Trilepton Analysis: The $WH \rightarrow WWW \rightarrow l\nu l\nu l\nu$ Signal

Signal Comparison Between my ntuple and Diboson_v15

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Summary

Accepted Lepton Categories

The $H \rightarrow WW$ group's Diboson_v15 code accepts the following lepton categories:

- Electrons: TCE, LCE, PEM and PHX (only 2nd and 3rd leptons are allowed to be LCE)
- Muons: CMUP, CMP, CMU, CMX, BMU, CMIOCES, CMIOPES
- All relevant cuts are summarized in the "backup" slides below.

Lepton p_T cuts used: Lead 20 GeV, 2nd 10 GeV, 3rd 10 GeV (unless LCE, see below)

Summary

Cuts	Number (out of 100,000)	%(from previous step)
Pass $HW \rightarrow WWW \rightarrow l\nu l\nu l\nu$ filter	2358	2.36
P_T , η cuts at generator-level	1902	80.6
Lead, 2nd, 3rd Reconstructed leptons found	1539	80.9
Same P_T , η cuts at reconstruction-level	1497	97.3
Pass Matching Criterion	1201	80.2
Pass Quality/Isolation Cuts	481	42.1
Diboson_v15 Result	529	
Diboson_v15 Result (using trilepton filter)	484	

Table: Result of running 100,000 events of *WH* (160 GeV) Higgs stntuple fhgs6f through both my ntuple and Diboson_v15.

Effect of Trilepton filter in Diboson_v15

Major difference b/w my ntuple and Diboson ntuple: my trilepton filter. So using the filter in the Diboson ntuple illustrates that Diboson_v15 is well suited to identify trilepton events.

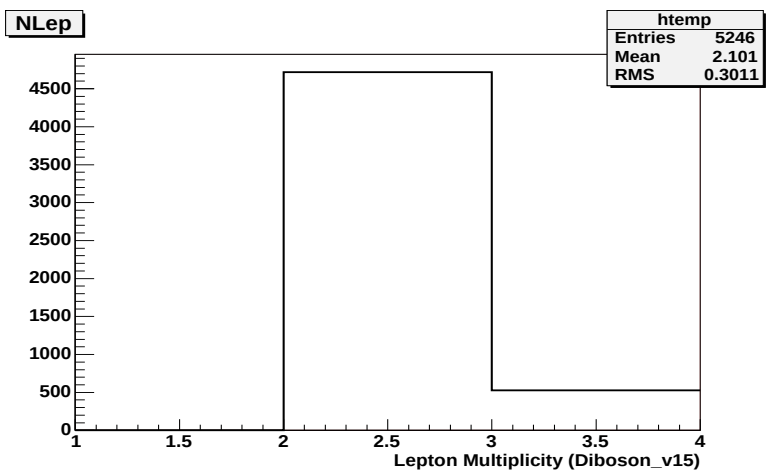

Figure: Lepton multiplicity from Diboson ntuple

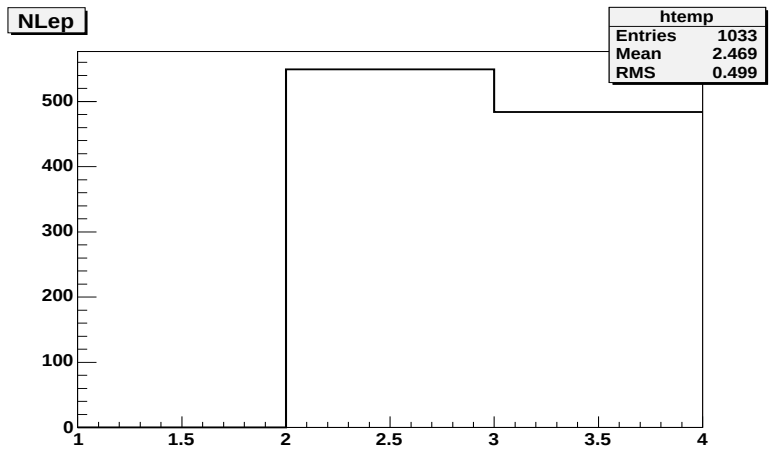

Figure: Lepton multiplicity from Diboson ntuple using the trilepton filter.

Lead Lepton p_T

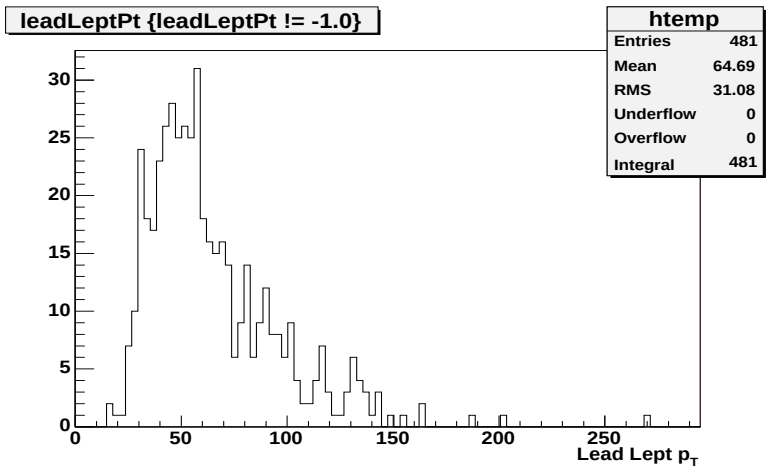

Figure: Lead lepton p_T from my ntuple

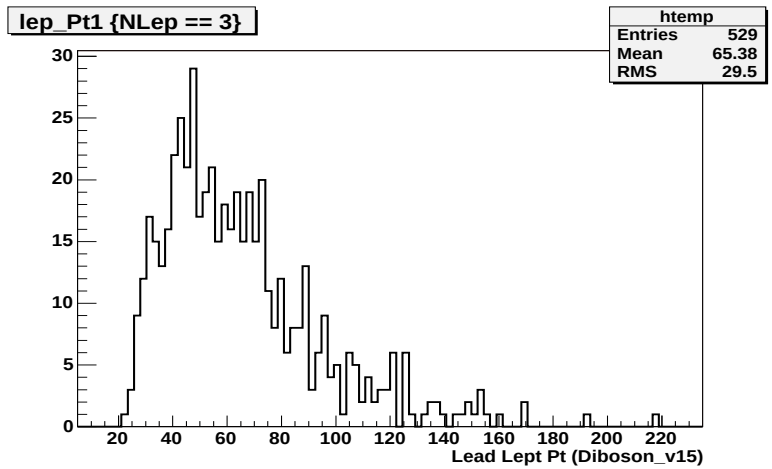

Figure: Lead lepton p_T from Diboson ntuple

2nd Lepton p_T

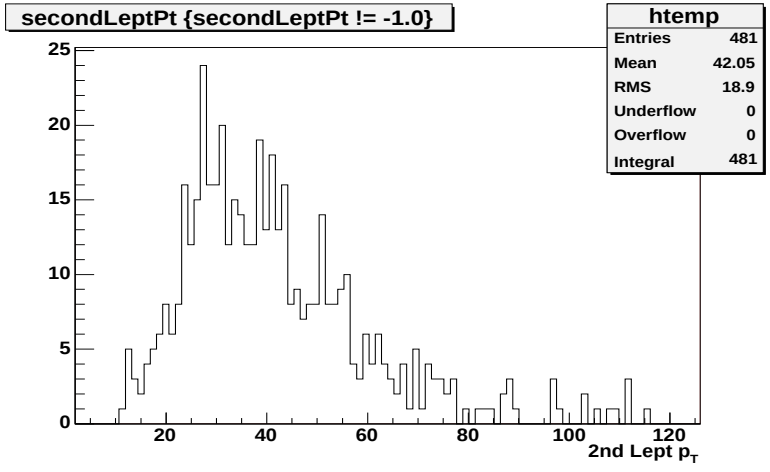

Figure: 2nd lepton p_T from my ntuple

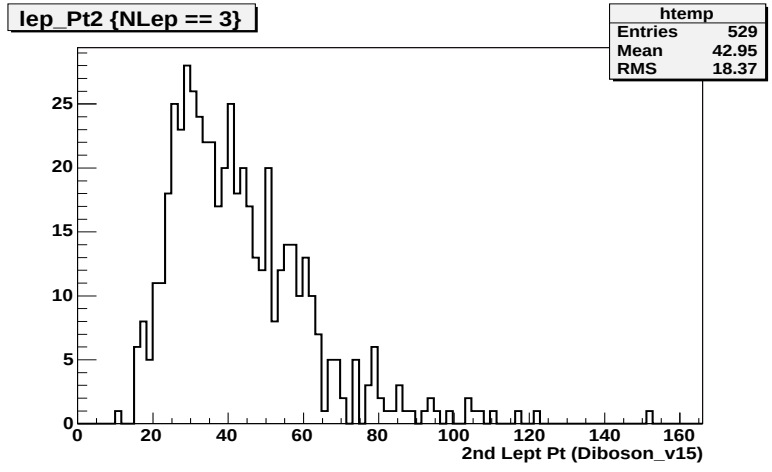

Figure: 2nd lepton p_T from my ntuple

3rd Lepton p_T

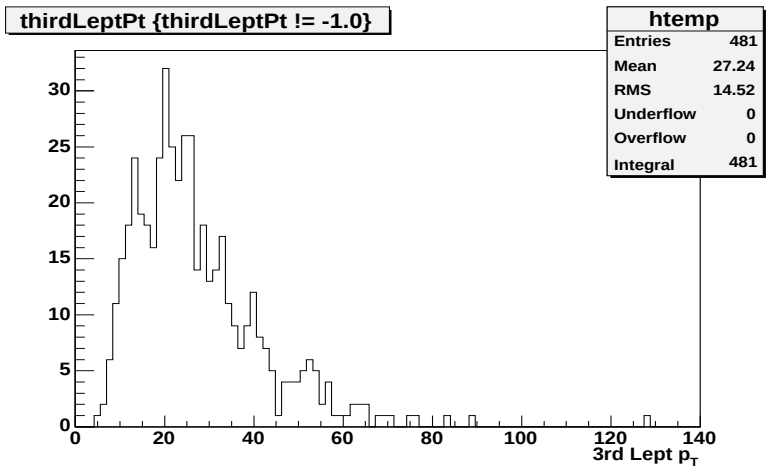

Figure: 3rd lepton p_T from my ntuple

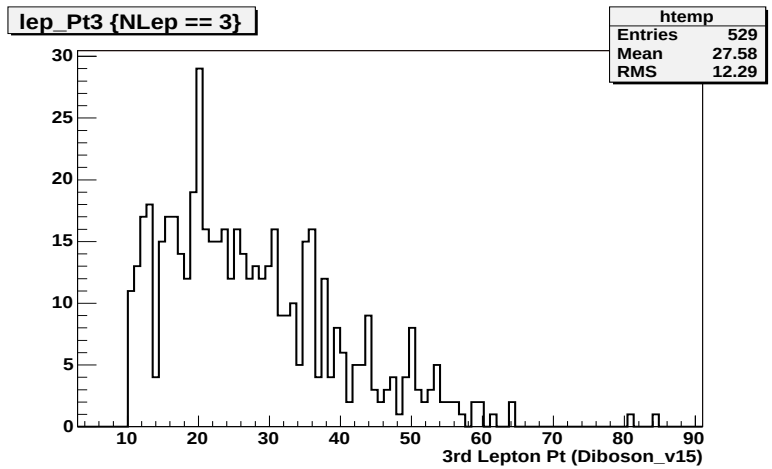

Figure: 3rd lepton p_T from my ntuple

MET

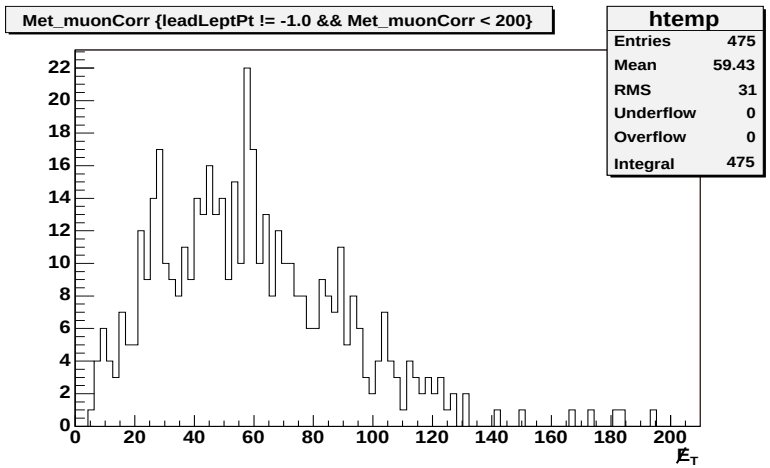

Figure: MET from my ntuple

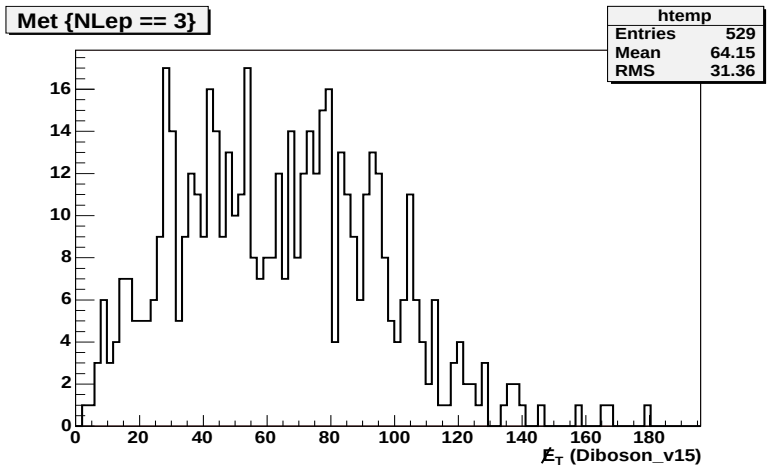

Figure: MET from Diboson ntuple

Lepton Category Cuts

Tight Central Electrons (TCE)

- isCentral
- $\frac{HadE}{EmE} < 0.055 + 0.00045 \cdot E$
- Lshr < 0.2
- $Cal.Iso. = \frac{Iso - LeakCorr \cdot E_T}{E_T} < 0.1$ (0.4 cone)
- $\frac{E}{P} < 2.5 + 0.015 \cdot E_T$
- $|Z0| < 60.0$
- $-3.0 < QDelX < 1.5$
- $|DelZ| < 3.0$
- NCotAxSeg ≥ 3
- NCotStSeg ≥ 2

Loose Central Electron (LCE)

- isCentral
- $\frac{HadE}{EmE} < 0.055 + 0.00045 \cdot E$
- $Cal.Iso. = \frac{Iso - LeakCorr \cdot E_T}{E_T} < 0.1$ (0.4 cone)
- $|Z0| < 60.0$
- NCotAxSeg ≥ 3
- NCotStSeg ≥ 2
- $((E_T < 20 \;\&\&\; TrackP_T > 5.0) || (TrackP_T > 10.0))$

Plug EM-Calorimeter Electron (PEM)

- isPlug
- $\frac{HadE}{EmE} < 0.05$
- $|PesEta| > 1.2$ and $|PesEta| < 2.0$
- $Cal.Iso. = \frac{Iso - LeakCorr \cdot E_T}{E_T} < 0.1$ (0.4 cone)
- PesPemDeltaR < 3.0
- Pes5x9U > 0.65
- Pes5x9V > 0.65
- Pem3x3Tower > 1.0
- PemChi2Three < 10.0

Phoenix Electron (PHX)

- isPlug
- $\frac{HadE}{EmE} < 0.05$
- $|PesEta| > 1.2$ and $|PesEta| < 2.0$
- $Cal.Iso. = \frac{Iso - LeakCorr \cdot E_T}{E_T} < 0.1$ (0.4 cone)
- PesPemDeltaR < 3.0
- Pes5x9U > 0.65
- Pes5x9V > 0.65
- Pem3x3Tower > 1.0
- PemChi2Three < 10.0
- $|Z0| < 60.0$
- NSvxHits ≥ 3

CMUP, CMU, CMP Muons

- NCotAxSeg ≥ 3
- NCotStSeg ≥ 2
- NSvxHits > 0
- $|Z0| < 60.0$
- Chi2CotDof < 4.0 (RunNumber ≥ 186598)
- Chi2CotDof < 3.0 (otherwise)
- $Cal.Iso. = \frac{Iso}{E_T}$ (0.4 cone)
- $EmE < 2.0 + \mathrm{Max}(0.0, 0.0115 \cdot (p - 100))$
- $HadE < 6.0 + \mathrm{Max}(0.0, 0.028 \cdot (p - 100))$
- $|CmuDelX| < 7.0$ (only CMUP, CMU)
- $|CmpDelX| < \mathrm{Max}(6.0, 150.0/P_T)$ (only CMUP, CMP)

CMX Muons

- NCotAxSeg ≥ 3
- NCotStSeg ≥ 2
- NSvxHits > 0
- $|Z0| < 60.0$
- Chi2CotDof < 4.0 (RunNumber ≥ 186598)
- Chi2CotDof < 3.0 (otherwise)
- $Cal.Iso. = \frac{Iso}{E_T}$ (0.4 cone)
- $EmE < 2.0 + \mathrm{Max}(0.0, 0.0115 \cdot (p - 100))$
- $HadE < 6.0 + \mathrm{Max}(0.0, 0.028 \cdot (p - 100))$
- $CmxDelX < \mathrm{Max}(6.0, 125.0/P_T)$

BMU Muons

- $|Z0| < 60.0$
- $EmE < 2.0 + \mathrm{Max}(0.0, 0.0115 \cdot (p - 100))$
- $HadE < 6.0 + \mathrm{Max}(0.0, 0.028 \cdot (p - 100))$
- $Cal.Iso. = \frac{Iso}{E_T}$ (0.4 cone)
- $Cal.E > 0.1$
- NHitsBmuStub > 2
- nSvxHits ≥ 3

CMIOCES Muons

- NCotAxSeg ≥ 3
- NCotStSeg ≥ 3
- nSvxHits ≥ 0
- $|Z0| < 60.0$
- $EmE < 2.0 + \mathrm{Max}(0.0, 0.0115 \cdot (p - 100))$
- $HadE < 6.0 + \mathrm{Max}(0.0, 0.028 \cdot (p - 100))$
- $Cal.Iso. = \frac{Iso}{E_T}$ (0.4 cone)
- $Cal.E > 0.1$
- Chi2CotDof < 3.0

CMIOPES Muons

- nSvxHits ≥ 0
- $|Z0| < 60.0$
- $EmE < 2.0 + \mathrm{Max}(0.0, 0.0115 \cdot (p - 100))$
- $HadE < 6.0 + \mathrm{Max}(0.0, 0.028 \cdot (p - 100))$
- $Cal.Iso. = \frac{Iso}{E_T}$ (0.4 cone)
- $Cal.E > 0.1$
- CotHitFraction > 0.6