Study of heavy-flavor jets with sPHENIX

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on behalf of the **sPHENIX** collaboration

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부산대학교
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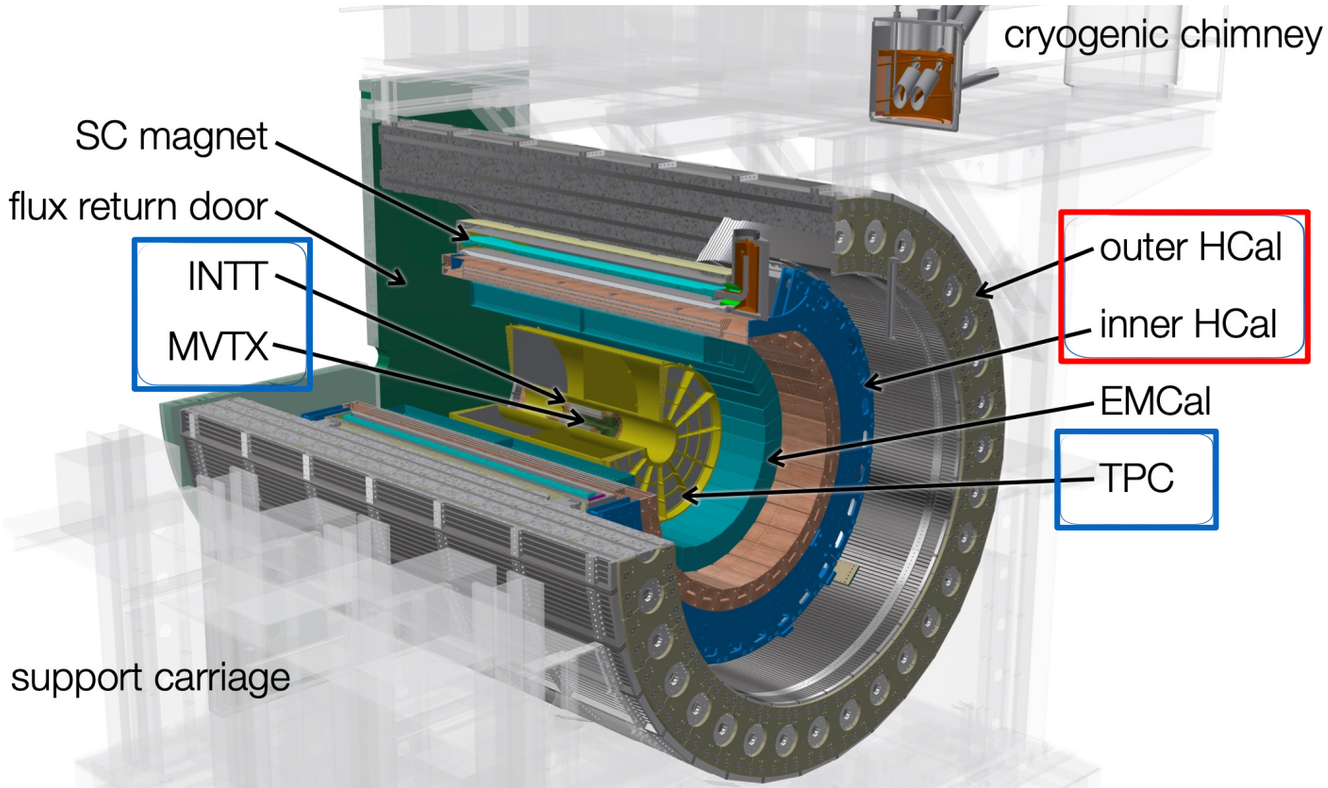
sPHENIX

Heavy-flavor jets in sPHENIX



Study of mass-dependent energy loss inside the QGP

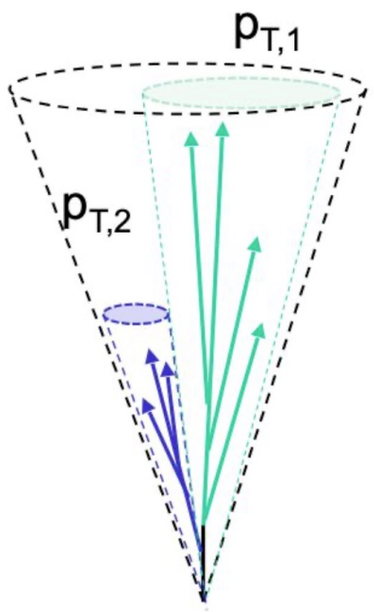
First HCal at RHIC for jet measurement

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

Large data sample (15 kHz trigger rate)

Jet structure

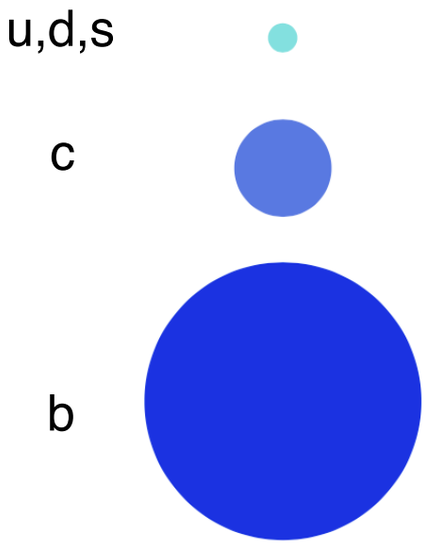
vary momentum/angular scale of probe



Parton energy loss

vary mass/momentum of probe

photon
gluon

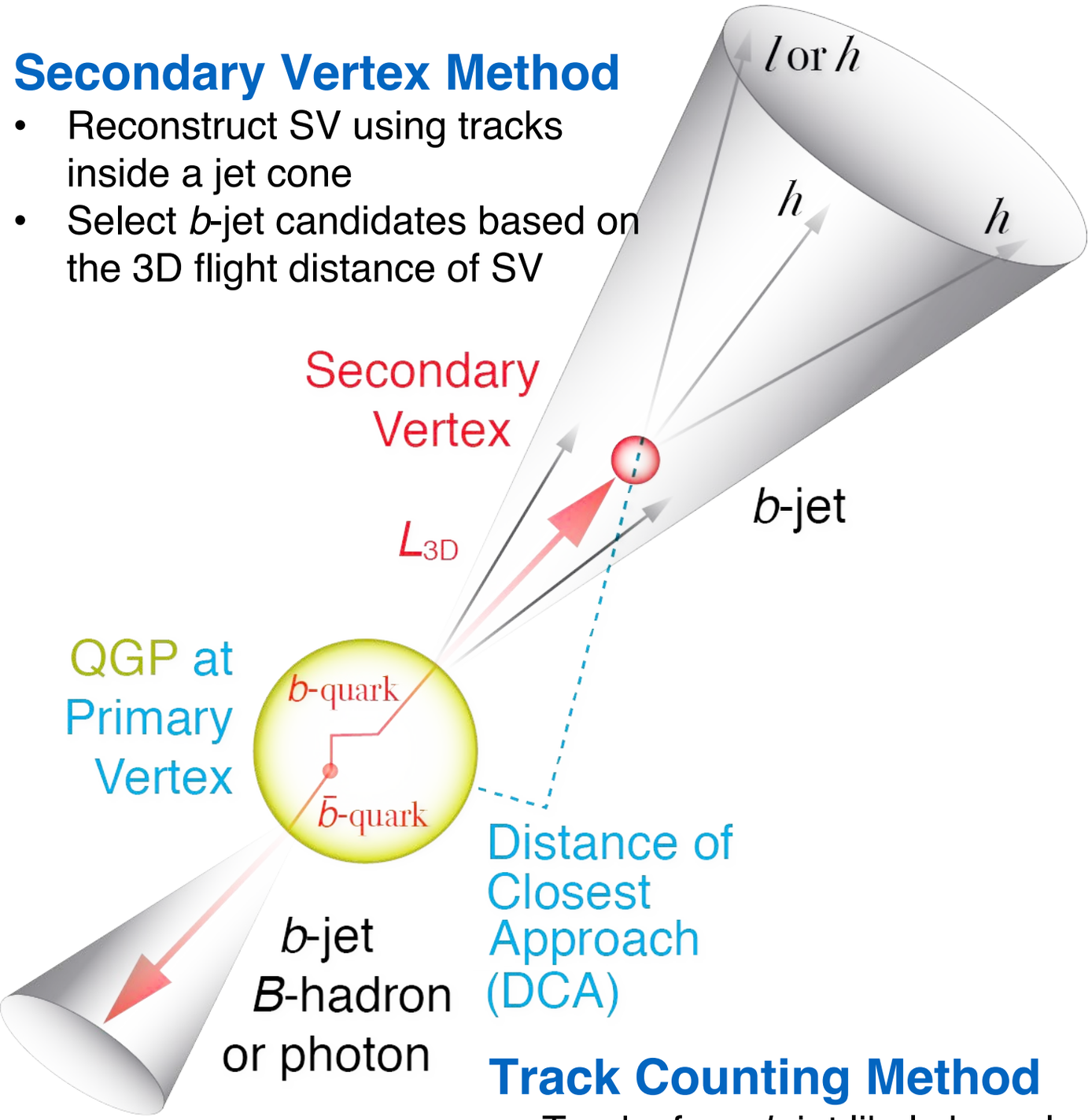


First *b*-jet measurement at RHIC!

b-jet tagging algorithms

Secondary Vertex Method

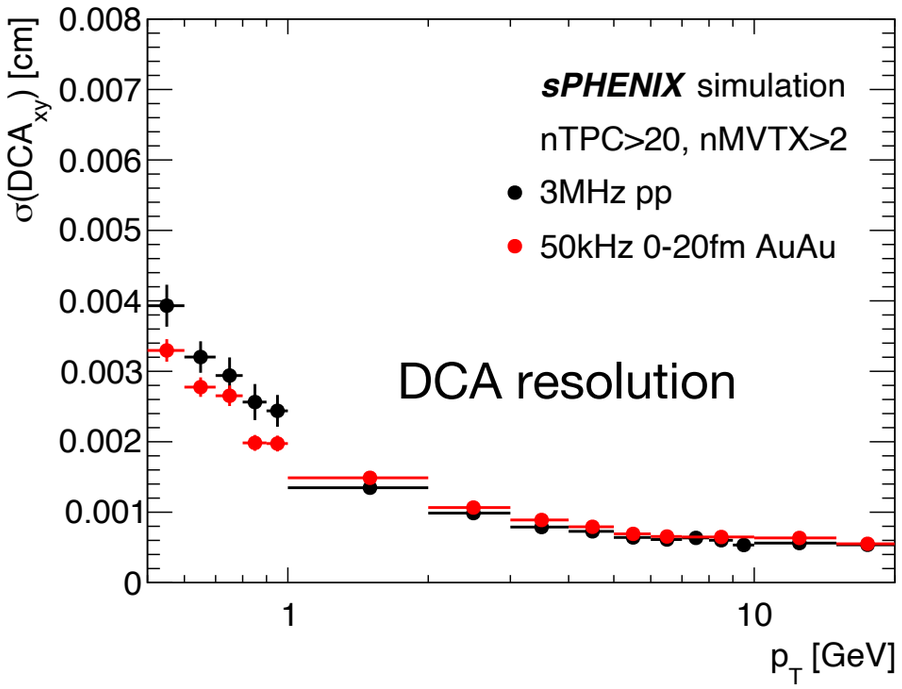
- Reconstruct SV using tracks inside a jet cone
- Select *b*-jet candidates based on the 3D flight distance of SV

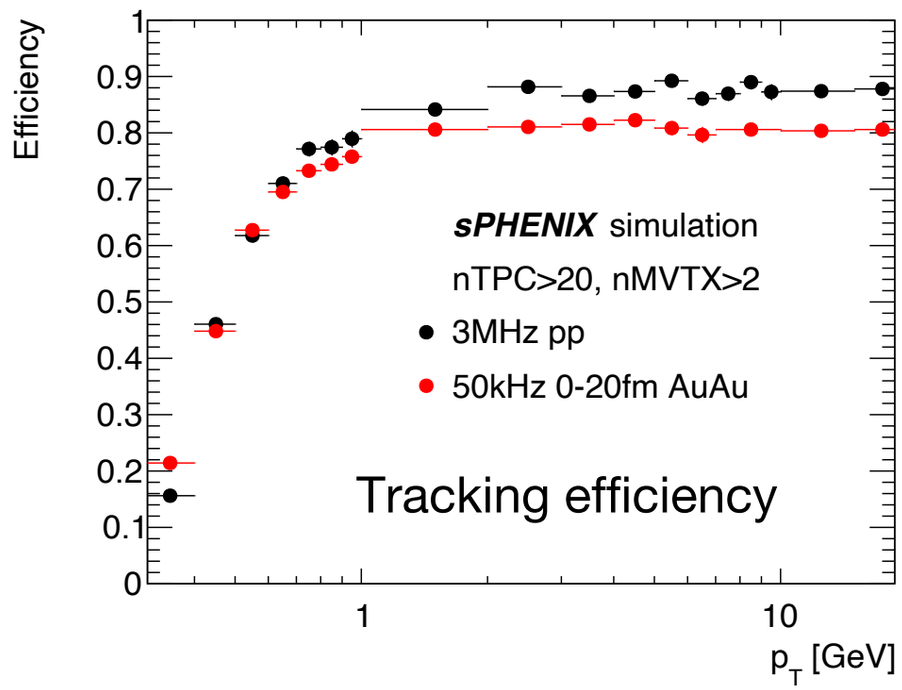


Track Counting Method

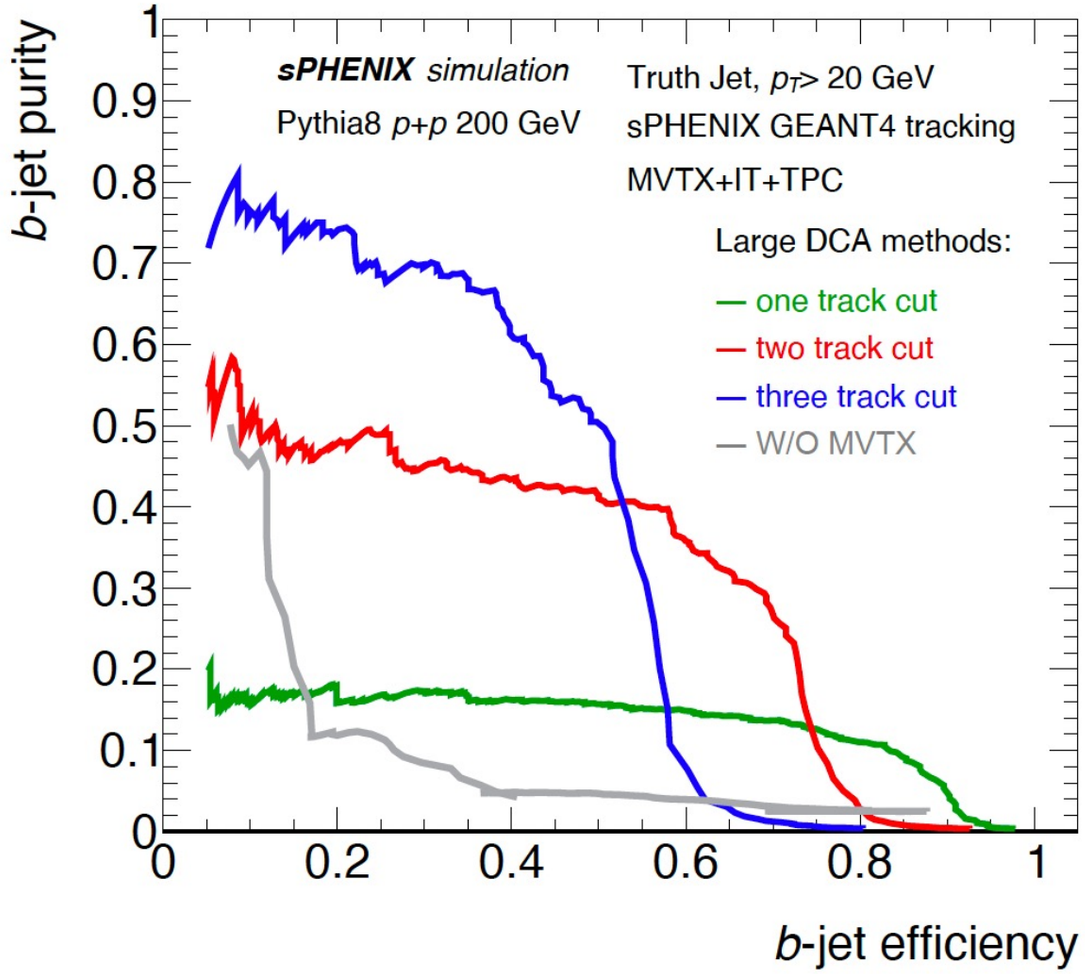
- Tracks from *b*-jet likely have large DCA
- Select *b*-jet candidates based on the number of tracks with large DCA

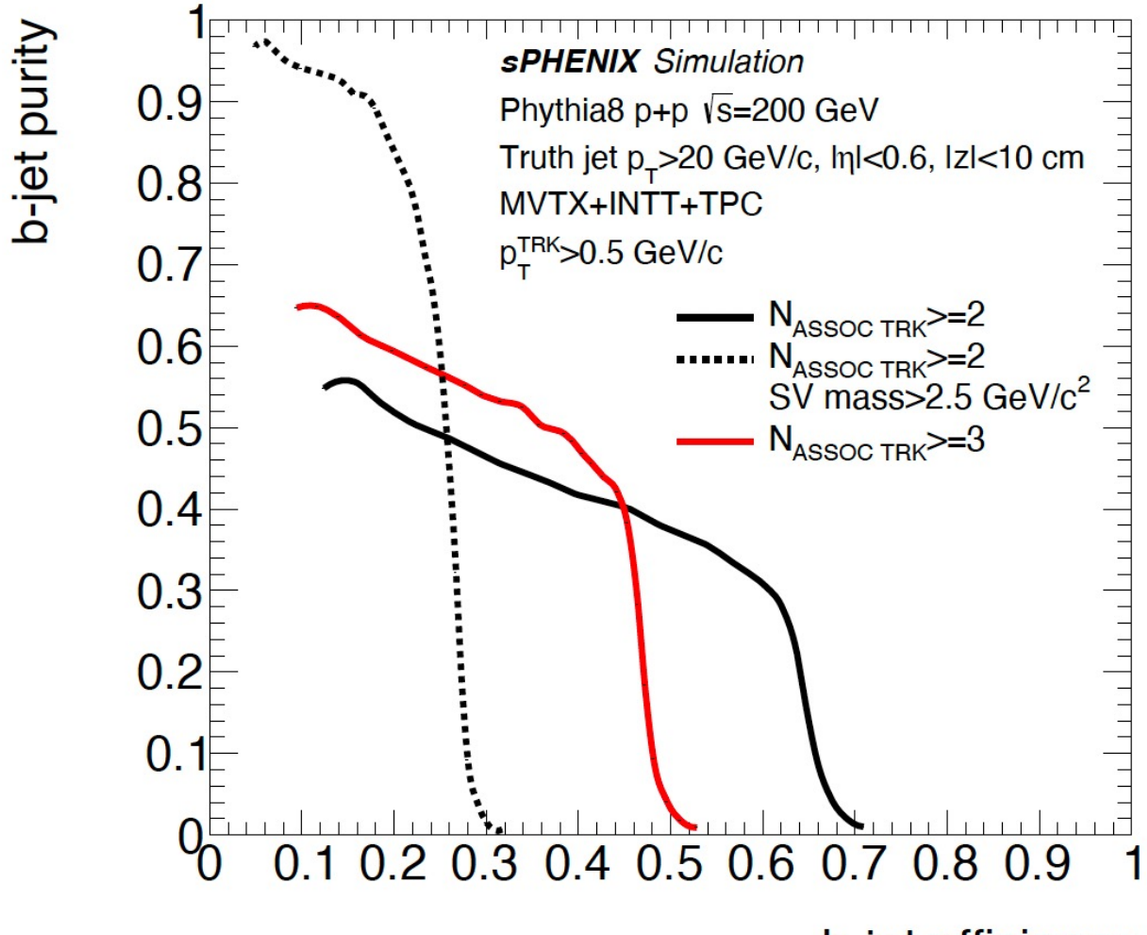
Tracking performance



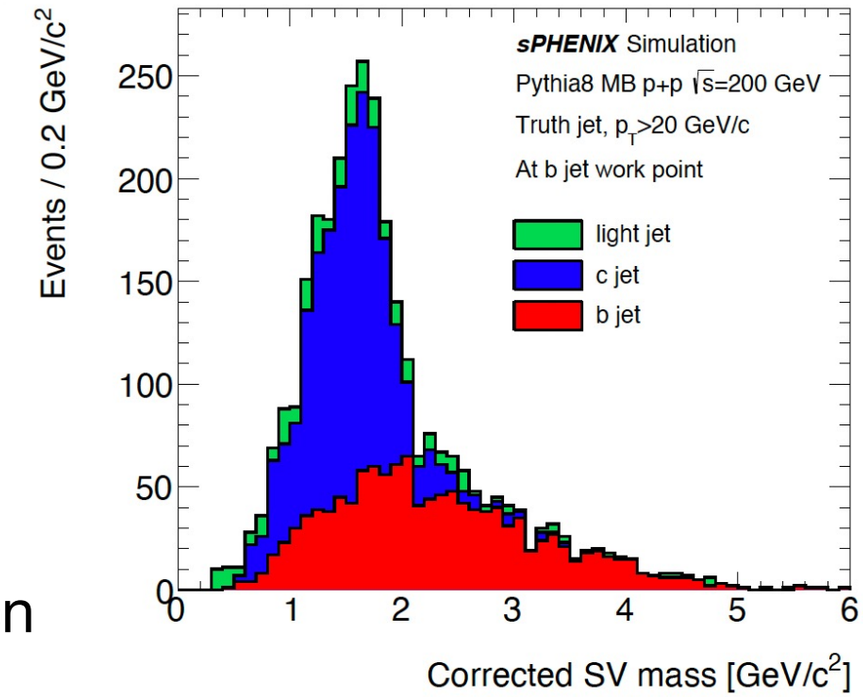


Performance in *p+p*

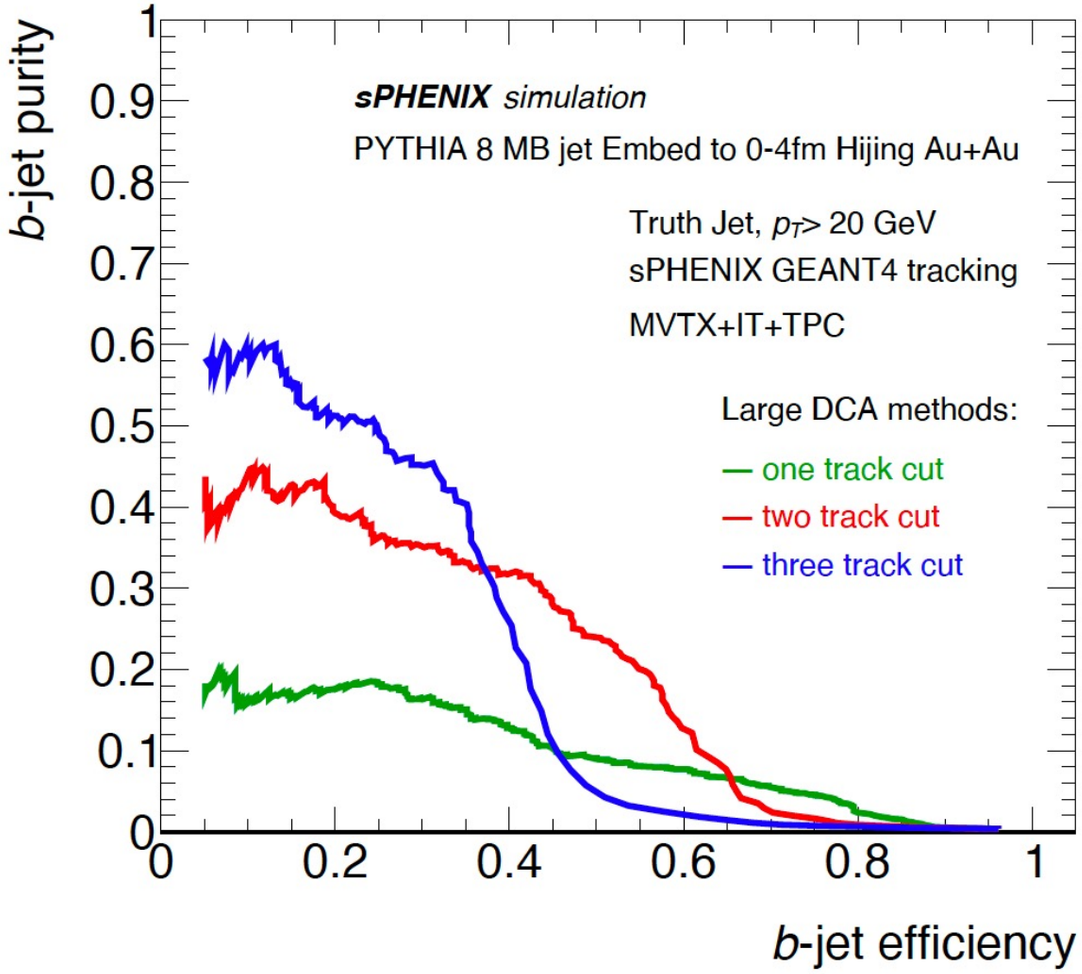


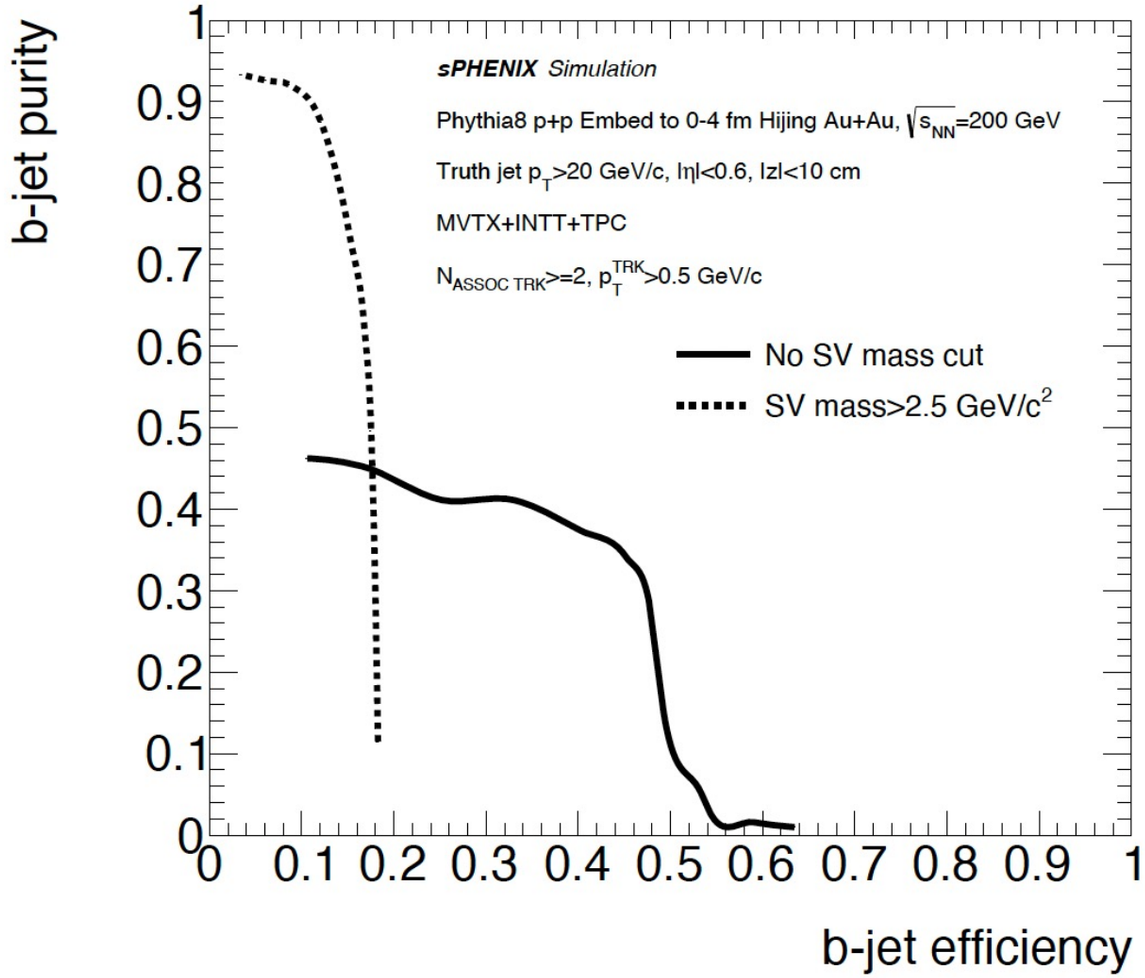


- Simulation study with inclusive jets in PYTHIA8
  1) Geant4 detector simulation
  2) Track and vertex reconstruction
  3) Analysis for b-jet tagging
- **~60% *b*-jet efficiency and ~40% *b*-jet purity** with the track counting method
  ➔Similar working point as CMS
- Properties of SV such as SV mass provides further discrimination power and data-driven validation



Performance in central Au+Au





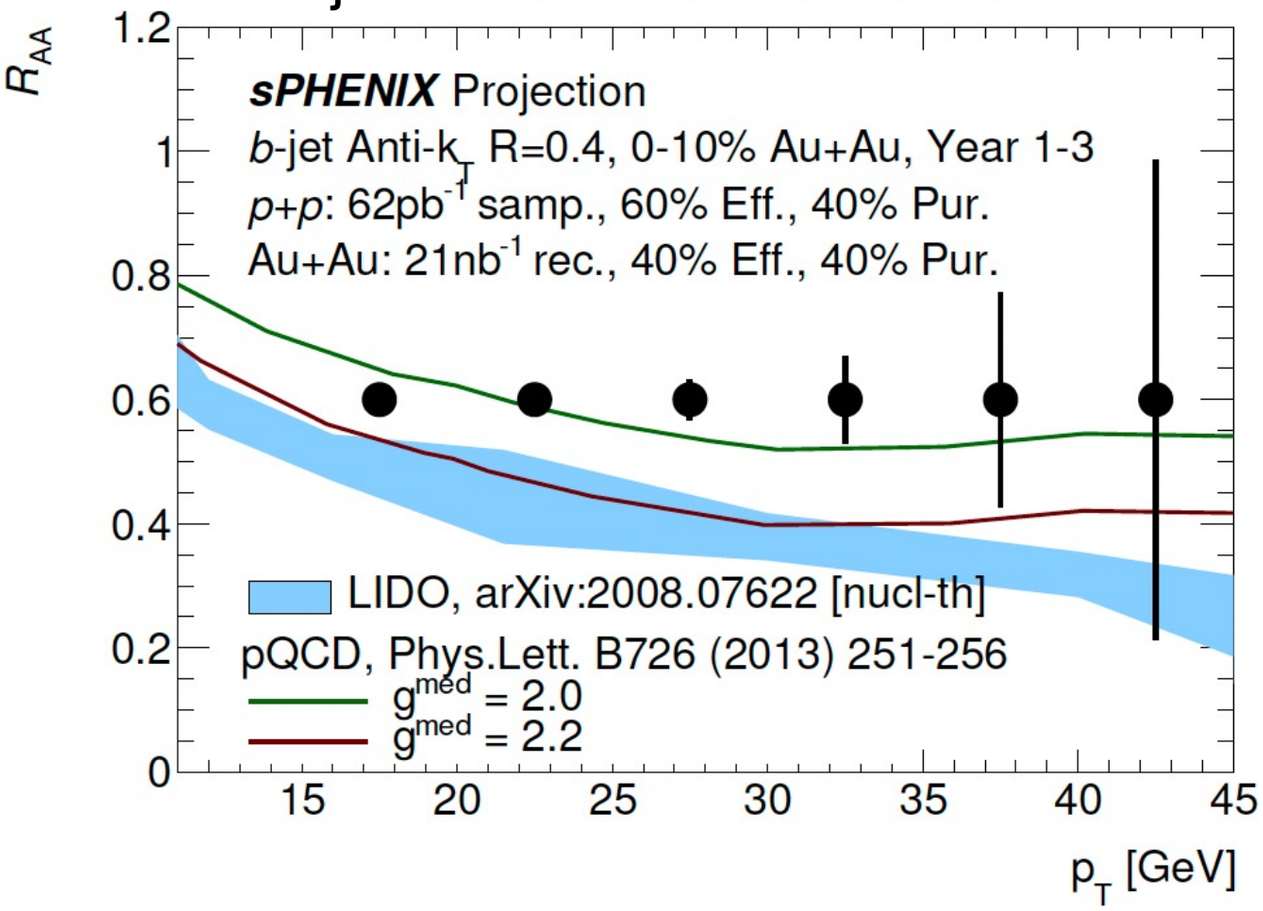
- Simulation study with inclusive jets in PYTHIA8 embedded to background events from HIJING Au+Au of 0-4 fm

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

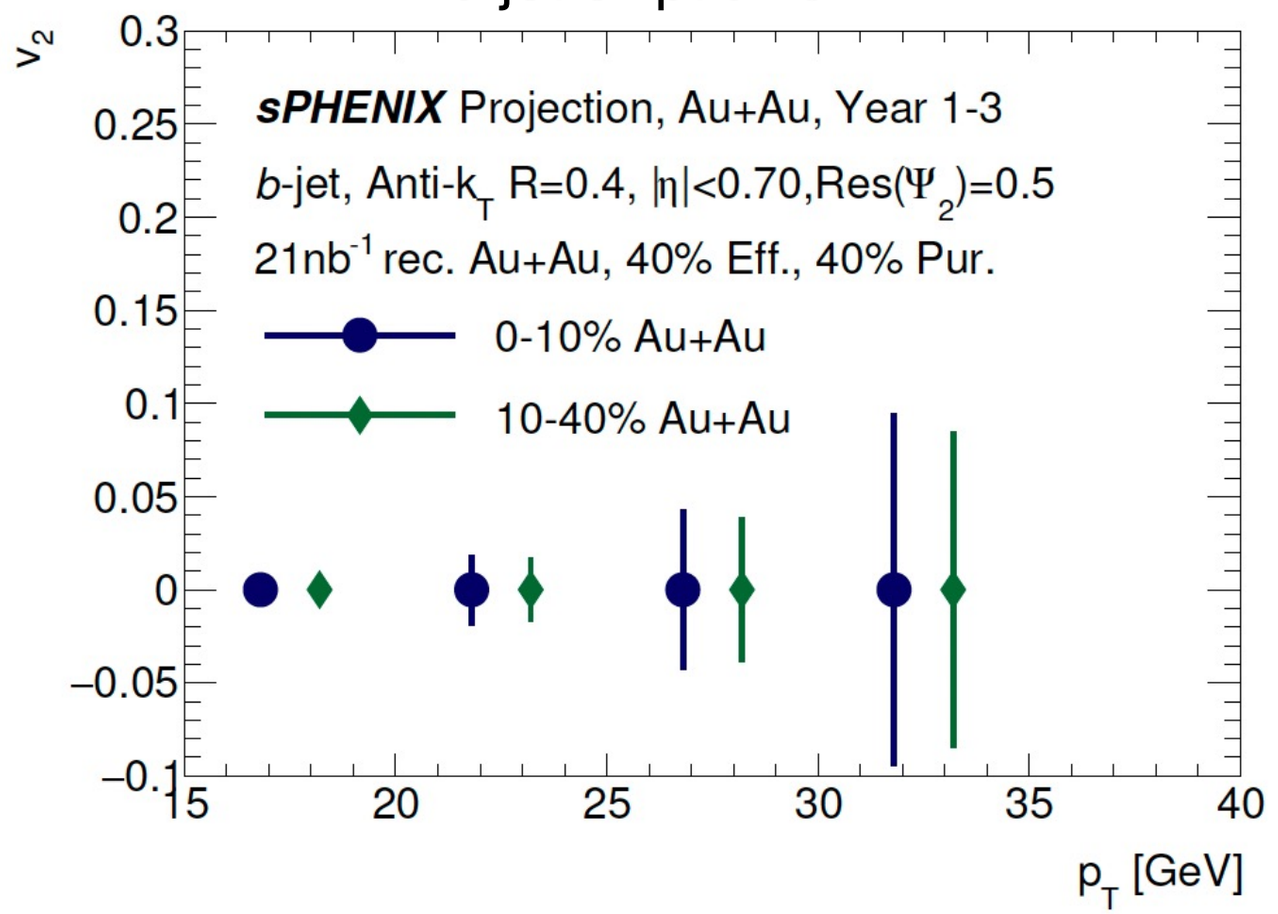
- Very high purity of *b*-jet samples can be selected with a SV mass cut

Outlook

b-jet nuclear modification factor



b-jet elliptic flow



- 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