Software Review: Update

11 March 2022
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Basic selection: 2 Muons with Pt > 20 GeV and |η| < 2.4 and SS charge
+ Muon isolation and Muon ID (detailed below).

Dataset:
/TTTo2L2Nu_TuneCP5_13TeV-powheg-pythia8/RunIISummer20UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v1/MINIAODSIM: ttbar (146,010,000 Events).
/TprimeBToTH_M-700_LH_TuneCP5_PSweights_13TeV-madgraph_pythia8/RunIISummer19UL18MiniAODv2-106X_upgrade2018_realistic_v16_L1v1-v1/MINIAODSIM: signal (389,500 events).

Isolation of the muons

Variables (VALUES TO BE CHECKED):

Muon_pfRelIso03_all: < 0.05 (tight), < 0.10 (loose).
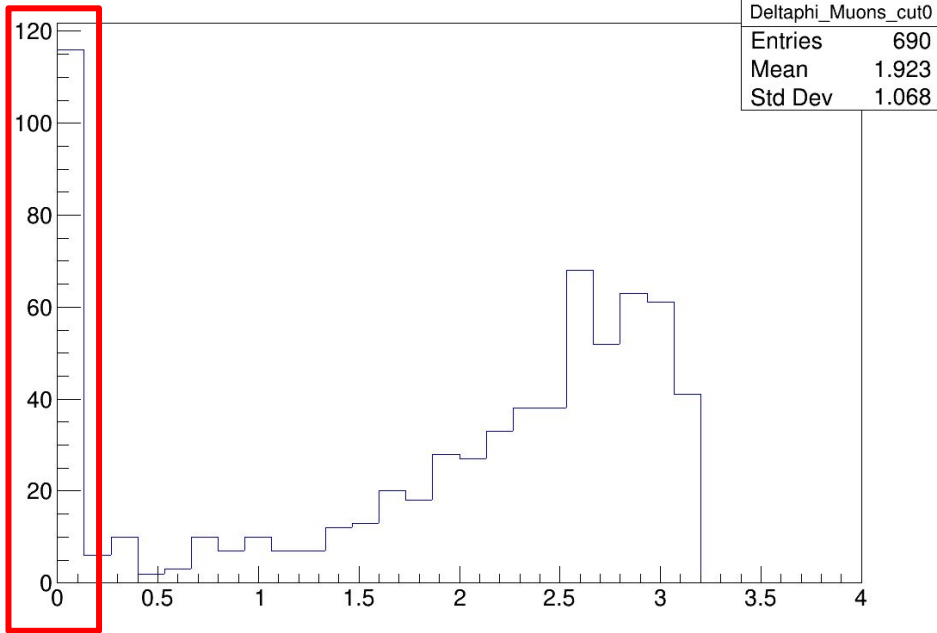
Muon_pfRelIso03_chg: < 0.05 (tight), < 0.10 (loose).

Muon_pfRelIso04_all: < 0.15 (tight), < 0.25 (loose).

Muon_miniPFRelIso_all: < 0.10 (loose), < 0.40 (loose).

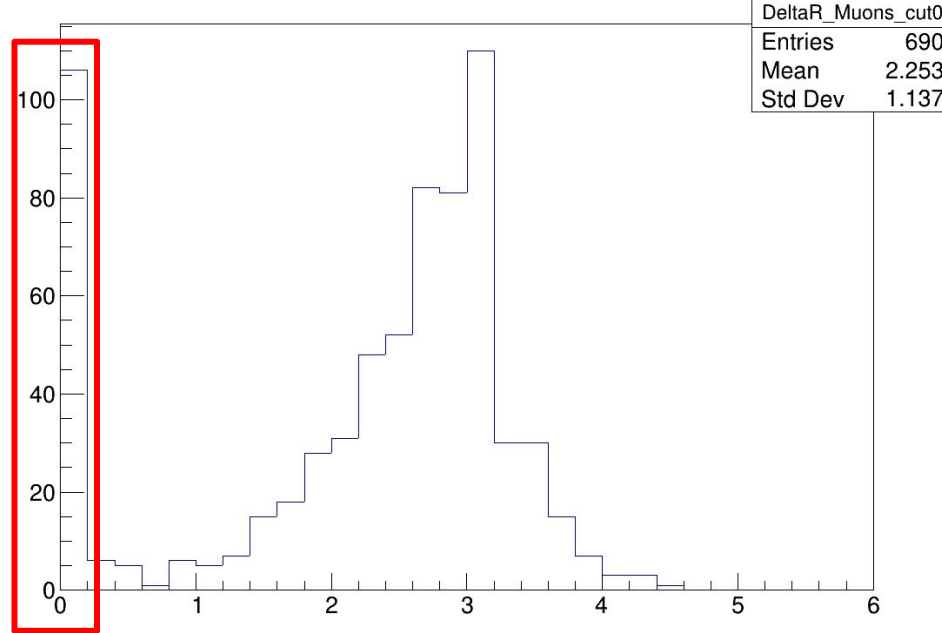Muon_miniPFRelIso_chg: < 0.10 (loose), < 0.40 (loose).

Application of the isolation (Muon_pfRelIso03_all tight, signal)
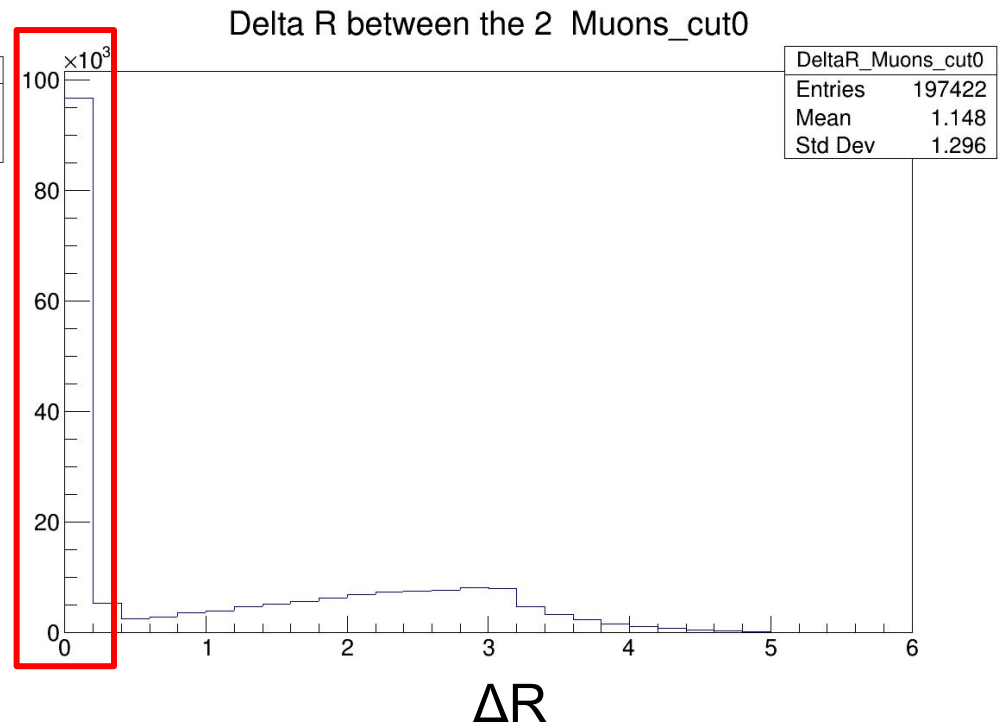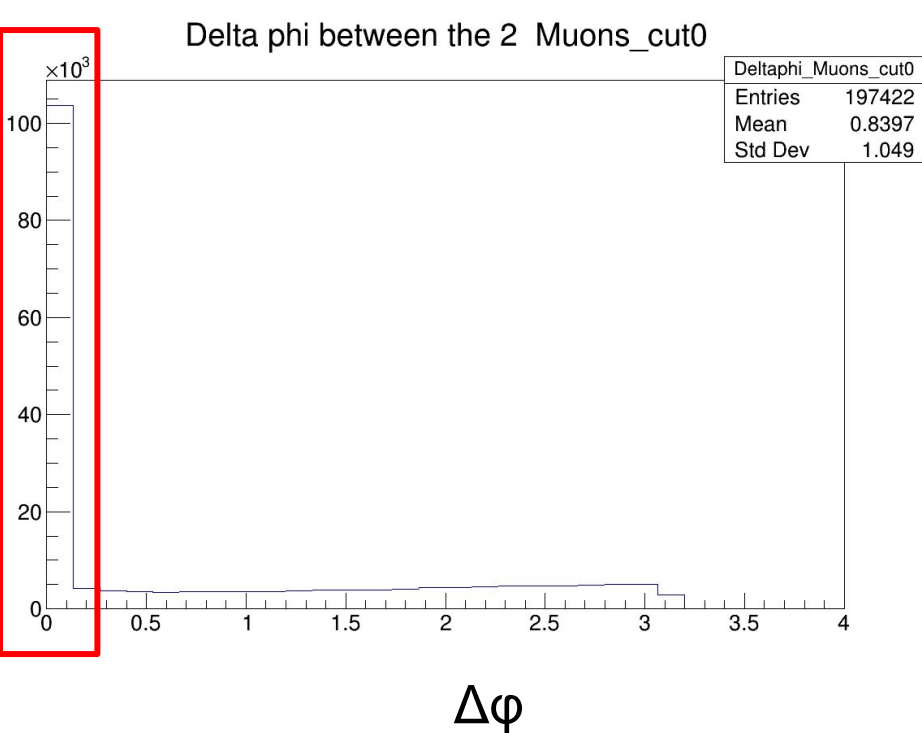
Delta phi between the 2 Muons_cut0

Deltaphi_Muons_cut0	
Entries	690
Mean	1.923
Std Dev	1.068

Δφ

Delta R between the 2 Muons_cut0

DeltaR_Muons_cut0	
Entries	690
Mean	2.253
Std Dev	1.137

ΔR

A lot of events (~15%) have Δφ and ΔR ≈ 0.

Application of the isolation (Muon_pfRelIso03_all tight, ttbar)

Delta phi between the 2 Muons_cut0

Deltaphi_Muons_cut0	
Entries	197422
Mean	0.8397
Std Dev	1.049

Δφ

Delta R between the 2 Muons_cut0

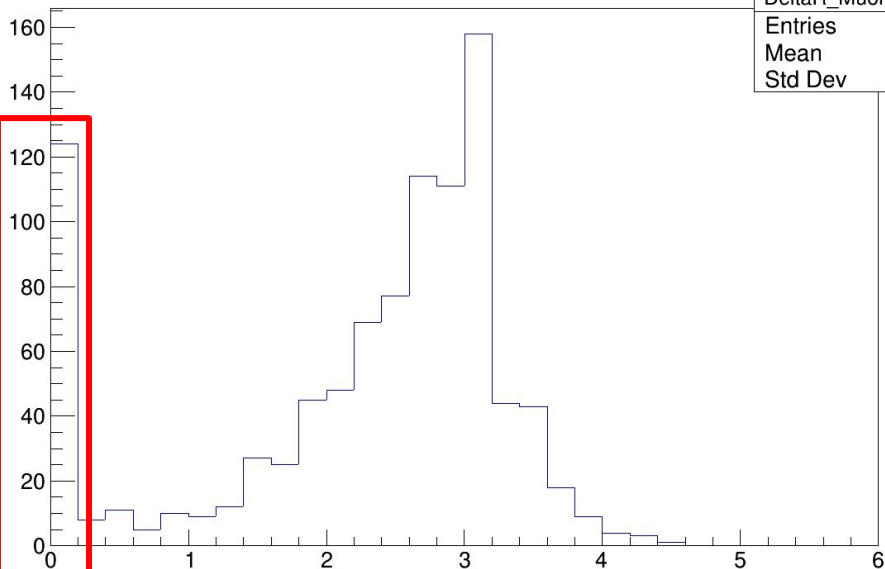| DeltaR_Muons_cut0	
Entries	197422
Mean	1.148
Std Dev	1.296

ΔR

Same thing for the background.

Application of the tight isolation with other variables (ΔR, signal)
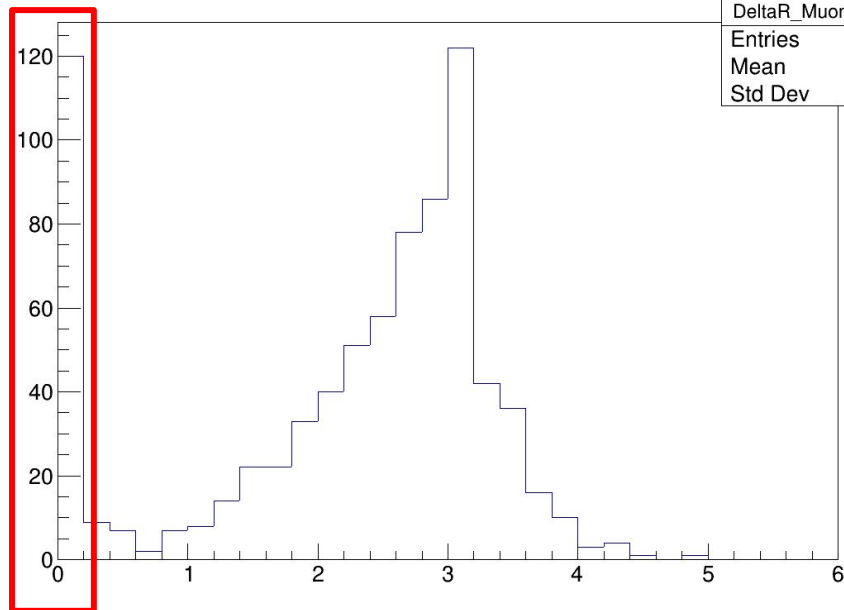
Delta R between the 2 Muons_cut0

DeltaR_Muons_cut0	
Entries	975
Mean	2.278
Std Dev	1.086

Delta R between the 2 Muons_cut0

DeltaR_Muons_cut0	
Entries	792
Mean	2.228
Std Dev	1.155

Muon_pfRelIso03_chg

Muon_pfRelIso04_all

Application of the tight isolation with other variables (ΔR, signal)

Delta R between the 2 Muons_cut0

DeltaR_Muons_cut0	
Entries	1053
Mean	2.324
Std Dev	1.061

Muon_miniPFRelIso_all

Delta R between the 2 Muons_cut0
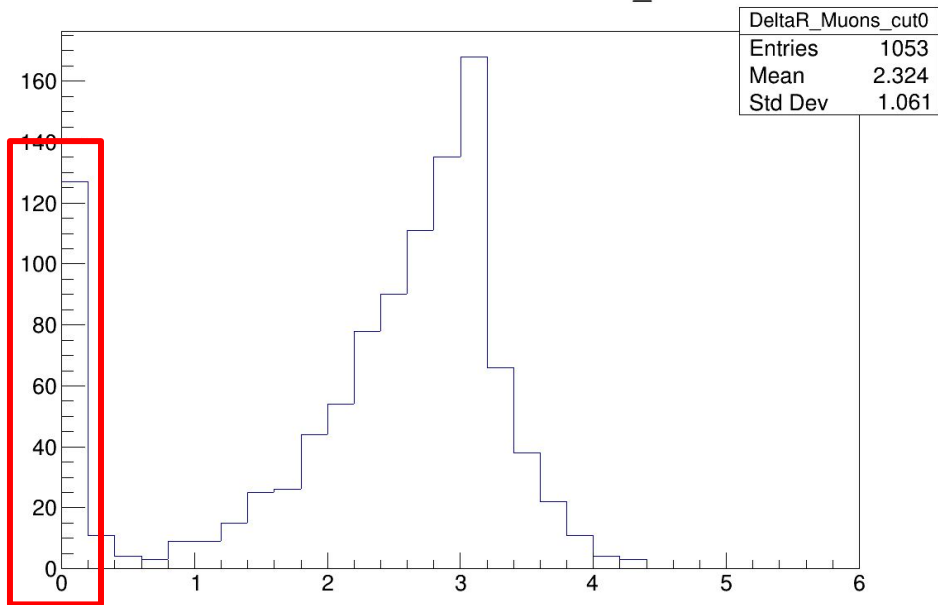
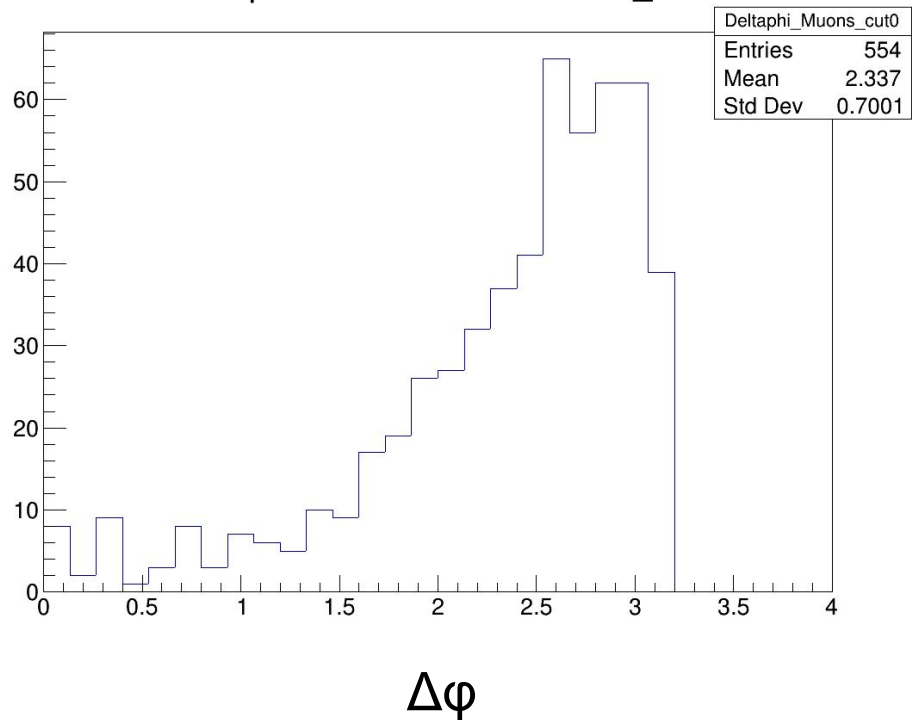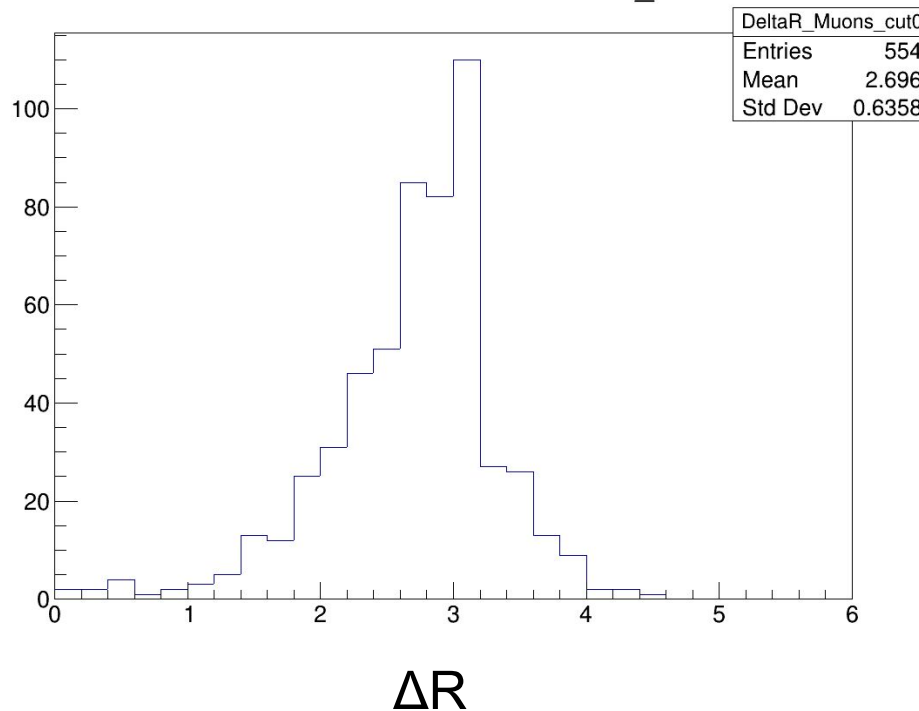| DeltaR_Muons_cut0	
Entries	1391
Mean	2.321
Std Dev	1.063
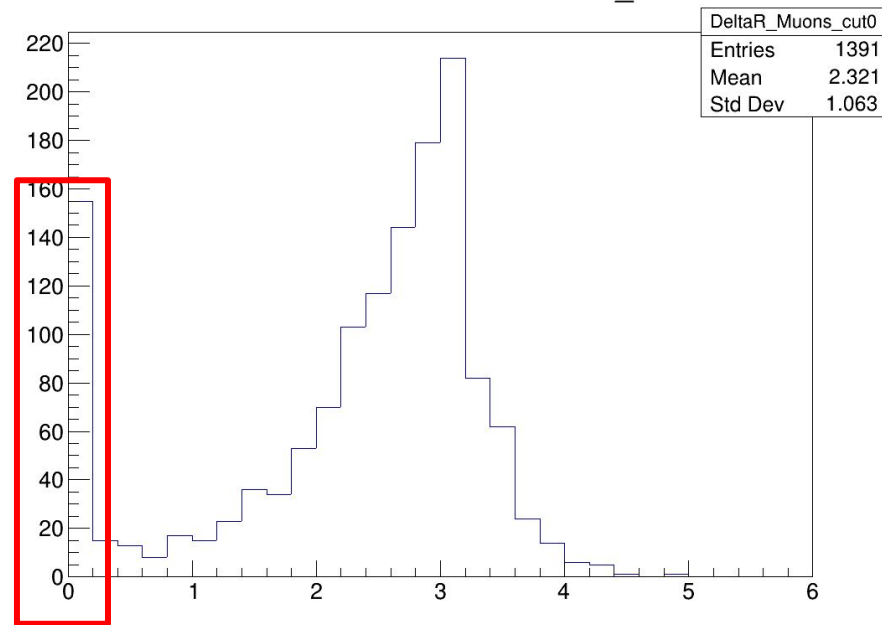
Muon_miniPFRelIso_chg

Same thing for all the variables.
⟶ Let's implement the MuonID.

Application of the isolation (Muon_pfRelIso03_all tight, signal) with loose ID
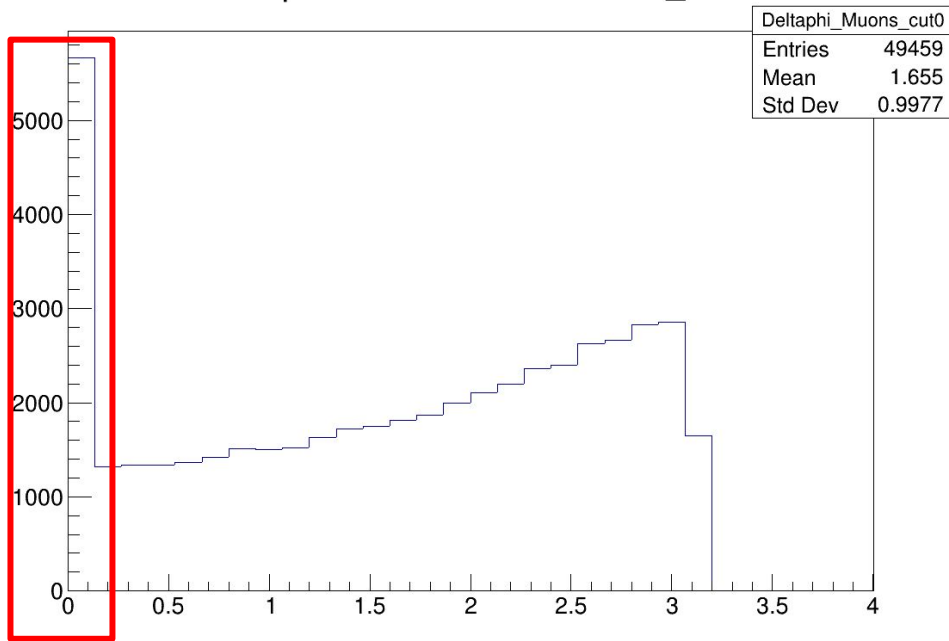
Delta phi between the 2 Muons_cut0

Delta R between the 2 Muons_cut0
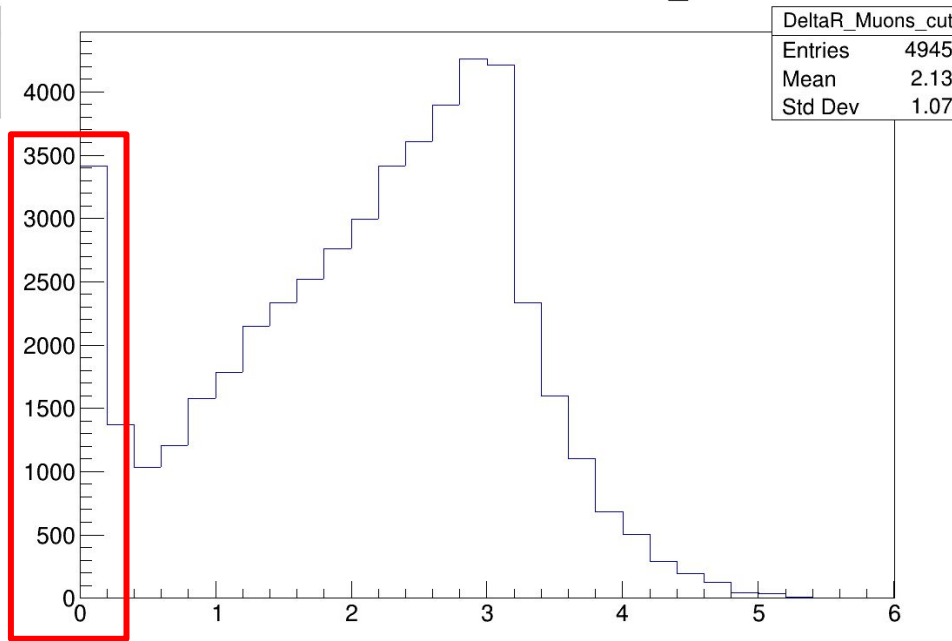
Δφ

ΔR

The peaks disappeared!

Application of the isolation (Muon_pfRelIso03_all tight, ttbar) with loose ID

Delta phi between the 2 Muons_cut0

Delta R between the 2 Muons_cut0
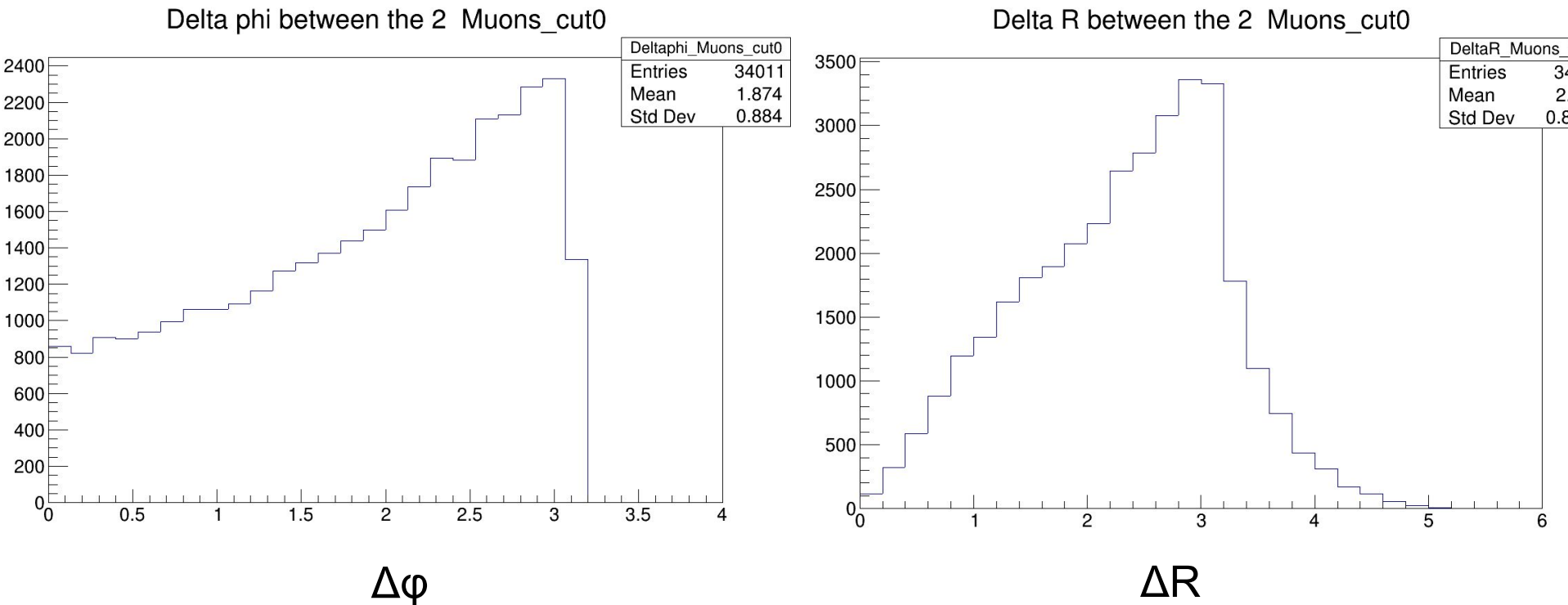

Deltaphi_Muons_cut0	
Entries	49459
Mean	1.655
Std Dev	0.9977

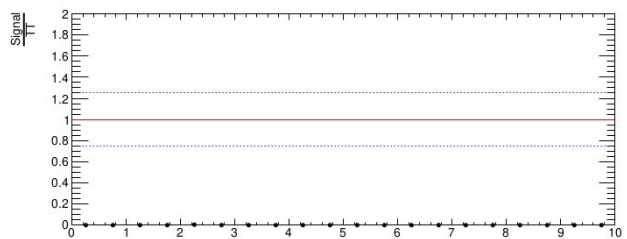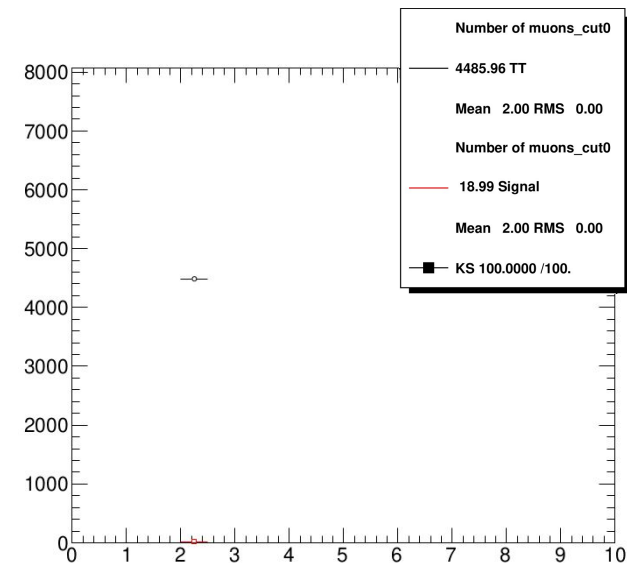| DeltaR_Muons_cut	
Entries	4945
Mean	2.13
Std Dev	1.07

Δφ

ΔR

The peaks still remain for the background.

Application of the isolation (Muon_pfRelIso03_all tight, ttbar) with tight ID

Delta phi between the 2 Muons_cut0

Deltaphi_Muons_cut0	
Entries	34011
Mean	1.874
Std Dev	0.884

Delta R between the 2 Muons_cut0

DeltaR_Muons_c	
Entries	34
Mean	2.
Std Dev	0.8

Δφ

ΔR

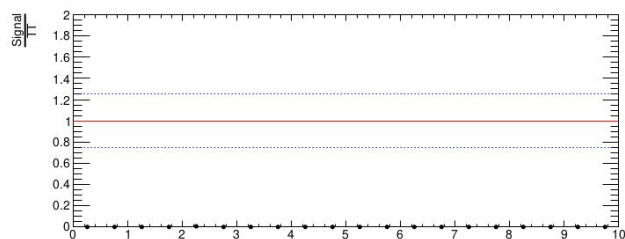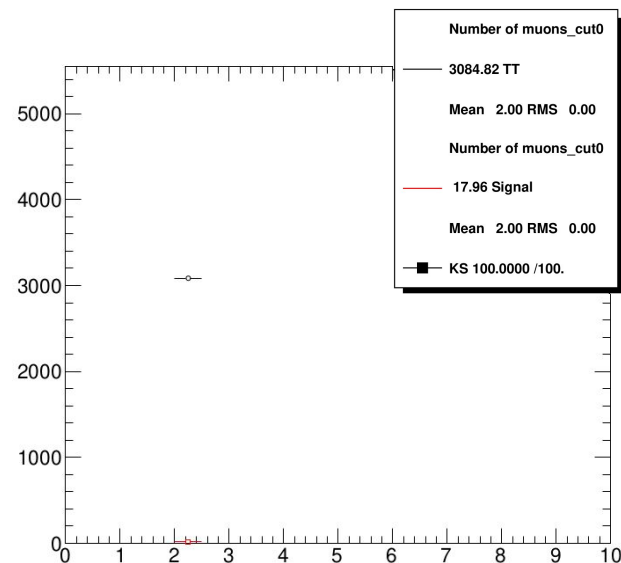The peaks disappear for tight MuonID.

Number of events: signal vs ttbar (loose and tight MuonID), lumi = 150fb⁻¹

Number of muons_cut0

4485.96 TT
Mean 2.00 RMS 0.00

Number of muons_cut0

18.99 Signal
Mean 2.00 RMS 0.00

KS 100.0000 /100.

Number of muons_cut0

3084.82 TT
Mean 2.00 RMS 0.00

Number of muons_cut0

17.96 Signal
Mean 2.00 RMS 0.00

KS 100.0000 /100.

S/B = 0.4% after scaling to the lumi

S/B = 0.5% after scaling to the lumi

Increase of 27% for S/B between the loose and tight MuonID. ⟶ Good! However, even for loose MuonID, the number of signal events (~19 events after the scaling to the lumi) is pretty low. ⟶ Lower the value for the isolation and check it for the five isolation variables, working with the loose MuonID for the moment (still possible to apply a cut to remove the events at ΔR = 0 for ttbar events. ⟶ OK?)

The muon reconstruction using generator information is done! ⟶ WHAT ABOUT NEUTRINOS?