BDT update

02/12/2024

Method

Approach 1

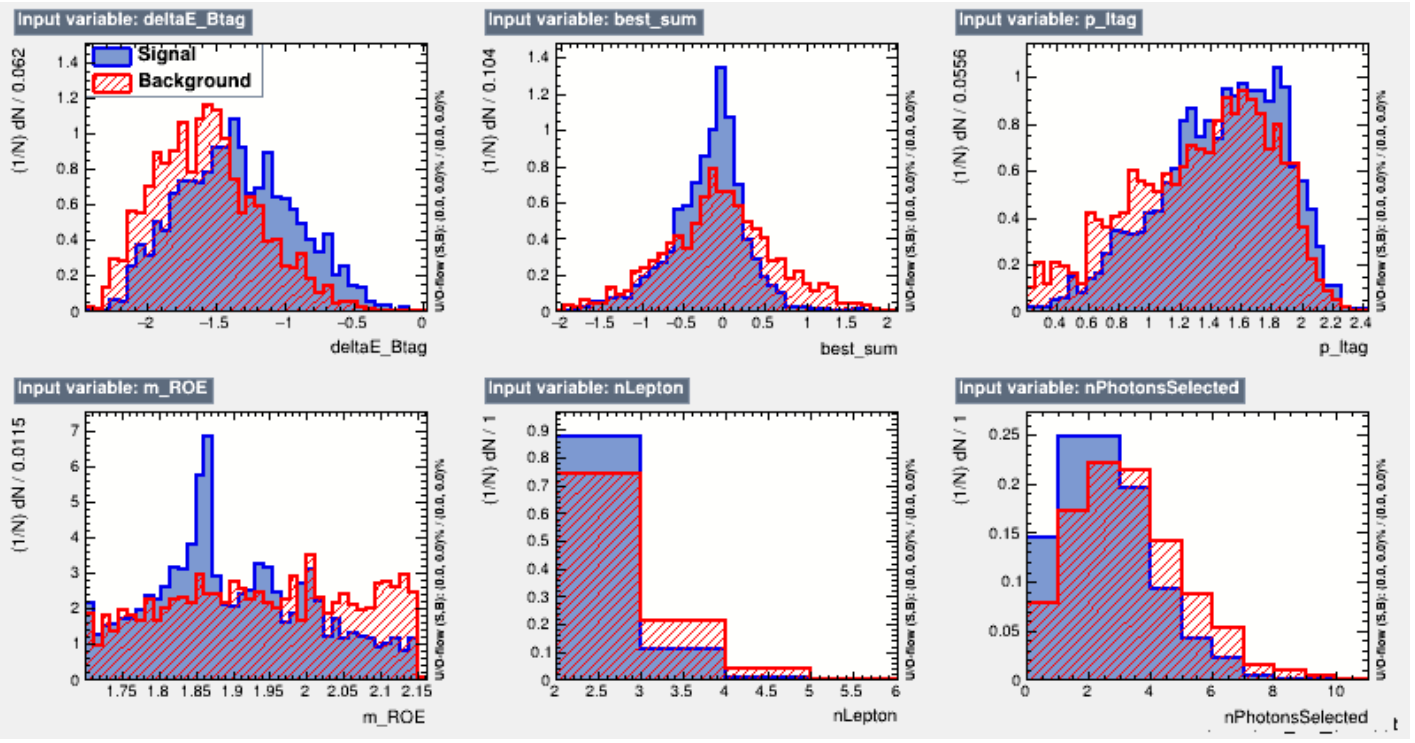
- Training and testing on 1M $\tau \rightarrow \pi$ sample.
- Applying on the 8.9 M $\tau \rightarrow$ generic signal and three stream of MC.
- Estimated the N_{sig} and N_{bg}.

Approach 2

- Training and testing on 8.9M $\tau \rightarrow$ generic sample.
- Applying on the 4.4 M $\tau \rightarrow$ generic signal and three stream of MC.
- Estimated the N_{sig} and N_{bg}.

Approach 1

- Training and testing on 1M $\tau \to \pi$ sample.
- Applying on the 8.9 M $\tau \to$ generic signal and one stream of MC.
- Estimated the N_{sig} and N_{bg}.



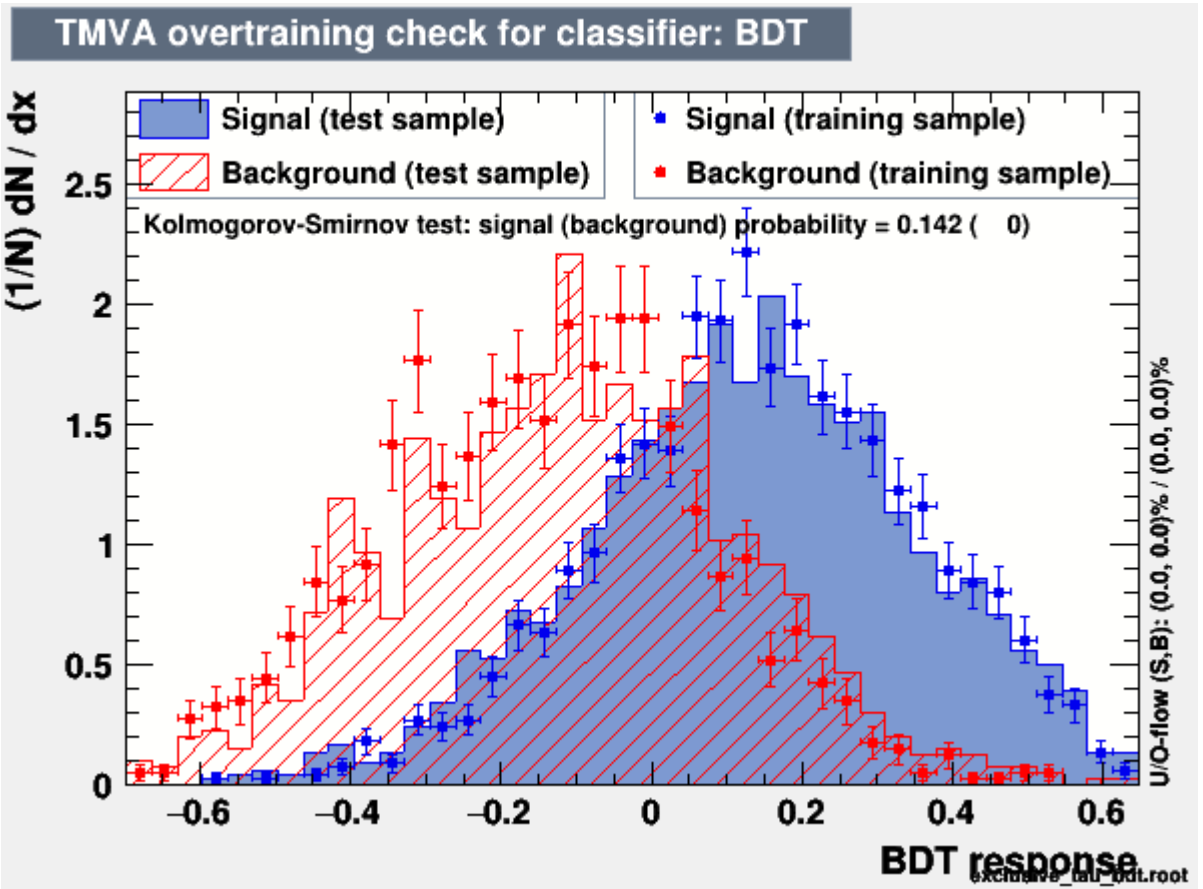
Var. importance

```
Ranking result (top variable is best ranked)
-------------------------------------------------
Rank : Variable         : Variable Importance
-------------------------------------------------
   1 : best_sum         : 3.626e-01
   2 : m_ROE            : 1.879e-01
   3 : deltaE_Btag      : 1.829e-01
   4 : p_ltag           : 1.395e-01
   5 : nPhotonsSelected : 6.620e-02
   6 : nLepton          : 6.089e-02
```

Approach 1

- Training and testing on 1M $\tau \rightarrow \pi$ sample.
- Applying on the 8.9 M $\tau \rightarrow$ generic signal and one stream of MC.
- Estimated the N_{sig} and N_{bg}.

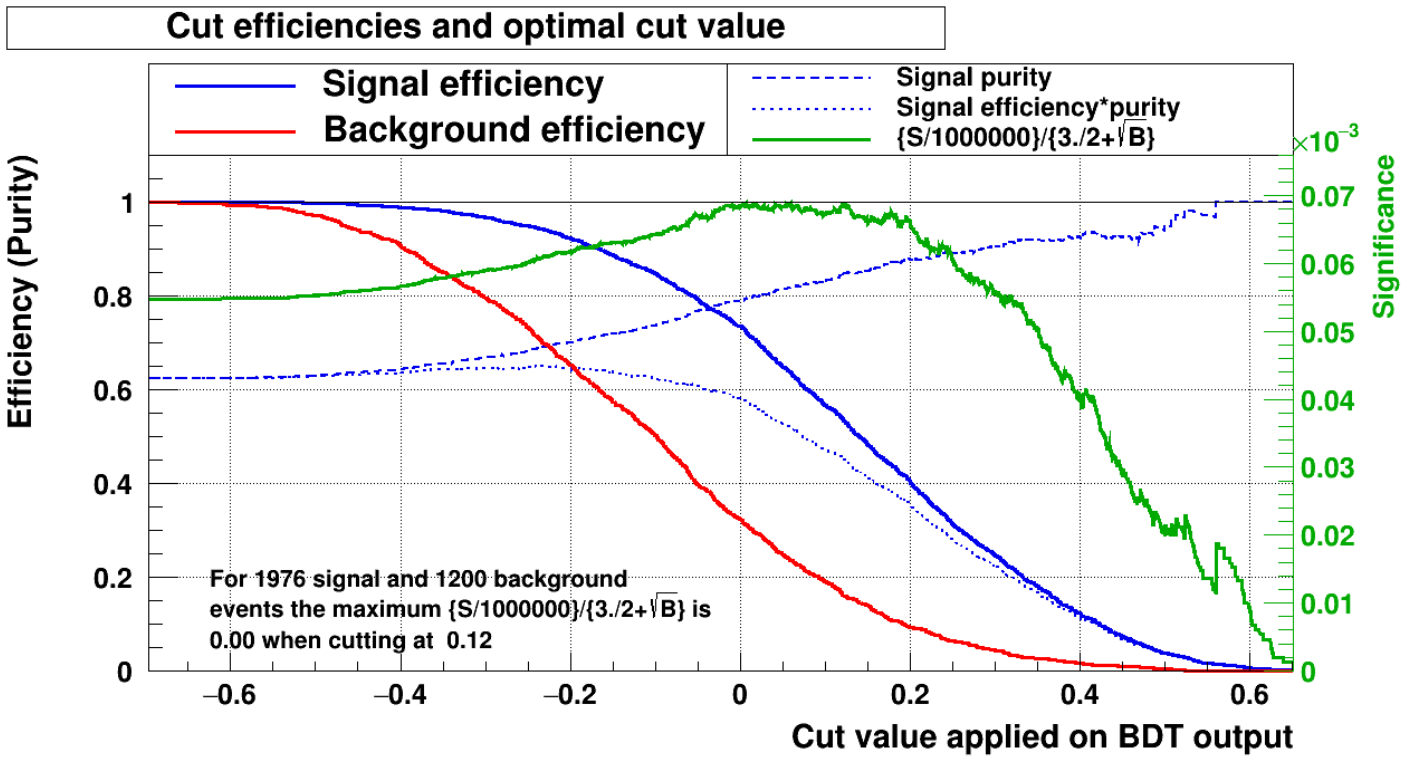
BDT response



Approach 1

- Training and testing on 1M $\tau \to \pi$ sample.
- Applying on the 8.9 M $\tau \to$ generic signal and one stream of MC.
- Estimated the N_{sig} and N_{bg}.

Ponzi FOM



BDT optimal cut

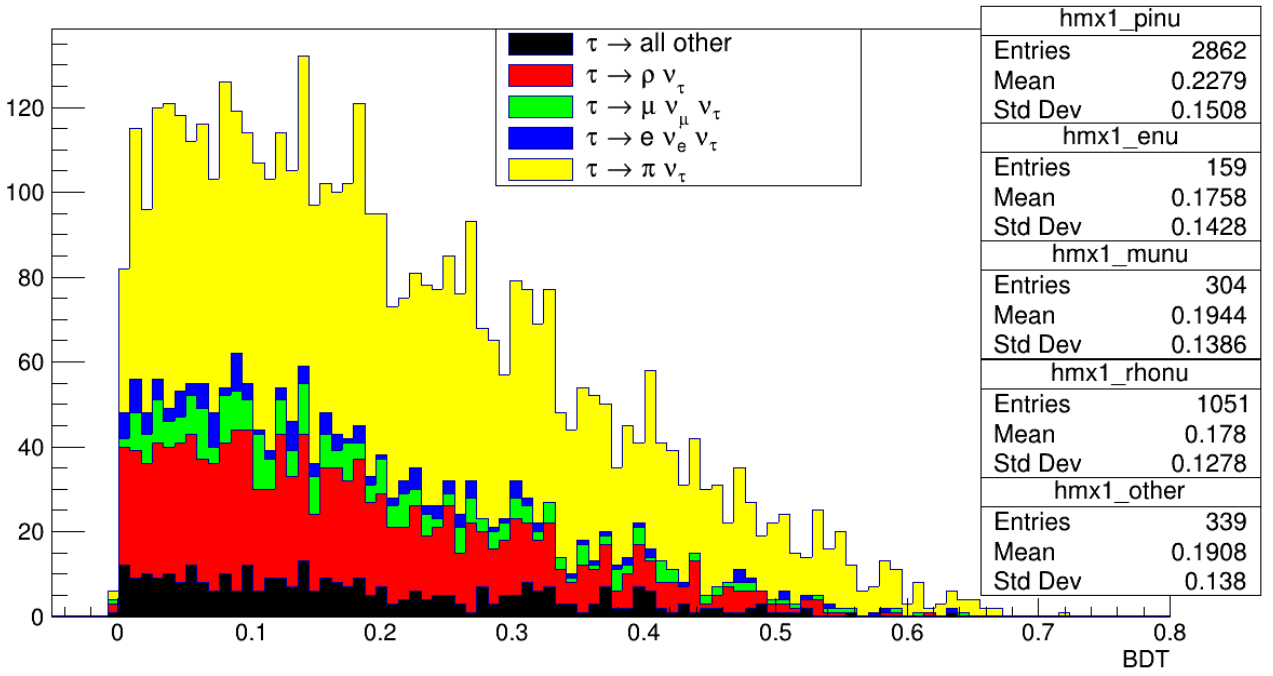
BDT > 0

Approach 1

- Training and testing on 1M $\tau \rightarrow \pi$ sample.
- Applying on the 8.9 M $\tau \rightarrow$ generic signal and one stream of MC.
- Estimated the N_{sig} and N_{bg}.

N_{pi}	2862	1
N_{e}	159	0.05
N_{mu}	304	0.10
N_{rho}	1051	0.37
N_{others}	339	0.12

BDT score

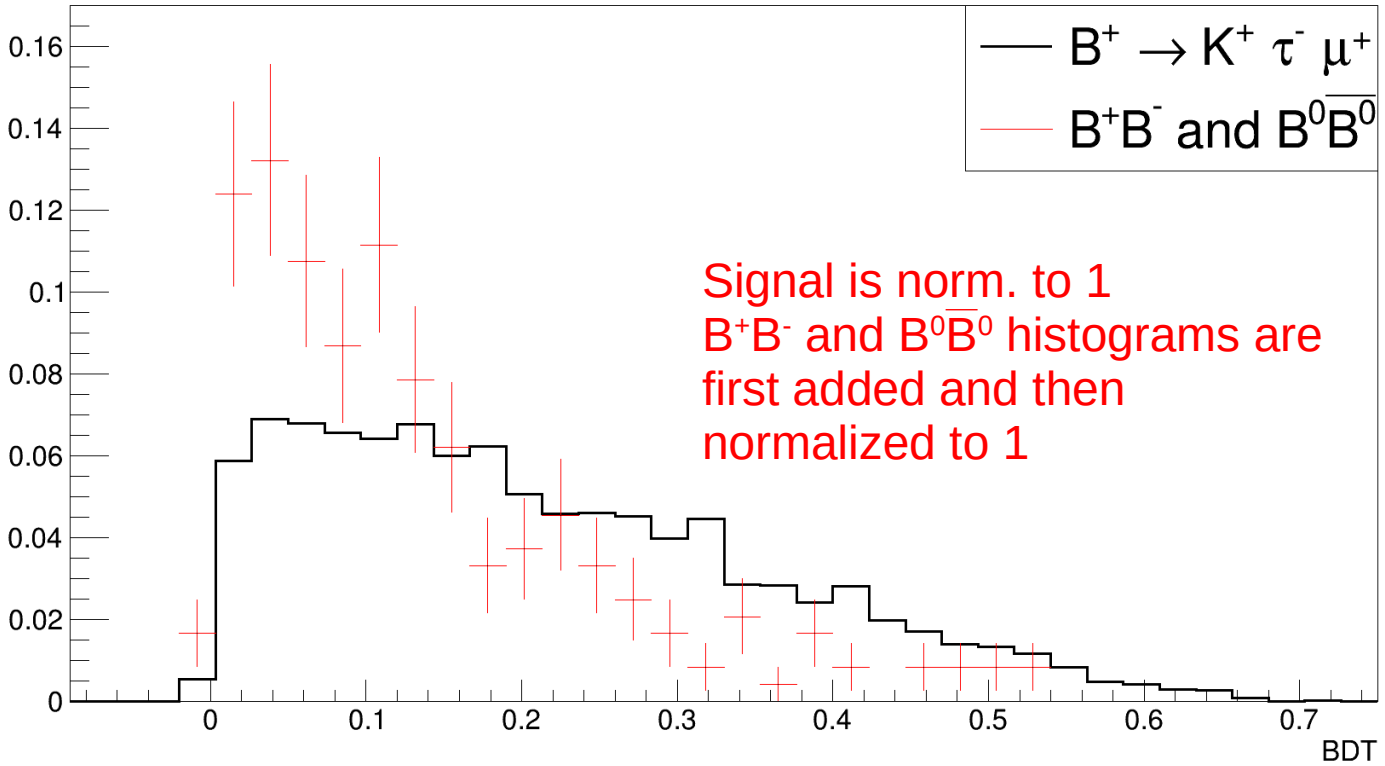


For 5×10^{-5} BF

$N_{sig} = 41$ & $N_{sig} = 25$ (for only pi mode)

Approach 1

Background calculation

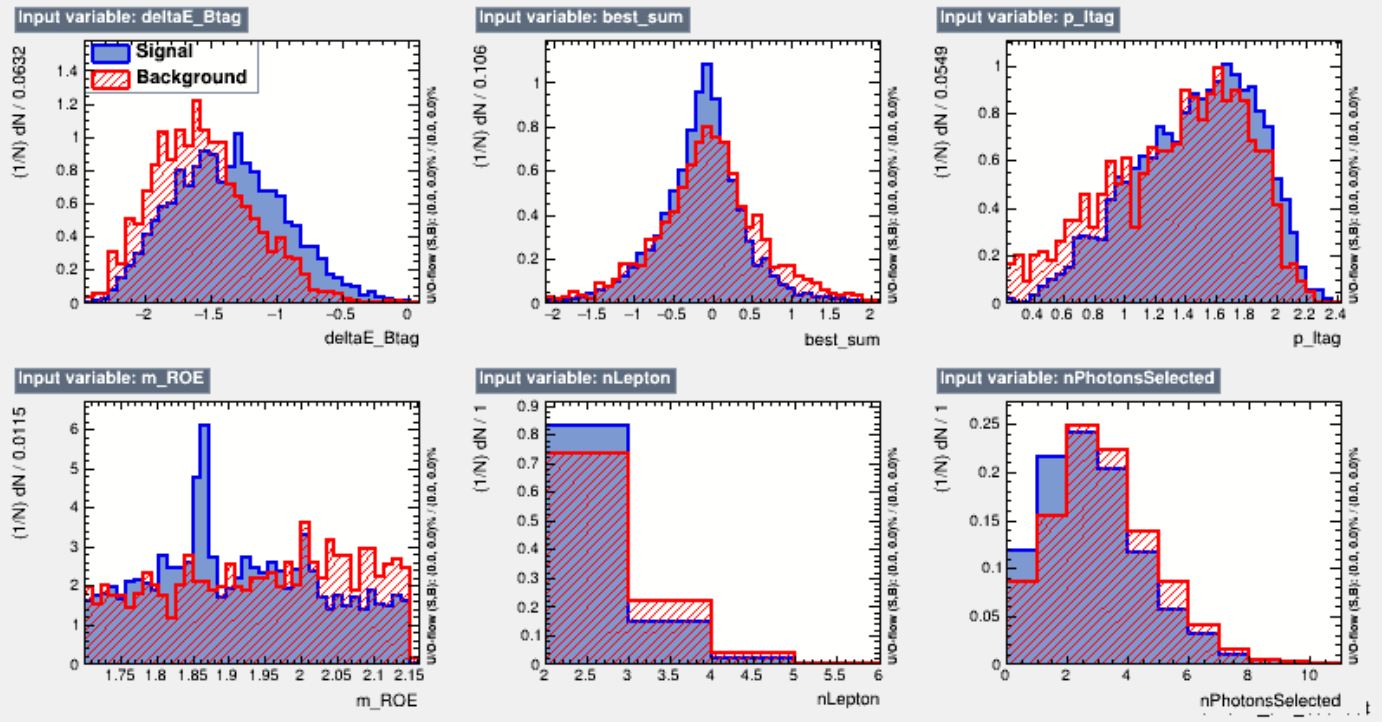


N_{B+B-} = 161

N_{B0B0} = 81

Approach 2

- Training and testing on 8.9M $\tau \rightarrow$ generic sample
- Applying on the 4.4 M $\tau \rightarrow$ generic signal and three stream of MC.
- Estimated the N_{sig} and N_{bg}.



Var. importance

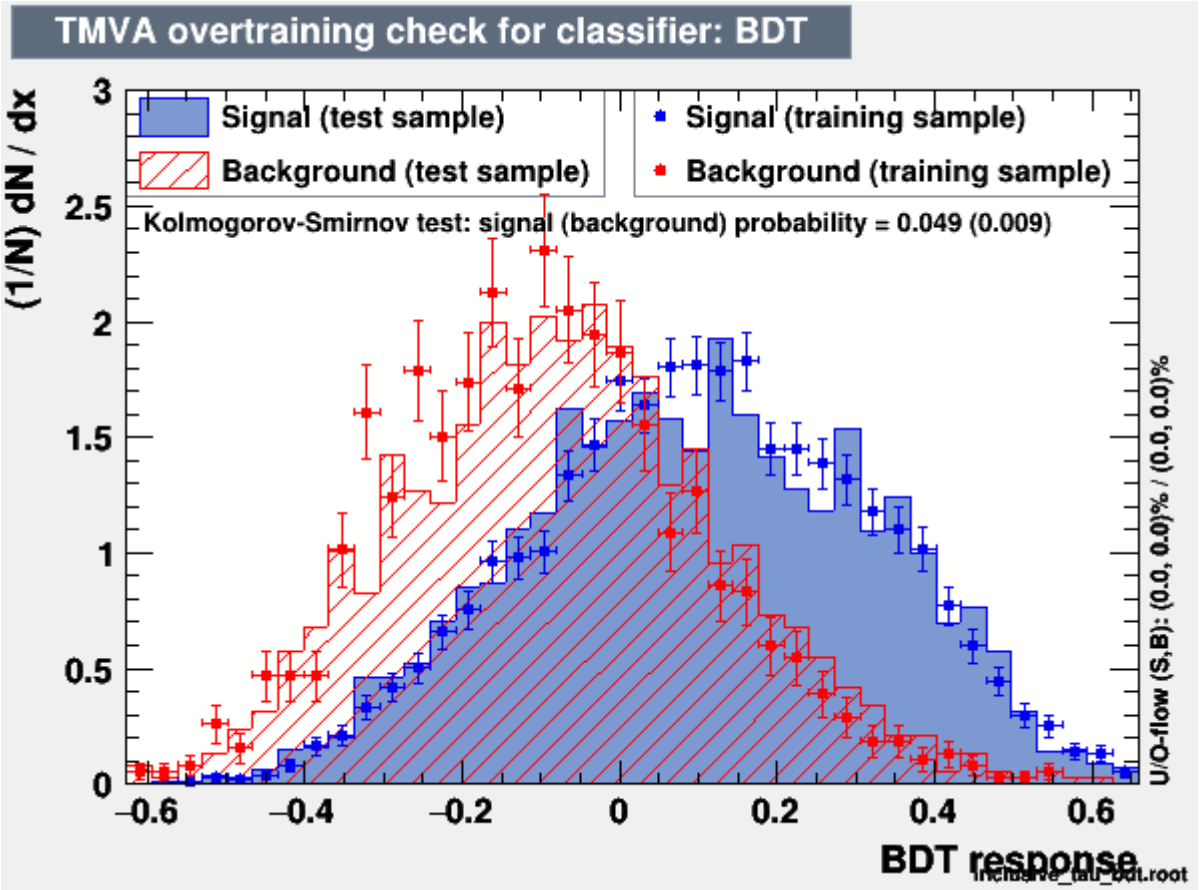
```
--------------------------------------------------
Rank : Variable         : Variable Importance
--------------------------------------------------
   1 : deltaE_Btag      : 2.559e-01
   2 : m_ROE            : 2.007e-01
   3 : p_ltag           : 1.972e-01
   4 : best_sum         : 1.819e-01
   5 : nPhotonsSelected : 8.310e-02
   6 : nLepton          : 8.123e-02
--------------------------------------------------
```

Approach 2

- Training and testing on 8.9M $\tau \rightarrow$ generic sample
- Applying on the 4.4 M $\tau \rightarrow$ generic signal and three stream of MC.
- Estimated the N_{sig} and N_{bg}.

MaxDepth=3 to MaxDepth=2

BDT response



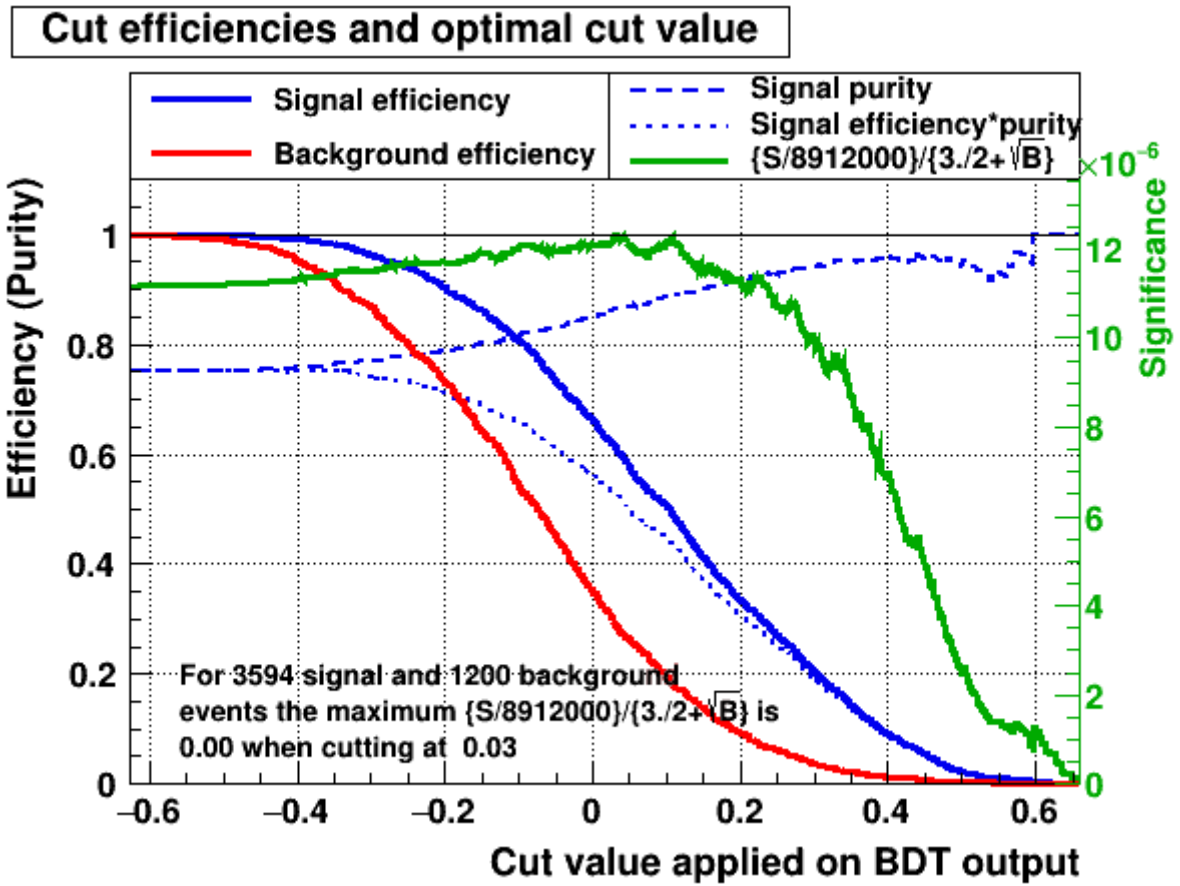
Approach 2

- Training and testing on 8.9M $\tau \rightarrow$ generic sample
- Applying on the 4.4 M $\tau \rightarrow$ generic signal and three stream of MC.
- Estimated the N_{sig} and N_{bg}.

BDT optimal cut

BDT > 0.03

Ponzi FOM

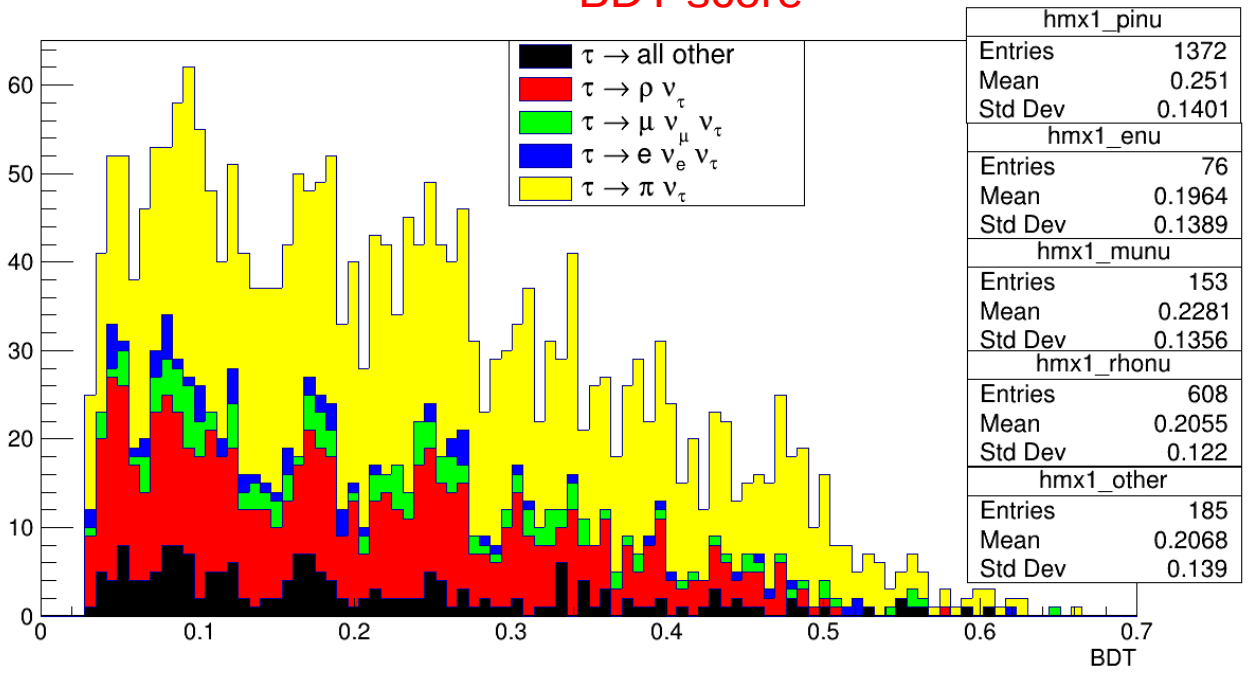


Approach 2

- Training and testing on 8.9M $\tau \rightarrow$ generic sample
- Applying on the 4.4 M $\tau \rightarrow$ generic signal and three stream of MC.
- Estimated the N_{sig} and N_{bg}.

N_{pi}	1372	1
N_{e}	76	0.05
N_{mu}	153	0.11
N_{rho}	608	0.44
N_{others}	185	0.13

BDT score

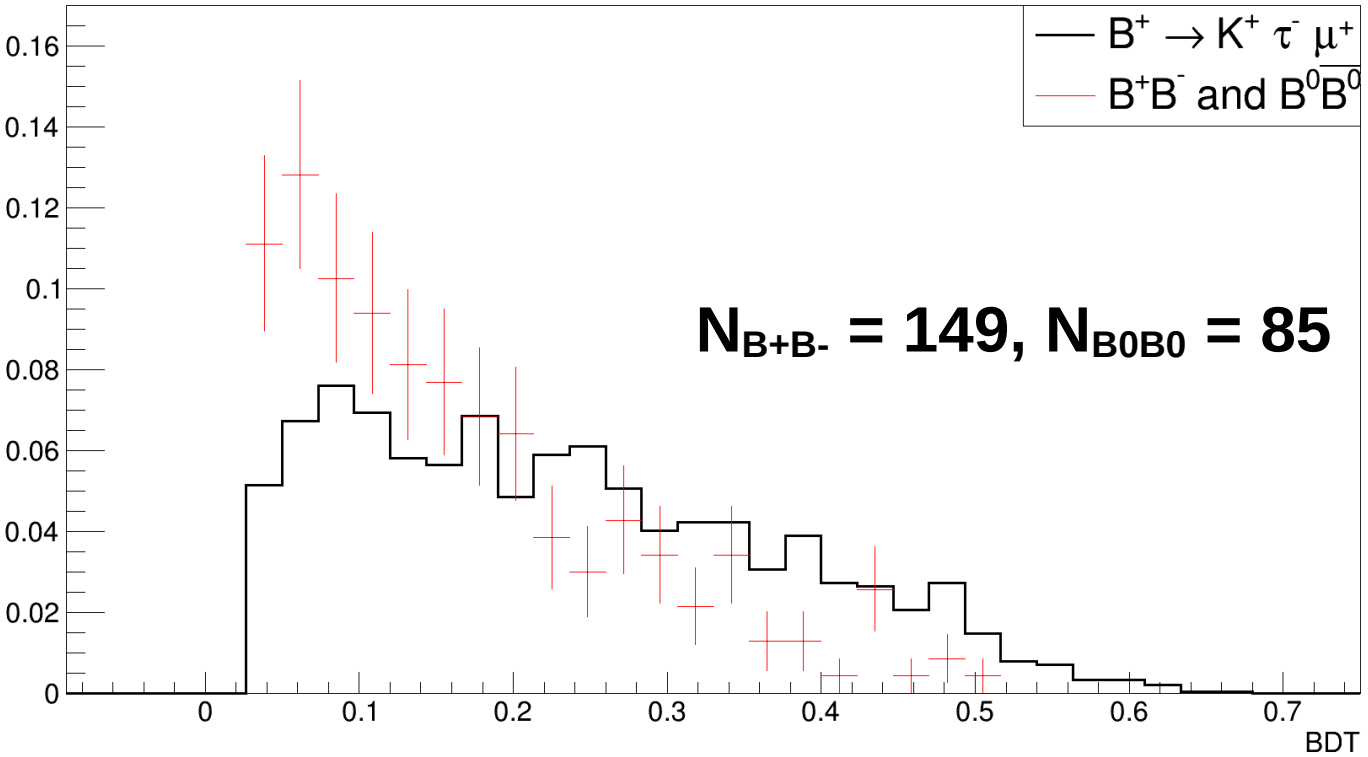


For 5×10^{-5} BF

$N_{sig} = 26$ & $N_{sig} = 12$ (for only pi mode)

Approach 2

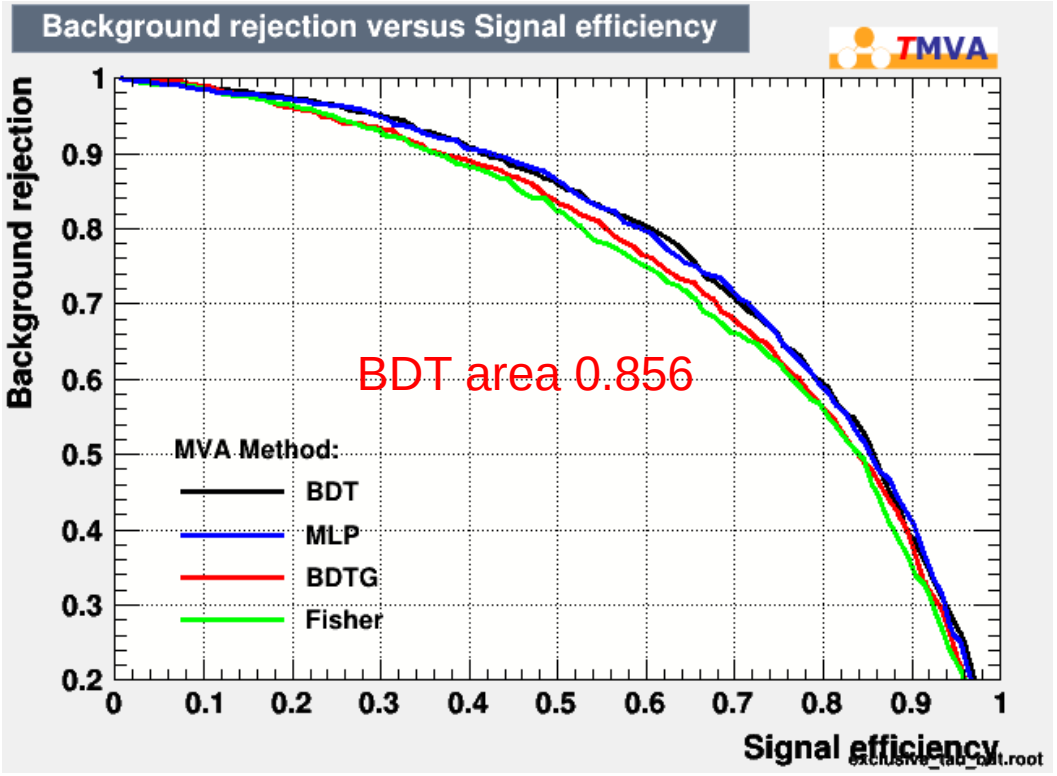
Background calculation



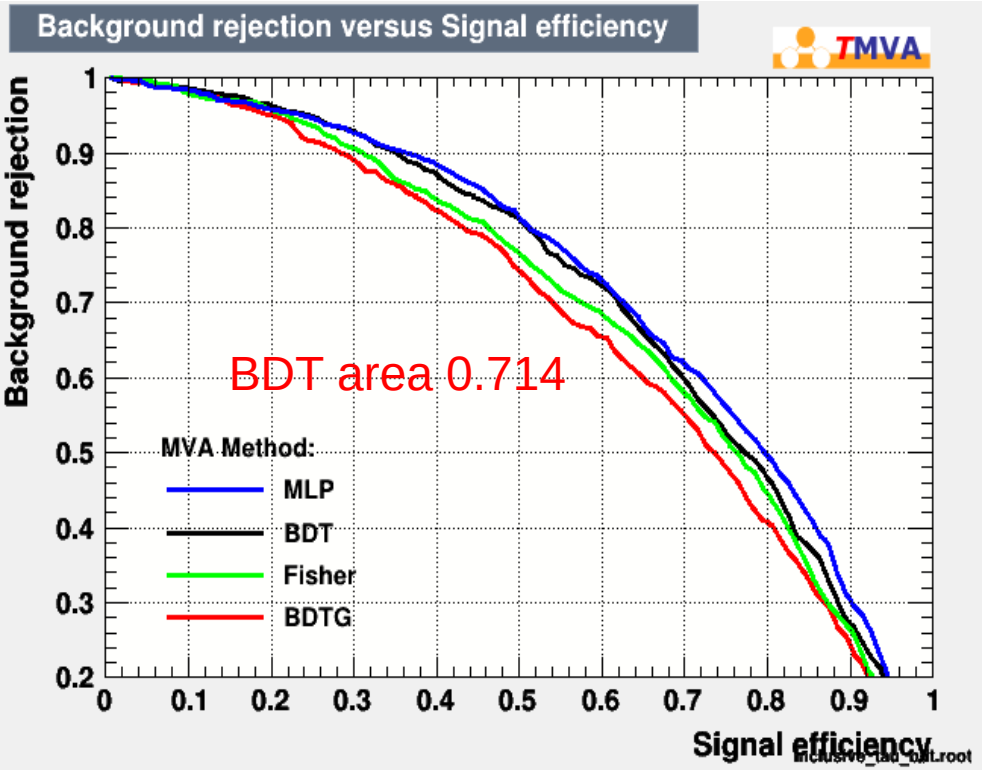
Back up

ROC

Approach 1

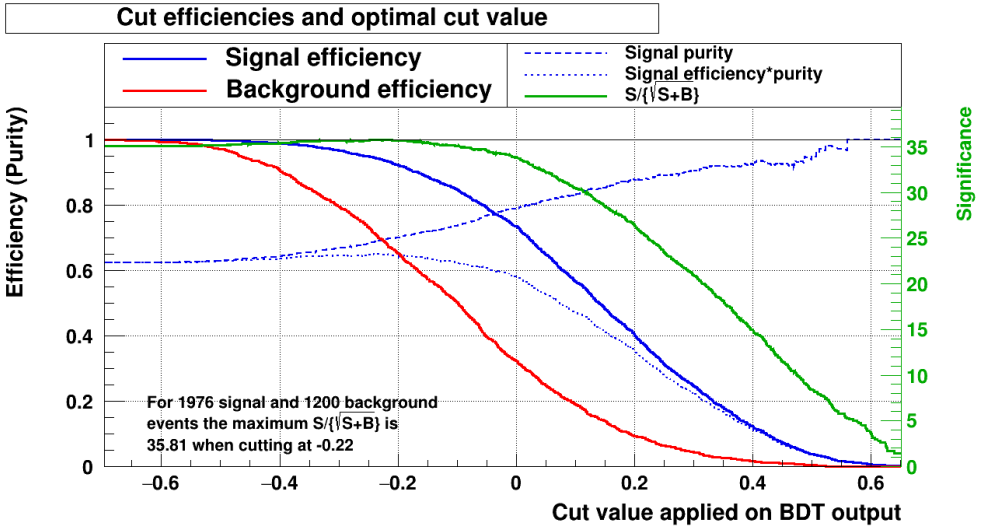


Approach 2

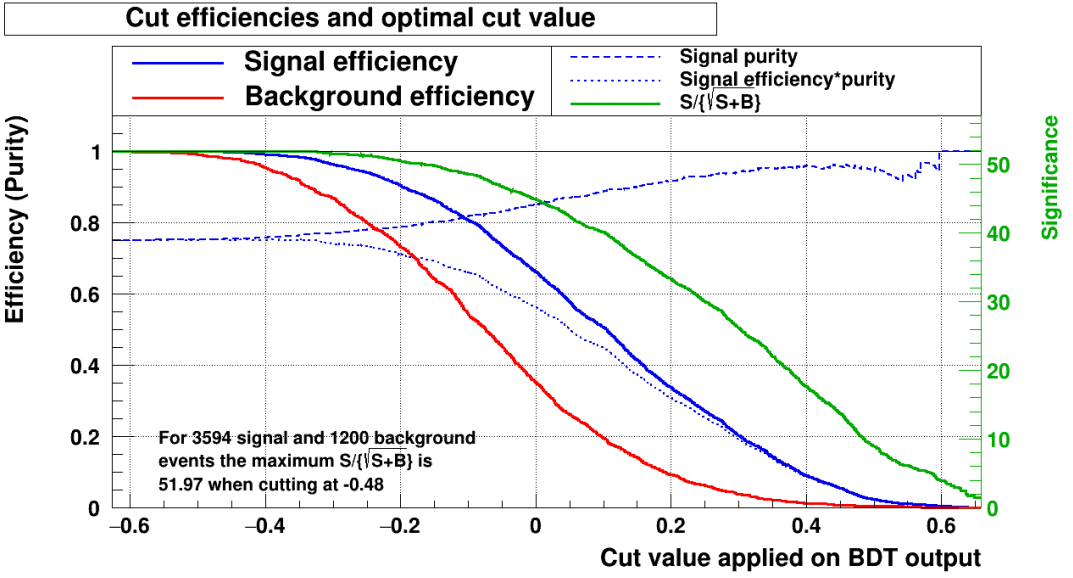


FOM

Approach 1



Approach 2



FOM

Approach 1

Classifier	(#signal, #backgr.)	Optimal-cut	S/(sqrt(S+B))	NSig	NBkg	EffSig	EffBkg
BDT:	(1976, 1200)	-0.2191	35.811	1848	815	0.9352	0.6792
BDTG:	(1976, 1200)	-0.6852	35.5719	1847	849	0.9347	0.7075
Fisher:	(1976, 1200)	-0.3163	35.5465	1895	947	0.959	0.7892
MLP:	(1976, 1200)	0.2156	35.7679	1843	812	0.9327	0.6767

Approach 2

Classifier	(#signal, #backgr.)	Optimal-cut	(S/8912000)/(3./2+sqrt(B))	NSig	NBkg	EffSig	EffBkg
BDT:	(3594, 1200)	0.0314	1.23194e-05	2201	344	0.6124	0.2867
BDTG:	(3594, 1200)	-0.3724	1.15212e-05	3121	835	0.8684	0.6958
Fisher:	(3594, 1200)	-0.0890	1.18993e-05	2761	602	0.7682	0.5017
MLP:	(3594, 1200)	0.6220	1.24545e-05	1668	183	0.4641	0.1525

Ponzi FOM

Approach 1

Classifier	(#signal,	#backgr.)	Optimal-cut	(S/500000)/(3./2+sqrt(B))	NSig	NBkg	EffSig	EffBkg
BDT:	(1976,	1200)	0.1203	0.00013825	1064	193	0.5385	0.1608
BDTG:	(1976,	1200)	0.1895	0.000132801	1304	329	0.6599	0.2742
Fisher:	(1976,	1200)	-0.0549	0.000130268	1484	453	0.751	0.3775
MLP:	(1976,	1200)	0.7125	0.000140337	956	147	0.4838	0.1225

Approach 2

Classifier	(#signal,	#backgr.)	Optimal-cut	(S/8912000)/(3./2+sqrt(B))	NSig	NBkg	EffSig	EffBkg
BDT:	(3594,	1200)	0.0314	1.23194e-05	2201	344	0.6124	0.2867
BDTG:	(3594,	1200)	-0.3724	1.15212e-05	3121	835	0.8684	0.6958
Fisher:	(3594,	1200)	-0.0890	1.18993e-05	2761	602	0.7682	0.5017
MLP:	(3594,	1200)	0.6220	1.24545e-05	1668	183	0.4641	0.1525