

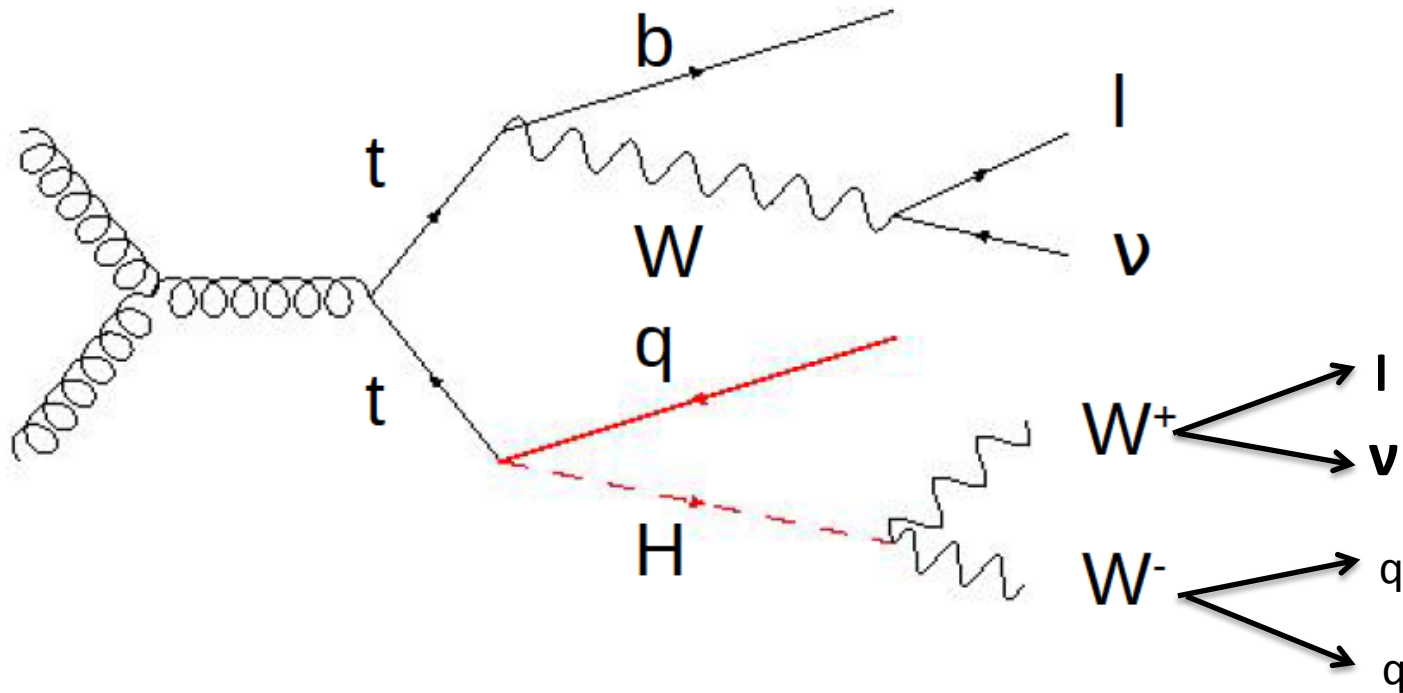
FCNC in $t\bar{t}$ decay

Same Sign di-lepton (2SSL)

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Signal



- the generated signal W decay is inclusive

Baseline selection

1. 2 Same Sign isolated Leptons (2SSL)

- $|\eta| < 2.5$ (2.4) for $e(\mu)$,
- $P_t \geq 30$ GeV,
- Veto on Z boson mass & low resonance mass
- for electrons fake rate and charge misidentification are incorporated (from CMS 8 TeV) :
 - fake rate (arising from hadronic jets),
 - Charge mis-identification [0.3% for $1.479 < |\eta| < 2.5$ (cms endcap), 0.03% for $|\eta| < 1.479$ (cms barrel)]

2. At least 4 Jets (P_t 50/30/20)

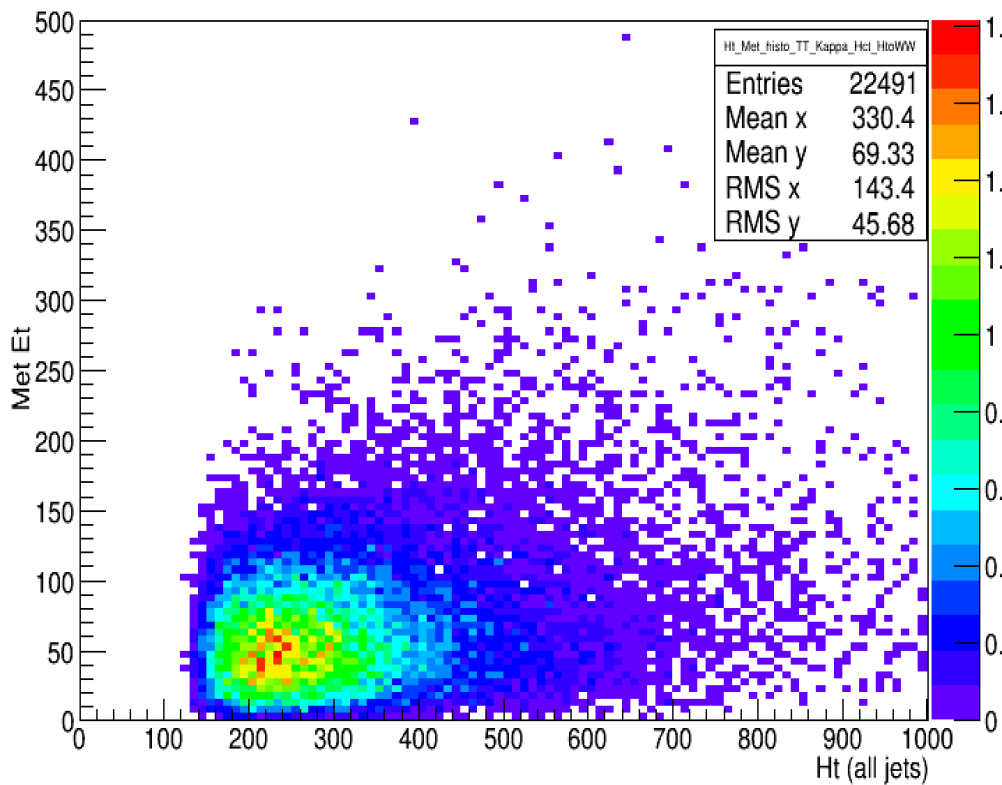
3. At least 1 CSV loose b-tagged jet (Combined Secondary Vertex at loose operating point ~ 10% mis-tagging rate)

Results

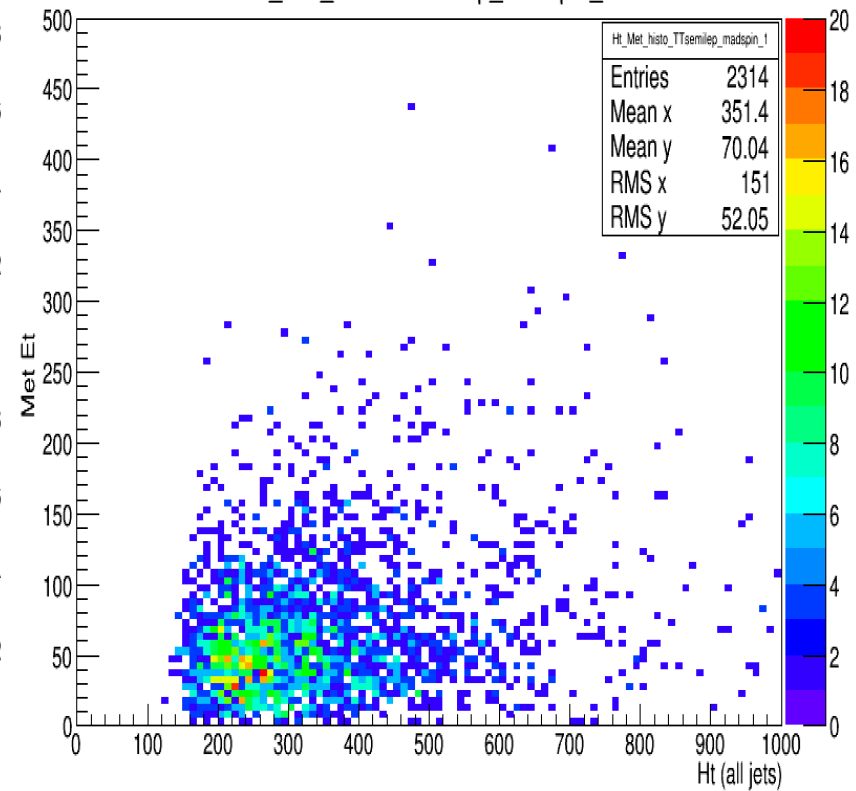
	initial	== 2 leptons	== 2 SSL	≥ 4 Jets	≥ 4 Jets 50/30/20	≥ 1CSVLB	Met Et ≥ 40	Met Et < 70 Ht > 140	70 < Met Et < 90 + H T > 120
TT Kappa Hct HtoWW	2.56e+05 ± 79	1.46e+04 ± 19.5	2.32e+03 ± 7.76	673 ± 4.18	649 ± 4.1	583 ± 3.89	422 ± 3.31	434 ± 3.36	148 ± 1.96
TT dilep madspin	6.78e+06 ± 3.44e+03	1.64e+06 ± 1.67e+03	5.63e+03 ± 97	861 ± 37.9	819 ± 37	746 ± 35.3	624 ± 32.3	395 ± 25.7	350 ± 24.2
TT semilep madspin 1	1.62e+07 ± 5.19e+03	5.04e+04 ± 303	1.39e+04 ± 159	4.7e+03 ± 92.5	4.58e+03 ± 91.4	4.21e+03 ± 87.6	2.93e+03 ± 73	3.11e+03 ± 75.3	1.1e+03 ± 44.7
TT semilep madspin 2	1.61e+07 ± 5.26e+03	5.03e+04 ± 307	1.39e+04 ± 162	4.65e+03 ± 93.3	4.52e+03 ± 92	4.15e+03 ± 88.2	2.92e+03 ± 74	3.02e+03 ± 75.3	1.12e+03 ± 45.9
SingleTop W madspin	4.74e+06 ± 2.11e+03	1.5e+05 ± 370	1.88e+03 ± 41.5	185 ± 13	175 ± 12.6	133 ± 11	87.9 ± 8.97	98.8 ± 9.51	33.9 ± 5.57
WToLNu-2Jets sm-no masses	2.58e+08 ± 5.39e+04	2.76e+05 ± 1.89e+03	6.89e+04 ± 944	103 ± 36.6	77.6 ± 31.7	64.6 ± 28.9	12.9 ± 12.9	51.7 ± 25.9	0 ± 0
WToLNu-3Jets sm-no masses	6.21e+07 ± 1.46e+04	9.56e+04 ± 606	2.56e+04 ± 313	384 ± 38.4	307 ± 34.3	169 ± 25.5	96 ± 19.2	150 ± 24	19.2 ± 8.59
WToLNu-4Jets sm-no masses	1.98e+07 ± 9.93e+03	4.72e+04 ± 488	1.43e+04 ± 268	2.54e+03 ± 113	2.42e+03 ± 110	1.29e+03 ± 80.7	876 ± 66.4	972 ± 70	322 ± 40.3
ZToLL50-2Jets sm-no masses	2.76e+07 ± 6.34e+03	6.9e+06 ± 3.1e+03	8.22e+03 ± 109	37.4 ± 7.34	28.8 ± 6.43	14.4 ± 4.55	0 ± 0	14.4 ± 4.55	0 ± 0
ZToLL50-3Jets sm-no masses	6.28e+06 ± 3.39e+03	1.46e+06 ± 1.64e+03	2.86e+03 ± 72.7	74 ± 11.7	59.2 ± 10.5	38.9 ± 8.48	3.7 ± 2.62	35.2 ± 8.07	3.7 ± 2.62
ZToLL50-4Jets sm-no masses	2.16e+06 ± 1.49e+03	4.98e+05 ± 707	1.6e+03 ± 40.2	372 ± 19.4	362 ± 19.1	201 ± 14.2	50.4 ± 7.13	185 ± 13.6	16.1 ± 4.03

Met and Ht cuts provided from TOP-13-017

Ht_Met_histoTT_Kappa_Hct_HtoWW



Ht_Met_histoTTsemilep_madspin_1

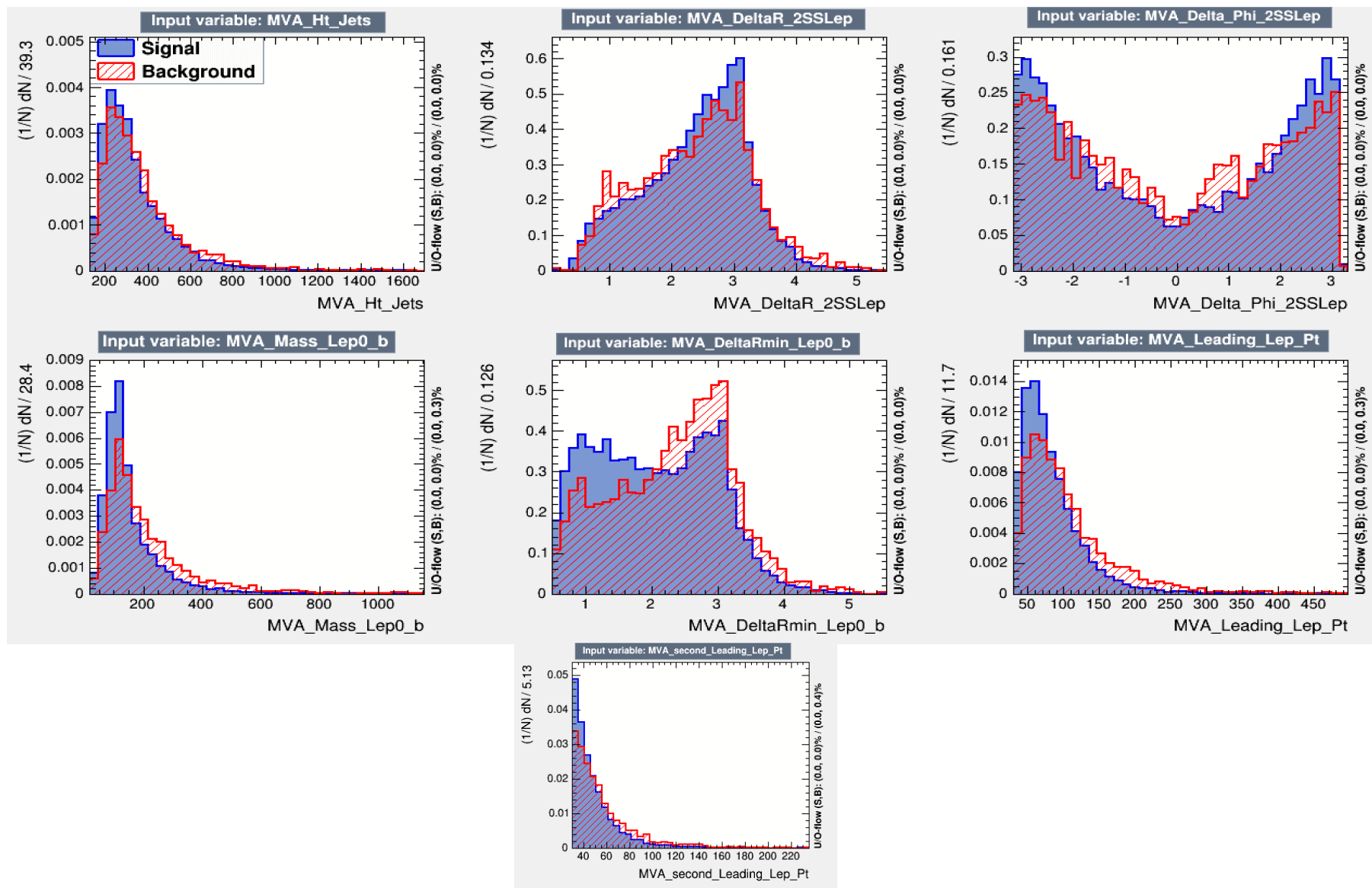


✧ Results from cut & count Analysis

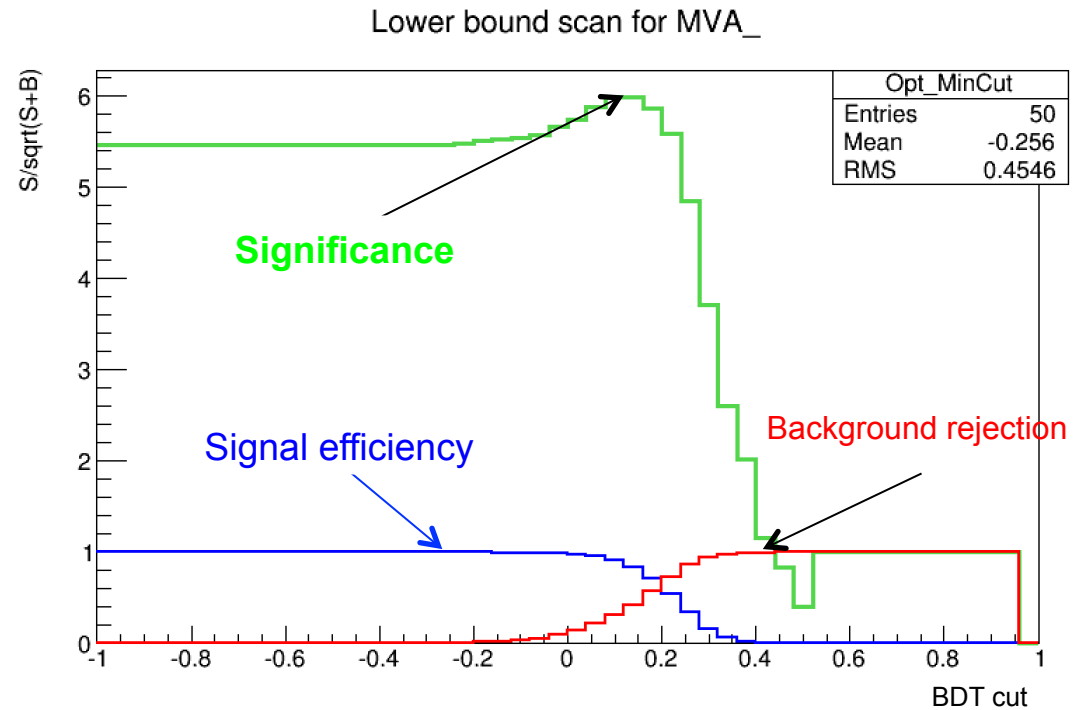
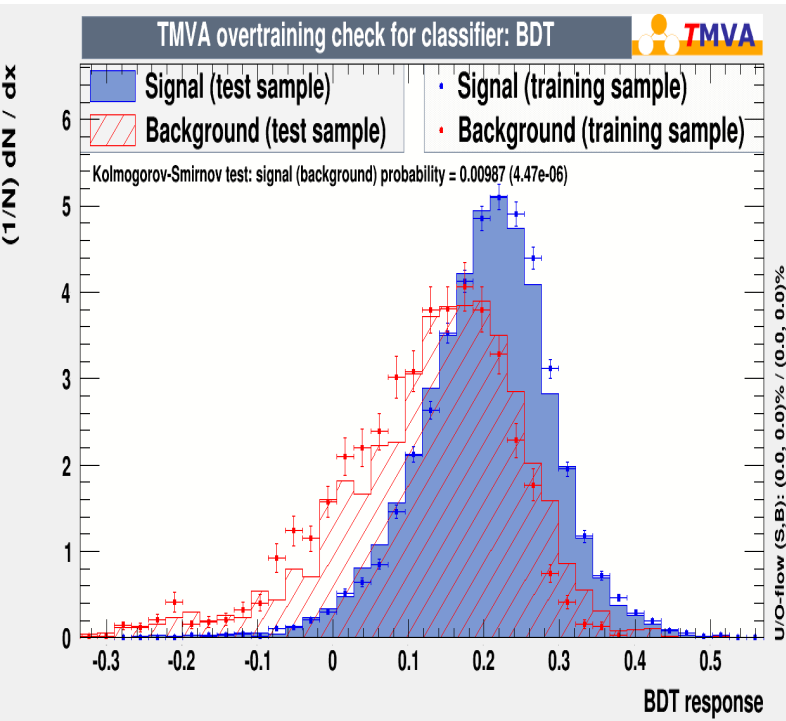
	Initial	2SSL	Jets ≥ 4	B jets ≥ 1
Signal	2.56e05	2.3e03	649	583
Main background {	tt+jets	3.91e07	3.34e04	9920
	W+jets	8.18e07	3.99e04	2730
	Z+jets	8.98e06	4.46e03	4210
				Total B = 10816

$$Sig = \frac{S}{\sqrt{S+B}} = 5.4$$

✧ MVA Analysis : Input Variables

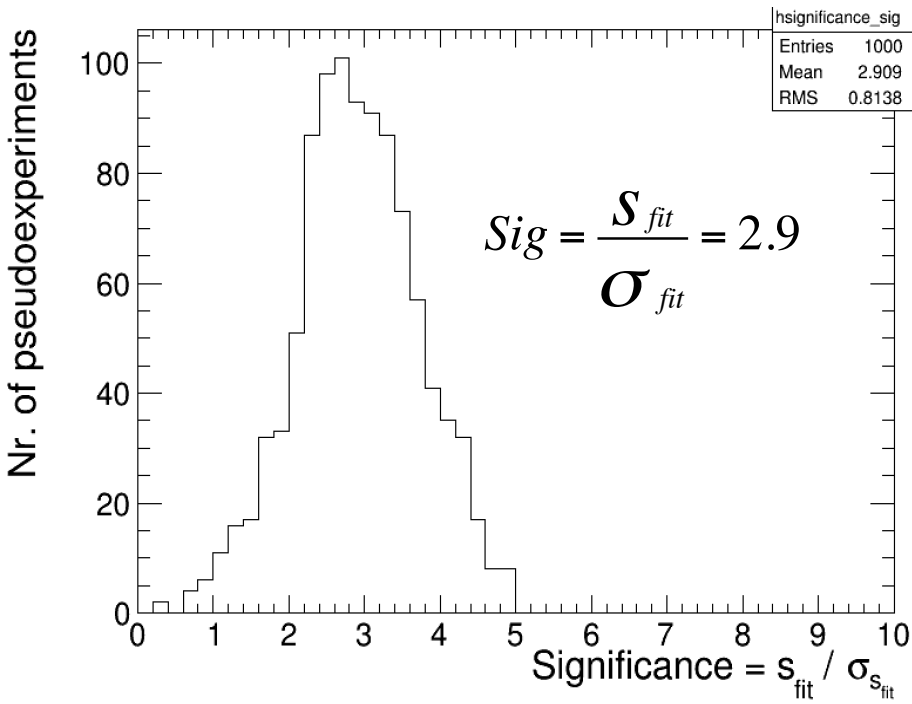


✧ MVA Analysis : BDT Response & Optimal cut

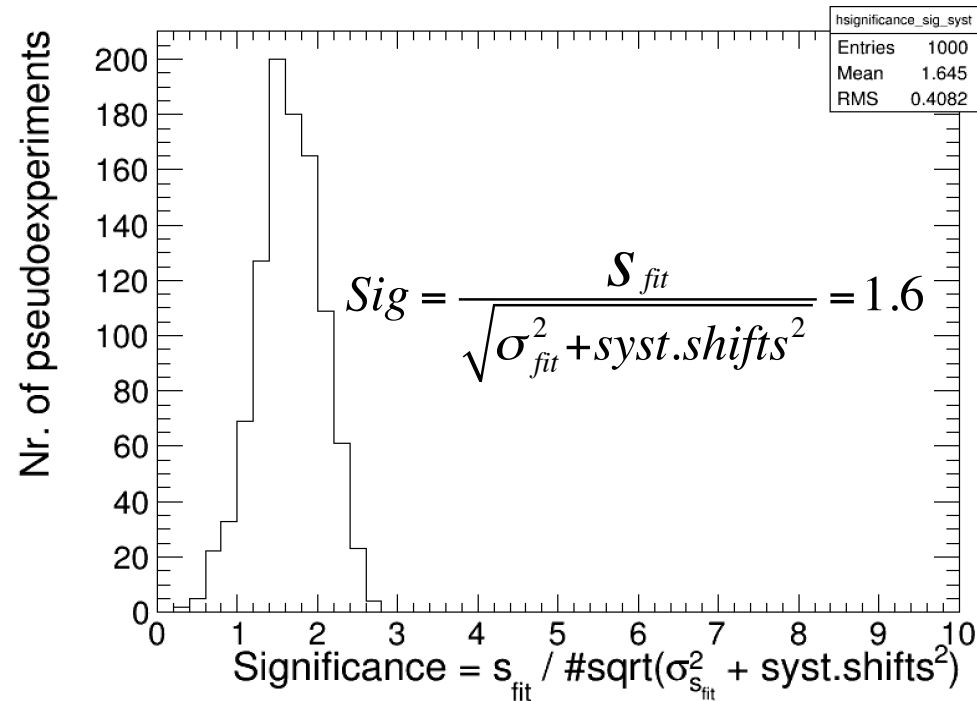


$$Sig = \frac{S}{\sqrt{S+B}} = 5.99 \quad at \ BDT_Cut = 0.136$$

✧ Shape Analysis : Template fit on MVA-BDT output



Inserting systematic uncertainties...
 uncertainty on level of 50% for tt+jets
 uncertainty on level of 10% for Z+jets



✧ Summary of Same Sign di-lepton final state:

uncertainty on level of 50% for tt+jets
uncertainty on level of 10% for Z+jets

	# Signal	# Background	Significance	Significance including systematic uncertainties
Cut and count	584	10816	$S/\sqrt{S+B} = \underline{5.46}$	$S/\sqrt{S+B+\sum(\text{syst. Shift})^2} = \underline{0.128}$
MVA cut and count	490	6220	$S/\sqrt{S+B} = \underline{5.9}$	$S/\sqrt{S+B+\sum(\text{syst. Shift})^2} = \underline{0.398}$
MVA template fit	584	10816	$\text{Sign}_{\text{fit}} / \sigma_{\text{s_fit}} = \underline{2.9}$	$\text{Sign}_{\text{fit}} / \sqrt{(\sigma_{\text{s_fit}})^2 + \sum(\text{syst. Shift})^2} = \underline{1.6}$

the significance is less affected by systematic uncertainties when using a Template fit