TOP-22-006 ARC-Authors Meeting: Dec 12, 2022

Summary of open questions

Aashwin Basnet 1, Ken Bloom 3, Florencia Canelli 5, Enrique Palencia Cortezon 2, Sergio Sánchez Cruz 5, Andrea Trapote Fernández 2, Reza Goldouzian 4, Bárbara Álvarez González 2, Xuan González 2, Mike Hildreth 4, Kevin Lannon 4, John Lawrence 4, Sascha Liechti 5, C. Eddie Mcgrady 4, Kelci Mohrman 4, Hannah Nelson 4, Wynona Wan 4, Andrew Wightman 3, Brian Winer 1, Furong Yan 3, Brent Yates 1, Henry Yockey 4, Mateusz Zarucki 4

1: The Ohio State University
2: University of Oviedo
3: University of Nebraska
4: University of Notre Dame
5: University of Zurich

Overview of status

- Our analysis twiki (with answers 83/86 of the questions) is here
- Questions that we would like to discuss today:

1. Handling of the renormalization/factorization systematics:
    - "L1016: how much shape effects remain after taking the uR and uF envelope? wouldn't it make more sense to treat them independently, to get the full shape effect?"
2. Interpretation of sensitivity:
    - "There are not many figures. Are there others that could be interesting to include, showing the effect of some non-zero WCs on the yields, for example? Currently it is difficult to understand why some WCs are well-constrained while others are not, and what features of the data are exploited in the fit to reach this sensitivity."
    - "About the results: It would be good to present & discuss in the paper what is the "relative" contribution of the individual (groups of) categories to the sensitivity to individual EFT operators. Did you try to study/understand/visualize this in some way? E.g. perhaps one could try to extract for each EFT operator the WC uncertainties arising from the individual (groups of) categories (by including/excluding them individually in the fit), and to use the relative fraction of the corresponding WC uncertainties^2 in the total sum of WC uncertainties^2 as a measure of the relative contribution of each individual (groups of) categories to the sensitivity to individual operators."

Renormalization and factorization systematics

- Currently using an envelope approach
  - An envelope approach is suggested on the TOP systematics twiki
  - How we implement it: Look at combinations of variations (where the scales are varied independently and together) and take the largest fluctuation as the "renormfact" systematic
  - We agree this would result in some shape effects being lost (specifically, effects that would fluctuate the low end of a distribution in the opposite direction as the high end)
- Have tested an alternative approach:
  - Treat muR and muF as independent systematics, and also de-correlate across processes (so we have a separate muR and muF nuisance parameter for each process)
  - Asimov limits are barely affected by this change (for profiled scans, largest change for any WC is an improvement of ~1%)
- We would like to discuss how the ARC would suggest proceeding

Interpretation of results

- We agree that it would be good to include some information in the paper about which categories provide the most sensitivity for the WCs
- What we already know:
  - The 4heavy WCs only impact 4t, and 4t contributes mainly to 2lss 3b, so the 2lss 3b categories are important for 4heavy WCs
  - The 2-qark-2-lepton WCs produce pairs of leptons without an intermediate Z, so the 3l off-Z categories are important for these
  - The WCs involving Z bosons should contribute to ttll and tllq and populate the on-Z channels, so the on-Z channels are important for these WCs
  - The 3l onZ 2b 2/3j categories are important for cQq13 and cQq83 WCs (when we use ptZ here we lose significant sensitivity to these WCs)
- We are continuing to work on several approaches to quantify which categories and processes are most important for each WC