

VBF with Pileup jets

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Inputs

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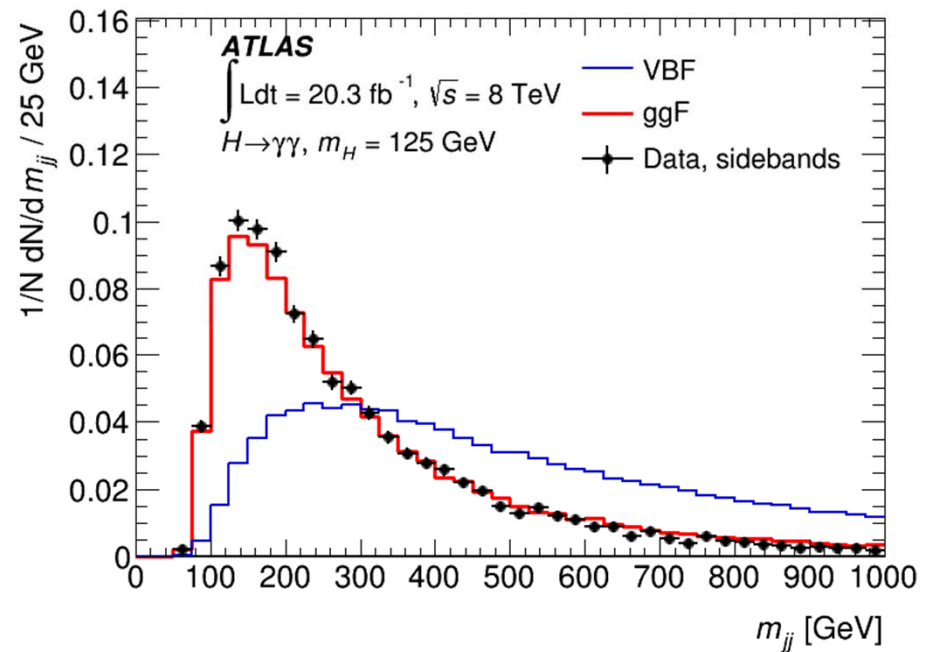
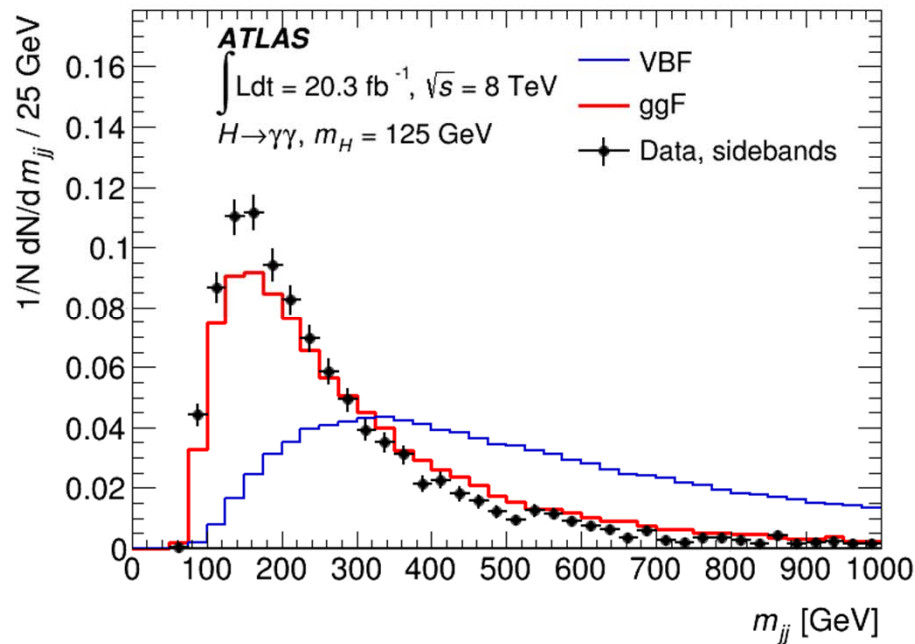
- ① Huijun produced the pileup jet tree attached with the original MC and data samples
 - ① Applied Jet pt, eta, JVF cuts, assume jet mass 0.
 - ① 7 jets per event with 25GeV cut, 2.3 jets per event with 30GeV cut
 - ① Same pileup jets for all signals and data
- ① Re-apply the VBF MVA selections use the new jets with pileup jets
 - ① Official MVA with 6 variables
 - ① Official MVA selection [0.3, 0.83]

m2J

3

Original

With Pileup



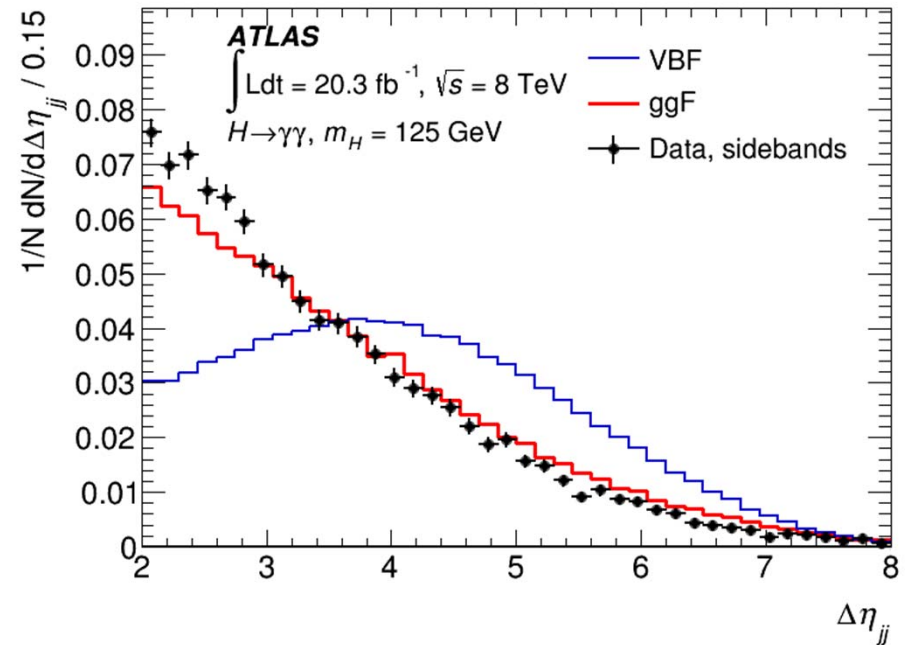
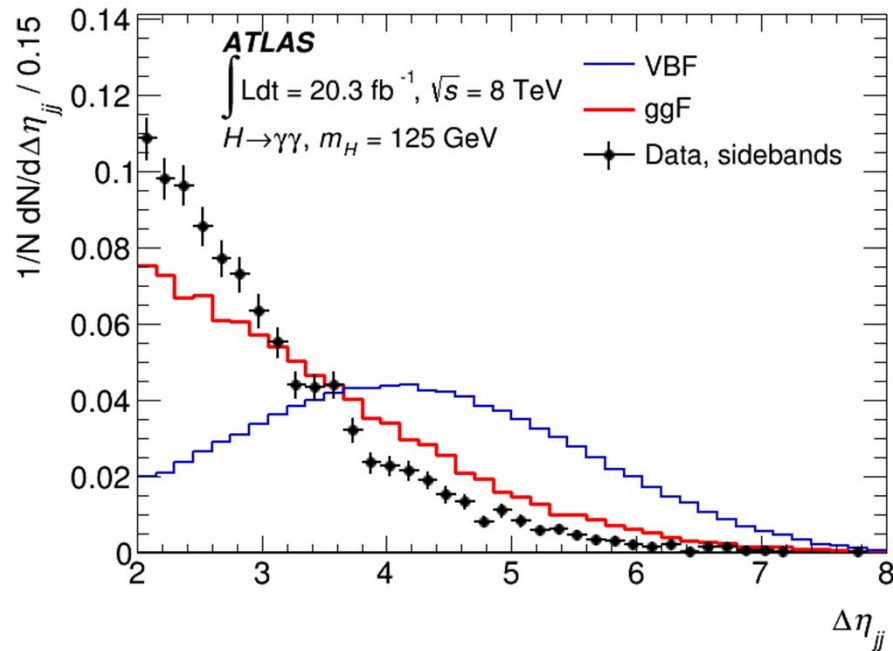
- ggF and sideband backgrounds get larger m2J
- VBF signal tends to get smaller m2J

dEta2J

4

Original

With Pileup

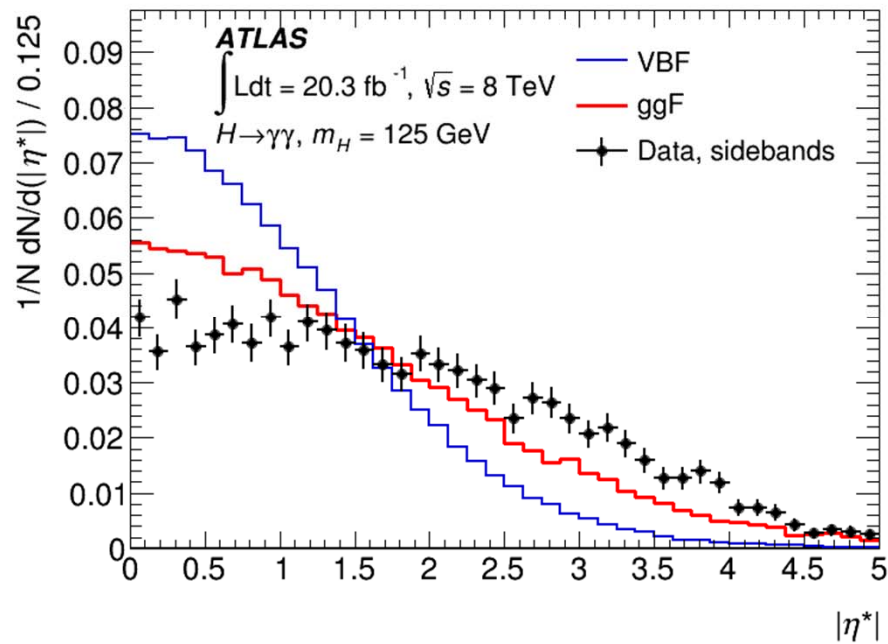


- ggF and sideband background get larger dEta2J
- VBF signal tends to get smaller dEta2J

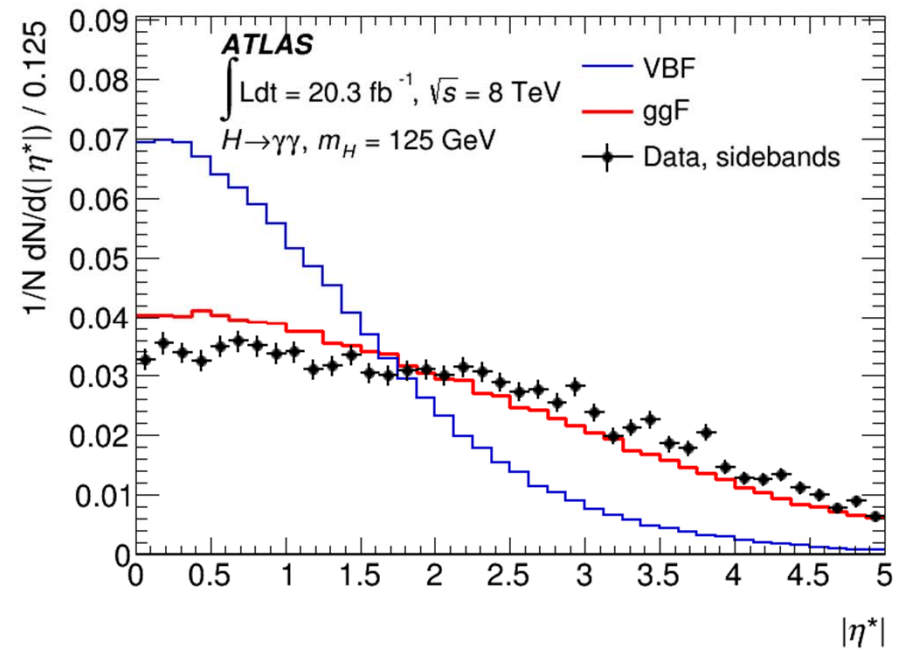
detaGJ

5

Original



With Pileup



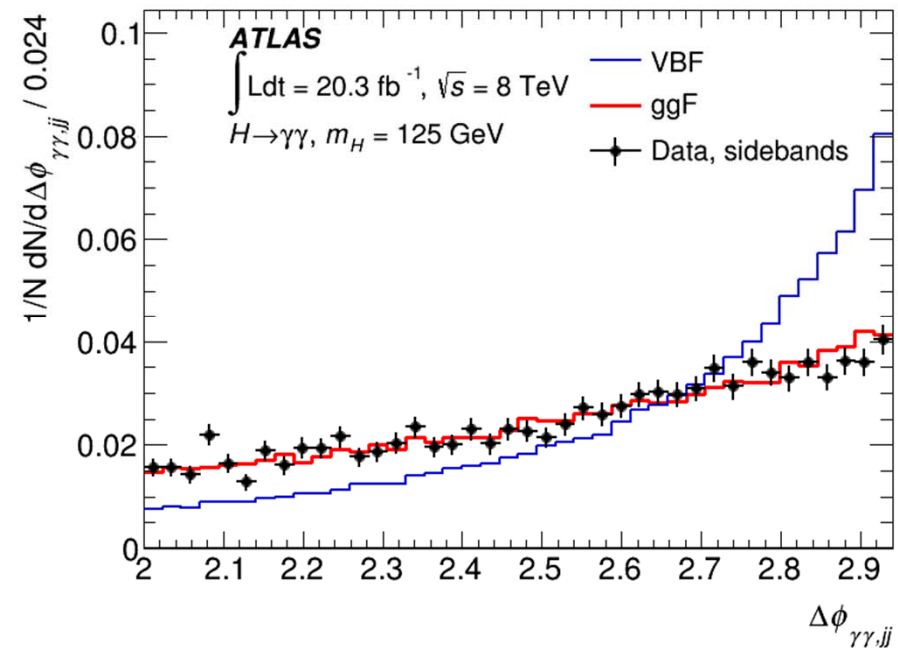
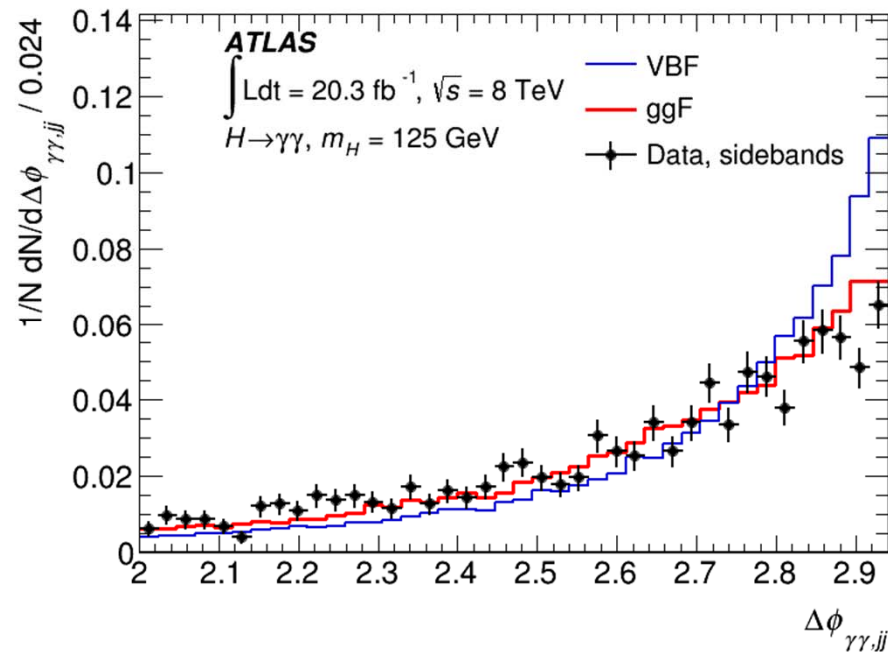
- VBF, ggF, sideband background get larger detaGJ

dPhiGJ

6

Original

With Pileup



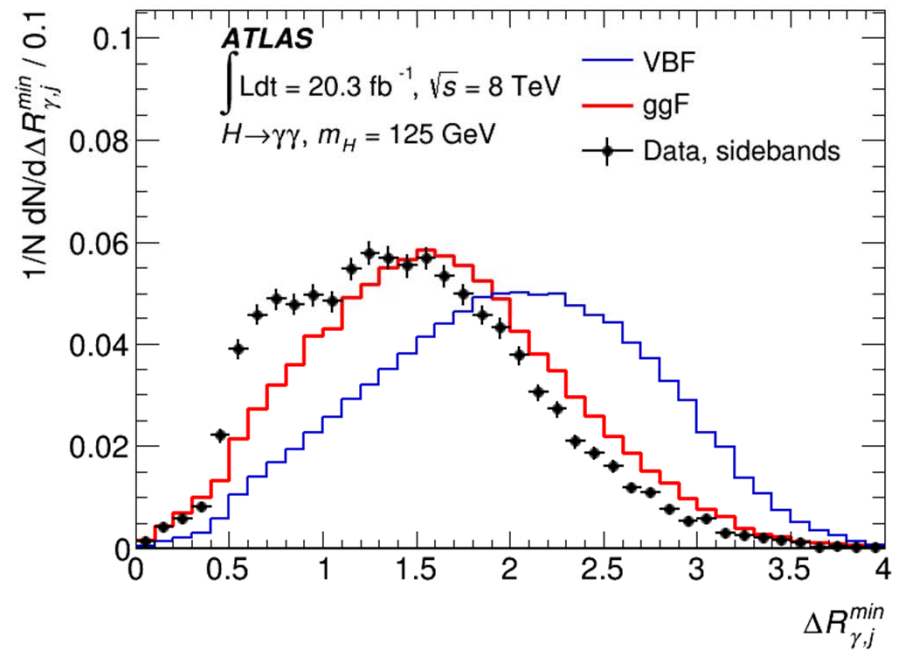
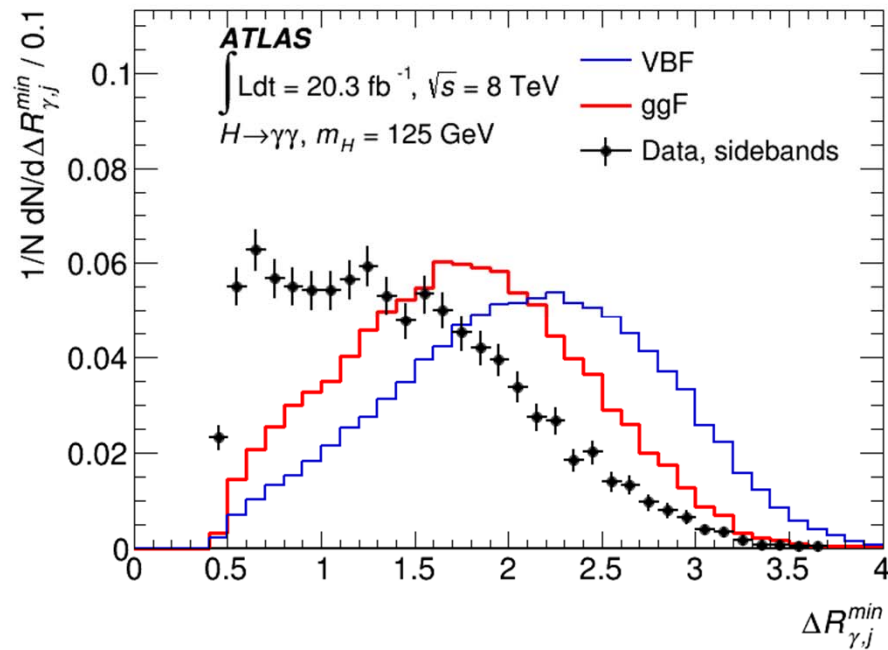
- VBF, ggF and sideband background get smaller dPhiGJ

dRGJ

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Original

With Pileup



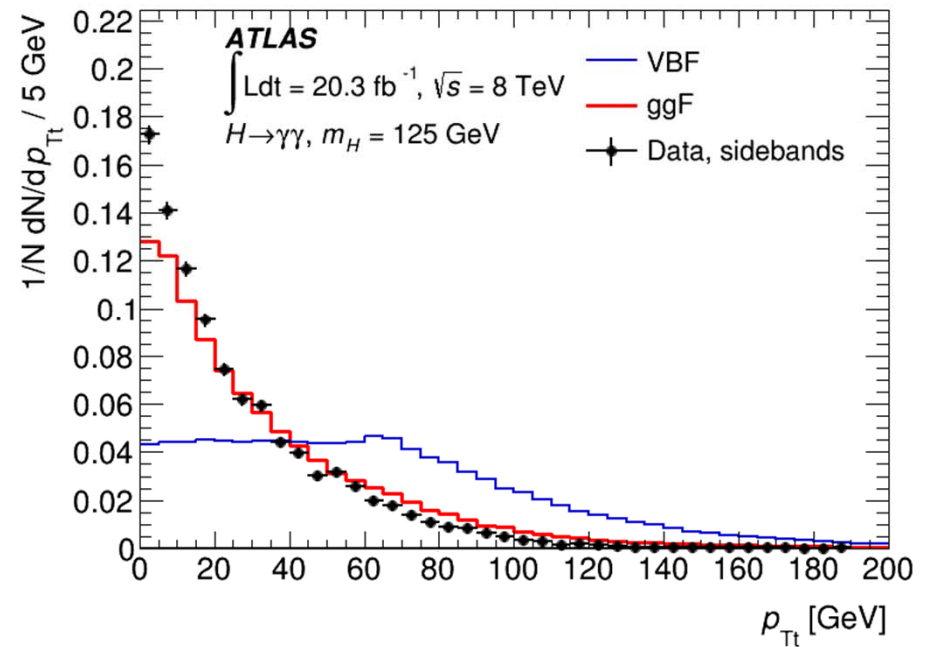
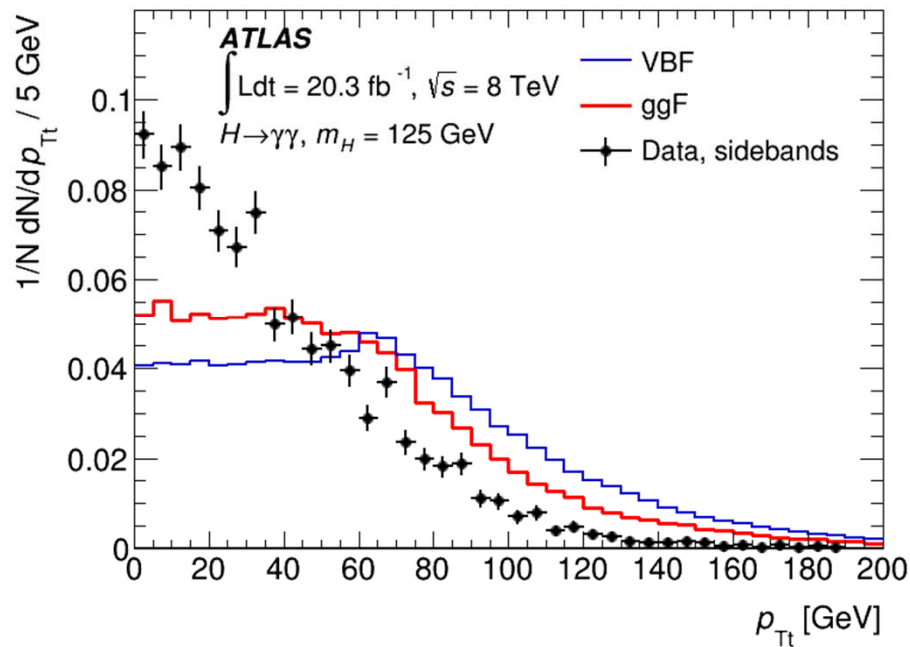
- Sideband background gets larger dRGJ

ptt

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Original

With Pileup



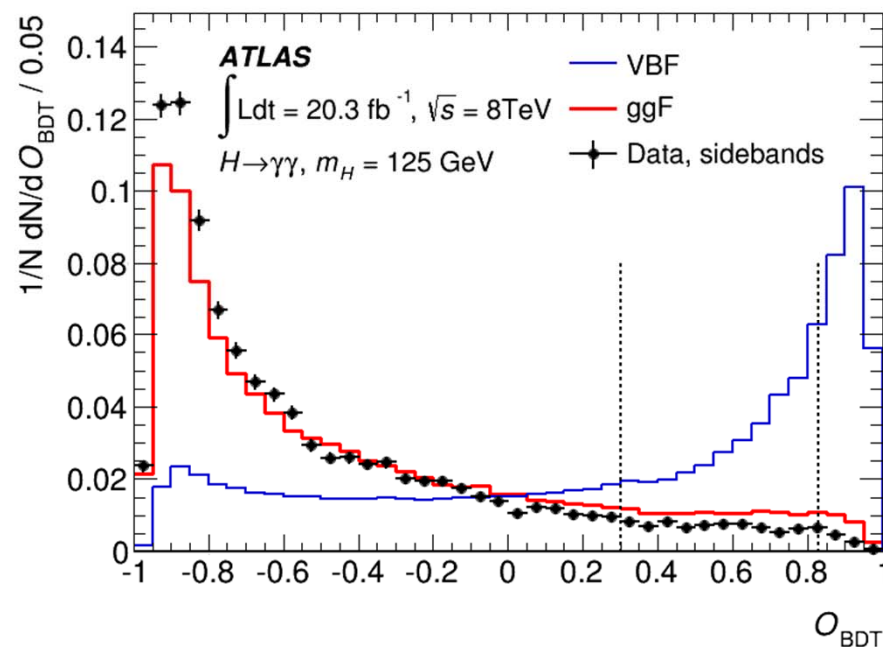
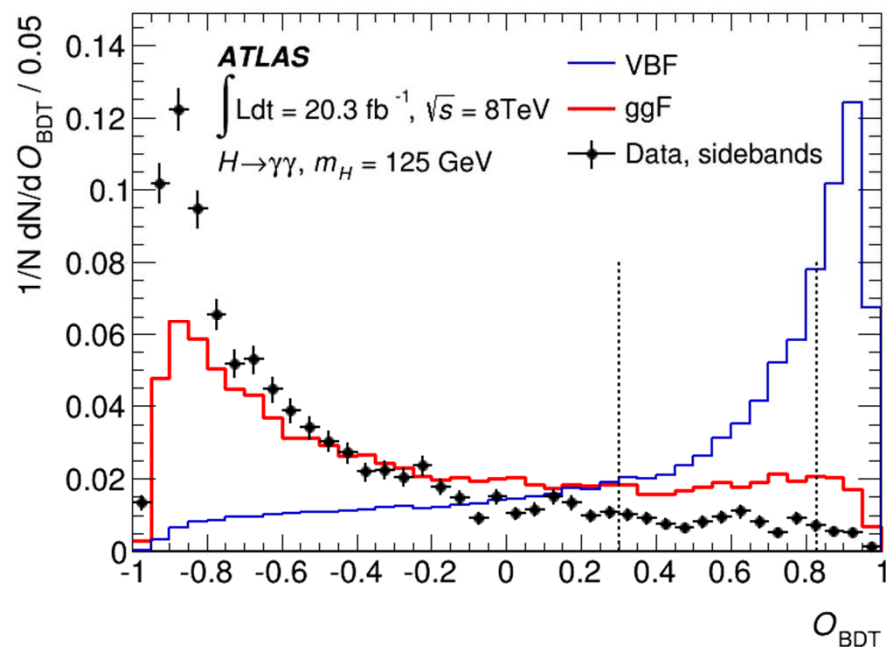
- Sideband background and ggF get smaller ptt

BDT

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Original

With Pileup



- ggF becomes more like sideband background
- VBF BDT less robust against background BDTs

Results (to be corrected)

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- Compare results with pileup jets (25 GeV jet pt cut)

Results	Official Loose	Official Tight	Pileup Loose	Pileup Tight
VBF signal	4.8	4.3	4.7	3.9
ggF	2.9	0.8	5.9	1.4
BK model	40.4	6.7	115.8	16.0
VBF Purity	61.1%	83.3%	43%	73.7
VBF Significance	0.71	1.4	0.4	0.9
Comb. significance	1.61		1.00	
Data	412	70	1161	168

- $\Delta\mu$ (VBF) increase **>30%** with pileup jets

Results

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- Compare results with pileup jets (30 GeV jet pt cut)

Results	Official Loose	Official Tight	Pileup Loose	Pileup Tight
VBF signal	4.8	4.3	4.5	3.9
ggF	2.9	0.8	5.6	1.3
BK model	40.4	6.7	110.6	15.9
VBF Purity	61.1%	83.3%	43.6%	73.9
VBF Significance	0.71	1.4	0.4	0.9
Comb. significance	1.61		1.00	
Data	412	70	1104	167

- $\Delta\mu$ (VBF) increase **>30%** with pileup jets

Conclusion

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- ⊙ VBF coupling measurement is quite effected by the pileup jets
 - ⊙ VBF signal is less signal like due to the contamination of the pileup jets
 - ⊙ More ggF and no-resonance backgrounds could pass the VBF selection due to larger m_{2J} and $d\text{Eta}_{2J}$ with pileup jets
- ⊙ New jet selections and VBF training are needed to reduce the effects of pileup jets