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First Look at Limits

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Updates on progress since last week

- Chayanit has producing 2D trigger weights binned in met and jet 2 pt to cross check
  - I need to remake light trees with these weights and have a look at control plots
- Cross-checked top control region with Higgs to tau tau
  - They get a scale factor of 0.9-1.1, we get 0.78 after applying top reweighting
  - Needs further study

Limits introduction

- Most systematics now implemented:
- lumi, lepton efficiency, JES, JER, UES, PU weight, V+jets and top data and MC stat., Z mumu→nunu extrapolation, other backgrounds MC stat, VBF signal theory uncertainties.
- Still missing:
  - ggH theory uncertainties, WGamma cross section uncertainty, error on QCD contribution.
- Also currently ignoring QCD
- Datacard maker written
  - Takes ~10 minutes to remake datacards with new selection if selection accessible with already made light trees

First try at limits

- Haven't fixed on QCD estimation method yet:
  - Pick region where QCD small/negligible
  - metsig>4, $min\Delta\phi(alljets, metnomu) > 1.5$
- 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%

Other regions tried

- 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 mjj$>$ 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%

Conclusions

- At preselection level limit is worse than prompt analysis
- Can get close to prompt limit just by adding CJV and mjj cuts
- Next steps: BDT, systematically optimise cut based
- More work to be done on trigger weights and top control region

Backup