

# SiPM thresholds study

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Due to the issues we are encountering so far, I and Giacomo started looking at the **20 GeV electron** runs impacting on different SiPM modules (from run number 906 to run 913).

The aim is to try to **extrapolate the thresholds** set at the test beam for each SiPM FERS, i.e. the ADC value and then the calibrated value under which we do not see a signal.

M8	Fers 15	Fers 16
M7	Fers 13	Fers 14
M6	Fers 11	Fers 12
M5	Fers 9	Fers 10
M4	Fers 7	Fers 8
M3	Fers 5	Fers 6
M2	Fers 3	Fers 4
M1	Fers 1	Fers 2

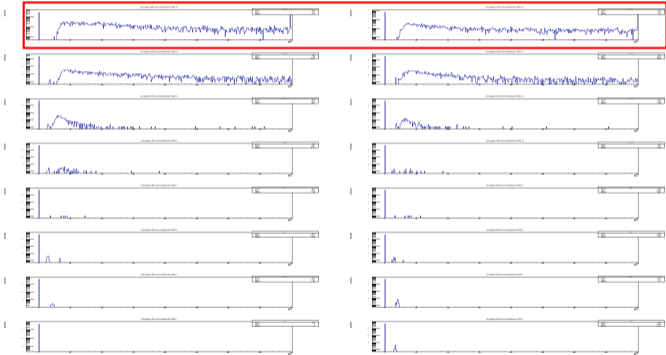
# Threshold extrapolation method

**Process:** the method is simple; given a run, for each event and FERS:

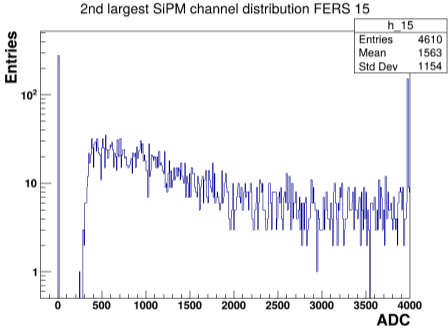
- Take the HG ADC values and store them in a vector: Values[312, 244, 152, 273, ...] (64 total values: one for each FERS channel).
- Organise the vector in descending order: Values[312, 273, 244, 152, ...].
- Take the 2<sub>nd</sub> largest value (**273**) → Majority = 2 trigger logic.
- Plot it.

In this way, we expect to have a high peak on the left and a distribution (our signal) on the right; the x-coordinate point where the distribution begins to rise is the **threshold**.

# Some examples:

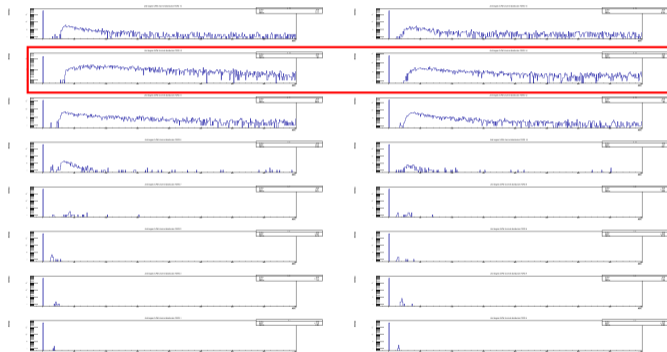


All FERS distributions when shooting in the red square.

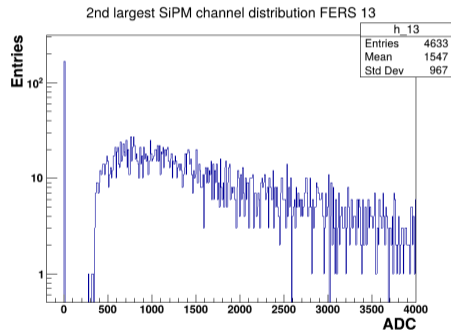


FERS 15 distribution.

# Some examples:

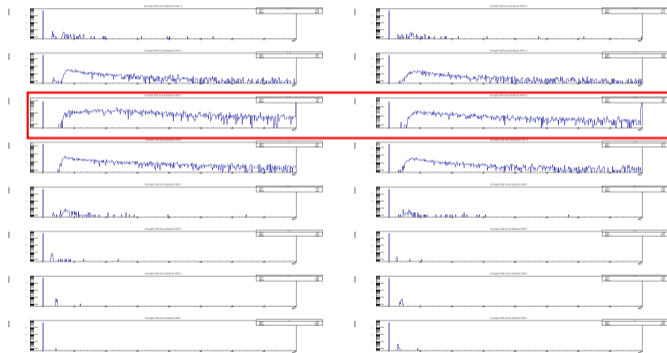


All FERS distributions when shooting in the red square.

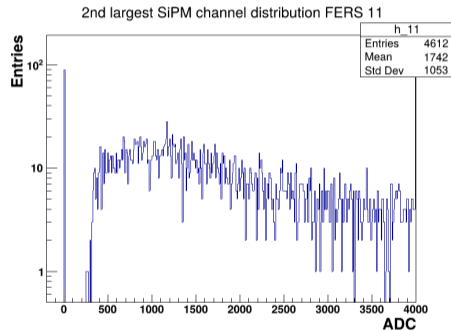


FERS 13 distribution.

# Some examples:

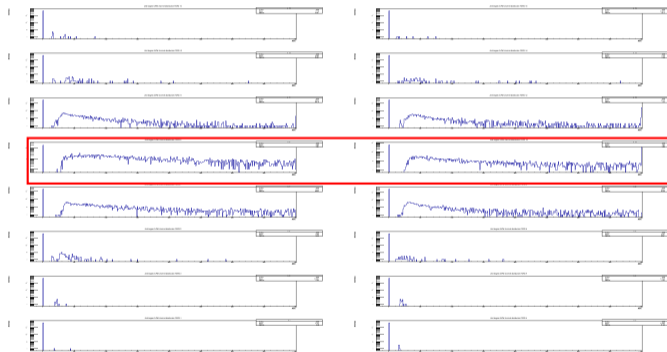


All FERS distributions when shooting in the red square.

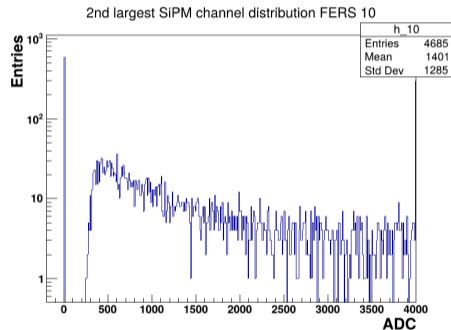


FERS 11 distribution.

# Some examples:

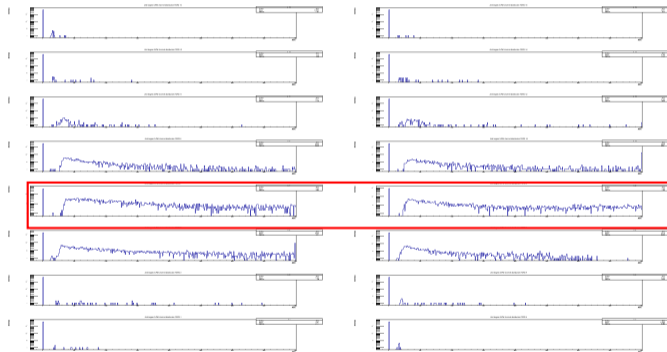


All FERS distributions when shooting in the red square.

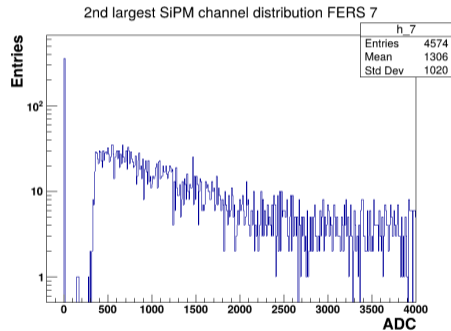


FERS 10 distribution.

# Some examples:

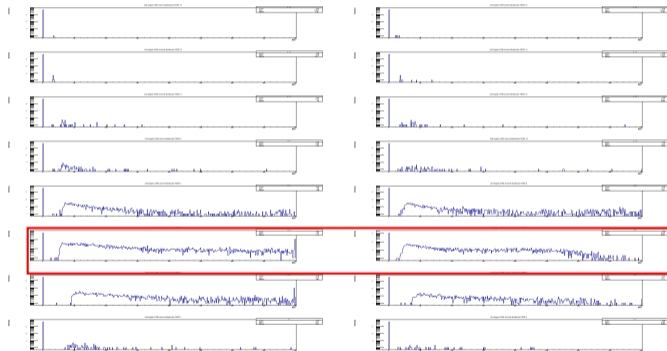


All FERS distributions when shooting in the red square.

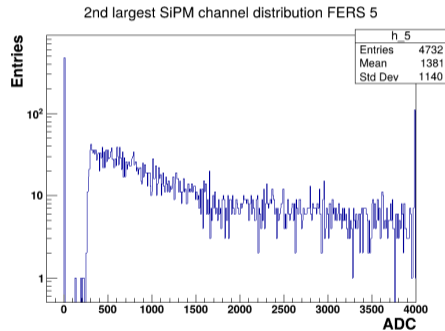


FERS 7 distribution.

# Some examples:

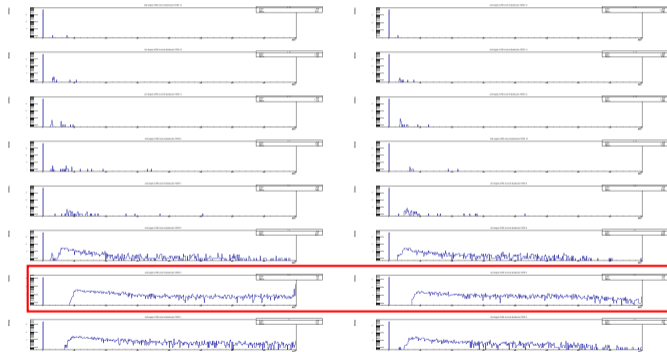


All FERS distributions when shooting in the red square.

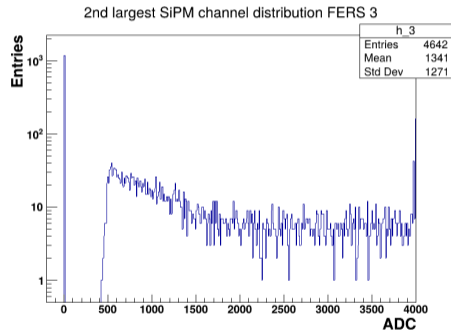


FERS 5 distribution.

# Some examples:

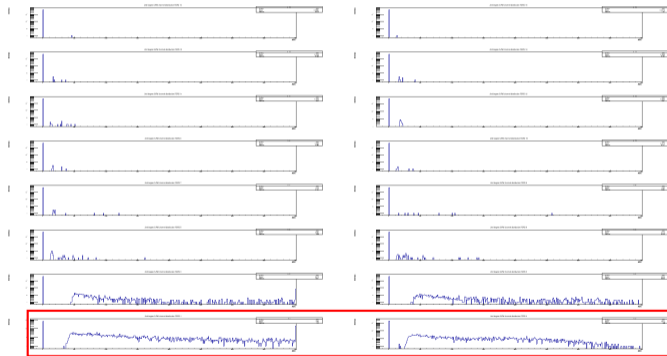


All FERS distributions when shooting in the red square.

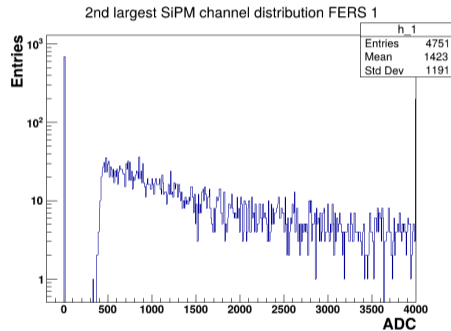


FERS 3 distribution.

# Some examples:



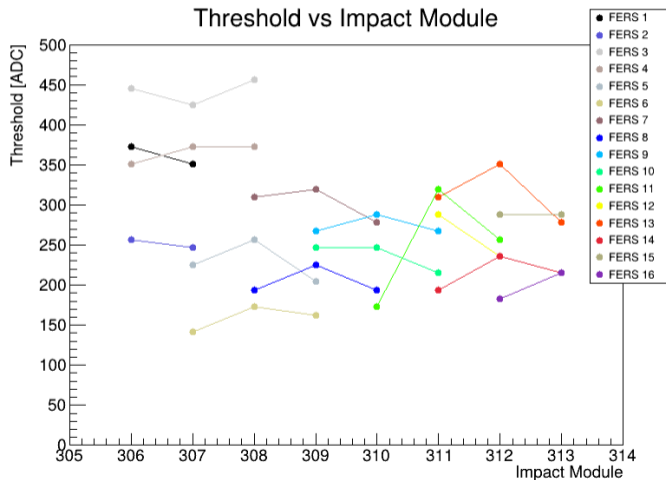
All FERS distributions when shooting in the red square.



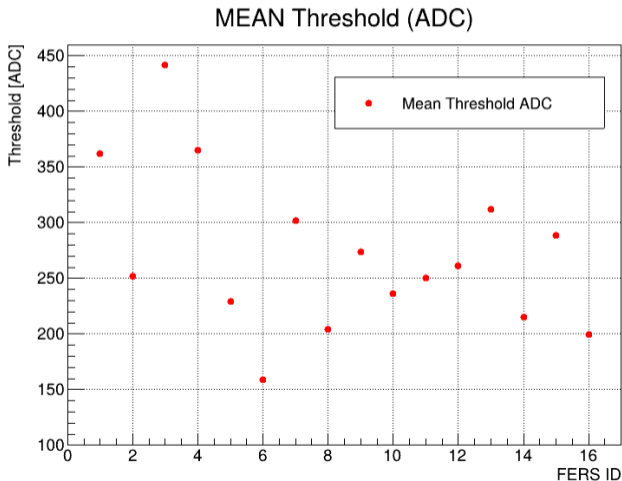
FERS 1 distribution.

# ADC threshold plot

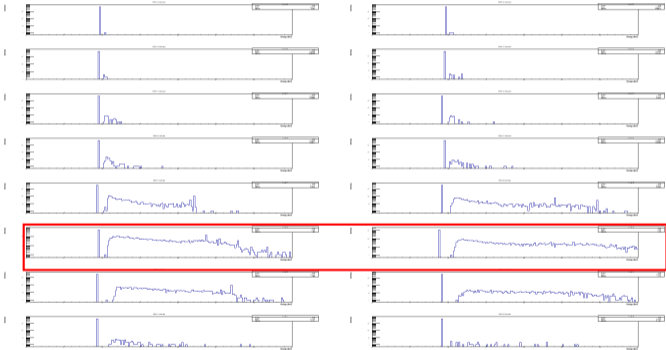
For most of the modules, thresholds are almost stable; for others, there are some variations.



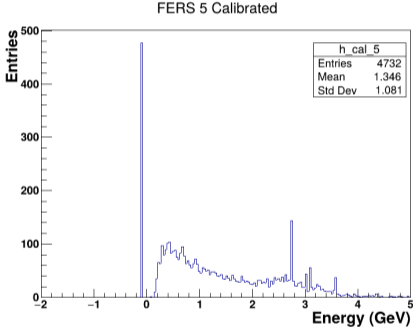
For each module calculate the mean value.



# Same exercise with calibrated values



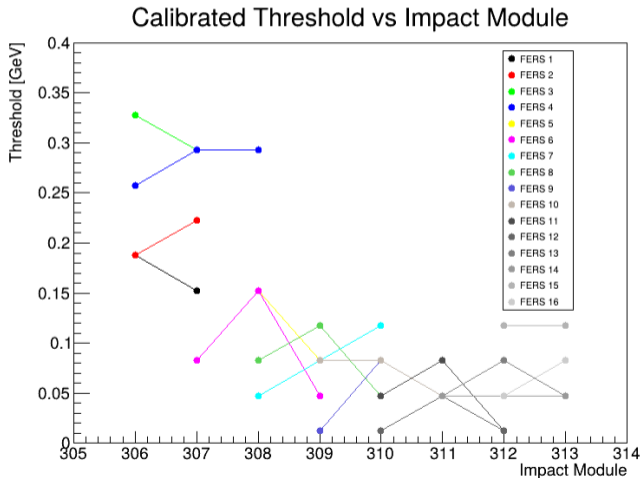
All FERS calibrated distributions when shooting in the red square.



FERS 5 calibrated distribution.

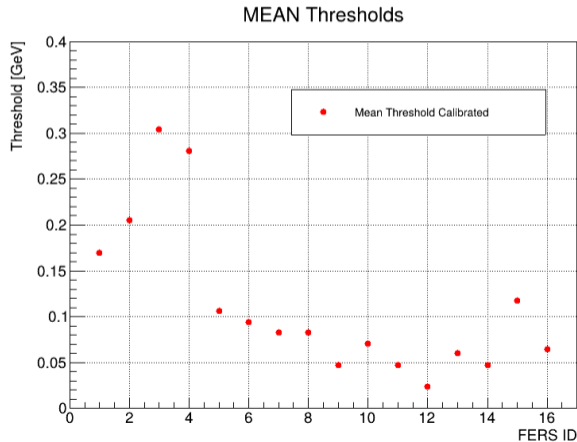
# Calibrated (GeV) threshold plot

The calibrated value is obtained taking the  $2_{nd}$  largest ADC value:  $CAL = (ADC_{2_{nd}} - PED) \cdot K$ .



# Calibrated (GeV) threshold mean plot

The first FERS have mostly a higher threshold; sometimes thresholds are quite big.



## Highlights:

- Threshold in ADC counts applied to FERS for triggering the readout measured to be between 150 and 450 ADC counts.
- Value in ADC counts of channel triggering the readout is converted to GeV using calibration tables; thresholds up to 300 MeV observed for two bottom modules, varying between 50 and 100 MeV for other modules.
- A simulation study where we insert these thresholds to see if they can account for features observed in testbeam data is needed.