Notes on extracting polarization observables

11-20-13

Formalism

$\left(\frac{d\sigma}{dX^{ij}d\phi^j}\right)^h \doteq f^h(X^{ij},\phi^j) = A^{ij} + B^{ij}\cos\phi^j + C^{ij}\cos 2\phi^j + hPD^{ij}\sin\phi^j$

where

- ij = index over Varset,Variable (3x5 matrix)
- $R2_\alpha^{ij} \doteq [A^{ij}, B^{ij}, C^{ij}, D^{ij}] \equiv [R_T + \epsilon_L R_L, R_{LT}, R_{TT}, R_{LT'}]$
  - $R2_\alpha^{ij} = f(Q^2, W, X^{ij})$

Event Selection

1. `eid`
2. `efid`
3. `momcorr`
4. `MM cut`

`R2` Extraction Method

Of the methods listed earlier:

1. Fit $f^h(X^{ij},\phi^j)$ to extract `R2`
2. Calculate Asymmetry $\doteq f^{h=+} - f^{h=-}$ and then extract D^{ij}
3. $\int f^h(X^{ij},\phi^j) * (\cos\phi/\cos 2\phi/\sin\phi)d\phi$ to extract $B^{ij}/C^{ij}/D^{ij}$

Method 3. is used, which even at the level of algorithmic detail is listed below.
NOTE that when multiplying by $\sin\phi$, the sign of the polarization is explicity used

For every `q2wbin`:

1. `h5[pol]` where `pol` $\in$ {POS,NEG,UNP,AVG}; `pol` $\neq$ AVG

2. h5m[pol,pob] = h5[pol]· h5f[pob]
    - pob ∈ {A,B,C,D}; pol ≠ AVG
    - h5f[pob]:
        - For every bin i, h5f[pob](i) = f[pob](i)
        - f[pob] ∈ {N.A.,cos ϕ,cos 2ϕ,sign(pol) sin ϕ}
3. hR2_Xij[pol,pob] = h5m[pol,pob] Project on to X^{ij}; pol ≠ AVG
4. hR2_Xij[pol=AVG,pob] = (hR2_Xij[pol=POS,pob] + hR2_Xij[pol=NEG,pob])/2

Notes on current Observations

Focussed only on <B/C/D>_1THETA

Consistencies:

1. <B/C>[pos]=<B/C>[neg]=<B/C>[unp]
2. exp-<C>[unp] ≈ sim-<C>[unp]

Inconsistencies:

1. !exp-D[unp] ≠ 0!
    - !D[pos] = -D[neg]
    - !D[unp] = D[pos]
2. !sim-D[unp] ≠ 0
    - !sim-D[unp] ≠ exp-D[unp]
3. !exp-B[unp] ≠ sim-B[unp]