COMBINATION OF SEARCHES FOR INVISIBLE HIGGS BOSON DECAYS WITH THE ATLAS DETECTOR

LHCC Poster Session – CERN, 27 February 2019

Introduction

- Searching for invisible decays of the Higgs boson
- Standard Model: BR \textasciitilde 10^{-3} via $H \rightarrow ZZ^{*} \rightarrow 4\nu$
- Higgs-Portal models connect Higgs boson to Dark Sector

Methodology

- Statistical combination of Run 2 analyses and the Run 1 combination
- Performing combination of likelihoods
- Common systematics are correlated across channels
- Profile likelihood ratio used as test statistic
- Limits on the BR at 95% confidence level set with the CLs technique based on the asymptotic approximation

Correlation model

- Correlated systematics include:
  - Run 2:
    - Luminosity
    -Muon + electron systematics
    - Jets
    - PDF uncertainty on signal
    - QCD scale uncertainty on signal (VH and ZH)
  - Run 1+2:
    - Parton shower modelling uncertainty for VH
    - Missing higher order corrections for ZH
    - Uncertainty on the jet multiplicity for VBF

Comparison to Direct Detection

- BR$(H \rightarrow \text{inv}) < 0.26 (0.17^{+0.07}_{-0.05})$ observed (expected) at 95% CL

Likelihood Scans

- ATLAS Preliminary
  - $\sqrt{s} = 7$ TeV, 4.7 fb$^{-1}$
  - $\sqrt{s} = 8$ TeV, 20.3 fb$^{-1}$
  - $\sqrt{s} = 13$ TeV, 36.1 fb$^{-1}$
  - $B^{\text{obs}}_{H \rightarrow \text{inv}} < 0.24$

Input channels

- Vector-Boson-Fusion [1]
- $Z(\rightarrow \text{leptons})H$ [2]
- $V(\rightarrow \text{hadrons})H$ [3]

Higgs portals

- Scalar WIMP
- Fermion WIMP
- Other experiments
  - CRESST-III
  - DarkSide50
  - LUX
  - PandaX-II
  - Xenon1T

![Diagram of Higgs boson decays and analysis results]

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1. arXiv: 1809.06663
5. ATLAS-CONF-2018-054

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