f0(980) v2

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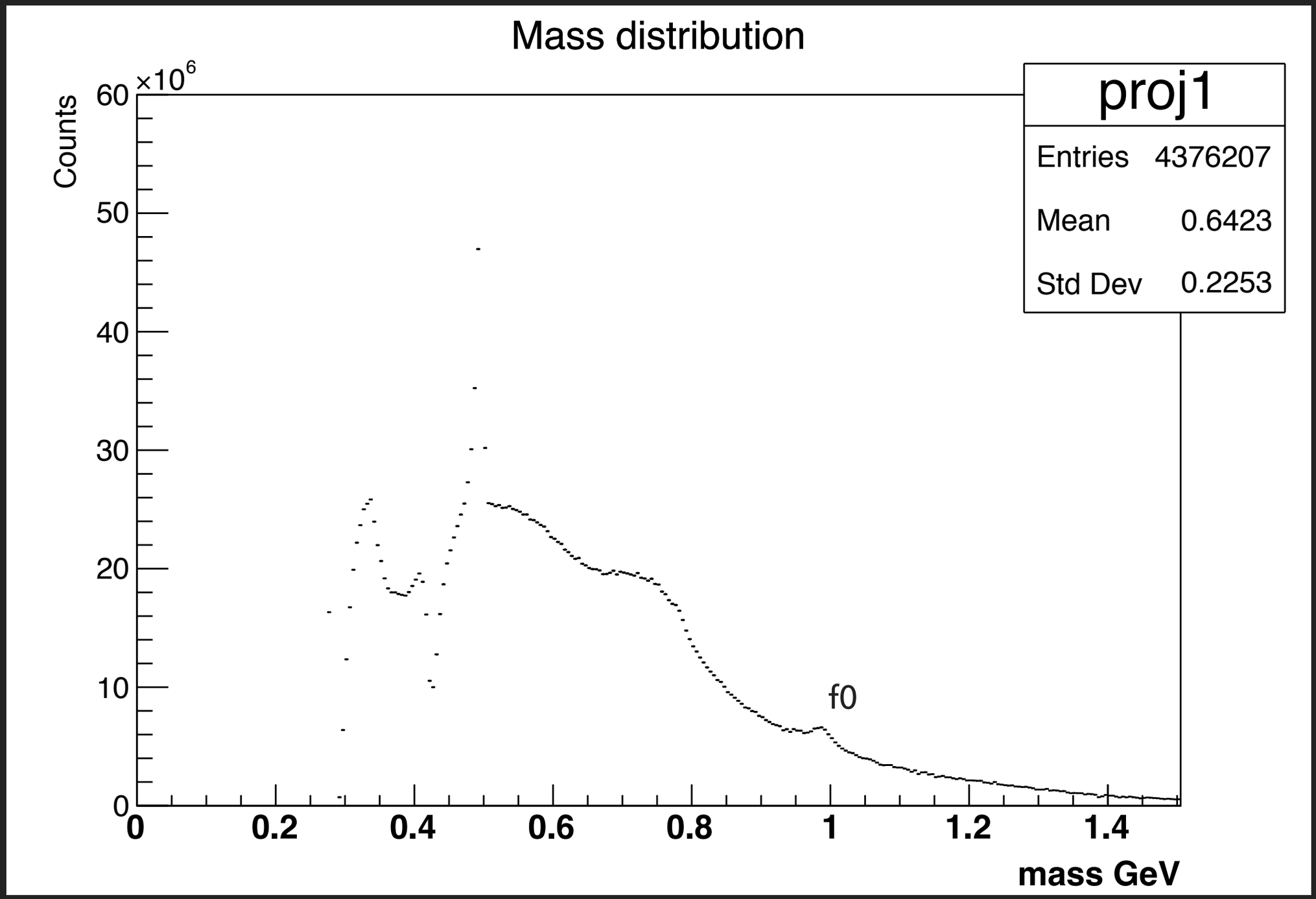
f0 peak



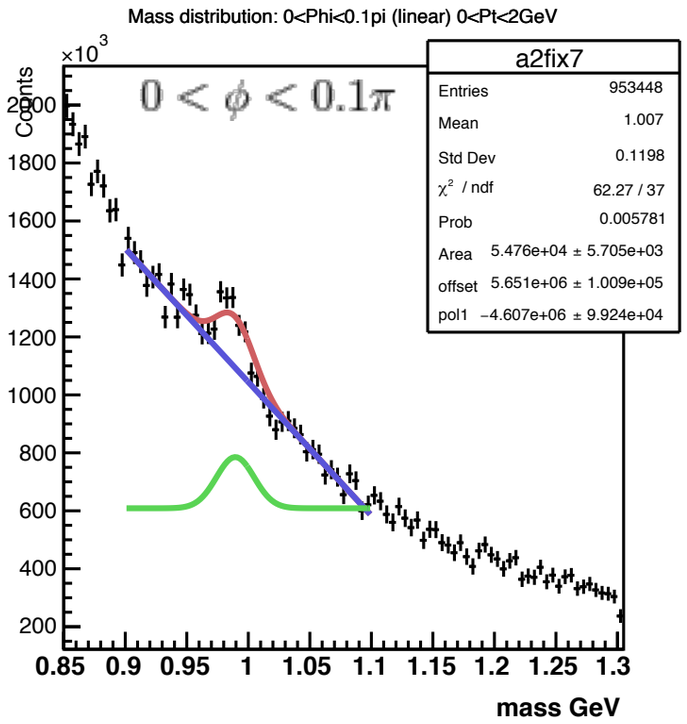
f0 mass = 989.4 MeV

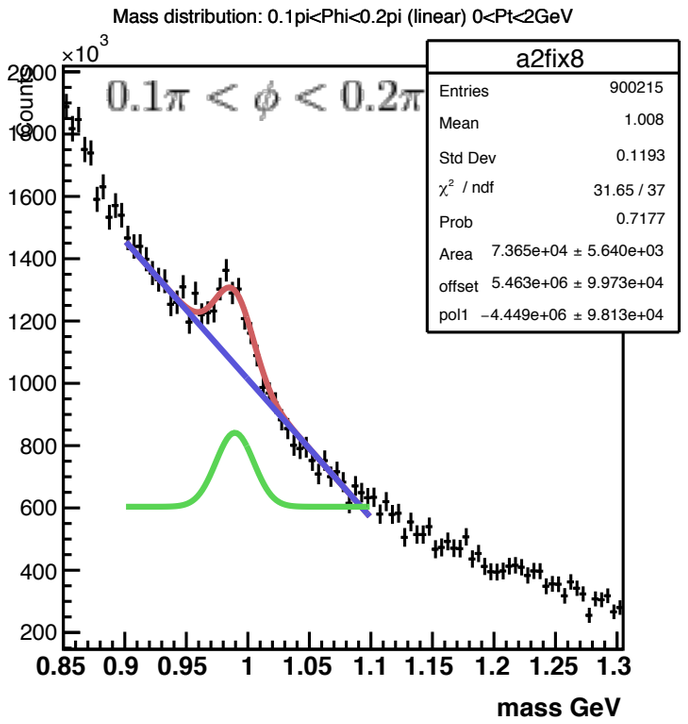
f0 width = 15.3 MeV

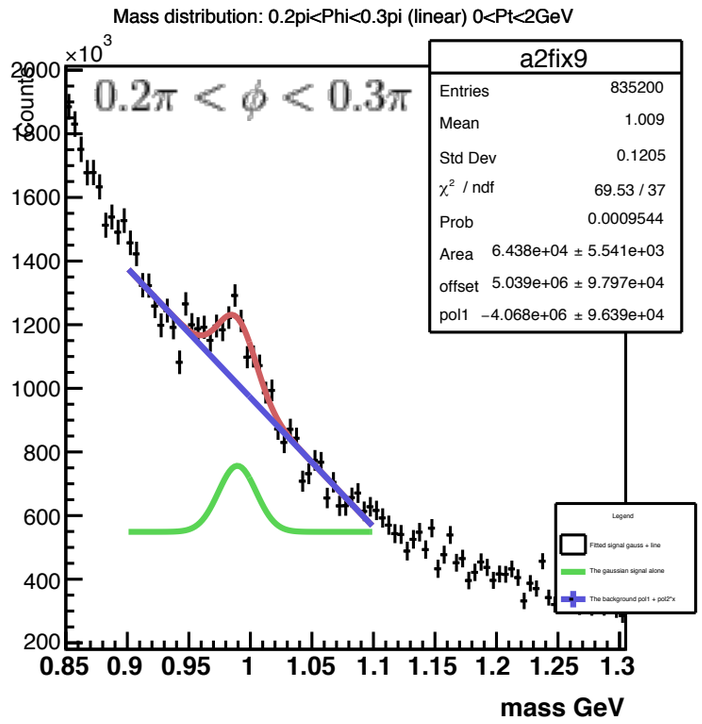
MOTIVATION

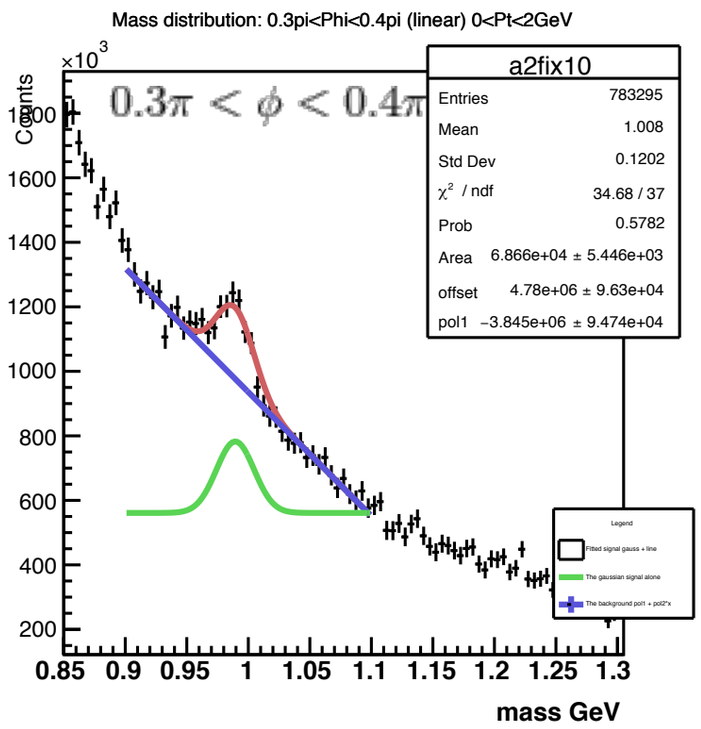
- Unknown whether f0 is a simple qq^{-}, a more exotic $qqq^{-}q^{-}$ state, or a KK^{-} 'molecule'
  - V. Baru et al. Phys. Lett. B 586 (2004) 53.
    - Likely-hood of KK^{-} state vs qq^{-}
  - J. Weinstein, N. Isgur, Phys. Rev. D 27, 588 (1983).
    - Model to examine $qqq^{-}q^{-}$ states
  - J. Weinstein, N. Isgur, Phys. Rev D 41, 2236 (1990).
    - Extend studies of $qqq^{-}q^{-}$, conclude that KK^{-} state is more likely
- f0 v2 analysis (NCQ scaling) to shed light on the physics

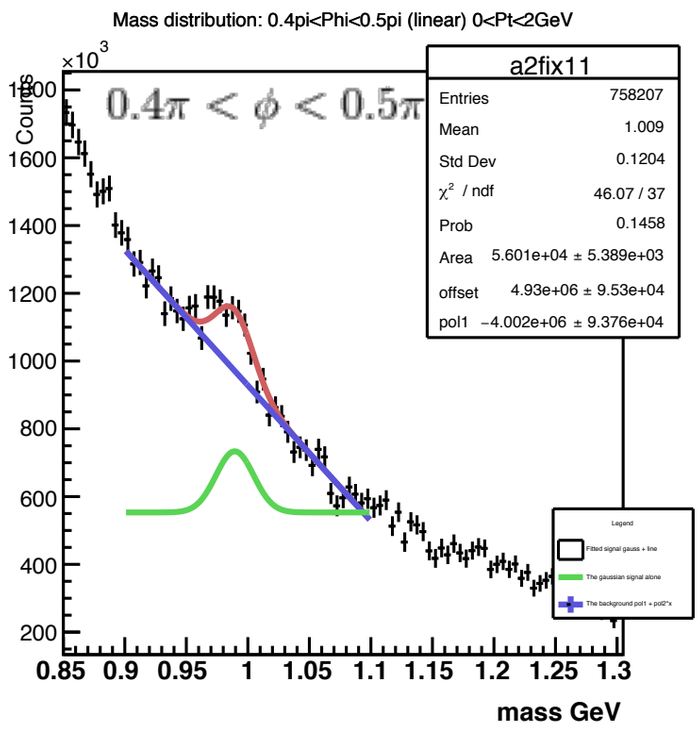
Number of f0





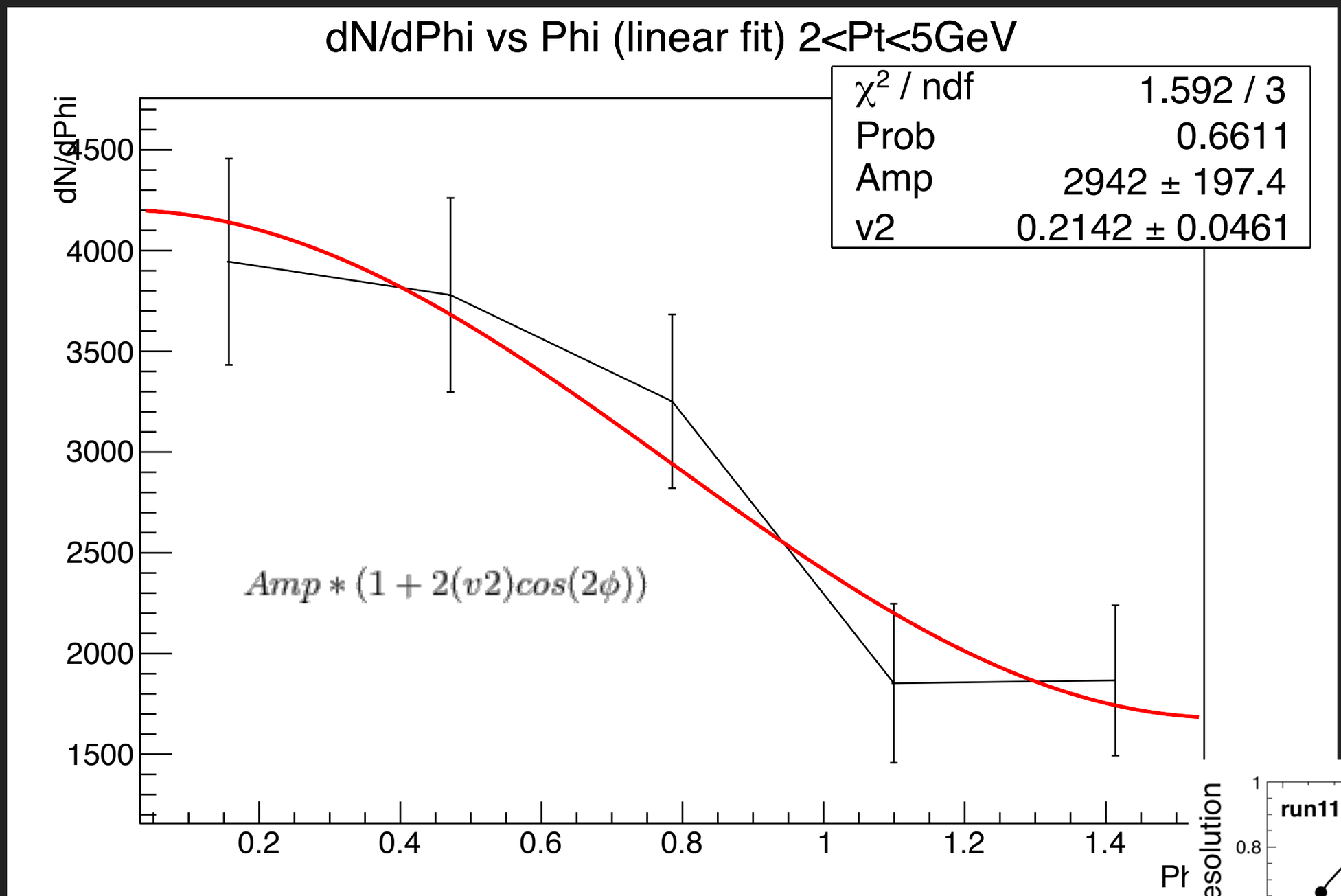




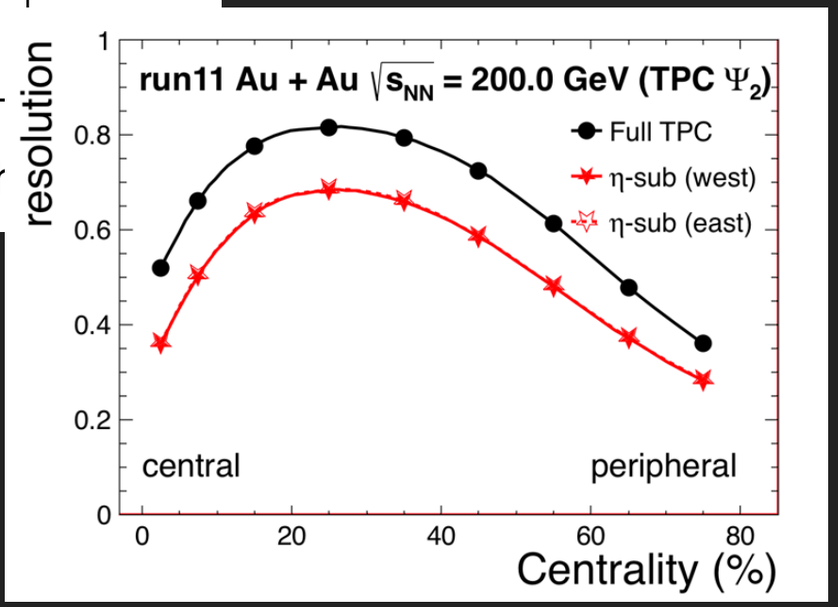


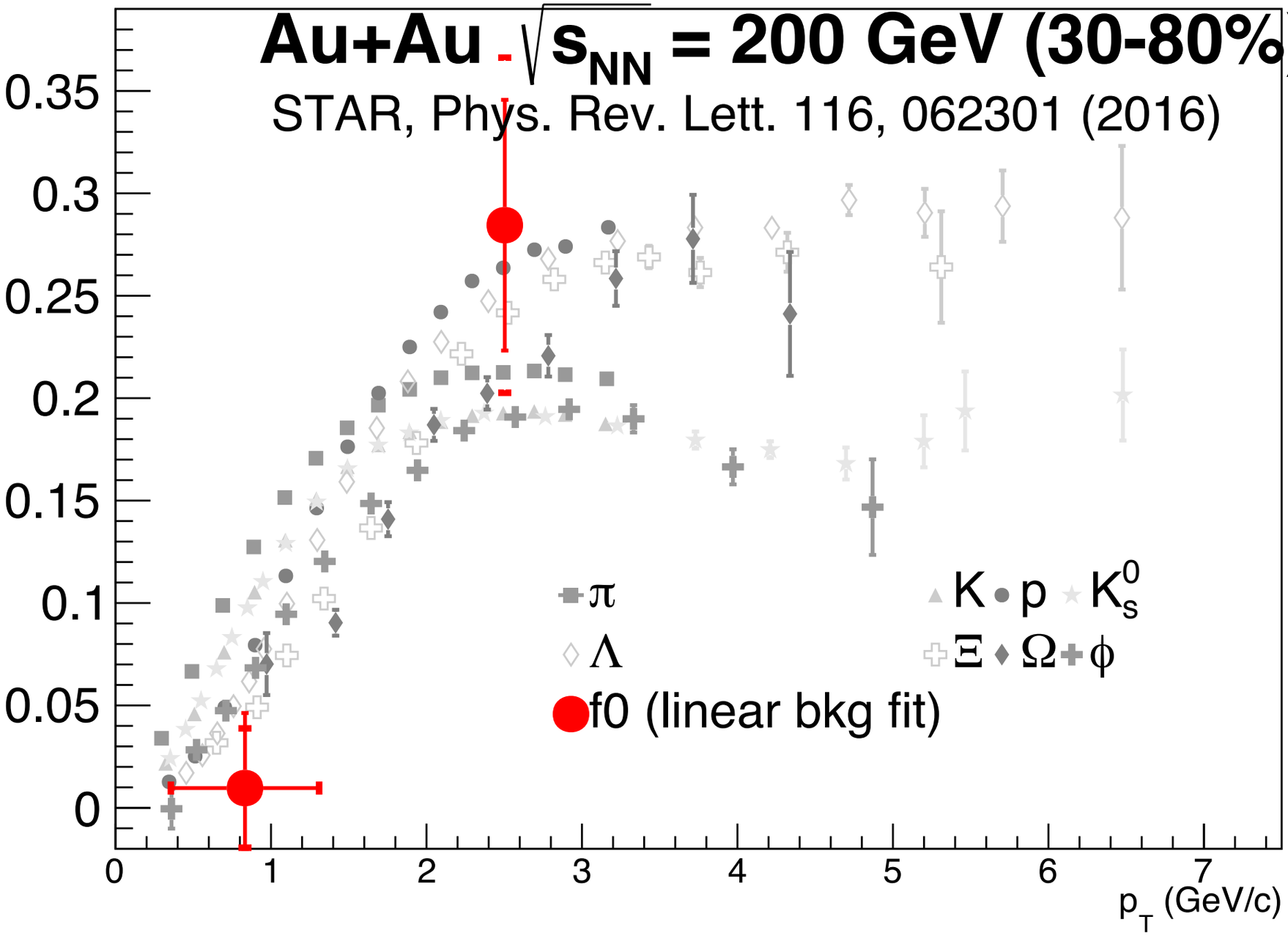
Shown is a linear + gaussian fit. Exponential and polynomial through order 5 were also fitted

v2 fit



This value of v2 is uncorrected for event plane resolution, but it is corrected for on the next slide

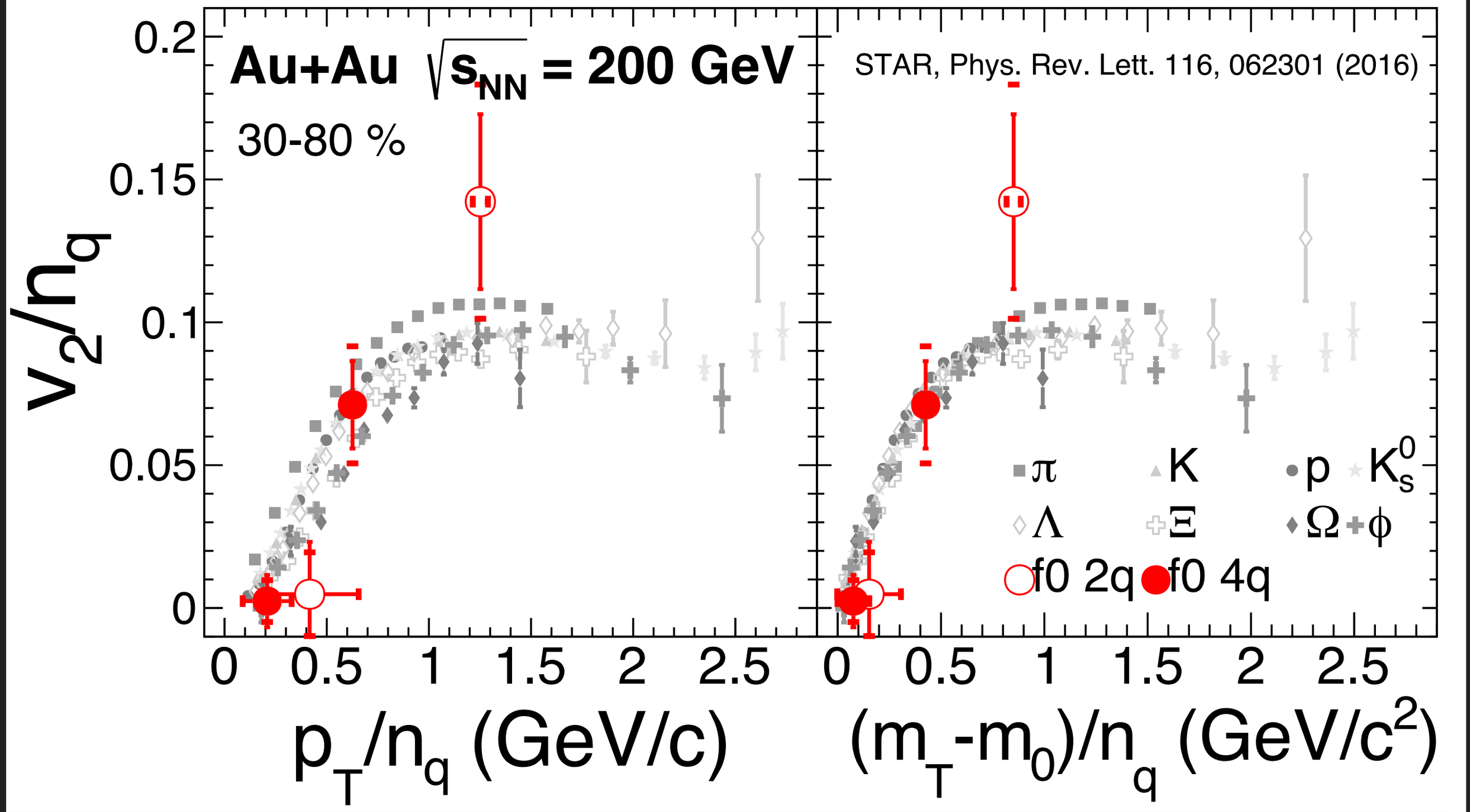




Systematic errors (the []) were calculated using the different background fits

The red point is a linear background fit.

f0 v2 for NCQ



Open circles are two quark model

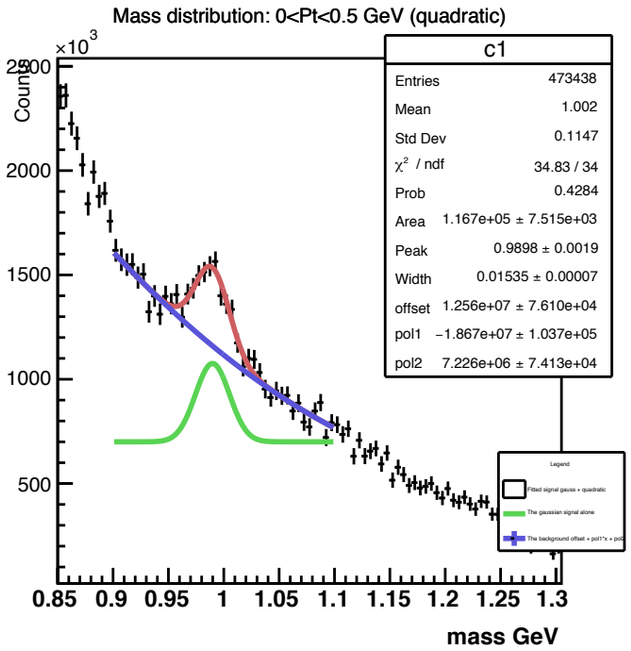
Filled circles are four quark model

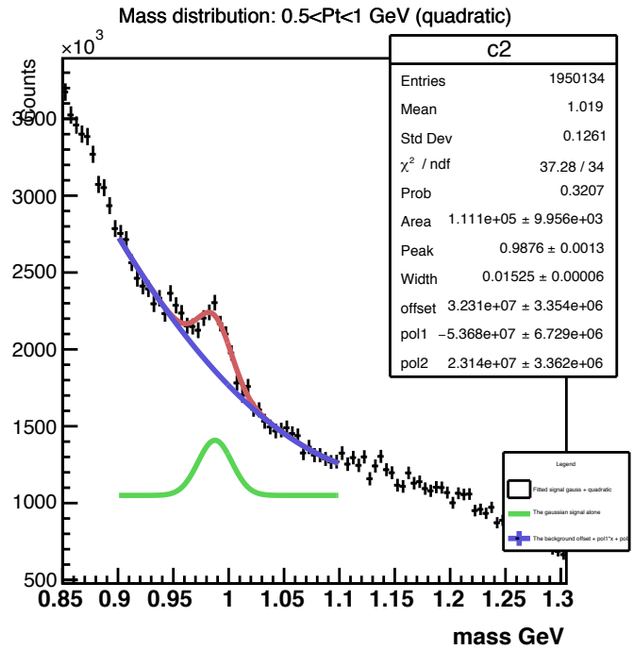
SUMMARY

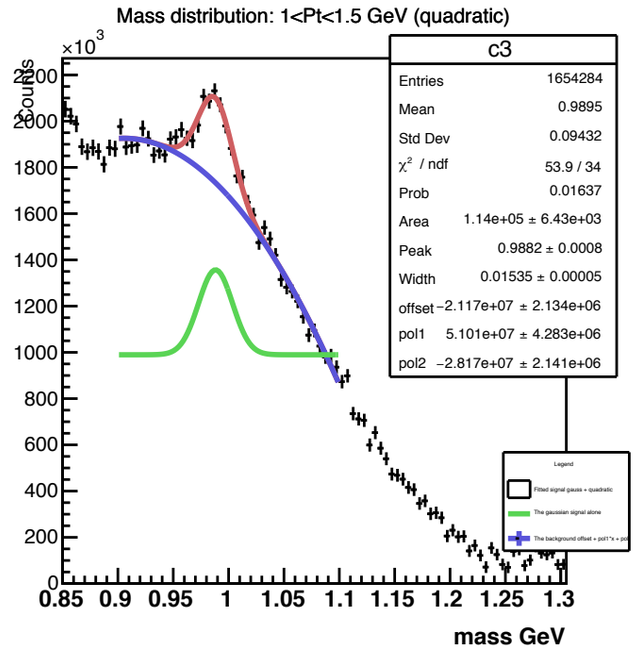
- First f0 v2 analysis, Run 11 data
- Tested NCQ scaling with nq=2 and nq=4
- Processing more data

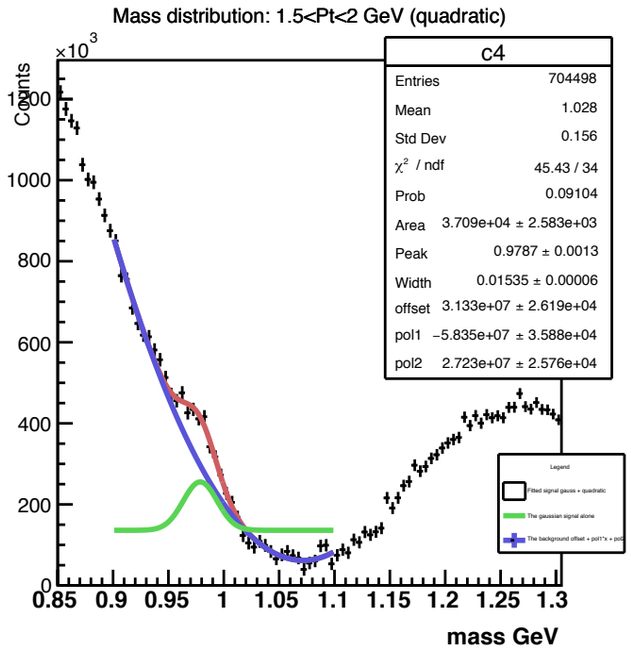
- Extra slides

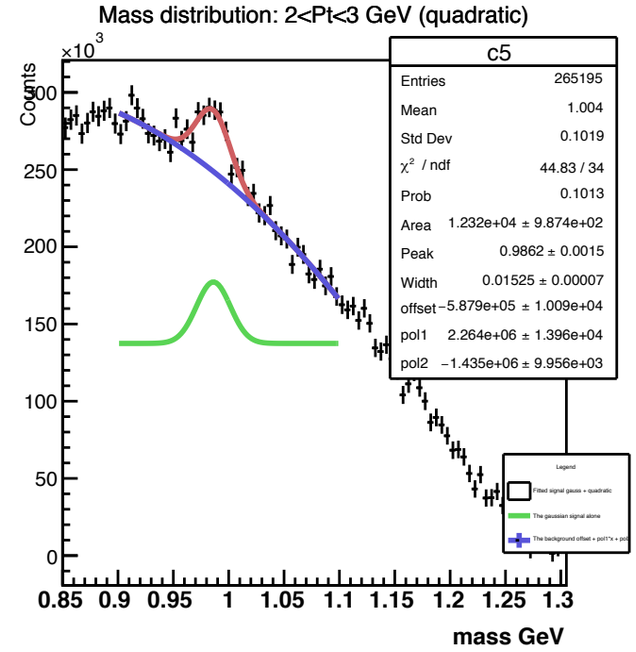
TEXT

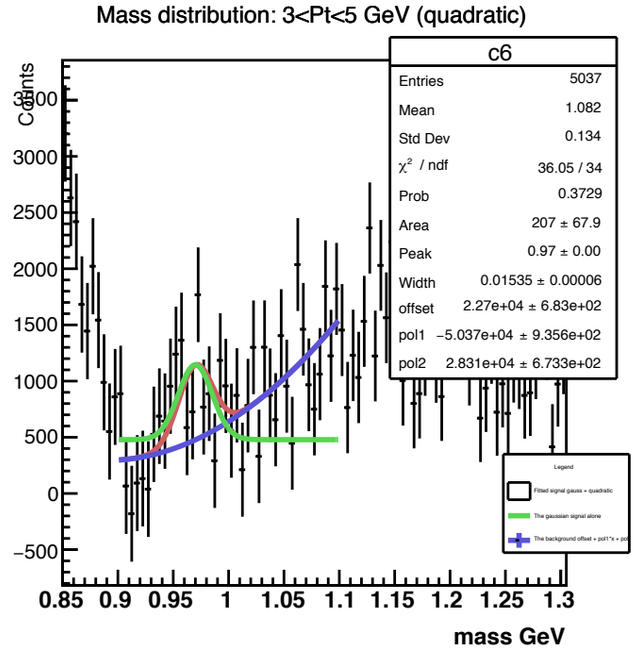








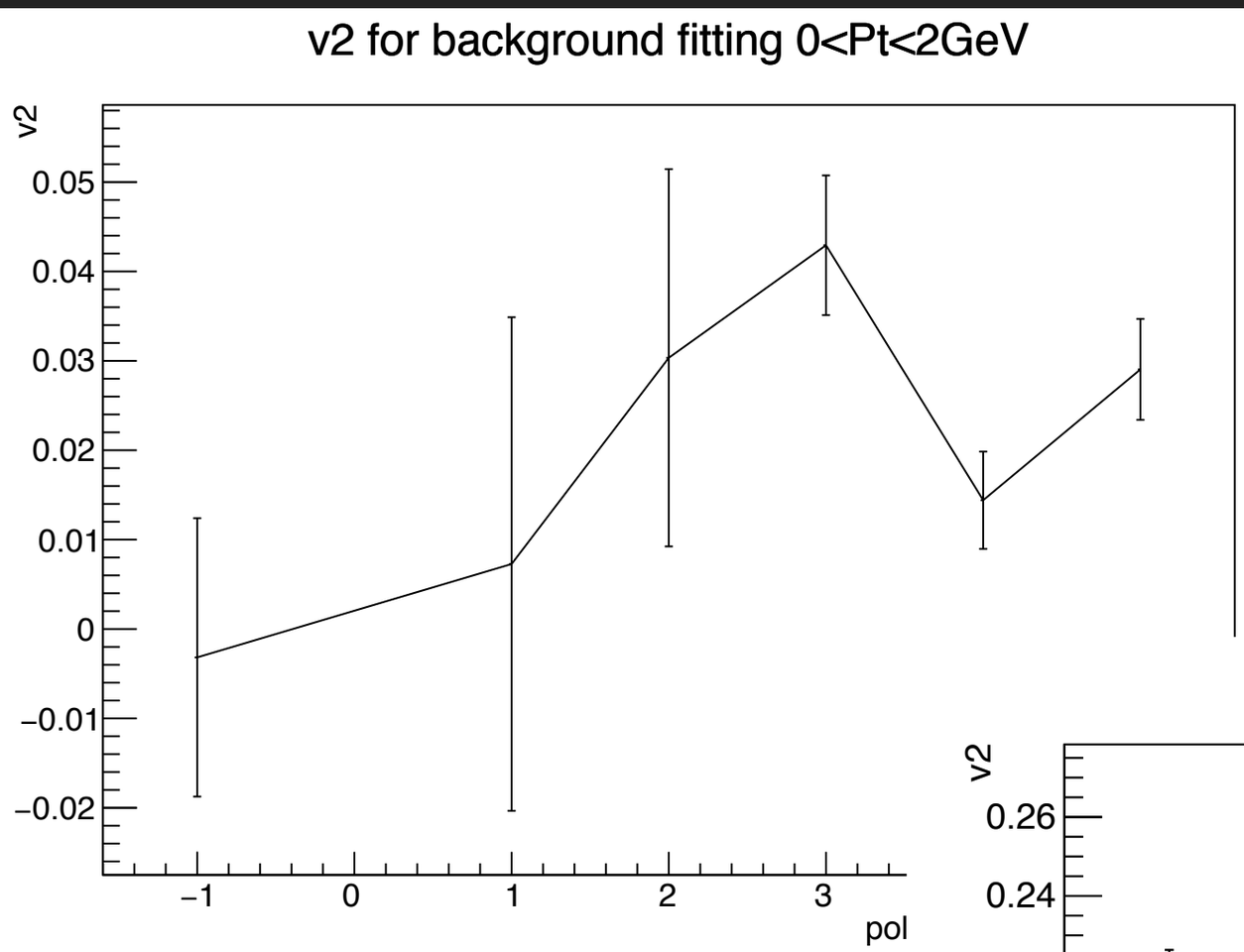




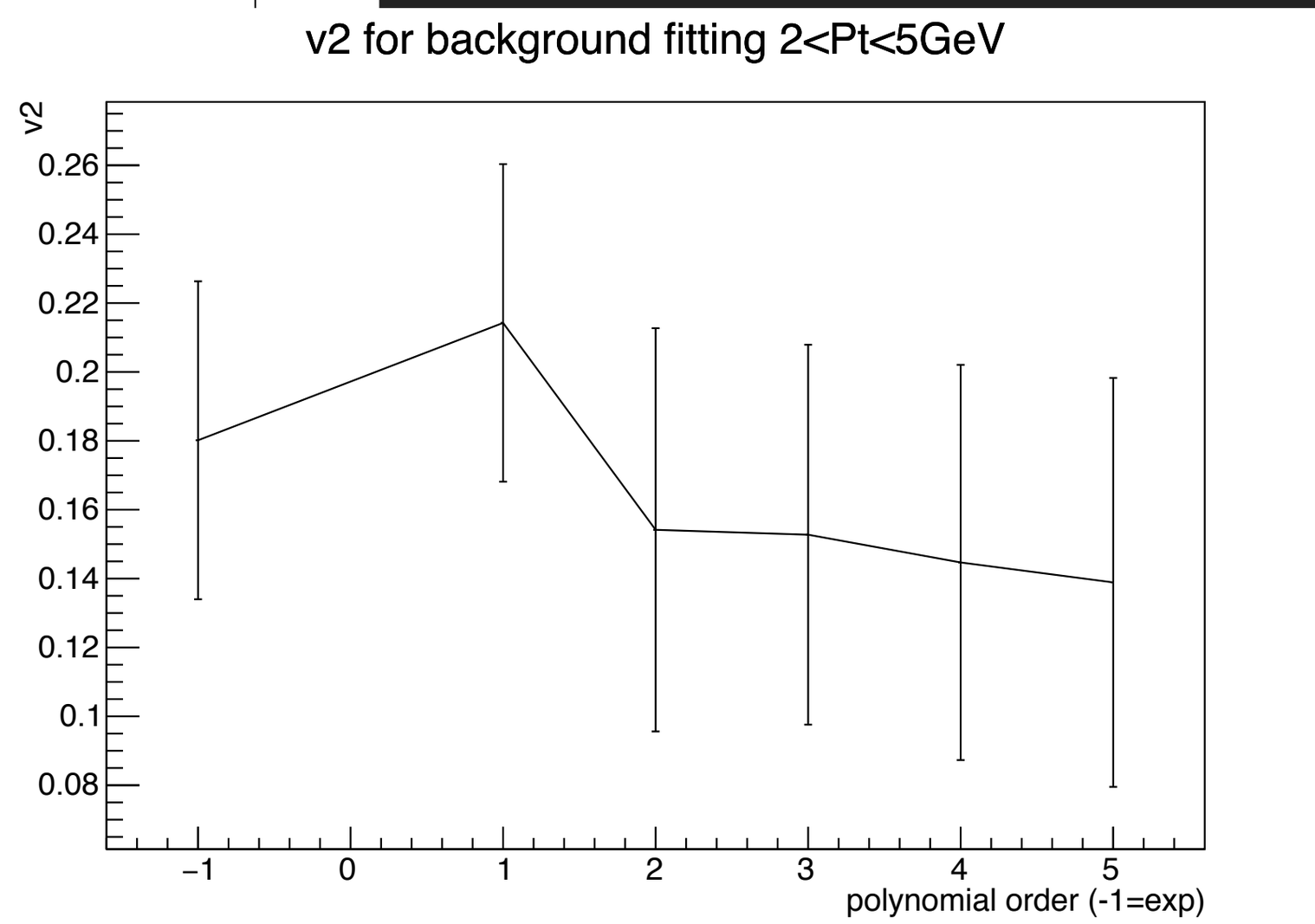
The yields (area) here were used to calculate the mean pt in the plotted bins.

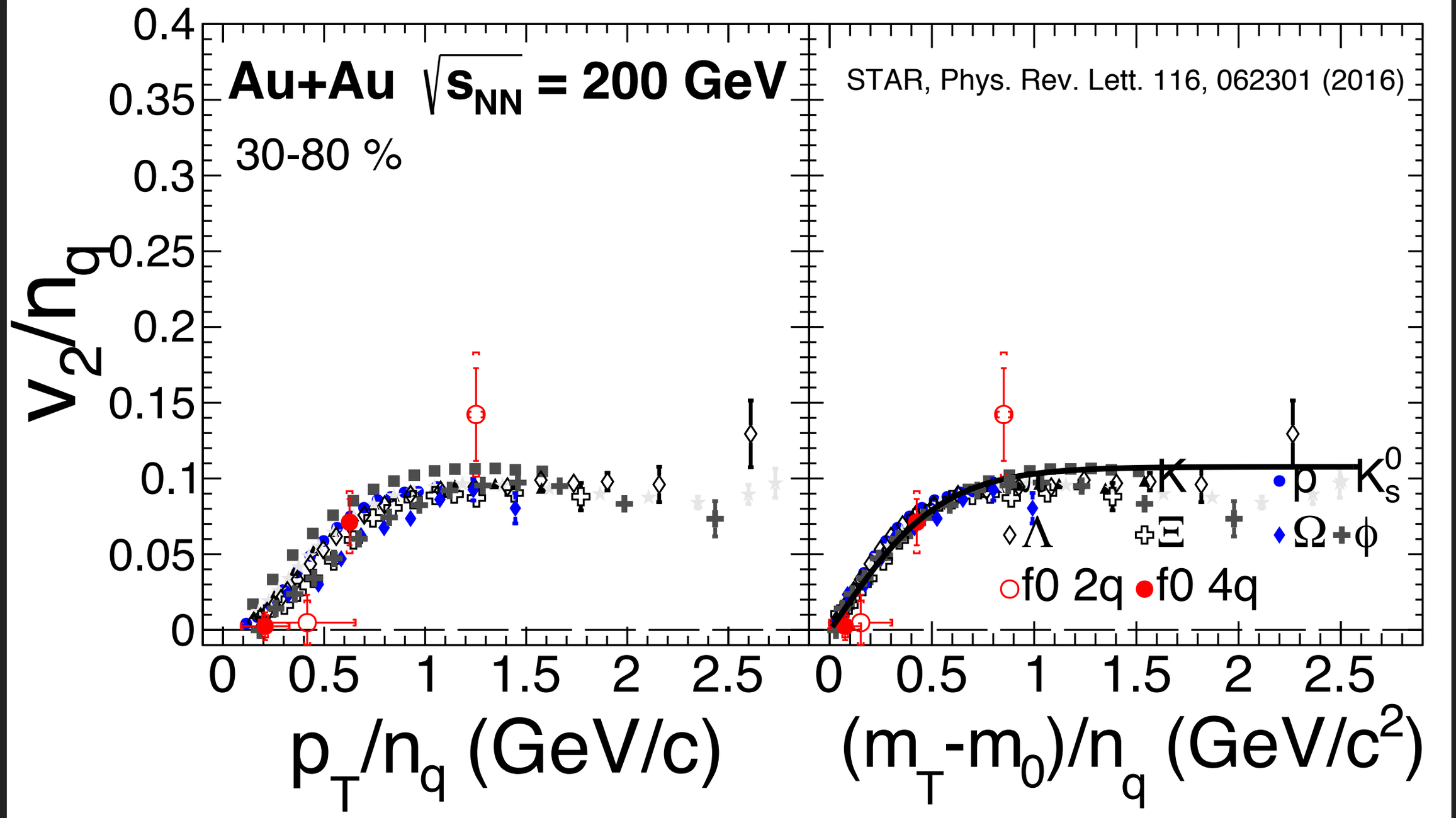
All phi bins are shown here

TEXT



Comparison of v2 for different background functions



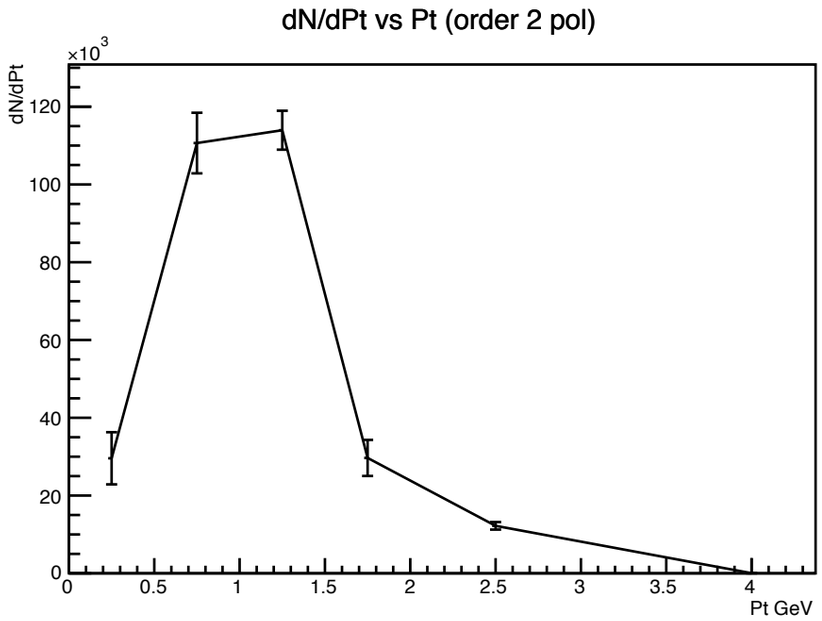


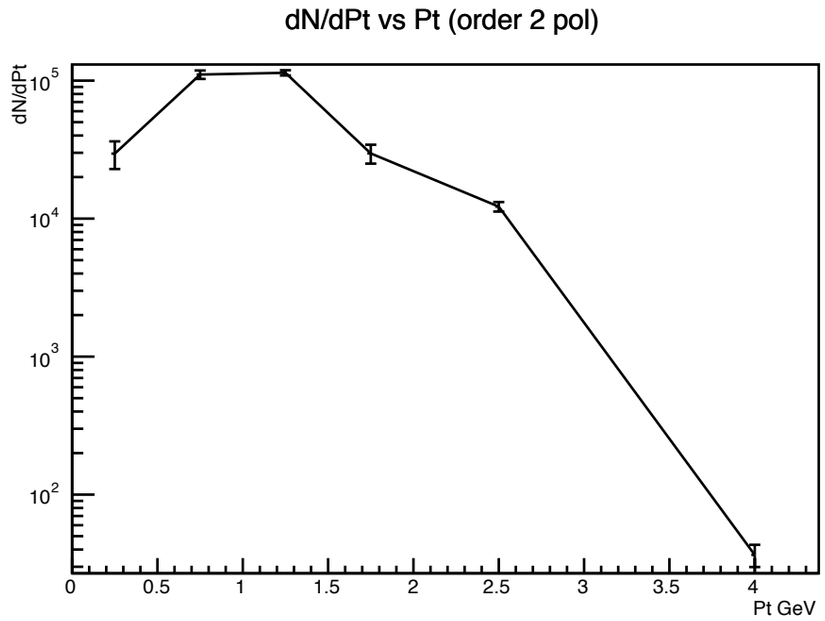
The linear background fit was chosen for these data points.

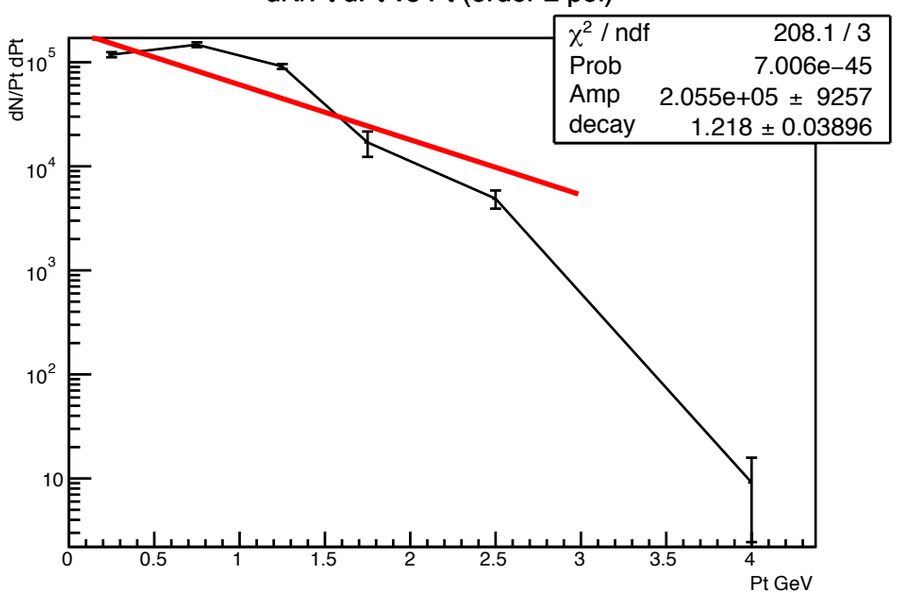
TO DO

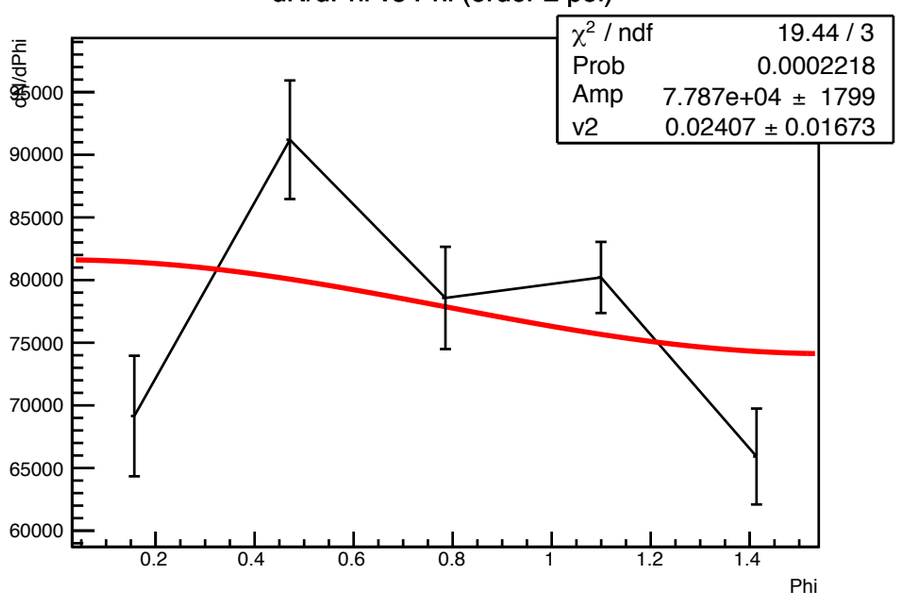
- Collect more statistics to narrow error bars
- Distinguish between the molecule and the 4 quark state if they remain possible after processing more data

TEXT









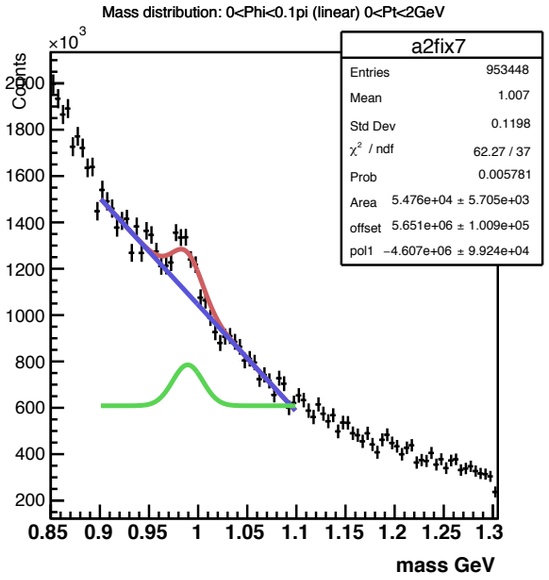
Example of different yields calculated.

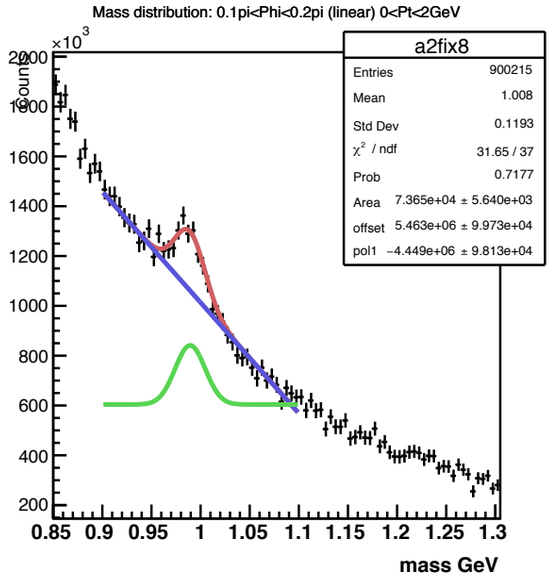
Bottom right fit is how v2 was extracted.

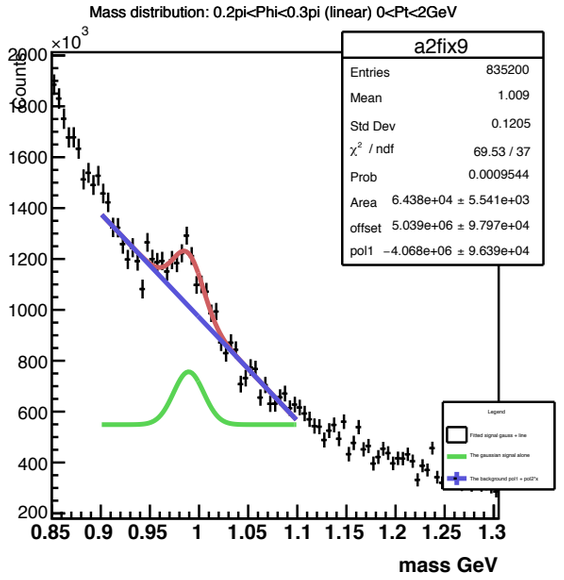
Note: the v2 plots shown at the beginning didn't have yield plots made, just fits performed and values extracted

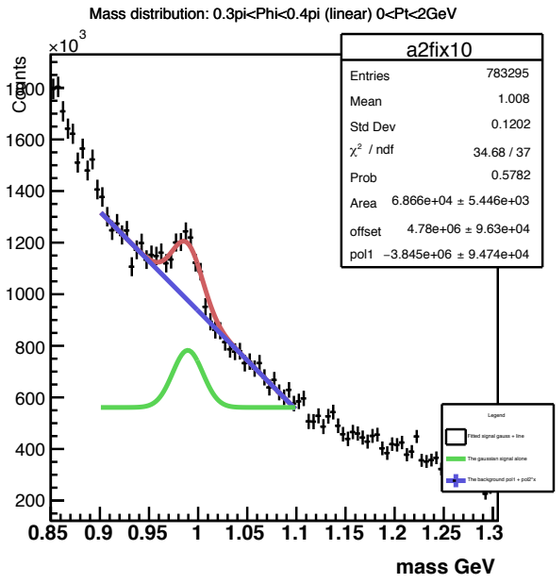
Bottom left plot is corrected for different pT bins

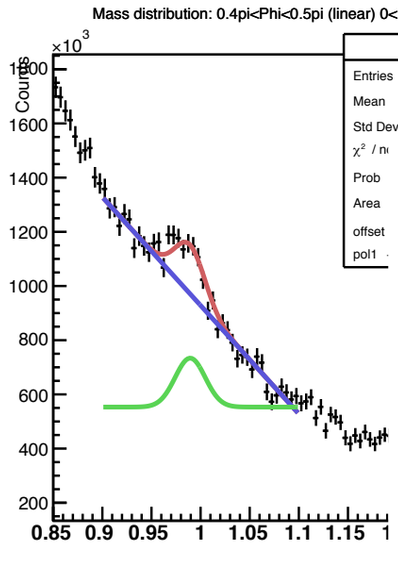
Linear phi yields

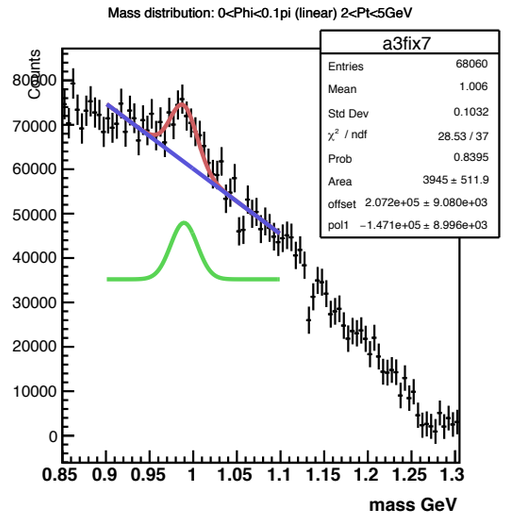


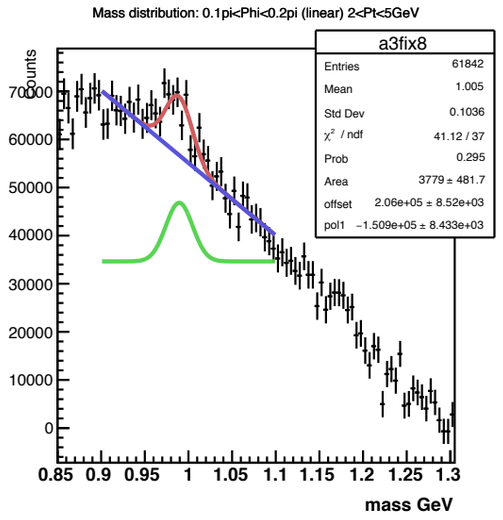


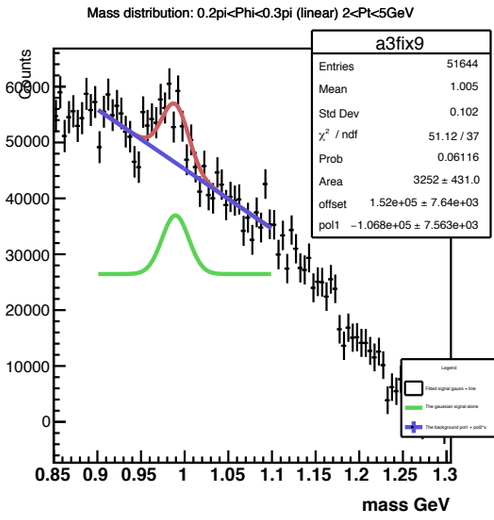


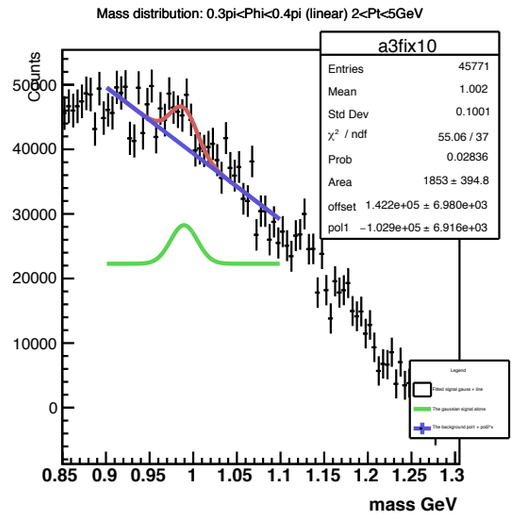


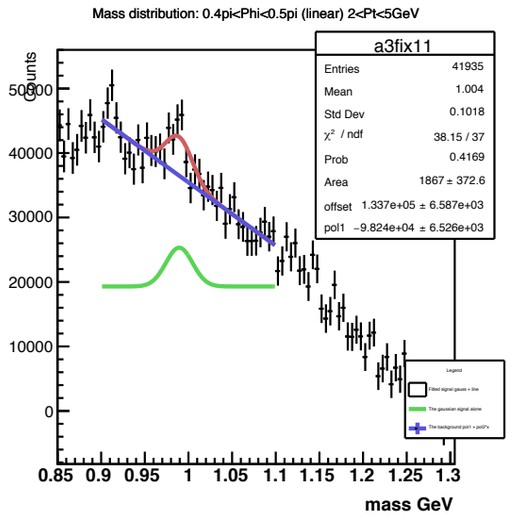




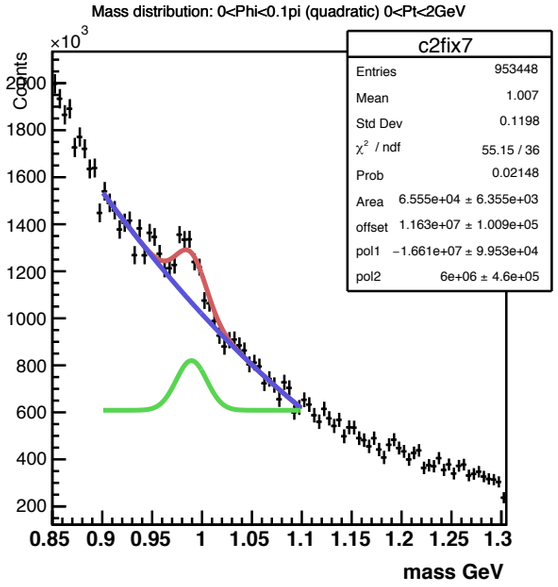


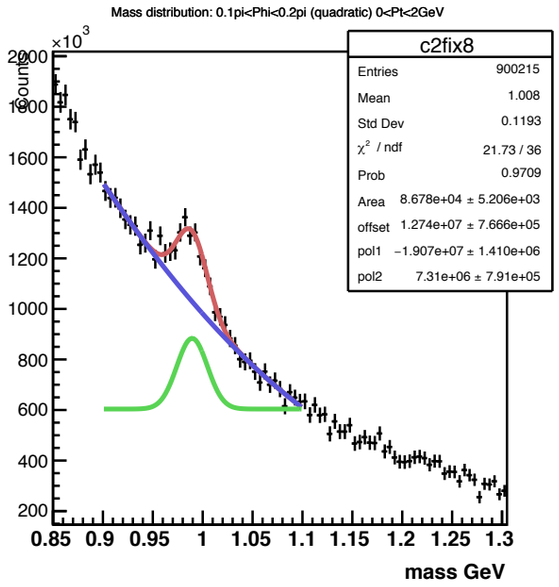


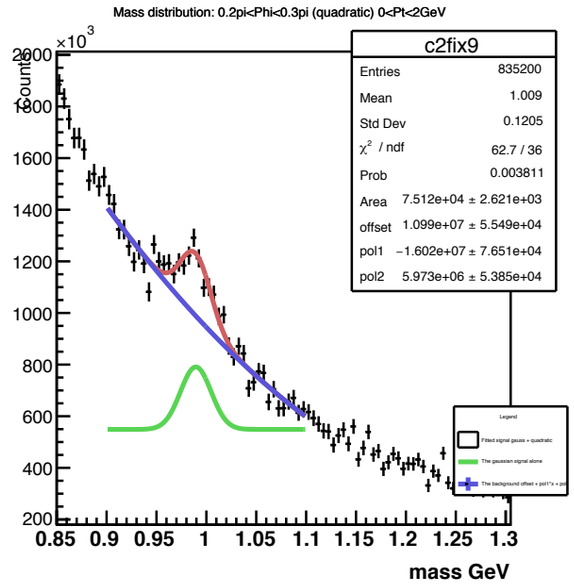


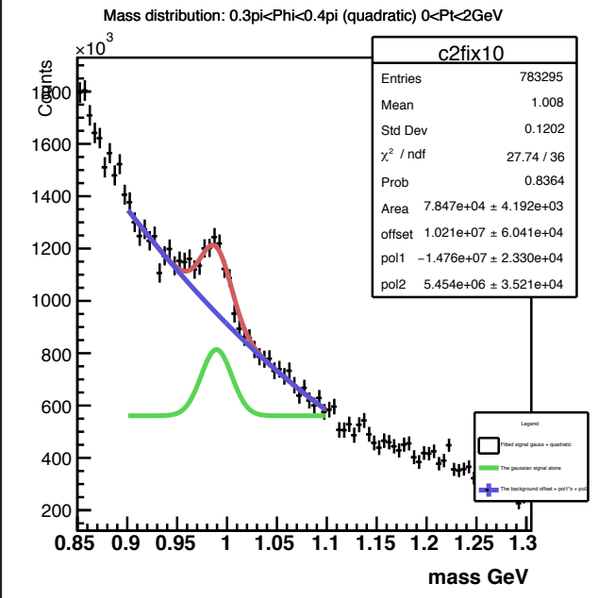


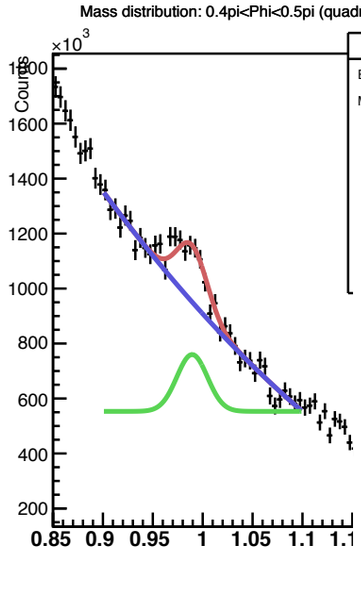
Quadratic phi yields

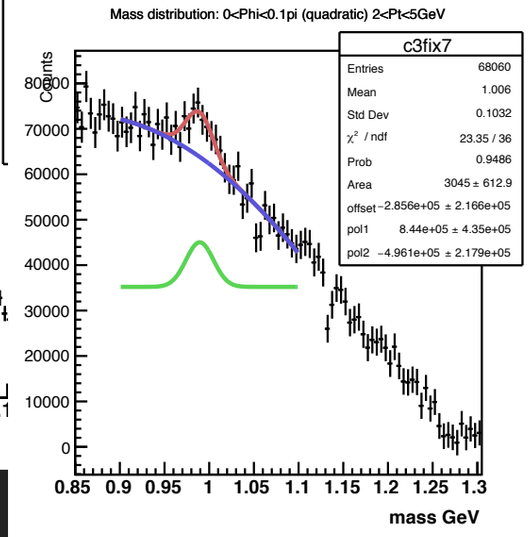


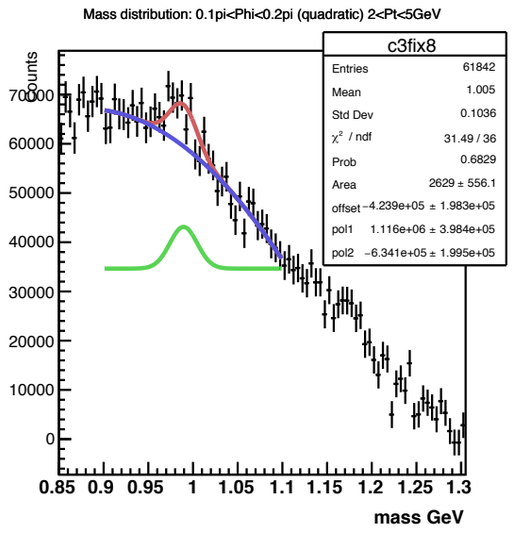


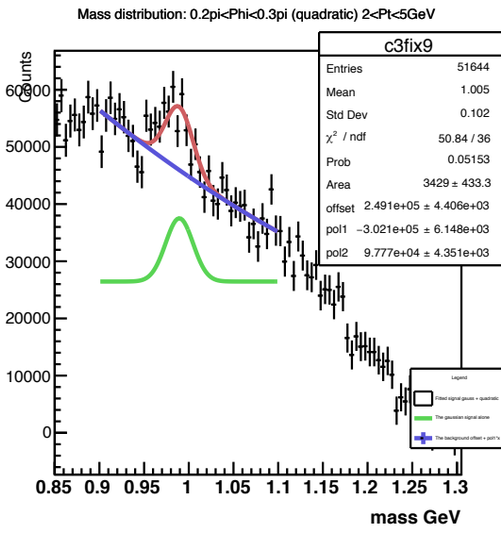


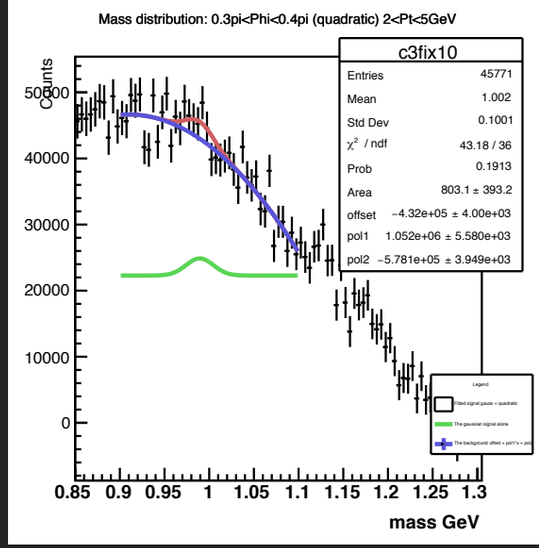


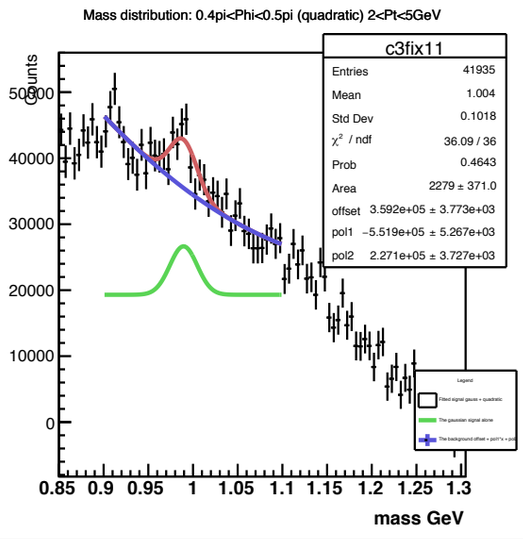




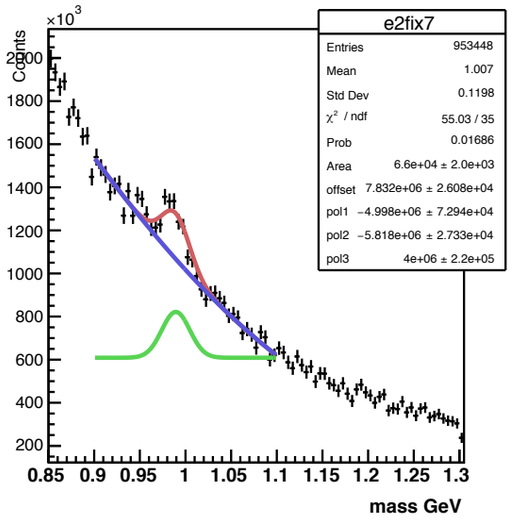


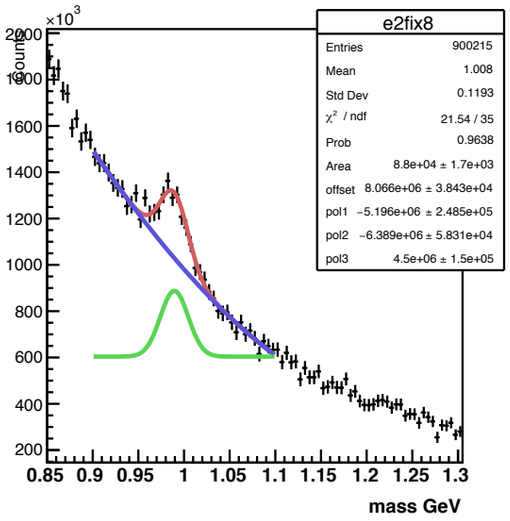


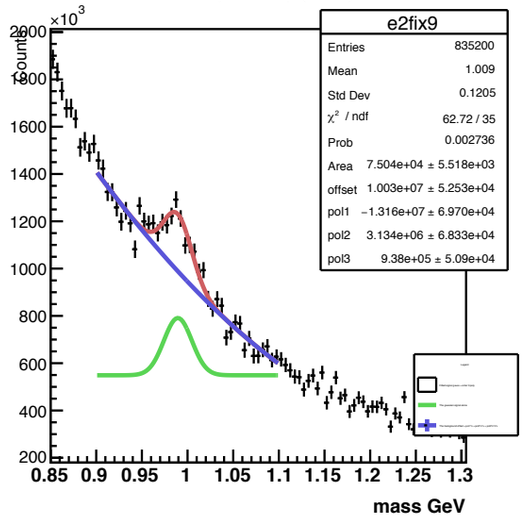


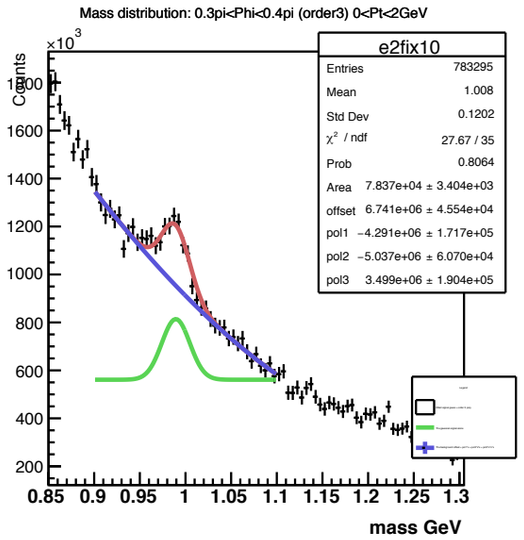


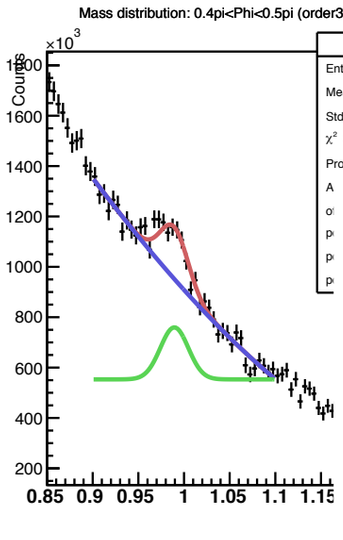
Phi yield polynomial 3

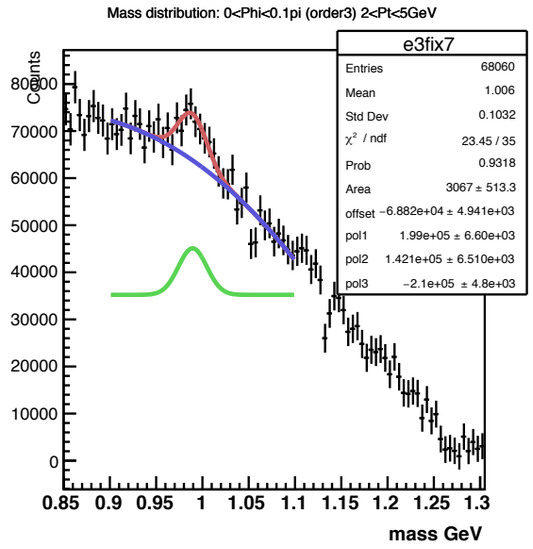


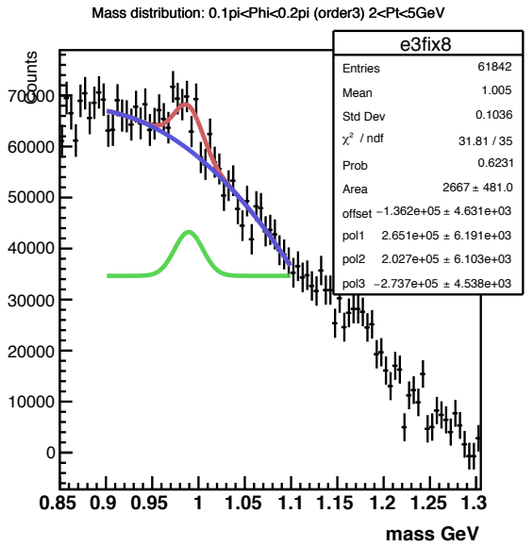


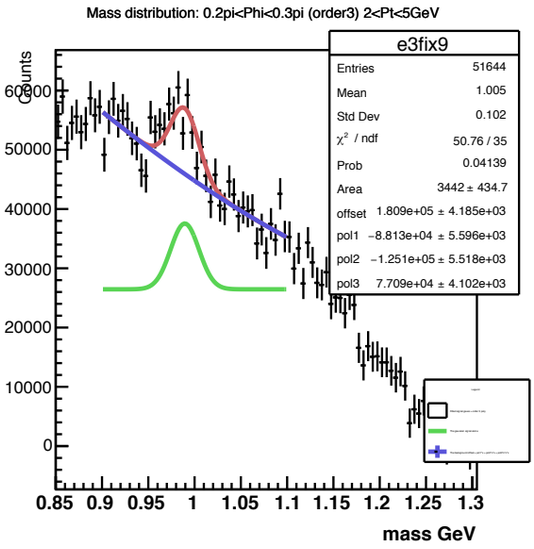


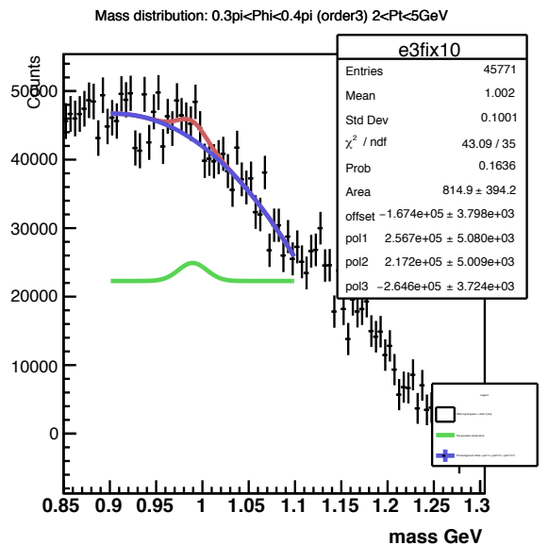


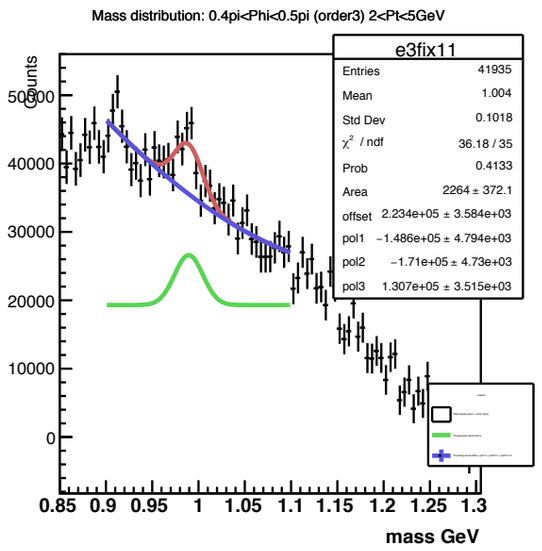




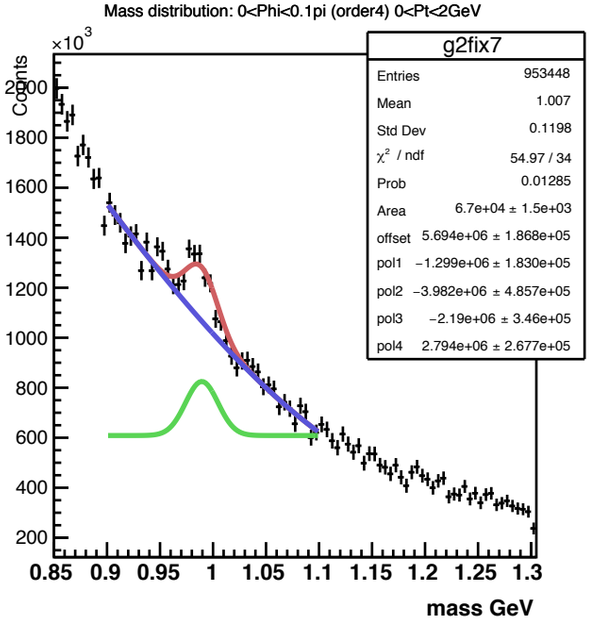








Pol 4 yield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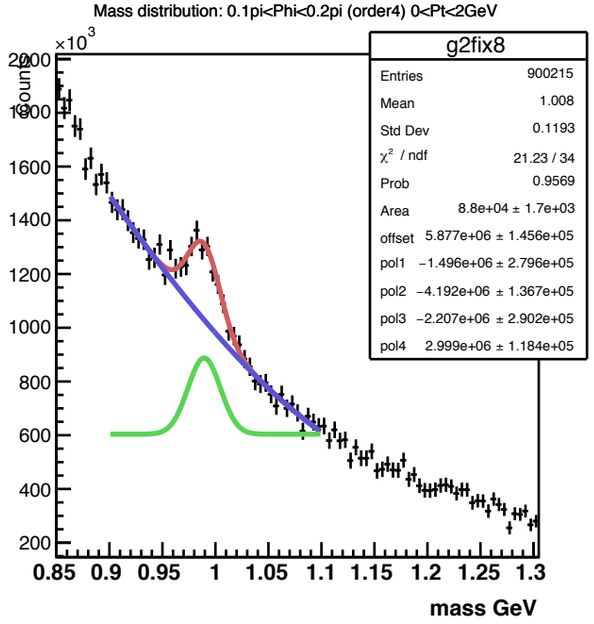
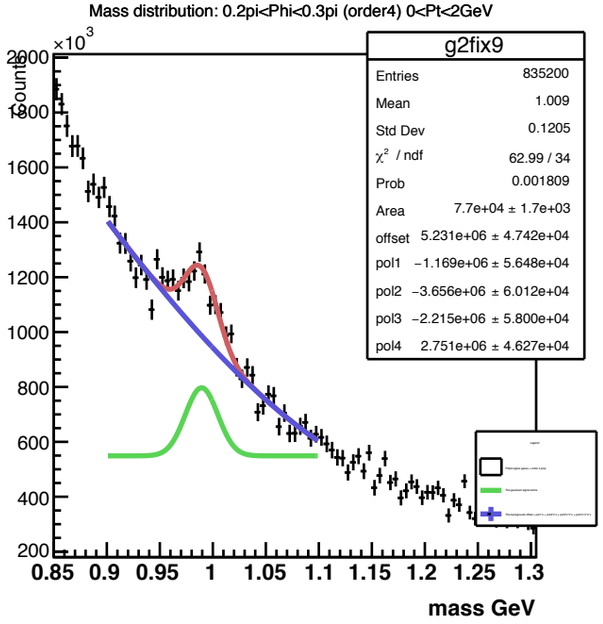
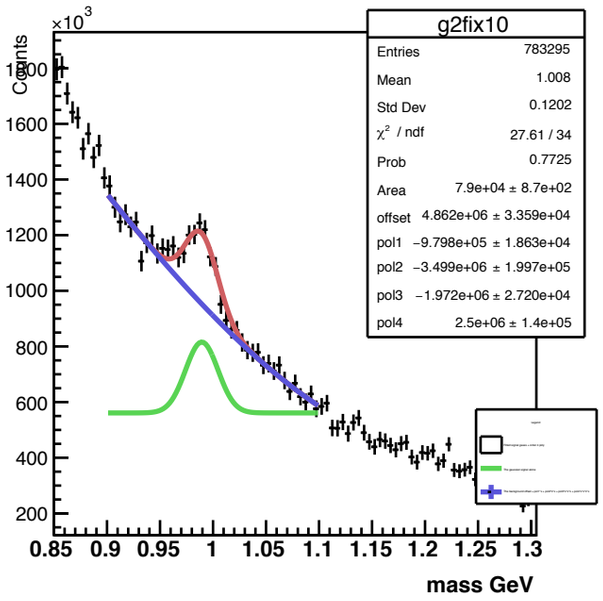
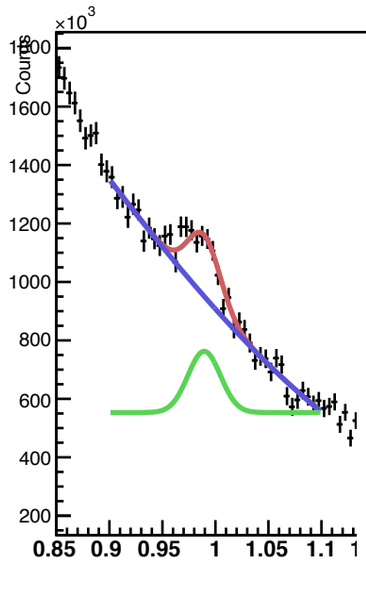
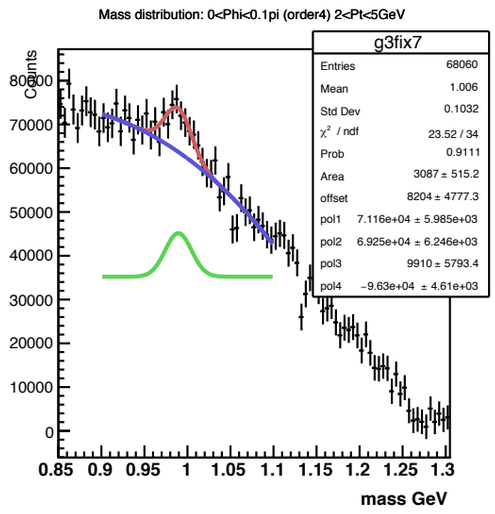
g2fix7
Entries 953448
Mean 1.007
Std Dev 0.1198
χ² / ndf 54.97 / 34
Prob 0.01285
Area 6.7e+04 ± 1.5e+03
offset 5.694e+06 ± 1.868e+05
pol1 −1.299e+06 ± 1.830e+05
pol2 −3.982e+06 ± 4.857e+05
pol3 −2.19e+06 ± 3.46e+05
pol4 2.794e+06 ± 2.677e+05
Counts
mass GeV

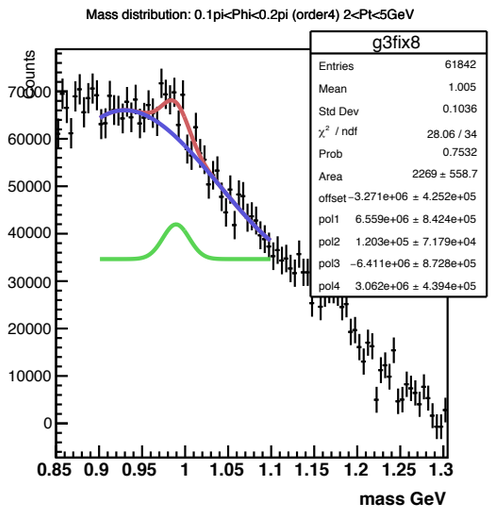

Mass distribution: 0.1pi<Phi<0.2pi (order4) 0<Pt<2GeV
g2fix8
Entries 900215
Mean 1.008
Std Dev 0.1193
χ² / ndf 21.23 / 34
Prob 0.9569
Area 8.8e+04 ± 1.7e+03
offset 5.877e+06 ± 1.456e+05
pol1 −1.496e+06 ± 2.796e+05
pol2 −4.192e+06 ± 1.367e+05
pol3 −2.207e+06 ± 2.902e+05
pol4 2.999e+06 ± 1.184e+05
Counts
mass GeV

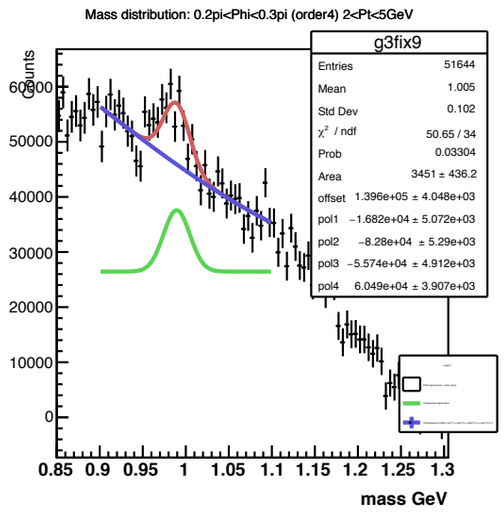

Mass distribution: 0.2pi<Phi<0.3pi (order4) 0<Pt<2GeV
g2fix9
Entries 835200
Mean 1.009
Std Dev 0.1205
χ² / ndf 62.99 / 34
Prob 0.001809
Area 7.7e+04 ± 1.7e+03
offset 5.231e+06 ± 4.742e+04
pol1 −1.169e+06 ± 5.648e+04
pol2 −3.656e+06 ± 6.012e+04
pol3 −2.215e+06 ± 5.800e+04
pol4 2.751e+06 ± 4.627e+04
Counts
mass GeV

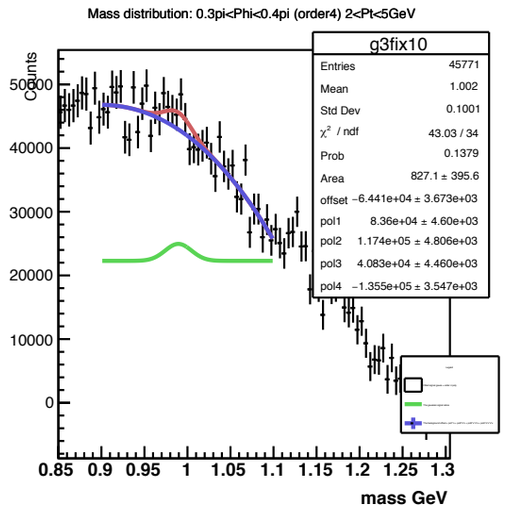

Mass distribution: 0.3pi<Phi<0.4pi (order4) 0<Pt<2GeV
g2fix10
Entries 783295
Mean 1.008
Std Dev 0.1202
χ² / ndf 27.61 / 34
Prob 0.7725
Area 7.9e+04 ± 8.7e+02
offset 4.862e+06 ± 3.359e+04
pol1 −9.798e+05 ± 1.863e+04
pol2 −3.499e+06 ± 1.997e+05
pol3 −1.972e+06 ± 2.720e+04
pol4 2.5e+06 ± 1.4e+05
Counts
mass GeV

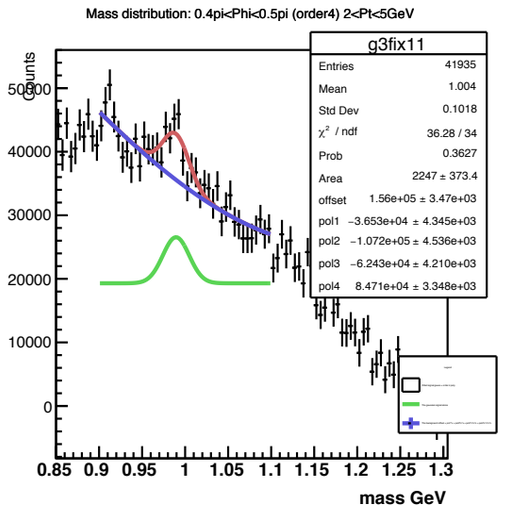

Mass distribution: 0.4pi<Phi<0.5pi (order4) 0<Pt<2GeV
g2fix11
Entries 758207
Mean 1.009
Counts


Mass distribution: 0<Phi<0.1pi (order4) 2<Pt<5GeV
g3fix7
Entries 68060
Mean 1.006
Std Dev 0.1032
χ² / ndf 23.52 / 34
Prob 0.9111
Area 3087 ± 515.2
offset 8204 ± 4777.3
pol1 7.116e+04 ± 5.985e+03
pol2 6.925e+04 ± 6.246e+03
pol3 9910 ± 5793.4
pol4 −9.63e+04 ± 4.61e+03
Counts
mass GeV

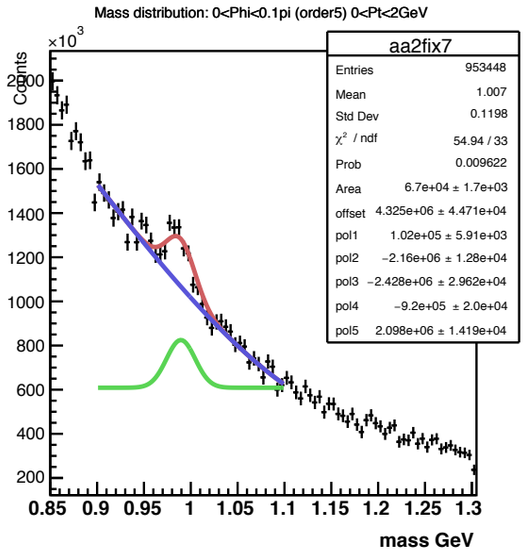

Mass distribution: 0.1pi<Phi<0.2pi (order4) 2<Pt<5GeV
g3fix8
Entries 61842
Mean 1.005
Std Dev 0.1036
χ² / ndf 28.06 / 34
Prob 0.7532
Area 2269 ± 558.7
offset −3.271e+06 ± 4.252e+05
pol1 6.559e+06 ± 8.424e+05
pol2 1.203e+05 ± 7.179e+04
pol3 −6.411e+06 ± 8.728e+05
pol4 3.062e+06 ± 4.394e+05
Counts
mass GeV

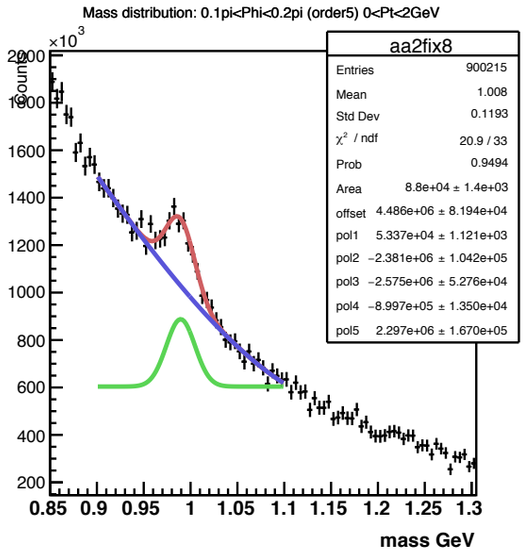

Mass distribution: 0.2pi<Phi<0.3pi (order4) 2<Pt<5GeV
g3fix9
Entries 51644
Mean 1.005
Std Dev 0.102
χ² / ndf 50.65 / 34
Prob 0.03304
Area 3451 ± 436.2
offset 1.396e+05 ± 4.048e+03
pol1 −1.682e+04 ± 5.072e+03
pol2 −8.28e+04 ± 5.29e+03
pol3 −5.574e+04 ± 4.912e+03
pol4 6.049e+04 ± 3.907e+03
Counts
mass GeV

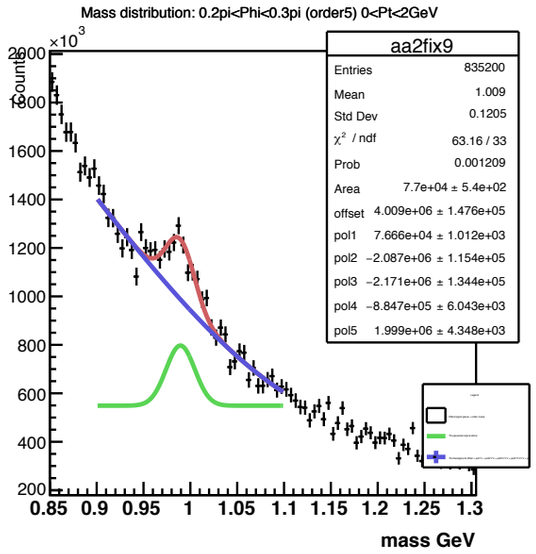

Mass distribution: 0.3pi<Phi<0.4pi (order4) 2<Pt<5GeV
g3fix10
Entries 45771
Mean 1.002
Std Dev 0.1001
χ² / ndf 43.03 / 34
Prob 0.1379
Area 827.1 ± 395.6
offset −6.441e+04 ± 3.673e+03
pol1 8.36e+04 ± 4.60e+03
pol2 1.174e+05 ± 4.806e+03
pol3 4.083e+04 ± 4.460e+03
pol4 −1.355e+05 ± 3.547e+03
Counts
mass GeV

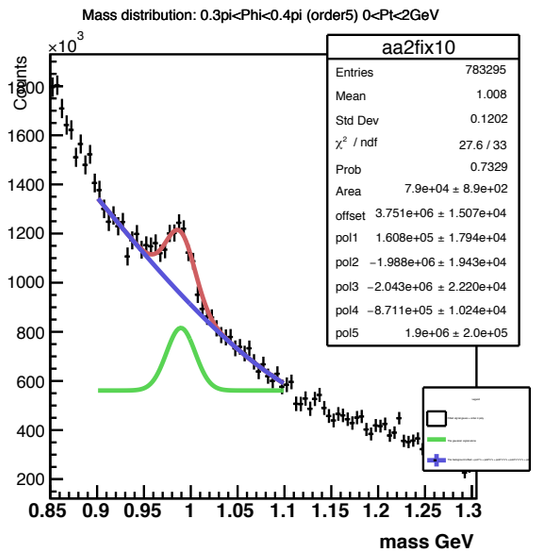

Mass distribution: 0.4pi<Phi<0.5pi (order4) 2<Pt<5GeV
g3fix11
Entries 41935
Mean 1.004
Std Dev 0.1018
χ² / ndf 36.28 / 34
Prob 0.3627
Area 2247 ± 373.4
offset 1.56e+05 ± 3.47e+03
pol1 −3.653e+04 ± 4.345e+03
pol2 −1.072e+05 ± 4.536e+03
pol3 −6.243e+04 ± 4.210e+03
pol4 8.471e+04 ± 3.348e+03
Counts
mass GeV

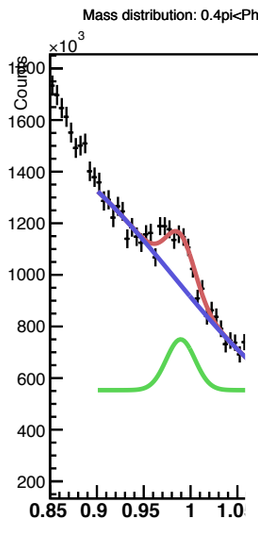
Pol 5 yield

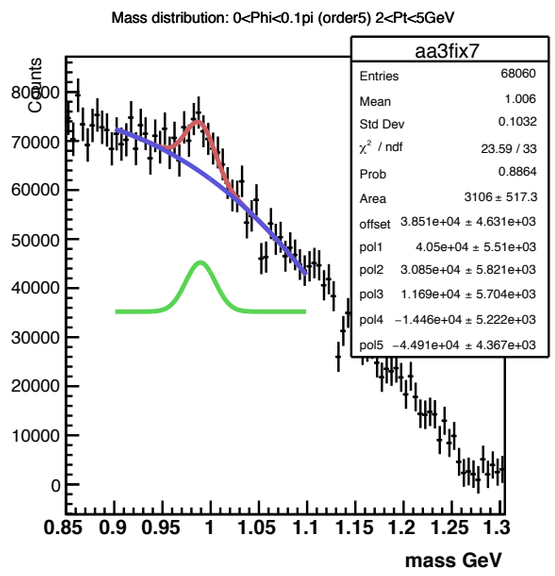

Mass distribution: 0<Phi<0.1pi (order5) 0<Pt<2GeV
aa2fix7
Entries 953448
Mean 1.007
Std Dev 0.1198
χ² / ndf 54.94 / 33
Prob 0.009622
Area 6.7e+04 ± 1.7e+03
offset 4.325e+06 ± 4.471e+04
pol1 1.02e+05 ± 5.91e+03
pol2 −2.16e+06 ± 1.28e+04
pol3 −2.428e+06 ± 2.962e+04
pol4 −9.2e+05 ± 2.0e+04
pol5 2.098e+06 ± 1.419e+04
Counts
mass GeV

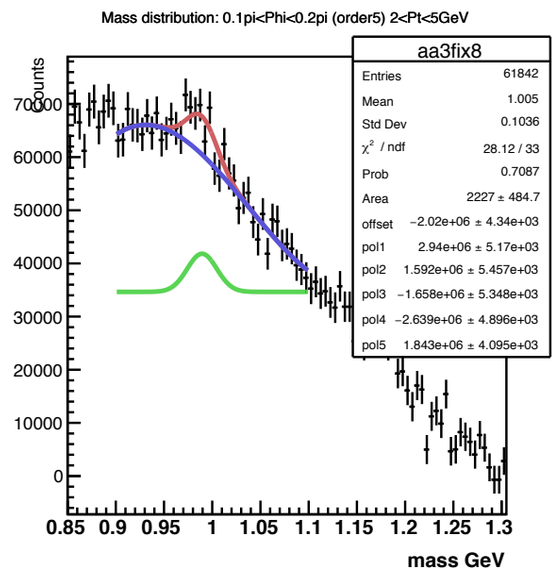

Mass distribution: 0.1pi<Phi<0.2pi (order5) 0<Pt<2GeV
aa2fix8
Entries 900215
Mean 1.008
Std Dev 0.1193
χ² / ndf 20.9 / 33
Prob 0.9494
Area 8.8e+04 ± 1.4e+03
offset 4.486e+06 ± 8.194e+04
pol1 5.337e+04 ± 1.121e+03
pol2 −2.381e+06 ± 1.042e+05
pol3 −2.575e+06 ± 5.276e+04
pol4 −8.997e+05 ± 1.350e+04
pol5 2.297e+06 ± 1.670e+05
Counts
mass GeV

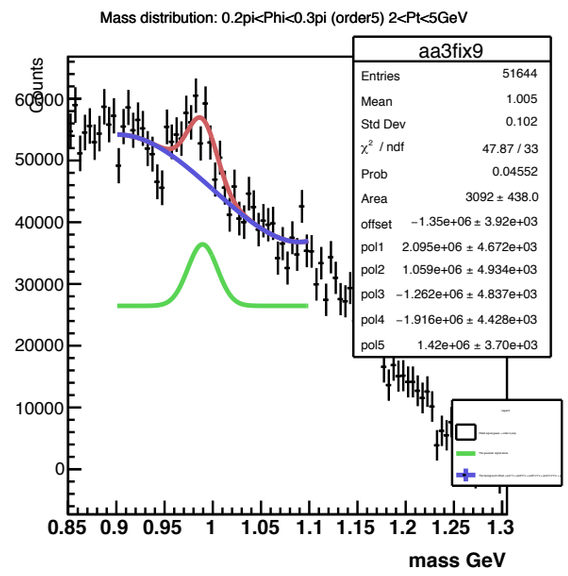

Mass distribution: 0.2pi<Phi<0.3pi (order5) 0<Pt<2GeV
aa2fix9
Entries 835200
Mean 1.009
Std Dev 0.1205
χ² / ndf 63.16 / 33
Prob 0.001209
Area 7.7e+04 ± 5.4e+02
offset 4.009e+06 ± 1.476e+05
pol1 7.666e+04 ± 1.012e+03
pol2 −2.087e+06 ± 1.154e+05
pol3 −2.171e+06 ± 1.344e+05
pol4 −8.847e+05 ± 6.043e+03
pol5 1.999e+06 ± 4.348e+03
Counts
mass GeV

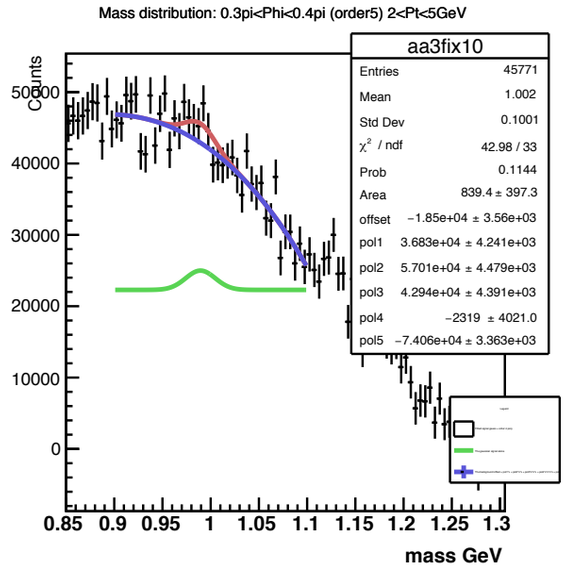

Mass distribution: 0.3pi<Phi<0.4pi (order5) 0<Pt<2GeV
aa2fix10
Entries 783295
Mean 1.008
Std Dev 0.1202
χ² / ndf 27.6 / 33
Prob 0.7329
Area 7.9e+04 ± 8.9e+02
offset 3.751e+06 ± 1.507e+04
pol1 1.608e+05 ± 1.794e+04
pol2 −1.988e+06 ± 1.943e+04
pol3 −2.043e+06 ± 2.220e+04
pol4 −8.711e+05 ± 1.024e+04
pol5 1.9e+06 ± 2.0e+05
Counts
mass GeV

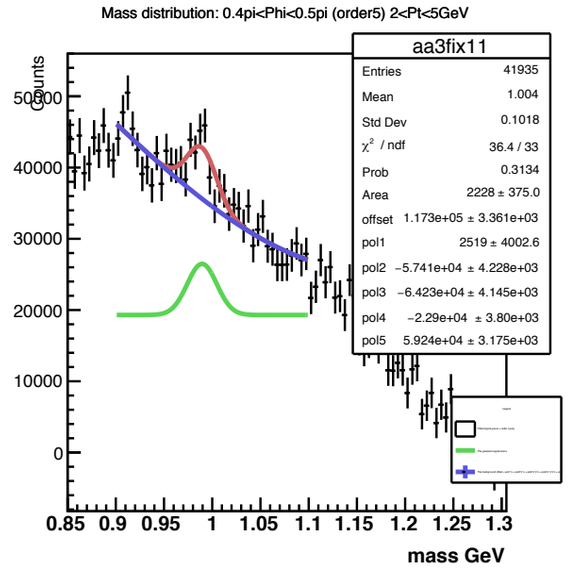

Mass distribution: 0.4pi<Phi<0.5pi (order5) 0<Pt<2GeV
aa2fix11
Counts
mass GeV


Mass distribution: 0<Phi<0.1pi (order5) 2<Pt<5GeV
aa3fix7
Entries 68060
Mean 1.006
Std Dev 0.1032
χ² / ndf 23.59 / 33
Prob 0.8864
Area 3106 ± 517.3
offset 3.851e+04 ± 4.631e+03
pol1 4.05e+04 ± 5.51e+03
pol2 3.085e+04 ± 5.821e+03
pol3 1.169e+04 ± 5.704e+03
pol4 −1.446e+04 ± 5.222e+03
pol5 −4.491e+04 ± 4.367e+03
Counts
mass GeV


Mass distribution: 0.1pi<Phi<0.2pi (order5) 2<Pt<5GeV
aa3fix8
Entries 61842
Mean 1.005
Std Dev 0.1036
χ² / ndf 28.12 / 33
Prob 0.7087
Area 2227 ± 484.7
offset −2.02e+06 ± 4.34e+03
pol1 2.94e+06 ± 5.17e+03
pol2 1.592e+06 ± 5.457e+03
pol3 −1.658e+06 ± 5.348e+03
pol4 −2.639e+06 ± 4.896e+03
pol5 1.843e+06 ± 4.095e+03
Counts
mass GeV


Mass distribution: 0.2pi<Phi<0.3pi (order5) 2<Pt<5GeV
aa3fix9
Entries 51644
Mean 1.005
Std Dev 0.102
χ² / ndf 47.87 / 33
Prob 0.04552
Area 3092 ± 438.0
offset −1.35e+06 ± 3.92e+03
pol1 2.095e+06 ± 4.672e+03
pol2 1.059e+06 ± 4.934e+03
pol3 −1.262e+06 ± 4.837e+03
pol4 −1.916e+06 ± 4.428e+03
pol5 1.42e+06 ± 3.70e+03
Counts
mass GeV


Mass distribution: 0.3pi<Phi<0.4pi (order5) 2<Pt<5GeV
aa3fix10
Entries 45771
Mean 1.002
Std Dev 0.1001
χ² / ndf 42.98 / 33
Prob 0.1144
Area 839.4 ± 397.3
offset −1.85e+04 ± 3.56e+03
pol1 3.683e+04 ± 4.241e+03
pol2 5.701e+04 ± 4.479e+03
pol3 4.294e+04 ± 4.391e+03
pol4 −2319 ± 4021.0
pol5 −7.406e+04 ± 3.363e+03
Counts
mass GeV


Mass distribution: 0.4pi<Phi<0.5pi (order5) 2<Pt<5GeV
aa3fix11
Entries 41935
Mean 1.004
Std Dev 0.1018
χ² / ndf 36.4 / 33
Prob 0.3134
Area 2228 ± 375.0
offset 1.173e+05 ± 3.361e+03
pol1 2519 ± 4002.6
pol2 −5.741e+04 ± 4.228e+03
pol3 −6.423e+04 ± 4.145e+03
pol4 −2.29e+04 ± 3.80e+03
pol5 5.924e+04 ± 3.175e+03
Counts
mass GeV

Exponential yield