FCNC 1L3B

Status on 15/01/2015

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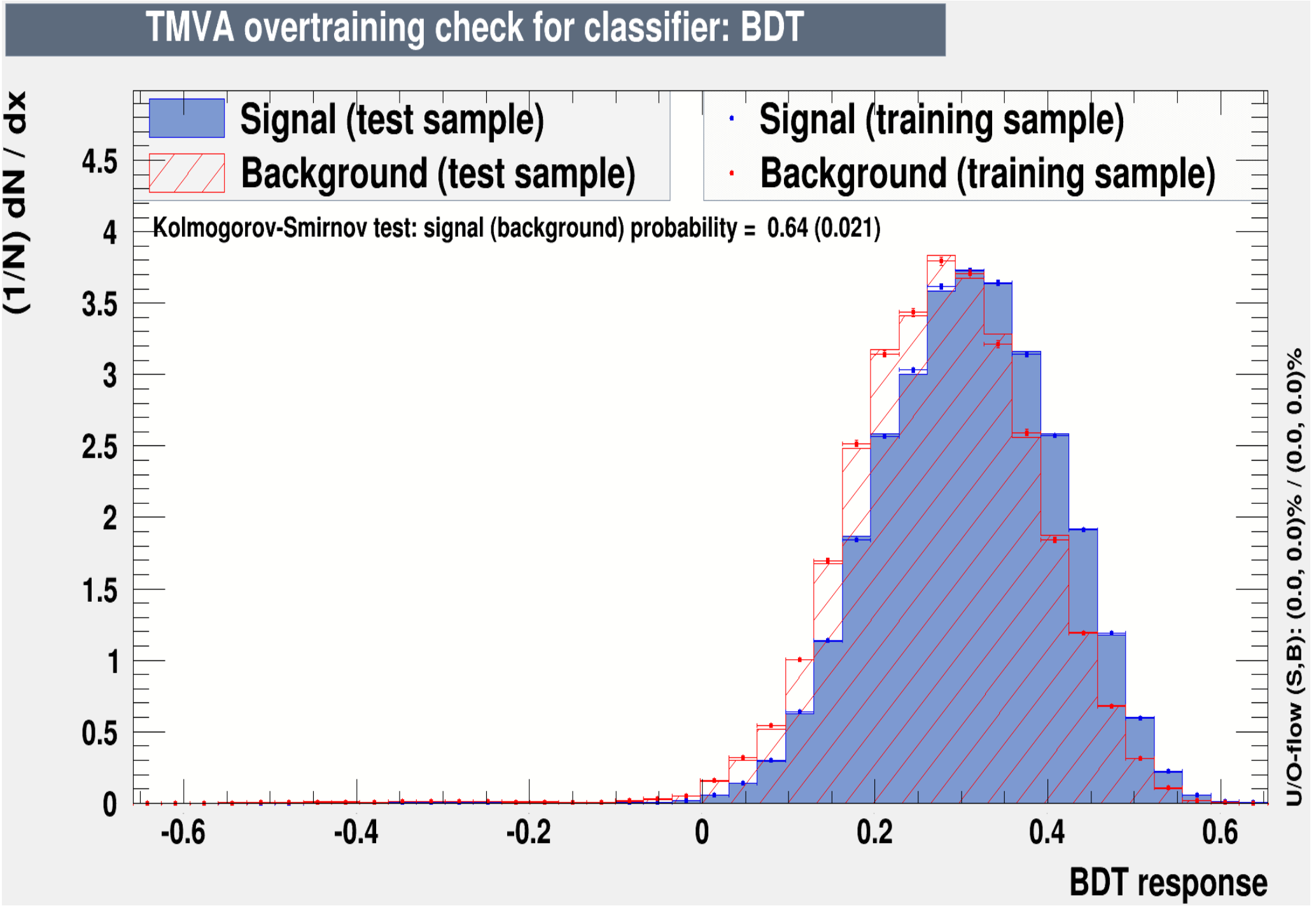
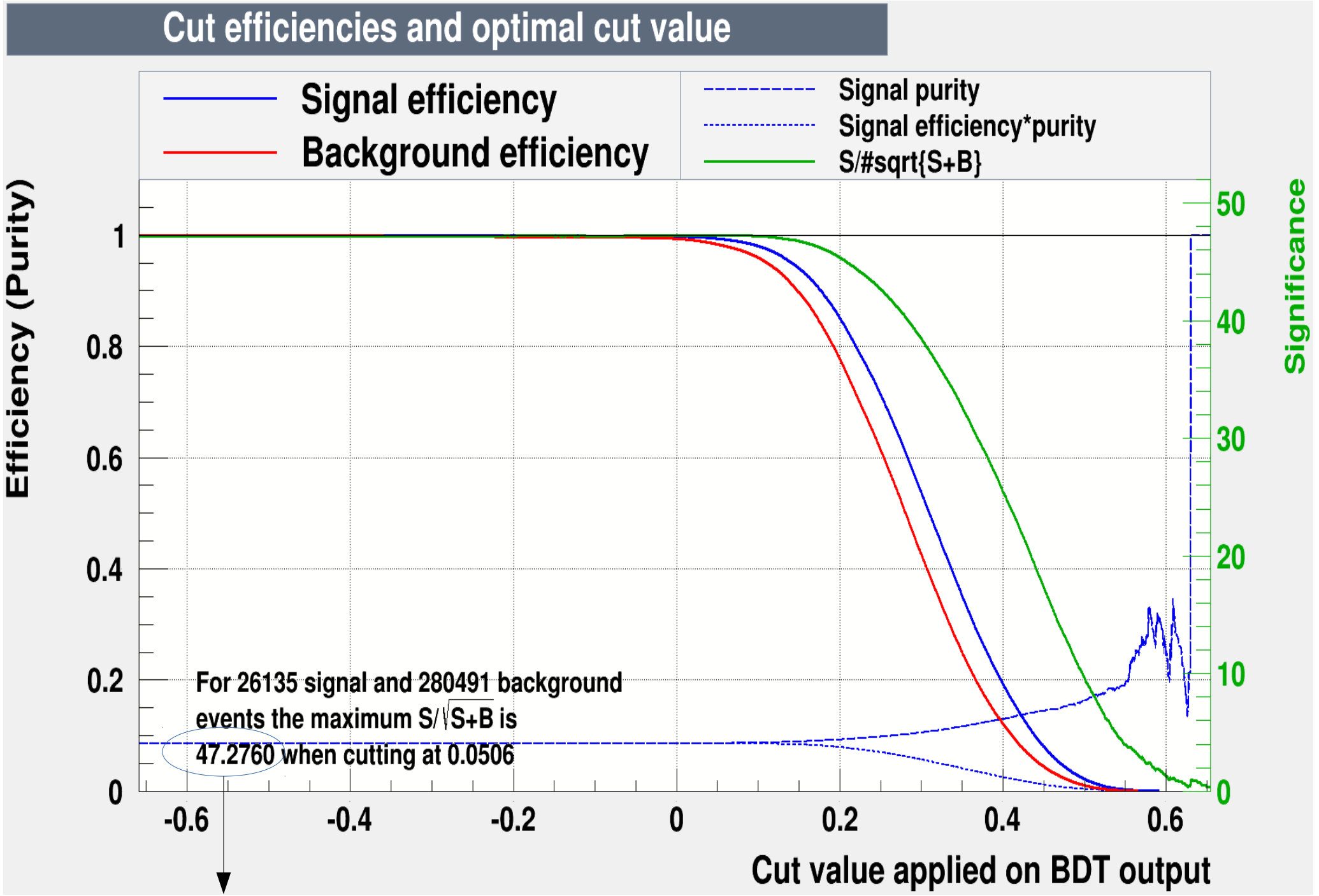
Baseline selection (reminder)
tt → tcH(bb)

- Xsec (tt → tcH(bb)) = 6.456 pb (assuming current best limit)
- Baseline selection
  - == 1 lepton (iso: CONE04, treshold: 0.2)
    - μ: P_T > 10 GeV, |η| < 2.4
    - e: P_T > 15 GeV, |η| < 2.5
  - >= 3 jets
    - cleaned from leptons with ΔR < 0.5, P_T < 20 GeV
    - P_T(jet1) > 40 GeV, P_T(jet2) > 40 GeV, P_T(jet3) > 35 GeV
    - |η| < 2.4
    - EeoverHE > 0.3
  - >= 3 CSVM b-tagged jets
  - M_T(lep,MET) >= 50 GeV

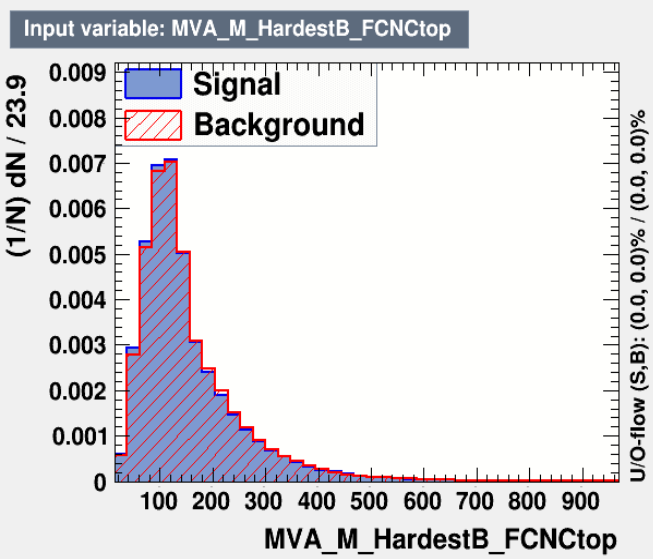

TMVA overtraining check for classifier: BDT
Signal (test sample)
Background (test sample)
Signal (training sample)
Background (training sample)
Kolmogorov-Smirnov test: signal (background) probability = 0.64 (0.021)
(1/N) dN / dx
U/O-flow (S,B): (0.0, 0.0)% / (0.0, 0.0)%
BDT response
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
-0.6
-0.4
-0.2
0
0.2
0.4
0.6

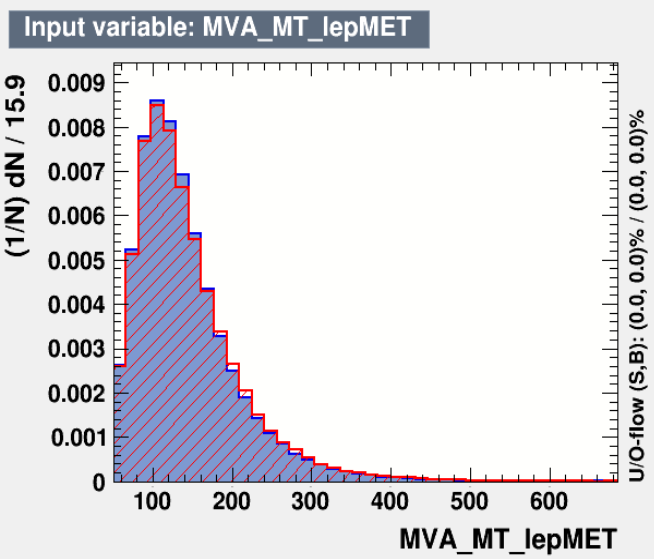


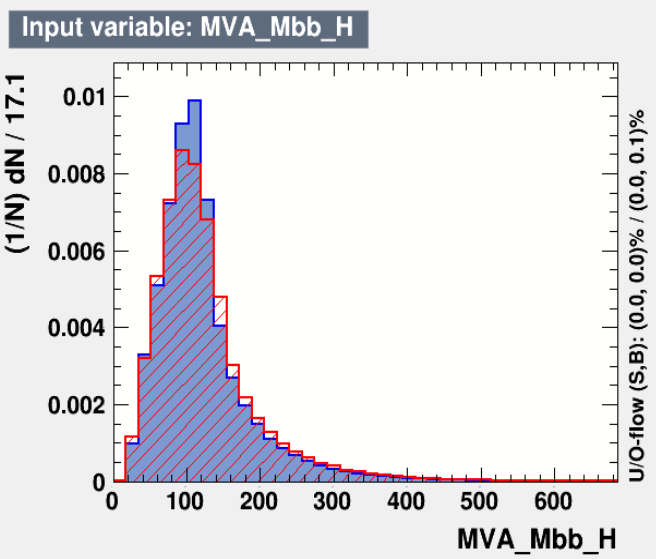
S/sqrt(S+B) after full baseline selection: 47.29

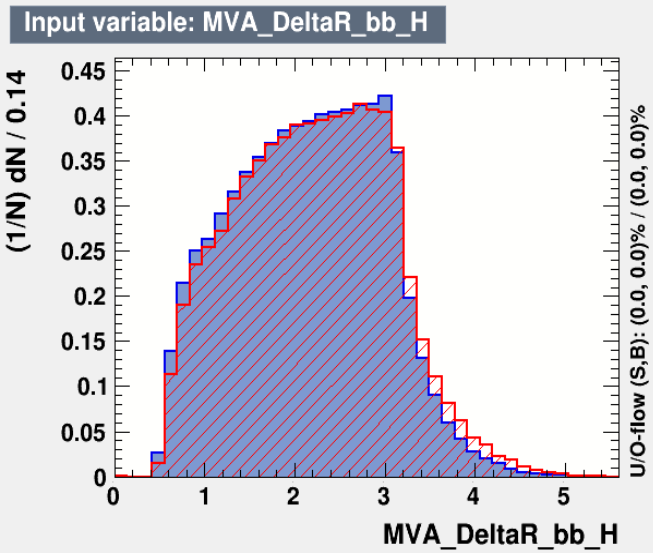
Clearly no improvement in significance compared to baseline selection!

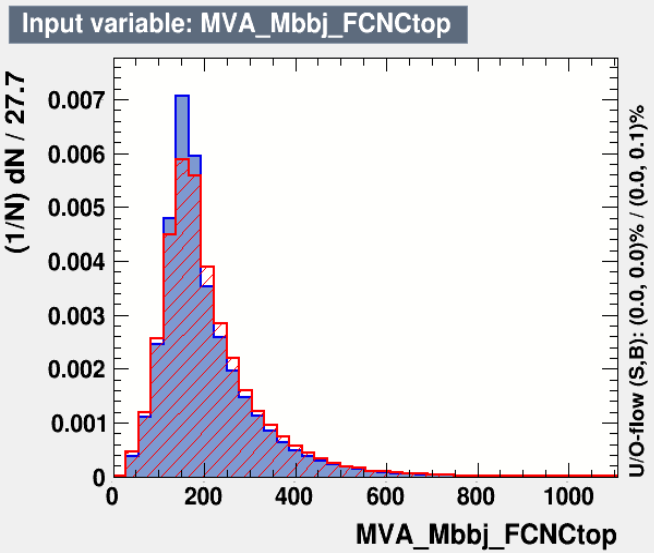
MVA input variable distributions

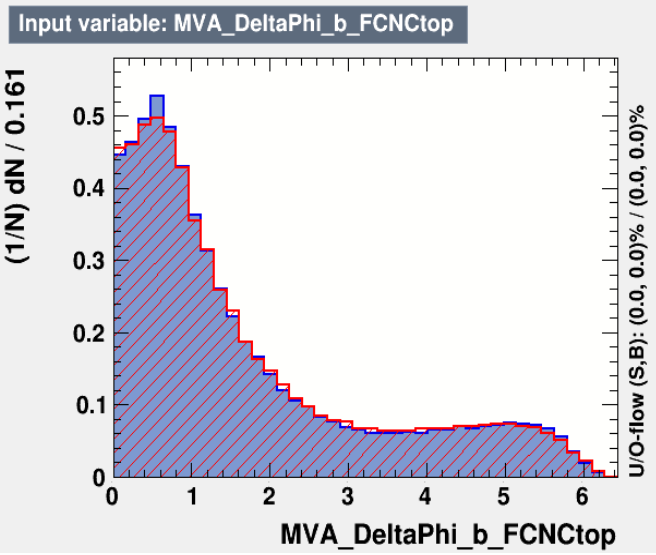




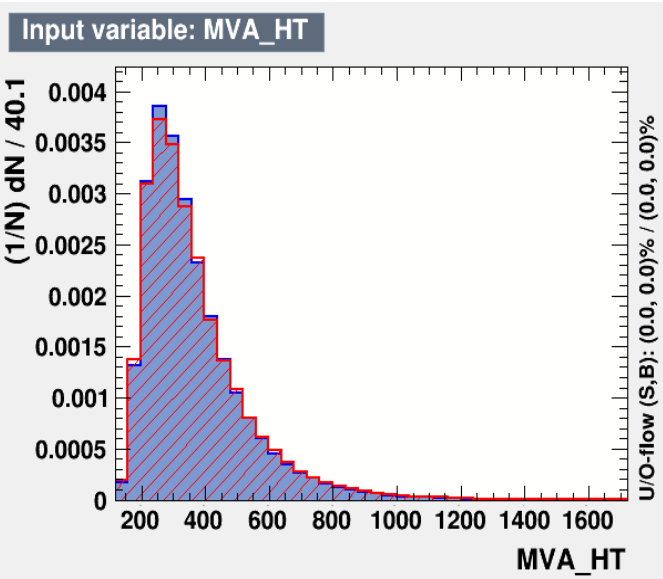


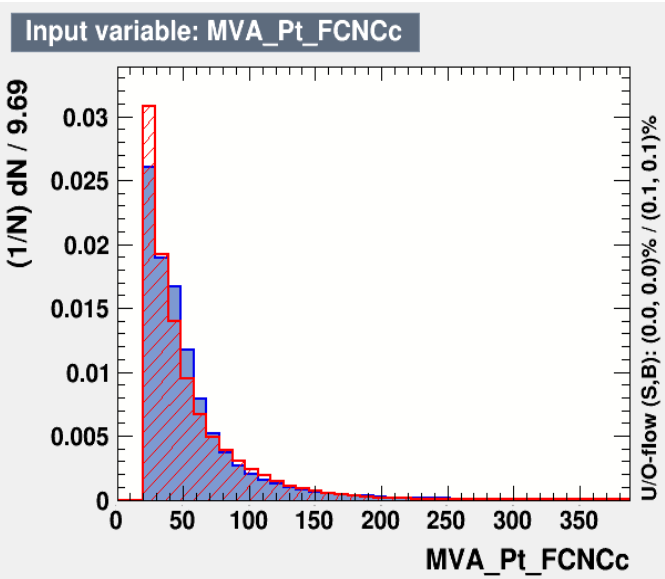


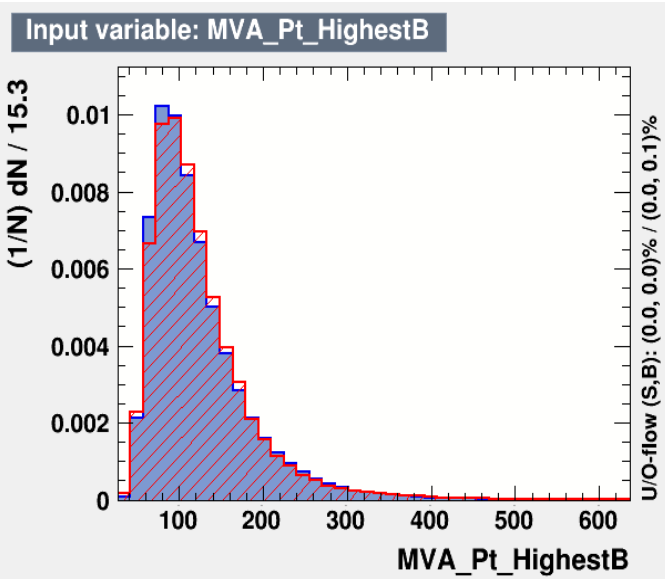


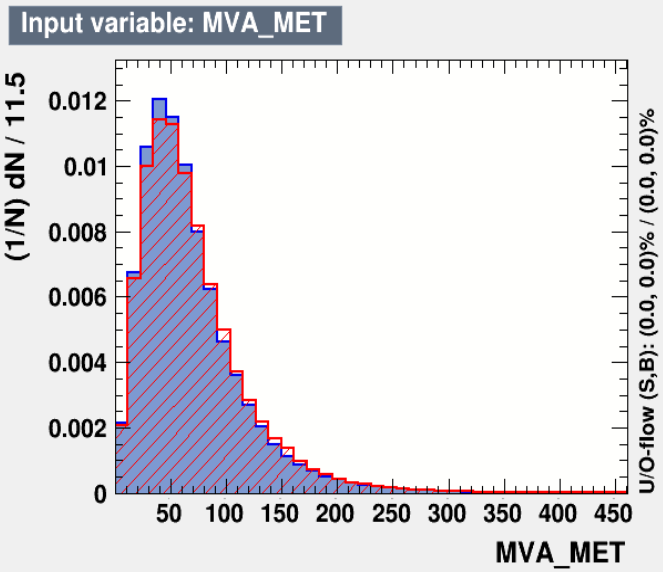


MVA input variable distributions









Reconstruction efficiency

- Current reconstruction:
  - P(hardest b-jet | b^{SM}) = 47.9%
  - P(χ^2_{min} ($b^H b^H$) | H) = ???
  - P(χ^2_{min} (j^{FCNC}) | t) = ???
- Next test for reconstruction
  - P(χ^2_{min} ($b^H b^H$) | H) = ???
  - P(χ^2_{min} (j^{FCNC}) | t) = ???
  - P(remaining b-jet | b^{SM}) = ???

tcZ coupling

- Same baseline selection as tcH coupling
- Xsection(tt->tcZ) = 0.033 pb
- S/sqrt(S+B) = 0.59 (no MVA)

BACKUP

Variables fed to MVA

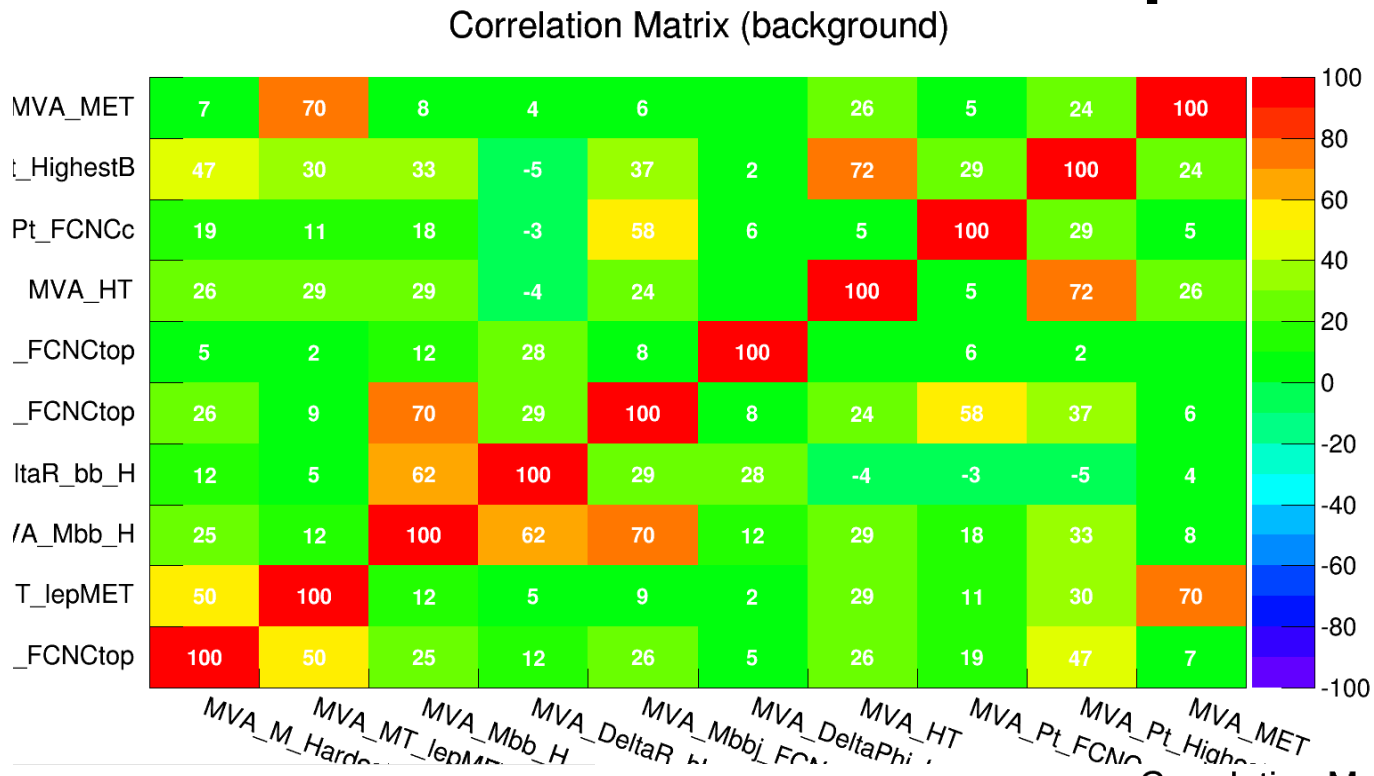
- MET
- M(lep, b^{SM}) (b^{SM}: hardest b-jet)
- $P_T(b^{SM})$
- $M(b_1, b_2)$ ($b_1 \neq b_2 \neq b^{SM}$)
- $\Delta R(b_1, b_2)$ ($b_1 \neq b_2 \neq b^{SM}$)
- $M(b_1, b_2, j_{FCNC})$ ($b_1 \neq b_2 \neq j_{FCNC}$)
- $P_T(j^{FCNC})$
- $\Delta\Phi(b^{SM}, t^{FCNC})$
- M_T(lep, MET)
- H_T

Simultaneous X^2-minimization to determine b_1, b_2 & j_{FCNC}

$$\chi^2 = \frac{(m_{b_1 b_1} - m_H)^2}{\sigma_H^2} + \frac{(m_{b_1 b_1 j} - m_t)^2}{\sigma_t^2}$$

~ 15 GeV ~16.21 GeV

Correlation of input variables



Ranking Variables

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--------------------------------------------------
Rank : Variable                : Separation
--------------------------------------------------
   1 : MVA_Pt_FCNCc            : 1.095e-02
   2 : MVA_Mbbj_FCNCtop        : 8.083e-03
   3 : MVA_Mbb_H               : 6.751e-03
   4 : MVA_HT                  : 3.640e-03
   5 : MVA_DeltaR_bb_H         : 3.185e-03
   6 : MVA_M_HardestB_FCNCtop  : 2.104e-03
   7 : MVA_Pt_HighestB         : 1.822e-03
   8 : MVA_DeltaPhi_b_FCNCtop  : 1.784e-03
   9 : MVA_MT_lepMET           : 1.238e-03
  10 : MVA_MET                 : 9.167e-04
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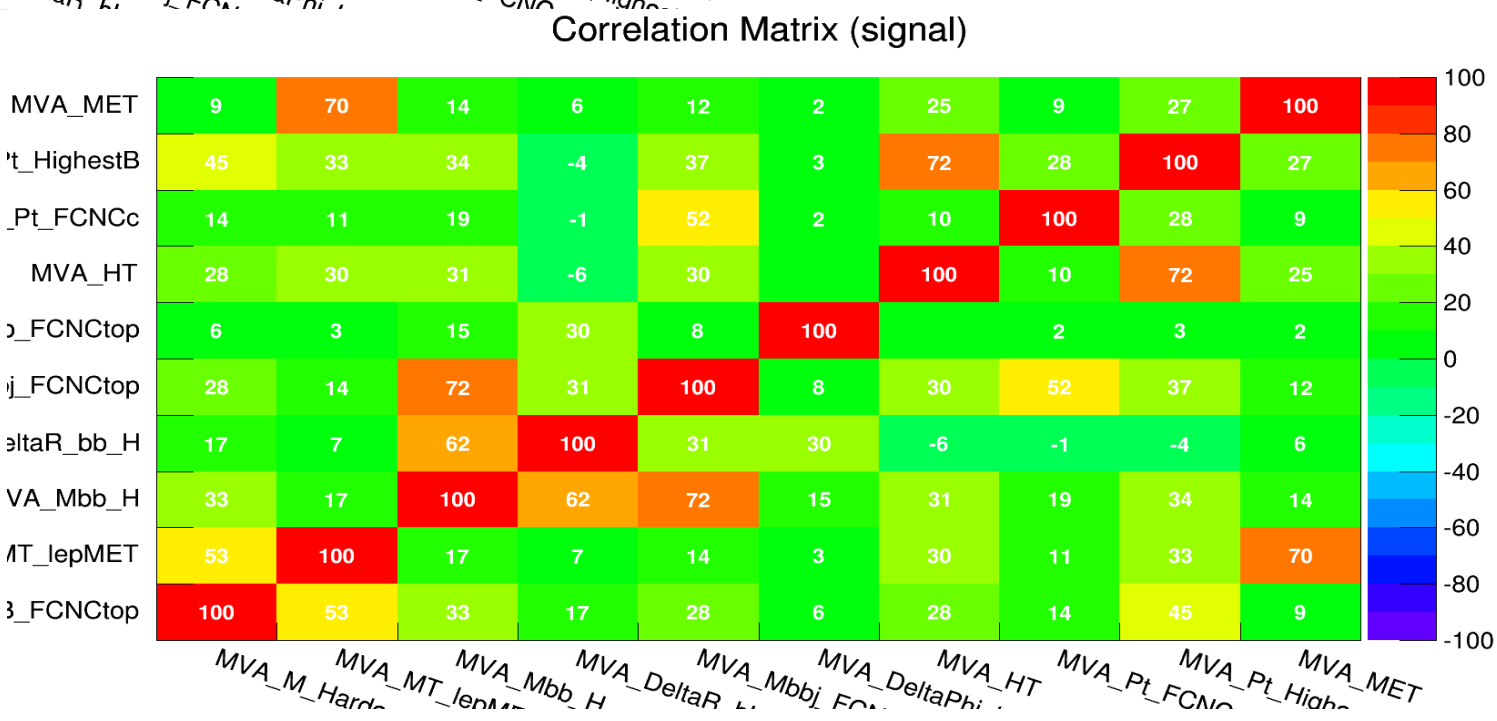
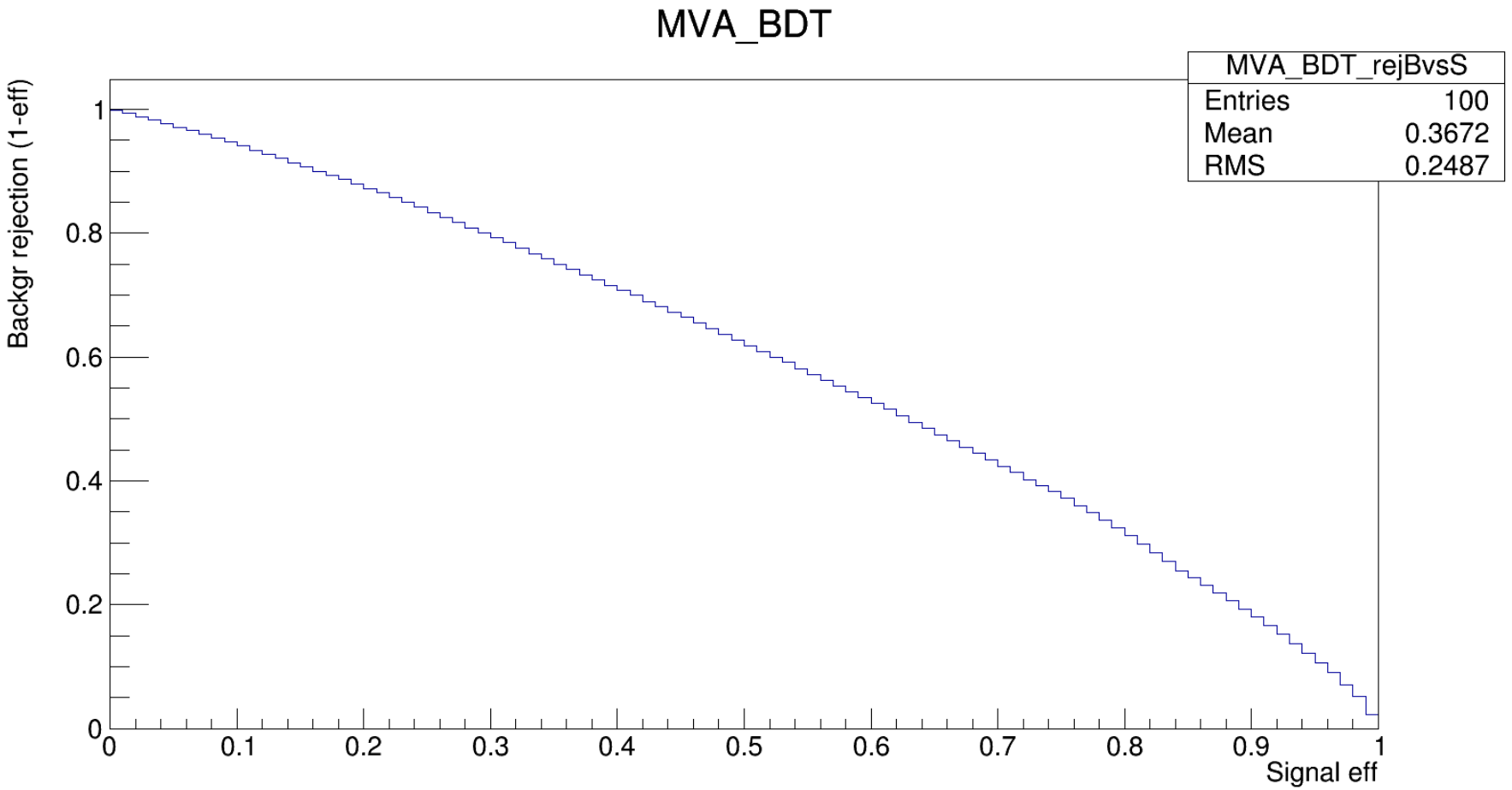


ROC-curve


MVA_BDT
MVA_BDT_rejBvsS
Entries 100
Mean 0.3672
RMS 0.2487
Backgr rejection (1-eff)
Signal eff
0
0.2
0.4
0.6
0.8
1
0.1
0.3
0.5
0.7
0.9