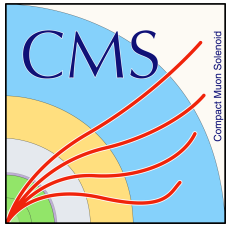
HEP Weekly Report
NTUA
3/6/2020

George Bakas



Status Report

- We have identified that the contamination in the control region coming form the subdominant processes is also significant and, in some cases, even more significant than the one coming from ttbar.
- Although it can be seen that selecting the b-tagging loose working point for our control region improves the situation concerning the ttbar contamination, the subdominant bkg still remains significant especially in the area around the W mass.

We tried 3 different fitting methods, all using the medium b-tagging working point for both regions (Signal and Control region) and decided that the best working method is:

- We fit only the 2btag region but we use a ttbar and subdominant bkg free area to generate the qcd template.
  We calculate this area using QCD = Data(0btag) – ttbar (0btag) – subdominant (0btag) where both ttbar and subdominant are taken from MC.

Next Step is Signal extraction and Unfolding on Parton and Particle levels

Signal Selection

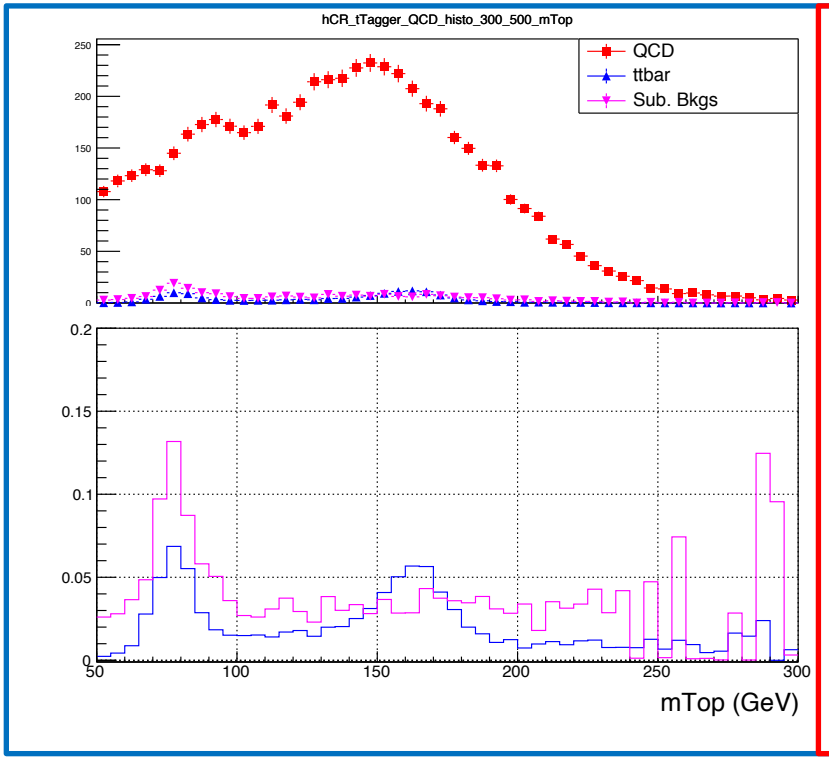
Variables	Selected Cut
pT (both leading jets)	> 400 GeV
Njets	> 1
N leptons	= 0
|eta| (both leading jets)	< 2.4
mJJ	> 1000 GeV
jetMassSoftDrop (only for fit)	(50,300) GeV
Top Tagger	> 0.2
B tagging (2 btagged jets)	> Medium WP
Signal Trigger	

Control Region Selection

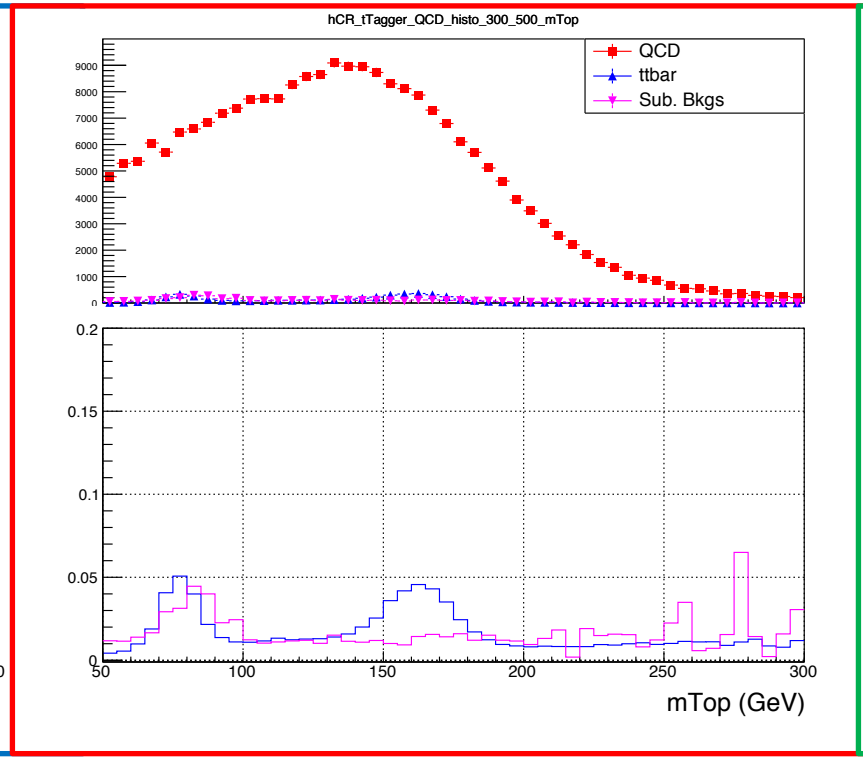
Variables	Selected Cut
pT (both leading jets)	> 400 GeV
Njets	> 1
N leptons	= 0
|eta| (both leading jets)	< 2.4
mJJ	> 1000 GeV
jetMassSoftDrop (only for fit)	(50,300) GeV
Top Tagger	> 0.2
B tagging (0 btagged jets)	< Medium WP
Control Trigger	

Contamination Plots Medium WP (CR, SR)

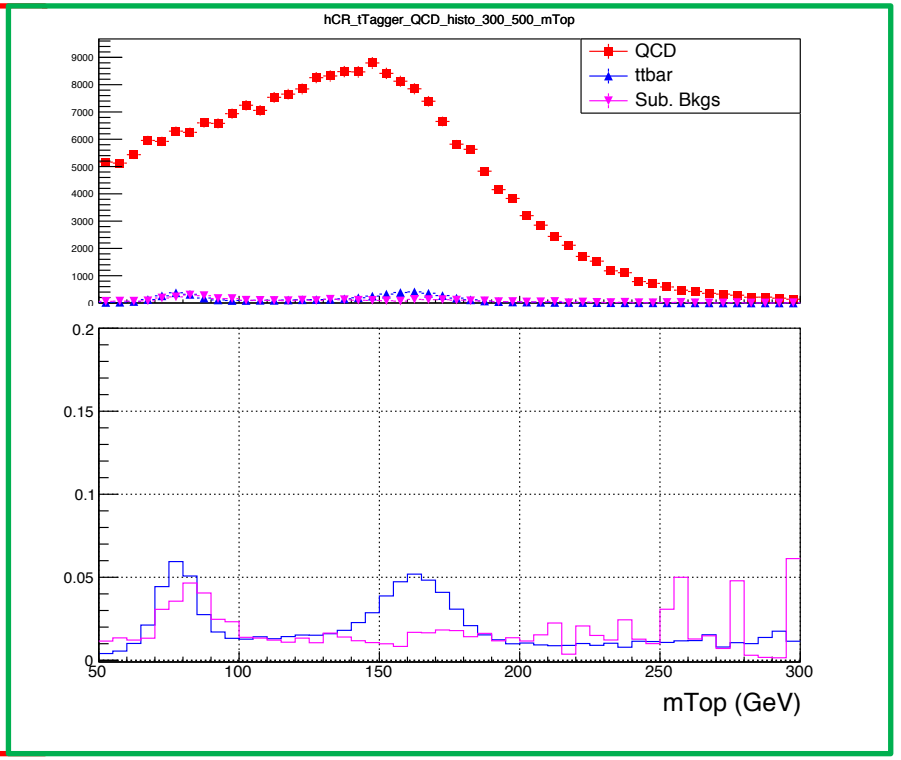
2016



2017

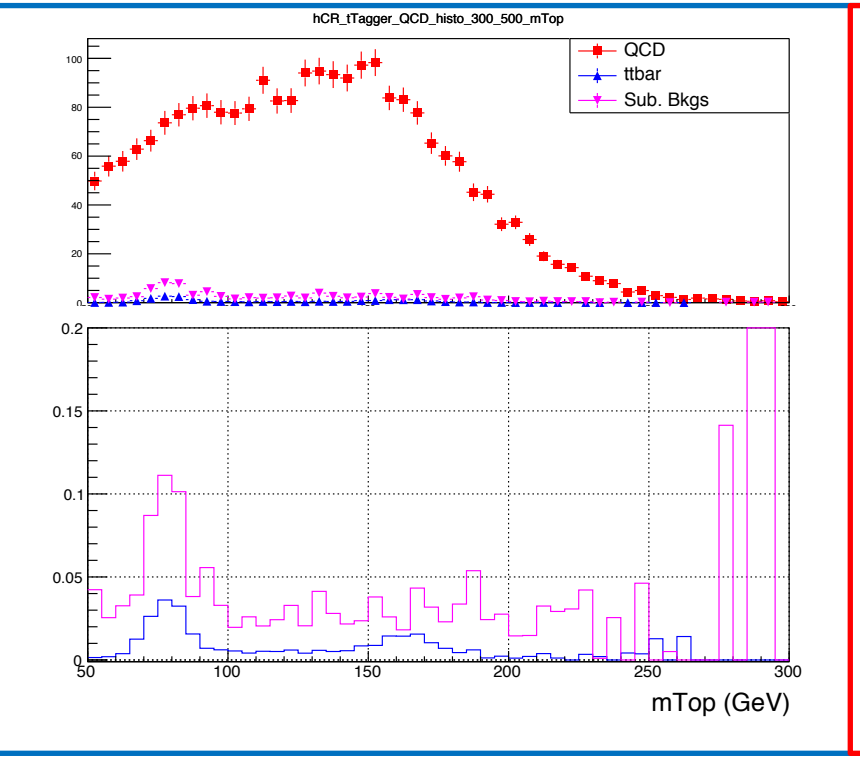


2018

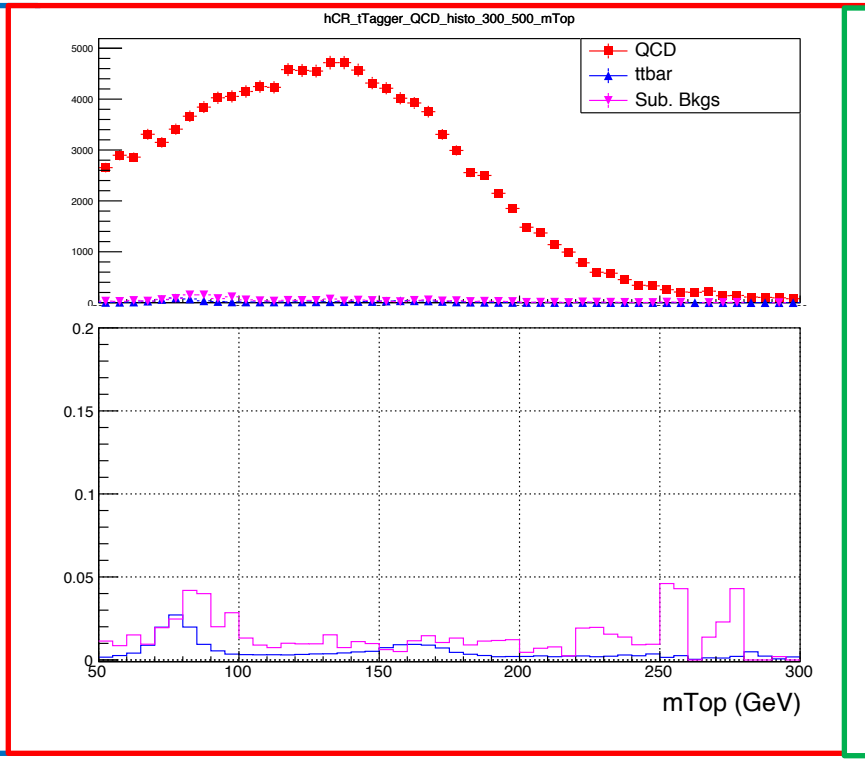


Contamination Plots Medium WP SR, Loose WP CR

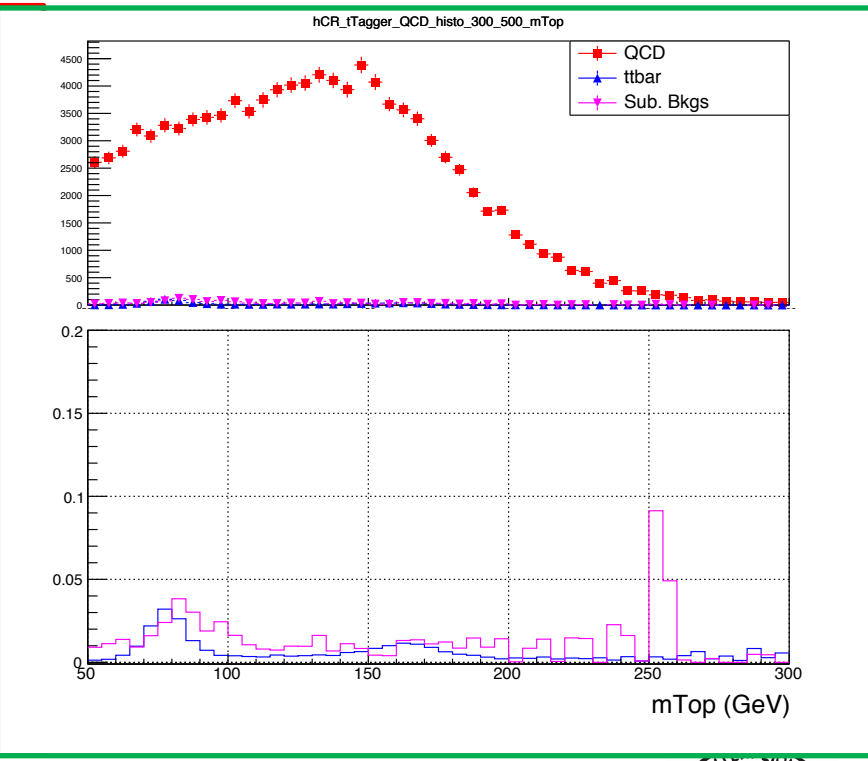
2016



2017



2018

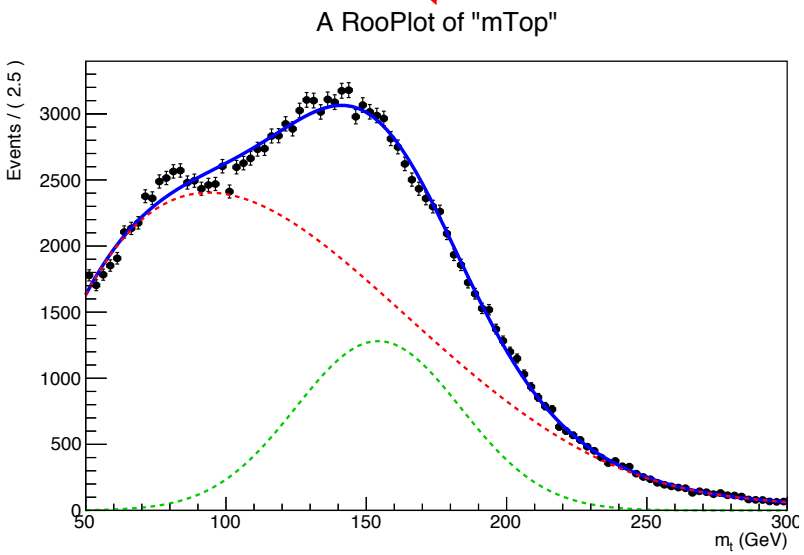


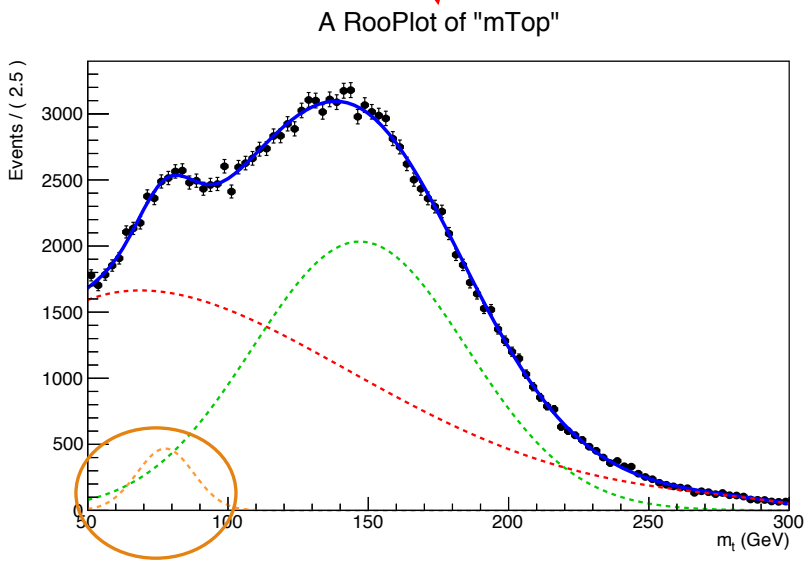
Mass Fit – Template fit results 2017

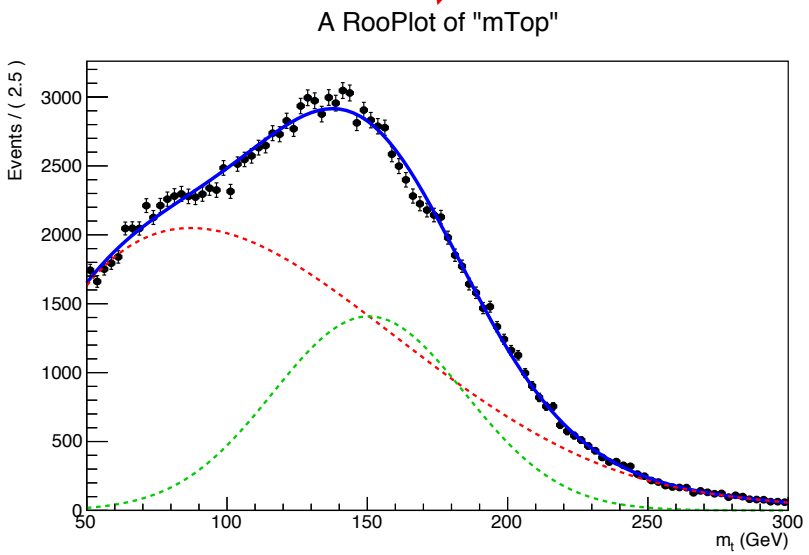
No subtraction, no extra Gauss

Extra Gaussian to explain peak at 75 GeV

Subtracted tt, subdominant bkgs from Data







- Medium WP for both SR and CR
- This happens also for using the Medium btag WP for SR and the Loose btag WP for the CR
- This is same for 2018
- 2016 not very sensitive because we have very few statistics → Control trigger with 1.67 pb-1

Simple Mass Fit 2016

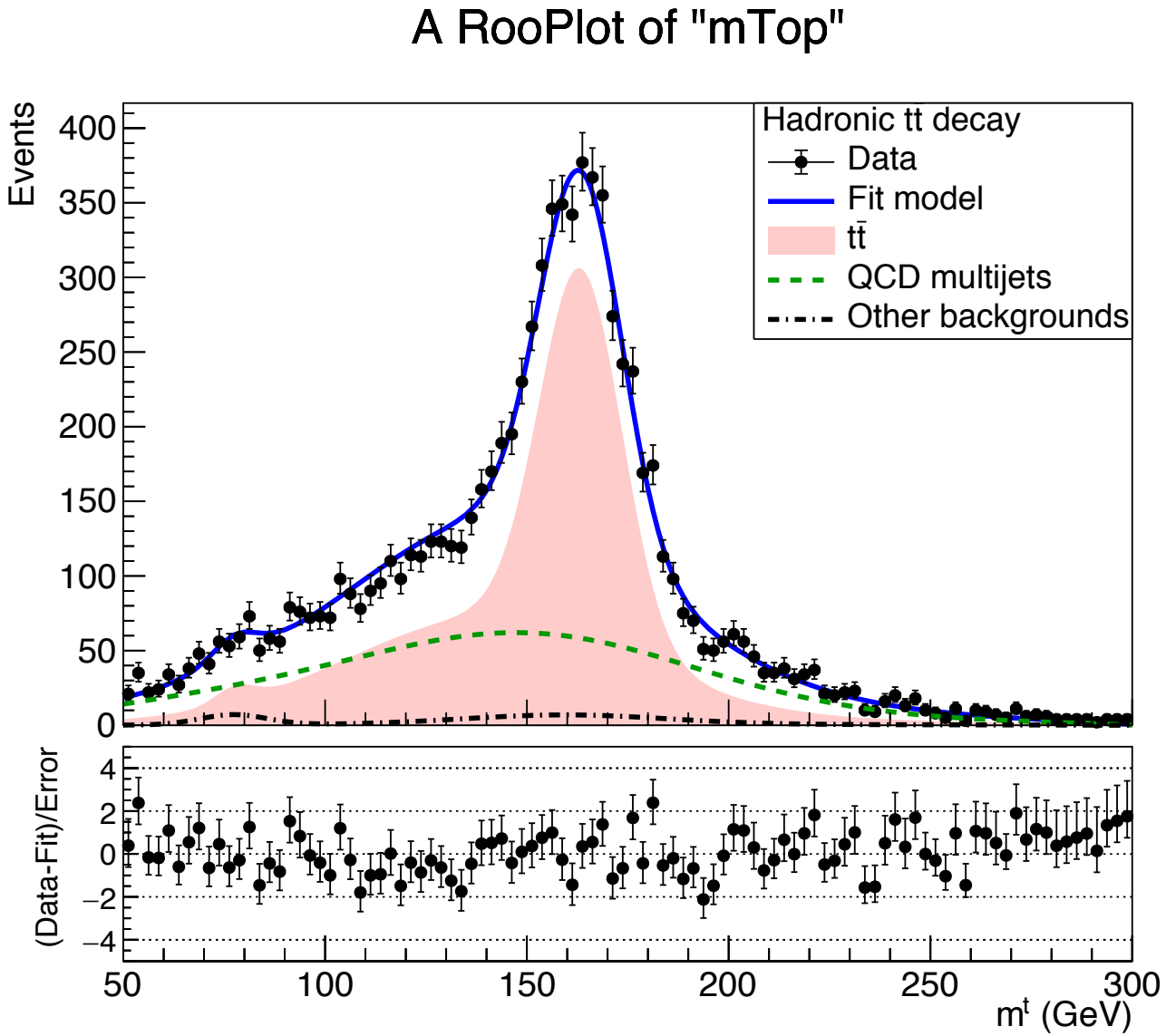
- Both SR and Control Region use the Medium btag WP.
- Intuition is to remove the ttbar and subdominant bkg contribution from the data Control Region

$$QCD_0(m^t) = D_0(m^t) - T_0(m^t) - Sub_0(m^t)$$

Floating Parameter	FinalValue +/- Error
kMassResol	9.2245e-01 +/- 2.72e-02
kMassScale	9.9906e-01 +/- 2.01e-03
kQCD_2b	6.8926e-02 +/- 5.06e-02
nFitBkg_2b	2.5236e+02 +/- 1.44e+02
nFitQCD_2b	2.9886e+03 +/- 1.73e+02
nFitSig2b	5.2694e+03 +/- 1.65e+02

Signal strength: r = 0.671244 ± 0.0252439

$$\frac{k_{QCD,MC}}{k_{QCD,Postfit}} = \frac{0.031}{0.069} = 0.44$$

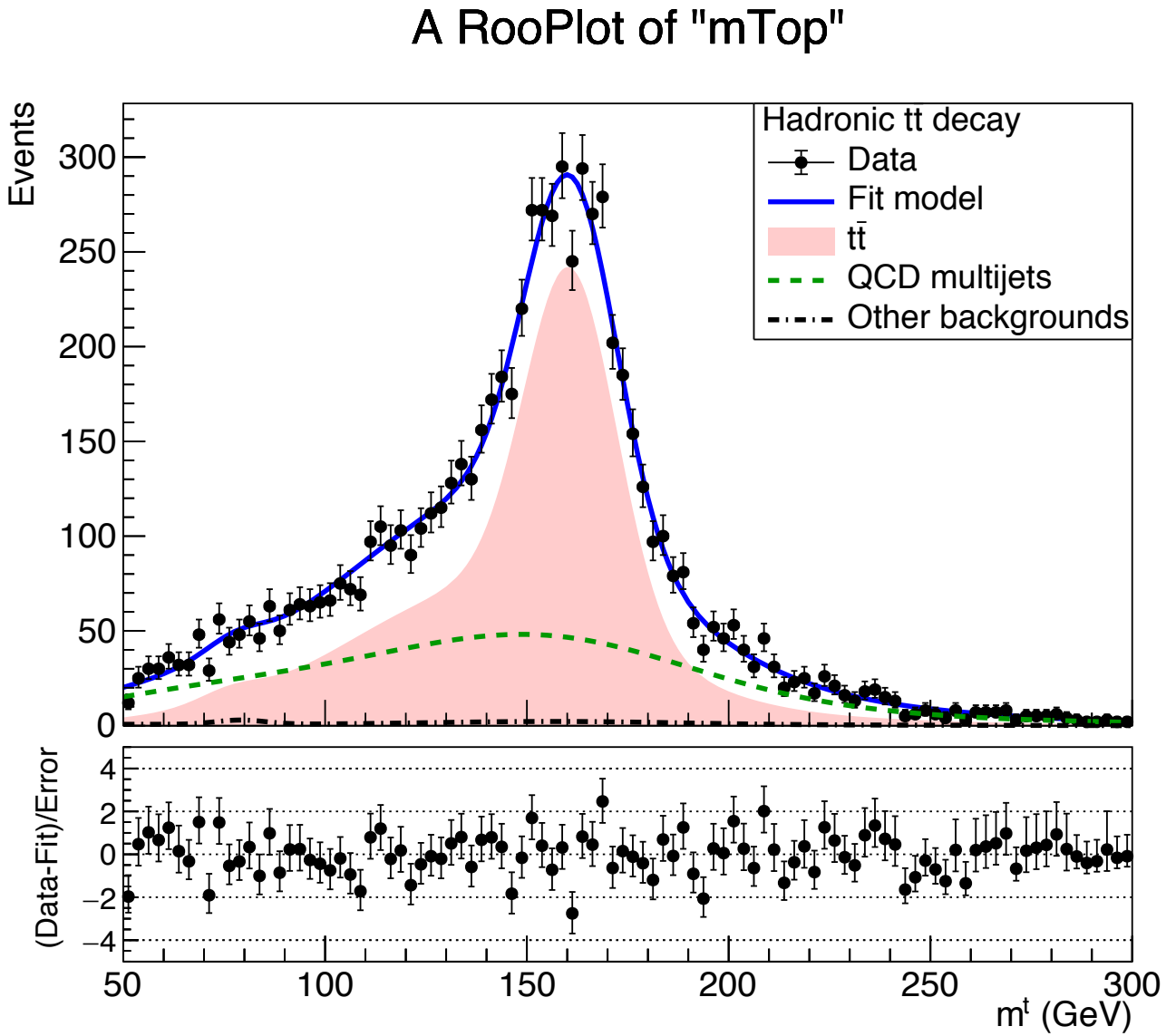


Simple Mass Fit 2017

Floating Parameter	FinalValue +/-	Error
kMassResol	1.0768e+00 +/-	3.81e-02
kMassScale	9.8571e-01 +/-	2.64e-03
kQCD_2b	1.4907e-02 +/-	5.33e-03
nFitBkg_2b	1.0582e+02 +/-	2.10e+02
nFitQCD_2b	2.4252e+03 +/-	2.47e+02
nFitSig2b	4.7140e+03 +/-	1.45e+02

Signal strength: r = 0.54567 ± 0.0191006

$$\frac{k_{QCD,MC}}{k_{QCD,Postfit}} = \frac{0.0052}{0.015} = 0{,}35$$



Simple Mass Fit 2018

Floating Parameter	FinalValue +/-	Error
kMassResol	1.0255e+00 +/-	2.90e-02
kMassScale	9.9031e-01 +/-	1.93e-03
kQCD_2b	1.4174e-02 +/-	3.50e-03
nFitBkg_2b	1.7555e+02 +/-	2.75e+02
nFitQCD_2b	4.4847e+03 +/-	3.13e+02
nFitSig2b	7.6642e+03 +/-	1.93e+02

Signal strength: r = 0.620045 ± 0.0183904

$$\frac{k_{QCD,MC}}{k_{QCD,Postfit}} = \frac{0.0026}{0.014} = 0.19$$