Future LHC EFT WG:

some input for the discussion

S. Kortner, A. Lister, H. Mildner and L. Xu
on behalf of the ATLAS Global EFT Fit effort

In addition to ongoing EFT efforts within the LHC Top WG, LHC SM WG and the LHC Higgs XSWGs, the experiments would strongly profit from a joint centrally coordinated EFT effort, involving close interactions between the theory and the experiment community. We support the targets outlined in the preliminary document.

Some highlighted topics follow, many overlaps with discussions in other LHC WGs, e.g. see https://indico.cern.ch/event/907129/ .

Challenges of global EFT fits

- Guidelines/recommendations on which MC tools with which settings to use.
  - We need a common model for a global Higgs/EW/Top fit,
    as symmetric as possible in flavour, but treating the top quark separately.
    E.g. dedicated SMEFTsim and SMEFTatNLO models being considered.
  - Which input parameter scheme (m_W vs alphaEW)?
  - Which operators can be neglected for certain Higgs/Top/EW processes
    because they are better constrained elsewhere? This would make the
    transition from individual to the global fit easier and more robust.

- If several MC tools/models are used for one EFT fit:
  - Recommendations on which models are best for which purpose.
  - Use the same conventions in defining and naming the parameters
    (ideally, otherwise provide dictionaries/translations).
  - Guidelines for consistency checks between the models. (Already available?)

2

Testing applicability of the EFT regime: need a common strategy

- Treatment of quadratic terms (in dim-6 EFT expansion).

  - Always show results for both *linear-only* and *linear+quadratic* terms?

  - How to treat observables in which dim-6 quadratic terms (c_i^2) are dominant?
    Is the linear fit of any value there?
    Ignore such observables in global fit? Or cut on the relevant phase space?

  - Should "double insertion" terms ($c_i * c_j$) also be considered as quad. terms?

- Energy scales:

  - How can we as experimentalists determine the energy scale probed by a
    given process in order to check if this is still in the EFT validity regime
    (p_T scale of the process or similar)? Can we cut out data close to EFT scale?

Theoretical systematic uncertainties

- Full list of relevant sources of uncertainties, and guidelines how to treat them.

  - Missing higher-order QCD and EW calculations
    (on SM, NP predictions, and interference as well as their correlation).
  - EFT impact on measurement uncertainties for SM input parameters.
    (E.g. should PDF be evaluated simultaneously with EFT parameters? How?)
  - Uncertainties from the truncation of coefficients in dim-6 expansion
    (i.e. coefficients whose contribution is much smaller than the exp. precision).
  - Other sources?

Measurements and Observables

- Guidance on important LHC measurements/observables and priorities
- Guidelines on how to include LEP and low-energy measurements