Heavy Flavor Capabilities of the sPHENIX Experiment

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Abstract

The sPHENIX detector at BNL’s Relativistic Heavy Ion Collider (RHIC) will measure a suite of unique jet and Upsilon observables with unprecedented statistics and kinematic reach at RHIC energies. The projected Au + Au events to be collected by sPHENIX from Years 1 - 3 is about 142 billion. A MAPS-based vertex detector upgrade to sPHENIX inner tracking system, the MVTX, will provide a precise determination of the impact parameter of tracks relative to the primary vertex in high multiplicity heavy ion collisions. These new capabilities will enable precision measurements of open heavy flavor observables, covering an unexplored kinematic regime at RHIC. The physics program, its potential impact, and recent detector development will be discussed in this poster.

sPHENIX Detector

- An upgrade of the PHENIX experiment, state-of-the-art jet detector at RHIC
- Study the inner workings of GGP with hard probes at a broad range of length scale
- Complementary to LHC experiments at different temperature and baryon chemical potential
- Enabling precision bottom quark physics studies at RHIC

MVTX Detector and Vertexing Capabilities

- MVTX: Monolithic Active Pixel Sensor (MAPS)-based vertex detector
- Adapting the inner barrel of ALICE inner tracking system (3 layers)
- Placed nearest the collision point
- High granularity of pixel pitches
- Track vertex distance of closest approach (DCA) resolution < 30 μm for pt > 1 GeV/c
- Precise vertexing and enables the b-jet and open heavy flavor physics programs

Upsilon Spectroscopy

- Measurement of the Υ(1S, 2S, 3S) states with precise invariant mass resolution
- Sufficient accuracy for clear separation of the Υ(1S, 2S, 3S) states
- Feasibility check of first measurement of Υ(3S) state in Au + Au collisions ongoing
- Sequential melting of Υ(1S, 2S, 3S) states: suppression due to color screening effect with the presence of the QGP medium

Summary

- Rich and comprehensive heavy flavor physics program
- MVTX provides precise vertexing, crucial for heavy flavor hadron reconstruction
- Large statistics and excellent tracking for precise heavy flavor measurements down to low pt
- Potential Υ(2S) pt differential measurements down to pt = 0
- Study hadronization mechanism of bottom quarks

References

- sPHENIX Collaboration, A. Adare et. al., arXiv: 1501.06197