List of Cuts applied

BeamEnergy > 6.5 GeV

52 cm < Zvertex < 78 cm and radius < 1

dE/dX > $((e^{-3.8x+3.3}+2)$ for Proton

dE/dX < $((e^{-4x+2}+2.5)$ for Pions

Proton Momentum > 0.3

PiPlus Momentum > 0.11

Piminus Momentum > 0.11

Additional cuts that need to be optimized

C.L > 0.005

Coplanarity between Rho and proton: (165 ,195) degree

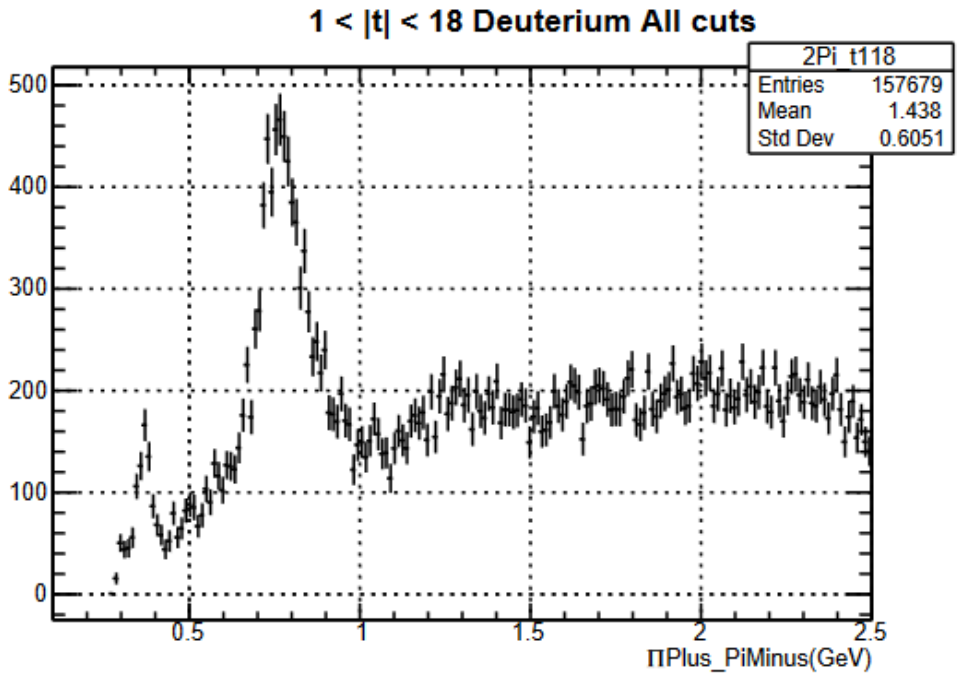
PipProt Invariant Mass > 1.8 && PimProt Invariant Mass > 1.8

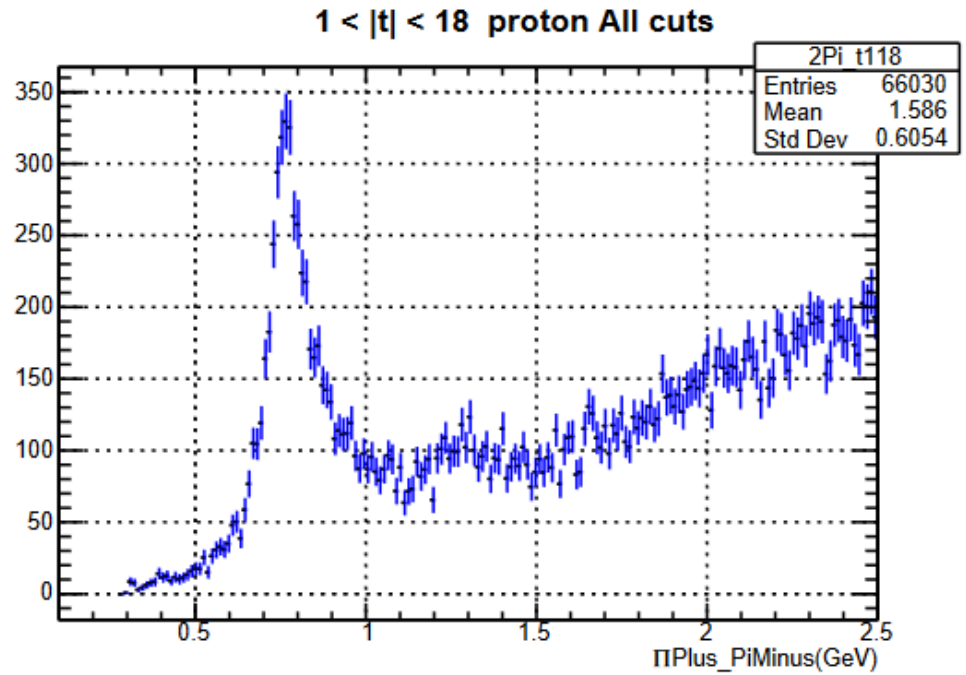
|t| >1 and |u| >1

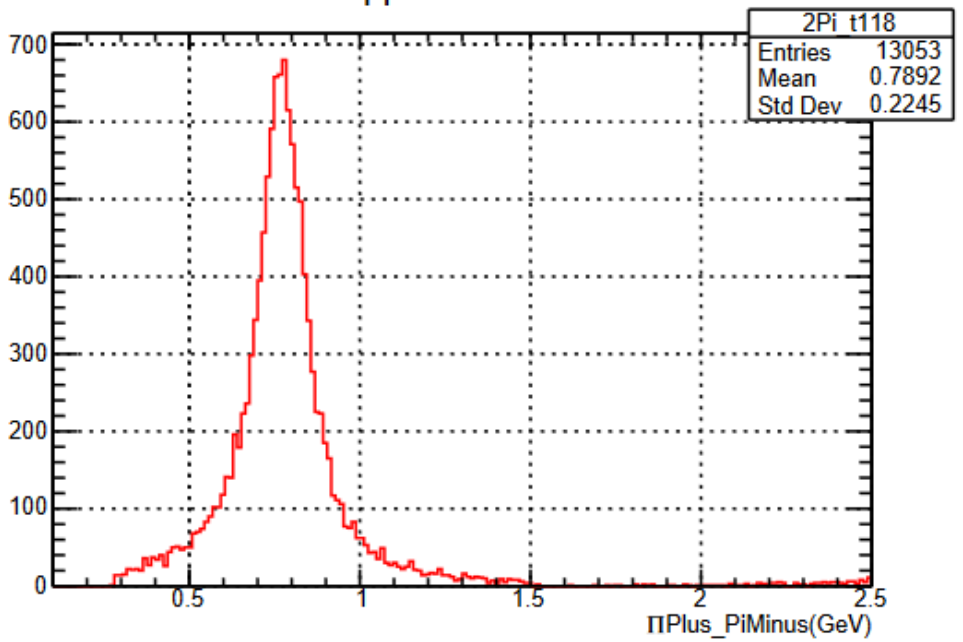
0.5 < MM2 < 1.3 (Missing Mass Squared) Deuterium

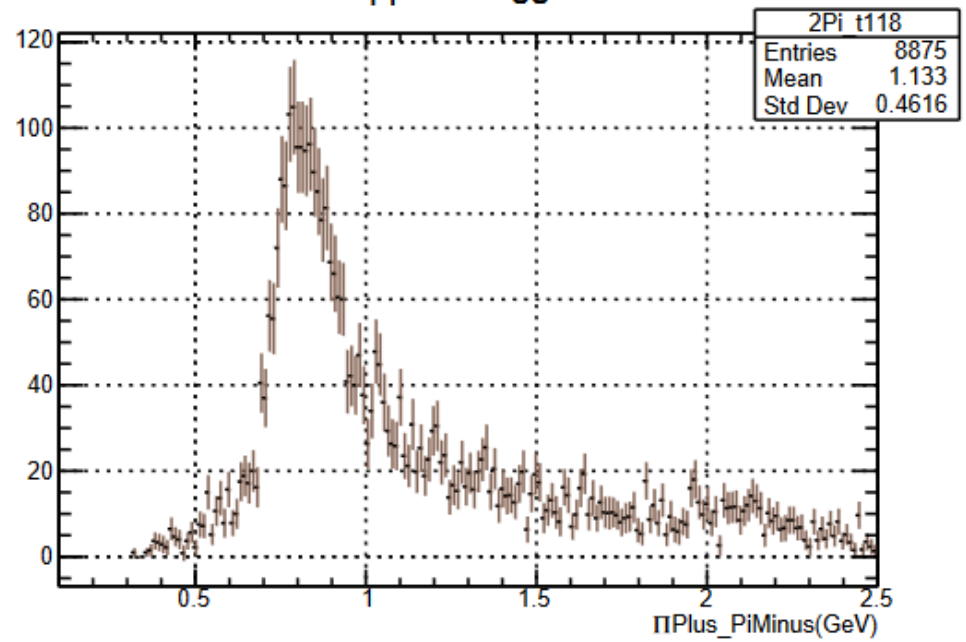
-0.02 < MM2 < 0.02 ; Proton

https://halldweb.jlab.org/wiki/images/8/8c/27_june.pdf (Previous meeting)

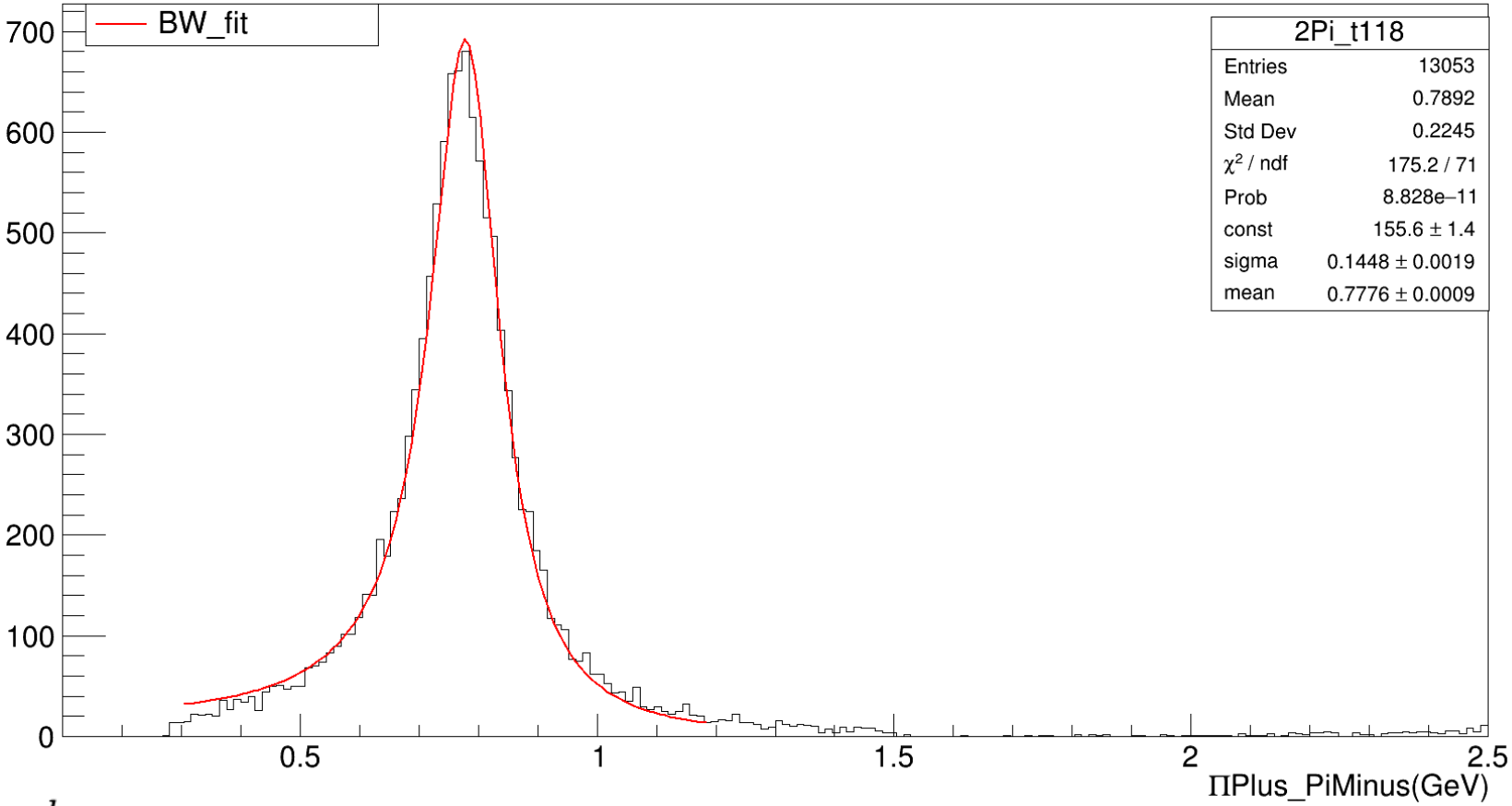

1 < |t| < 18 Deuterium All cuts
2Pi t118
Entries 157679
Mean 1.438
Std Dev 0.6051
ΠPlus_PiMinus(GeV)


1 < |t| < 18 proton All cuts
2Pi t118
Entries 66030
Mean 1.586
Std Dev 0.6054
ΠPlus_PiMinus(GeV)


1 < |t| < 18 MC All cuts
2Pi t118
Entries 13053
Mean 0.7892
Std Dev 0.2245
ΠPlus_PiMinus(GeV)


1 < |t| < 18 Bggen All cuts
2Pi t118
Entries 8875
Mean 1.133
Std Dev 0.4616
ΠPlus_PiMinus(GeV)

Fitting using Relativistic Breit–Wigner function



$$f(E) = \frac{k}{\left(E^2 - M^2\right)^2 + M^2\Gamma^2} ,$$

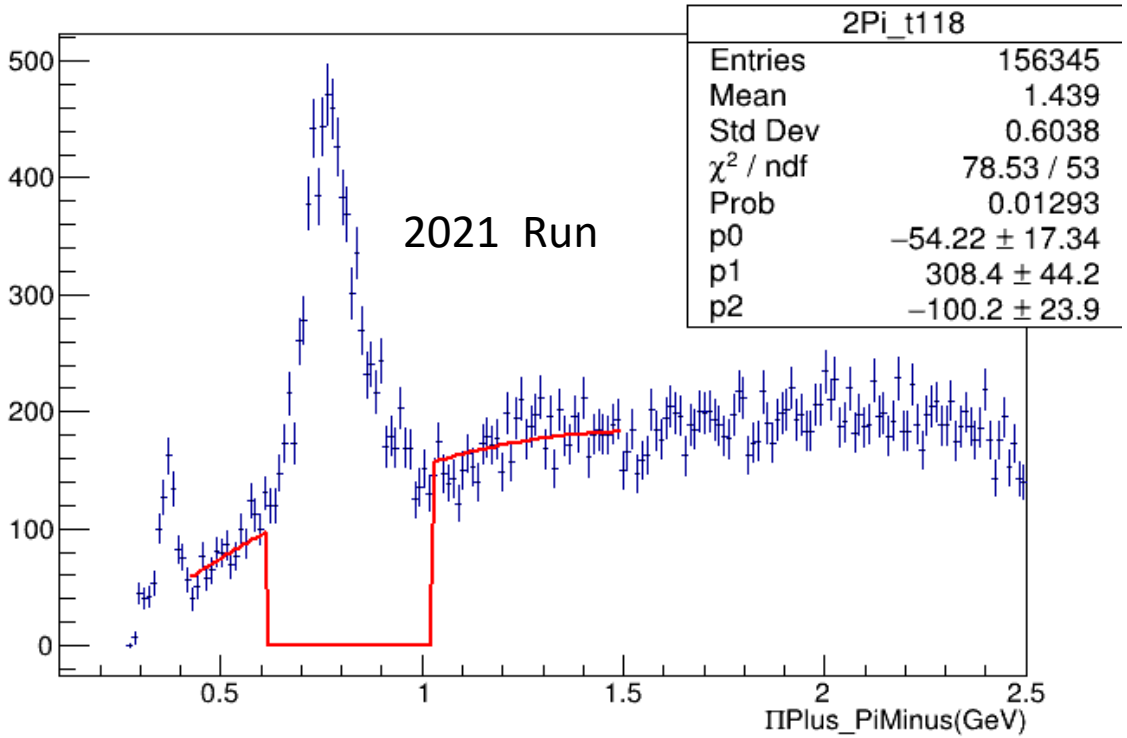
where k is a constant of proportionality, equal to

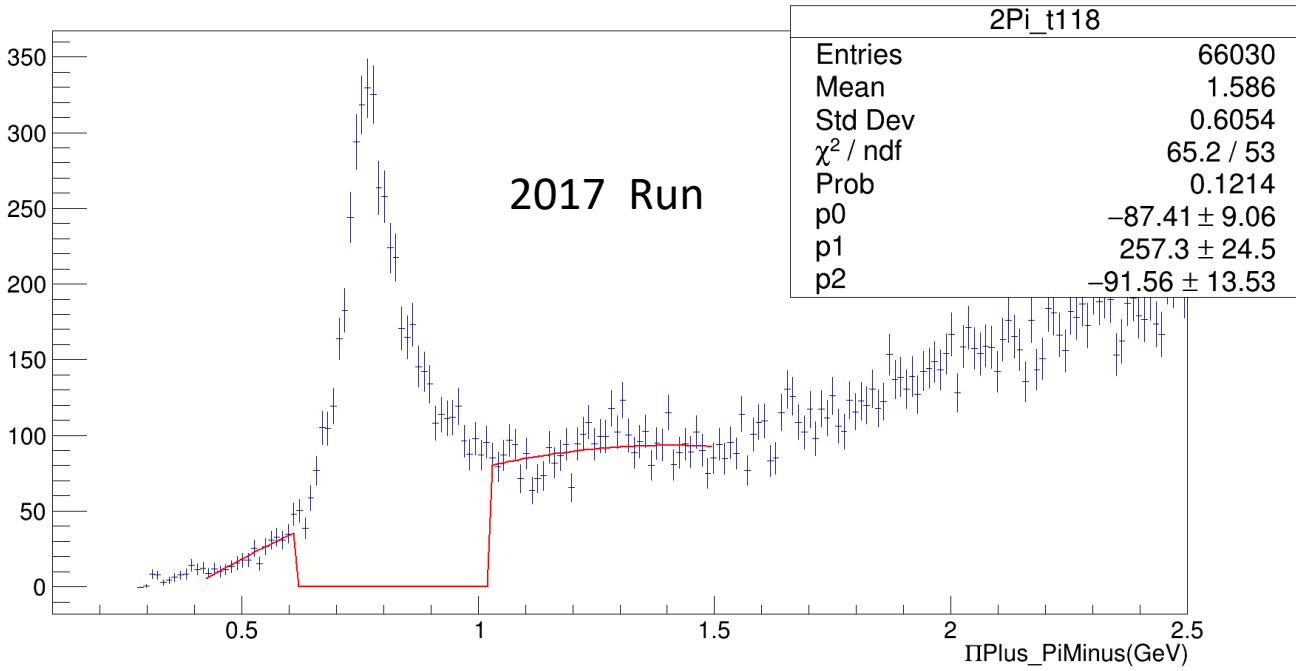
$$k = \frac{2\sqrt{2}M\Gamma\gamma}{\pi\sqrt{M^2+\gamma}} \qquad \text{with} \qquad \gamma = \sqrt{M^2\left(M^2+\Gamma^2\right)} .$$

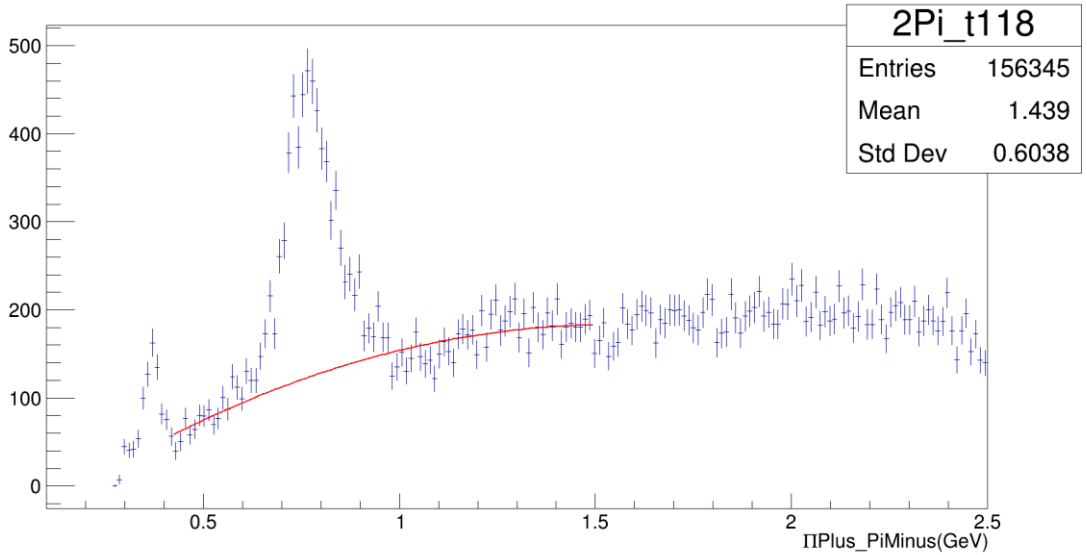
(This equation is written using natural units, $\hbar = c = 1$.)

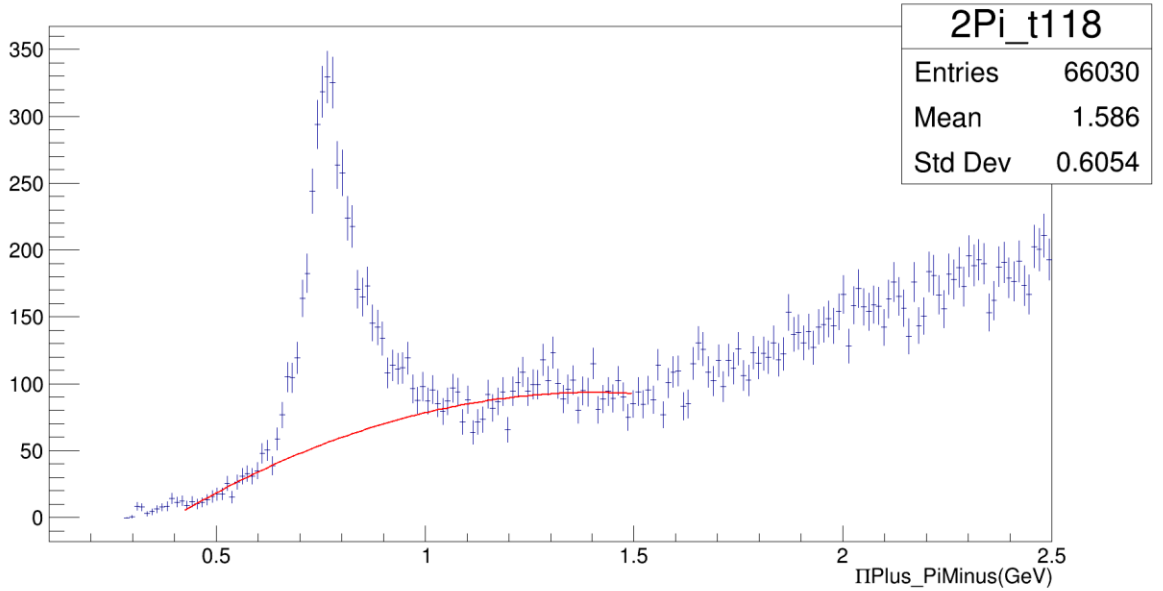
M = 0.775 GeV , Width = 145 MeV for Rho0 Meson.

Estimation of Background for Deuterium and Proton Target



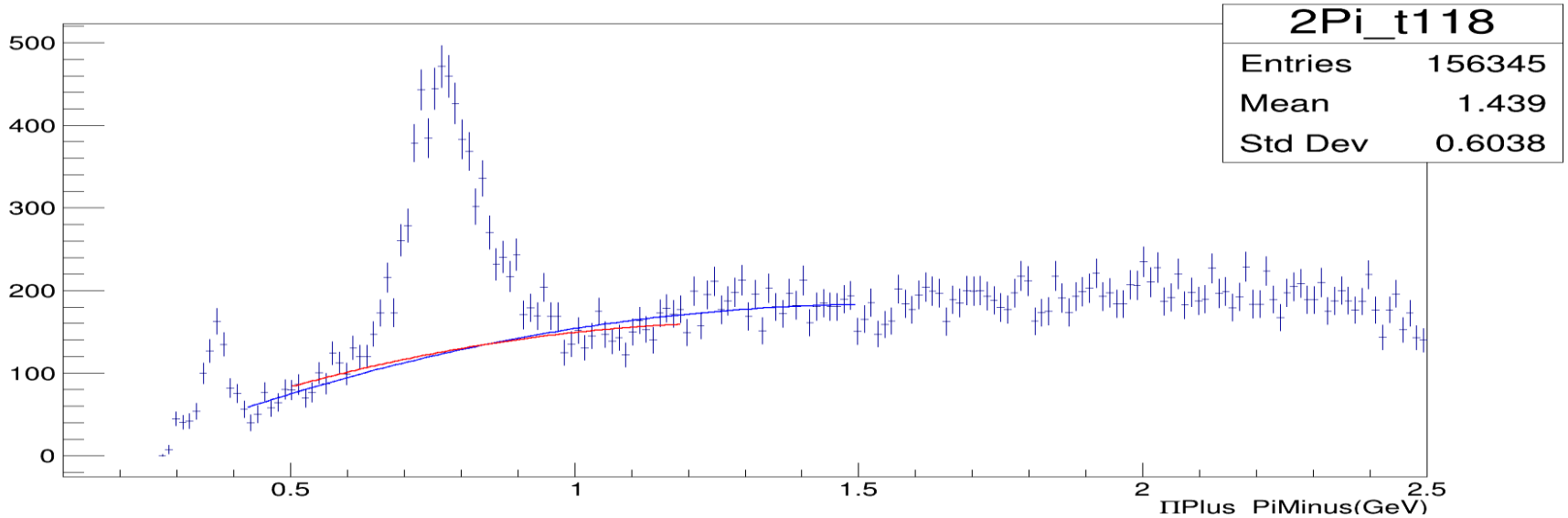




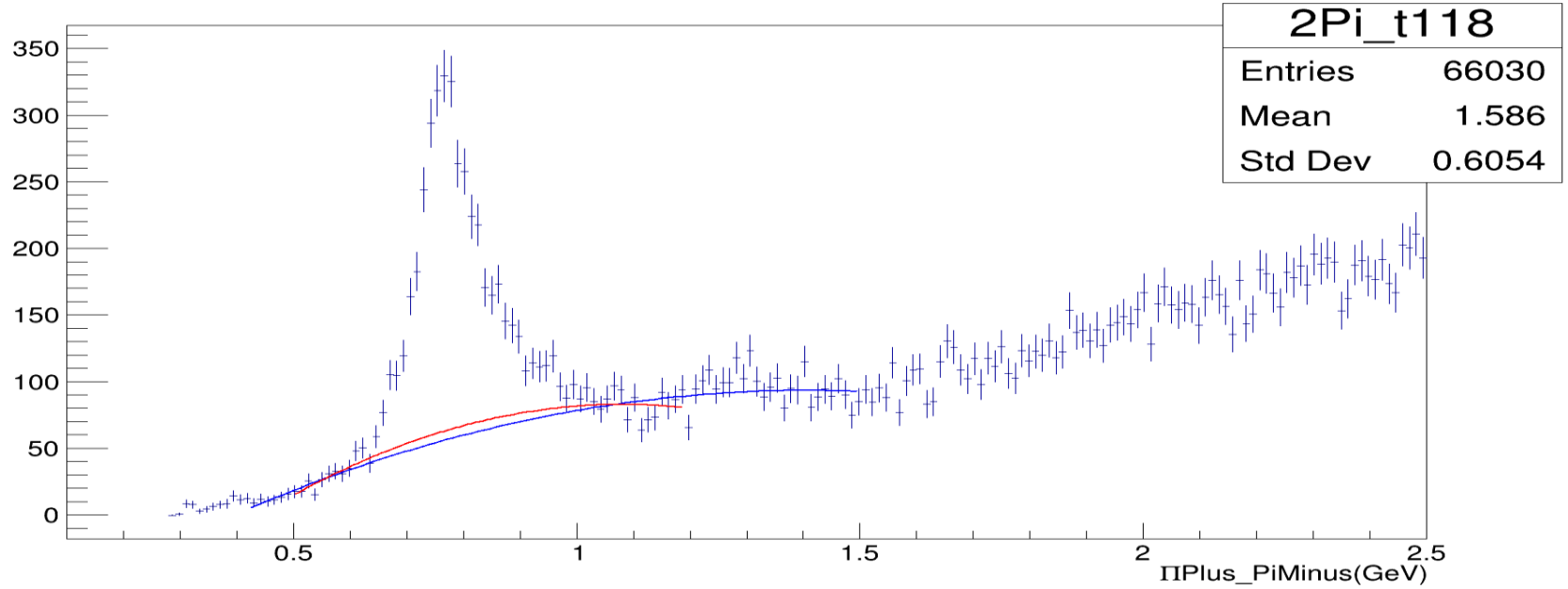


Estimation of Background Polynomial function.

Deuterium target with 2nd order Bg Polynomial



Proton target with 2nd order Bg Polynomial



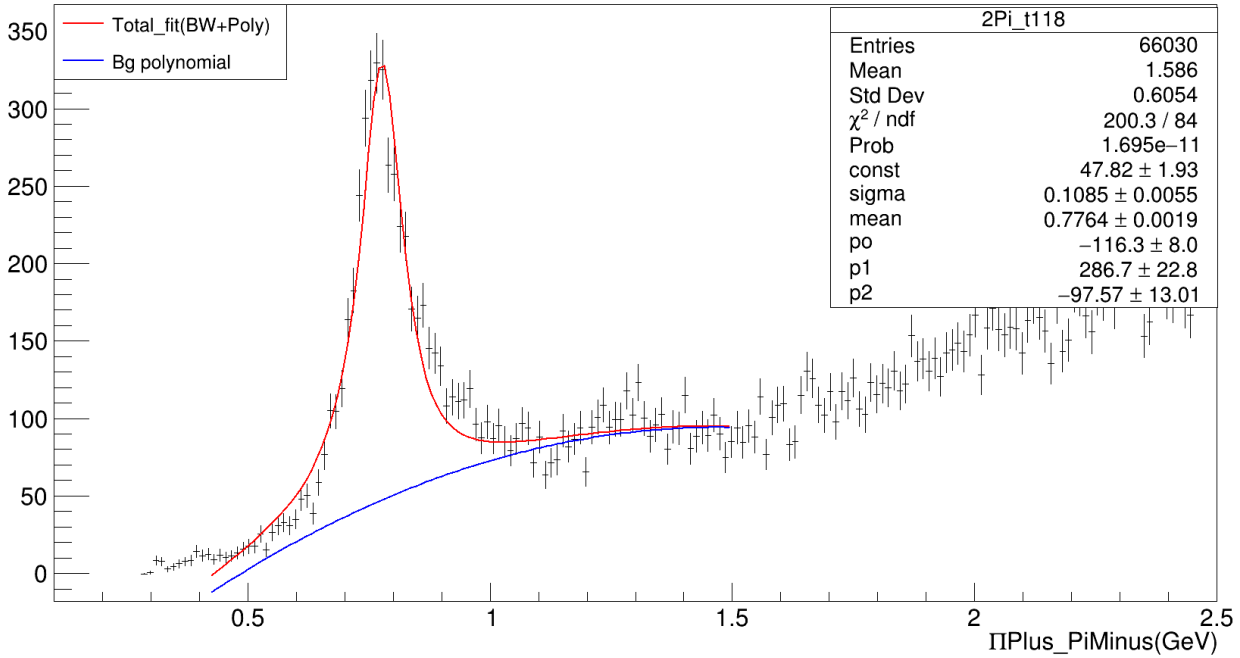
A) Setting the Parameter

6 parameter (3 from BW and 3 from poly)

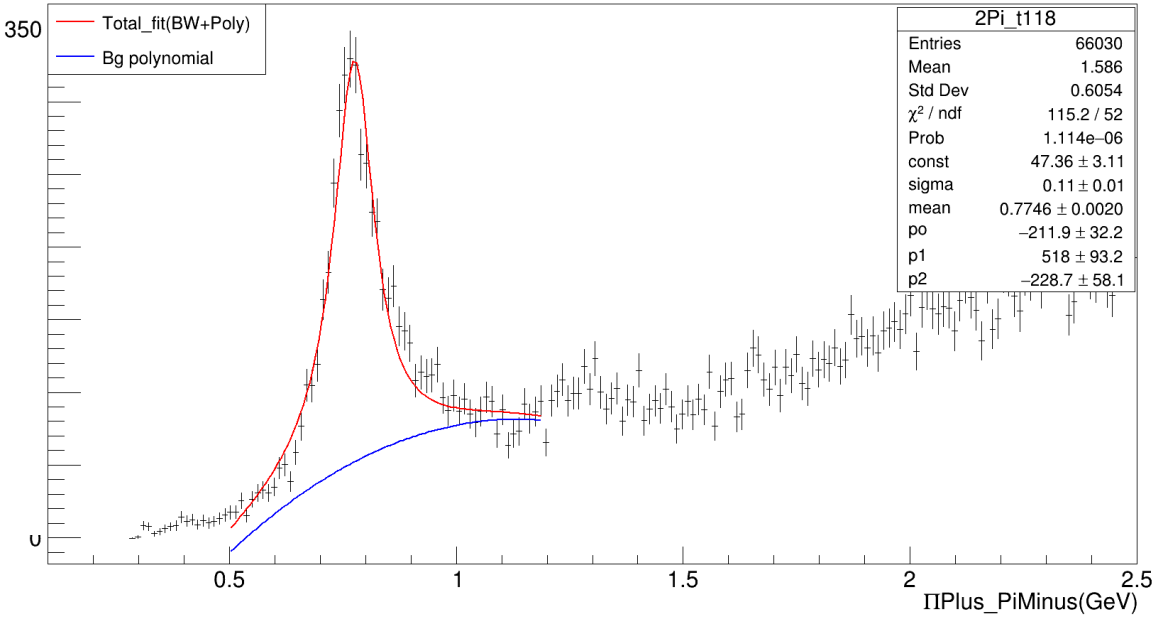
Set Mean of (BW) = 775 MeV

Sigma of (BW) = 145 MeV

Allowing parameter of polynomial.




```
////// Breit-weigner Relativistic Case
 Double_t mybwr(Double_t* x, Double_t* par)
{
  Double_t mm = (par[2]*par[2]); // Gamma = par[1] M =par2
  Double_t gg = (par[1]*par[1]);
  Double_t mg = (par[2]*par[1]);
  Double_t xxMinusmm = ((x[0]*x[0]) - (par[2]*par[2]));
  Double_t y = sqrt(mm *(mm +gg));
  Double_t k = (0.90031631615710606*mg*y)/(sqrt(mm+y)); //2*sqrt(2)/pi = 0.9003163....
  Double_t bw = (par[0]*(k/(xxMinusmm*xxMinusmm + mg*mg)));
  Double_t poly = par[3]+par[4]*x[0]+par[5]*x[0]*x[0];
  return poly + bw;
}
```



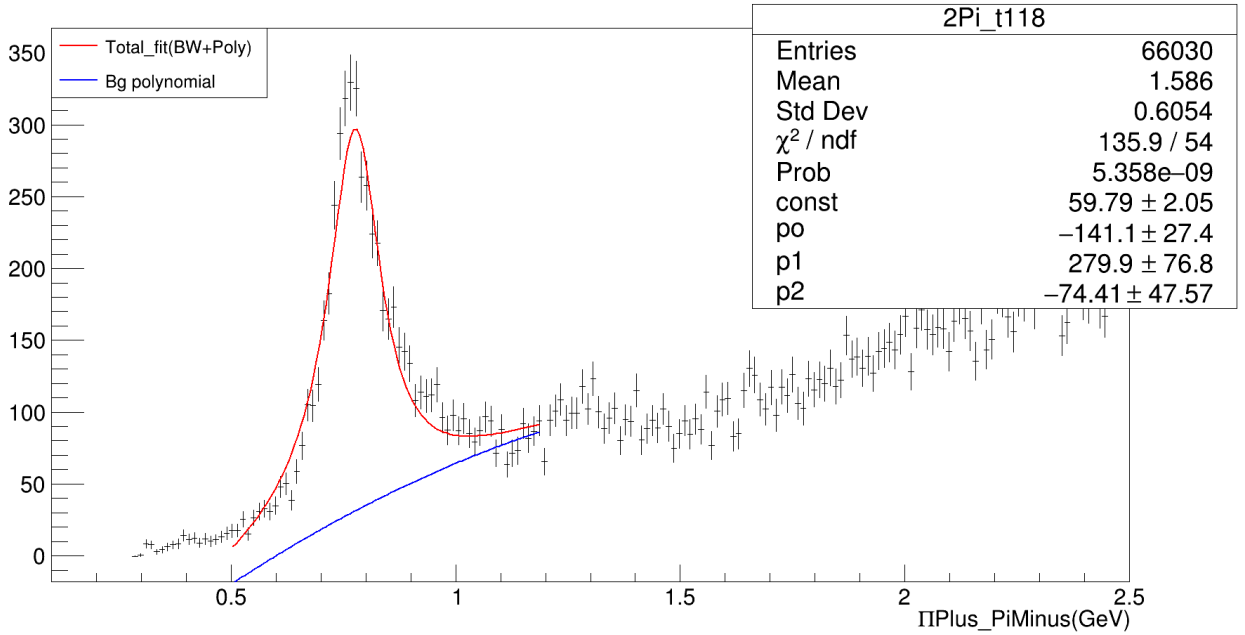
B) Fixing the Parameter of BW Function

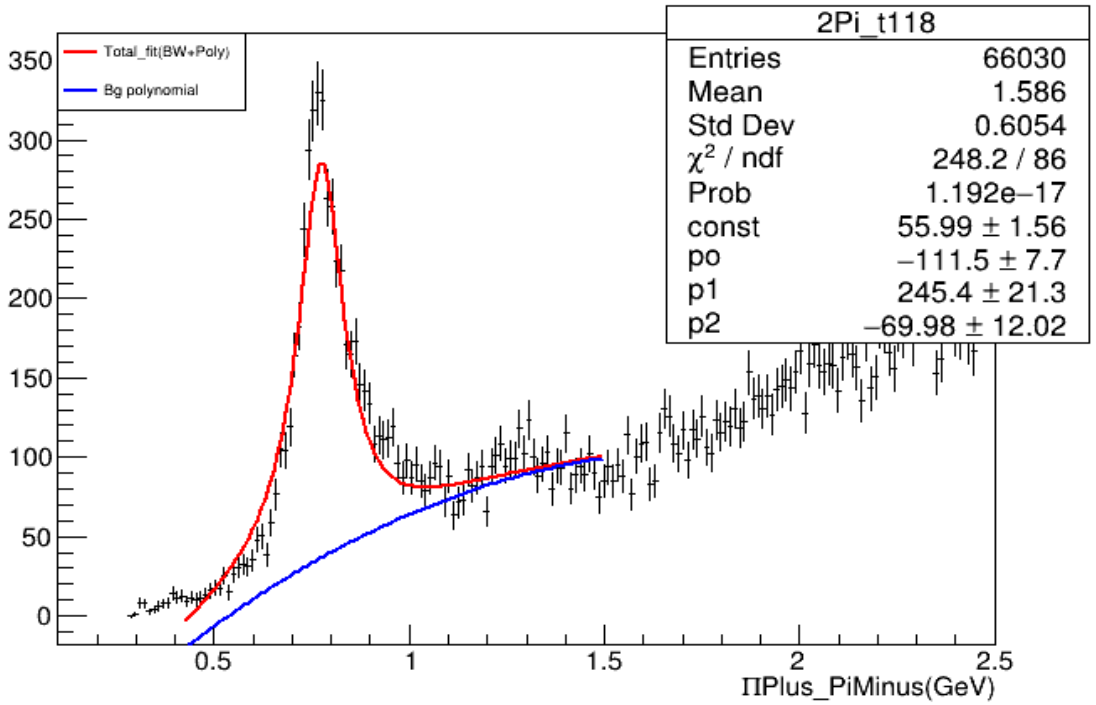
6 parameter (3 from BW and 3 from poly)

Fix Mean of (BW) = 775 MeV

Fix Sigma of (BW) = 145 MeV

Allowing parameter of polynomial.





C) Fixing the Parameter of BW Function and poly function

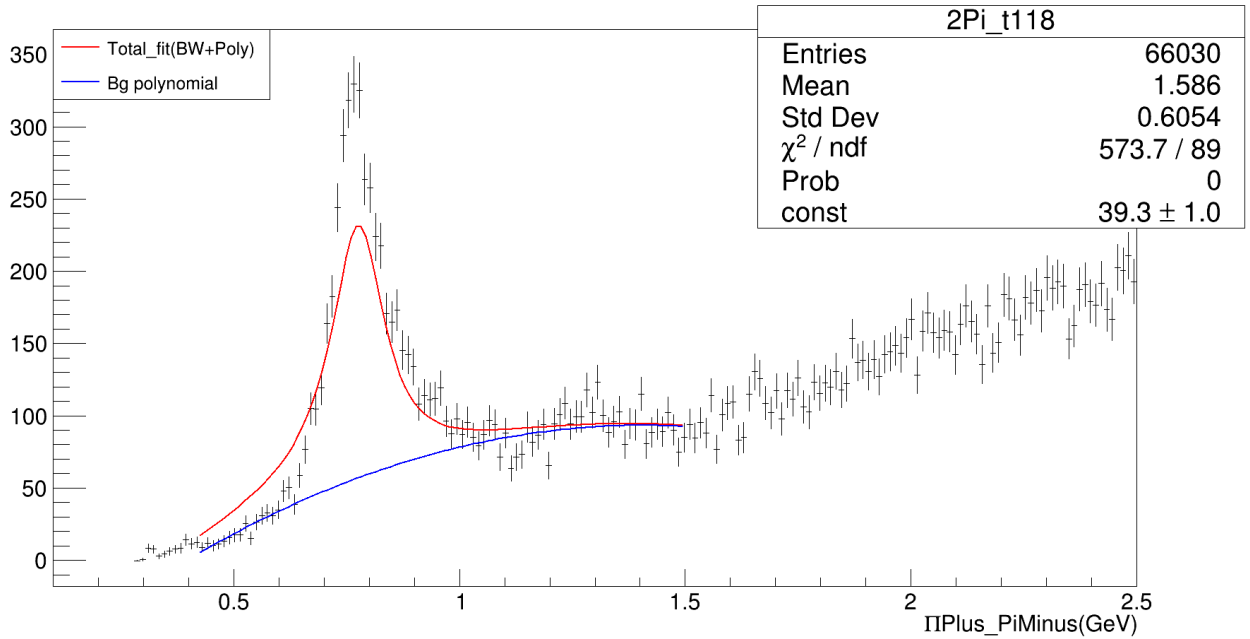
6 parameter (3 from BW and 3 from poly)

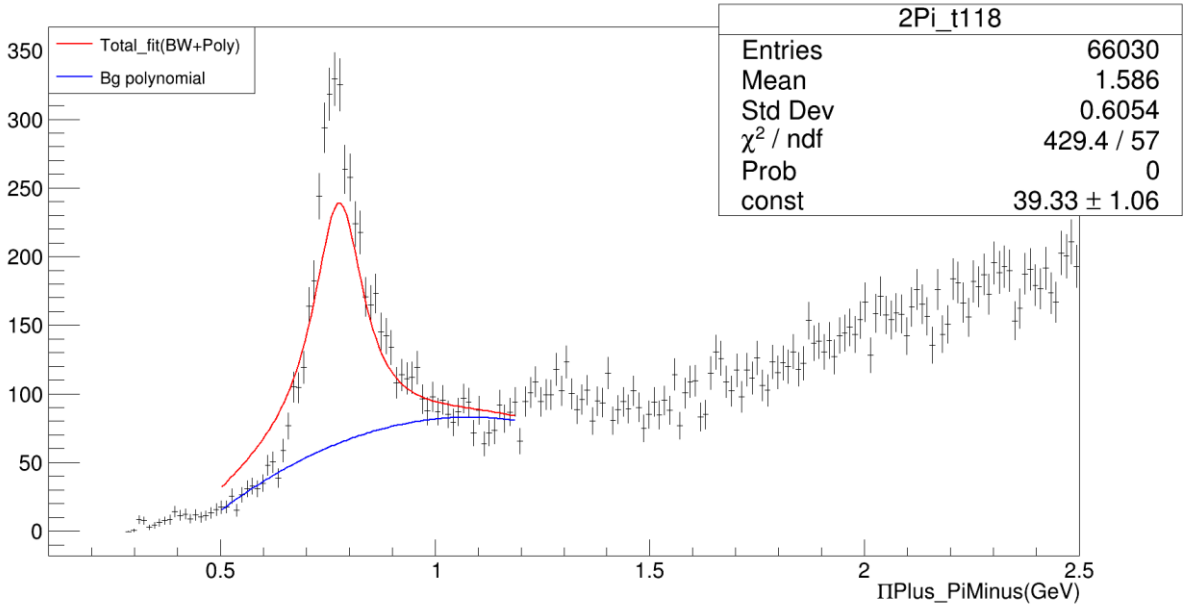
Fix Mean of (BW) = 775 MeV

Fix Sigma of (BW) = 145 MeV

Allow the Amplitude (BW)

Fix estimated Bg Polynomial.





D) Fixing all the Parameter of BW Function and poly function

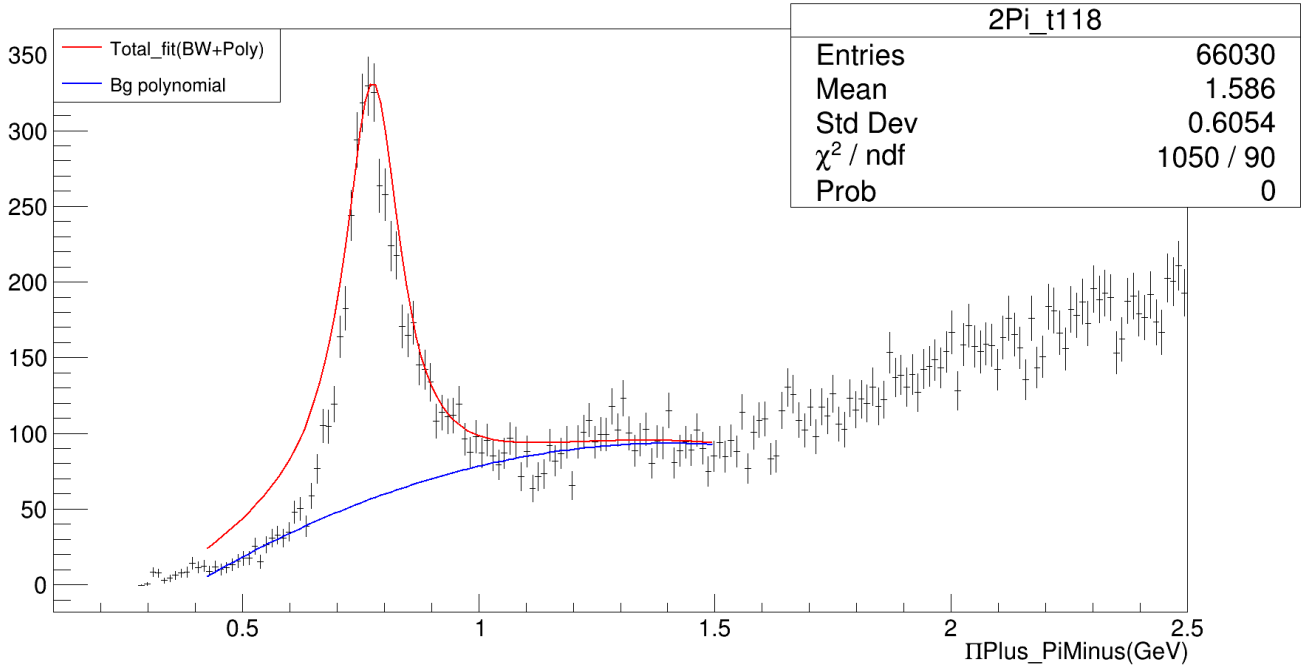
6 parameter (3 from BW and 3 from poly)

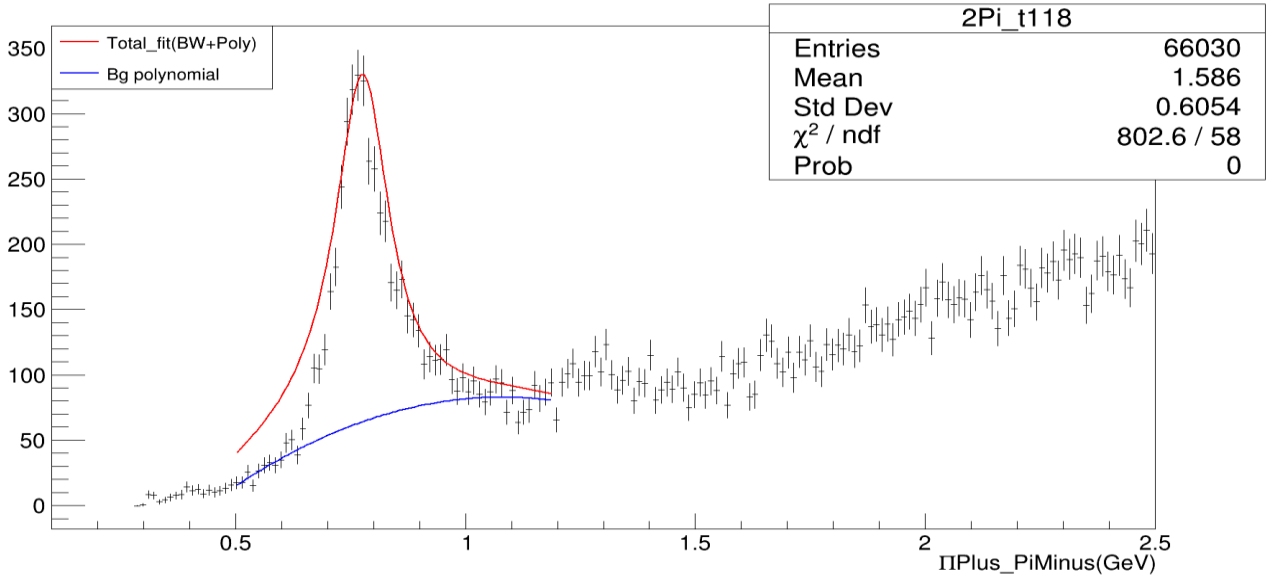
Fix Mean of (BW) = 775 MeV

Fix Sigma of (BW) = 145 MeV

Fix the Amplitude (BW)

Fix estimated Bg Polynomial.

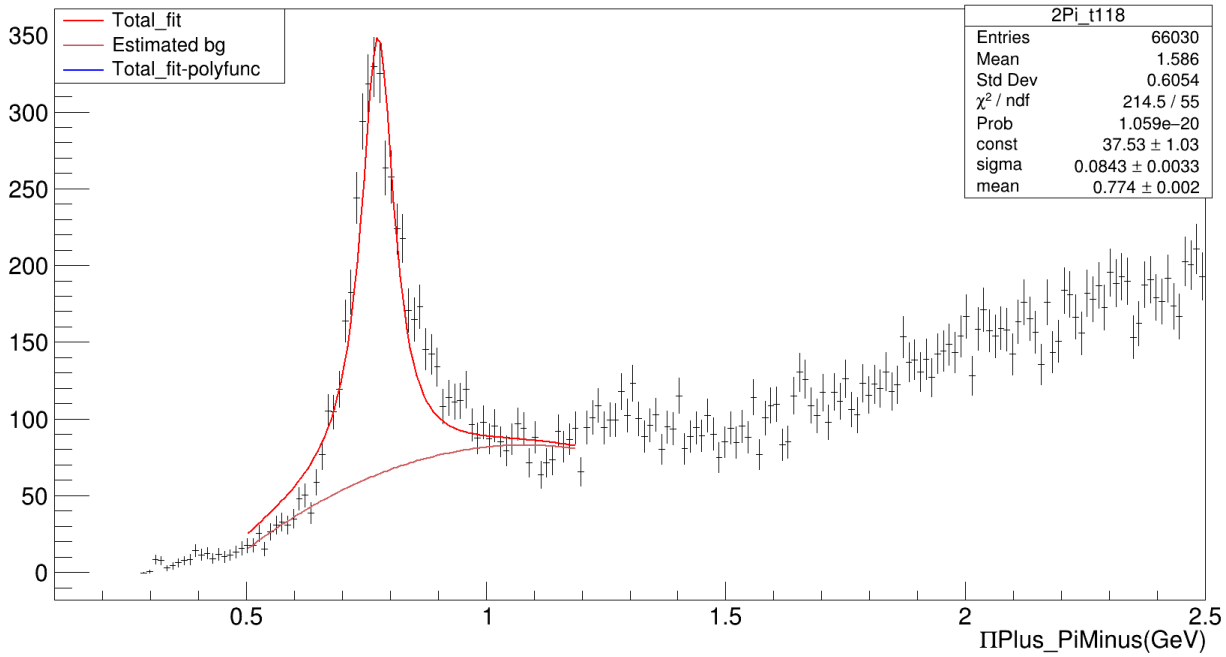


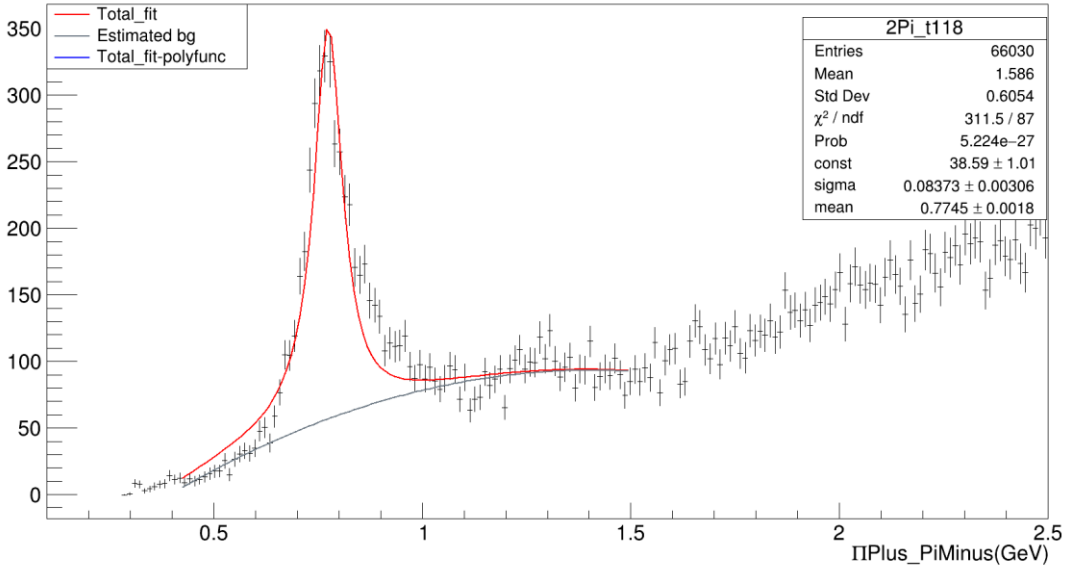


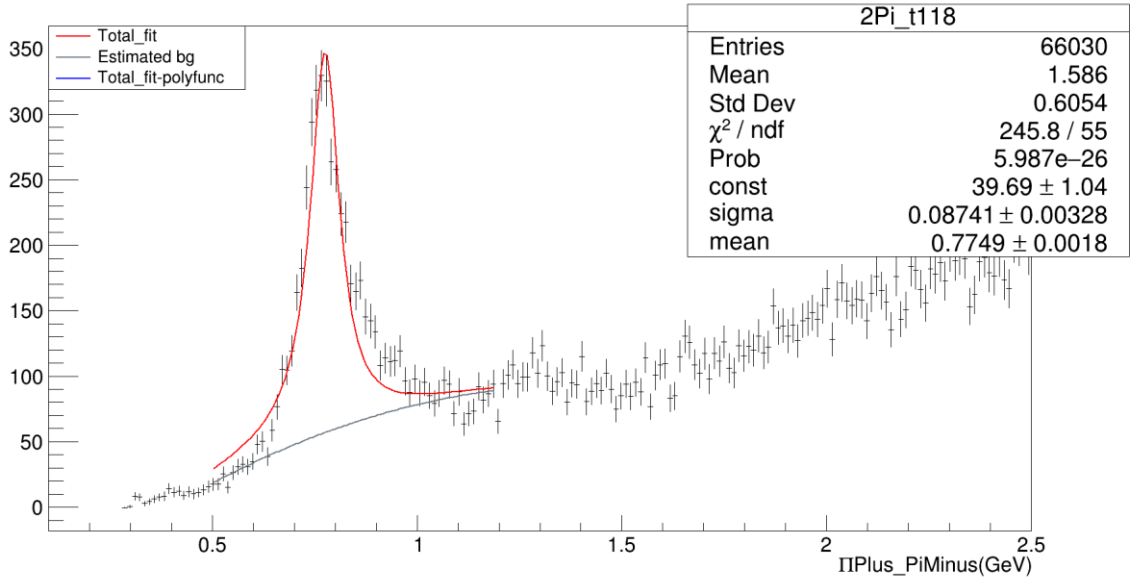
D) Fixing the Parameter poly function

6 parameter (3 from BW and 3 from poly)

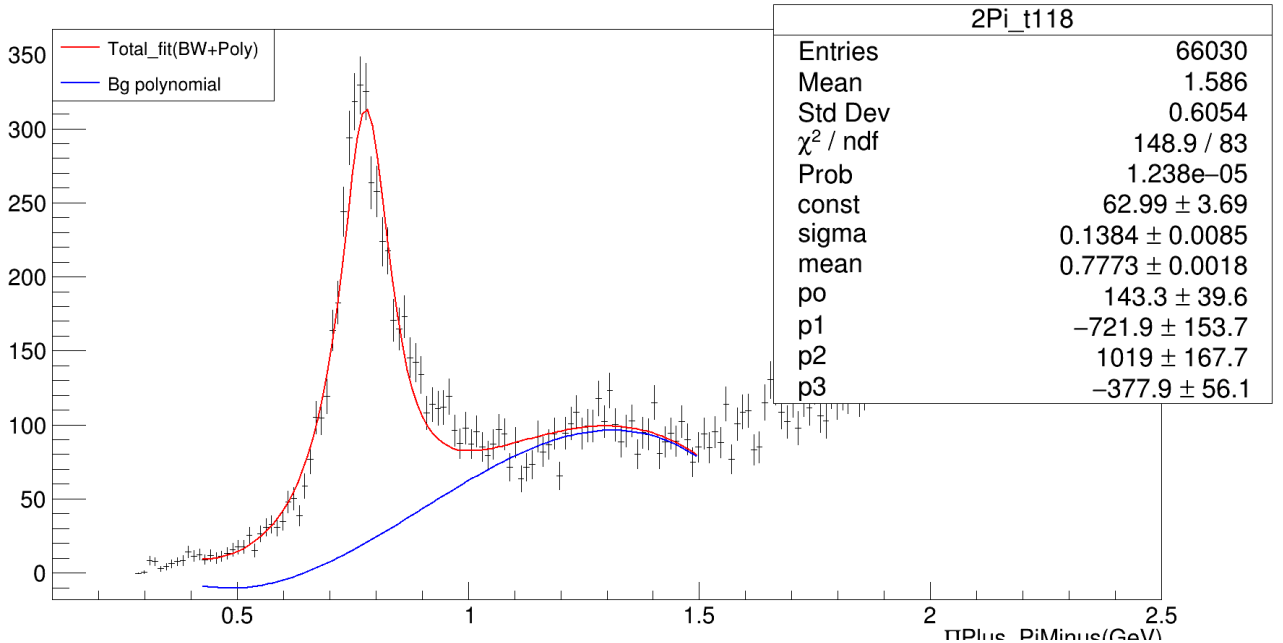
Fix estimated Bg Polynomial.

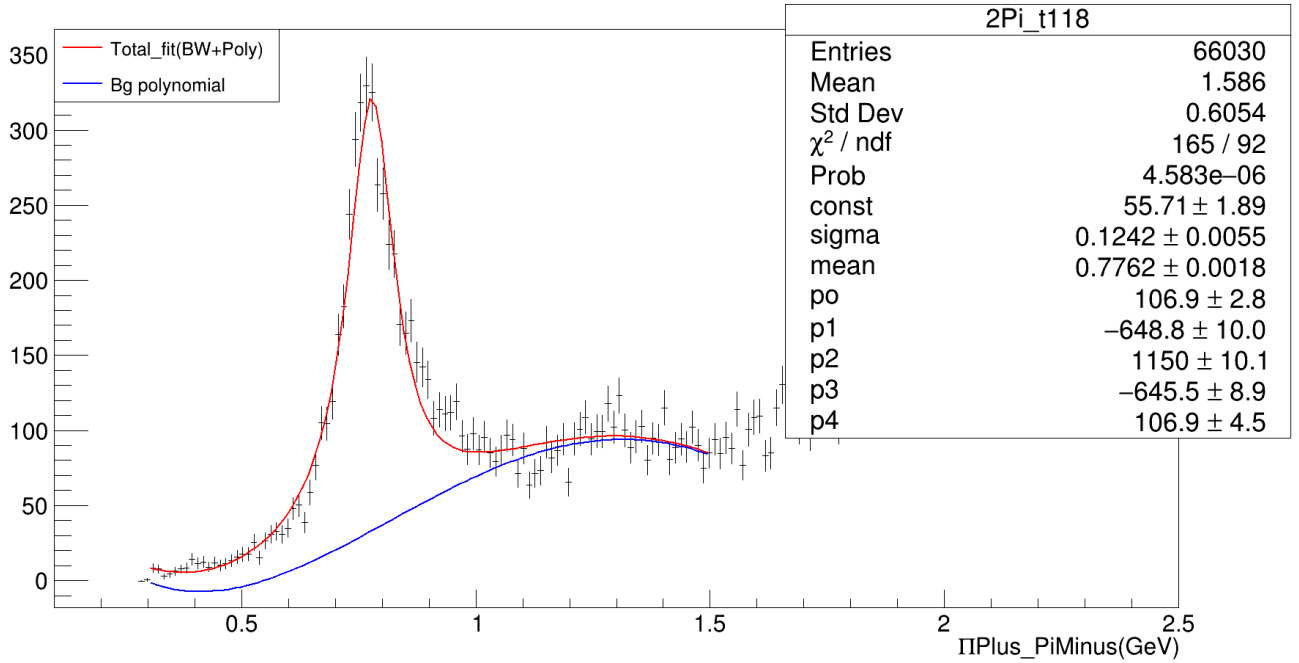


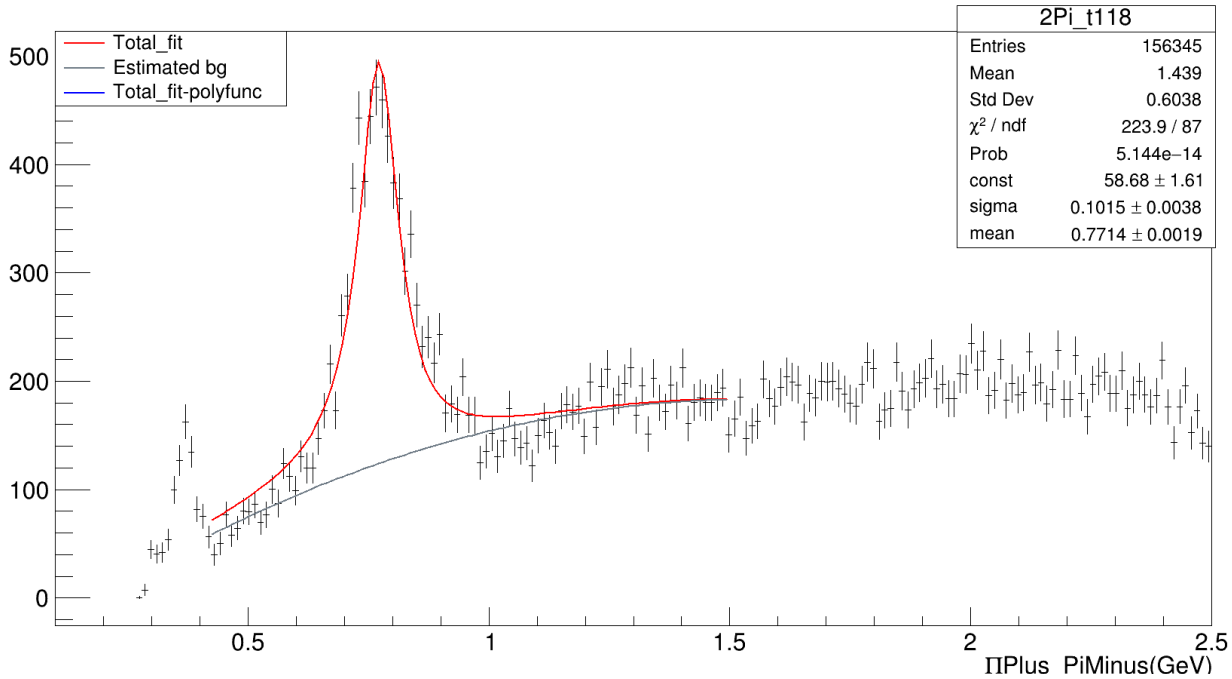


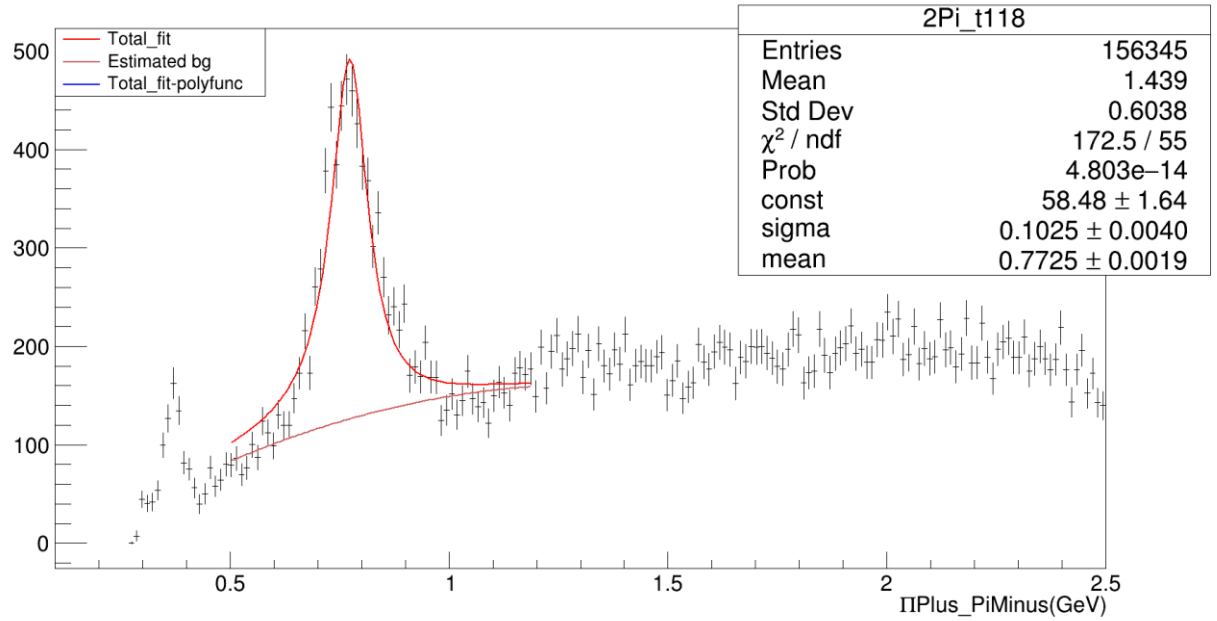


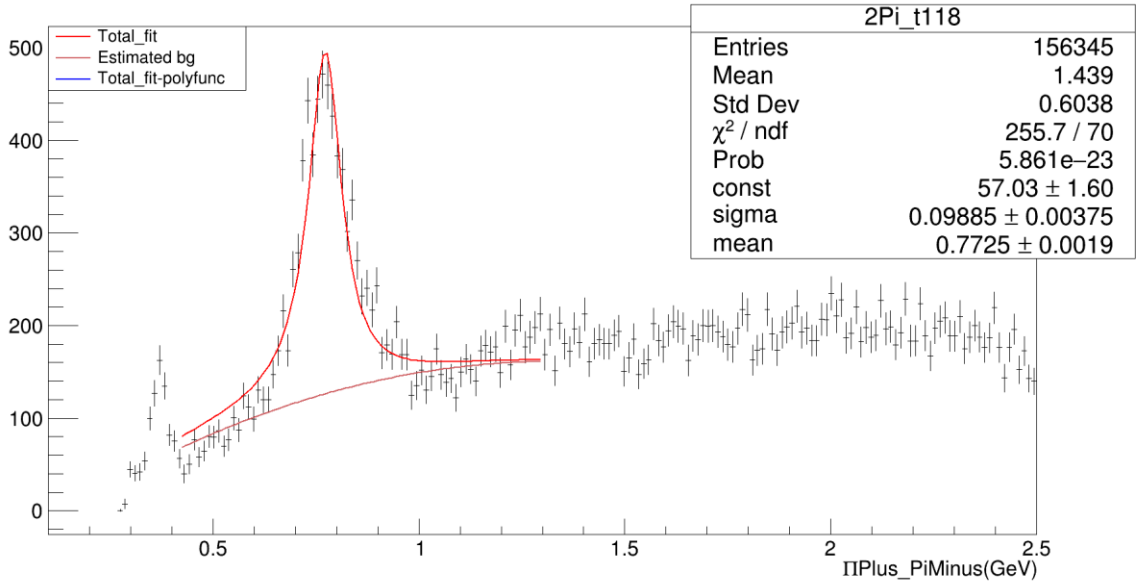
3rd and 4th order Polynomial + BW function






Total_fit
Estimated bg
Total_fit-polyfunc
2Pi_t118
Entries 156345
Mean 1.439
Std Dev 0.6038
χ² / ndf 223.9 / 87
Prob 5.144e−14
const 58.68 ± 1.61
sigma 0.1015 ± 0.0038
mean 0.7714 ± 0.0019
ΠPlus PiMinus(GeV)


Total_fit
Estimated bg
Total_fit-polyfunc
2Pi_t118
Entries 156345
Mean 1.439
Std Dev 0.6038
χ² / ndf 172.5 / 55
Prob 4.803e−14
const 58.48 ± 1.64
sigma 0.1025 ± 0.0040
mean 0.7725 ± 0.0019
ΠPlus_PiMinus(GeV)


Total_fit
Estimated bg
Total_fit-polyfunc
2Pi_t118
Entries 156345
Mean 1.439
Std Dev 0.6038
χ² / ndf 255.7 / 70
Prob 5.861e−23
const 57.03 ± 1.60
sigma 0.09885 ± 0.00375
mean 0.7725 ± 0.0019
ΠPlus_PiMinus(GeV)

Feedback

What are the best technique that I can implement to remove background?

Two BW function + polynomial of 2nd order.