

Single top (+ $t\bar{t}$): $TH \rightarrow 1\ell 3b$ *hut* at present exclusion

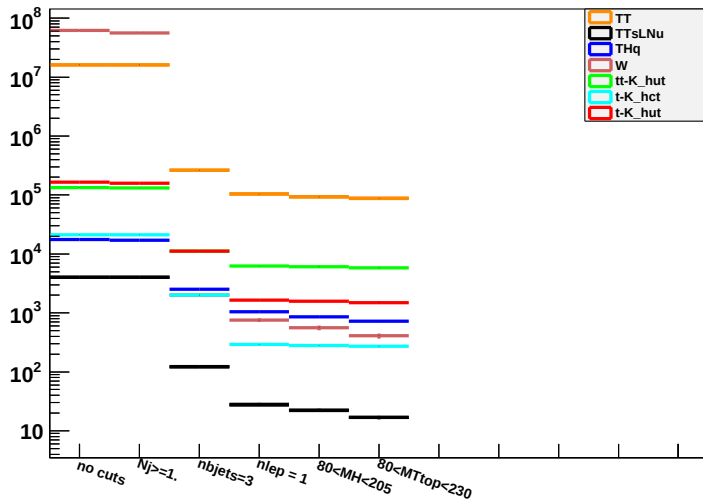
Lorenzo Basso

Optimisation

- $p_\ell^T > 20 \text{ GeV}$, $p_j^T > 40 \text{ GeV}$
- isolation: CONE04 with threshold = 0.20
- $N_J \geq 1$ (J = light and b jets)
- $N_\ell = 1$, $N_b = 3$
- W reco
- ✗ H candidate as pair of b jets closest to M_H
- ✗ t candidate as b with closest $M^T(b \ell \nu)$ to M_t
- ✓ together
- $80 \text{ GeV} < |M(bb) - M_H| < 205 \text{ GeV}$
- loose top reco: $80 \text{ GeV} < M^T(b \ell \nu) < 230 \text{ GeV}$

Backgrounds - cutflow

$\sqrt{s} = 13 \text{ TeV}$



Filled after the $N_b = 3$ and $N_{ell} = 1$ cuts.

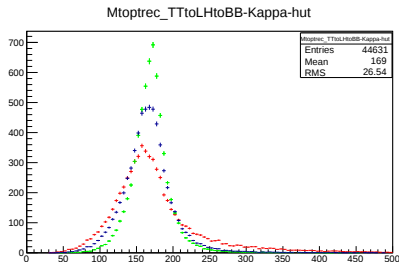
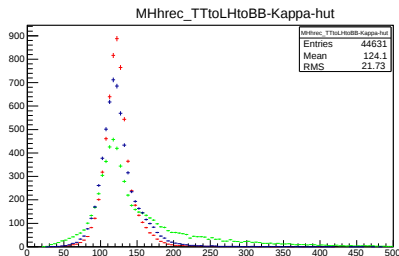
8 Variables with relative importance when trained on the single-top sample only:

Variable	Importance
$M(H)$	$2.43 \cdot 10^{-1}$
$p^T(H)$	$2.18 \cdot 10^{-1}$
$\eta(H)$	$1.55 \cdot 10^{-1}$
$\Delta R(H, \text{MET})$	$1.10 \cdot 10^{-1}$
$M(\text{top})$	$9.47 \cdot 10^{-2}$
$\Delta R(H, \ell)$	$8.26 \cdot 10^{-2}$
$M^T(\ell\nu)$	$7.56 \cdot 10^{-2}$
$p^T(b_3)$	$2.81 \cdot 10^{-2}$

Discarded ones: $p^T(b_1)$, $p^T(b_2)$, $\Delta R(bb)|_H$: correlated with $p^T(H)$ all other lepton variables: $p^T(\ell)$, $\eta(\ell)$, $\Delta\phi, \Delta\eta, \dots$: no discrimination power

Which $M(H)$ and $M(\text{top})$?

Higgs and top reco



Red: H reco only

Green: t reco only

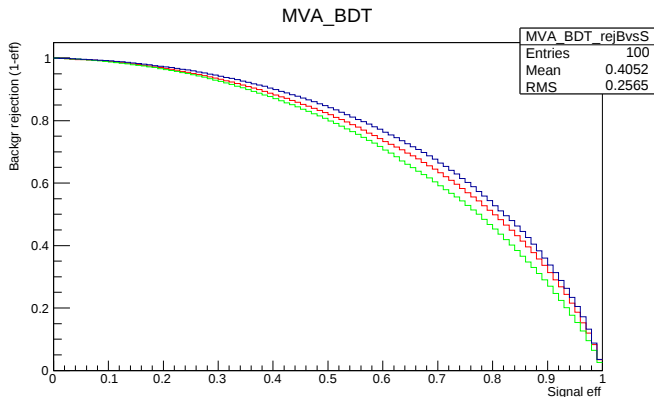
Blue: simultaneously

```
if( (abs(MTallin - 173.0) + abs(MHallin - 125.0)) <  
(abs(MTall - 173.0) + abs(MHall - 125.0)) )
```

```
MTall = MTallin;
```

```
MHall = MHallin;
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Higgs and top reco: MVA



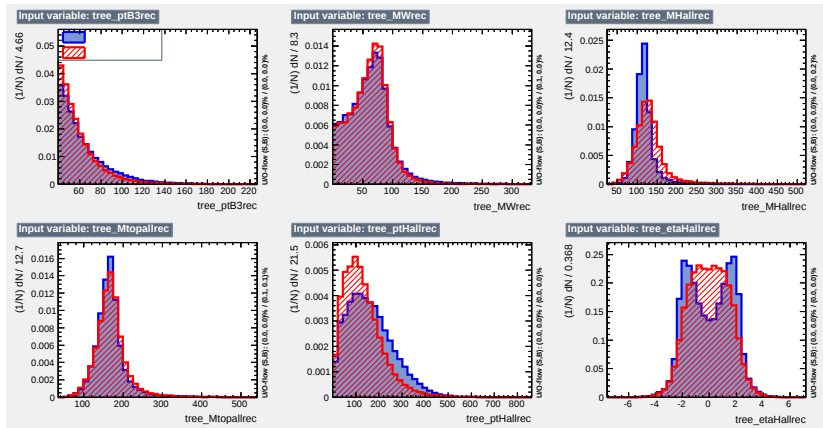
Red: H reco only

Green: t reco only

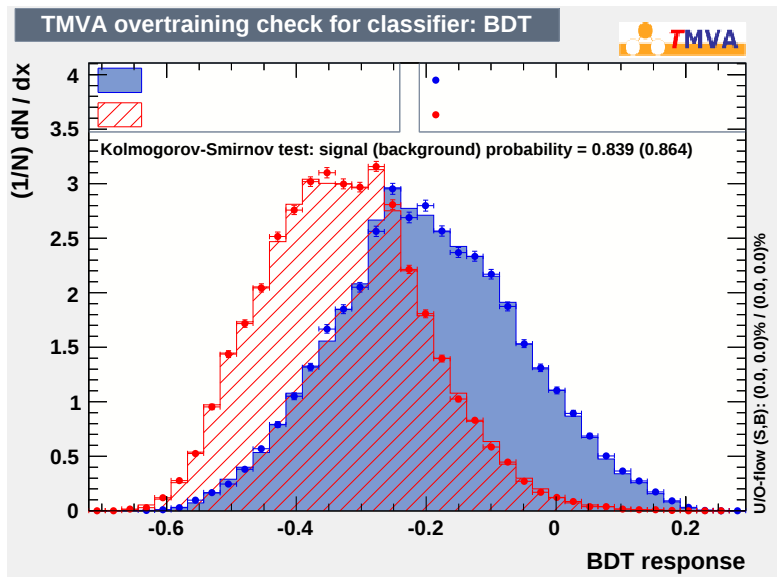
Blue: simultaneously

MVA: variables

Signal: only single top



MVA: overtraining



What's next

- reading of the MVA
- single top vs. combination: MVA on $t\bar{t}$ bar seems useless. I will try: training on the single top only, reading to the sum of signals
- cut-and-count: other variables to cut on after selecting top-quark and Higgs masses?