Weekly Report

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- Tau trigger check for Run3
  - Results are reported in July 25th MCG meeting;
- Multilepton
  - Grid space
  - Dihiggs report
- CEPC

Lepton+tau trigger check

- Previously, ttH use 1l/2l trigger in 5 channels
  - 1l2τ,2lss1τ,2los1τ,2los2τ,3l1τ
- Now new triggers with τ information available.
  - need to validate and compare the performance for Run3

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	

- 2 new triggers: 1lepton+1τ selected;
  - HLT_mu20_ivarloose_tau20_mediumRNN_tracktwoMVA_L1TAU8_03dRtt
  - HLT_e24_lhmedium_nod0_ivarloose_L1EM22VHI_tau20_mediumRNN_tracktwoMVA_L1TAU8_03dRtt

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 determination

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	Current configuration in 2017. (Trigger reference: ATL-COM-PHYS-2018-410)
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_mu8noL1

Offline Pt cut:
To check the trigger benchmark, we require the leading lepton/Pt just +1GeV over the trigger.
Like, for 2e17 trigger, require 2 electron pt>18GeV.

Results

weight calculated by
crossx*mcWeightOrg*lepSFObjTight*lepSFTrigTight*JVT_EventWeight*SherpaNJetWeight*MV2c10_70_EventWeight*lumi/totalEventsWeighted

Weighted evts;	1L	2L			
Trigger/Channel:	1l2tau	2lss1tau	2los1tau	2los2tau	3l1tau
Nominal	6.73	5.76	6.41	0.11	0.31
Nominal || NewTrigs	7.88	14.00	18.37	0.27	1.18
NewTrigs	7.67	13.81	18.10	0.27	0.39
NewTrigs e+tau best	3.97	8.74	8.51	0.19	0.35
NewTrigs mu+tau best	3.57	7.42	12.54	0.15	0.25
NewTrigs/Nominal	109%	239%	281%	245%	139%

Conclusion: We gain a lot from the new triggers.

Require leading jet Pt>50GeV

	1l2tau	2lss1tau	2los1tau	2los2tau	3l1tau
Nominal	6.73	5.76	6.41	0.11	0.31
Nominal || NewTrigs	7.88	14.00	18.37	0.27	1.18
NewTrigs	7.67	13.81	18.10	0.27	0.39
+leading jet Pt>50GeV					
Nominal	1.41	3.28	4.10	0.06	0.06
Nominal || NewTrigs	1.46	3.39	6.60	0.07	0.07
NewTrigs	1.42	3.27	6.41	0.07	0.07

Not reasonable to require jet pt on L1 in our phase space.
Plan not to apply those jet pt related trigger.

Why gain?

- New trigger require the leading lepton and tau, has no requirement for subleading lepton, which benefits yields.

	2lss1tau	2los1tau	2los2tau
Nominal	5.76	6.41	0.11
Nominal || NewTrigs	14.00	18.37	0.27
NewTrigs	13.81	18.10	0.27
NewTrigs e+tau best	8.74	8.51	0.19
NewTrigs mu+tau best	7.42	12.54	0.15
NewTrigs/Nominal	239%	281%	245%
Require Subleading Lepton Pt>20GeV			
Nominal || NewTrigs	9.15	10.50	0.22
NewTrigs	9.03	10.34	0.22
NewTrigs e+tau best	6.15	6.14	0.18
NewTrigs mu+tau best	5.06	7.13	0.10
NewTrigs/Nominal	156%	161%	200%

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

Multilepton

- Yesenia asked to give a report on Friday's dihiggs meeting
- Grid space still not work; Dimitrois checking;