

First glance at the systematic impact on migrations

Marc Escalier, Huijun ZHANG, Yu ZHANG

Migration

- Currently only VBF process available. (waiting for h010Allsys samples)
- Categorization is based on “Basic categories”, implemented in h010
- In addition, the MVA based VBF categories are tested.
- The migration of one category is defined as events come in/out the category rather than chasing where the events go.
- Relatively Migration = $\frac{N_{sys} - N_{nominal}}{N_{nominal}}$

Migration due to photon related systematics

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	0.00	0.00% $\pm$ 0.00%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	0.00	0.00% $\pm$ 0.00%
VH MET	0.04	-0.00	-0.70% $\pm$ 0.11%
VH hadronic	0.16	0.00	2.75% $\pm$ 0.21%
VBF cutbased	1.53	-0.01	-0.54% $\pm$ 0.01%
GGF	11.46	0.00	0.03% $\pm$ 0.00%
VBF mva high	3.16	-0.02	-0.49% $\pm$ 0.01%
VBF mva low	2.18	0.00	0.03% $\pm$ 0.00%

Table 2: "EG_RESOLUTION_ALL_1up"

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	0.00	0.00% $\pm$ 0.00%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	0.00	0.00% $\pm$ 0.00%
VH MET	0.04	-0.00	-0.07% $\pm$ 0.01%
VH hadronic	0.16	0.00	0.00% $\pm$ 0.00%
VBF cutbased	1.53	-0.00	-0.01% $\pm$ 0.00%
GGF	11.46	-0.00	-0.02% $\pm$ 0.00%
VBF mva high	3.16	-0.00	-0.01% $\pm$ 0.00%
VBF mva low	2.18	-0.01	-0.27% $\pm$ 0.01%

Table 4: "EG_SCALE_ALL_1up"

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	0.00	2.31% $\pm$ 10.02%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	0.00	2.02% $\pm$ 0.49%
VH MET	0.04	0.00	3.55% $\pm$ 0.54%
VH hadronic	0.16	0.00	2.68% $\pm$ 0.20%
VBF cutbased	1.53	0.04	2.45% $\pm$ 0.06%
GGF	11.46	0.30	2.64% $\pm$ 0.02%
VBF mva high	3.16	0.08	2.51% $\pm$ 0.04%
VBF mva low	2.18	0.06	2.70% $\pm$ 0.05%

Table 13: "PH_EFF_ID_Uncertainty_1up"

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	0.00	4.04% $\pm$ 17.44%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	0.00	3.99% $\pm$ 0.97%
VH MET	0.04	0.00	3.97% $\pm$ 0.61%
VH hadronic	0.16	0.01	3.95% $\pm$ 0.30%
VBF cutbased	1.53	0.06	3.69% $\pm$ 0.09%
GGF	11.46	0.45	3.91% $\pm$ 0.03%
VBF mva high	3.16	0.12	3.80% $\pm$ 0.06%
VBF mva low	2.18	0.08	3.84% $\pm$ 0.08%

Table 15: "PH_EFF_TRKISO_Uncertainty_1up"

- For photon ID and ISO, these migrations are quite close to each other, which may refer to the inclusive changing.

Migration due to photon related systematics

- The migrations due to photon related variables are either negligible or behave inclusively

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	0.00	0.00% $\pm$ 0.00%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	0.00	0.00% $\pm$ 0.00%
VH MET	0.04	0.00	0.00% $\pm$ 0.00%
VH hadronic	0.16	0.00	0.00% $\pm$ 0.00%
VBF cutbased	1.53	-0.00	-0.16% $\pm$ 0.00%
GGF	11.46	-0.04	-0.38% $\pm$ 0.00%
VBF mva high	3.16	-0.01	-0.18% $\pm$ 0.00%
VBF mva low	2.18	-0.00	-0.01% $\pm$ 0.00%

Table 16: "PH_Iso_DDonoff"

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	-0.00	-26.22% $\pm$ 124.08%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	-0.00	-13.62% $\pm$ 3.46%
VH MET	0.04	-0.00	-1.39% $\pm$ 0.22%
VH hadronic	0.16	0.00	1.53% $\pm$ 0.12%
VBF cutbased	1.53	-0.06	-3.70% $\pm$ 0.09%
GGF	11.46	0.07	0.61% $\pm$ 0.01%
VBF mva high	3.16	-0.06	-1.84% $\pm$ 0.03%
VBF mva low	2.18	0.01	0.26% $\pm$ 0.01%

Table 17: "PRW_DATASF_1down"

Migration due to jet related systematics

- There are 4 grouped systematics for jets, and we have contacted the expects to investigate what are they and the correlation within them.

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	0.00	0.00% $\pm$ 0.00%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	-0.01	-36.08% $\pm$ 9.98%
VH MET	0.04	0.01	33.72% $\pm$ 4.88%
VH hadronic	0.16	0.02	11.15% $\pm$ 0.83%
VBF cutbased	1.53	0.08	5.20% $\pm$ 0.13%
GGF	11.46	-0.10	-0.91% $\pm$ 0.01%
VBF mva high	3.16	0.15	4.63% $\pm$ 0.08%
VBF mva low	2.18	0.06	2.80% $\pm$ 0.06%

Table 5: "JET_GroupedNP_1_1up"

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	0.00	0.00% $\pm$ 0.00%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	0.00	0.00% $\pm$ 0.00%
VH MET	0.04	0.02	64.72% $\pm$ 8.98%
VH hadronic	0.16	-0.00	-0.48% $\pm$ 0.04%
VBF cutbased	1.53	0.06	3.71% $\pm$ 0.09%
GGF	11.46	-0.08	-0.70% $\pm$ 0.01%
VBF mva high	3.16	0.15	4.79% $\pm$ 0.08%
VBF mva low	2.18	0.07	3.12% $\pm$ 0.06%

Table 9: "JET_GroupedNP_3_1up"

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	0.00	0.00% $\pm$ 0.00%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	0.00	0.00% $\pm$ 0.00%
VH MET	0.04	0.00	8.04% $\pm$ 1.22%
VH hadronic	0.16	-0.01	-5.56% $\pm$ 0.43%
VBF cutbased	1.53	0.02	1.15% $\pm$ 0.03%
GGF	11.46	-0.01	-0.10% $\pm$ 0.00%
VBF mva high	3.16	0.02	0.70% $\pm$ 0.01%
VBF mva low	2.18	0.02	0.74% $\pm$ 0.02%

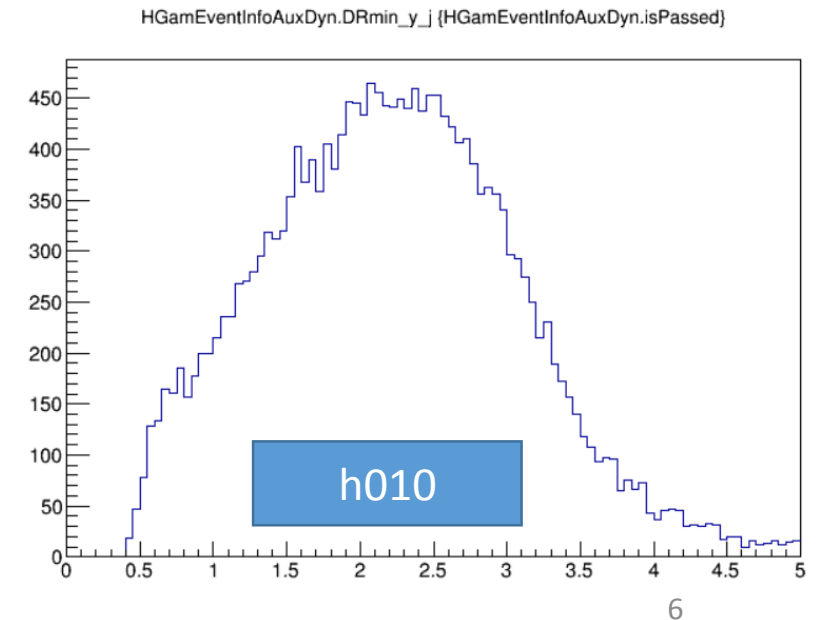
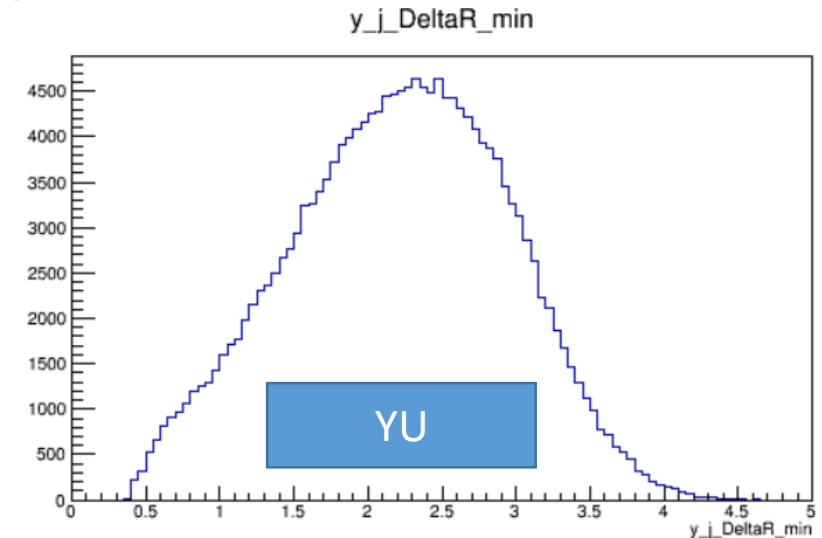
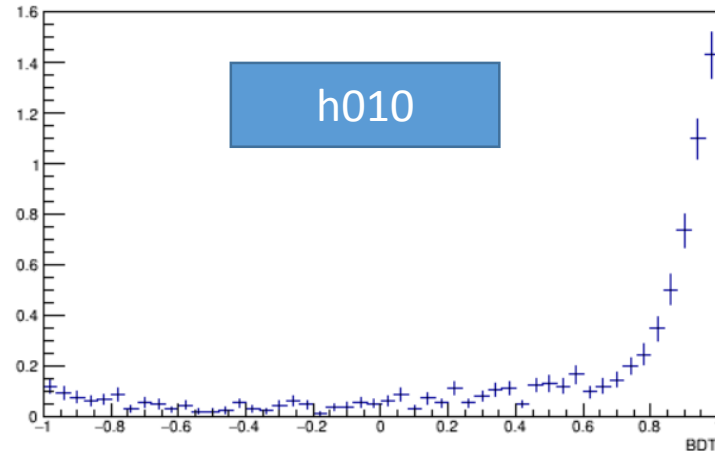
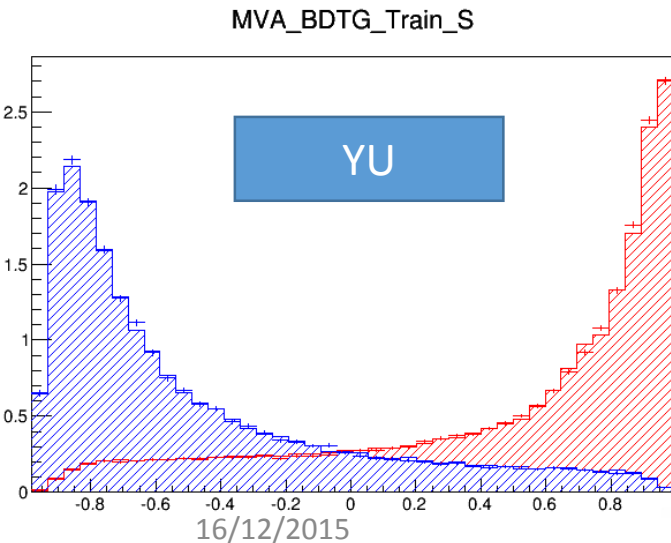
Table 7: "JET_GroupedNP_2_1up"

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-% $\pm$ -%
TTH leptonic	0.00	-0.00	-59.78% $\pm$ 344.17%
VH 2 leptons	0.00	0.00	-% $\pm$ -%
VH leptonic	0.02	-0.00	-22.40% $\pm$ 5.86%
VH MET	0.04	0.02	56.48% $\pm$ 7.92%
VH hadronic	0.16	-0.01	-4.34% $\pm$ 0.33%
VBF cutbased	1.53	-0.02	-0.98% $\pm$ 0.02%
GGF	11.46	0.00	0.03% $\pm$ 0.00%
VBF mva high	3.16	-0.05	-1.67% $\pm$ 0.03%
VBF mva low	2.18	-0.03	-1.36% $\pm$ 0.03%

Table 11: "JET_JER_SINGLE_NP_1up"

un-consistency on BDT distribution

- May due to the different calculation of $\Delta R_{\min, y_j}$
- In h010, all the jets are considered while in the training, only the 2 leading jets
- Under investigating



A simple Summary

- Photon related systematics have little impact on migration in VBF category
- Jet related systematics have strong impact on migration in VBF category
- For other systematic and other processes, we are waiting for h010

Backup

some general ideas

- For the final fit we shall focus on the systematics which have both obvious absolute migration and relative migration, and drop the “negligible/negligible” cases.
- Here only photon and jets are taken into account, since only these two source a affect VBF category
- As we are using the relative migration, we can cancel the impact of photon related systematic on the inclusive yields

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-nan% $\pm$ -nan%
TTH leptonic	0.00	0.00	0.00% $\pm$ 0.00%
VH 2 leptons	0.00	0.00	-nan% $\pm$ -nan%
VH leptonic	0.02	0.00	0.00% $\pm$ 0.00%
VH MET	0.04	0.01	13.69% $\pm$ 2.05%
VH hadronic	0.16	-0.00	-0.01% $\pm$ 0.00%
VBF cutbased	1.53	0.01	0.80% $\pm$ 0.02%
GGF	11.46	-0.01	-0.07% $\pm$ 0.00%
VBF mva high	3.16	0.00	0.10% $\pm$ 0.00%
VBF mva low	2.18	-0.01	-0.41% $\pm$ 0.01%

Table 1: "EG_RESOLUTION_ALL_1down"

Category	Nominal 4 fb^{-1}	Migrations	Relatively
TTH hadronic	0.00	0.00	-nan% $\pm$ -nan%
TTH leptonic	0.00	0.00	0.00% $\pm$ 0.00%
VH 2 leptons	0.00	0.00	-nan% $\pm$ -nan%
VH leptonic	0.02	-0.01	-36.08% $\pm$ 9.98%
VH MET	0.04	0.01	33.72% $\pm$ 4.88%
VH hadronic	0.16	0.02	11.15% $\pm$ 0.83%
VBF cutbased	1.53	0.08	5.20% $\pm$ 0.13%
GGF	11.46	-0.10	-0.91% $\pm$ 0.01%
VBF mva high	3.16	0.15	4.63% $\pm$ 0.08%
VBF mva low	2.18	0.06	2.80% $\pm$ 0.06%

Table 5: "JET_GroupedNP_1_1up"