W charge asymmetry studies: pseudorapidity rebinning

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Object and event selection

For this analysis, the events are collected when triggered by the presence of at least one electron with large transverse energy and η cut:

- $P_T > 25$ GeV
- $|\eta| < 2.5$

Several Monte Carlo event generators are used to simulate the signal and background processes:

- MadGraph5 aMC@NLO - event samples for the W and Z boson signal and top background.
- PYTHIA 8 with NNPDF3.0 - parton shower.
- PYTHIA 8 and POWHEG - diboson backgrounds.
- GEANT4 - detector response.

Probability Density Function fits*

QCD background modeled by analytical function:

f(x) = x*exp({-x^2} / {ax^2+bx+c}) *

a = 4.0 ∈ [−10.0, 10.0]
b = 6.0 ∈ [0.0, 20.0]
c = 2.9 ∈ [0.3, 6.0]
X ∈ [0.0, 2.0, 150.0]

Signal and EWK backgrounds are modeled with simulation based fitting functions.

As a minimum finder used Minos
*both codes uses the same function
*new function to come
smth like that f(x) = (x*exp({-x^2} / {ax^2+bx+c})*({ax^2+bx+c})

NEW improvements!

Lepton efficiencies are measured in different eta bins:

- **New electron eta binning:**

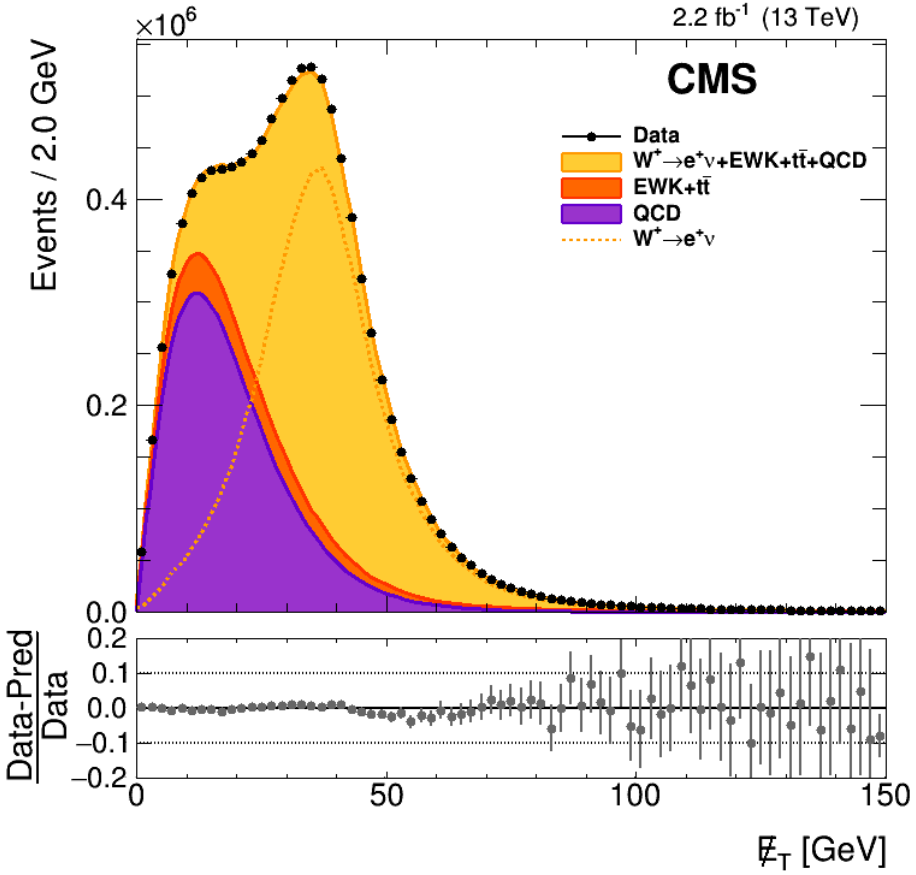
  -2.5, -2.0, -1.566, -1.4442, -1.0, -0.5,
  0.0,
  0.5, 1.0, 1.4442, 1.566, 2.0, 2.5

- **New muon eta binning:**

  -2.4 -2.1, -1.2, -0.9, -0.3, -0.2,
  0.0,
  0.2, 0.3, 0.9,1.2, 2.1, 2.4

Old binning:
0.0, 0.2, 0.4, 0.6, 0.8, 1.0, 1.2, 1.4, 1.6, 1.85, 2.1, 2.5
(for muons: up to 2.4)

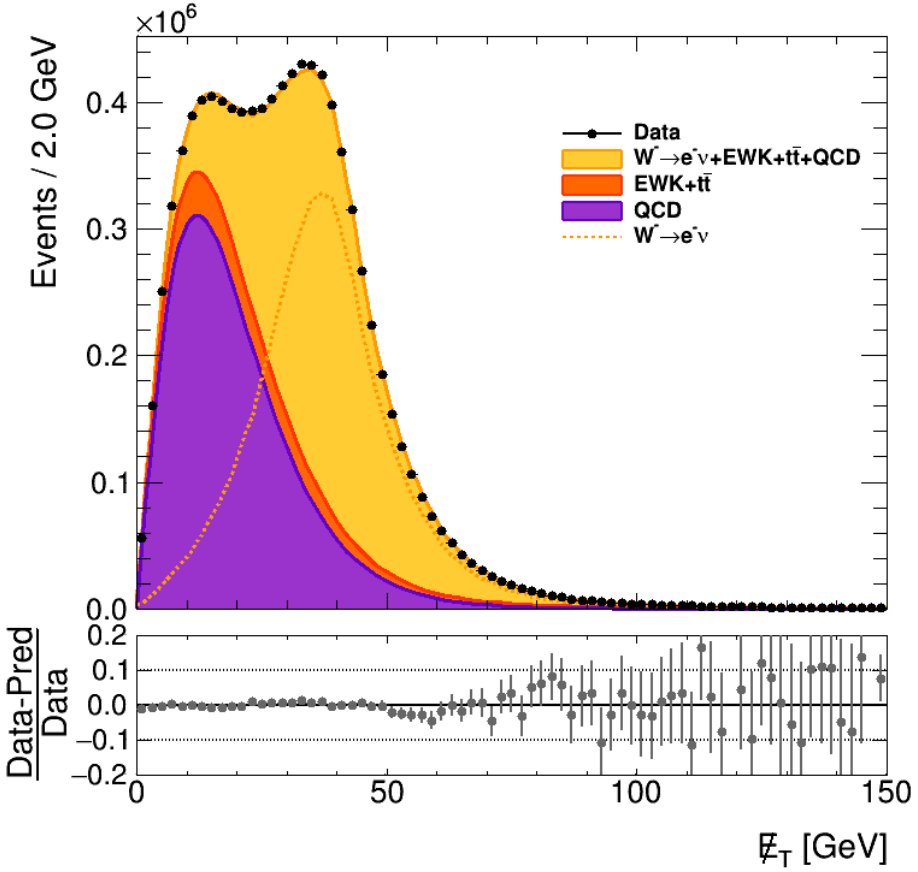
Comparing missing E_T for the whole eta region (W^+)



Old binning

New binning

Comparing missing E_T for the whole eta region (W^-)

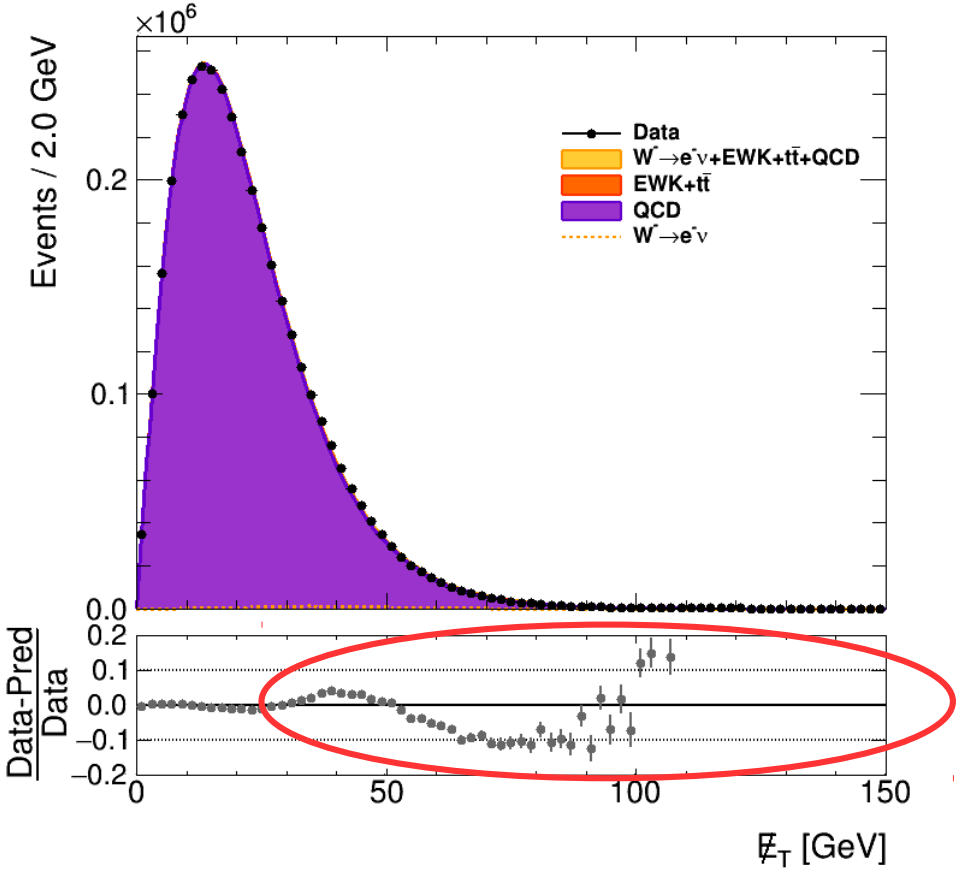


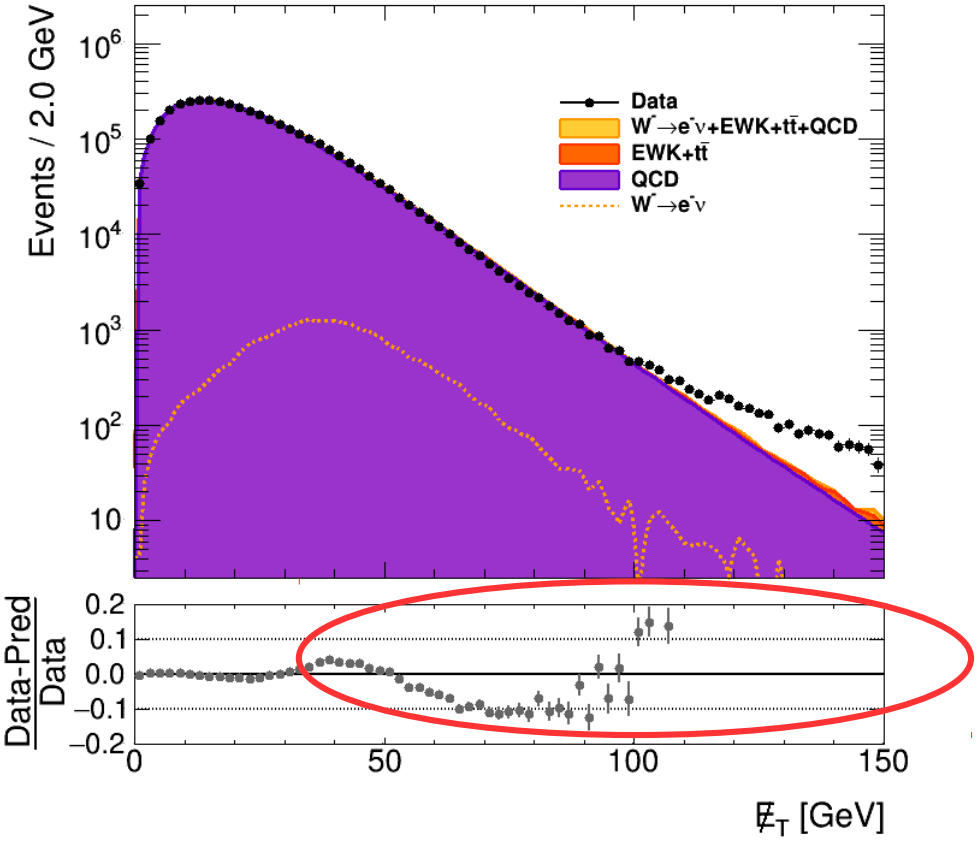
Old binning

New binning

More results next week!!

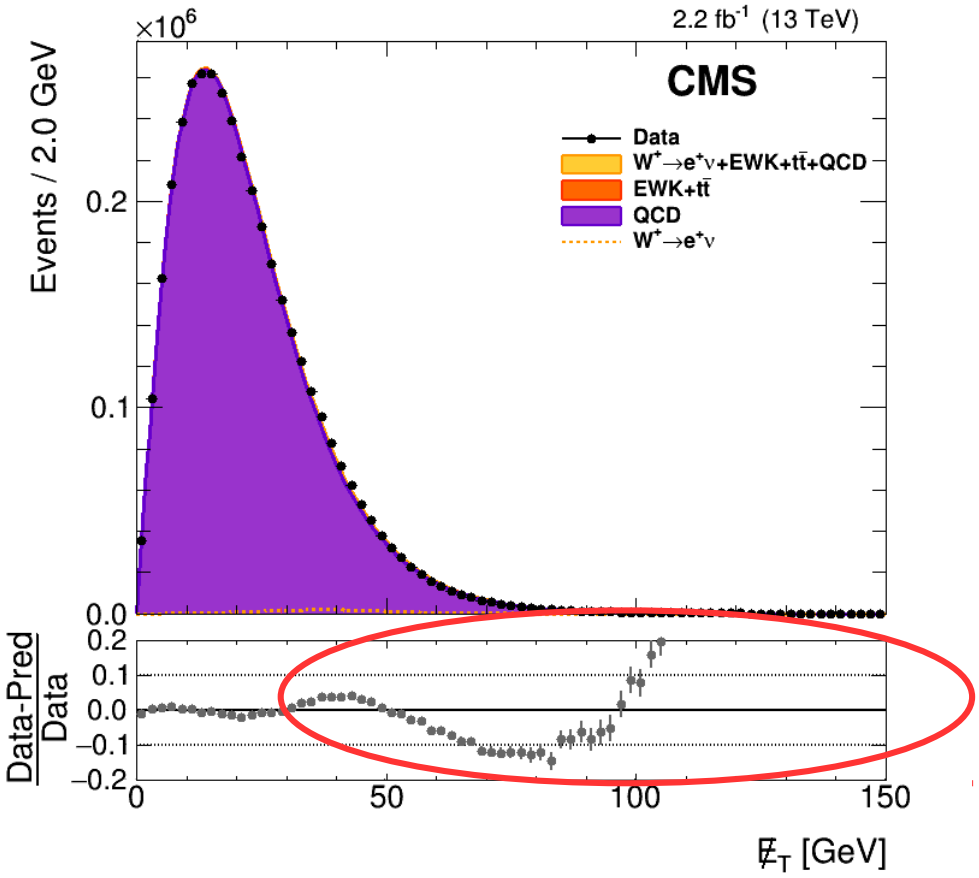
Control region

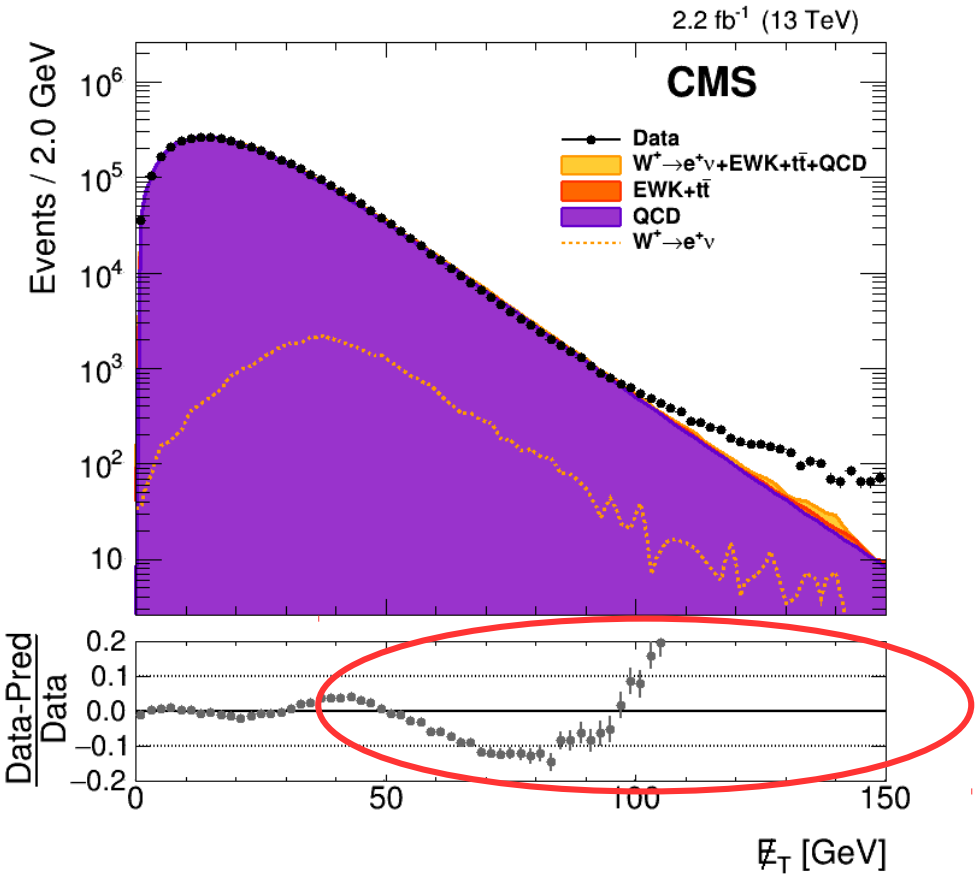




Problem with QCD estimation at high missing E_T

Control region



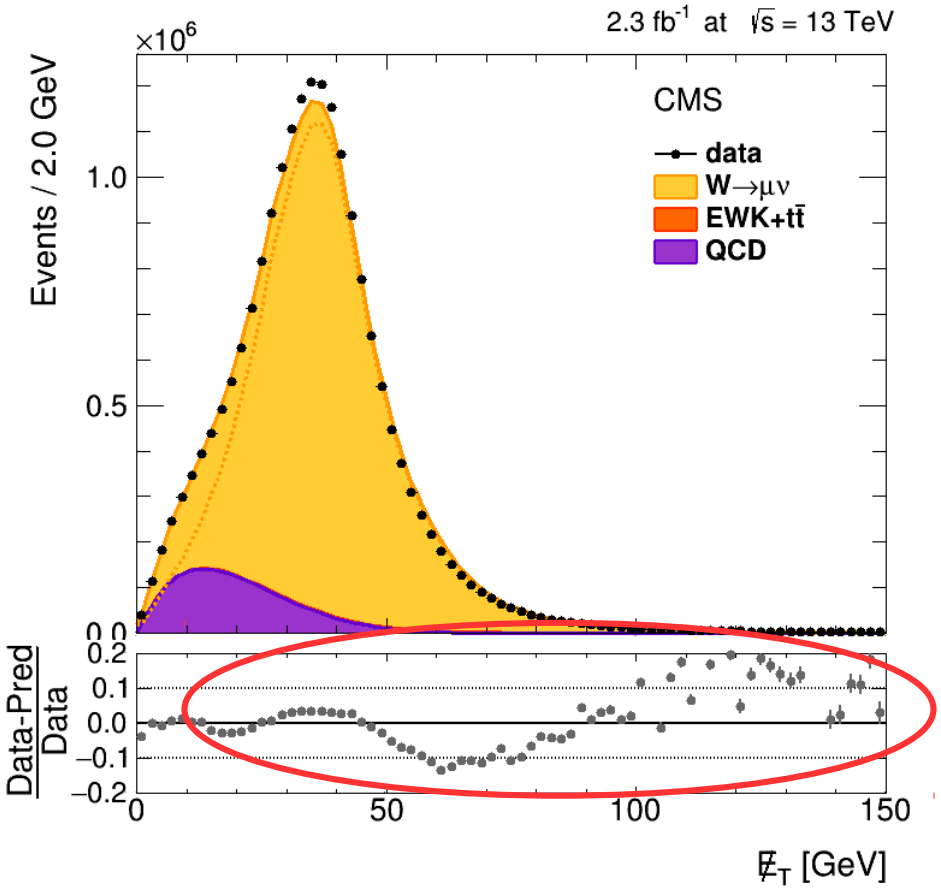


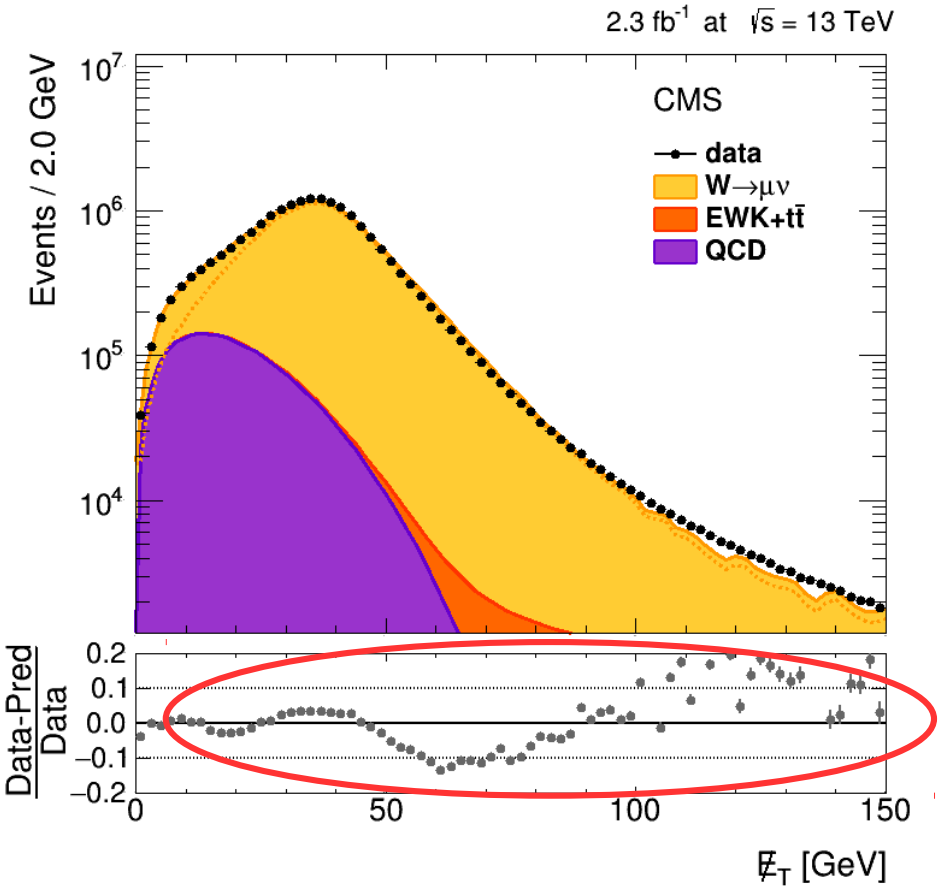
Main suspect is a bad fit(Maria says it might be *a* parameter)

Muons

$P_T > 25$ GeV
$|\eta| < 2.4$

Same problem with the fit

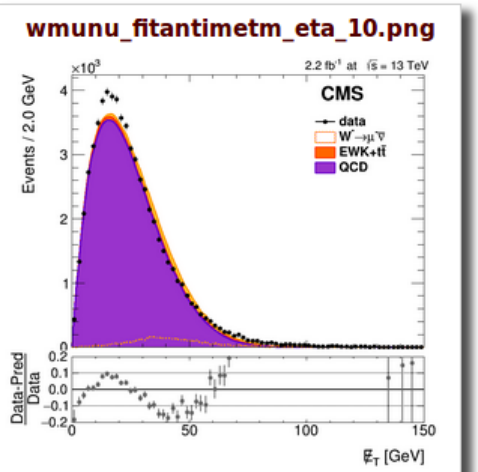




Eta binned results

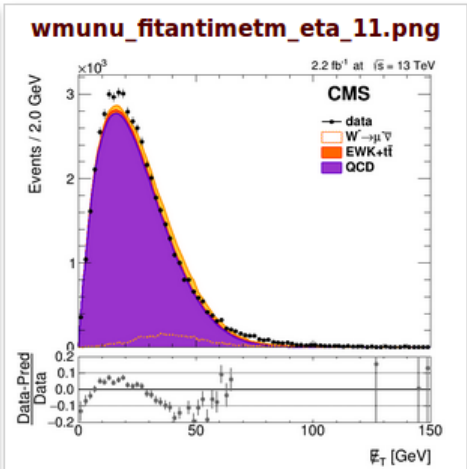
It’s BAD and it’s from my side, I’ll fix it, but in general problem remains

wmunu_fitantimetm_eta_10.png



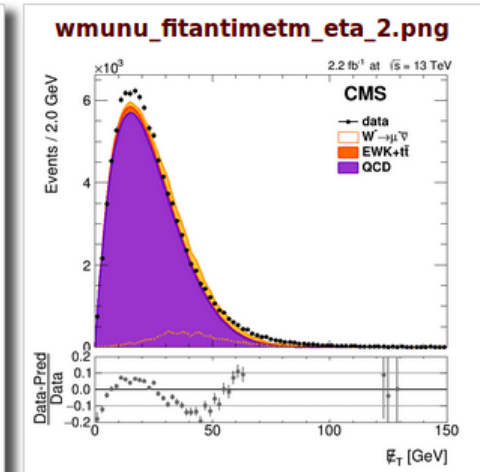
Also as [.pdf]

wmunu_fitantimetm_eta_11.png



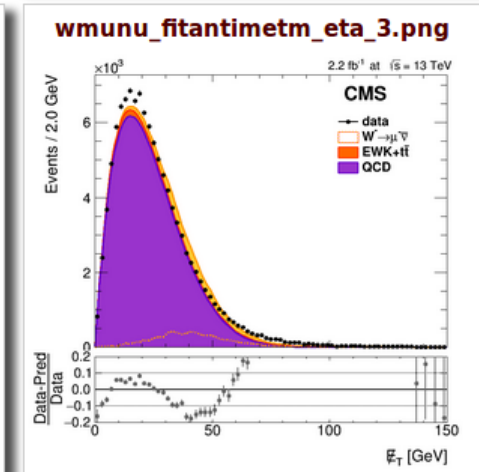
Also as [.pdf]

wmunu_fitantimetm_eta_2.png



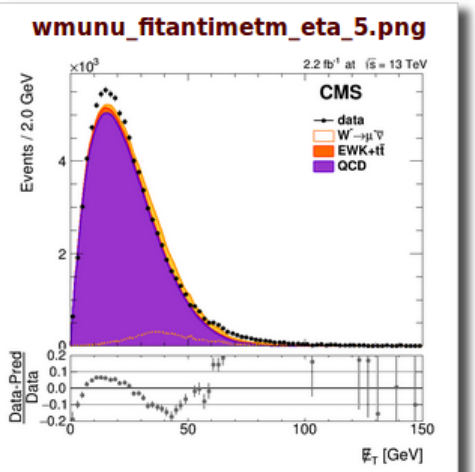
Also as [.pdf]

wmunu_fitantimetm_eta_3.png



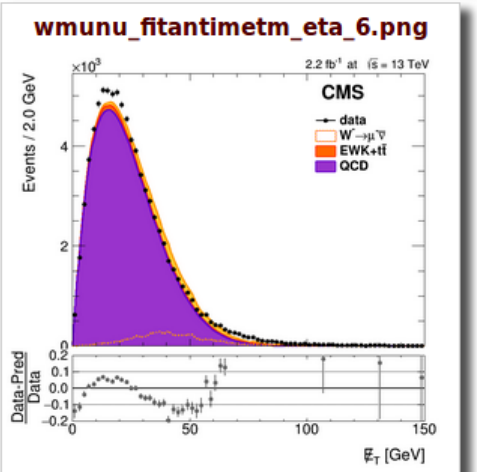
Also as [.pdf]

wmunu_fitantimetm_eta_5.png



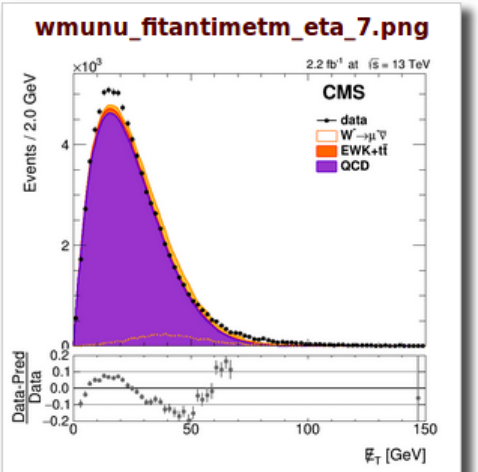
Also as [.pdf]

wmunu_fitantimetm_eta_6.png



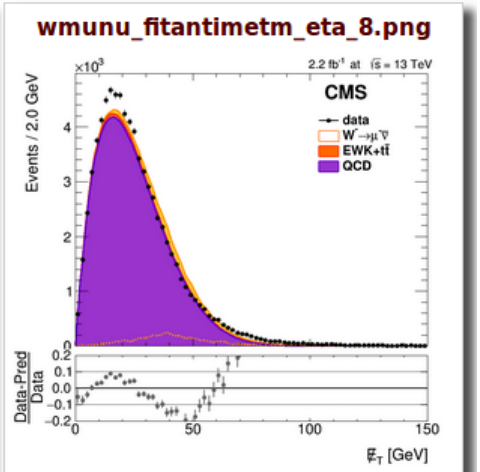
Also as [.pdf]

wmunu_fitantimetm_eta_7.png



Also as [.pdf]

wmunu_fitantimetm_eta_8.png



Also as [.pdf]

Maria proposed a strategy

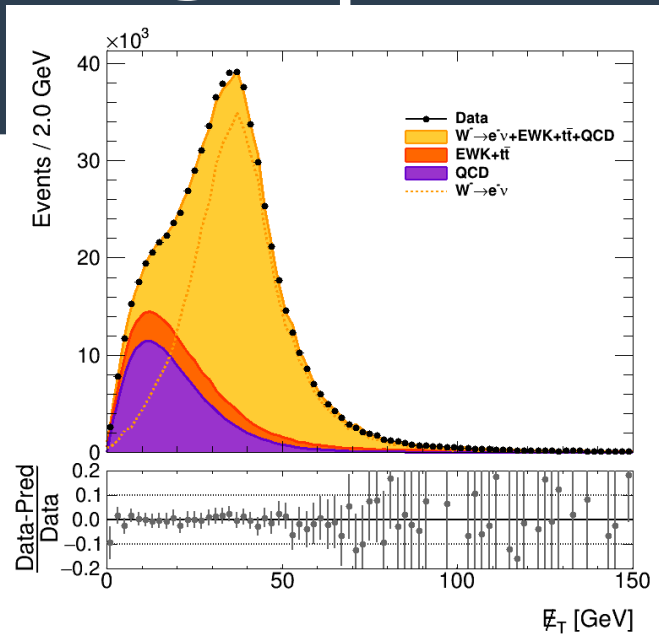
1) Build normalized plots, for control region for different eta bins and see how shape depends on eta.

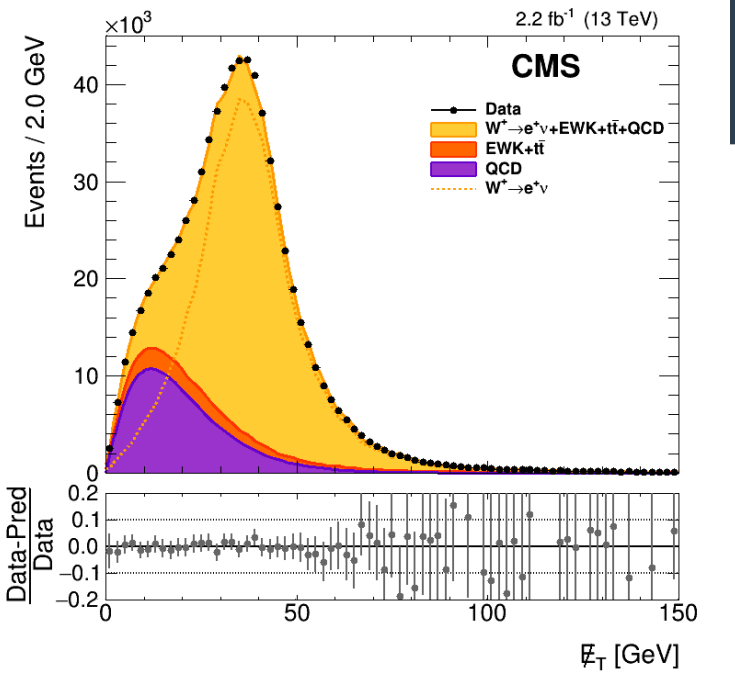
2) If it shifts, then build a plot of a1 parameter as a function of eta and see how it behaves (the problem may be in too thin or too wide ***a*** fitting range)

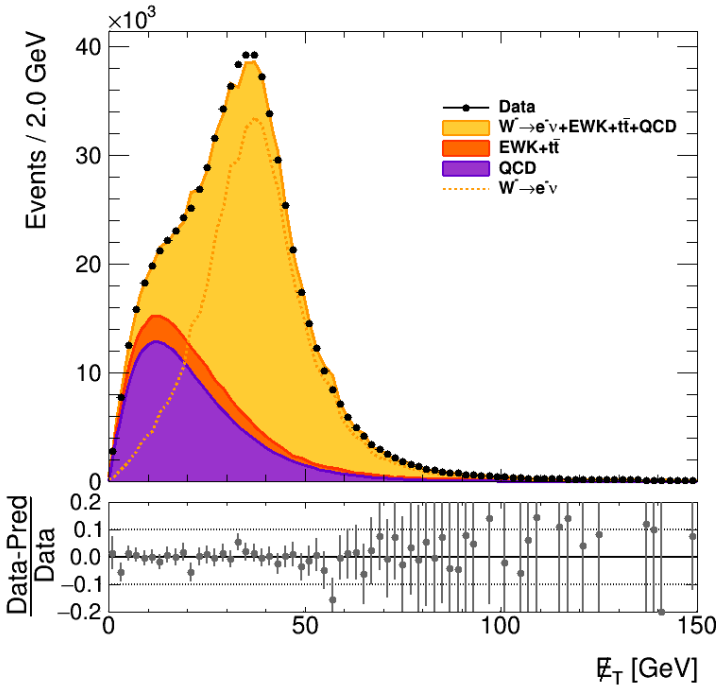
We can always try to change fitting function or vary parameter ranges.

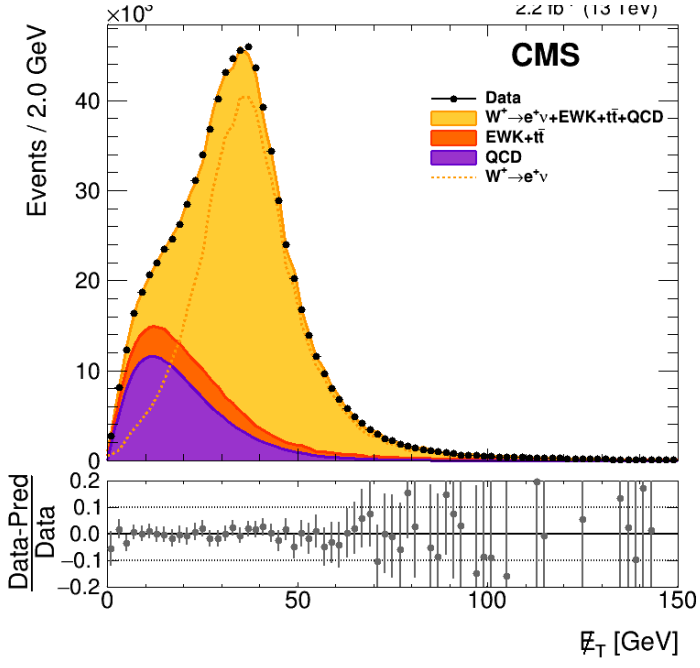
Back up

Missing E_T for eta 0.4-0.6, 0.6-0.8

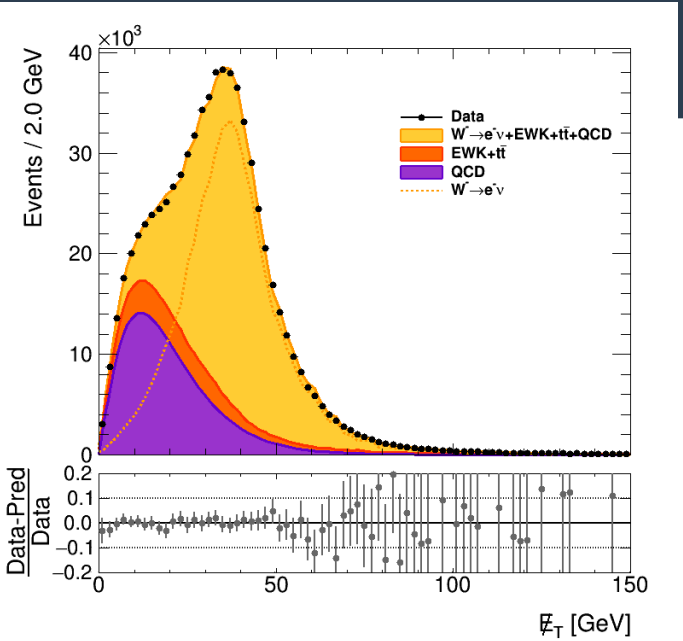


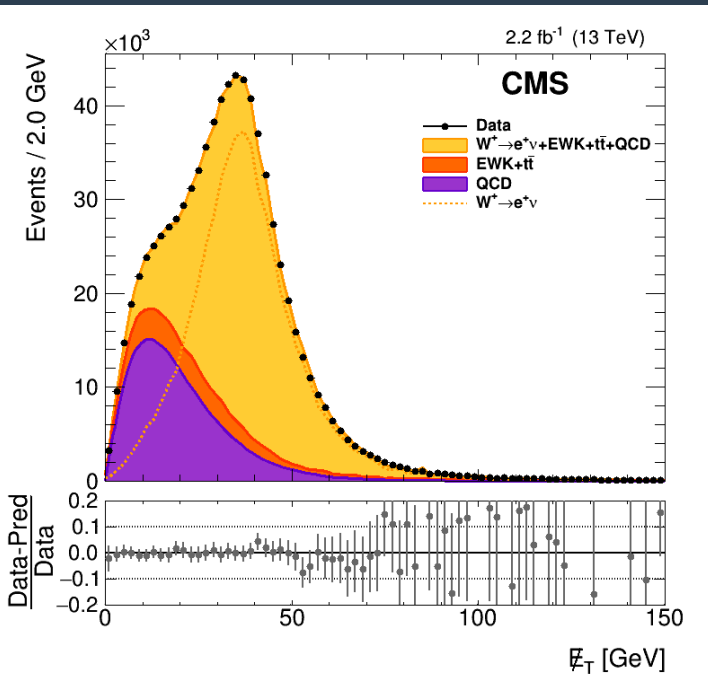


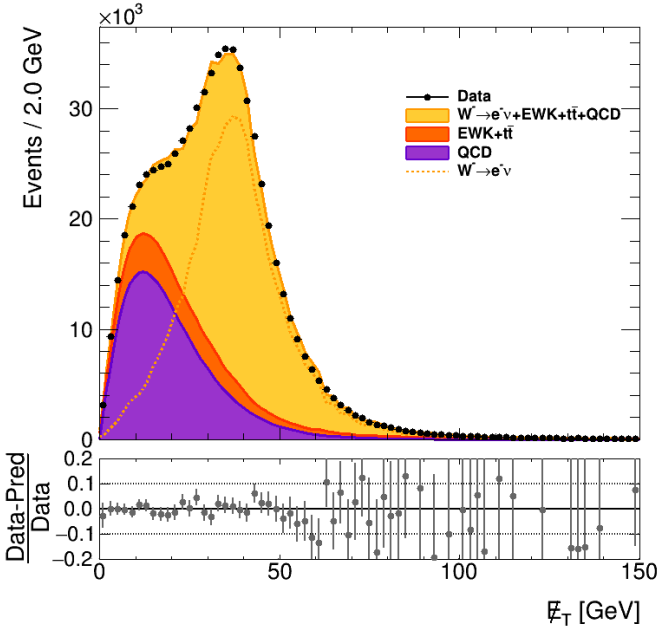


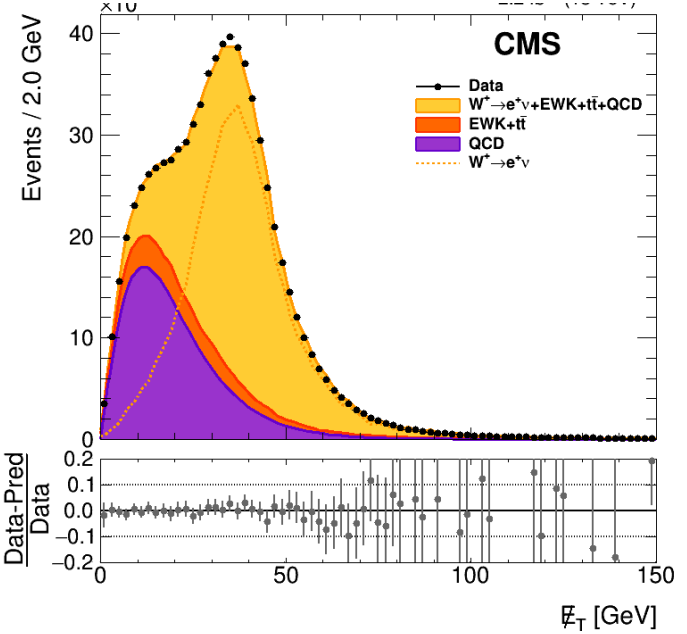


Missing E_T for eta 0.8-1.0 1.0-1.2

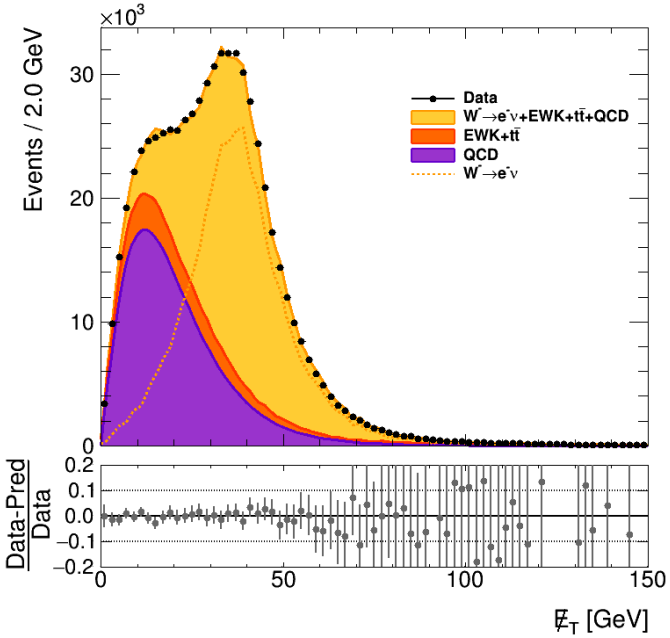


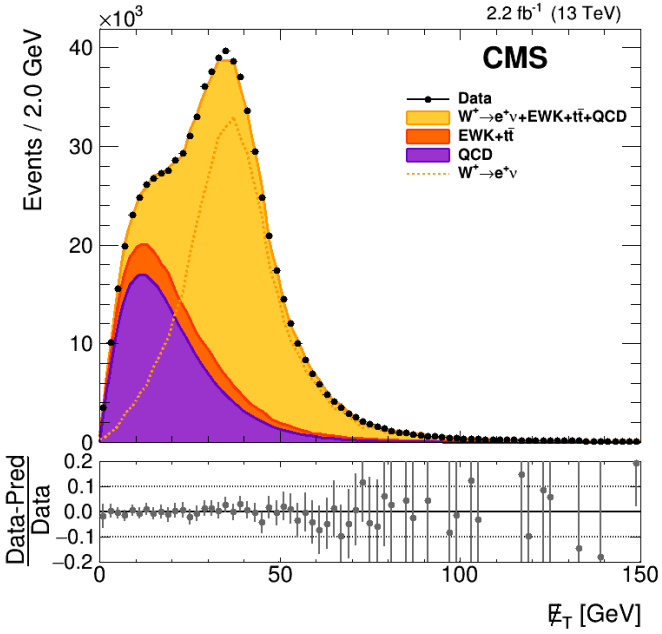


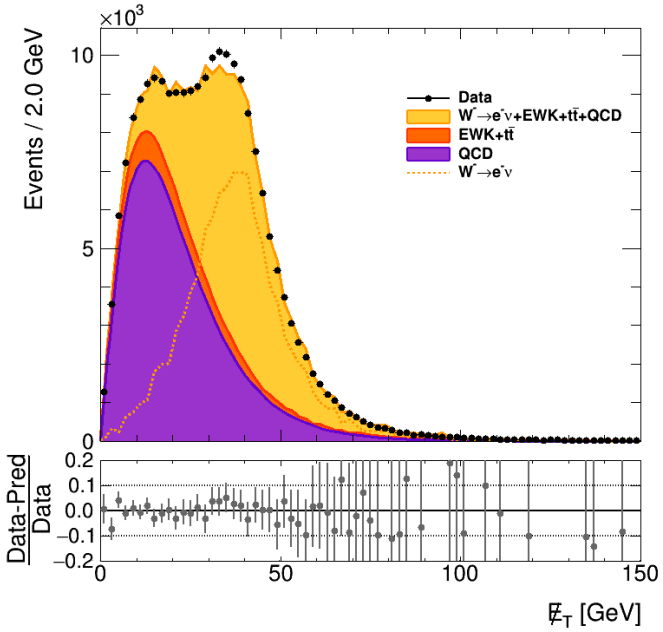


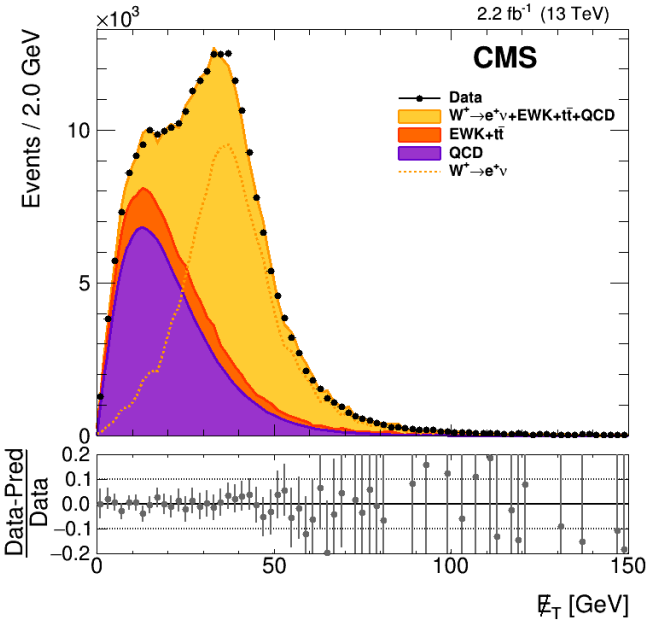


Missing E_T for eta 1.2-1.4 1.4-1.6

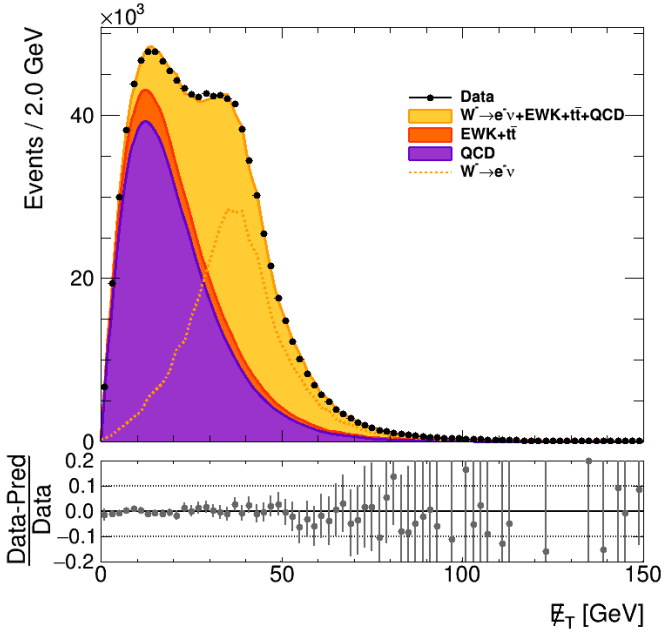


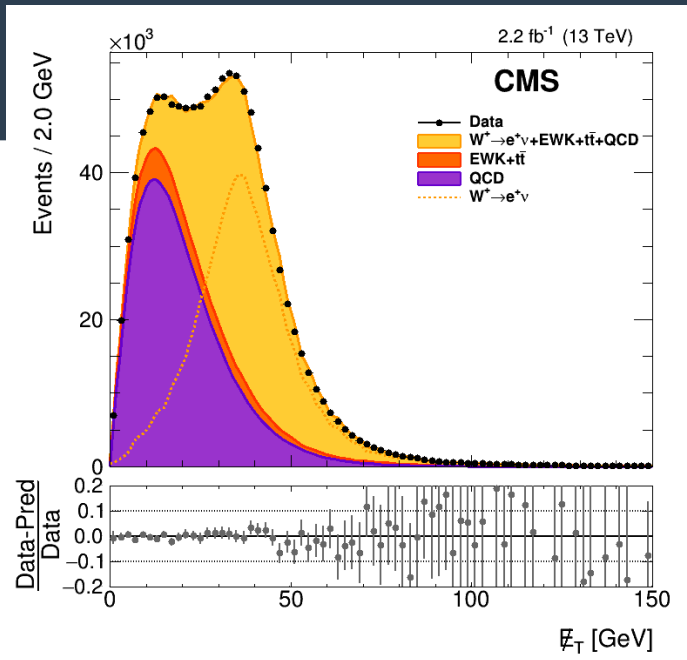


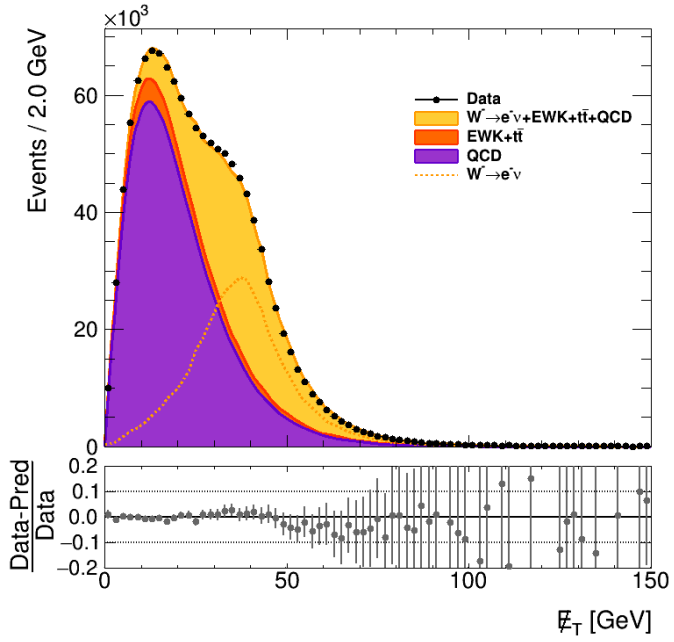


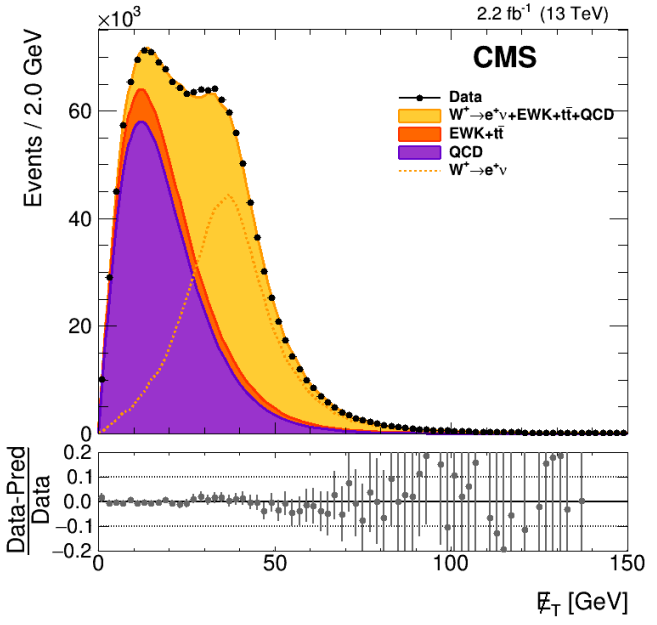


Missing E_T for eta 1.6-1.9 1.9-2.1

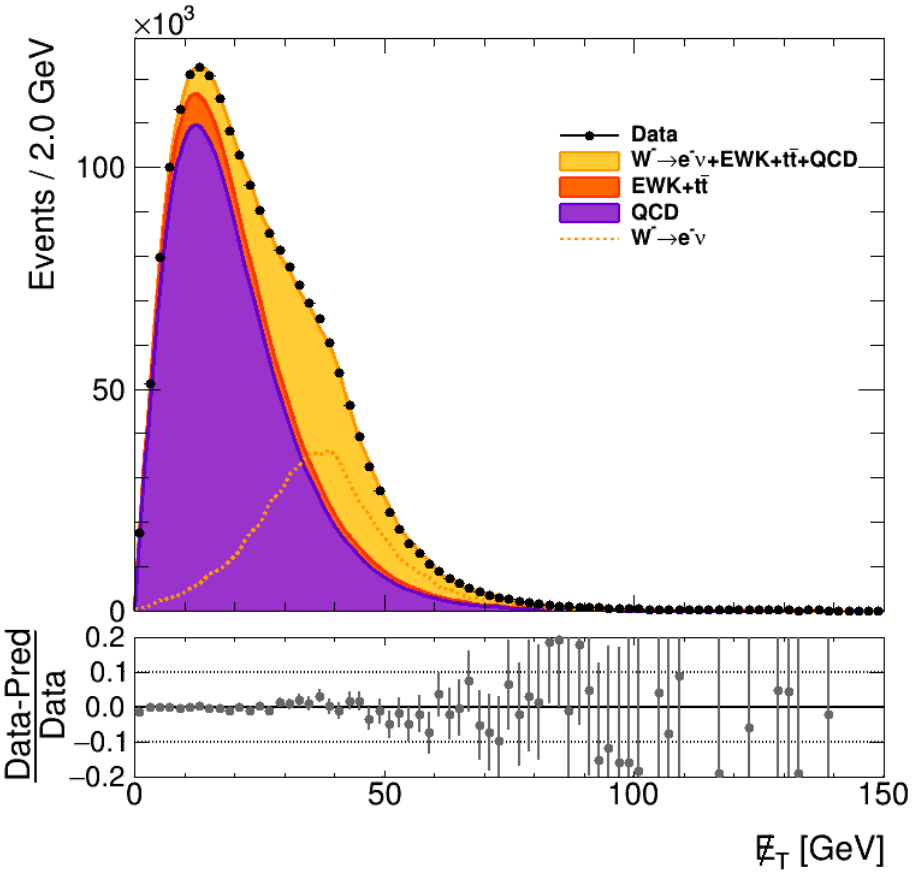


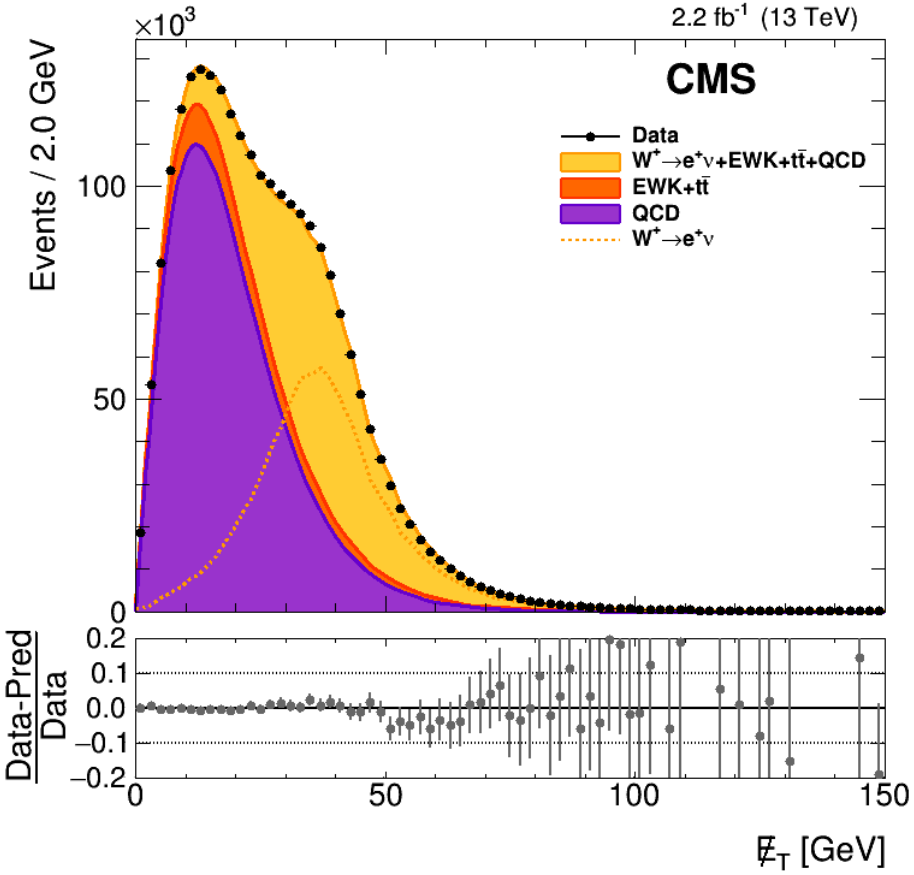






Missing E_T for eta 2.1-2.5





Fit table for bin 1.2-1.4

```
 *** Yields *** (1.2,1.4) :
Selected: 704761
  Signal: 435573.4003 +/- 2210.683183
     QCD: 201324.4345 +/- 2896.693949
   Other: 67852.89905 +/- 2056.653743
AntiSelected: 177600
  Signal: 780.6002841 +/- 98.07050961
     QCD: 176673.0977 +/- 437.1072762
   Other: 136.4313625 +/- 17.14051803


  RooFitResult: minimized FCN value: -6489281.266, estimated distance to minimum: 4.019910745e-06
                covariance matrix quality: Full, accurate covariance matrix
                Status : MIGRAD=4 HESSE=0 MINOS=6

    Constant Parameter    Value
  --------------------  ------------
                 dewkm    1.7478e-01

    Floating Parameter  InitialValue    FinalValue (+HiError,-LoError)    GblCorr.
  --------------------  ------------  ----------------------------------  --------
              a1_qcdm    4.0000e+00    1.1259e+00 (+1.60e-01,-1.59e-01)  <none>
             a2_aqcdm    6.0000e+00    8.6016e+00 (+1.69e-01,-1.70e-01)  <none>
              a2_qcdm    6.0000e+00    7.5408e+00 (+2.33e-01,--0.00e+00)  <none>
             a3_aqcdm    2.9000e+00    1.5736e+00 (+5.22e-02,-5.17e-02)  <none>
              a3_qcdm    2.9000e+00    1.3676e+00 (+5.04e-02,-5.29e-02)  <none>
                cewkm    1.2670e-01    1.5578e-01 (+4.87e-03,-4.83e-03)  <none>
            nAntiQCDm    1.6872e+05    1.7667e+05 (+4.38e+02,-4.36e+02)  <none>
            nAntiSigm    6.6119e+02    7.8060e+02 (+9.23e+01,-9.71e+01)  <none>
                nQCDm    1.4095e+05    2.0132e+05 (+3.14e+03,-3.09e+03)  <none>
                nSigm    5.6381e+05    4.3557e+05 (+2.42e+03,-2.39e+03)  <none>


  Correlation Matrix
 --------------------
   1.0000  -0.9563  -0.5214   0.8219  -0.3955  -0.1879   0.0004  -0.0013   0.0665   0.0794
  -0.9563   1.0000   0.4986  -0.9333   0.3783   0.1797  -0.0129   0.0453  -0.0636  -0.0759
  -0.5214   0.4986   1.0000  -0.4286   0.8499  -0.0374  -0.0002   0.0007   0.6463  -0.7016
   0.8219  -0.9333  -0.4286   1.0000  -0.3251  -0.1544   0.0024  -0.0084   0.0546   0.0652
  -0.3955   0.3783   0.8499  -0.3251   1.0000  -0.0688  -0.0001   0.0005   0.4093  -0.4072
  -0.1879   0.1797  -0.0374  -0.1544  -0.0688   1.0000  -0.0001   0.0002  -0.5404  -0.2108
   0.0004  -0.0129  -0.0002   0.0024  -0.0001  -0.0001   1.0000  -0.2665   0.0000   0.0000
  -0.0013   0.0453   0.0007  -0.0084   0.0005   0.0002  -0.2665   1.0000  -0.0001  -0.0001
   0.0665  -0.0636   0.6463   0.0546   0.4093  -0.5404   0.0000  -0.0001   1.0000  -0.6612
   0.0794  -0.0759  -0.7016   0.0652  -0.4072  -0.2108   0.0000  -0.0001  -0.6612   1.0000

  Chi2 Test
 -----------
       prob = 1
   chi2/ndf = 0.3968

  KS Test
 ---------
   prob = 0.8188
   prob = 0.592 with 1000 pseudo-experiments

fitresWem_bin_6.txt (END)
```

Input ntuple files

Enums for isolated e^+ , e^- (signal region):

- **eData**
- **eWenu (MC)**
- **eEWK (τ channel and DY)**
- **eQCD**
- **eBKG (diboson and $t\bar{t}$)**

Enums for non isolated e^+,e^- (control region):

- **eAntiData**
- **eAntiWenu**
- **eAntiEWK**
- **eAntiQCD**