Lepton selection with Top MVA Lepton ID

Search for Four top in Tau Final States

Anshul Kapoor Huiling Hua[1] Hongbo Liao[1]

[1]IHEP

February 8, 2023

Outline

Lepton definition of SS

- Tight electron: preselection + Top lepton MVA ID(+Conversion rejection and Charge consistency for electron)
- lepton preselection == loose lepton = Kinematics+ IP+Iso(+POG working point for muon)
- SFs:
  - preselection is taken into account in Top lepton MVA ID SFs,
  - Conversion rejection and Charge consistency not need to consider SF
  - All SFs needed to consider is the TOP MVA SFs
- Implementation self checked! same as the SS AN

Top Lepton MVA

- distinguish between “prompt” leptons and non-prompt leptons
  - prompt leptons
    - leptons produced at the primary interaction vertex in decays of W and Z bosons and tau leptons
  - non-prompt letpons
    - reconstructed leptons originating from hadrons misidentified as leptons, from heavy-flavor hadron decays, and from photon conversions
- Top MVA UL v1 used by SS

Top Lepton MVA: nput features and order

	Kinematics	
f0	p_T	Transverse momentum of a lepton
f1	$\|\eta\|$	Pseudorapidity of a lepton
	Isolation	
f2	I_{rel}	Relative isolation using the cone size of 0.4
f3	I_{ch}^{mini}	Relative mini isolation with pt dependent cone size including charged (neutral) PF objects
f4	I_{neu}^{mini}	
	Properties of the closest jet	
f5	N_{trk}	Number of charged particles associated with the jet
f6	pt^{rel}	Fraction of the lepton momentum in transverse direction to the jet axis
f7	p_T^{ratio}	Ratio between the lepton and jet transverse momenta
f8	$BTag$	The DeepJet b tagging discriminator
	Impact parameter	
f9	SIP_{3D}	3D impact parameter significance
f10	$log(d_{xy})$	Transverse impact parameter with respect to the primary vertex
f11	$log(d_{xy})$	Longitudinal impact parameter with respect to the primary vertex
	Other	
f12	ID_{MVA}^{e}	POG electron MVA ID discriminant (Fall17v2noIso)
f13	P_{seg}^{μ}	Compatibility of track segments in the muon system with the expected pattern of a minimum ionizing particle

- There are some mismatch between TOP MVA AN and the code implementation recommended by kirill
- Deep B jet sore in AN but Deep CSV in code

Syncronization check with kirill

- Total syncronization seems impossible
  - Different input file is the biggest problem, MiniAOD for SS but NanoAOD for us
- Should we do the check for lepton definition?

Significance comparison between previous lepton and SS lepton

regions	tttt	uncert	tt	uncert	qcd	uncert	ttX	uncert	VV	uncert	singleTop	uncert	WJets	uncert	s+b	data	data/bg	sensitivity
1tau0ISR	3.60	0.03	1756.88	9.21	689.54	110.51	61.11	3.11	0.03	0.01	38.72	3.01	13.66	1.48	2563.54	-1.00	-0.00	0.07
1tau1ISR	1.83	0.02	166.32	2.51	0.00	0.00	11.46	0.98	0.00	0.00	4.97	1.06	1.28	0.70	185.87	-1.00	-0.01	0.13

Table 1: old lepton selection

regions	tttt	uncert	tt	uncert	qcd	uncert	ttX	uncert	VV	uncert	singleTop	uncert	WJets	uncert	s+b	data	data/bg	sensitivity
1tau0ISR	3.65	0.03	1730.96	9.15	689.31	110.51	60.99	3.07	0.03	0.01	37.98	2.97	13.24	1.46	2536.15	-1.00	-0.00	0.07
1tau1ISR	1.77	0.02	219.30	2.94	0.23	0.23	11.43	1.24	0.00	0.00	6.41	1.21	1.52	0.55	240.65	-1.00	-0.00	0.11

Table 2: new lepton selection

Todo list and future plan

- Reproduce results for fake tau estimation in 1tau0l(1-2 days)
- Reproduce BDT in 1tau1l (1-2 days)
- Apply all necessary corrections and check data/MC agreement
  - B tag shape correction ongoing
  - one week
- Systematic study
  - one week
- Complete the analysis before the end of February!

Section 1

Back up