Open Heavy Flavor Physics with sPHENIX

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Outline

● sPHENIX Overview
● Tracking Detector Status and Recent Results
● Heavy Flavor Measurement Projections
● Status and Outlook
sPHENIX Physics Program

Bulk physics
sPHENIX Detector

- 1.4 T Solenoidal B Field
- 15 kHz trigger and streaming readout
- $|\eta| < 1.1$ and full $2\pi$ azimuthal coverage
- All detectors critical for completion of our physics goals, tracking detectors most critical for execution of our HF program

sPHENIX BUP, 2022.
Tracking Detectors

- **MVTX**
  - Precision vertexing
  - Technology from ALICE inner tracker

- **INTT**
  - Fast detector to resolve bunch crossings

- **TPC**
  - Primary tracker, crucial for momentum resolution

- **TPOT**
  - Micromegas tracker for TPC space charge distortion calibration
Tracking Detector Status
MVTX Status

sPHENIX Preliminary, Cosmic run, Run 25475
August 18, 2023

sPHENIX Preliminary, p+p, 200 GeV, 05/31/2024
INTT Status

August 18, 2023

sPHENIX Preliminary
Au+Au $\sqrt{s_{NN}} = 200$ GeV

INTT Number of clusters

August 18, 2023

sPHENIX Preliminary
Au+Au $\sqrt{s_{NN}} = 200$ GeV

Number of clusters at inner barrel

Number of clusters at outer barrel
TPC Status

Clusters drifting in TPC
TPOT Status

07/11/2023

sPHENIX Preliminary
Au+Au $|s_{NN}| = 200$ GeV

sPHENIX Preliminary
Au+Au $|s_{NN}| = 200$ GeV
All Tracking Subsystems Event Display
$K_S^0$ and $\Lambda^0$ Reconstruction with TPC

- First TPC Data from Run 24 (~1s of planned physics production rate)
Projections
\( \Lambda_c^+ \) Measurements and Hadronization

- RHIC and LHC data suggest a significant enhancement of the charm baryon to meson production ratio in sPHENIX collision systems (p+p, p+Au, Au+Au)
- First ever p+p \( \Lambda_c/D^0 \) measurement at RHIC energies
- Increased understanding of charm hadronization in the QGP
Energy Loss Measurements

- Increased understanding of energy loss in the QGP
- p+p data crucial for baseline

See talk by Jakub Kvapil at 11:30!
Collectivity

**sPHENIX Simulation**

- Enhanced understanding of HF collective motion through evolution of the QGP
- Precision bottom measurements to constrain heavy quark diffusion transport parameter
**D^0 v_1 and TSSA**

- Quantitative access to initial electromagnetic field strength in heavy ion collisions

**sPHENIX Simulation**

- Constraints on trigluon correlation function
Conclusion and Outlook

- Run24 p+p data-taking is ongoing!
- Crucial time for HF program and baseline measurements for the entire heavy ion physics program
- Exciting for the collaboration and looking forward to Au+Au running in 2025!

Full set of current and future sPHENIX results: https://www.sphenix.bnl.gov/PublicResults