Preliminary Cross section ratio of He4/D2 and C12/D2

Event Selection: Data

- No Extra Tracks : 5 extra showers
- Beam Energy(6.5-10.8)
- CL > 10^-3
- (PiPlus + PiMinus + Proton -Beam).P() = Pmiss < 300 Mev/c
- Proton Vertex(52,78 cm)
- Additional Cuts.(Proton's Theta cut based on |t| distribution)

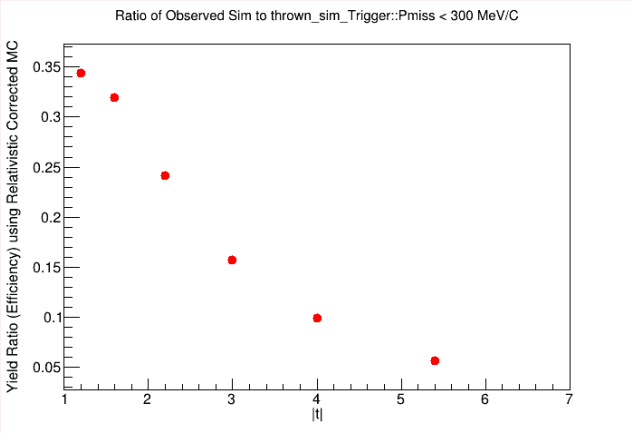
Angular cuts:

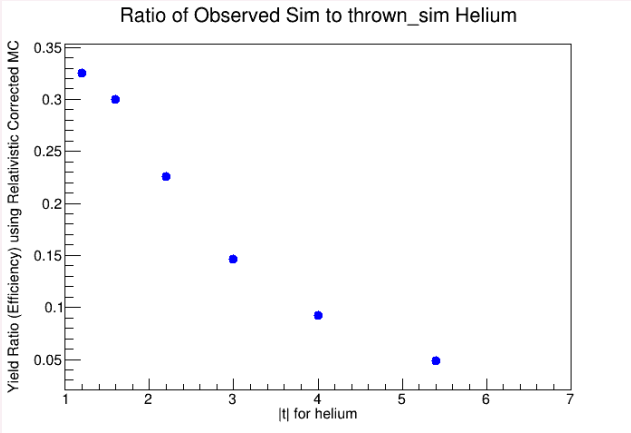
Range of |t|	Proton Theta				
1.0-1.4	>25				
1.4-1.8	>25				
1.8-2.6	>25				
2.6-3.4	>25				
3.4-4.6	>20				
4.6-6.2	>15				

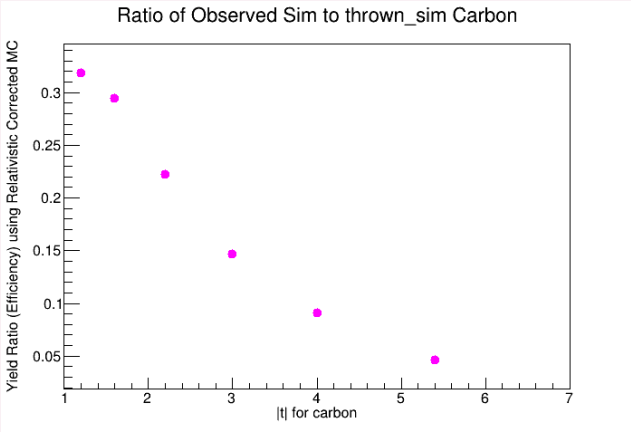
Angular cuts:

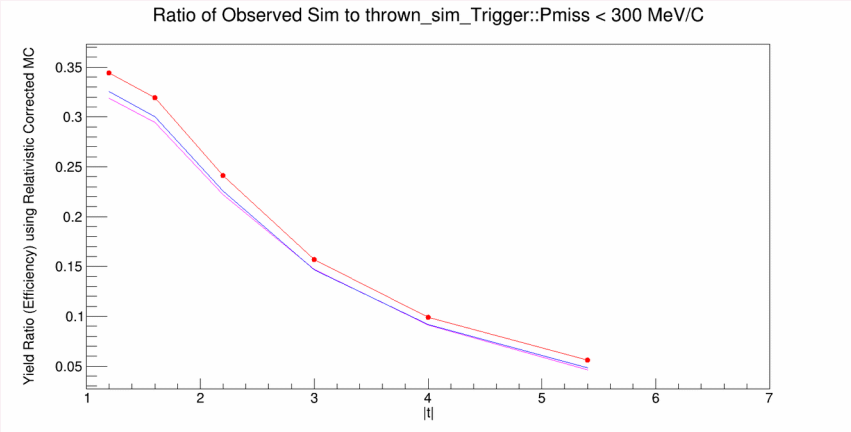
Range of |t|	PiPlus Theta	PiMinus Theta	ProtonTheta		
1.0-1.4	<35/No cut	<35/Nocut	>25		
1.4-1.8	<35/No cut	<35/Nocut	>25		
1.8-2.6	<35/No cut	<35/Nocut	>25		
2.6-3.4	<35/No cut	<35/Nocut	>25		
3.4-4.6	<35/Nocut	<35/Nocut	>20		
4.6-6.2	<35/Nocut	<35/Nocut	>15		

Efficiency

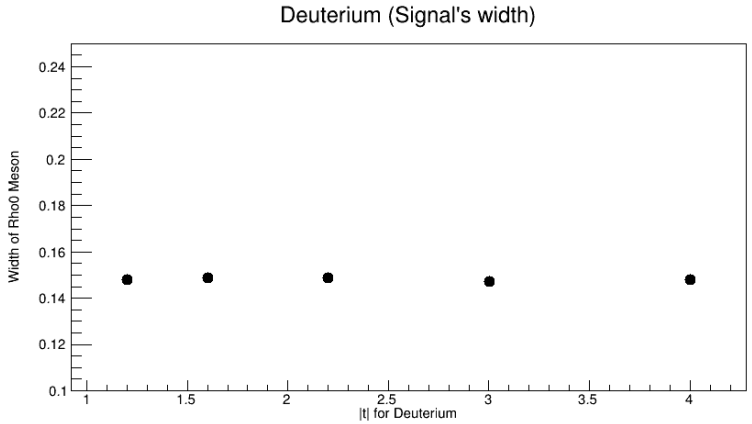

Ratio of Observed Sim to thrown_sim_Trigger::Pmiss < 300 MeV/C
Yield Ratio (Efficiency) using Relativistic Corrected MC
|t|

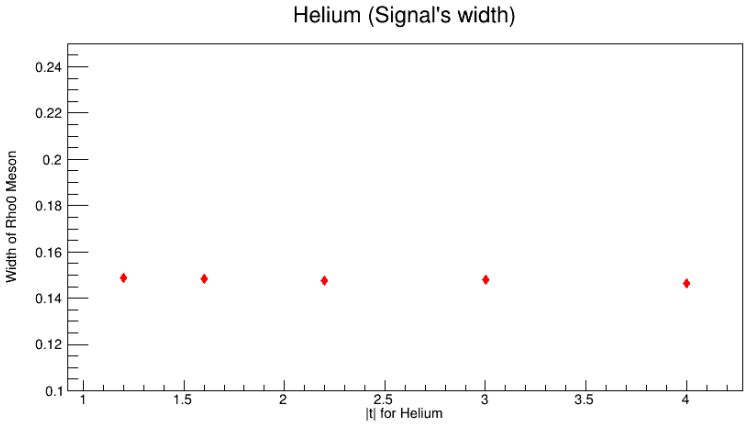

Ratio of Observed Sim to thrown_sim Helium
Yield Ratio (Efficiency) using Relativistic Corrected MC
|t| for helium

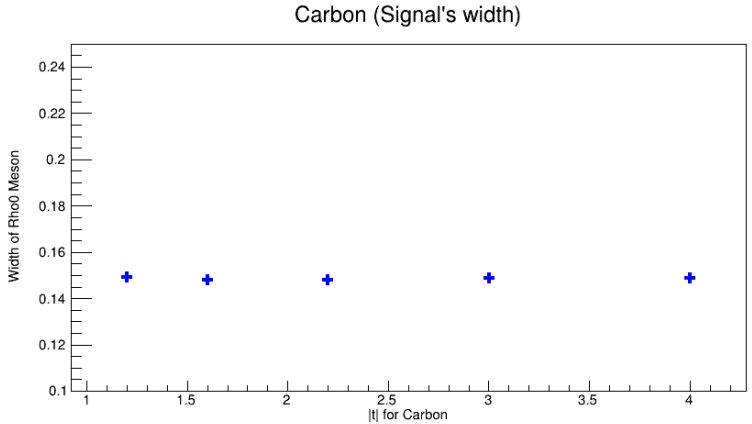

Ratio of Observed Sim to thrown_sim Carbon
Yield Ratio (Efficiency) using Relativistic Corrected MC
|t| for carbon


Ratio of Observed Sim to thrown_sim_Trigger::Pmiss < 300 MeV/C
Yield Ratio (Efficiency) using Relativistic Corrected MC
|t|

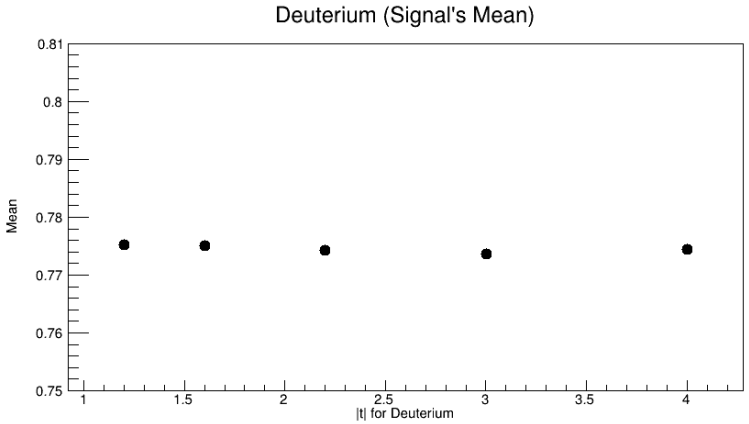
Signal Width of Thrown Simulation from Fitting

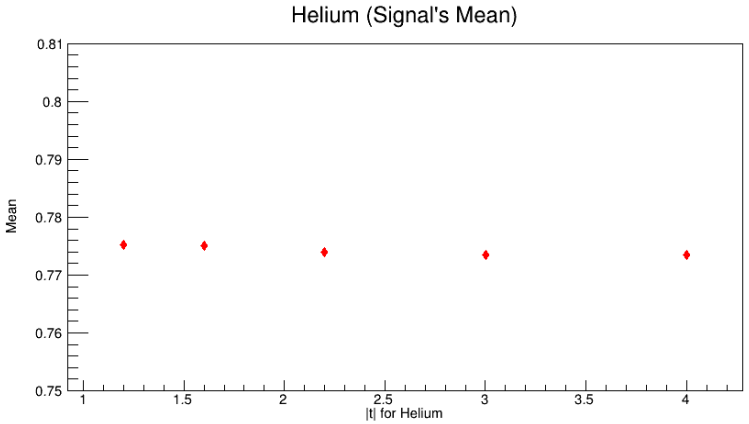


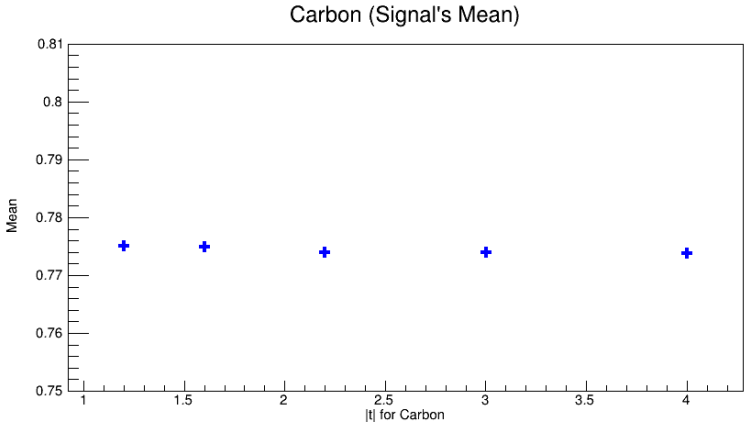




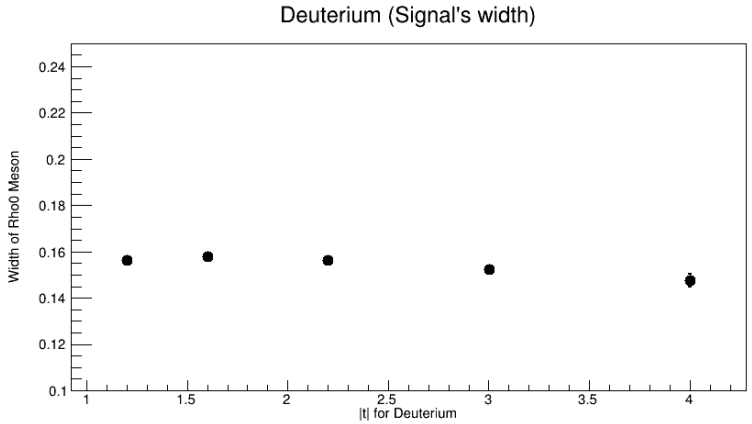
Signal Mean of Thrown Simulation from Fitting

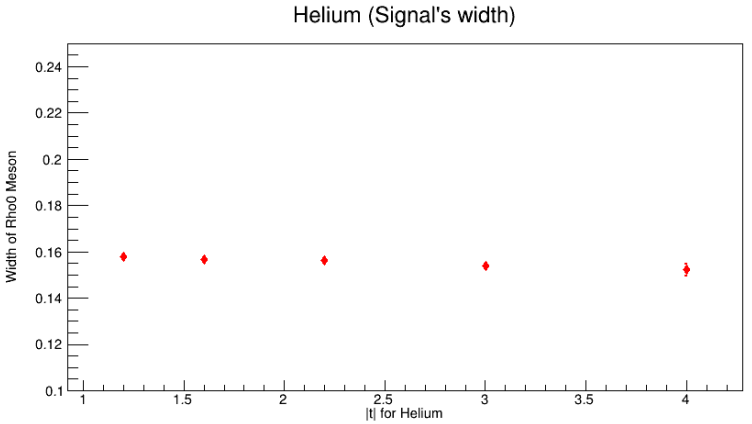


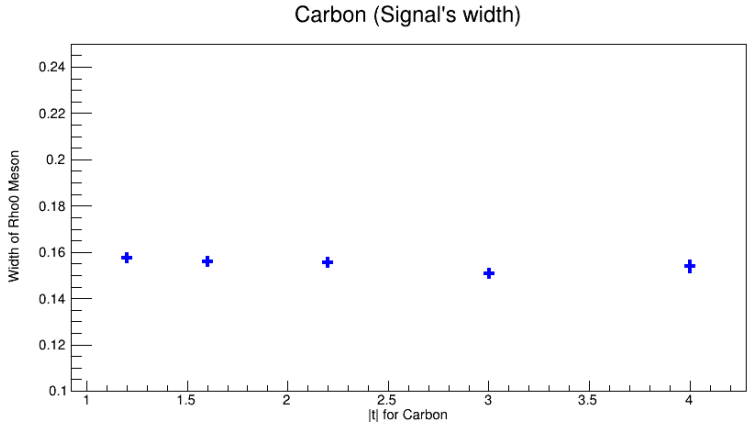




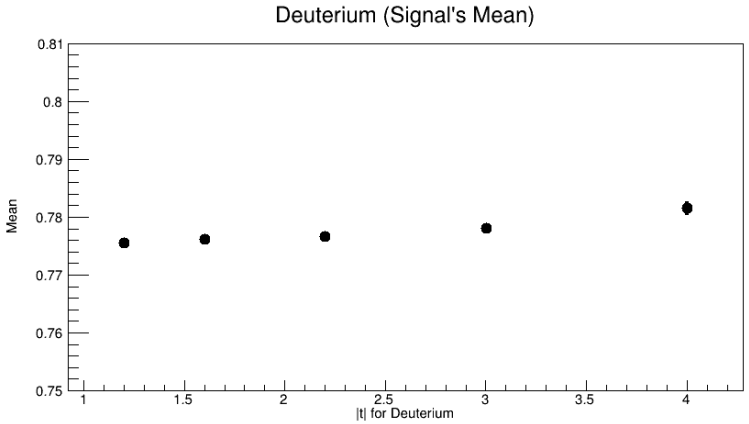
Reconstructed MC (Sigma)

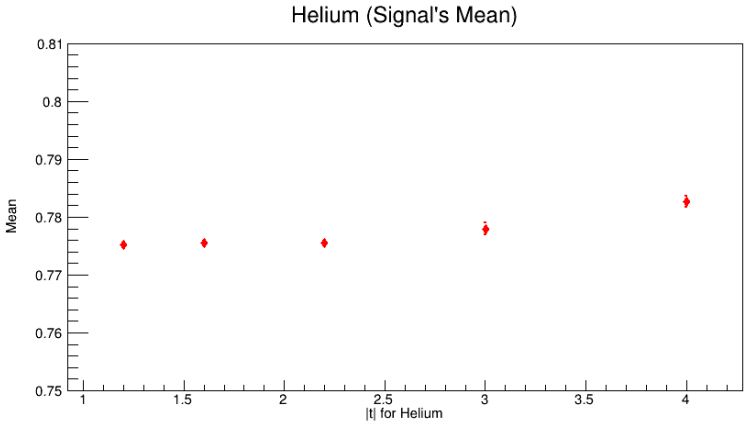


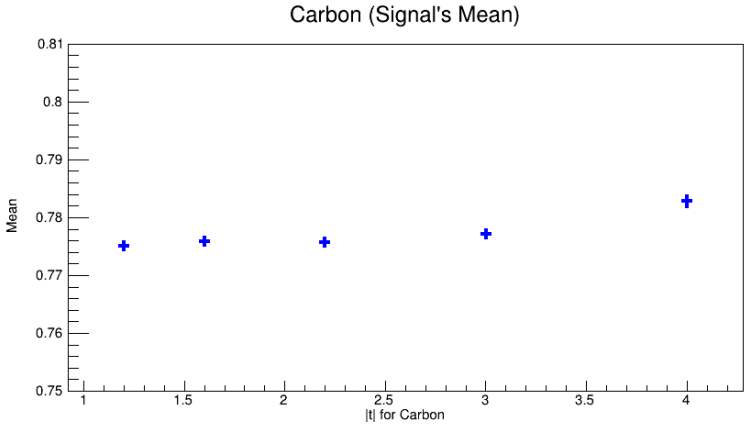




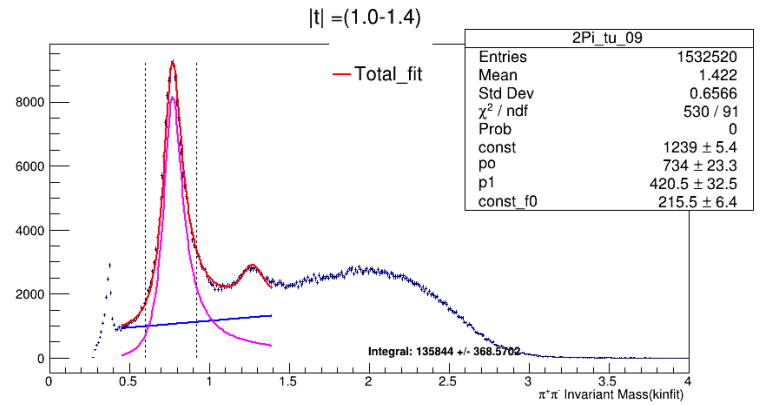
Reconstructed MC mean

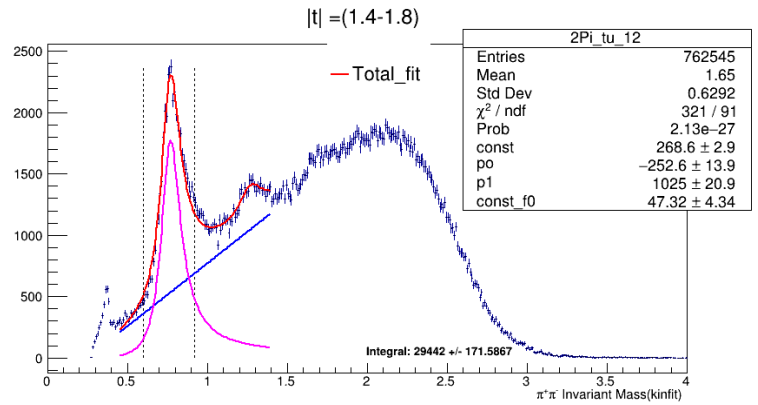


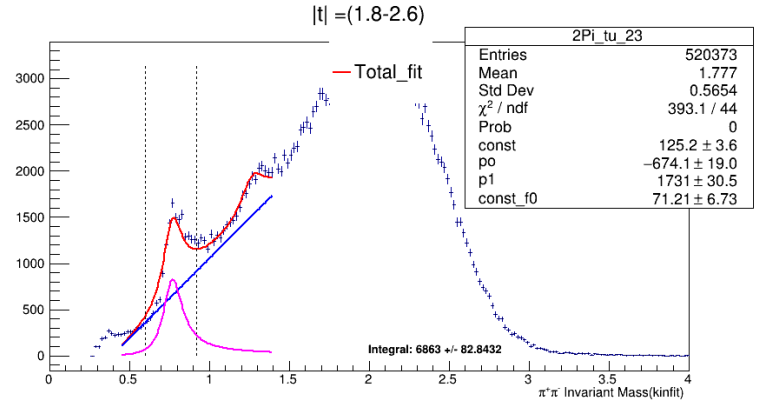


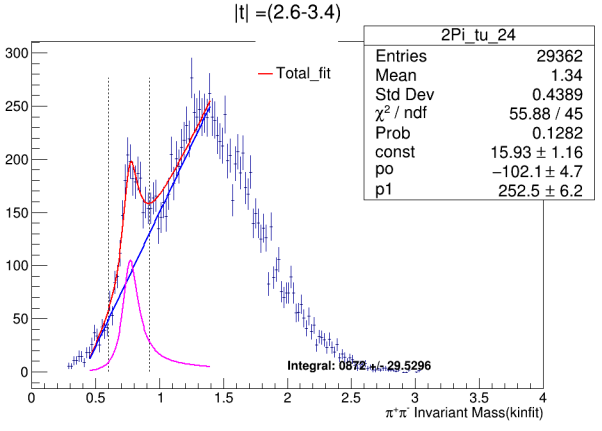


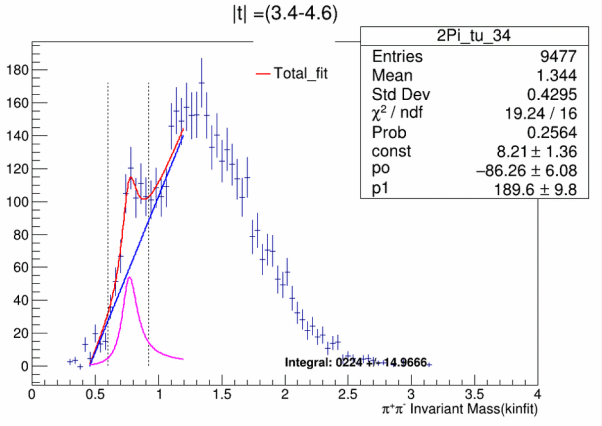
Data:: D2: Fixing Mean =0.77526 , sigma =0.1525







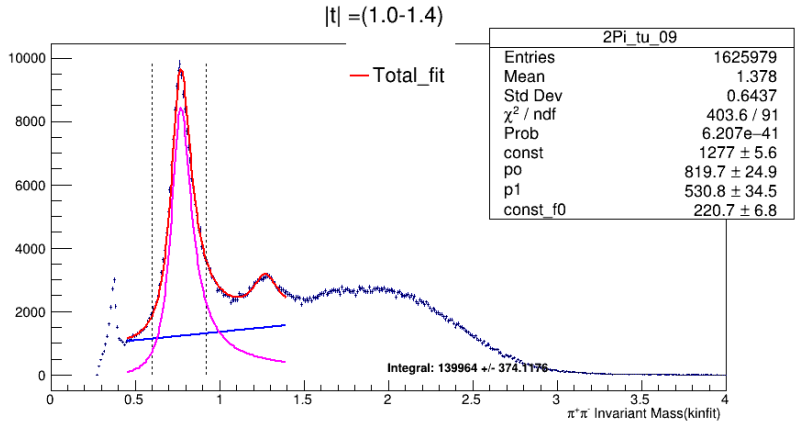


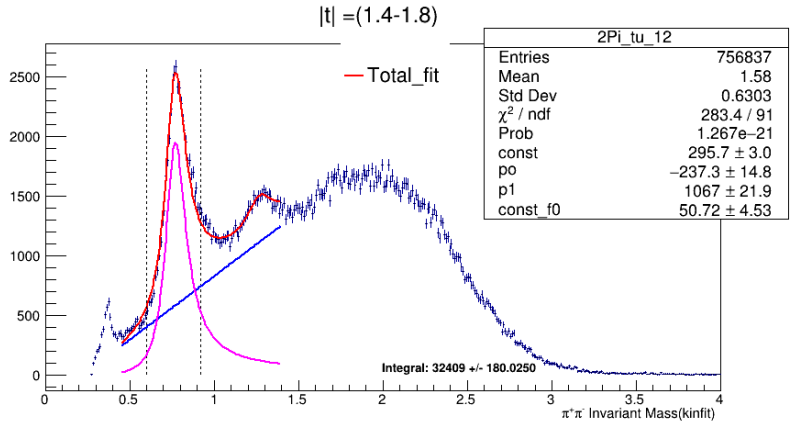


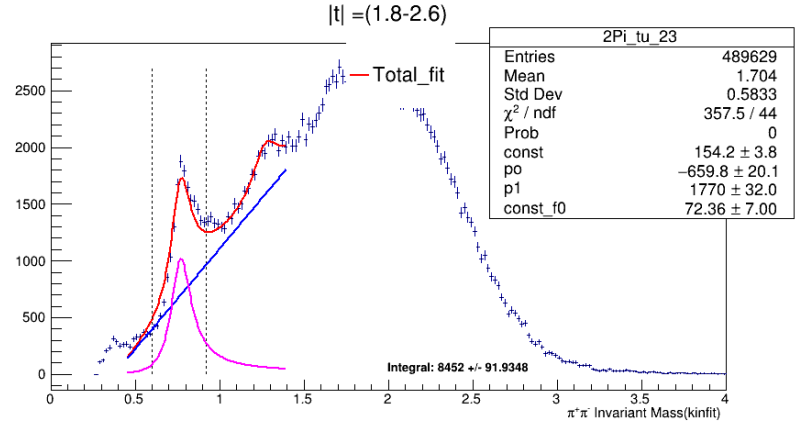
For First 3 histogram :
$\mathbf{p}_\theta > 25°$

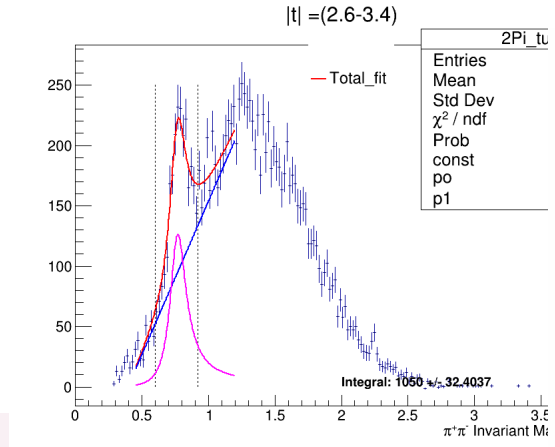
For last 2 histogram:
$\pi^+_\theta < 35°$, $\pi^-_\theta < 35°$, $\mathbf{p}_\theta > 25/20°$

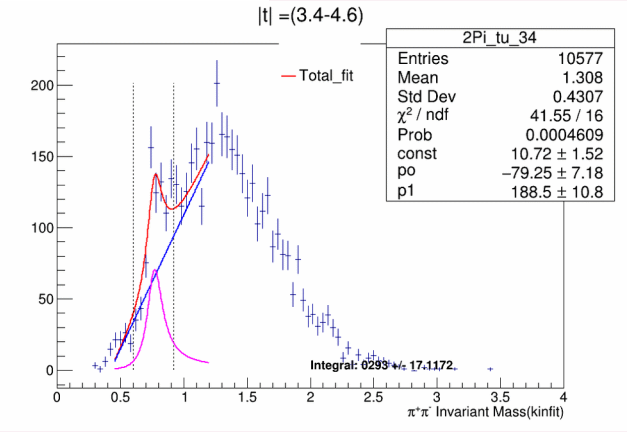
Data:: He4: Fixing Mean =0.77526 , sigma =0.1525







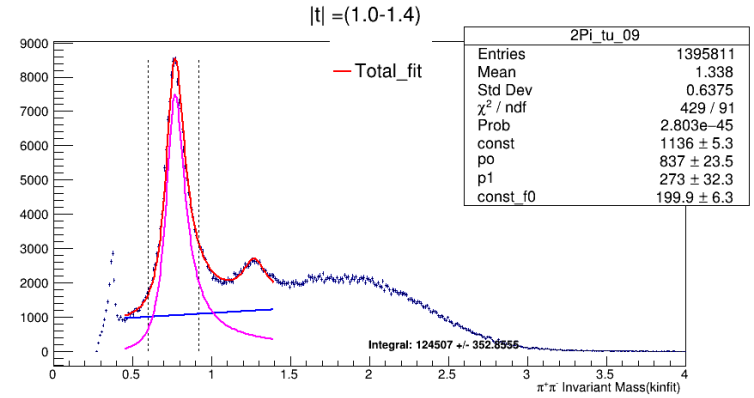


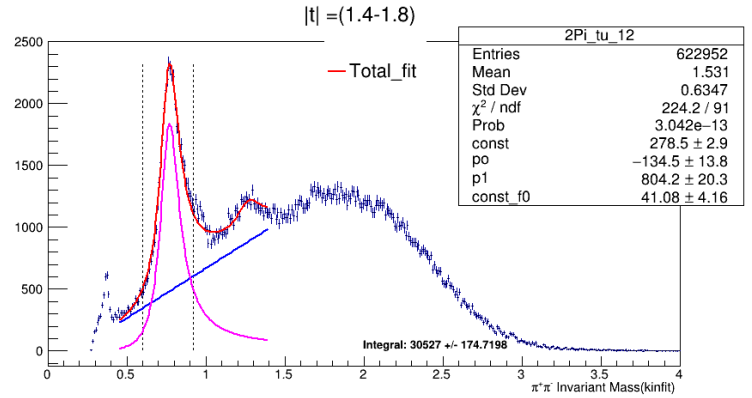


For First 3 histogram :
$\mathbf{p}_\theta > 25°$

For last 2 histogram:
$\pi^+_\theta < 35°$, $\pi^-_\theta < 35°$, $\mathbf{p}_\theta > 25/20°$

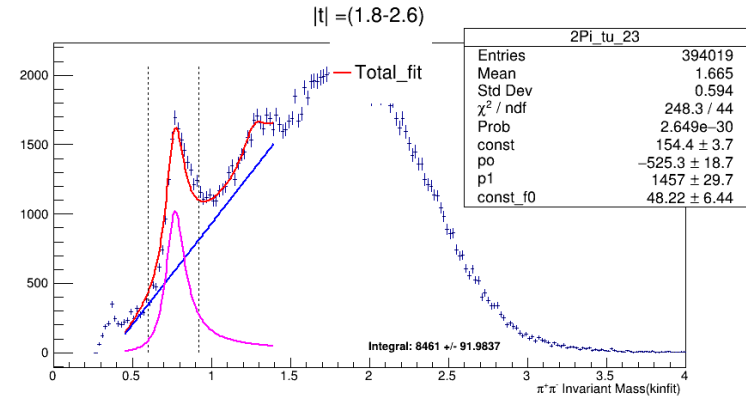
Data:: C12: Fixing Mean =0.77526 , sigma =0.1525

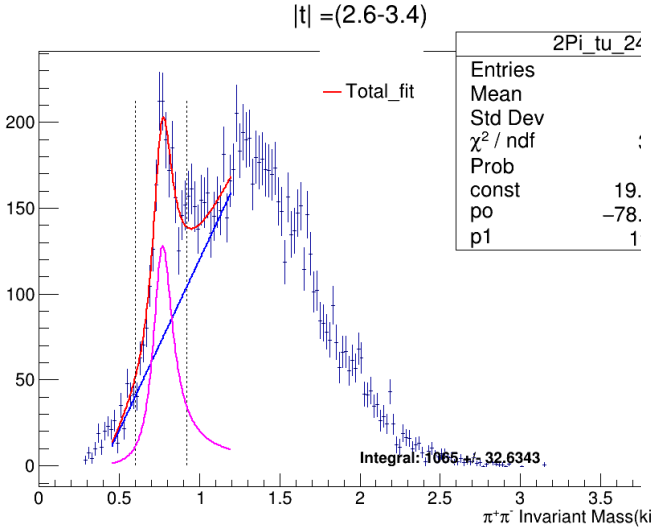


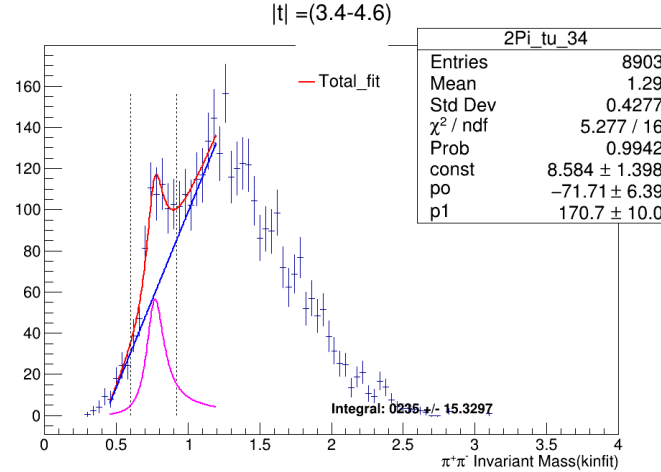


For First 3 histogram :
$p_\theta > 25°$

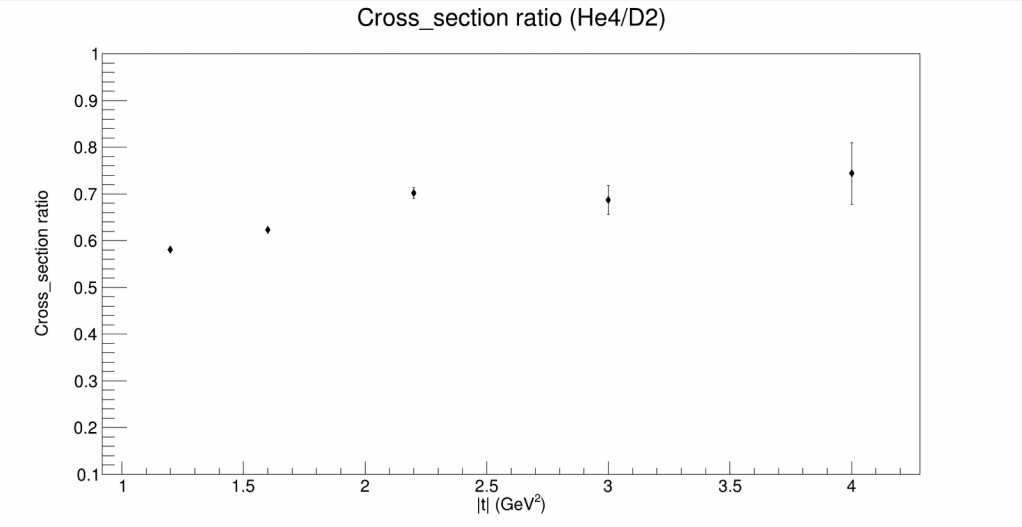
For last 2 histogram:
$\pi^+_\theta < 35°$, $\pi^-_\theta < 35°$, $p_\theta > 25/20°$

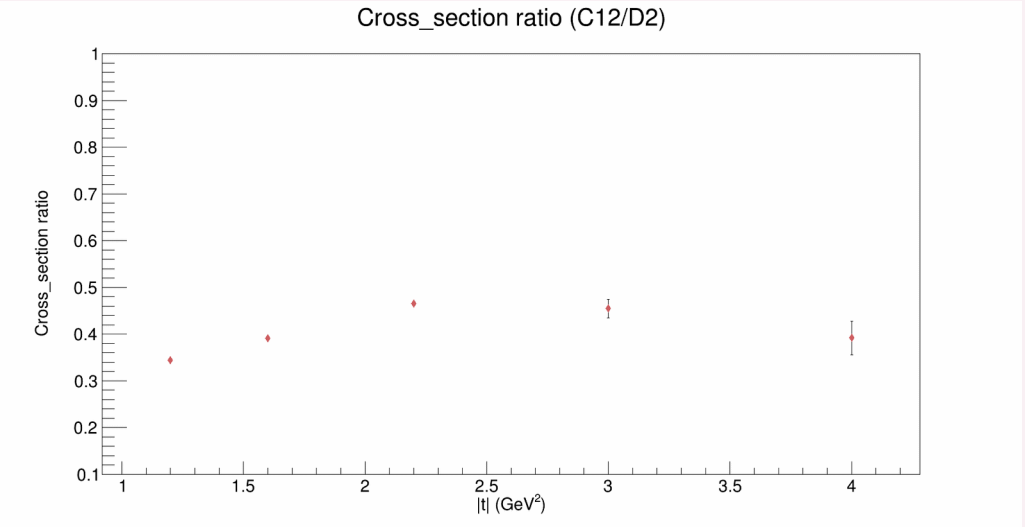






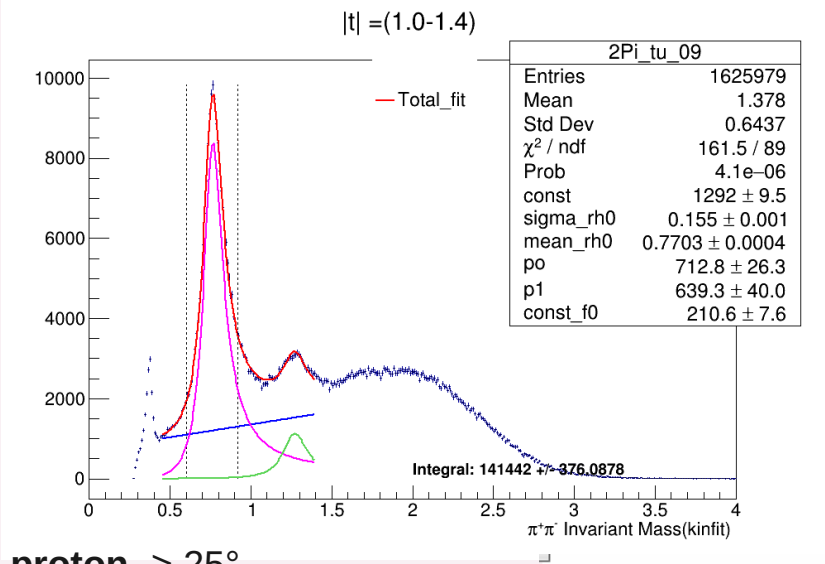
Cross-section Ratio(Mean and Sigma Fixed)



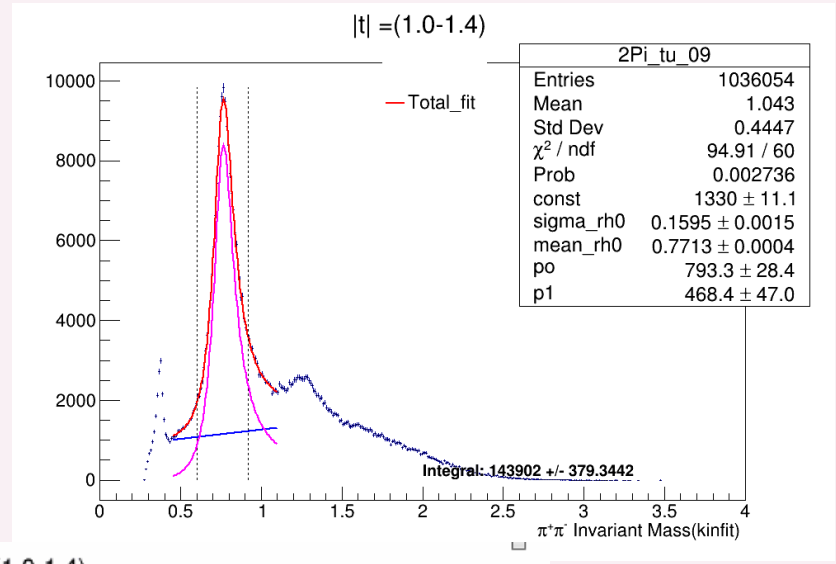


Backup Slides Data(Fit)

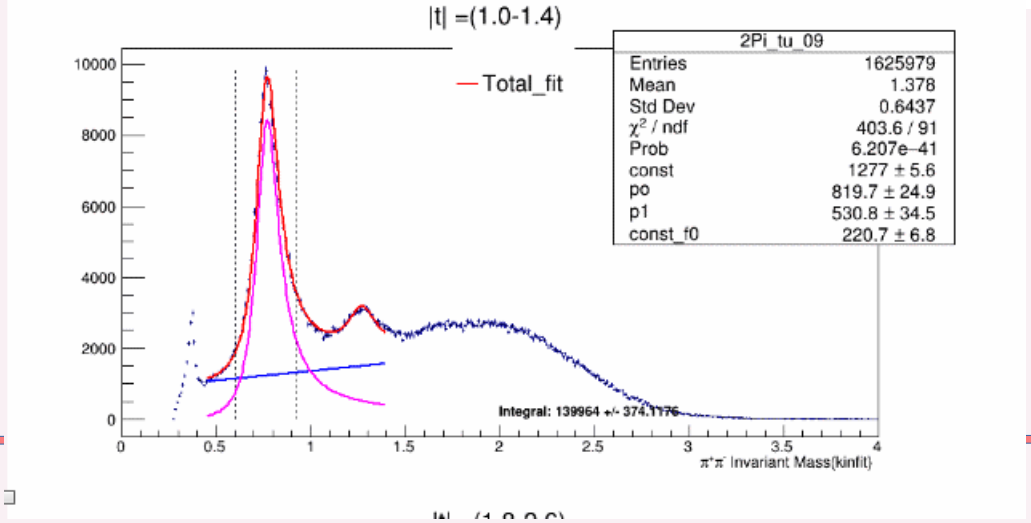
Comparing Fit of Helium Data using different methods.



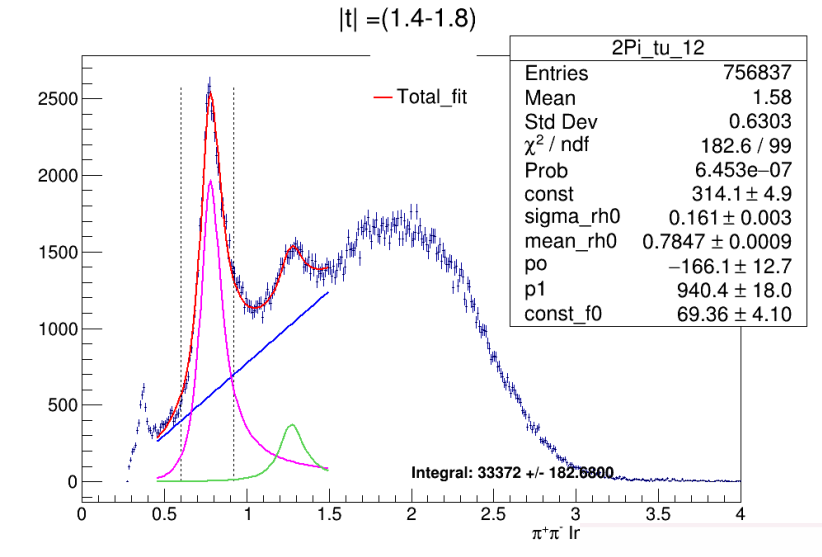
proton$_\theta$ > 25°

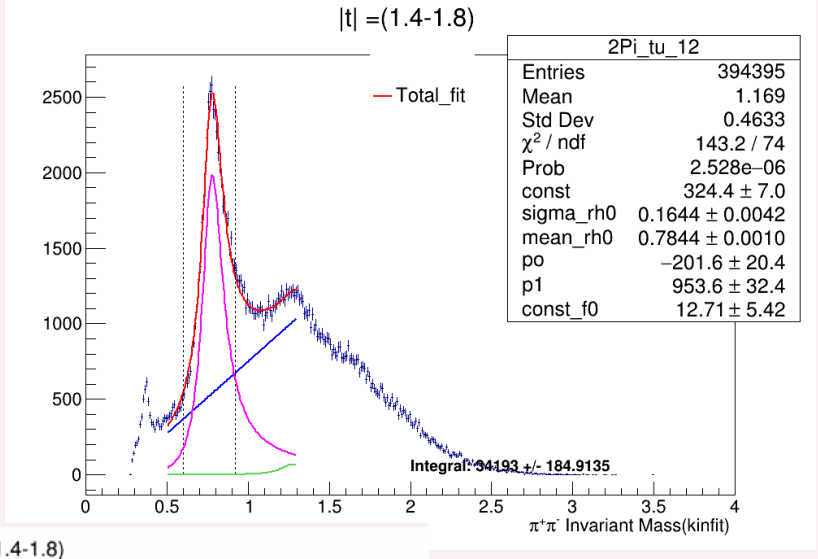


π^+_θ < 35°, π^-_θ < 35°, **p$_\theta$** > 25°,

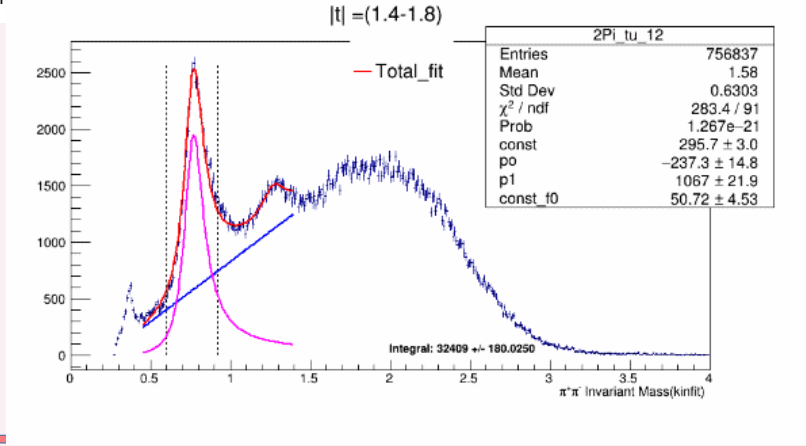


Mean and Sigma Fixed.
proton$_\theta$ > 25°,



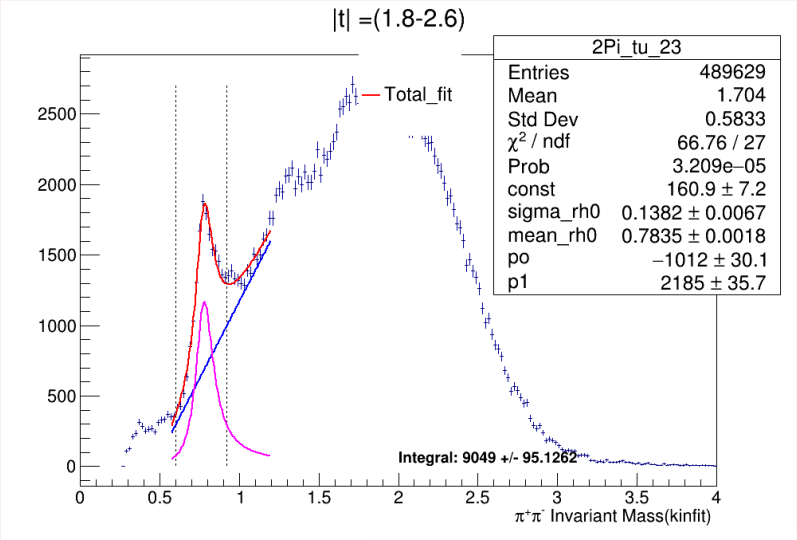


proton$_\theta$ > 25°

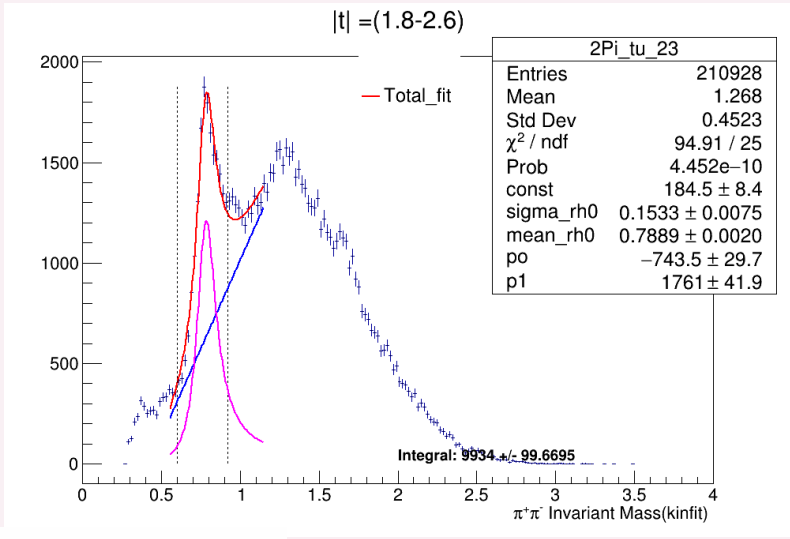


π^+_θ < 35°, π^-_θ < 35°, **p$_\theta$** > 25°,

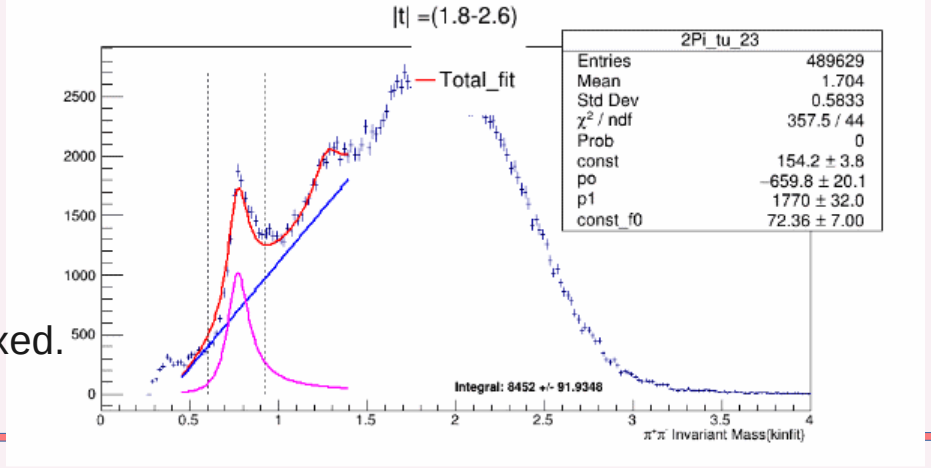
Mean and Sigma Fixed.
proton$_\theta$ > 25°



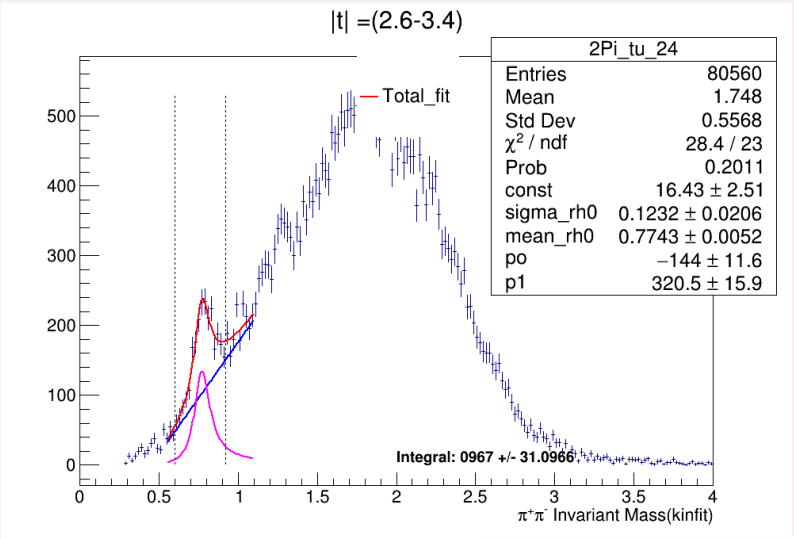
proton$_\theta$ > 25°



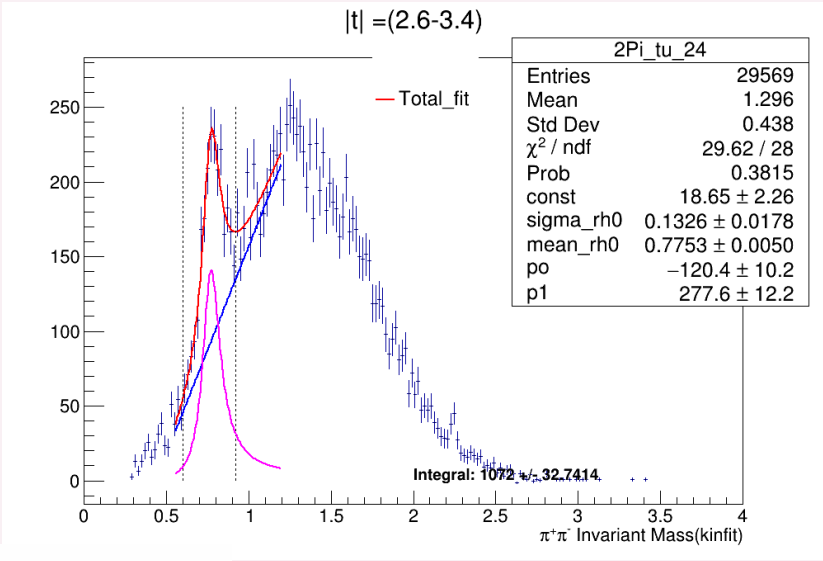
π^+_θ < 35°, π^-_θ < 35°, p_θ > 25°,



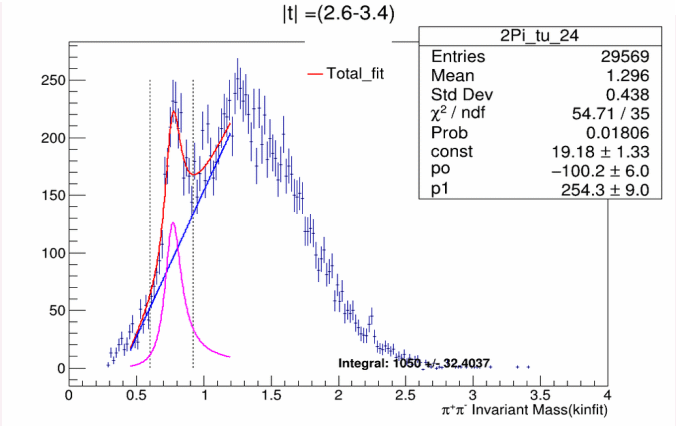
Mean and Sigma Fixed.
proton$_\theta$ > 25°



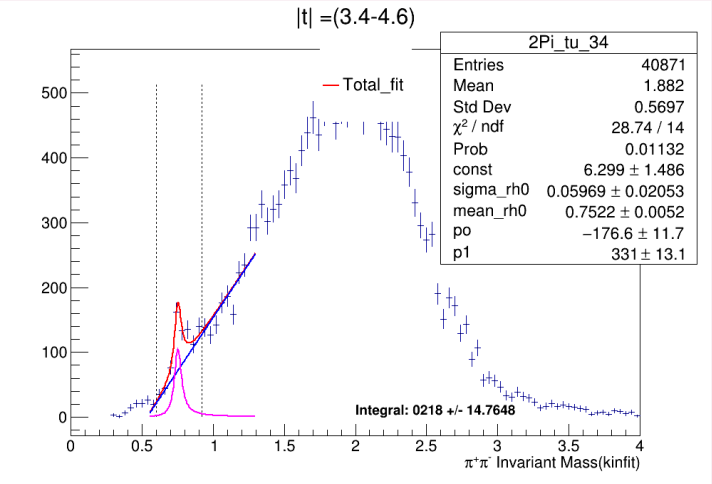
proton$_\theta$ > 25°



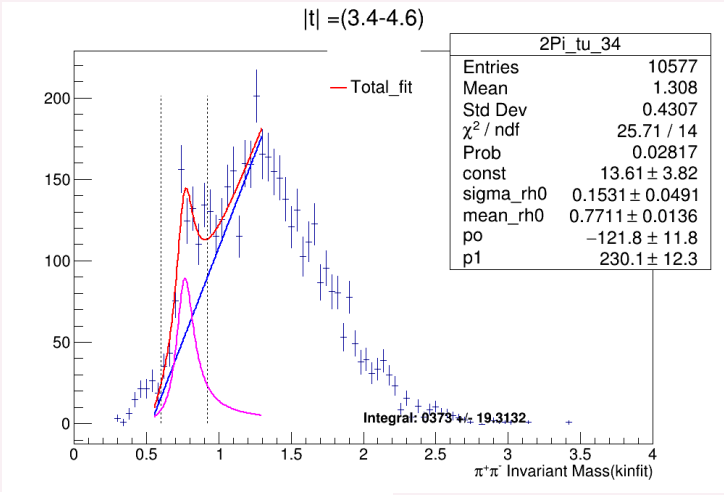
π^+_θ < 35°, π^-_θ < 35°, $\mathbf{p}_\theta$ > 25°,



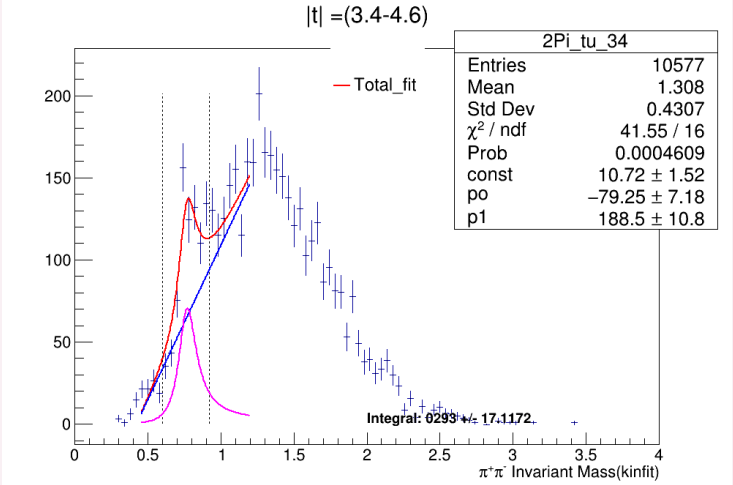
Mean and Sigma Fixed.
π^+_θ < 35°, π^-_θ < 35°, $\mathbf{p}_\theta$ > 25°,



proton$_\theta$ > 20°

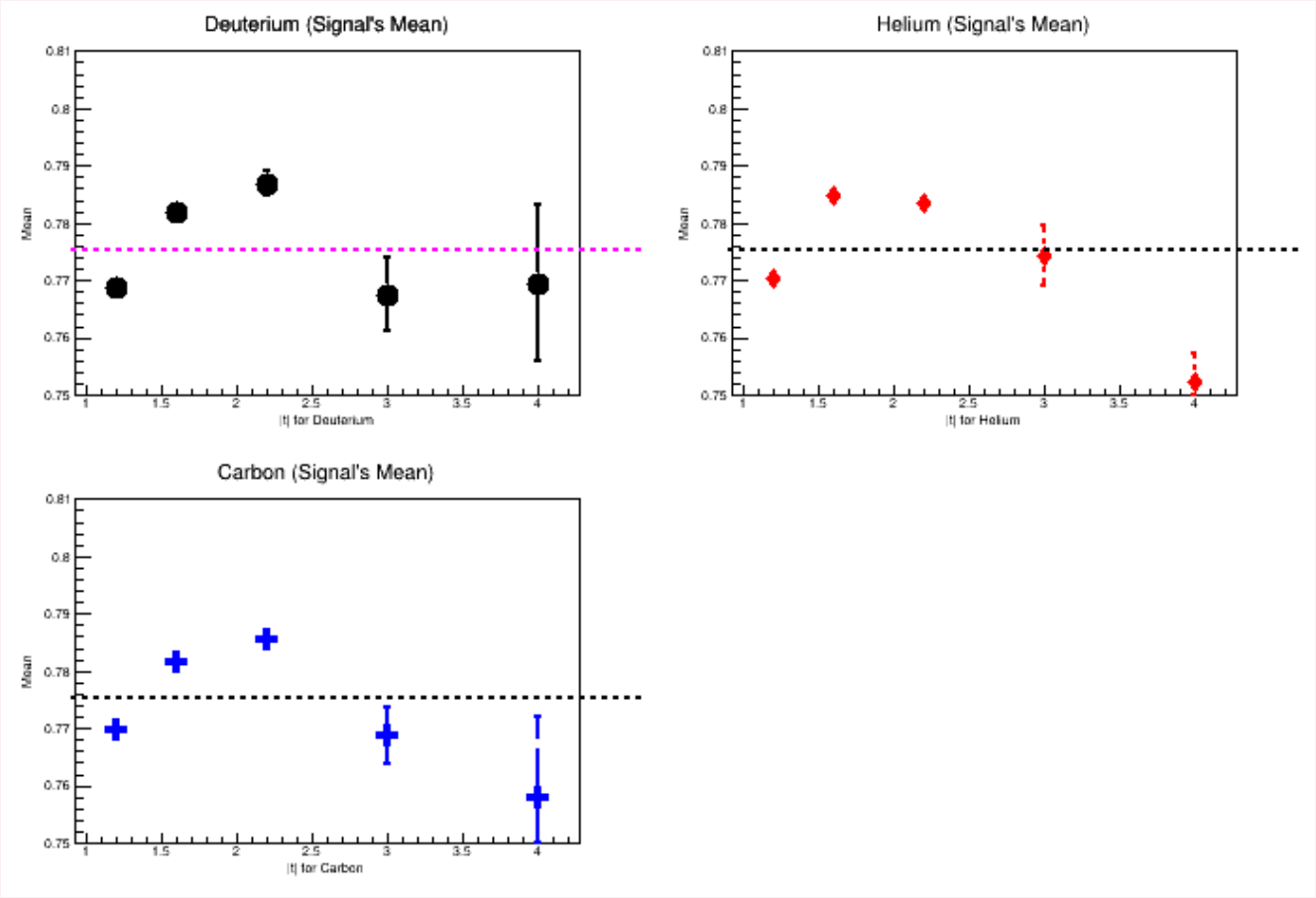


π^+_θ < 35°, π^-_θ < 35°, **p$_\theta$** > 20°,

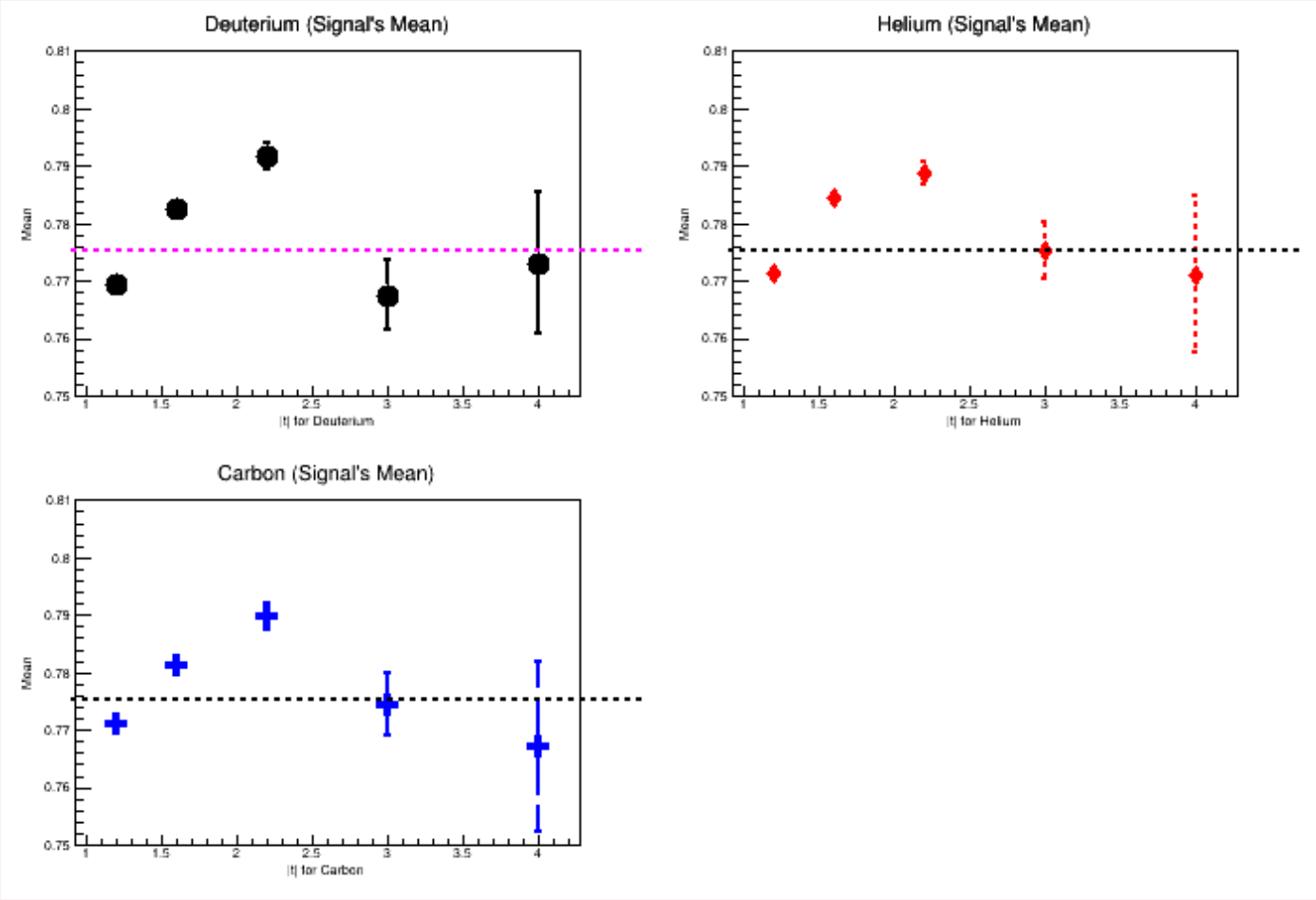


Mean and Sigma Fixed.
π^+_θ < 35°, π^-_θ < 35°, **p$_\theta$** > 20°,

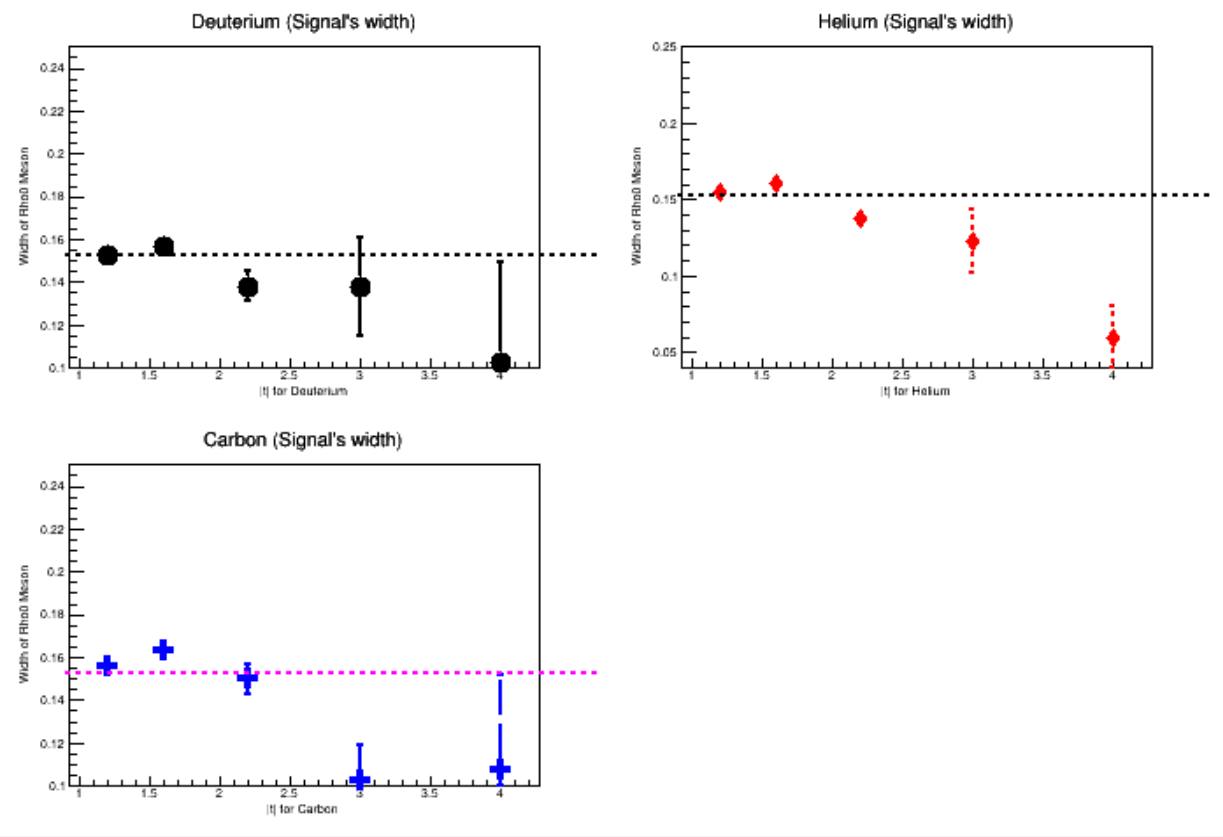
Mean of fit: Proton >25°



Mean of fit:PiPlus & PiMinus θ <35°, Proton >(25/20)°



Sigma of fit: Protonθ >(25/20)°

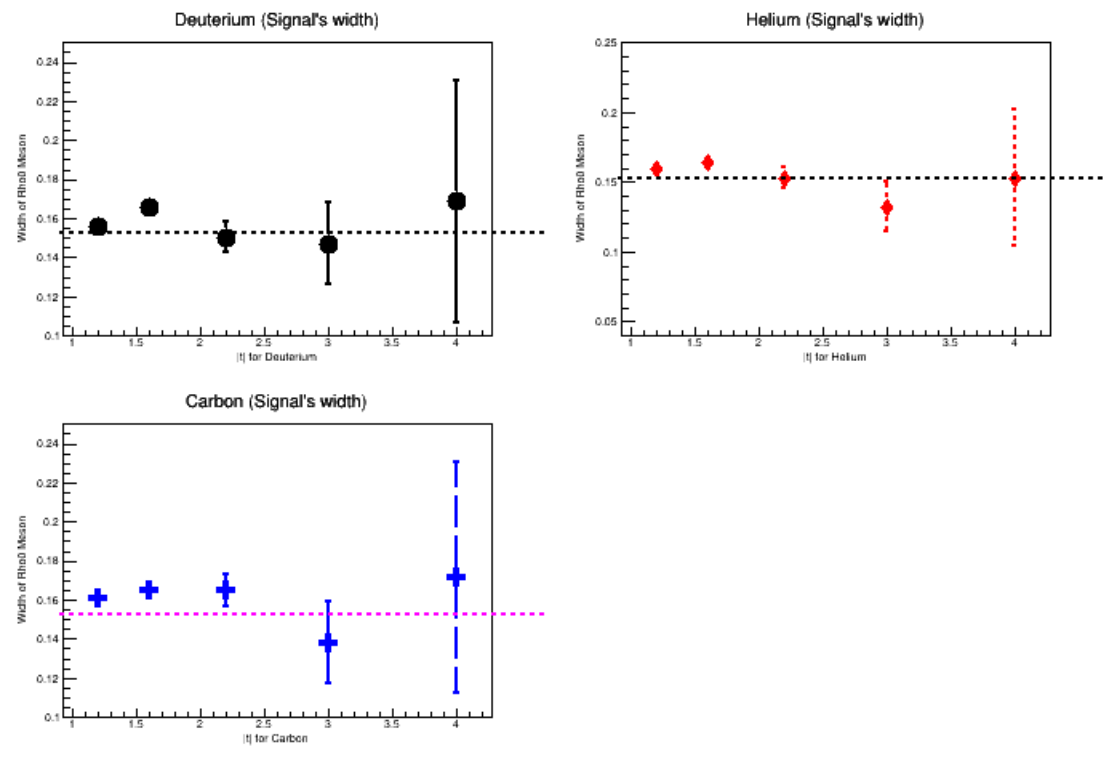


Absence of theta angle cuts for pions indicates background non-conformity to a linear polynomial of order 1.

Evidenced by the Rho0 meson width observed outside this range.

To fully understand how the background behaves at high |t| we need to include a more complex quadratic background.

Sigma of fit:PiPlus & PiMinus θ <35°, Proton >(25/20)°

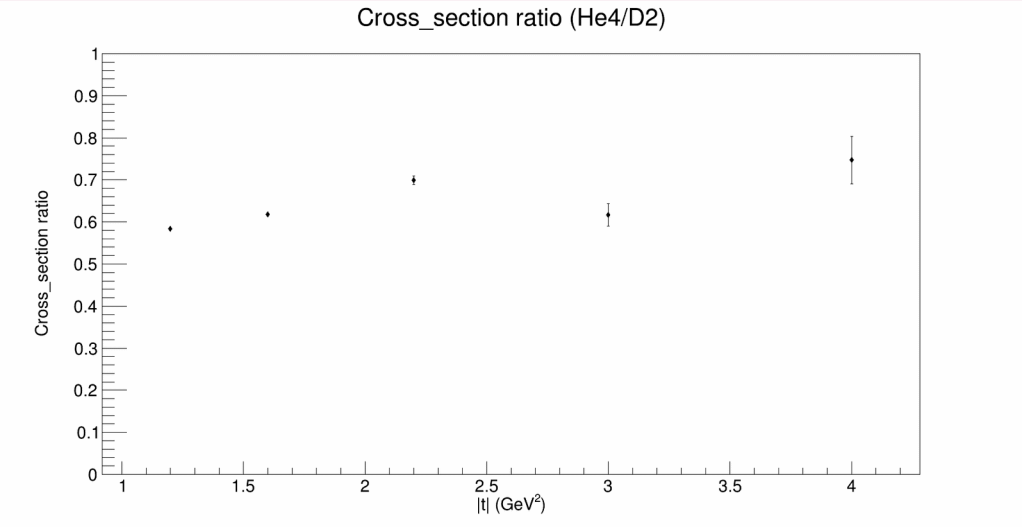


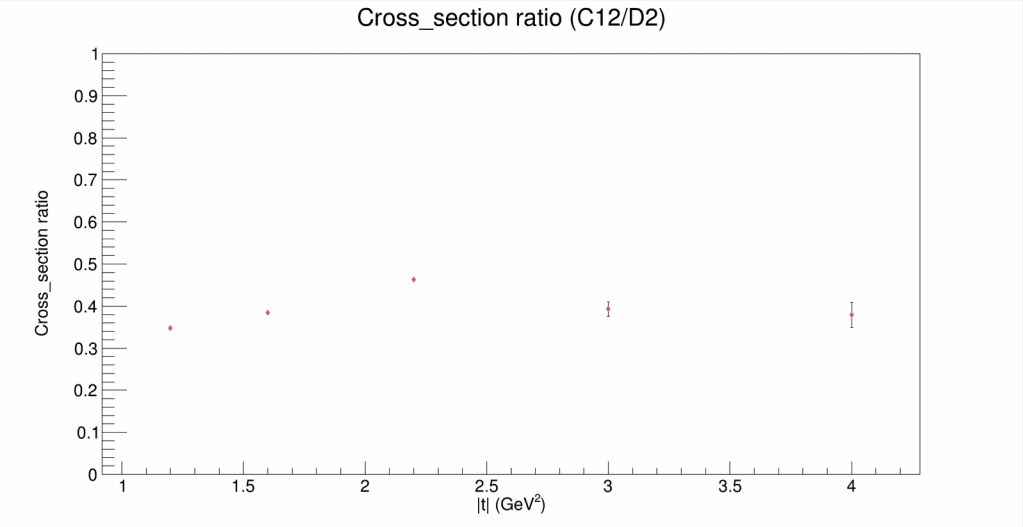
* Cut applied to Theta angle <35 shows background conformity to a linear polynomial of order 1.

* Evidenced by the observed width of the Rho0 meson within this range.

:Cross Section Ratio:PiPlus & PiMinus θ <35°, Proton >(25/20)°

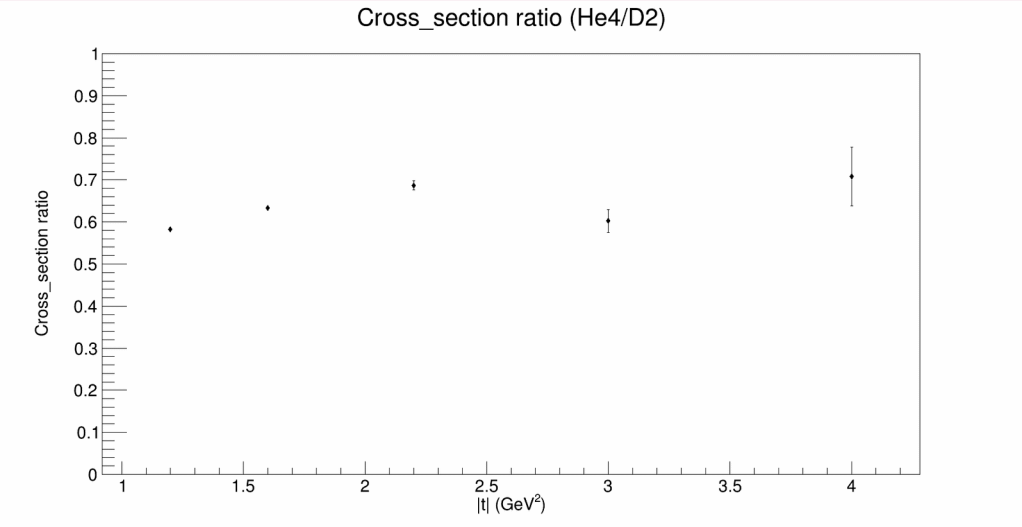
Parameters are set free while doing fitting.

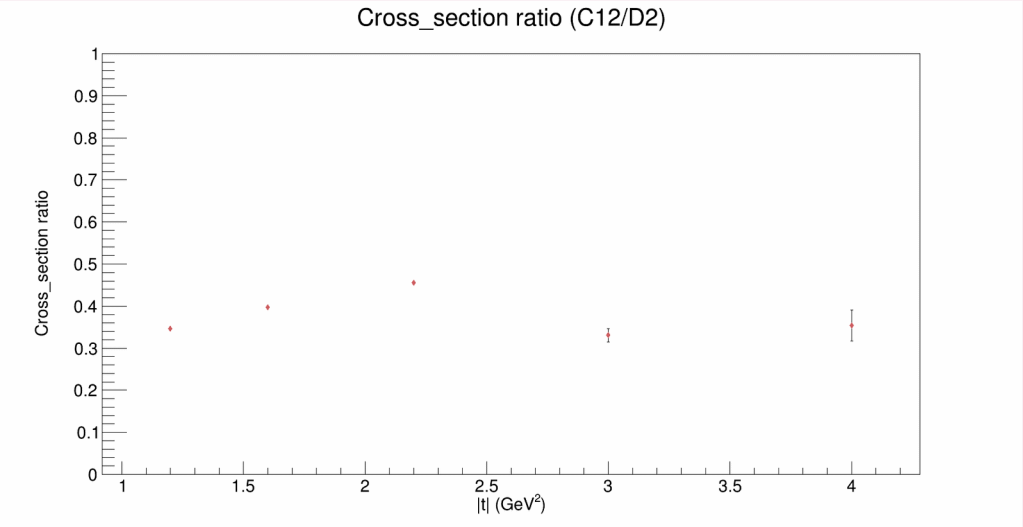




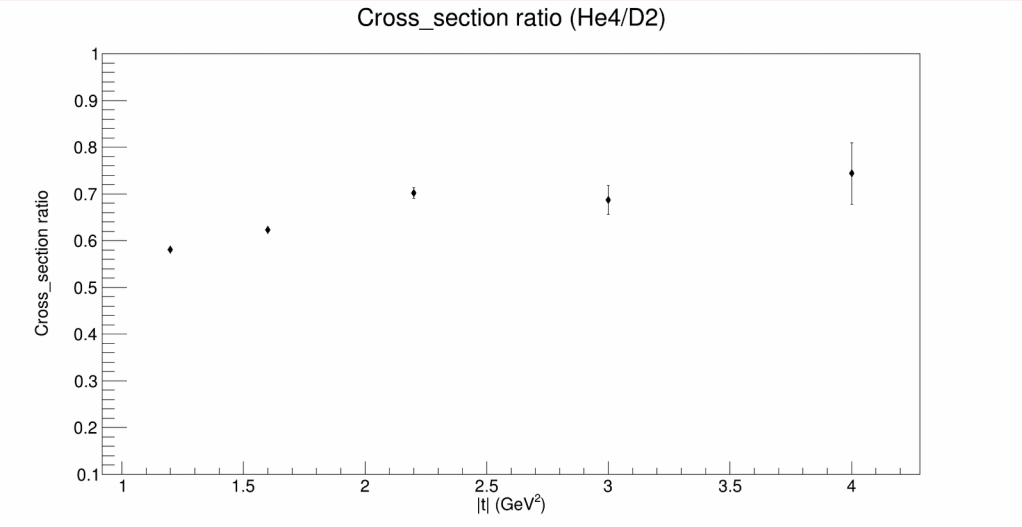
Ratio of Cross Section: Protonθ >(25/20)°

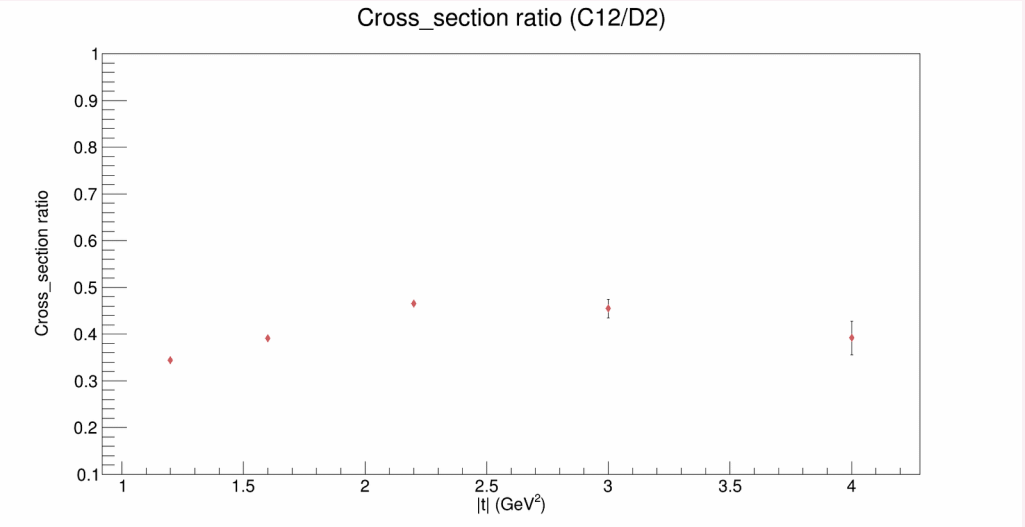
Fitting Parameters are set Free.





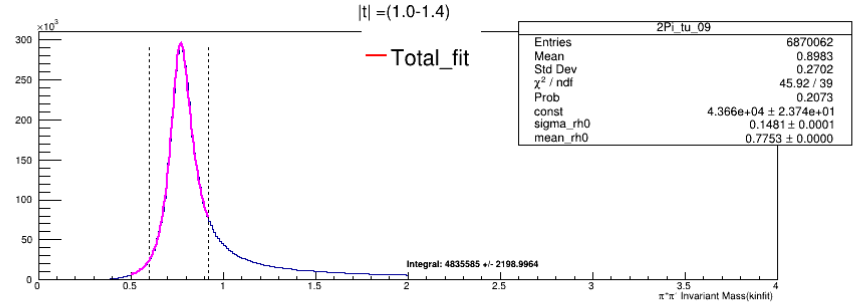
Cross-section Ratio(Mean and Sigma Fixed)

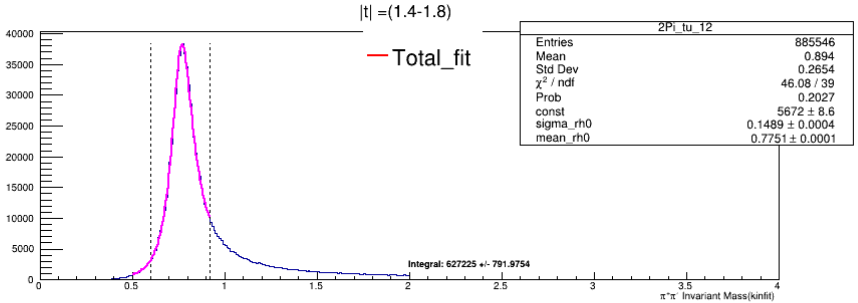


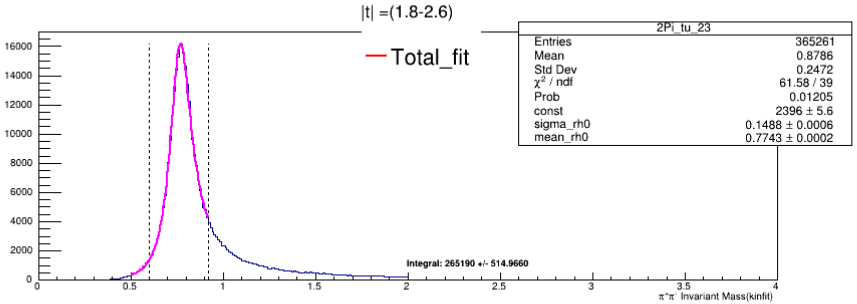


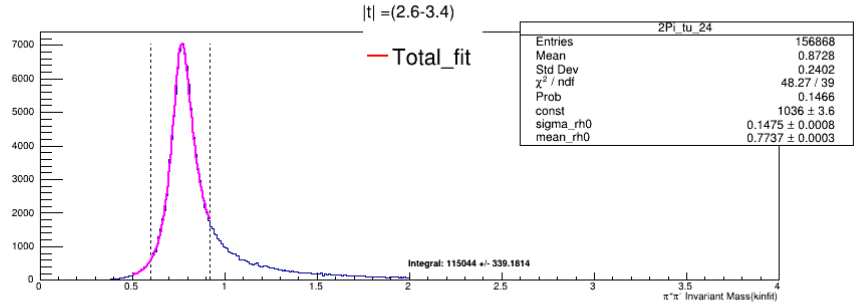
Backup Slides Simulation(Fit)

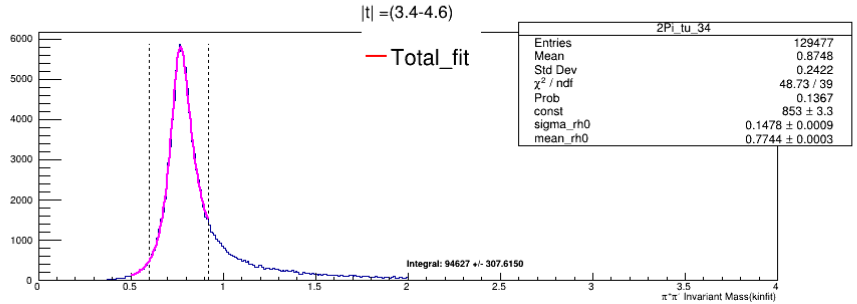
A) Thrown : D2

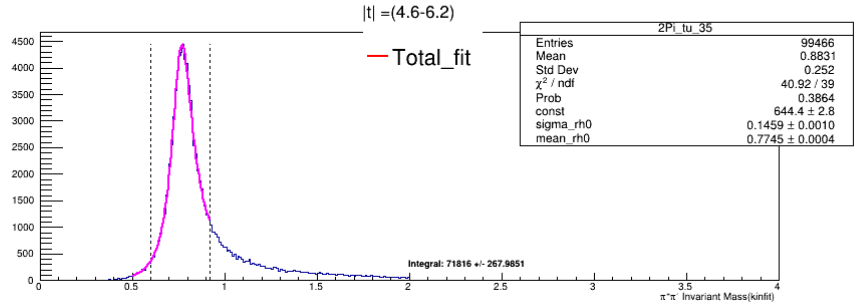

|t| =(1.0-1.4)
Total_fit
2Pi_tu_09
Entries 6870062
Mean 0.8983
Std Dev 0.2702
χ² / ndf 45.92 / 39
Prob 0.2073
const 4.366e+04 ± 2.374e+01
sigma_rh0 0.1481 ± 0.0001
mean_rh0 0.7753 ± 0.0000
Integral: 4835585 +/- 2198.9964
π⁺π⁻ Invariant Mass(kinfit)


|t| =(1.4-1.8)
Total_fit
2Pi_tu_12
Entries 885546
Mean 0.894
Std Dev 0.2654
χ² / ndf 46.08 / 39
Prob 0.2027
const 5672 ± 8.6
sigma_rh0 0.1489 ± 0.0004
mean_rh0 0.7751 ± 0.0001
Integral: 627225 +/- 791.9754
π⁺π⁻ Invariant Mass(kinfit)

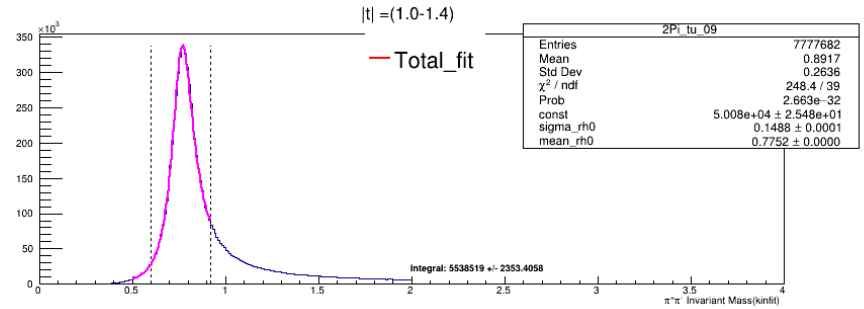

|t| =(1.8-2.6)
Total_fit
2Pi_tu_23
Entries 365261
Mean 0.8786
Std Dev 0.2472
χ² / ndf 61.58 / 39
Prob 0.01205
const 2396 ± 5.6
sigma_rh0 0.1488 ± 0.0006
mean_rh0 0.7743 ± 0.0002
Integral: 265190 +/- 514.9660
π⁺π⁻ Invariant Mass(kinfit)

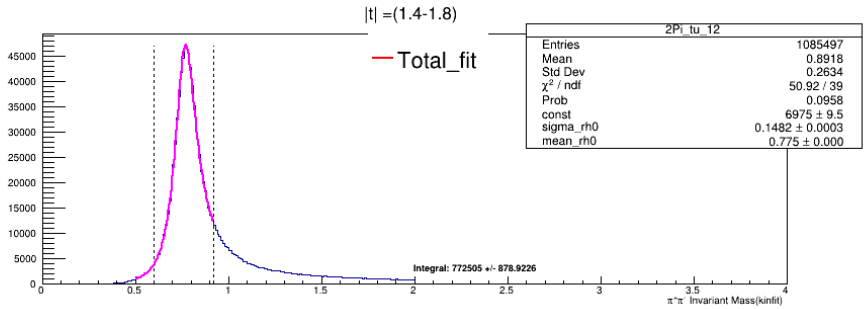

|t| =(2.6-3.4)
Total_fit
2Pi_tu_24
Entries 156868
Mean 0.8728
Std Dev 0.2402
χ² / ndf 48.27 / 39
Prob 0.1466
const 1036 ± 3.6
sigma_rh0 0.1475 ± 0.0008
mean_rh0 0.7737 ± 0.0003
Integral: 115044 +/- 339.1814
π⁺π⁻ Invariant Mass(kinfit)

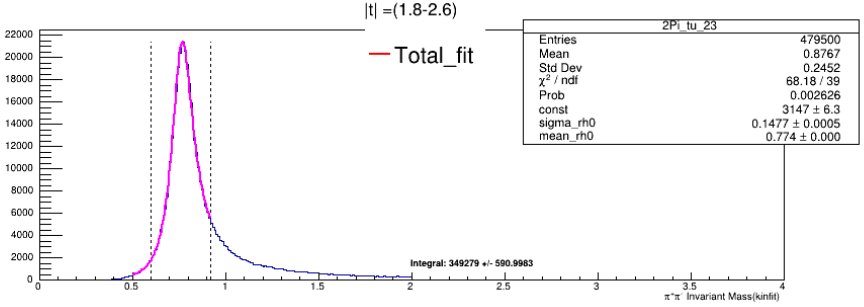

|t| =(3.4-4.6)
Total_fit
2Pi_tu_34
Entries 129477
Mean 0.8748
Std Dev 0.2422
χ² / ndf 48.73 / 39
Prob 0.1367
const 853 ± 3.3
sigma_rh0 0.1478 ± 0.0009
mean_rh0 0.7744 ± 0.0003
Integral: 94627 +/- 307.6150
π⁺π⁻ Invariant Mass(kinfit)

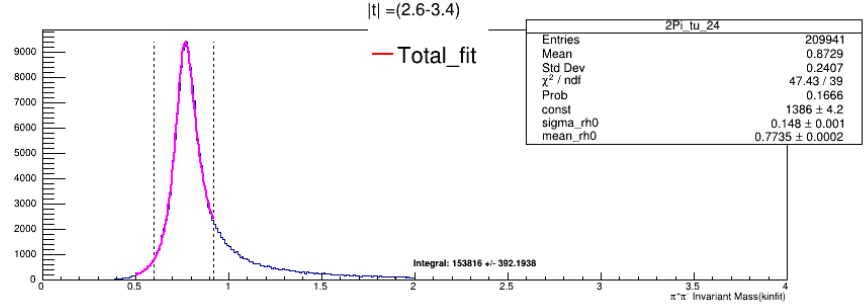

|t| =(4.6-6.2)
Total_fit
2Pi_tu_35
Entries 99466
Mean 0.8831
Std Dev 0.252
χ² / ndf 40.92 / 39
Prob 0.3864
const 644.4 ± 2.8
sigma_rh0 0.1459 ± 0.0010
mean_rh0 0.7745 ± 0.0004
Integral: 71816 +/- 267.9851
π⁺π⁻ Invariant Mass(kinfit)

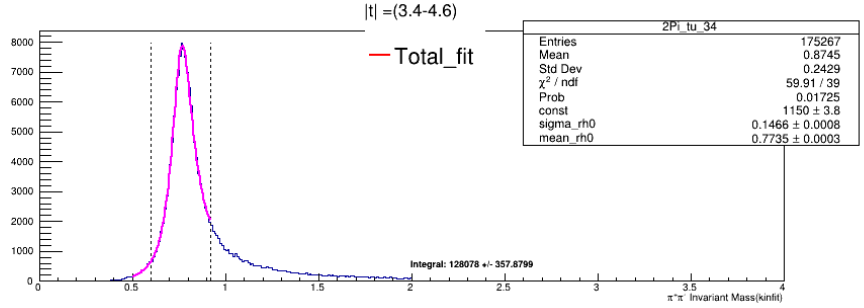
B) Thrown He4

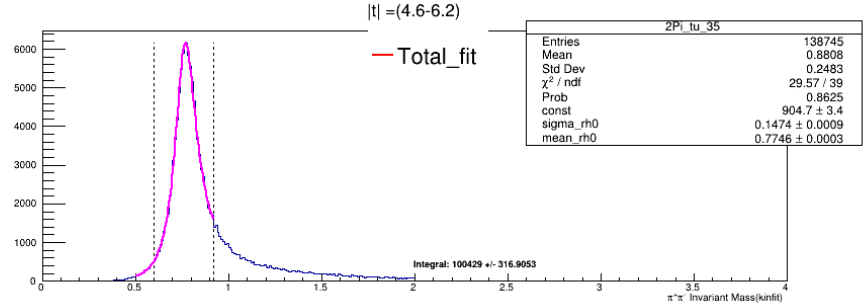

|t| =(1.0-1.4)
Total_fit
2Pi_tu_09
Entries 7777682
Mean 0.8917
Std Dev 0.2636
χ² / ndf 248.4 / 39
Prob 2.663e−32
const 5.008e+04 ± 2.548e+01
sigma_rh0 0.1488 ± 0.0001
mean_rh0 0.7752 ± 0.0000
Integral: 5538519 +/- 2353.4058
π⁺π⁻ Invariant Mass(kinfit)


|t| =(1.4-1.8)
Total_fit
2Pi_tu_12
Entries 1085497
Mean 0.8918
Std Dev 0.2634
χ² / ndf 50.92 / 39
Prob 0.0958
const 6975 ± 9.5
sigma_rh0 0.1482 ± 0.0003
mean_rh0 0.775 ± 0.000
Integral: 772505 +/- 878.9226
π⁺π⁻ Invariant Mass(kinfit)

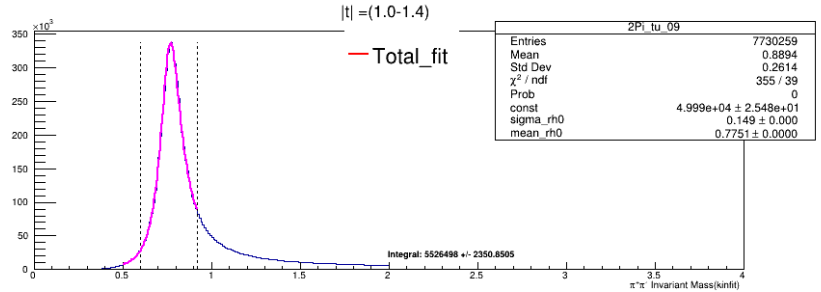

|t| =(1.8-2.6)
Total_fit
2Pi_tu_23
Entries 479500
Mean 0.8767
Std Dev 0.2452
χ² / ndf 68.18 / 39
Prob 0.002626
const 3147 ± 6.3
sigma_rh0 0.1477 ± 0.0005
mean_rh0 0.774 ± 0.000
Integral: 349279 +/- 590.9983
π⁺π⁻ Invariant Mass(kinfit)

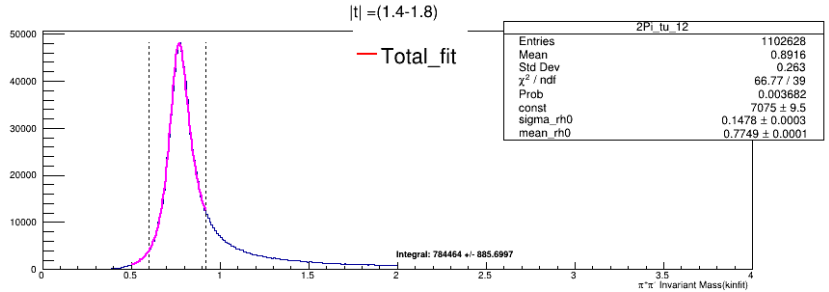

|t| =(2.6-3.4)
Total_fit
2Pi_tu_24
Entries 209941
Mean 0.8729
Std Dev 0.2407
χ² / ndf 47.43 / 39
Prob 0.1666
const 1386 ± 4.2
sigma_rh0 0.148 ± 0.001
mean_rh0 0.7735 ± 0.0002
Integral: 153816 +/- 392.1938
π⁺π⁻ Invariant Mass(kinfit)

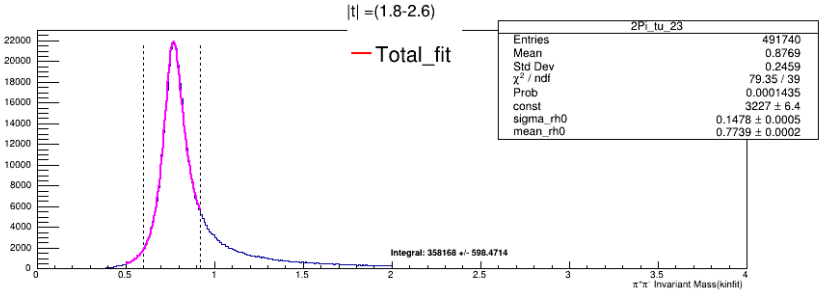

|t| =(3.4-4.6)
Total_fit
2Pi_tu_34
Entries 175267
Mean 0.8745
Std Dev 0.2429
χ² / ndf 59.91 / 39
Prob 0.01725
const 1150 ± 3.8
sigma_rh0 0.1466 ± 0.0008
mean_rh0 0.7735 ± 0.0003
Integral: 128078 +/- 357.8799
π⁺π⁻ Invariant Mass(kinfit)

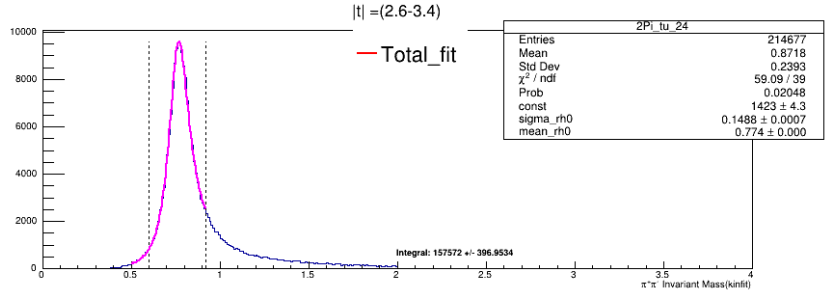

|t| =(4.6-6.2)
Total_fit
2Pi_tu_35
Entries 138745
Mean 0.8808
Std Dev 0.2483
χ² / ndf 29.57 / 39
Prob 0.8625
const 904.7 ± 3.4
sigma_rh0 0.1474 ± 0.0009
mean_rh0 0.7746 ± 0.0003
Integral: 100429 +/- 316.9053
π⁺π⁻ Invariant Mass(kinfit)

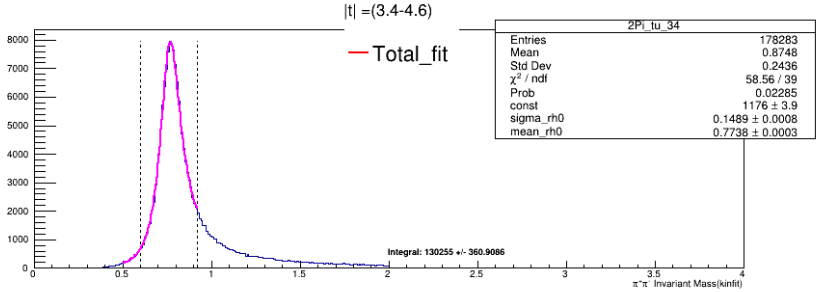
C)Thrown C12

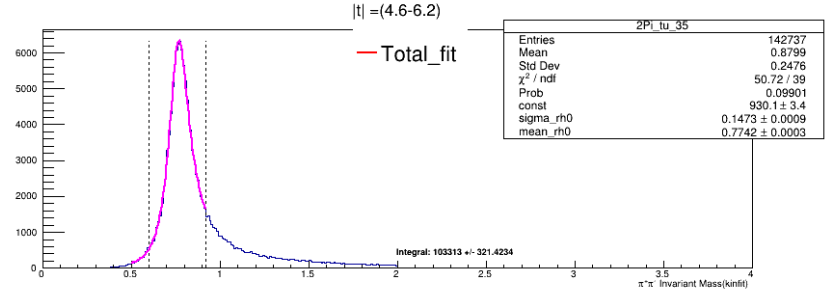

|t| =(1.0-1.4)
Total_fit
2Pi_tu_09
Entries 7730259
Mean 0.8894
Std Dev 0.2614
χ² / ndf 355 / 39
Prob 0
const 4.999e+04 ± 2.548e+01
sigma_rh0 0.149 ± 0.000
mean_rh0 0.7751 ± 0.0000
Integral: 5526498 +/- 2350.8505
π⁺π⁻ Invariant Mass(kinfit)


|t| =(1.4-1.8)
Total_fit
2Pi_tu_12
Entries 1102628
Mean 0.8916
Std Dev 0.263
χ² / ndf 66.77 / 39
Prob 0.003682
const 7075 ± 9.5
sigma_rh0 0.1478 ± 0.0003
mean_rh0 0.7749 ± 0.0001
Integral: 784464 +/- 885.6997
π⁺π⁻ Invariant Mass(kinfit)


|t| =(1.8-2.6)
Total_fit
2Pi_tu_23
Entries 491740
Mean 0.8769
Std Dev 0.2459
χ² / ndf 79.35 / 39
Prob 0.0001435
const 3227 ± 6.4
sigma_rh0 0.1478 ± 0.0005
mean_rh0 0.7739 ± 0.0002
Integral: 358168 +/- 598.4714
π⁺π⁻ Invariant Mass(kinfit)

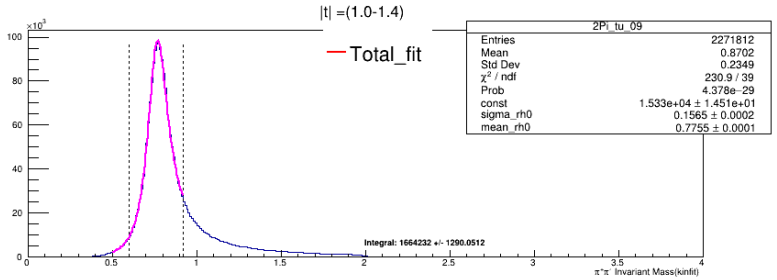

|t| =(2.6-3.4)
Total_fit
2Pi_tu_24
Entries 214677
Mean 0.8718
Std Dev 0.2393
χ² / ndf 59.09 / 39
Prob 0.02048
const 1423 ± 4.3
sigma_rh0 0.1488 ± 0.0007
mean_rh0 0.774 ± 0.000
Integral: 157572 +/- 396.9534
π⁺π⁻ Invariant Mass(kinfit)

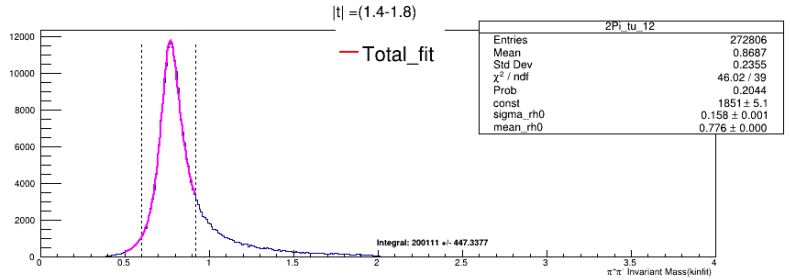

|t| =(3.4-4.6)
Total_fit
2Pi_tu_34
Entries 178283
Mean 0.8748
Std Dev 0.2436
χ² / ndf 58.56 / 39
Prob 0.02285
const 1176 ± 3.9
sigma_rh0 0.1489 ± 0.0008
mean_rh0 0.7738 ± 0.0003
Integral: 130255 +/- 360.9086
π⁺π⁻ Invariant Mass(kinfit)

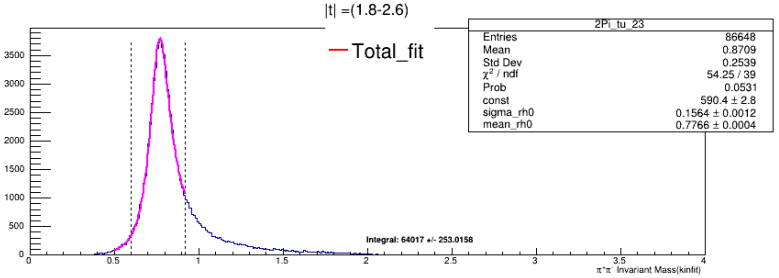

|t| =(4.6-6.2)
Total_fit
2Pi_tu_35
Entries 142737
Mean 0.8799
Std Dev 0.2476
χ² / ndf 50.72 / 39
Prob 0.09901
const 930.1 ± 3.4
sigma_rh0 0.1473 ± 0.0009
mean_rh0 0.7742 ± 0.0003
Integral: 103313 +/- 321.4234
π⁺π⁻ Invariant Mass(kinfit)

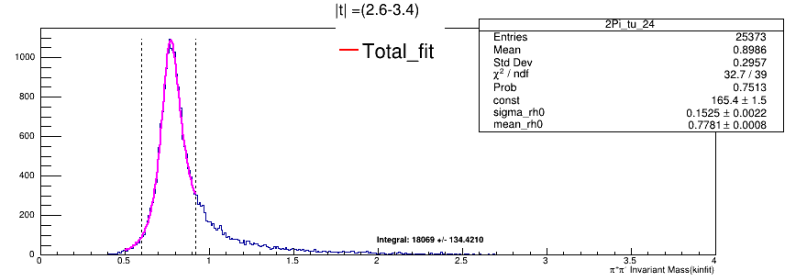
- Reconstructed Simulation.

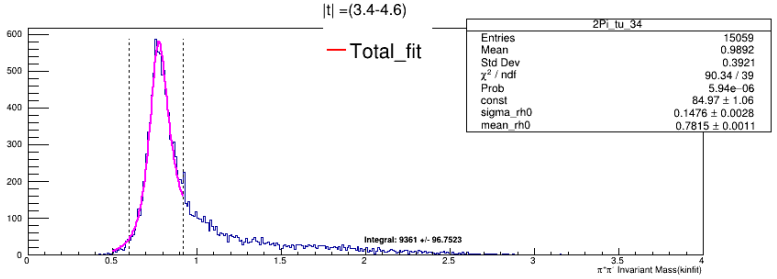
A)Recons:Sim D2



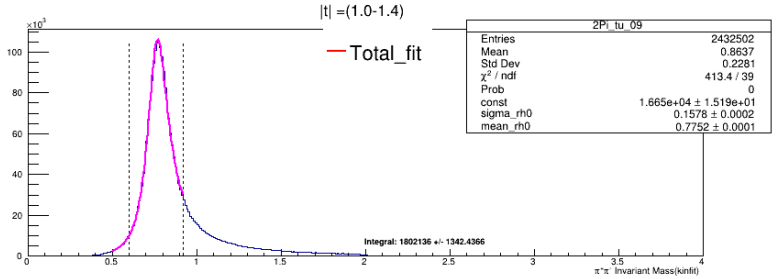


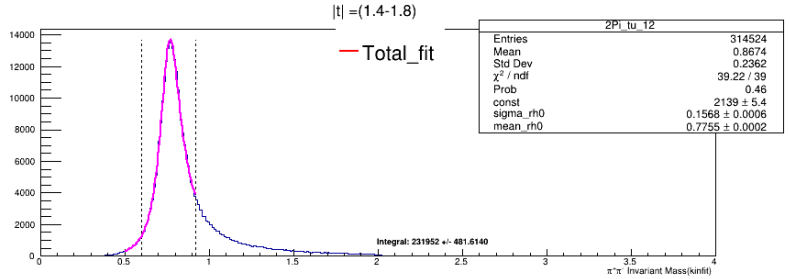


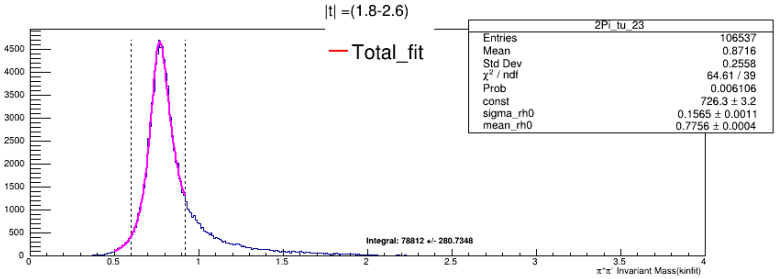


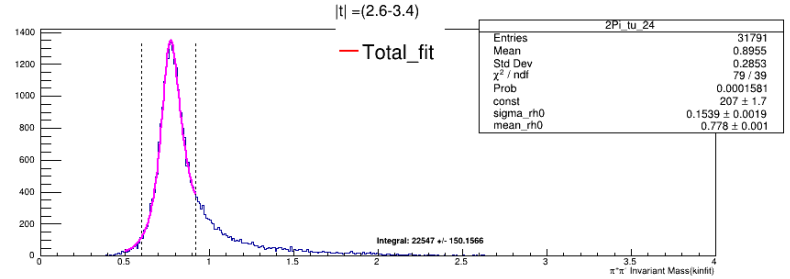


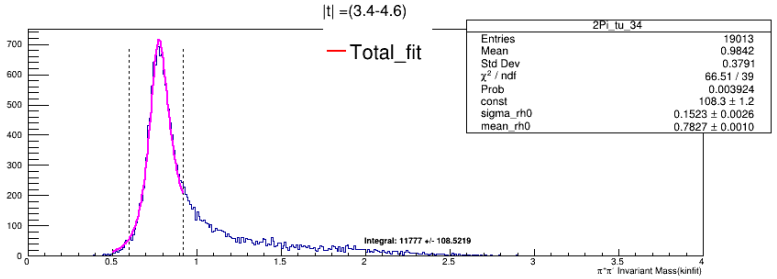
B) Recons Sim: He4



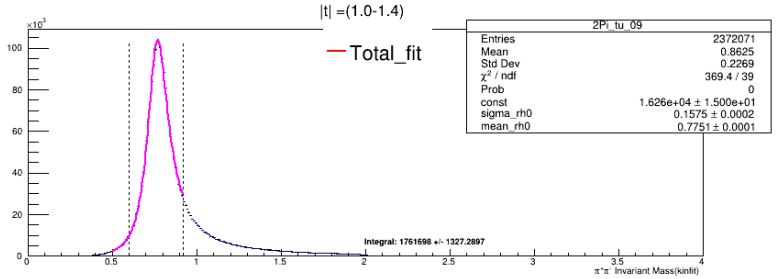


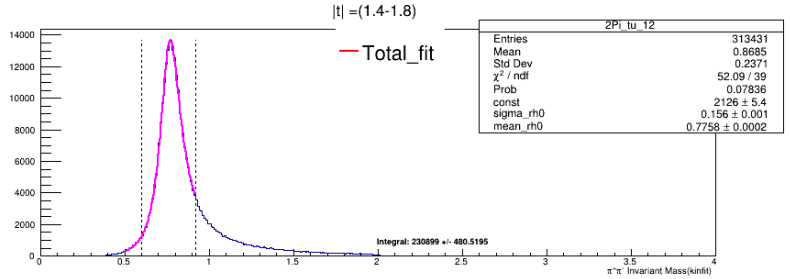


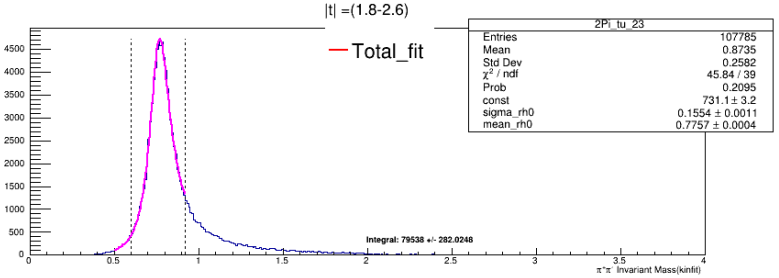


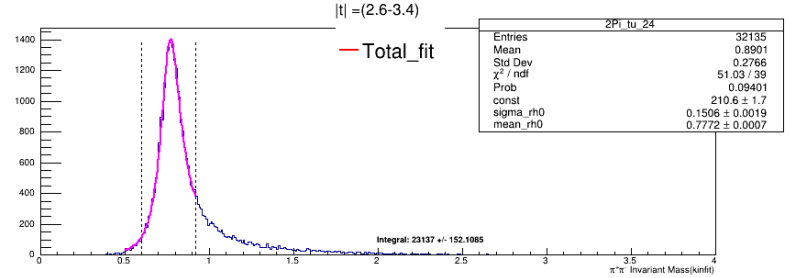


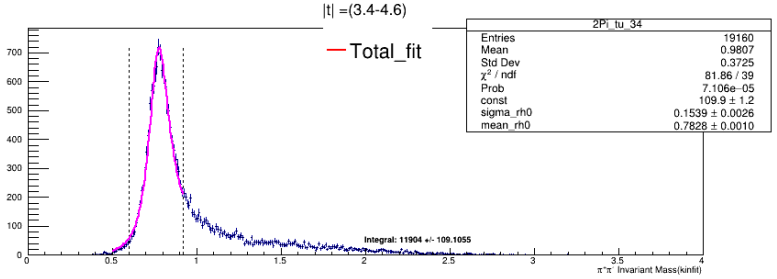
C)Recons sim: C12

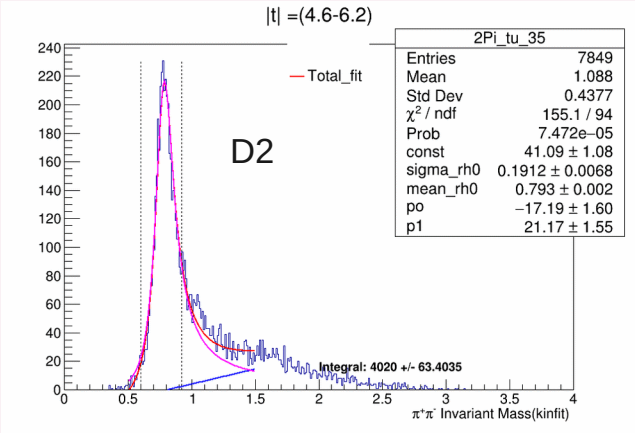


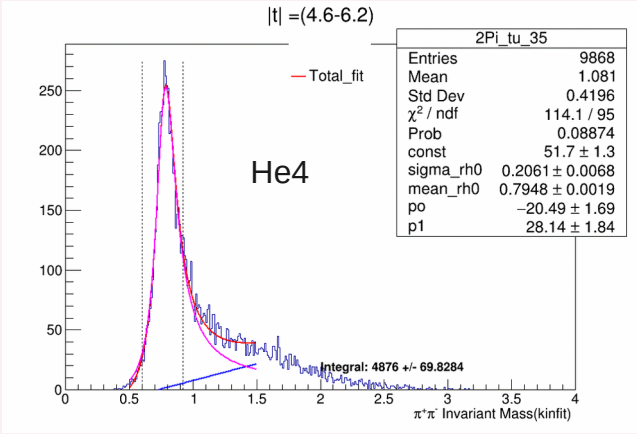


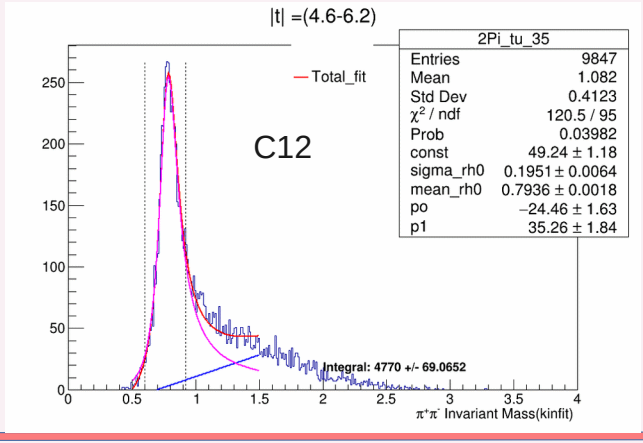







|t| =(4.6-6.2)
Total_fit
D2
2Pi_tu_35
Entries 7849
Mean 1.088
Std Dev 0.4377
χ² / ndf 155.1 / 94
Prob 7.472e−05
const 41.09 ± 1.08
sigma_rh0 0.1912 ± 0.0068
mean_rh0 0.793 ± 0.002
po −17.19 ± 1.60
p1 21.17 ± 1.55
Integral: 4020 +/- 63.4035
π⁺π⁻ Invariant Mass(kinfit)


|t| =(4.6-6.2)
Total_fit
He4
2Pi_tu_35
Entries 9868
Mean 1.081
Std Dev 0.4196
χ² / ndf 114.1 / 95
Prob 0.08874
const 51.7 ± 1.3
sigma_rh0 0.2061 ± 0.0068
mean_rh0 0.7948 ± 0.0019
po −20.49 ± 1.69
p1 28.14 ± 1.84
Integral: 4876 +/- 69.8284
π⁺π⁻ Invariant Mass(kinfit)


|t| =(4.6-6.2)
Total_fit
C12
2Pi_tu_35
Entries 9847
Mean 1.082
Std Dev 0.4123
χ² / ndf 120.5 / 95
Prob 0.03982
const 49.24 ± 1.18
sigma_rh0 0.1951 ± 0.0064
mean_rh0 0.7936 ± 0.0018
po −24.46 ± 1.63
p1 35.26 ± 1.84
Integral: 4770 +/- 69.0652
π⁺π⁻ Invariant Mass(kinfit)