

Joseph Seele University of Colorado at Boulder seele@down.colorado.edu



Second Electron-Ion Collider Workshop - March 16, 2004 Jefferson Lab



Outline



- Monte Carlo
 - History of Development
 - Basic Structure
 - Current State
- Question of Jets
 - Events Displays of e⁻p from MC at
 - 10 GeV on 50 GeV
 - 10 GeV on 150 GeV
 - 10 GeV on 250 GeV

Hadronic Angular Distributions of Event Samples



 (\mathbf{D})

The physics monte carlo was primarily derived from the HERMES monte carlo





An elementary detector simulation was built in ELECTRA, a GEANT based system



Second Electron-Ion Collider Workshop



Structure of the Monte Carlo



The physics monte carlo consists of a framework called GMC (Generator Monte Carlo) inside which a simulation, based on either external or internal calculations, is built.





Structure of the Monte Carlo



There are three current simulations based on separate packages

- disNG (deep inelastic scattering Next Generation) This is an internal code built originally for HERMES, but then adapted to a colliding beam experiment setup for EIC.
- pepsi4 (<u>p</u>olarized <u>e</u>lectron-<u>p</u>roton <u>s</u>cattering <u>i</u>nteractions) A standard external package for polarized electron proton scattering.
- aroma An external package to simulate the production of heavy quarks in electron proton scattering through boson-gluon fusion.
- (insert your generator here)



Current State of Development





Second Electron-Ion Collider Workshop





Question of Jets

- The possibility of jets in EIC was explored in the MC using disNG at 3 collision energies with unpolarized species.
 - 10 GeV on 50 GeV
 - 10 GeV on 150 GeV
 - 10 GeV on 250 GeV
- $W^2 > 4.0$ and $Q^2 > 0.5$ were used in the analysis.





Most events look like this one







Joseph Seele

















Again most events look like this one

Joseph Seele







Joseph Seele







Joseph Seele







Joseph Seele







Again most events look like this one

Joseph Seele







Joseph Seele







Joseph Seele







Joseph Seele



Essentially θ is the angle that the hadrons' momentum vectors make with the momentum vector of the incident electron.



Theta Distribution at 10 GeV on 50 GeV





hadronic theta distribution - 10 GeV on 50 GeV

Joseph Seele



Theta Distribution at 10 GeV on 150 GeV



hadronic theta distribution - 10 GeV on 150 GeV

Joseph Seele



Theta Distribution at 10 GeV on 250 GeV





hadronic theta distribution - 10 GeV on 250 GeV

Joseph Seele



Conclusions



- Monte Carlo
 - Development is proceeding with Pythia6.
 - Development then to shift to RAPGAP.
 - The MC and all its documentation can be found at <u>http://www.npl.uiuc.edu/~eic</u> for anyone interested in performing simulations.
 - If you are interested in helping with development please contact myself (<u>seele@down.colorado.edu</u>), Naomi Makins (<u>makins@uiuc.edu</u>) or Antje Bruell (<u>abr@lns.mit.edu</u>)

Question of Jets

- The uncertainty about whether we can speak of jets or not depends on the definition that we wish to use for a jet.
- The issue is not completely closed though. I would like to see a more quantitative assessment (and plan on performing one).