Follow-up regarding ggF uncertainty recommendations

Recap: "WG1 scheme"

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	ons and fractional					_				— .
STXS	sig stat	mu	res	mig01	mig12	рТН	qm_b	qm_top	VBF	Tot
Incl	48.52 +/- 0.00	+4.6%	+2.2%	-0.0%	-0.0%	-0.1%	-0.2%	+0.2%	-0.0%	+5.1%
FWDH	4.29 +/- 0.05	+4.4%	+1.8%	-0.5%	-0.3%	-0.5%	-0.6%	+0.0%	+0.0%	+4.9%
VBF_J3V	0.26 +/- 0.01	+7.9%	+7.9%	+3.9%	+16.1%	-2.6%	-2.4%	+0.1%	-32.0%	+37.9%
VBF_J3	0.35 +/- 0.01	+7.9%	+7.9%	+3.9%	+16.1%	-0.7%	-0.9%	+0.2%	+23.5%	+30.8%
ØJ	27.21 +/- 0.13	+3.8%	+0.1%	-4.1%	+0.0%	+0.0%	-0.2%	+0.0%	+0.0%	+5.6%
1J_0-60	6.53 +/- 0.06	+5.2%	+4.5%	+7.9%	-6.8%	-4.5%	-3.9%	+0.0%	+0.0%	+13.9%
1J_60	4.51 +/- 0.05	+5.2%	+4.5%	+7.9%	-6.8%	+3.1%	+4.9%	+0.0%	+0.0%	+13.8%
1J_120	0.72 +/- 0.02	+5.2%	+4.5%	+7.9%	-6.8%	+14.0%	+5.0%	+0.5%	+0.0%	+19.5%
1J_200	0.15 +/- 0.01	+5.2%	+4.5%	+7.9%	-6.8%	+16.0%	+5.0%	+10.6%	+0.0%	+23.5%
2J_0-60	1.23 +/- 0.02	+7.9%	+7.9%	+3.9%	+16.1%	-7.4%	-7.2%	+0.0%	+0.0%	+22.4%
2J_60	1.85 +/- 0.03	+7.9%	+7.9%	+3.9%	+16.1%	-1.0%	-0.1%	+0.0%	+0.0%	+20.0%
2J_120	0.98 +/- 0.02	+7.9%	+7.9%	+3.9%	+16.1%	+6.8%	+5.0%	+0.7%	+0.0%	+21.7%
2J_200	0.43 +/- 0.01	+7.9%	+7.9%	+3.9%	+16.1%	+15.5%	+5.0%	+12.0%	+0.0%	+28.4%
=ØJ	30.09 +/- 0.13	+3.8%	+0.1%	-4.1%	+0.0%	+0.0%	-0.2%	+0.0%	+0.0%	+5.6%
=1J	12.97 +/- 0.08	+5.2%	+4.5%	+7.9%	-6.8%	-0.3%	+0.0%	+0.2%	+0.0%	+12.5%
>=2J	5.47 +/- 0.05	+7.9%	+7.9%	+3.9%	+16.1%	+0.1%	-0.7%	+1.1%	-0.0%	+20.0%
>=1J 60-200	9.07 +/- 0.06	+6.2%	+5.8%	+6.4%	+1.9%	+3.4%	+3.7%	+0.1%	+0.1%	+11.9%
>=1J 120-200	1.93 +/- 0.03	+6.8%	+6.5%	+5.5%	+7.1%	+9.6%	+5.0%	+0.6%	+0.5%	+17.0%
>=1J >200	0.59 +/- 0.01	+7.2%	+7.0%	+5.0%	+10.1%	+15.6%	+5.0%	+11.5%	-0.0%	+25.1%
>=1J >60	9.66 +/- 0.07	+6.3%	+5.8%	+6.3%	+2.4%	+4.2%	+3.8%	+0.8%	+0.1%	+12.3%
>=1J >120	2.52 +/- 0.03	+6.9%	+6.6%	+5.4%	+7.8%	+11.0%	+5.0%	+3.2%	+0.4%	+18.4%
>=1	18.43 +/- 0.09	+6.0%	+5.5%	+6.7%	-0.0%	-0.2%	-0.2%	+0.4%	-0.0%	+10.6%

The "WG1 scheme" is presented in the first contribution on the agenda: indico/event/618048/

Recap: "STXS scheme"

	and Creations									
	ons and fractiona				. 10		5420	5200		- .
STXS	sig stat	mu	res	mig01	mig12	D60	D120	D200	VBF	Tot
Incl	48.52 +/- 0.00	+4.6%	+2.2%	-0.0%	-0.0%	-0.0%	-0.0%	+0.2%	-0.0%	+5.1%
FWDH	4.29 +/- 0.05	+4.4%	+1.8%	-0.5%	-0.3%	-0.6%	-0.2%	+0.1%	+0.0%	+4.9%
VBF_J3V	0.26 +/- 0.01	+7.9%	+7.9%	+3.9%	+16.1%	+1.4%	+0.6%	+0.0%	-32.0%	+37.7%
VBF_J3	0.35 +/- 0.01	+7.9%	+7.9%	+3.9%	+16.1%	+4.0%	+2.0%	+0.0%	+23.5%	+31.1%
ØJ	27.21 +/- 0.13	+3.8%	+0.1%	-4.1%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+5.6%
1J_0-60	6.53 +/- 0.06	+5.2%	+4.5%	+7.9%	-6.8%	-12.1%	-1.3%	+0.0%	+0.0%	+17.5%
1J_60	4.51 +/- 0.05	+5.2%	+4.5%	+7.9%	-6.8%	+11.6%	-1.3%	+0.0%	+0.0%	+17.1%
1J_120	0.72 +/- 0.02	+5.2%	+4.5%	+7.9%	-6.8%	+11.6%	+10.5%	+0.0%	+0.0%	+20.0%
1J_200	0.15 +/- 0.01	+5.2%	+4.5%	+7.9%	-6.8%	+0.1%	+0.0%	+14.2%	+0.0%	+19.0%
2J_0-60	1.23 +/- 0.02	+7.9%	+7.9%	+3.9%	+16.1%	-12.1%	-1.3%	+0.0%	+0.0%	+23.3%
2J_60	1.85 +/- 0.03	+7.9%	+7.9%	+3.9%	+16.1%	+11.6%	-1.3%	+0.0%	+0.0%	+23.1%
2J_120	0.98 +/- 0.02	+7.9%	+7.9%	+3.9%	+16.1%	+11.6%	+10.5%	+0.0%	+0.0%	+25.3%
2J_200	0.43 +/- 0.01	+7.9%	+7.9%	+3.9%	+16.1%	+0.0%	+0.0%	+14.3%	+0.0%	+24.5%
=ØJ	30.09 +/- 0.13	+3.8%	+0.1%	-4.1%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+5.6%
=1J	12.97 +/- 0.08	+5.2%	+4.5%	+7.9%	-6.8%	-1.7%	-0.6%	+0.2%	+0.0%	+12.6%
>=2J	5.47 +/- 0.05	+7.9%	+7.9%	+3.9%	+16.1%	+3.7%	+1.3%	+1.1%	-0.0%	+20.4%
>=1J 60-200	9.07 +/- 0.06	+6.2%	+5.8%	+6.4%	+1.9%	+11.6%	+1.2%	+0.0%	+0.1%	+15.9%
>=1J 120-200	1.93 +/- 0.03	+6.8%	+6.5%	+5.5%	+7.1%	+11.6%	+10.5%	+0.0%	+0.5%	+20.4%
>=1J >200	0.59 +/- 0.01	+7.2%	+7.0%	+5.0%	+10.1%	+0.0%	+0.0%	+14.3%	-0.0%	+20.8%
>=1J >60	9.66 +/- 0.07	+6.3%	+5.8%	+6.3%	+2.4%	+10.9%	+1.1%	+0.9%	+0.1%	+15.5%
>=1J >120	2.52 +/- 0.03	+6.9%	+6.6%	+5.4%	+7.8%	+8.9%	+8.0%	+3.4%	+0.4%	+18.3%
>=1	18.43 +/- 0.09	+6.0%	+5.5%	+6.7%	-0.0%	-0.1%	-0.0%	+0.5%	-0.0%	+10.6%

The "STXS scheme" is presented in Kerstin's contribution on the agenda: <u>indico/event/618048/</u> The evaluation of the uncertainties are in the discussion entry on the agenda.

1. Follow-up on jet bins uncertainties

The VBF region

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- For now, still use uncertainties derived as documented in Section 8.3 of YR3 (<u>1307.1347</u>). The associated <u>ggF uncertainty tool</u> was used using shapes from the MC used for central (Powheg NNLOPS) with the STXS VBF selection. Uncertainties are coming from MCFM (as described in YR3).
- **New**: The VBF region now has it's 2-jet uncertainty uncorrelated from the other jet bins (following comment by M. Duehrssen and following brief discussion during meeting)
- **Ongoing**: results are being derived by Gionata: Higgs+3j @NLO. Might replace current VBF uncertainties. Will at least be used for cross checks.
- New: Uncertainty correlation matrices
- New: Cross checks using the jet veto efficiency method (JVE)
 - Comparing both total uncertainty and uncertainty correlation

Note: both the "WG1" scheme and "STXS" scheme treat the jet bins the same way. Hence no need to compare these when looking at jet bins only.

Table 1.19: Predited cross sections for $gg \rightarrow H$ with VBF topology. The QCD uncertainties shown for POWHEG NNLOPS are not valid (the third jet is from the showering). Fixed order NLO predictions with two and three jets are provided by GOSAM+SHERPA. The last two rows show result from normalizing the inclusive cross section to 46.18 pb.

 $p_{T,j3}$ / GeV

> 30

218⁺³²₋₃₂ fb

 240^{+17}_{-54} fb

228⁺³³₋₃₃ fb

 $m_{jj} > 400 \text{ GeV}, \Delta y_{jj} > 2.8$

< 30

435⁺⁵⁴₋₅₄ fb

 329^{+92}_{-84} fb

455⁺⁵⁷₋₅₇ fb

no jet veto

653⁺⁸⁶₋₈₆ fb

 512^{+152}_{-133} fb

 610^{+74}_{-120} fb

 683^{+90}_{-90} fb

The VBF region

From YR4: Powheg NNLOPS about 10% above GoSam+Sherpa in inclusive VBF 2j region

MG5, k = 1.41 721_{-188}^{+214} fb 463_{-118}^{+129} ftpredictions using STXS Stage-1 VBF topology cuts gives

Prediction

HJJ@NLO

HJJJ@NLO

POWHEG NNLOPS

NNLOPS, k = 1.05

aMCNLO MG5

- Difference to YR4 cuts:
 - 1. $|y_{\rm H}| < 2.5$
 - 2. $p_{\rm TH} < 200 \, {\rm GeV}$
 - 3. $p_T(j_3) = 30 \text{ GeV threshold} \rightarrow p_T(Hjj) = 25 \text{ GeV}$

HJJ@NLO $\sigma_{\geq 2j, \text{VBF cuts}} = 0.56^{+0.08}_{-0.12}$ $\sigma_{\geq 2j, \text{VBF } 3jv} = 0.35^{+0.0}_{-0.11}$ $\sigma_{\geq 2j, \text{VBF } 3j} = 0.21^{+0.19}_{-0.10}$

no jet veto

 283^{+36}_{-36} fb

214⁺⁶²₋₅₇ fb

 296^{+38}_{-38} fb

 302^{+87}_{-80} fb

 $m_{jj} > 600 \text{ GeV}, \Delta y_{jj} > 4.0$

< 30

198⁺²⁴₋₂₄ fb

 142^{+39}_{-37} fb

 207^{+25}_{-25} fb

 $p_{T,j3}$ / GeV

> 30

85⁺¹²₋₁₂ fb

Note: $p_{T,Hjj}$ cut at 25 GeV very challenging theoretically!

VBF topo region	GoSam+Sherpa	NNLOPS	Rel. diff.	Similar to YR4
≥2 jets	(0.56 ± 0.12) pb	0.63 pb	+12.5%	results.
$p_{\rm T}(Hjj) < 25~{ m GeV}$	(0.35 ± 0.11) pb	0.27 pb	-23%	HJJ@NLO w big
$p_{\mathrm{T}}(Hjj) > 25 \mathrm{GeV}$	(0.21 ± 0.19) pb	0.36 pb	(+71%)	error. Waiting for HJJJ@NLO

Quark mass effects and EW correction (+5%) accounted for by simply scale factors

Table 1.19: Predited cross sections for $gg \rightarrow H$ with VBF topology. The QCD uncertainties shown for POWHEG NNLOPS are not valid (the third jet is from the showering). Fixed order NLO predictions with two and three jets are provided by GOSAM+SHERPA. The last two rows show result from normalizing the inclusive cross section to 46.18 pb.

The VBF region

From YR4: Powheg NNLOPS about 10% above GoSam+Sherpa in inclusive VBF 2j region

New GoSam+Sherpa predictions using STXS Stage-1 VBF topology cuts gives

- Difference to YR4 cuts:
 - 1. $|y_{\rm H}| < 2.5$
 - 2. $p_{\rm TH} < 200 \, {\rm GeV}$
 - 3. $p_T(j_3) = 30$ GeV threshold $\rightarrow p_T(Hjj) = 25$ GeV

HJJ@NLO $\sigma_{\geq 2j, \text{VBF cuts}} = 0.56^{+0.08}_{-0.12}$ $\sigma_{\geq 2j, \text{VBF } 3jv} = 0.35^{+0.0}_{-0.11}$ $\sigma_{\geq 2j, \text{VBF } 3j} = 0.21^{+0.19}_{-0.10}$

Note: $p_{T,Hjj}$ cut at 25 GeV very challenging theoretically!

	VBF topo region	GoSam+Sherpa	NNLOPS	Rel. diff.	Similar to YR4
	≥2 jets	(0.56 ± 0.12) pb	0.63 pb	+12.5%	results.
	$p_{\rm T}(Hjj) < 25~{ m GeV}$	(0.35 ± 0.11) pb	0.27 pb	-23%	HJJ@NLO w big
	$p_{\rm T}(Hjj) > 25~{ m GeV}$	(0.21 ± 0.19) pb	0.36 pb	(+71%)	error. Waiting for HJJJ@NLO
O.	$p_{\mathrm{T}}(Hjj)$ > 25 G	eV (0.292 ± 0.069)	pb 0.36 pb	+23% sc I	HJJJ@NLO very prelim!

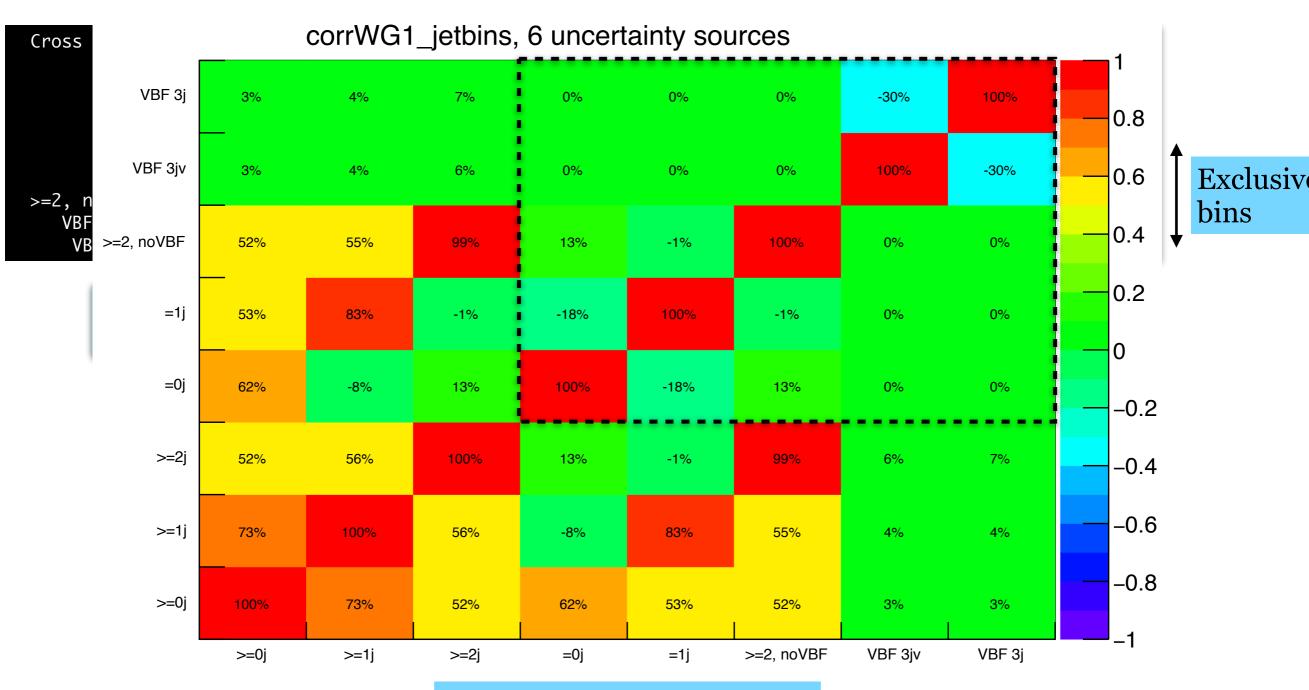
	$m_{jj} > 4$	$400 \text{ GeV}, \Delta y_j$	$_{j} > 2.8$	$m_{jj} > 6$	00 GeV, Δy_{jj}	$_{j} > 4.0$
		$p_{T,j3}$ /	GeV		$p_{T,j3}$ /	GeV
Prediction	no jet veto	< 30	> 30	no jet veto	< 30	> 30
POWHEG NNLOPS	$653^{+86}_{-86}~{ m fb}$	$435^{+54}_{-54}~{ m fb}$	$218^{+32}_{-32}{ m fb}$	283^{+36}_{-36} fb	198^{+24}_{-24} fb	85^{+12}_{-12} fb
aMCNLO MG5	$512^{+152}_{-133}~{ m fb}$	329^{+92}_{-84} fb	-	214^{+62}_{-57} fb	142^{+39}_{-37} fb	_
HJJ@NLO	$610^{+74}_{-120}~{ m fb}$	435^{+0}_{-70} fb	-	268^{+32}_{-55} fb	195^{+0}_{-31} fb	
HJJJ@NLO	-	_	$240^{+17}_{-54}{ m fb}$	-	_	97^{+5}_{-22} fb
NNLOPS, $k = 1.05$	683^{+90}_{-90} fb	455^{+57}_{-57} fb	$228^{+33}_{-33}{ m fb}$	$296^{+38}_{-38}{ m fb}$	207^{+25}_{-25} fb	89^{+13}_{-13} fb
MG5, <i>k</i> = 1.41	$721^{+214}_{-188}~{ m fb}$	$463^{+129}_{-118}~{ m fb}$	_	302^{+87}_{-80} fb	$200^{+55}_{-52}~{ m fb}$	

Jet bins

Cross secti	ons and fraction	nal uncerta	inties									
STXS	sig stat	mu	res	mig01	mig12	VBF2j	VBF3j	pTH	qm_top	Tot		
>=0j	48.52 +/- 0.04	+4.6%	+2.1%	-0.0%	-0.0%	+0.3%	-0.0%	-0.1%	+0.2%	+5.1%		
>=1j	18.40 +/- 0.02	+6.0%	+5.5%	+6.7%	-0.0%	+0.7%	-0.0%	-0.2%	+0.4%	+10.6%		
>=2j	5.47 +/- 0.01	+7.8%	+7.8%	+3.9%	+16.1%	+2.3%	-0.0%	+0.1%	+1.1%	+20.1%		
=0j	30.12 +/- 0.03	+3.8%	+0.1%	-4.1%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+5.6%	♠	
=1j	12.92 +/- 0.02	+5.2%	+4.5%	+7.9%	-6.8%	+0.0%	+0.0%	-0.3%	+0.2%	+12.5%		Exclusiv
>=2, noVBF	4.84 +/- 0.01	+8.9%	+8.9%	+4.4%	+18.2%	+0.0%	+0.0%	+0.3%	+1.2%	+22.5%		
VBF 3jv	0.27 +/- 0.00	+0.0%	+0.0%	+0.0%	+0.0%	+20.0%	-32.0%	-2.5%	+0.1%	+37.8%		bins
VBF 3j	0.36 +/- 0.00	+0.0%	+0.0%	+0.0%	+0.0%	+20.0%	+23.5%	-0.9%	+0.2%	+30.9%	¥	

New VBF 2j source that makes the VBF bins uncorrelated with other (exclusive) jet bins

Jet bins



Resulting correlation matrix.

Cross check with JVE

Since Powheg NNLOPS is used for central values, the central values of eps0 and eps1 is taken from there. These are:

 $\varepsilon_0 = \sigma_0 / \sigma_{\ge 0} = 0.621$ $\varepsilon_1 = \sigma_1 / \sigma_{\ge 1} = 0.703$

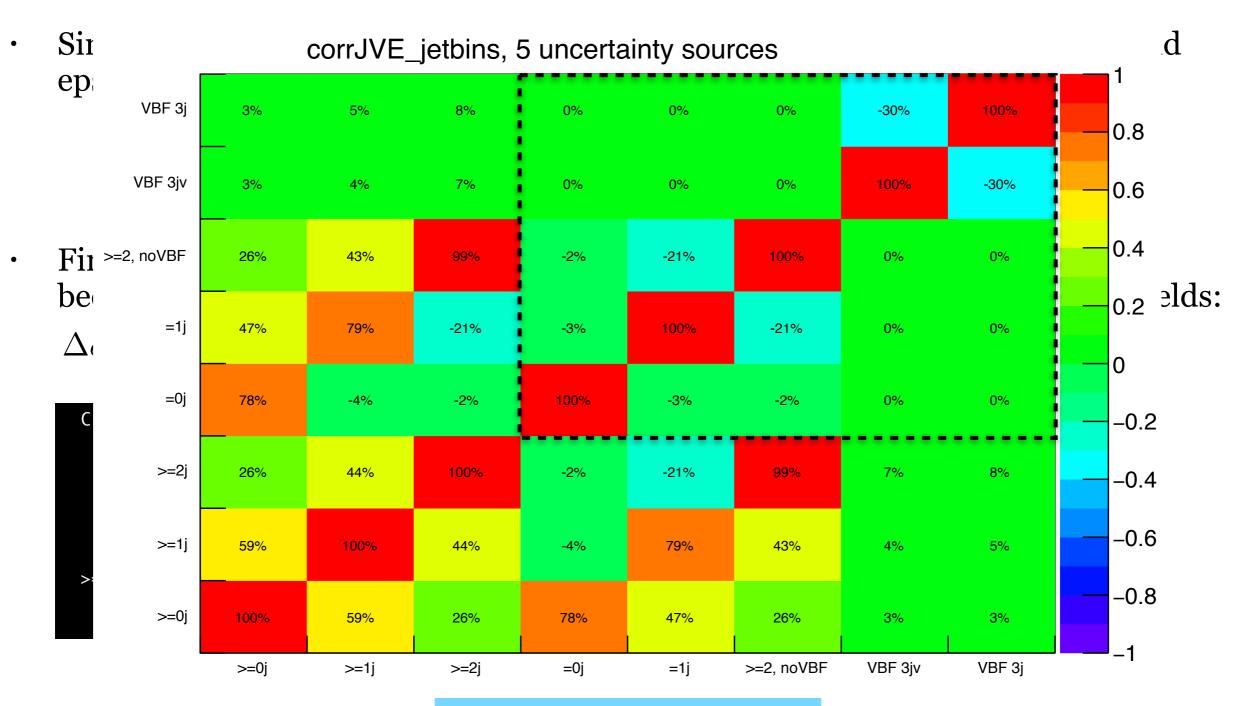
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First cross check: choosing JVE uncertainties such that the total uncertainty becomes equal to the BLPTW uncertainties used in the "WG1 scheme". This yields:

 $\Delta \sigma_{\text{incl}} = 2.48 \,\text{pb} (5.1\%), \ \Delta \sigma_{0 \to \geq 1} = \sigma_{\text{incl}} \Delta \varepsilon_0 = 1.25 \,\text{pb}, \ \Delta \sigma_{1 \to \geq 2} = 0.88 \,\text{pb}$

Cross secti	ons and fracti	onal uncert	ainties						
STXS	sig sta	t incl	mig01	mig12	VBF2j	VBF3j	pTH	qm_top	Tot
>=0j	48.52 +/- 0.0	4 +5.0%	-0.0%	-0.0%	+0.3%	-0.0%	-0.1%	+0.2%	+5.0%
>=1j	18.40 +/- 0.0	2 +4.9%	+6.8%	-0.0%	+0.7%	-0.0%	-0.2%	+0.4%	+8.4%
>=2j	5.47 +/- 0.0	1 +4.5%	+6.2%	+16.1%	+2.3%	-0.0%	+0.1%	+1.1%	+18.0%
=0j	30.12 +/- 0.0	3 +5.1%	-4.1%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+6.6%
=1j	12.92 +/- 0.0	2 +5.1%	+7.0%	-6.8%	+0.0%	+0.0%	-0.3%	+0.2%	+11.0%
>=2, noVBF	4.84 +/- 0.0	1 +5.1%	+7.0%	+18.1%	+0.0%	+0.0%	+0.3%	+1.2%	+20.2%
VBF 3jv	0.27 +/- 0.0	0 +0.0%	+0.0%	+0.0%	+20.0%	-32.0%	-2.5%	+0.1%	+37.8%
VBF 3j	0.36 +/- 0.0	0 +0.0%	+0.0%	+0.0%	+20.0%	+23.5%	-0.9%	+0.2%	+30.9%

Cross check with JVE



Resulting correlation matrix.

Comparison using notation presented by Kerstin

	Enactional	impact of oach up	containty	COURCO					
<i>//=</i>	STXS	<pre>impact of each ur sig stat</pre>	mu	res	mig01	mig12	VBF2j	VBF3j	Total
"WG1"		abs uncertainty	2.25	1.04	1.25	0.88	0.13	0.08	< uncertainty
		, , , , , , , , , , , , , , , , , , ,							in pb
BLPTW	>=0j	48.52 +/- 0.04	1.00	1.00	-0.01	-0.00	1.00	-0.02	
jet bin	>=1j	18.40 +/- 0.02	0.49	0.97	0.99	-0.00	1.00	-0.02	
e e	>=2j	5.47 +/- 0.01	0.19	0.41	0.17	1.00	1.00	-0.02	
uncerts.	=0j	30.12 +/- 0.03	0.51	0.03	-1.00	0.00	0.00	0.00	
	=1j	12.92 +/- 0.02	0.30	0.56	0.82	-1.00	0.00	0.00	
	>=2, noVBF		0.19	0.41	0.17	1.00	0.00	0.00	
	VBF 3jv		0.00	0.00	0.00	0.00	0.43	-1.00	
	VBF 3j	0.36 +/- 0.00	0.00	0.00	0.00	0.00	0.57	1.00	Fractional
			$(0,05 \oplus 1,0)$	4) pb = 2.48 pb					
			(2.25 1.04	4) po = 2.46 po					
	Fractional	impact of each ur							impact of total
	Fractional STXS	impact of each ur sig stat			mig12	VBF2j	VBF3j		
JVE	STXS		ncertainty	source		VBF2j 0.13	VBF3j 0.08		impact of total uncertainty in
JVE	STXS	sig stat abs uncertainty	ncertainty incl 2.48	source mig01 1.25	mig12 0.88	0.13	0.08		impact of total uncertainty in each bin.
JVE	STXS Total >=0j	sig stat abs uncertainty 48.52 +/- 0.04	ncertainty incl 2.48 1.00	source mig01 1.25 -0.00	mig12 0.88 -0.00	0.13 1.00	0.08 -0.02		impact of total uncertainty in each bin. <i>x</i> and <i>z</i> etc in
JVE	STXS Total >=0j >=1j	sig stat abs uncertainty 48.52 +/- 0.04 18.40 +/- 0.02	ncertainty incl 2.48 1.00 0.37	source mig01 1.25 -0.00 1.00	mig12 0.88 -0.00 -0.00	0.13 1.00 1.00	0.08 -0.02 -0.02		impact of total uncertainty in each bin. x and z etc in Kerstin's
JVE	STXS Total >=0j >=1j >=2j	sig stat abs uncertainty 48.52 +/- 0.04 18.40 +/- 0.02 5.47 +/- 0.01	ncertainty incl 2.48 1.00 0.37 0.10	source mig01 1.25 -0.00 1.00 0.27	mig12 0.88 -0.00 -0.00 1.00	0.13 1.00 1.00 1.00	0.08 -0.02 -0.02 -0.02		impact of total uncertainty in each bin. <i>x</i> and <i>z</i> etc in
JVE	STXS Total >=0j >=1j >=2j =0j	sig stat abs uncertainty 48.52 +/- 0.04 18.40 +/- 0.02 5.47 +/- 0.01 30.12 +/- 0.03	ncertainty incl 2.48 1.00 0.37 0.10 0.63	<pre>source mig01 1.25 -0.00 1.00 0.27 -1.00</pre>	mig12 0.88 -0.00 -0.00 1.00 0.00	0.13 1.00 1.00 1.00 0.00	0.08 -0.02 -0.02 -0.02 0.00 -		impact of total uncertainty in each bin. x and z etc in Kerstin's
JVE	STXS Total >=0j >=1j =0j =1j	<pre>sig stat abs uncertainty 48.52 +/- 0.04 18.40 +/- 0.02 5.47 +/- 0.01 30.12 +/- 0.03 12.92 +/- 0.02</pre>	ncertainty incl 2.48 1.00 0.37 0.10 0.63 0.27	<pre>source mig01 1.25 -0.00 1.00 0.27 -1.00 0.73</pre>	mig12 0.88 -0.00 -0.00 1.00 0.00 -1.00	0.13 1.00 1.00 1.00 0.00 0.00	0.08 -0.02 -0.02 -0.02 0.00 -0.00		impact of total uncertainty in each bin. x and z etc in Kerstin's tables. Extracted from
JVE	STXS Total >=0j >=1j =0j =1j >=2, noVBF	<pre>sig stat abs uncertainty 48.52 +/- 0.04 18.40 +/- 0.02 5.47 +/- 0.01 30.12 +/- 0.03 12.92 +/- 0.02 4.84 +/- 0.01</pre>	ncertainty incl 2.48 1.00 0.37 0.10 0.63 0.27 0.10	<pre>source mig01 1.25 -0.00 1.00 0.27 -1.00 0.73 0.27</pre>	mig12 0.88 -0.00 -0.00 1.00 0.00 -1.00 1.00	0.13 1.00 1.00 1.00 0.00 0.00 0.00	0.08 -0.02 -0.02 -0.02 0.00 -0.00 0.00		impact of total uncertainty in each bin. <i>x</i> and <i>z</i> etc in Kerstin's tables.
JVE	STXS Total >=0j >=1j =0j =1j	<pre>sig stat abs uncertainty 48.52 +/- 0.04 18.40 +/- 0.02 5.47 +/- 0.01 30.12 +/- 0.03 12.92 +/- 0.02 4.84 +/- 0.01 0.27 +/- 0.00</pre>	ncertainty incl 2.48 1.00 0.37 0.10 0.63 0.27	<pre>source mig01 1.25 -0.00 1.00 0.27 -1.00 0.73</pre>	mig12 0.88 -0.00 -0.00 1.00 0.00 -1.00	0.13 1.00 1.00 1.00 0.00 0.00	0.08 -0.02 -0.02 -0.02 0.00 -0.00		impact of total uncertainty in each bin. x and z etc in Kerstin's tables. Extracted from

Sign convention used: positive uncertainty (pull) means jettier/harder topology.

Second JVE comparison

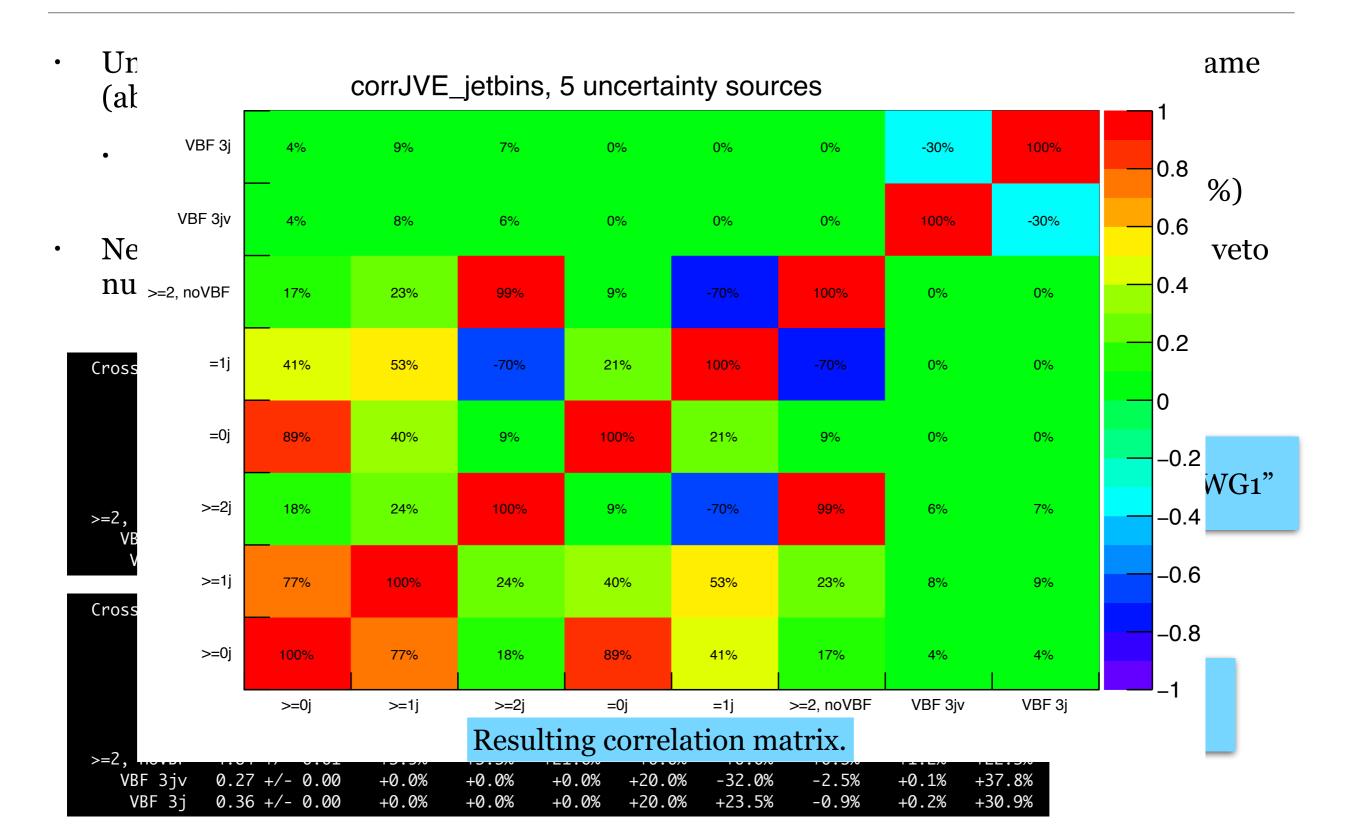
- Uncertainty correlations fairly similar between JVE and BLPTW when using the same (absolute) migration uncertainties
 - JVE has stronger anti-correlation between =1 and >=2 jets (-21% vs -1% for BLTPW). BLTWP has more anti-corrlation between =0 and =1 jets (-18% vs -3%)

Next comparing JVE with N3LO uncertainties: 3.9% for inclusive, and precise jet veto numbers derived by Pier+Fabrizio:
 epso = 0.617 +- 0.012

	eps1 :	= 0.681	+- 0.	057
--	--------	---------	-------	-----

Cross secti	ons and fraction	nal unce <u>rta</u>	inties								
STXS	sig stat	mu	res	mig01	mig12	VBF2j	VBF3j	pTH	qm_top	Tot	
>=0j		+4.6%	+2.1%	-0.0%	-0.0%	+0.3%	-0.0%	-0.1%	+0.2%	+5.1%	
>=1j	18.40 +/- 0.02	+6.0%	+5.5%	+6.7%	-0.0%	+0.7%	-0.0%	-0.2%	+0.4%	+10.6%	
>=2j	5.47 +/- 0.01	+7.8%	+7.8%	+3.9%	+16.1%	+2.3%	-0.0%	+0.1%	+1.1%	+20.1%	
=0j	30.12 +/- 0.03	+3.8%	+0.1%	-4.1%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+5.6%	"WG1"
=1j	12.92 +/- 0.02	+5.2%	+4.5%	+7.9%	-6.8%	+0.0%	+0.0%	-0.3%	+0.2%	+12.5%	WGI
>=2, noVBF	4.84 +/- 0.01	+8.9%	+8.9%	+4.4%	+18.2%	+0.0%	+0.0%	+0.3%	+1.2%	+22.5%	
VBF 3jv	0.27 +/- 0.00	+0.0%	+0.0%	+0.0%	+0.0%	+20.0%	-32.0%	-2.5%	+0.1%	+37.8%	·
VBF 3j	0.36 +/- 0.00	+0.0%	+0.0%	+0.0%	+0.0%	+20.0%	+23.5%	-0.9%	+0.2%	+30.9%	
Cross secti	ons and fractior	nal uncerta	iinties								
Cross secti STXS	ons and fraction. sig stat	nal uncerta incl	uinties eps0	eps1	VBF2j	VBF3j	рТН	qm_top	Tot		
STXS				eps1 -0.0%	VBF2j +0.3%	VBF3j -0.0%	pTH -0.1%	qm_top +0.2%	Tot +3.9%		
STXS >=0j	sig stat	incl +3.8%	eps0	-	9	5		• •			
STXS >=0j >=1j	sig stat 48.52 +/- 0.04	incl +3.8% +3.8%	eps0 -0.0%	-0.0%	+0.3%	-0.0%	-0.1%	+0.2%	+3.9%		
STXS >=0j >=1j	sig stat 48.52 +/- 0.04 18.40 +/- 0.02 5.47 +/- 0.01	incl +3.8% +3.8%	eps0 -0.0% +3.2%	-0.0% -0.0%	+0.3% +0.7%	-0.0% -0.0%	-0.1% -0.2%	+0.2% +0.4%	+3.9% +5.0%		JVE
STXS >=0j >=1j >=2j =0j	sig stat 48.52 +/- 0.04 18.40 +/- 0.02 5.47 +/- 0.01	incl +3.8% +3.8% +3.4% +3.9%	eps0 -0.0% +3.2% +2.9%	-0.0% -0.0% +19.1%	+0.3% +0.7% +2.3%	-0.0% -0.0% -0.0%	-0.1% -0.2% +0.1%	+0.2% +0.4% +1.1%	+3.9% +5.0% +19.8%		JVE
STXS >=0j >=1j >=2j =0j =1j	sig stat 48.52 +/- 0.04 18.40 +/- 0.02 5.47 +/- 0.01 30.12 +/- 0.03	incl +3.8% +3.8% +3.4% +3.9%	eps0 -0.0% +3.2% +2.9% -1.9%	-0.0% -0.0% +19.1% +0.0%	+0.3% +0.7% +2.3% +0.0%	-0.0% -0.0% -0.0% +0.0%	-0.1% -0.2% +0.1% +0.0%	+0.2% +0.4% +1.1% +0.0%	+3.9% +5.0% +19.8% +4.3%		JVE
STXS >=0j >=1j >=2j =0j =1j	sig stat 48.52 +/- 0.04 18.40 +/- 0.02 5.47 +/- 0.01 30.12 +/- 0.03 12.92 +/- 0.02 4.84 +/- 0.01	incl +3.8% +3.8% +3.4% +3.9% +3.9%	eps0 -0.0% +3.2% +2.9% -1.9% +3.3%	-0.0% -0.0% +19.1% +0.0% -8.1%	+0.3% +0.7% +2.3% +0.0% +0.0%	-0.0% -0.0% -0.0% +0.0% +0.0%	-0.1% -0.2% +0.1% +0.0% -0.3%	+0.2% +0.4% +1.1% +0.0% +0.2%	+3.9% +5.0% +19.8% +4.3% +9.6%		JVE

Second JVE comparison



New: Uncertainty correlation WG1 scheme

http://dgillber.web.cern.ch/dgillber/ggF_uncertainty_2017/

corrWG1, 8 uncertainty sources

>=1	4%	4%	-8%	78%	80%	54%	46%	53%	55%	53%	43%	-8%	83%	56%	93%	66%	47%	90%	61%	100%	1
>=1J>120	-2%	4%	5%	3%	39%	63%	64%	50%	70%	87%	93%	5%	24%	74%	85%	99%	95%	89%	100%	61%	
>=1J >60	1%	4%	-2%	47%	69%	68%	62%	54%	67%	76%	73%	-2%	62%	69%	100%	91%	77%	100%	89%	90%	0.8
>=1J >200	-4%	-2%	6%	-9%	26%	55%	70%	42%	62%	80%	98%	6%	11%	67%	70%	89%	100%	77%	95%	47%	0.6
>=1J 120-200	-1%	6%	4%	8%	43%	65%	60%	51%	71%	88%	88%	4%	29%	75%	88%	100%	89%	91%	99%	66%	0.6
>=1J 60-200	1%	4%	-4%	54%	73%	68%	59%	53%	65%	72%	66%	-4%	67%	67%	100%	88%	70%	100%	85%	93%	0.4
>=2J	6%	7%	13%	-1%	-1%	0%	2%	94%	99%	95%	77%	13%	-1%	100%	67%	75%	67%	69%	74%	56%	0.4
=1J	0%	0%	-18%	95%	97%	65%	54%	0%	-1%	-1%	-1%	-18%	100%	-1%	67%	29%	11%	62%	24%	83%	0.0
=0J	0%	0%	100%	-17%	-17%	-12%	-10%	12%	13%	12%	10%	100%	-18%	13%	-4%	4%	6%	-2%	5%	-8%	0.2
>=2J_200->	-3%	-1%	10%	-18%	12%	39%	54%	56%	73%	88%	100%	10%	-1%	77%	66%	88%	98%	73%	93%	43%	0
>=2J_120-200	-2%	-1%	12%	-10%	6%	21%	21%	82%	94%	100%	88%	12%	-1%	95%	72%	88%	80%	76%	87%	53%	0
>=2J_60-120	0%	0%	13%	1%	-2%	-4%	-4%	96%	100%	94%	73%	13%	-1%	99%	65%	71%	62%	67%	70%	55%	 -0.2
>=2J_0-60	2%	1%	12%	10%	-8%	-24%	-22%	100%	96%	82%	56%	12%	0%	94%	53%	51%	42%	54%	50%	53%	-0.2
=1J_200->	-5%	-2%	-10%	28%	70%	90%	100%	-22%	-4%	21%	54%	-10%	54%	2%	59%	60%	70%	62%	64%	46%	 -0.4
=1J_120-200	-5%	-2%	-12%	38%	82%	100%	90%	-24%	-4%	21%	39%	-12%	65%	0%	68%	65%	55%	68%	63%	54%	-0.4
=1J_60-120	-2%	-1%	-17%	83%	100%	82%	70%	-8%	-2%	6%	12%	-17%	97%	-1%	73%	43%	26%	69%	39%	80%	 -0.6
=1J_0-60	2%	1%	-17%	100%	83%	38%	28%	10%	1%	-10%	-18%	-17%	95%	-1%	54%	8%	-9%	47%	3%	78%	-0.0
=0J	0%	0%	100%	-17%	-17%	-12%	-10%	12%	13%	12%	10%	100%	-18%	13%	-4%	4%	6%	-2%	5%	-8%	 -0.8
VBF_J3	-30%	100%	0%	1%	-1%	-2%	-2%	1%	0%	-1%	-1%	0%	0%	7%	4%	6%	-2%	4%	4%	4%	-0.0
VBF_J3V	100%	-30%	0%	2%	-2%	-5%	-5%	2%	0%	-2%	-3%	0%	0%	6%	1%	-1%	-4%	1%	-2%	4%	 _1
	VB	r VB/ _J3V	r3	/ =1.	/_0=10 _0-60	€0.12	120-2	200-2	2J_0-6		$\frac{2}{120}$	2) =0, 200 -200	, ≈1, ~>	<u>ک</u> یر ا	2, 2=7	J 60-2	1J 120. 100	'J <u>~</u> 200 200	/J →≤7) →60	'J ^{_2} =1 120	•

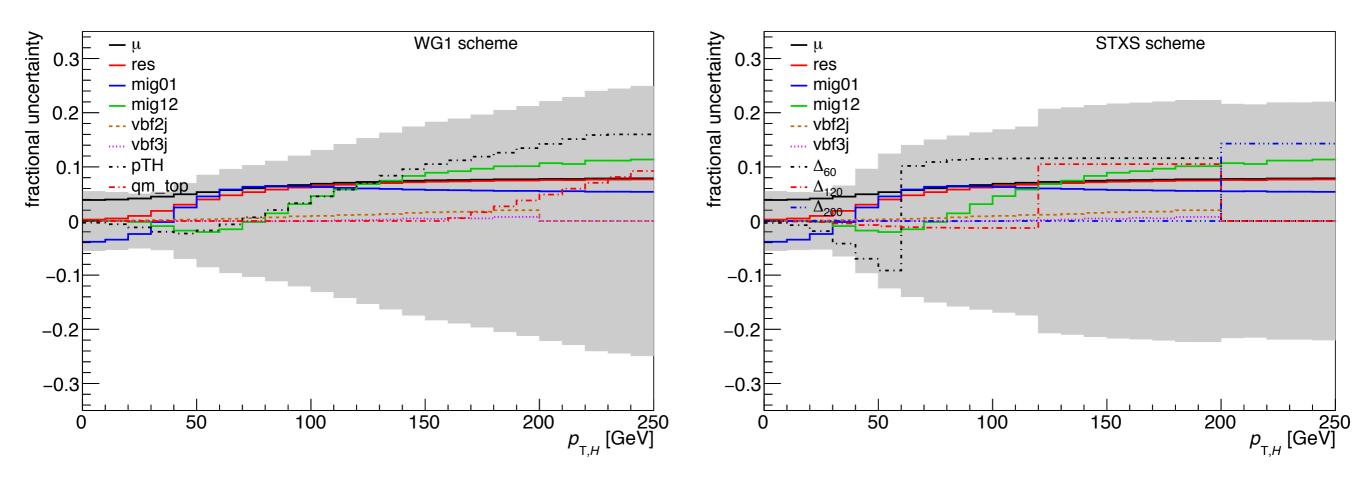
New: Uncertainty correlation STXS scheme

																					-
>=1	4%	4%	-8%	59%	60%	52%	58%	49%	49%	45%	49%	-8%	82%	55%	67%	53%	56%	69%	60%	100%	I
>=1J >120	5%	13%	5%	-19%	47%	66%	29%	36%	82%	94%	68%	5%	16%	81%	84%	97%	67%	86%	100%	60%	0.8
>=1J >60	5%	12%	-2%	-15%	82%	74%	36%	12%	78%	75%	47%	-2%	38%	65%	100%	86%	49%	100%	86%	69%	0.0
>=1J >200	0%	0%	7%	10%	10%	9%	58%	66%	66%	62%	98%	7%	15%	76%	43%	47%	100%	49%	67%	56%	0.6
>=1J 120-200	6%	16%	3%	-26%	52%	75%	16%	22%	75%	92%	49%	3%	14%	72%	86%	100%	47%	86%	97%	53%	0.0
>=1J 60-200	6%	13%	-3%	-16%	84%	76%	32%	7%	75%	73%	40%	-3%	38%	61%	100%	86%	43%	100%	84%	67%	 0.4
>=2J	7%	10%	12%	-14%	12%	14%	4%	76%	94%	90%	85%	12%	-3%	100%	61%	72%	76%	65%	81%	55%	0.4
=1J	-1%	-2%	-18%	80%	64%	52%	66%	6%	-6%	-8%	0%	-18%	100%	-3%	38%	14%	15%	38%	16%	82%	 0.2
=0J	0%	0%	100%	-13%	-13%	-11%	-12%	11%	11%	11%	11%	100%	-18%	12%	-3%	3%	7%	-2%	5%	-8%	0.2
>=2J_200->	0%	0%	11%	-0%	-0%	-0%	40%	74%	75%	69%	100%	11%	0%	85%	40%	49%	98%	47%	68%	49%	 0
•=2J_120-200	2%	7%	11%	-33%	25%	44%	-0%	50%	90%	100%	69%	11%	-8%	90%	73%	92%	62%	75%	94%	45%	0
>=2J_60-120	2%	5%	11%	-32%	31%	23%	-0%	57%	100%	90%	75%	11%	-6%	94%	75%	75%	66%	78%	82%	49%	 -0.2
>=2J_0-60	-2%	-6%	11%	33%	-32%	-30%	-1%	100%	57%	50%	74%	11%	6%	76%	7%	22%	66%	12%	36%	49%	-0.2
=1J_200->	0%	0%	-12%	47%	48%	41%	100%	-1%	-0%	-0%	40%	-12%	66%	4%	32%	16%	58%	36%	29%	<mark>58%</mark>	-0.4
=1J_120-200	3%	10%	-11%	1%	81%	100%	41%	-30%	23%	44%	-0%	-11%	52%	14%	76%	75%	9%	74%	66%	52%	-0.4
=1J_60-120	3%	7%	-13%	6%	100%	81%	48%	-32%	31%	25%	-0%	-13%	64%	12%	84%	52%	10%	82%	47%	60%	-0.6
=1J_0-60	-3%	-8%	-13%	100%	6%	1%	47%	33%	-32%	-33%	-0%	-13%	80%	-14%	-16%	-26%	10%	-15%	-19%	59%	-0.0
=0J	0%	0%	100%	-13%	-13%	-11%	-12%	11%	11%	11%	11%	100%	-18%	12%	-3%	3%	7%	-2%	5%	-8%	-0.8
VBF_J3	-29%	100%	0%	-8%	7%	10%	0%	-6%	5%	7%	0%	0%	-2%	10%	13%	16%	0%	12%	13%	4%	-0.0
VBF_J3V	100%	-29%	0%	-3%	3%	3%	0%	-2%	2%	2%	0%	0%	-1%	7%	6%	6%	0%	5%	5%	4%	_1
	VB	F_J3V	r3	/ =1.	l_0=10 _0-60	1_60-12	120-2 20	200.	2J_0-60	2, ² , 60.	20^{2}	n, ≈0, ,200. ,200	, ≈1, ∴	<u> </u>	ו ^{בר} ט	J 60-2	1J 120. 100	1 220 200 200	زی ^ر 60 ('J <u>~</u> ≥1 J <u>~</u> 120	- 1

corrSTXS, 9 uncertainty sources

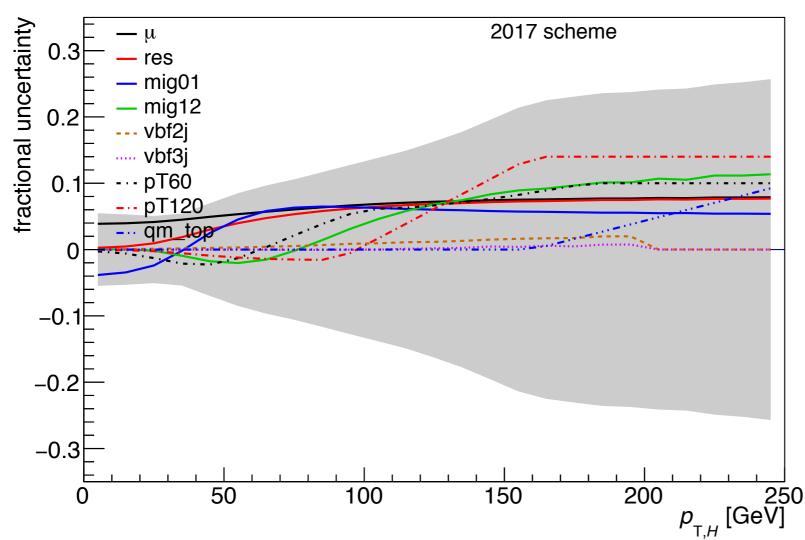
Merging of the two schemes

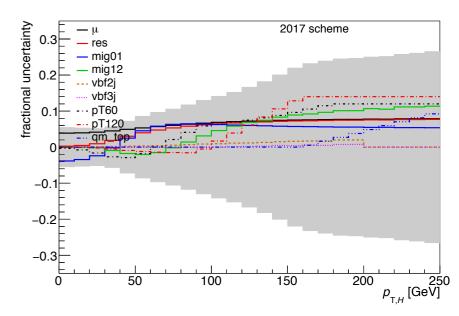
- The perturbative uncertainty on the pT spectrum are obtained in different ways between the two schemes
 - In the "WG1" scheme, this uncertainty is taken as a shape uncertainty from Powheg's scale variations (integral poorly defined)
 - The procedure in Kerstin's talk defines the integral, but not the shape results in theta function behaviour when plotting uncertainty vs pT (see below)
- Point raised during meeting to attempt to merge the schemes
 - Attempt to keep the integral while assigning smooth shape



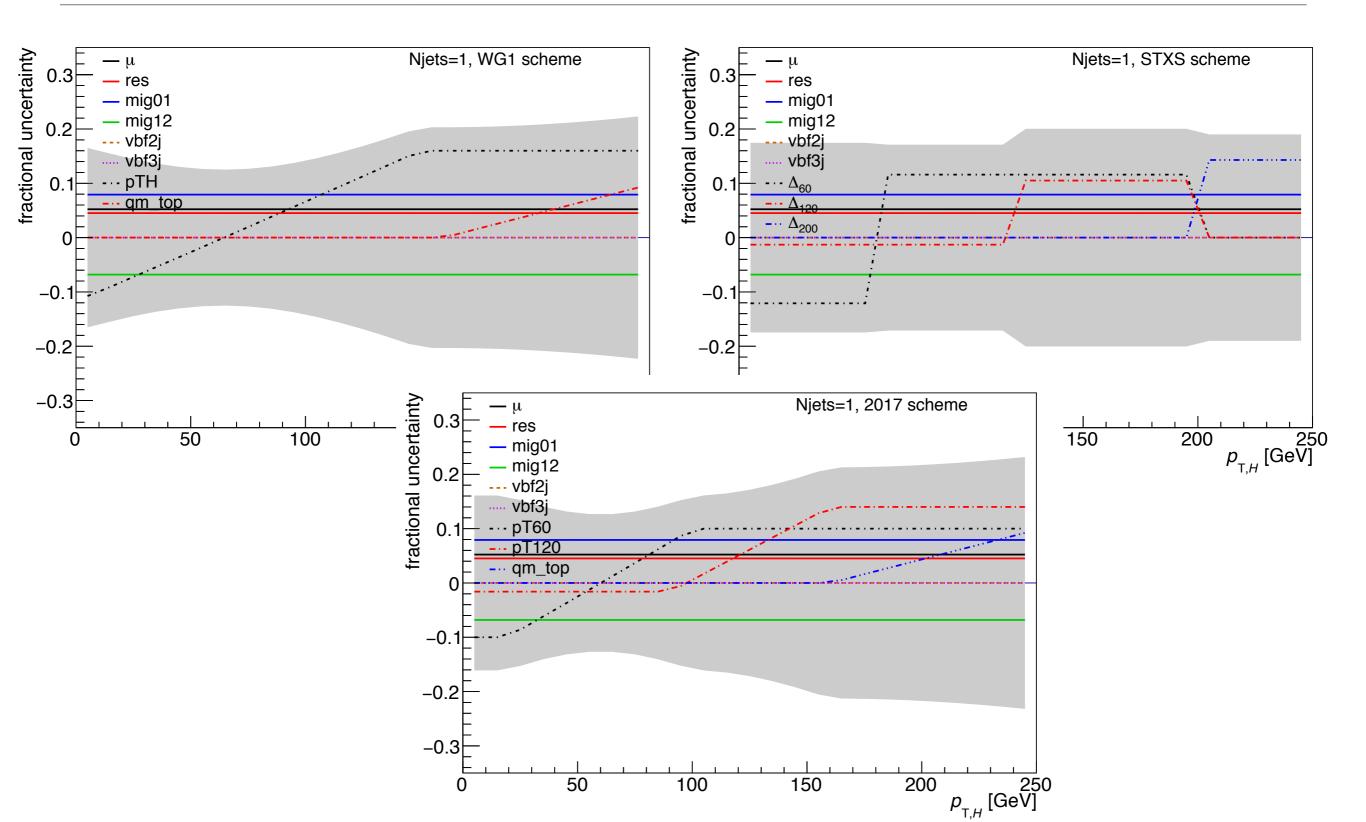
Merging of the two schemes

- Point raised during meeting to attempt to merge the schemes
 - Result "2017 scheme"
- Three pT dependent components:
 - pT60 & pT120 for migrations across these boundaries
 - Keeping the finite top mass uncertainty that becomes large at high pT (in place of D200 in STXS scheme)

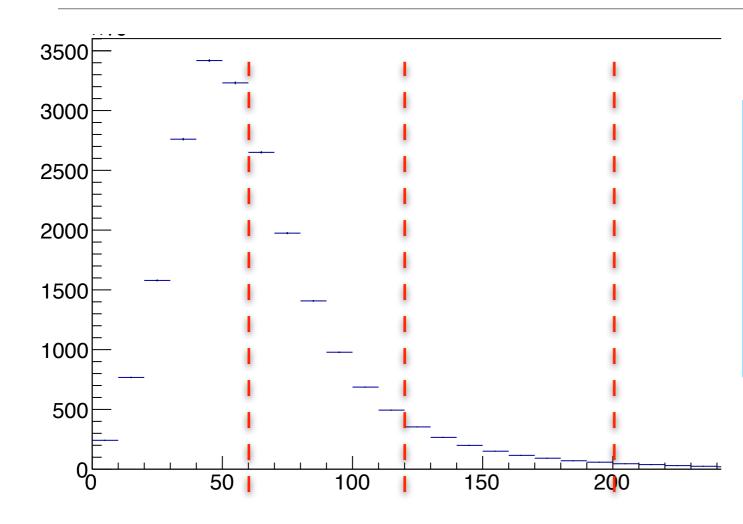




Higgs p_T uncertainties, Njets=1



$p_{T,H}$ uncertainty for $N_{jets} = 1$, with cut at 60 GeV



Cut at 60 GeV cuts spectrum in half Uncertainty on integral provided by jet bin uncertainty: 12.5%.

Uncertainty from 60 GeV and up from NNLOPS. Difficult to find a smooth shape that yield the desired uncertainty from 60 GeV and up.

Uncertainties, "2017 scheme"

	ons and fractional	L uncerta	inties								
STXS	sig stat	mu	res	mig01	mig12	VBF2j	VBF3j	рТ60	pT120	qm_top	Tot
Incl	48.52 +/- 0.00	+4.6%	+2.1%	-0.0%	-0.0%	+0.3%	-0.0%	+0.0%	+0.2%	+0.2%	+5.1%
FWDH	4.27 +/- 0.01	+4.5%	+1.9%	-0.5%	-0.2%	+0.0%	+0.0%	-0.3%	-0.1%	+0.0%	+4.9%
VBF_J3V	0.27 +/- 0.00	+0.0%	+0.0%	+0.0%	+0.0%	+20.0%	-32.0%	-1.6%	+1.1%	+0.1%	+37.8%
VBF_J3	0.36 +/- 0.00	+0.0%	+0.0%	+0.0%	+0.0%	+20.0%	+23.5%	-0.2%	+2.5%	+0.2%	+31.0%
=ØJ	27.25 +/- 0.03	+3.8%	+0.1%	-4.1%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+5.6%
=1J_0-60	6.49 +/- 0.01	+5.2%	+4.5%	+7.9%	-6.8%	+0.0%	+0.0%	-4.8%	-1.6%	+0.0%	+13.5%
=1J_60-120	4.50 +/- 0.01	+5.2%	+4.5%	+7.9%	-6.8%	+0.0%	+0.0%	+4.8%	-0.9%	+0.0%	+13.4%
=1J_120-200	0.74 +/- 0.00	+5.2%	+4.5%	+7.9%	-6.8%	+0.0%	+0.0%	+10.0%	+10.1%	+0.5%	+18.9%
=1J_200->	0.15 +/- 0.00	+5.2%	+4.5%	+7.9%	-6.8%	+0.0%	+0.0%	+10.0%	+14.0%	+10.5%	+23.7%
>=2J_0-60	1.22 +/- 0.01	+8.9%	+8.9%	+4.4%	+18.2%	+0.0%	+0.0%	-5.9%	-1.6%	+0.0%	+23.3%
>=2J_60-120	1.86 +/- 0.01	+8.9%	+8.9%	+4.4%	+18.2%	+0.0%	+0.0%	-0.2%	-0.2%	+0.0%	+22.5%
>=2J_120-200	0.99 +/- 0.00	+8.9%	+8.9%	+4.4%	+18.2%	+0.0%	+0.0%	+6.6%	+10.6%	+0.6%	+25.8%
>=2J_200->	0.42 +/- 0.00	+8.9%	+8.9%	+4.4%	+18.2%	+0.0%	+0.0%	+10.0%	+14.0%	+11.8%	+30.7%
=0J	30.12 +/- 0.03	+3.8%	+0.1%	-4.1%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+0.0%	+5.6%
=1J	12.92 +/- 0.02	+5.2%	+4.5%	+7.9%	-6.8%	+0.0%	+0.0%	-0.1%	-0.4%	+0.2%	+12.5%
>=2J	5.47 +/- 0.01	+7.8%	+7.8%	+3.9%	+16.1%	+2.3%	-0.0%	+0.4%	+2.9%	+1.1%	+20.3%
>=1J 60-200	9.09 +/- 0.01	+6.2%	+5.8%	+6.4%	+1.9%	+0.9%	+0.1%	+4.2%	+1.7%	+0.1%	+11.8%
>=1J 120-200	1.96 +/- 0.01	+6.8%	+6.5%	+5.5%	+6.9%	+1.5%	+0.4%	+8.0%	+10.4%	+0.6%	+18.5%
>=1J >200	0.58 +/- 0.00	+7.9%	+7.7%	+5.4%	+11.6%	+0.0%	+0.0%	+10.0%	+14.0%	+11.4%	+26.7%
>=1J >60	9.68 +/- 0.01	+6.3%	+5.9%	+6.3%	+2.5%	+0.8%	+0.1%	+4.6%	+2.5%	+0.8%	+12.2%
>=1J >120	2.54 +/- 0.01	+7.0%	+6.8%	+5.5%	+8.0%	+1.2%	+0.3%	+8.4%	+11.2%	+3.0%	+19.9%
>=1	18.40 +/- 0.02	+6.0%	+5.5%	+6.7%	-0.0%	+0.7%	-0.0%	+0.0%	+0.5%	+0.4%	+10.6%

Correlation matrix "2017 scheme"

																						1
>=1	4%	5%	-7%	76%	77%	58%	48%	53%	55%	51%	45%	-8%	82%	56%	91%	62%	49%	89%	<mark>59%</mark>	100%		
>=1J >120	2%	9%	4%	-1%	32%	68%	70%	48%	64%	91%	93%	4%	20%	74%	81%	99%	95%	86%	100%	<mark>59%</mark>		0.8
>=1J >60	2%	6%	-2%	41%	69%	71%	63%	53%	65%	76%	72%	-2%	60%	69%	100%	87%	76%	100%	86%	89%		0.0
>=1J >200	0%	4%	6%	-9%	21%	57%	72%	47%	61%	87%	98%	6%	10%	71%	70%	90%	100%	76%	95%	49%		0.6
>=1J 120-200	2%	11%	4%	2%	36%	70%	67%	47%	64%	91%	88%	4%	24%	73%	83%	100%	90%	87%	99%	62%		0.0
>=1J 60-200	2%	6%	-3%	46%	73%	70%	59%	52%	63%	71%	66%	-3%	65%	66%	100%	83%	70%	100%	81%	91%		0 4
>=2J	7%	8%	13%	-3%	-1%	8%	11%	93%	98%	92%	81%	13%	-1%	100%	66%	73%	71%	69%	74%	56%		0.4
=1J	-0%	-0%	-18%	93%	93%	64%	51%	-0%	-1%	-2%	-2%	-18%	100%	-1%	65%	24%	10%	60%	20%	82%		0.0
=0J	0%	0%	100%	-16%	-16%	-12%	-9%	12%	13%	11%	9%	100%	-18%	13%	-3%	4%	6%	-2%	4%	-8%		0.2
>=2J_200->	0%	4%	9%	-18%	8%	42%	57%	60%	73%	92%	100%	9%	-2%	81%	66%	88%	98%	72%	93%	45%		
•=2J_120-200	0%	3%	11%	-15%	6%	35%	36%	75%	87%	100%	92%	11%	-2%	92%	71%	91%	87%	76%	91%	51%		0
>=2J_60-120	0%	-0%	13%	-0%	-1%	-1%	-1%	97%	100%	87%	73%	13%	-1%	98%	63%	64%	61%	65%	64%	55%		0.0
>=2J_0-60	1%	-0%	12%	9%	-9%	-17%	-15%	100%	97%	75%	60%	12%	-0%	93%	52%	47%	47%	53%	48%	53%		-0.2
=1J_200->	0%	5%	-9%	27%	61%	90%	100%	-15%	-1%	36%	57%	-9%	51%	11%	59%	67%	72%	63%	70%	48%		0.4
=1J_120-200	-1%	4%	-12%	36%	77%	100%	90%	-17%	-1%	35%	42%	-12%	64%	8%	70%	70%	57%	71%	68%	58%		-0.4
=1J_60-120	-2%	-1%	-16%	74%	100%	77%	61%	-9%	-1%	6%	8%	-16%	93%	-1%	73%	36%	21%	69%	32%	77%		0.0
=1J_0-60	1%	-1%	-16%	100%	74%	36%	27%	9%	-0%	-15%	-18%	-16%	93%	-3%	46%	2%	-9%	41%	-1%	76%		-0.6
=0J	0%	0%	100%	-16%	-16%	-12%	-9%	12%	13%	11%	9%	100%	-18%	13%	-3%	4%	6%	-2%	4%	-7%		0.0
VBF_J3	-30%	100%	0%	-1%	-1%	4%	5%	-0%	-0%	3%	4%	0%	-0%	8%	6%	11%	4%	6%	9%	5%		-0.8
VBF_J3V	100%	-30%	0%	1%	-2%	-1%	0%	1%	0%	0%	0%	0%	-0%	7%	2%	2%	0%	2%	2%	4%		4
$VBI_03V = 003 = 038 = 038 = 138 = 038 = 138 = 038 = 138 = 038 = 038 = 038 = 038 = 038 = 038 = 038 = 238 = $													· — I									

corr2017, 9 uncertainty sources