sPHENIX Run24
Au+Au commissioning

Akitomo Enokizono

Run24 Au+Au commissioning

- Au+Au commissioning started 10/1, and C-AD started working on conditioning RF, training DX magnet, repairing PS modules etc.
  - sPHENIX started measuring meaningful Au+Au data on 10/7, only 2 weeks left

- Two main goals for Au+Au commissioning for sPHENIX
  - Make sure TPC will work on the high intensity of Au+Au collisions
  - Resolve or mitigate MVTX background issue

  so…
  - The other subsystems including INTT were considered as lower priorities and it was hard to find the time to take calibration data for INTT

INTT calibration data we took

Default config: LVL1 delay=114, DAC0=35, Trigger mode (n-collision=100, open-time=60)

Run number	Run type	Beam profile	#Evts	Calibration type	Config parameters	Subsystems	Comment
54279	Physics		5.8M	Zero-field run	Default	Big Partition	
54280	Physics		10.6M	Zero-field run	Default	Big Partition	
54281	Physics		6.5M	Zero-field run	Default	Big Partition	
54373	Physics		4.8M	Timing scan	LVL1=114	Big Partition	
54374	Physics		4.3M	Timing scan	LVL1=112	Big Partition	
54377	Physics		4.7M	Timing scan	LVL1=113	Big Partition	
54379	Physics		3.2M	Timing scan	LVL1=115	Big Partition	
54405	Beam		40M	Timing scan	LVL1=116	GL1+standalone	
54406	Beam		39M	Timing scan	LVL1=115	GL1+standalone	
54409	Beam		38M	Timing scan	LVL1=114	GL1+standalone	
54410	Beam		37M	Timing scan	LVL1=113	GL1+standalone	
54413	Beam		38M	Timing scan	LVL1=112	GL1+standalone	
54453	Beam		26M	DAC0 scan	DAC0=35	GL1+standalone	
54455	Beam		25M	DAC0 scan	DAC0=40	GL1+standalone	
54456	Beam		25M	DAC0 scan	DAC0=45	GL1+standalone	
54458	Beam		24M	DAC0 scan	DAC0=30	GL1+standalone	
54459	Beam		25M	DAC0 scan	DAC0=25	GL1+standalone	
54460	Beam		25M	DAC0 scan	DAC0=20	GL1+standalone	
54462	Beam		25M	DAC0 scan	DAC0=15	GL1+standalone	
54465	Physics	x-ang=2.0mrad	0.9M	Beam X-ang scan	Default	Big Partition	
54466	Physics	x-ang=1.5mrad	1.0M	Beam X-ang scan	Default	Big Partition	
54467	Physics	x-ang=1.0mrad	1.5M	Beam X-ang scan	Default	Big Partition	
54468	Physics	x-ang=0.5mrad	1.6M	Beam X-ang scan	Default	Big Partition	
54469	Physics	x-ang=0.0mrad	2.8M	Beam X-ang scan	Default	Big Partition	No vtx cut
54470	Physics	x-ang=0.0mrad	3.0M	Beam X-ang scan	Default	Big Partition	With vtx cut
54679	Beam		16M	Bias scan	Bias=50V	GL1+standalone	
54681	Beam		12M	Bias scan	Bias=75V	GL1+standalone	
54685	Beam		16M	Bias scan	Bias=100V	GL1+standalone	
54686	Beam		15M	Bias scan	Bias=50V	GL1+standalone	
54687	Beam		14M	Bias scan	Bias=75V	GL1+standalone	
54688	Beam		14M	Bias scan	Bias=100V	GL1+standalone	
54692	Beam		30M	DAC scan	DAC: 8 12 16 20 24 28 32 36	GL1+standalone	
54694	Beam		26M	DAC scan	DAC: 28 32 36 40 44 48 52 56	GL1+standalone	
54695	Beam		26M	DAC scan	DAC: 48 52 56 60 64 68 72 76	GL1+standalone	
54696	Beam		24M	DAC scan	DAC: 68 72 76 80 84 88 92 96	GL1+standalone	
54698	Beam		25M	DAC scan	DAC: 88 92 96 100 104 108 112 116	GL1+standalone	
54699	Beam		24M	DAC scan	DAC: 108 112 116 120 124 128 132 136	GL1+standalone	
54670	Beam		23M	DAC scan	DAC: 128 132 136 140 144 148 152 156	GL1+standalone	
54678	Beam		23M	DAC scan	DAC: 148 152 156 160 164 168 172 176	GL1+standalone	

- INTT was basically in big-partition and kept taking Au+Au data with trigger mode.
- Some of the INTT data with special condition were taken in big partition.
  - Zero-field runs and beam x-angle scan runs
  - All subsystems are in, but MVTX data is suffering from the auto recovery issue.
- Joseph, Mai, Manami, Takahiro, Tomoya and Yuko worked to take data in big-partition and standalone and keep the log
  - Timing scan, DAC0 scan, Bias scan and DAC scan

INTT performance plot

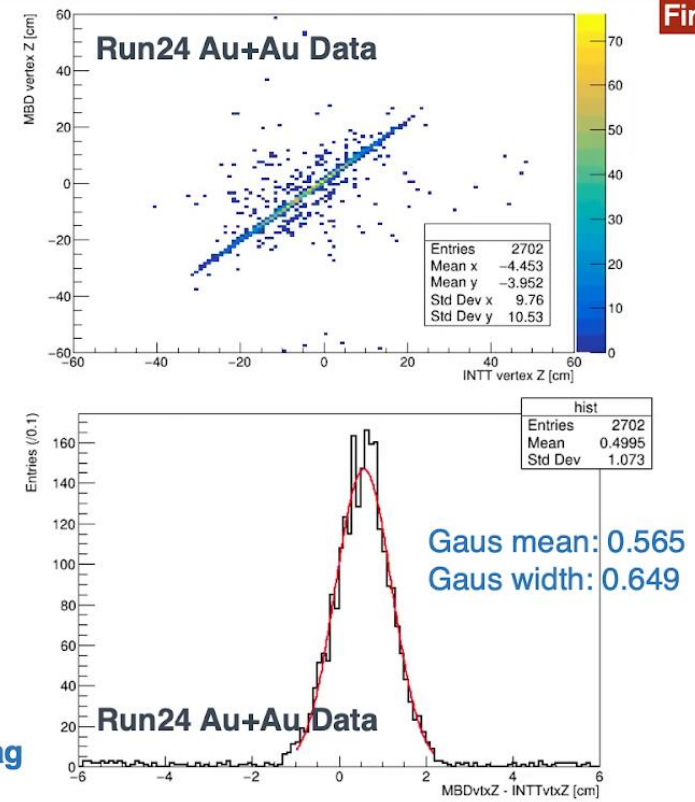
Vertex Z correlation b/w INTT and MBD

- Run: 54280 (In zero field)
- Analysis build: ana.439
- Production tag: 2024p007

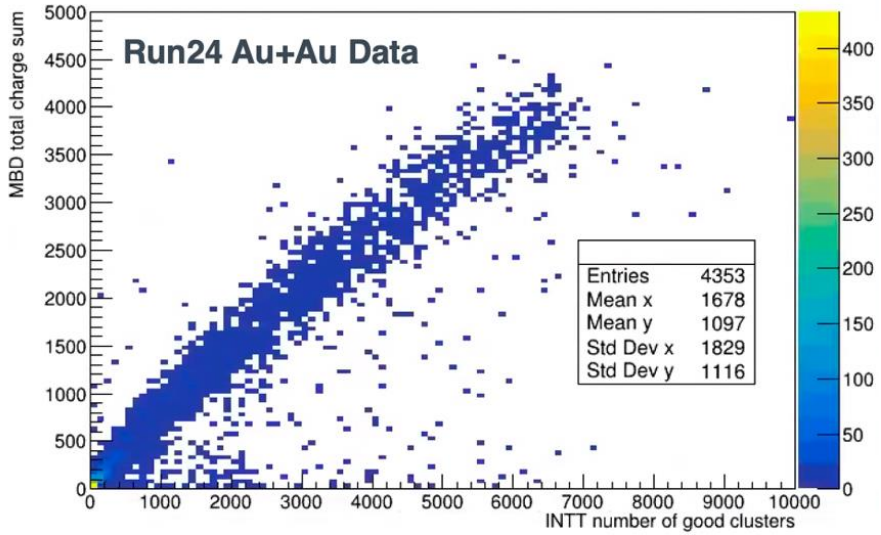
- Event selection
  - eID > 1000 (first 1k no MBD vtxZ)
  - MBDNS_vtx30cm_Trig == 1
  - MBD_total_charge_sum > 0
  - INTTNClus_Good > 500
  - MBDvtxZ != nan
  - INTTvtxZ != nan

The vertex Z difference becomes smaller (0.565 cm) with this product tag

*Good cluster: cluster size < 6 && cluster adc > 35

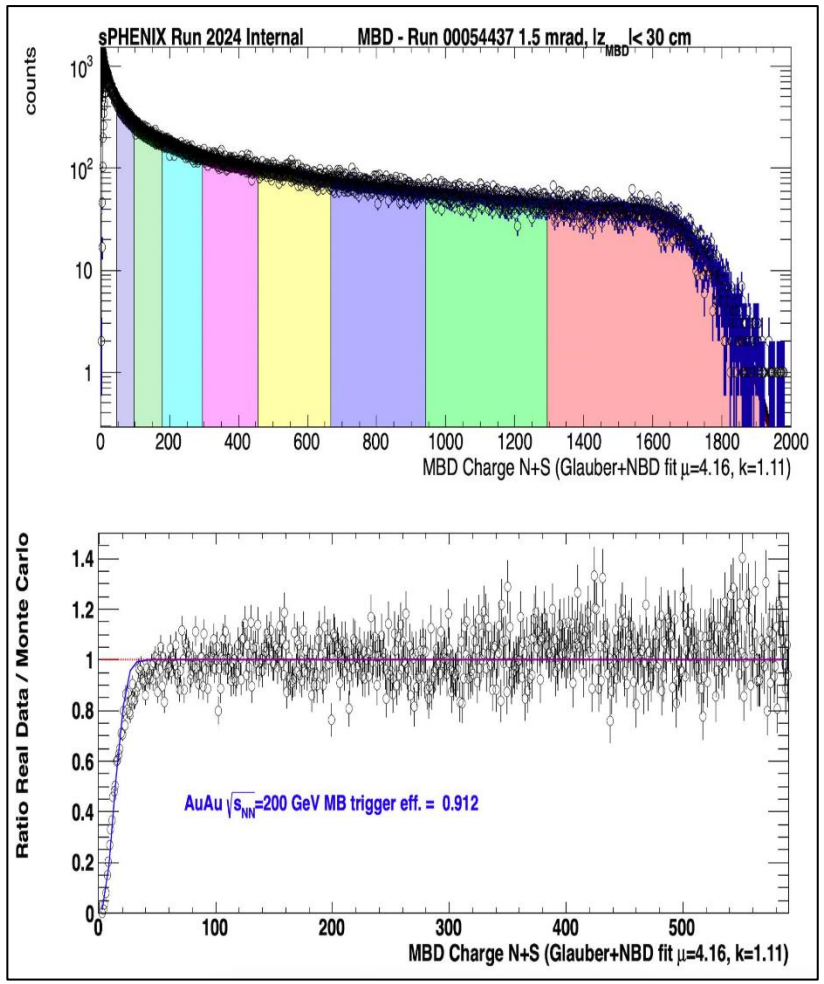


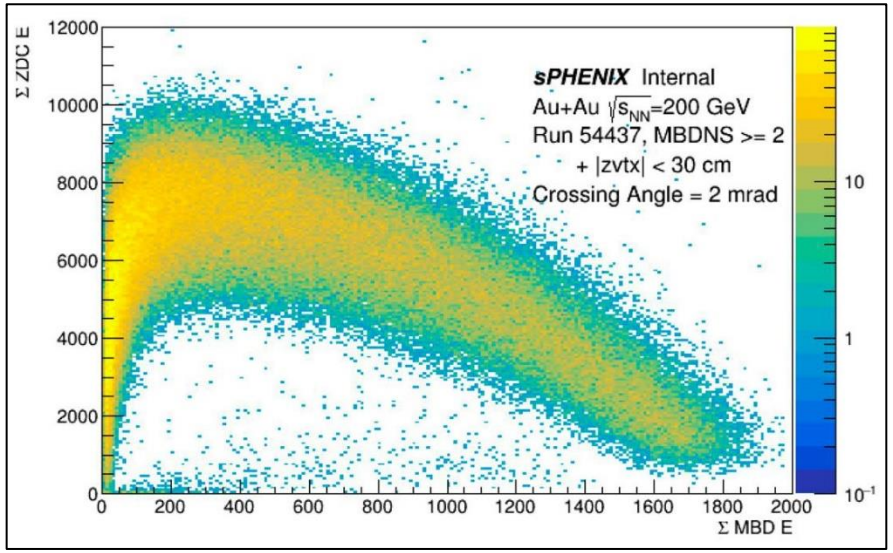
First 10k events

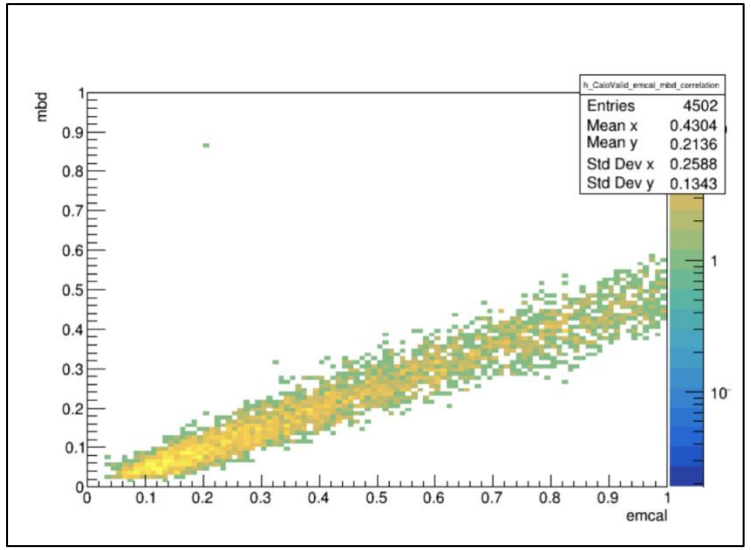


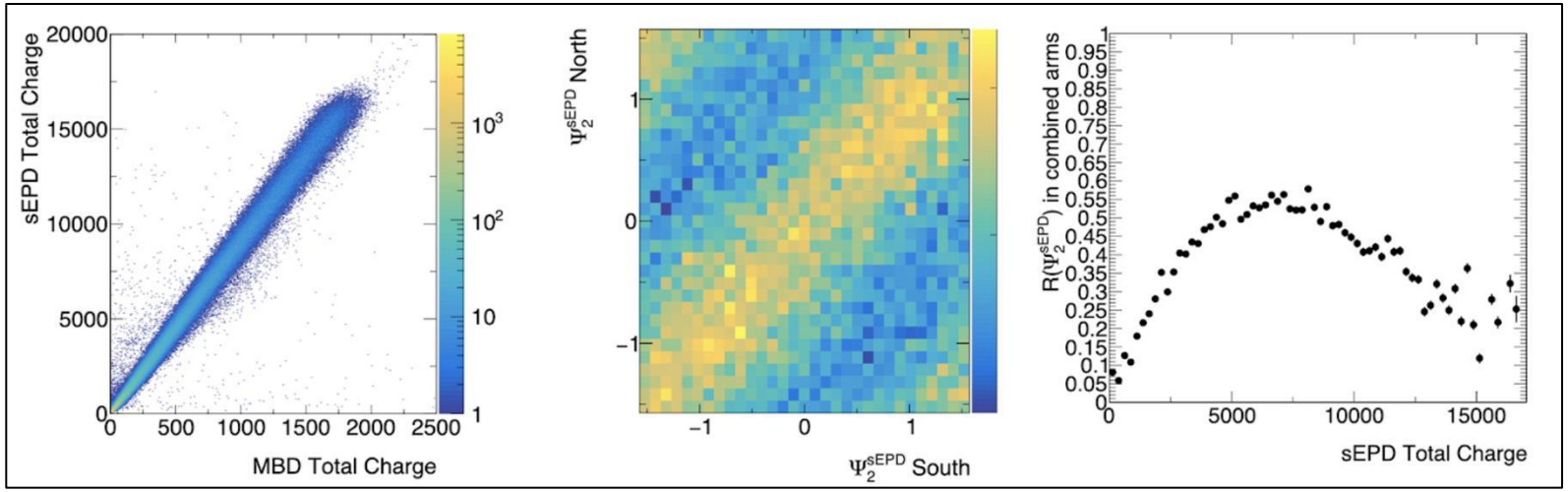
Cheng-Wei and Mahiro work independently for the INTT performance plot

Other subsystems

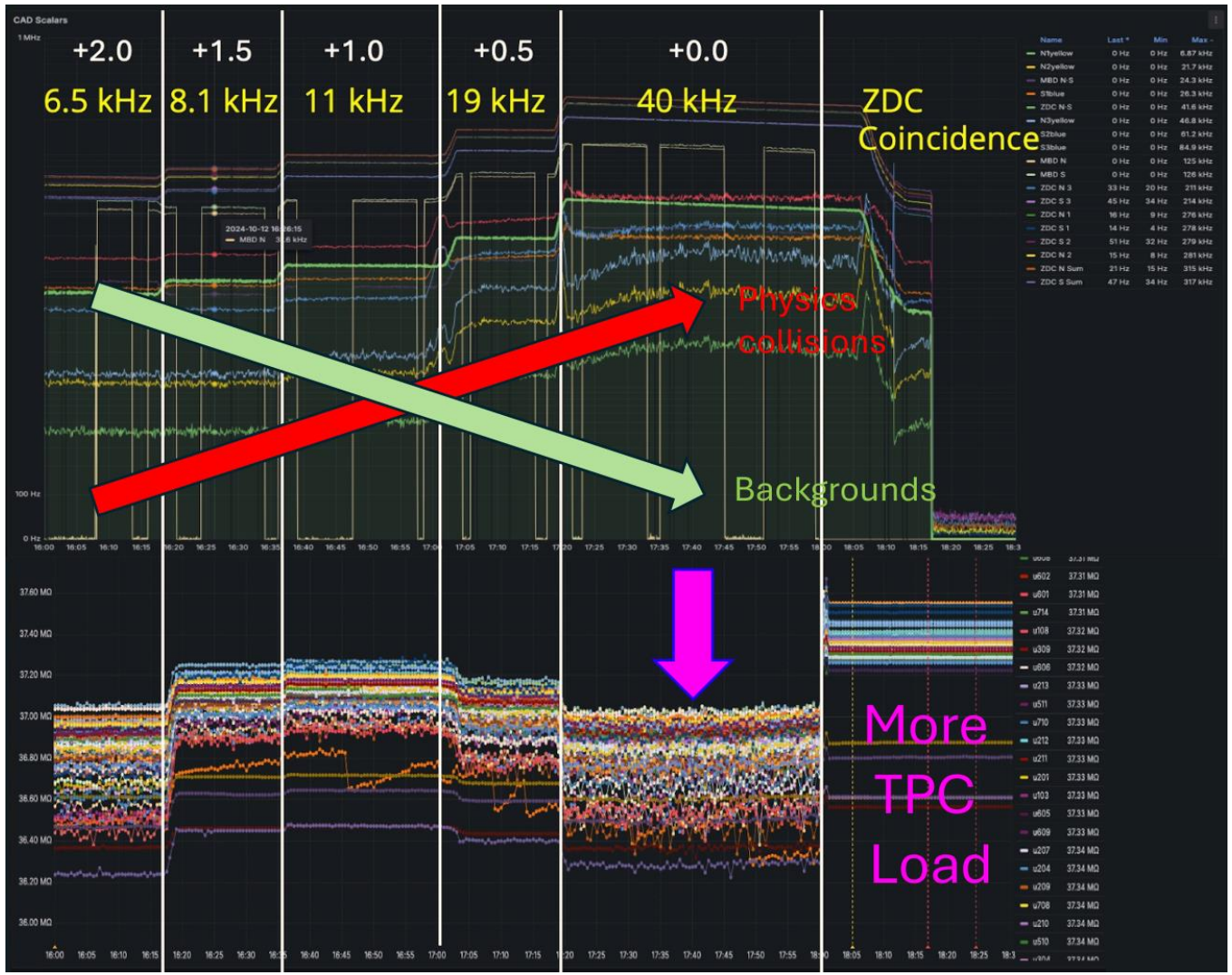






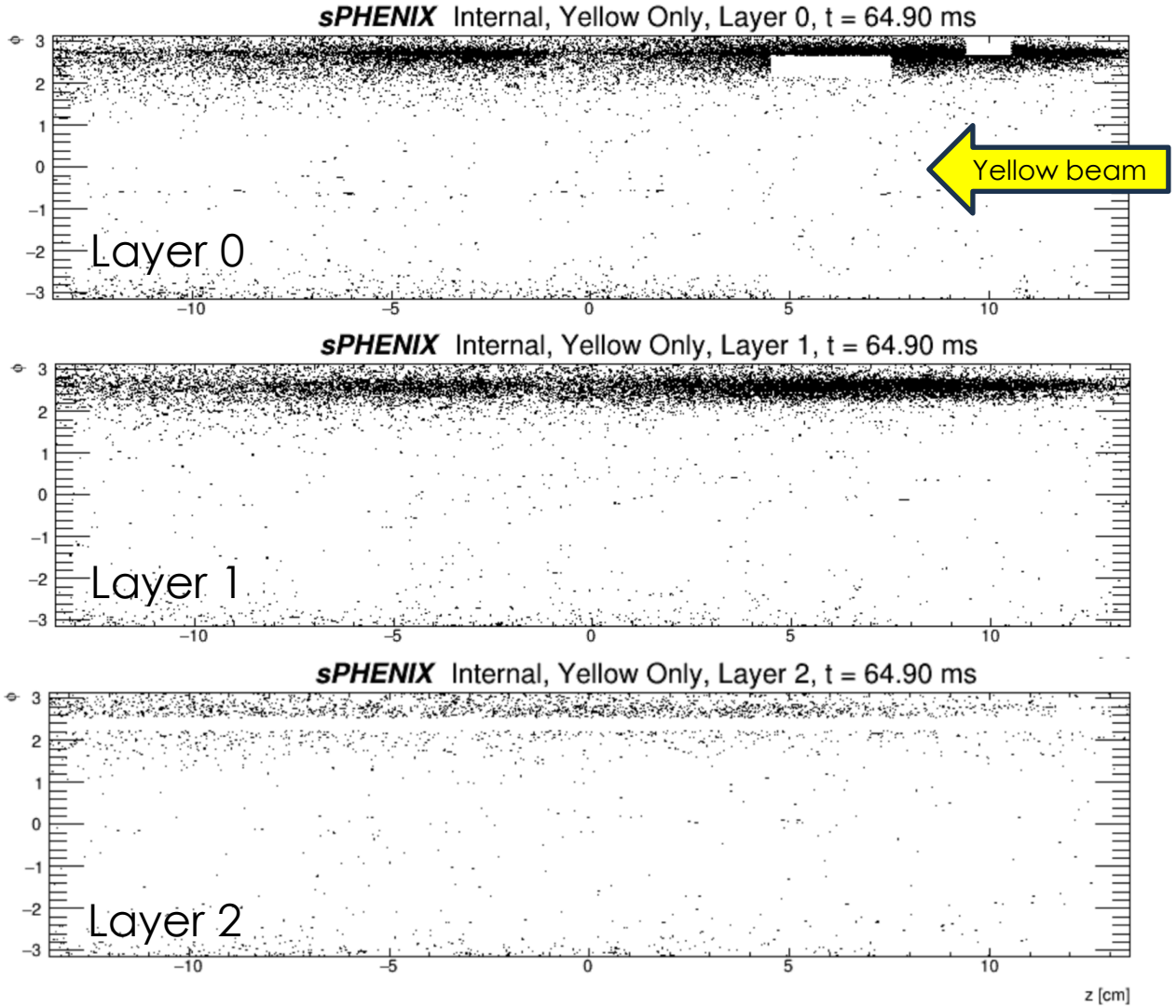


TPC status



- Tom and Charles were working on site
- TPC load test showed some optimal beam crossing angle.
  - Survived at ZDC coincidence = 40kHz
  - The beam crossing angle changed from 2-mrad to 1-mrad based on the load test.
- Data acquisition rate is 4-5kHz now (limited by the bandwidth to bbox) but basically TPC is working for a high rate of Au+Au collisions
  - Bbox is doubled for next year

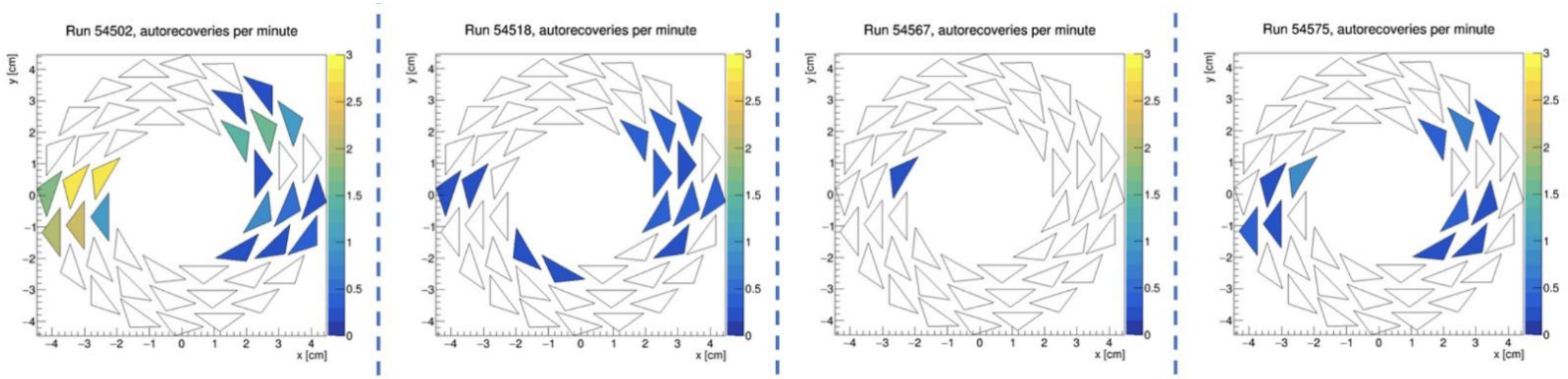
MVTX background and auto-recovery



- No problem in p+p but lots of beam background splash even with one bunch single beam…
- Ends up with persistent auto-recovery mode.
  - Auto-recovery takes 10 sec.

On-site work by Cameron and remote analysis by Hao-Ren

Work with C-AD

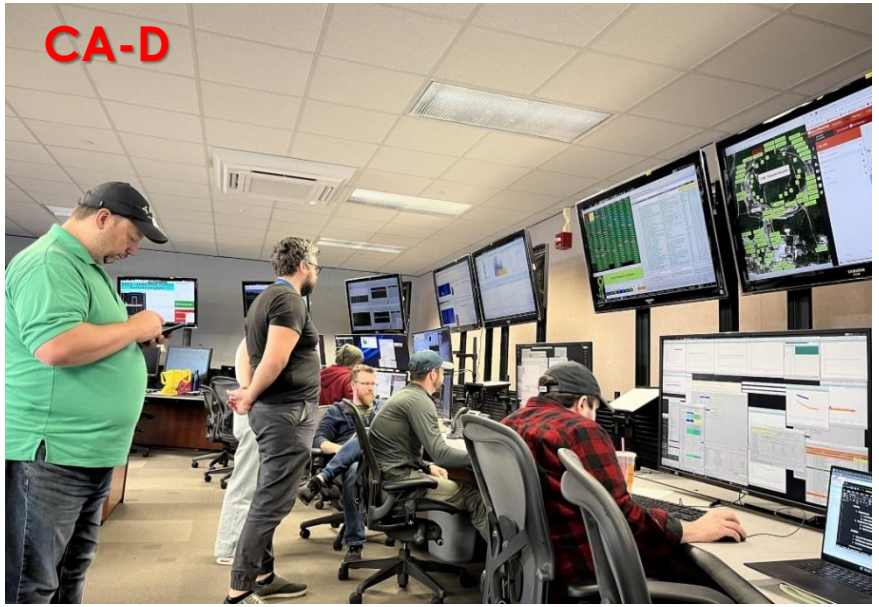


Baseline configuration
1x1 bunches
2 mrad crossing
0mm global radial change
No bump

Yellow optimization
1 bunch
1 mrad crossing
-0.5mm global radial change
-8mm bump in 8 o'clock arc

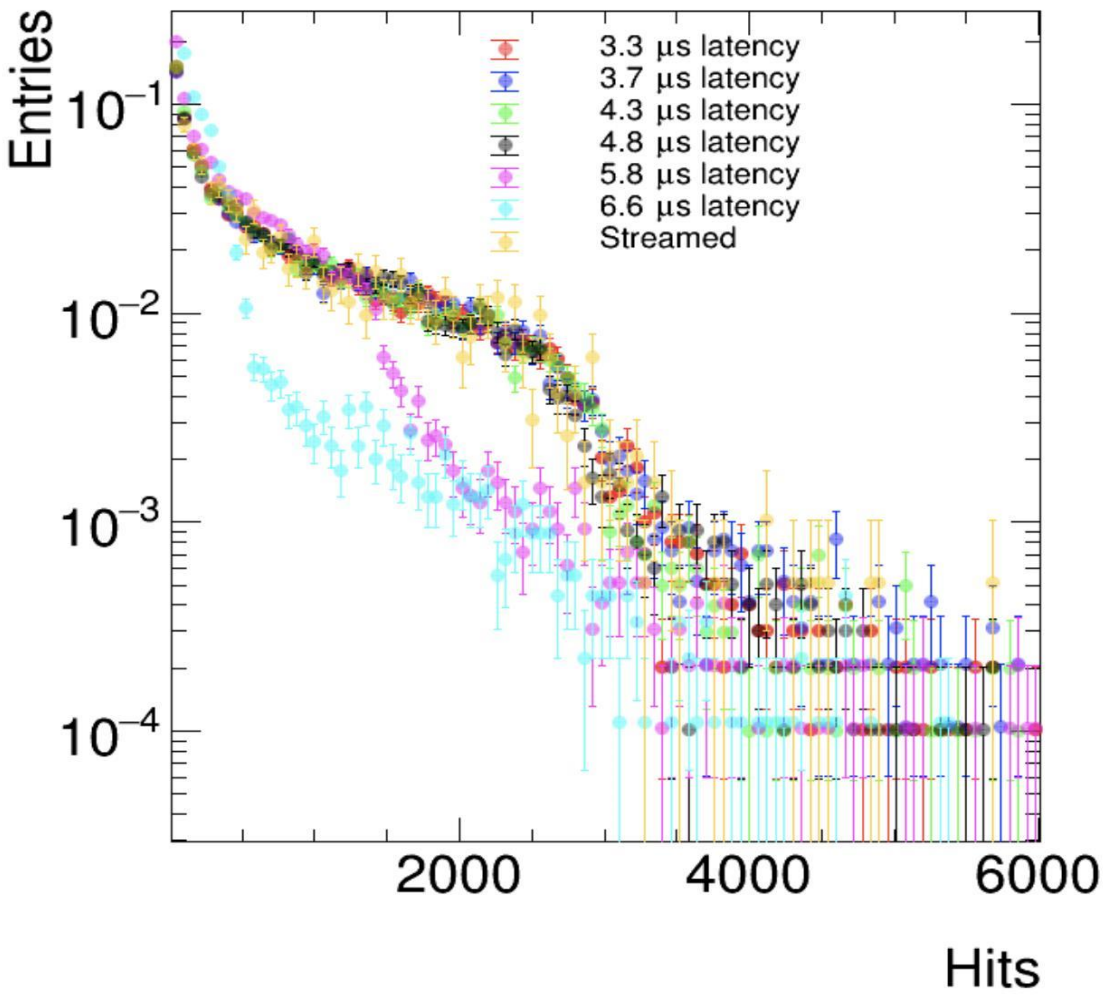
Blue optimization
1 bunch
1 mrad crossing
-0.41mm global radial change
No bump

Final optimization
1x1 bunches
1 mrad crossing
-0.39mm global radial change
Yellow -8mm bump in 8 o'clock arc

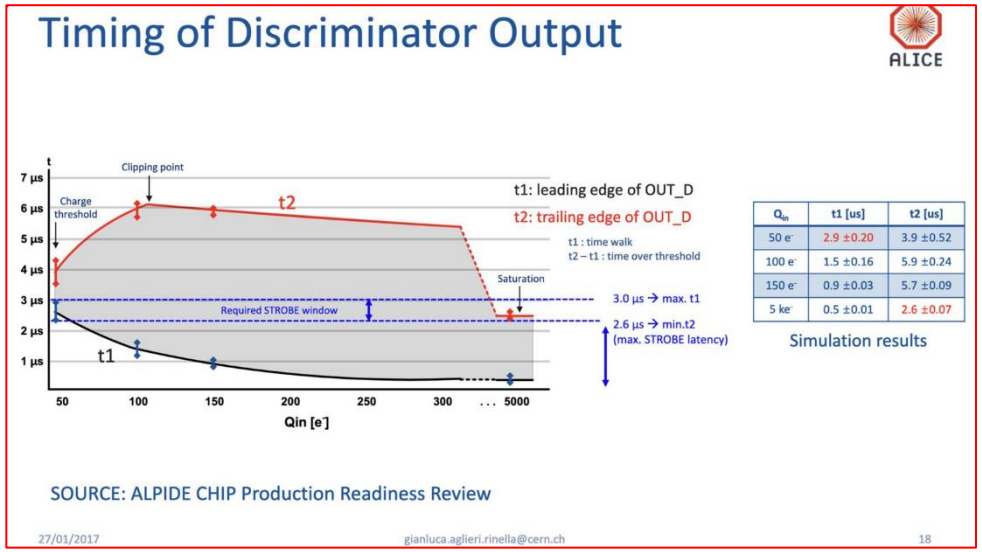


- MVTX group is coordinating with C-AD team to adjust beam condition to find a better beam optics to have less background to MVTX
  - Day time of Au+Au commissioning was decided to this study

MVTX in trigger mode



Jamie Nagle (PAC Meeting)



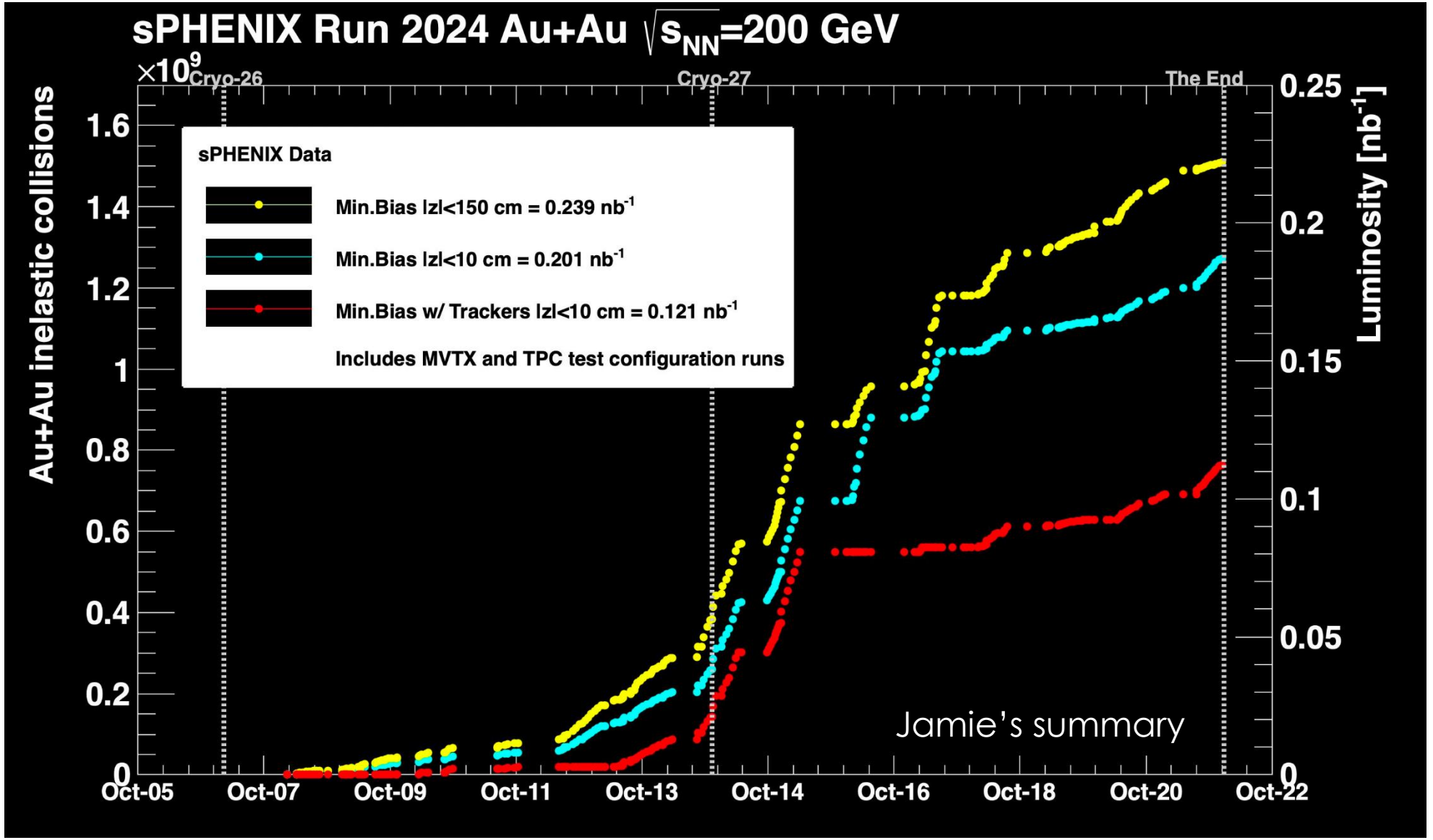
Q_{in}	t1 [us]	t2 [us]
50 e⁻	2.9 ±0.20	3.9 ±0.52
100 e⁻	1.5 ±0.16	5.9 ±0.24
150 e⁻	0.9 ±0.03	5.7 ±0.09
5 ke⁻	0.5 ±0.01	2.6 ±0.07

ALICE ALPIDE supports triggered mode with 2.5 microsecond latency. Reduces AR by x10-20.

sPHENIX default is 3.7 ms.
Latency scan yielded encouraging results,
But full analysis needed to understand efficiency for low p_T kaons and protons

Confident that next year running in triggered mode and with C-AD improvements,
MVTX will be fully functional.

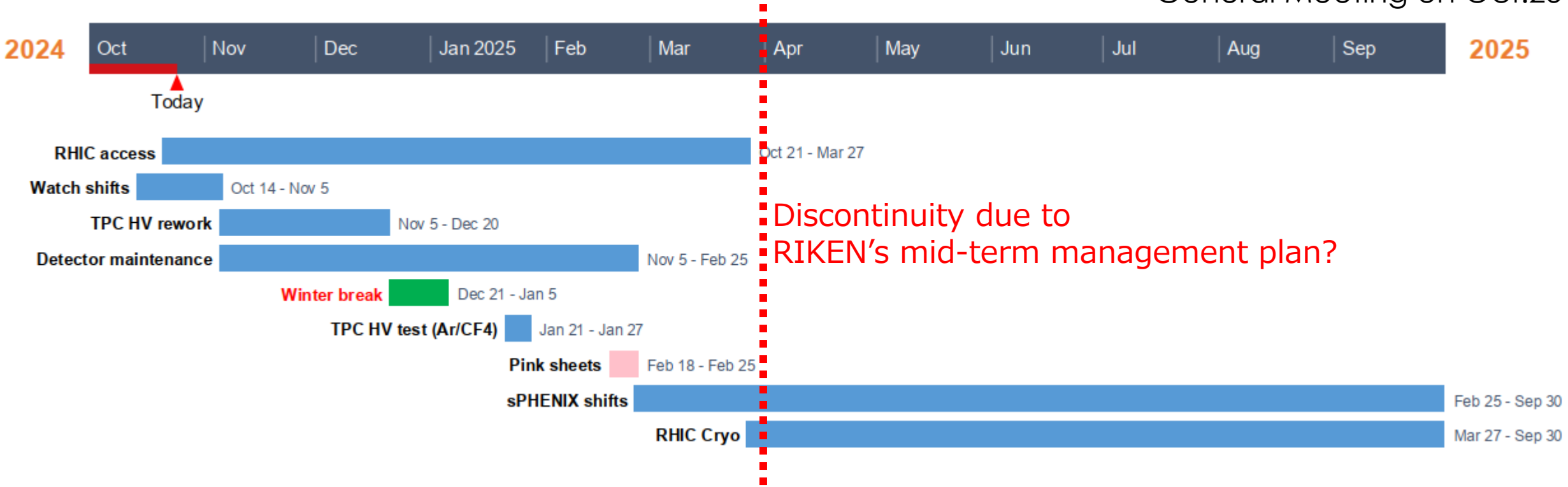
Run24 Au+Au commissioning



End of Run24 Au+Au party (Oct. 21)

FY2025 Shutdown

John's slides from sPHENIX General Meeting on Oct.25



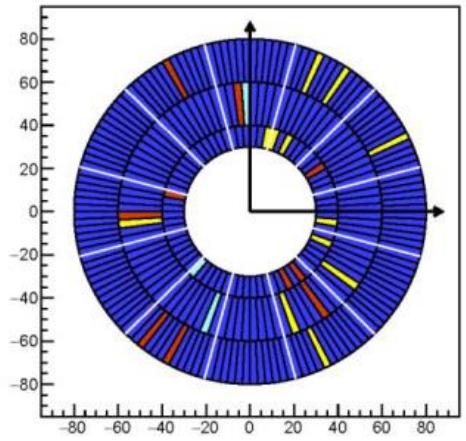
- We will not remove X-wing and MVTX to realign the beam pipe which will take 5 months
- We will remove INTT ROCs to replace the dead/unstable TPC FEEs and to tackle noise issue
  - Probably we don't need to be at BNL during ROC removal (Rachid and techs can do as they did for Run24 commissioning) but we must be at BNL when ROCs are re-installed and check their connectivity and data, and make a correct mapping…
- Need to return to Japan before Mar 31, then quickly travel back to BNL again? Another solution?

TPC FEE reinstallation?

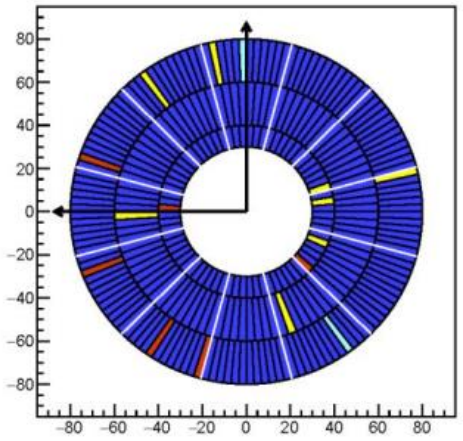
Transceiver/FEE replacement

- Yellow: Transceivers are dead, Red: FEEs are dead, Cyan: Unstable FEEs.
- Plan is to work on Yellow first, and then Red and Cyan.

Facing TPC North



Facing TPC South

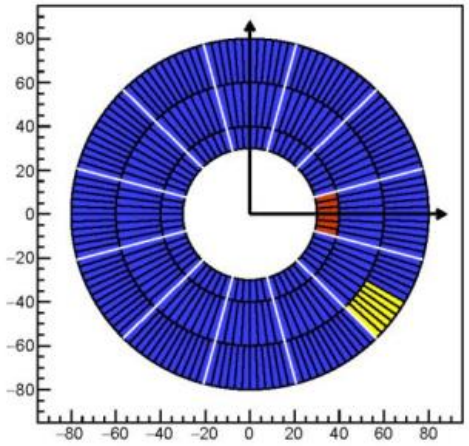


Transceiver (pluggable)

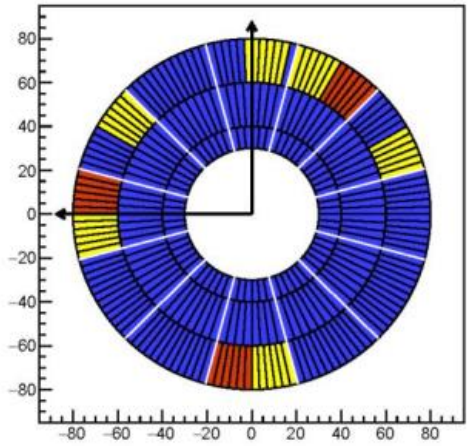
Noisy electronics (grounding issue?)

- Yellow: Moderately noisy (still can live). Red: Very noisy (should be fixed)
- Unfortunately, mostly south.

Facing TPC North



Facing TPC South



- Will start replacing optical transceivers in north once the bore became accessible.
  - Thu/Fri next week?
  - Then south...

- Replacing FEEs will happen later. Hopefully with FEEs from new production.
  - PCB production of the new FEEs started yesterday (Palpilot).
  - Partial turn-key assembly contract is being sourced to the vendor (EdmondMarks).
    - We will likely get assembled boards in early to mid December.
  - Burn-in and cooling pad/plate attaching need to be done for the new FEEs
  - Then south...

Takao and Jim's slides from sPHENIX Planning Meeting on Oct.31

Schedules

- PAC meeting on November 7-8th
  - Akiba-san's report for the detail
- INTT analysis workshop at Korea University on November 18th - 29th
- Collaboration meeting on December 12th - 13th at BNL
- Re-installation of INTT-ROCs sometime in Jan-Feb if sPHENIX decide to remove them for the TPC FEE work (Hope NOT!!!)
- Run25 is starting at the end of March 2025