Measurement of charm and bottom yields in Au+Au collisions at RHIC-PHENIX experiment

R. Akimoto for the PHENIX Collaboration
Center for Nuclear Study, Graduate School of Science, University of Tokyo

Introduction

Heavy Quark Measurement
- Behavior of heavy quark inside QGP is not fully understood.
  - e⁺ decayed from D and B mesons have unexpectedly large high-p_T suppression and large collective flow.
  - test of models which describe parton behavior inside QGP
- Only created at the early stage of heavy ion collision
  - information of the early stage

charm/bottom yields from e⁺ DCA distribution
- DCA : Distance of Closest Approach
  - different lifetime -> different DCA shape
- Need a detector with precise DCA resolution (< 100μm)
  - Silicon vertex tracker (VTX) is developed.
  - Barrel type detector with 4 barrels
  - Installed at the end of 2010 and started taking data of p+p and Au+Au collision from RHIC Run-11.

charm/bottom yields extraction

DCA distribution of each component
- non-photonic electron : from heavy flavored hadrons & Kaon
  - created & decayed by PYTHIA + Gaussian convolution (mean: evaluated by GEANT, σ: DCA resolution)
- photonic electron
  - from dalitz decay of pseudo-scalar mesons
    - Gaussian distribution (mean: evaluated by GEANT, σ: DCA resolution)
  - from photon conversion
    - Gaussian distribution (mean & σ: evaluated by GEANT)

Conversion veto & photonic electron yield evaluation
- e⁺ from photon conversion has large DCA tail.
  - large background at region dominated by heavy flavor signal
- e⁺ from photon conversion can be tagged.
  - Hits made by the e⁺ track pair are very near.
  - Order in azimuthal angle of hits created by e⁺ track and e⁻ track is decided by magnetic field. (opening angle ~ 0)
  - Track has another hit near associated hits are tagged out.
- Photonic electron yield is evaluated by amount of tagged electron and tagging efficiency (evaluated by GEANT simulation)
- In high p_T region, amount of e⁺ from photon conversion is enough small after the tagging.
  - But there still remains e⁺ from photon conversion comparable to heavy flavor signal in low p_T region.
  - Conversion-rich side is not used for low p_T region. (Conversion signal has large asymmetry in DCA sign)
- Remaining conversion e⁺ is evaluated by side-band region for DCA in the beam direction.

Result

bottom fraction in heavy flavor
- not much modified from p+p.
  - bottom is suppressed as well as charm.
  - heavy flavor suppression is already measured.

Nuclear modification factor (R_AA) of charm/bottom
- R_AA's of both charm & bottom are less than 1 at high p_T, especially R_B of bottom is very small.
  - FONLL + result from e/h correlation is used as reference for R_AA since analysis for p+p runs are not completed.

Overview of the VTX

<table>
<thead>
<tr>
<th>Life-time (μm)</th>
<th>Life-time (μm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>D_S</td>
<td>132.9</td>
</tr>
<tr>
<td>D_L</td>
<td>149.9</td>
</tr>
<tr>
<td>D diagonal</td>
<td>59.9</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Beam A</th>
<th>Beam B</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.5 GeV/c</td>
<td>2-2.5 GeV/c</td>
</tr>
</tbody>
</table>