An LHC EFT WG?
… a discussion @ HEFT2020

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https://indico.cern.ch/event/908975/

to join the WG mailing list:
https://simba3.web.cern.ch/simba3/SelfSubscription.aspx?groupName=lhc-eftwg

Thanks to Jose and the whole HEFT LOC for setting up a great mtg, despite the difficult times.

And thanks for having accepted to host this special session…

What are LHC working groups?

- Established under the umbrella of the LPCC, as part of the LPCC mandate from the CERN management, and in collaboration with the management of the LHC experiments
- They address topics of common interest to several LHC experiments, primarily in the context of the interpretation of LHC data, and typically in collaboration with the theory community
- Depending on the subject, LHC WGs carry out data combinations/ comparisons, assess MC tools and TH predictions and systematics, develop commonly agreed standards for various aspects of exptl analyses and provide recommendations to the physics groups of the experiments
- They provide input to the LHCC for discussions related to the run plans
- List of currently active LHC WGs ** :

- **Top quark**
- **Electroweak**
- **Flavour**
- **Dark Matter**
- **Machine Learning**
- **Forward physics**

** *PDF4LHC & HXSWG are supported by LPCC, but are not under its umbrella*

Why an LHC EFT working group?

- EFT methods benefit from a common methodology applied to data analyses in areas traditionally considered distinct. The same operators can appear in the EFT interpretation of top, Higgs, EW and low-E measurements, etc
- An EFT WG could provide the framework in which general aspects of EFT analyses are discussed, providing recommendations that guarantee the coherence and consistency of the EFT approaches adopted by the different WGs, leading to stronger scientific outcomes
- The EFT WG would not centralize the dedicated discussions taking place within each WG to define the experimental strategies related to a given set of observables (eg selection of template XSs).
- It would rather centralize the discussion of issues of common interest to all EFT analyses, collecting input from all relevant WGs, and helping negotiate common prescriptions and approaches in view of global fits etc.
- The WG would also provide a forum for dedicated discussions of more theoretical nature

Recent activities, as possible templates for WG initiatives

CERN-LPCC-2018-01

Interpreting top-quark LHC measurements in the standard-model effective field theory

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Abstract

This note proposes common standards and prescriptions for the effective-field-theory interpretation of top-quark measurements at the LHC.

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Proposal for the validation of Monte Carlo implementations of the standard model effective field theory

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Abstract

We propose a procedure to cross-validate Monte Carlo implementations of the standard model effective field theory. It is based on the numerical comparison of squared amplitudes computed at specific phase-space and parameter points in pairs of implementations. Interactions are fully linearised in the effective field theory expansion. The squares of linear effective field theory amplitudes and their interference with standard-model contributions are compared separately. Such pairwise comparisons are primarily performed at tree level and a possible extension to the one-loop level is also briefly considered. We list the current standard model effective field theory implementations and the comparisons performed to date.

Preparing this discussion

Early feedback was collected, and implemented in the google doc:

https://docs.google.com/document/d/120Jp8BFqBFWgZcMoIZEl7SEpGcdA4-vX7WqE7-NSQp4/

I will briefly summarize here its original contents.

Additional comments were posted in the last few days by participants.

I will leave these to the following contributions and to the final discussion.

General aspects of the WG mandate and goals setting

- Discussions should address all aspects, from EFT tools, to their use and applications in fits etc, to the more formal QFT aspects

- An important target of the WG would be to highlight, define and agree on what are the relevant questions. Reaching consensus on the answers, while desirable, may not always be possible, and cannot be set as part of the mandate. Different perspectives should be documented and can be incorporated in alternative analysis approaches by the experiments.

- Previous experience and discussions in various contexts showed a clear polarization in perspective on some issues. The group should deliver even if there is no consensus on all points, provided the issues are properly spelled out, and those using the tools do it in a coherent way. Defining the context and implications of issues for which consensus cannot be reached could be a notable contribution of the WG.

Proto-list of topics for open issues, directions, focused activities

- Address the challenges of global EFT fits, including inputs from top, EW, Higgs, etc. These range from the consistent use of MC tools, to a coordination of different experimental analysis to identify correlated systematics, generation settings, etc.etc.
- map classes of observables (eg diboson final states) to classes of EFT op's, to streamline the EFT interpretation
- reassess the perspective for the future measurements of specific Higgs properties (eg the selfcoupling) in the broader EFT context.
- discuss how to incorporate first-principle TH constraints (eg positivity of EFT coefficients for specific operators) in the global fits
- incorporate in a more systematic way the impact of EFT op's in the modeling of Higgs production (*as well as of backgrounds*) not just decays etc.
- Reference to concrete BSM models can help making this exercise less generic and more incisive, by selecting, for specific BSM scenarios, the set of op's that must be taken into account.
- Discuss how to incorporate first-principle TH constraints in the global fits — eg positivity of EFT coefficients for specific operators, unitarity, …
- Review in more detail the procedures used by the experiments to define the domain of applicability of the EFT regime, particularly for complex fiducial analyses with different cuts etc

A proposal for the composition of the WG leadership and its selection

- Core conveners:
  - TH reps
  - EXP reps
- Contacts with other WGs:
  - [1 TH and 1 exp for the Top, EW WGs] + [1 TH and 2 exp for HXSWG]

Nomination process:

WG contacts: proposed by the respective WG conveners (HXSWG Steering Group for the HXSWG)

TH conveners: I am collecting (self)nominations. Will be reviewed with the WG contacts

EXP conveners: selected as usual by Physics Coordinators

The discussion

- Short scheduled contributions [5’ + discussion]. There is room to add more, post a request on the vidyo chat box, followed by open discussion
- Let’s focus on general aspects, like
  - targets, documentation goals
  - collaboration and synergies among the EFT WG and the EW, Top and HXSWG
  - operation mode, subgroups?, …
  - convenership issues
  - …
- Discussion rules: enter your name in the chat box if you have a question or want to comment, I’ll process requests