CSCTF improvements for 2011

CSCTF group

on behalf of CSCTF group:

D. Acosta, G.P. Di Giovanni, J. Hugon, M. Fisher, I. Furic, J. Gartner,
K. Kotov, A. Kropivnitskaya, A. Madorsky, M. Matveev,
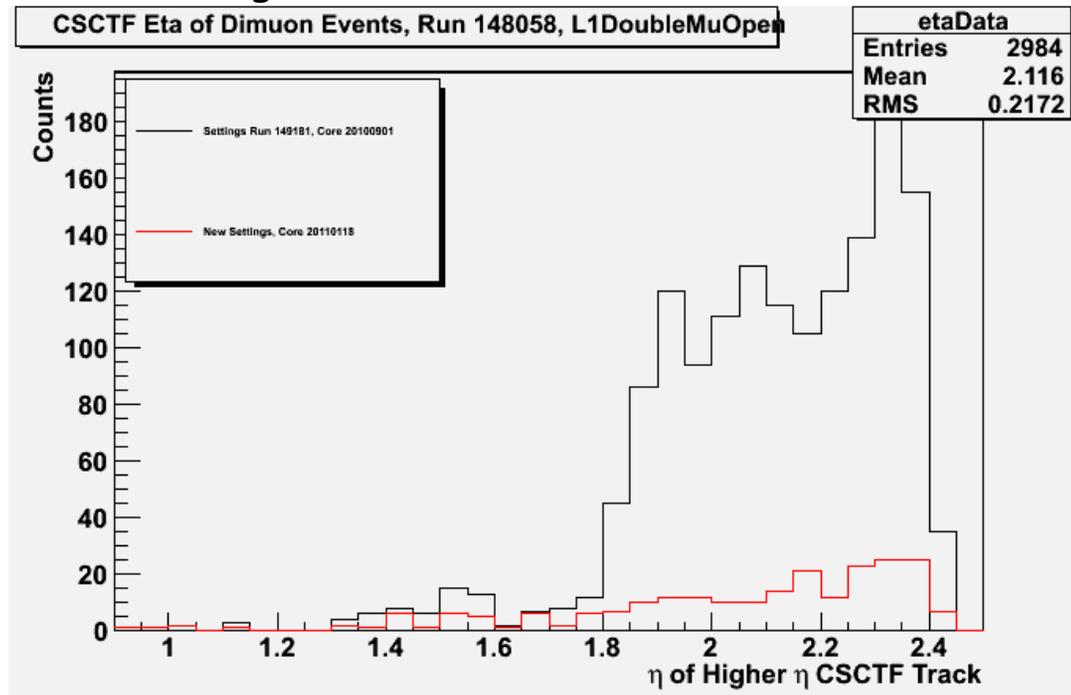P. Padley, L. Redjimi, B. Scurlock, L. Uvarov

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

Ghost Cancellation News

New Ghost Cancelation 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.

CSCTF Eta of Dimuon Events, Run 148058, L1DoubleMuOpen

etaData	
Entries	2984
Mean	2.116
RMS	0.2172

Settings Run 149181, Core 20100901

New Settings, Core 20110118

Cut Dimuon Rate by 86% Overall
-> ghost problem at high eta is solved
-> we didn't lose in efficiency of dimoun 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 ≤ 3GeV) 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 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
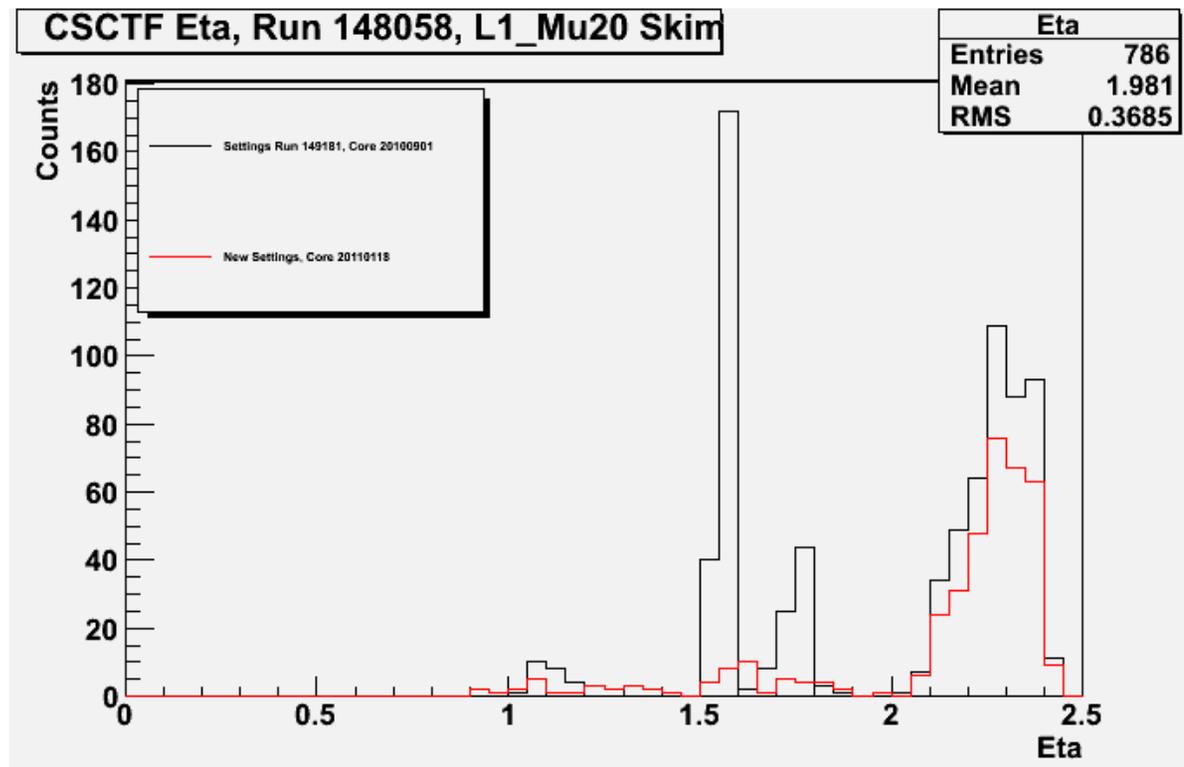
Cut Rate by 89% in eta 1.5-1.7!

4

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 (|CLCT patter| > 1 && pt_csctf > 5 GeV) pt_csctf = 5 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-----  ----xxx----
ly1       -------xx--- ---xx------- ------xx---- ----xx----- -----xx---- ----xx----- -----xx---- ----xx----- -----x----
ly2 key   -----x----- -----x----- ------x----- -----x----- ------x----- -----x----- ------x----- -----x----- ------x-----
ly3       ---xxx----- -----xxx--- ----xx----- -xxx------ ----xx---- ---xx----- ----xx---- ---xxx----- ----x------
ly4       -xxx----- [4] [-4] -xxx--- -xxx- [3] [-3] -xxx-- ---xx-- [2] [-2] xx--- ---xxx---- [1] [-1] xxx--- ---xxx--- [0]
ly5       xxx------ -----xxx -xxx----- ------xxx-- --xxx-- ----xxx---- ---xxx---- ---xxx---
               |            |            |            |            |            |            |            |            |
// 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)
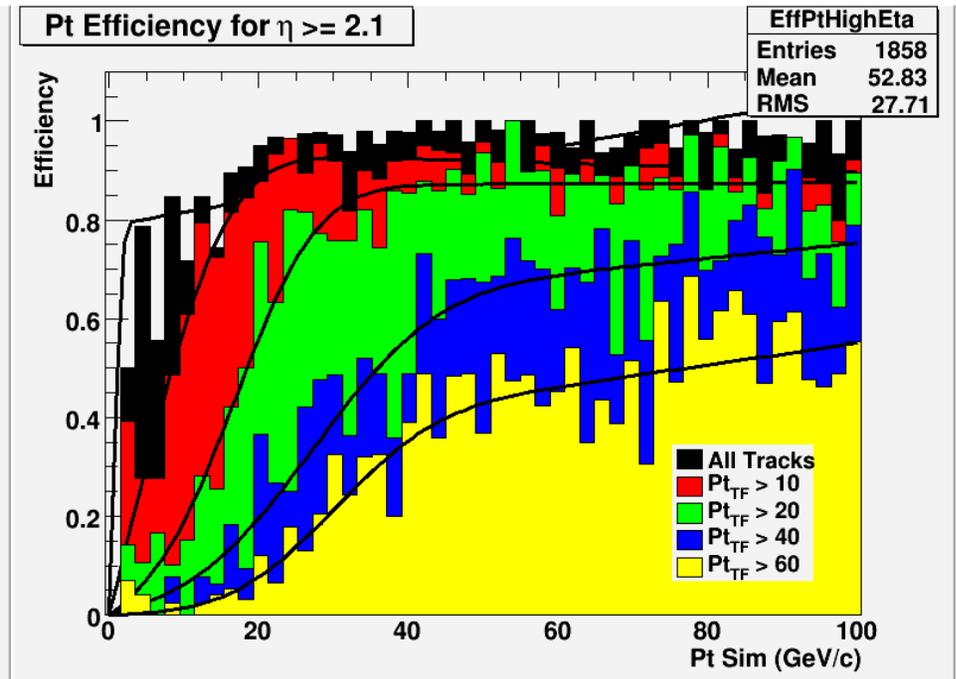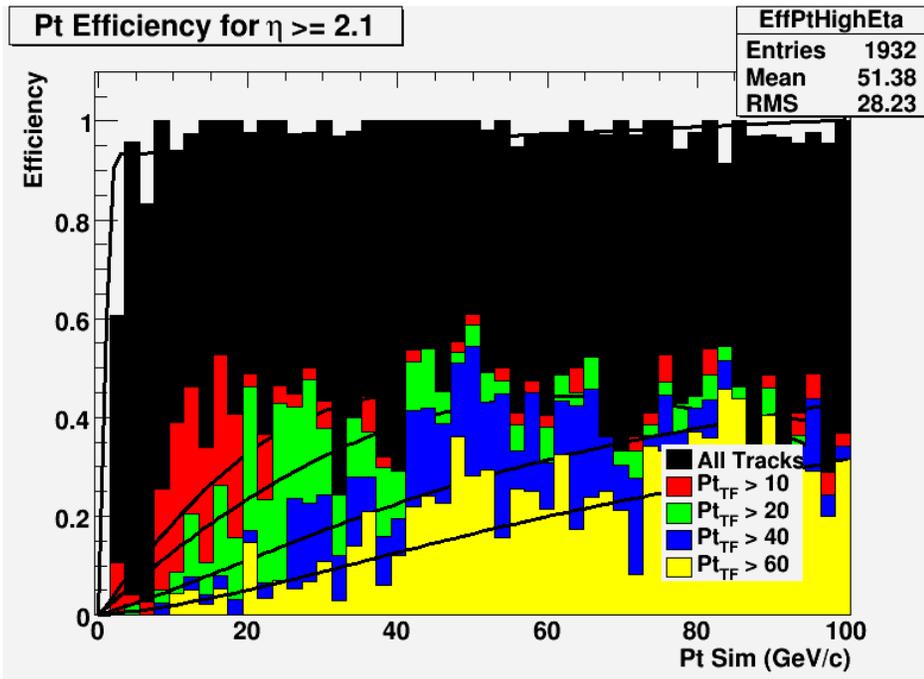
Old Core/ Old Settings

New Core/ New Settings
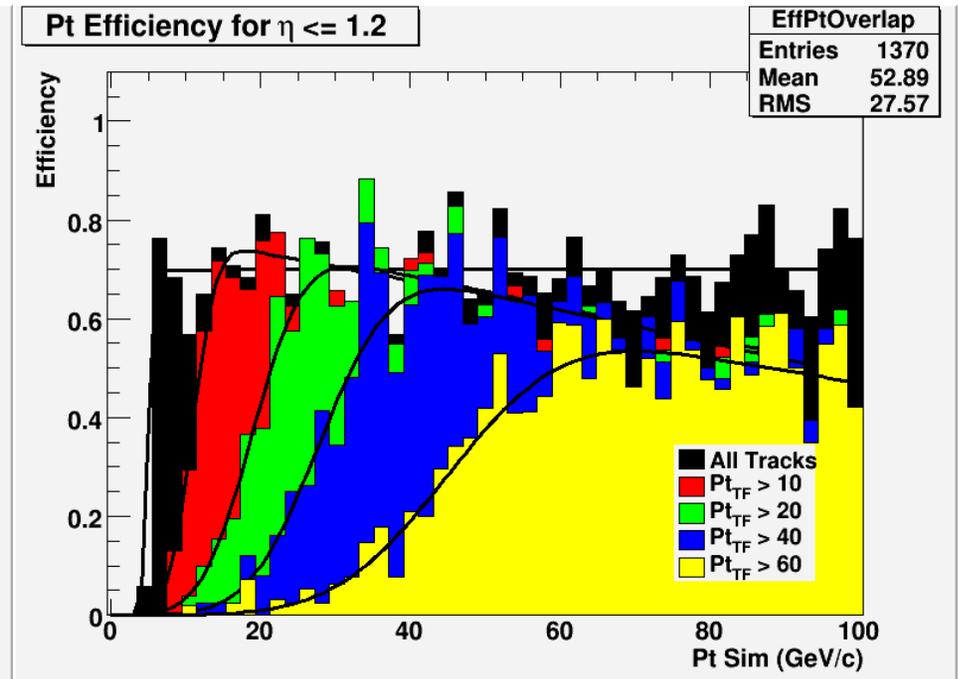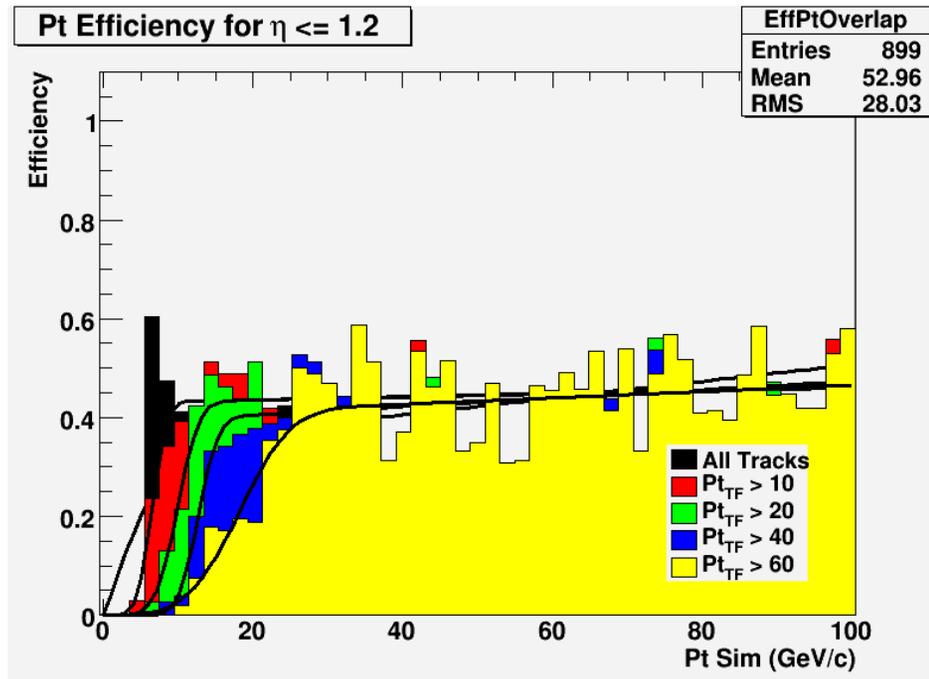
Improvement in efficiency reconstruction and pt assignment

Improvement in high eta region (eta >2.1)

Old Core/ Old Settings
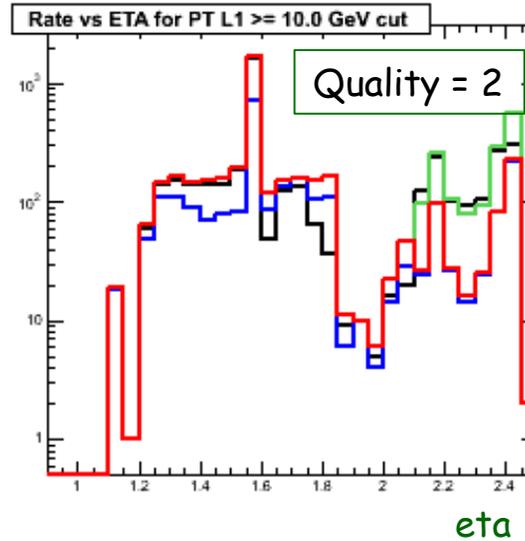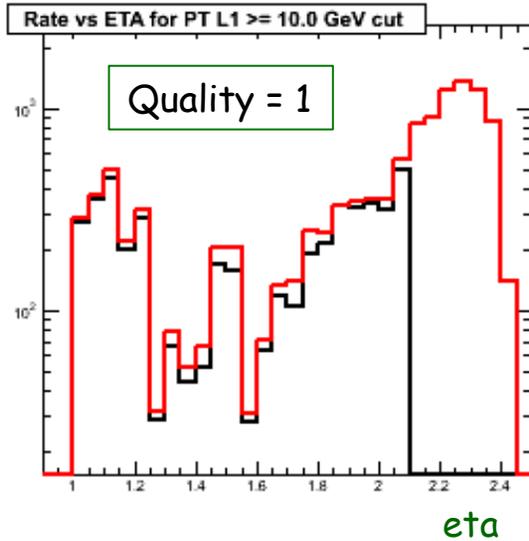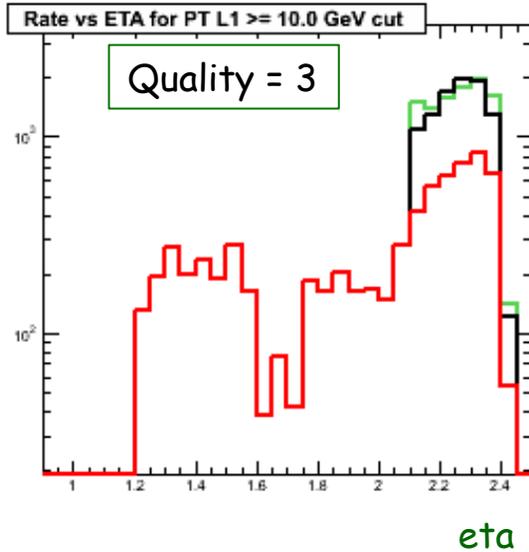
New Core/ New Settings

$P_T > 20 \sim 85\%$ 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

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