



# FCNC search in single top involving hard photon

*Phenomenological investigations @ 13 TeV*

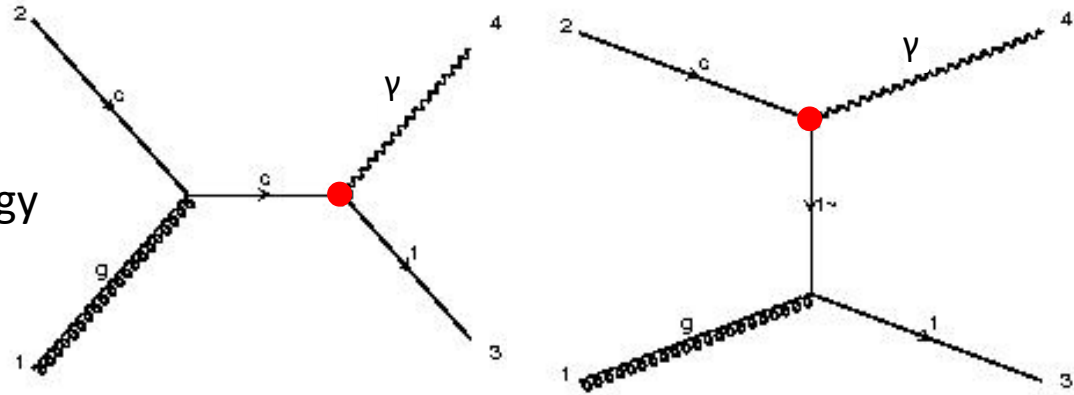
Eric CONTE

# Single top & hard photon

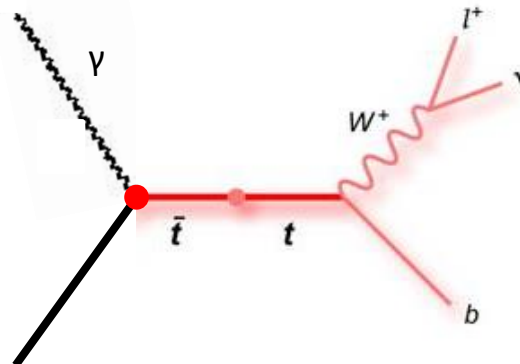
Feynman diagrams :

$$\frac{\kappa_{\gamma qt}}{\Lambda}$$

Single top topology

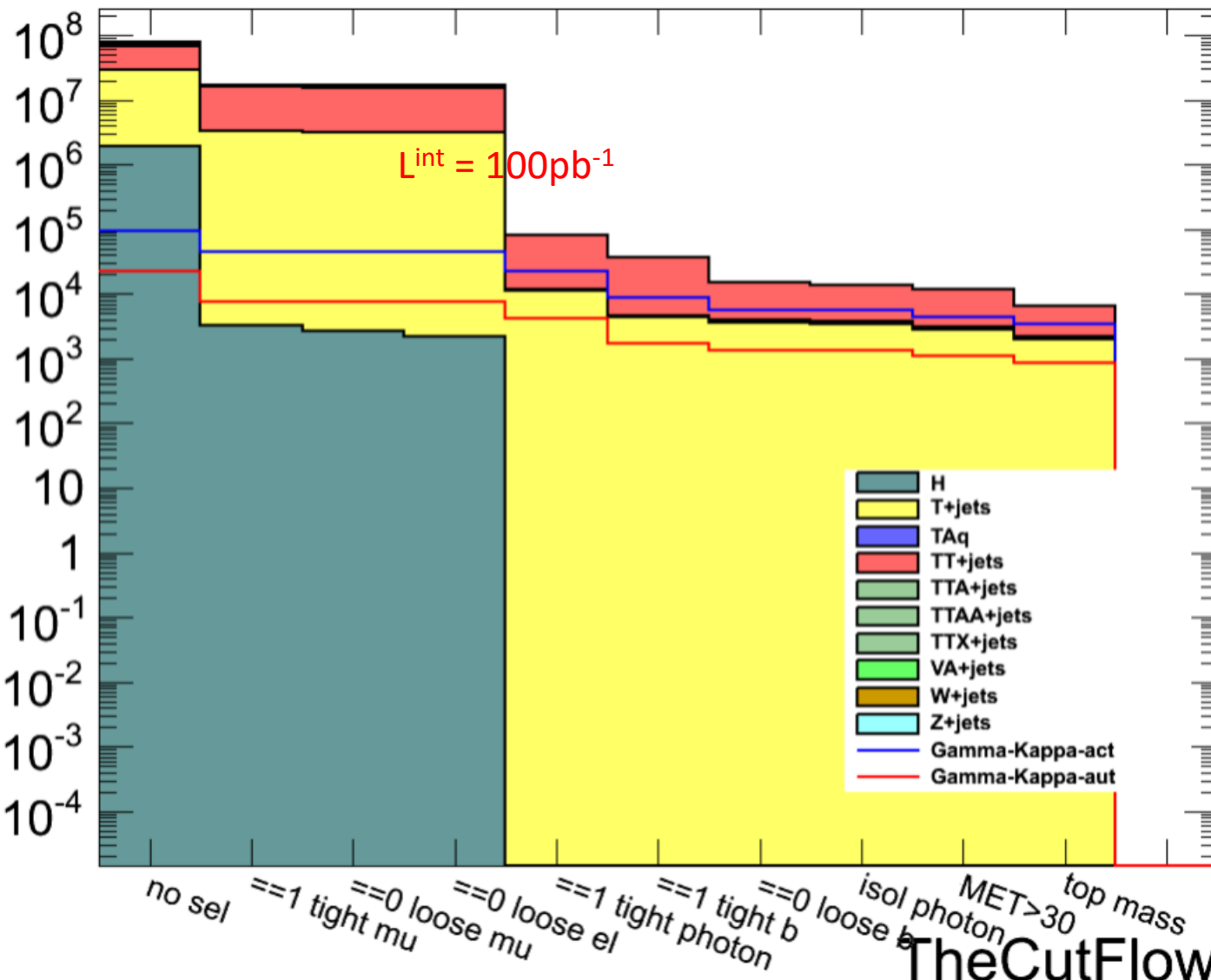


TTbar topology



# First selection

Cut-flow



All background source are not showed !

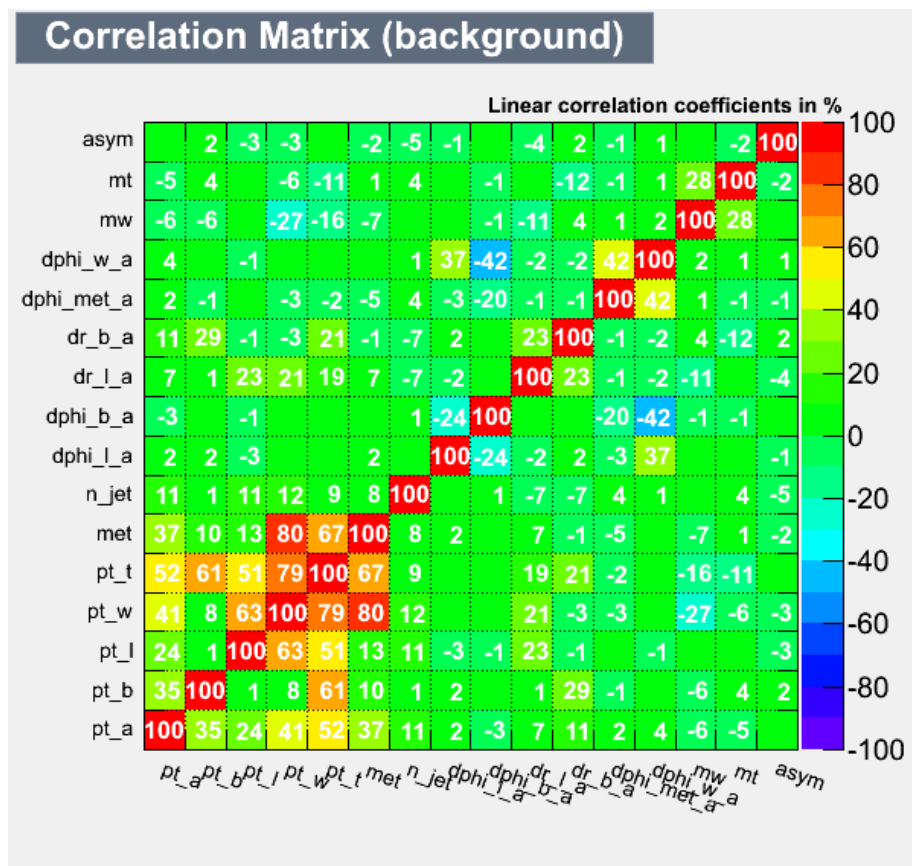
But the dominant one are there!

# Single top & hard photon

## MVA: toward a list of variables

First attempt (Kappa\_act)

- # jets
- Photon PT
- Lepton PT
- B PT
- Top PT
- W PT
- Charge asymmetry
- Top MT
- W MT
- DeltaR between b and photon
- DeltaR between lepton and photon
- DeltaPhi between b and photon
- DeltaPhi between lepton and photon
- DeltaPhi between MET and photon
- DeltaPhi between W and photon



Remove less useful and strongly correlated variables: W PT & MET

# Single top & hard photon

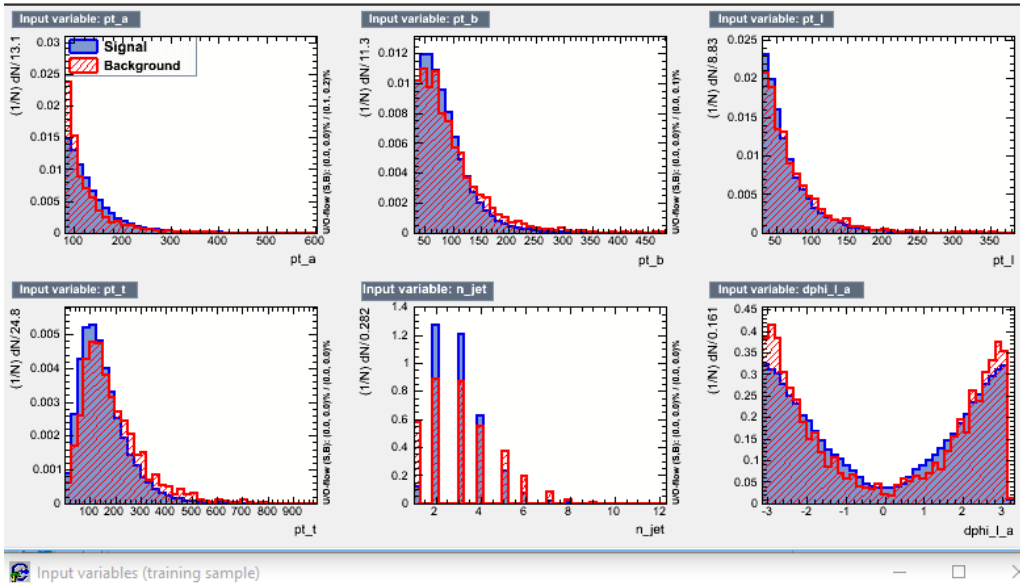
MVA : Kappa\_aut

```
--- BDT : -----  
--- BDT : Rank : Variable : Variable Importance  
--- BDT : -----  
--- BDT : 1 : pt_a : 1.183e-01  
--- BDT : 2 : n_jet : 1.156e-01  
--- BDT : 3 : mt : 8.950e-02  
--- BDT : 4 : dr_b_a : 8.134e-02  
--- BDT : 5 : mw : 7.516e-02  
--- BDT : 6 : dphi_w_a : 7.461e-02  
--- BDT : 7 : pt_t : 7.396e-02  
--- BDT : 8 : dr_l_a : 6.357e-02  
--- BDT : 9 : dphi_b_a : 5.685e-02  
--- BDT : 10 : asym : 5.558e-02  
--- BDT : 11 : dphi_met_a : 5.379e-02  
--- BDT : 12 : pt_b : 4.937e-02  
--- BDT : 13 : dphi_l_a : 4.707e-02  
--- BDT : 14 : pt_l : 4.534e-02  
--- BDT : -----
```

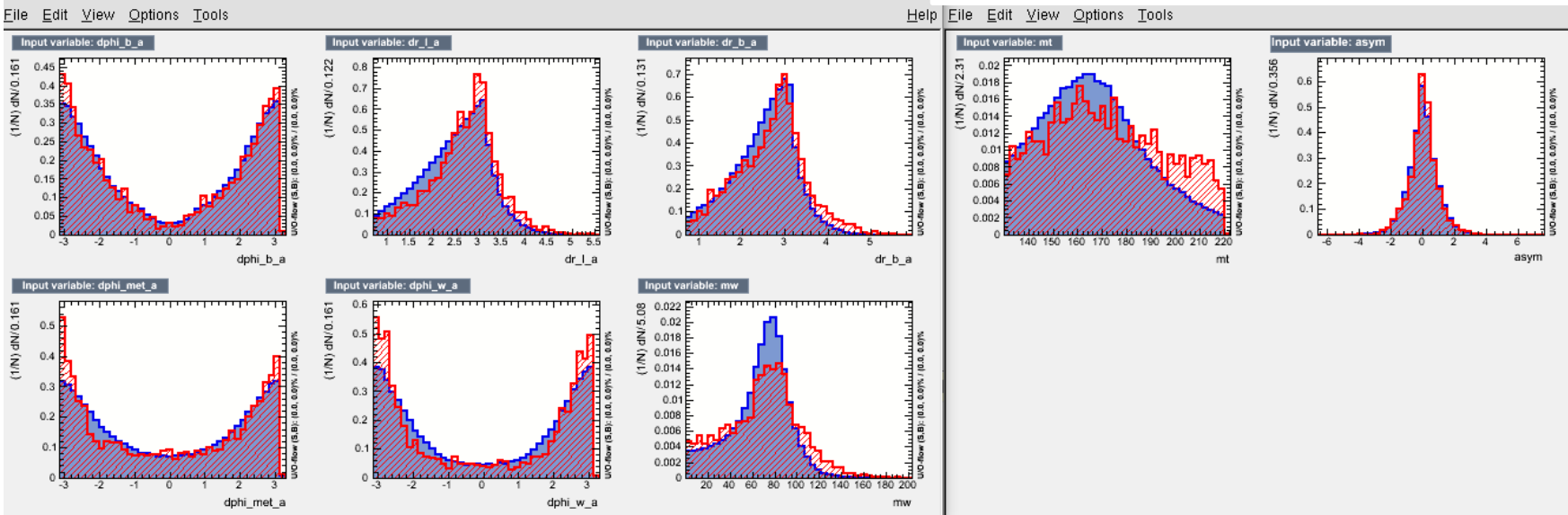
Reliable variable?



# Single top & hard photon



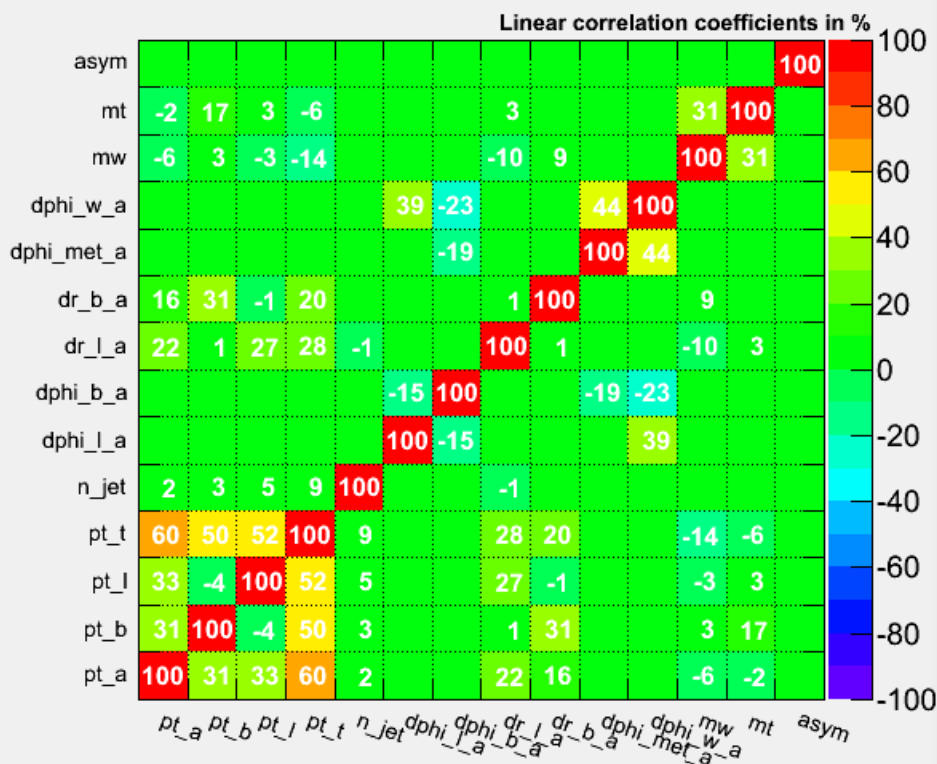
MVA : Kappa\_aut



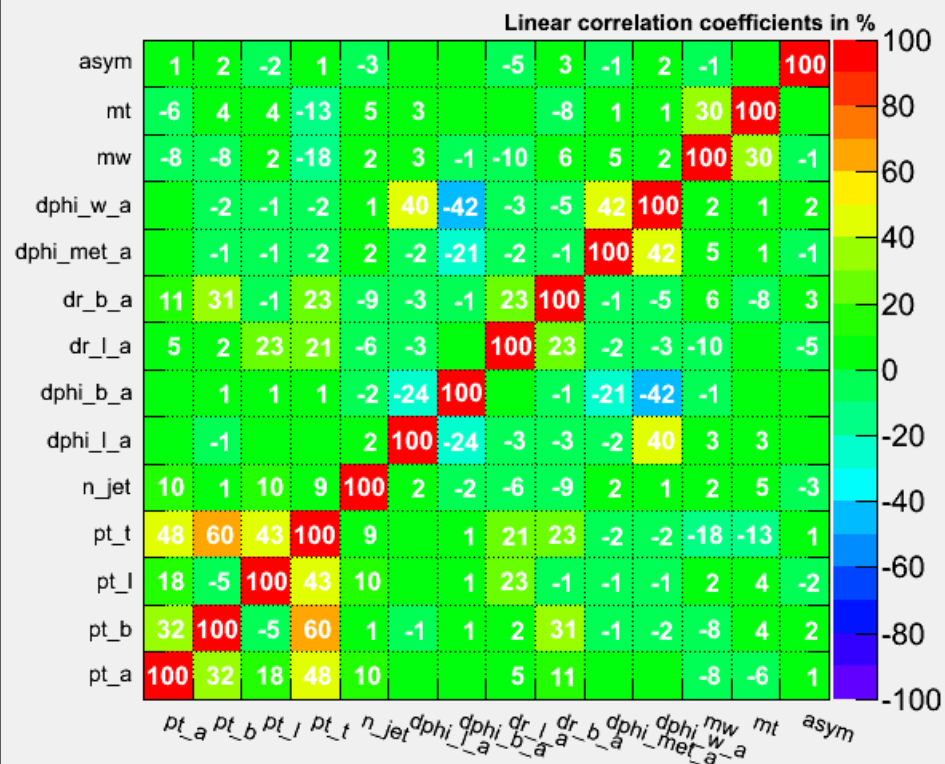
# Single top & hard photon

MVA : Kappa\_aut

## Correlation Matrix (signal)

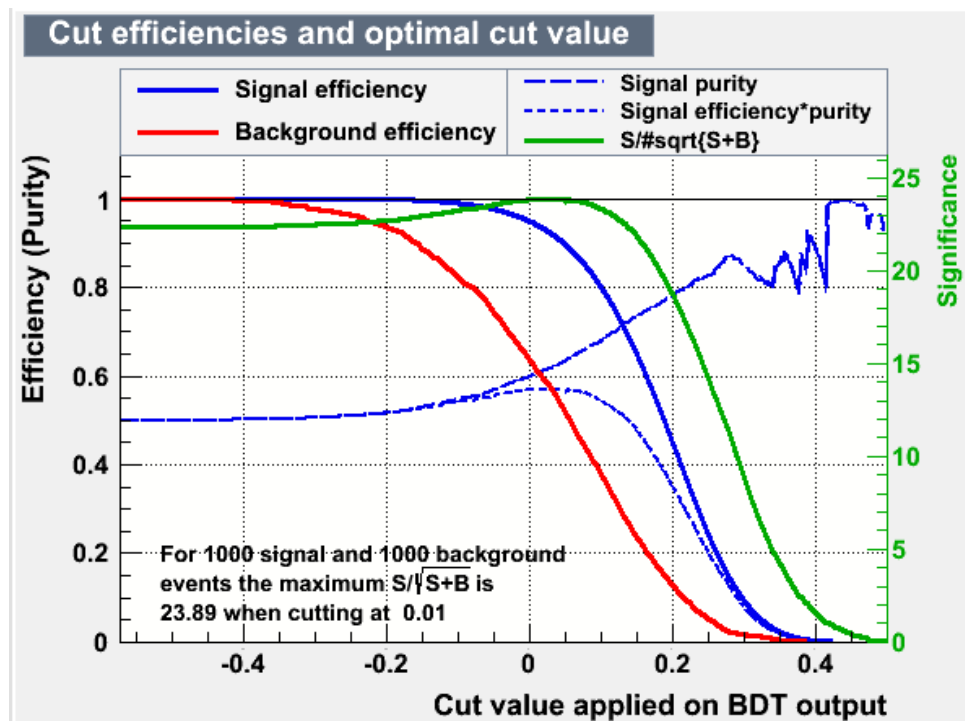
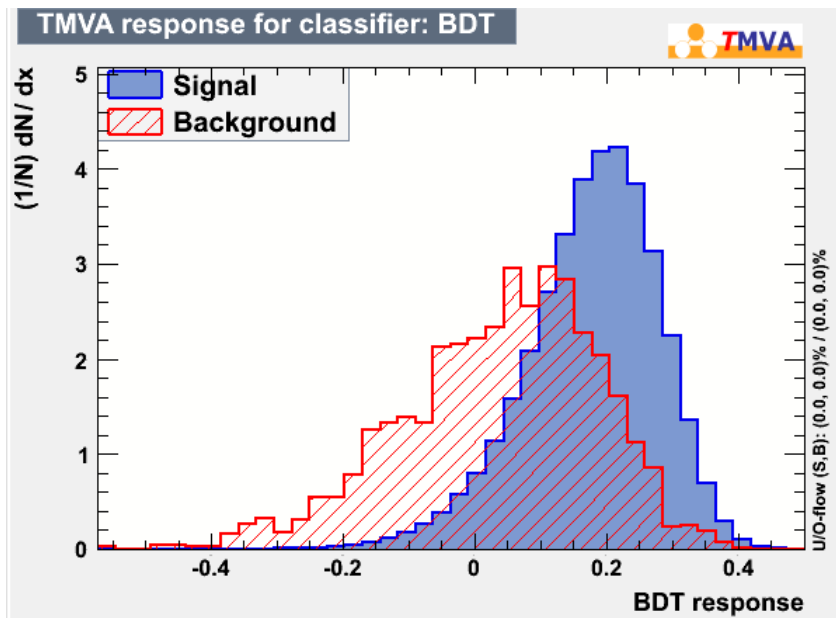


## Correlation Matrix (background)



# Single top & hard photon

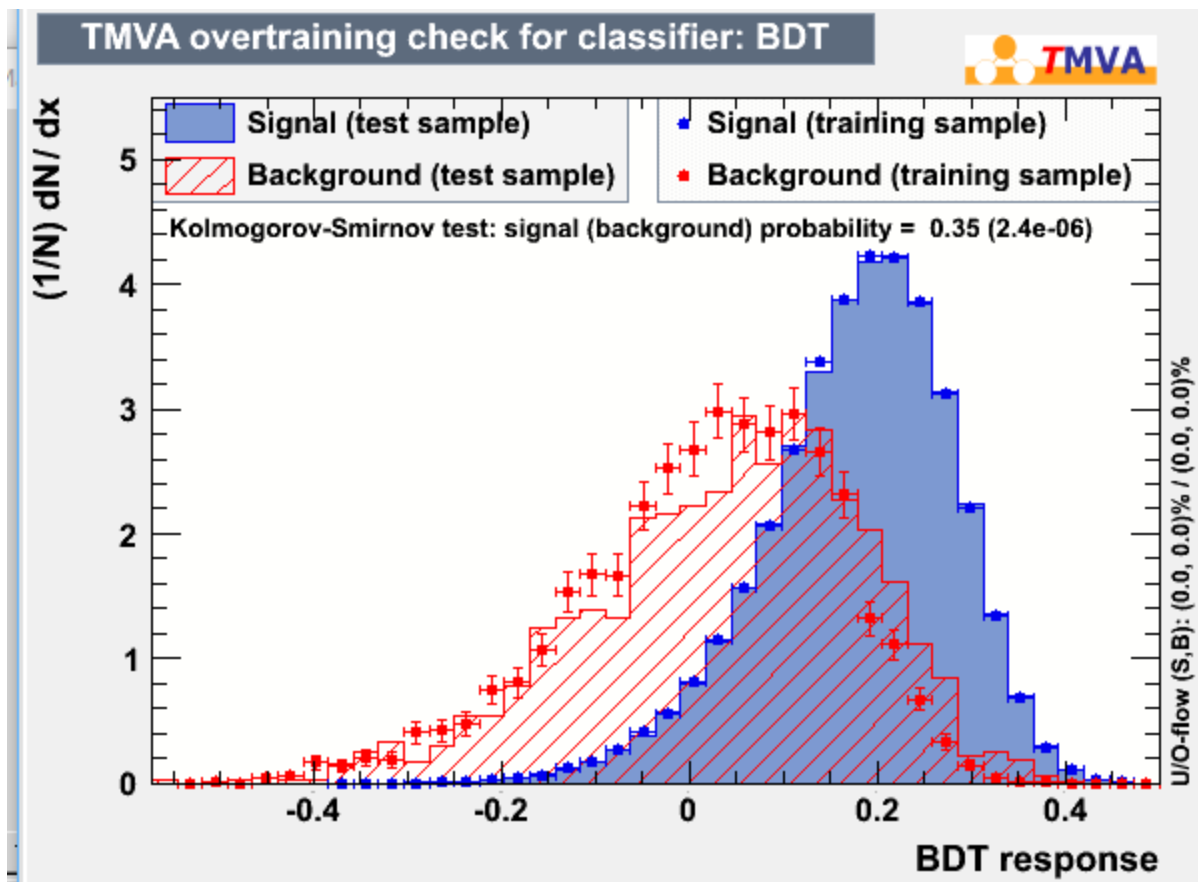
MVA : Kappa\_aut





# Single top & hard photon

MVA : Kappa\_aut



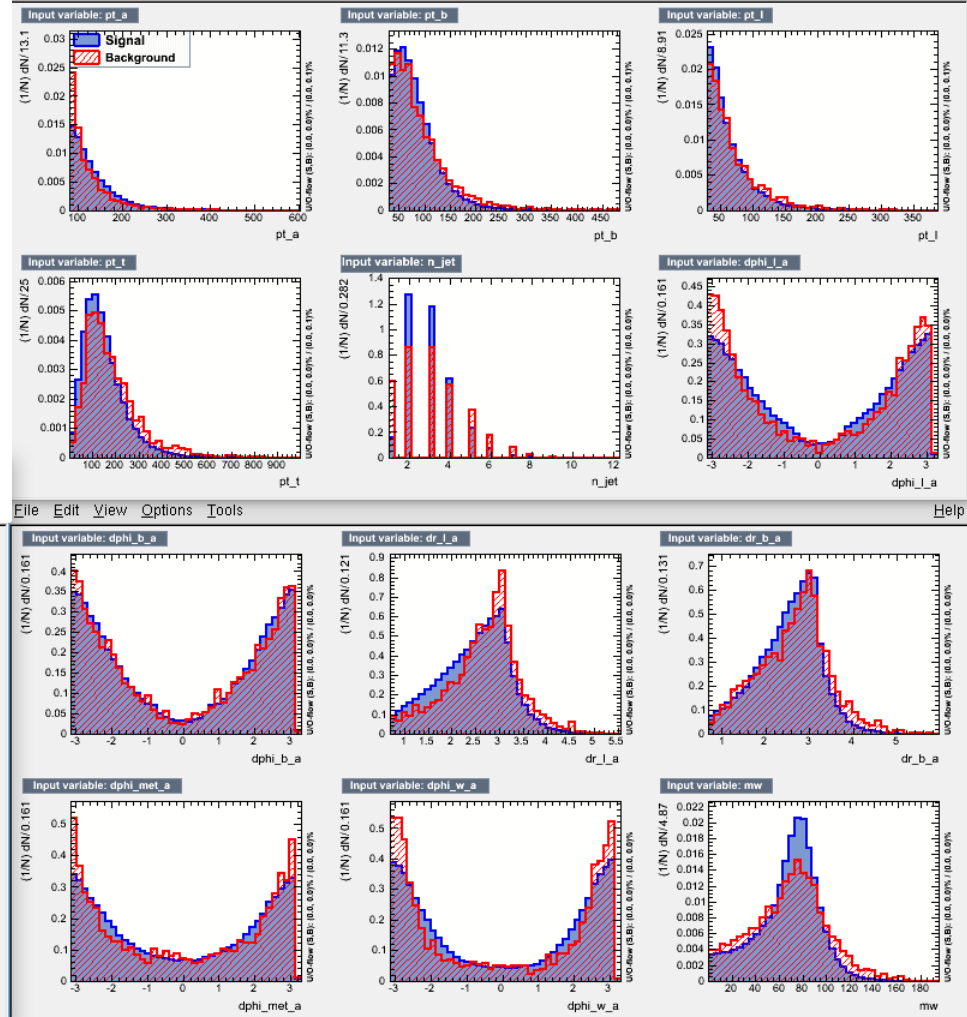
# Single top & hard photon

## MVA : Kappa\_act

- --- Factory : Ranking input variables (method specific)...
- --- BDT : Ranking result (top variable is best ranked)
- --- BDT : -----
- --- BDT : Rank : Variable : Variable Importance
- --- BDT : -----
- --- BDT : 1 : n\_jet : 1.342e-01
- --- BDT : 2 : pt\_a : 1.157e-01
- --- BDT : 3 : pt\_t : 8.961e-02
- --- BDT : 4 : dr\_b\_a : 8.264e-02
- --- BDT : 5 : mw : 7.964e-02
- --- BDT : 6 : dr\_l\_a : 6.603e-02
- --- BDT : 7 : dphi\_w\_a : 6.290e-02
- --- BDT : 8 : mt : 6.288e-02
- --- BDT : 9 : dphi\_met\_a : 6.063e-02
- --- BDT : 10 : dphi\_b\_a : 6.016e-02
- --- BDT : 11 : pt\_l : 5.790e-02
- --- BDT : 12 : pt\_b : 4.826e-02
- --- BDT : 13 : asym : 4.385e-02
- --- BDT : 14 : dphi\_l\_a : 3.554e-02
- --- BDT : -----

# Single top & hard photon

MVA : Kappa\_act

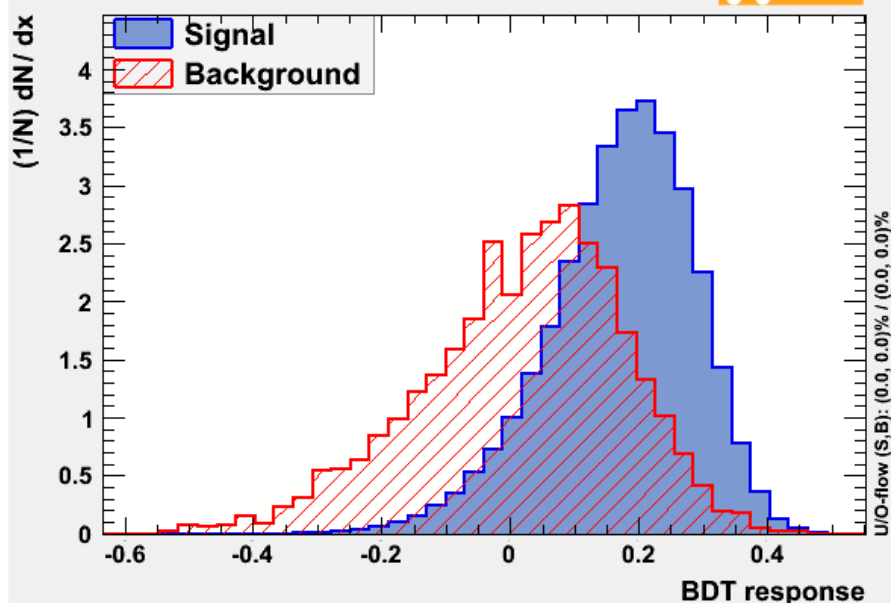




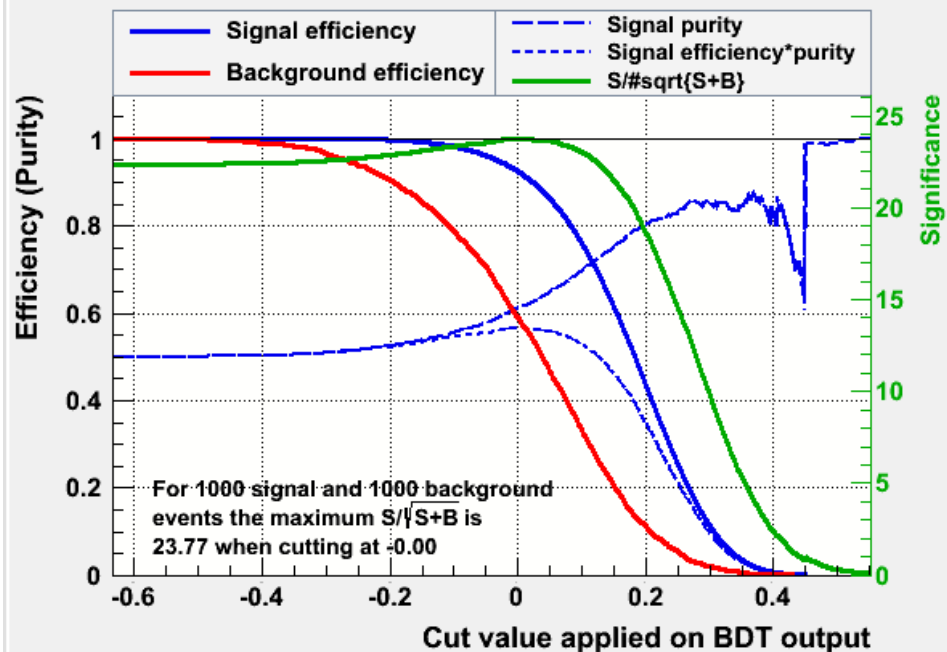
# Single top & hard photon

MVA : Kappa\_act

TMVA response for classifier: BDT

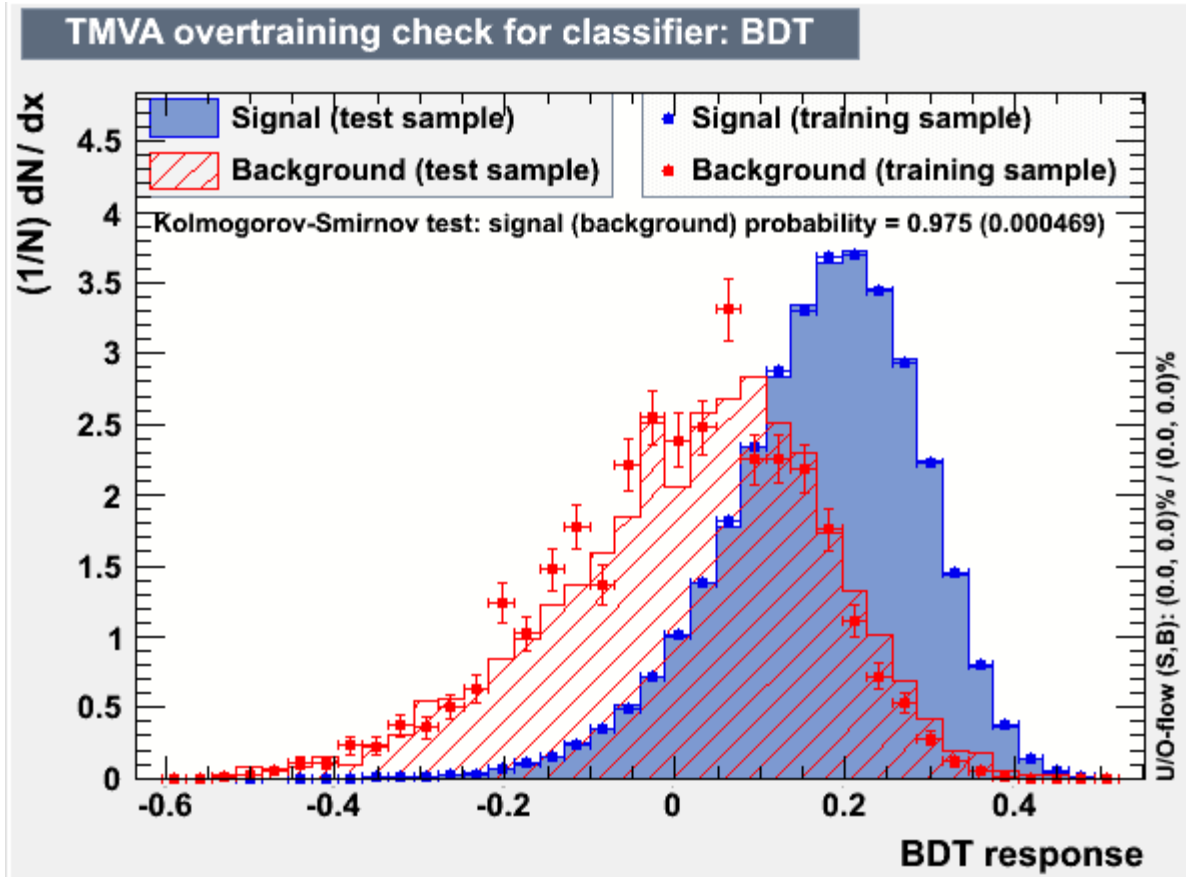


Cut efficiencies and optimal cut value



# Single top & hard photon

MVA : Kappa\_act



Overtraining?

## What remains to do since the last meeting:

- Fix the problem of normalization: **OK**
- Some photon background sources are underestimated: **not yet**
- Cross-check and understanding of photon isolation: **not yet**
- Implementing TMVA: **OK**
- Exclusion limit plot for
  - Cut-and-count analysis: **not yet**
  - MVA analysis: **not yet**