Interplay between jet and $v_2$

ShinIchi Esumi  
Inst. of Physics, Univ. of Tsukuba

measurements and simulations
Jet suppression modification with 2-particle $\Delta \phi$ correlation

Jet suppression with 2-particle $\Delta \phi$ correlation.
Jet modification and geometry (and $v_2$)

QM08: STAR, PHENIX

QM04: STAR

Mach-cone shape depends on R.P. angle.

Mach-cone is a source of $v_2$
shape(1) = f_1(x)
shape(2) = f_2(x)
shape(3) = f_3(x)
shape(4) = f_4(x)
shape(5) = f_5(x) = f_4(-x)
shape(6) = f_6(x) = f_3(-x)
shape(7) = f_7(x) = f_2(-x)
shape(8) = f_8(x) = f_1(-x)
Simulation

- trigger angle selection among (1) - (8) regions
- two different ways of mixing (top: r.p. random, bottom: r.p. aligned)
- flow subtraction (two components flow+jet model, with inclusive flow measurement, with zyam-like normalization)

\[ \phi_{ASSO} - \phi_{TRIG} \text{ (rad)} \]
trigger angle selection among (1) - (8) regions

top : left-right separated trigger w.r.t. R.P.
bottom : left-right non-separated
line : average of all (1) - (8)

with experimental E.P. resolution ~0.7
Simulation

trigger angle selection among (1) - (8) regions

- Top: left-right separated trigger w.r.t. R.P.
- Bottom: left-right non-separated
- Line: average of all (1) - (8)

with true R.P. (resolution = 1.0)

Flow-subtracted correlation

\[ \phi_{ASSO} - \phi_{TRIG} \text{ (rad)} \]
Simulation

flow-subtracted correlation

\[ \phi_{\text{ASSO}} - \phi_{\text{TRIG}} \text{ (rad)} \]

no R.P. dependence on jet shape
(This will be a pure non-flow.)
RHIC 200GeV Au+Au, mid-central collisions at mid-$p_T$ region (1-4 GeV/c) with $v_2 = 0.1 \sim 0.2$

* Significant semi-hard (mini-jet) fraction relative to soft-thermal contribution $\sim$ several*10%

* Significant $v_2$ effect from the semi-hard component relative to soft-thermal particle $v_2$ $\sim$ several*10%

* Significant smearing on jet shape even with $\sigma_{R.P.} \sim 0.7$
  But it’s not really because of poor accuracy of E.P. angle, it’s more because mini-jets push up the inclusive $v_2$ which is subtracted.

* RHIC data analysis is in progress…
* E.P. can also be biased by correlated pair even with large $\eta$ gap…
Au+Au, 200 GeV

“jet”

Δφ(rad) Δη

QM08 STAR

3<p_T^{trig}<4, 1.5<p_T^{trig}<2.0 GeV/c

Ridge shape depends on R.P. angle.
Ridge is a source of of v_2

Jet does not depends on it
Jet reduces v_2

Δφ = φ_{assoc} - φ_{trig} (rad)

Δη

Δφ(rad)
(1) Away side of a back-to-back (b-t-b) jet is wider in \( \eta \) than in \( \phi \).

(2) If there are two parallel b-t-b jets, away side of one b-t-b jet can be near side of the another b-t-b jet.

(3) Suppression as well as modification of b-t-b jet would depend on relative angle w.r.t. almond geometry, we know this from \( v_2 \) measurement and believe this is the major source of \( v_2 \) at high \( p_T \).

(4) Therefore, there should be inter b-t-b jets correlation give by the geometry from (3), this could make near side ridge like effect, especially if the effect (3) has shaper dependence than \( v_2 (=\cos 2x) \).

(5) We always measure inclusive \( v_2 \), which includes the effect (3). Therefore any modification which generates the elliptic anisotropy would be included in the measured \( v_2 \).

(6) We subtract BG contribution with this \( v_2 \) from (5) by maximizing BG contribution assuming zero jet yield at minimum at any \( d\phi \).

(7) If near and away side jets overlap each other, this subtraction underestimates the jet yield and can change the extracted jet shape.

(8) If you extract angular dependence of jet w.r.t. R.P., the results will easily be affected by the choice of \( v_2 \) from (5).