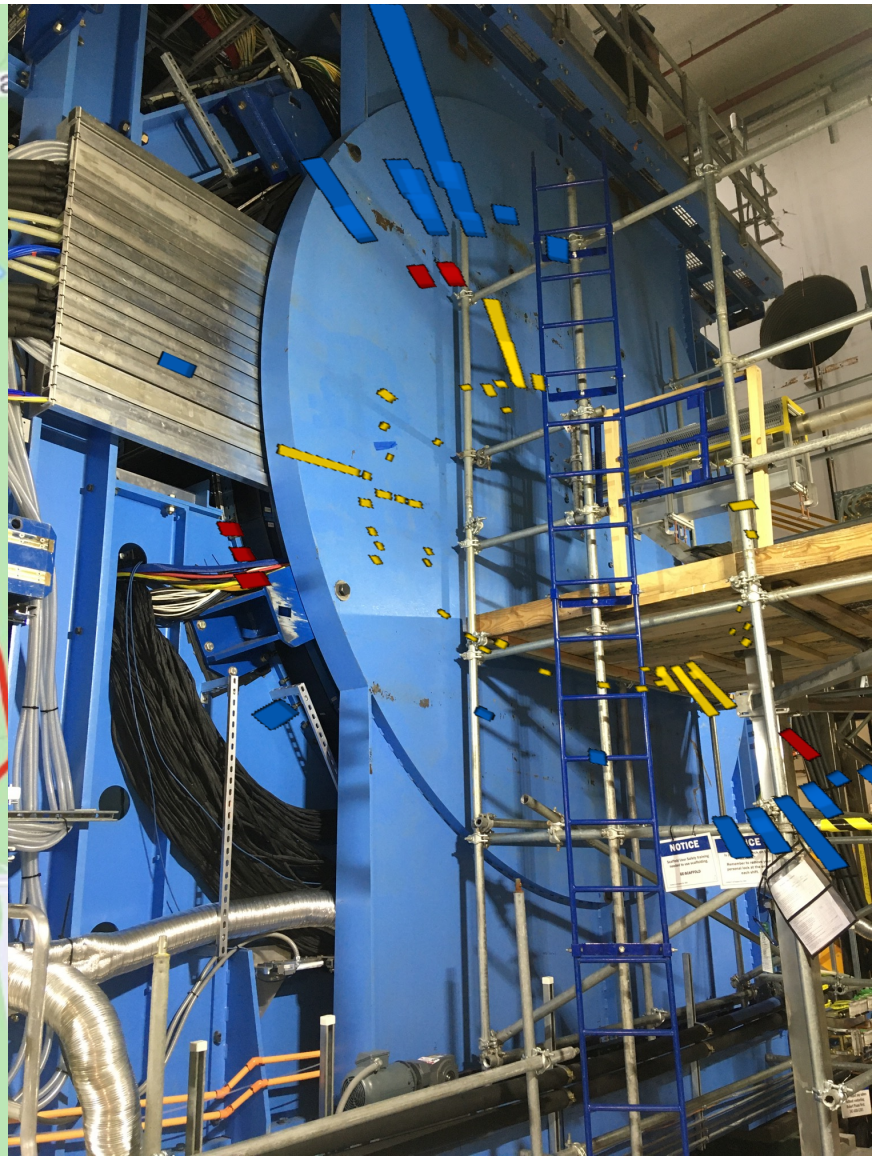
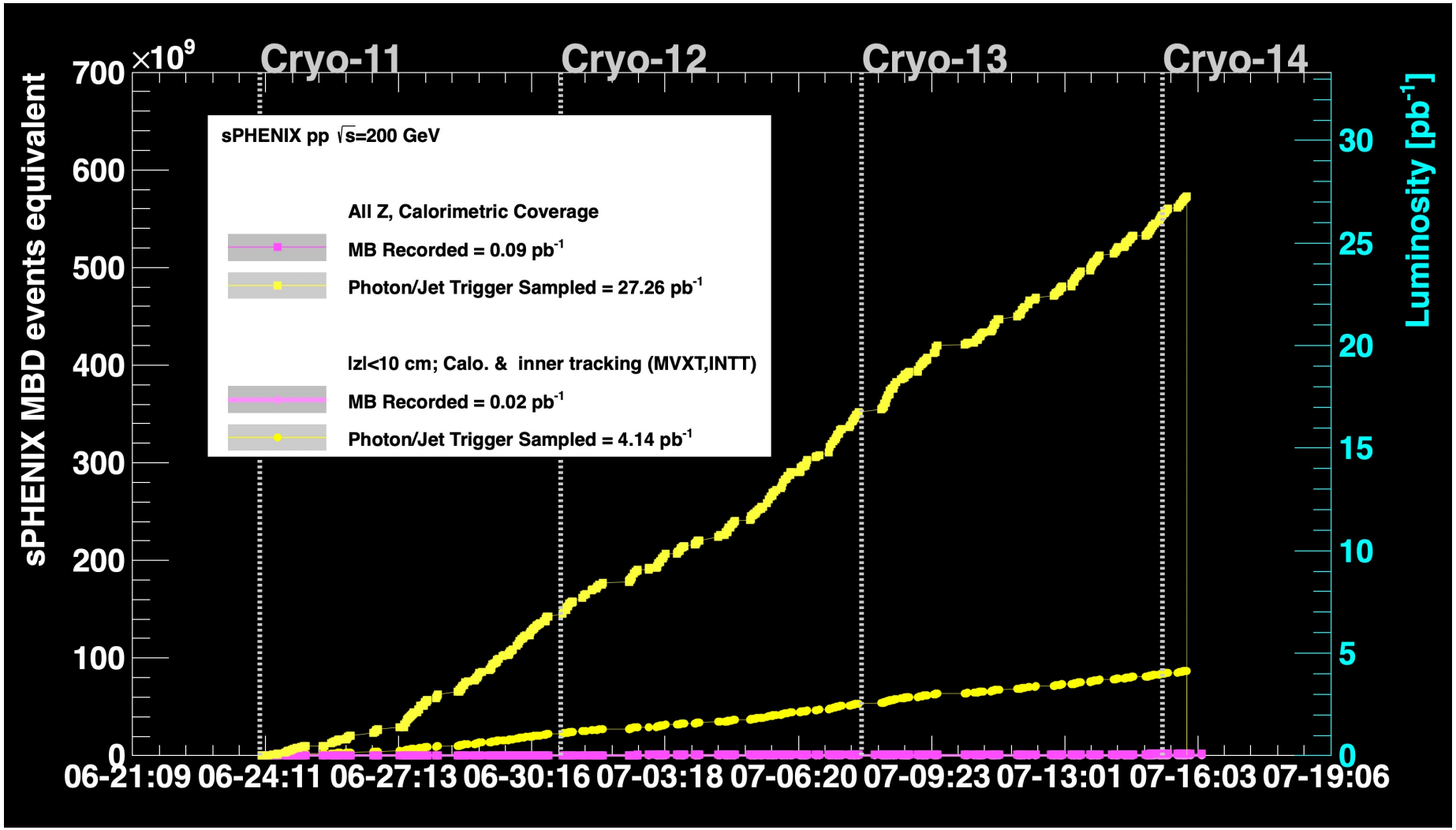
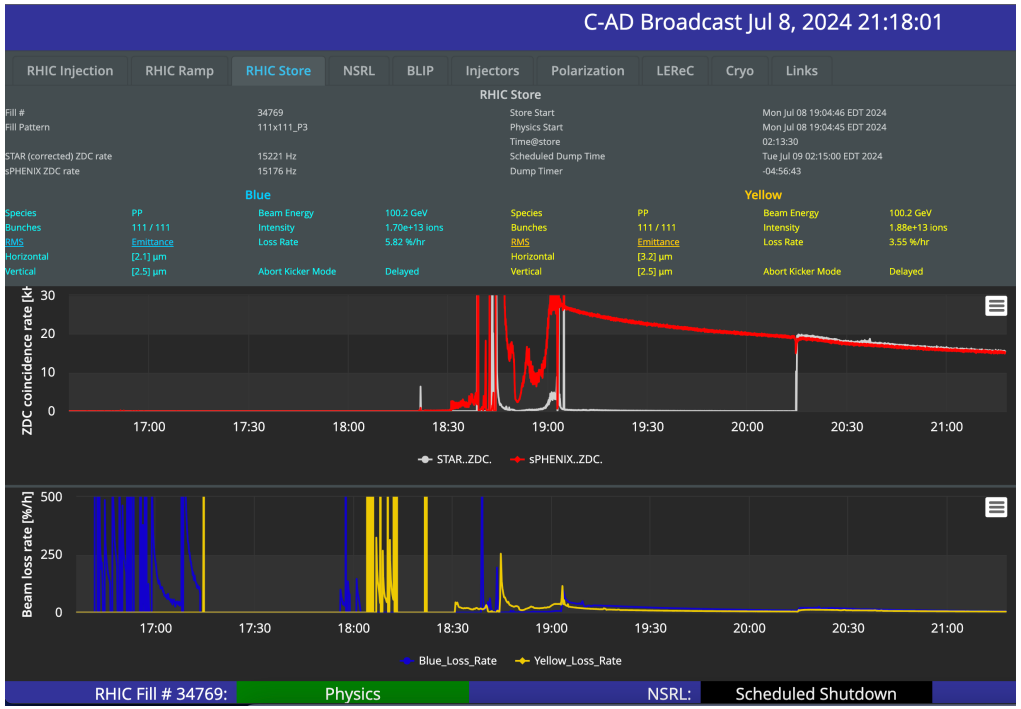
sPHENIX Status
RHIC Coordination Meeting
July 16, 2024

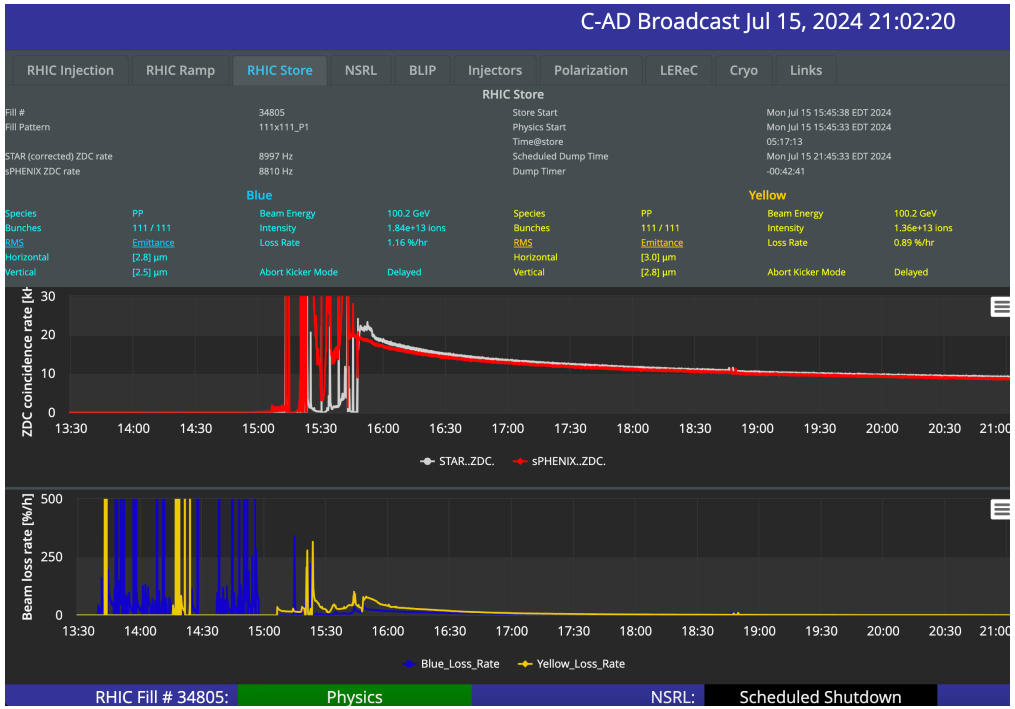
Jamie Nagle
University of Colorado Boulder
sPHENIX Run Coordinator

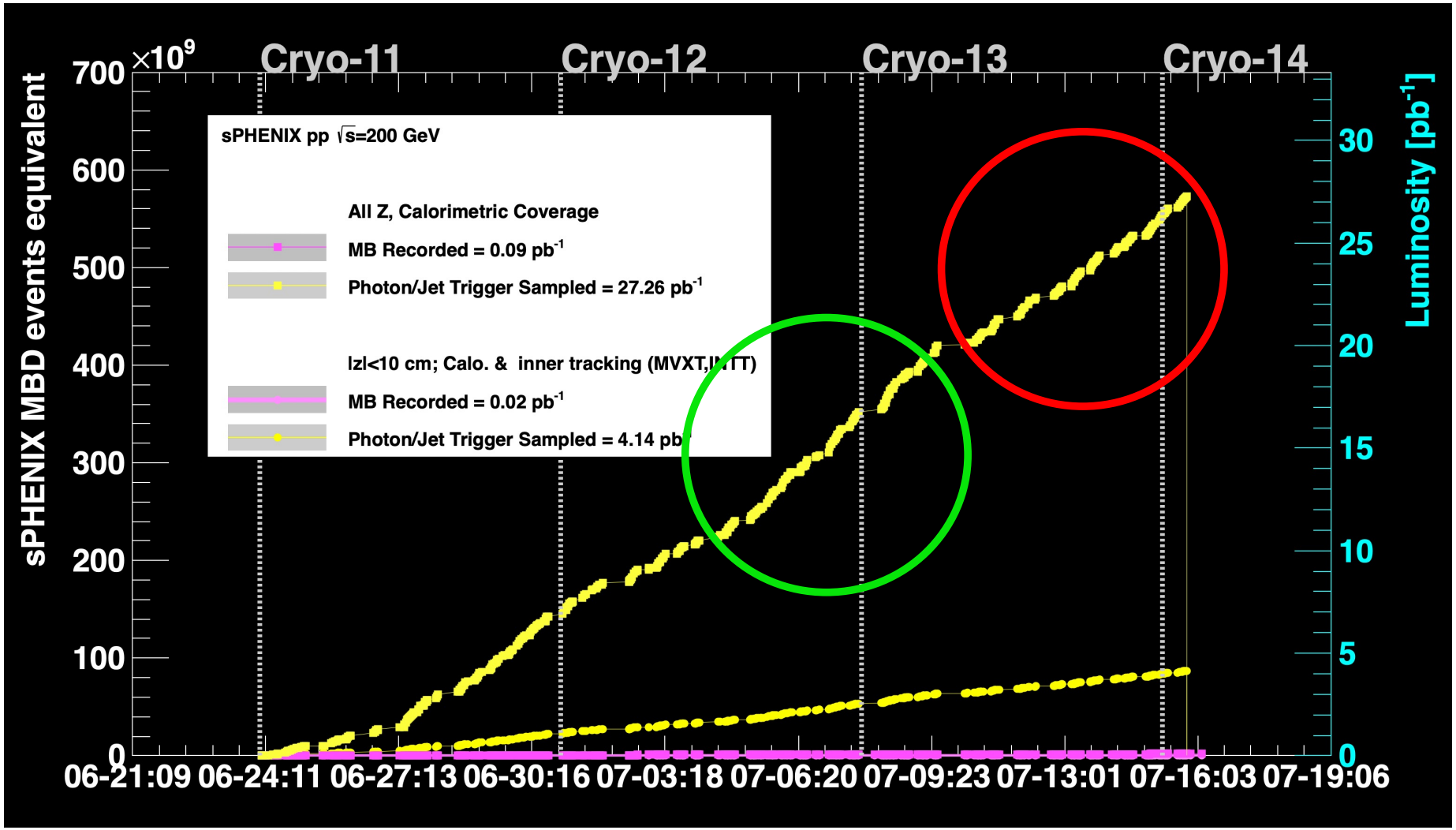



sPHENIX MBD events equivalent
×10^9
700
600
500
400
300
200
100
0
Cryo-11
Cryo-12
Cryo-13
Cryo-14
Luminosity [pb^-1]
30
25
20
15
10
5
0
sPHENIX pp √s=200 GeV
All Z, Calorimetric Coverage
MB Recorded = 0.09 pb^-1
Photon/Jet Trigger Sampled = 27.26 pb^-1
|z|<10 cm; Calo. & inner tracking (MVXT,INTT)
MB Recorded = 0.02 pb^-1
Photon/Jet Trigger Sampled = 4.14 pb^-1
06-21:09
06-24:11
06-27:13
06-30:16
07-03:18
07-06:20
07-09:23
07-13:01
07-16:03
07-19:06

After a week of higher intensities, much of the last week returned to lower intensities, and thus sPHENIX is integrating luminosity at a significantly lower rate.



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Cryo-12
Cryo-13
Cryo-14
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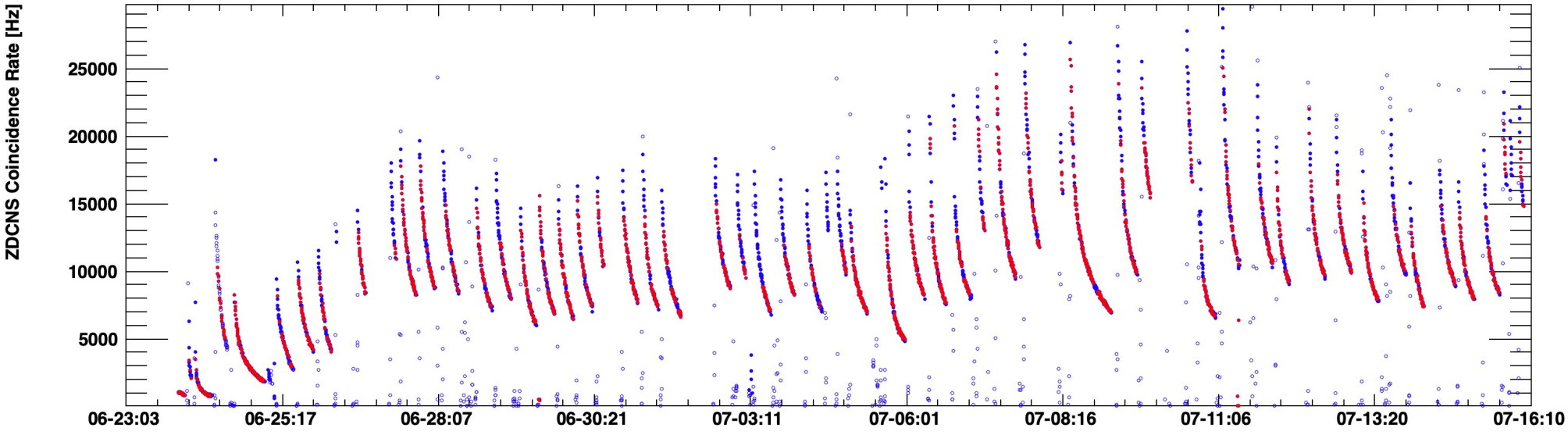
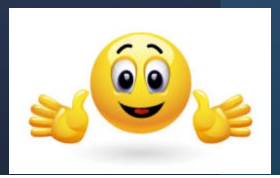
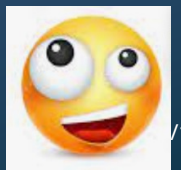
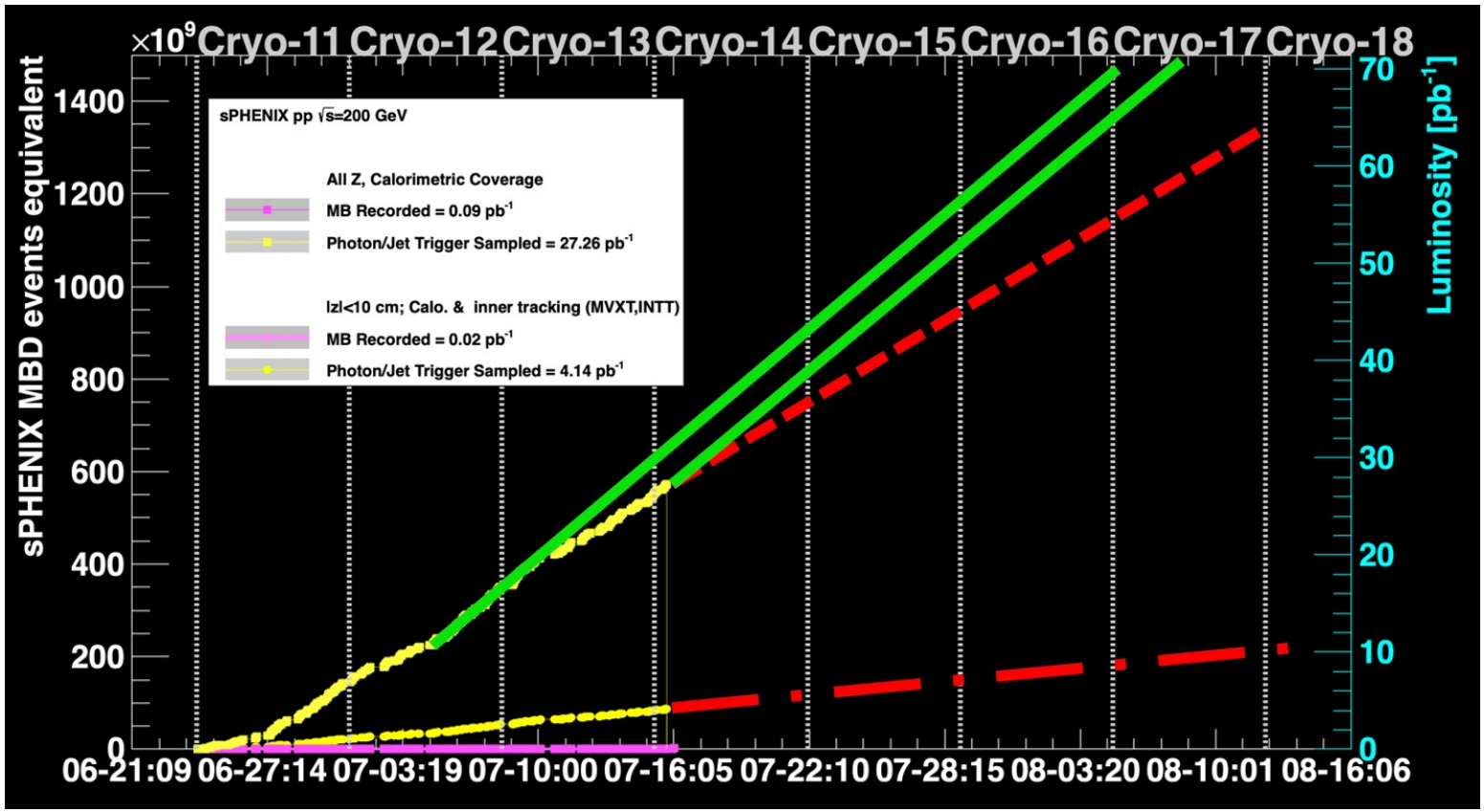

ZDCNS Coincidence Rate [Hz]
25000
20000
15000
10000
5000
06-23:03
06-25:17
06-28:07
06-30:21
07-03:11
07-06:01
07-08:16
07-11:06
07-13:20
07-16:10

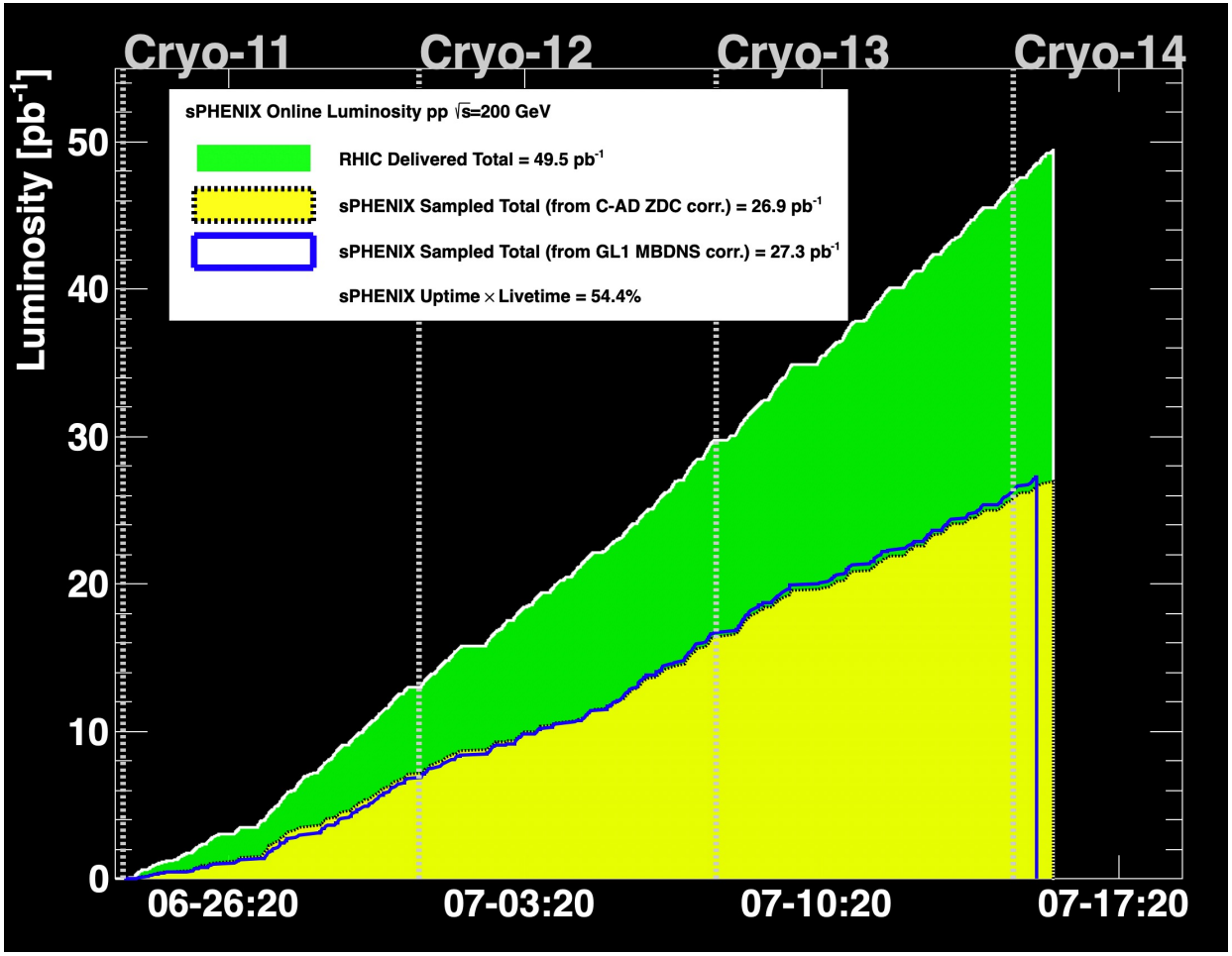




A few extrapolations…

- Current rates yield 45 pb^{-1} (All Z) in 2 weeks
- Current rates yield 62 pb^{-1} (All Z) in 4 weeks
- Current rates yield 10 pb^{-1} (|z|<10 cm) in 4 weeks

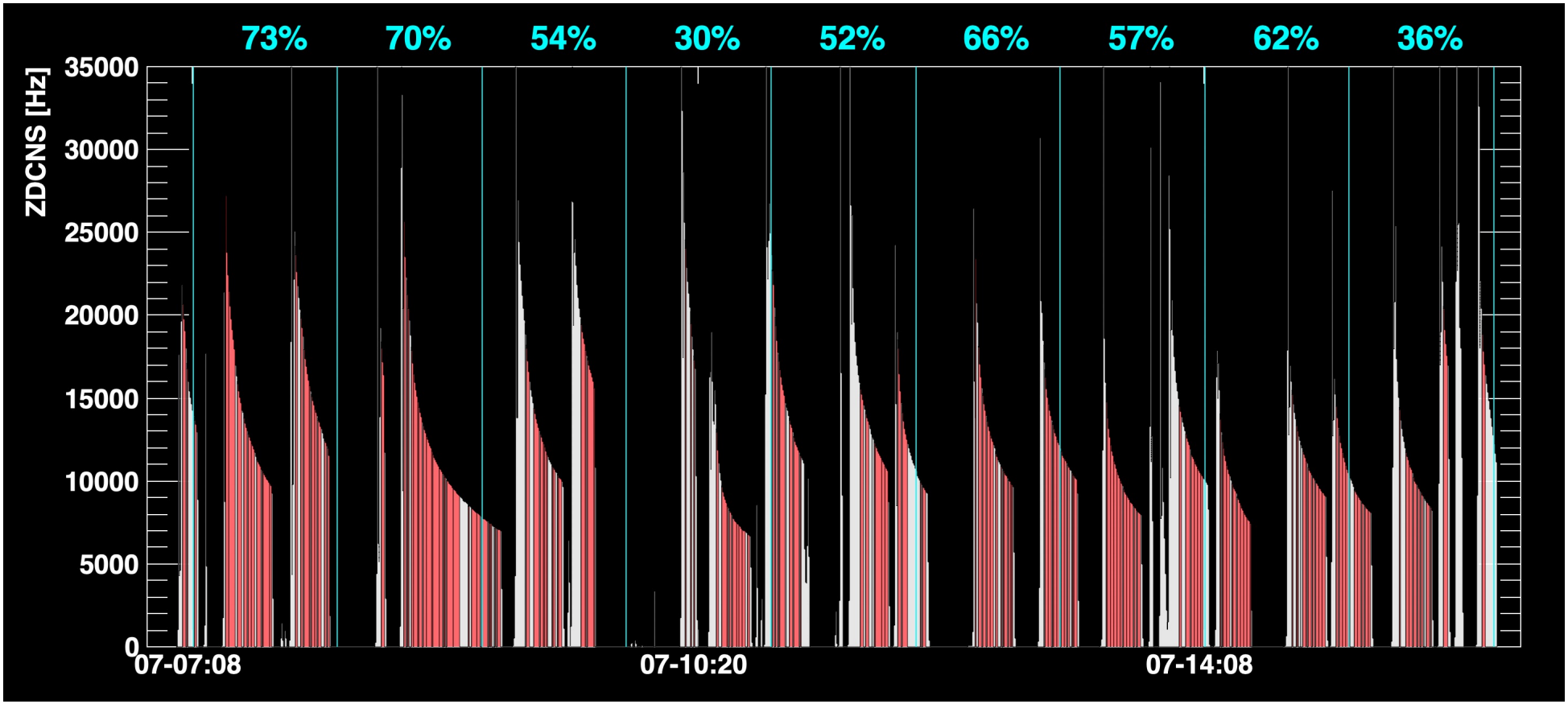




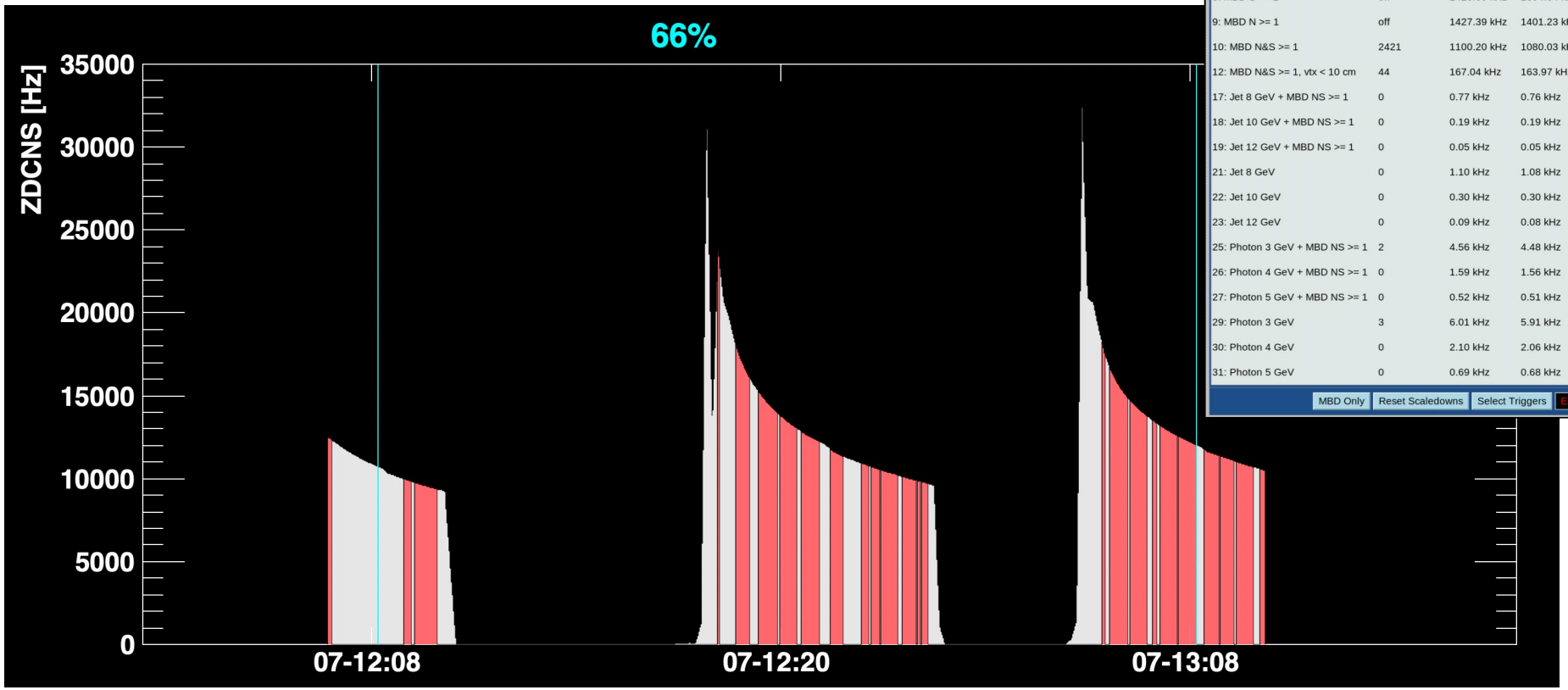
Implemented identical ZDC coincidence correction as C-AD (thanks Kiel/Angelika)

Also, fully corrected MBDNS luminosity measure.

Vernier scan last Thursday.
Then the values can be updated.
Currently assuming
ZDCNS σ = **0.23 mb**,
MBDNS>=1 σ = **21 mb**



Average efficiency is close to Beam-Use-Proposal projected value of 60%.
Still working on final accounting method.



Trigger Input Control

Trigger Control

LL1 Server OK

(ZDCN+ZDCS)/ZDC Coinc: 18
(MBD N+S >= 1)/ZDC Coinc: 67
MBD S/ZDC Coinc: 87
MBD N/ZDC Coinc: 88

Rejection Factors (MBD)

Jet 6: 163	Photon 2: 44
Jet 8: 1422	Photon 3: 241
Jet 10: 5686	Photon 4: 693
Jet 12: 20284	Photon 5: 2117

Livetime (MBD)
98%

	Scaledown	Raw	Live	Scaled	Livetime
0: Clock	93831	9383.00 kHz	9215.15 kHz	0.10 kHz	98.21%
1: ZDC South	off	151.20 kHz	148.46 kHz	0.00 kHz	98.19%
2: ZDC North	off	144.61 kHz	141.96 kHz	0.00 kHz	98.16%
3: ZDC Coincidence	47	16.30 kHz	15.99 kHz	0.33 kHz	98.09%
8: MBD S >= 1	off	1420.09 kHz	1394.04 kHz	0.00 kHz	98.17%
9: MBD N >= 1	off	1427.39 kHz	1401.23 kHz	0.00 kHz	98.17%
10: MBD N&S >= 1	2421	1100.20 kHz	1080.03 kHz	0.45 kHz	98.17%
12: MBD N&S >= 1, vtx < 10 cm	44	167.04 kHz	163.97 kHz	3.64 kHz	98.16%
17: Jet 8 GeV + MBD NS >= 1	0	0.77 kHz	0.76 kHz	0.76 kHz	98.29%
18: Jet 10 GeV + MBD NS >= 1	0	0.19 kHz	0.19 kHz	0.19 kHz	98.46%
19: Jet 12 GeV + MBD NS >= 1	0	0.05 kHz	0.05 kHz	0.05 kHz	96.95%
21: Jet 8 GeV	0	1.10 kHz	1.08 kHz	1.08 kHz	98.11%
22: Jet 10 GeV	0	0.30 kHz	0.30 kHz	0.30 kHz	98.36%
23: Jet 12 GeV	0	0.09 kHz	0.08 kHz	0.08 kHz	97.35%
25: Photon 3 GeV + MBD NS >= 1	2	4.56 kHz	4.48 kHz	1.49 kHz	98.32%
26: Photon 4 GeV + MBD NS >= 1	0	1.59 kHz	1.56 kHz	1.56 kHz	98.39%
27: Photon 5 GeV + MBD NS >= 1	0	0.52 kHz	0.51 kHz	0.51 kHz	98.54%
29: Photon 3 GeV	3	6.01 kHz	5.91 kHz	1.48 kHz	98.30%
30: Photon 4 GeV	0	2.10 kHz	2.06 kHz	2.06 kHz	98.33%
31: Photon 5 GeV	0	0.69 kHz	0.68 kHz	0.68 kHz	98.38%

MBD Only | Reset Scaledowns | Select Triggers | Expert Control

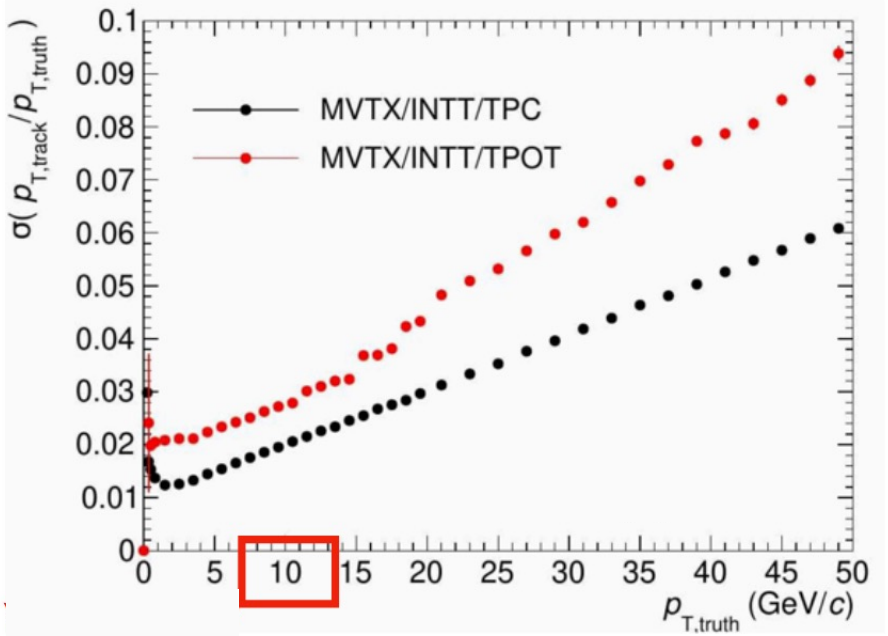
Short updates

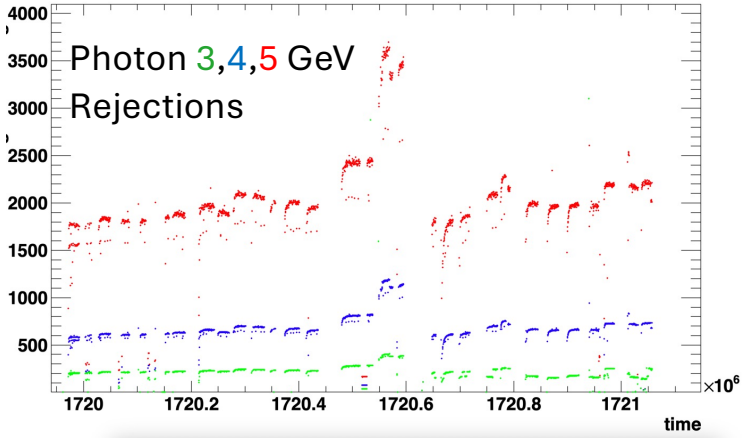
Last night failure of ¼ EMCal Voltage Controller/Supply. Accesses to fix.

Working on MVTX clock errors; also, the leading cause of run stoppage in ALICE.

Examining tracking performance without TPC since we already have a lot of data in this category. TPOT only covers 8% of acceptance but may yield good resolution. Matching to EMCal clusters under study.

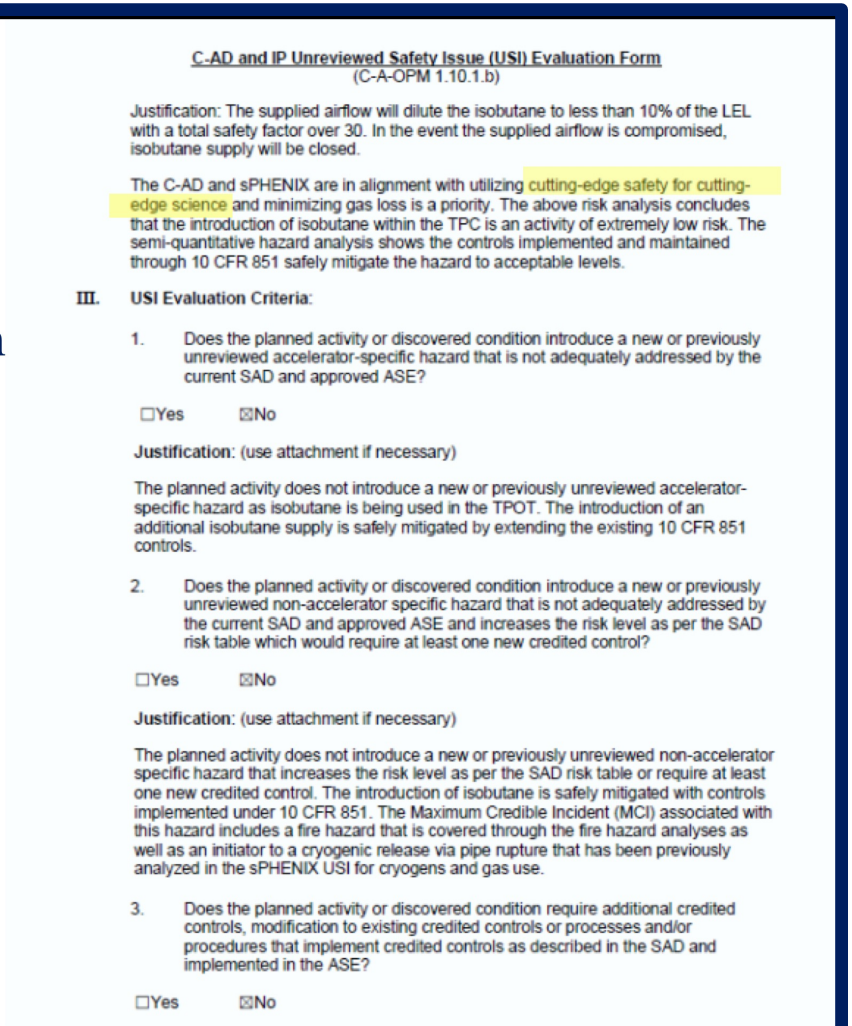
Trigger performance stable. Overall improved monitoring / offline QA nearly complete.





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-OPM 1.10.1.b)

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 cutting-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:**

1. 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.

2. 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 analyses as well as an initiator to a cryogenic release via pipe rupture that has been previously analyzed in the sPHENIX USI for cryogens and gas use.

3. 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

Table 1: Scenarios Requiring Isobutane Valve Isolation			
Location	**Scenario**	**Engineered Control/Response**	**Administrative Control/Response**
IR8 (sPHENIX Detector Hall)	Bore Dehimidifiers $\sum N > 100$ cfm and $\sum S > 100$ cfm	Turn off Isobutane Supply (KGT) and alarm sPHENIX Control Room	No Change
IR8 (sPHENIX Detector Hall)	Ceiling VESDA HSSD Smoke Detected		No Change
IR8 (sPHENIX Detector Hall)	Bore VESDA HSSD Smoke Detected		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.

Summary

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

Recent decrease in luminosity needs remedy.

Smaller sample within |z| < 10 cm enables significant additional program with
MVTX & INTT & TPOT

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