D^0-meson elliptic flow using event-shape-engineering technique in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV from STAR

Yue Liang, *for the STAR Collaboration*

Kent State University & Lawrence Berkeley National Laboratory

Charm quarks are sensitive to the entire evolution of the system created in ultra-relativistic collisions of heavy ions, as they are produced in initial hard scatterings in these collisions. Recent results from the STAR experiment show that in 10-40% central Au+Au collisions at the top RHIC energy the D^0-meson v_2 follows the Number-of-Constituent-Quark (NCQ) scaling similarly as light-flavor hadrons. Study of correlation between heavy-flavor hadron flow and soft particle flow can provide further insights into the charm quark interactions with the QGP.

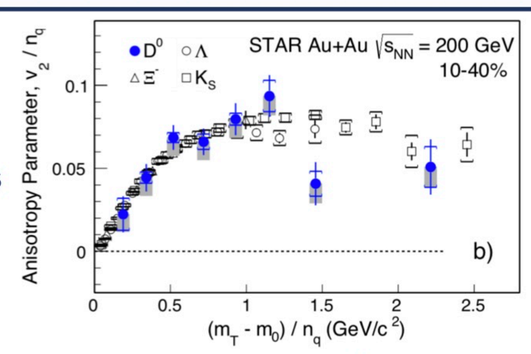
In this poster, we present D^0-meson v_2 as a function of an event shape variable q_2, magnitude of the reduced flow vector, in Au+Au collisions at $\sqrt{s_{NN}}$ = 200 GeV by the STAR experiment. The measurement utilizes the STAR Heavy Flavor Tracker (HFT) and the 1.1 billion minimum bias events collected in year 2016. The results are compared to those of light-flavor and strange-flavor hadrons. Furthermore, we also show results utilizing the Forward Meson Spectrometer (FMS) covering the range of $2.5<\eta<4$. which helps to reduce the non-flow contribution to the D^0 v_2 measurement.

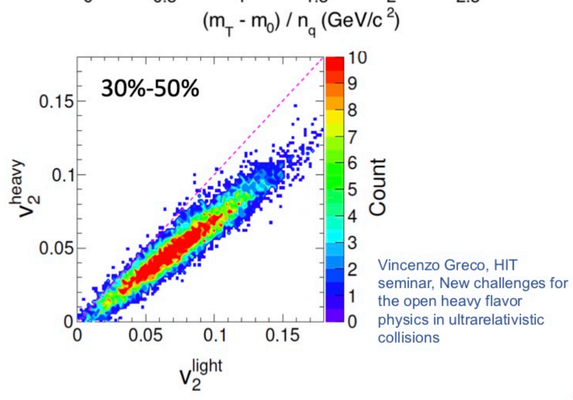
Motivation

- Measurment shows that D^0 meson v_2 follows the same NCQ-scaling as other light-flavor hadrons.*
- Event-Shape-Engineering (ESE) study of D^0 meson v_2 probes the heavy-light flow correlations, offering new insight into QGP medium transport properties.**

* J. Adam, et al. (STAR), Phys. Rev. Lett. 118, 212301 (2017)

** J. Adam, et al. (STAR), Phys.Rev. C96 (2017) no.6, 064903



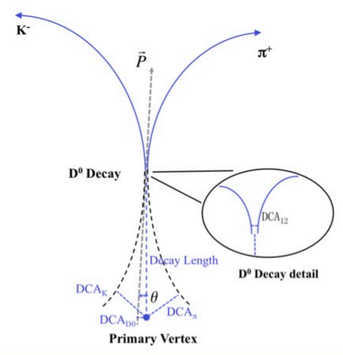


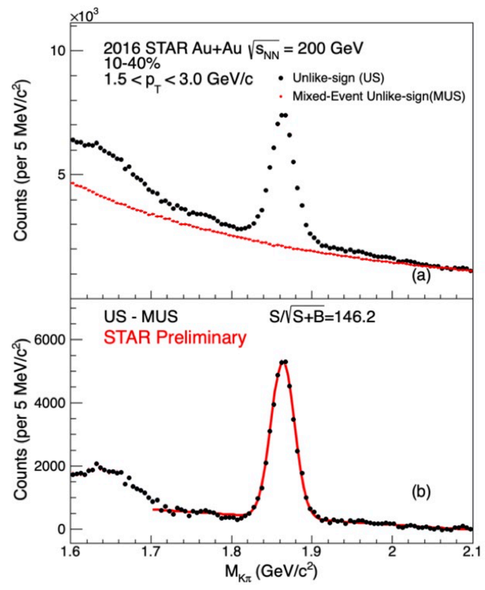
Vincenzo Greco, HIT seminar, New challenges for the open heavy flavor physics in ultrarelativistic collisions

D^0 reconstruction

- STAR Au+Au $\sqrt{s_{NN}}$ = 200 GeV 2016 Dataset: 1.1 billion minimum bias, 660 M events with FMS.
- Topological reconstruction of D^0 decay vertex using HFT.

D^0 decay topology:



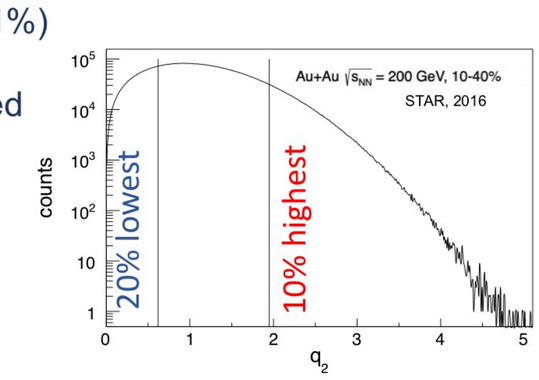


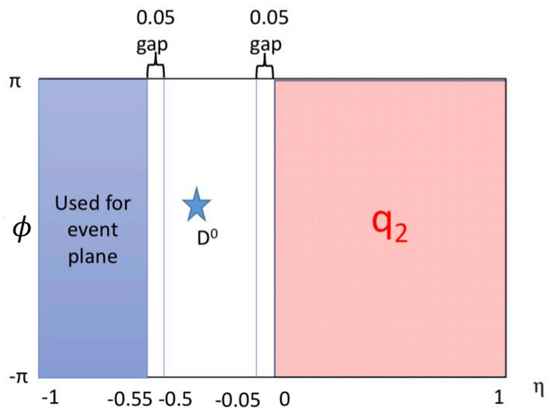
Event-Shape-Engineering (ESE) Method

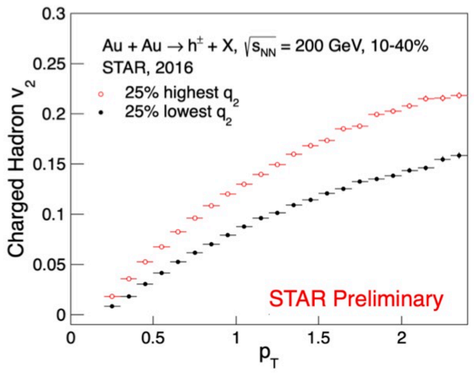
- Event selection based on two approaches: collision centrality and reduced flow vector q_2*.
- Event shape is determined using the reduced flow vector in each narrow (1%) centrality bin.
- The event shape analysis is performed with a three-subevent technique.
- * Phys. Lett., B719:394–398, 2013

$$Q_{2,x} = \sum_i^M \cos(2\phi_i), \quad Q_{2,y} = \sum_i^M \sin(2\phi_i),$$

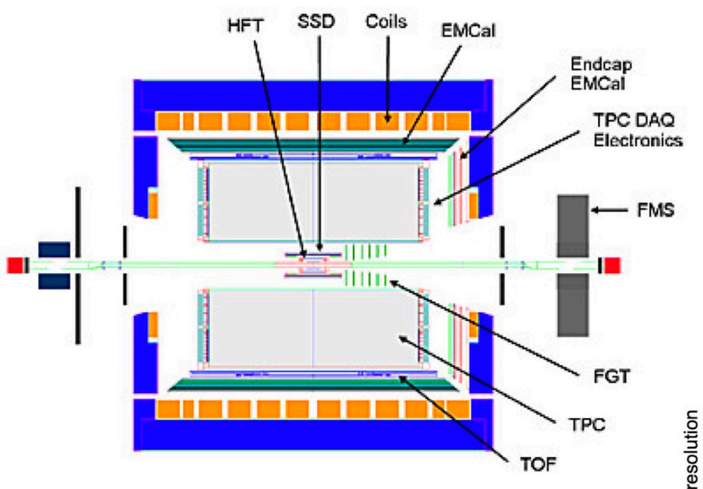
$$q_2 = Q_2 / \sqrt{M},$$



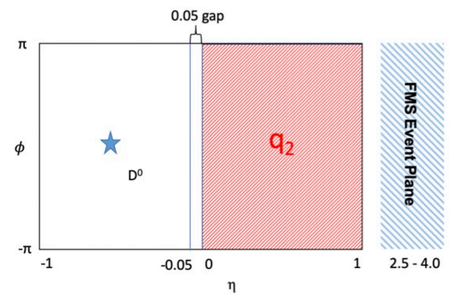


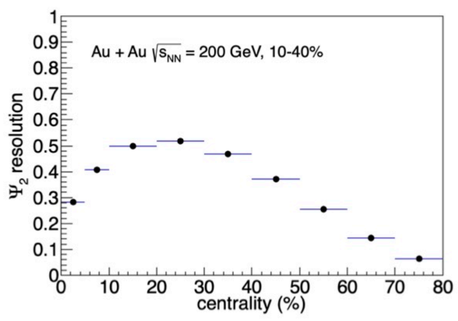


Forward Meson Spectrometer(FMS) as event plane detector

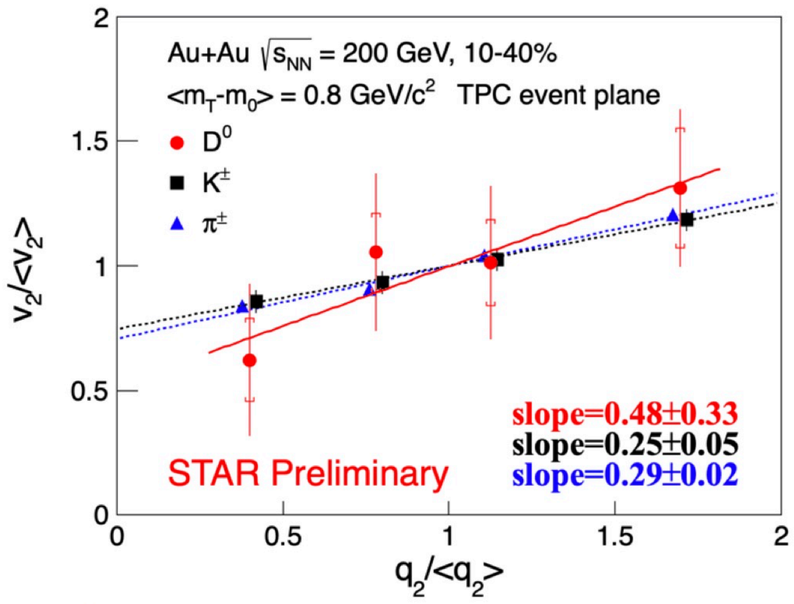


- Acceptance: $2.5<\eta<4.0$, full azimuth.
- Large η-gap w.r.t. the TPC suppresses non-flow contribution significantly.

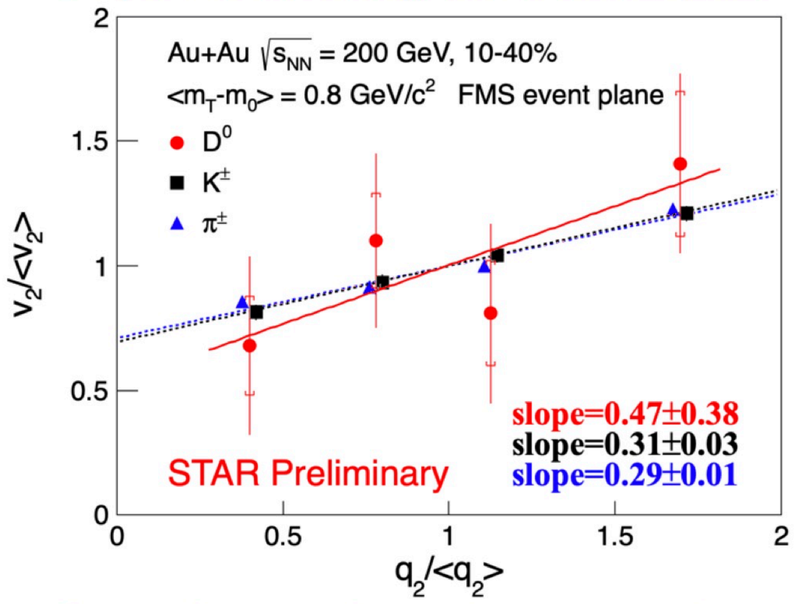




Results



D^0 v_2 as a function of q_2, with TPC event plane



D^0 v_2 as a function of q_2, with FMS event plane

Conclusions and Outlook

- Reduced flow vector q_2 can be used to distinguish events with different elliptic flow v_2.
- v_2 vs q_2 has a linear increasing trend for pions and kaons. Hint of increasing trend for D^0 mesons.
- Future higher statistics analysis including 2014 dataset and compared to model calculations.

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The STAR Collaboration
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KENT STATE UNIVERSITY

BERKELEY LAB