

# EFT session Higgs Hunting 2025

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# EFTs: Where do we stand?

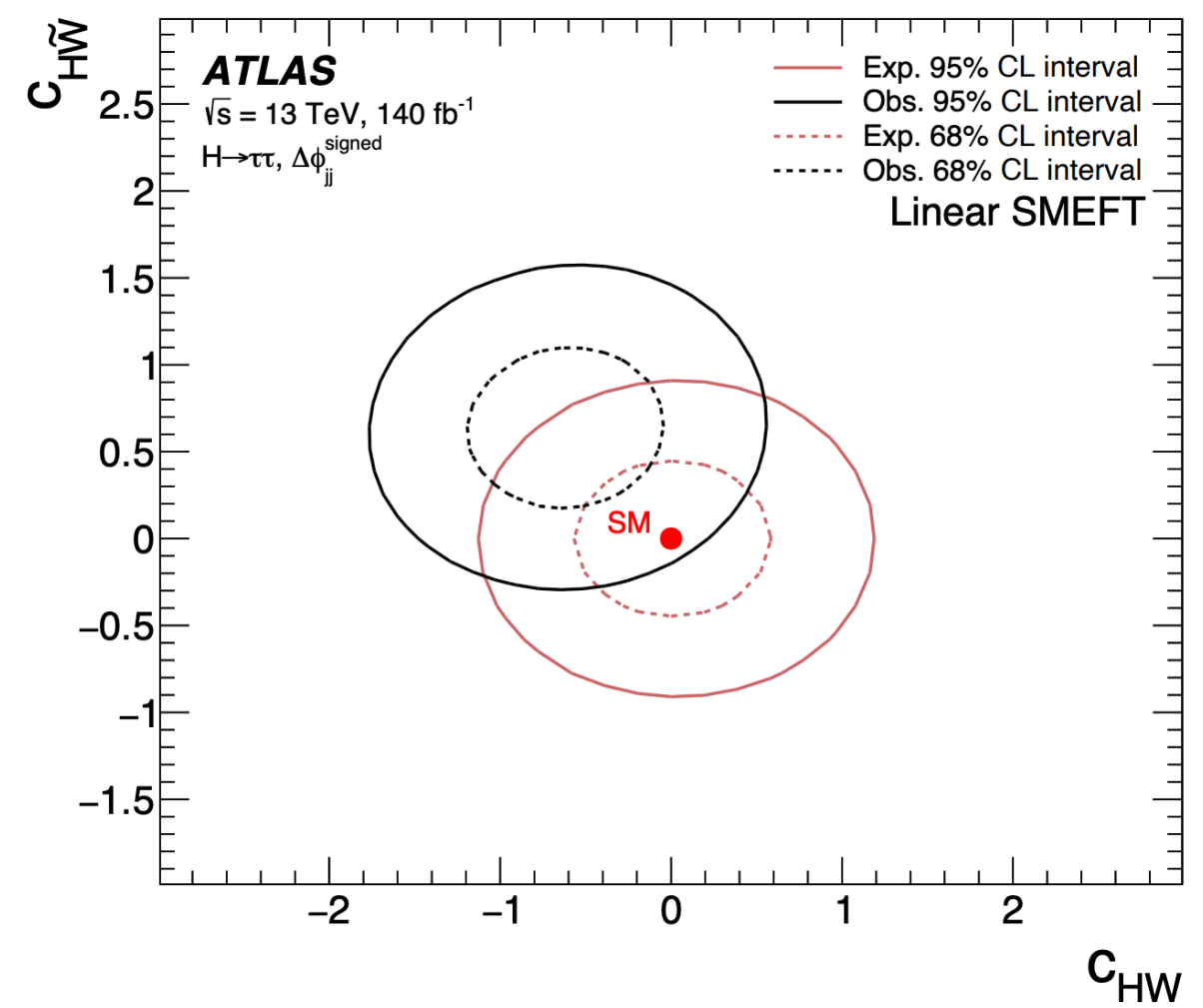
Last year few points were identified in the discussion → where do we stand this year?

## Need to include in EFT interpretations

- CP odd operators: **progress since last year**
- linear+quadratic interpretations: **both ATLAS and CMS**
- STXT and differential interpretations have similar constraining power, STXS more sensitivity to Hqq, Hll and HVqq vertices: **both ATLAS and CMS**
- match UV interpretations to EFTs ( top down approach): **progress from theory side (and also experiment)**
- need to add more channels to EFT combinations ( top, EW, Higgs, **di-higgs**, EWPO).
- need to add more observables to EFT combinations: **ongoing**
- ATLAS+CMS global combination
- improvements in theory predictions and EFT truncation to be better treated

# CP even-odd

## Differential measurements in $H \rightarrow \tau\tau$

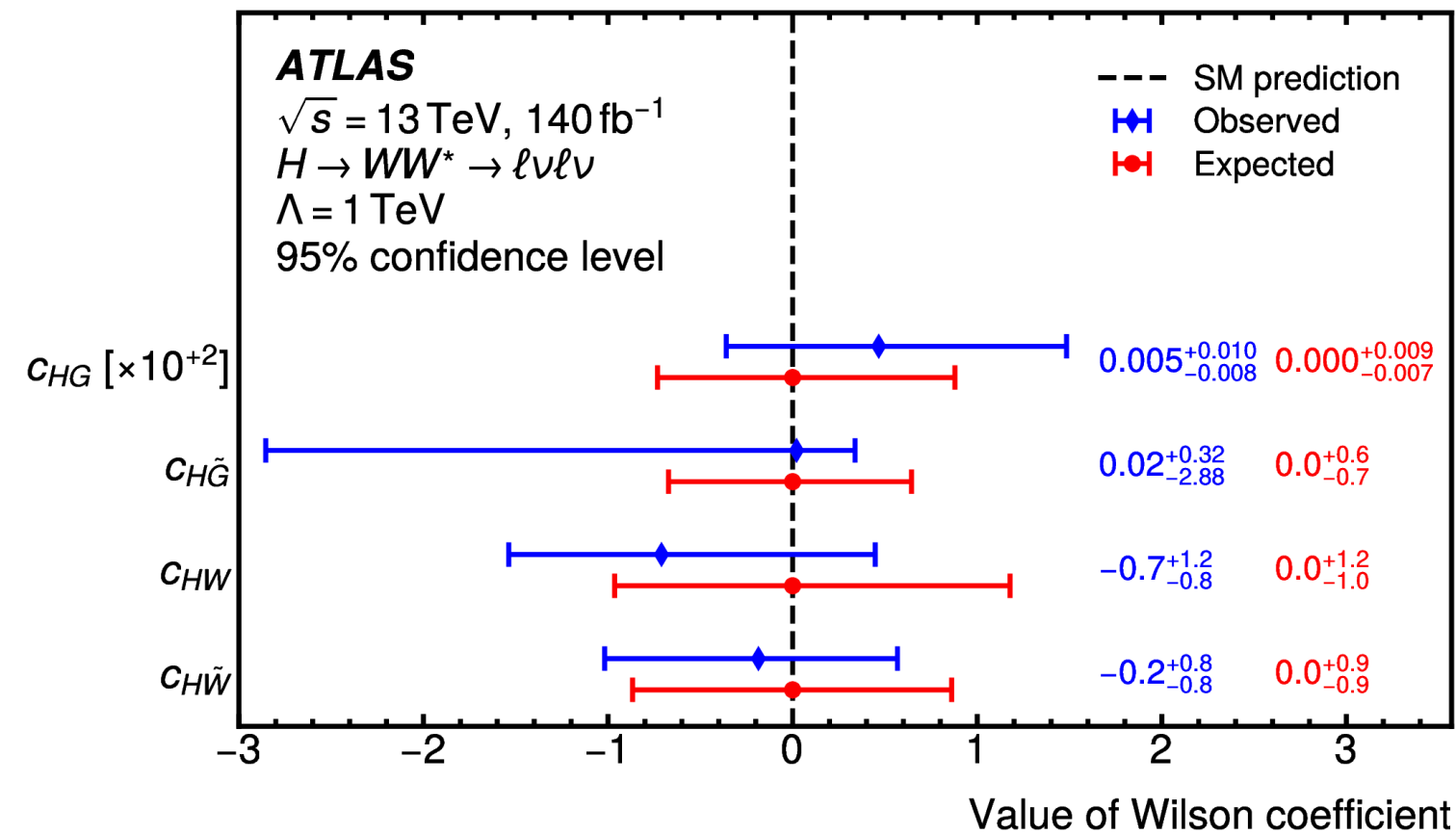


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2D  $\rightarrow$  no loss of sensitivity, as  $\Delta\phi_{\text{signed}}$  shape is affected differently by the 2 operators

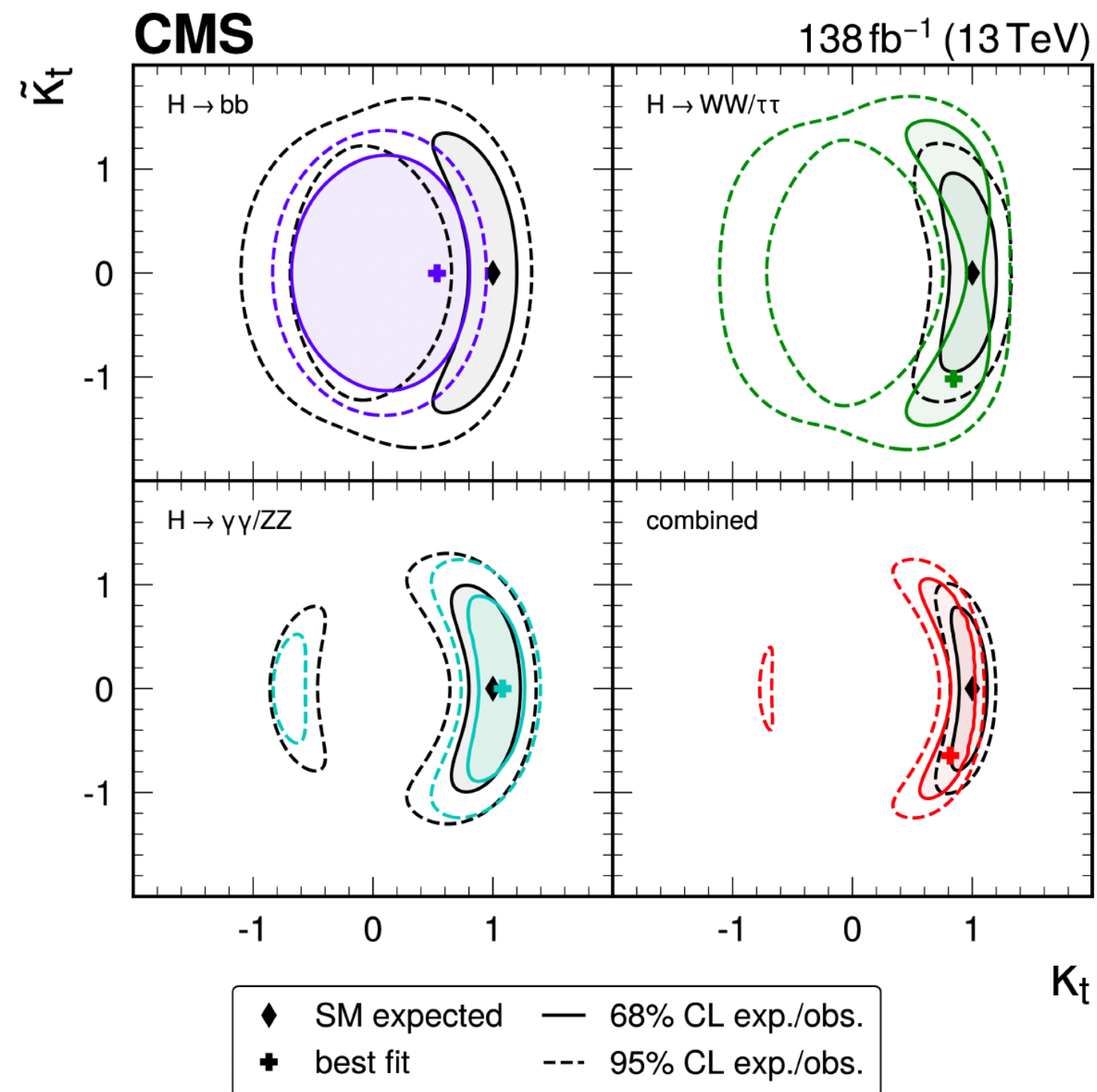
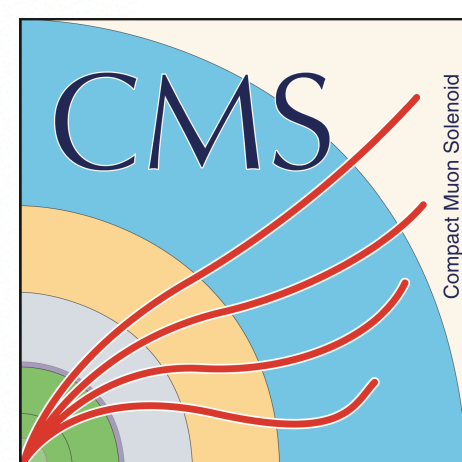
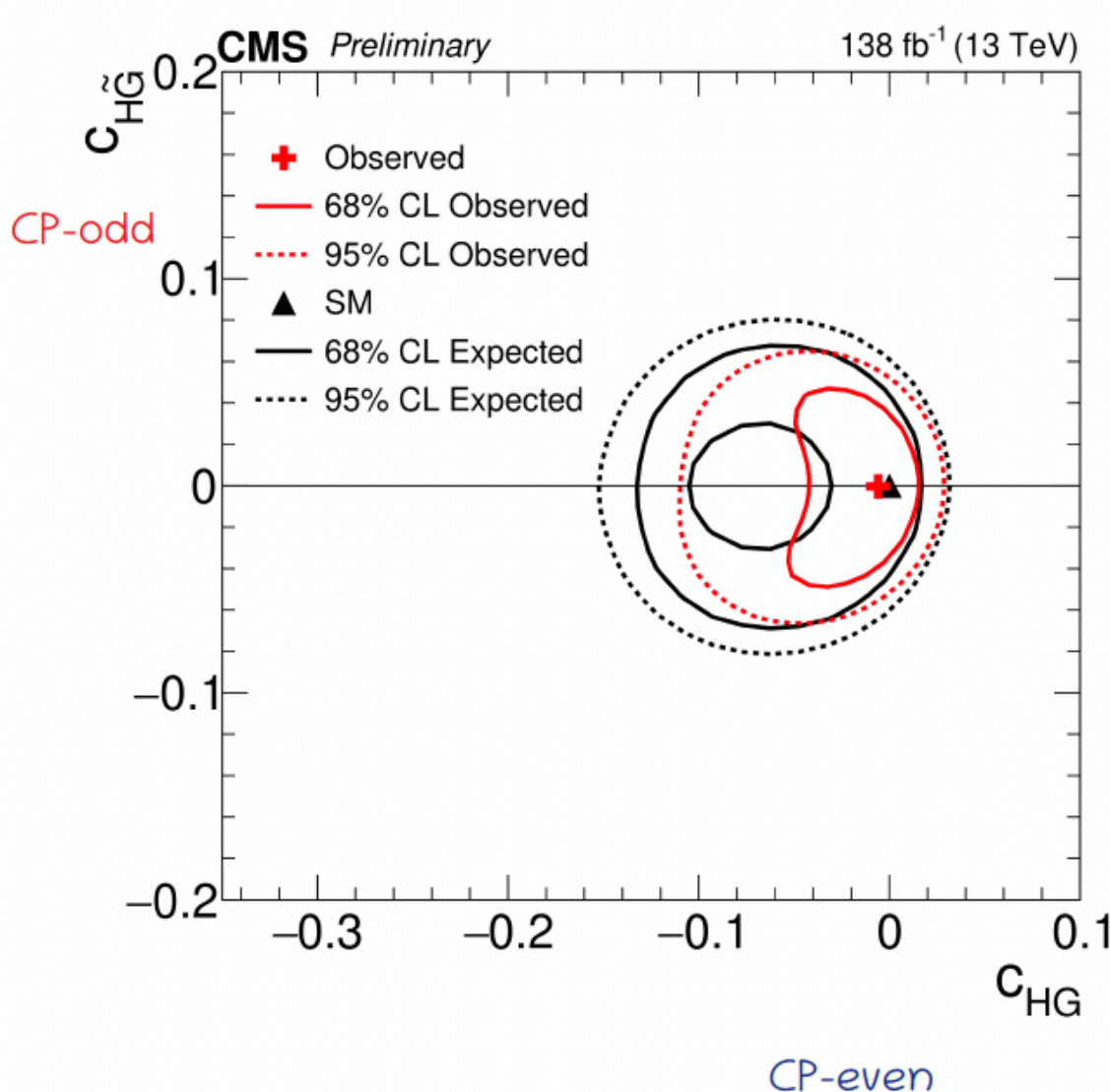
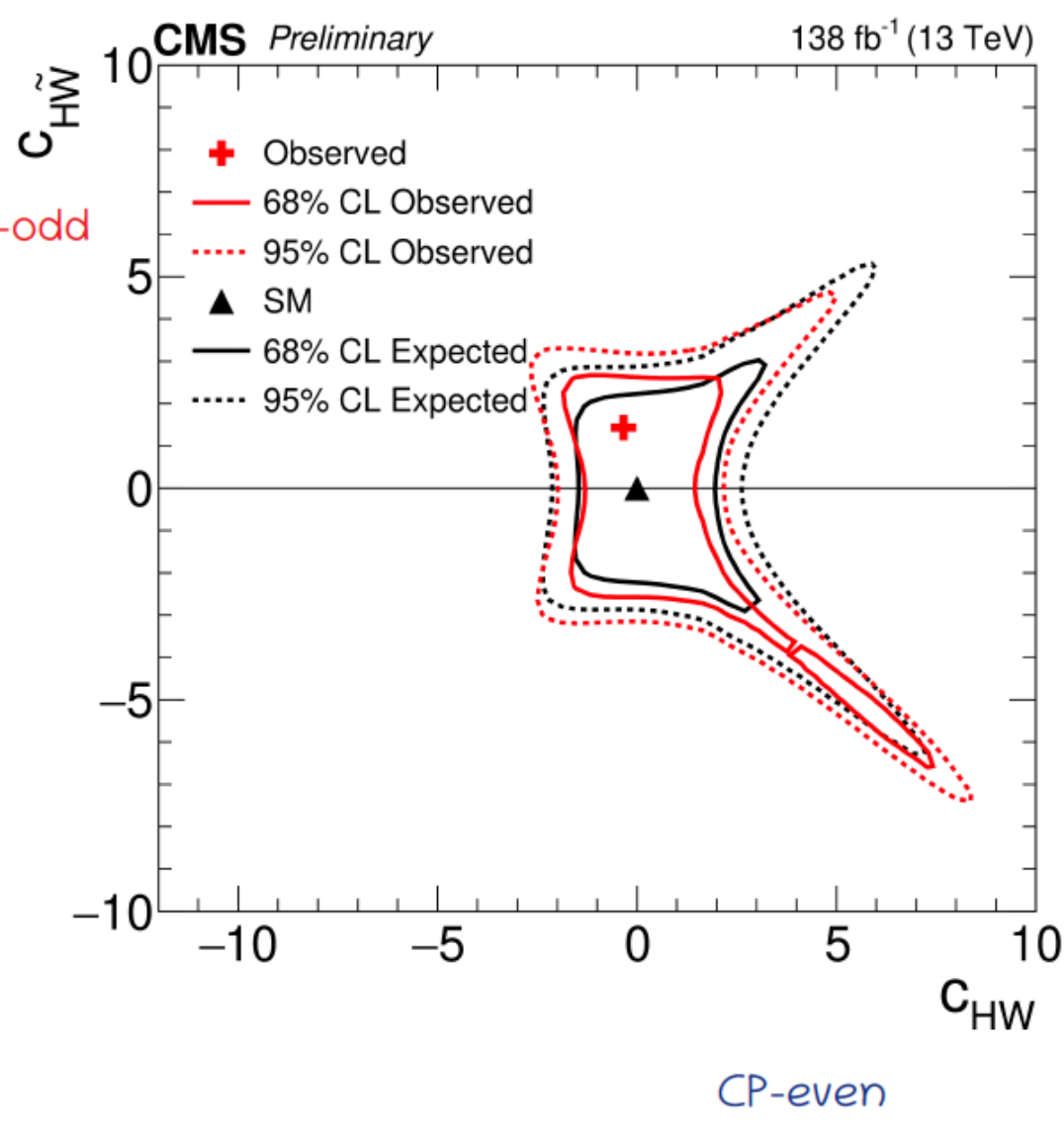
$ggF + VBF H \rightarrow WW^* \rightarrow \ell\nu\ell\nu$  STXS CP arXiv:2504.07686



## $t\bar{t}H$ $tH$ Anomalous Higgs to top coupling

## Differential measurements in $H \rightarrow WW^* + 2 \text{ jets}$

HIG-24-004



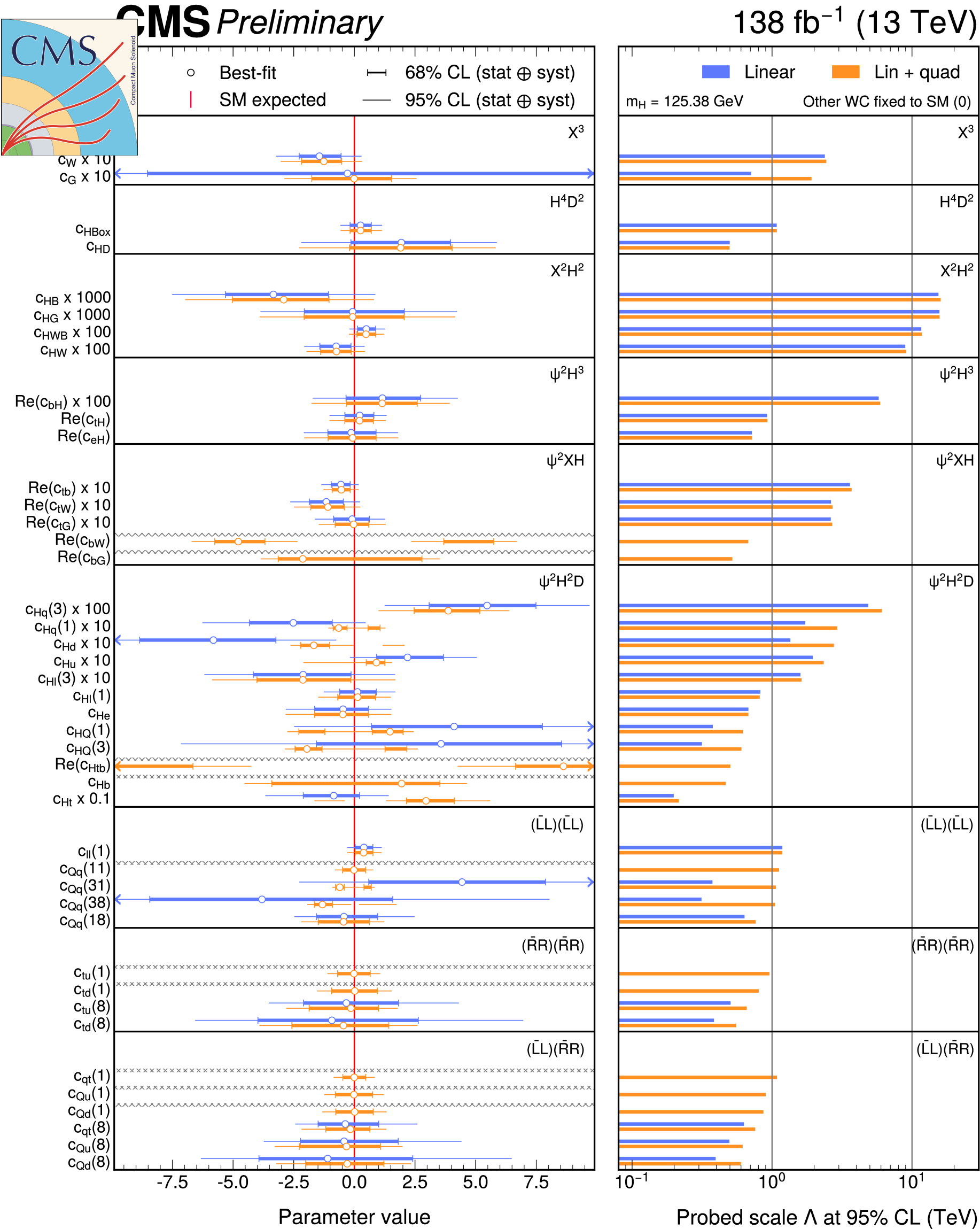
arXiv:2407.10896v2

# STXT fits

19 coefficients fitted individually

JHEP11(2024)097

43 coefficients fitted individually ( Linear and linear+quadratic!)

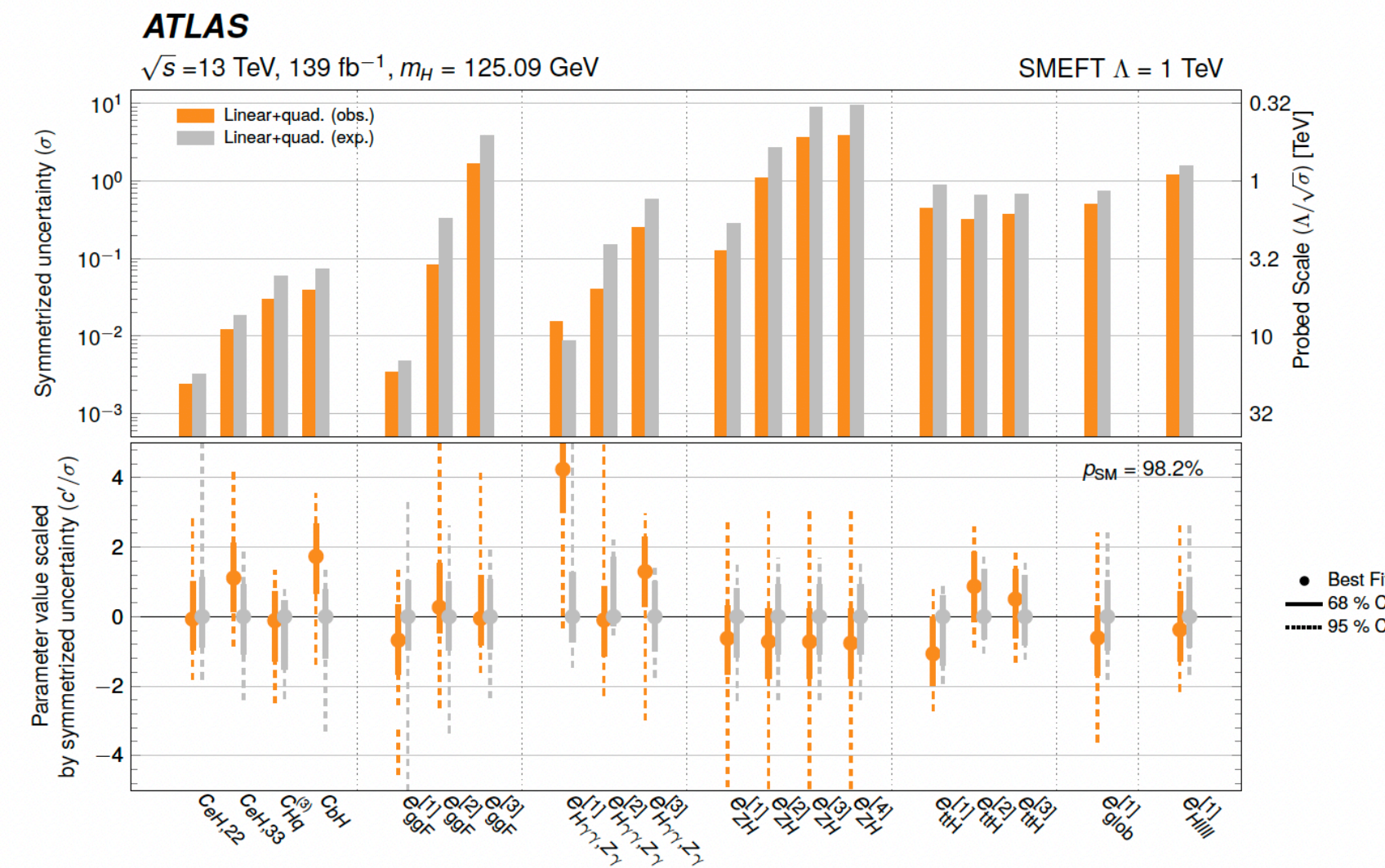
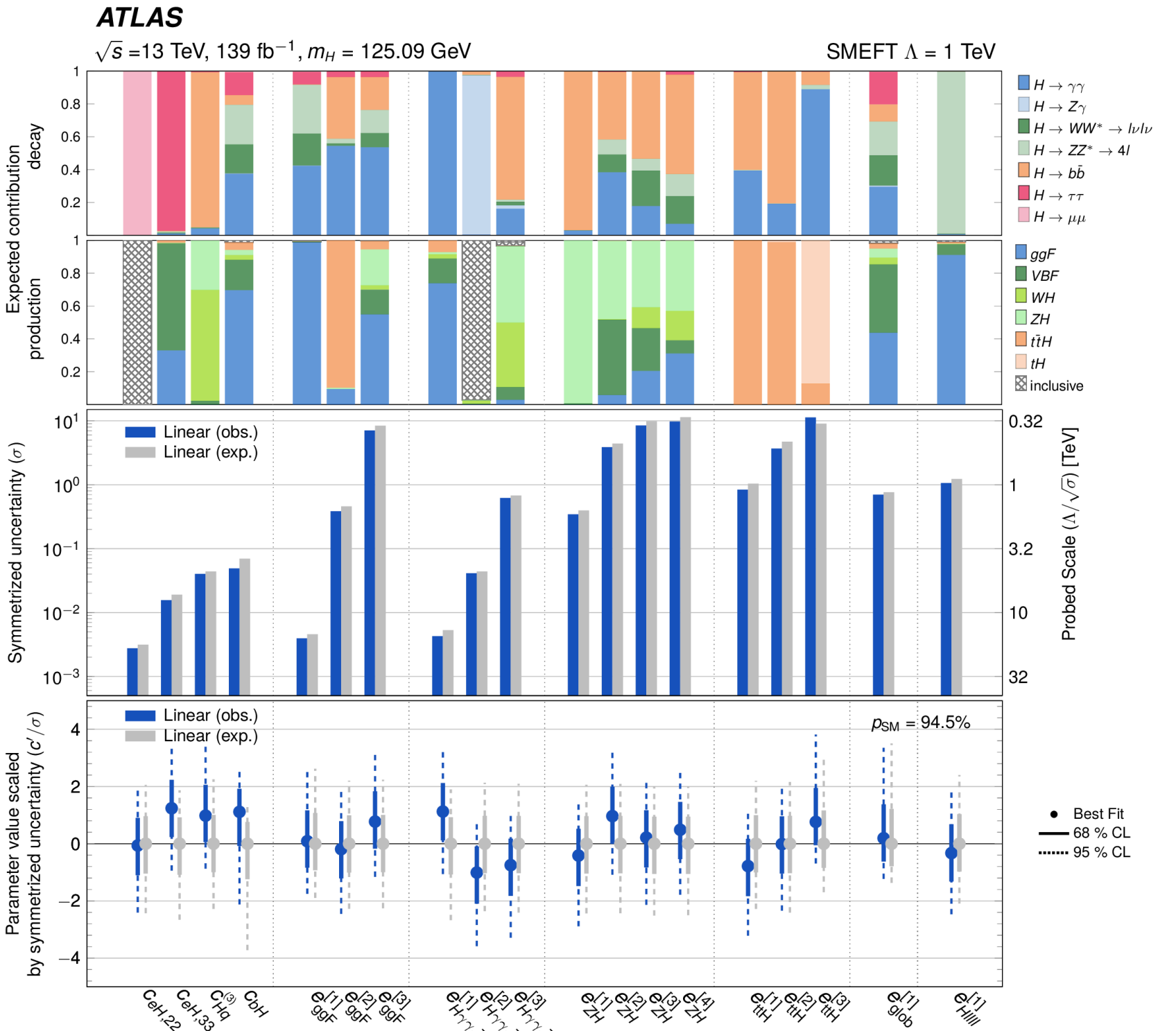


HIG-21-018



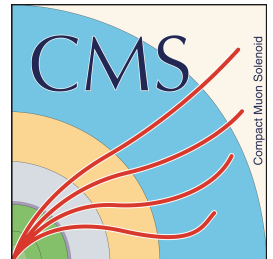
generally linear+ quadratic central values  
do agree but there are exceptions.  
The terms  $O(\Lambda^4)$  have larger  
constraints on the least constrained  
Wilson Coefficients ( more important  
far from SM)

some WC only constrained when  
quartic terms are included

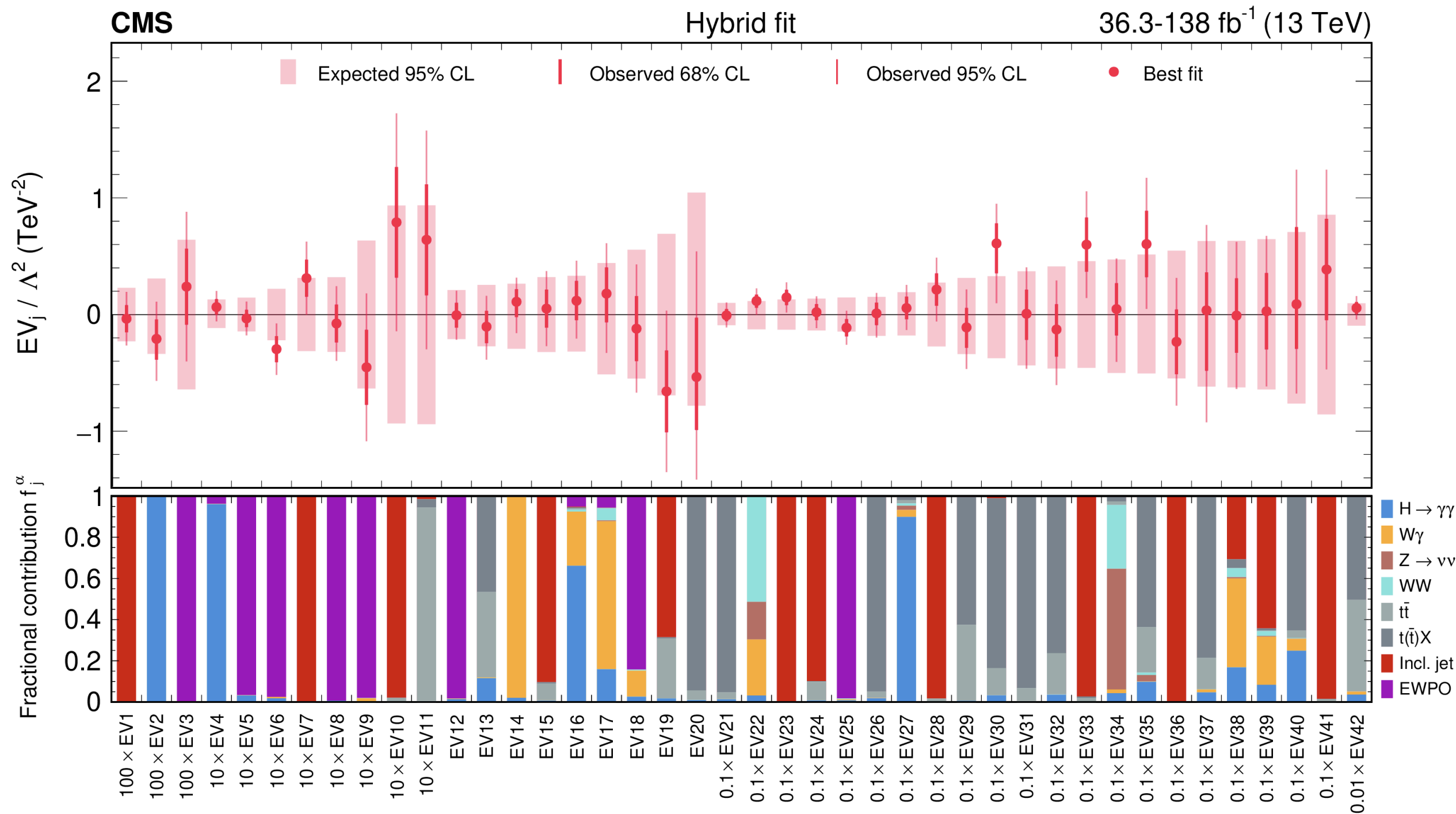


# EW+top+Higgs +EWPO

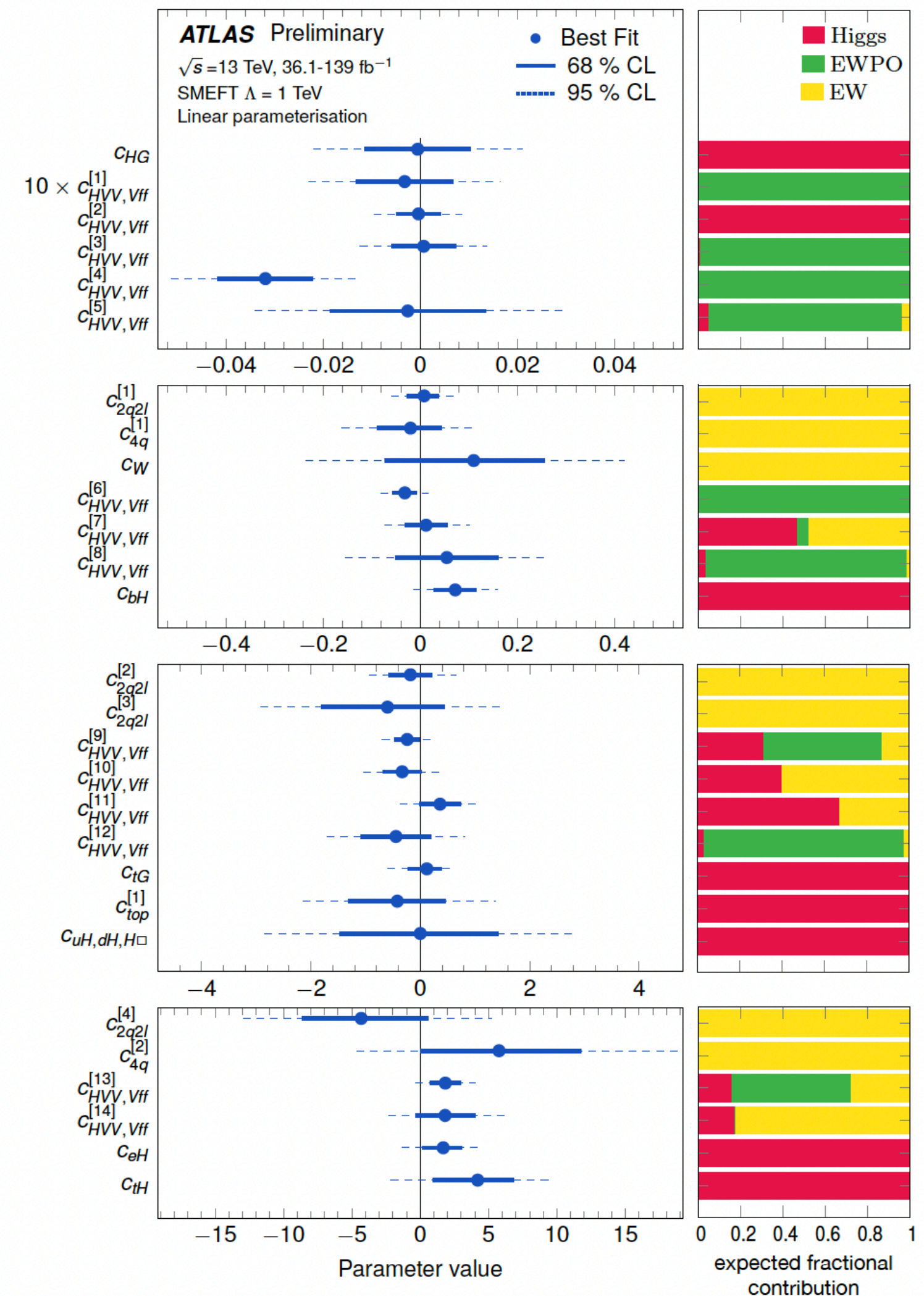
Principal Components Analysis done by both experiments now, including also EWPO ( which increases the number of eigenvectors)



43 EigenVectors

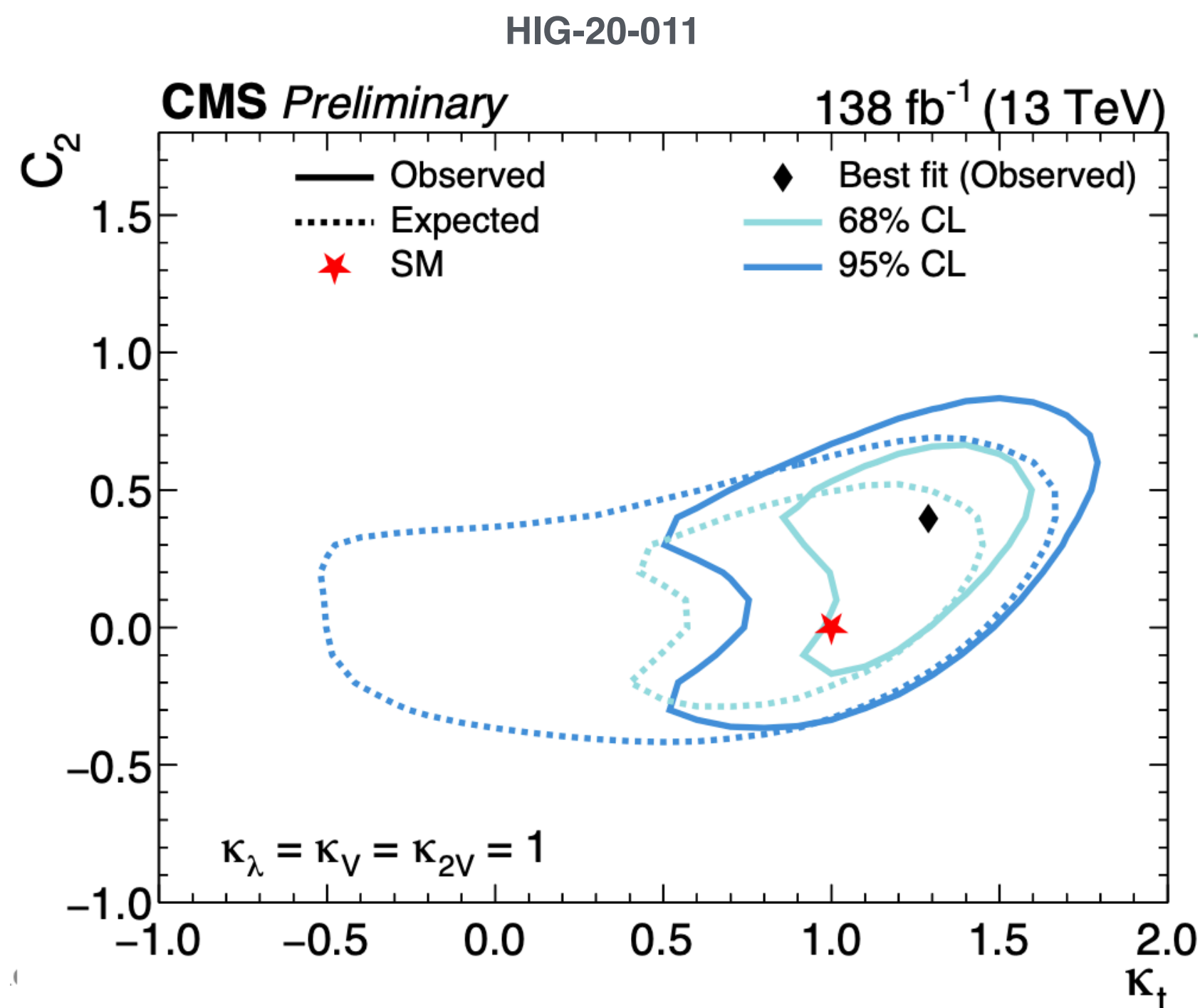
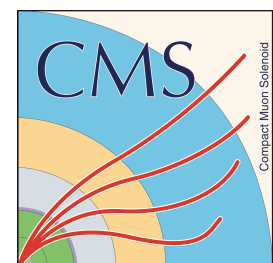


28 EigenVectors

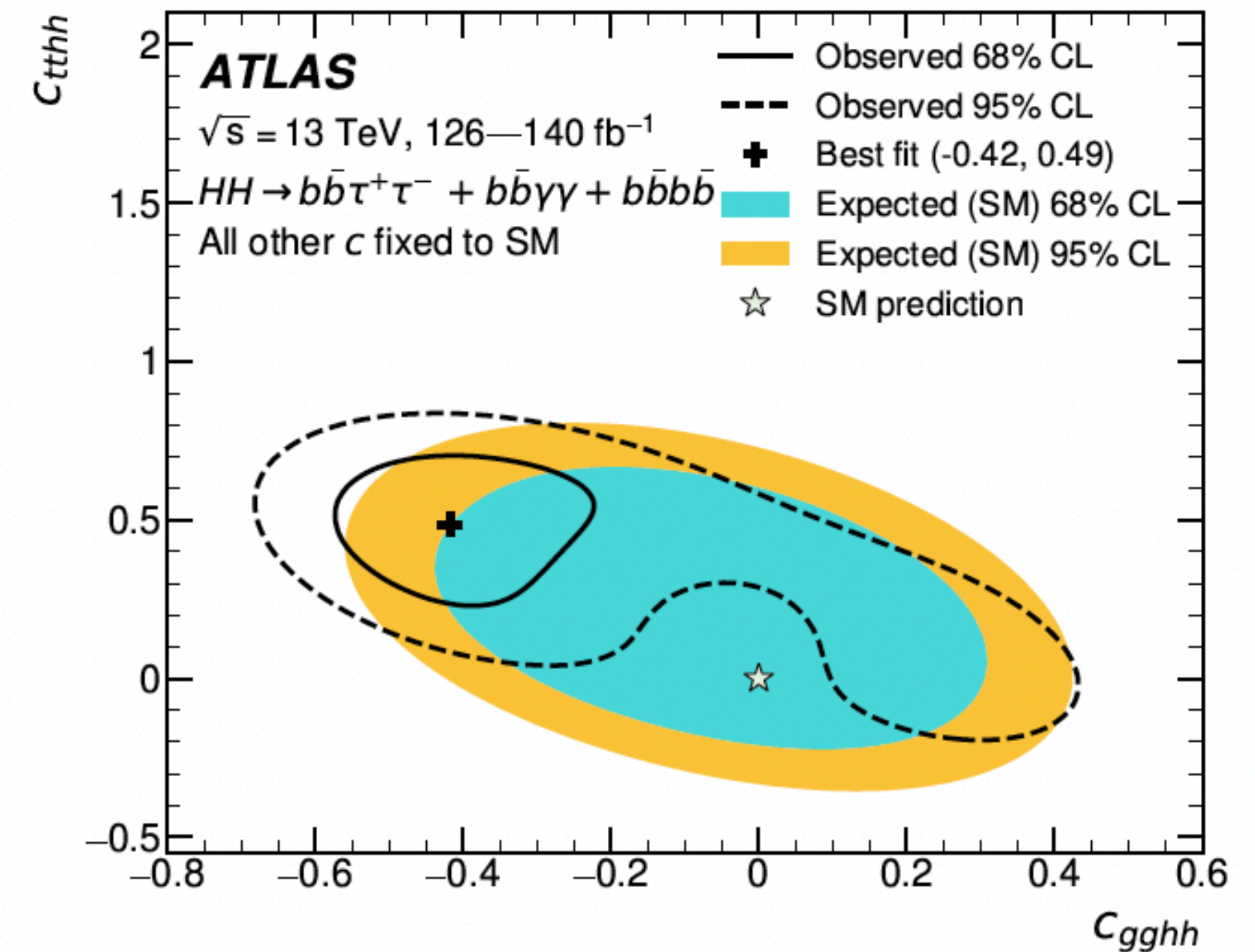


# Inclusion of di-Higgs still underway

HEFT interpretation: Regime of validity **wider w.r.t. SMEFT**. Particularly useful in regions of phase space where **BSM effects are still weakly constrained (HH production)**.



arXiv:2406.09971v2



# Top down approach

What about guiding the measurements such that they can be more sensitive to Wilson Coefficients that would present larger variations within specific models?

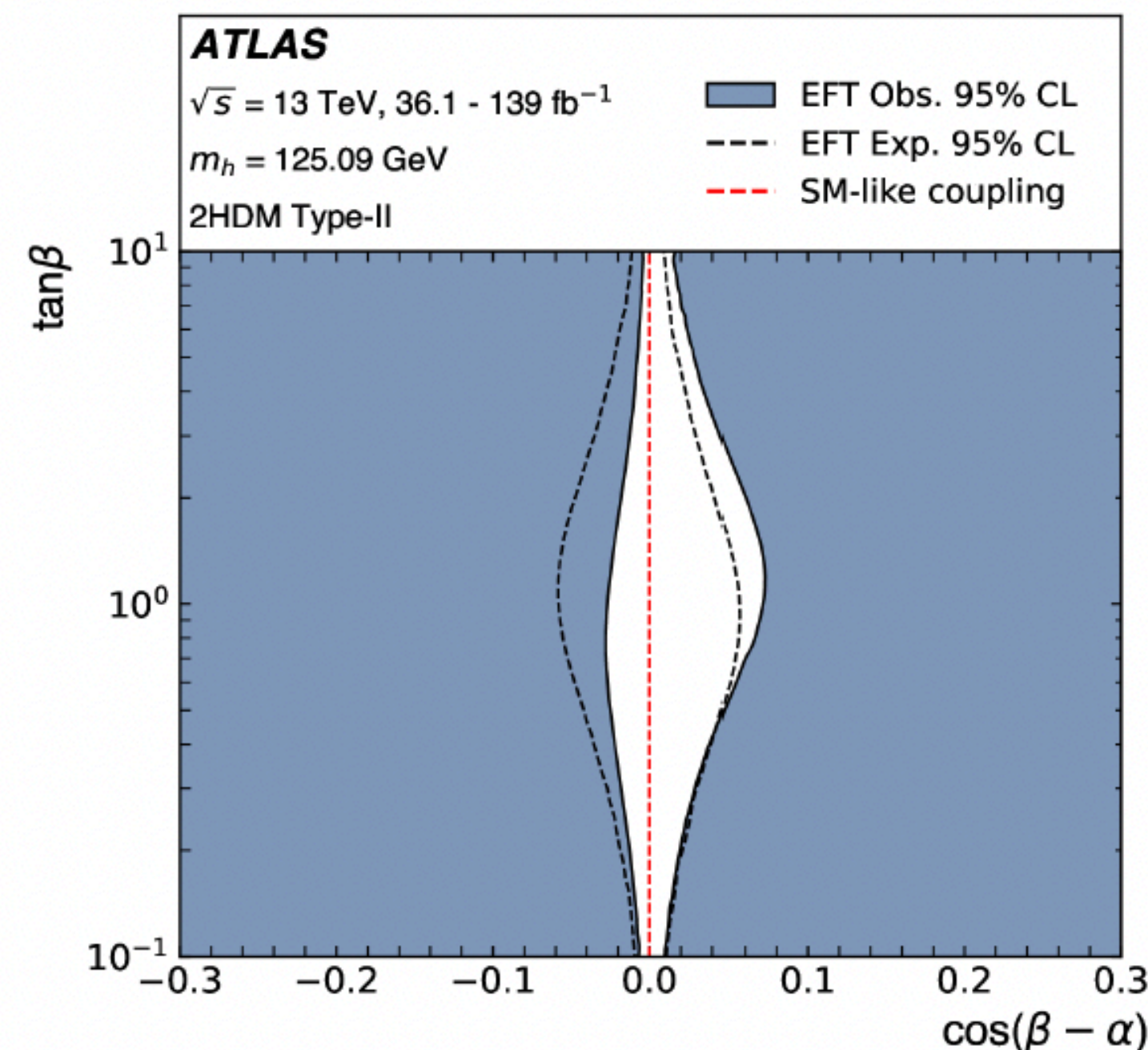
- Comes at the cost of losing generality, but can lead help us not to miss important features in the data.
- Requires matching models with EFTs.

arXiv:2112.10787v1

The leading IR/UV dictionary (tree-level, dimension 6 SMEFT) is already there since few years ago. Automation is needed to achieve 1 Loop. The one-loop, dimension 6 dictionary is almost complete **"SOLD"** (only heavy vectors missing) and extensions to general EFTs under way!

**Example: The 2HDM Lagrangian can be written as a SMEFT expansion!**

arXiv:2402.05742v



arXiv:2402.05742v2

concrete examples on SMEFT expansion used to  
constrain a UV-complete model

