

Disclaimer: Just a collection of ideas from Alexandra Carvalho, Torben Lange, Fabio Monti (for now)

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1. “The HH reweighter toolkit”


- a. General approach/parametrization not new but the methods used are new, was pioneered by Alexandra Carvalho and Tomaso Dorigo
- b. We could create a python/C++ based reweighter tool for CMS/ATLAS analysis that can take different sets of coefficients as input and this paper documenting its use
- c. Together we could release a new set of coefficients for HEFT with a special focus on the boosted region at 13.6 (13 TeV)
- d. Extract coefficients also for SMEFT
- e. Discuss the binning/choice optimization
- f. Provide uncertainties for the method
- g. Also understand additional differential theory uncertainties
- h. Give an overview of the statistical performance of the method in different phase space regions to highlight the validity of the model

Notes:

People CMS: Alexandra Carvalho, Matheus Coelho, Pedro Mercandante, Torben Lange, Nicola de Filips (for now)

People ATLAS:

People theory:



1. “Efficient Di-Higgs signal modelling with the Matrix inversion method”

- a. Summary of the general approach, references to previous application. Model (for HH) was pioneered by Luca Cadamuro, later Fabio Monti, Marcel Rieger, Torben Lange before application to more production modes (with list increasing) i.e not original work needs to be referenced – was used on CMS Nature HH comb
- b. Overview of Basis sets/parameterizations used during Run2, highlight of limitations / problems with these / non positivity of signals/ stat limitations. Here we can also add ATLAS, i.e share between experiments what has been used. (Documentation/Sharing with ATLAS)
- c. Approaches to the optimization of basis sets, quality criteria for the performance of a given basis/parameterization. (Original to this work)
- d. Statistical aware approach to the Matrix inversion method and its implications (Original to this work)
- e. Recommendations for Run3 and beyond: ggHH (SM, HEFT, SMEFT?), qqHH, VHH, ttHH, HHH (Overview and some basis sets original to this work, we can synchronize with ATLAS in i.e expanding HEFT to 5D)

- f. Validation / Closure of different basis sets either on LHE or in more realistic phase space, use LHE closure to estimate an uncertainty for this method i.e look at closure / stat power as function of POIS, assign either flat or POI space dependent uncertainty (Original to this work)
- g. Outlook: Potential future use cases like non-resonant/resonant inference / production modes/scenarios that dont make it into e), remaining limitations

People CMS: Marcel Rieger, Torben Lange, Fabio Monti, Alexandra Carvalho, Nathan Prouvost, Yihui Lai (VHH), Giacomo Zecchinelli (ttHH), Aravind Sugunan (HHH), Mathias Schroeder (HHH), Xiangran Li (HHH) (growing list, especially adding SMEFT) (for now)

People ATLAS: names

People theory:

==> It can include SMEFT with the matrix inversion method (also on VBF HH, ttHH, and HHH?)

1. "Utilizing UV Model constraints in the HH sector"
  - a. Recommendations/new mapping for experiments to explore. It could include mappings to HEFT and to SMEFT
  - b. Recasts of CMS / ATLAS results if possible (i.e full likelihoods needed or just parameter ranges), depending on what can be shared/used outside experimental context

People CMS: Alexandra Carvalho, Torben Lange (for now)

People ATLAS:

People theory:

==> could LHC WG4 conveners help to identify the interested theorists' parts? (There should be at least Florian Goertz for matching with HEFT) — see COMETA 1st general meeting, Jona Motta talk

2. "Efficient Di-Higgs signal modelling with the Matrix inversion method — to model interference between resonant and non-resonant with general parametrization"
  - a. Physics model approach: In CMS, we saw that it is possible and can be a tool. This modelling part we could already start synchronized among experiments
  - b. Signal-only study of realistic smearing in a few benchmarks with different widths and interference patterns for 4b and bbgg phase space for the exercise
  - c. Personpower on the theory side could contribute with toy analysis tests – it is also an opportunity for statistical training

People CMS: Alexandra Carvalho, Torben Lange, Daniel Winterbotton, Chuxue Yang (for now)

People ATLAS:  
People theory: