Area 2 targets:
Inputs for discussion

A. Jafari, for Area 2 activists

5th General meeting LHC EFT working group
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Area 2 of LHC EFT WG

Predictions and Tools

This is the home page of the Predictions and Tools Activity Area of the LHC Effective Field Theory Working Group.

* Send mail to conveners

Topics covered by the activity area

This activity area addresses all issues of how to simulate EFT and generate events; understanding of the limitations of the models and agreements on the way to proceed in the EFT publications and calculations. Identification and estimation of all relevant theory systematics, and calculation in a form which is usable in likelihood fits by the experimental community; investigation of matters related to the computational limitations in the events production for experimental analyses.

- Guidance
  - Availability (analytic & numeric), usage, assumptions, uncertainties, interplay of tools
  - Reweighting techniques to reduce the full detector simulation sample size (and validation of those techniques)
  - Higher-order corrections in SM couplings
- Deliverables
  - Cross-validation at tree and loop levels
  - Common MC generation and/or settings across experiments
  - Observable calculations (including e.g. fiducial cross-sections, see Area 3.) and analytical parameterizations (also to NLO), comparisons between tools, uncertainties
  - Tools to relate parameters, measured quantities, etc
- Specific theory developments
  - Recommendations for the treatment of unstable particles (combining EFT dependence in production, total width, and decay; treatment in MC tools) (**)
- EFT in PDFs, alpha_s, shower and hadronization

Area 2: what has been done so far?

Working group meetings:

- General and activity area meetings: Indico category
- Dedicated Area 2 meeting (Jan 31 2022)
- Area 2 slot in the 3rd general meeting (22 Nov 2021)
- Area 2 report in the 2nd general meeting (03 May 2021)
- Dedicated Area 2 meeting (14 Dec 2020)

Summary of Tools Presented at Meetings

- Presentations on the following tools are available through the links below:
  - SMEFTSim
  - SMEFT@NLO
  - Madgraph5_aMC@NLO
  - EFT in JHUGen
  - EFT in SHERPA
  - EFT in VBFNLO
  - EFT in Powheg-Box
  - Proposal for the validation of MC implementations of SMEFT
- Application and comparison of the available predictions and tools :
  - ATLAS studies incl. SMEFTsim vs SMEFTatNLO comparison
  - CMS studies incl. MadGraph, JHUgen and analytical comparisons
  - Matching studies for ttW/Z/h + jet in SMEFT
  - A treatment for pure SM (EFT) and interference terms for dimension-6 operators in VBS and diboson production

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Area 2: what's next?

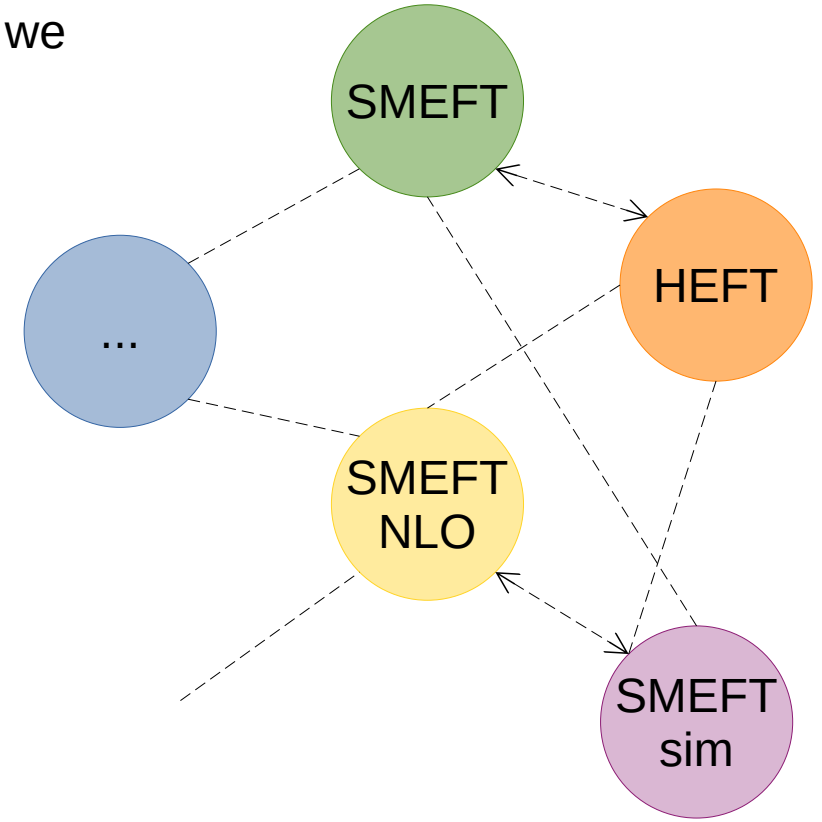
Cross talk between available models and tools

Shall we aim at a database for **conversions** such that we can walk from one model to the other?

Some ideas:

- A dictionary of notations
  - At LO and at the one-loop level?
- Cross validation of tools

Prerequisites: validate it on some agreed-upon observables?



Cross talk between available models and tools

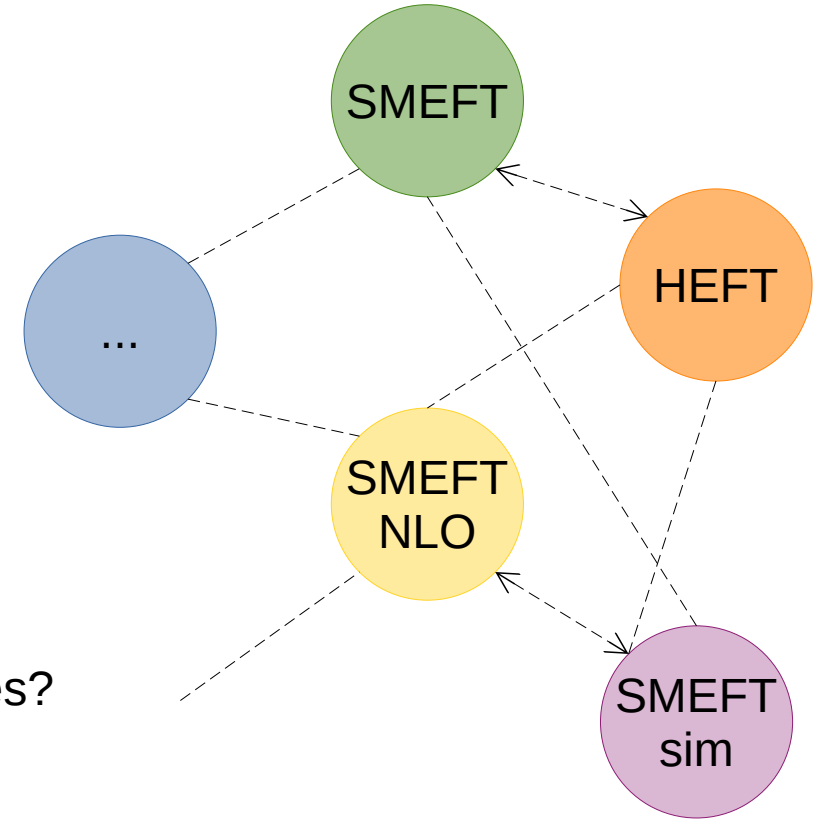
Shall we aim at a database for a number of **standard observables**, such that we can walk from one model to the other?

Some ideas:

- Predictions in different inputs/flavors/orders
- Benchmark for different values of relevant parameters (α_s, PDFs, NLO EWK, …)
- Collection of numerical values for NLO predictions where MC production is not possible
- Shared EFT parametrisation

Talk by Matthew

Prerequisites: common “binning”? Similar phase spaces?



EFT in experimental corner

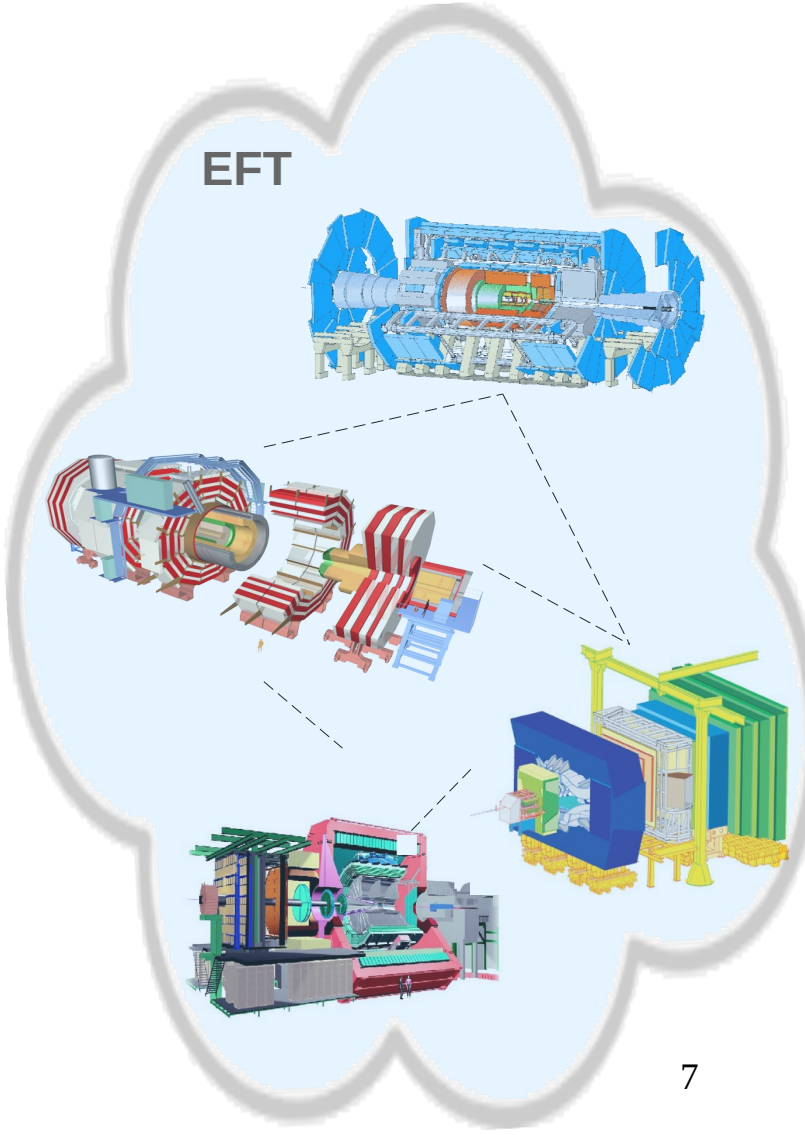
Comparability of model implementations and results, validation of techniques

Some ideas:

- Statistical/theory uncertainties in MC generation procedures
  - Generation of EFT samples, reweighting and its different practical ways, …

Talk by Olivier

- Considering helicity-aware generation?
- Some standard EFT samples (can be small) common across experiments?
- More practically towards NLO: reweight existing SM samples?



EFT beyond Matrix-Element

How ignorant we are if we consider EFT “only” at ME?

- What is the effect of EFT in the PDF fitting/extraction?

Anything else?