

Measurements of  $\gamma p \rightarrow p \pi^+ \pi^-$  cross section with the CLAS detector for  $0.4 \text{ GeV}^2 < Q^2 < 1.0 \text{ GeV}^2$  and  $1.3 \text{ GeV} < W < 1.825 \text{ GeV}$

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### **Comments from the Ad Hoc Committee (W. Armstrong, N. Markov, M. Ripani – chair)**

#### **Overall Comments**

We all agree that the paper has much improved. This second round of questions and comments addresses a few remaining points about content and style.

#### **Comments by Whit Armstrong**

This version is a substantial improvement over the previous version. The authors have addressed almost all major issues and I would recommend they pursue publication.

That said, there is still room for improvements that go beyond typos.

The relative resonant contributions shown FIG. 20 are very interesting. One possible feature that may be present is a turning at  $Q^2 = 0.725$ . Of course the  $W \sim 1.65$  data could use some higher  $Q^2$  points to really make this something to note but because there are no associated uncertainties on this plot it is hard to know whether or not I should make anything of these fluctuations. Therefore it would be useful to assign some uncertainties: experimental uncertainties (since each point matches to data in FIG. 18) and model uncertainties.

Also, visually improving this plot would be well worth it since it is a main result. It will very likely be cited and reproduced if it looks great. Moving the legend away from the data points, or better yet, annotating the different  $W$  bins instead of a legend, would go a long way in making this plot look better.

#### **Comments on figures:**

Many figures have titles which provide redundant information in the caption. IMO it is best to leave off the titles (at the top of the graphs) unless it is really necessary.

#### **Corrections**

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line 65: "benefit from the detailed  $Q^2$  binning that is..." -> "benefit from a finer  $Q^2$  binning which is valuable for investigating the resonant structure through ..."

FIG. 3: Sector miss-spelled in titles (which can be removed; see comment above).

FIG. 4: Same as FIG. 3.

Eq. 10: Use latex math " $\tan$ "

### Comments by Nikolay Markov

There is a significant improvement in every aspect of the paper.

I have only a few comments

1. I would suggest including in the introduction some of the more general remarks, i.e. what kind of physics is being studied by investigating of the nucleon resonances and their properties.
2. "Experimental setup" is mostly devoted to the target. Is it really that important?
3. Fig. 20 – is the second from top line (triangles) partially hidden under legend?

### Comments by Marco Ripani

85 This subsequent complete analysis → The complete analysis

99 Bended → Bent

113 perhaps you can avoid mentioning that the beam was polarized, since the spin information was not used in the analysis

147 excluded from the consideration → excluded from the analysis

209 "It turned out that the CC had some inefficient zones and their map could not be reproduced by the Monte Carlo." → in fact I think nobody ever thought that the GSIM nphel simulation would reproduce reality (for that you would have needed a detailed simulation of the optics). So I would simply say, "It turned out that the CC had some inefficient zones that could not be simulated by the Monte Carlo technique as being too dependent on the detailed optical properties and alignment of the mirrors.."

214 "Thus the inefficient zones can be differentiated from the efficient zones by more pronounced few photoelectron peak. This fact was used for their geometrical separation." This is too vague. Can you provide some quantitative statement about how the differentiation was made ? Was it made by considering the average nphel ? Or what else ? We should give figures here, to make the reader understand what was done exactly.

235 " Since the Monte Carlo did not reproduce the photoelectron spectrum well enough, this cut was applied only to the experimental data, and good electrons lost in this way were recovered by the following procedure." → "Since we had no way of reproducing the photoelectron spectrum by means of a Monte Carlo simulation, good electrons lost by this cut in the experimental data were recovered by the following procedure."

318 "had been developed" → "have been developed"

328 “do not lead to the substantial” → “do not lead to a substantial”

361 “had the “normal” direction of the torus magnetic field → “used a torus magnetic field configuration”

Fig. 8 for  $\pi^-$ . Perhaps it would be better to show at least one slice in  $\theta$  (as Fig. 8b ?) showing how the fiducial cut catches the flat region in  $\phi$ . It is difficult for the reader to figure out how that works by just looking at the 2D figure as in this case it looks like the cut at forward angles could have been wider.

626-658 You should add the total number of  $2\pi$  events after all cuts, along with the Faraday cup charge, etc., total as sum of all 4 topologies and total for each topology, just to give the reader an idea about the total statistics analyzed.

Fig. 15. The upper limit 40 in the graph is cut off.

D. Efficiency evaluation. Can you calculate and report the average efficiency, averaged by the number of accepted events in each 5D cell over all accepted cells ? Together with the above total number of reconstructed events within cuts, this can give an idea of the global features of the analysis.

730 “contain many questionable cells with extremely small efficiency.” → “contain many cells with extremely small efficiency.”

E-radiative corrections. You are separating soft photon emission by the hard one based on a 10 MeV emitted photon energy cut. But when you calculated radiated event ratios in formula (14), are you selecting radiated and non-radiated events based on the same missing mass cuts applied in the analysis ? That is important as by selecting the same cut you make sure that the amount of “soft”/“hard” radiation you are estimating in the correction of formula (14) is the same as actually present in the experimental data that are subject to the same cuts.

1023 “The results, improve” → “The results improve” (remove the comma)

1048 “(and therefore a model dependence of the obtained cross sections)” → “(with a very modest model dependence of the obtained cross sections)” otherwise with the current wording it sounds like the model dependence has to be counted among the improvements.