

Status $t\bar{t}$ bar: $t\bar{c}Z \rightarrow 3 \text{ leptons}$
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Object selection and cuts

selections	iso/b-tag	cuts
$p_T(\ell) > 20$ GeV $\eta(e/\mu) < 2.5(2.4)$; $p_T(j) > 40$ GeV, $\eta(j) < 2.4$	combinedIso CONE04, b-tag CVS loose	$N(\ell) \equiv 3$, $N(j) > 1$, $N(b) > 0$, $N(OSSF_{pair}) > 0$, $ M(\ell\ell) - M_Z < 15$ GeV, $ M(\ell\ell j) - M_T < 35$ GeV

	Initial	3 leptons	At least 2 jets	At least 1 loose bjet	At least 1 OSSF pair	Invariant Mass Z	Invariant Mass FCNC top
TTsemilep Kappa Zct Ztoll	$2.09\text{e}+03 \pm 0.718$	243 ± 0.239	161 ± 0.195	136 ± 0.179	72.2 ± 0.13	55.2 ± 0.114	41.9 ± 0.0989
TTdilep WToLNu madspin	$1.93\text{e}+03 \pm 7.6$	150 ± 2.12	87.6 ± 1.62	80.6 ± 1.55	33.6 ± 1	7.95 ± 0.488	4.44 ± 0.365
TTdilep ZToLL madspin	803 ± 2.54	209 ± 1.3	123 ± 0.996	114 ± 0.956	55 ± 0.665	34.7 ± 0.528	13 ± 0.324
TTsemilep ZToLL madspin 1	$1.68\text{e}+03 \pm 5.3$	111 ± 1.36	84.4 ± 1.19	74.9 ± 1.12	38.7 ± 0.805	28.1 ± 0.687	11 ± 0.43
TTsemilep ZToLL madspin 2	$1.68\text{e}+03 \pm 5.3$	113 ± 1.37	85.6 ± 1.2	75.7 ± 1.13	38.4 ± 0.803	27.7 ± 0.682	10.9 ± 0.428
WZToLLLLNu	$2.57\text{e}+05 \pm 60.5$	$1.53\text{e}+04 \pm 15.5$	$1.98\text{e}+03 \pm 5.53$	586 ± 3.01	272 ± 2.05	201 ± 1.76	61.9 ± 0.978
ZToLL50-3Jets sm-no masses	$6.28\text{e}+06 \pm 3.39\text{e}+03$	$6.14\text{e}+03 \pm 107$	$2.12\text{e}+03 \pm 62.6$	720 ± 36.5	298 ± 23.5	281 ± 22.8	118 ± 14.8
ZToLL50-4Jets sm-no masses	$2.16\text{e}+06 \pm 1.49\text{e}+03$	$2.92\text{e}+03 \pm 54.3$	$1.93\text{e}+03 \pm 44.2$	719 ± 26.9	374 ± 19.4	348 ± 18.7	138 ± 11.8
ZZToLLLL sm-no masses	$3.59\text{e}+04 \pm 135$	$2.75\text{e}+03 \pm 37.4$	193 ± 9.9	58.9 ± 5.47	30.5 ± 3.93	23.4 ± 3.44	9.65 ± 2.21

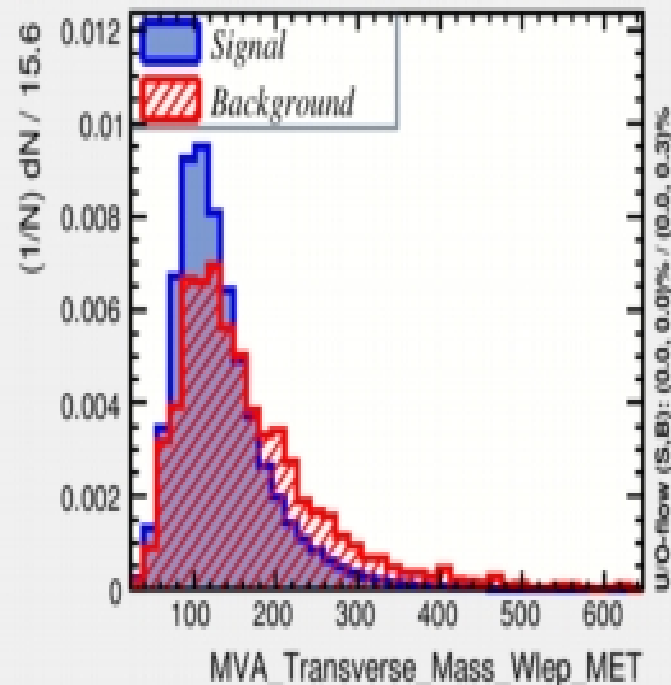
MVA: BDT

Ranking input variables (method specific)...

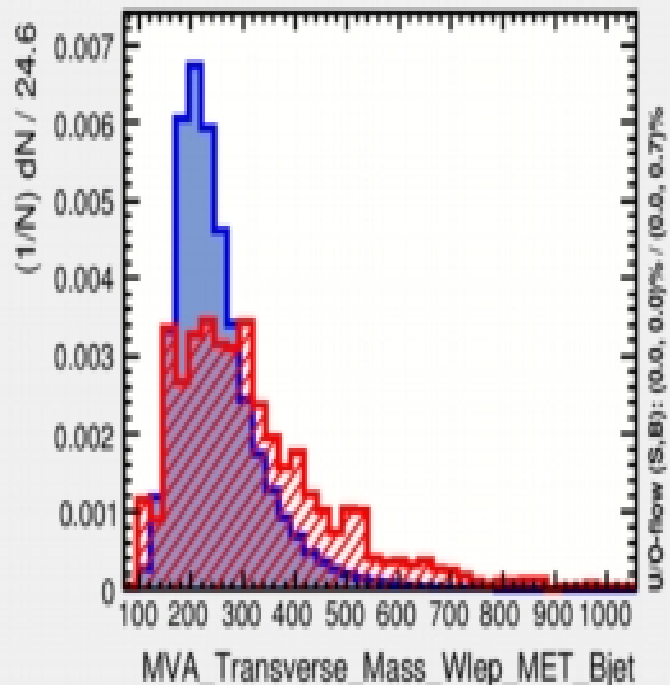
Ranking result (top variable is best ranked)

Rank	Variable	Variable Importance
1	MVA_Nb_CSVM_jets	1.191e-01
2	MVA_Transverse_Mass_Wlep_MET_Bjet	1.041e-01
3	MVA_Inv_Mass_FCNCtop	7.039e-02
4	MVA_Pt_FCNCtop	5.742e-02
5	MVA_DeltaR_Wlep_Zcan	4.966e-02
6	MVA_DeltaEta_Wlep_MET	4.957e-02
7	MVA_Inv_Mass_Leptons	4.489e-02
8	MVA_DeltaEta_Wlep_Zcan	3.950e-02
9	MVA_DeltaR_Bjet_Zcan	3.806e-02
10	MVA_DeltaEta_Bjet_FCNCtop	3.540e-02
11	MVA_DeltaEta_Leptons_Zcan	3.488e-02
12	MVA_DeltaR_Wlep_MET	3.462e-02
13	MVA_DeltaR_Leptons_Zcan	3.404e-02
14	MVA_MET	3.313e-02
15	MVA_Nb_jets	2.955e-02
16	MVA_DeltaEta_Bjet_Zcan	2.835e-02
17	MVA_Transverse_Mass_Wlep_MET	2.810e-02
18	MVA_DeltaPhi_Wlep_MET	2.782e-02
19	MVA_DeltaPhi_Bjet_FCNCtop	2.633e-02
20	MVA_DeltaR_Bjet_FCNCtop	2.591e-02
21	MVA_Pt_Zcandidate	2.439e-02
22	MVA_DeltaPhi_Wlep_Zcan	2.307e-02
23	MVA_DeltaPhi_Bjet_Zcan	2.269e-02
24	MVA_DeltaPhi_Leptons_Zcan	1.897e-02

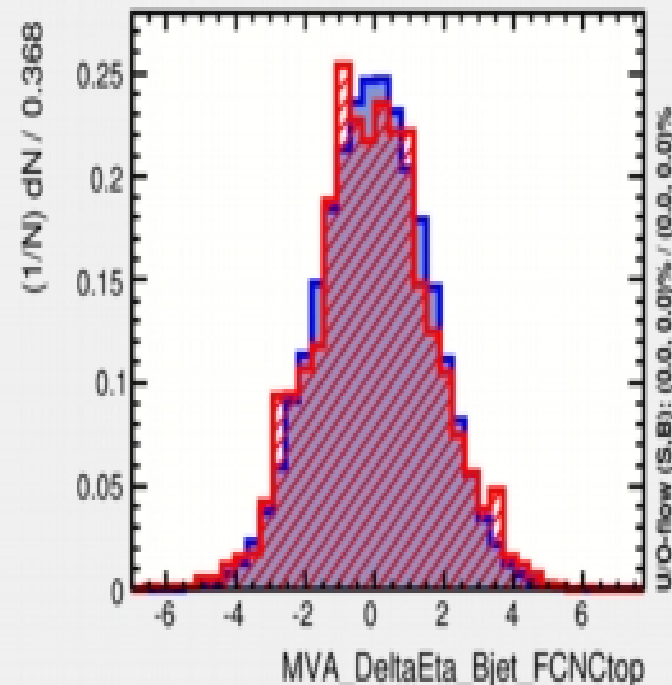
Input variable: MVA_Transverse_Mass_Wlep_MET



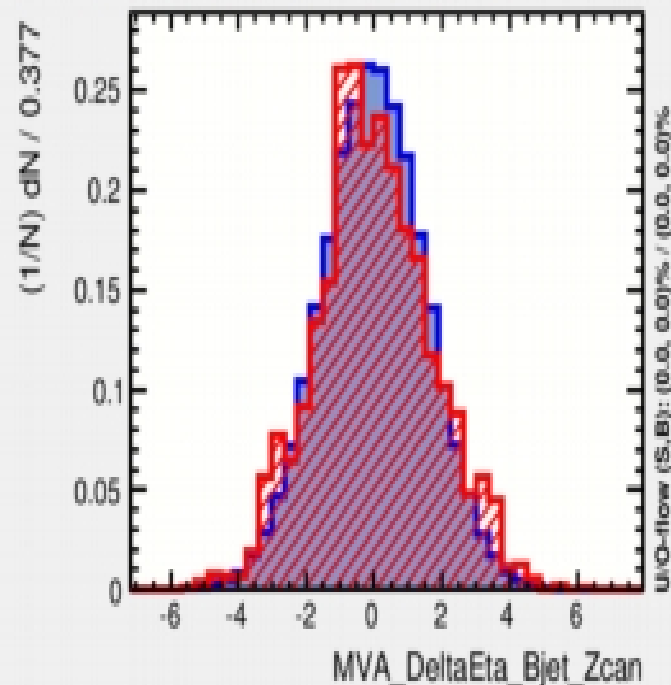
Input variable: MVA_Transverse_Mass_Wlep_MET_Bjet



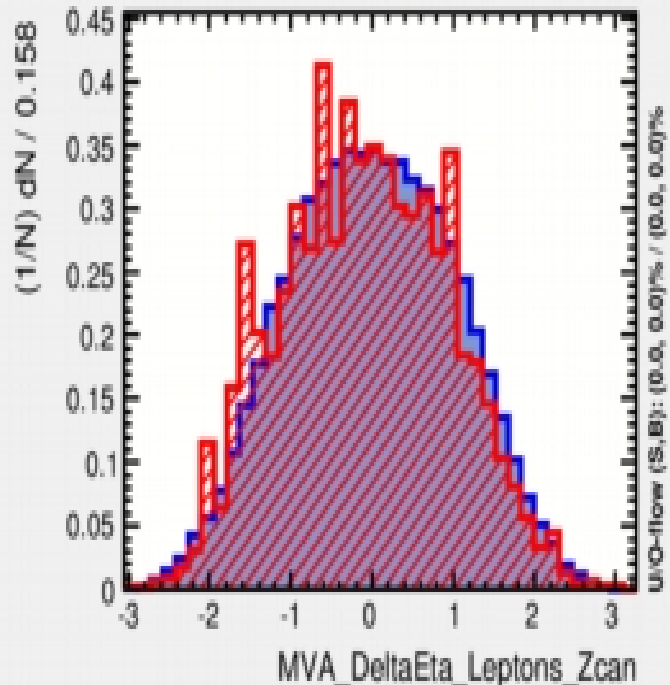
Input variable: MVA_DeltaEta_Bjet_FCNCtop



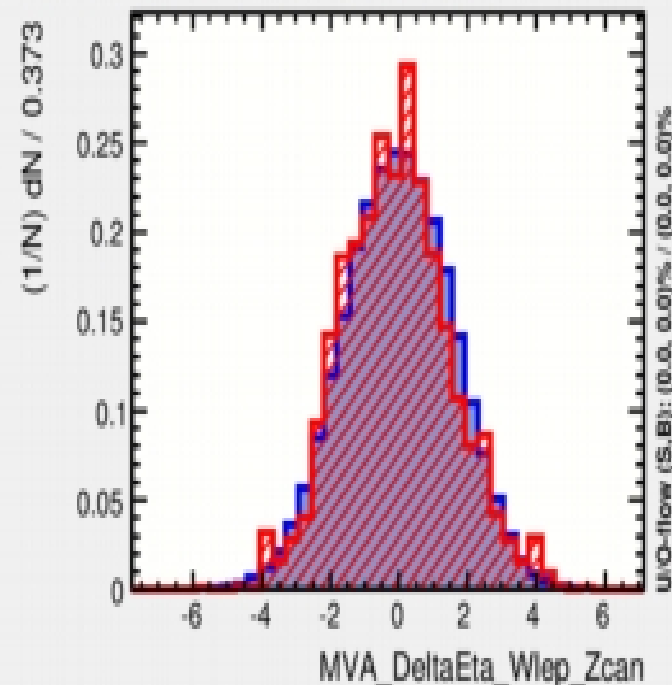
Input variable: MVA_DeltaEta_Bjet_Zcan

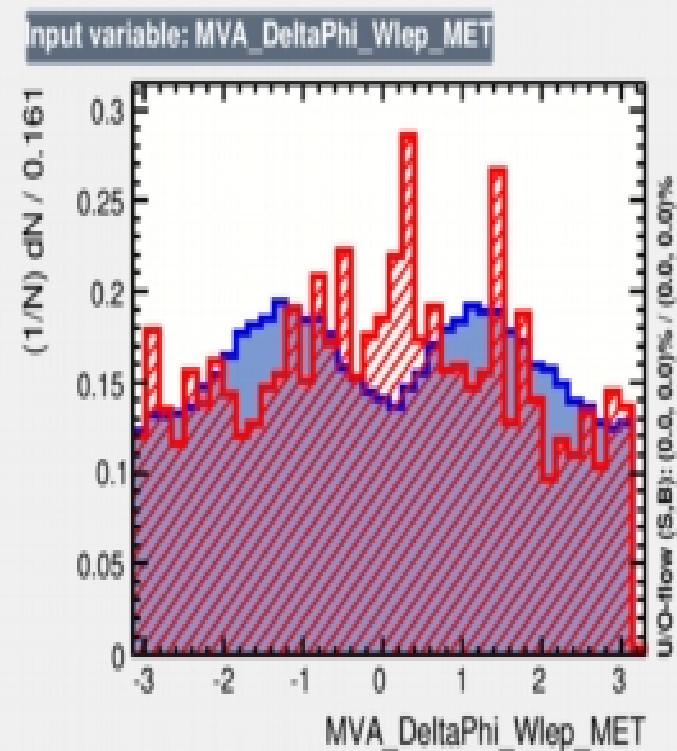
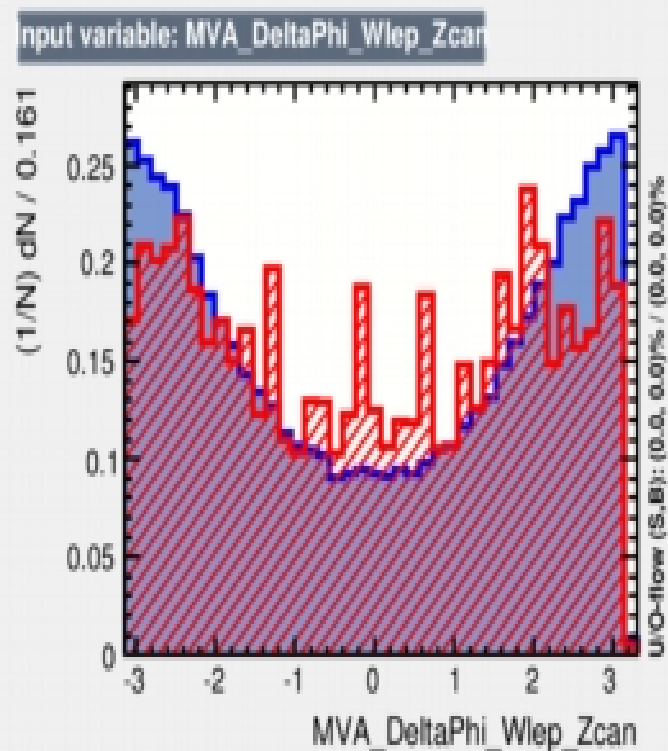
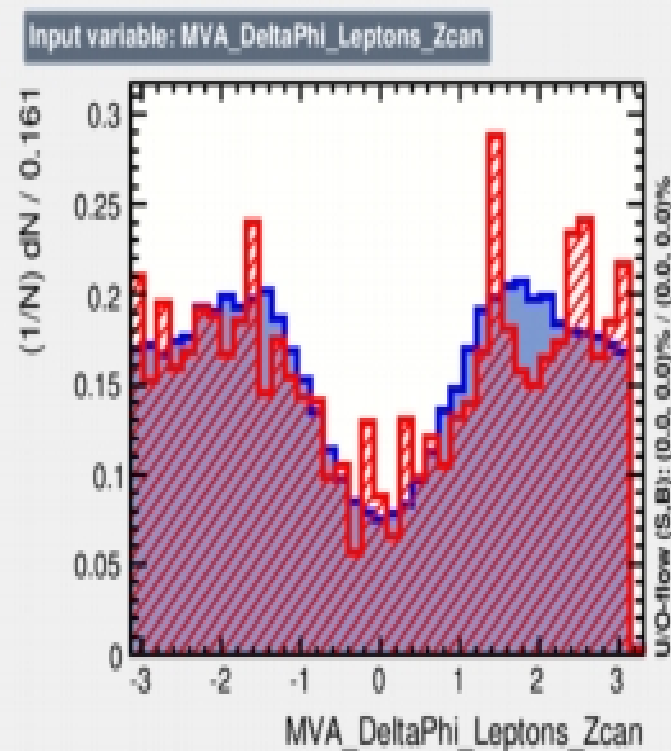
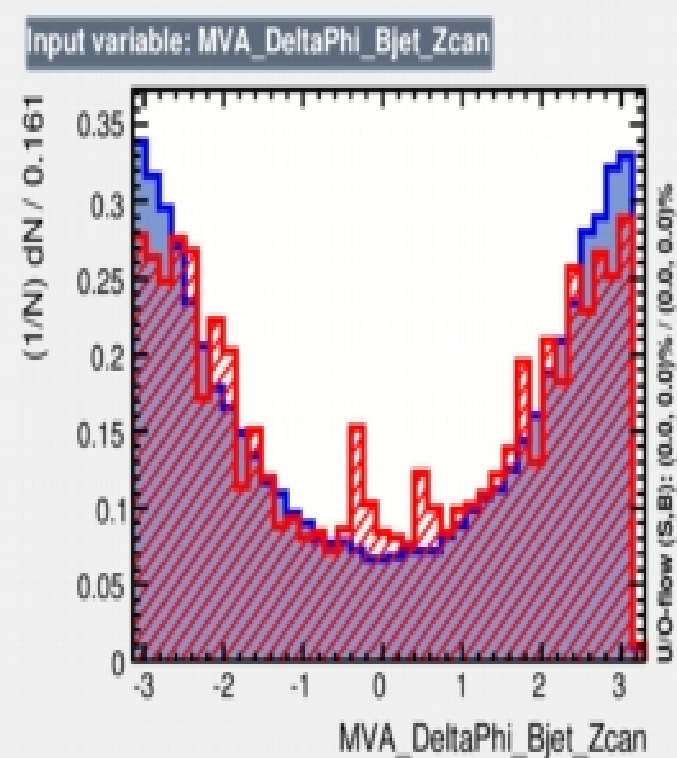
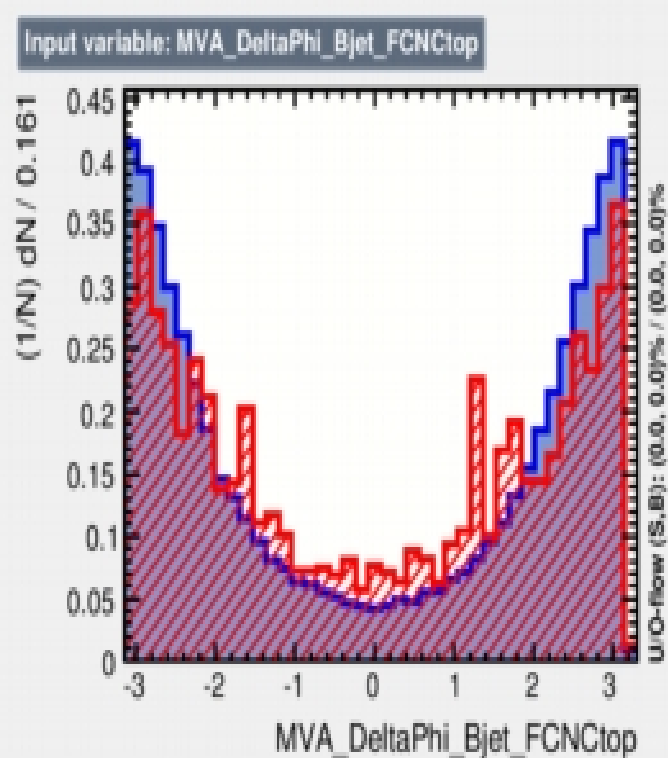
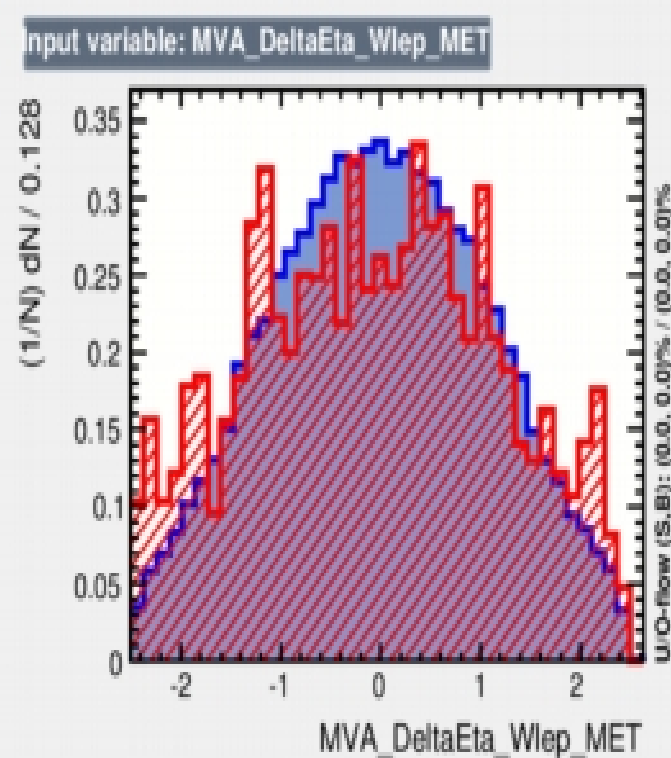


Input variable: MVA_DeltaEta_Leptons_Zcan

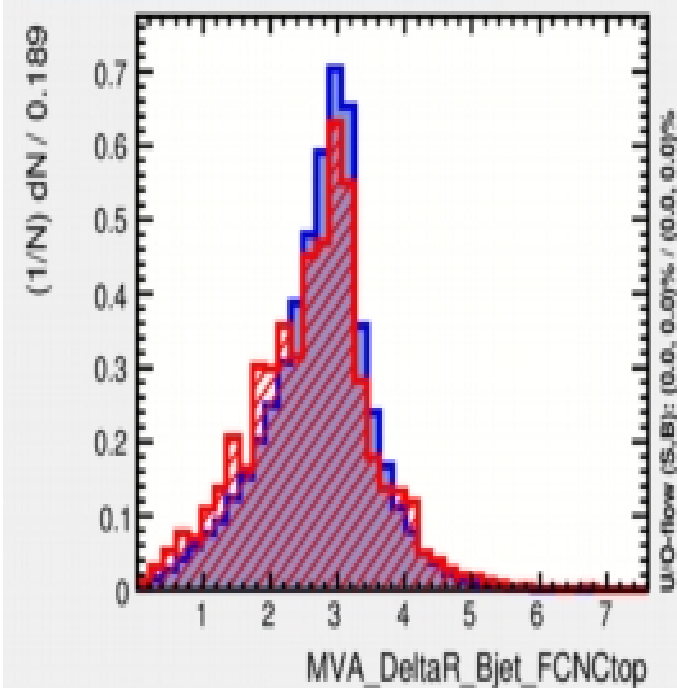


Input variable: MVA_DeltaEta_Wlep_Zcan

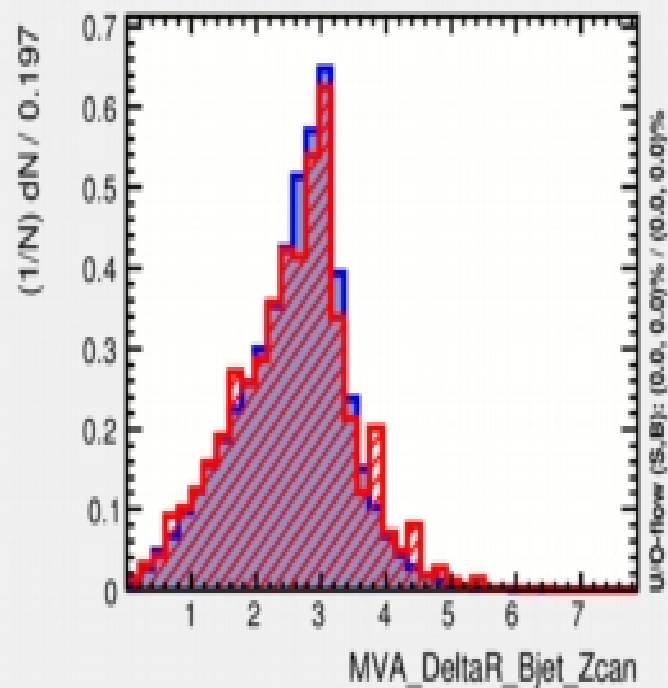




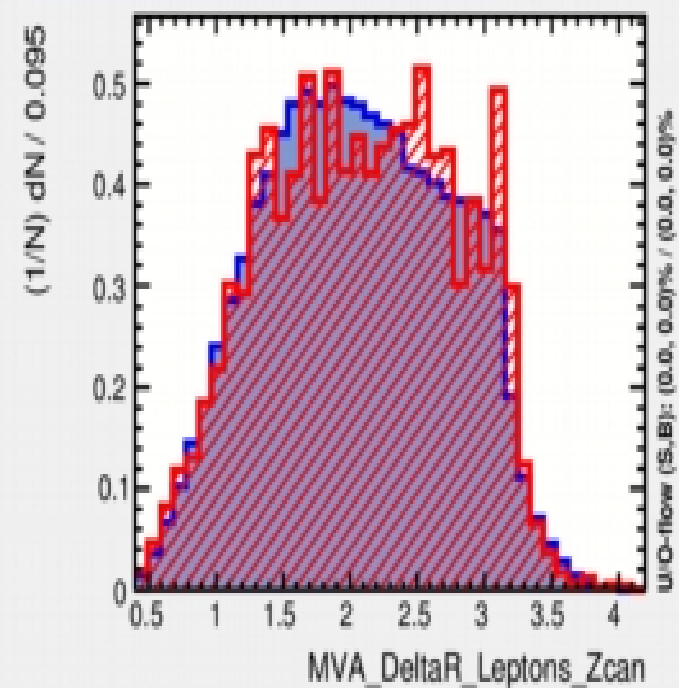
Input variable: MVA_DeltaR_Bjet_FCNCtop



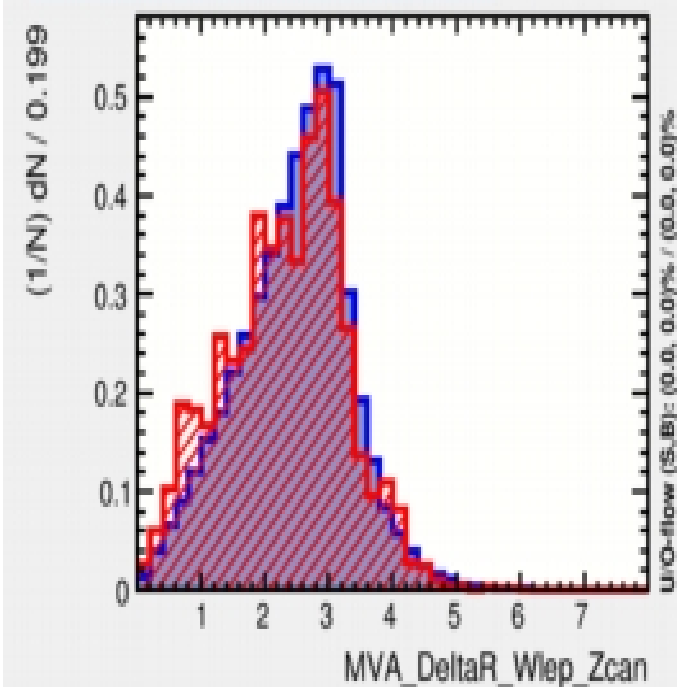
Input variable: MVA_DeltaR_Bjet_Zcan



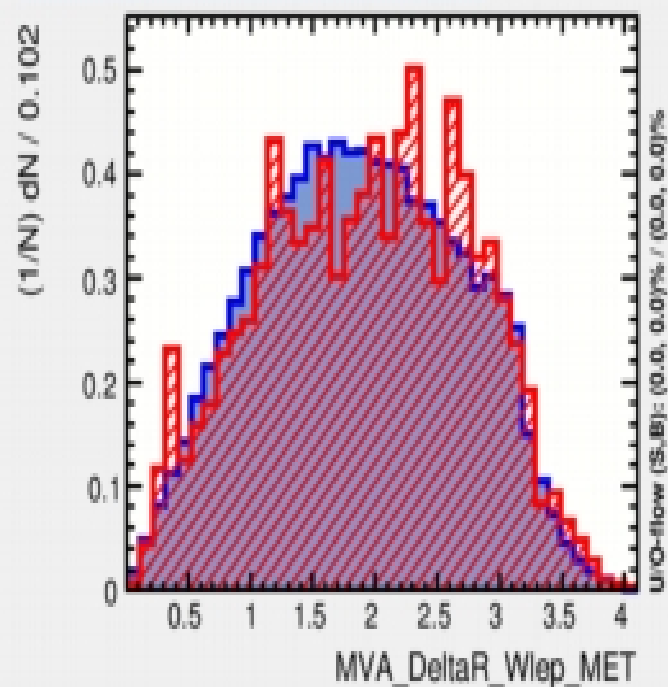
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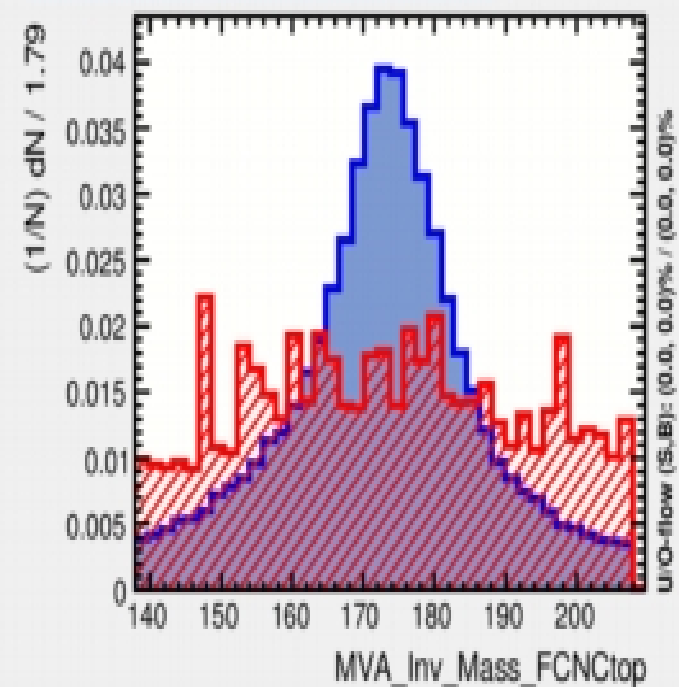
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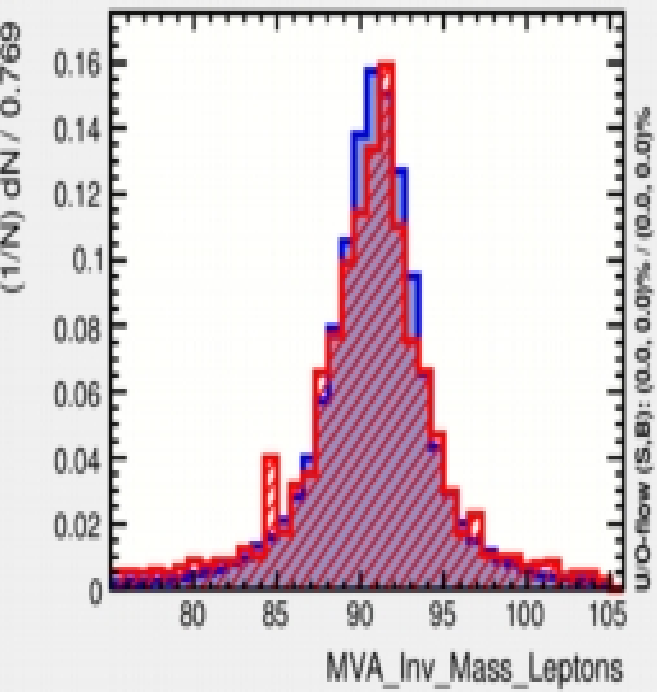
Input variable: MVA_DeltaR_Wlep_MET



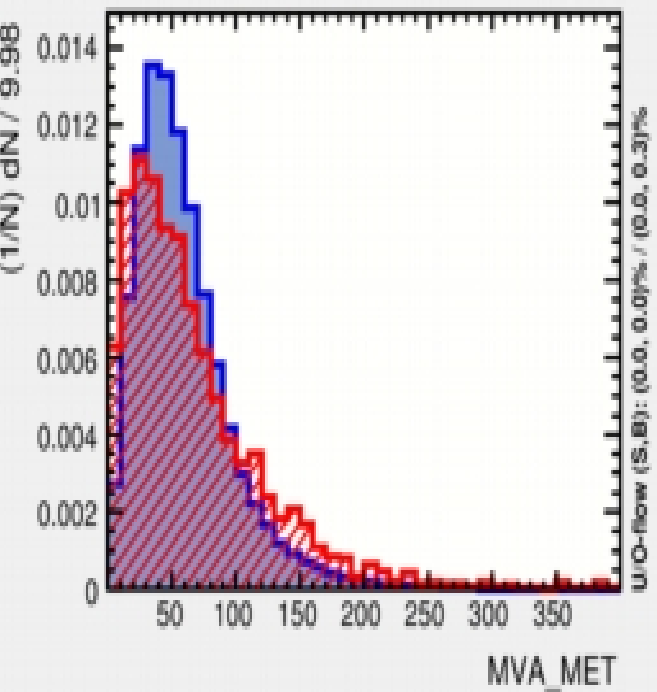
Input variable: MVA_Inv_Mass_FCNCtop



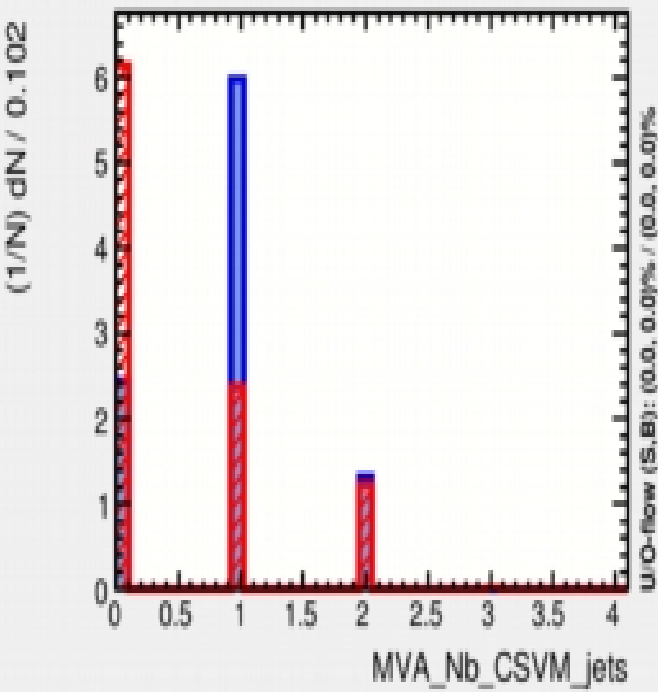
Input variable: MVA_Inv_Mass_Leptons



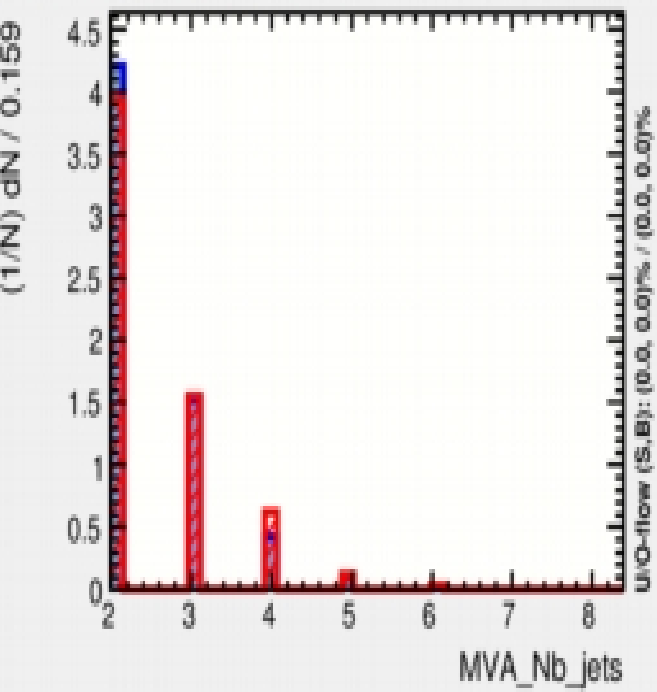
Input variable: MVA_MET



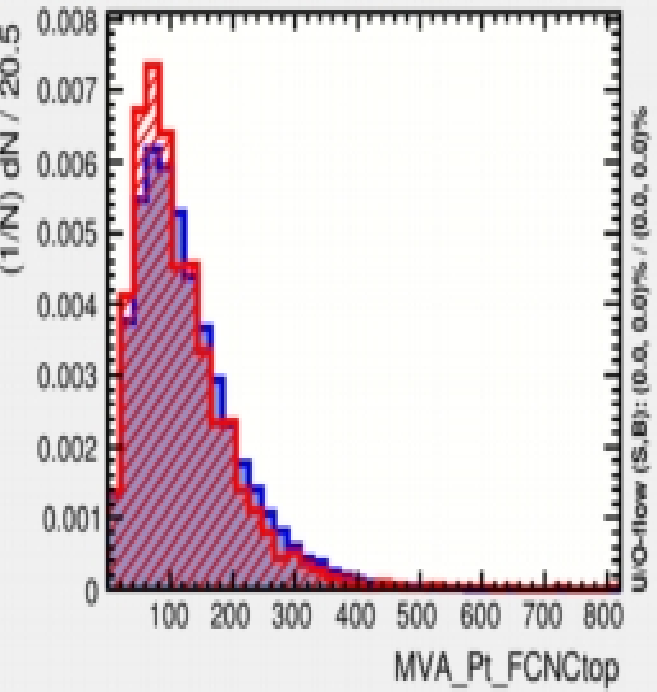
Input variable: MVA_Nb_CSVM_jets



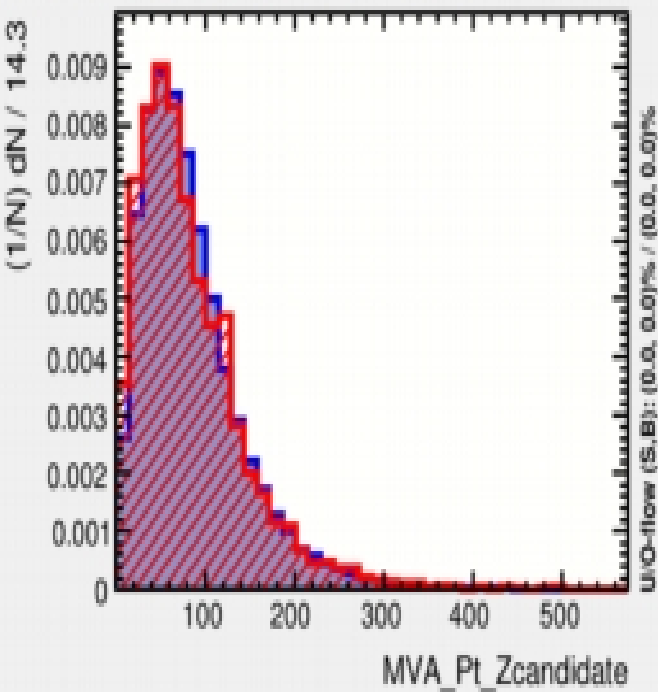
Input variable: MVA_Nb_jets



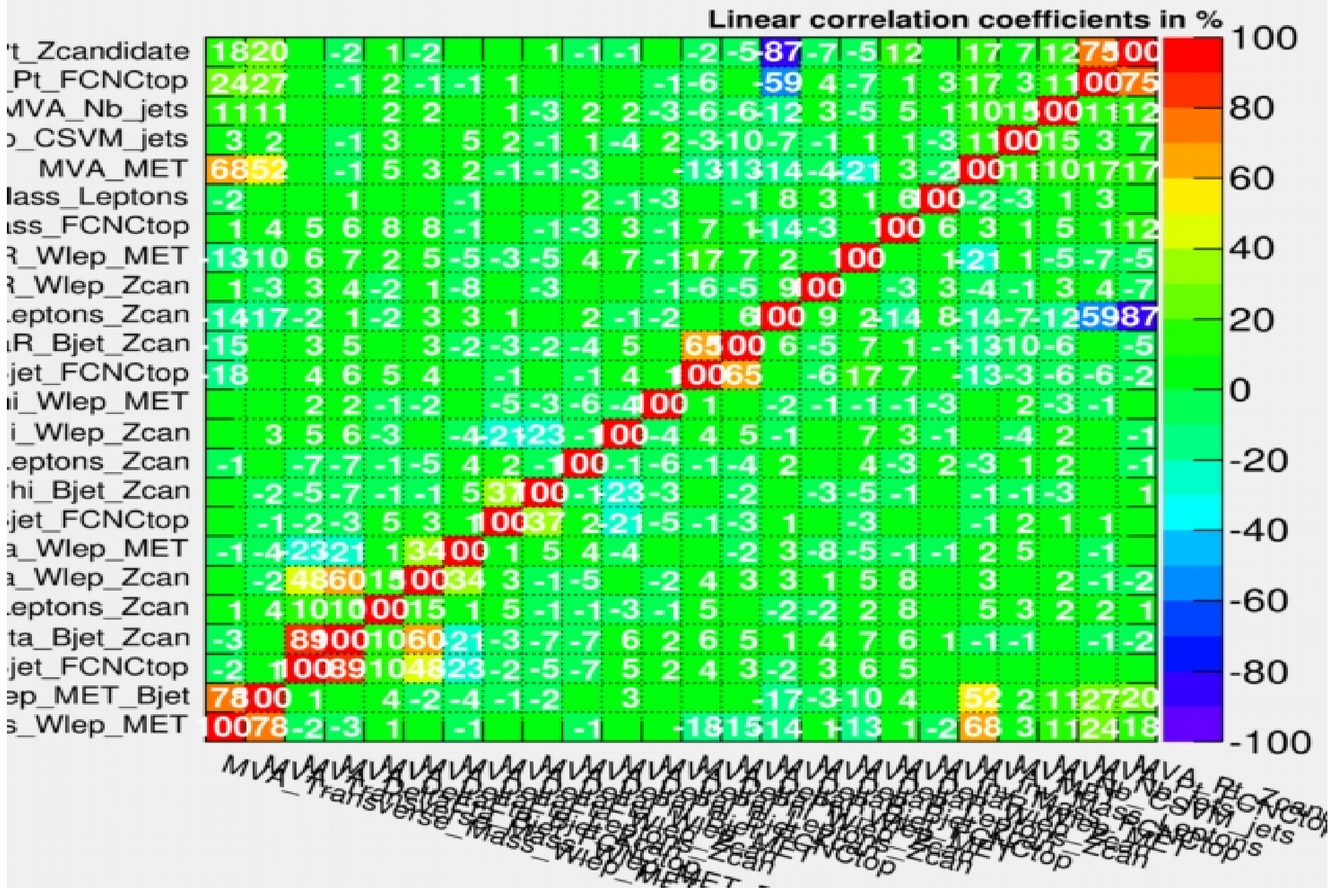
Input variable: MVA_Pt_FCNCtop



Input variable: MVA_Pt_Zcandidate



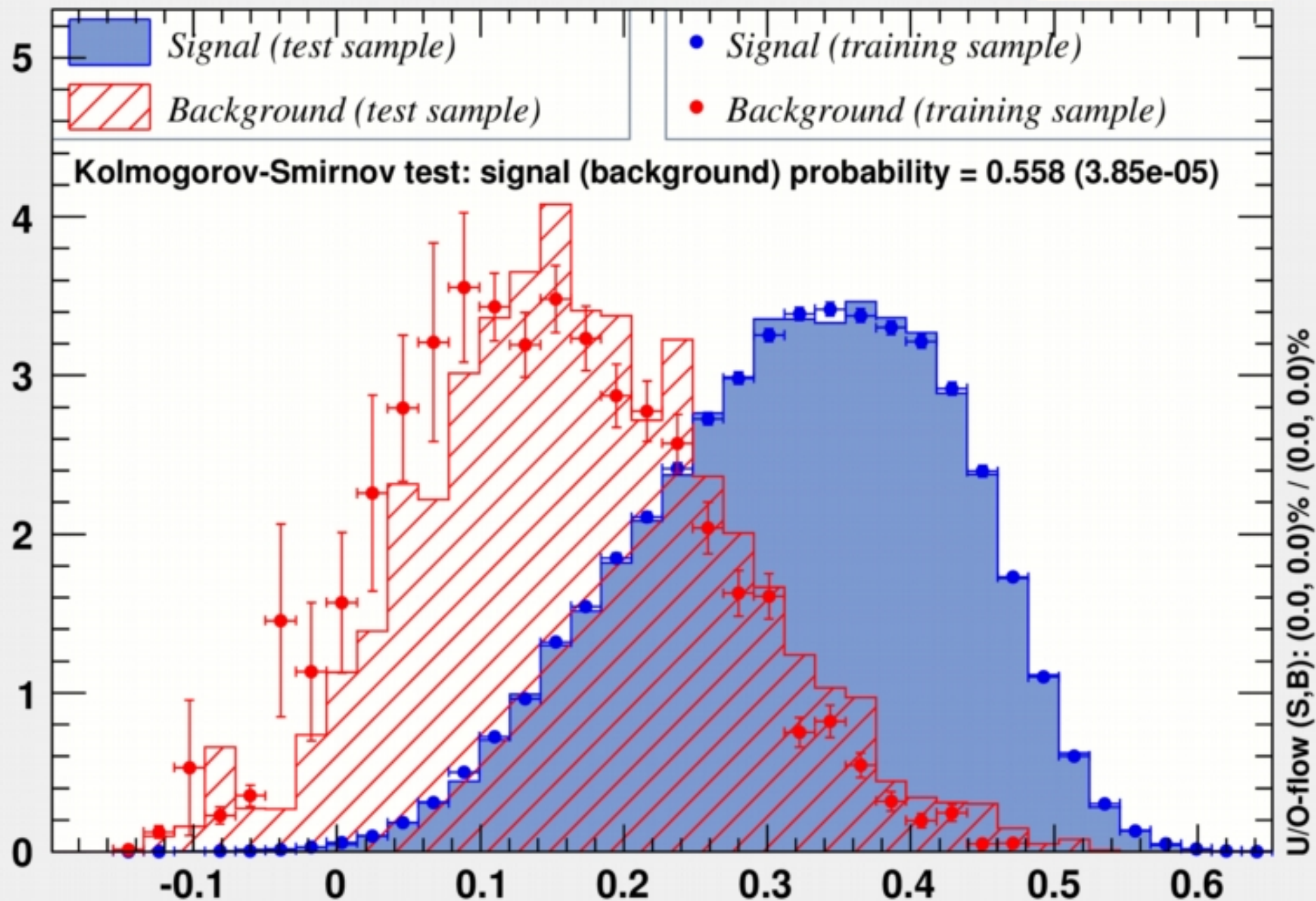
Correlation Matrix (background)



TMVA overtraining check for classifier: BDT



$(1/N) dN / dx$



Z+jets not included in training

BDT response

Cut efficiencies and optimal cut value

