TOF single electron v_2 in 200 GeV Au+Au collisions at STAR

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In heavy ion collisions, the anisotropic flow is strongly sensitive to the partonic rescattering. The elliptic flow parameter v_2 from Fourier expansion of the azimuthal distributions is considered as good probe to extrapolate early pressure and density[1]. The mass dependence of v_2 for identified light hadrons can be well reproduced by a hydrodynamical model in the low p_T region (p_T<2 GeV/c), which indicates that the collective motion evolves in early partonic phase of the collisions[2]. The p_T dependence of v_2 scaled by the number of constituent quarks is observed to be universal. The scaling behavior can be illuminated by a quark coalescence model[3]. For heavy flavor quark, due to its extremely heavy mass, it can acquire flow only when light quarks punch it very frequently in a dense medium. The thermal equilibrium in the bulk matter could be approached through sufficient interactions. Therefore, the measurement of v_2 for heavy quarks is vital to test the light flavor thermalization and partonic density in the early stage of heavy ion collisions.

Charmed meson v_2 can be indirectly measured through single electron v_2 because of their strong angular correlation[4, 5]. The measurement of single electron v_2 from STAR will enhance our understanding of the partonic thermalization in the high dense matter. But it is still a challenge due to the huge photon conversion from the virulent material in the STAR detector.

In this analysis, we try to develop a method to measure single electron v_2 from the data taken with the STAR experiment during the $\sqrt{s_{NN}}$=200 GeV Au+Au run in 2004. A total of 19 million 0-80% minimum bias Au+Au events were used. Inclusive electrons are separated from hadrons with more than 90% purity after applying a cut of their dE/dx ($0<n\sigma_e<3$) in the Time Projection Chamber (TPC) and a cut of $|1/\beta-1|<0.03$ in the Time-of-Flight (TOF) at mid-rapidity($-0.7<\eta<0$). In the cylinder with beam direction (z axis) and azimuthal plane, the invariant mass of the e^+e^- pair is reconstructed in the r-z plane with an opening angle cut of ($\phi_{e^+e^-}<\pi/10$) in the azimuthal plane [6]. The photonic electrons are identified from the previous invariant mass subtracted by the combinatorial background in a very low mass region ($M_{e^+e^-}$<15 MeV).

The event plane is reconstructed by the tracks exclude electron candidates ($n\sigma_e<0$ or $n\sigma_e>3$) to remove the auto-correlations. The event plane angle is used as reference to obtain the azimuthal distributions ($dN/d\phi$). The v_2 can be extracted from $dN/d\phi$ in each p_T bin corrected by the event resolution, which is around 72% from random sub-event method. The inclusive and photonic

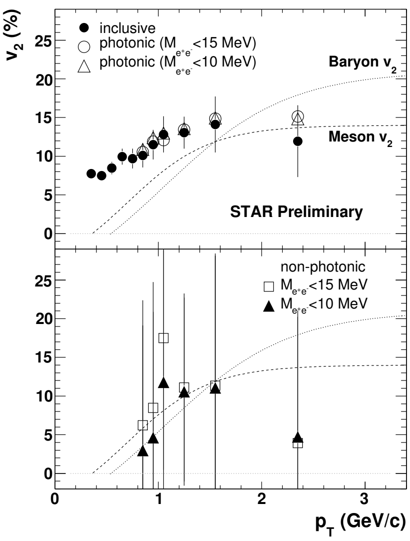

FIG. 1: Upper panel: Inclusive electron and photonic electron v_2. Bottom panel: non-photonic electron v_2.

electron v_2 are shown in the upper panel of Fig. 1. They are higher than the meson and baryon v_2 shown in lines[5] in the low p_T due to the decay kinematics. The different invariant mass cuts are systematically tried for the photonic electron v_2. The non-photonic electron v_2 and its propagated error can be derived from the formulae:

$$v_2^{non} = \frac{rv_2^{inc} - v_2^{pho}}{r-1}, \sigma_{v_2^{non}} \simeq \frac{r\sigma_{v_2^{inc}}}{r-1},$$

where r is the yield ratio of inclusive over photonic electron[7]. The statistic error of photonic electron is negligible comparing to that of inclusive electron. The non-photonic electron v_2 is shown in the bottom panel of Fig. 1. The wild error bars are due to the very small r (∼1.3-1.5 at 2-3 GeV/c), which is related to the huge photon conversion from the material, and large errors of inclusive electron v_2 limited by the small acceptance of current TOF tray. The coming update for STAR detector will provide us a very good chance to measure non-photonic electron v_2 precisely. The hydrodynamic model and quark coalescence model for heavy flavors will be tested from this future experiment at STAR.

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