



CSCTF improvements for 2011

CSCTF group

on behalf of CSCTF group:

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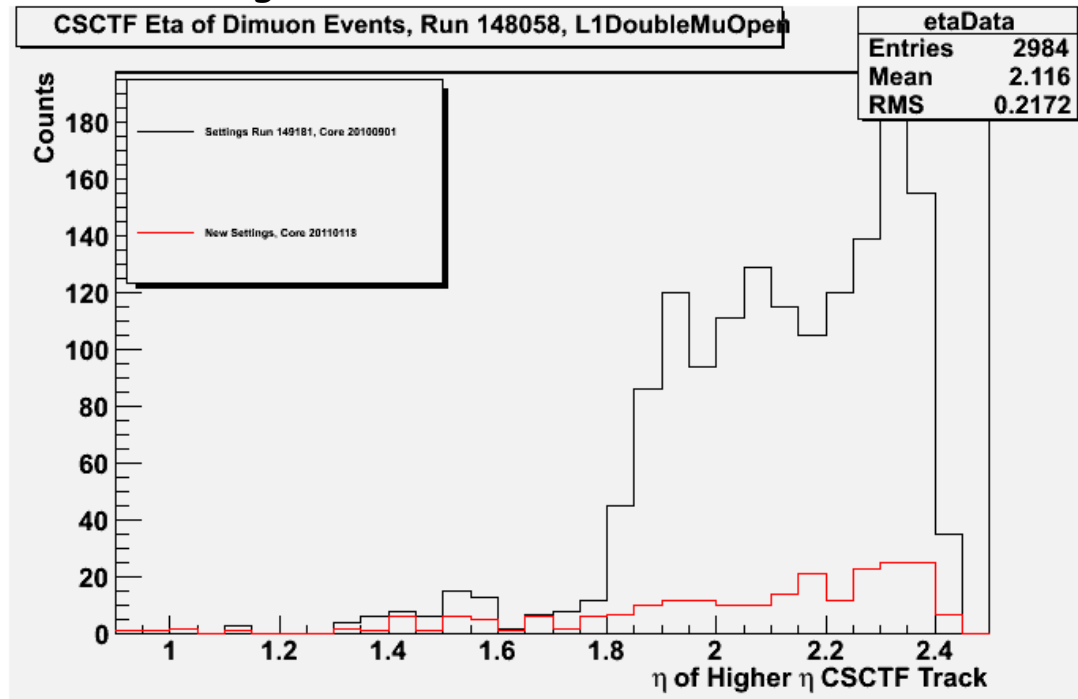
- Ghost cancelation logic: high rate at $\eta > 1.8$ is suppressed
- High rate at η bin 1.5-1.6 is partially suppressed
- PT assignment: improvement in all η regions
- Extra zero suppression logic

Ghost Cancellation News

New Ghost Cancellation logic

we switched from cancelling ghosts in an eta-phi box to checking if they share a segment:

The ghost cancellation logic compares track segment numbers of each candidate with all other available candidates. Candidates that share at least one segment are considered to be ghosts, and in such case the track with lower rank is removed.



Cut Dimuon Rate by 86% Overall

-> ghost problem at high eta is solved

-> we didn't lose in efficiency of dimuon trigger with new logic

Tight eta window

Tight eta window from 6 to 4 (from 0.075 to 0.05)

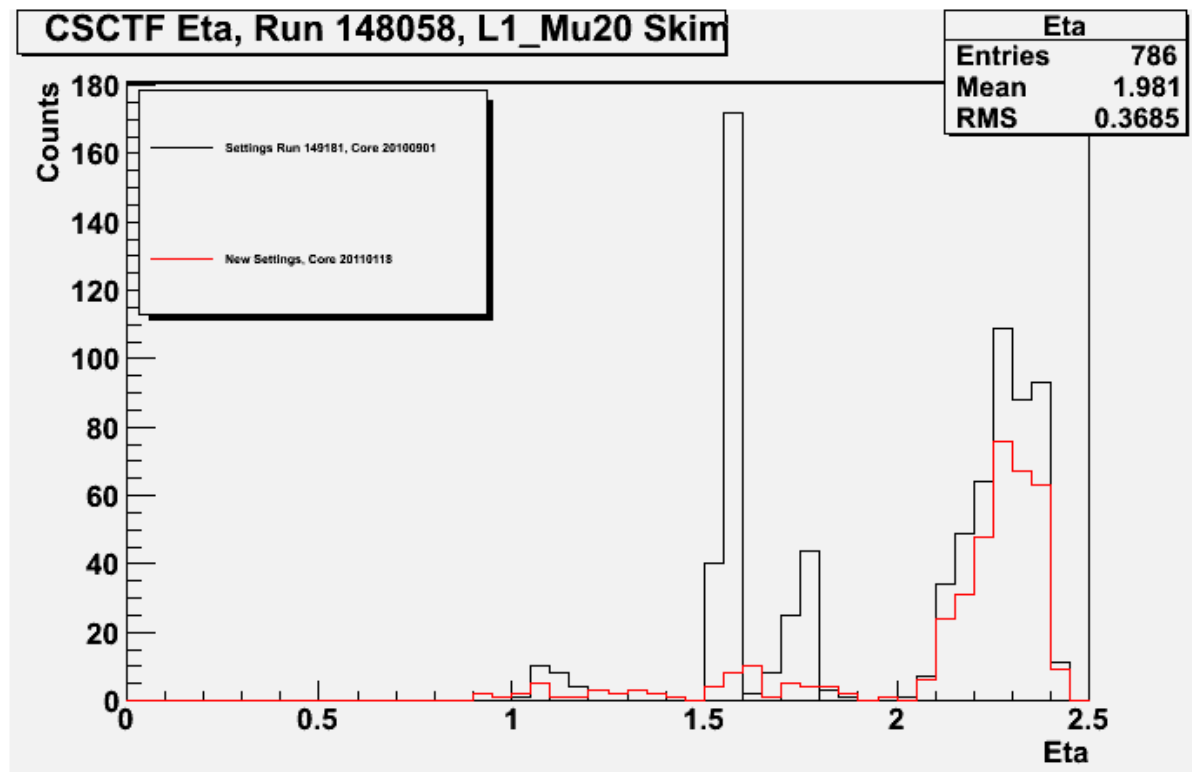
- Rate of the low pt tracks are changed:

| Pt | Change in the efficiency reconstruction after eta window tight from 6 to 4 |
|--------|--|
| 2 GeV | 35% |
| 3 GeV | 68% |
| 4 GeV | 88% |
| 5+ GeV | 98% |

- We suppress very low Pt muons ($Pt \leq 3\text{GeV}$) that have small delta phi but large delta eta, which is why tightening the window in eta helps reduce rate especially in eta region 1.5-1.7 where we almost have no 3 station tracks. The reduction of rate is very important for high luminosity runs.
- Eta window 4 is efficient for Pt mouns $> 3\text{ GeV}$

High rate in eta 1.5-1.6 bin

- Tight eta window from 6 to 4 bit (from 0.075 to 0.05) to suppress contribution of low pt tracks
- Use CLCT pattern information to suppress contribution of low pt tracks
- Stop make shift in eta region 1.5-1.7 to separate ME1/1 and ME1/2
The peak in the old distribution was because of an introduced nonlinearity. We removed that, so the peak spreads out in 1.5-1.7



Cut Rate by **89%** in eta 1.5-1.7!

PT assignment

- PTLUTs:

- overlap region:

- use all possible combination on track with DT stubs
- 2 and 3 station tracks with DT have Quality = 3 and we use DT phiBend information for PT assignment

- CLCT pattern for mode 6, 7, 13 (ME1-ME2, ME1-ME3, ME1-ME4 tracks):

- rate in eta ~1.4-1.8 could drop by factor ~2 for Quality = 2 tracks

make pt assignment using dphi12 and after:

if ($|\text{CLCT patter}| > 1$ && $\text{pt_csctf} > 5 \text{ GeV}$) $\text{pt_csctf} = 5 \text{ GeV}$

- high eta region:

ME2-ME3-ME4, ME2-ME3, ME3-ME4 and ME3-ME4 have Quality = 1 in new PTLUTs

Use max pt solution from 3 links to get efficiency to ~80% for high pt tracks

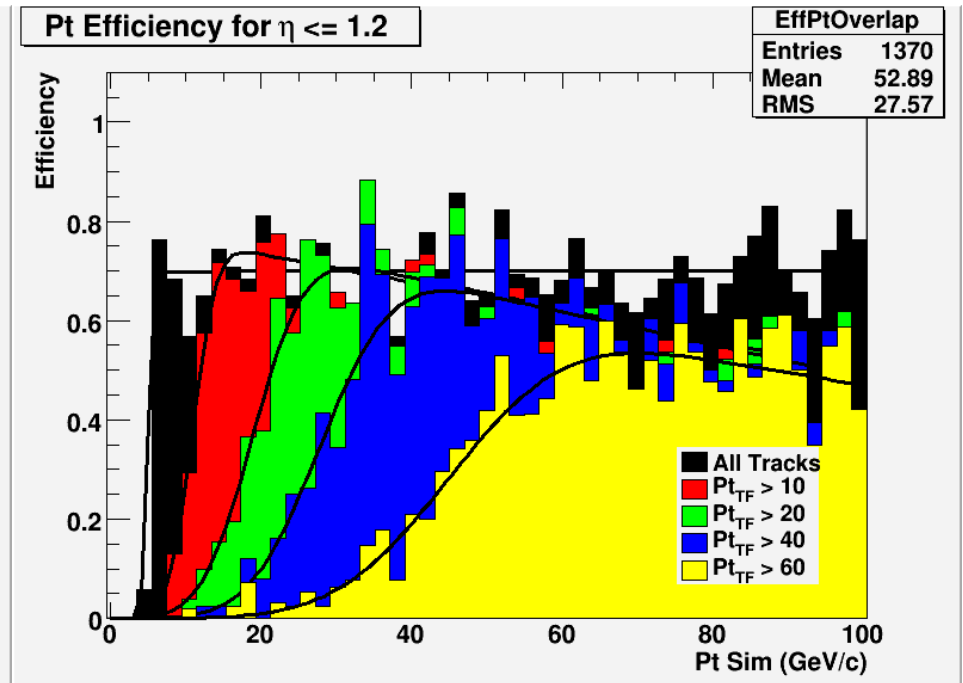
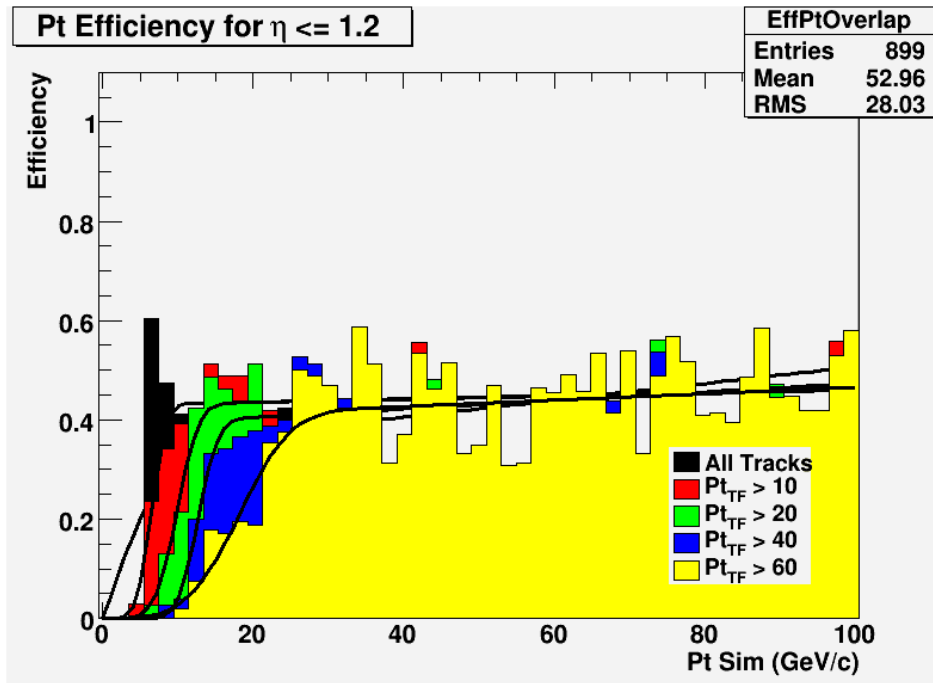
CLCT patter definition:

```
Hit pattern LUTs for 1 layer: - = don't care, xx= one hit or the other or both
Pattern      id=2      id=3      id=4      id=5      id=6      id=7      id=8      id=9      idA
Bend dir     bd=0      bd=1      bd=0      bd=1      bd=0      bd=1      bd=0      bd=1      bd=0
             |        |        |        |        |        |        |        |        |
ly0  -----xxx xxx----- -----xxx- -xxx----- -----xxx- -xxx----- -----xxx- -----xxx-----
ly1  -----xx----- -xx----- -----xx----- -xx----- -----xx----- -xx----- -----xx----- -xx-----
ly2 key -----x----- -x----- -----x----- -x----- -----x----- -x----- -----x----- -x-----
ly3  -----xxx----- -xxx----- -----xx----- -xx----- -----xx----- -xx----- -----xx----- -xx-----
ly4  -xxx- 4 --4 -xxx- -xxx- 3 --3 -xxx- -xx- 2 --2 -xx- -xxx- 1 --1 -xxx- -xxx- 0
ly5  xxx- 4 --4 -xxx- -xxx- 3 --3 -xxx- -xxx- 2 --2 -xxx- -xxx- 1 --1 -xxx- -xxx- 0
             |        |        |        |        |        |        |        |        |
// Extent   0123456789A 0123456789A 0123456789A 0123456789A 0123456789A 0123456789A 0123456789A 0123456789A 0123456789A
// Avg.bend - 8.0 hs   + 8.0 hs   -6.0 hs   +6.0 hs   -4.0 hs   +4.0 hs   -2.0 hs   +2.0 hs   0.0 hs
// Min.bend -10.0 hs  + 6.0 hs   -8.0 hs   +4.0 hs   -6.0 hs   +2.0 hs   -4.0 hs   0.0 hs   -1.0 hs
// Max.bend  -6.0 hs   +10.0 hs  -4.0 hs   +8.0 hs   -2.0 hs   +6.0 hs   0.0 hs   +4.0 hs   +1.0 hs
```

Improvement in overlap DT-CSC region ($\eta < 1.2$)

Old Core/ Old Settings

New Core/ New Settings

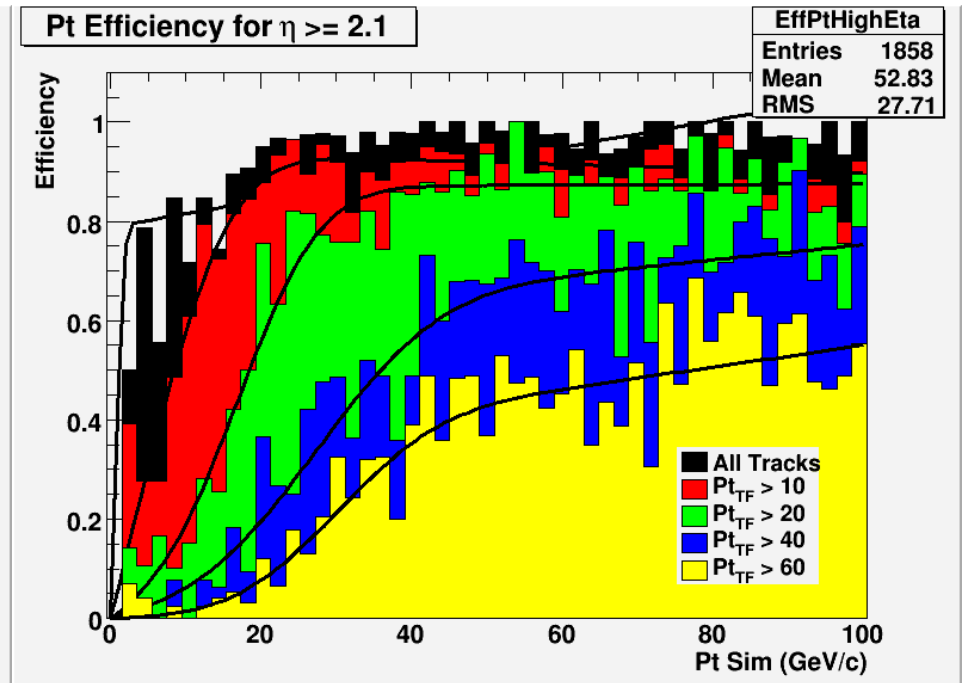
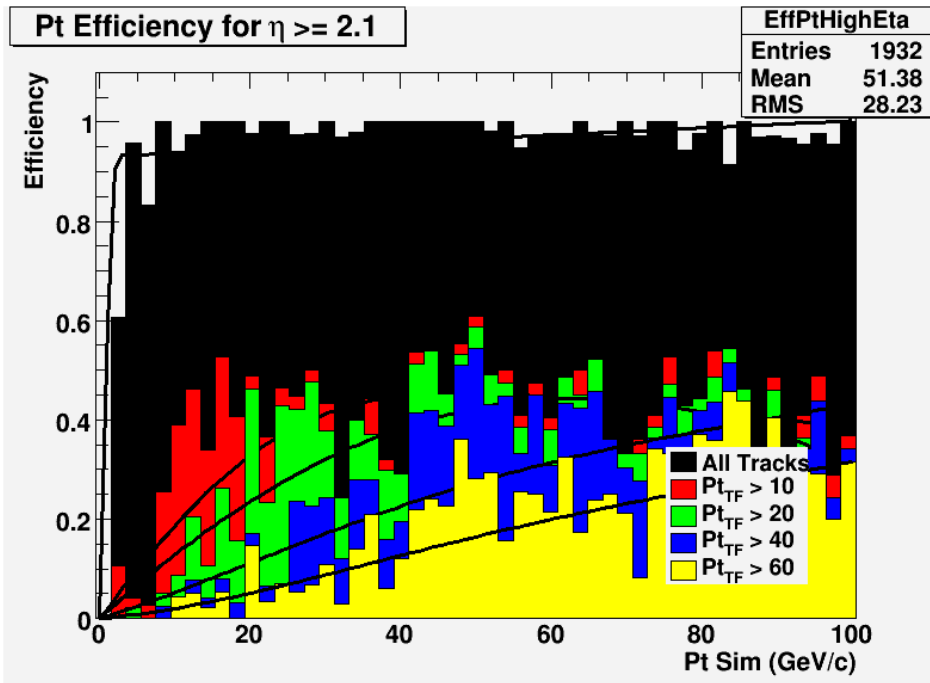


Improvement in efficiency reconstruction and pt assignment

Improvement in high eta region ($\eta > 2.1$)

Old Core/ Old Settings

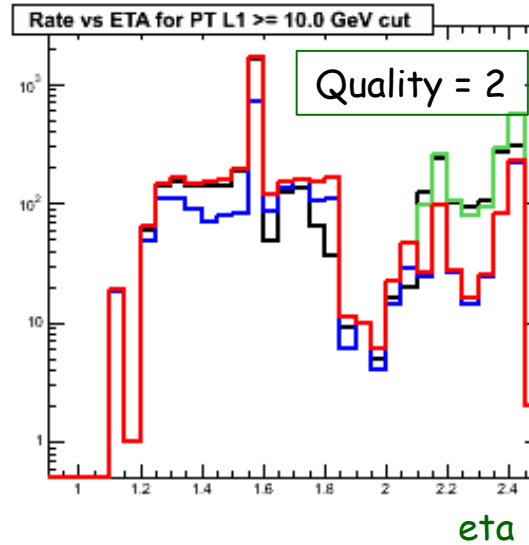
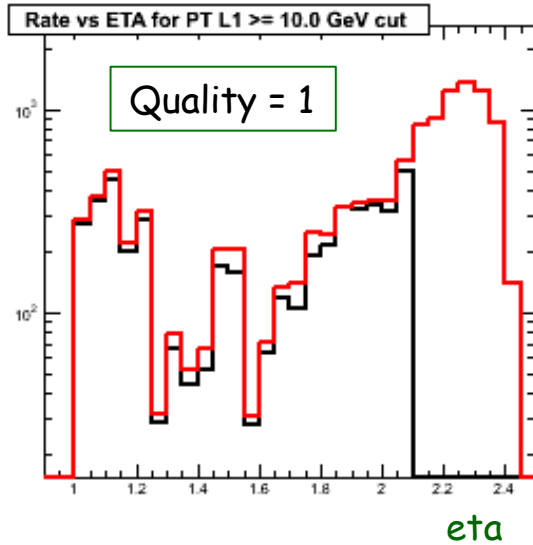
New Core/ New Settings



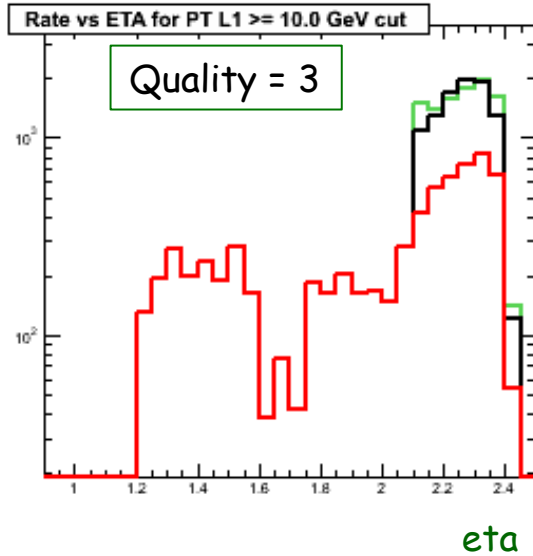
$P_T > 20 \sim 85\%$ eff

Due to Quality redefinition in this region
we could improve efficiency without increasing of the rate

Rate study with new PTLUTs

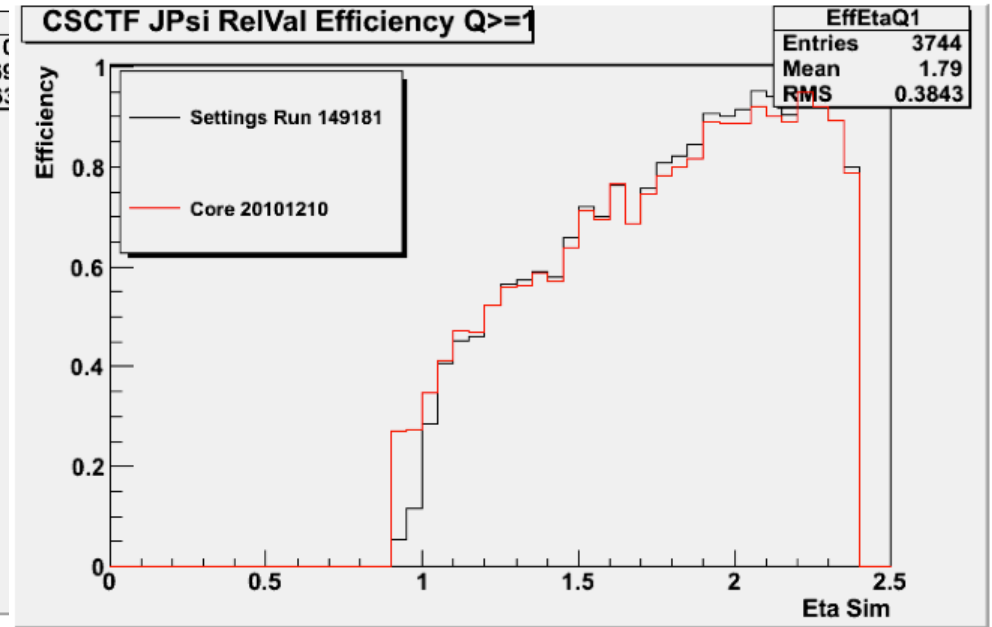
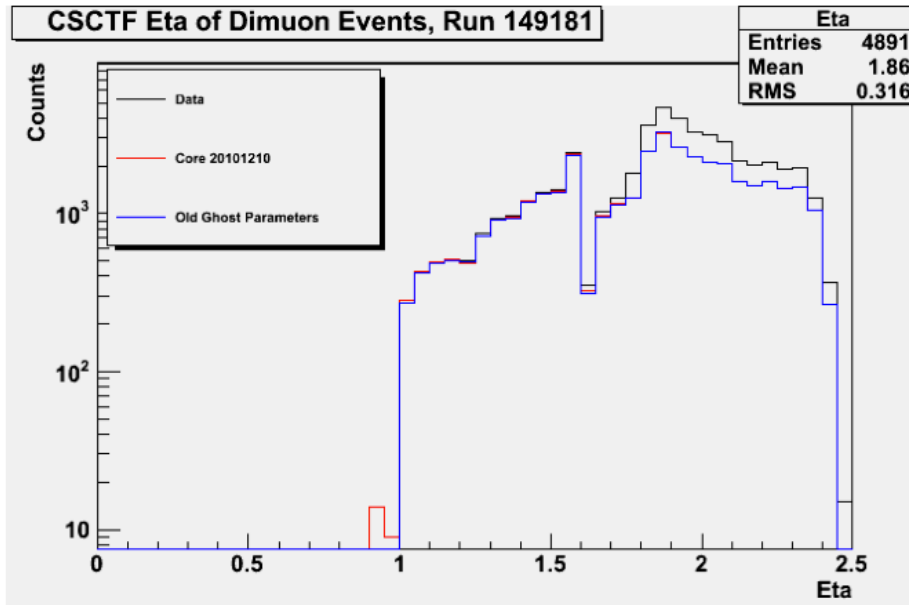


--- Old method 2010
 --- New method
 --- New method + high eta
 --- New method + CLCT patter



For Quality = 3 we use here old (2010) method
 -- 3 max pt tracks will not increase rate with new quality definition
 -> our proposal to use 3 max pt method at high eta region > 2.1

Test new ghost cancellation logic with J/Psi



New ghost cancellation logic (red) almost didn't reduce efficiency of J/Psi

Extra Zero Suppression

we are testing firmware with extra zero suppression at Point 5:
we still have problem to read new data format with unpacker
we are are trying to solve this problem

This changes of firmware will not influence on trigger performance.
It is influence only on DAQ