Mass dependent fit of PWA results for $\eta\pi^0$ system. Part N....

1.*TRC: " The best values for the a2 parameters have not been used in the MDF. Using the PDG mass is OK but the width needs to be broadened to account for resolution. We don't have a good simulation to determine this but if we start with the eta pi- result (118 MeV) then we can make a pretty good estimate. We suggest fixing the a2 width at 120 MeV. To add this into the study of sys errors you should include 110 MeV and 130 MeV. Your sys study already uses 118 MeV so some of this has already been done."*

Table 1. Results of MDF with average solutions at fixed a_2^0 resonance parameters. Masses and widths are in GeV/c^2.

Mass a_2	Width a_2^0	Mass π_1^0	Width π_1^0	χ^2
0.1320	0.110	1.265 $\pm$ 0.020	0.389 $\pm$ 0.060	1.18
0.1320	0.120	1.265 $\pm$ 0.021	0.411 $\pm$ 0.064	1.14
0.1320	0.130	1.261 $\pm$ 0.022	0.433 $\pm$ 0.070	1.12
$\chi^2 < 2$	0.120	1.257, σ =0.025	0.354, σ=0.058	<2
$errGP < 0.05$	0.120	1.281, σ =0.020	0.321, σ=0.055	3.2, σ=0.7

For estimation of the systematical errors due to ambiguous solutions the following procedure was applied (the same as in Note-2):

1. In each mass bin one solution was chosen randomly at large numbers $\simeq 10^3$ combinations
2. The a_2 resonance mass was fixed as 1320 MeV/c^2 and width as: 110, 120 and 130 MeV/c^2
3. The simultaneous fit of intensities of D^+ and P^+ waves and phase difference was done in mass interval $1.1 < M(\eta\pi^0) < 1.74$ GeV/c^2.

Fig. 1 shows mass of π_1^0 resonance if width of a_2^0 resonance is fixed as 110, 120 and 130 MeV/c^2; Fig. 2 the same for width of π_1^0; Fig. 3 the same for χ^2 distributions.

2.*TRC: " We still have some questions about the MDF analysis method. For example,* *on page 4 of Note2 you report chisq/dof around 1.2 using the average of the ambiguous solutions, but the fits to individual random selections of PWA results (fig 5 page 9) give much larger chisq, with none as low as 1.2. Why are these so different?"*

To check the systematic errors calculation procedure (described above) I calculated the χ^2/ndf for individual solutions: 1, 2, 3, 4, 5, 6, 7, 8 using the same **standard E852** procedure *BWfit.cc*, which I used for MDF with average solutions (Table 1). I obtained the χ^2/ndf:4.03, 2.46, 2.83, 1.80, 2.96, 2.28, 1.76, 3.56 respectively. These results seems to be distributed according with χ^2/ndf for randomly selected solutions (Fig.3). Note that if I do the same fit with average solutions I obtain less χ^2/ndf (Table 1). The error matrix of the average solutions seems to be different then in the case of the individual solutions.

3. *TRC: " As Ludmila has pointed out, the distribution of chisq values (page 9) has a long tail on it and this affects how we report the sys errors. We would like to see scatter plots of pi1 mass and pi1 width vs. chisq. Also, we would like to know what these look like, and what fig 5 looks like, if you reject fits that have large chisq (¿2 sigma). These would correspond to fits that match the resonance hypothesis well. We note that the mass and width in Table 1 of the paper do not match the peak positions or averages in fig 5 page9 of note 2. This means that the resonance parameters are correlated with chisq so we need to document that. Lastly, we would also like to see scatter plots of pi1 mass vs. pi1 width, with and without the chisq cut.*

O'K. Here are the different scatter plots (Fig.4 and Fig.5). The width of a_2^0 is fixed at 120 MeV/c^2. As for me, I don't see the clear correlations between χ^2 and the π_1^0 resonance parameters on Fig.4. Due to absence of clear correlations between χ^2 and the resonance parameters the cut on $\chi^2 < 2$ doesn't change the distributions of mass and width of π_1^0 resonance (Fig.6).

I see the clear correlation between width and its error (Fig.5, left panel). We already reported it in Note2. This correlation allowed us to reject the solutions with large errors and to cut the tail of the distribution of π_1^0 width (Fig.7).

Why do you expect that the correlation between χ^2/ndf and the π_1^0 resonance parameters allows us to distinguish the "physical" set of solutions from the "unphysical" one? We have small χ^2 not only in the case than the set of solutions fits well the resonance hypothesis but also if the errors of parameters are large and **any hypothesis** fit well. We reject this possibility by cut on the parameters errors (Fig.7).

5. *TRC: " The scatter plots and histograms requested in item 7) suggest an alternative way to determine the pi1 resonance parameters. The average values, or the most probable values, could be taken from the frequency histograms after a chisq cut. The random errors could be taken from the widths of the distributions. This would avoid averaging the amps before the MDF. The answers should be similar to your previous method but this method would be easier to explain. We would like to see these results for comparison.*

I put the mean values obtained with cuts $\chi^2 < 2$ and $errGP < 0.05$ in Table 1. All the results (fixed width 120 MeV) coincide inside the fit errors range.

6. *TRC: " 9) It looks like the label on fig 2c in the draft is wrong. It should be D-P, not P-D."*

Yes, you are right.

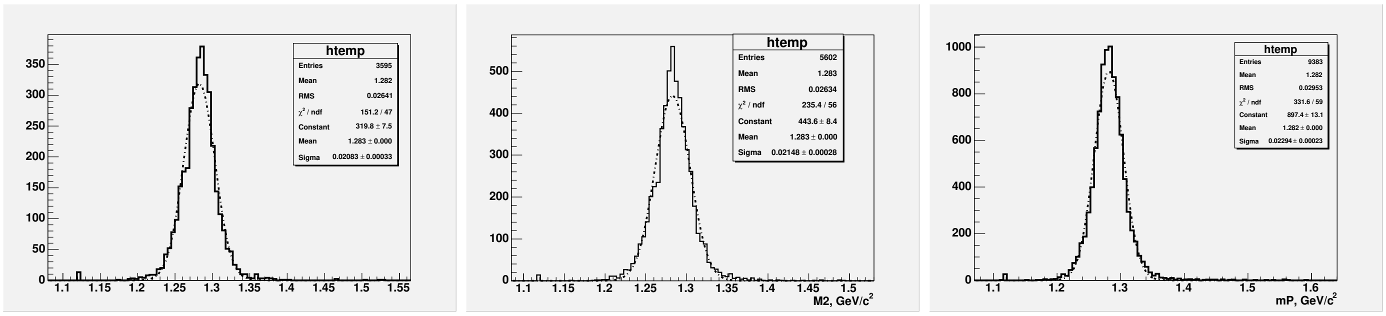

FIG. 1: Mass of π_1^0 resonance if width of a_2^0 resonance is fixed as: 110, 120 and 130 MeV/c^2;

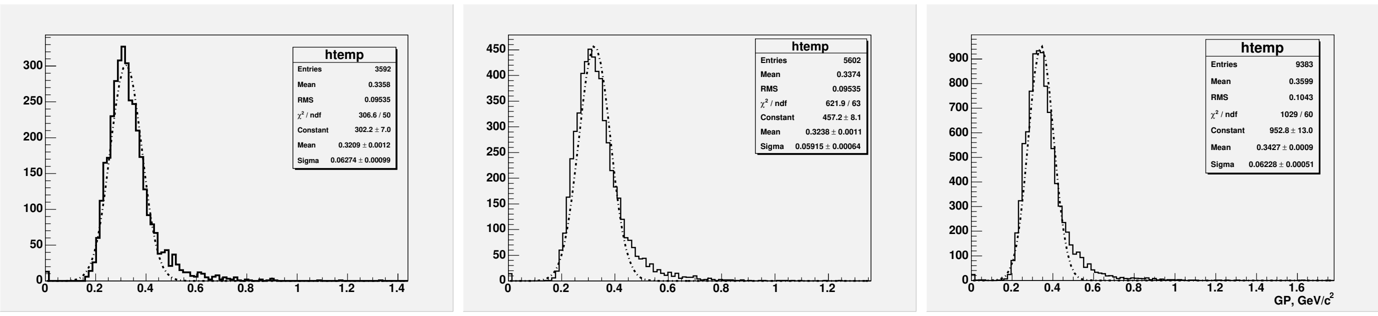

FIG. 2: Width of π_1^0 resonance if width of a_2^0 resonance is fixed as: 110, 120 and 130 MeV/c^2;

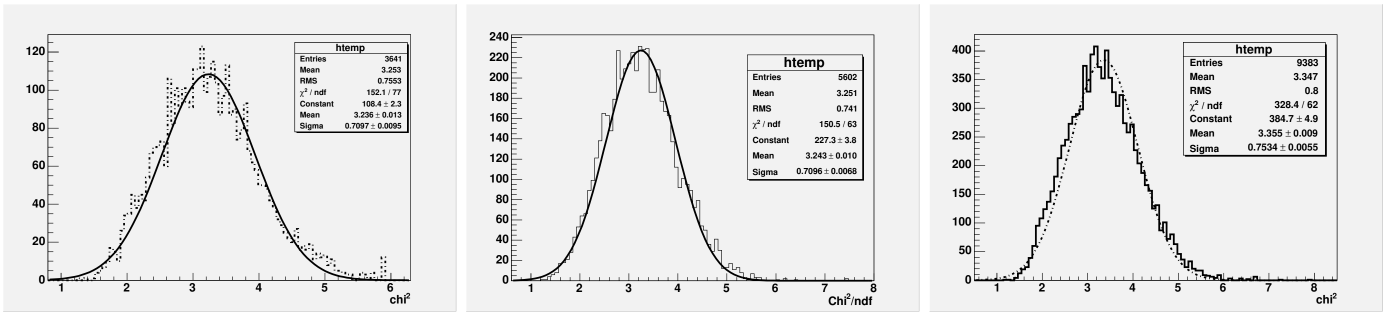

FIG. 3: χ^2/ndf of π_1^0 resonance if width of a_2^0 resonance is fixed as: 110, 120 and 130 MeV/c^2;

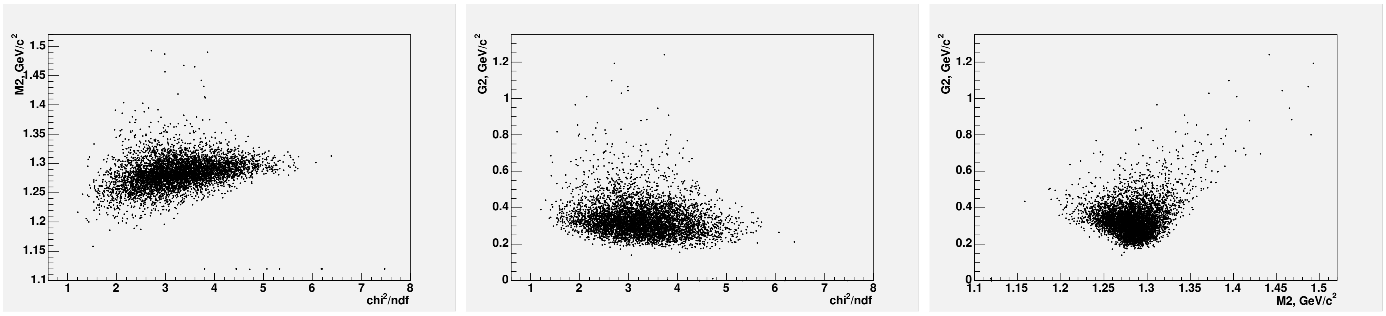

FIG. 4: From the left to right side: χ^2/ndf versus π mass, χ^2/ndf versus π width, π mass versus π width

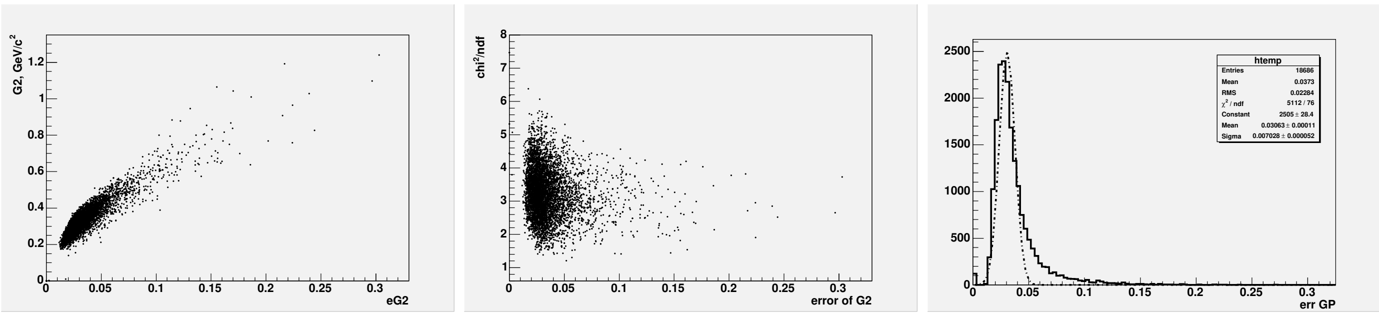

FIG. 5: From the left to right side: Error of the width of π_1^0 resonance versus its width; χ^2/ndf versus error of π_1^0 width, error of π_1^0 width

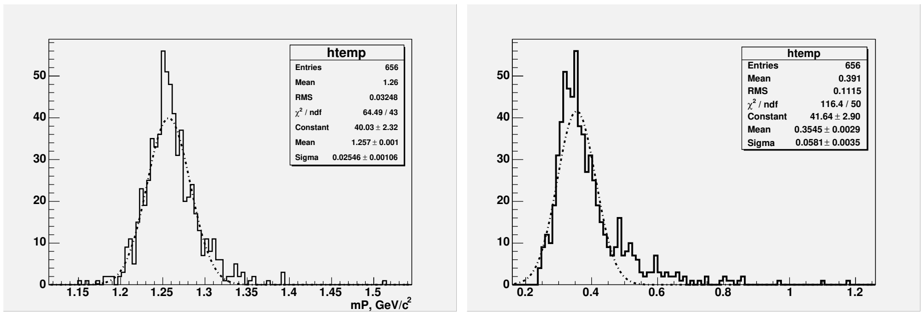

FIG. 6: Mass and width of π_1^0 resonance. $\chi^2/ndf < 2$

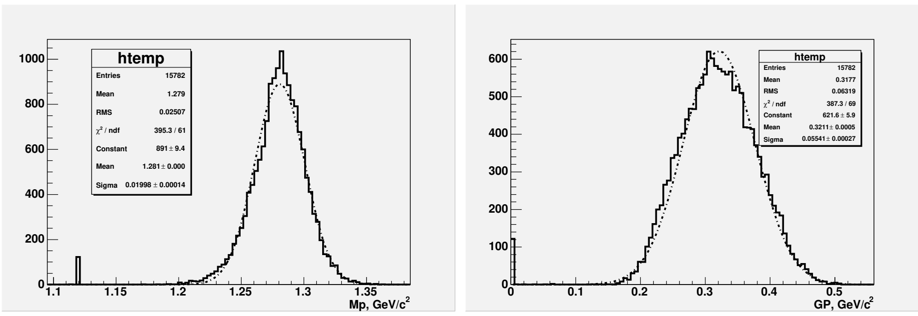

FIG. 7: Mass and width of π_1^0 resonance. $errorGP < 0.05$