

Control Region and Systematic Errors

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Collider Detector at Fermilab

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Summary

- 1 Control Regions
 - Basic Values
 - Discriminating Variables
 - NN Control

- 2 Limits w/ Systematics

- 3 Conclusion

The Regions

- NoZPeak Control: $10.0 < E_T < 20.0$
- InZPeak Control: $N_{\text{Jet}} == 0$

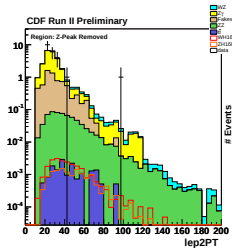
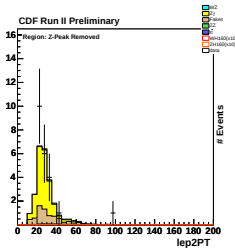
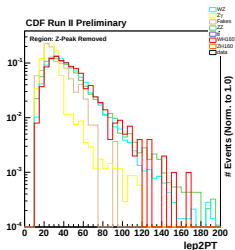
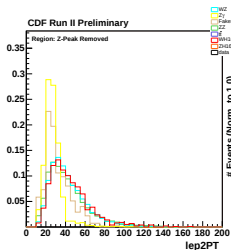
Control Region Counts

Process	NoZPeak	InZPeak
<i>WZ</i>	0.73	28.5
<i>ZZ</i>	0.68	3.18
<i>Z</i> γ	17.4	5.01
Fakes (WW, <i>W</i> +Jets, <i>Z</i> +Jets)	6.35	7.22
<i>t</i> $\bar{t}$	0.02	0.00
<i>WH</i> 160 Signal	0.02	0.05
<i>ZH</i> 160 Signal	0.01	0.06
Background Stack	25.1	43.9
Total Background + MC signal	25.1	44.0
data(4.8 fb ⁻¹)	22	45

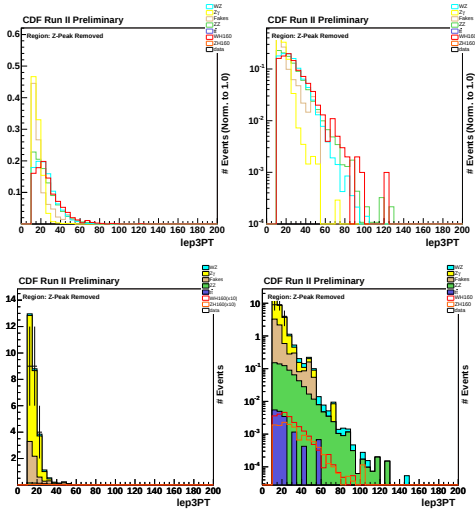
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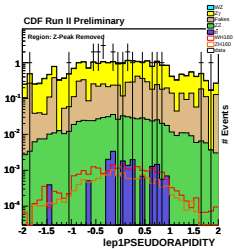
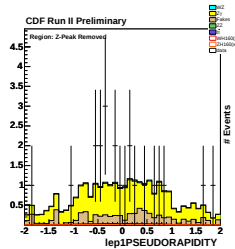
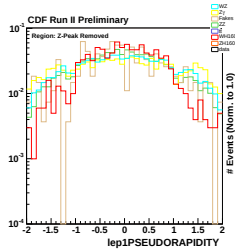
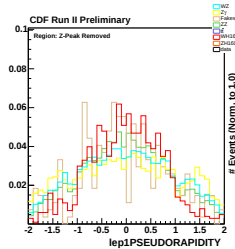
NoZ Peak: 2nd Lept. p_T



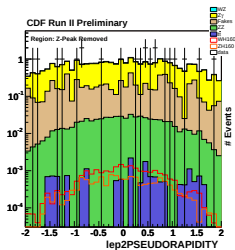
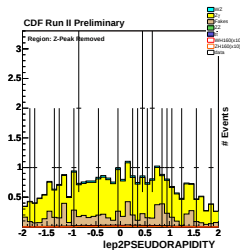
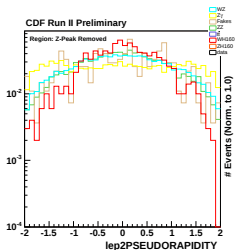
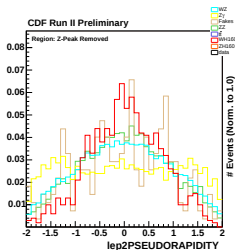
NoZ Peak: 3rd Lept. p_T



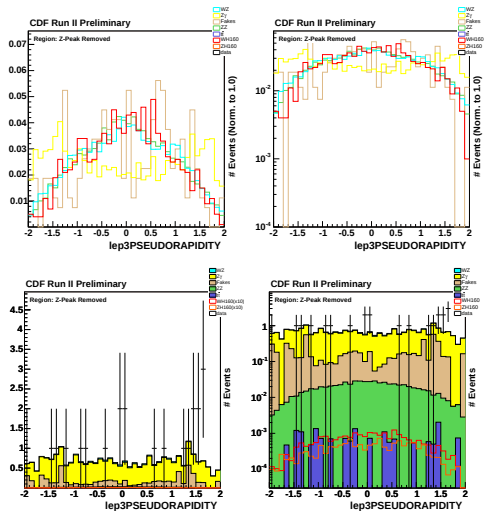
NoZ Peak: Lead Lept. η



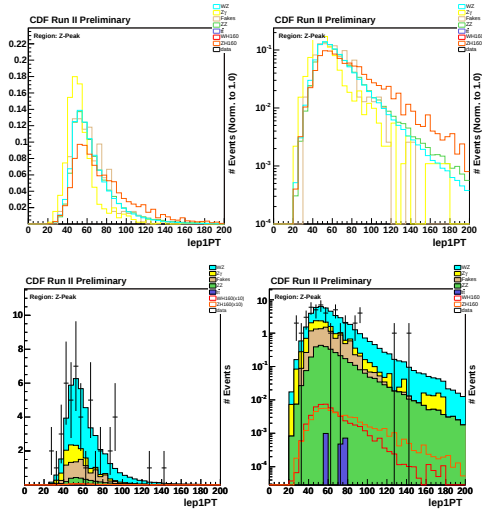
NoZ Peak: 2nd Lept. η



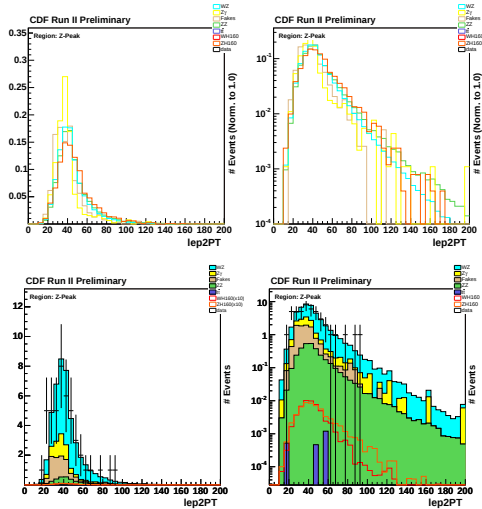
NoZ Peak: 3rd Lept. η



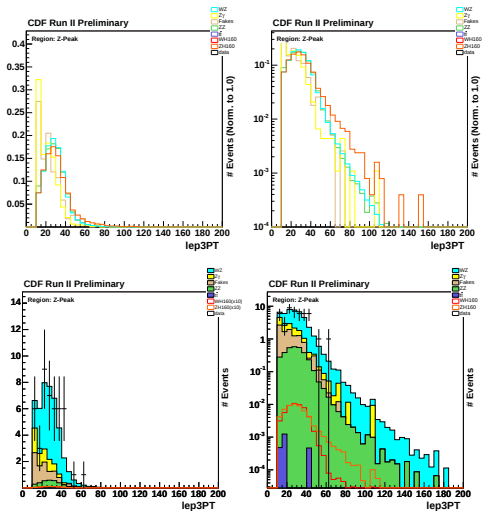
InZ Peak: Lead Lept. p_T



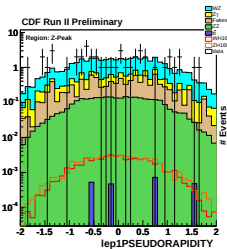
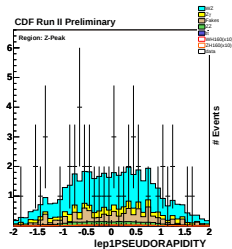
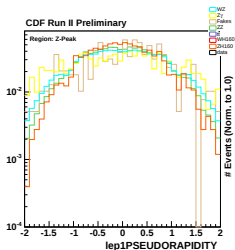
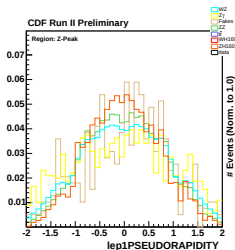
InZ Peak: 2nd Lept. p_T



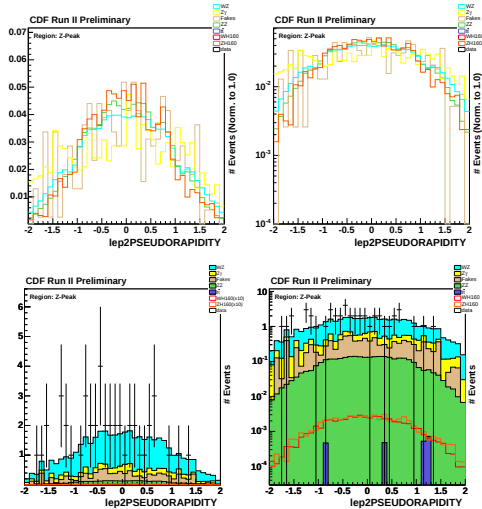
InZ Peak: 3rd Lept. p_T



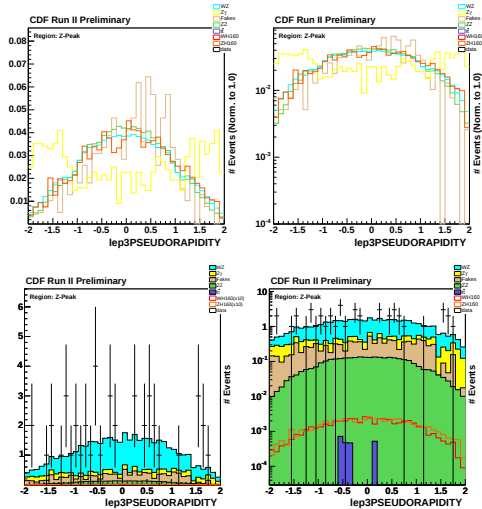
InZ Peak: Lead Lept. η



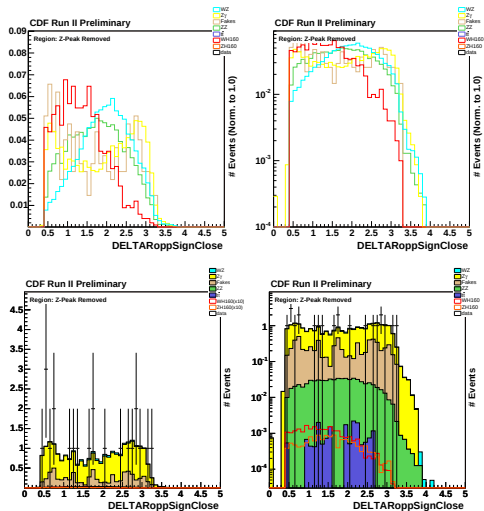
InZ Peak: 2nd Lept. η



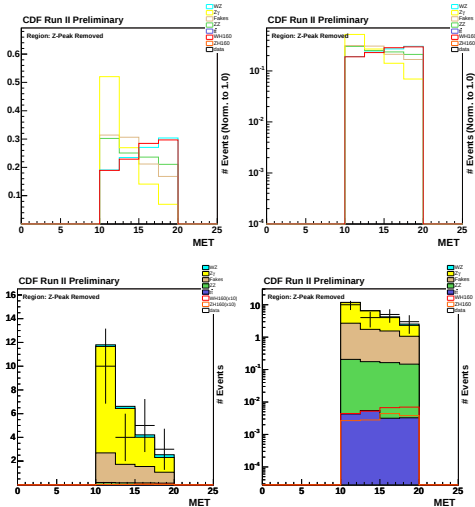
InZ Peak: 3rd Lept. η



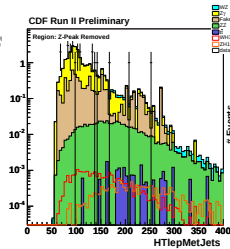
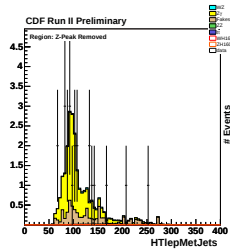
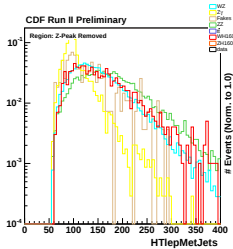
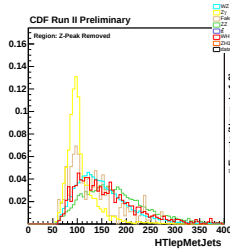
NoZ Peak: ΔR Opp. Sign Close



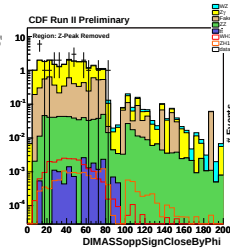
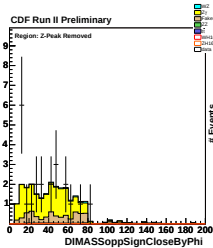
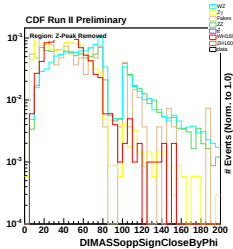
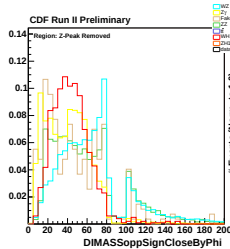
NoZ Peak: $\cancel{E}_T$



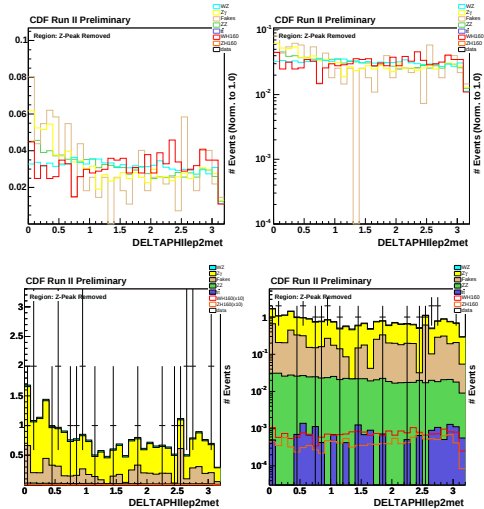
NoZ Peak: H_T leptons, $\cancel{E}_T$, Jets



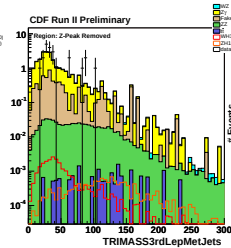
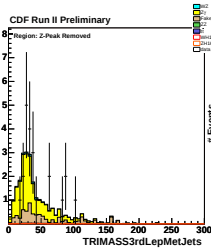
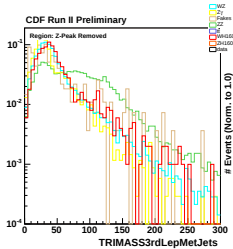
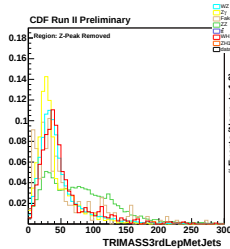
NoZ Peak: Dimass Opp. Sign. Close by ϕ



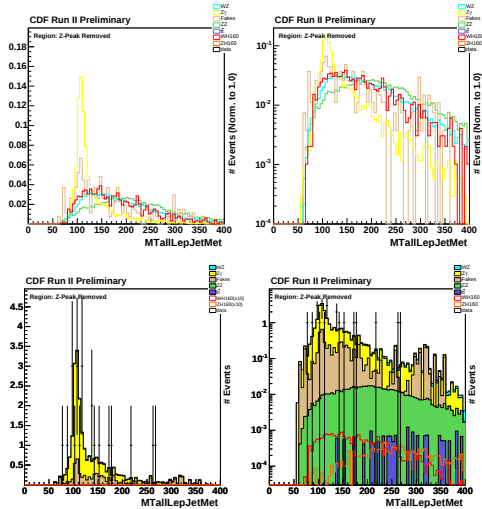
NoZ Peak: $\Delta\phi$ 2nd lepton and $\cancel{E}_T$



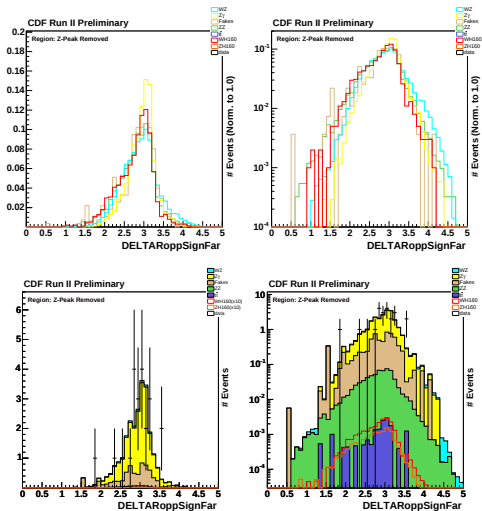
NoZ Peak: Inv. Mass of 3rd lepton, $\cancel{E}_T$, Jets



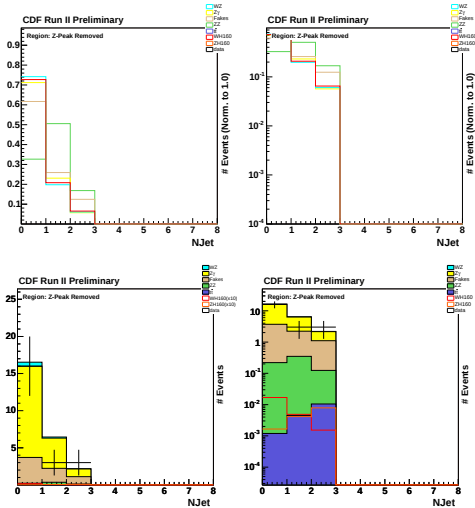
NoZ Peak: m_T leptons, $\cancel{E}_T$, Jets



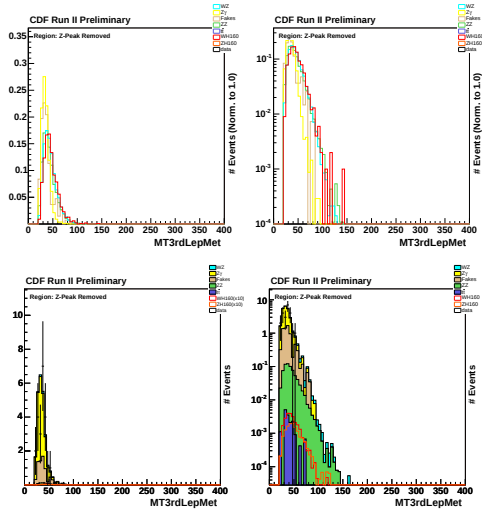
NoZ Peak: ΔR Opp. Sign Far



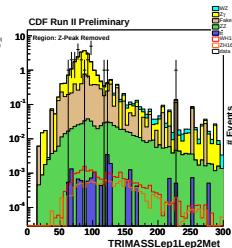
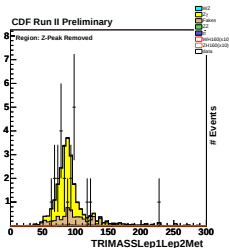
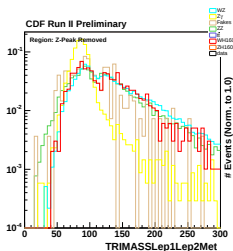
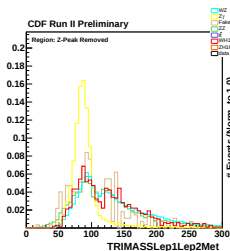
NoZ Peak: NJet



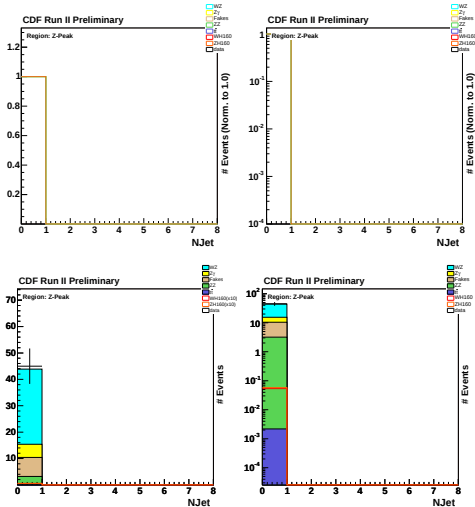
NoZ Peak: m_T 3rd lepton, $\cancel{E}_T$



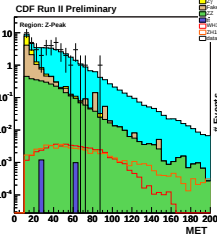
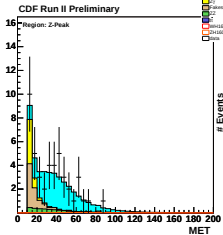
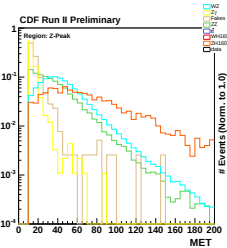
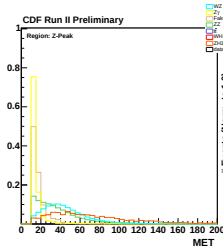
NoZ Peak: Inv. Mass Lep1, Lep2, $\cancel{E}_T$



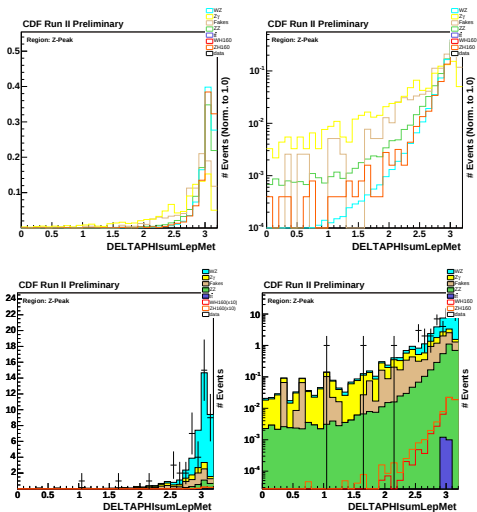
InZ Peak: NJet



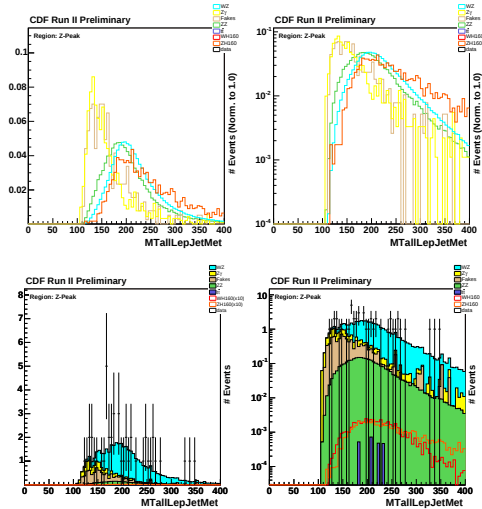
InZ Peak: $\cancel{E}_T$



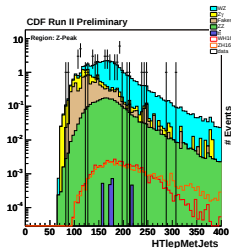
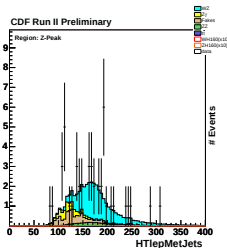
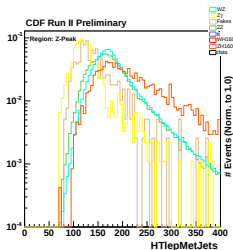
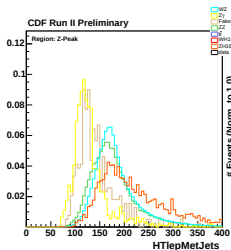
InZ Peak: $\Delta\phi$ Leptons, $\cancel{E}_T$



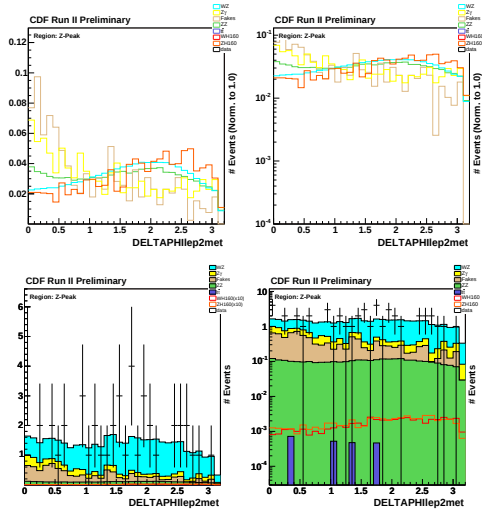
InZ Peak: m_T Leptons, $\cancel{E}_T$, Jets



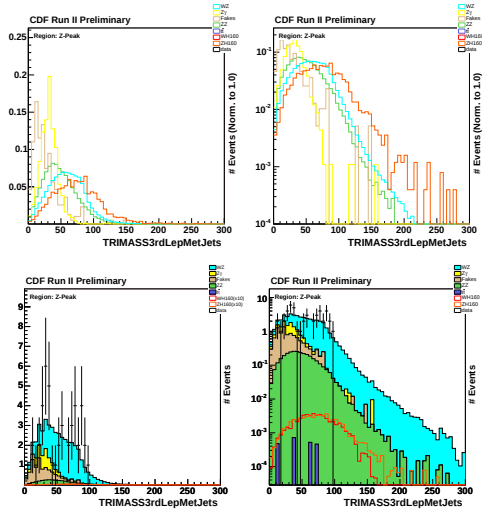
InZ Peak: H_T Leptons, $\cancel{E}_T$, Jets



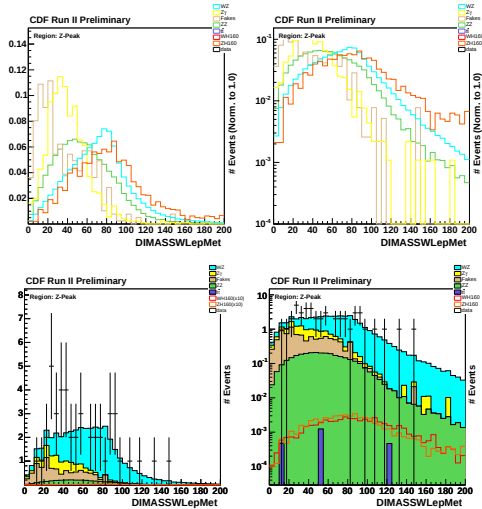
InZ Peak: $\Delta\phi$ 2nd Lepton, $\cancel{E}_T$



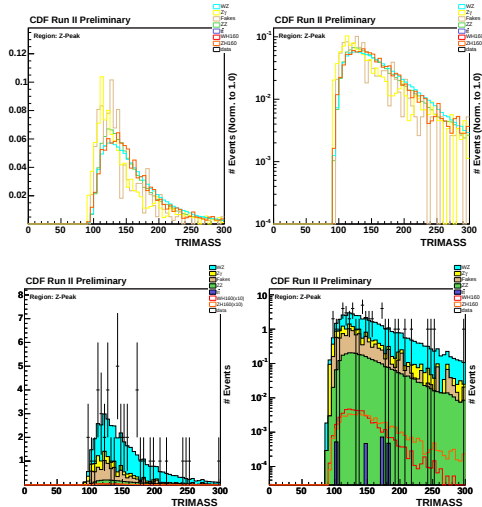
InZ Peak: Inv. Mass 3rd Lepton, $\cancel{E}_T$, Jets



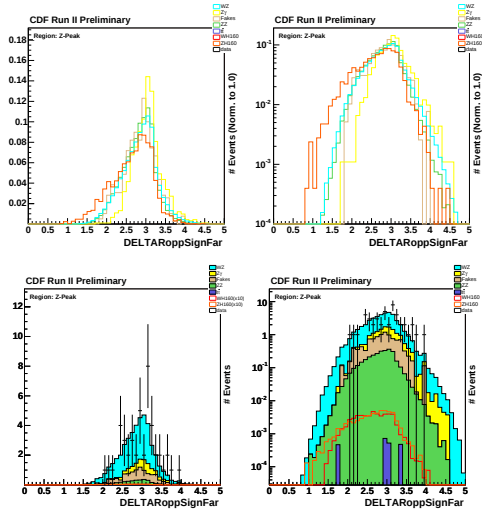
InZ Peak: Inv. Mass W-Lepton, $\cancel{E}_T$



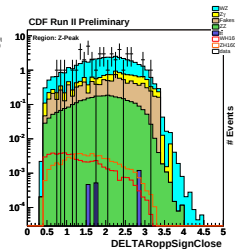
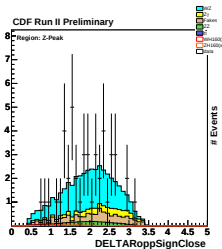
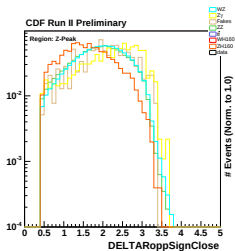
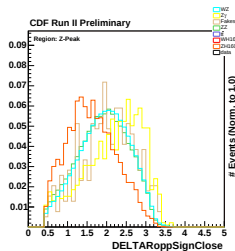
InZ Peak: Trilepton Inv. Mass



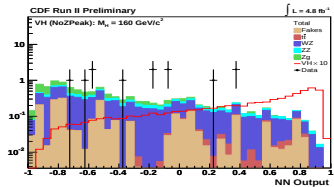
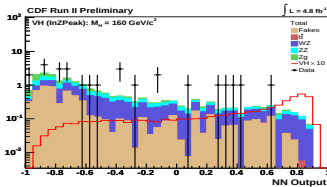
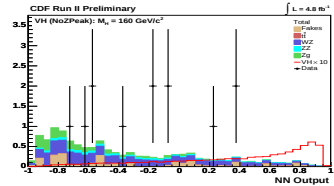
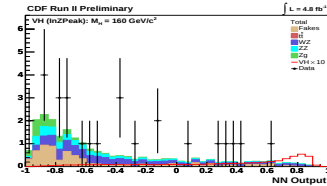
InZ Peak: ΔR Opp. Sign. Far



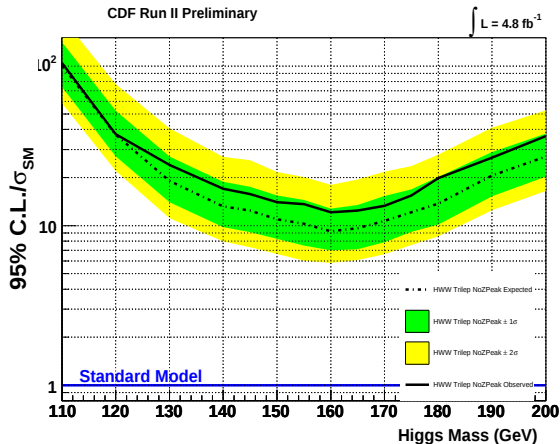
InZ Peak: ΔR Opp Sign Close



NN Control



NoZPeak: Limits w/ Systematics

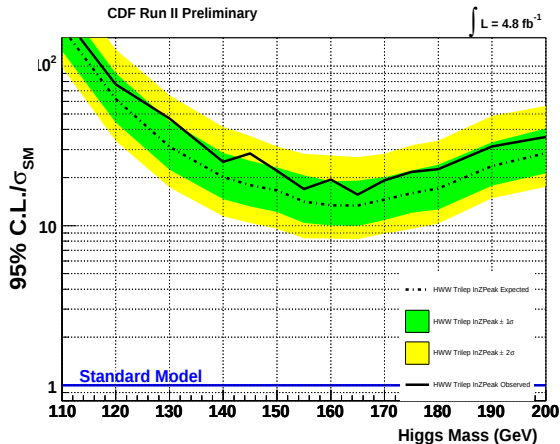


NoZPeak Limit Summary

Sensitivity(NoZPeak)	110	120	130	140	145	150	155
$+2\sigma/\sigma_{SM}$	187	76.7	39.6	27.1	26.2	21.9	20.3
$+1\sigma/\sigma_{SM}$	137	53.3	27.2	19.5	17.6	15.8	14.4
Median/ σ_{SM}	99.0	37.4	19.0	13.9	12.3	11.3	10.1
$-1\sigma/\sigma_{SM}$	73.2	27.7	14.0	10.5	9.26	8.35	7.62
$-2\sigma/\sigma_{SM}$	59.8	22.1	11.4	8.04	7.15	6.88	6.22
Observed/ σ_{SM}	104	37.5	24.0	17.1	15.8	14.0	13.6
Sensitivity(NoZPeak)	160	165	170	175	180	190	200
$+2\sigma/\sigma_{SM}$	18.1	18.7	21.8	24.1	28.2	42.6	50.3
$+1\sigma/\sigma_{SM}$	13.2	13.4	15.8	17.4	19.6	29.1	37.2
Median/ σ_{SM}	9.29	9.60	10.9	12.2	13.8	20.5	26.5
$-1\sigma/\sigma_{SM}$	6.93	7.31	8.22	9.15	10.5	15.2	19.9
$-2\sigma/\sigma_{SM}$	5.64	6.10	6.76	7.49	8.77	12.8	16.4
Observed/ σ_{SM}	12.1	12.4	13.3	15.5	19.8	26.6	36.3

Table: Trilepton NoZPeak Region Expected and Observed Sensitivity

InZPeak: Limits w/ Systematics



InZPeak Limit Summary

Sensitivity(NoZPeak)	110	120	130	140	145	150	155
$+2\sigma/\sigma_{SM}$	354	127	63.1	40.6	37.4	33.6	28.6
$+1\sigma/\sigma_{SM}$	246	87.8	42.8	29.0	26.7	23.7	20.5
Median/ σ_{SM}	175	61.4	29.7	20.1	17.9	16.6	14.4
$-1\sigma/\sigma_{SM}$	126	44.3	21.8	14.5	13.0	11.8	10.7
$-2\sigma/\sigma_{SM}$	94.6	33.5	17.2	11.4	10.5	9.11	8.55
Observed/ σ_{SM}	201	76.9	46.8	25.1	28.3	22.1	16.9
Sensitivity(NoZPeak)	160	165	170	175	180	190	200
$+2\sigma/\sigma_{SM}$	28.7	26.2	29.4	30.8	33.0	45.6	56.8
$+1\sigma/\sigma_{SM}$	19.2	18.5	20.5	22.1	23.6	33.2	40.1
Median/ σ_{SM}	13.7	13.5	14.5	16.0	17.0	23.3	28.6
$-1\sigma/\sigma_{SM}$	10.2	9.92	10.9	11.9	12.8	17.4	21.9
$-2\sigma/\sigma_{SM}$	8.25	8.29	8.97	9.69	10.4	14.7	17.4
Observed/ σ_{SM}	19.4	15.6	19.2	21.7	22.6	31.4	35.9

Table: Trilepton *InZPeak* Region Expected and Observed Sensitivity

Signal Region Counts

Process	NoZPeak	InZPeak
WZ	$5.92 \pm 0.81_{\text{syst}} \pm 2.43_{\text{stat}}$	$7.69 \pm 1.05_{\text{syst}} \pm 2.77_{\text{stat}}$
ZZ	$1.28 \pm 0.17_{\text{syst}} \pm 1.13_{\text{stat}}$	$3.96 \pm 0.54_{\text{syst}} \pm 2.00_{\text{stat}}$
$Z\gamma$	$2.04 \pm 0.36_{\text{syst}} \pm 1.43_{\text{stat}}$	$2.73 \pm 0.49_{\text{syst}} \pm 1.56_{\text{stat}}$
Fakes (WW, W+Jets, Z+Jets)	$2.28 \pm 0.68_{\text{syst}} \pm 1.51_{\text{stat}}$	$6.54 \pm 1.96_{\text{syst}} \pm 2.56_{\text{stat}}$
$t\bar{t}$	$0.14 \pm 0.02_{\text{syst}} \pm 0.37_{\text{stat}}$	0.02
WH160 Signal	$0.53 \pm 0.13_{\text{syst}} \pm 0.73_{\text{stat}}$	0.02
ZH160 Signal	$0.16 \pm 0.04_{\text{syst}} \pm 0.40_{\text{stat}}$	$0.51 \pm 0.12_{\text{syst}} \pm 0.71_{\text{stat}}$
Background Stack	$11.7 \pm 1.32_{\text{syst}} \pm 3.42_{\text{stat}}$	$20.9 \pm 2.64_{\text{syst}} \pm 4.57_{\text{stat}}$
data(4.8 fb^{-1})	12	27

Conclusion

- Trilepton Note in 7 days.