

sPHENIX Status

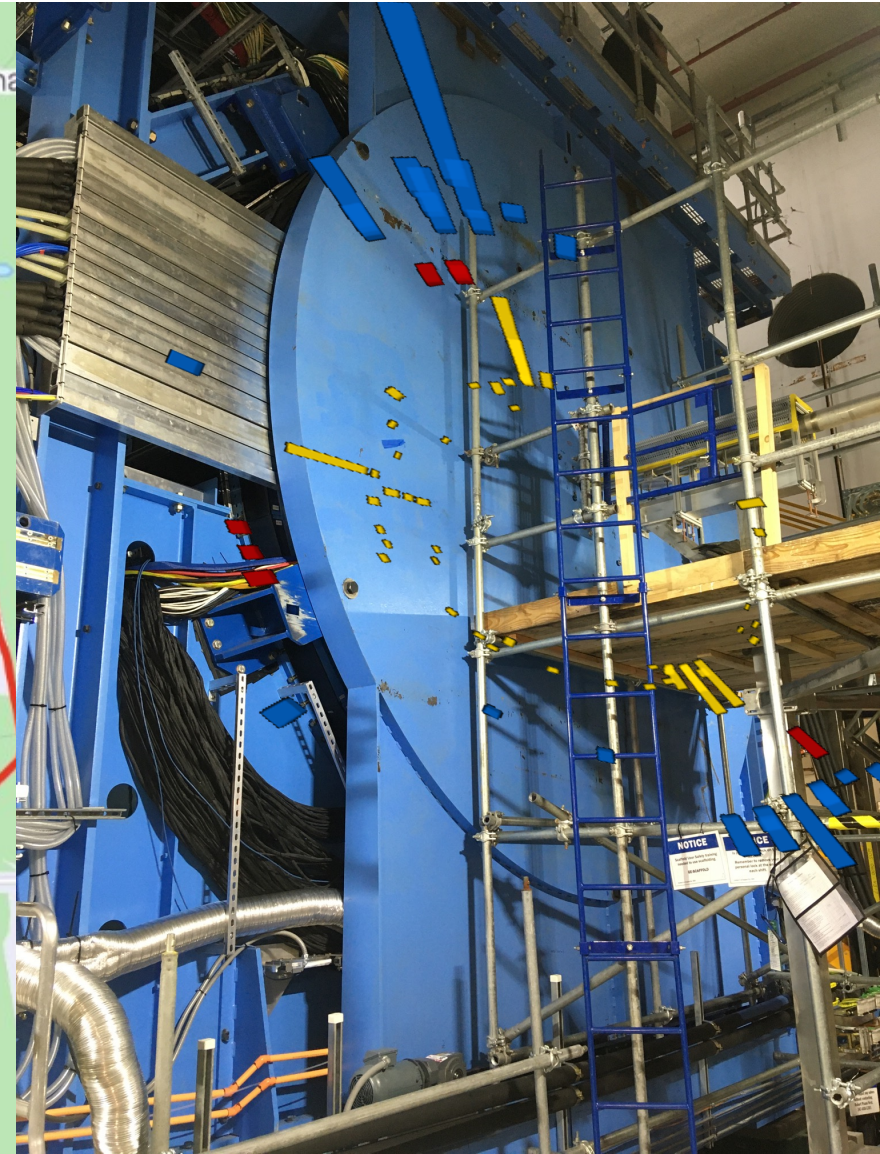
RHIC Coordination Meeting

July 23, 2024

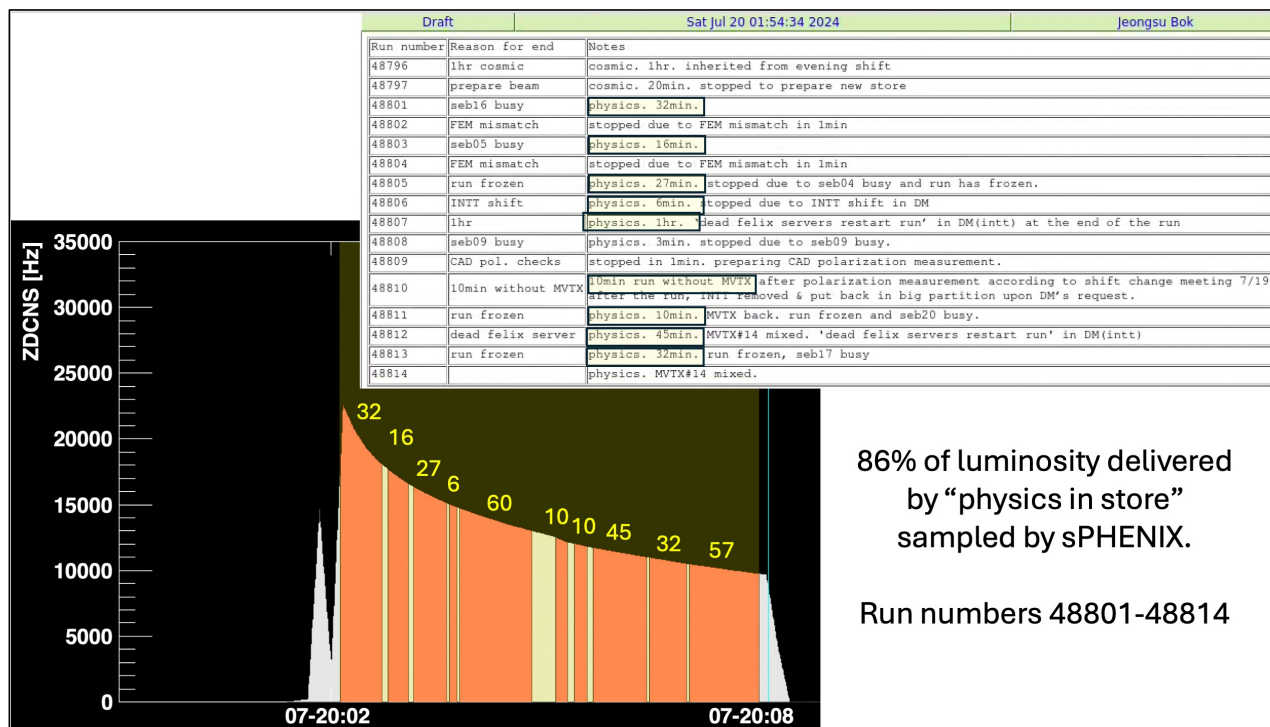
Jamie Nagle
University of Colorado Boulder
sPHENIX Run Coordinator

7/22/24

sPHENIX 2024



Focused effort to increase data taking efficiency



Start of physics data taking now 4-5 minutes after "physics declared", down from 11-12 minutes.

Faster recovery decision tree from high trigger rate issues.

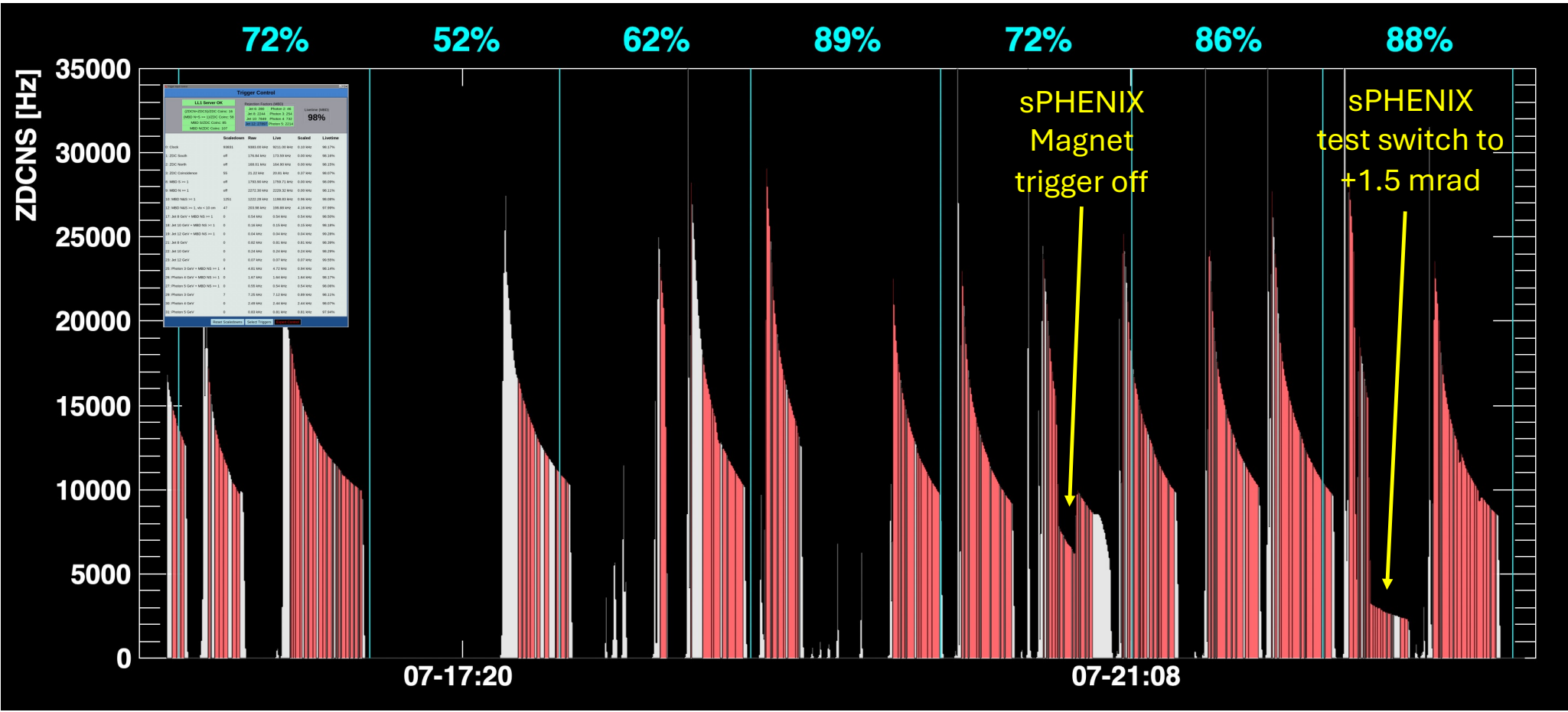
Dissection of individual stores.

After testing and analysis of backgrounds, sPHENIX is now keeping silicon voltages (MVTX, INTT) through polarization measurements.

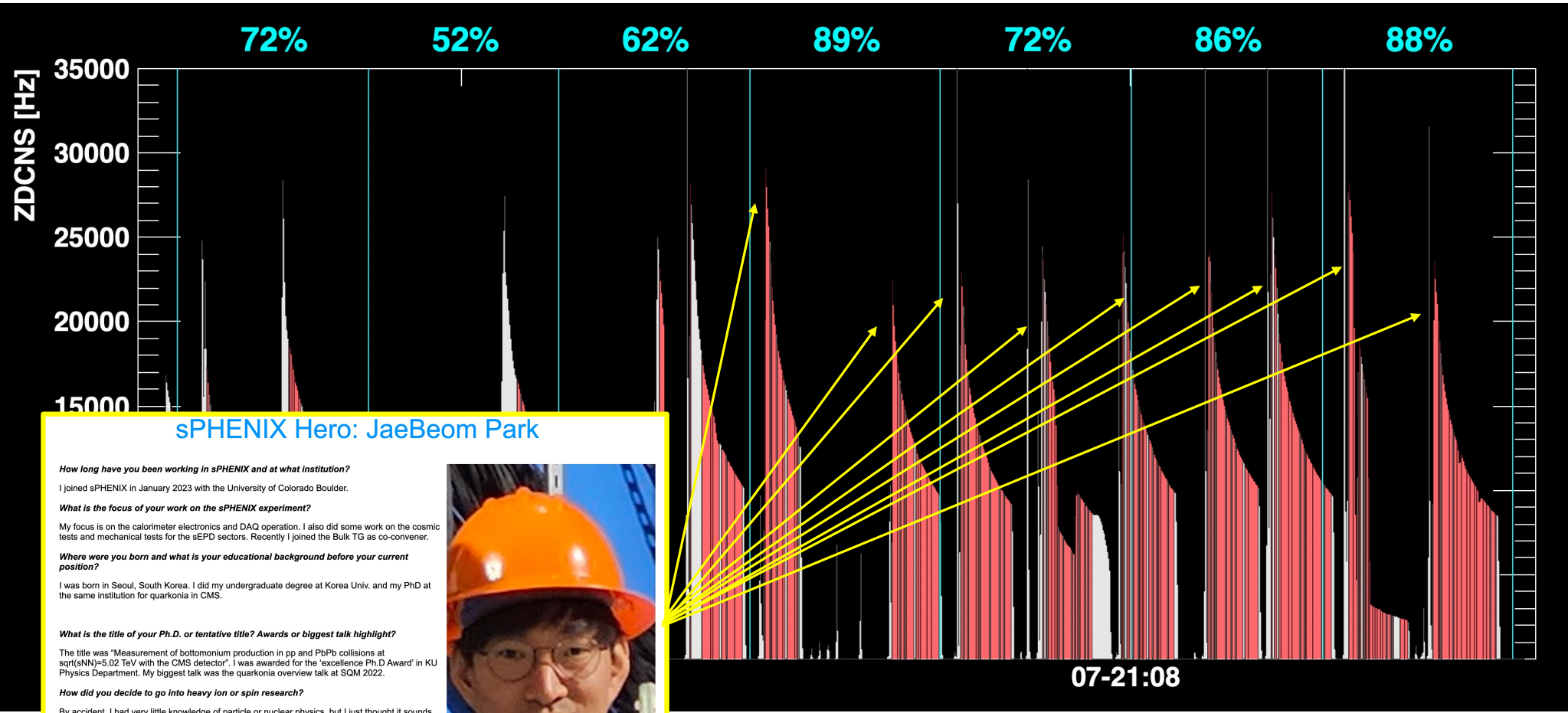
MVTX still examining keeping voltage on during "STAR-into-collision" event.

SEB hangs; new diagnostic tools.

MVTX DMA drops at highest rates.



Excellent efficiency this past week. Average livetime during data taking 98%.
 Reminder, goal for this run in BUP was 60%. Only taking data at high lumi for 4 weeks.



sPHENIX Hero: JaeBeom Park

How long have you been working in sPHENIX and at what institution?

I joined sPHENIX in January 2023 with the University of Colorado Boulder.

What is the focus of your work on the sPHENIX experiment?

My focus is on the calorimeter electronics and DAQ operation. I also did some work on the cosmic tests and mechanical tests for the sEPD sectors. Recently I joined the Bulk TG as co-convener.

Where were you born and what is your educational background before your current position?

I was born in Seoul, South Korea. I did my undergraduate degree at Korea Univ. and my PhD at the same institution for quarkonia in CMS.

What is the title of your Ph.D. or tentative title? Awards or biggest talk highlight?

The title was "Measurement of bottomonium production in pp and PbPb collisions at $\sqrt{s_{NN}}=5.02$ TeV with the CMS detector". I was awarded for the 'excellence Ph.D Award' in KU Physics Department. My biggest talk was the quarkonia overview talk at SQM 2022.

How did you decide to go into heavy ion or spin research?

By accident. I had very little knowledge of particle or nuclear physics, but I just thought it sounds cool.

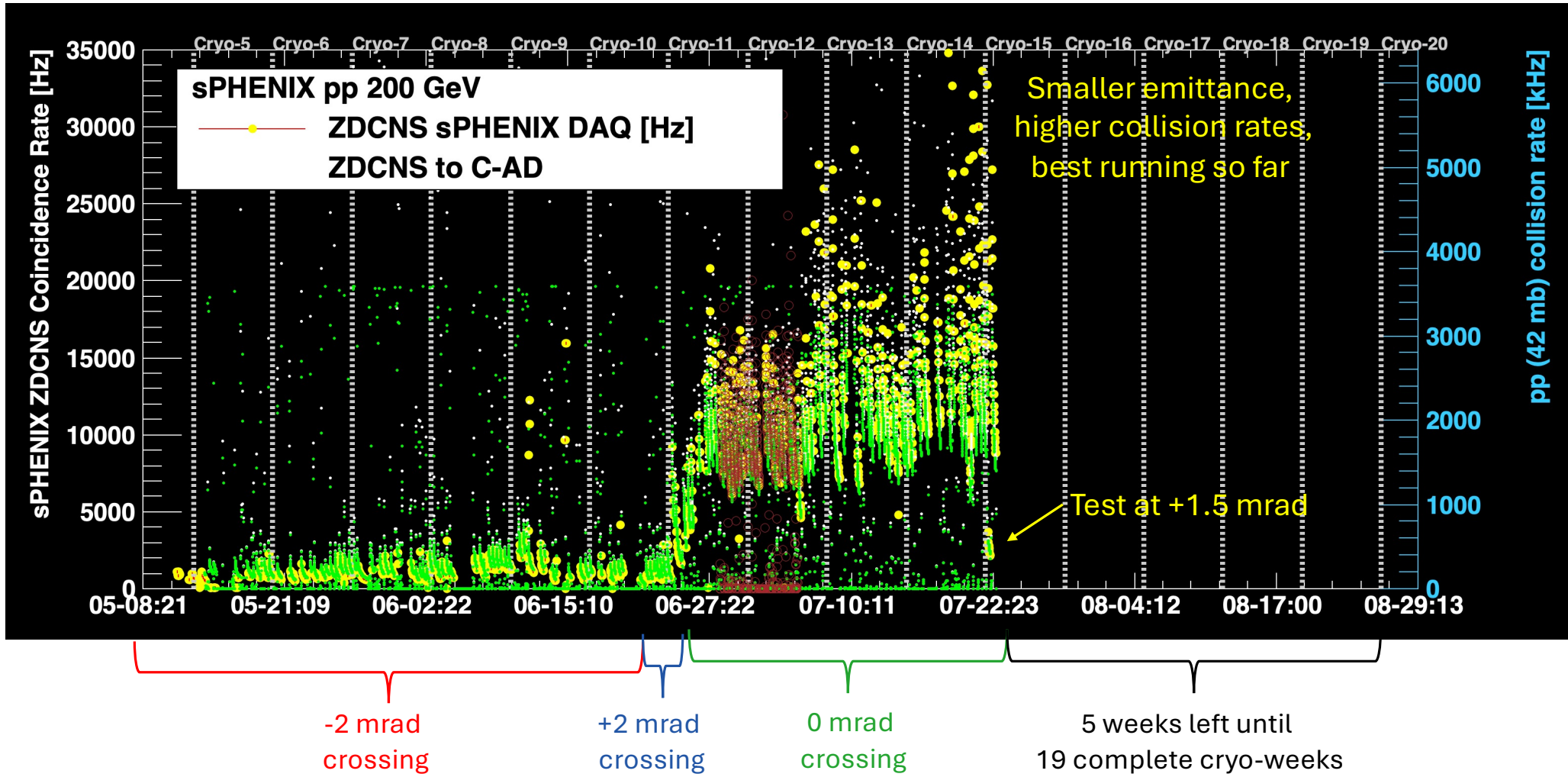
What do you like to do in your spare time?

I like playing GO or tennis (started again this year in BNL). Also, I like museums and just walking. But mostly I enjoy laying down and feel the fact that I am resting.

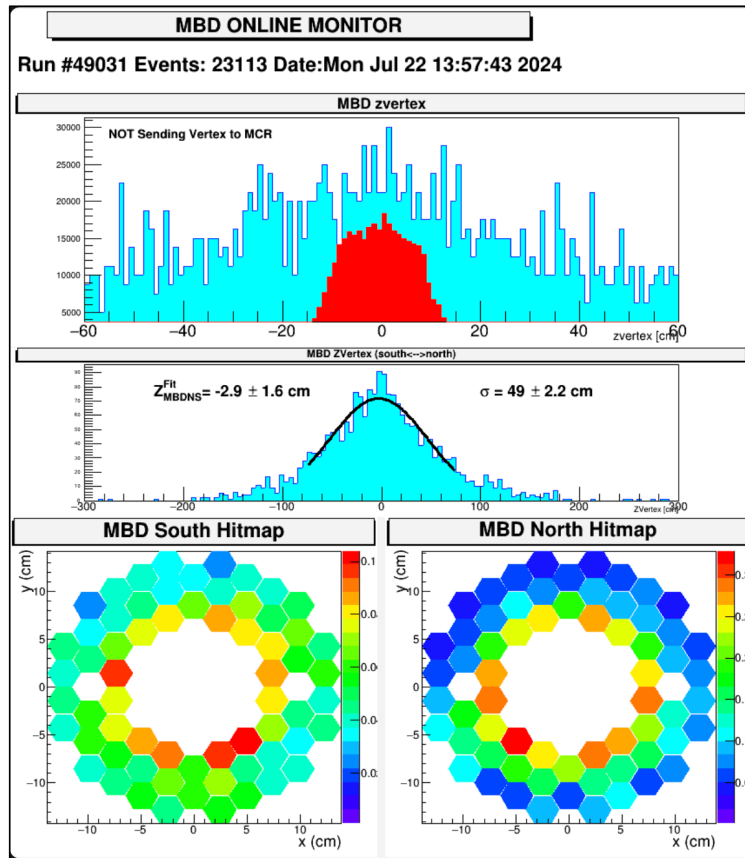
Fun fact?

I was in an undergrad rock band for a couple of years and did some fun music! Miss that time.

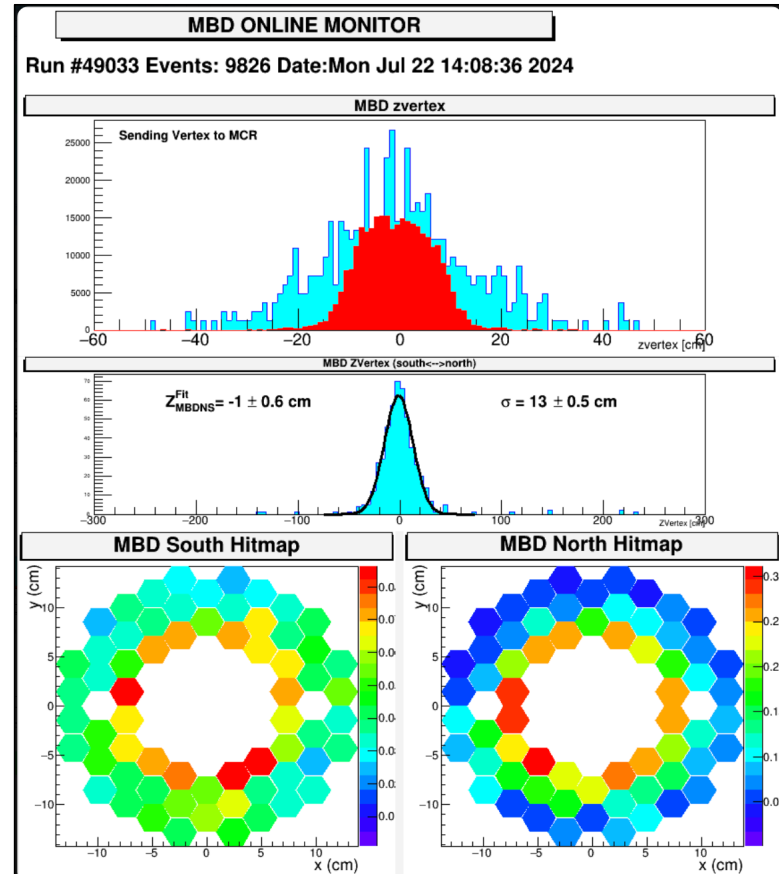




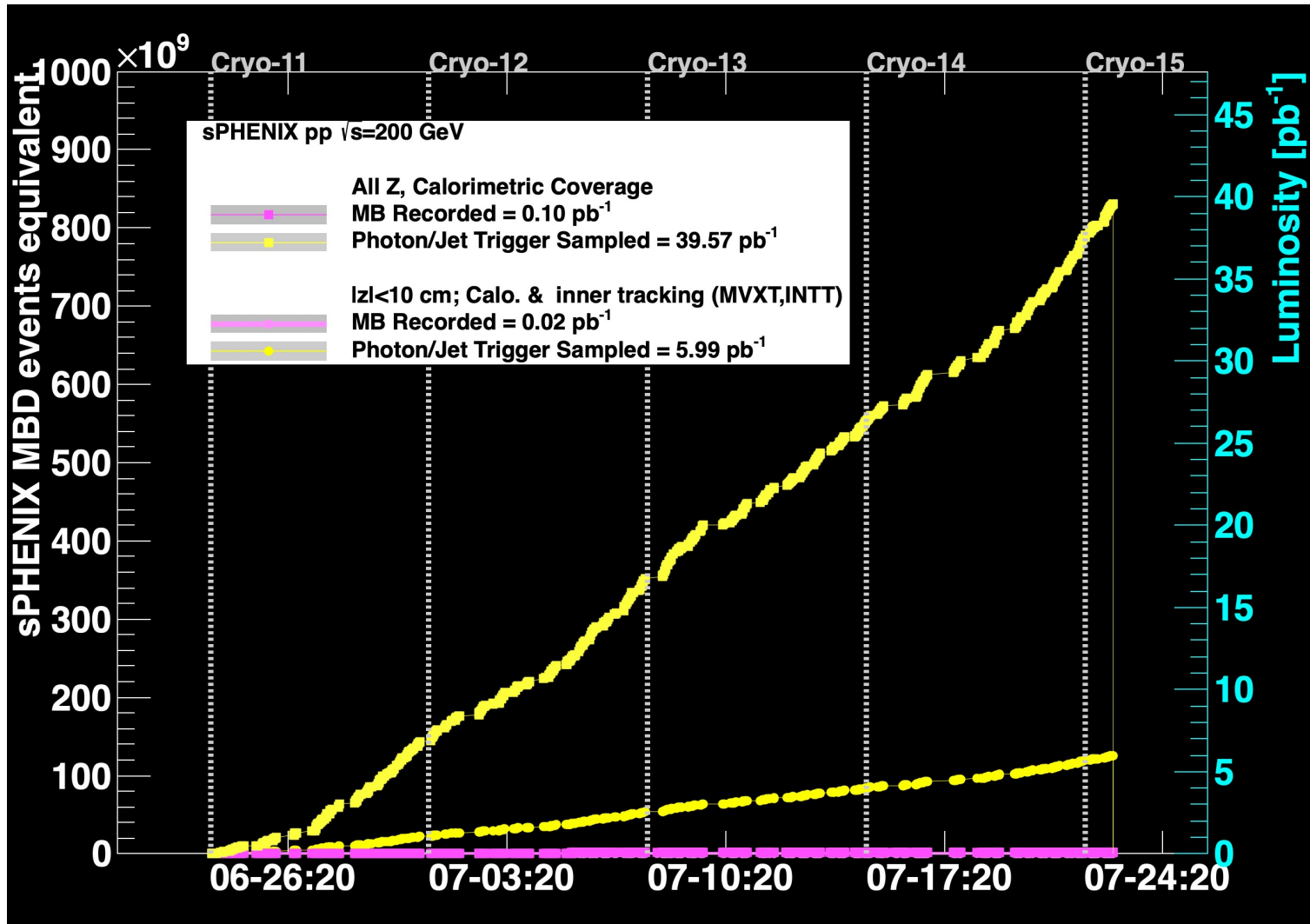
0 mrad



+1.5 mrad



ZDCNS rate down by 1/5 and then need to account for double interactions and acceptance change.



TPC Status

Heavy lift by many people appears heading towards success.

(Kin) An “all negative” USI (Unresolved Safety Issue) — concerning our usage of isobutane in TPC — has been signed by C-AD this morning, after the AESRC (Accel. & Expt. Safety Review Com.) review on July 17, 2024. [This is good news.](#)

- A walkthrough has been scheduled on Tuesday, July 23, 2024, at 11 am.
- We also need isobutane delivery, finish testing and procedure revision etc.

Flowing isobutane in TPC of sPHENIX

- Agreement to implement the July 12 version of the USI.
- There will be an AESRC review tomorrow and after that, the USI would be ready for signatures.
- We are also updating procedures, alarm instructions and necessary training.
- Walkthrough will be scheduled in consultation with AESRC.
- Target date for operation: earlier next week.

C-AD and IP Unreviewed Safety Issue (USI) Evaluation Form
(C-A-CRM 1101.1)

Justification: The supplied airflow will dilute the isobutane to less than 10% of the LEL with a total safety factor over 30. In the event the supplied airflow is compromised, isobutane supply will be closed.

The C-AD and sPHENIX are in alignment with utilizing cutting-edge safety for outcrop-edge science and minimizing gas loss is a priority. The above risk analysis concludes that the introduction of isobutane within the TPC is an activity of extremely low risk. The semi-quantitative hazard analysis shows the controls implemented and maintained through 10 CFR 851 safely mitigate the hazard to acceptable levels.

III. USI Evaluation Criteria:

- Does the planned activity or discovered condition introduce a new or previously unreviewed accelerator-specific hazard that is not adequately addressed by the current SAD and approved ASE?
 - Yes No
 - Justification:** (use attachment if necessary)
 - The planned activity does not introduce a new or previously unreviewed accelerator-specific hazard as isobutane is being used in the TPOT. The introduction of an additional isobutane supply is safely mitigated by extending the existing 10 CFR 851 controls.
- Does the planned activity or discovered condition introduce a new or previously unreviewed non-accelerator specific hazard that is not adequately addressed by the current SAD and approved ASE and increases the risk level as per the SAD risk table which would require at least one new credited control?
 - Yes No
 - Justification:** (use attachment if necessary)
 - The planned activity does not introduce a new or previously unreviewed non-accelerator specific hazard that increases the risk level as per the SAD risk table or require at least one new credited control. The introduction of isobutane is safely mitigated with controls implemented under 10 CFR 851. The Maximum Credible Incident (MCI) associated with this hazard includes a fire hazard that is covered through the fire hazard analysis as well as an initiator to a cryogenic release via pipe rupture that has been previously analyzed in the sPHENIX USI for cryogenics and gas use.
- Does the planned activity or discovered condition require additional credited controls, modification to existing credited controls or processes and/or procedures that implement credited controls as described in the SAD and implemented in the ASE?
 - Yes No

7/23/24

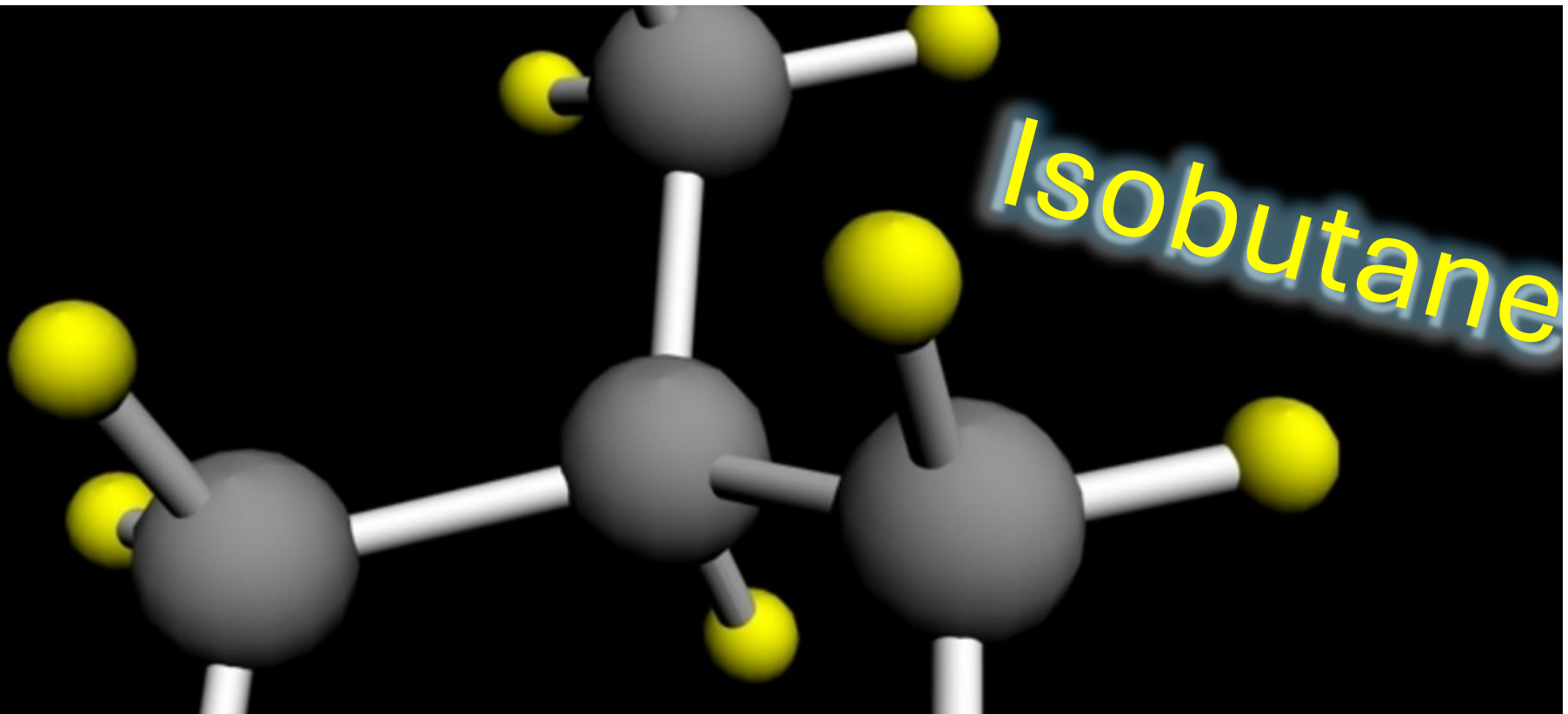
Table 1: Scenarios Requiring Isobutane Valve Isolation

Location	Scenario	Engineered Control/Response	Administrative Control/Response
IR8 (sPHENIX Detector Hall)	Bore Dehumidifiers ZN > 100 cfm and ZS > 100 cfm		No Change
IR8 (sPHENIX Detector Hall)	Ceiling VESDA HSSD Smoke Detected		No Change
IR8 (sPHENIX Detector Hall)	Bore VESDA HSSD Smoke Detected	Turn off Isobutane Supply (KGT) and alarm sPHENIX Control Room	No Change
IR8 (sPHENIX Detector Hall)	Bore isobutane detected		Alarm MCR; Resume after handheld flammable gas survey
Gas Mixing House	GMH Vent Fan Fail		No Change
Gas Mixing House	Isobutane Shed Vent Fan Fail		No Change
Gas Mixing House	GMH Isobutane Detected		Alarm MCR; Resume after handheld flammable gas survey
Gas Mixing House	>6% Isobutane Mixture		No Change
Gas Mixing House	Emergency Stop Button		No Change

- We are implementing the above controls necessary for sPHENIX to flow isobutane from the Gas Mixing House to the IR.
- The firmware and software implementation/changes are done by an outside company as well as a BNL software engineer.
- Fans in the isobutane shed and the Gas Mixing House are being restored.
- Ventilation in the IR bore (~ inside Magnet doors) needs to be maintained continuously.

sPHENIX 2024

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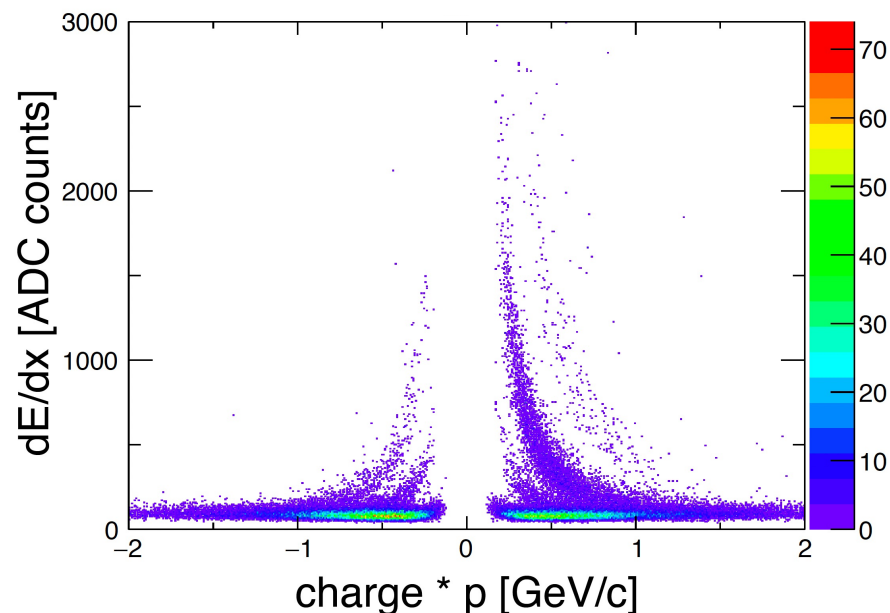
Additional training for new shift crews done yesterday.

<https://www.c-ad.bnl.gov/esshq/snd/opm/Ch03/03-16.PDF>
<https://www.c-ad.bnl.gov/esshq/snd/opm/Ch11/11-02-03.PDF>

TPC Performance with original gas (no nitrogen) mixture at 4.3 kV.

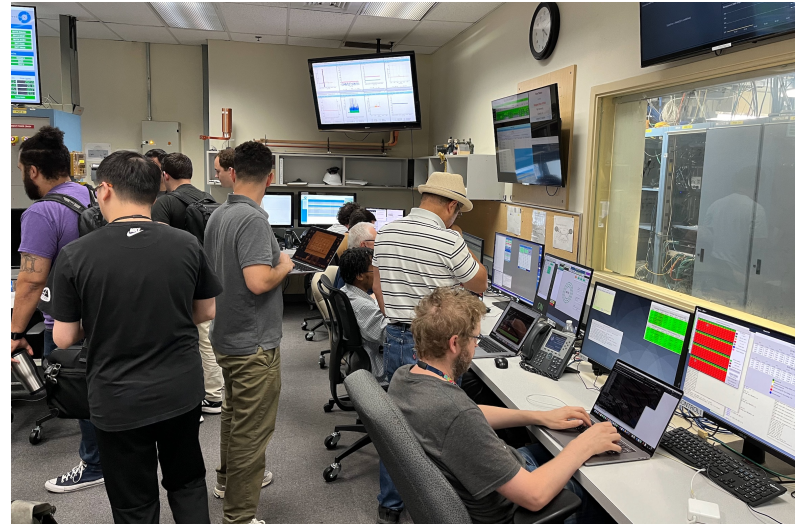
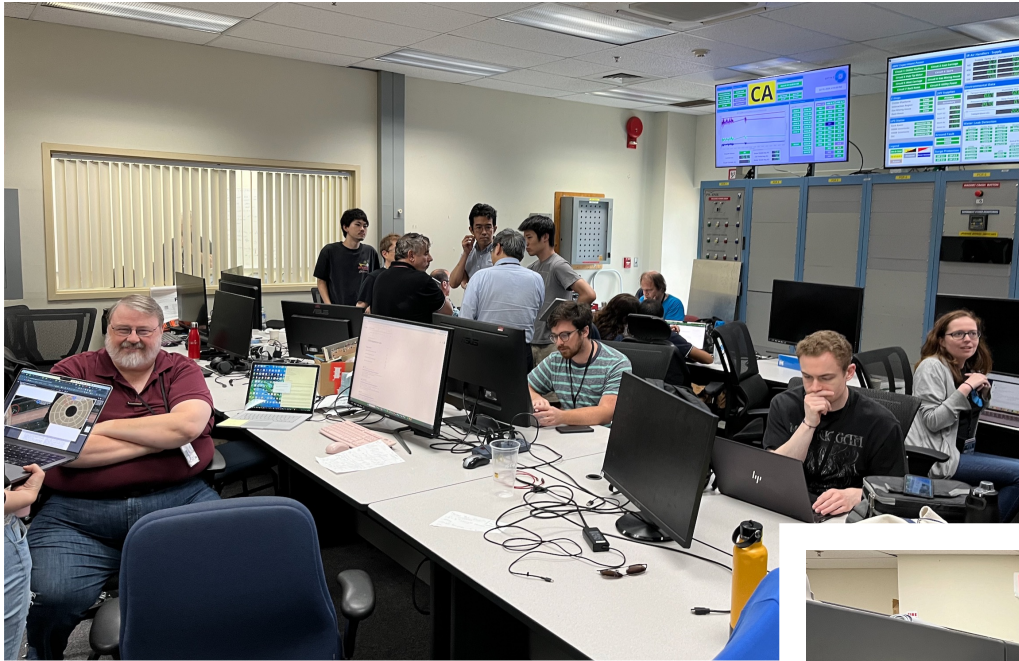
At this Voltage, cannot operate TPC safely.
Permanent damage to some stripes.

However, it means that with improved stability, the performance is encouraging.



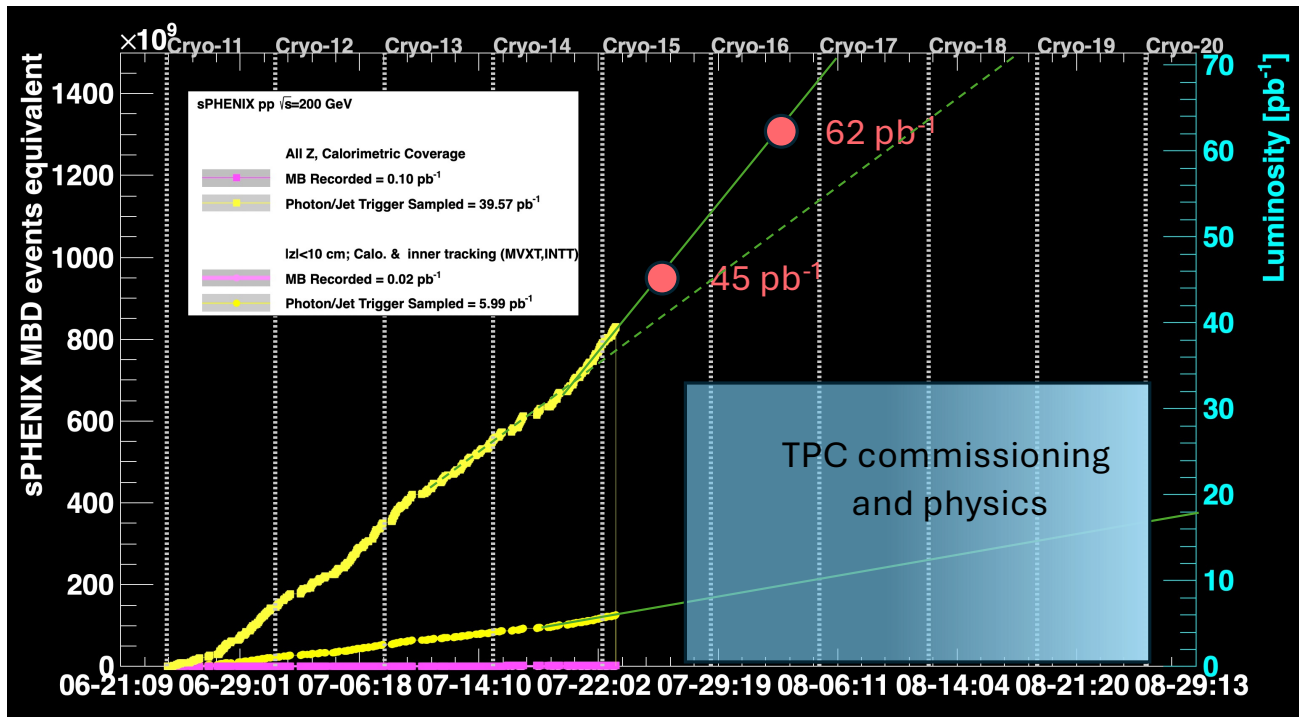
Optimal schedule –

- (1) Tuesday, July 23, 2024 at 11 am – walk through of gas system
 - (2) 30+ hours to fully mix gas and flow
 - (3) Best case, turning on TPC HV on Friday, July 26, 2024
 - (4) Working out detailed schedule and checks (cosmics with no beam, low bunch store, ..)
- Still firmware issues to be worked out, many details, need for very fast analysis check turnaround, what rates can be handled... **Plan to use APEX time for throughput testing.**



Commitment versus Contribution





Excellent data set for photons, jets, dijets, π^0 , η , but only 15% of it with tracking (MVTX, INTT, TPOT) – think fragmentation functions, substructure, etc.

Only 4 cryo-weeks left of nominal pp running for TPC commissioning and some physics. Likely (TBD) request stores at 0 crossing and then steer into +1.5 mrad for TPC tests/running. Attempt to make up some physics by running full (100%) streaming (if possible).

Quite likely to want +3 weeks of pp, and then only 3 weeks of AuAu for Run-2025 prep/testing (which would mean switching on September 16, 2024) – again TBD.

Summary

sPHENIX is efficiently using the luminosity provided and can take more.

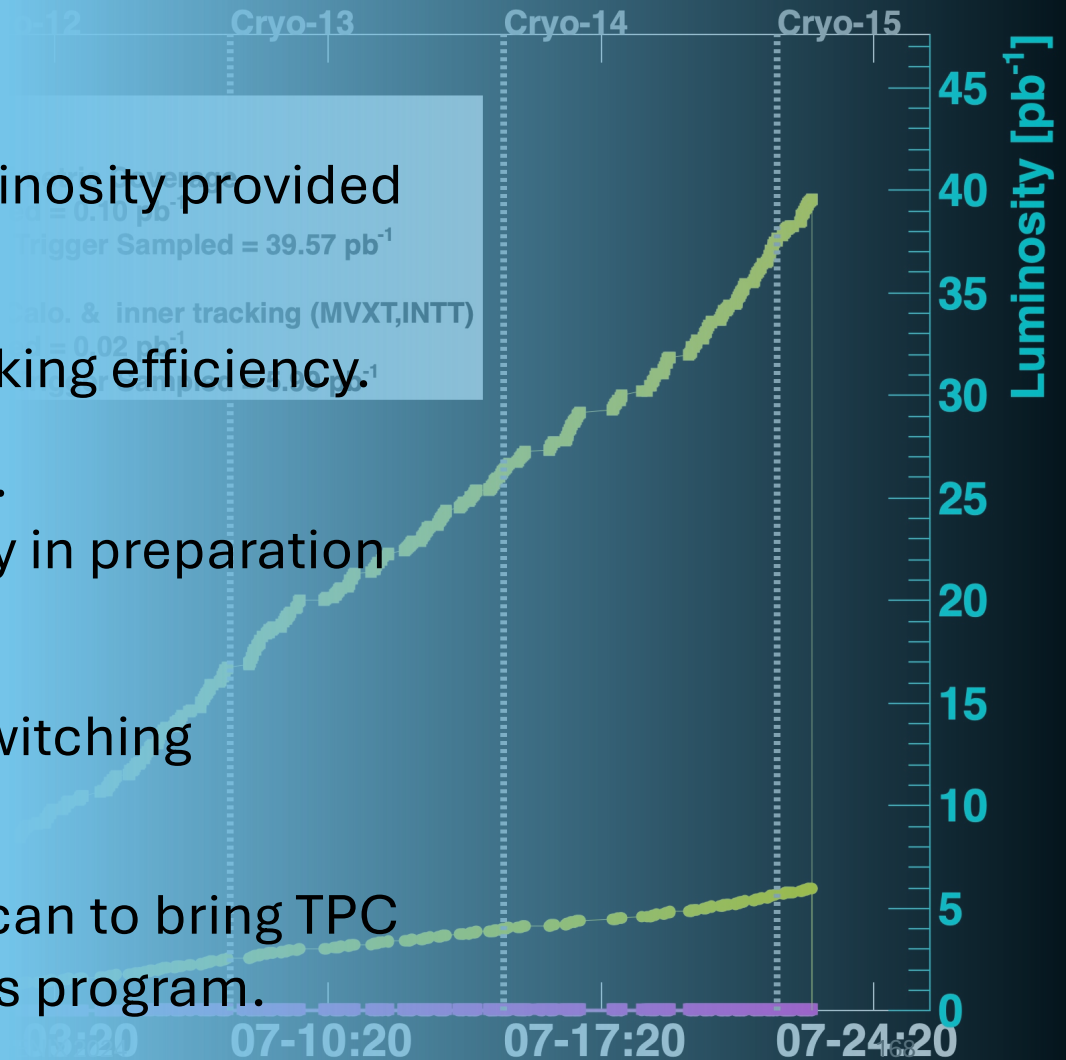
Significant improvements in data taking efficiency.

MVTX & INTT in full streaming mode.

Working on data throughput stability in preparation for TPC data taking.

Discussion with C-AD on optimal switching
0 mrad $\leftarrow \rightarrow$ +1.5 mrad

Working as hard (and safely) as we can to bring TPC online and push towards full physics program.



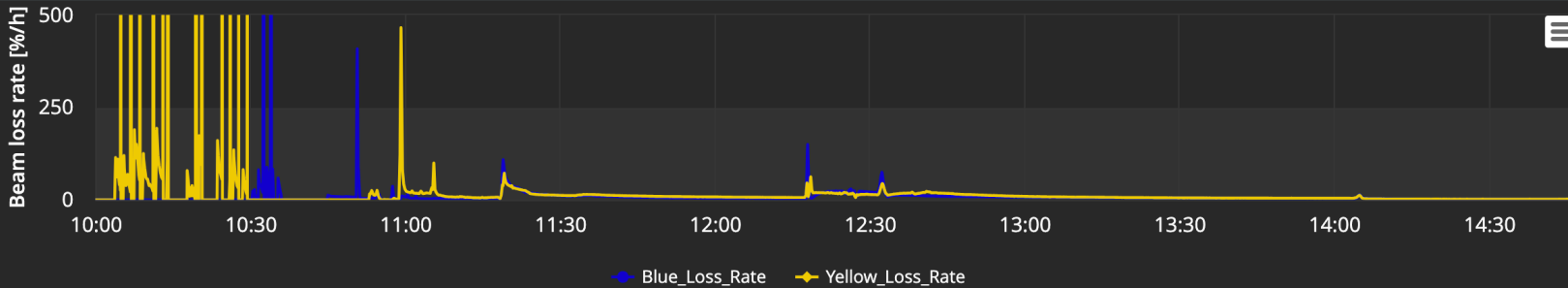
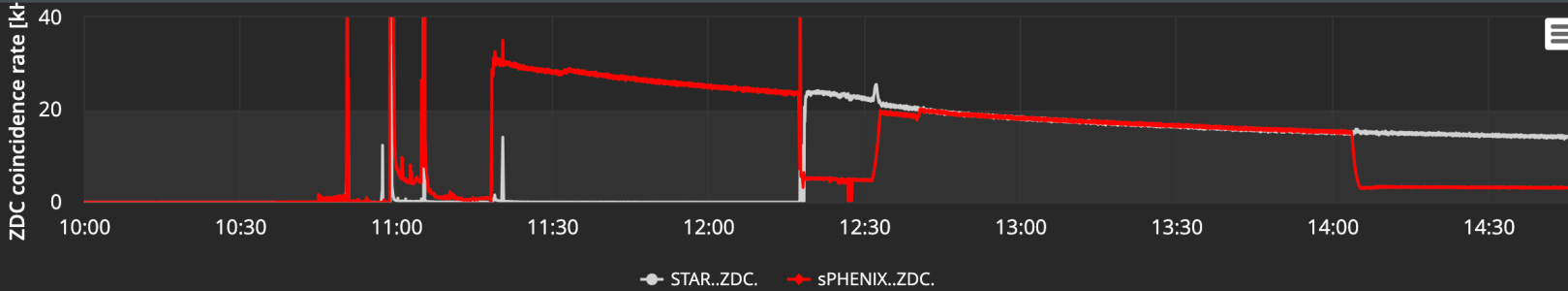
C-AD Broadcast Jul 22, 2024 14:47:18

- RHIC Injection
- RHIC Ramp
- RHIC Store**
- NSRL
- BLIP
- Injectors
- Polarization
- LEReC
- Cryo
- Links

RHIC Store

Fill #	34846	Store Start	Mon Jul 22 11:20:23 EDT 2024
Fill Pattern	111x111_P1	Physics Start	Mon Jul 22 11:20:22 EDT 2024
		Time@store	03:27:16
STAR (corrected) ZDC rate	13593 Hz	Scheduled Dump Time	Mon Jul 22 18:21:43 EDT 2024
sPHENIX ZDC rate	3075 Hz	Dump Timer	-03:34:03

Blue				Yellow			
Species	PP	Beam Energy	100.2 GeV	Species	PP	Beam Energy	100.2 GeV
Bunches	111 / 111	Intensity	1.79e+13 ions	Bunches	111 / 111	Intensity	1.54e+13 ions
RMS	Emittance	Loss Rate	1.40 %/hr	RMS	Emittance	Loss Rate	1.87 %/hr
Horizontal	[2.1] μm			Horizontal	[2.5] μm		
Vertical	[1.8] μm	Abort Kicker Mode	Delayed	Vertical	[2.8] μm	Abort Kicker Mode	Delayed

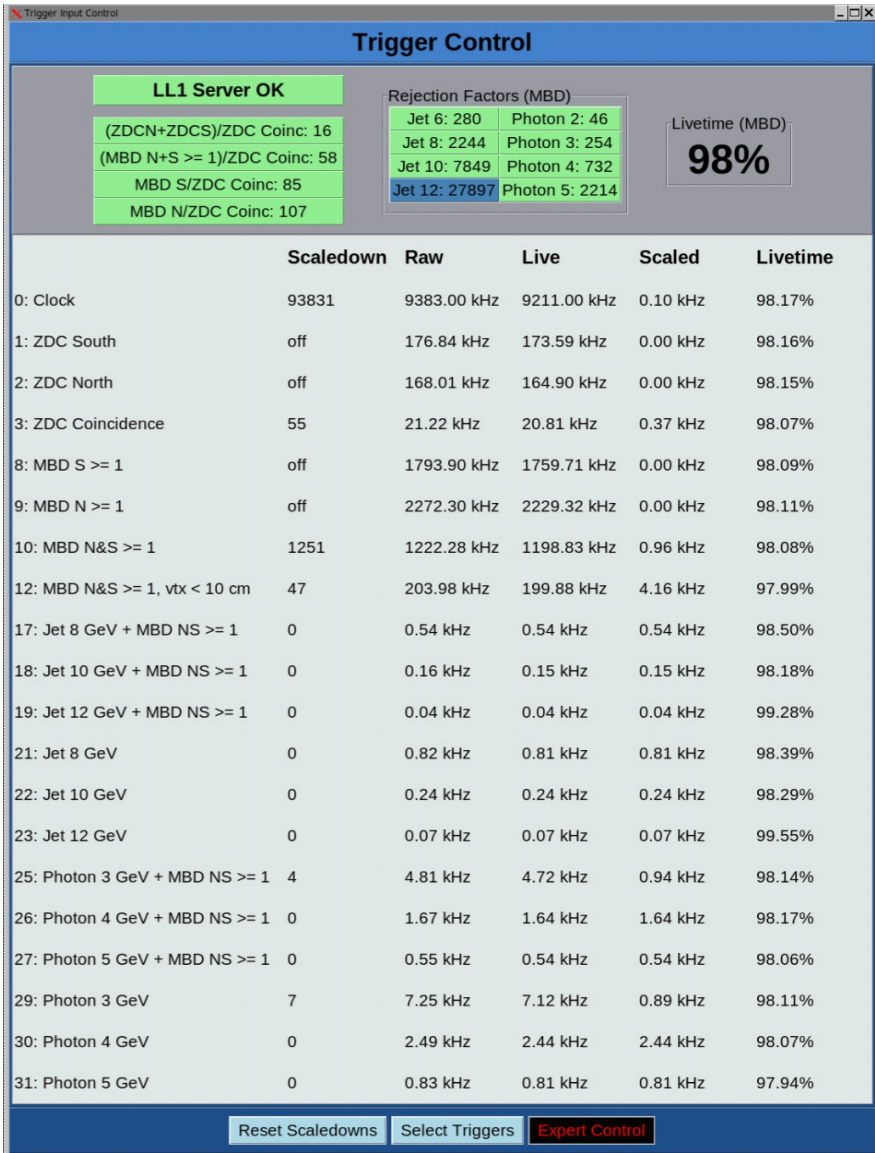


RHIC Fill # 34846:

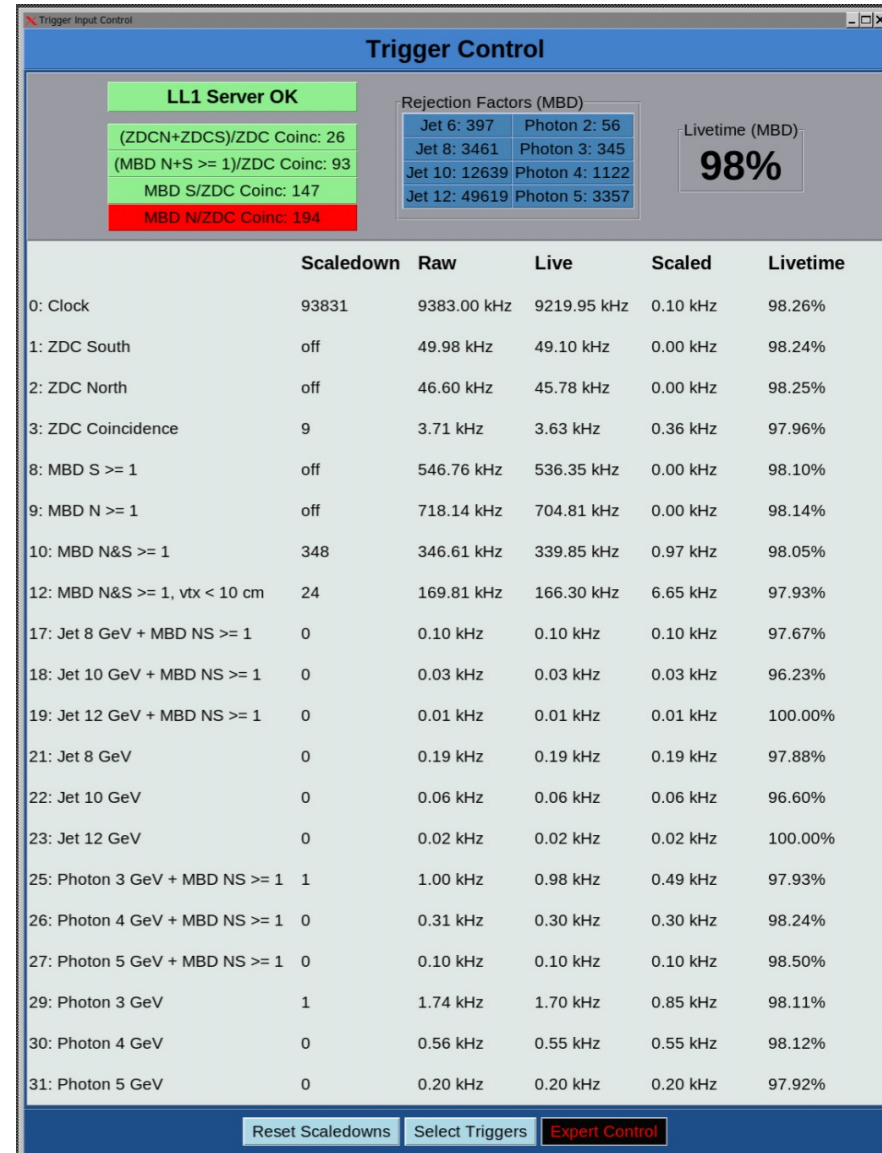
Physics

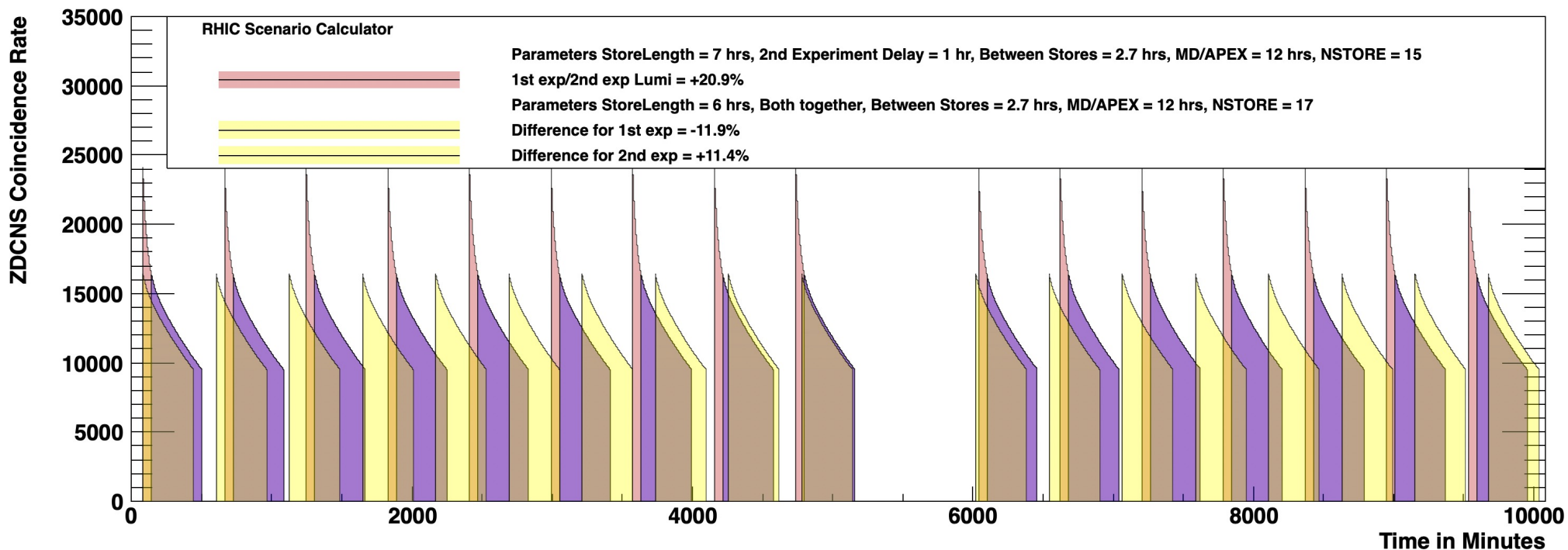
NSRL:

Machine Setup



Monday, July 22, 2024 at 2:00 pm...





Input parameters - example real store ZDCNS, store length, delay between 1st and 2nd experiment, time between stores, MD/APEX time each week. Last two values tuned to get 15 stores/week, matching RHIC performance.

Output results – number of stores per week, relative luminosities between 1st and 2nd experiment and changes if bringing both experiments into collisions at the same time.

Important for RHIC to continue to push on intensity, which is difficult if start of store is beam-beam limited.