

PID with the Tragaldabas detector

A short review

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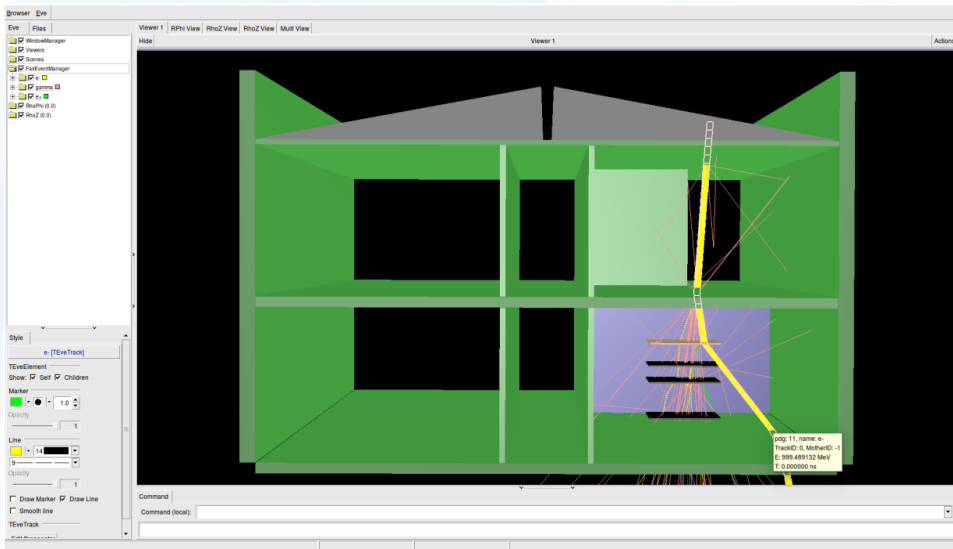


**Yanis Fontenla
PhD Work, 2019**

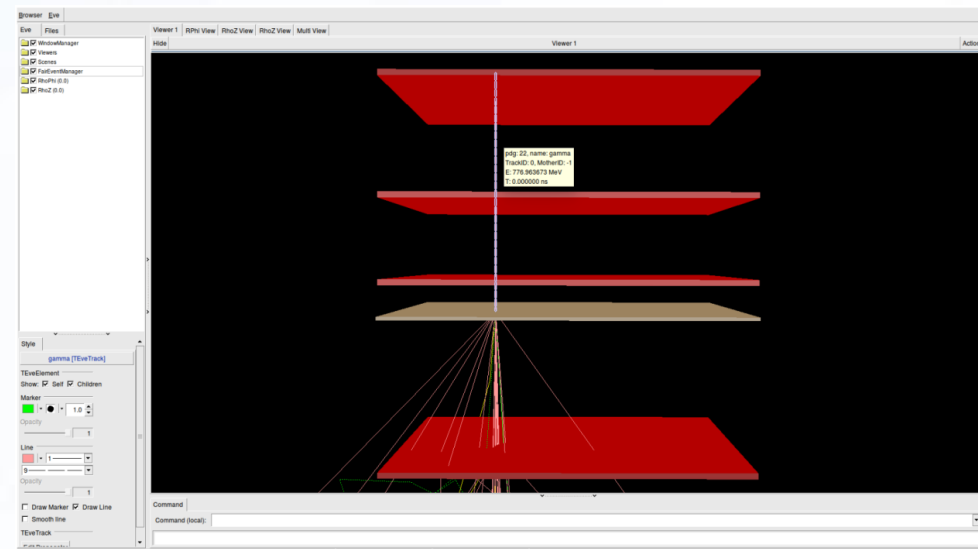
**Marwan Ajoor
PhD Work, 2022**

Goal:
Develop and test a PID method
for the Tragaldabas detector

Particle identification method **based on realistic simulations** of cosmics over Tragaldabas



Tragaldabas inside the building

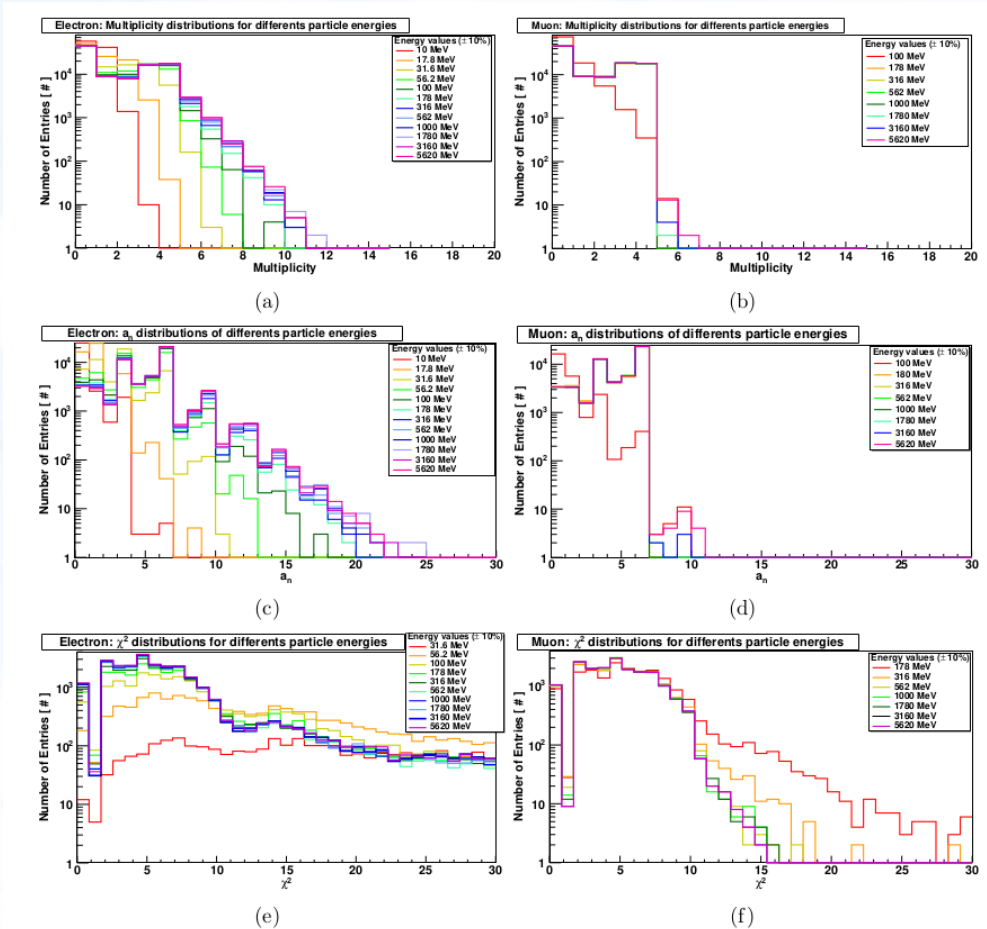


Different detector configurations/scenarios:

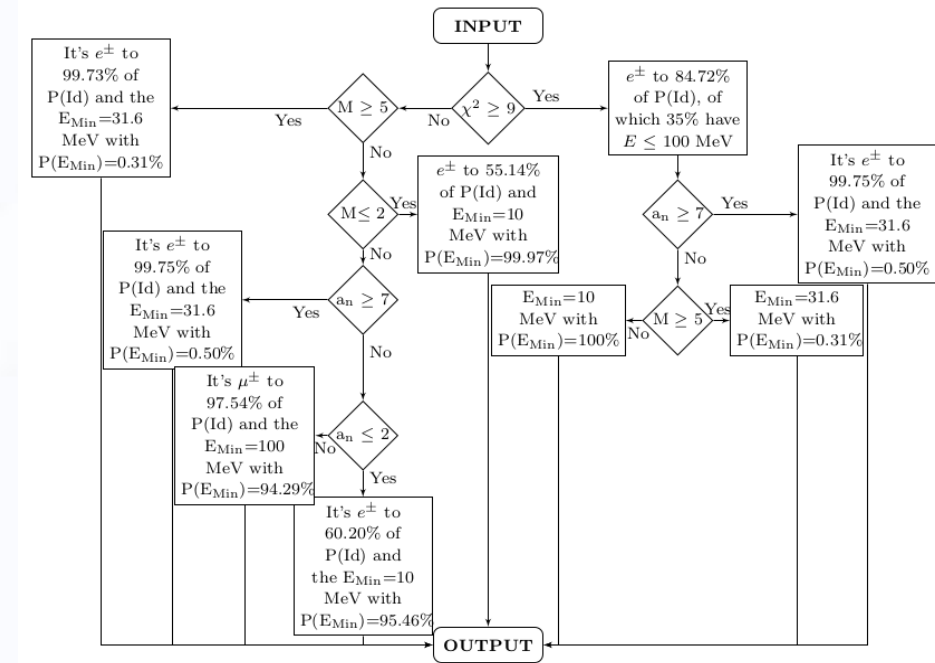
- 3 or 4 active planes
- Pb layer ON - OFF

Selection of most representative observables:

- **Hit multiplicity "M"**
- **Weighted range "a_n"**
- **Chiz of TimTrack**



Broad range of energies!



PID algorithms implemented

Output:

- **PID probability**
- **Most likely energy range**

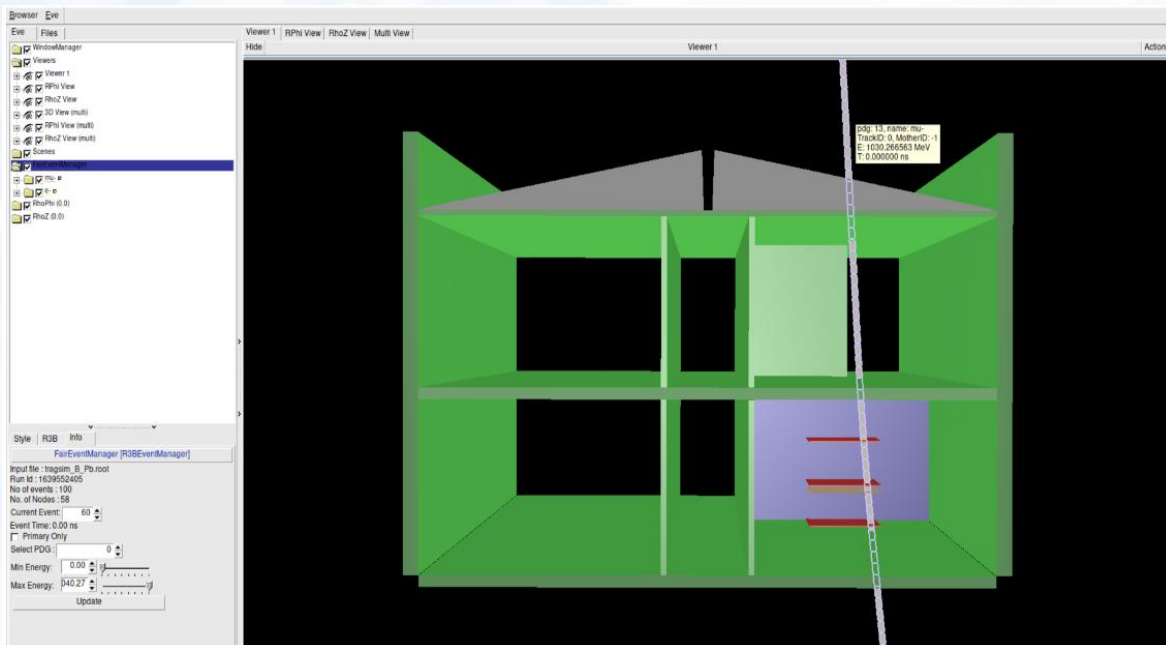
Validation check with complex simulated data:

Accuracy:

Active Planes	Realistic Simulation
4	87.9 ± 1.5
3	90.2 ± 1.4
4 with 1 cm of Pb	91.9 ± 1.6
4 with 1.5 cm of Pb	90.3 ± 1.6

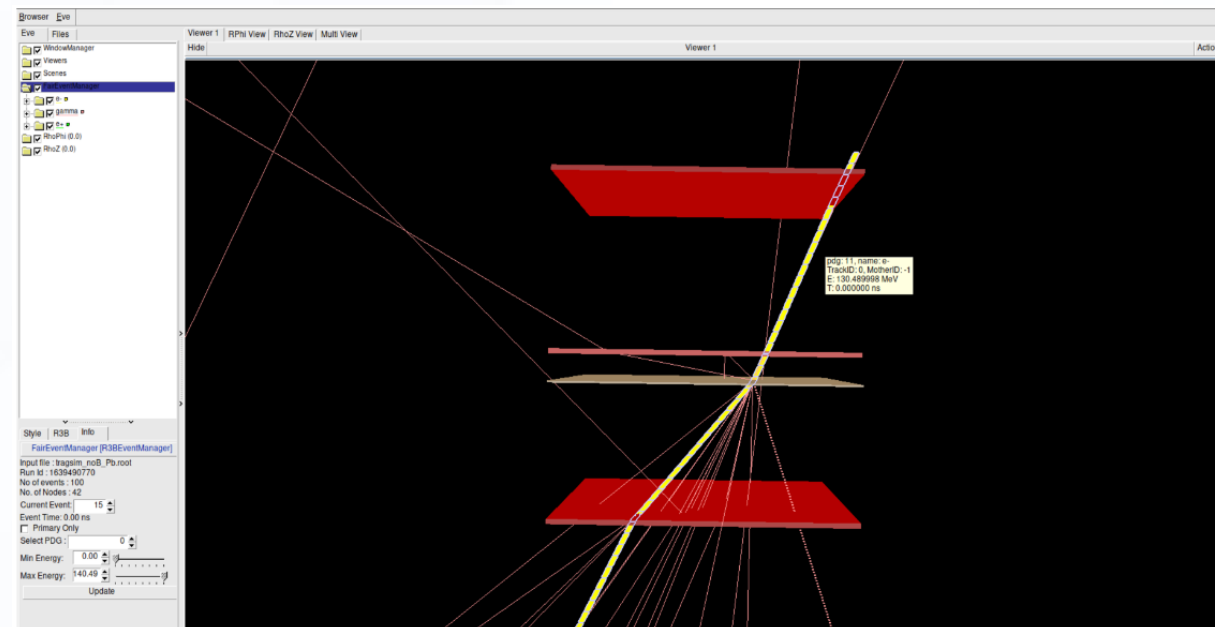
How did it fail??

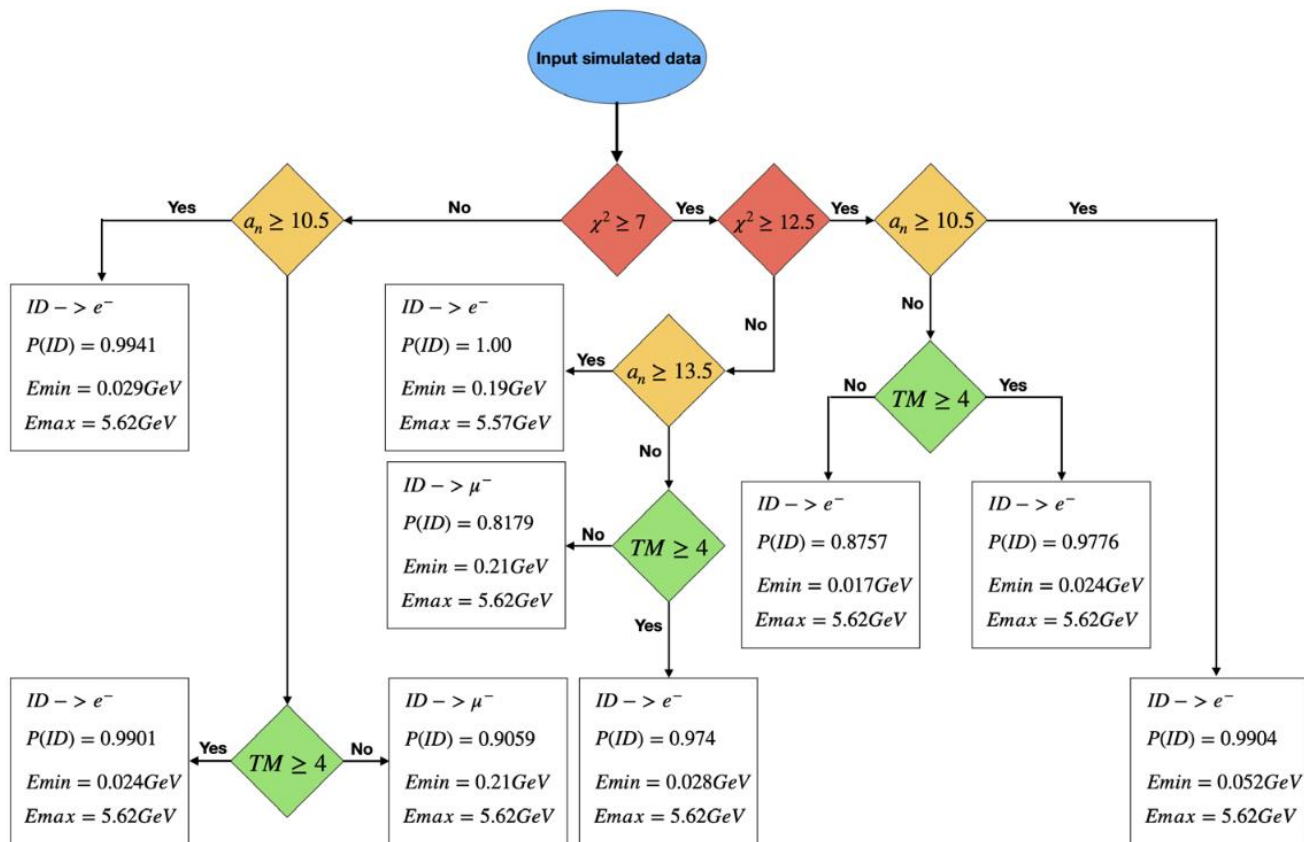
Active Planes	Misidentification				
	$e \rightarrow \mu$	$\gamma \rightarrow \mu$	$\gamma \rightarrow e$	$p \rightarrow e$	$p \rightarrow \mu$
4	68.5	0.3	20.6	9.4	1.1
3	66.7	0.8	20.6	11	0.8
4 with 1 cm of Pb	47.3	0.9	36.5	14.9	0.4
4 with 1.5 cm of Pb	65.2	0.3	21.7	11.9	0.9



- **Focus on actual Tragaldabas configuration**

- **New simulations**





- **New analysis**
- **Improved cuts**
- **Better output**

First application to real data!

From:

- 50% electrons - 50% muons
- PID probability ~90%

Pb layer:
Improved capabilities



To:

- 30% electrons - 70% muons
- PID probability ~95%

