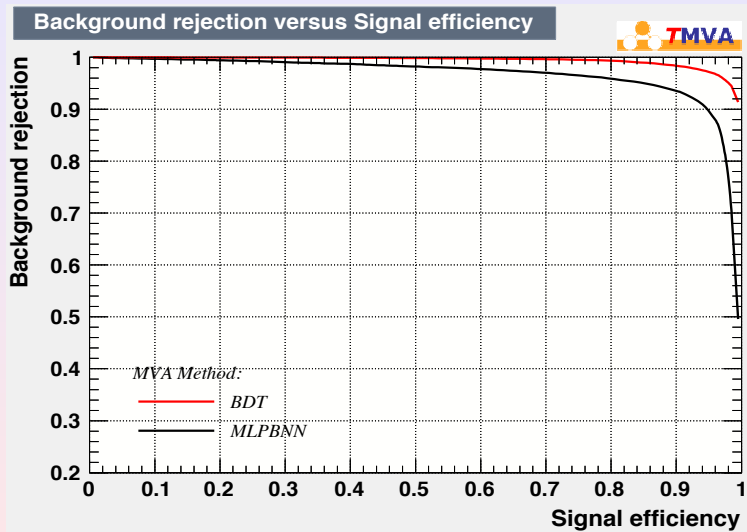


The MVA Method for The Heavy Higgs Signal via Two B-jets plus Di-photon and Background

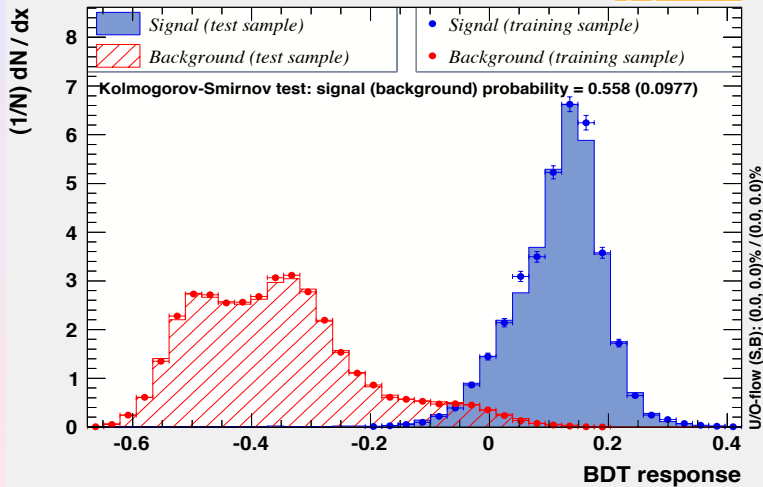
Chun Du

2014.04.02

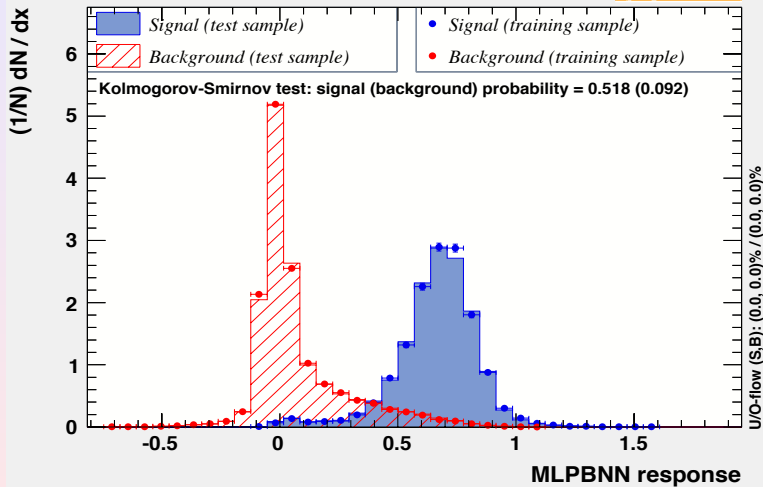
- Choose events with number of bjet ≥ 2 , number of photon ≥ 2 .
- 2HDM $H \rightarrow hh \rightarrow bb\gamma\gamma$ signal events for training: 10483; for testing: 10545, $m_H = 300\text{GeV}$.
- SM process $bb\gamma\gamma$ background events for training: 48914; for testing: 46427.
- Basic cuts: $|\eta_{b,\gamma}| \leq 2.5$, $PT_{b,\gamma} \geq 25\text{GeV}$.
- Input variables: $m_{\gamma\gamma}$, m_{bb} , $m_{bb\gamma\gamma}$, $PT_{\gamma,leading}$, $PT_{\gamma,sub-leading}$, $PT_{b,leading}$, $PT_{b,sub-leading}$, $\sum_b PT$, $\sum_{b,\gamma} PT$, ΔR_{bb} , $\Delta R_{\gamma\gamma}$, $\Delta R_{b_1\gamma_1}$, $\Delta R_{b_1\gamma_2}$, $\Delta R_{b_2\gamma_1}$, $\Delta R_{b_2\gamma_2}$.



TMVA overtraining check for classifier: BDT



TMVA overtraining check for classifier: MLPBNN

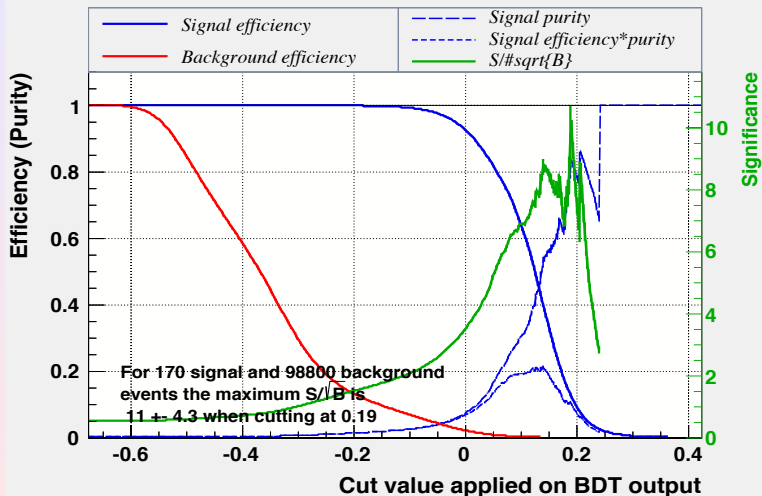


Cuts	σ_{total}	$b\bar{b}\gamma\gamma$ selection	p_T sum	$(m_{b\bar{b}}, m_{\gamma\gamma})$	$m_{b\bar{b}\gamma\gamma}$
$H(300 \text{ GeV}) \rightarrow b\bar{b}\gamma\gamma$ [fb]	1	0.17	0.13	0.06	0.06
$b\bar{b}\gamma\gamma$ [fb]	6.729×10^3	98.8	44.4	0.28	0.12
$t\bar{t}\gamma\gamma$ [fb]	11.5	0.51	0.45	2.4×10^{-3}	7.5×10^{-4}
S/B	1.6×10^{-4}	1.8×10^{-3}	3.0×10^{-3}	0.21	0.50
$S/\sqrt{B}$	0.40	0.55	0.63	3.57	5.5

TABLE III: The event cut efficiency for the LHC 14 TeV run of the signal and background processes, where both irreducible and reducible background processes are taken into account. We impose the cuts of $b\bar{b}\gamma\gamma$ selections (21), the optimal p_T sum cuts as given in Fig. 6, the invariant mass cuts of (23) and (24). The cut efficiency of $S/\sqrt{B}$ is estimated for the integrate luminosity of $\int \mathcal{L} dt = 1000 \text{ fb}^{-1}$.

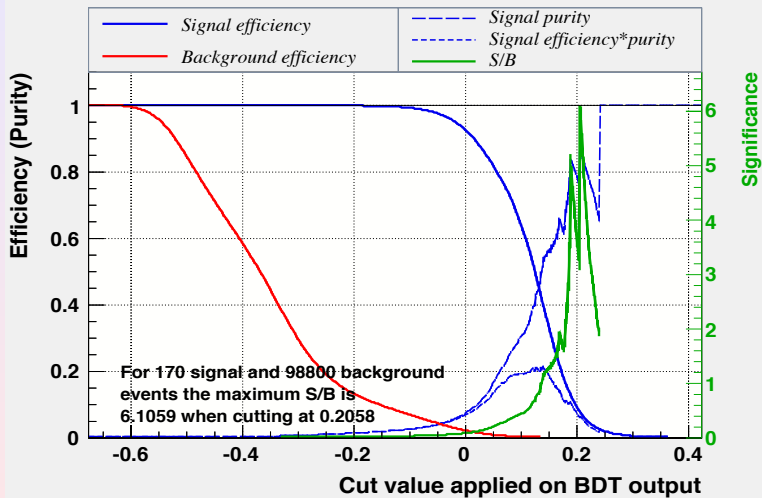
Cut efficiencies for BDT

Cut efficiencies and optimal cut value

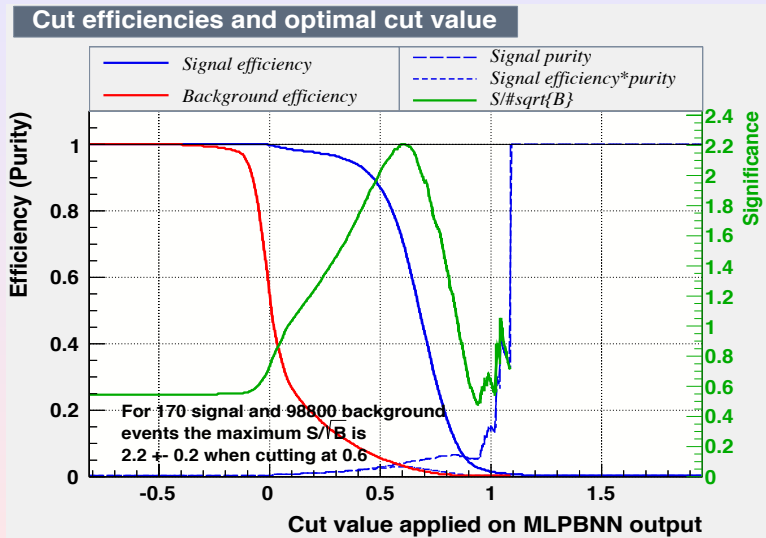


Cut efficiencies for BDT

Cut efficiencies and optimal cut value



Cut efficiencies for MLPBNN



Cut efficiencies for MLPBNN

Cut efficiencies and optimal cut value

