University of Nebraska Lincoln

hltPixelTracks performances in Upgrade

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Datasets

- CMSSW version:
- CMSSW_4_2_8_SLHCstd2 (Standard)
- CMSSW_4_2_8_SLHCtk3 (Phase1)

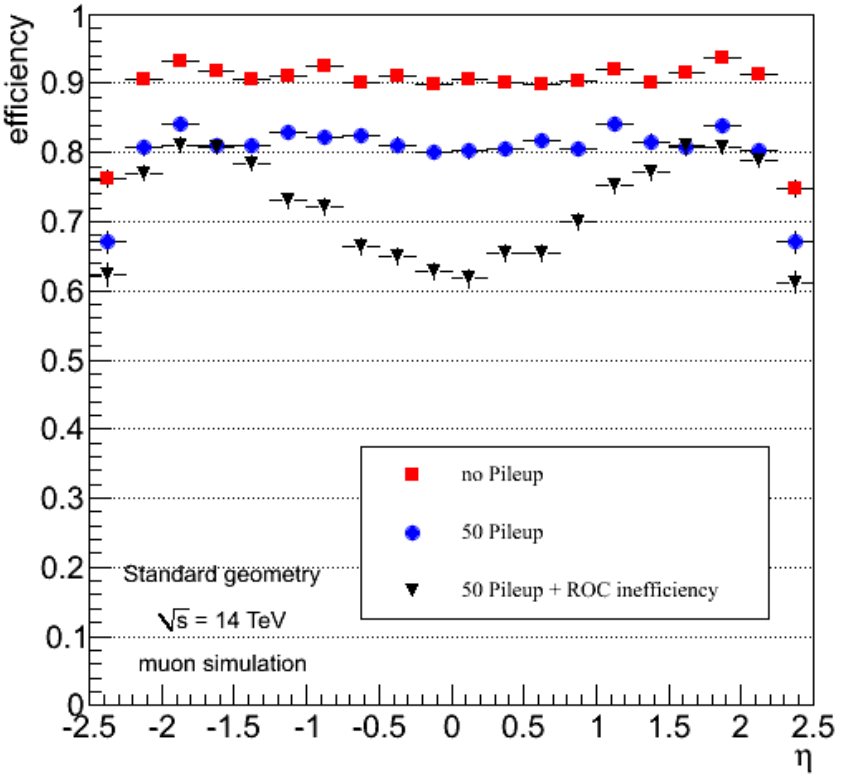
- Standard geometry:
- ttbar:
- /RelValTTbar_Tauola/CMSSW_4_2_3_patch3-DESIGN42_V11_110612_special-v1/GEN-SIM
- Muon:
- /RelValFourMuPt_1_200/CMSSW_4_2_3_patch3-DESIGN42_V11_110612_special-v1/GEN-SIM

- Phase1 geometry:
- ttbar:
- /TTbar_Tauola_14TeV/Summer12-DESIGN42_V17_SLHCTk-v1/GEN-SIM
- Muon:
- /RelValFourMuPt_1_200/CMSSW_4_2_3_patch3-DESIGN42_V11_110612_special-v1/GEN-SIM

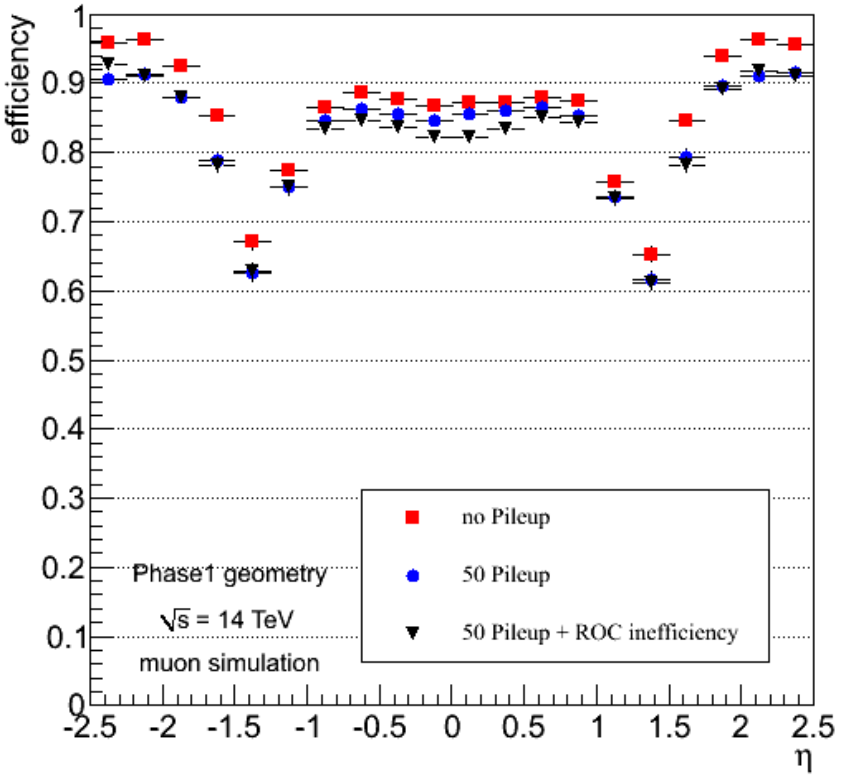
- In the following slides you are going to see
  - Efficiency vs Eta
  - Efficiency vs Pt
  - Fake rate vs Eta
  - Fake rate vs Pt
- For each of the cases I shall show Muon sample and ttbar sample in successive slides

hltPixelTracks Efficiency vs. η (Muon)

Standard Geometry



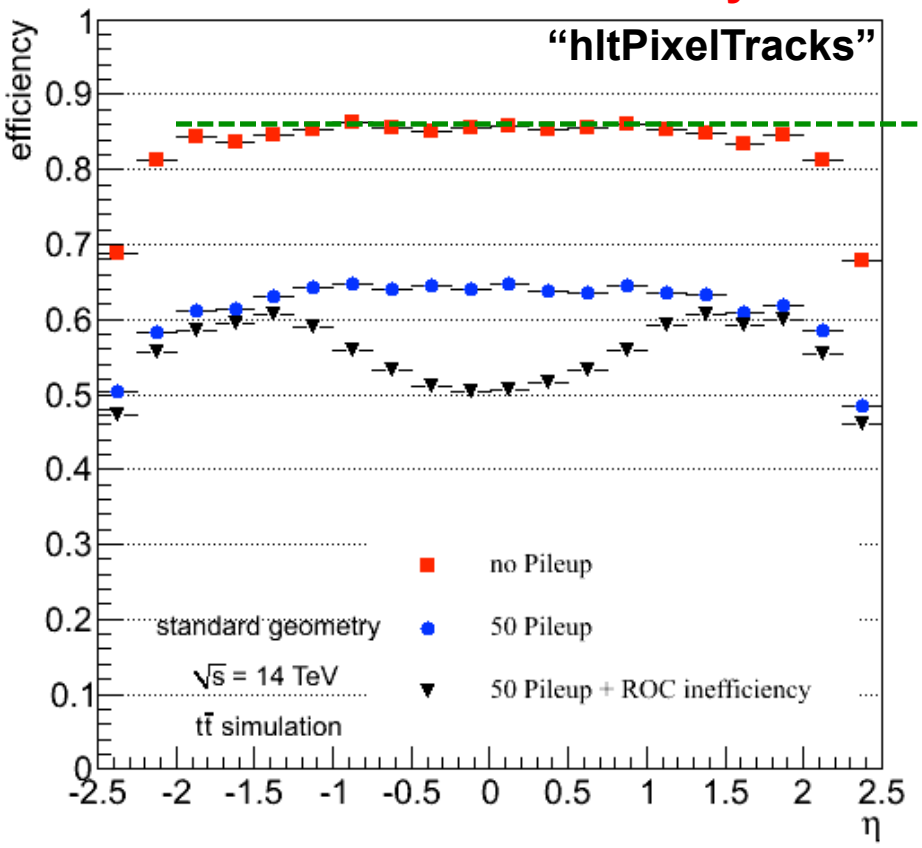
Phase1 Geometry



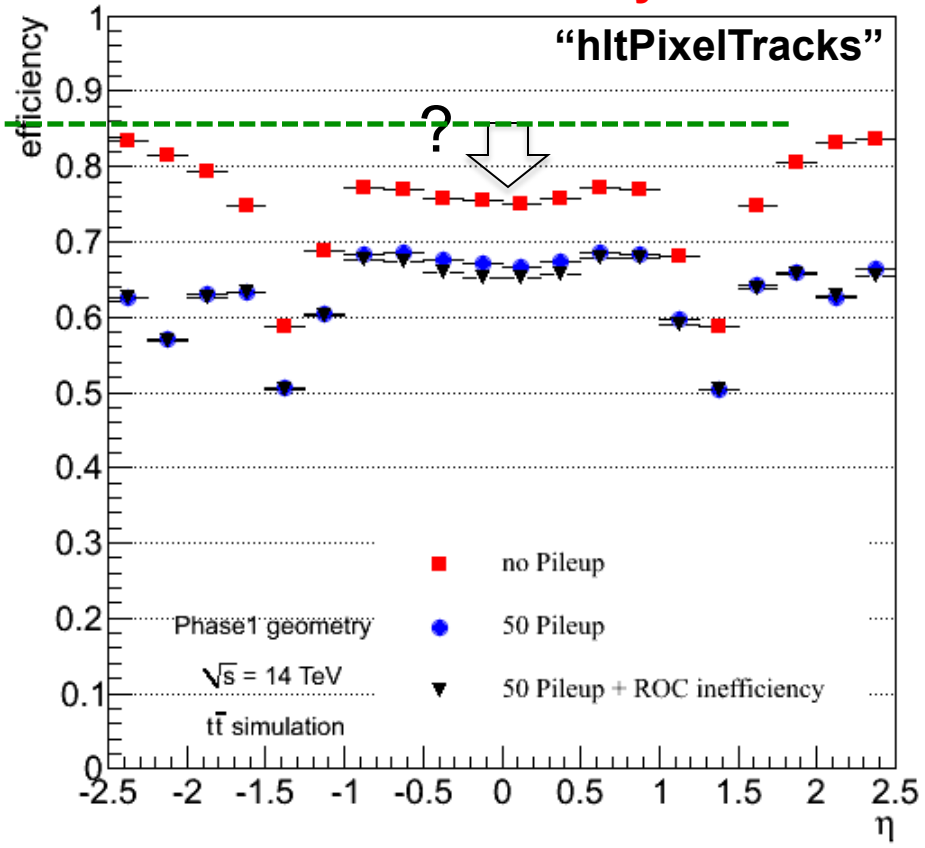
- No PU: Efficiency for Std Geo is 90% and Phase1 is 85-88%
- With 50 PU: Efficiency for Std Geo is 80% and Phase1 is ~ 85% (for central)
- With 50 PU + 20% ROC inefficiency: Phase1 efficiency better than Std Geo !

hltPixelTracks Efficiency vs. η (ttbar)

Standard Geometry



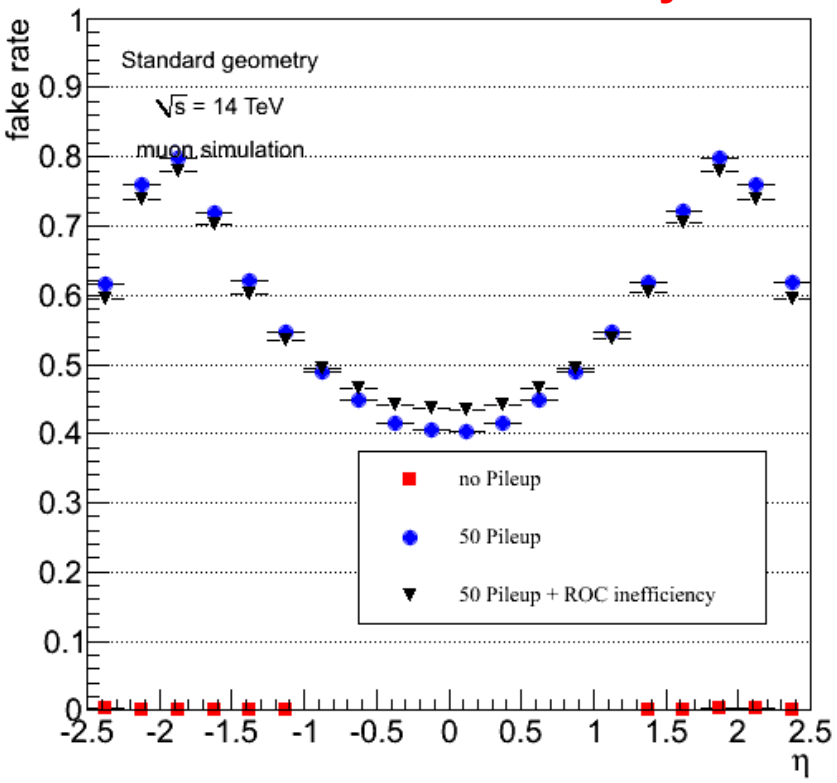
Phase1 Geometry



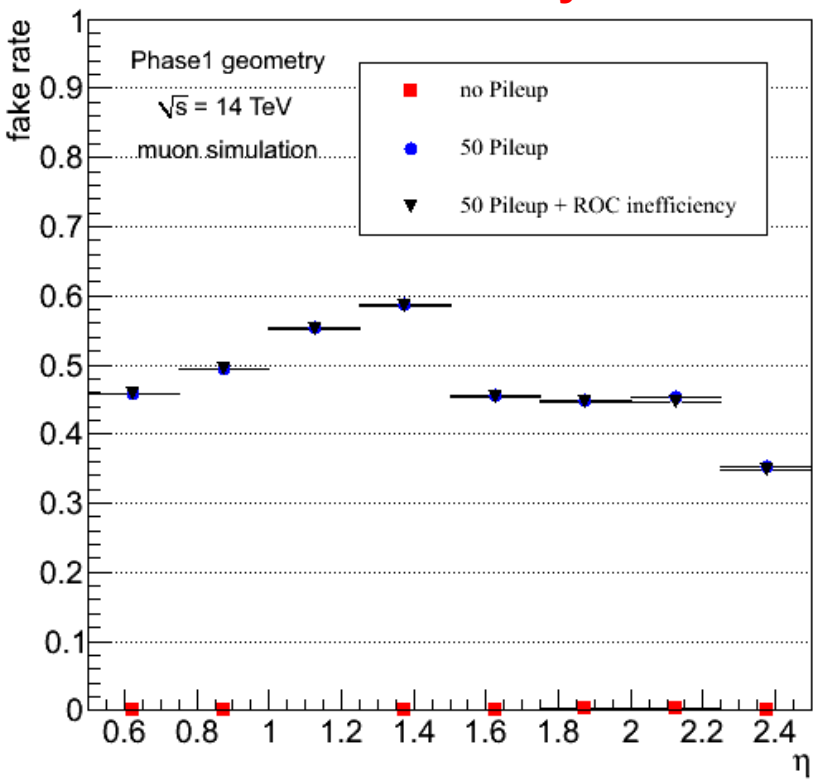
- No PU: Efficiency for Std Geo is 85% and Phase1 is < 80% !!!!
- With 50 PU: Efficiency for Std Geo is 65% and Phase1 is ~ 70% (for central)
- With 50 PU + 20% ROC inefficiency: for Std Geo – efficiency visibly lower but in Phase1 – not much different than 50 PU

hltPixelTracks Fake rates vs. η (Muon)

Standard Geometry



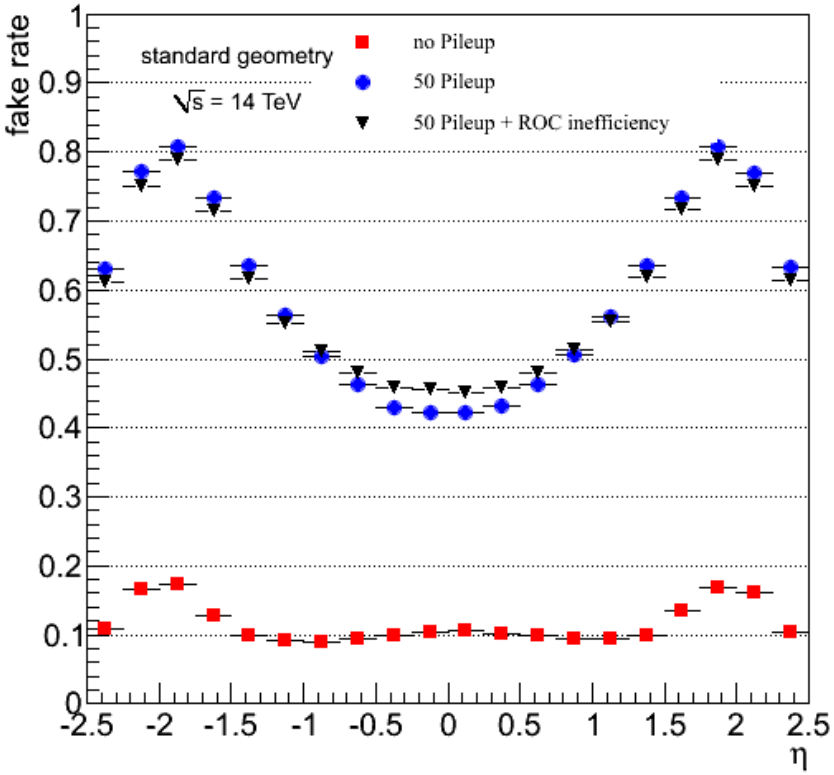
Phase1 Geometry



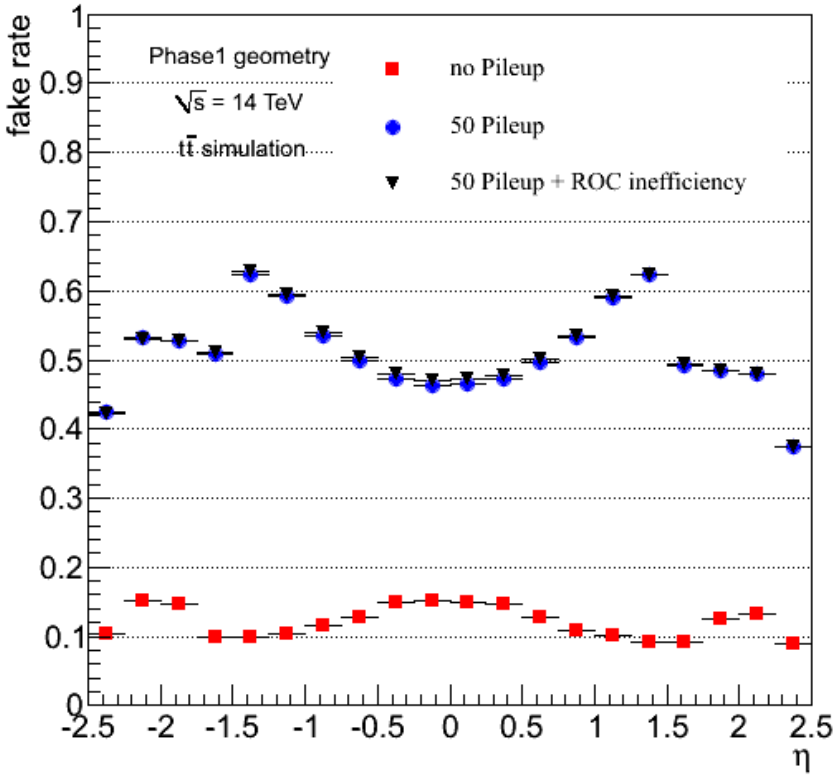
- Fake rates are almost zero for no PU case in both geometries
- For 50PU – Phase1 fake rate is better

hltPixelTracks Fake rates vs. η (ttbar)

Standard Geometry



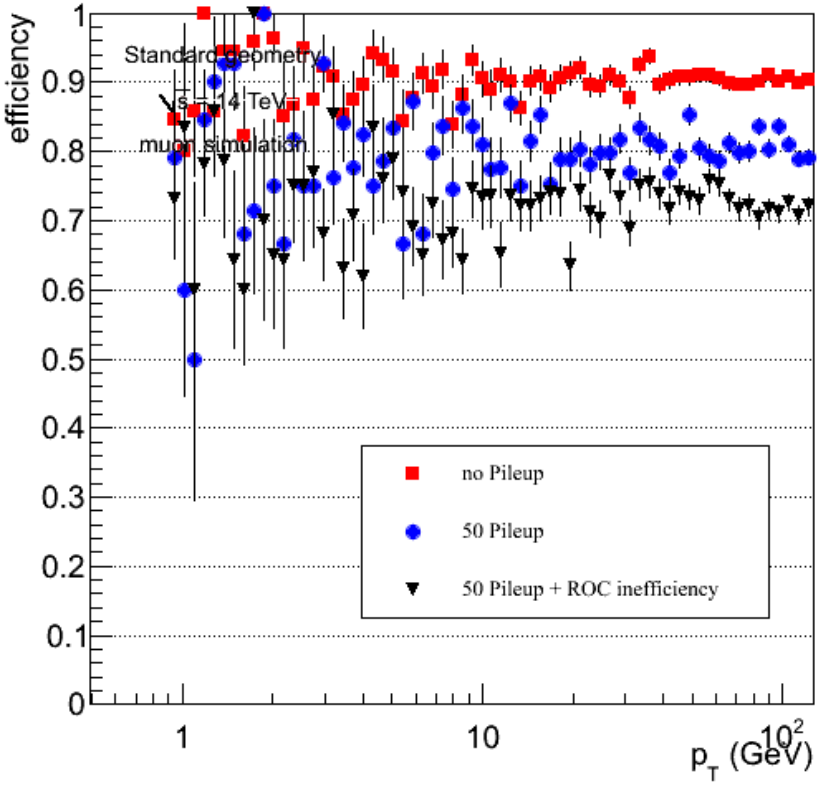
Phase1 Geometry



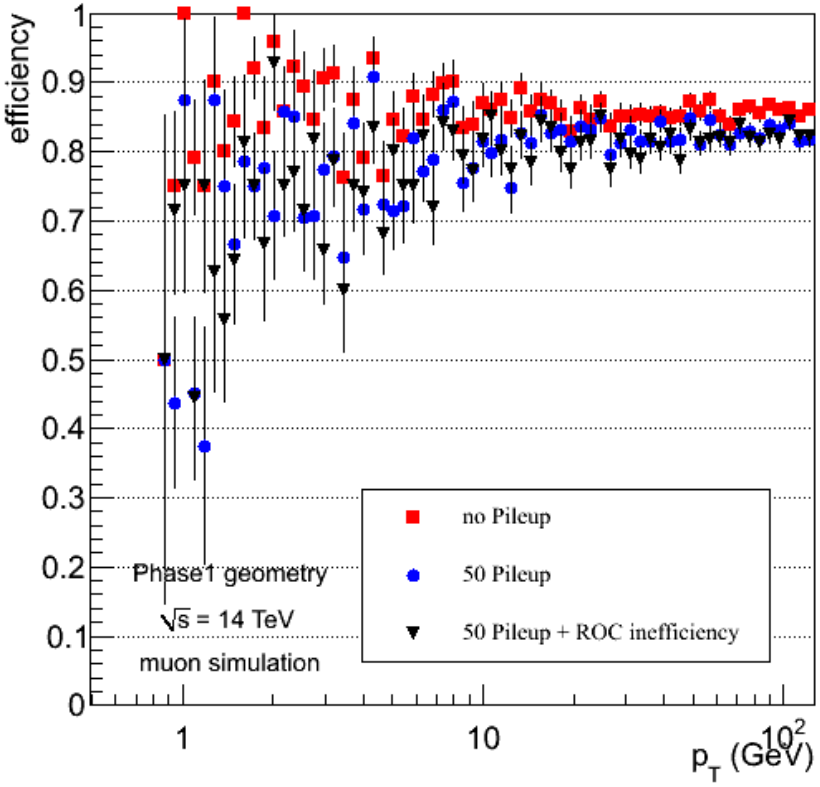
- Fake rates are lower for Phase1 towards the end cap
- But for No PU case fake rate is not better for Phase1

hltPixelTracks Efficiency vs p_T (Muon)

Standard Geometry

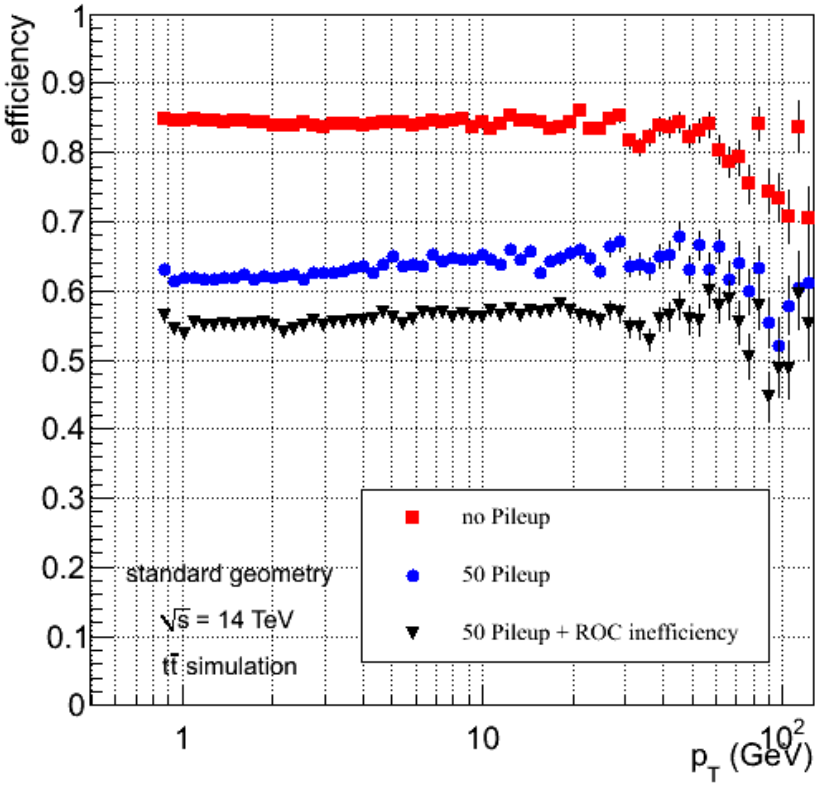


Phase1 Geometry

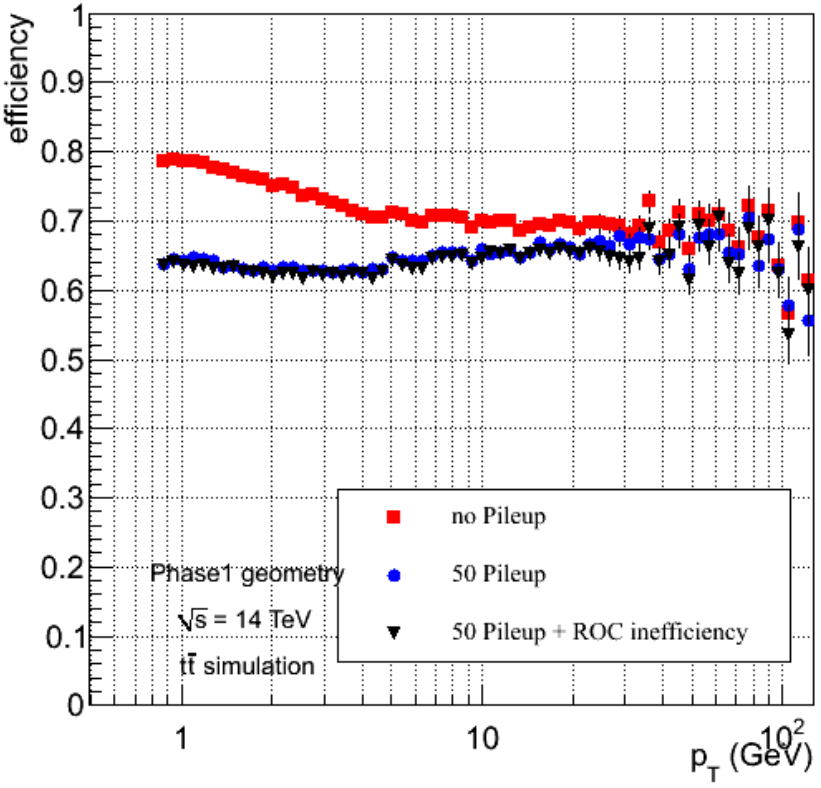


hltPixelTracks Efficiency vs p_T (ttbar)

Standard Geometry

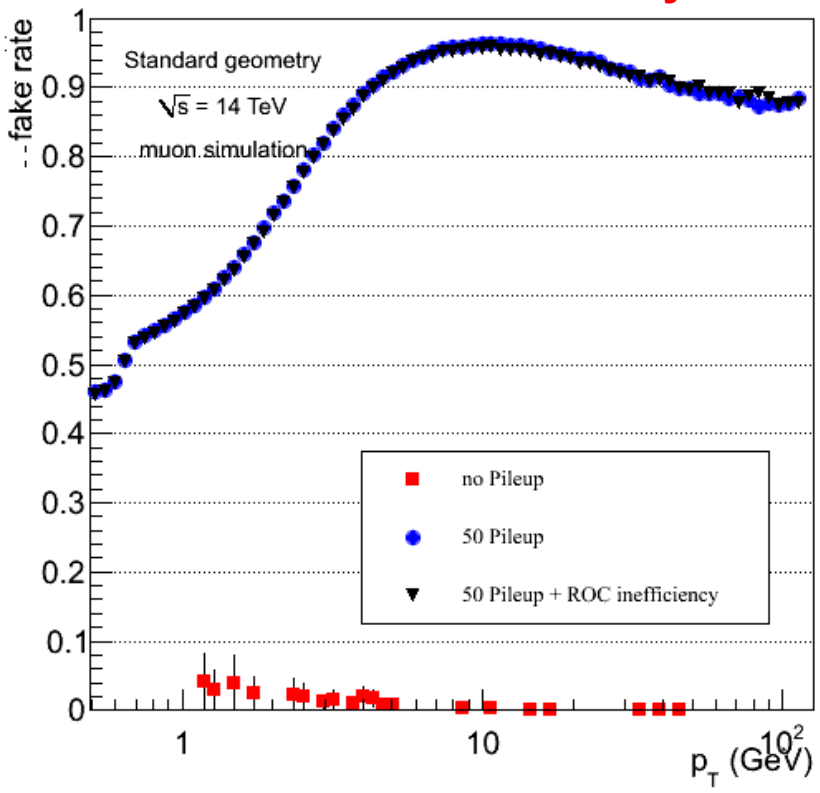


Phase1 Geometry

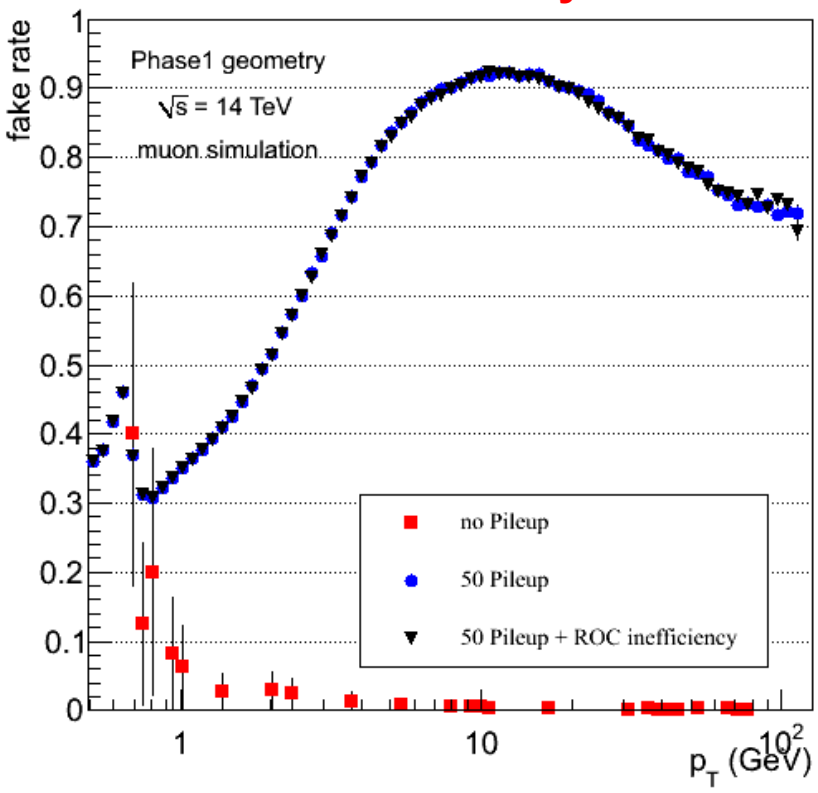


hltPixelTracks Fake rates vs p_T (Muon)

Standard Geometry

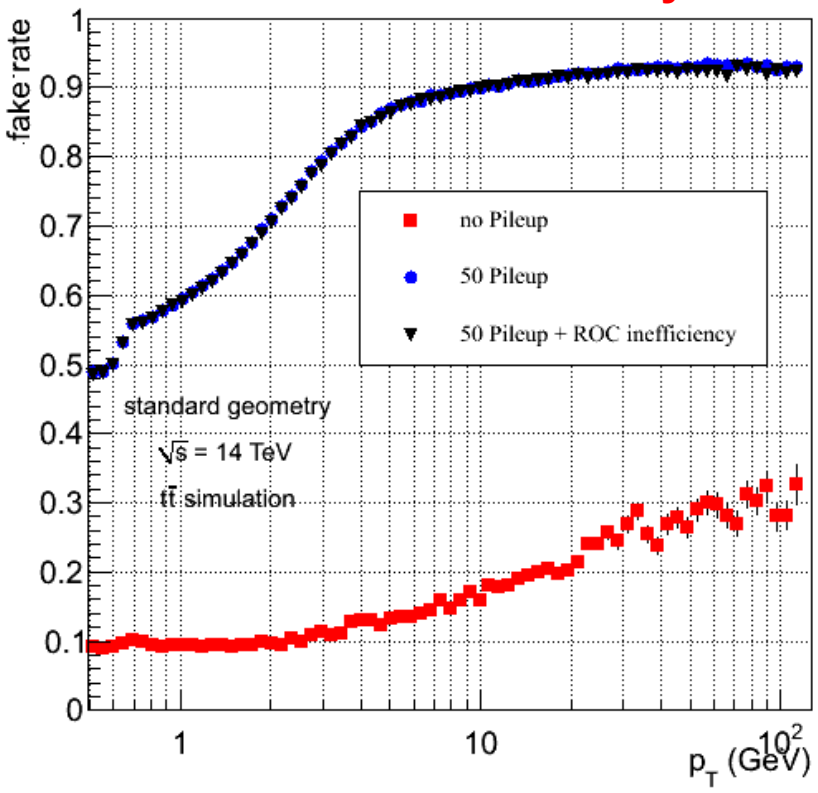


Phase1 Geometry

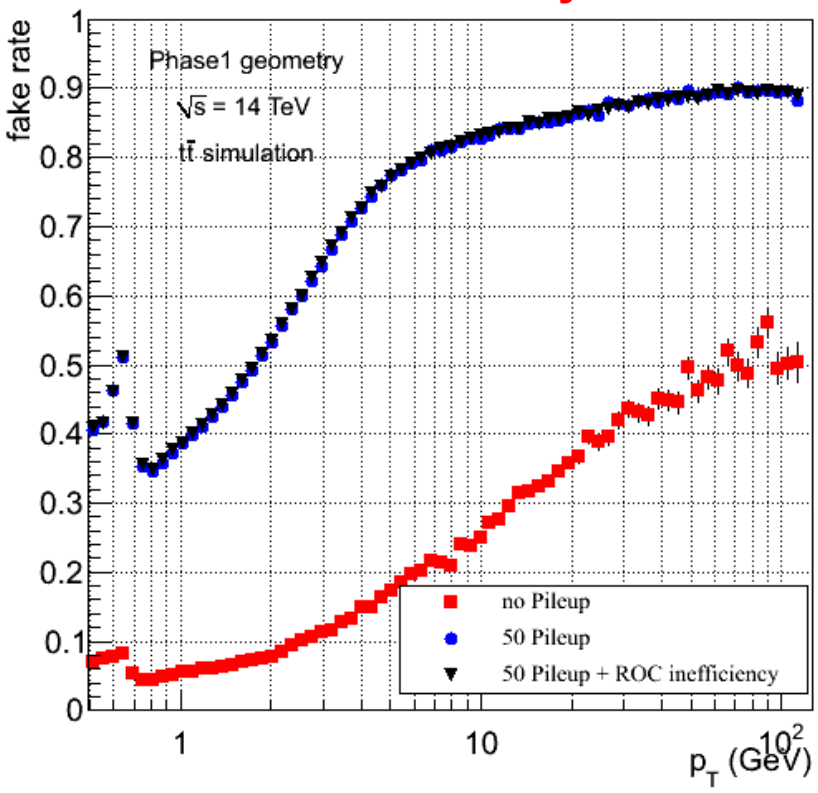


hltPixelTracks Fake rates vs p_T (ttbar)

Standard Geometry



Phase1 Geometry



Investigating the lower efficiency of Phase1

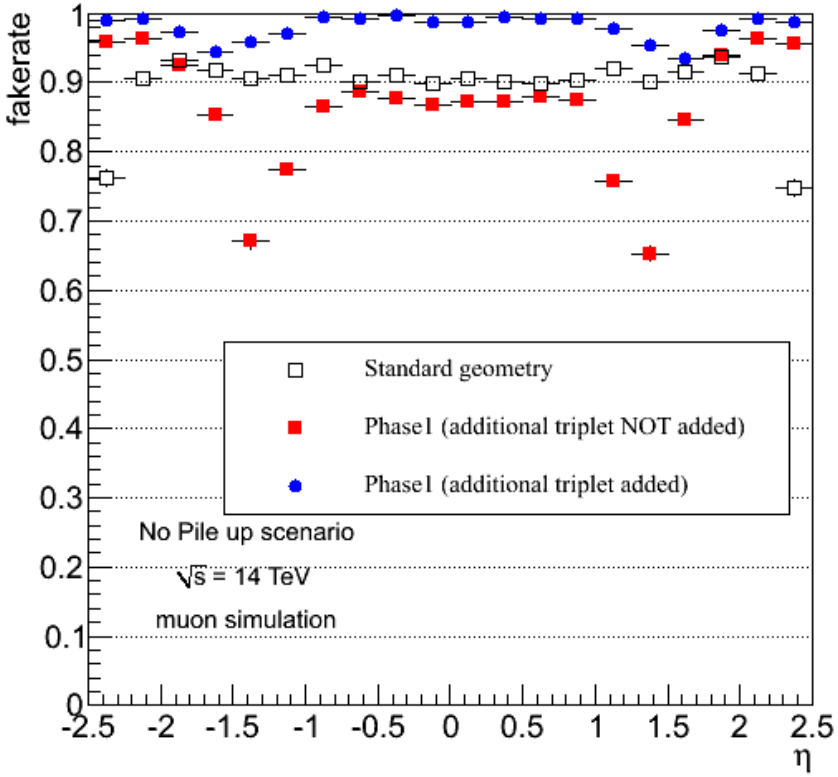
In the main config file for Phase1:

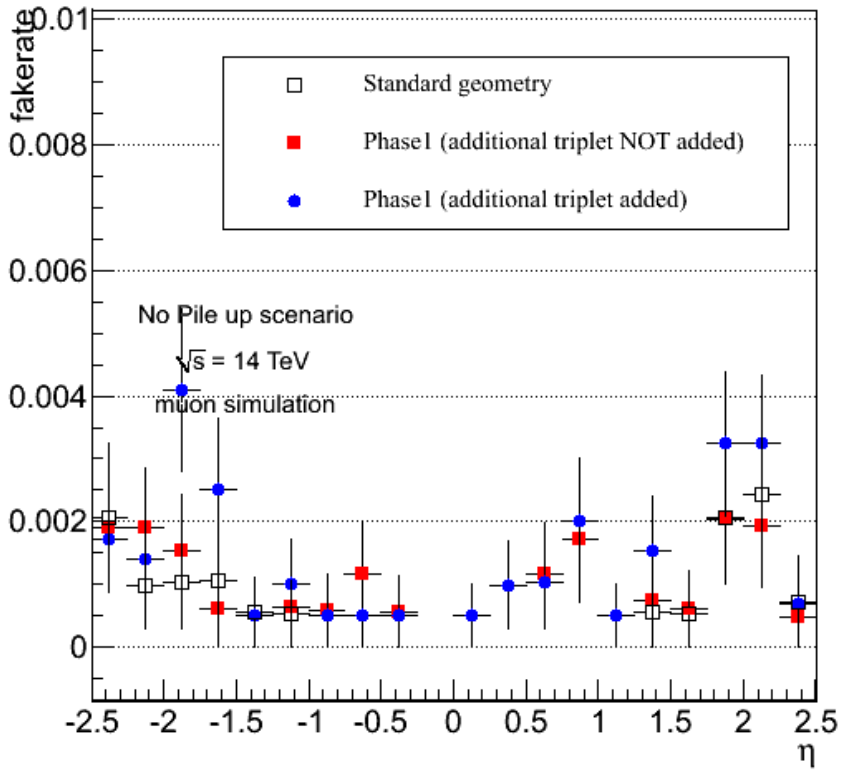
```
process.load('RecoPixelVertexing.PixelTriplets.quadrupletseedmerging_cff')

SeedMergerPSet = cms.PSet(
        layerListName = cms.string('PixelSeedMergerQuadruplets'),
        addRemainingTriplets = cms.bool(True),
        mergeTriplets = cms.bool(True),
        ttrhBuilderLabel = cms.string('hltESPTTRHBuilderPixelOnly')
    )

process.hltPixelTracks.SeedMergerPSet.addRemainingTriplets = cms.bool( True )
```

- If “True”, the seed merger will add all the triplets to the seed collection which could not be merged.
- For the results shown so far I kept it as “False”
- In the following slides I switched that to “True” and compared the efficiency/fakerate
  - Additional triplet NOT added ⇔ False
  - Additional triplet added ⇔ True

Efficiency and Fake rate comparisons (Muon)

Comparing StdGeo with Phase1 with all remaining Triplets added and not added

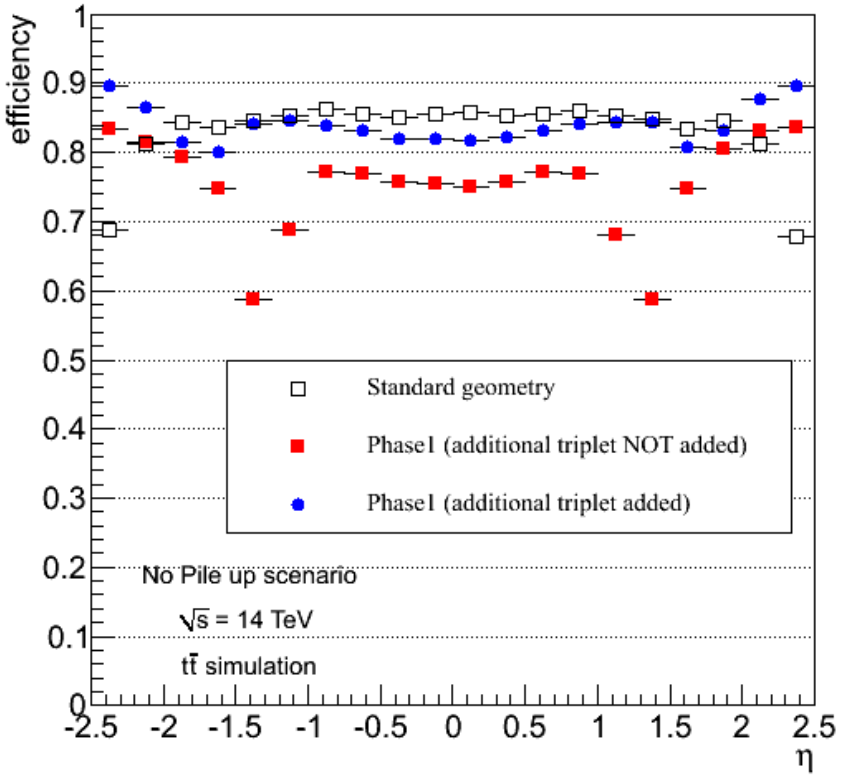


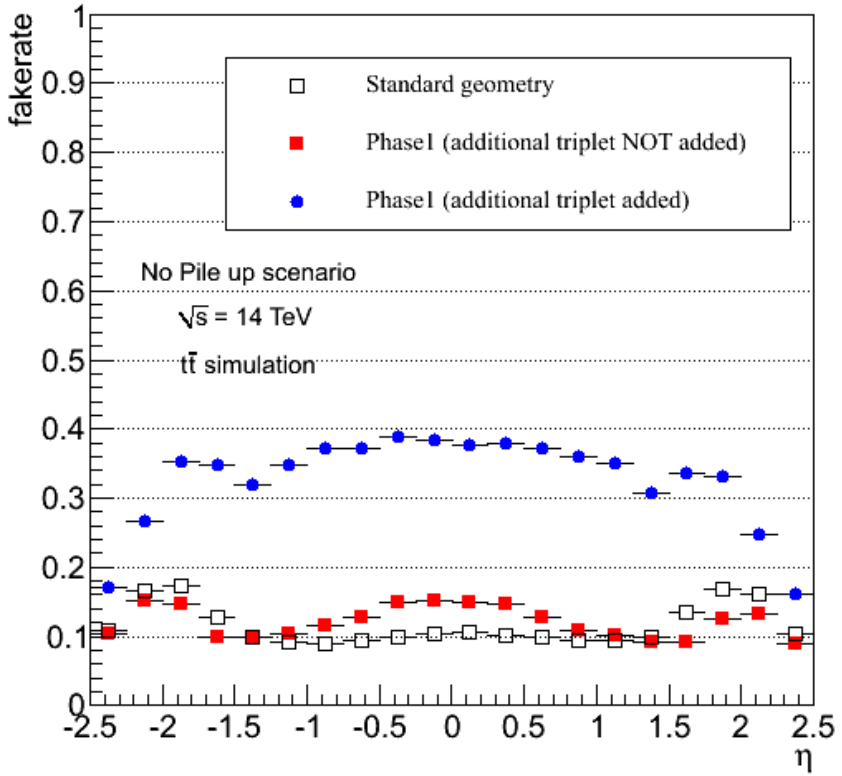


- Efficiency gets much better by adding those additional triplets which could not be merged, But Fake Rate is seen to be much higher.

Efficiency and Fake rate for hltpixeltracks (ttbar)

Comparing StdGeo with Phase1 with all remaining Triplets added and not added





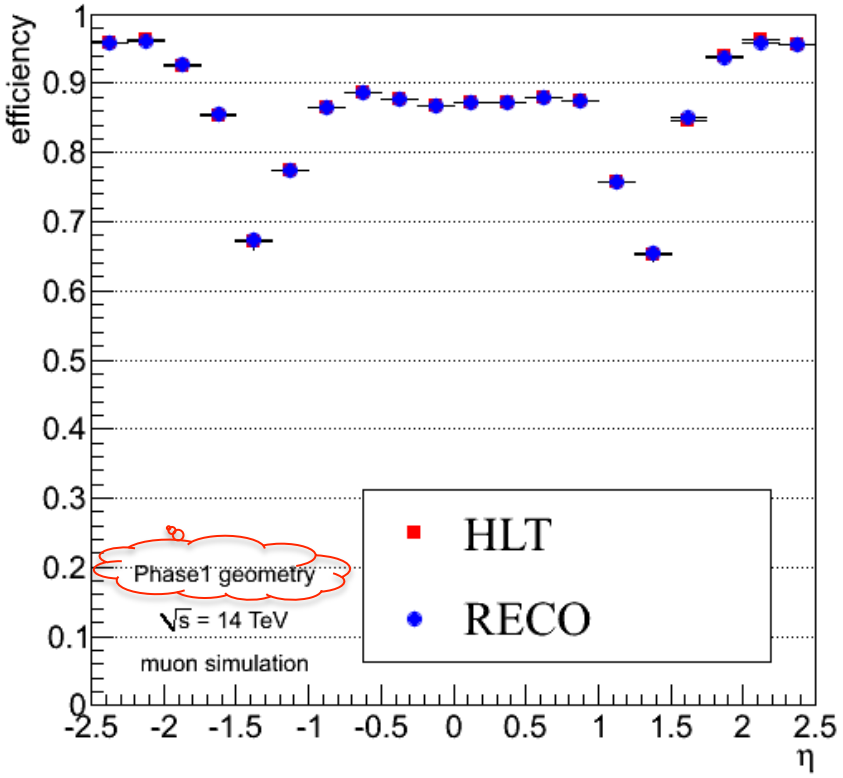
- Efficiency gets much better by adding those additional triplets which could not be merged, But Fake Rate is seen to be much higher.

- In the following slides you are going to see some additional tests / cross-checks
  - RECO vs HLT (no PU) for Phase1, StdGeo
  - RECO vs HLT for 50 PU for StdGeo
  - Whether TrackAssociator and quickTrackAssociator make any difference

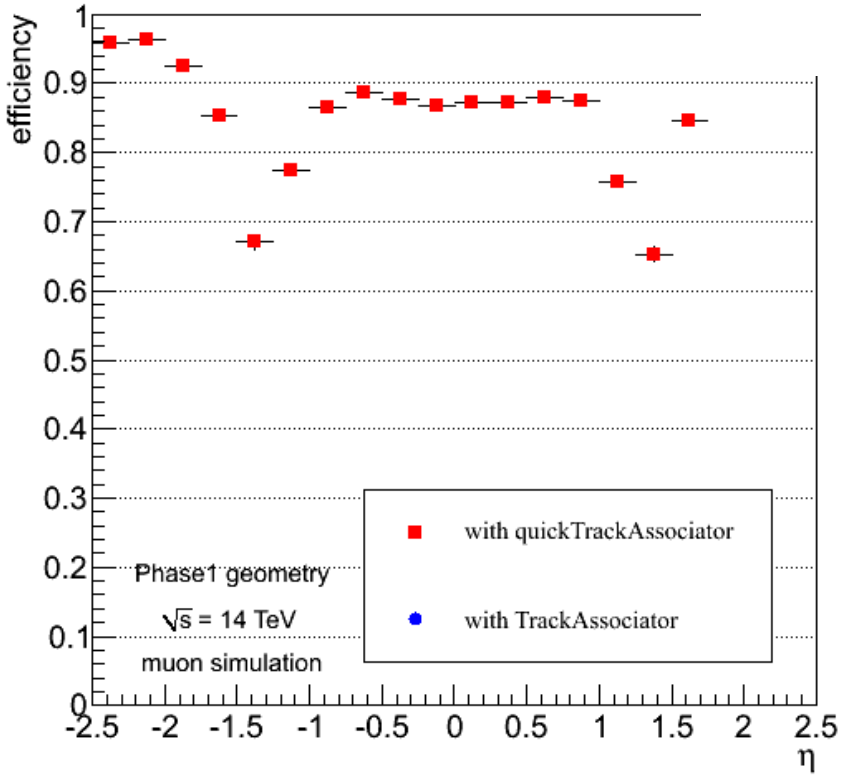
Efficiency in Phase1 Geometry (Muon)

RECO “pixelTracks”

HLT “hltPixelTracks”



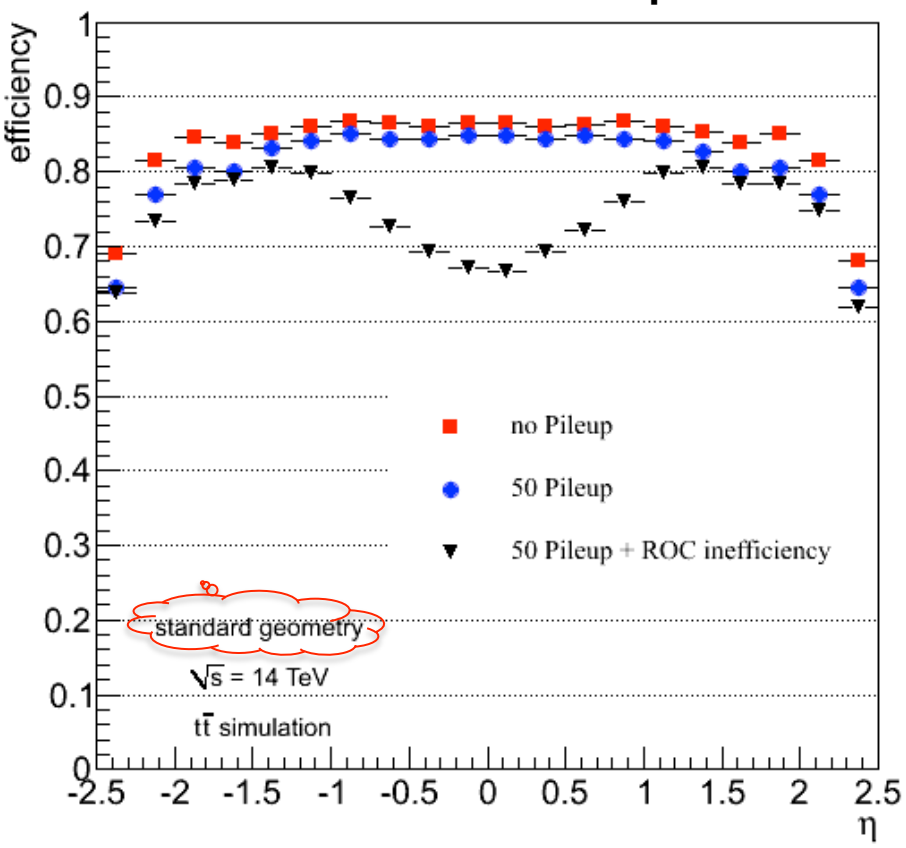
Comparing quickTrackAssociator With TrackAssociator



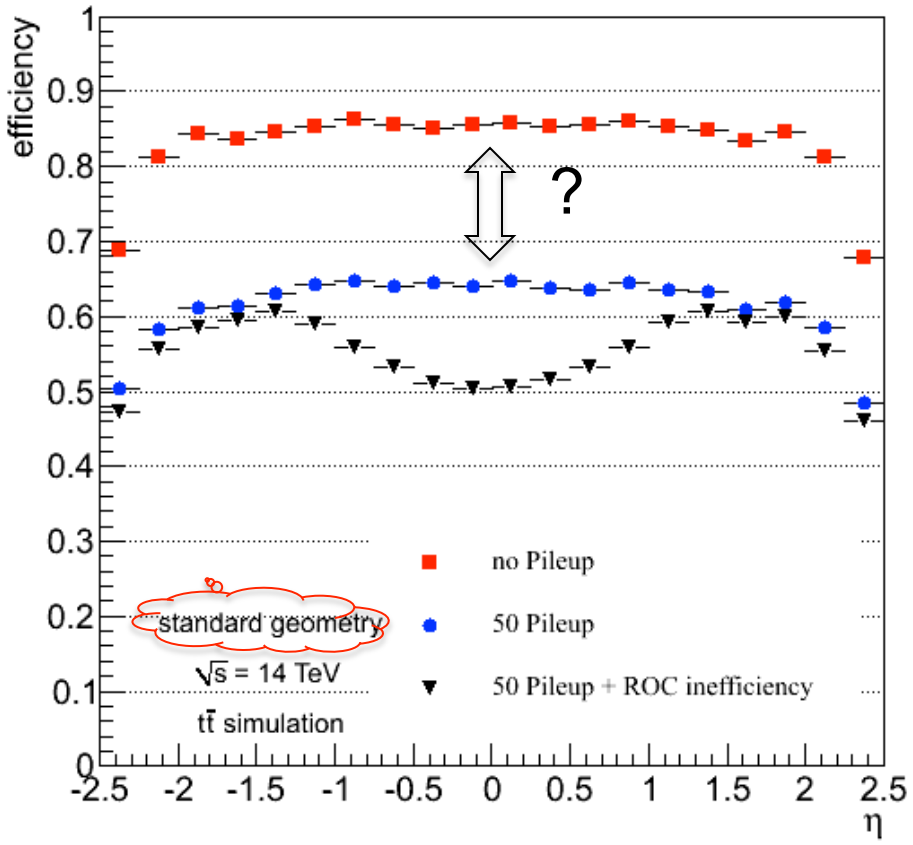
- No difference between RECO and HLT for NoPU
- No difference between TrackAssociator and quick TrackAssociator

Efficiency in Std Geometry (ttbar) (RECO vs. HLT)

RECO **"pixelTracks"**



HLT **"hltPixelTracks"**



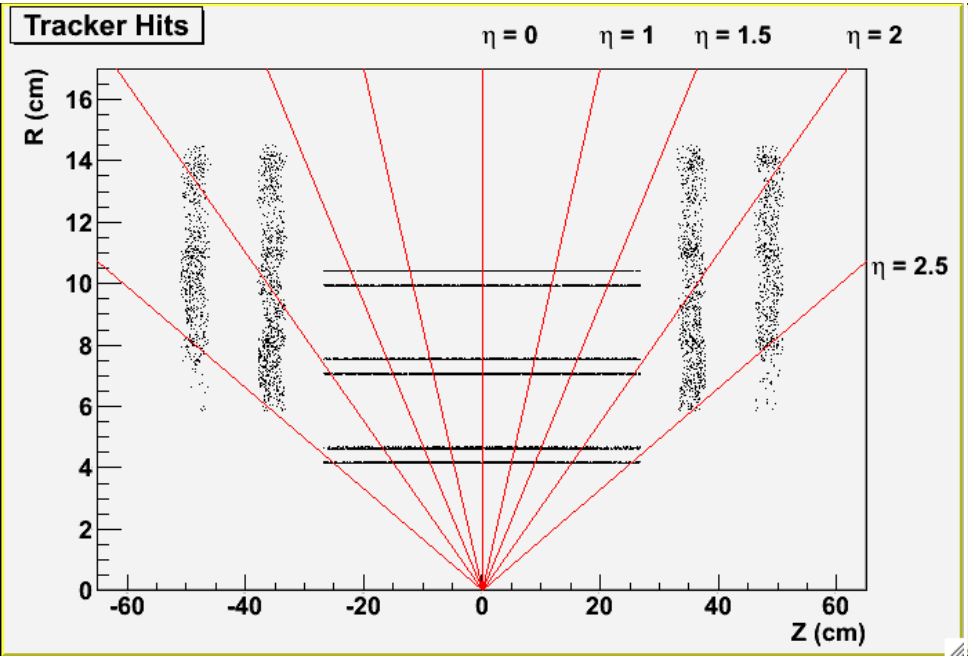
- Even for ttbar the difference between RECO and HLT negligible
- However for 50 PU the difference is sizable

Outstanding work

- Quadruplets + Only remaining triplets from
  (BPix1+BPix2+BPix3)
  (BPix1+BPix2+FPix1_pos)
  (BPix1+BPix2+FPix1_neg)

Just to cover for those gaps where one can not get 4 hits

Standard Geometry



Phase1 Geometry