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

Bug Fix, Neutrinos and MET, Close Leptons

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Summary

Bug, Old Summary Table

- I found a logical flaw in my selection that excluded a portion of events where the 2nd or 3rd lepton failed either the P_T or η cuts, but a 4th lepton could then fill in and pass the event.
- Double counted electrons are now removed at the first level looking at reconstructed leptons. (requested last week)
- P_T and η plots of failed events below. (requested last week)

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	1725	90.7
Same P_T , η cuts at reconstruction-level	1597	92.6
Pass Matching Criterion	1041	65.2
Pass Quality/Isolation Cuts	848	81.5

Table: Old table

Big Fixed, New Summary Table

Cuts	Number (out of 100,000)	%(from previous step)
Pass $HW \longrightarrow WWW \longrightarrow l\nu l\nu l\nu$ 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	964	80.3

Table: New table

Six Ways to Fail

To double check that I am now passing all events that should be passing P_T and η cuts, I direct all *failed* events to a separate `TTree` where info is saved with NO cuts made. There are 6 ways an event can fail here:

- Fail Lead Lepton $P_T < 16.0$ GeV
- Fail 2nd Lepton $P_T < 8.0$ GeV
- Fail 3rd Lepton $P_T < 2.0$ GeV
- Fail Lead Lepton η cuts
- Fail 2nd Lepton η cuts
- Fail 3rd Lepton η cuts

Plot each of these 6 values, requiring the other five to pass their cuts:

Fail Lead Lept P_T

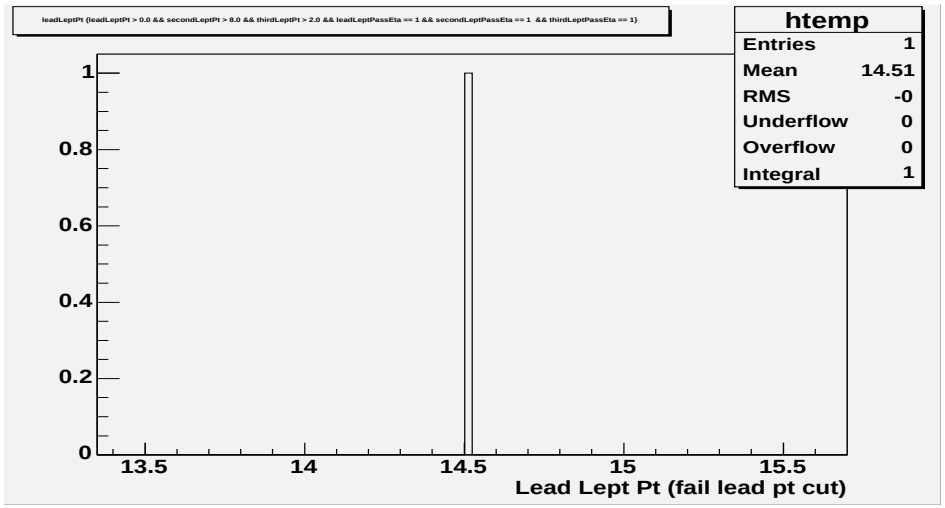

Figure: P_T of Leading Leptons that passed the other five cuts.

Fail 2nd Lept P_T

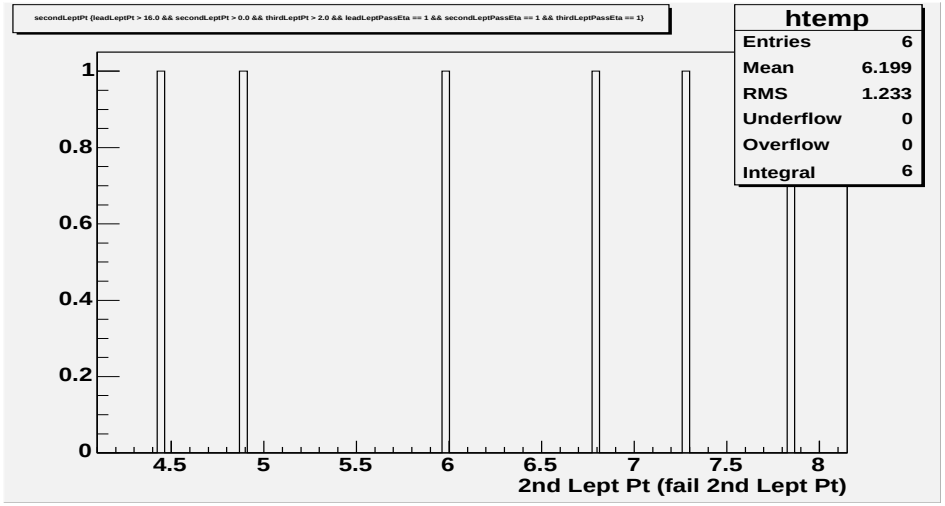

Figure: P_T of Second Leptons that passed the other five cuts.

Fail 3rd Lept P_T

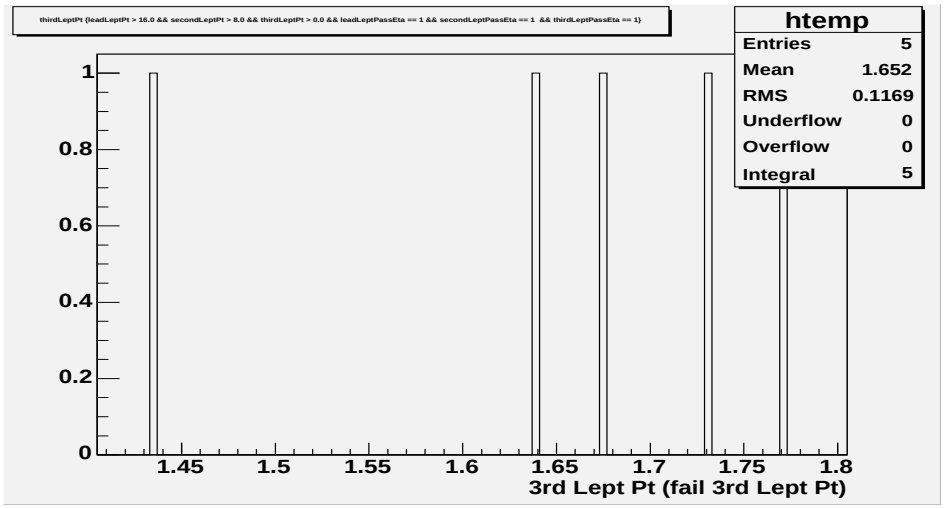

Figure: P_T of Third Leptons that passed the other five cuts.

Fail Lead Lept η

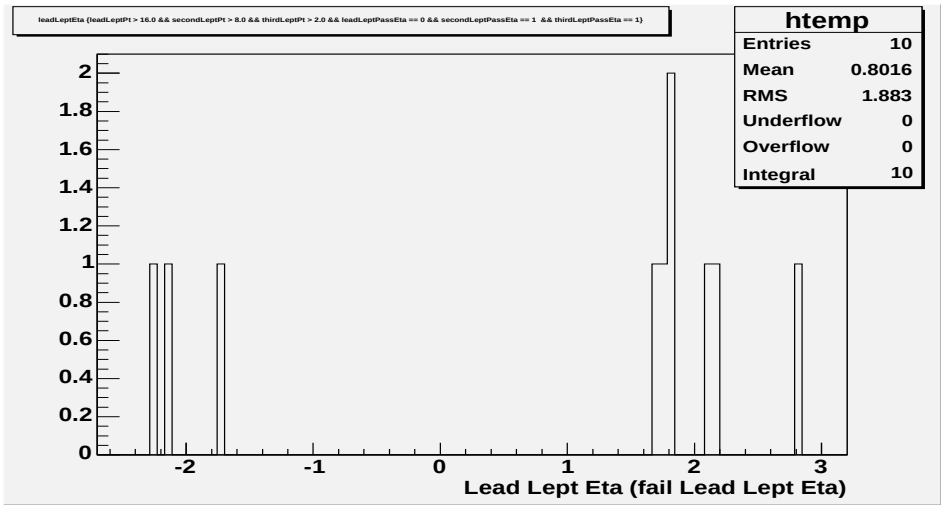

Figure: η of Leading Leptons that passed the other five cuts.

Fail 2nd Lept η

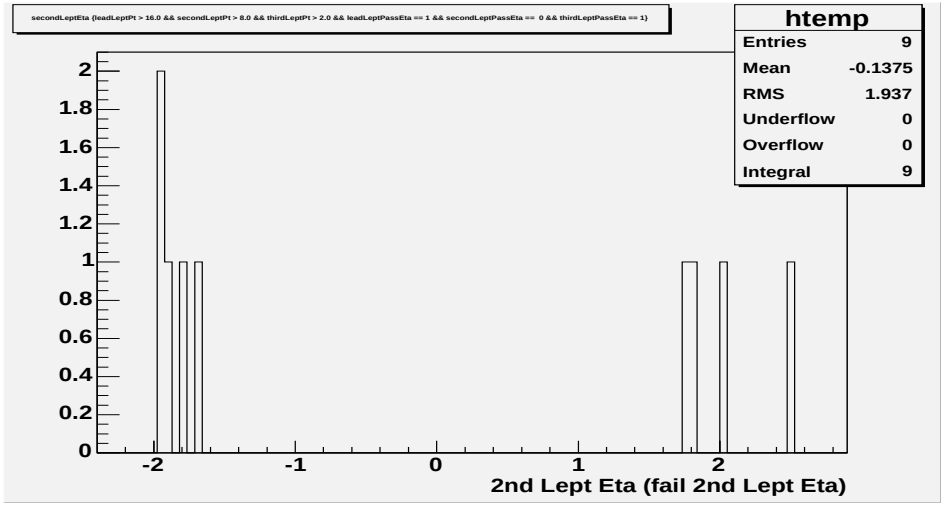

Figure: η of Second Leptons that passed the other five cuts.

Fail 3rd Lept η

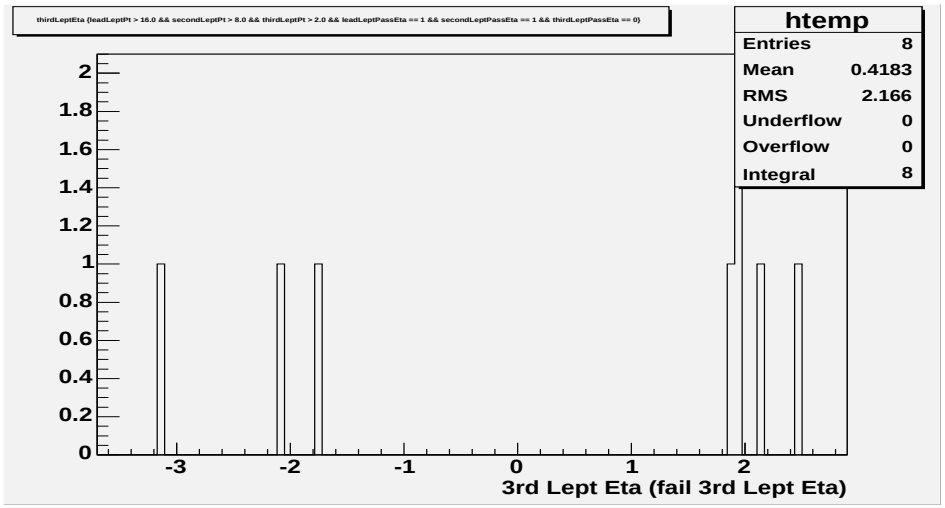

Figure: η of Third Leptons that passed the other five cuts.

Generator-Level Neutrinos

The momentum of each neutrino is vectorially-summed, this is the E_T of the resulting vector.

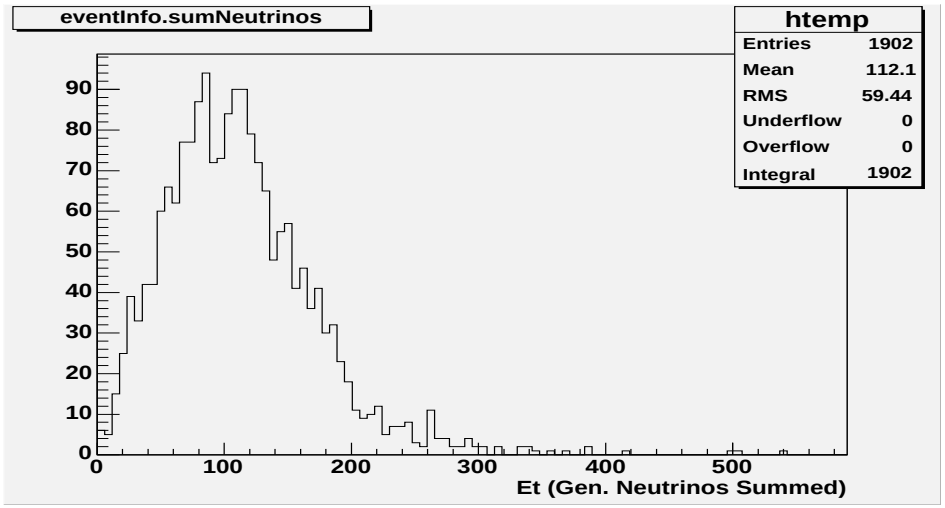

Figure: E_T of vectorially-summed neutrinos for each event.

Reconstructed Missing E_T of Trilepton Events

- Varsha's email, Ray Culberson's words: "met[0] is the vector sum of the tower energies. No requirements are made with respect to whether the towers are in jets, or leptons, etc. the vertex is assumed to be at 0,0,0."
- "met[4] is the same as met[0] but the z of the vertex is set to be the highest sumPt ZVertex and the x and y are set to be the beamline"

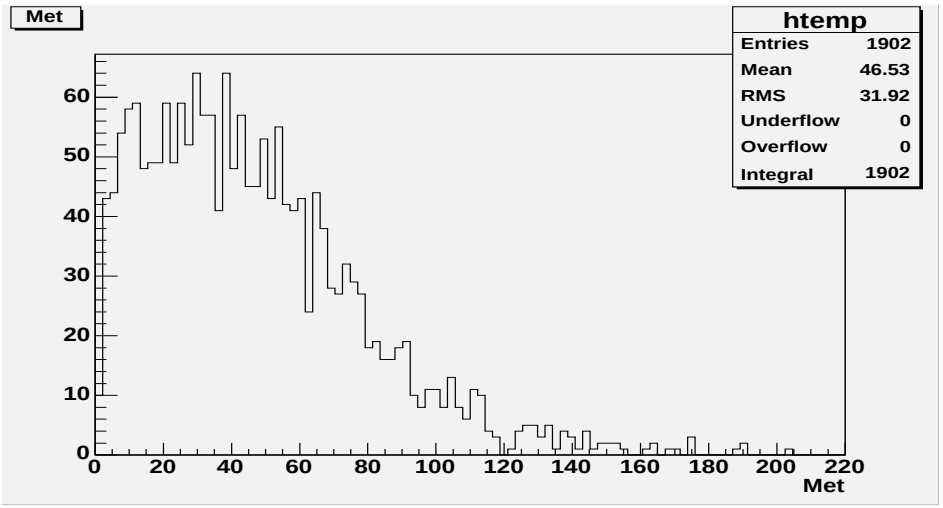

Figure: Missing E_T (TStnMetBlock::Met[4]) of events passing the trilepton filter.

Reconstructed Missing E_T in ntp_14

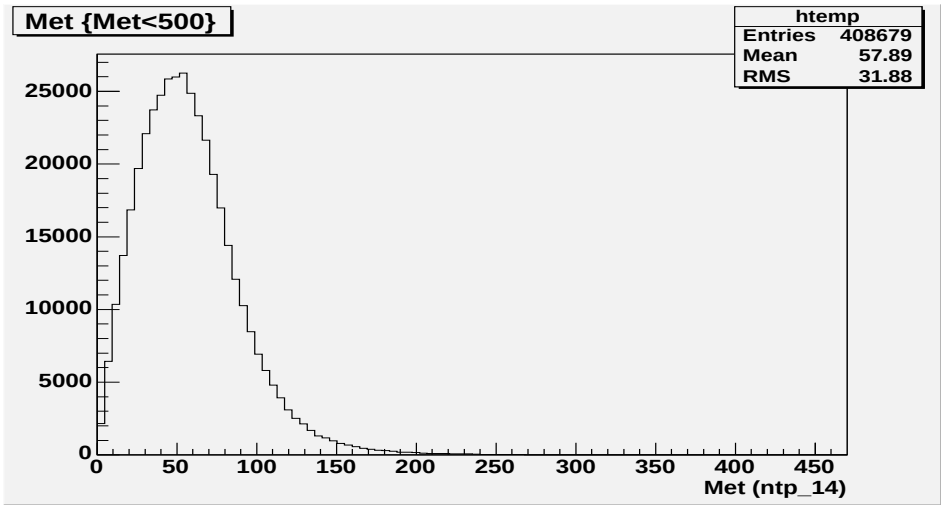

Figure: Missing E_T in ntp_14.

Close Leptons

	Number of Event w/ "Close Leptons"	%
P_T , η cuts at generator-level	267/1902	14.0
P_T , η cuts at reconstruction-level	241/1497	16.1
Pass Matching Criterion	175/1201	14.6
Pass Quality/Isolation Cuts	113/964	11.7

Table: This is the number of events that have at least two of the three leptons within each others' 0.4 cone.

Neutrino Sum E_T

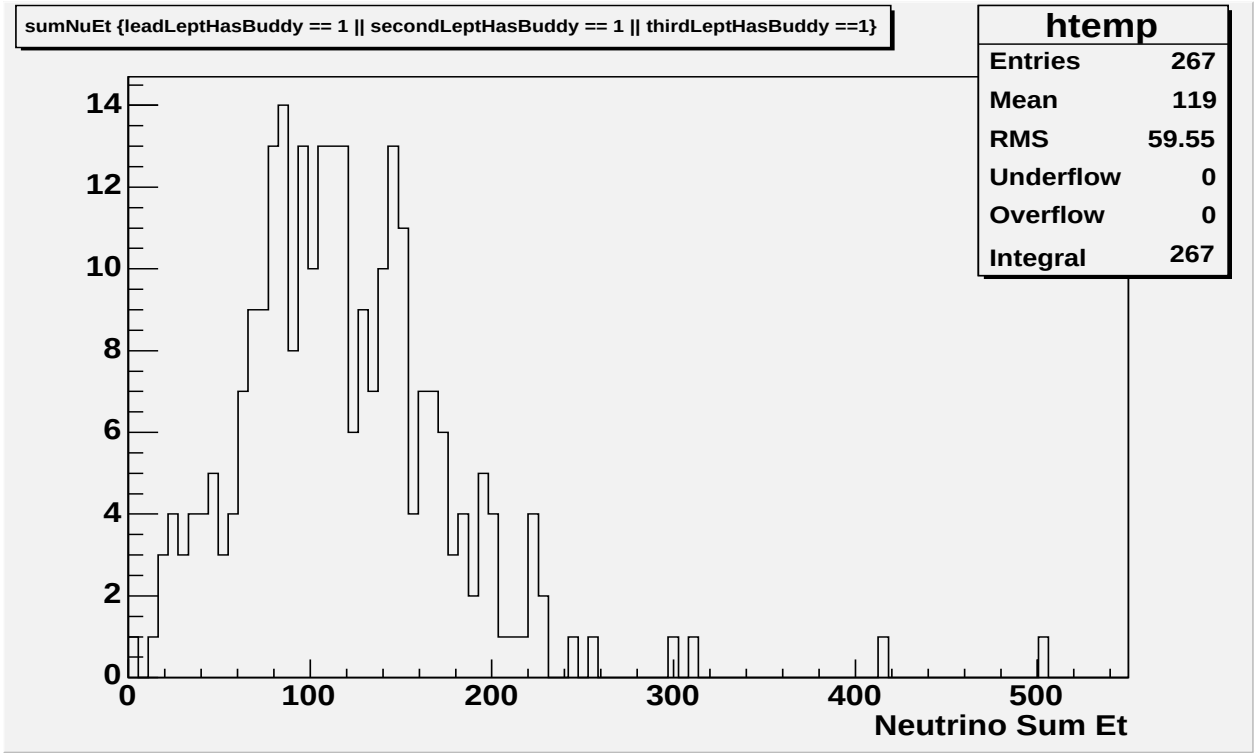

Figure: E_T of summed neutrinos for events with close leptons. There does not seem to be a significant deviation from the full distribution.

Close Leptons: Met

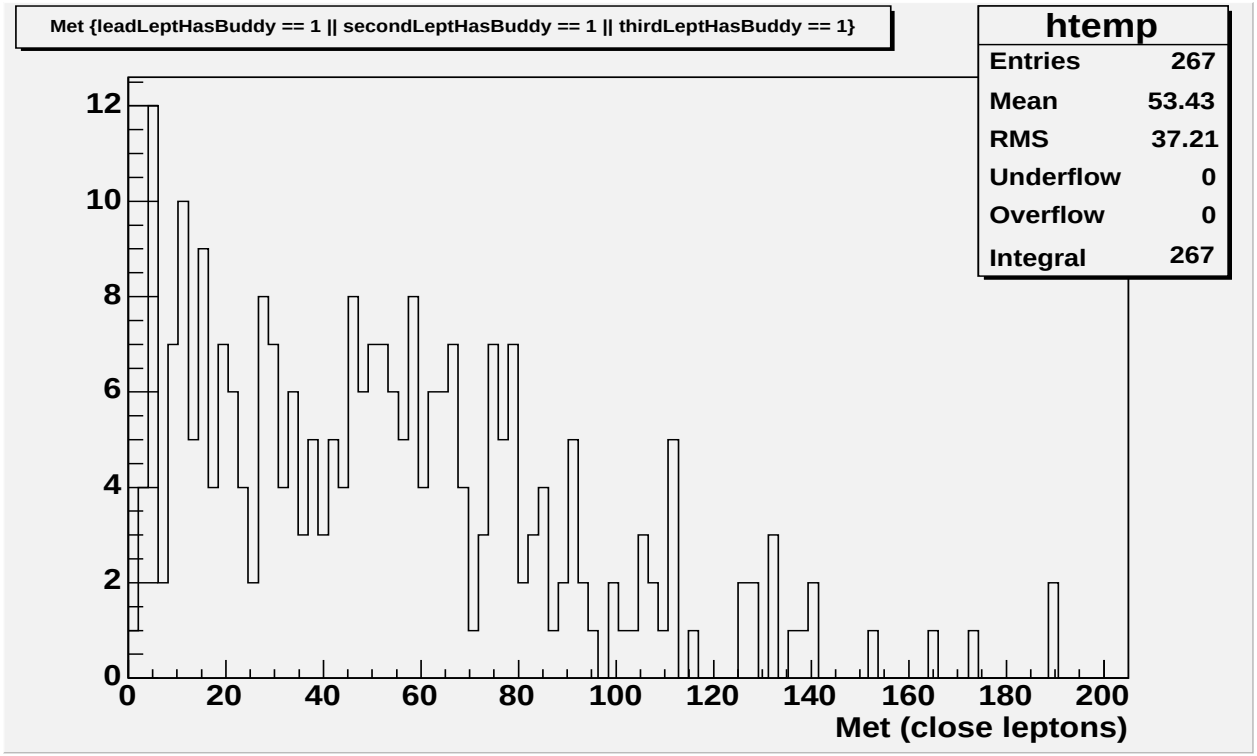

Figure: Reconstructed MET for events with close leptons

Close Leptons: Lead Lepton P_T

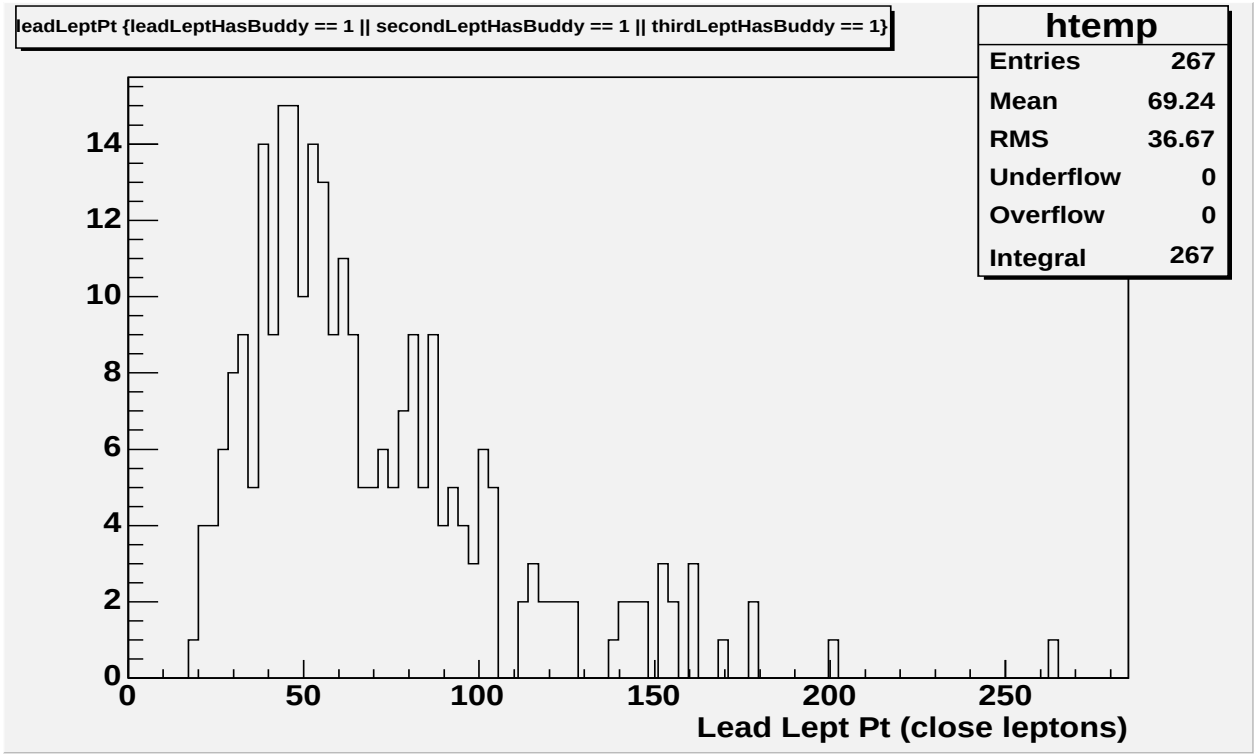

Figure: Leading Lepton P_T for events with close leptons

Close Leptons: 2nd Lepton P_T

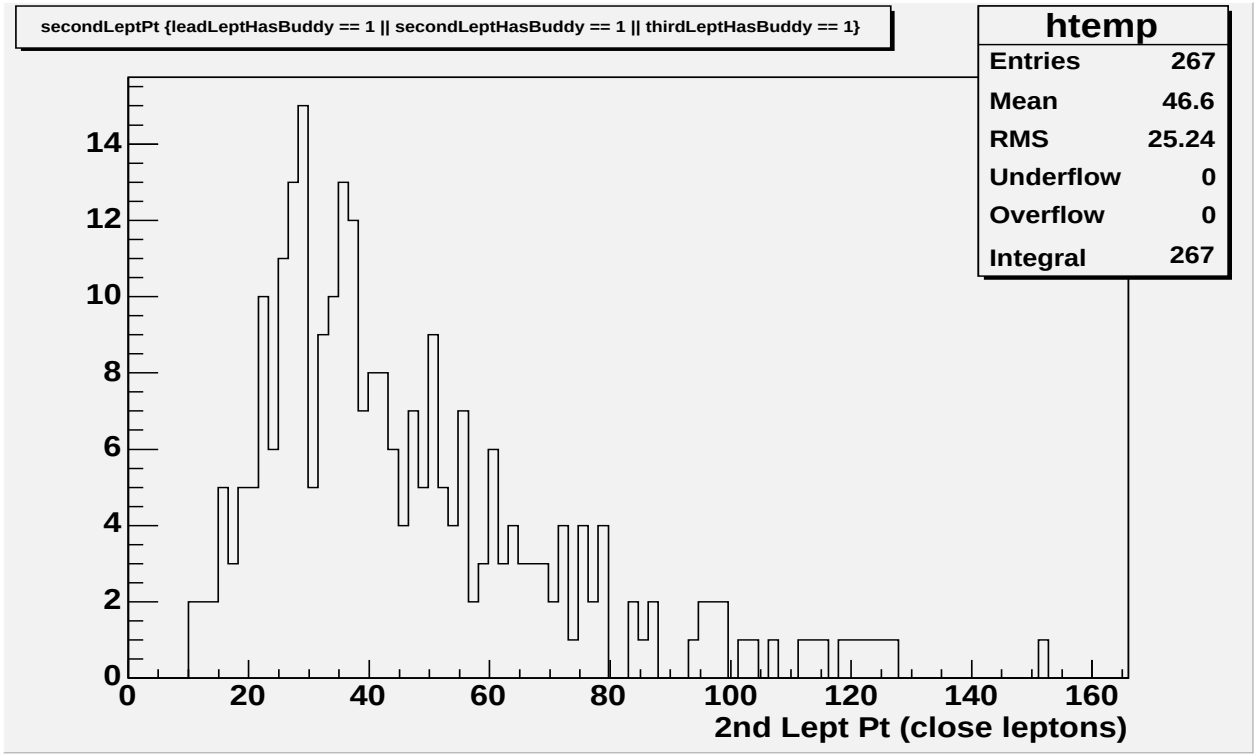

Figure: 2nd Lepton P_T for events with close leptons

Close Leptons: 3rd Lepton P_T

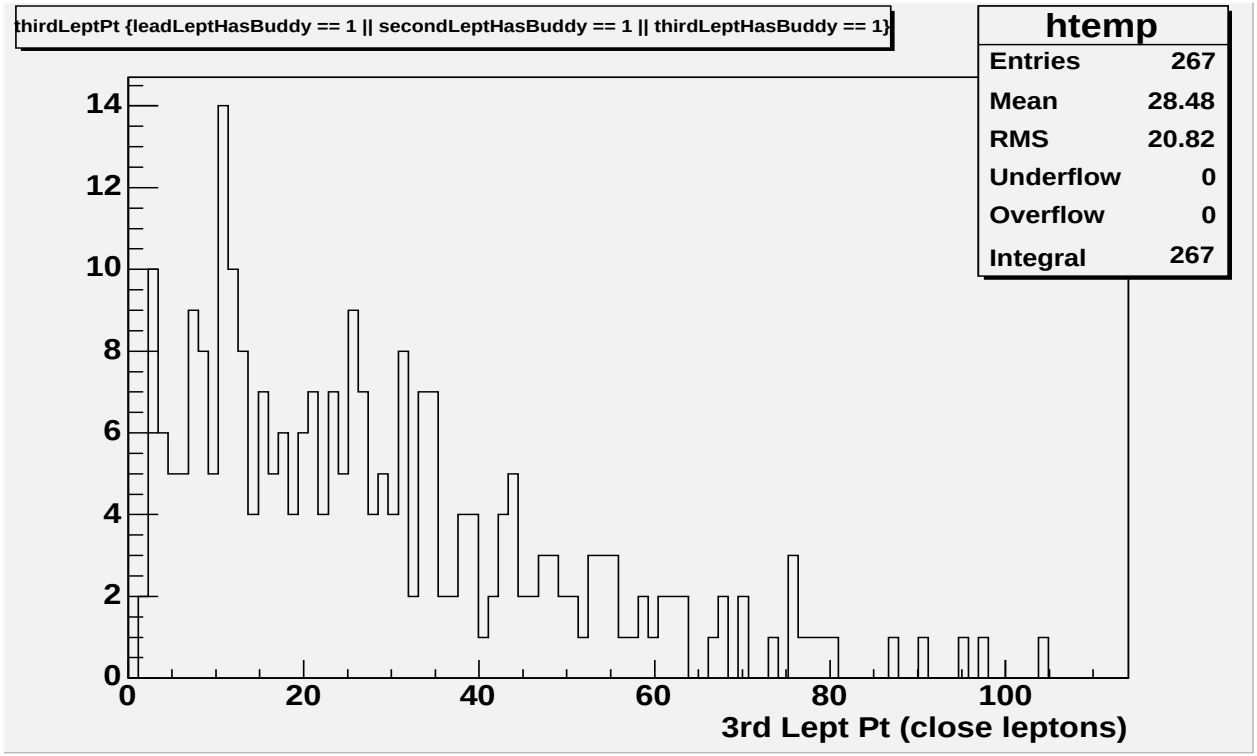

Figure: 3rd Lepton P_T for events with close leptons

Close Leptons: Lead Lepton η

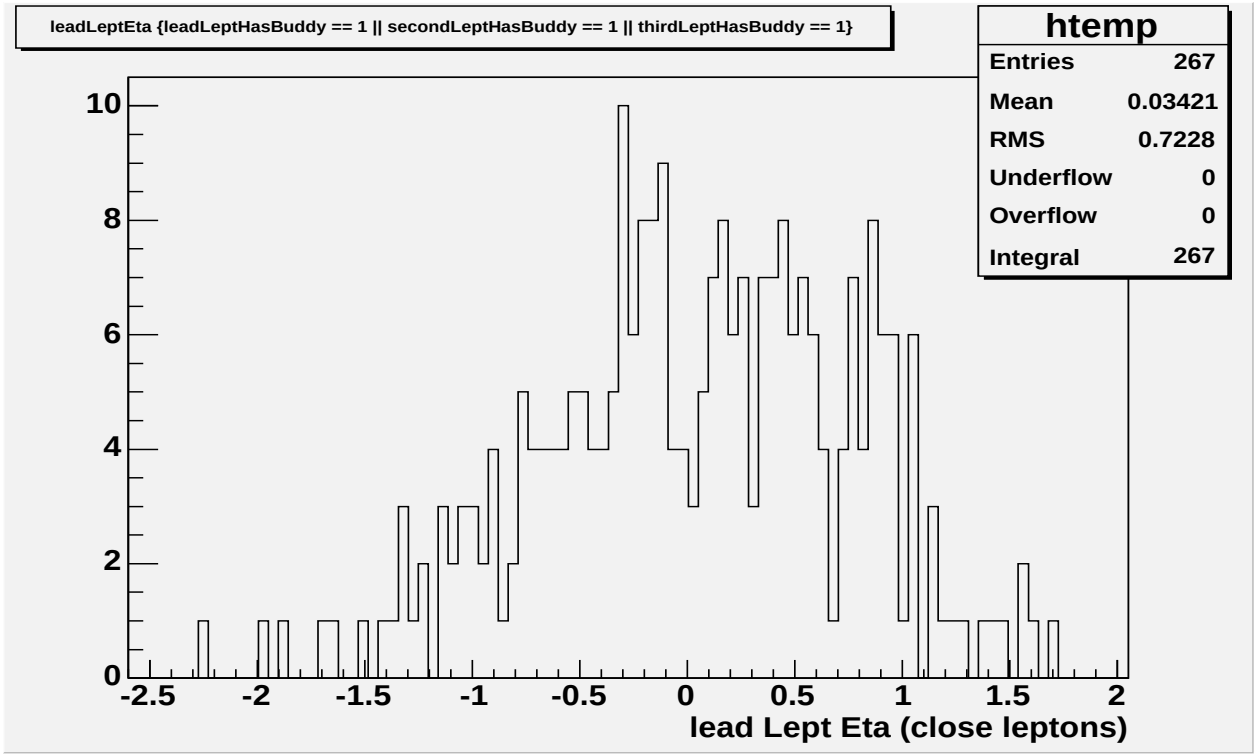

Figure: Leading Lepton η for events with close leptons

Close Leptons: 2nd Lepton η

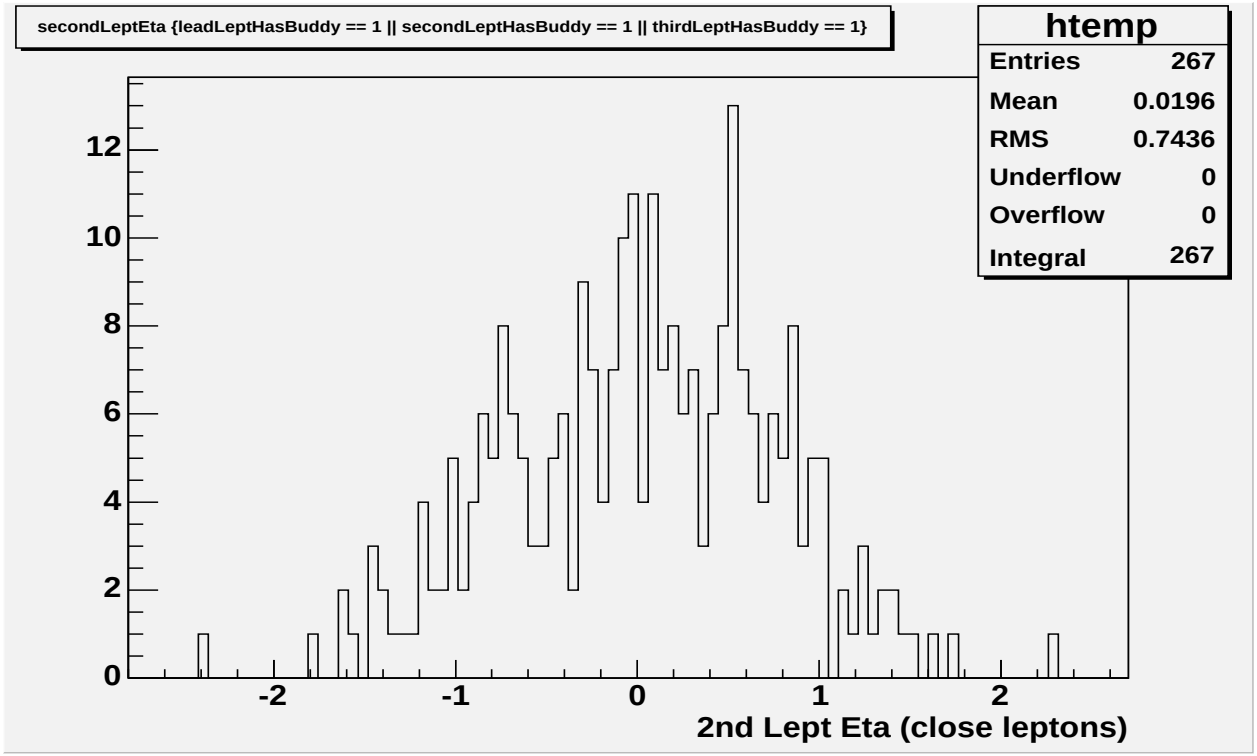

Figure: 2nd Lepton η for events with close leptons

Close Leptons: 3rd Lepton η

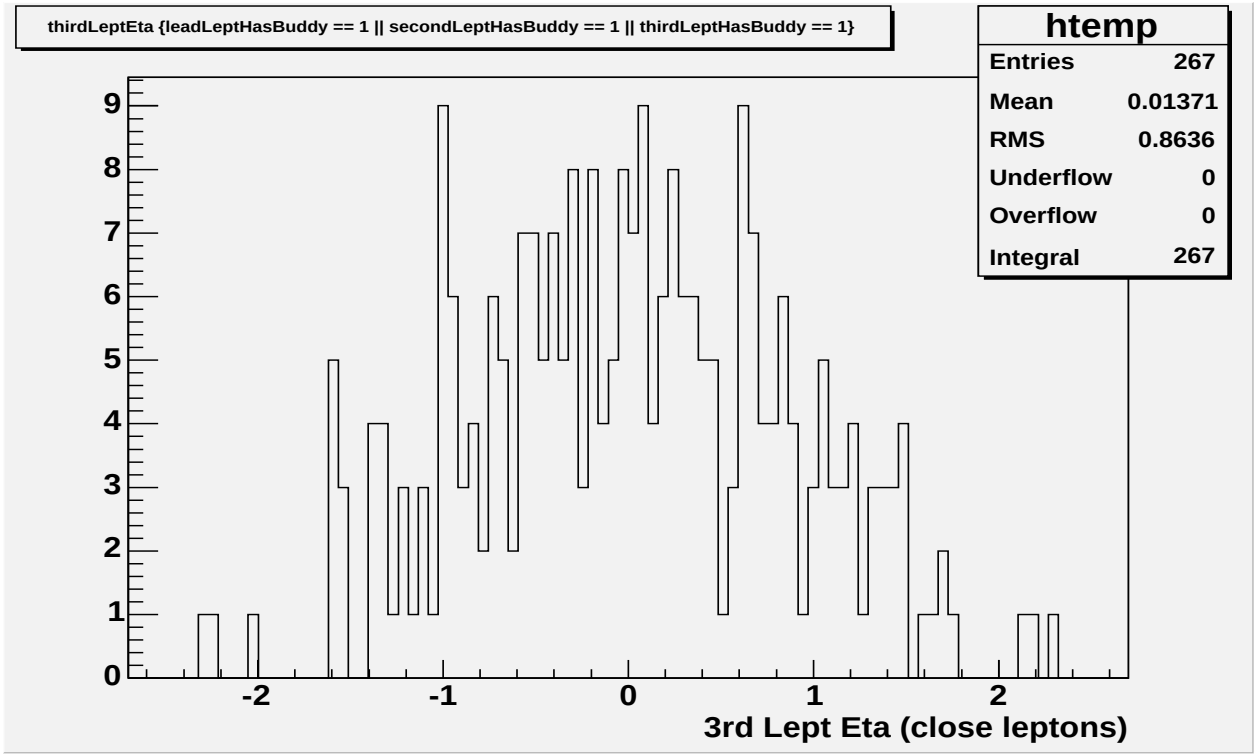

Figure: 3rd Lepton η for events with close leptons