

Current Status

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INSTITUTE OF EXPERIMENTAL PARTICLE PHYSICS (ETP)



1 Samples

2 Triggers

2.1 Single lepton triggers

2.2 Dilepton triggers

3 Selections

Sample

 σ [pb]

$t\bar{t}$ + jets

/TTTo2L2Nu_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18NanoAODv2	831.76 \times 0.10706
/TTToSemiLeptonic_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18NanoAODv2	831.76 \times 0.4411
/TTToHadronic_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18NanoAODv2	831.76 \times 0.45441

DY + jets

/DYJetsToLL_M-10to50_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	646.06
/DYJetsToLL_M-50_HT-70to100_TuneCP5_PWeights_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	211.21
/DYJetsToLL_M-50_HT-100to200_TuneCP5_PWeights_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	183.2
/DYJetsToLL_M-50_HT-200to400_TuneCP5_PWeights_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	55.29
/DYJetsToLL_M-50_HT-400to600_TuneCP5_PWeights_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	7.846
/DYJetsToLL_M-50_HT-600to800_TuneCP5_PWeights_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	1.933
/DYJetsToLL_M-50_HT-800to1200_TuneCP5_PWeights_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	0.831
/DYJetsToLL_M-50_HT-1200to2500_TuneCP5_PWeights_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	0.183
/DYJetsToLL_M-50_HT-2500toInf_TuneCP5_PWeights_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	0.004

Single top

/ST_s-channel_4f_leptonDecays_TuneCP5_13TeV-amcatnlo-pythia8/RunIISummer20UL18NanoAODv2	3.3633
/ST_tW_top_5f_inclusiveDecays_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18NanoAODv2	35.85
/ST_tW_top_5f_NoFullyHadronicDecays_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18NanoAODv2	
/ST_tW_antitop_5f_inclusiveDecays_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18NanoAODv2	35.85
/ST_t-channel_top_4f_inclusiveDecays_TuneCP5_13TeV-powheg-madspin-pythia8/RunIISummer19UL18NanoAODv2	136.02
/ST_t-channel_antitop_4f_inclusiveDecays_TuneCP5_13TeV-powheg-madspin-pythia8/RunIISummer19UL18NanoAODv2	80.95

W + jets

/WJetsToLNu_HT-70to100_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	1501.56
/WJetsToLNu_HT-100to200_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	1609.9
/WJetsToLNu_HT-200to400_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	475.0
/WJetsToLNu_HT-400to600_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	67.40
/WJetsToLNu_HT-600to800_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	16.75
/WJetsToLNu_HT-800to1200_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	7.5
/WJetsToLNu_HT-1200to2500_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	1.66
/WJetsToLNu_HT-2500toInf_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	0.0391
/WJetsToLNu_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18NanoAODv2	61526.7

Diboson

/WW_TuneCP5_13TeV-pythia8/RunIISummer20UL18NanoAODv2	118.7
/WZ_TuneCP5_13TeV-pythia8/RunIISummer20UL18NanoAODv2	47.13/65.5443?
/ZZ_TuneCP5_13TeV-pythia8/RunIISummer20UL18NanoAODv2	15.8274/16.523?
/ZZTo2L2Nu_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18NanoAODv2	

$t\bar{t}$ + X

/TTWJetsToLNu_TuneCP5_13TeV-amcatnloFXFX-madspin-pythia8	0.2043
/TTWJetsToQQ_TuneCP5_13TeV-amcatnloFXFX-madspin-pythia8	0.4062
/TTZToLLNuNu_M-10_TuneCP5_13TeV-amcatnlo-pythia8	0.2529
/TTZToQQ_TuneCP5_13TeV-amcatnlo-pythia8	0.5297
/TTGJets_TuneCP5_13TeV-amcatnloFXFX-madspin-pythia8	3.697
/tHtobb_M125_TuneCP5_13TeV-powheg-pythia8	
/tHtNonbb_M125_TuneCP5_13TeV-powheg-pythia8	

Table 3.1: Trigger paths of individual channels are connected via OR.

Channel	Trigger paths
electron	HLT_Ele32_WPTight_Gsf
	HLT_Ele28_eta2p1_WPTight_Gsf_HT150
muon	HLT_IsoMu24

- Trigger SFs available for RunIISummer20UL18
 - Should also be applicable to RunIISummer19UL18
- Potential loss of events in low p_T region
- Recovery of dilepton events failing dilepton triggers

Channel	Trigger paths
double electron	require single electron trigger
double muon	required single muon trigger
electron-muon	required single electron or(and?) single muon trigger

Dilepton triggers as suggested by TOP PAG

- Lowest unprescaled triggers as suggested by TOP PAG¹
- Trigger SFs not publically available (or not found)

Table 3.2: Trigger paths of individual channels are connected via OR.

Channel	Trigger paths
double electron	HLT_Ele23_Ele12_CaloIdL_TrackIdL_IsoVL
	HLT_Ele23_Ele12_CaloIdL_TrackIdL_IsoVL_DZ
electron-muon	HLT_Mu23_TrkIsoVVL_Ele12_CaloIdL_TrackIdL_IsoVL
	HLT_Mu23_TrkIsoVVL_Ele12_CaloIdL_TrackIdL_IsoVL_DZ
	HLT_Mu8_TrkIsoVVL_Ele23_CaloIdL_TrackIdL_IsoVL_DZ
	HLT_Mu12_TrkIsoVVL_Ele23_CaloIdL_TrackIdL_IsoVL_DZ
double muon	HLT_Mu17_TrkIsoVVL_Mu8_TrkIsoVVL_DZ_Mass3p8
	HLT_Mu17_TrkIsoVVL_Mu8_TrkIsoVVL_DZ_Mass8

¹<https://twiki.cern.ch/twiki/bin/view/CMS/TopTriggerYear2018>

Dilepton triggers used in recent TTo2L2Nu analysis²

- Additional use of single lepton double lepton
- Recovery of double lepton events failing double lepton triggers
- Trigger SF not publically available

Channel	Trigger paths
double electron	HLT_Ele23_Ele12_CaloIdL_TrackIdL_IsoVL HLT_Ele23_Ele12_CaloIdL_TrackIdL_IsoVL_DZ HLT_Ele32_WPTight_Gsf
electron-muon	HLT_Mu23_TrkIsoVVL_Ele12_CaloIdL_TrackIdL_IsoVL HLT_Mu23_TrkIsoVVL_Ele12_CaloIdL_TrackIdL_IsoVL_DZ HLT_Mu12_TrkIsoVVL_Ele23_CaloIdL_TrackIdL_IsoVL_DZ HLT_Mu8_TrkIsoVVL_Ele23_CaloIdL_TrackIdL_IsoVL_DZ HLT_Ele32_WPTight_Gsf HLT_IsoMu24
double muon	HLT_Mu17_TrkIsoVVL_Mu8_TrkIsoVVL_DZ_Mass3p8 HLT_Mu17_TrkIsoVVL_Mu8_TrkIsoVVL_DZ_Mass8 HLT_IsoMu24

²<https://twiki.cern.ch/twiki/bin/viewauth/CMS/TOP20009>

Muons

- $p_T > 25 \text{ GeV}$
- $|\eta| < 2.4$
- CutBasedIdTight³
- PFIsoLoose

Electrons

- $p_T > 25 \text{ GeV}$
- $|\eta| < 2.4$
- Exclude barrel-endcap transition
 $1.4442 < |\eta| < 1.5660$
- CutBasedIdTight⁴

³<https://twiki.cern.ch/twiki/bin/view/CMS/SWGuideMuonIdRun2>

⁴[https://twiki.cern.ch/twiki/bin/viewauth/CMS/](https://twiki.cern.ch/twiki/bin/viewauth/CMS/CutBasedElectronIdentificationRun2)

CutBasedElectronIdentificationRun2

Jets

- AK4 jets
- $p_T > 30 \text{ GeV}$
- $|\eta| < 2.4$
- TightLepVeto jetId⁵
- Exclude jets with $\Delta R_{j\ell} < 0.4$

b jets

- DeepJet medium WP

⁵<https://twiki.cern.ch/twiki/bin/view/CMS/JetID13TeVRun2018>

Lepton pair

- 2 fully selected OC leptons
- $m_{ll} > 12 \text{ GeV}$
- Same lepton flavour exclude
 $76 \text{ GeV} < m_{ll} < 106 \text{ GeV}$

MET

- Same lepton flavour
 $|\vec{E}_T| > 30 \text{ GeV}$

Filter Name	Data	MC
Flag_goodVertices	X	X
Flag_globalSuperTightHalo2016Filter	X	X
Flag_HBHENoiseFilter	X	X
Flag_HBHENoiseIsoFilter	X	X
Flag_EcalDeadCellTriggerPrimitiveFilter	X	X
Flag_BadPFMuonFilter	X	X
Flag_BadPFMuonDzFilter ⁶	X	X
Flag_eeBadScFilter	X	X
Flag_ecalBadCalibFilter	X	X

⁶Not in nanoAODv2

⁷<https://twiki.cern.ch/twiki/bin/view/CMS/MissingETOptionalFiltersRun2>