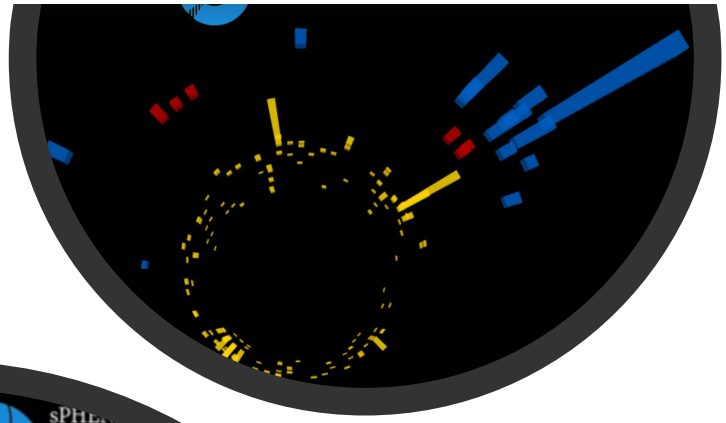
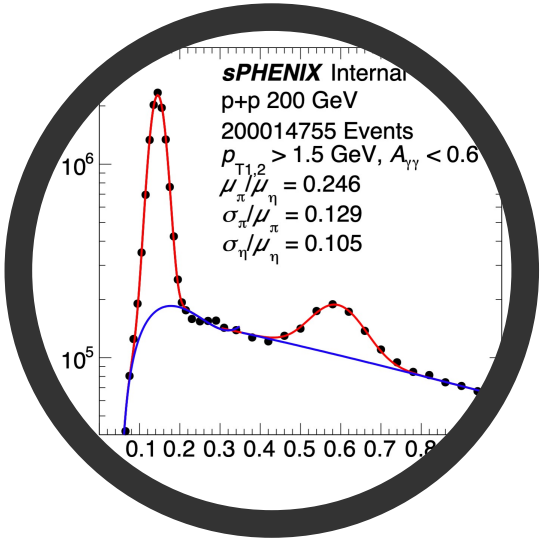
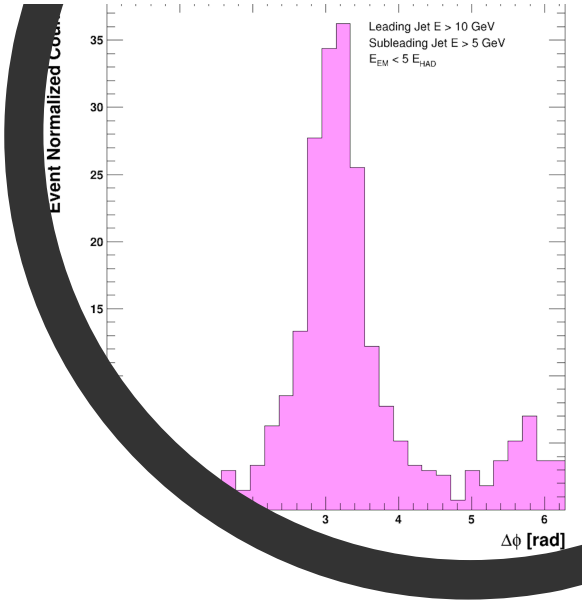
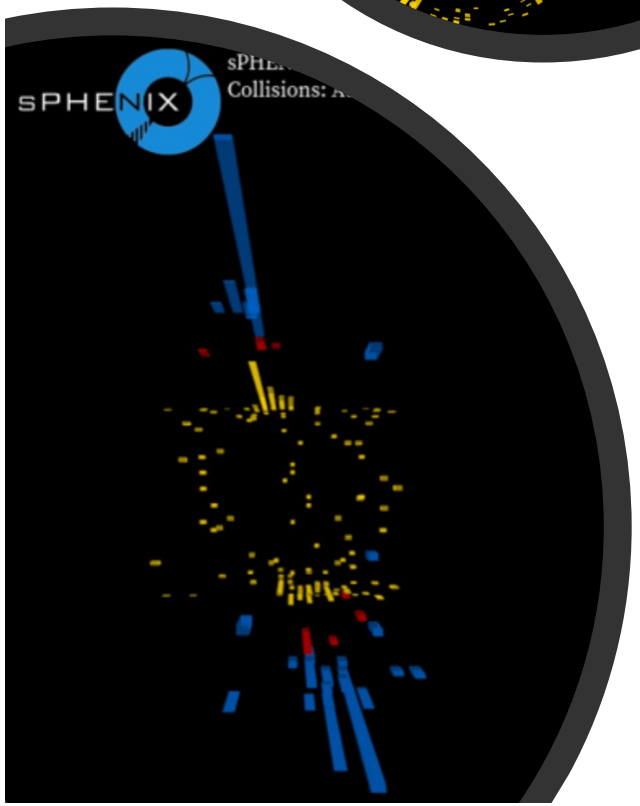
# sPHENIX Status
# RHIC Coordination Meeting
# June 04, 2024

**Jamie Nagle**
**University of Colorado Boulder**
**sPHENIX Run Coordinator**

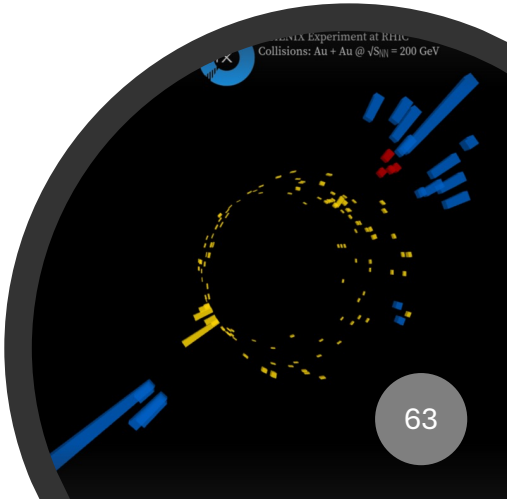





# First some plots for encouragement…

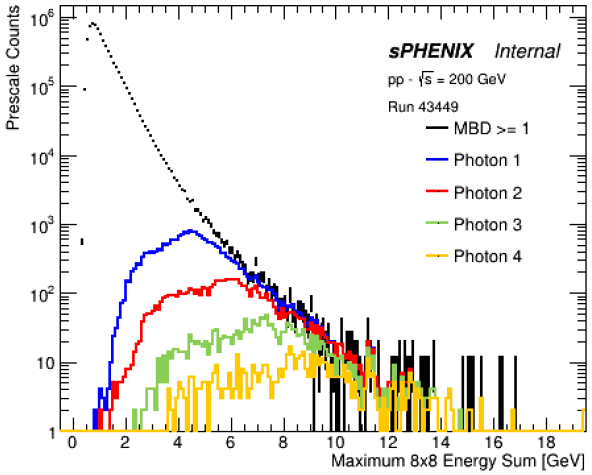


# Two steps forward, one step back...

Global Level 1/G Timing Module (GL1/GTM) was discovered to not handle multiple triggers and live/scaled trigger vectors. New firmware by Joe Mead over the weekend, tested yesterday.

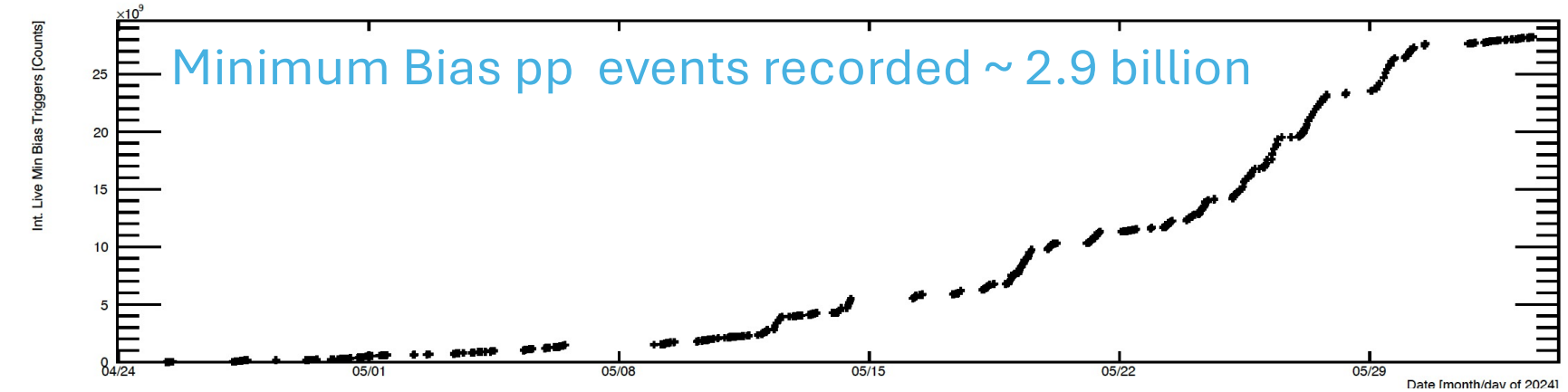
Now back to running with full jet trigger mix.

Updating lower turn on curve with new firmware by Cheng-Yi Chi to shift precision bits lower.

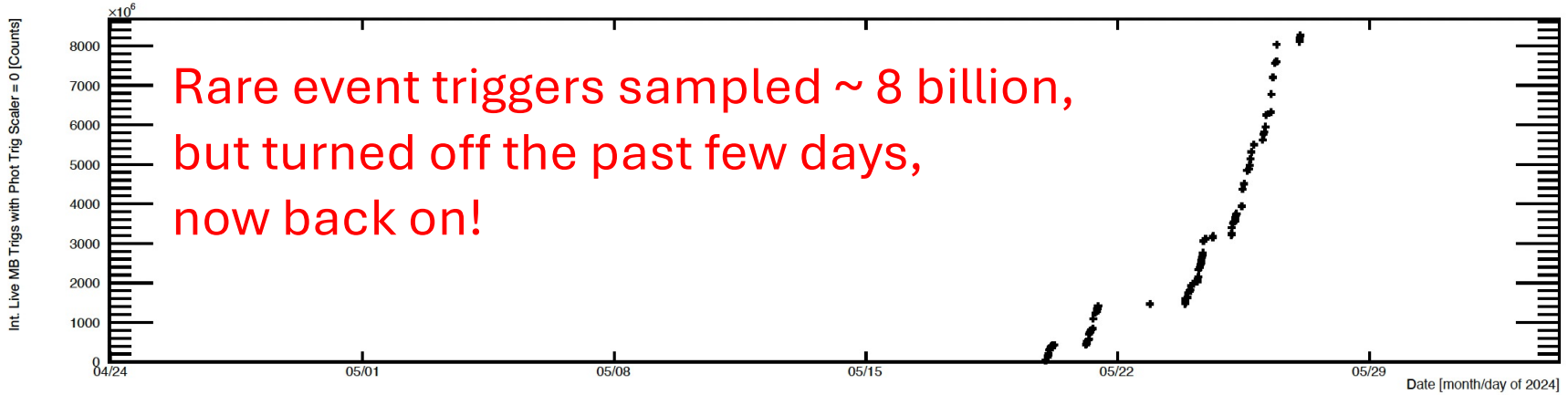



| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 3: ZDC Coincidence | 20 | | Modify | 1716.08 Hz | 1674.75 Hz | 79.78 Hz | 97.59% |
| 4: HCAL Singles | off | | Modify | 54015.80 Hz | 52755.98 Hz | 0.00 Hz | 97.67% |
| 5: HCAL Coincidence | off | | Modify | 9383060.56 Hz | 9162124.65 Hz | 0.00 Hz | 97.65% |
| 8: MBD S >= 1 | off | | Modify | 1078412.26 Hz | 1052696.39 Hz | 0.00 Hz | 97.62% |
| 9: MBD N >= 1 | off | | Modify | 279170.78 Hz | 272499.67 Hz | 0.00 Hz | 97.61% |
| 10: MBD N&S >= 1 | 300 | | Modify | 180192.81 Hz | 175944.90 Hz | 584.42 Hz | 97.64% |
| 11: MBD N&S >= 2 | off | | Modify | 90314.92 Hz | 88168.86 Hz | 0.00 Hz | 97.62% |
| 12: MBD N&S >= 1, vtx < 10 cm | off | | Modify | 34722.73 Hz | 33893.21 Hz | 0.00 Hz | 97.61% |
| 13: MBD N&S >= 1, vtx < 30 cm | off | | Modify | 84297.75 Hz | 82337.84 Hz | 0.00 Hz | 97.68% |
| 14: MBD N&S >= 1, vtx < 60 cm | off | | Modify | 123221.28 Hz | 120367.45 Hz | 0.00 Hz | 97.68% |
| 15: HCAL Singles + MBD NS >= 1 | off | | Modify | 19399.13 Hz | 18937.75 Hz | 0.00 Hz | 97.62% |
| 16: Jet 4 GeV + MBD NS >= 1 | 1 | | Modify | 10858.14 Hz | 10598.94 Hz | 5299.47 Hz | 97.61% |
| 17: Jet 6 GeV + MBD NS >= 1 | 0 | | Modify | 1495.32 Hz | 1456.23 Hz | 1456.23 Hz | 97.39% |
| 18: Jet 8 GeV + MBD NS >= 1 | 0 | | Modify | 642.41 Hz | 623.82 Hz | 623.82 Hz | 97.11% |
| 19: Jet 10 GeV + MBD NS >= 1 | 0 | | Modify | 290.93 Hz | 281.63 Hz | 281.63 Hz | 96.81% |
| 20: Jet 4 GeV | off | | Modify | 65375.38 Hz | 63809.57 Hz | 0.00 Hz | 97.60% |
| 21: Jet 6 GeV | off | | Modify | 11749.18 Hz | 11465.95 Hz | 0.00 Hz | 97.59% |
| 22: Jet 8 GeV | off | | Modify | 6051.45 Hz | 5897.02 Hz | 0.00 Hz | 97.45% |
| 23: Jet 10 GeV | off | | Modify | 3403.96 Hz | 3315.21 Hz | 0.00 Hz | 97.39% |
| 24: Photon 1 GeV+ MBD NS >= 1 | off | | Modify | 88056.40 Hz | 85974.74 Hz | 0.00 Hz | 97.64% |
| 25: Photon 2 GeV + MBD NS >= 1 | 5 | | Modify | 20797.05 Hz | 20296.90 Hz | 3382.82 Hz | 97.60% |
| 26: Photon 3 GeV + MBD NS >= 1 | 0 | | Modify | 4835.52 Hz | 4716.98 Hz | 4716.98 Hz | 97.55% |
| 27: Photon 4 GeV + MBD NS >= 1 | 0 | | Modify | 1457.19 Hz | 1420.35 Hz | 1420.35 Hz | 97.47% |
| 28: Photon 1 GeV | off | | Modify | 951186.90 Hz | 928679.22 Hz | 0.00 Hz | 97.63% |
| 29: Photon 2 GeV | off | | Modify | 112697.32 Hz | 109970.37 Hz | 0.00 Hz | 97.58% |
| 30: Photon 3 GeV | off | | Modify | 29416.21 Hz | 28704.92 Hz | 0.00 Hz | 97.58% |
| 31: Photon 4 GeV | off | | Modify | 9419.21 Hz | 9188.52 Hz | 0.00 Hz | 97.55% |
| | | | Reset GL1 | | | | |

# Two steps forward, one step back…



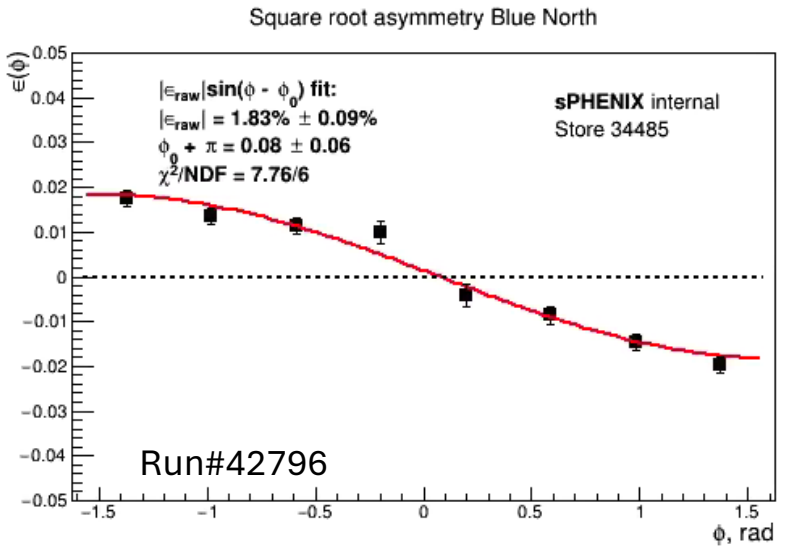

Minimum Bias pp events recorded ~ 2.9 billion




Rare event triggers sampled ~ 8 billion,
but turned off the past few days,
now back on!

# Big step forward for sPHENIX Spin Program

Courtesy of Devon Loomis




| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 34485.203 | May 17, 2024 10:17:58 Fri | B2D | 0.0 ± -100.0 | 0.0 ± -57.3 | 0.00 ± -1.00 | sweep | 100.22 |
| 34485.102 | May 16, 2024 23:46:11 Thu | Y1D | 39.6 ± 2.3 | -1.3 ± 4.9 | 0.22 ± 0.17 | sweep | 100.22 |
| 34485.202 | May 16, 2024 23:44:16 Thu | B2D | 33.0 ± 2.5 | 3.0 ± 4.4 | 0.87 ± 0.44 | sweep | 100.22 |

$$A_N = \frac{e_N(\phi)}{\sin(\phi - \phi_0)} \frac{1}{P}$$

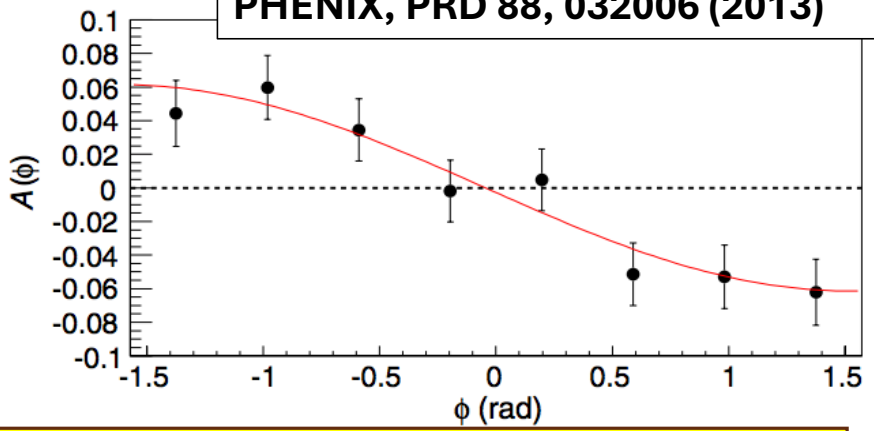
0 rad.

~33%

$$A_N = \frac{1.83}{0.33} \sim 0.054$$

Consistent!

**PHENIX, PRD 88, 032006 (2013)**




Confirmed the spin vector is pointing vertical in 1008 and observed asymmetries are consistent with published data.

# Another big step forward (we hope)

TPC humidity issue has been improved after we replaced air-conditioner with dehumidifiers in the north bore


TPC on

Dew point sensors inside the magnet bore

Thanks Marianna (ES&F) for lending us the dehumidifiers.

Replace north portable air conditioners with dehumidifiers

# Step backwards on MVTX

- Start of run, MVTX recorded data in 89 μs windows
  → now tunable to different windows: 10 μs and 5 μs would be most common
- We saw increased data errors at 5 μs and so “Standard” became 10 μs
- Unfortunately, DAQ rate became unstable
- Two issues:
  - Data rate would fluctuate and fill DMA, then DMA stops
  - Clock error would stop data from one end point
- Experts are investigating….


However, we are missing strobes (10 μs of data) and then multiple minutes of entire data. MVTX not in physics ready mode.

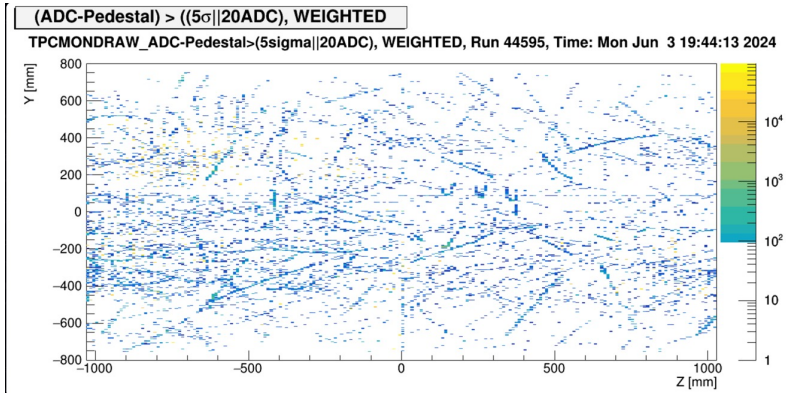
# The *Cha-Cha* for the TPC

Right now, there is no “safe” working point voltage with beam close to physics performance.  Running at 3500 V or 3700 V as parking voltage.

With beam and the vertical scan, data was taken at 4000  V, but even at 4100  V and very low collision rate  there was additional damage seen.

Multiple analyses ongoing, useful discussions, key **hypotheses** / ideas to  test.

## Background and localized large charge




## Potential  gas additive (N or Isobutane)

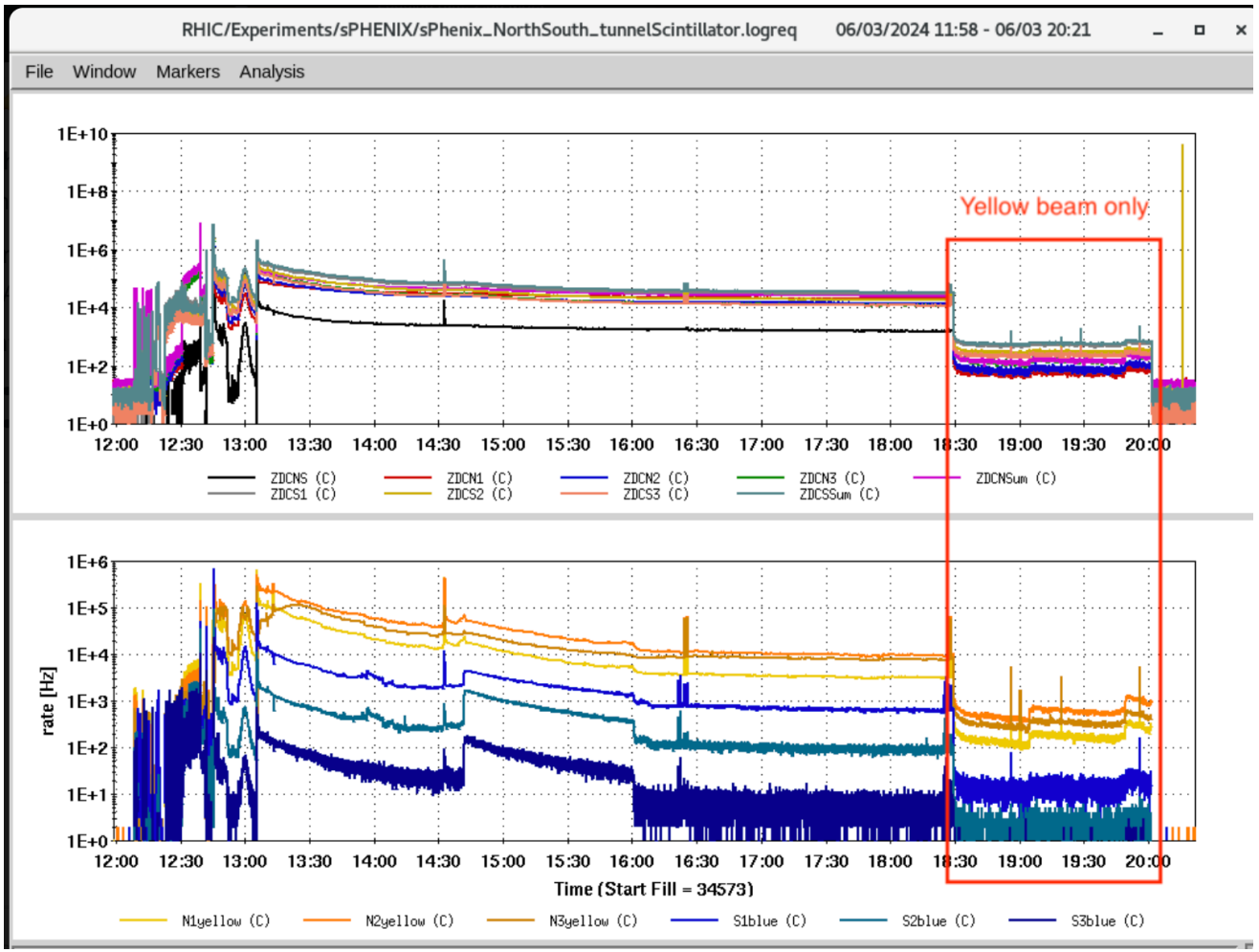
Canary chamber tests ongoing

3rd  gas port added for mixture

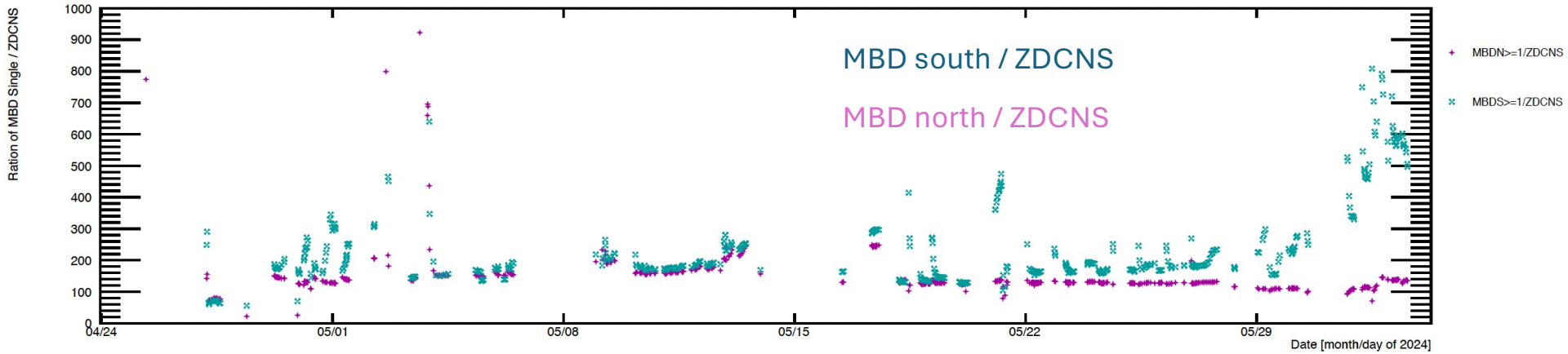
Note that ALICE has added Nitrogen as quencher

Careful decision  at  end  of  this week

# Thank you for single beam tests, analyzing now



# Backgrounds, backgrounds, backgrounds




Many indicators of changing backgrounds.

Resulting in challenges checking timing at the start of store.

Concerns about MVTX occupancy high tail.

Increasing currents on SiPMs in calorimeters.

Investigating this contribution to TPC instability.

We are compiling quantitative information – follow up with dedicated meeting later this week (TBD).

# Challenges and working together

Now in Cryo Week #8, and are taking physics data with rare triggers and pipelined electronics (GL1, EMCAl, HCal, MBD, ZDC/SMD, sEPD).

Reliability (update) is being worked on.

INTT, MVTX have data dropping issues.

TPC currently testing hypothesize in order to Find working point. Firmware work in parallel.

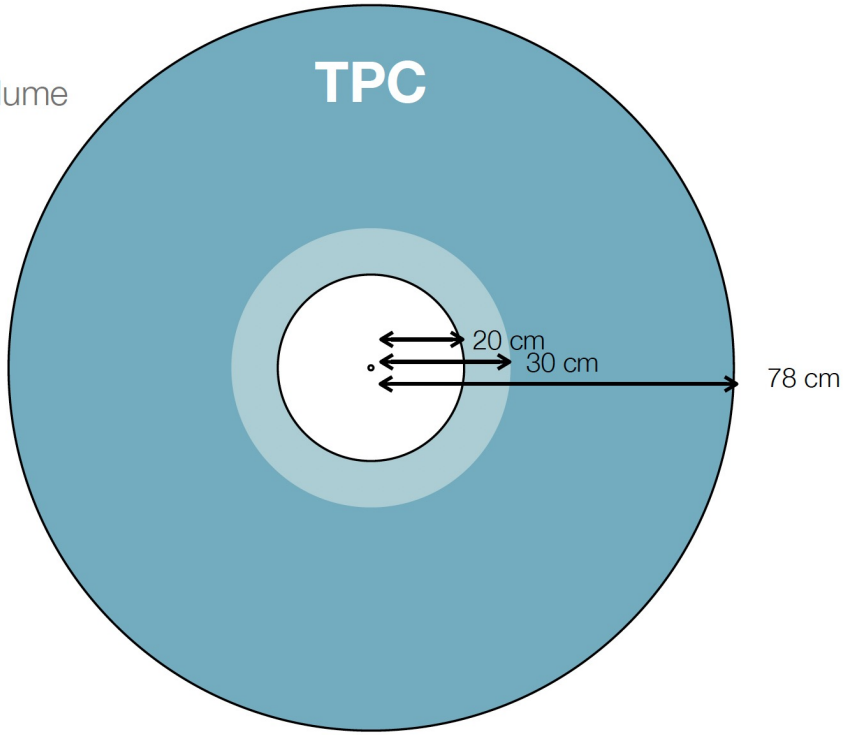

Pressure is building and we are fraying a bit (apologies). We are working to pace ourselves and keep an eye on the overall physics goals.

We greatly appreciate all of C-AD's hard work and support.

20 cm: inner field cage

30-78 cm: instrumented volume

78 cm: outer field cage




“Horizontal” tracks appear more concentrated near inner radius. Quantitative plots forthcoming.