



Status of MSD subsystem

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MSD: CNAO 2023 data taking

- 3 x-y planes were placed after the second magnet.
- installation procedure was smooth.
- we had to replace one ADC board the first period out of the beam time (1 h time needed).
- no other hardware problems to report.
- dismantling and radioprotection checks with no problem.

MSD: CNAO 2023 data taking

→ MSD working correctly all the time.

→ We had an apparent problem spotted by Online Monitoring plots for sensor n. 3 (y sensor of second station) for runs:

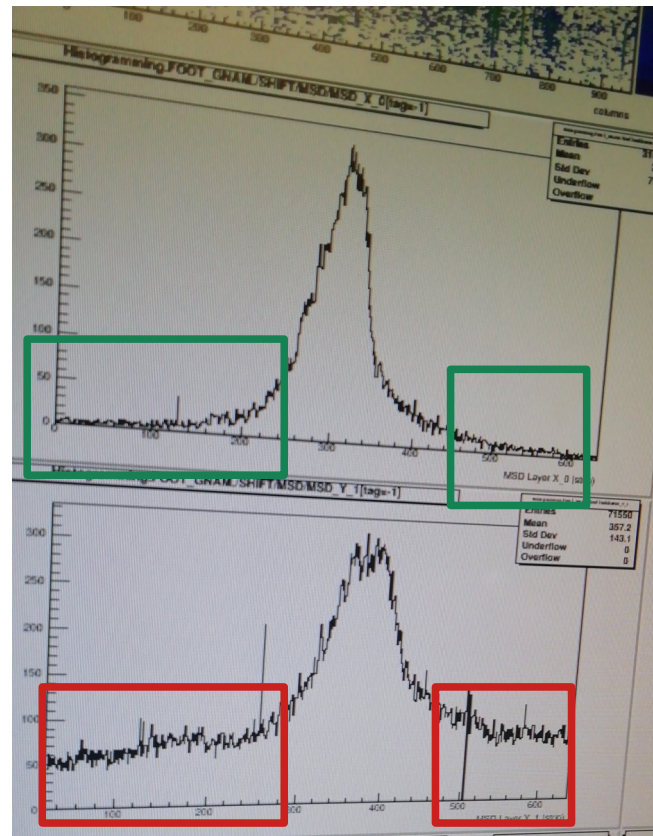
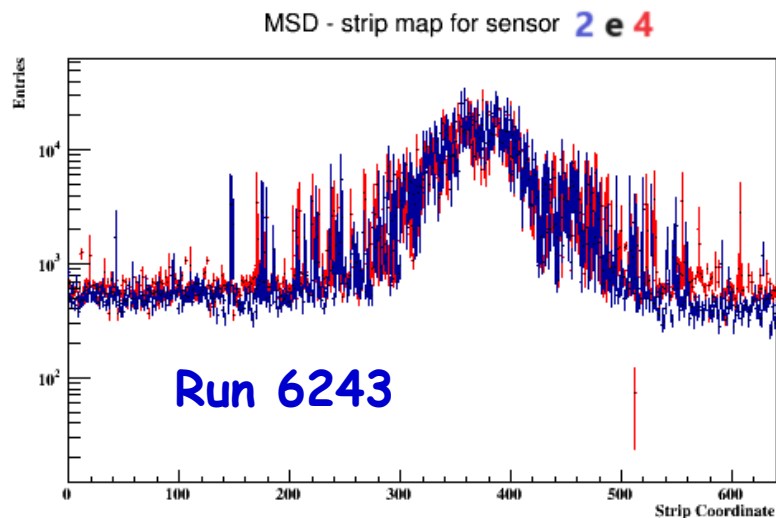
6206

.....

6243

.....

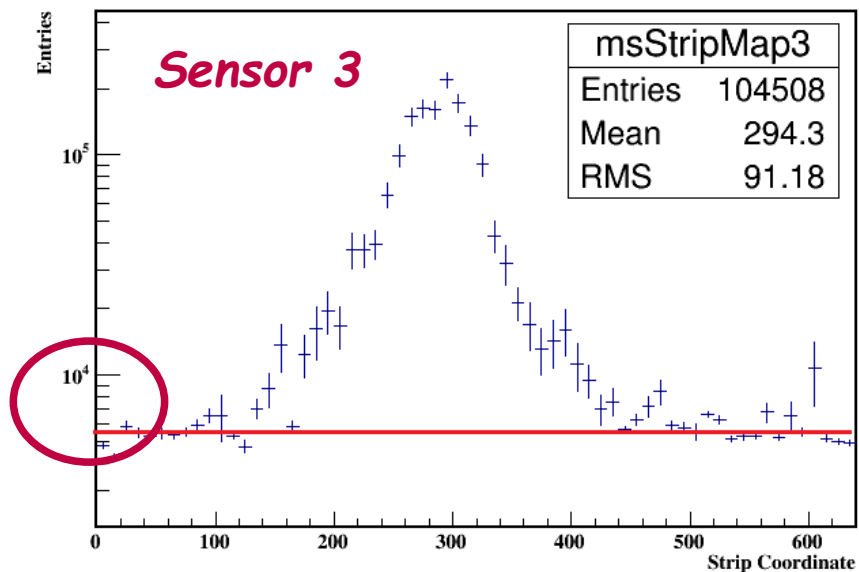
No difference in SHOE for cluster occupancy between $y1(2)$ and $y2(4)$



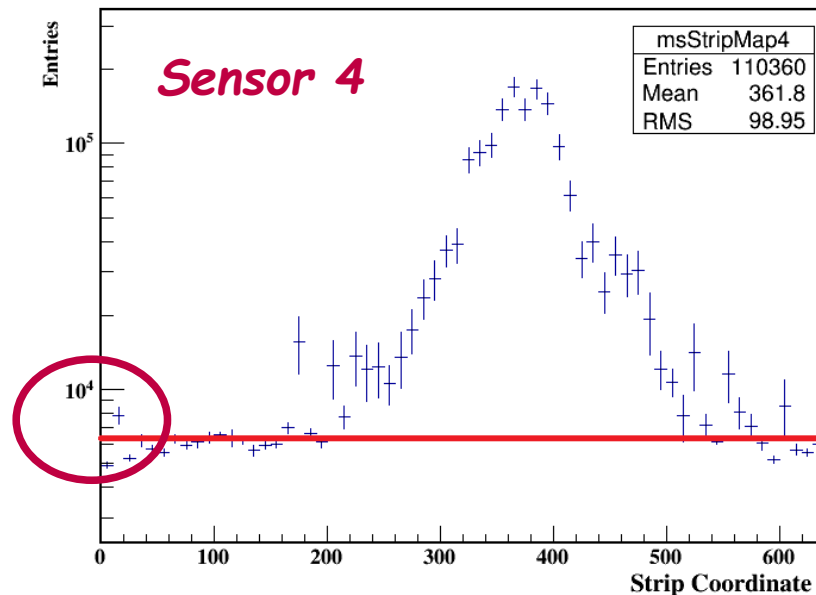
MSD: CNAO 2023 data taking

→ no problem in cluster occupancy (SHOE reconstruction) between the x and y sensors of the second station (Run 6243)

MSD - strip map for sensor 3



MSD - strip map for sensor 4



Most probable explanation could be bad tuning of the Online Monitoring for these plots.

MSD: CNAO 2023 data taking

→ Pedestal and noise (aka strip calibration)

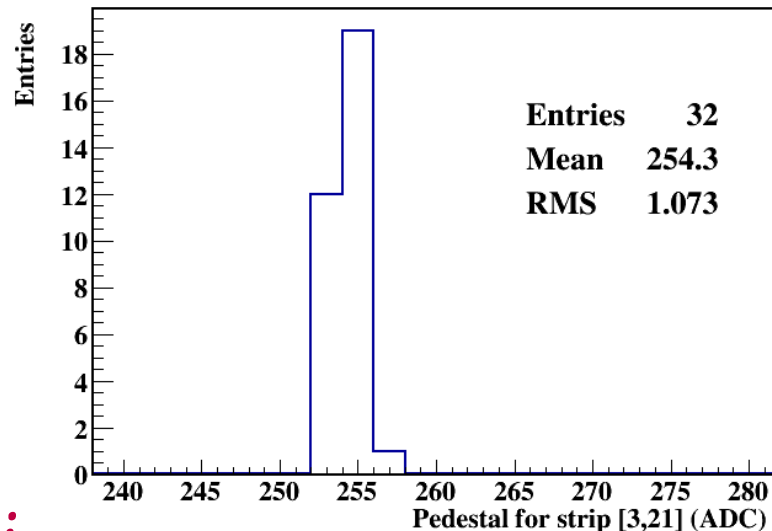
We had 32 calibration runs during the two data taking periods.

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

→ Preliminary study of calibration stability

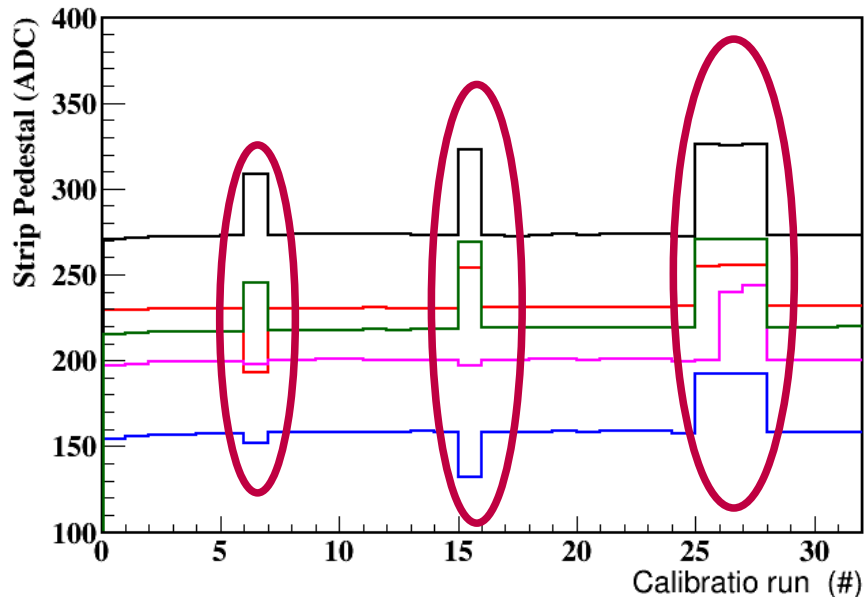
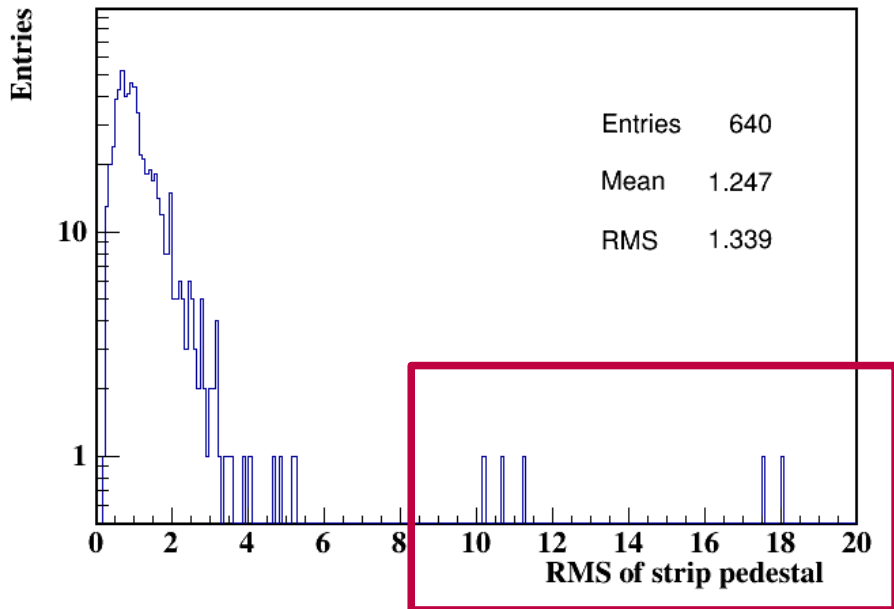
Sensor 1, Strip [3,21]:

pedestal distribution over all calibration runs:



MSD: CNAO 2023 data taking

→ Pedestal and noise (aka strip calibration)



Are they true pedestal fluctuations? Or should we use other sets? **Work in progress**

MSD: CNAO 2023 data taking

→ Pedestal and noise (aka strip calibration)

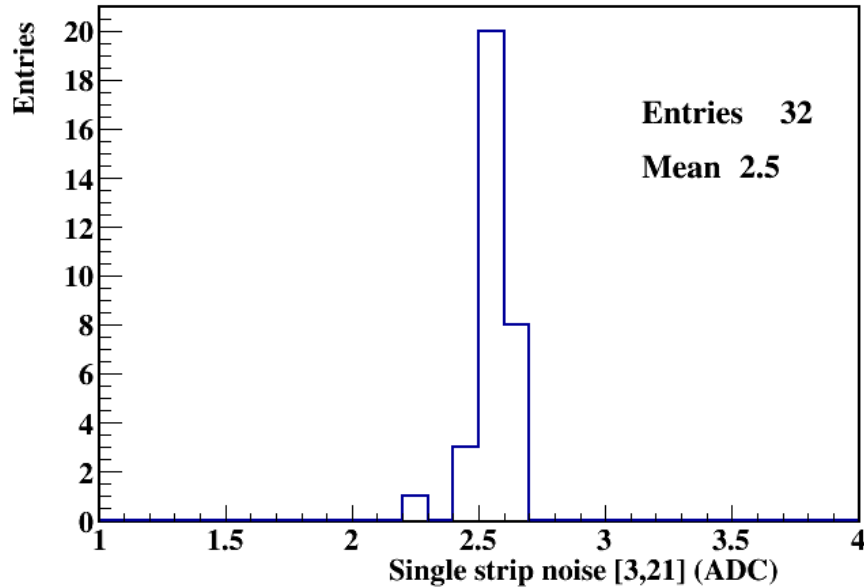
| | | | | | | |
|---------------------|----------|----------|----------|----------|----------|----------|
| <i>Sensor #</i> | <i>1</i> | <i>2</i> | <i>3</i> | <i>4</i> | <i>5</i> | <i>6</i> |
| <i># bad strips</i> | <i>5</i> | <i>2</i> | <i>5</i> | <i>2</i> | <i>3</i> | <i>1</i> |

All bad/suspicious strips that change abruptly the pedestal are typically the first of a chip (not always).

Work in progress to understand better this part and the effect (if any) on signal reconstruction.

MSD: CNAO 2023 data taking

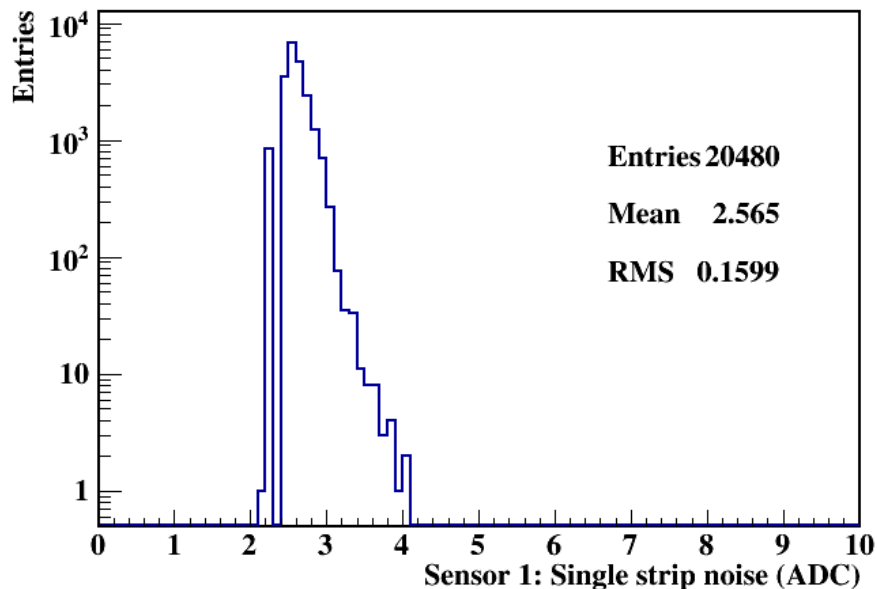
→ Pedestal and **noise** (aka strip calibration)



Single strip noise distribution for strip [3,21] over all calibration runs.

MSD: CNAO 2023 data taking

→ Pedestal and noise (aka strip calibration)

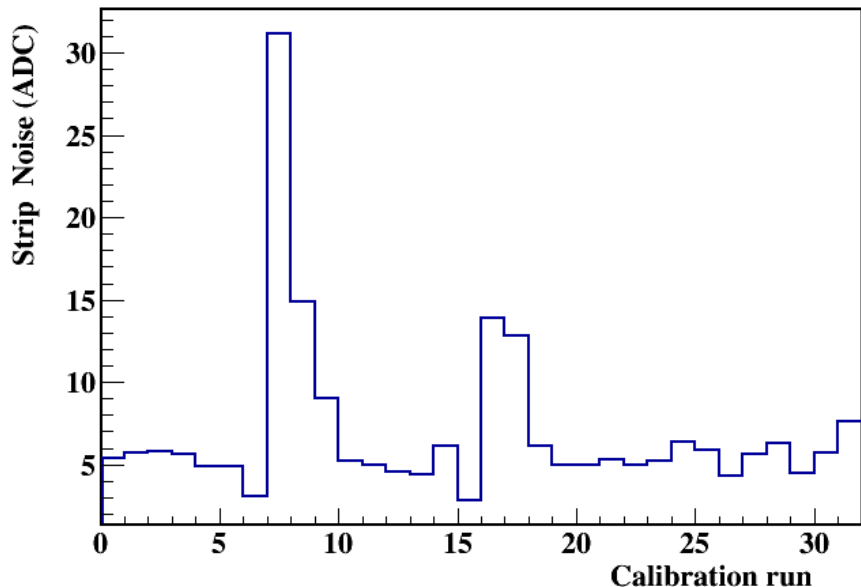


Single strip noise distribution for sensor 1, all strips, all calibration runs.

→ only 14 strips with noise > 3 ADC

MSD: CNAO 2023 data taking

→ Pedestal and **noise** (aka strip calibration)



Sensor 3, strip [0,12]: Strip noise for all calibration runs.

Most probable noise around 5 ADC. Some spikes.

Under investigation to understand instabilities.

MSD: CNAO 2023 data taking

→ Pedestal and noise (aka strip calibration)

Strips with possible problems/bad: *strip noise > 4.0 ADC*

| <i>Sensor #</i> | <i>1 (1x)</i> | <i>2 (1y)</i> | <i>3 (2x)</i> | <i>4 (2y)</i> | <i>5 (3x)</i> | <i>6 (3y)</i> |
|------------------------------------|---------------|---------------|---------------|---------------|---------------|---------------|
| <i>Average single strips noise</i> | <i>2.6</i> | <i>2.2</i> | <i>2.1</i> | <i>2.2</i> | <i>2.1</i> | <i>2.6</i> |
| <i># bad strips</i> | <i>0</i> | <i>2</i> | <i>1</i> | <i>6</i> | <i>3</i> | <i>1</i> |

MSD: future data taking

- define a mechanical setup system like the IT.
We have found a mechanical engineer support in Perugia for this work (Cristiano Turrioni, CMS).
Start beginning of next year. (C. Turrioni, G. Silvestre)
- help to understand MSD Online Monitoring plots
- define a set of specific MSD tools to investigate quickly abnormal behaviour during data taking.

MSD: next analysis steps

- eta function correction implementation. Gianluigi defined the corrections to be implemented that were implemented by Riccardo Zini (BO master thesis) on a separate branch. Should be merged in the main branch.
- Start beginning of next year (SHOE expert).

MSD: next analysis steps

→ proton detection efficiency (B. Di Ruzza, L. Servoli)

In progress.

Data from 2021 MSD dedicated data taking at Trento proton accelerator. (228, 157, 70 MeV)

→ three x-y planes.

→ autoalignment of the x and y sensors (SHOE clusters).

→ use of **SHOE gold clusters** coordinates (separate x and y view) for planes 1 and 3 to draw a track and then look at possible clusters in 2nd plane (**from raw data**)

MSD: next analysis steps

→ noisy strip study and tagging (L. Salvi, G. Silvestre)

In progress.

Data from 2021 GSI ^{16}O data taking.

Study a better algorithm to identify problematic strips, tag them and study the effect of their removal on cluster reconstruction on several data taking campaign.