

$VH \rightarrow VWW$ Trilepton Analysis: First Limits and New Cuts

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Summary

1 Basic Preselection

2 From last week...

3 New Cuts

- $\cancel{E}_T > 20.0$ GeV for NoZ Peak
- NJet $\neq 0$ In Z Peak

4 Conclusions

5 Still Working On...

Reminder: Basic Preselection

- $\cancel{E}_T > 10.0 \text{ GeV}$
- Basic Lepton ID (for two or three leptons)
- Good Run (accesses a list of good runs)
- Triggered Lepton (trigger bits passed for data)
- Max Δz_0 within limits
- Trilepton identified for event, but not same-sign analysis trileptons.

No-Z-Peak Region: Ranked Discriminating Variables

- $\cancel{E}_T$
- ΔR Opp. Sign Close
- H_T : 3 leptons, $\cancel{E}_T$, Jets
- Dilepton Inv. Mass of Opp. Sign Close (by ϕ) Leptons
- M_T : 3 leptons, $\cancel{E}_T$, Jets
- Inv. Mass of 3rd lepton, $\cancel{E}_T$, Jets
- $\Delta\phi$ b/w 2nd lepton and $\cancel{E}_T$
- M_T : 3 leptons
- M_T : 3rd lepton, $\cancel{E}_T$
- ΔR Opp. Sign Far
- NJet
- 2nd lepton p_T

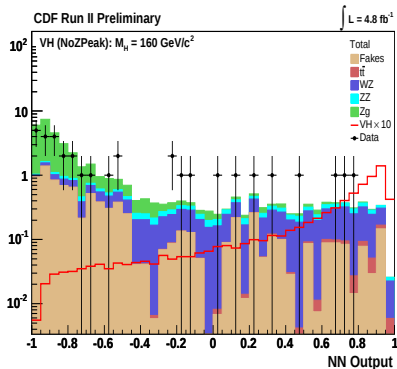
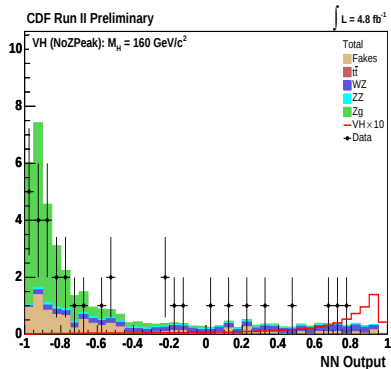
In-Z-Peak Region: Ranked Discriminating Variables

- NJet
- $\cancel{E}_T$
- H_T : 3 leptons, $\cancel{E}_T$, Jets
- M_T : 3 leptons, $\cancel{E}_T$, Jets
- $\Delta\phi$ Opp. Sign Close
- Inv. Mass of 3rd lepton, $\cancel{E}_T$, Jets
- $\Delta\phi$ b/w 2nd lepton and $\cancel{E}_T$
- Trilepton Inv. Mass
- $\Delta\phi$ b/w Sum of the 3 leptons and $\cancel{E}_T$
- 2nd lepton p_T
- ΔR Opp. Sign Close
- ΔR Opp. Sign Far
- $\Delta\phi$ b/w Sum of Opp. Sign leptons on Z-peak and 3rd lepton

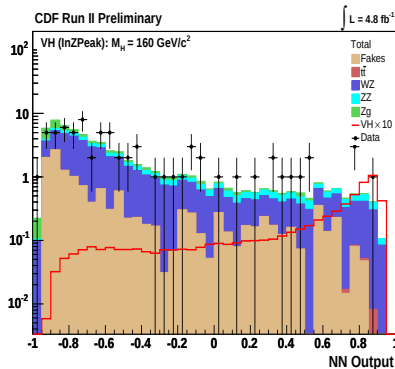
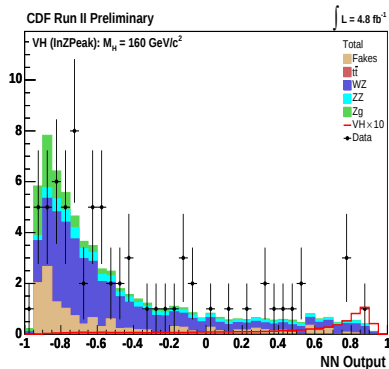
Reminder: Event Count

Process	NoZPeak	InZPeak
WZ	6.83	36.4
ZZ	1.99	7.23
$Z\gamma$	22.7	9.12
Fakes (WW, W +Jets, Z +Jets)	8.63	13.8
$t\bar{t}$	0.34	0.06
$WH160$ Signal	0.57	0.07
$ZH160$ Signal	0.18	0.58
Background Stack	40.1	66.5
Total Background + MC signal	40.28	67.2
data(4.8 fb^{-1})	34	72

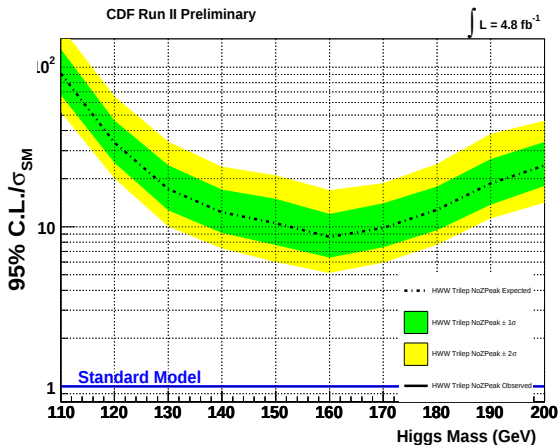
Reminder: Neural Net: No Z Peak



Reminder: Neural Net: In Z Peak

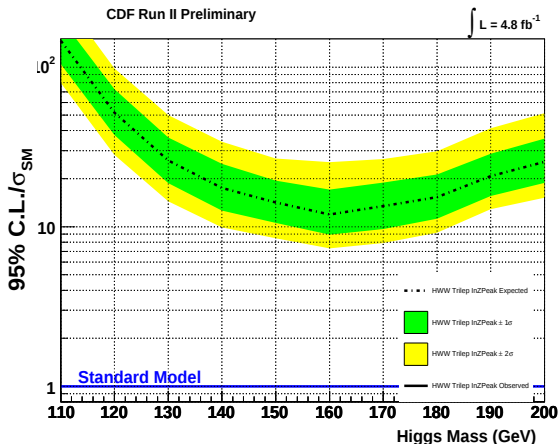


New: No Z Peak: Limits



GeV	Limit
110	91.3
120	33.7
130	17.2
140	12.3
150	10.5
160	8.64
170	9.84
180	12.8
190	18.7
200	24.2

New: In Z Peak: Limits

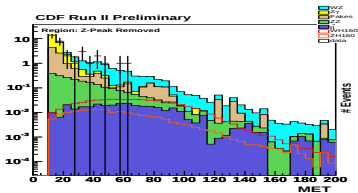
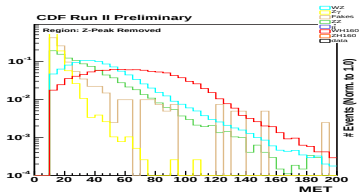
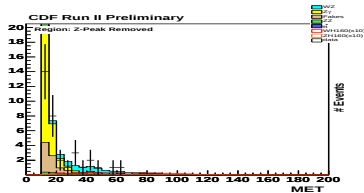
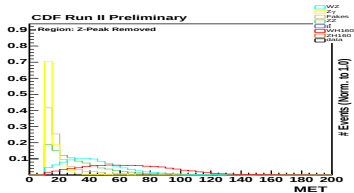


GeV	Limit
110	146
120	52.0
130	26.0
140	17.5
150	14.2
160	11.9
170	13.5
180	15.3
190	20.8
200	25.5

Preselection
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$E_T > 20.0$ GeV for NoZPeak
NJet $\neq 0$ In Z Peak

E_T for NoZPeak



New Cuts: $\cancel{E}_T > 20.0$ GeV for No Z Peak

Increase $\cancel{E}_T >$ cut from 10.0 to 20.0 GeV.

Process	Old Count	New Count
WZ	6.83	6.11
ZZ	1.99	1.31
$Z\gamma$	22.7	2.44
Fakes (WW, W+Jets, Z+Jets)	8.63	2.28
$t\bar{t}$	0.34	0.32
WH160 Signal	0.57	0.54
ZH160 Signal	0.18	0.16
Background Stack	40.1	12.2
Total Background + MC signal	40.28	12.9
data(4.8 fb $^{-1}$)	34	12

NN Results

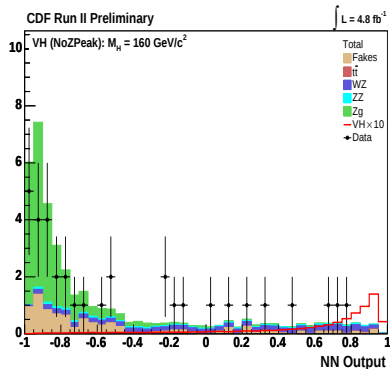


Figure: $\cancel{E}_T > 10$ GeV

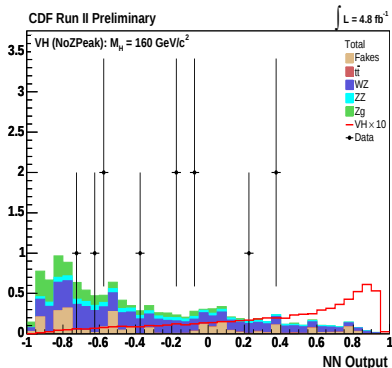


Figure: $\cancel{E}_T > 20$ GeV

NN Results Log

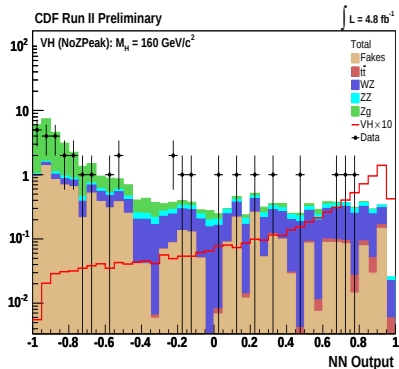


Figure: $\cancel{E}_T > 10$ GeV

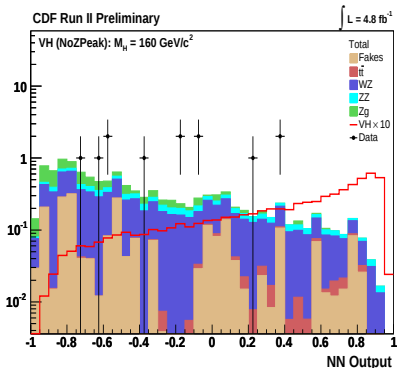
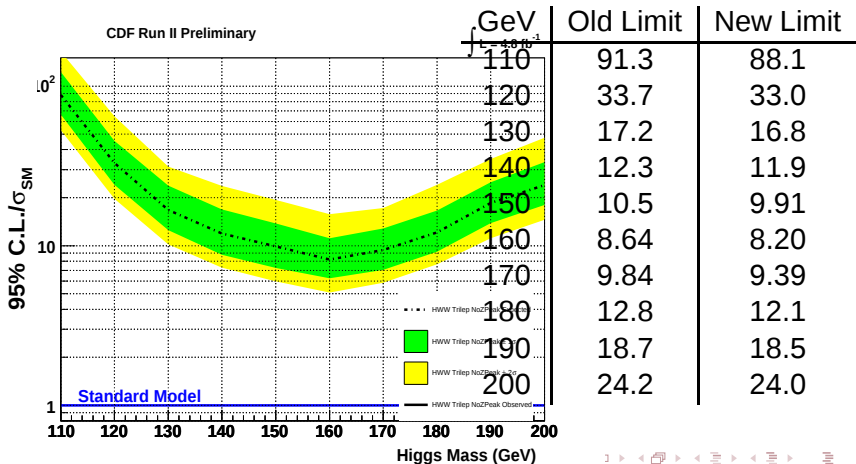


Figure: $\cancel{E}_T > 20$ GeV

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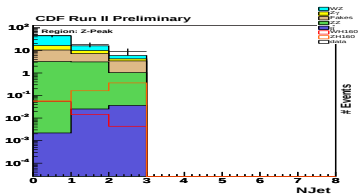
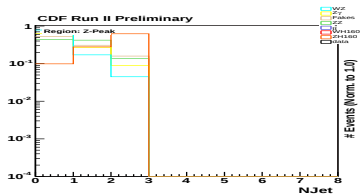
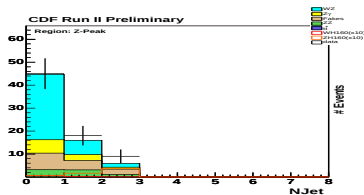
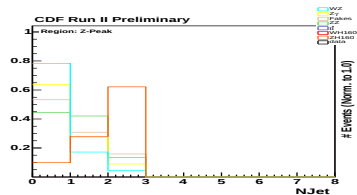
Limit Results



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NJet $\neq 0$ In Z Peak

In Z Peak: NJet



New Cuts: NJet $\neq 0$ for the In-Z-Peak Region

Process	Old Count	New Count
WZ	36.4	7.91
ZZ	7.23	4.06
$Z\gamma$	9.12	3.30
Fakes (WW, W+Jets, Z+Jets)	13.8	6.54
$t\bar{t}$	0.06	0.06
WH160 Signal	0.07	0.02
ZH160 Signal	0.58	0.53
Background Stack	66.5	21.8
Total Background + MC signal	67.2	22.35
data(4.8 fb $^{-1}$)	72	27

NN Results

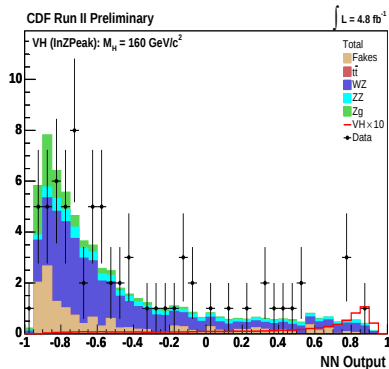


Figure: All NJet

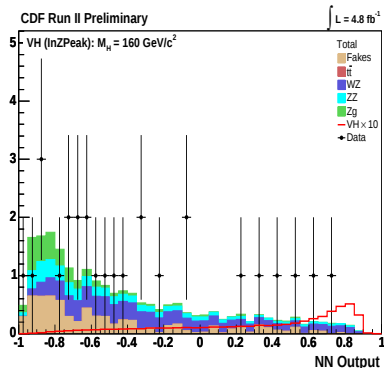


Figure: $\cancel{E}_T > 20 \text{ GeV}$

NN Results Log

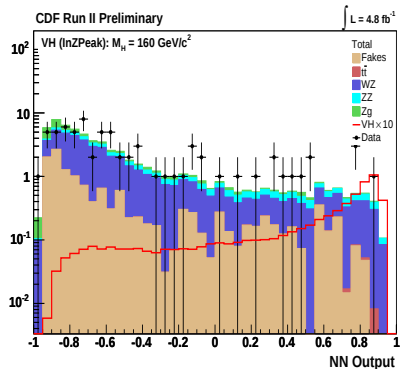


Figure: NJet $\neq 0$

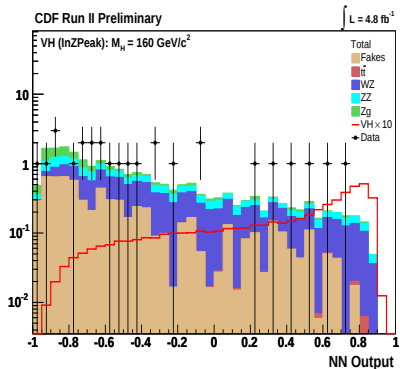
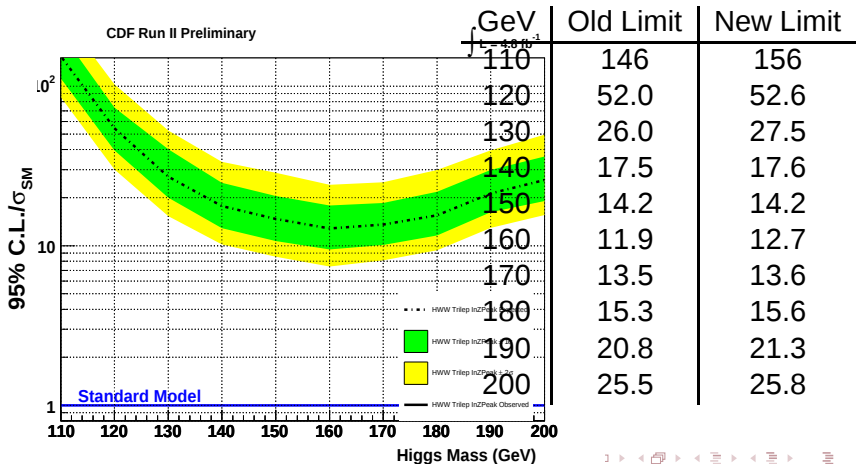


Figure: $\cancel{E}_T > 20 \text{ GeV}$

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Conclusions

- Increasing the $\cancel{E}_T$ cut to 20.0 GeV for outside the Z peak region cuts down the $Z\gamma$ and some Fakes.
- Removing NJet=0 from the Z peak region drastically cuts the WZ contribution.
- No Z Peak Control Region: $10.0 < \cancel{E}_T < 20.0$
- In Z Peak Control Region: NJet = 0

Still Working On...

- Systematic Errors
- Data curve in limits
- Plot variables for $NN > 0.75$
- Revisit input variables with new cuts