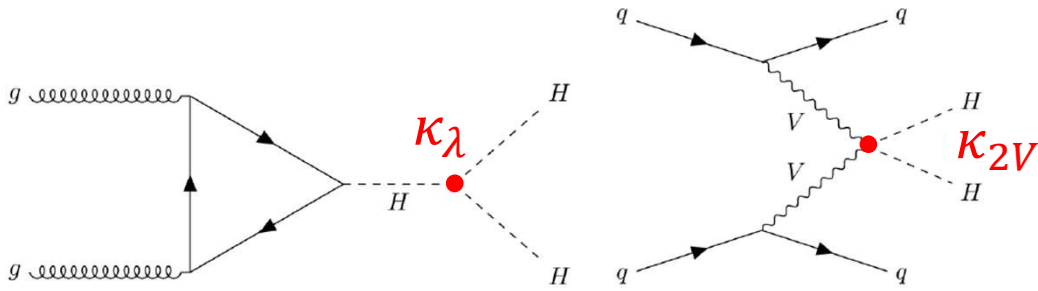


Di-Higgs Summary & Discussion

*Verena Martinez Outschoorn
UMass Amherst*

Higgs Hunting Workshop, September 20-22, 2021

Di-Higgs Cross Section Limits

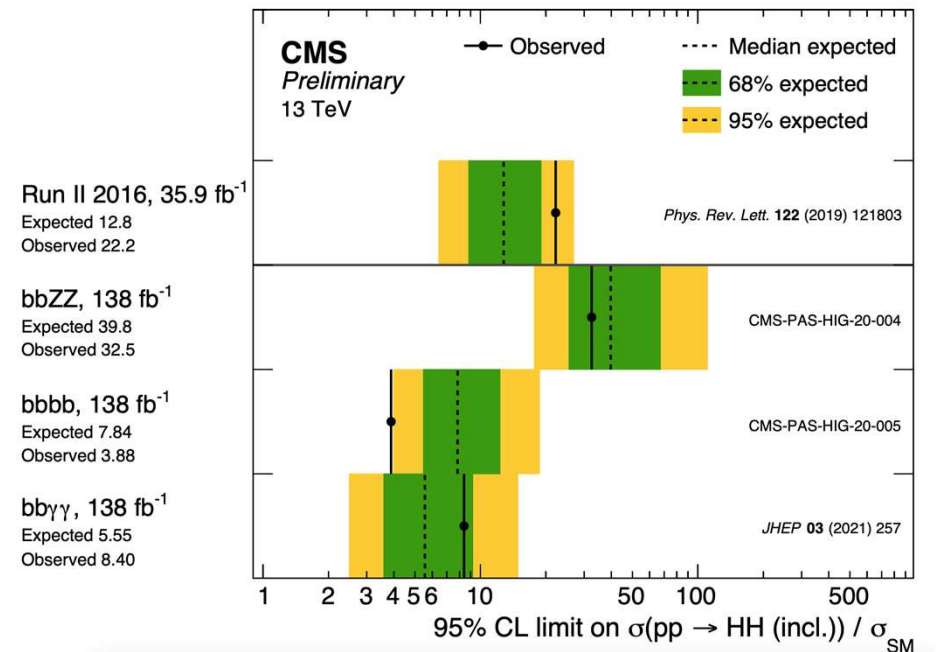
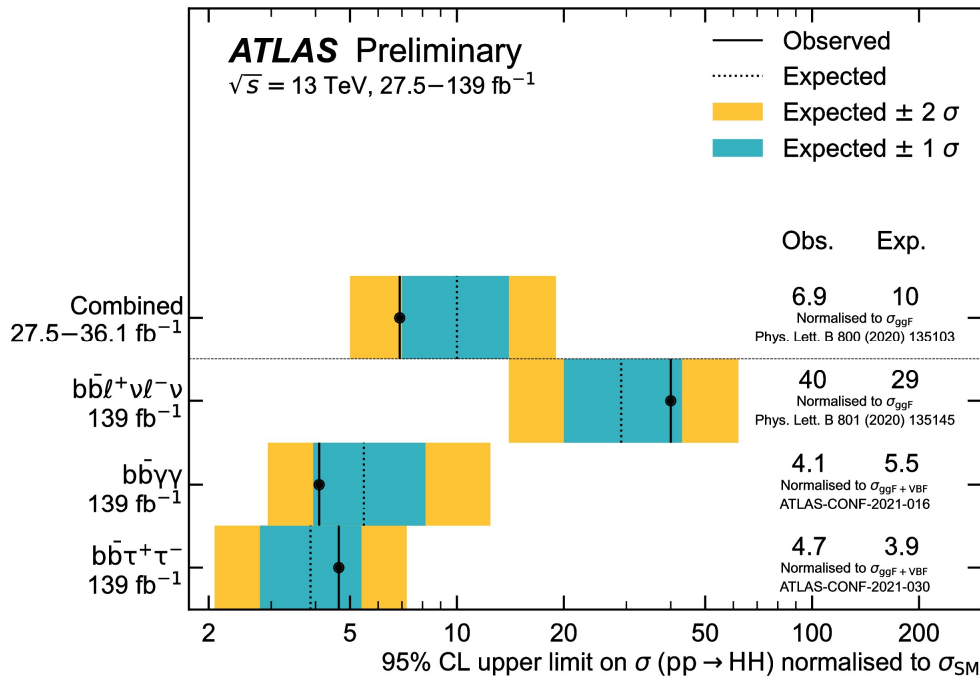


$pp \rightarrow HH$ at 13 TeV

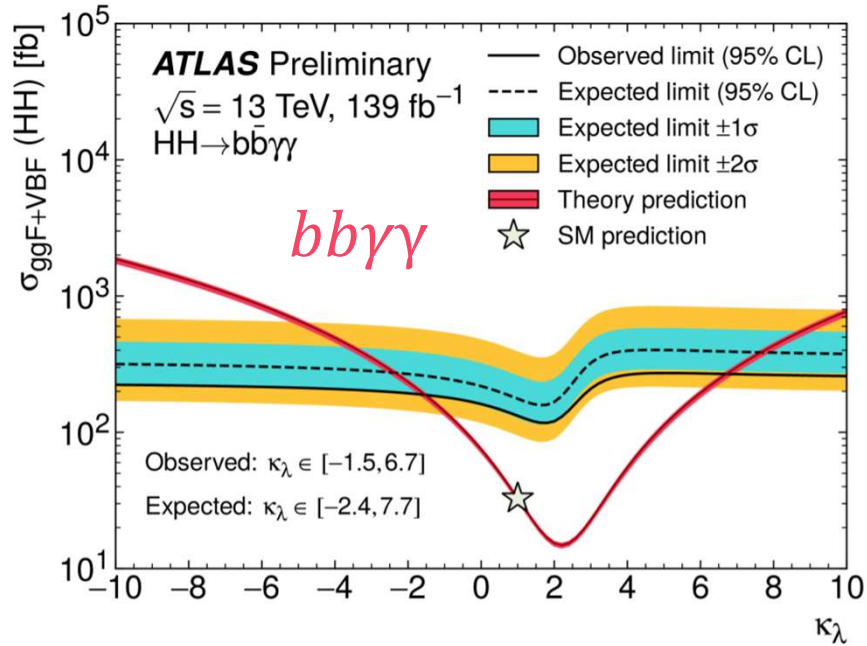
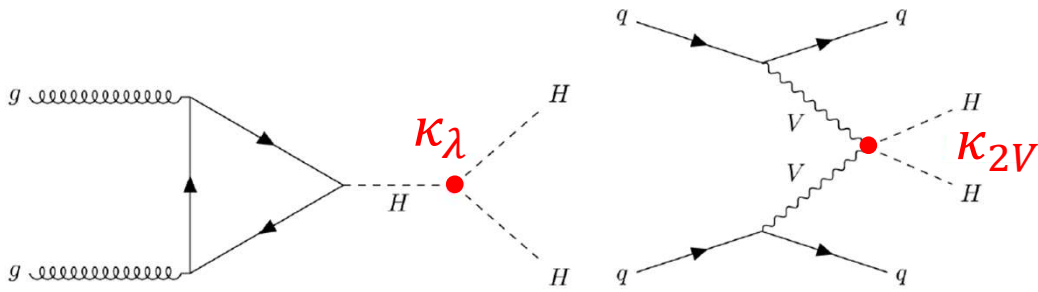
ggF
 $\sigma_{SM} = 31.1^{+2.1}_{-7.2} \text{ fb}$

VBF
 $\sigma_{SM} = 1.73 \pm 0.04 \text{ fb}$

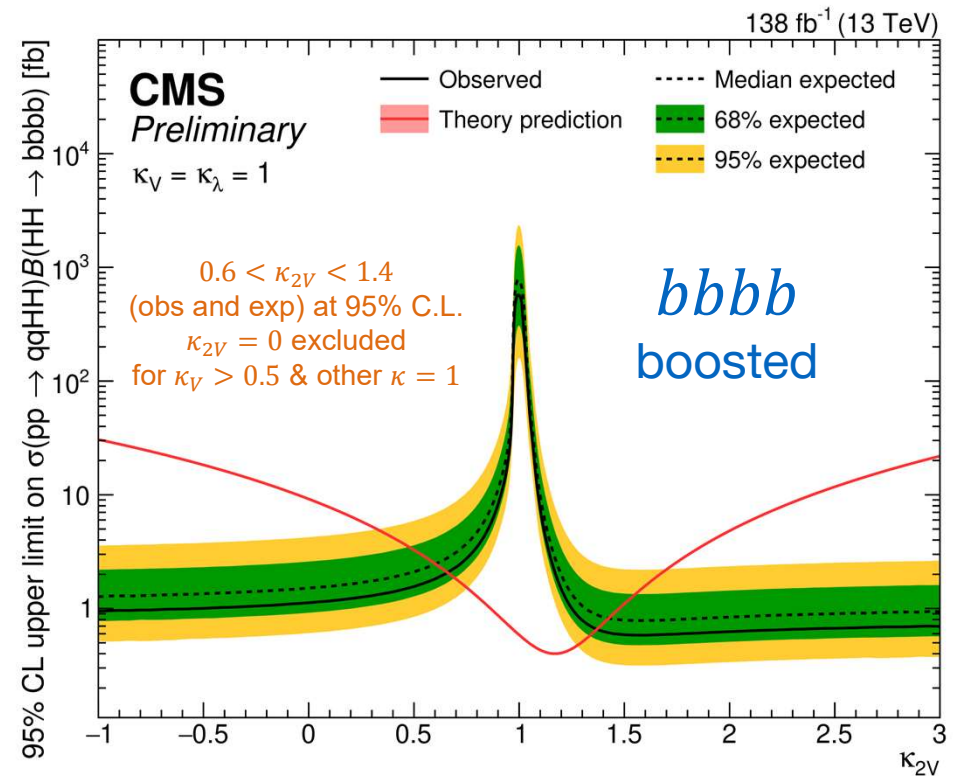
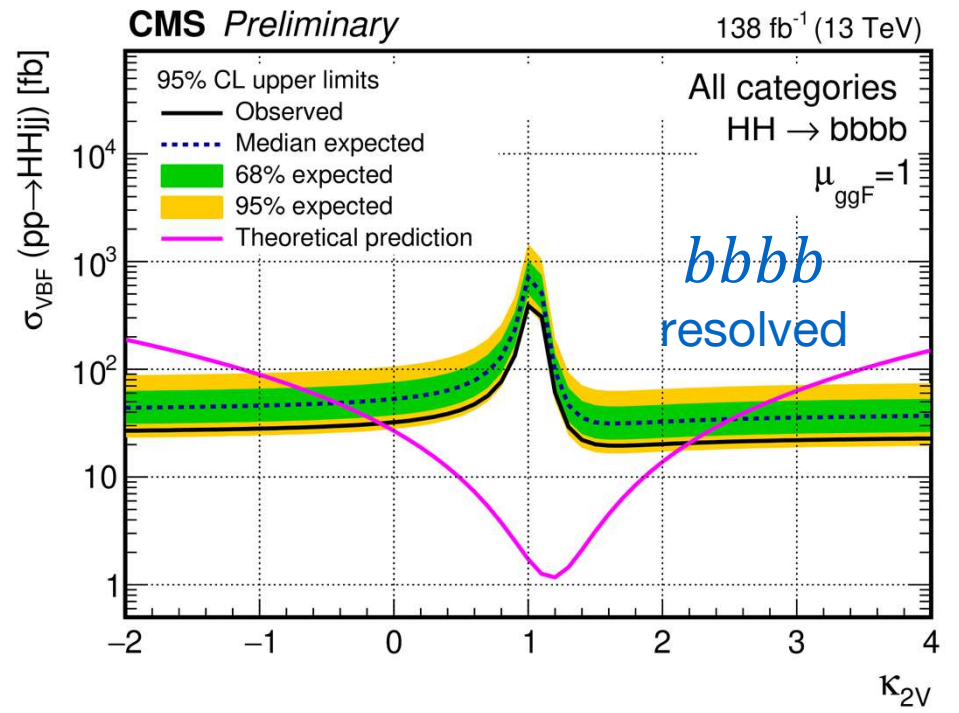
$\frac{\sigma(pp \rightarrow HH)}{\sigma_{SM}}$ at 13 TeV		Partial Run 2 (2015-16)		Full Run 2 (2015-18)	
		Obs	Exp	Obs	Exp
$HH \rightarrow bbyy$	ATLAS	20.3	26	4.1	5.5
	CMS	23.6	18.8	7.7	5.2
$HH \rightarrow bb\tau\tau$	ATLAS	12.5	15	4.7	3.9
	CMS	31.4	25.1		
$HH \rightarrow bbbb$	ATLAS	12.9	21		
	CMS	74.6	36.9	3.6	7.3
Combination	ATLAS	6.9	10		
	CMS	22.2	12.8		



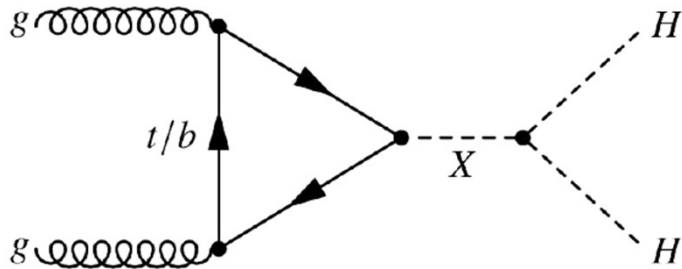
Coupling Analysis



Limit on κ_λ at 95% C.L.		Obs	Exp
<i>HH</i> \rightarrow <i>bbyy</i>	ATLAS	-1.5 – 6.7	-2.4 – 7.7
	CMS	-3.3 – 8.5	-2.5 – 8.2
<i>HH</i> \rightarrow <i>bbbb</i>	ATLAS		
	CMS	-2.3 – 9.4	-5.0 – 12.0
Combination <i>partial Run 2</i>	ATLAS	-5.0 – 12.0	-5.8 – 12.0
	CMS	-11.8 – 18.8	-7.1 – 13.6

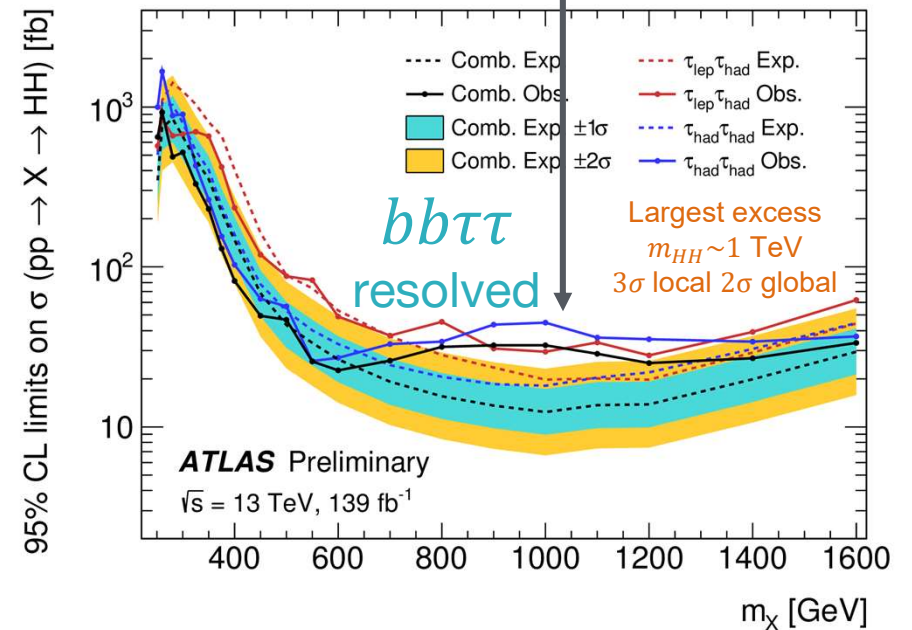
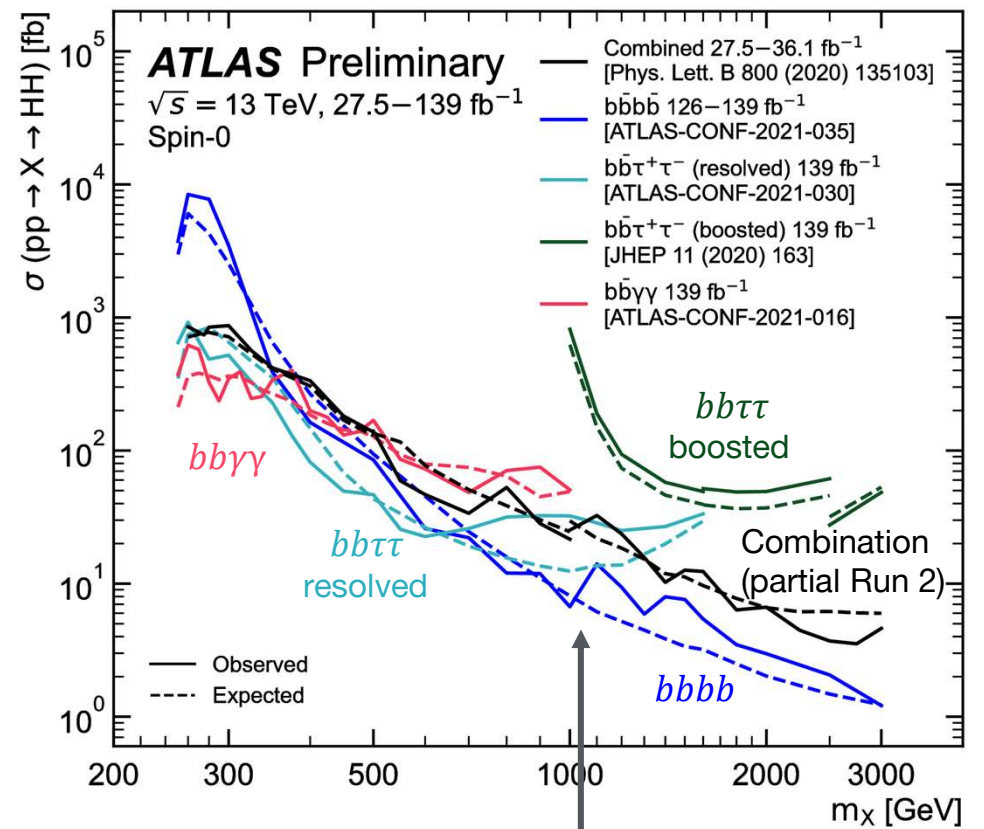
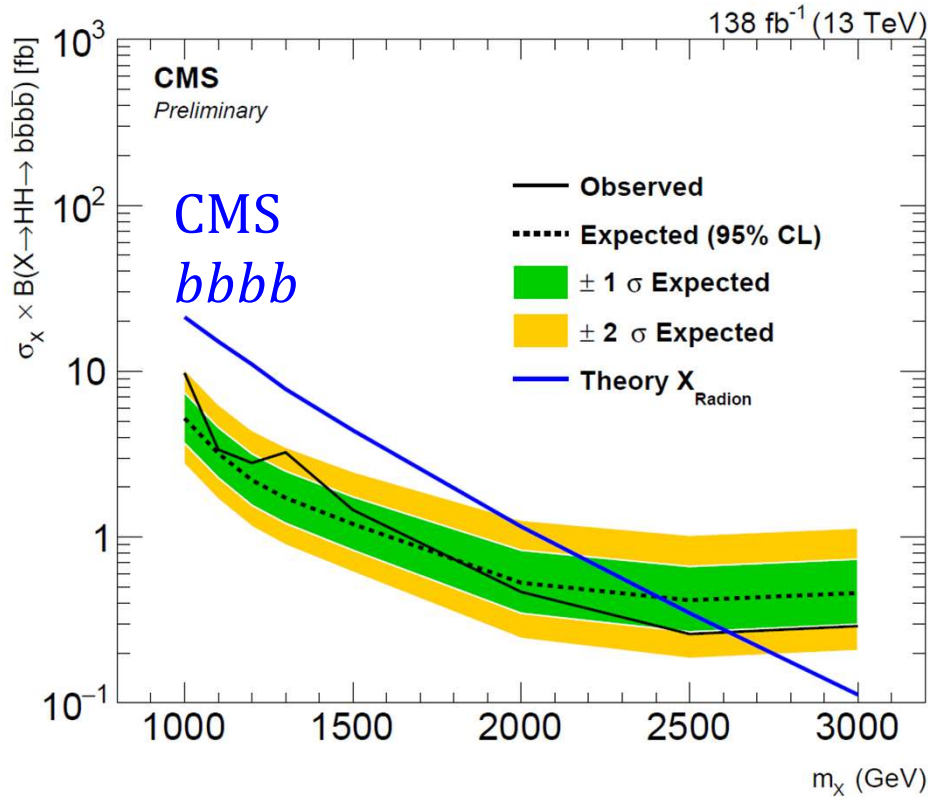


Resonant Di-Higgs Searches



Benchmark Models for X

- Radion (spin-0)
- Bulk graviton (spin-2)



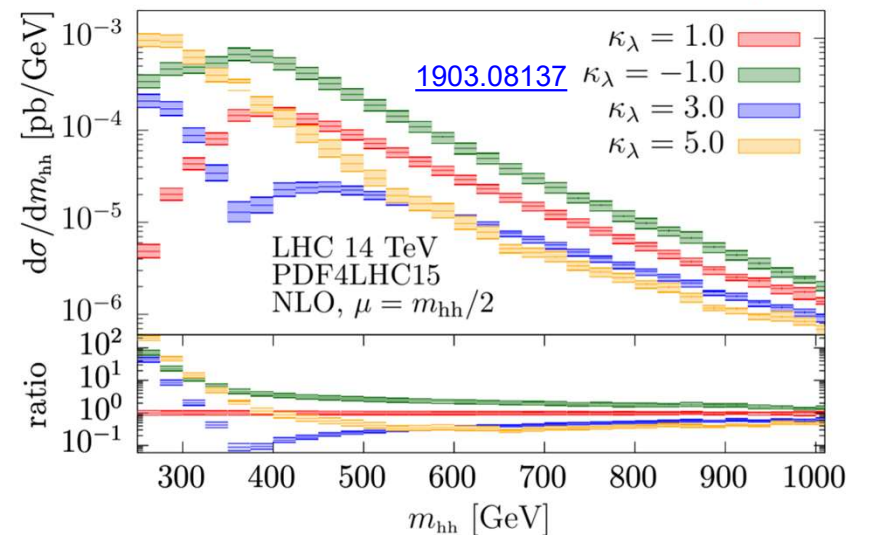
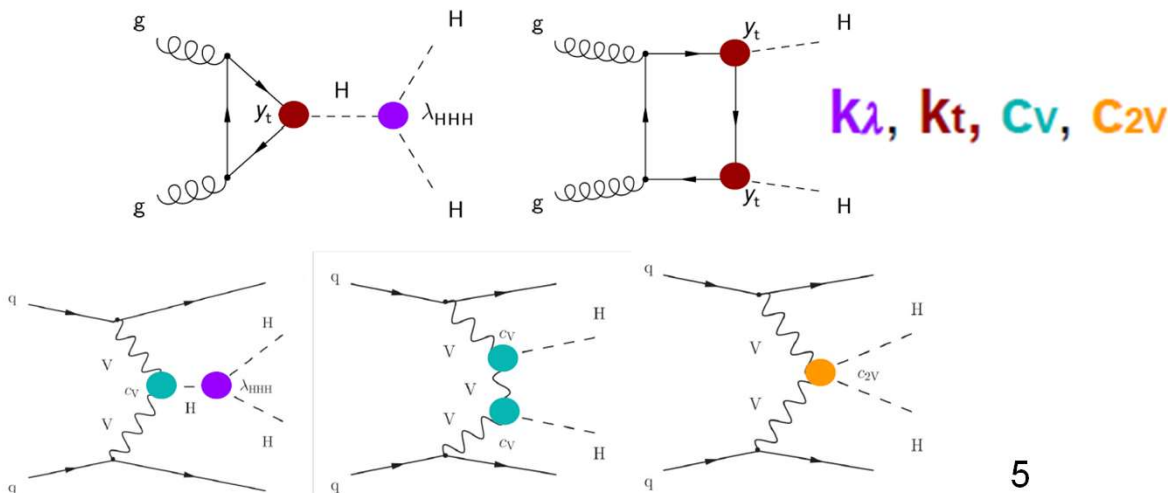
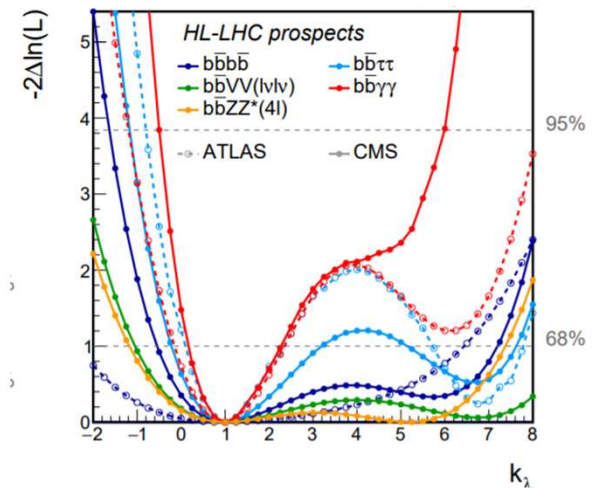
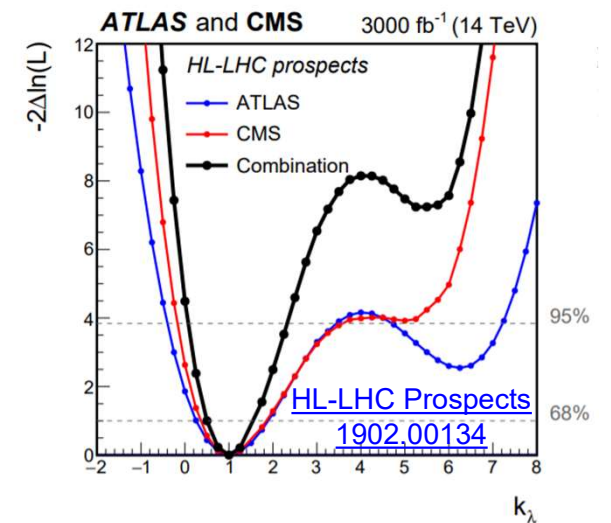
Future Directions

Towards evidence for di-Higgs production

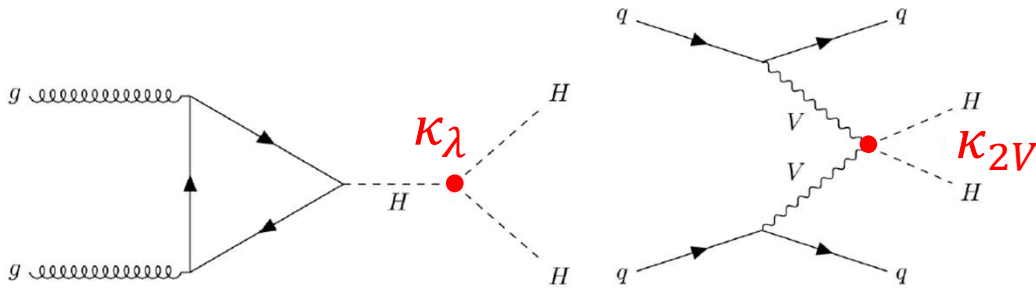
- Improvements in trigger
- New analysis techniques

Search for BSM physics

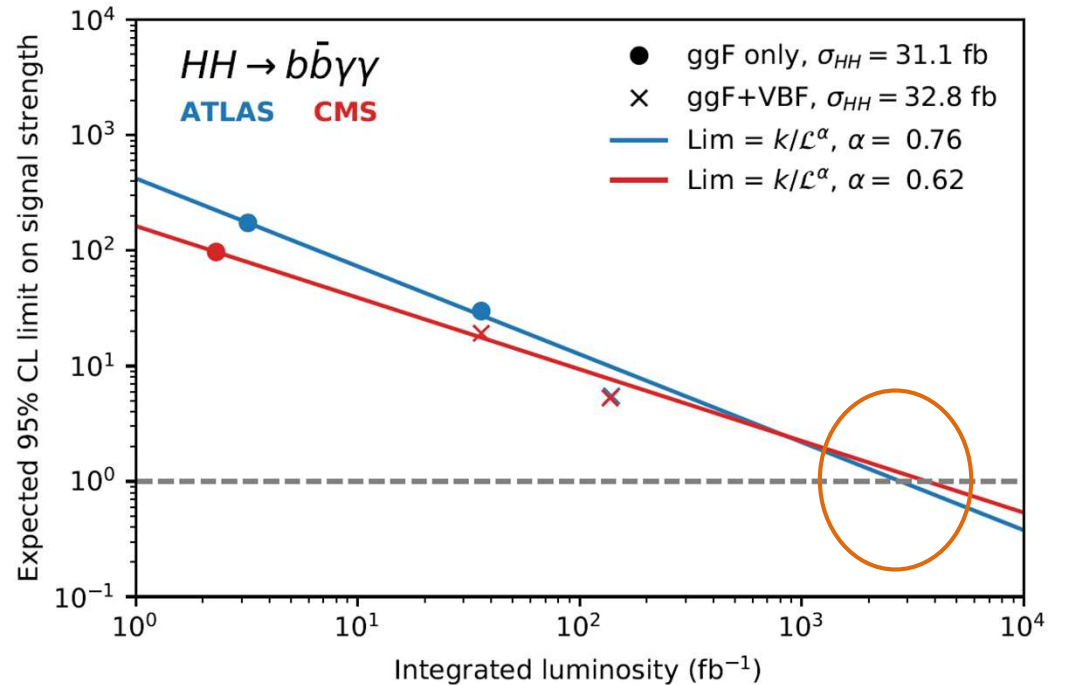
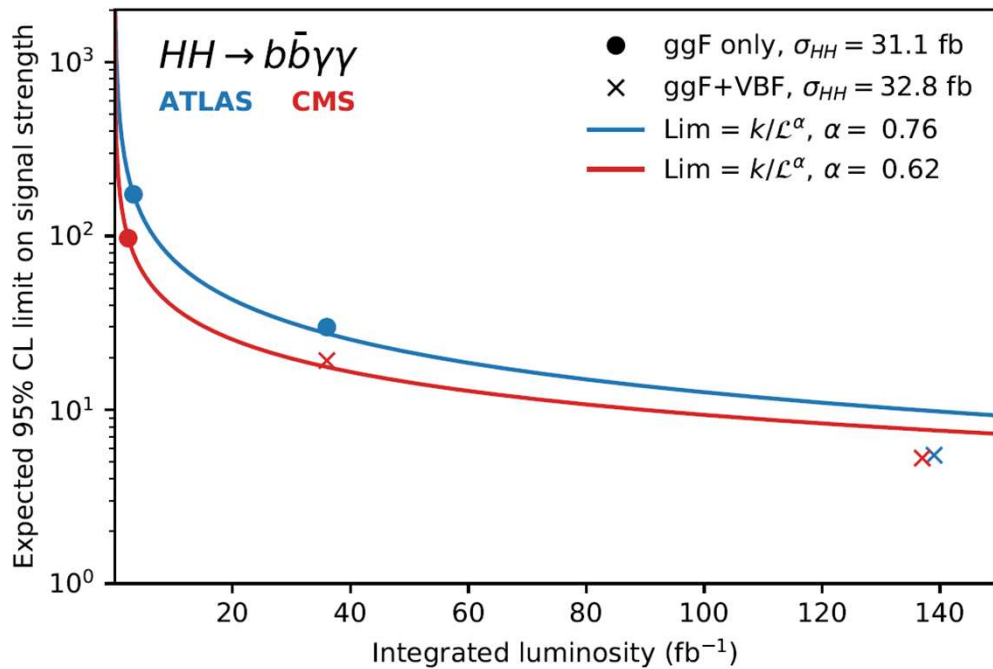
- Modifications to the cross section & kinematics
- EFT analysis
 - Studying coupling modifications
- Other searches for new particles & interactions beyond di-Higgs resonant searches



Into the Future



$\frac{\sigma(pp \rightarrow HH)}{\sigma_{SM}}$ at 13 TeV		Partial Run 2 (2015-16)		Full Run 2 (2015-18)	
		Obs	Exp	Obs	Exp
$HH \rightarrow b\bar{b}\gamma\gamma$	ATLAS	20.3	26	4.1	5.5
	CMS	23.6	18.8	7.7	5.2



Plots from M. Kagan & R. Teixeira de Lima