



sPHENIX



Open Heavy Flavor Physics with sPHENIX

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University of California - Los Angeles

Outline

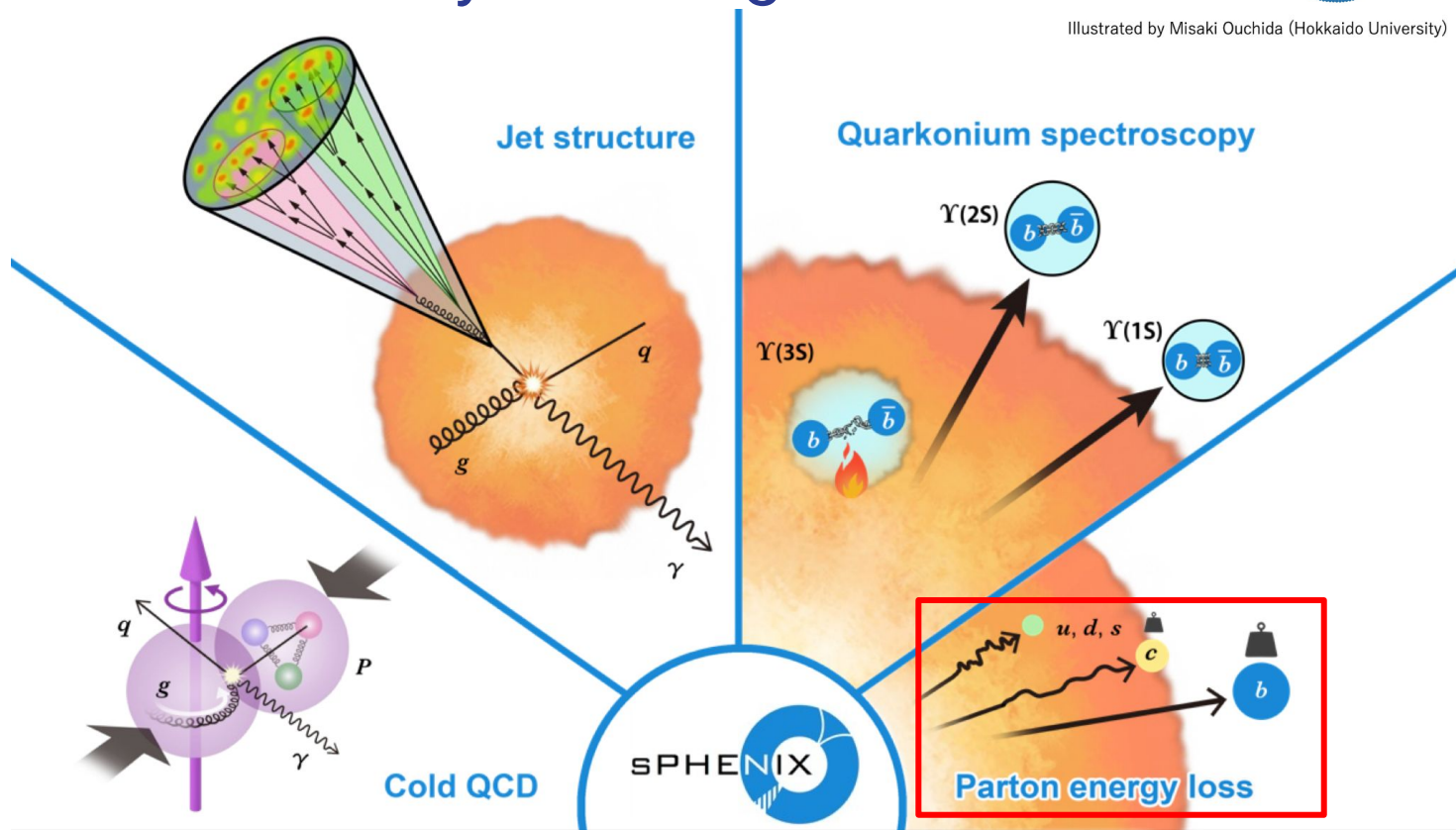


- sPHENIX Overview
- Tracking Detector Status and Recent Results
- Heavy Flavor Measurement Projections
- Status and Outlook

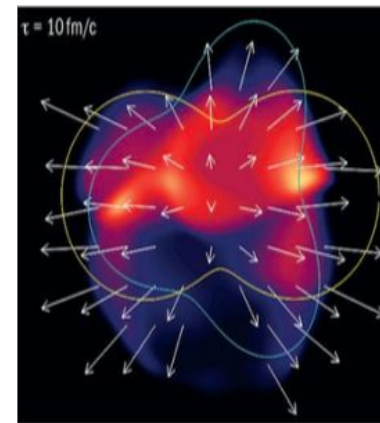
sPHENIX Physics Program



Illustrated by Misaki Ouchida (Hokkaido University)



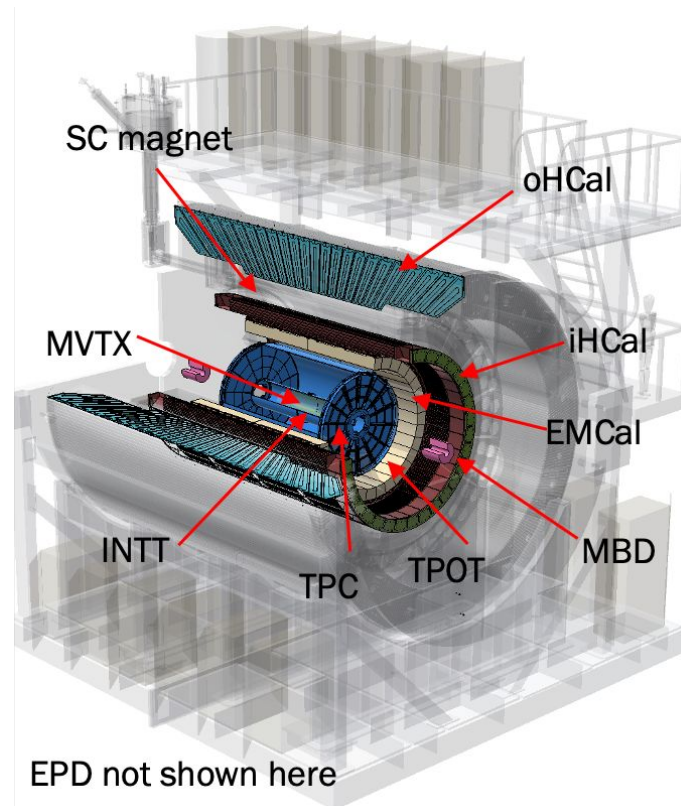
Bulk physics





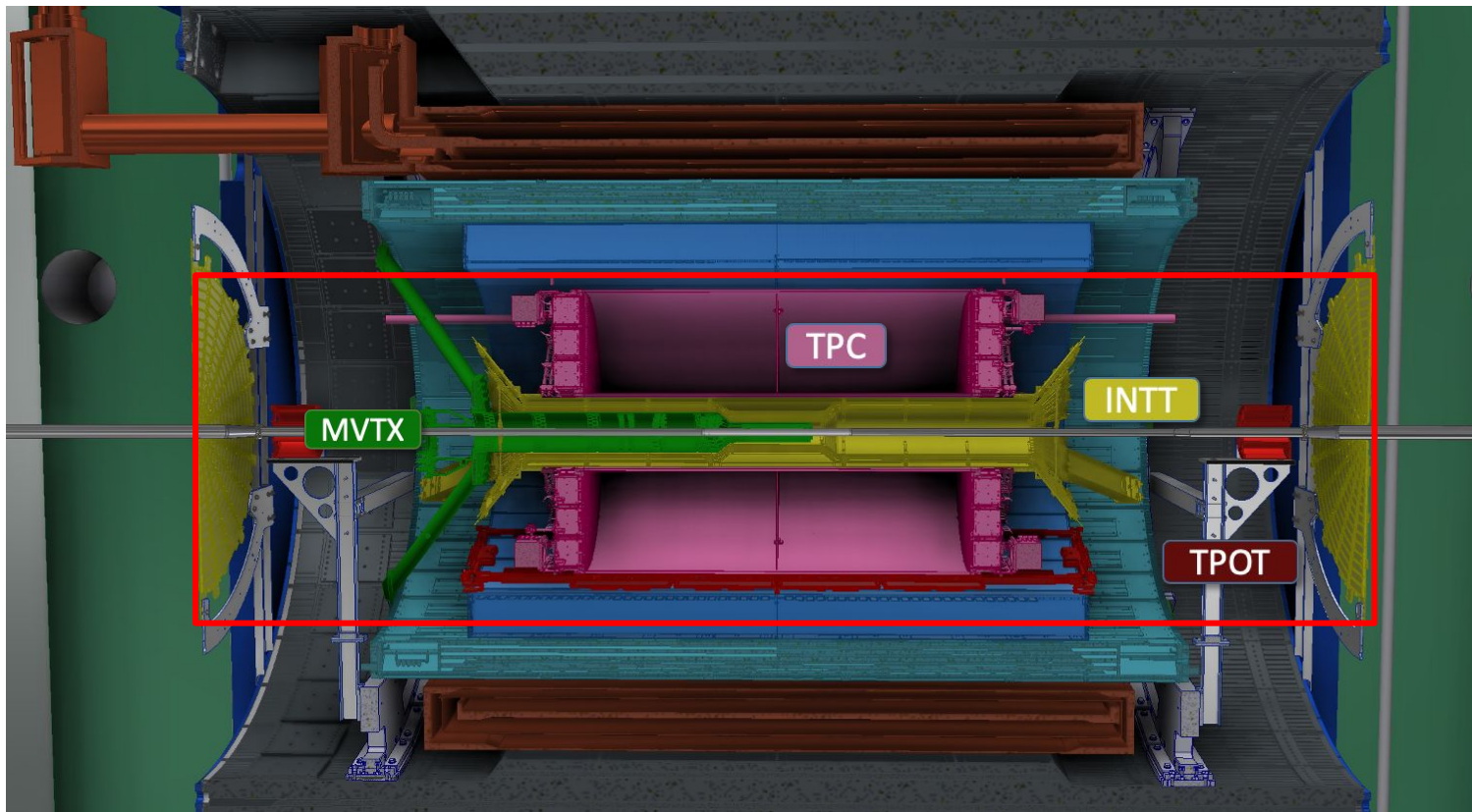
sPHENIX Detector

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



sPHENIX BUP, 2022.

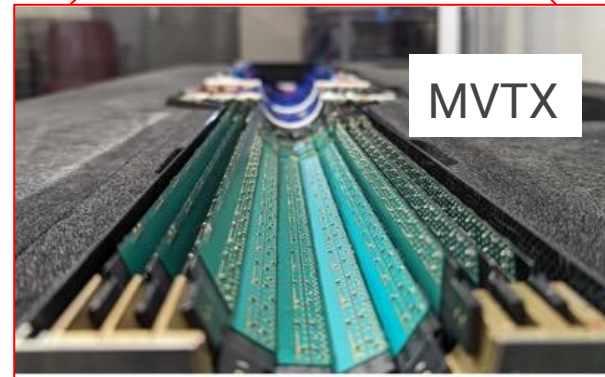
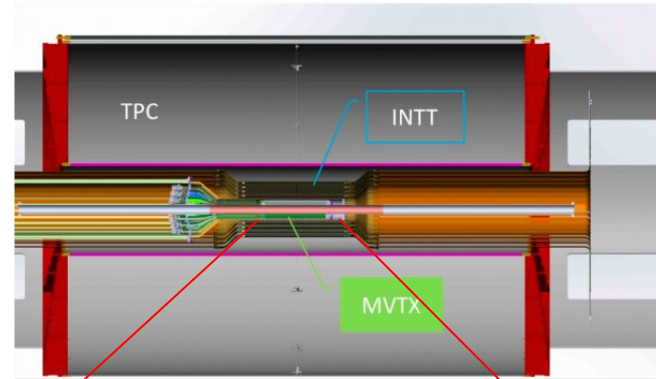
Tracking Detectors





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



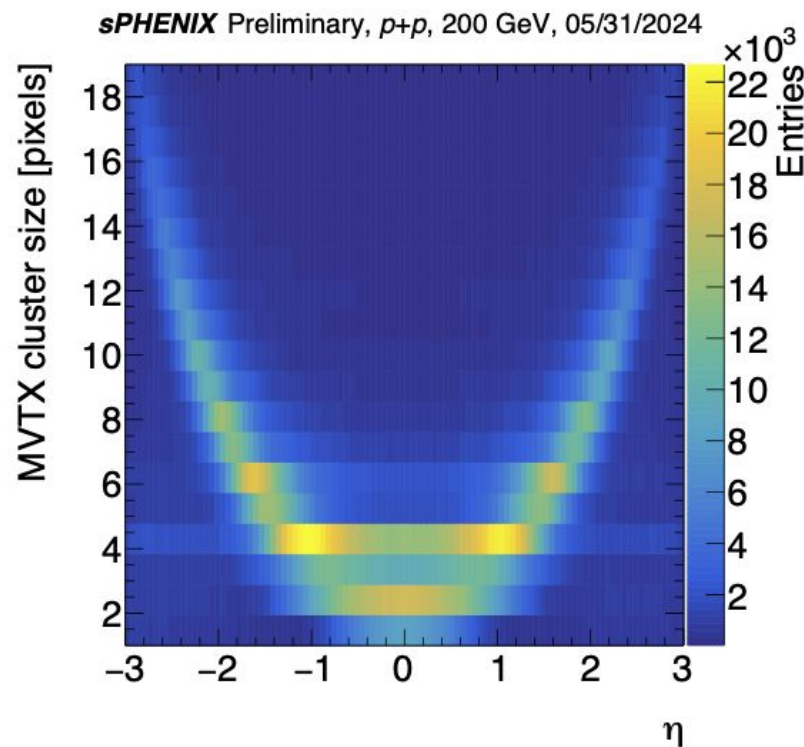
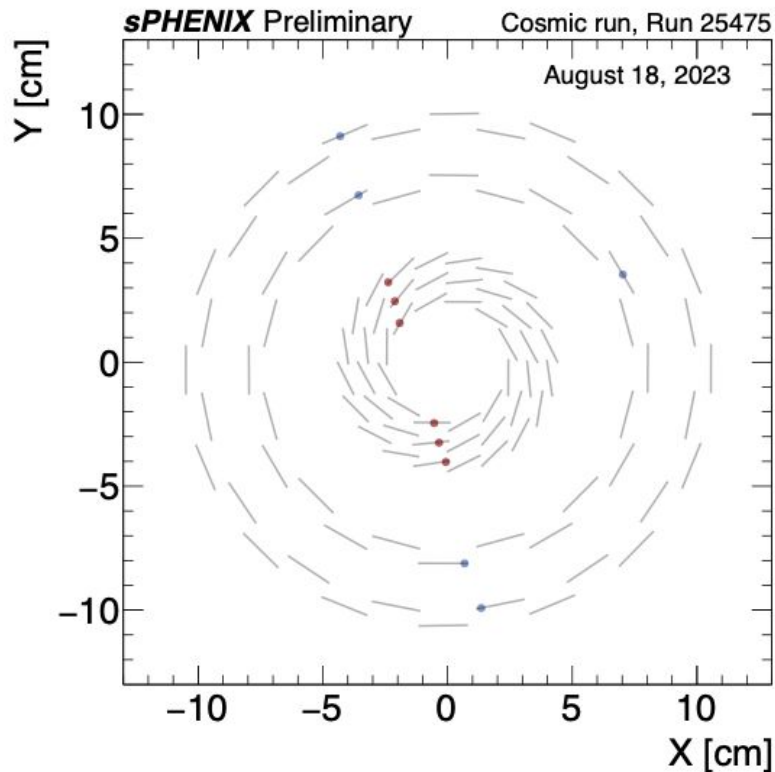


SPHENIX

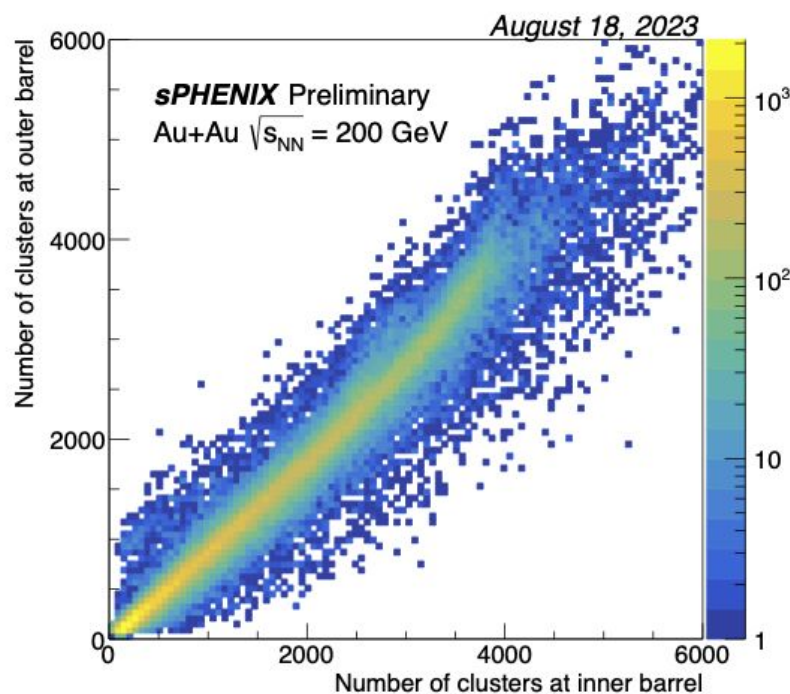
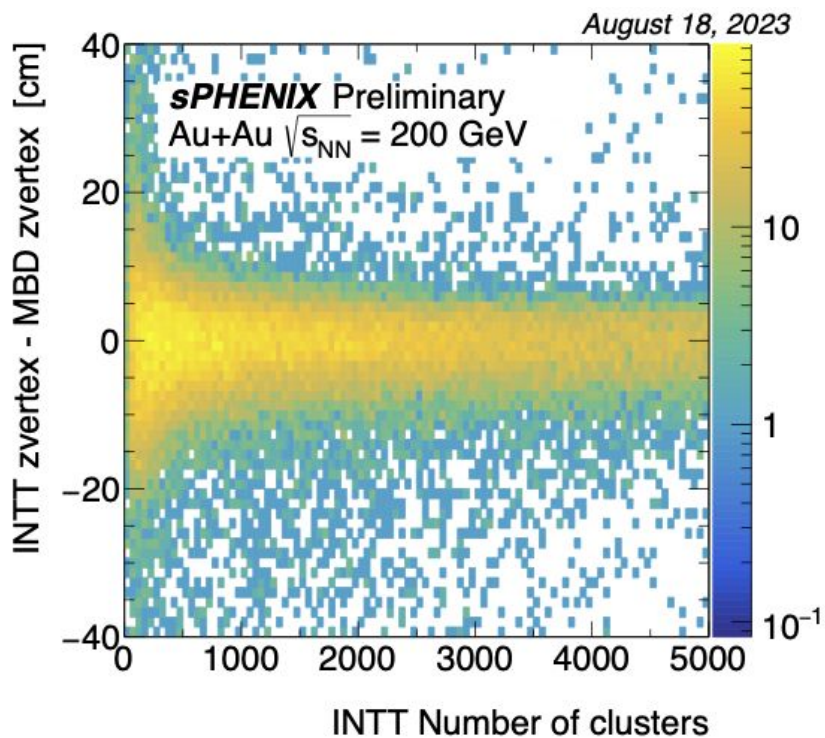


Tracking Detector Status

MVTX Status



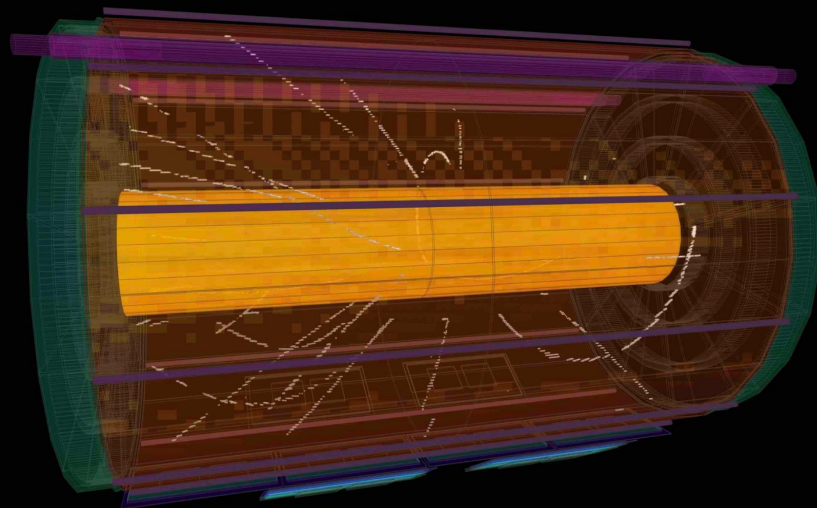
INTT Status



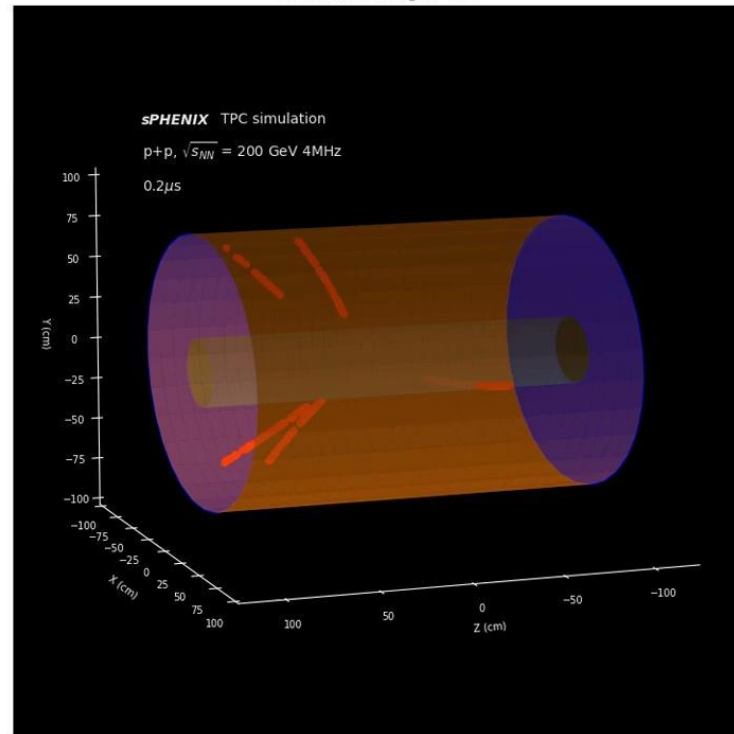
TPC Status



sPHENIX Time Projection Chamber
2024-05-11, Run 41967 - Event 5055
p+p 200 GeV, 1.4 T Magnetic Field



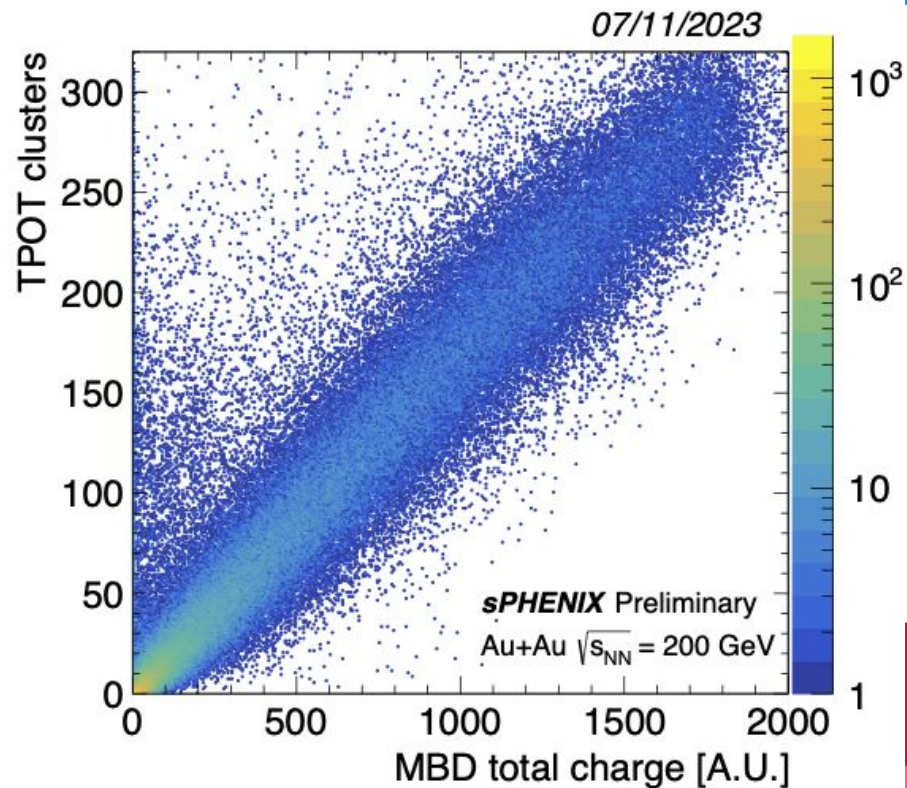
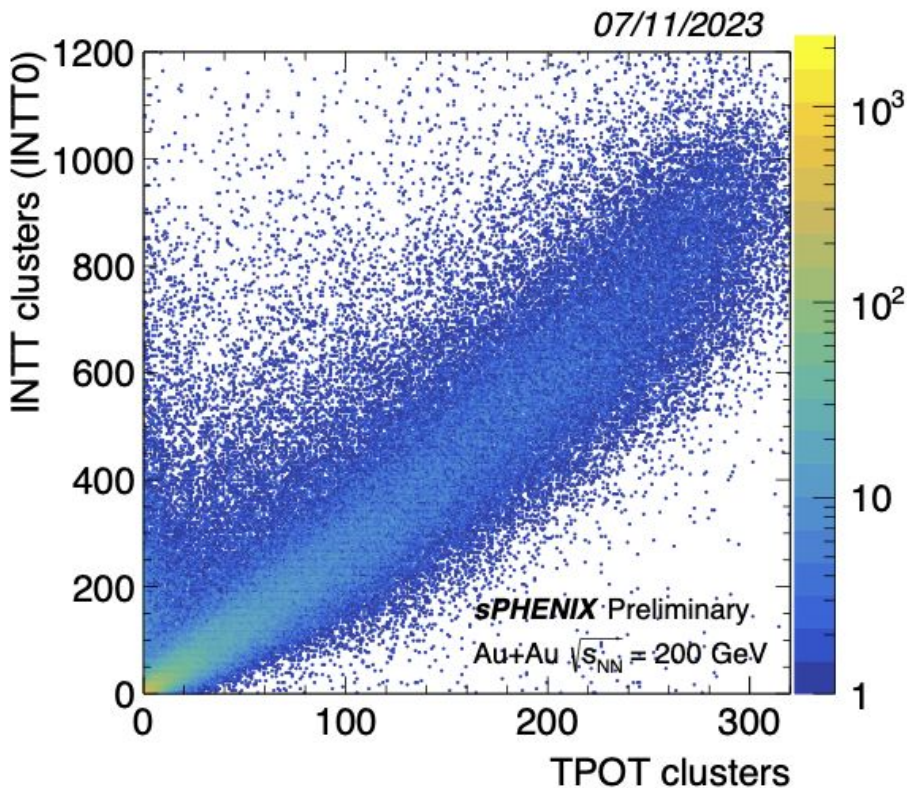
Clusters drifting in TPC



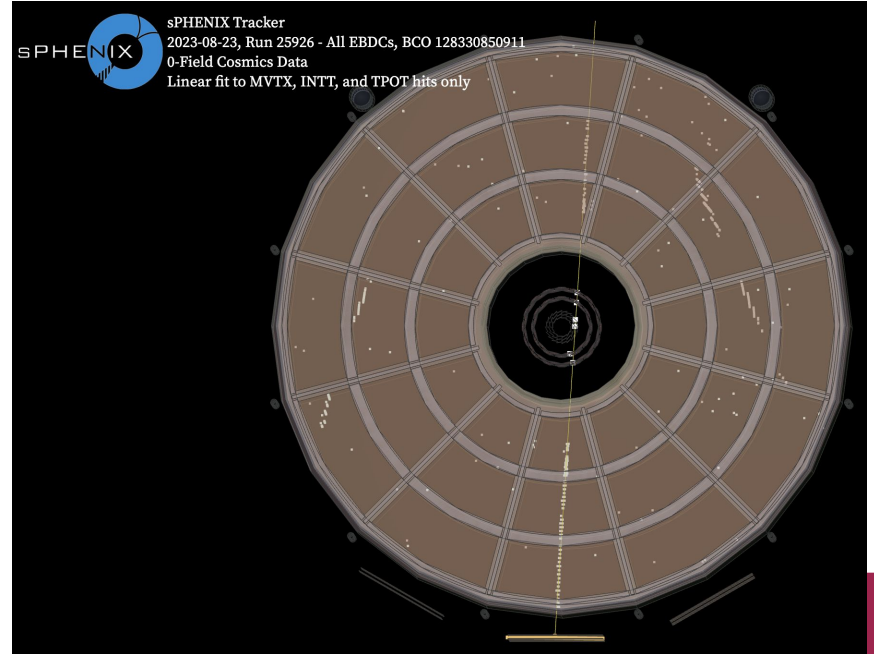
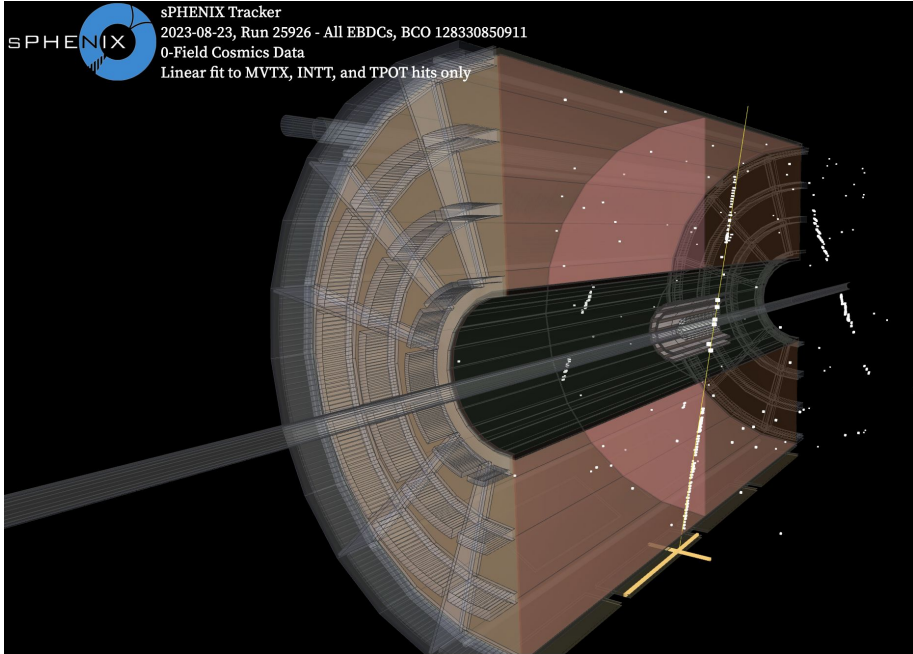
TPOT Status



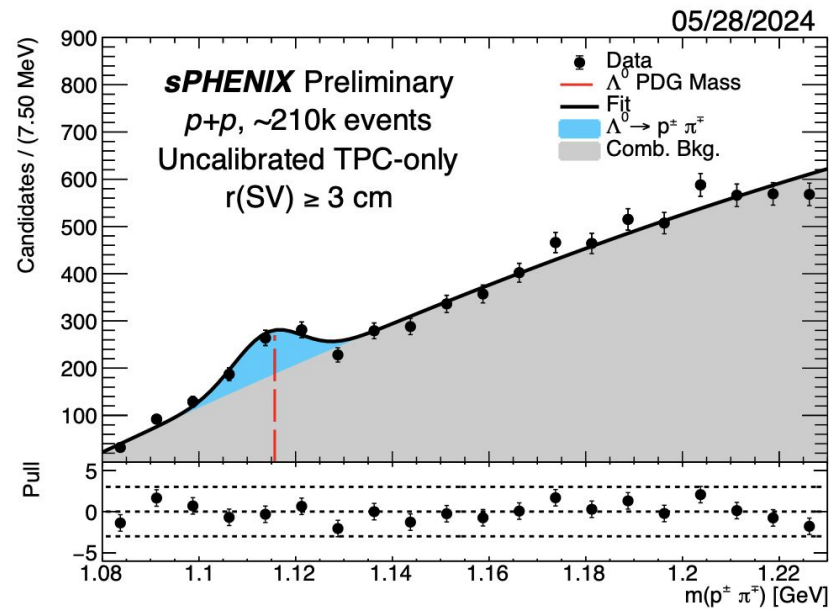
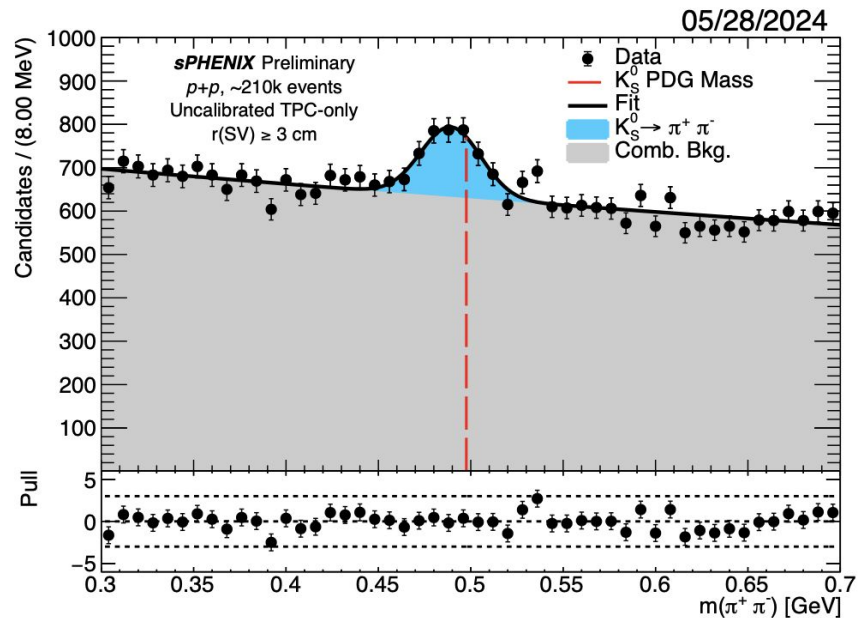
sPHENIX



All Tracking Subsystems Event Display



K_S^0 and Λ^0 Reconstruction with TPC



- First TPC Data from Run 24 (~1s of planned physics production rate)

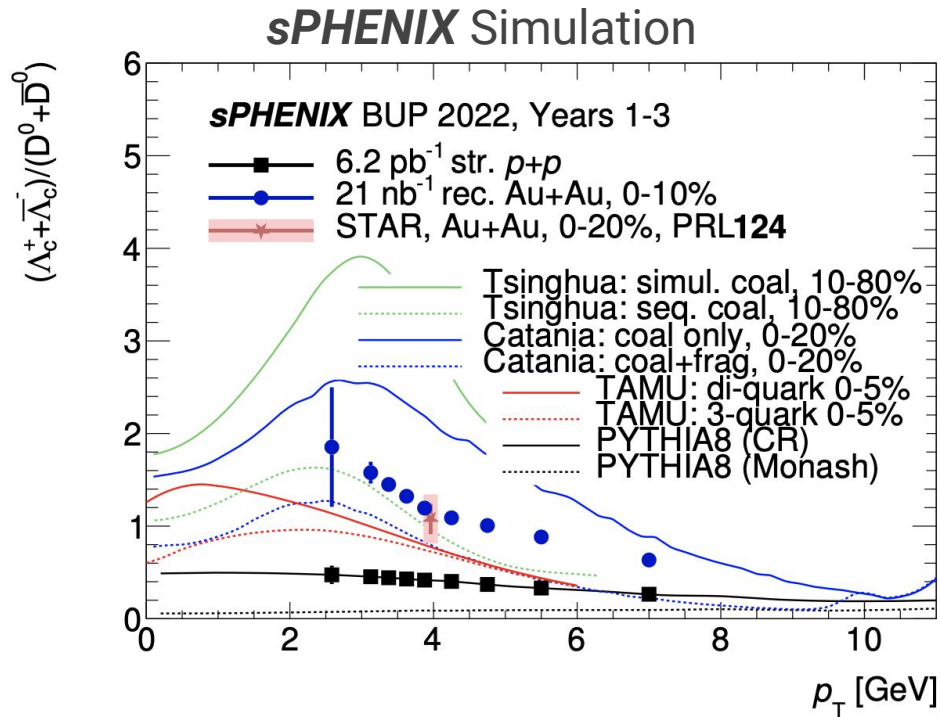


Projections

Λ_c^+ Measurements and Hadronization



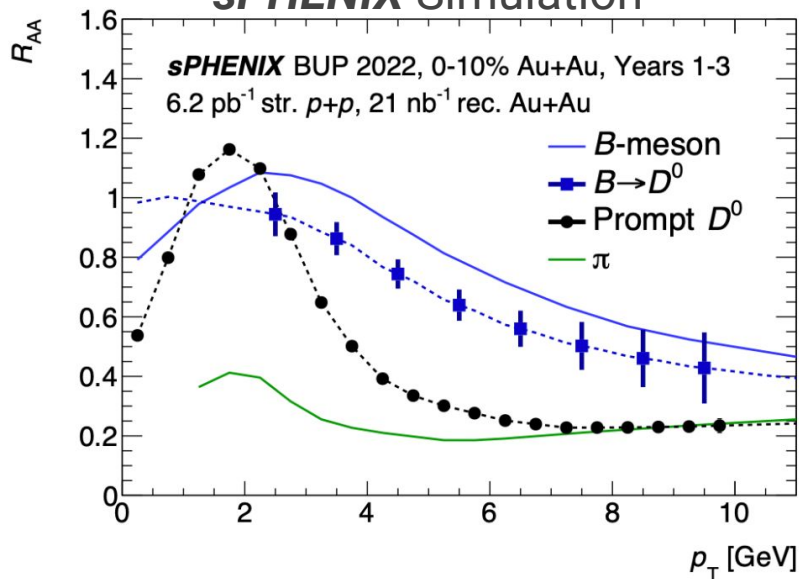
- RHIC and LHC data suggest a significant enhancement of the charm baryon to meson production ratio in sPHENIX collision systems (p+p, p+Au, Au+Au)
- First ever p+p Λ_c/D^0 measurement at RHIC energies
- Increased understanding of charm hadronization in the QGP



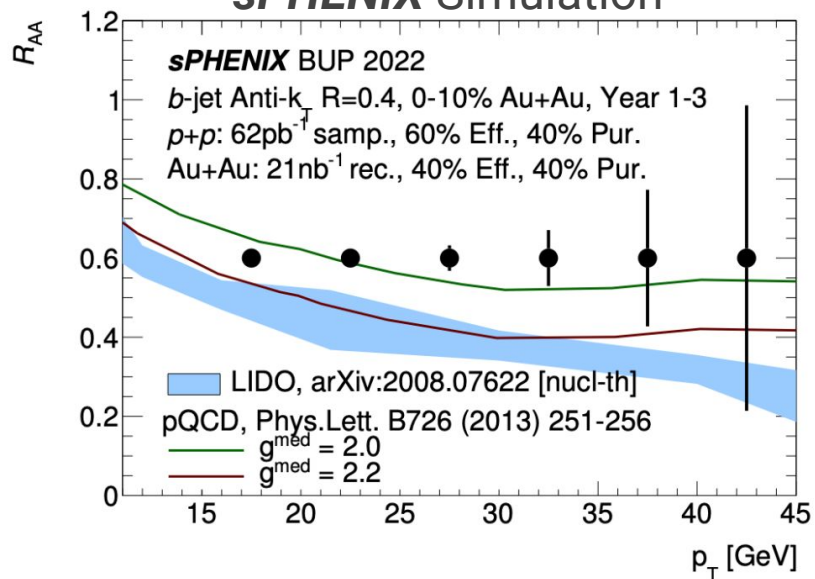


Energy Loss Measurements

sPHENIX Simulation



sPHENIX Simulation



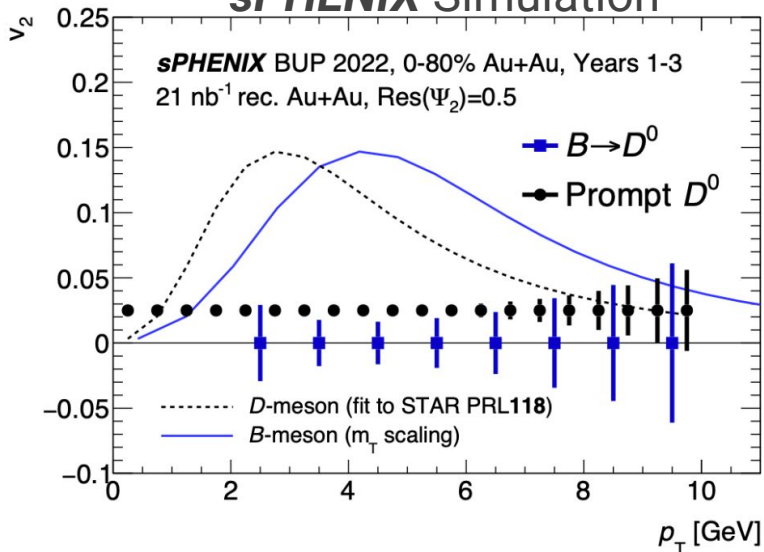
- Increased understanding of energy loss in the QGP
- $p+p$ data crucial for baseline

See talk by Jakub Kvapil at 11:30!

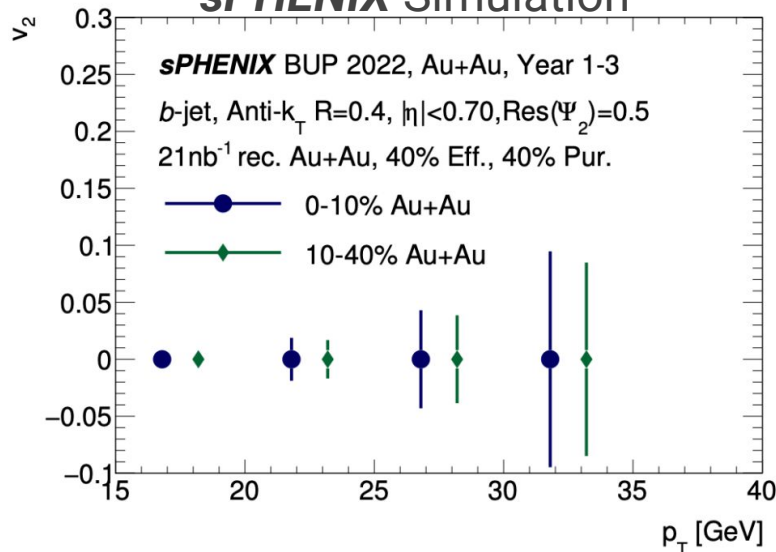


Collectivity

sPHENIX Simulation



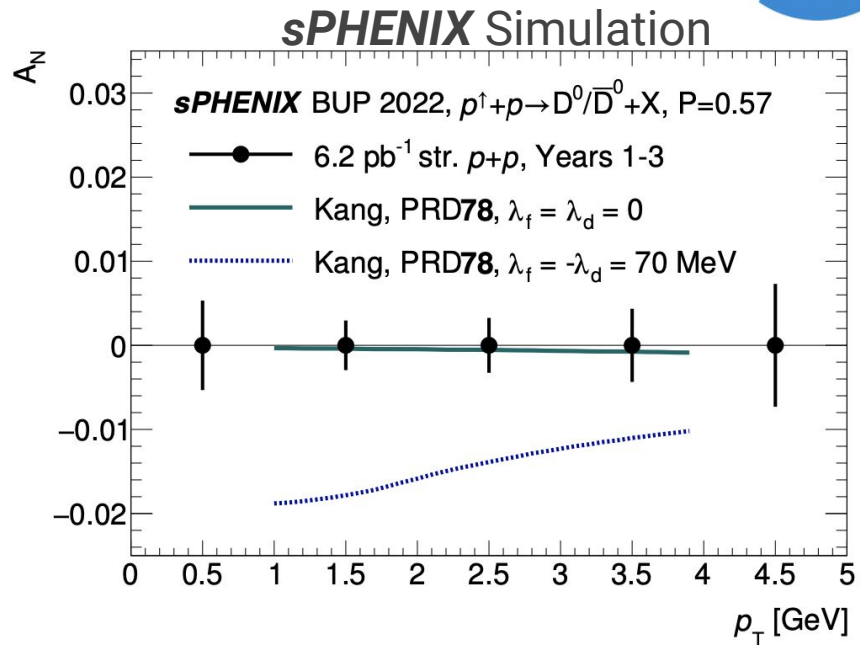
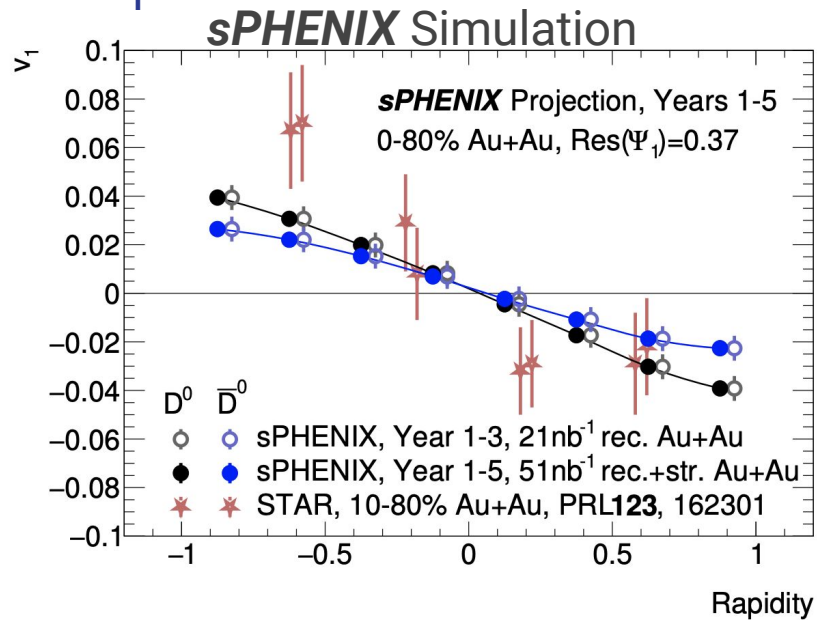
sPHENIX Simulation



- 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

- 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!

Species	$\sqrt{s_{NN}}$ [GeV]	Physics Weeks	Min. Bias Rec. Lum. $ z < 10$ cm	Calo. Trigger Lum. $ z < 10$ cm
Run-2024, Scenario A, 6 cryo-weeks Au+Au + 20/24/28 cryo-weeks $p+p$				
Au+Au	200	n/a	n/a (Commissioning running)	
$p+p$	200	13/17/21	0.34/0.44/0.54 pb^{-1} [@ 5kHz] 2.3/3.1/3.9 pb^{-1} [10%-str]	23/31/39 pb^{-1}
Run-2024, Scenario B, 20/24/28 cryo-weeks $p+p$ + 6 cryo-weeks Au+Au				
$p+p$	200	9/13/17	0.23/0.34/0.44 pb^{-1} [@ 5kHz] 1.5/2.3/3.1 pb^{-1} [10%-str]	15/23/31 pb^{-1}
Au+Au	200	3	0.4 nb^{-1} (3B events)	not needed
Run-2025, 24/28 cryo-weeks				
Au+Au	200	20.5/24.5	5.2/6.3 nb^{-1} (35B/43B events)	not needed

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