Extended Scalars Subgroup:

ATLAS/CMS results since the last workshop

The 22nd Workshop of the LHC Higgs Working Group, 3-5 December 2025

Experiment contacts:
Lidija Zivkovic, Nikolaos Rompotis (ATLAS)
Alexandra Carvalho, Khawla Jaffel (CMS)

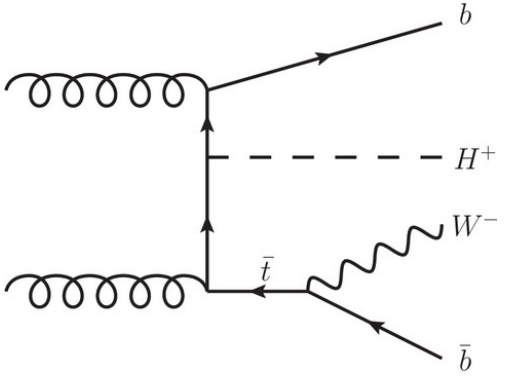
Theory contacts:
Thomas Biekötter, Tania Robens

Some ATLAS results

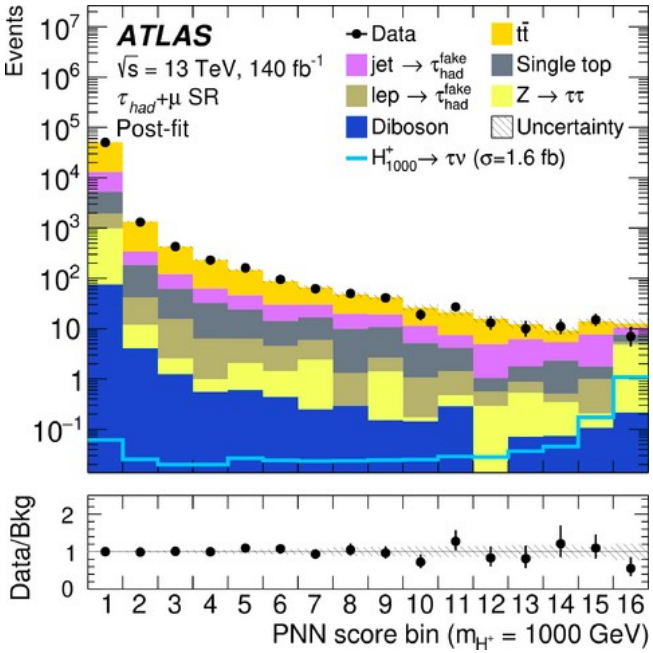
HDBS-2018-39

- ## Charged Higgs to taunu

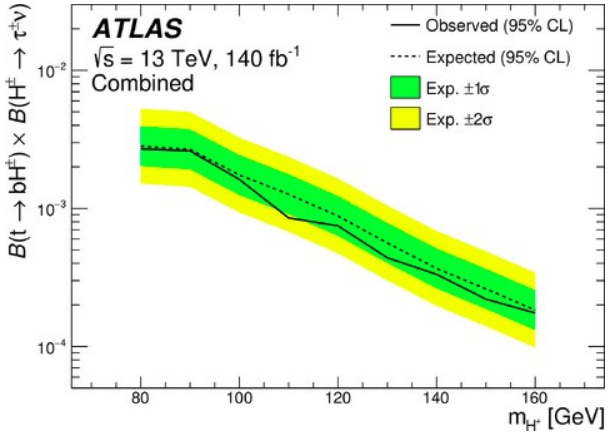
Full run-2 covering from 80 GeV till 3 TeV

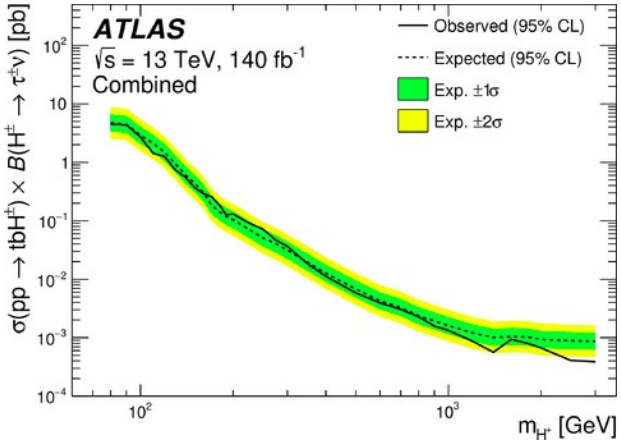


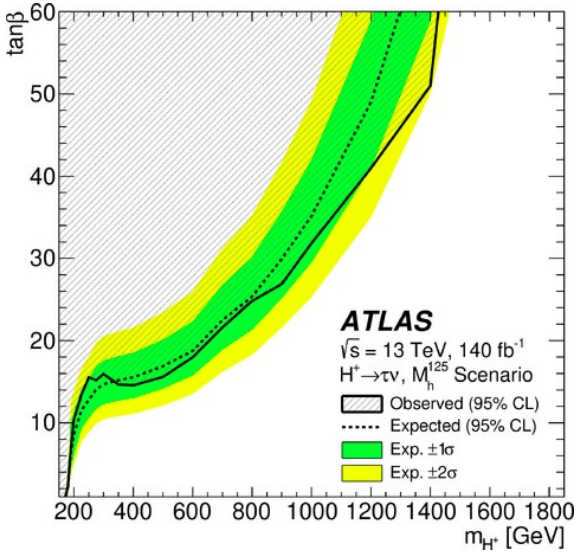
Both leptonic and hadronic tau decays are considered. Parametric NN that uses kinematics a final discriminant



Branching ratio limits (low mass), cross section limits (high mass) and interpretation in various MSSM scenarios

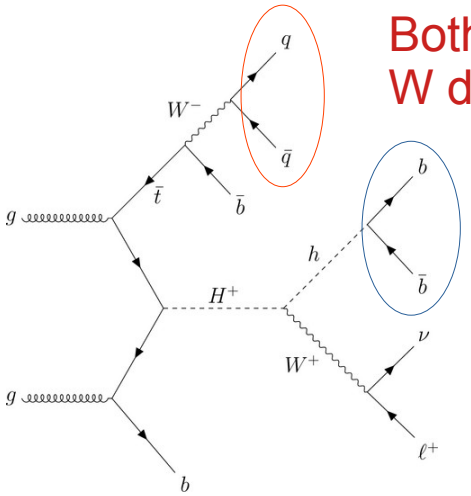






Some ATLAS results

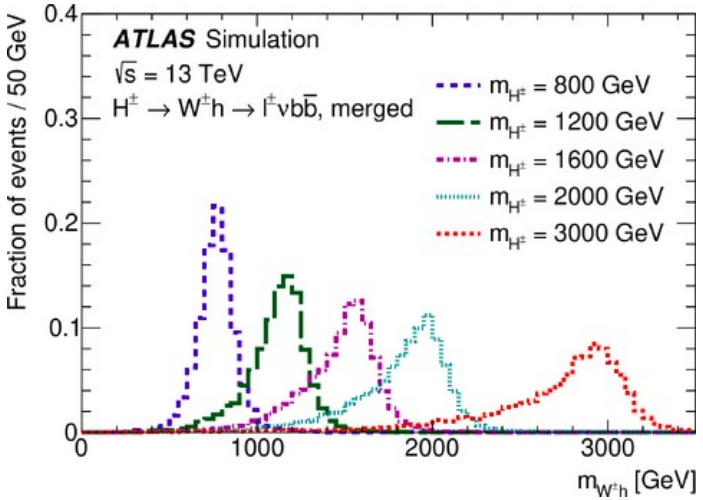
- $H^+ \rightarrow W^+ h$ HMBS-2024-45 Full run-2 covering m_{H^+} from 250 GeV till 3 TeV

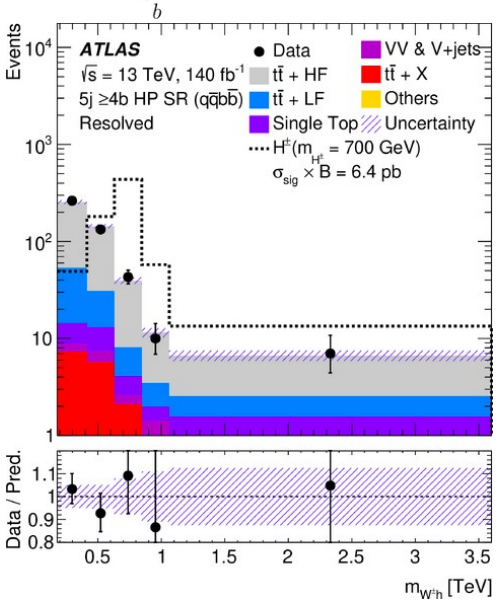


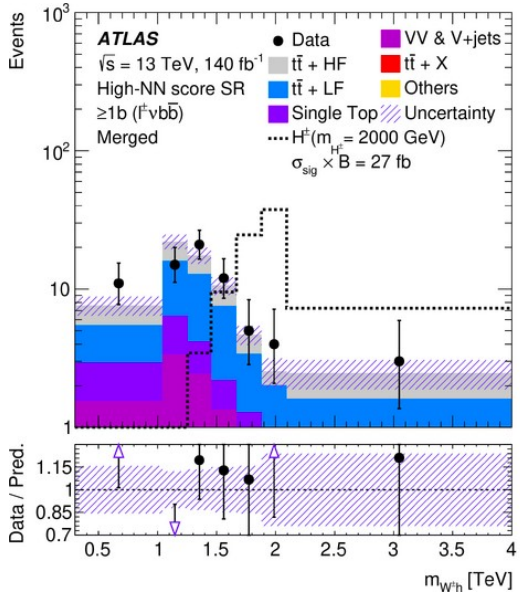
Both leptonic and hadronic W decays are considered

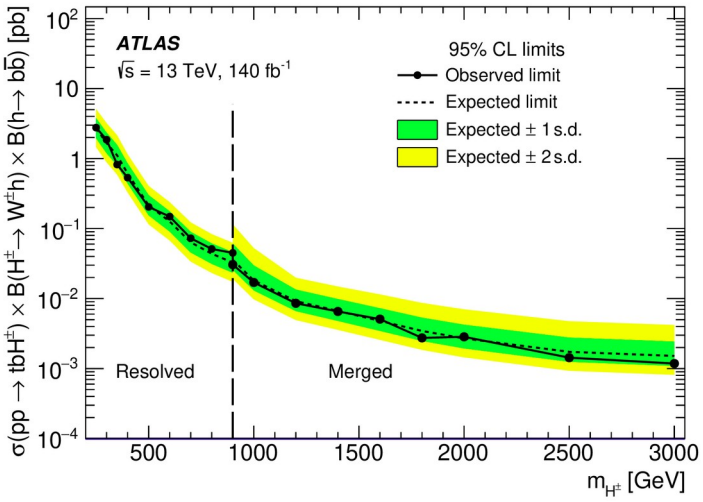
bb pair resolved or merged

Several categories depending how many jets and how many of them are b-tagged





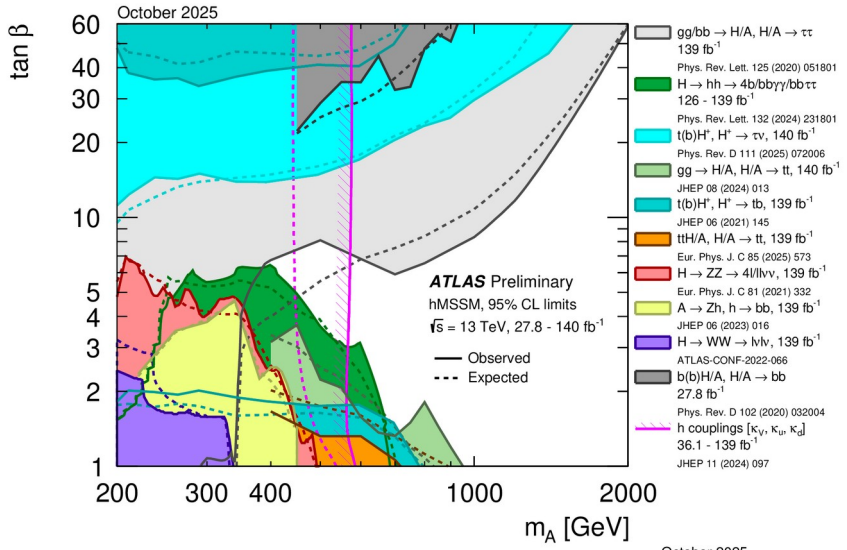


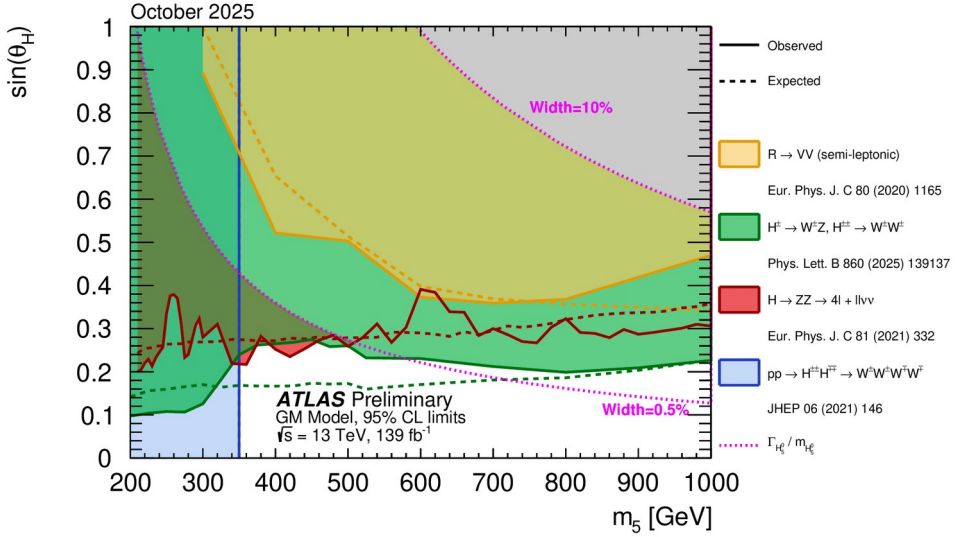


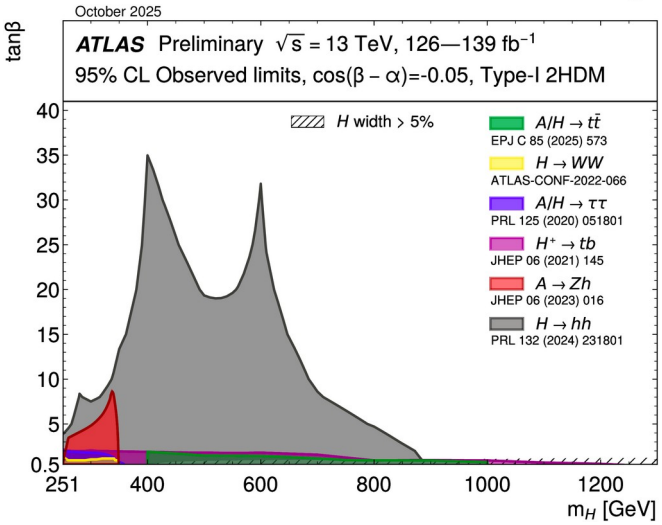
Some ATLAS results

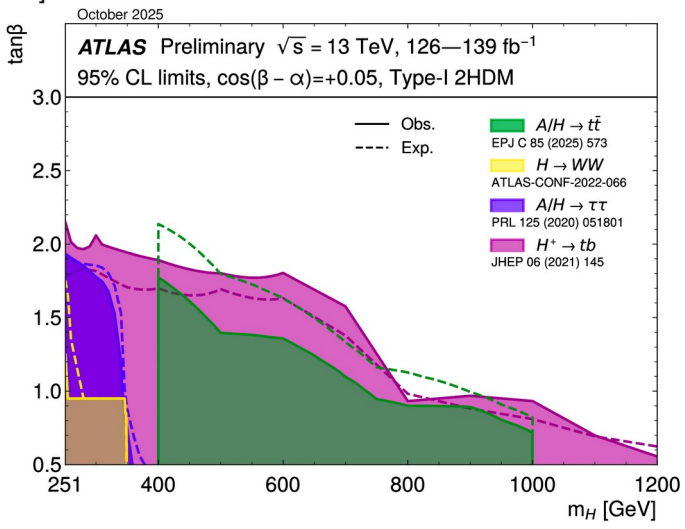
- Summary plots

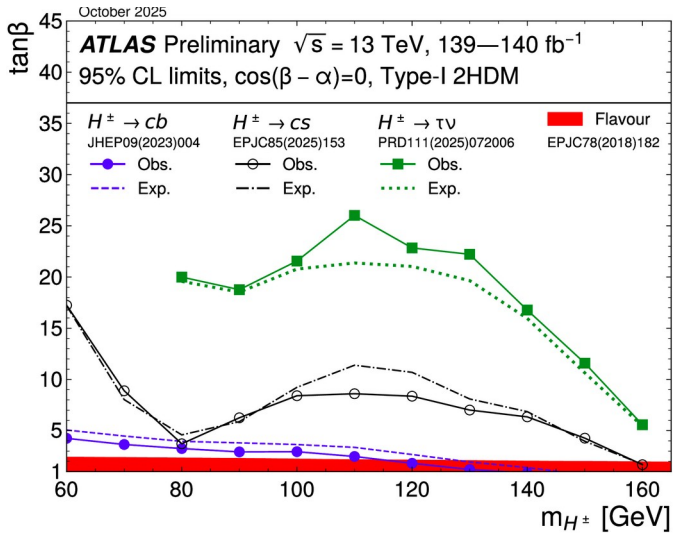
ATL-PHYS-PUB-2025-042











Some CMS results

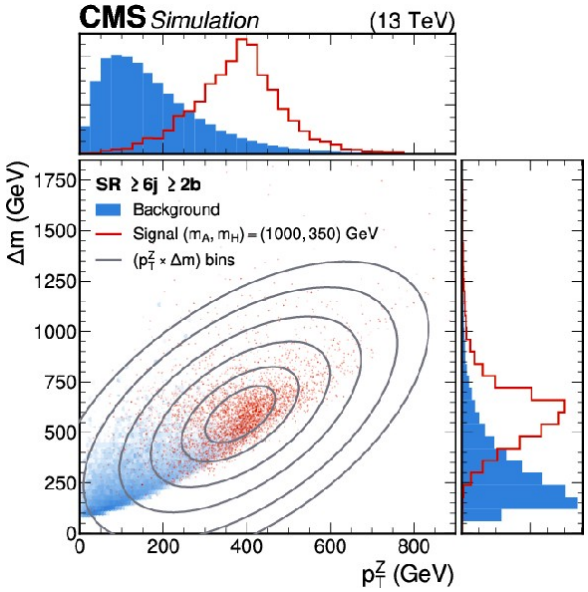
- A→ZH→ll tt

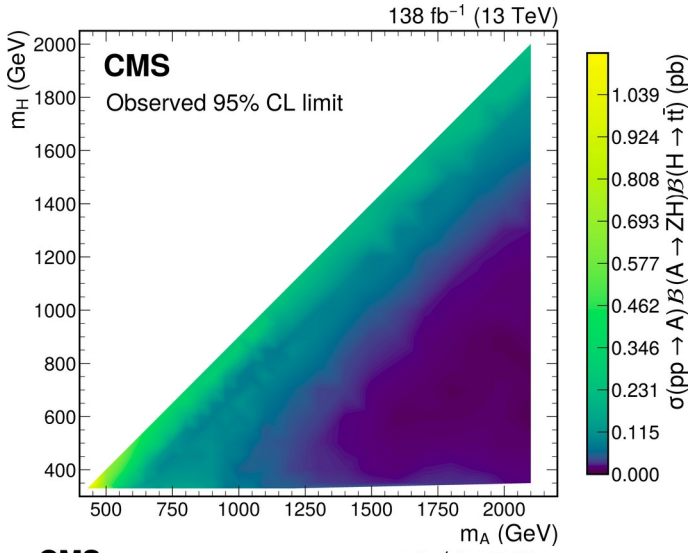
B2G-23-006
Full Run 2 data

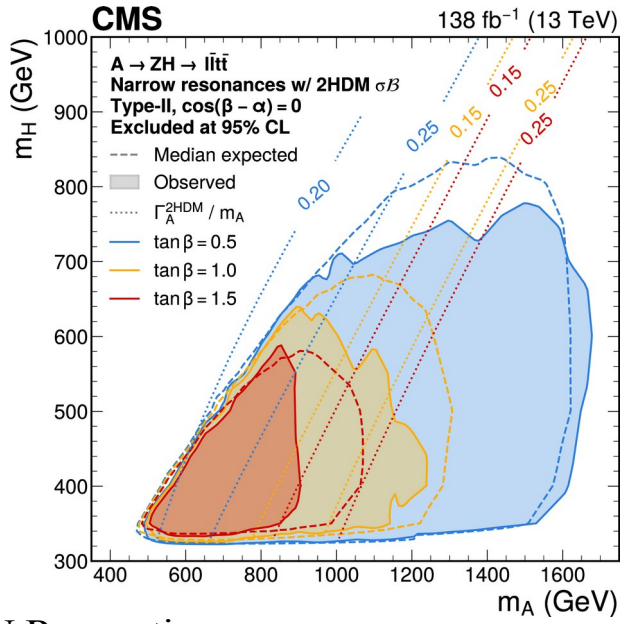
Z→ ee/μμ and fully hadronic ttbar

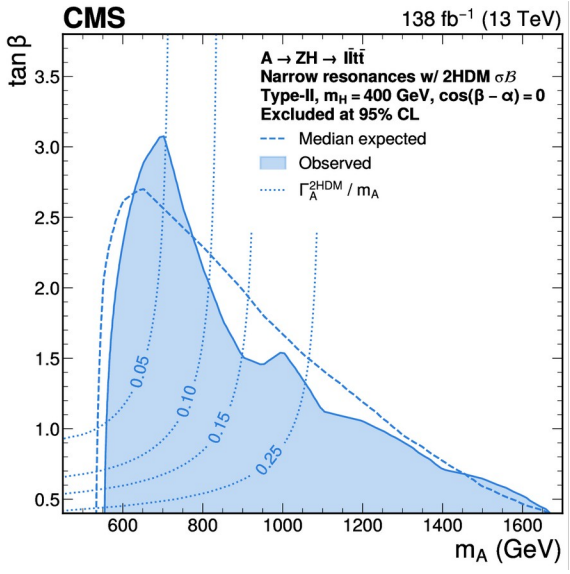
Results obtained by a simultaneous fit of the $\Delta m = m(ttZ) - m(tt)$ and the p_T^Z variables.

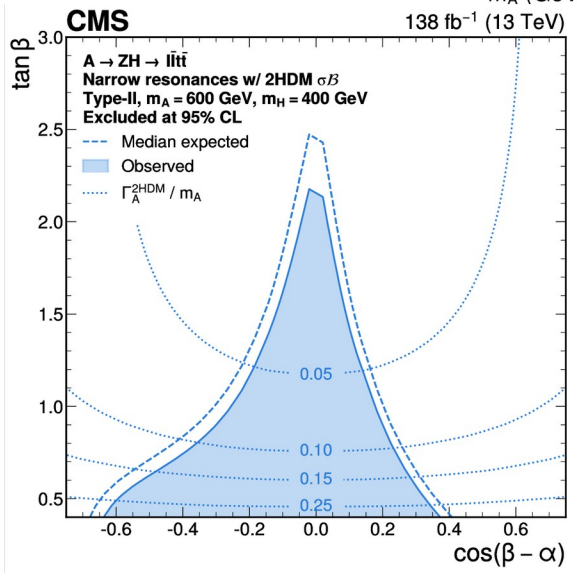
2D cross section limits are provided, as well as interpretations on the 2HDM









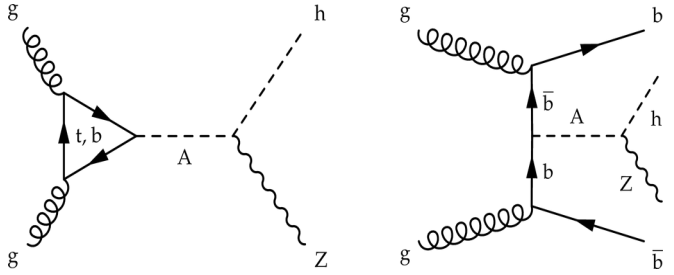


Some CMS results

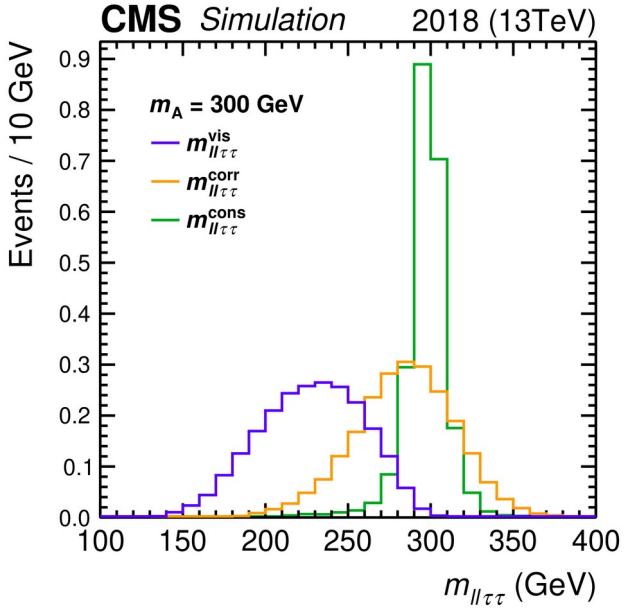
HIG-22-004
Full Run 2 data

- A→ Zh

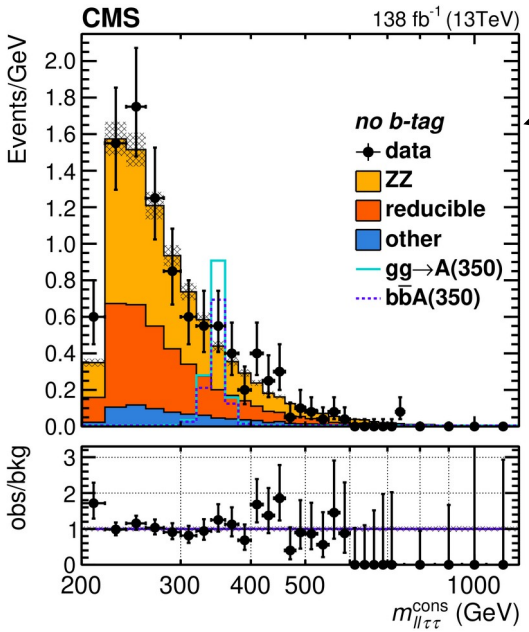
With Z→ ee/μμ and h→ ττ in the lephad and hadhad channels
Both ggF and b-associated productions are included



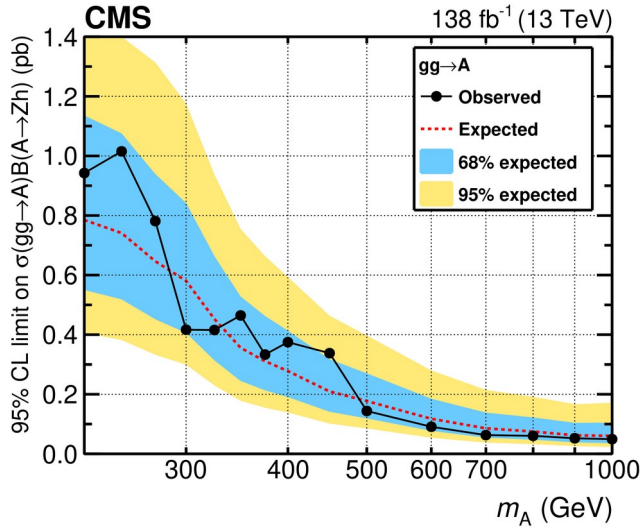
Using dedicated techniques to improve ττ mass resolution and in addition the h-mass constraint to obtain m_A resolution of 5-7%

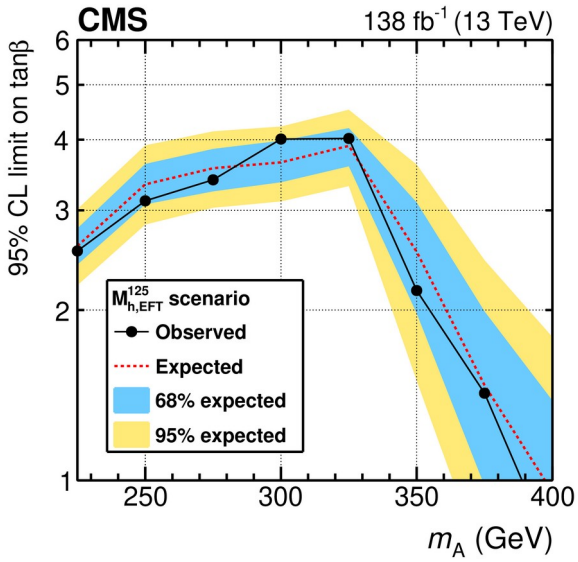


Signal region fit



Cross section limits, interpretation and 2D limits as well (not shown here)

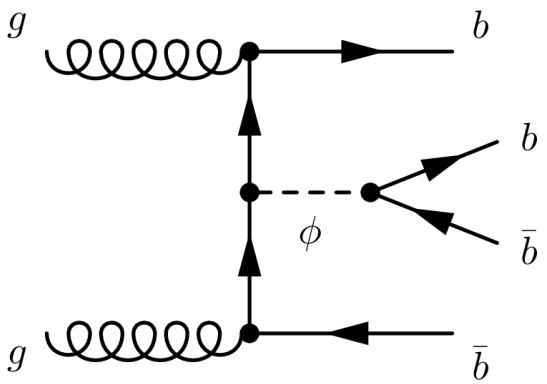




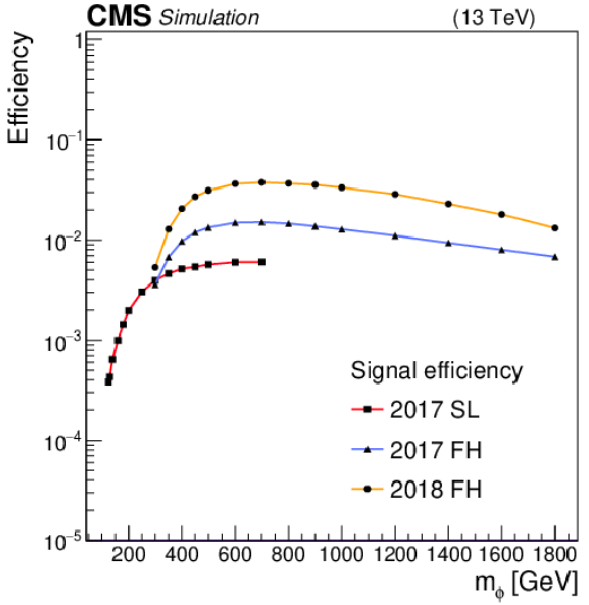
Some CMS results

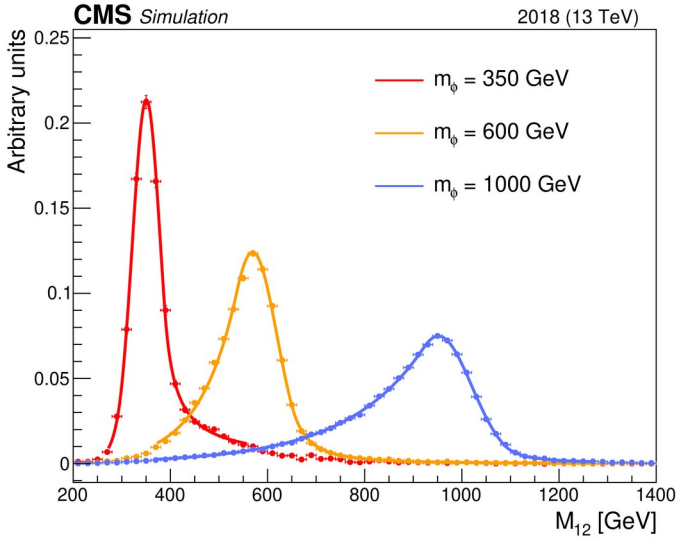
SUS-24-001
Run 2: 36.7–126.9 fb^{-1}

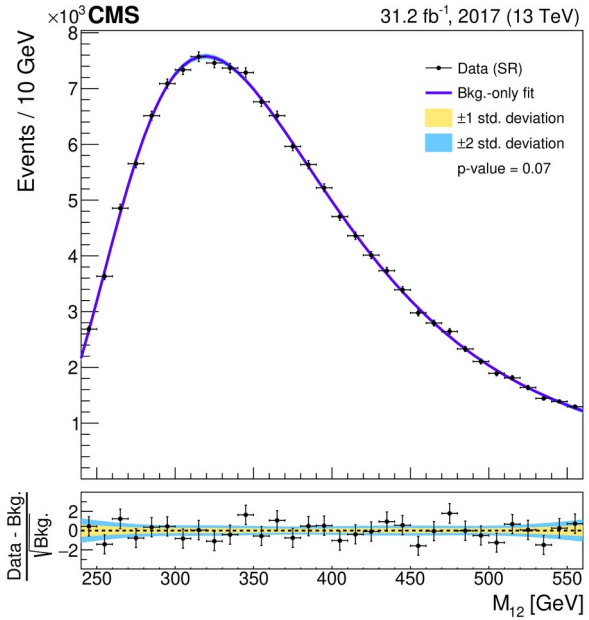
- Heavy Higgs to bb

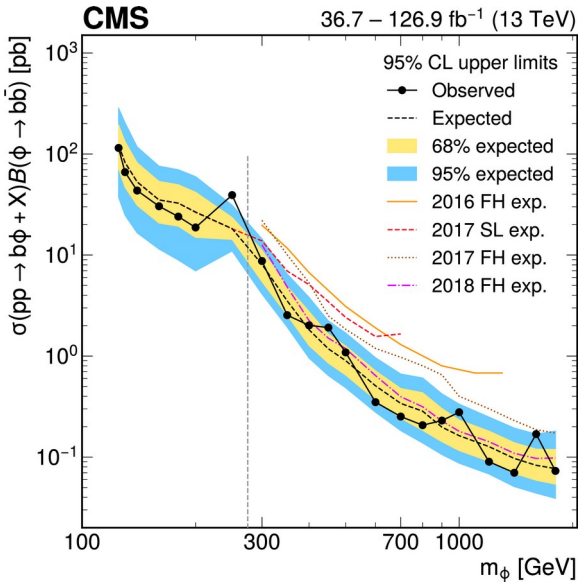


- Challenging to trigger
- at least b-tagged 3 jets are required
- Fully hadronic (FH) and semi-leptonic (SL) channel (muon-in-jet)
- Parametric fit of the mass of the first leading two jets to extract signal
- Results: cross-section limits, MSSM and 2HDM interpretations







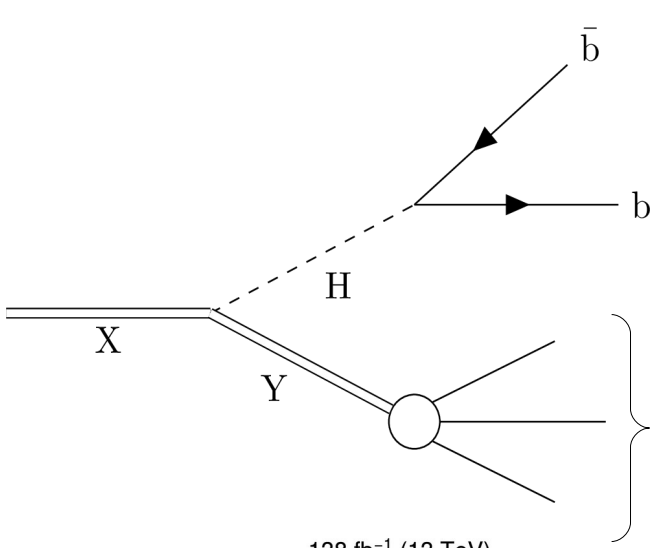


Some CMS results

B2G-24-015

Full Run 2 data

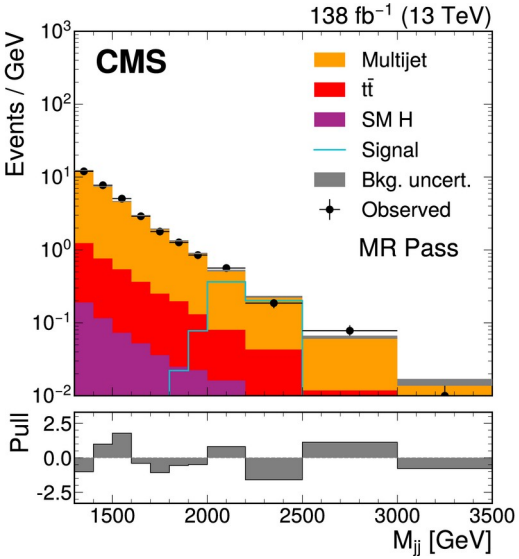
- X → Y h with h → bb

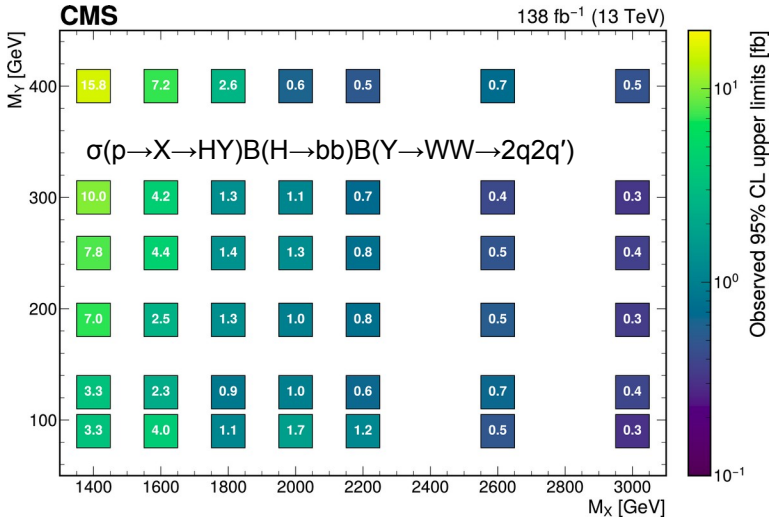


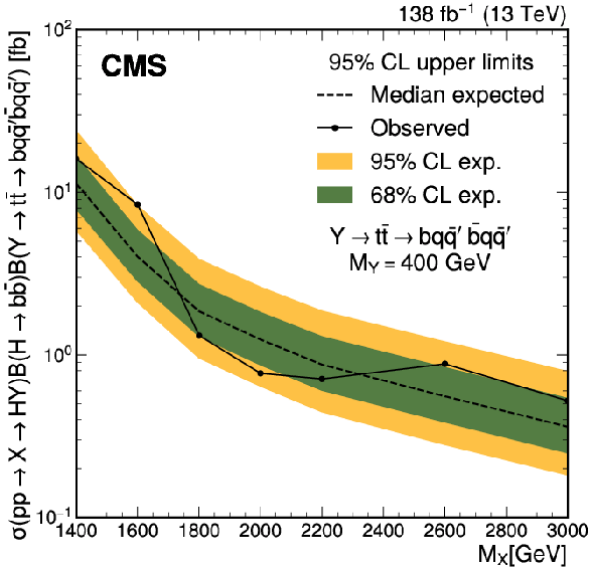
Boosted bb, reco-ed as a single large radius jet

Single large radius jet coming from:
- Y→ WW
- Y→ qq or tt
- Y = top

- Events selected by triggers requiring significant jet activity
- 2 leading jets (300 GeV), mass(jet-jet) > 1300 GeV
- Different multivariate algorithms deal with h(bb) and Y
- signal and control regions based on the algorithm scores, all fitted together for final result







Final words

- Please look at the NMSSM slides (next talk) as well since they include results relevant to Extended scalars as well