

Sydney group update

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THE UNIVERSITY OF
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Carl: fit studies for tW dilepton [Rui Zhang (Bonn)]

- **Recap:** The Asimov fit at 1/fb with $t\bar{t}$ norm floated looks good.
- At 140/fb some modelling systematics are heavily constrained.
- Work suggesting large constraints are expected with large lumi. [[arXiv:1805.03961](#)]
- But why only for some systematics?
- For bin i , the Poisson fluctuations are $\sqrt{n_i}$ and systematic fluctuations Δ_i give:

$$\Delta \otimes \Delta \equiv \sum_i \frac{\Delta_i^2}{n_i}$$

- $\Delta \otimes \Delta$ measures how large the systematic is wrt. statistical uncertainty.

Prediction of constraint

$$\hat{\sigma}_\alpha \propto \frac{1}{\sqrt{(1 + \mathcal{L} \cdot \Delta_0 \otimes \Delta_0) - \mathcal{L} \cdot \frac{(s_0 \otimes \Delta_0)^2}{s_0 \otimes s_0}}}. \quad (9)$$

If $1 \ll \mathcal{L} \cdot \Delta_0 \otimes \Delta_0 - \mathcal{L} \cdot \frac{(s_0 \otimes \Delta_0)^2}{s_0 \otimes s_0}$, then

$$\hat{\sigma}_\alpha \propto \frac{1}{\sqrt{\mathcal{L}}}. \quad (10)$$

- Further investigation shows the dominant term is $(1 + \mathcal{L} DxD)$:

$$DxD := \Delta_0 \otimes \Delta_0$$

$$1 + \sum_{\text{bins}} \frac{\Delta_i^2}{n_i} \triangleq 1 + \Delta \otimes \Delta$$

- By calculating this term, we will be able to predict whether a NP will be constrained or not before fitting.
For templates scaled to 1/fb, with L=140.5fb
 - If $DxD > 0.1$, $1 + \mathcal{L} DxD \geq 100$, heavily constraint!
 - If $DxD < 0.01$, $1 + \mathcal{L} DxD \leq 2$, moderate constraint!
 - If $DxD < 0.001$, $1 + \mathcal{L} DxD \approx 1$, no constraint!

1j1b+2j1b+2j2b fit

NP: Rebin=2, 3 region(s)	DxD	Lumi	Expected	Individual fitted	Global fitted
tW_DS_FS	1.631	140.5	0.066	+0.0690446	+0.225827
tW_HS	0.225	140.5	0.175	+0.292288	+0.394982
tW_PS	0.677	140.5	0.102	+0.176357	+0.445011
ttbar_HS	7.647	140.5	0.030	+0.0315471	+0.105612
ttbar_PS	12.392	140.5	0.024	+0.0278024	+0.15949
tW_AR	0.070	140.5	0.303	+0.314089	+0.80614
ttbar_AR	0.416	140.5	0.130	+0.238656	+0.348416
EG_RES_ALL	0.001	140.5	0.923	+0.894918	+0.912652
EG_SCALE_ALL	0.002	140.5	0.880	+0.785246	+0.914841
Jet_BJES_Response	0.010	140.5	0.640	+0.153673	+0.539892
Jet_EffectiveNP_Detector1	0.001	140.5	0.962	+0.916339	+0.963045
Jet_EffectiveNP_Detector2	0.000	140.5	0.997	+0.974359	+0.989216
Jet_EffNP_Mixed1	0.001	140.5	0.947	+0.865421	+0.940758
Jet_EffNP_Mixed2	0.001	140.5	0.932	+0.844878	+0.940311
Jet_EffNP_Mixed3	0.000	140.5	0.994	+0.97833	+0.984879
Jet_EffNP_Modelling1	0.050	140.5	0.352	+0.155567	+0.698478
Jet_EffNP_Modelling2	0.001	140.5	0.935	+0.838842	+0.9253
Jet_EffNP_Modelling3	0.001	140.5	0.957	+0.888183	+0.956658
Jet_EffNP_Modelling4	0.000	140.5	0.994	+0.981166	+0.986044
Jet_EffNP_Statistical1	0.000	140.5	0.980	+0.953993	+0.97608
Jet_EffNP_Statistical2	0.001	140.5	0.927	+0.81522	+0.926097
Jet_EffNP_Statistical3	0.000	140.5	0.986	+0.969077	+0.980248

If $DxD > 0.1$, $1+\mathcal{L}DxD \gtrsim 100$, heavily constraint!
 If $DxD < 0.01$, $1+\mathcal{L}DxD \lesssim 2$, moderate constraint!
 If $DxD < 0.001$, $1+\mathcal{L}DxD \approx 1$, no constraint!

Results of 1j1b region fit in backup