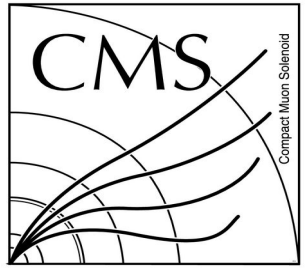

WG3 extended Higgs sector: experimental summary

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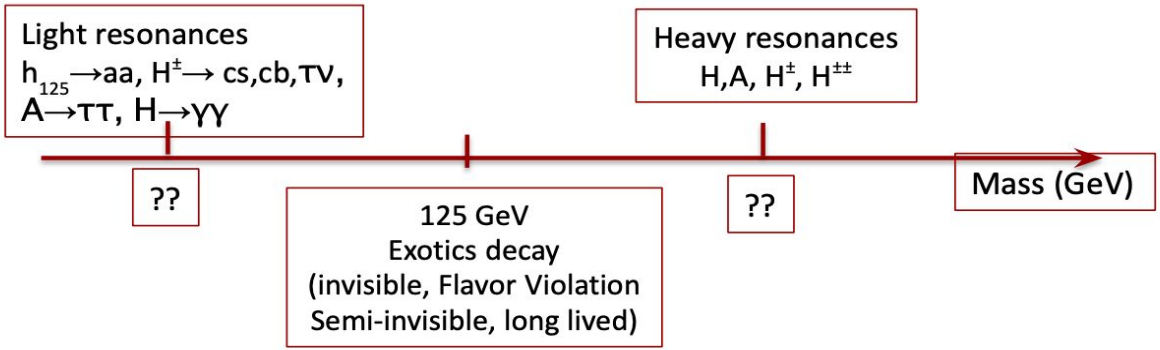
Massachusetts Institute of Technology

Theory: Tania Robens (Zagreb), Rui Santos (ISEL.CFTC,Lisbon)
ATLAS: Lidjia Zivkovic (Belgrade), Nikos Rompotis (Liverpool)
CMS: MariarosariaD'Alfonso (MIT), Santeri Laurila (CERN)

Overview of recent experimental

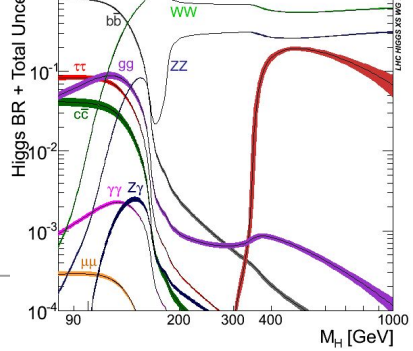
https://twiki.cern.ch/twiki/bin/view/AtlasPublic/HDBSPublicResults
https://cms-results-search.web.cern.ch



What are the gaps?
Missing signature/interpretations ?
New trends of results

Summary: Heavy Neutral Higgs

Search a more massive partner of the h_{125}



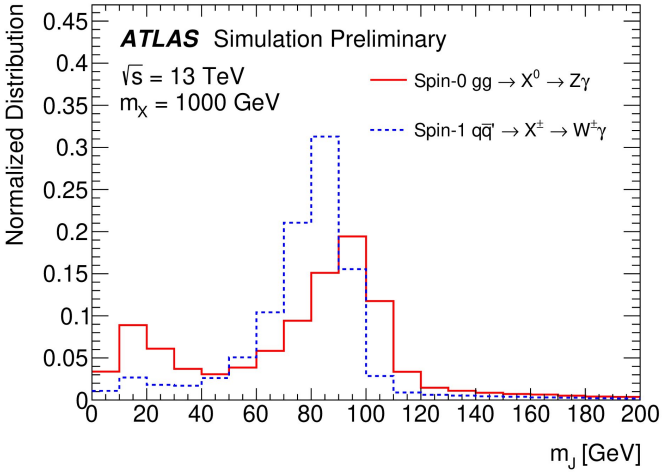
	ATLAS	CMS
A/H→ττ	139 /fb: PRL 125(2020)051801	36 /fb *JHEP 09 (2018)007*
A/H→μμ	36 /fb JHEP 07 (2019) 117	36 /fb PLB 798(2019)
H→WW	36 /fb: EPJC 78(2018)24	36 /fb JHEP 03 (2020) 034
A/H→bb	28 /fb Phys. Rev. D 102 (2020) 032004	36 /fb JHEP 08 (2018) 113
A/H→tt	20 /fb: PRL 119(2017)191803 (8 TeV)	36 /fb Eur. Phys. J. C 77 (2017) 578
H→γγ	139 /fb Phys. Lett. B 822 (2021) 136651	
H→Zγ	139 /fb ATLAS-CONF-2021-041	
H→ZZ	139 /fb: arXiv:2009.14791	36 /fb: JHEP 06(2018)127

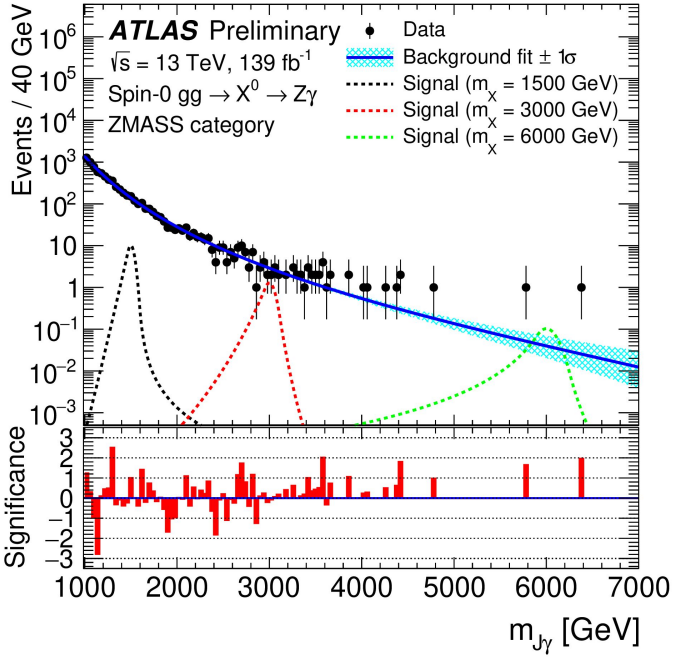
Highlight ATLAS:

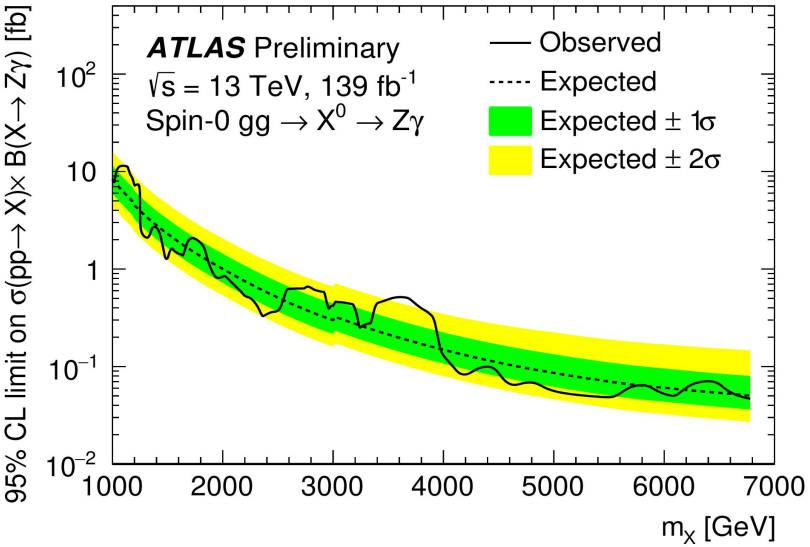
ATLAS-CONF-2021-041

γ + Z/W

with Z/W hadronic final reconstructed as a large cone jet







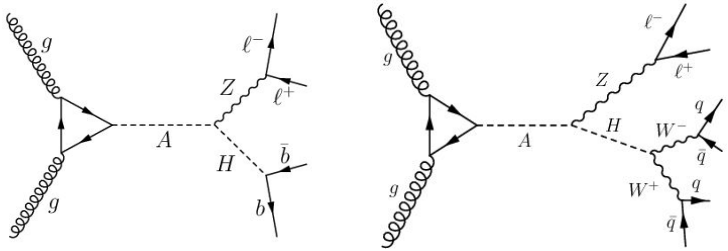
Summary: Neutral Higgs non h_{125}

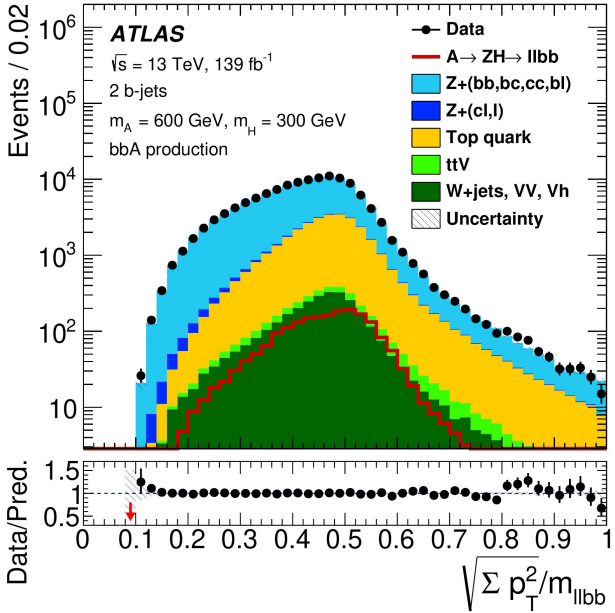
Two Higgs bosons better than one.

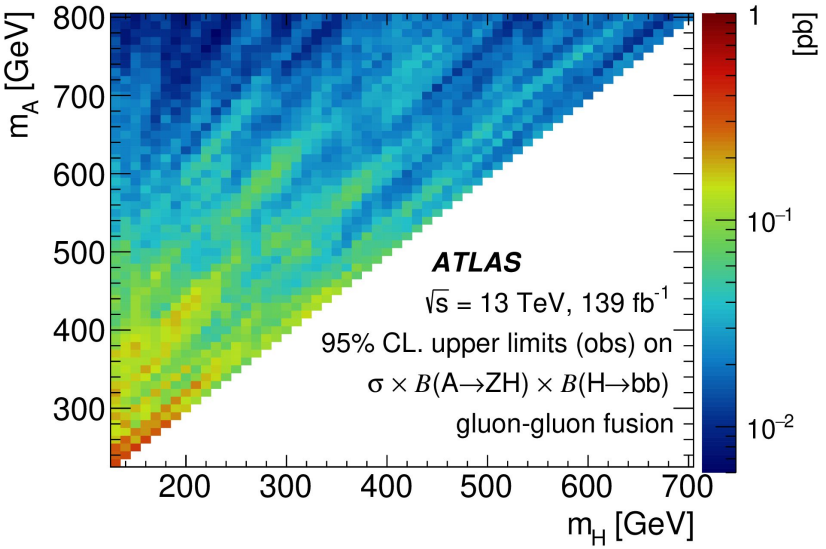
	ATLAS	CMS
$H \rightarrow Z\,A \rightarrow llbb$	139/fb Eur. Phys. J. C. 81 (2021) 396	36/fb JHEP 03 (2020) 055
$H \rightarrow Z(ll,\nu\nu)\, h_{125}(bb)$	139/fb ATLAS-CONF-2020-043	
$H/A \rightarrow Z(ll)A/H$ $H \rightarrow bb$ and $H \rightarrow WW$	139/fb Eur. Phys. J. C. 81 (2021) 396	
$H/A_{MSSM} \rightarrow h_s(bb) + h_{125}(\tau\tau)$		http://cms-results.web.cern.ch/cms-results/public-results/publications/HIG-20-014/index.html
$X \rightarrow Y(bb)\, h_{125}(bb)$		https://cds.cern.ch/record/2790886

Highlight ATLAS:

https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/PAPERS/HDBS-2018-13/





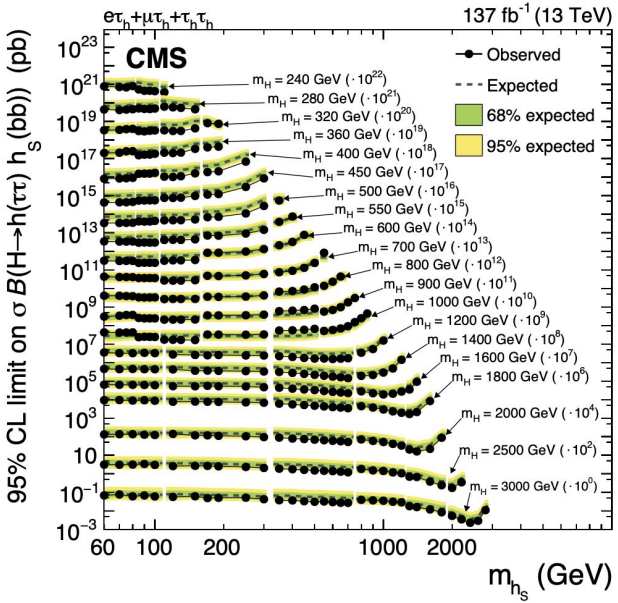


Highlight CMS: X → Y(H) X

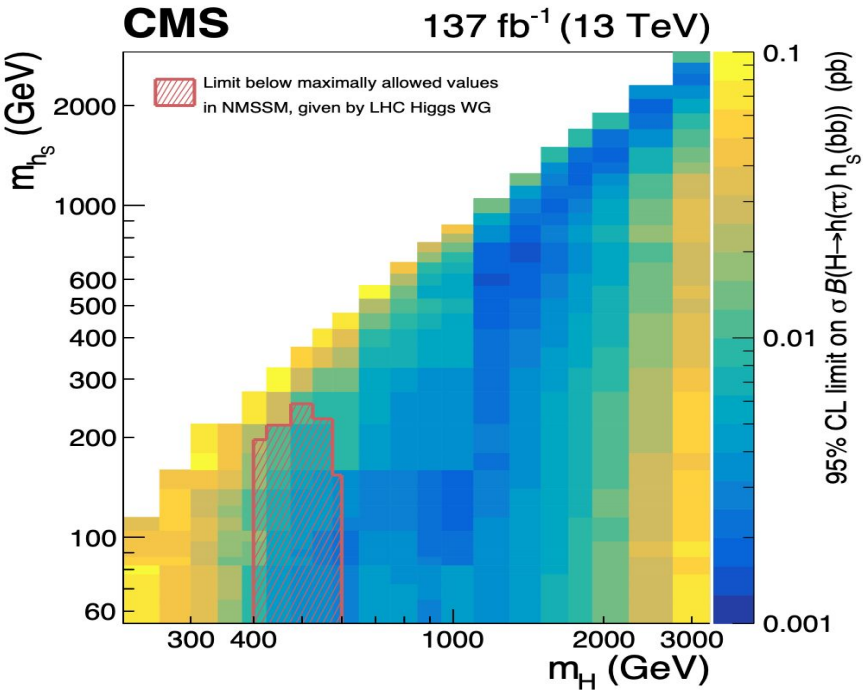
HIG-20-014 Submitted to JHEP
https://arxiv.org/abs/2106.10361

$H/A_{MSSM} \rightarrow h_s(bb) + h_{125}(\tau\tau)$ inspired by NMSSM

Upper limits on h_s from (m_H = 240 GeV) to 2.7 fb (m_H = 3 TeV)



BR ($h_{125}(\tau\tau)$) 6%
→ improvements possible exploring other decay mode

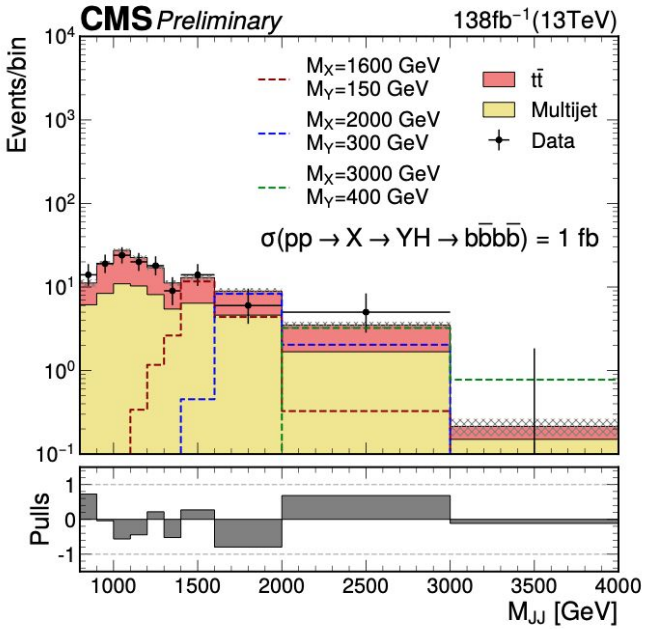


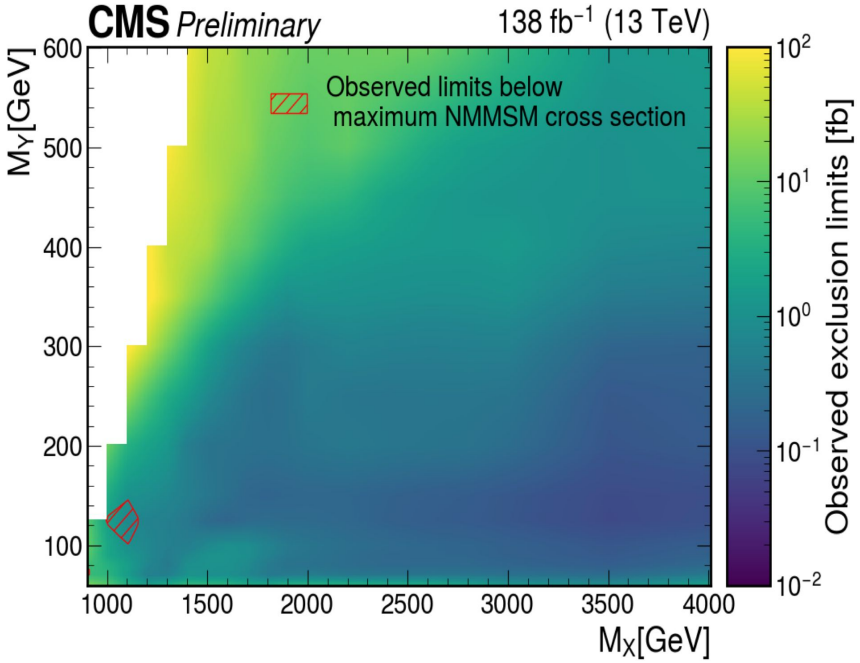
Constrained for masses of m_H ~400-620 GeV and mh_s ~60-250 GeV

Highlight CMS: X → Y(H) X

https://cds.cern.ch/record/2790886

X→Y(**bb**) $\mathbf{h_{125}}$(**bb**) inspired by NMSSM



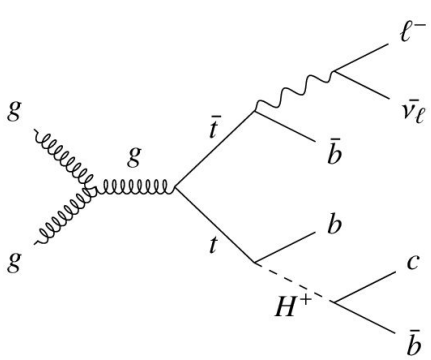


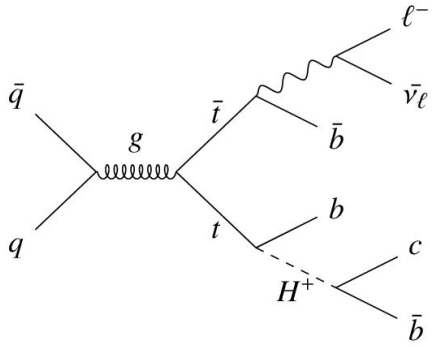
Summary: charged Higgs non h_{125}

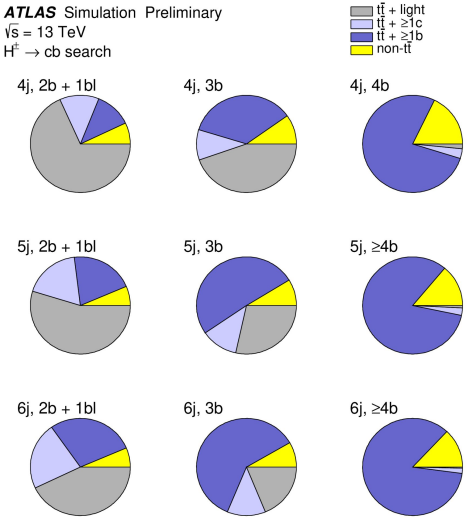
	ATLAS	CMS
$H^{\pm} \rightarrow tb$	139 /fb JHEP 06 (2021) 145	36 /fb JHEP 2020:096 + JHEP 2020:126
$H^{\pm} \rightarrow cb$	139 /fb ATLAS-CONF-2021-037	
$H^{\pm} \rightarrow cs$		36/fb Phys. Rev. D 102, 072001 (2020)
$H^{\pm} \rightarrow \tau_h \nu$	36 /fb JHEP 09 (2018) 139	36/fb *JHEP 2019:142*
$H^{+} \rightarrow Wa$	137/fb ATLAS-CONF-2021-047	36/fb Phys. Rev. Lett. 123, 131802 (2019)
$H^{+} \rightarrow WZ$	137/fb JHEP 06 (2021) 146 non VBF	137/fb VBF channel *https://arxiv.org/abs/2104.04762*
$H^{++} \rightarrow W^{+}W^{+}$	139 /fb JHEP 06 (2021) 146	

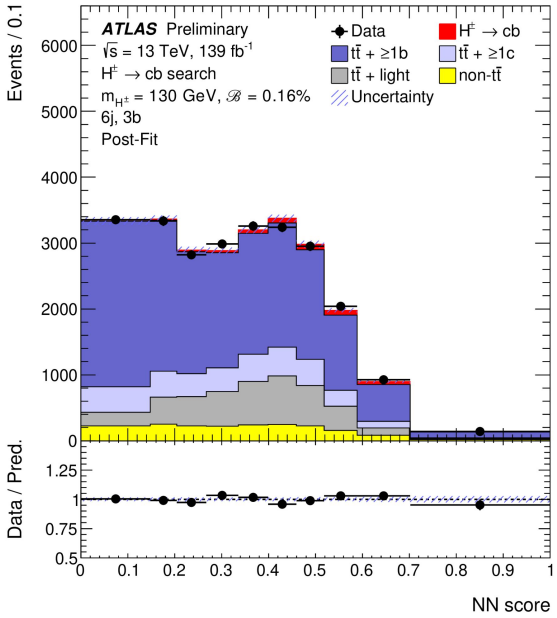
Highlight ATLAS:

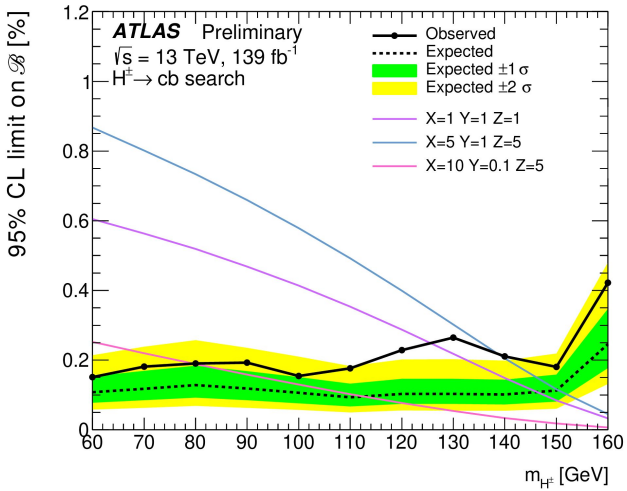
https://atlas.web.cern.ch/Atlas/GROUPS/PHYSICS/CONFNOTES/ATLAS-CONF-2021-037/











Summary

Many results need to be updated with the full Run2 luminosity.

New Run3 dataset will further improve the reach of statistically limited channels.

Improved analysis techniques will allow to explore new channels/phase space.

Model independent way of interpreting the results are available, some specific models are investigated.