



Plans for MUonE 2025 run

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Layout:

1. Summary of achievements up to now (brief history)

last in time test beam September 2023 (several days of recorded data with 2-station Tracker and ECAL).

Presently evaluating the quality of the 6 full days of recorded data.

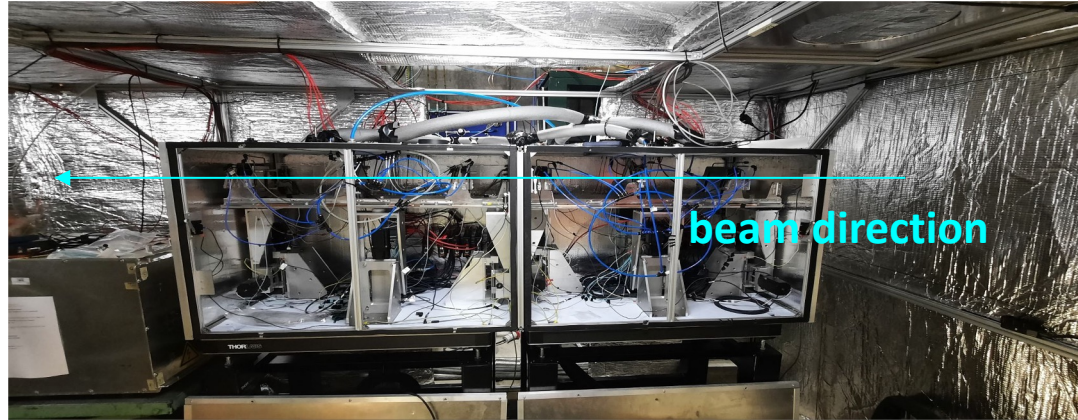
(see next slide →)

2. Activities between now and 2025
3. 2025 run: emphasis on physics program

Test beam 2023 - 2 stations configurations :



During Tracker+ECAL data taking
(MUonE main user until 12th September)



During Etalon data taking
(MUonE running parasitically upstream
AMBER 26th – 28th September)



Very fruitful data recorded in both periods

Some history of finding elastic events...:

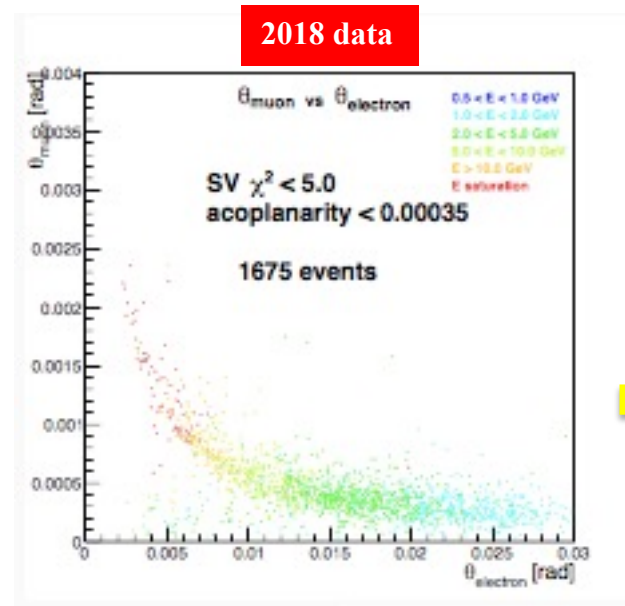
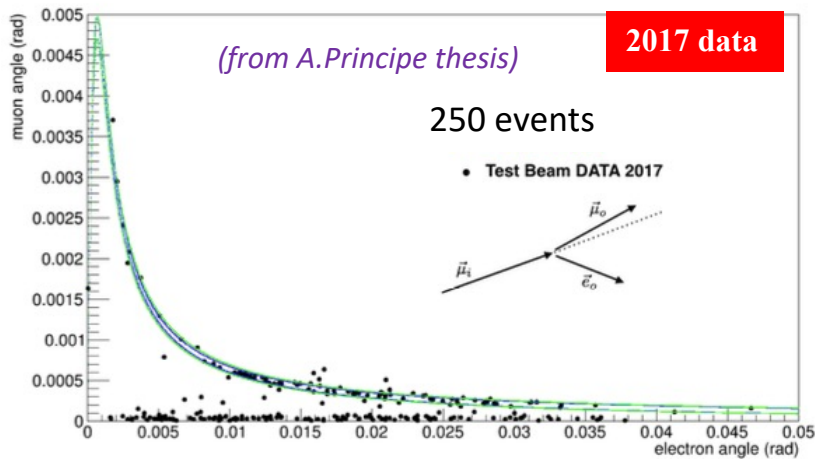
1. Test beam in 2017 (UA9 setup, to study MS).
2. Test beam in 2018 with AGILE Si tracker and a calorimeter
3. *Test beam in 2021 first 2S test (CMS box + 1 Pisa AI station)*
4. *Test beam in 2022 only 1 station, no elastic definition possible*
5. Test beam in 2023:
 - a) “long” run with muons (*for the 1st time*) under analysis now
 - b) **parasitic** run with etalon (hadrons+muons collected data)

No problem in finding elastic events, BUT

now must determine all the other elements of the analysis i.e. *efficiencies, backgrounds, resolutions, particles ID,..*

➡ which should be measured with the 2023 data under study.

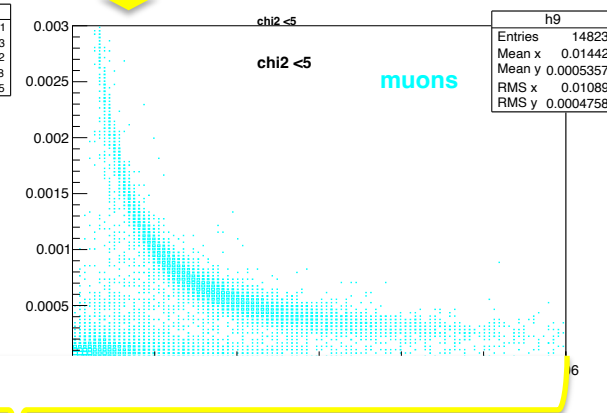
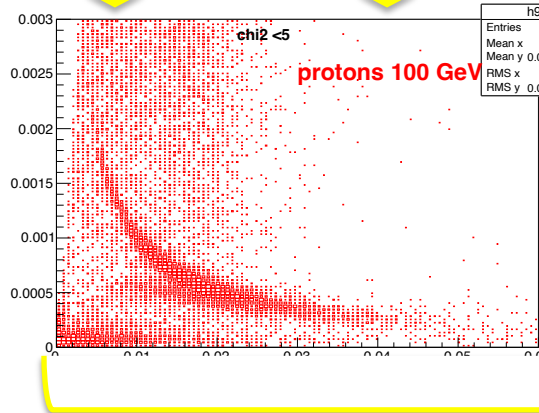
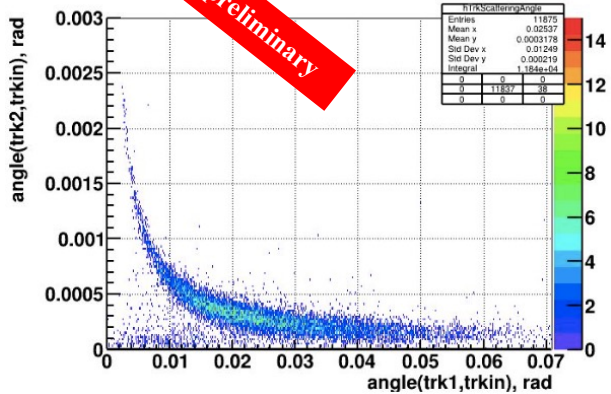
From previous test beams data:



(published in JINST 16(2021) P06005)

From 2023 data:

NOT PUBLIC – DO not circulate



Subset of 2023 main user data set

ETALON data (parasitic, 2023)

2. From now to 2025, in order to make clear plans, we must know:

- ➡ How many ‘final’ modules can we have from CMS (*before end of 2024*)?
under investigations/negotiations with CMS upgrade-II tracker collab.
(Meeting with CMS scheduled for next week)

- ➡ **Aim:** have enough stations to learn as much as possible about the performance in data collection and reconstruction/selection.
 - 5 complete stations could be an optimum (*and realistic*) to request a long running time and be confident that the commissioning time should be reasonable having learnt from running in 2023 ➡ **physics measurement possible**

In case of worse scenarii:

- 3 complete stations minimum (see LoI) would be still useful to optimize the apparatus performance and acquire valuable experience under full running conditions, even in a shorter running period.

- 2 complete stations still would be worthwhile running, establishing and optimizing high rate performance of the apparatus and DAQ system.
And learning to operate untested up-to-now hardware elements like BMS integrated in the DAQ of MUonE, and the muon filter behind the calorimeter, and bringing the calorimeter to the best possible performance.

3. Goals to achieve in 2025 : focus on physics program

★ measurement of leptonic contributions
(confirmation/comparison if a measurement is performed with 2023 data)

★ measurement of hadronic contributions:

Prerequisite: achieve sufficient statistics with:

‘good’ hardware (modules, DAQ, calorimeter)

enough beam time (requested allocation must be well supported by results from 2023 and hardware procurement from CMS)

At condition: a fully operational detector system and DAQ at high muon beam rate.



physics measurement of had corrections possible with O(15%) stat

Between now to 2025 however A LOT of WORK REMAINS:



- ★ conclude analysis of 2023 data → support to submit to SPSC the **MUonE Experiment Proposal**
- prepare calorimeter (understand all the details of PbWO4 or change to other available crystals???)
- work on DAQ (tracker stations + ECAL all merged)
- Important question: should we ask some beam time on M2 in 2024? With which setup? With which aims? *(to be discussed within the collaboration)*
- but a crucial point in view of the near (and far) future is :

TO GET MORE EXPERIMENTALIST (*young*) COLLABORATORS



Thank you for your attention