Evidence from d+Au measrements for final-state suppression of high p_T hadrons in Au+Au collisions at RHIC

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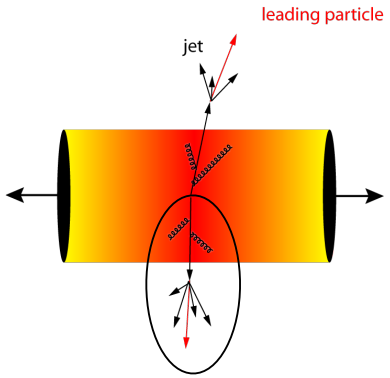
Introduction

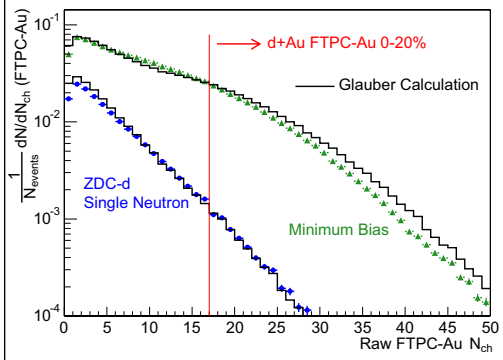
- Brief Motivation
- Charged Particle Multiplicity
- p_T Spectra
- Nuclear Effects
- Azimuthal Correlations
- Summary

Collisions



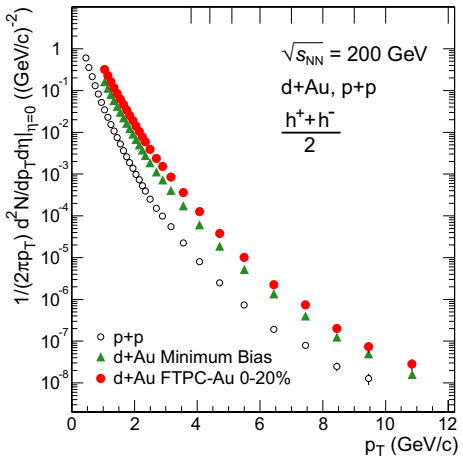
- Expect energy loss when particles traverse medium
- Single particle inclusive yields and back-to-back correlations show high p_T suppression
- Causes for suppression? IS effects (gluon density) or FS effects (energy loss in medium)
- If IS effects are at play, expect to find suppression in d+Au
- Look at d+Au and compare to p+p and Au+Au collisions to separate IS and FS effects

Charged Particle Multiplicity



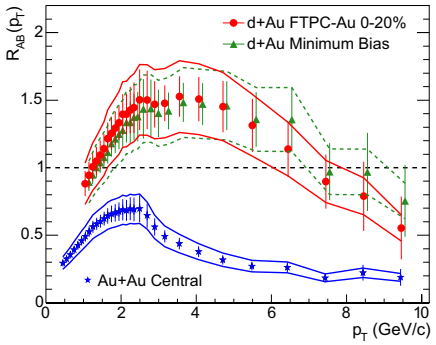
- Uncorrected charged particle multiplicity distributions
- Centrality based on charged particle multiplicity for $-3.8<\eta<-2.8$ in FTPC-Au
- Cross check centrality tag with method using a spectator neutrons in ZDC-d
- ZDC-d neutron tagged events biased toward low multiplicity

pT Spectra for Charged Hadrons



- Inclusive p_T distributions for min bias, central d+Au, and p+p
- Charged hadrons with $|\eta|<0.5$
- Enhanced compared to p+p

Nuclear Effects

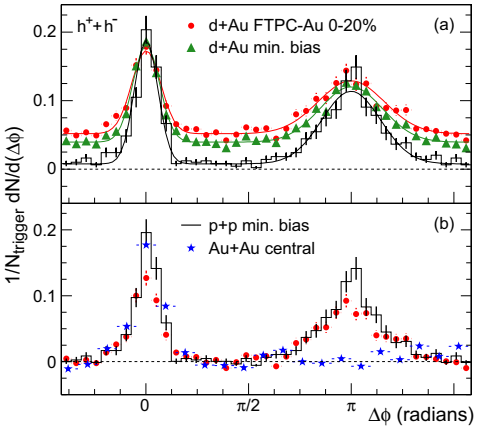


- Compare d+Au and Au+Au spectra to p+p using R_{AB}

$$R_{AB}(p_T) = \frac{d^2N/dp_T d\eta}{T_{AB} d^2\sigma^{pp}/dp_T d\eta}$$

- $T_{AB} = \langle N_{bin} \rangle / \sigma^{pp}_{inel}$
- In absence of nuclear effects (Cronin, nuclear shadowing, gluon saturation), $R_{AB} = 1$ if collisions scale with N_{bin}
- Au+Au central shows suppression in all p_T

Azimuthal Correlations



- Two particle azimuthal distributions for p +p, d+Au, and Au+Au
- For two particle azimuthal correlations use particles with $|\eta|<0.7$, $4<p_T(\text{trig})<6$GeV, and associated particles with $2<p_T<p_T(\text{trig})$

$$D(\Delta\phi) \equiv \frac{1}{N_{trigger}} \frac{1}{\epsilon} \frac{dN}{d(\Delta\phi)}$$

$$D(\Delta\phi) = A_N \frac{e^{-(\Delta\phi)^2/2\sigma_N^2}}{\sqrt{2\pi}\sigma_N} + A_B \frac{e^{-(|\Delta\phi|-\pi)^2/2\sigma_B^2}}{\sqrt{2\pi}\sigma_B} + P$$

Which is it IS or FS effect?

- Predictions of pQCD models that incorporate nuclear shadowing, Cronin Effect, and partonic energy loss in dense matter, and gluon saturation were compared to the results
- All models looked at predict $R_{dA}>1$ for $2<p_T<6$ and peak of 1.1-1.5 for $2.5<p_T<4$
- Gluon saturation models predict suppression in central d+Au events and enhancement similar to Cronin Effect for both d+Au and Au+Au collisions
- R_{dA} and R_{AA} are qualitatively different and explained by pQCD models without gluon saturation effects.
- pT suppression in Au+Au collisions is attributed to the medium produced in those collisions, where scattering of hadronic jet fragments may contribute

Summary

- d+Au collisions show an enhancement in inclusive p_T distributions as opposed to suppression in Au+Au events
- Expect suppression in d+Au if IS effects cause suppression. Instead, find enhancement
- Gluon saturation models predict d+Au enhancement, but fail to reproduce the suppression of Au+Au events
- Results suggest Cronin effect plays significant role in d+Au
- Suppression in Au+Au attributed to interactions with medium produced