Status of MSD subsystem

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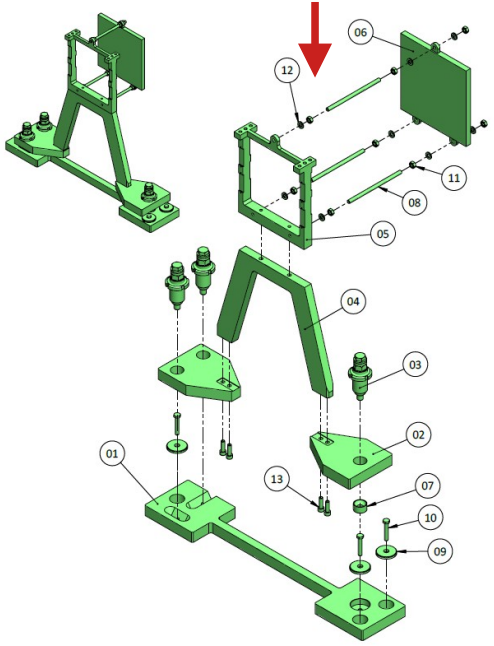
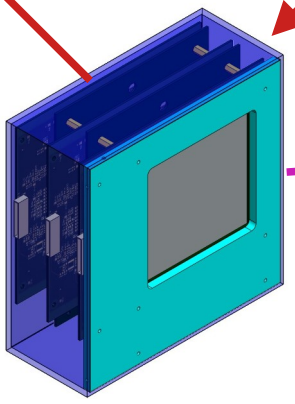
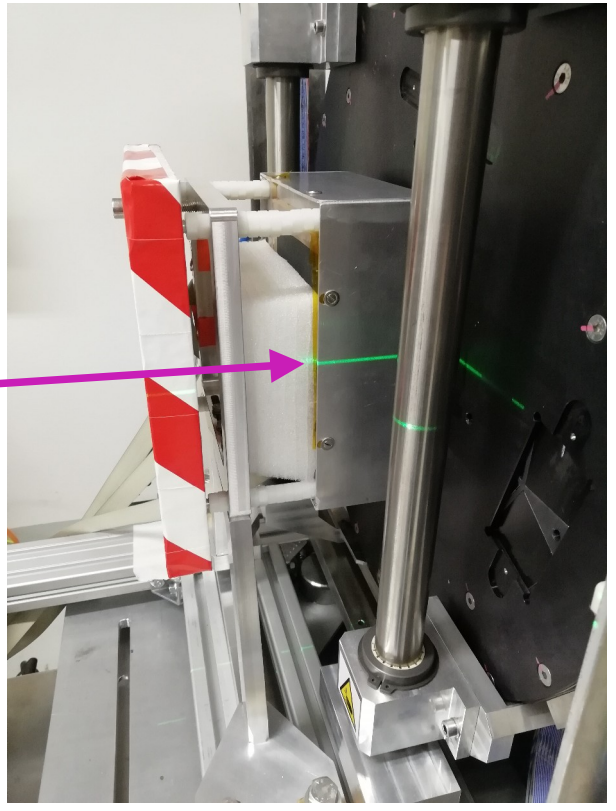
MSD: New mechanical setup.

interface to MSD box

new smaller box
(closer to magnet)







Same structure of IT Setup.

MSD: CNAO 2024 data taking

→ 3 x-y planes were placed after the second magnet.

→ installation procedure was smooth.

→ no other hardware problems to report.

→ running without relevant problems.

→ one small noise problem related to presence of light sources on the experimental room (see calibration slides)

MSD: CNAO 2024 data taking

Connection scheme for CNAO 2024 MSD system.

All these sensor are the same of CNAO 2023 data taking.

→ all eta-function and gain corrections are the same.

Beam Order	Name	DE10Nano	Connector 0: J5, 1: J7	View	Ch. 0	Ch. 639
0	L06	1	1	X	Door	Wall
1	L05	3	0	Y	Up	Down
2	L04	2	1	X	Door	Wall
3	L03	2	0	Y	Up	Down
4	L08	3	1	X	Door	Wall
5	L01	1	0	Y	Up	Down

MSD: CNAO 2024 data taking

→ Pedestal and noise (aka strip calibration)

We had 29 calibration runs during the second data taking.
Goal was an updated calibration for
each data taking period, one-two hours
validity for each calibration, more or less.

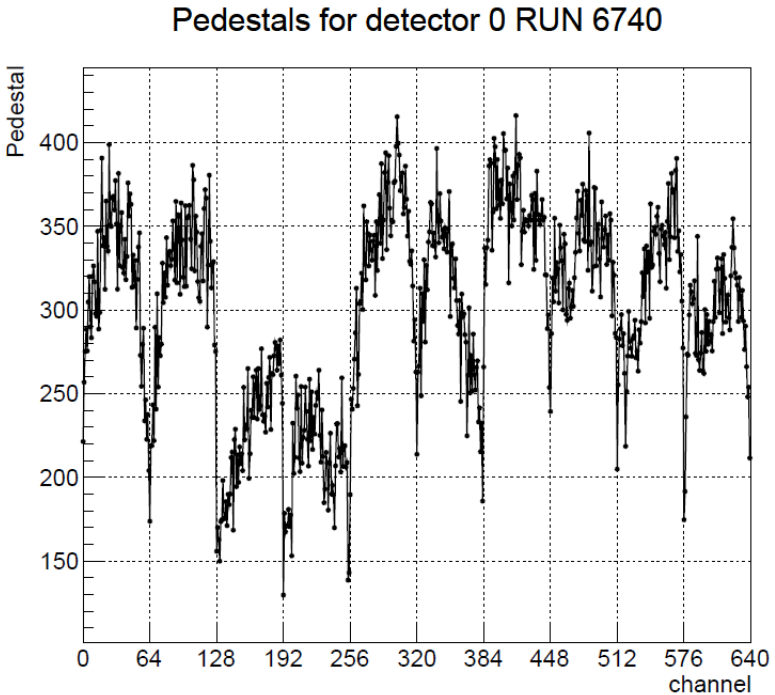
→ *Preliminary evaluation of files looking at the elog:*

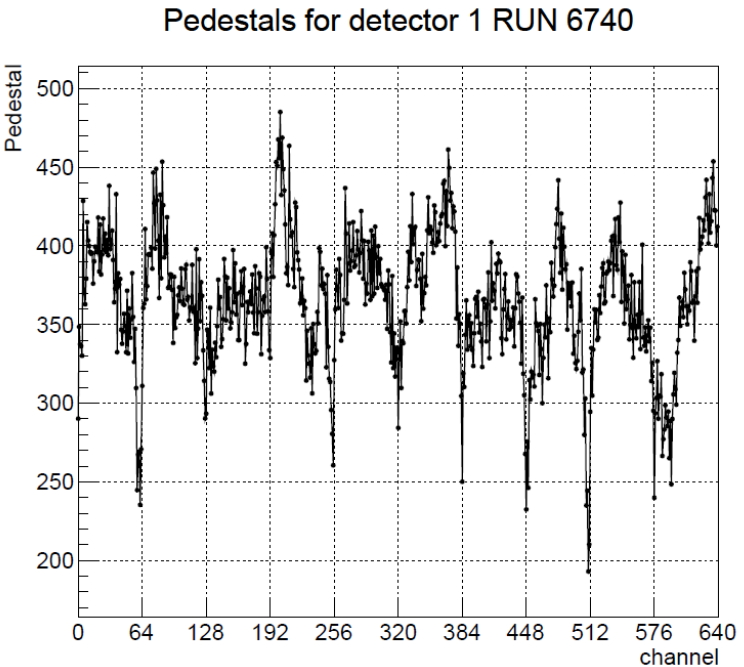
Only 19 runs are considered up to now as valid calibrations.
Most of the discarded ones have .cal files with no content.

```
#sensorId stripId AsicId Asi
#sensorId: 0
 0    0  0  0    0.0 0.0 1
 0    1  0  1    0.0 0.0 1
 0    2  0  2    0.0 0.0 1
 0    3  0  3    0.0 0.0 1
 0    4  0  4    0.0 0.0 1
 0    5  0  5    0.0 0.0 1
 0    6  0  6    0.0 0.0 1
 0    7  0  7    0.0 0.0 1
 0    8  0  8    0.0 0.0 1
 0    9  0  9    0.0 0.0 1
 0   10  0 10    0.0 0.0 1
 0   11  0 11    0.0 0.0 1
 0   12  0 12    0.0 0.0 1
 0   13  0 13    0.0 0.0 1
 0   14  0 14    0.0 0.0 1
 0   15  0 15    0.0 0.0 1
 0   16  0 16    0.0 0.0 1
 0   17  0 17    0.0 0.0 1
 0   18  0 18    0.0 0.0 1
 0   19  0 19    0.0 0.0 1
 0   20  0 20    0.0 0.0 1
 0   21  0 21    0.0 0.0 1
```

MSD: CNAO 2024 data taking problem

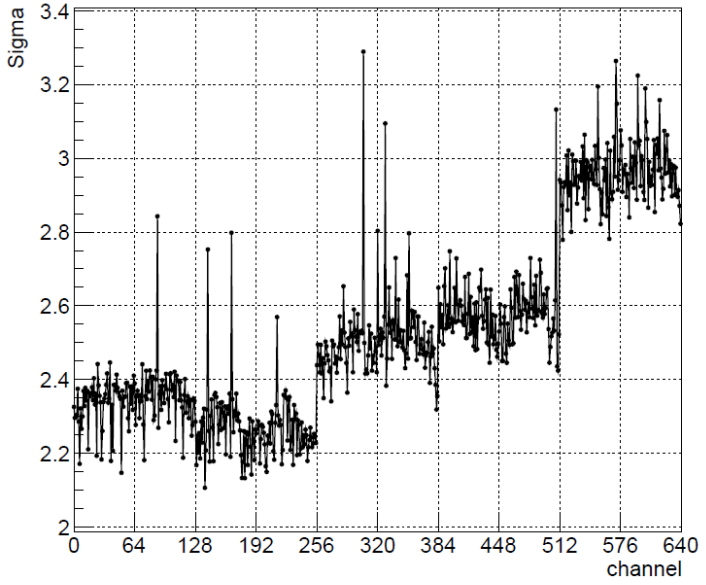
→ Pedestal of sensor 0 and sensor 1: no apparent difference

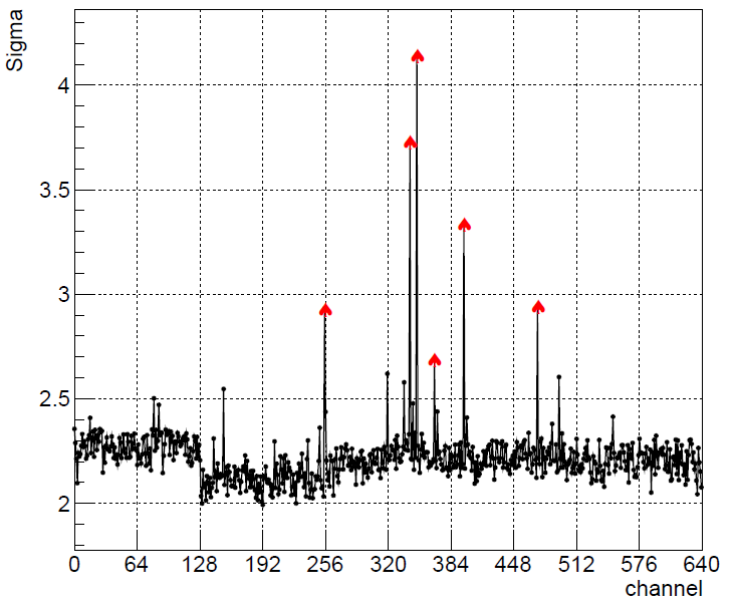




MSD: CNAO 2024 data taking

→ Single Strip noise of sensor 0 and sensor 1: noise pattern different first week

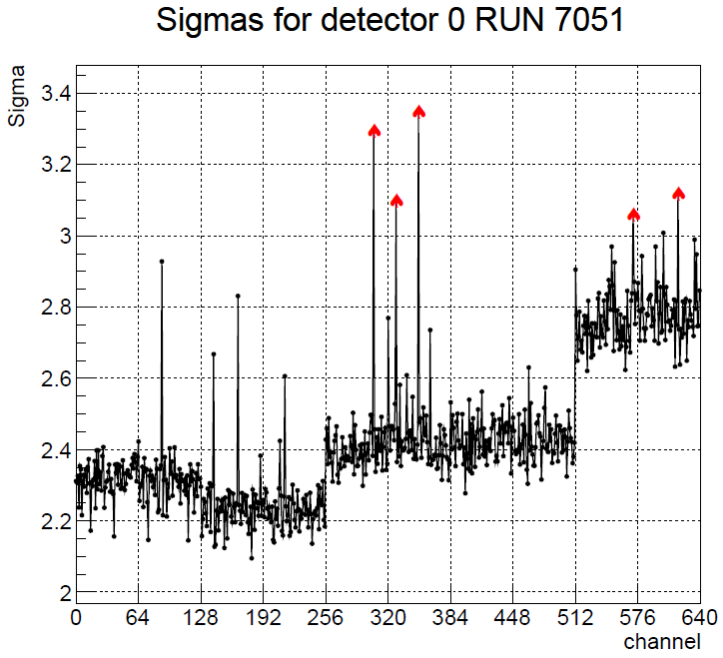


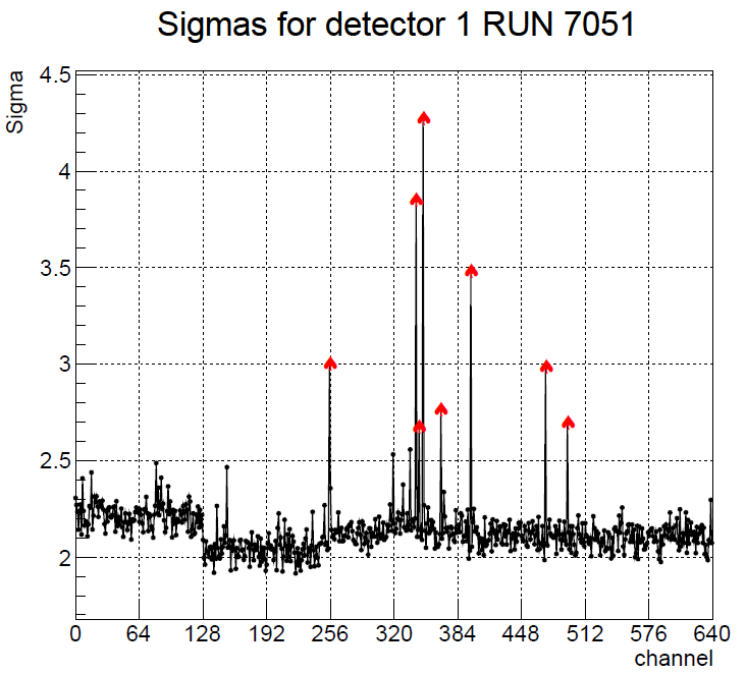


Possible light source on in the experimental room

MSD: CNAO 2024 data taking

→ **Single Strip noise** covered a surveillance camera.





Noise reduced by 0.2 ADCs on average for sensor 0 and 5.

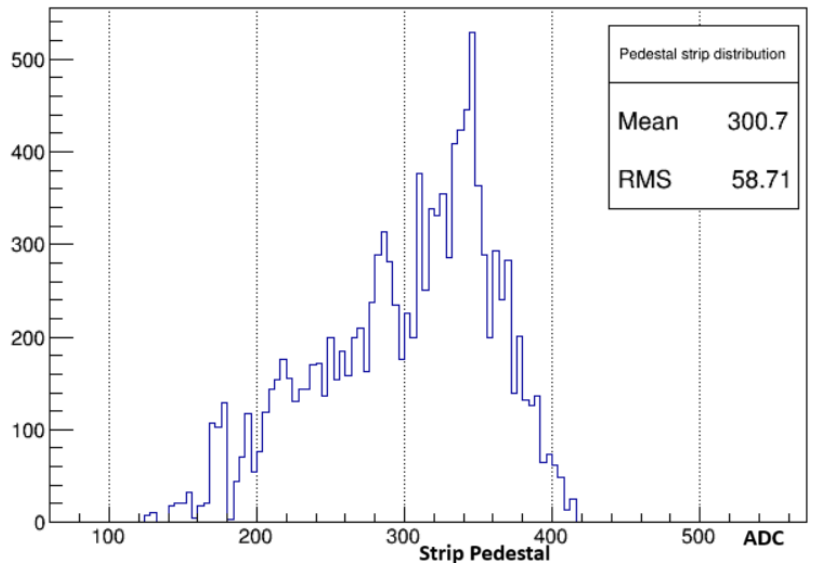
MSD: CNAO 2024 data taking

→ Pedestal and noise (aka strip calibration)

We had 19 good calibration runs during the second data taking.
Goal was an updated calibration for each data taking period, one-two hours validity for each calibration, more or less.

→ *Preliminary study of strip pedestal*

Total distribution for all sensors and all calibrations → RMS ~ 60 as expected



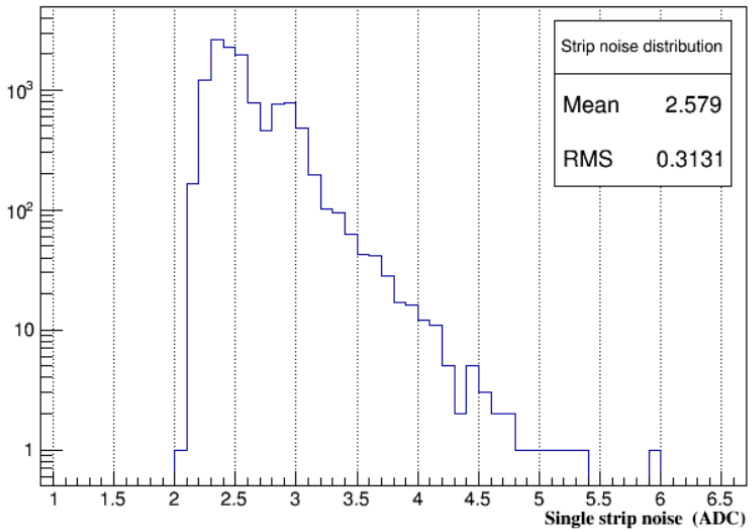
MSD: CNAO 2024 data taking

→ Pedestal and noise (aka strip calibration)

We had 19 good calibration runs during the second data taking period.

Goal was an updated calibration for each data taking period, one-two hours validity for each calibration, more or less.

→ *Preliminary study of strip noise distribution*



Total distribution for all sensors and all calibrations → $\sigma \sim 2.5 \pm 0.3$ ADC → very stable

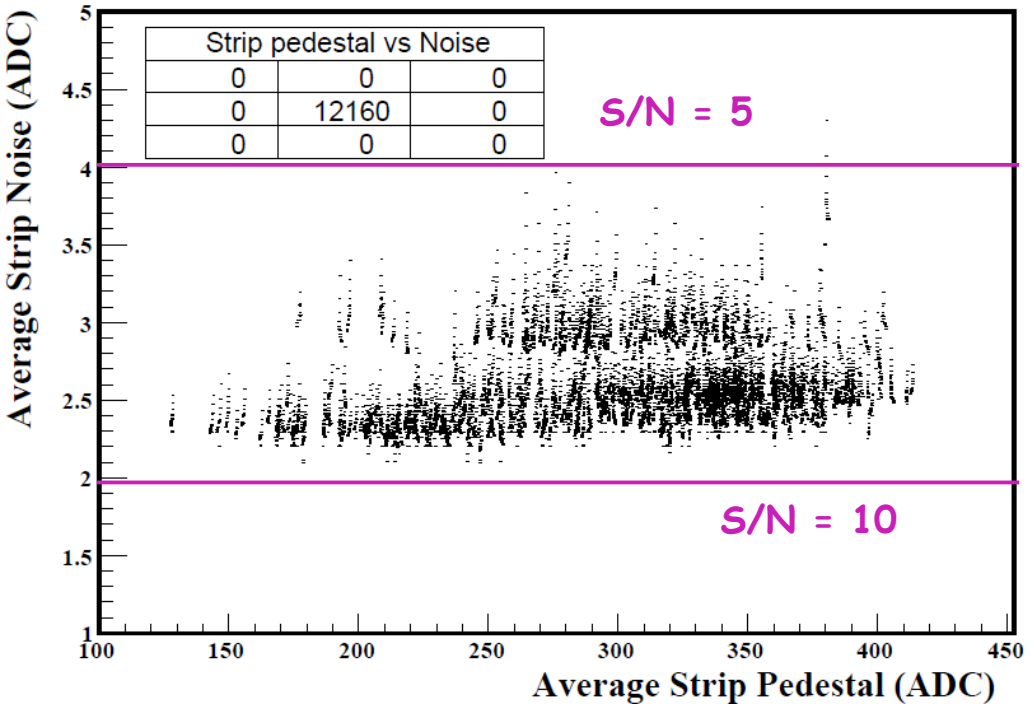
MSD: CNAO 2024 data taking

Average Strip Pedestal vs average Strip Noise

→ No significant correlation.

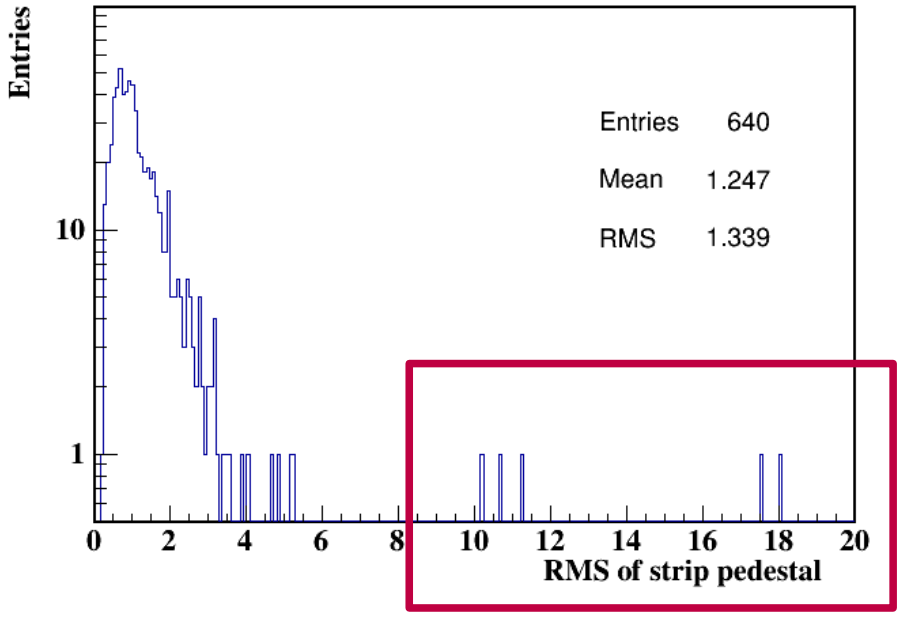
→ Two populations due to light influence on external sensors

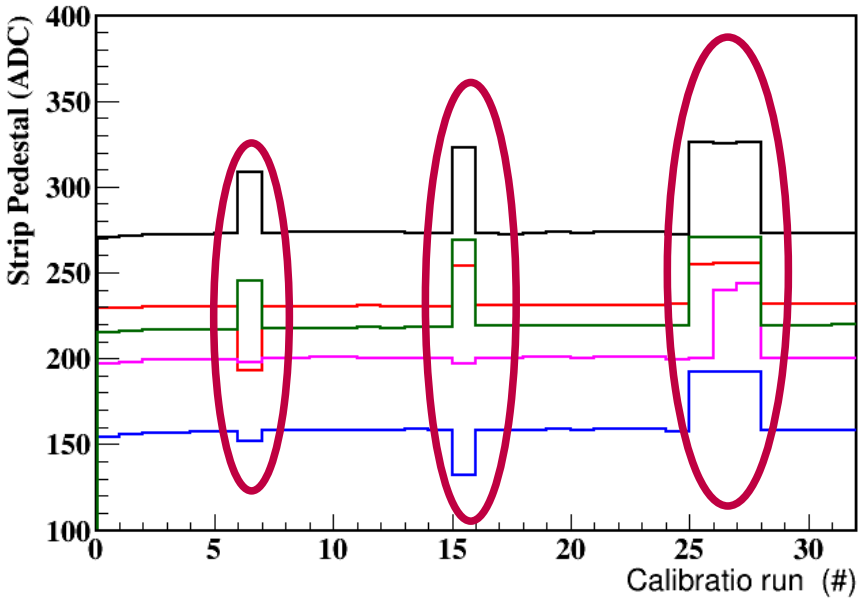
→ MIP S/N for single strip is > 5.



MSD: CNAO 2023 data taking

→ Pedestal variation in time.





We have no such behaviour with CNAO 2024 data taking.

MSD: CNAO 2024 valid pedestals

```
TAMSD_Pedestal_6918.cal
TAMSD_Pedestal_6919.cal
TAMSD_Pedestal_6926.cal
TAMSD_Pedestal_6928.cal
TAMSD_Pedestal_6935.cal
TAMSD_Pedestal_6945.cal
TAMSD_Pedestal_6952.cal
TAMSD_Pedestal_6961.cal
TAMSD_Pedestal_6967.cal
TAMSD_Pedestal_6984.cal
TAMSD_Pedestal_7001.cal
TAMSD_Pedestal_7003.cal
TAMSD_Pedestal_7016.cal
TAMSD_Pedestal_7020.cal
TAMSD_Pedestal_7028.cal
TAMSD_Pedestal_7033.cal
TAMSD_Pedestal_7051.cal
TAMSD_Pedestal_7073.cal
TAMSD_Pedestal_7082.cal
```

These calibration files should cover all the data taken in 2024.

Still working on the other 10 discarded calibrations to undestand the reasons.

MSD: next months work

→ Rerunning all the calibration data for:
GSI 2021, HIT 2022, CNAO 2023 to validate them and define noisy strips.

→ find MSD single sensor proton detection efficiency (analysis of dedicated run in Trento june 2021).

MSD: next months work

→ Evaluate the need to have a full spare MSD to quickly substitute the current one in case of accident/problems during future data taking.

→ Sensors
→ ADC boards
→ DE10nano
→ Mechanical box