High-pT non-photonic electron production in p+p collisions at √s=200 GeV

Xiaozhi Bai[1,3], Mustafa Mustafa[2], Zhenyu Ye[3,1] for the STAR Collaboration

1.Central China Normal University, 2. Lawrence Berkeley National Laboratory, 3. University of Illinois at Chicago

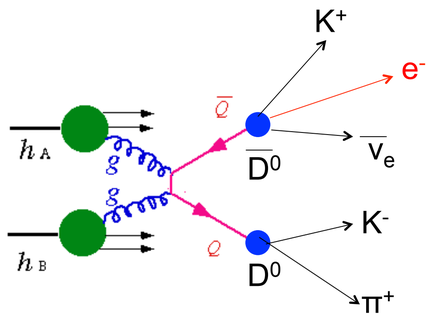
XXIV QUARK MATTER DARMSTADT 2014

Abstract

Measurement of heavy flavor production in proton+proton collisions tests the validity of the pQCD frameworks for the heavy quark production. It also provides a baseline for the interpretation of heavy flavor production in nucleus+nucleus collisions. We present an improved measurement of non-photonic electron (NPE) production at high transverse momentum (2.5< p_T <12 GeV/c) in proton-proton collisions at √s=200 Gev The result is based on about 24 pb^{-1} data recorded during the year 2012 run by the STAR experiment at the Relativistic Heavy Ion Collider. The measured NPE production cross-section is compared to pQCD model calculations.

Motivation

Heavy-flavor production in p+p collisions is calculable by perturbative QCD with inputs from universal parton distribution functions and fragment functions, albeit with large uncertainties from the choice of quark mass, factorization and renormalization scale parameters. Precise measurements of heavy-flavor production cross section in p+p collisions are essential to validate such a framework and to constrain the available parameter space [1]. These measurements also provide a baseline to interpret heavy-flavor measurements in heavy-ion collisions for the study of quark-gluon plasma and its interaction with heavy-flavor quarks.



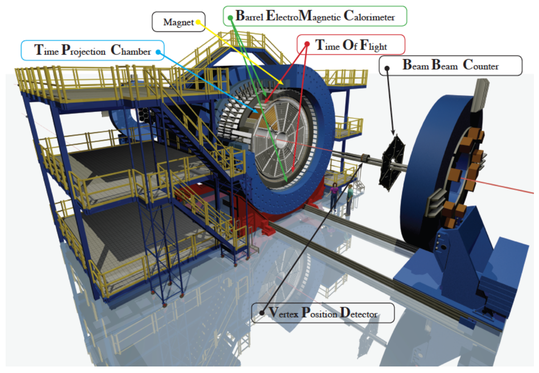
The invariant cross section for nonphotonic electron is calculate according to:

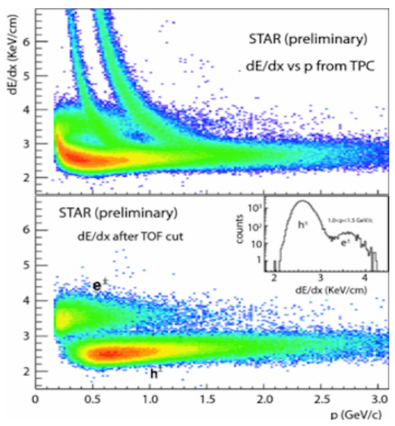
$$E\frac{d^3\sigma}{dp^3}=\frac{1}{L}\frac{1}{2\pi p_T dp_T dy}\frac{N_{npe}}{\varepsilon_{trk}\varepsilon_{trg}\varepsilon_{dEdx}\varepsilon_{EMC}}$$

$$N_{npe}=N_{inclusive}*purity-N_{photonic}/e_{photonic}$$

N_{npe}: electrons from open heavy flavor decay
$N_{photonic}$: electrons from photon conversion, π^0/η Dalitz decay
purity: purity of inclusive electron
$\varepsilon_{photonic}$ photonic electron reconstruction efficiency
$\varepsilon_{trk/trg}$: tracking or trigger effiiciency
$\varepsilon_{dEdx/EMC}$: electron ID (dE/dx or EMC) efficiency

STAR Experiment





Time Projection Chamber (TPC)
large acceptance: |η|<~1.3, 0<Φ<2π
tracking, momentum
Electron ID through energy loss dE/dx

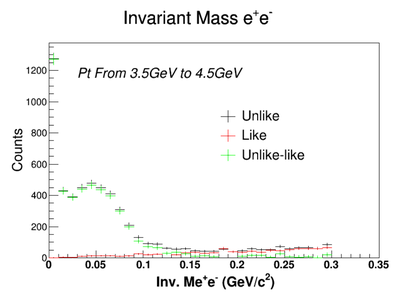
Barrel Electromagnetic Calorimeter (BEMC)
large acceptance: |η|<1, 0<Φ<2π
electron ID through E/p and shower shape
triggering on high p_T electron

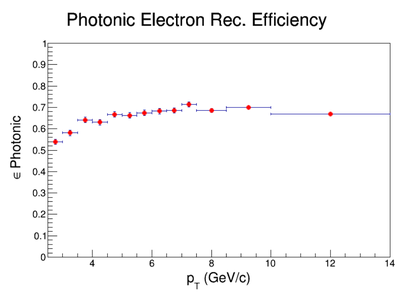
Beam Beam Counter (BBC)
minbias triggering

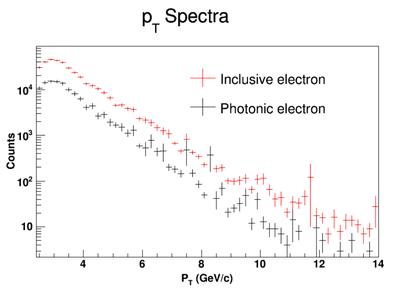
Electron identification:
$-1<n\sigma_e<3$
$0.3<p/E<1.5$
N-BSMD-strips(η)>1
N-BSMD-strips(ϕ)>1

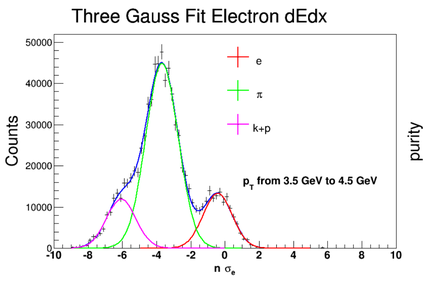
Photonic electron selection:
$m_{e+e-}<0.24$ GeV/c^2

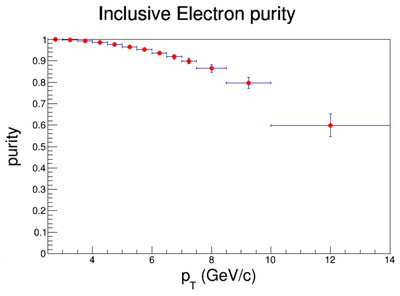
Data Analysis

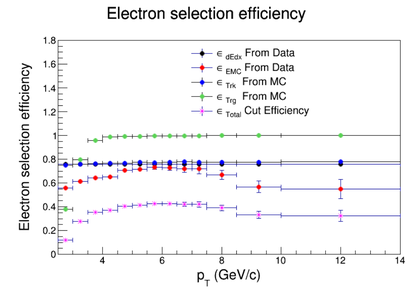






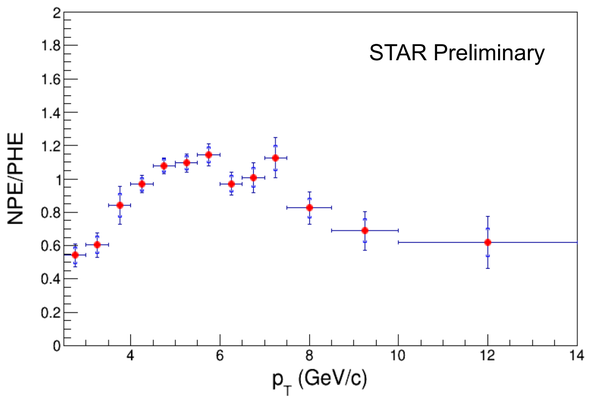




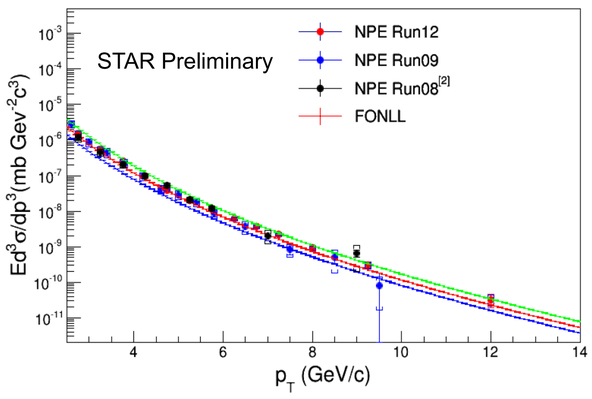


Results

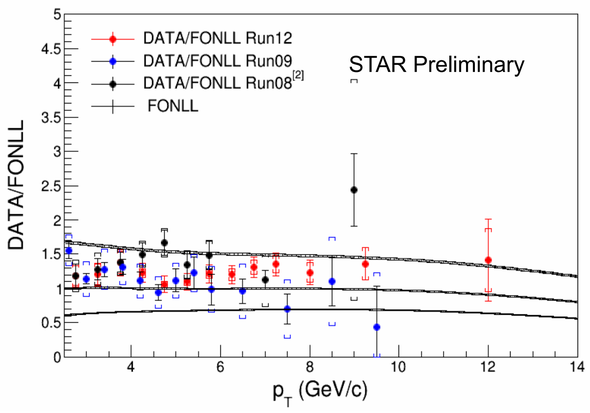
NPE and PHE Ratio



Non-photonic Electron Cross Section



Data and Fonll Ratio



Summary and Outlook

1) A new and improved high p_T NPE cross section measurement in p+p collisions at √s=200 GeV at STAR
2) Results consistent with pQCD FONLL calculation [1] and previous STAR measurement [2]
3) NPE spectra will be extended to lower pT using 700M MinBias events collected during year 2012 RHIC run

References: [1] R.E.Nelson, R.Vogt, and A.D.Frawley, Phys.Rev.C 87 (2013) 014908 [2] STAR collaboration, Phys. Rev. D **83** (2011) 52006

Office of Science U.S. DEPARTMENT OF ENERGY

UIC University of Illinois at Chicago

CENTRAL CHINA NORMAL UNIVERSITY