

Progress with Limits

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Reminder of last week

- ▶ Most systematics now implemented:
 - Still missing: ggH theory uncertainties, WGamma cross section uncertainty, error on QCD contribution.
- ▶ Still currently ignoring QCD
- ▶ Had tried region with less QCD:
 - $m_{\text{sig}} > 4$, $\min \Delta\phi(\text{alljets}, \text{metnomu}) > 1.5$
 - expected limit: 0.9102
- ▶ Added $m_{jj} > 1000$ and CJV
 - expected limit: 0.5371

Updates

- ▶ Top reweighting is now fully included, no noticeable change to expected limit
- ▶ Prompt selection has been applied to parked data
 - Expected limit 51%, ignoring top and QCD
 - Worse limit seems to be due to fewer data events in Z control region
- ▶ Lxplus5 shut down, need to transfer limit code to IC SL5 machines

Scan through variables

- ▶ Have now also scanned through m_{jj} , met significance and jetmetdphi cut
- ▶ Best working point found was $\text{metsig} > 4$, $m_{jj} > 1000$, $\text{jetmetdphi} > 2.5$
 - Expected limit: 0.2764

Process	ggH	qqH	zvv	wmu	wel	wtau	top	wg	vv	total
Rate	21.5	316.0	143.8	71.9	47.7	10.2	4.4	3.6	5.4	287

- ▶ Weights for V+jets regions decrease further needs investigating
 - w_{enu} : 0.32, w_{munu} : 0.38, w_{tau} : 0 (clearly wrong), top : 0.55
- ▶ Limits ignoring systematics are 10.2%, was 16.6% for prompt
- ▶ 19 events in Z control region, was 12 for prompt

Uncertainty Impact Check- some low impact not listed

Nuisance	% change from removal	% change from addition
CMS_eff_m:	-0.7%	3.8%
CMS_scale_j:	-2.8%	3.8%
CMS_res_j:	0.0%	0.0%
CMS_scale_met:	0.0%	0.4%
CMS_VBFHinv_puweight:	-4.3%	29.6%
CMS_VBFHinv_zvv_norm:	-2.8%	27.7%
CMS_VBFHinv_zvv_stat:	-15.6%	84.1%
CMS_VBFHinv_wmu_norm:	-0.7%	4.7%
CMS_VBFHinv_wmu_stat:	-0.7%	3.8%
CMS_VBFHinv_wel_norm:	-0.7%	4.7%
CMS_VBFHinv_wel_stat:	-1.4%	6.7%
CMS_VBFHinv_tau_eff:	0.0%	0.0%
CMS_VBFHinv_wtau_norm:	0.0%	18.1%
CMS_VBFHinv_wtau_stat:	0.0%	17.1%
CMS_VBFHinv_zvv_extrapfacunc:	-9.2%	63.1%
CMS_VBFHinv_top_norm:	0.0%	0.0%
CMS_VBFHinv_top_stat:	0.0%	0.9%

The Wtau problem

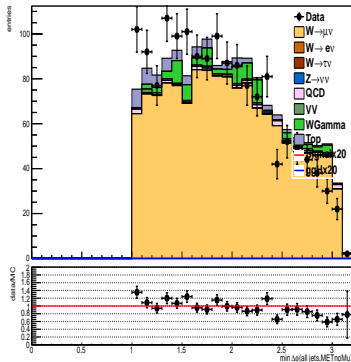
- ▶ W tau background weight is concerning
 - Only 2 events in data control region
- ▶ Added top reweighting and NCBkg became larger than NCData
- ▶ First remove CJV from all categories
 - Limit improved by a couple of percent on removal, seems redundant
- ▶ Doesn't change number of data events in tau control region

Loosening jet met dphi

- Next step: try loosening jetmetdphi cut in tau control region

Cut	NCDData	NSMC	Exp. Limit
>1.0	24	$118 \pm 32 \pm 24$	0.3926
>0.0	136	$118 \pm 12 \pm 10$	0.2803

- Is this extrapolation valid?
 - Check difference in mu nu shape where we have enough events
- Weight changes from 0.48 to 0.39 when cut loosened to 1.0
- Apply a 20% systematic to WTau estimate to account for this
 - Expected limit goes to 0.2998



Conclusions

- ▶ Next steps: BDT
- ▶ More work to be done on trigger weights
- ▶ Anne Marie raised the point that our W +jets and W Gamma samples may overlap
 - Filter has been added to light tree maker, will be applied next time light trees are remade

Backup

First try at limits

► Haven't fixed on QCD estimation method yet:

- Pick region where QCD small/negligible
- $\text{metsig} > 4$, $\min \Delta\phi(\text{alljets}, \text{metnomu}) > 1.5$

► Rates:

Process	ggH	qqH	zvv	wmu	wel	wtau	top	wg	vv	total bkg
Rate	146	930	1065	670	467	1207	76	84	41	3610

► Expected Limit: 0.9102

- Prompt expected was 0.49

► Wtau is dominant background

Uncertainty Impact Check - Impacts above 0.5%

Nuisance	% change from removal	% change from addition
lumi_8TeV:	-0.9%	0.0%
CMS_eff_e:	-0.9%	3.5%
CMS_eff_m:	-0.9%	13.3%
CMS_scale_j:	-28.1%	487.0%
CMS_res_j:	-2.6%	121.2%
CMS_scale_met:	-0.9%	13.3%
CMS_VBFHinv_puweight:	-0.9%	48.6%
CMS_VBFHinv_zvv_norm:	-0.9%	23.8%
CMS_VBFHinv_zvv_stat:	-2.6%	86.0%
CMS_VBFHinv_wmu_norm:	-0.9%	3.5%
CMS_VBFHinv_wmu_stat:	-0.9%	3.5%
CMS_VBFHinv_wel_norm:	-0.9%	3.5%
CMS_VBFHinv_wel_stat:	-0.9%	7.9%
CMS_VBFHinv_tau_eff:	-0.9%	74.9%
CMS_VBFHinv_wtau_norm:	-3.4%	175.9%
CMS_VBFHinv_wtau_stat:	-5.2%	234.0%
CMS_VBFHinv_zvv_extrapfacunc:	-8.6%	188.2%
pdf_qqbar:	-0.9%	0.0%

Scanned through variables

► Add CJV

- Expected limit: 0.7090

Process	ggH	qqH	zvv	wmu	wel	wtau	top	wg	vv	total
Rate	115	880	909	510	342	886	41	67	29	2783

► Add CJV and $m_{jj} > 1000$

- Expected limit: 0.5371

Process	ggH	qqH	zvv	wmu	wel	wtau	top	wg	vv	total
Rate	68	668	457	291	192	285	17	32	15	1288

Uncertainty Impact Check - cjv mjj1000

Nuisance	% change from removal	% change from addition
lumi_8TeV:	-0.7%	0.5%
CMS_eff_m:	-0.7%	8.0%
CMS_scale_j:	-23.3%	289.8%
CMS_res_j:	-0.7%	30.1%
CMS_VBFHinv_puweight:	-0.7%	23.0%
CMS_VBFHinv_zvv_norm:	-0.7%	22.1%
CMS_VBFHinv_zvv_stat:	-5.1%	85.4%
CMS_VBFHinv_wmu_norm:	-0.7%	5.0%
CMS_VBFHinv_wmu_stat:	-0.7%	5.0%
CMS_VBFHinv_wel_norm:	-0.7%	5.0%
CMS_VBFHinv_wel_stat:	-0.7%	8.0%
CMS_VBFHinv_wtau_norm:	-2.2%	116.0%
CMS_VBFHinv_wtau_stat:	-2.9%	144.1%
CMS_VBFHinv_zvv_extrapfacunc:	-9.5%	120.1%
CMS_VBFHinv_top_stat:	-0.4%	2.0%
pdf_qqbar:	-0.4%	0.0%