

Differentiating Hadrons and Mu's with HDCal

C. Milstene-Progress Report-Oct 9-03

- Hadrons passing the Muon algorithm in B-Bbar jets are rejected by a track hit multiplicity cut in HDCal which leaves most of the real Mu's untouched in B-Bbar, see resolvingAmbiguities.ppt in (<http://home.fnal.gov/~caroline>)
- We will study now the Maximum Number of Layers Involved in HDCal on single Hadrons and Muons at different energies and see how it applies on B-Bbar To disentangle Hadrons from Muons in jets.

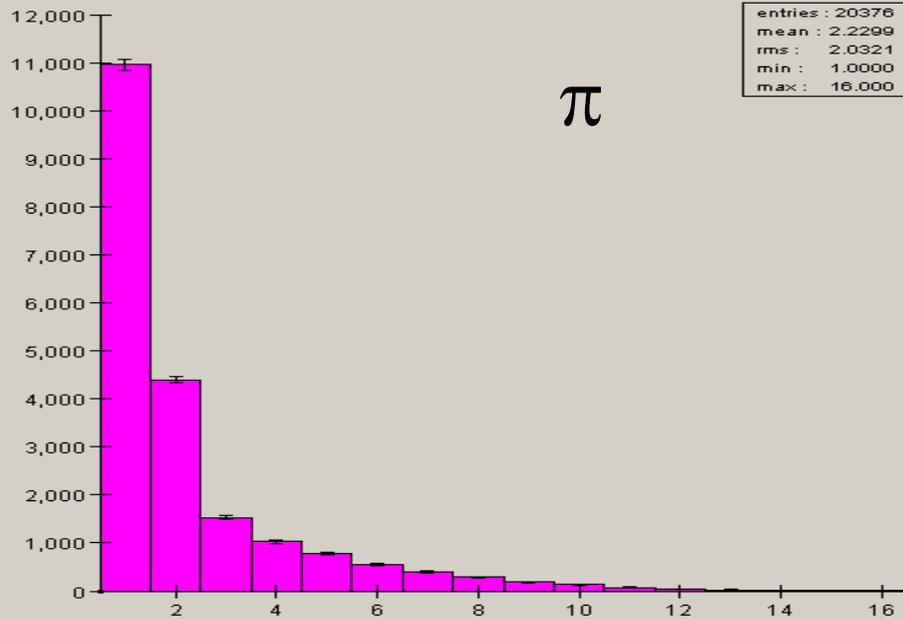
Differentiating Patterns

The HDCal Number of Hits/Layer which is higher in Pions than in Muons and has been used previously.

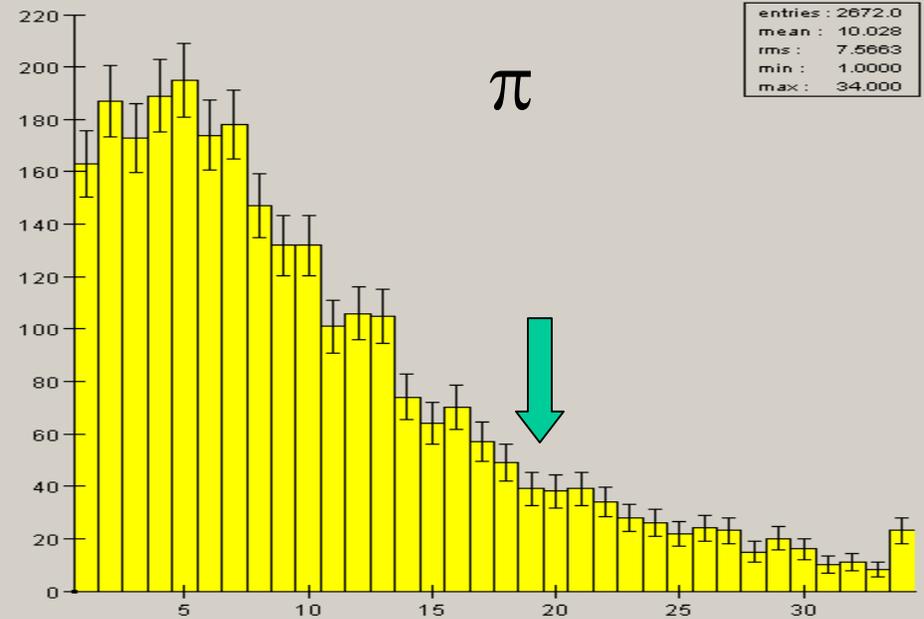
- The total number of layers involved in each event is shown In the next 2 transparencies at 5GeV and 10 GeV.
- A cut at 20 Layers can be used from 5 GeV. It allows to get rid of the bulk of the Pions without really depleting the Muons.
- At higher Momentum the cut could be shifted at 25 layers as seen on the 10 GeV slide.

Layers & Hits - 5GeV Single Pi's & Mu's

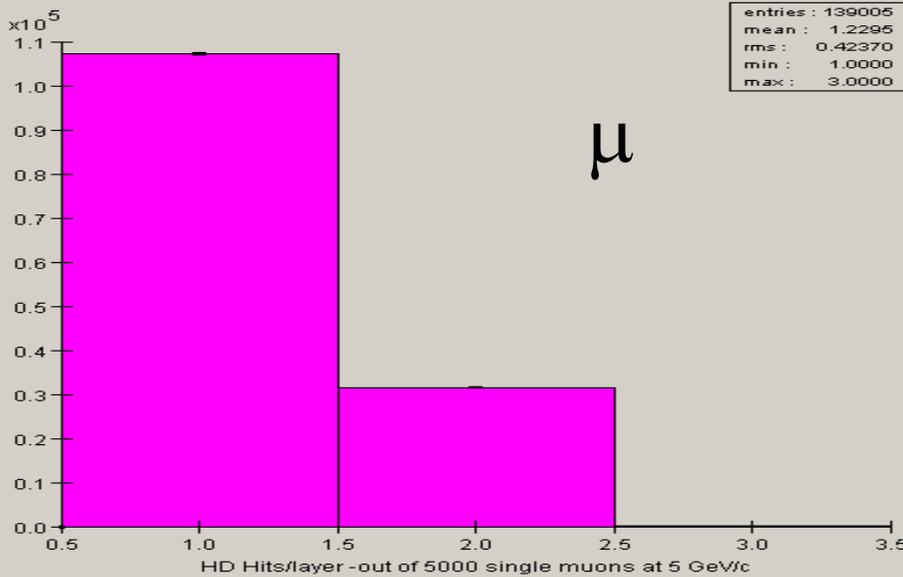
HD Hits per Layer with hit (Real Muon)



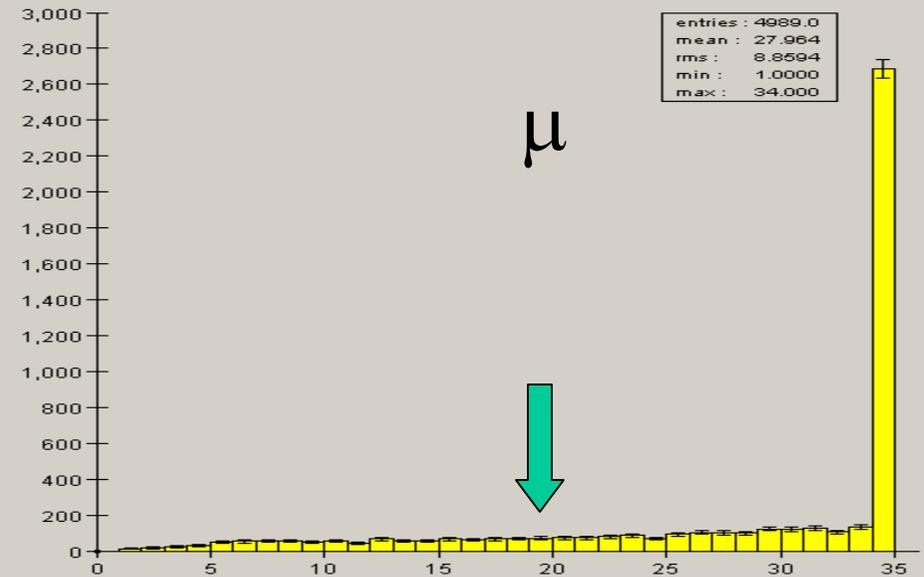
Detected- - Number of Layers with hits HD for Detected Particles



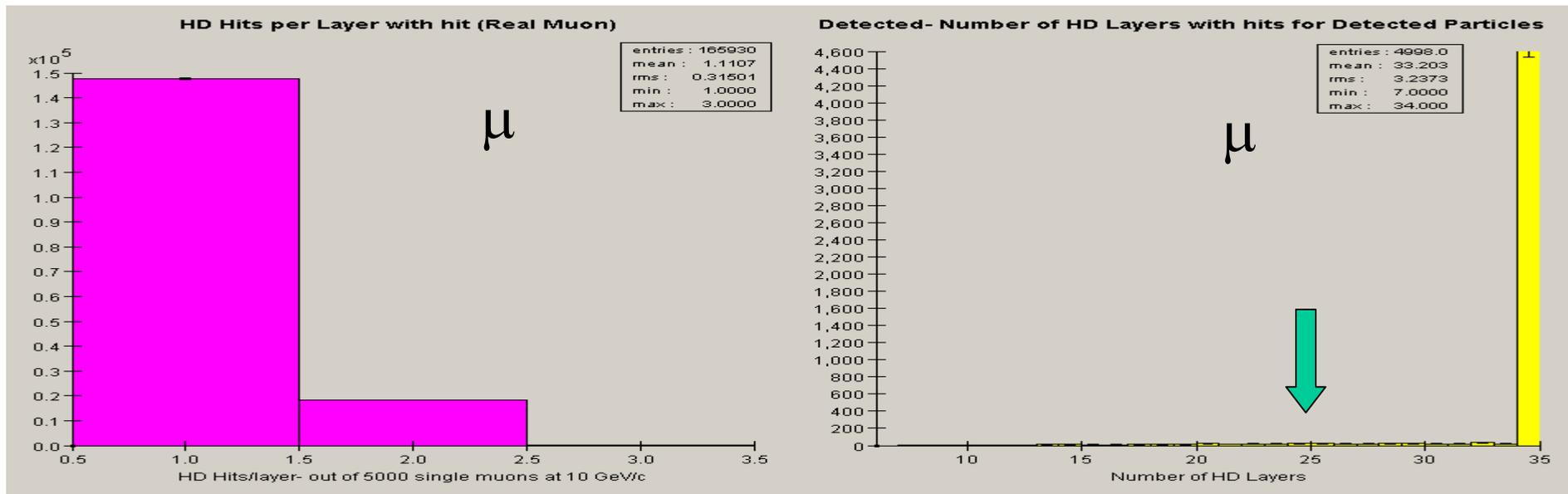
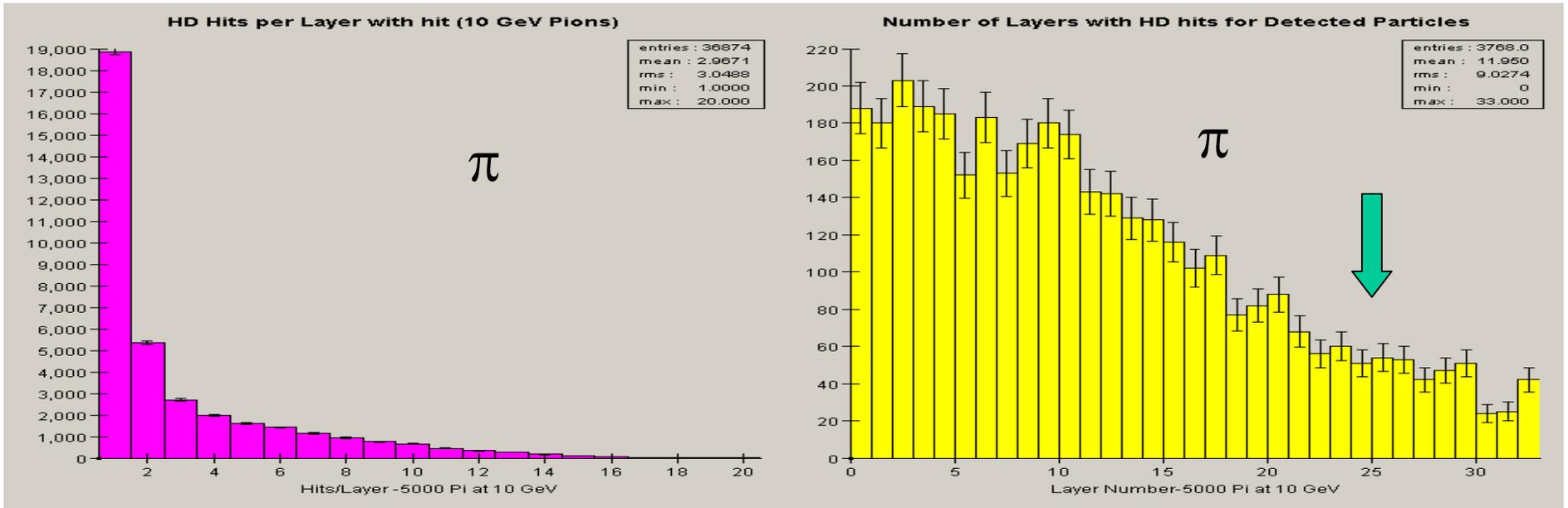
HD Hits per Layer with hit (Real Muon)



Detected- Number of HD Layers with hits - Detected Particles



Layers & Hits - 10 GeV Single Pi's & Mu's



Applying the cuts in B-Bbar Jets Events

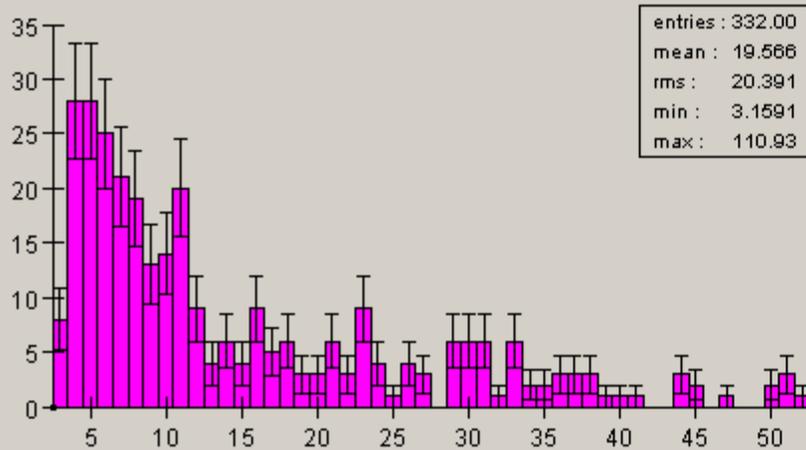
- To resolve the ambiguities the cut in the Maximum number of Layers with hits per track is applied and the 2 next slides show the Muons and the Contamination before and after the cut.

Again the HDCal information allow to get rid of ~50%
Of the contamination leaving the Muons almost untouched

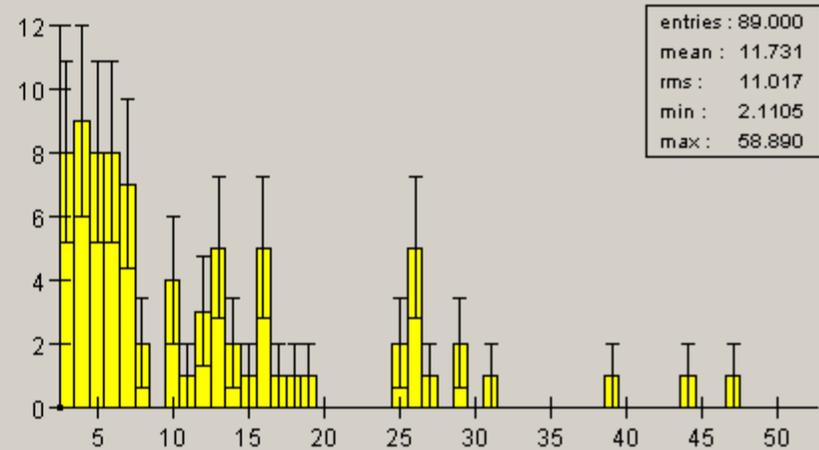
Using also the Cut on the Hits/layer event by event, together
With the Maximum Number of Layers cut allow to get rid
Of 75% of the Contamination.

Hadron Contamination- From 5000 B-Bbar

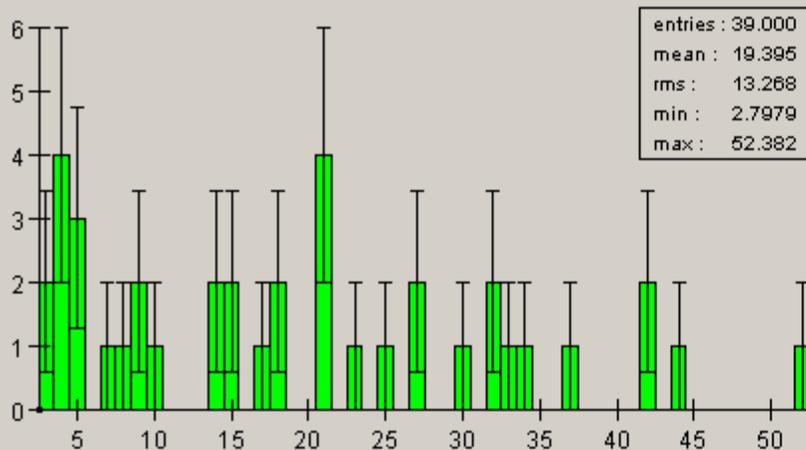
PMC(Mu-Detected)



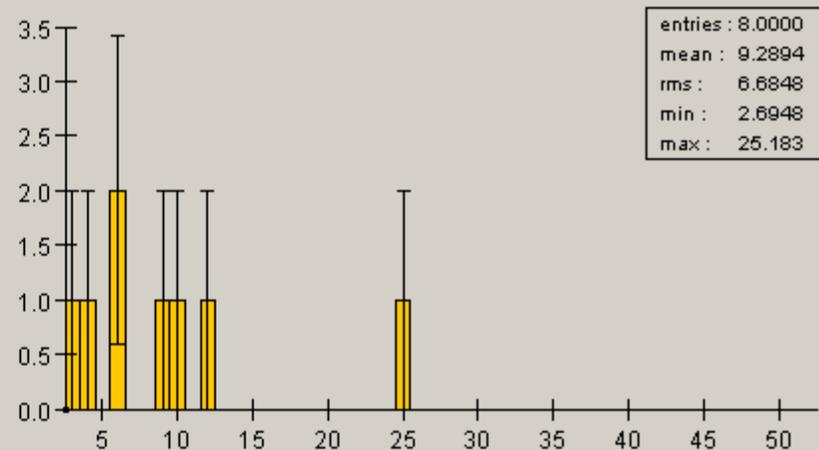
PMC (Pions-Detected)



PMC (Kaons-Detected)

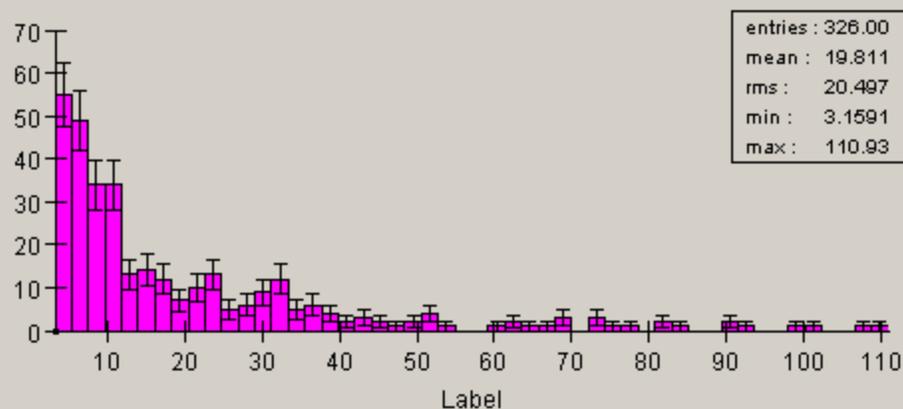


PMC (Protons-Detected)

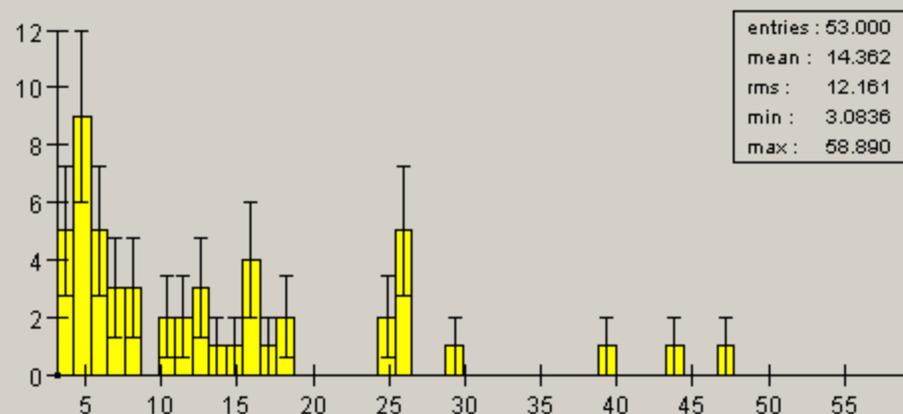


Using the Maximum Layer Cut on 5000 B-Bbar

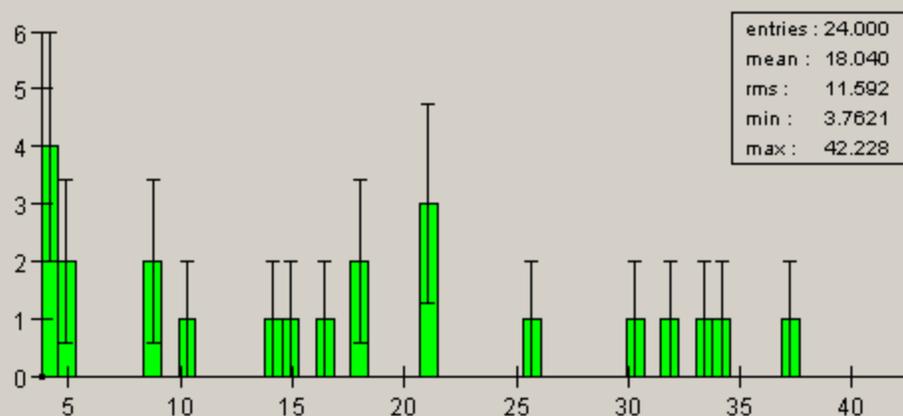
P(Mu-Detected)-5000 B-Bbar-LayerMax Cut



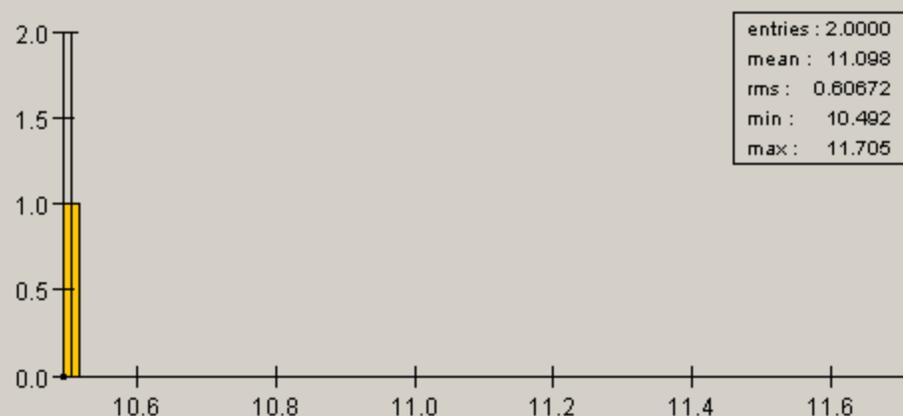
P (Pions-Detected)



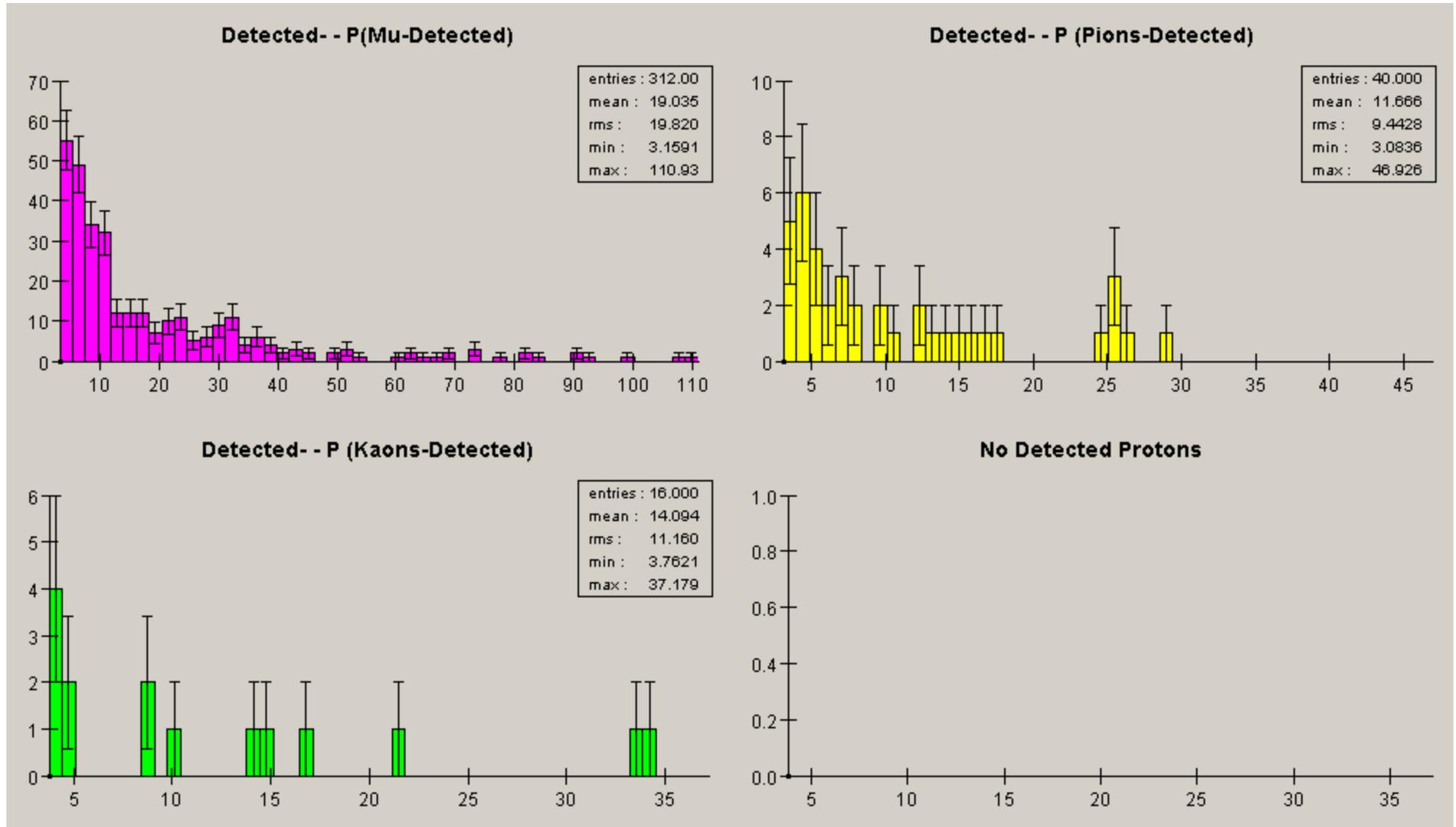
Detected- - P (Kaons-Detected)



Detected- - P (Protons-Detected)



After Maximum Layer and Hits/Layer Cuts Combined- 5000 B-Bbar Events



Wrong Particle Wrong Association in 5000 B-Bbar

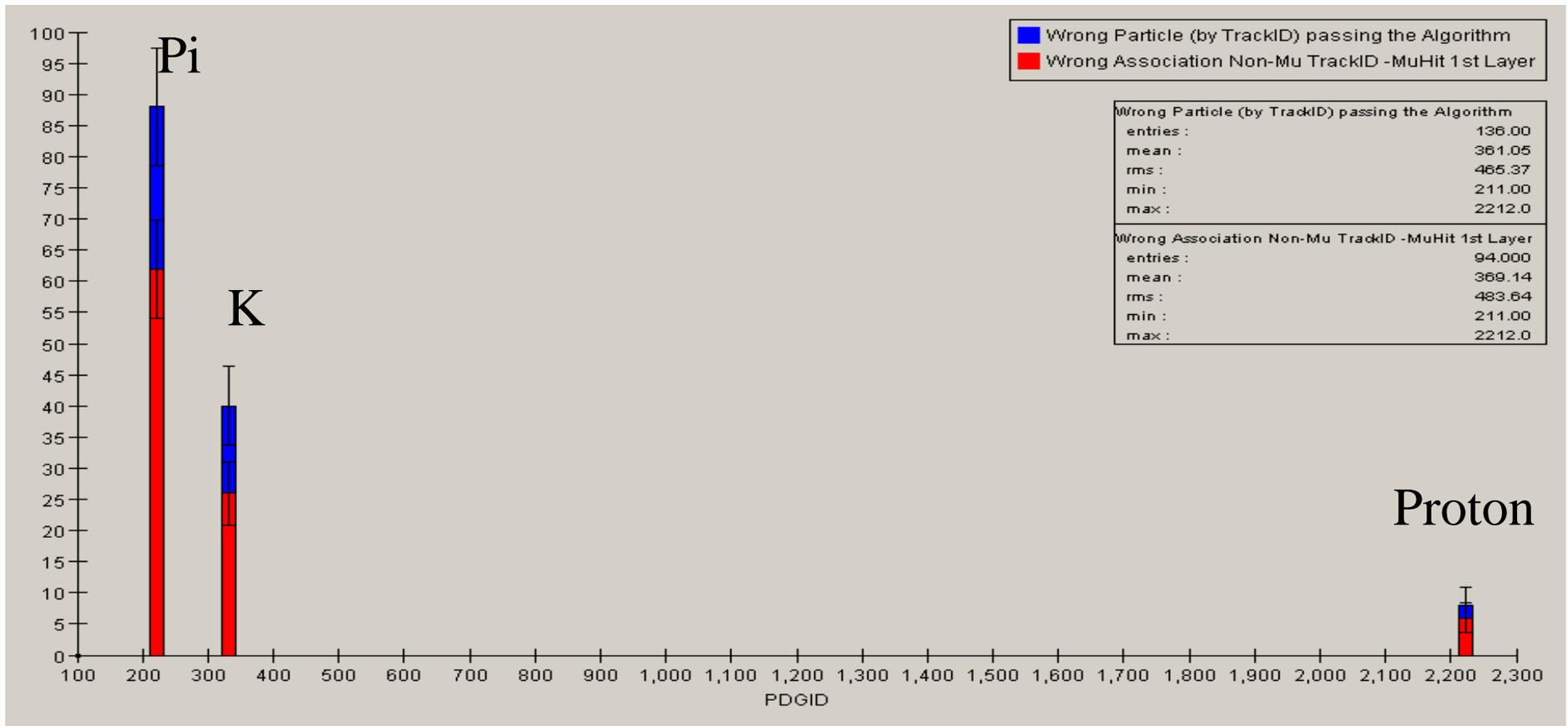
The Wrong Particles: Non Muons passing the Algorithm,
We started with 136 tracks and end up with 56tracks

The Wrong Association: Those non-Muons with a Hit in
the 1st layer of MuCal with a Muon Monte-Carlo ID,
we started with 94 and end up with 38 tracks.

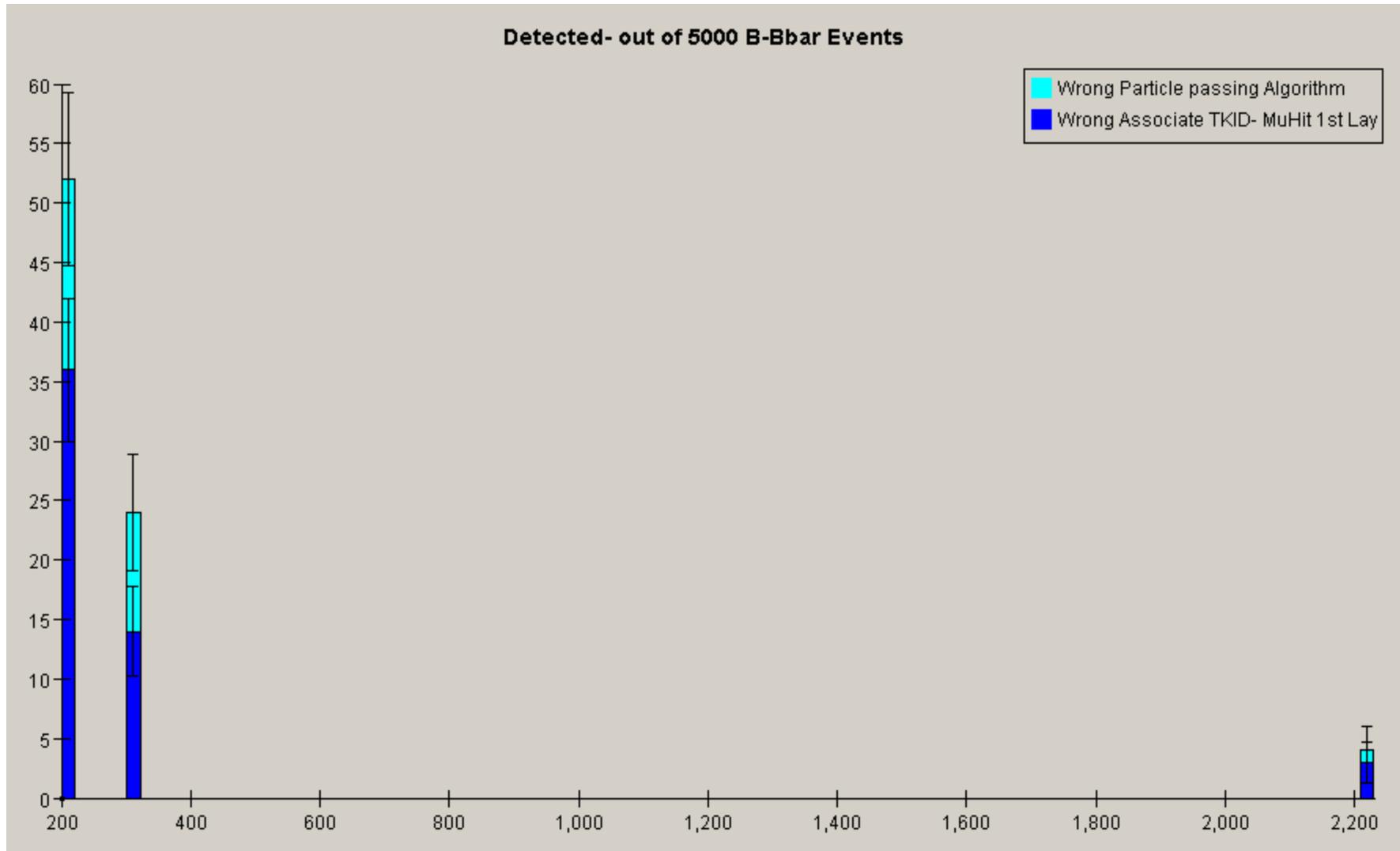
Wrong Particle Wrong Association-From 5000 B- Bbar events

In Blue: Non Muons passing the Algorithm, 136 tracks

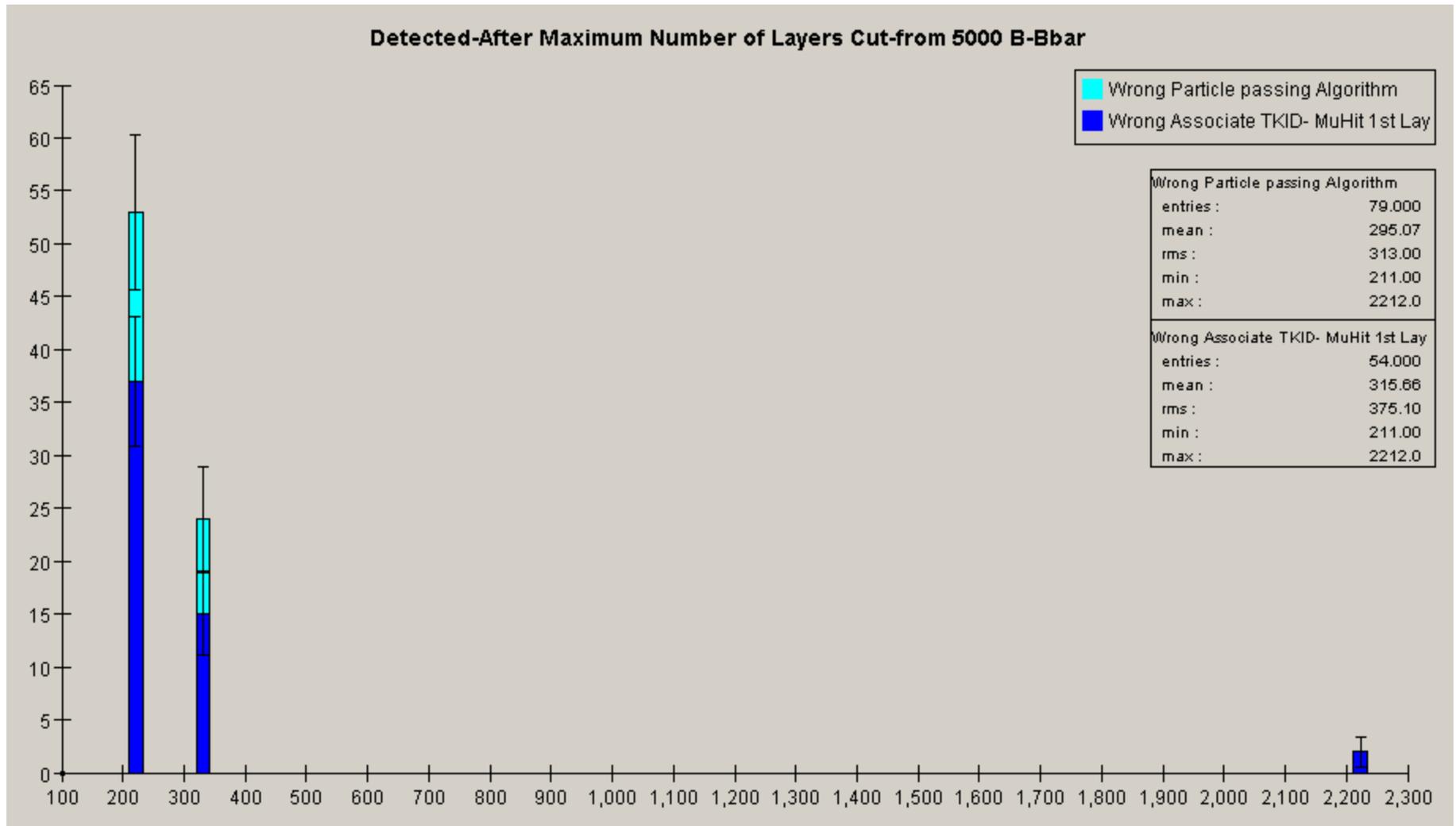
In Red : Those non-Muons with a Hit in the 1st layer of MuCal with a Muon Monte-Carlo ID, 94/136 = ~70% of them



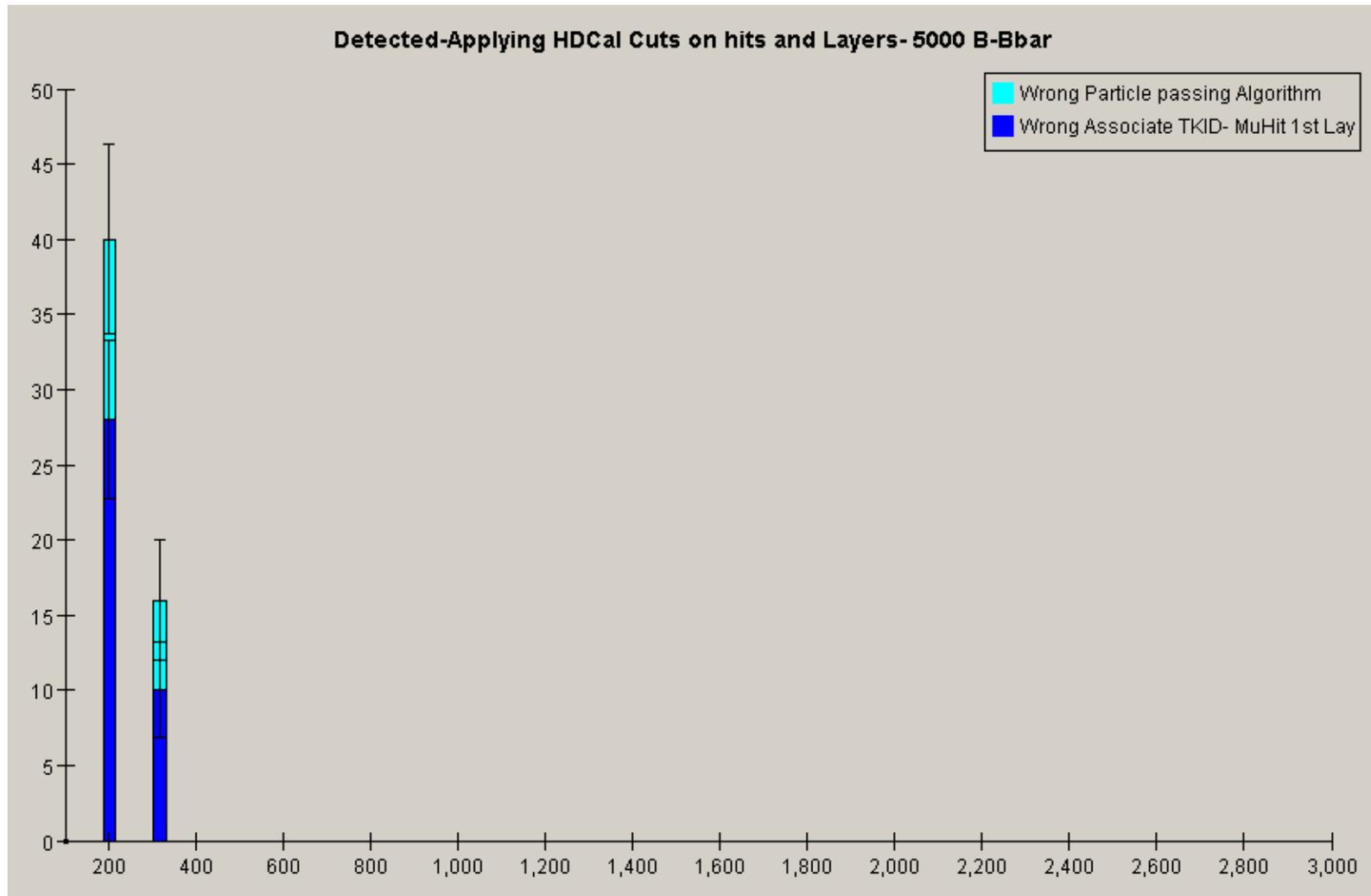
Wrong Particle Wrong Association after Hits/Layer/Event Cut - 5000 B-Bbar



Wrong Particle Wrong Association After Maximum Number of Layers Cut-5000 B-Bb



Wrong Particle Wrong Association After HD Layers and Hits Cuts-5000 B-Bbar



Momentum Dependant Cuts

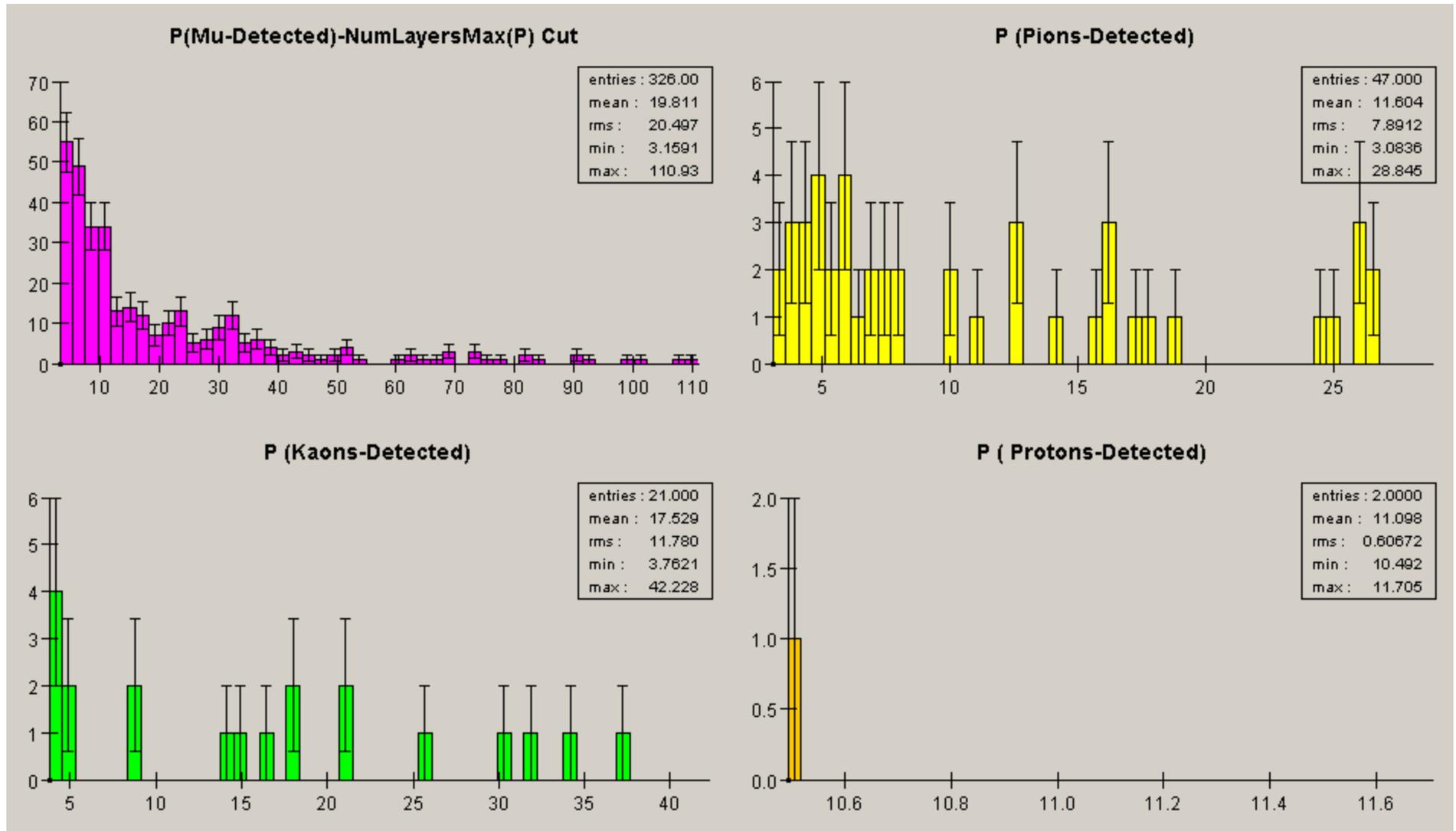
- Next slide, a table of Hits and Layers cuts based on the Mu distribution of the variables is shown. The Maximum Number of Hits/Layer has been reported for Mu's, as the momentum dependant cut value.
- The Momentum dependant cut, for the Maximum Number of Layers with hits, is based on the distributions for Mu's (shown previously only for 5 and 10 GeV/c).

Momentum Dependant Cuts(cont1)

P(GeV/c)	Max(#Hits/Lay/track)	Cut on(#Layers With Hits)
3	3.0	No Cuts
5	2.5	20
10	2.	25
20	2.	30
50	2.	30

Momentum Dependant Cut-(cont2)

Max Layer Number -5000 B-Bbar

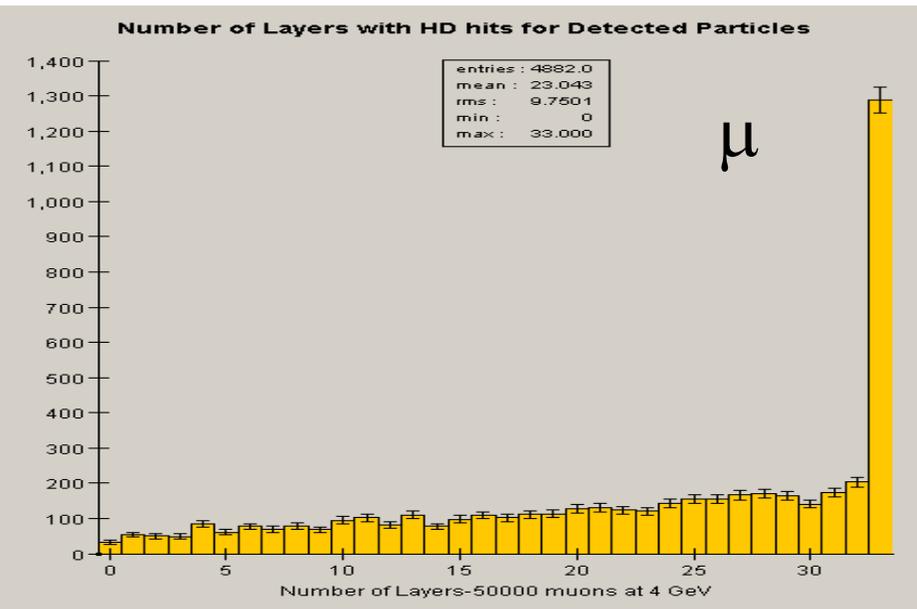
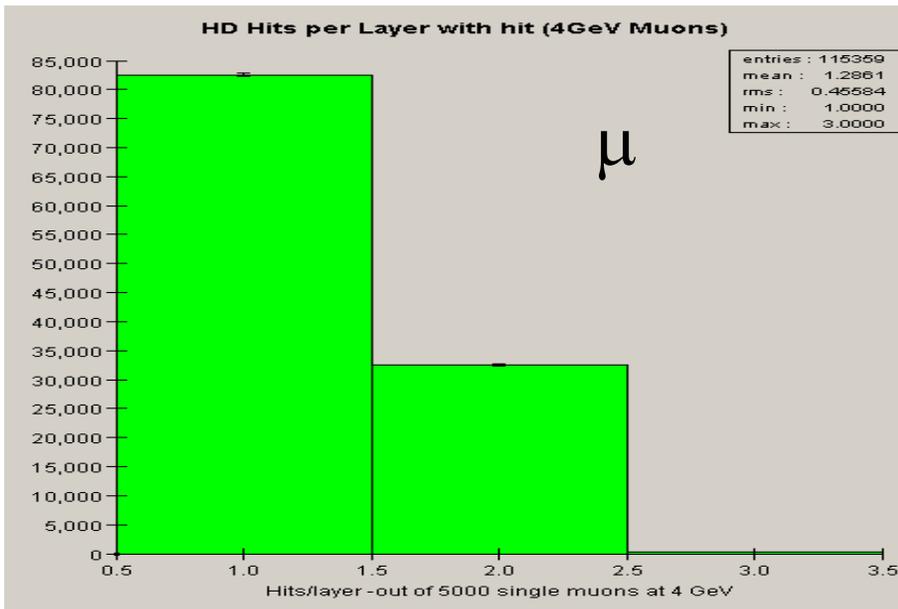
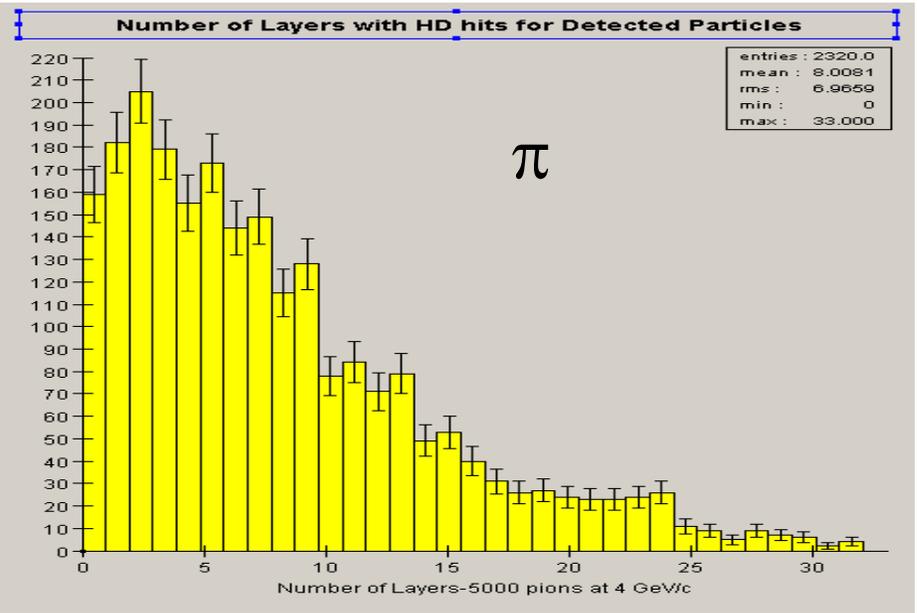
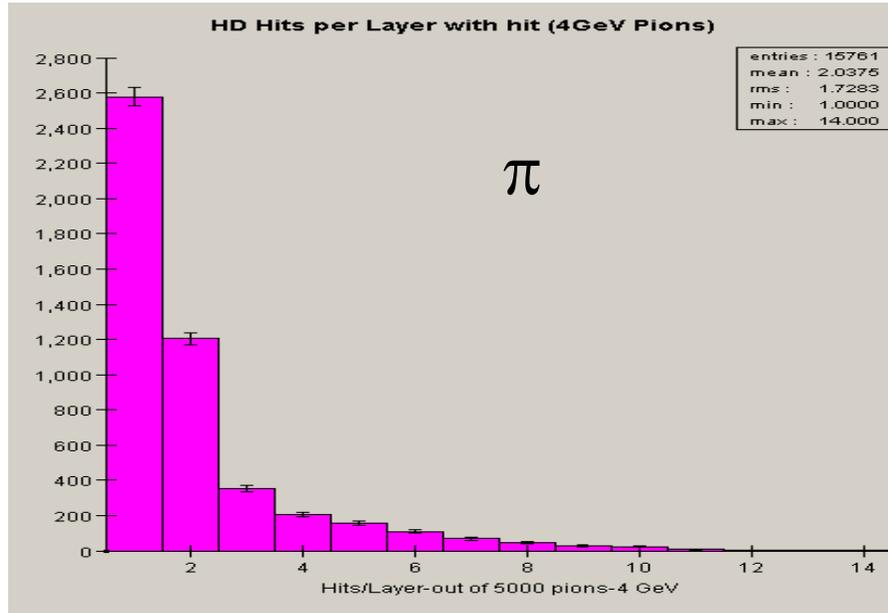


Conclusion

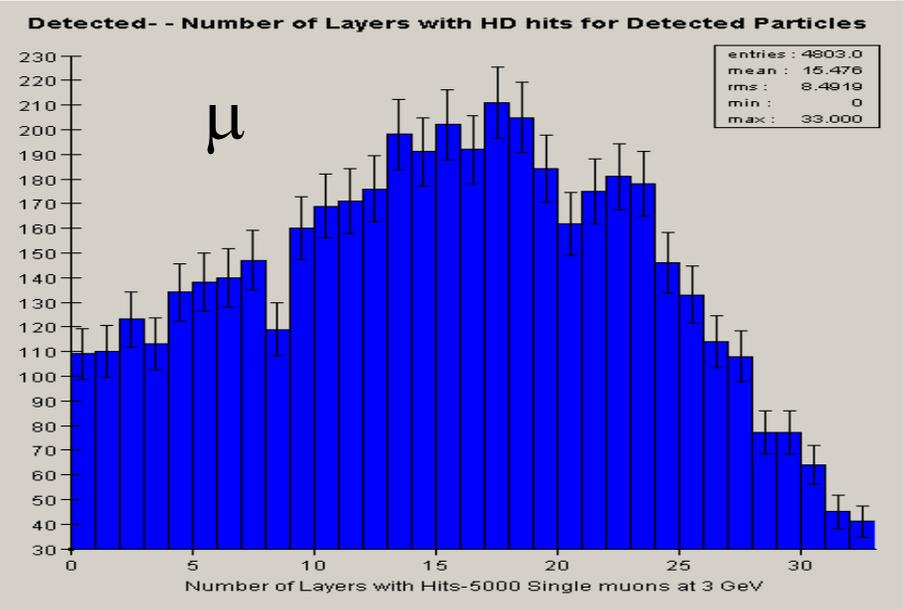
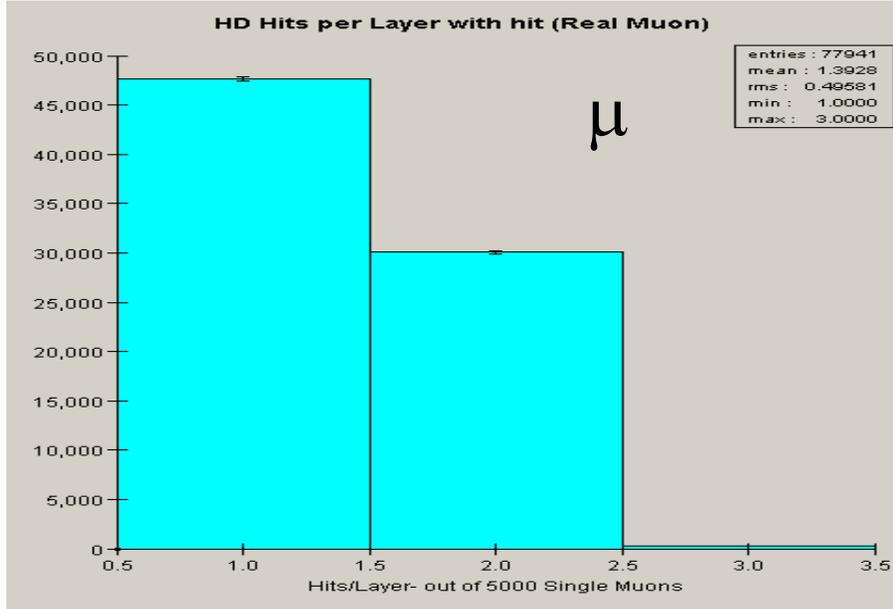
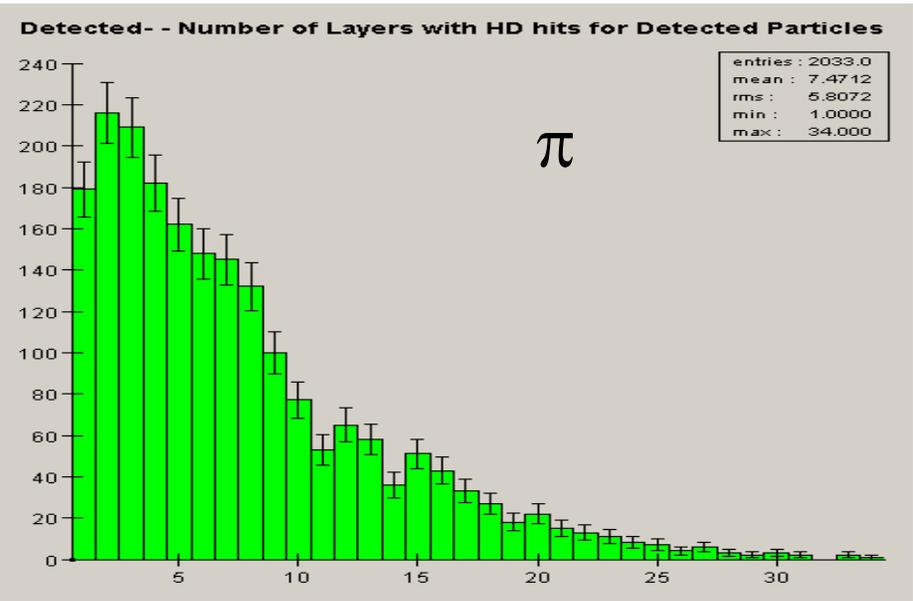
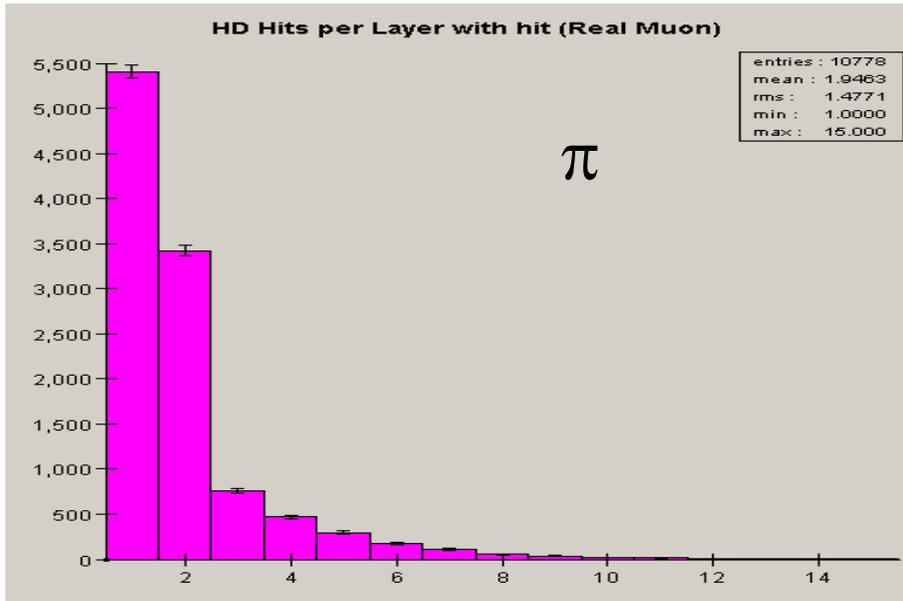
The HD Calorimeter has a large potential in filtering out
The contamination of the Muon sample from Hadrons

The Momentum dependant cut on the Maximum Number
Of Layers with Hits is very effective against the contamination
and has the mildest effect on the Muons.

Layers & Hits- 4 GeV Single Pi's & Mu's



Layers&Hits-3GeV Single Pi's&Mu's



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