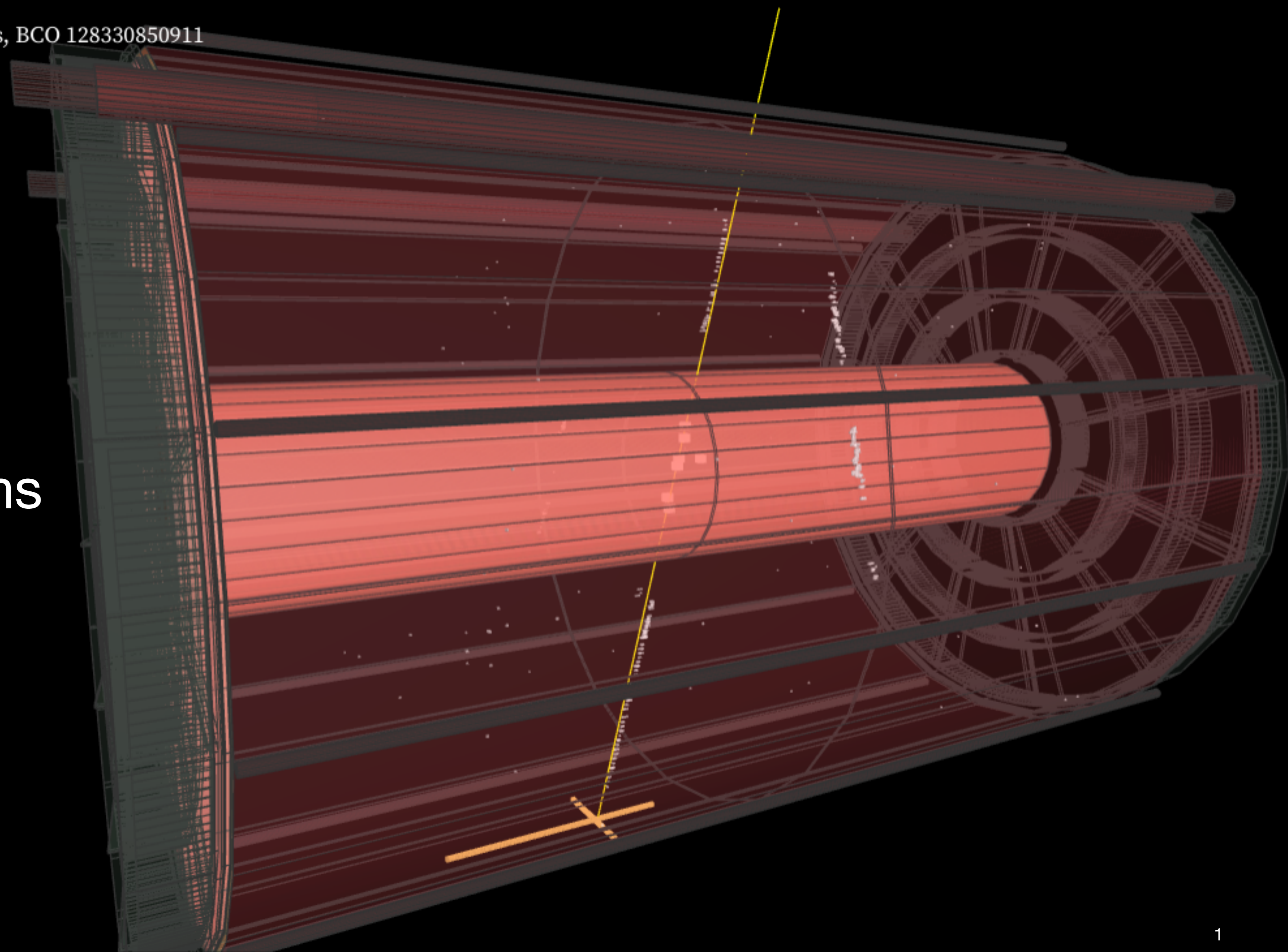




sPHENIX Tracker

2023-08-23, Run 25926 - All EBDCs, BCO 128330850911

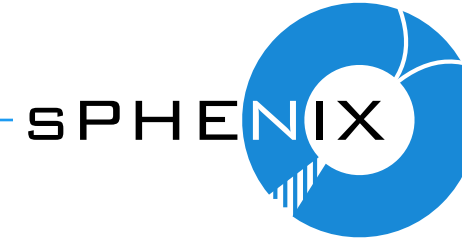
0-Field Cosmics Data



# Answers to PAC homework questions



# Question 1: Can you be ready for Run 2024?

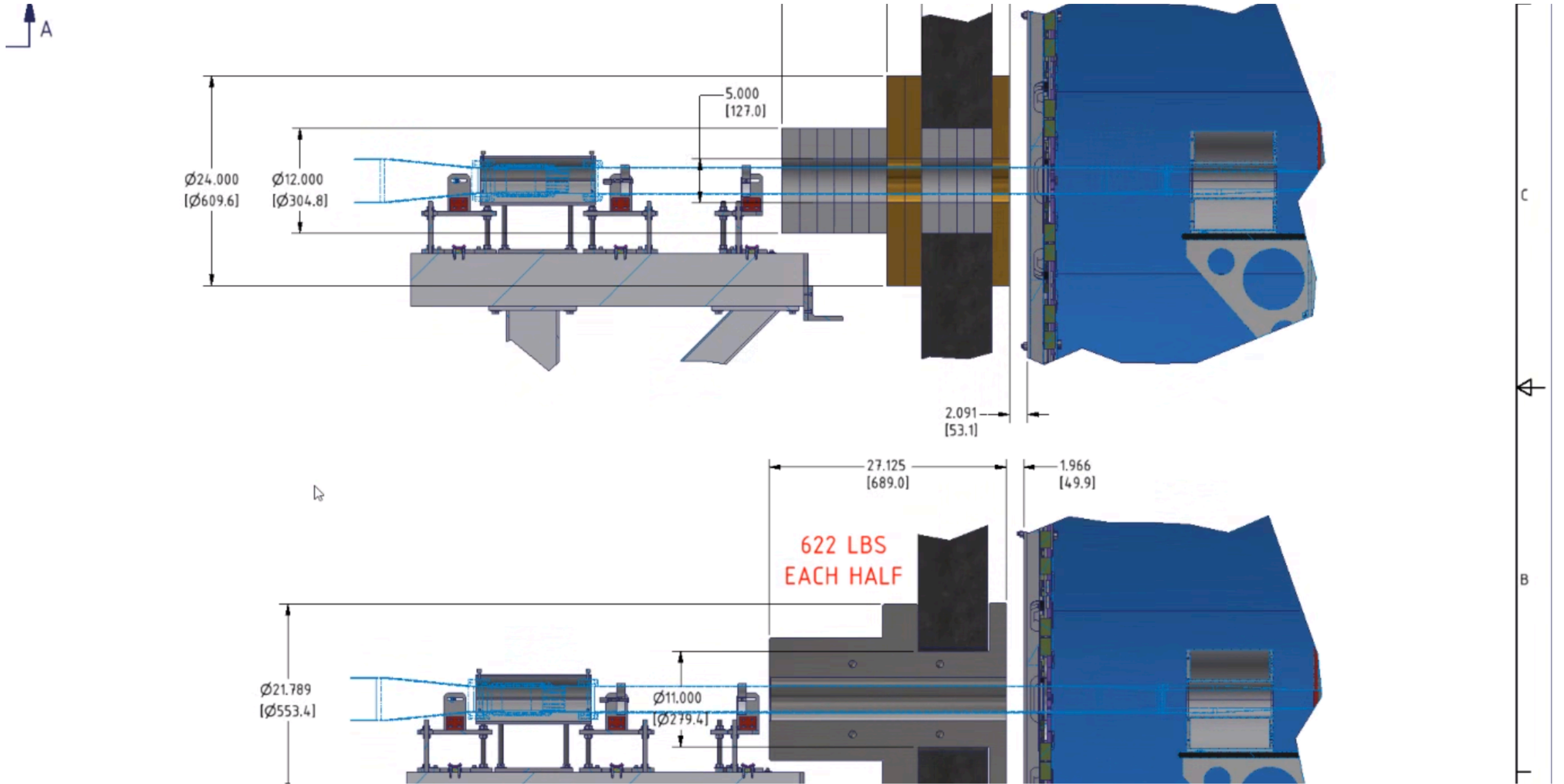


Q: “Is there an estimate on the schedule and effort needed for diagnosing/fixing issues with TPC HV/readout and MVTX readout reset, and in-beam Au-Au operations especially to understand the TPC space-charge issues? When will a decision be expected regarding run scenarios A versus B if sPHENIX is to make the choice?”

A: We are considering development and repair activities which can be completed in early December, 2023. At this time, we do not foresee any work which would prevent us from being ready to continue commissioning in January, 2024.

1. We began opening the detector to investigate possible TPC repairs last week and plan to access the high voltage cards, front end electronics, and pad plane on a number of sectors this week or next.
2. We have started a design of additional shielding which could mitigate problems with the MVTX readout.
3. We are discussing ways to reproduce MVTX readout problems with radiation sources and other means in order to test remediation measures.
4. We have been exercising the diffuse laser, which is one of our major ways of dealing with space charge corrections, during cosmic ray data taking after the end of the Run 23. Development of digital current measurement both offline and in firmware will continue throughout the shutdown.

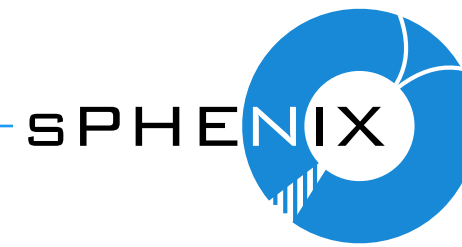
If it does not impact the RHIC preparation, we would prefer to decide scenario A vs B in the first week of November, giving us the maximum time to assess our readiness for Run 24 and to understand the C-AD repair and preparation schedule.



Design options for shielding are being explored



# Question 2: Run 2024 scenarios and readiness for Run 2025



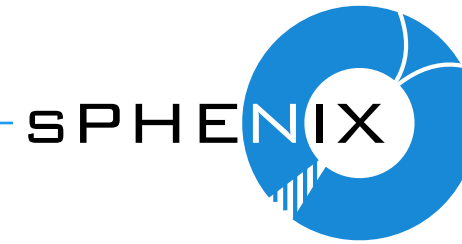
Q: “Please clarify how you would commission sPHENIX in the case of “Scenario B” in order to be prepared for AuAu in Run 25. We heard different things at different times as to whether AuAu is, or is not, necessary for commissioning, and whether the AuAu running late in Run24 in Scenario B would be commissioning, or physics running.”

A: In both scenarios A and B, Au+Au beam time in 2024 is needed to confirm that several outstanding commissioning items are resolved (c.f., Table 6 in commissioning document). These include:

- Mitigation of the MVTX beam-background related readout issues through a combination of changes to the beam setup, speed-up of the recovery procedure and dedicated shielding.
- TPC zero-suppression, readout and DAQ tuning for high rate Au+Au data taking.
- Stability of overall operations (with particular attention to the TPC) for high rate Au+Au data taking.
- This will also allow to collect data for developing space charge correction in AuAu”

In scenario B, initial tests in Au+Au will be performed to confirm that these issues are resolved and no further unexpected significant differences between p+p and Au+Au operations are present. If these tests indicate no or only minor need for additional improvements, we will be able to proceed to Au+Au physics data taking as indicated in Table 2.4 of the BUP. If issues are found in need of further studies/commissioning, a fraction of the Au+Au carry-over time will be used for additional commissioning to ensure readiness for 2025.

# Question 3: Disadvantages of commissioning with pAu



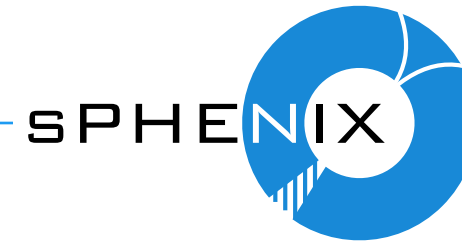
Q: “In Scenario A you proposed AuAu commissioning at the beginning of Run24. What would be the advantages or disadvantages of using pAu at the beginning of Run24 instead, for the purpose of commissioning sPHENIX with sPHENIX making all the choices needed for its commissioning? ”

A: The disadvantages of commissioning pAu with pAu at the beginning of Run 24 vastly outweigh any potential benefits:

- As stated in response to Q2, Au+Au running in Run24 is needed to ensure readiness for Run25. Therefore commissioning with p+Au implies running three species, with the associated setup and ramp-up costs of 2.5 weeks. In addition, switching from p+Au to running a symmetric system implies additional costs for moving the DX magnets
- There has never been a RHIC run with pp, pAu and AuAu in one year. Given the other major tasks on C-AD's plate -- the major valve box repair, the reinstallation of the blue snake, and the as-yet uncommissioned extended EBIS source, and the 56 MHz RF system -- we think the introduction of this operational novelty represents a very significant risk to the success of the remaining RHIC program. Running a third collision system in one run would require significant C-AD and collaboration resources that should be dedicated to luminosity improvement and machine repairs/improvements, and detector commissioning.
- MVTX beam background optimization and other commissioning items requires Au beams in both directions. The background mitigation in pA may also have to be redone for p+p and Au+Au operation given differences between asymmetric/symmetric beam setups.
- We estimate that in scenario A, four weeks of p+p commissioning are still required. Correspondingly, only 4 weeks of p+p commissioning might be converted to p+Au running. With the additional setup needed and the sPHENIX needs for commissioning, any time freed up for p+Au physics data taking would be minimal or zero (and possible a net-negative overall).

In summary, commissioning with p+Au would incur significant cryo-week and resource costs, with likely minimal or zero physics benefits.

# Question 4: Prerequisites for p+Au running



Q: “By how much would C-AD luminosity projections need to increase, relative to the August 2023 projections, in order for you to support adding five weeks of p+Au running? In your 2022 BUR, with the old luminosity projections you supported five weeks of p+Au running after having collected 45 pb<sup>-1</sup> calo triggered luminosity in pp. If the C-AD projections, and the number of cryoweeks, were sufficient to accumulate that pp luminosity, and to do 5 weeks of p+Au, would you favor this? What about 40 pb<sup>-1</sup>? 35 pb<sup>-1</sup>? ”

A: Consistent with the considerations for the 2021 and 2022 BUP, but also reflecting the new conditions of Run-23's premature end, we would support a p+Au run in a scenario where:

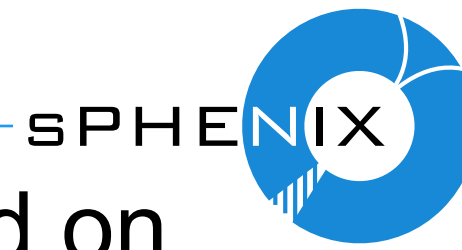
- A. sPHENIX has recorded 45/pb of p+p physics data
- B. sPHENIX has a minimum of 3 weeks of AuAu collision data recorded
- C. Sufficient time is left for a significant p+Au data set to be collected (e.g., 5 weeks of p+Au physics running)

We recall that even with 45/pb of p+p data, statistics in p+p will still be the limiting factor in p+p vs Au+Au comparisons.



# Question 5: Computing needs

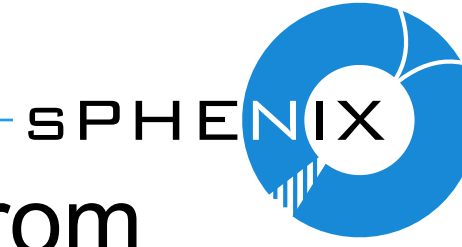
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Q: “In regards to computing needs, especially those for sPHENIX in 2025, were Jamie’s numbers based on the current luminosity estimates? -- or on the earlier estimates?”

A (from Jamie D.): “ [The] needs are based on past luminosity estimates”.

# Question 6: p+Au connection to EIC



Q: “Please provide us with the plots (from the literature? from recent conference talks by theorists? or from your own efforts?) that support what you see as a crisp example of how a specific pAu measurement (either polarized or unpolarized) made in the closing years of the RHIC program can be compared to which specific future eA measurement from the EIC, and what this comparison can teach us. Which is to say please share what you see as “the money plot” making the case that a specific pAu measurement is particularly important to enhancing the science impact of the future EIC program. ”

A: At central rapidities we can improve nuclear PDFs and the nuclear fragmentation functions. In support of the p+Au program we have the rather unique charged hadron asymmetries that were found to decrease in p+Au in PHENIX. We can extend on these measurements between the former PHENIX muon arm rapidities and the central charged pion asymmetries from PHENIX.

