Neutral pions and photon measurement at RHIC-PHENIX

Takao Sakaguchi, CNS, Univ. of Tokyo, for the PHENIX Collaboration

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 collisions at Relativistic heavy ion collider (RHIC) at Brookhaven National Laboratory (BNL) has been expected to produce a similar phase transition.

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. In the Year-1, it is concentrated on the detection of π^0's because the energy loss by parton multiple scattering in hot dense matter can be observed via π^0's, which results in quenching on high pT regions. The direct photons from the very initial stage of the collisions caused by the compton scattering of quarks and gluons is also special interest, and the precise π^0 measurement is crucial for subtracting the background photons.

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 from photon measurement.

Figures 1 and 2 show the transverse momentum (pT) spectra of identified π^0's up to $\sim 4\,\mathrm{GeV/c}$ 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 $\pi^0 \to \gamma\gamma$ channel with Electromagnetic Calorimeter (EMCal). UA1 power-law

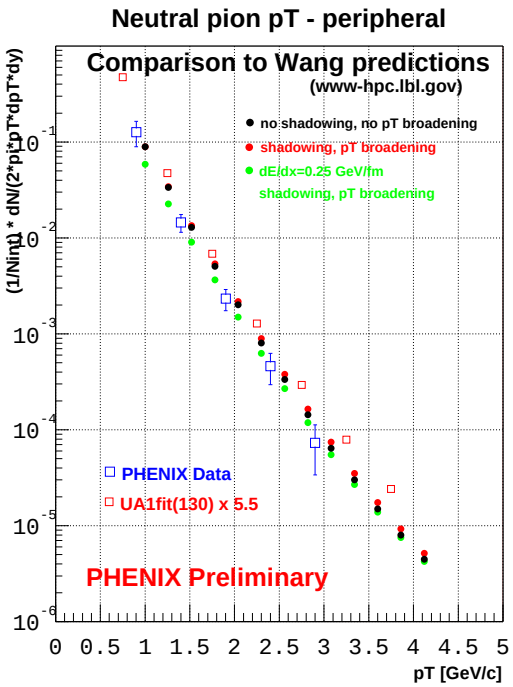

Figure 1: P_T spectrum for peripheral events

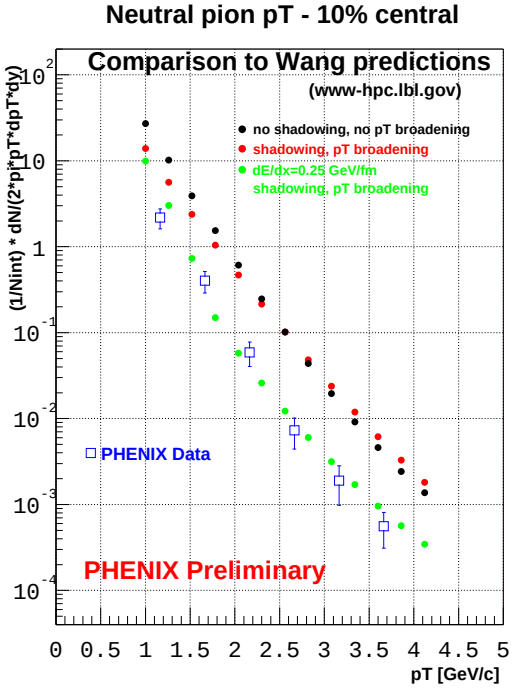

Figure 2: P_T spectrum for central events

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 scenarios, while the data are inconsistent with scenarios 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 this talk, the most recent results from photon measurement will be presented, and the things learned in RHIC Year-1 will be discussed.