New output variables in SIMC

Reynier Cruz Torres

May 31, 2017

simc version: “simc_gfortran.12”

Momentum variables

h_spec_p:	hadron spectrometer central momentum	[MeV/c]
h_pfi:	hadron generated momentum	[MeV/c]
h_pf:	hadron reconstructed momentum	[MeV/c]
e_spec_p:	electron spectrometer central momentum	[MeV/c]
e_pfi:	electron generated momentum	[MeV/c]
e_pf:	electron reconstructed momentum	[MeV/c]

Angular variables

h_spec_th:	hadron spectrometer central angle	
theta_pi:	hadron generated in-plane angle	
theta_p:	hadron reconstructed in-plane angle	
e_spec_th:	electron spectrometer central angle	[degrees]
theta_ei:	electron generated in-plane angle	[degrees]
theta_e:	electron reconstructed in-plane angle	[degrees]
theta_rq:	recoil-q angle	[degrees]

Other variables

xB: Bjorken scaling variable

Generated and reconstructed, proton and electron in-plane angles (theta_pi, theta_p, theta_ei, theta_e)

$$\cos\theta_{\mathrm{LHRS}} = \frac{\cos\theta_c - \mathrm{e\_yptar}\cdot\sin\theta_c}{\sqrt{1+\mathrm{e\_xptar}^2+\mathrm{e\_yptar}^2}}$$

$$\cos\theta_{\mathrm{RHRS}} = \frac{\cos\theta_c + \mathrm{h\_yptar}\cdot\sin\theta_c}{\sqrt{1+\mathrm{h\_xptar}^2+\mathrm{h\_yptar}^2}}$$

Generated and reconstructed, proton and electron momenta (h_pfi, h_pf, e_pfi, e_pf)

$$p = p_c\cdot[1+\delta/100]$$

- All the variables with subscript C denote spectrometer central parameters.
- All the variables starting with e_ (h_) denote electron (hadron) arm variables

Recoil – q angle (theta_rq)

$$\theta rq = acos(-PmPar/Pm)$$

Pm: Missing momentum magnitude
PmPar: Missing momentum component parallel to the q vector

Approximation for the in-plane angle equation

$$\boxed{\begin{aligned}\cos\theta_{\mathrm{LHRS}} &= \frac{\cos\theta_c - \mathrm{e\_yptar}\cdot\sin\theta_c}{\sqrt{1+\mathrm{e\_xptar}^2+\mathrm{e\_yptar}^2}} \\ \cos\theta_{\mathrm{RHRS}} &= \frac{\cos\theta_c + \mathrm{h\_yptar}\cdot\sin\theta_c}{\sqrt{1+\mathrm{h\_xptar}^2+\mathrm{h\_yptar}^2}}\end{aligned}}$$

In the limit where xptar and yptar are small (as is the case most of the time), the denominator can be neglected. Also: yptar≈sin(yptar) and 1≈cos(yptar). Thus:

$$\cos\theta_{\mathrm{LHRS}} \approx \cos\theta_c - \mathrm{e\_yptar}\cdot\sin\theta_c \approx \cos\theta_c \cos\mathrm{e\_yptar} - \sin\mathrm{e\_yptar}\,\sin\theta_c$$

$$\cos\theta_{\mathrm{RHRS}} \approx \cos\theta_c + \mathrm{h\_yptar}\cdot\sin\theta_c \approx \cos\theta_c \cos\mathrm{h\_yptar} + \sin\mathrm{h\_yptar}\,\sin\theta_c$$

$$\cos\theta_{\mathrm{LHRS}} \approx \cos(\theta_c + \mathrm{e\_yptar})$$

$$\cos\theta_{\mathrm{RHRS}} \approx \cos(\theta_c - \mathrm{h\_yptar})$$

$$\boxed{\begin{aligned}\theta_{\mathrm{LHRS}} &= \theta_c + \mathrm{e\_yptar} \\ \theta_{\mathrm{RHRS}} &= \theta_c - \mathrm{h\_yptar}\end{aligned}}$$