MIP test with few sensors and long scolopendra noise.

Lorenzo for the Firenze INFN lab. group: Eugenio, Seba, Sasha, Raffaello, Oscar…

Introduction

- Using ground muons, 2 LYSO cristaly + WLF fibers (thanks Sasha!)
  - First LYSO: old PD (VTH2090) + WLF-SiPM (10um)
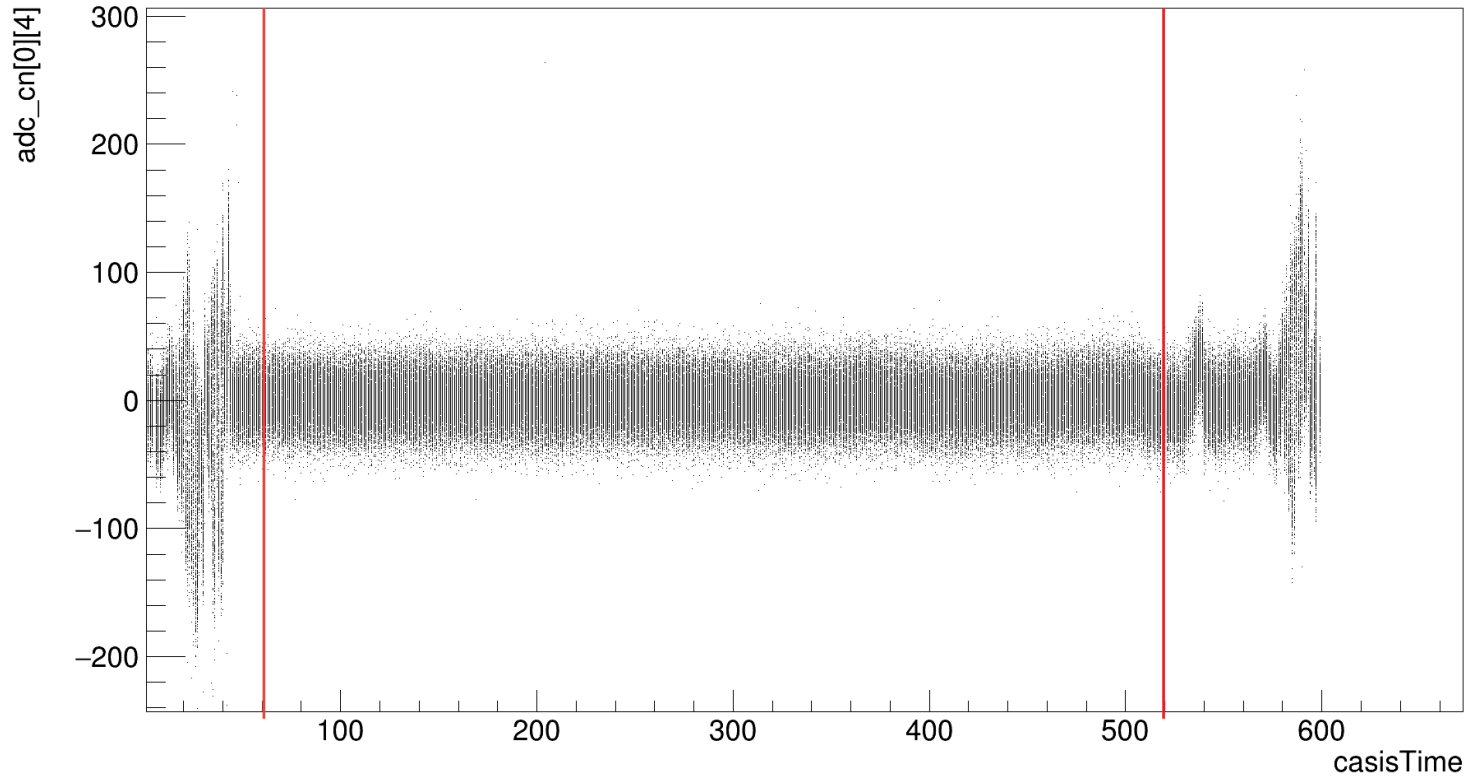 - Second LYSO: new PD (attached with optical greases).
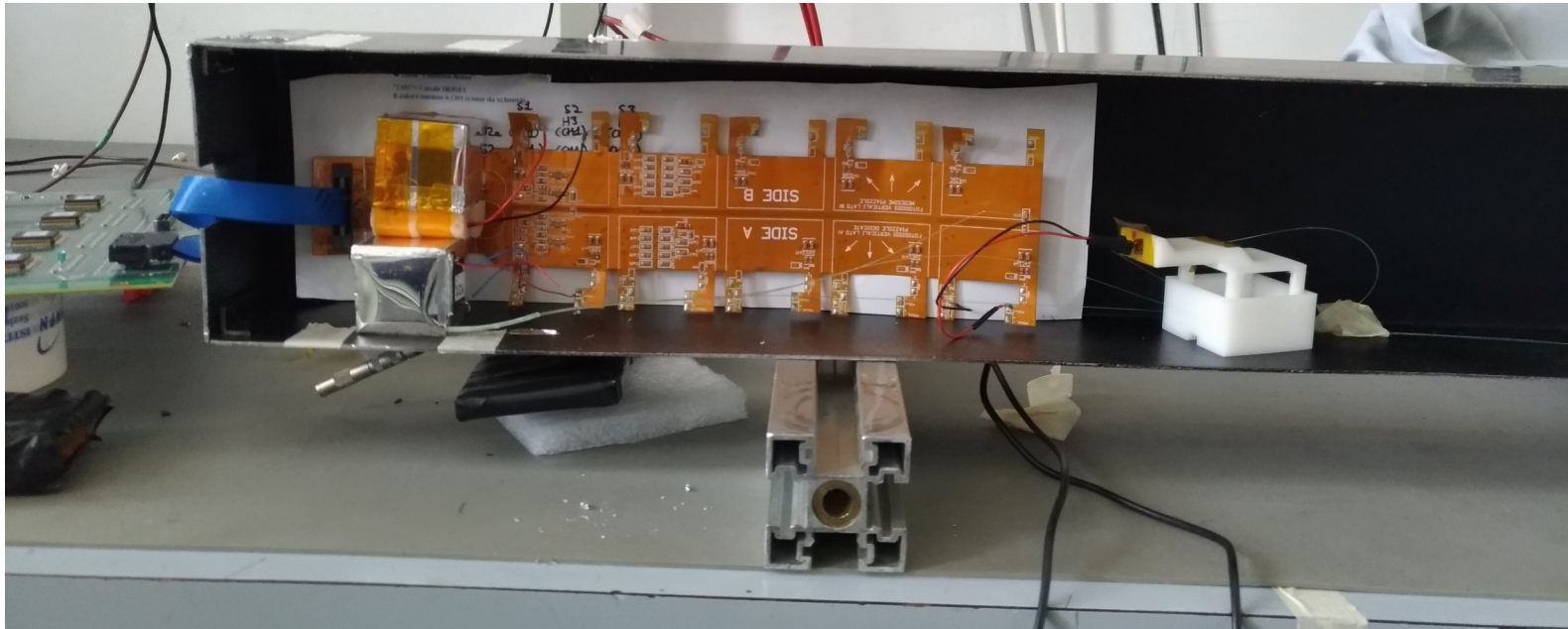
PDs and SiPM bias: 72-3.5 V
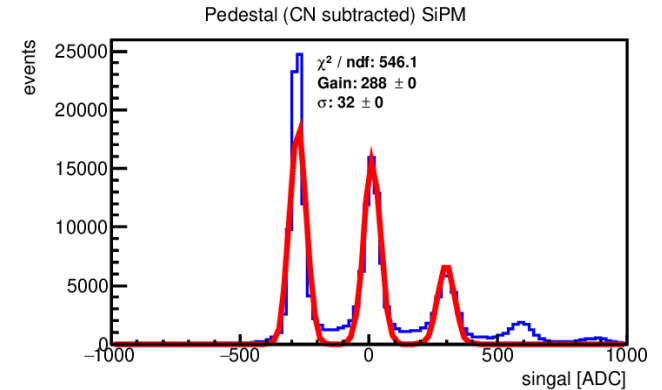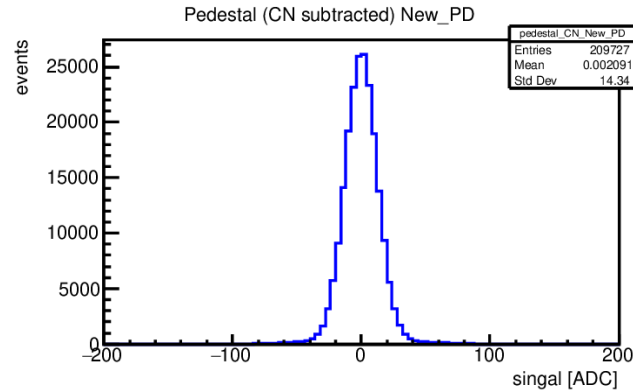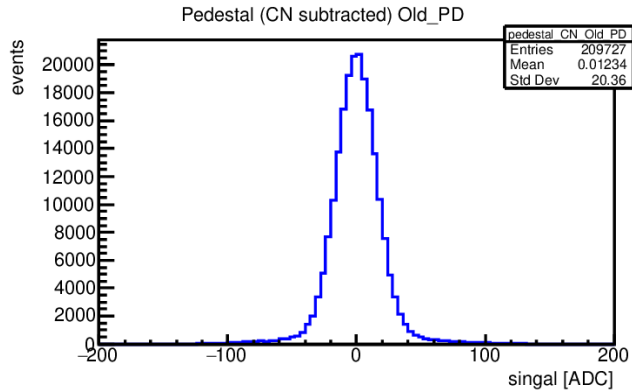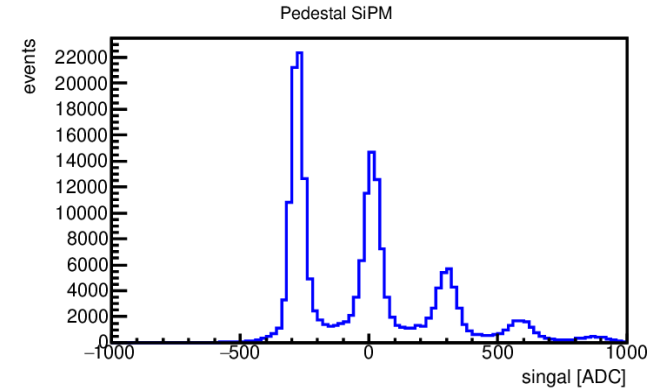
SiPM coupled with the WLF using 0.5 mm teflon layer
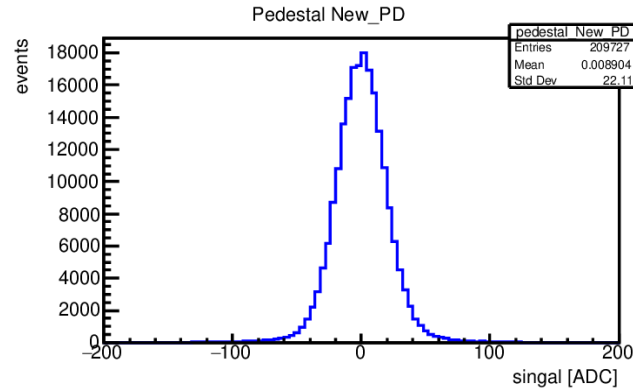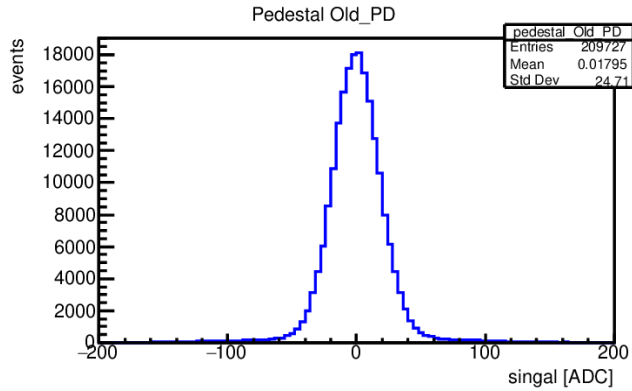
PD channels w/o Rk, SiPM channel with Rk

- casisTime window: selecting events to avoid strange features

Pedestal

- Smaller noise on the new PD, especially after CN subtraction.
- SiPM gain ~ 300 ADC

Physics signals
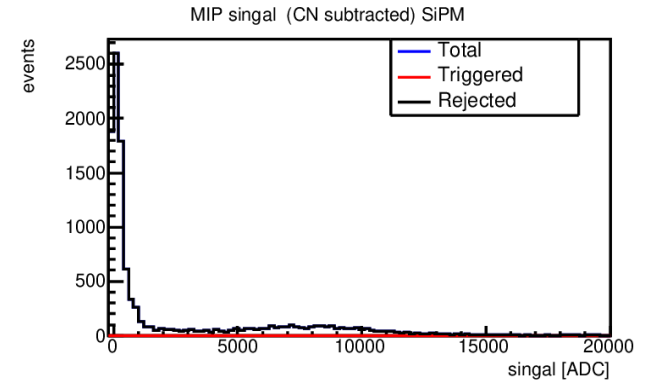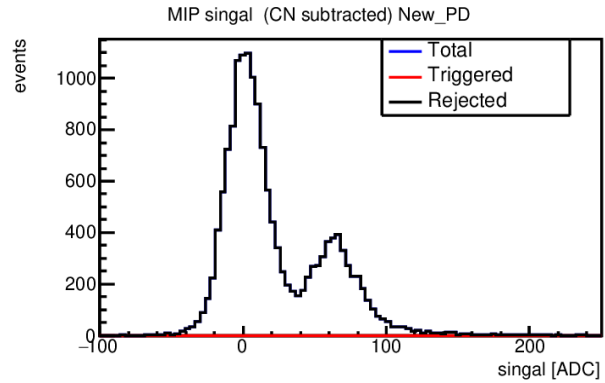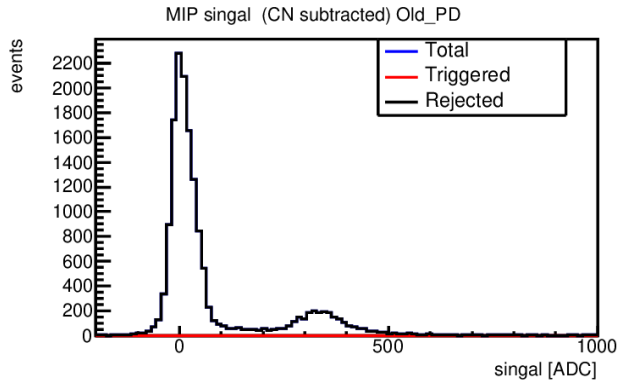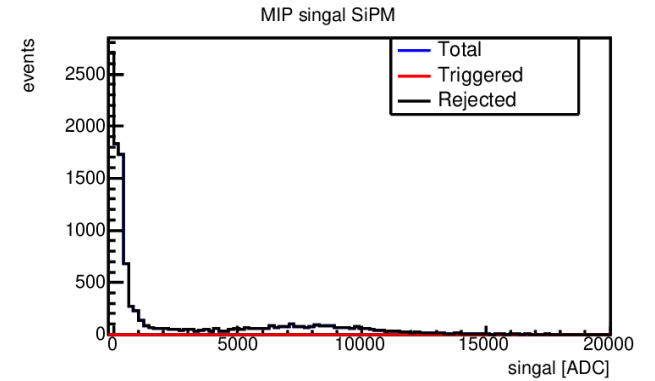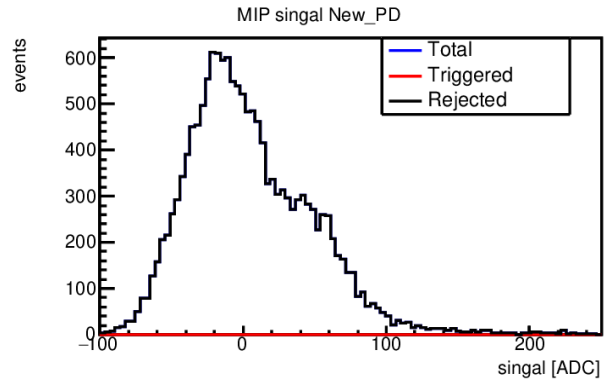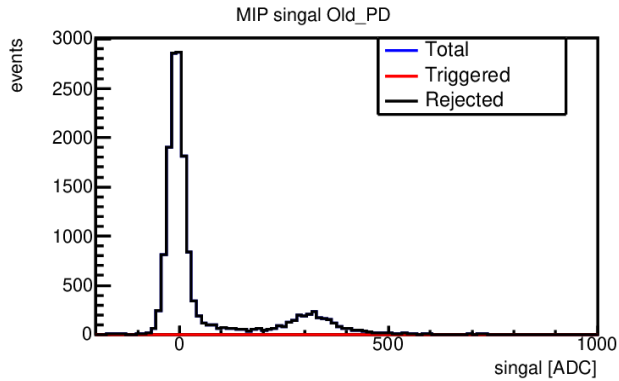
- Self-trigger information is not present during this acquisition (??).
- A lot of muons are outside the cubes, MIP and ped. with new PD are not well separated.

Correlation and selection

Old PD vs new PD

Old PD vs SiPM
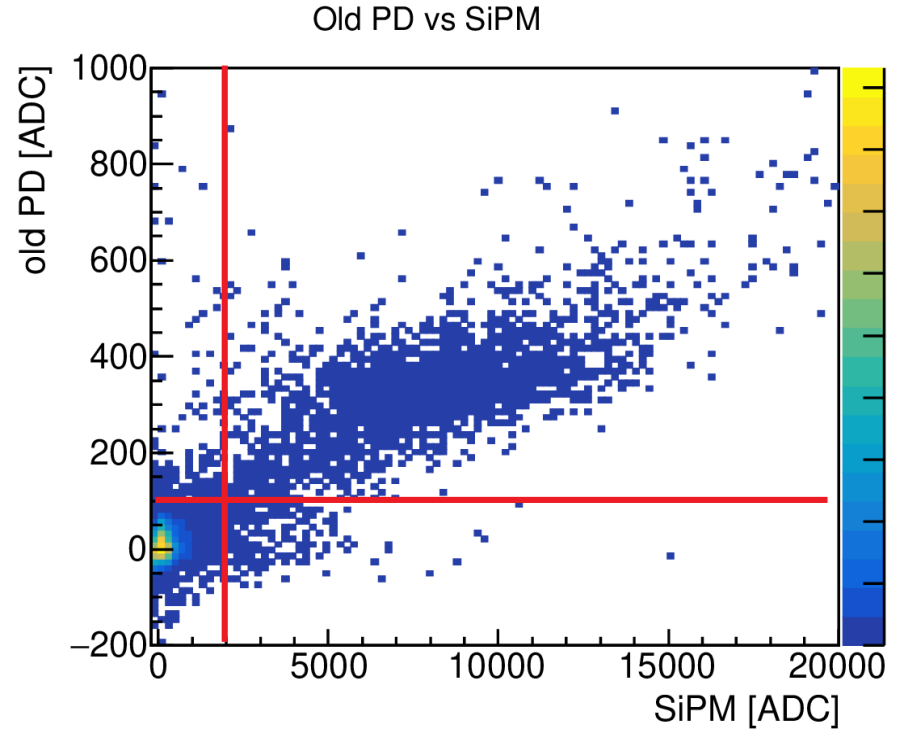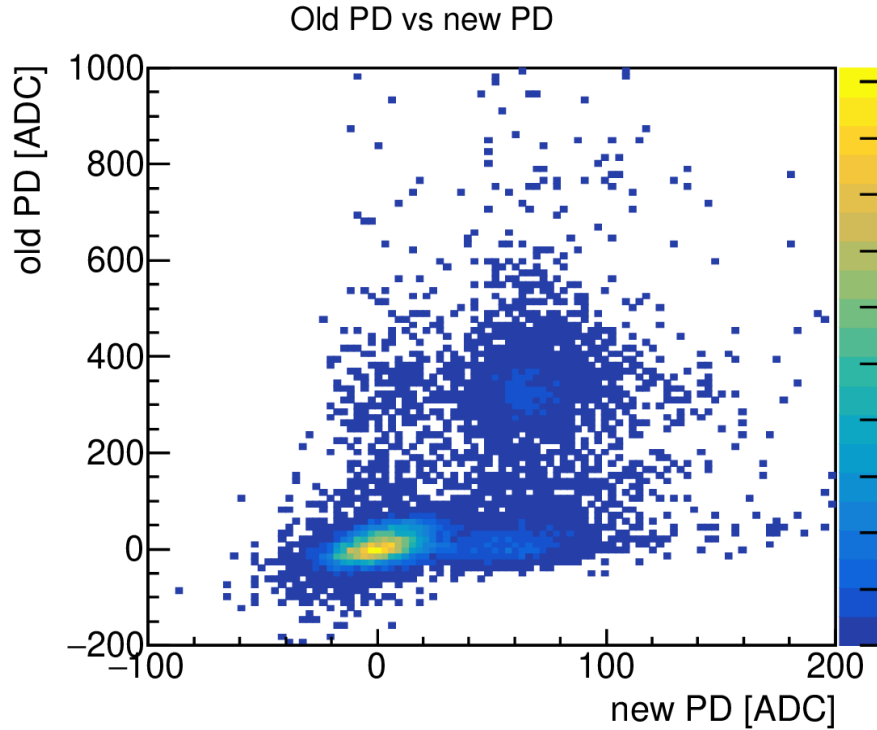
- Box cut on the SiPM-LPD to select "true MIP"
- Some muons will miss the cube with the new PD, but not so much.

MIP fit

MIP singal Old_PD

MIP singal New_PD

MIP singal SiPM

MIP singal (CN subtracted) Old_PD

χ² / ndf: 0.7
Peak: 329.5 ± 2.0
σ_G: 42.0 ± 3.2
σ_L: 14.7 ± 2.1

MIP singal (CN subtracted) New_PD

χ² / ndf: 1.0
Peak: 64.7 ± 0.6
σ_G: 13.8 ± 0.8
σ_L: 2.7 ± 0.4

MIP singal (CN subtracted) SiPM

χ² / ndf: 1.0
Peak: 7761.8 ± 97.9
σ_G: 2000.0 ± 25.4
σ_L: 395.9 ± 35.5
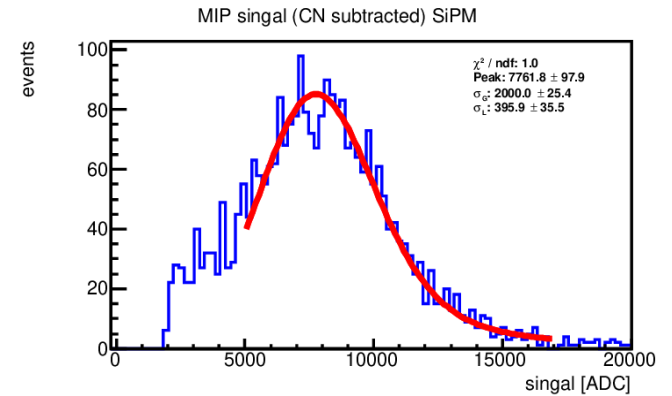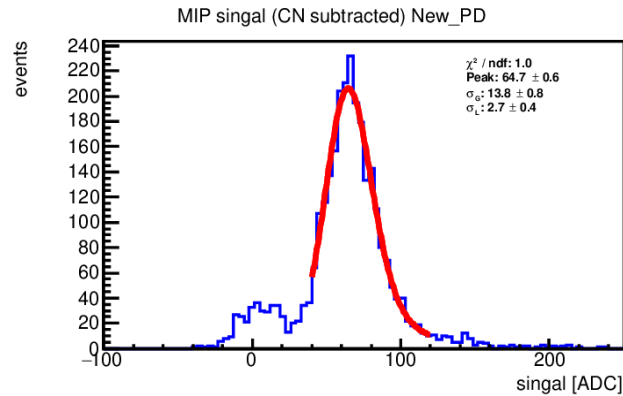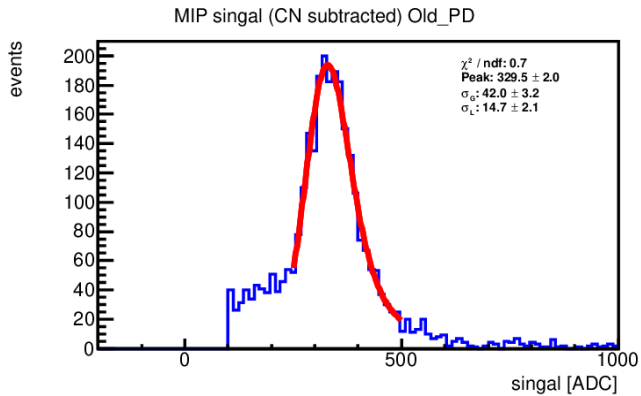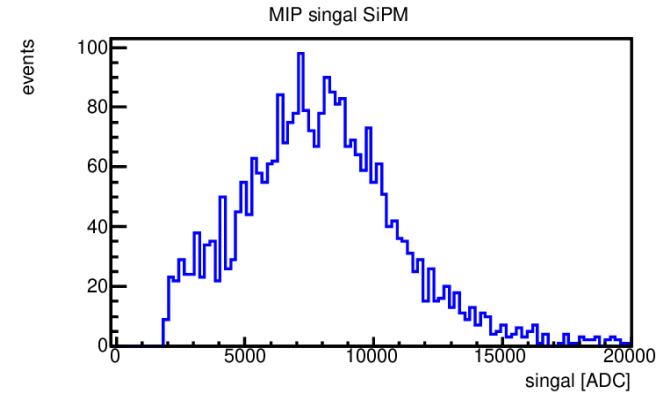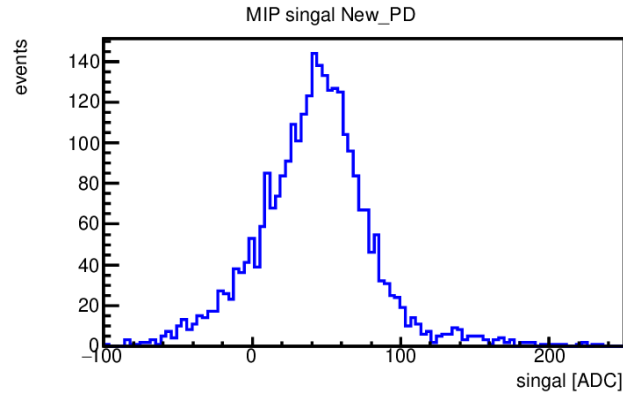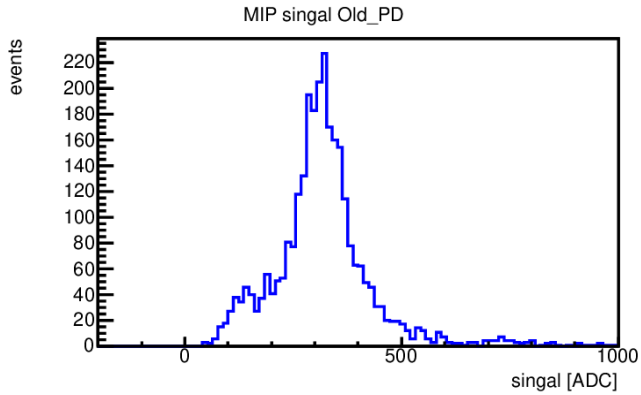
- Old PD / new PD ~ 5 (to much? 3.5 expected?)
- SiPM MIP ~ 7700 ADC ~ 26 ph (to much? I expected 10 ph)

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Testing the long scolopendra

- Testing: (selecting events inside the "good" casisTime window)
  - Scolopendra without PDs
  - Scolopendra without PDs + "long nose"
  - Scolopendra with PDs
  - Scolopendra with PDs + "long nose"

Scolopendra noise

Noise

Std. Dev. [ADC]

- all chan.
- Large PD
- Small PD

chan

Noise, after CN sub.

Std. Dev. [ADC]

- all chan.
- Large PD
- Small PD
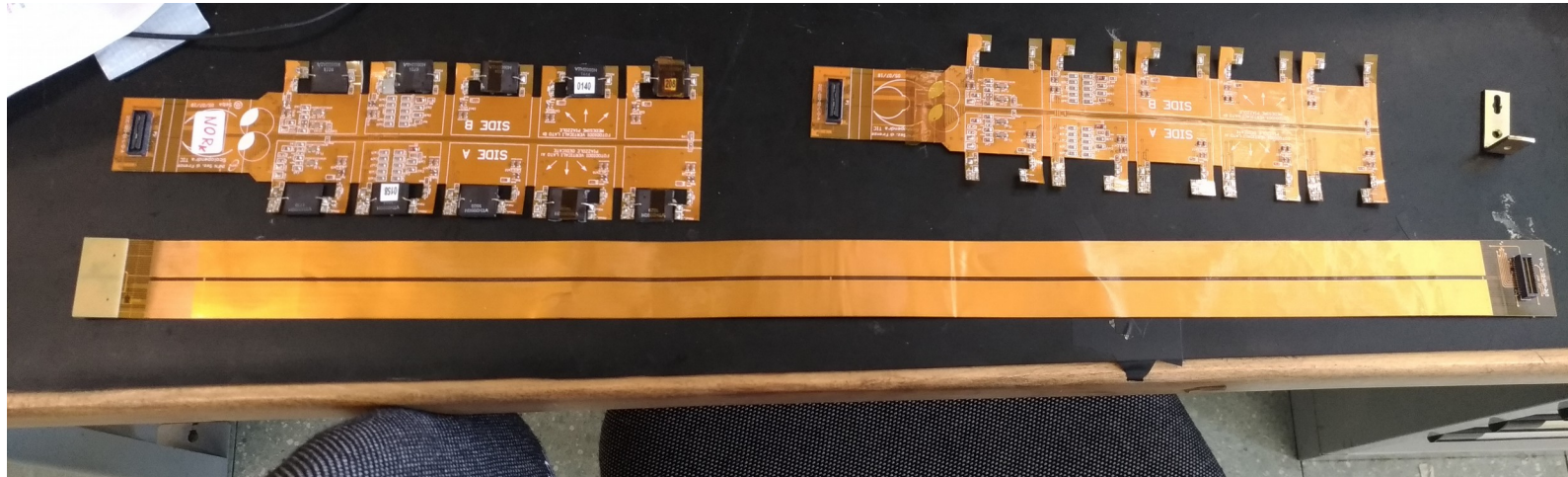
chan

CN diode
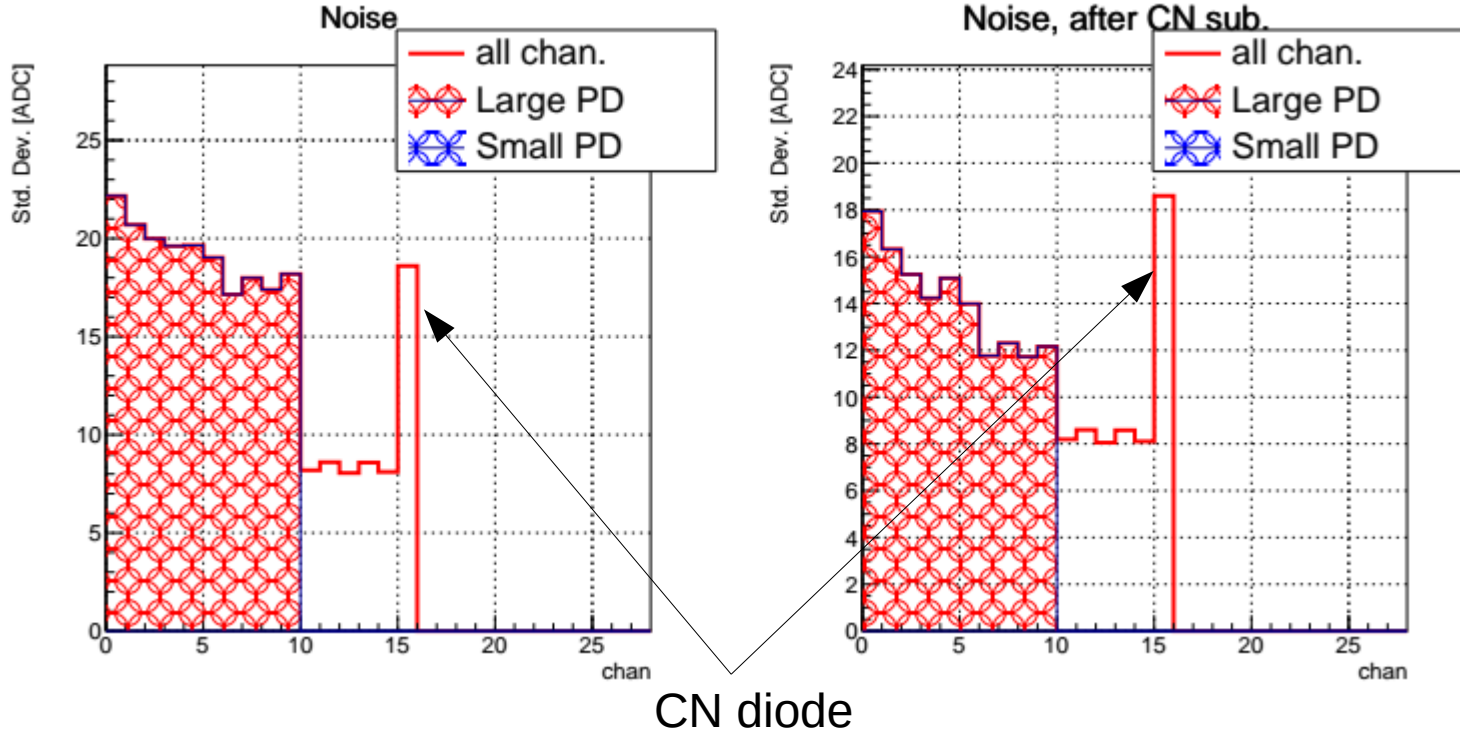
● Mean RMS ~ 18 ADC (14 ADC CN sub.)

Legend: Large PD means that those are channels meant to be connected to the large PD

Testing the first chip only which reads large PD only

5 channels of this chip are connected to an empty connector.

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Scolopendra + long nose noise

Legend: Large PD means that those are channels meant to be connected to the large PD

Testing the first chip only which reads large PD only

5 channels of this chip are connected to an empty connector.

- Mean RMS ~ 28 ADC (26 ADC CN sub.)
- It is ~30% bigger than the previous test.

Scolopendra+LPDS noise

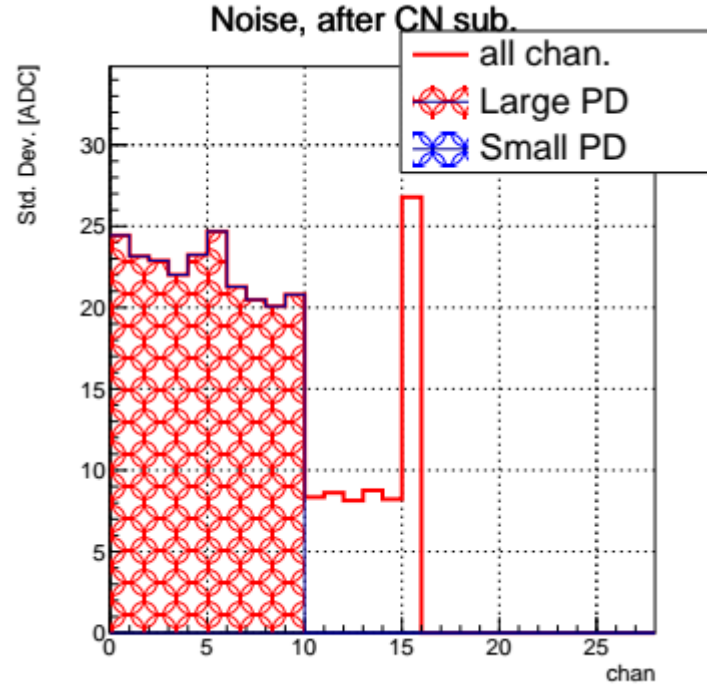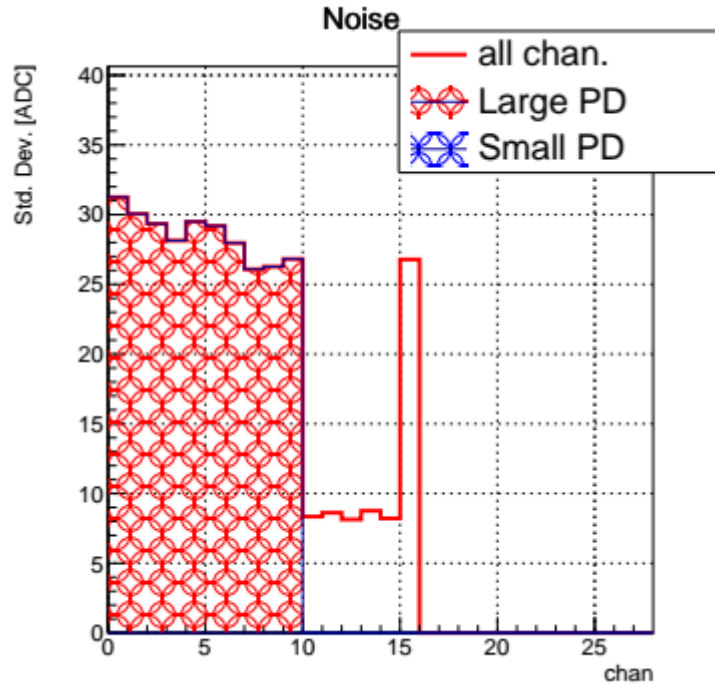
PD bias: 40 V (Keithely)

Testing the first chip only which reads large PD only

5 channels of this chip are connected to an empty connector.

- Mean RMS ~ 26 ADC (16 ADC CN sub.)
- It is similar to the scolopendra + long nose without PD, the CN correction work slightly better.

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Scolopendra+LPDS+long nose noise

PD bias: 40 V (Keithely)

Testing the first chip only which reads large PD only

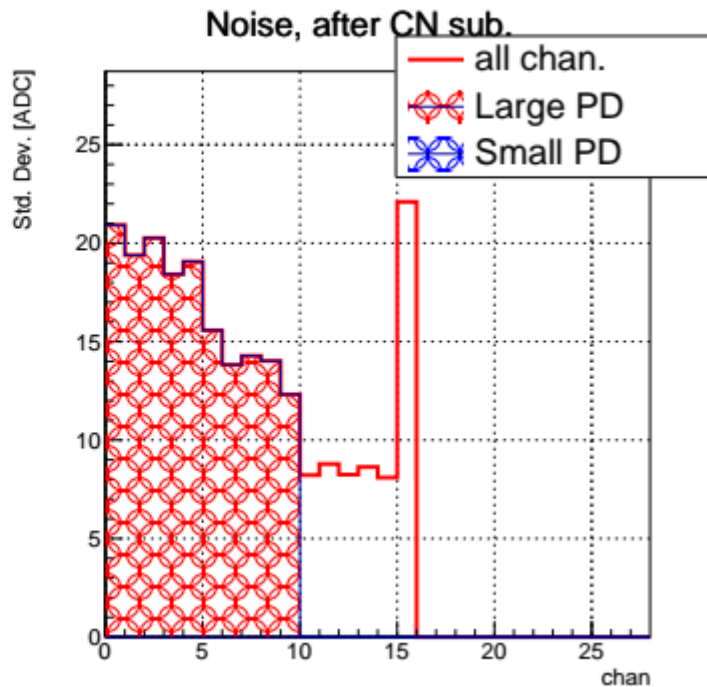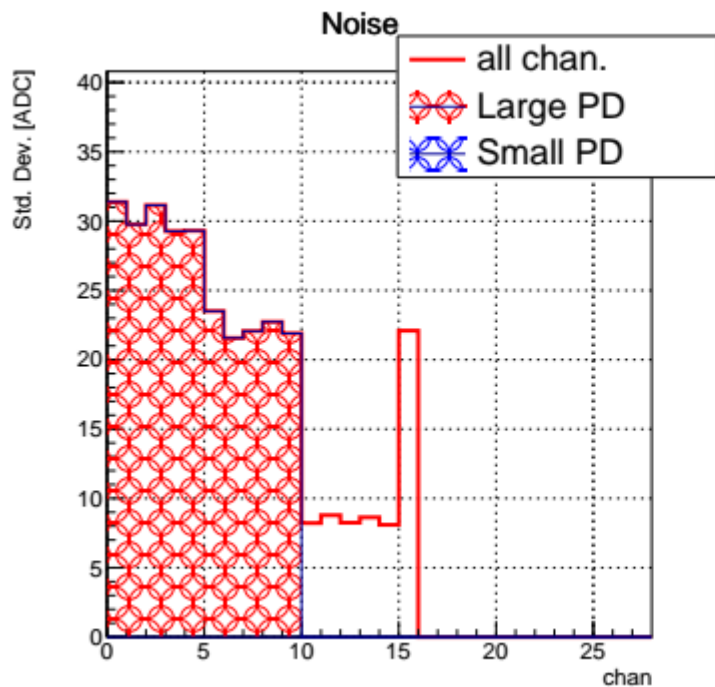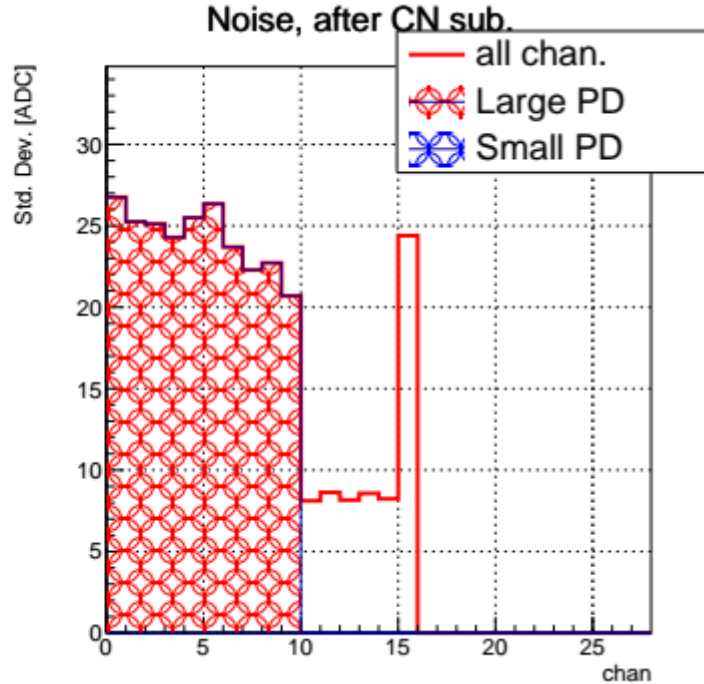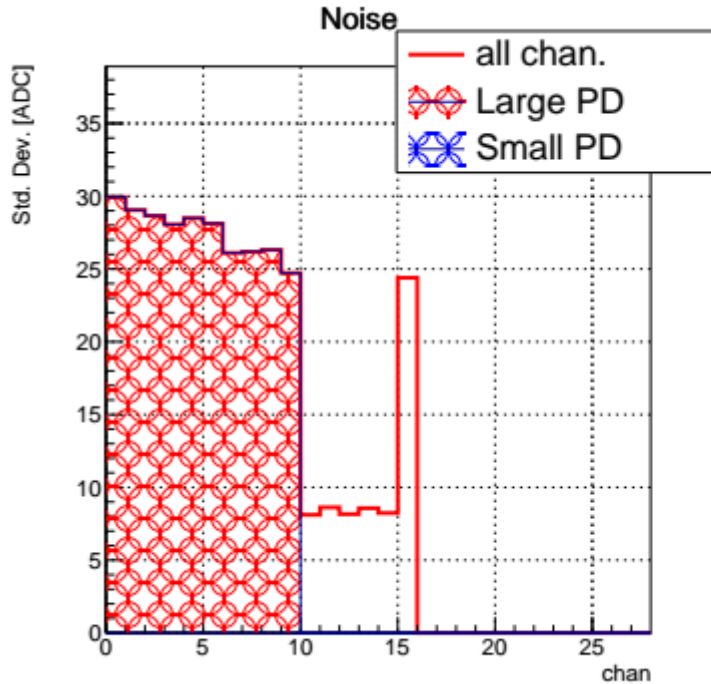5 channels of this chip are connected to an empty connector.

- Mean RMS ~ 27 ADC (24 ADC CN sub.)
- Very similar to the scolo+nose without PDs (??).

Comparison
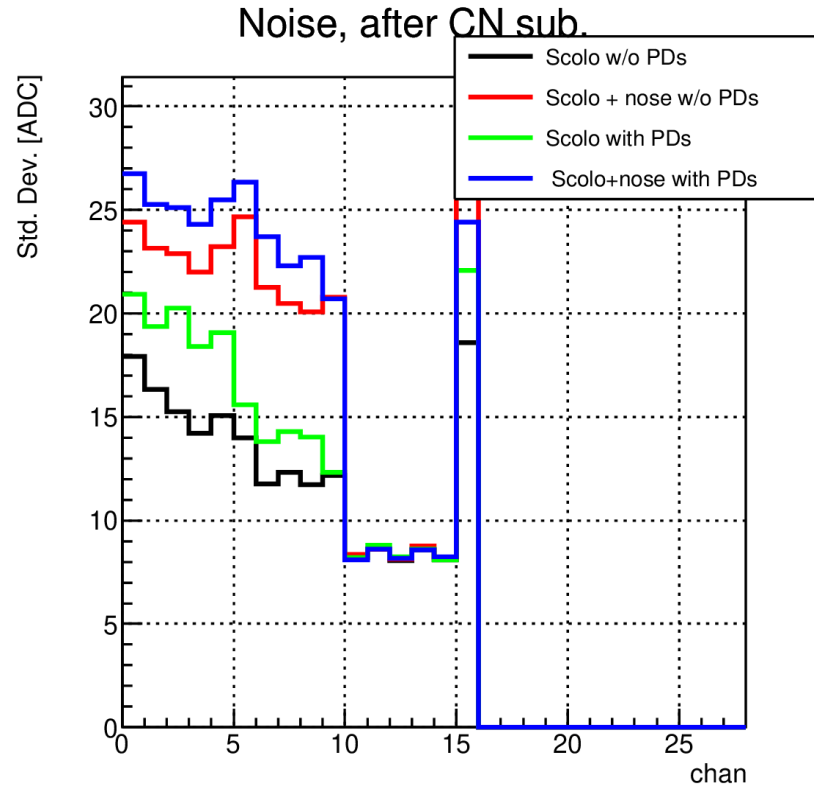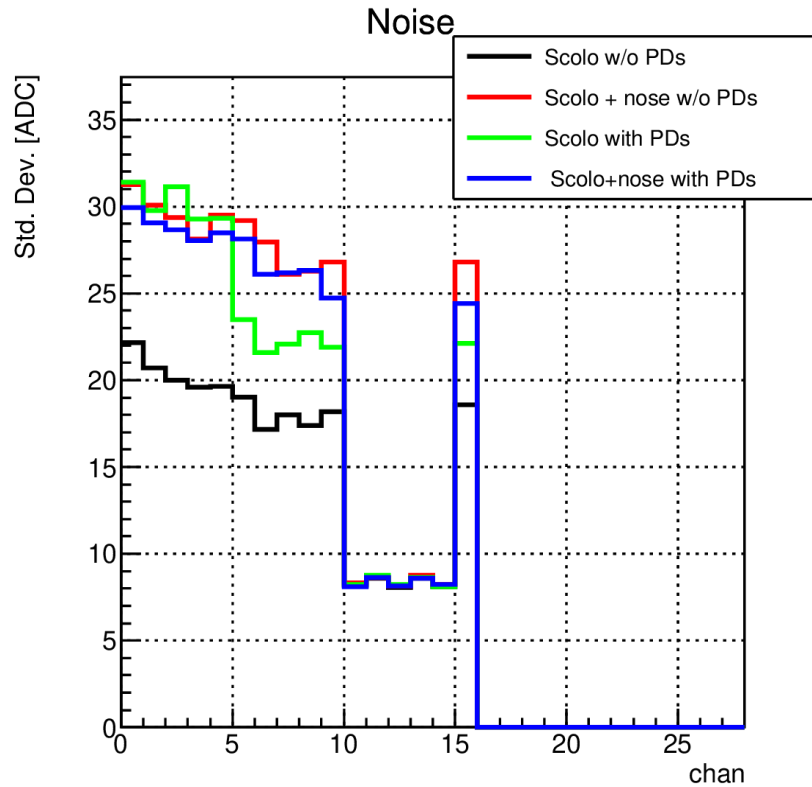
- Best config. Vs worst config. ~ 50% (from 20 to 30 ADC).
- Long nose affects channels > 5 when PDs are connectedù
- CN subtraction does not work so mush with the nose.

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Interference with casisTime
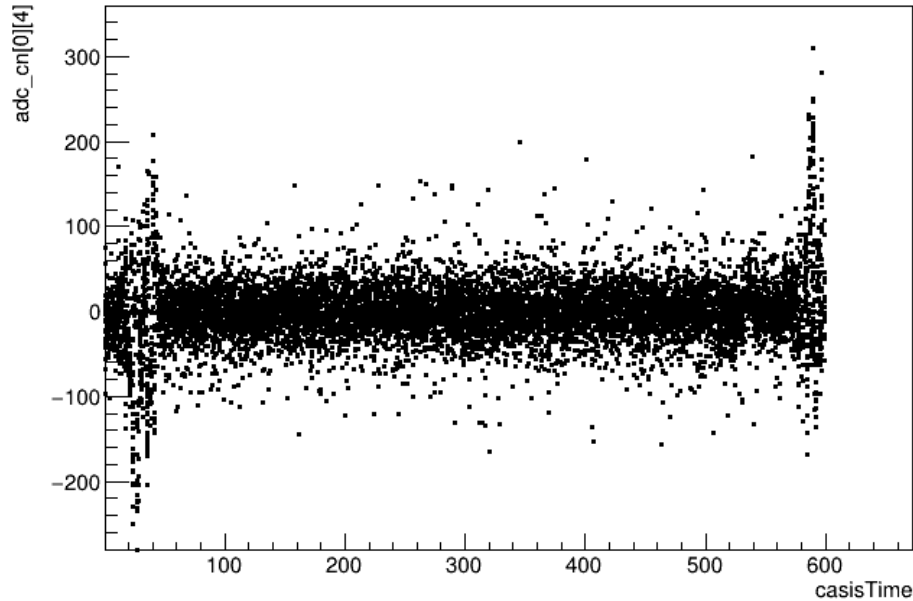
Scolo + PDs   Scolo + Pds + long nose
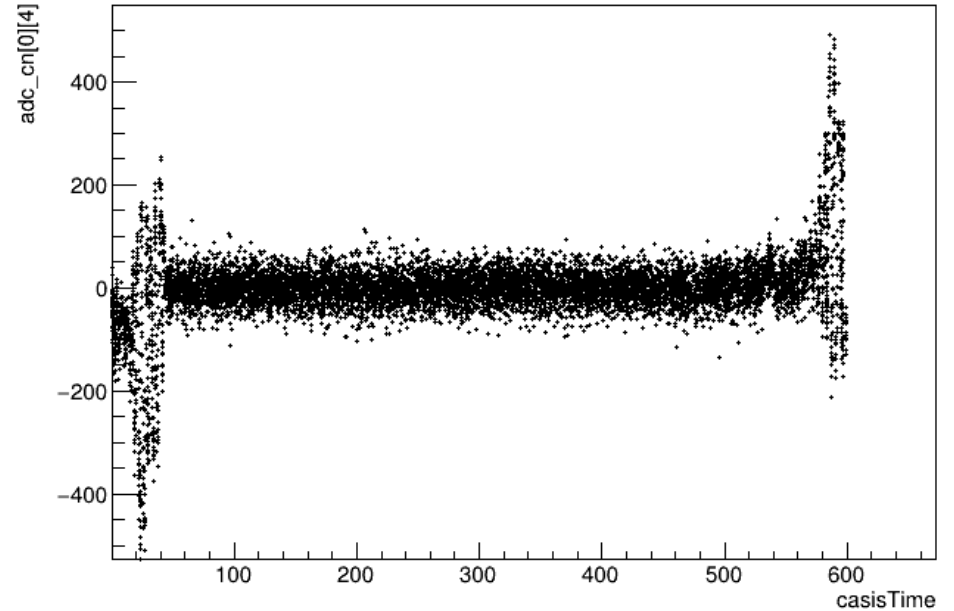
- Interference seems bigger with the long nose, even if the RMS within the "good" casisTime range is very similar.

Summary and next step

- MIP test: SiPM to high (We will try to use 1mm teflon), new PD to samll (Sasha applied again teh optical greases and we are now acquiring).

- Long nose: similar noise (30% bigger at most) but larger EM interference (??)

- We started the assembly of a prototype layer (thanks Seba)
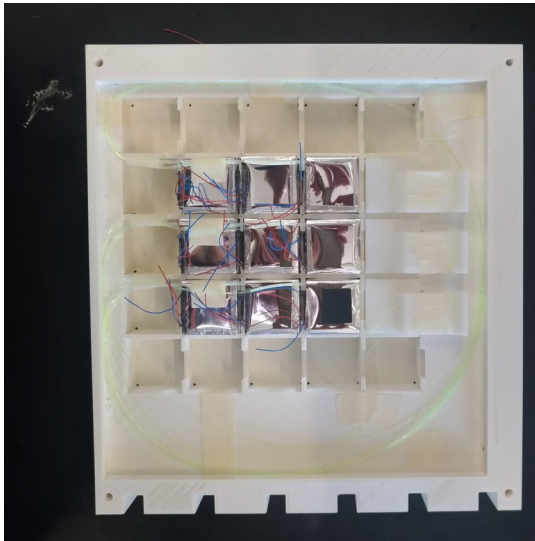
Pds connected to the 2 scolos

SiPM not installed, so far

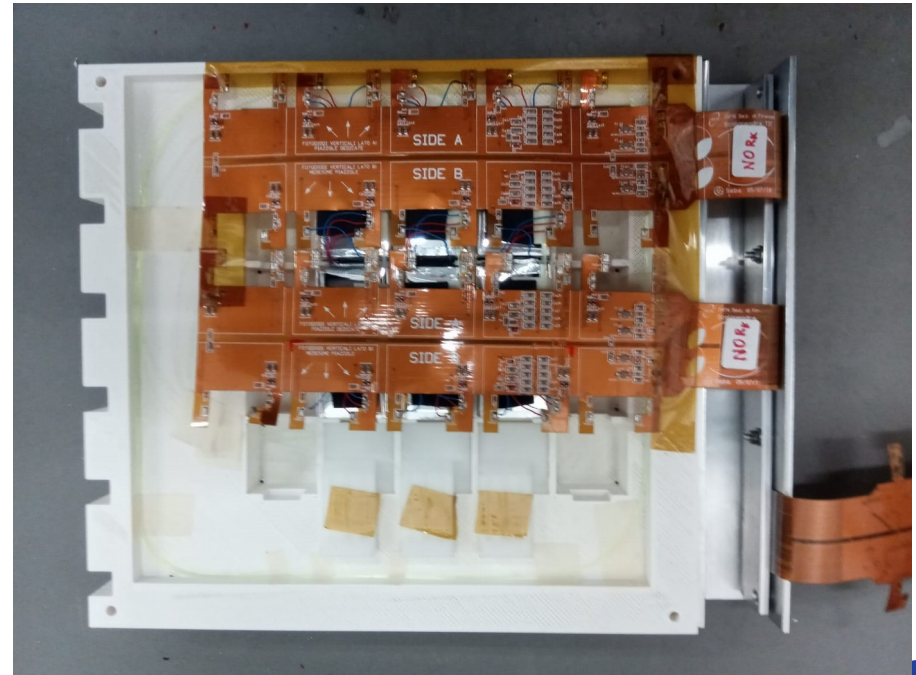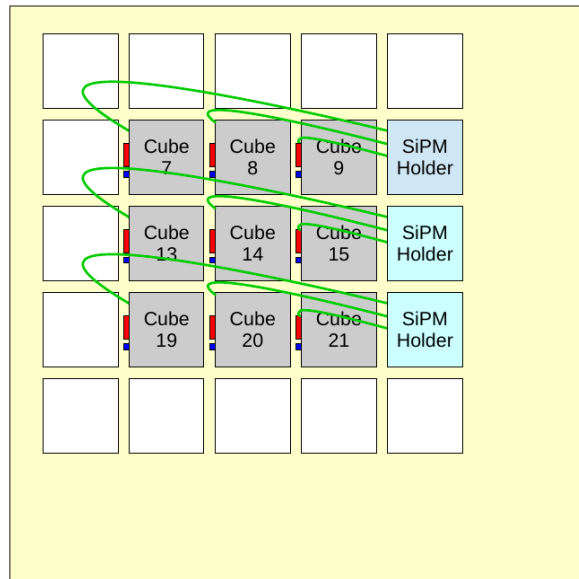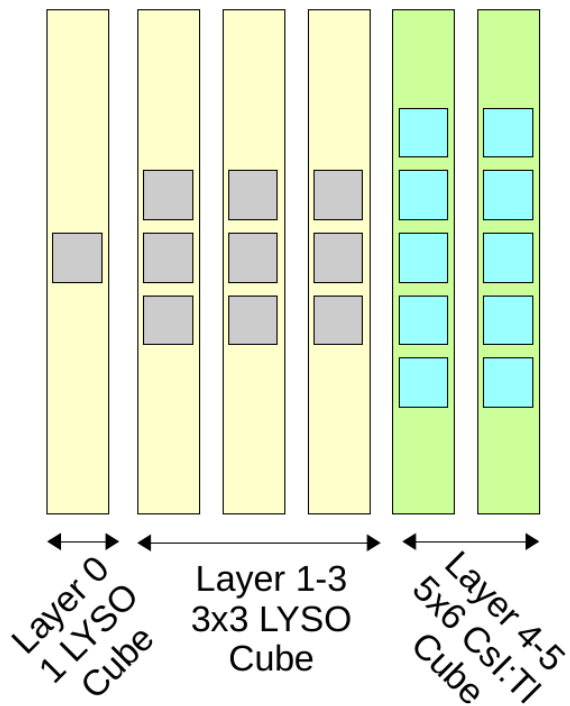| Cube	Large PD	Small PD	WLS Fiber
7	Sc1-AV5A H1-Ch4	Sc1-AS5A H2-Ch4	Sc3-AV5A H3-Ch9
8	Sc1-AV5B H1-Ch9	Sc1-AS5B H2-Ch9	Sc3-AS5B H4-Ch14
9	Sc2-AV5B H1-Ch14	Sc2-AS5B H2-Ch14	Sc3-AV5B H3-Ch14
13	Sc1-AV4A H1-Ch3	Sc1-AS4A H2-Ch3	Sc3-AV4A H3-Ch8
14	Sc1-AV4B H1-Ch8	Sc1-AS4B H2-Ch8	Sc3-AS4B H4-Ch13
15	Sc2-AV4B H1-Ch13	Sc2-AS4B H2-Ch13	Sc3-AV4B H3-Ch13
19	Sc1-AV3A H1-Ch2	Sc1-AS3A H2-Ch2	Sc3-AV3A H3-Ch7
20	Sc1-AV3B H1-Ch7	Sc1-AS3B H2-Ch7	Sc3-AS3B H4-Ch12
21	Sc2-AV3B H1-Ch12	Sc2-AS3B H2-Ch12	Sc3-AV3B H3-Ch12

🟢 See attached document by Eugenio.

Miscellaneous

- We tried to decreases the EM interference by changing the grond connections, using new filters …. (thanks Raffaello). With a single PD connected to a scolo inside the metal box the EM interference are very small.

- But when the system is more complicated the EM interference come back (here 2 PDs and 1 SiPM
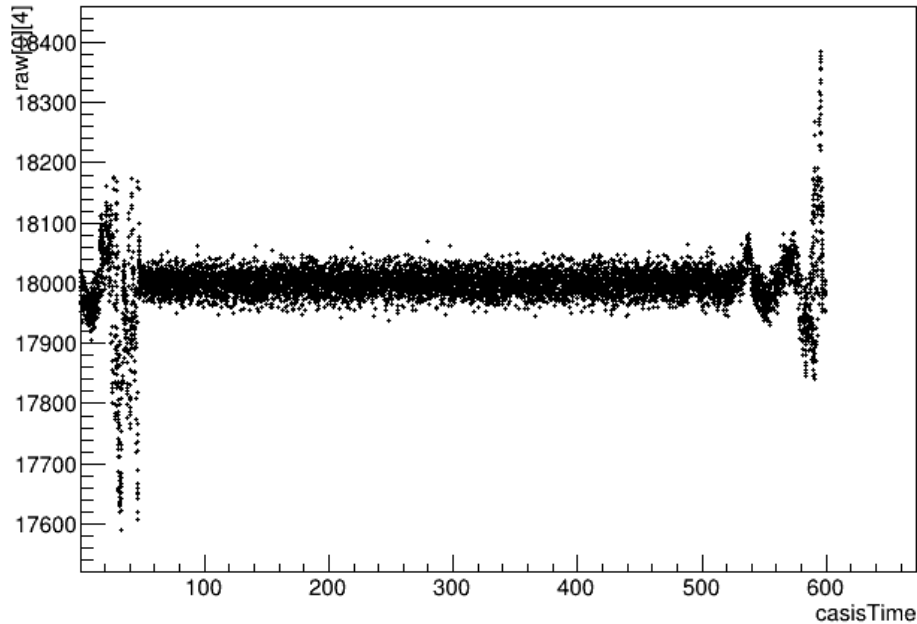
- Residual casisTime dependence of the signal and calibration mode discussed by Eugenio.

Miscellaneous (2)

- 15 CsI layer + a lot of CsI cubes to be stored….

CODICE ARTICOLO PRODUTTORE: TO22015102
Armadio Dry SD 151-21/VERSIONE ESD NO RUOTE
€ 1.970,00 / Pezzo Fornitore I-TRONIK S.R.L.

- External dimensions: (W x H x D) 500 x 630 x 580 mm
- Internal dimensions: (W x H x D) 490 x 560 x 450(530) mm
- Weight: 37,1 kg
- Weight on shelf: 30 kg
- Max. loading capacity: 100 kg
- Body: Steel, conductive coated 10^6-10^8 Ω/sq
- Shelves (W x D): 3 pcs, 468 x 380 mm adjustable.
- Volume: 135 L
- Voltage: 230 V AC (120 V AC optional)
- Power consumption: 35 W/h
- Protection class: hard grounded, Class 1
- Humidity level cabinet: Drying 1% RH *