ALICE weekly meeting update

ρ mass spectrum analysis

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Introduction

- Some bugs were found within the fitting macro relating to the energy dependant width $\Gamma_{(E)}$ and the from of the RBW function applied to ρ , f_0 and f_2 resonances.

- Effects of phase space are also accounted for within the fitting produces mass values for the ρ much closer to the PDG value then before.

Changes made to fitting 1

- Energy dependence of the ρ width is described by…

$$\Gamma_{(E)} = \Gamma_0 \left(\frac{q}{q_\rho} \right)^{2l+1} \frac{E}{M_\rho}$$

- RBW is given by…

$$F_{(E)} = \frac{2YM_\rho E\Gamma_{(E)}}{\pi(E^2 - M_\rho^2)^2 + \left(\frac{E^4\Gamma_{(E)}^2}{M_\rho^2} \right)}$$

…for resonances with wide widths, and…

$$F_{(E)} = \frac{2YM_\rho E\Gamma_{(E)}}{\pi(E^2 - M_\rho^2)^2 + M_\rho^2\Gamma_{(E)}^2}$$

…for resonances with narrow widths.

Changes made to fitting 2

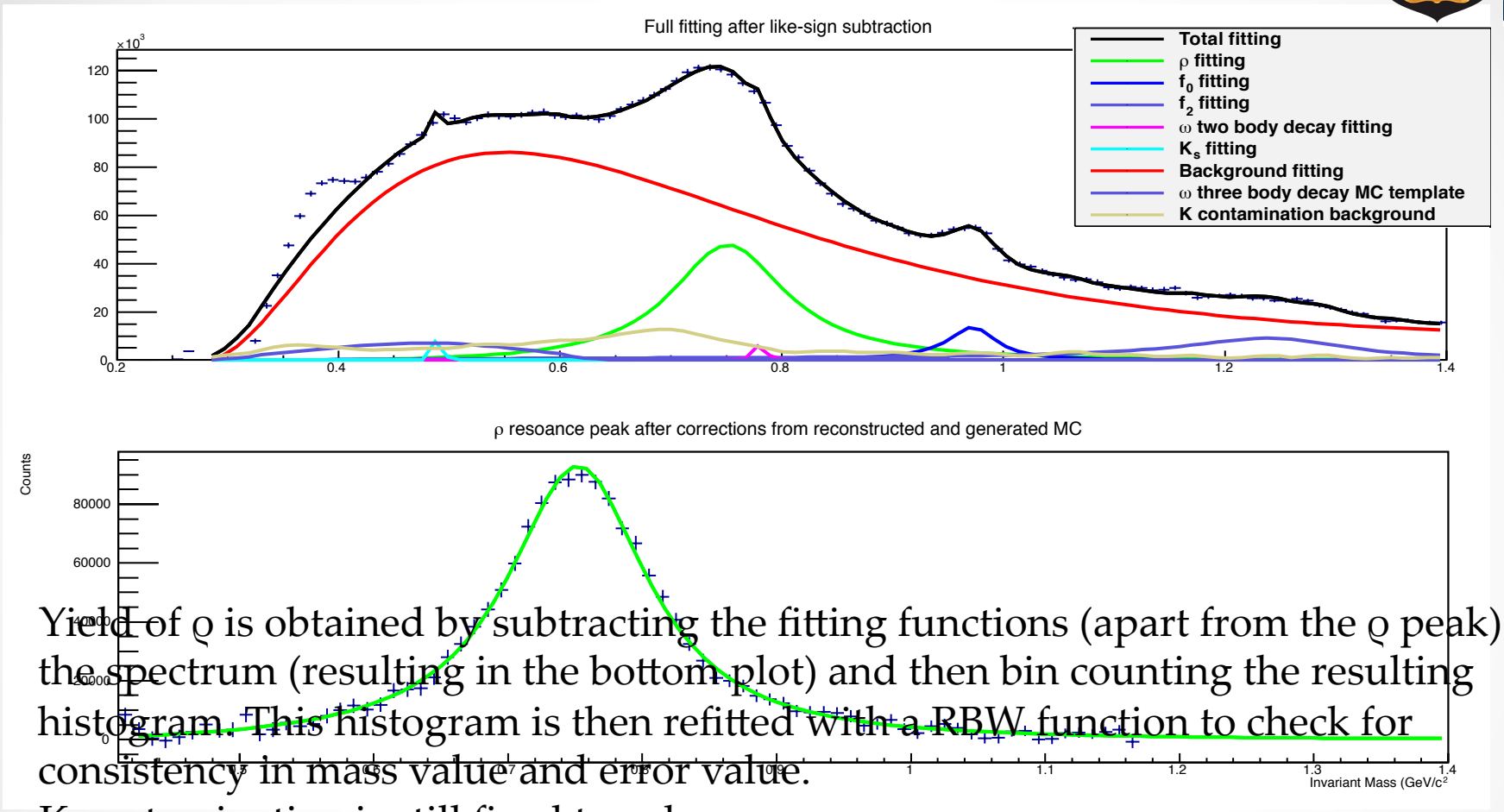
- Phase space is corrected for using the back ground function

$$B = (x - x_0)^{\alpha} \exp(-\beta x + \gamma x^3)$$

- In the fitting the large resonance functions are multiplied by the back ground function so that the full fitting is of the form.

$$Fitting = (1 + BW_{\rho} + BW_{f_0} + BW_{f_2})B$$

Full fitting and relevant components to ρ fitting using fixed K contamination background.

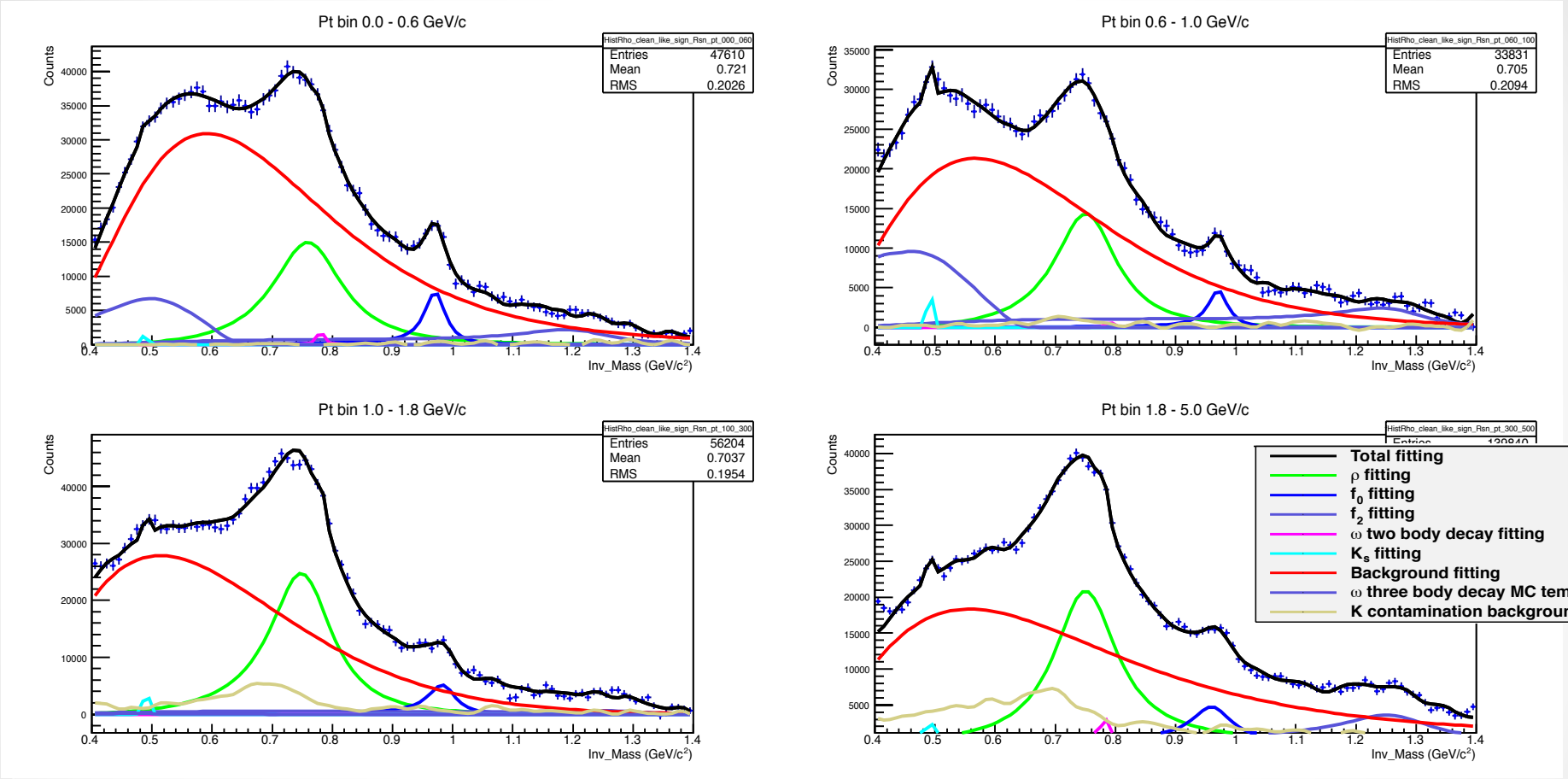


- Yield of ρ is obtained by subtracting the fitting functions (apart from the ρ peak) from the spectrum (resulting in the bottom plot) and then bin counting the resulting histogram. This histogram is then refitted with a RBW function to check for consistency in mass value and error value.
- K contamination is still fixed to value calculated from MC

	Mass of ρ (GeV/c²)	χ/ndf
Value	0.773 ± 0.0013	61/81

Fitting data with larger p_t binning (like-sign subtraction)

- Split p_t binning so that there are about equal statistics in each.



p_t bin (GeV/c)	Mass ϱ (GeV/c²)	X^2/ndf
0.0 – 0.6	0.773 ± 0.0027	54/81
0.6 – 1.0	0.774 ± 0.00213	106/81
1.0 – 1.8	0.773 ± 0.00129	127/81
1.8 – 5.0	0.772 ± 0.00114	107/81

Conclusions and plans

- Inclusion of both phase space corrections and energy dependence on the ρ width now give mass values for the ρ that are closer to the PDG value.
- Have systematics on the way -> List of things to include
  - Fitting range
  - Background subtraction method (like-sign vs mixing)
  - TPC n sigma (3.5 vs 2.5)
  - Tracks cuts
  - Material budget
- Total p_t binning for bin of size 0.2 GeV/c for ρ yield vs p_t ($d^2N/dp_t dy$)
- Lastly start on ρ to π ratio
- Notes for Midterm are being complied for completion of first draft for the end of August.

Backup

Data sets used

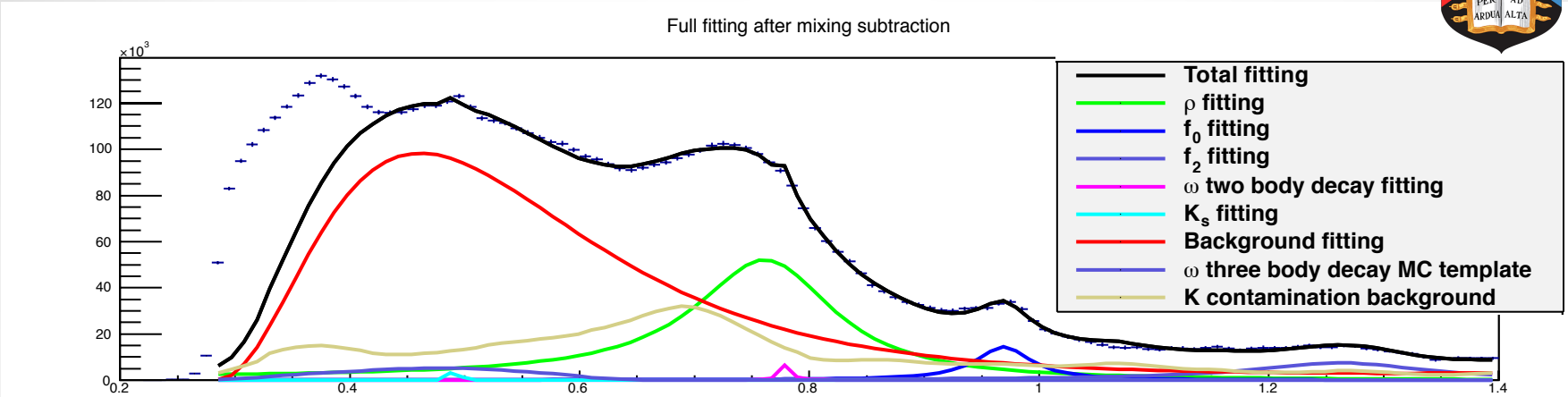
- Data (7 Tev p-p)
  - Period LHC10c pass 3 7 Tev AOD073 ~29 million events
- MC Pythia 6
  - LHC11b5 ~350,000 events
  - pp, Phojet, 0.5T, 7,000 Gev, LHC10c anchor runs, ID#261
- MC Phojet
  - LHC11b6 ~350,000 events
  - pp, Pythia, 0.5T, 7,000 Gev, LHC10c anchor runs, ID#260

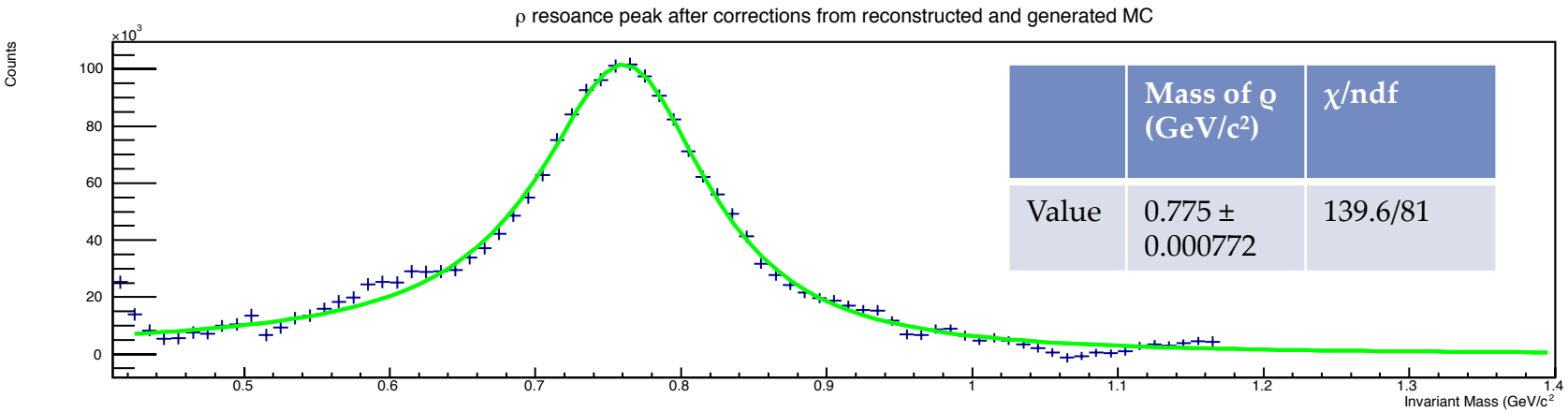
Cuts made on data and reconstructed MC

- Min Number of clusters TPC = 80
- TPC max $\chi^2 = 4$
- Min number of clusters ITS = 0
- ITS max χ^2 = 1e+20
- Eta range = 0.8
- Track pt > 0.15
- DCA (xy) = 0.02cm
- DCA (z) = 0.2cm
- TPC sigma = 3

- Mixing parameters
  - Max difference in multiplicity = 1
  - Number of mixing tracks = 10
  - Max difference in angle = 1e20
  - Max difference in z-vertex = 1

Full fitting (mixing subtraction)





	Mass of ρ (GeV/c²)	χ/ndf
Value	0.775 ± 0.000772	139.6/81

- In the case of the spectrum after mixing background subtraction, the remaining background is such that it over shadows the three body decay ω peak.

Fitting parameters

- Features included in fitting –
  - ρ meson resonance – fitted with relativistic Breit-wigner function. Mass is ~ 20 MeV below PDG value (775 MeV/c^2)
  - f_0 and f_2 resonance – each fitted with relativistic Breit-wigner functions. Masses are in PDG mass range (~970 MeV/c^2 and ~1270 MeV/c^2 for f_0 and f_2 respectfully.
  - K_s resonance – fitted with single Gaussian function.
  - Background – described using a polynomial times exponential function.
  - ω meson resonance ($\omega \rightarrow \pi^+ + \pi^-$) fitted with with relativistic Breit-wigner function.
  - ω meson three body decay ($\omega \rightarrow \pi^+ + \pi^- + \pi^0$) is simulated and taken as a template in MC and scaled within the fitting.
  - K contamination is simulated in MC and used as a template.