Status of the 2015 data analysis

Incident angle effect

Héctor García Cabrera

GOBIERNO DE ESPAÑA
MINISTERIO DE CIENCIA E INNOVACIÓN
Ciemat
Centro de Investigaciones Energéticas, Medioambientales y Tecnológicas
cfp CIEMAT física de partículas

Context

The idea of this analysis is to check the effect of the incident angle of the particles in the efficiency, multiplicity, energy reconstruction, etc.

Repository for this analysis:

https://gitlab.cern.ch/hegarcia/sdhcal-angleanalysis

Test Beams: SPS May 2015 and PS June 2015

Wide range of energies: 2 – 70 GeV Pions

Several rotation angles: 22, 20, 10 (Last one only low energies 10GeV max.)

SDHCAL: 49 layers installed in the prototype.

Raw Stream-Out

Raw *.slcio* files from 2015 are byte collections which need to be converted to CalorimeterHits.

Previous data sizes and header shifts are valid except for the DIF header size which is 24 bytes.

ASIC frames with all pads fired (64 hits) were removed at this stage.

Slow Control data (DIF and ASIC Temperature) not extracted.

Trivent v0.3

The CalorimeterHit collections are used to make the time event reconstruction and encoded.

Adapted to accept the current *json* format of the mapping file.

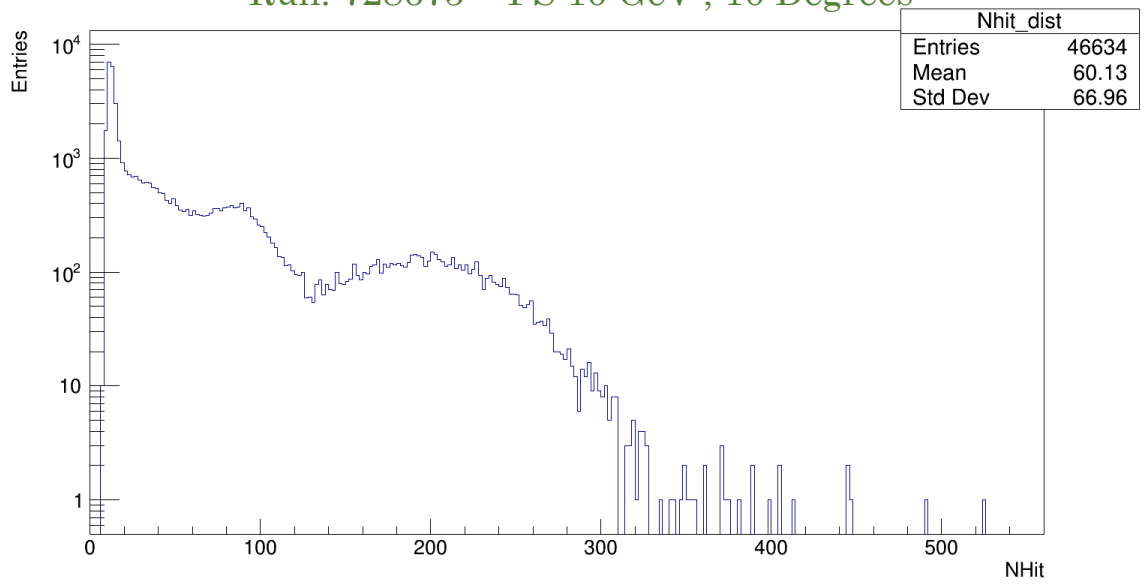
Still unfamiliar with the Gain Correction, turned off.

Cuts:

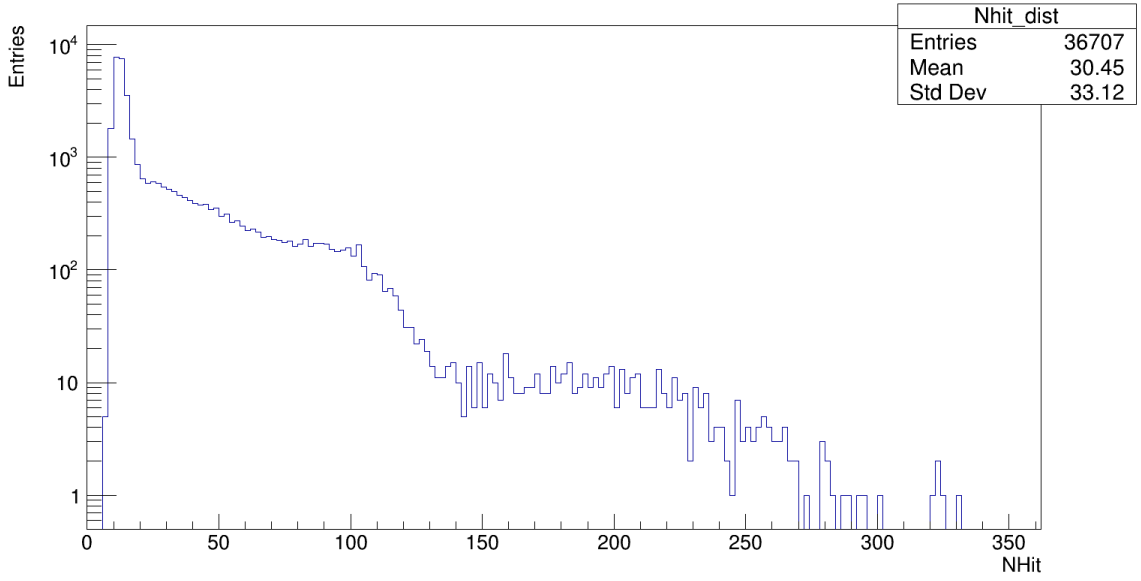
- Total Nhit in the readout < 200000 (electronic noise cut)
- Nhit > 7 to start the time reconstruction
- Nlayers with signal > 7

First nHits distributions

Run: 728675 – PS 10 GeV ; 10 Degrees



Run: 728456 – SPS 10 GeV ; 22.46 Degrees



Particles selection. Muon selection variables

Density: $\rho = \frac{nHit}{nLayers}$

$\boldsymbol{nHit} \rightarrow$ total number of hits in the detector.

$\boldsymbol{nLayers} \rightarrow$ number of layers with signal.

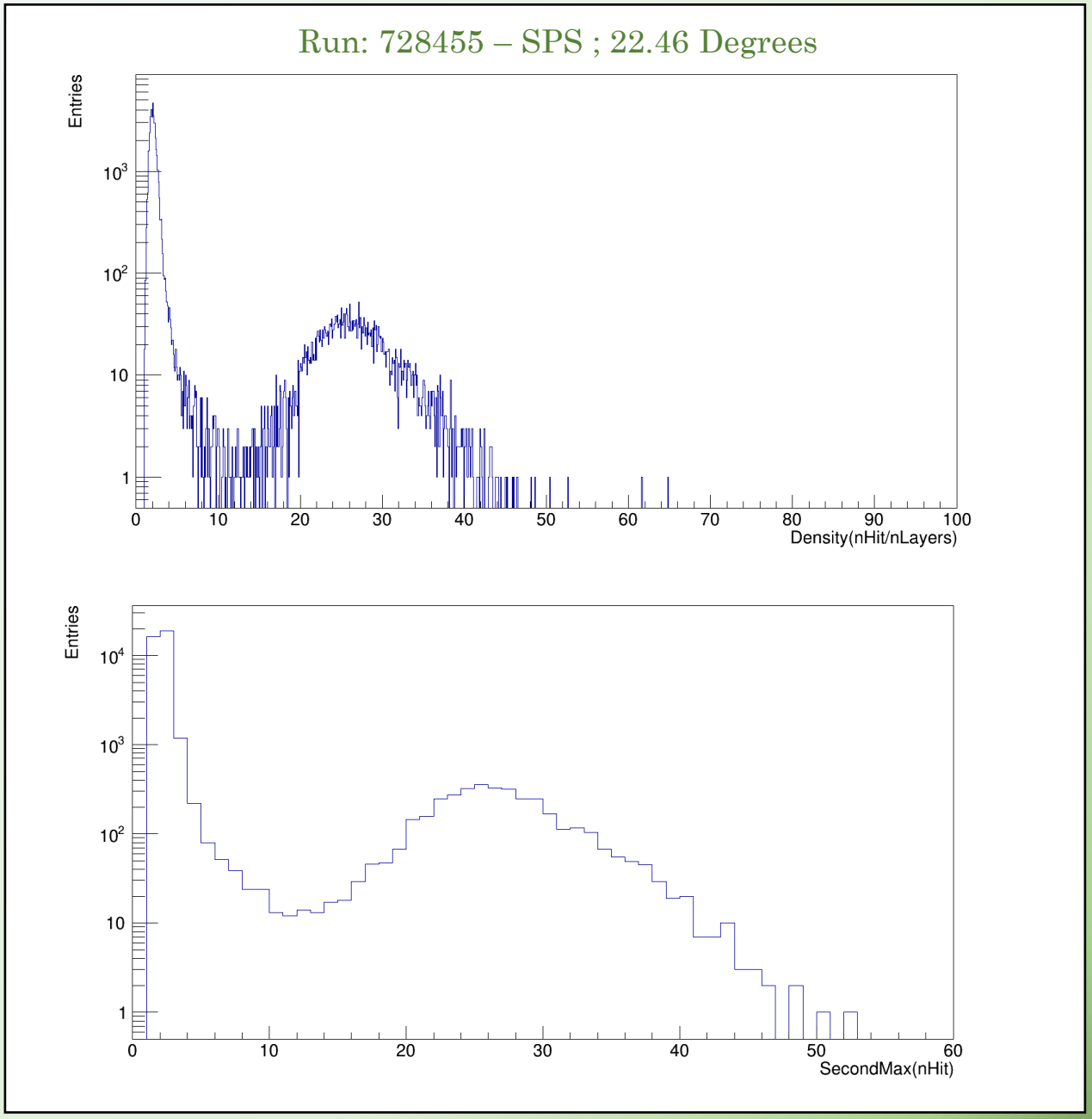
Second maximum of hits in a single layer: Hit_{Max2}

Penetrability Condition (P.C.):

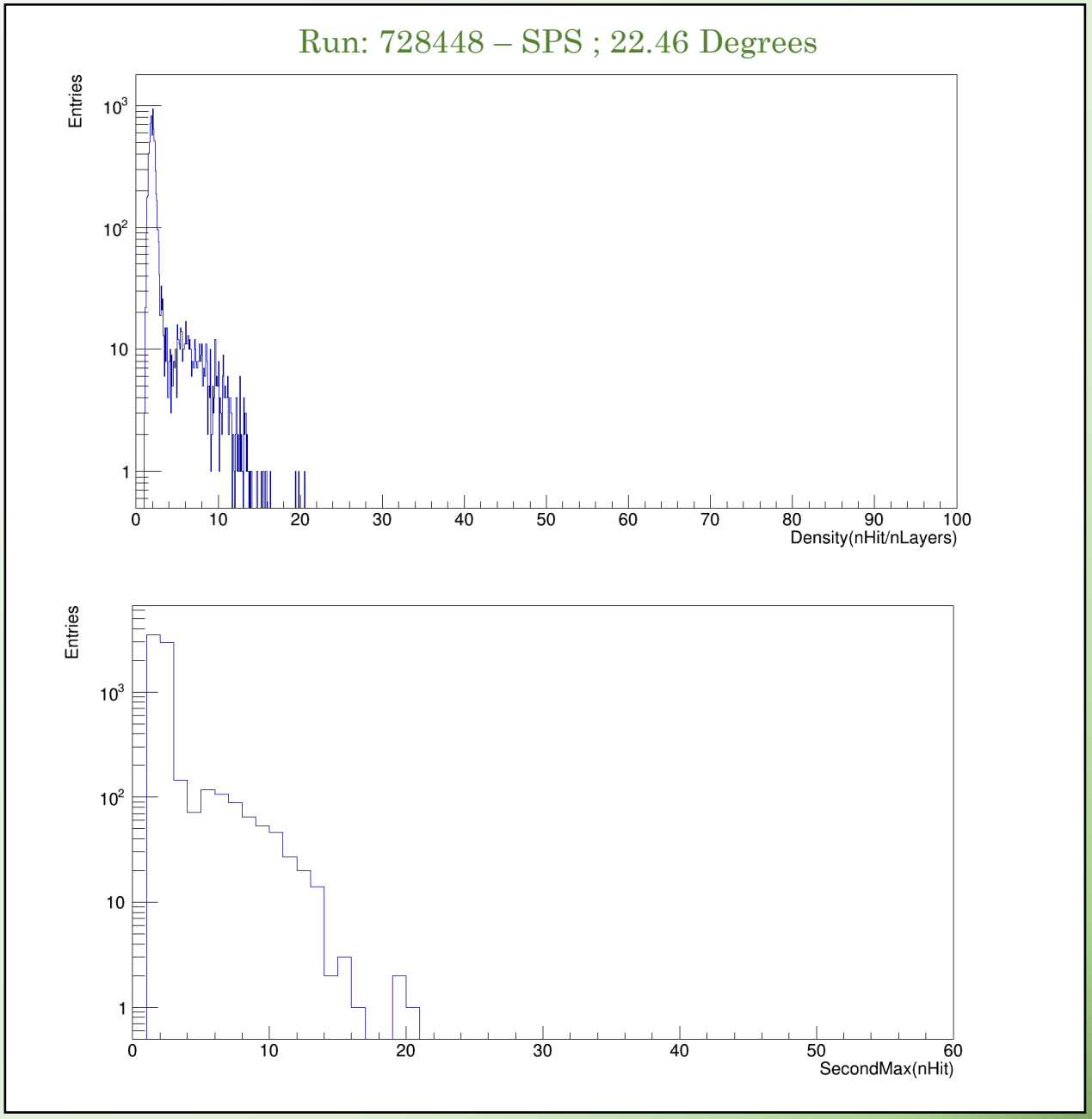
SDHCal

- Layers 00-11: at least 9 with signal.
- Layers 12-23: at least 9 with signal.
- Layers 24-35: at least 9 with signal.
- Layers 36-48: at least 9 with signal.

Density and Hit_{Max2} – 70GeV

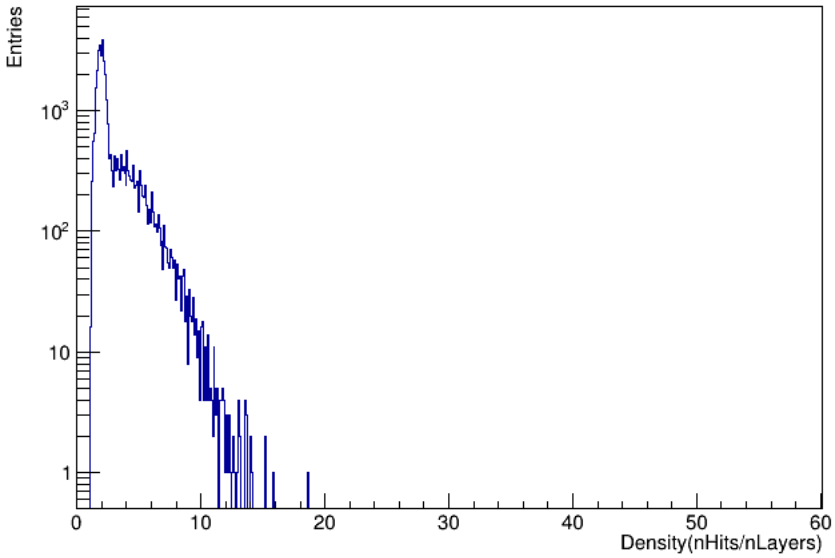


Density and Hit_{Max2} – 10GeV

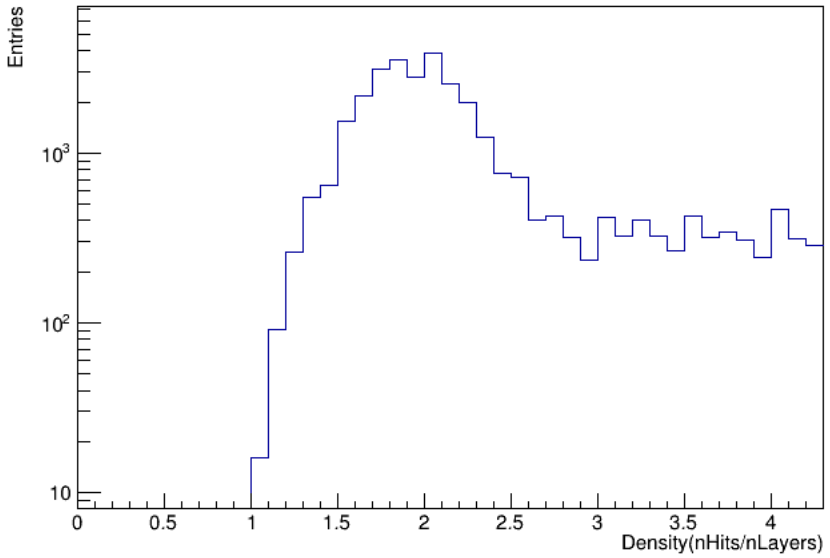


Density and Hit_{Max2} – 4GeV

Run: 728661 – PS ; 20 Degrees



Close up

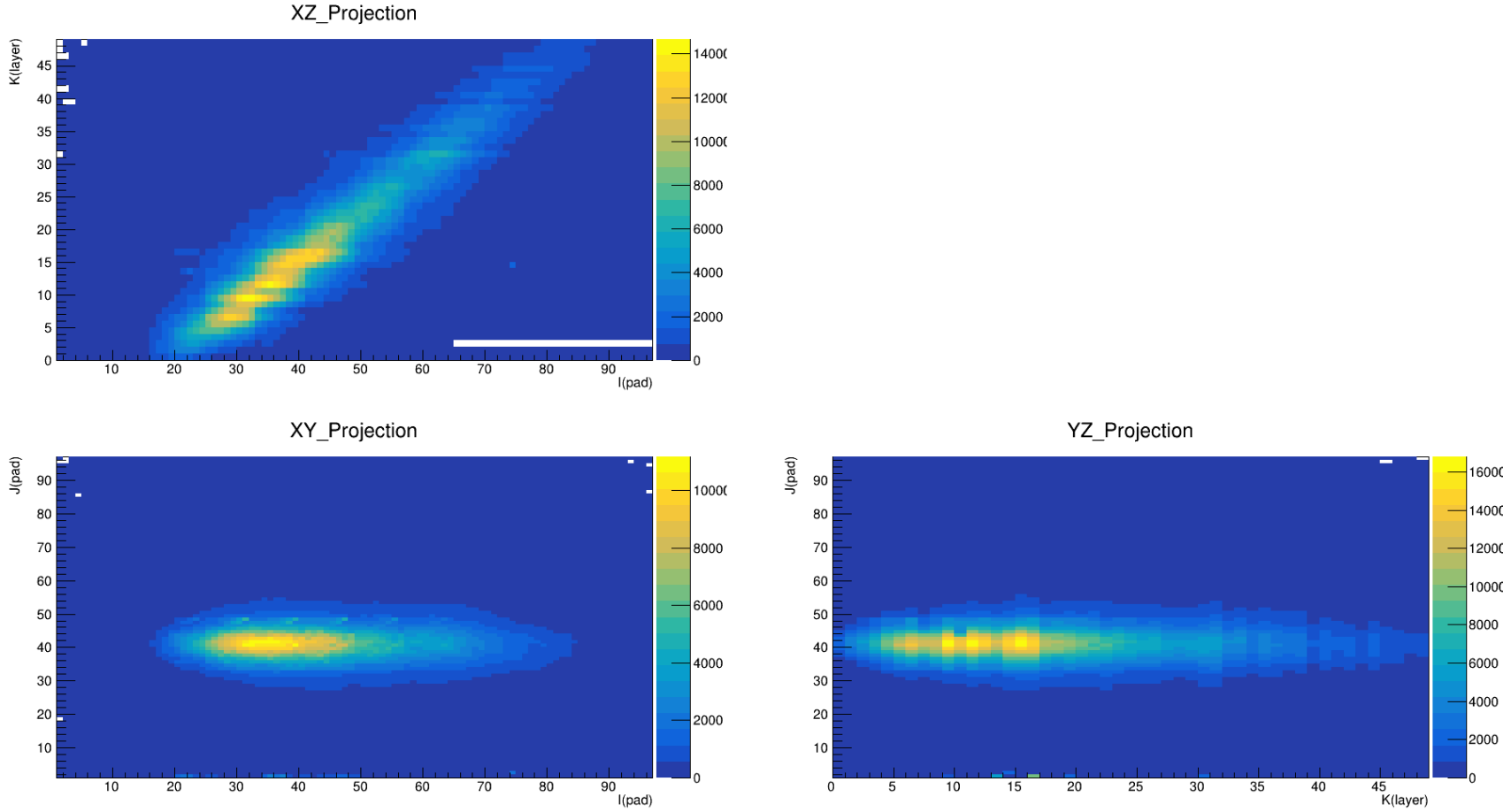


Applying cuts. Showers Profile – 70GeV

Muons/Cosmics → $(\rho < 3 \; or \; Hit_{Max2} < 5) + P.C.$

P.C. Separates Muons and Cosmics

Run: 728455 – SPS ; 22.46 Degrees



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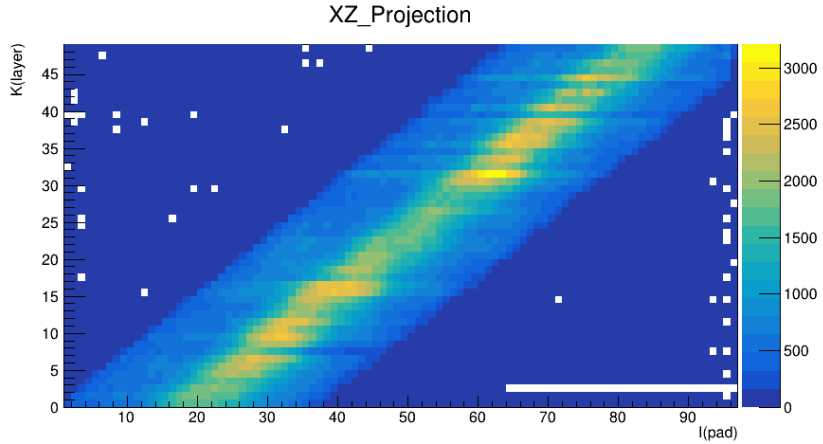

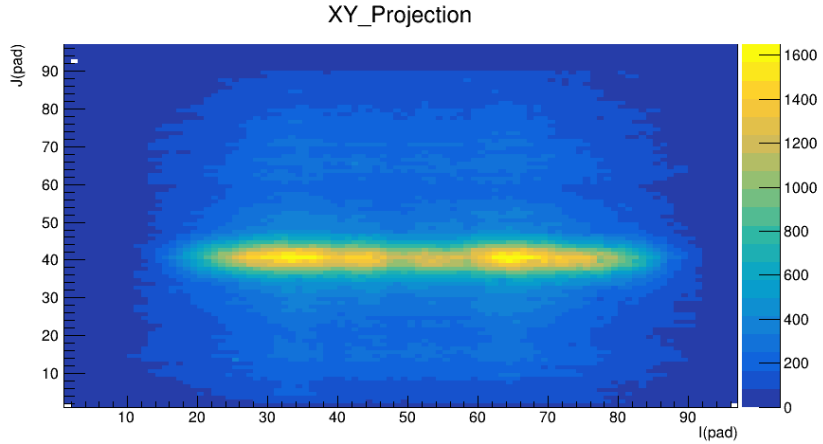

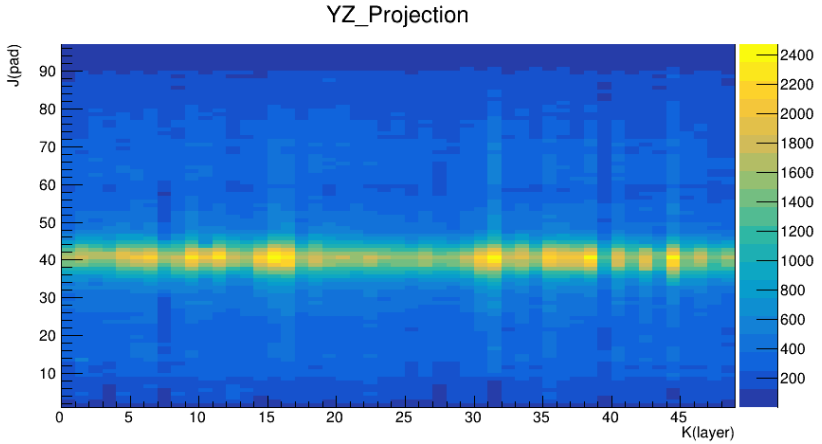

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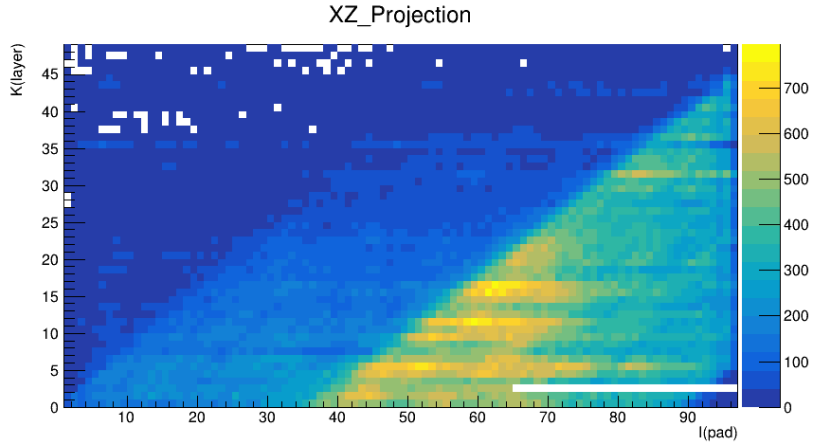

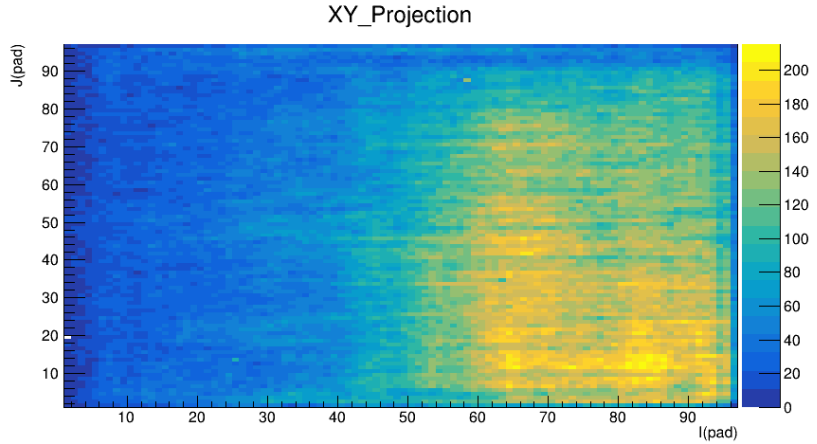

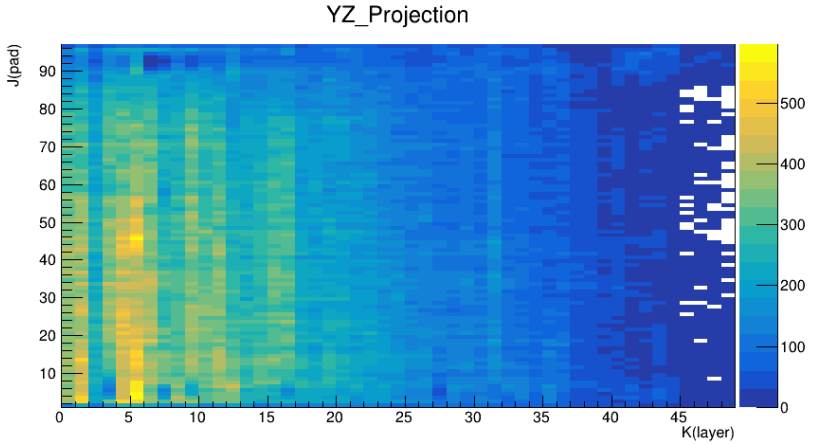

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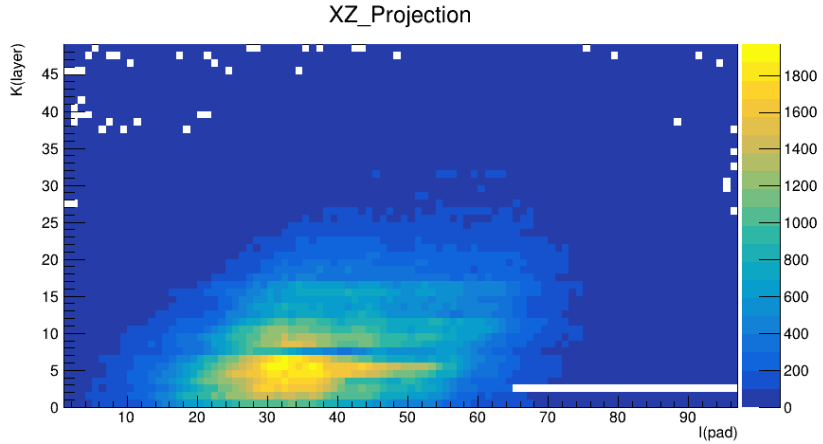
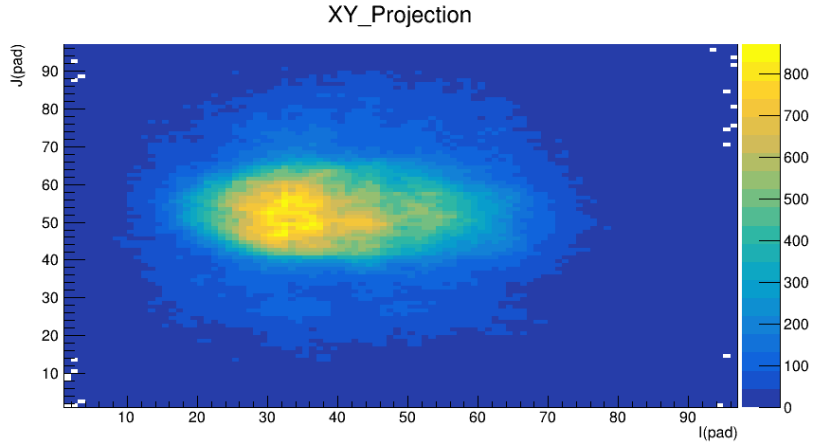
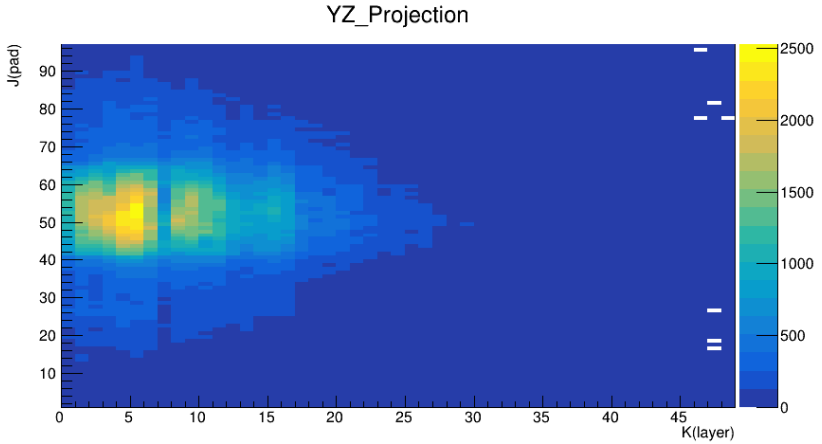
Run: 728661 – PS ; 20 Degrees







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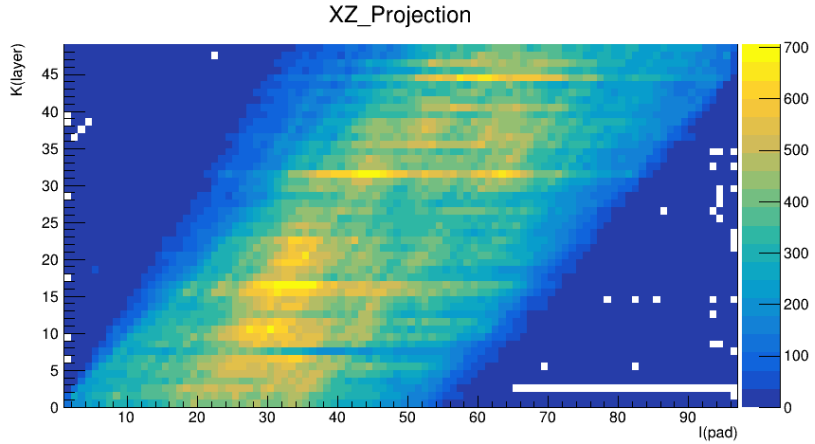

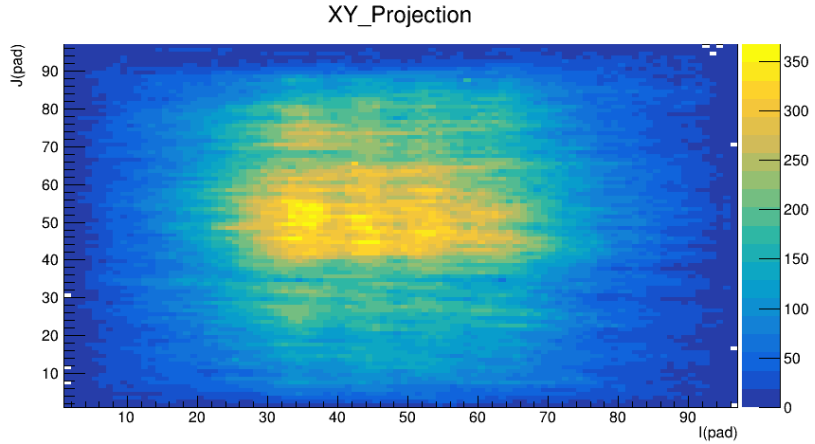

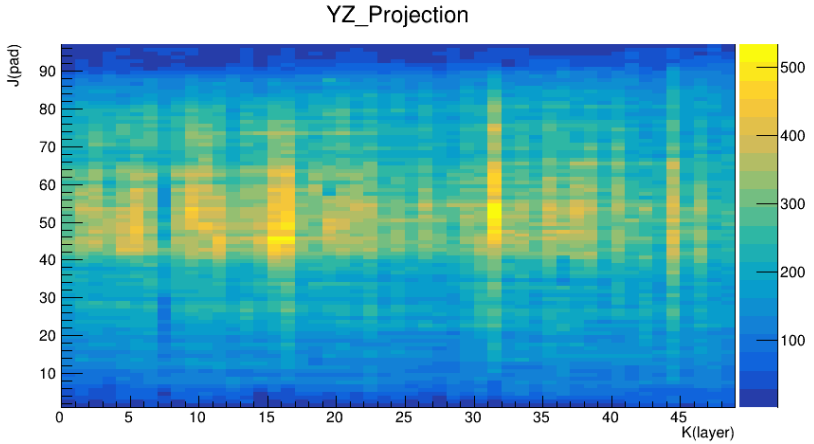

Applying cuts. Cosmics Profile – 4GeV

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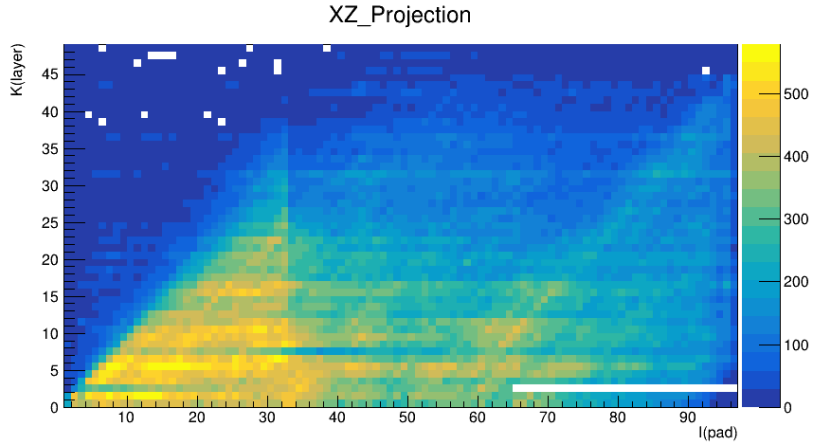
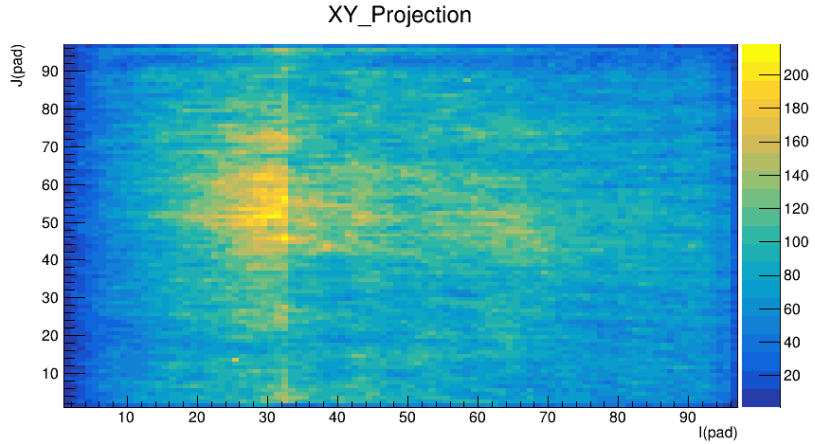
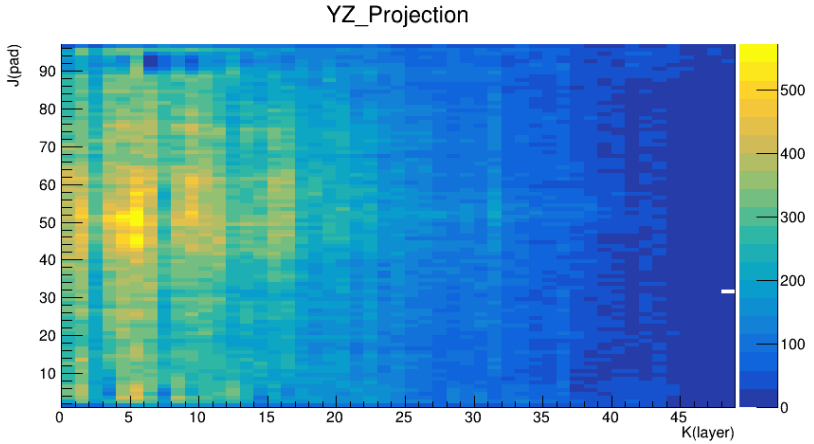






Tracks reconstruction

The process of track reconstruction is made in a few steps:

- A first approximation by taking the mean value of all clusters in each layer
- This approximation is fitted to a straight line.
- Then the closest cluster with a distance less than 20.8 mm in X and Y to the previous approximation is selected for each layer. *(It is possible that a layer has no cluster selected)*
- The final track is the set of selected clusters fitted to a straight line.

Finally the following cuts are applied to select the tracks:

$$|\alpha_Y| < 0.0.04$$

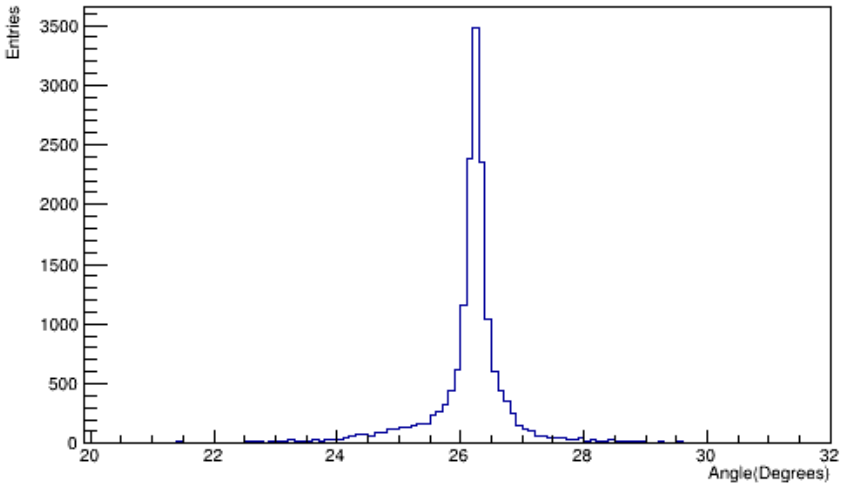
Where α_Y is the slope of the tracks in the Y axis.
No less than 5 layers with clusters selected

Track angles. SPS TB – 70 GeV

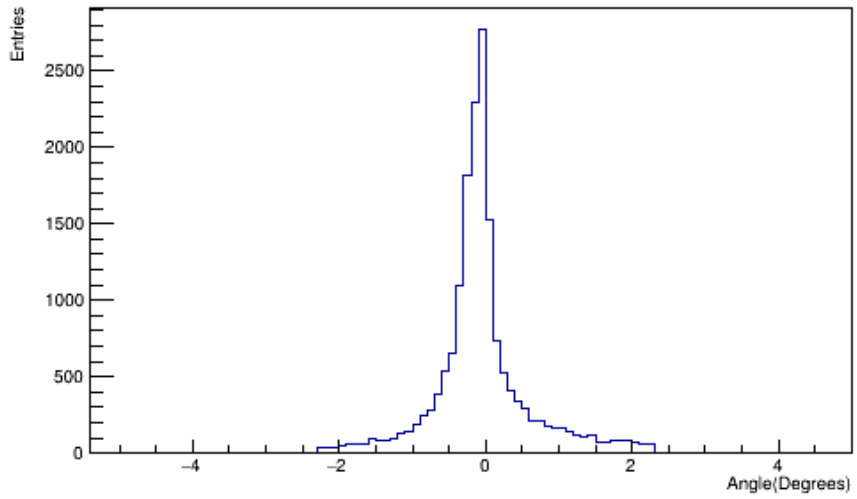
We can compute the value of the incident angle from the reconstructed track of the muons.

Run: 728455 – SPS ; 22.46? Degrees

X axis



Y axis

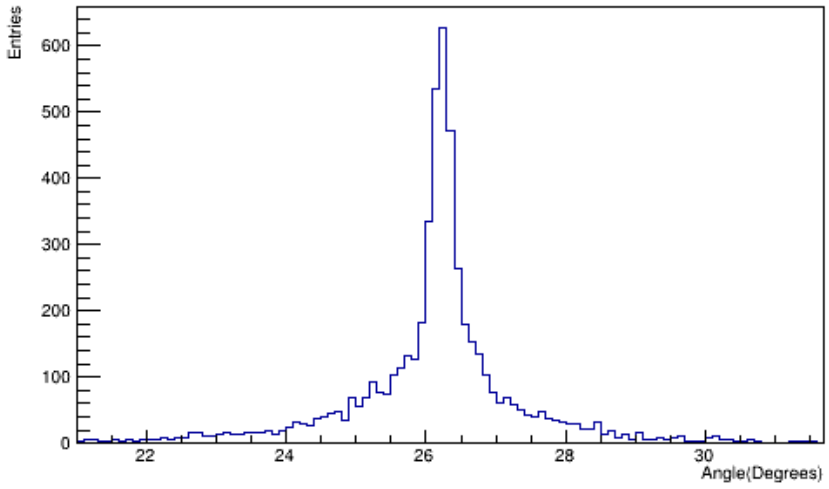


Track angles. SPS TB – 50 GeV

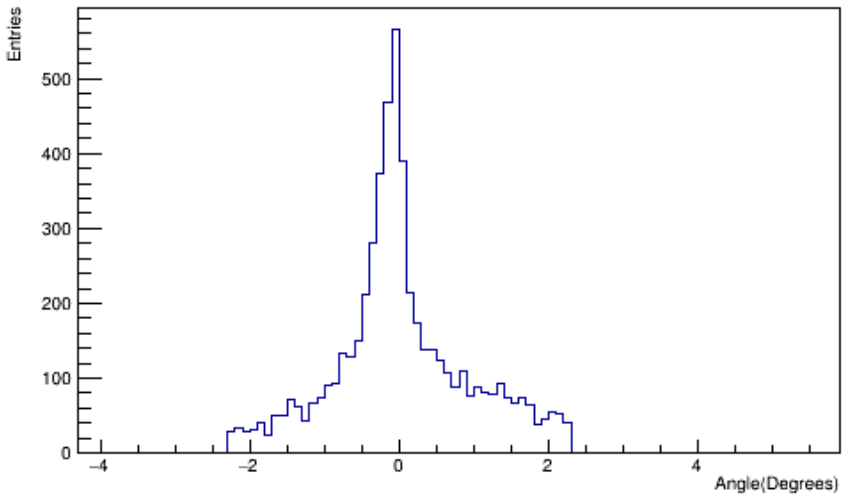
We can compute the value of the incident angle from the reconstructed track of the muons.

Run: 728452 – SPS ; 22.46? Degrees

X axis



Y axis

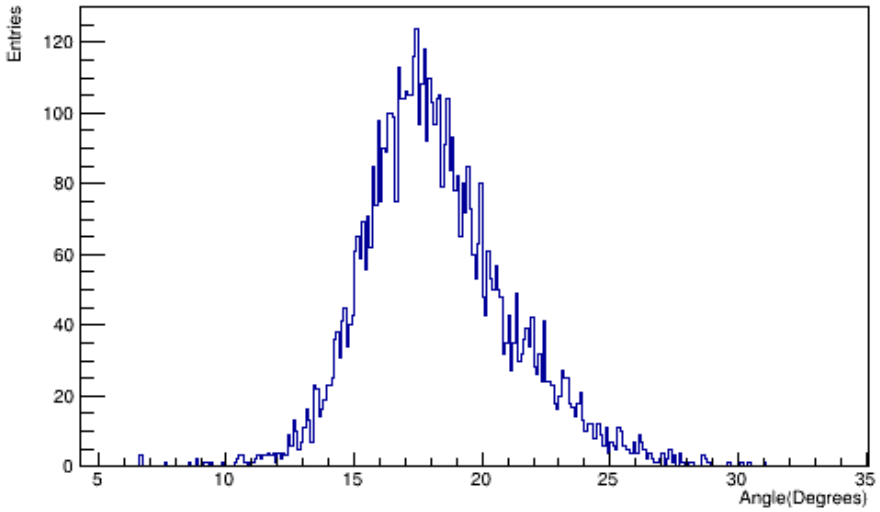


Track angles. PS TB – 4 GeV

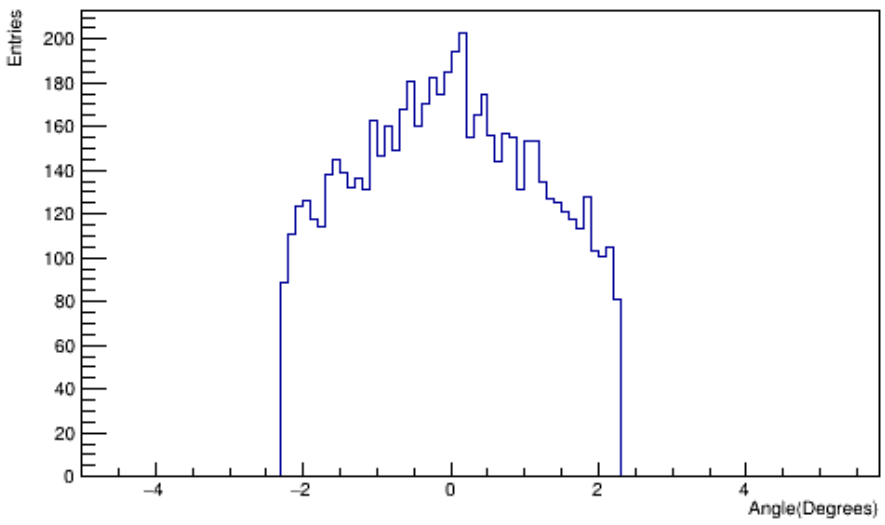
We can compute the value of the incident angle from the reconstructed track of the muons.

Run: 728661 – PS ; 20? Degrees

X axis



Y axis



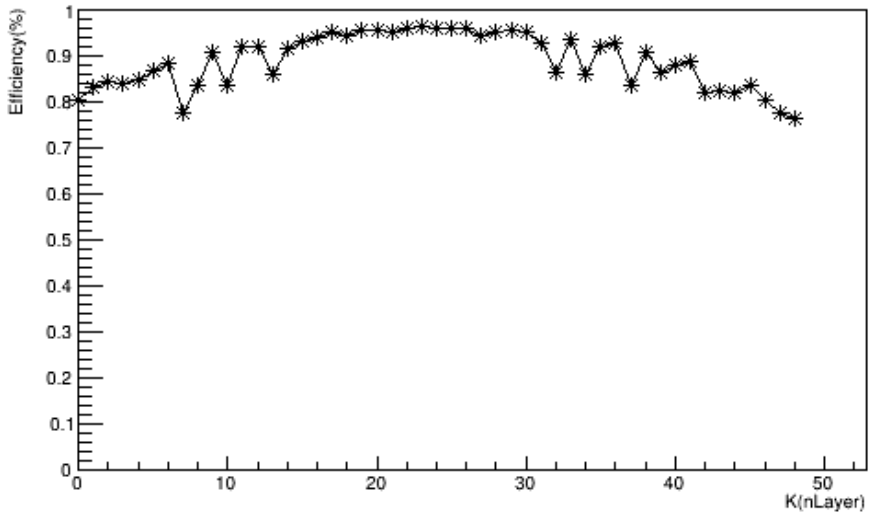
Efficiencies and multiplicities. SPS TB – 70 GeV

Efficiencies: A layer is said to be efficient if there is a cluster in the track of a reconstructed muon in such layer.

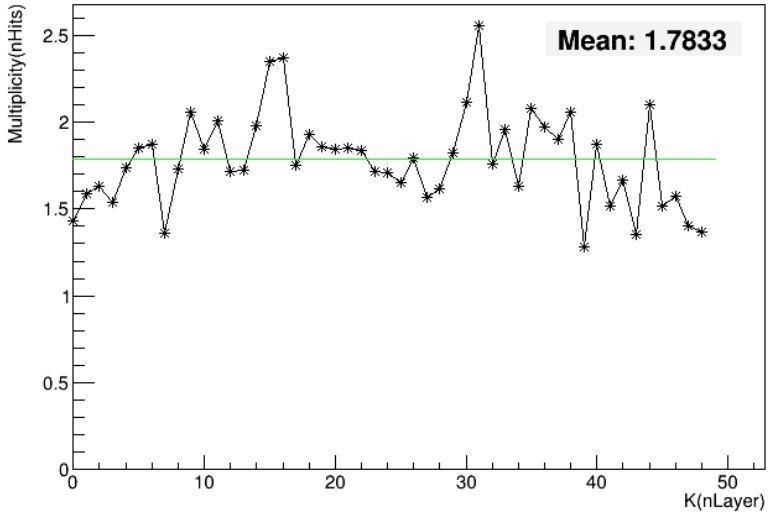
Multiplicities: If a layer is efficient the multiplicity is defined as the size (in number of pads) of the cluster associated to that layer.

Run: 728455 – SPS

Efficiency



Multiplicity



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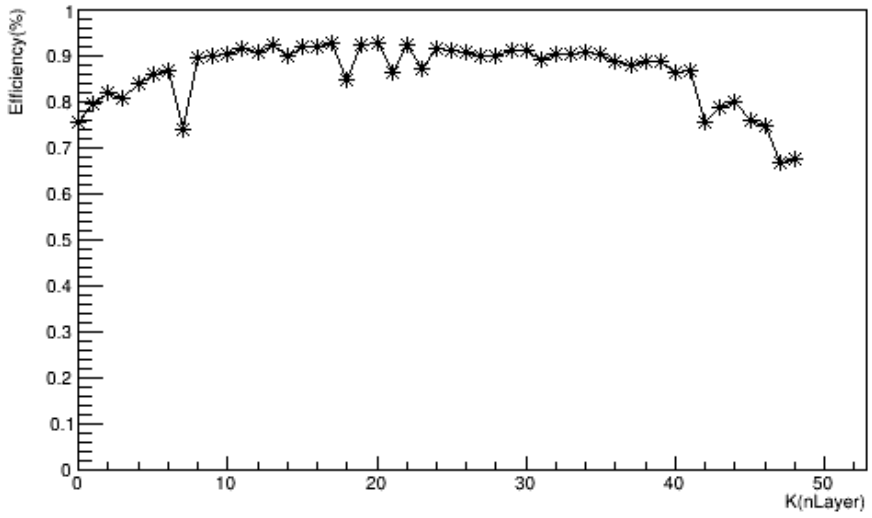
Run: 728661 – PS

Efficiency



Multiplicity