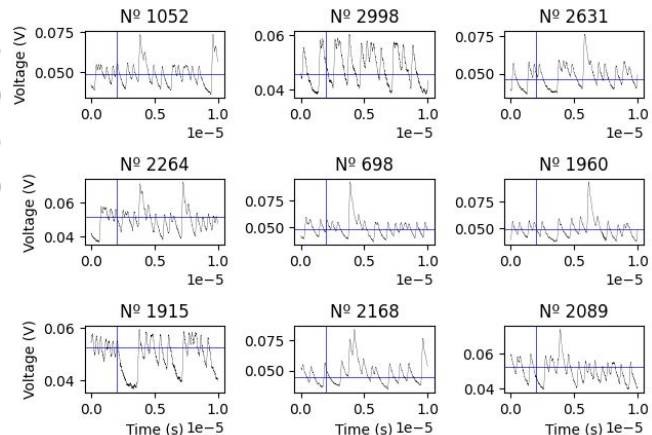
Introduction

- 5 trays have been measured so far
- The first two trays (68 and 115) have already been analysed and presented
 - Results from tray 68, Photosensor WG meeting on 2024/02/13 - <https://indico.fnal.gov/event/63323/>*
 - Results from tray 68, Photosensor WG meeting on 2024/02/27 - <https://indico.fnal.gov/event/63509/>*
 - Results from tray 115, Photosensor WG meeting on 2024/05/07 - <https://indico.fnal.gov/event/64609/>*
- The third tray (tray 62) was received from CIEMAT on 2024/04/11
- It contains boards with the following strip-IDs:
5030, 5033, 5036, 5049, 5050, 5058, 5063, 6019, 6023, 6024, 6025, 5976, 6029, 6034, 4918, 6042, 6043, 6049, 6055, 6058
- Carlos concluded the measurements of the third tray on 2024/05/06
- Gain (at 3 different OV_s), DCR, XTP and APP results are shown in the following slides
- We have found 4 DCR outliers
 - 2 of them had already been spotted by CACTUS (5976-2, 6043-4)
 - We found 4918-4 and 6043-3 to have a high DCR as well

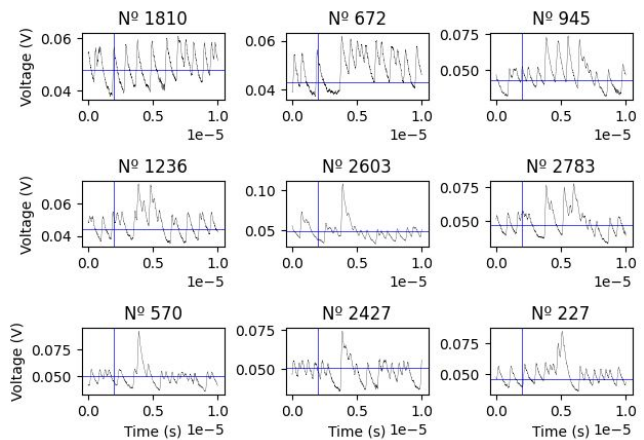
Outliers information 5976-2, very high DCR, $\sim 2e+7$ mHz/mm²



Iterator 1, Socket 1, Strip ID 5976, SiPM 2, T.C. 1, 2024-05-01 11:57:00

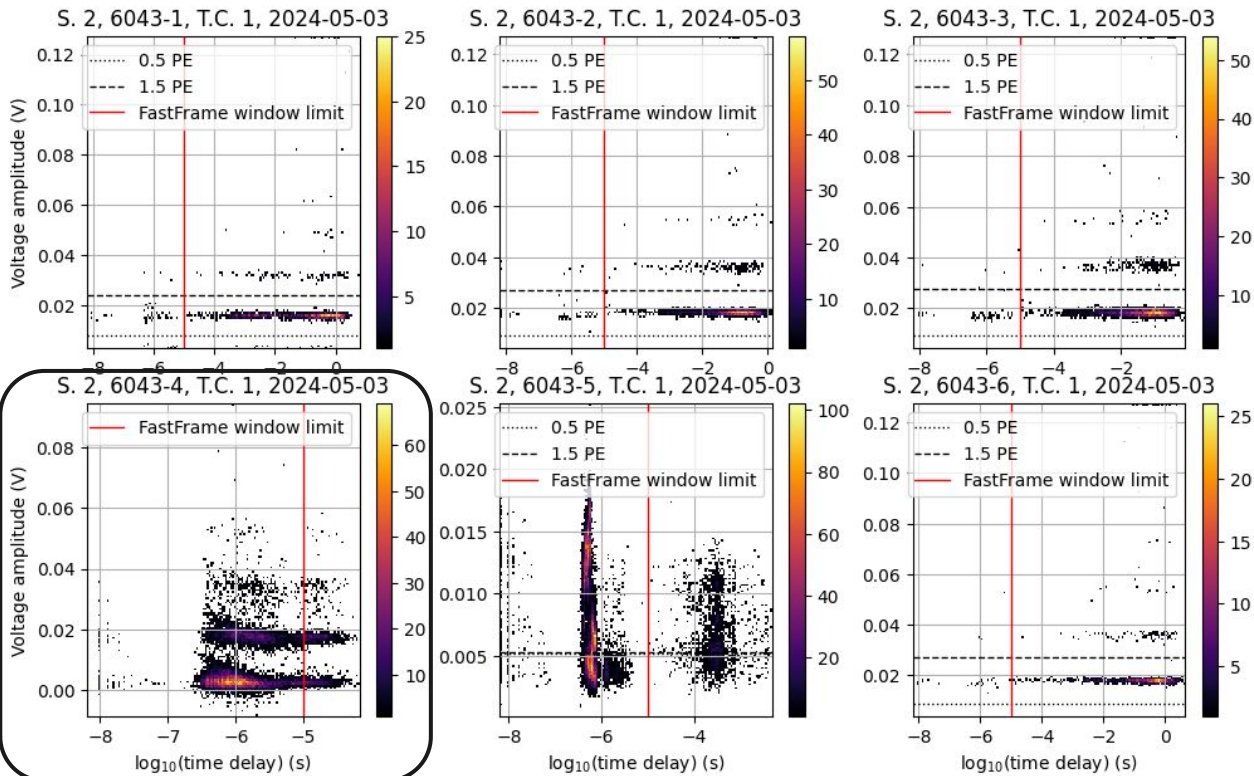


Iterator 1, Socket 1, Strip ID 5976, SiPM 2, T.C. 1, 2024-05-01 11:57:00

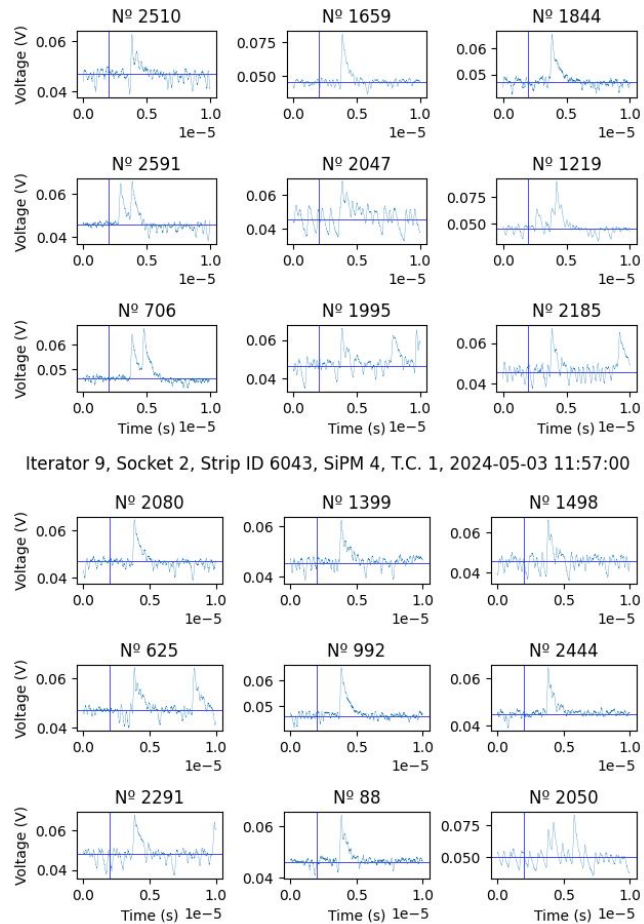


DCR of 5976-2 is 6 orders of magnitude higher than expected
This one was already spotted by CACTUS as a noisy one

Outliers information 6043-4, very high DCR, $\sim 3e+5$ mHz/mm²



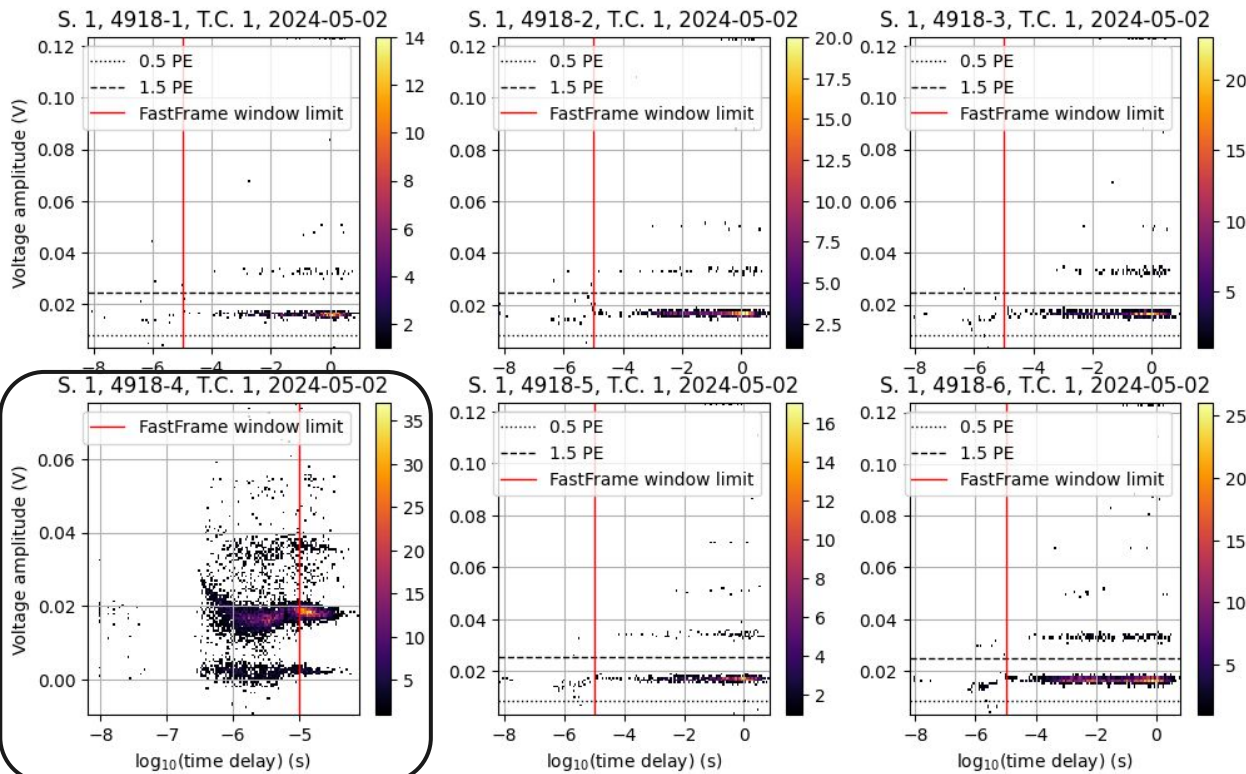
Iterator 9, Socket 2, Strip ID 6043, SiPM 4, T.C. 1, 2024-05-03 11:57:00



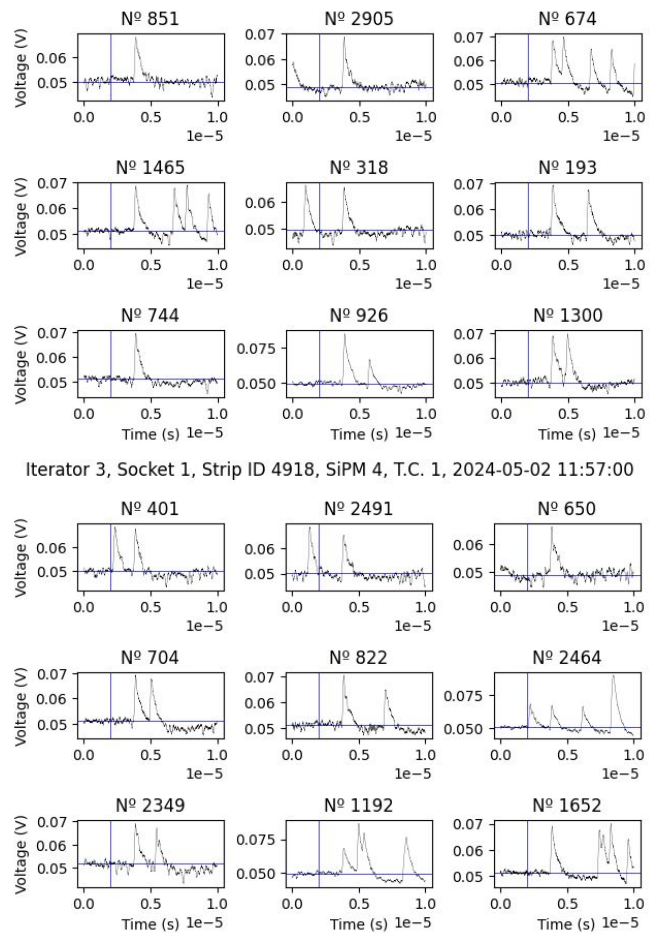
Iterator 9, Socket 2, Strip ID 6043, SiPM 4, T.C. 1, 2024-05-03 11:57:00

DCR of 6043-4 is 4 orders of magnitude higher than expected
This one was already spotted by CACTUS as a noisy one

Outliers information 4918-4, very high DCR, $\sim 4e+6$ mHz/mm²

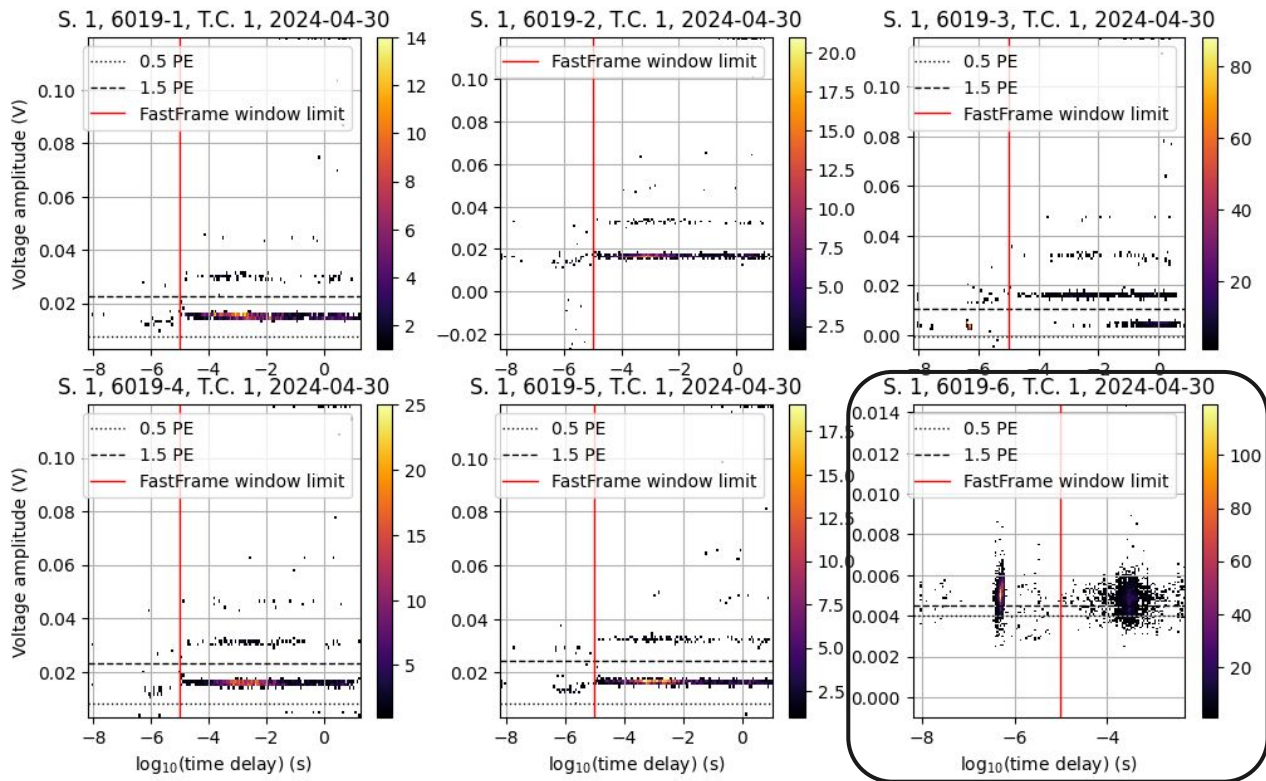


Iterator 3, Socket 1, Strip ID 4918, SiPM 4, T.C. 1, 2024-05-02 11:57:00

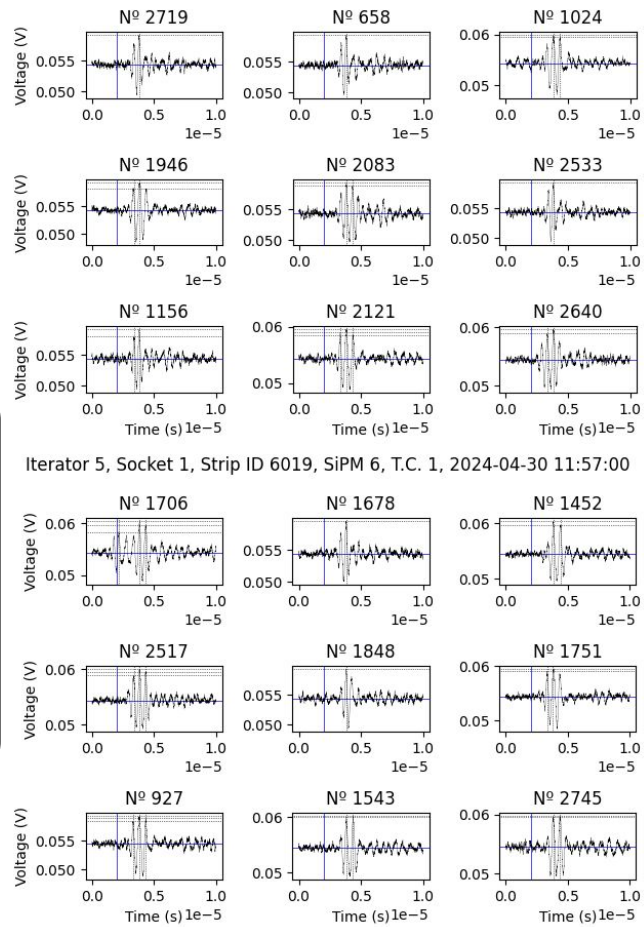


DCR of 4918-4 is 5 orders of magnitude higher than expected

Outliers information 6019-6, only electronic noise was acquired



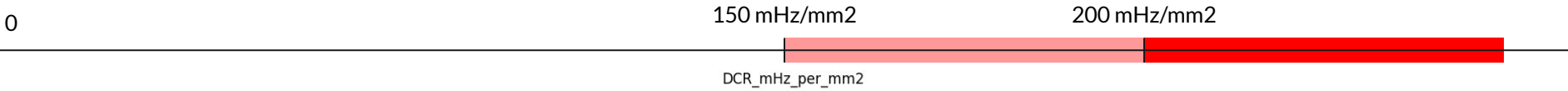
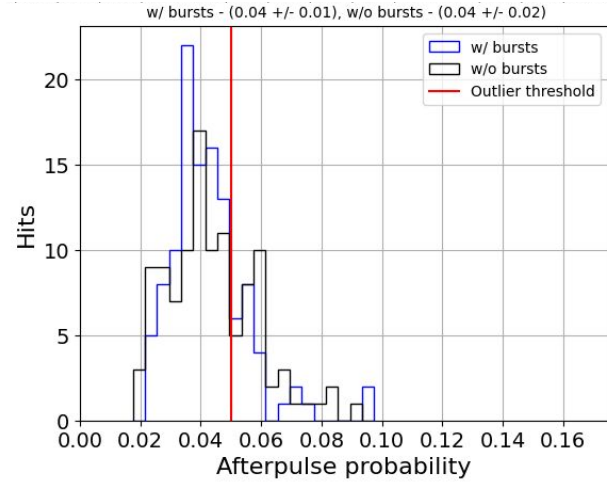
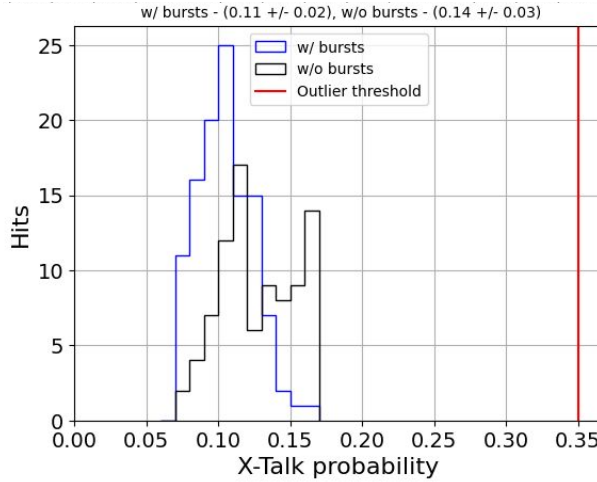
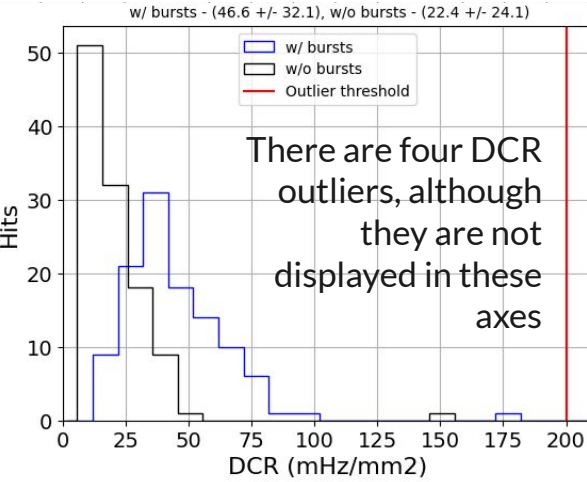
Iterator 5, Socket 1, Strip ID 6019, SiPM 6, T.C. 1, 2024-04-30 11:57:00



Iterator 5, Socket 1, Strip ID 6019, SiPM 6, T.C. 1, 2024-04-30 11:57:00

Apart from 6019-6, for SiPMs 5050-6, 6042-6 and 6043-5 we also had this electronic noise problem

Dark noise results



	4918	5030	5033	5036	5049	5050	5058	5063	5976	6019	6023	6024	6025	6029	6034	6042	6043	6049	6055	6058
1	30.5	61.9	36.9	20.9	39.2	42.4	36.0	44.9	52.5	39.5	23.8	38.0	45.9	46.9	51.5	52.9	64.7	83.1	29.8	49.2
2	38.2	47.5	36.6	68.3	79.7	25.3	36.1	73.5	nan	50.0	37.8	34.5	34.4	34.9	45.4	74.8	178.0	68.8	20.1	17.2
3	38.5	47.0	40.2	39.3	26.1	22.3	11.8	54.3	67.5	29.6	32.2	25.7	63.7	33.7	40.7	52.7	303.3	70.6	26.0	22.6
4	nan	35.2	32.7	41.1	30.6	18.3	21.9	54.4	42.6	59.5	58.0	26.3	62.7	67.1	49.2	72.6	nan	73.3	42.6	26.2
5	39.0	52.2	39.6	17.2	53.0	26.7	20.1	36.0	45.4	61.0	28.5	25.2	59.7	41.3	39.2	41.9	nan	52.2	37.3	41.5
6	75.6	58.7	45.8	30.7	14.4	nan	16.3	36.4	31.4	nan	50.1	65.5	37.3	51.3	35.9	nan	56.8	92.0	23.9	28.4

- DAQ problem
- DCR outlier

Dark noise results

DCR_mHz_per_mm2

	4918	5030	5033	5036	5049	5050	5058	5063	5976	6019	6023	6024	6025	6029	6034	6042	6043	6049	6055	6058
1	30.5	61.9	36.9	20.9	39.2	42.4	36.0	44.9	52.5	39.5	23.8	38.0	45.9	46.9	51.5	52.9	64.7	83.1	29.8	49.2
2	38.2	47.5	36.6	68.3	79.7	25.3	36.1	73.5	nan	50.0	37.8	34.5	34.4	34.9	45.4	74.8	178.0	68.8	20.1	17.2
3	38.5	47.0	40.2	39.3	26.1	22.3	11.8	54.3	67.5	29.6	32.2	25.7	63.7	33.7	40.7	52.7	303.3	70.6	26.0	22.6
4	nan	35.2	32.7	41.1	30.6	18.3	21.9	54.4	42.6	59.5	58.0	26.3	62.7	67.1	49.2	72.6	nan	73.3	42.6	26.2
5	39.0	52.2	39.6	17.2	53.0	26.7	20.1	36.0	45.4	61.0	28.5	25.2	59.7	41.3	39.2	41.9	nan	52.2	37.3	41.5
6	75.6	58.7	45.8	30.7	14.4	nan	16.3	36.4	31.4	nan	50.1	65.5	37.3	51.3	35.9	nan	56.8	92.0	23.9	28.4

XTP

	4918	5030	5033	5036	5049	5050	5058	5063	5976	6019	6023	6024	6025	6029	6034	6042	6043	6049	6055	6058
1	0.1	0.14	0.13	0.1	0.09	0.09	0.12	0.11	0.11	0.12	0.09	0.14	0.09	0.09	0.1	0.1	0.09	0.1	0.12	0.11
2	0.08	0.12	0.1	0.09	0.1	0.1	0.15	0.09	nan	0.08	0.11	0.11	0.11	0.14	0.12	0.11	0.07	0.1	0.16	0.13
3	0.1	0.1	0.1	0.1	0.12	0.12	0.11	0.09	0.08	0.12	0.09	0.13	0.09	0.13	0.1	0.13	0.08	0.08	0.14	0.12
4	nan	0.1	0.16	0.1	0.12	0.09	0.12	0.12	0.11	0.1	0.07	0.14	0.09	0.09	0.1	0.11	nan	0.1	0.13	0.13
5	0.11	0.11	0.09	0.12	0.07	0.09	0.11	0.12	0.08	0.12	0.07	0.11	0.07	0.12	0.1	0.1	nan	0.07	0.13	0.11
6	0.09	0.12	0.1	0.09	0.09	nan	0.11	0.12	0.09	nan	0.07	0.1	0.1	0.11	0.08	nan	0.1	0.07	0.14	0.11

APP

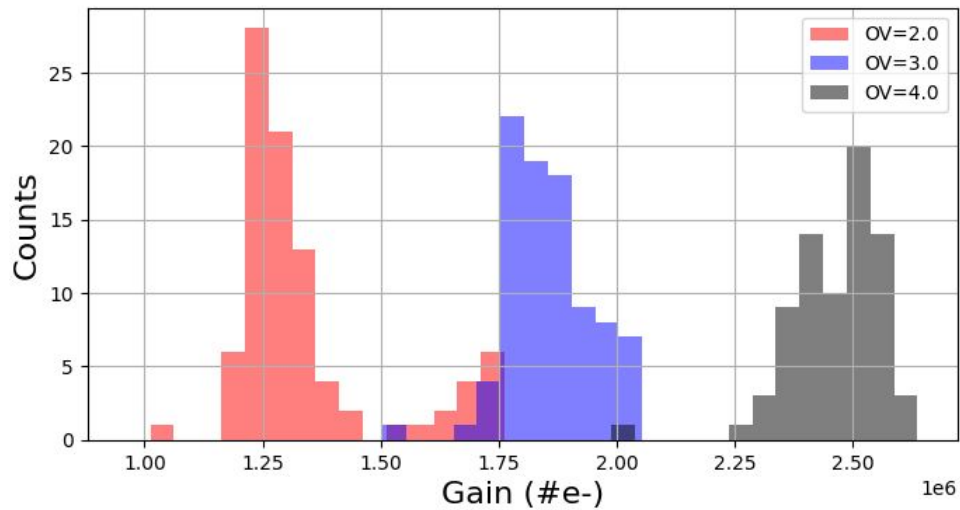
	4918	5030	5033	5036	5049	5050	5058	5063	5976	6019	6023	6024	6025	6029	6034	6042	6043	6049	6055	6058
1	0.029	0.042	0.05	0.061	0.034	0.033	0.039	0.032	0.054	0.041	0.043	0.07	0.033	0.035	0.027	0.043	0.044	0.036	0.055	0.053
2	0.036	0.036	0.055	0.047	0.035	0.048	0.036	0.043	nan	0.043	0.036	0.038	0.031	0.051	0.051	0.049	0.024	0.036	0.058	0.046
3	0.036	0.042	0.048	0.044	0.048	0.054	0.028	0.023	0.061	0.011	0.053	0.034	0.045	0.025	0.026	0.026	0.027	0.035	0.039	0.035
4	nan	0.036	0.053	0.043	0.039	0.033	0.021	0.039	0.047	0.031	0.027	0.043	0.094	0.041	0.035	0.041	nan	0.032	0.049	0.043
5	0.041	0.045	0.054	0.035	0.036	0.034	0.039	0.031	0.072	0.042	0.042	0.048	0.096	0.034	0.044	0.035	nan	0.036	0.035	0.04
6	0.032	0.044	0.047	0.036	0.068	nan	0.04	0.046	0.049	nan	0.026	0.041	0.056	0.03	0.04	nan	0.028	0.04	0.021	0.054

- DAQ problem
- DCR outlier

The APP outliers displayed here may not be so. APP analysis needs to be cross-checked with the previous analysis. We are making improvements in such direction.

Gain results

Tray 62 - Boards 4918,5030,5033,5036,5976,6019,6023-6025,6029,6034,6042-6043,6049,6055,6058



gain_in_#e-
overvoltage_v=3.0
Boards: 4918,5030,5033,5036,5976,6019,6023-6025,6029,6034,6042-6043,6049,6055,6058
Mean +/- std: (1854529.93 +/- 467532.57)

	4918	5030	5033	5036	5976	6019	6023	6024	6025	6029	6034	6042	6043	6049	6055	6058
1	1.9e+06	1.8e+06	1.7e+06	1.9e+06	2.0e+06	1.7e+06	1.8e+06	nan	2.0e+06	1.8e+06	1.8e+06	1.9e+06	1.8e+06	1.8e+06	1.7e+06	1.8e+06
2	1.9e+06	1.9e+06	1.9e+06	1.9e+06	nan	1.8e+06	1.8e+06	1.9e+06	2.0e+06	1.8e+06	1.8e+06	1.7e+06	1.9e+06	1.8e+06	1.8e+06	1.8e+06
3	1.9e+06	2.0e+06	1.8e+06	2.0e+06	2.0e+06	1.8e+06	1.8e+06	nan	1.9e+06	1.9e+06	1.8e+06	1.9e+06	1.8e+06	1.8e+06	1.8e+06	1.9e+06
4	nan	1.5e+06	1.9e+06	2.0e+06	2.0e+06	1.8e+06	1.8e+06	2.0e+06	2.0e+06	1.8e+06	1.9e+06	nan	nan	1.8e+06	1.8e+06	1.9e+06
5	1.9e+06	1.9e+06	2.0e+06	1.9e+06	2.0e+06	1.8e+06	1.8e+06	2.0e+06	2.0e+06	1.8e+06	1.9e+06	1.8e+06	1.9e+06	1.8e+06	1.9e+06	1.8e+06
6	1.9e+06	1.9e+06	1.8e+06	1.9e+06	2.0e+06	1.8e+06	1.7e+06	nan	2.0e+06	1.8e+06	1.9e+06	1.8e+06	1.9e+06	1.9e+06	1.9e+06	1.9e+06

* Every SiPM for which there's a nan entry or any board which does not appear at all is due to a data-taking problem (to be retested)

Gain results

gain_in_#e-
overvoltage_V=2.0

Boards: 4918,5030,5033,5036,5976,6019,6023-6025,6029,6034,6042-6043,6049,6055,6058
Mean +/- std: (1854529.93 +/- 467532.57)

	4918	5030	5033	5036	5976	6019	6023	6024	6025	6029	6034	6042	6043	6049	6055	6058
1	1.3e+06	1.2e+06	1.2e+06	1.3e+06	1.7e+06	1.2e+06	1.2e+06	nan	1.7e+06	1.2e+06	1.2e+06	1.3e+06	1.2e+06	1.2e+06	1.3e+06	1.3e+06
2	1.3e+06	1.3e+06	1.3e+06	1.3e+06	nan	1.2e+06	1.2e+06	1.5e+06	1.7e+06	1.2e+06	1.3e+06	1.2e+06	1.3e+06	1.2e+06	1.4e+06	1.3e+06
3	1.3e+06	1.4e+06	1.2e+06	1.3e+06	1.7e+06	1.2e+06	1.3e+06	1.6e+06	1.6e+06	1.3e+06	1.3e+06	1.3e+06	1.2e+06	1.3e+06	1.3e+06	1.3e+06
4	nan	1.0e+06	1.3e+06	1.4e+06	1.7e+06	1.2e+06	1.2e+06	1.7e+06	1.7e+06	1.3e+06	1.3e+06	nan	nan	1.2e+06	1.3e+06	1.4e+06
5	1.3e+06	1.3e+06	1.4e+06	1.3e+06	nan	1.2e+06	1.2e+06	1.7e+06	1.7e+06	1.3e+06	1.3e+06	1.3e+06	1.3e+06	1.2e+06	1.4e+06	1.3e+06
6	1.3e+06	1.3e+06	1.3e+06	1.3e+06	nan	1.3e+06	1.2e+06	1.7e+06	1.7e+06	1.2e+06	1.3e+06	1.2e+06	1.3e+06	1.3e+06	1.4e+06	1.4e+06

gain_in_#e-
overvoltage_V=3.0

Boards: 4918,5030,5033,5036,5976,6019,6023-6025,6029,6034,6042-6043,6049,6055,6058
Mean +/- std: (1854529.93 +/- 467532.57)

	4918	5030	5033	5036	5976	6019	6023	6024	6025	6029	6034	6042	6043	6049	6055	6058
1	1.9e+06	1.8e+06	1.7e+06	1.9e+06	2.0e+06	1.7e+06	1.8e+06	nan	2.0e+06	1.8e+06	1.8e+06	1.9e+06	1.8e+06	1.8e+06	1.7e+06	1.8e+06
2	1.9e+06	1.9e+06	1.9e+06	1.9e+06	nan	1.8e+06	1.8e+06	1.9e+06	2.0e+06	1.8e+06	1.8e+06	1.7e+06	1.9e+06	1.8e+06	1.8e+06	1.8e+06
3	1.9e+06	2.0e+06	1.8e+06	2.0e+06	2.0e+06	1.8e+06	1.8e+06	nan	1.9e+06	1.9e+06	1.8e+06	1.9e+06	1.8e+06	1.8e+06	1.8e+06	1.9e+06
4	nan	1.5e+06	1.9e+06	2.0e+06	2.0e+06	1.8e+06	1.8e+06	2.0e+06	2.0e+06	1.8e+06	1.9e+06	nan	nan	1.8e+06	1.8e+06	1.9e+06
5	1.9e+06	1.9e+06	2.0e+06	1.9e+06	2.0e+06	1.8e+06	1.8e+06	2.0e+06	2.0e+06	1.8e+06	1.9e+06	1.8e+06	1.9e+06	1.8e+06	1.9e+06	1.8e+06
6	1.9e+06	1.9e+06	1.8e+06	1.9e+06	2.0e+06	1.8e+06	1.7e+06	nan	2.0e+06	1.8e+06	1.9e+06	1.8e+06	1.9e+06	1.9e+06	1.9e+06	1.9e+06

gain_in_#e-
overvoltage_V=4.0

Boards: 4918,5030,5033,5036,6019,6023,6029,6034,6042-6043,6049,6055,6058
Mean +/- std: (1854529.93 +/- 467532.57)

	4918	5030	5033	5036	6019	6023	6029	6034	6042	6043	6049	6055	6058
1	2.5e+06	2.4e+06	2.3e+06	2.4e+06	2.3e+06	2.4e+06	2.4e+06	2.4e+06	2.5e+06	2.4e+06	2.4e+06	2.3e+06	2.4e+06
2	2.5e+06	2.5e+06	2.6e+06	2.4e+06	2.4e+06	2.3e+06	2.5e+06	2.6e+06	2.4e+06	2.5e+06	2.4e+06	2.5e+06	2.5e+06
3	2.5e+06	2.5e+06	2.4e+06	2.6e+06	2.4e+06	2.4e+06	2.5e+06	2.4e+06	2.6e+06	2.5e+06	2.5e+06	2.5e+06	2.5e+06
4	nan	2.0e+06	2.5e+06	2.5e+06	2.4e+06	2.4e+06	2.5e+06	2.6e+06	nan	nan	2.3e+06	2.5e+06	2.6e+06
5	2.5e+06	2.5e+06	2.5e+06	2.4e+06	2.4e+06	2.3e+06	2.5e+06	2.5e+06	2.6e+06	2.5e+06	2.5e+06	2.6e+06	2.5e+06
6	2.6e+06	2.5e+06	2.4e+06	2.5e+06	2.4e+06	2.4e+06	2.4e+06	2.6e+06	2.5e+06	2.5e+06	2.5e+06	2.5e+06	2.6e+06

* Every SiPM for which there's a nan entry or any board which does not appear at all is due to a data-taking problem (to be retested)

Summary

- We found 4 DCR outliers (2 of them had already been noticed by CACTUS)
- APP analysis needs to be further investigated
 - understand our analysis more deeply
 - cross-check with the down-selection analysis
- Some boards need to be re-tested (~3% of the SiPMs for darknoise, and some boards for gain)
- The analysis of two additional trays is ongoing
- On 2024/09/25 we received 5 more 'trays' from CIEMAT, its measurement is ongoing

