Study of heavy flavor hadronization in eA collision via BeAGLE simulation

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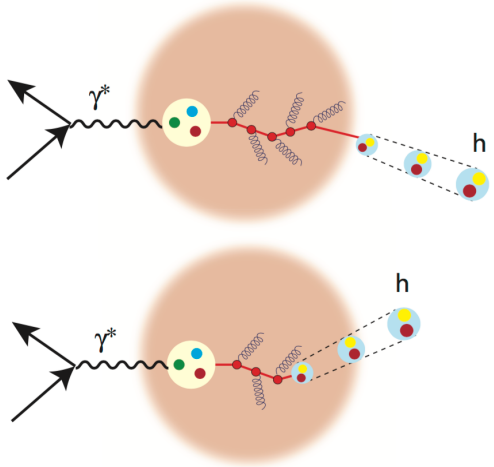
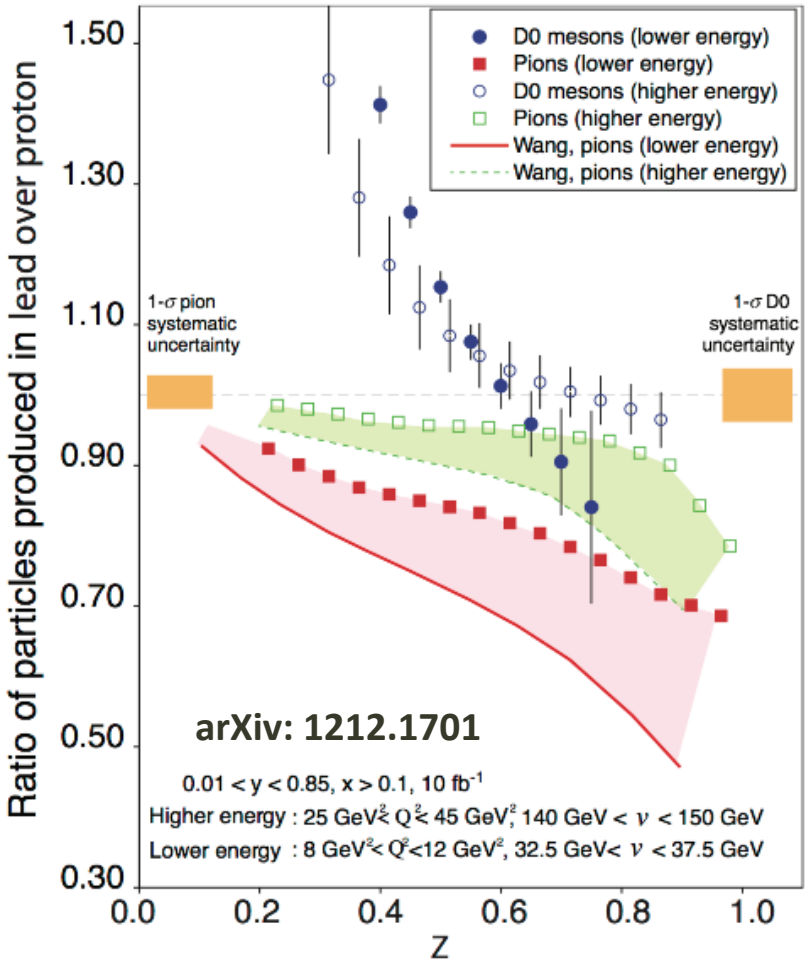
ATHENA Jet/HF/EW/BSM WG meeting

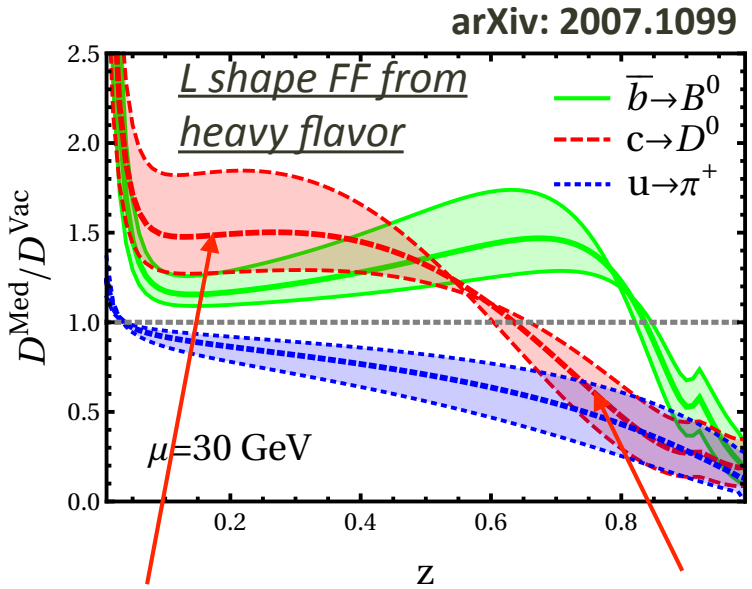
Motivation

- Study nuclear modification of (light and) hadrons in different eA system
  - Hadronization scale
  - Energy loss mechanism inside nucleus





Would be interesting to also look at Λ_c (Eloss on parton level or hadron level or mixed?)



enhancement at low z

suppression at high z

Nuclear modification in eA

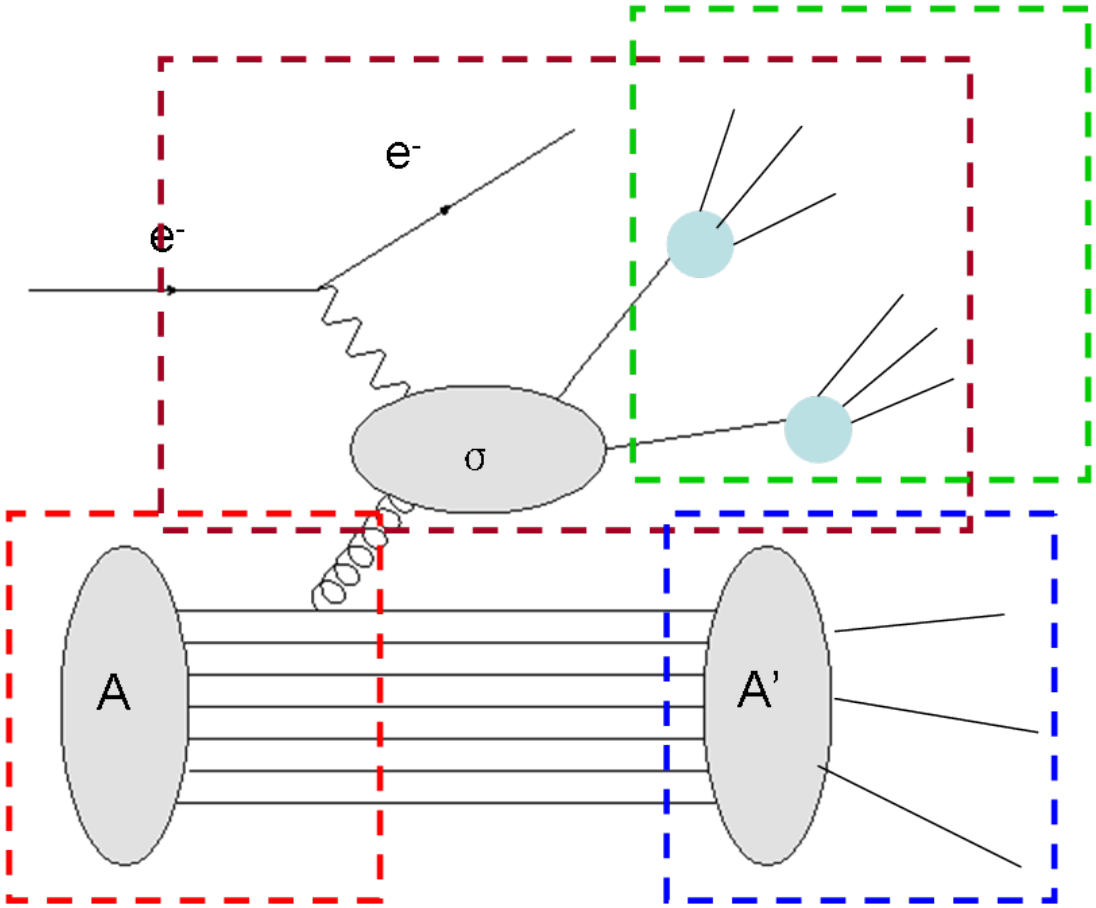
- Nuclear modification of final state hadrons in eA as function of z
  - Fractional energy of the final state hadron z: $z = \frac{P\cdot p}{P\cdot q} \overset{\text{Target}}{=} \frac{E_h}{\nu}$
  - Double ratio definition 1: $R_A^h(\nu, Q^2, z, p_t^2) = \frac{\left(\frac{N^h(\nu,Q^2,z,p_t^2)}{N^e(\nu,Q^2)}\right)_A}{\left(\frac{N^h(\nu,Q^2,z,p_t^2)}{N^e(\nu,Q^2)}\right)_D},$
  - Double ratio definition 2: $R_{eA}^h(p_T,\eta,z) = \frac{\left.\frac{N^h(p_T,\eta,z)}{N^{\text{inc}}(p_T,\eta)}\right|_{\text{e+Au}}}{\left.\frac{N^h(p_T,\eta,z)}{N^{\text{inc}}(p_T,\eta)}\right|_{\text{e+p}}}$

↓

inclusive jet production to minimize initial state effect (PDF and nPDF)

Event generator for ep and eA collisions

- PythiaeRHIC for ep collisions
- BeAGLE for eA collisions



A hybrid model consisting of DPMJet and PYTHIA with nPDF EPS09.

Nuclear geometry by DPMJet and nPDF provided by EPS09.

Parton level interaction and jet fragmentation completed in PYTHIA.

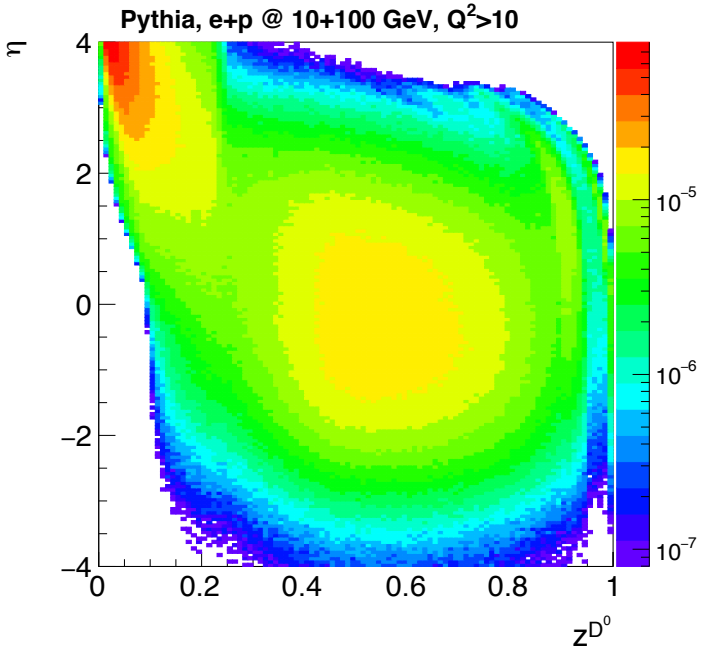
Nuclear evaporation (gamma dexcitation/nuclear fission/fermi break up) treated by DPMJet

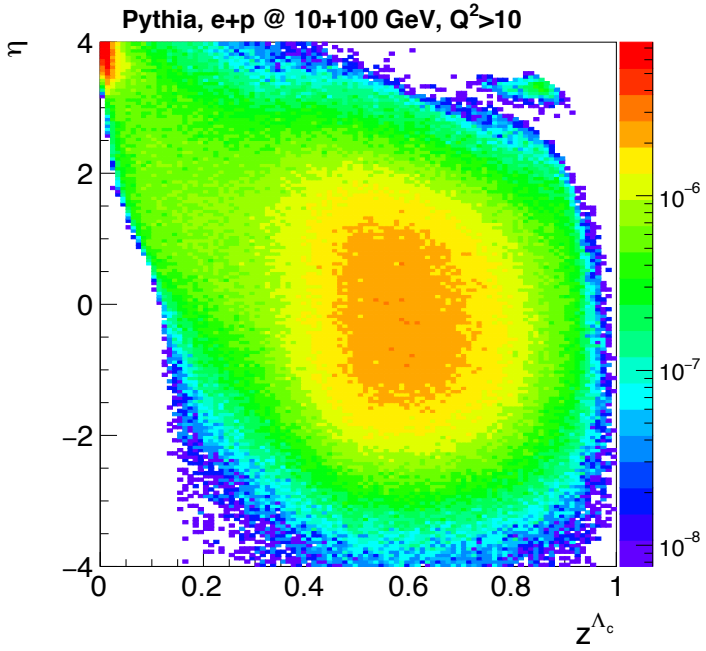
Energy loss effect from routine by Salgado&Wiedemann to simulate the nuclear fragmentation effect in cold nuclear matter

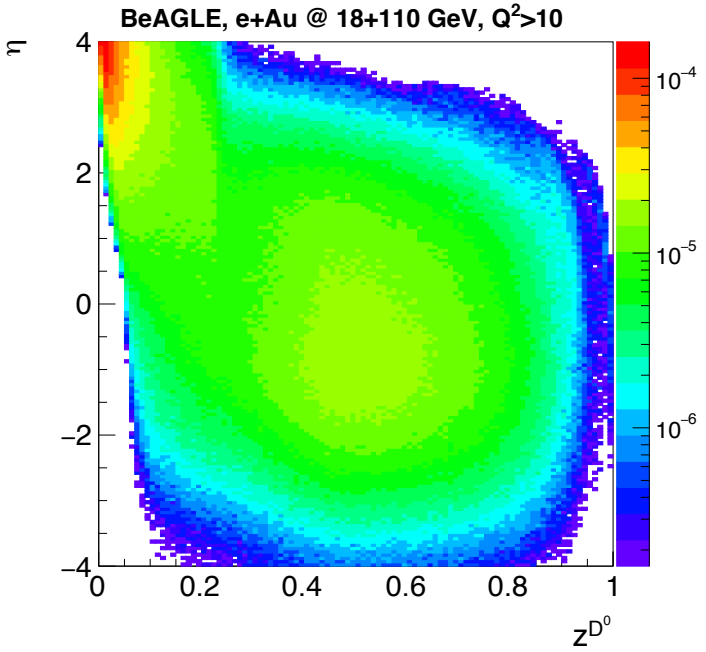
z distribution of c hadron at generator level

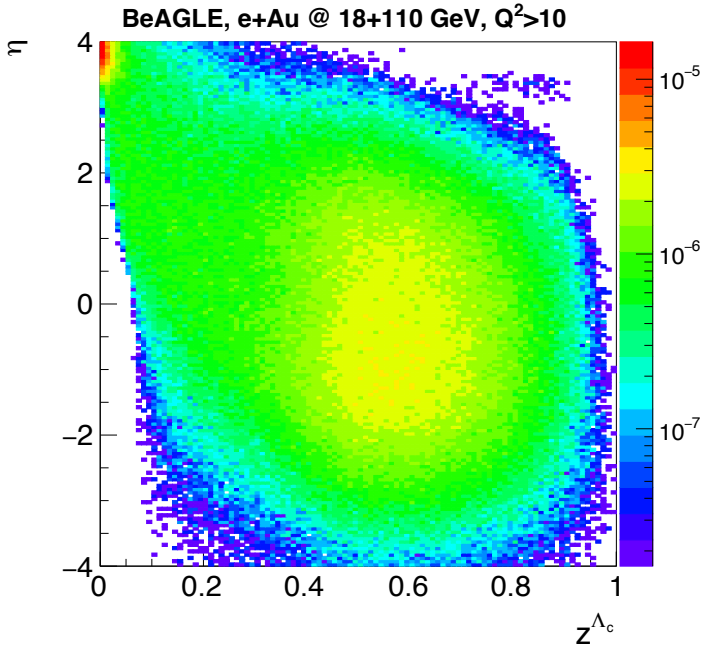
e+p

e+Au



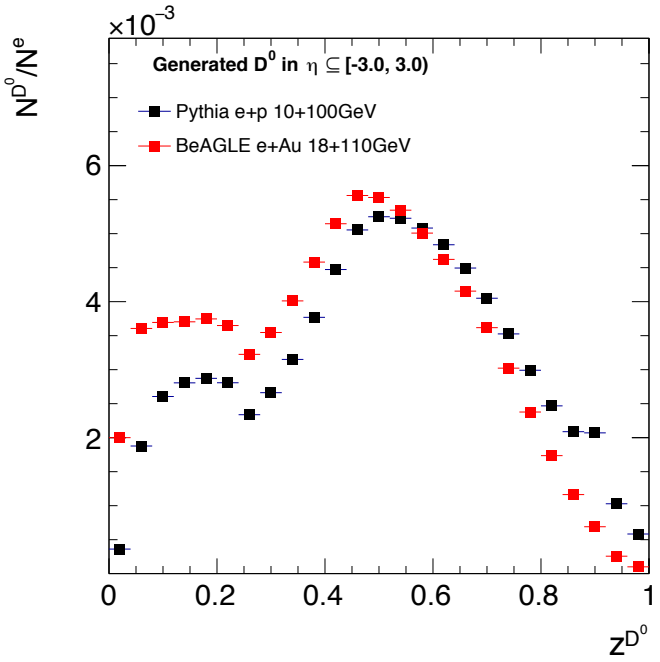


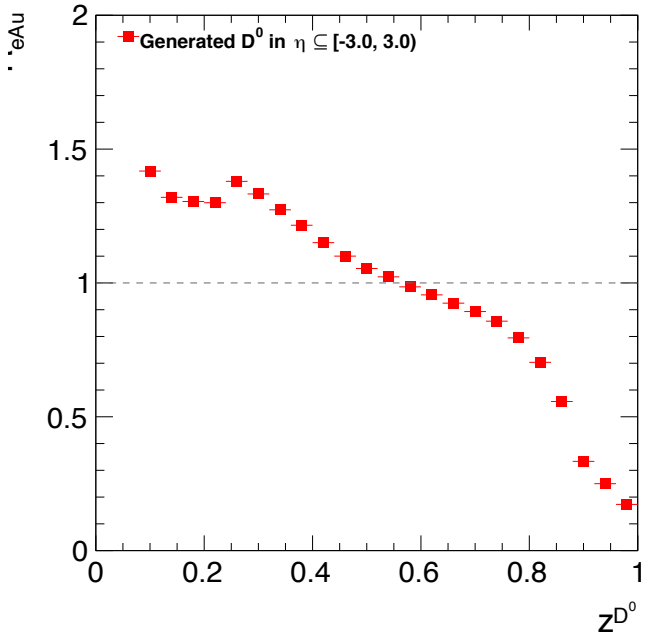




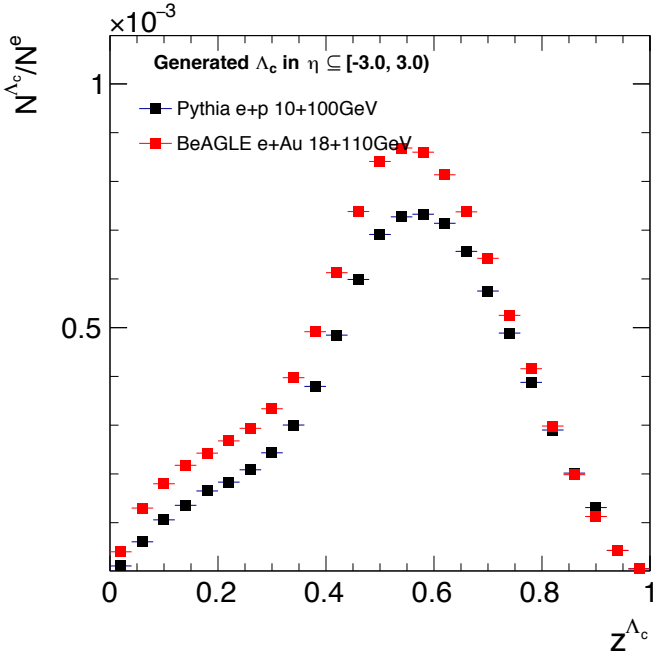
R_{eA} of c hadron at generator level

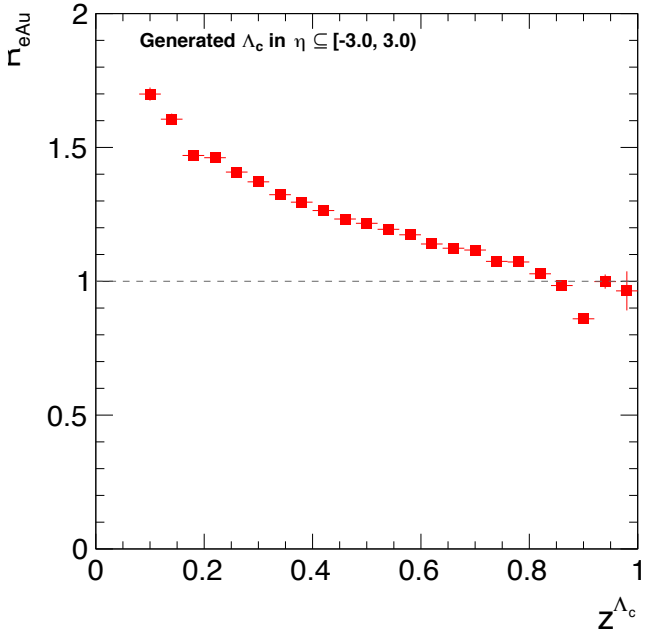
D^0





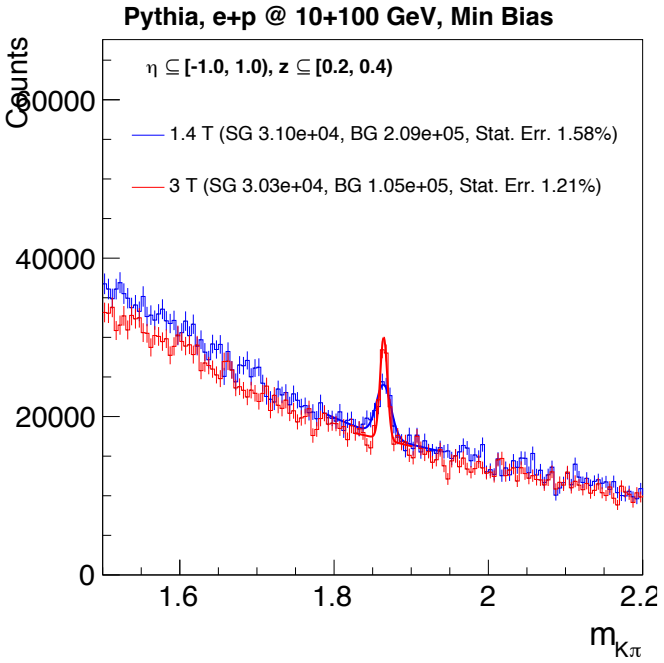
Λ_c

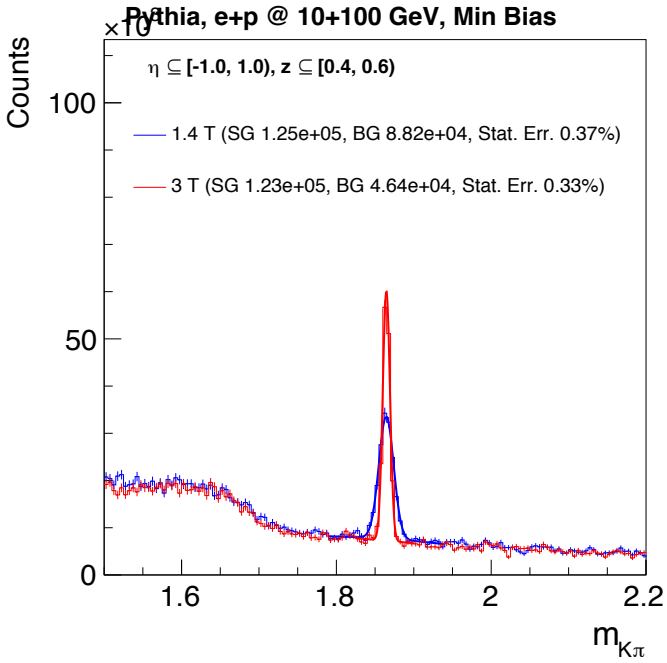


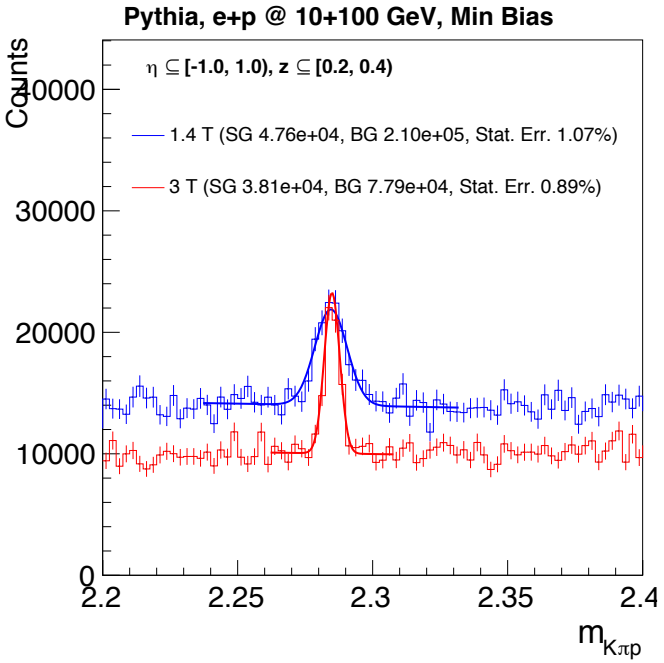


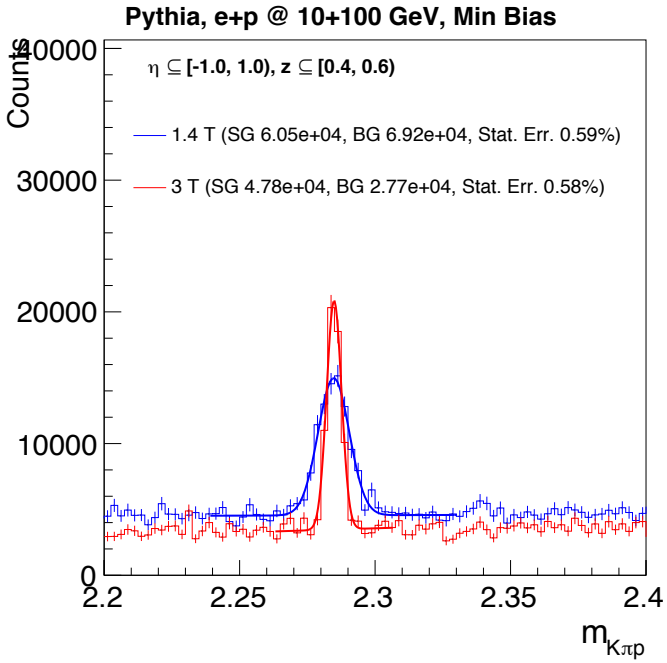
Previous fast simulation results

- Need new parameters for fast simulation
- Reconstruct charm hadrons in eA events







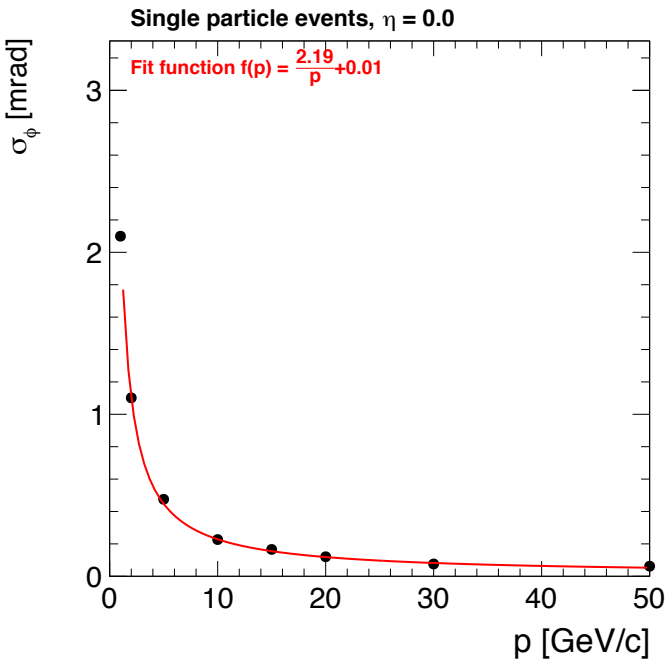


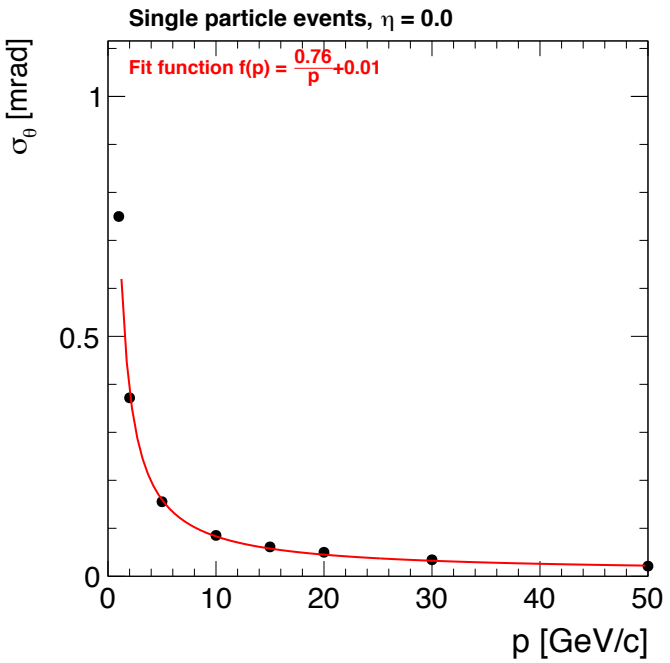
Summary

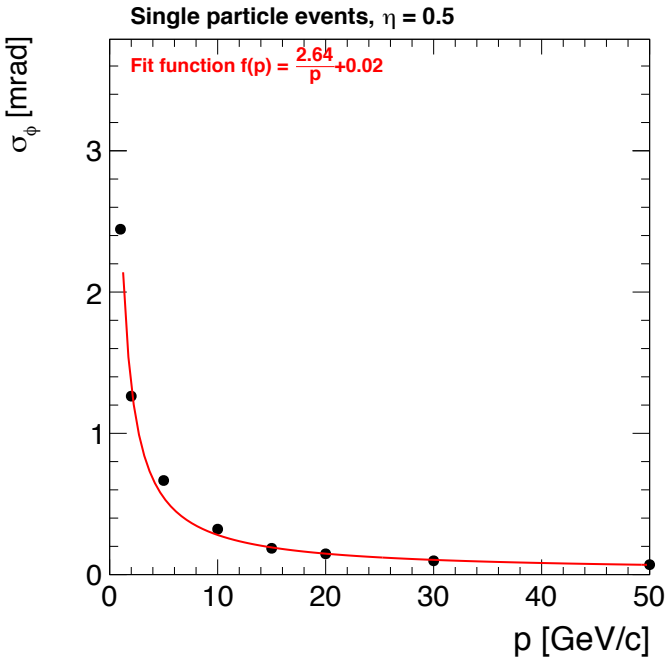
- A first look at charm hadron R_{eAu} at generator level
  - PythiaeRHIC for e+p, BeAGLE for e+Au
- Look at charm hadron R_{eAu} at reconstruction level, and get the projected statistical uncertianty for EIC luminosity
  - Reconstruct D^0 from $K\pi$
  - Reconstruct Λ_c from $K\pi p$
  - Gathering smearing parameters for fast simulation

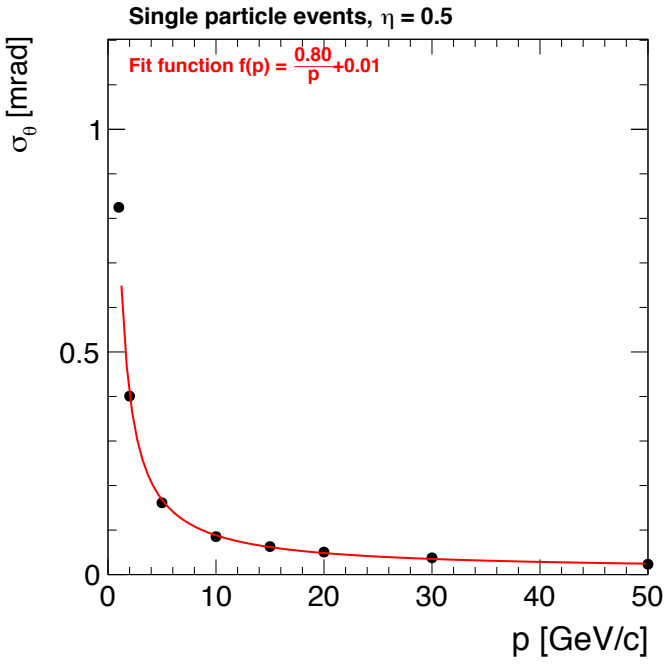
Track propagation — AllSi, no material map

- Barrel: using a cylinder surface at r = 91cm









Track propagation — AllSi, no material map

- Forward: using a disk surface at z = 190cm