Run 15 RHIC Machine/Experiments Meeting

9 June 2015

<u>Agenda:</u>

- **Run 15 Schedule** (Pile)

Run 15 plan based on 22 weeks cryo operation

with 10 day extension of the 100 GeV pp run and 3 days added to end

- 20 Jan, Begin cool-down to 4.5K
- 21 Jan (morning), Blue cold
- 22 Jan (evening), Yellow cold
- 23 Jan (after midnight), Beam in Blue
- 7 Feb, First overnight stores for experiments
- 10 Feb (3 days early) store 18662, Begin 9 week **√s=200 GeV pp** physics run

- 14-17 Mar, Power Dip downtime

- 27 April (Mon, 0700), End 10.9 week √s=200 GeV pp physics run

- ~~8~~ **4** May (~~Fri~~ **Mon**), ***[4 days early, store 19020]***
  Begin 5 week **√s=200 GeV/n pAu** physics run

~~12~~ **8** June (~~Fri~~ **Mon**), End 5 week √s=200 GeV/n pAu physics run

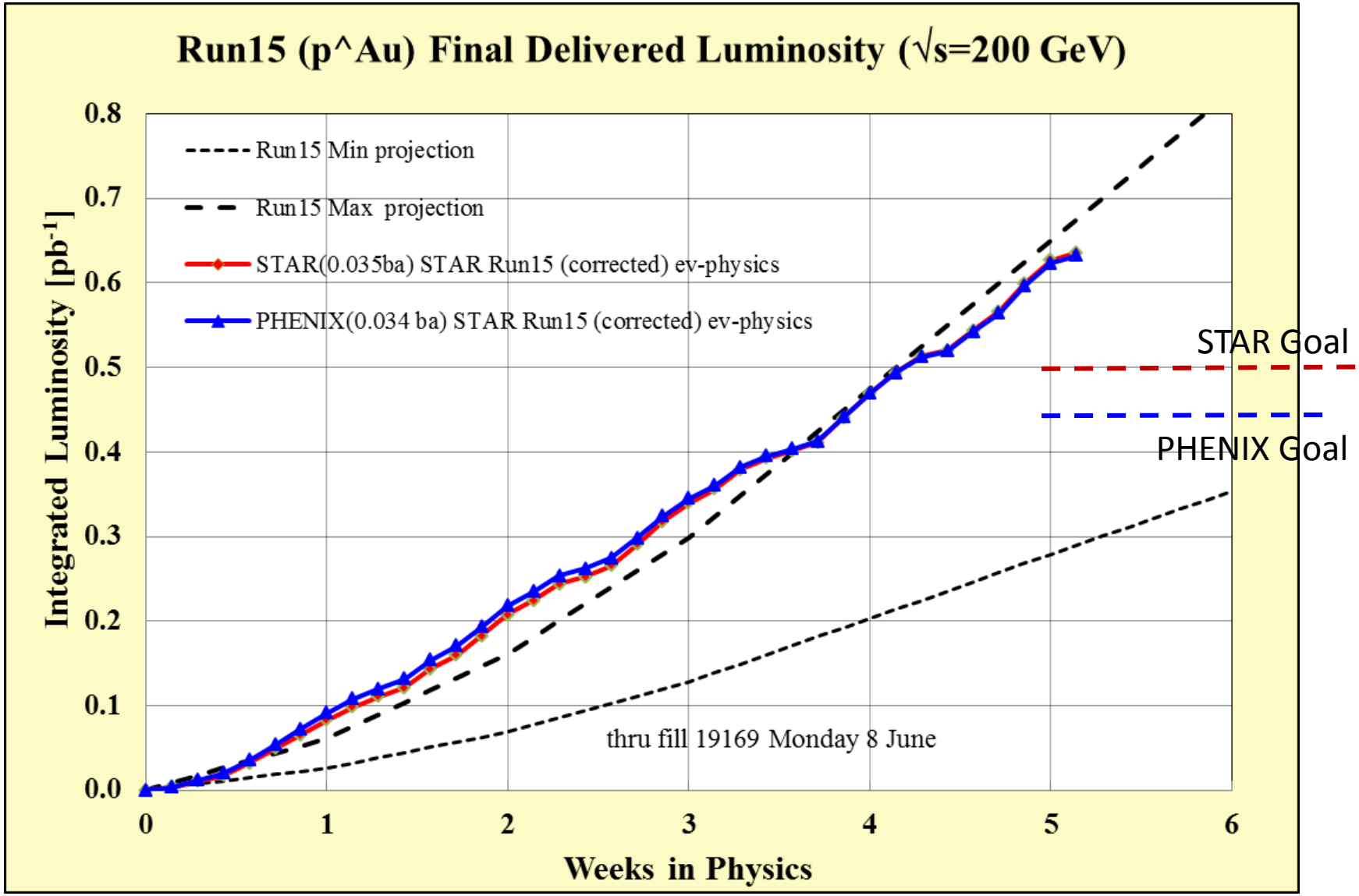
today, 9 June…

- ~~15~~ ~~**11**~~ **9** June (~~Mon Thu~~ **Tue**), Begin 2 week **√s=200 GeV/n pAl** physics run
- ~~19~~ **22**June (~~Fri~~ **Mon**), End ~~11~~ **13 day** √s=200 GeV/n pAl physics run

- ~~19~~ **22**June (Fri), begin cryo warm-up
- ~~23~~ **25** June, cryo warm-up complete, ***22.4 cryo weeks*** of operation

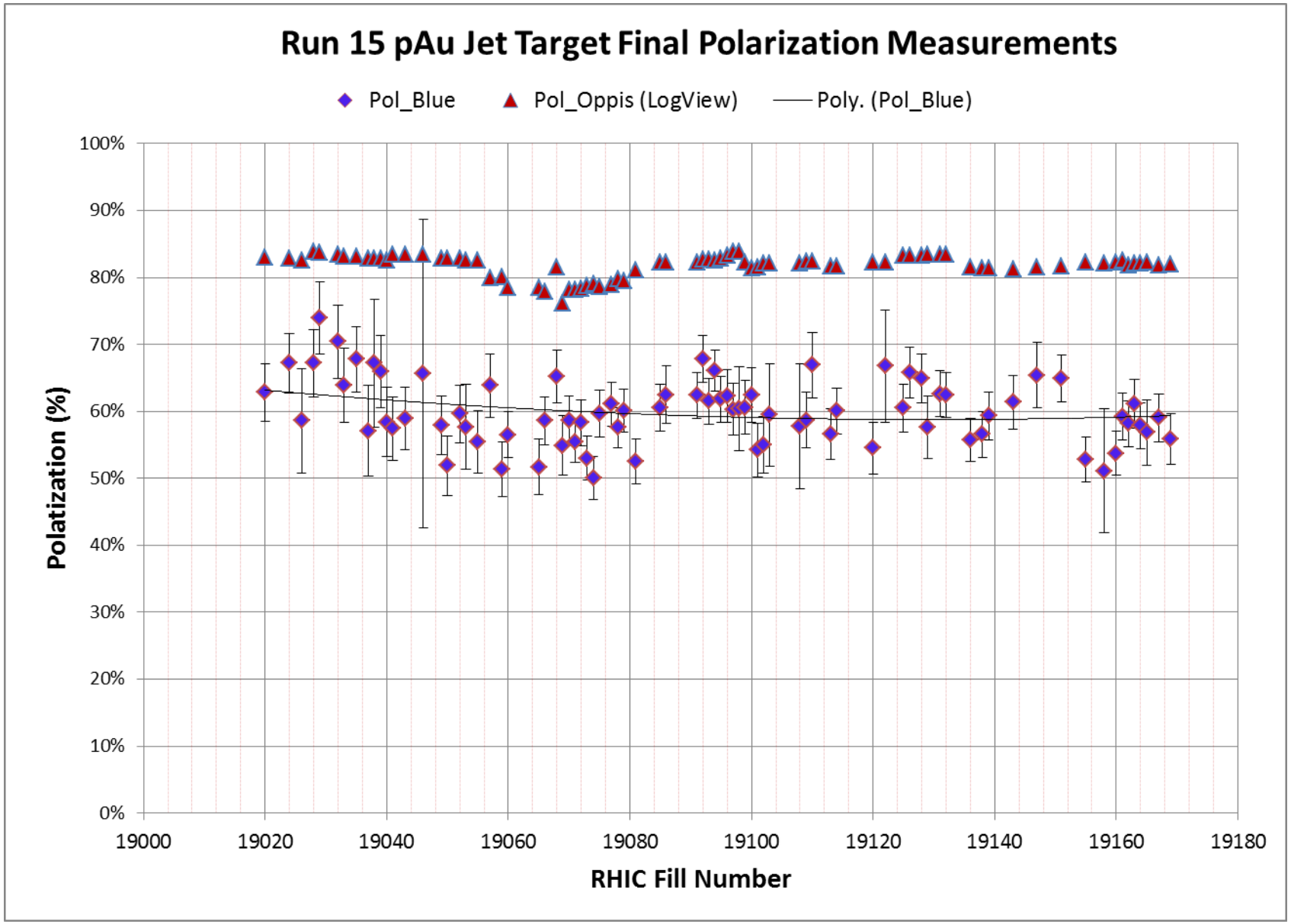
See http://www.rhichome.bnl.gov/AP/Spin2015/ for the Run Coordinator's detailed plan

Through final fill 19169, 6/8/15

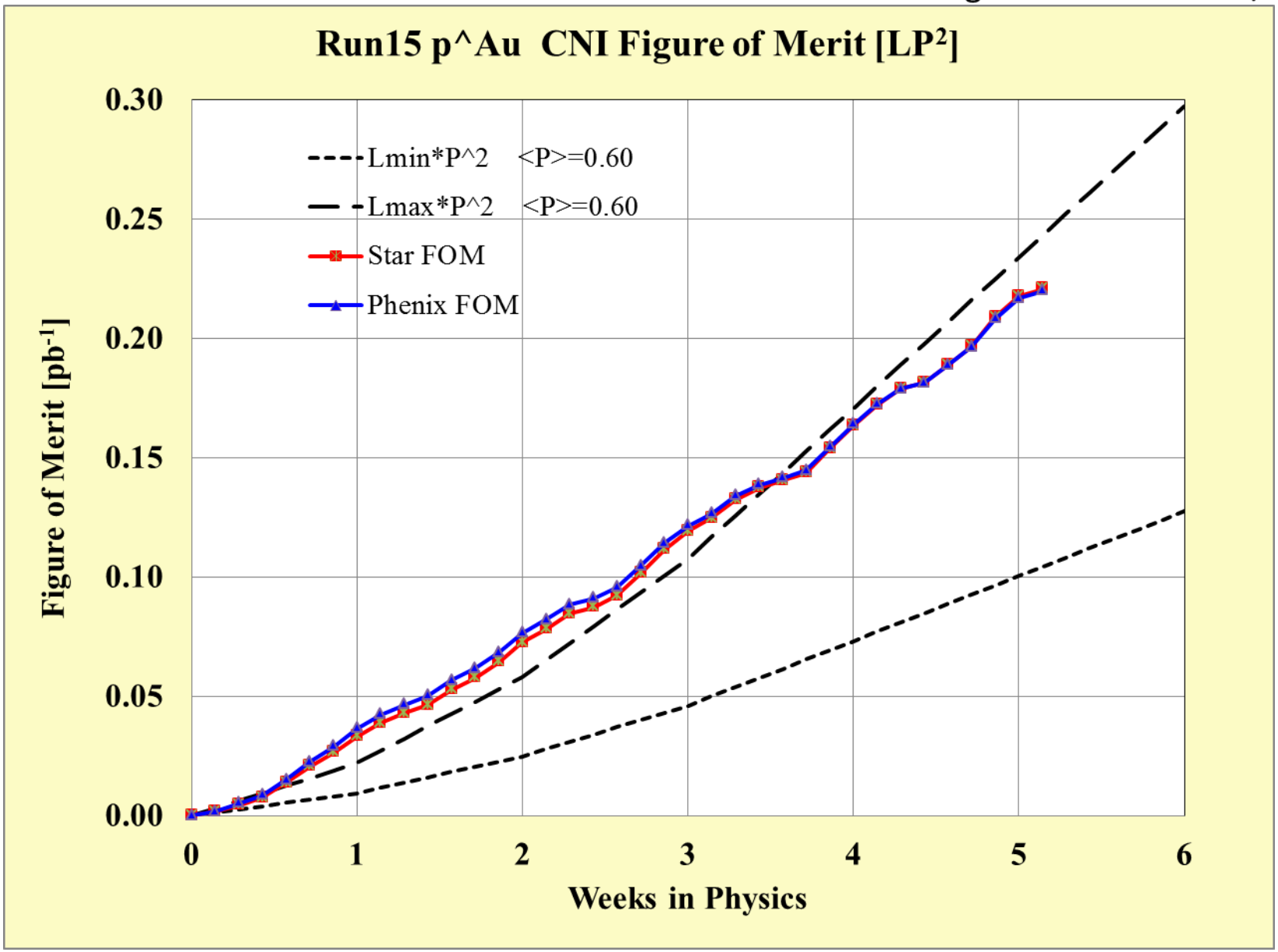


error weighted average 58.6 ± 0.45%

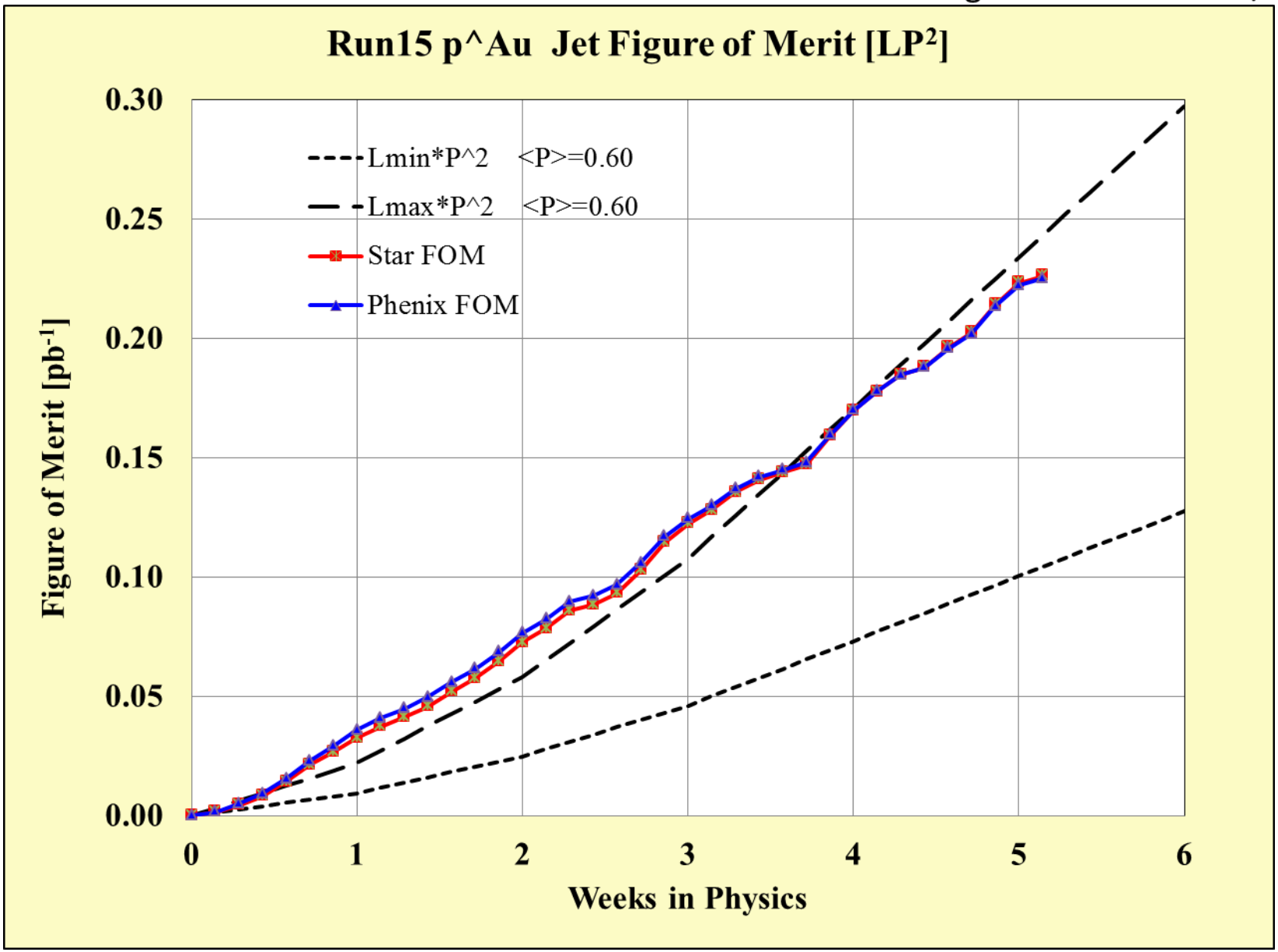
Through final fill 19169, 6/8/15



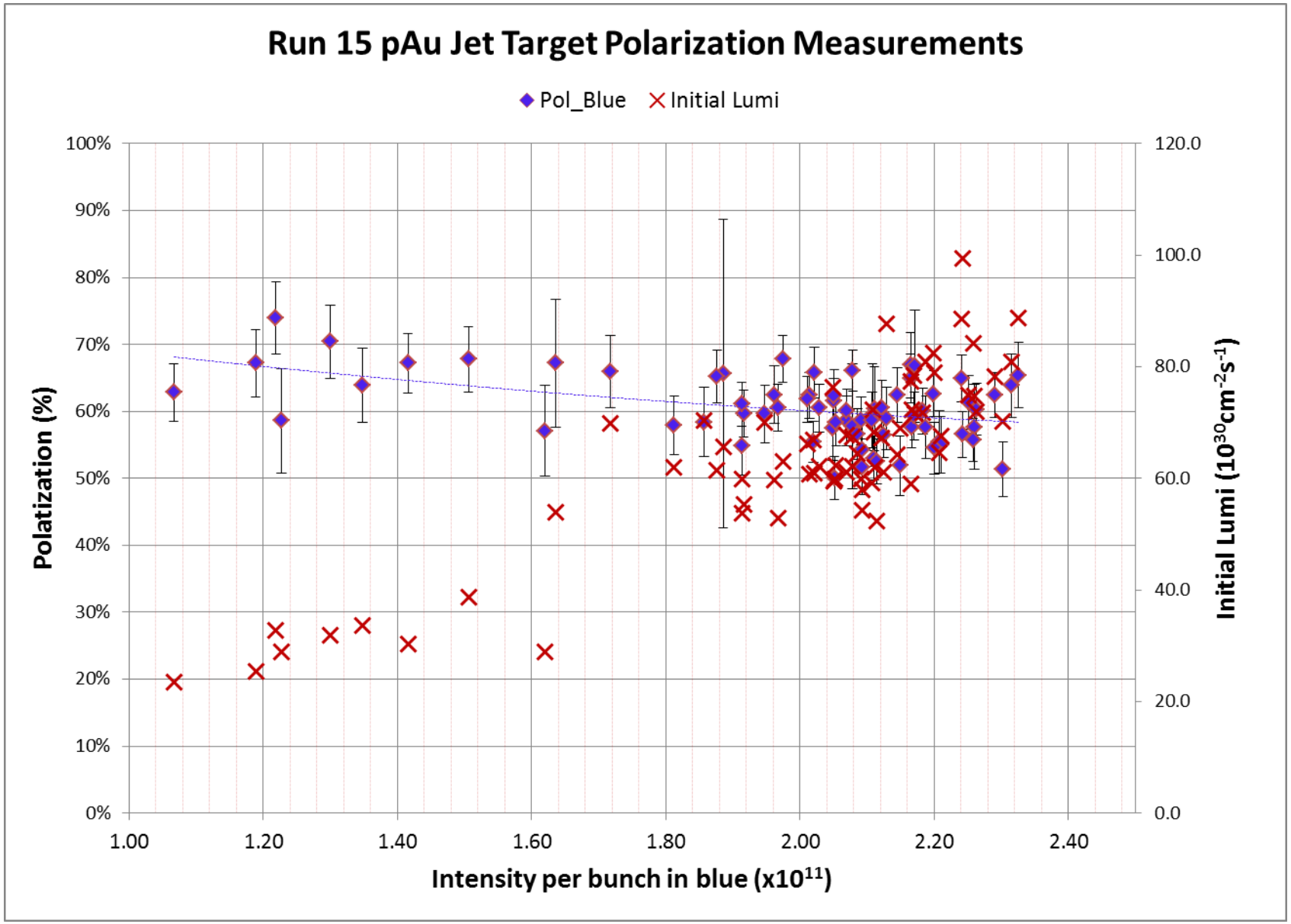
Through final fill 19169 6/9/15

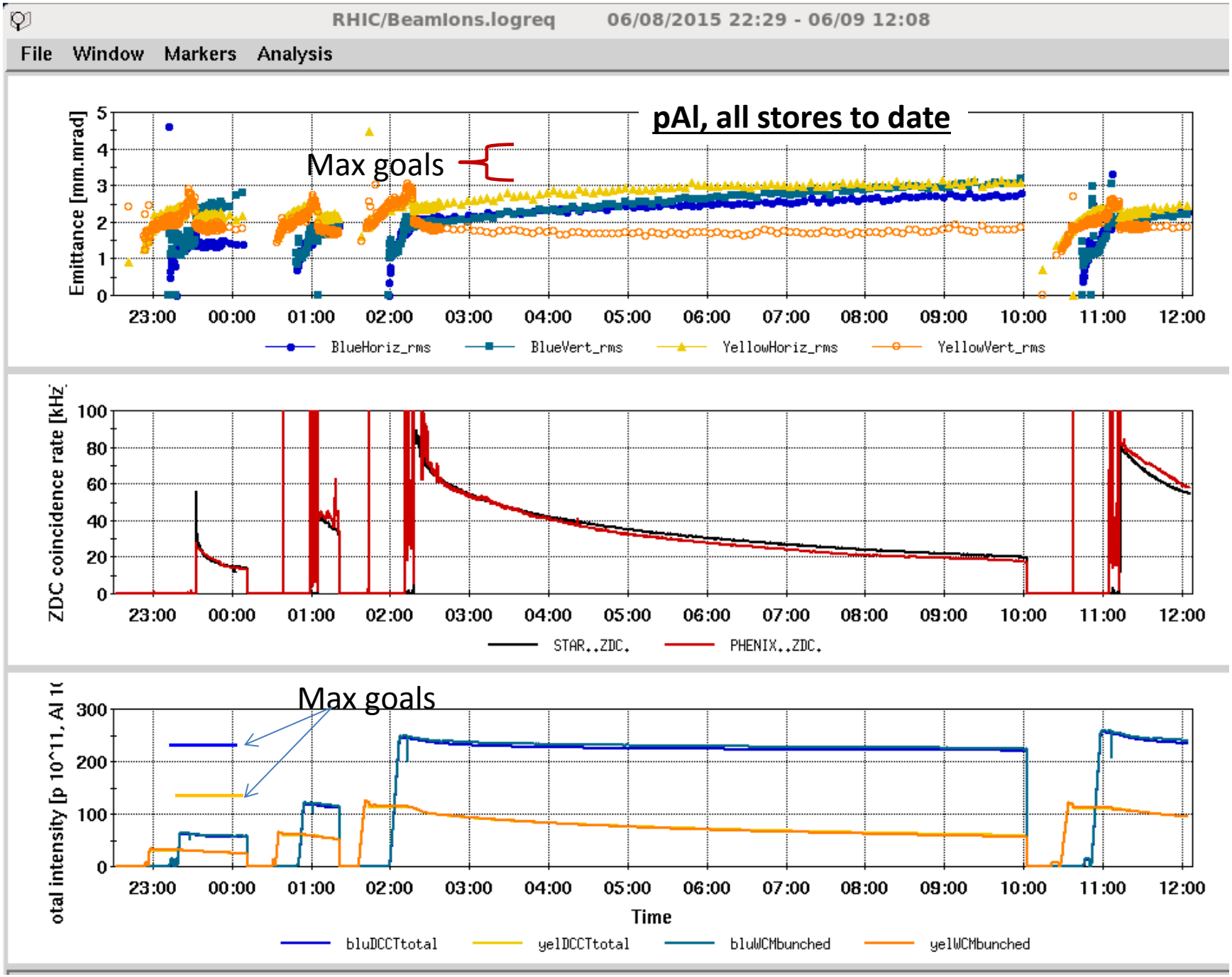


Through final fill 19169 6/9/15

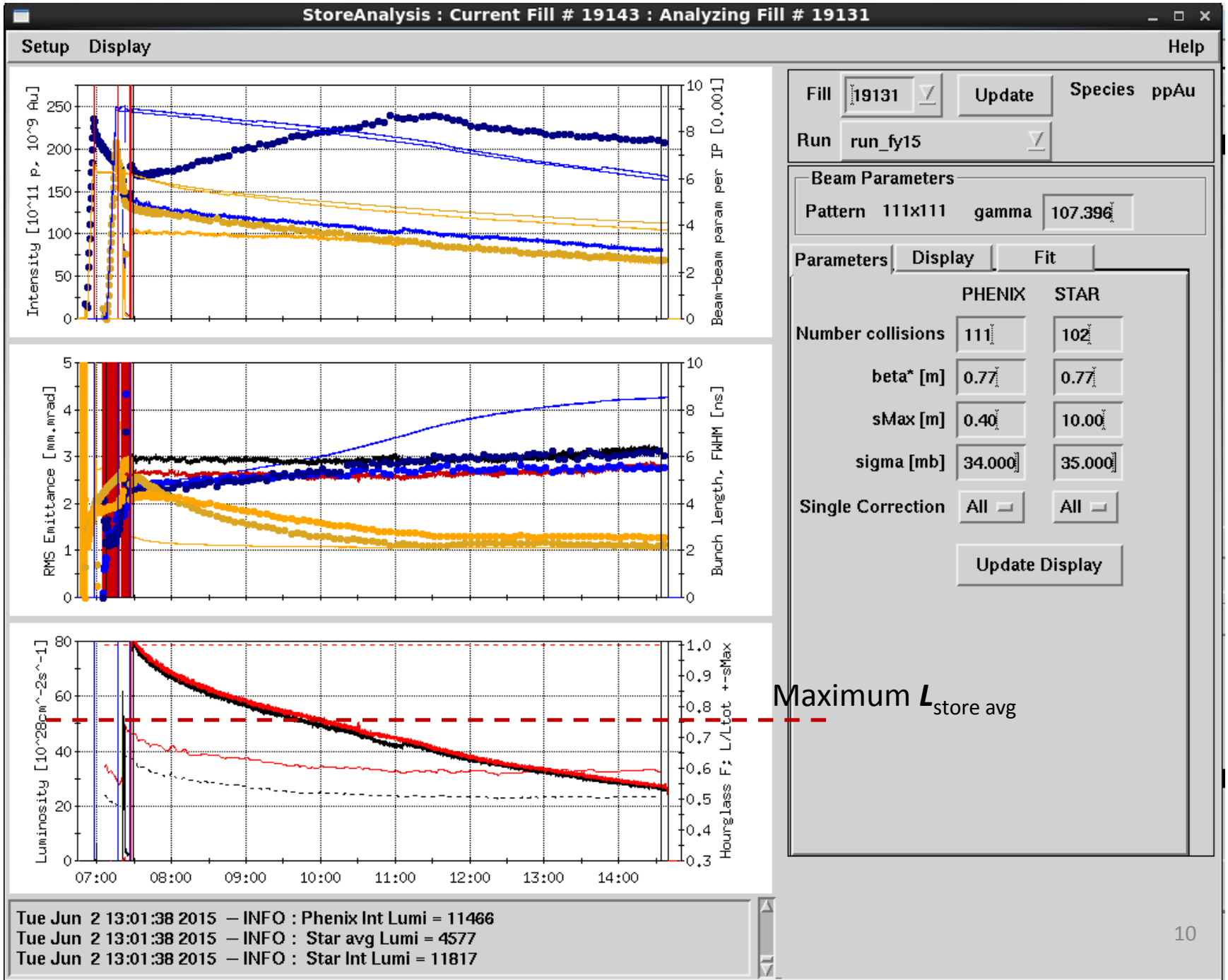


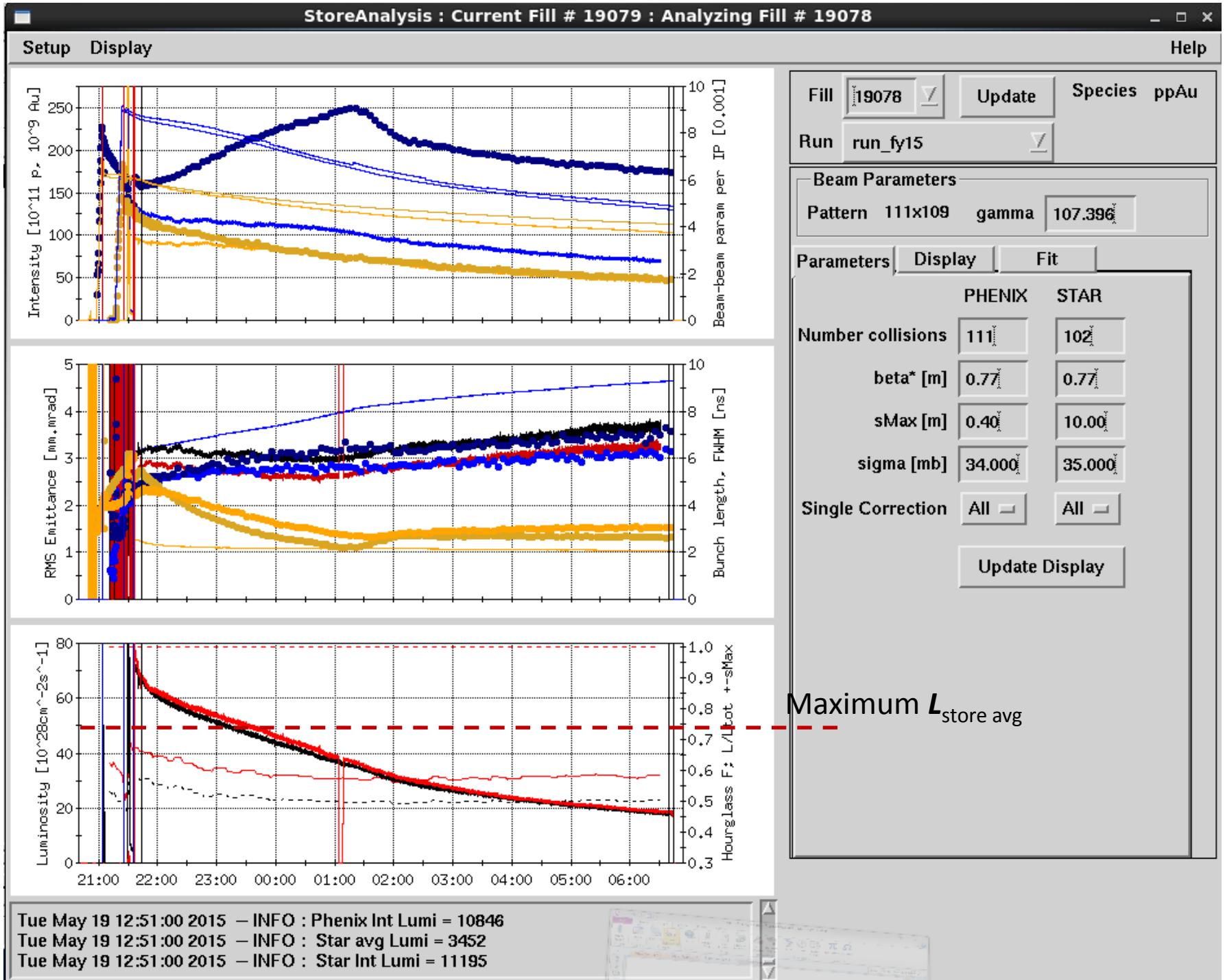
Through fill 19151, 6/4/15 (not final store)




RHIC/BeamIons.logreq 06/08/2015 22:29 - 06/09 12:08
File Window Markers Analysis
pAl, all stores to date
Max goals
Emittance [mm.mrad]
BlueHoriz_rms
BlueVert_rms
YellowHoriz_rms
YellowVert_rms
ZDC coincidence rate [kHz]
STAR..ZDC.
PHENIX..ZDC.
Max goals
otal intensity [p 10^11, Al 1
Time
bluDCCTtotal
yelDCCTtotal
bluWCMbunched
yelWCMbunched

Archive


StoreAnalysis : Current Fill # 19143 : Analyzing Fill # 19131
Setup
Display
Help
Intensity [10^11 p, 10^9 Au]
Beam-beam param per IP [0.001]
RMS Emittance [mm.mrad]
Bunch length, FWHM [ns]
Luminosity [10^28cm^-2s^-1]
Hourglass F; L/Ltot +-sMax
07:00
08:00
09:00
10:00
11:00
12:00
13:00
14:00
Fill
19131
Update
Species
ppAu
Run
run_fy15
Beam Parameters
Pattern
111x111
gamma
107.396
Parameters
Display
Fit
PHENIX
STAR
Number collisions
111
102
beta* [m]
0.77
0.77
sMax [m]
0.40
10.00
sigma [mb]
34.000
35.000
Single Correction
All
All
Update Display
Maximum $L_{\text{store avg}}$
Tue Jun 2 13:01:38 2015 — INFO : Phenix Int Lumi = 11466
Tue Jun 2 13:01:38 2015 — INFO : Star avg Lumi = 4577
Tue Jun 2 13:01:38 2015 — INFO : Star Int Lumi = 11817



Maximum $L_{\text{store avg}}$

http://www.bnl.gov/cad/esfd

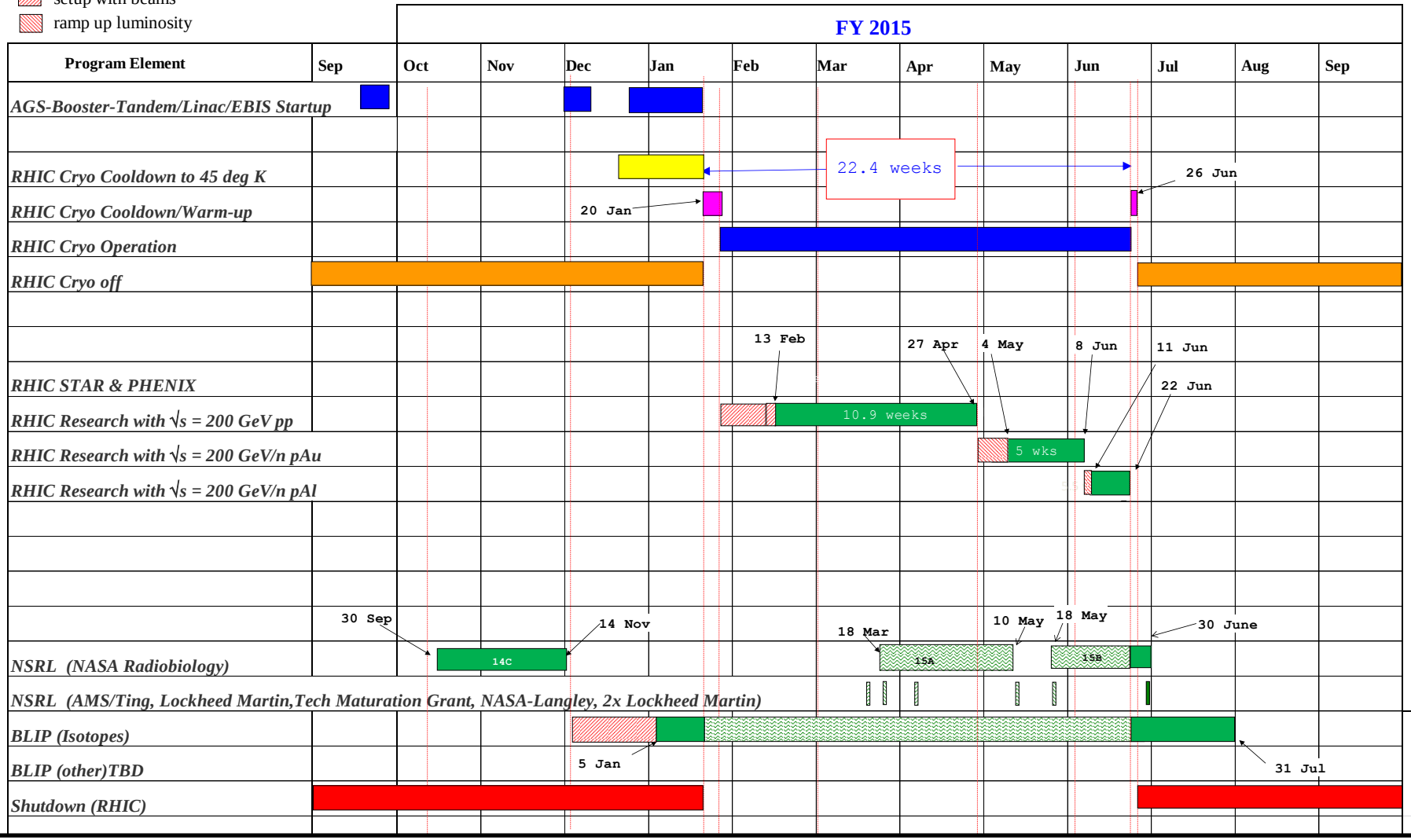
Scheduling Physicist: Makdisi/Pile

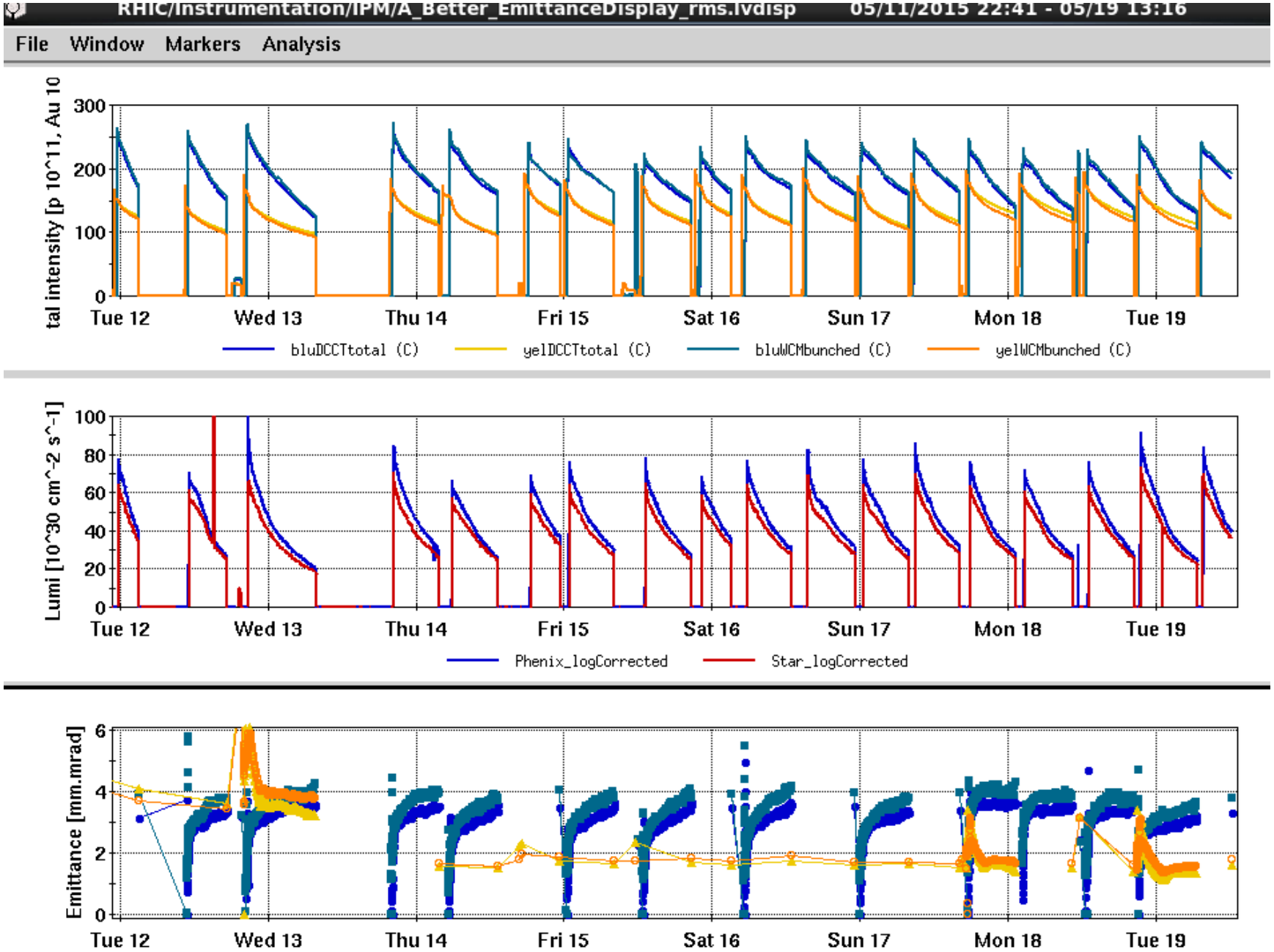
C-A Operations-FY15

19 May 15

concurrent with RHIC
setup with beams
ramp up luminosity

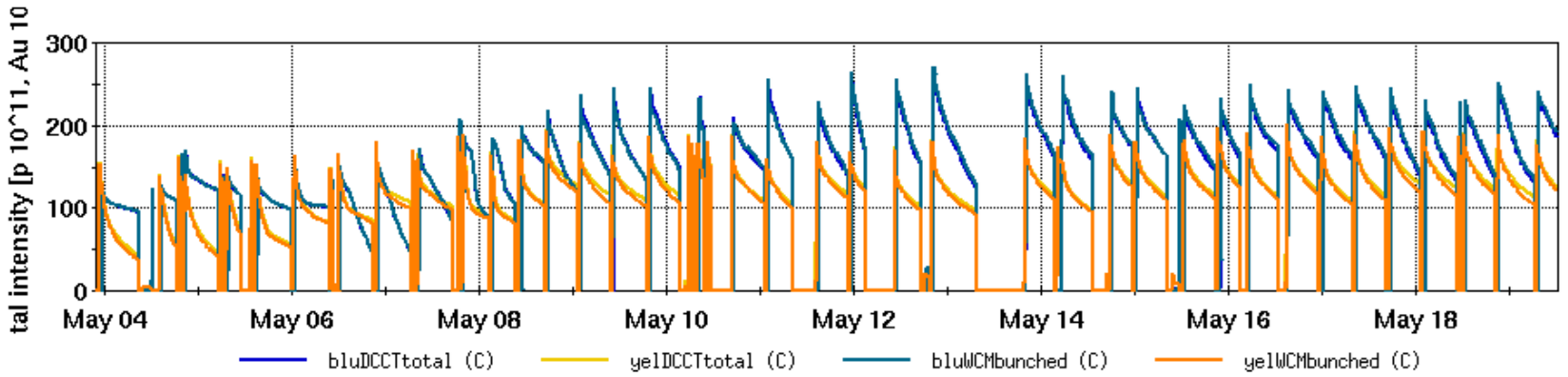
as run,planned

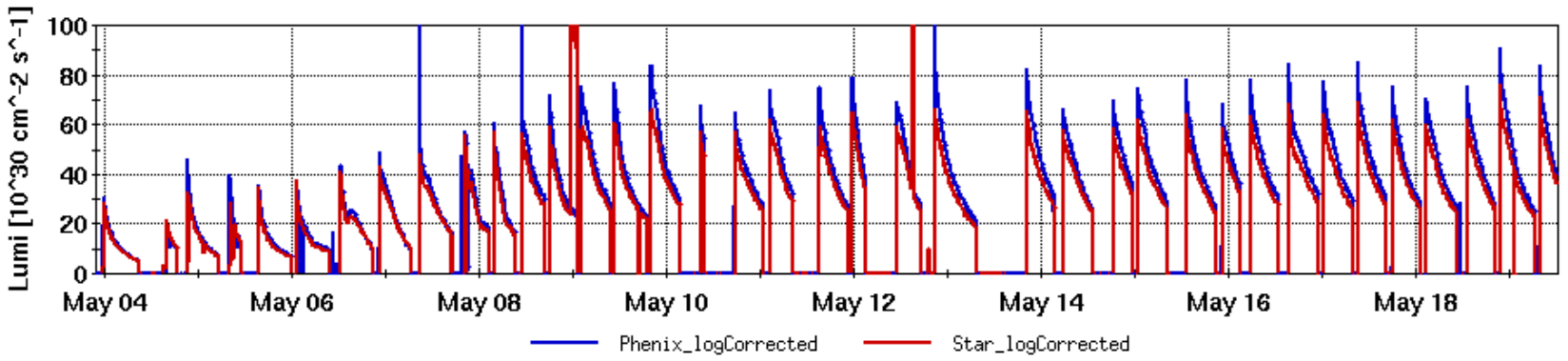


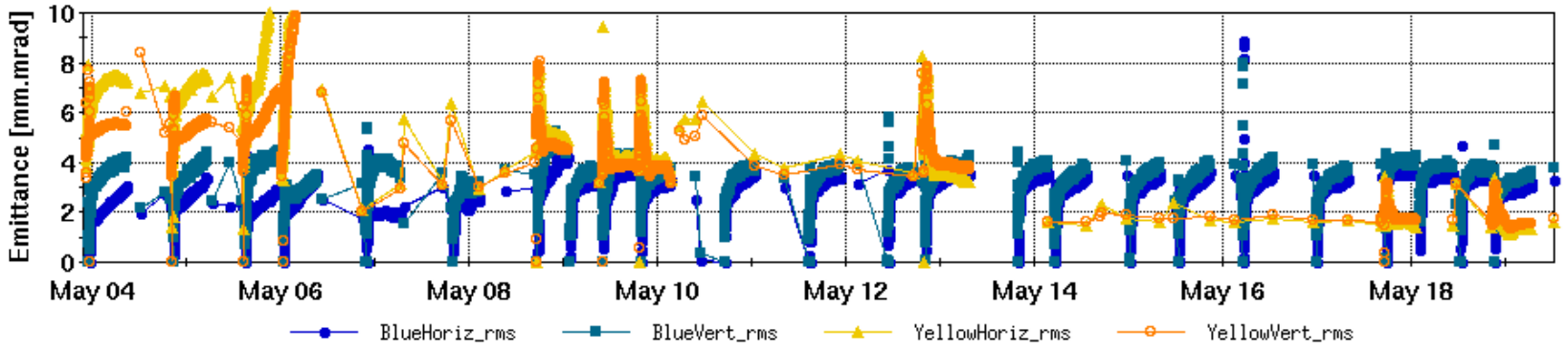

RHIC/Instrumentation/IPM/A_Better_EmittanceDisplay_rms.lvdisp 05/11/2015 22:41 - 05/19 13:16
File Window Markers Analysis
tal intensity [p 10^11, Au 10
300
200
100
0
Tue 12
Wed 13
Thu 14
Fri 15
Sat 16
Sun 17
Mon 18
Tue 19
bluDCCTtotal (C)
yelDCCTtotal (C)
bluWCMbunched (C)
yelWCMbunched (C)
Lumi [10^30 cm^-2 s^-1]
100
80
60
40
20
0
Phenix_logCorrected
Star_logCorrected
Emittance [mm.mrad]
6
4
2
0

RHIC/Instrumentation/IPM/A_Better_EmittanceDisplay_rms.lvdisp 05/03/2015 21:52 - 05/19 12:23

File Window Markers Analysis







p+Au @ 200 GeV, Experiment Goals

PHENIX:

- 5 week goal is 190 nb−1 sampled within |z| < 40 cm and polarization (transverse) = 60%.
- Assumptions:
  - Uptime = 70%
  - Fraction of events within 40 cm = 70%
  - Live Time = 90%

→ delivered lumi = 190/(0.7*0.7*0.9)= 430 nb-1

STAR:

- 5 week goal is 300 nb−1 sampled and polarization (transverse) = 60%.
- Assumptions:
  - Sampling efficiency = 60%

→ delivered lumi = 300/(0.6)= 500 nb-1

Pol goal = 60% (experiments)

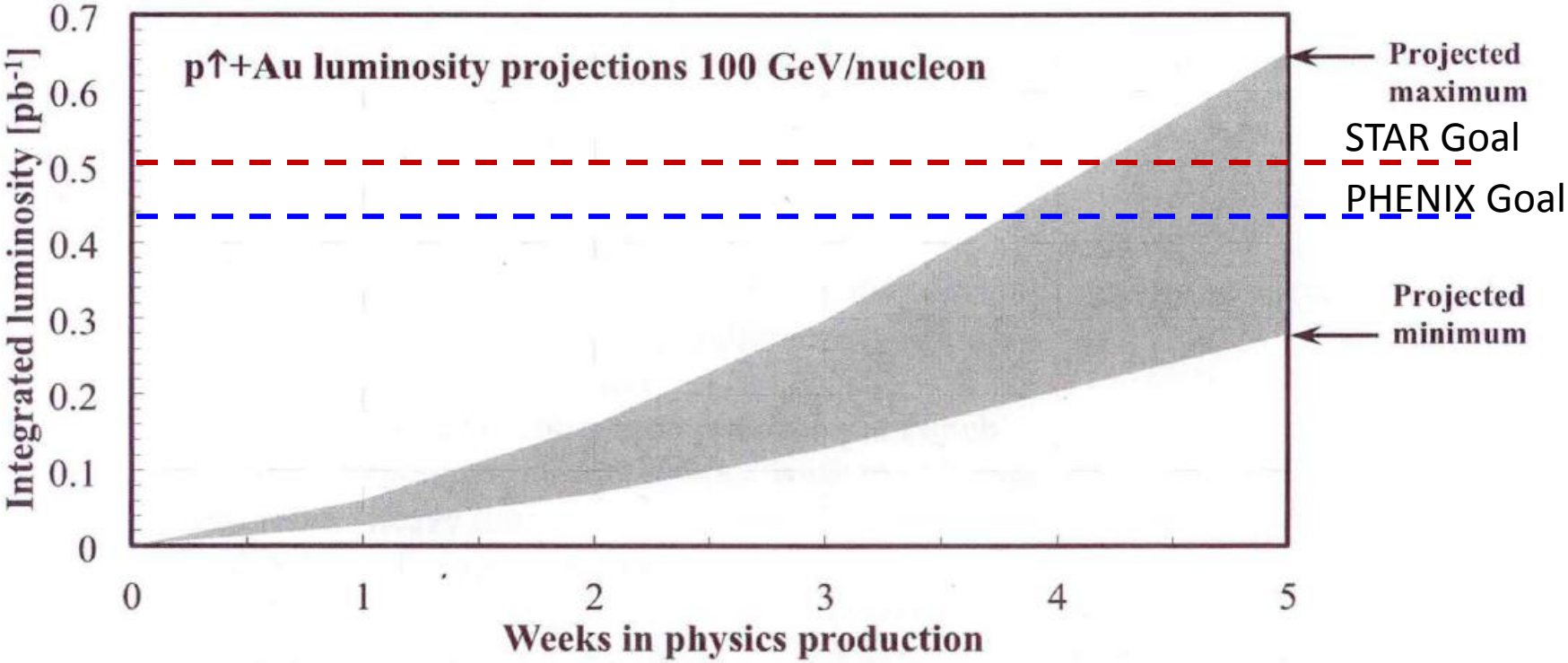
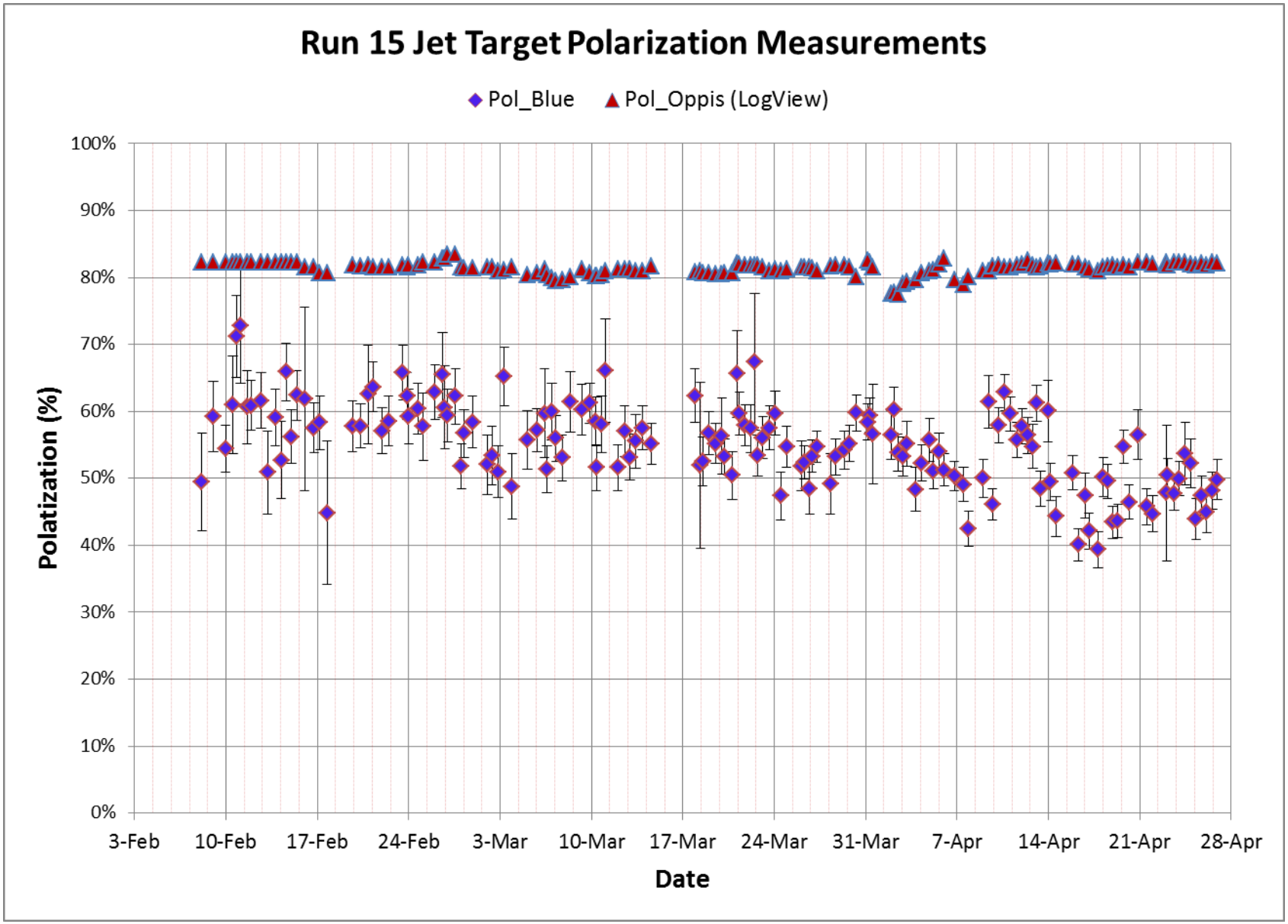
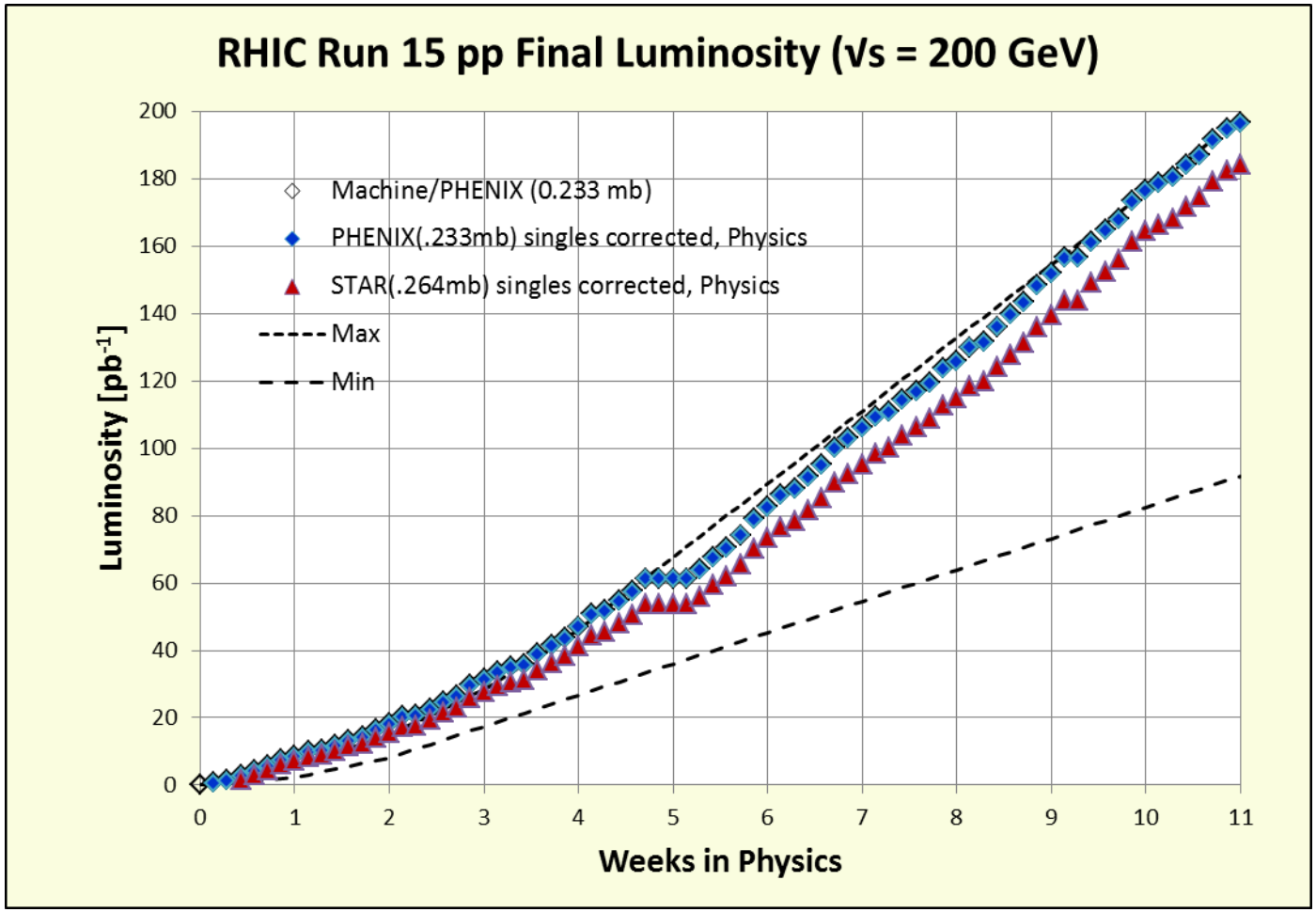


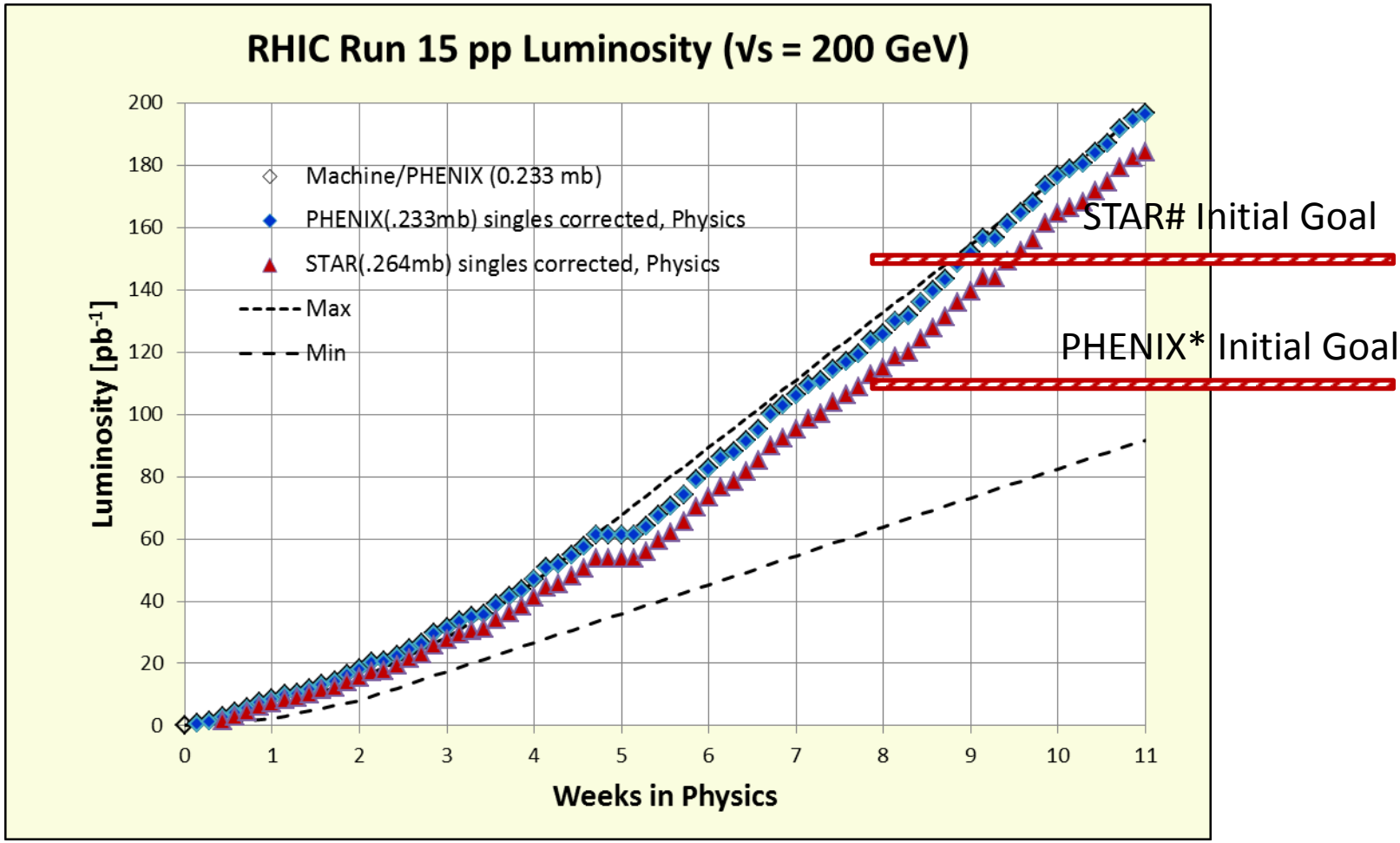
Figure 4: Projected minimum and maximum integrated luminosities for p↑+Au at 100 GeV/nucleon assuming linear weekly luminosity ramp-up in 4 weeks. The average store polarization of the proton beam expected to be close to the polarization achieved in the 100 GeV p↑+p↑ run.



through fill 18926, 4/20/15


RHIC Run 15 pp Final Luminosity (√s = 200 GeV)
Machine/PHENIX (0.233 mb)
PHENIX(.233mb) singles corrected, Physics
STAR(.264mb) singles corrected, Physics
Max
Min
Luminosity [pb-1]
Weeks in Physics
0
20
40
60
80
100
120
140
160
180
200
0
1
2
3
4
5
6
7
8
9
10
11

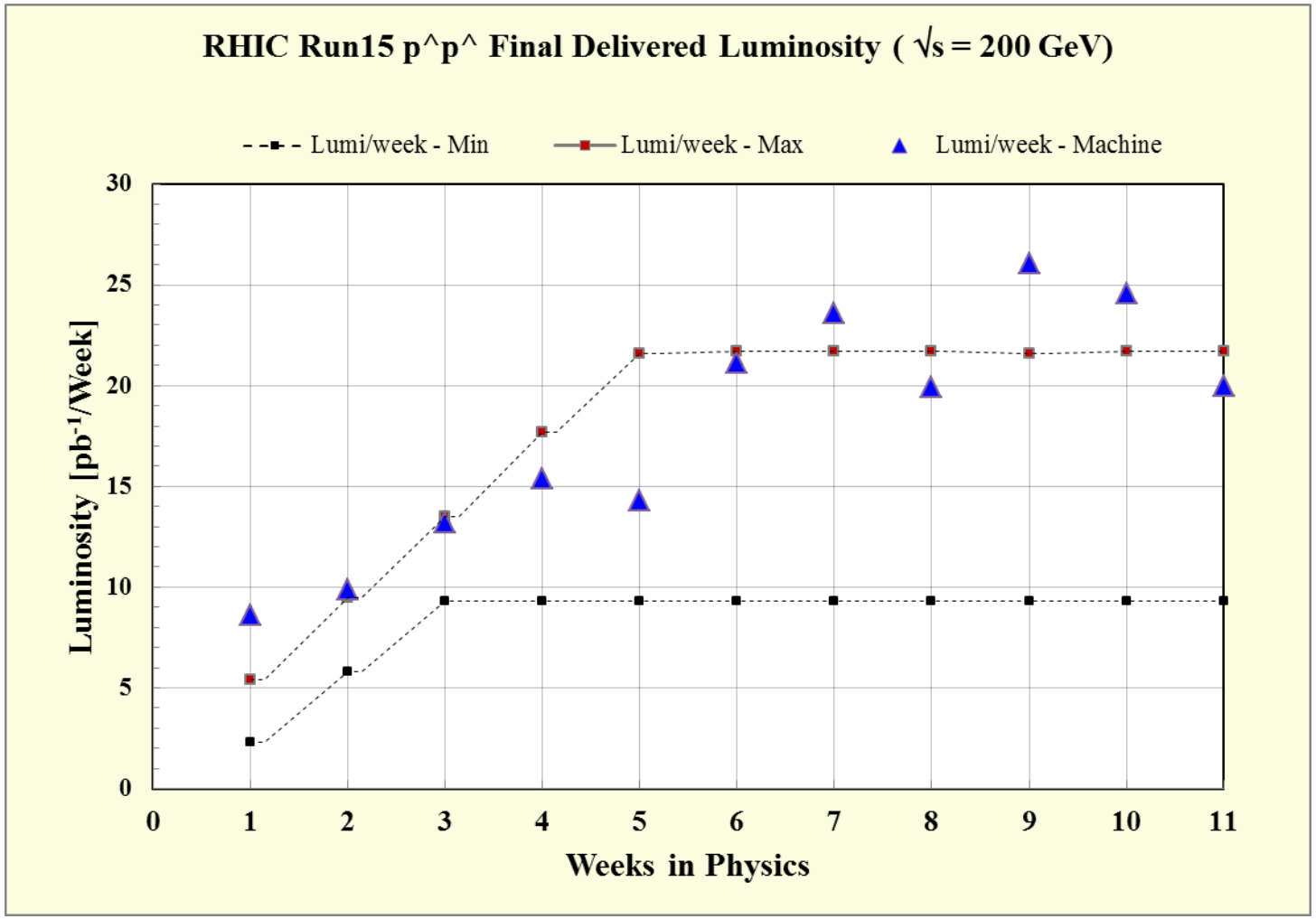
Through final store (18953) 27 April



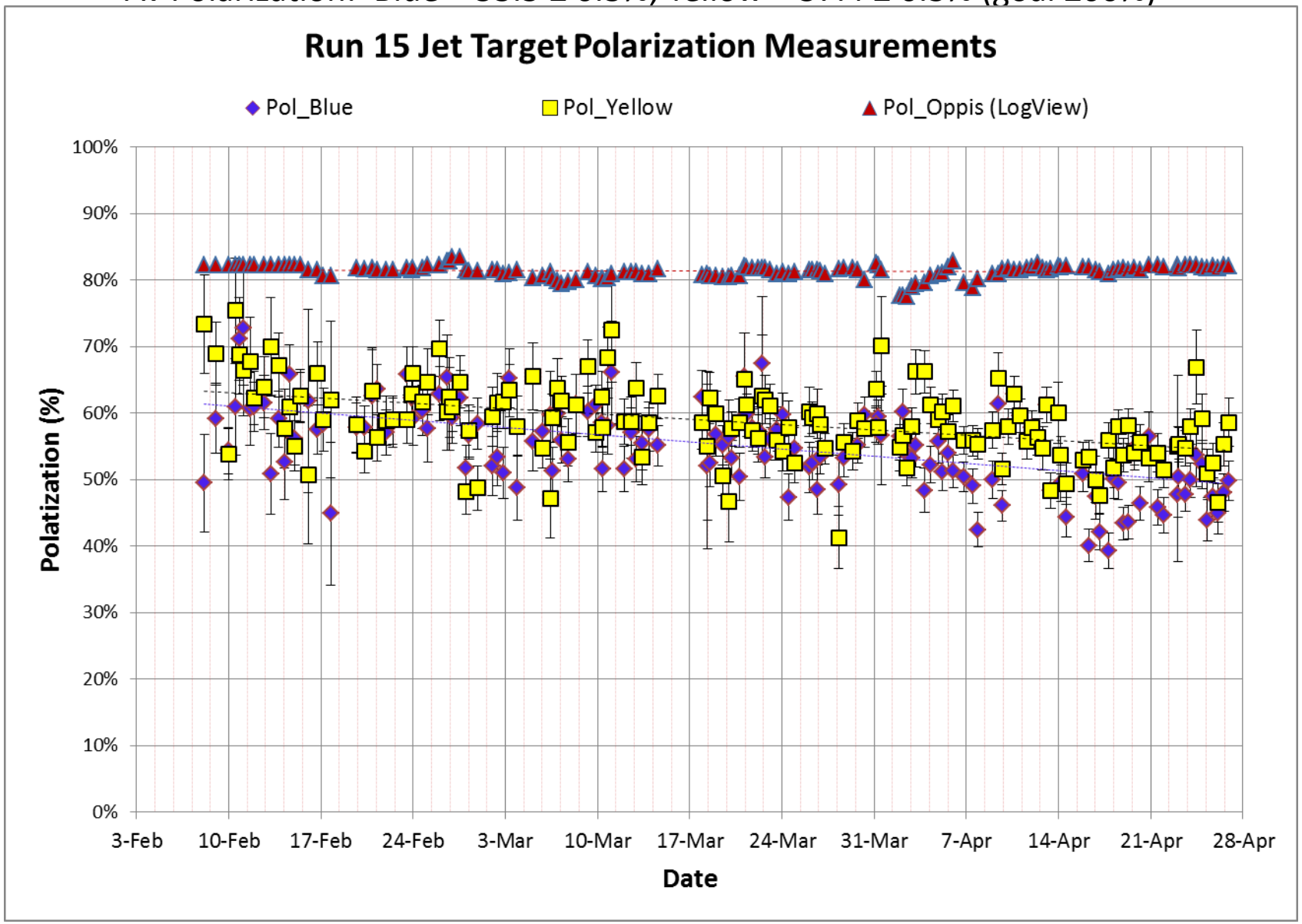
*Based on beam use request

Based on beam use request with 12 weeks physics

Through final store (18953) 27 April

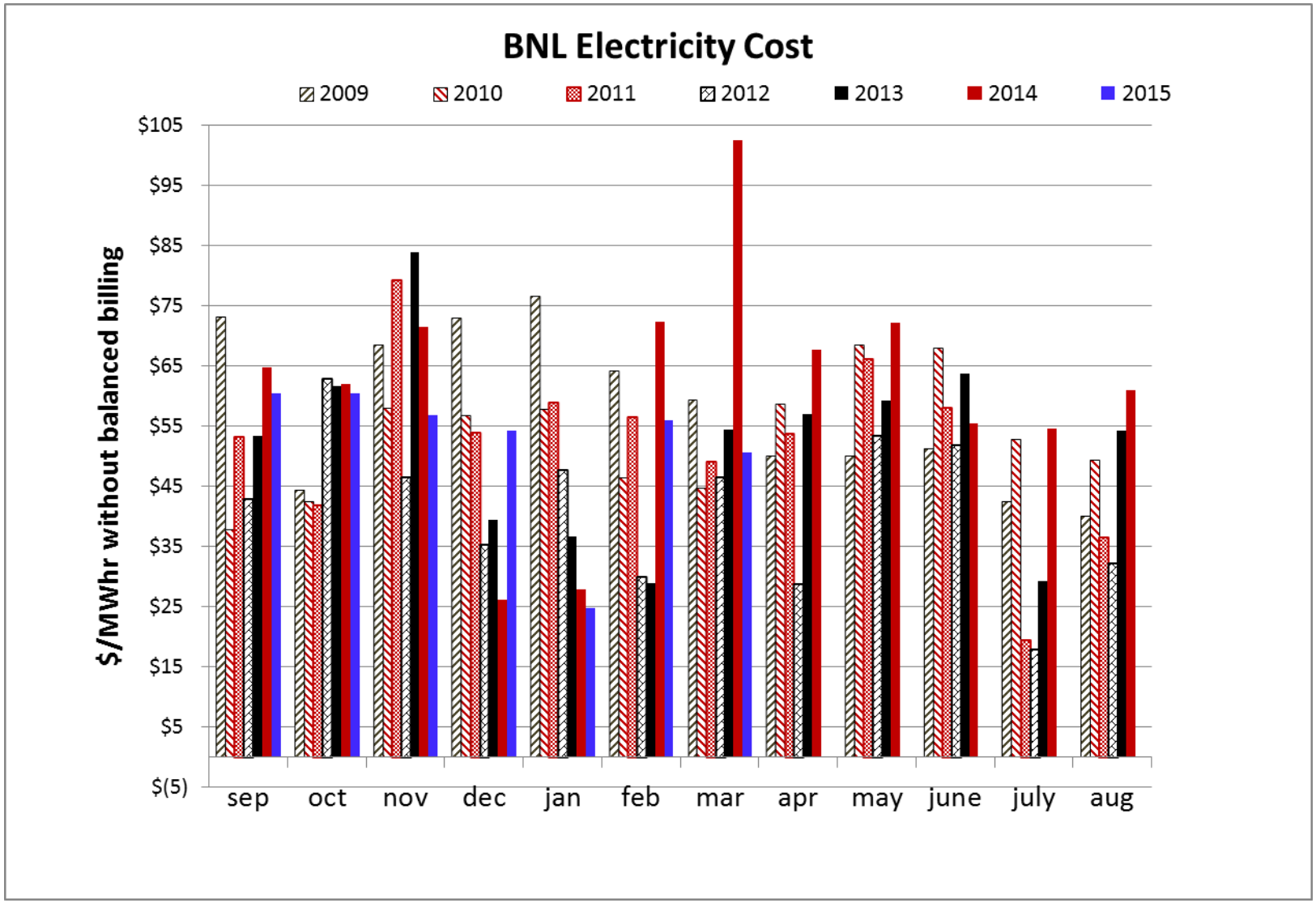


Av Polarization: Blue = 53.5 ± 0.3%; Yellow = 57.4 ± 0.3% (goal ≥60%)

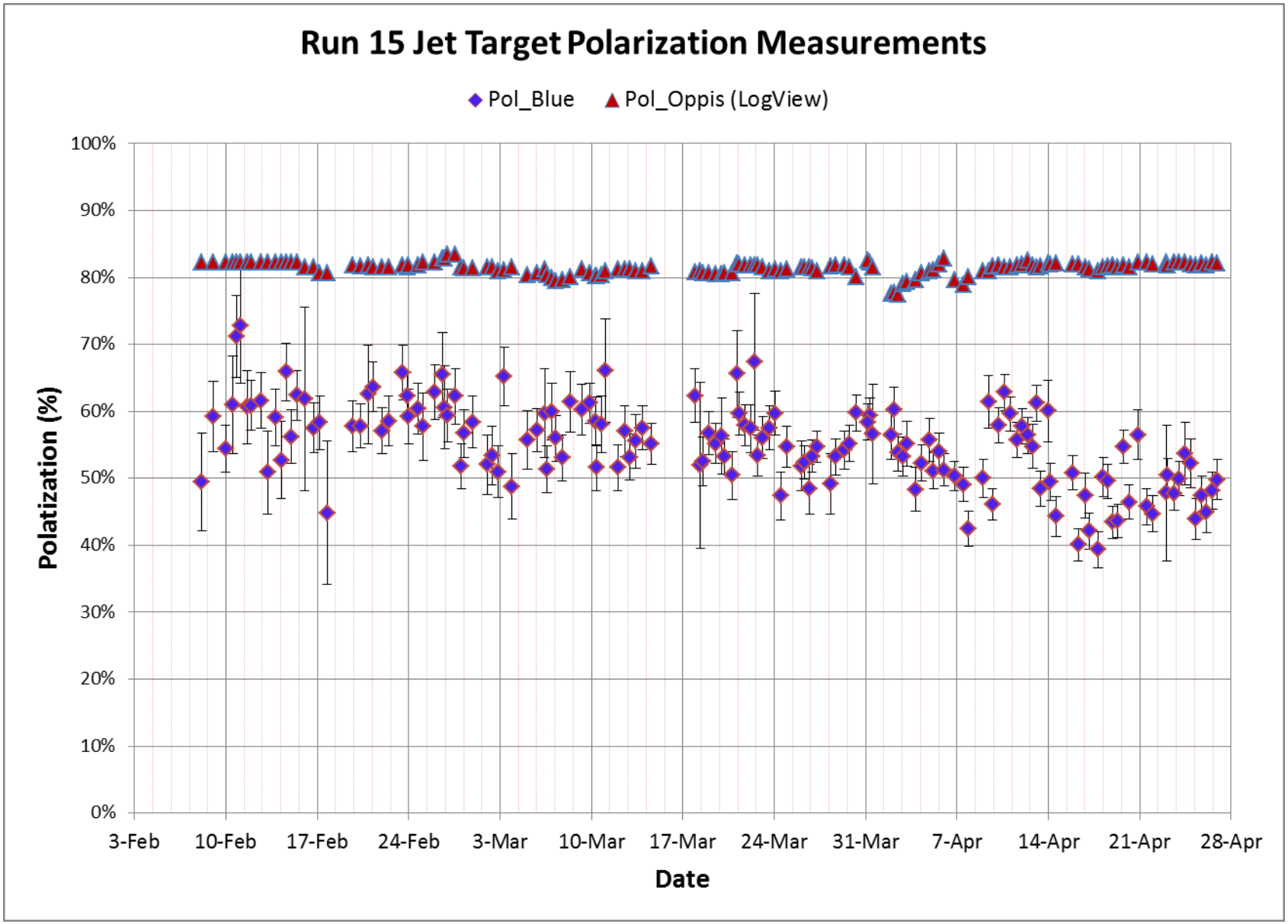


through fill 18926, 4/20/15

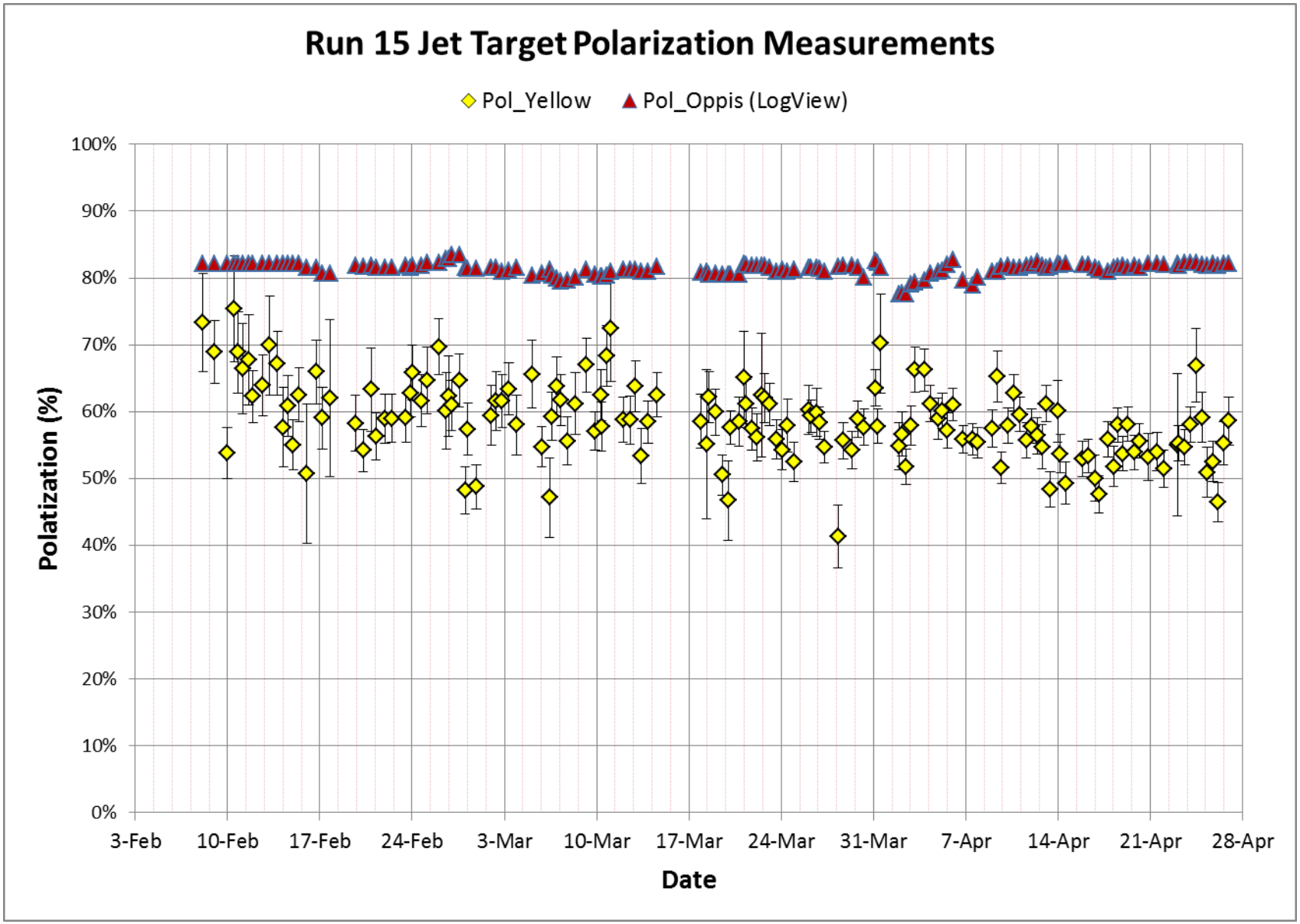
Balanced Billing for the lab - +1,483K through Mar 2015



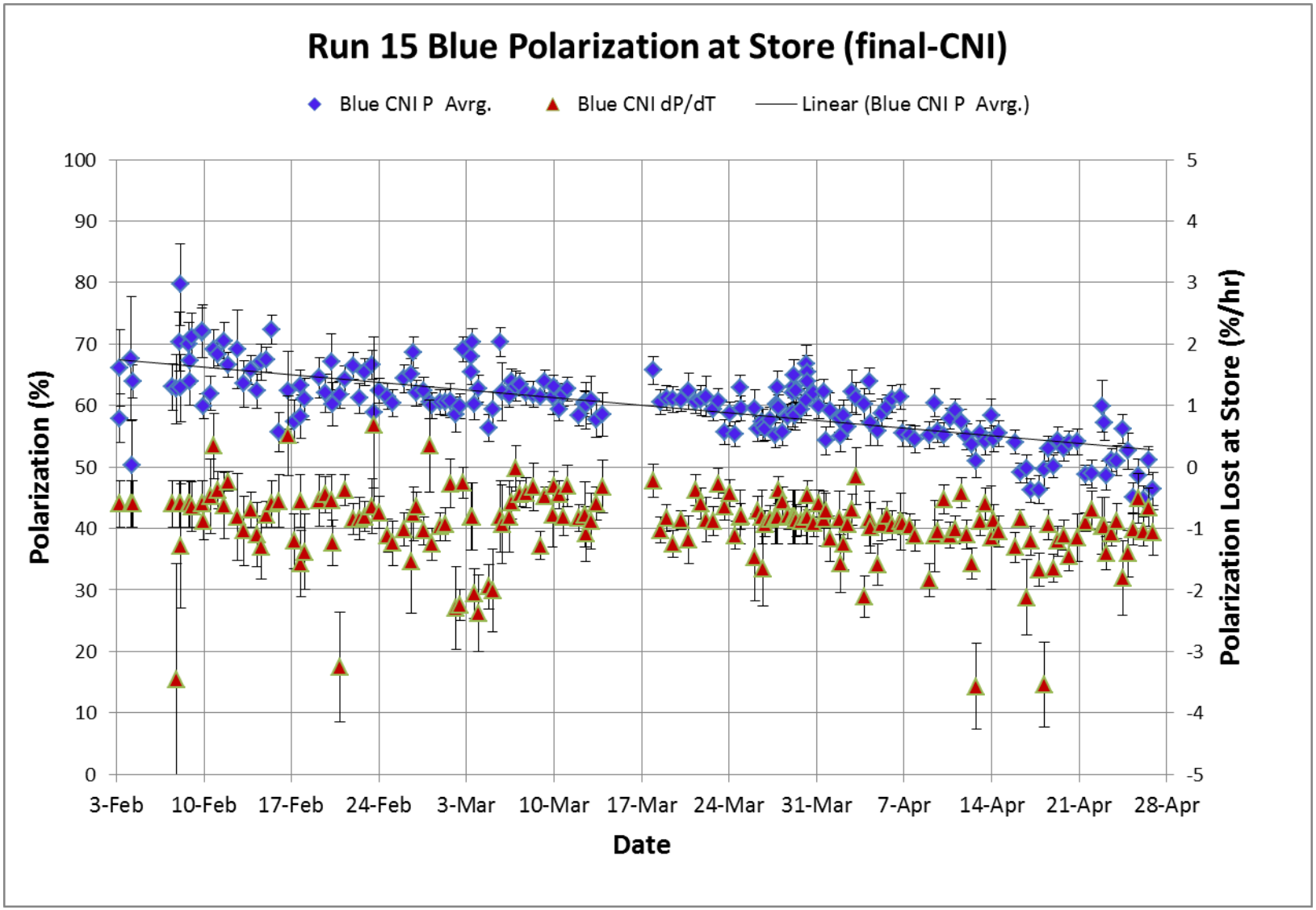
Supplemental 1



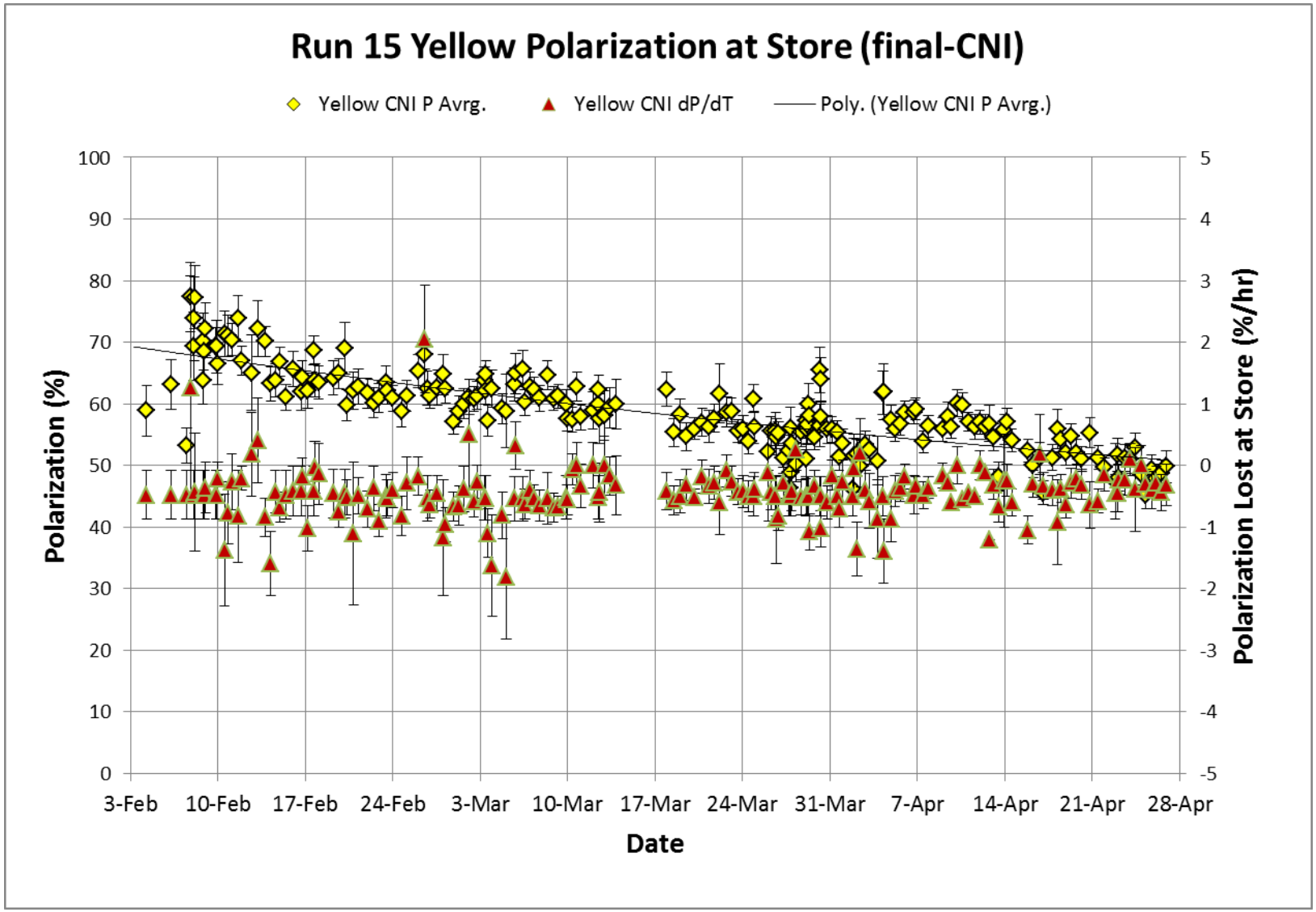
through fill 18926, 4/20/15



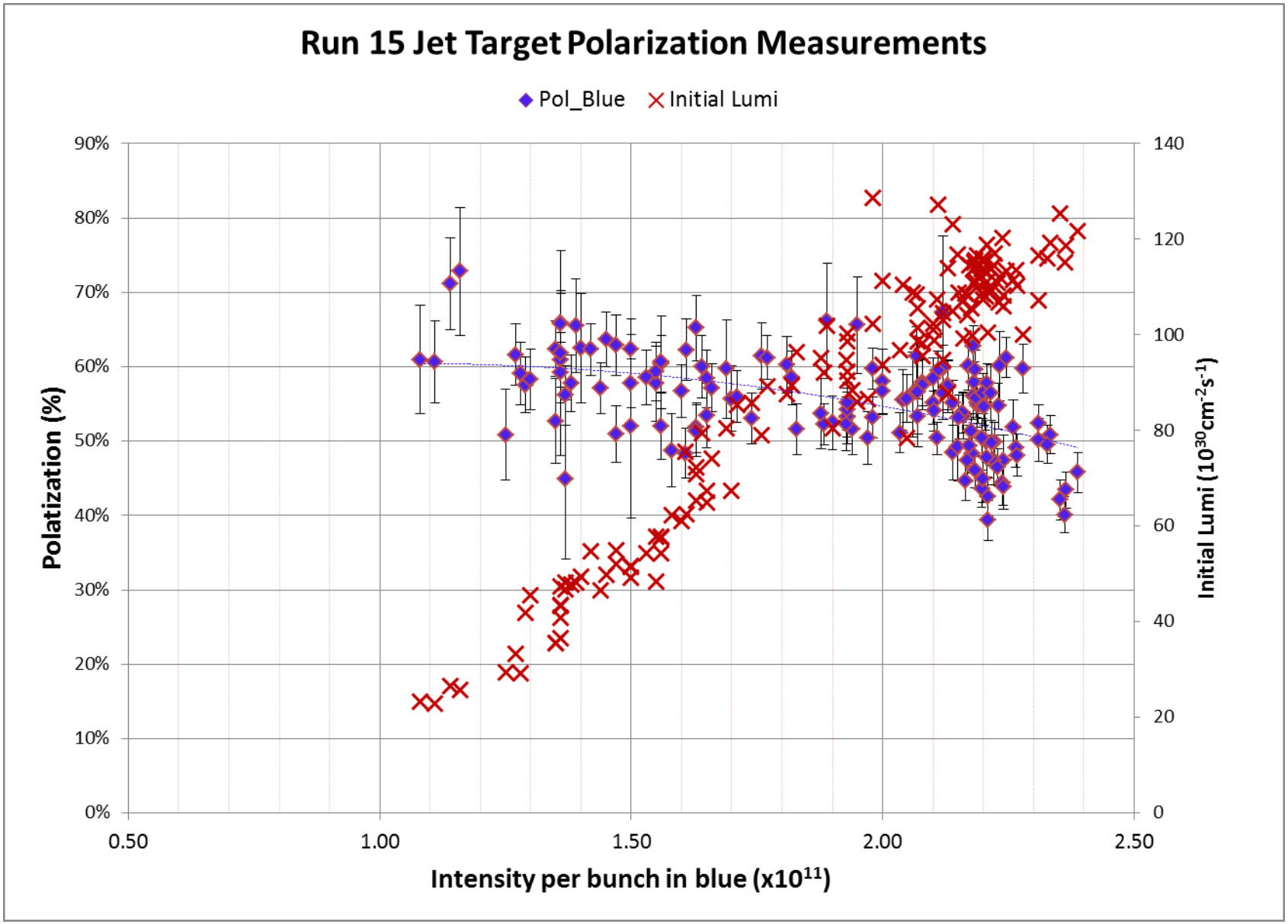
through fill 18926, 4/20/15

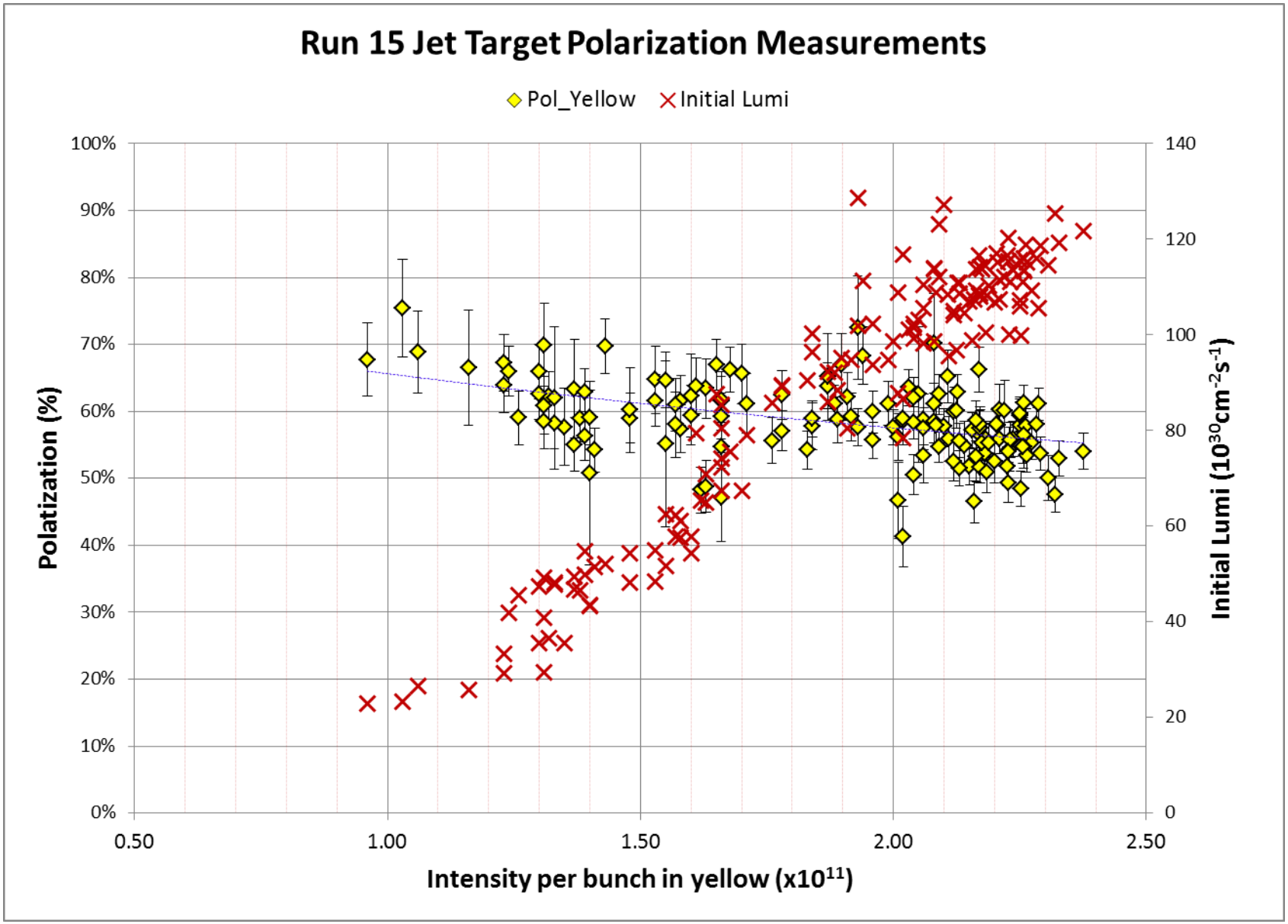


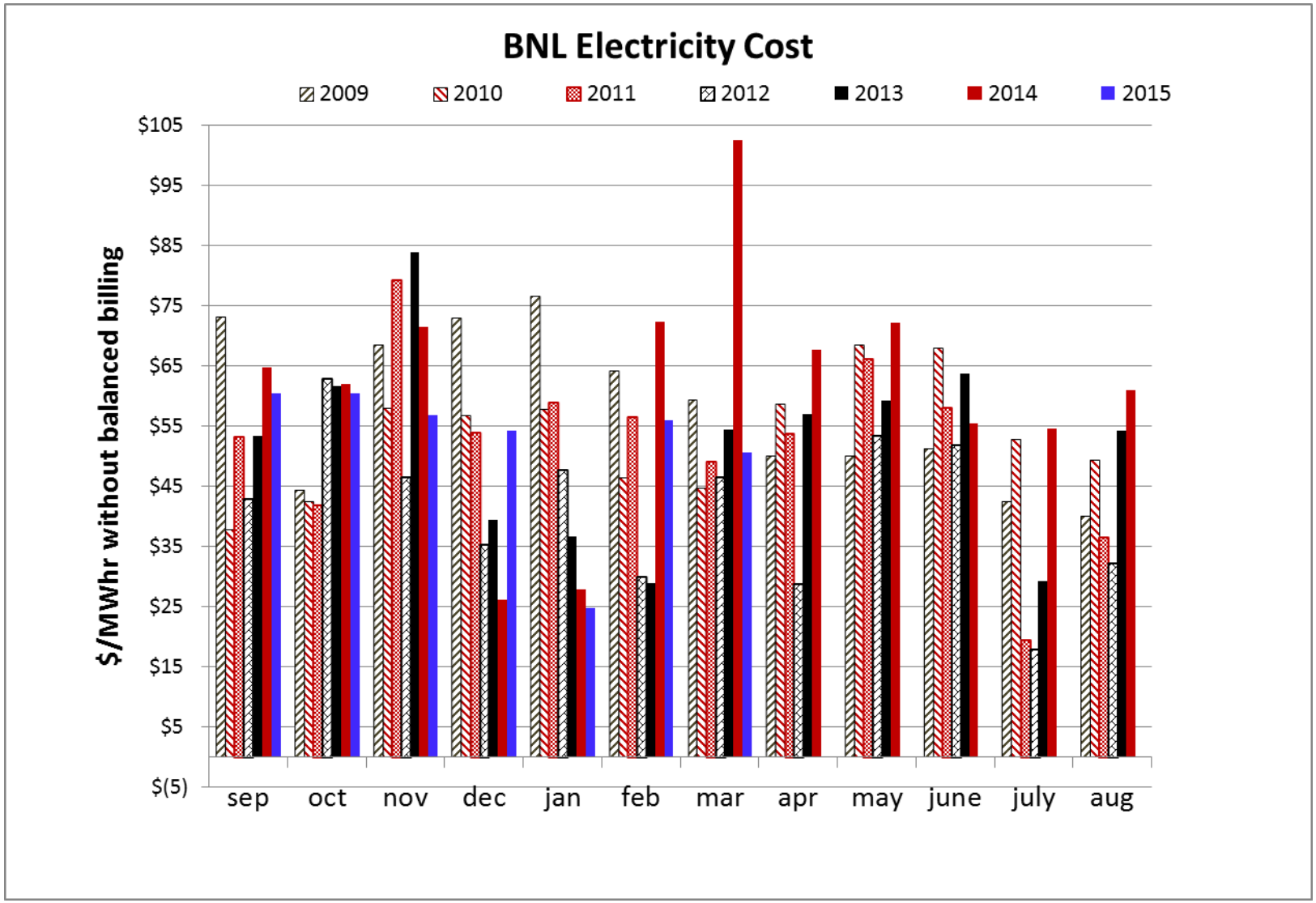
through fill 18928, 4/20/15



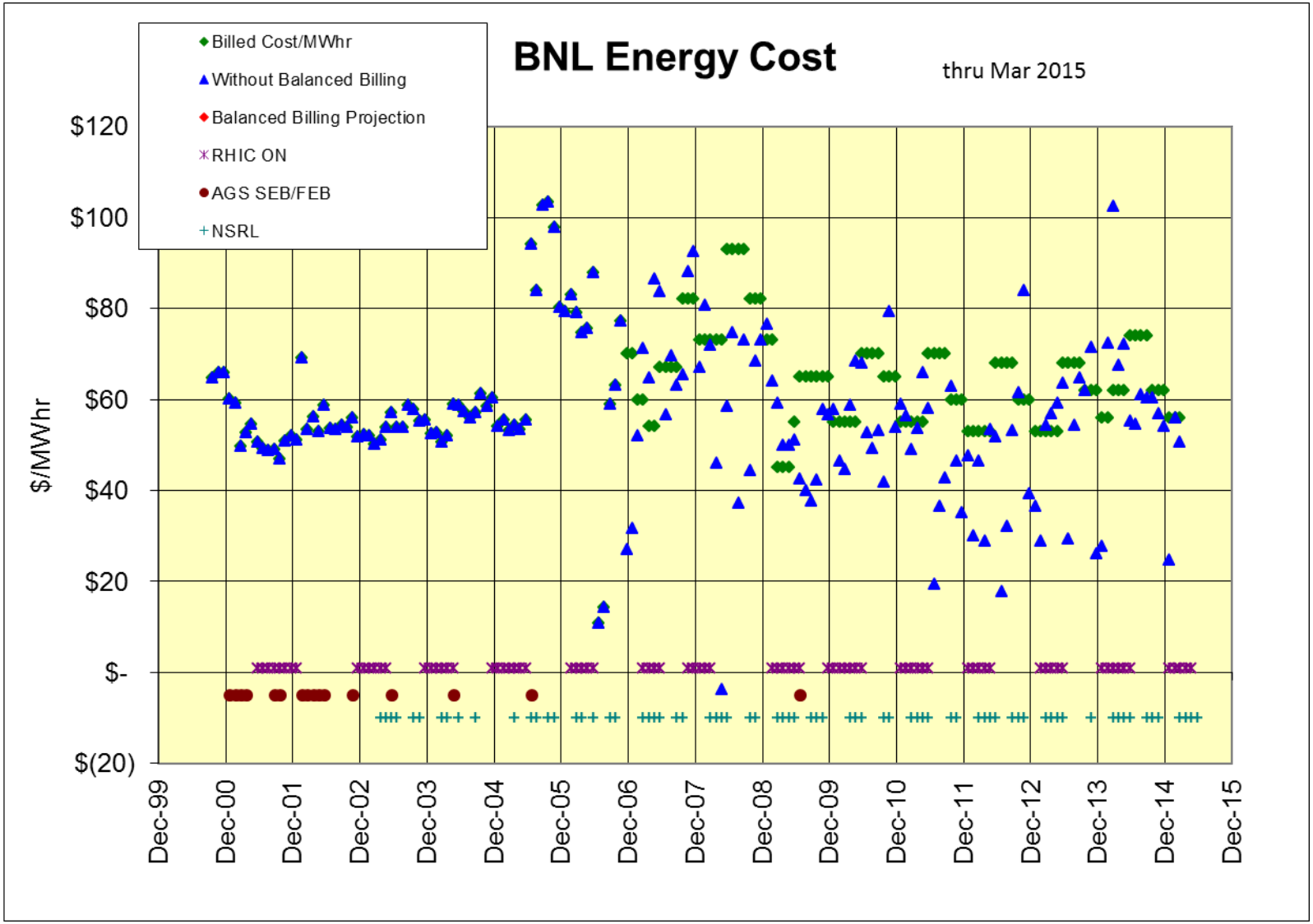
through fill 18928, 4/20/15

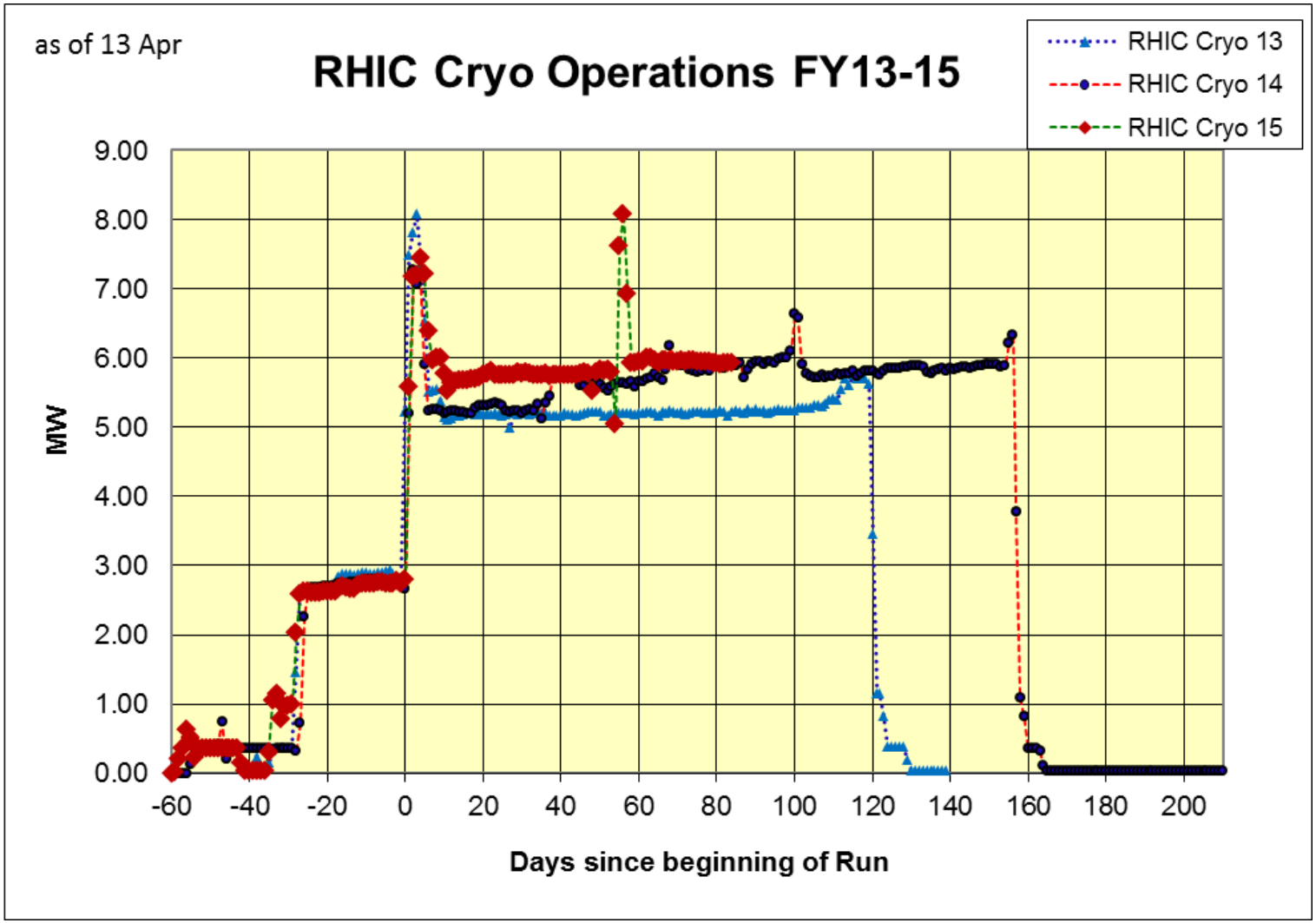

Run 15 Jet Target Polarization Measurements
Pol_Blue
Initial Lumi
Polatization (%)
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.50
1.00
1.50
2.00
2.50
Intensity per bunch in blue (x10^11)
140
120
100
80
60
40
20
0
Initial Lumi (10^30cm^-2s^-1)

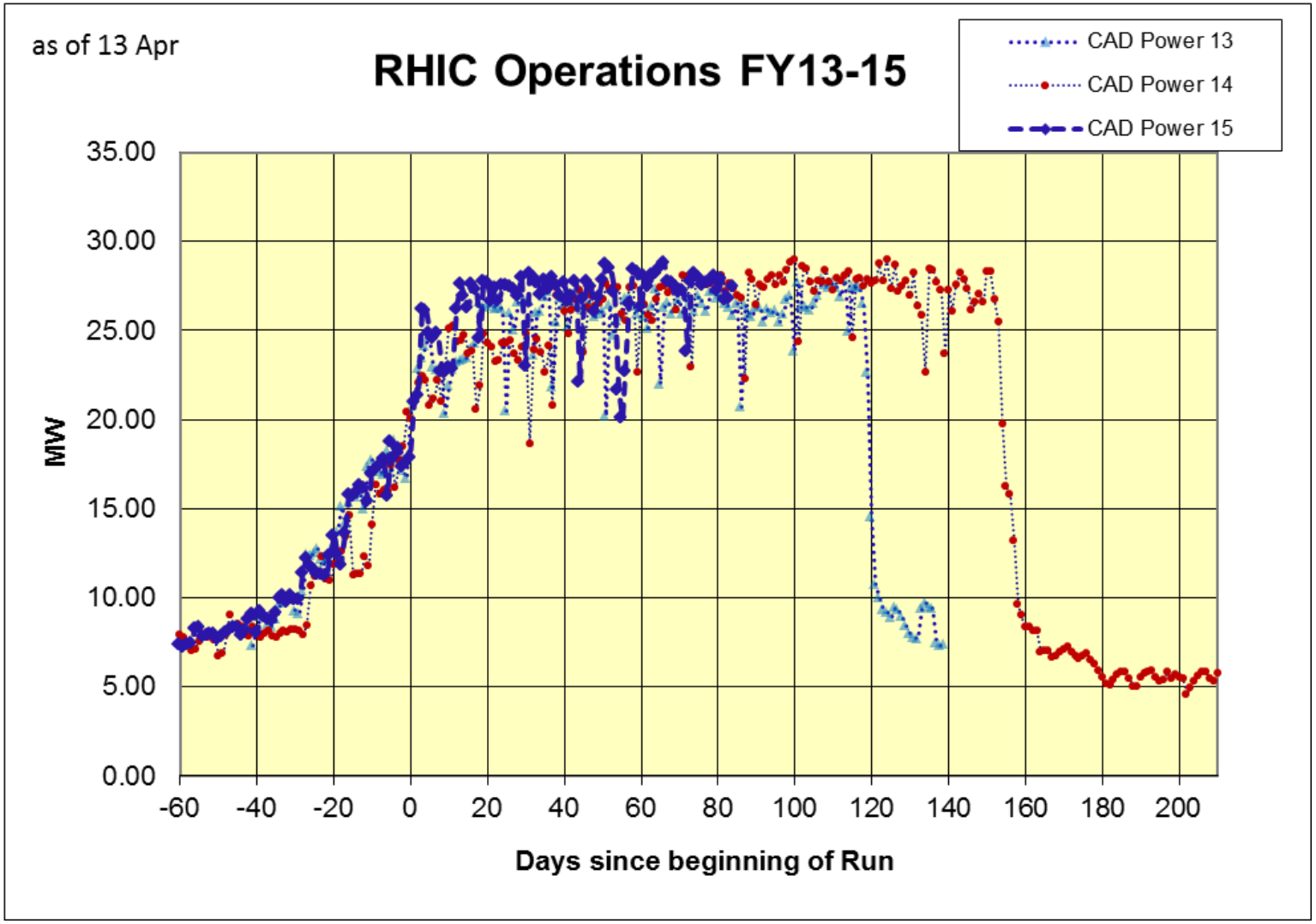

Run 15 Jet Target Polarization Measurements
Pol_Yellow
Initial Lumi
Polatization (%)
100%
90%
80%
70%
60%
50%
40%
30%
20%
10%
0%
0.50
1.00
1.50
2.00
2.50
Intensity per bunch in yellow (x10^11)
140
120
100
80
60
40
20
0
Initial Lumi (10^30cm^-2s^-1)

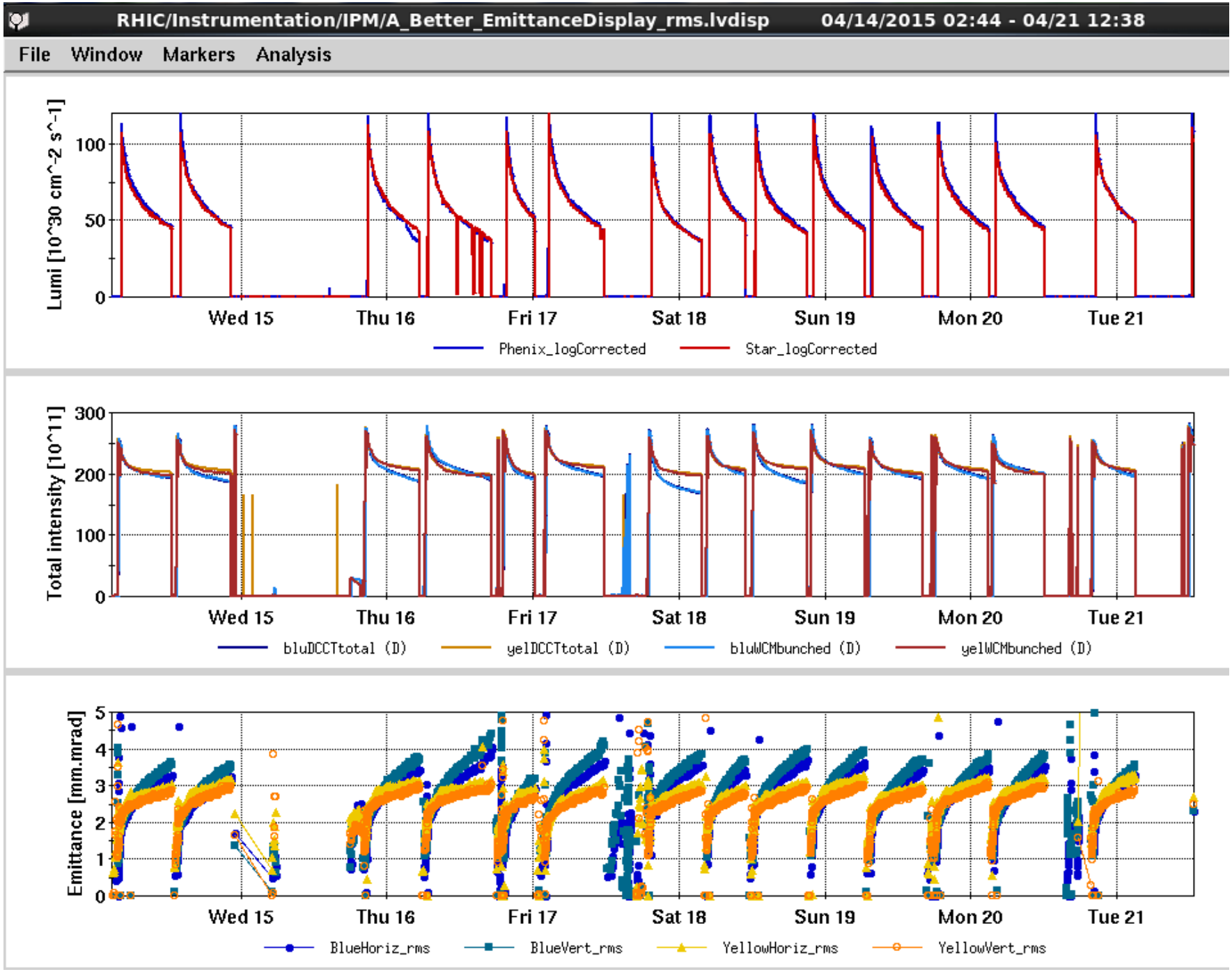

BNL Electricity Cost
2009
2010
2011
2012
2013
2014
2015
$/MWhr without balanced billing
$105
$95
$85
$75
$65
$55
$45
$35
$25
$15
$5
$(5)
sep
oct
nov
dec
jan
feb
mar
apr
may
june
july
aug

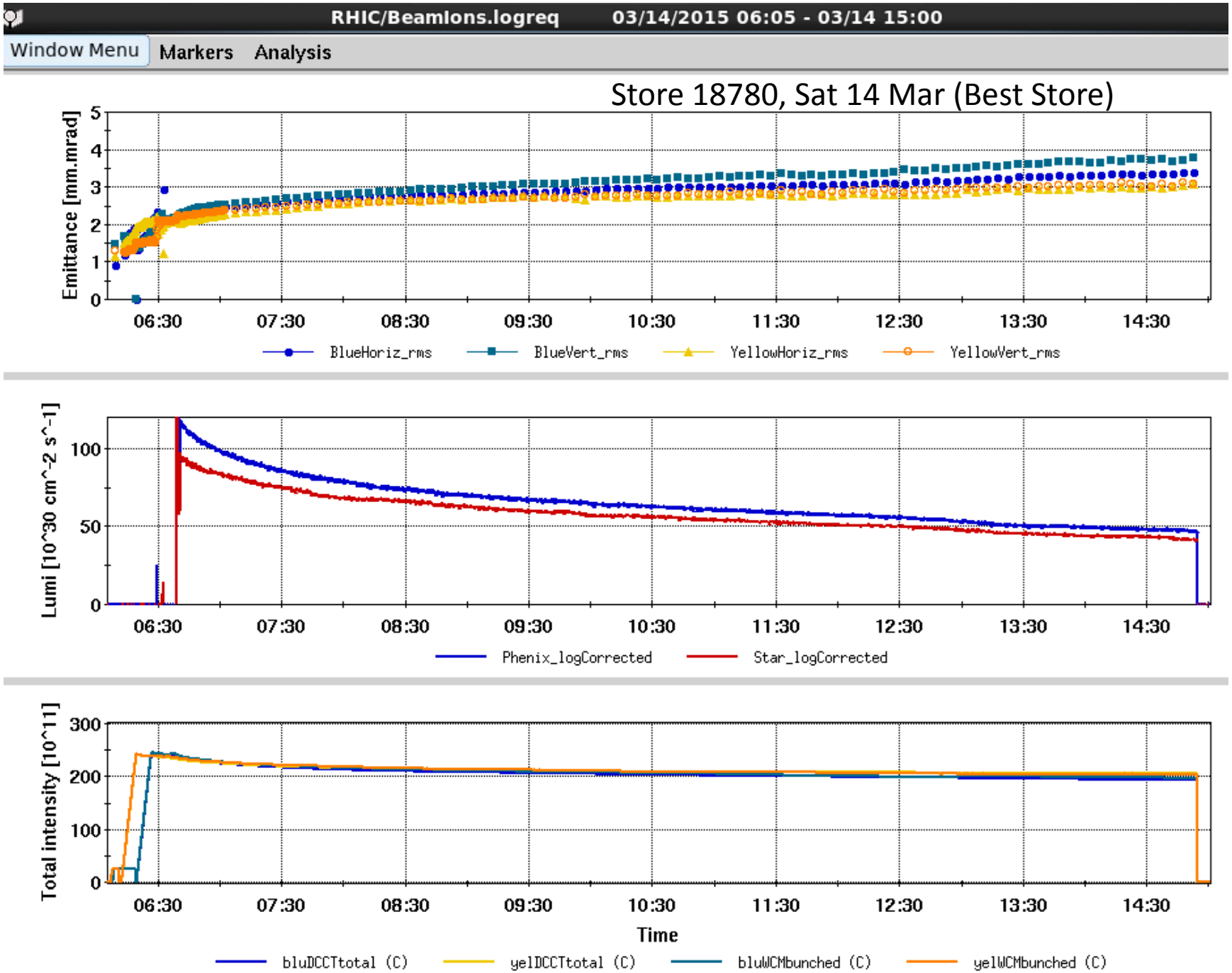
Balanced Billing for the lab - +1,483K through Mar 2015




as of 13 Apr
RHIC Cryo Operations FY13-15
RHIC Cryo 13
RHIC Cryo 14
RHIC Cryo 15
MW
9.00
8.00
7.00
6.00
5.00
4.00
3.00
2.00
1.00
0.00
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
200
Days since beginning of Run


as of 13 Apr
RHIC Operations FY13-15
CAD Power 13
CAD Power 14
CAD Power 15
MW
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
-60
-40
-20
0
20
40
60
80
100
120
140
160
180
200
Days since beginning of Run

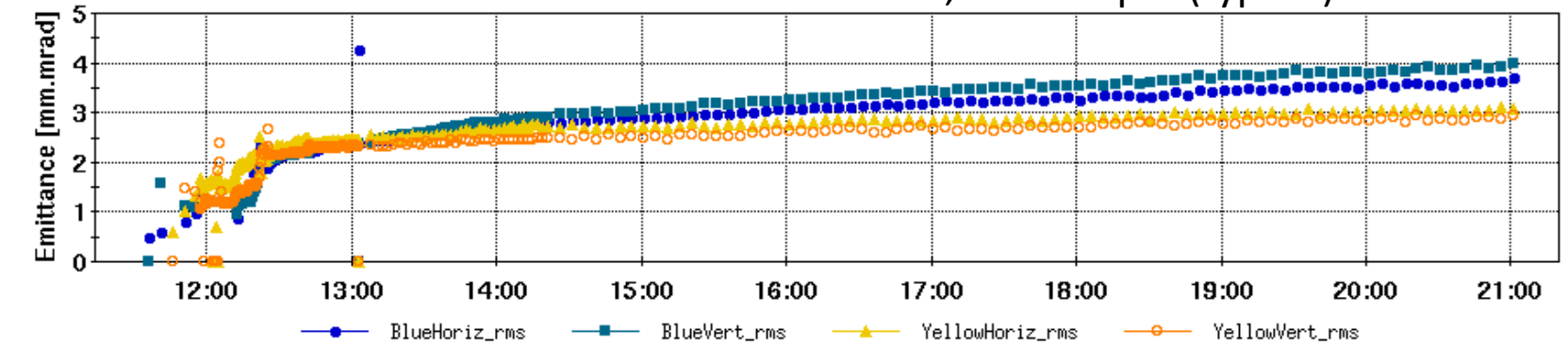

RHIC/Instrumentation/IPM/A_Better_EmittanceDisplay_rms.lvdisp
04/14/2015 02:44 - 04/21 12:38
File
Window
Markers
Analysis
Lumi [10^30 cm^-2 s^-1]
100
50
0
Wed 15
Thu 16
Fri 17
Sat 18
Sun 19
Mon 20
Tue 21
Phenix_logCorrected
Star_logCorrected
Total intensity [10^11]
300
200
100
0
bluDCCTtotal (D)
yelDCCTtotal (D)
bluWCMbunched (D)
yelWCMbunched (D)
Emittance [mm.mrad]
5
4
3
2
1
0
BlueHoriz_rms
BlueVert_rms
YellowHoriz_rms
YellowVert_rms

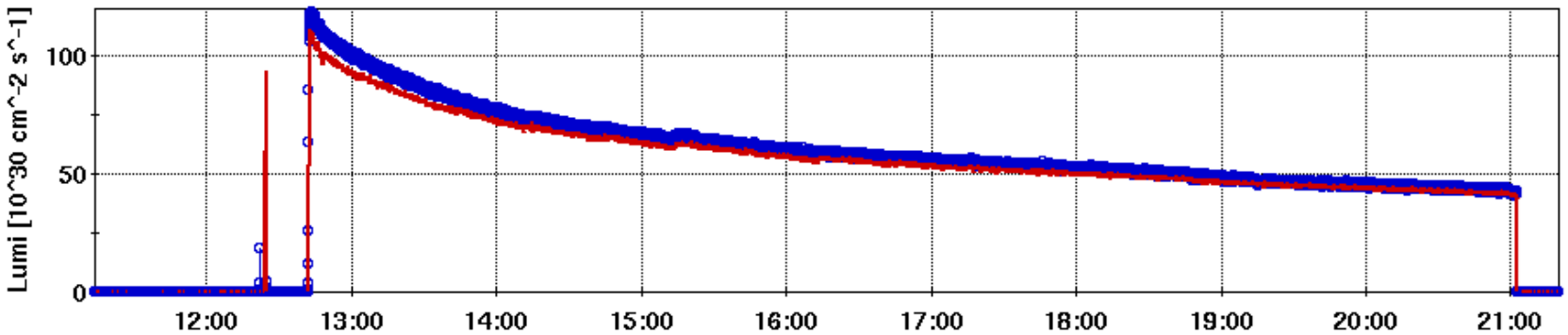

RHIC/BeamIons.logreq 03/14/2015 06:05 - 03/14 15:00
Window Menu
Markers
Analysis
Store 18780, Sat 14 Mar (Best Store)
Emittance [mm.mrad]
0
1
2
3
4
5
06:30
07:30
08:30
09:30
10:30
11:30
12:30
13:30
14:30
BlueHoriz_rms
BlueVert_rms
YellowHoriz_rms
YellowVert_rms
Lumi [10^30 cm^-2 s^-1]
0
50
100
Phenix_logCorrected
Star_logCorrected
Total intensity [10^11]
0
100
200
300
Time
bluDCCTtotal (C)
yelDCCTtotal (C)
bluWCMbunched (C)
yelWCMbunched (C)

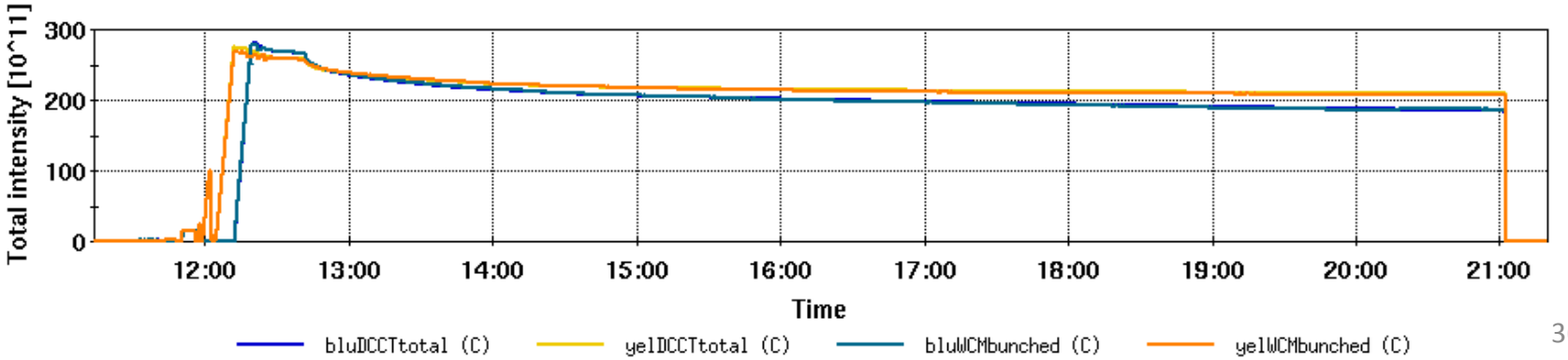
RHIC/BeamIons.logreq 04/18/2015 11:13 - 04/18 21:19

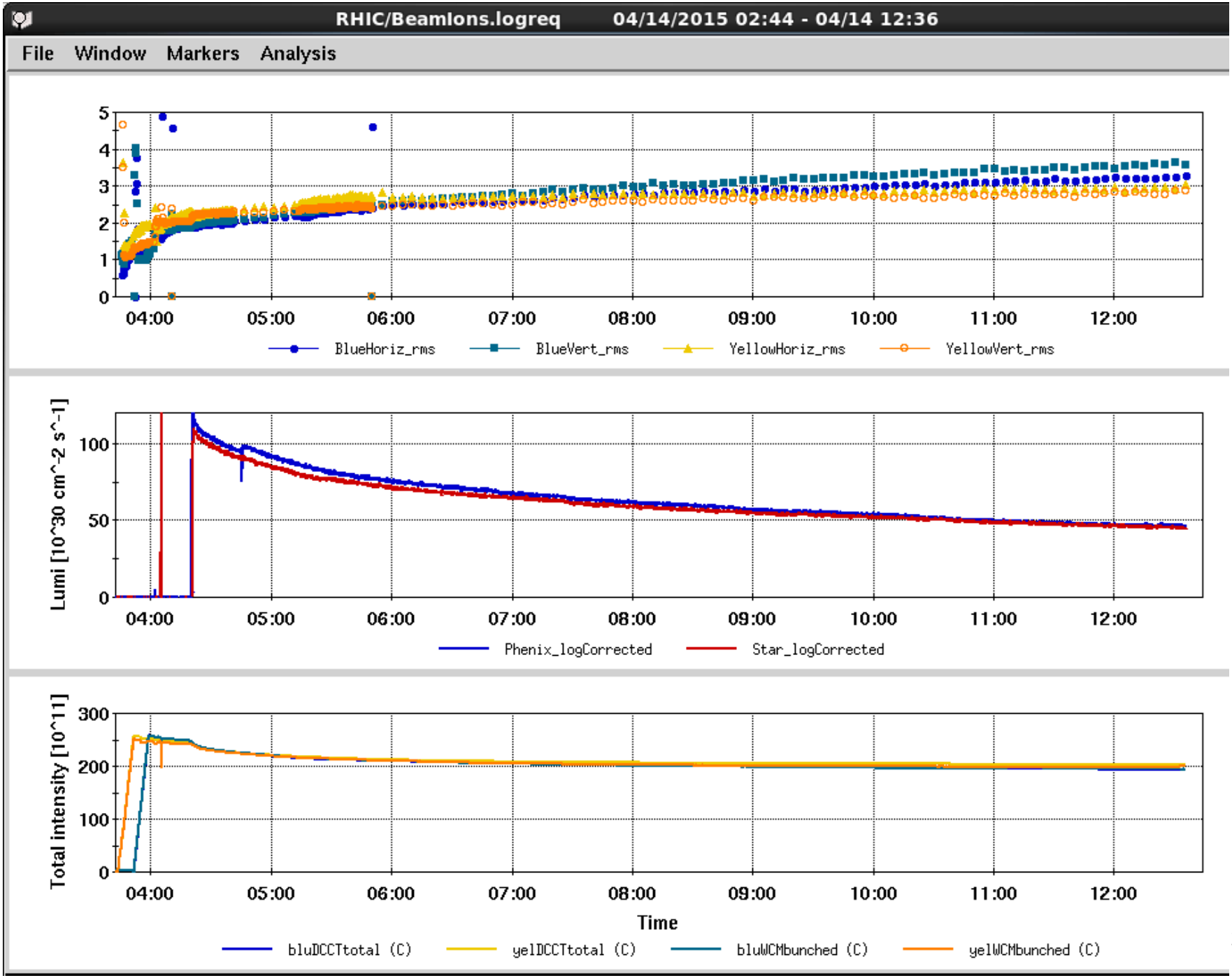
File Window Markers Analysis

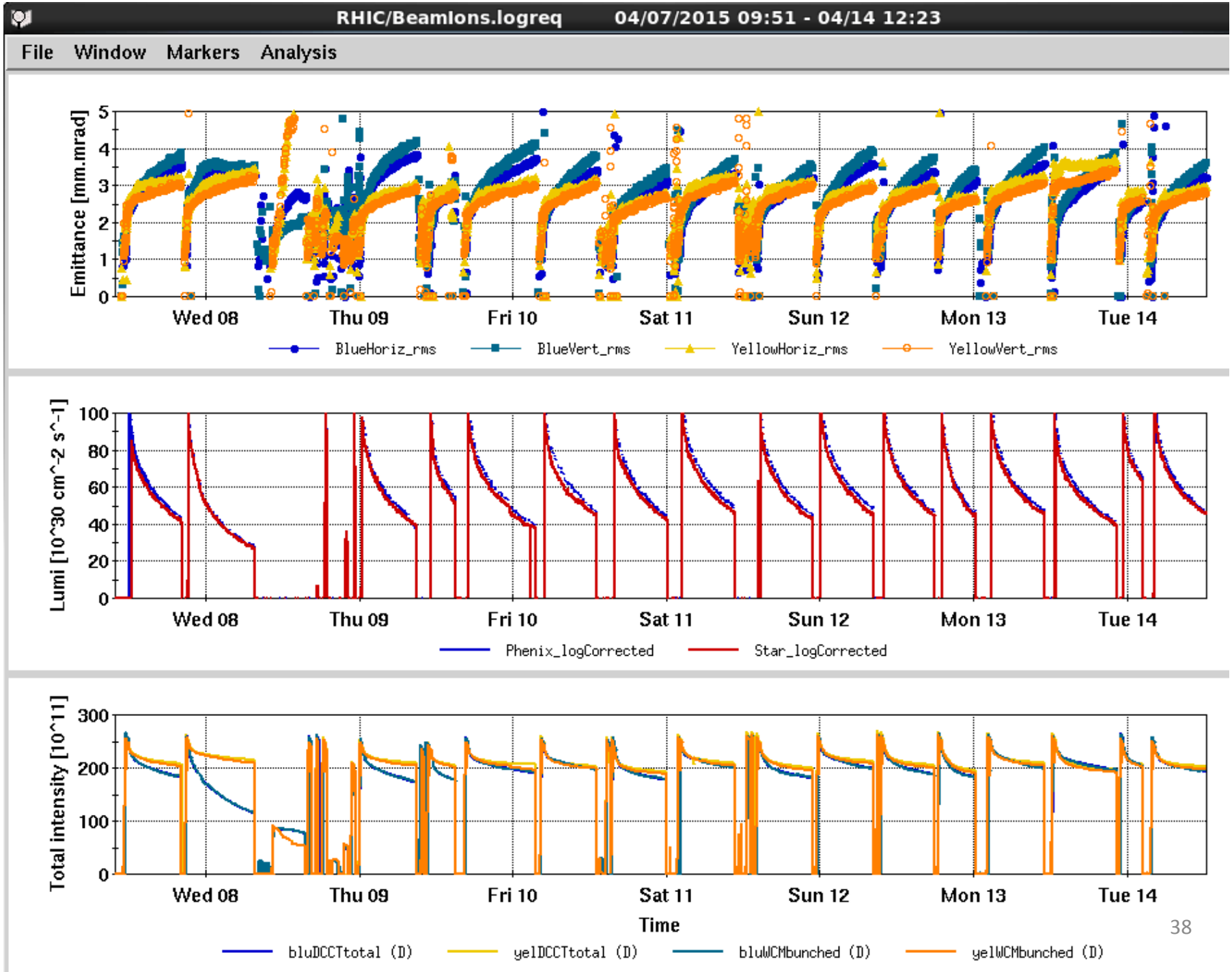
Store 18922, Sat 18 April (typical)



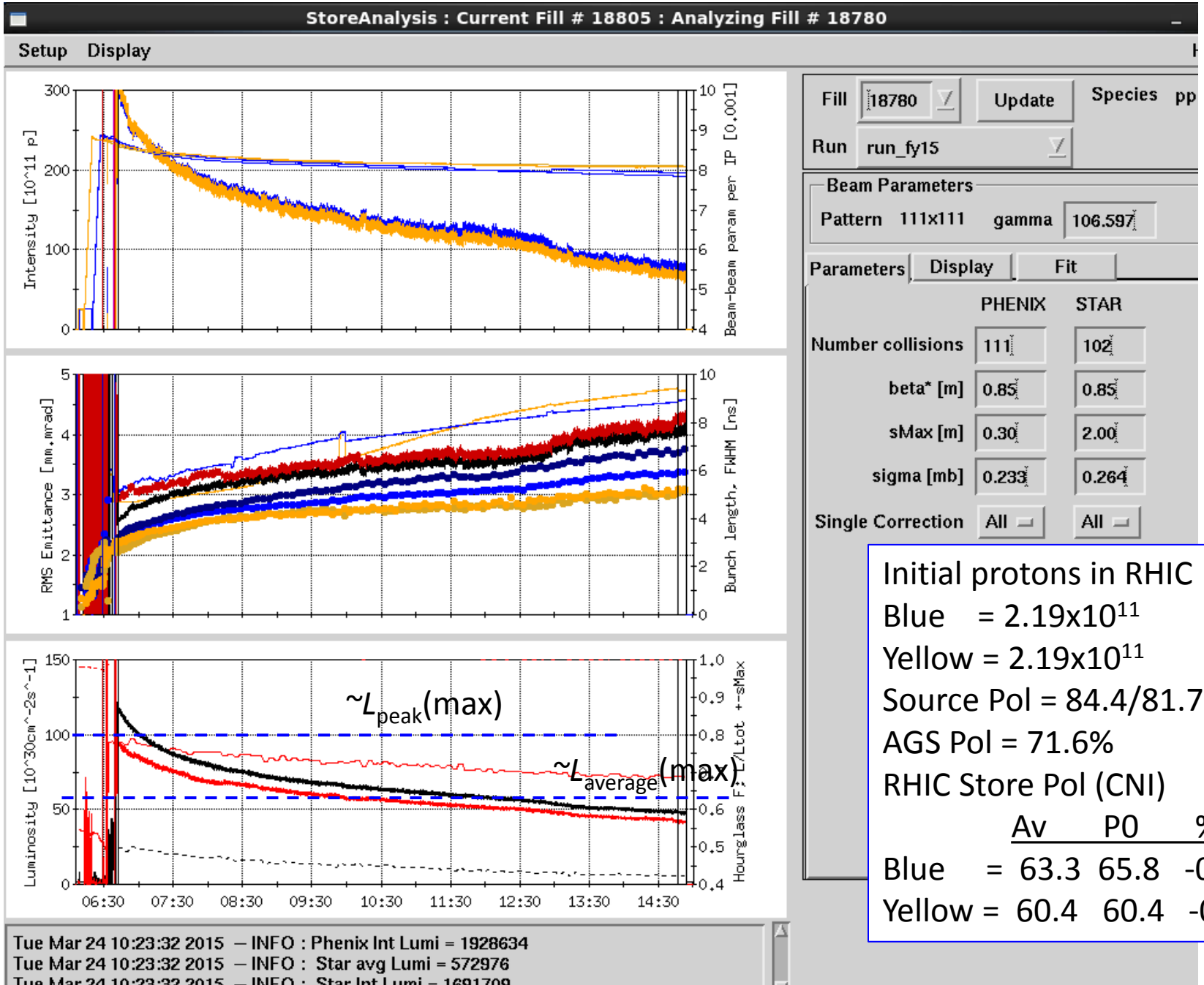





RHIC/BeamIons.logreq 04/14/2015 02:44 - 04/14 12:36
File Window Markers Analysis
BlueHoriz_rms
BlueVert_rms
YellowHoriz_rms
YellowVert_rms
Lumi [10^30 cm^-2 s^-1]
Phenix_logCorrected
Star_logCorrected
Total intensity [10^11]
Time
bluDCCTtotal (C)
yelDCCTtotal (C)
bluWCMbunched (C)
yelWCMbunched (C)


RHIC/BeamIons.logreq 04/07/2015 09:51 - 04/14 12:23
File Window Markers Analysis
Emittance [mm.mrad]
Wed 08
Thu 09
Fri 10
Sat 11
Sun 12
Mon 13
Tue 14
BlueHoriz_rms
BlueVert_rms
YellowHoriz_rms
YellowVert_rms
Lumi [10^30 cm^-2 s^-1]
Phenix_logCorrected
Star_logCorrected
Total intensity [10^11]
Time
bluDCCTtotal (D)
yelDCCTtotal (D)
bluWCMbunched (D)
yelWCMbunched (D)

Still Best Store to Date – 18780, Sat 14 Mar –



Initial protons in RHIC

Blue = 2.19×10^{11}

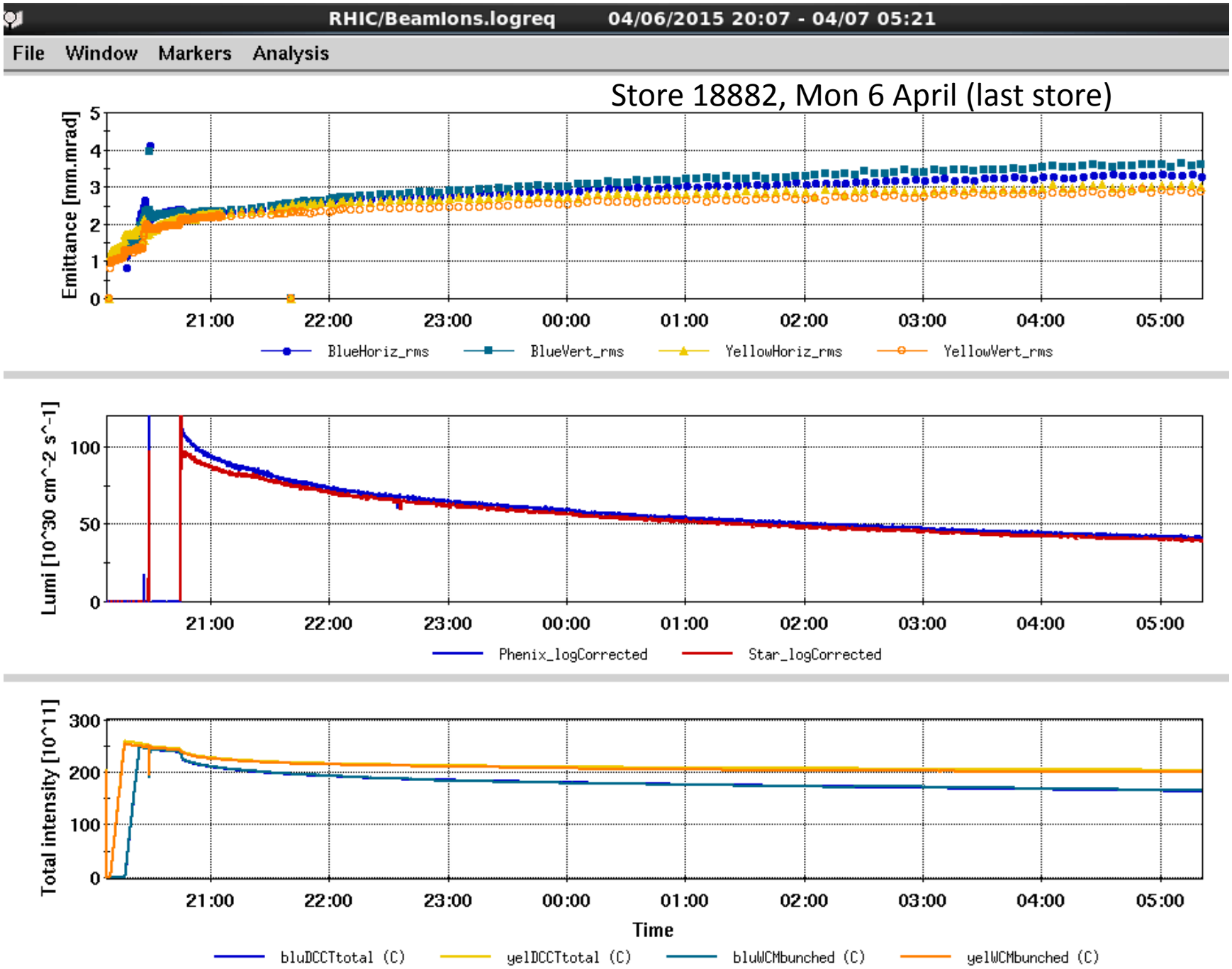
Yellow = 2.19×10^{11}

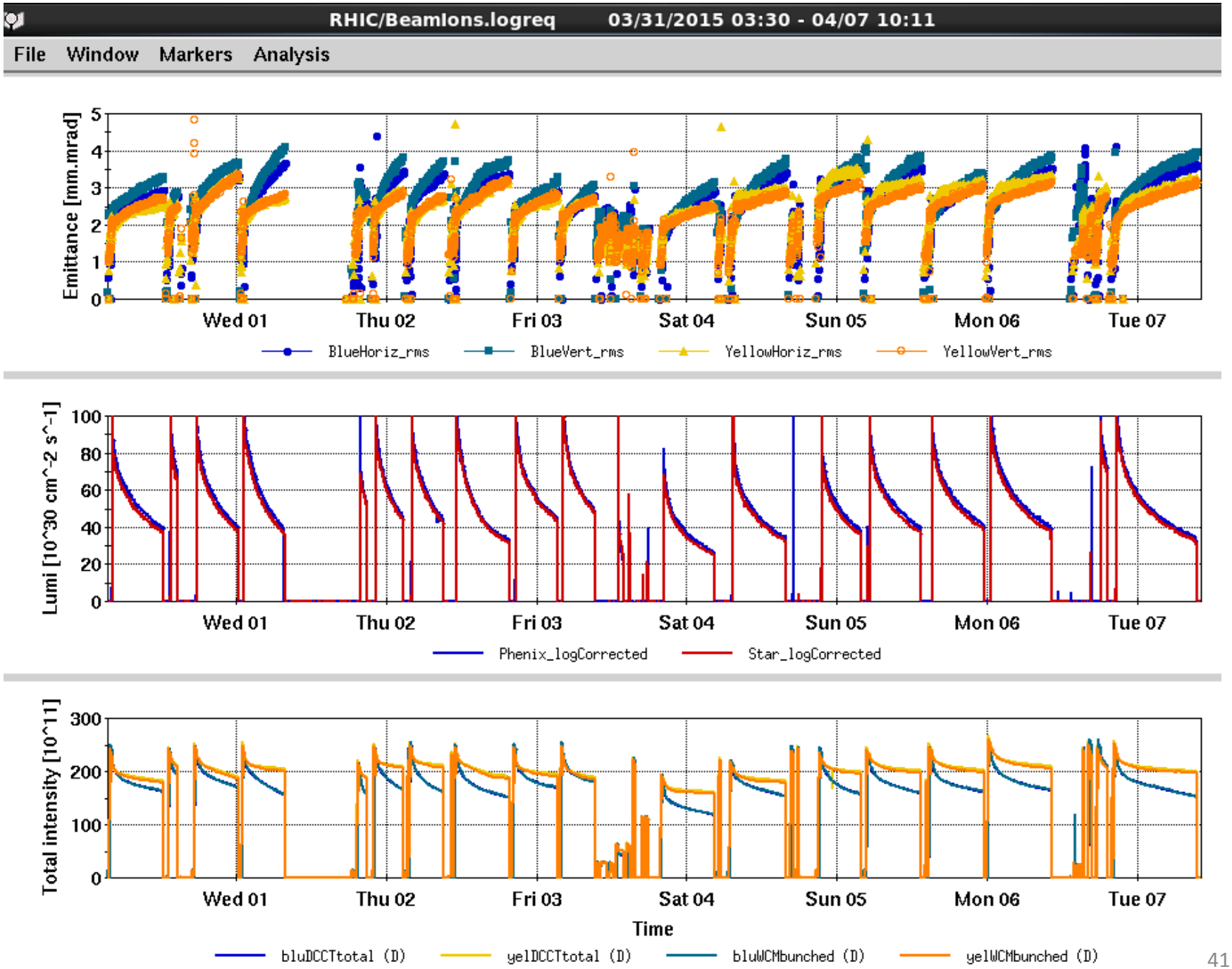
Source Pol = 84.4/81.7%

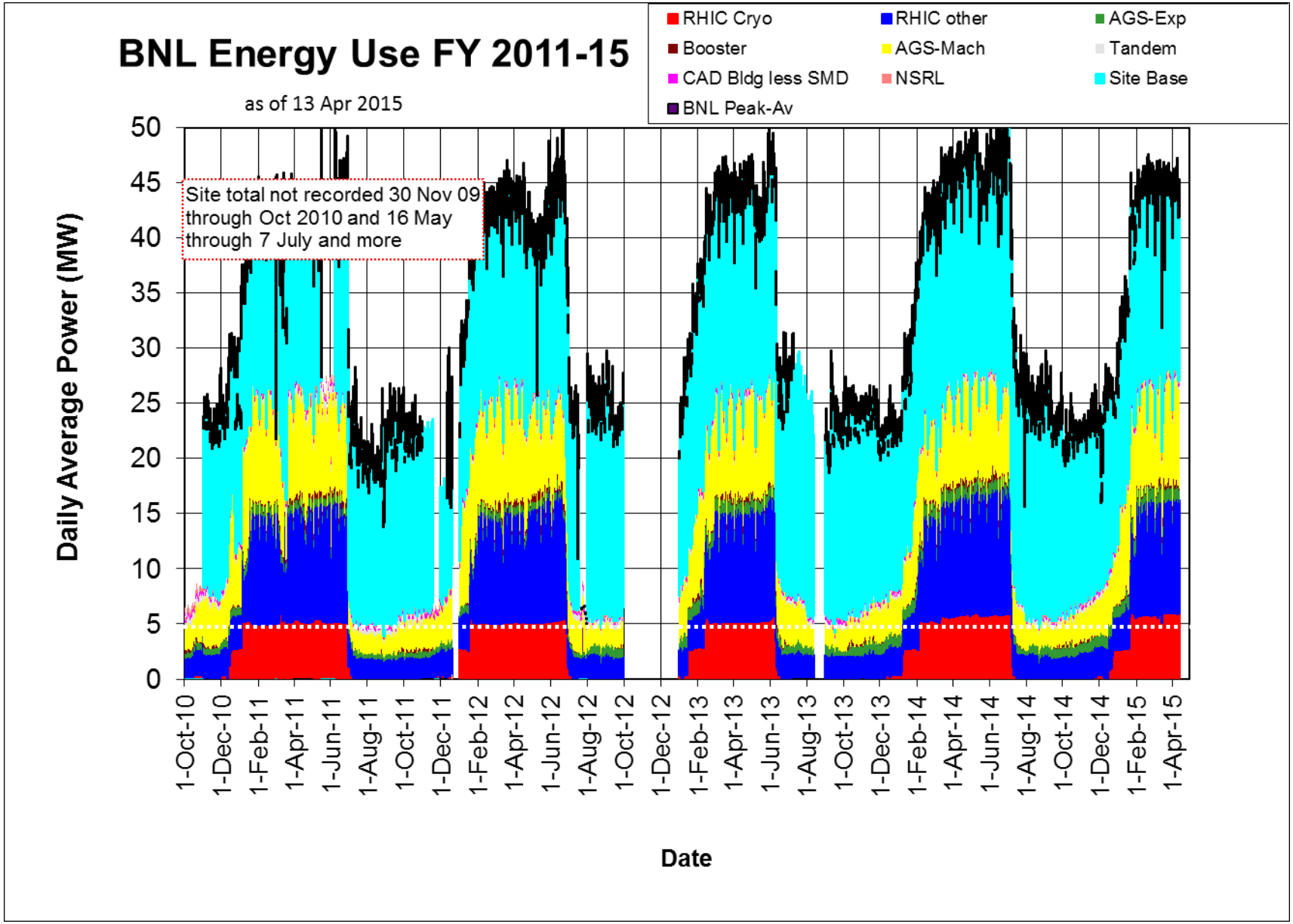
AGS Pol = 71.6%

RHIC Store Pol (CNI)

	Av	P0	%/hr
Blue =	63.3	65.8	-0.78
Yellow =	60.4	60.4	-0.52

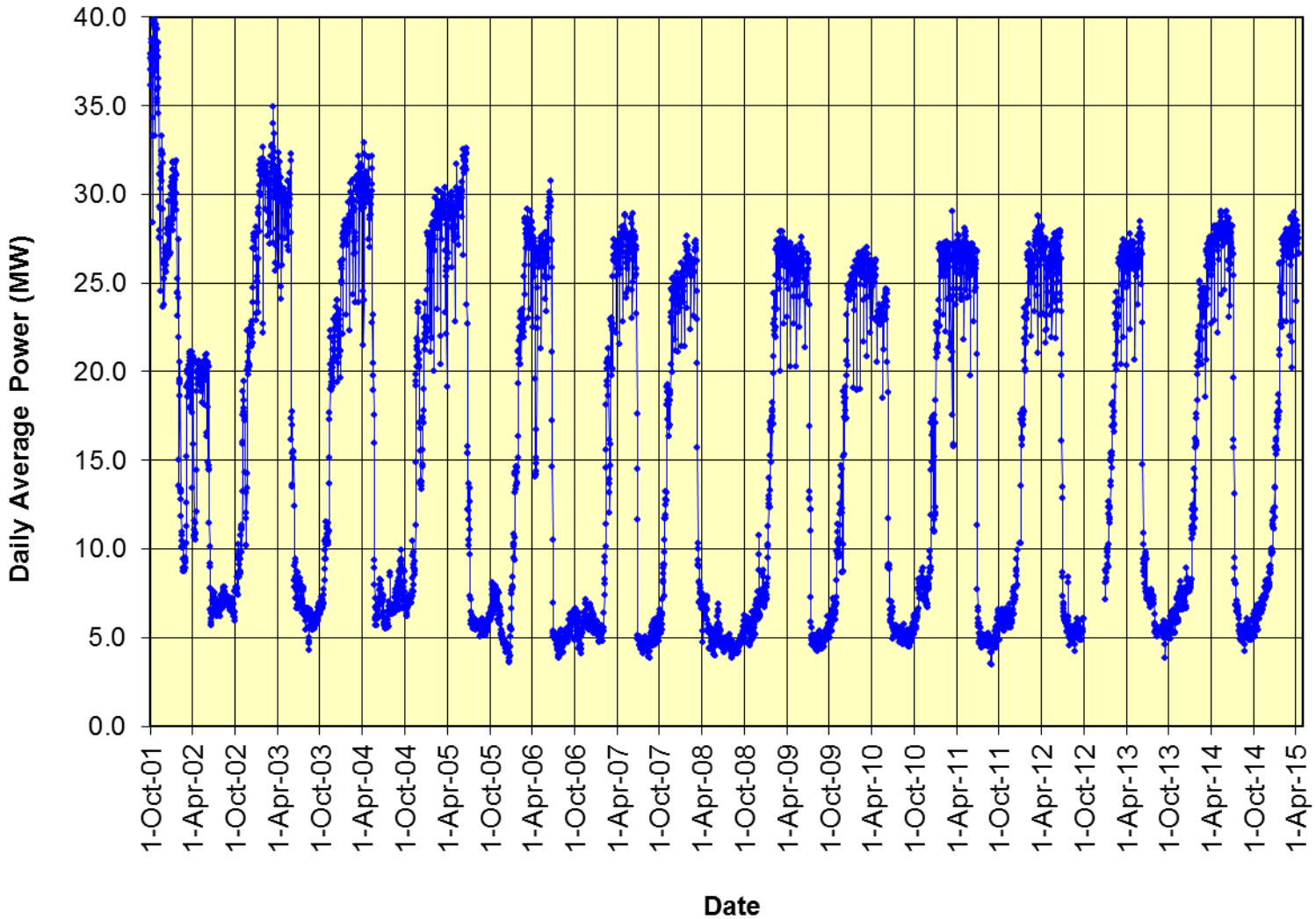

RHIC/BeamIons.logreq 04/06/2015 20:07 - 04/07 05:21
File Window Markers Analysis
Store 18882, Mon 6 April (last store)
Emittance [mm.mrad]
BlueHoriz_rms
BlueVert_rms
YellowHoriz_rms
YellowVert_rms
Lumi [10^30 cm^-2 s^-1]
Phenix_logCorrected
Star_logCorrected
Total intensity [10^11]
Time
bluDCCTtotal (C)
yelDCCTtotal (C)
bluWCMbunched (C)
yelWCMbunched (C)


RHIC/BeamIons.logreq 03/31/2015 03:30 - 04/07 10:11
File Window Markers Analysis
Emittance [mm.mrad]
Wed 01
Thu 02
Fri 03
Sat 04
Sun 05
Mon 06
Tue 07
BlueHoriz_rms
BlueVert_rms
YellowHoriz_rms
YellowVert_rms
Lumi [10^30 cm^-2 s^-1]
Phenix_logCorrected
Star_logCorrected
Total intensity [10^11]
Time
bluDCCTtotal (D)
yelDCCTtotal (D)
bluWCMbunched (D)
yelWCMbunched (D)


BNL Energy Use FY 2011-15
as of 13 Apr 2015
RHIC Cryo
RHIC other
AGS-Exp
Booster
AGS-Mach
Tandem
CAD Bldg less SMD
NSRL
Site Base
BNL Peak-Av
Site total not recorded 30 Nov 09 through Oct 2010 and 16 May through 7 July and more
Daily Average Power (MW)
0
5
10
15
20
25
30
35
40
45
50
1-Oct-10
1-Dec-10
1-Feb-11
1-Apr-11
1-Jun-11
1-Aug-11
1-Oct-11
1-Dec-11
1-Feb-12
1-Apr-12
1-Jun-12
1-Aug-12
1-Oct-12
1-Dec-12
1-Feb-13
1-Apr-13
1-Jun-13
1-Aug-13
1-Oct-13
1-Dec-13
1-Feb-14
1-Apr-14
1-Jun-14
1-Aug-14
1-Oct-14
1-Dec-14
1-Feb-15
1-Apr-15
Date

as of 13 Apr 2015

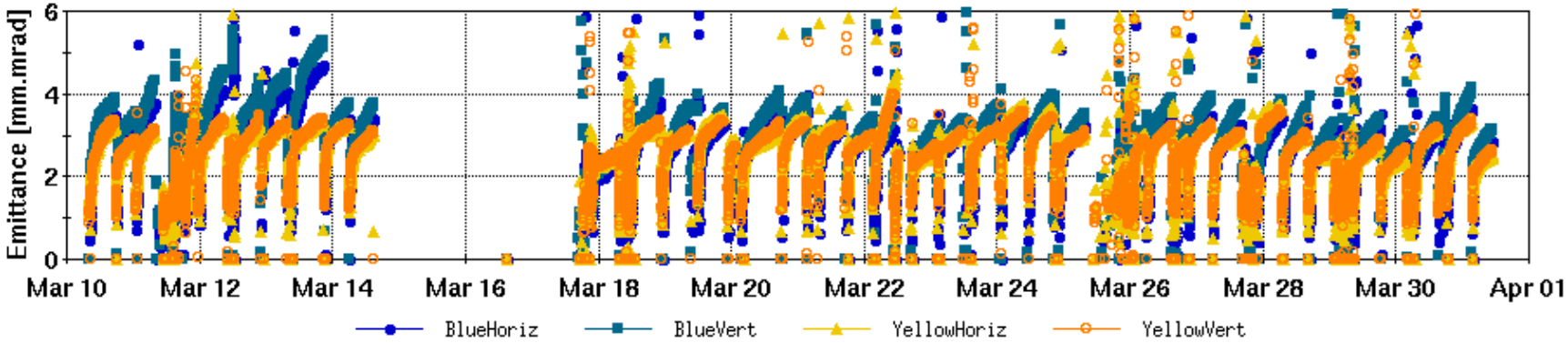
C-AD Energy Use FY 2002-15

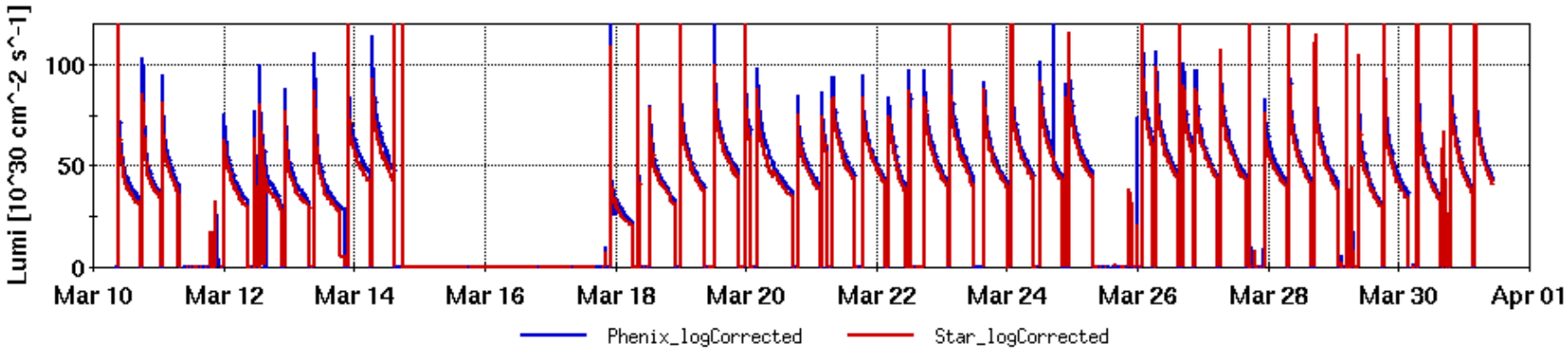


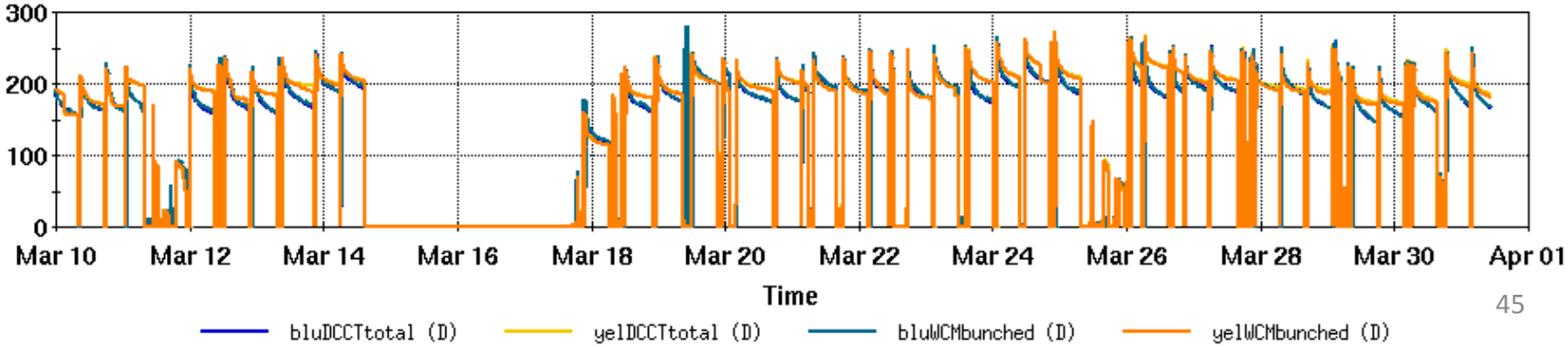
RHIC/BeamIons.logreq 03/10/2015 00:00 - 03/31 23:59
File Window Markers Analysis
~Lumi (max)
Lumi [10^30 cm^-2 s^-1]
120
100
80
60
40
20
0
Mar 10
Mar 12
Mar 14
Mar 16
Mar 18
Mar 20
Mar 22
Mar 24
Mar 26
Mar 28
Mar 30
Apr 01
Phenix_logCorrected
Star_logCorrected
~Lumi (max)
~ions/bunch (max)
Total intensity [10^11]
300
200
100
0
Time
bluDCCTtotal (D)
yelDCCTtotal (D)
bluWCMbunched (D)
yelWCMbunched (D)

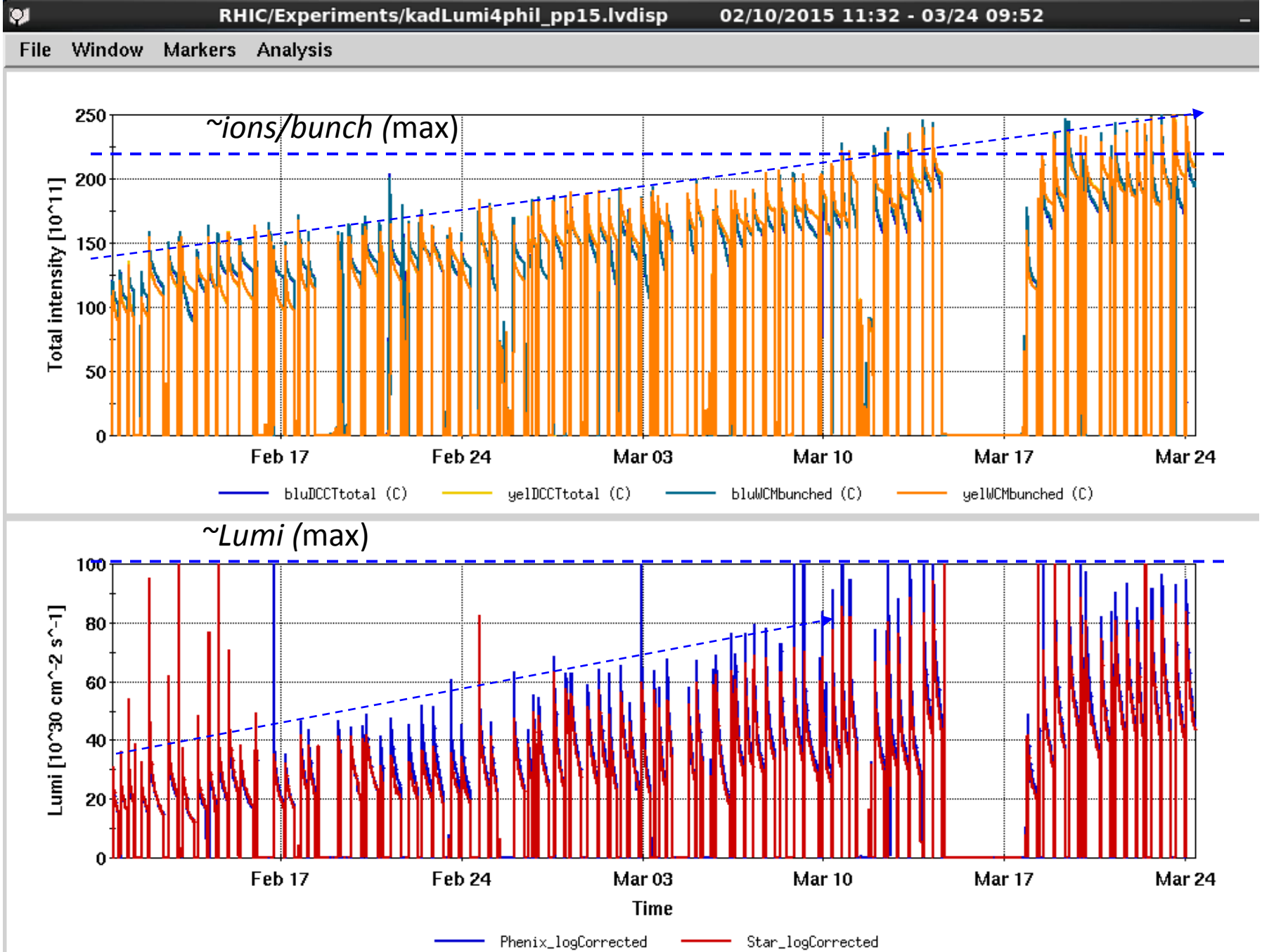
RHIC/BeamIons.logreq 03/10/2015 00:00 - 03/31 23:59

File Window Markers Analysis








RHIC/Experiments/kadLumi4phil_pp15.lvdisp 02/10/2015 11:32 - 03/24 09:52
File Window Markers Analysis
~ions/bunch (max)
Total intensity [10^11]
250
200
150
100
50
0
Feb 17
Feb 24
Mar 03
Mar 10
Mar 17
Mar 24
bluDCCTtotal (C)
yelDCCTtotal (C)
bluWCMbunched (C)
yelWCMbunched (C)
~Lumi (max)
Lumi [10^30 cm^-2 s^-1]
100
80
60
40
20
0
Feb 17
Feb 24
Mar 03
Mar 10
Mar 17
Mar 24
Time
Phenix_logCorrected
Star_logCorrected

Run 15 plan based on 22 weeks cryo operation

and Fischer et.al. RHIC Collider Projections (FY 2013 – FY 2022), 21 Sep 2014

- 20 Jan, Begin cool-down to 4.5K
- 21 Jan (morning), Blue cold
- 22 Jan (evening), Yellow cold
- 23 Jan (after midnight), Beam in Blue
- 7 Feb, First overnight stores for experiments
- 10 Feb (3 days early) store 18662, Begin 9 week **√s=200 GeV pp** physics run

- ***14-17 Mar, Power Dip downtime***

- ***today, 24 Mar…***

- 17 April (Fri), End 9 week √s=200 GeV pp physics run – ***note this is a Friday!***

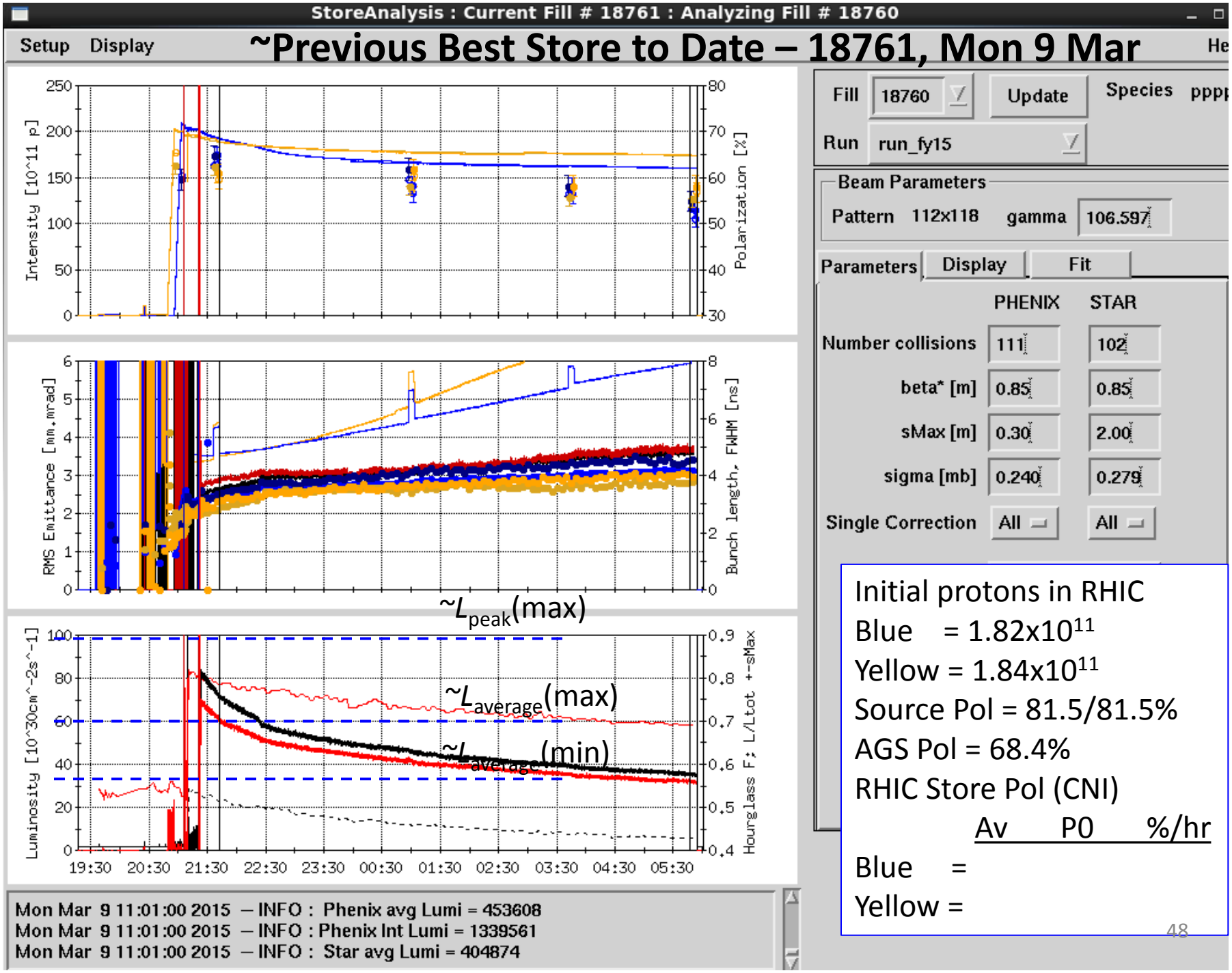
- 28 April (Tue), Begin 5 week **√s=200 GeV/n pAu** physics run
- 2 June (Tue), End 5 week √s=200 GeV/n pAu physics run

- 5 June (Fri), Begin 2 week **√s=200 GeV/n pAl** physics run
- 19 June (Fri), End 2 week √s=200 GeV/n pAl physics run

- 19 June (Fri), begin cryo warm-up
- 23 June, cryo warm-up complete, ***22.0 cryo weeks*** of operation

See http://www.rhichome.bnl.gov/AP/Spin2015/ for the Run Coordinator's detailed plan

~Previous Best Store to Date – 18761, Mon 9 Mar



Initial protons in RHIC

Blue = 1.82×10^{11}

Yellow = 1.84×10^{11}

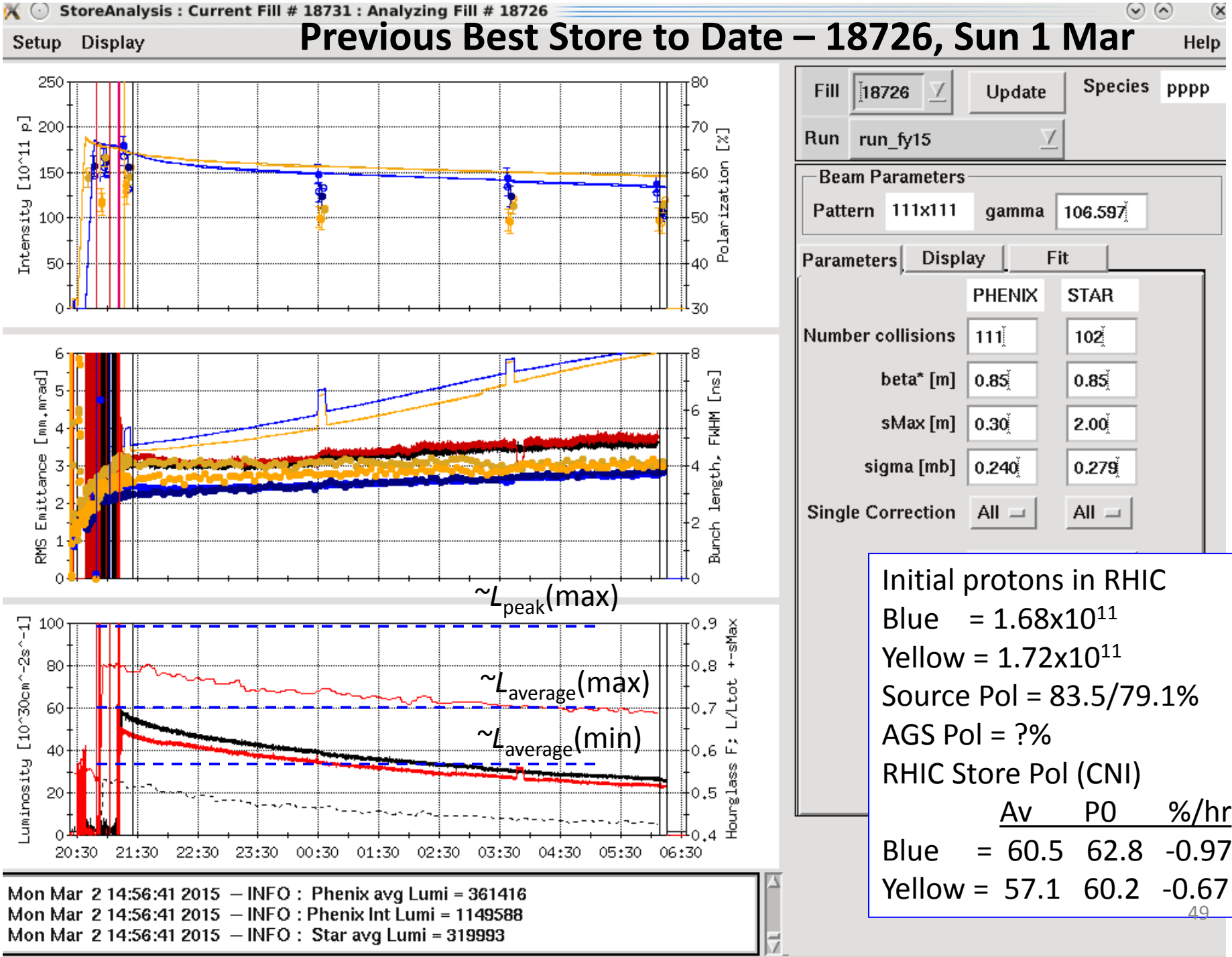
Source Pol = 81.5/81.5%

AGS Pol = 68.4%

RHIC Store Pol (CNI)

	Av	P0	%/hr
Blue =			
Yellow =			

Previous Best Store to Date – 18726, Sun 1 Mar



Initial protons in RHIC

Blue = 1.68×10^{11}

Yellow = 1.72×10^{11}

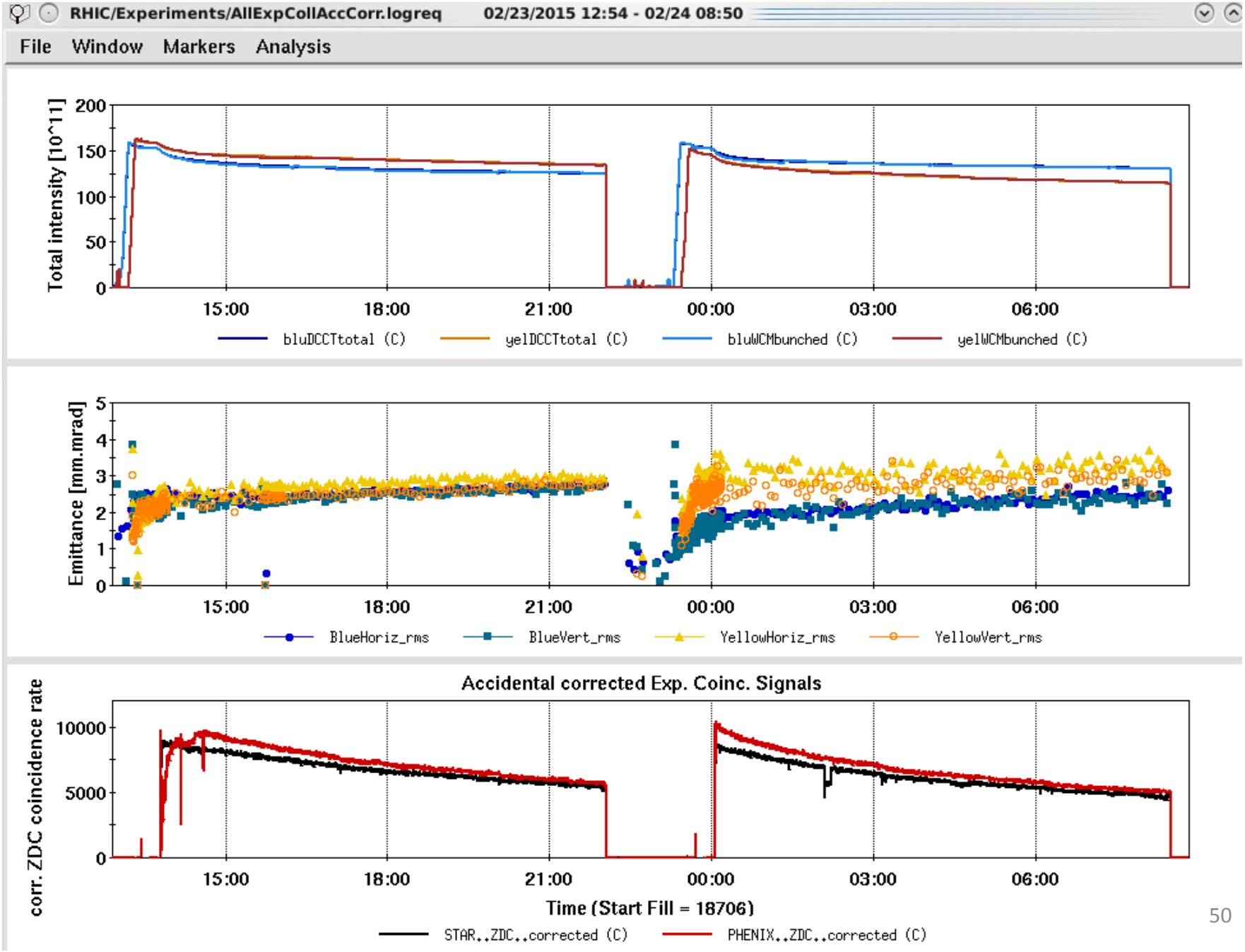
Source Pol = 83.5/79.1%

AGS Pol = ?%

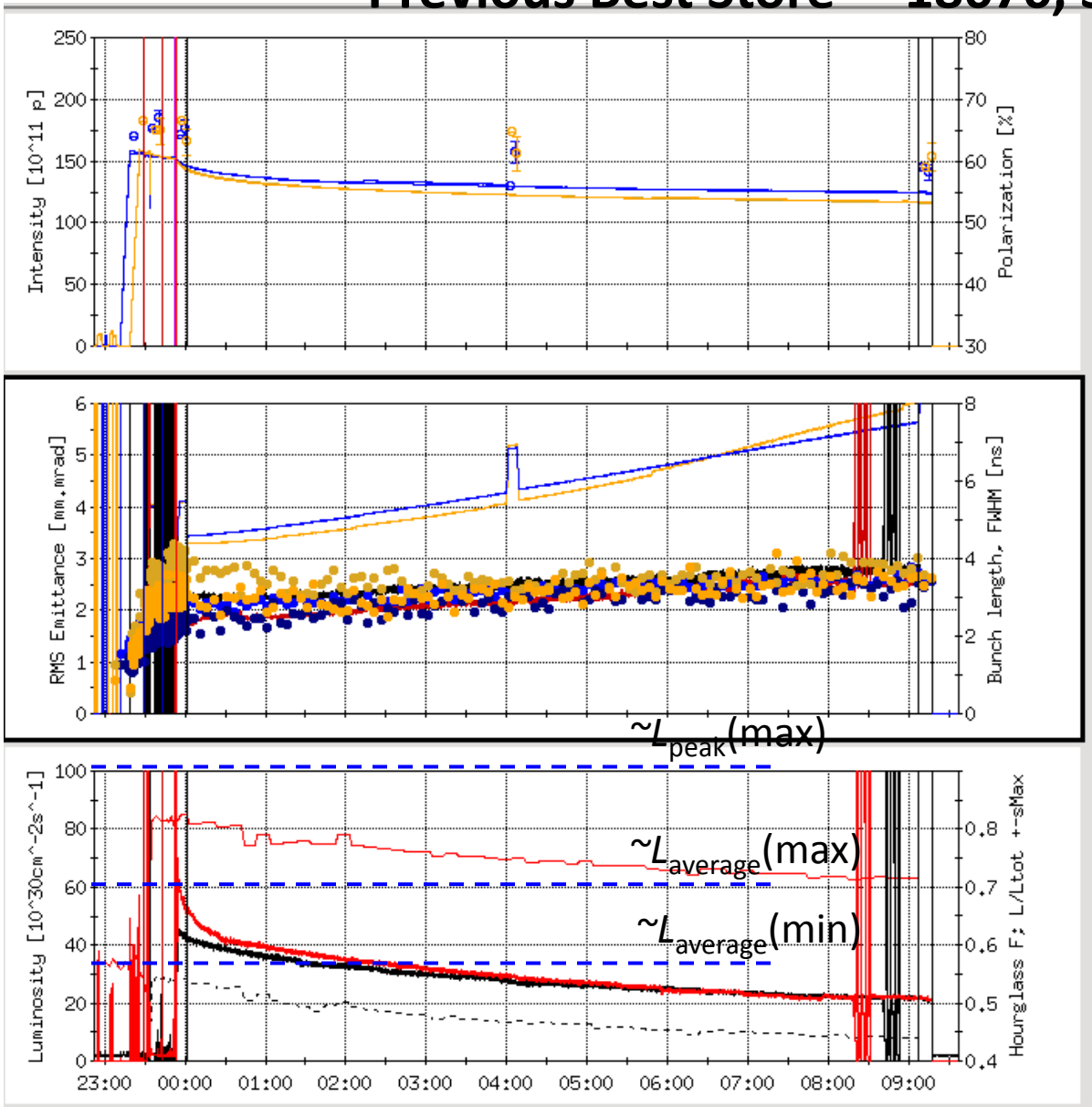
RHIC Store Pol (CNI)

	Av	P0	%/hr
Blue =	60.5	62.8	-0.97
Yellow =	57.1	60.2	-0.67

23 Feb stores 18706 & 18707



Previous Best Store – 18676, Sat 14 Feb



Tue Feb 17 12:10:13 2015 – INFO : Phenix avg Lumi = 274750
Tue Feb 17 12:10:13 2015 – INFO : Phenix Int Lumi = 917098
Tue Feb 17 12:10:13 2015 – INFO : Star avg Lumi = 288131

Fill 18676 Update Species pppp
Run run_fy15

Beam Parameters
Pattern 118x129 gamma 106.597

Parameters | Display | Fit

	PHENIX	STAR
Number collisions	111	102
beta* [m]	0.85	0.85
sMax [m]	0.30	2.00
sigma [mb]	0.240	0.279
Single Correction	All	All

Update Display

Source Pol = 81.8/81.9%
AGS Pol = 73.7%
RHIC Store Pol

	Av	P0	%/hr
Yellow =	66.8	70.2	-0.68
Blue =	67.4	68.7	-0.78

PHENIX goals 9 weeks, 50pb-1 recorded within 40 cm vertex with 60% pol
STAR goals 12 weeks, 90 pb-1 recorded and 500M MB events, 60 % pol

Estimate of required lumi (based on Run 12 efficiencies):
STAR = 90/0.6 = 150 pb-1
PHENIX = 50/0.35 = 140 pb-1

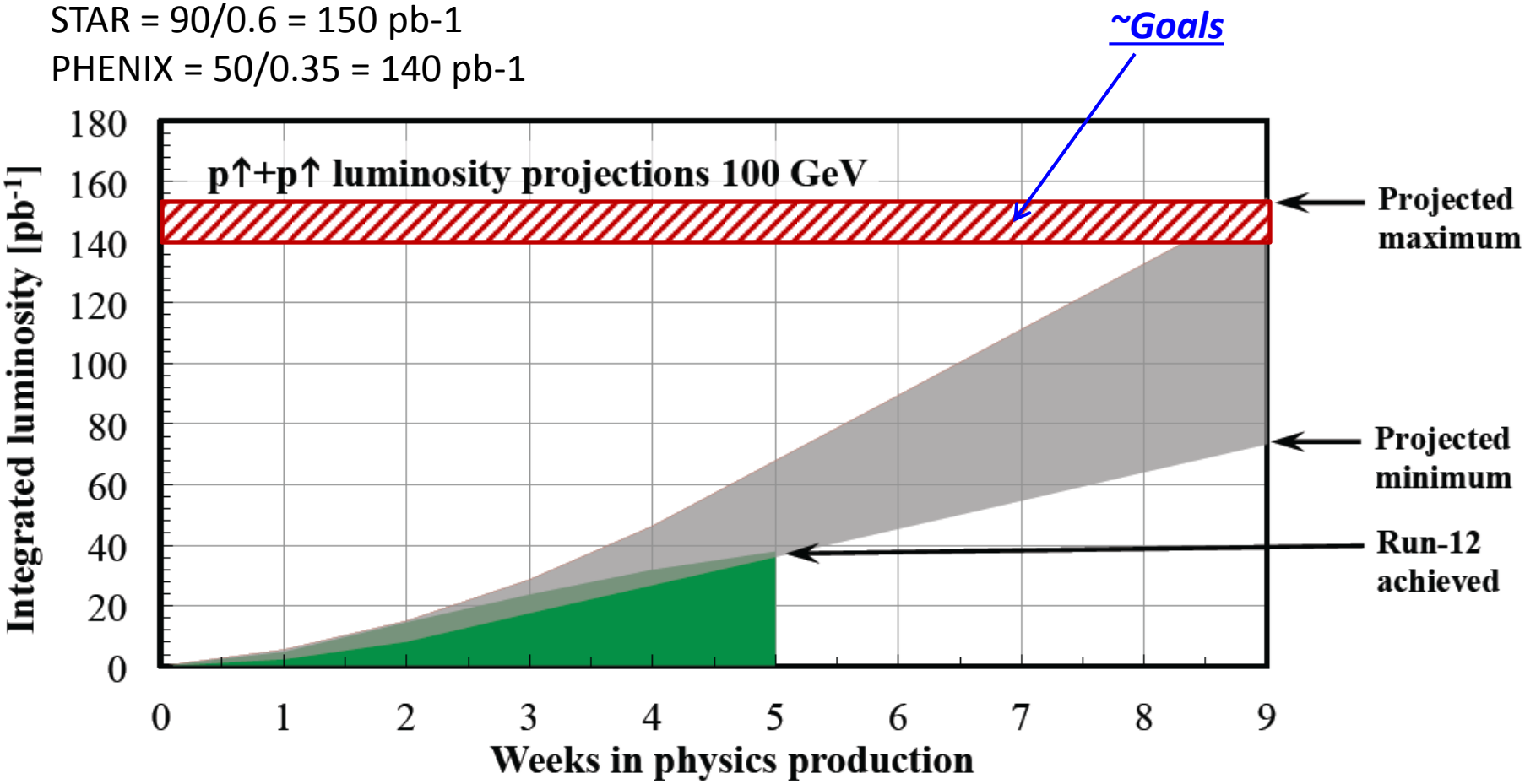
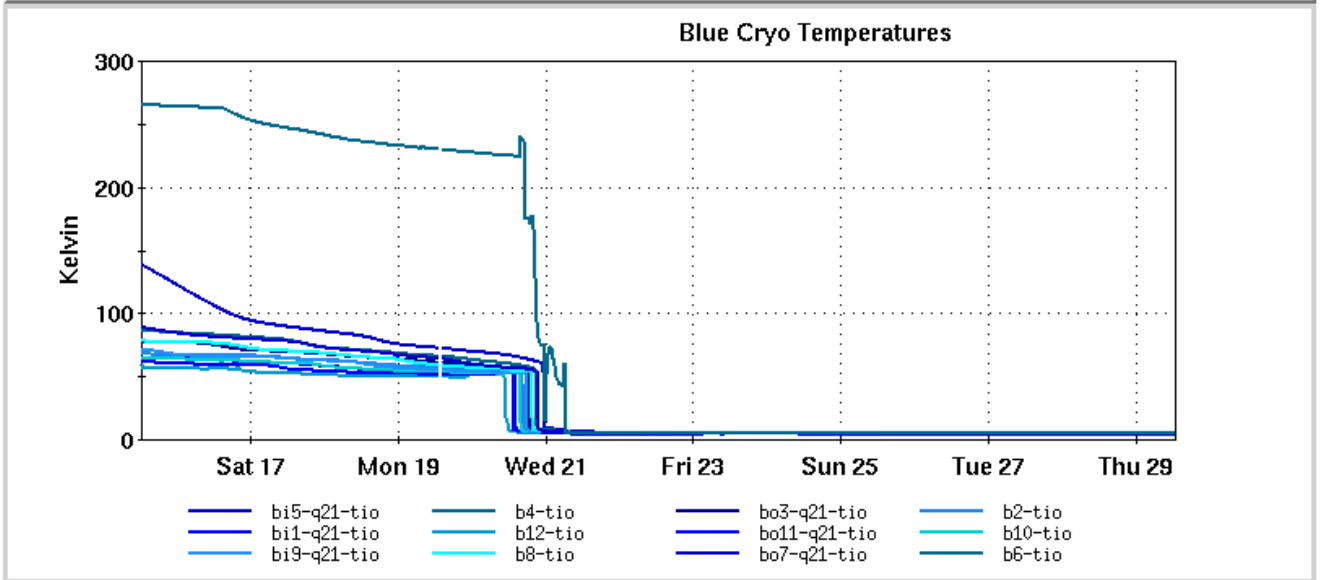


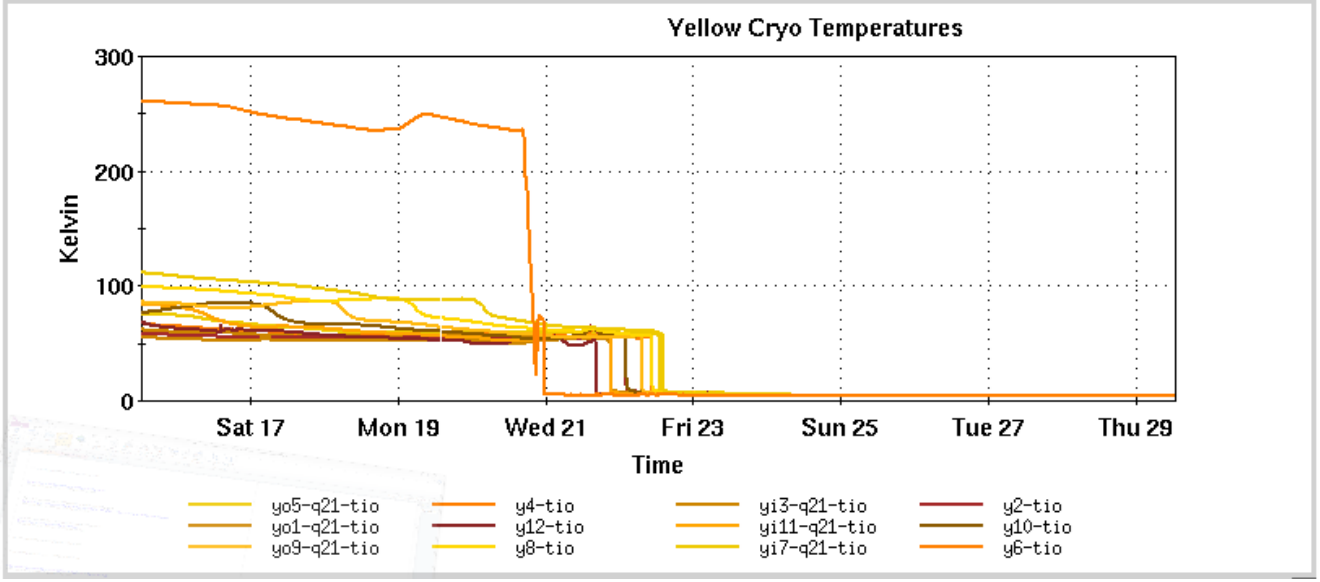
Figure 3: Projected minimum and maximum integrated luminosities for polarized proton collisions at 100 GeV beam energy, assuming linear weekly luminosity ramp-up in 5 weeks. An average store polarization between 59% and up to 63% is expected.

Cryogenic Blue & Yellow Rings (14 days)

Ring Summary (1 day) Sector Plots (1 day) Sector Plots (14 days)

File Window Markers Analysis





ePHENIX Update!

symmetry dimensions of particle physics

A joint Fermilab/SLAC publication

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Photo by Andy Freeberg, SLAC National Accelerator Laboratory

breaking

January 16, 2015

20-ton magnet heads to New York

A superconducting magnet begins its journey from SLAC laboratory in California to Brookhaven Lab in New York.

By Justin Eure

PDF download

Imagine an MRI magnet with a central chamber spanning some 9 feet—massive enough to accommodate a standing African elephant. Physicists at the US Department of Energy's Brookhaven National Laboratory need just such an extraordinary piece of equipment for an upcoming experiment. And, as luck would have it, physicists at SLAC

most popular

January 16, 2015
20-ton magnet heads to New York
A superconducting magnet begins its journey from SLAC laboratory in California to Brookhaven Lab in New York.

January 13, 2015
Dark horse of the dark matter hunt
Dark matter might be made up of a type of particle not many scientists are looking for: the axion.

January 12, 2015
Mirror, mirror
After more than six years of grinding and polishing, the first-ever dual-surface mirror for a major telescope is complete.

symmetry tweets

January 19, 2015
ICYMI: Accelerator-driven carbon dating advances everything from archaeology to medicine: http://t.co/hqMcZnCCw4

Who's Who for 2015

RHIC 100 x 100 GeV polarized protons:
Run Coordinator: Vincent Schoefer, schoefer@bnl.gov , 631-344-8453 (office)

RHIC 100 x 100 GeV/n polarized protons on gold and polarized protons on aluminum:
Run Coordinator: Chuyu Liu, cliu1@bnl.gov , 631-344-4431 (office)

Scheduling Physicists:
Yousef Makdisi, makdisi@bnl.gov, 631-344-4932(office) 631-??
Phil Pile, pile@bnl.gov, 631-344-4643 (office), 631-834-2005 (cell)

AGS Liaison:
Haixin Huang, huanghai@bnl.gov , 631-344-5446 (office)

The Plan for Run 15: 22 weeks of cryo operations

Cool-down from 50 K to 4 K	0.5 weeks	
Set-up mode 1 (p↑+p↑ at 100 GeV)	2.5 weeks	(no dedicated time for experiments)
Ramp-up mode 1	0.5 weeks	(8 h/night for experiments)
Data taking mode 1	9 weeks	
Set-up mode 2 (p↑+Au at 100 GeV/nucleon)	1.5 weeks	(no dedicated time for experiments)
Data taking mode 2 with further ramp-up	5 weeks	
Set-up mode 3 (p↑+Al at 100 GeV/nucleon)	0.5 weeks	(no dedicated time for experiments)
Data taking mode 3+1 with further ramp-up	2 weeks	
Warm-up	0.5 week	

From Fischer et. al., RHIC Collider Projections (FY 2014 – FY 2022), 21 Sep 2014