Notes on extracting polarization observables

11-14-13

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)
- $R2^{ij}_\alpha \doteq [A^{ij}, B^{ij}, C^{ij}, D^{ij}] \equiv [R_T + \epsilon_L R_L, R_{LT}, R_{TT}, R_{LT'}]$
  - $R2^{ij}_\alpha = f(Q^2, W, X^{ij})$

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]`$\cdot$ `h5f[pob]`
   - `pob` $\in$ {A,B,C,D}; `pol` $\neq$ AVG

- `h5f[pob]`:
  - For every bin `i`, `h5f[pob](i)` = `f[pob](i)`
  - `f[pob]` $\in$ {N.A.,$\cos\phi$,$\cos 2\phi$,sign(pol) $\sin\phi$}

3. `hR2_Xij[pol,pob]` = `h5m[pol,pob]` `Project` on to X^{ij}; `pol` $\neq$ AVG
4. `hR2_Xij[pol=AVG,pob]` = (`hR2_Xij[pol=POS,pob]` + `hR2_Xij[pol=NEG,pob]`)/2

Notes on current Observations

1. `R2_Xij[UNP,D]` $\neq 0$ for Simulation. Why?
2. `R2_Xij[UNP,D]` $\neq 0$ for Experiment.

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Use `printf`