

## Answers to Reviewers' comments:

Reviewer #1: The results on azimuthal asymmetry in dihadron production are a continuation of previous work from the COMPASS Collaboration. However, the precision is greatly increased and combination with previous data improve the final results even further. With the increased precision, the comparison with the two theories is far more definitive than in the previous publication with Bacchetta and Radici clearly preferred over Ma et al.. The comparison with the Collins asymmetry also brings out new and interesting physics. However, I do have a few comments and questions which need to be addressed. I also have some minor comments to help improve the manuscript. Given the above, I recommend the manuscript for publication in Physics Letters B after a minor revision and answering of my questions.

### Questions / comments

- Section 1, para. 2, second last sentence. I do not know what "correctly" means but would be happy to remove the word.

**Done**

- Section 1, last line. The statistics increase by "four", but in the abstract it was "three" ? Then in results, the number is  $3.5 \times 10^7$ , but the previous paper for NH3 had  $5.8 \times 10^6$ , i.e. a factor of 6 difference, so I am confused by all these different numbers.

**For NH<sub>3</sub> the old paper quoted  $10.9 \times 10^7$  for 2007. 2010 data is a factor 3 larger than 2007 giving an overall factor 4 between 2007 and 2007+2010. We have modified the abstract accordingly.**

- Section 3. In the previous paper, there was a cut on  $M_X > 2.4$  GeV and here on  $E_{miss}$ . Why the change ?

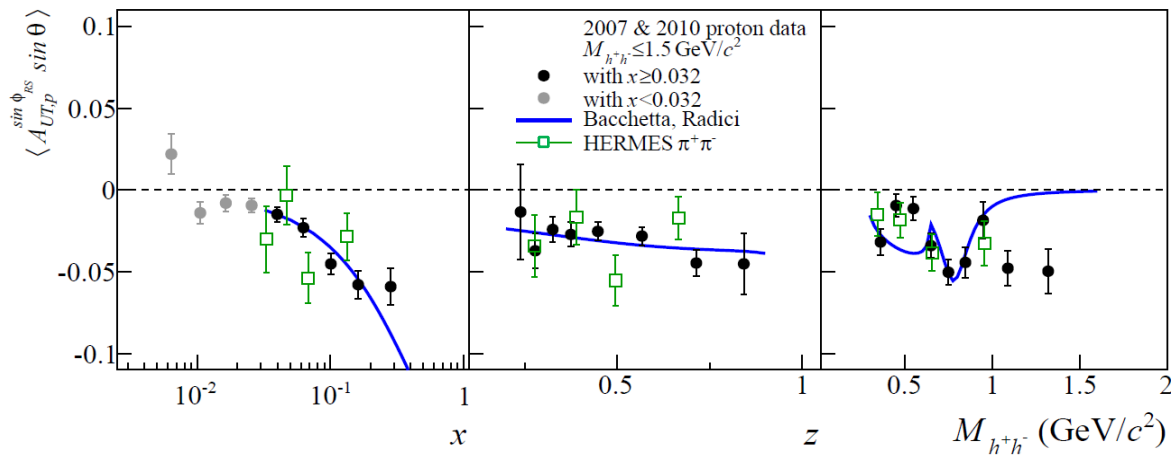
**The two cuts are equivalent ( $E_{miss} = (M_X^2 - M_p^2)/2M_p$  in the reaction  $\ell p \rightarrow \ell' p_{h1} p_{h2} X$ ) and therefore there is no change in the analysis between this article and previous published paper (this also to answer your comment concerning different systematics between 2007 and 2010).**

- Section 4. The comment about HERMES would be better made if their points were shown, so I recommend adding them to the COMPASS plot.

**The reason why the HERMES data are not shown in the plots is twofold:**

- Their published data are on identified pions
- We evaluate gamma-nucleon asymmetries while Hermes published lepton-nucleon asymmetries (with in addition a change of sign due to an extra  $\pi$  in the definitions of the modulation).

**To be able to show the results on the same plot we will have therefore to scale Hermes points by  $\langle 1/D_{nn} \rangle$  and change the sign of their asymmetries; something we prefer to avoid in a paper. Nevertheless hereafter a modified version of Fig.5 with Hermes points in is shown; as you may see the agreement is quite good, even if the precision of COMPASS points is much larger.**



- Figure 5. How are the systematics combined in the combination of the data sets ? The resulting systematics look like those from the recent data. However, I would expect some differences given there we some differences in procedure, e.g. the  $M_X/\text{Emiss}$  cuts.

**The combined result is given by the weighted mean of 2007 and 2010 data, using the statistical and systematic errors added in quadrature as weights. After this the total statistical uncertainty is subtracted back in quadrature to obtain the systematic uncertainty. For this reason it is correct to say that the 2010 data dominates both the statistical and the systematic errors.**

**We would like to remind that we have not observed systematic effects in the studies performed and therefore we only quote an upper limit that is proportional to the statistical error of the data.**

Minor

- Section 1, para. 2, l.3. "... In this reaction, a new ... function appears ..."

**Done**

- Section 1, para. 2, second last sentence. "... using existing ..."; no need for "presently".

**Done**

- Section 1, the formatting changes: paragraphs are indented and then not.

**Done**

- Section 3, para. 2, second sentence. "... and the average transverse polarisation ...". Adding "transverse" helps here (if that is what is meant) as the longitudinal is also 0.8, so you think you are reading the same thing twice as is.

**Done**

- A few lines later. "... compensate for acceptance ... up in the opposite direction ..." makes it clearer if that is what was meant.

**Done**

- Section 4. " $x > 0.03$ " -> " $x \geq 0.032$ " as in figure and no need for rounding.

**Done**

- Line later. "... work have higher ..." rather than "show".

**Done**

- Section 4, "COMPASS were calculated" -> "COMPASS was calculated".

**Corrected**

- Figure 5, caption. "cureves" -> "curves".

**Corrected**

- Section 5, para. 3, last sentence. "... such a correlation ..."

**Done**

- Ref. 10 looks strange with a "%" sign.

**Corrected**

**Finally, in a footnote before the conclusions, we cite a recent publication on the same subject:  
"After finalizing the present paper, a new publication appeared [42] reproducing with Monte Carlo calculations the observations of this section."**