**Valparaiso University group comments:**

On behalf of the Valparaiso University group we offer our congratulations to the authors on this interesting study of Transverse Single Spin Asymmetries using both neutral pion production and jet production. As you noted clearly in the paper these measurements should help to inform our understanding of the fundamental processes giving rise to these observations that do not match current theoretical models in several different ways.

The following are our suggested edits, comments, and questions that we hope will ultimately make this generally well written manuscript even better. The preceding numbers are the corresponding line numbers in the paper.

One general comment: To be consistent throughout the paper we suggest that you say "transversely polarized proton-proton collisions" instead of "proton-proton collisions" or "polarized proton-proton collisions in each instance where it is appropriate. We have tried to point out the relevant instances, but we are not sure about its application for each instance in the Introduction except where you refer to your measurements. Please use it where relevant.

Done

2: "transversely polarized proton-proton collisions …”

Done

129: is found => was found

Done

142: “can be” => “have been”

Done

166-167: This function is no doubt correct, but it contains variables/parameters that are not defined: k, k\_perp, M, 1T (also seen in line 159 as part of the represention of the Sivers funiction. Both instances have associate references so the reader can search these out and, if these are not used later, that if probably OK.

The references have full information and they are not used anywhere else in the paper, so we just kept them.

170-172: Should this have a reference?

Done

193: an asymmetry => the single-spin asymmetry

Done

194: is => was

Done

207: transversely polarized proton-proton

Done

240: "density" is ambiguous. It may refer to the composition of the scintillator blocks or the number of blocks per unit area perpendicular to the beam. Assuming this means the latter we suggest "differ in size and density of blocks.”

It was referring to material density and changed as suggested in the new version.

240: The use of alternative terms presumably to refer to the same thing is unnecessarily confusing.  The detecting elements in the FMS are the "lead glass blocks", a.k.a. "blocks".  In the next sentence you refer to these blocks as "towers" without makng the connection.  Then, only a few sentences later these are referred to as "cells".  Why the changes?  If you do not want to use "blocks" consistently we suggest that you choose between "towers" and "cells" as being synonymous with "blocks".   For example on line 240 you could write:  "The blocks or towers closer ..."  Then, following this keep "towers" and don't introduce "cells" as an alternative.

Used towers for all cases in the new version

281: “thresholds of …” => “thresholds for …”

Done

282-287: We do not understand the meaning of the different thresholds as noted by the separating "/" marks. What are the different thresholds supposed to be for?

They represent multiple thresholds for a single trigger. For example, Jet patch trigger has two energy thresholds: JP1, JP2 in 2011. To make this more clear, we modified the 1st sentence in this paragraph as (Line292 in the new version):

“Different $E\_\mathrm{T}$ thresholds were applied for each trigger including the same type of trigger.”

311: "FMS -- cluster ..." => "FMS: cluster …"

Done

332: ".. and other cuts for the pi0 candidates." => ".. and other cuts for the pi0 candidates descruibed below.”

Done

342: "... signal fractions ..." => "... signal fraction ..." You determine the signal fraction (singular) in each of the two regions.

Done

346: "The signal and background shapes for the pi0 mass distribution ..." => "The expected signal and background shape parameters for the two-photon invariant mass distribution …"

Done

347: "... in each energy bin ... " => "... in each pi0 energy bin … "

Done

348-349: "The parameters of the shape functions are allowed ..." => "The parameters of the skewed Gaussian functions are allowed …"

Done

Fig. 2: “proton-proton collisions” => “transversely polarized proton-proton collisions”

"0.3 GeV/c2), which is used for…” Remove the comma after“),”

Done

368: should this be “transversely polarized proton-proton event …”

No. PYTHIA can only do unpolarized simulation.

Fig 3. “polarized proton-proton” => “transversely polarized proton-proton”

Done

395: Equation 3 is missing.

It is below line 400 and Eq. (2).

438-440: What "nature of the pi0 reconstruction algorithm" makes a background subtraction either unnecessary or impossible or inadvisable? Are you expecting the reader to be sufficiently insightful to understand that?

A: We modified the sentence to “For this way of $\pi^0$ reconstruction, we do not perform a background subtraction for the Collins asymmetry. The possible influence from background is studied through the mass dependence of the asymmetry as discussed in Sec. IV-D”. See L474-478 in the new version.

455-461: So, what uncertainty are you using? The initial values that apparently seem too large or some other corrected values? A sentence addressing this here would be helpful.

The value of the uncertainty is in the next paragraph. To make it more clear, we also added two sentences at the end of 2nd paragraph in that sub-section, i.e., Sec. III-A., **Lines 512-516 in the new version:**

“In summary, the uncertainties of $x\_\mathrm{F}$ and $p\_T$ for $\pi^0$ TSSA are 4.4~\% for 500~GeV and 3.0\% for 200~GeV data. The jet TSSA is also presented versus $x\_\mathrm{F}$ in next section, and the $x\_\mathrm{F}$ uncertainties are 7.8~\% for 500~GeV and 8.5~\% for 200~GeV data.”

474: presumably this should read "pi0 energy/jet energy”?

Done

486: We are not familiar with this wording using "drawn"? An alternative: "is not included in the final results." If that is not a suitable alternative we do not know what you mean to convey to the reader.

This sentence is modified accordingly. See lines 511-514 in the new version.

489-504: This section would be helped by a figure showing the energy spectrum of reconstructed jets to which you are referring.

It is shown in the analysis note in page 71, we think it is too trivial to be included in the paper.

546: "TSSA in 200 GeV" => "TSSA for 200 GeV”

Done

555-556: It might be nice to show the background asymmetries rather than simply say that they are consistent with zero. This would show how well the data support that claim.

These plots can be found in pages 82-84 in the analysis note. We think it is a bit trivial to show in the paper, so not included.

567-568: This "saturation" may be a bit of an overstatement after seeing the figure. For all three x\_F the data from 200 GeV are still rising over the full data range. At 500 GeV the limited data are, within errors, nearly consistent with uniform A\_N over the full range. So, these data really do not show the rise in A\_N that you claim and the notion of saturation may not be relevant.

OK, we removed that sentence in the new version.

571: should this be “transversely polarized proton-proton collisions …” ?

Yes and done

589-590: "...shows that the mean transverse momenta in the region of x\_F< 0.4 ..." => "...shows that the mean transverse momentum as a function of x\_F in the region of x\_F < 0.4 …”

Done

Fig. 6: "Comparison of the transverse single-spin asymmetry as a function of Feynman-x for inclusive …" => "Comparison of this measurement of the transverse single-spin asymmetry as a function of Feynman-x for inclusive …"

Done

614: "... considered isolated ..." => "... considered to be isolated

…”

Done

632: " transversely polarized proton-proton collisions …”

Done

645: should this be “transversely polarized proton-proton collisions…” ?

Done

658: "than the pi0 one" => "than the pi0 ones”

Done

676: "2011 in transversely" => "2011 with transversely”

Removed “taken in 2011” in the new version.

Fig. 9: It would be helpful to have a line drawn across the figure at A\_N = 0.

Done

688: "of particle's" => "of a particle's" presumably this is to be singular. If not, then you must write "of particles’ "

Done

700-703: "The value of this cut was balanced between the benefit of excluding those events with large uncertainty and the loss of statistics..”

Done

708-715: First, when you say "A study of this region" we do not know to what region you are referring. You speak of two regions: one < 2 GeV/c^2 and one > 2 GeV/c^2. To what region are you referring when you write "A study of this region"? Second, we find your observation that the asymmetry of the background and the pi0 signal are "very similar" to be surprising if I understand what you mean by "background". If the background is obtained by combing two photons that are not a decay-pair from a pi0 decay but a random combination of two photons in the jet why would it be reasonable to expect that these background events would exhibit an asymmetry that it "similar" to the asymmetry from the real pi0 events?

The first point is now cleared in the new version.

On the second point, it is possible that two photons from pi0 decay are separated into two pi0 candidates with different mass, and each one can contribute to the expected asymmetry in some level. So, it is not surprising that current asymmetry results do not show clear difference for signal and background, in particular in the sense that they are both consistent with zero within uncertainty.

The sentence is modified to (L747-750 in new version):

“A comparison of the Collins results in the region of (0, 0.2) GeV/$c^2$ and those in the region of (0.2, 0.3) GeV/$c^2$ did not show a clear mass dependence in both data sets.”

738-739: "… proton-proton collisions, and inlcuded also previous forward ..." => "… transversely polarized proton-proton collisions that include previous forward …"

Done

740: "The calculatoins are adopted for ..." => "The calculations are adapted for ..." "adopted" means "selected" or "chosen" from a selection already available. Or, were the calculations modified to match your kinematics? I don't know which it should be. Just be sure to choose the right word.

The calculations are indeed modified to match our kinematics, i.e., obtained from authors after providing them the exact kinematics of our data.

748: Please fix if needed after dealing with my earlier question regarding Fig. 5 on page 8.

We drop saturation statement and the sentence is modified as (L786-788 in new version):

“the calculations show the same trend of asymmetries rising with $p\_\mathrm{T}$ as the data, but the magnitude of the predicted asymmetry is much smaller than the measurements.”

772: We propose changes to this section to put the discussion into the correct tense.

Done as following the suggestions in below.

775: Suggest using “transversely polarized proton-proton collisions”

Done

776: is done => was done

Done

778-779: "was found comparing ..." => "was found when comparing …"

Done

783: are also => were also

Done

786: are measured => were measured

Done

794: "transversely polarized proton-proton collisions …"

Done

802: can not -> cannot

Done