BeAGLE Update

MDB

22-Nov-2016
Three major pieces – Consistency!

DPMJET-III
Nuclear Effects
  - Glauber model
  - Fermi momentum
  - Intranuclear cascade
    For slow hadrons
      (in target rest frame)
  - Evaporation/
    De-excitation/
    Nuclear Breakup

Pythia 6
DIS Collision
  ep or en ONLY
  Links to LHAPDF
  For nuclear pdfs.

PyQM
(From Alberto & Co.)
  Rescattering &
  Quenching for
  fast partons
  In (mean-field) nucleus

/DTEVT*/
  Event b
  Pre-collision nuclons
  in nucleus (in TRF)
  Results from INC & Fluka

/PYEVET*/
  Results from hard
  scattering

Output File
New issue for an eA collider!

What is the momentum of the nucleon in a nucleus in the lab frame? What is the mass of the proton inside the nucleus? Model dependent. DPMJET & Pythia assume nucleons on-mass-shell.

Target Rest Frame

$M_Au = 197 \times 0.99983 \text{ amu}$, $1 \text{ amu} = 0.931494 \text{ GeV}$

Laboratory Frame

$\gamma \beta = \frac{p_z}{M} = 42.9491$

$M_p = 1.0073 \text{ amu}$, $M_n = 1.0087 \text{ amu}$

$\frac{p_z(p)}{p_z(n)} = \gamma \beta M_p = 40.299 \text{ GeV/c}$

$\frac{p_z(n)}{p_z(p)} = \gamma \beta M_p = 40.355 \text{ GeV/c}$

NOT 40 GeV!
Recent changes to BeAGLE (also w/ Liang)

- Made Pythia consistent with DPMJET
  - Main collision is not ALWAYS ep, often en!
  - Nucleon and nucleus have same velocity (rapidity) in the laboratory frame. NOT same p/nucleon!
  - Remaining issue for later: Fermi-momentum ignored for struck nucleon.
- Made PyQM consistent with DPMJET
  - Use same position in nucleus for both
  - Use same rotational orientation (z along $\gamma^*$) for both
  - Remaining issue: Recoil momentum to nucleus.
Ongoing changes to BeAGLE

- Started removing (commenting out) unused parts of DPMJET
  - Unused collisions: pp, pA, AA, νA etc.
  - Note: if we need them, just use DPMJET3 directly.
  - Don't try to support all possible functionality.
- Actual rename & cleanup
  - Fixed bug where you could only run in the main directory!
Installation at JLAB

- I now have a JLAB lab-wide computer account.
- What actual computers should I use?
- Will I need a specific user account there?
- Should I get a JLAB email account?
- Where should I install BeAGLE?
- Where should Liang install Sartre?
Appendix.
Impact of Fermi Momentum

Proton in Au nucleus.
Target rest frame w/ electron beam along -z.
Boost to lab by $\gamma, \beta$: $\gamma \beta = 42.95$

Consider $p_x = p_y = 0$, $p_z = 0.1\text{GeV}$

Naive: $\{M; 0, 0, 0\}$, $p_{z_{\text{lab}}} = \gamma \beta M = 40.3 \text{ GeV}$,

Correct: $\{E = \sqrt{p^2 + M^2}; p_x, p_y, p_z\}$

$p_{z_{\text{lab}}} = \gamma \beta E + \gamma p_z = 44.8 \text{ GeV}$

NOTE: $\gamma p_z$ term = 4.3 GeV!