ggH @ CMS

26th March 2018

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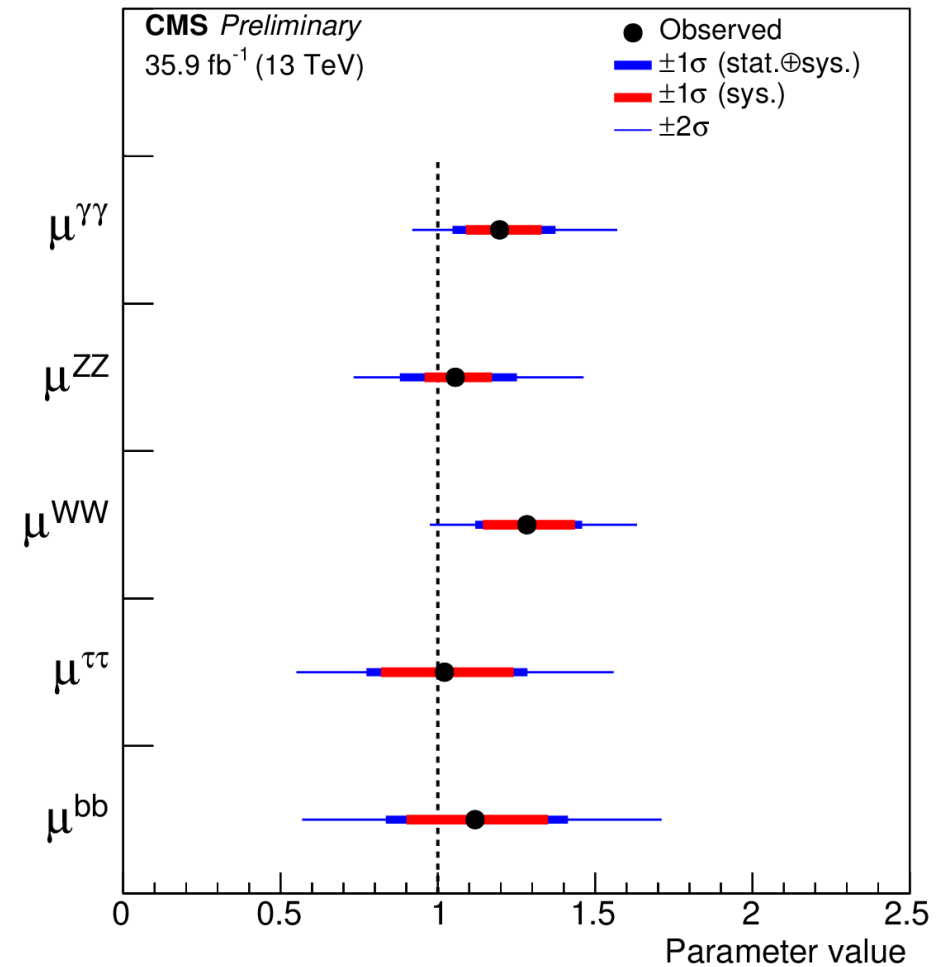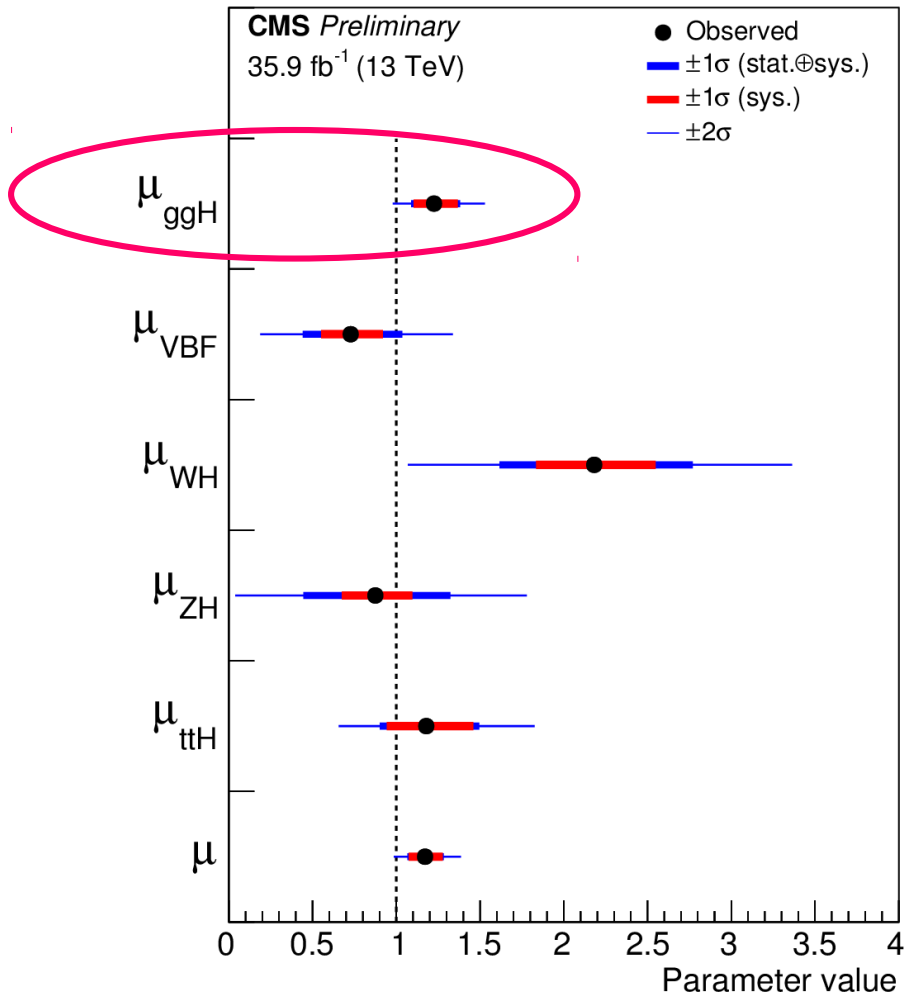(INFN Milano-Bicocca)

The 14th Workshop of the LHC Higgs Cross Section Working Group
https://indico.cern.ch/event/665524

- Recent CMS results

- Feedback from CMS to theory community

CMS results

● **CMS-PAS-HIG-17-031**: Combined measurements of the Higgs boson's couplings at $\sqrt{s}$ = 13 TeV

- Different production mechanisms

- Different Higgs decays

CMS results

- Generators used:

  - **Madgraph5_aMC@NLO** (Higgs p_T and n-jets *weighted* to NNLOPS)

  - **Powheg 2.0** (Higgs p_T and n-jets *weighted* to NNLOPS)

  - **NNLOPS**

- **Uncertainty scheme**:

  - 9 independent nuisances:

    - 2-scales, 4-jets-bin-migrations, 2-Higgs-pT-migration, top-mass-treatment

  - https://indico.cern.ch/event/618048/attachments/1430472/2210567/WG1_March_meeting_followup.pdf

  - https://indico.cern.ch/event/618048/contributions/2519117/attachments/1428957/2193875/WG1_March16_2017.pdf

  - And the actual "code" implementation:
    https://indico.cern.ch/event/618048/attachments/1430472/2204126/ggF_qcd_uncertainty_2017.cxx
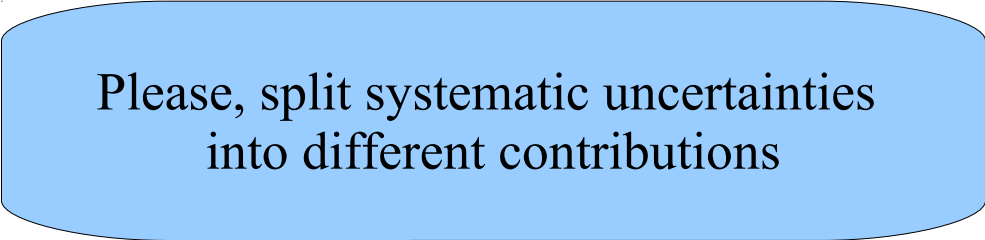
- 2017 Nov 1st dedicated meeting about **boosted Higgs**: *https://indico.cern.ch/event/675782/*

  - CMS result: Phys. Rev. Lett. 120 (2018) 071802

  - ggH → bb in high Higgs p_T regime (reconstructed **p_T > 450 GeV**)

    - Experimentally challenging: dedicated jet reconstruction/substructures techniques to reconstruct invariant mass, including b-tagging algorithms

    - Validated on Z→bb in boosted regime

CMS feedback & questions
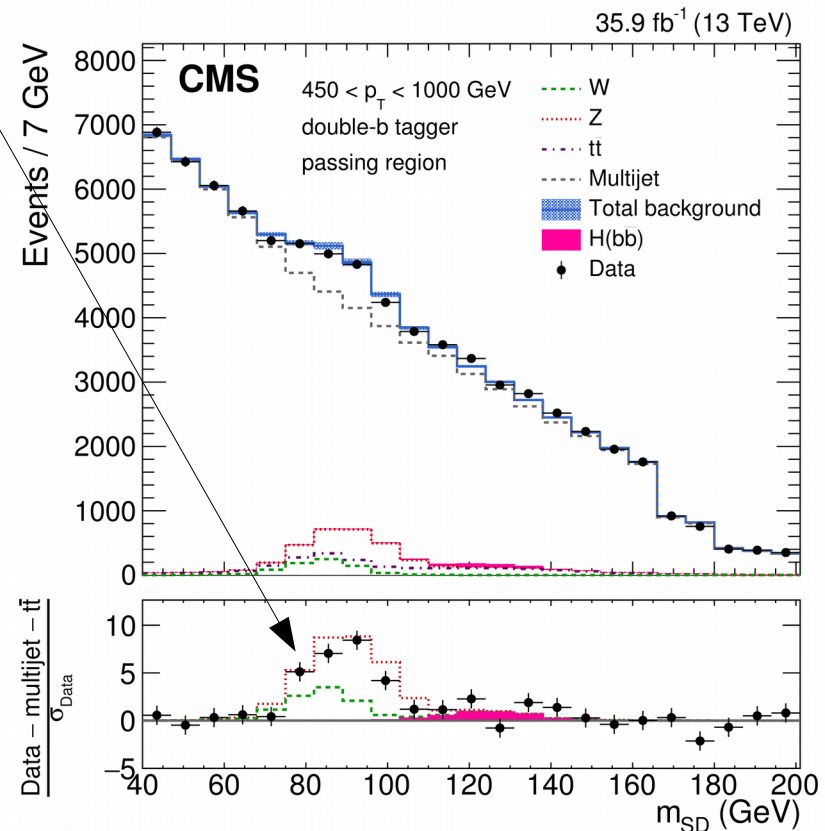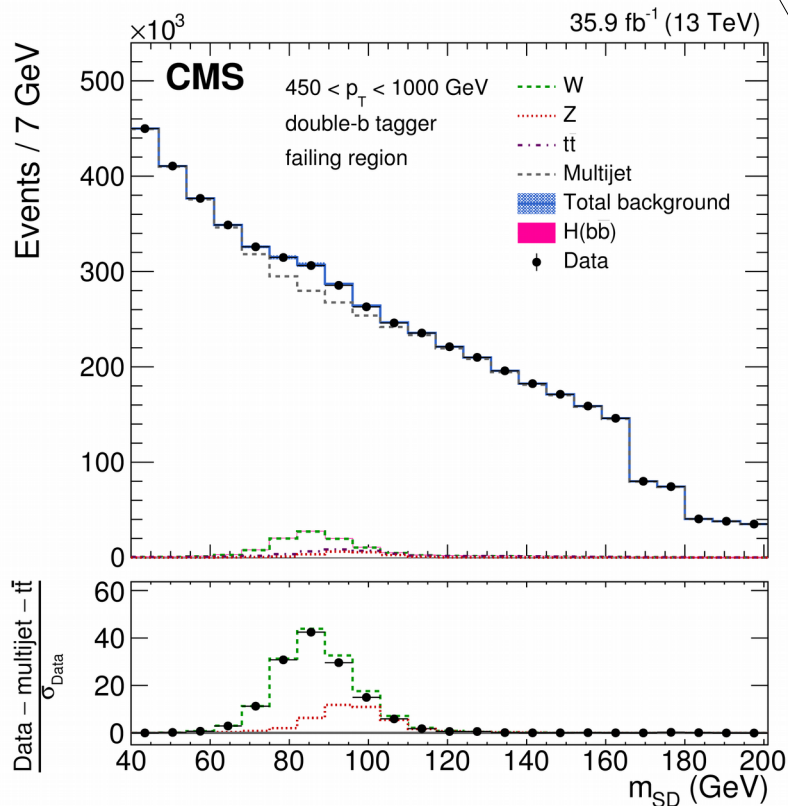
- Questions and wishlist from CMS to the theory community:

  - Common **prediction** and **uncertainty** for Higgs **high p_T** phase space

    - Important to look for deviations w.r.t. SM expectations in the high p_T spectrum

    - Important when combining the low p_T spectrum to the high p_T one

  - Common **parton shower** tunes and uncertainties

    - Different PS produce different predictions: uniform approach among experiments?

    - Tunes in PS: uniform approach among experiments?

    - Uncertainties related to PS can be as big as the current experimental precision

  - Uncertainties in **VBF** phase space:

    - How much should we "trust" jet distributions and correlations?

    - How much scale variation is a good proxy for uncertainties in this regime?

    - How much an inclusive 2-jet phase space should correlate with high $M_{jj}/\Delta\eta_{jj}$ phase space? Completely decouple? N% correlation?

- What would you like us to measure?

- How would you prefer the results to be presented?

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Please, split systematic uncertainties into different contributions