Classical Lost-Lepton Background

Tag & Probe Efficiencies (Update)
Isolated Tracks Implementation in Method

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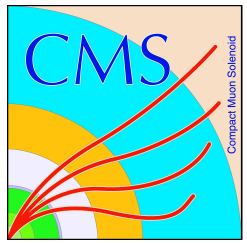
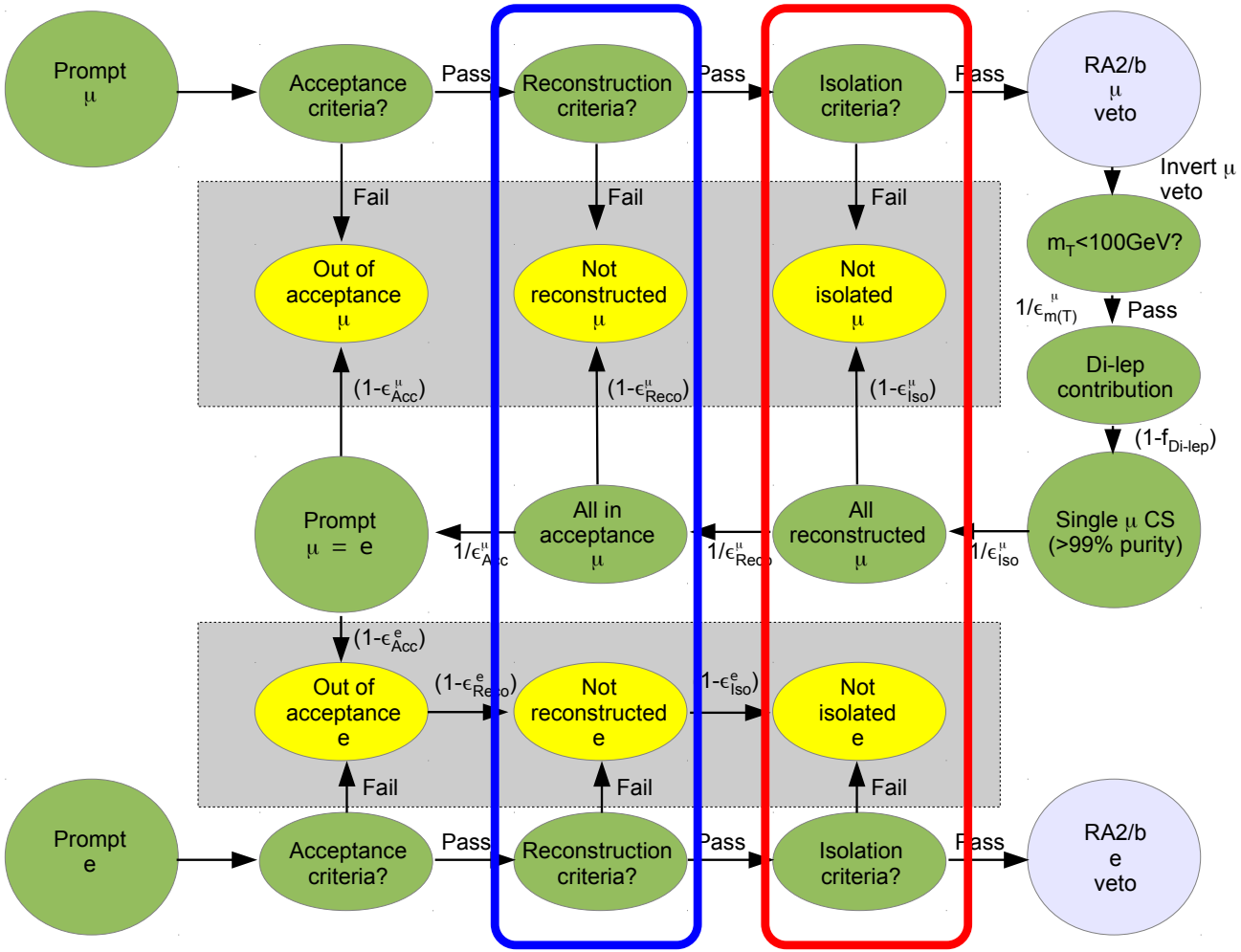


Tag & Probe Efficiencies for Lost-Lepton Background



- Deriving reco & iso Efficiencies via Tag&Probe

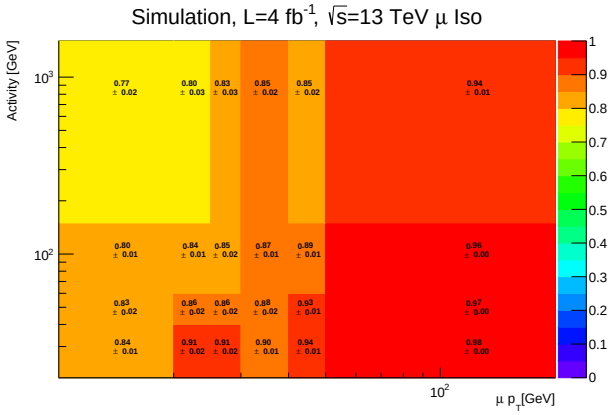
Electron Muon Lepton Tag & Probe Setup

- Muon:
  - Reco/ID: "Tight" ID, $p_T > 10 GeV$, $|\eta| < 2.4$
  - Iso: Mini Isolation: Max Cone: 0.2 Min Cone: 0.05 $\delta\beta I(rel) < 0.2$
- Electron:
  - Reco/ID: "Veto" ID, $p_T > 10 GeV$, $|\eta| < 2.5$
  - Iso: Mini Isolation: Max Cone: 0.2 Min Cone: 0.05 $\delta\beta I(rel) < 0.1$
- Tag & Probe:
  - Tag: Isolated μ/e (high purity RA2b definition)
  - ID: (problematic direct comparison to eff from $t\bar{t}$ & W + jets)
    - ★ Problem: ChargedPFCands(slimmedPhotons) → Reco&ID muon(electron)
    - ★ Problem: Muons: chargedPFCands, bad ratio signal / background, electron: slimmedPhotons miniAOD stores only down to 14 GeV → use AOD (not done)
  - Iso: (directly comparable to eff from $t\bar{t}$ & W + jets)
    - ★ Tag: Iso muon(Electron)
    - ★ Probe: Reco/ID muon(electron) → Iso muon(electron)

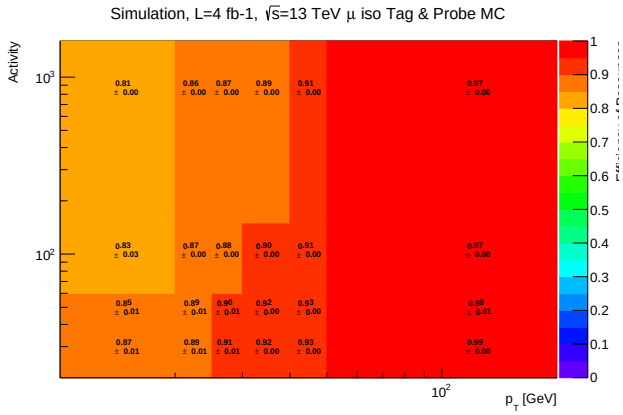
Tag & Probe μ Isolation/Reconstruction Efficiencies

Comparison $t\bar{t}$ & W + jets vs DY Tag & Probe μ Iso Efficiencies

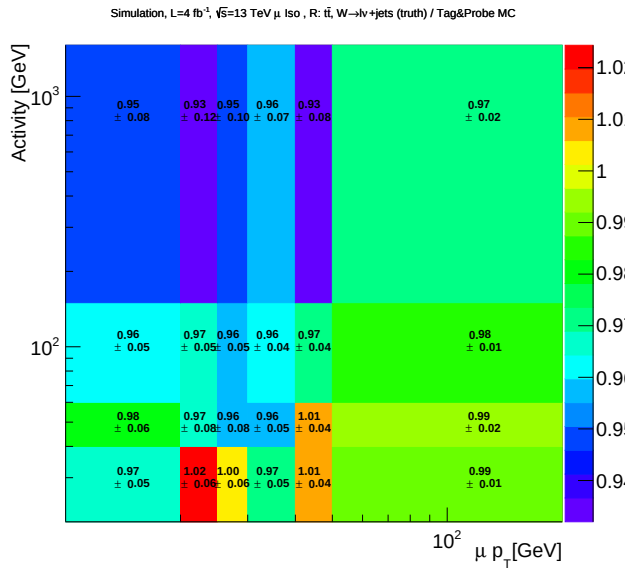
- μ Iso $t\bar{t}$ & W + jets eff. (truth info.)



- μ Iso DY eff. (Tag & Probe)



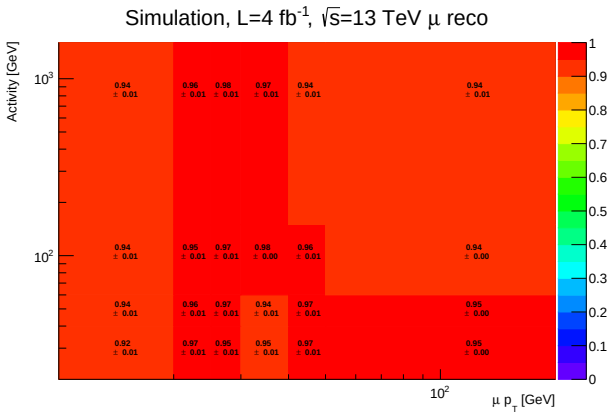
- μ iso radio



- Efficiencies obtained (using truth information) from $t\bar{t}$ & W + jets and DY are in good agreement
- Lepton p_T and Activity are sufficient topology independent to be transfered from DY to signal region! (Confirm Florent)
- Overall the efficiencies from DY are slightly higher. (No cuts applied to DY $t\bar{t}$ & W + jets baseline applied)

Comparison $t\bar{t}$ & W + jets vs DY-Truth μ Reco Efficiencies

- μ ID $t\bar{t}$ & W + jets eff. (truth info.)



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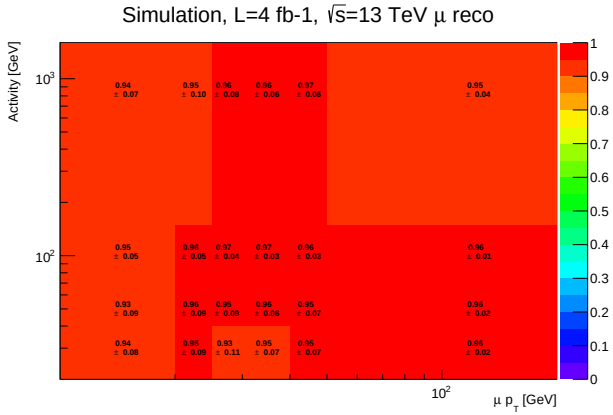
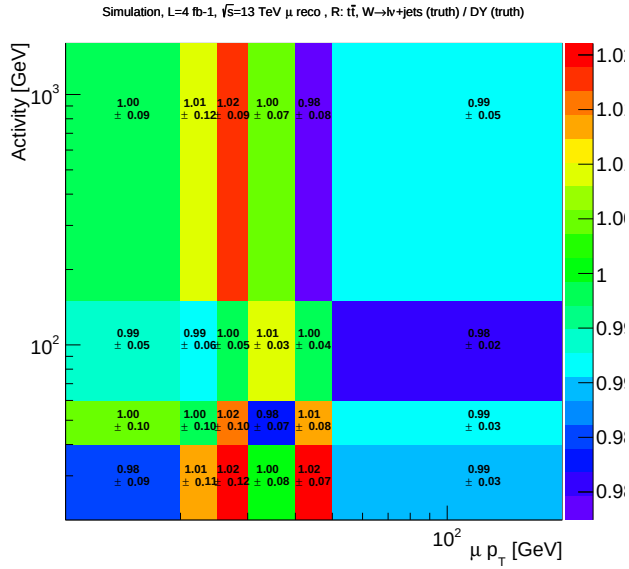


- μ ID Tag & Probe eff.



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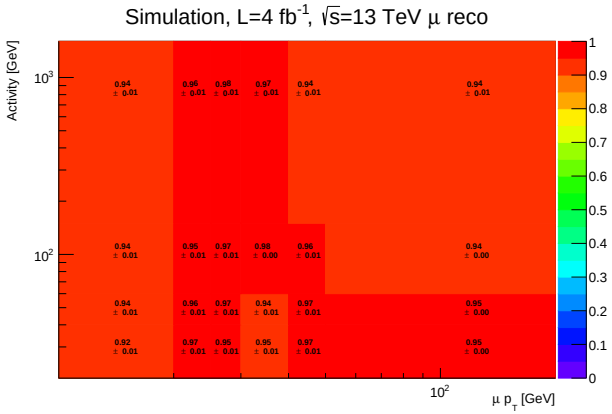
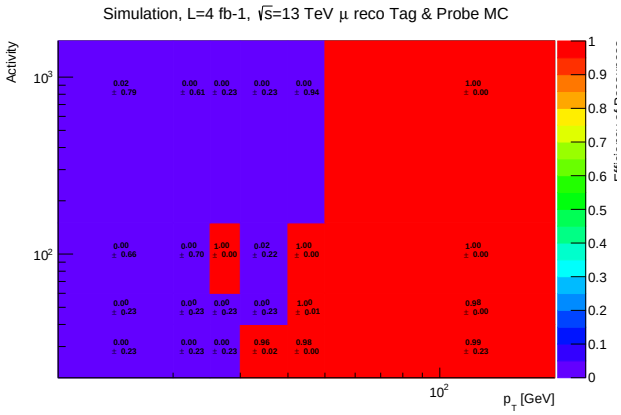
- $t\bar{t}$ & W + jets eff. matching from all in acceptance (gen lepton) including non reco leptons
- $Z \rightarrow ll$ eff. start with chargedPFCands/slimmedPhotons (slimmedMuon/slimmedElectron) (non reco excluded only test for ID)

Comparison $t\bar{t}$ & W + jets vs DY Tag & Probe μ Reco Efficiencies

- μ Reco $t\bar{t}$ & W + jets eff. (truth info.)



- μ Reco DY eff. (Tag & Probe)



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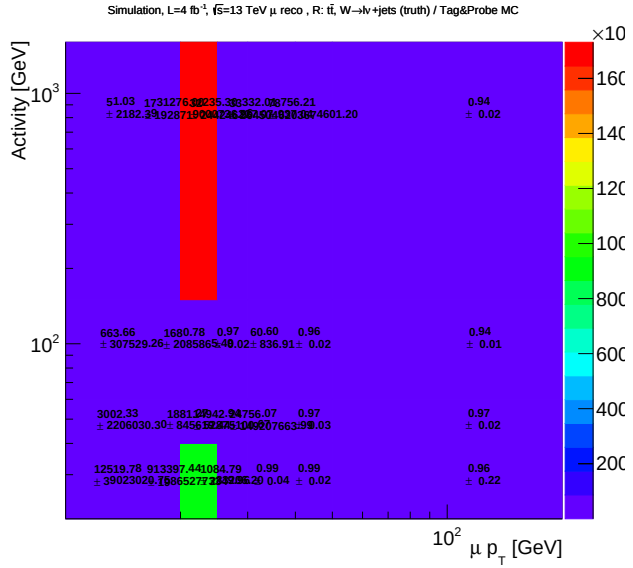

- Starting from probe charged pfCand too high background to signal event ratio in failing. (Here only DY sample used full SM process a lot higher background)
- Need to apply more cuts on probe to achieve higher purity. (follow official approach)

Tag & Probe e Efficiencies

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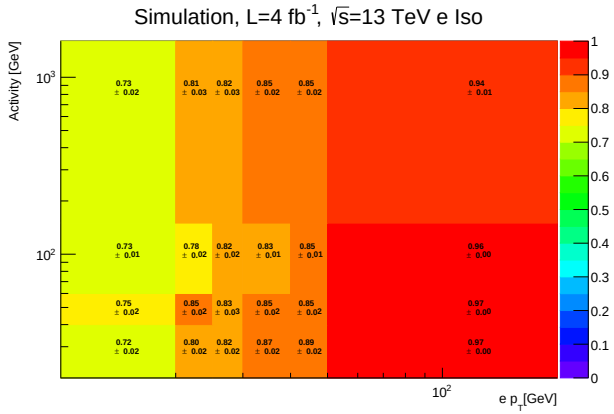

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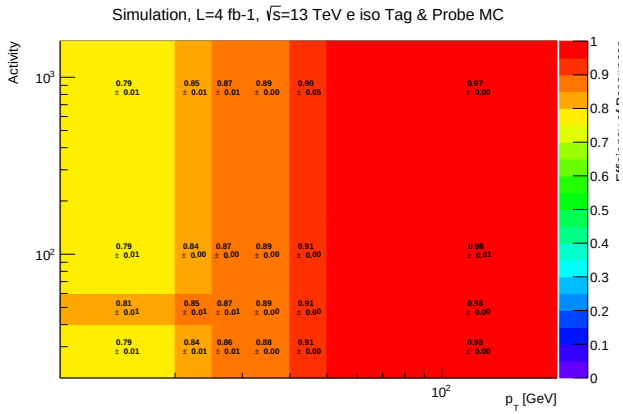

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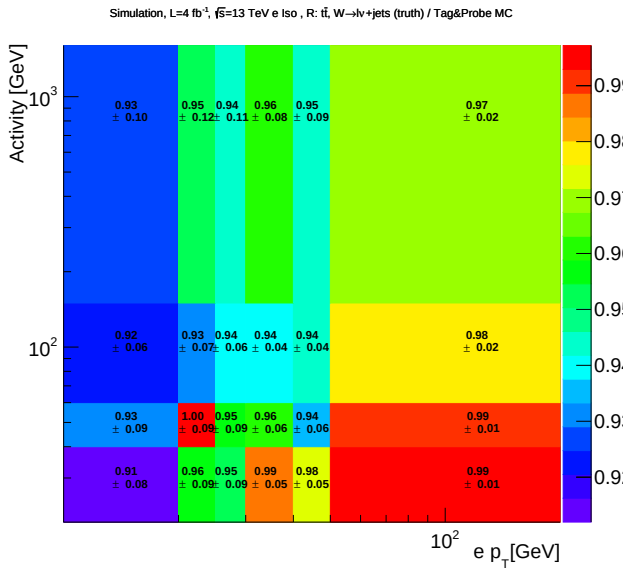

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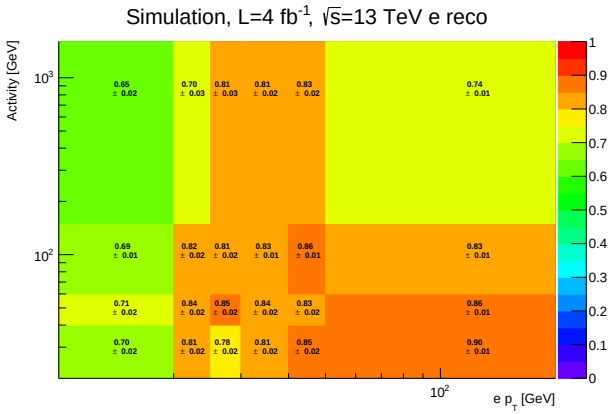
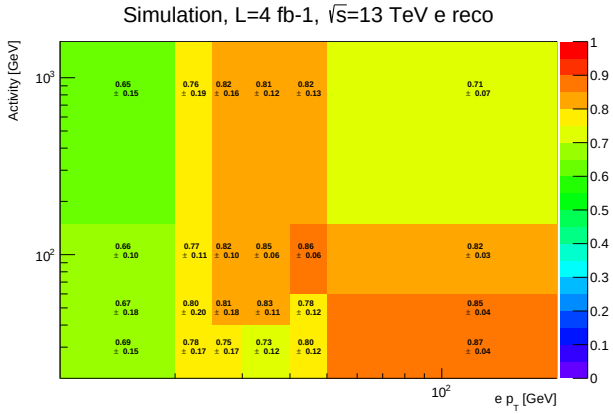
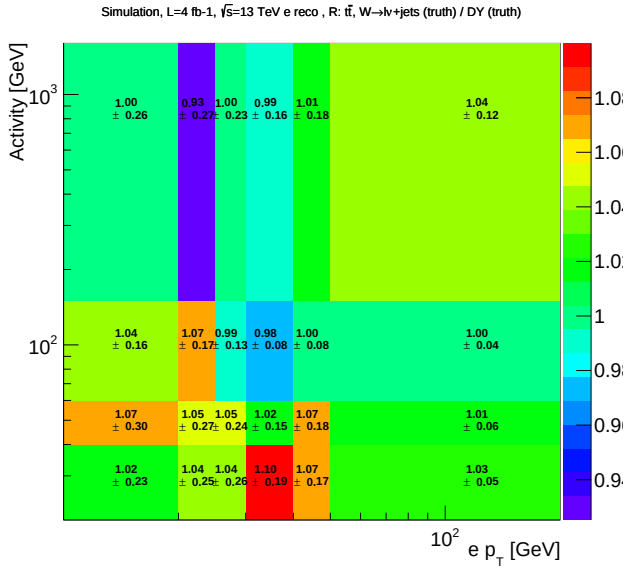


- e ID DY eff. (truth info.)



- e ID Tag & Probe eff.



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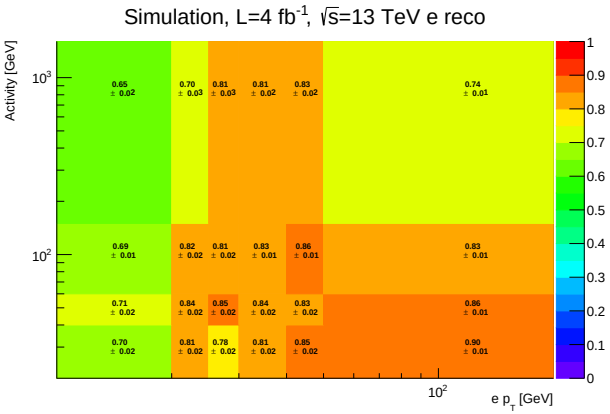

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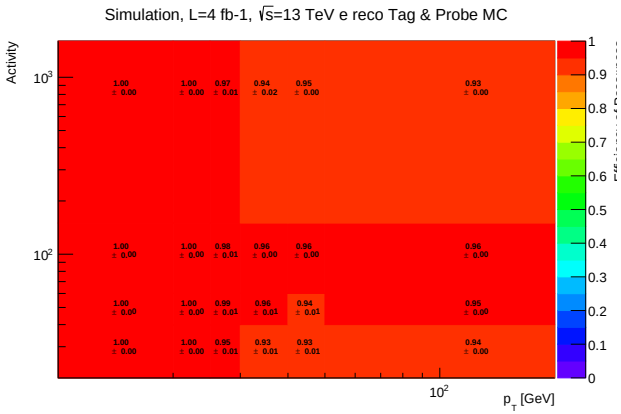

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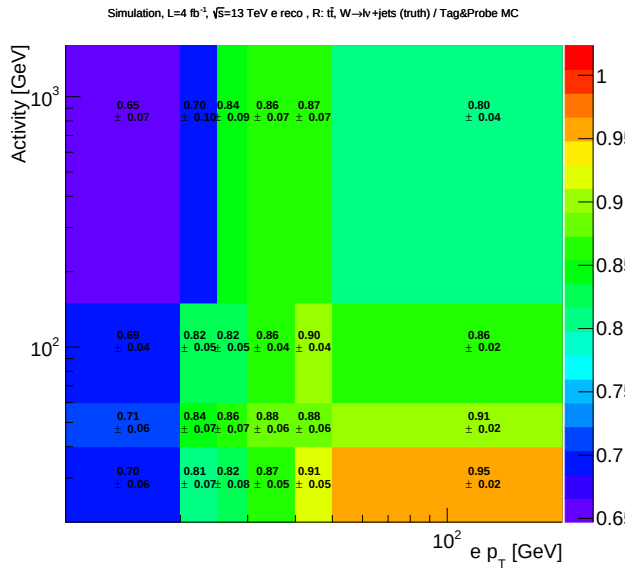


- Starting from probe charged pfCand too high background to signal event ratio in failing. (Here only DY sample used full SM process a lot higher background)
- Need to apply more cuts on probe to achieve higher purity. (follow official approach)

Isolated e/μ Tracks: Implementation in Lost-Lepton Method

Classical Lost-Lepton Estimation with Isotrack Reduction

- Isolated track (mainly pdgID=11,13) reduce lost-lepton background even further 22% reduction (on baseline)
- Current idea of including this reduction in method:
  - Apply full classical lost-lepton method. In the very end correct for isolated track reduction of lost-lepton background ($C_{IsoTrack}$)
  - Problem: Mixture of (classical) lepton efficiencies and isolated track efficiencies. (note: correcting relative to single lep. control-sample)
  - Correction of lost-lepton background depends not only on isolated track efficiencies but also on lepton eff.
  - $p_{full}(\epsilon_{ll}, \epsilon_{IsoTrackRel}) = p_{ll}(\epsilon_{ll}) * (1 - C_{IsoTrack}(\epsilon_{ll}, \epsilon_{IsoTrackRel}))$
  - $C_{IsoTrackRel}(\epsilon_{ll}, \epsilon_{isotrack}) = \frac{(1-\epsilon_{ll})*\epsilon_{IsoTrack}}{\epsilon_{ll}}(1 - \epsilon_{ll}) * \epsilon_{IsoTrack}/\epsilon_{ll}$
  - Sample to derive $C_{IsoTrackRel}$ consists of only failing (lost-lepton) events.
  - Deriving/estimating uncertainties complicated. Note: $\epsilon_{ll}(\epsilon_{e/\mu acc,reco,iso,m_T})$

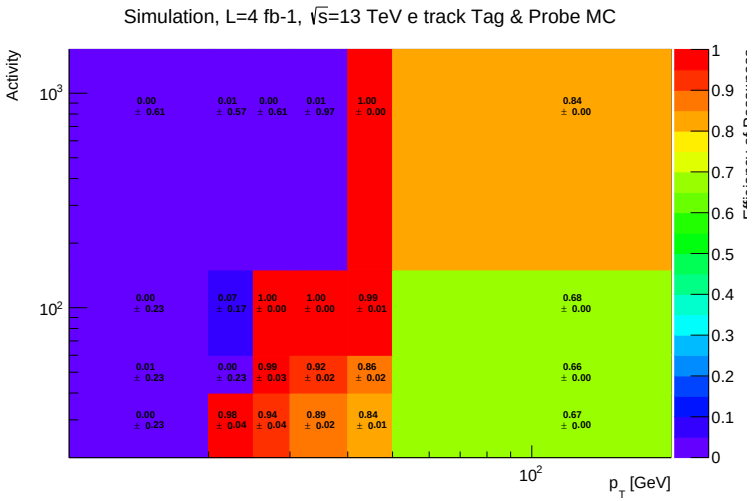
Isolated Track: Elec & Muon Tracks

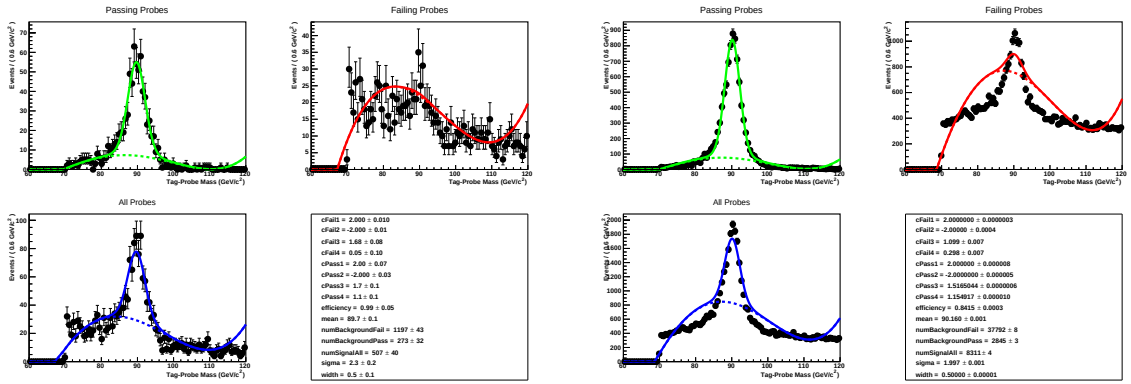
- Muon, Electron Tracks:
  - Charged PFCand, $p_T > 5 GeV$, $m_T < 100 GeV$ ask for pdgID=11,13
  - Iso: $\Sigma(p_T(Tracks)\Delta R < 0.3)/(p_T Track) < 0.2$ (with $dz < 0.05$)
- Tag & Probe:
  - Tag: Isolated μ/e (high purity RA2b definition)
  - Probe:
    - ★ Probe: chargedPFCands $\rightarrow$ iso Mu/Elec Track
    - ★ Problem: Large amount chargedPFCands, bad ratio signal / background
    - ★ Problem: Small statistics due to deriving efficiencies of isolated tracks to failing isolated leptons (not applied yet)
    - ★ Problem: No $m_T < 100 GeV$ applicable

Isolated e Tracks: First try with Tag&Probe

μ similar not shown here

First Look at Isolated Electron Tracks





- Starting with any charged track (applying only p_T, η cuts) as probe
- Most bins too bad background/signal events (see middle plot)
- Adaptation of background fit function can help in some bins, BUT here only DY $H_T > 400 GeV$ sample used. Expected a lot worse contamination in data.
- This lose definition of probe candidates has too high background/signal ratio.
- Apply some sort of preselection (can test for isolation by starting with pdgID lepton track but excluding pdgID determination efficiency!)

Conclusion

- Bug fixed (moved to eGamma maintained tools)
- Lepton Isolation eff:
  - Still residual difference visible. Try applying $H_T > 500 GeV$ cut more busy environment
- Lepton ID/Reco eff:
  - Starting with slimmedMuon/slimmedElecon as probe tests only for ID criteria not sufficient
  - Starting with chargedTrack too high background/signal ratio in failing collection (for muons)
  - Starting with slimmedPhoton starts only at 14 GeV (in miniAOD) need to move to AOD
- Lepton Tracks:
  - Start with charged tracks (only p_T, η cuts applied)
  - Suffers from very bad background/signal ratio even when looking at 'pure' DY sample
  - Need to start with some sort of preselection maybe pdgID already applied (cant test for pdgID efficiency)

Backup