Weekly Report

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November 9.2020

Signal leakage

- Some of the events may fail 3l channel but satisfy 2l channel
- Remove the third lepton how many signal would pass 2lss criterion

3l selection

Preselection

- Trilepton type
- Total charge $= \pm 1$
- Single, di-lepton trigger && event trigger match
- Lepton Loose Quality:
  - **ID:** isLoose or isLooseLH
  - **Isolation:** FCLoose(electron) or PflowLoose(Muon)
  - $p_T^{\ell_0} > 10\ \text{GeV}\ \ \&\&\ p_T^{\ell_1} > 15\ \text{GeV}\ \ \&\&\ p_T^{\ell_2} > 15\ \text{GeV}$
- **Tau Veto:** # of taus through RNN =0
- **charged BDT Loose && Ambiguity Type Cut** (require good quality electron and suppress photon)
- **b jets veto:** # of b-jets = 0
- **Jet multiplicity:** # of jets >= 1
- **Lepton Tight Quality:** the SS pair should pass tight quality, no requirement for the opposite sign
- **Low Mass Veto:** the invariant mass of any SFOS pair should be larger than 12 GeV
- **Z Mass Veto:** the invariant mass of any SFOS pair should exclude Z Mass region by at least 10 GeV

3l selection

Object Definition

	Electron			Muon		
	Loose	*Tight*	*Anti-Tight*	*Loose*	*Tight*	*Anti-Tight*
p_T	$p_T > 10$ GeV			$p_T > 10$ GeV		
$\|\eta\|$	$\|\eta\| < 2.5$ && ! $(1.37 < \|\eta\| < 1.52)$			$\|\eta\| < 2.5$		
$d_0/\sigma(d_0)$	$d_0/\sigma(d_0) < 5$			$d_0/\sigma(d_0) < 3$		
$\|z_0 \sin(\theta)\|$	$\|z_0 \sin(\theta)\| < 0.5\ mm$			$\|z_0 \sin(\theta)\| < 0.5\ mm$		
ID	LooseLH	TightLH	Fail the tight quality	Loose	Tight	Fail the tight quality
Isolation	FCLoose	FCTight		PflowLoose	PflowTight	

Refer to the group twiki

Training study

- Option 1 : train HH vs diboson, but regard lepton flavor as a variable
- Option 2 : train HH vs diboson for each lepton channel:
  - ee , eu , uu

- Control
  - Option 1
    - Training sample ee_a , eu_a , uu_a
    - Test sample ee_b , eu_b , uu_b
  - Option 2
    - Training sample ee_a+eu_a+uu_a
    - Test sample ee_b+eu_b+uu_b
  - In this case training and testing events are not mixed

Training study

- In principle the lepton flavor information has been labeled, there should be big difference.
  - Some pro & cons
    - Option 1 : certain classify on lepton flavor, smaller error on the model
    - Option 2 : more statistics, and corr

- However this example may not good enough to demonstrate
  - Lepton flavor isn't sensitive for HH vs diboson
  - Also the distribution not vary a lot for different option

-->The models Look almost same

```
 1 : n_mindR_l1j       : 1.369e-01
 2 : m_l2j             : 1.277e-01
 3 : n_mindR_l2j       : 1.120e-01
 4 : m_ll              : 4.577e-02
 5 : Mt_nojets         : 3.864e-02
 6 : m_all             : 3.559e-02
 7 : eta_sublepton     : 3.457e-02
 8 : eta_leadinglepton : 2.915e-02
 9 : n_MET             : 1.176e-02
10 : channel           : 1.712e-03
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```
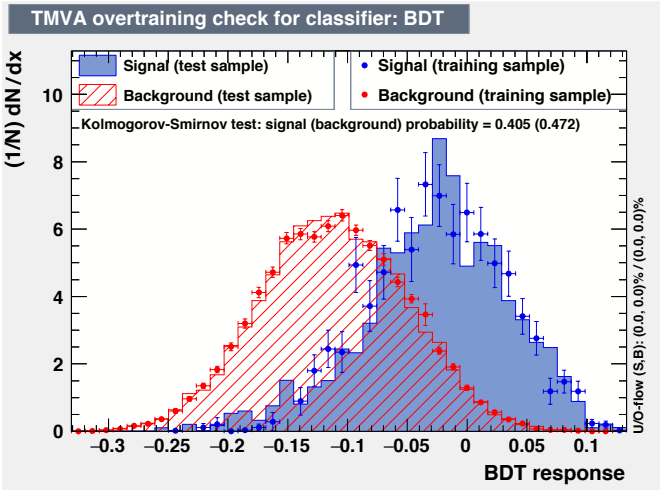
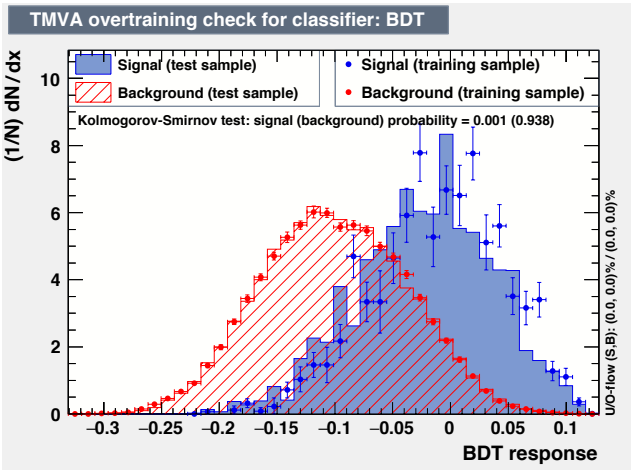
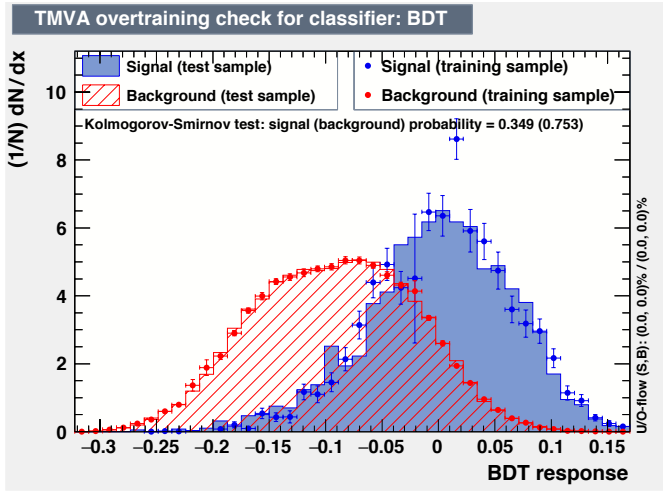

BDT distribution



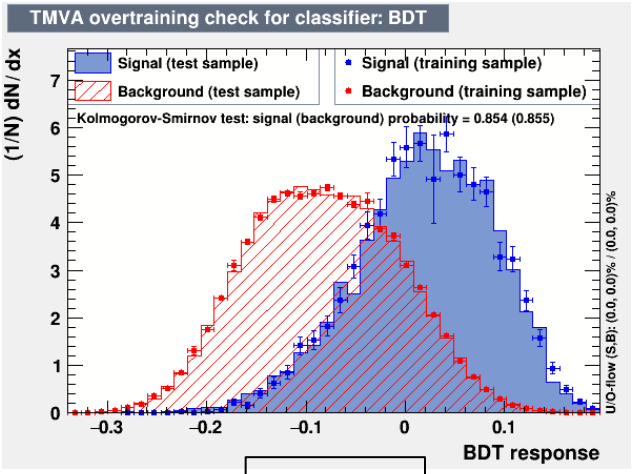
ee



uu



eu



ee

❖ yields

Option 1	ee	eu	uu	total
hh	0.117	0.401	0.203	0.721
diboson	90.466	389.923	165.967	646.356
significance				0.0283

Option 2	total
hh	0.734
diboson	653.537
significance	0.0287