Daniel CARMAN

General:
 - In most of your figures the labels on the plots and the axes are too small.
   - Fig. 1: increase size not only of the labels but also the line thickness
DONE
   - Fig. 4: increase size of plot titles and axis labels/numbers
DONE
   - Figs. 5, 6, 7: increase size of axis labels
DONE

DONE - Be consistent with how you list the final state. You have all of the following combinations: e^+e^-p', e^+e^-p, $p'e^+e^-$, and e^-e^+p.

DONE - Be consistent with usage of "cross section" vs. "cross-section". We keep the hyphen only in the sentence « cross-section ratio », as in this case « cross section » works as an adjective.

DONE Page 1:
 - Line 29. Use "(Ffs)".
DONE
 - Line 30. Use "(PDFs)".
DONE
 - Line 32. Use "... FFs and PDFs [2].".
DONE
 - Line 40. Use "... experimentally. Deeply Virtual Compton Scattering ...".
DONE
 - Line 44. Use "... process, Timeline Compton ...".
DONE
 - Line 55. Use "... applies (see Fig. 1, left). The ...".
DONE
 - Line 62. Use "... apply to the other GPDs E, \tilde{E}, and \tilde{H}."
DONE
 - Line 65. Use "... state (see Fig. 1, right).".
DONE

Page 2:
DONE - Line 81. Use "As presented in Refs. [15,16], the BH contribution dominates over the TCS contribution in the total cross section by two orders of magnitude in the kinematic range accessible at Jefferson Lab (JLab).".
This is the notation adopted in the original article, that we refer to, so we would like to keep it for consistency - Line 92. What the meaning of the "--" superscript on M? This is pretty cumbersome notation if it does not have any meaning.
DONE - Line 108. Begin a new paragraph with "In this work, two ...".
DONE - Fig. 2. This figure is confusing to me. What defines the plane containing the p'? You need two vectors to define a plane?
Added some explanation in caption
Circularly polarized beam, unpolarized target, added now in the text - Eq. 5. What is the meaning of the "circle-dot U" subscript on the asymmetry? Again,
   this is pretty cumbersome notation if you do not explain it to the reader.

DONE - Line 121. Use "... and allows access to the imaginary ...".
DONE - Line 122. Use "Here the superscript $+/-$ stands for ...".
DONE - Eq. 6. You have changed notation here compared to Eq. 5. In Eq. 5 you used "sigma" for the cross section. In Eq. 6 you used "dsigma". Was this intentional? What does it mean?
We have now put d\sigma everywhere, to be consistent. It means that the cross section can ideally be differential. In our case we are limited by statistics, so we must integrate on most kinematic variables.

REPLY HERE WITHOUT CHANGING THE TEXT - Eq. 6. I find your notation confusing. Doesn't F mean 0 deg to 90 deg and B 90 deg to 180 deg? For the different F/B

terms you are integrating over these angular regions. Your notation in Eq. 6 looks like you are referring to fixed angles and not an integration.
Having infinite statistics, in principle the FB asymmetry could be computed for given, exact, values of theta and phi. In reality due to our limited statistics we must integrate over angular regions (defined in the second column of page 4), both in the F and B directions. We do not take the full ranges 0-90/90-180.

DONE - Line 131. Use "... coverage of the detectors, compared ...".
DONE - Line 141. This is the first time that you have mentioned that your photons are not real but quasi-real. It seems to me that you should introduce this notion earlier to explain the concept to the reader. Added « with quasi-real photon beam » the first time we introduce the measurement, at line 48.
DONE - Line 143. Use "... one positron, and one proton.".
DONE - Line 158. Use "... = v/c$, where v is ...".

Page 3:
DONE - Line 169. Use "... to ensure kinematics in the quasi-real ...".
DONE - Line 171. Use "... photon were determined ...".
DONE - Line 173. Use "... of the final state proton ...".
DONE - Line 175. Use "... electron were constrained ...".
DONE - Line 190. Use "... ϕ, and J/ψ ...".
DONE - Line 193. Use "Bethe-Heitler".
DONE - Line 194. Use "normalized".
DONE - Line 207. Use "{\it e.g.}"
DONE - Line 208. Begin a new paragraph beginning with "The photon polarization ...".
DONE - Line 210. Use "statistical uncertainties.".
DONE - Line 218. Use "... polarization P_{trans} that can be calculated analytically
...".
DONE Note I also suggest to use P_{trans} and not $P_{trans.}$ here and in Eq. 9.
DONE - Line 245. Use "... shift was calculated ...".
DONE - Line 247. Use "This procedure was necessary ...".
DONE - Line 251. Use "... associated with the binning ...".
DONE - Line 252. Use "... and with the rejection of ...".
DONE - Line 260. Use "... than the statistical uncertainties, typically ...".

Page 4:
DONE - Fig. 4 caption. Line 2. Use "t-bins".
DONE - Line 272. Use "t-dependence".
DONE - Line 274. Use "t-dependence".
DONE - Line 276. Use "... calculations were performed ...".
DONE - Line 281. Use "... models, while BH-only ...".
DONE - Line 298. Use "... was computed for each $-t$ bin as:".
DONE - Line 299. Add a comma after Eq. 10 for proper punctuation.
DONE - Line 300. Use "... in the forward/backward angular bins, ...".
DONE - Line 310. Use "... systematic uncertainties by computing ...".

Page 5:
DONE - Fig. 6. You mention the solid curve in the caption. What about the other curves? Referred to caption of Fig. 5, and done the same for Fig. 7
DONE - Line 344. Use "... parameterizations that appears ...".
DONE - Line 358. Use "Timeline Compton Scattering".
DONE - Line 360. Use "... forward/backward asymmetries ...".
DONE - Line 361. Use "... non-zero, providing strong ...".
DONE - Line 379. Use "... ultra-peripheral collisions ...".

Refs:
DONE - Use {\it et al.} throughout.
DONE - [18]. This is the only reference where you are listed authors last name first and then initial. Be consistent with the style of your other references.
DONE - [19]. Use "Phys. Rev. D".
DONE - [20]. Use "Nucl. Phys.".

DONE - [40]. Use "Phys. Lett. B".
DONE - [43]. Use "Eur. Phys. J. C".
DONE - [49]. You should not list a bunch of names and then follow it with an "et al.". The purpose of "et al." is to replace the bunch of names.

Dear Pierre,

I have read through the draft of your CLAS12 paper on TCS targeting Phys. Rev. Lett. and have several minor comments.

1) Your Fig 3 shows the invariant mass'?'?spectrum with three visible signals of \omega/\rho,\phi, and J/psi vector mesons.'?'? There is one more signal around 2.6 GeV.'?'? Can you clarify who'?'?this guy is, if possible?

It is a statistical fluctuation. There are roughly 20 counts in that bin, so fluctuations are likely.

2) Your Figs 5 - 7 show asymmetries while your fig captions indicate "BH amplitudes contributing to the cross sections". It is unclear how it works.'?'? Then the symbols'?'?(red open triangles) may indicate that BH is data.'?'? Then what horizontal'?'?bars mean?
It means that the we ran the simulation including only the BH process (no TCS). Therefore the cross-section weight that is applied to the reconstructed event contains only BH.
We have now simplified the sentence: « The red triangles show the asymmetry computed for simulated BH events. »

The horizonthal bars are defined in the caption of Fig. 5.

3) Finally, for the same figures you show predictions using different models.'?'? I am sure that the authors generated predictions upon your request.'?'? If that is the case then they deserve acknowledge
DONE « Our acknowledgements, at the end of the article, start with thanking the three theorists that helped us. We have added an explicit mention to the model curves they produced. »

Thanks, Igor

Igor Strakovsky

Dear Pierre, Silvia, Stepan,

Congratulations on this result and a well-written manuscript. I really enjoyed reading it. I hope the following comments are helpful as you make final preparations for submission.

Best of luck for a speedy trip through peer-review,
Axel

- There's a slight mismatch between the plurality of the acronyms: FF, PDF, GPD, and CFF. On lines 29 and 30, you define the plural terms "form factors" and "parton distribution functions" with singular acronyms FF and PDF. You use a different convention for "GPDs" and "CFFs." It would sound better to me if it were "FFs" and "PDFs".

We believe we have now applied the same convention (singular or plular whenever necessary) for all kinds of distributions.

- Since the discussion and summary make a big deal of the "D-term," I think that you might consider introducing it and its role to the audience in the Introduction.

The sensitivity of Afb to the D-term was not one of the initial motivations driving this measurement, we found out about it when comparing our measurement to model predictions. Given the limited space available (and we have currently reached the maximum length limit for PRL), we prefer to leave the D-term part out of the introduction, mentioning it at the end as a « cherry on the cake » 😊

- The topic sentence for the paragraph beginning on line 63 introduces BH. The next sentence doesn't seem to follow. Maybe that sentence could move to the paragraph above.

DONE

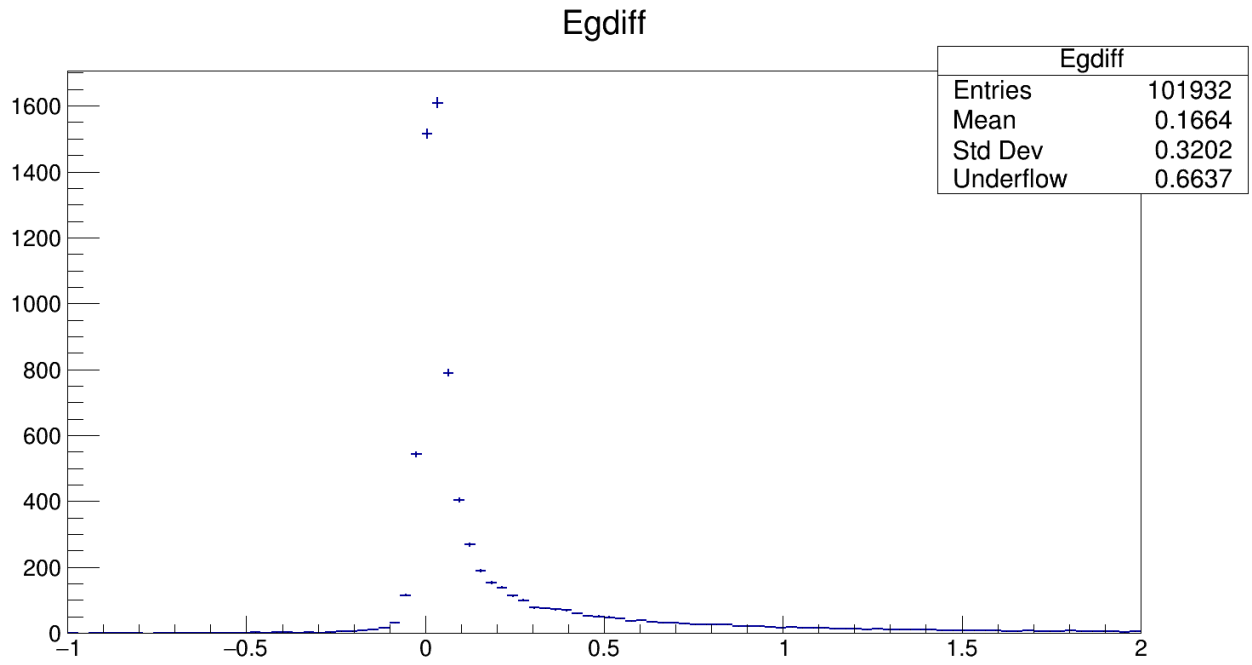
- On line 82, I recommend changing "...the total cross-section over the one of TCS by two orders of magnitude." to "...the total cross-section over that of TCS by two orders of magnitude" to make it easier to parse and avoid number confusion.

Sentence already corrected by D. Carman.

- Since the photon energy and Q^2 are determined from the kinematics of the final state particles, I'm a little curious about what resolution you can achieve. I'm also curious what that implies for your determination of the photon polarization. I didn't read the analysis note, so if these are non-issues, feel free to disregard.

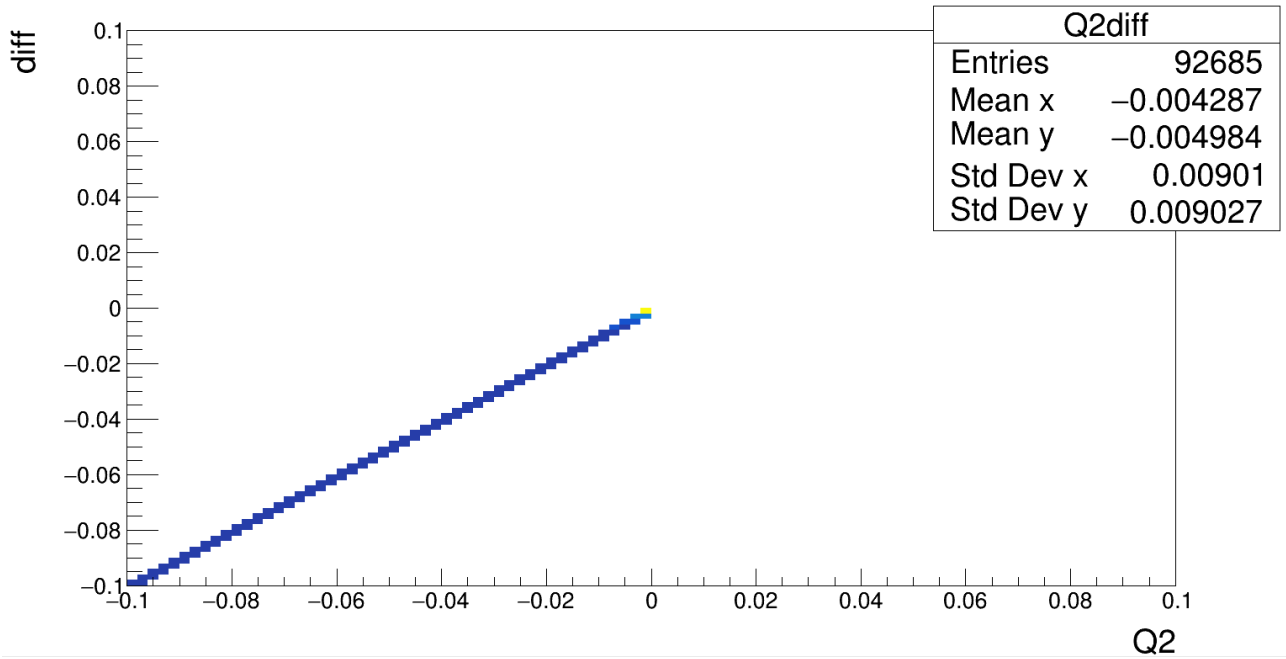
For the determination of the polarization, the method is described in the analysis note (and it can be found on the analysis-review web page). There is roughly a linear dependence between photon energy and beam polarization.

Concerning resolutions, here is the resolution from simulations on Egamma :



If we consider the standard deviation (0.32 GeV) and our average Egamma (7.29 GeV), it means ~4% « relative » resolution. Given the linear dependence, we can assume a similar impact on the value of the polarization. 4% is negligible vs the total systematics, which are of the order of 10% for the photon polarization asymmetry.

Here below is the resolution on Q2, from simulations, as a function of Q2.



The standard deviation of the difference is small (0,009 GeV^2).

We integrate on Q2, and we select events for Q2<0.15, which is well above the resolution. So we believe that the resolution on Q2 has no impact on our analysis and results.

- Line 344 "which" -> "that"

DONE