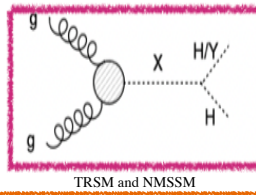
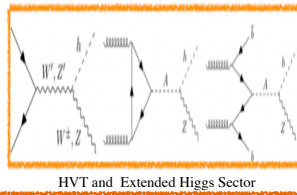
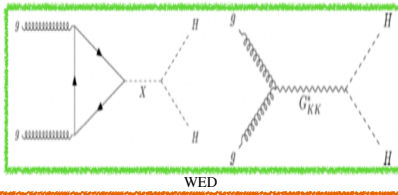


Searches for Higgs boson production through decays of heavy resonances in CMS

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Motivation

- Many theories predicted new massive resonances could interact with SM Higgs
- New resonances could be:
 - Higgs in Extended Higgs sectors
 - Bulk Graviton or Radion in Warped Extra Dimensions (WED)
 - W' or Z' in Heavy Vector Triplet (HVT) model
- New resonances could decay into:
 - Two standard model Higgs
 - A SM Higgs and a new scalar Y in NMSSM or TRSM
 - A SM Higgs and a vector boson in HVT or Extended Higgs Sector.
- A combination of HH/HY could provide a best sensitivity in a wide mass range



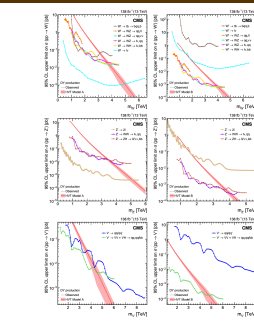
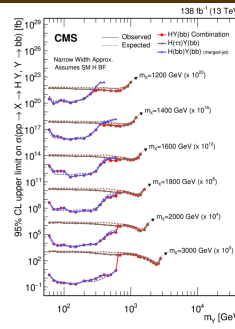
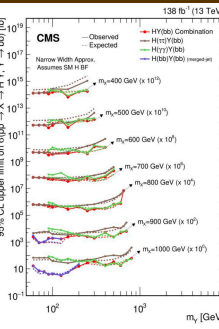
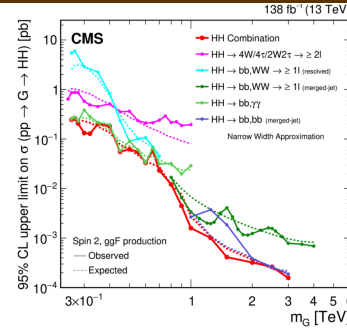
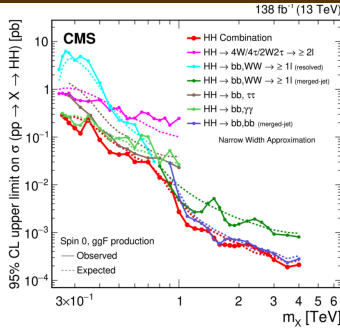
Analyses in combination

Target final state	Ref.	Mass coverage (GeV)	Comment	
Y	H	m_X		
Z($\ell\ell + \nu\nu$)	$\tau\tau$	225-800		
W($\ell\nu$)	bb	225-1000	resolved jets	
Z($\ell\ell$)	bb	1000-4500	W $\rightarrow \ell\nu$ and merged bb jet	
Z(qq)	bb	800-4600	Z $\rightarrow \ell\ell/\nu\nu$ and merged bb jet	
	bb	1300-6000	two merged jets	
H	H	m_X		
bb	W($\ell\nu$)W($\ell\nu + qq$)	250-900	resolved + merged	
bb	W($\ell\nu$)W($\ell\nu + qq$)	800-4500	merged	
WW + $\tau\tau$	WW + $\tau\tau$	250-1000	multilepton final state	
Y	H	m_X	m_Y	
bb	$\tau\tau$	240-3000	60-2800	resolved jets and τ leptons
bb	$\gamma\gamma$	300-1000	90-800	resolved jets and photons
bb	bb	900-4000	60-600	two merged bb jets

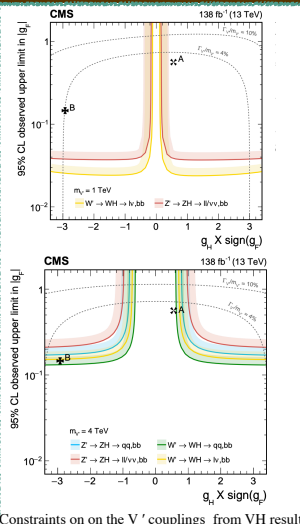
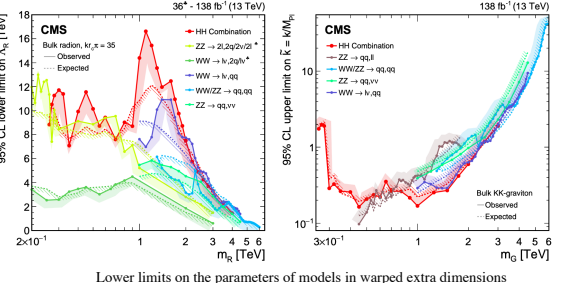
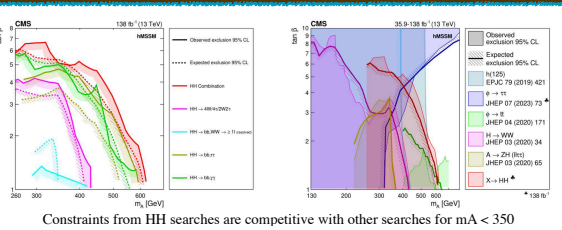
Combination Procedures

- Systematics alignment
 - Correlate the systematics in same resources
- Overlap removal
- Normalization of branching fractions
- Statistic tests
 - Goodness of Fit
 - Pulls and Impacts
 - Bias tests...

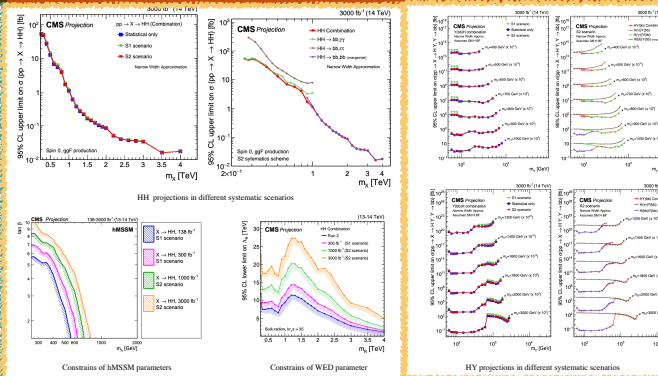
HH/HY searches combination



Model interpretations



HL-LHC Projections



Summary:

- A combination of HH/HY searches in CMS has been performed.
- HH/HY Combination results are presented
- Best sensitivities achieved in a wide X/Y mass ranges
- HL-LHC projections are also presented
- Several VH searches are also included and summarized.
- The results are interpreted in different models:
 - WED, NMSSM and HVT models

