BUAP in ALICE

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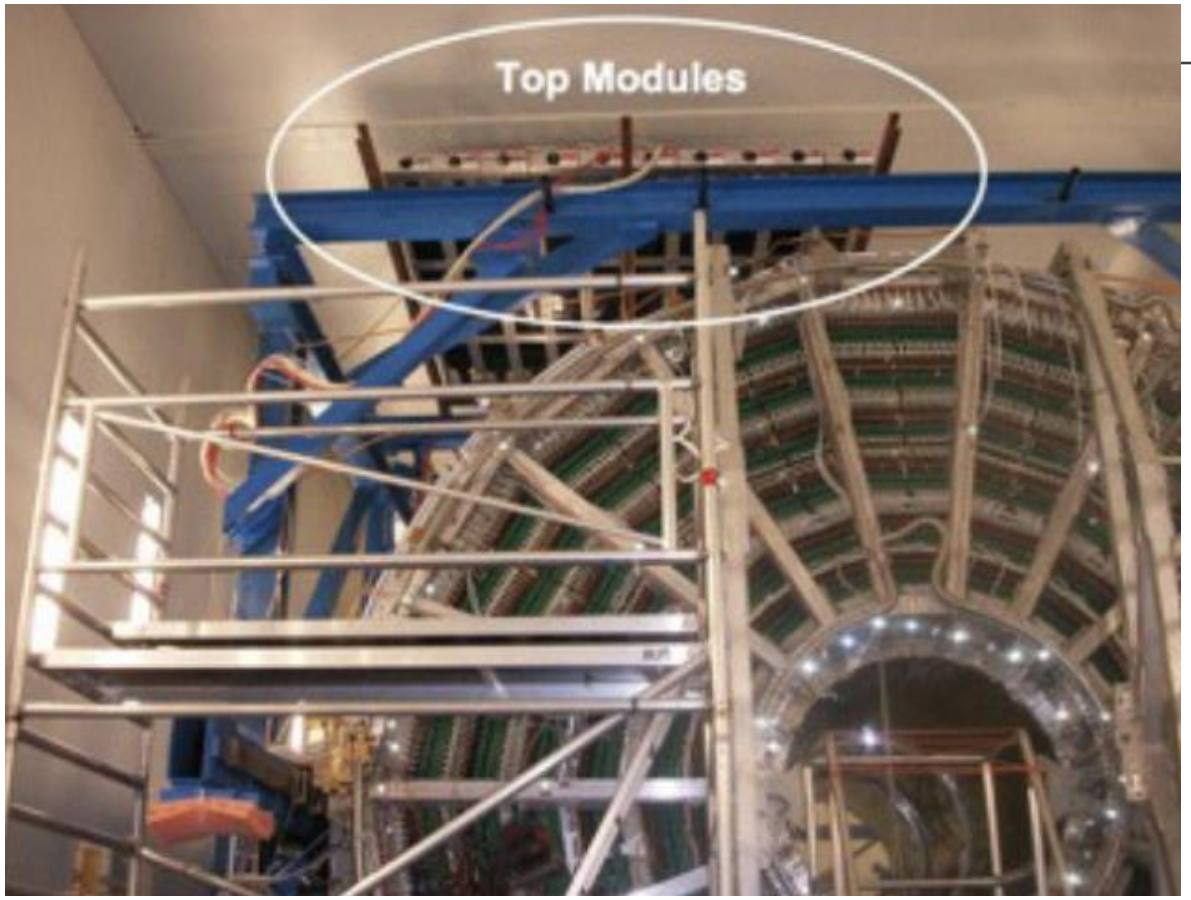
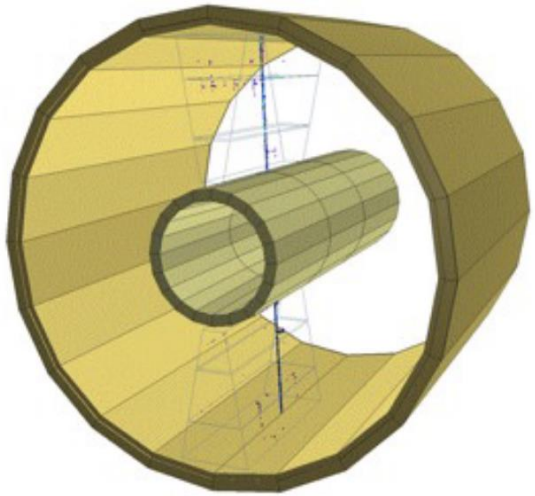
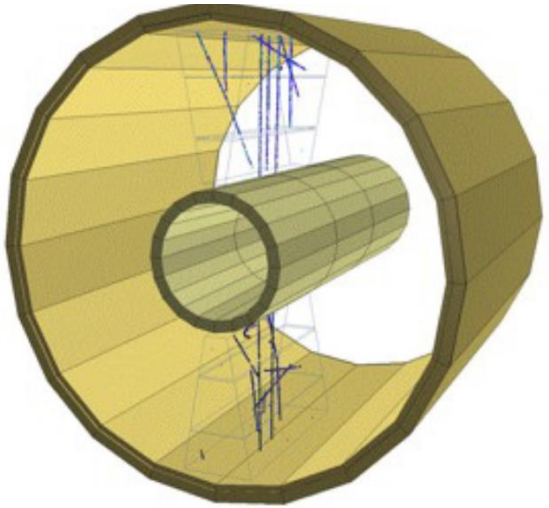
ALICE-DAY, 25.11.2024

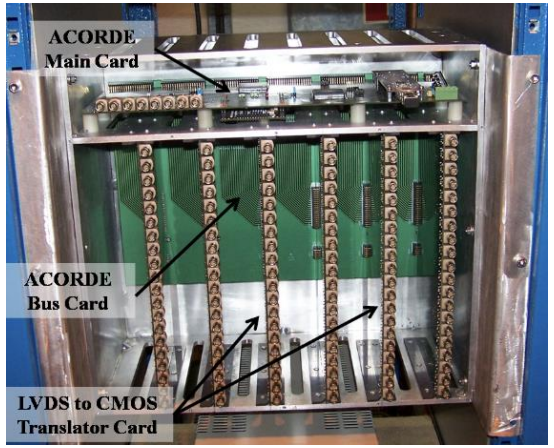
TPC calibration in P2 clean room

2007, 17 years ago



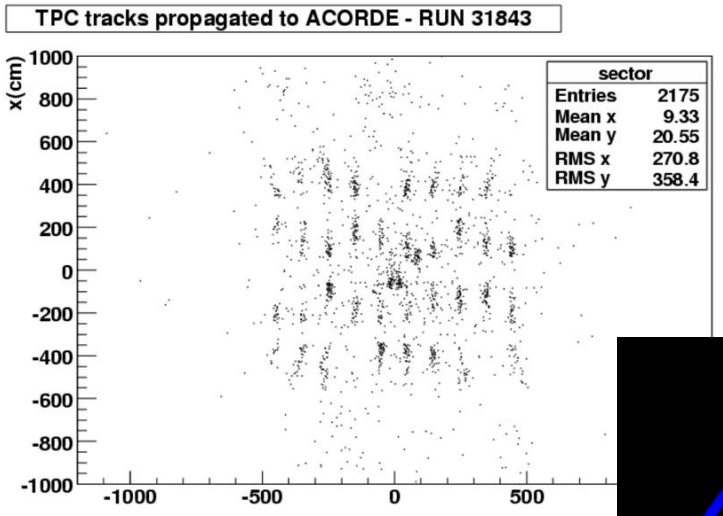




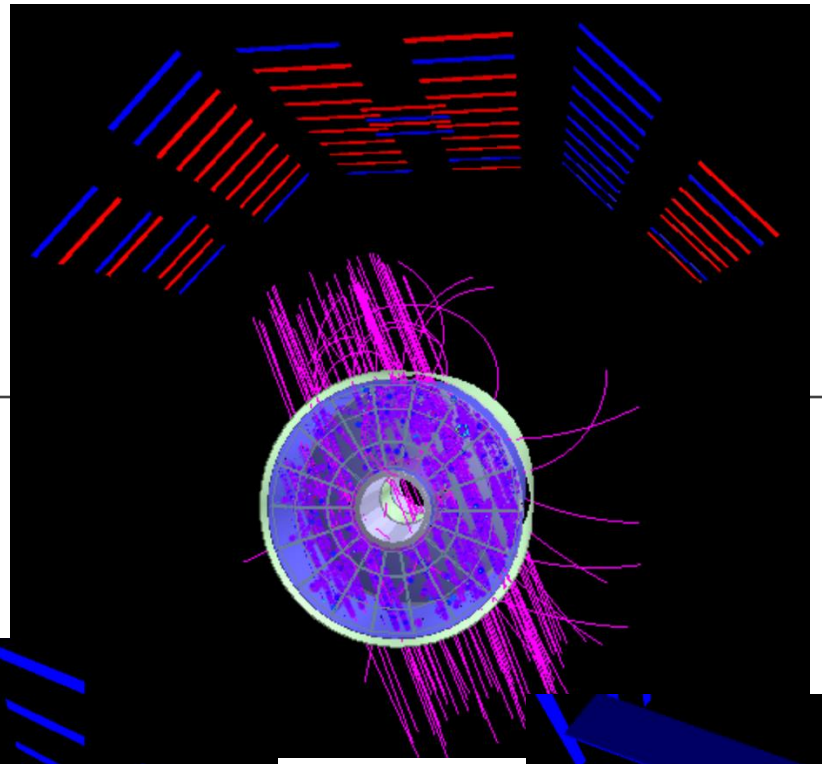


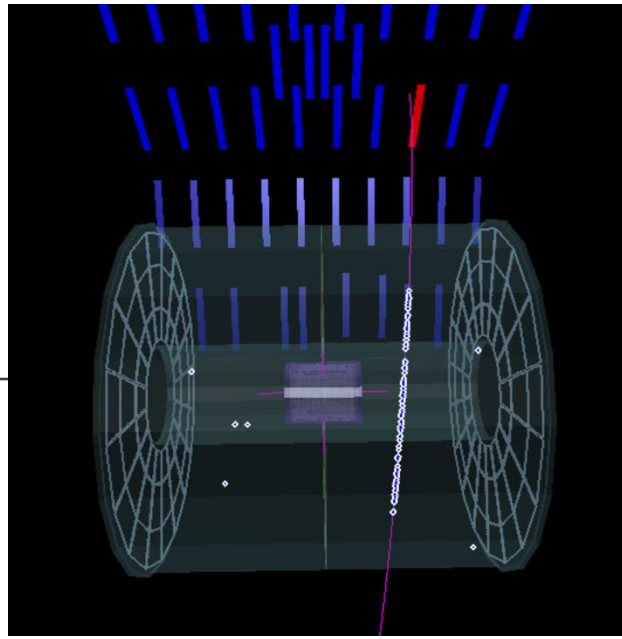
2007, 17 years ago

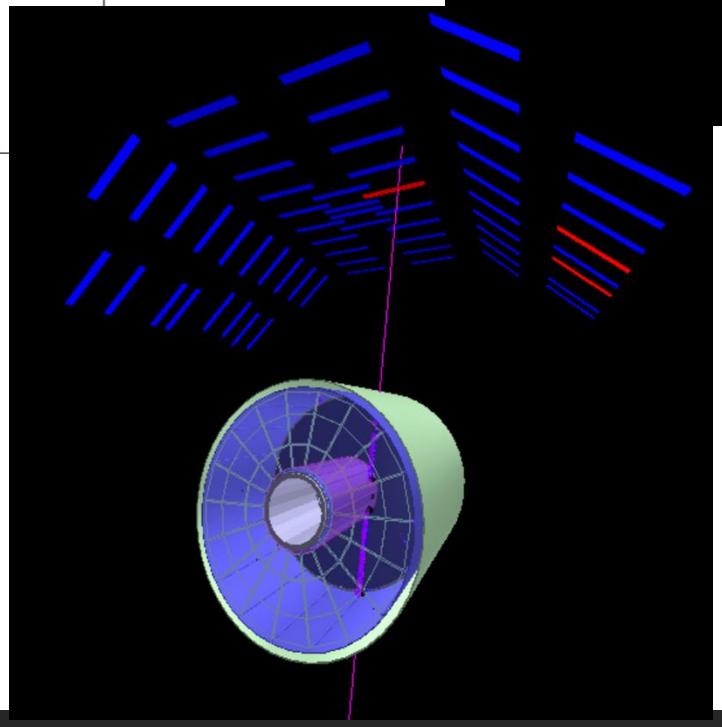
2007, 17 years ago

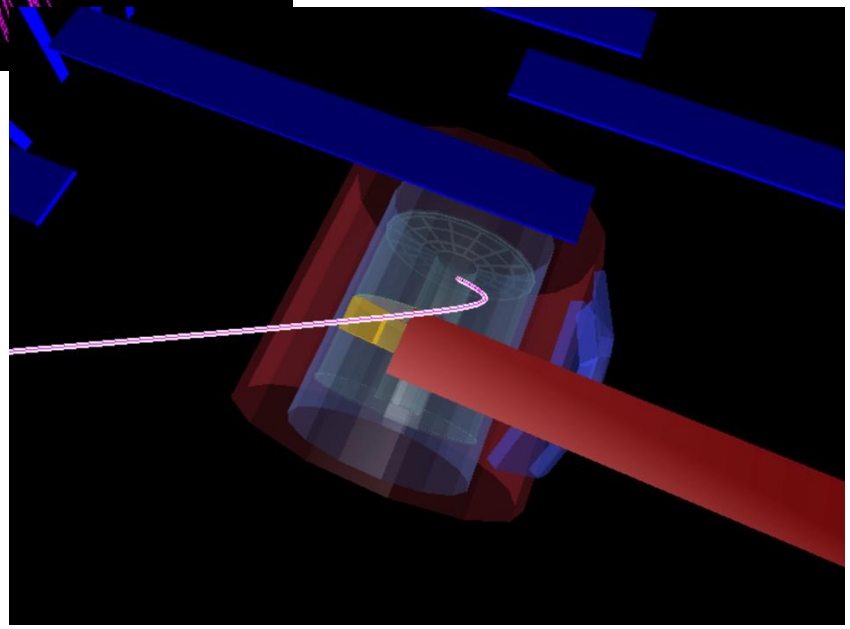


RUN 31843

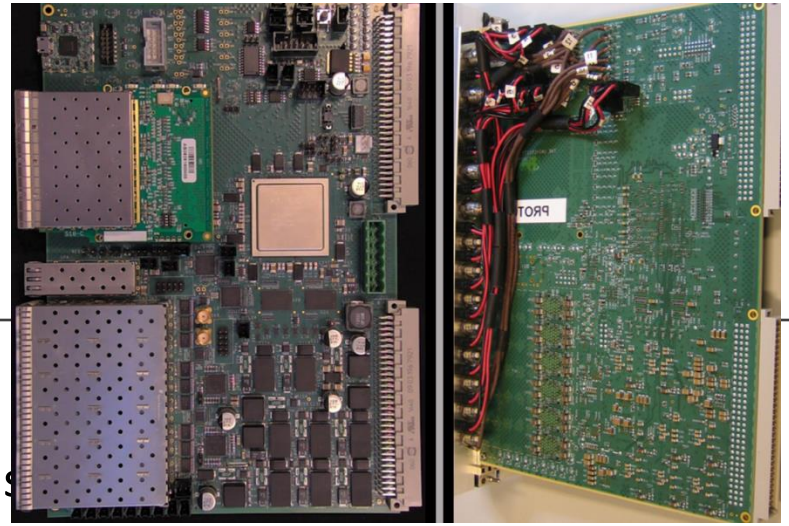


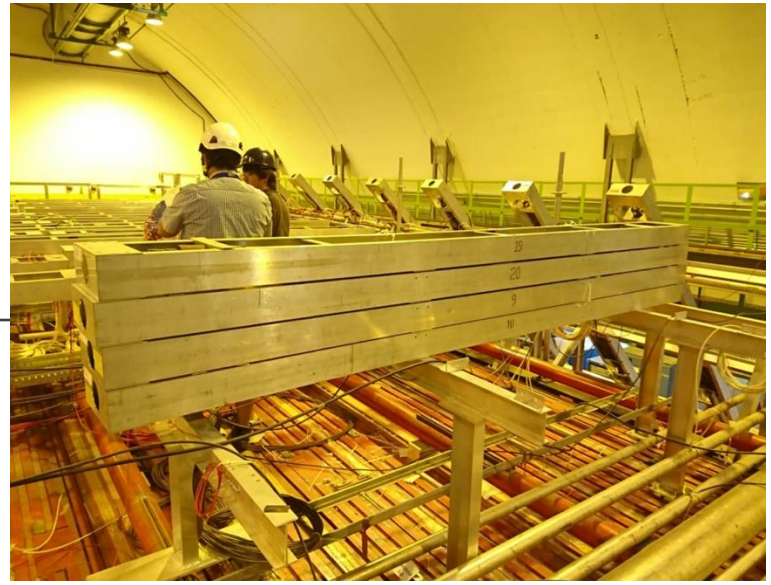






DETECTOR





ACORDE:

- design and construction
- Electronics, DCS and offline
- Online monitoring and data analysis

AD

- construction and installation
- DCS

CTP for Run3

FDD

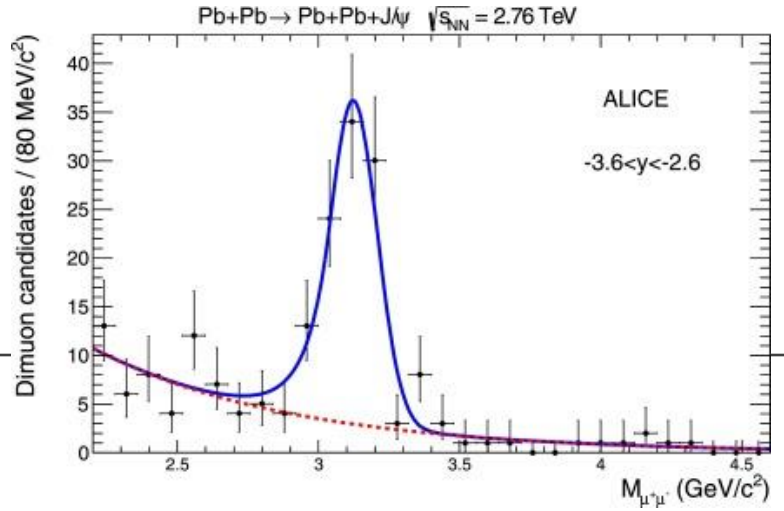
- DCS → in collaboration with Sinaloa

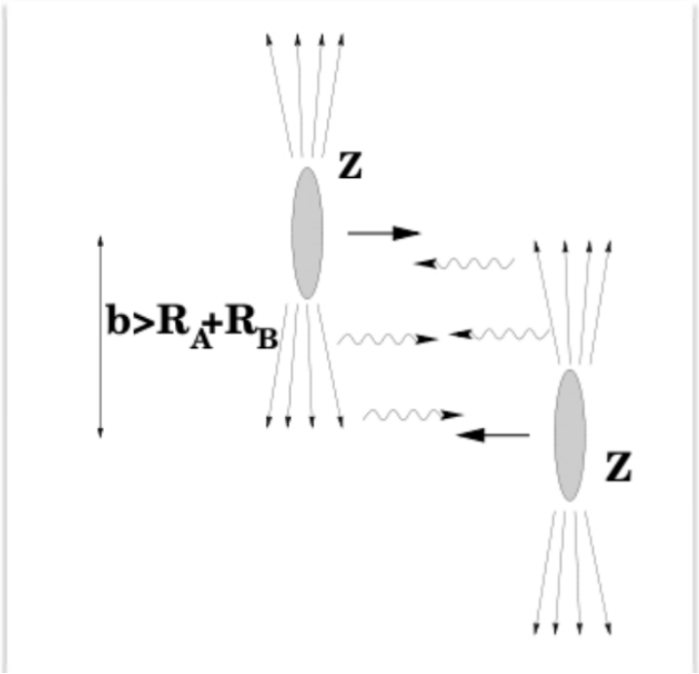
MuonID → see talk by Yael A. Vásquez

ANALYSIS

- PLB 718 (2013) 1273-1283: Coherent J/psi photoproduction in ultra-peripheral Pb-Pb collisions at 2.76 TeV
- Four pions in UPC (Alice Physics Week, Padova 2013): https://indico.cern.ch/event/223720/contributions/1531777/attachments/367263/511183/marioRC_fourpionsUPC_APW_Padova_vf.pdf → Exclusive four pion photoproduction in ultraperipheral Pb-Pb collisions at 5.02 TeV (submitted to PLB, arXiv:2404.07542)
- Anaysis of van der Meer scans taken with pp collisions in 2015 → in collaboration with Sinaloa (https://alice-notes.web.cern.ch/system/files/notes/analysis/494/2017-Aug-11-analysis_note-AN_pp_vdm_2015.pdf)
- JCAP 01 (2016) 032, Study of cosmic ray events with high muon multiplicity using the ALICE detector at the CERN Large Hadron Collider
- Multimuons in cosmic-ray events as seen in ALICE at the LHC (2024) → submitted to JCAP, arXiv:2410.17771
- Angular correlation in UPC → see Josué Martínez talk

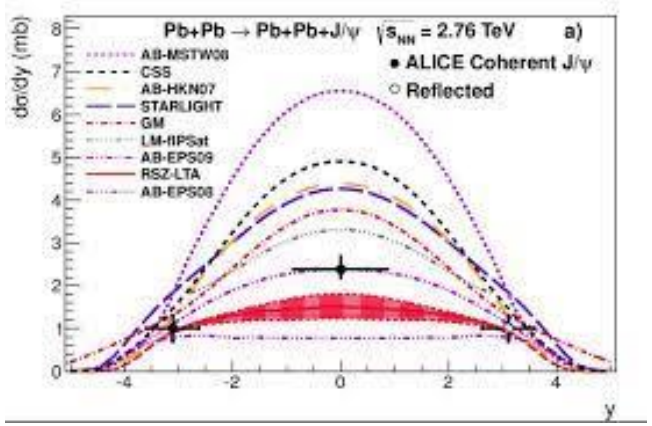
ANALYSIS



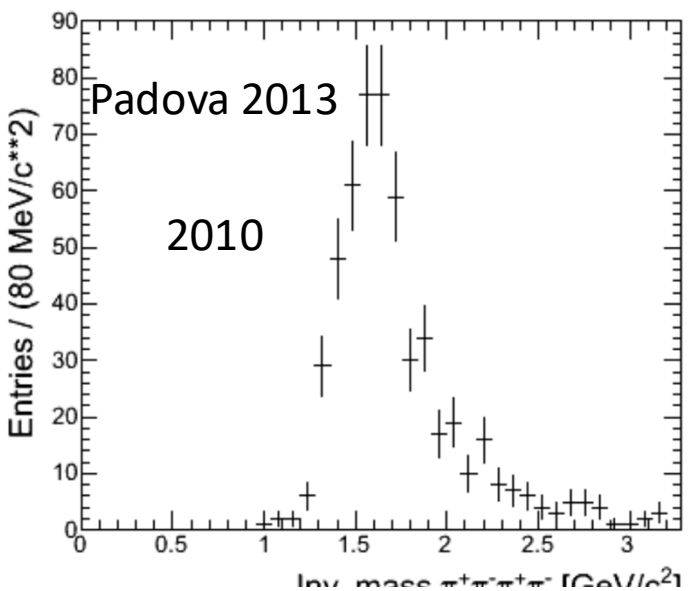


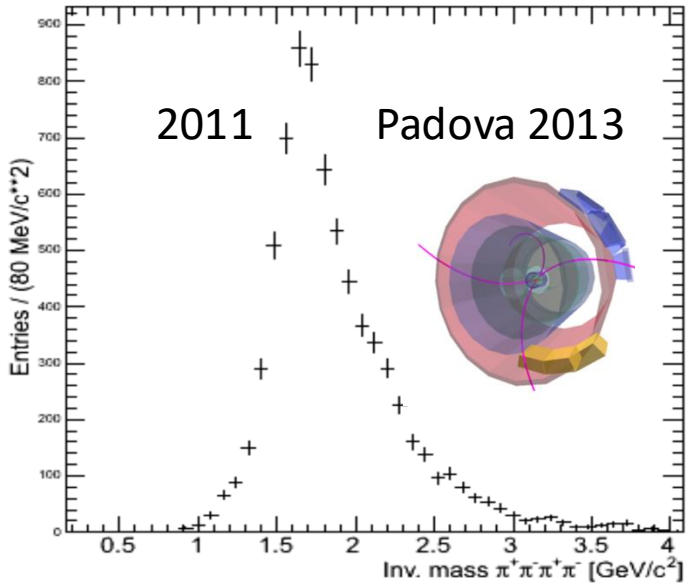
- The photo production of vector mesons can be studied in ultra peripheral collisions (UPC) at LHC.
- UPC occurs if b > R_A+R_B —> the photons and nuclei can interact in several ways.
- Hadronic interactions are suppressed: only interactions mediated by the strong electromagnetic field behaving as a flux of virtual photons possible.
- LHC is used as a photon collider.

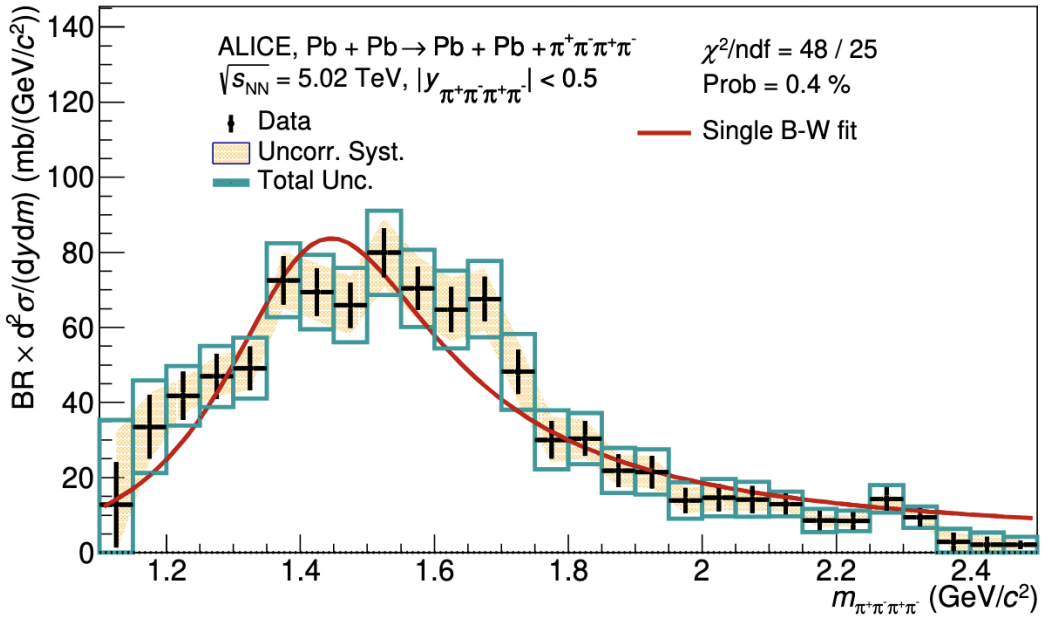
- Coherent process: photon interacts with the entire ion (all nucleons). In most of the cases there are not neutron emission (80%)
- Incoherent process: the photon interacts with single nucleon (most of the times the target nucleus dissociates)

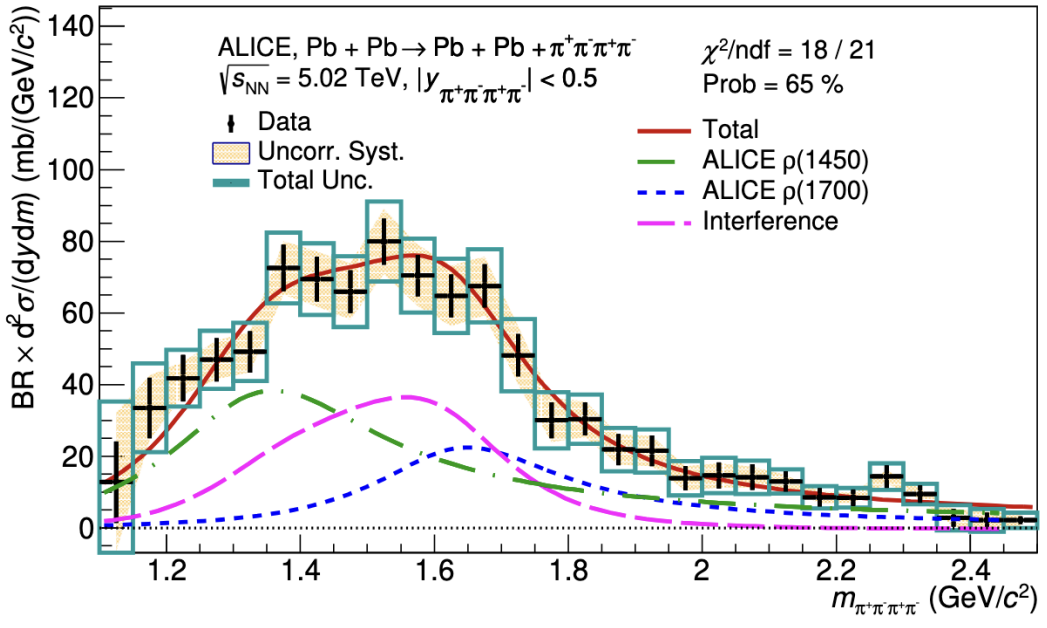


ANALYSIS


Padova 2013
2010
Entries / (80 MeV/c**2)


2011
Padova 2013
Entries / (80 MeV/c**2)
Inv. mass π⁺π⁻π⁺π⁻ [GeV/c²]


ALICE, Pb + Pb → Pb + Pb + π⁺π⁻π⁺π⁻
√sNN = 5.02 TeV, |yπ⁺π⁻π⁺π⁻| < 0.5
χ²/ndf = 48 / 25
Prob = 0.4 %
Data
Uncorr. Syst.
Total Unc.
Single B-W fit
BR × d²σ/(dydm) (mb/(GeV/c²))
mπ⁺π⁻π⁺π⁻ (GeV/c²)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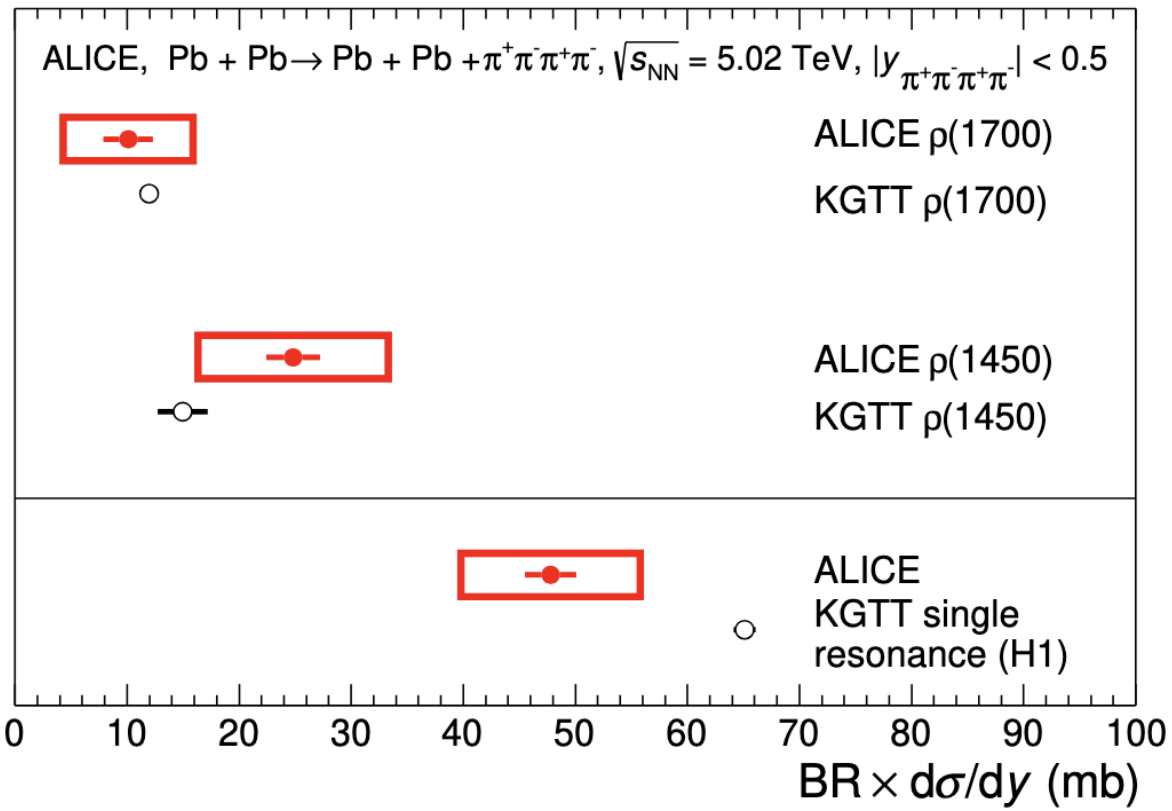
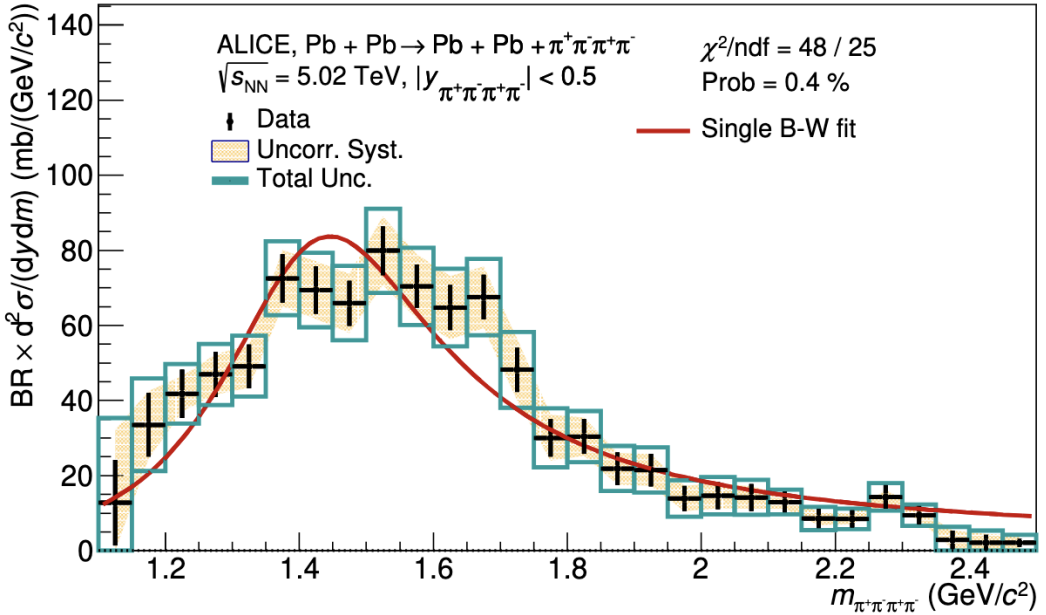
√sNN = 5.02 TeV, |yπ⁺π⁻π⁺π⁻| < 0.5
χ²/ndf = 18 / 21
Prob = 65 %
Data
Uncorr. Syst.
Total Unc.
Total
ALICE ρ(1450)
ALICE ρ(1700)
Interference
BR × d²σ/(dydm) (mb/(GeV/c²))
mπ⁺π⁻π⁺π⁻ (GeV/c²)

ANALYSIS


ALICE, Pb + Pb → Pb + Pb + π⁺π⁻π⁺π⁻, √sNN = 5.02 TeV, |yπ⁺π⁻π⁺π⁻| < 0.5
ALICE ρ(1700)
KGTT ρ(1700)
ALICE ρ(1450)
KGTT ρ(1450)
ALICE
KGTT single resonance (H1)
0 10 20 30 40 50 60 70 80 90 100
BR × dσ/dy (mb)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Uncorr. Syst.
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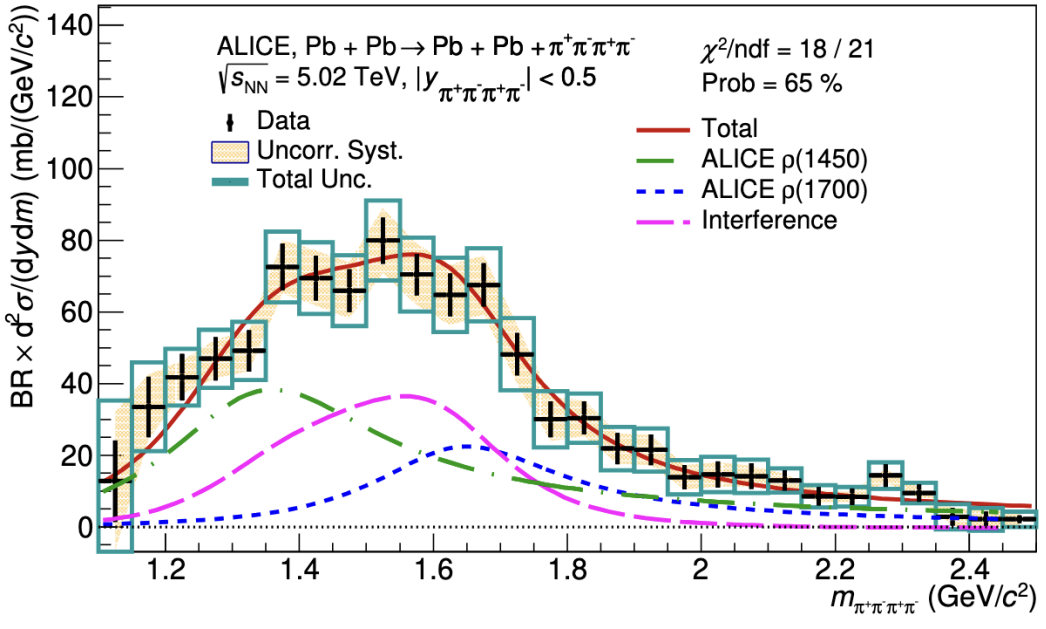
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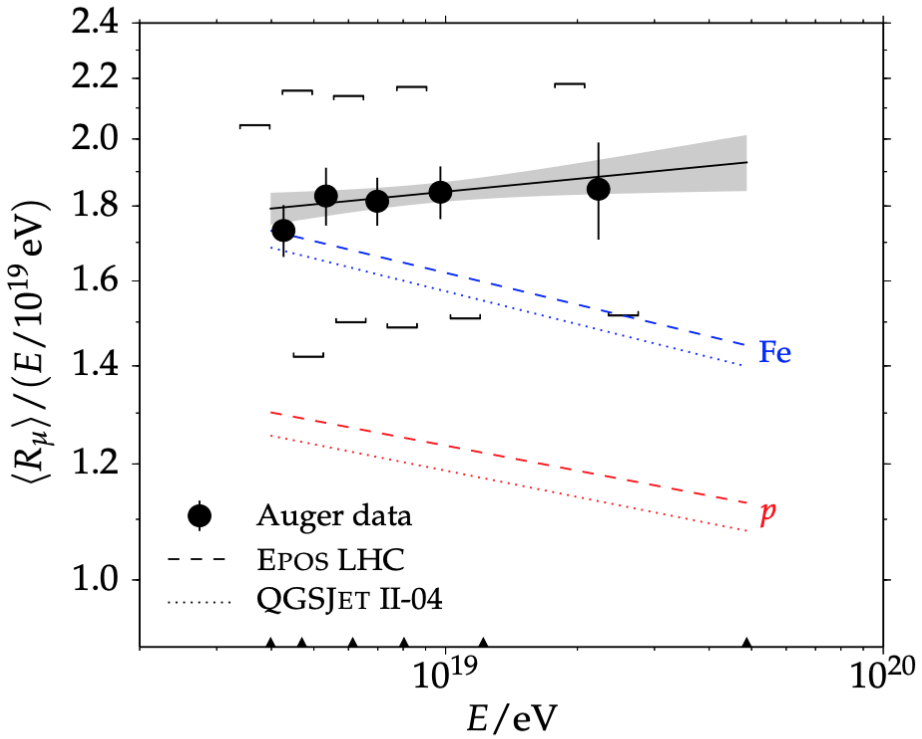
Data
Uncorr. Syst.
Total Unc.
Total
ALICE ρ(1450)
ALICE ρ(1700)
Interference
BR × d²σ/(dydm) (mb/(GeV/c²))
mπ⁺π⁻π⁺π⁻ (GeV/c²)

Why to study Cosmic rays (CR) with ALICE?

- One of the main observables that can be useful to understand the characteristics of the primary cosmic ray is the number of muons produced along the EAS.

Phys. Rev. D 91, 032003 (2015)



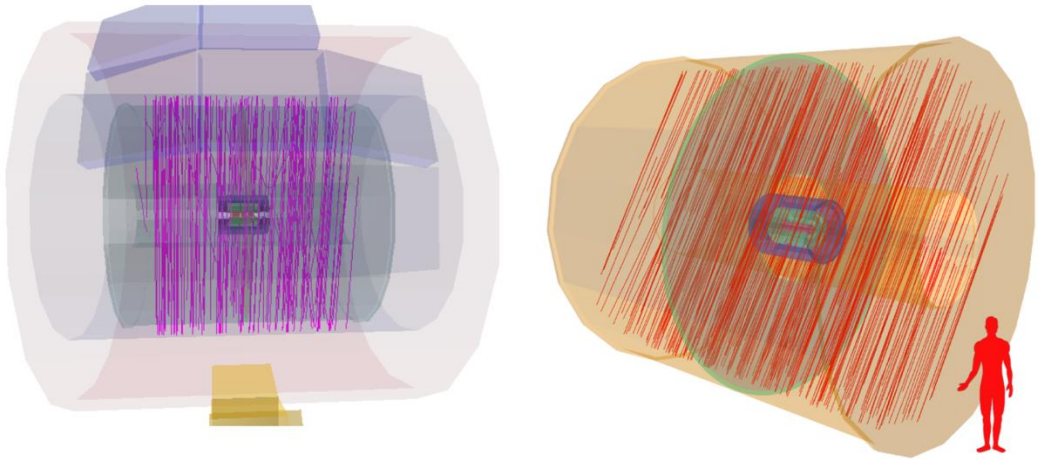
- Several studies on the muon component of EAS have been carried out with experimental arrangements on the surface.
- For example, the Pierre Auger observatory reported an excess of the muon content for inclined events (Phys. Rev. D 91, 032003 (2015)).
- This result motivated theoretical works: deconfined thermal balls (Phys. Rev. D 95, 063005 (2017)), string percolation (arXiv 209.6474), reduction of the energy transfer from the hadronic to the electromagnetic components of the EAS (PoS(ICRC2013)1182), enhancement of multi-strange hadrons (Phys. Lett. B 810 (2020) 135837)

ANALYSIS

Why to study Cosmic rays (CR) with ALICE?

- One of the main observables that can be useful to understand the characteristics of the primary cosmic ray is the number of muons produced along the EAS.

- In 30.8 days (Run 1 data), ALICE collected 5 events with more than 100 muons.
- In ALICE's cosmic paper, we reported that the frequency of such kind of events can be reproduced with the QGSJET II-04 hadronic interaction model (tuned with LHC data).
- These events are originated due to EAS from primary cosmic rays whose composition is dominated by a heavy component (Fe) with energies larger than 10^{16} eV.
- The core of the EAS is located very close from the ALICE at LHC with a zenith angles less than 50 degrees.
- This result may put significant constraints on alternative, more exotic, production mechanisms (e.g. QGP in cosmic ray showers Astropart.Phys.17:355-365,2002).



ANALYSIS

Why to study Cosmic rays (CR) with ALICE?

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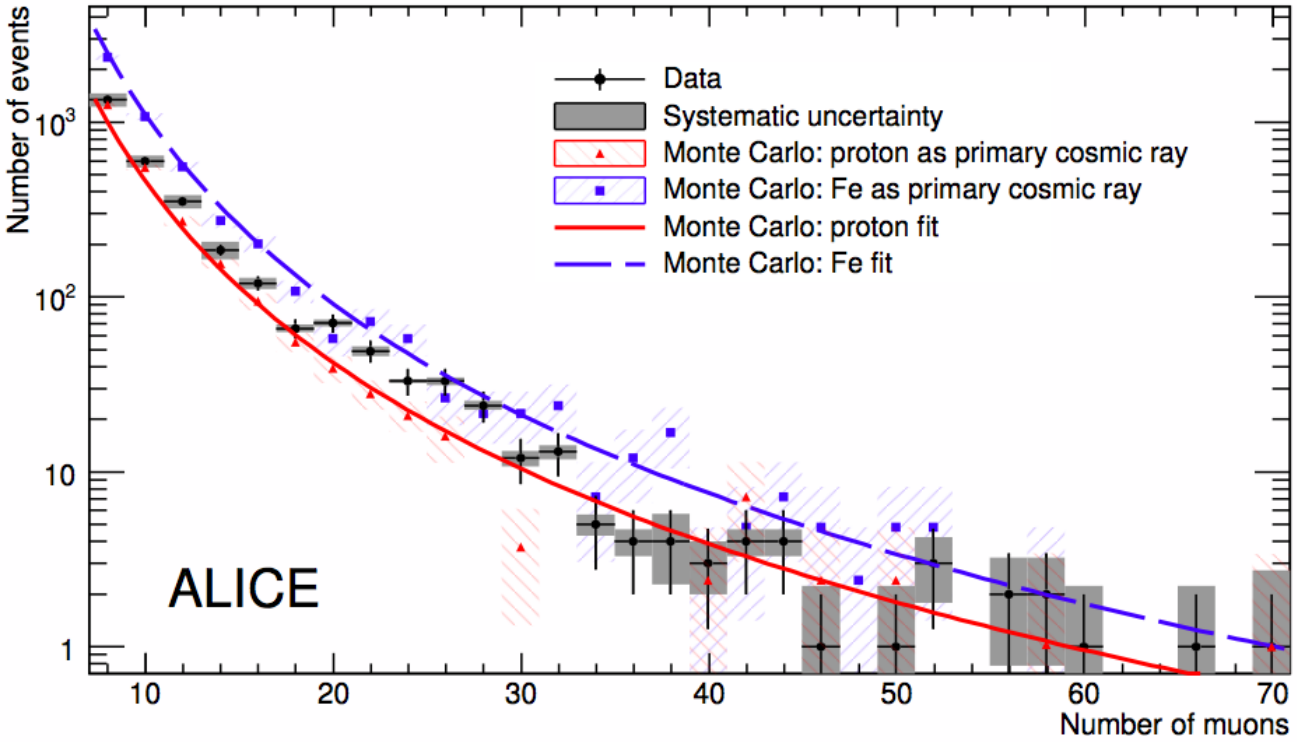
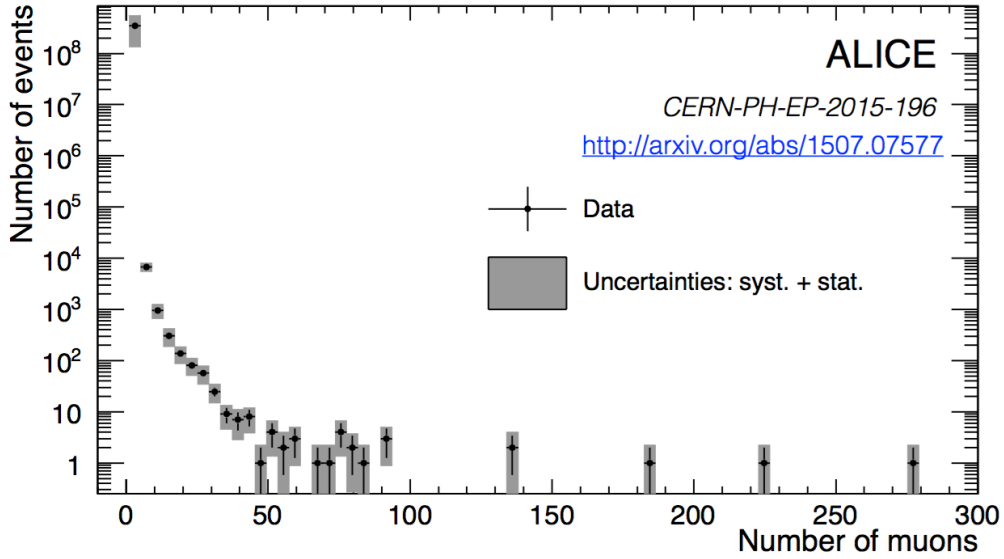


ALICE results on Cosmic Ray Physics



We find a smooth distribution up to #μ < 70 and 5 events with more than 100 atmospheric muons (HMM)

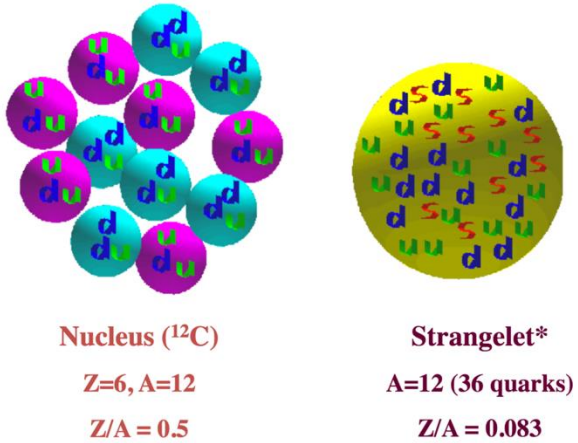
ANALYSIS

The ALICE results on high muon multiplicity events motivated some

theoretical work:

Strange quark matter

Roughly equal numbers of u, d, s quarks in a single 'bag' of cold hadronic matter.

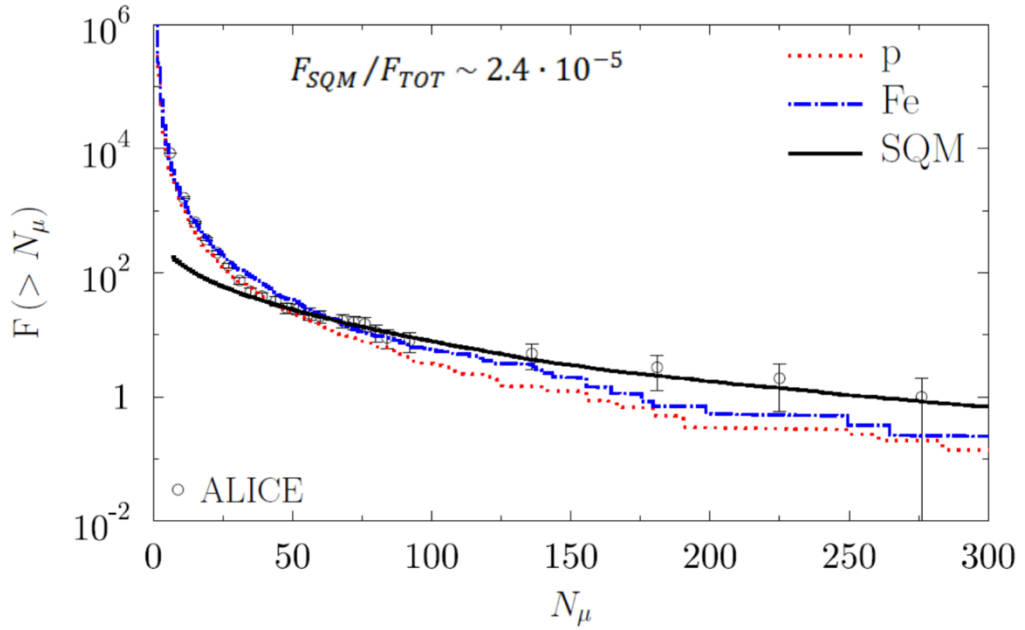


Nucleus (^{12}C)
Z=6, A=12
Z/A = 0.5

Strangelet*
A=12 (36 quarks)
Z/A = 0.083

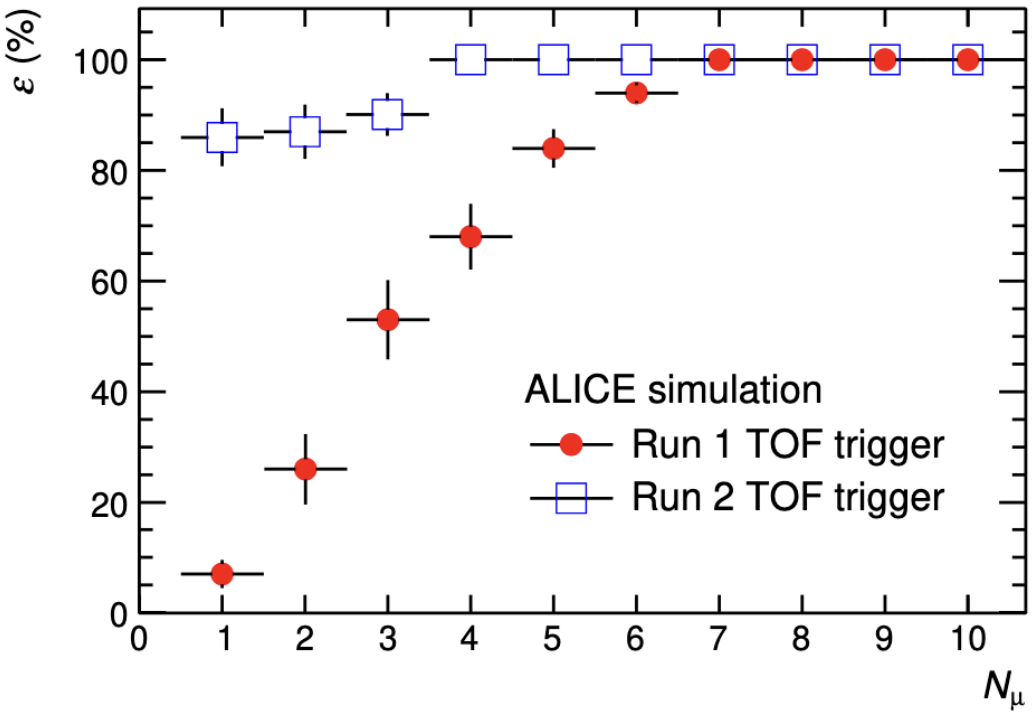
*small lump of Strange Quark Matter

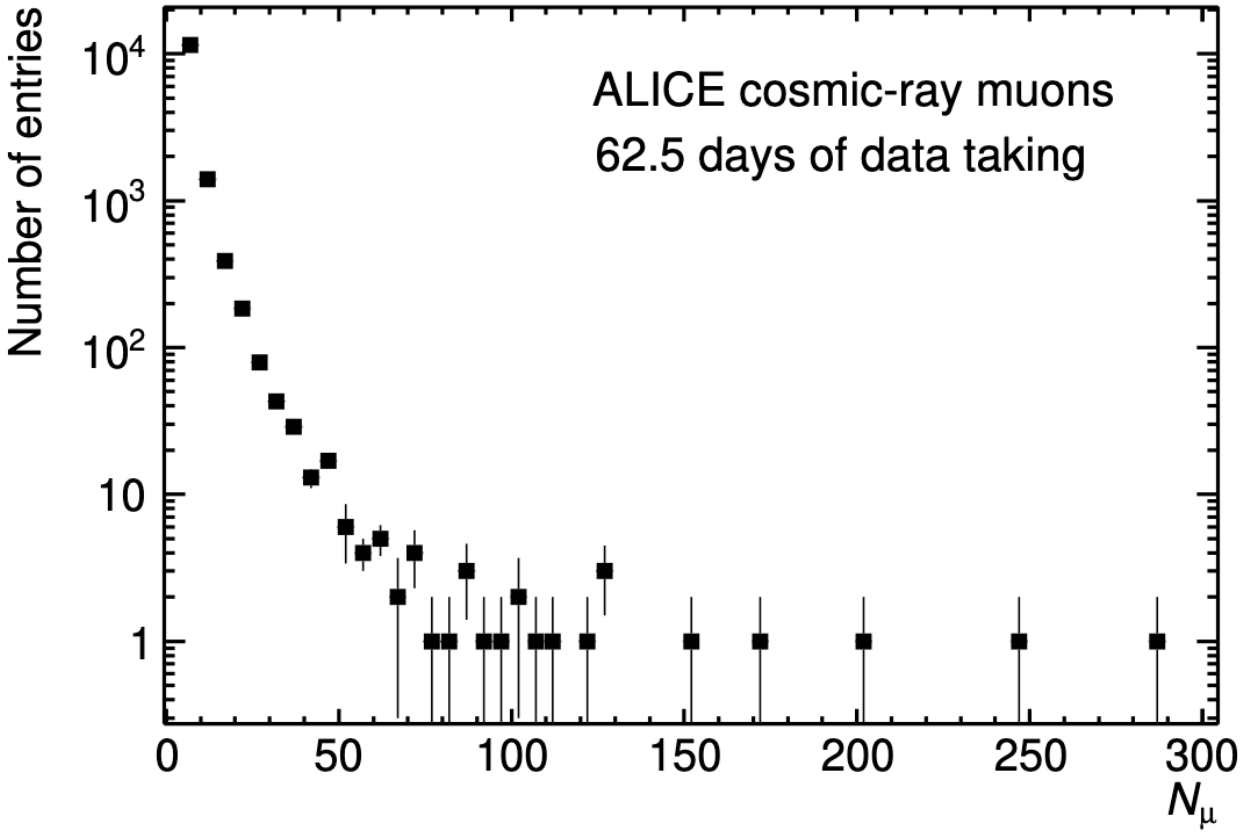
High multiplicity muon bundles from strange quark matter

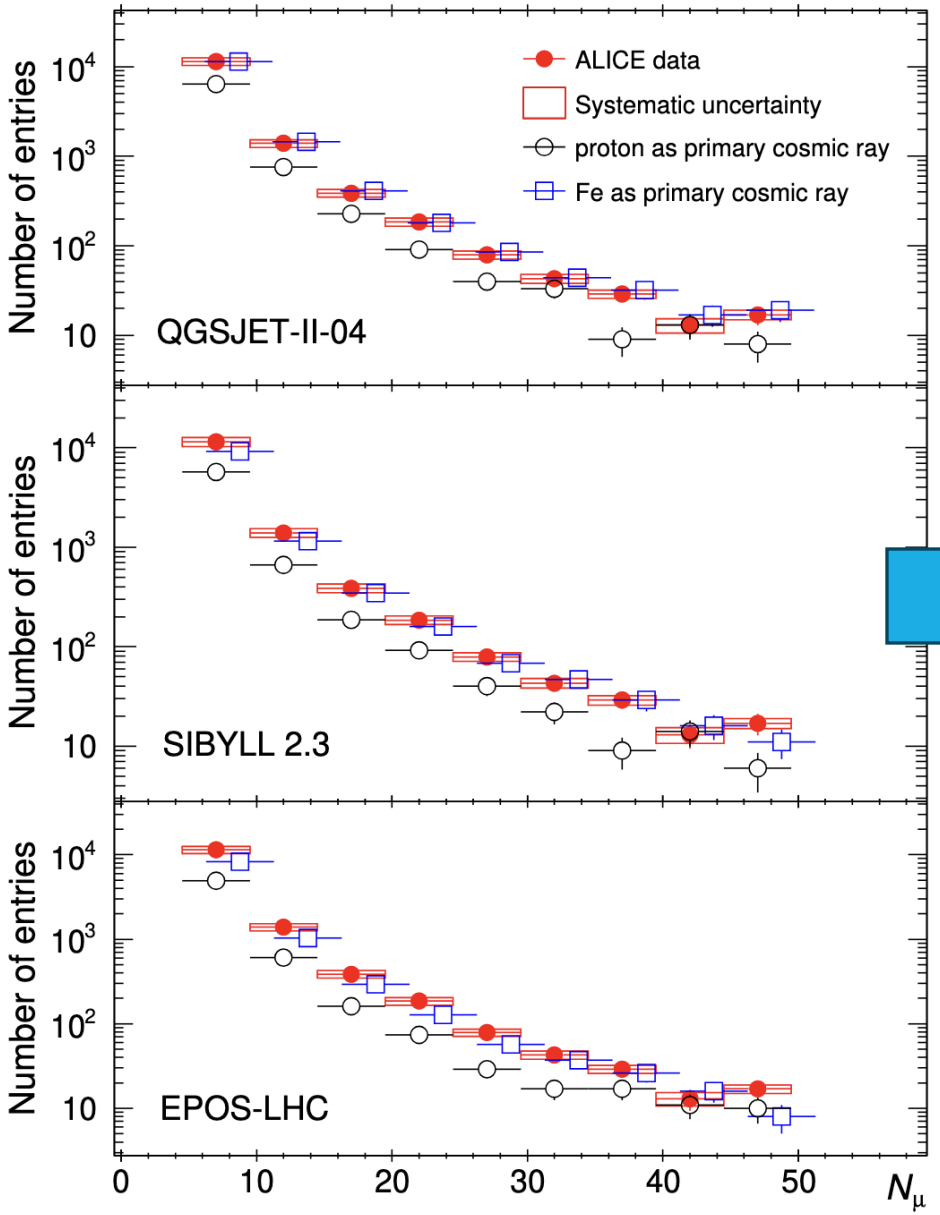


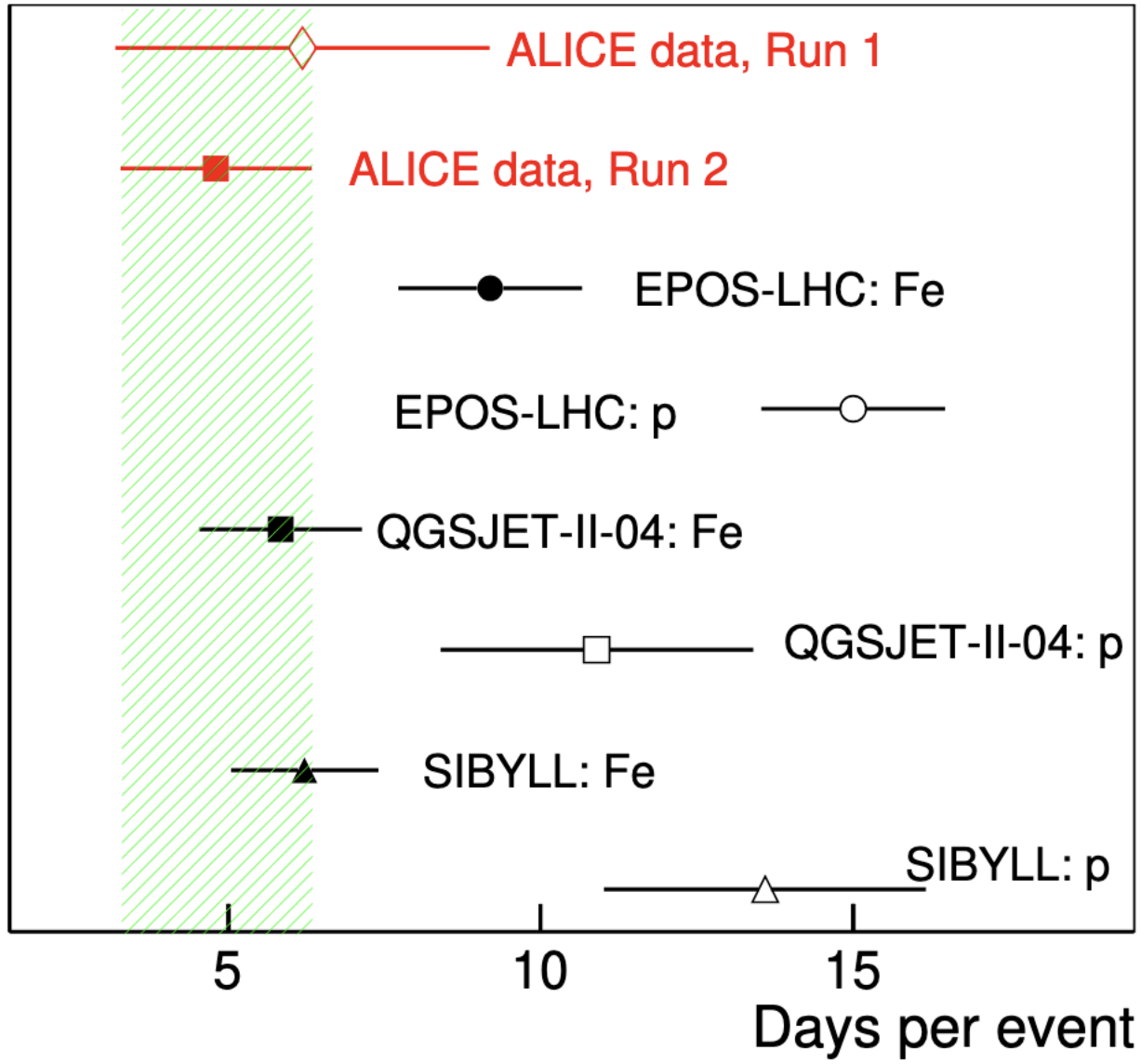
Integral multiplicity distribution of muons for the ALICE data (circles) published in JCAP 01 (2016) 032. Monte Carlo simulations for primary protons (dotted line); iron nuclei (dashed dot line) and primary strangelets with mass A taken from the $A^{-7.5}$ distribution (full line) with abundance of the order of $2 \cdot 10^{-5}$ of the total primary flux.

ANALYSIS


ε (%)
100
80
60
40
20
0
0
1
2
3
4
5
6
7
8
9
10
N_μ
ALICE simulation
Run 1 TOF trigger
Run 2 TOF trigger


Number of entries
10^4
10^3
10^2
10
1
0
50
100
150
200
250
300
N_μ
ALICE cosmic-ray muons
62.5 days of data taking


ALICE data
Systematic uncertainty
proton as primary cosmic ray
Fe as primary cosmic ray
Number of entries
QGSJET-II-04
SIBYLL 2.3
EPOS-LHC
N_μ


ALICE data, Run 1
ALICE data, Run 2
EPOS-LHC: Fe
EPOS-LHC: p
QGSJET-II-04: Fe
QGSJET-II-04: p
SIBYLL: Fe
SIBYLL: p
Days per event

ANALYSIS

One CMS group is interested in exgtending this study with a synched cosmic data taking campaign

GK **Georgios Krintiras** 6 de noviembre de 2024, 4:06 a.m.

Synched ALICE-CMS cosmic data-taking campaign?

Para: Joakim Nystrand, Roman Lavicka, mario.rodriguez@correo.buap.mx, alessand@to.infn.it, Cc: Daniel Tapia Takaki, Andrea Giammanco Detalles

No suele recibir correo electrónico de georgios.krintiras@cern.ch. Por qué es esto importante

Dear conveners,

congratulations for your recent followup result with HMM cosmic events.

We were wondering whether there would be any interest from ALICE side to setup a synched cosmic data-taking campaign with CMS?

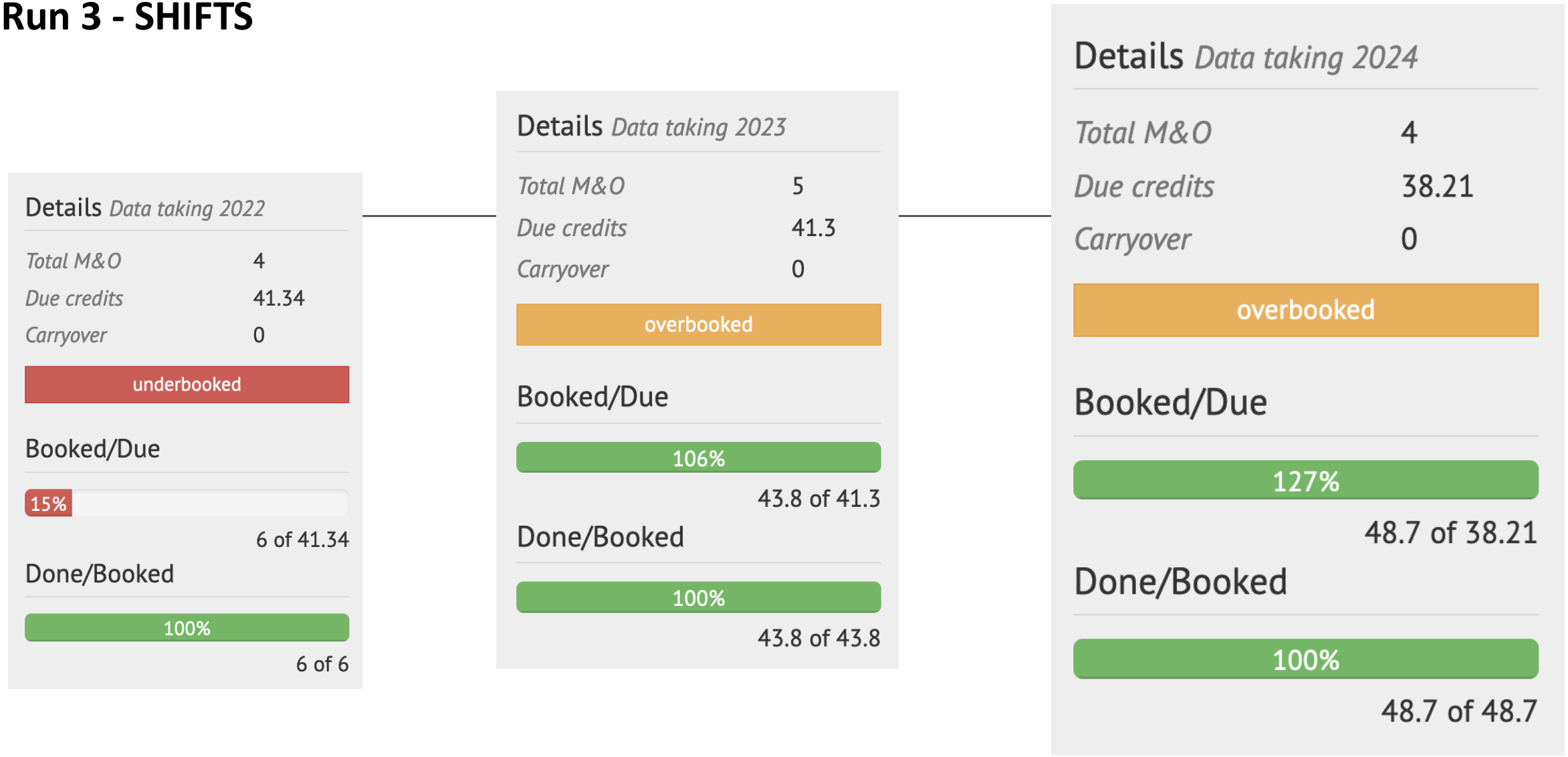
It would be a nice extension since LEP times, but not sure what steps would entail from our collaborations. But certainly it's an interesting idea we could pursuit at least.

We could setup a chat if you're available and think as a nice initiative too.

Regards and thanks all,

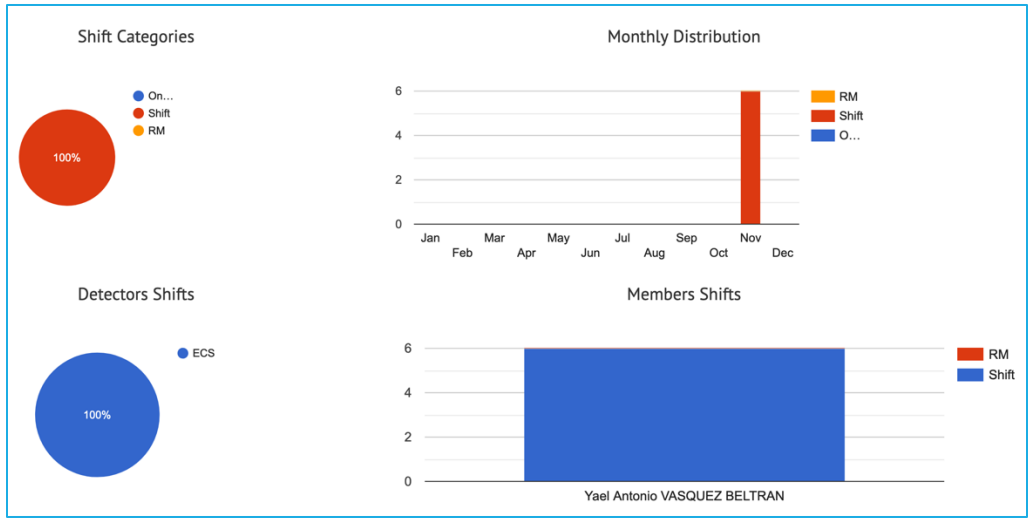
Andrea and Georgios

Run 3 - SHIFTS

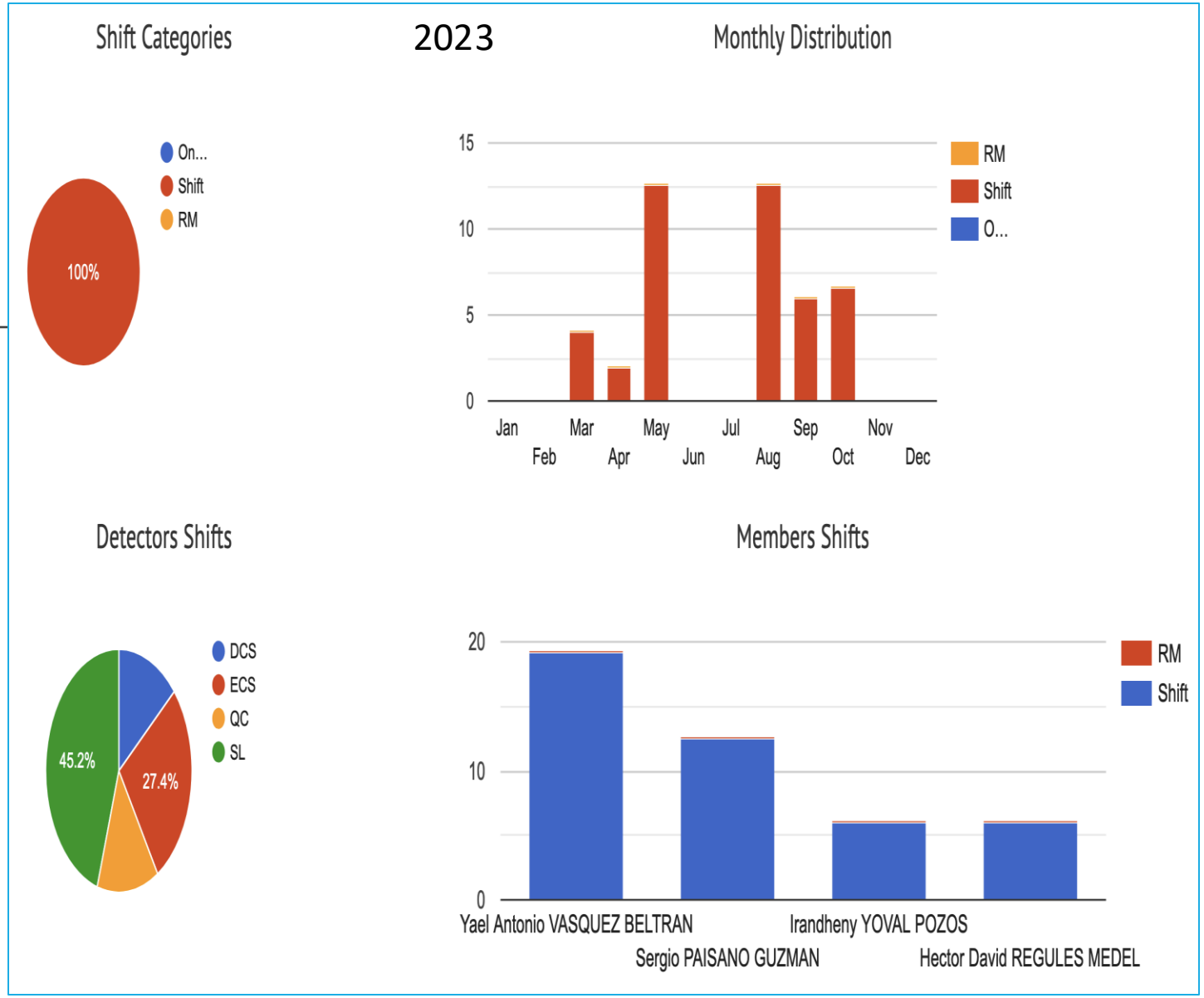

Details Data taking 2022
Total M&O 4
Due credits 41.34
Carryover 0
underbooked
Booked/Due
15%
6 of 41.34
Done/Booked
100%
6 of 6
Details Data taking 2023
Total M&O 5
Due credits 41.3
Carryover 0
overbooked
Booked/Due
106%
43.8 of 41.3
Done/Booked
100%
43.8 of 43.8
Details Data taking 2024
Total M&O 4
Due credits 38.21
Carryover 0
overbooked
Booked/Due
127%
48.7 of 38.21
Done/Booked
100%
48.7 of 48.7

Run 3 - SHIFTS

2022

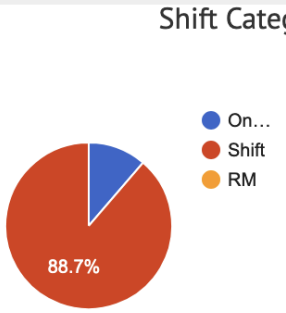


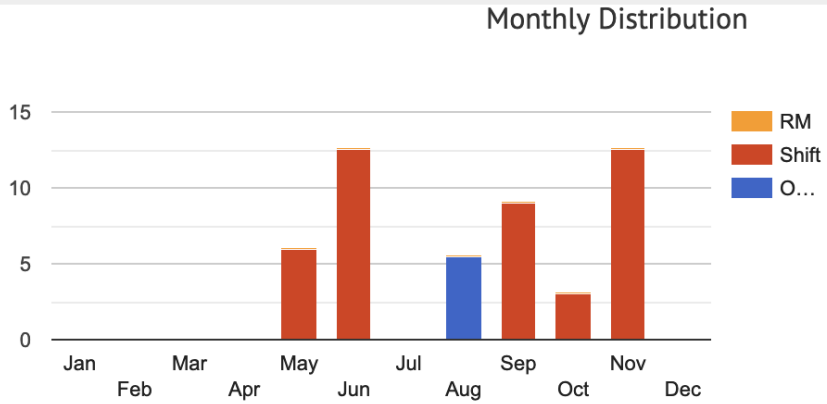
2023

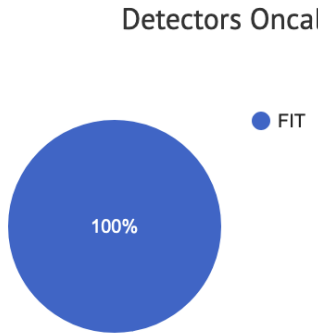


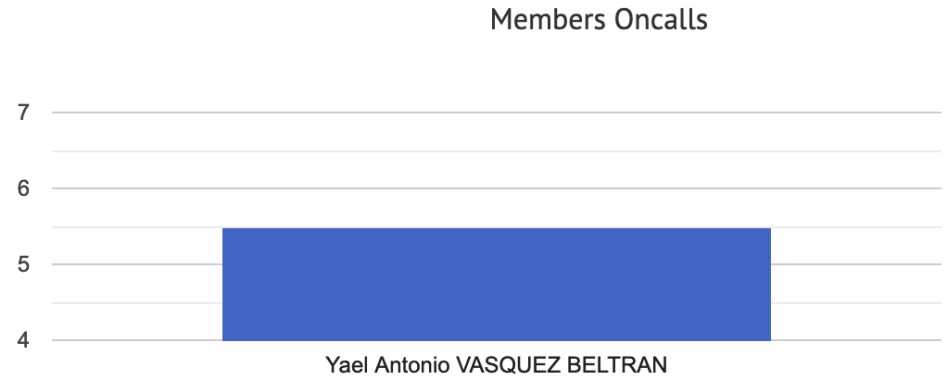
Run 3 - SHIFTS

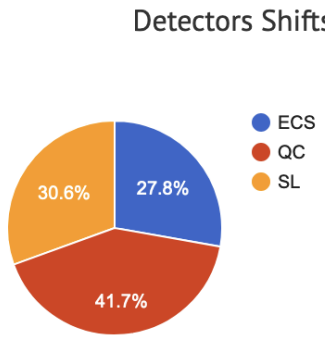
2024

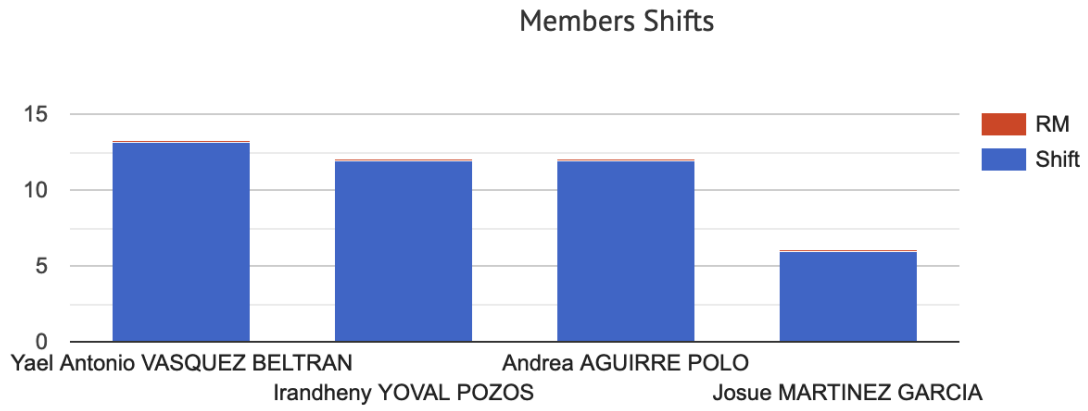




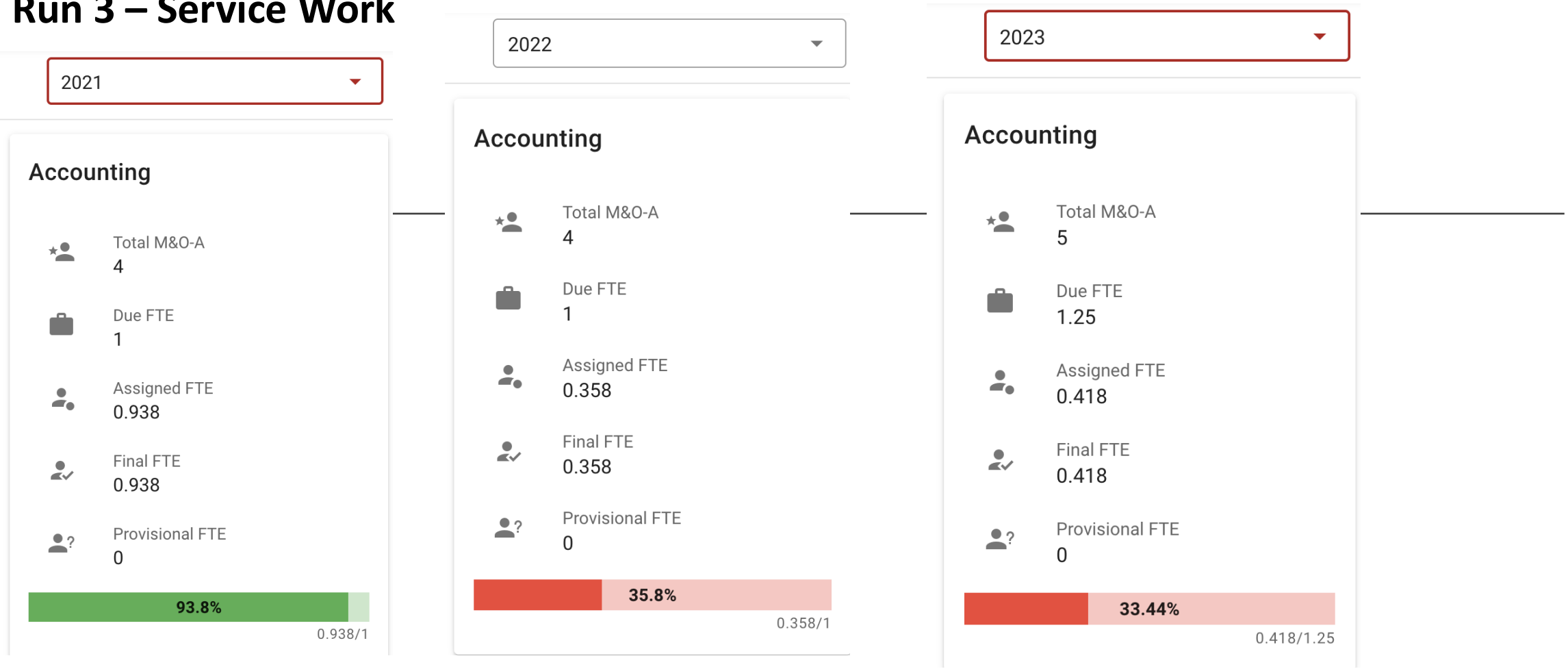








Run 3 – Service Work

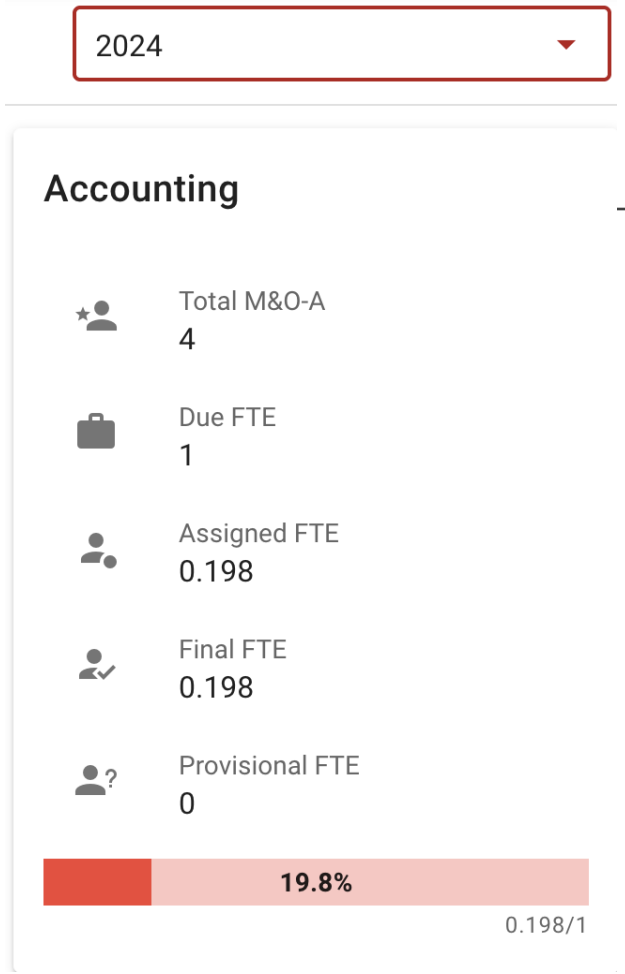


Arturo Fernandez
Mario Iván Martínez
Mario Rodríguez

Saúl Anibal Rodríguez (PhD student)
Sergio Paisano (PhD student)
Mario Rodríguez

Sergio Paisano (PhD student)
Mario Rodríguez

Run 3 – Service Work



Irandheny Yoval (PhD student)
Mario Rodríguez

Other two PhD students are contributing with the SW in 2024. The accounting will be updated at the end of the year.

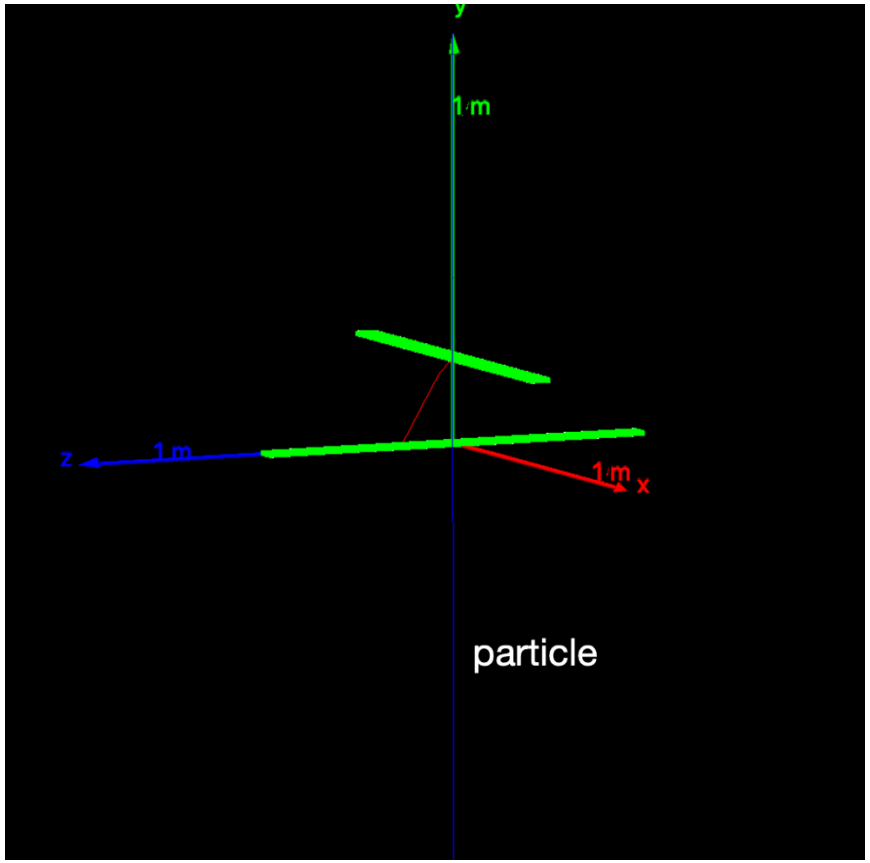
- Yael A. Vasquez Beltrán (FDD)
- Josué Martínez García (luminosity)

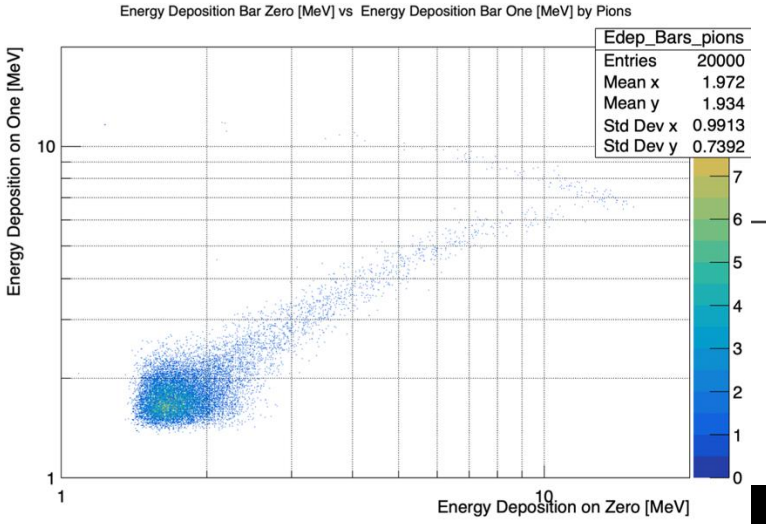
For 2025, first/second year PhD students are joining to SW efforts:

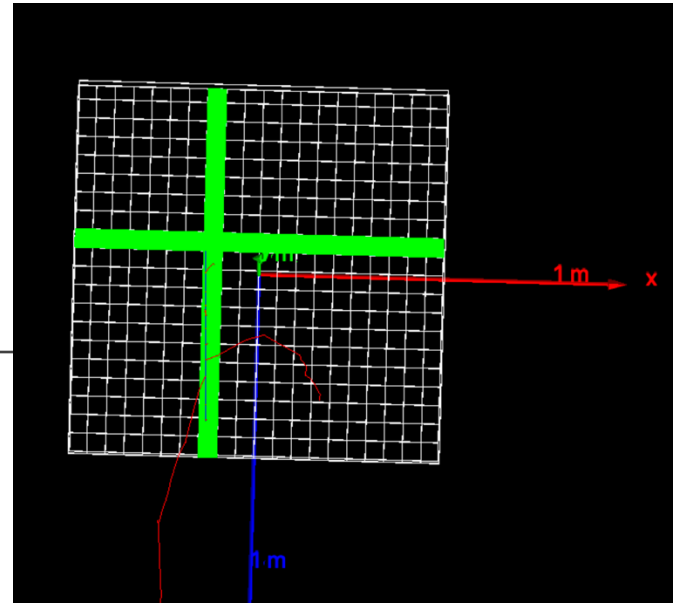
- Diana Rosales Herrera
- César Ramirez Álvarez
- David Régules
- Andrea Aguirre
- Mario Armando Talamantes

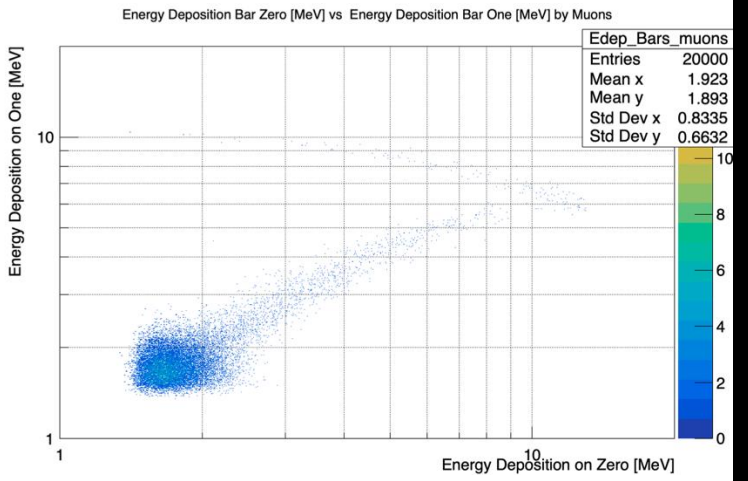
Run 3 – and beyond

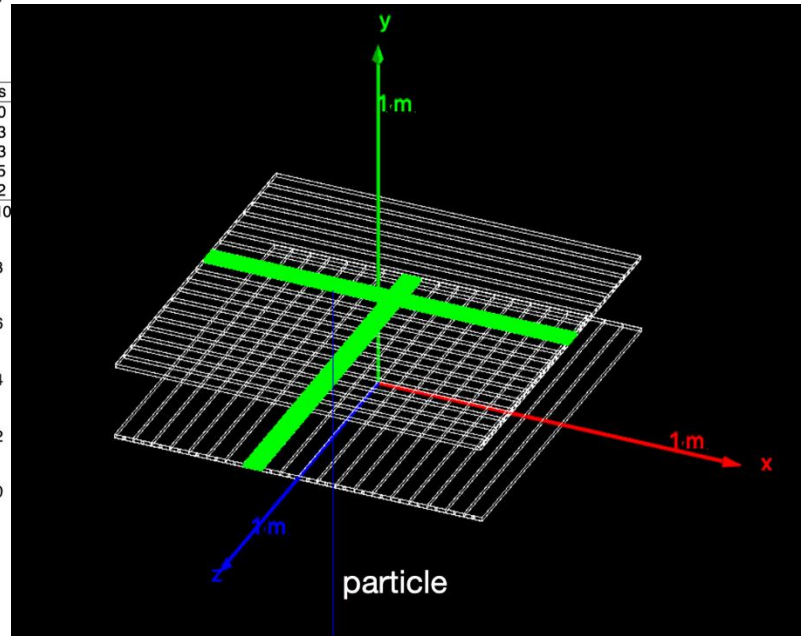
Plastic scintillator bars for MuonID simulation in Geant4









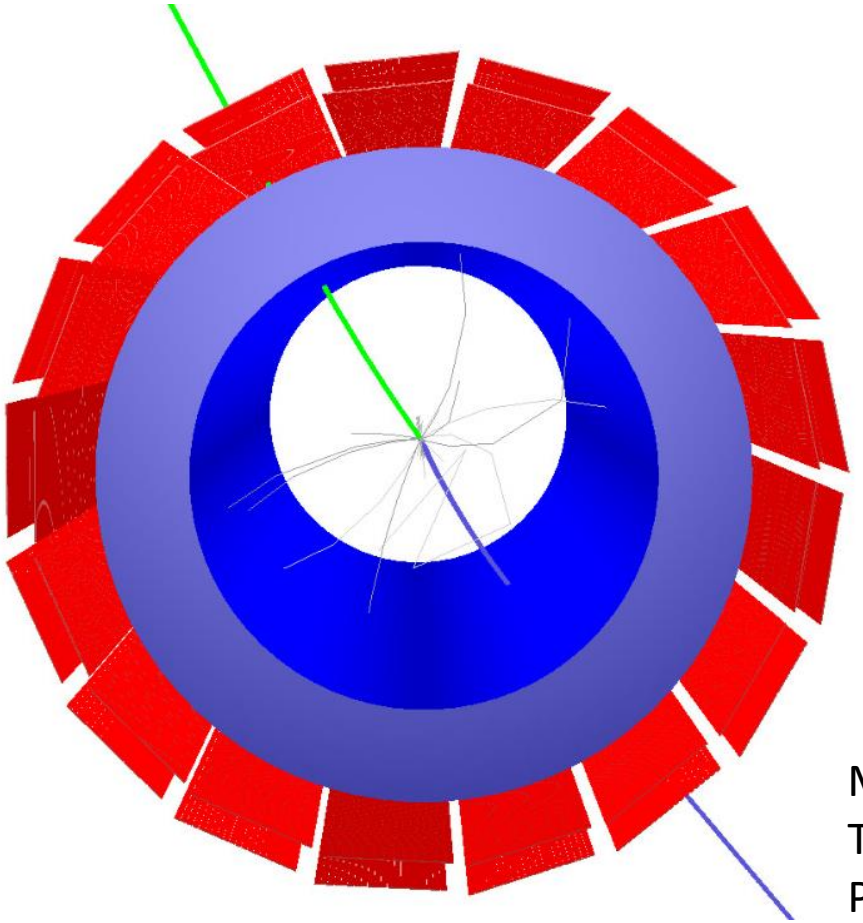


Leonardo Fernández,
Master student

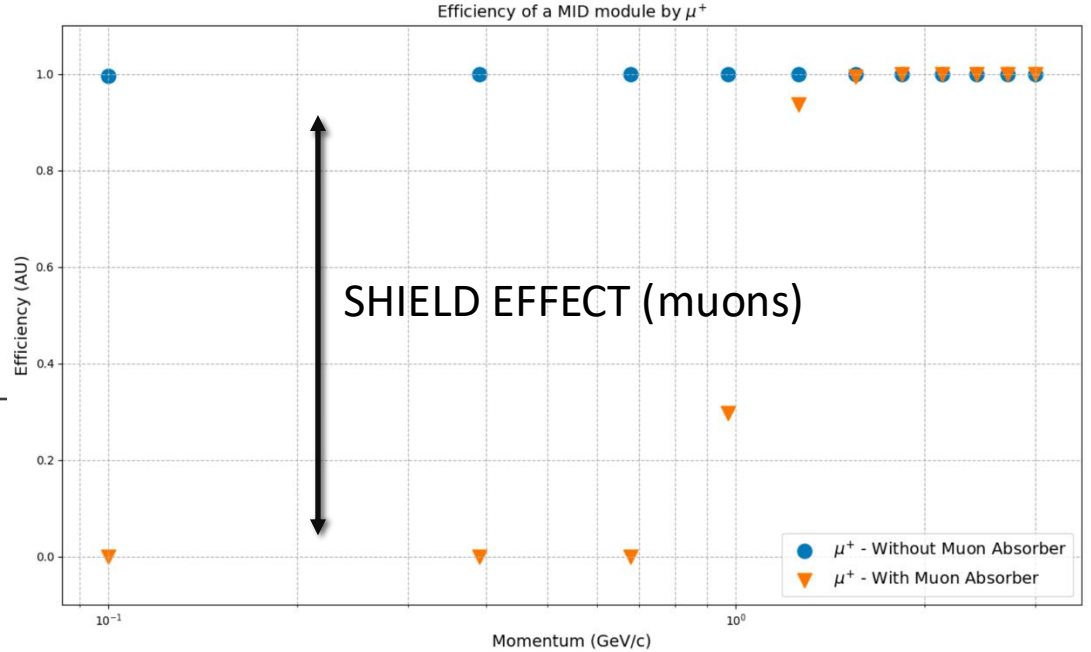
Simulated p+p event at 13 teV

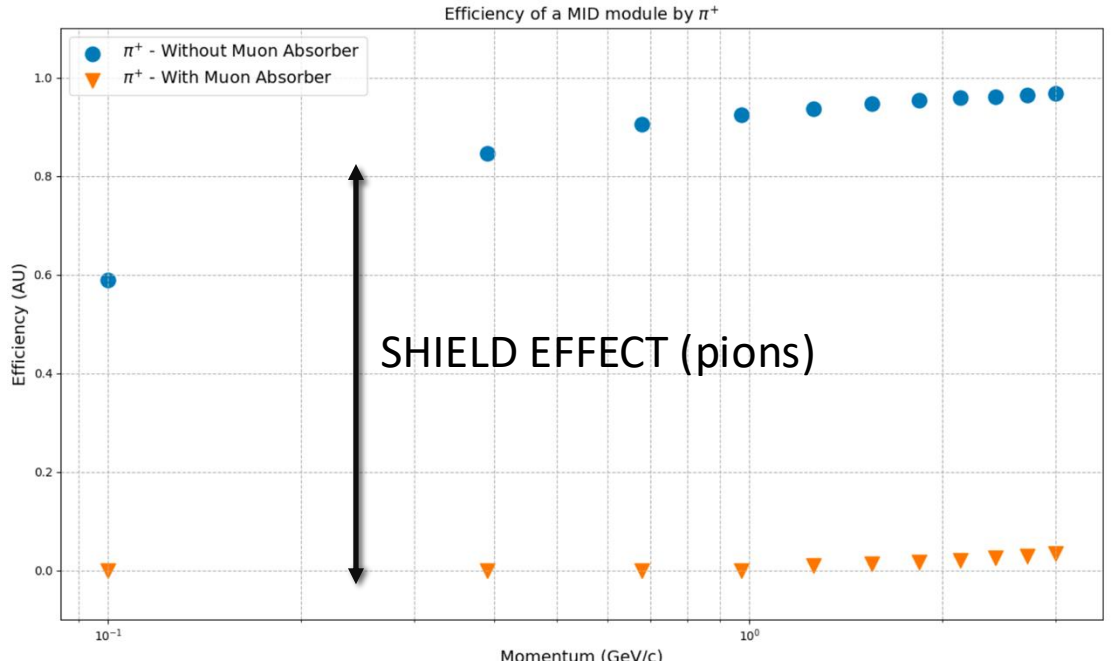
Run 3 – and beyond

MuonID simulation project implemented in FairRoot → next step is to migrate it to O2



Simulated p+p event at 13 teV





Mario Armando Talamantes Johnson, PhD student

Run 3 – and beyond

How is affected the Muon Multiplicity distribution assuming QGP like events in Extensive Air Showers?

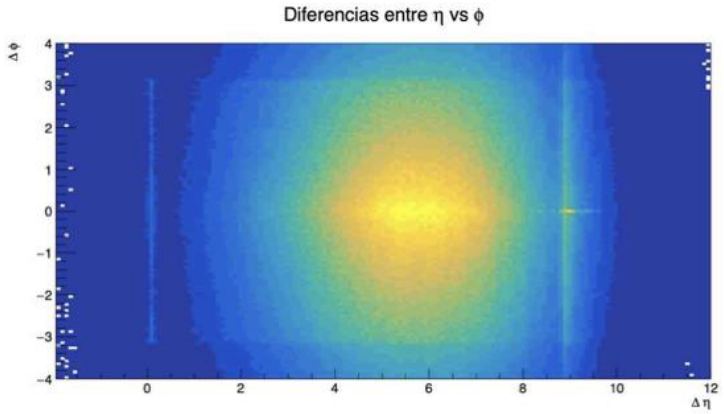


Figure 2. EPOS-LHC Fusion ON

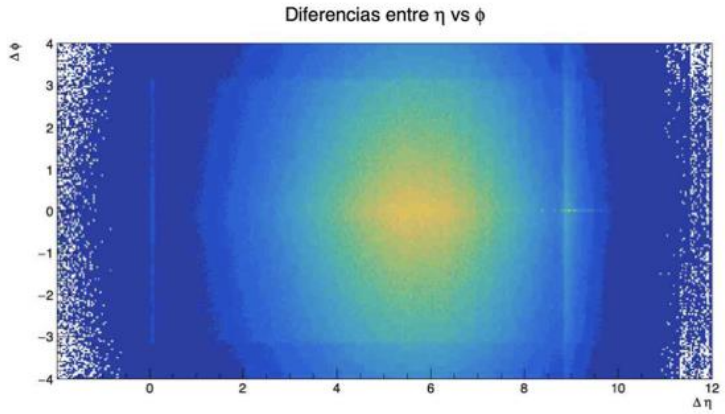


Figure 3. EPOS-LHC Fusion OFF

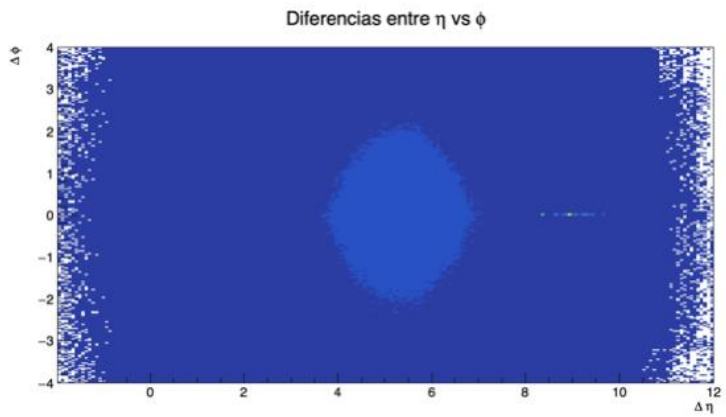


Figure 4. QGSJETII-04

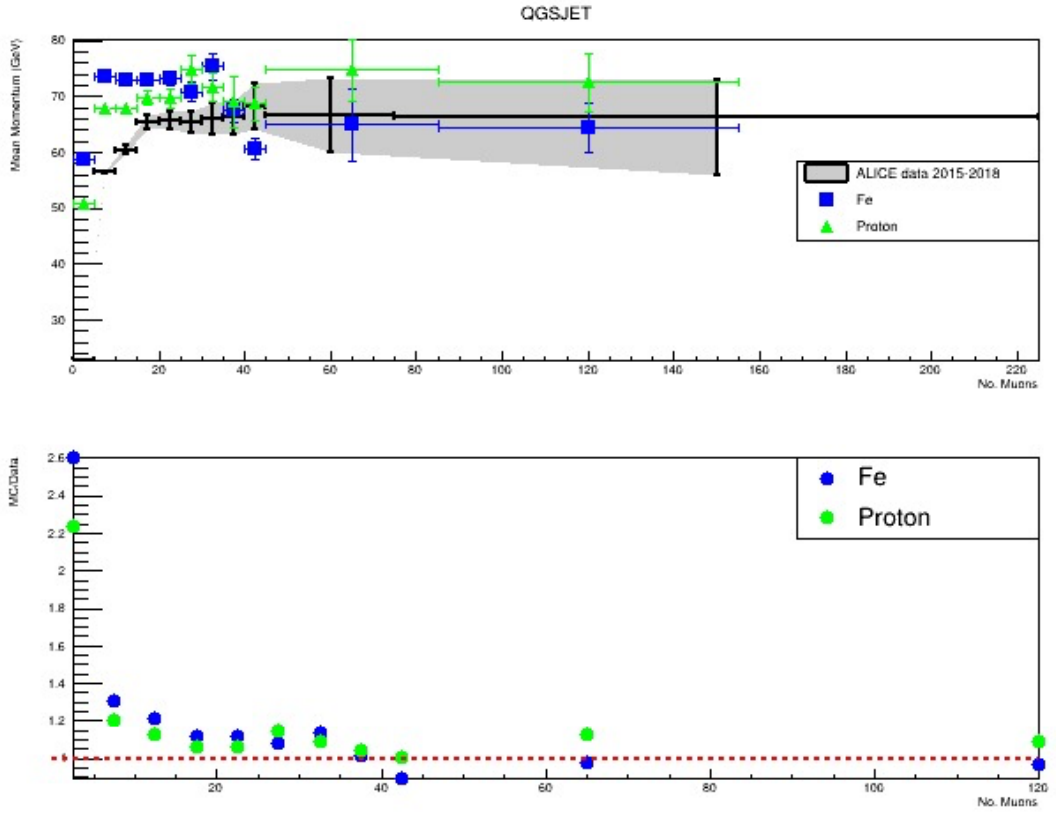
Irandheny Yoval Pozos,
PhD student

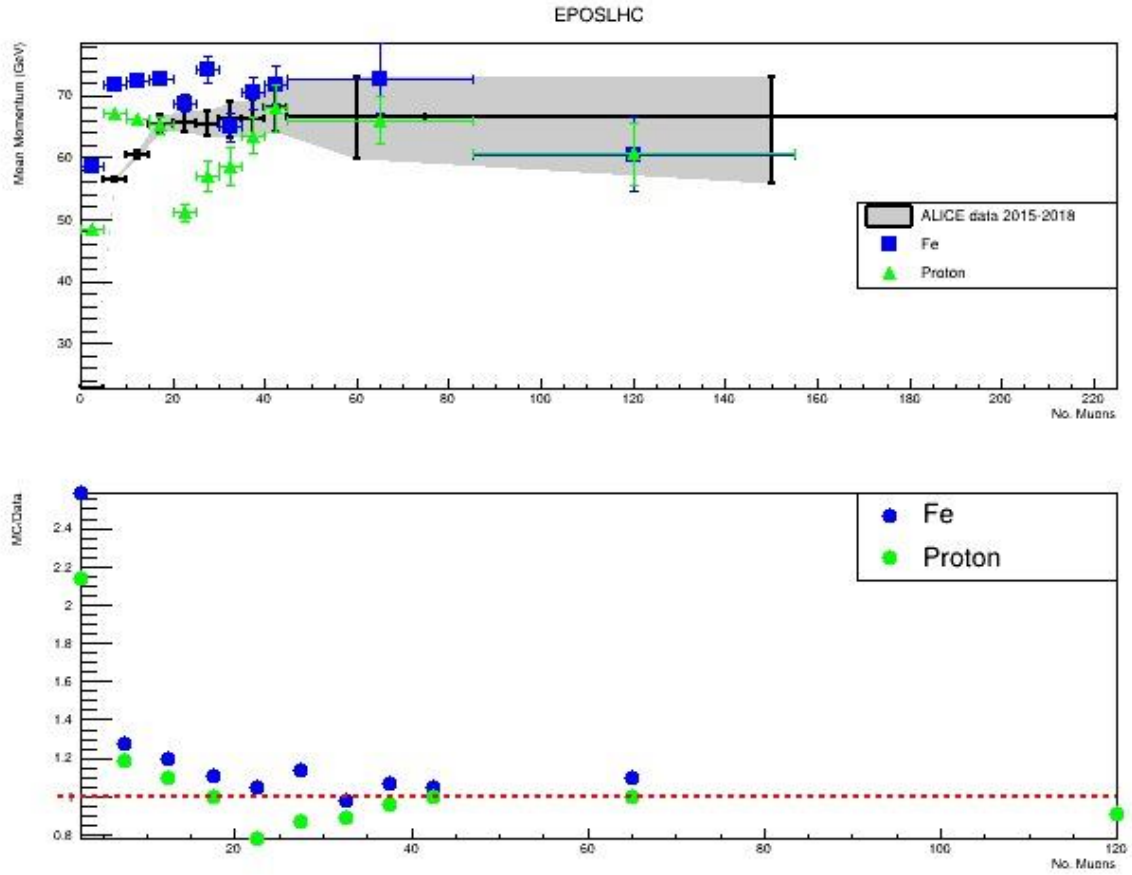
Is the muon puzzle related with the observed strangeness enhacement in pp collisions reported by ALICE?

Run 3 – and beyond

Irandheny Yoval Pozos, PhD student and Lorena del Río (undergraduated student)

Complementary studies of the current cosmic-ray data sample

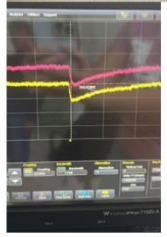


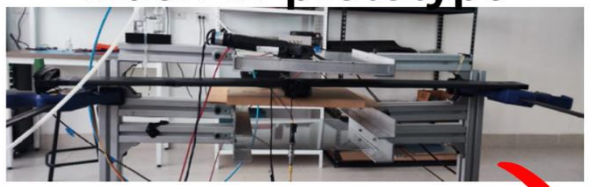


Run 3 – and beyond

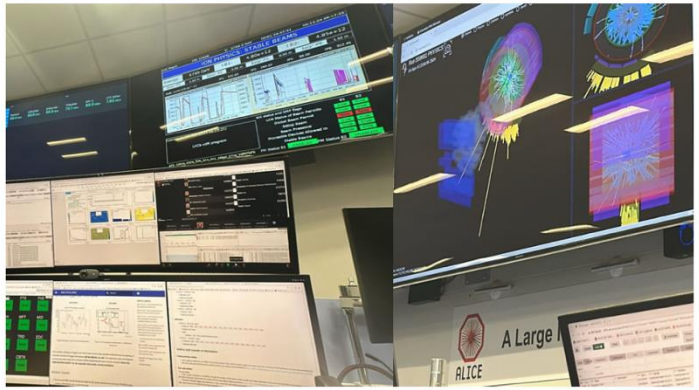
Andrea Aguirre,

Particle's lab at ecocamps: Testing Plastic Scintillator Option for Muon-ID prototype





QC shifts as expert in heavy ions 2024



BEAM test 2024

QC shifts in pp runs 2024

Run 3 – and beyond

List of PhD BUAP students working in ALICE

- Irandheny Yoval Pozos (cosmics, strangeness, shifts, service work with MFT group)
- Yael Antonio Vásquez Beltrán (MuonID-plastic scintillator, shifts, service work with FDD group)
- Sergio Paisano Guzmán (UPC-4 pions analysis, shifts, service work with Luminosity and FDD groups)
- Josué Martínez García (UPC-Angular correlations, shifts, service work with Luminosity group)

Next year joining to some service work in ALICE

- Mario Armando Talamantes Johson (MuonID-simulations)
- Diana Rosales Herrera (Color String Percolation Model)
- César Ramírez Álvarez (light mesons in UPC)
- David Régules Medel (RPC detectors for MuonID)
- Andrea Aguirre Polo (ML for small systems)

Potential new PhD students:

- Leonardo Fernández
- Beymar Mamani
- Pedro Antonio García

Run 3 – and beyond

- Cosmics
- Strangeness in OO, pO
- Small systems
- UPC (angular correlations and light mesons)
- Detector (MuonID-ALICE3, RPC & plastic scintillators in collaboration with CINVESTAV and UAS)
- Electronics and DCS → see talk by Guillermo Tejeda (in collaboration with UAS)
- FDD (service work)
- Luminosity (service work)