Higgs to WW:
Leptons in $H^0 \to W^+W^-$

Doug Benjamin, Dean Andrew Hidas,
Mark C. Kruse
Duke University/CDF

Peter Bussey, Aidan Robson,
Richard St. Denis, Stan Thompson
University of Glasgow/CDF

16 Nov 2006

	N	Br_1	Br_2	$Br_1 \times Br_2$	$\frac{Br_1 \times Br_2}{Tot}$	Sum
$\mu\mu$	1	1	1	1.00000	0.1111	0.1111
e μ	2	1	1	2.00000	0.2222	0.3333
e e	1	1	1	1.00000	0.1111	0.4444
$\tau_\mu\ \mu$	2	0.17	1	0.34800	0.0387	0.4831
$\tau_e\ \mu$	2	0.17	1	0.34800	0.0387	0.5218
τ_μe	2	0.17	1	0.34800	0.0387	0.5604
τ_e e	2	0.17	1	0.34800	0.0387	0.5991
$\tau_\mu\tau_\mu$	1	0.17	0.17	0.03028	0.0034	0.6025
$\tau_e\tau_\mu$	2	0.17	0.17	0.06055	0.0067	0.6092
$\tau_e\tau_e$	1	0.17	0.17	0.03028	0.0034	0.6126

Trigger Options: Generator Level Study

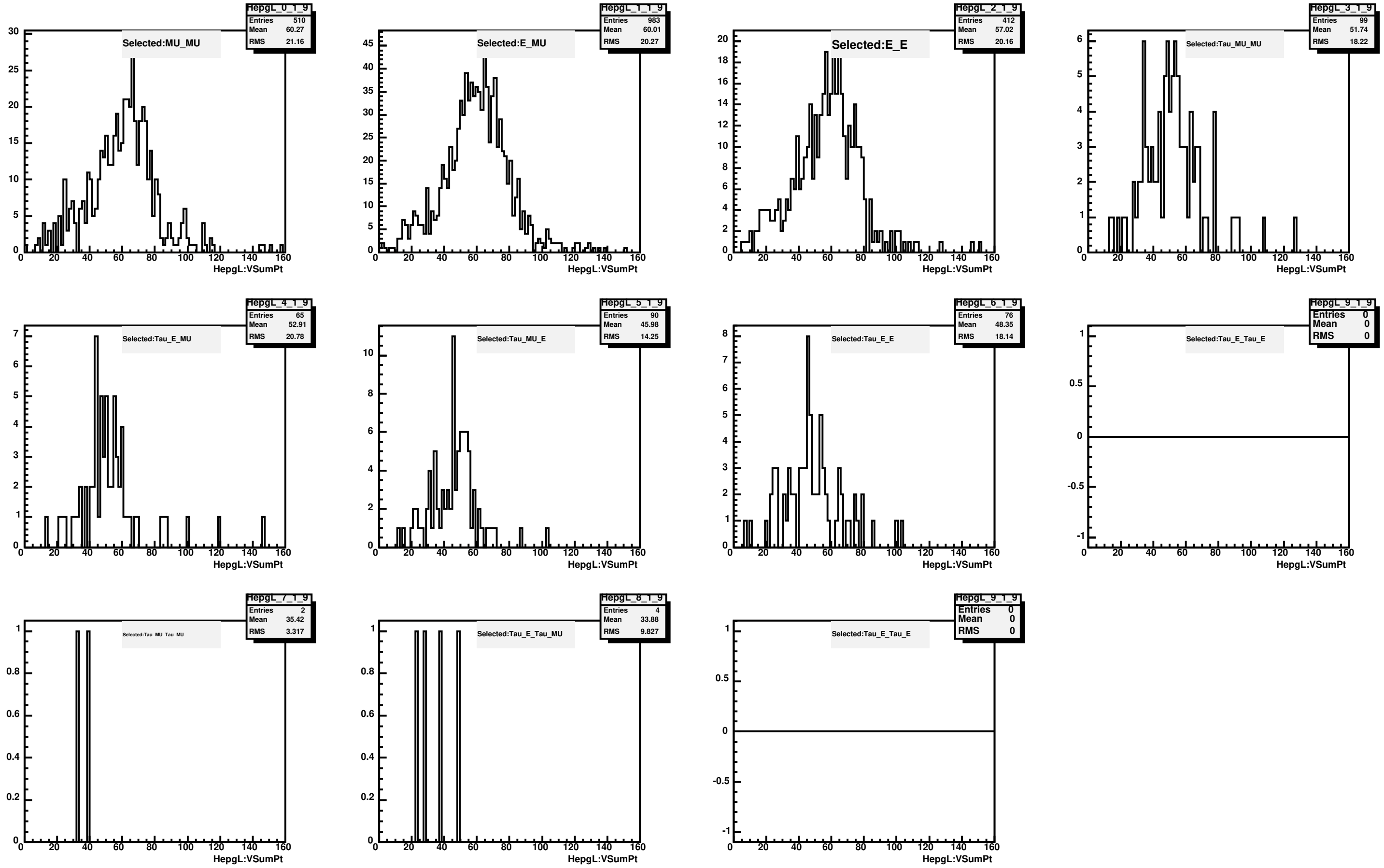
Lepton 1	20	0	10	10	0	0	20
Lepton 2	10	10	10	10	0	0	10
neutrinos	0	20	20	0	30	20	20
$\mu\mu$	0.99	0.94	0.93	0.99	0.86	0.94	0.93
e μ	0.98	0.94	0.92	0.98	0.86	0.94	0.92
e e	0.98	0.94	0.92	0.98	0.86	0.94	0.91
τ_μ μ	0.63	0.90	0.57	0.64	0.80	0.90	0.56
τ_e μ	0.61	0.91	0.57	0.63	0.80	0.91	0.56
τ_μe	0.63	0.90	0.57	0.64	0.79	0.90	0.56
τ_e e	0.60	0.90	0.56	0.62	0.79	0.91	0.55
$\tau_\mu\tau_\mu$	0.30	0.78	0.38	0.43	0.78	0.91	0.31
$\tau_e\tau_\mu$	0.30	0.77	0.37	0.42	0.79	0.89	0.30
$\tau_e\tau_e$	0.31	0.75	0.34	0.39	0.77	0.88	0.28

Leptons

- Look at the leptons categorized by charged stable and decay products of tau
- For decay products with tau, “2” label applies (ie. p_{t2})

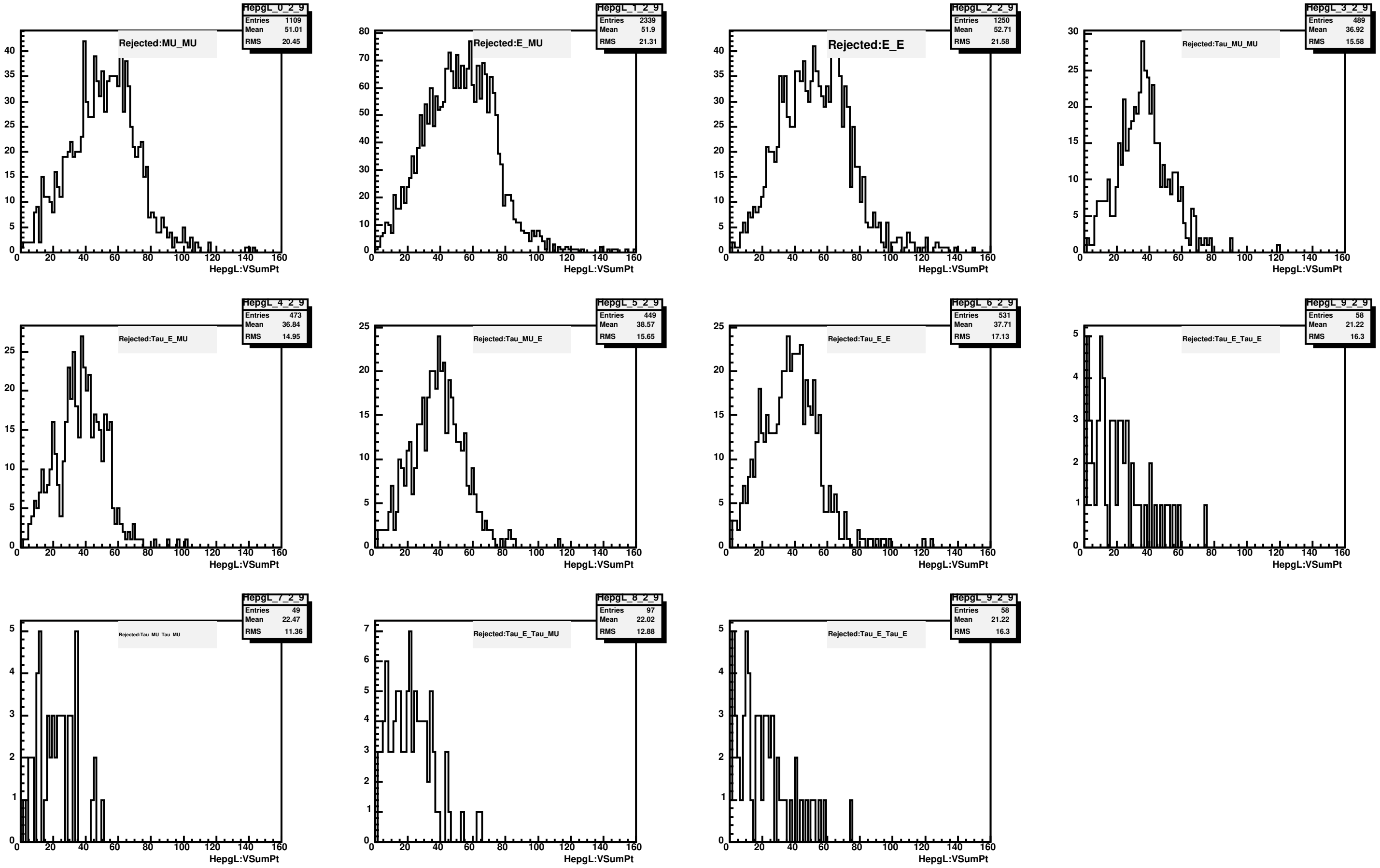
Kinematics: HepG: VSumPt Selected

$$M_{Higgs} = 160$$



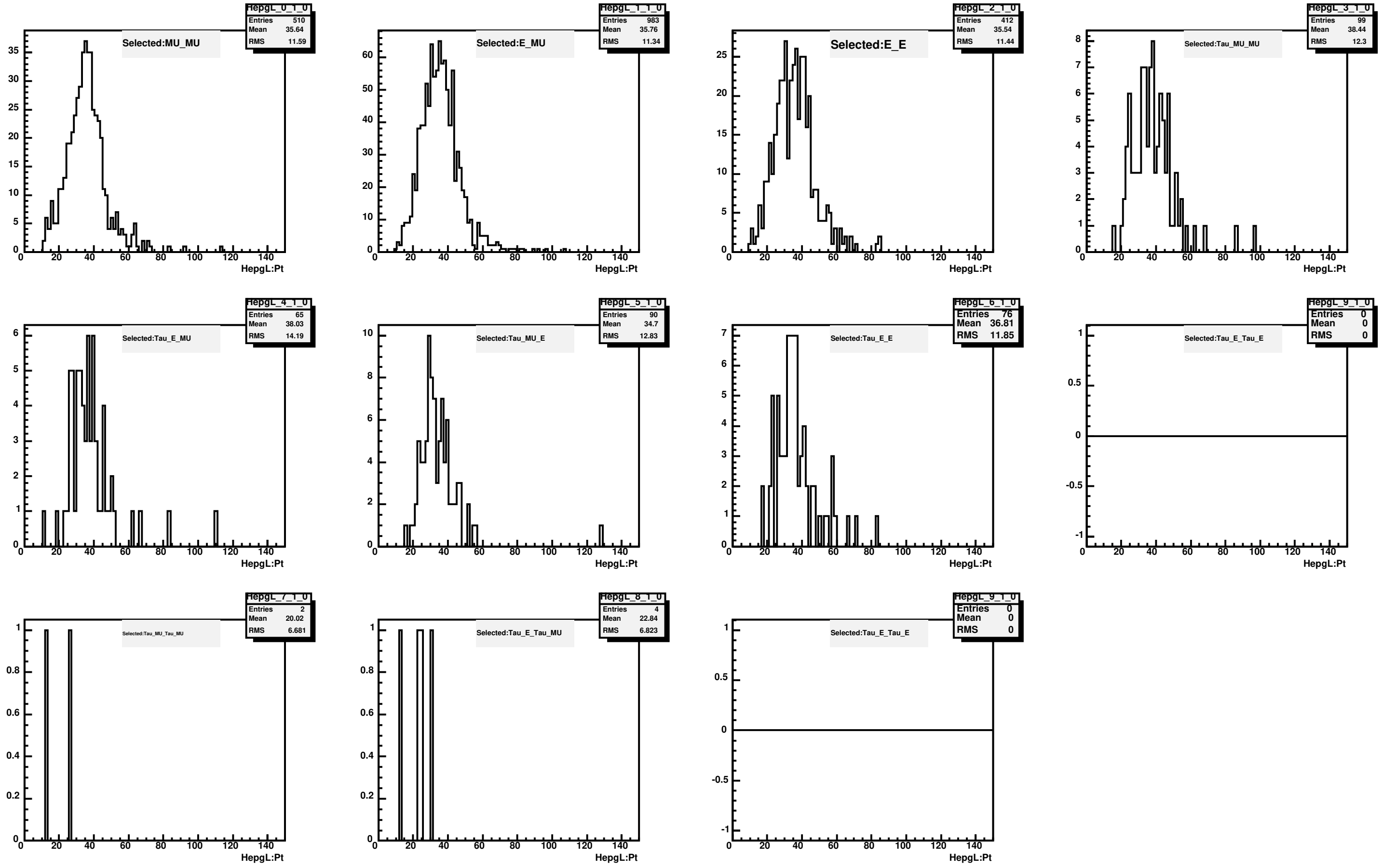
Kinematics: HepG: VSumPt Rejected

$$M_{Higgs} = 160$$



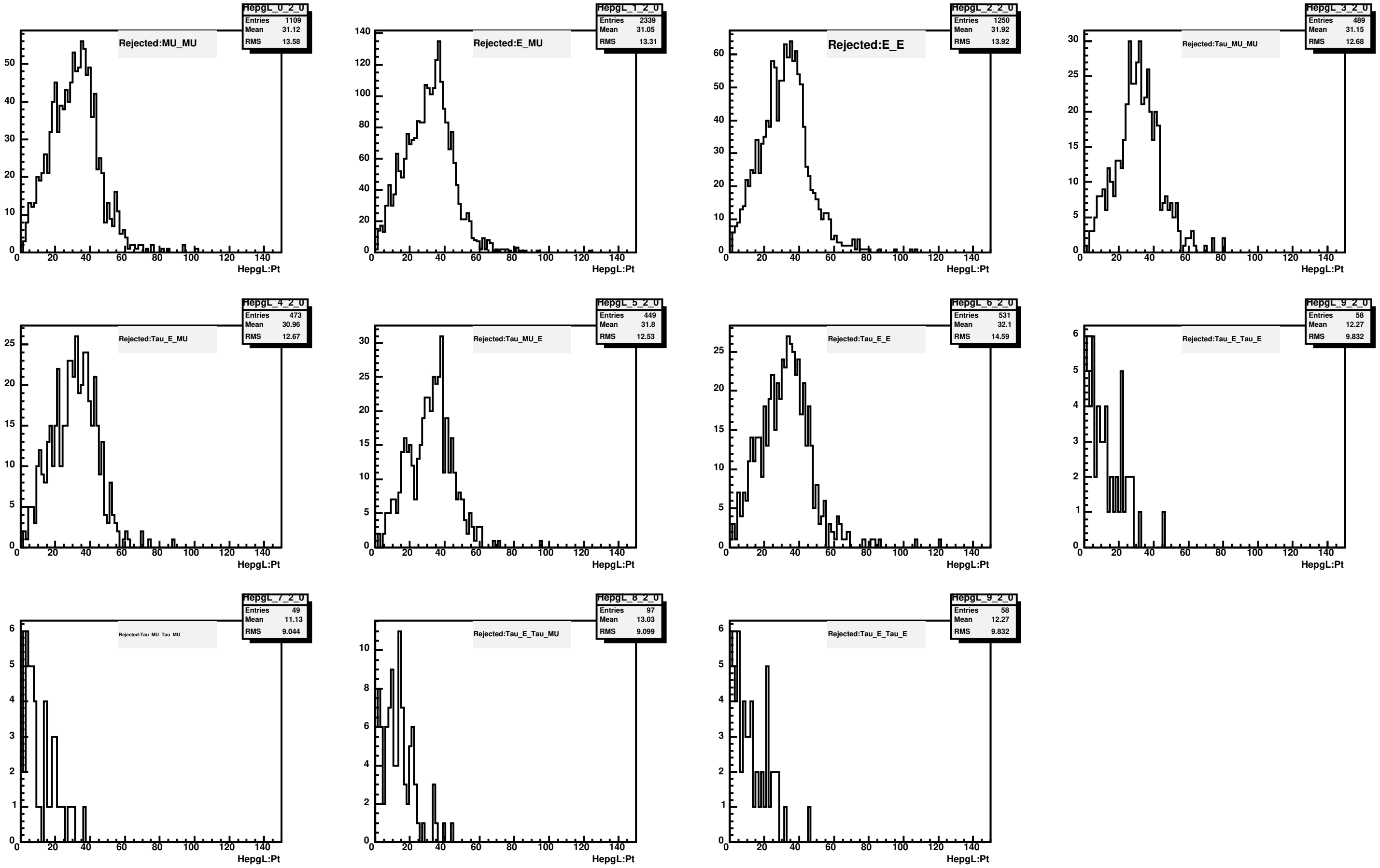
Kinematics: HepG: Pt1 Selected

$$M_{Higgs} = 160$$



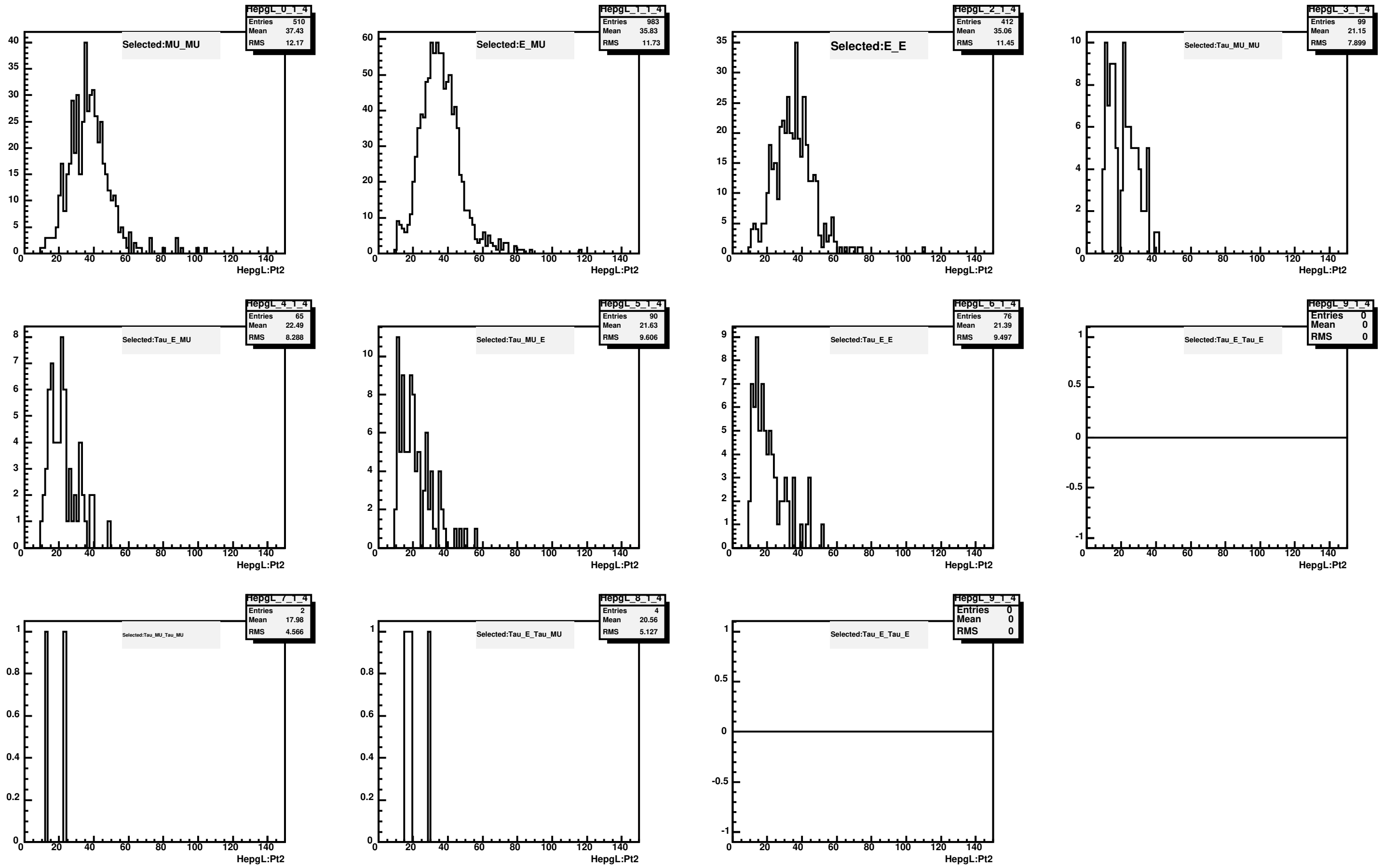
Kinematics: HepG: Pt1 Rejected

$$M_{Higgs} = 160$$



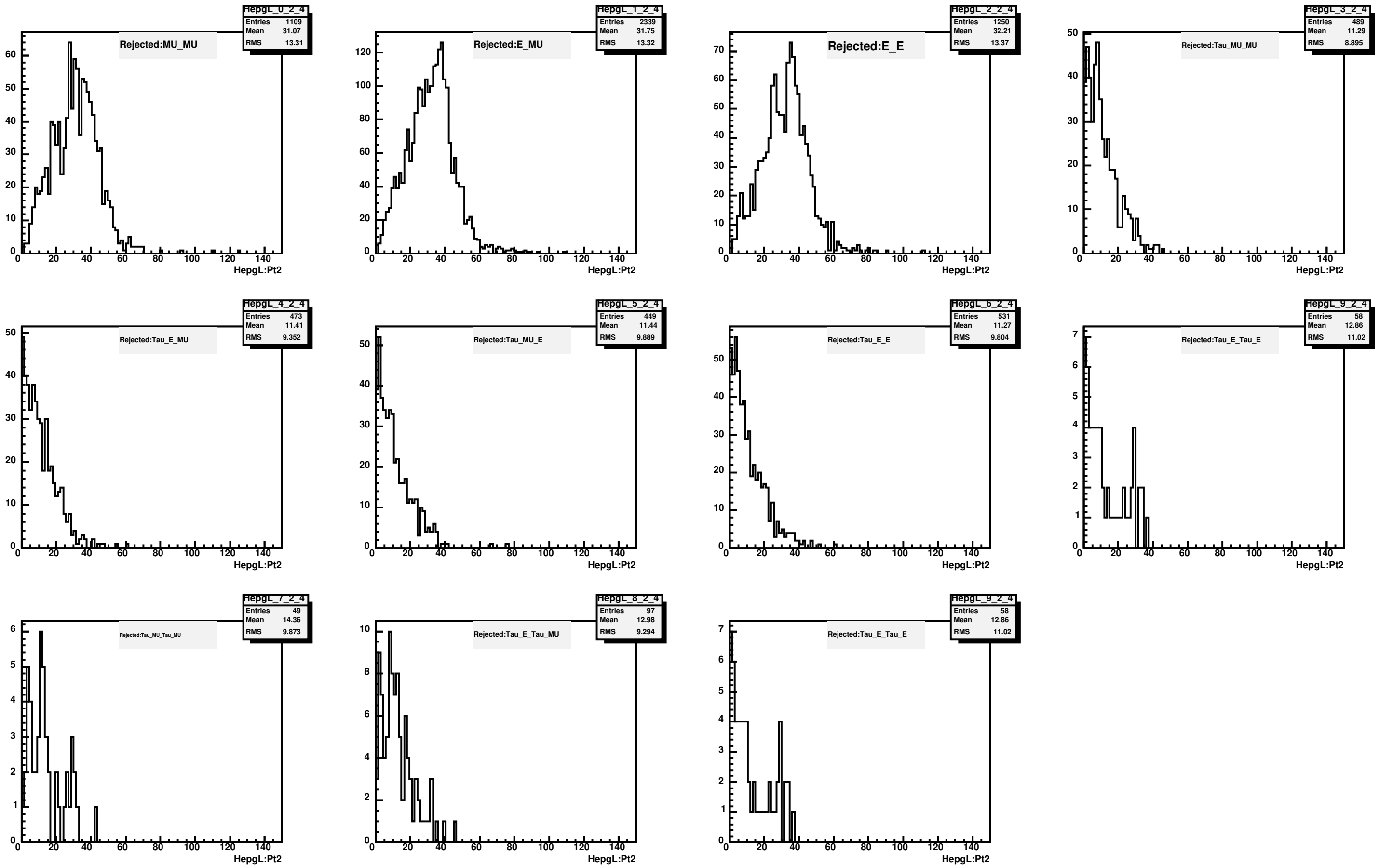
Kinematics: HepG: Pt2 (τ decay prod)

Selected $M_{Higgs} = 160$

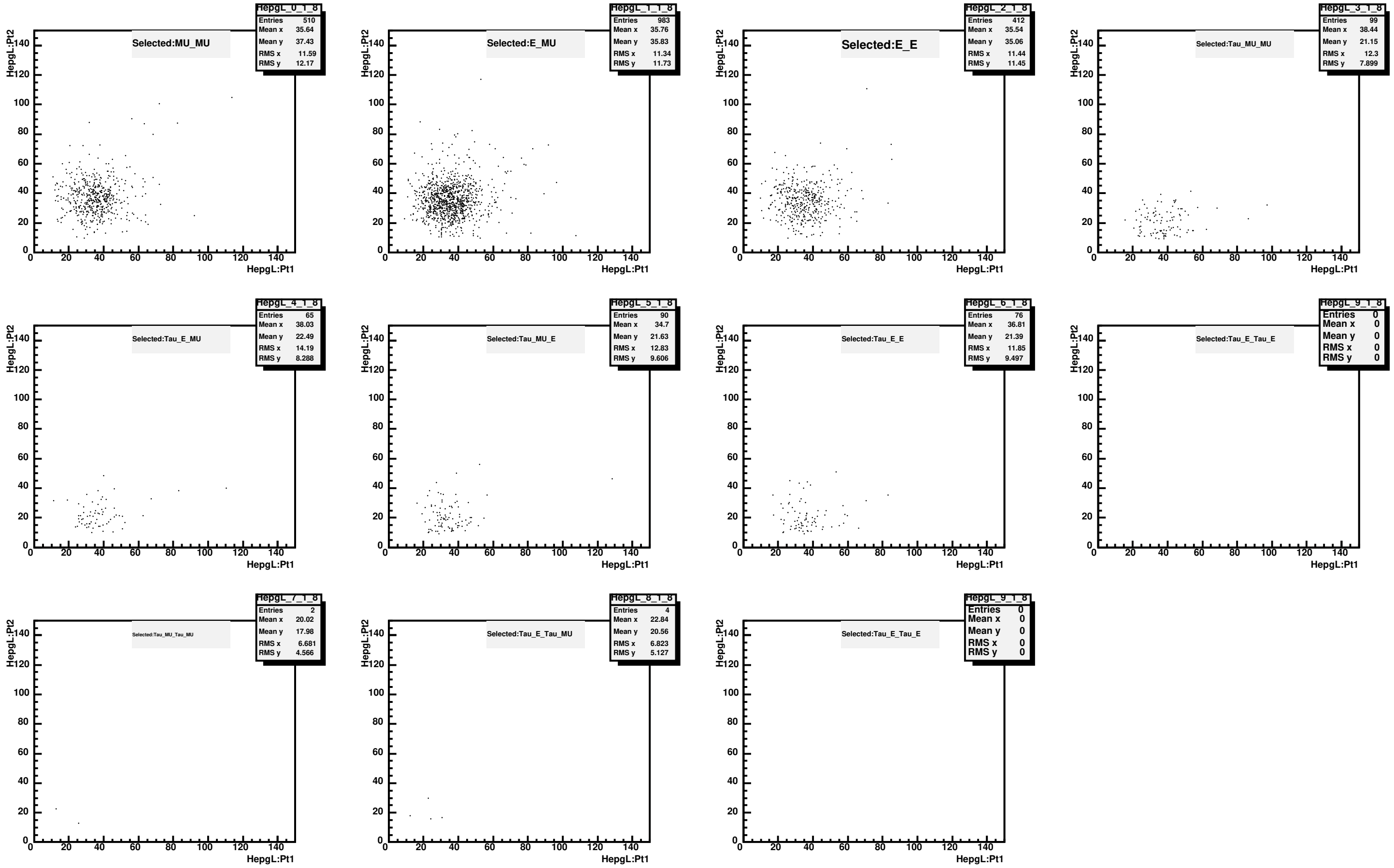


Kinematics: HepG: Pt2 (τ decay prod)

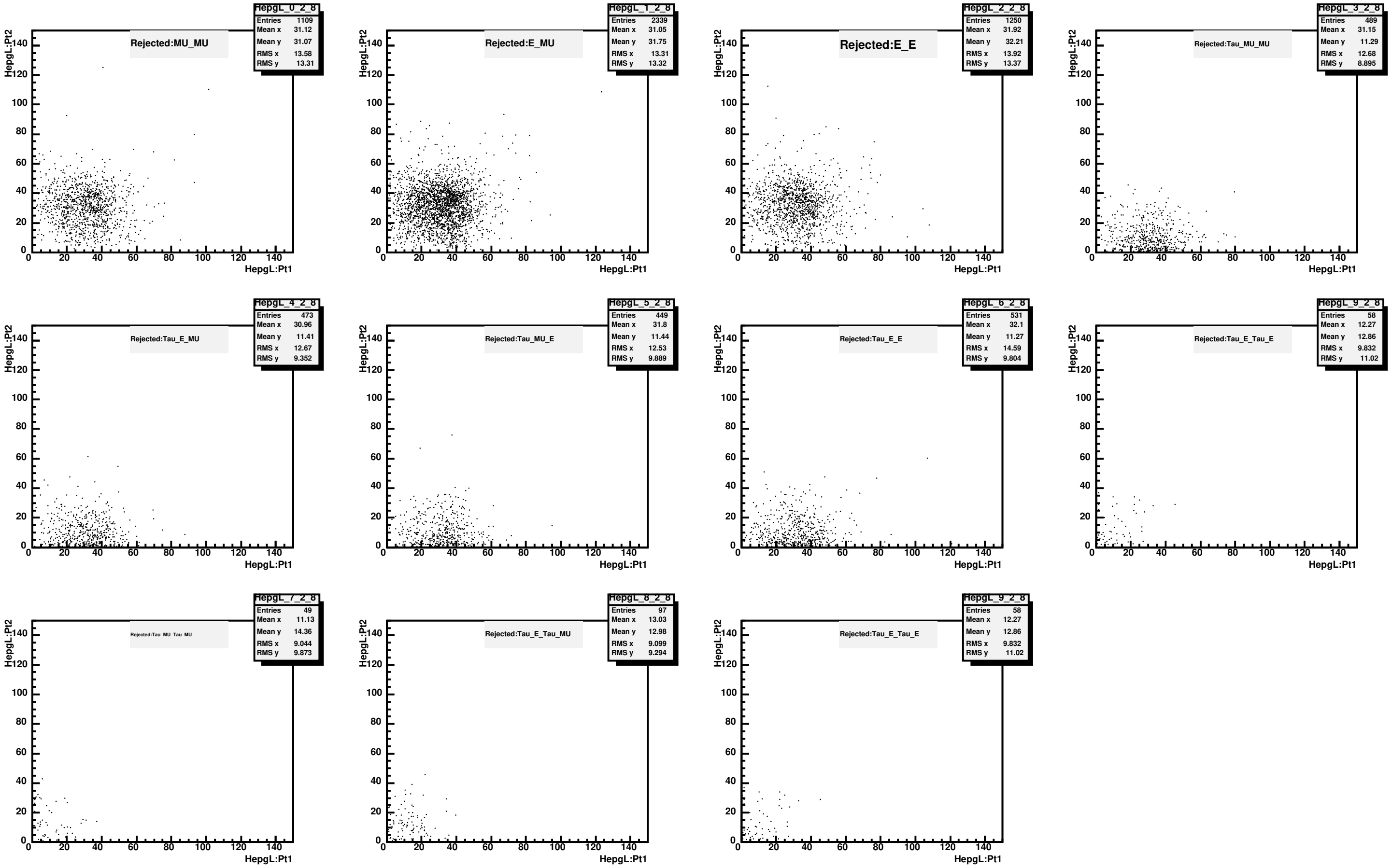
Rejected $M_{Higgs} = 160$



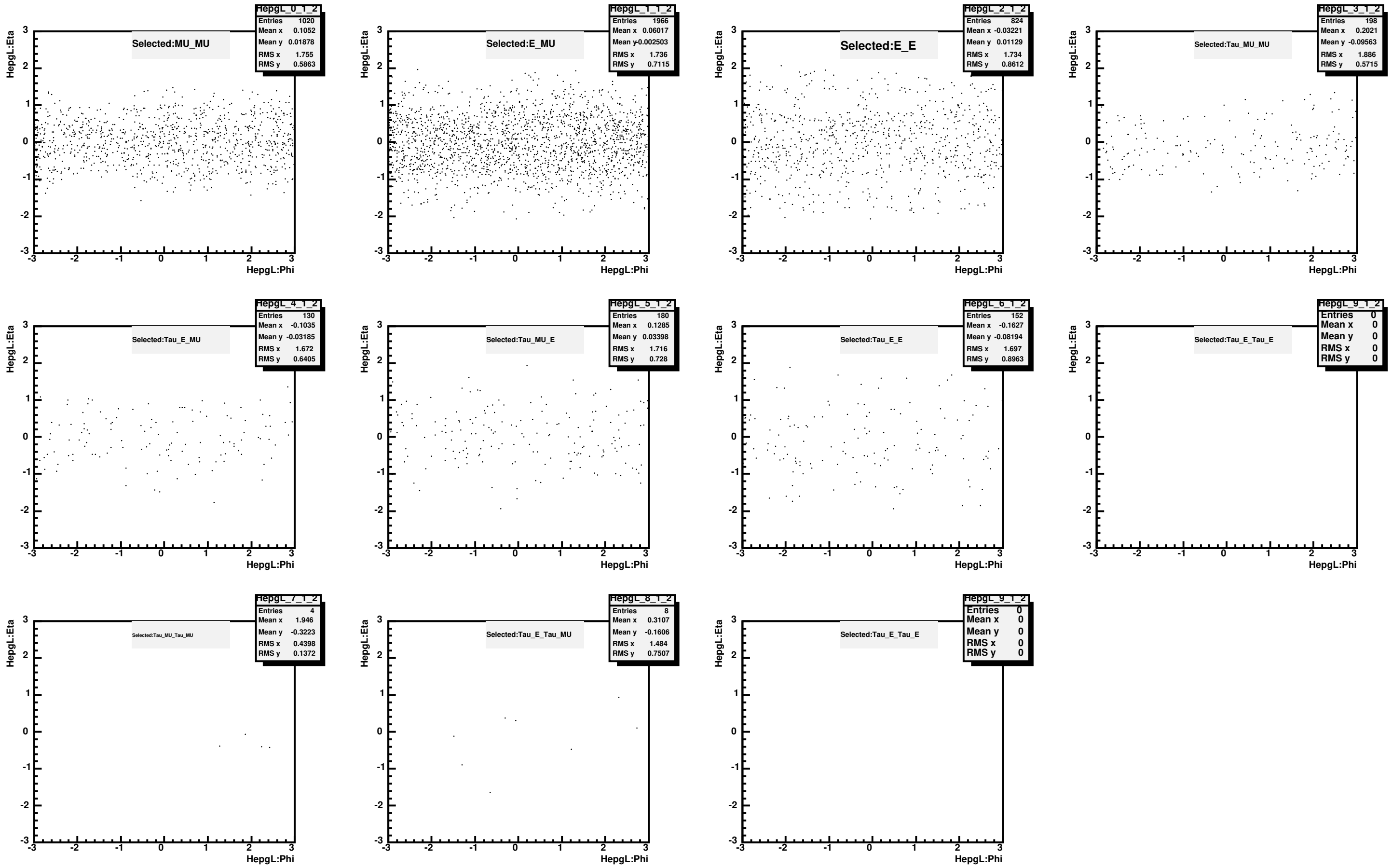
Kinematics: HepG: Pt1vs Pt2(τ decay prod) Selected $M_{Higgs} = 160$



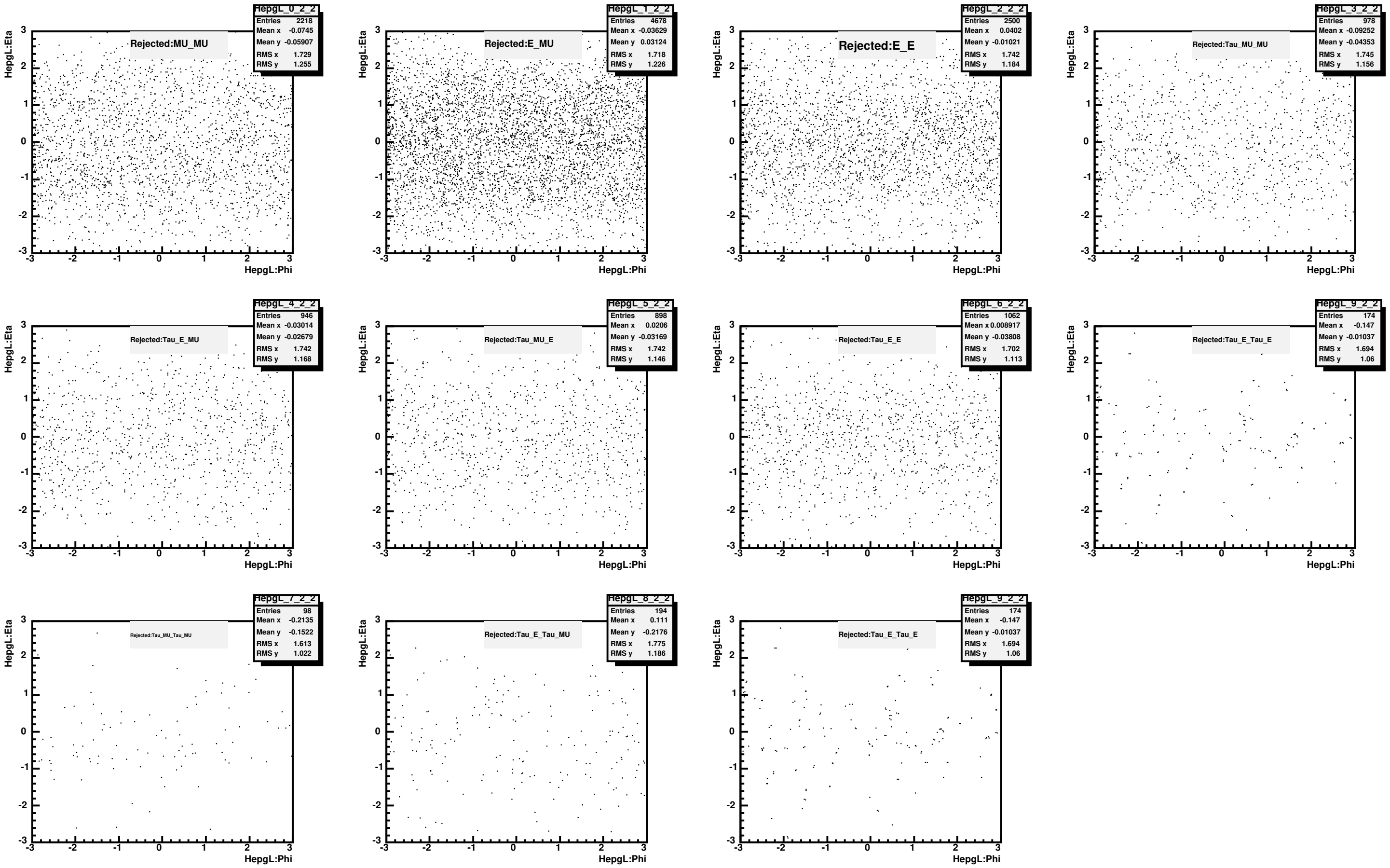
Kinematics: HepG: Pt1vs Pt2(τ decay prod) Rejected $M_{Higgs} = 160$



Kinematics: HepG: Selected $M_{Higgs} = 160$



Kinematics: HepG: Rejected $M_{Higgs} = 160$



Conclusions and Further Studies

- Suprised by how much eta-phi is missed
- SumPt helpful for double tau.
- Need to look at how well reconstructed tracks match Hepg

Backups

Triggers

Using:

- ELECTRON_CENTRAL_18
- MET_PEM
- from MUON_CMUP18 or MUON_CMUP18_L2_PT15
- from MUON_CMX18 or MUON_CMX18_L2_PT15

Will Try:

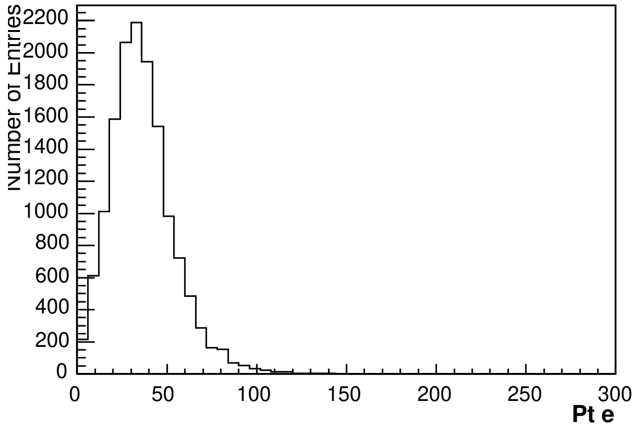
- SUSY_DILEPTON
- TEST_MET_PLUG
- BMU?

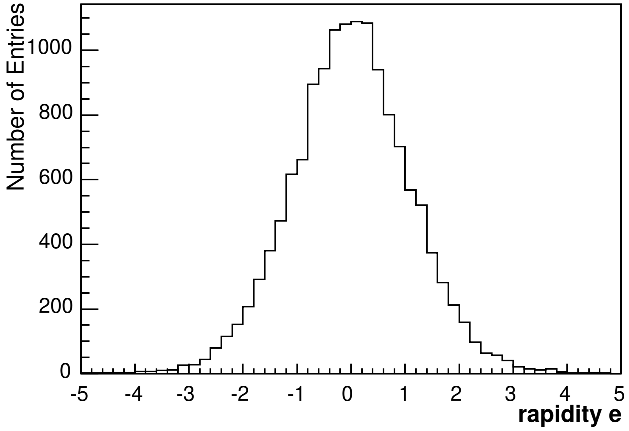
Standard 20/10 Cuts

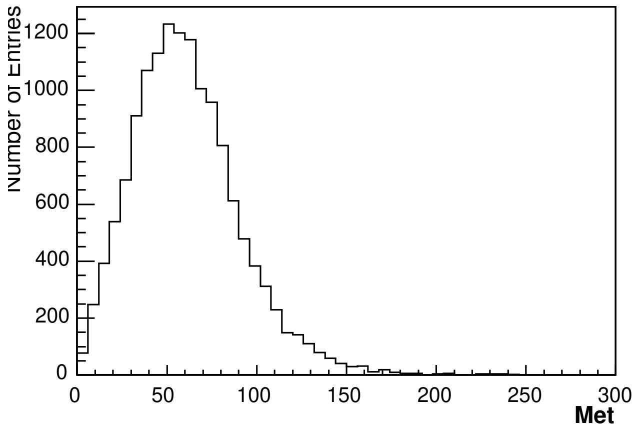
Decay	N	Integral	ECut	ε	Integral
$\mu\mu$	11159	11159	11011	0.99	11011
e μ	22135	33294	21698	0.98	32709
e e	11053	44347	10795	0.98	43504
τ_μ μ	3843	48190	2407	0.63	45911
τ_e μ	3973	52163	2415	0.61	48326
τ_μe	3867	56030	2417	0.63	50743
τ_e e	3950	59980	2378	0.60	53121
$\tau_\mu\tau_\mu$	328	60308	97	0.30	53218
$\tau_e\tau_\mu$	677	60985	203	0.30	53421
$\tau_e\tau_e$	372	61357	117	0.31	53538

Generate 100000 Events, $m_H = 160$ GeV/c^2. ECut: Apply 20/10 cut to leptons. Note that this is not realistic for all rapidities.

MET, Lepton p_t and η from VBF (gg same)







Pythia Generator Level, $m_H = 160$ GeV/c^2