

Systematics & Spurious signal

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Migration due to systematic

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.04	0.00	$2.07\% \pm 1.03\%$
TTH leptonic	0.00	0.00	-
VH 2 leptons	0.00	0.00	-
VH leptonic	0.00	0.00	$2.40\% \pm 14.82\%$
VH MET	0.04	0.00	$3.04\% \pm 1.44\%$
VH hadronic	2.15	0.06	$2.62\% \pm 0.17\%$
VBF cutbased	0.92	0.02	$2.69\% \pm 0.26\%$
GGF	154.39	3.96	$2.57\% \pm 0.02\%$
VBF mva high	0.92	0.02	$2.31\% \pm 0.23\%$
VBF mva low	2.43	0.06	$2.46\% \pm 0.15\%$

Table 96: "PH_EFF_ID_Uncertainty__1up"

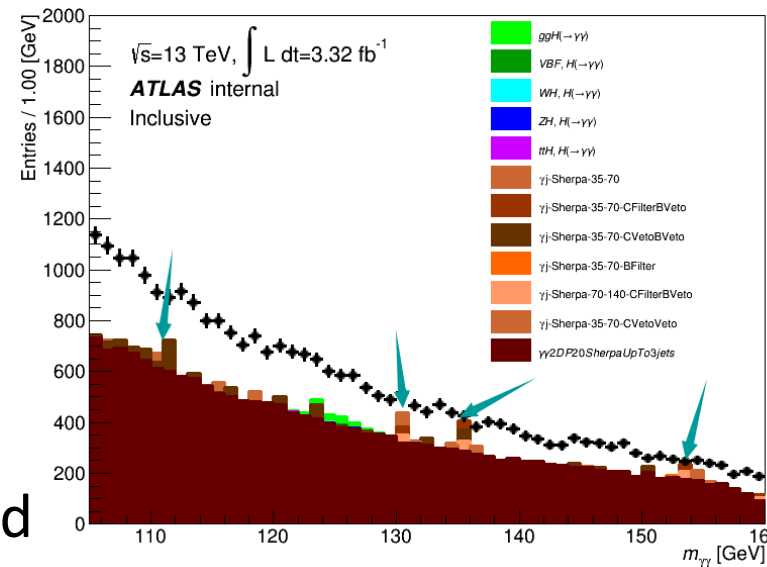
- All the systematics on all the processes have been calculated
 - Grouped in: Flavor tagging, Jet, Lepton, MET, Photon related
- Have been added to the Supporting document in the appendix section
- Several general ideas:
 - Photon related systematics should consider inclusively
 - Most analyses need to consider jet related systematics, e.g. VH met, which has no jets requirement
 - Some categories have extremely low statistic, which are hard to see what happened

MVA based category

- The bug I showed last time is fixed. ->due to a issue of unit
- We are planning to import the MVA based categorization for VBF process to the Hgam Framework for h011
- Now we have CatCoup_dev and CatCoup_Moriond2016, maybe we should delete the second one?
- Any changings from other categories? VH_had ?

Spurious signals

- Calculated using HGamTool
 - Using the workspace from Marc
 - 5 different BKG models are tested
- Using the AF2 sample
 - To have more statistics and less bumps on background shape
 - Only consider yy sample, because the yj sample is with low statistic
- Since the scale of the MC is wrong, we rescale the MC to data



No function passes

1. Low statistic even for AF2 sample
2. Something wrong in the tool

spurious signal for the model

$SS/dS, <20\%$

$SS/S_{reference} < 10\%$, which is the SM expected signal yield

Function	S	$\max(S/\delta S)$	$\max(S/S_{ref})$	Result
Bern3	0.04	-1.5 %	0.0 %	Pass
Bern4	0.04	1.5 %	0.0 %	Pass
Bern5	0.04	-1.3 %	0.0 %	Pass
ExpPoly1	0.10	-3.8 %	0.1 %	Pass
ExpPoly2	0.05	1.7 %	0.0 %	Pass
Dijet	0.05	2.5 %	0.0 %	Pass

Function	S	$\max(S/\delta S)$	$\max(S/S_{ref})$	Result
Bern3	40.10	-48.9 %	27.6 %	Fail
Bern4	47.64	53.2 %	32.7 %	Fail
Bern5	52.71	52.2 %	36.1 %	Fail
ExpPoly1	102.37	-126.6 %	71.9 %	Fail
ExpPoly2	49.91	59.9 %	34.3 %	Fail
Dijet	49.51	73.4 %	33.9 %	Fail

==> No PDF passes all the selections

Jet systematic for different scenarios

- We are trying to understand the effect of different way to group JES
- thank you to Chris, Tony et al., for the dedicated production of this study
- The 4 scenarios refer to 4 different algorithms of grouping
- The sum-sqrt of each scenario is calculated:
 - If they are similar, we could continue to use the h010 result, which only considered scenario 1
 - Otherwise we may need to consider the JES component one by one
- The calculation is only with VBF and ggH sample
- May need some further discussion with jet experts

GGH

channel	GGF	VBF mva high	VBF mva low
Nominal	154.39	0.92	2.43
Scenario 1	-0.31% $\pm$ 0.00%	-0.13% $\pm$ 0.01%	7.40% $\pm$ 0.44%
Scenario 2	-0.02% $\pm$ 0.00%	-7.91% $\pm$ 0.80%	8.96% $\pm$ 0.53%
Scenario 3	-0.29% $\pm$ 0.00%	1.98% $\pm$ 0.19%	15.87% $\pm$ 0.93%
Scenario 4	-0.32% $\pm$ 0.00%	1.98% $\pm$ 0.19%	15.87% $\pm$ 0.93%

Table 1: "JET_GroupedNP_1_1up"

channel	GGF	VBF mva high	VBF mva low
Nominal	154.39	0.92	2.43
Scenario 1	0.17% $\pm$ 0.00%	-8.72% $\pm$ 0.88%	-12.55% $\pm$ 0.79%
Scenario 2	0.13% $\pm$ 0.00%	-7.71% $\pm$ 0.78%	-6.28% $\pm$ 0.39%
Scenario 3	0.26% $\pm$ 0.00%	-16.76% $\pm$ 1.74%	-18.68% $\pm$ 1.20%
Scenario 4	0.29% $\pm$ 0.00%	-16.76% $\pm$ 1.74%	-18.76% $\pm$ 1.21%

Table 2: "JET_GroupedNP_1_1down"

channel	GGF	VBF mva high	VBF mva low
Nominal	154.39	0.92	2.43
Scenario 1	0.05% $\pm$ 0.00%	0.08% $\pm$ 0.01%	3.09% $\pm$ 0.19%
Scenario 2	-0.06% $\pm$ 0.00%	-6.78% $\pm$ 0.68%	10.64% $\pm$ 0.63%
Scenario 3	-0.02% $\pm$ 0.00%	0.00% $\pm$ 0.00%	-6.19% $\pm$ 0.38%
Scenario 4	0.03% $\pm$ 0.00%	0.01% $\pm$ 0.00%	3.11% $\pm$ 0.19%

Table 3: "JET_GroupedNP_2_1up"

channel	GGF	VBF mva high	VBF mva low
Nominal	154.39	0.92	2.43
Scenario 1	-0.04% $\pm$ 0.00%	0.00% $\pm$ 0.00%	-3.21% $\pm$ 0.20%
Scenario 2	0.07% $\pm$ 0.00%	-8.75% $\pm$ 0.88%	-11.72% $\pm$ 0.74%
Scenario 3	0.01% $\pm$ 0.00%	0.00% $\pm$ 0.00%	1.41% $\pm$ 0.09%
Scenario 4	-0.02% $\pm$ 0.00%	0.03% $\pm$ 0.00%	-5.23% $\pm$ 0.32%

Table 4: "JET_GroupedNP_2_1down"

channel	GGF	VBF mva high	VBF mva low
Nominal	154.39	0.92	2.43
Scenario 1	-0.05% $\pm$ 0.00%	6.50% $\pm$ 0.63%	10.49% $\pm$ 0.62%
Scenario 2	-0.12% $\pm$ 0.00%	-1.69% $\pm$ 0.17%	12.94% $\pm$ 0.76%
Scenario 3	0.01% $\pm$ 0.00%	0.00% $\pm$ 0.00%	0.00% $\pm$ 0.00%
Scenario 4	0.00% $\pm$ 0.00%	0.00% $\pm$ 0.00%	0.00% $\pm$ 0.00%

Table 5: "JET_GroupedNP_3_1up"

channel	GGF	VBF mva high	VBF mva low
Nominal	154.39	0.92	2.43
Scenario 1	0.00% $\pm$ 0.00%	-2.77% $\pm$ 0.28%	-15.37% $\pm$ 0.98%
Scenario 2	0.16% $\pm$ 0.00%	-8.72% $\pm$ 0.88%	-20.14% $\pm$ 1.30%
Scenario 3	-0.02% $\pm$ 0.00%	0.01% $\pm$ 0.00%	1.41% $\pm$ 0.09%
Scenario 4	0.00% $\pm$ 0.00%	0.00% $\pm$ 0.00%	0.00% $\pm$ 0.00%

Table 6: "JET_GroupedNP_3_1down"

VBF

channel	GGF	VBF mva high	VBF mva low
Nominal	11.50	2.02	2.59
Scenario 1	-0.79% $\pm$ 0.01%	5.10% $\pm$ 0.10%	5.85% $\pm$ 0.10%
Scenario 2	-0.51% $\pm$ 0.00%	2.32% $\pm$ 0.04%	3.74% $\pm$ 0.06%
Scenario 3	-0.89% $\pm$ 0.01%	5.93% $\pm$ 0.11%	8.25% $\pm$ 0.14%
Scenario 4	-0.96% $\pm$ 0.01%	5.91% $\pm$ 0.11%	8.35% $\pm$ 0.14%

Table 1: "JET_GroupedNP_1_1up"

channel	GGF	VBF mva high	VBF mva low
Nominal	11.50	2.02	2.59
Scenario 1	0.77% $\pm$ 0.01%	-3.84% $\pm$ 0.07%	-4.73% $\pm$ 0.08%
Scenario 2	0.19% $\pm$ 0.00%	-2.08% $\pm$ 0.04%	-3.02% $\pm$ 0.05%
Scenario 3	0.72% $\pm$ 0.01%	-6.63% $\pm$ 0.13%	-6.33% $\pm$ 0.11%
Scenario 4	0.75% $\pm$ 0.01%	-6.41% $\pm$ 0.12%	-6.44% $\pm$ 0.11%

Table 2: "JET_GroupedNP_1_1down"

channel	GGF	VBF mva high	VBF mva low
Nominal	11.50	2.02	2.59
Scenario 1	-0.06% $\pm$ 0.00%	1.27% $\pm$ 0.02%	0.97% $\pm$ 0.02%
Scenario 2	-0.65% $\pm$ 0.01%	3.79% $\pm$ 0.07%	4.51% $\pm$ 0.07%
Scenario 3	-0.05% $\pm$ 0.00%	-0.10% $\pm$ 0.00%	-0.20% $\pm$ 0.00%
Scenario 4	-0.19% $\pm$ 0.00%	1.23% $\pm$ 0.02%	1.25% $\pm$ 0.02%

Table 3: "JET_GroupedNP_2_1up"

channel	GGF	VBF mva high	VBF mva low
Nominal	11.50	2.02	2.59
Scenario 1	0.07% $\pm$ 0.00%	-0.71% $\pm$ 0.01%	-1.05% $\pm$ 0.02%
Scenario 2	0.38% $\pm$ 0.00%	-3.57% $\pm$ 0.07%	-3.47% $\pm$ 0.06%
Scenario 3	-0.02% $\pm$ 0.00%	-0.33% $\pm$ 0.01%	0.20% $\pm$ 0.00%
Scenario 4	-0.06% $\pm$ 0.00%	-1.38% $\pm$ 0.03%	-0.58% $\pm$ 0.01%

Table 4: "JET_GroupedNP_2_1down"

channel	GGF	VBF mva high	VBF mva low
Nominal	11.50	2.02	2.59
Scenario 1	-0.37% $\pm$ 0.00%	4.97% $\pm$ 0.09%	5.27% $\pm$ 0.09%
Scenario 2	-0.67% $\pm$ 0.01%	4.66% $\pm$ 0.09%	7.19% $\pm$ 0.12%
Scenario 3	0.01% $\pm$ 0.00%	-0.51% $\pm$ 0.01%	0.06% $\pm$ 0.00%
Scenario 4	0.00% $\pm$ 0.00%	0.00% $\pm$ 0.00%	-0.00% $\pm$ 0.00%

Table 5: "JET_GroupedNP_3_1up"

channel	GGF	VBF mva high	VBF mva low
Nominal	11.50	2.02	2.59
Scenario 1	0.14% $\pm$ 0.00%	-4.64% $\pm$ 0.09%	-4.23% $\pm$ 0.07%
Scenario 2	0.36% $\pm$ 0.00%	0.24% $\pm$ 0.00%	0.48% $\pm$ 0.01%
Scenario 3	-0.03% $\pm$ 0.00%	0.23% $\pm$ 0.00%	0.00% $\pm$ 0.00%
Scenario 4	-0.09% $\pm$ 0.00%	0.00% $\pm$ 0.00%	0.00% $\pm$ 0.00%

Table 6: "JET_GroupedNP_3_1down"

On VBF

- GGH

Scenario(%)	1	2	3	4
Up	0.87	1.06	0.89	0.98
down	0.78	0.55	0.72	0.76

- VBF_high

Scenario(%)	1	2	3	4
Up	7.2	6.5	5.9	6.0
down	6.0	4.2	6.6	6.6

- VBF_low

Scenario(%)	1	2	3	4
Up	8.0	9.2	8.3	8.5
down	6.4	4.6	6.3	6.4

On ggH sample

- GGH

Scenario	1	2	3	4
Up	0.31	0.13	0.29	0.32
down	0.17	0.21	0.26	0.29

- VBF_high

Scenario	1	2	3	4
Up	6.5	10.0	2.0	2.0
down	9.1	14.5	16.8	16.8

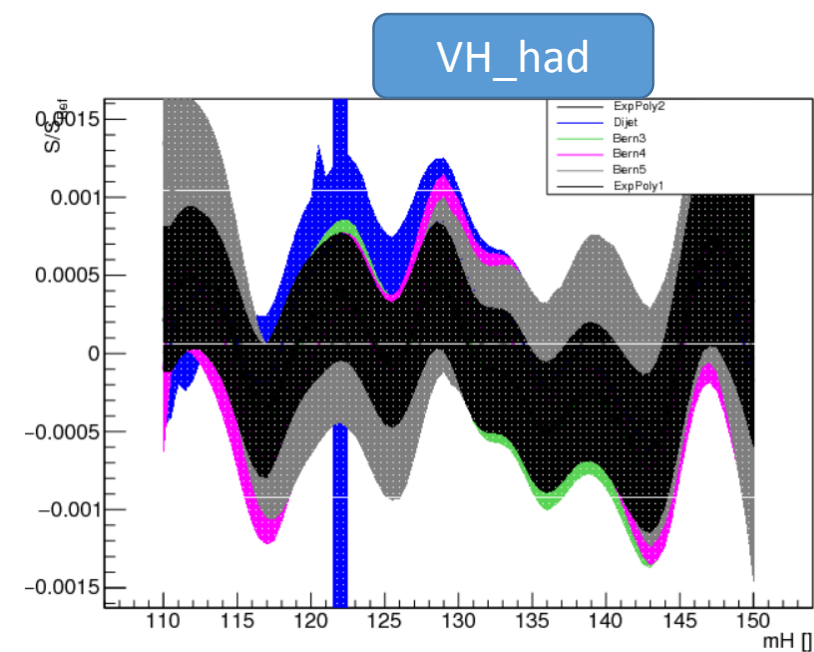
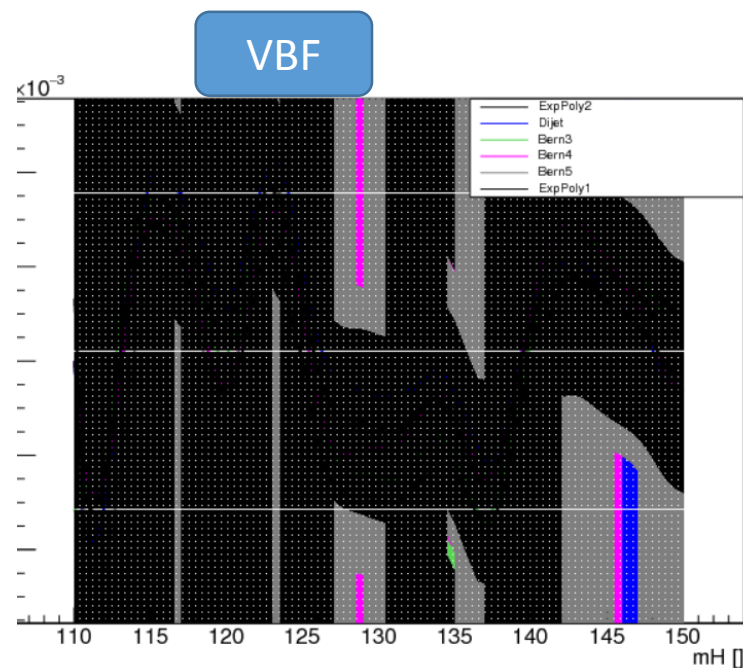
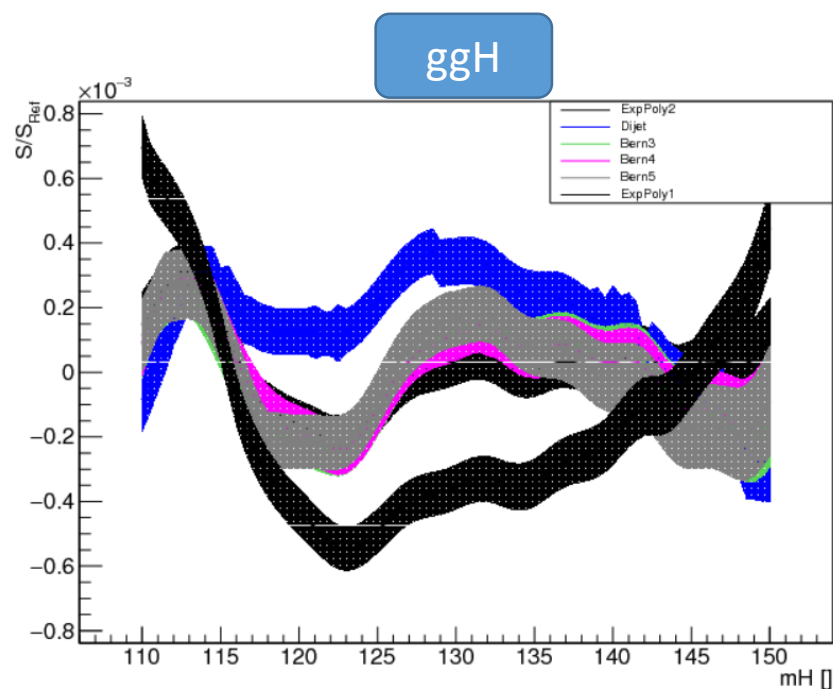
- VBF_low

Scenario	1	2	3	4
Up	16.7	19.0	17.0	16.2
down	20.0	24.1	18.1	19.0

Backup

Spurious signals

- Some preliminary results
- The tool still have some bugs(cannot select the best function automatically) and under developing



Function	S	max(S/deltaS)	max(S/Sref)	Result
Bern3	0.04	-1.5 %	0.0 %	Pass
Bern4	0.04	1.5 %	0.0 %	Pass
Bern5	0.04	-1.3 %	0.0 %	Pass
ExpPoly1	0.10	-3.8 %	0.1 %	Pass
ExpPoly2	0.05	1.7 %	0.0 %	Pass
Dijet	0.05	2.5 %	0.0 %	Pass

Function	S	max(S/deltaS)	max(S/Sref)	Result
Bern3	0.00	-0.7 %	0.0 %	Pass
Bern4	0.00	0.7 %	0.0 %	Pass
Bern5	-0.00	-0.7 %	-0.0 %	Pass
ExpPoly1	0.00	0.9 %	0.0 %	Pass
ExpPoly2	0.00	-0.8 %	-0.0 %	Pass
Dijet	0.00	1.0 %	0.0 %	Pass

Function	S	max(S/deltaS)	max(S/Sref)	Result
Bern3	0.00	0.7 %	-0.1 %	Pass
Bern4	-0.00	0.7 %	-0.1 %	Pass
Bern5	0.01	1.2 %	0.1 %	Pass
ExpPoly1	0.00	-0.6 %	-0.1 %	Pass
ExpPoly2	0.00	-0.7 %	-0.1 %	Pass
Dijet	0.00	1.0 %	0.1 %	Pass