

RUN 11 RHIC MACHINE/EXPERIMENTS MEETING

7 Jun 2011

Agenda:

- $\sqrt{s} = 200$ GeV AuAu progress
- 27 GeV Run (or other)

**Run 11 Plan based on PAC recommendation/ALD Guidance and available funds
6/7/10 update**

- 3 Jan, Begin cool-down to 4.5K
- 8 Jan, Cool-down to 4.5K complete in both rings, preliminary setup begins
- 24 Jan, 1 week Ramp-up with 8 hr/night beam to experiments
- **11 Feb (machine and ~experiments), begin ~10 week physics run ($\sqrt{s} = 500$ GeV pp)**
- 7 Mar, cryo troubles, extended maintenance, 0900 hrs till 2000 hrs 14 Mar – lost 7.5 days
- 17 Mar, power distribution problem, extended maintenance, 1930 hrs till 0315 hrs 20 Mar – lost 2.3 days
- **18 Apr, end 9.4 week physics run at $\sqrt{s} = 500$ GeV**
- 18 Apr jet target polarization measurement at injection (<5%)
- 19 Apr, short maintenance followed by setup for $\sqrt{s} = 18$ GeV AuAu
- **23 Apr, begin ~1 week physics run ($\sqrt{s} = 19.6$ AuAu)**
- **2 May 08:00, end 1.3 week physics run at $\sqrt{s} = 19.6$ GeV**
- 2 May, begin setup for $\sqrt{s} = 200$ AuAu
- 5 May, begin 2 day Ramp-up with 8 hr/night beam to experiments
- **6 May 11:37, begin ~8 week physics run at ($\sqrt{s} = 200$ GeV/n AuAu)**
- **7 Jun- TODAY**
- **29 June, end 7.7 wk AuAu physics run at $\sqrt{s} = 200$ GeV/n , begin warm-up**
- **30 June, cryo warm-up ~ complete, end 25.4 weeks cryo operation**

What's missing :

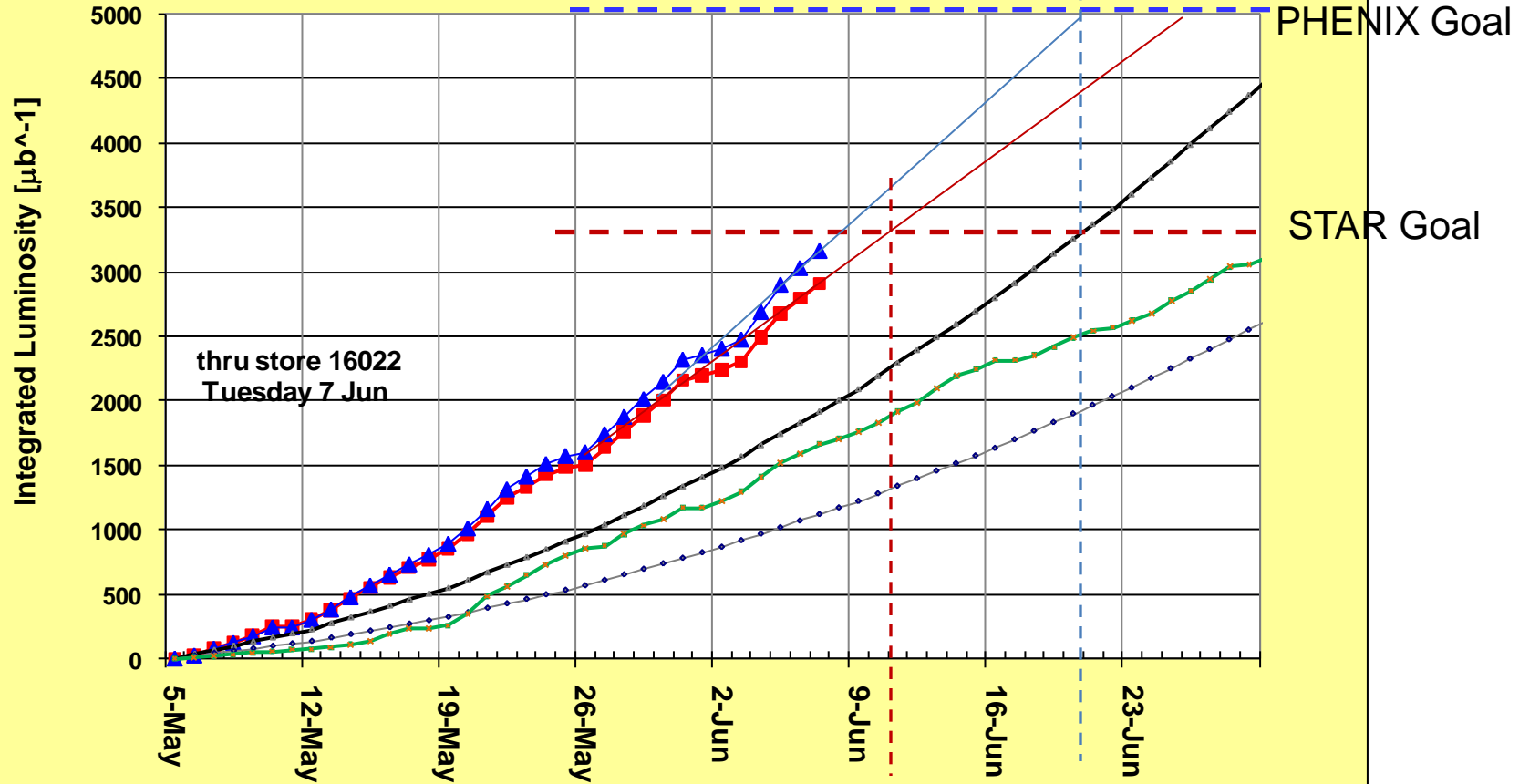
~~Run into July?~~

- 27 GeV AuAu; Uranium test/physics run
- Low energy test run

PREP TIME REQ'D, NEED DECISION SOON!

Run11 RHIC AuAu Integrated Luminosity for Physics ($v_s = 200 \text{ GeV/n}$)

■ STAR ▲ PHENIX — Lmax ● Lmin — PHENIX Run10



Run 11 100 x 100 GeV/n Au-Au (Phenix)

thru fill 16016

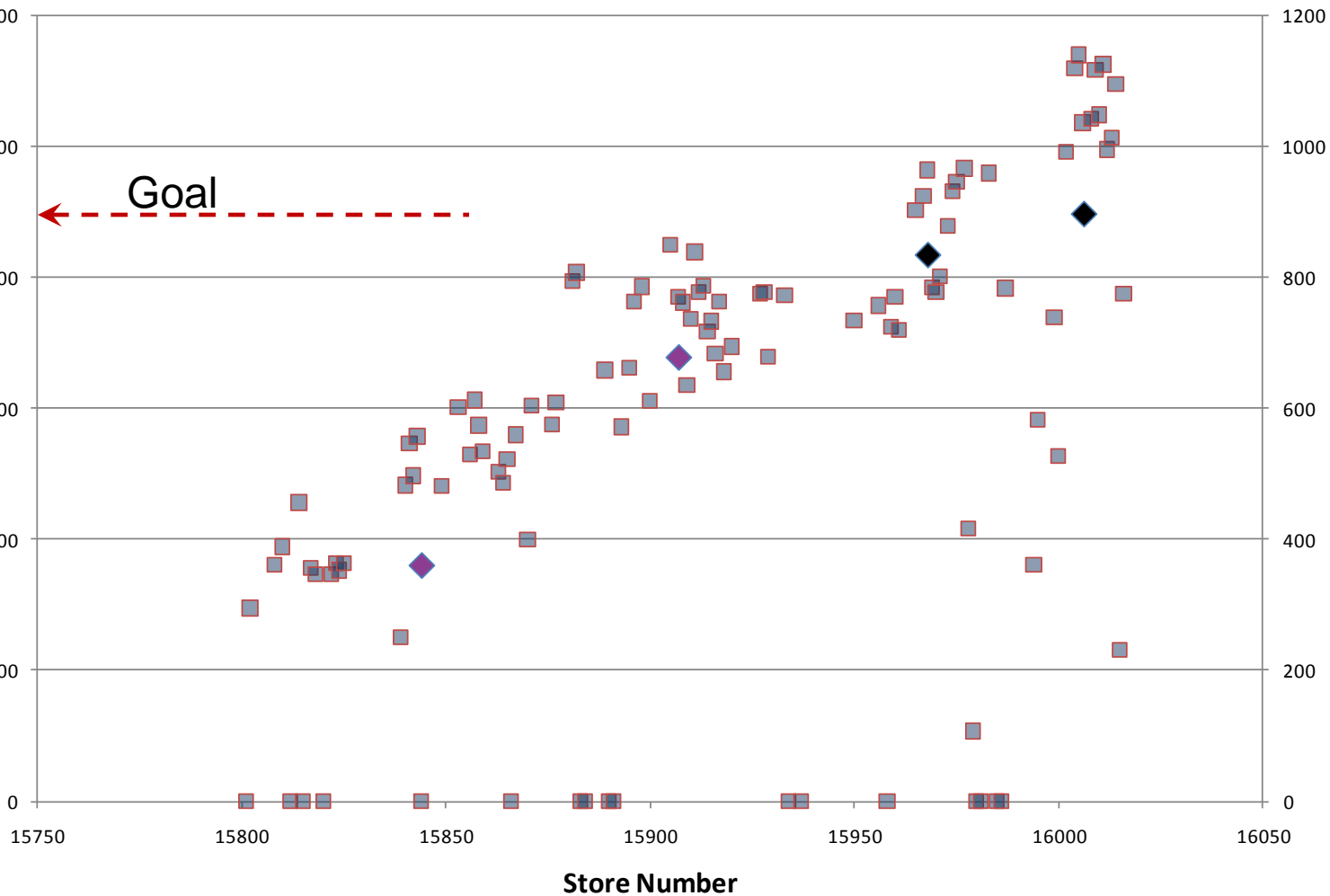
■ 60% time at store Integrated lumi

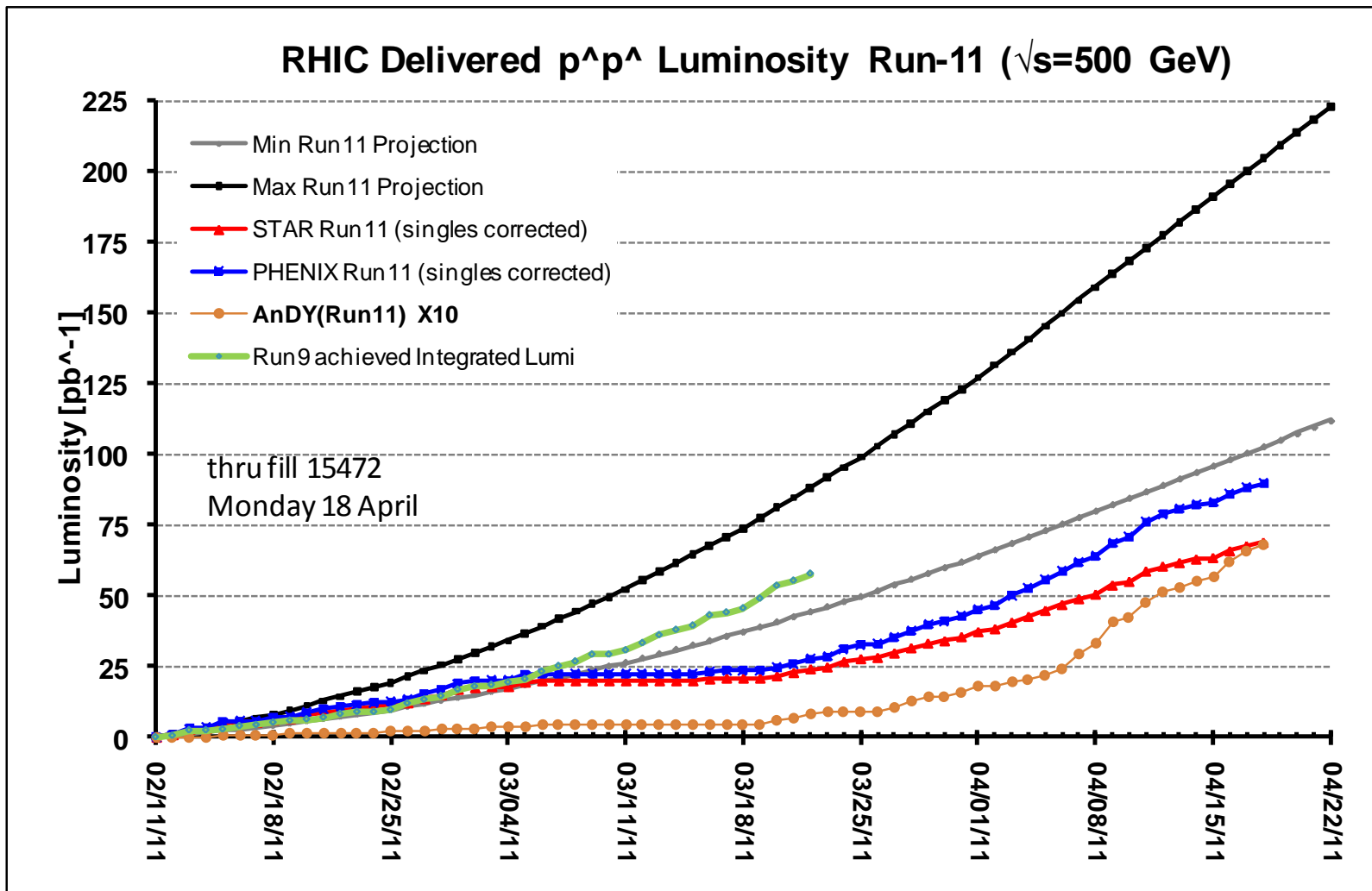
◆ Delivered Integrated Lumi/week (Physics)

lumi/week for >3 hr stores and 60% time at store (μb^{-1})

Delivered lumi/week (μb^{-1})

Goal

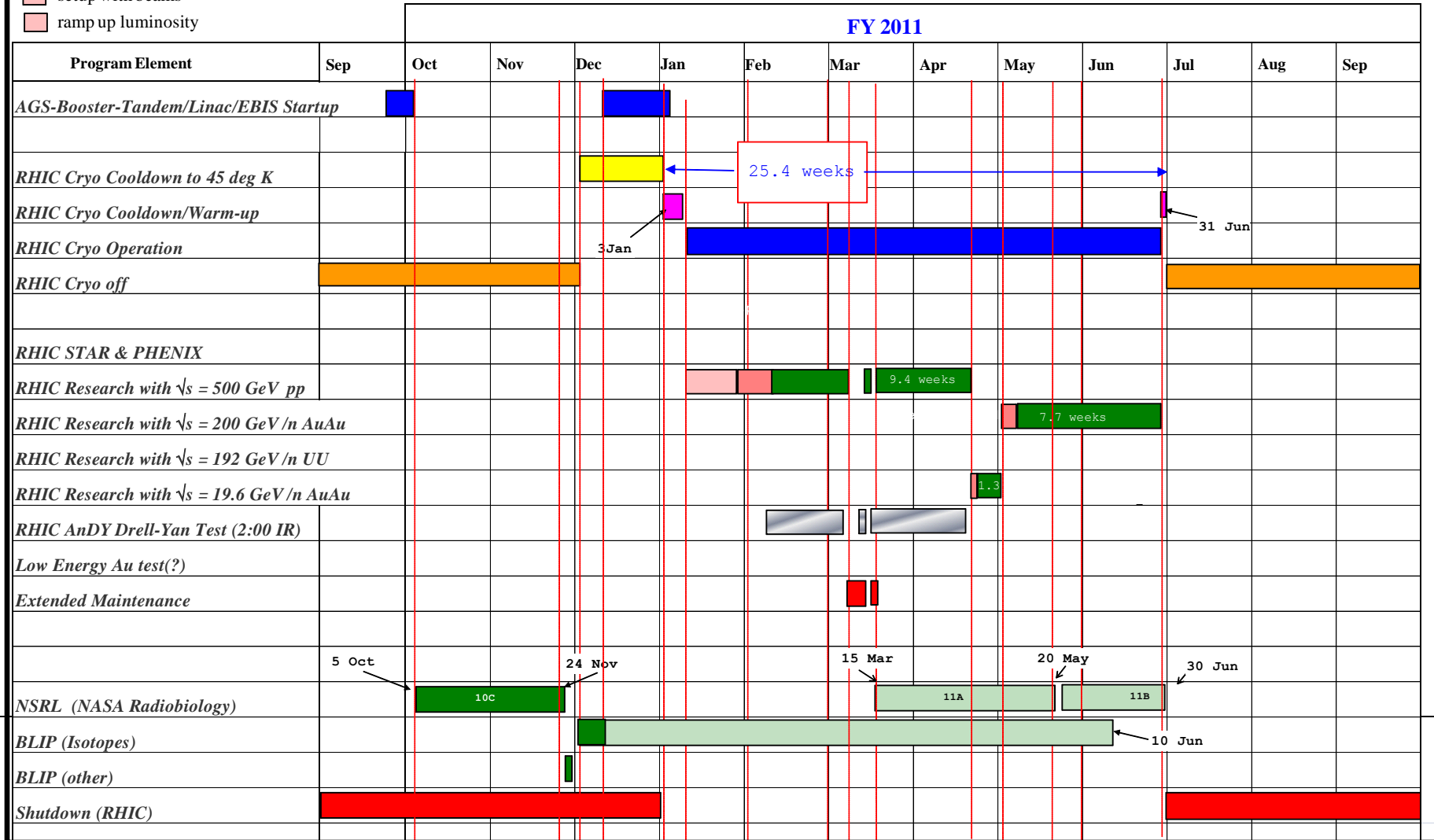




C-A Operations-FY11

as run/planned

- concurrent with RHIC
- setup with beams
- ramp up luminosity



Old information

$\sqrt{s} = 200 \text{ GeV/n AuAu}$ luminosity goals (24 May efficiencies)

STAR

2000 μb^{-1} sampled / 60% = 3300 μb^{-1} delivered

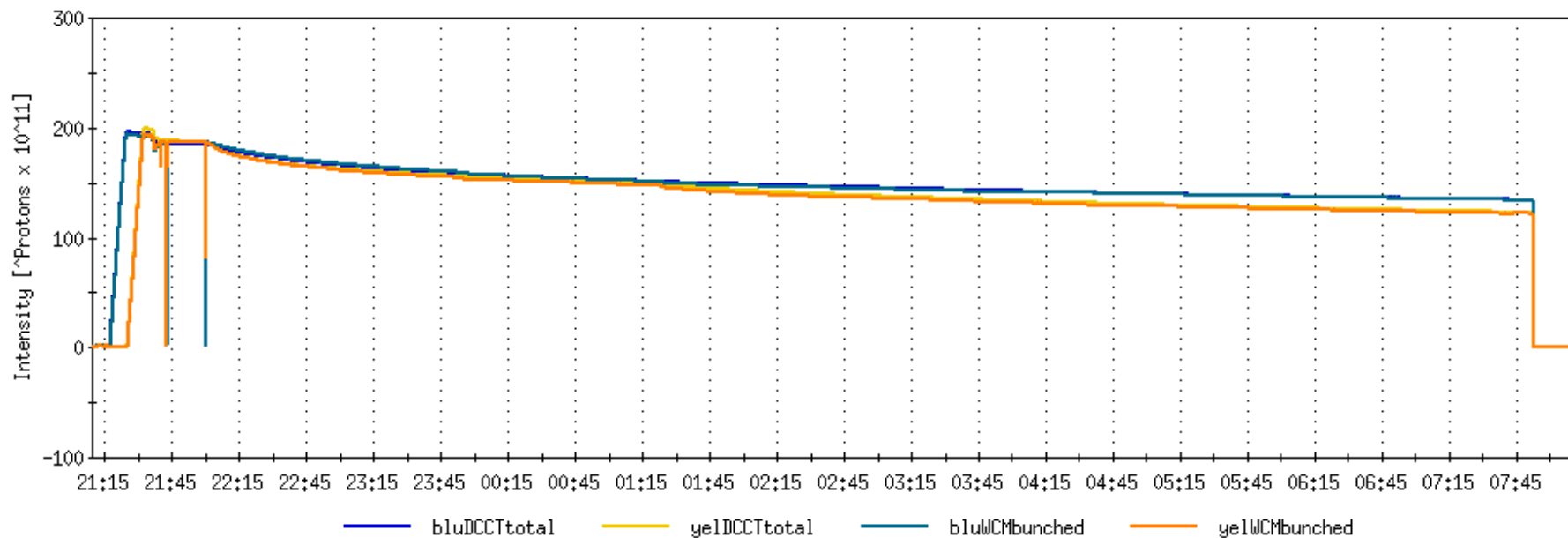
PHENIX

700 μb^{-1} sampled / 14% = 5000 μb^{-1} delivered

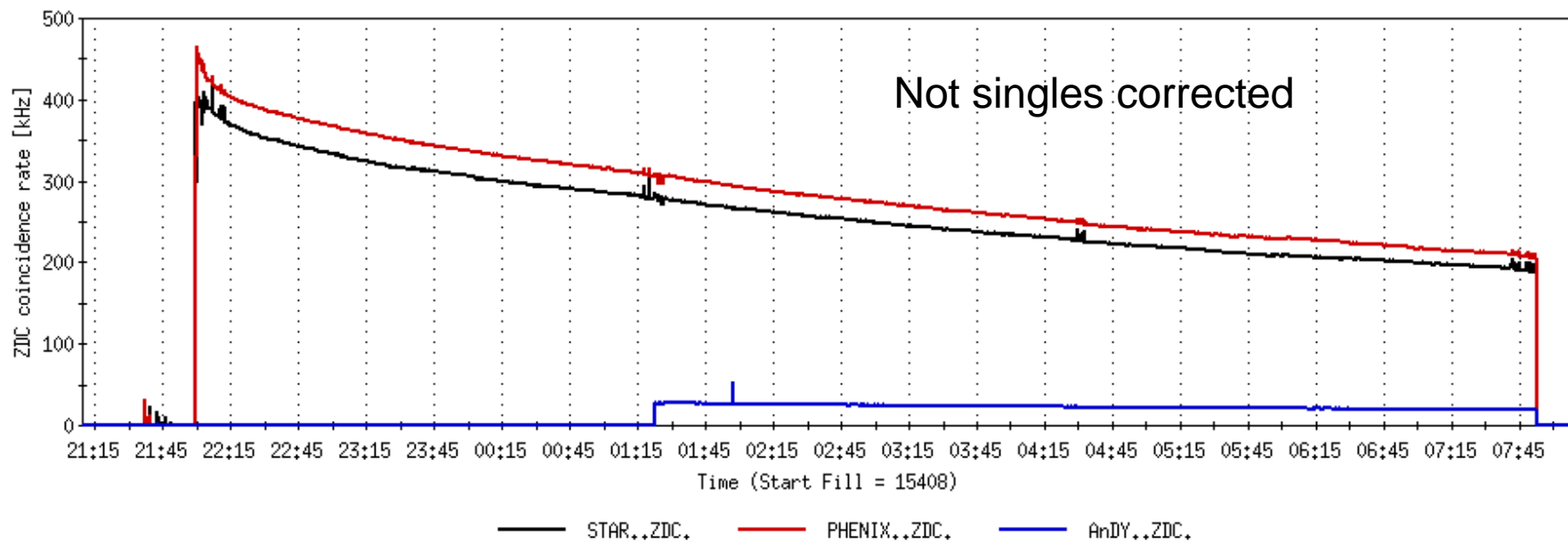
Estimate from PHENIX Beam Use Proposal – 15.8%

- Live Time = 97%
- Uptime = 65%
- +/- 10 cm vertex = 25%

9.7 hour store comparing AnDY Lumi to STAR and PHENIX



Experimental Coincidence Signals



9.7 hour store comparing AnDY Lumi to STAR and PHENIX

β^* 's
 PHENIX ~ 0.7 m
 STAR ~ 0.8 m
 AnDY ~ 3 m

Not singles corrected

Lumi

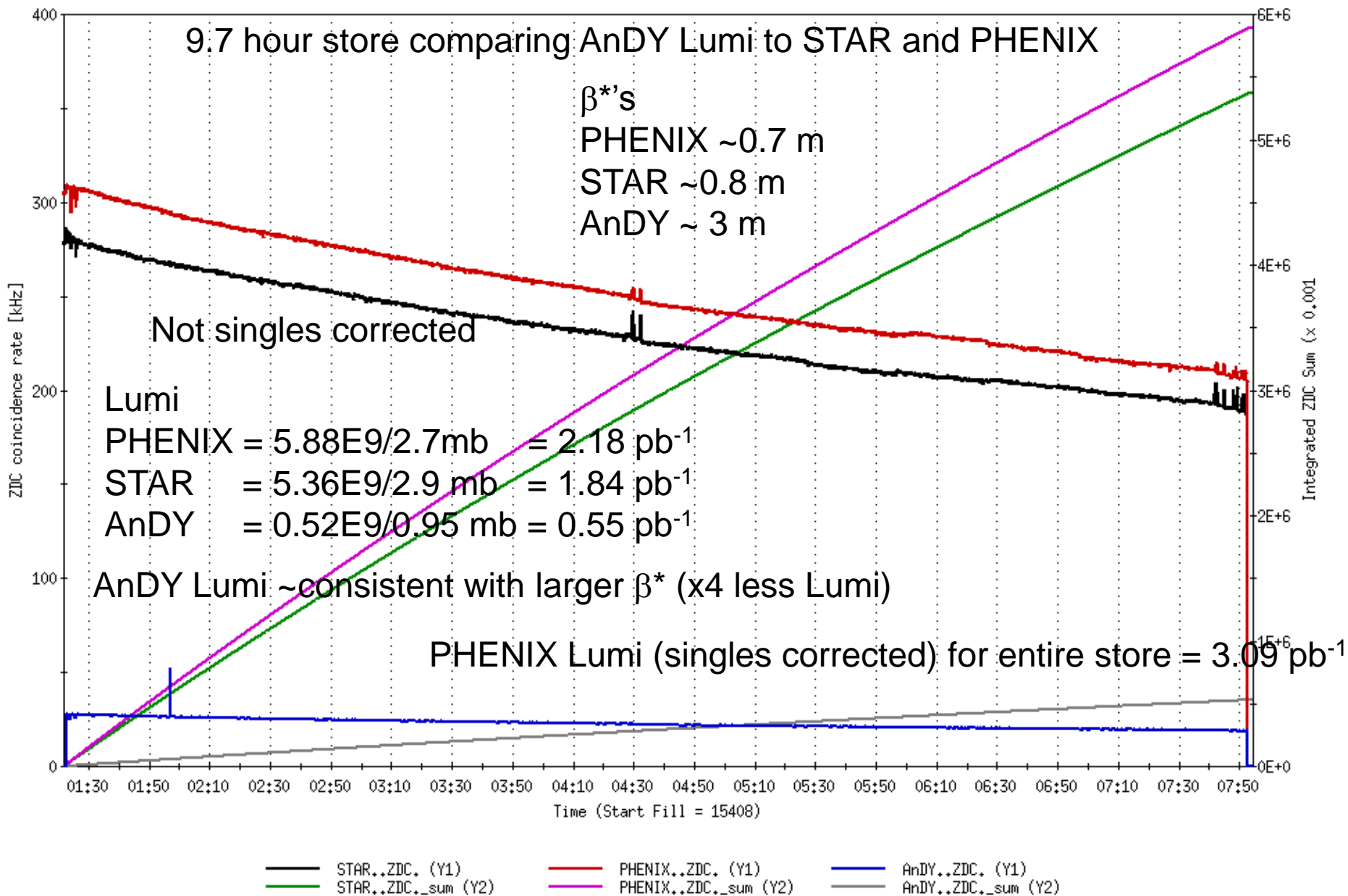
PHENIX = $5.88E9/2.7\text{mb} = 2.18 \text{ pb}^{-1}$

STAR = $5.36E9/2.9 \text{ mb} = 1.84 \text{ pb}^{-1}$

AnDY = $0.52E9/0.95 \text{ mb} = 0.55 \text{ pb}^{-1}$

AnDY Lumi \sim consistent with larger β^* (x4 less Lumi)

PHENIX Lumi (singles corrected) for entire store = 3.09 pb^{-1}



— STAR..ZDC. (Y1) — PHENIX..ZDC. (Y1) — AnDY..ZDC. (Y1)
— STAR..ZDC._sum (Y2) — PHENIX..ZDC._sum (Y2) — AnDY..ZDC._sum (Y2)

Time = Thu Apr 7 07:53:47 2011(+3ms), PHENIX.ZDC._sum = 5.88466e+06
 Time = Thu Apr 7 07:53:47 2011(+7ms), STAR.ZDC._sum = 5.36565e+06
 Time = Thu Apr 7 07:51:30 2011(+70ms), AnDY.ZDC._sum = 526993

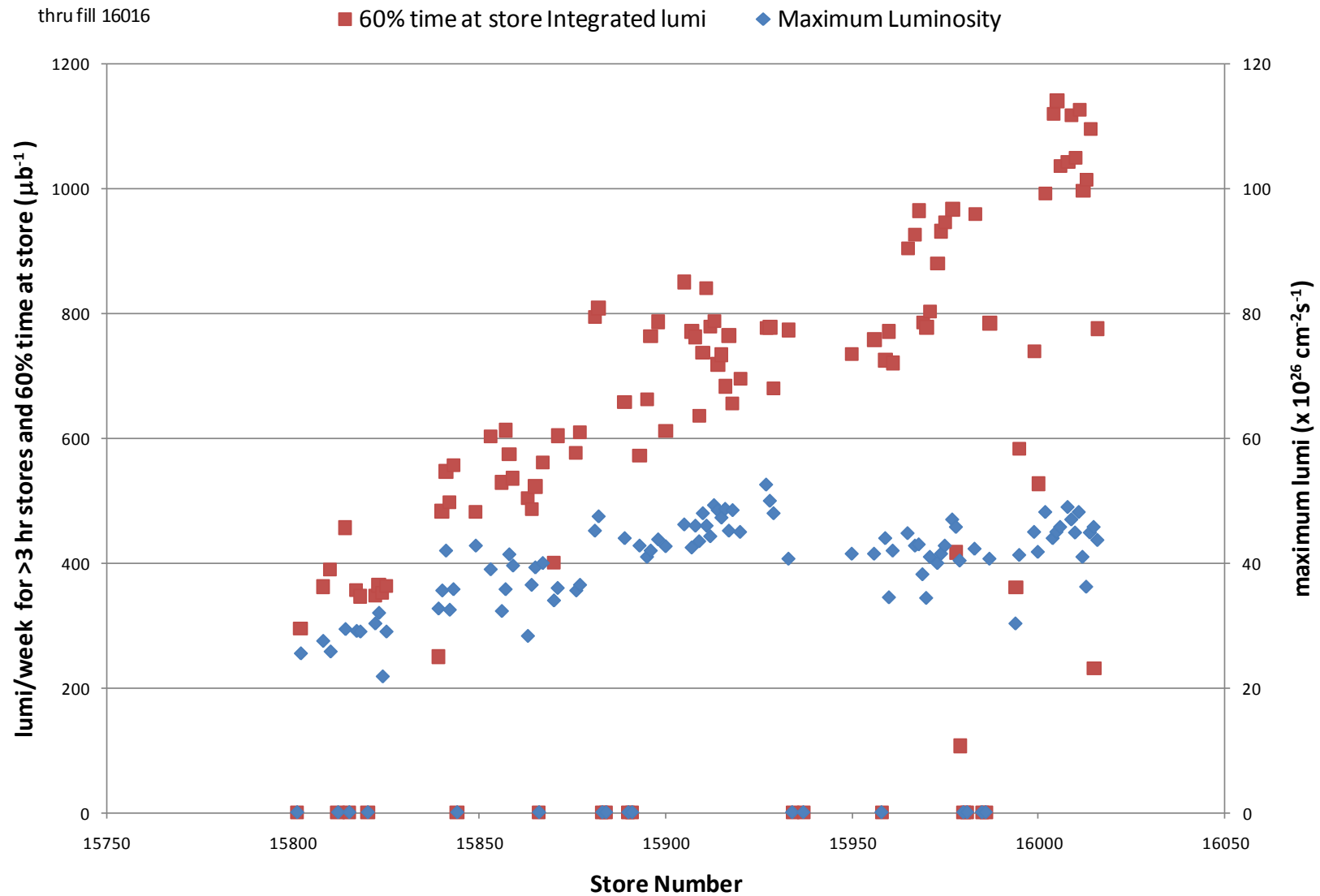
Store 15408 – AnDY projection

- 2:00 $\beta^* = 3$ meters
 - AnDY fraction of store 15408 = $0.55/3.09 = 18\%$
- With 2:00 $\beta^* = 1.5$ meters
 - AnDY fraction of store 15408 would have been $2 \times 18\% = 36\%$
 - using Fischer et.al. 11 May 2010 [Table 7](#) lumi projections for Run12

| <u>Physics Weeks</u> | <u>Max Lumi</u> | <u>Min Lumi</u> | <u>AnDY Est (1.5 m β^*)</u> |
|----------------------|----------------------|----------------------|--|
| 8 | 276 pb ⁻¹ | 98 pb ⁻¹ | 35-99 pb ⁻¹ |
| 10 | 388 pb ⁻¹ | 134 pb ⁻¹ | 48-140 pb ⁻¹ |
| 12 | 500 pb ⁻¹ | 170 pb ⁻¹ | 61-180 pb ⁻¹ |

→ 100 pb⁻¹ is not an unreasonable expectation for a 10-12 week run

Run 11 100 x 100 GeV/n Au-Au (Phenix)

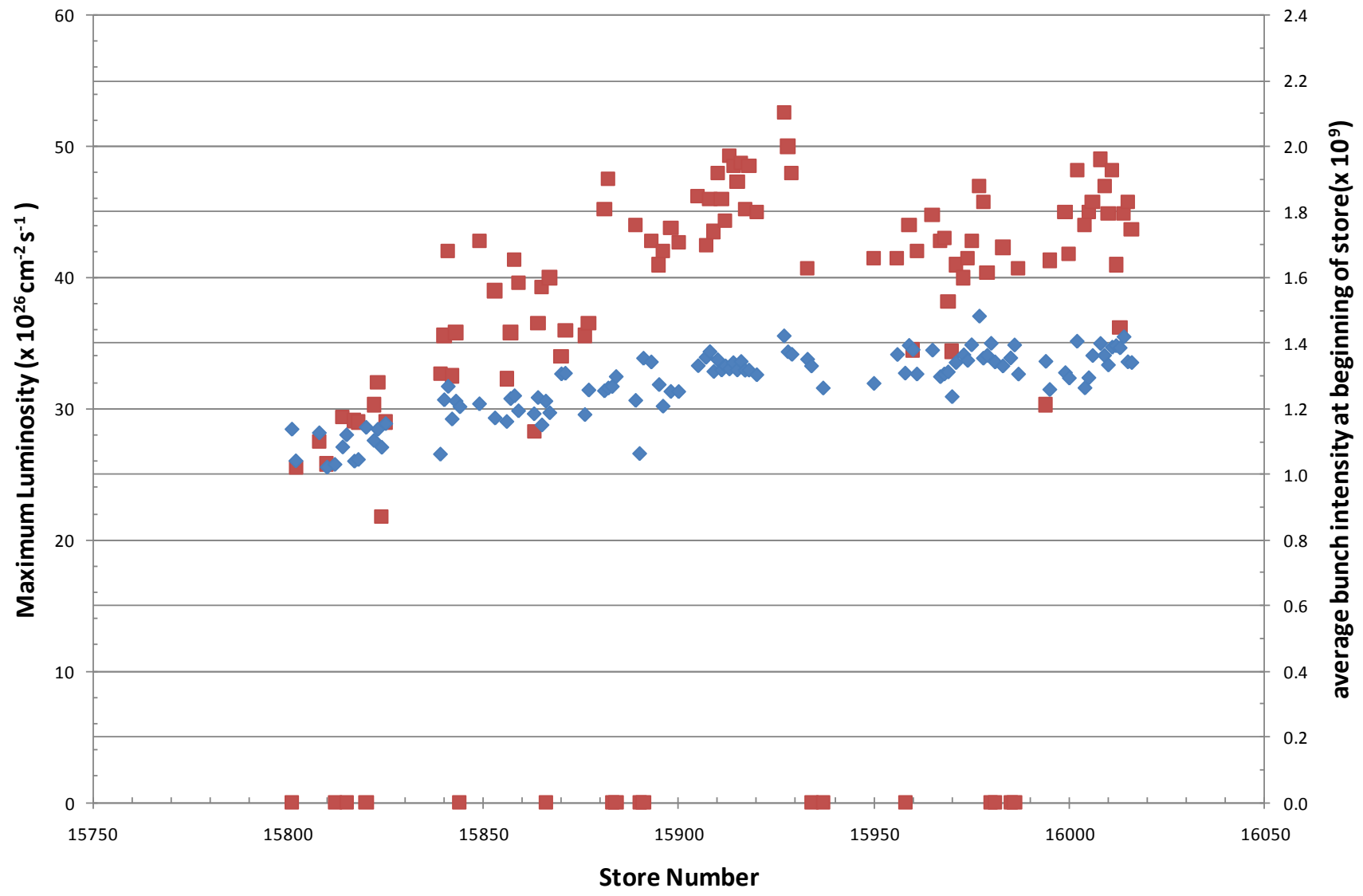


Run 11 100 x 100 GeV/n Au-Au (Phenix)

thru fill 16016

■ Maximum Luminosity (>3 hr store)

◆ Blue/Yellow Average Bunch Intensity

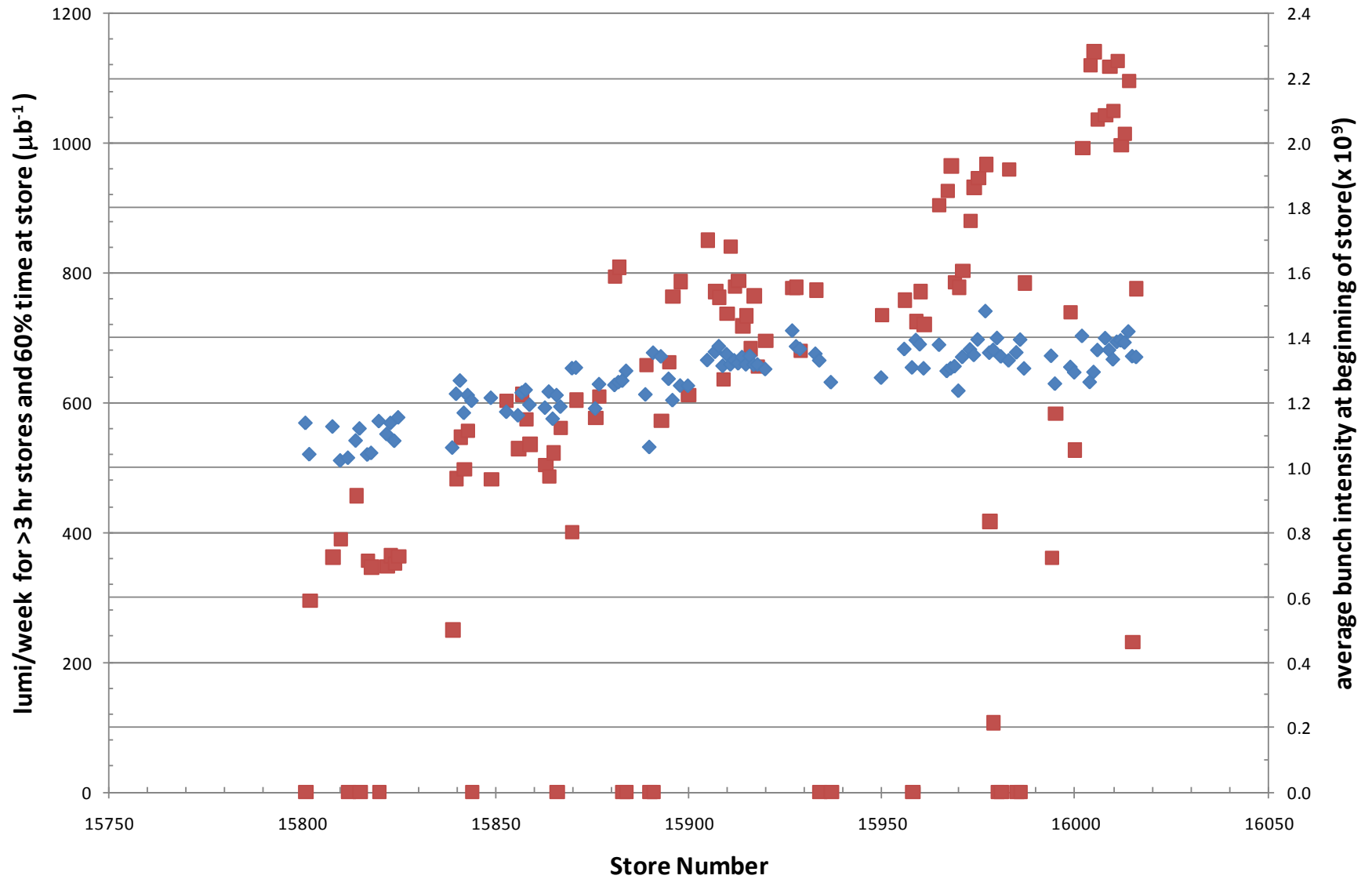


Run 11 100 x 100 GeV/n Au-Au (Phenix)

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■ 60% time at store Integrated lumi

◆ Blue/Yellow Average Bunch Intensity

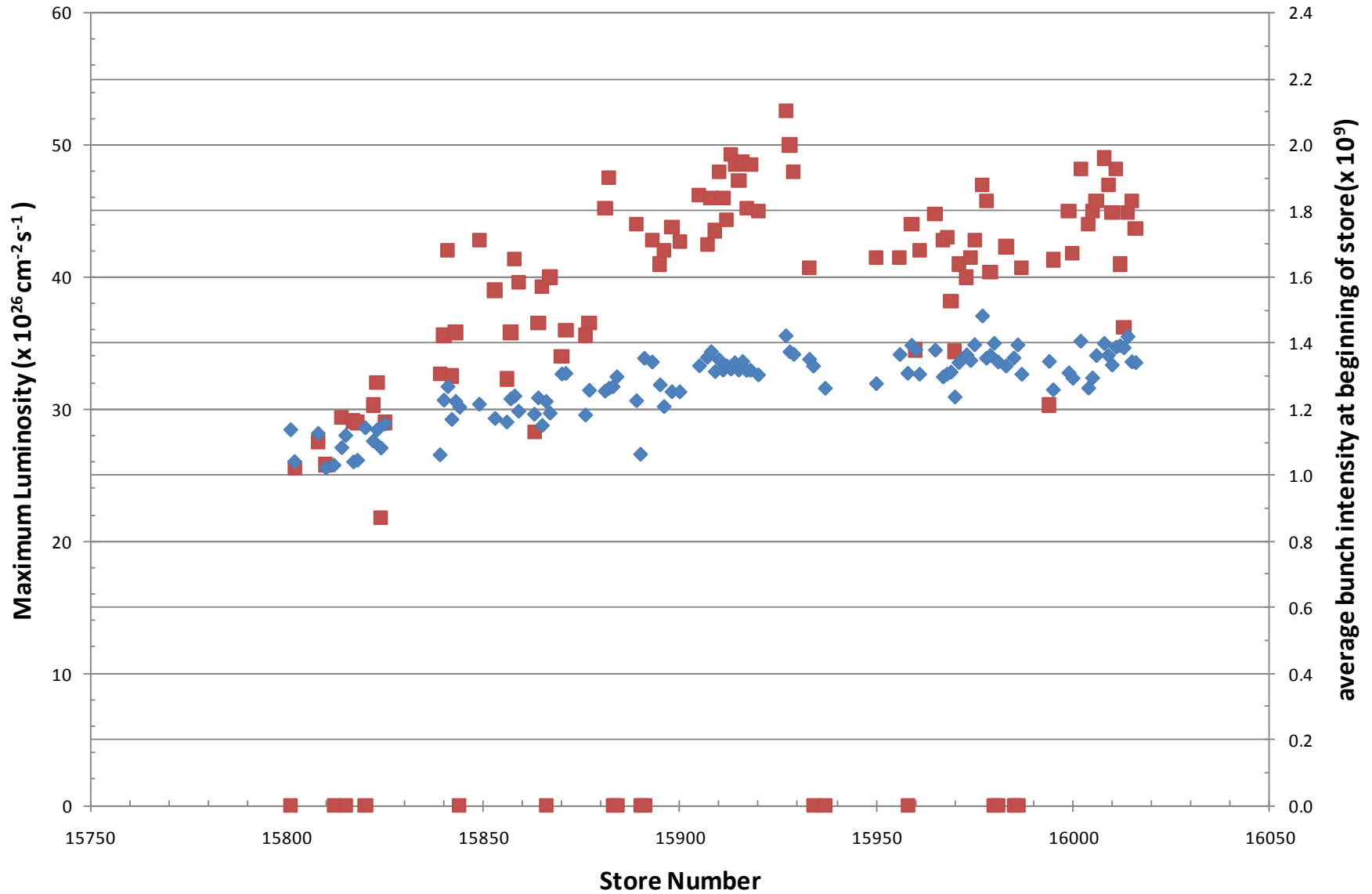


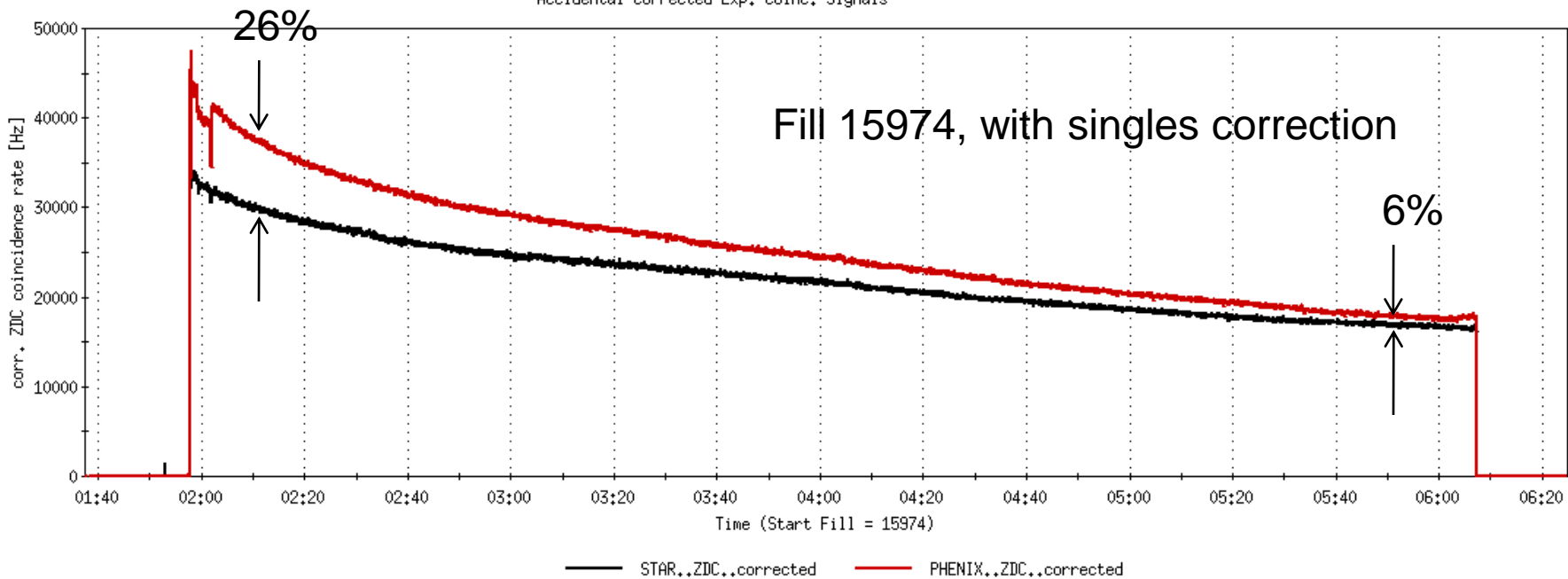
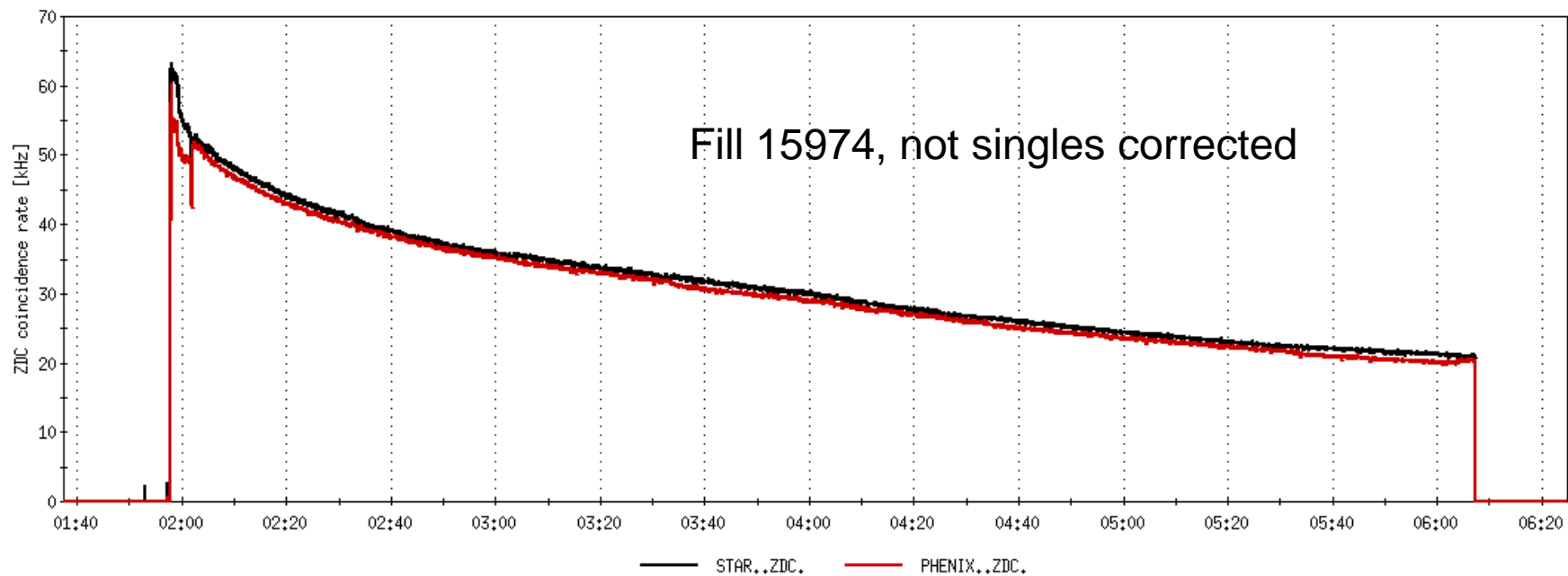
Run 11 100 x 100 GeV/n Au-Au (Phenix)

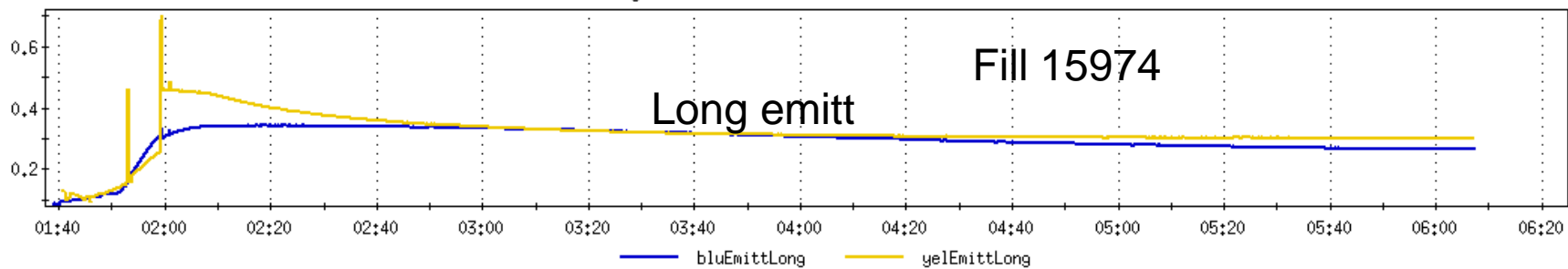
thru fill 16016

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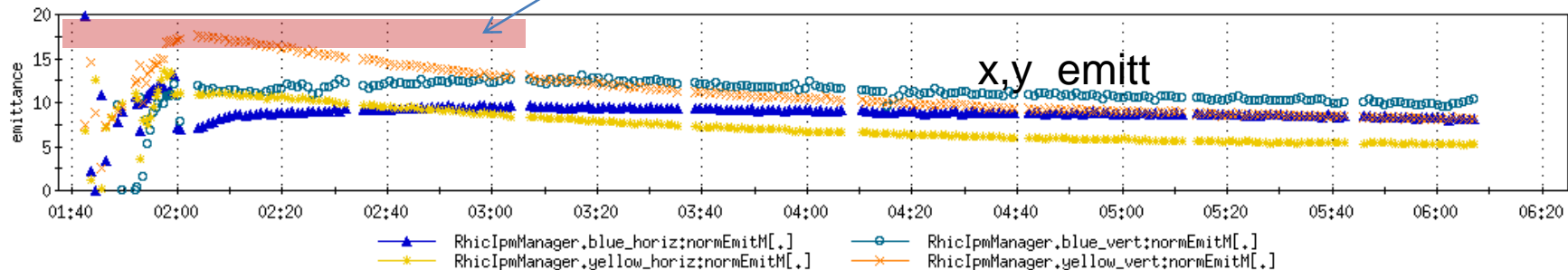
◆ Blue/Yellow Average Bunch Intensity



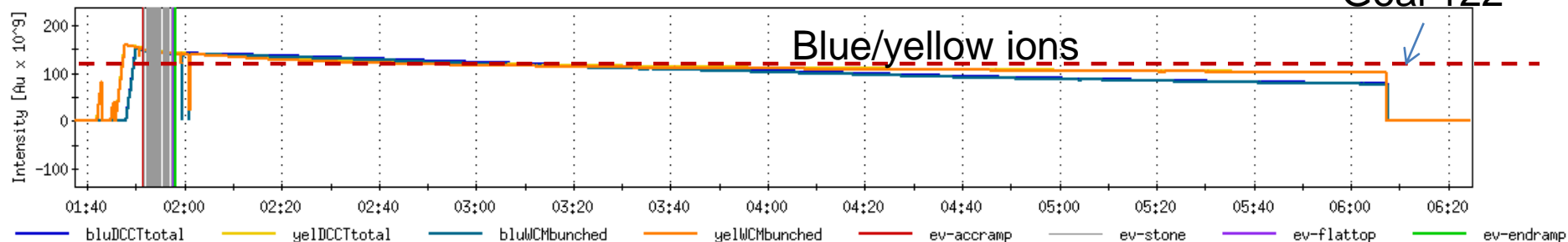




Goal 17-20

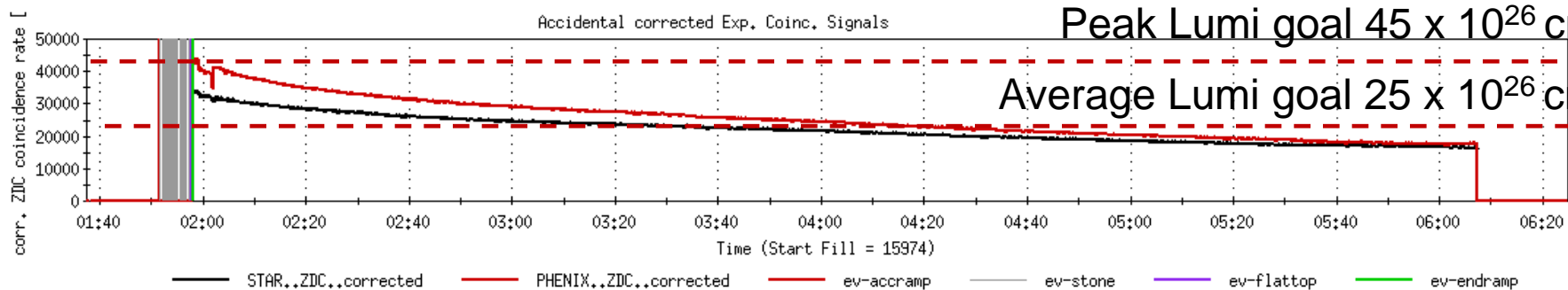


Goal 122



Peak Lumi goal $45 \times 10^{26} \text{ cm}^{-2}\text{s}^{-1}$

Average Lumi goal $25 \times 10^{26} \text{ cm}^{-2}\text{s}^{-1}$



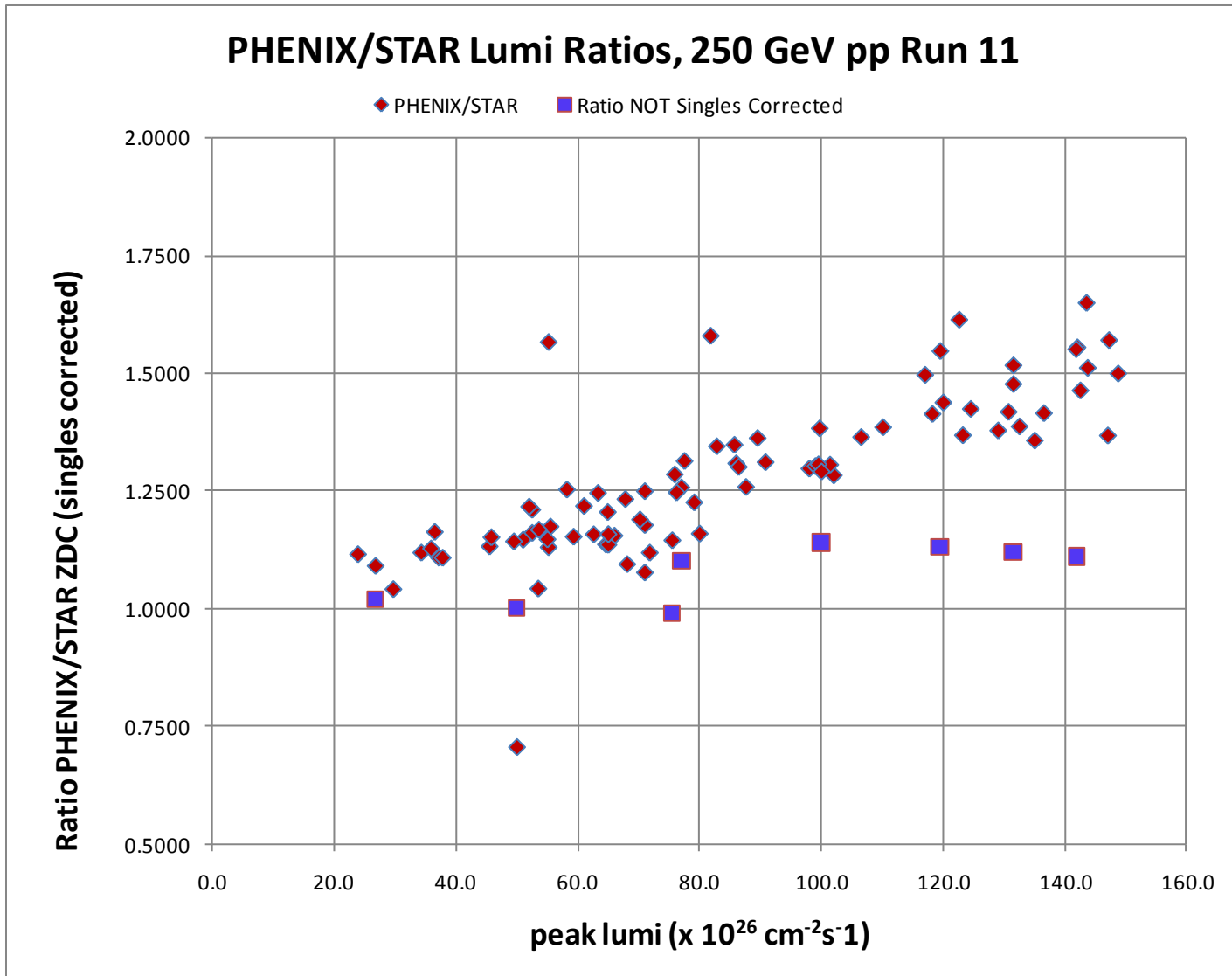
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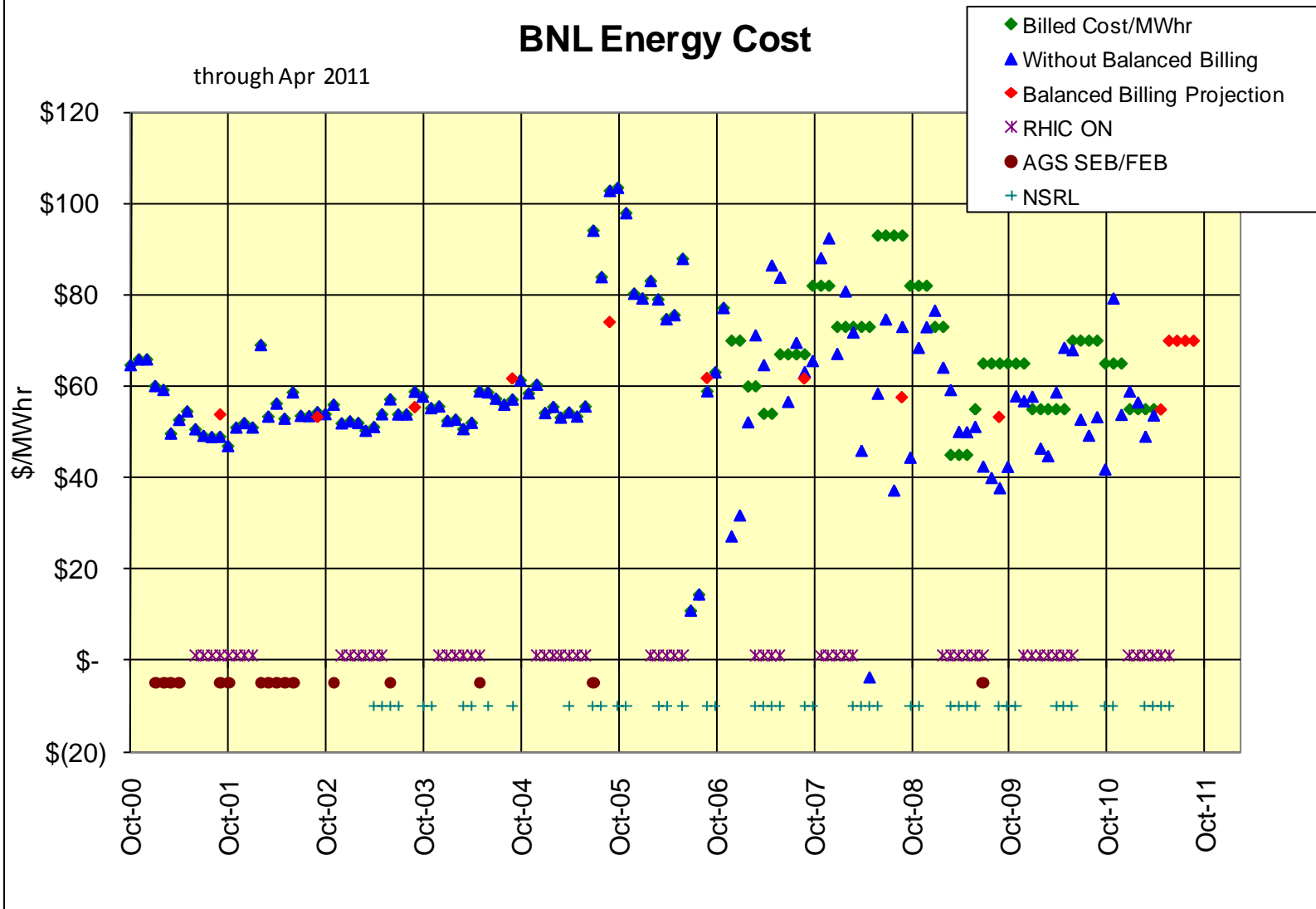
→ 100 pb⁻¹ is not an unreasonable expectation for a 10-12 week run

i.e. there's still an issue with singles corrections.



BNL Energy Cost

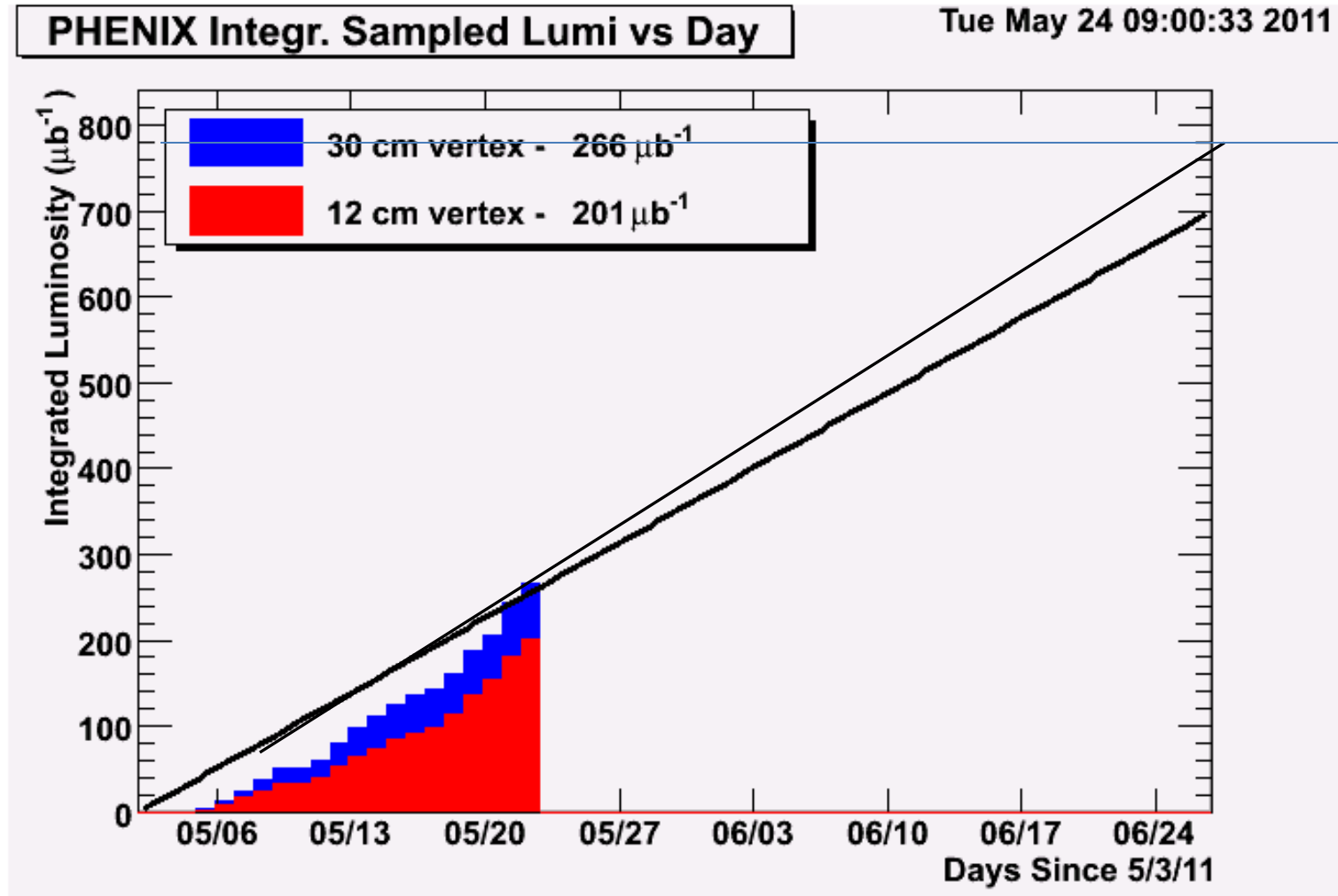
through Apr 2011



Through fill 15928 delivered 1474 μb^{-1}

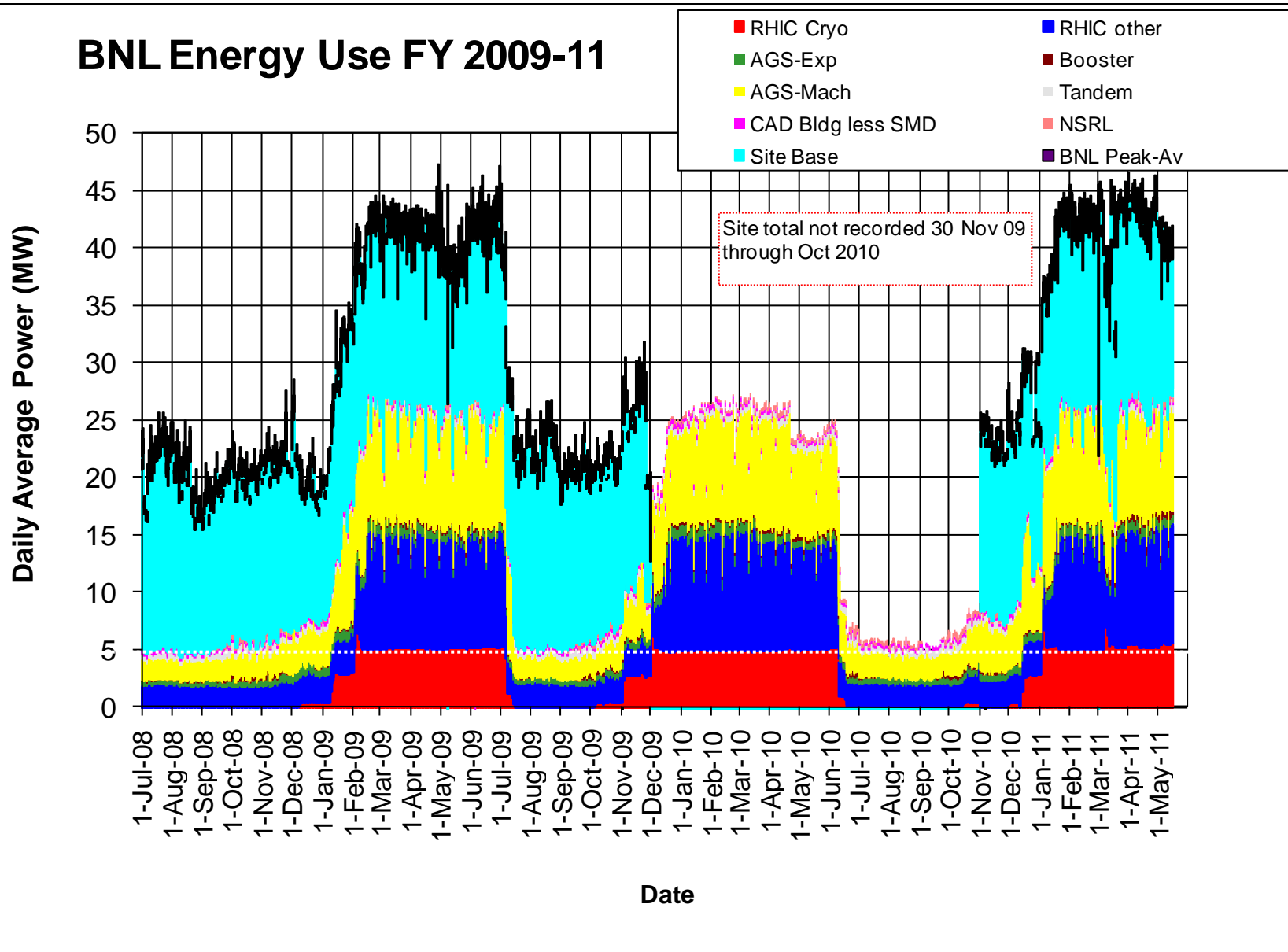
201 μb^{-1} of 700 μb^{-1} accumulated in 12cm vertex

→ Efficiency = $201/1474 = 14\%$



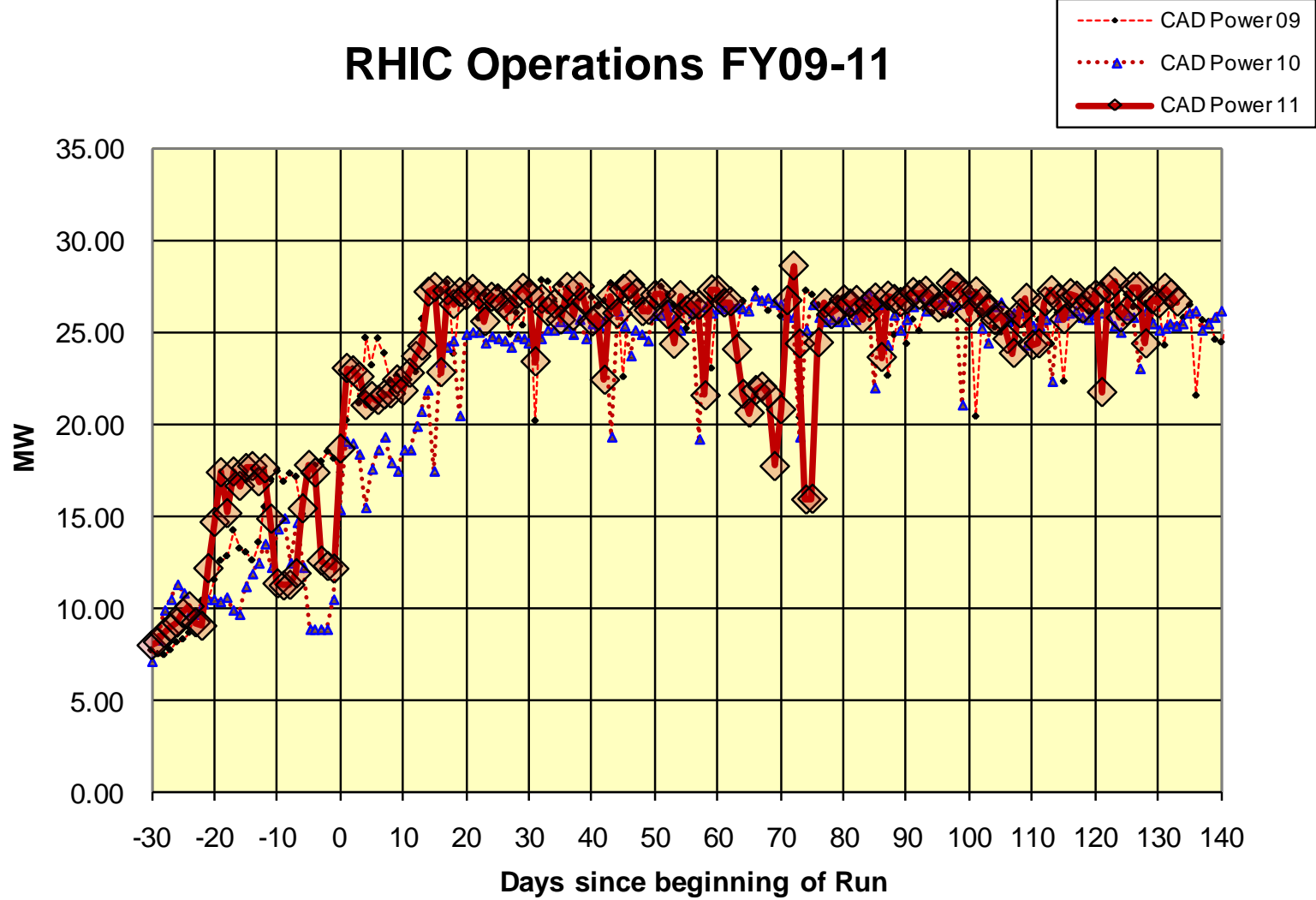
Through 16 May 2011

BNL Energy Use FY 2009-11



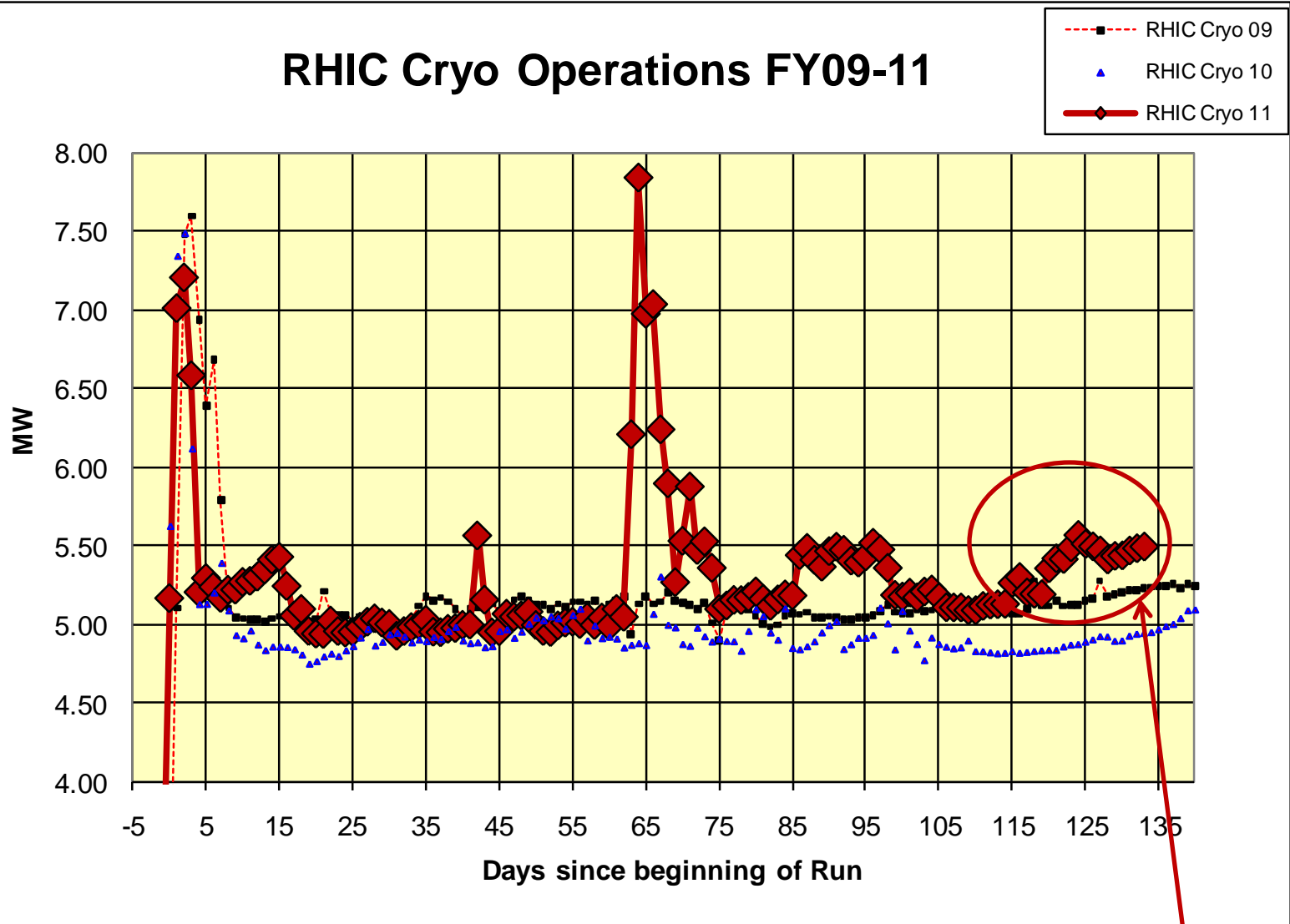
Through 16 May 2011

RHIC Operations FY09-11



Through 16 May 2011

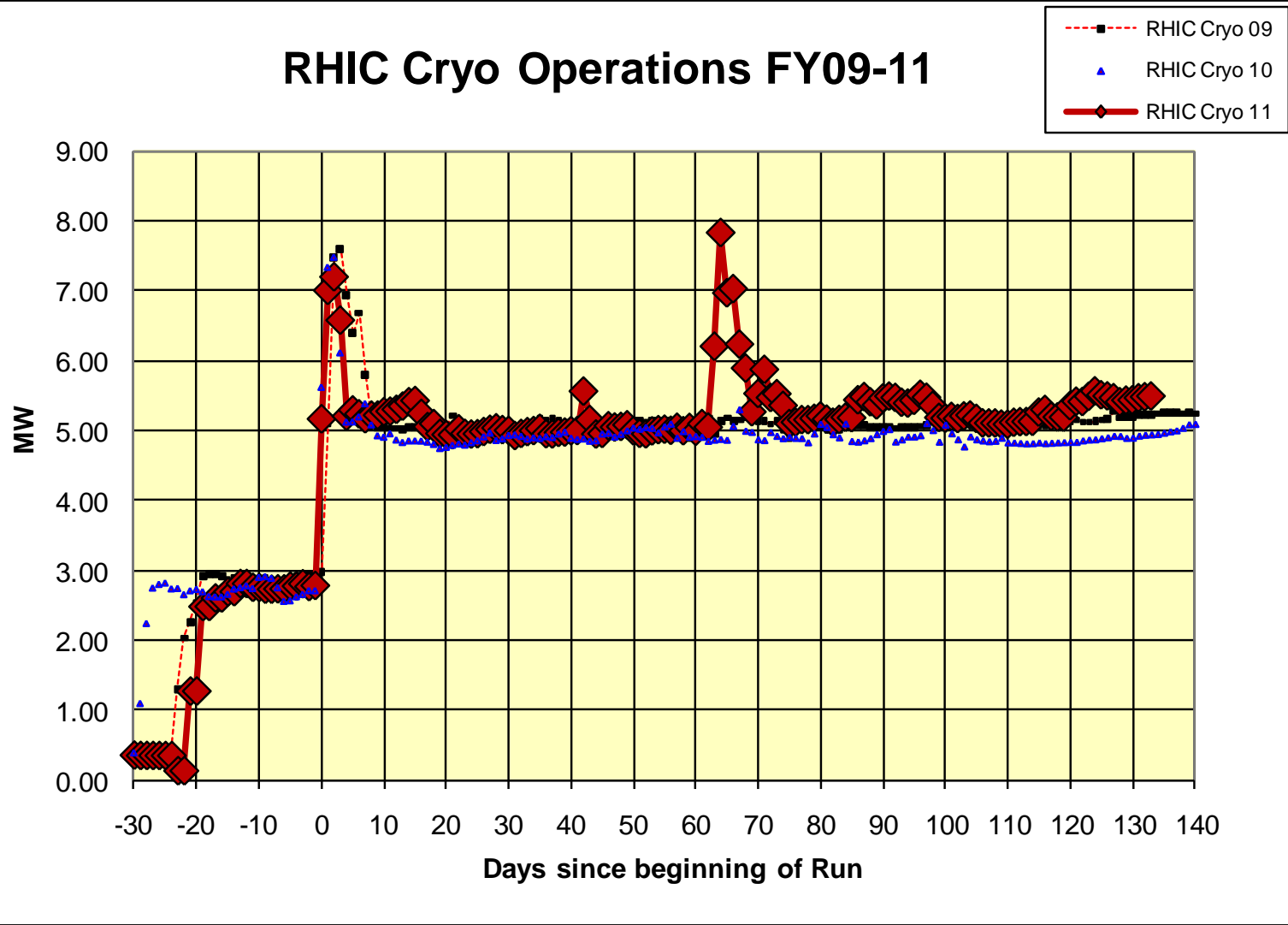
RHIC Cryo Operations FY09-11



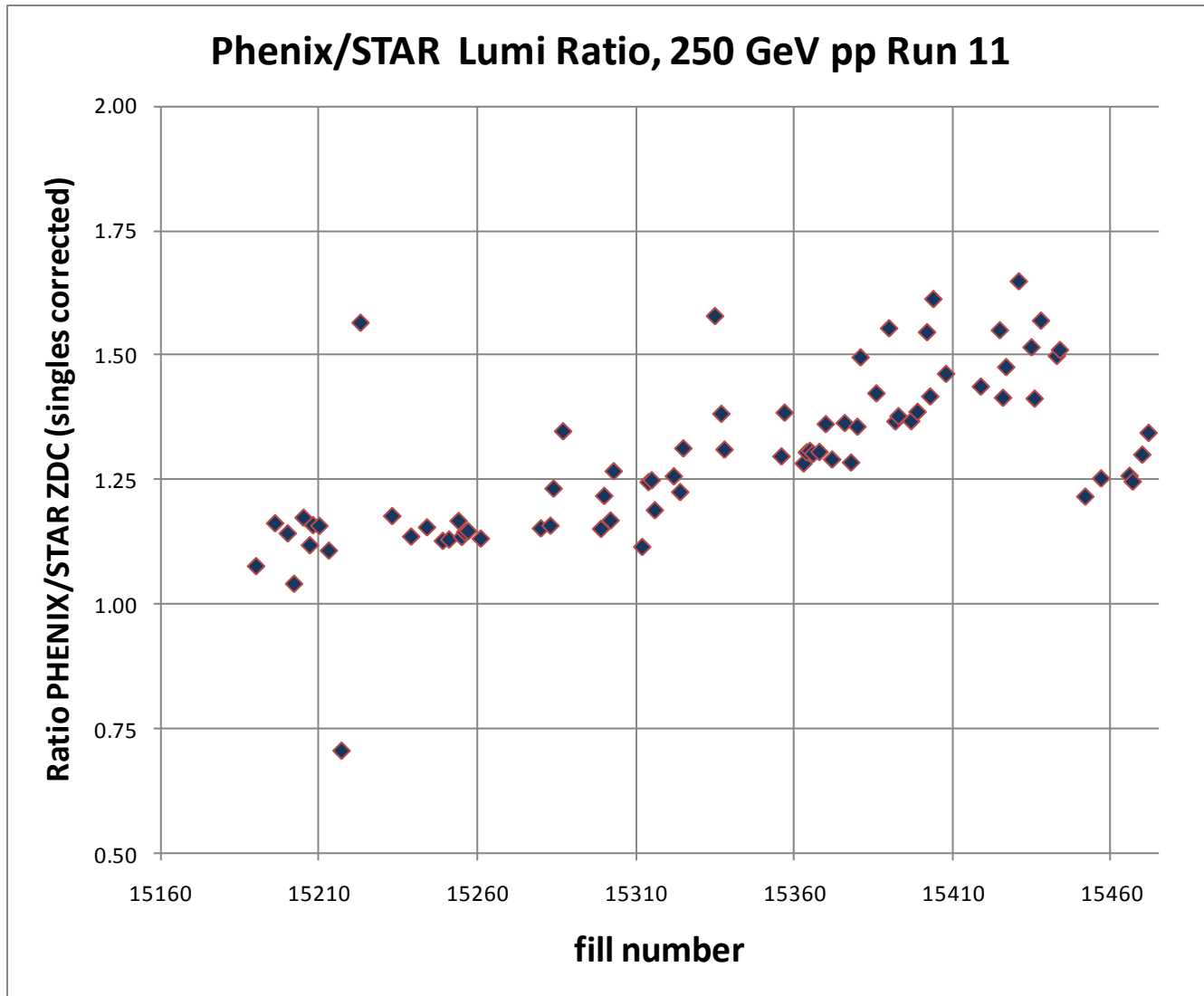
Possible oil contamination in one of the heat exchangers

Through 16 May 2011

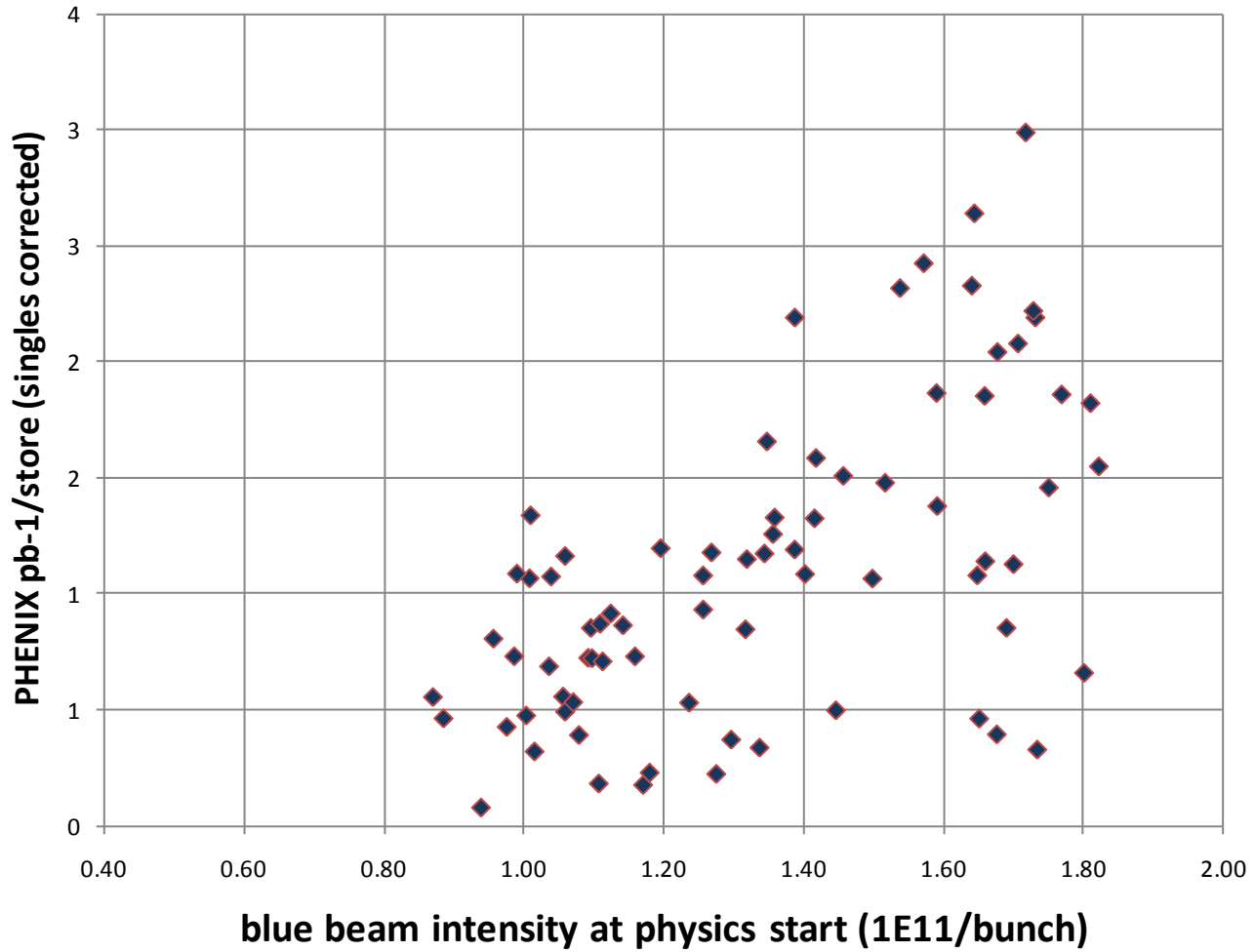
RHIC Cryo Operations FY09-11



Final Lumi should change as it appears there's an issue with the singles correction



Phenix Lumi vs beam intensity, 250 GeV pp Run 11

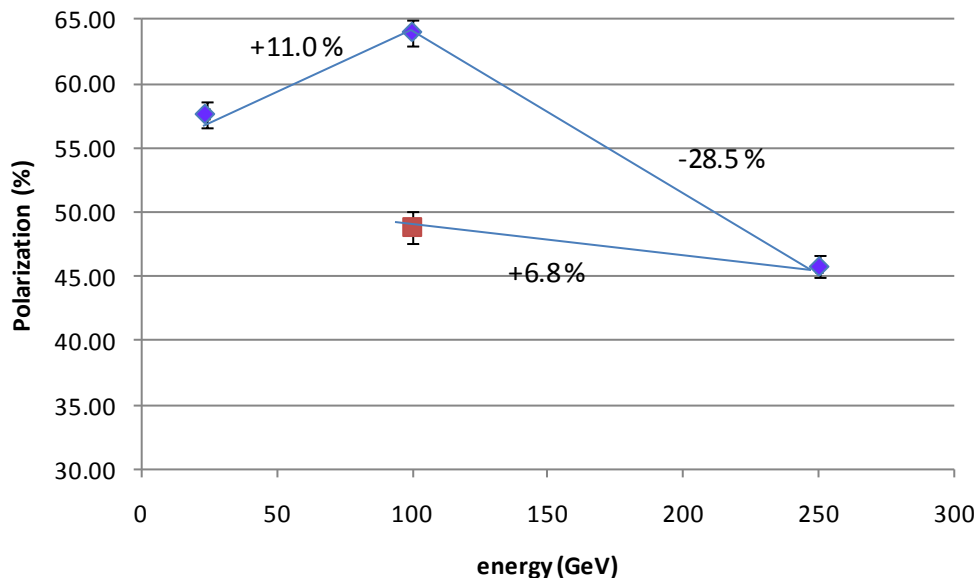


Run 11 Plan based on PAC recommendation/ALD Guidance and available funds 4/26/10 update (1/2)

- 3 Jan, Begin cool-down to 4.5K
- 8 Jan, Cool-down to 4.5K complete in both rings, preliminary setup begins
- ~11 Jan, 2 ½ weeks beam setup for $\sqrt{s} = 500$ GeV pp in RHIC begins.
- 15 Jan, power supply work/DX training complete
- 17 Jan, first successful ramp
- 19 Jan, 1st maint day
- 24 Jan, 1 week Ramp-up with 8 hr/night beam to experiments
- **11 Feb (machine and ~experiments), begin ~10 week physics run ($\sqrt{s} = 500$ GeV pp)**
- 16 Feb, AGS Jump Quads in routine operation for RHIC injection
- 24 Feb, 9 MHz cavity in routine operation
- 7 Mar, cryo troubles, extended maintenance, 0900 hrs till 2000 hrs 14 Mar – lost 7.5 days
- 17 Mar, power distribution problem, extended maintenance, 1930 hrs till 0315 hrs 20 Mar – lost 2.3 days
- 28 March – 1 April, PAC 2011
- **15 April Continuing Resolution Ends, guidance to follow**
- **18 Apr, end 9.4 week pp physics run at $\sqrt{s} = 500$ GeV**
- 18 Apr jet target polarization measurement at injection (<5%)
- 19 Apr, short maintenance followed by setup for $\sqrt{s} = 18$ GeV AuAu
- **23 Apr, begin ~1 week physics run ($\sqrt{s} = 19.6$ AuAu)**

- **2 May, end 1.3 week physics run at $\sqrt{s} = 19.6$ GeV**

Up down ramp, Blue Beam polarization with current analyzing powers

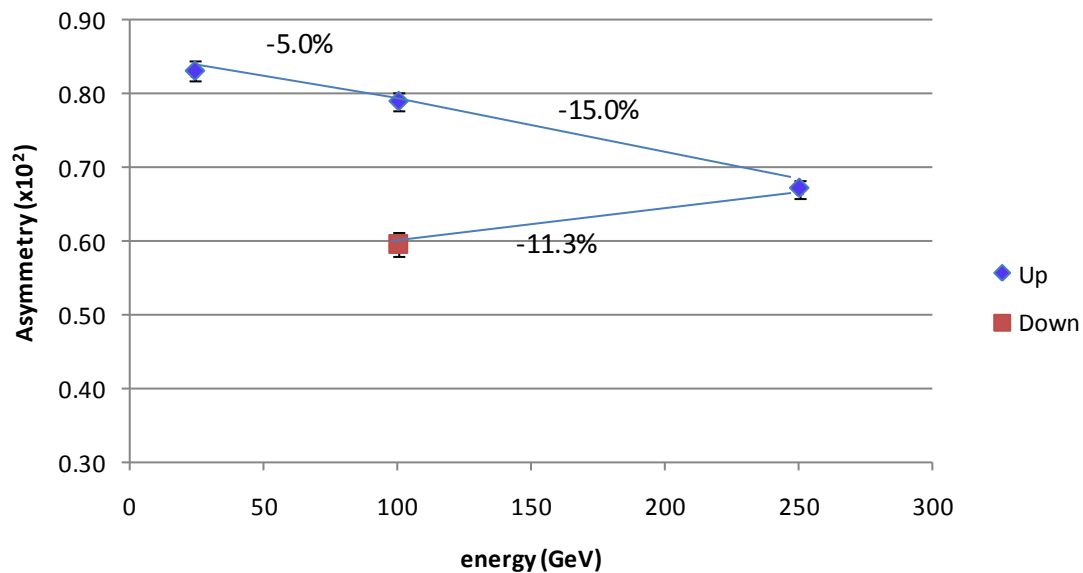


7 April Up-Down Ramp measurement
Blue Beam

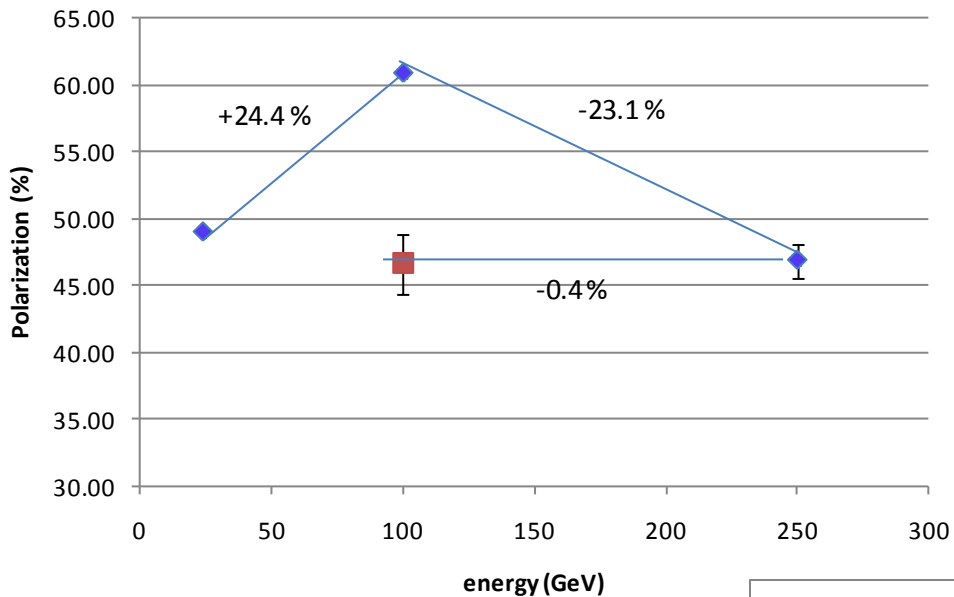
Current CNI average analyzing powers are:

| Energy | AN |
|--------|--------|
| 24 | 0.0144 |
| 100 | 0.0122 |
| 250 | 0.0147 |

Up down ramp, Blue Beam Asymmetry



Up down ramp, Yellow Beam
polarization (#1 only) with current analyzing powers



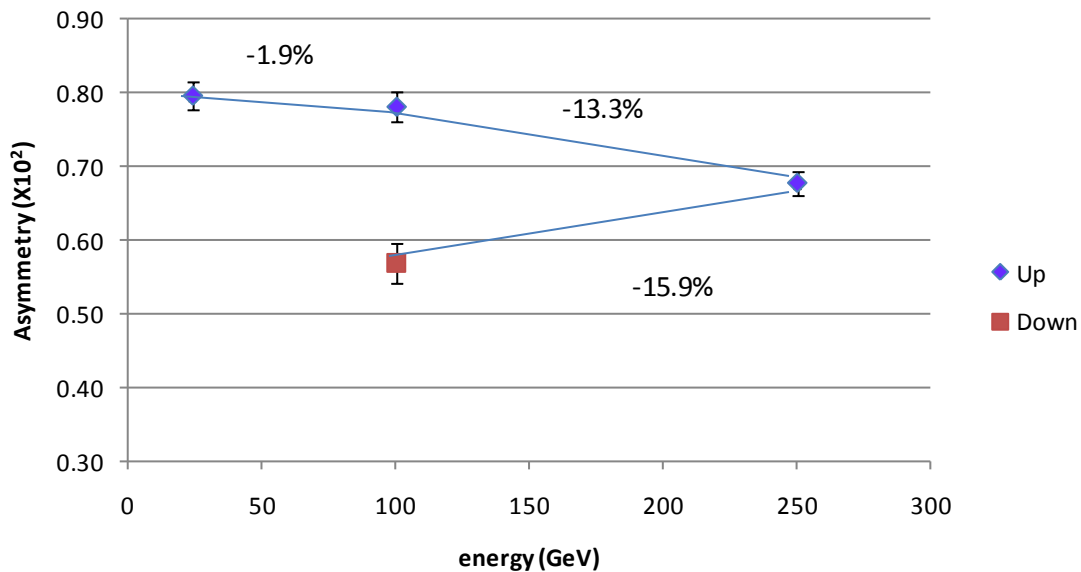
7 April Up-Down Ramp measurement
 Yellow Beam (only Yellow 1 was used as Yellow 2 was acting up)

Current CNI average analyzing powers are:

| Energy | AN |
|--------|--------|
| 24 | 0.0144 |
| 100 | 0.0122 |
| 250 | 0.0147 |

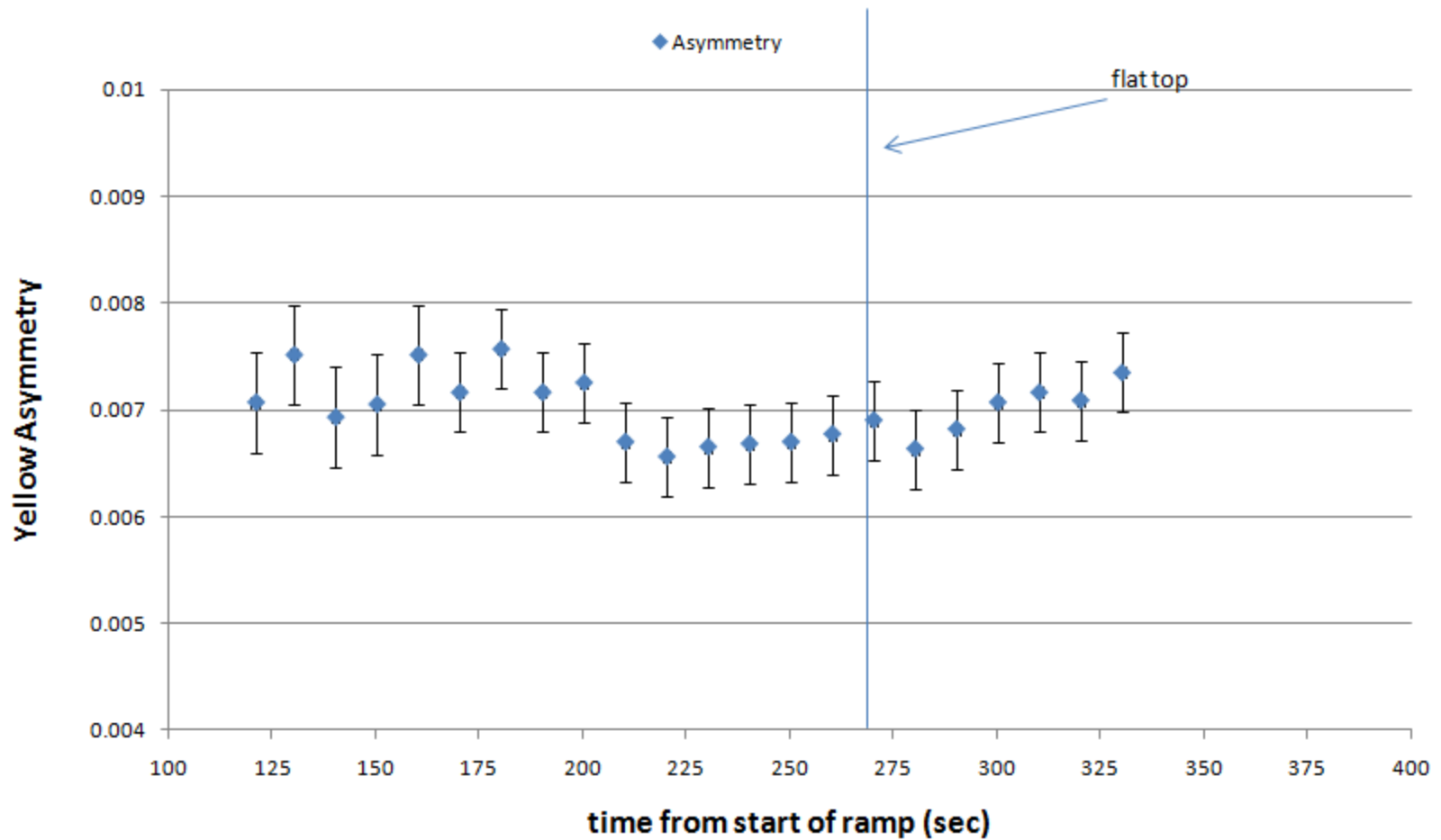
◆ Up
 ■ Down

Up down ramp, Yellow Beam
asymmetry (CNI #1 only)

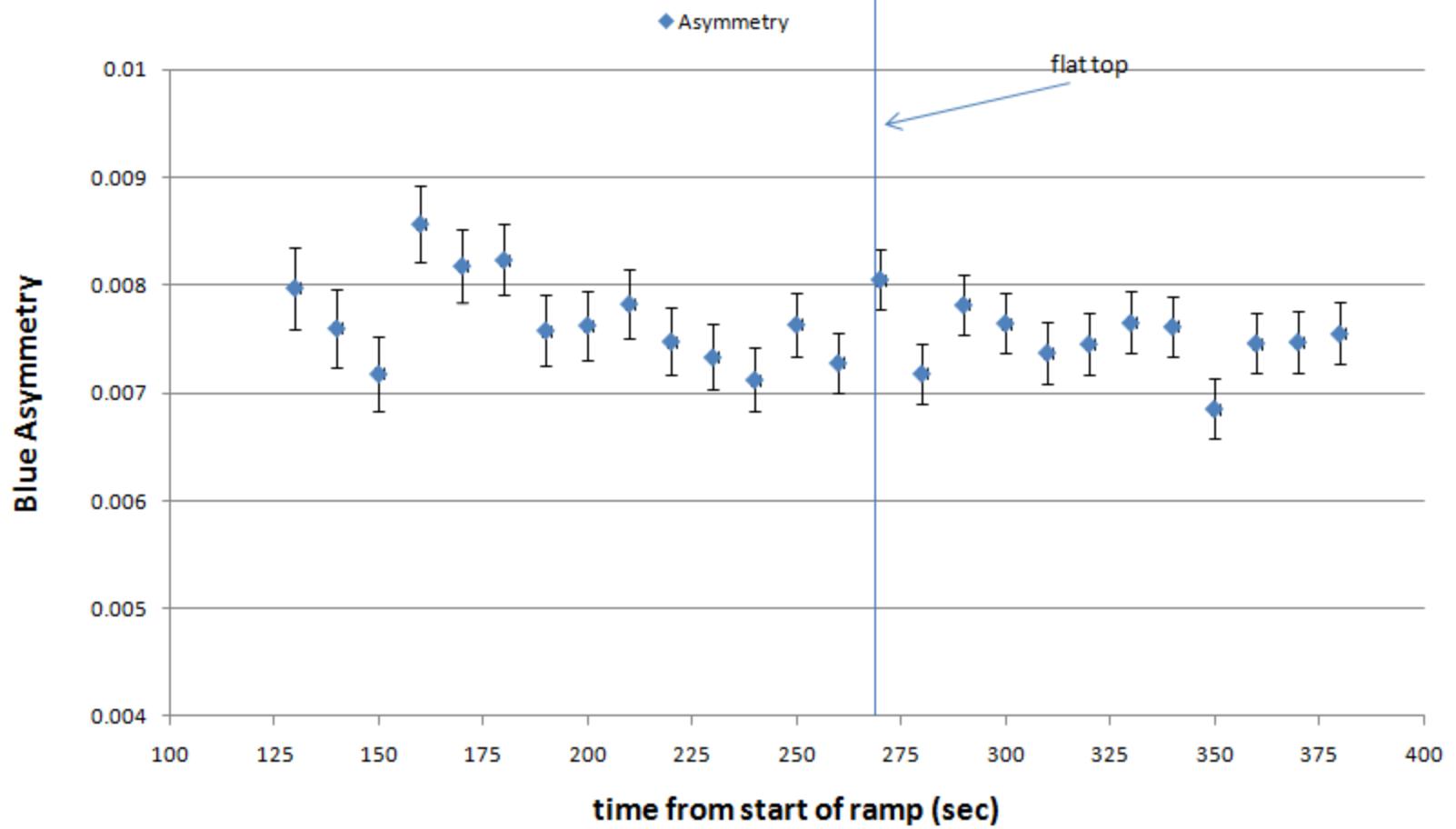


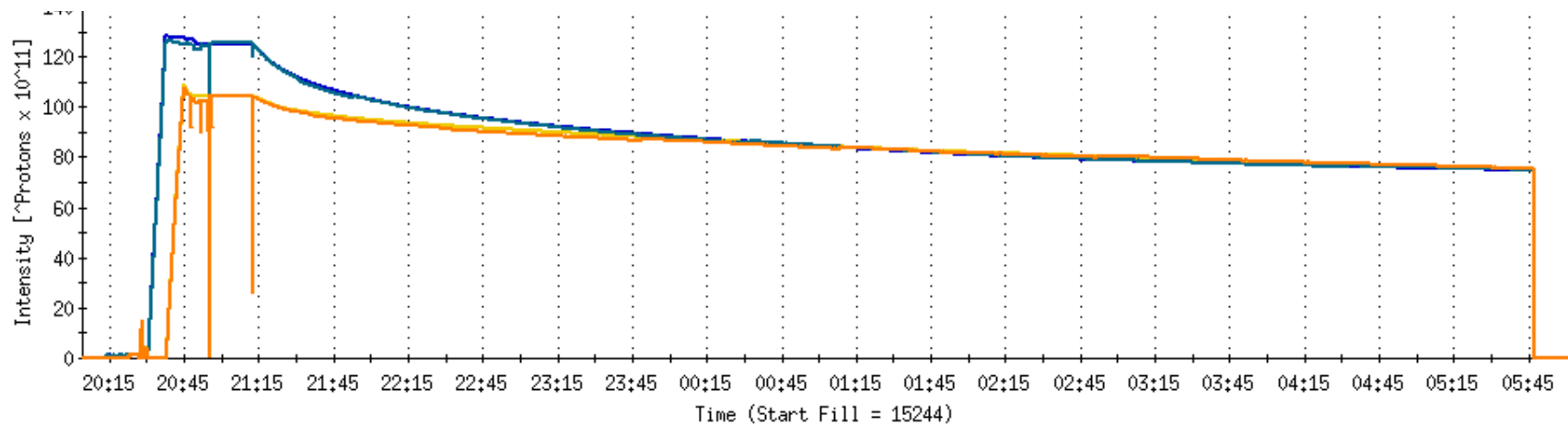
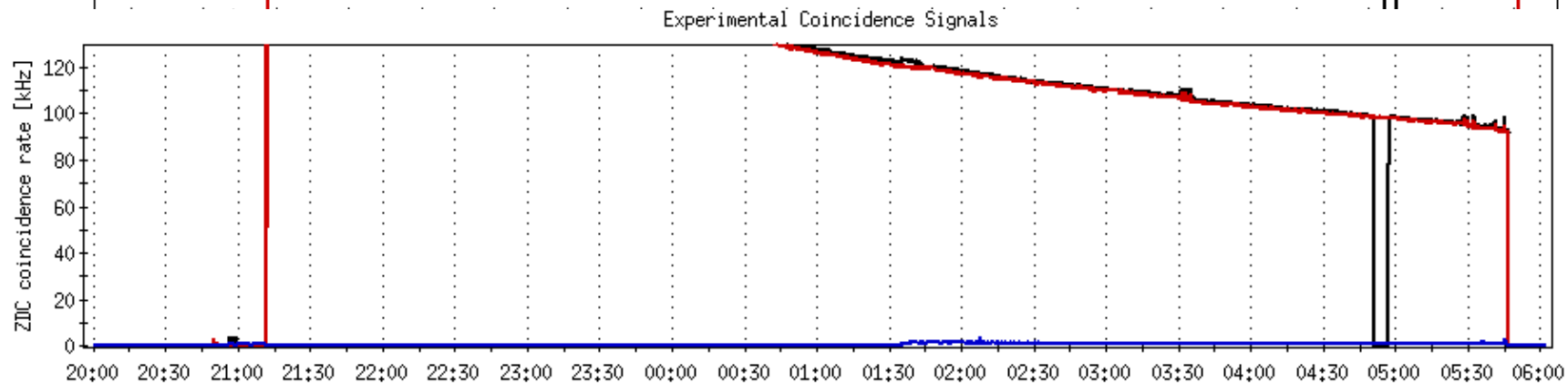
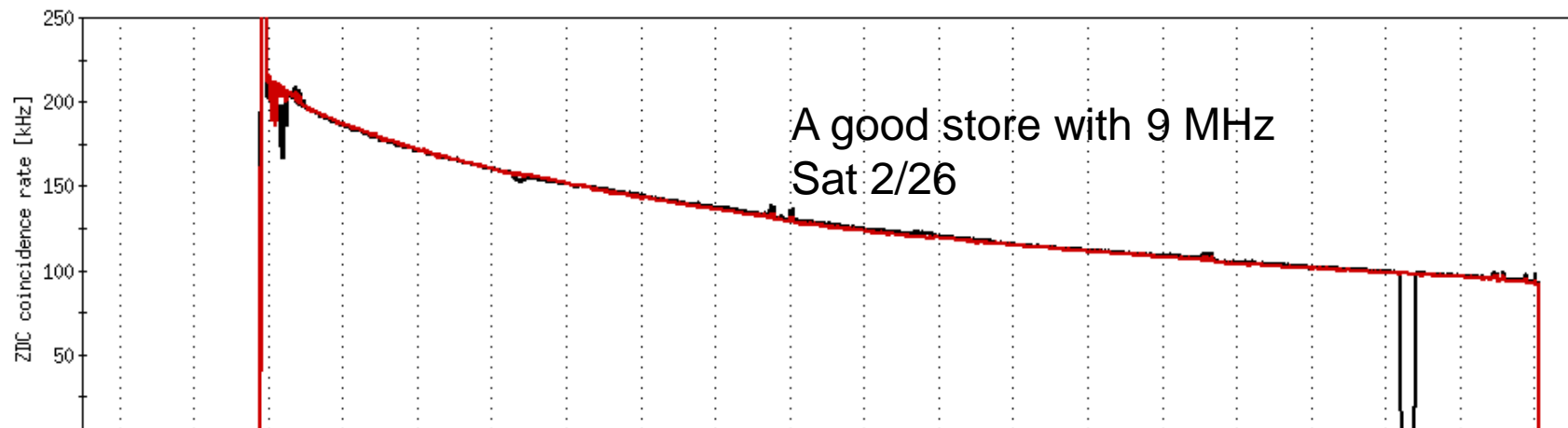
◆ Up
 ■ Down

CNI On the Ramp, fill 15366



CNI On the Ramp, fill 15378





— bluDCCTtotal

— ye1DCCTtotal

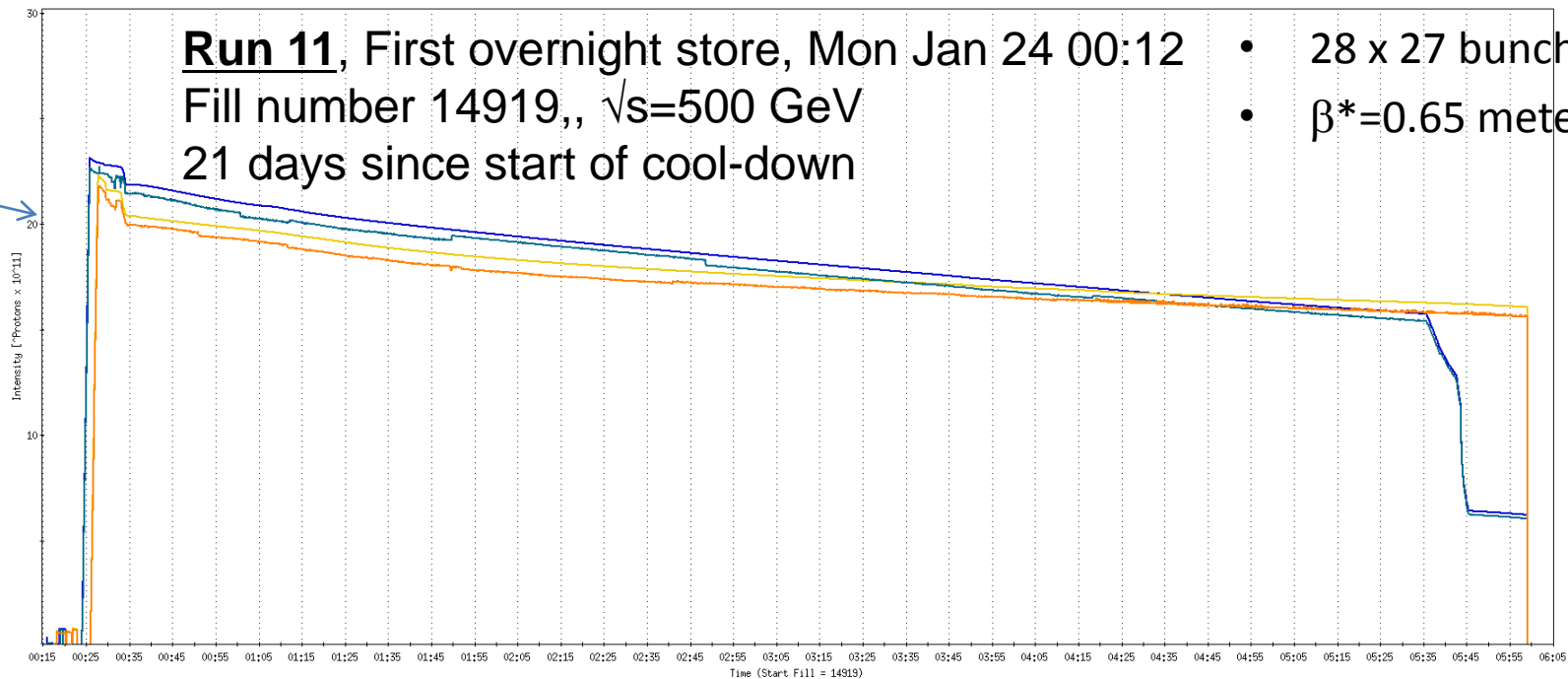
— bluWCMbunched

— ye1WCMbunched

Run 11, First overnight store, Mon Jan 24 00:12
Fill number 14919,, $\sqrt{s}=500$ GeV
21 days since start of cool-down

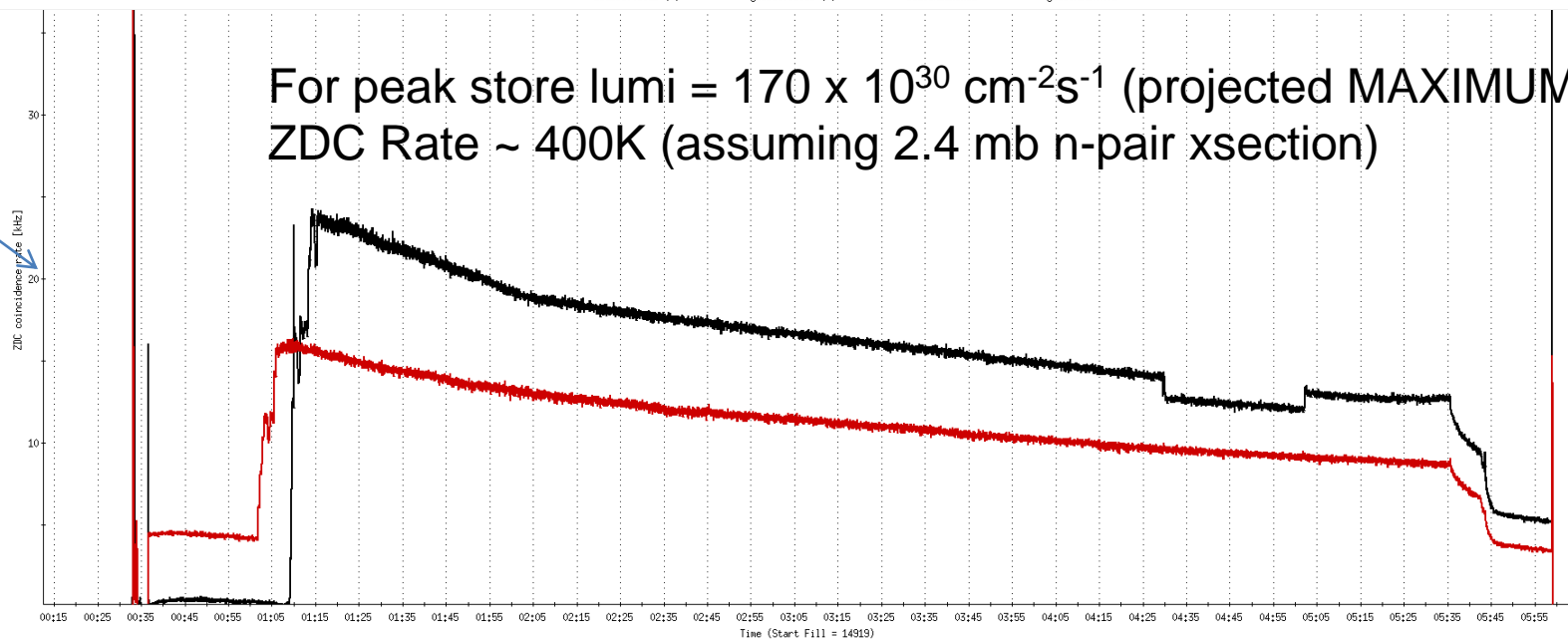
- 28 x 27 bunches
- $\beta^*=0.65$ meters

20 x 10¹¹



For peak store lumi = $170 \times 10^{30} \text{ cm}^{-2}\text{s}^{-1}$ (projected MAXIMUM)
ZDC Rate ~ 400K (assuming 2.4 mb n-pair xsection)

20K



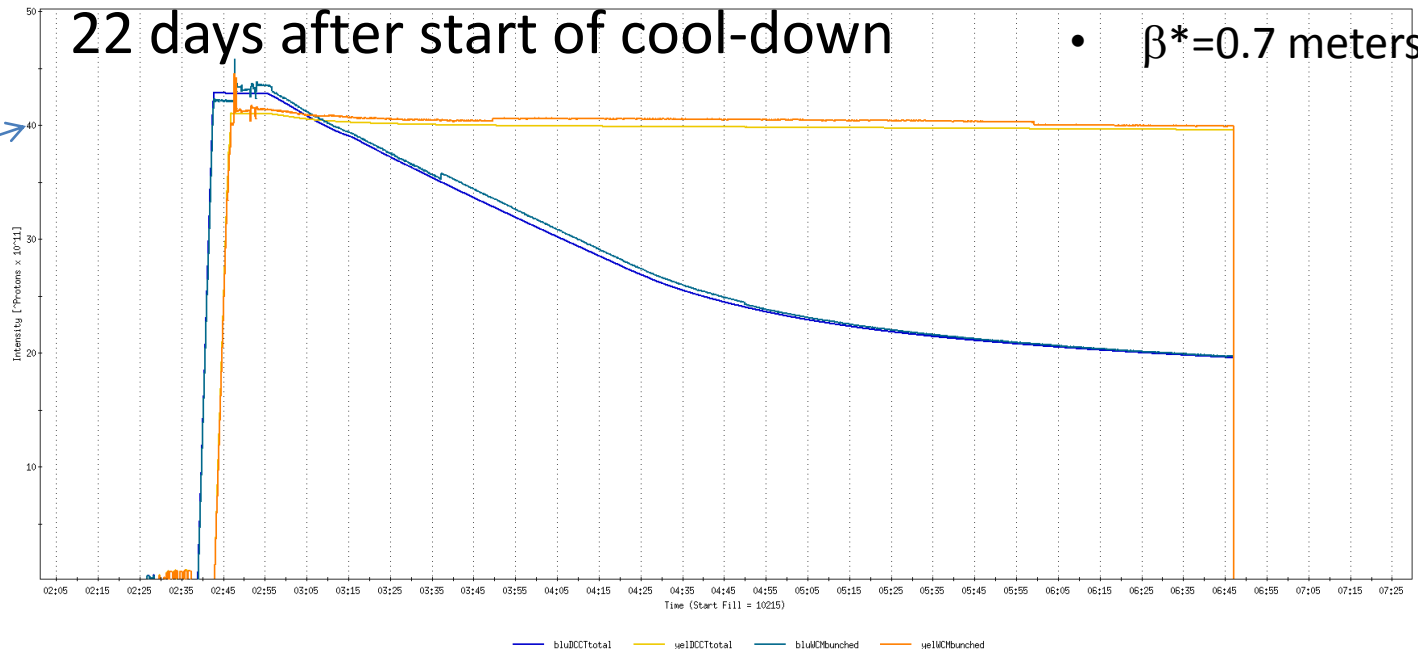
Run 9, First overnight store at $\sqrt{s}=500$ GeV

• 56 x 56 bunches

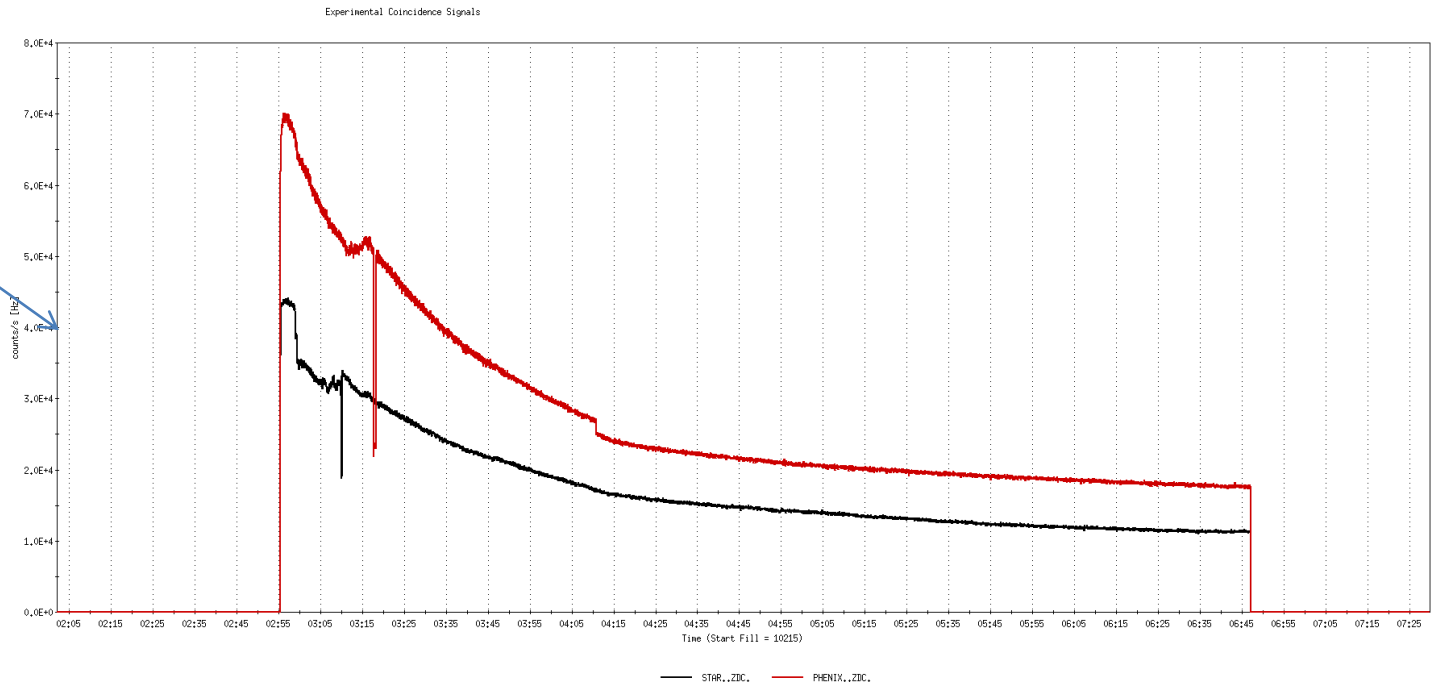
• $\beta^*=0.7$ meters

22 days after start of cool-down

40×10^{11}

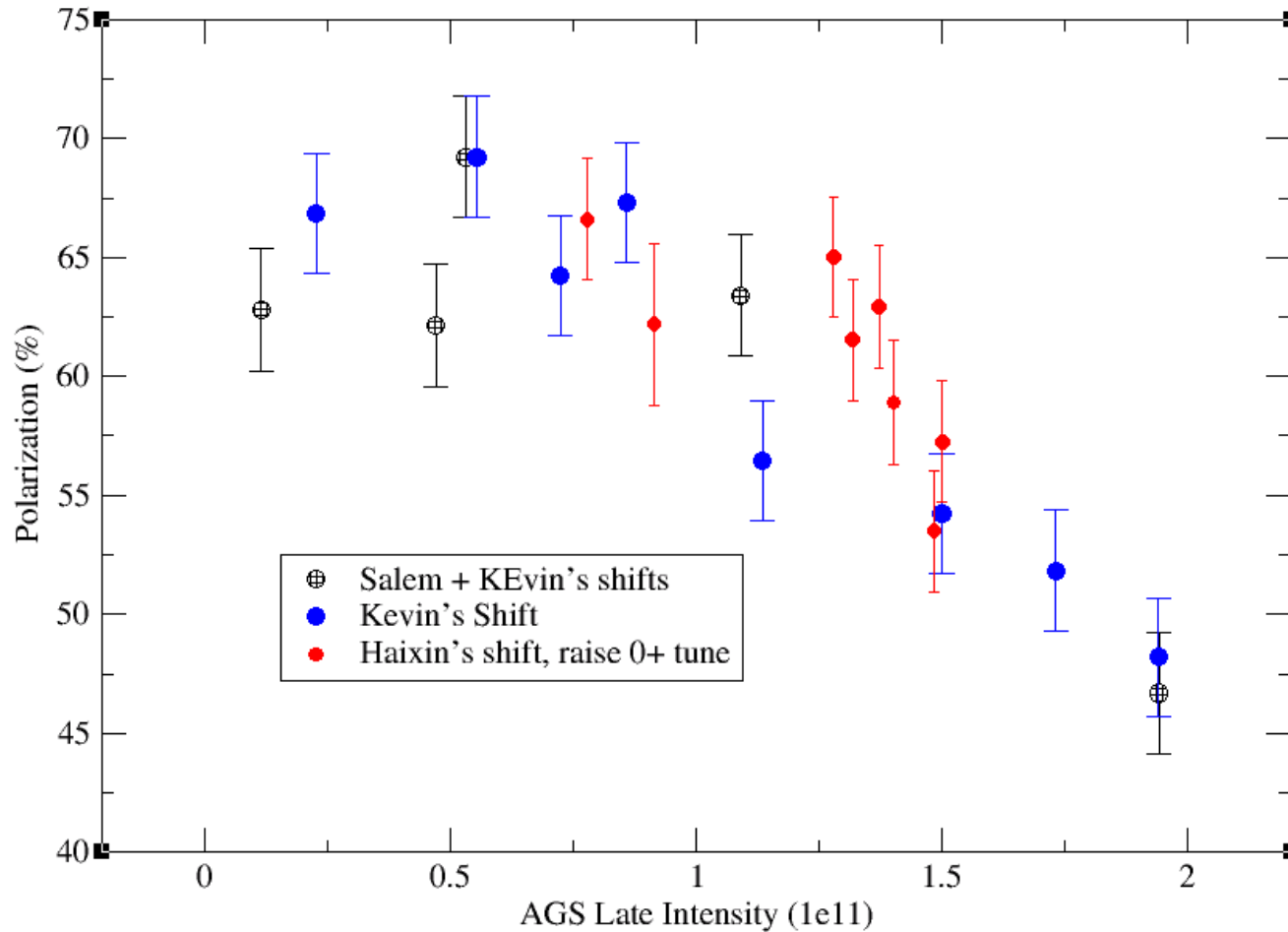


40K



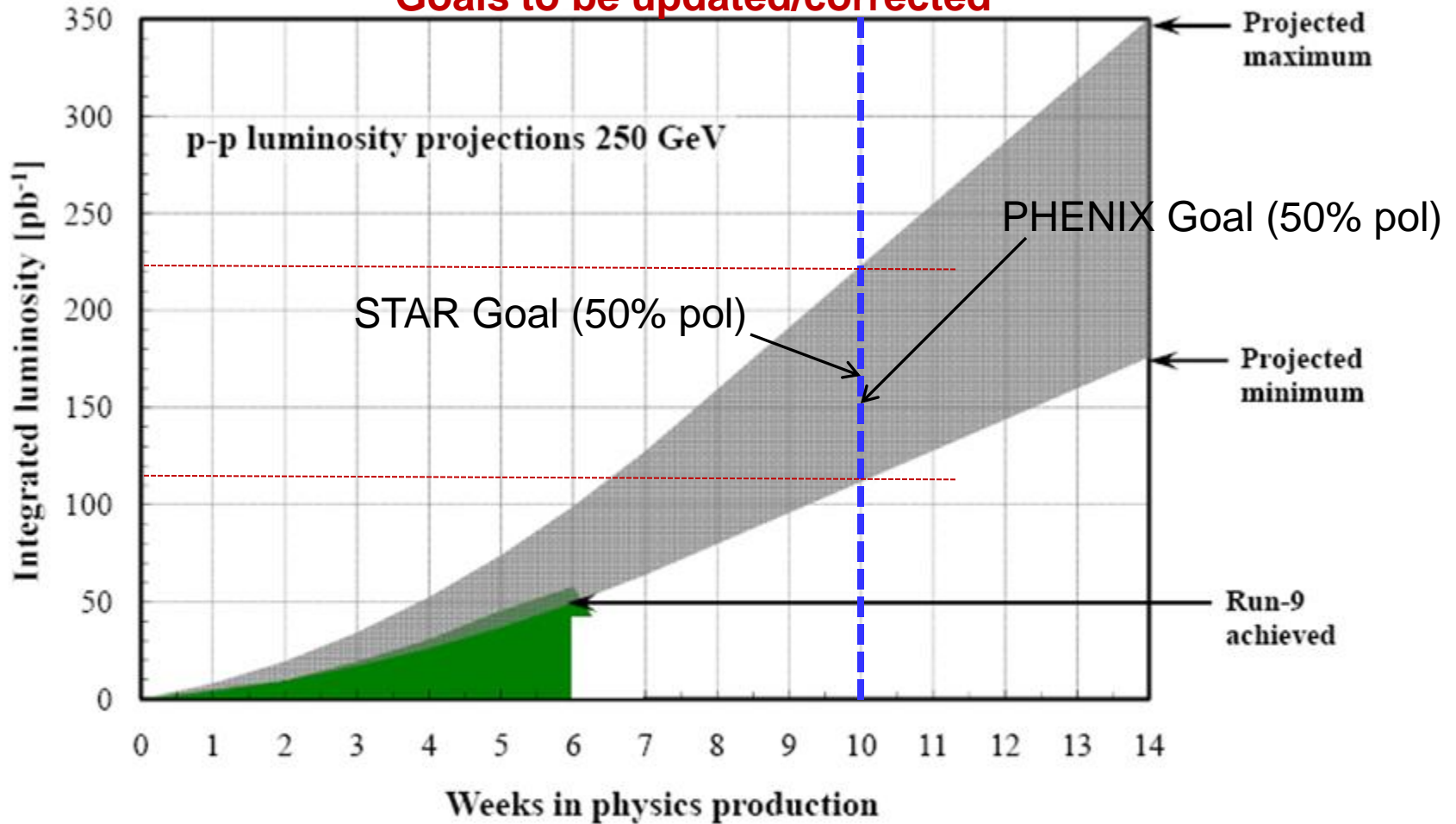
G0: X, Y = [-0.402176, 34.134]

AGS pp log, 23 Feb 09, 00:26



Run-11 p[↑]-p[↑] luminosity projections

Goals to be updated/corrected

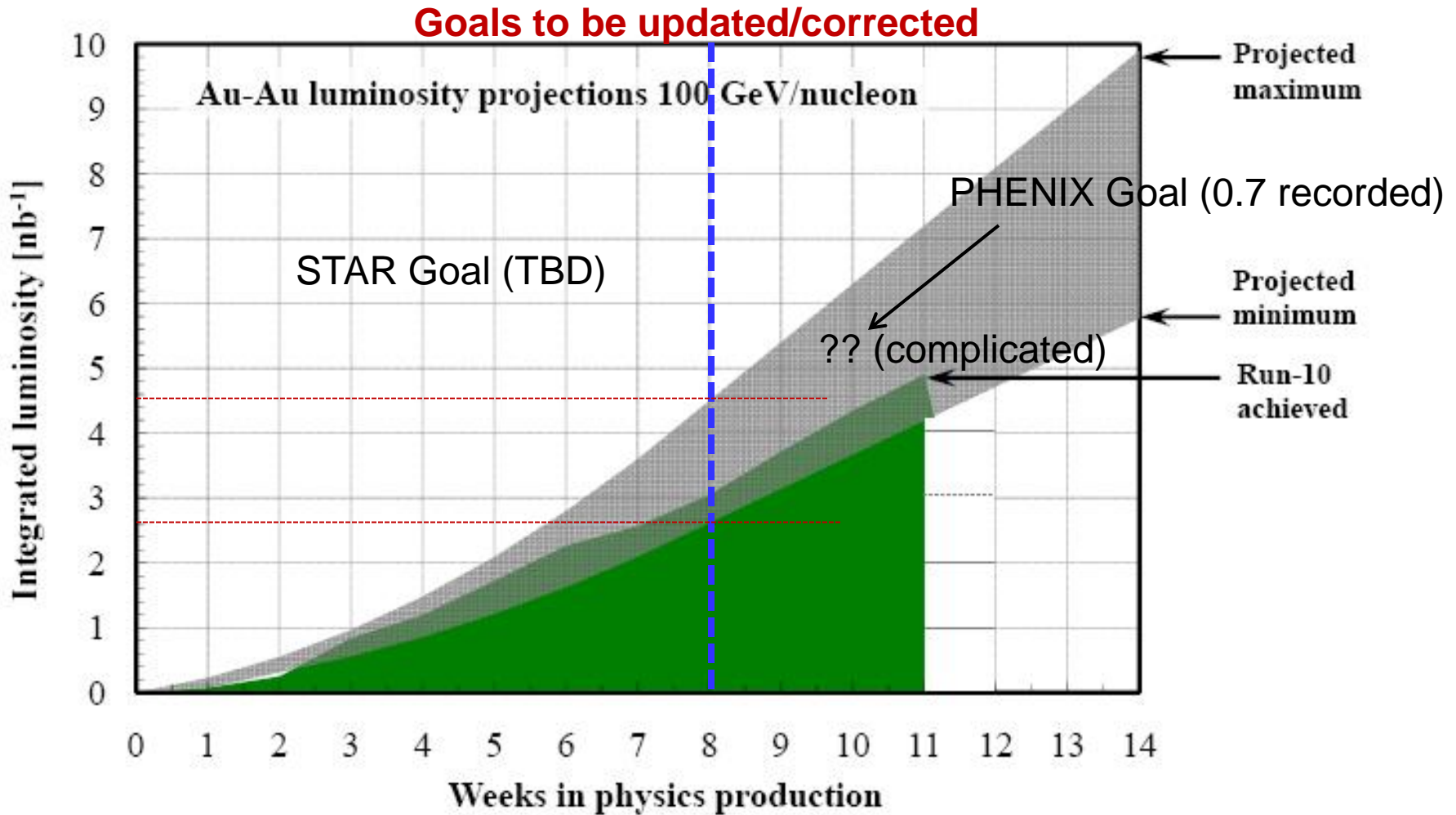


Assume 8 weeks to ramp-up for max.

Expect store $P_{\text{avg}} = 35\text{-}50\%$, L_{avg} up to $100 \times 10^{30} \text{cm}^{-2} \text{s}^{-1}$ (+80%).

[from Run-9 to max projection: $\beta^* = 0.7 \rightarrow 0.6 \text{ m}$, $N_b = 1.1 \rightarrow 1.4 \times 10^{11}$]

Run-11 Au-Au luminosity projections 100 GeV/nucleon



Assume 6 weeks to ramp-up for min, and 8 weeks for max (stoch. cooling re-commissioning).

Expect L_{avg} up to $25 \times 10^{26} \text{cm}^{-2} \text{s}^{-1}$ (+25%).

[from Run-10 to max: $\beta^* = 0.75 \rightarrow 0.65$ m, $N_b = 1.1 \rightarrow 1.1 \times 10^9$, more cooling]