Dear Analysis Review Committee,

Thank you for all your work on the analysis note. To respond more efficiently we are sending you answers to some of the 'large' questions sooner than the rest to avoid repeating any later work. The committee statements are in blue below and our response follows.

We have come up with a first set of comments on your paper. Apologies - it is a fairly lengthy list. Please let us know if anything is unclear or if we should try to set up a meeting to discuss. I think a major point we have to solve first is to get a handle on what range in Q^2-p_miss-theta_pq you are trying to average over, and how this averaging is done both for radiative corrections and comparisons with models.

The Q^2 distribution that we are averaging over for the two, 2.6-GeV data sets is shown in Fig. 1 below (which reproduces the top two panels of the right-hand column of Fig. 23 of the analysis note). We do not show the third E5 data set since the statistics for extracting

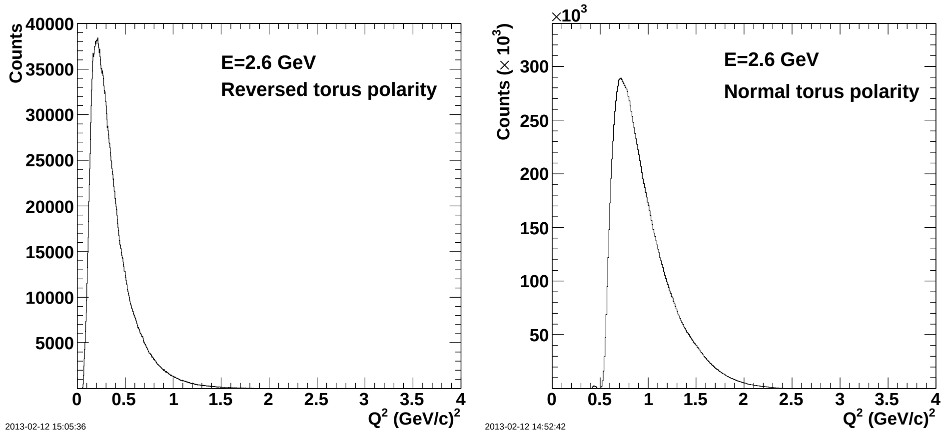

Figure 1: Distribution of Q^2 for the reversed-torus-polarity data (left-hand side) and normal-torus-polarity data (right-hand side).

A'_{LT} are poor. The range of θ_{pq}^{cm} that we average over in the data for each value of p_m is shown in Fig. 2 below for the two data sets at 2.6 GeV with opposite torus polarities. The quantity θ_{PQ}^{cm} is defined the same way as θ_{pq} except it is in the center-of-mass frame where the total momentum of the final proton-neutron pair is zero. The quantities θ_{pq}^{cm} and p_m are extracted from the measured properties of the scattered electron and proton. The cuts are the same ones used to select events to extract A'_{LT}. At each value of p_m there is a range of angles contributing to the asymmetry which reflects the ranges in Q^2 and in x_{Bj} (Bjorken x).

We first discuss our method for averaging over the kinematics for the comparison with the model from Jeschonnek and van Orden (JVO). We start with the calculation of the asymmetry A'_{LT} which is a function of Q^2, p_m, and x_{Bj} and indirectly depends on θ_{pq}^{cm} (we discuss this connection explicitly below). We use the same kinematic quantities as JVO. We have calculations of A'_{LT} for fifteen values of Q^2. For each Q^2 point we have, in turn,

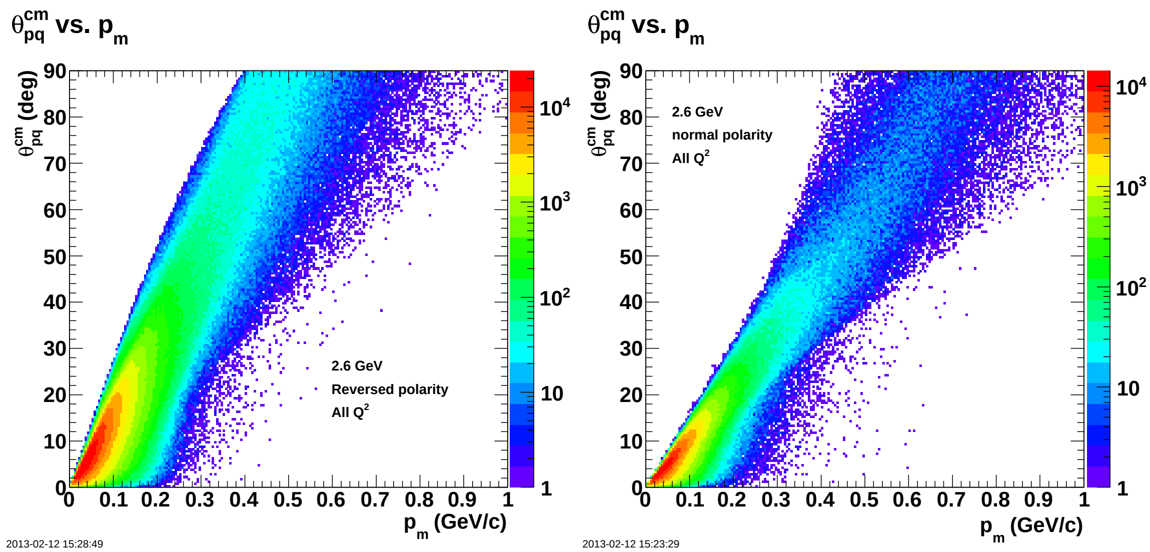

Figure 2: Distribution of θ_{pq}^{cm} versus missing momentum p_m for the 2.6 GeV, reversed-torus-polarity data (left-hand side) and the normal-torus-polarity data (right-hand side).

calculations for six values of x_{Bj} which are, finally, functions of p_m. For each x_{Bj} we take the values of the asymmetry at each of the fifteen values of Q^2 and average them at each p_m weighted by the Q^2 distributions show in Fig. 1 for each torus polarity setting. The results for these Q^2-averaged asymmetries at different x_{Bj} are shown in Fig. 3 as a function of p_m. With these results in hand we then average the curves in Fig. 3 over x_{Bj} weighted by the Bjorken x distribution for each torus polarity. The x_{Bj} distributions are shown in Fig. 4 (which reproduce the ones in Fig. 11 in the analysis note). The final result and comparison with the data is shown in Figs. 35-36 of the analysis note.

For the comparison of our results with the calculation by Arenhövel we have a set of his calculations as functions of p_m for twelve different values of Q^2 in the range $Q^2 = 0.35 - 1.20$ GeV^2. The calculations are averaged over Q^2 weighted by the distributions shown in Fig. 1. The comparison with data is shown in Figs. 35-36 of the analysis note.

For the calculations from Jean-Marc Laget, we have only two calculations near the peak of the Q^2 distributions in Fig. 1. Our plan is to obtain more complete sets of calculations (in Q^2 and x_{Bj} coverage) for the Arenhövel calculations and others after getting feedback on the extraction of A'_{LT}.

We now discuss how we apply the radiative corrections discussed in Section 6.2.4 of the analysis note. We start with a set of EXCLURAD calculations of the ratio of the radiatively corrected cross section to the Born approximation for both polarized and unpolarized electrons (see Ref. 25 in the analysis note). These ratios are functions of $\cos\theta_{pq}^{cm}$, ϕ_{pq}, and Q^2 (see Appendix G in the analysis note for plots). We assume $x_{Bj} = 1$. From these discrete arrays we create interpolating functions. To apply these radiative corrections to our data we convert the $\cos\theta_{pq}^{cm}$ dependence to missing momentum p_m using

$$p_m = \sqrt{\left(\frac{q_L}{2} + p\frac{E_W}{W}\cos\theta_{pq}^{cm}\right)^2 + p^2\sin^2\theta_{pq}^{cm}} \tag{1}$$

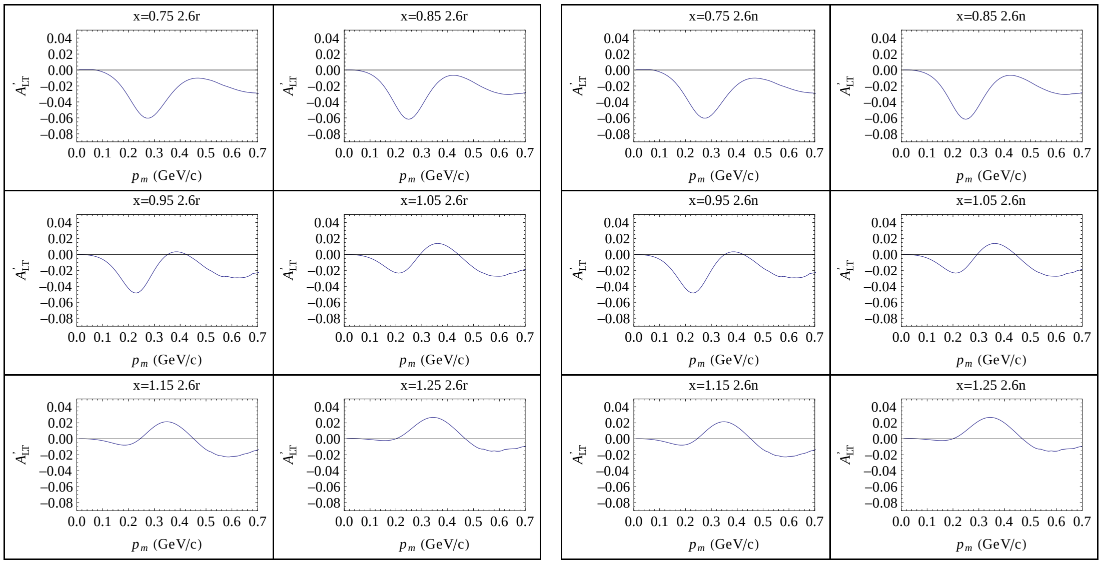

Figure 3: Plots of A'_{LT} from JVO averaged over the Q^2 distributions shown in Fig. 1 at different values of x_{Bj} for the reversed-torus-polarity data (left-hand two panels) and the normal-torus-polarity data (right-hand two panels). The label on each plot is the value of x_{Bj} and the data set 2.6r (2.6n) for the reversed (normal) torus polarity data set.

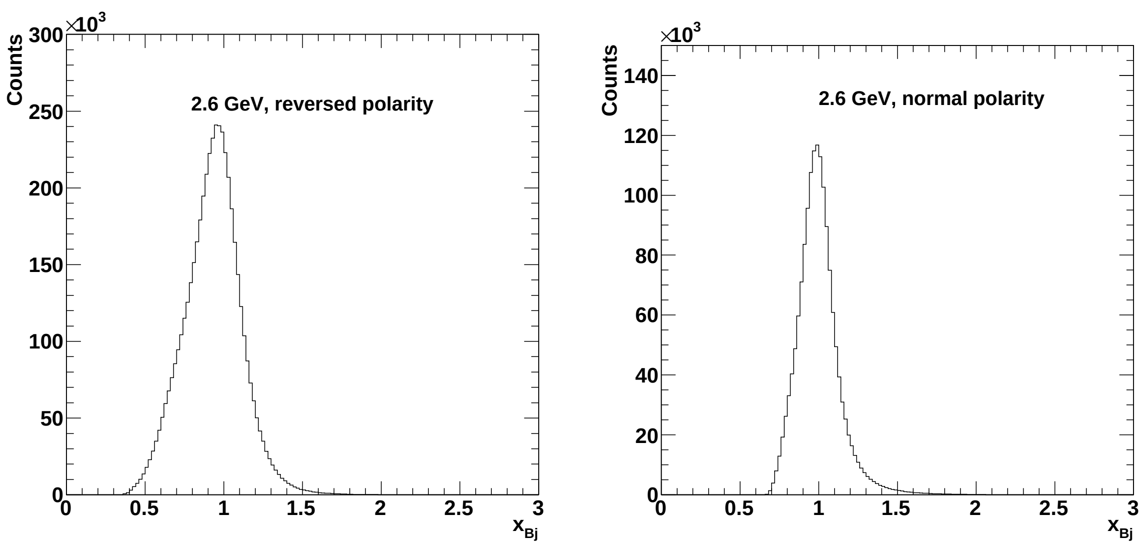

Figure 4: Distributions of Bjorken x for the reversed-torus-polarity data (left-hand side) and the normal-torus-polarity data (right-hand side).

where p is the proton/neutron 3-momentum in the center of mass and is equal to

$$p = \sqrt{\frac{[W^2 - (m_p + m_n)^2]\,[W^2 - (m_p - m_n)^2]}{4W^2}}, \tag{2}$$

m_p and m_n are the proton and neutron masses respectively,

$$E_W = M_d + \nu = M_d + \frac{\mathrm{Q}^2}{2m_p x_{Bj}} \quad , \tag{3}$$

where we have used the definition of Bjorken x, $x_{Bj} = \mathrm{Q}^2/2m_p\nu$, M_d is the deuteron mass, ν is the energy transfer, q_L is the magnitude of the photon 3-momentum in the lab frame, and

$$W^2 = M_d^2 + 2M_d\nu - Q^2 = M_d^2 + Q^2\left(\frac{M_d}{m_p x_{Bj}} - 1\right) \tag{4}$$

is the residual mass extracted from the electron information. See equations 2.15-2.19 in Ref. 11 in the analysis note. We note here these is no need to include the Jacobian in our application of the radiative corrects since we use the ratio of the radiatively corrected cross section to the Born approximation. Next, from the interpolating functions of the polarized/unpolarized radiative corrections (which are now functions of Q^2, p_m, ϕ_{pq}) we create discrete arrays for six values of Q^2 in the range $\mathrm{Q}^2 = 0.2 - 1.7$ GeV^2, seventeen values of p_m in the range $p_m = 0.035 - 1.435$ GeV/c, and seventeen values of ϕ_{pq} in the range $\phi_{pq} = 14^\circ - 174^\circ$. These functions are loaded into a three-dimensional histogram in ROOT (TH3D histogram) which has methods (trilinear interpolation based on the 8 nearest bin center points)to interpolate the value of the radiative correction given a Q^2, p_m, and ϕ_{pq} point. The correction is applied event-by-event. The histograms used to construct A'_{LT} are weighted by the inverse of the radiative correction interpolated from the 3D histograms.

The radiative corrections can be refined by adding another dimension to the independent variables that describe the function. We considered the effect of using values of Bjorken x that are not equal to one. We found the effect was small, typically much less than 1% in A'_{LT} and since the overall impact of the radiative corrections on A'_{LT} is limited relative to the statistical uncertainties (see Fig. 90 in the analysis note) we did not pursue this refinement.