Area 4 Targets: Fitting Exercise

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Area 4

Fits and Related Systematics

This is the home page of the Fits and Related Systematics Activity Area of the LHC Effective Field Theory Working Group.

* Send mail to conveners

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  - Documents
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Topics covered by the activity area

This activity area covers issues which are either generic, i.e. they don't depend on specific final states, or that concern the interpretation, preparation and performance of global fits of ATLAS, CMS, LHCb results, together with additional existing measurements, future projections, experimental systematics related to EFT.

- Experimental EFT fits: ATLAS+CMS+... combination of H+EW+Top
- Inputs and outputs, fitting procedures and tools
  - Practical considerations of limited time and experimental input
  - Fitting benchmarks for synchronisation
  - Comparisons of input information between experimental results
  - Compare fits: experimental/theory, among different groups
  - Consideration of common WG fit, framework and/or approaches
- Comparison to, and inclusion of, non-LHC constraints (LEP, Tevatron, flavor, g-2, EDM, etc.) in fits and/or to set priorities among targeted measurements/operators and in sensitivity optimization
- Theoretical systematics, and their correlations (see Area 2.)
- Experimental systematics, and their correlations (see Area 3.)
- Presentation of EFT Fits: multi-D likelihoods, covariance, flat directions, etc…
- Projections of EFT fit constraining power

The Fit

One prime objective of Area 4 is to bring ATLAS and CMS to the level where a robust procedure for a combination is built. It is proposed to perform an exercise to combine ATLAS and CMS constraints in the EFT framework

The scope of this exercise is **not** to provide a comprehensive combination of the available information from all LHC processes, but rather to identify key aspects that may need to be addressed in such a study in the future:

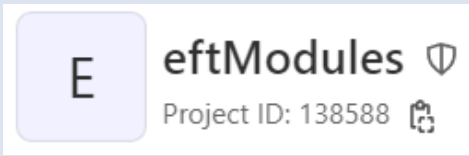
1. Implement the conventions and recommendations of the WG
2. Identify possible technical difficulties that may arise in the process of combining inputs
3. Determine optimal configuration of the fitting techniques to be used in future combinations

See earlier talk by Fabian Stager for the details

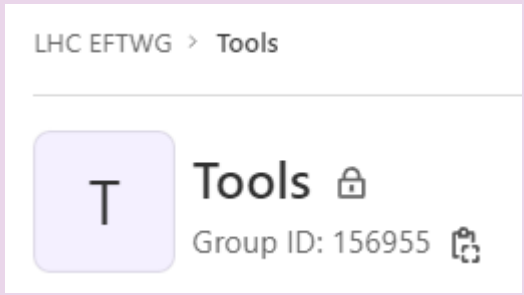
Consolidation

CMS Implementation

ATLAS Implementation



LHC EFT WG Repository



Fully Public?
Public tags?
Public Results?

Benchmarks / Validation / Exploration

Area 1 Target (see Ilaria's slides) – testing the truncation and uncertainty prescriptions

- Public note contains 4/5 proposals , does not make recommendations
- We can directly experiment with each proposal and make comparisons to converge towards the most robust approach(s)

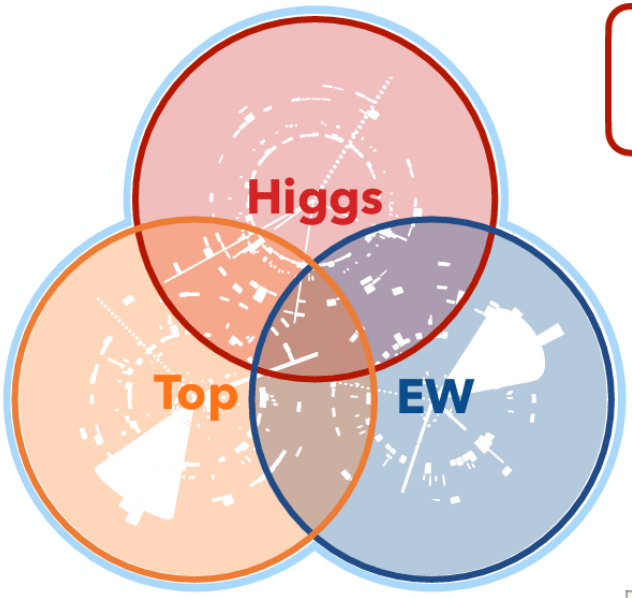
Area 3 Target (see Anke's slides) – testing pre-trained ML models for optimal observables

- This should be tested on single analyses / EFT coefficients first
- But existing Area 4 combination fit is an ideal testing ground for extension to multiple processes

Area 5 Target (see Kristin's slides) – fit benchmark UV complete models mapped to SMEFT

- This should be tested on single analyses / EFT coefficients first
- But existing Area 4 combination fit is an ideal testing ground for extension to multiple processes

Extensions



Sketch inspired from Ken Mimasu

Single Top (t-channel)

H→yy
H→yy + H→ZZ*→4l
+VH, H→$b\bar{b}$

Wγ production
WW production
WZ production
EW Zjj production
EWPO - Zpole data

Inclusion of more (top) physics analyses!

Inputs		Linear	Linear + quadratic
Wγ	CMS		
H$\gamma\gamma$	CMS		
single top	CMS		
Higgs comb.	ATLAS		
WW	ATLAS		
WZ	ATLAS		
EW Zjj	ATLAS		
Zpole obs.	LEP		

Extensions

Currently using public information only (HEPData) – ideally analyses with rivet routines, covariance matrices etc

- Does it have to stay this way?
- We are making any approximations in these studies that the 'real' fit will not, and which hinder / complicate the exercise in a non-negligible way?
- The mandate is **not** to perform the real physics combinations, but is it possible to avoid unnecessary challenges?
- Regardless we should otherwise encourage the experiments to make all useful information public (covoariance matrices, full likelihoods etc)

Bimodal

The Area 4 fitting exercise can be both:

- **Proactive;**
  - Producing a complex fit
  - Extending to new processes
  - Seeking out problems towards producing a real powerful physics result

- **Reactive;**
  - Responding to proposals from other areas
  - Responding to requests / queries from experiments / theorists

BACKUP