Profiling hot and dense nuclear medium with high transverse momentum hadrons produced in d+Au and Au+Au collisions by the PHENIX experiment at RHIC

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After the accumulation of data in various collision systems at different energies at RHIC, the hot dense medium created in Au+Au collisions has been found to have very low shear viscosity (η/s), meaning the system is strongly coupled and has very short mean free path. The interaction of jets produced in the initial hard scattering and the hot dense medium created in heavy ion collisions have been of interest from the beginning of RHIC, since it provides characteristic properties of the medium, such as mean free path and opacity. PHENIX has measured the identified high transverse momentum (p_T) hadrons, such as π^0 and η, with large data sets taken in Year-7 and -10 Au+Au runs and Year-8 d+Au run. We have found that the fractional energy loss ($\Delta E/E$) for high p_T π^0 is strongly dependent on centrality (Figure 1), p_T, and collision energy[1,2]. The azimuthal angle dependence of π^0 nuclear modification factors (R_{AA}) indicated that the energy loss of hadrons is path-length (L) dependent, and that the power is greater than 2 (L^n, n>2), which is inconsistent with pQCD-inspired models as demonstrated in Figure 2. Cold nuclear matter effects, such as k_T smearing can be measured with d+Au collisions. PHENIX has measured high p_T π^0 and η in addition to reconstructed jets in d+Au collisions and quantified these effects.

In this presentation, the latest results on high p_T π^0, η, and jet-related observables in d+Au and Au+Au collisions are presented and discussed.

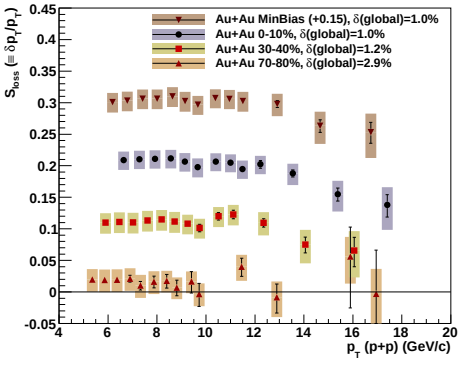

Figure 1: *Centrality dependence of fractional energy loss ($\Delta E/E$) of π^0 in 200GeV Au+Au collisions.*

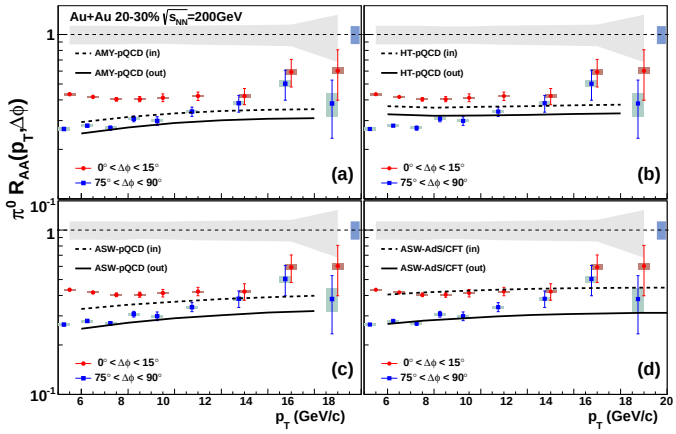

Figure 2: *Azimuthal angle dependence of π^0 R_{AA} in semi-central Au+Au collisions. Top panels show pQCD-inspired, and bottom panels show AdS/CFT-inspired models on data.*

[1] A. Adare *et al.* [PHENIX Collaboration], arXiv:1208.2254 [nucl-ex].

[2] A. Adare *et al.* [PHENIX Collaboration], Phys. Rev. Lett. **109**, 152301 (2012) [arXiv:1204.1526 [nucl-ex]].