CMSDASIA2012

Physics with Taus

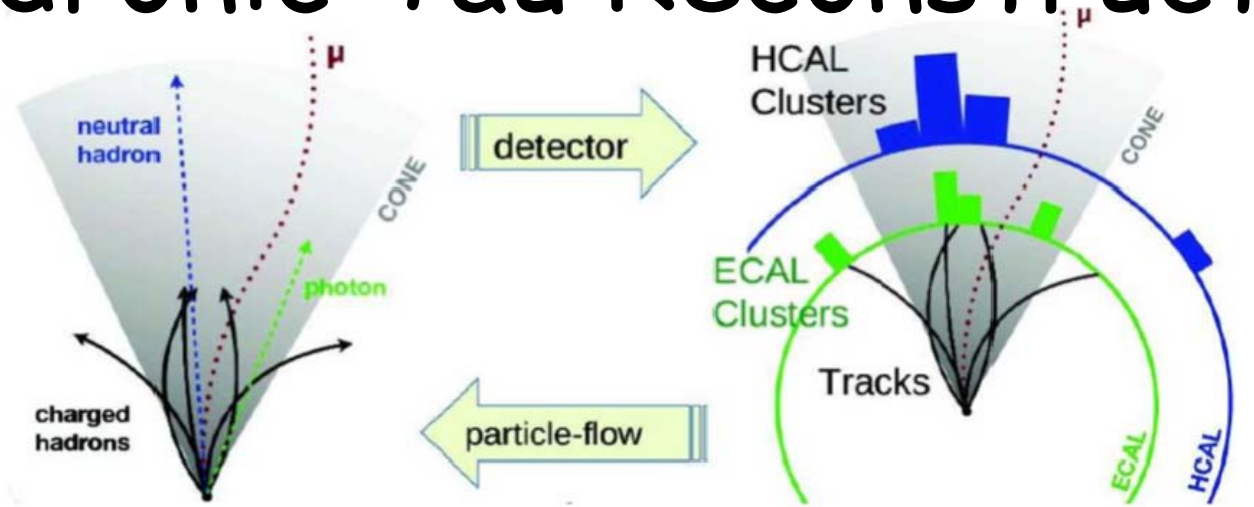
By: ROY, Debarati,
GUO, Wei,
MAI, Shu-Hao,
SUWONJANDEE, Narumon,

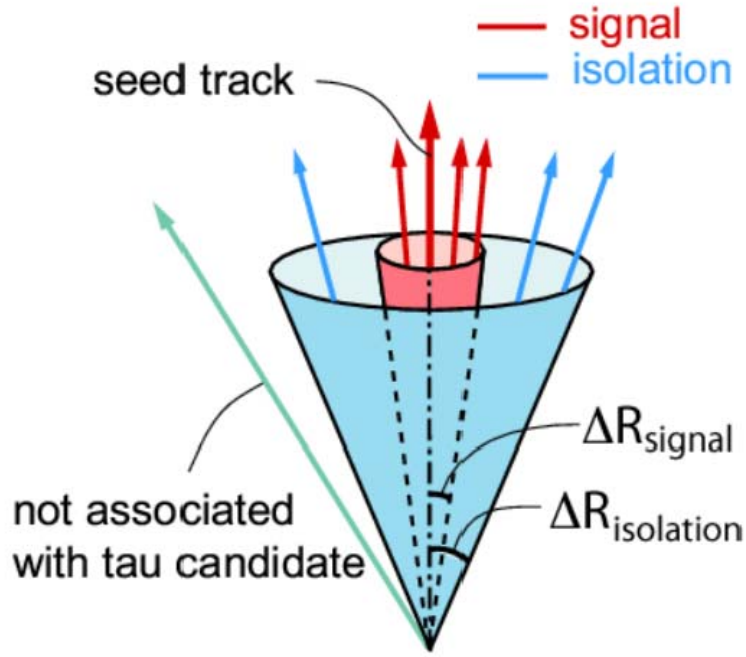
Supervised by: **HILDRETH, Mike**

Outline

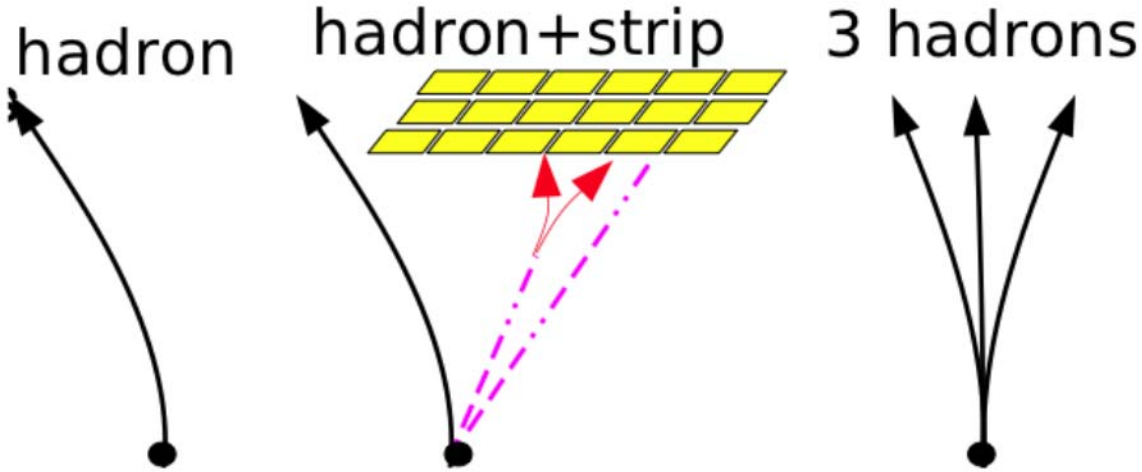
- Tau Reconstruction & Identification
- Analysis
  - Background Estimation
  - Analysis Optimization
  - Systematics
- Conclusion

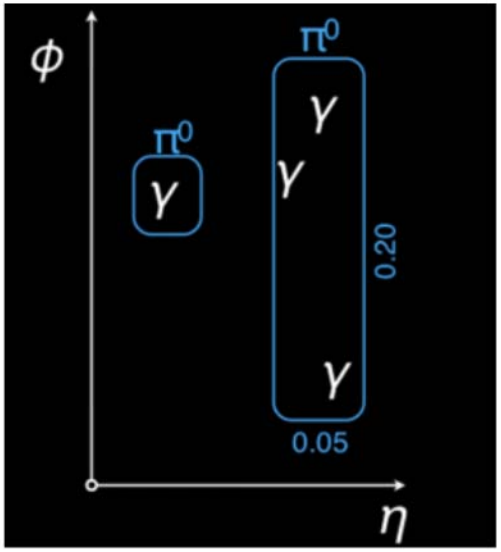
Hadronic Tau Reconstruction





Hadronic Tau Identification

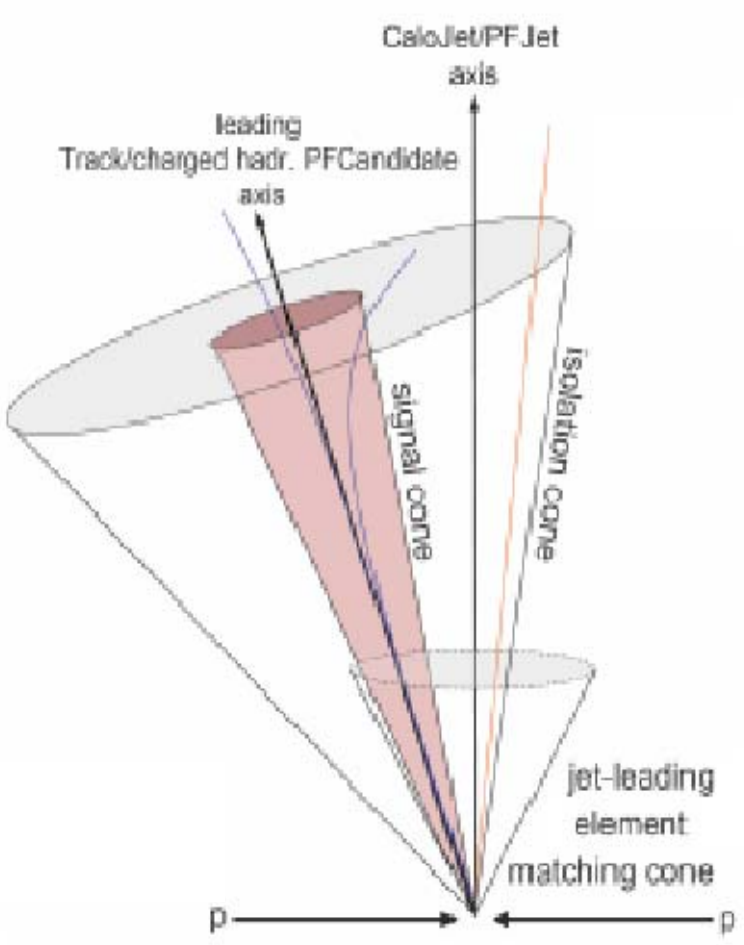




Hadronic Tau Reconstruction and Identification

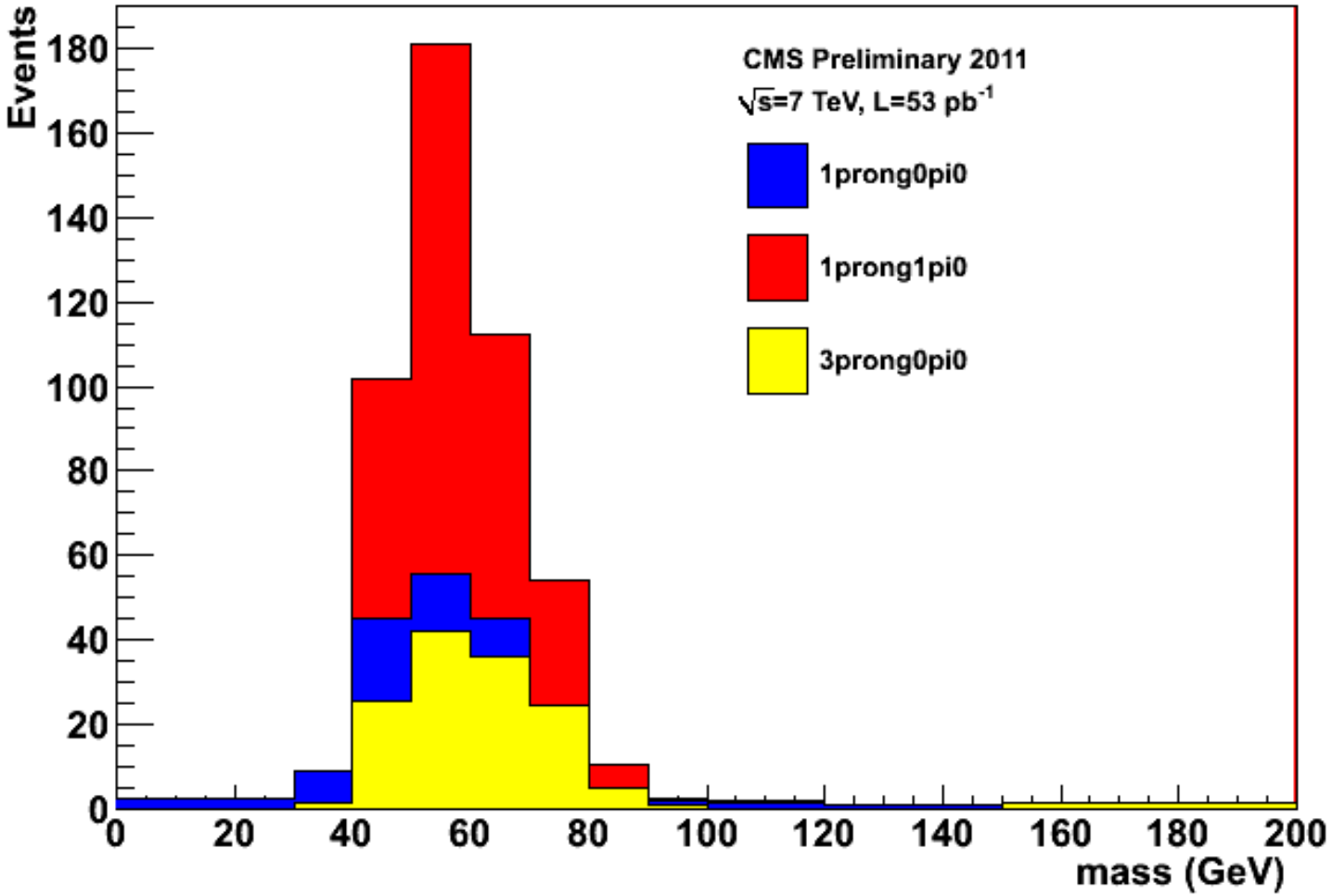
- Build tau jet from individual constituents using particle flow (PF)

1) Calorimeter clustering
2) Tracking + extrapolation to calorimeters
3) Muon ID
4) Electron pre-ID
5) Topological linkage of elements
6) Final particle ID and jet building

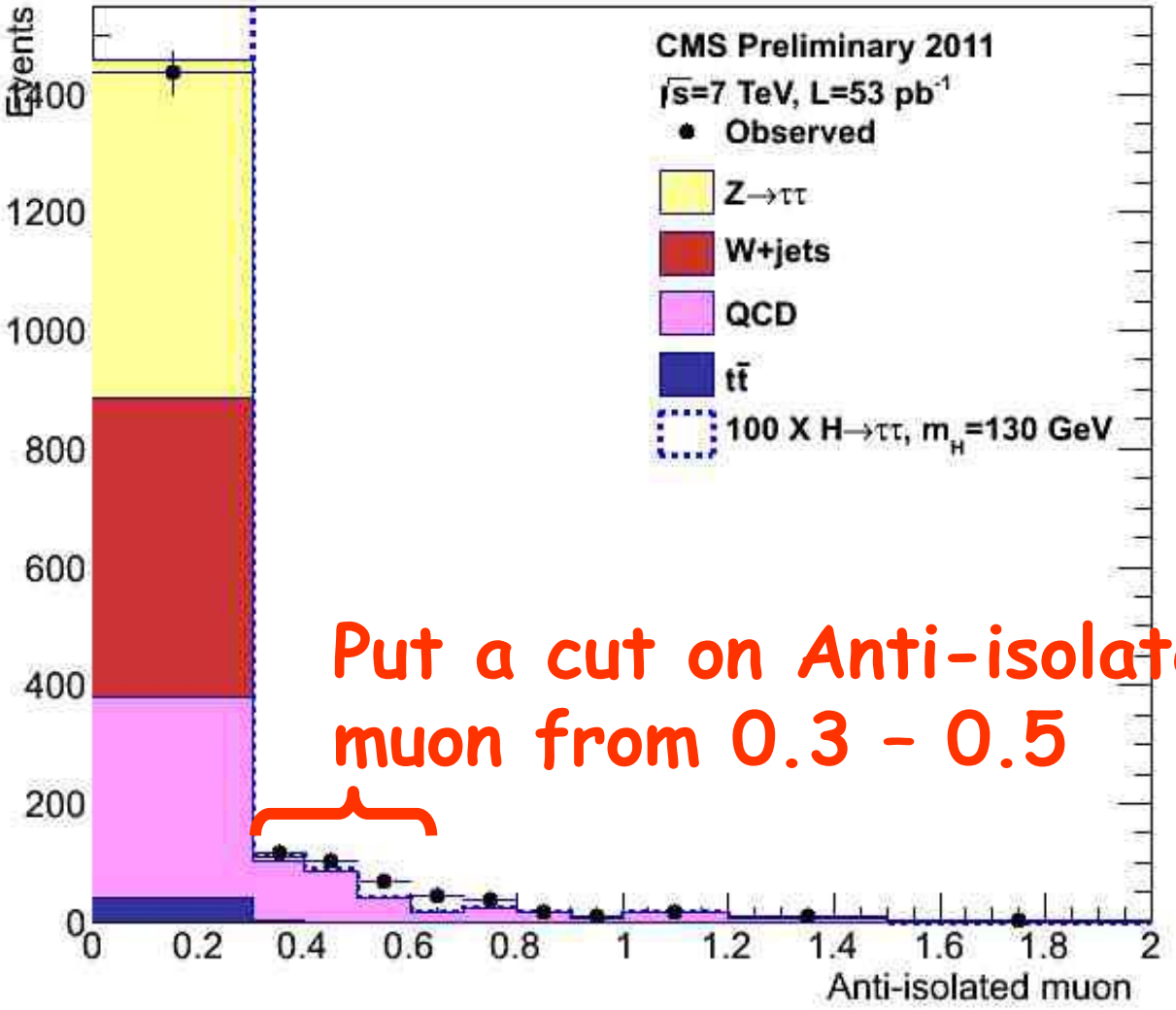


Analysis for Physics with Taus

- Tau lepton in final state in CMS
- Lead us to search for SM Higgs boson in tau-tau channel
- Detector sees the hadronic tau as a narrow jet
  - Chance to mix jets from tau-H and jets from quark-gluon
- Separate genuine tau from faking tau
  - DK-modes is reconstructed
  - small isolation deposit is measured -> sum PT of all particles around tau
-

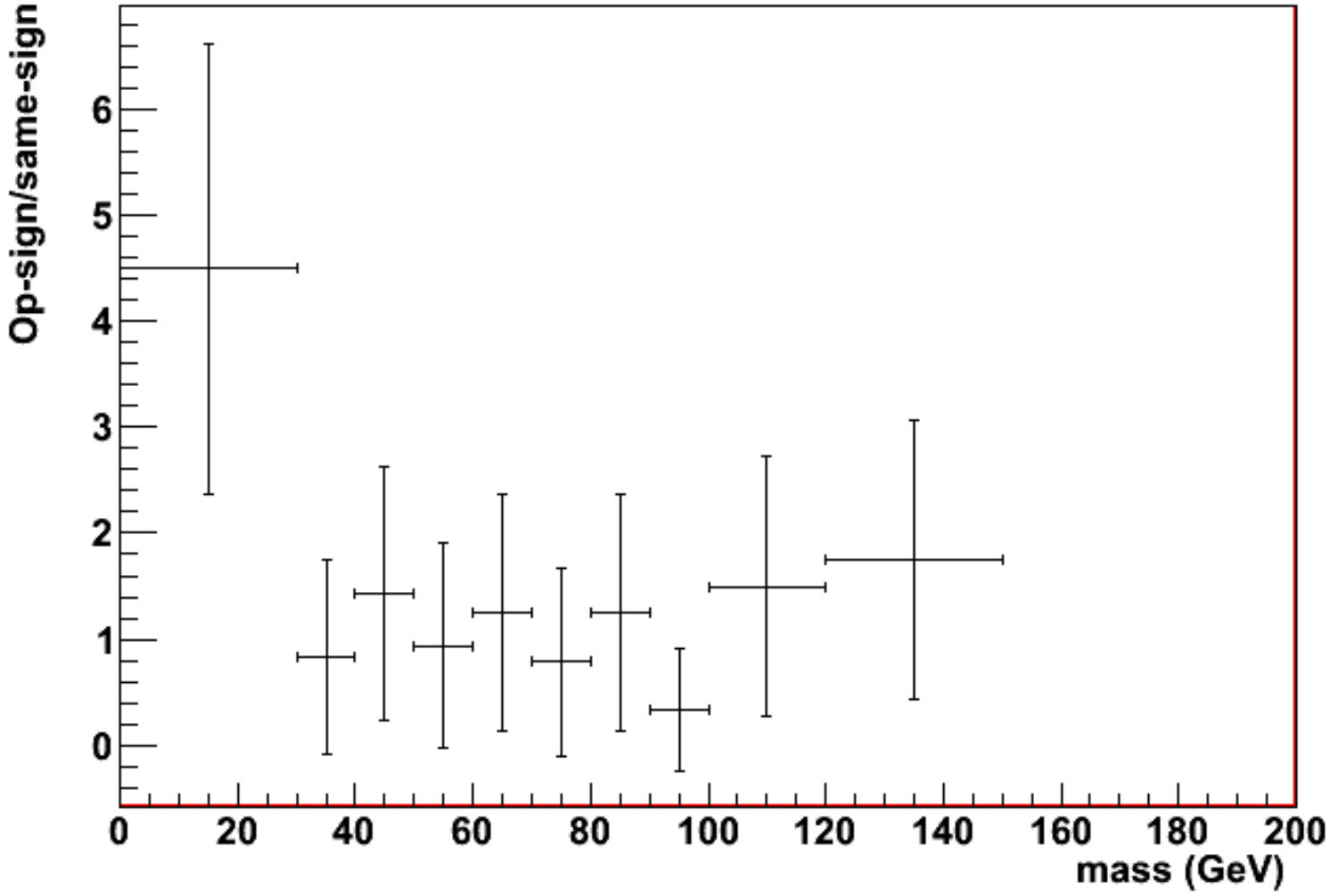

Events
180
160
140
120
100
80
60
40
20
0
0
20
40
60
80
100
120
140
160
180
200
mass (GeV)
CMS Preliminary 2011
√s=7 TeV, L=53 pb-1
1prong0pi0
1prong1pi0
3prong0pi0

Anti-isolated Muon

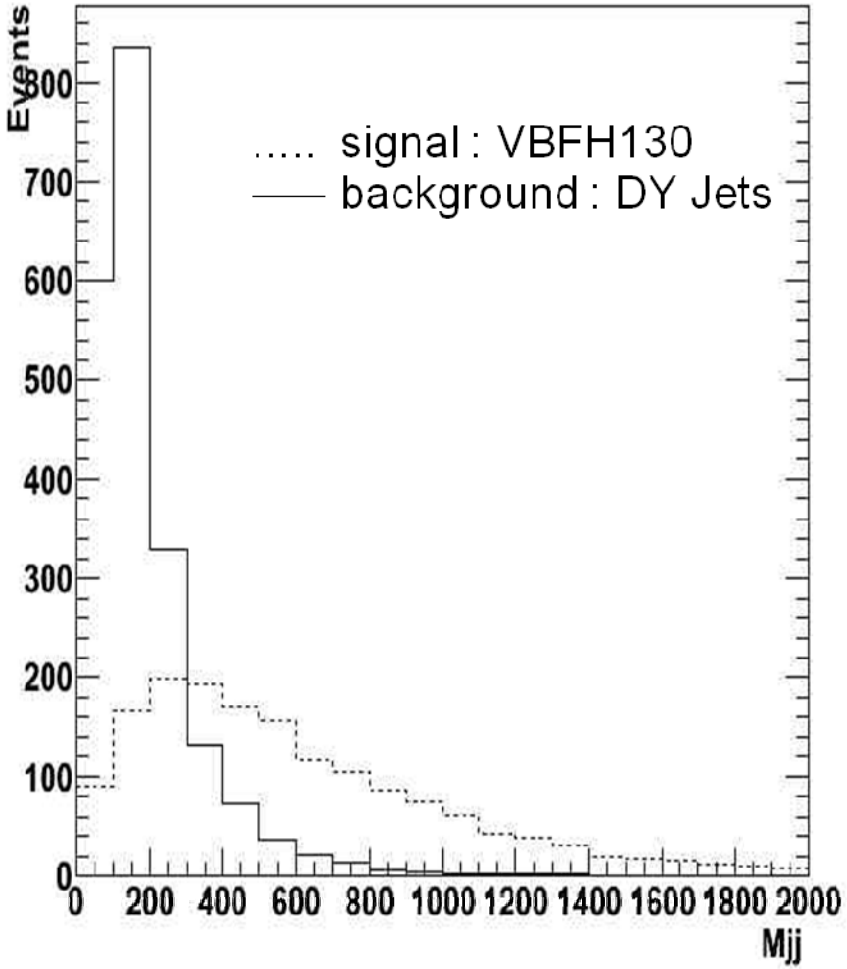


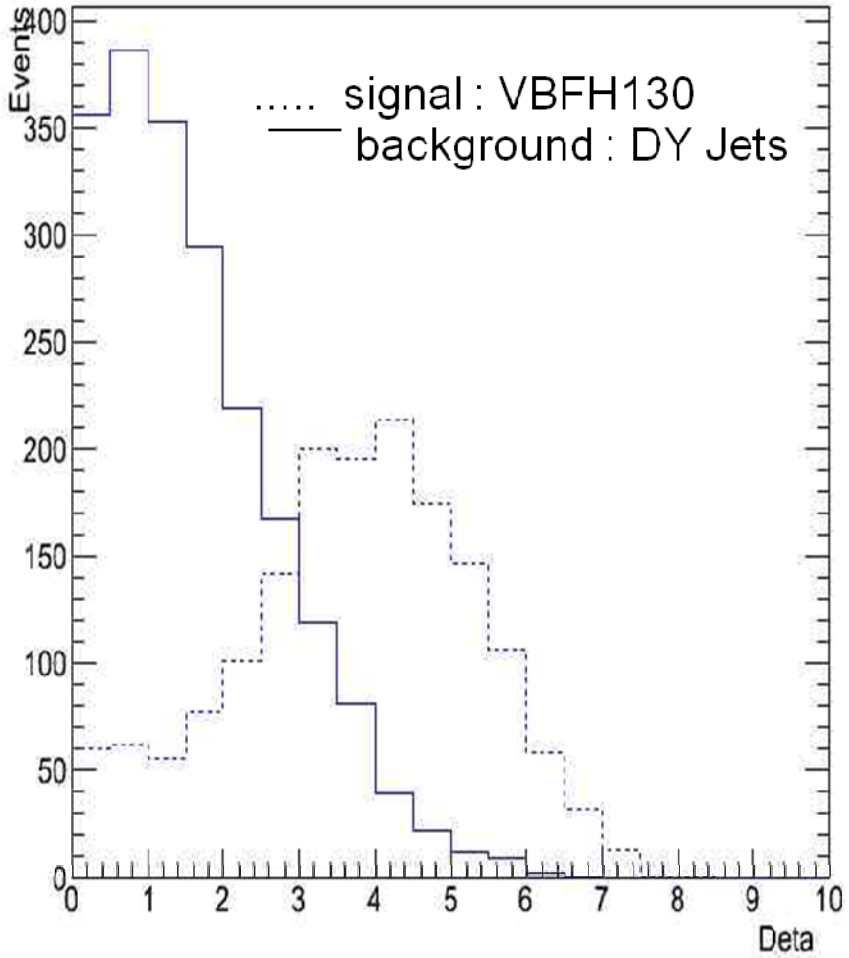
Put a cut on Anti-isolated muon from 0.3 – 0.5

Ratio Same-Sign to Opposite-Sign

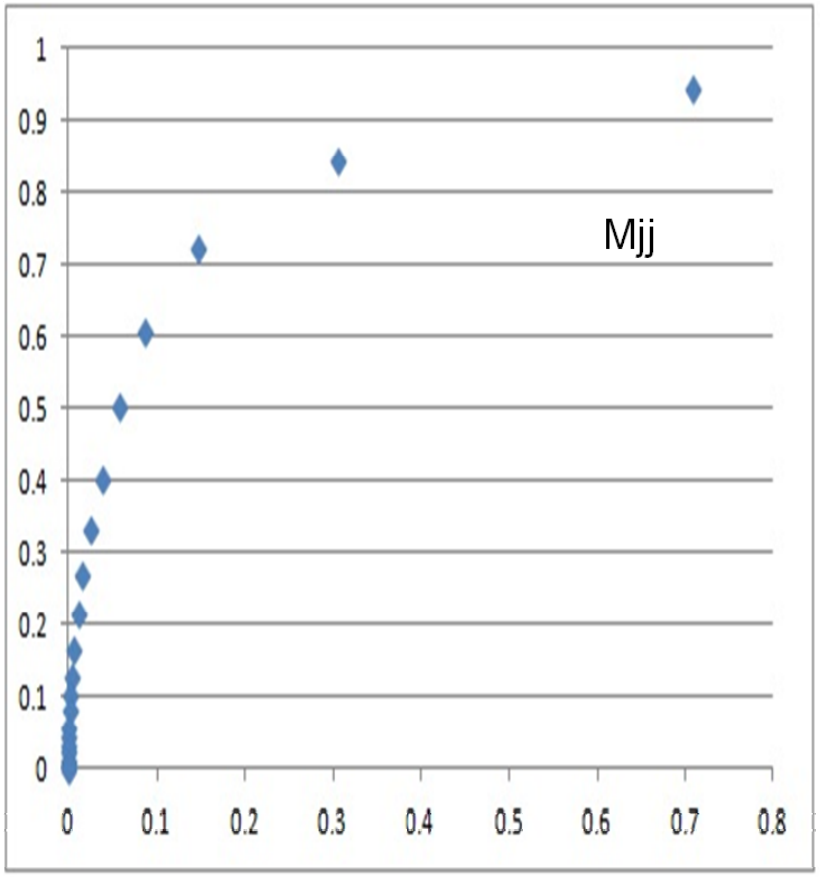


Analysis Optimization

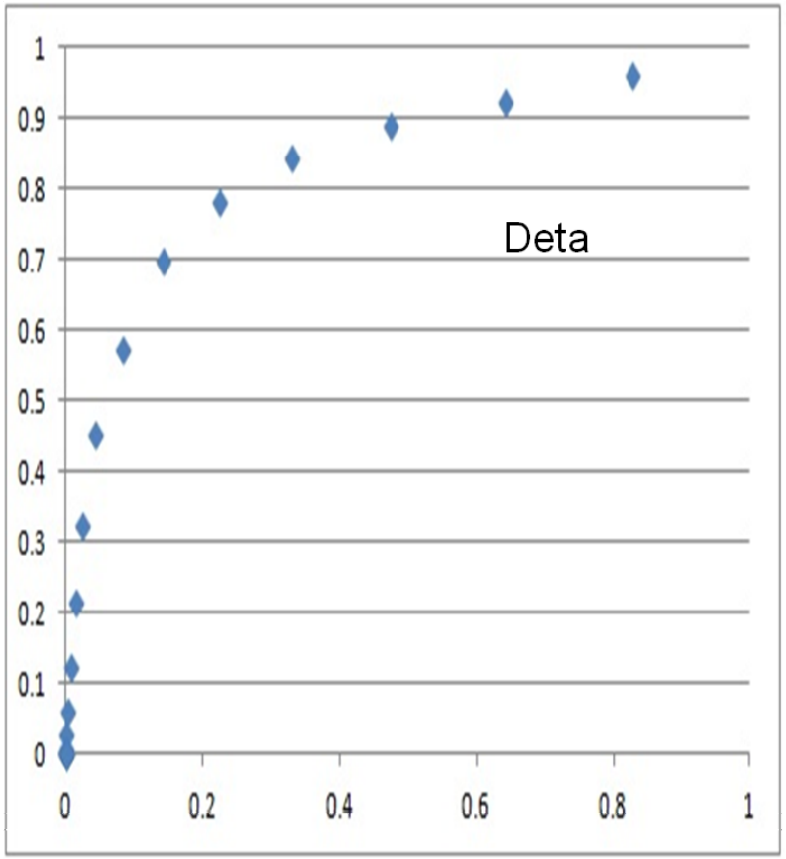




Analysis Optimization
(Rate of Change)

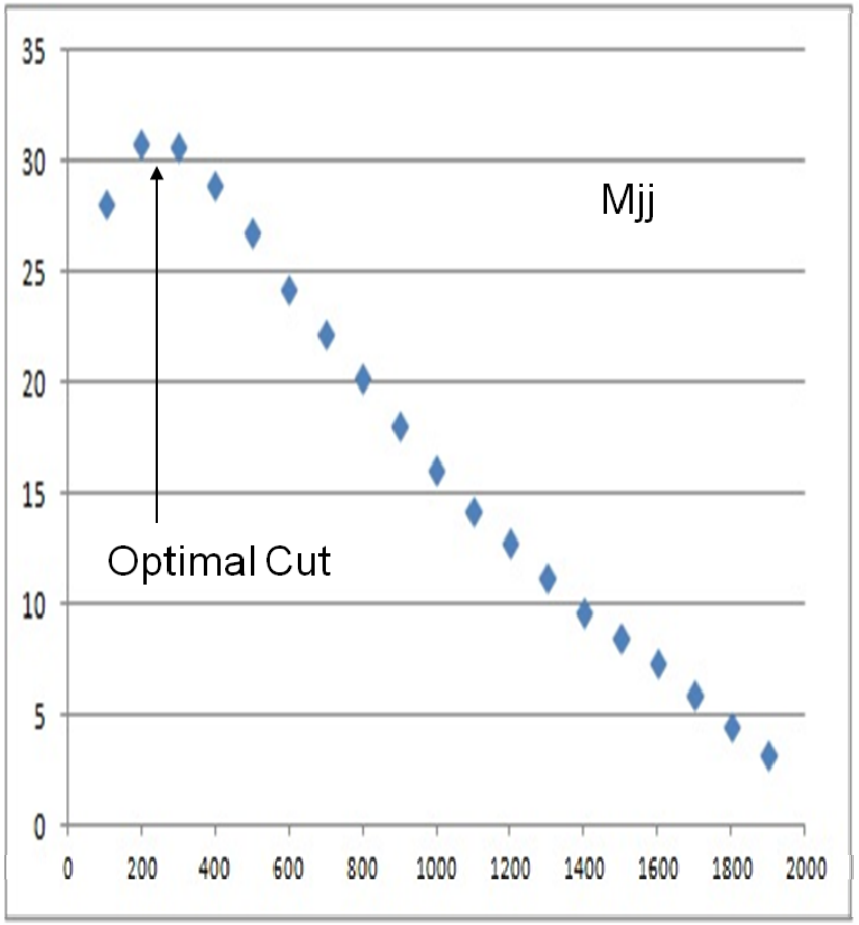


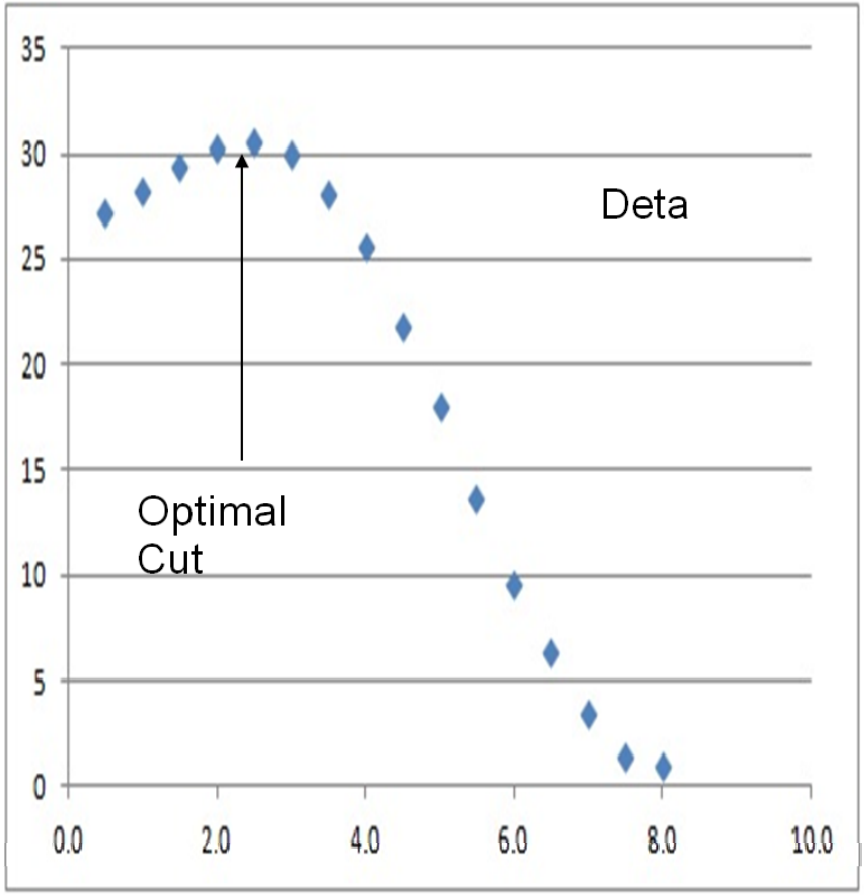
x axis : Signal (VBFH130) Eff.
y axis : Background (DY Jets) Eff.



x axis : Signal (VBFH130) Eff.
y axis : Background (DY Jets) Eff.

Analysis Optimization
(Significance)





Signal (VBHF130) over the square root of signal (VBHF130) + background (DY Jets) as a function of the cut.

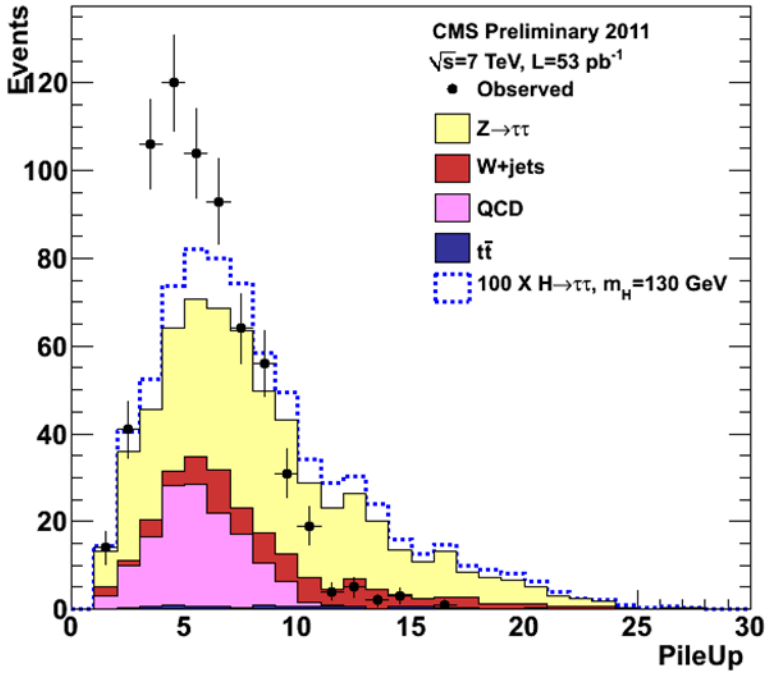
Systematics

All weighting to fit data

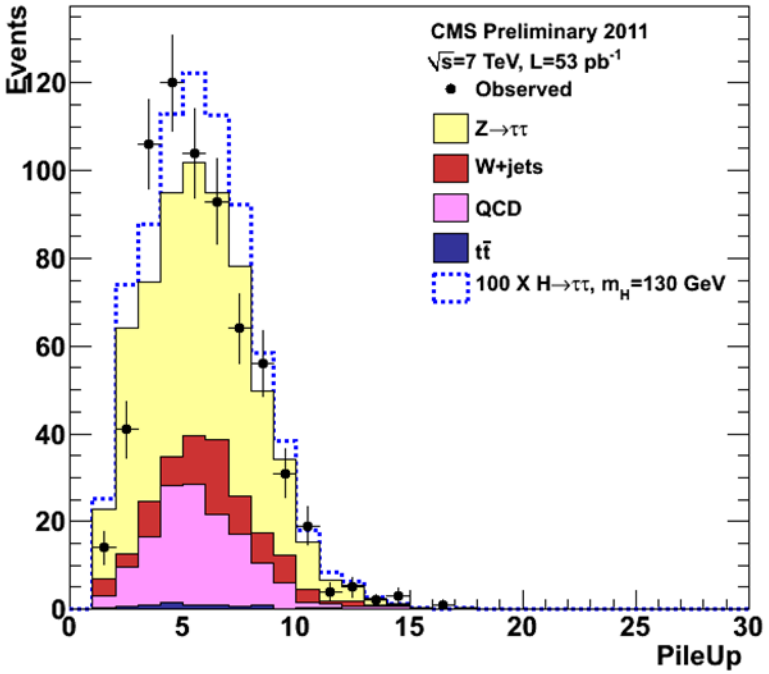
- puWeight
- HLTweightMu
- HLTweightTau
- SFMu
- SFTau
- sampleWeight

Pile up reweighting

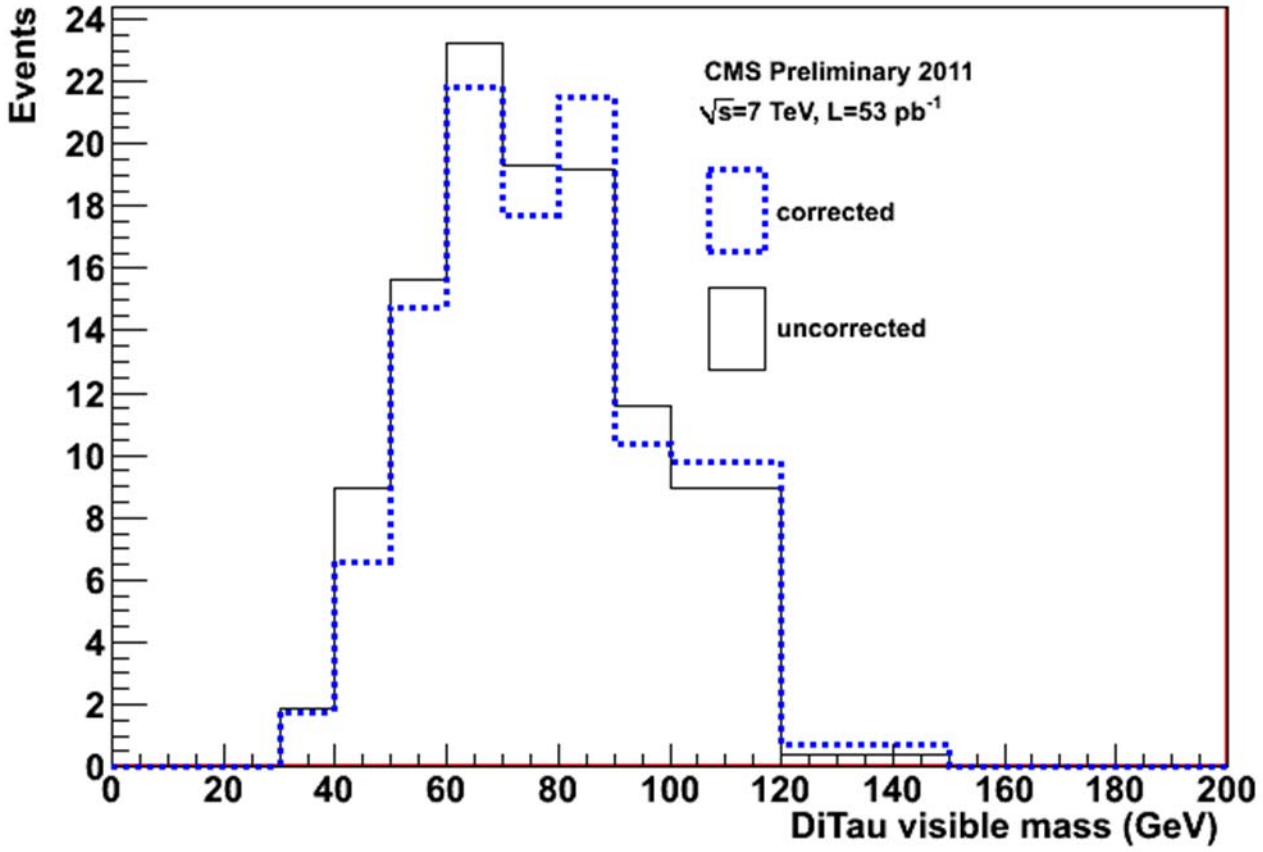
Before



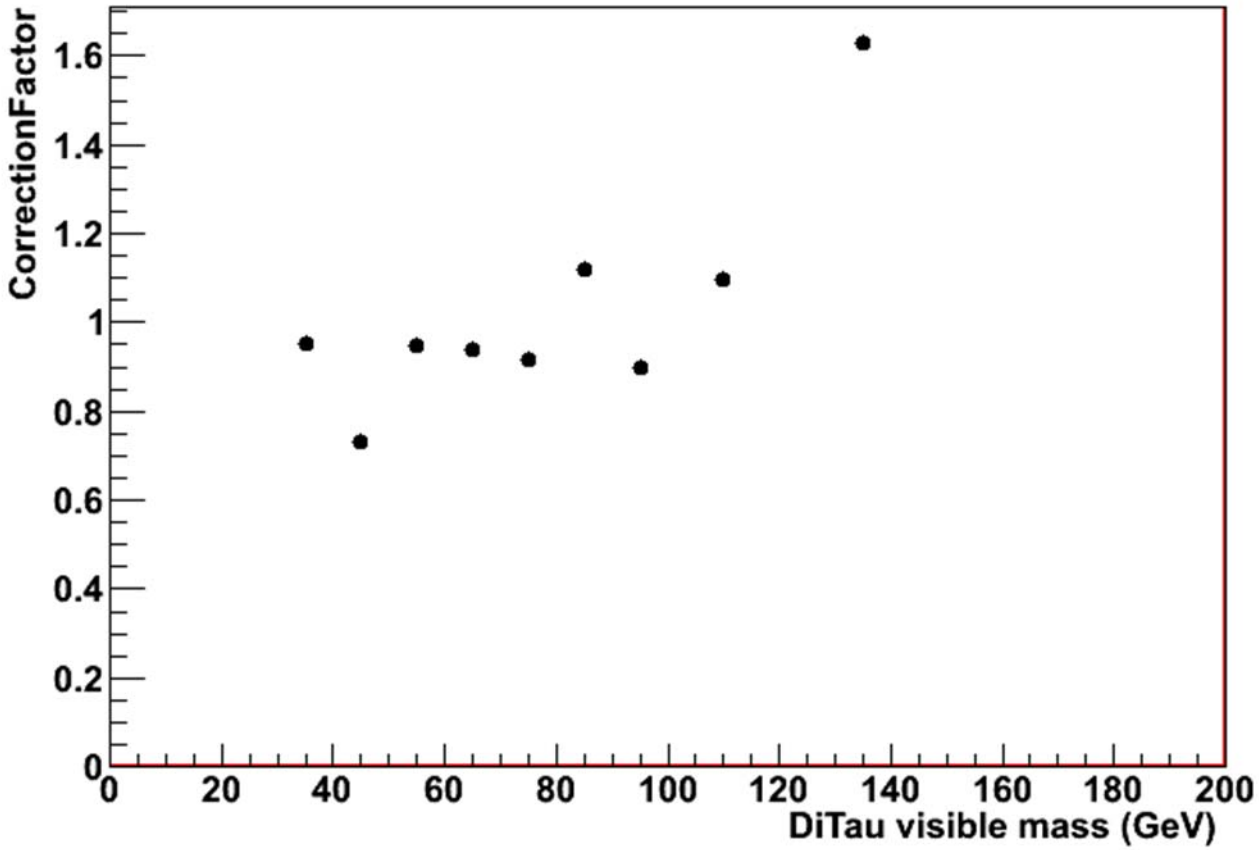
After



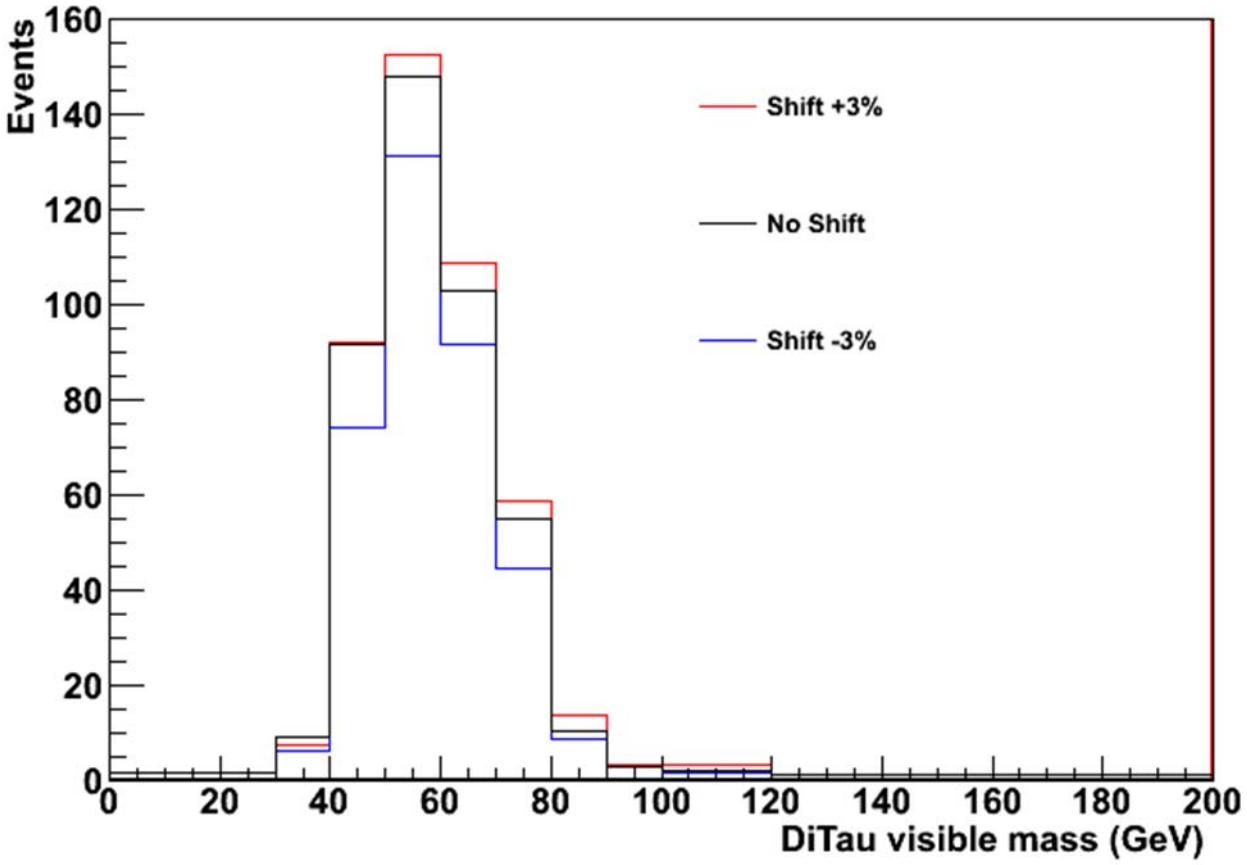
Corrected and before corrected by inclusive selection (Signal)



Correction of inclusive selection



Shifting of Tau Momentum measurement (DYJets)



Conclusion

Thank You

Background

- QCD: most high-p_T single tracks have some other charged/neutral particles nearby
  - isolation is a very powerful cut
  - have to be careful in "noisy" environments
    - (like ttbar events)
- QCD: charge of single particle is essentially random
  - requiring tau candidates of opposite sign helps with:
    - picking up signal in resonance searches
      - require opposite sign particles
    - measuring background
      - use same-sign pairs as background distribution