Studying heavy flavor production via unlike-sign and like-sign dimuon mass spectra in p+p collisions at 200 GeV in the PHENIX Experiment

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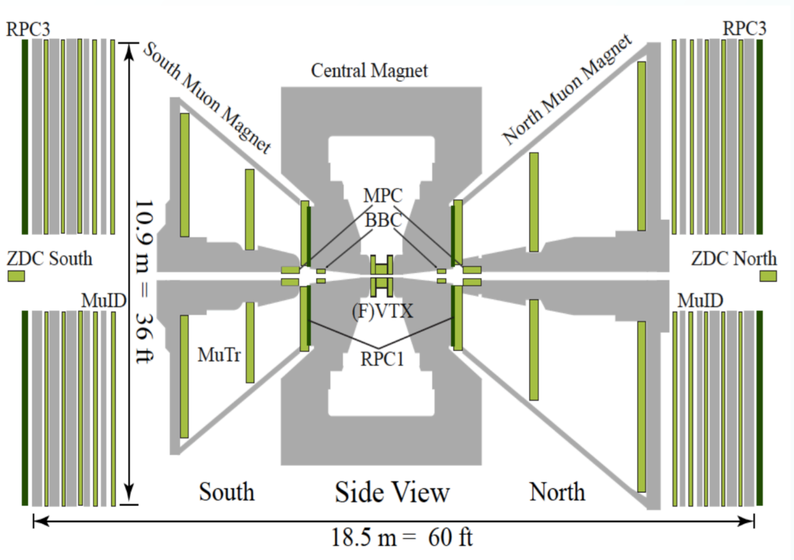
The dimuon mass spectrum, unlike-sign as well as like-sign, is a unique probe to directly access the different stages of a heavy-ion collision. The unlike-sign intermediate ($1< m_{\mu\mu}<2.5$ GeV/c^2) and high ($4.5< m_{\mu\mu}<8$ GeV/c^2) mass regions are dominated by semi-leptonic decays of open charm and bottom, and therefore provide information about the heavy flavor dynamics. The like-sign dimuon mass spectrum in the high mass region mostly comprise of bottom decays coming from B^0 oscillations, which provides a strong constraint to the bottom cross-section. This poster will present the current status of the analysis of open heavy flavor (charm and bottom) using the high statistics 2015 p+p data collected with the PHENIX detector in the rapidity range $1.2 < |y| < 2.2$ at 200 GeV. In this poster, we present the status of the analysis to determine charm and bottom separated yields by exploiting a double-differential fit done simultaneously in mass and p_T, for both unlike and like sign mass spectra, and with charm and bottom as free parameters.

PHENIX muon arms

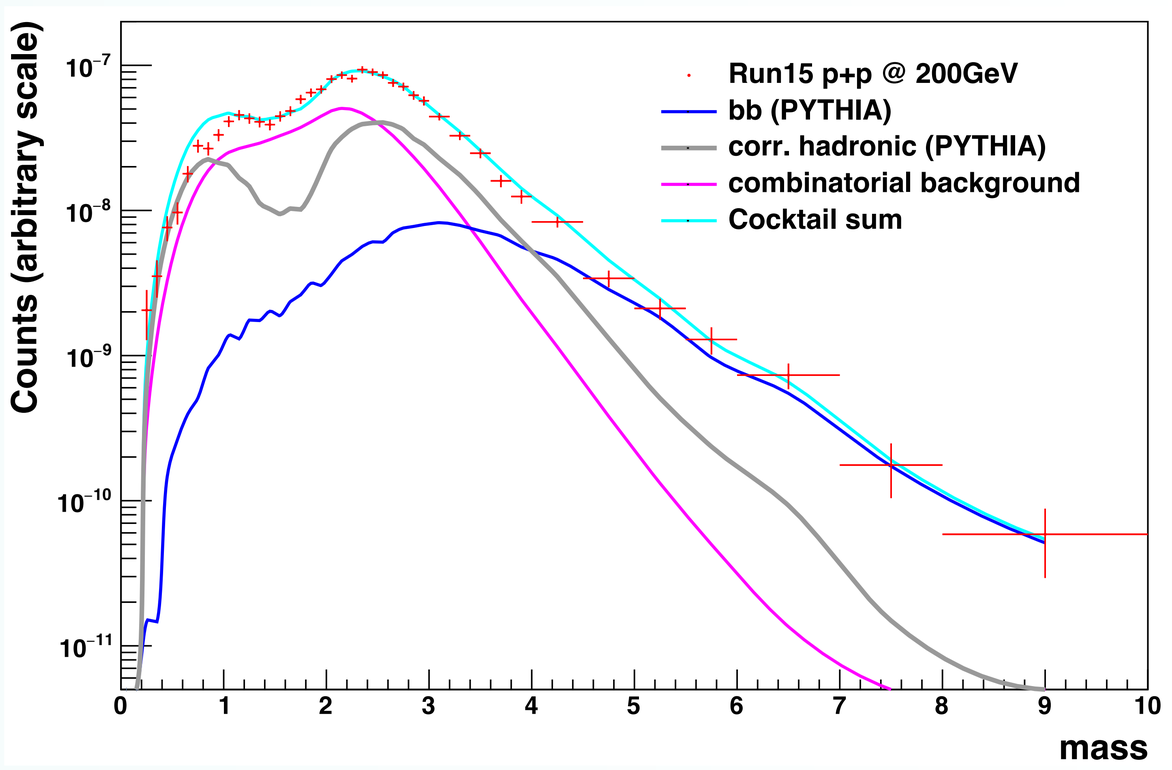


- PHENIX Muon arms consists of three stations of cathode strip chambers(MuTr) for momentum measurement and five layers of proportional tube planes(MuID) for muon identification.
- ~7 interaction lengths of copper/iron absorber material in front of each muon arm to suppress hadron background.

Motivation

- Heavy quark production is a very useful tool to test pQCD theories.
- Provides a baseline to test for nuclear effects in other systems.

The like-sign dimuon spectrum



- Like-sign dimuon pairs consists of:
  - Combinatorial pairs
    - Estimated using event mixing technique
  - Correlated pairs
    - Correlated hadronic pairs
      - Estimated from PYTHIA + GEANT4 simulations
    - Bottom pairs
      - Originates due to B-decay chain and B^0 oscillations (see figure)

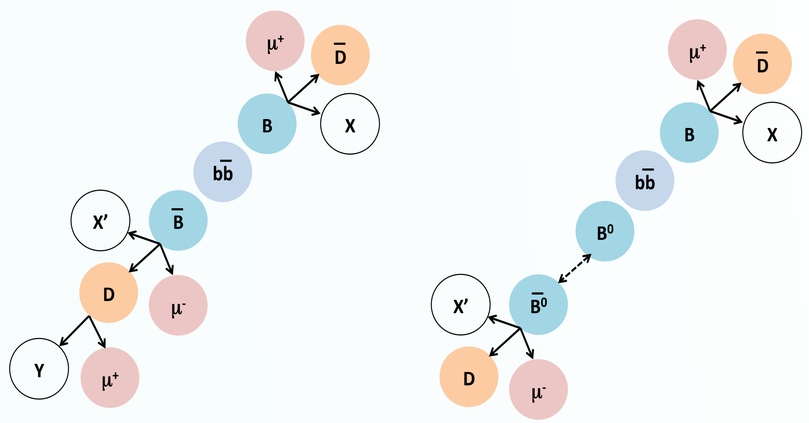
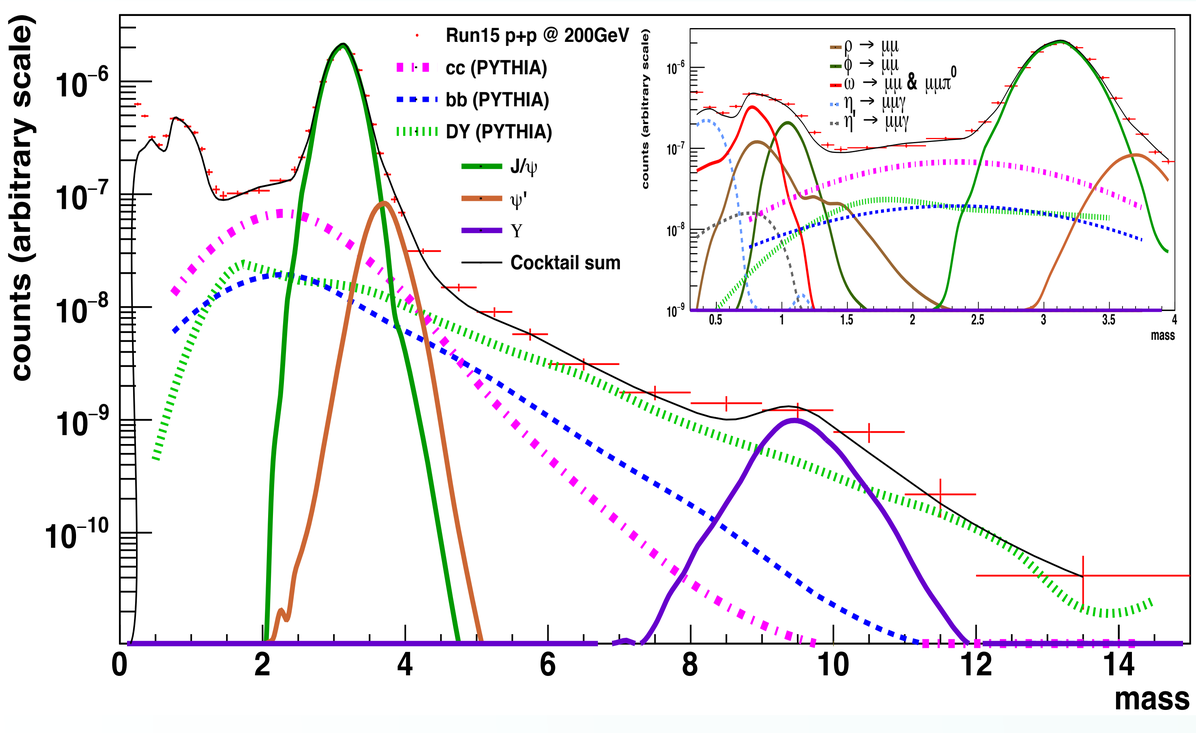


Figure: Cartoon illustrating dimuon pairs from bottom from B-decay chain (left) and B^0 oscillations (right)

The unlike-sign dimuon spectrum



- Like-sign subtracted data to remove combinatorial background pairs and correlated hadronic background.
- Dimuons from meson decays normalized using previous PHENIX measurements.
- Intermediate mass regions dominated by dimuons from charm while high mass region dominated by dimuons from bottom and Drell-yan.

Summary

- **Current heavy quark simulations together with known sources of backgrounds are in reasonable agreement with data.**
- **Charm and bottom decays dominate different parts of the unlike and like-sign dimuon phase space. By simultaneous fitting to mass and p_T, one can separate charm and bottom contributions.**

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