Charged hadron and open heavy flavor muon v_2 in PHENIX Au+Au collisions at 200 GeV

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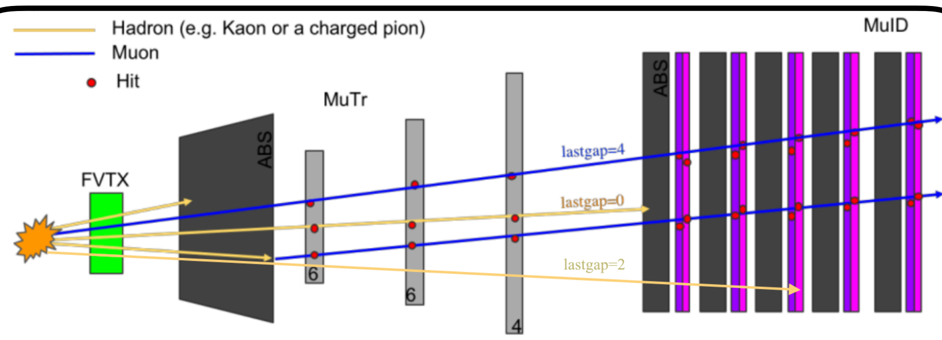
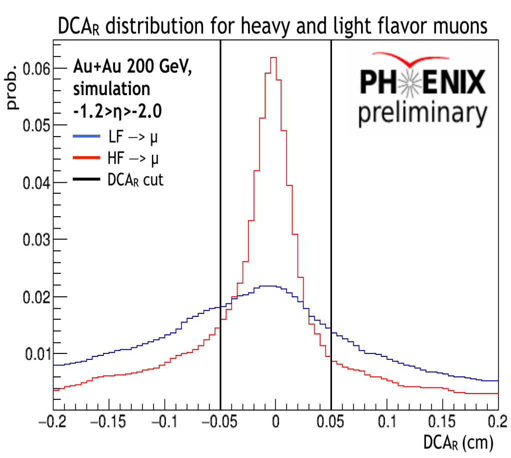
Motivation

- Heavy quark (charm and bottom) production is a powerful tool for probing the QGP
  - Large mass (M_c~1.3 GeV/c^2, M_b~4.2 GeV/c^2) means they are produced in initial hard scatterings
- Of particular interest is any rapidity-dependence in v_2 measurements as particles produced in different rapidity ranges could be subject to different temperatures and pressure gradients in the QGP

PHENIX Muon Arm Analysis

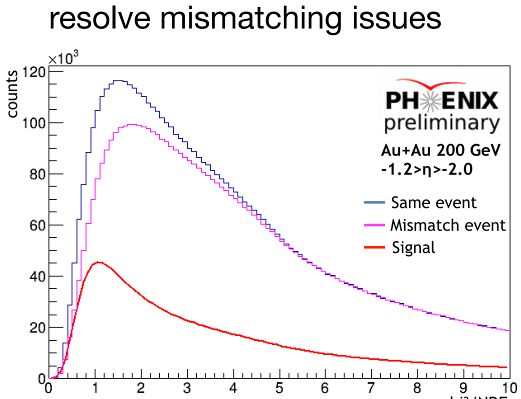




- PHENIX muon spectrometers provide separation of hadrons and muons and precise particle tracking and momentum
- Addition of FVTX gives ability to discriminate on radial distance of closest approach, allowing extraction of heavy flavor particle decays

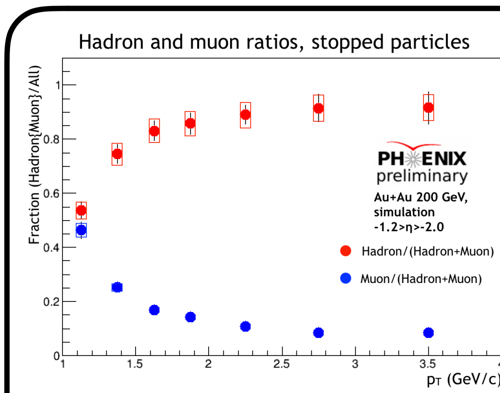
Background Subtraction

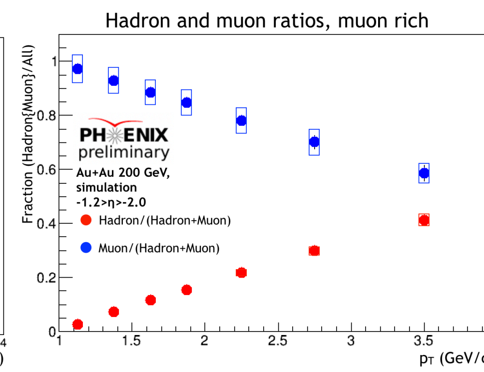
- Due to particles scattering in absorber a single MuTr track can match to multiple tracks in the FVTX
- Because of this we combine a single MuTr track with all matched FVTX tracks and with tracks from 5 mixed events with similar vertex/multiplicity
- By normalizing the mixed event data and subtracting it out we resolve mismatching issues



- Fit same event distribution to a combined function of mixed event and landau
- Scaling factor of fit is normalization of mixed event distribution
- Extract signal from difference between same and mismatch distributions

Heavy Flavor Extraction



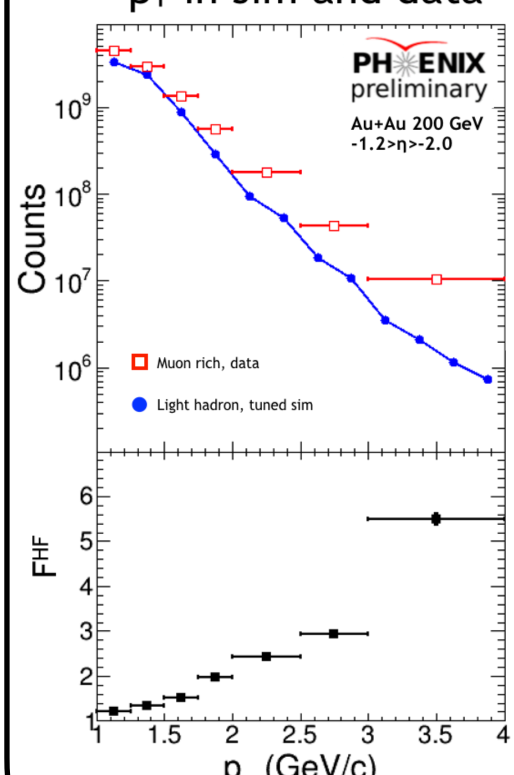


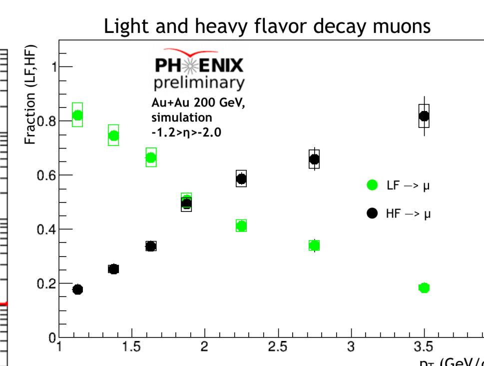
- After tuning PYTHIA+GEANT4 simulation we extract hadron and muon ratios for the different layers of the MuID
- From particle fractions and v_2 in the different layers of the MuID we can extract charged hadron and muon elliptic flow

$$N^{stopped} v_2^{stopped} = N_h^{stopped} v_2^{h} + N_\mu^{stopped} v_2^{\mu}$$

$$N^{muon\ rich} v_2^{muon\ rich} = N_h^{muon\ rich} v_2^{h} + N_\mu^{muon\ rich} v_2^{\mu}$$

p_T in sim and data

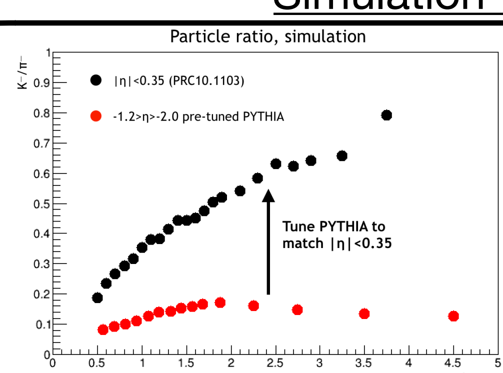


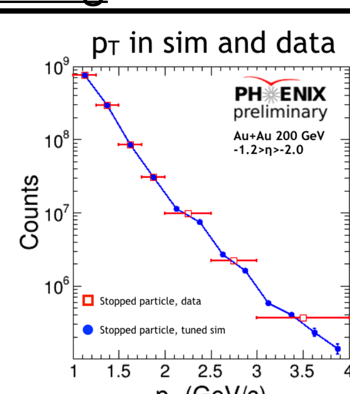


- By comparing light hadron simulation and data in the final MuID layer we extract the fraction of open heavy flavor muons
- We determine v_2 of light flavor muons from tuned simulation, and use this, with the open heavy flavor fraction to measure open heavy flavor elliptic flow

$$v_2^{HF} = \frac{1}{F^{HF}}\left(v_2^{\mu} - (1 - F^{HF}) v_2^{LF}\right)$$

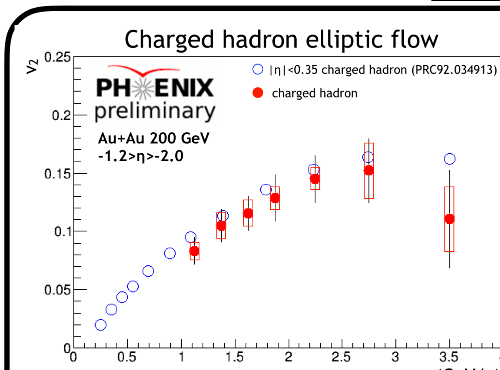
Simulation Tuning

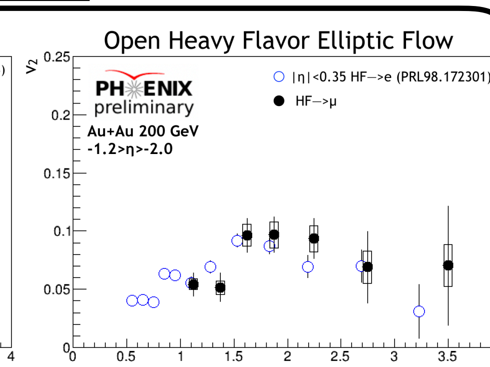




- We tune PYTHIA+GEANT4 detector simulation to match particle ratios from previous PHENIX results
- Also tune p_T distribution to match data for stopped particles

Results





- Charged hadron elliptic flow is systematically lower than the same measurement at mid-rapidity —> rapidity dependence of charged hadron v_2
- Open heavy flavor elliptic flow is consistent with previous PHENIX results for mid-rapidity —> no significant rapidity-dependence of heavy flavor v_2