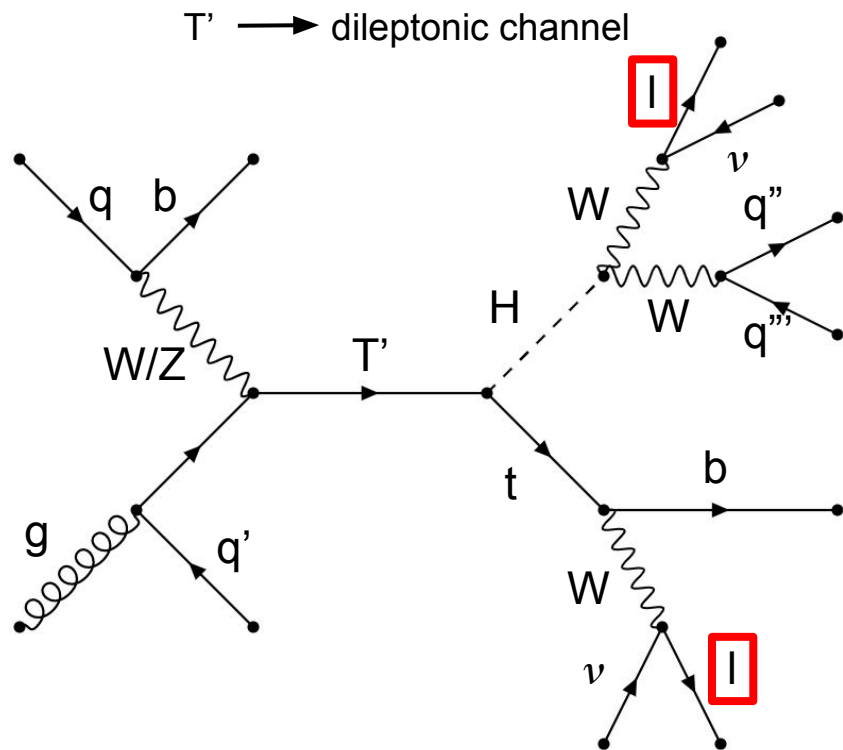


Search for a single production $T' \rightarrow \text{top} + H$ in dileptonic SS final state

15 June 2022
Benjamin Blancon, IP2I
DESY meeting

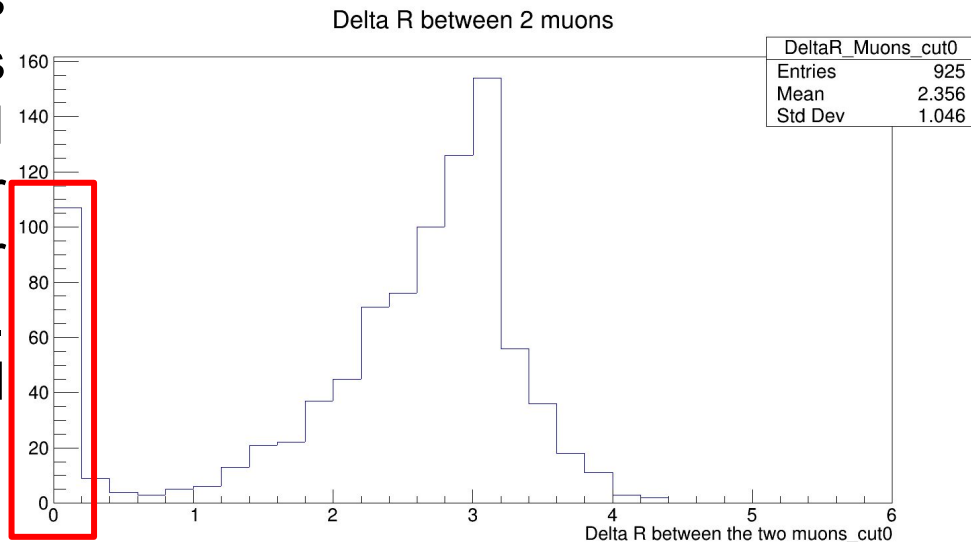


We are looking for a dileptonic final state with same sign leptons (muons/electrons). The final state has at least 3 jets (with one b-jet) and 2 neutrinos in addition. The variable of interest is the S_t (sum of leptons + jets P_t).

We are only focused on muons for the moment.

Identification of Muons

I studied isolation variables for muons and I had the same problem as Guillaume. → There is a peak around 0 for ΔR and $\Delta\phi$ when we ask for loose or medium MuonID, no matter what the value of the isolation variable. It appears for both signal and background.



→ Need to ask for MuonID (tight) to remove these peaks.

ΔR with tight isolation variable
Muon_miniPFRellso_all (signal)

Application of the ID + Isolation (Muon_pfRelIso03_all)

ID	Isolation	Signal	TTbar	S/B	Mis-charged and mis-isolated rate for TTbar
Loose	Nothing	179.7	154738.6	0.11%	-
	Loose	30.3	7967.4 (peak for $\Delta R/\Delta\phi \approx 0$)	0.38%	5.3%
	Tight	26.6	4869.2 (peak for $\Delta R/\Delta\phi \approx 0$)	0.55%	3.3%
Medium	Nothing	173.4	150785.1	0.11%	-
	Loose	29.1	6359.1 (peak for $\Delta\phi \approx 0$)	0.46%	4.2%
	Tight	25.5	3439.5 (peak for $\Delta\phi \approx 0$)	0.74%	2.3%
Tight	Nothing	170.3	149321.4	0.11%	-
	Loose	28.7	6128.9	0.47%	4.1%
	Tight	25.1	3273.7	0.77%	2.2%

Cut-based selection for Muons

Basic selection (Cut 0): 2 SS Muons with tight MuonID, $P_t > 20$ GeV, $|\eta| < 2.4$ and tight isolation ($\text{Muon_miniPFRellso_all} < 0.05$).

Two strategies for the moment:

Strategy 1: Cut 1: P_t of the leading muon > 80 GeV.

Cut 2: P_t of the subleading muon > 40 GeV.

Cut 3: $\Delta R > 1.8$.

Cut 4: at least one b-jet (b-tag DeepJet loose).

Strategy 2: Cut 1: Sum of the P_t of the two muons > 160 GeV.

Cut 2: $\Delta R > 1.8$.

Cut 3: at least one b-jet (b-tag DeepJet loose).

Datasets (UL 2018)

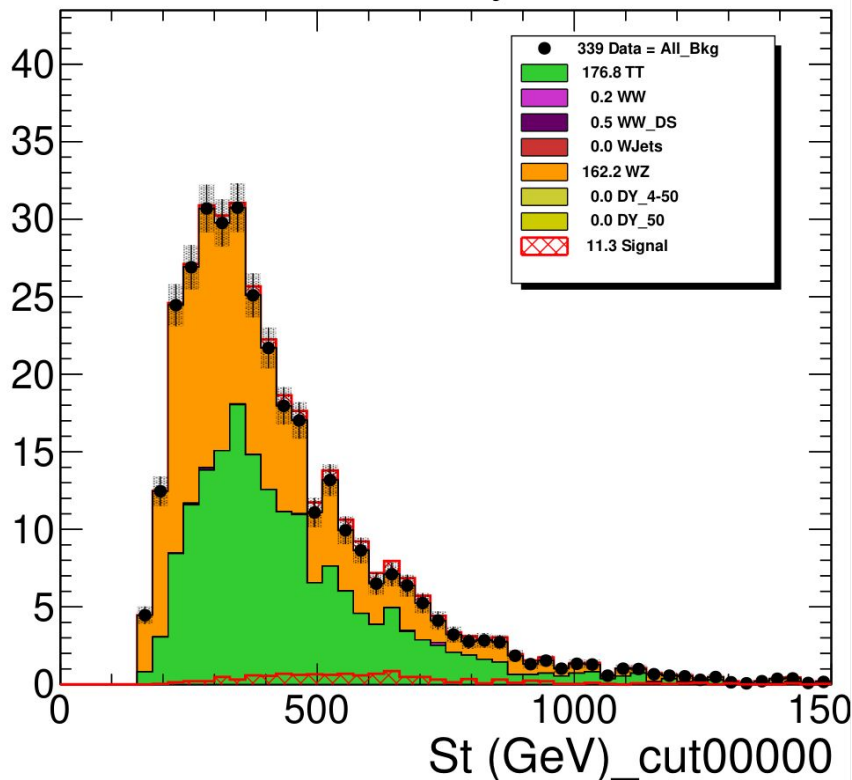
Process	Cross-section (fb)	Dataset name
Signal	89	/TprimeBToTH_M-700_LH_TuneCP5_PSweights_13TeV-madgraph_pythia8/RunIISummer19UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v1/MINIAODSIM
TTbar	87315	/TTTo2L2Nu_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v1/MINIAODSIM
WW	12178	/WWTo2L2Nu_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v2/MINIAODSIM
WW (Double Scattering)	169.75	/WWTo2L2Nu_TuneCP5_DoubleScattering_13TeV-pythia8/RunIISummer19UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v1/MINIAODSIM
W + Jets	61334900	/WJetsToLNu_TuneCP5_13TeV-amcatnloFXFX-pythia8/RunIISummer20UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v2/MINIAODSIM
WZ	4429.7	/WZTo3LNu_TuneCP5_13TeV-amcatnloFXFX-pythia8/RunIISummer20UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v2/MINIAODSIM
Drell-Yan	18610000	/DYJetsToLL_M-4to50_HT-100to200_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v2/MINIAODSIM
	6020850	/DYJetsToLL_M-50_TuneCP5_13TeV-madgraphMLM-pythia8/RunIISummer20UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v2/MINIAODSIM

Strategy 1: St after Cut 4 ($L = 150\text{fb}^{-1}$)

Events/ 30.00

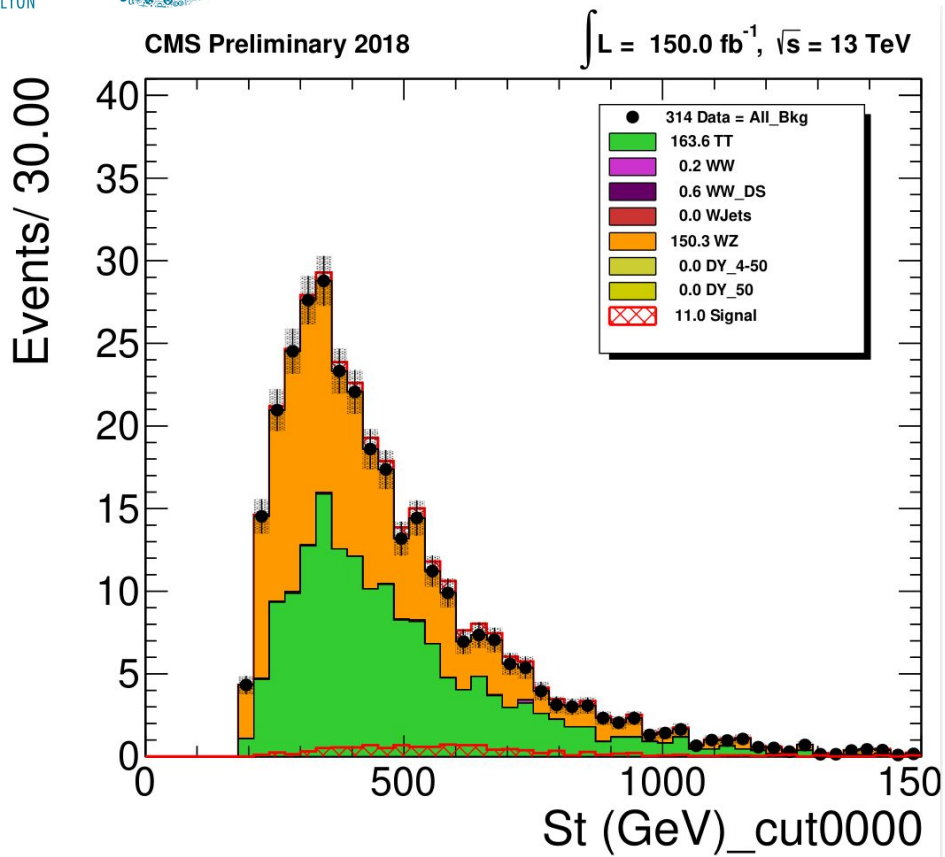
CMS Preliminary 2018

$\int L = 150.0 \text{ fb}^{-1}$, $\sqrt{s} = 13 \text{ TeV}$



Selection	Signal	Background	S/B
Cut 0	25.1	24262.8	0.10%
Cut 1	17.3	3064.9	0.56%
Cut 2	12.7	1693.9	0.75%
Cut 3	12.4	1415.7	0.88%
Cut 4	11.3	339.7	3.33%

Strategy 2: St after Cut 3 ($L = 150\text{fb}^{-1}$)



Selection	Signal	Background	S/B
Cut 0	25.1	24262.8	0.10%
Cut 1	12.7	1493.6	0.85%
Cut 2	12.2	1223.3	1.00%
Cut 3	11.0	314.7	3.50%

Next steps

Retune the cuts with respect to truth $T' \longrightarrow$ top + H in dileptonic final state.

Work on reducing the WZ background.

Add new backgrounds (Single top, ttH, ttW, ttZ, WWW, WH, ZH, ZZ).

Define criteria for good electrons.

Add the others channels with electrons.

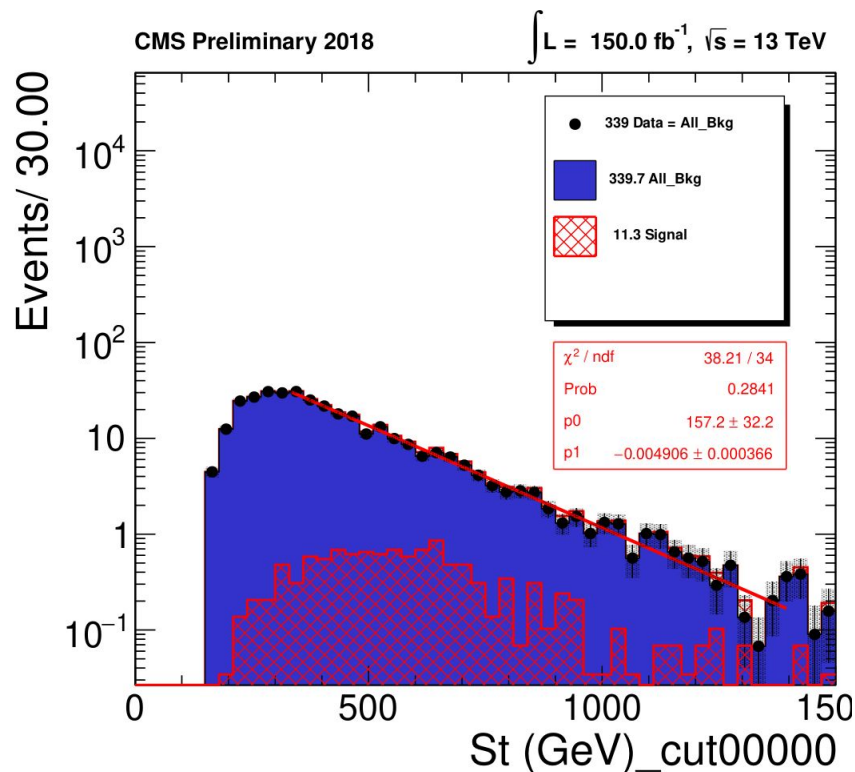
Thanks for your attention!

Back-up

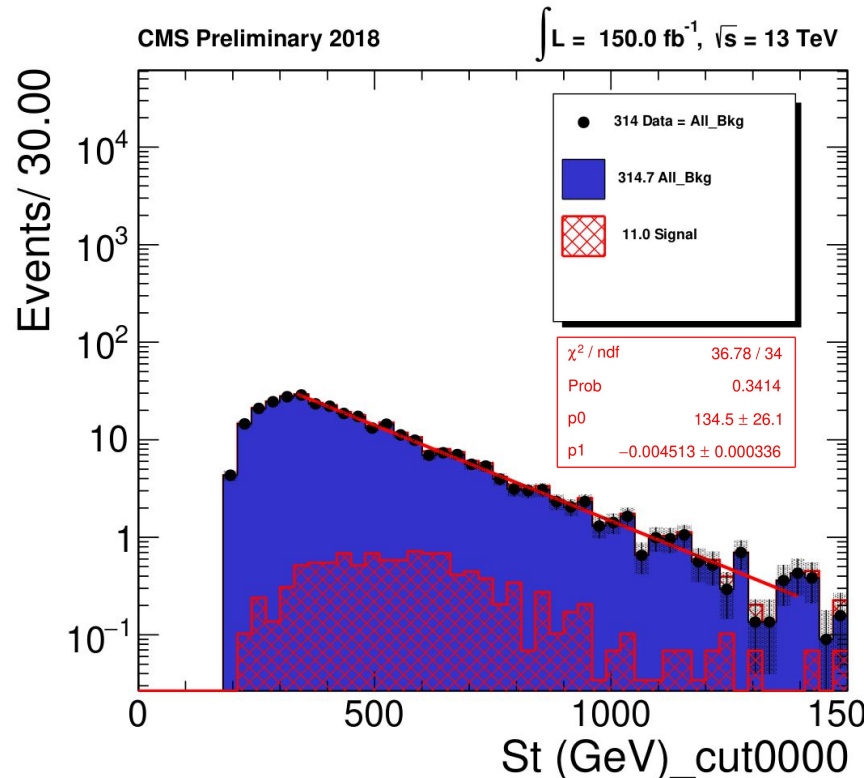
Application of the ID + Isolation (Muon_pfRelIso03_chg)

ID	Isolation	Signal	TTbar	S/B	Mis-charged and mis-isolated rate for TTbar
Loose	Nothing	179.7	154738.6	0.11%	-
	Loose	24.3	7407.4	0.33%	5.0%
	Tight	19.0	4486.0	0.42%	3.0%
Medium	Nothing	173.4	150785.1	0.11%	-
	Loose	23.4	5953.5	0.39%	4.0%
	Tight	18.3	3281.5	0.56%	2.2%
Tight	Nothing	170.3	149321.4	0.11%	-
	Loose	22.9	5696.7	0.40%	3.8%
	Tight	18.0	3084.8	0.58%	2.1%

St after the selection (log scale)



Strategy 1



Strategy 2