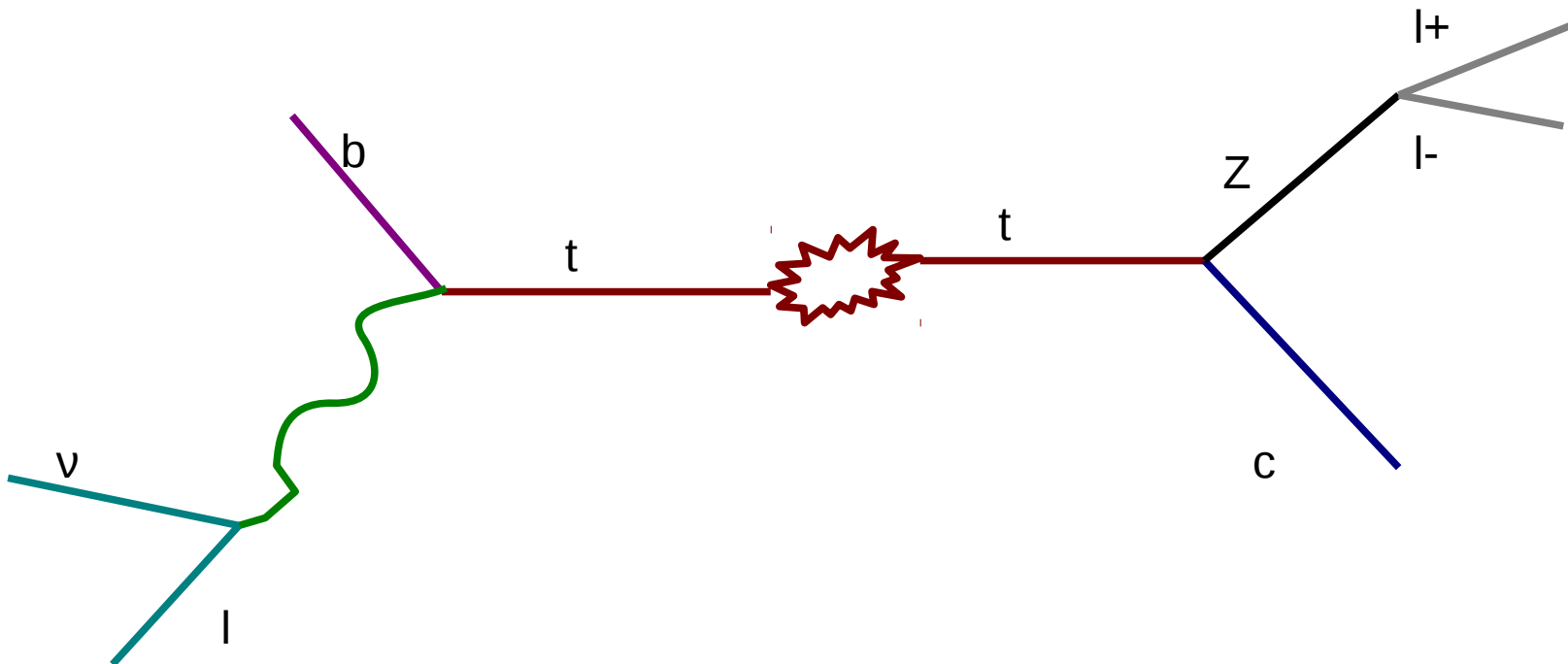


Status of $t\bar{t}$ $\rightarrow$ 3 leptons

Isis Van Parijs



Object selection

Object selection:

- Lepton pt:
 - Electrons and muons: $pt > 20 \text{ GeV}$
 - Electrons $|\eta| < 2.5$ en muons $|\eta| < 2.4$
- Jets: $pt > 40$, $|\eta| < 2.4$, $EE_{\text{overHE}}() > 0.3$
- Cone 04
- B jet discriminator: CSV loose

Cutflow

- Number of jets ≥ 2
- Number of b-jets ≥ 1
- At least 1 OSSF pair
- Z mass window of 15 GeV
- Top mass window of 35 GeV

Reconstruction efficiencies in signal sample:

$$\varepsilon(Z(l)|MC_{\text{particle}}) = 98\%$$

$$\varepsilon(W(l)|MC_{\text{particle}}) = 90\%$$

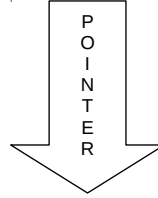
$$\varepsilon(b|MC_{\text{particle}}) = 76\%$$

$$\varepsilon(c|MC_{\text{particle}}) = 88\%$$

$$\varepsilon(b\&c|MC_{\text{particle}}) = 79\%$$

Cutflow with fake leptons:

	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	$2.09\text{e}+03 \pm 0.718$	242 ± 0.239	159 ± 0.193	134 ± 0.178	72.1 ± 0.13	55.1 ± 0.113	41.9 ± 0.0989
TTdilep WToLNU madspin	$1.93\text{e}+03 \pm 7.6$	149 ± 2.11	85 ± 1.6	77.9 ± 1.53	33.3 ± 0.999	7.74 ± 0.482	4.35 ± 0.361
TTdilep ZToLL madspin	803 ± 2.54	209 ± 1.29	121 ± 0.988	112 ± 0.949	55.2 ± 0.667	34.9 ± 0.53	13.3 ± 0.327
TTdilep madspin	$6.78\text{e}+06 \pm 3.44\text{e}+03$	$4.04\text{e}+03 \pm 82.1$	$1.41\text{e}+03 \pm 48.5$	$1.23\text{e}+03 \pm 45.2$	379 ± 25.1	71.7 ± 10.9	41.7 ± 8.34
TTsemilep HToZZ madspin2	267 ± 0.34	2.64 ± 0.0339	0.00174 ± 0.00087	0.00174 ± 0.00087	0.00087 ± 0.000615	0.00087 ± 0.000615	0.00087 ± 0.000615
TTsemilep ZToLL madspin 1	$1.68\text{e}+03 \pm 5.3$	110 ± 1.36	82.8 ± 1.18	73.5 ± 1.11	38.5 ± 0.804	28 ± 0.685	11 ± 0.43
TTsemilep ZToLL madspin 2	$1.68\text{e}+03 \pm 5.3$	111 ± 1.37	84.4 ± 1.19	74.4 ± 1.12	38 ± 0.799	27.2 ± 0.675	10.5 ± 0.42
WZToLLNu	$2.57\text{e}+05 \pm 60.5$	$1.53\text{e}+04 \pm 15.5$	$1.73\text{e}+03 \pm 5.17$	497 ± 2.77	268 ± 2.04	199 ± 1.75	61.2 ± 0.973
ZToLL50-3Jets sm-no masses	$6.28\text{e}+06 \pm 3.39\text{e}+03$	$3.13\text{e}+03 \pm 76.1$	777 ± 37.9	250 ± 21.5	137 ± 15.9	124 ± 15.1	46.3 ± 9.25
ZToLL50-4Jets sm-no masses	$2.16\text{e}+06 \pm 1.49\text{e}+03$	$1.66\text{e}+03 \pm 40.9$	959 ± 31.1	323 ± 18	186 ± 13.7	172 ± 13.2	49.4 ± 7.06
ZZToLLJJ sm-no masses	$2.12\text{e}+05 \pm 480$	83.7 ± 9.54	14.1 ± 3.92	6.53 ± 2.66	1.09 ± 1.09	1.09 ± 1.09	1.09 ± 1.09
ZZToLLLL sm-no masses	$3.59\text{e}+04 \pm 135$	$2.75\text{e}+03 \pm 37.3$	181 ± 9.58	51.3 ± 5.1	30 ± 3.9	21.8 ± 3.33	10.2 ± 2.27



	Initial	3 leptons	At least 2 jets	At least 1 CSVL	At least 1 OSSF pair	Inv Mass Z	Inv Mass FCNC
Zct	$2.09\text{e}+03 \pm 0.718$	242 ± 0.239	159 ± 0.193	134 ± 0.178	133 ± 0.177	128 ± 0.173	97.4 ± 0.151
TTdilep WToLNU	$1.93\text{e}+03 \pm 7.6$	149 ± 2.11	85 ± 1.6	77.9 ± 1.53	60.1 ± 1.34	14.9 ± 0.669	7.89 ± 0.487
TTdilep ZToLL	803 ± 2.54	209 ± 1.29	121 ± 0.988	112 ± 0.949	104 ± 0.915	78.1 ± 0.793	29.5 ± 0.487
TTdilep	$6.78\text{e}+06 \pm 3.44\text{e}+03$	$4.04\text{e}+03 \pm 82.1$	$1.41\text{e}+03 \pm 48.5$	$1.23\text{e}+03 \pm 45.2$	946 ± 39.7	240 ± 20	88.4 ± 12.1
TTsemilep HToZZ 2	267 ± 0.34	2.64 ± 0.0339	0.00174 ± 0.00087	0.00174 ± 0.00087	0.00087 ± 0.000615	0.00087 ± 0.000615	0.00087 ± 0.000615
TTsemilep ZToLL 1	$1.68\text{e}+03 \pm 5.3$	110 ± 1.36	82.8 ± 1.18	73.5 ± 1.11	72 ± 1.1	61.5 ± 1.02	24.3 ± 0.638
TTsemilep ZToLL 2	$1.68\text{e}+03 \pm 5.3$	111 ± 1.37	84.4 ± 1.19	74.4 ± 1.12	72.4 ± 1.1	62.4 ± 1.02	24.8 ± 0.646
WZToLLNu	$2.57\text{e}+05 \pm 60.5$	$1.53\text{e}+04 \pm 15.5$	$1.73\text{e}+03 \pm 5.17$	497 ± 2.77	495 ± 2.77	446 ± 2.63	137 ± 1.45
ZToLL50-3Jets	$6.28\text{e}+06 \pm 3.39\text{e}+03$	$3.13\text{e}+03 \pm 76.1$	777 ± 37.9	250 ± 21.5	248 ± 21.4	231 ± 20.7	87 ± 12.7
ZToLL50-4Jets	$2.16\text{e}+06 \pm 1.49\text{e}+03$	$1.66\text{e}+03 \pm 40.9$	959 ± 31.1	323 ± 18	321 ± 18	294 ± 17.2	91.8 ± 9.62
ZZToLLJJ	$2.12\text{e}+05 \pm 480$	83.7 ± 9.54	14.1 ± 3.92	6.53 ± 2.66	6.53 ± 2.66	6.53 ± 2.66	3.26 ± 1.88
ZZToLLLL	$3.59\text{e}+04 \pm 135$	$2.75\text{e}+03 \pm 37.3$	181 ± 9.58	51.3 ± 5.1	50.3 ± 5.05	45.7 ± 4.82	21.8 ± 3.33

Final Numbers for MVA

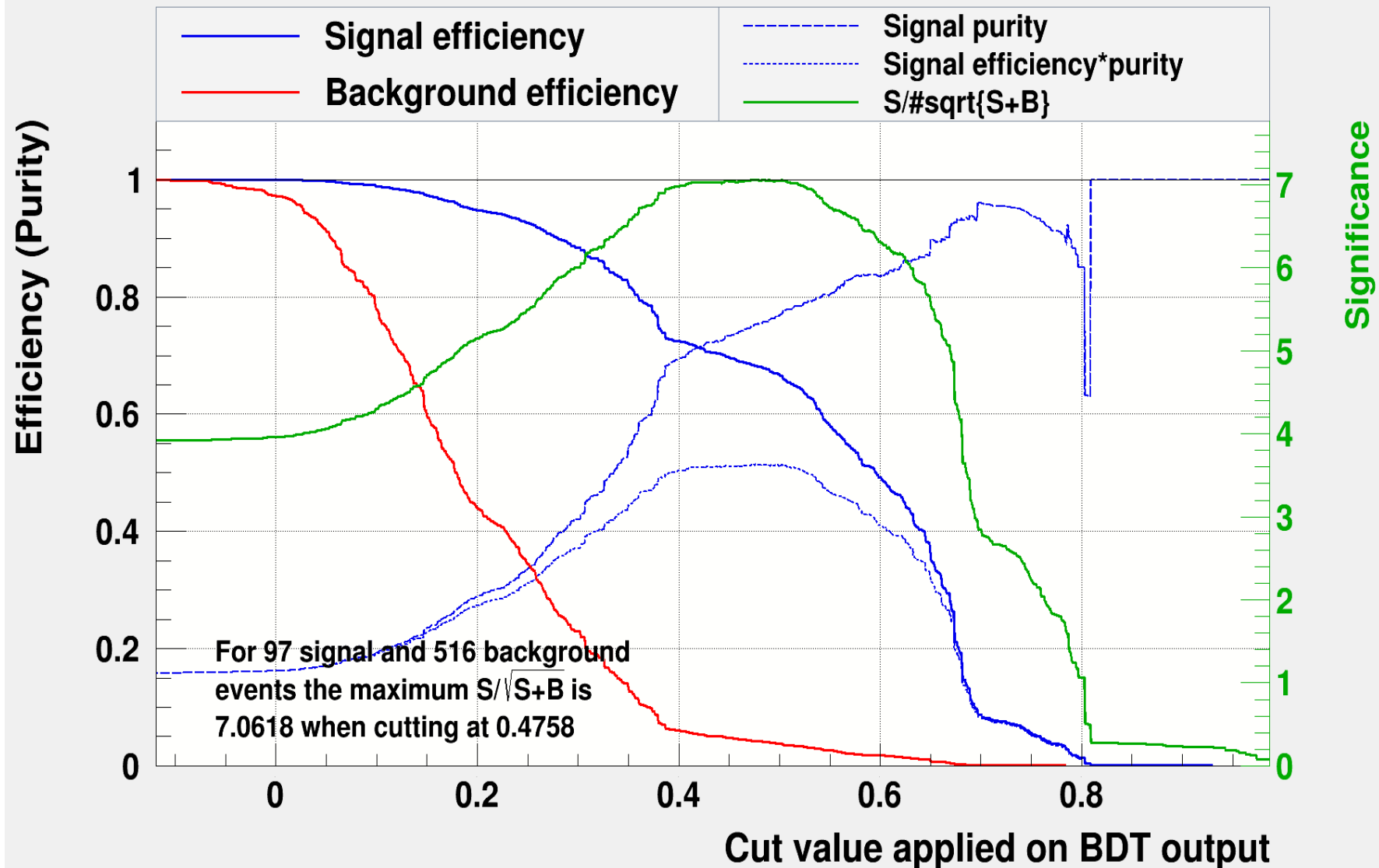
Zct	97.4 ± 0.151
TTdilep WToLNu	7.89 ± 0.487
TTdilep ZToLL	29.5 ± 0.487
TTdilep	88.4 ± 12.1
TTsemilep HToZZ	0.00087 ± 0.000615
TTsemilep ZToLL 1	24.3 ± 0.638
TTsemilep ZToLL 2	24.8 ± 0.646
WZToLLLNu	137 ± 1.45
ZToLL50-3Jets	87 ± 12.7
ZToLL50-4Jets	91.8 ± 9.62
ZZToLLJJ	3.26 ± 1.88
ZZToLLLL	21.8 ± 3.33
Signal	97
Background	516
MVA significance	7.06
MVA input variables in order of importance	- Invariant mass $l_w b_{top}$ - #b-jets - Invariant Mass $l_z l_{c_{top}}$

Main backgrounds

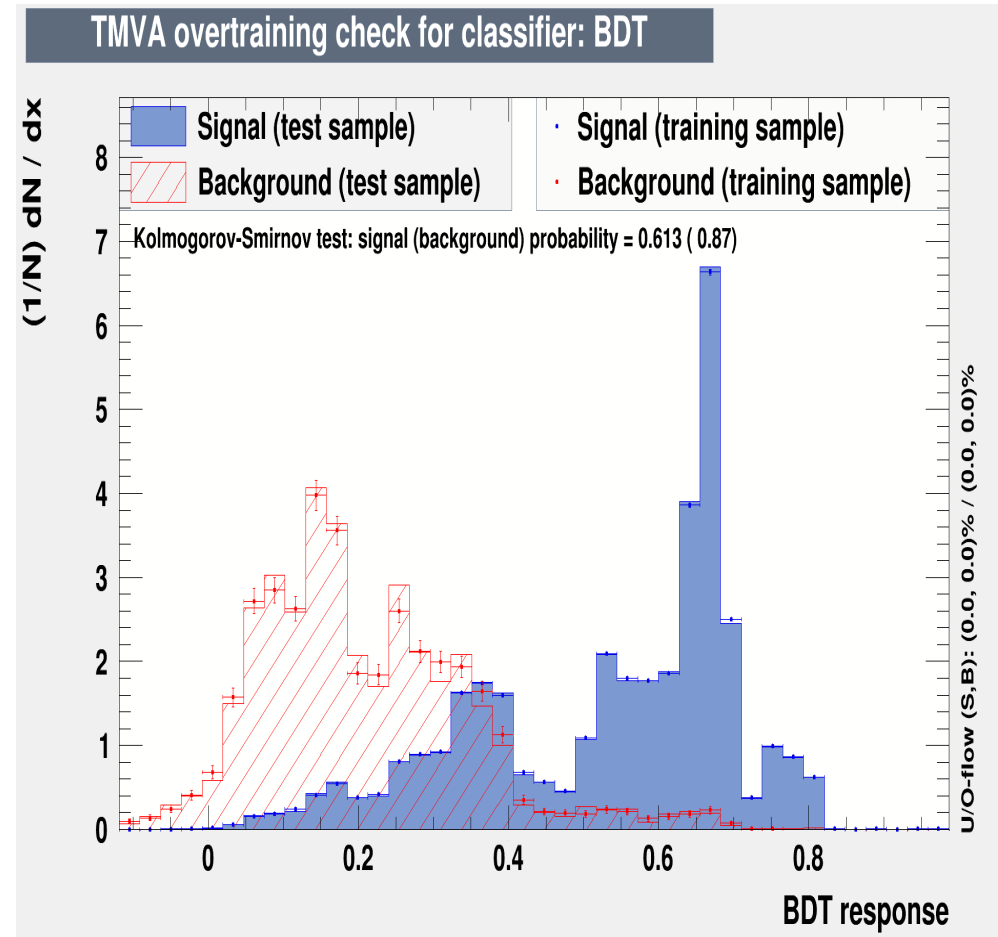
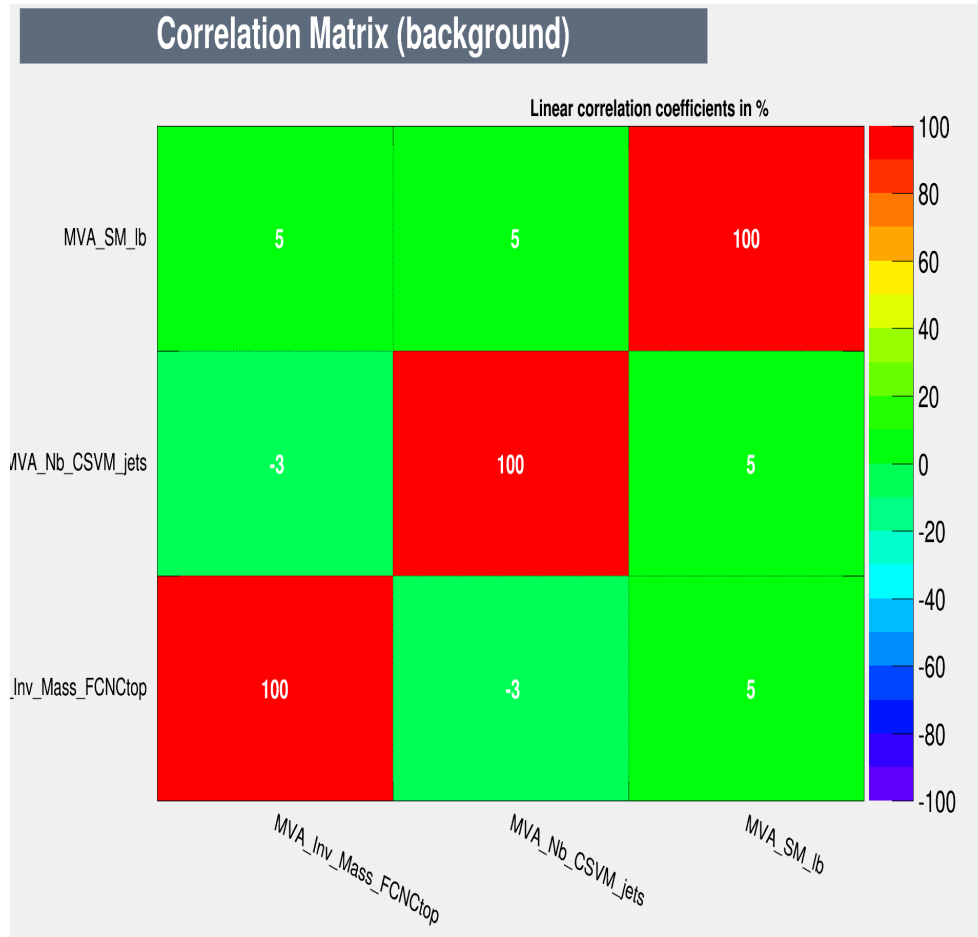
Used for training
Low statistics

MVA: trained on WZ

Cut efficiencies and optimal cut value



MVA: trained on WZ



Input variables

