A Search for Hybrid Baryons in Hall B with CLAS12
CLAS12 Proposal Review - Comments/Answers

May 23, 2016

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1). All the reviewers were impressed with the proposal and agreed that a very thorough job has been made in simulating the analysis and that the physics case is well made. The comments and suggestions from the reviewers are collated below

We definitely appreciate the time this committee has spent reviewing our proposal. We have done our best to address each of the points that you have raised. As well, we have also updated several sections regarding the experimental approach where further studies have made progress since the proposal was submitted for CLAS Collaboration review.

2). p7: Are there any (even simple-minded) theoretical studies that indicate that the hybrid baryons should have a comparable width to the standard N^*? Or that the photocoupling is of similar magnitude?

We have updated Section 2.3 in the proposal with predictions from the Bag Model to support the decays widths that we have used as the basis for our Monte Carlo studies presented in Section 4. We have also provided a reference to the model for the evaluation of the hybrid electrocoupling values.

3). Also could the (disputed) sightings of hybrid states in the meson sector with widths of similar magnitude to standard mesons be mentioned as a possible indication that hybrids are not expected to have large unobservable widths?

As noted in the reply to the preceding question, we have included width predictions for the model of hybrid baryons.

4). P7 Fig. 2: Should probably mention what the other curves are (maybe in the caption) so readers don't have to look up the paper.

The caption has been updated.

5). P9. 3rd para: A result similar → A theoretical result similar

The suggested change was made.

6). p13: Is there an estimated timescale for calculations at the physical pion mass to become available?

The issue with performing such calculations is not so much in redoing them at a lower pion mass, it is dealing with the instabilities of the resonances as the pion mass is reduced. In order to handle this proper, further development of the LQCD framework is required. At the present time the path forward is being considered. A firm timescale to overcome all issues is not yet clear but work in this direction continues.

7). p22 1st para: providing a nicely complementary range of measurable photon virtualities → providing a complementary range of measurable photon virtualities, including the gap region for the lower beam energy setting.

We have updated this sentence following your suggestion, but with our own wording.

8). p24 called FASTMC → (FASTMC) this had already been defined.

The suggested change was made.

9). p27 1st para: with a detection efficiency lower than in the inclusive case where the value of W_{rec} is determined → with a correspondingly lower.

The suggested change was made.

10). p32 1st para: since kinematic region -¿ since the kinematic region

The suggested change was made.

11). p38 1st para: completely dominates (this assumes the forward tagger is triggered on charged particles i.e. ignoring the photon flux - text is probably OK as is though)

There are a number of issues tied in with your question regarding the operation of the FT and its performance in a realistic beam environment at the nominal CLAS12 luminosity. We do not want to get into this in the proposal and are most comfortable leaving the text as written.

12). p38 3rd para: the farm → a CPU farm

The suggested change was made with a slight change in the wording employed.

13). p43: These ratio → These ratios

The suggested change was made.

14). FASTMC is an important part of you studies. Could you provide some more details on it?

It is odd that for a program that has been used by so many proposals for their modeling, there is no CLAS-Note or CLAS12-Note describing this program. We have therefore added

some further description in Section 4.3 where we first mention the FASTMC program.

15). Figs. 4,5,6: what are the solid lines?

We have finalized these figures and updated the figure captions. The curves shown are a fit to the data points.

16). P.21, Fig 12. In the text it says that positive torus current causes increase in minimum detectable Q^2, while negative current lowers the minimum values. Fig. 12 shows that in both cases minimal Q^2 is about 0.2 GeV^2. Could you clarify?

This discussion was needlessly obtuse. The discussion has been updated.

17). P. 48, Eq 8, last line: $105\cos\theta \rightarrow 105\cos^2\theta$.

This typo has been fixed.

18). Fig 15, right. What are the dots?

Actually the black points are the computations of the JM15 model where the data exist. The caption has been updated.

19). Fig 20. How do you select exclusivity cuts?

These are just cuts somewhat arbitrary chosen at $\pm 3\sigma$. The final choice of cuts will depend on the final event selection cuts employed and the backgrounds that are present.

20). Figs. 25, 26: The depletion at 35° is much more prominent for p and K^+ than for π^-. Could you clarify why?

There was a problem with the set of reconstructed figures for both Figs. 25 and 26. We have now replaced these plots. They should make more sense now. The π^- are typically emitted at large angles and mainly populate the central detector.

21). Since the full proposal is presenting such detailed studies of proposed analysis and running conditions, it will be nice to see somewhere a short "executive summary" where with tables or simple statements there will be details of the overall proposal : i.e. most important expected physics outputs and effects in hadron structure models, specific running conditions (i.e a table including triggers and effects on other parallel programs in CLAS12), expected more difficult points on the analysis-model dependencies, backgrounds, ambiguities, acceptances ..... and so on.

What we had intended as an "executive summary" was labeled as "abstract". We have simply changed the label. An complete "executive summary" for the run group is being prepared that will serve as a cover letter summarizing the three different proposals that are

part of this run group. We felt that including that information within this proposal was not the appropriate place.
