Fitting Exercise: CMS Vision

Pietro Govoni, Alexander Grohsjean, Pedja Milenovic, Kirill Skovpen

3rd of May 2021

snapshot of existing results

TOP

- multiple approaches
  - unfolded distributions
  - fits at detector level using reweighted MC truth for EFT
  - full detector level analysis including first experience with machine learning
- Warsaw basis (mainly dim6top, but also NLO predictions)

HIGGS

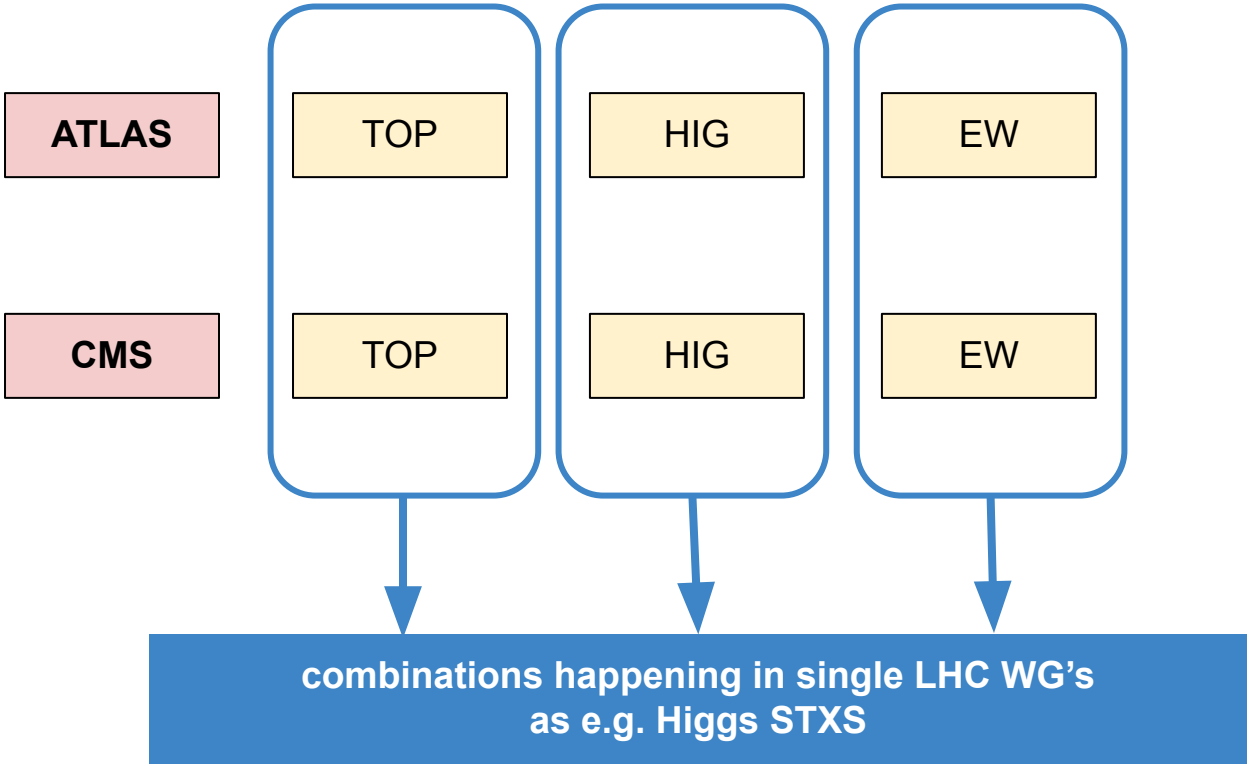
- multiple approaches
  - STXS
  - dedicated analyses using ME techniques and fully-simulated BSM
  - unfolded distributions (not yet used for EFT)
- different bases but easily translatable at LO: Higgs and SILH so far

SMP

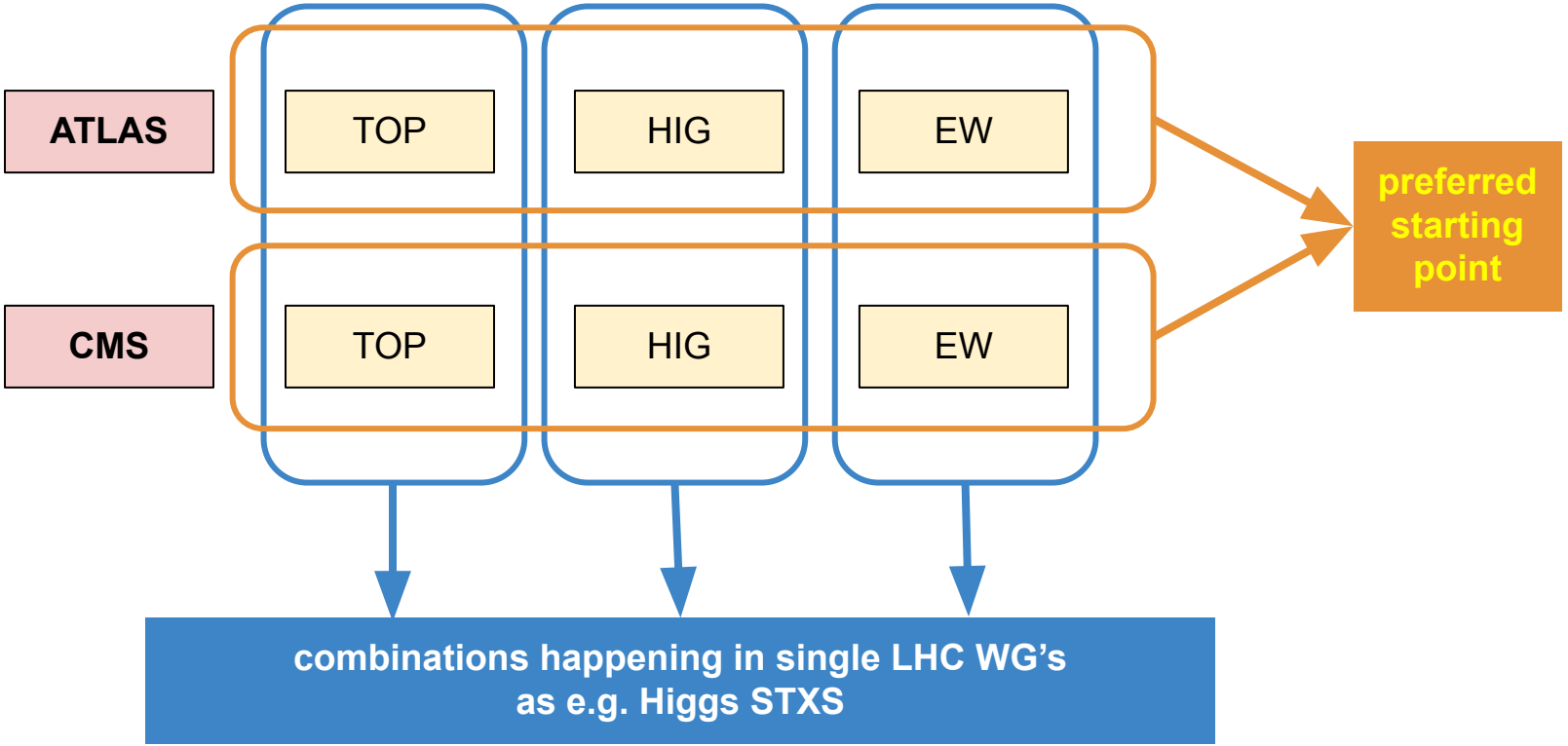
- in most of the cases dedicated analyses with fully-simulated BSM
- several operator sets used, including dim-8 ones
- typically a small set of operators considered

see talk in 1st LHC EFT meeting for more details

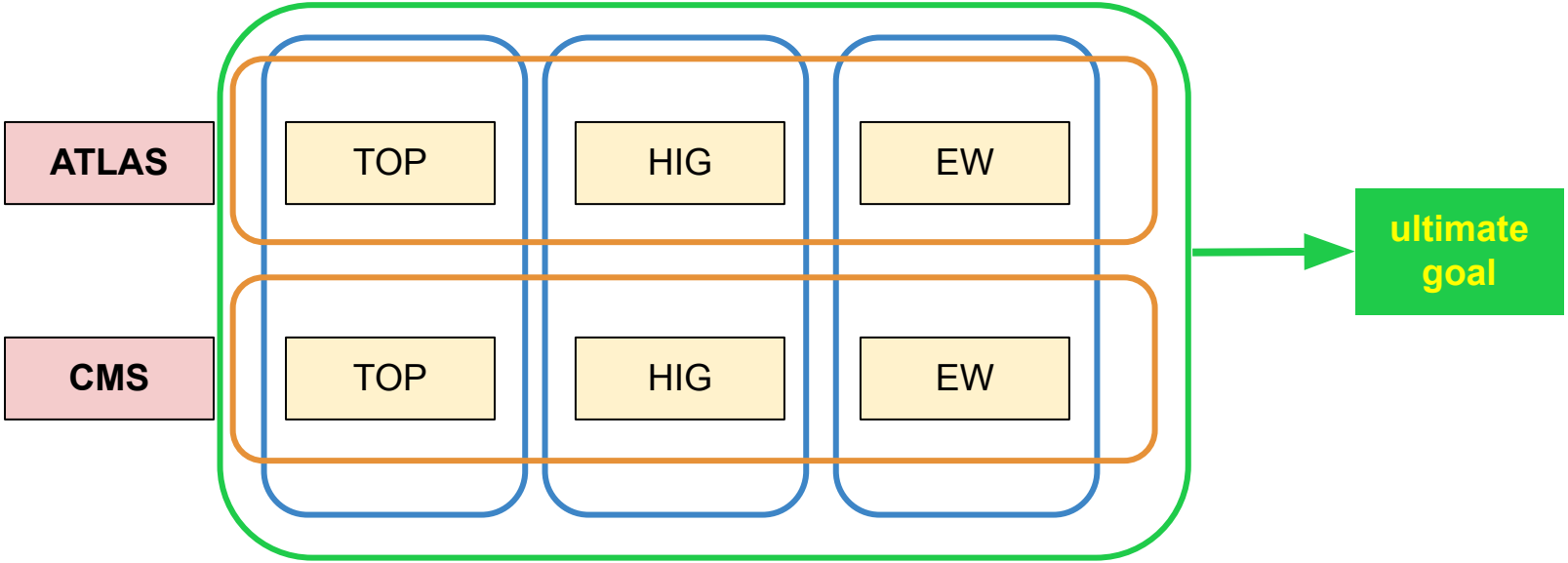
combination ordering



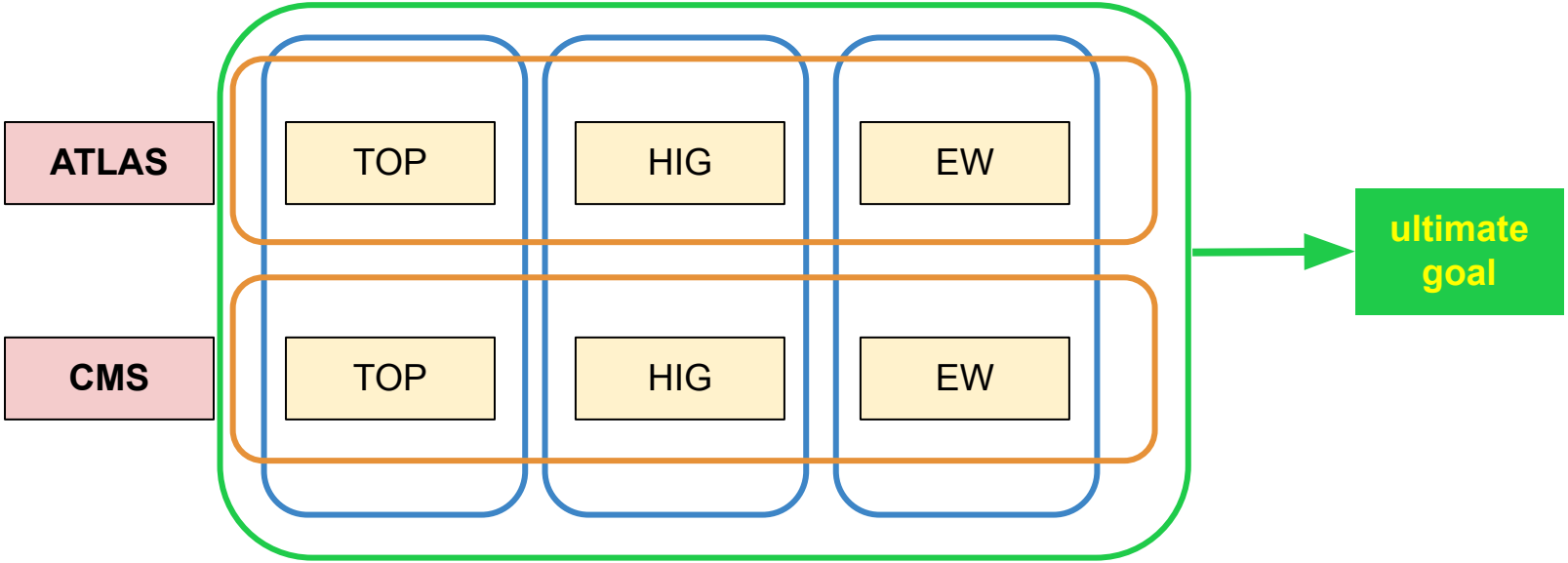
combination ordering



combination ordering



combination ordering



- this choice dictates a timescale for a joint data combination which most probably goes beyond a year

CMS internal EFT fit I

- data combination with ATLAS can happen only **after internal combination** is done **within CMS**
  - author list is restricted to experiment, but individual theory authorship is possible (rules exist for significant contributions)
- combination **based on MC** can start **immediately** with workspaces from published analyses which can evolve to a publication of MC projections with a flexible author list (theory+experiment)
- keep the **first exercise** with CMS data **simple:**
  - **dim 6 in the Warsaw** basis
  - gather final states from t**op, higgs, EW physics with Run 2 results**
  - **not to include everything** from the beginning: **incremental addition** of analyses
  - be able to and jointly fit analyses performed with **different technical approaches** (STXS, unfolded histograms, dedicated EFT analyses at detector level…)
- need for **recommendations from theory**
  - technical deployment of the Warsaw basis, relate to other bases
  - when needed, treatment of NLO effects

CMS internal EFT fit II

- explore the potential of **being orthogonal** to already existing EFT combinations
  - understand and omit **biasing SM assumptions** (e.g. background, unfolding)
  - might prefer being selective: **dedicated analyses w./ combination in mind**
    - orthogonal phase spaces (ATLAS example of HWW and WW)
    - probe **optimal observables** and **ML based techniques** including nuisance parameters
- implement prescriptions for **EFT related uncertainties** as discussed in Gauthiers talk today (and understand potential of GEO SMEFT?)

fitting with ATLAS analyses

- first interactions may start immediately based on **expected results from MC** simulations
- using **likelihoods (workspaces)** is an interesting and important part of the exercise
- crucial to have regular working meetings within the LHC EFT WG to facilitate the combination

- agree on **EFT modeling implementation** in the fit (e.g. should we allow for the possibility of dim. 8 inclusion from the beginning?)
- agee on **naming conventions** for samples and nuisances
- agree on compatible **common nuisances** treatment (for pdf, luminosity)
- define a **common procedure for unitarisation** when needed and s**ystematic uncertainties**
- develop / share instruments that allow to **run fitting tests quickly**
- while ATLAS and CMS results are signed by the entire collaboration, rules do exist to allow individual theory colleagues to have a **significant work recognised with authorship**