Study of heavy-flavor jets with sPHENIX

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on behalf of the sPHENIX collaboration

Quark Matter 2022 - the 29th International Conference
on Ultra-relativistic Nucleus-Nucleus Collisions
4-10 April 2022, Krakow, Poland
Heavy-flavor jets in sPHENIX

**Jet structure**
- vary momentum/angular scale of probe

**Parton energy loss**
- vary mass/momentum of probe

- $u,d,s$
- gluon
- photon

**Study of mass-dependent energy loss inside the QGP**

**First HCal at RHIC for jet measurement**

**Precise tracking and vertexing with the tracking system for heavy-flavor study**

**Large data sample (15 kHz trigger rate)**

**First $b$-jet measurement at RHIC!**
**b-jet tagging algorithms**

**Secondary Vertex Method**
- Reconstruct SV using tracks inside a jet cone
- Select $b$-jet candidates based on the 3D flight distance of SV

**Track Counting Method**
- Tracks from $b$-jet likely have large DCA
- Select $b$-jet candidates based on the number of tracks with large DCA

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Tracking performance

DCA resolution

- $sPHENIX$ simulation
  - nTPC>20, nMVTX>2
- 3MHz pp
- 50kHz 0-20fm AuAu

Tracking efficiency

- $sPHENIX$ simulation
  - nTPC>20, nMVTX>2
- 3MHz pp
- 50kHz 0-20fm AuAu
Performance in $p+p$

- Simulation study with inclusive jets in PYTHIA8
  1) Geant4 detector simulation
  2) Track and vertex reconstruction
  3) Analysis for $b$-jet tagging
- ~60% $b$-jet efficiency and ~40% $b$-jet purity
  with the track counting method
  ➔ Similar working point as CMS
- Properties of SV such as SV mass provides
  further discrimination power and data-driven validation
• Simulation study with inclusive jets in PYTHIA8 embedded to background events from HIJING Au+Au of 0-4 fm

• ~40% $b$-jet efficiency and ~40% $b$-jet purity with both methods ➔ Similar working point as CMS

• Very high purity of $b$-jet samples can be selected with a SV mass cut
- First heavy-flavor jet measurements at RHIC with sPHENIX will provide important information on mass-dependent response inside the QGP
- Data taking will be started in early 2023!

- Analysis framework is being tuned with Mock Data Challenges
- New tagging algorithms will be explored