

Weekly Report

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Lepton+tau trigger check

- Inherit from Maosen's work
- Previously, ttH use 1l/2l trigger in 5 channels

1l2tau	2lss1tau	2los1tau	2los2tau	3l1tau
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- Now new triggers with tau information available.
 - need to validate and compare the performance

New Triggers	1Lep	2Lep
HLT_mu20_ivarloose_tau20_mediumRNN_tracktwoMVA_L1TAU8_03dRtt	HLT_mu20_iloose_L1MU15	HLT_2e12_lhloose_L12EM10VH
HLT_e24_lhmedium_nod0_ivarloose_L1EM22VHI_tau20_mediumRNN_tracktwoMVA_L1TAU8_03dRtt	HLT_mu50	HLT_e17_lhloose_mu14
HLT_mu14_ivarloose_tau25_mediumRNN_tracktwoMVA	HLT_e24_lhmedium_L1EM20VH	HLT_mu18_mu8noL1
HLT_e17_lhmedium_nod0_ivarloose_tau25_mediumRNN_tracktwoMVA	HLT_e60_lhmedium	HLT_2e17_lhvloose_nod0
HLT_e24_lhmedium_nod0_ivarloose_tau35_mediumRNN_tracktwoMVA	HLT_e120_lhloose	HLT_e17_lhloose_nod0_mu14
HLT_e17_lhmedium_nod0_ivarloose_tau25_mediumRNN_tracktwoMVA_L1EM15VHI_2TAU12IM_4J12	HLT_mu26_ivarmedium	HLT_mu22_mu8noL1
HLT_mu14_ivarloose_tau25_mediumRNN_tracktwoMVA_L1MU10_TAU12IM_3J12	HLT_e26_lhtight_nod0_ivarloose	
HLT_mu14_ivarloose_tau35_mediumRNN_tracktwoMVA	HLT_e60_lhmedium_nod0	
HLT_mu14_ivarloose_L1MU11_tau35_mediumRNN_tracktwoMVA_L1MU11_TAU20IM	HLT_e140_lhloose_nod0	

Environment

- Sample: (mc16d)
 - mc16_13TeV:mc16_13TeV.345873.PowhegPythia8EvtGen_A14NNPDF23_NNPDF30ME_ttH125_allhad.digit.AOD.e6553_e5984_s3126_r11478_d1523_r11479 0.23082pb;
 - mc16_13TeV:mc16_13TeV.345874.PhPy8EG_A14NNPDF23_NNPDF30ME_ttH125_hdamp352p5_semilep.digit.AOD.e6474_e5984_s3126_r11478_d1523_r11479 0.22276pb;
 - mc16_13TeV:mc16_13TeV.345875.PhPy8EG_A14NNPDF23_NNPDF30ME_ttH125_hdamp352p5_dilep.digit.AOD.e6474_e5984_s3126_r11478_d1523_r11479 0.05343pb;
- HIGG8D1 Derivation;
- GN1: AnalysisTop,21.2.75; ttHMultiAna: Branch: at75-apolici-2019-07-12
- Trigger reference: ATL-COM-PHYS-2018-410

SR and nominal trigger

All triggers are obtained with 'OR' logic

SR	
Common	passEventCleaning
OneL2tau	onelep_type>0 && lep_Pt_0>27e3 && nTaus_OR_Pt25==2
TwoLSS1tau	dilep_type>0 && nTaus_OR_Pt25==1 && lep_ID_0*lep_ID_1>0
TwoLOS1tau	dilep_type>0&&lep_ID_0*lep_ID_1<0&&nTaus_OR_Pt25==1
TwoLOS2tau	dilep_type>0 && tau_charge_0*tau_charge_1<0&&nTaus_OR_Pt25==2 && (lep_ID_0*lep_ID_1<0)
ThreeL1tau	(trilep_type>0&&nTaus_OR_Pt25==1&&(total_charge+tau_charge_0)==0
Nominal	2017
onelep	HLT_mu26_ivarmedium HLT_mu50 HLT_e26_lhtight_nod0_ivarloose HLT_e60_lhmedium_nod0 HLT_e140_lhloose_nod0
twolep	HLT_2e17_lhvloose_nod0 HLT_e17_lhloose_nod0_mu14 HLT_mu22_mu 8noL1

Offline Pt cut

- To check the trigger benchmark, we require the leading lepton/Pt just +1GeV over the trigger.
 - No requirements for subleading lepton and so on, which benefits;

All results are obtained with 'OR' logic		onelep	twolep			
Trig config \ channel (all numbers are #evts(weighted))		1l2tau	2lss1tau	2los1tau	2los2tau	3l1tau
Nominal		376(6.73)	146(5.76)	544(6.41)	34(0.11)	130(0.31)
Nominal NewTrigs		446, 7.88	484, 14.00	1475, 18.37	102, 0.27	216, 1.18
NewTrigs		436, 7.67	475, 13.81	1411, 18.10	102, 0.27	160, 0.39
NewTrigs e+tau best		216, 3.97	292, 8.74	844, 8.51	71, 0.19	120, 0.35
NewTrigs mu+tau best		226, 3.57	282, 7.42	866, 12.54	54, 0.15	112, 0.25
NewTrigs/Nominal		109%	239%	281%	245%	139%

Conclusion: We gain a lot from the new triggers.

Require Jet Pt>50GeV

	1l2tau	2lss1tau	2los1tau	2los2tau	3l1tau
Nominal(OnelepTrigs for 1l2tau, DilepTrigs for >=2l, and RunYear=2017)	107(1.41)	87(3.28)	375(4.10)	24(0.06)	66(0.06)
Nominal NewTrigs	114(1.46)	99(3.39)	478(6.60)	34(0.07)	74(0.07)
NewTrigs	111(1.42)	94(3.27)	439(6.41)	34(0.07)	71(0.07)

lep+tau triggers that have requirements on L1 Jets are not useful for our phase space.

Add $l_{2,pt} > 20\text{GeV}$

Require Lep_Pt_1 > 20GeV		1l2tau	2lss1tau	2los1tau	2los2tau	3l1tau
Nominal(OnelepTrigs for 1l2tau, DilepTrigs for $\geq 2l$, and RunYear=2017)			146(5.76)	544(6.41)	34(0.11)	
Nominal NewTrigs			320, 9.15	1067, 10.50	80, 0.22	
NewTrigs			313, 9.03	1023, 10.34	80, 0.22	
NewTrigs e+tau best			215, 6.15	669, 6.14	59, 0.18	
NewTrigs mu+tau best			185, 5.06	646, 7.13	45, 0.10	
NewTrigs/Nominal			156%	161%	200%	

Compared with requiring second lepton pt,
results are reduced.
We are benefited from free the second lepton.

CEPC correlation

- Asked by Manqi in June 24th;
- $\nu\nu H$ and $ZH, H \rightarrow \nu\nu$:
 - $\nu\nu H$ 0.78%, ZH 1.08%, anti-correlation -28%
- Add other ZH :
 - $\nu\nu H$ 0.76%, ZH 0.62%, anti-correlation -16%

