27pSL-7 Lepton and photon measurement at RHIC-PHENIX

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It is predicted from lattice QCD calculation that at high energy density, a phase transition from hadronic matter to a plasma of deconfined quarks and gluons may occur to form Quark Gluon Plasma (QGP) similar to those found in the early universe a few microseconds after the Big Bang. Relativistic heavy ion collions at Relativistic heavy ion collider (RHIC) at Brookhaven National Laboratory (BNL) has been expected to produce a similar phase transition.

Leptons and photons have long been considered as excellent probes of early stages of the collisions because they have a long mean free path compared to the size of the nuclear volume involved in the collisions. The PHENIX experiment of RHIC is dedicated to measure the hadrons, photons, electrons with the pseudo-rapidity range of -0.35< η <0.35 in its central arm, and muons with the pseudo-rapidity range of -1.2< $|\eta|$ <2.3, with an excellent capability of particle identifications that allows us to explore many interesting phenomena.

In the RHIC Year-1 RUN, PHENIX has succeeded to observe all the particles described above, and deduced the interesting results.

Figures 1 and 2 show the transverse momentum (pT) spectra of identified π^0's up to $\sim$ 4 GeV/c for (a)peripheral, and (b)central events together with the predictions including (1)neither shadowing nor pT broadening, (2)shadowing and pT broadening, and (3)dE/dx=0.25 GeV/fm, shadowing and pT broadening. π^0's are observed in $\pi^0 \rightarrow \gamma\gamma$

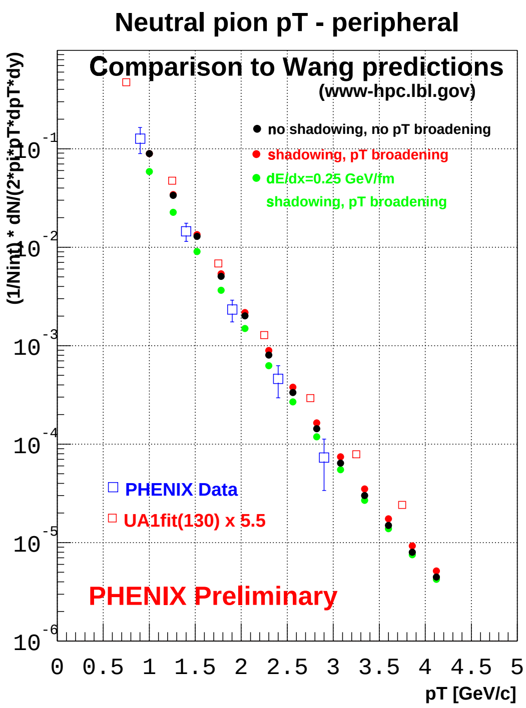

Figure 1: Transverse momentum spectrum for peripheral events

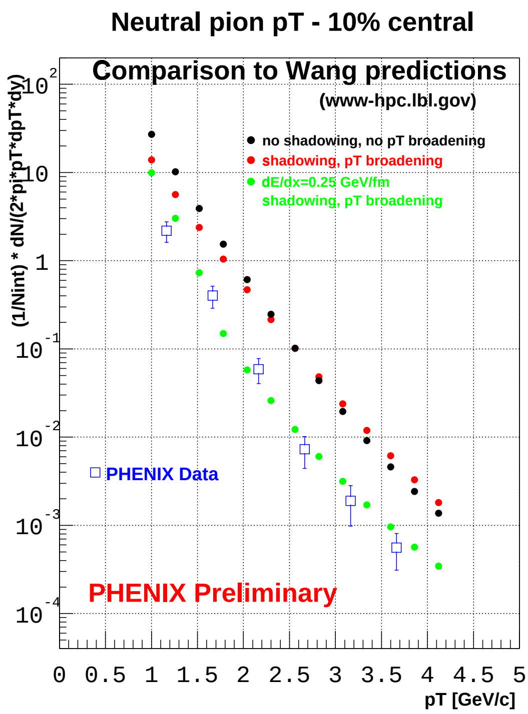

Figure 2: Transverse momentum spectrum for central events

channel with Electromagnetic Calorimeter (EMCal). UA1 power-law fits data are scaled to the energy of $\sqrt{S_{NN}}$=130 GeV and number of binary collisions in Au+Au collisions in the Year-1 experiment. For the peripheral events, the data are not inconsistent with any of senarios, while the data are inconsistent with senarios without dE/dx loss for the central events. The substantial deficit was also observed particularly at higher pT in per-collision yields for central events compared to that for peripheral events. From these results, it is found that the data were inconsistent with straightforward scaling with binary collisions, and were not inconsistent with strong effects from the dense medium.

In PHENIX, a primary electron identification device of ring imaging cherenkov detector (RICH) is installed, and has been successfully operated in Year-1 as well. Figure 3 shows the single electron spectrum expected from various known sources. Electrons decayed from charm quarks in Au+Au collisions at RHIC energy are expected to be $\sim$ 5 times larger than in p+p collisions at ISR energy. The e/π ratios are then expected to reach $\sim 10^{-3}$ in Au+Au collisions at RHIC energy, while $\sim 2.0 \times 10^{-4}$ was in p+p collisions at ISR energy. Figure 4 shows the uncorrected inclusive electron spectrum obtained in the experiment. The spectrum is measured up to 4GeV/c, and compared with $\pi^{\pm}$ and h^{-} spectra in the same acceptance. It is also seen that the $\pi^{\pm}$ spectra are well consistent with π^{0}.

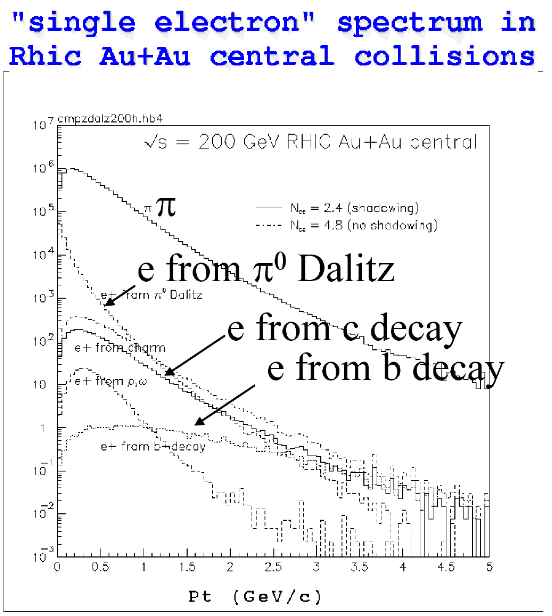

Figure 3: Predicted single electron spectrum from various sources

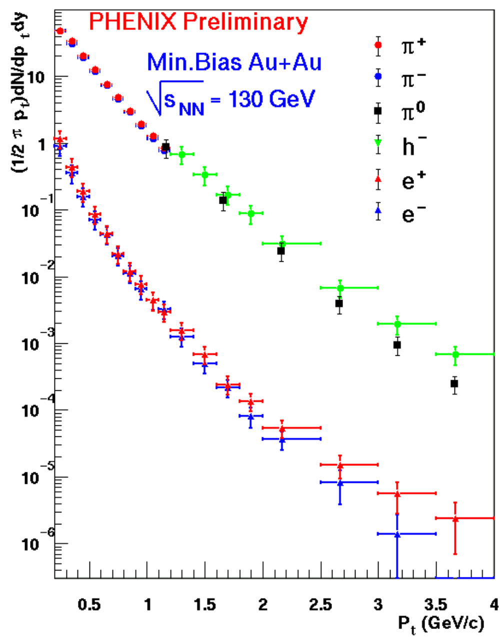

Figure 4: Observed inclusive electron spectrum together with other hadron spectra

In this talk, the most recent results from lepton and photon measurement will be presented, and the things learned in RHIC Year-1 will be discussed. The plan for next year RUN including the capabilities of muon measurement and its commissioning schdule will also be reported.