UNIVERSITY OF LIVERPOOL

LEVERHULME TRUST

2 years in Muone

Flash talk session

Clément Devanne

In the beginning, there was nothing...

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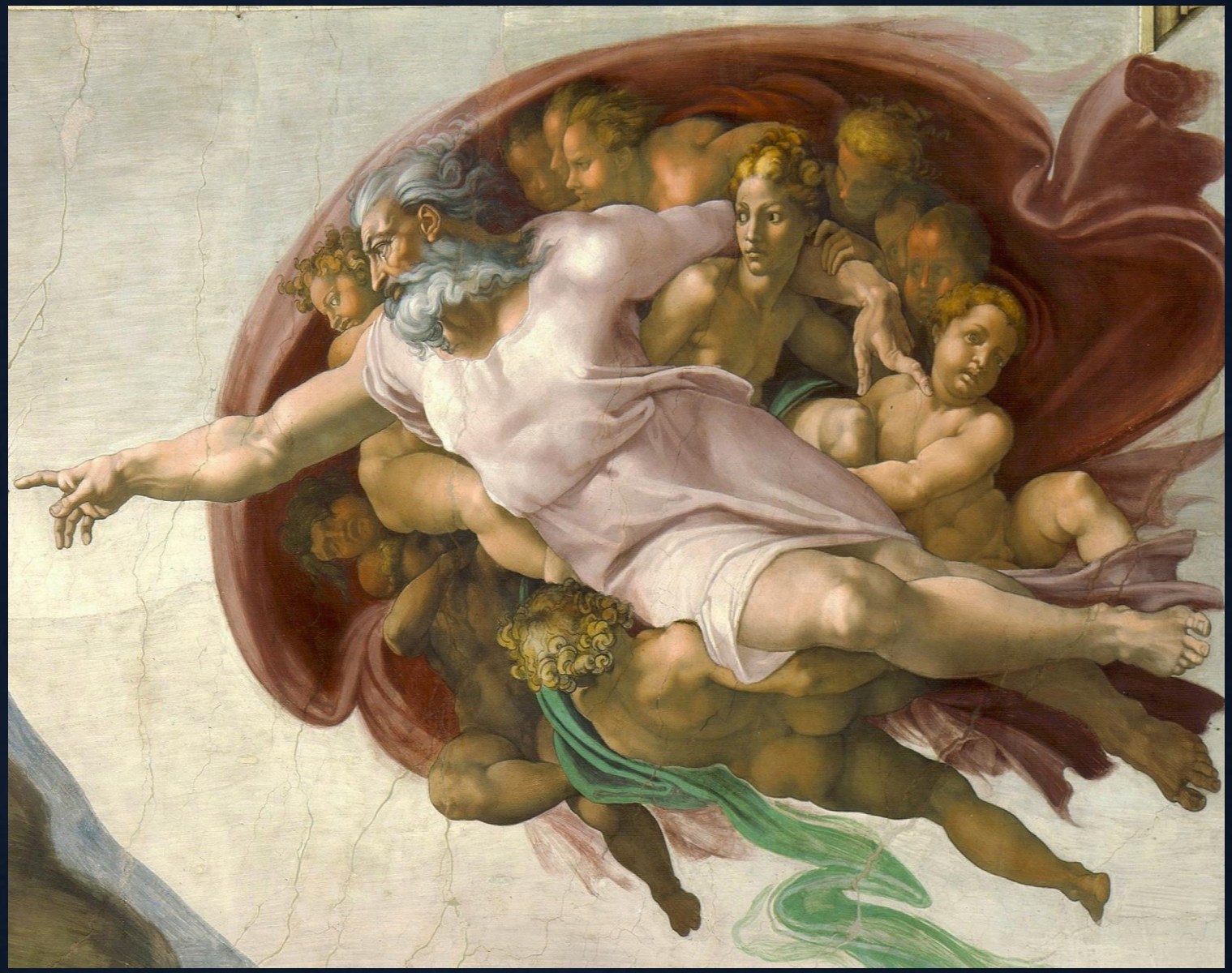
...But God



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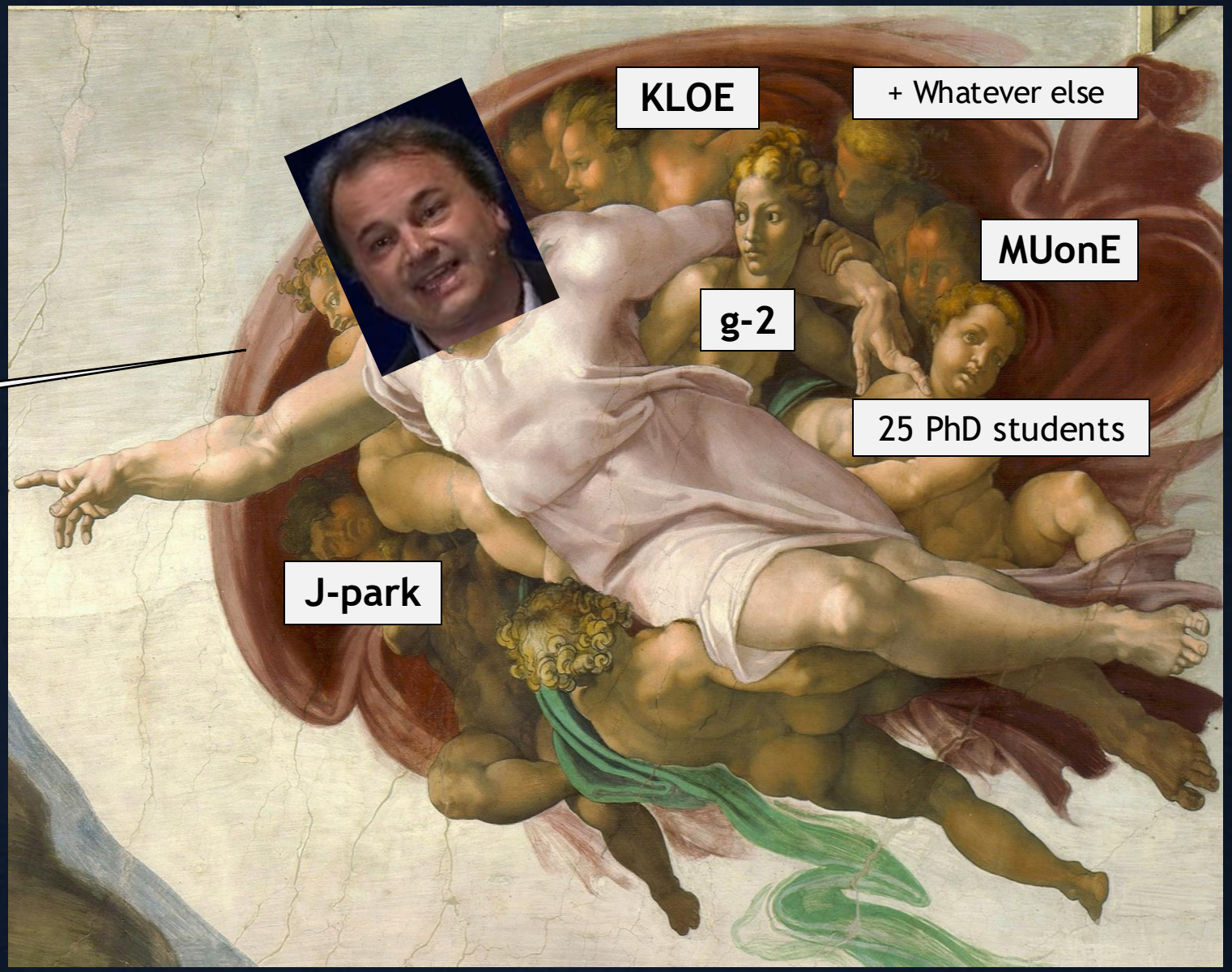

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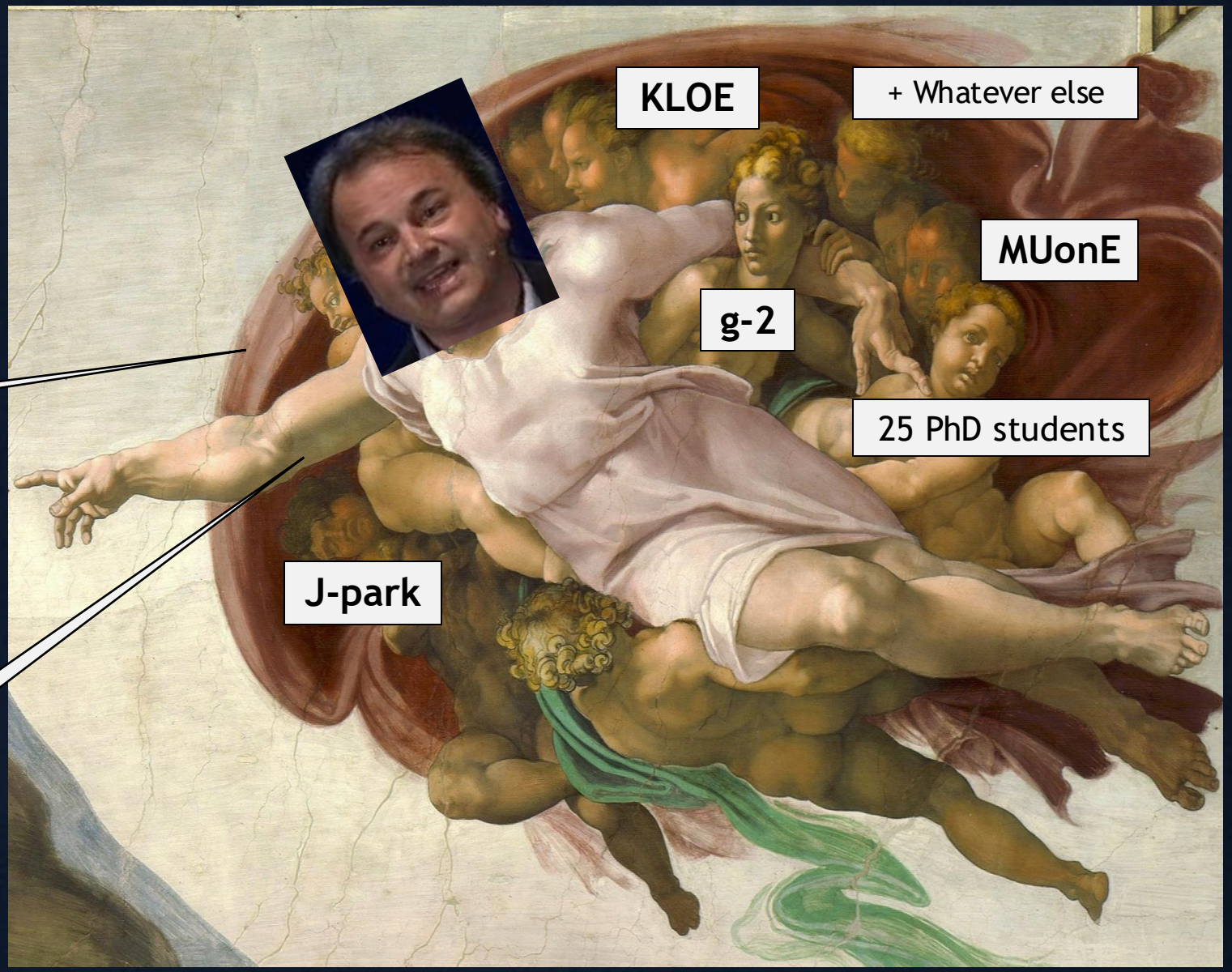

I got you a PhD

But I am like super busy bro

I leave you in the care...
... of my ***spiritual son***

So, I went to meet the spiritual son...

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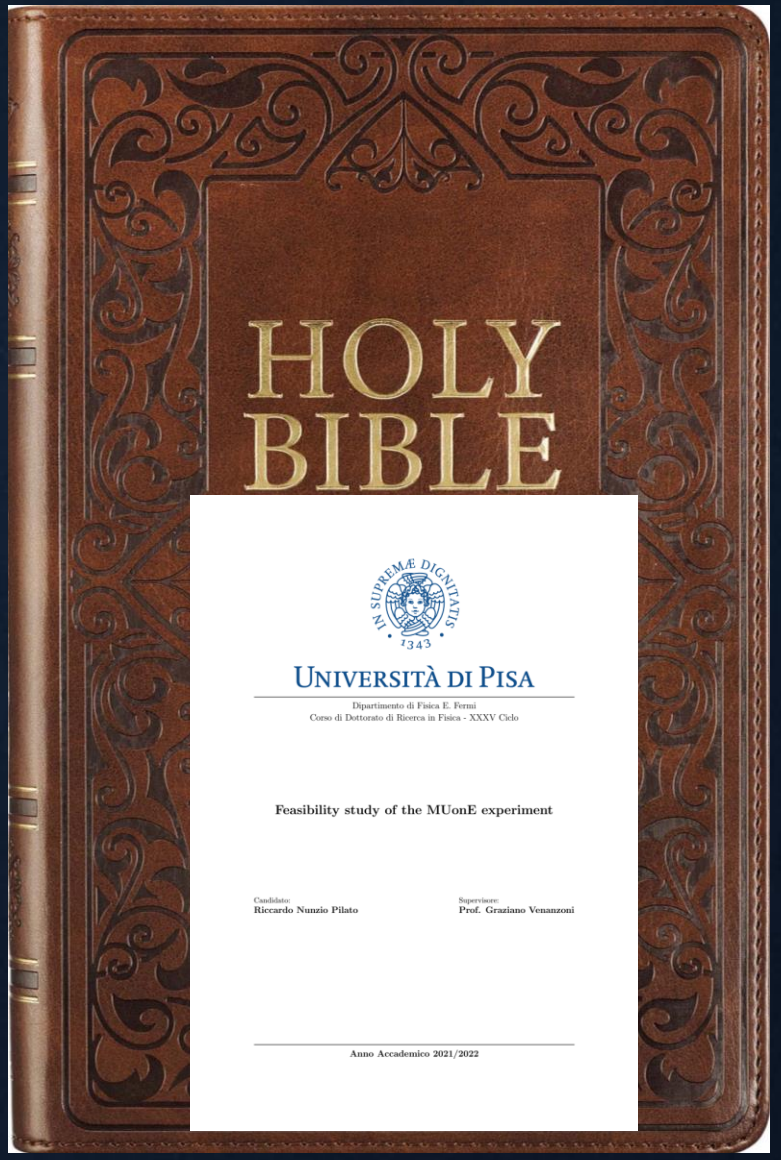
Hey, welcome to MUonE!

Read my Thesis

So, I went to meet the spiritual son...



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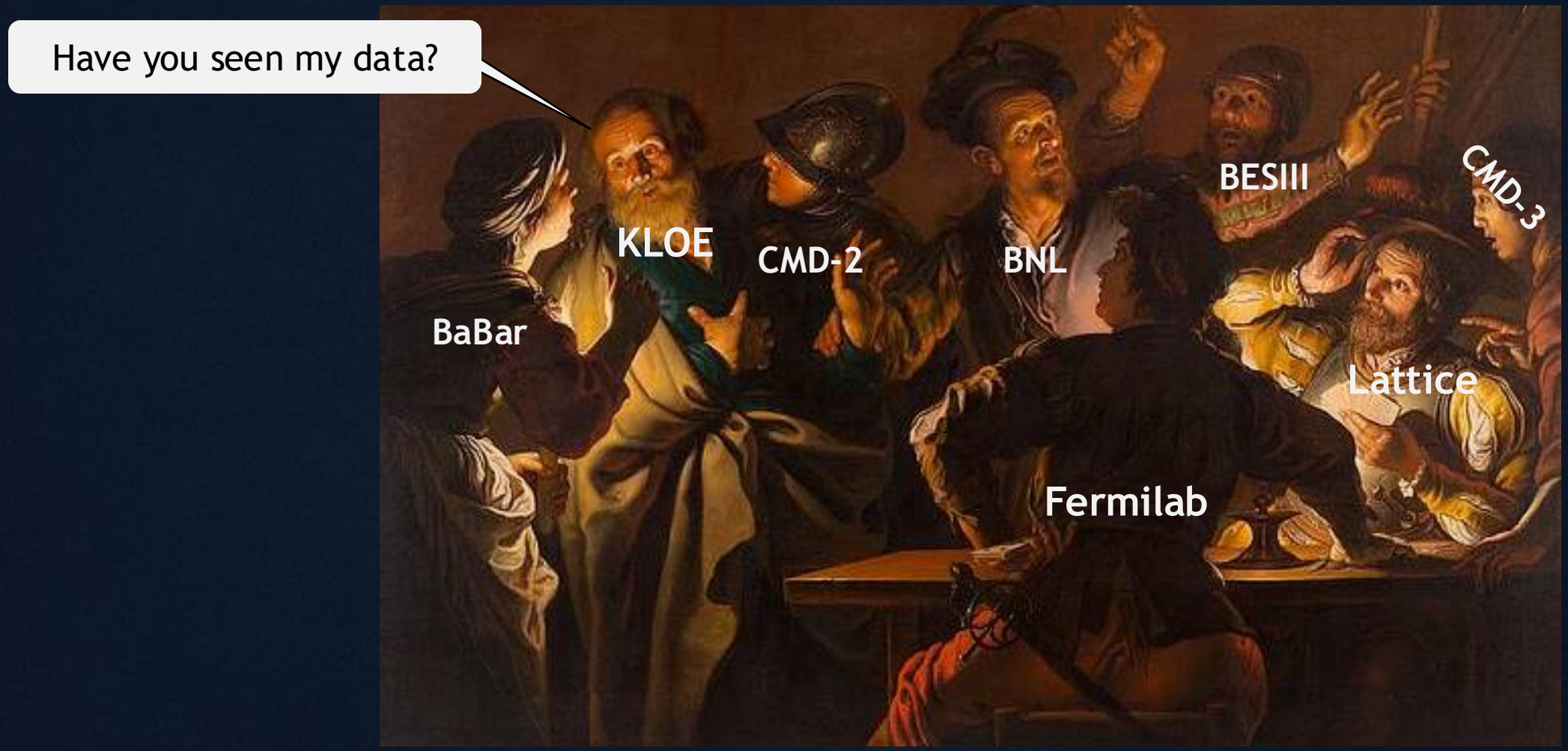
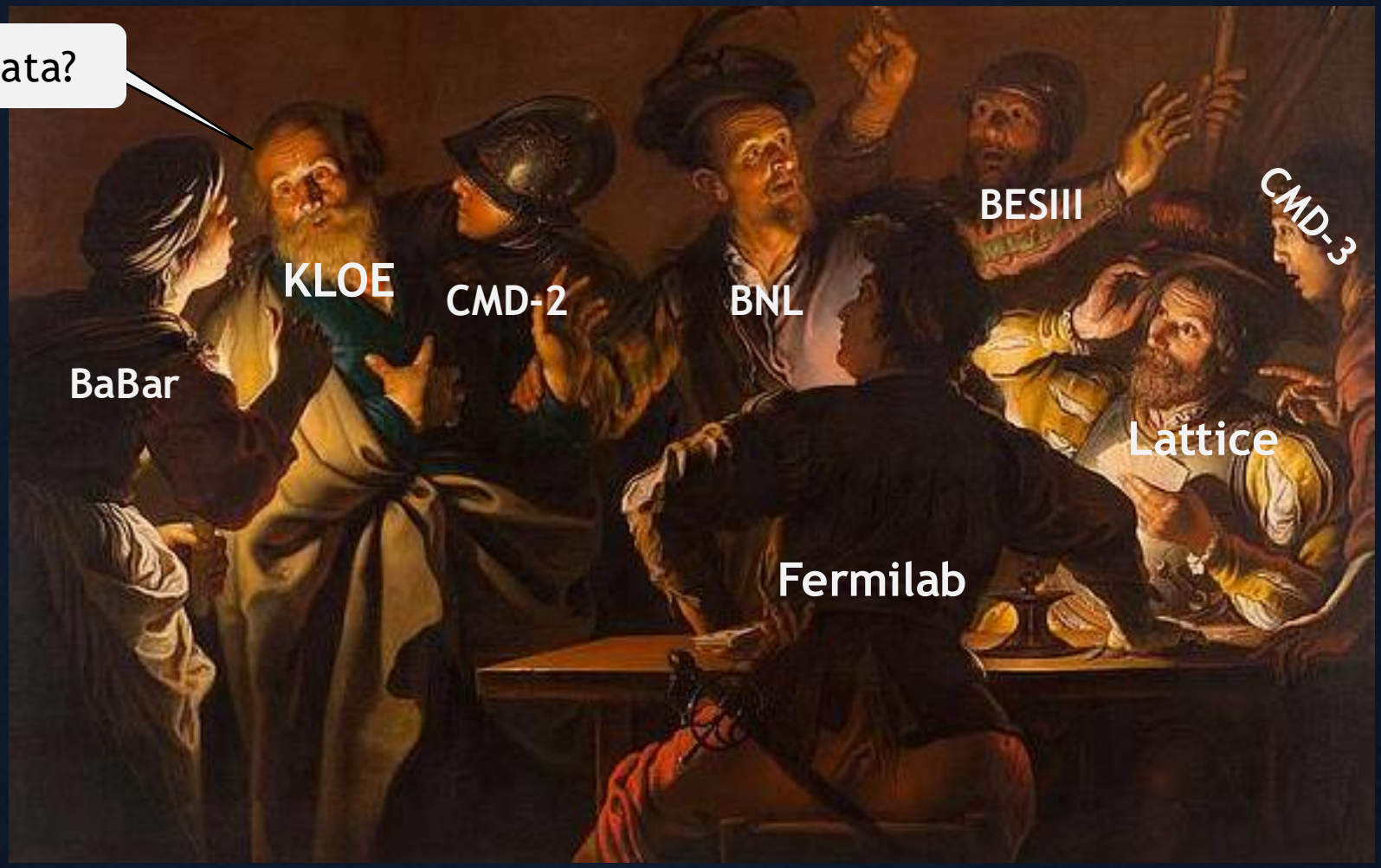


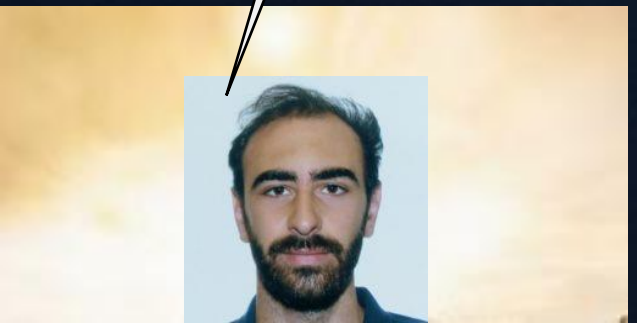
So, I spent time to understand the experiment, and the situation…

Have you seen my data?



See how confuse they are.

They need us!



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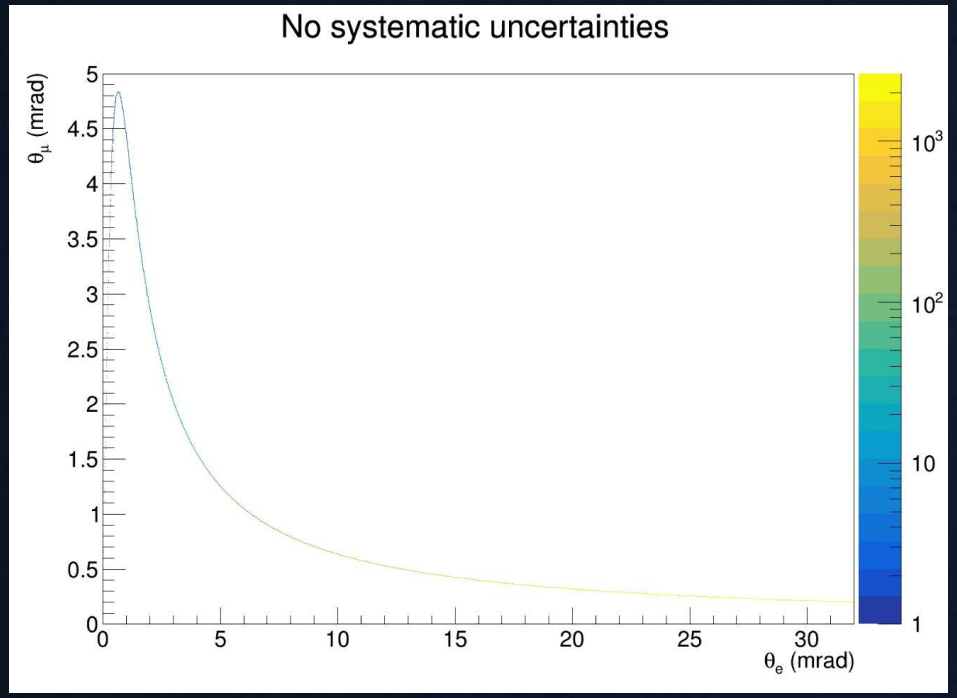
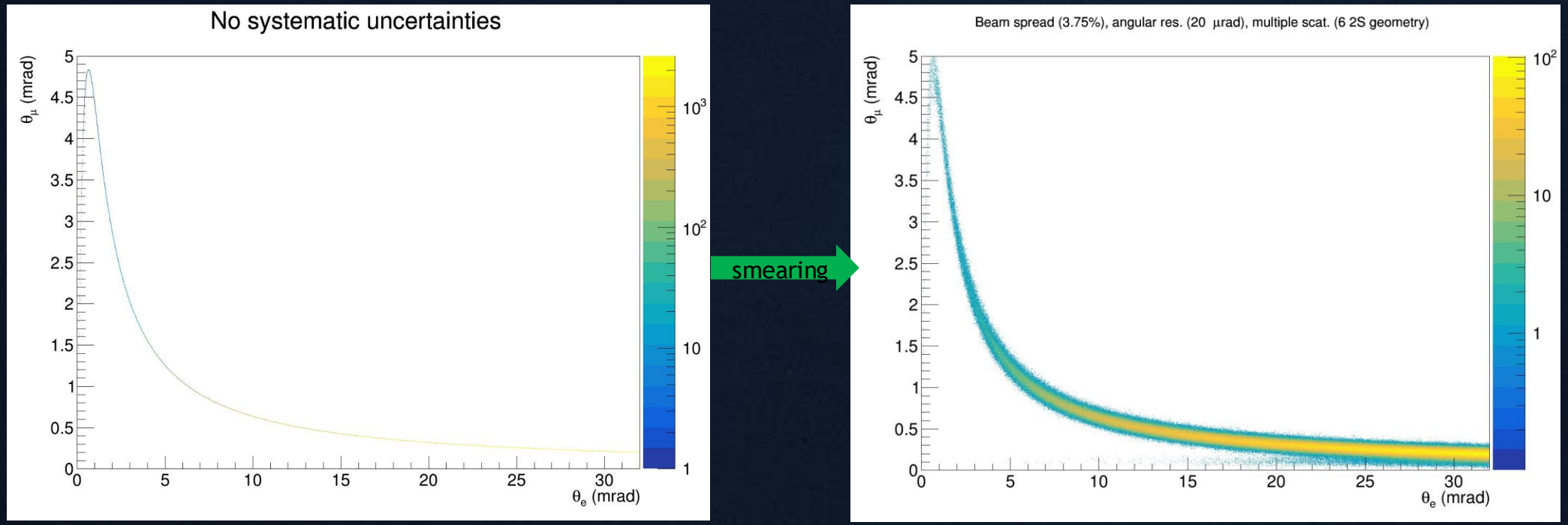
- Generate elastic event (*mesmer*)



Firsts contributions: Study of the systematics using fast simulation…

- Generate elastic event (*mesmer*)
- Smear the scattered angles to estimate effects from: (no step-by-step simulation)
  - Angular resolution
  - Beam energy spread
  - Multiple scattering



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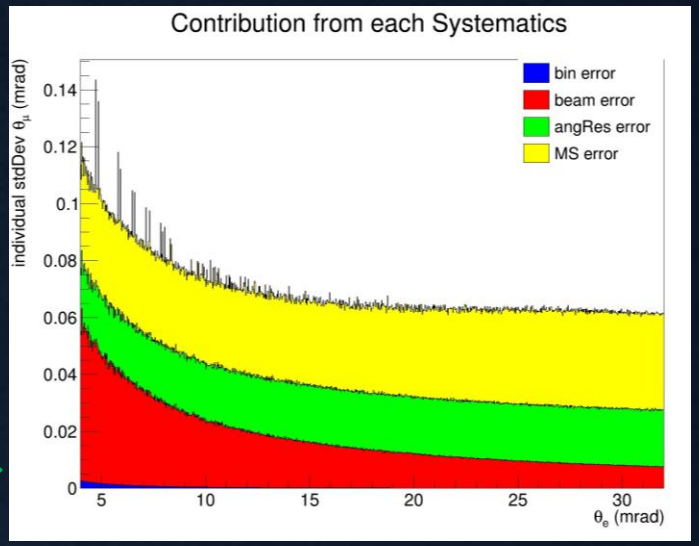
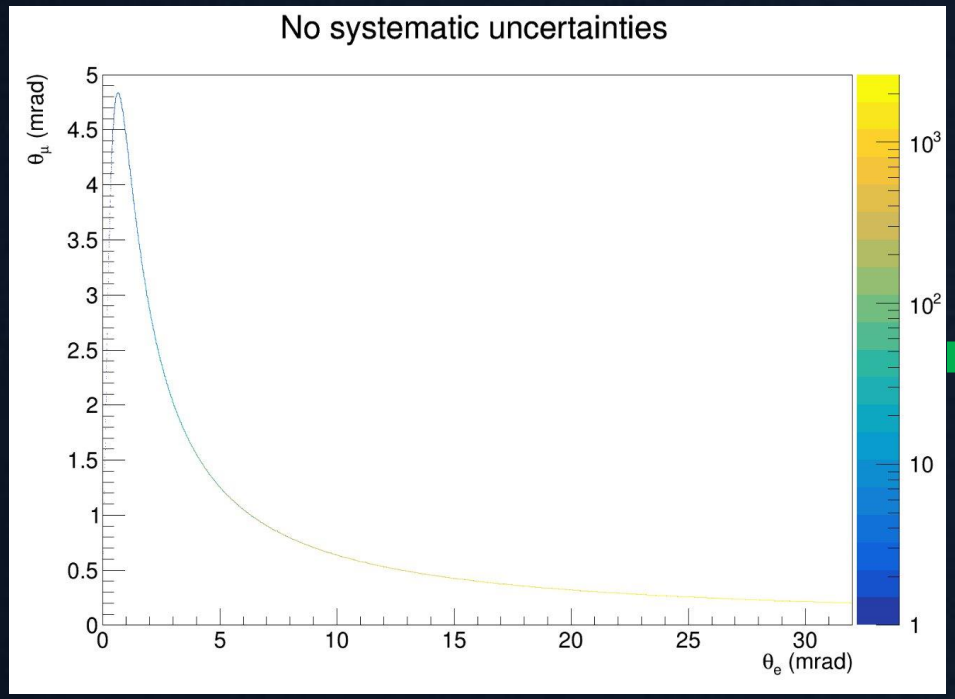
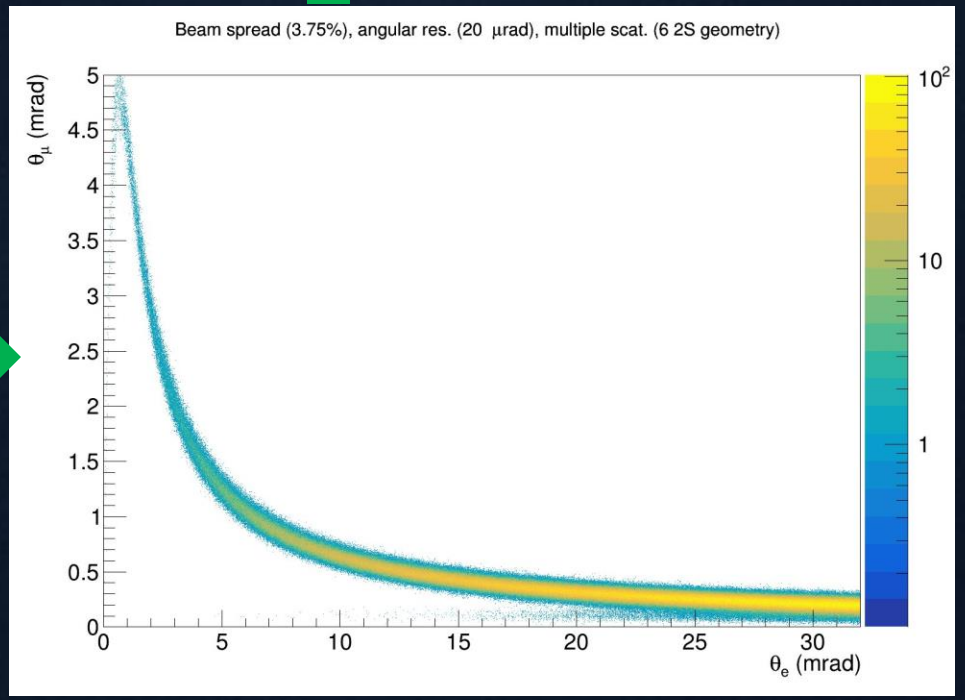




smearing



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- Use twice the same generated sample of elastic events
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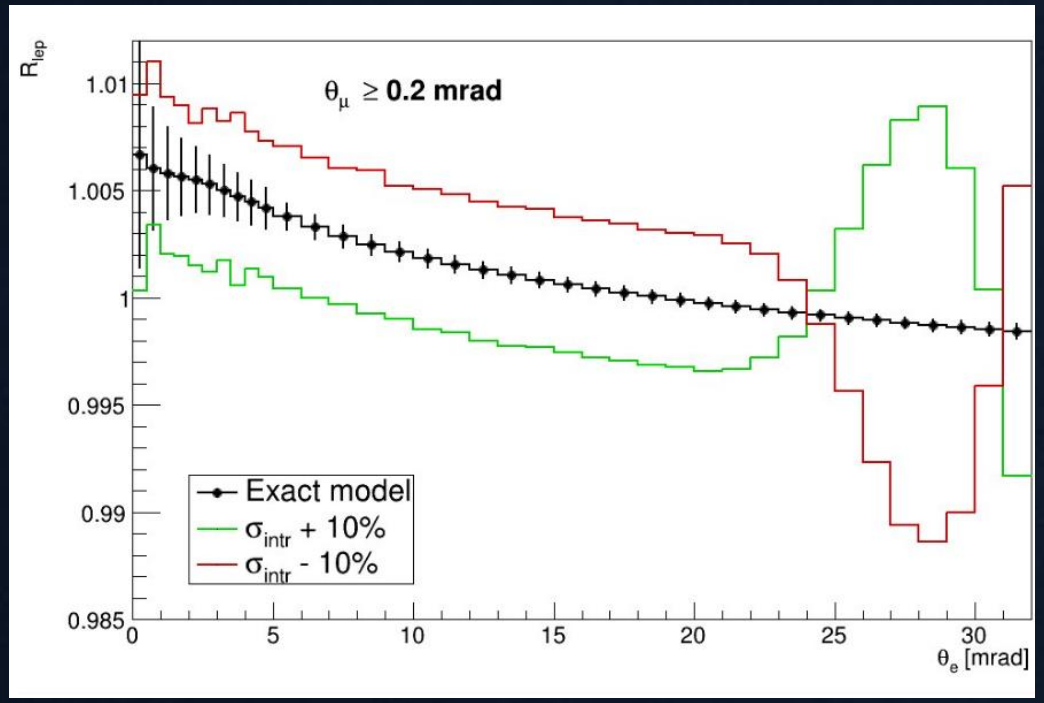
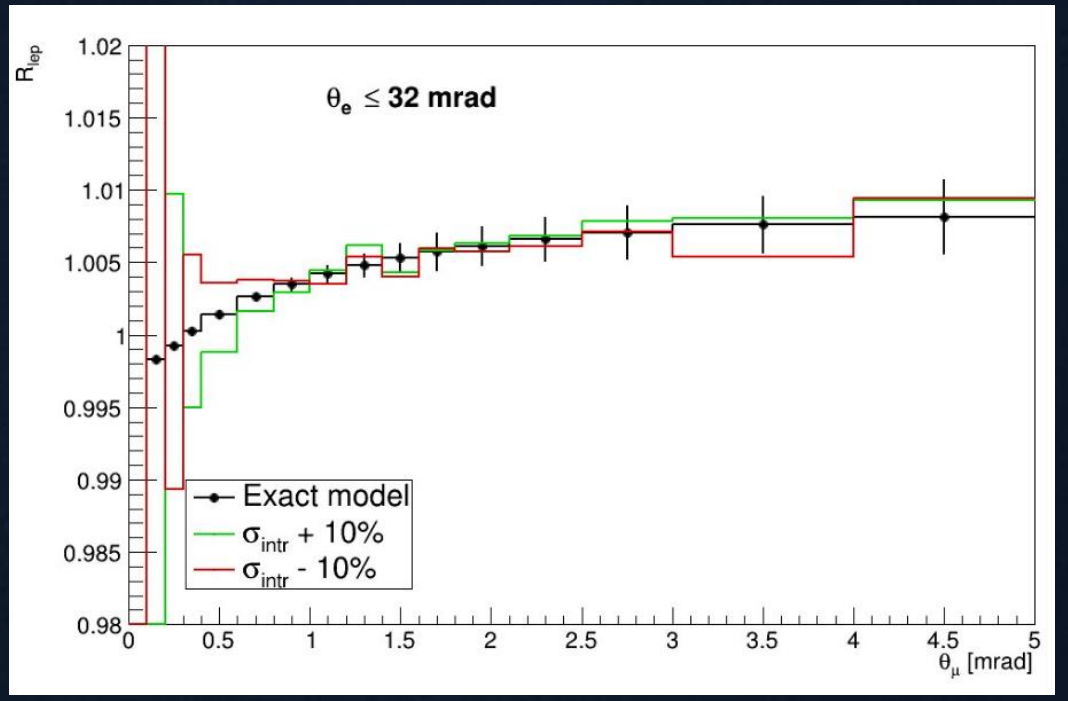
  - See effect on Data/MC ratio if we are wrong in our systematics





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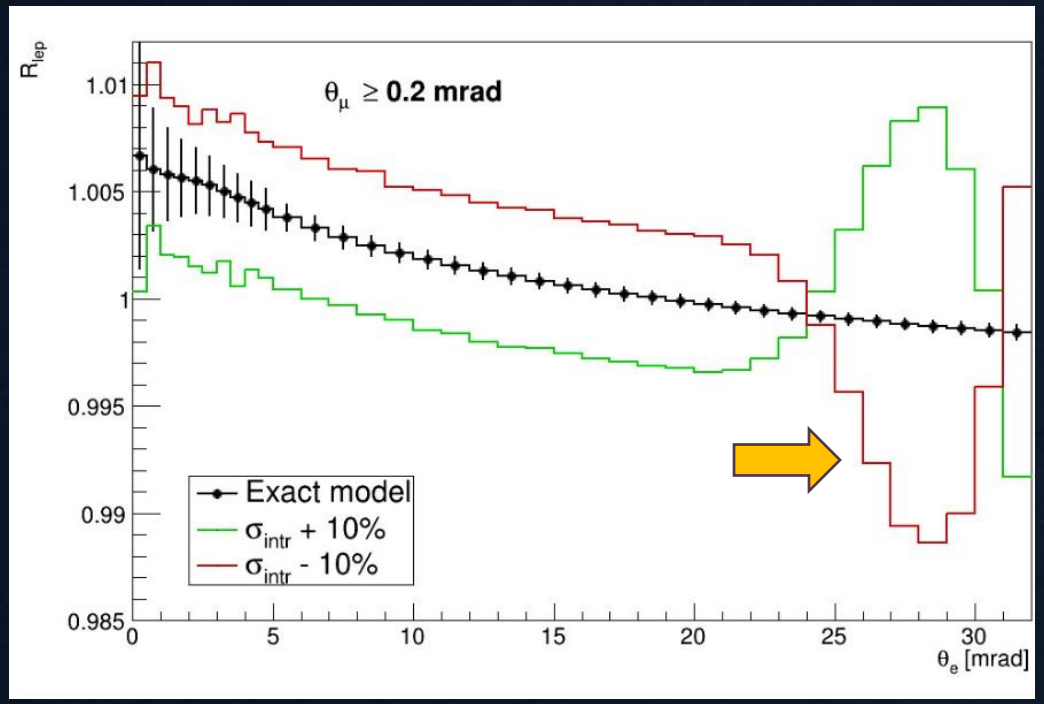

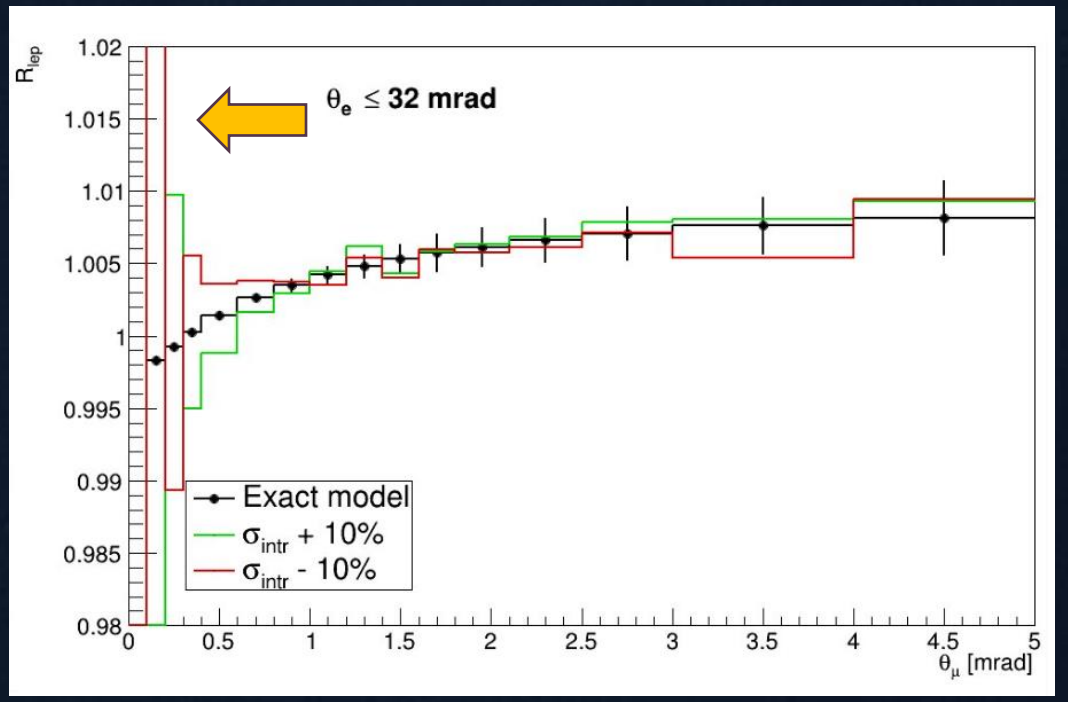

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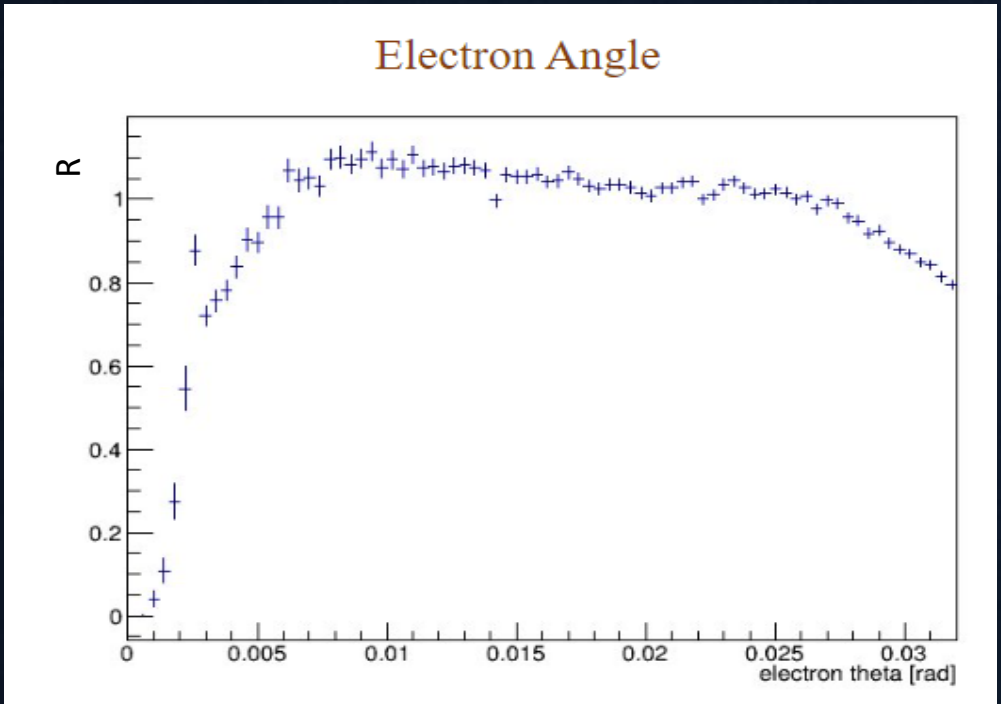
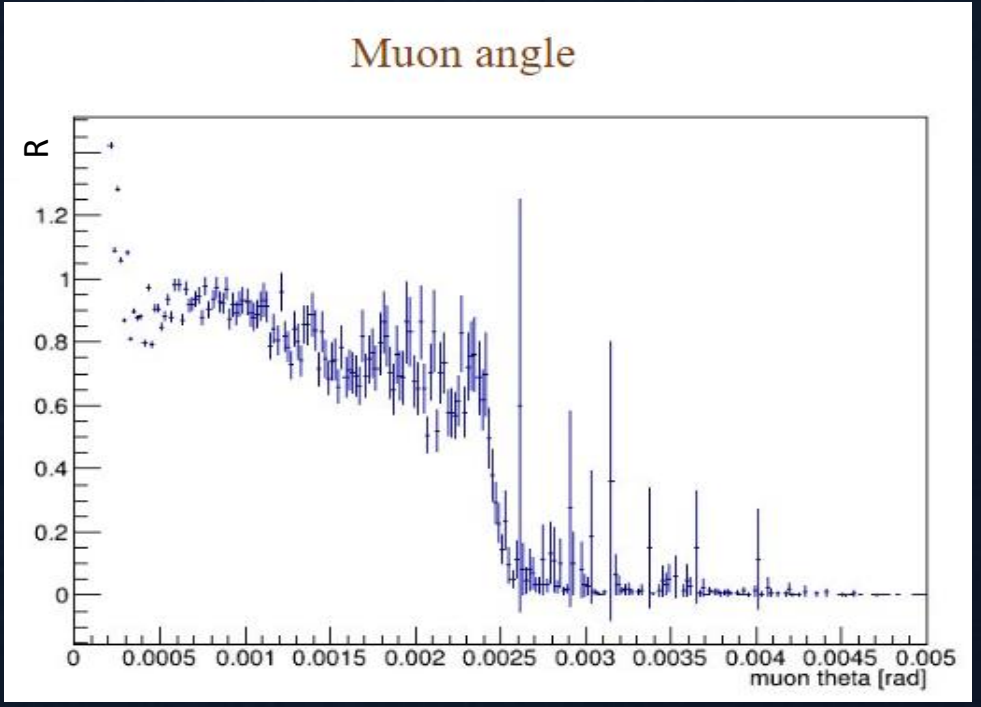
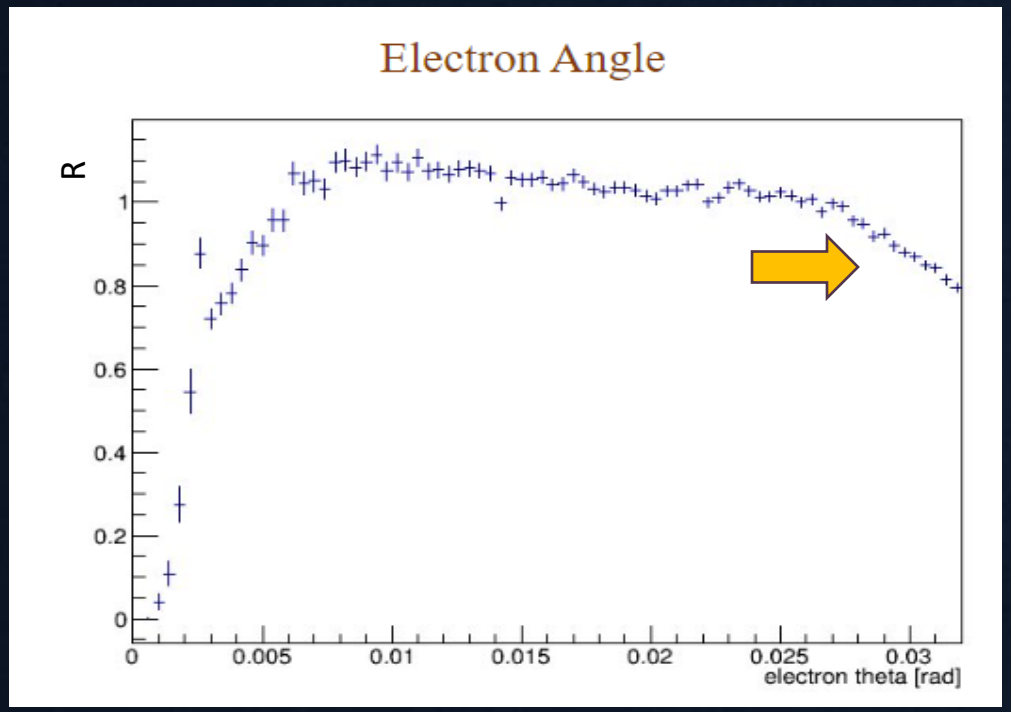
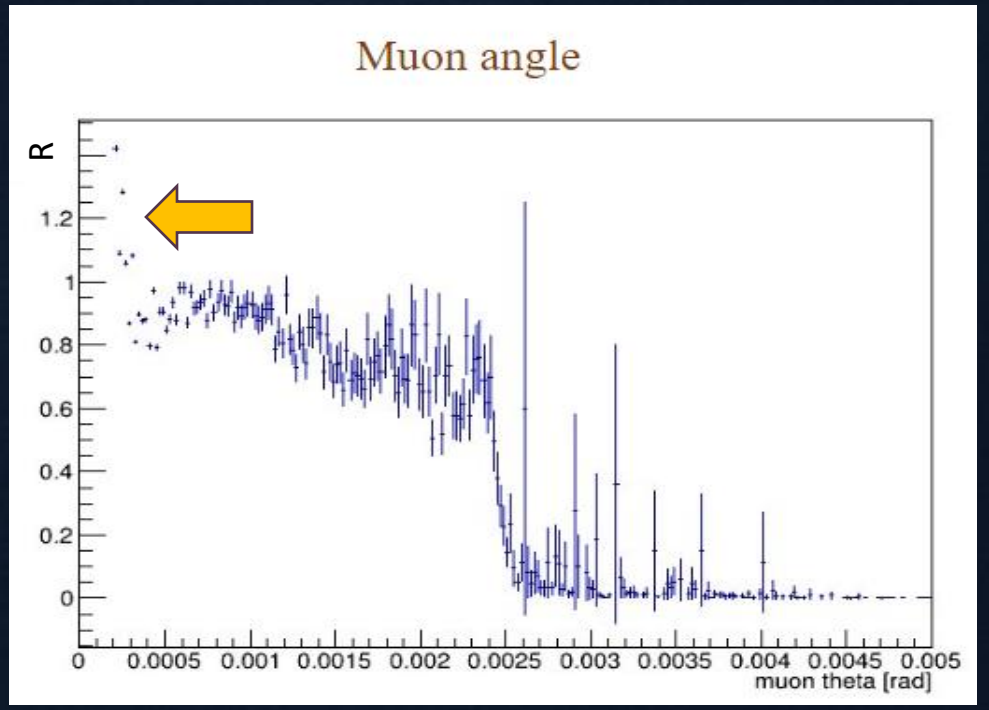




Data/MC comparison

- The data/MC ratio was terrible, because the simulation was/is to improve
- But we can still see some effect similar to the previous study





Data/MC : N-1 analysis

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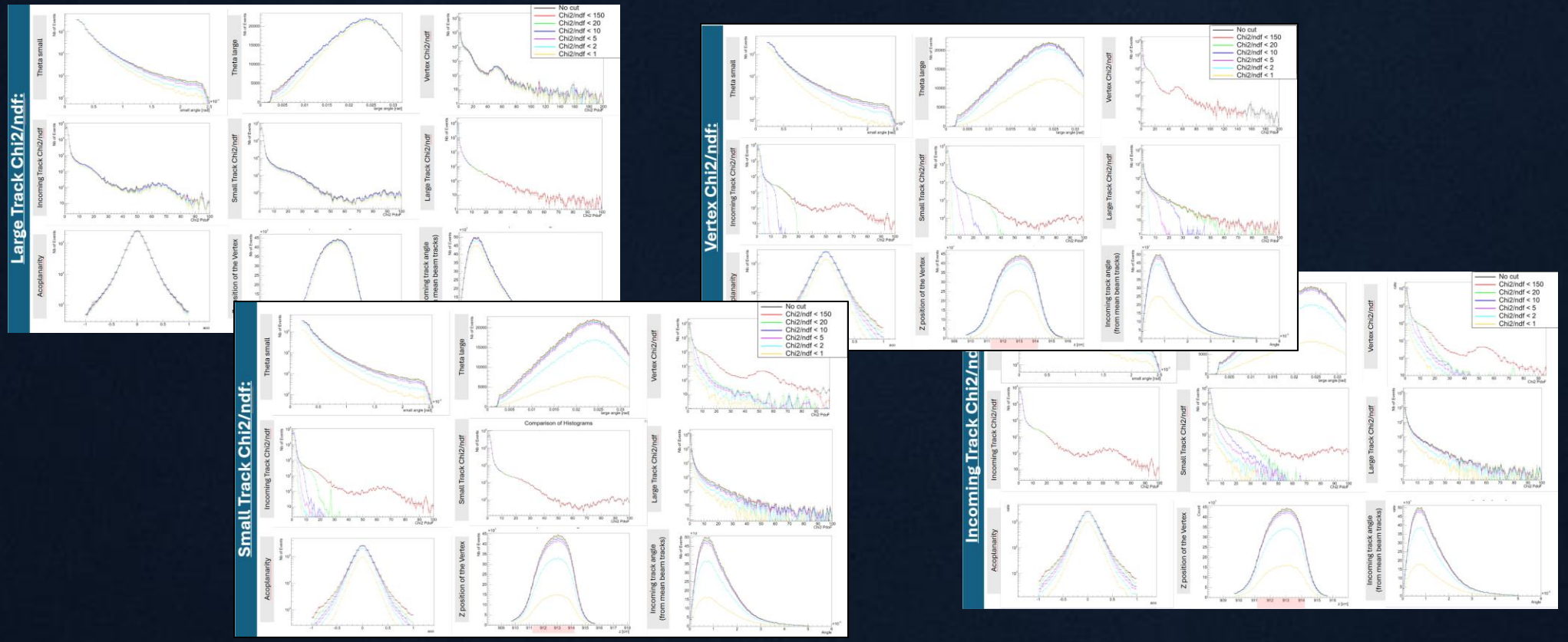
- Because Data/MC was terrible, people were going mad, and I had to produce tons of plots doing a N-1 analysis to find best settings and parameters to have pretty plots
- … but the problem being the simulation it was useless… and annoying



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Review the FairMUonE code for the reconstruction

Ask Fedor to check the maths

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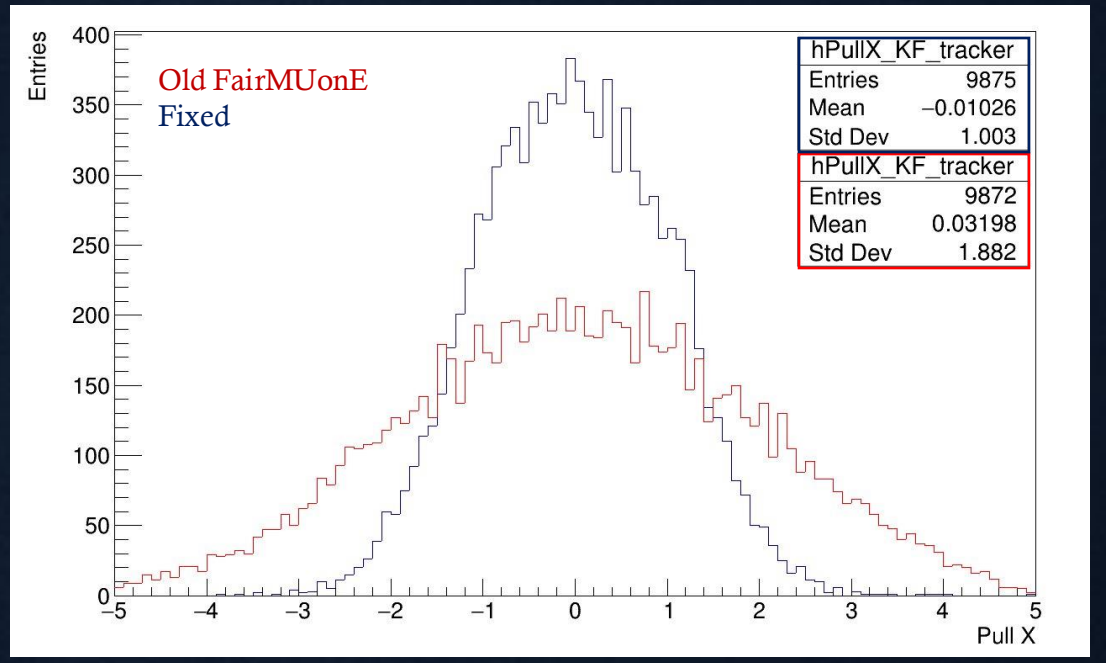

For the Pull we should have:

- Mean = 0
- Std dev = 1

$$\mathrm{Pull}(X_{\mathrm{KF}}) = \frac{X_{\mathrm{MC}} - X_{\mathrm{KF}}}{\sigma(X_{\mathrm{KF}})}$$

Efficiency - simulation

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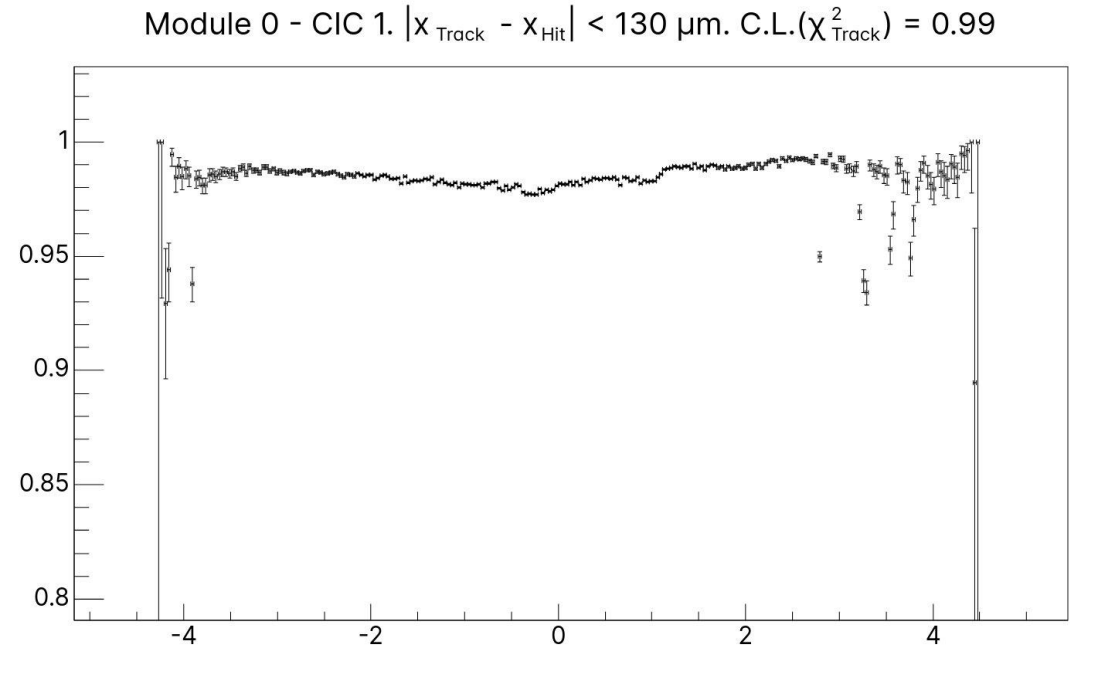
- Hit Efficiency of modules in simulation are close to 100%
  (track reco efficiency ~100%)

- For real data it is 98~99% and not homogenous
  (track reco efficiency ~90%)



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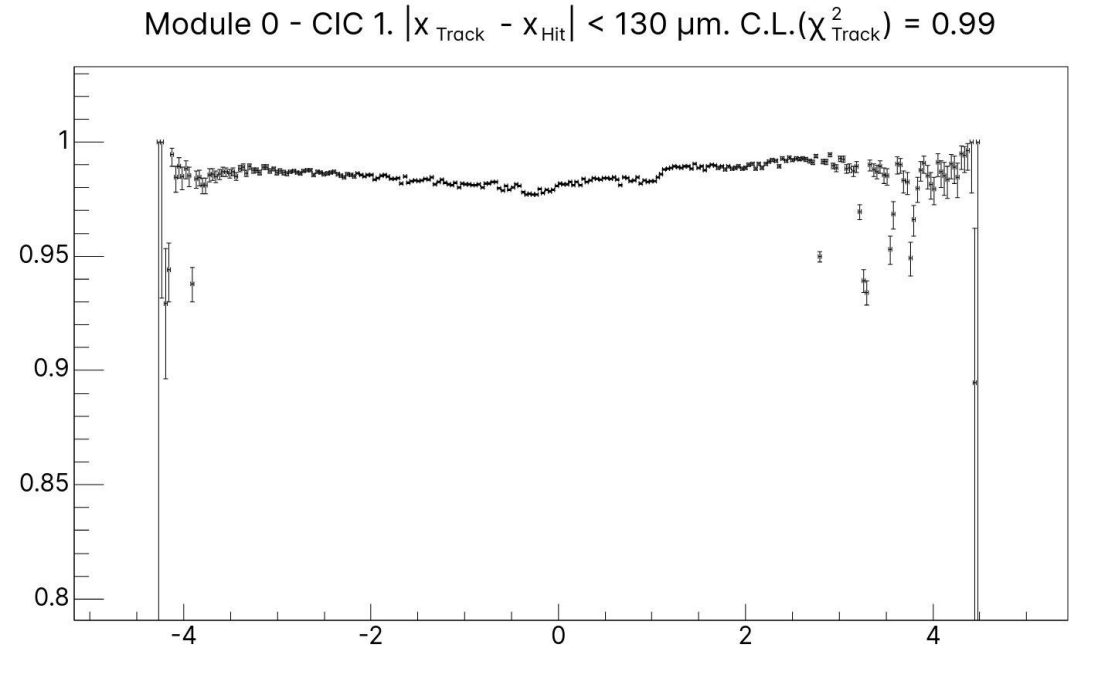

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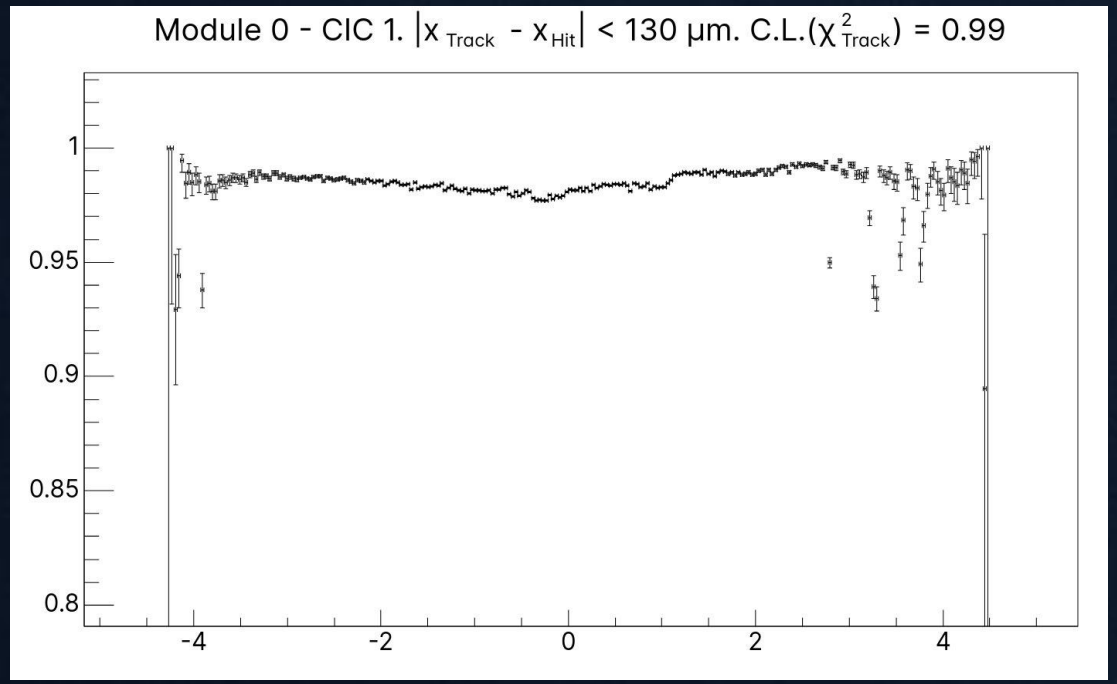

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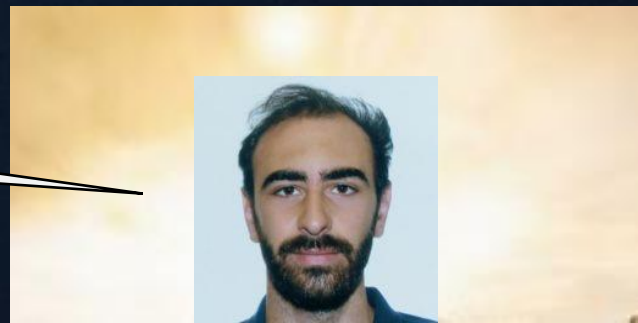
That's good



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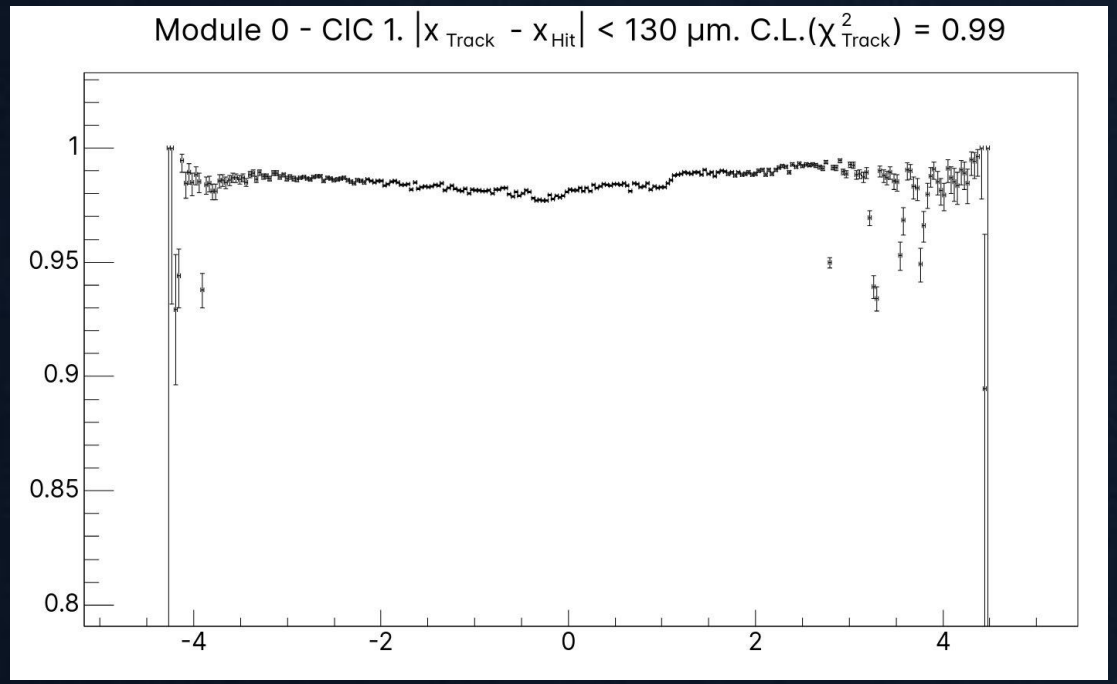

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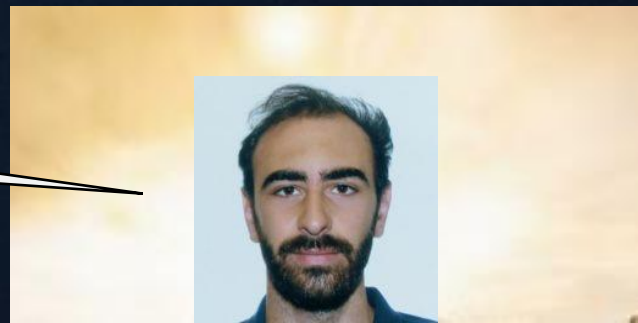

Sensor per sensor alignment

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I have a code for modules and station alignment

Split modules into two separate sensors and adapt the alignment procedure

Sensor per sensor alignment

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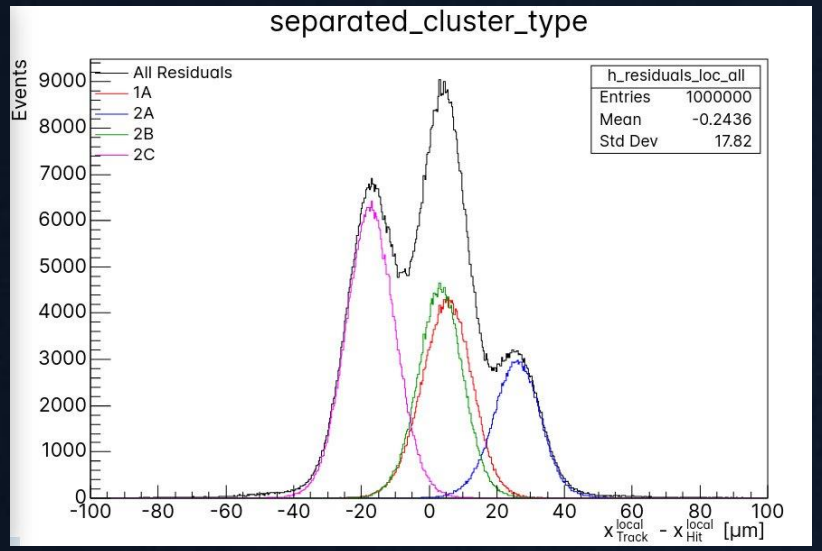
- I have some promising results



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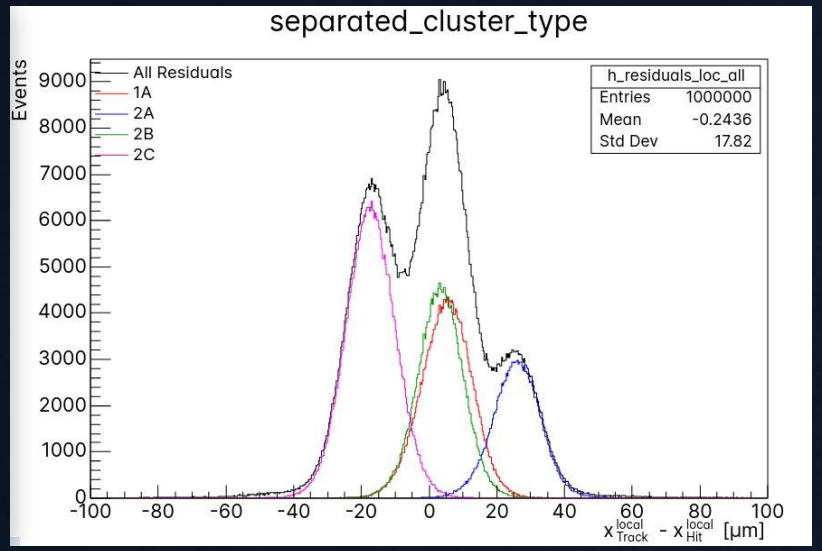

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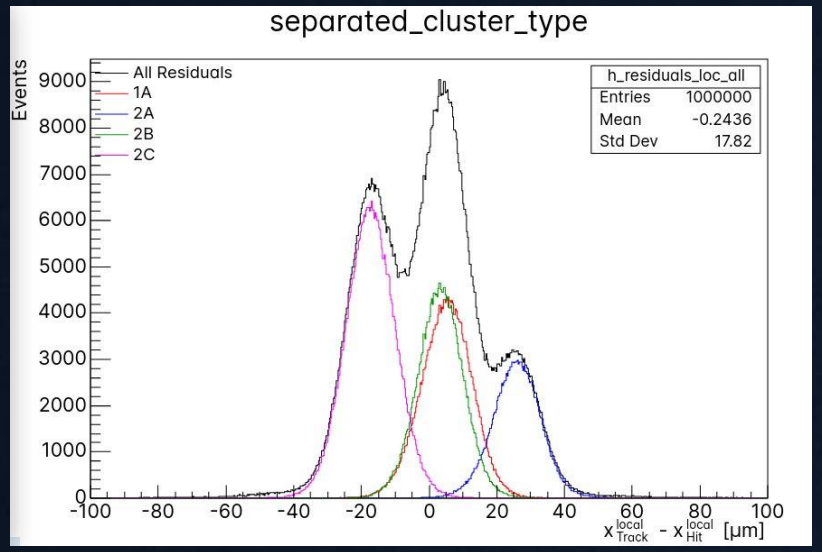

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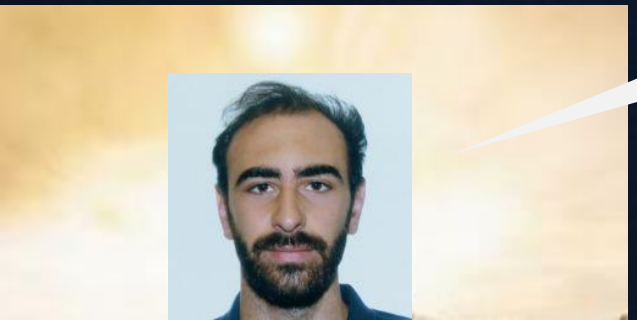

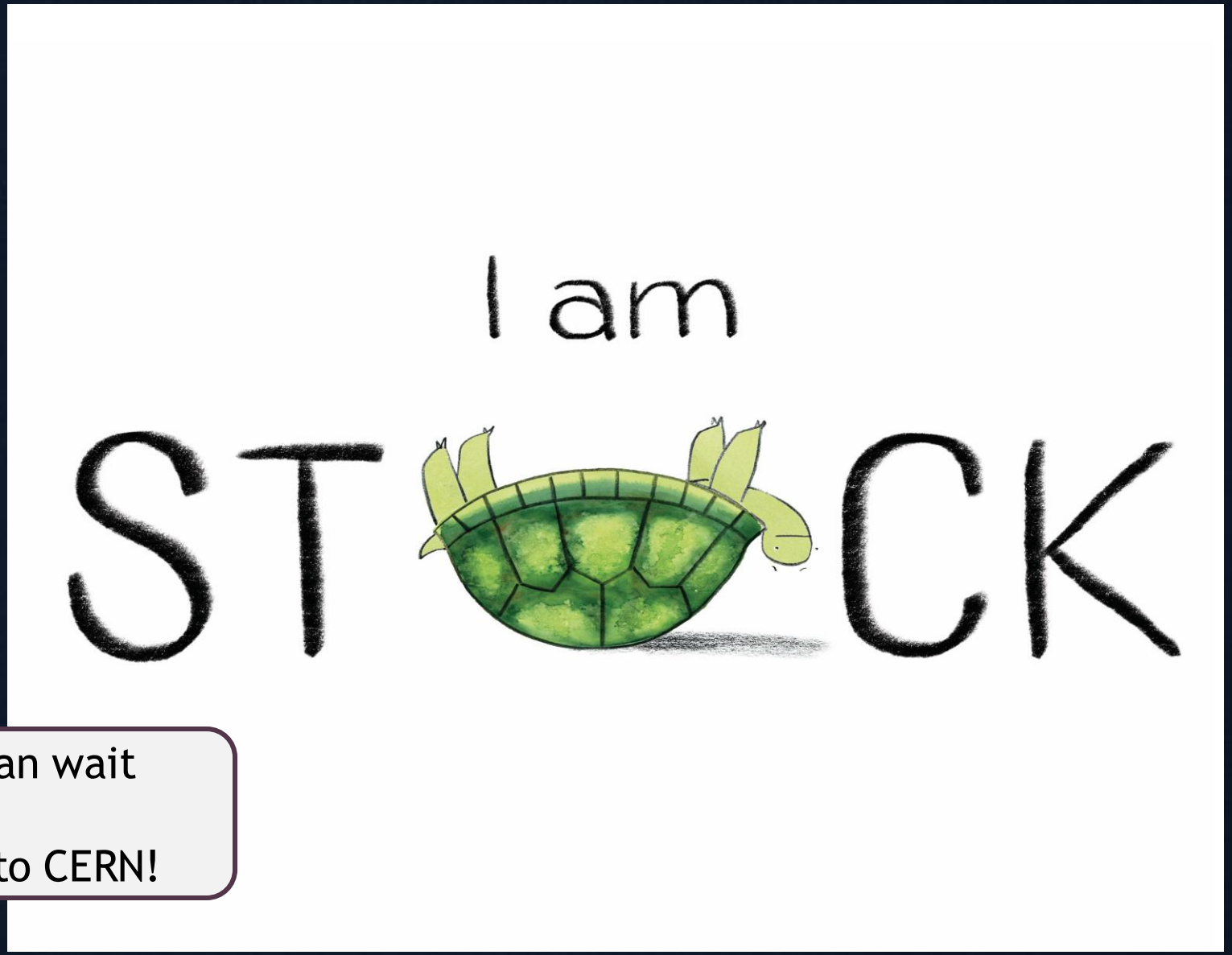

MUonE 2025

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- With Giorgia and Eugenia we studied all modules to be used for 2025 run
- Scan noise, pedestal, strip quality, depletion voltage…
- I was mainly writing the codes that produce some plots…

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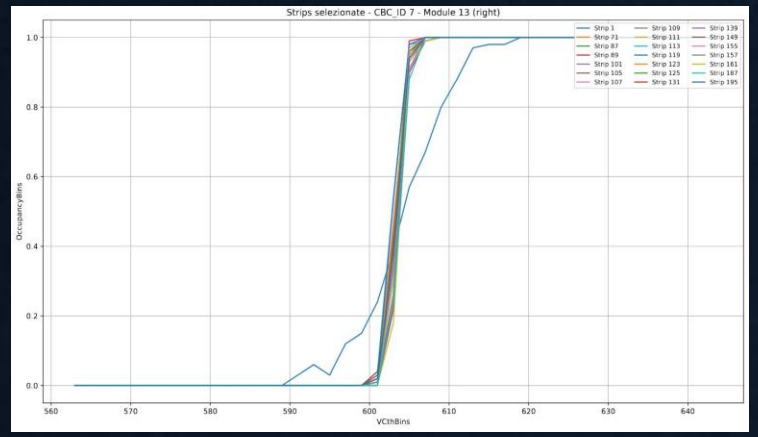

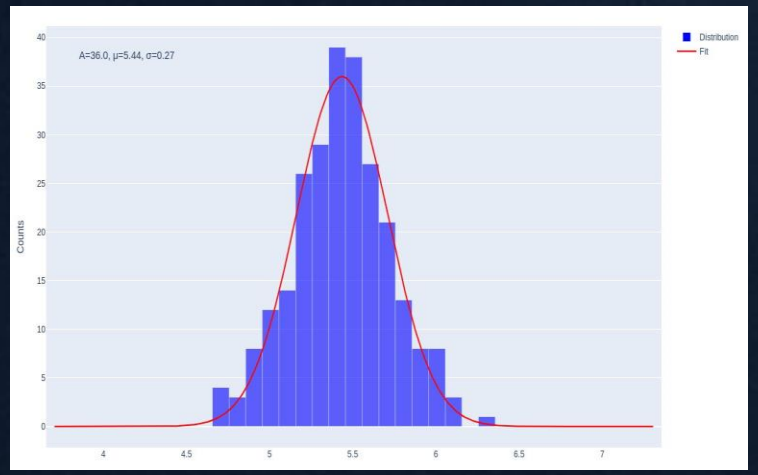

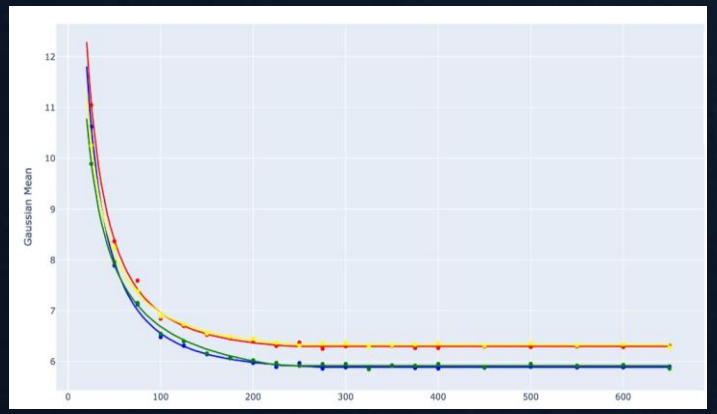

I just show some plots and skip this part fast even if it was important.

I didn't enjoy it

MUonE 2025 – timing synchromisation

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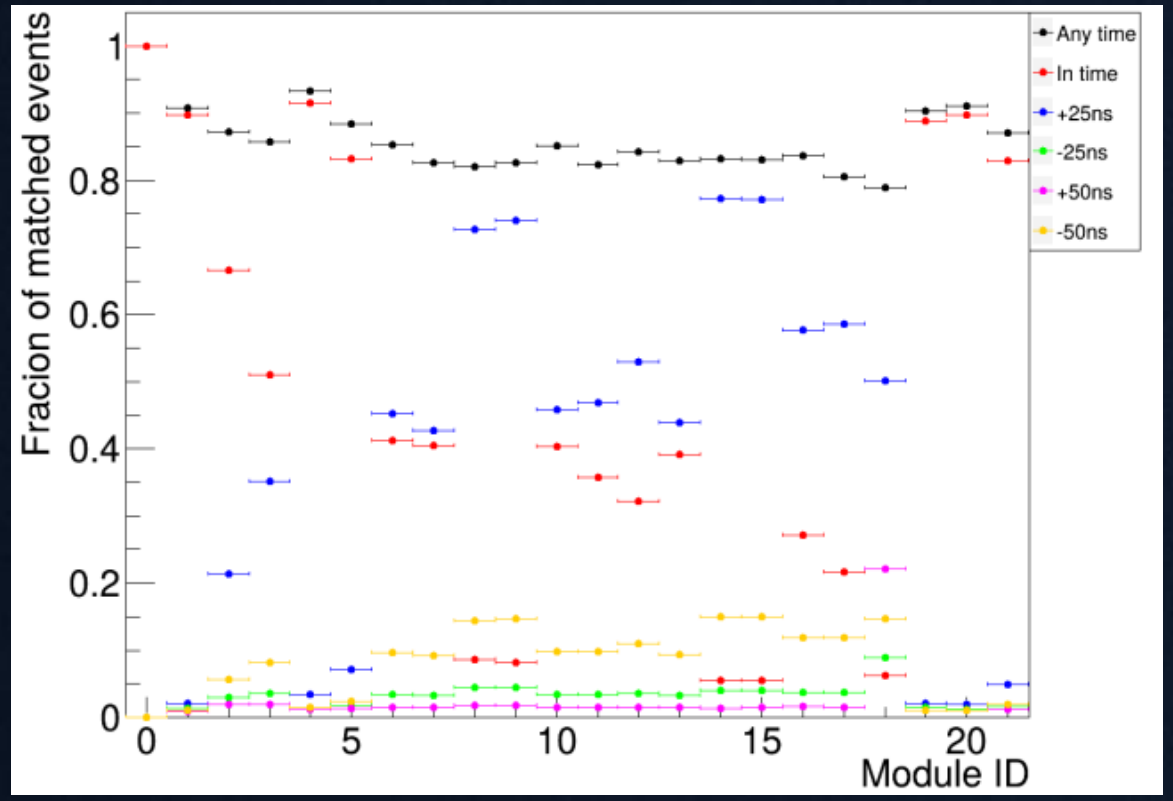
- Use one module as reference
- Maximizing the fraction of matched events for all modules



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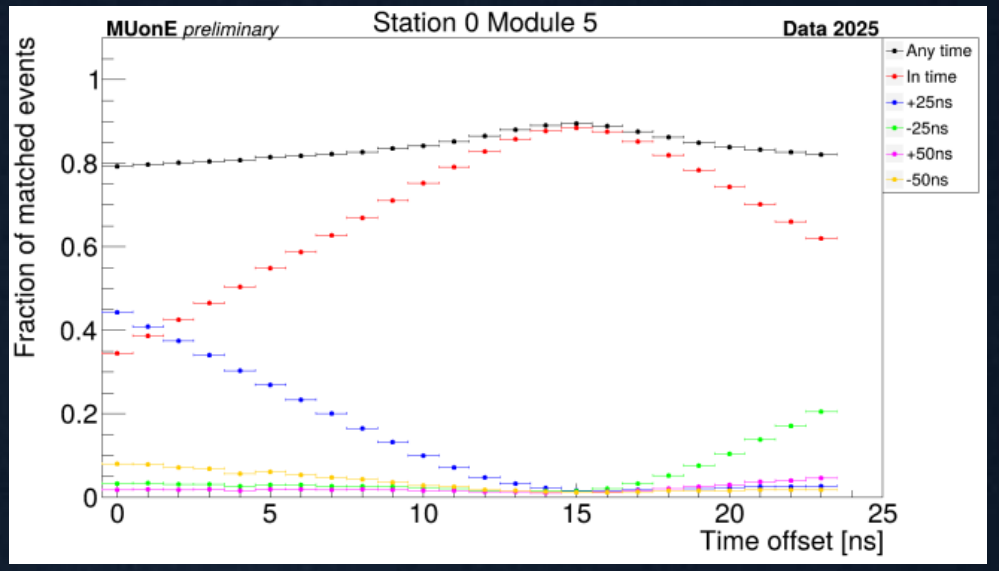

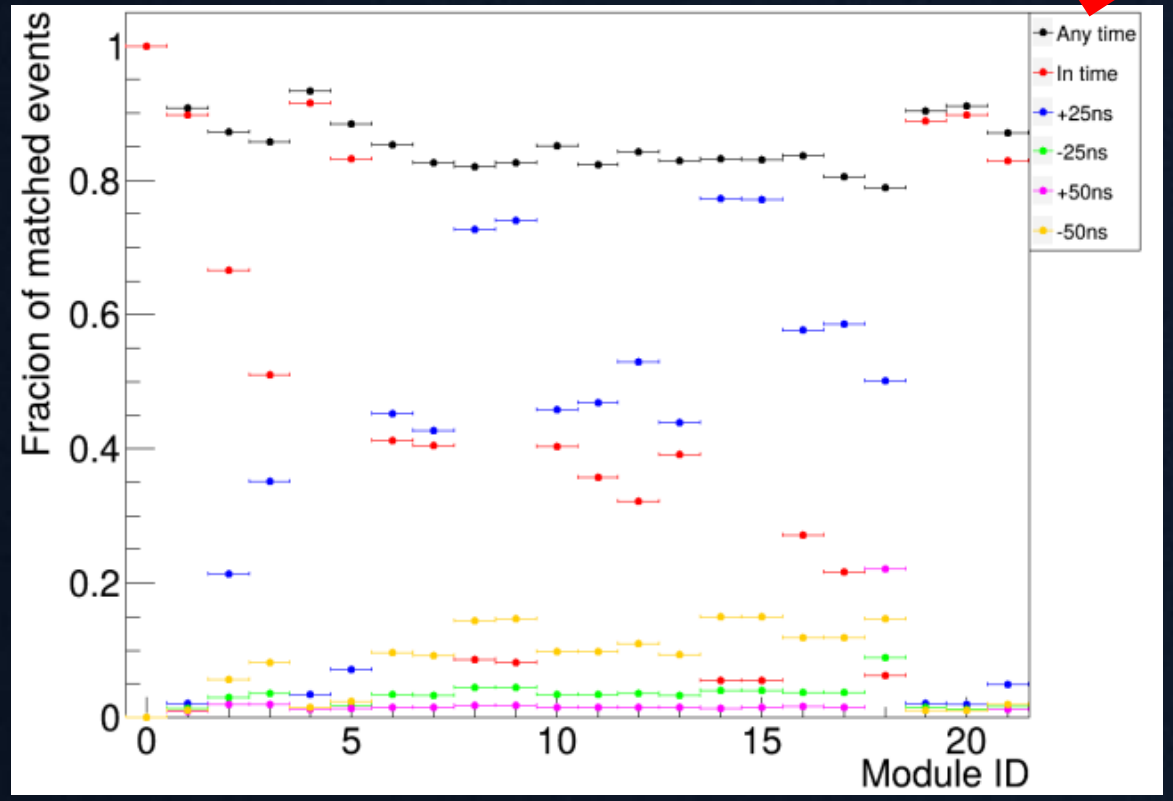

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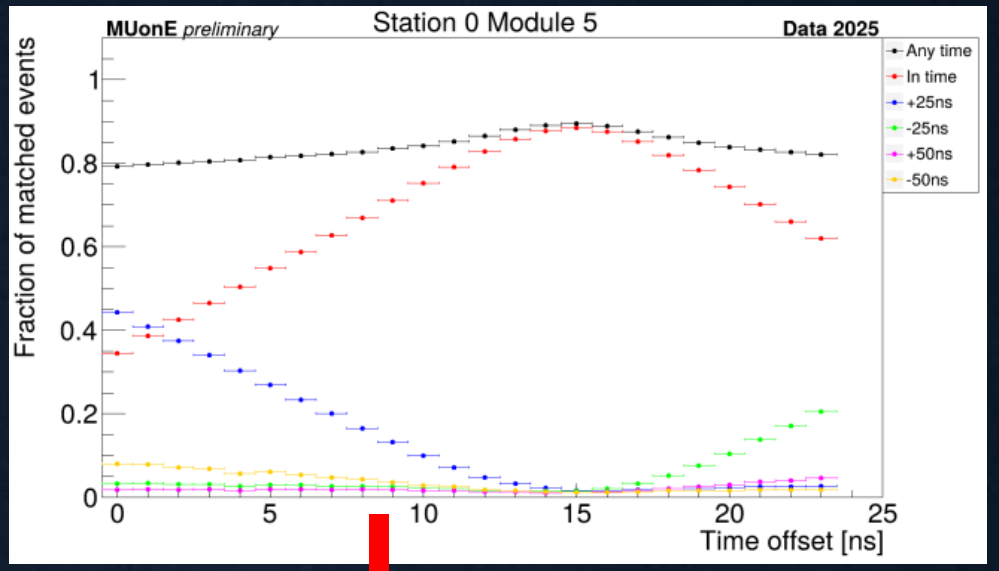

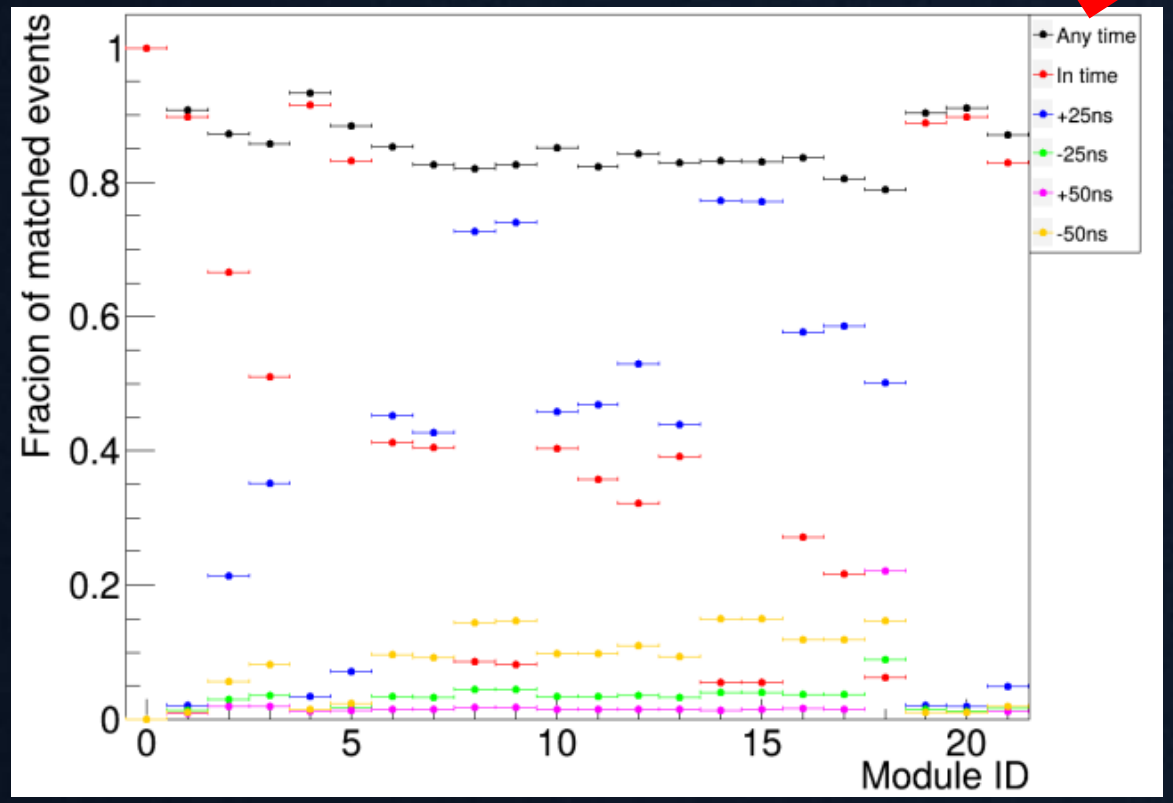

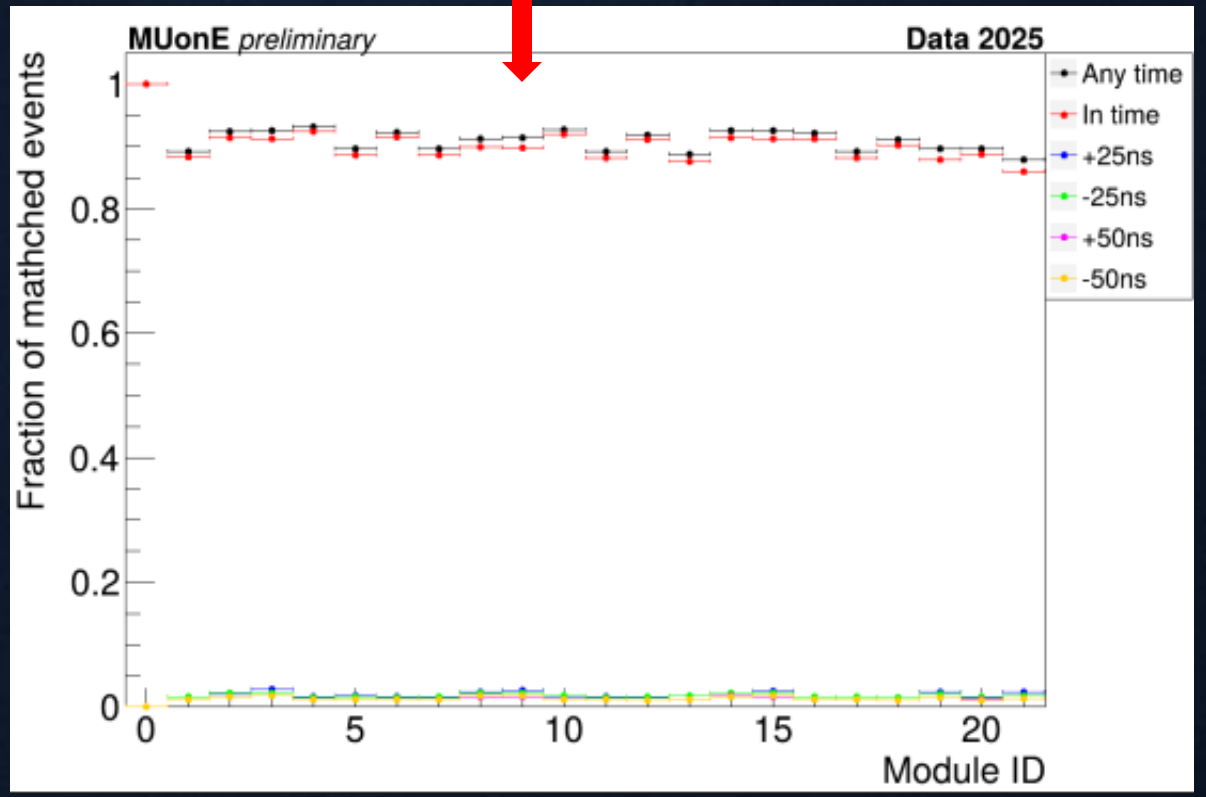

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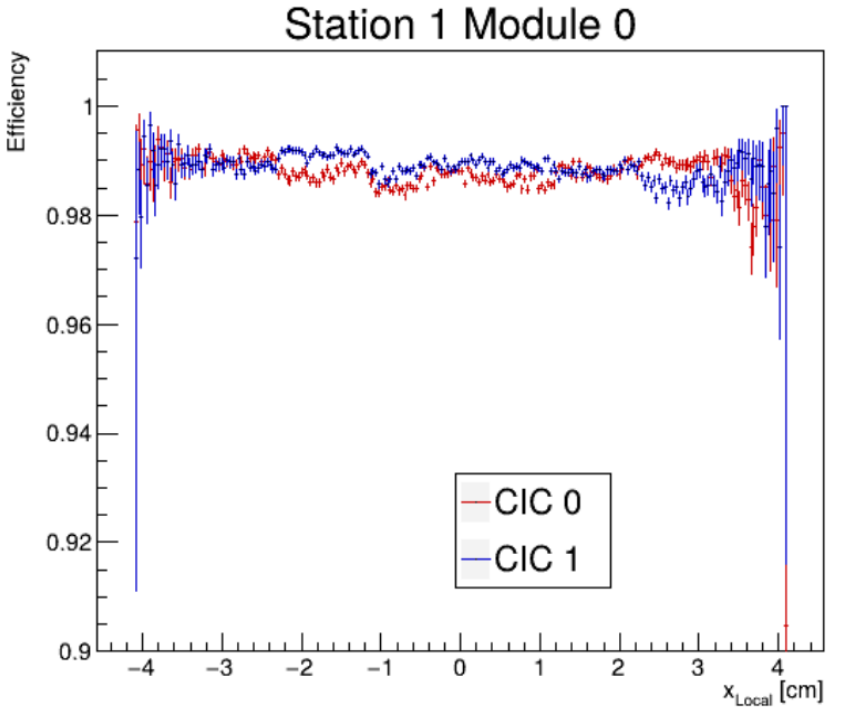

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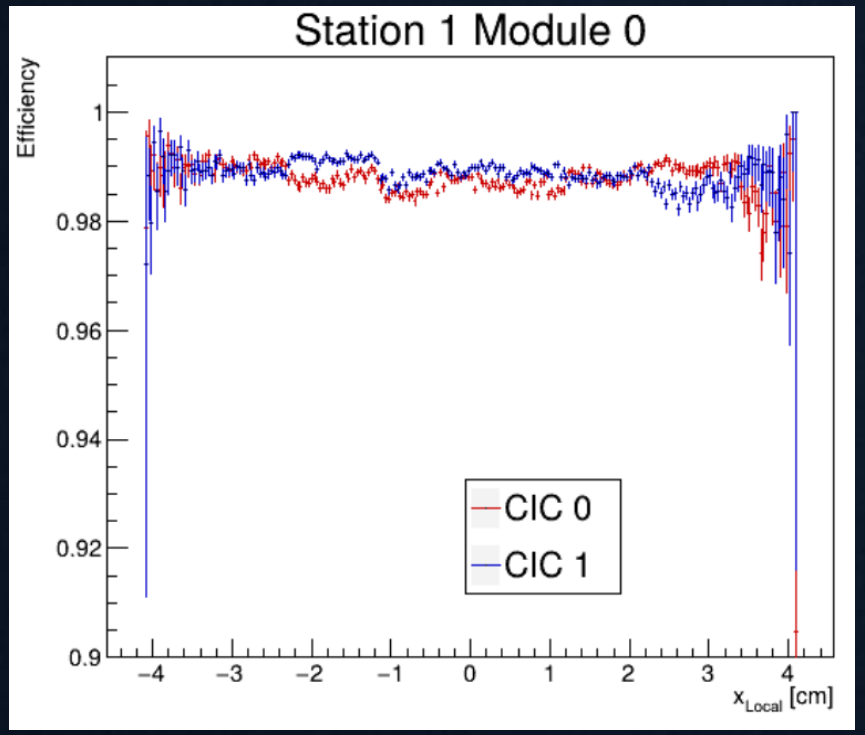

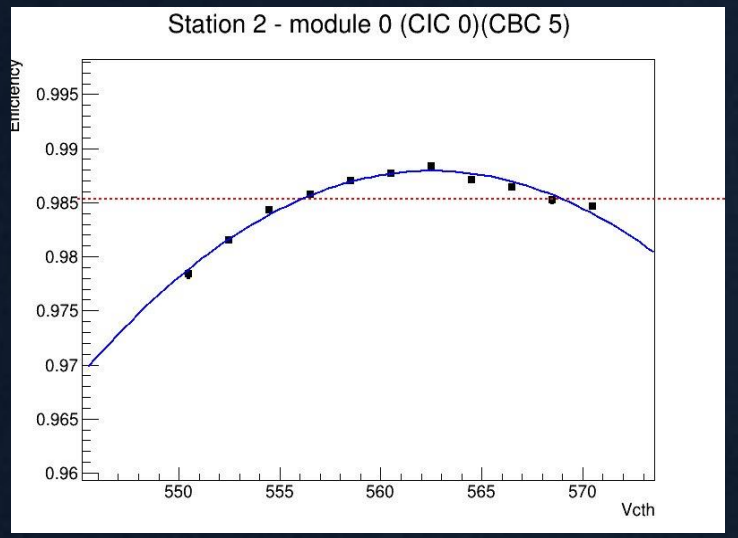

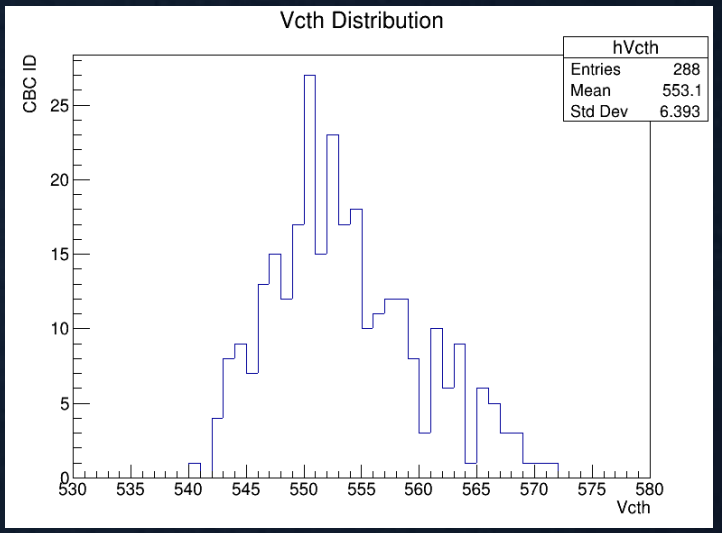

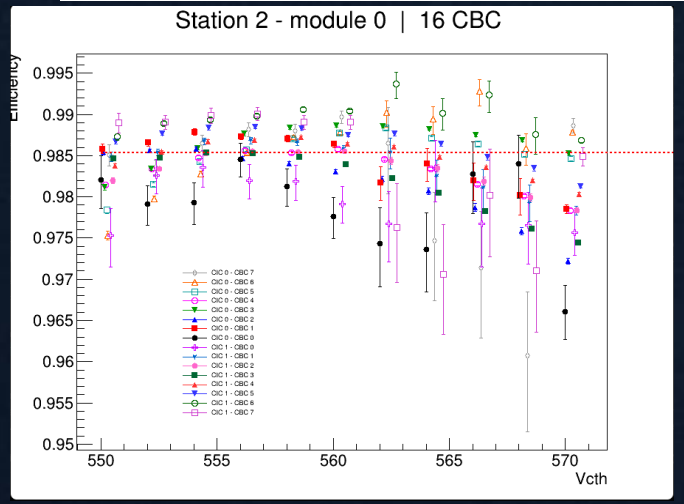

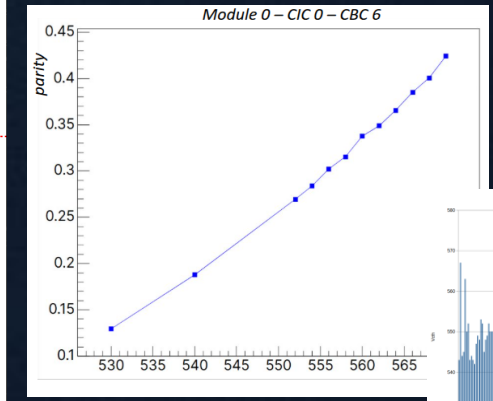

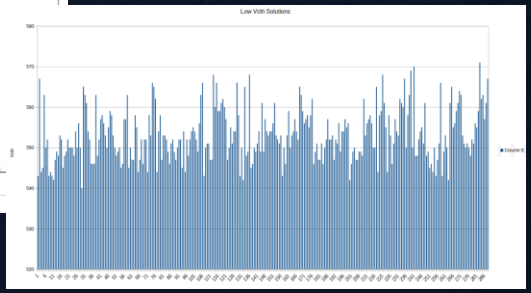

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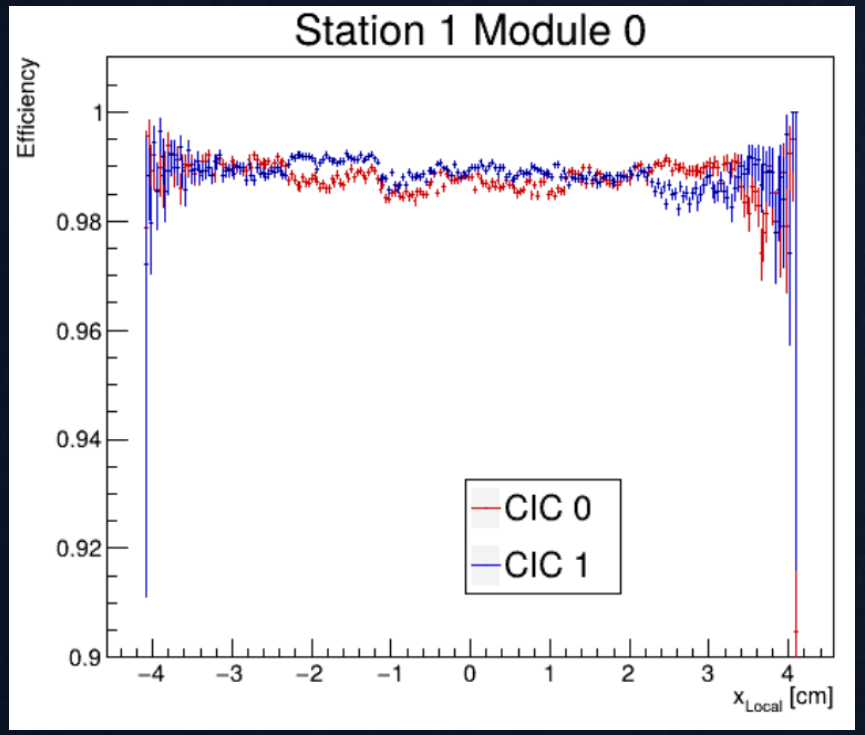
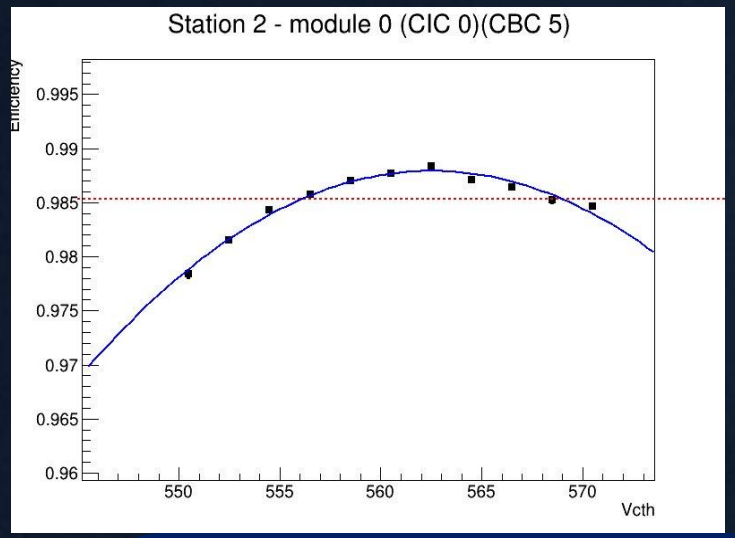
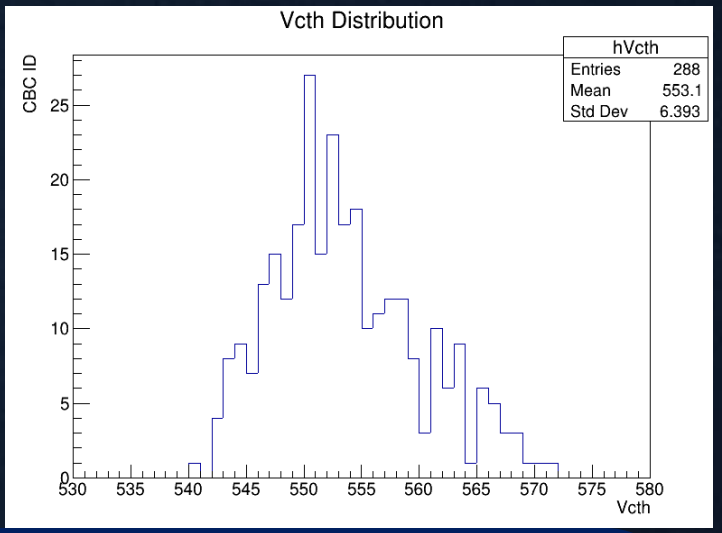
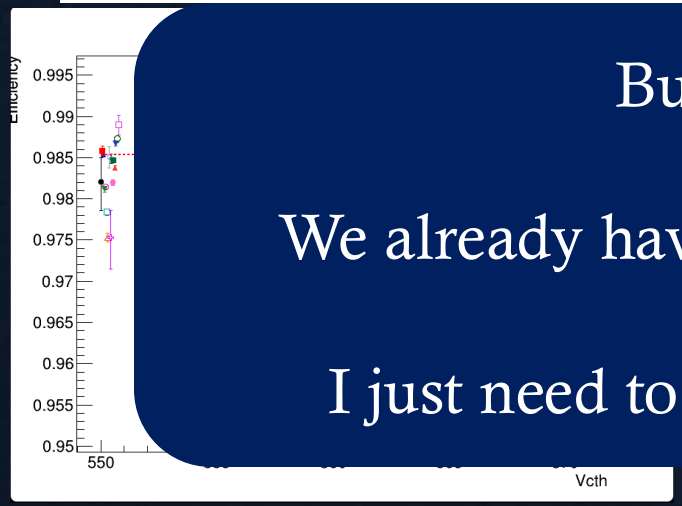




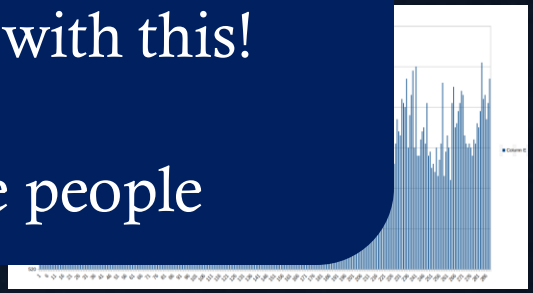




But actually…

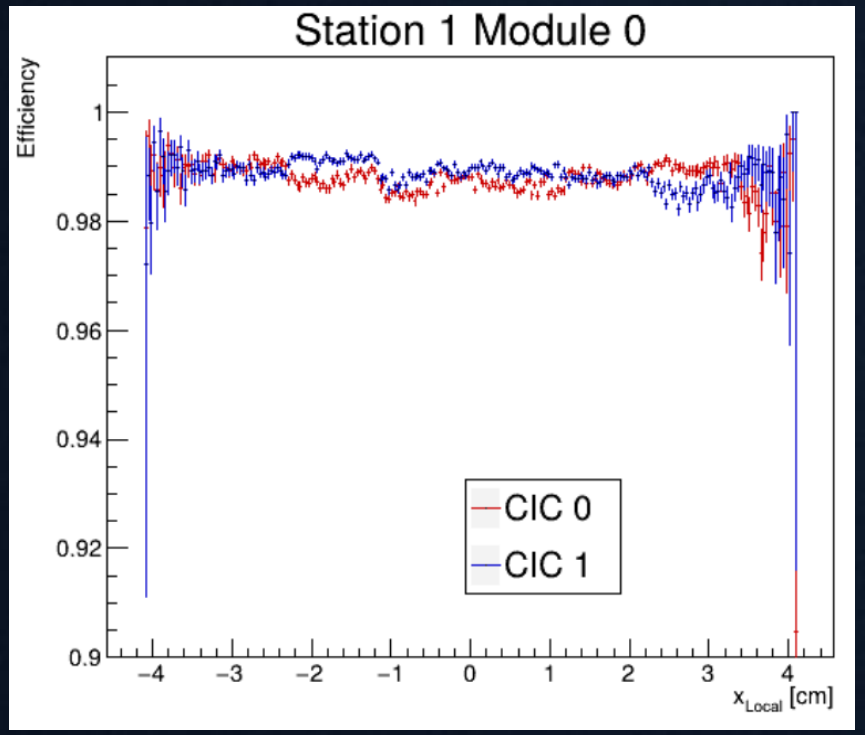
We already have tools to deal with this!

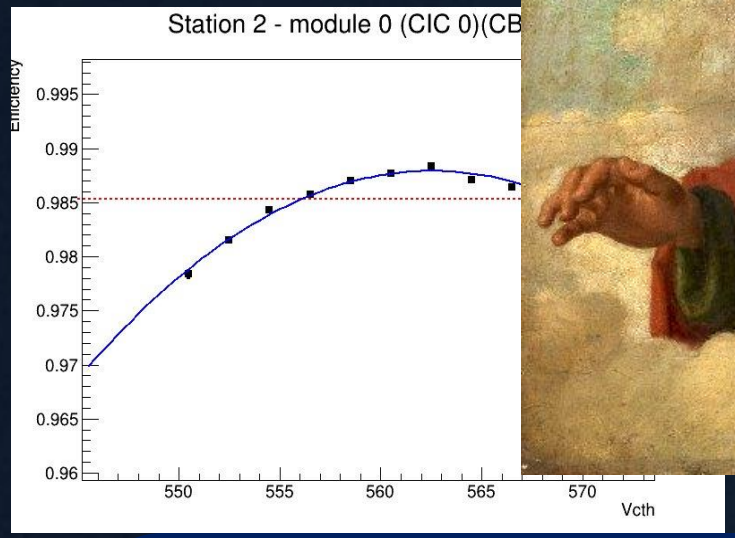
I just need to convince some people

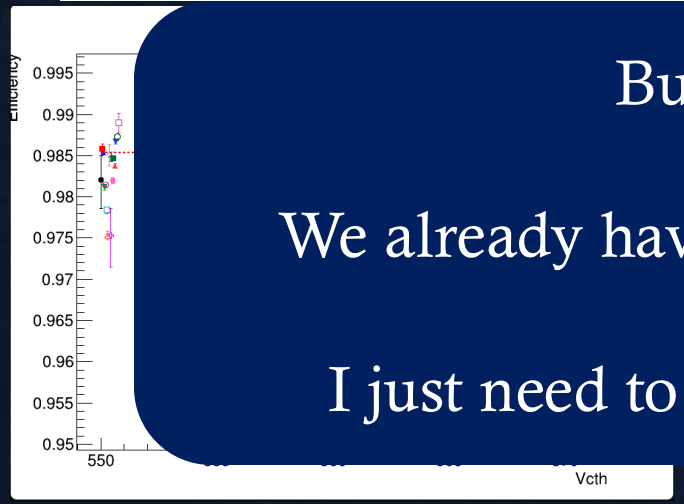


MUonE 2025 – tuning efficiency and threshold

- We want to control the module efficiency for this run
- We tried to tune the threshold for each CBC to have a flat
- Despite our efforts… Not possible







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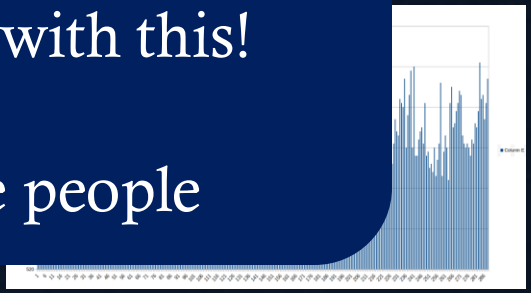

In the meantime... In a galaxy not so far

MUONE

MUONE

A NEW SOFTWARE MANAGER

There is tension in the MUonE collaboration...

The Krakow group, responsible for the software, is overwhelmed and has stopped listening to the analysts led by the Italian team.

The Italians blame Krakow for the lack of progress, and communication between them has all but ceased...

Who will bring balance to the collaboration?

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Who will bring balance to the collaboration?

I AM THE CHOOSEN ONE

This is a picture of me if I never had lost my hairs...

MUonE 2025 – Pêle-mêle

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Implemented 2025 data format into FairMUonE

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Made the reconstruction blind of the nature of data (data or MC)

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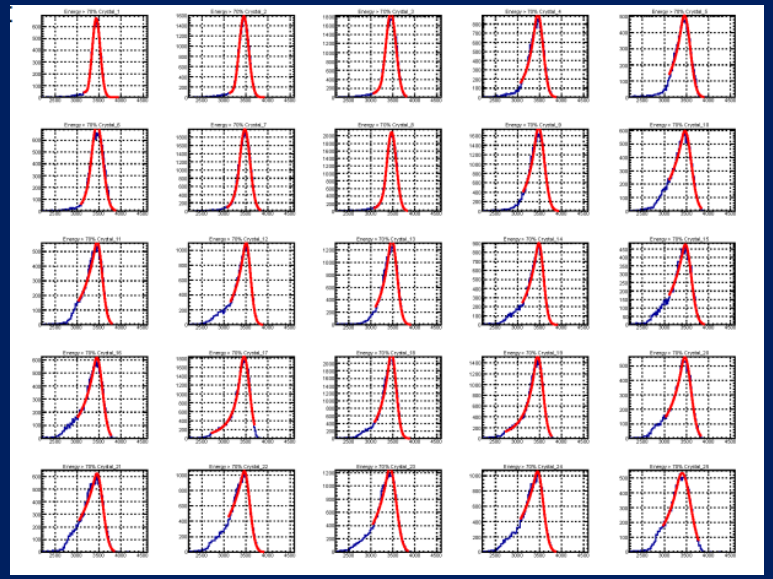
Helped in the integration of calorimeter reconstruction / digitization / geometry



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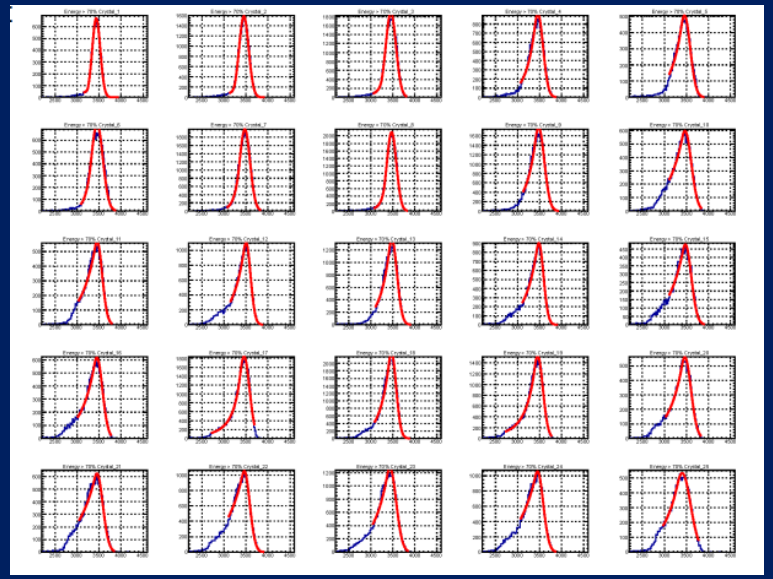
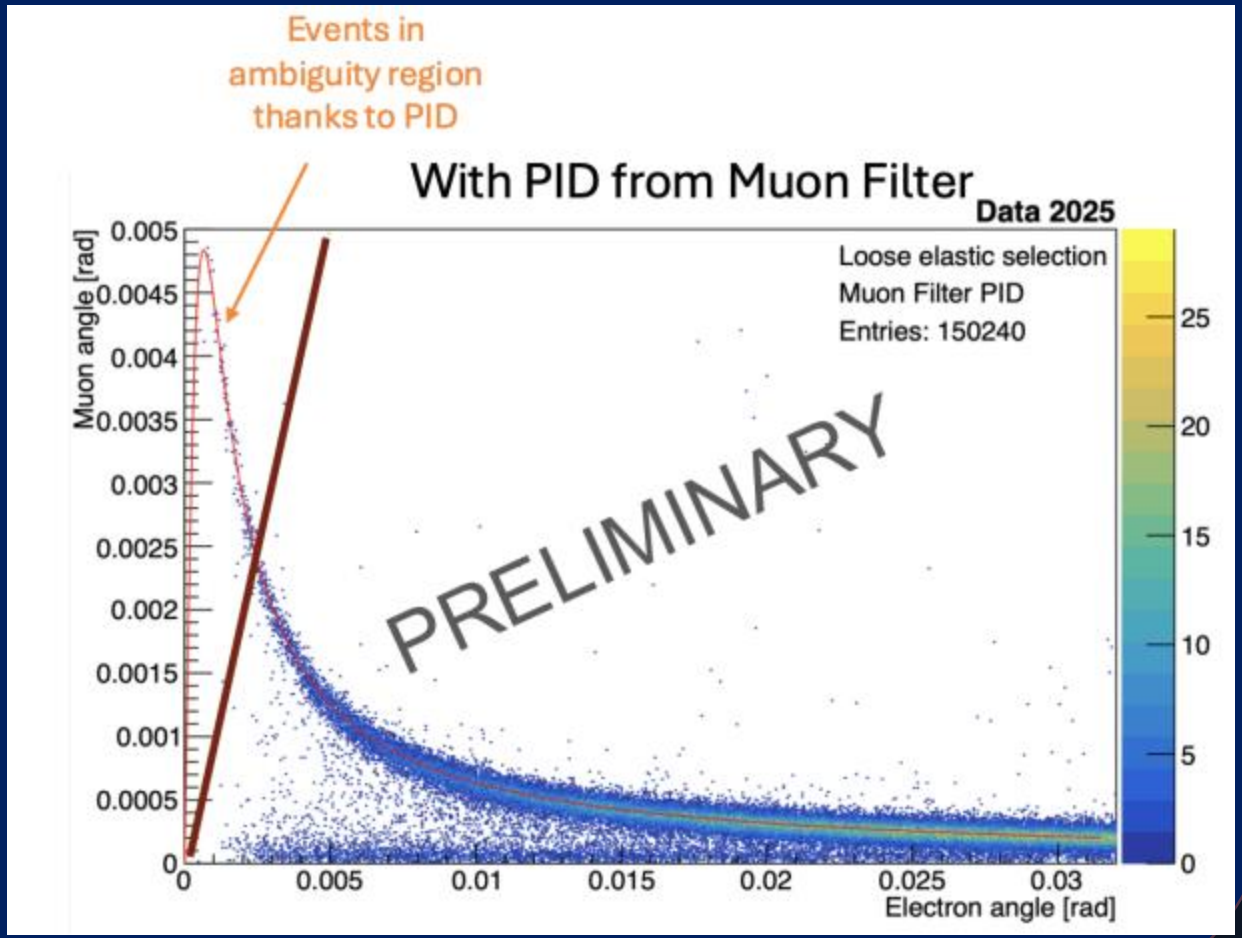
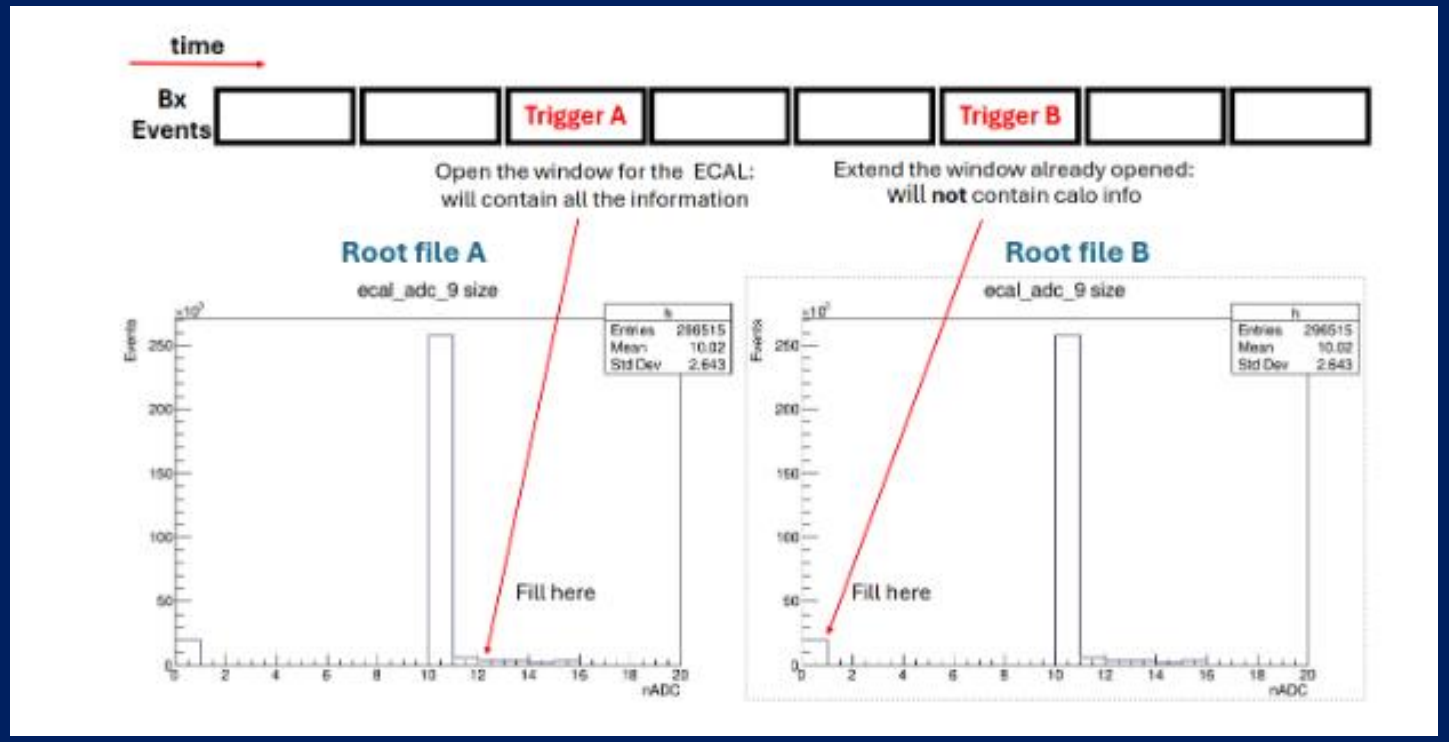
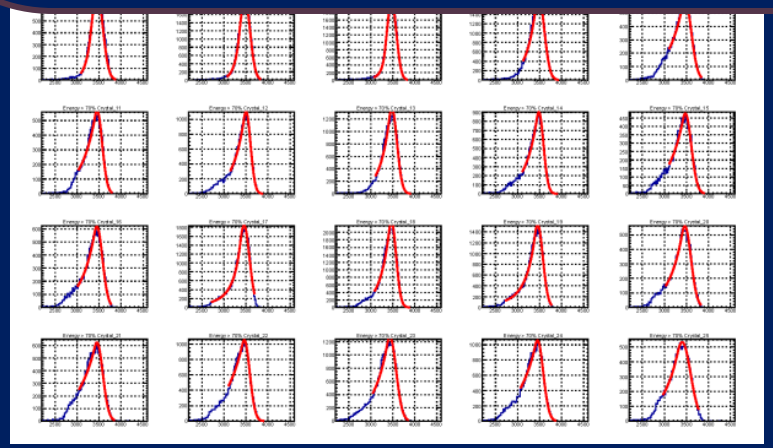


Developed muon filter reconstruction



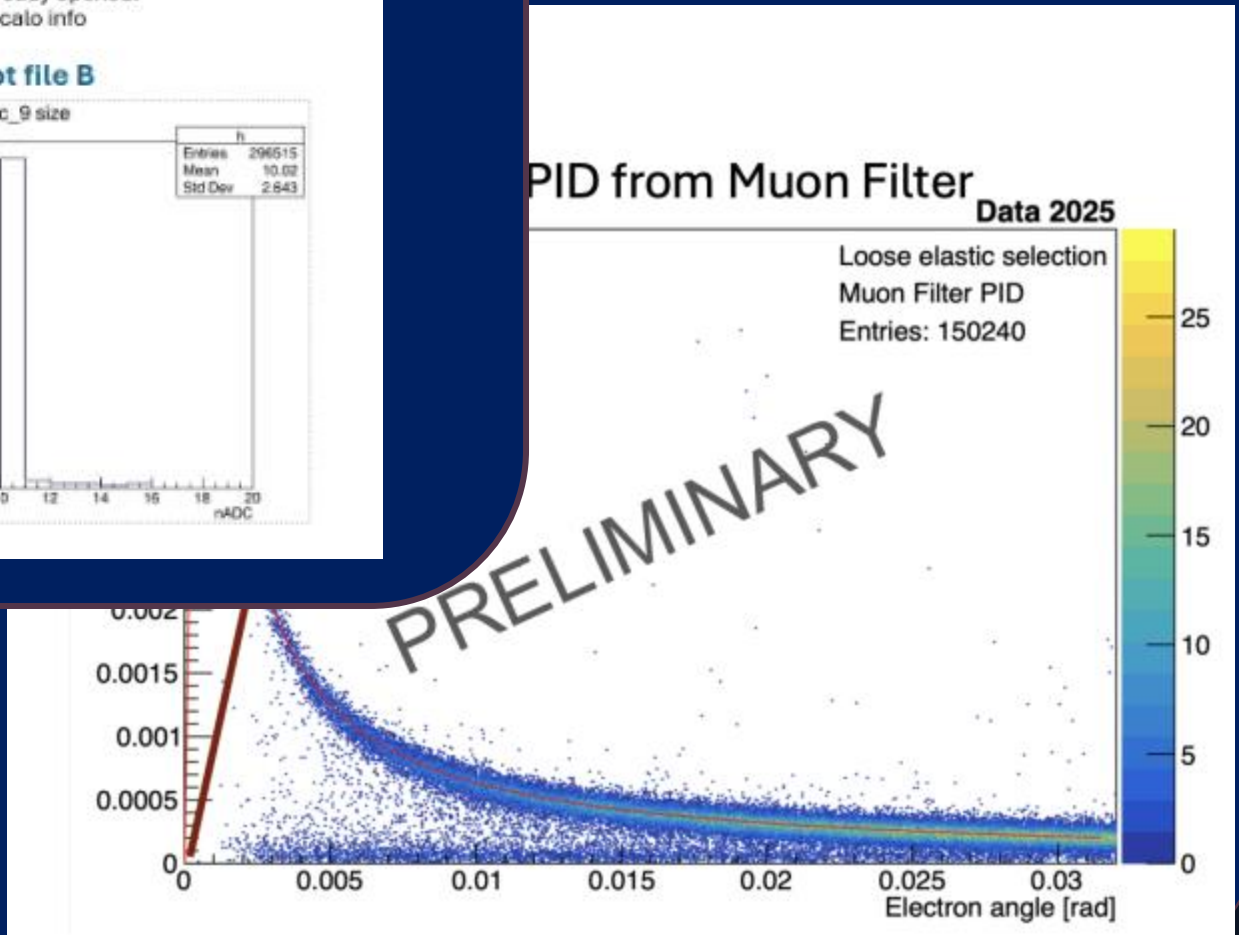
Helped to spot and fix random problems



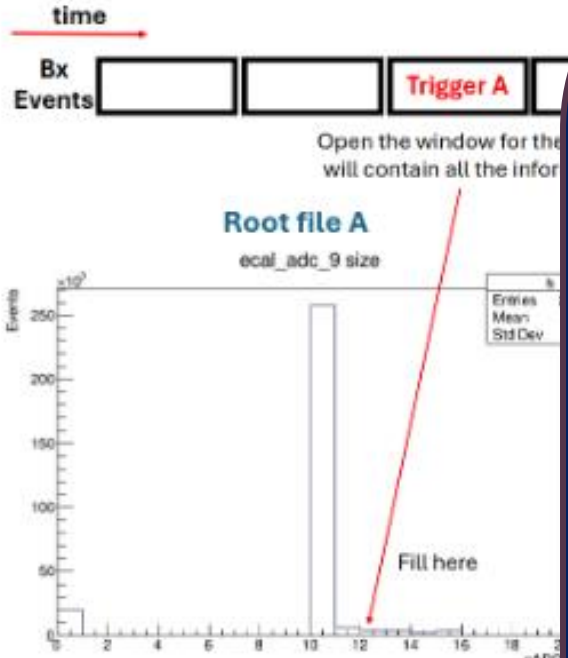


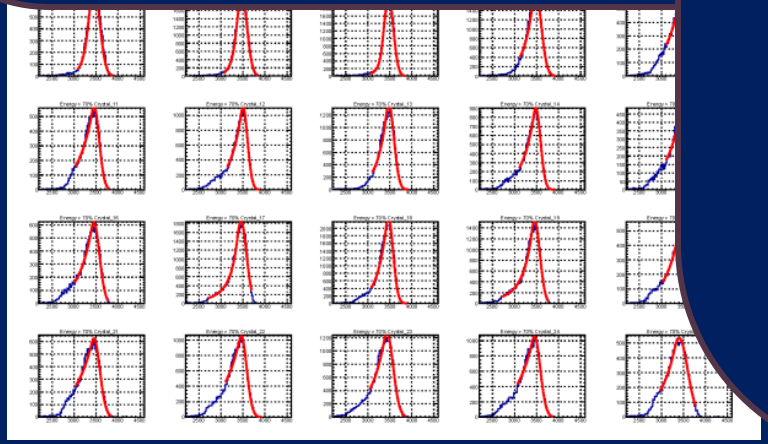
r reconstruction

PID from Muon Filter



Helped to spot and fix random problems





Mapped the detector geometry and correspondence between physical object and different software (CIC / CBC)

1.2.4 V Modules:

Figure 12 shows an V-module. The picture is as explicit as for U module so I wont repeat you might be used to the explanation now.

As usual, an V module is represented from the beam point of view in Figure 13

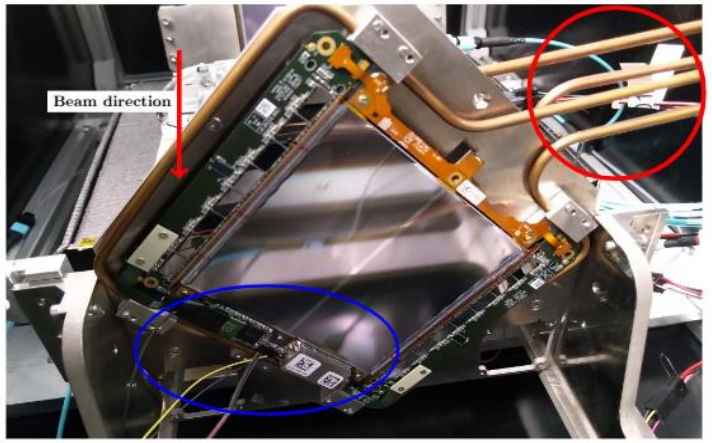
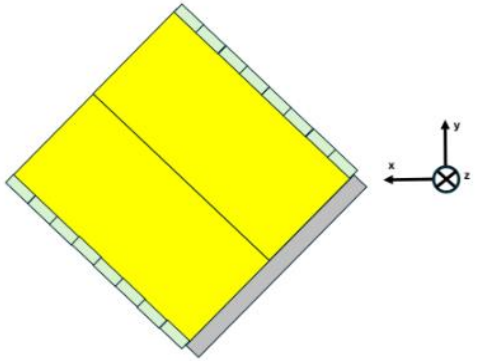


Figure 12: V module from the beam's point of view



	α	θ	γ
X-module	0°	-13.5°	180°
Y-module	-90°	-13.5°	0°
U-module	-45°	0°	0°
V-module	-135°	0°	180°

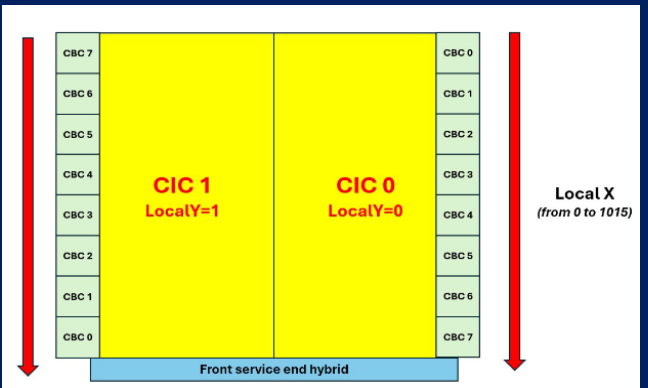


Figure 25: Map of the 2S modules

	CIC 0 ⇔ localY=0 localX	CIC 1 ⇔ localY=1 localX
CBC 0	0 → 126	889 → 1015
CBC 1	127 → 253	762 → 888
CBC 2	254 → 380	635 → 761
CBC 3	381 → 507	508 → 634
CBC 4	508 → 634	381 → 507
CBC 5	635 → 761	257 → 380
CBC 6	762 → 888	127 → 253
CBC 7	889 → 1015	0 → 116

Table 13: Mapping of CBCs in softwares to decoded localX

Representation of the ***spiritual son*** during the 2025 test run

Representation of the ***spiritual son*** during the 2025 test run

Sorry, the ***spiritual son*** didn't make it...

I am the new Sheriff in town!

Thanks...