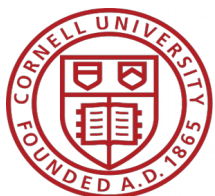


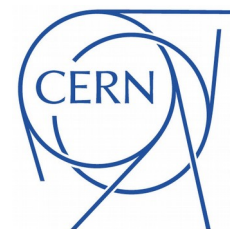


Off-shell subgroup: Experimental Overview

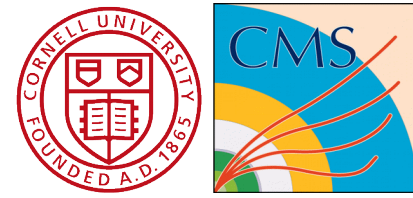
L. Soffi, R. Di Nardo



Cornell University



Activities of the subgroup

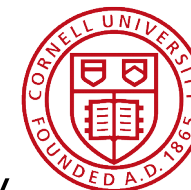


- Review potential of **off-shell and signal-background interference** in **experimental analyses**
→ **MC tools** and **phenomenology** studies
- **Off-shell measurement and width constraint**
→ **h**->**VV** signal-background interference
→ **extra-scalars** interference effects w/ h and background
→ h width constraint using **h**→ **$\gamma\gamma$**
- Experimental contacts:

	Off-shell	h→ $\gamma\gamma$
ATLAS	Roberto Di Nardo	TBD
CMS	TBD	Livia Soffi

→ Thanks to Jian and Yanyan for their important contributions for YR4 preparation

Off-shell results from RUN1

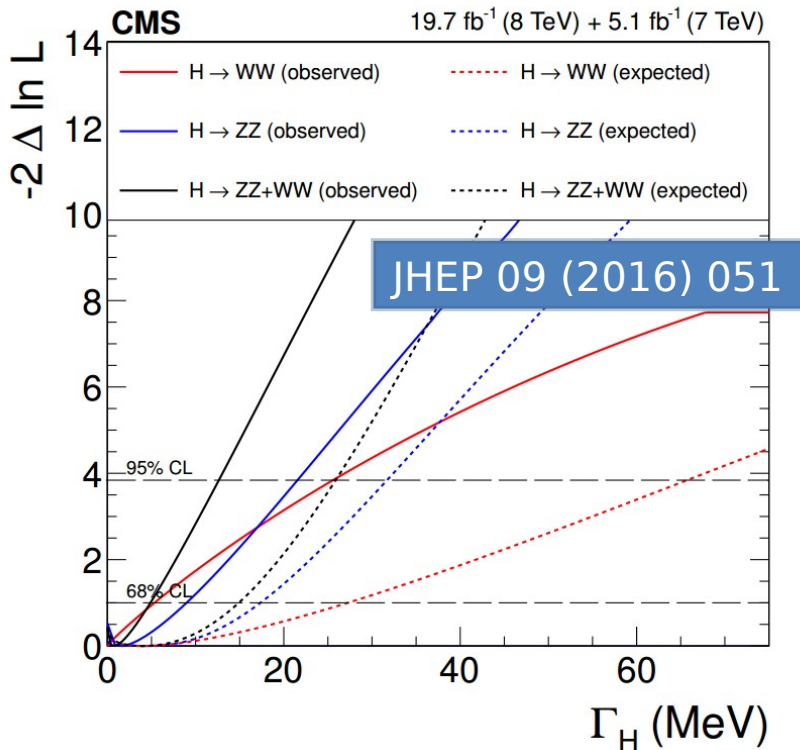


- Well established **RUN1 results for the ZZ and WW combination** by both ATLAS and CMS (4l+llvv+lvlv)

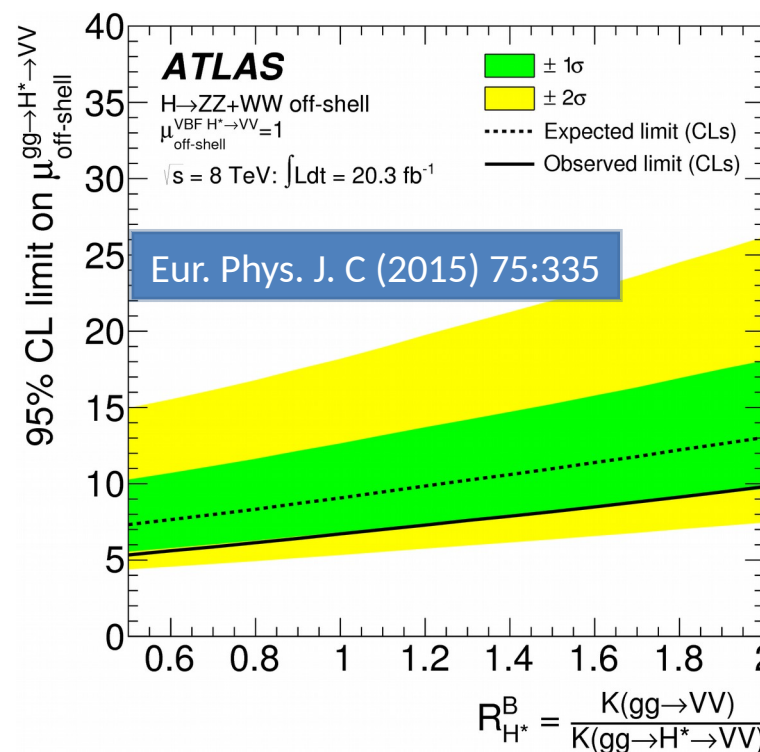
→ Additional constraint on **BSM off-shell couplings**

→ Includes interpretation as **limit on Γ_H**

→ **MC tools: gg2VV, MCFM, Phantom**



$\Gamma_H < 13$ (26) MeV obs (exp)



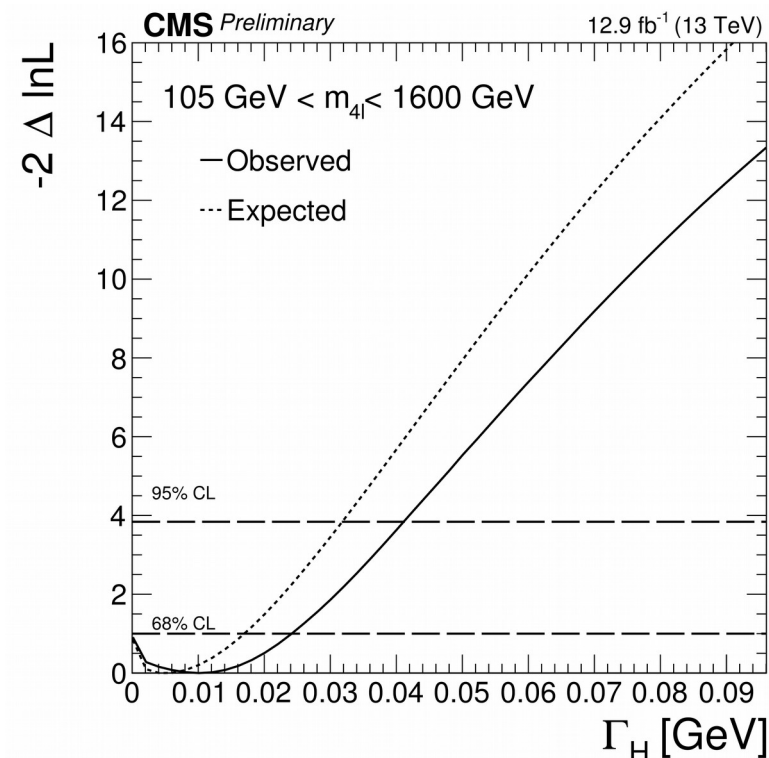
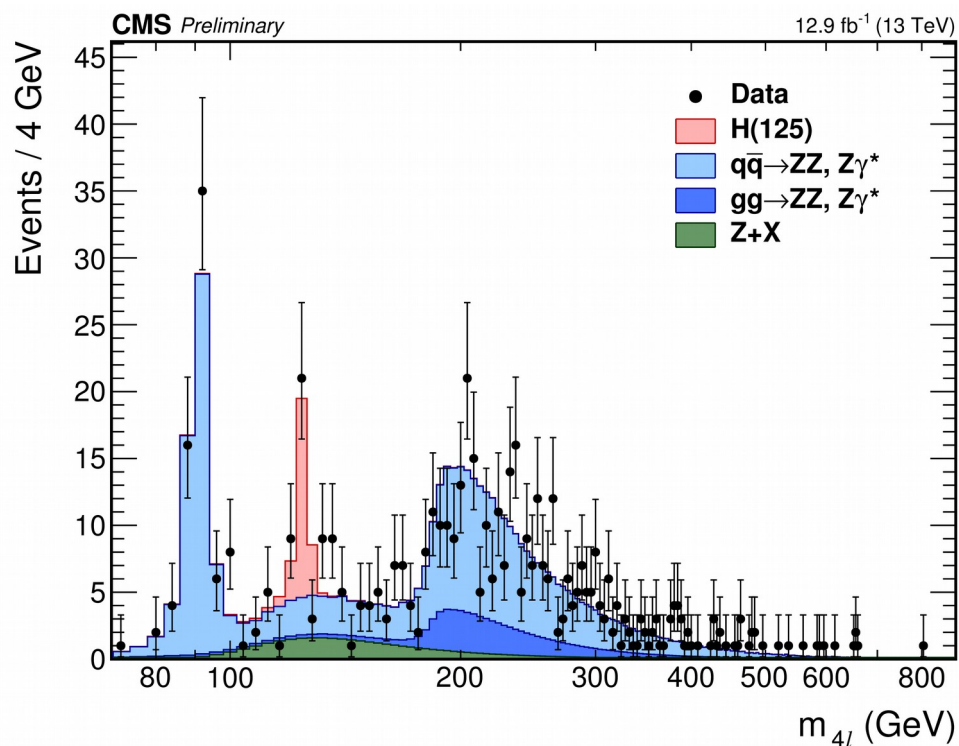
R_{H^*} in 6.7-11 (5.1-8.6) obs (exp)

$\Gamma_H < 33$ (23) MeV obs(exp)

Recent Results from Run2



- Preliminary results on **width constraints** only from CMS
- Framework: MCFM + JHUGEN + HNNLO within MELA

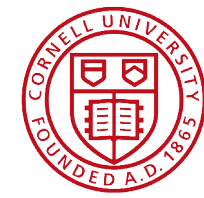


Parameter	$m_{4\ell}$ range	Observed	Expected
Γ_H (GeV)	[100, 1600]	$0.010^{+0.014}_{-0.010}$ [0.000, 0.041]	$0.004^{+0.013}_{-0.004}$ [0.000, 0.032]
Γ_H (GeV)	[105, 140]	$0.3^{+1.4}_{-0.0}$ [0.0, 3.9]	$0.0^{+1.1}_{-0.0}$ [0.0, 2.7]

CMS-HIG-16-033

→ Already better than Run1 4l only

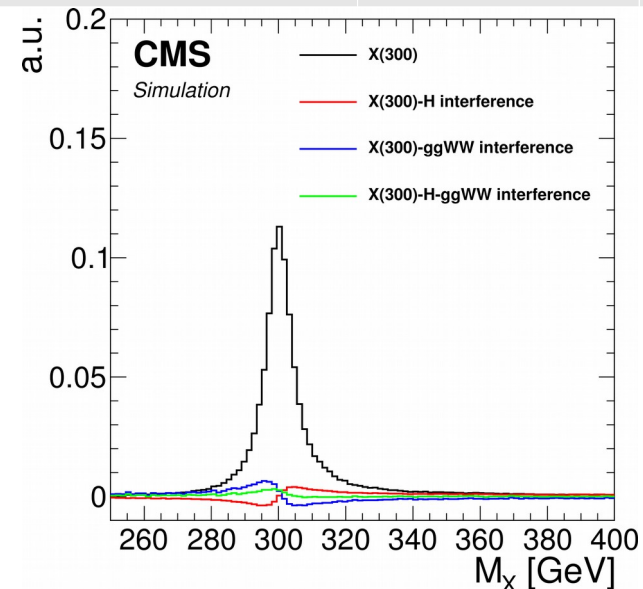
Run2 heavy scalars overview



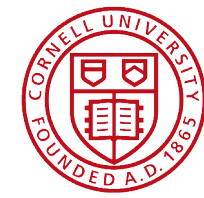
- Latest results on heavy resonances $h \rightarrow VV$ presented by ATLAS and CMS at ICHEP'16 in August ($\sim 13 \text{ fb}^{-1}$)

	ATLAS:	Dataset	Lumi	CMS:	Dataset	Lumi
$H \rightarrow WW$	ATL-CONF-2016-074/062	2015+2016	13.3 fb^{-1}	CMS-HIG-16-023	2015	2.3 fb^{-1}
$H \rightarrow ZZ \rightarrow 2l2\nu$	ATL-CONF-2016-056	2015+2016	13.2 fb^{-1}	CMS-HIG-16-001	2015	2.3 fb^{-1}
$H \rightarrow ZZ \rightarrow 4l$	ATL-CONF-2016-079	2015+2016	14.8 fb^{-1}	CMS-HIG-16-033	2016	12.9 fb^{-1}
$H \rightarrow WZ/ZZ \rightarrow \text{lep and had}$	ATL-CONF-2016-016/71/75/68	2015+2016	13.2 fb^{-1}			

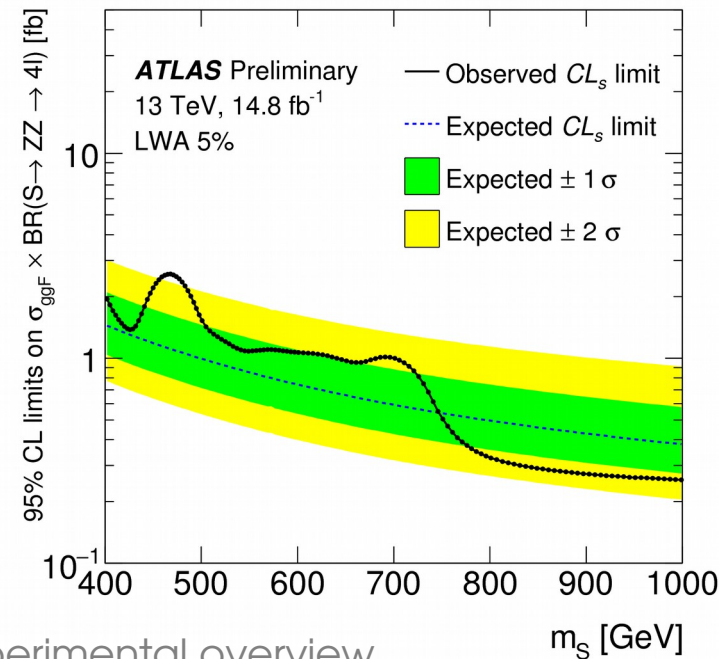
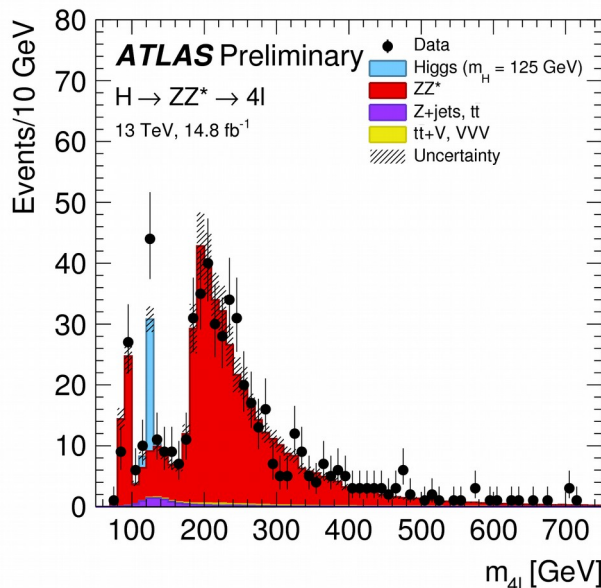
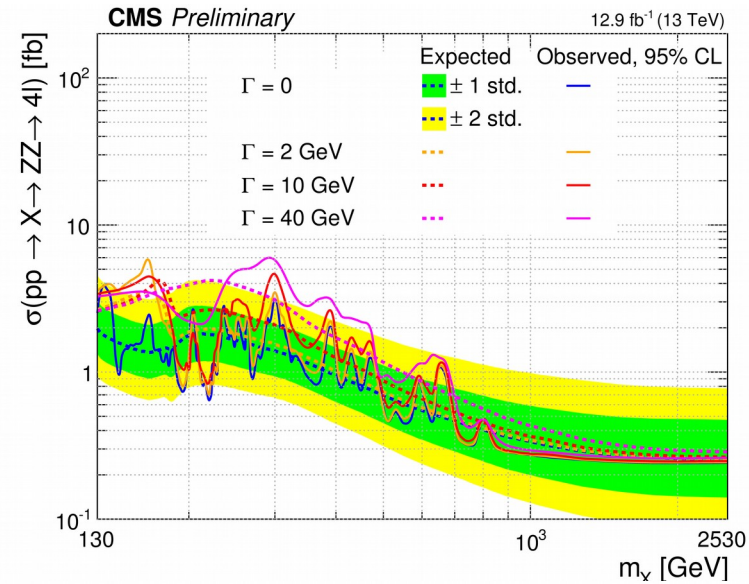
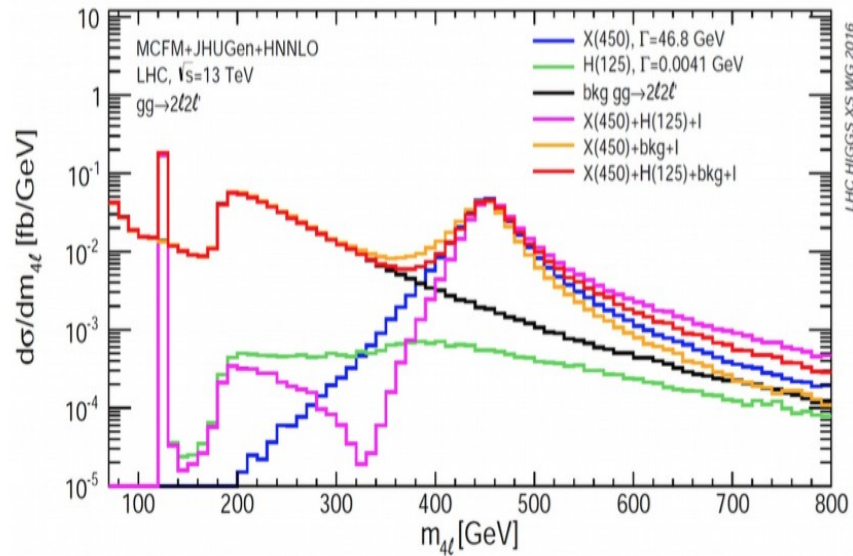
- Full interferences (X,h-offshell,B):
 \rightarrow partial cancellation effect ~ 1 10% with respect to the signal



Heavy Scalars Searches



- Full Interference added in the S+B model using gg2VV/JHUGEN tools

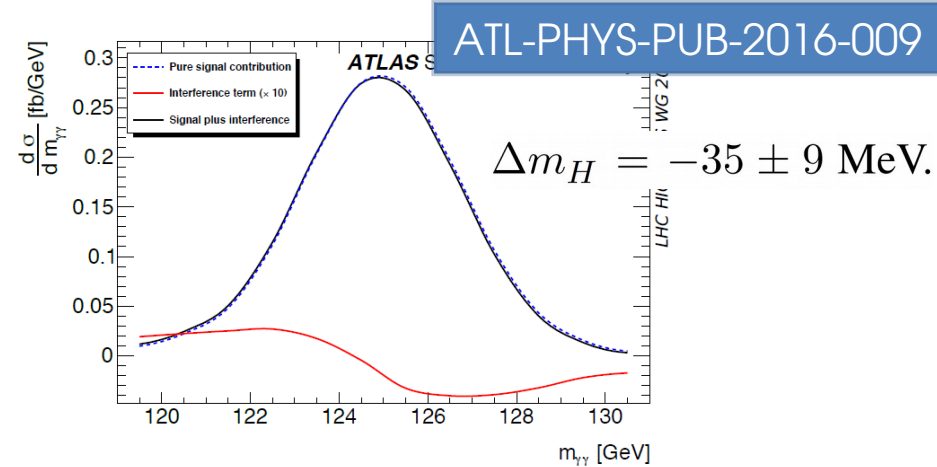
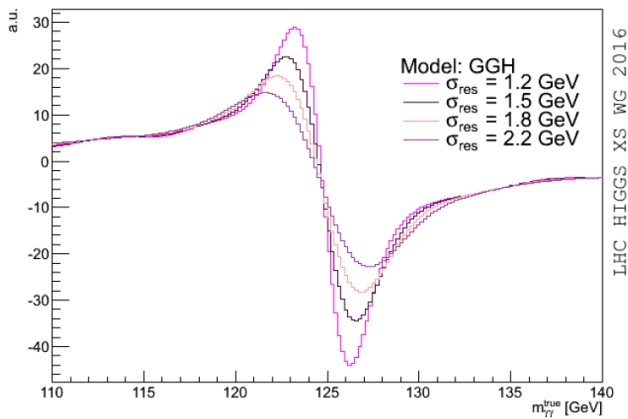


H → γγ latest results



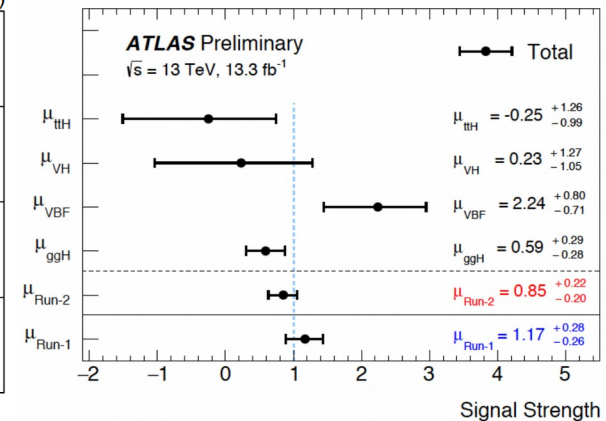
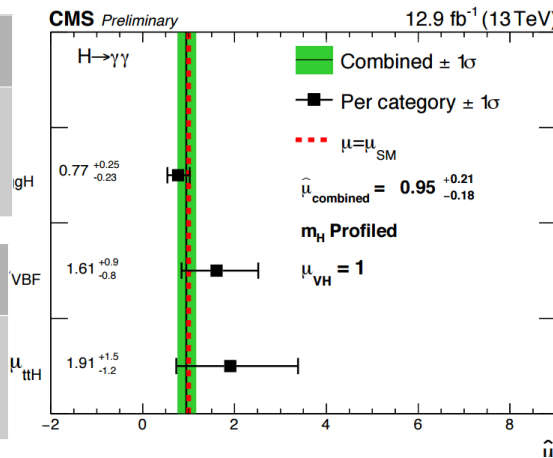
YR4: Sherpa 2 matched to DIRE parton shower → projections for 13 TeV

ATLAS 8 TeV: Sherpa 2 matched to CSS parton shower



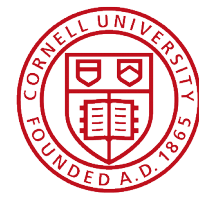
	ATLAS:	Dataset	Lumi
H → γγ	ATLAS-CONF-2016-067	2015+2016	13.3 fb ⁻¹

	CMS:	Dataset	Lumi
H → γγ	CMS-HIG-16-020	2016	12.9 fb ⁻¹



- Results on fiducial and differential cross-sections and signal strengths → still no Run2 public analyses using interference effects

Perspective for 2017



- Big effort to complete in time the **YR4 tasks**
 - Thanks to the hard work done from all the contributors in the past months!!
- It is time to **think about the future**:
 - First purpose of all analyses at the beginning of Run2 was the high priority exotica searches and **Higgs Re-Discovery**
 - Now start to explore new territories also in Higgs physics:
 - Probe new energy ranges → **High mass searches**
 - **Off-shell region exploited for Higgs width constraints**
 - Perform Higgs Width measurements in **all decays channels**
 - 2016+2017 statistic should be enough to start looking at the **$H \rightarrow \gamma\gamma$ channel**