Imperial College London

Higgs to Invisible Combinations

Run I legacy result: HIG-15-012

Contributing analyses: HIG-13-030, HIG-14-038, EXO-12-055

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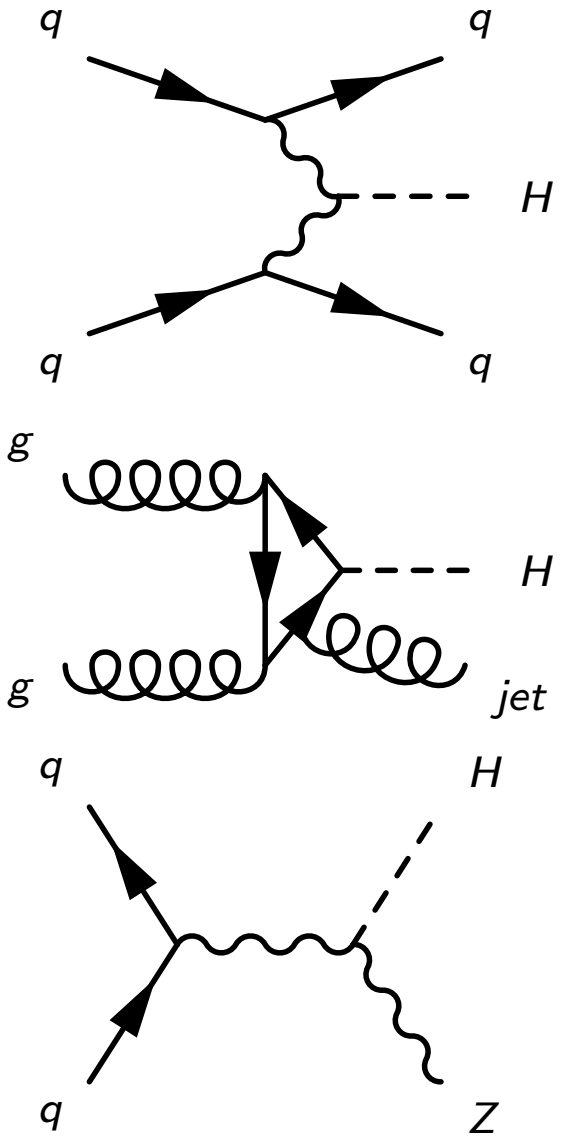
Run I Reminder

- Run 1 Prompt data searches in Z($\ell\ell$)H, Z(bb)H and VBF channels published in HIG-13-030
- VBF parked update and EXO-12-055 added for HIG-15-012
- 95% C.L. observed (expected) limit 36 (30) %

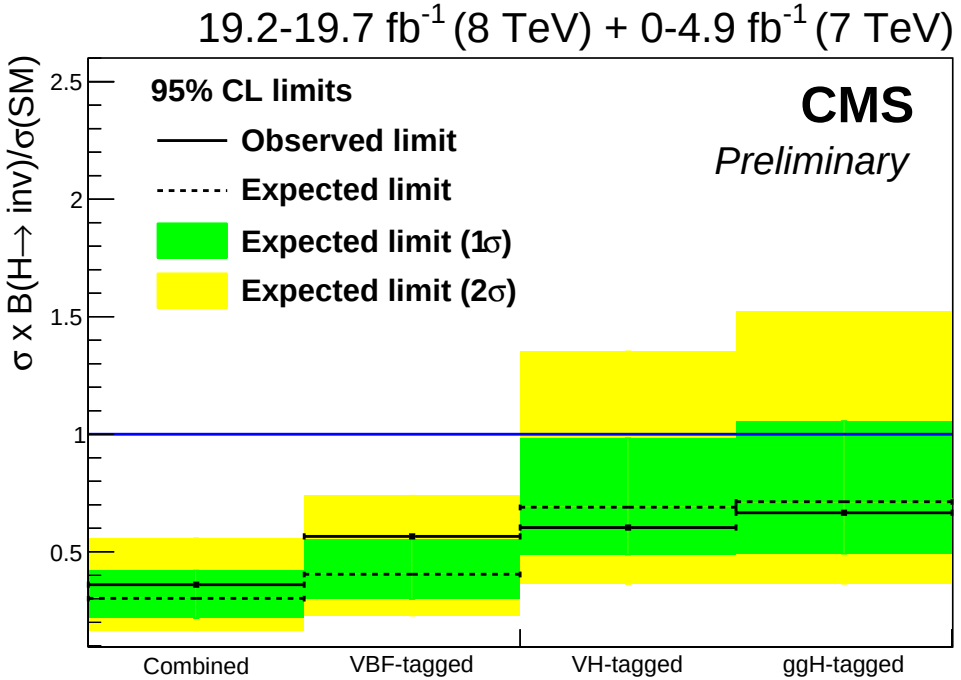
Run II

- Run I legacy Higgs uncertainties can still accommodate significant BSM properties
- Invisible group has good integration with combination group
- We must make sure we retain the orthogonality of the channels we achieved in run I



Results - by production mode tag

- We gain significantly from combination of all analyses
- VBF tagged is VBF analysis
- VH-tagged is Z(ll)H + Z(bb)H + boosted and resolved from monojet+V(had)H
- ggH-tagged is monojet from monojet+V(had)H



Backup

Limits

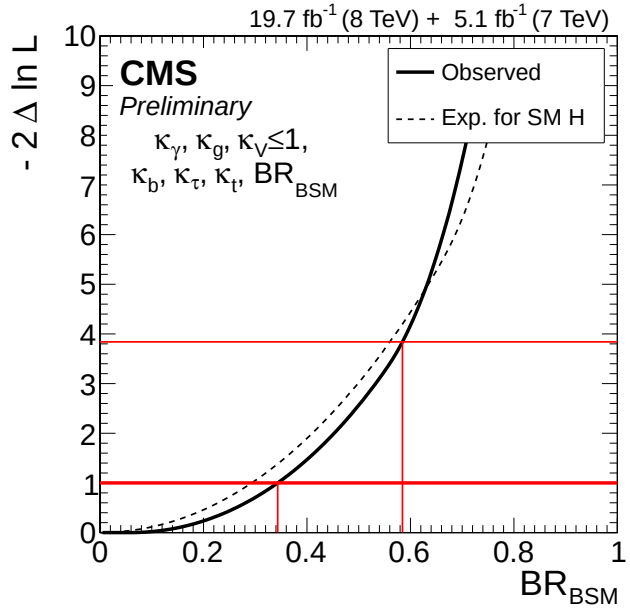
- 95% CL upper limits set using asymptotic method in combine assuming SM Higgs boson production and acceptance

Channel	Observed (expected) upper limits on $\frac{\sigma}{\sigma_{SM}}\cdot$B(H$\rightarrow$inv) (%)
VBF	57 (40)
Monojet+V(had)H	54 (62)
Z(ll)H	83 (86)
Z(bb)H	182 (199)
Combined	36 (30)

Why Higgs to Invisible?

Experimental motivation

- Current measurements of the 125 GeV Higgs boson are compatible with Standard Model (SM) expectations
  - large uncertainties can still accommodate significant beyond the SM (BSM) properties
- Additional Higgs bosons with exotic decays are not excluded



Theoretical motivation

- Many BSM theories predict Higgs boson decays to invisible final states:
  - e.g. SUSY, extra dimensions, fourth-generation neutrinos
- These final state particles are often dark matter candidates