

# Summary of MC discussion for bbH

# Post-YR4 comparison between bbh generators

- Change of a shower scale in MG5\_aMC@NLO makes the predictions for  $\geq 1b$  jet event category closer to POWHEG

From YR4, Table 122

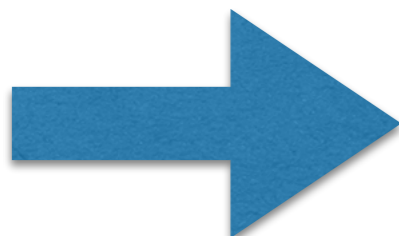
		inclusive	$0j_b$	$\geq 1j_b$
$\sigma$ [pb]	MG5_AMC	0.369 <sup>+19.7%</sup> <sub>-18.8%</sub>	0.243 <sup>+22.5%</sup> <sub>-23.0%</sub>	0.126 <sup>+32.5%</sup> <sub>-28.3%</sub>
	POWHEG	0.375 <sup>+20.3%</sup> <sub>-17.9%</sub>	0.281 <sup>+21.8%</sup> <sub>-18.6%</sub>	0.0943 <sup>+16.6%</sup> <sub>-16.5%</sub>
	SHERPA 4FS	0.370 <sup>+15.4%</sup> <sub>-26.8%</sub>	0.264 <sup>+11.8%</sup> <sub>-26.0%</sub>	0.105 <sup>+26.9%</sup> <sub>-28.8%</sub>
	SHERPA 5FS	0.586 <sup>+30.4%</sup> <sub>-22.7%</sub>	0.423 <sup>+20.6%</sup> <sub>-15.7%</sub>	0.162 <sup>+56.1%</sup> <sub>-40.7%</sub>
acceptance	MG5_AMC	1	0.659	0.342
	POWHEG	1	0.749	0.251
	SHERPA 4FS	1	0.717	0.283
	SHERPA 5FS	1	0.723	0.277

*Preliminary*  
MG5\_aMC@NLO runs with new shower scale:

$\sigma(\geq 1j_b) = 0.083 \text{ pb} \pm 17.0\%$   
 $\epsilon(\geq 1j_b) = 0.22 \pm 6\%$

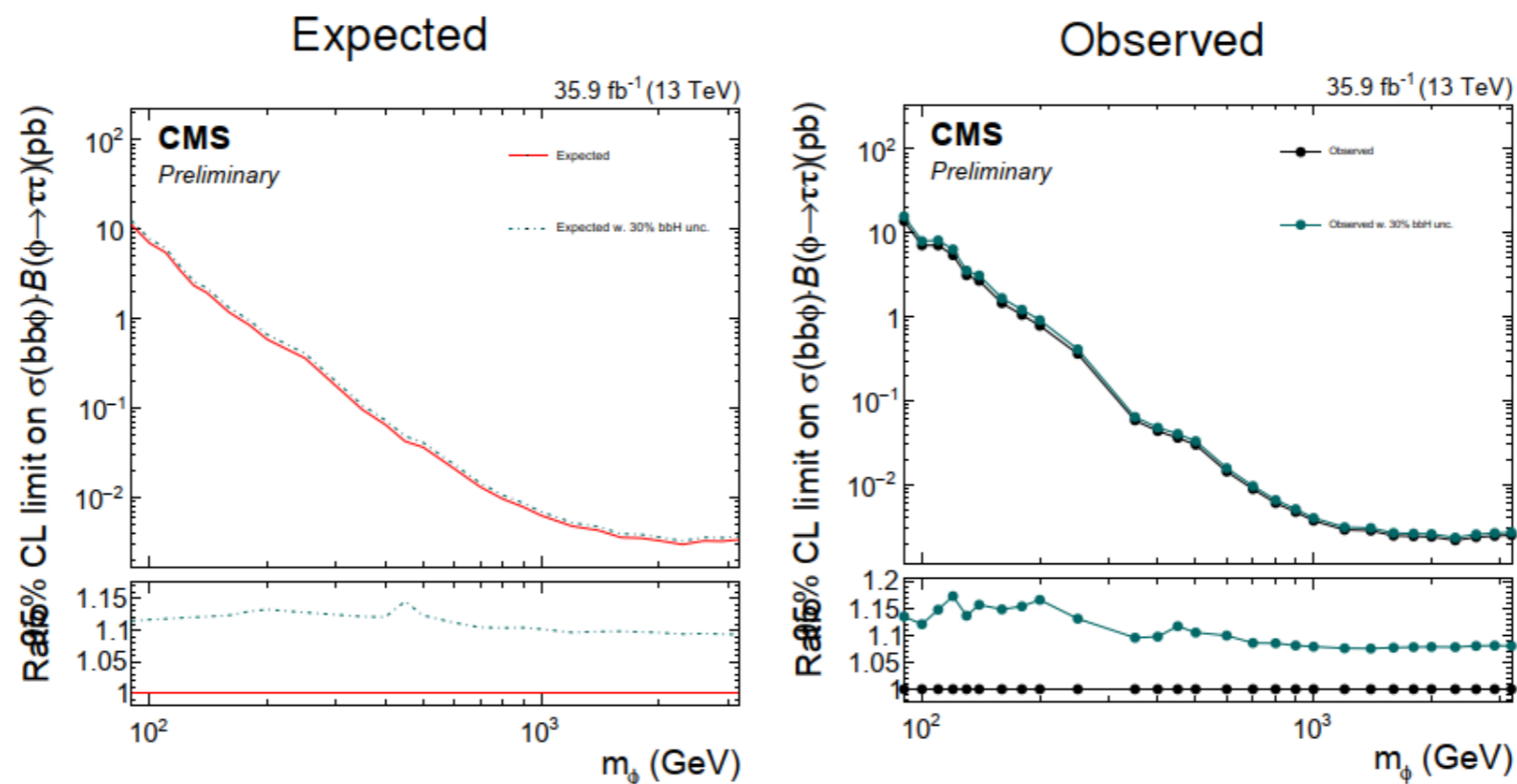
Work is going from CMS side (Janek Bechtel, KIT) to reproduce YR4 POWHEG numbers and evaluate POWHEG acceptance uncertainty

...slide from A. Nikitenko



for MG5\_aMC this was done with  $Q_{sh} \sim s/4$ ;  
new default shower scale  $Q_{sh} \sim H_T/2$  shows a different picture

- the difference in the acceptance predictions by the different generators should be taken into account as an additional uncertainty
- 30 % difference makes the SUSY bbH cross-section limits (in CMS) ~ 15 % worse (by Artur Gottmann, KIT)



■ Worse limits by up to 15% for expected & observed

...slide from A. Nikitenko

# Plans for the MC comparison

## CENTRAL GOAL:

### Guideline for setup of MCs for bbH with reasonable uncertainties

#### *How to achieve that?*

- ★ Compare bbH MCs with most up to date settings (shower scale, PDFs, etc) in realistic (experimental) environment, comparing b-jet multiplicities and possibly distributions.
- ★ Step 0: Have agreement at NLO QCD level (as done for YR4)
- ★ Include shower-scale uncertainties (on top of perturbative ones)
- ★ Consider matching with different shower (eg, Pythia and Herwig)
- ★ Further understand differences in POWHEG and MG5\_aMC@NLO
- ★ It would be nice to also include Sherpa again in the comparison
- ★ Repeat the exercise for heavy Higgs bosons ( $m_H \gg 125$  GeV)
- ★ Finally: We should be honest about the large uncertainties in bbH, which will certainly remain at the 30% level overall.