Higgs Experimental Overview

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Caltech

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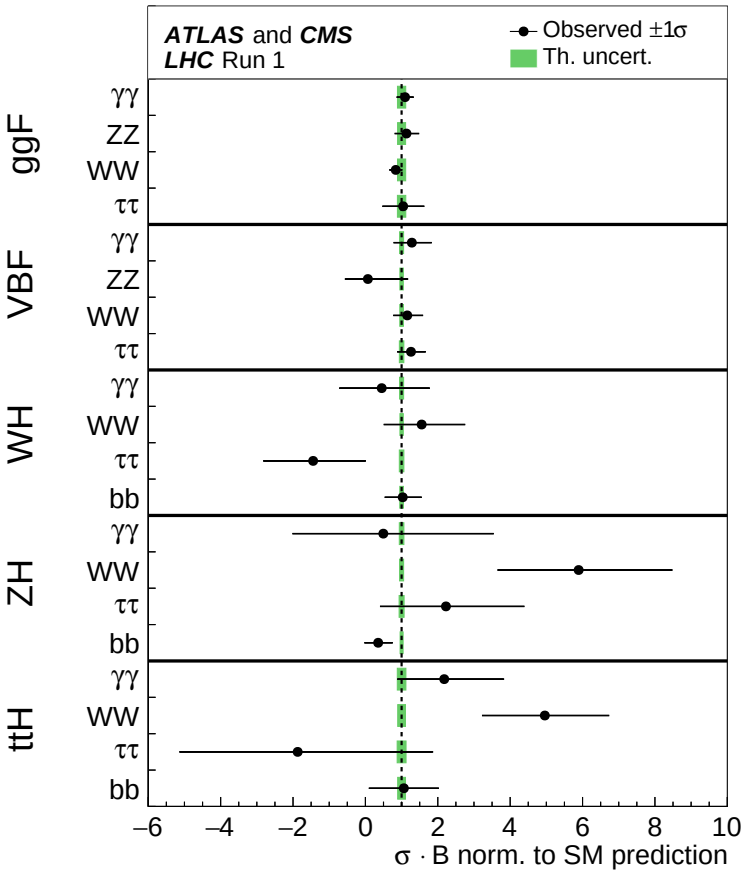
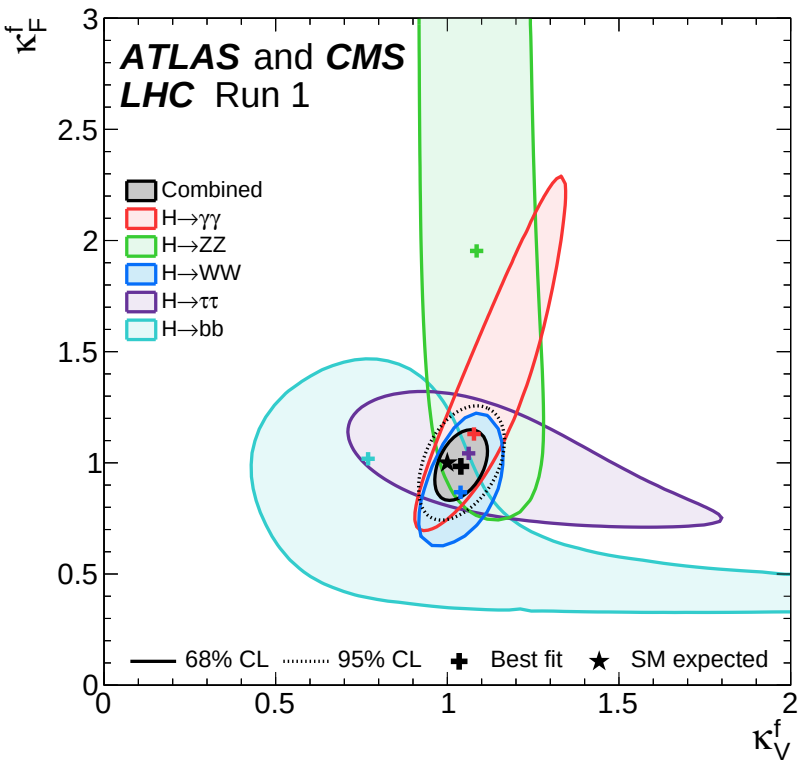
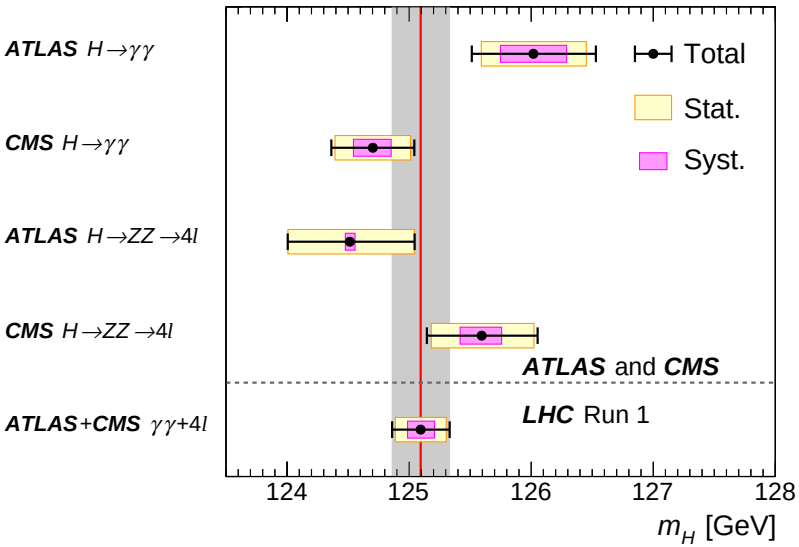
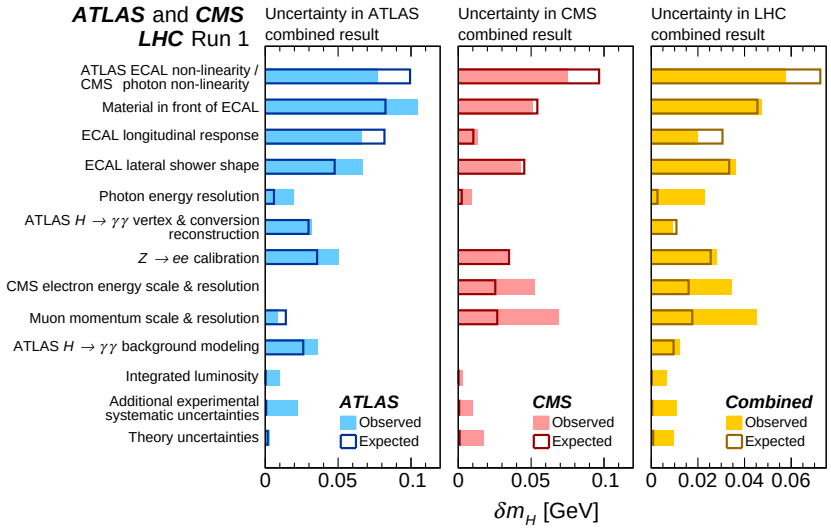
Run 1 ATLAS+CMS Combination: Couplings





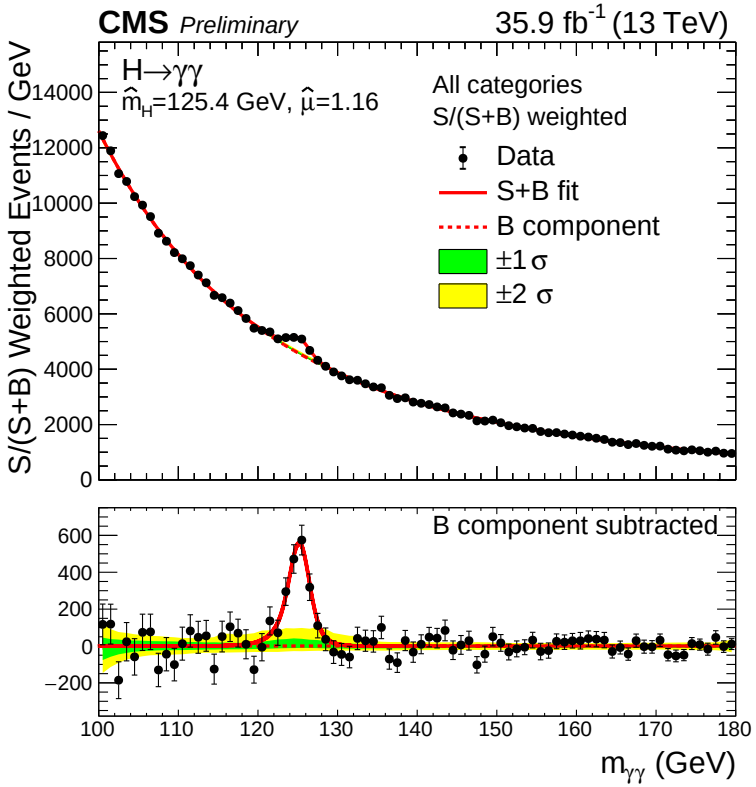
Run 1 ATLAS+CMS Combination: Mass

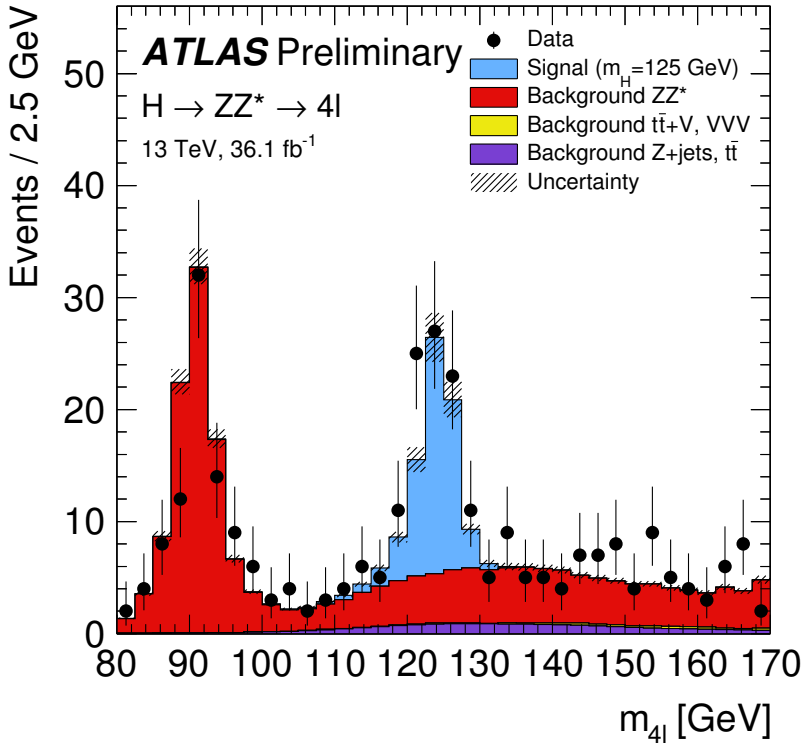




- $m_H = 125.09 \pm 0.24$
  $(\pm 0.21(\text{stat.}) \pm 0.11(\text{syst.}))$ GeV

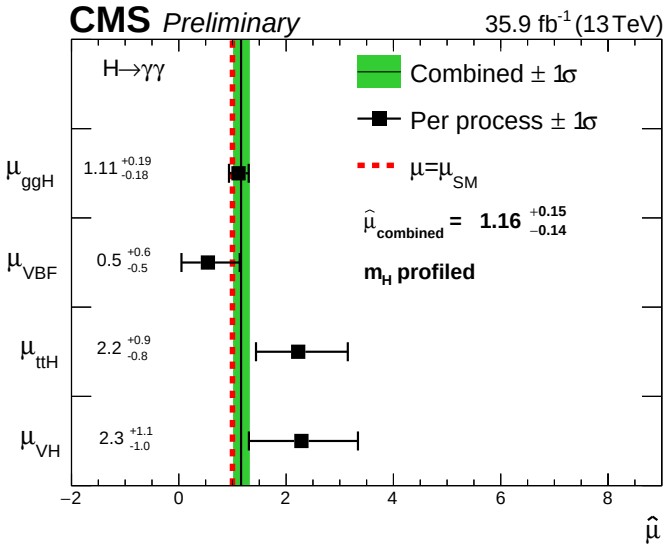
Run 2: Higgs is Still Here

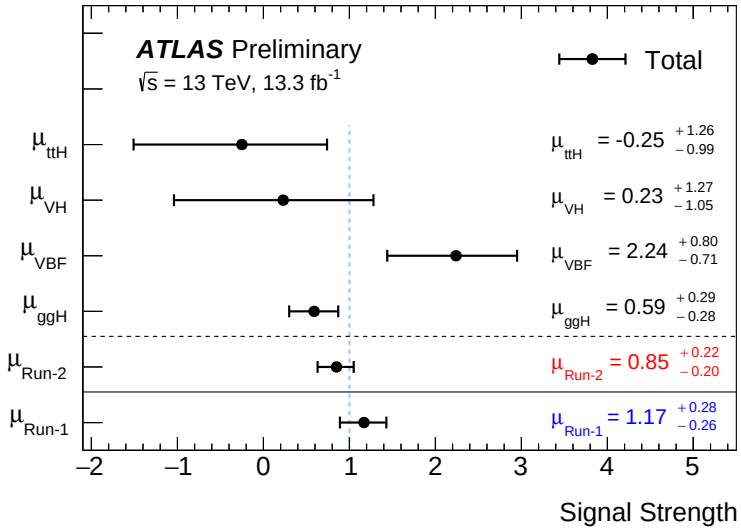




- Well beyond assessing statistical significance for discovery channels

Run 2: Higgs is Still Here





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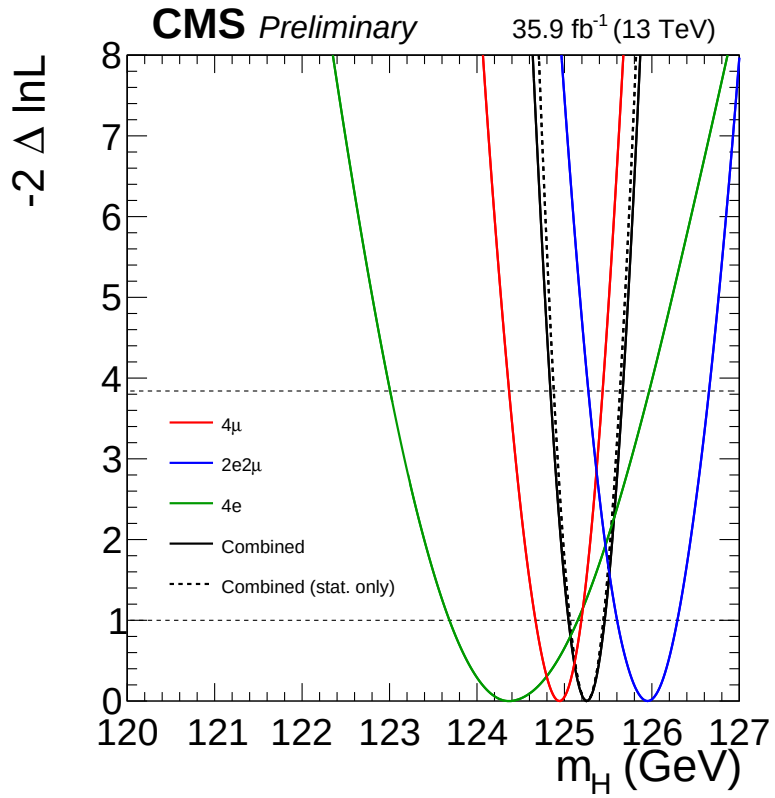

- Higgs mass measurement in muon channel competitive with Run 1 combination
- Calorimeter-related systematic uncertainties mean that most precise measurements in electron and photon channels will take more time

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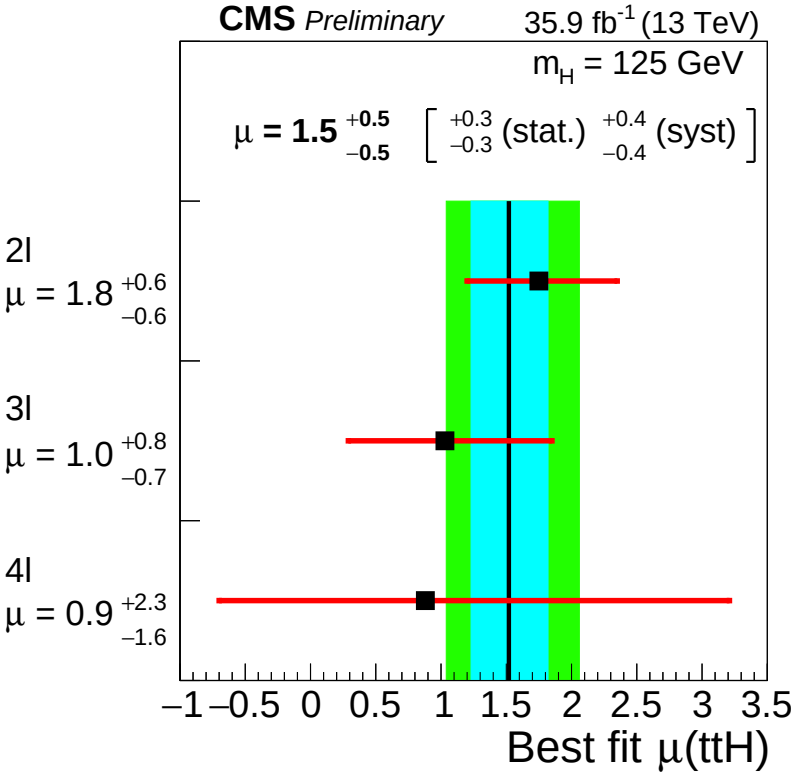

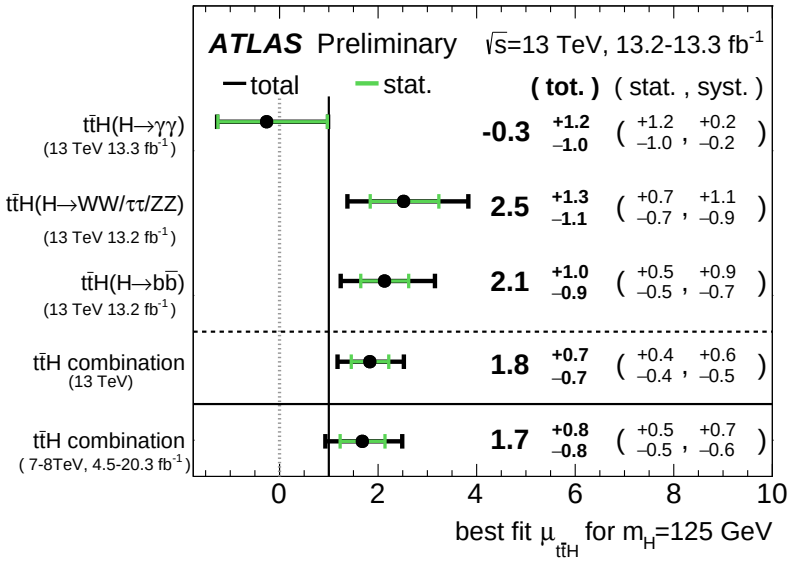

- Expected cross section increases by a factor of ~ 4 from 8 to 13 TeV
- Results still consistent with Standard Model

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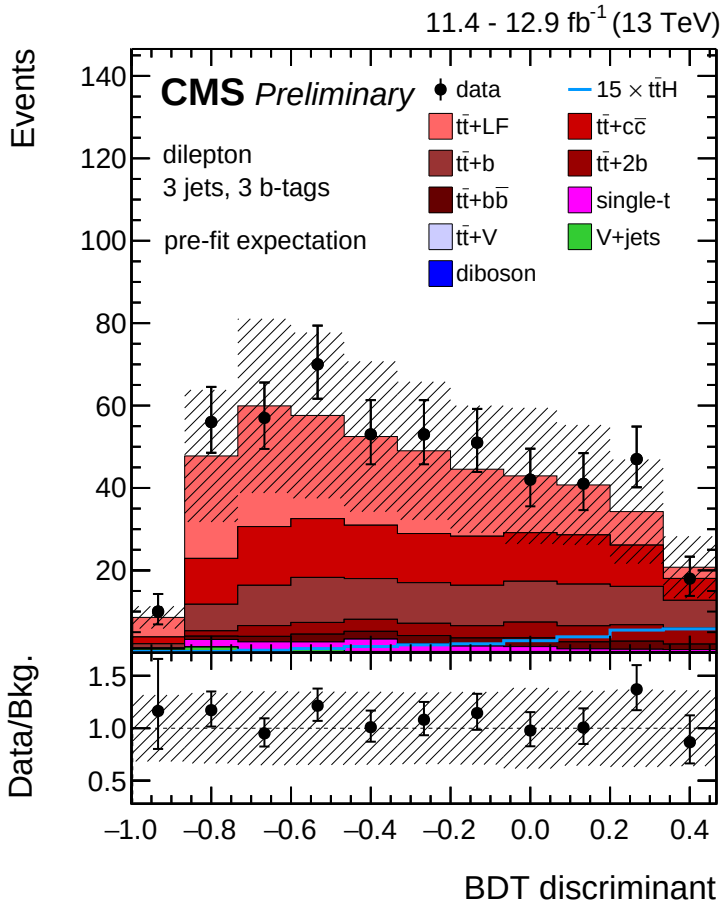
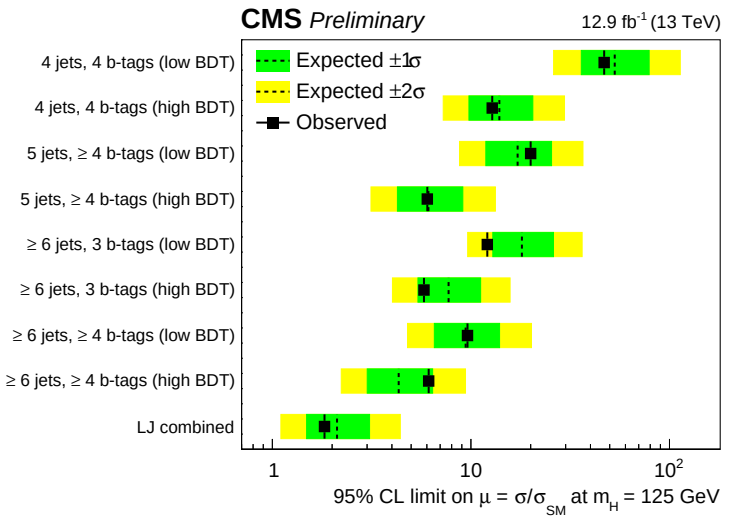


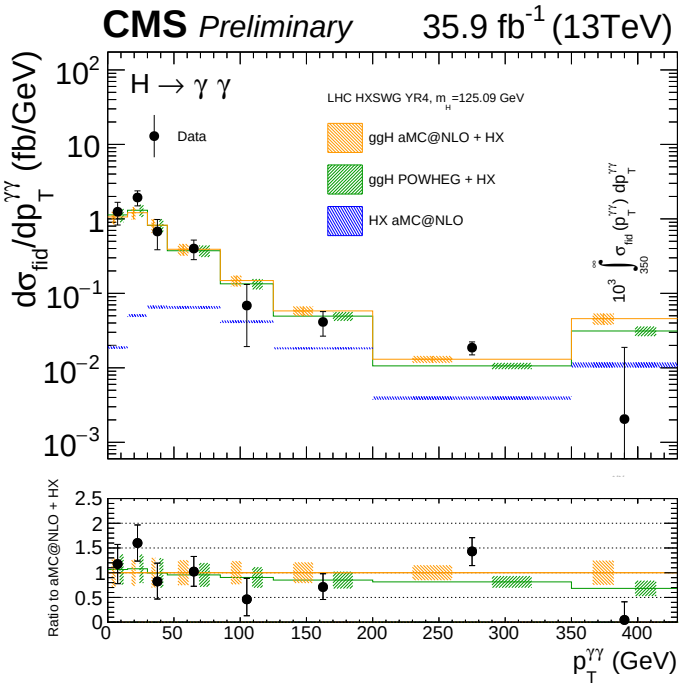


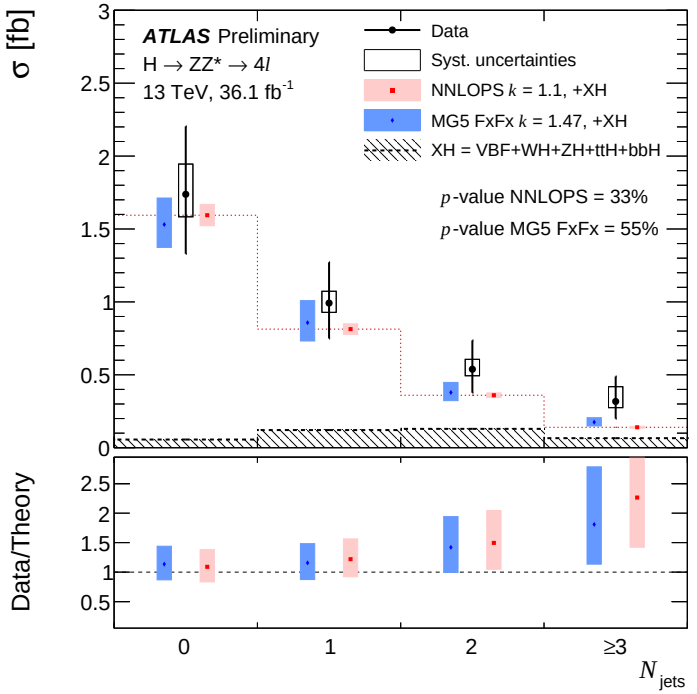
- Modelling of $t\bar{t}$+heavy flavour crucial to $t\bar{t}H$ measurements
- Interesting theoretical issues and related practical issues for MC production

Beyond Coupling Fits

- Two paths forward beyond the usual coupling fits and μ values from Run 1
  1. Fiducial and Differential cross sections (typically unfolded to particle-level phase-space definitions)
  2. Simplified Template Cross Sections

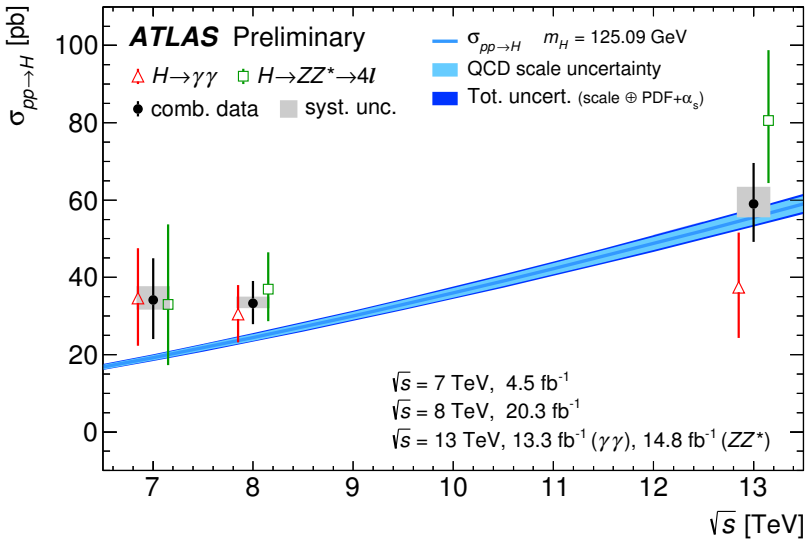
Fiducial and Differential Cross Sections





- Well established experience with unfolded QCD, Vector Boson, Top measurements
- Clear path forward with increased integrated luminosity
- Model (in)-dependence places constraints on event-level multivariate classifiers
- Trade-off between sensitivity and model depencence

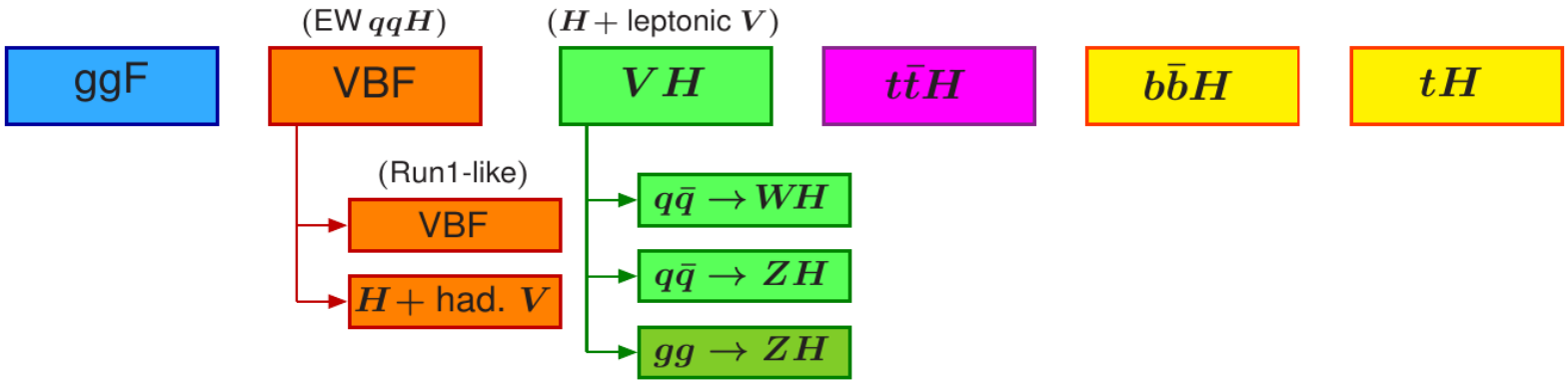
Fiducial and Differential Cross Sections

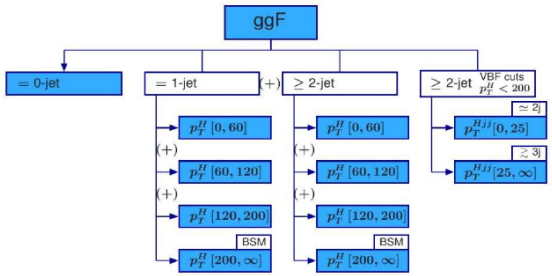


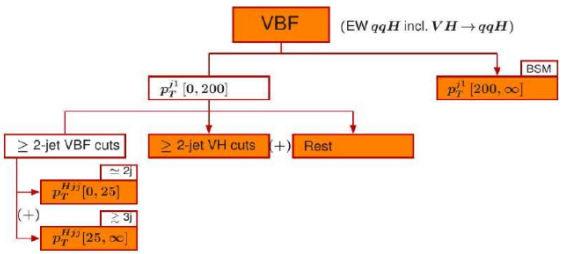
- Fiducial and differential cross sections can be combined by defining phase space in terms of Higgs kinematics (requires assuming Standard Model decay kinematics)

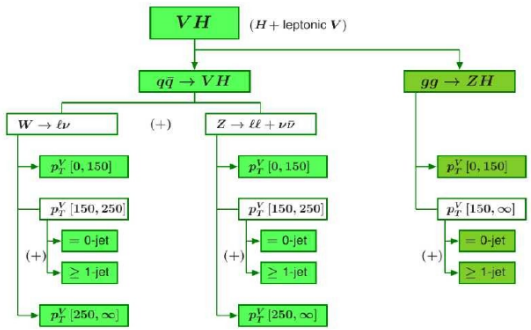
Simplified Template Cross Sections

- Finer-granularity categorization of Higgs production at truth level to better factorize theoretical input and uncertainties from reported experimental results
- Staged approach to scale with integrated luminosity

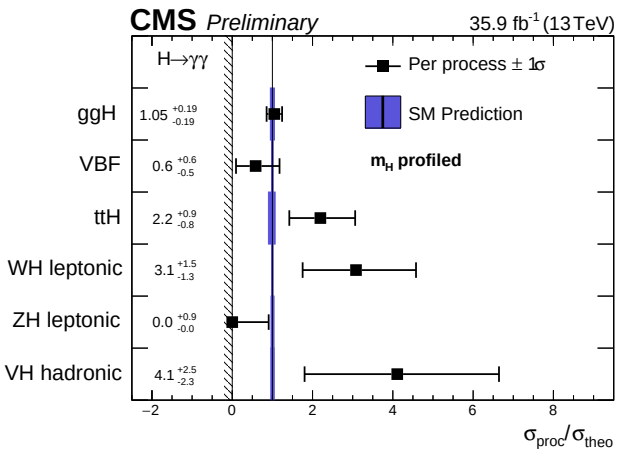


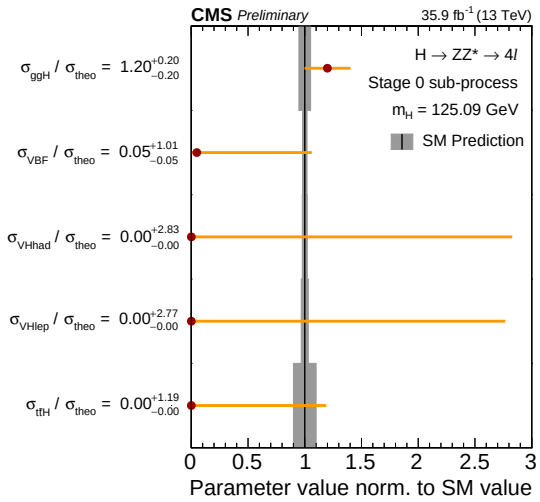


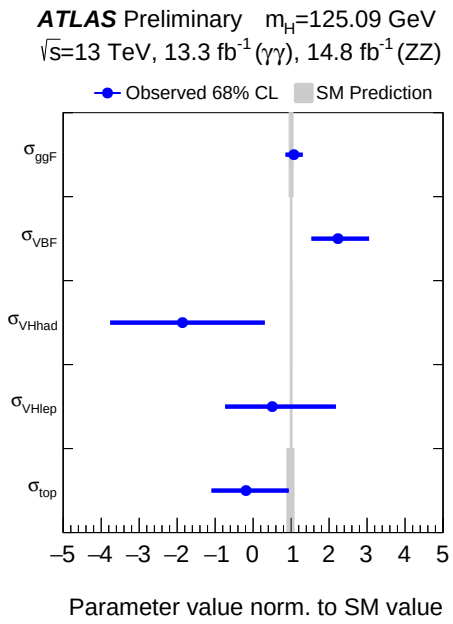




Simplified Template Cross Sections: Stage 0 Results

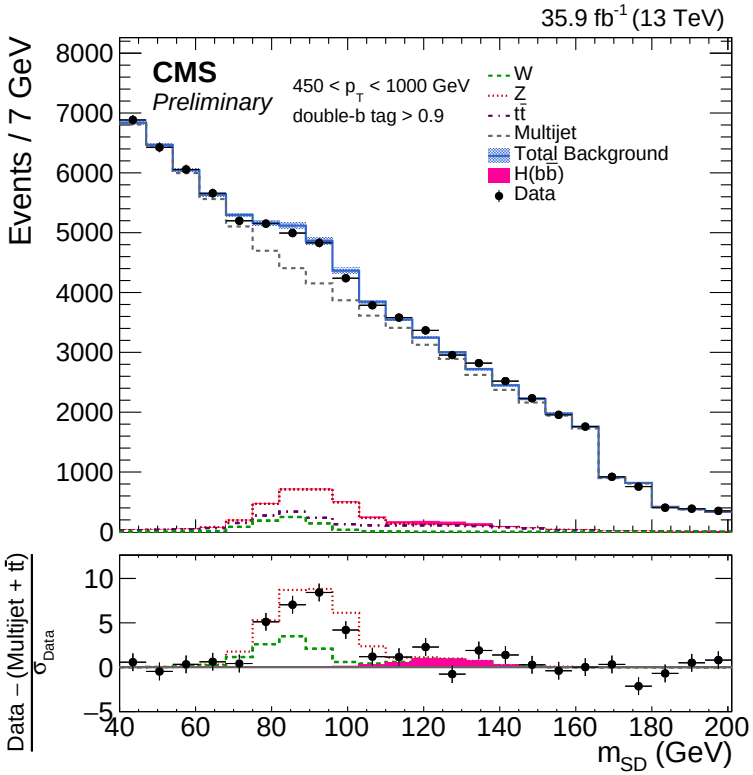


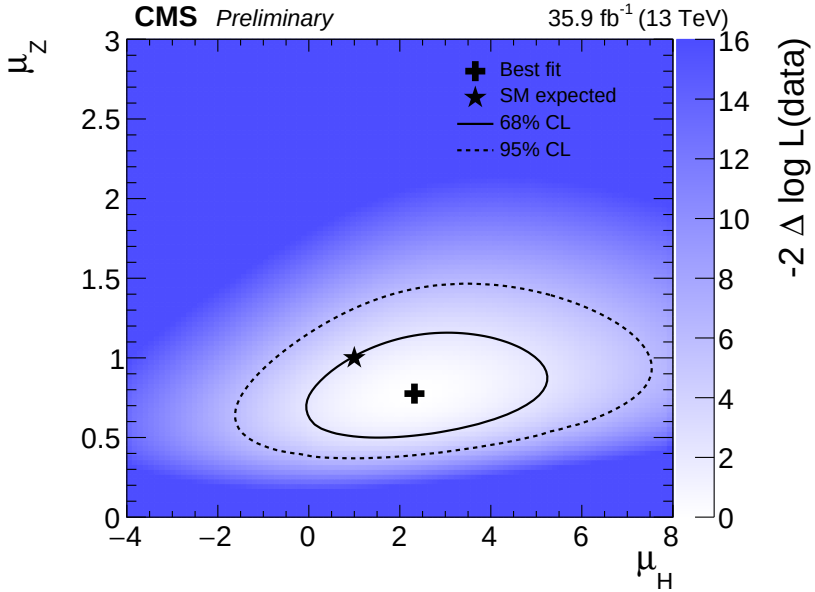




- First results with "Stage 0" definitions
- Moving towards "Stage 1" with further splitting
- Some subtleties dealing with bins with limited sensitivity, strong correlations, non-Gaussian behaviour, etc

Boosted Higgs Production





CMS-HIG-17-010

- Search for boosted $H \to b\bar{b}$ production with jet substructure, selecting $p_T^H > 450$ GeV
- May be one of the first channels explicitly sensitive to finite top mass effects, electroweak corrections, etc