

Report of activities

20/04/2013

Outline

- Introduction
- MC/Data sample
- For approval?
- Checks on raw data files
- Final comments

Puebla HEP Meeting

Comments to:

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. Introduction

GOAL: to compare the MMD from 2011 data with respect to the MMD from Monte Carlo (Corsika, Fe and protons as primary) with an absolute normalization.

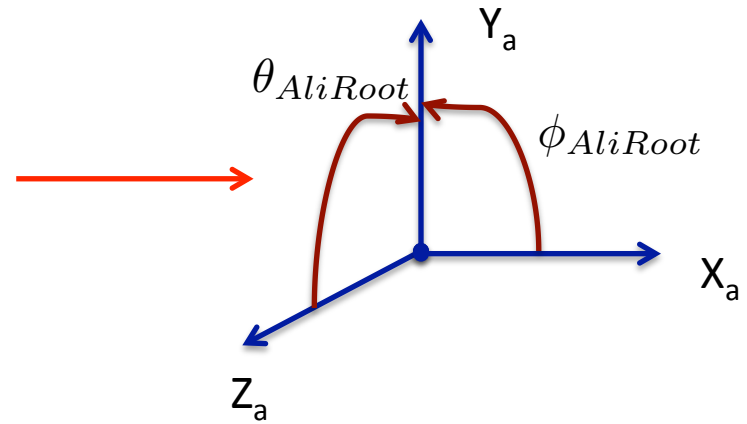
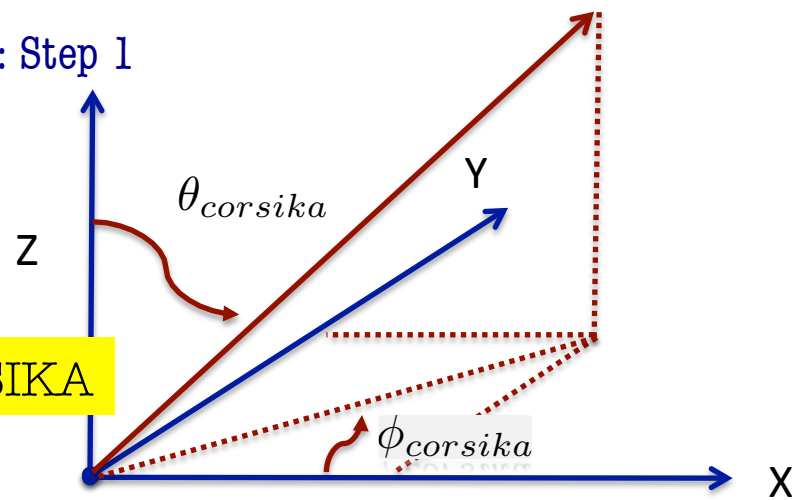
I used the MC production provided by Bruno for protons and Fe nuclei (CORSIKA 6990) → energy of the primary cosmic rays ranging from 10^{14} to 10^{18} eV.

Steps for the Monte Carlo reconstruction:

- 1.- To change the coordinate system: CORSIKA → ALIROOT
- 2.- To pass the muons at surface level through the molasse and the detectors with AliRoot: AliGenCorsikaMRC and AliACORDEv2 classes.
- 3.- To reconstruct the Monte Carlo generation → @ Puebla and @ UNAM
- 4.- To analyze the AliESDs.root files (from MC reconstructed) with AliCosmic class

MC: Step 1

CORSIKA



It is necessary to use the rotation matrix respect to the X-axis

$$\begin{bmatrix} 1 & 0 & 0 & 0 \\ 0 & \cos\theta & \sin\theta & 0 \\ 0 & -\sin\theta & \cos\theta & 0 \\ 0 & 0 & 0 & 1 \end{bmatrix}$$

Spatial coordinates

$$\begin{aligned} X_{ali} &= X_{cor} \\ Y_{ali} &= 4000 \text{ cms.} \\ Z_{ali} &= -Y_{cor} \end{aligned}$$

Momentum coordinates

$$\begin{aligned} Px_{ali} &= -Pz_{cor} \\ Py_{ali} &= Py_{cor} \\ Pz_{ali} &= Px_{cor} \end{aligned}$$

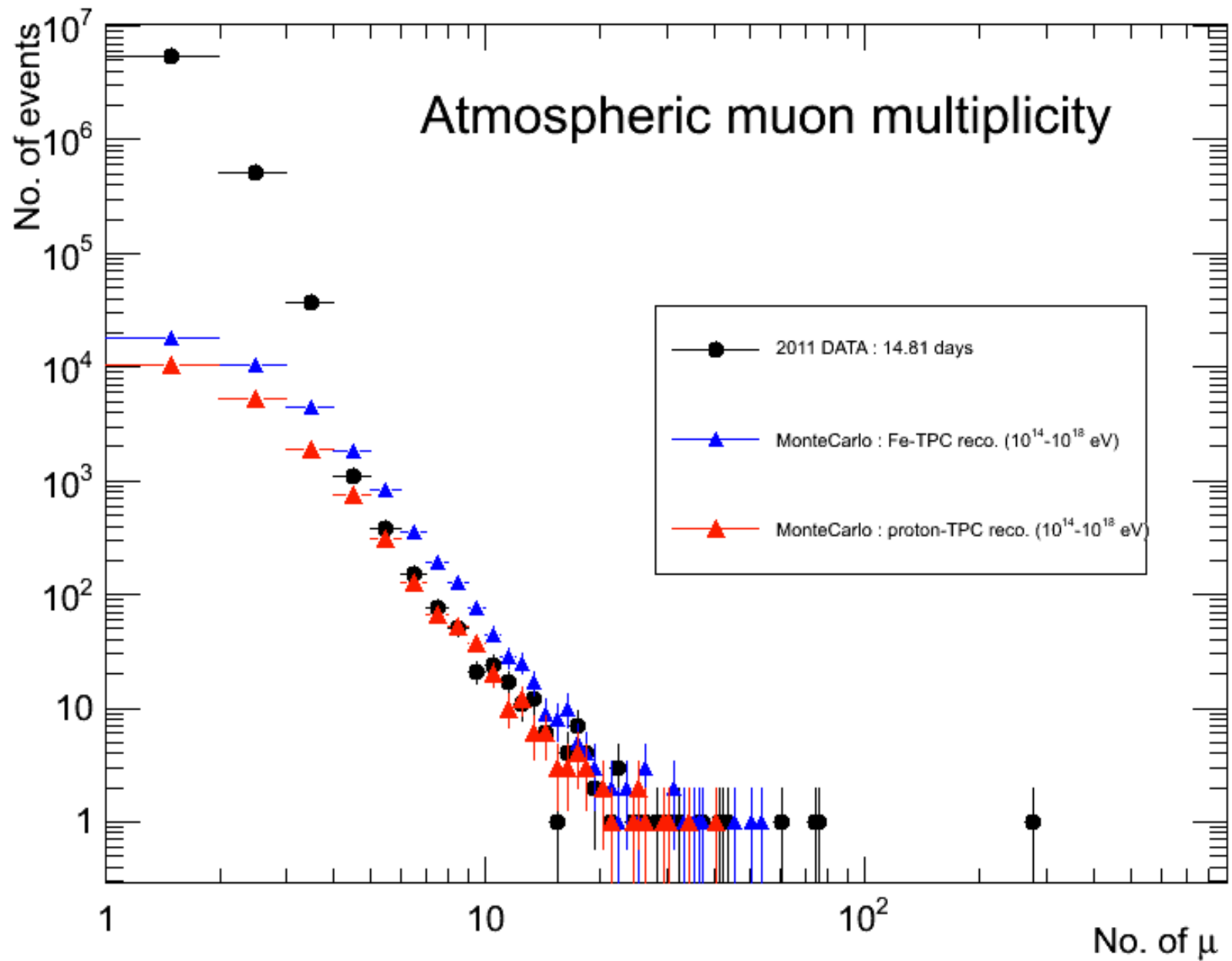
⌘ Cosmic runs: summary of statistics for 2011 data (NO BEAM RUNS)

YEAR	PERIOD	# RUNS	DURATION (DAYS)	# OF EVENTS	# OF ANALYZED EVENTS	Live time analyzed (days)
2011	LHC11a	41	5.41	39,646,338	38,853,411	5.30
	LHC11b	21	1.24	6,188,454	4,612,176	0.92
	LHC11c	32	2.12	9,545,193	8,246,834	1.83
	LHC11d	70	4.82	9,350,408	9,168,457	4.72
	LHC11e	26	1.78	4,617,867	4,580,220	1.76
	LHC11f	5	0.28	667,697	667,697	0.28
TOTAL		195	15.65	70,015,957	66,128,795	14.81

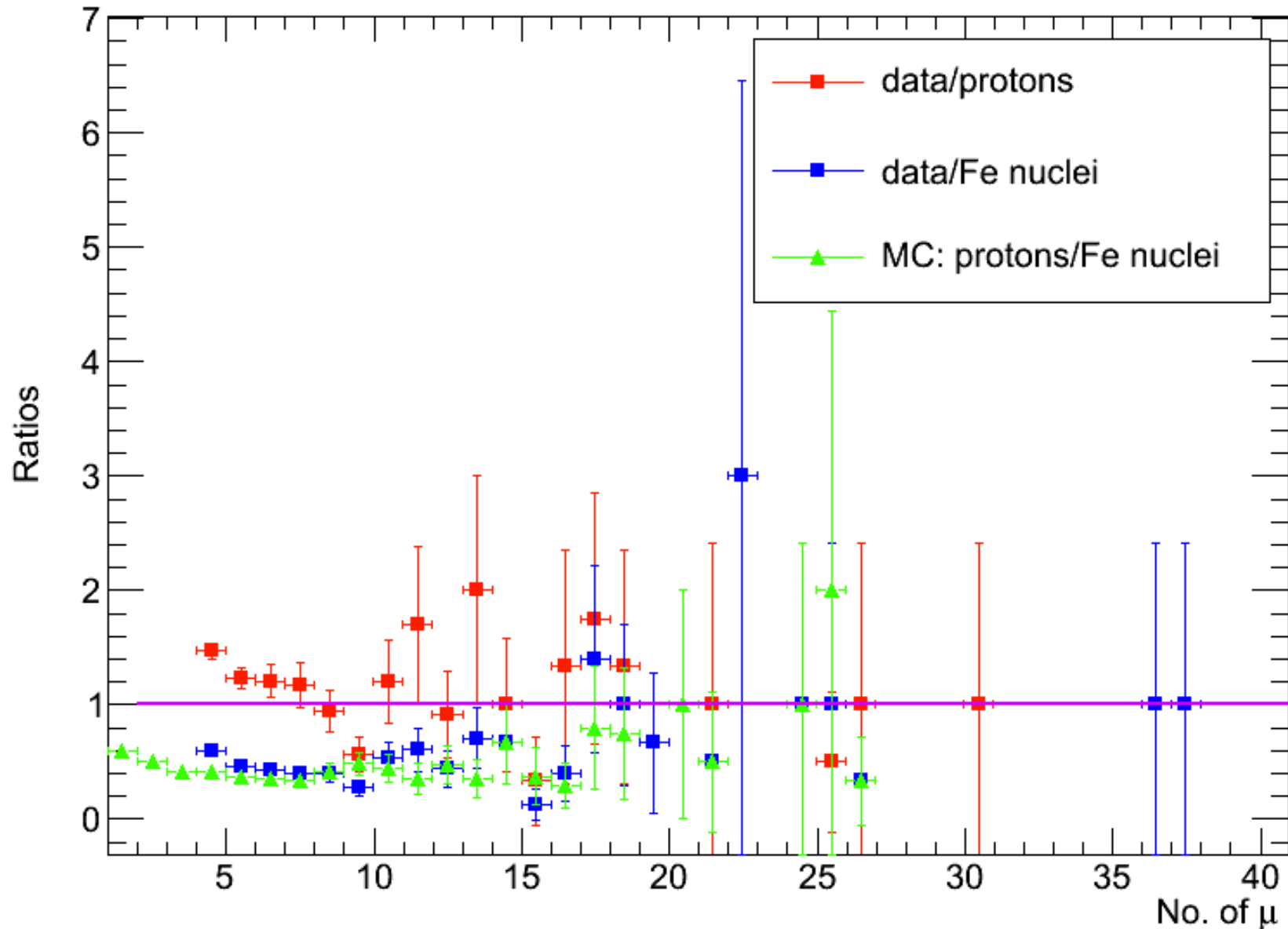
For TPC reconstruction, we selected only those events with at least 4 muons in the large area:

Chunk	#events (Fe) with #mu>4	#events (proton) with #mu>4
Fe/p_tree_1014_1015_wrall_1.root	7,417	6,228
Fe/p_tree_1014_1015_wrall_2.root	7,473	6,266
Fe/p_tree_1014_1015_wrall_3.root	7,335	6,287
Fe/p_tree_1014_1015_wrall_4.root	4,678	3,166
Fe/p_tree_1015_31015_wrall_1.root	19,235	12,880
Fe/p_tree_31015_1016_wrall_1.root	8,117	6,170
Fe/p_tree_1016_31016_wrall_1.root	1,063	988
Fe/p_tree_31016_1017_wrall_1.root	124	124
Fe/p_tree_1017_31017_wrall_1.root	10	10
Fe/p_tree_31017_1018_wrall_1.root	1	1

- MC / Data sample



- MC / Data sample



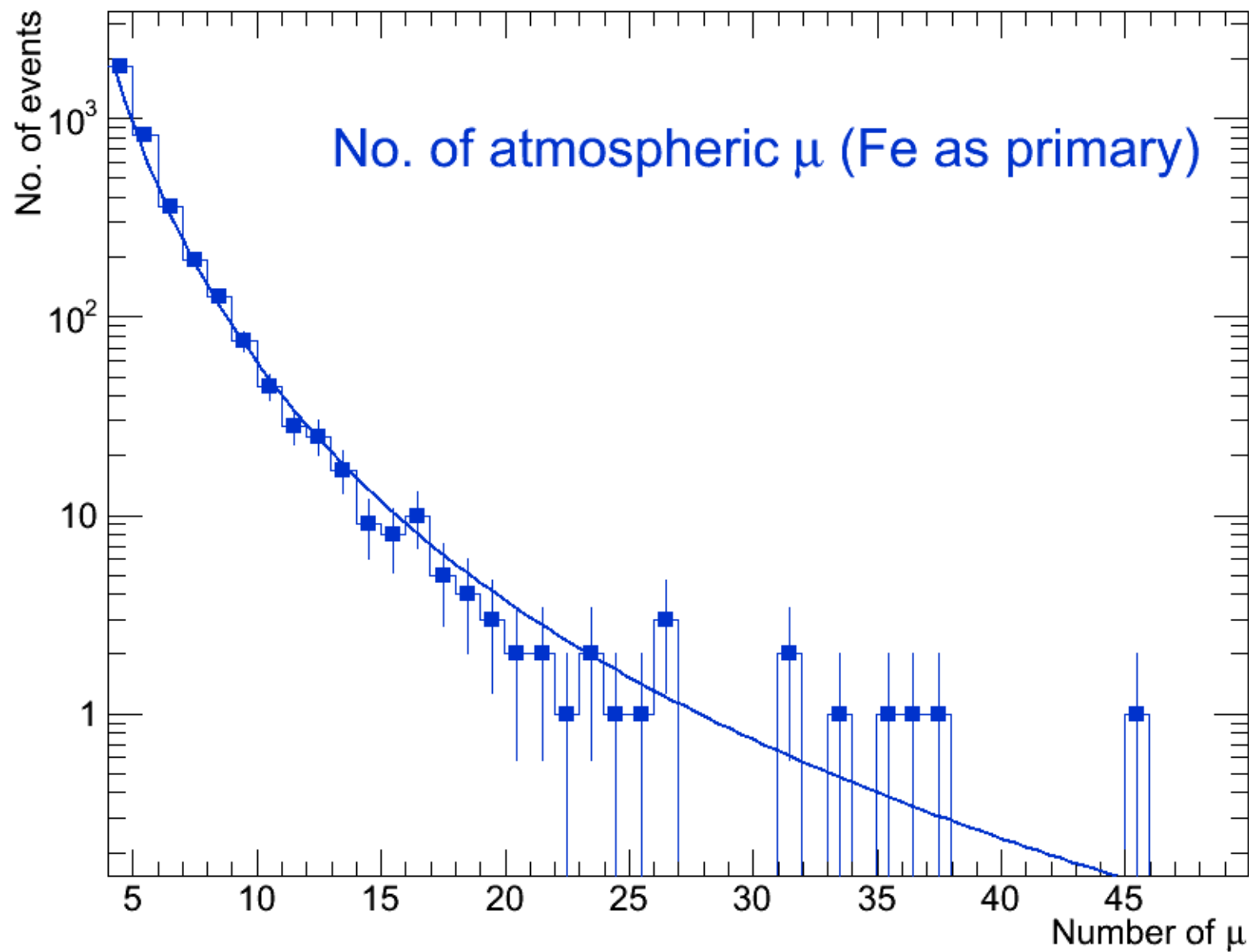
The data is close to the protons for $4 < \# \mu < 15$

- MC / Data sample

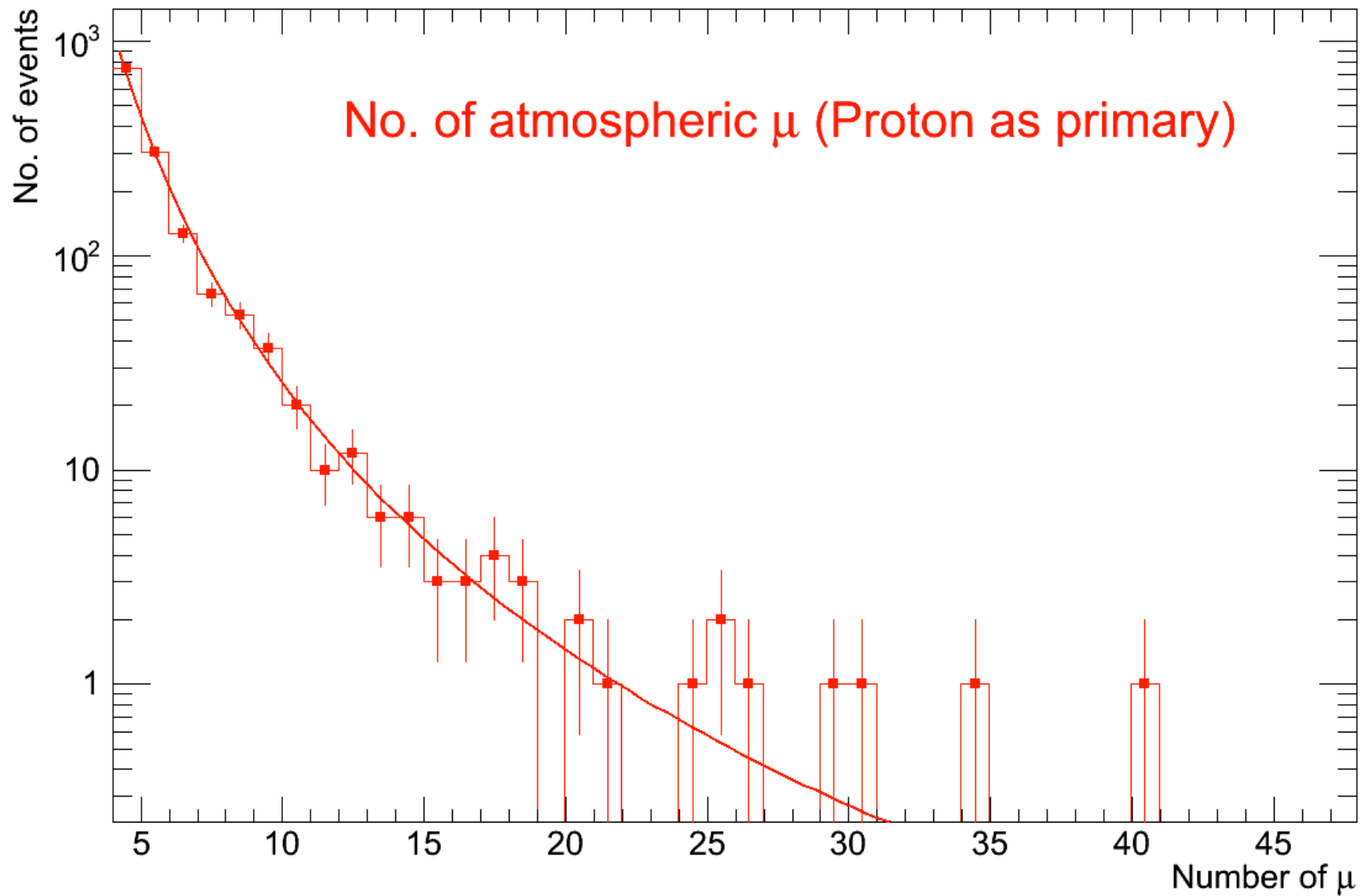
Simple exponential fit for MC curves:

```
TF1 * fit = new TF1("fit","[0]*TMath::Power(x,[1])",4,60);
```

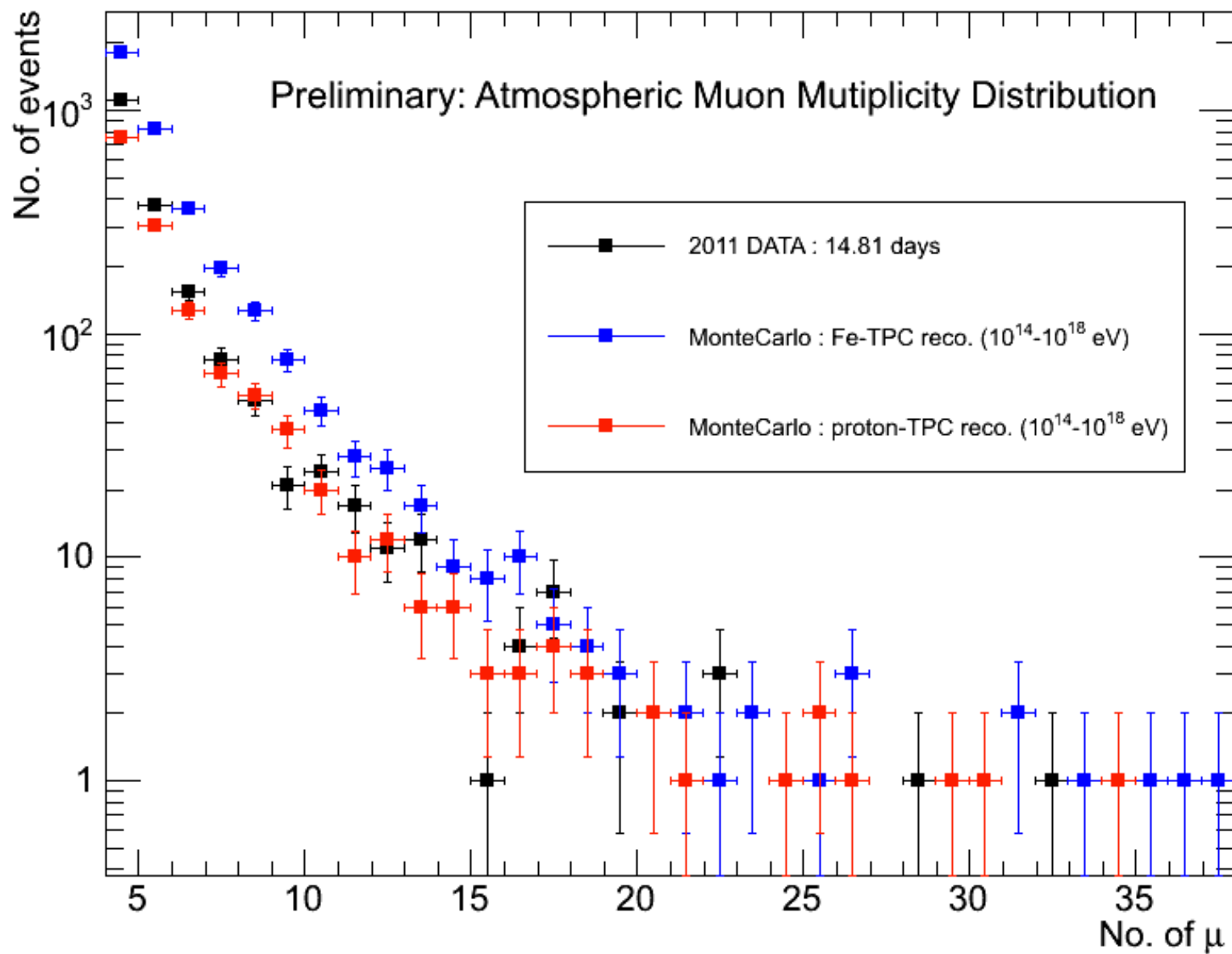
- MC / Data sample



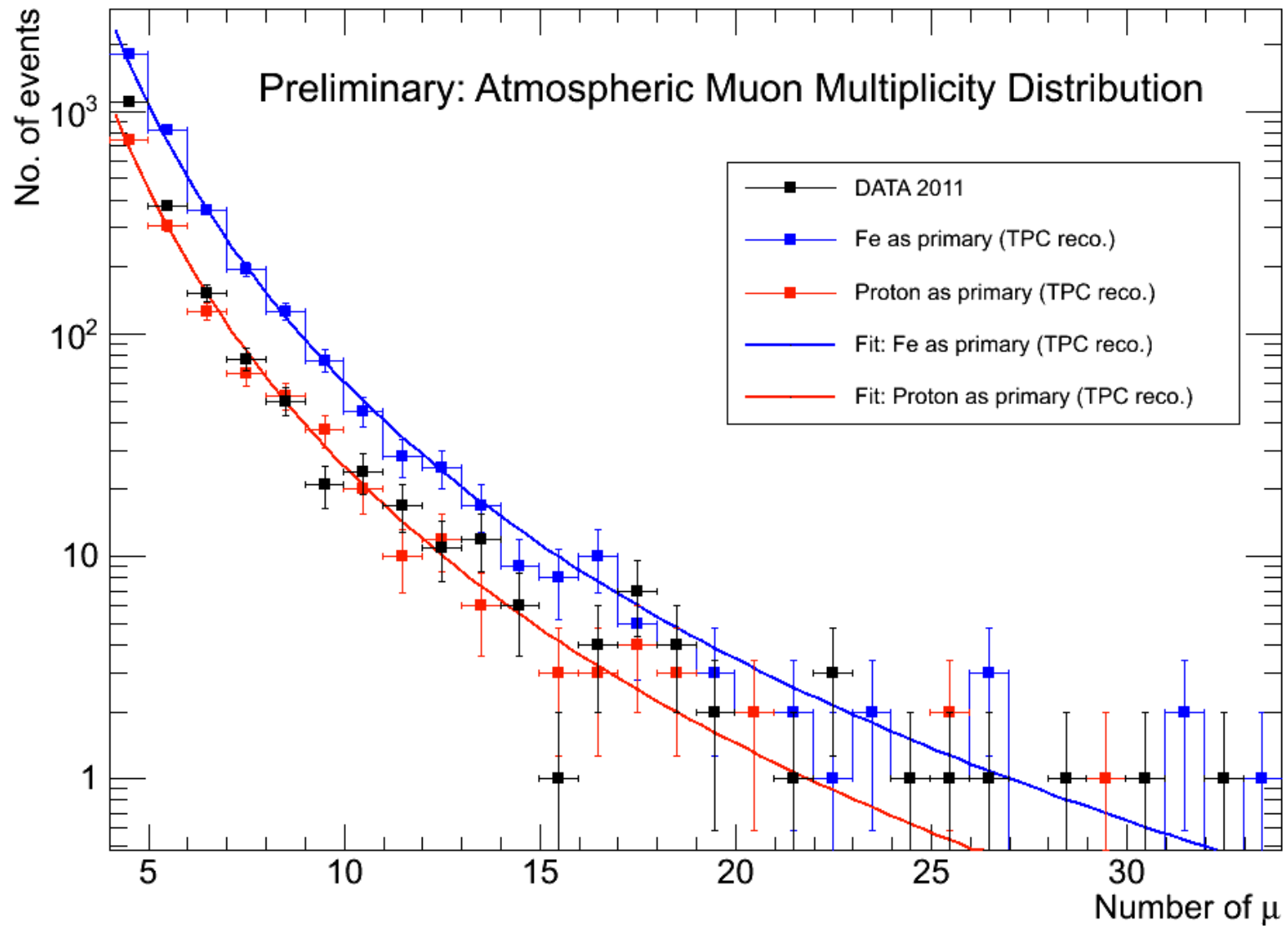
- MC / Data sample



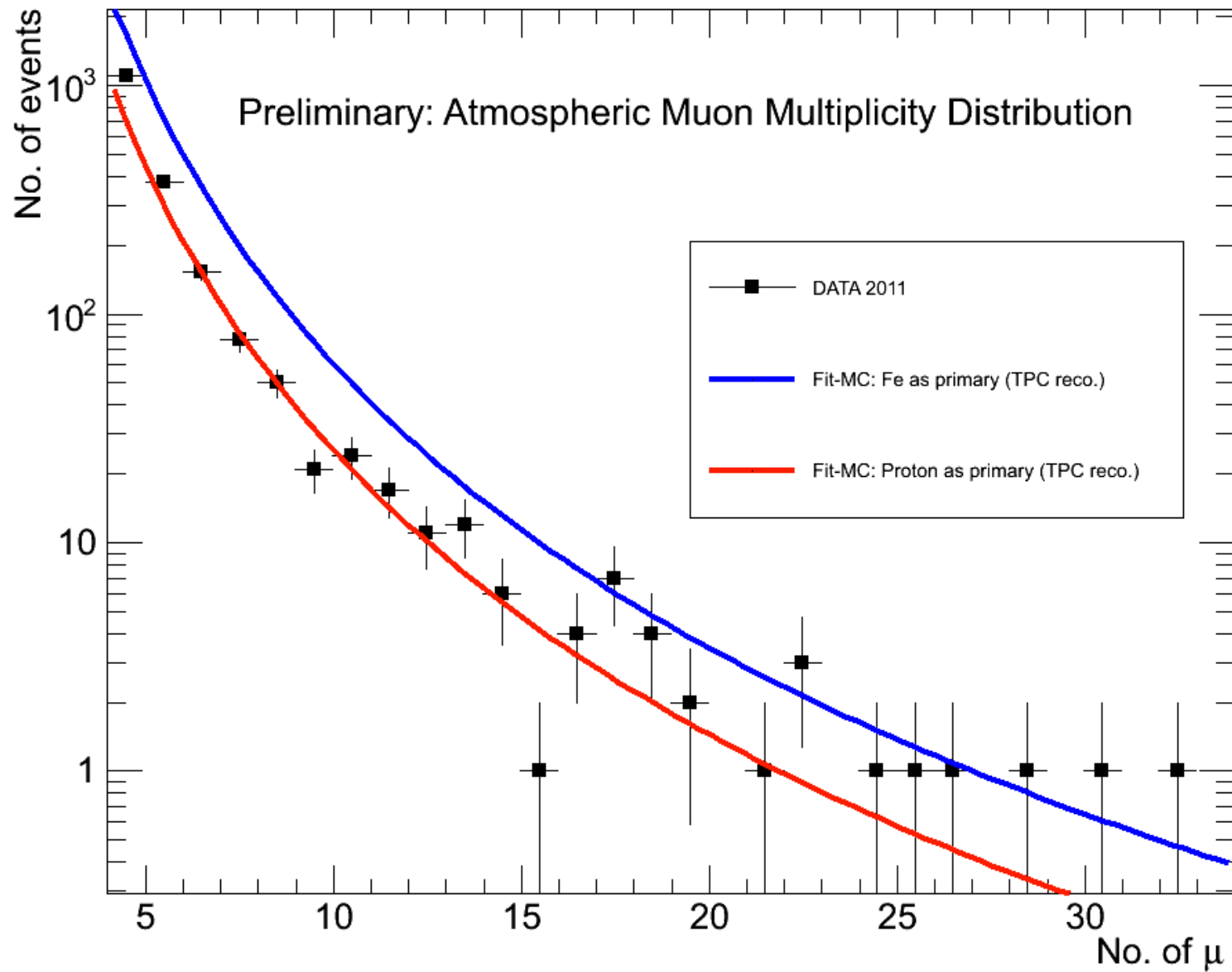
- MC / Data sample



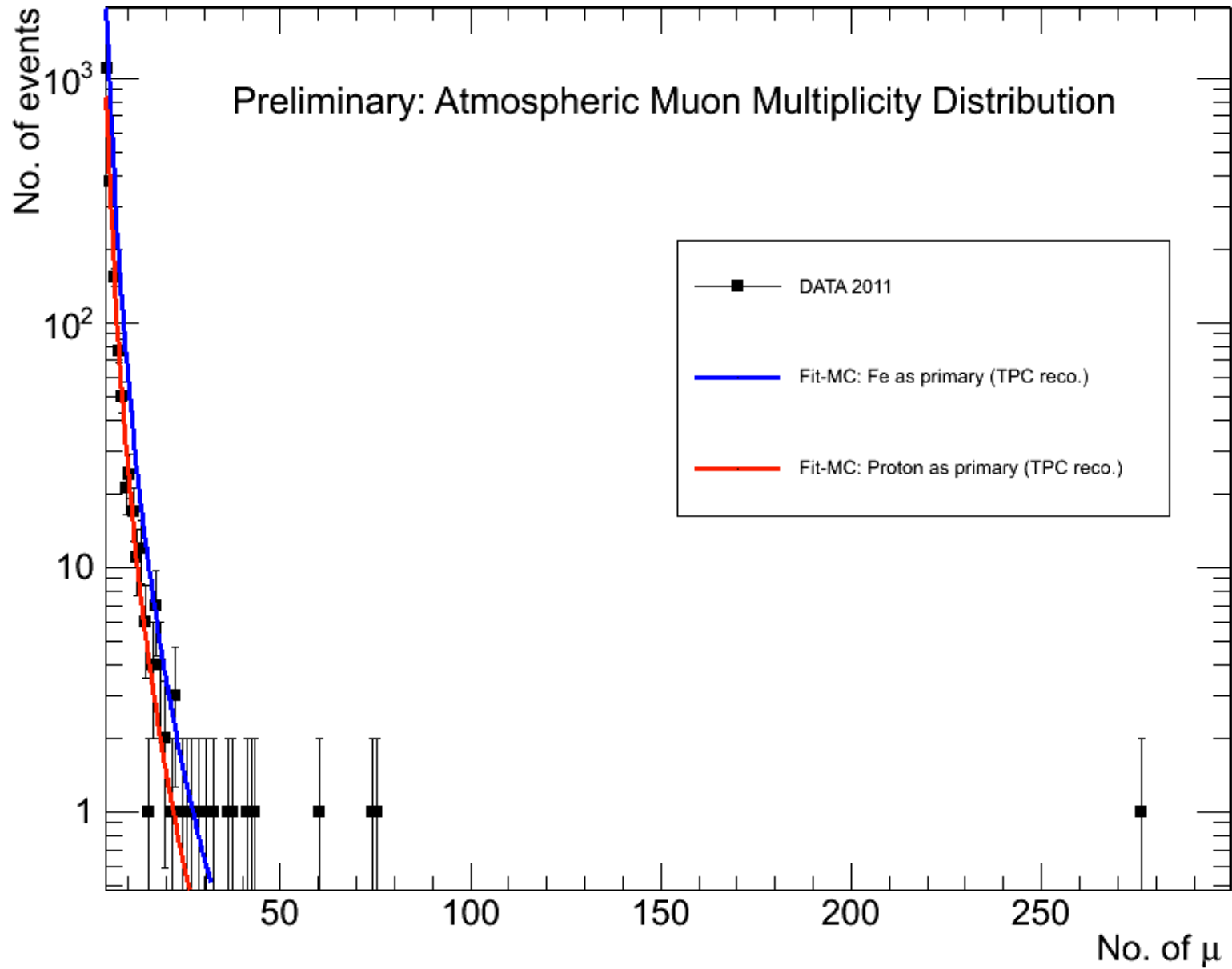
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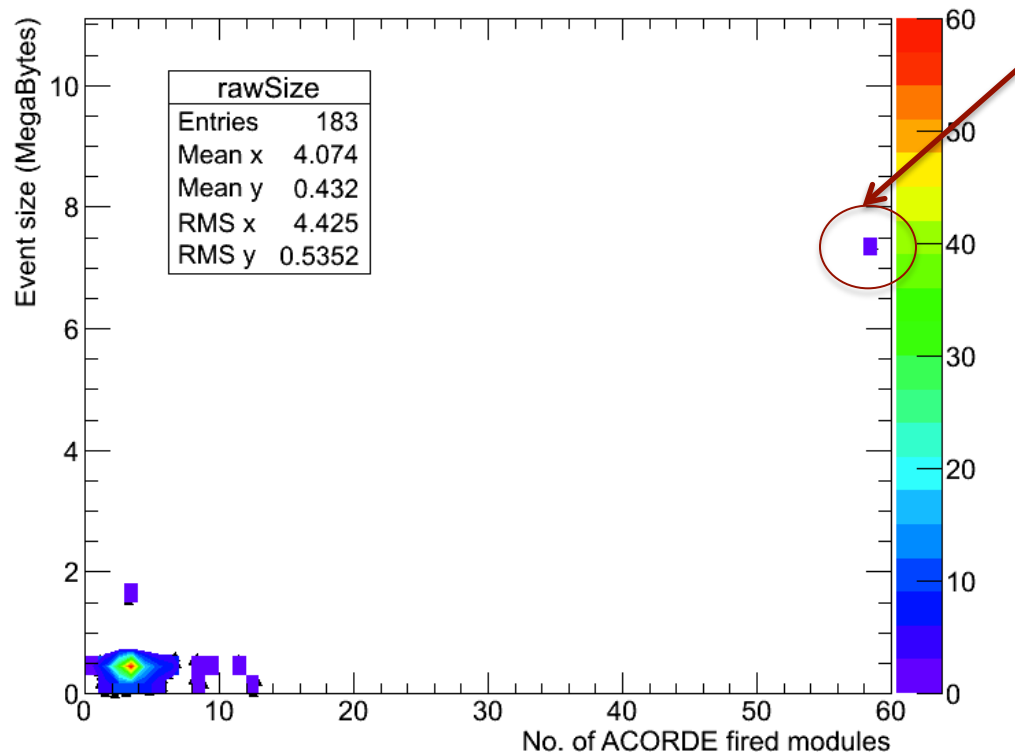


- Checks on raw data files

How to be sure that the TPC is not missing some muon bundles during the raw data reconstruction?

A. Look for the event size of High Muon Multiplicity Events

The event size information is not available on AllESDs.root files → we should take a look directly into the raw.root files (chunk per chunk, for all the physics triggers ... very slow, but it seems to work)

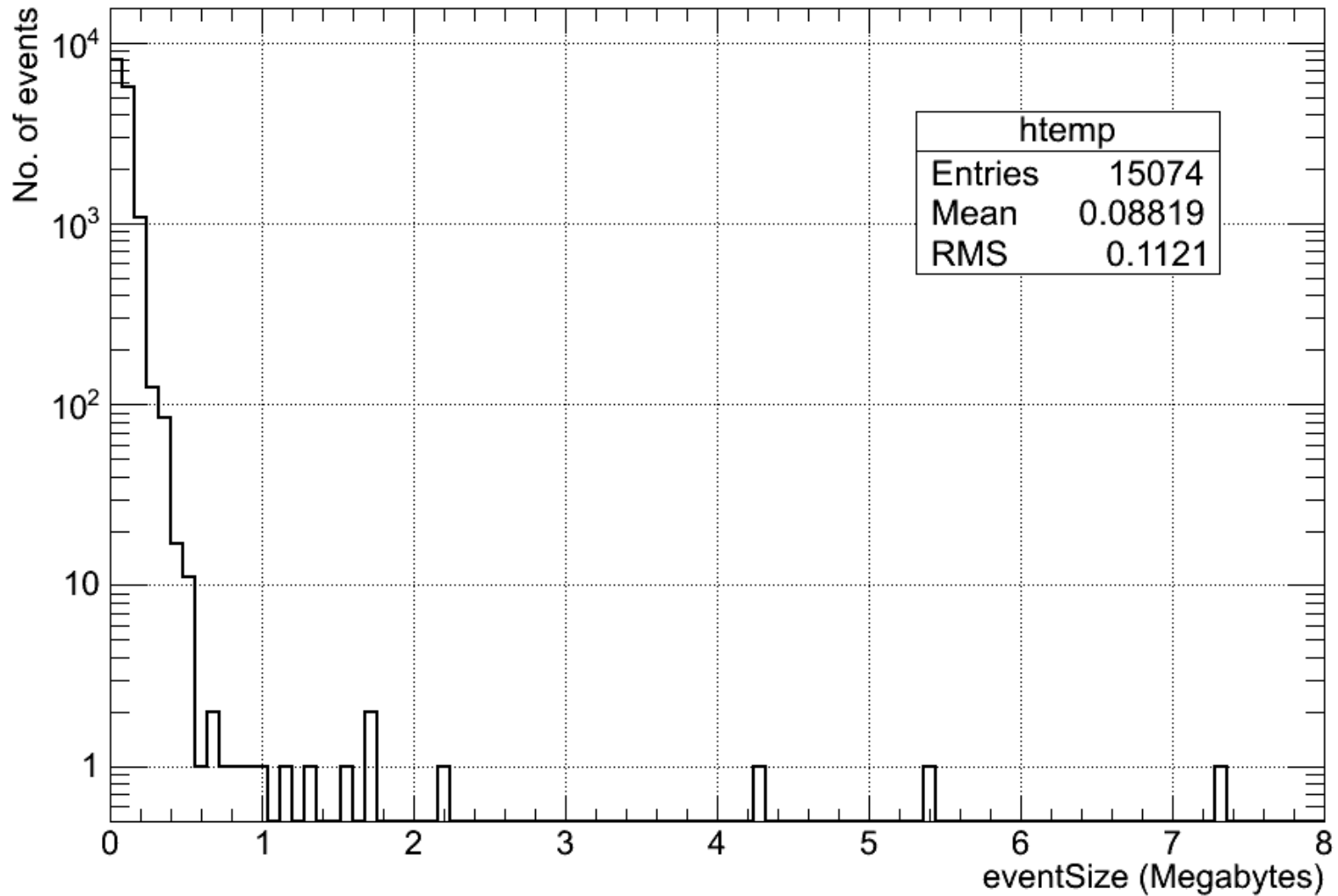


Event triggered by ACORDE with 276 atmospheric muons

As a first step, we can correlate the number of ACORDE fired modules VS the event Size

- Checks on raw data files

I checked 3 chunks: 10000109547020.10, 10000110519022.20 and 11000152599020.10



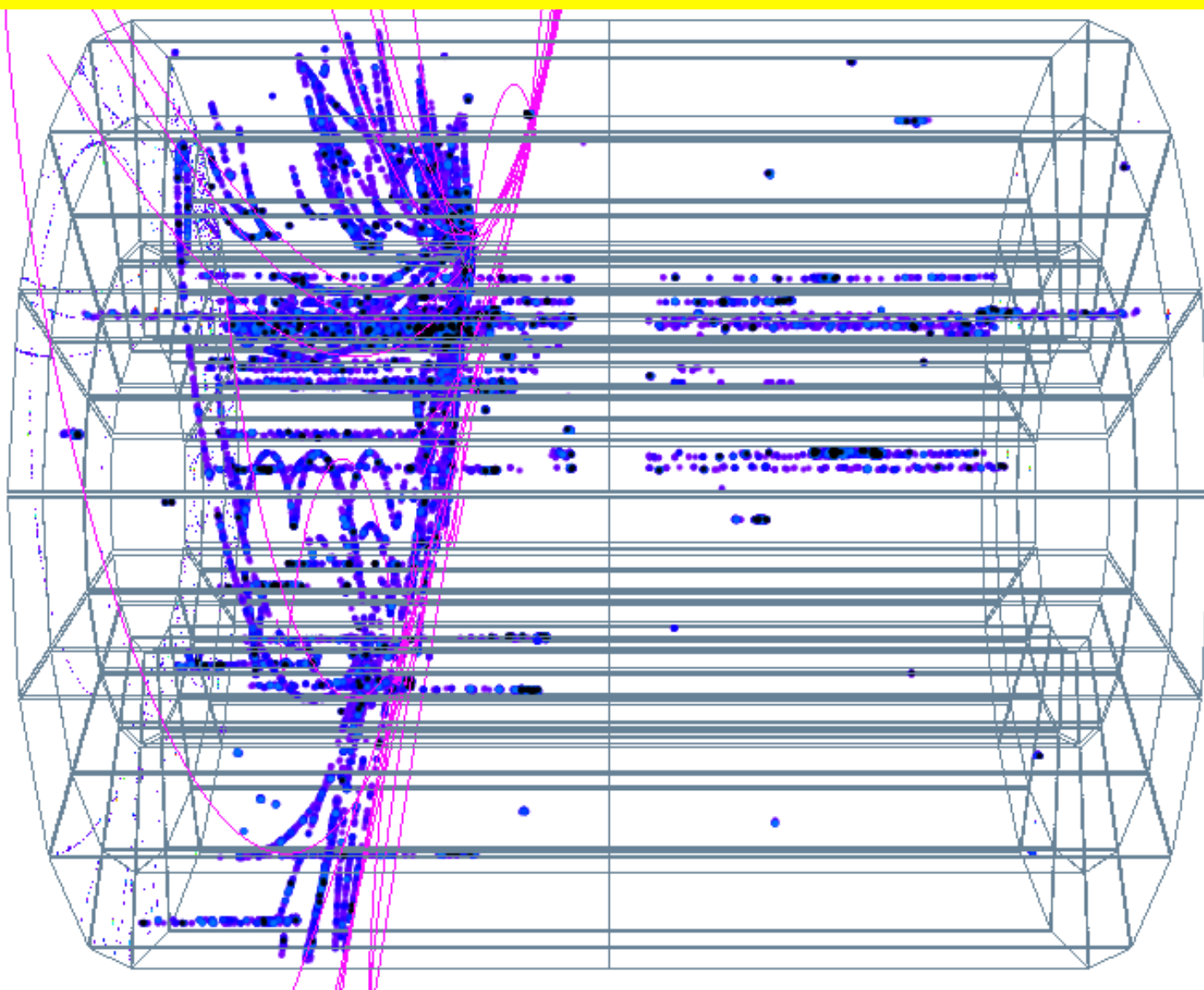
- Checks on raw data files

List of events with eventSize > 1

Trigger: 6 No. of event: 169 File: 10000109547020.10/raw.root nAMU: 0 eventSize: 1.00581
Trigger: 6 No. of event: 1482 File: 10000109547020.10/raw.root nAMU: 0 eventSize: 1.72511
Trigger: 6 No. of event: 1646 File: 10000109547020.10/raw.root nAMU: 0 eventSize: 1.75084
Trigger: 8 No. of event: 3723 File: 10000109547020.10/raw.root nAMU: 0 eventSize: 2.22053
Trigger: 2 No. of event: 4286 File: 10000110519022.20/raw.root nAMU: 0 eventSize: 1.13752
Trigger: 8 No. of event: 5019 File: 10000110519022.20/raw.root nAMU: 0 eventSize: 1.34633
Trigger: 11 No. of event: 6353 File: 10000110519022.20/raw.root nAMU: 0 eventSize: 5.37344
Trigger: 3 No. of event: 8090 File: 10000110519022.20/raw.root nAMU: 0 eventSize: 4.28956
Trigger: 33 No. of event: 314 File: 11000152599020.10/raw.root nAMU: 0 eventSize: 1.54997
Trigger: 4 No. of event: 372 File: 11000152599020.10/raw.root nAMU: 0 eventSize: 7.35994

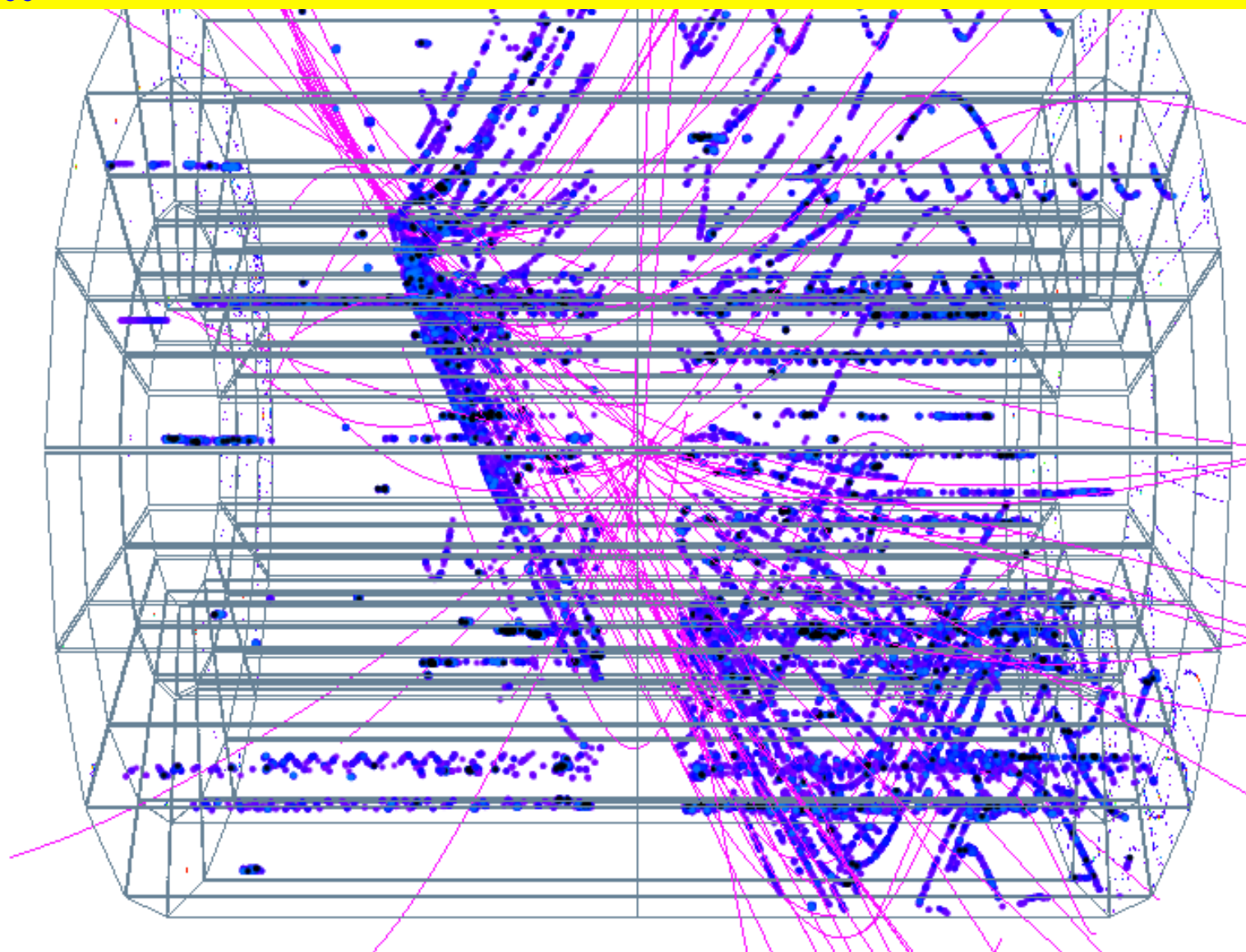
- Checks on raw data files

Trigger: 6 No. of event: 169 File: 10000109547020.10/raw.root nAMU: 0 eventSize: 1.00581



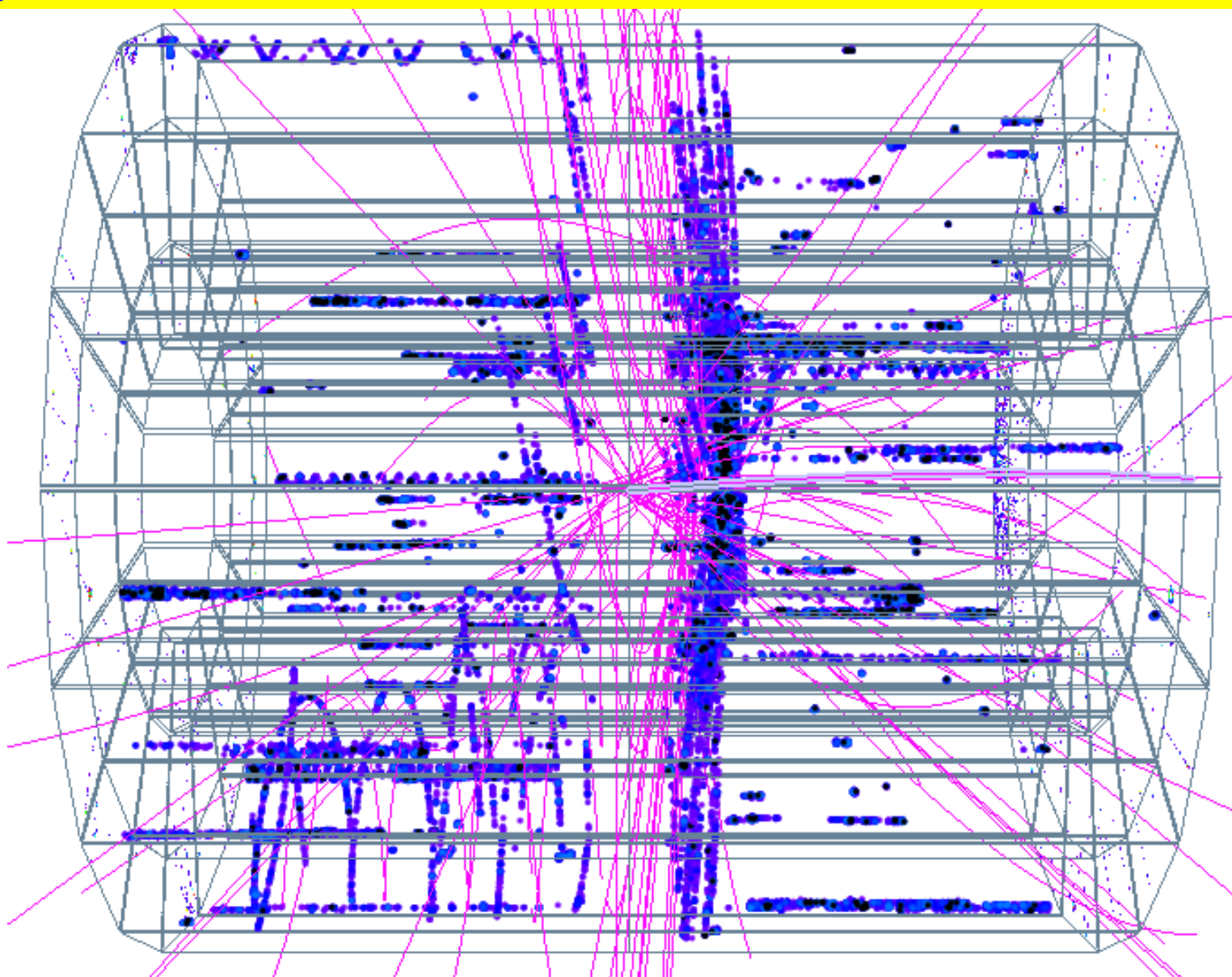
- Checks on raw data files

Trigger: 6 No. of event: 1482 File: 10000109547020.10/raw.root nAMU: 0 eventSize: 1.72511



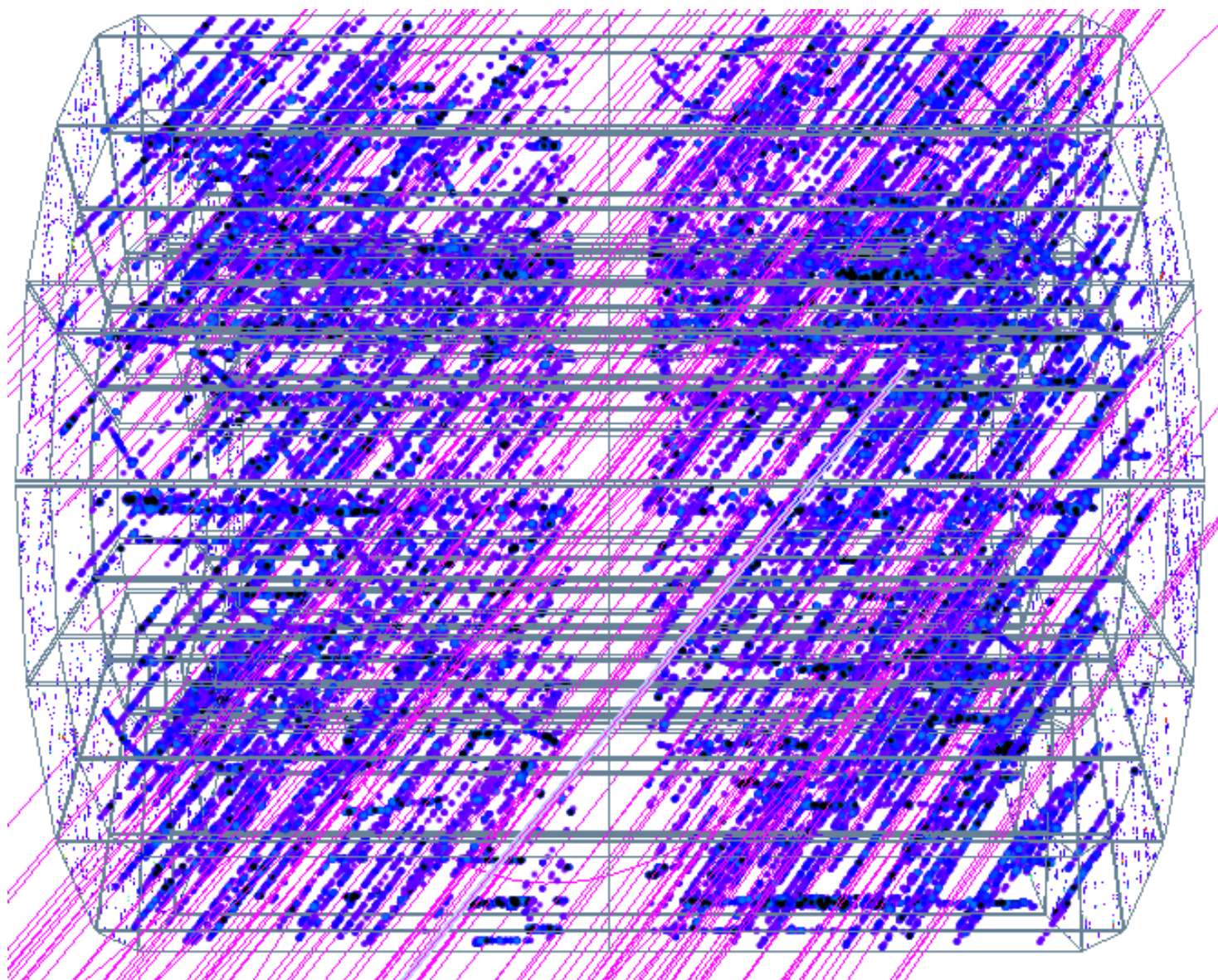
- Checks on raw data files

Trigger: 6 No. of event: 1646 File: 10000109547020.10/raw.root nAMU: 0 eventSize: 1.75084



- Checks on raw data files

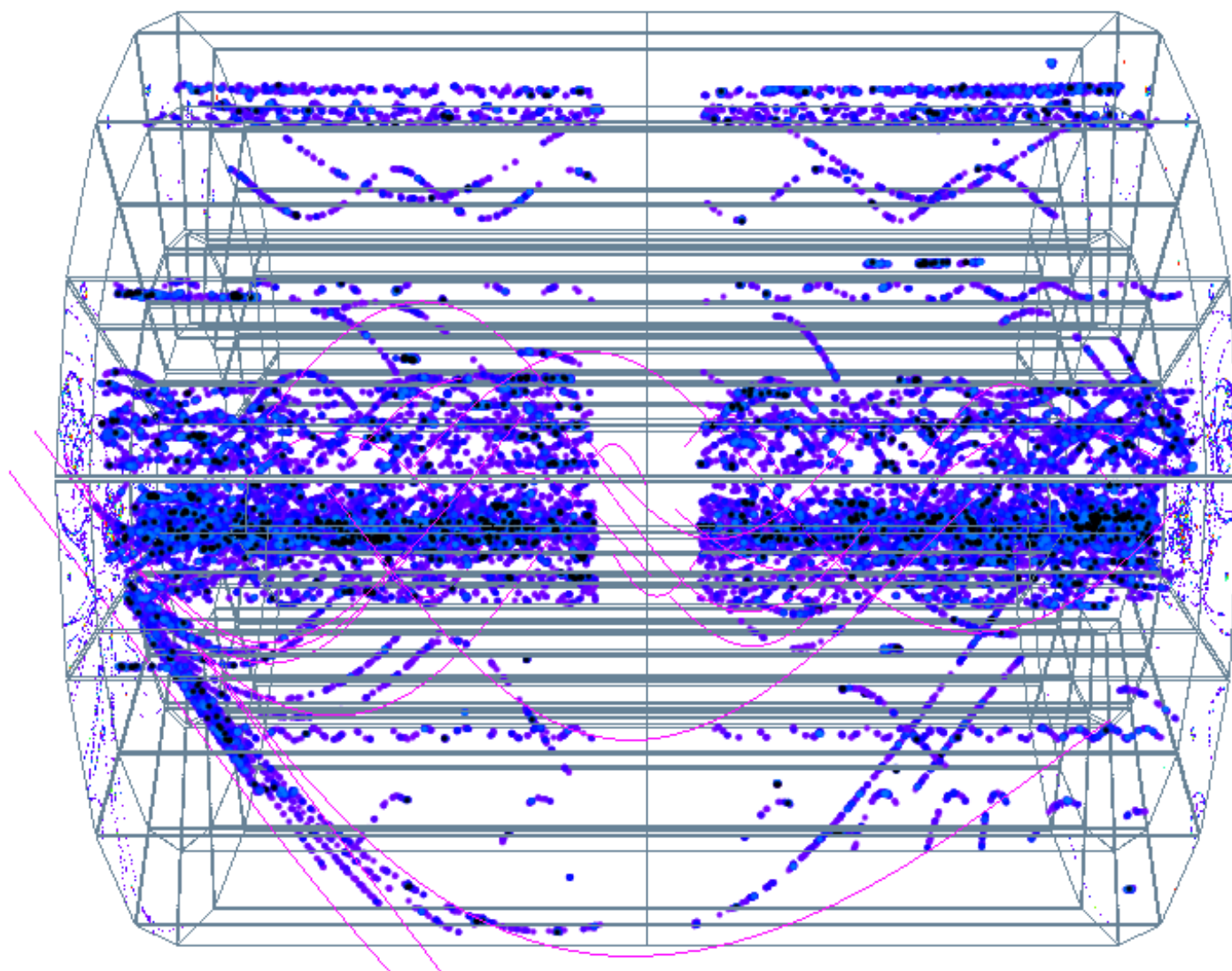
Trigger: 8 No. of event: 3723 File: 10000109547020.10/raw.root nAMU: 0 eventSize: 2.22053



89 muons

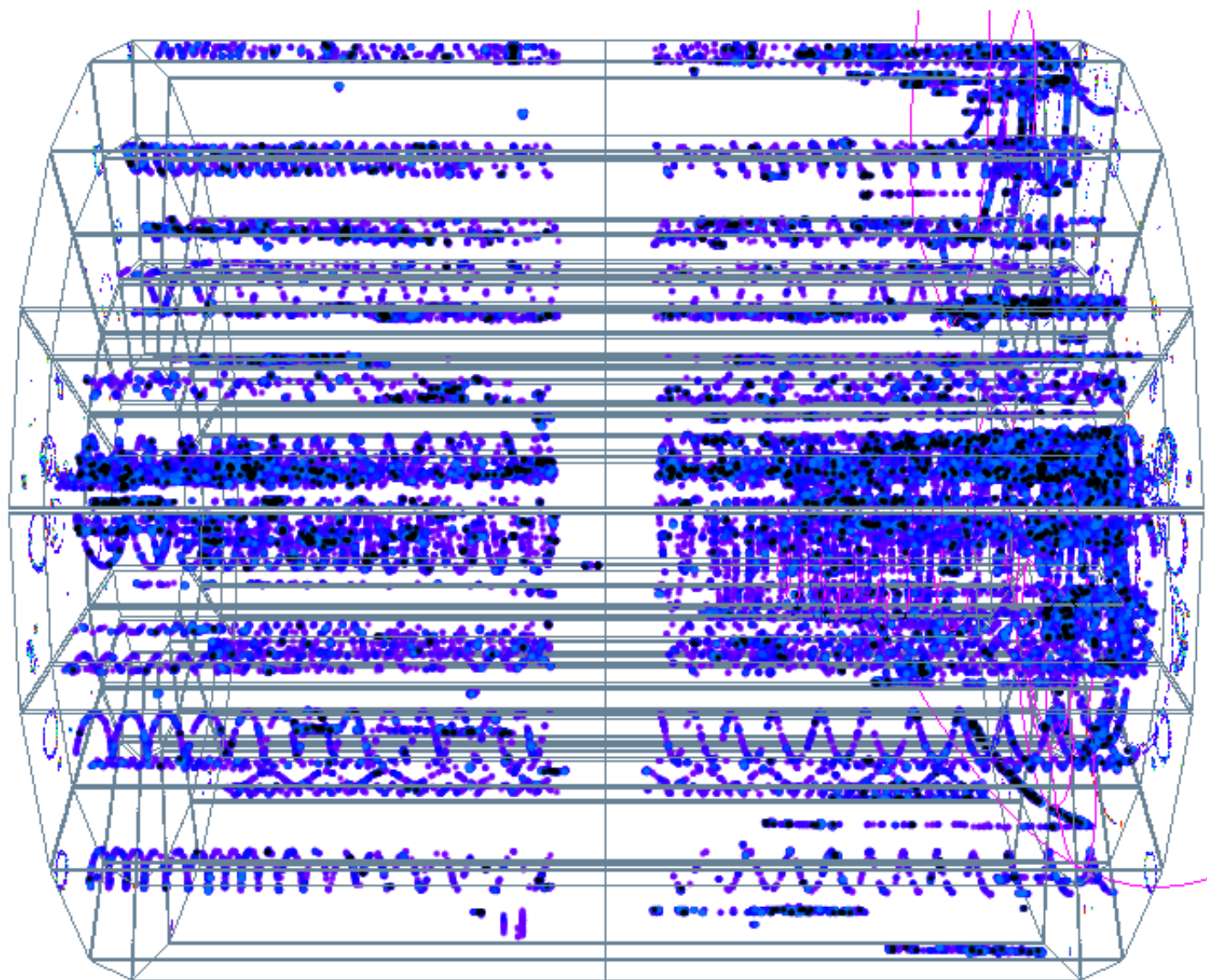
- Checks on raw data files

Trigger: 2 No. of event: 4286 File: 10000110519022.20/raw.root nAMU: 0 eventSize: 1.13752



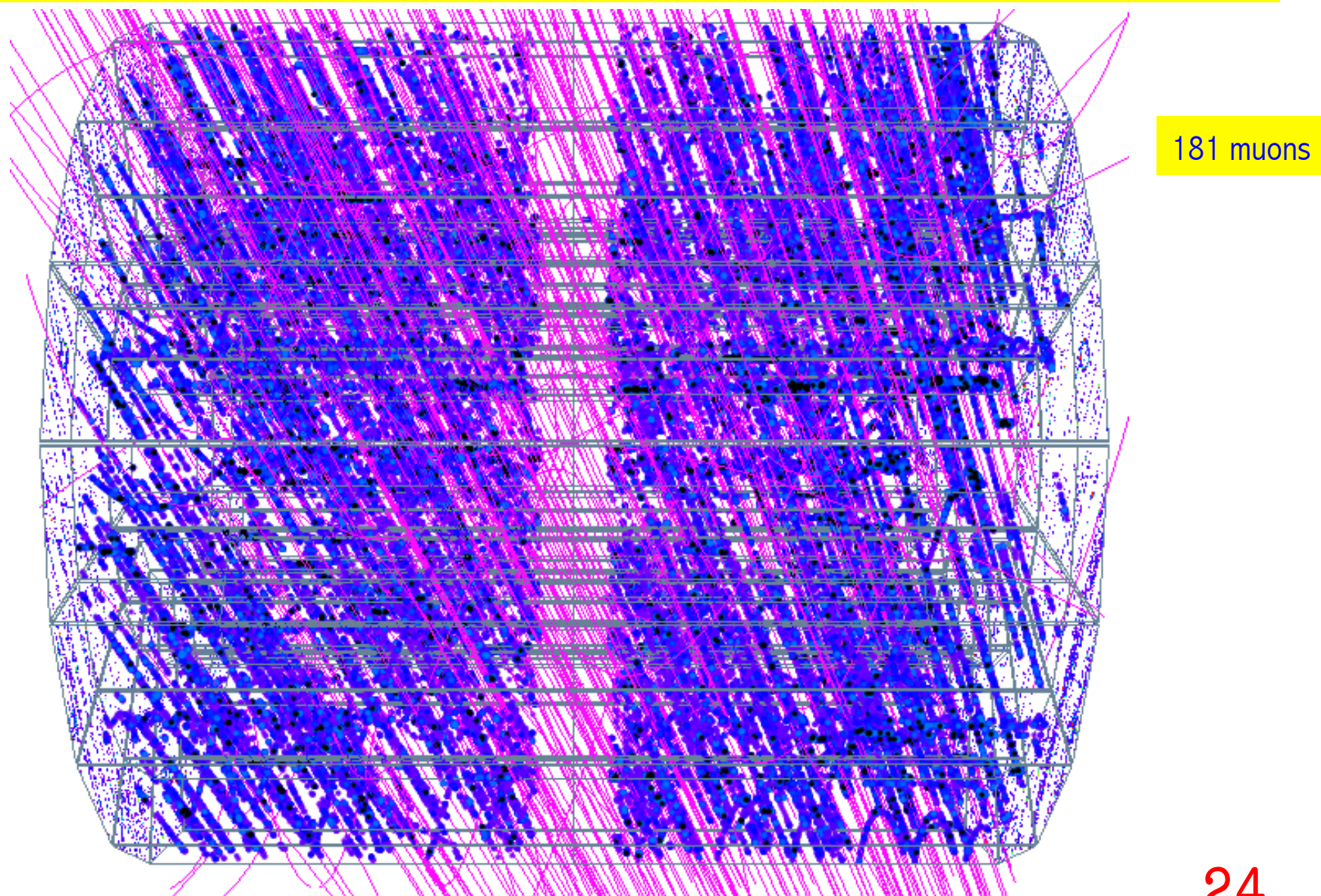
- Checks on raw data files

Trigger: 8 No. of event: 5019 File: 10000110519022.20/raw.root nAMU: 0 eventSize: 1.34633



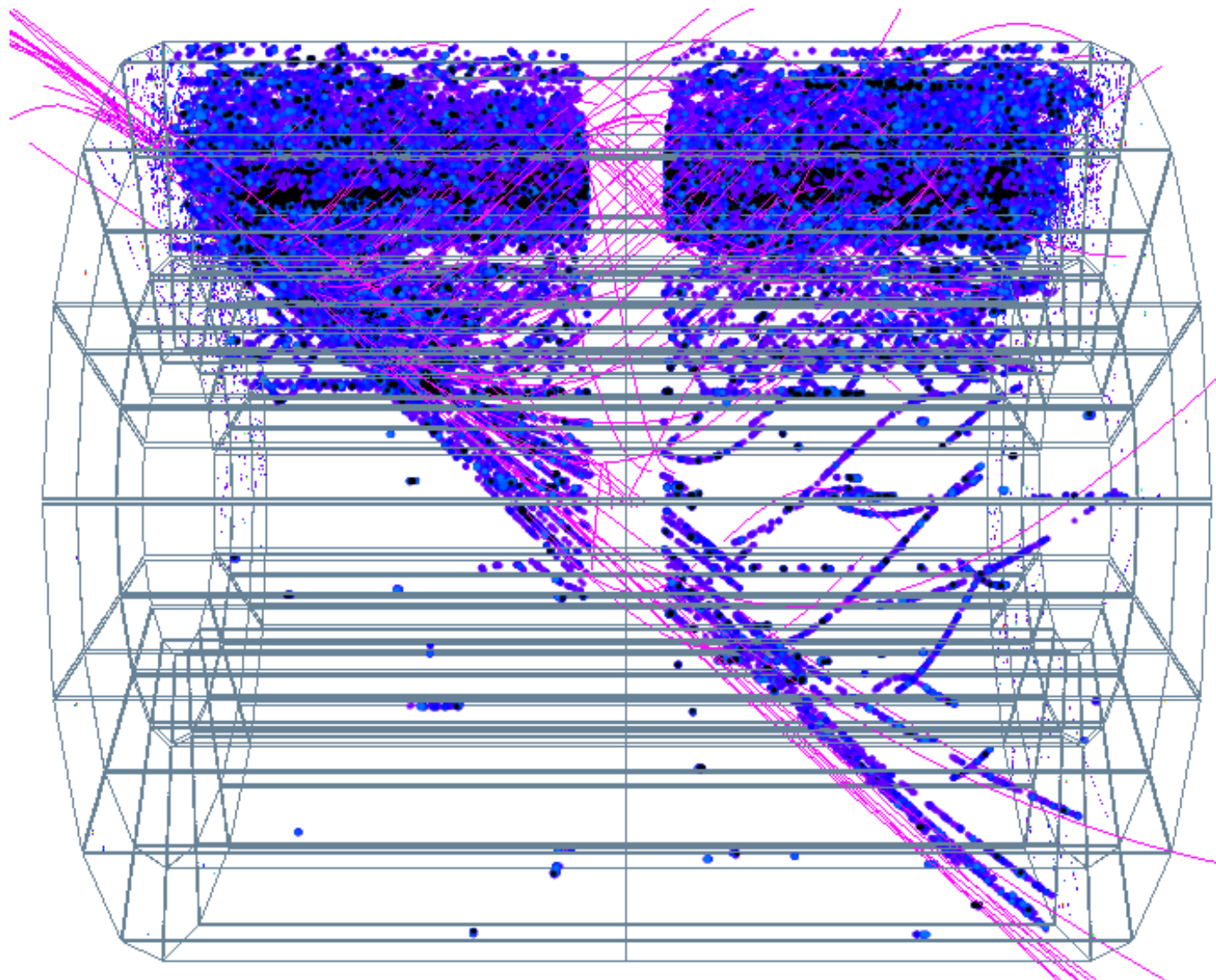
- Checks on raw data files

Trigger: 11 No. of event: 6353 File: 10000110519022.20/raw.root nAMU: 0 eventSize: 5.37344



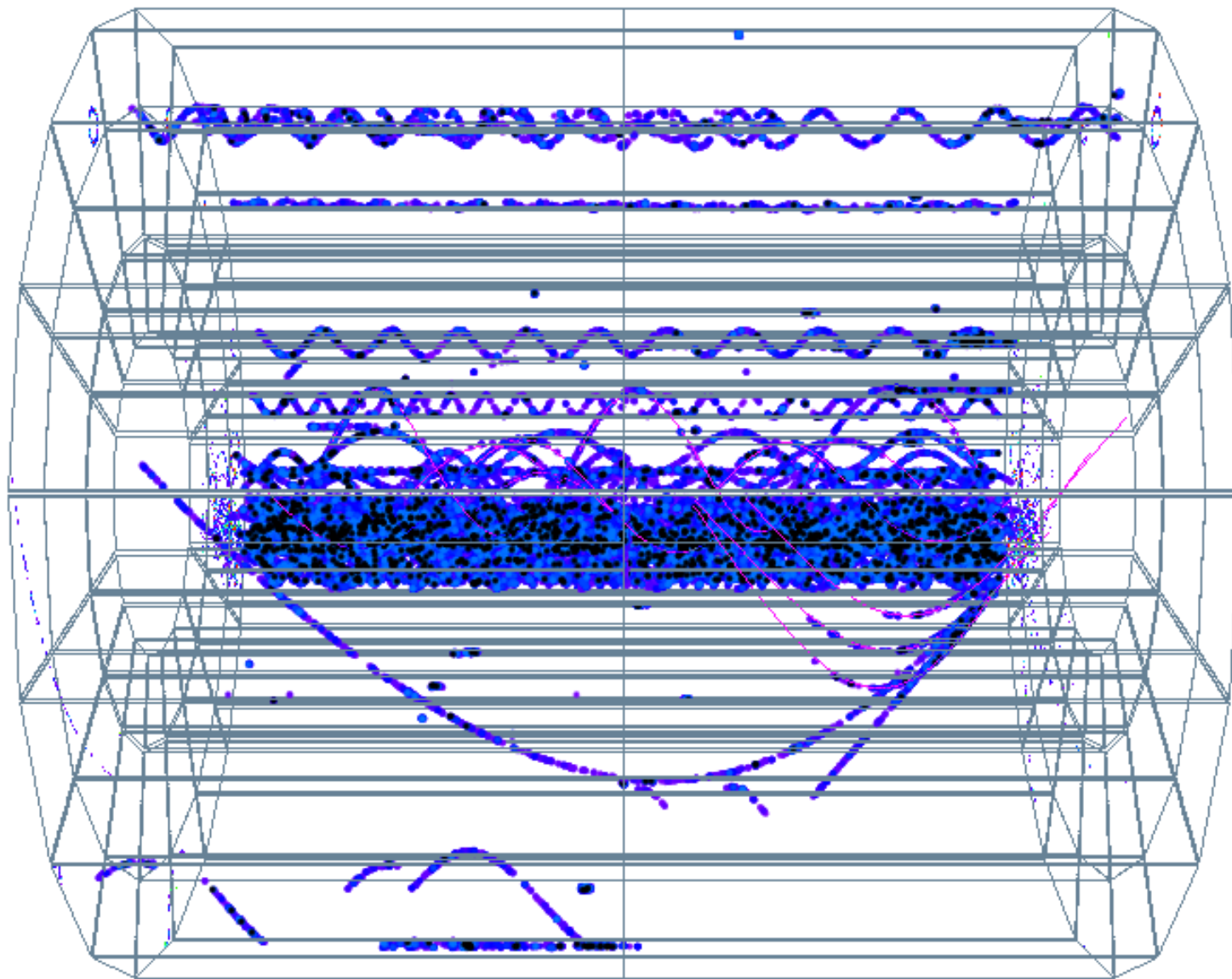
- Checks on raw data files

Trigger: 3 No. of event: 8090 File: 10000110519022.20/raw.root nAMU: 0 eventSize: 4.28956



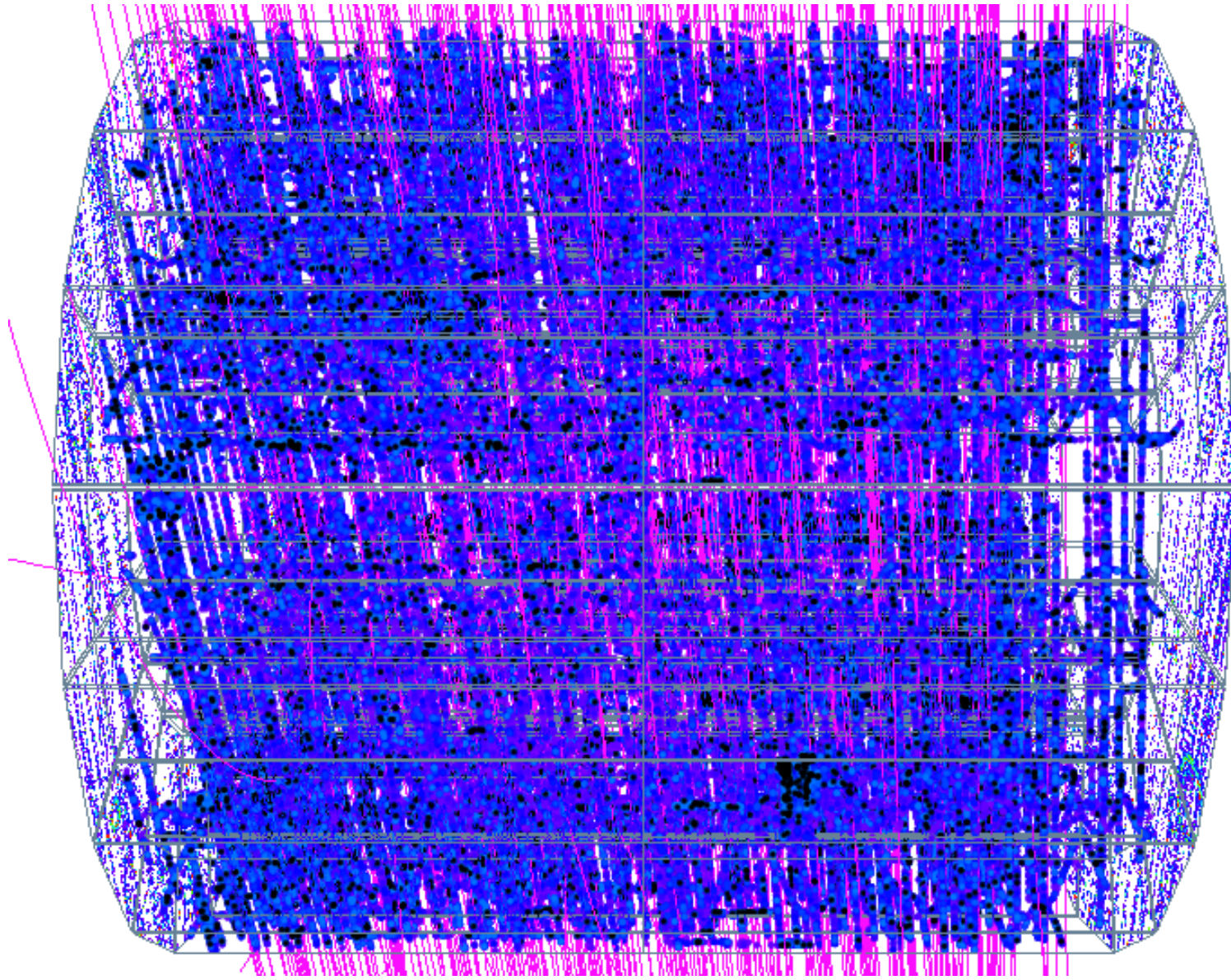
- Checks on raw data files

Trigger: 33 No. of event: 314 File: 11000152599020.10/raw.root nAMU: 0 eventSize: 1.54997



- Checks on raw data files

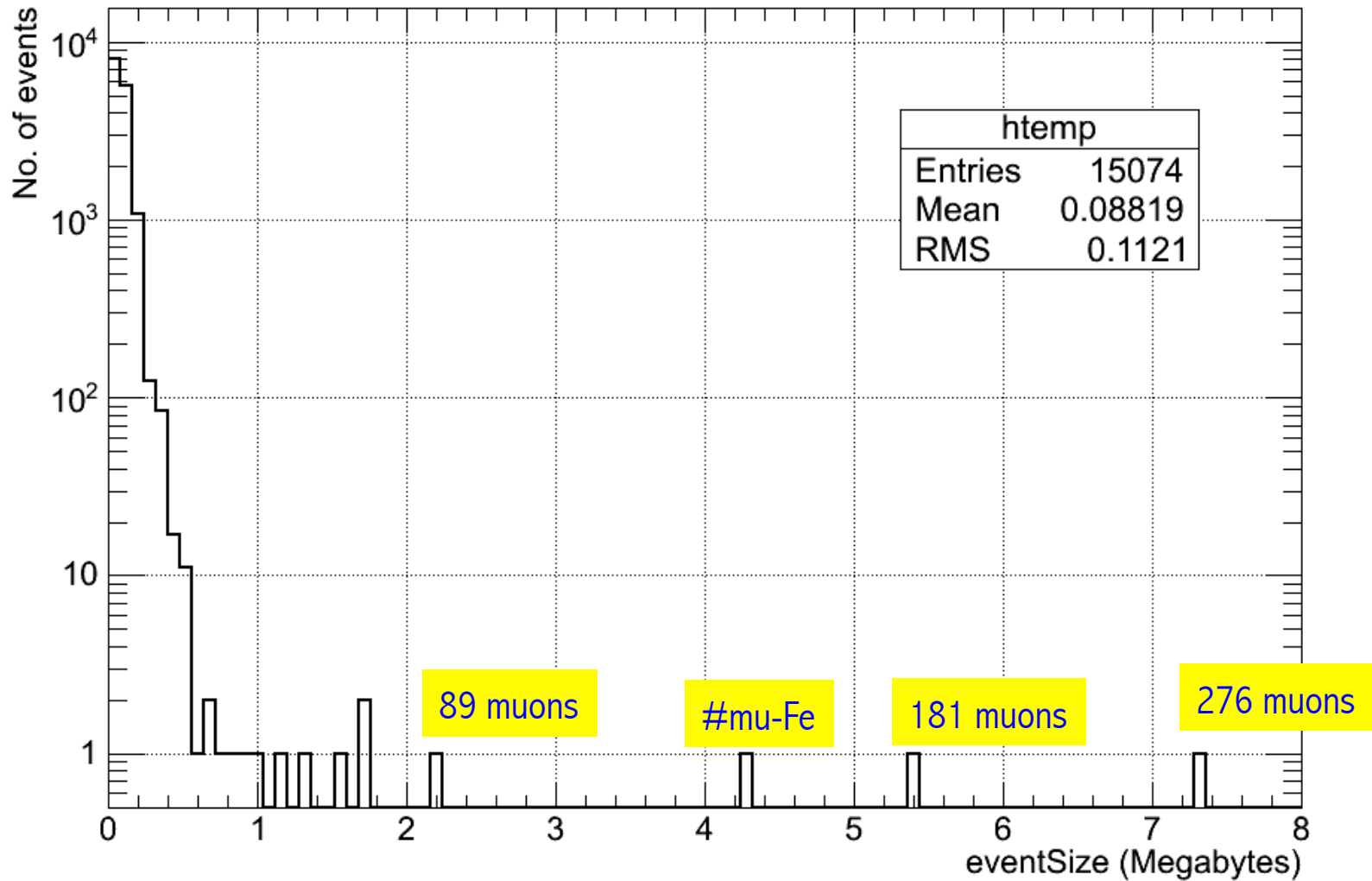
Trigger: 4 No. of event: 372 File: 11000152599020.10/raw.root nAMU: 0 eventSize: 7.35994



276 muons

- Checks on raw data files

I checked 3 chunks: 10000109547020.10, 10000110519022.20 and 11000152599020.10



- Final comments

The study of Monte Carlo for protons and Fe nuclei is finished with CORSIKA 6990 → the next step is to run with CORSIKA 73500 (Bruno already sent the new MC production)

The data is close to the protons for $4 < \#mu < 15$

What about the systematic uncertainties ?

Acc x Eff. = $\#muons @ TPC (Fe/protons) / \#muons @ GHOST Scint. ?$

The event size of muons bundles ($\#mu > 100$) should be bigger than 2