BDT Study Using Correlation Based Method Part3

Progress Report on Tau Final States of TTTT

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Outline

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BDT related questions

- if we want to define a loose region for BDT training to account for low statictic in some channels, how to determine the loose cut?
- how to do the training in 1tau0l channel?

Full variable list

variable name in code	meaning	notes
variables already considered:		
jets_number	number of jets	
jets_MHT	MHT of all jets	
jets_HT	HT of all jets	
jets_invariantMass	invariantMass of all jets	
jets_transMass	transvesive mass of all jets	
jet_minDeltaR	minimum delta R of jets	
jets_centrality	centrality of jets	
jets_bScore	sum of b score of all jets	
jets_average_deltaR	average δR of jets	
jets_4largestBscoreSum	b score sum of the 4 jets with the largesr b score	
jets_1pt, jets_11pt	leading jets pt, up to 11th highest pt of jets	
jets_1eta, jets_11eta	η of jets	
jets_1phi, jets_11phi	ϕ of jets	
jets_HTDividedByMet	HT of jets/Met	
MetDividedByHT	Met/HT	
jets_MHTDividedByMet	MHT/Met	
jets_leptonsMVAT_minDeltaR	minimum δr of the jets and tight leptons system	
jets_tausF_minDeltaR	minimum δR of the jets and fakeable taus	
jets_spherilty	spherility of jets	
jets_aplanarity	aplanarity of jets	
variables to be add:		
	Met/ squra root of HT	
	The η difference between the leading and sub-leading jets	
	absolute ϕ difference between the leading and sub-leading jets	
	HT of the six highest-pT jets divided by the total HT in the event	
	transverse momenta of the jet with the seventh-largest pT in the event	
	The sum of the masses of R = 0.8 jets	
	invariant Mass of of leading two jets	
	mass of leading lepton and second leading jet	
	ϕ between leading lepton and leading jet	
	Ratio of HT of first four leading jets to rest	
	ratio of jet mass to momentum to discriminate merged jets	

Table: jets and lepton variables

Full variable list

variable name in code	meaning	notes
variables already considered: bjetsL_num, bjetsM_num, bjetsT_num bjetsL_HT, bjetsM_HT, bjetsT_HT bjetsL_MHT, bjetsM_MHT, bjetsT_MHT bjetsL_invariantMass, bjetsL_invariantMass, bjetsL_invariantMass bjetsL_transMass, bjetsL_transMass, bjetsL_transMass bjetsL_minDeltaR, bjetsM_minDeltaR, bjetsT_minDeltaR bjetsL_leptonsMVAT_minDeltaR, bjetsM_leptonsMVAT_minDeltaR, bjetsT_leptonsMVAT_minDeltaR bjetsL_tausF_minDeltaR bjetsL_1pt, bjetsL_4pt bjetsL_1eta, bjetsL_4eta bjetsL_1phi, bjetsL_4phi bjetsM_1pt, bjetsM_4pt bjetsM_1eta, bjetsM_4eta bjetsM_1phi, bjetsM_4phi nonbjetsL_num nonbjetsL_1pt,nonbjetsL_1eta, nonbjetsL_1phi		
variables to be add	η difference between the leading and sub-leading b-tagged jets absolute ϕ difference between the leading and sub-leading b tagged jets mean of the DeepJet b-tag scores of the b jets	

Table: b jets related variables

Full variable list

variable name in code	meaning	notes
variables already considered:		
Met_pt		
Met_phi		
forwardJets_num	number of forward jets	
toptagger_num	number of reconstructed hadronic top	
toptagger_MHT	MHT of all tops	
toptagger_HT	HT of all tops	
toptagger_invariantMass	invariant mass of all tops	
toptagger_transMass	transversive mass of all tops	
toptagger_minDeltaR_v1	minimum δ R of tops	
toptagger_leptonsMVAT_minDeltaR	minimum δ R of tops and leptons	
toptagger_1pt, toptagger_3pt	leading to third top pt	
toptagger_1eta, toptagger_3eta	η of tops with pt from leading to third	
toptagger_1phi, toptagger_3phi	ϕ of tops with pt from leading to third	
variables to be add:		

Table: top related variables

Full variable list

variable name in code	meaning	notes
variables already considered: muonsL_number,muonsF_number, muonsT_number muonsT_1pt,muonsT_3pt muonsT_1eta, muonsT_3eta muonsT_1phi, muonsT_2phi elesMVAL_number,elesMVAF_number,elesMVAT_number elesMVAF_1pt leptonsMVAT_number,leptonsMVAF_number,leptonsMVAL_number leptonsMVAT_transMass,leptonsMVAF_transMass,leptonsMVAL_transMass leptonsMVAT_1pt,leptonsMVAT_3pt leptonsMVAT_1eta,leptonsMVAT_3eta leptonsMVAT_1phi,leptonsMVAT_3phi		
variables to be add:	mt of lepton1 and lepton2 mass of the 2 leptons sign of the same-sign lepton pair $\delta\eta$ of leading and second lepton	

Table: top related variables

Full variable list

variable name in code	meaning	notes
variables already considered: tausL_number,tausF_number,tausT_number tausL_MHT,tausF_MHT,tausT_MHT tausL_HT,tausF_HT,tausT_HT tausL_invariantMass,tausF_invariantMass,tausT_invariantMass tausL_minDeltaR,tausF_minDeltaR,tausT_minDeltaR tausF_leptonsT_transMass,tausL_leptonsT_transMass,tausT_leptonsT_transMass tausF_leptonsT_invariantMass,tausL_leptonsT_invariantMass,tausT_leptonsT_invariantMass tausF_leptonsTMVA_minDeltaR,tausL_leptonsTMVA_minDeltaR,tausT_leptonsTMVA_minDeltaR tauL_1pt,tauL_3pt tauL_1eta,tauL_3eta tauL_1phi,tauL_3phi		
variables to be add:		

Table: top related variables

Outline

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Next Step

- Add more variables
- add various correction
- Hyperparameter optimazation (SS AN)
- maybe loosen baseline selection for higher statistics

Backup

back up

Outline

EventSelection

- MET fillters
- HLT requirements
  - HLT_PFHT450_SixJet40_BTagCSV_p056==1, HLT_PFHT400_SixJet30_DoubleBTagCSV_p056==1
  - HLT_PFJet450
- loose preselection
  - tausL.size()>0, jets.size()>2(fixed here), bjetsL.size()>1
  - HT>400
- Subchannel requirements

MC reweighting

- genWeight
- prefireWeight
- PileUp reweighting

Event Yield

1Tau0L
raw entries:

TTTT = 237121.000000
TT = 45781.000000
TTX = 59520.000000
VV = 9.000000
VVV = 100.000000
WJets = 0.000000
DY = 0.000000
singleTop = 3795.000000
TX = 7749.000000
QCD = 315.000000
background = 7787.433668

1Tau2L
raw entries:

TTTT = 36053.000000
TT = 670.000000
TTX = 5439.000000
VV = 0.000000
VVV = 6.000000
WJets = 0.000000
DY = 0.000000
singleTop = 2286.000000
TX = 800.000000
QCD = 0.000000
background = 21.088795

1Tau3L
raw entries:

TTTT = 2215.000000
TT = 0.000000
TTX = 321.000000
VV = 0.000000
VVV = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 22.000000
TX = 27.000000
QCD = 0.000000
background = 0.882240

1Tau0L
weighted:

TTTT = 1727.402161
TT = 12808721.094352
TTX = 76752.367739
VV = 715.464884
vvv = 13.558634
WJets = 0.000000
DY = 0.000000
singleTop = 178.302566
TX = 7694.366882
QCD = 279.102358
background = 13822.328266

1Tau2L
weighted:

TTTT = 277.013738
TT = 49317.260154
TTX = 5682.610249
VV = 0.000000
vvv = 0.725201
WJets = 0.000000
DY = 0.000000
singleTop = 114.770694
TX = 799.258622
QCD = 0.000000
background = 46.837393

1Tau3L
weighted:

TTTT = 16.702130
TT = 0.000000
TTX = 323.867294
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 1.096257
TX = 27.411090
QCD = 0.000000
background = 0.840136

1Tau0L
scaled to LUMI:

TTTT = 9.463674
TT = 6151.841389
TTX = 237.177114
VV = 0.138518
vvv = 1.103006
WJets = 0.000000
DY = 0.000000
singleTop = 115.069084
TX = 13.340787
QCD = 7303.658368
background = 13822.328266

1Tau2L
scaled to LUMI:

TTTT = 1.517636
TT = 31.243461
TTX = 14.239847
VV = 0.000000
vvv = 0.106212
WJets = 0.000000
DY = 0.000000
singleTop = 0.292115
TX = 0.955757
QCD = 0.000000
background = 46.837393

1Tau3L
scaled to LUMI:

TTTT = 0.091504
TT = 0.000000
TTX = 0.803764
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 0.002790
TX = 0.033581
QCD = 0.000000
background = 0.840136

Event Yield

1Tau1Mu
raw entries:

TTTT = 96510.000000
TT = 15790.000000
TTX = 17317.000000
VV = 6.000000
VVV = 9.000000
WJets = 0.000000
DY = 0.000000
singleTop = 2222.000000
TX = 2782.000000
QCD = 0.000000
background = 80.029567

1Tau1Mu
weighted:

TTTT = 750.823160
TT = 1988643.247954
TTX = 20245.956260
VV = 465.543882
vvv = 0.607881
WJets = 0.000000
DY = 0.000000
singleTop = 114.866833
TX = 2706.830801
QCD = 0.000000
background = 1081.337876

1Tau1Mu
scaled to LUMI:

TTTT = 4.113429
TT = 1005.211880
TTX = 56.540381
VV = 0.078666
vvv = 0.079142
WJets = 0.000000
DY = 0.000000
singleTop = 15.823899
TX = 3.603908
QCD = 0.000000
background = 1081.337876

1Tau1E
raw entries:

TTTT = 77566.000000
TT = 13243.000000
TTX = 14947.000000
VV = 2.000000
VVV = 19.000000
WJets = 0.000000
DY = 0.000000
singleTop = 2857.000000
TX = 2322.000000
QCD = 2.000000
background = 82.771878

1Tau1E
weighted:

TTTT = 595.308610
TT = 1714597.442319
TTX = 17514.991634
VV = 414.892860
vvv = 1.584673
WJets = 0.000000
DY = 0.000000
singleTop = 122.716495
TX = 2319.020958
QCD = 2.174466
background = 939.704393

1Tau1E
scaled to LUMI:

TTTT = 3.261433
TT = 864.721378
TTX = 48.748242
VV = 0.032859
vvv = 0.214777
WJets = 0.000000
DY = 0.000000
singleTop = 20.507983
TX = 3.120045
QCD = 2.359110
background = 939.704393

1Tau1L
raw entries:

TTTT = 174076.000000
TT = 29033.000000
TTX = 32264.000000
VV = 8.000000
VVV = 28.000000
WJets = 0.000000
DY = 0.000000
singleTop = 5079.000000
TX = 5104.000000
QCD = 2.000000
background = 162.801445

1Tau1L
weighted:

TTTT = 1346.131770
TT = 3703240.690273
TTX = 37760.947894
VV = 880.436742
vvv = 2.192554
WJets = 0.000000
DY = 0.000000
singleTop = 237.583328
TX = 5025.851758
QCD = 2.174466
background = 2021.042269

1Tau1L
scaled to LUMI:

TTTT = 7.374862
TT = 1869.933258
TTX = 105.288623
VV = 0.111525
vvv = 0.293919
WJets = 0.000000
DY = 0.000000
singleTop = 36.331883
TX = 6.723952
QCD = 2.359110
background = 2021.042269

Event Yield

1Tau2OS
raw entries:

TTTT = 23961.000000
TT = 643.000000
TTX = 4050.000000
VV = 0.000000
VVV = 4.000000
WJets = 0.000000
DY = 0.000000
singleTop = 1971.000000
TX = 544.000000
QCD = 0.000000
background = 16.543800

1Tau2SS
raw entries:

TTTT = 12092.000000
TT = 27.000000
TTX = 1389.000000
VV = 0.000000
VVV = 2.000000
WJets = 0.000000
DY = 0.000000
singleTop = 315.000000
TX = 256.000000
QCD = 0.000000
background = 4.544995

1Tau2L
raw entries:

TTTT = 36053.000000
TT = 670.000000
TTX = 5439.000000
VV = 0.000000
VVV = 6.000000
WJets = 0.000000
DY = 0.000000
singleTop = 2286.000000
TX = 800.000000
QCD = 0.000000
background = 21.088795

1Tau2OS
weighted:

TTTT = 182.618180
TT = 46463.399858
TTX = 4118.349976
VV = 0.000000
vvv = 0.584920
WJets = 0.000000
DY = 0.000000
singleTop = 99.430589
TX = 545.692495
QCD = 0.000000
background = 40.979358

1Tau2SS
weighted:

TTTT = 94.395558
TT = 2853.860295
TTX = 1564.260273
VV = 0.000000
vvv = 0.140281
WJets = 0.000000
DY = 0.000000
singleTop = 15.340105
TX = 253.566127
QCD = 0.000000
background = 5.858035

1Tau2L
weighted:

TTTT = 277.013738
TT = 49317.260154
TTX = 5682.610249
VV = 0.000000
vvv = 0.725201
WJets = 0.000000
DY = 0.000000
singleTop = 114.770694
TX = 799.258622
QCD = 0.000000
background = 46.837393

1Tau2OS
scaled to LUMI:

TTTT = 1.000484
TT = 29.721410
TTX = 10.264518
VV = 0.000000
vvv = 0.085810
WJets = 0.000000
DY = 0.000000
singleTop = 0.253072
TX = 0.654548
QCD = 0.000000
background = 40.979358

1Tau2SS
scaled to LUMI:

TTTT = 0.517152
TT = 1.522051
TTX = 3.975329
VV = 0.000000
vvv = 0.020403
WJets = 0.000000
DY = 0.000000
singleTop = 0.039044
TX = 0.301209
QCD = 0.000000
background = 5.858035

1Tau2L
scaled to LUMI:

TTTT = 1.517636
TT = 31.243461
TTX = 14.239847
VV = 0.000000
vvv = 0.106212
WJets = 0.000000
DY = 0.000000
singleTop = 0.292115
TX = 0.955757
QCD = 0.000000
background = 46.837393

Event Yield

2Tau1E
raw entries:

TTTT = 2180.000000
TT = 84.000000
TTX = 1025.000000
VV = 0.000000
VVV = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 267.000000
TX = 230.000000
QCD = 0.000000
background = 3.241680

2Tau1Mu
raw entries:

TTTT = 2774.000000
TT = 98.000000
TTX = 1122.000000
VV = 0.000000
VVV = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 264.000000
TX = 273.000000
QCD = 0.000000
background = 3.476008

2Tau1L
raw entries:

TTTT = 4954.000000
TT = 182.000000
TTX = 2147.000000
VV = 0.000000
VVV = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 531.000000
TX = 503.000000
QCD = 0.000000
background = 6.717688

2Tau1E
weighted:

TTTT = 16.596552
TT = 8862.153584
TTX = 1066.149400
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 27.158919
TX = 225.444790
QCD = 0.000000
background = 7.559703

2Tau1Mu
weighted:

TTTT = 21.142830
TT = 11436.690755
TTX = 1174.287908
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 12.408789
TX = 262.325478
QCD = 0.000000
background = 8.960338

2Tau1L
weighted:

TTTT = 37.739382
TT = 20298.844339
TTX = 2240.437308
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 39.567708
TX = 487.770268
QCD = 0.000000
background = 16.520041

2Tau1E
scaled to LUMI:

TTTT = 0.090925
TT = 4.823582
TTX = 2.390926
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 0.069125
TX = 0.276070
QCD = 0.000000
background = 7.559703

2Tau1Mu
scaled to LUMI:

TTTT = 0.115832
TT = 5.929230
TTX = 2.675061
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 0.031583
TX = 0.324465
QCD = 0.000000
background = 8.960338

2Tau1L
scaled to LUMI:

TTTT = 0.206757
TT = 10.752811
TTX = 5.065987
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 0.100708
TX = 0.600535
QCD = 0.000000
background = 16.520041

Event Yield

2Tau2OS
raw entries:

TTTT = 353.000000
TT = 2.000000
TTX = 119.000000
VV = 0.000000
VVV = 1.000000
WJets = 0.000000
DY = 0.000000
singleTop = 4.000000
TX = 36.000000
QCD = 0.000000
background = 0.457729

2Tau2SS
raw entries:

TTTT = 147.000000
TT = 0.000000
TTX = 16.000000
VV = 0.000000
VVV = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 3.000000
TX = 5.000000
QCD = 0.000000
background = 0.041054

2Tau2L
raw entries:

TTTT = 500.000000
TT = 2.000000
TTX = 135.000000
VV = 0.000000
VVV = 1.000000
WJets = 0.000000
DY = 0.000000
singleTop = 7.000000
TX = 41.000000
QCD = 0.000000
background = 0.498783

2Tau2OS
weighted:

TTTT = 2.088281
TT = 142.350423
TTX = 117.081043
VV = 0.000000
vvv = 0.018778
WJets = 0.000000
DY = 0.000000
singleTop = 0.869543
TX = 36.226800
QCD = 0.000000
background = 0.395161

2Tau2SS
weighted:

TTTT = 1.359831
TT = 0.000000
TTX = 16.357750
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 0.158186
TX = 4.815694
QCD = 0.000000
background = 0.033499

2Tau2L
weighted:

TTTT = 3.448112
TT = 142.350423
TTX = 133.438793
VV = 0.000000
vvv = 0.018778
WJets = 0.000000
DY = 0.000000
singleTop = 1.027728
TX = 41.042494
QCD = 0.000000
background = 0.428660

2Tau2OS
scaled to LUMI:

TTTT = 0.011441
TT = 0.091864
TTX = 0.259295
VV = 0.000000
vvv = 0.002693
WJets = 0.000000
DY = 0.000000
singleTop = 0.002213
TX = 0.039095
QCD = 0.000000
background = 0.395161

2Tau2SS
scaled to LUMI:

TTTT = 0.007450
TT = 0.000000
TTX = 0.028013
VV = 0.000000
vvv = 0.000000
WJets = 0.000000
DY = 0.000000
singleTop = 0.000403
TX = 0.005083
QCD = 0.000000
background = 0.033499

2Tau2L
scaled to LUMI:

TTTT = 0.018891
TT = 0.091864
TTX = 0.287308
VV = 0.000000
vvv = 0.002693
WJets = 0.000000
DY = 0.000000
singleTop = 0.002616
TX = 0.044179
QCD = 0.000000
background = 0.428660

Outline