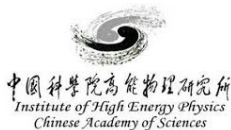


VBF off-shell analysis

Abdualazem Fadol

October 29, 2020



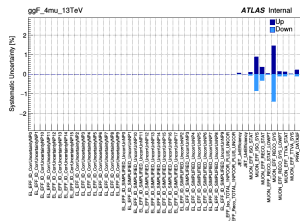
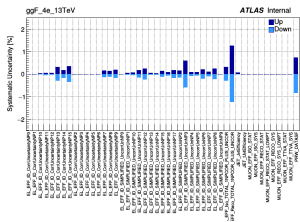
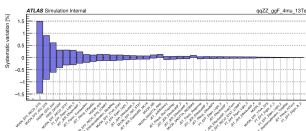
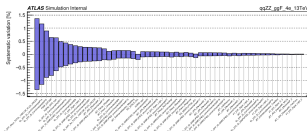
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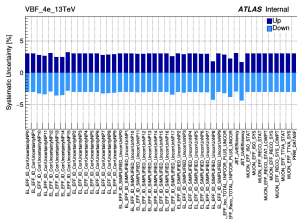
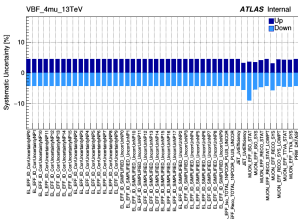
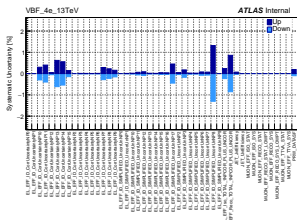
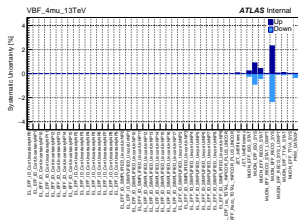
Experimental systematic uncertainties

Cross-check the $qqZZ$ and $ggZZ$ for the HZZ high mass note



Experimental systematic uncertainties

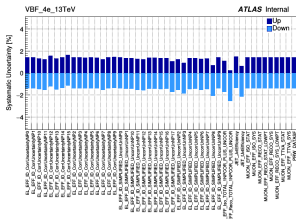
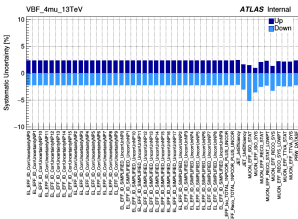
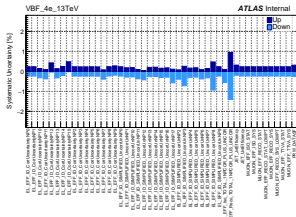
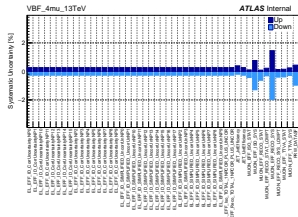
Normalisation systematic for the VBF signal: new vs old minitrees



- Comparing the old (top plots) vs new (bottom plots) minitrees.
- It seems that the systematic branches are not filled properly in new minitrees.

Experimental systematic uncertainties

Normalisation systematic for the SBI5: new vs old minitrees



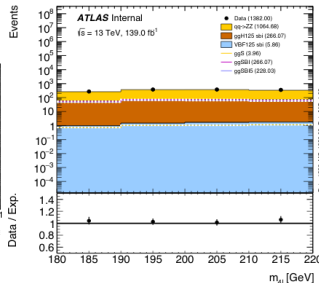
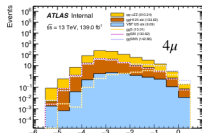
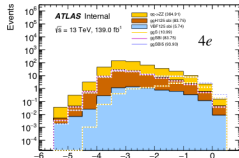
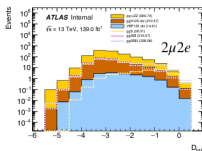
□ Comparing the old (top plots) vs new (bottom plots) minitrees.

Study the normalisation effect of $qqZZ$

Fixing/floating the normalisation

5

- The events divided into 12 bins (MELA variable) in $m_{4\ell}[200, 2000]$ GeV.
- Plus a CR with MELA in 4 bins in $m_{4\ell}[180, 220]$ GeV, see slides [here](#).
- These regions are fitted simultaneously with fixing/floating the $qqZZ$ normalisation.
- Then estimate the signal and μ_{qqZZ} strength in the two cases.



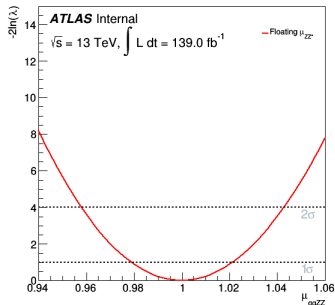
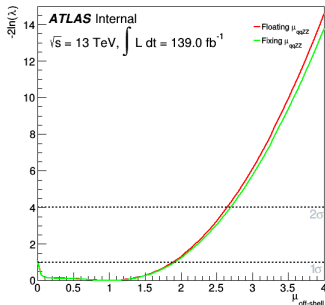
Study the normalisation effect of $qqZZ$

Fixing/floating the normalisation

- No luminosity systematic uncertainty is considered when floating the normalisation.
- Also, including only the shape systematic in case of floating the normalisation.
- This study is performed for the ggF , but our goal is to do the same thing for the VBF.
- I'm going to compare the signal strength when fixing/floating the $qqZZ$ background.
- The fit is performed by using Asimov data.

Study the normalisation effect of $qqZZ$

Fixing/floating the normalisation



	Strength value	$\sigma_{ggF} \times \text{BR}(H \rightarrow ZZ \rightarrow 4\ell)^{+1\sigma, -2\sigma}_{-1\sigma, -2\sigma}$ (fb) @95 CLs
μ_{qqZZ}	$1.00^{+0.01}_{-0.01}$	-
μ_{ggF} float	$1.00^{+0.89}_{-0.99}$	$3.148^{+3.58, +4.41}_{-2.26, -1.69}$
μ_{ggF} fixed	$0.99^{+0.92}_{-0.99}$	$3.142^{+3.59, +4.48}_{-2.27, -1.69}$

□ The strength values and upper limit at 95% CLs

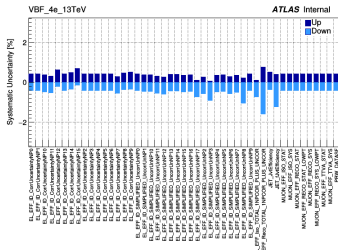
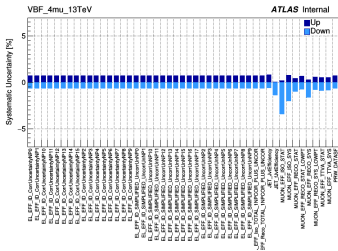
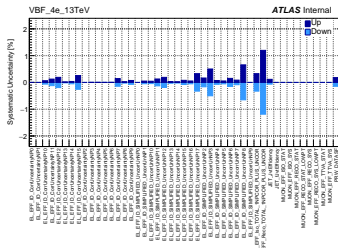
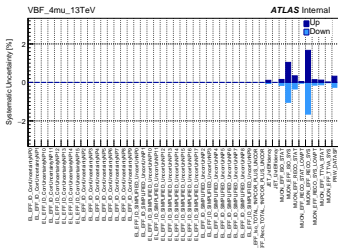
- We are able to reproduce the systematic numbers that shown on the high mass note (HZZ).
- The new systematic minitrees that Martin provided are strange.
- Now there's problem with all the samples not just SBI5.
- We can apply the study of floating/fixing the $qqZZ$ normalisation on the VBF.
- It is to cross-check the study on these slides [here](#), then do the same study for the VBF.
- The conclusion from the study that Martina did is that the fit look better when we fits signal and CR regions together.



Thanks!

Additional slides

Normalisation systematic for the BKG: new vs old minitrees



□ Comparing the old (top plots) vs new (bottom plots) minitrees.