# **Referee Report on**

## Precision Measurements of A<sup>n</sup><sub>1</sub> in the Deep Inelastic Regime by the JLAB HALL A Collaboration

## submitted to PRL

### General Comments:

The paper discusses a measurement of the double spin asymmetry  $A^n_1$  at relatively high x. The statistical precision of the data is comparable to earlier world data. As the data cover no new kinematic regime as x above 0.5 they don't provide new possibilities to test the predictions of several models that the d-quark polarization goes to 1 for  $x \rightarrow 1$ . The test of these models need high precision data at x>0.5, which are not provided in this paper.

In the following several points are listed, which should be addressed before the paper is published in any journal.

- 1. It is very surprising that the RHIC W-data, which are the cleanest way to access light quark polarizations are not even mentioned not is there sensitivity to the d-quark polarization discussed.
- 2. The paper does not discuss any momentum / x-resolution discussed, neither are the data unfolded for the detector resolutions and the radiative corrections, which don't factorize. This has been shown in many papers by the HERMS collaboration.
- 3. It is very surprising that only LO models are used, despite the fact that several modern polarized PDFs exist in NLO since years. It is requested to include at least one NLO prediction in Fig. 1 and 2. including their uncertainties.
- 4. Has any of the theoretical predictions shown an uncertainty, if yes they need to be included in the figures, if not, the paper should give the reader an idea about the uncertainties possible in the different models.
- 5. As pointed out the result on the u-quark polarization is basically completely dominated by earlier proton measurements not part of this paper.
- 6. The paper lists several different models, but does not make clear for the non-expert reader what the consequences would be for our understanding of spin physics, if one of the models is ruled out or proven correct. An answer like there is OAM in the wave function of the proton is insufficient as this is know from the moment the polarized splitting function came out different to the unpolarised ones, or many other effects. The referee does not believe there is any possibility to get any qualitative measure of OAM from an inclusive DIS measurement.

Due to all the above listed points and that the paper does not represent any new information compared to earlier measurements, not does allow to rule out any of the different models publication in PRL cannot be recommended. It is suggested that the points are addressed and the paper is resubmitted to PRD or PRC.

### Some Specific Comments:

**line 64:** Reference 3 should be updated with Phys.Rev.Lett. 113 (2014) 012001 **line 77/78:** which in the infinite-momentum frame equals the fraction of the nucleon momentum

carried by the struck quark. This is only true at LO, this should be made clear.

**line 119:** should it not read  $A^n_1 \rightarrow 0 < 0$ 

line 126: there is a space missing after 0.6

line 148: the term "on double-spin electron-nucleon asymmetries" sounds strange.

Fig 1 & 2: the systematic uncertainties should be explicitly discussed. It should be pointed out how they are shown and which ones are shown.