

# Progress Report on Tau Final States of TTTT

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# Outline

# EventSelection

- MET fillters
- HLT requirements
  - `HLT_PFHT450_SixJet40_BTagCSV_p056==1,`  
`HLT_PFHT400_SixJet30_DoubleBTagCSV_p056==1`
- loose preselection
  - `tausL.size()>0, jets.size()>3, bjetsL.size()>1`
- Subchannel requirements

# MC reweighting

- genWeight
- prefireWeight
- PileUp reweighting

# Event Yield

1Tau0L  
TTTT:  
raw entries = 220330  
weighted = 1591.5  
event yield = 8.71915

TTTo2L2Nu:  
raw entries = 2168  
weighted = 145462  
event yield = 96.3281

TTToHadronic:  
raw entries = 9038  
weighted = 2.70907e+06  
event yield = 1660.12

TTToSemiLeptonic:  
raw entries = 20763  
weighted = 6.01767e+06  
event yield = 2443.62

TTGJets:  
raw entries = 2834  
weighted = 15631.5  
event yield = 63.4339

ttZJets:  
raw entries = 17823  
weighted = 17275.6  
event yield = 41.1586

ttWJets:  
raw entries = 8313  
weighted = 7992.68  
event yield = 8.62468

tth:  
raw entries = 16918  
weighted = 16470.6  
event yield = 20.8422

WZ:  
raw entries = 0  
weighted = 0  
event yield = 0

WW:  
raw entries = 0  
weighted = 0  
event yield = 0

ZZ:  
raw entries = 0  
weighted = 0  
event yield = 0

WGJets:  
raw entries = 3  
weighted = 3.277  
event yield = 0.0294014

ZGJetsToLLG:  
raw entries = 2  
weighted = 707.885  
event yield = 0.0174903

WWW:  
raw entries = 8  
weighted = 1.14755  
event yield = 0.171829

WWZ:  
raw entries = 14  
weighted = 2.72211  
event yield = 0.391874

WWW:

ZZZ:  
raw entries = 12  
weighted = 0.190055  
event yield = 0.0272573

WZZ:  
raw entries = 19  
weighted = 0.784277  
event yield = 0.114066

WZG:  
raw entries = 13  
weighted = 0.382511  
event yield = 0.0137398

WGG:  
raw entries = 0  
weighted = 0  
event yield = 0

ZGGJets:  
raw entries = 0  
weighted = 0  
event yield = 0

WJetsToLNu:  
raw entries = 0  
weighted = 0  
event yield = 0

DYJetsToTauTau:  
raw entries = 0  
weighted = 0  
event yield = 0

tZq\_ll:

tZq\_nunu:  
raw entries = 17  
weighted = 1.41722  
event yield = 0.0506871

ST\_tw\_antitop:  
raw entries = 36  
weighted = 31.944  
event yield = 43.7221

ST\_tw\_top:  
raw entries = 33  
weighted = 30.6889  
event yield = 42.3024

TGJets:  
raw entries = 23  
weighted = 129.575  
event yield = 2.95958

THW:  
raw entries = 5941  
weighted = 5790.99  
event yield = 6.11297

THQ:  
raw entries = 346  
weighted = 330.736  
event yield = 1.06487

QCD\_HT200to300\_h:  
raw entries = 0  
weighted = 0  
event yield = 0

QCD\_HT300to500\_h:

QCD\_HT500to700\_h:  
raw entries = 16  
weighted = 13.8882  
event yield = 0.864978

QCD\_HT700to1000\_h:  
raw entries = 62  
weighted = 56.4307  
event yield = 0.88647

QCD\_HT1000to1500\_h:  
raw entries = 40  
weighted = 32.1457  
event yield = 0.287155

QCD\_HT1500to2000\_h:  
raw entries = 52  
weighted = 44.6813  
event yield = 0.0485158

QCD\_HT2000toInf\_h:  
raw entries = 48  
weighted = 40.2675  
event yield = 0.0183201

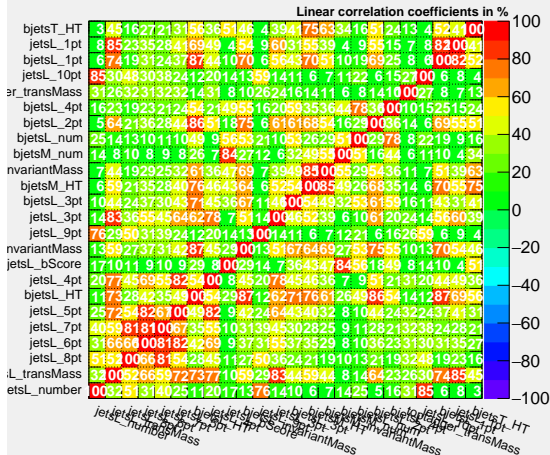
Total BKG = 4433.39

# TMVA Setup

- ROOT6, TMVA4.3.0
- Signal: TTTT\_TuneCP5; Background: TTTo2L2Nu, TTToHadronic, TTToSemiLeptonic
- Global weight and event weight same in event yield calculation
- Input Variables: 24, same as before

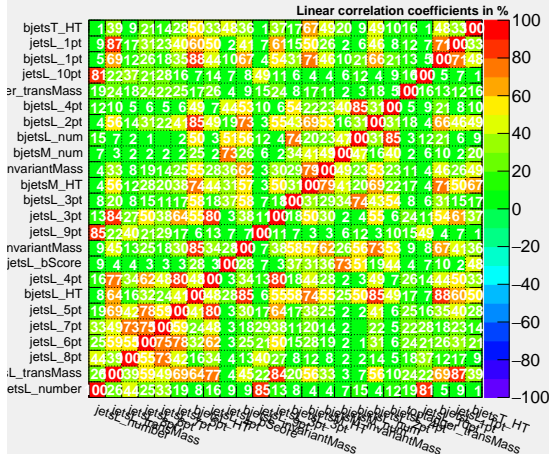
# Input Variable Correlation

## Correlation Matrix (signal)



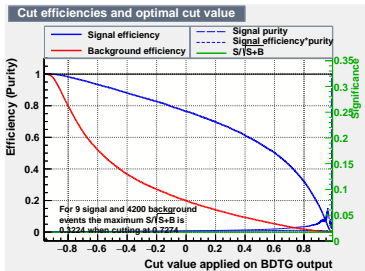
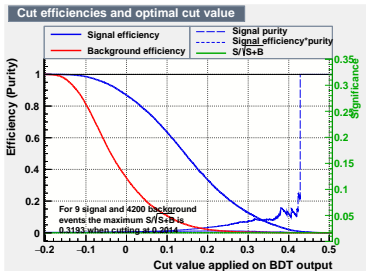
# Input Variable Correlation

## Correlation Matrix (background)





# Significance



# Significance

```
--- =====  
--- Classifier  ( #signal, #backgr.)  Optimal-cut  S/sqrt(S+B)    NSig    NBkg    EffSig    EffBkg  
--- CutsSA: (    9,    4200)    0.1950    0.24602  1.777021  50.39589  0.1974  0.012  
--- BDTG: (    9,    4200)    0.7274    0.322433  3.588084  120.2479  0.3987  0.02863  
--- BDT: (    9,    4200)    0.2014    0.319321  2.976952  83.93702  0.3308  0.01999  
--- =====
```

# Cross Section

```
TTTT{ baseDir+"TTTT_TuneCP5_PSweights_13TeV-amcatnlo-pythia8_correctnPartonsInBorn.root", 0.01197};
TTTo2L2Nu{ baseDir+"TTTo2L2Nu_TuneCP5_PSweights_13TeV-powheg-pythia8.root", 373. };
TTToHadronic{baseDir+"TTToHadronic_TuneCP5_PSweights_13TeV-powheg-pythia8.root", 367. };
TTToSemiLeptonic{baseDir+"TTToSemiLeptonic_TuneCP5_PSweights_13TeV-powheg-pythia8.root", 90.6};
ss TTGJets(baseDir+"TTGJets_TuneCUETP8M1_13TeV-amcatnloFFFX-madspin-pythia8.root", 3.773 );//TTGJets
ttZJets(baseDir+"ttZJets_13TeV_madgraphMLM-pythia8.root", 0.6559);////something with the files
ttWJets(baseDir+"ttWJets_13TeV_madgraphMLM.root", 0.2014 );
ttH{baseDir+"ttH_4f_ctcvcp_TuneCP5_13TeV_madgraph_pythia8.root", 0.3372 };//ttH

WZ(baseDir+"WZ_TuneCUETP8M1_13TeV-pythia8.root", 2.343 );
WW(baseDir+"WW_TuneCUETP8M1_13TeV-pythia8.root", 6.430 );
ssWWTo2L2Nu+"WWTo2L2Nu_DoubleScattering_13TeV-pythia8.root", 0.1697 );
ss (baseDir+"WpWpJJ_EWK-QCD_TuneCUETP8M1_13TeV-madgraph-pythia8.root", 0.05390 );//?missing this in other places
ZZ(baseDir+"ZZ_TuneCUETP8M1_13TeV-pythia8.root", 1.016 );//ZZ
WGJets(baseDir+"WGJets_MonoPhoton_PtG-40to130_TuneCUETP8M1_13TeV-madgraph.root", 1.269 );//
ZGJetsToLLG(baseDir+"ZGJetsToLLG_EW_L0_13TeV-sherpa.root", 0.1319 );//

WWW(baseDir+"WWW_4F_TuneCUETP8M1_13TeV-amcatnlo-pythia8.root", 0.2086 );//
WWZ(baseDir+"WWZ_TuneCUETP8M1_13TeV-amcatnlo-pythia8.root", 0.1651 );//
ss WWG(baseDir+"WWG_TuneCUETP8M1_13TeV-amcatnlo-pythia8.root");//
ZZZ(baseDir+"ZZZ_TuneCUETP8M1_13TeV-amcatnlo-pythia8.root", 0.01398 );//
WZZ(baseDir+"WZZ_TuneCUETP8M1_13TeV-amcatnlo-pythia8.root", 0.05565 );//
WZG(baseDir+"WZG_TuneCUETP8M1_13TeV-amcatnlo-pythia8.root", 0.04123 );//
WGG(baseDir+"WGG_5f_TuneCUETP8M1_13TeV-amcatnlo-pythia8.root", 1.819 );
ZGGJets(baseDir+"ZGGJets_ZToHad0rNu_5f_L0_madgraph_pythia8.root", 0.3717 );
```

# Cross Section

```
ss WJetsToNu(baseDir+"WJetsToNu_TuneCUETP8M1_13TeV-madgraphMLM-pythia8.root", 50300 );//WJets
DYJetsToTauTau(baseDir+"DYJetsToTauTau_ForcedMuEleDecay_M-50_TuneCUETP8M1_13TeV-amcatnloFXFX-pythia8_ext1.root", 1983 );
e_Top
tZq_ll(baseDir+"tZq_ll_4f_ckm_NLO_TuneCP5_PWeights_13TeV-amcatnlo-pythia8.root", 0.07358 );
ss tZq_nunu(baseDir+"tZq_nunu_4f_13TeV-amcatnlo-pythia8_TuneCUETP8M1.root", );//???
ST_tw_antitop(baseDir+"ST_tw_antitop_5f_inclusiveDecays_13TeV-powheg-pythia8_TuneCUETP8M2T4.root", 38.06 );
ST_tw_top(baseDir+"ST_tw_top_5f_inclusiveDecays_13TeV-powheg-pythia8_TuneCUETP8M2T4.root", 38.09 );

TGJets(baseDir+"TGJets_TuneCUETP8M1_13TeV_amcatnlo_madspin_pythia8.root", 2.967 );
THW(baseDir+"THW_ctcvcp_HIncl_M125_TuneCP5_13TeV-madgraph-pythia8.root", 0.1467 );
THQ(baseDir+"THQ_ctcvcp_HIncl_13TeV-madgraph-pythia8_TuneCUETP8M1.root", 0.8816 );

0 //2.466e+08 +- 2.190e+05 pb
200 //2.801e+07 +- 2.608e+04 pb
QCD_HT200to300(baseDir+"QCD_HT200to300_TuneCUETP8M1_13TeV-madgraphMLM-pythia8.root", 1.710e+3 ); // 1.710e+06 +- 1.626e+0
QCD_HT300to500(baseDir+"QCD_HT300to500_TuneCUETP8M1_13TeV-madgraphMLM-pythia8.root", 3.473e+02); // 3.473e+05 +- 3.327e+
QCD_HT500to700(baseDir+"QCD_HT500to700_TuneCUETP8M1_13TeV-madgraphMLM-pythia8.root", 3.220e+01); // 3.220e+04 +- 3.100e+
QCD_HT700to1000(baseDir+"QCD_HT700to1000_TuneCUETP8M1_13TeV-madgraphMLM-pythia8.root", 6.839e+0); // 6.839e+03 +- 6.602
QCD_HT1000to1500(baseDir+"QCD_HT1000to1500_TuneCUETP8M1_13TeV-madgraphMLM-pythia8.root", 1.207e+0); // 1.207e+03 +- 1.16
QCD_HT1500to2000(baseDir+"QCD_HT1500to2000_TuneCUETP8M1_13TeV-madgraphMLM-pythia8.root", 0.1201); // 1.201e+02 +- 1.160e
QCD_HT2000toInf(baseDir+"QCD_HT2000toInf_TuneCUETP8M1_13TeV-madgraphMLM-pythia8.root", 0.02524); // 2.524e+01 +- 2.436e-
```