

Run 12 RHIC Machine/Experiments Meeting

17 Apr 2012

Agenda:

- Status reports
- Polarization issues update (E. Aschenauer)
- Other business

With 17 April update of lumi

Run 12 Plan based on 20 weeks cryo operation
23 week schedule based on 4/10/12 Vigdor guidance

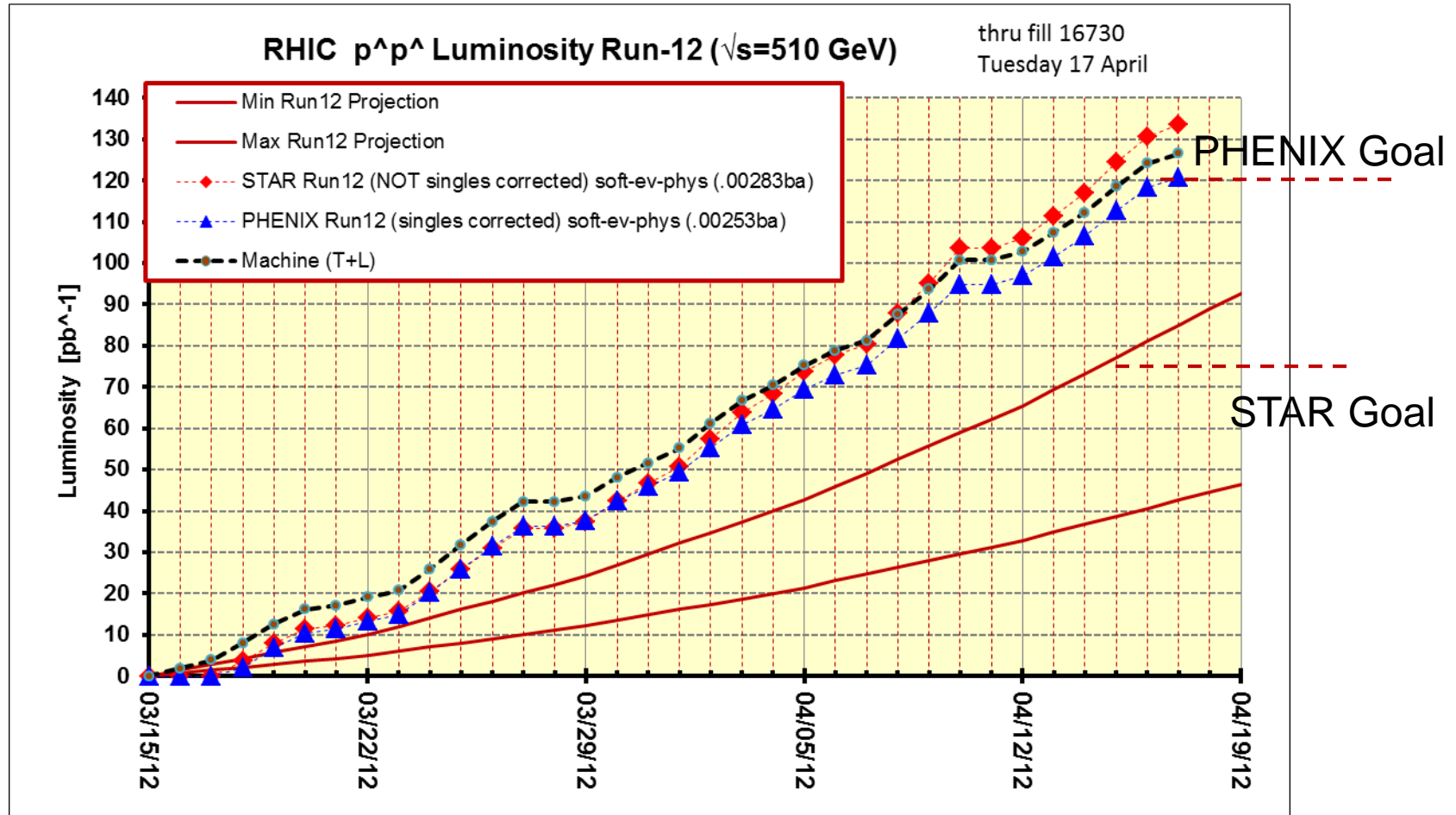
- 17 Jan, Begin cool-down to 4.5K
- 20 Jan, Cool-down to 4.5K in Blue and Yellow Ring complete, begin magnet setup
- 21-28 Jan, pp injection setup
- 28 Jan-3 Feb, LLRF, Ramp and store setup, begin 8 hr/night for experiments
- 3-10 Feb, 1 week ramp-up with 8 hrs/night for experiments
- 10 Feb, with store # 16397, begin 4 weeks pp physics with further ramp-up
- 16 Feb, 24/7 stores begin
- 12 (Monday) March, end 4.4 weeks $\sqrt{s} = 200$ GeV pp, begin ½ week setup for $\sqrt{s} = 510$ GeV pp
- 16 March, begin 5 week pp physics (machine only) $\sqrt{s} = 510$ GeV
- 17/18 March, STAR/PHENIX physics start with longitudinal polarization
- **Today – 17 April**
- 18 April (Wednesday 1300), end physics begin pp beam development/APEX
- 19 April (Thursday, 0800), end 4.9 week pp physics run at $\sqrt{s} = 510$ GeV

Tentative Cu-Au and Uranium-Uranium plan (subject to change)

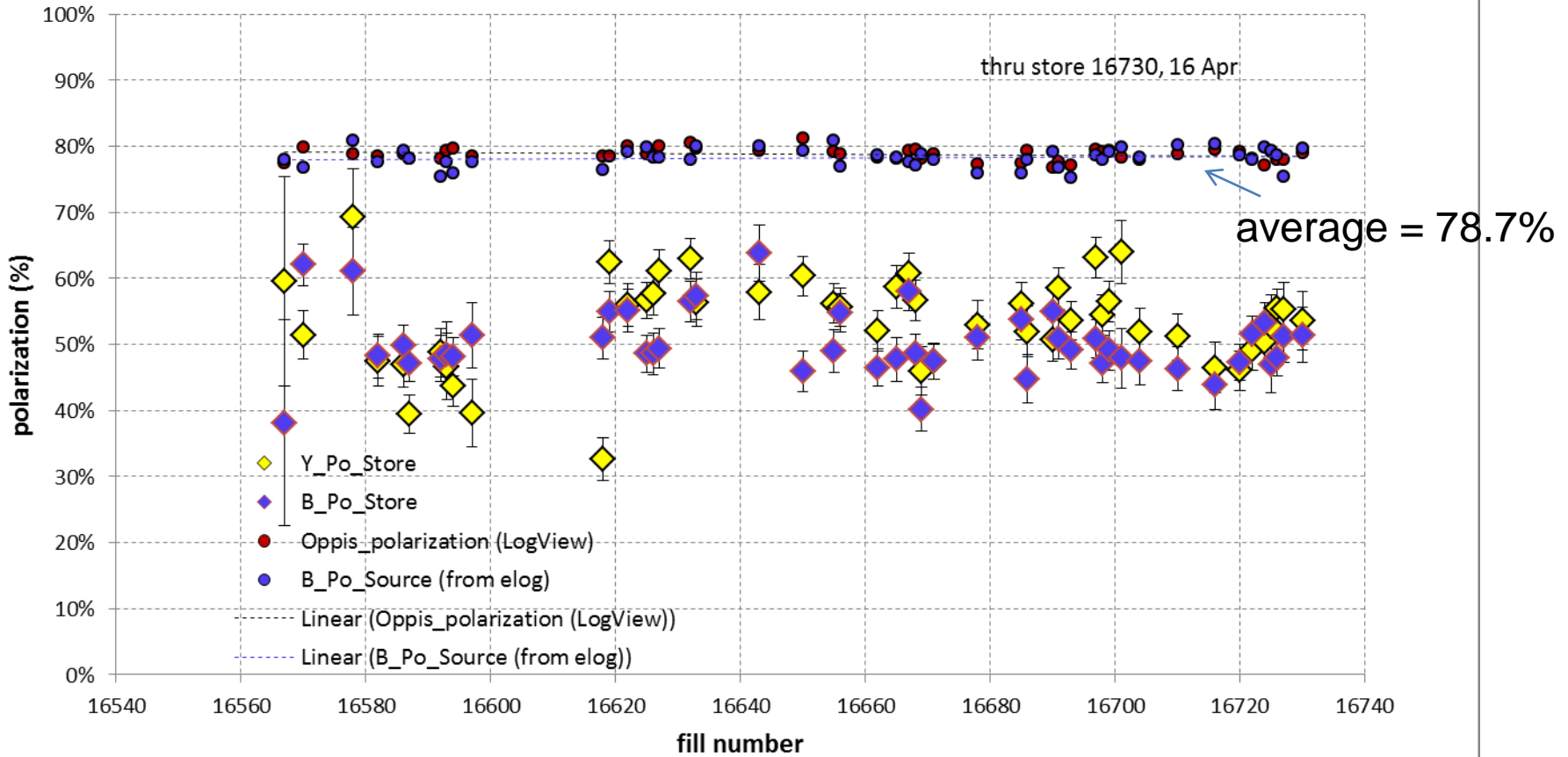
STAR request for ~2 day $\sqrt{s} = 15$ GeV/n AuAu development run is pending

- 19 April (Thursday), begin 1 week setup for UU (with overnight stores for experiments ~ Sunday night)
- 26 April (Thursday), begin 3 week UU physics run
- 17 May (Thursday) end 3 week $\sqrt{s} = 193$ GeV/n UU run, begin setup for $\sqrt{s} = 200$ GeV/n CuAu
- 19 May (Saturday – my ambitious estimate) begin CuAu physics run
- 20-25 May: IPAC
- 25 June (Monday), end 5.3 week $\sqrt{s} = 200$ GeV/n CuAu run, begin cryo warm-up
- 28 June, cryo warm-up complete (23.3 cryo-weeks) **Total Physics Weeks = 17.6**

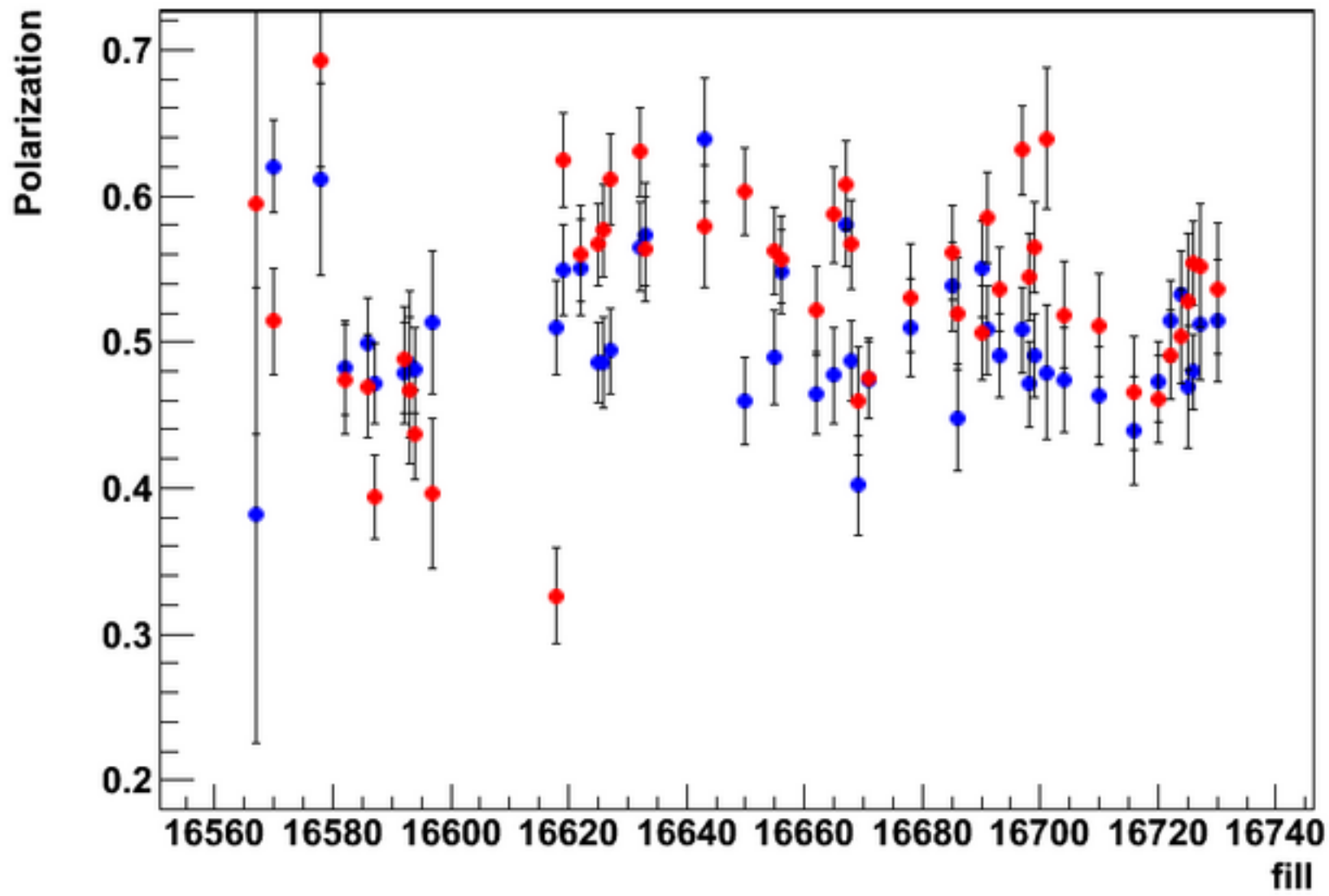
Thru fill 16730, 17 Apr



Run12 255 x 255 Gev pp Jet target Polarization results

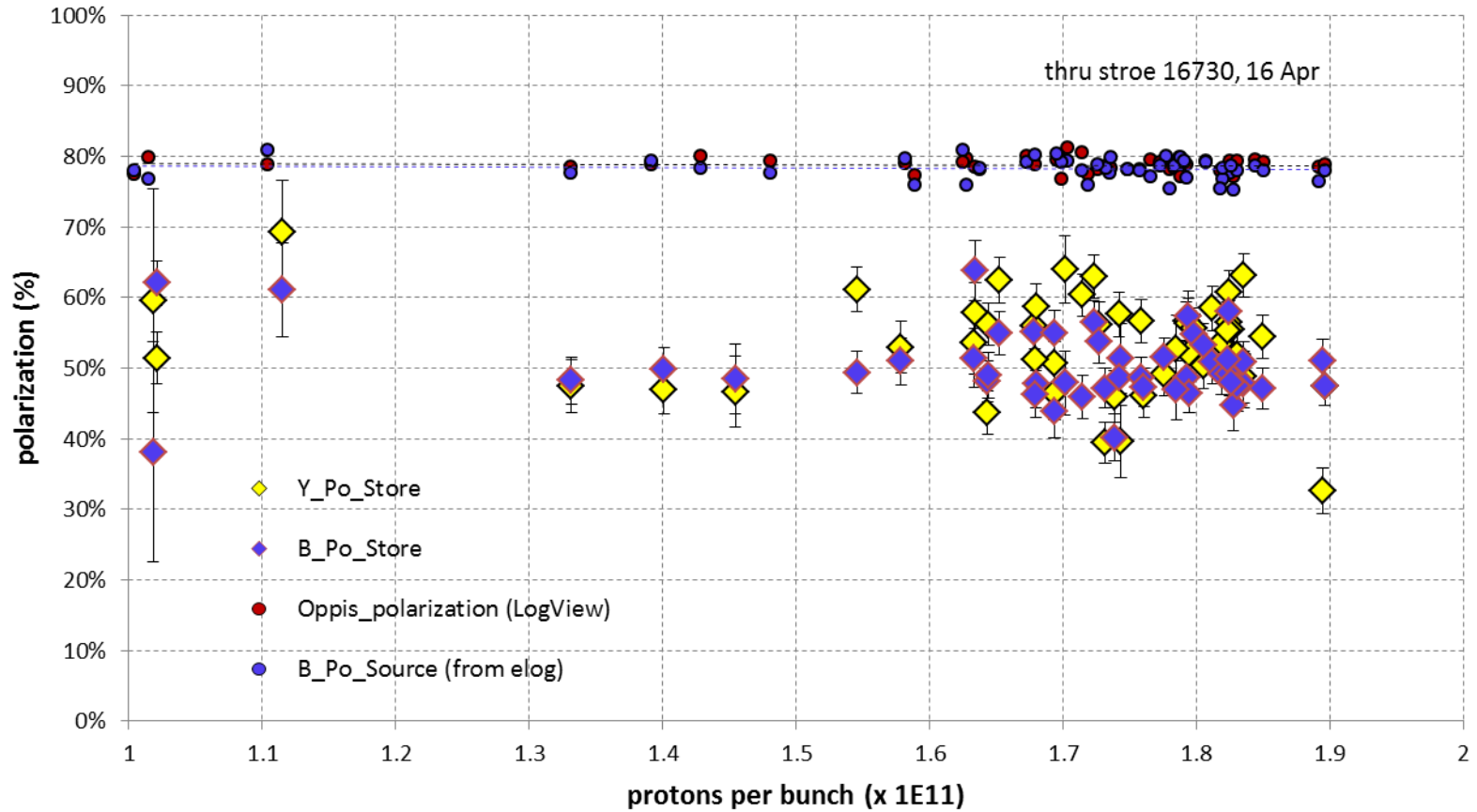


Blue weighted average = $50.2\% \pm 0.5\%$, 36% below source pol
Yellow weighted average = $53.3\% \pm 0.5\%$, 32% below source pol



Run12 255 x 255 Gev pp Jet target Final Polarization results

thru stroe 16730, 16 Apr



Where we are with Uranium (From K. Zeno)

Into the booster 8×10^8 in 4 bunches

These are then combined into one bunch

Booster extraction 6.5×10^8 / bunch

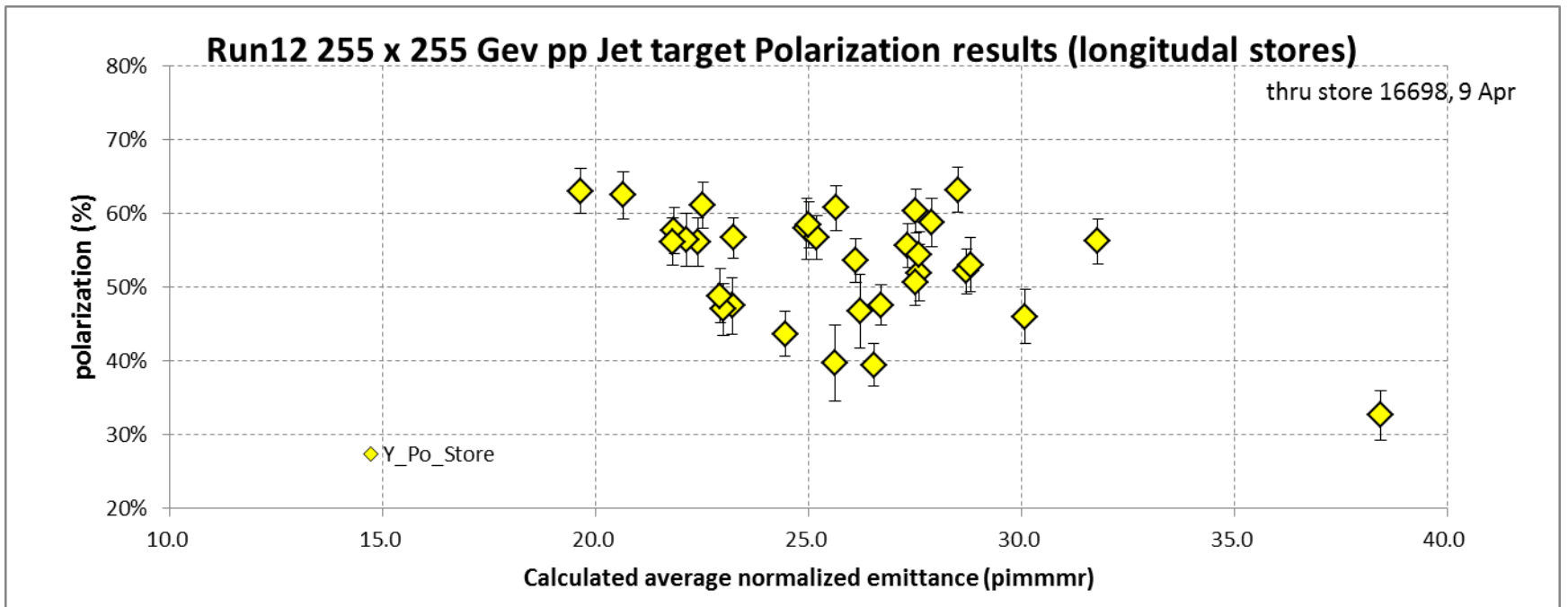
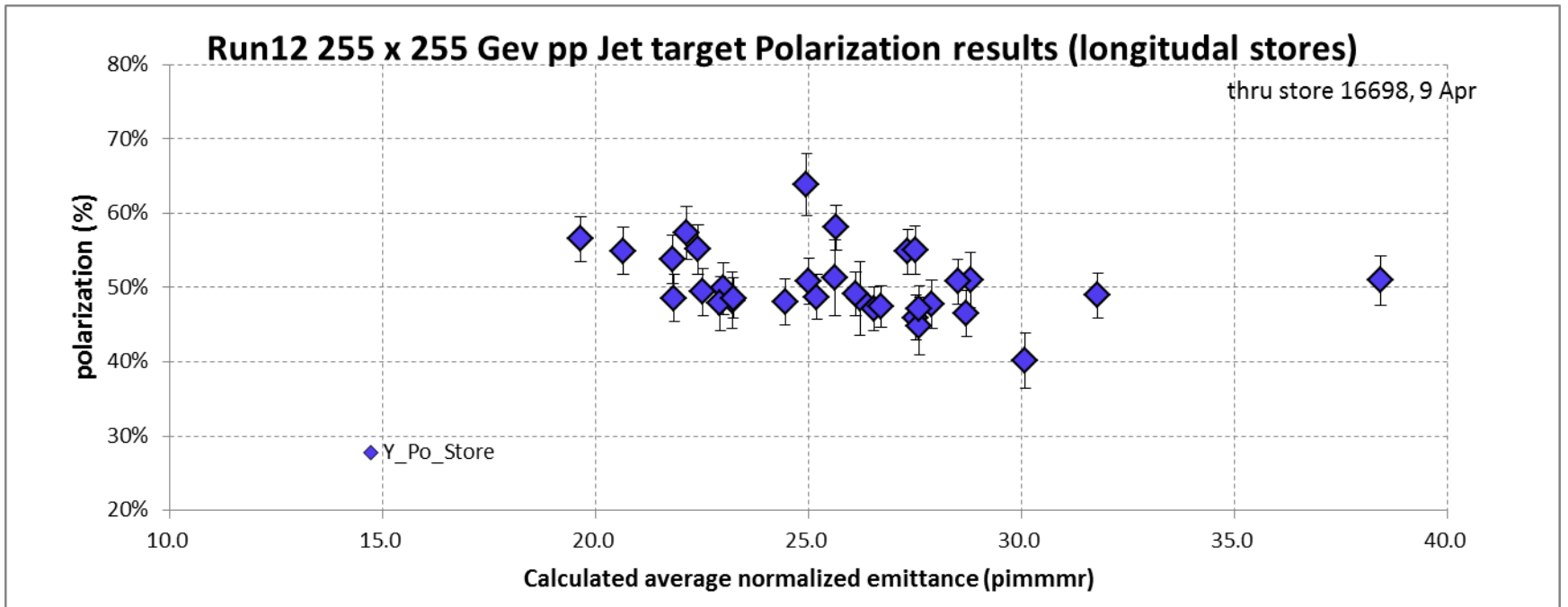
30% efficiency into the AGS

AGS extraction is at 2×10^8 / bunch

Desired (Wolfram) $\sim 7 \times 10^8$ / bunch

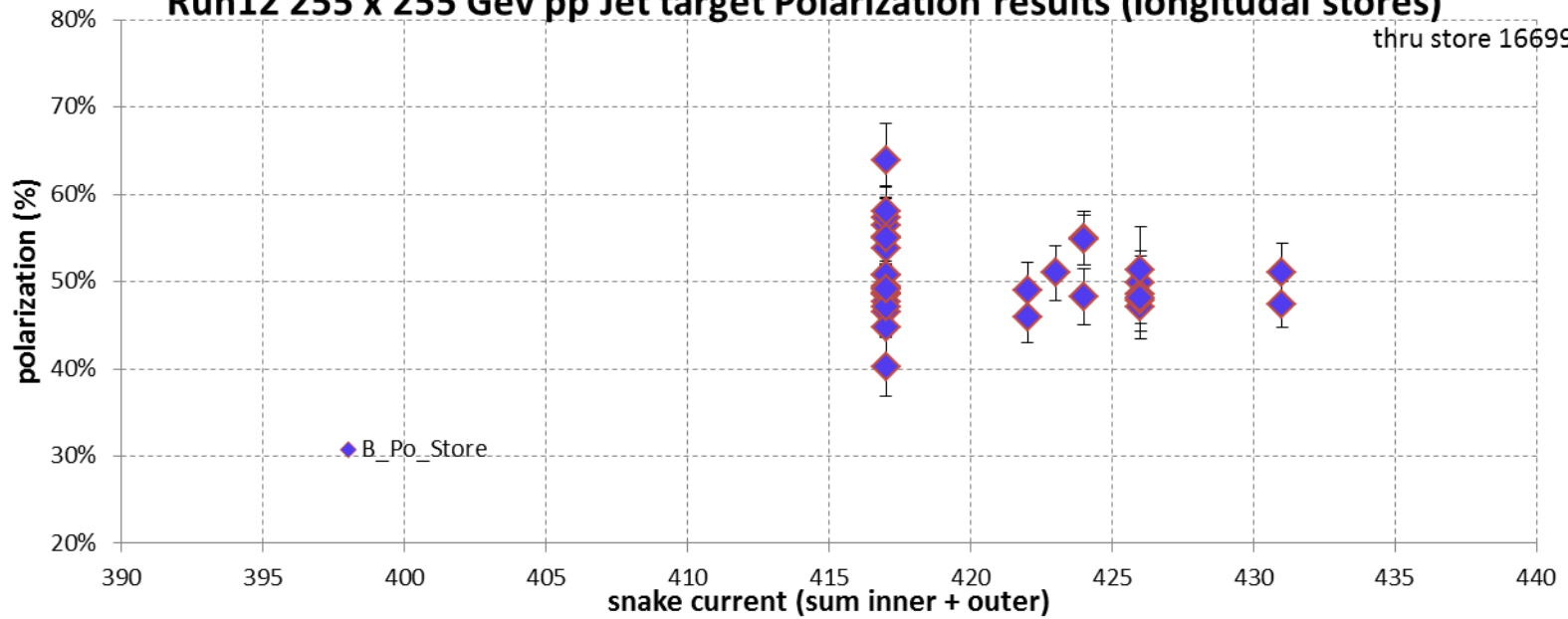
$\ggg 6 \times 10^8$ / bunch in RHIC

Other Slides



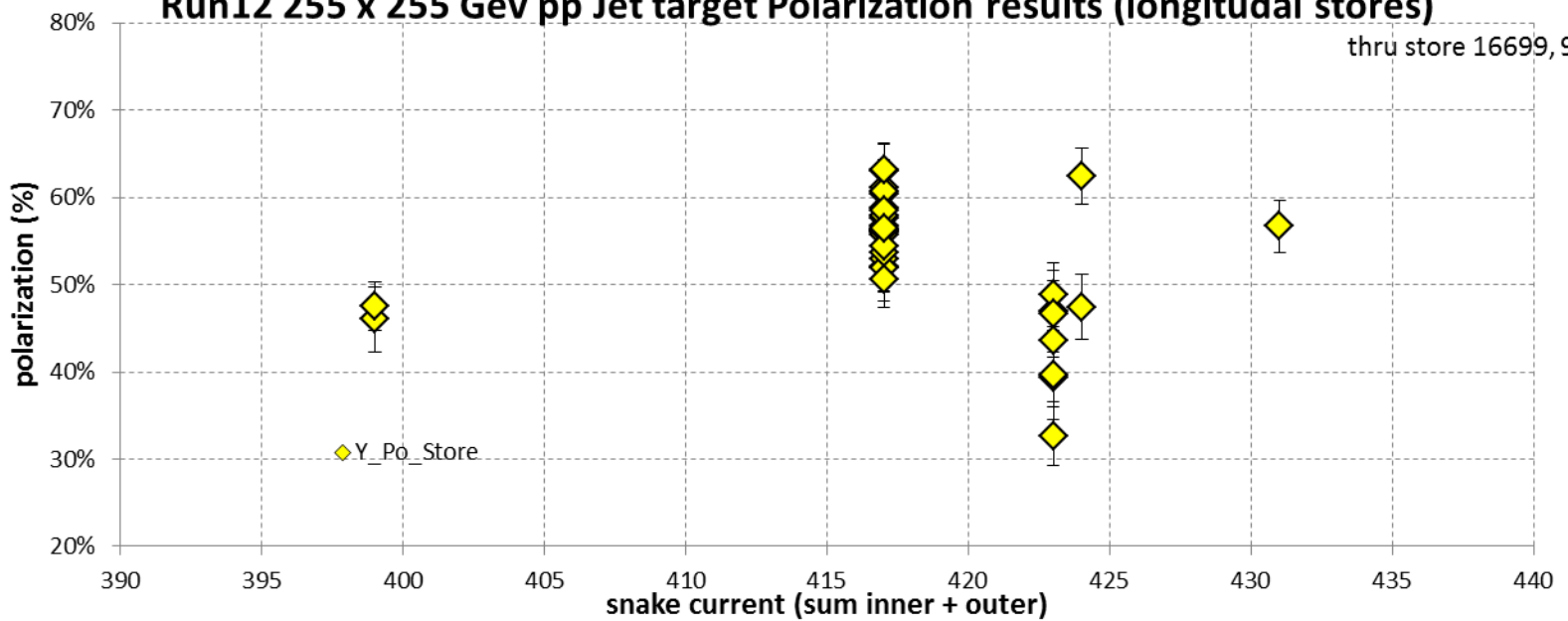
Run12 255 x 255 Gev pp Jet target Polarization results (longitudinal stores)

thru store 16699, 9 Apr



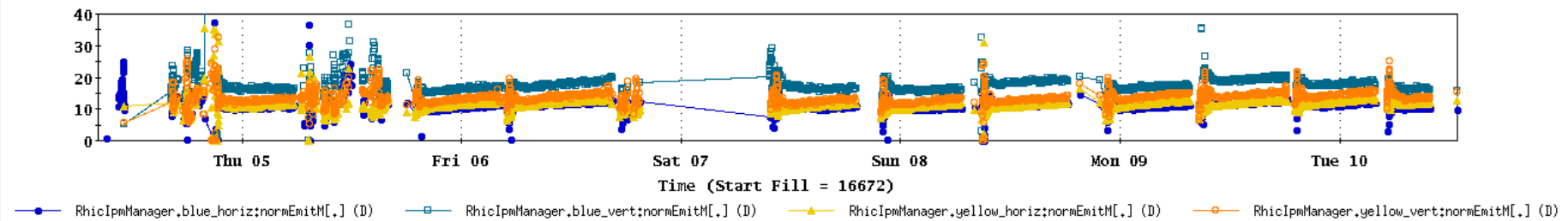
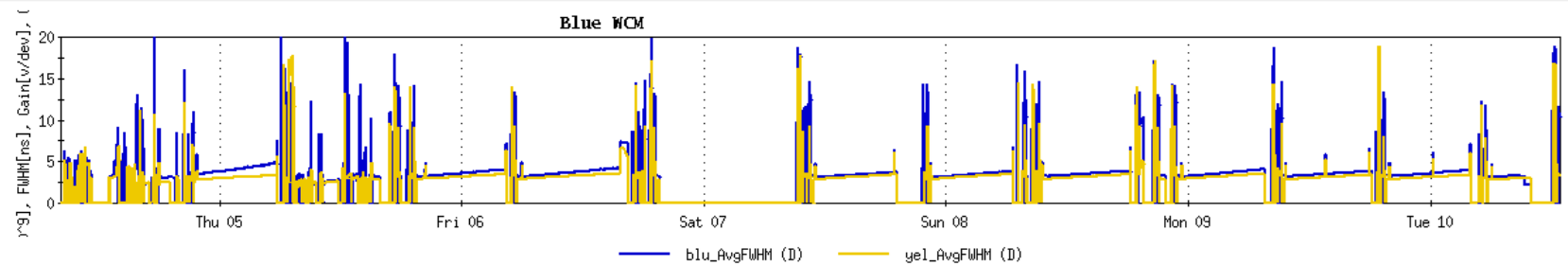
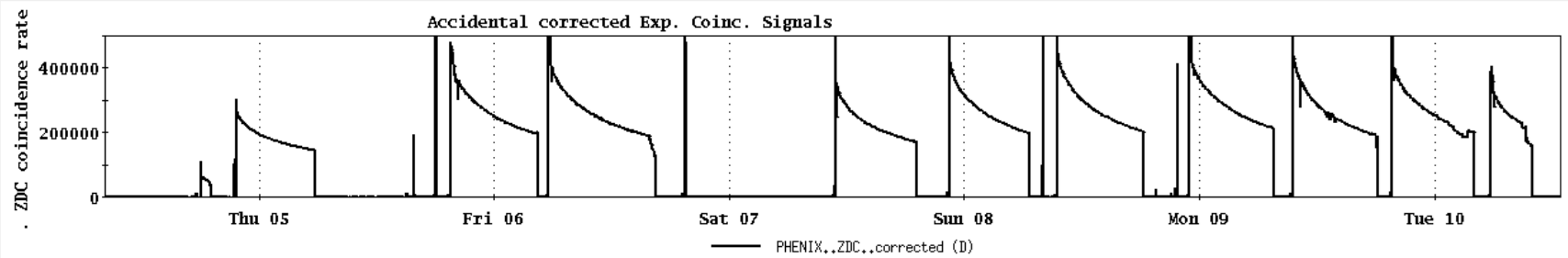
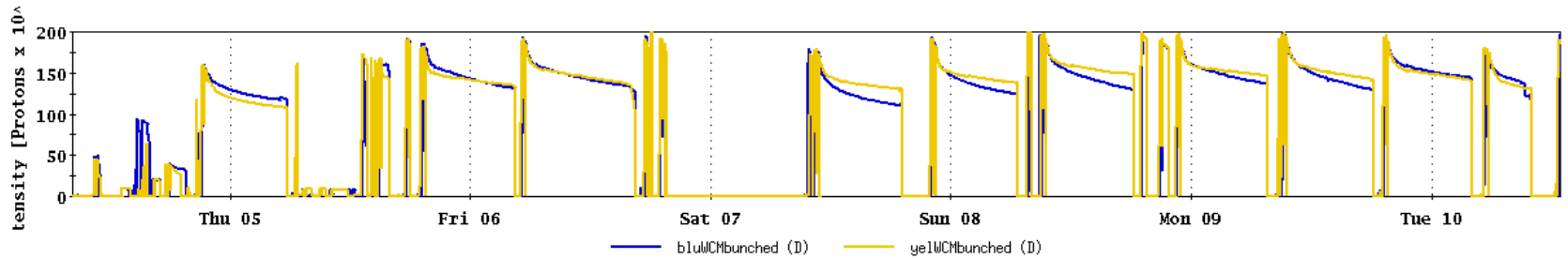
Run12 255 x 255 Gev pp Jet target Polarization results (longitudinal stores)

thru store 16699, 9 Apr






4 Apr – 10 Apr stores

File Window Markers Analysis

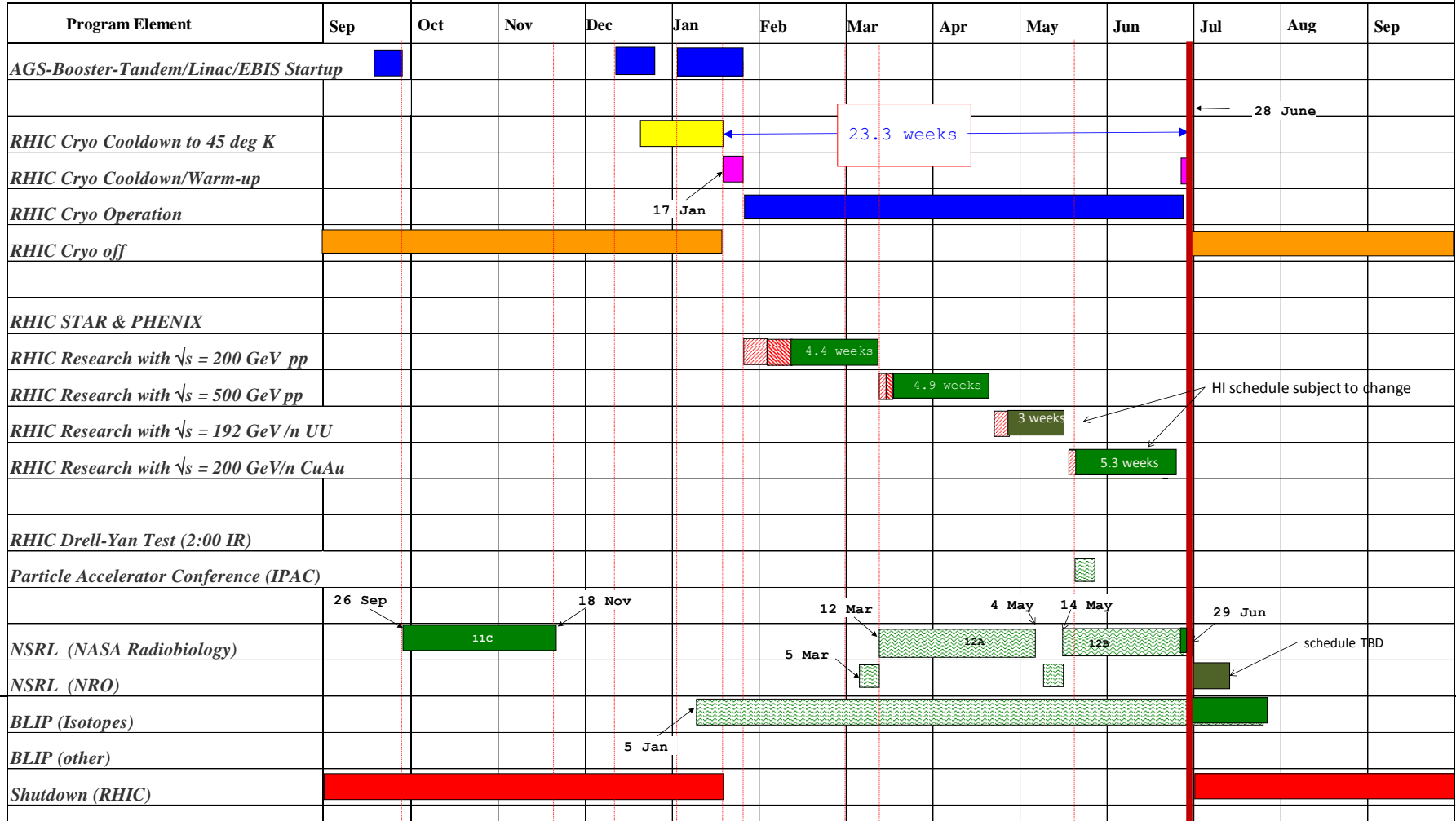


C-A Operations-FY12

in progress/planned

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

FY 2012



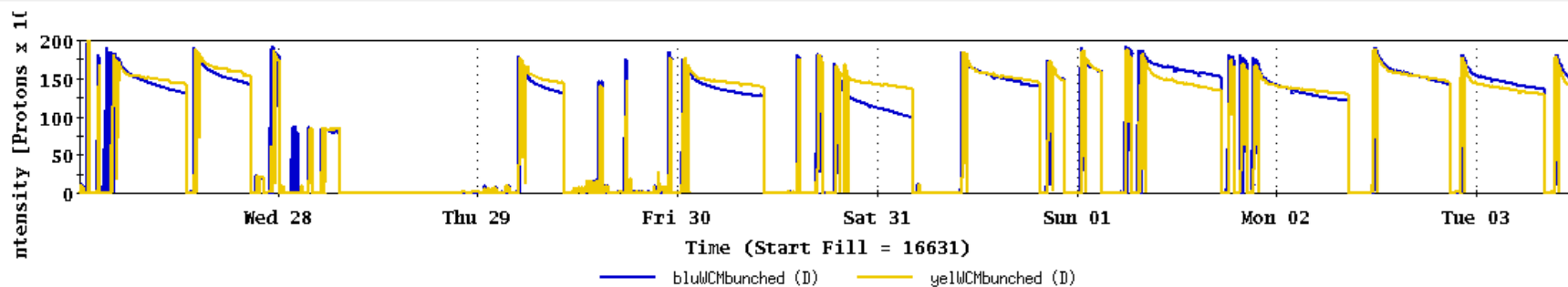
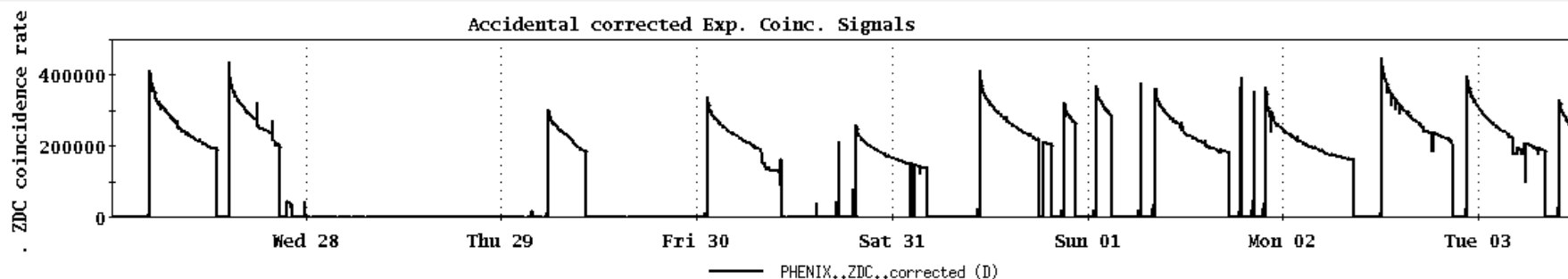
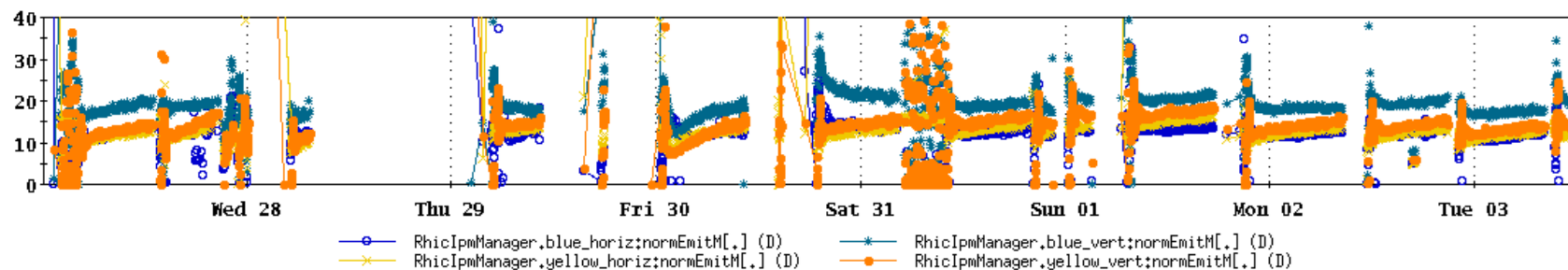
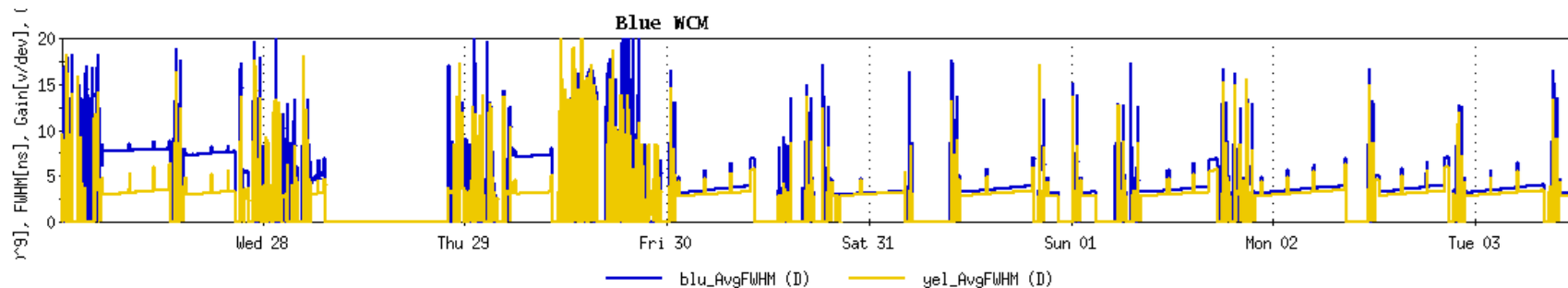
Run 12, $\sqrt{s} = 510$ GeV polarized proton run – experiment goals

STAR Goal for 5 weeks longitudinal polarization (50% polarization):

- Sampled Luminosity = 45 pb^{-1} with 50% polarization
- Delivered Luminosity = 75 pb^{-1}

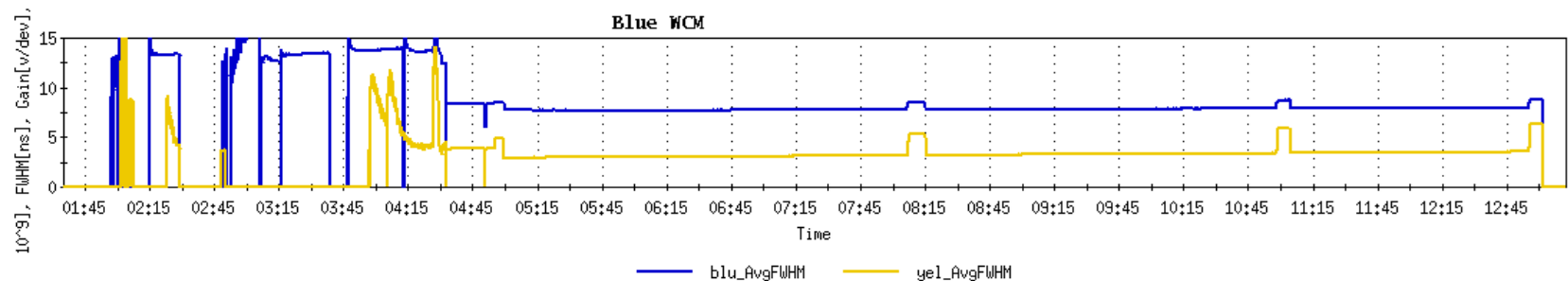
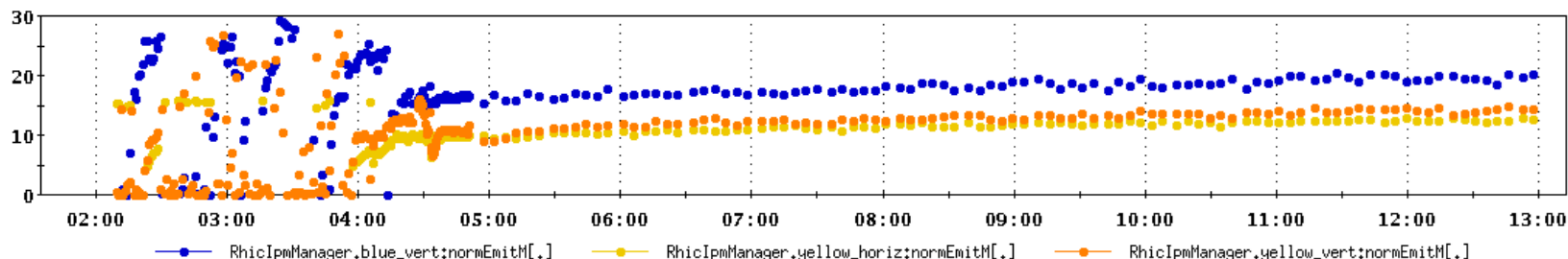
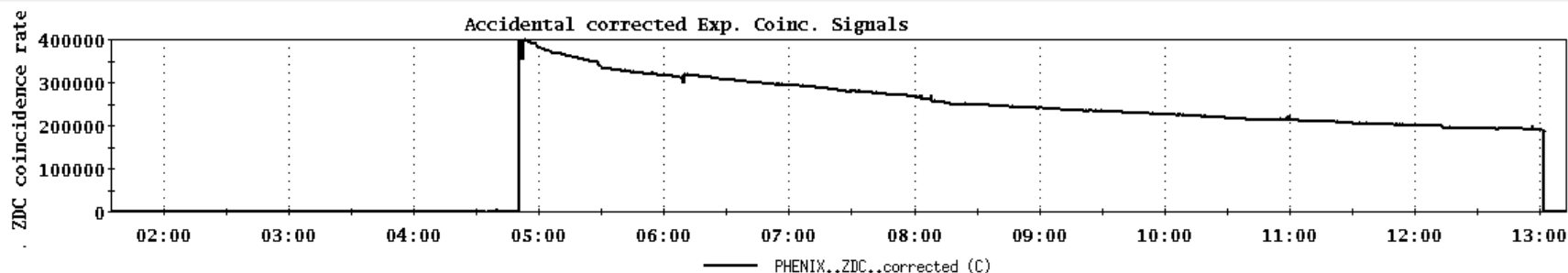
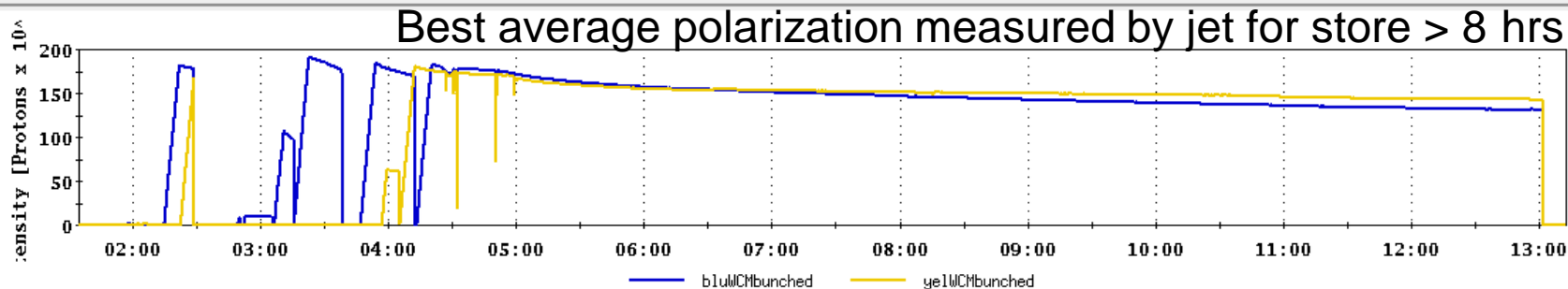
PHENIX Goal for 5 weeks longitudinal polarization (50% polarization):

- Sampled Luminosity = 30 pb^{-1} with $|z| < 30 \text{ cm}$
= 10 pb^{-1} with $|z| < 10 \text{ cm}$
- Delivered Luminosity = ~~75 pb^{-1}~~ changed to 120 pb^{-1} , 3/29/12, Ed O'Brien email

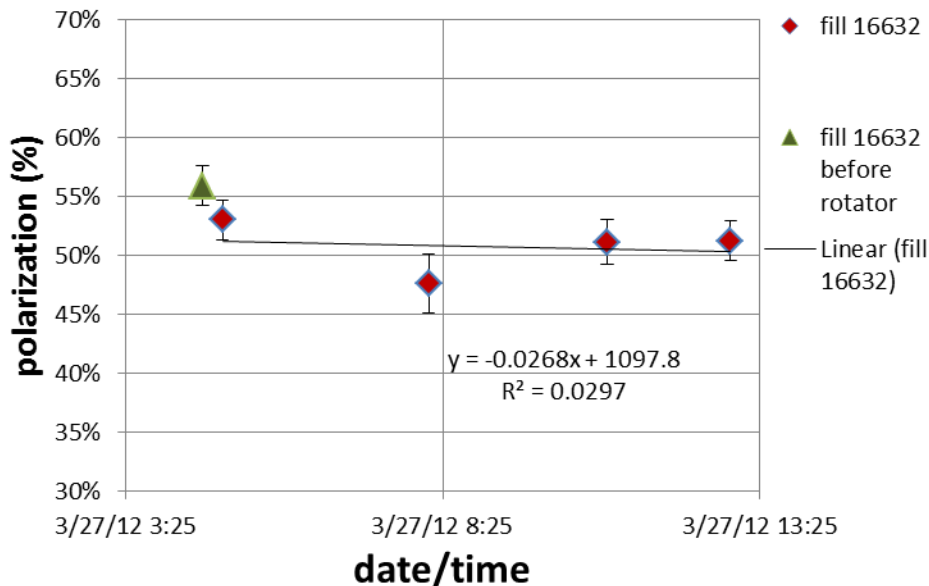


Store 16632, Blue jet = 56.5 +/- 3.0; Yellow jet = 63.0 +/- 3.1

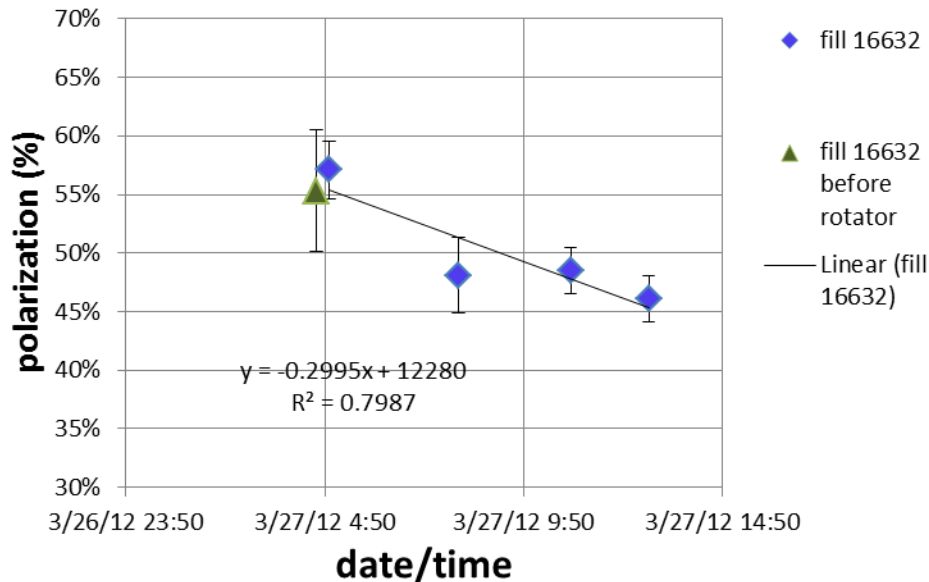
File Window Markers Analysis



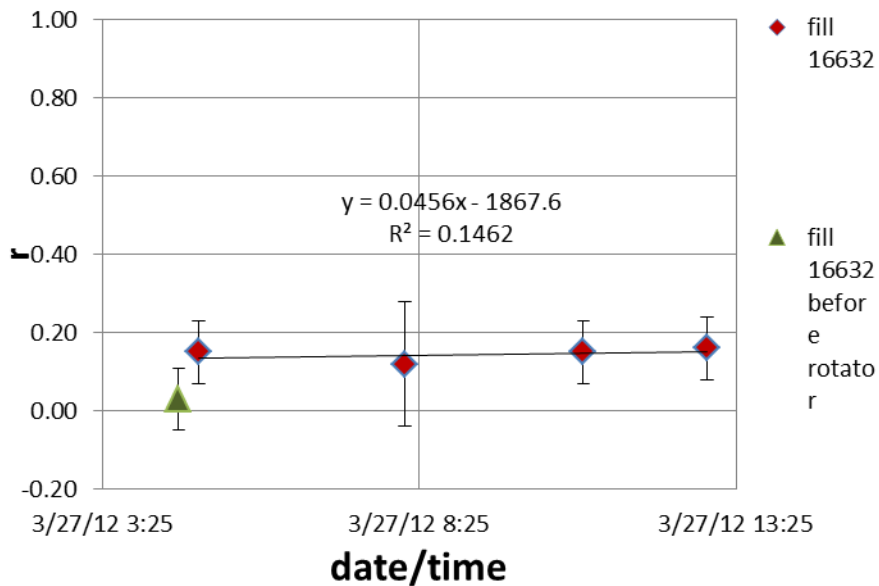
Yellow (Y1D) CNI results Run12, 510 GeV pp



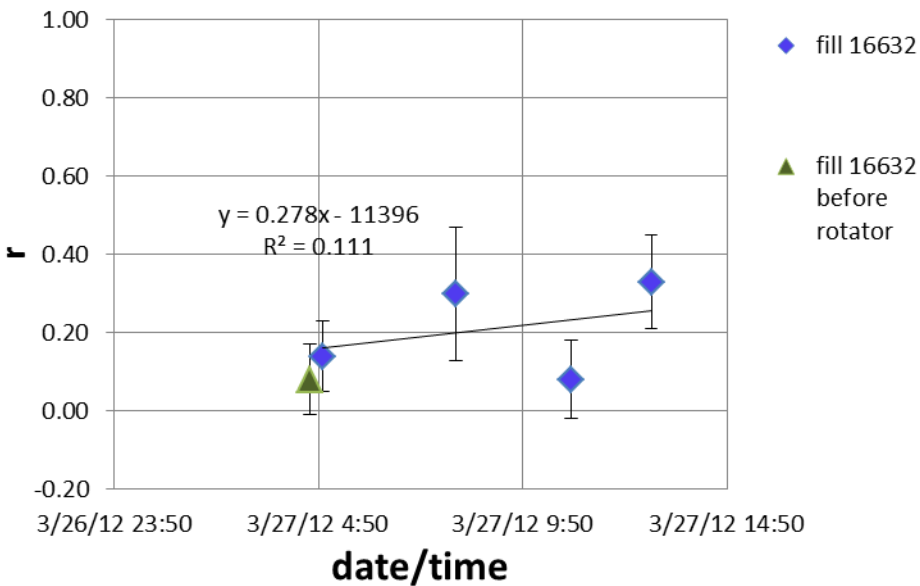
Blue (B1U) CNI results Run12, 510 GeV pp



Yellow (Y1D) CNI results Run12, 510 GeV pp



Blue (B1U) CNI results Run12, 510 GeV pp

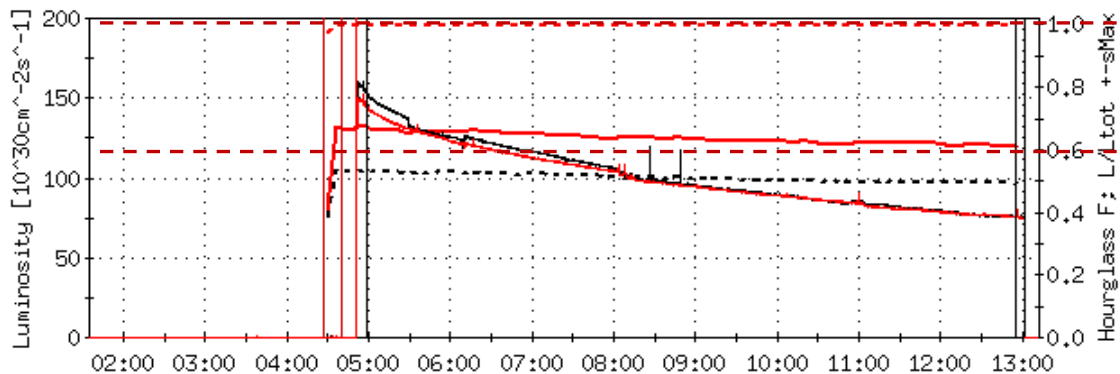
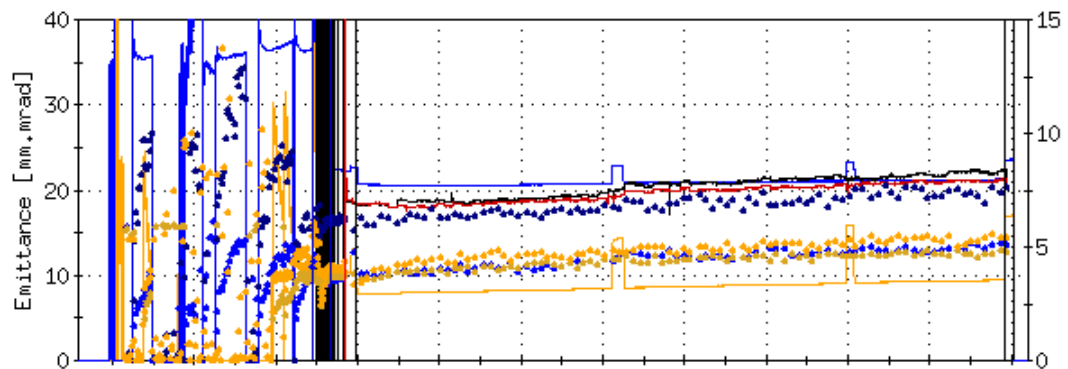
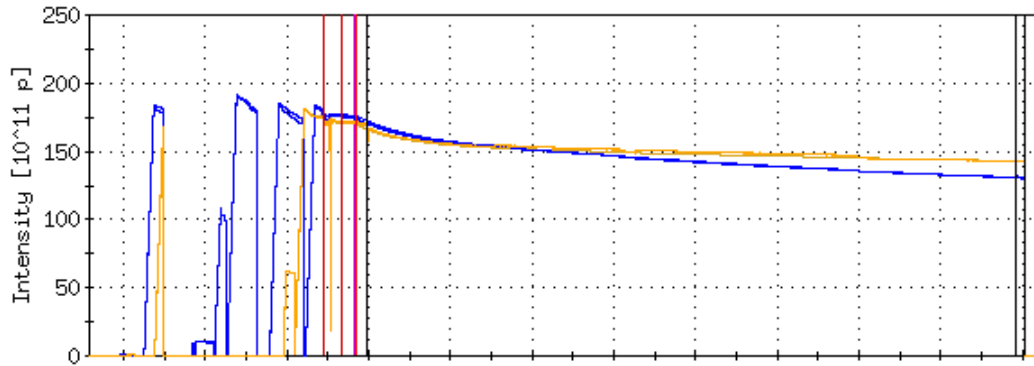


Store 16632

Best average polarization measured by jet for store > 8 hrs

Setup Display

Help



Fill Update Species
Run

Beam Parameters
Pattern gamma

Collision Parameters

	PHENIX	STAR
No collisions	<input type="text" value="107"/>	<input type="text" value="102"/>
beta* [m]	<input type="text" value="0.65"/>	<input type="text" value="0.65"/>
sMax [m]	<input type="text" value="0.30"/>	<input type="text" value="2.00"/>
sigma [mb]	<input type="text" value="2.530"/>	<input type="text" value="2.830"/>

Single Correction All No

Update Display

Fit

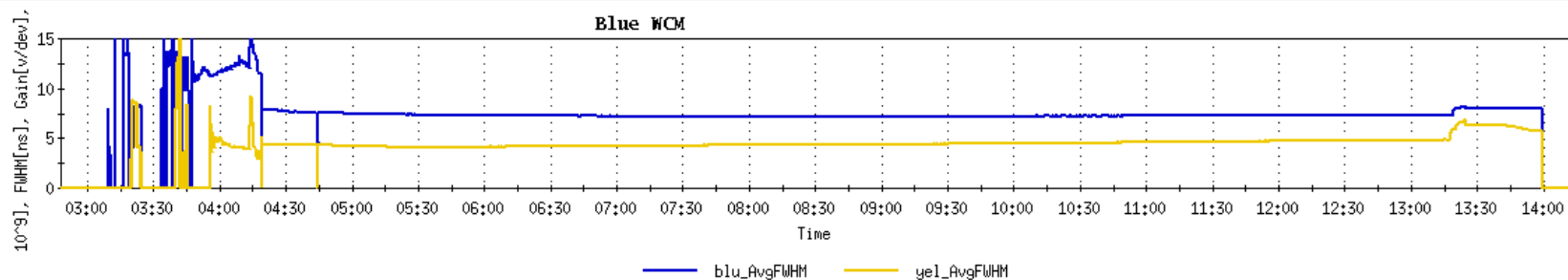
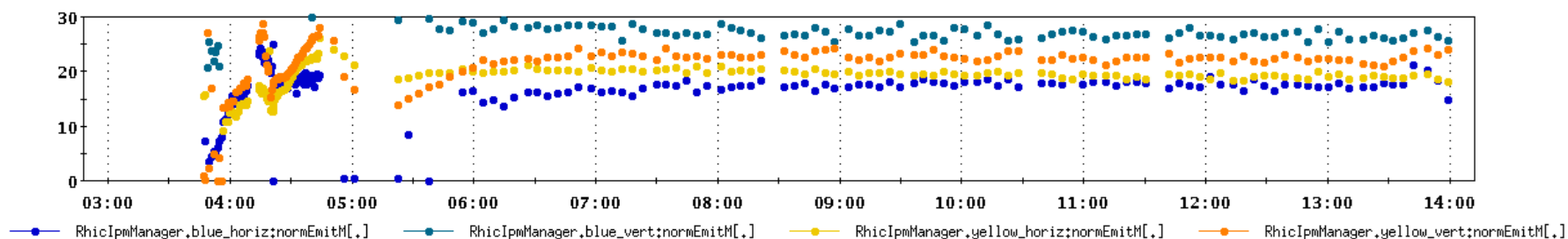
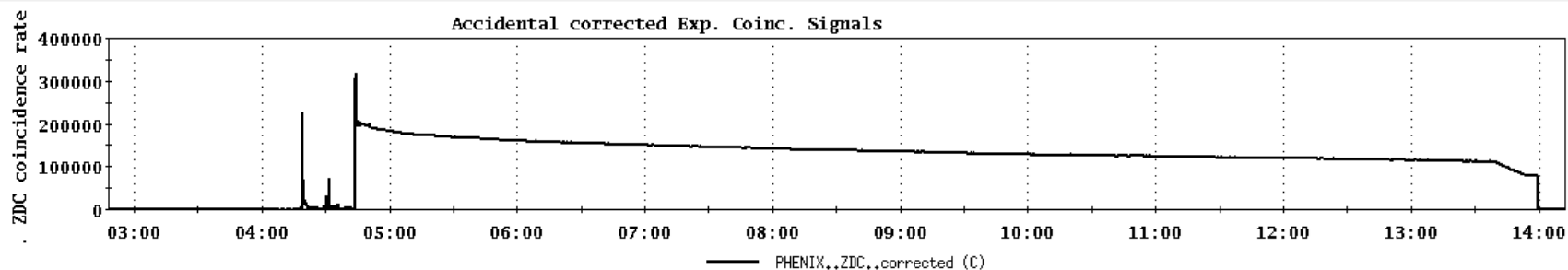
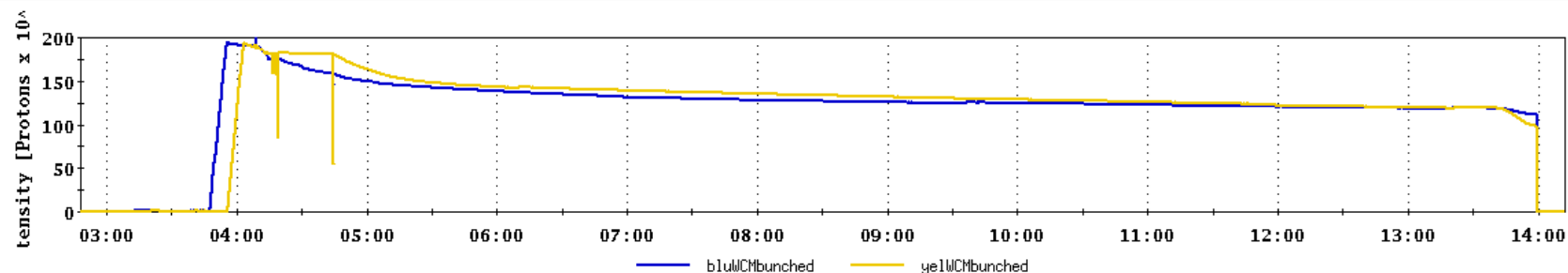
Peak lumi goal

Average lumi goal

dect wcm zdc Exp Fit

Store 16618, Blue jet = 51.0 +/- 3.2; Yellow jet = 32.6 +/- 3.3

File Window Markers Analysis Worst average polarization measured by jet for store > 8 hrs



Store 16618

Worst average polarization measured by jet for store > 8 hrs

Setup Display Help

Fill Species

Run

Beam Parameters

Pattern gamma

Collision Parameters

	PHENIX	STAR
No collisions	<input type="text" value="107"/>	<input type="text" value="102"/>
beta* [m]	<input type="text" value="0.65"/>	<input type="text" value="0.65"/>
sMax [m]	<input type="text" value="0.30"/>	<input type="text" value="2.00"/>
sigma [mb]	<input type="text" value="2.530"/>	<input type="text" value="2.830"/>

Single Correction

Fit

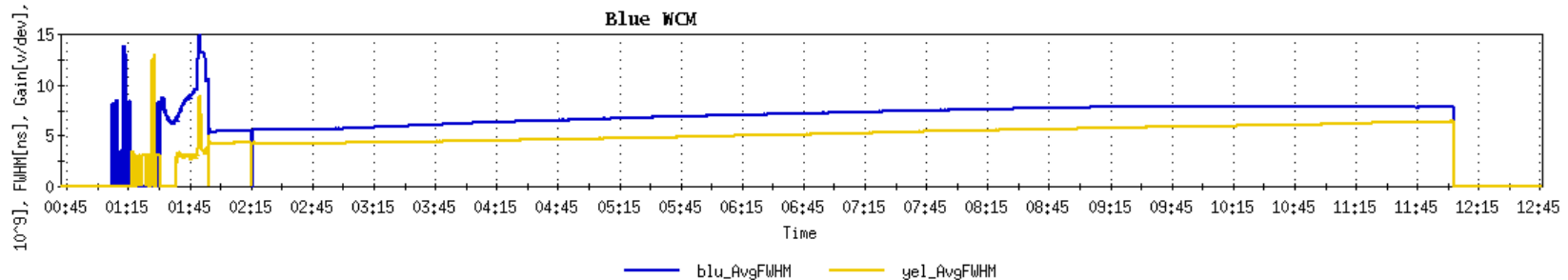
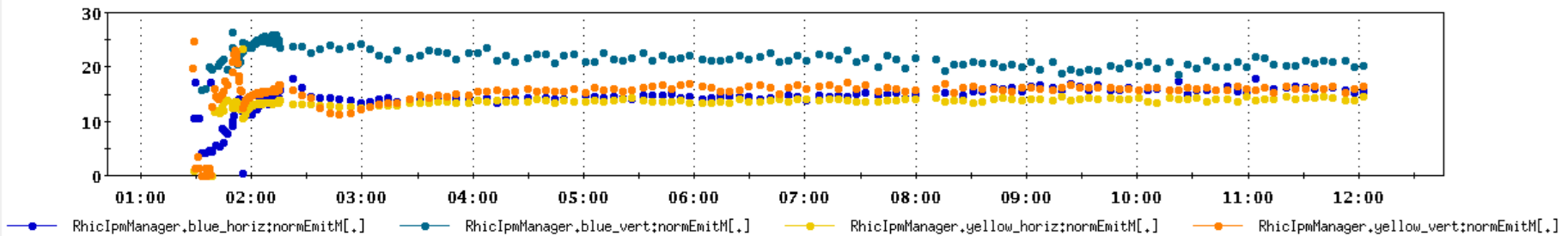
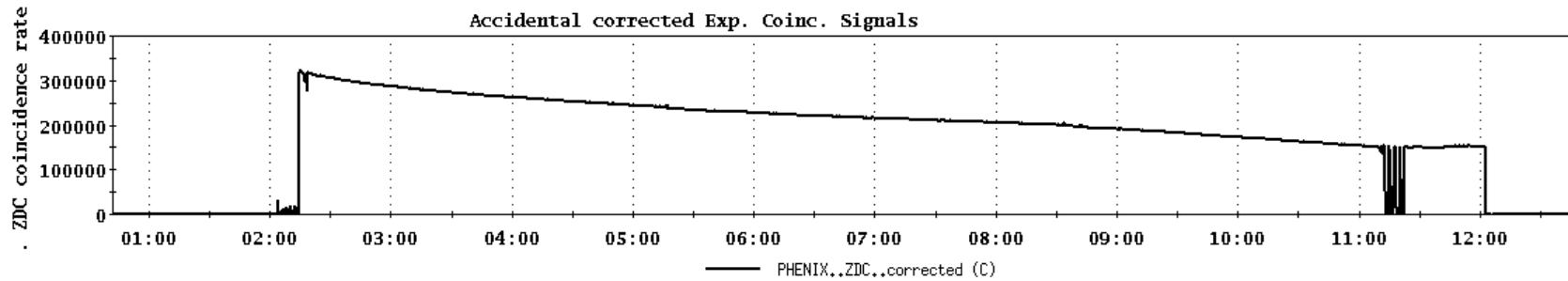
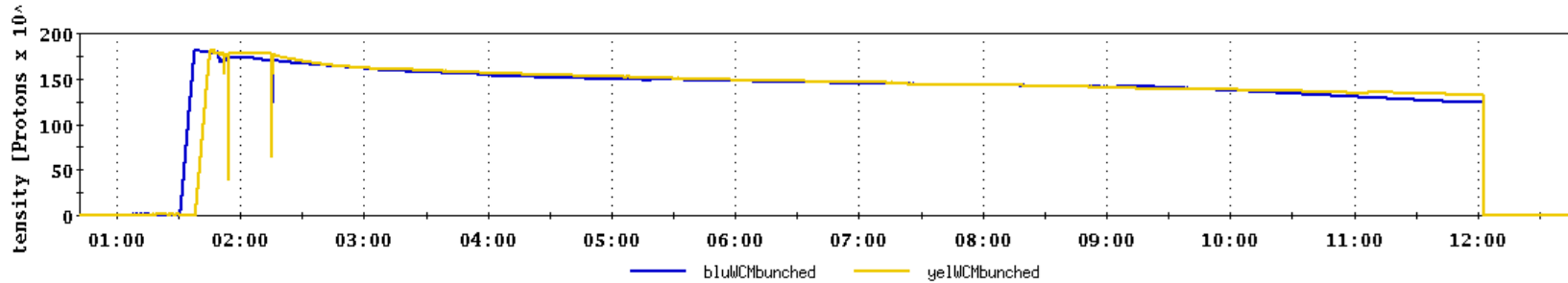
dcct wcm zdc Exp Fit

The figure displays three time-series plots for Store 16618, spanning from 03:00 to 14:00. The top plot shows Intensity [10¹¹ p] on the y-axis (0 to 250) against time. It features a sharp rise at approximately 04:00, reaching a peak of about 200, followed by a gradual decay to a steady state of approximately 120. The middle plot shows Emittance [mm_mrad] on the left y-axis (0 to 40) and FWHM bunch length [ns] on the right y-axis (0 to 15) against time. Both parameters show a sharp increase at 04:00 and then stabilize. The bottom plot shows Luminosity [10³⁰ cm⁻² s⁻¹] on the left y-axis (0 to 200) and Hourglass F: L/Ltot +- sMax on the right y-axis (0.0 to 1.0) against time. Luminosity peaks at 04:00 and stabilizes around 130. The Hourglass F parameter shows a step change at 04:00 from 0.0 to approximately 0.65.

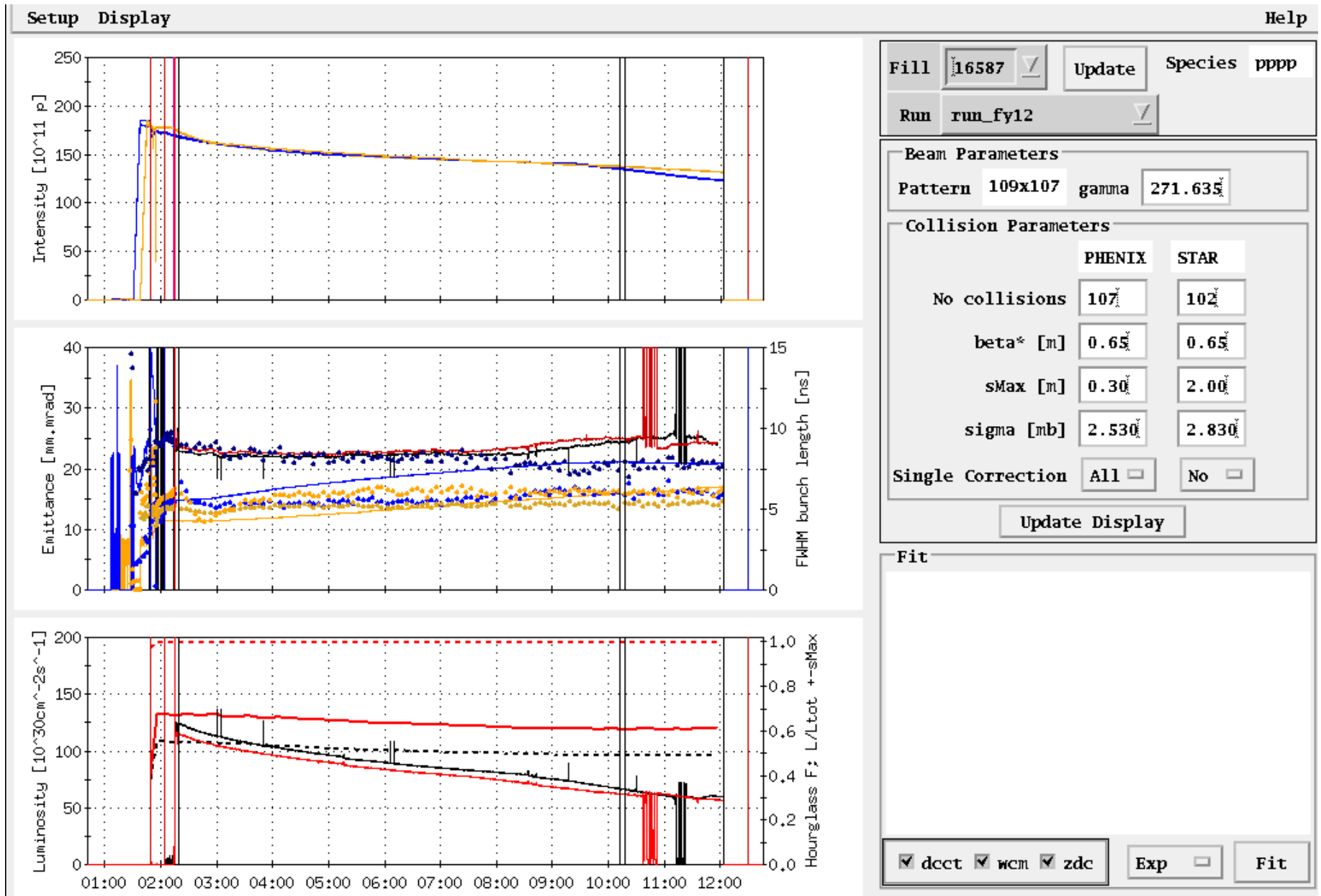
Store 16587, Blue jet = 47.2 +/- 2.8; Yellow jet = 39.4 +/- 2.9

Next to worst average polarization measured by jet for store > 8 hrs

File Window Markers Analysis



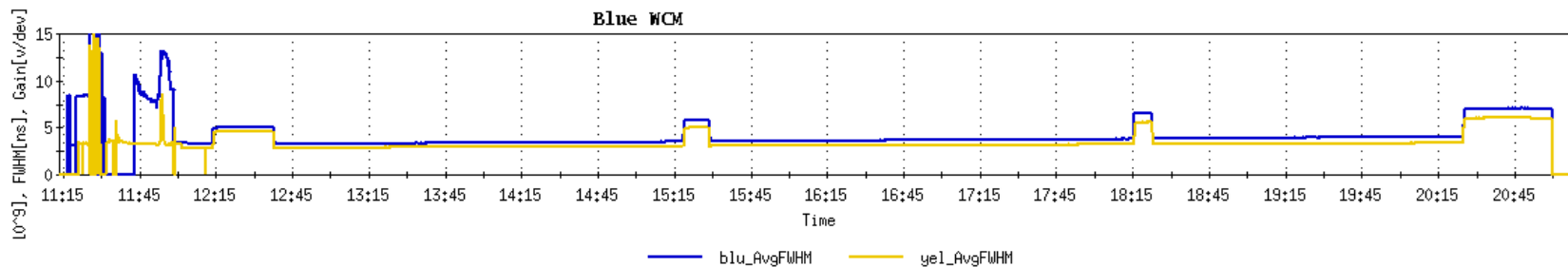
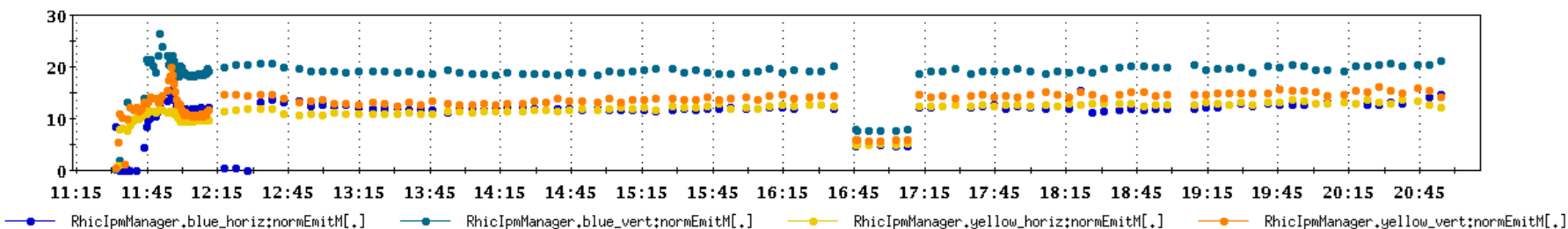
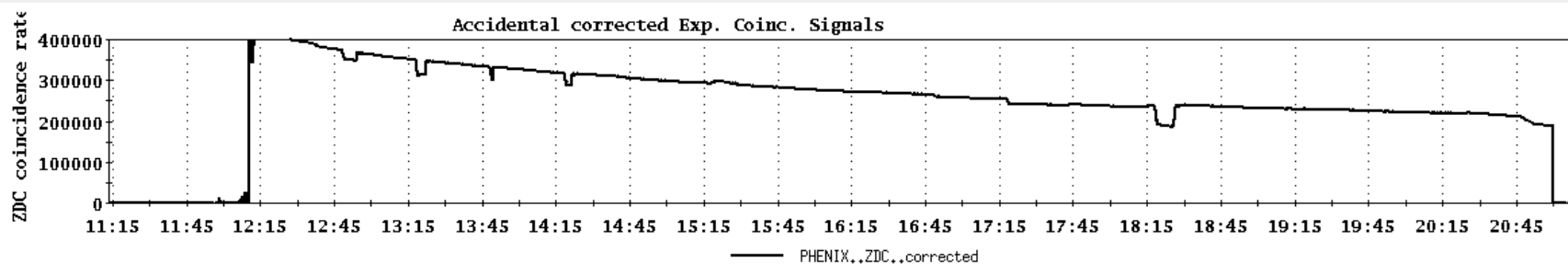
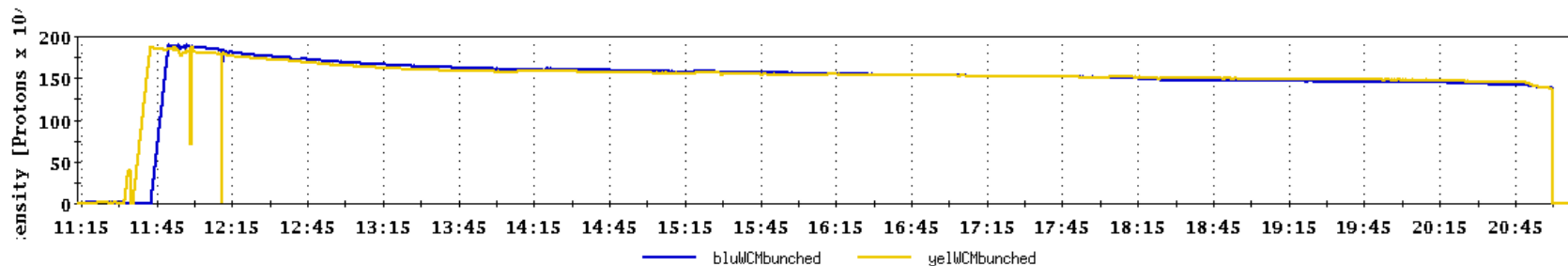
Store 16587 Next to worst average polarization measured by jet for store > 8 hrs



Store 16667, Blue jet = 58.1 +/- 2.9; Yellow jet = 60.7 +/- 3.1

File Window Markers Analysis

Second best average polarization measured by jet for store > 8 hrs



Store 16667 Second best average polarization measured by jet for store > 8 hrs

Setup Display
Help

Fill Species

Run

Beam Parameters

Pattern gamma

Collision Parameters

	PHENIX	STAR
No collisions	<input type="text" value="107"/>	<input type="text" value="102"/>
beta* [m]	<input type="text" value="0.65"/>	<input type="text" value="0.65"/>
sMax [m]	<input type="text" value="0.30"/>	<input type="text" value="2.00"/>
sigma [mb]	<input type="text" value="2.530"/>	<input type="text" value="2.830"/>

Single Correction All No

Fit

Peak lumi goal

Average lumi goal

dcut
 wcm
 zdc

Store 16632, 3/27/12

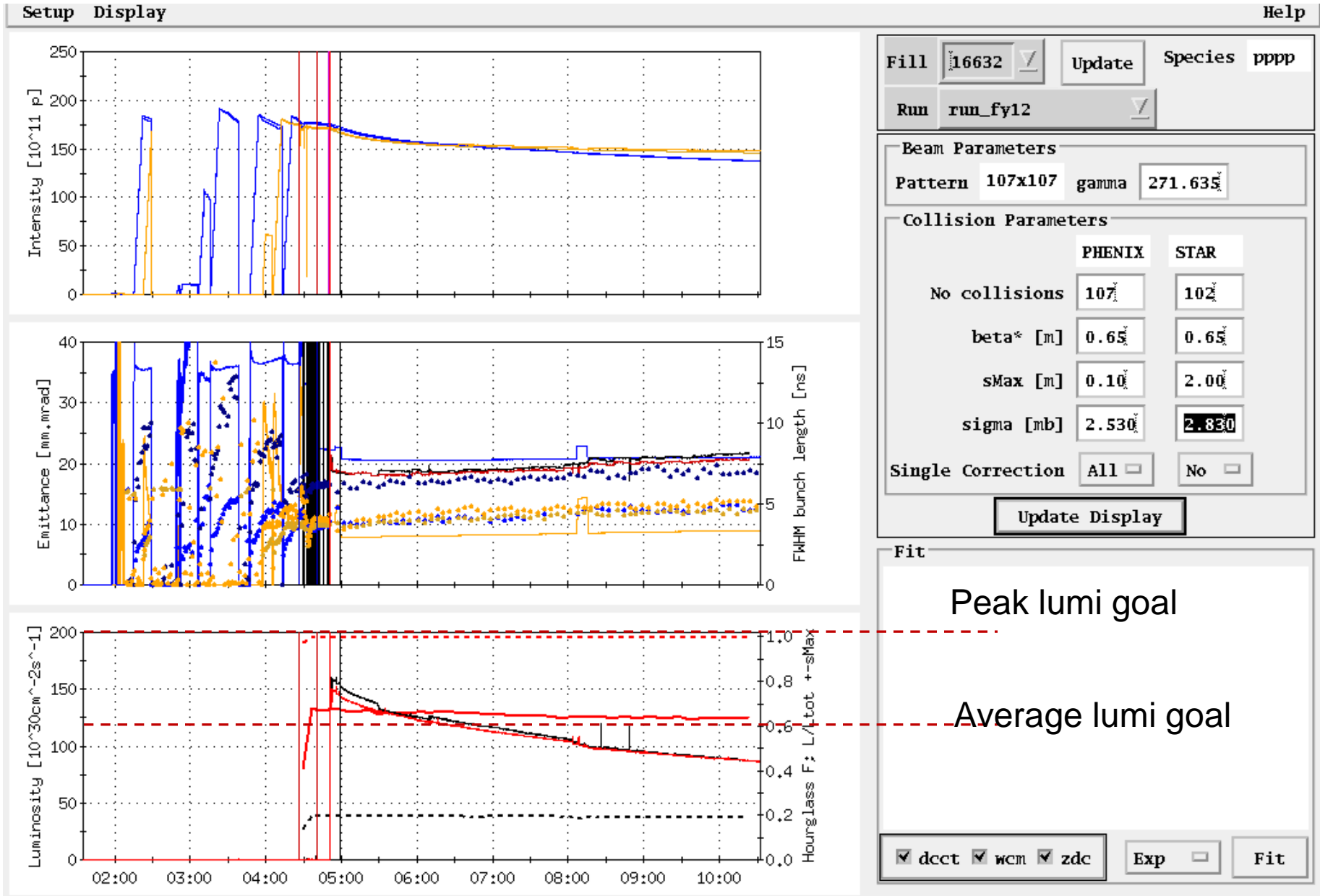
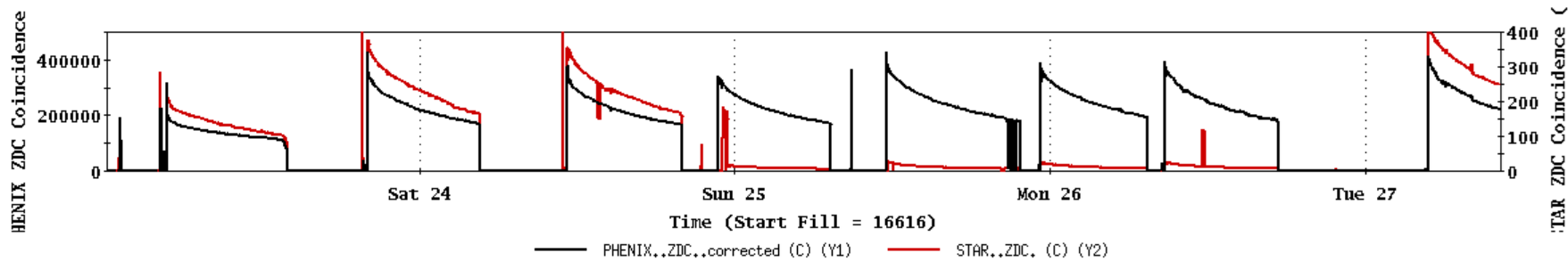
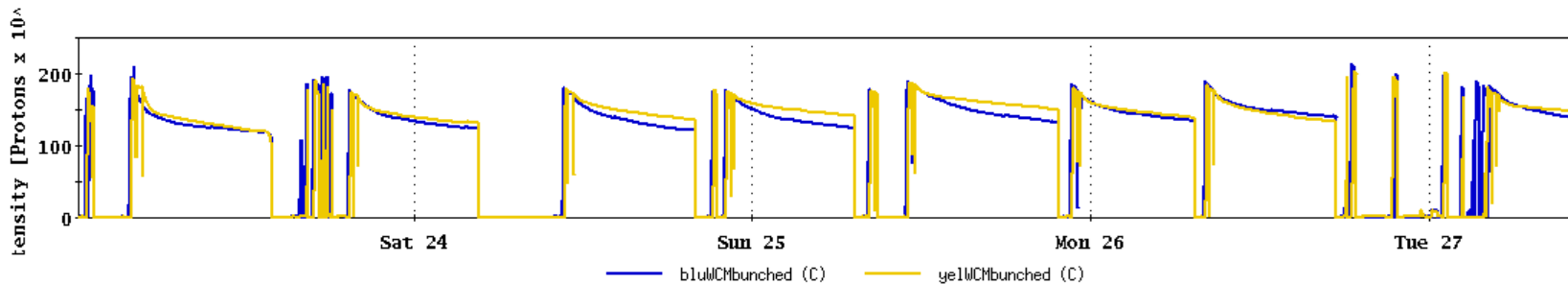
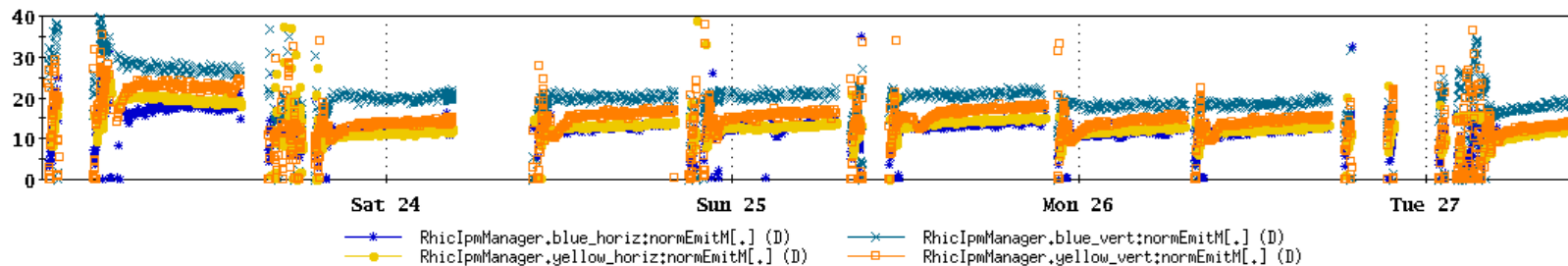
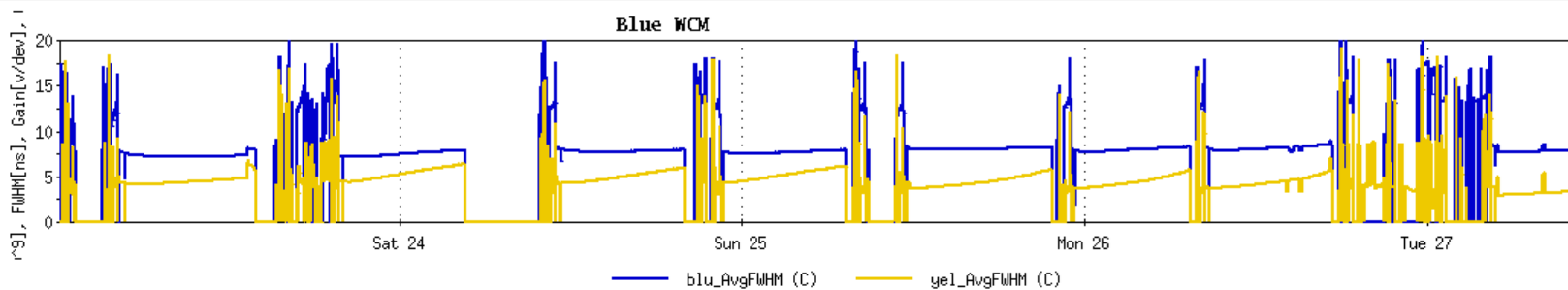
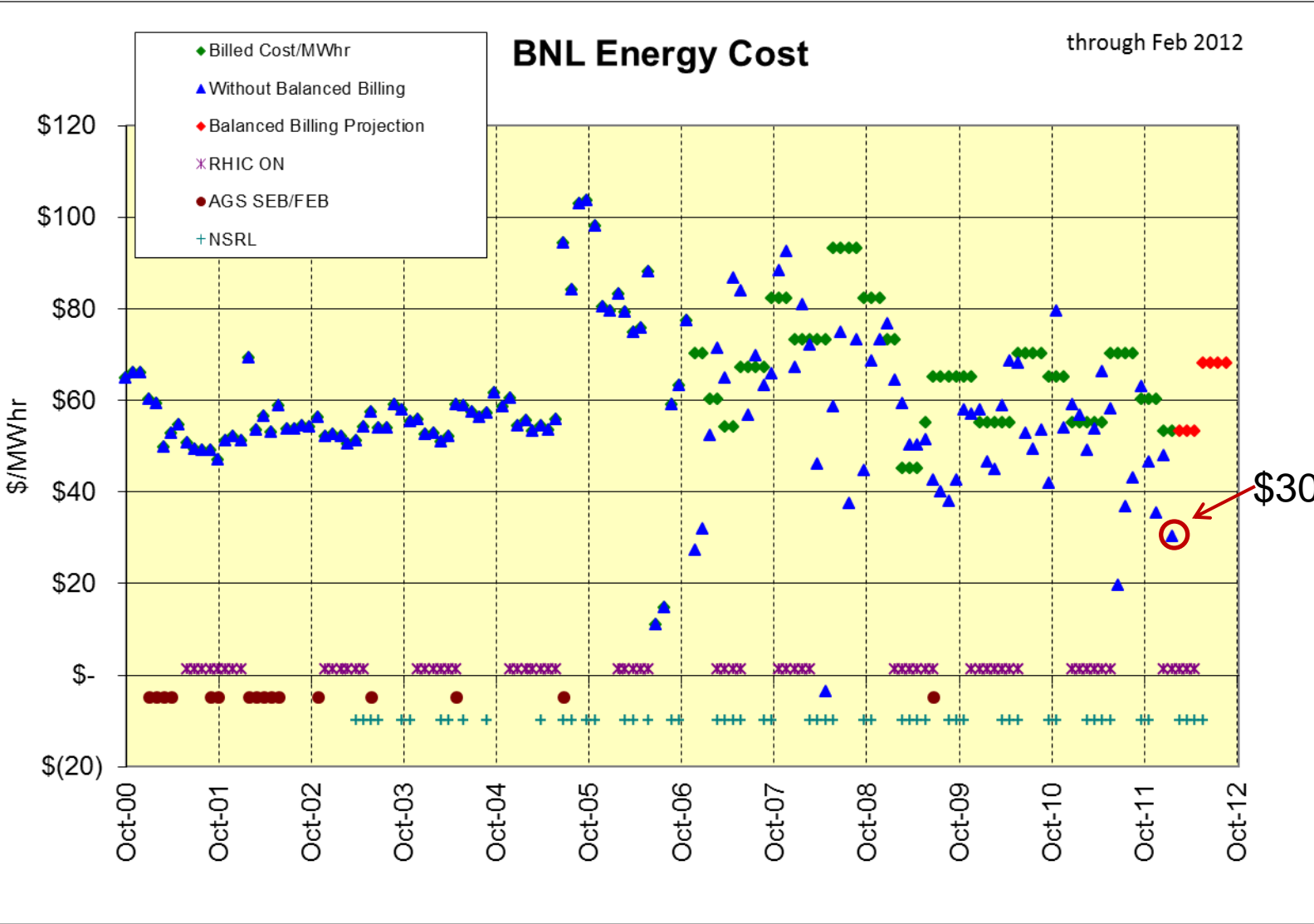


Table2: Max lumi parameters: 1.65×10^9 /bunch, $0.6 \beta^*$, 20-25 mmmr emitt \rightarrow peak = $200 \times 10^{30} \text{ cm}^{-2} \text{ s}^{-1}$

23 Mar – 27 Mar stores

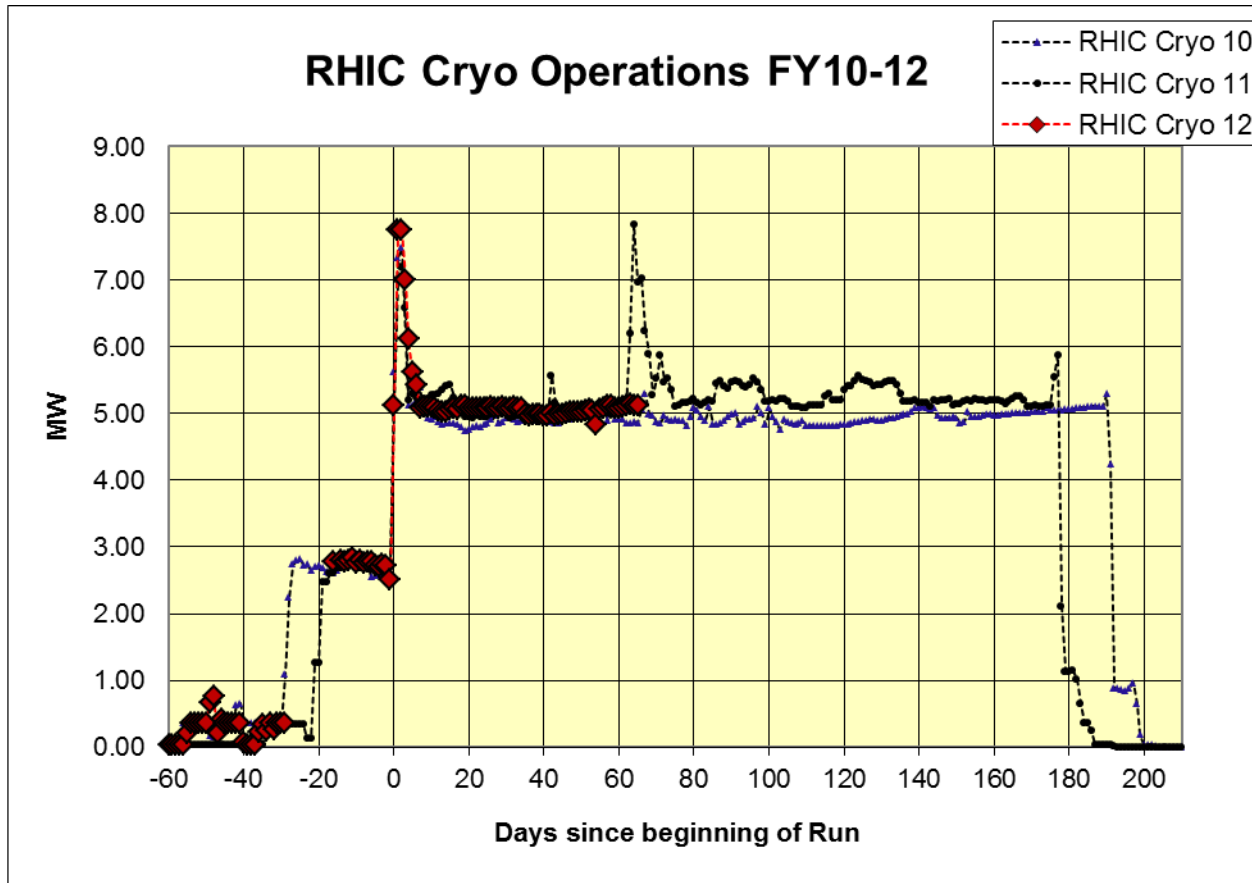


\$ in BNL Balanced Billing Bank for FY12 (through Feb) = +\$1,825K

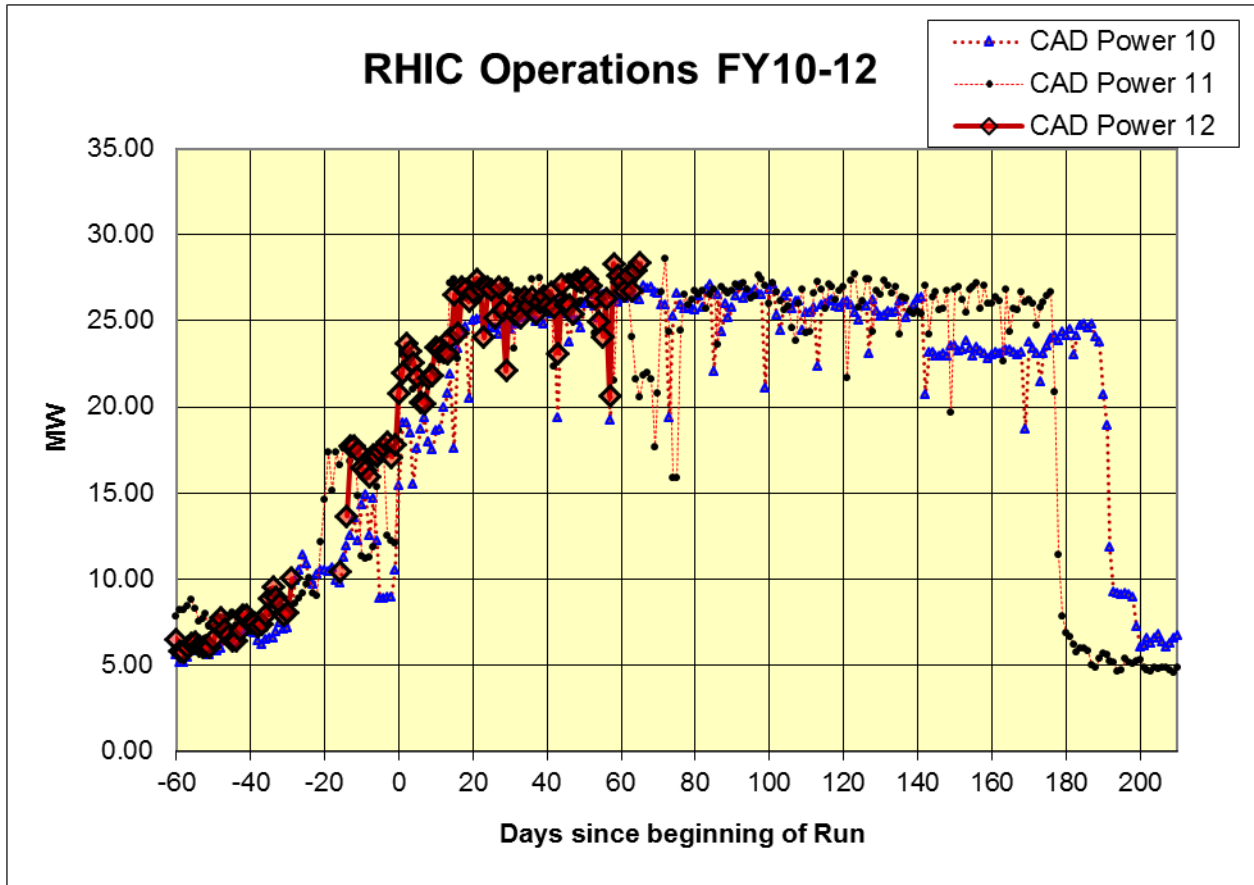


\$30/MWhr

As of 22 Mar 2012

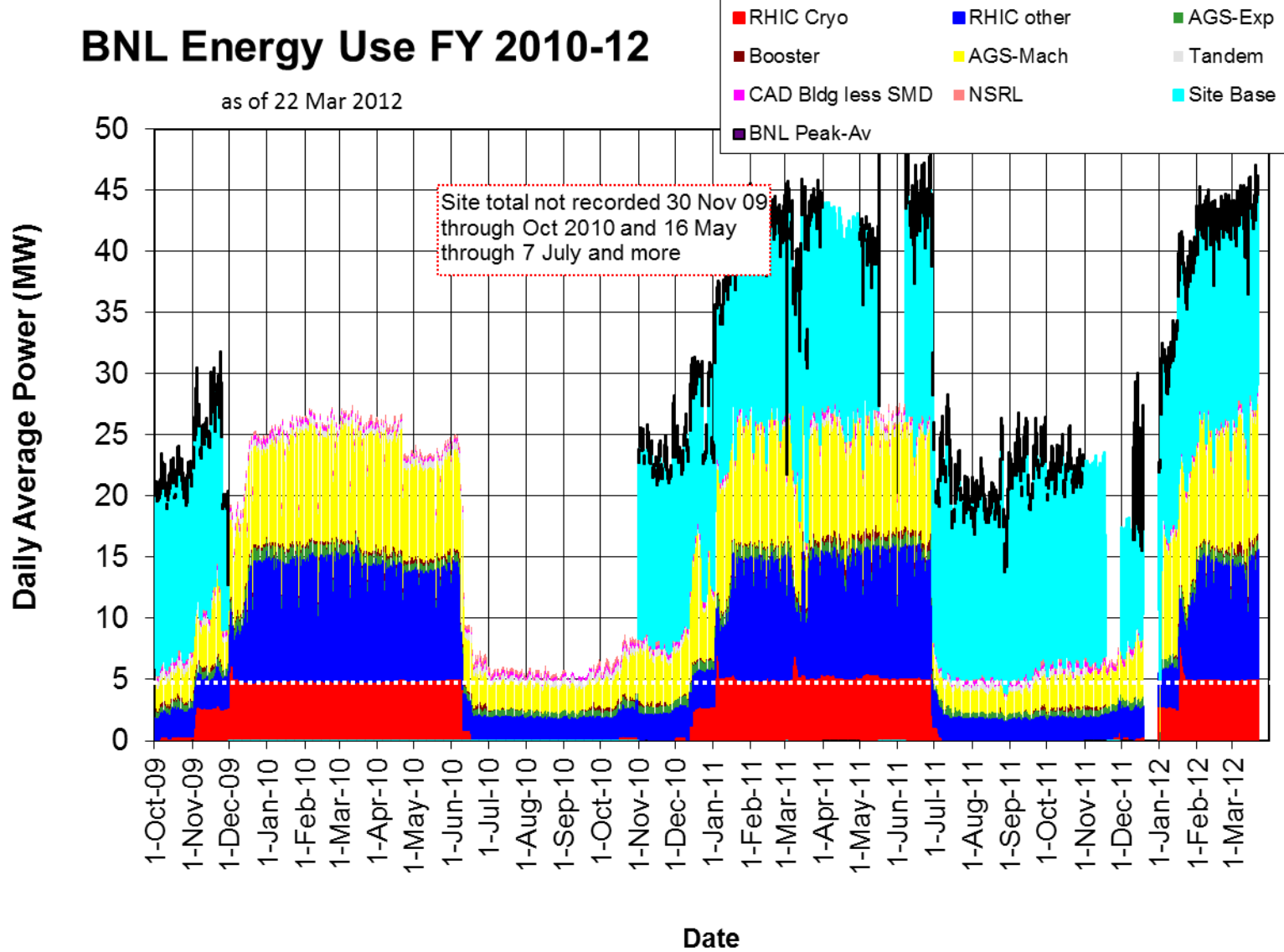


As of 22 Mar 2012

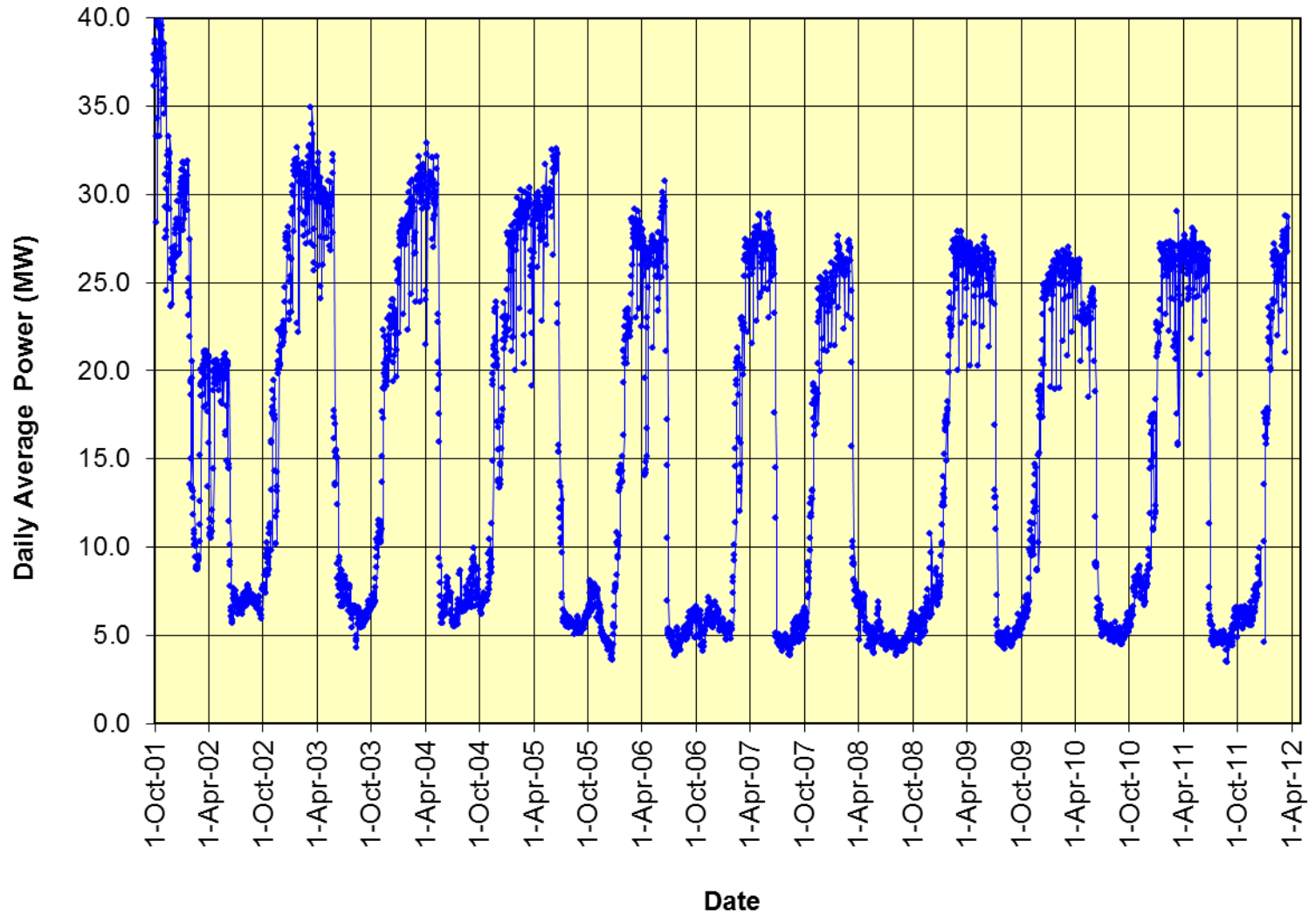


BNL Energy Use FY 2010-12

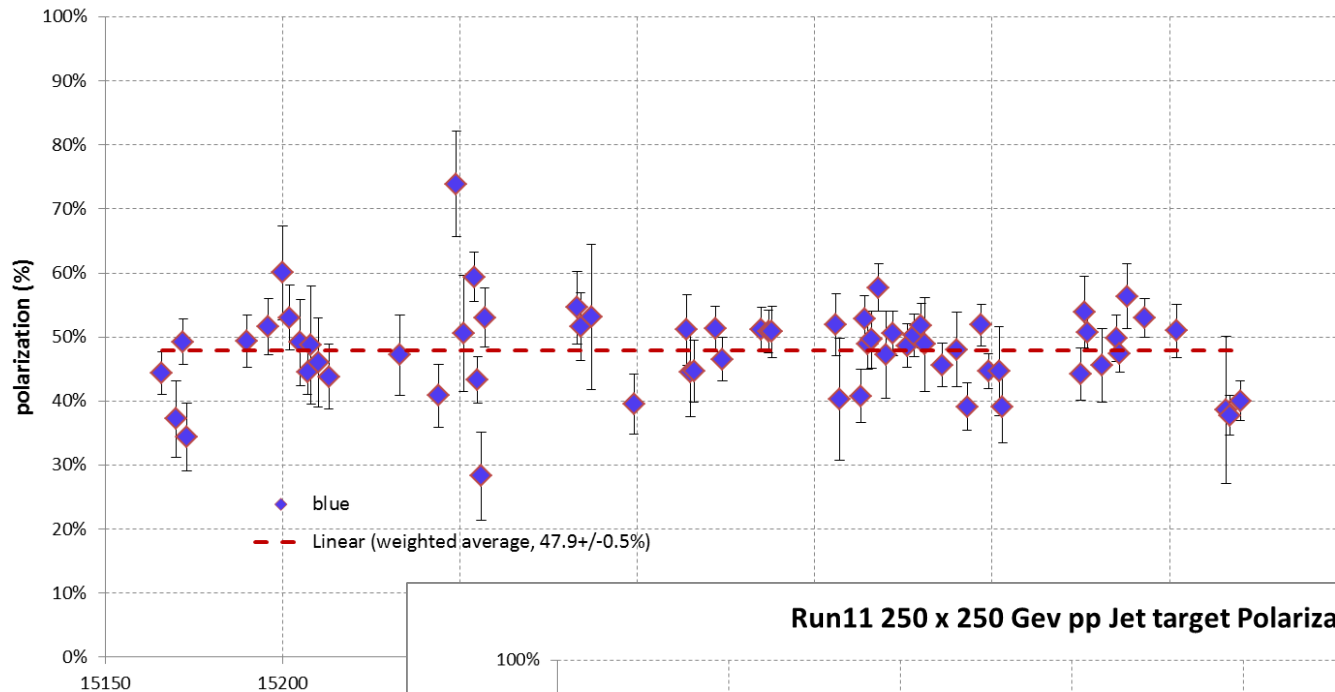
as of 22 Mar 2012



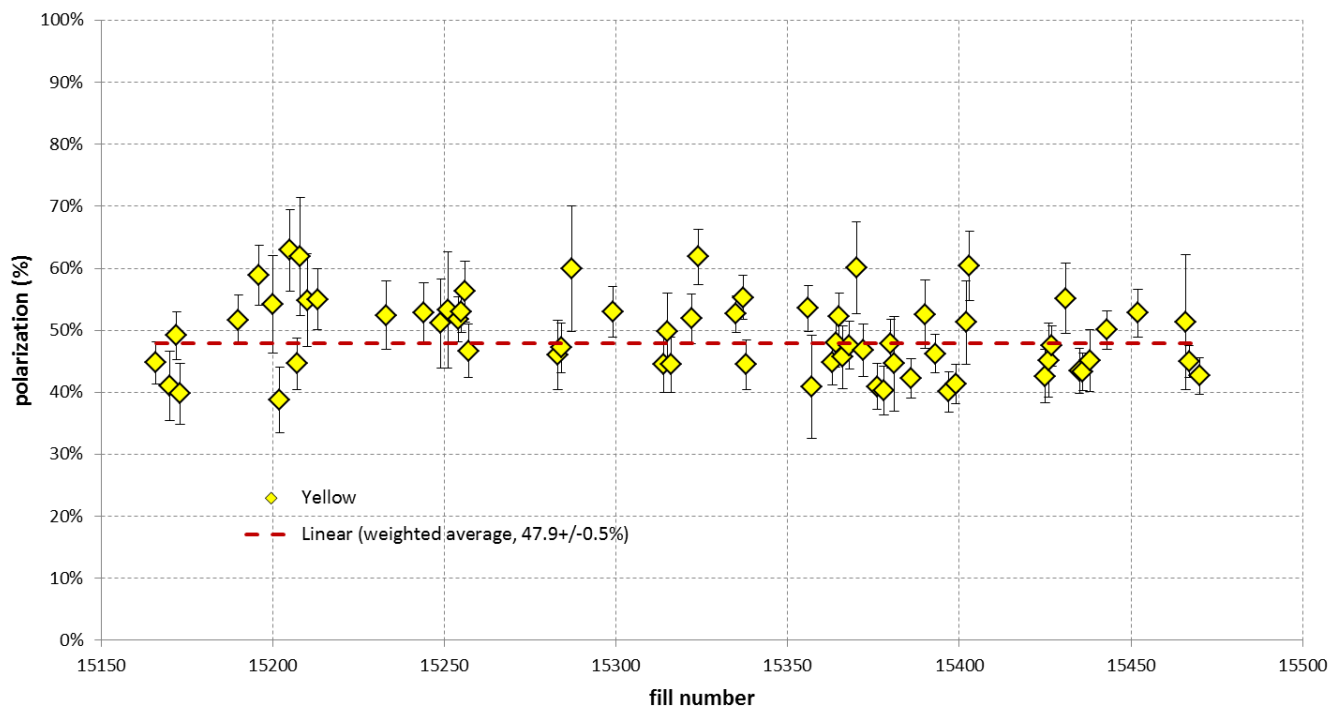
C-AD Energy Use FY 2002-12



Run11 250 x 250 Gev pp Jet target Polarization results

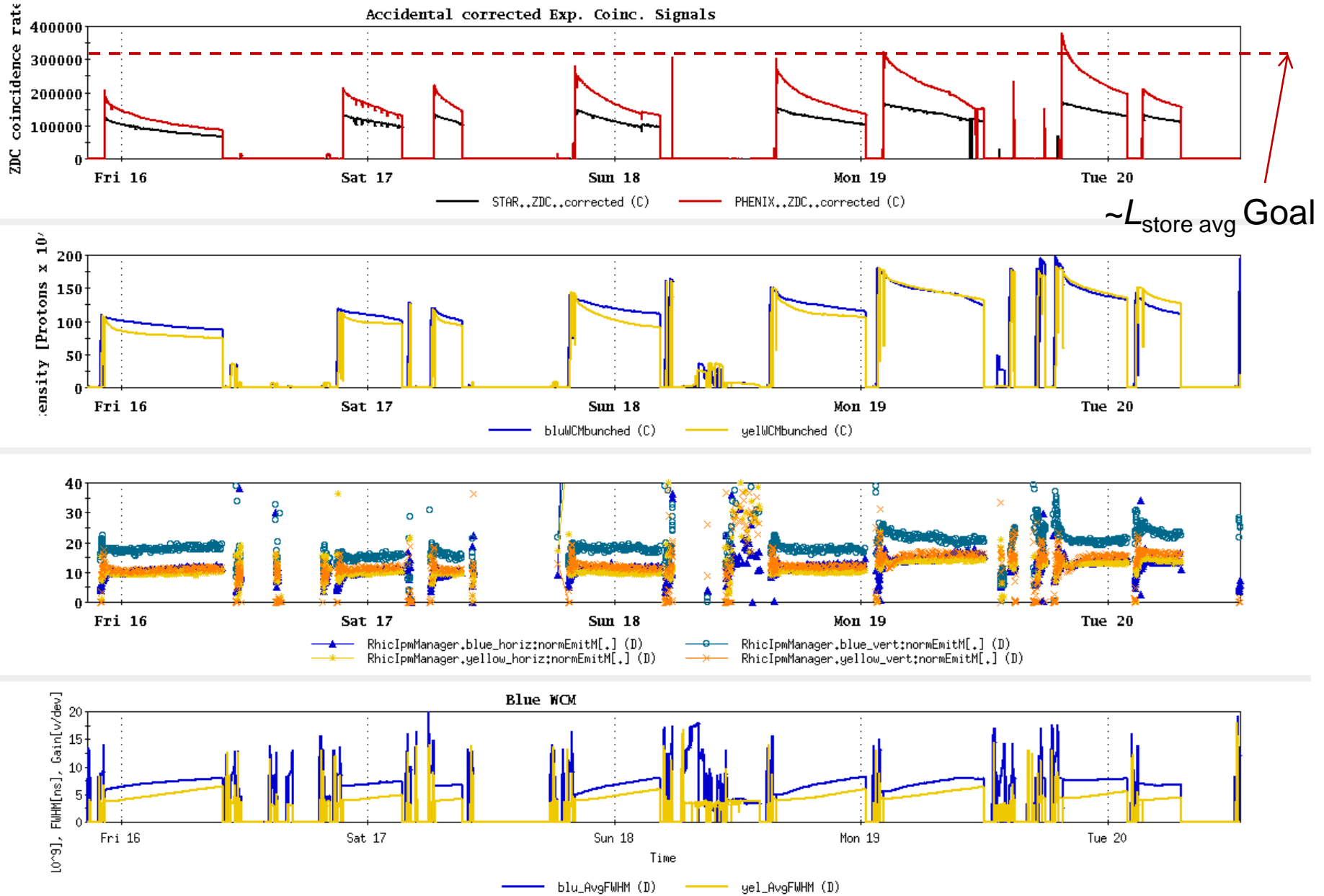


Run11 250 x 250 Gev pp Jet target Polarization results



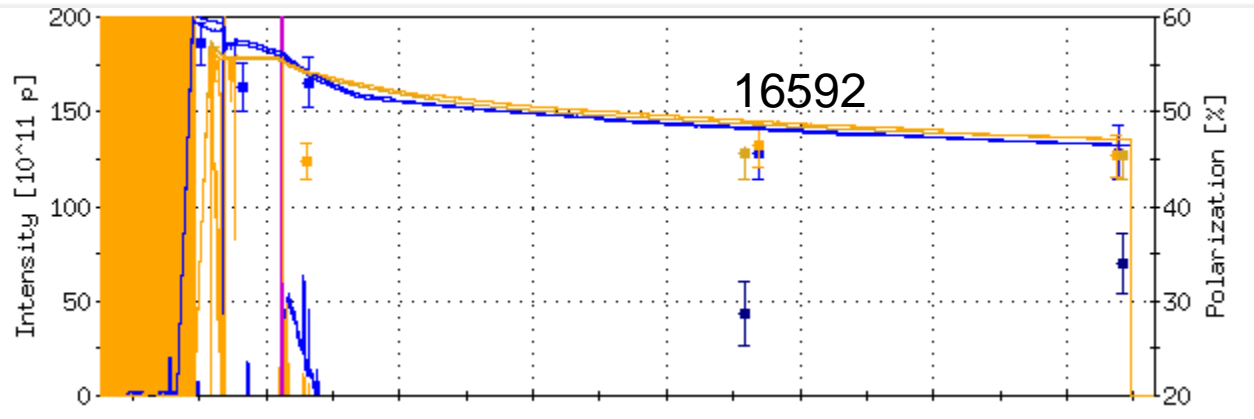
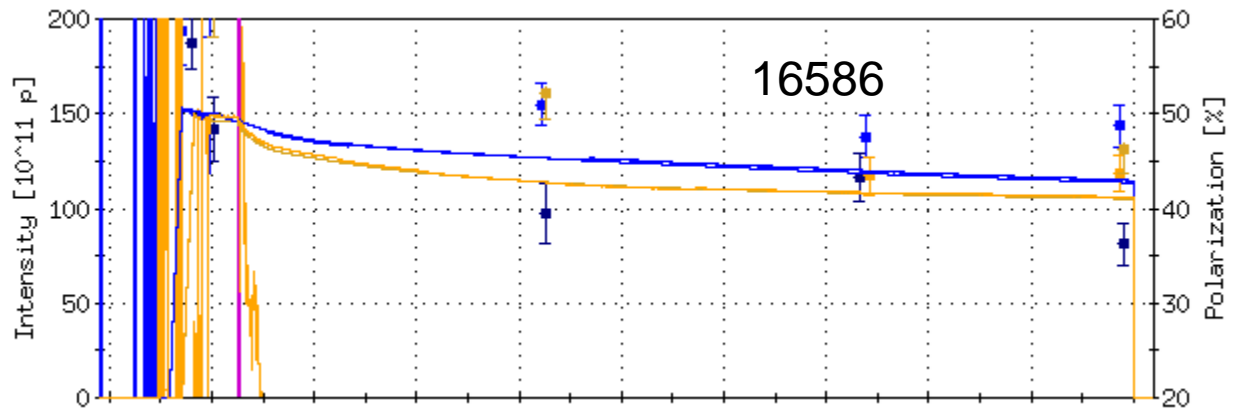
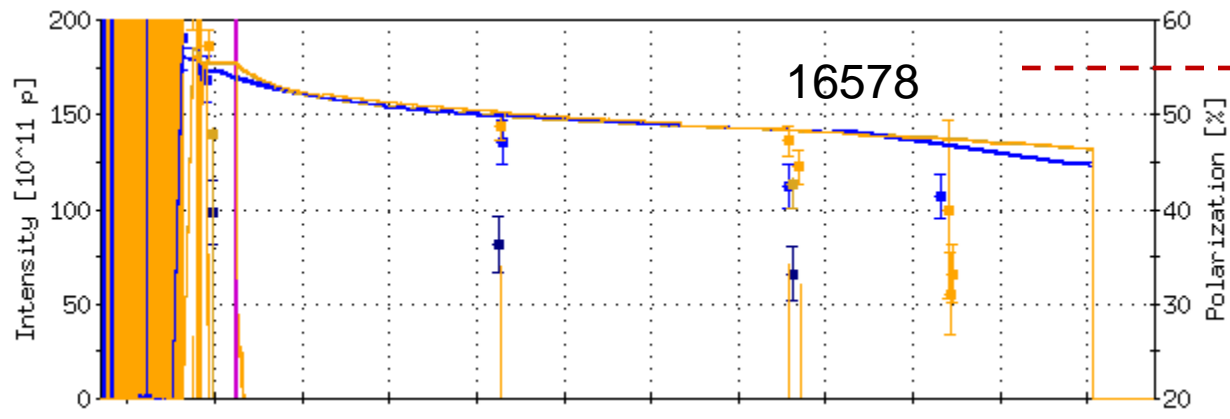
All "physics" stores beginning with 16570, 15 March

File Window Markers Analysis



From "StoreAnalysis" program in "StartUp"

Polarization Goal



Expectation for 5 weeks physics:
45-95 pb⁻¹ delivered luminosity with 45-50% polarization

Run 12 projection for $\sqrt{s} = 500$ GeV pp

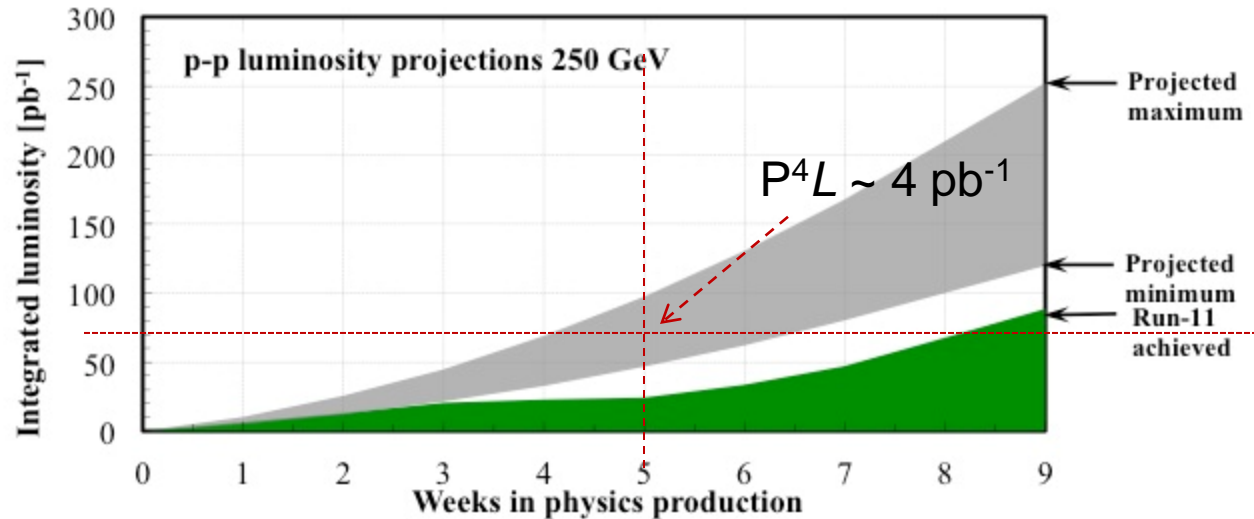
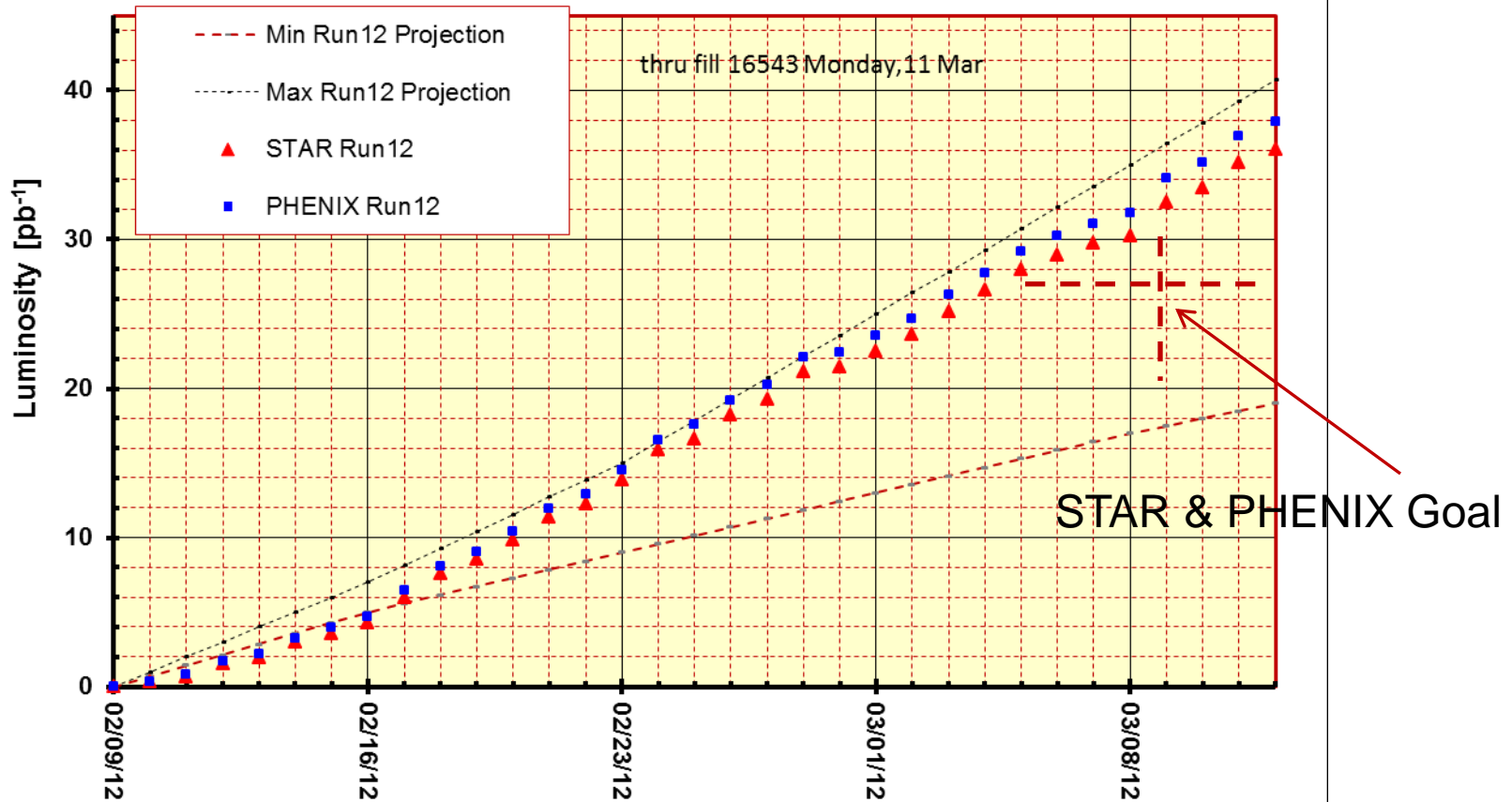


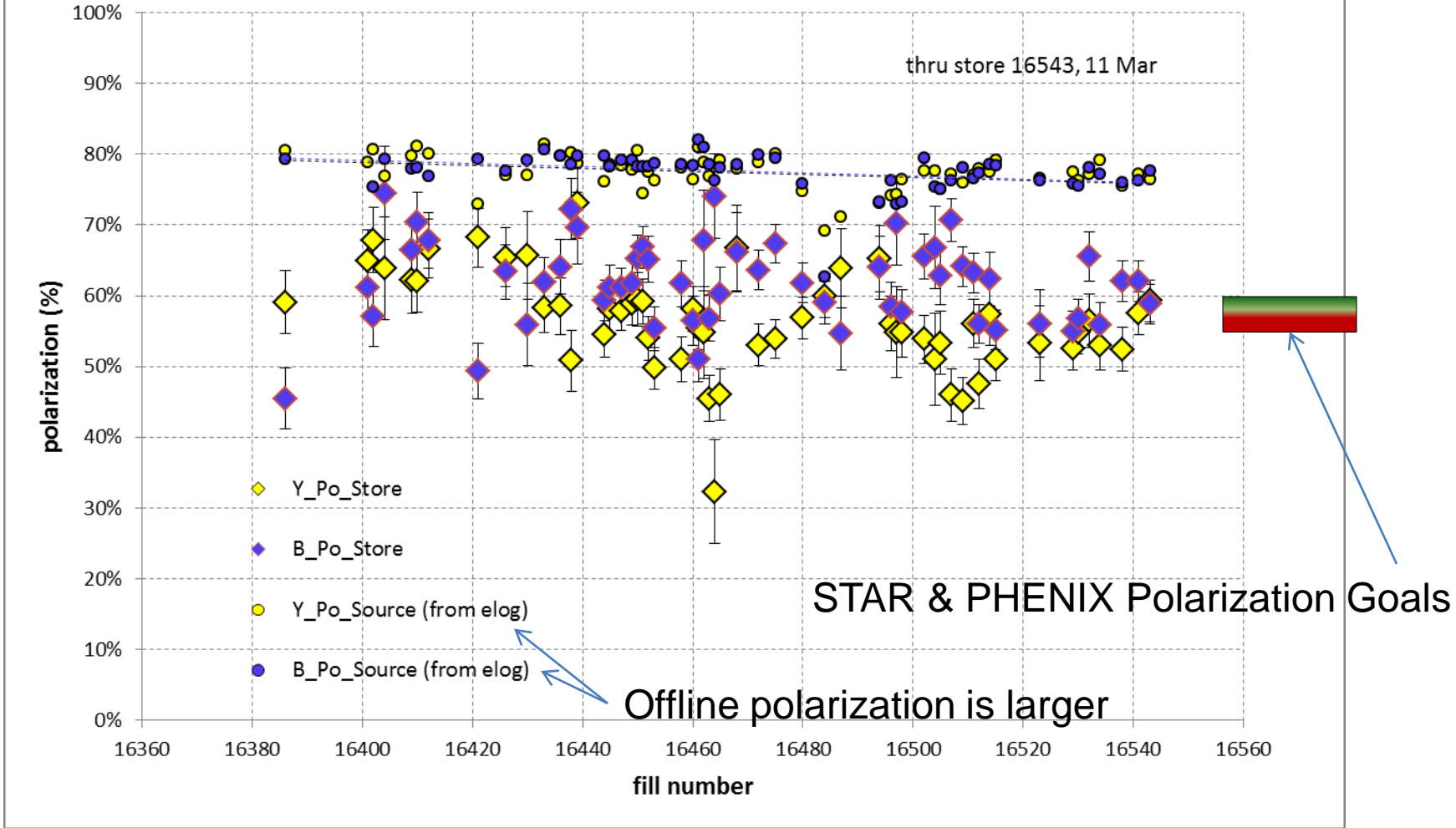
Figure 4: Projected minimum and maximum integrated luminosities for polarized proton collisions at 250 GeV beam energy, assuming linear weekly luminosity ramp-up in 8 weeks. An average store polarization between 45 and 50% is expected.

From Fischer et. Al. "RHIC Collider Projections (FY 2012 – FY 2016)"
14 October 2011

RHIC p⁺p⁺ Final Physics Luminosity Run-12 ($\sqrt{s}=200$ GeV)
Preliminary Run12 xsections (STAR/PHENIX 0.275/0.29 mb)



Run12 100 x 100 Gev pp Jet target Final Polarization results

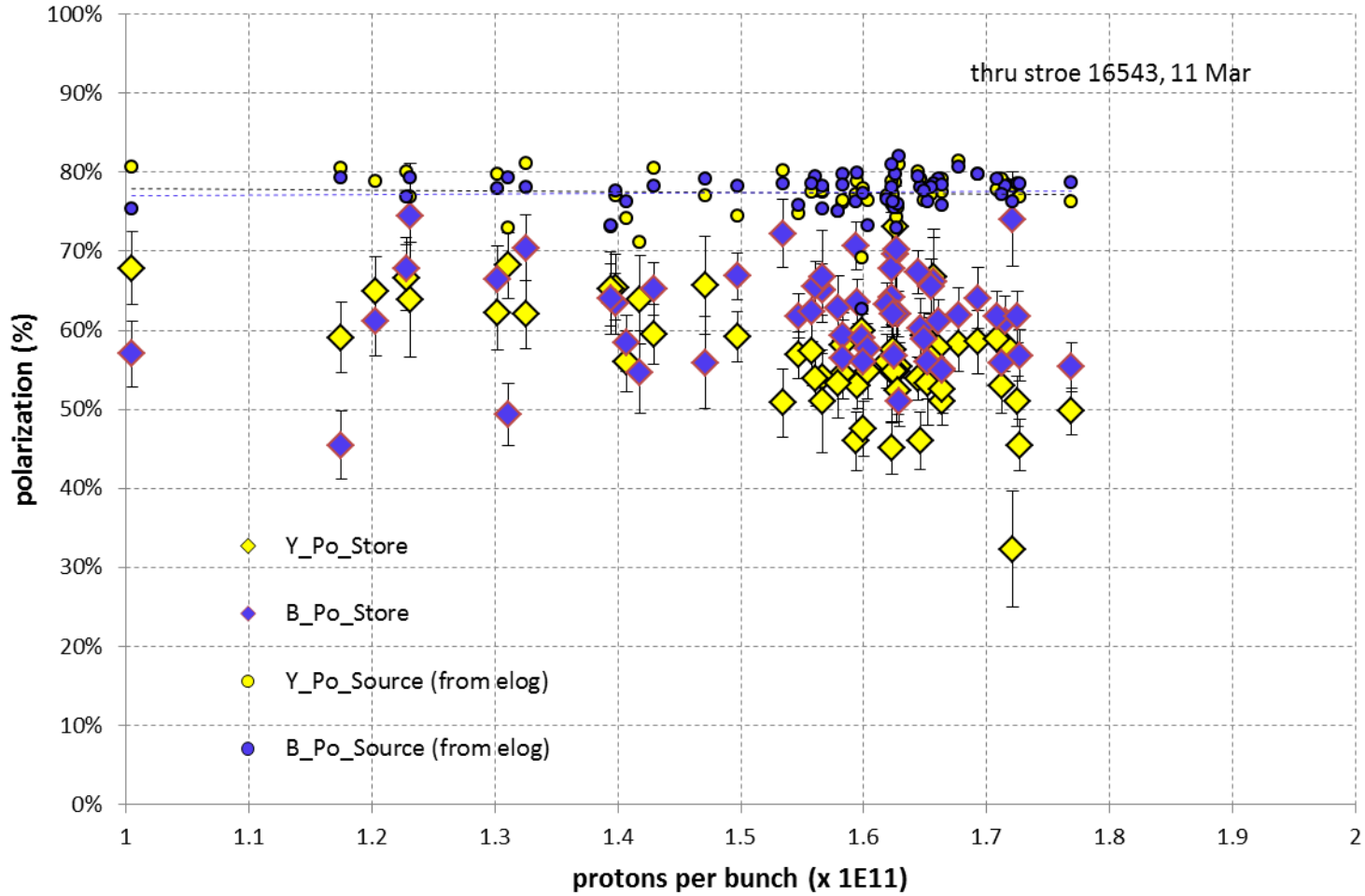


Blue Jet weighted average = $61.2\% \pm 0.5\%$;
 Yellow Jet weighted average = $55.8\% \pm 0.5\%$;

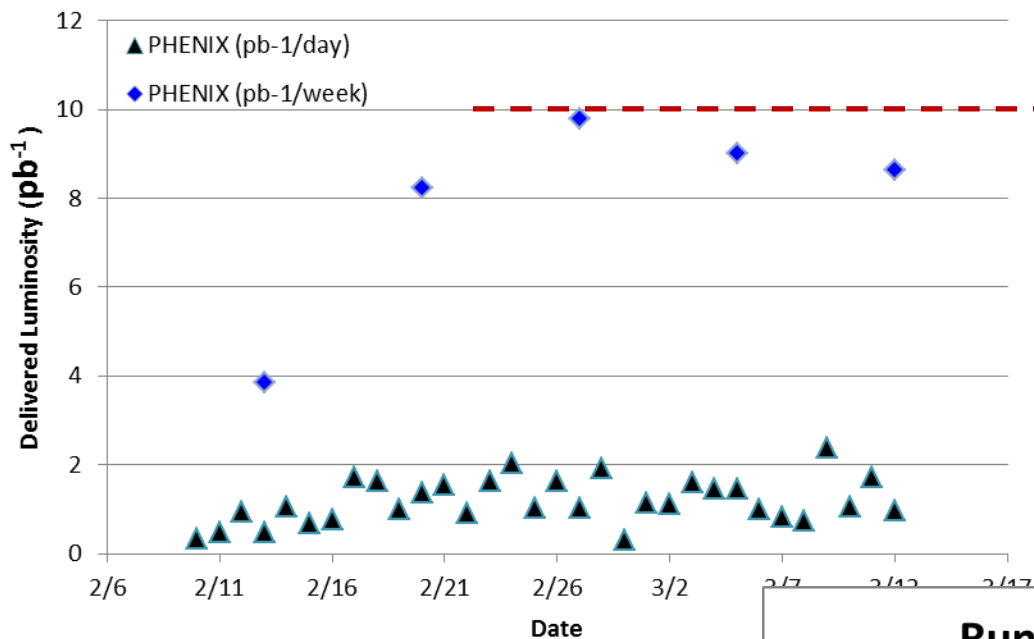
source blue average = 77.5% → **20% lost**
 source yellow average = 77.4% → **28% lost**

Run12 100 x 100 Gev pp Jet target Final Polarization results

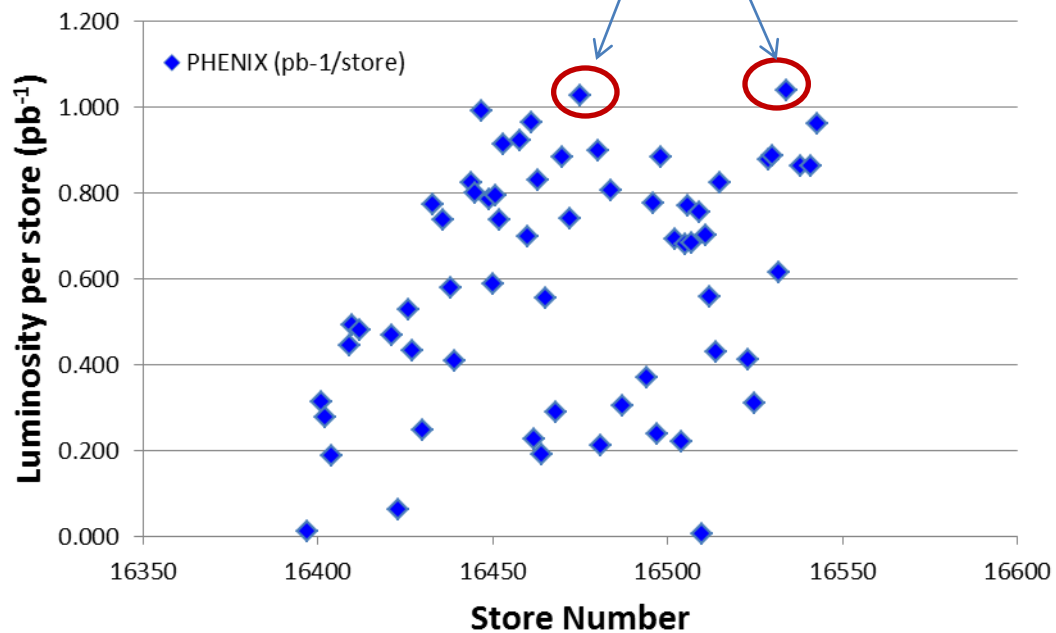
thru stroe 16543, 11 Mar



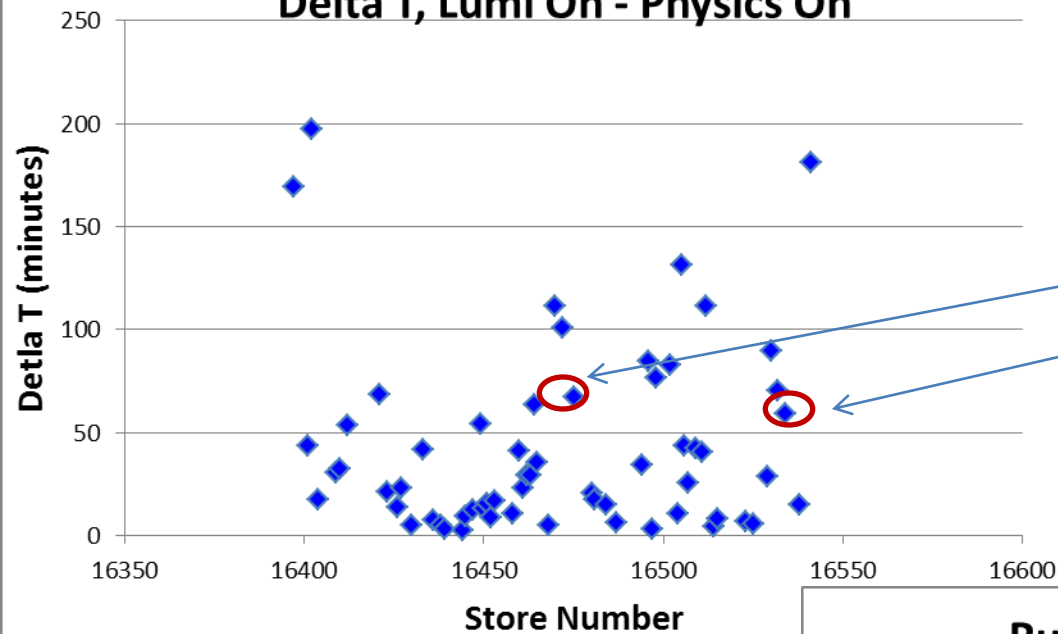
Run 12 100 x 100 GeV pp Lumi



Run 12 PHENIX Luminosity per Store

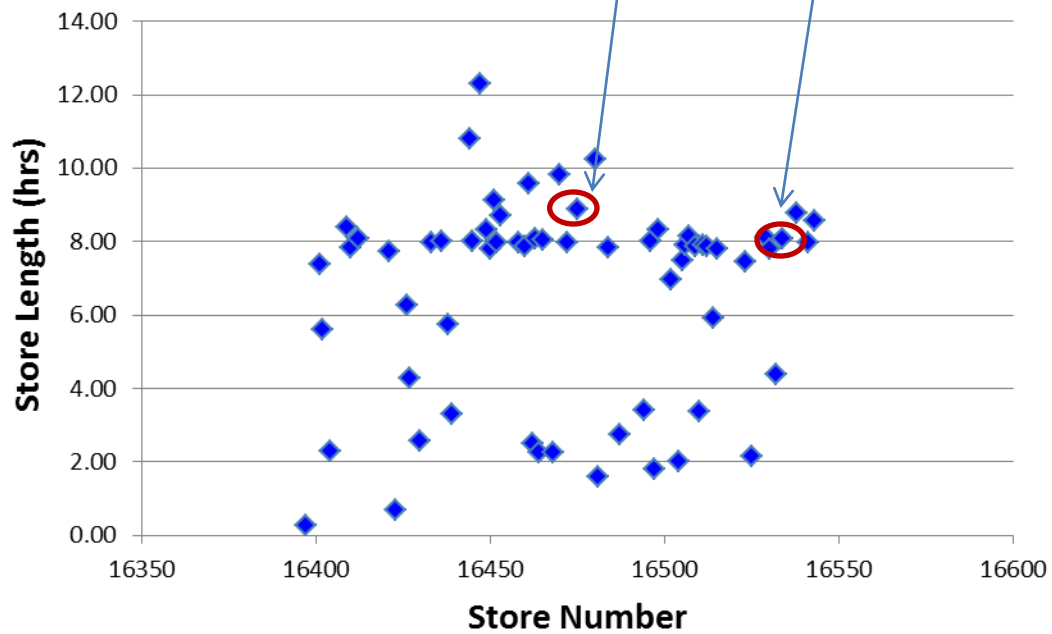


Run 12 100 x 100 GeV pp Delta T, Lumi On - Physics On

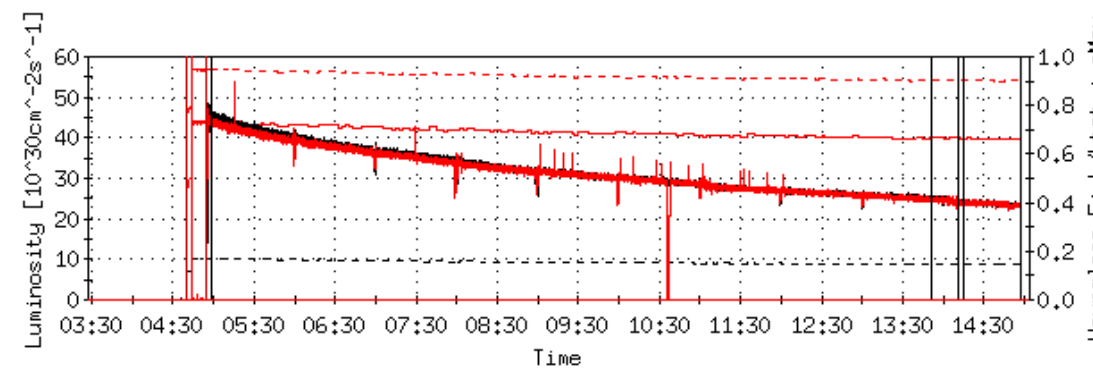
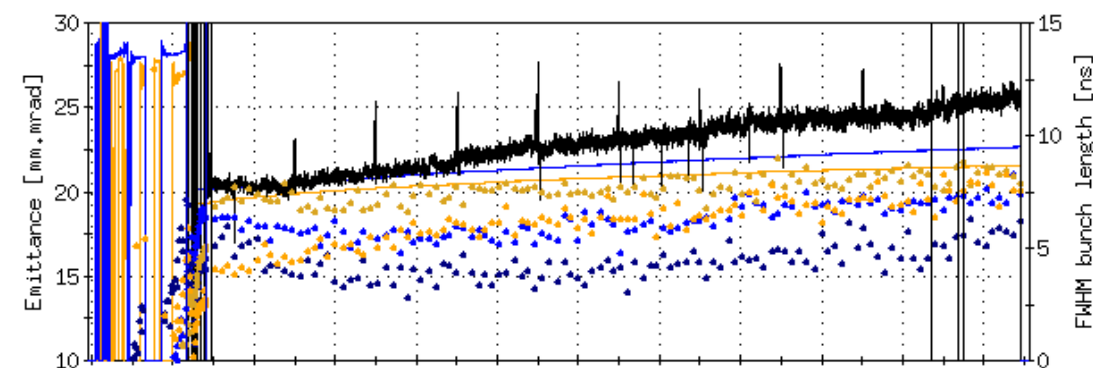
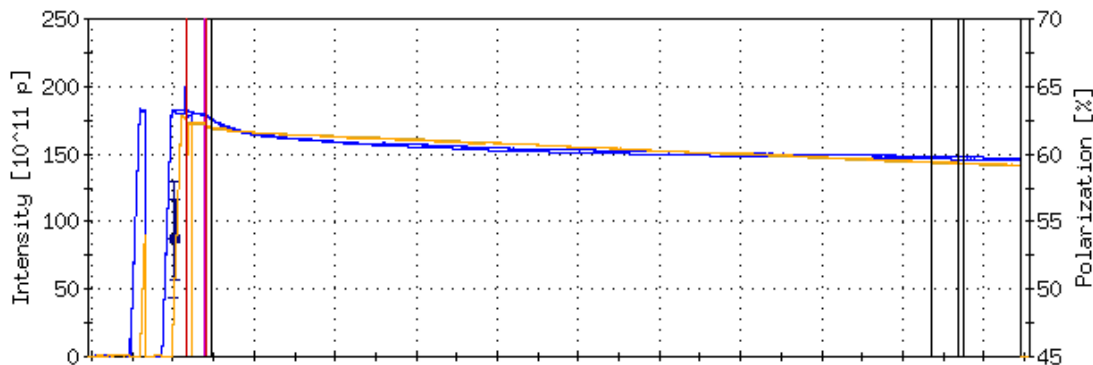
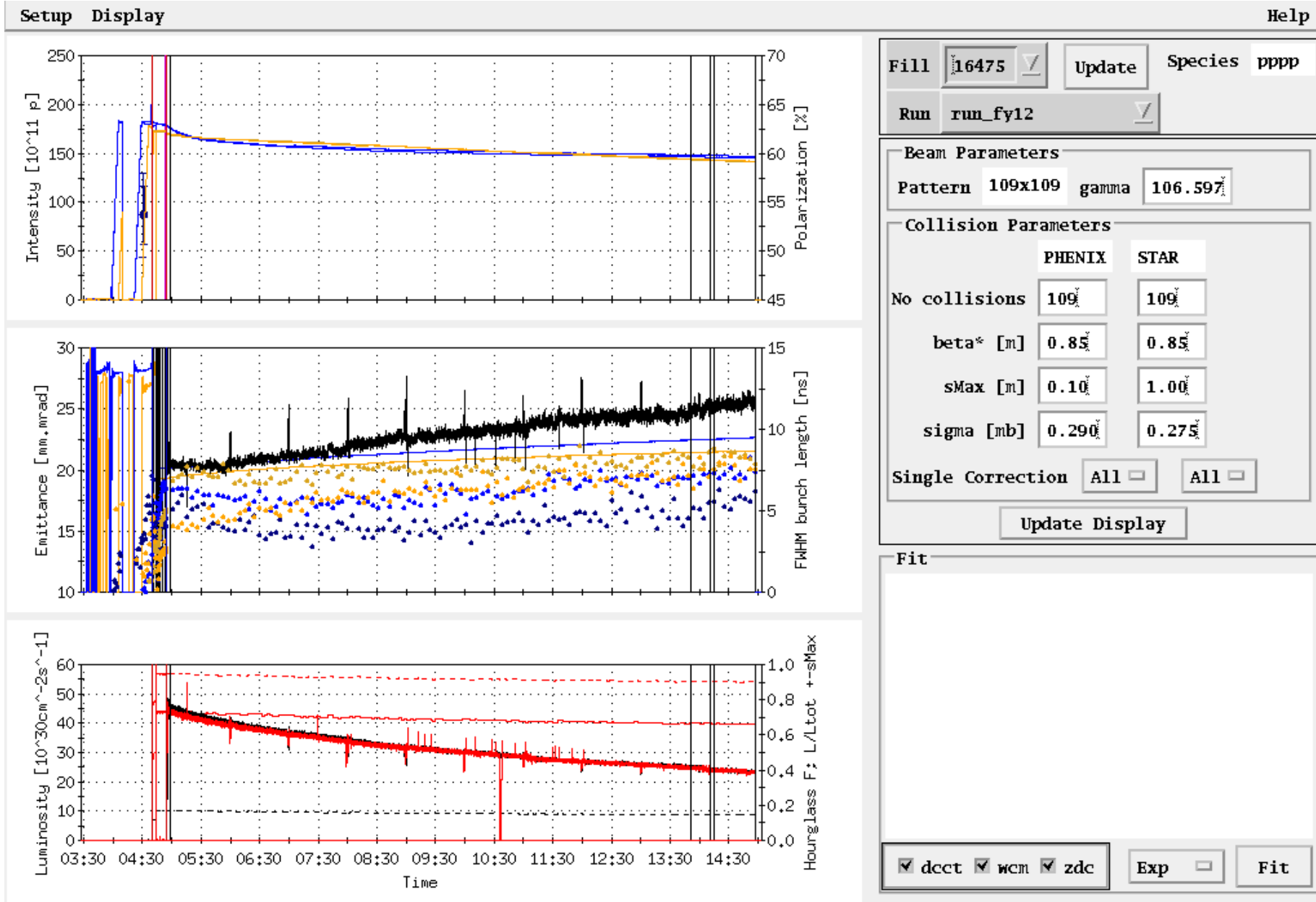


Best stores, 16475 and 16534

Run 12 PHENIX PhysicsStore Length

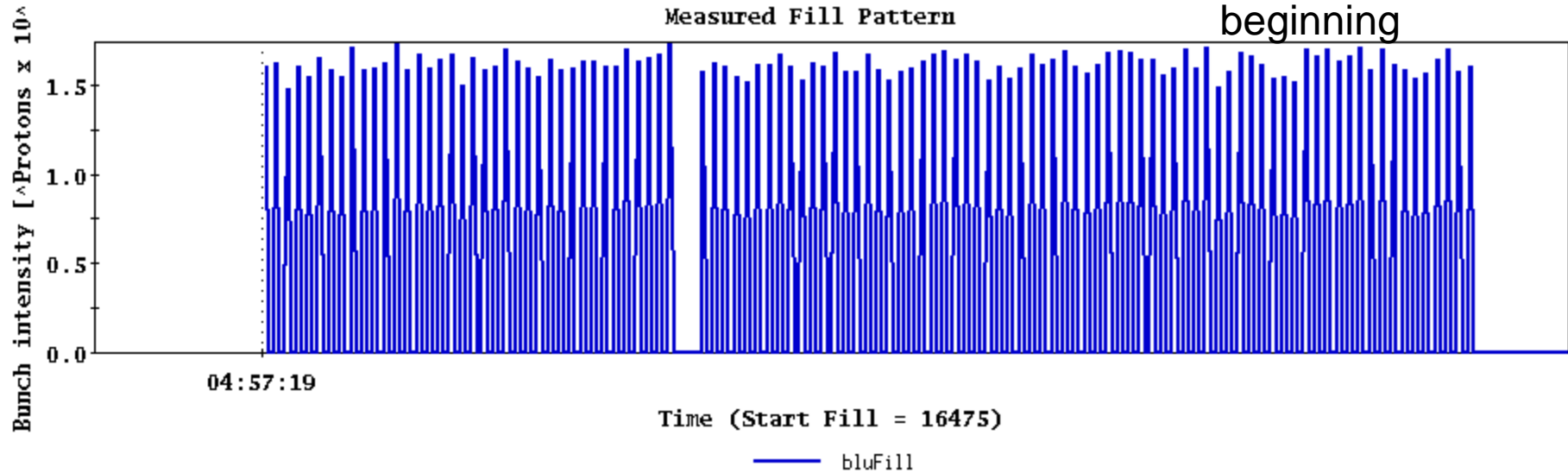


Fill 16475, 27 Feb, 8.9 hours physics store (10 hour Lumi on Store), PHENIX 1.03 pb⁻¹

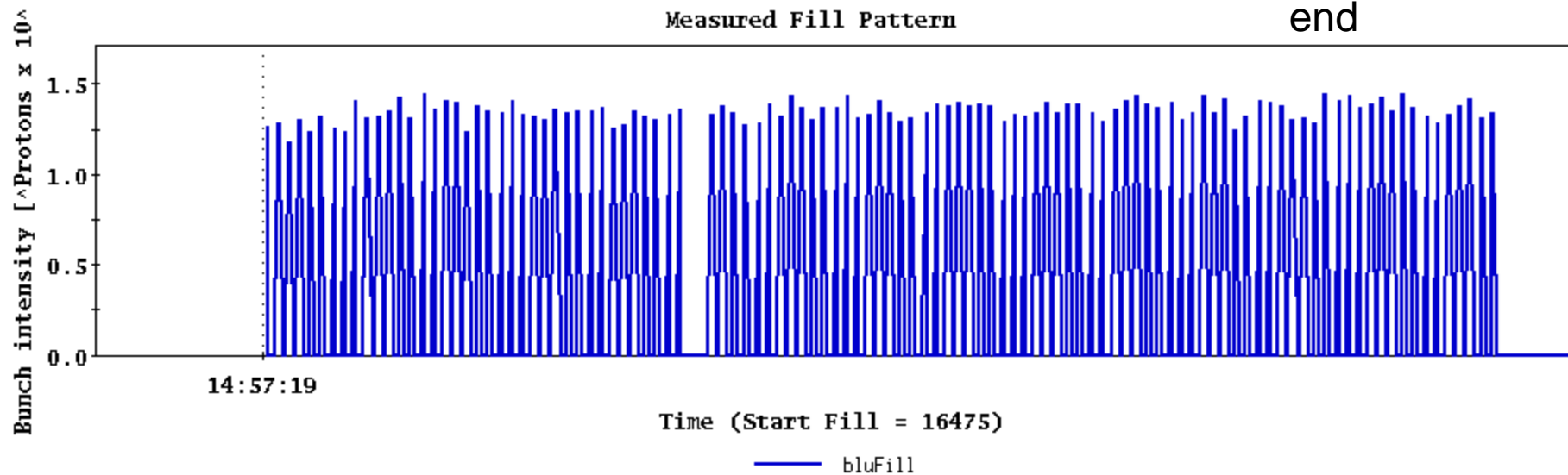


Fill 16475, 27 Feb, 8.9 hours physics store (10 hour Lumi on Store), PHENIX 1.03 pb⁻¹

File Window Markers Analysis

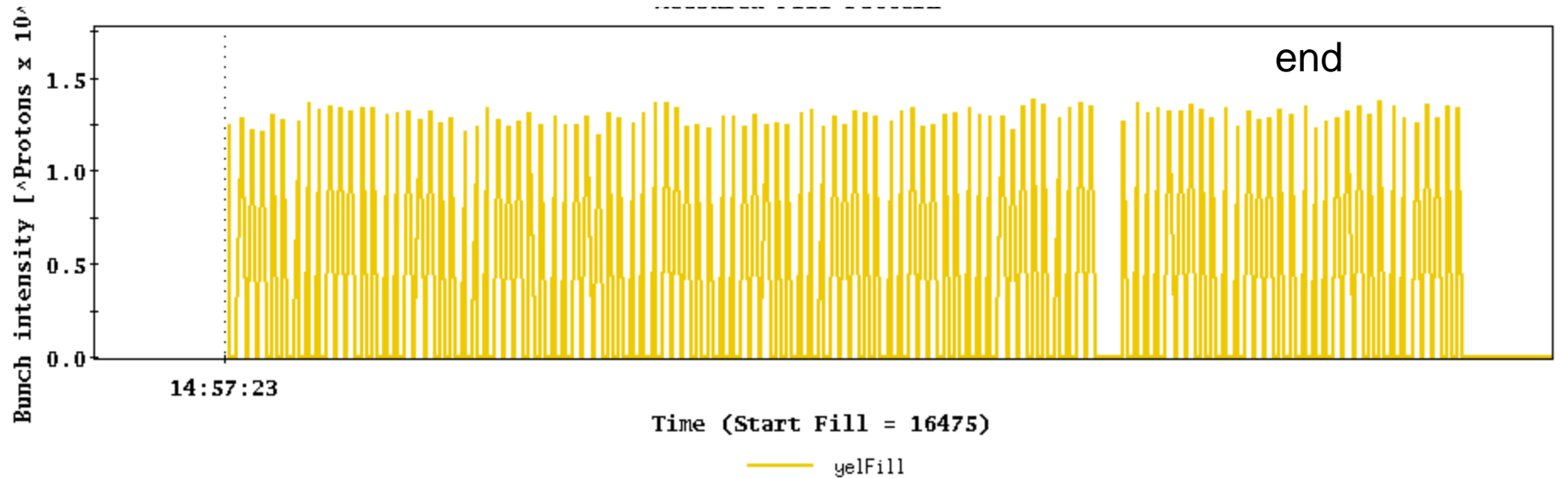
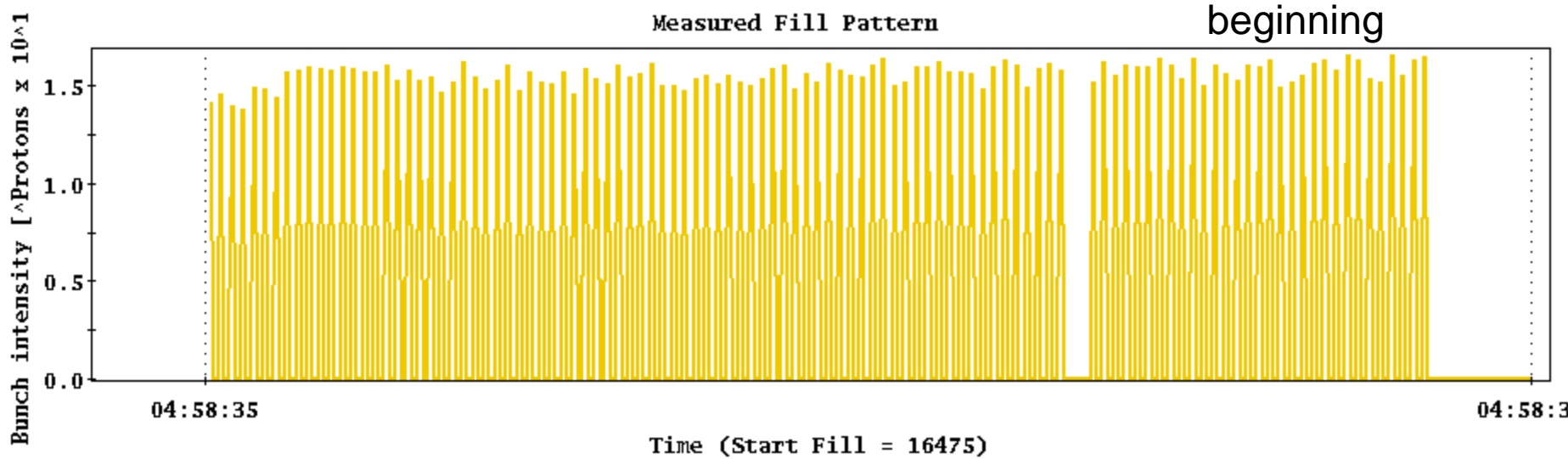


File Window Markers Analysis



Fill 16475, 27 Feb, 8.9 hours physics store (10 hour Lumi on Store), PHENIX 1.03 pb⁻¹

File Window Markers Analysis



Fill 16534, 9 Mar, 8.1 hours physics store (9.1 hr Lumi on store), PHENIX 1.04 pb⁻¹

Setup Display
Help

The figure consists of three vertically stacked plots sharing a common x-axis representing time from 05:30 to 15:30. The top plot shows Intensity [10¹¹ p] (left y-axis, 0-250) and Polarization [%] (right y-axis, 45-70). The middle plot shows Emittance [mm.mrad] (left y-axis, 10-30) and FWHM bunch length [ns] (right y-axis, 0-15). The bottom plot shows Luminosity [10³⁰ cm⁻² s⁻¹] (left y-axis, 0-60) and Hourglass F; L/Ltot +- sMax (right y-axis, 0.0-1.0). All plots show a sharp rise at approximately 06:30, followed by a gradual decay and stabilization.

Fill Species

Run

Beam Parameters

Pattern gamma

Collision Parameters

	PHENIX	STAR
No collisions	<input type="text" value="109"/>	<input type="text" value="109"/>
beta* [m]	<input type="text" value="0.85"/>	<input type="text" value="0.85"/>
sMax [m]	<input type="text" value="0.10"/>	<input type="text" value="1.00"/>
sigma [nb]	<input type="text" value="0.290"/>	<input type="text" value="0.275"/>

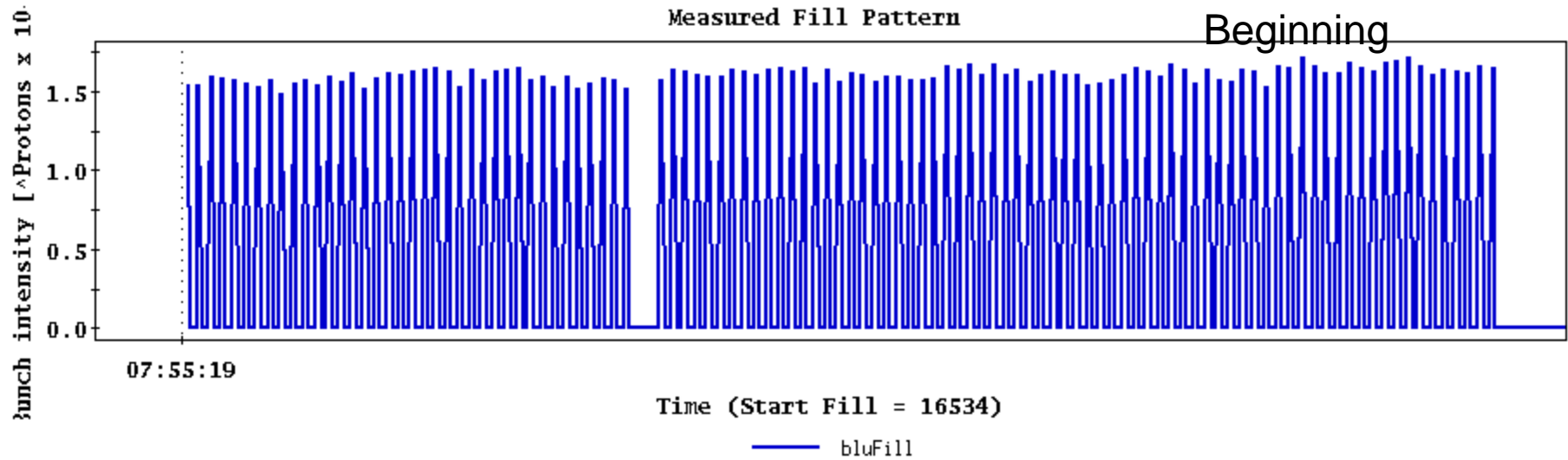
Single Correction All All

Fit

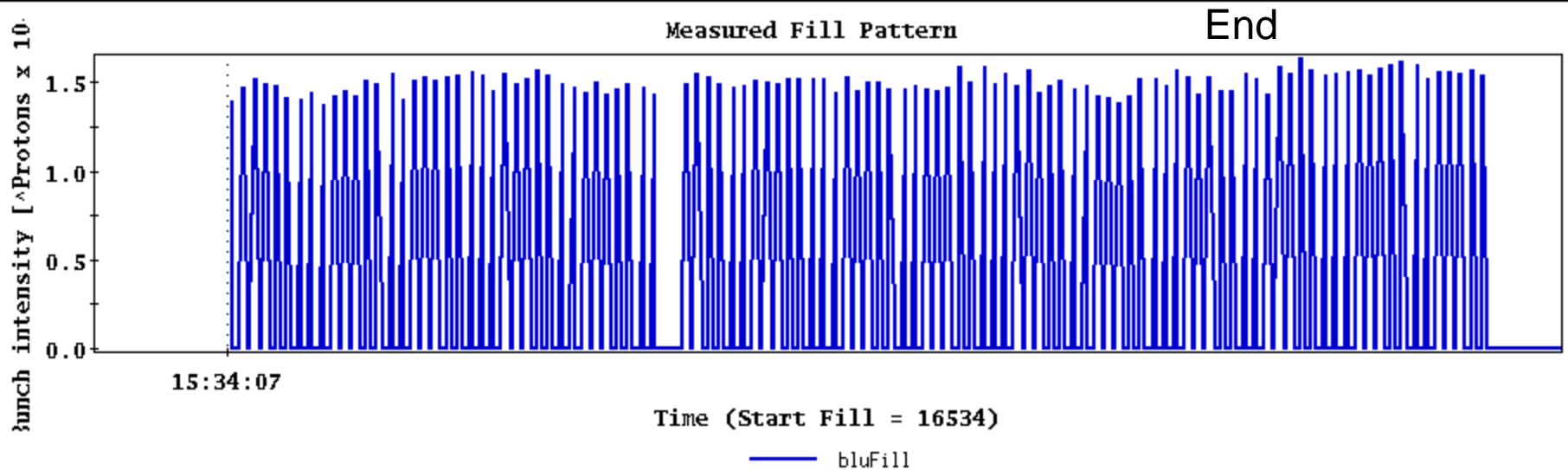
dcut wcm zdc

Fill 16534, 9 Mar, 8.1 hours physics store (9.1 hr Lumi on store), PHENIX 1.04 pb⁻¹

File Window Markers Analysis

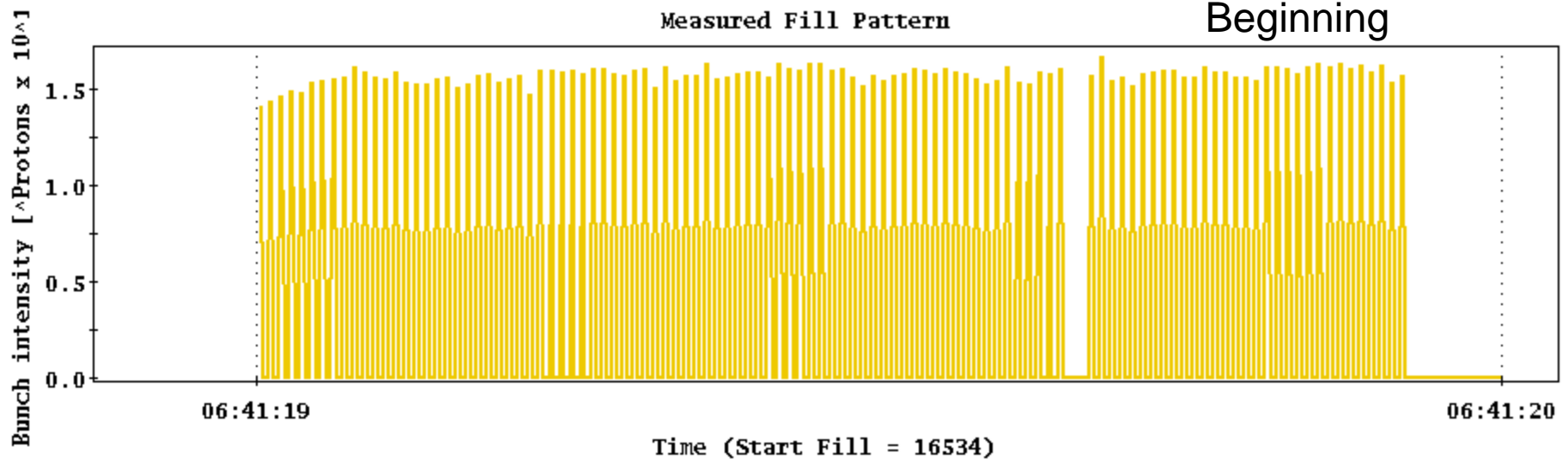


File Window Markers Analysis

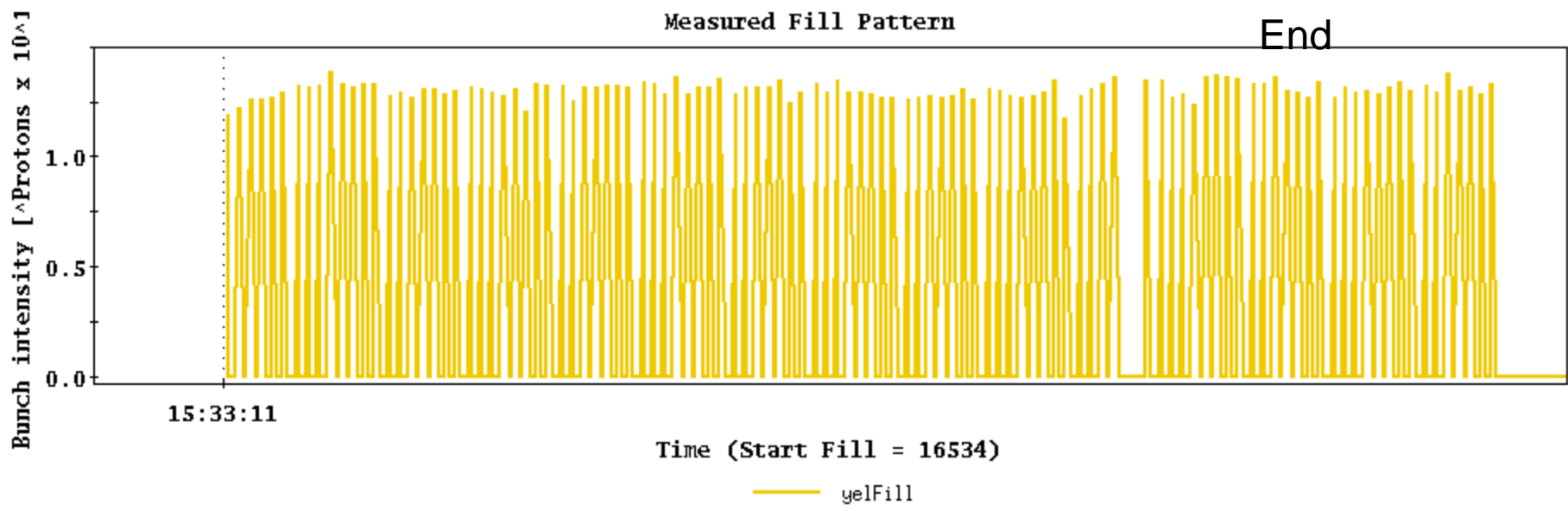


Fill 16534, 9 Mar, 8.1 hours physics store (9.1 hr Lumi on store), PHENIX 1.04 pb⁻¹

File Window Markers Analysis

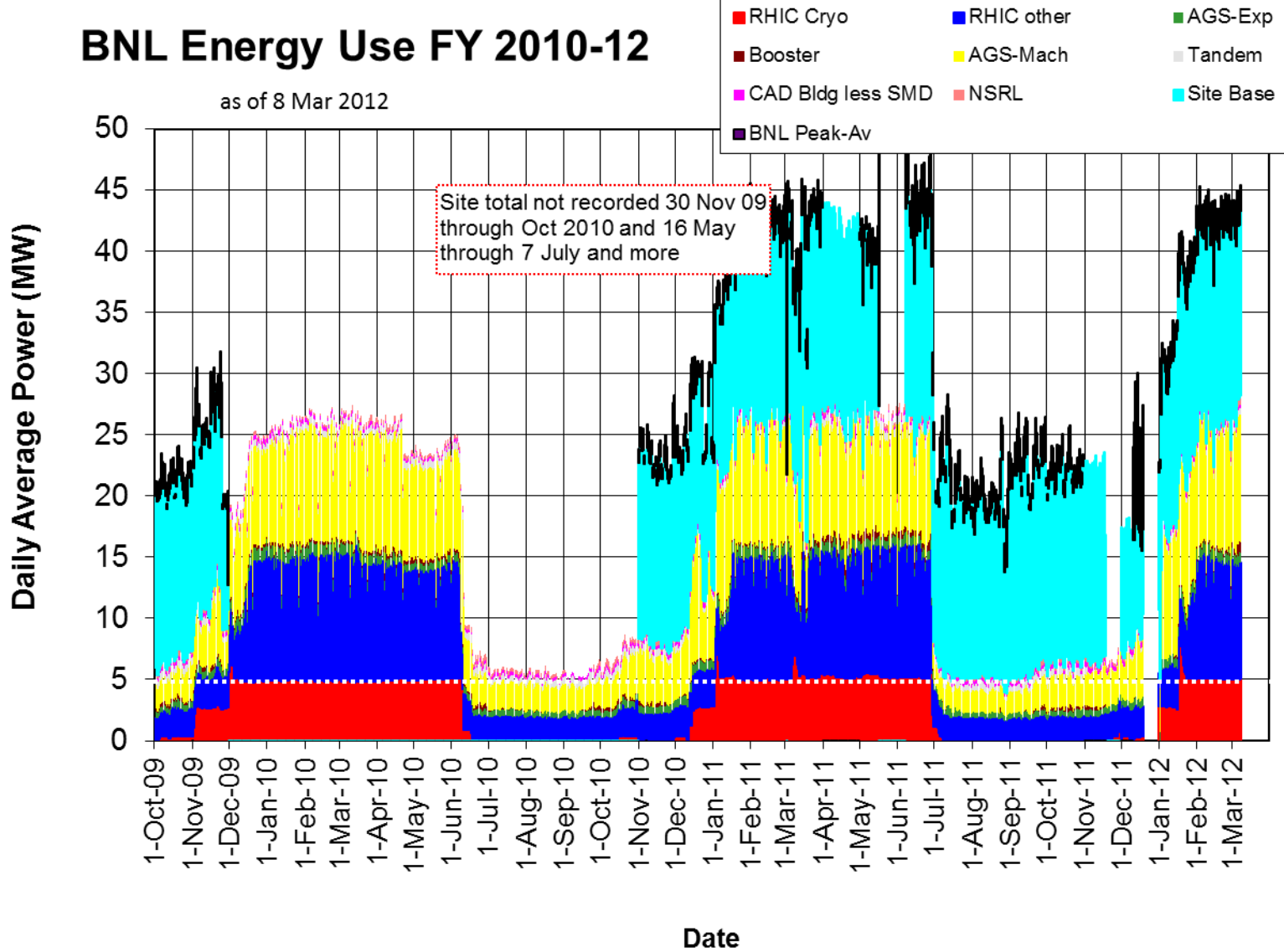


File Window Markers Analysis



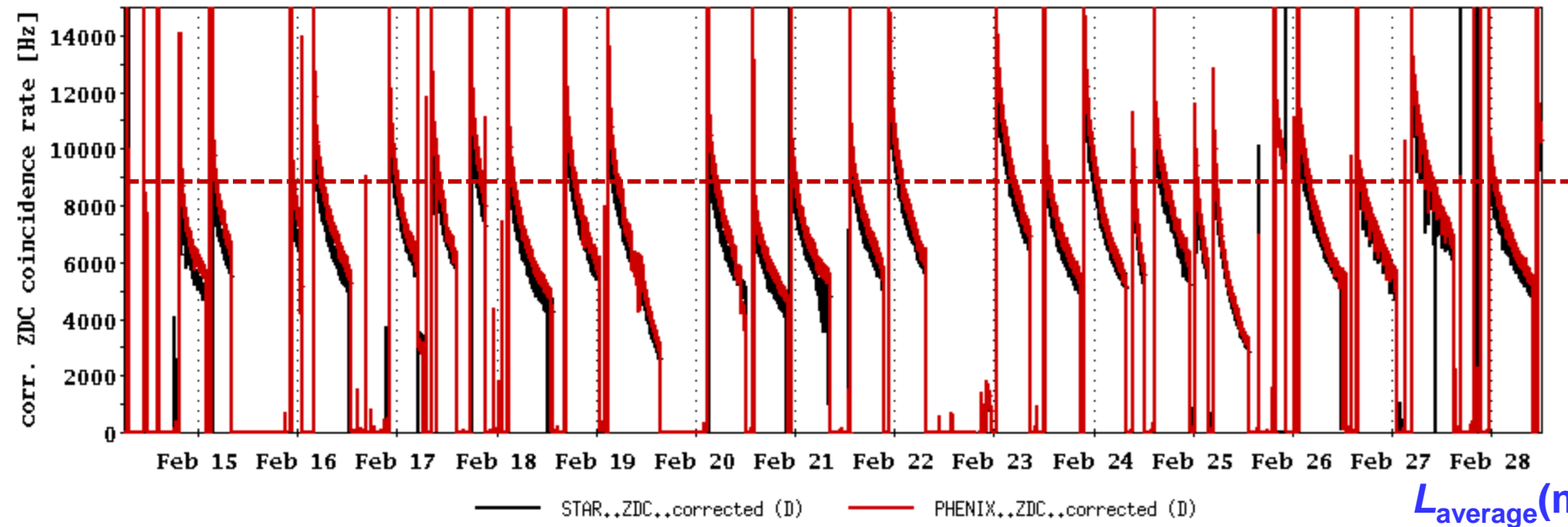
BNL Energy Use FY 2010-12

as of 8 Mar 2012

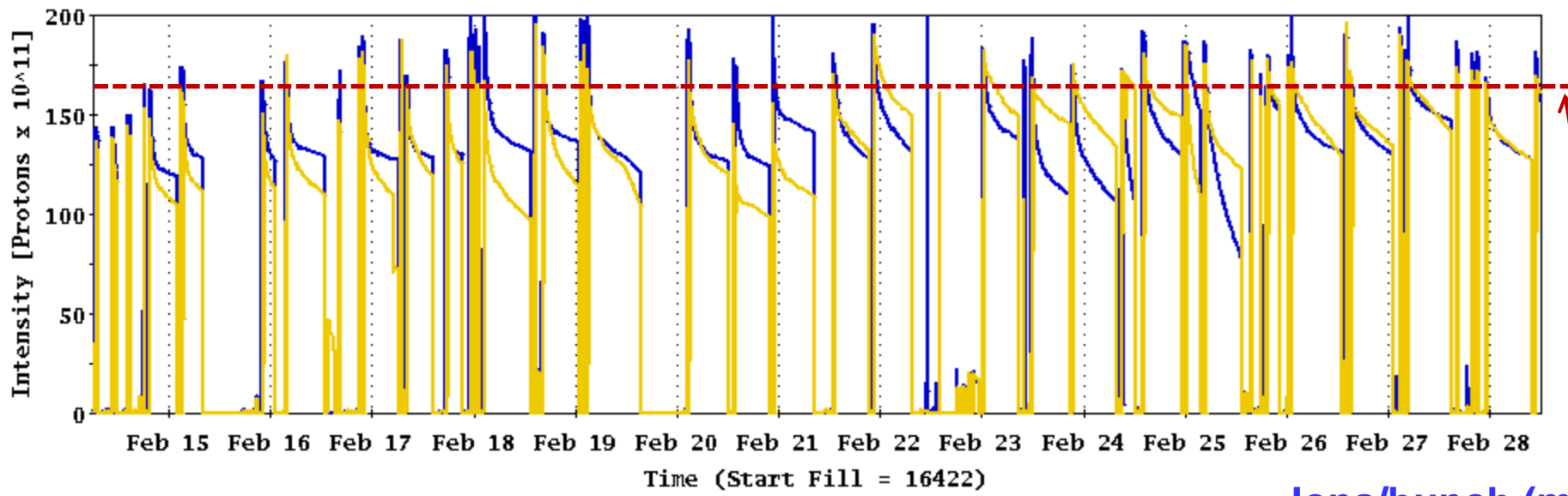


Accidental corrected Exp. Coinc. Signals

Past Week

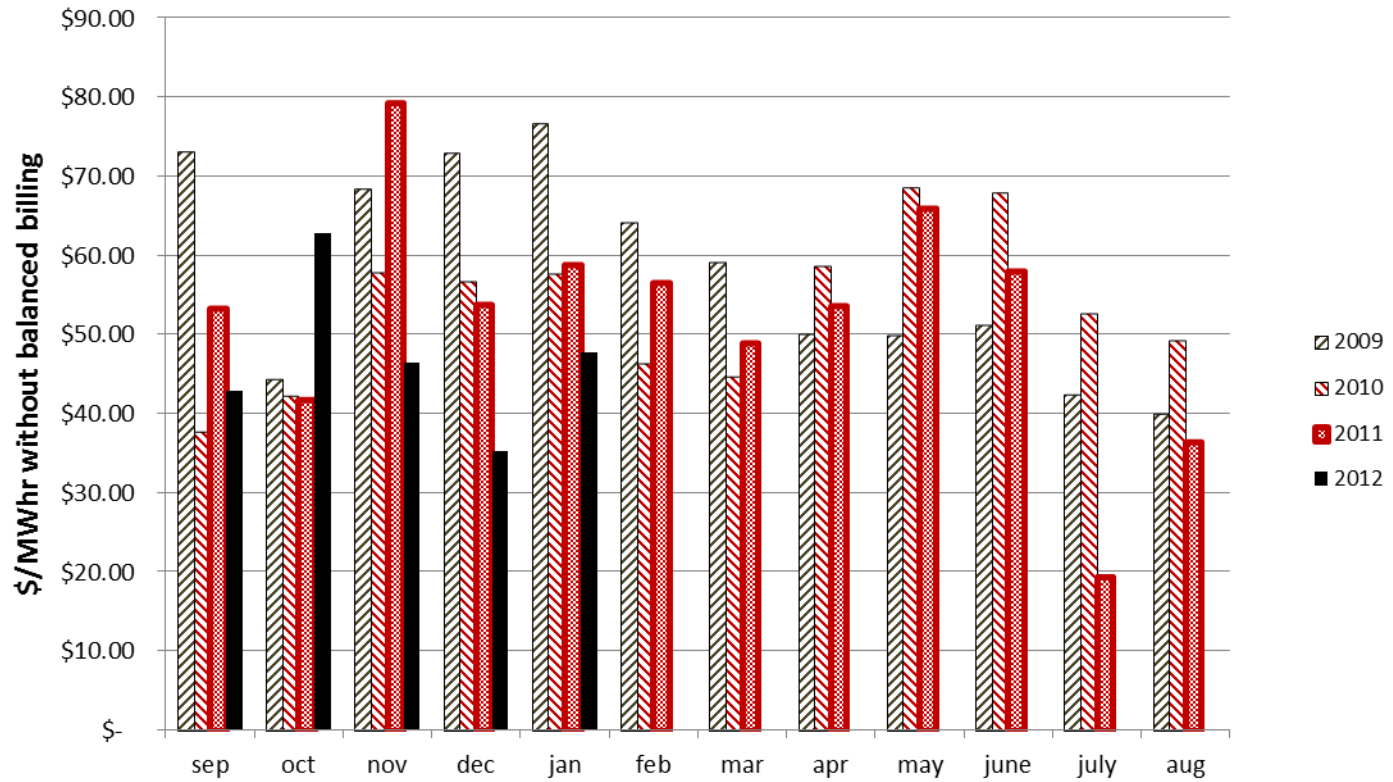


Lverage (m
(0.29 mb xsec

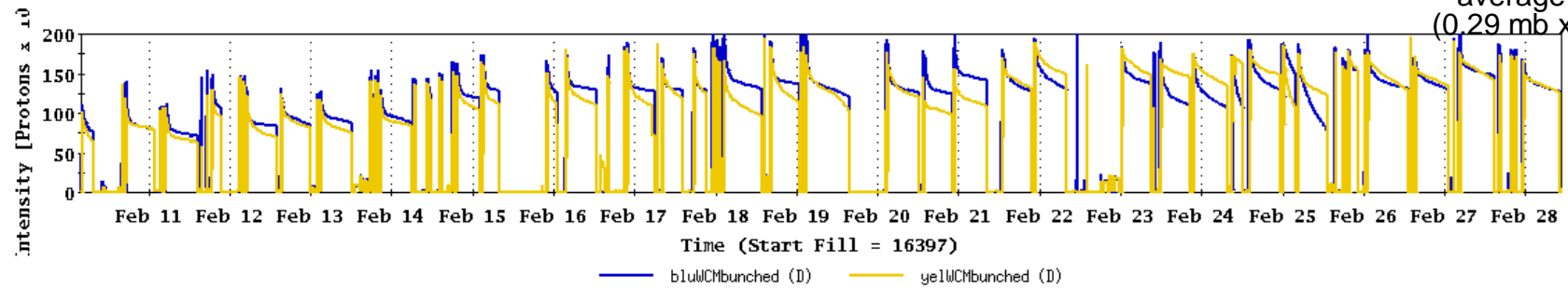
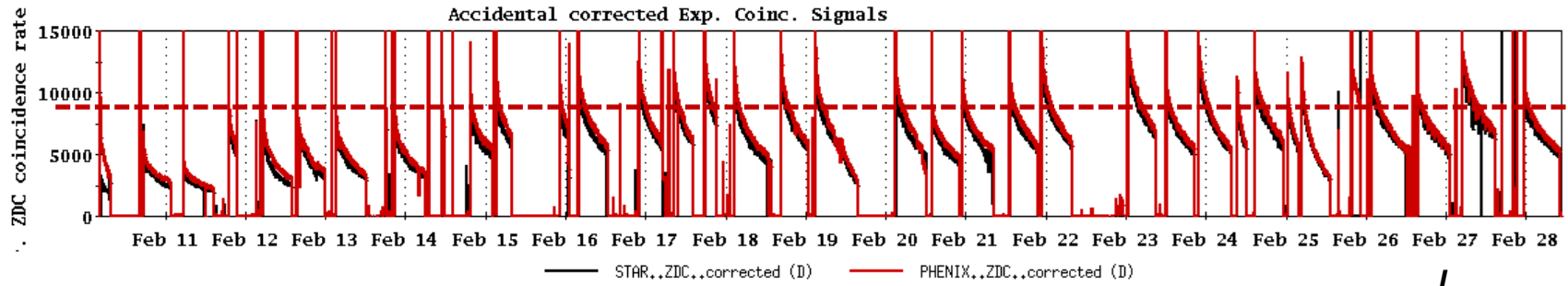
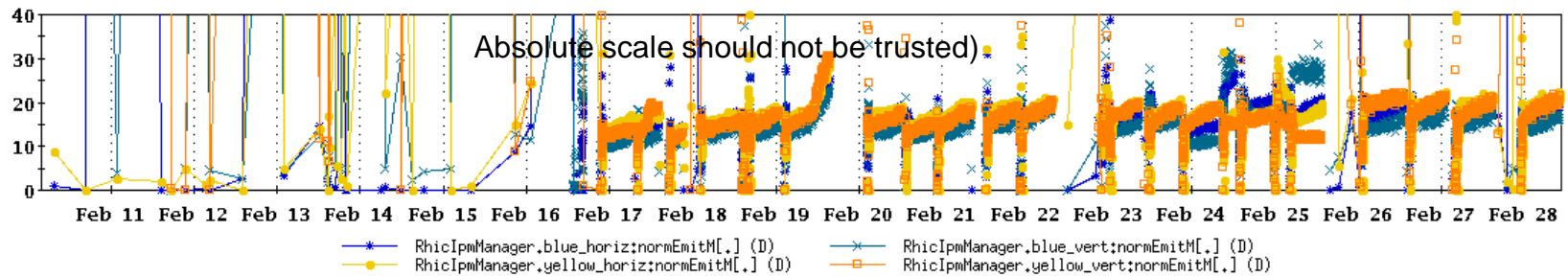
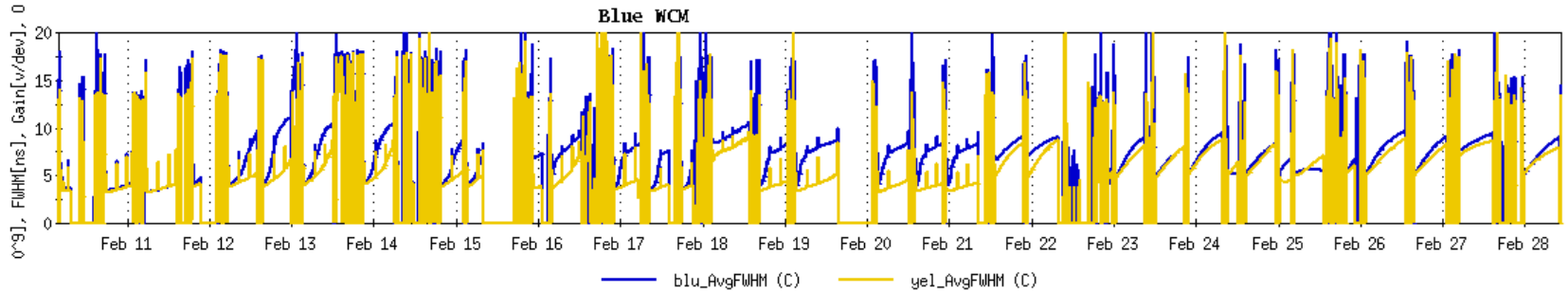


Ions/bunch (ma

BNL Electricity Cost

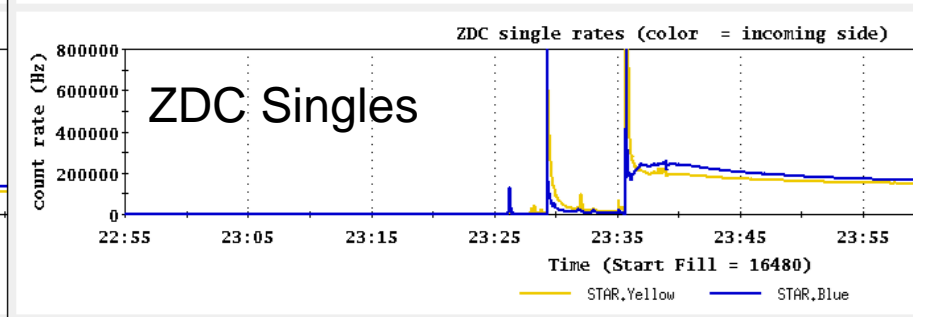
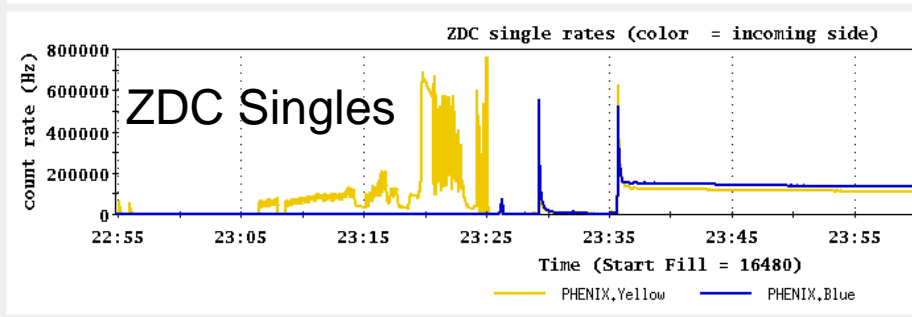
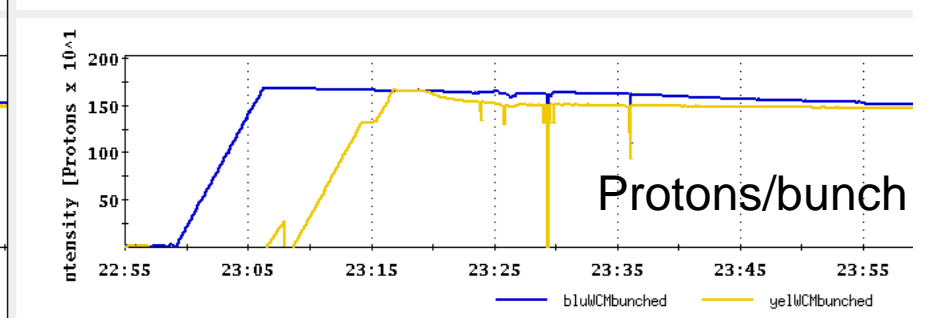
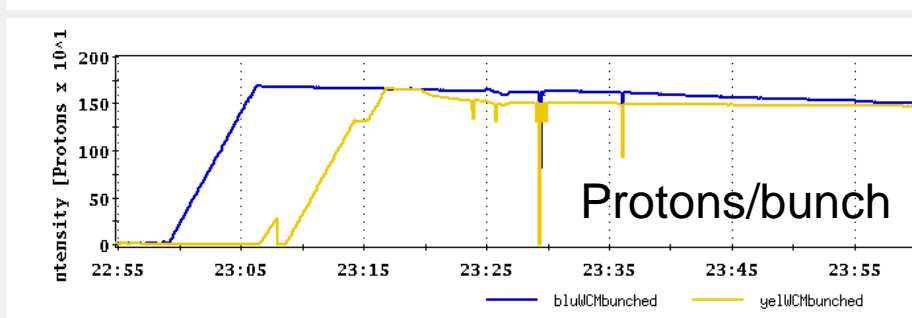
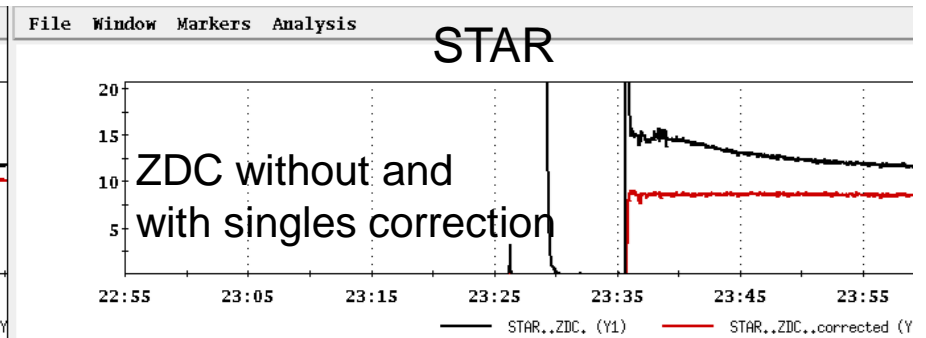
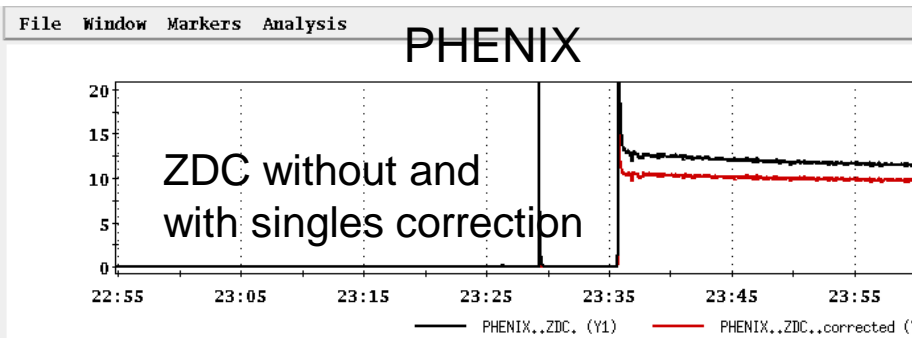


Run 12 Physics Stores to 28 Feb

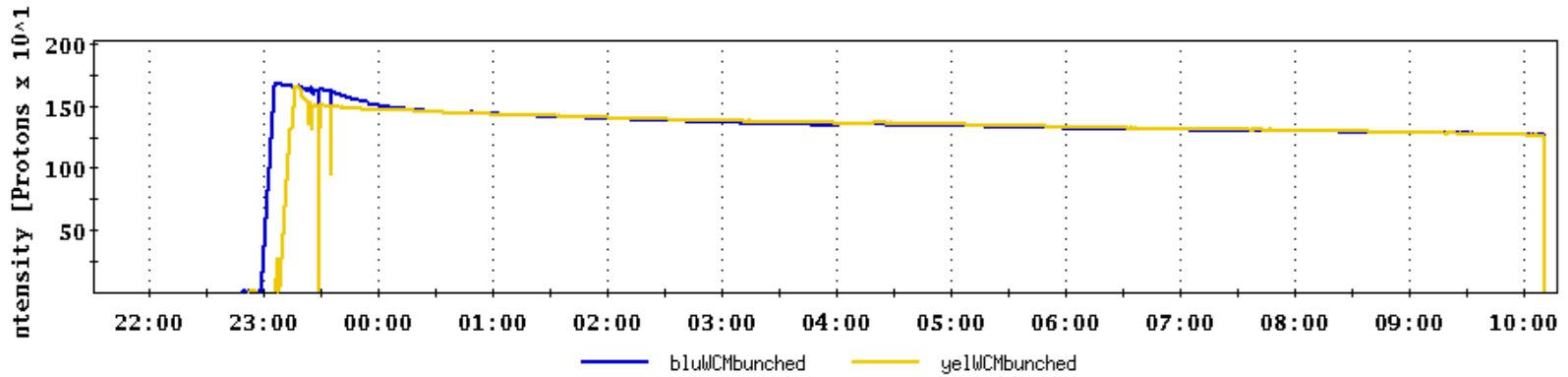
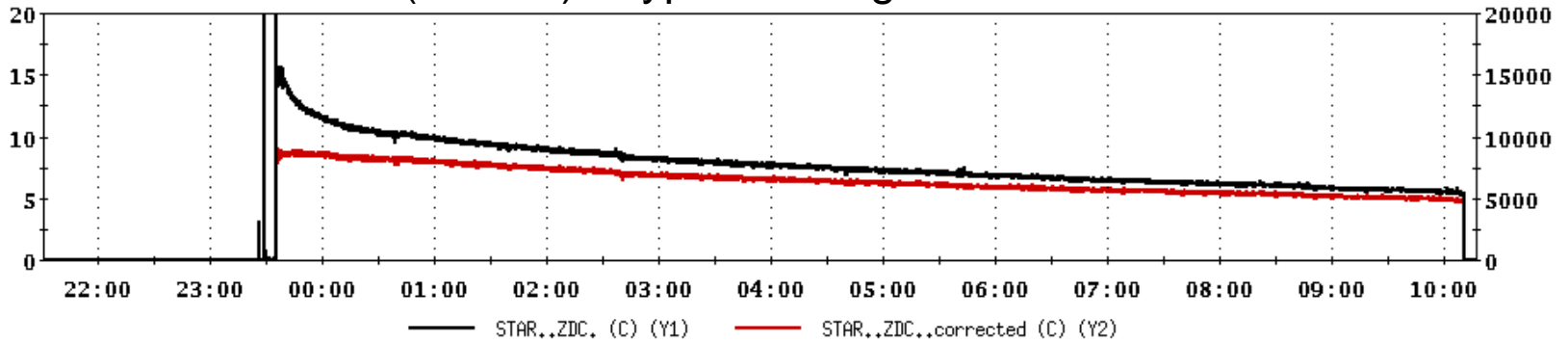


$L_{\text{average}}(\text{max})$
(0.29 mb x section)

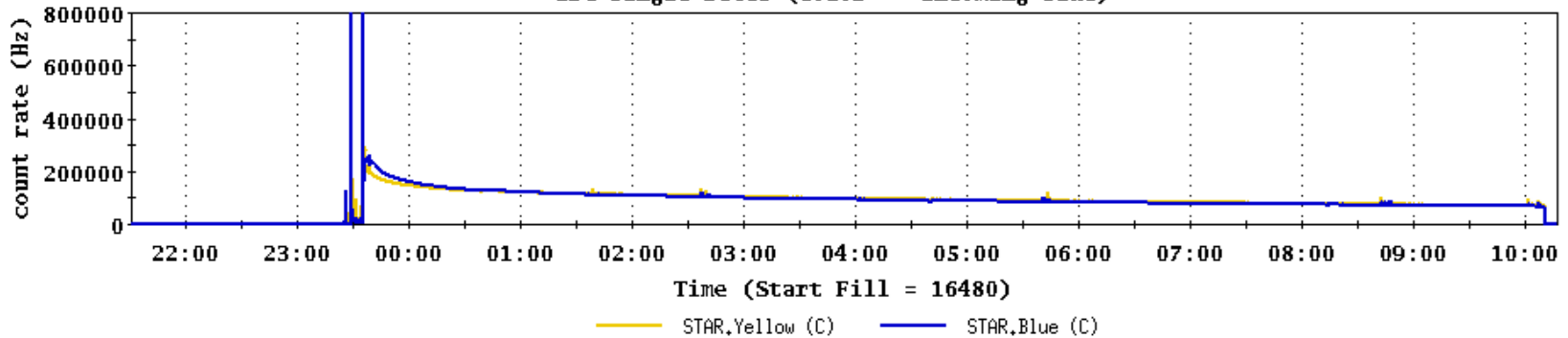
Store 16480 (27 Feb) – typical background issues



Store 16480 (27 Feb) – typical background issues

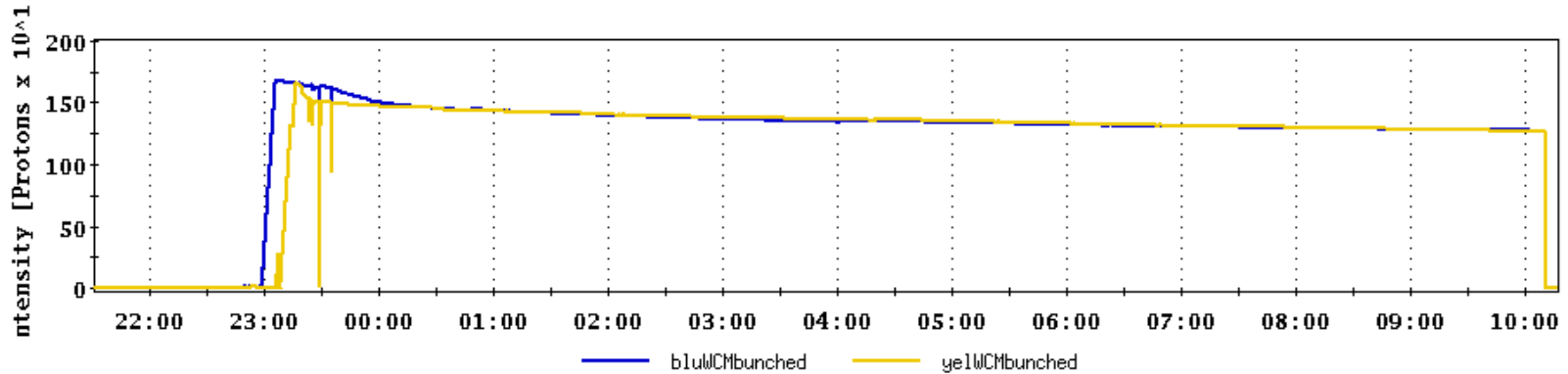
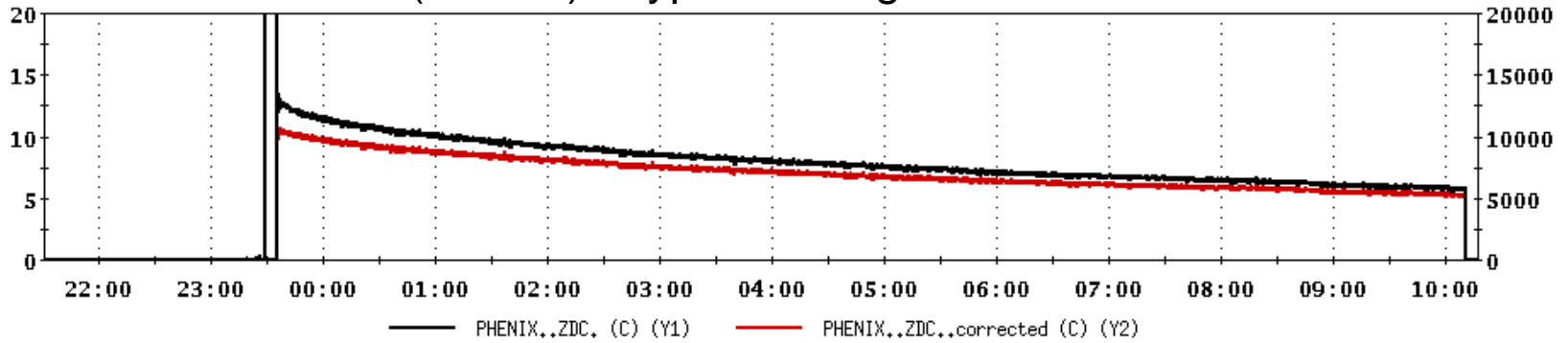


ZDC single rates (color = incoming side)

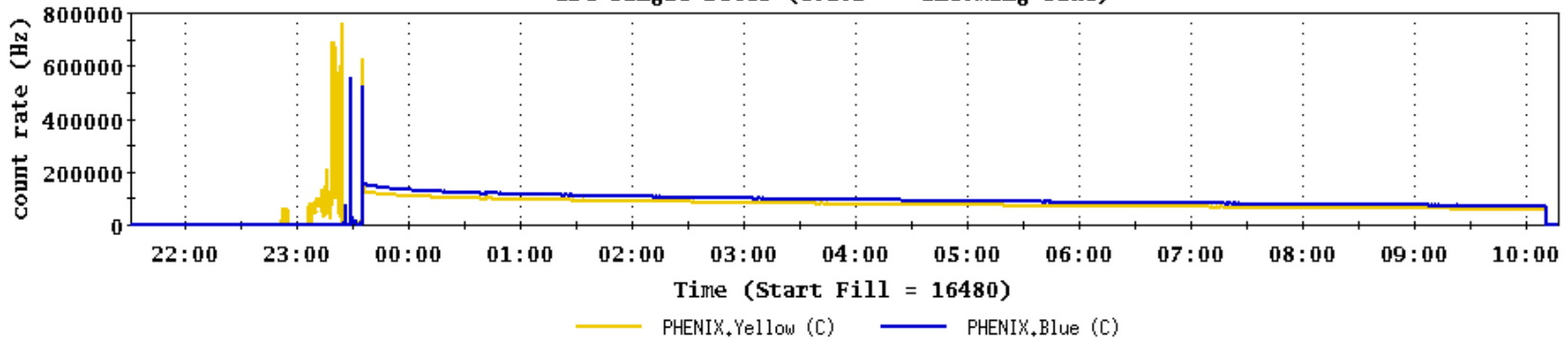


File Window Markers Analysis

Store 16480 (27 Feb) – typical background issues



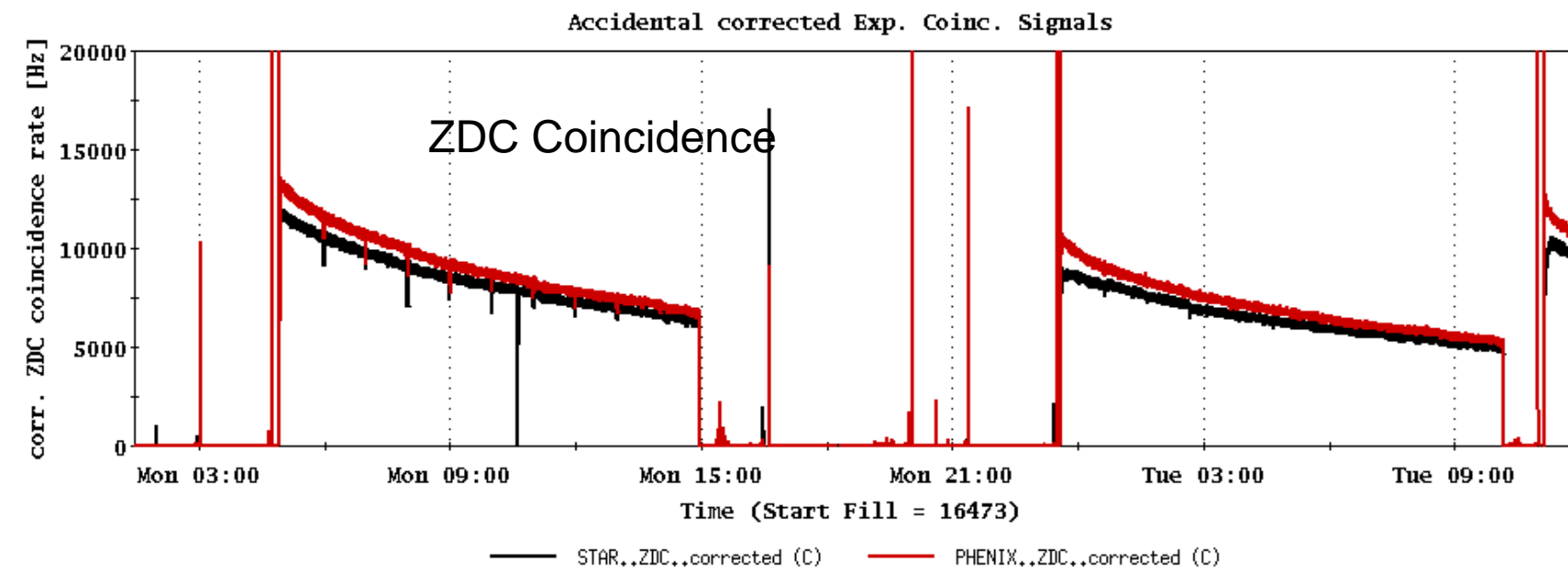
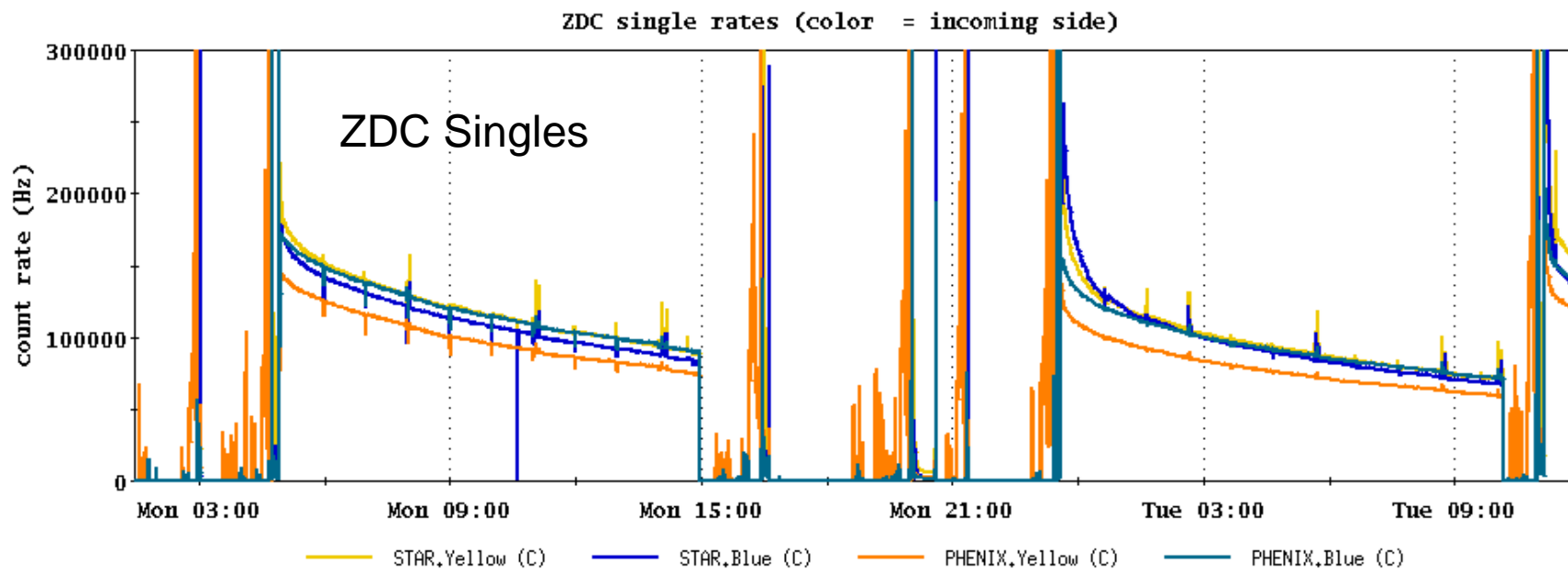
ZDC single rates (color = incoming side)



Collision steering corrections background issues 26-27 Feb

RHIC/Experiments/AllExpCollAccCorr.logreq 02/27/2012 01:27 - 02/28 11:45

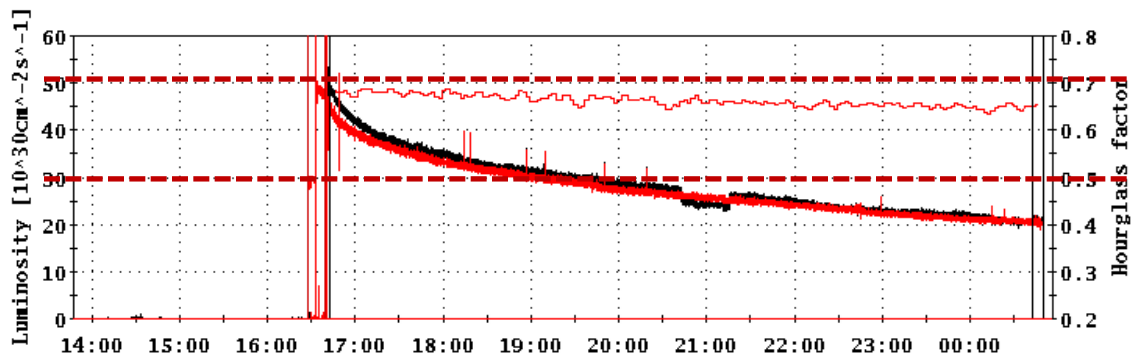
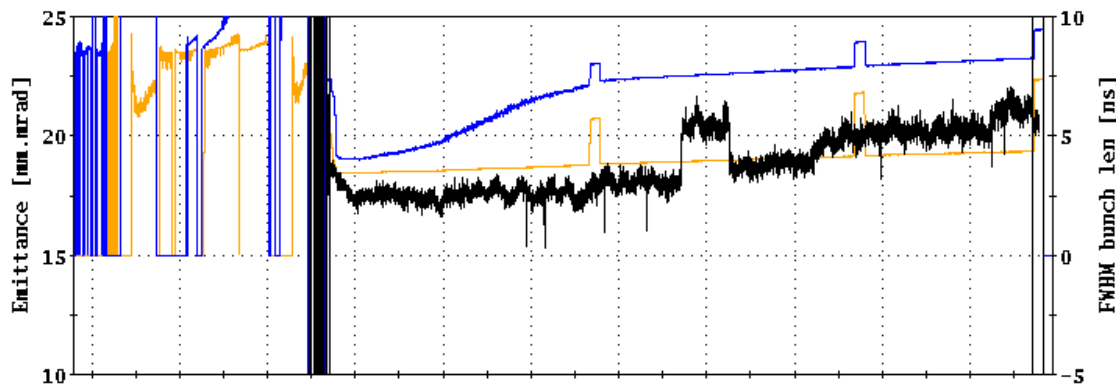
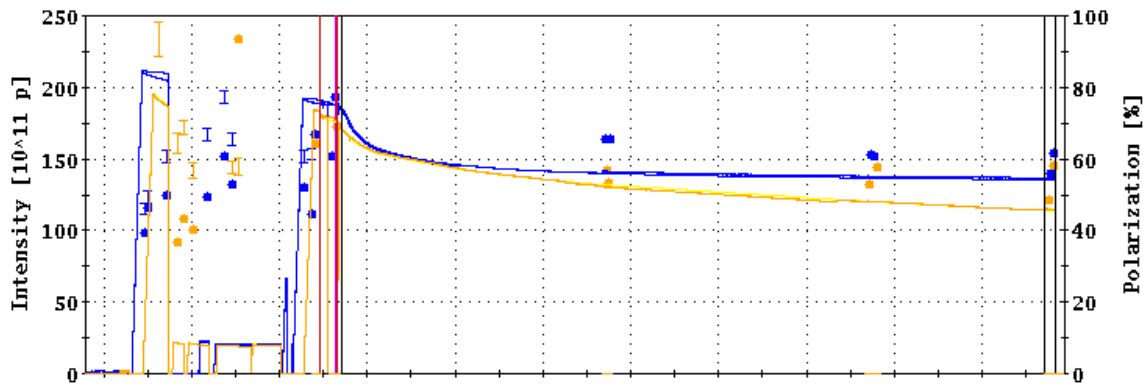
File Window Markers Analysis



Example -- Store 16445, Sat Feb 18

Setup Display

Help



Fill Update Species

Run

Beam Parameters

Pattern gamma

Collision Parameters

	PHENIX	STAR
No collisions	<input type="text" value="107"/>	<input type="text" value="102"/>
beta* [m]	<input type="text" value="0.85"/>	<input type="text" value="0.85"/>
sigma [mb]	<input type="text" value="0.284"/>	<input type="text" value="0.270"/>
Single Correction	<input type="checkbox"/> All	<input type="checkbox"/> All
sig(1n)/sig(2n)	<input type="text" value="3.000"/>	<input type="text" value="3.000"/>

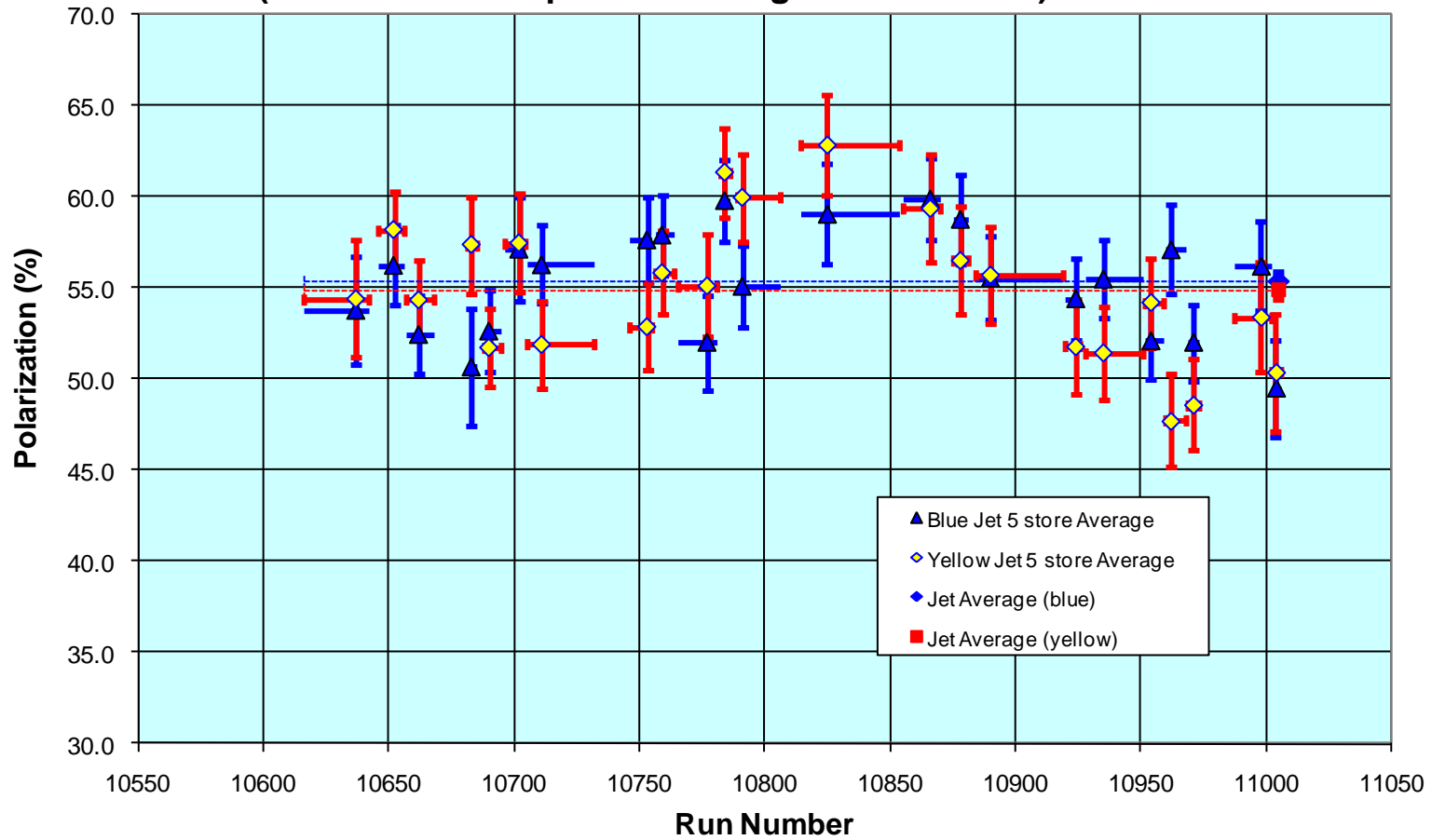
Fit

dcct wcm zdc Exp Fit

$L_{\text{peak}}(\text{max})$

$L_{\text{store average}}(\text{max})$

**Run 9 200 GeV Jet Target, preliminary results
(thru 28Jun each point is average over 5 stores)**



Blue Jet weighted average = 55.4 ± 0.5

Yellow Jet weighted average = 54.9 ± 0.5

Run 12 projection for $\sqrt{s} = 200$ GeV pp

STAR Goal: 27 pb⁻¹ delivered with 55-60 % polarization

PHENIX Goal: 27 pb⁻¹ delivered with 55-60 % polarization

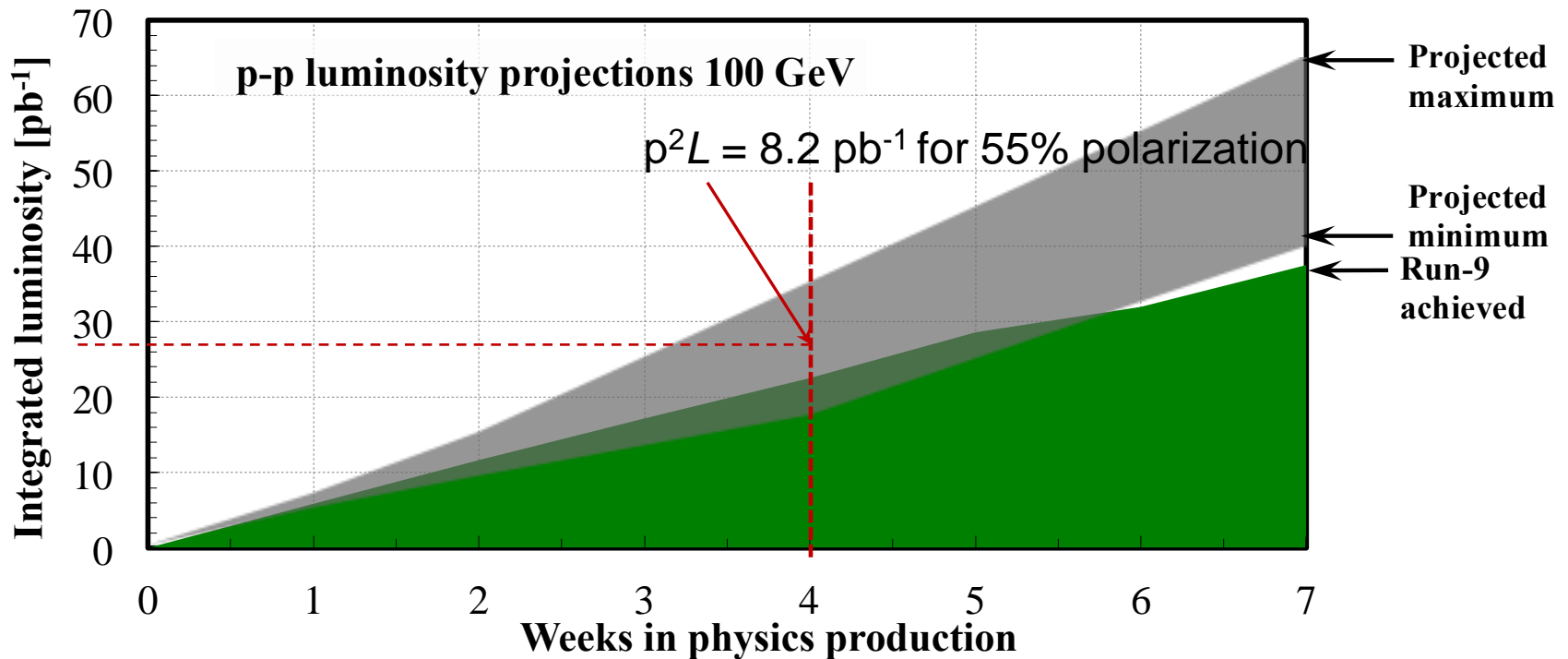


Figure 3: Projected minimum and maximum integrated luminosities for polarized proton collisions at 100 GeV beam energy, assuming a linear weekly luminosity ramp-up in 4 weeks. An average store polarization between 50 and 60% is expected.

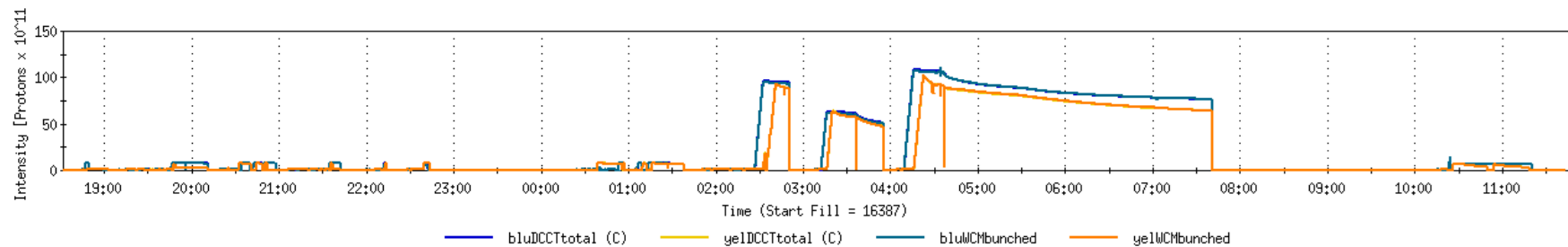
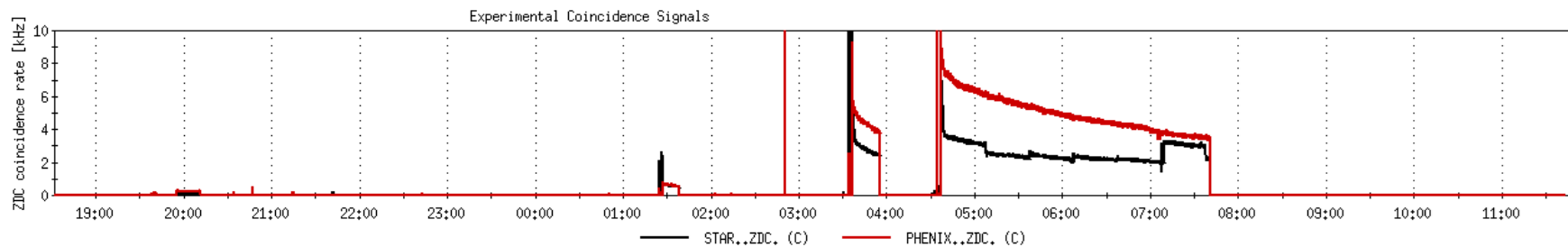
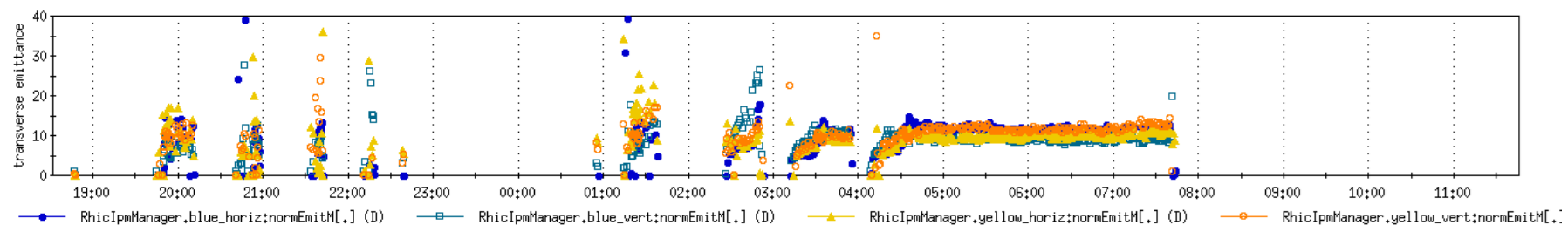
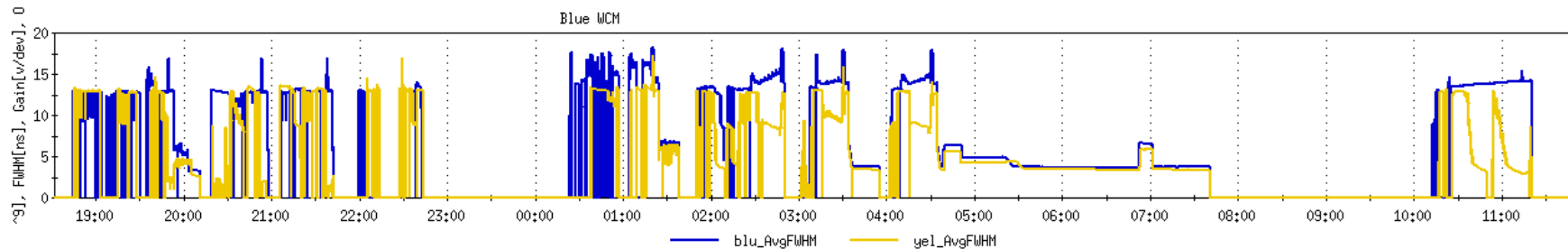
From Fischer et. Al. "RHIC Collider Projections (FY 2012 – FY 2016)"

14 October 2011

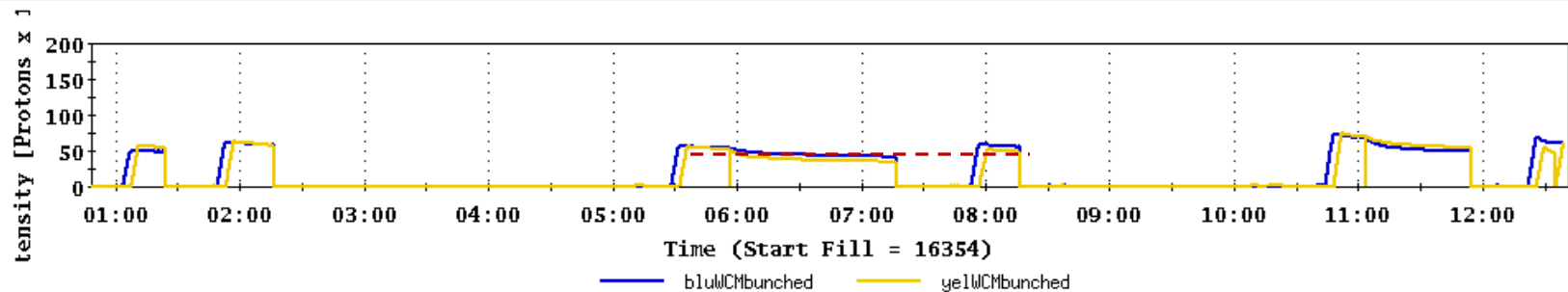
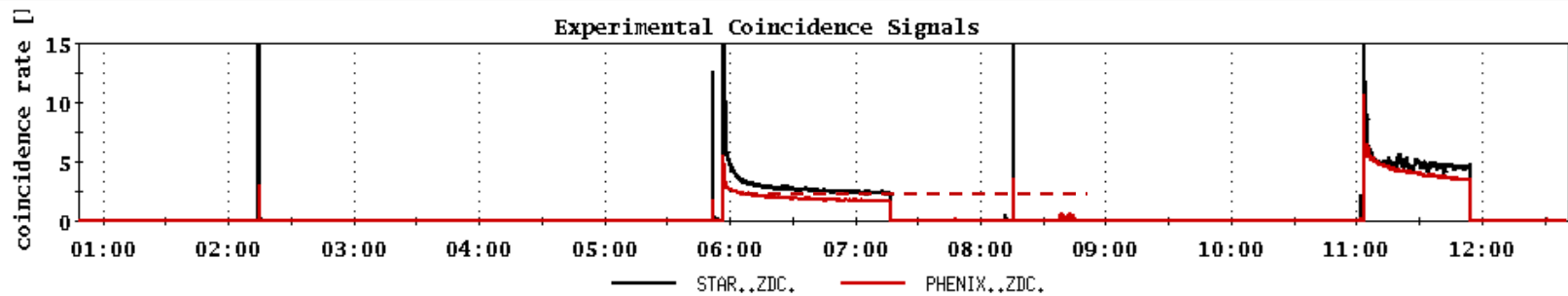
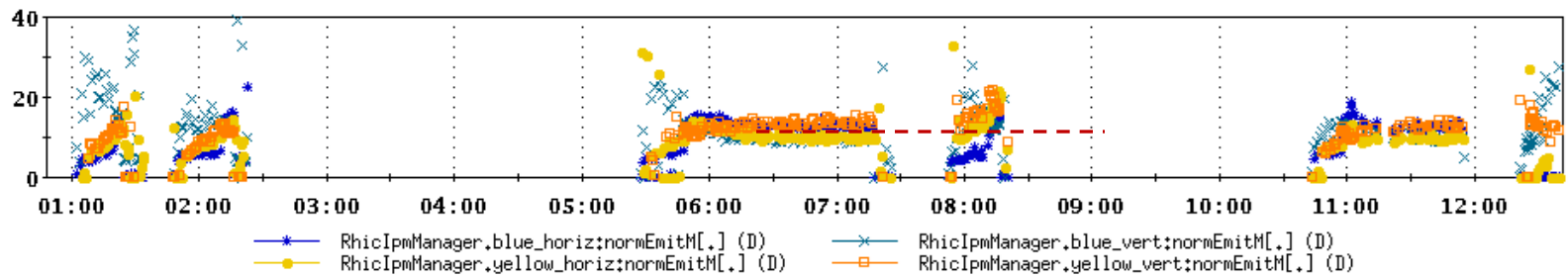
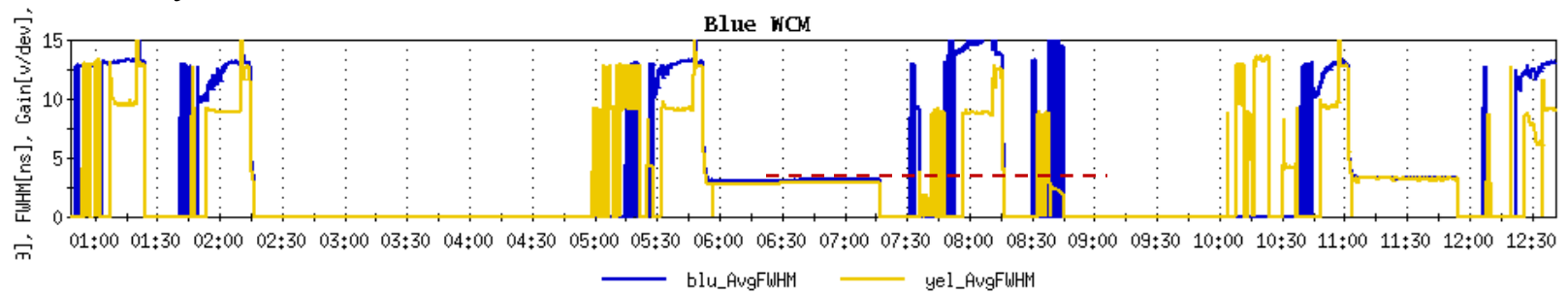
First Physics Store (#16397, 04:01, 10 Feb)

RHIC/BeamIons.logreq 02/09/2012 18:31 - 02/10 11:46

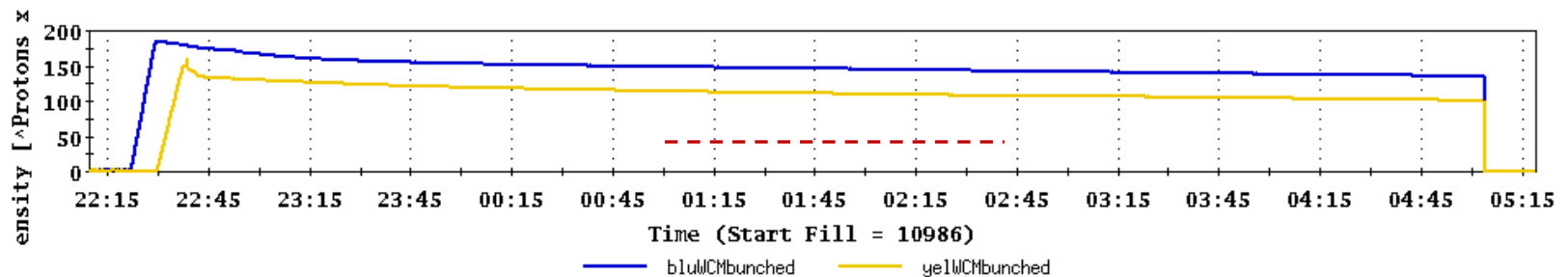
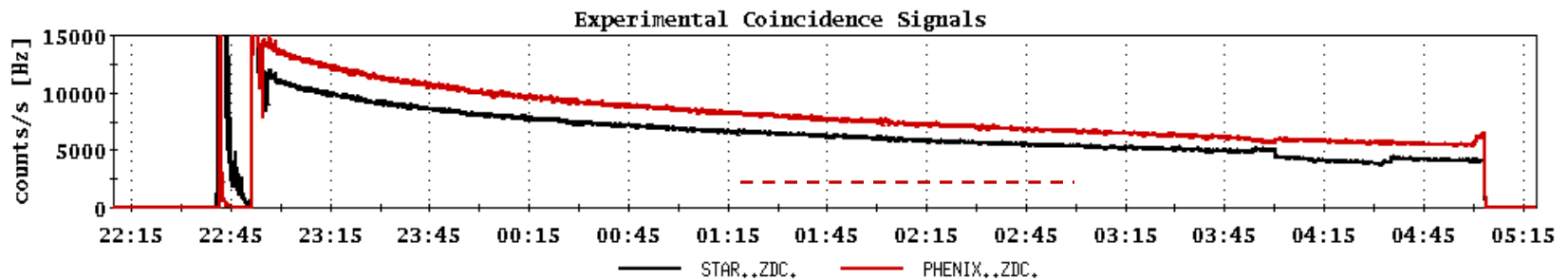
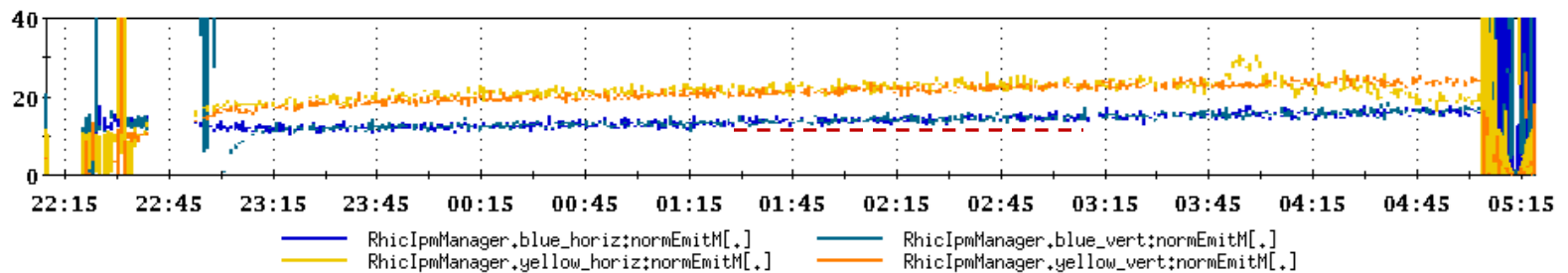
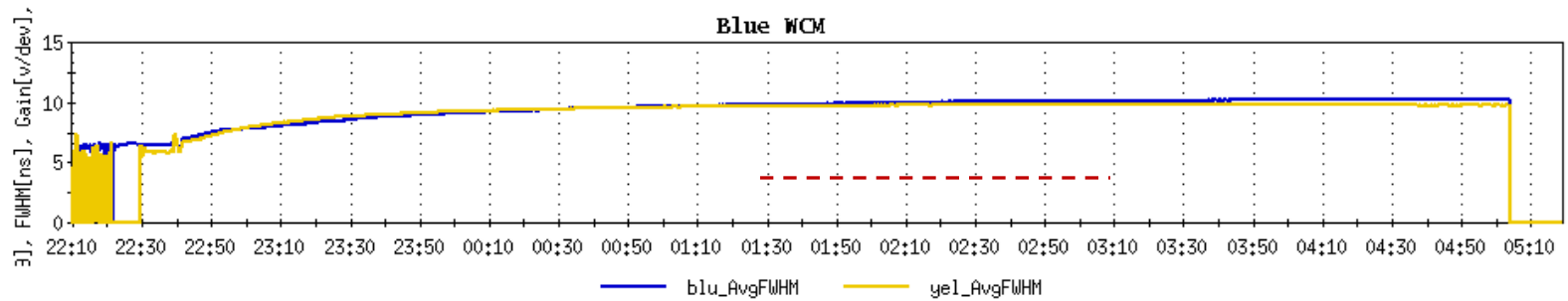
File Window Markers Analysis



Today, 7 Feb 2012

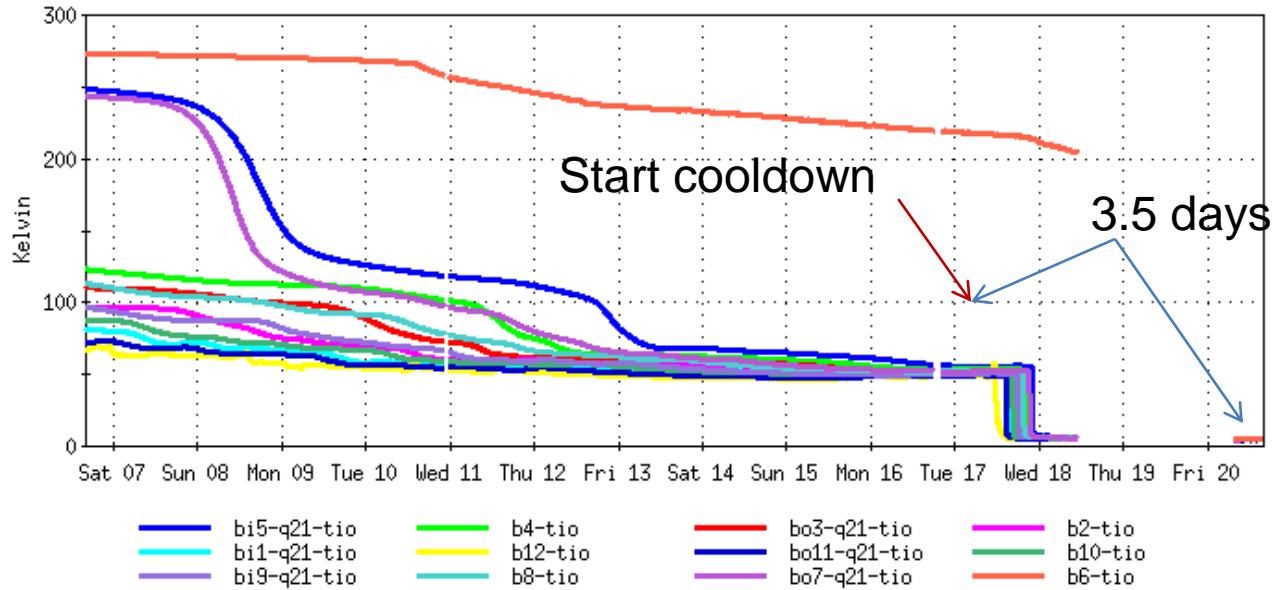


Typical Store from Run 9, 100 x 100 GeV pp

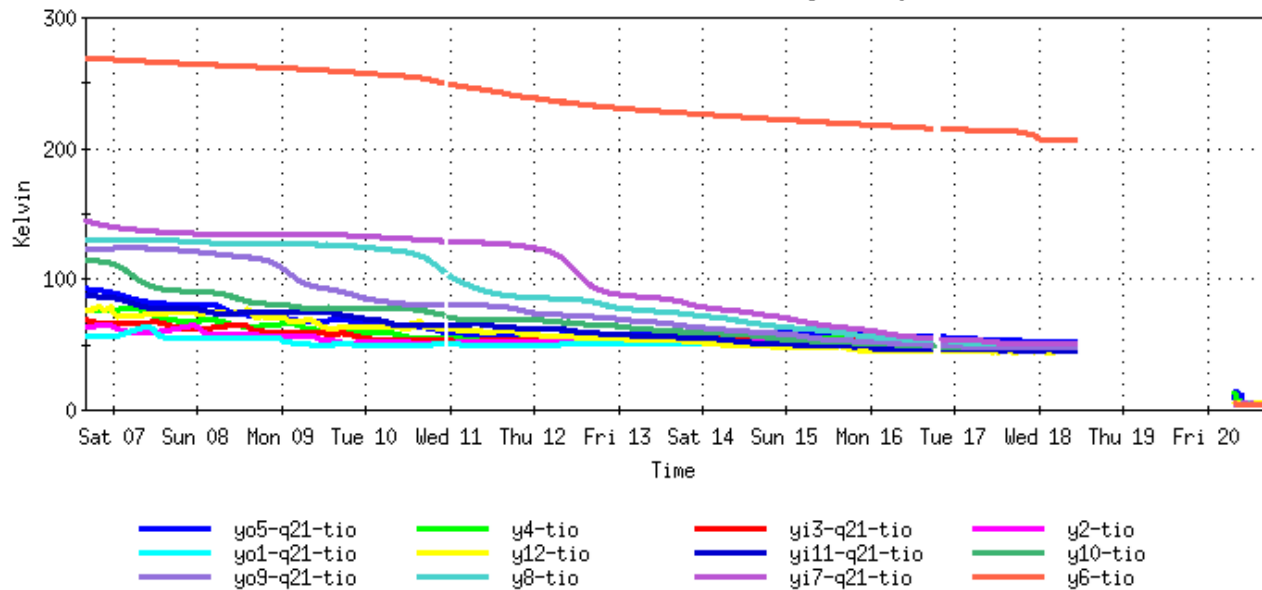


Blue Cryo Temperatures

As of 16:18 hrs 20 Jan



Yellow Cryo Temperatures



Recommendations following the June 6-8, 2011 PAC

For Run 12 the PAC recommends the following (*in order of priority*):

- 5 weeks of running with polarized proton collisions at 200 GeV.
- 7 weeks of running with polarized proton collisions at 500 GeV.
- 5 weeks of running with Cu+Au collisions at 200 GeV.
- 3 weeks of running with U+U collisions at 193 GeV.

For Run13 the PAC recommends the following (*not* in order of priority):

- 12 weeks of running with polarized proton collisions at 500 GeV.
- 5 week of running with polarized proton collisions at 200 GeV.
- 7 weeks of running with Au+Au collisions at full energy.

Cryo Issue

Our helium supplier no longer able to meet our peak demand of 4 trailers in a one week period. They can give us one trailer a week starting on December 31st, so we expect to have all the helium we need, on time, but we will have to store most of it in the dewars outside 1006B. This will result in our 4K cooldown being a little less stable and predictable than it has been for the past few years when we received all of the helium at 1005R over a short period of time. Because of this, I expect the 4K cooldown will take a least one additional day.

Cryogenic System Cooldown Projection based on Full Compressor Power Starting on January 17, 2012

.5 to 1 MW – Nov 23, 2011 through Dec 18, 2011 (temporary peaks up to 2 MW)

Scrub of RHIC rings and cryo plant, 14 atm pressure test of blue sextants 2/3 and 8/9 M-lines. Main compressor testing and scrub.

2.8 MW – Dec 19, 2011 through Jan 16, 2012

12/19/11	Start 45K cooldown of cryo plant
12/20/11	Start 45K wave in both RHIC rings
12/31/11	First liquid helium delivery, 1006B
01/07/12	Second liquid helium delivery, 1006B
01/14/12	Third liquid helium delivery, 1005R

6 to 8 MW – Jan 17, 2012 through Jan 22, 2012

01/17/12	Start 4K wave in Blue ring, Hi potting (3 days)
01/20/12	Estimate blue ring cold and stable, soak complete, ready for magnet powering.
01/20/12	Start 4K wave in Yellow ring, Hi potting (3 days)
01/21/12	Fourth liquid helium delivery
01/23/12	Estimate yellow ring cold and stable, soak complete, ready for magnet powering.

5 MW starting on Jan 23, 2012

01/23/12	Start T7 turbine
----------	------------------

FY2012

Sept billed at \$70/MWhr actual cost \$42.86 -- \$438K added to bank

Oct billed at \$60/MWhr actual cost \$62.80 -- \$45.5K withdrawn from bank

FY2012 Bank Total = \$392,563

FY2012 Electric Rates			FY11 Rates
Month	Original	Revised	As Billed
	\$/kWh	\$/kWh	\$/kWh
Oct-11	0.060		0.065
Nov-11	0.060		0.065
Dec-11	0.060		0.065
Jan-12	0.053		0.055
Feb-12	0.053		0.055
Mar-12	0.053		0.055
Apr-12	0.053		0.055
May-12	0.053		0.055
Jun-12	0.068		0.070
Jul-12	0.068		0.070
Aug-12	0.068		0.070
Sep-12	0.068		0.070

From Fischer et. al. "RHIC Collider Projections (FY 2012 – FY 2016)"

14 October 2011

Cool-down from 50 K to 4 K	1 week	
Set-up mode 1 (p↑-p↑ at 100 GeV)	1 week	(no dedicated time for experiments)
Ramp-up mode 1	2 week	(8 h/night for experiments)
Data taking mode 1 with further ramp-up	5 weeks	
Set-up mode 2 (p↑-p↑ at 250 GeV)	½ week	(no dedicated time for experiments)
Ramp-up mode 2	1 week	(8 h/night for experiments)
Data taking mode 2 with further ramp-up	7 weeks	
Set-up mode 3 (U-U at 100 GeV/nucleon)	1 week	(no dedicated time for experiments)
Data taking mode 3 with further ramp-up	3 weeks	
Warm-up	½ week	



Run 12 projection for $\sqrt{s} = 500$ GeV pp

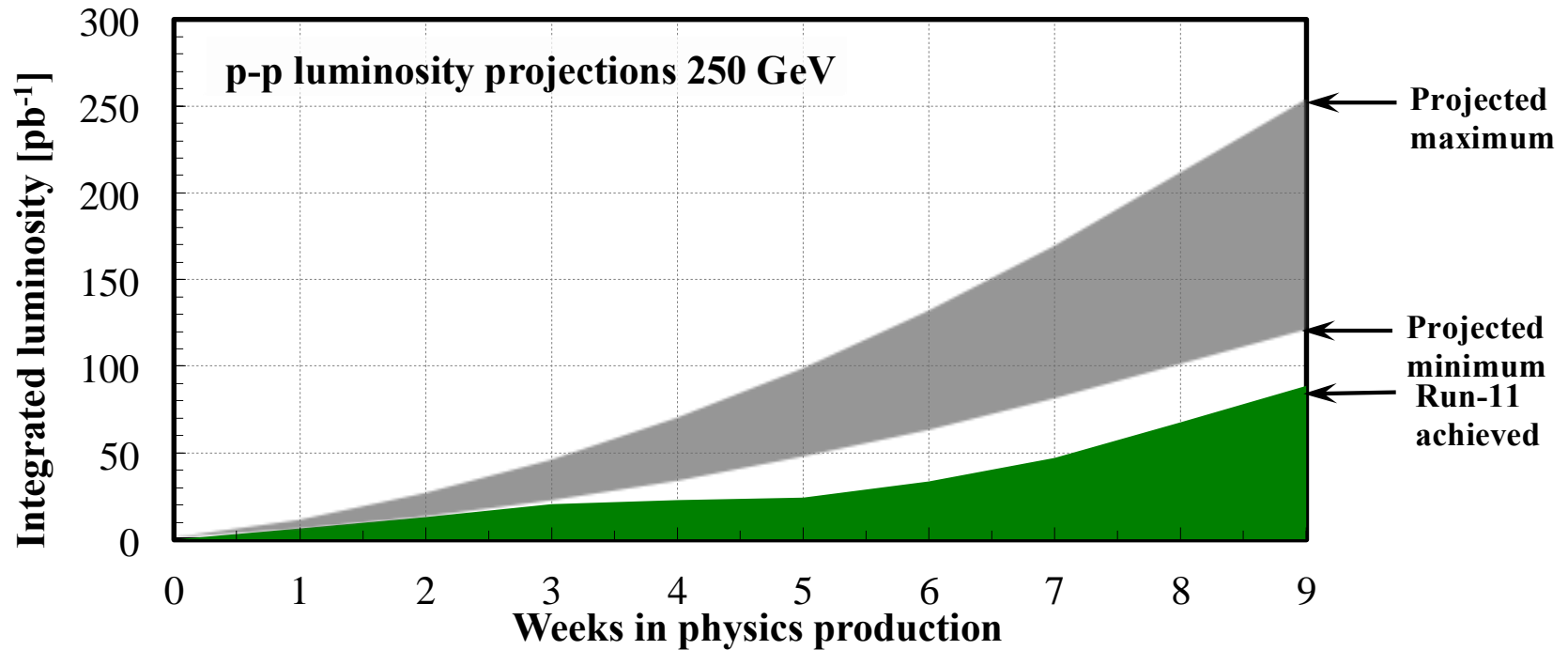


Figure 4: Projected minimum and maximum integrated luminosities for polarized proton collisions at 250 GeV beam energy, assuming linear weekly luminosity ramp-up in 8 weeks. An average store polarization between 45 and 50% is expected.

From Fischer et. Al. "RHIC Collider Projections (FY 2012 – FY 2016)"

14 October 2011

Run 12 projection for $\sqrt{s} = 193$ GeV/n UU

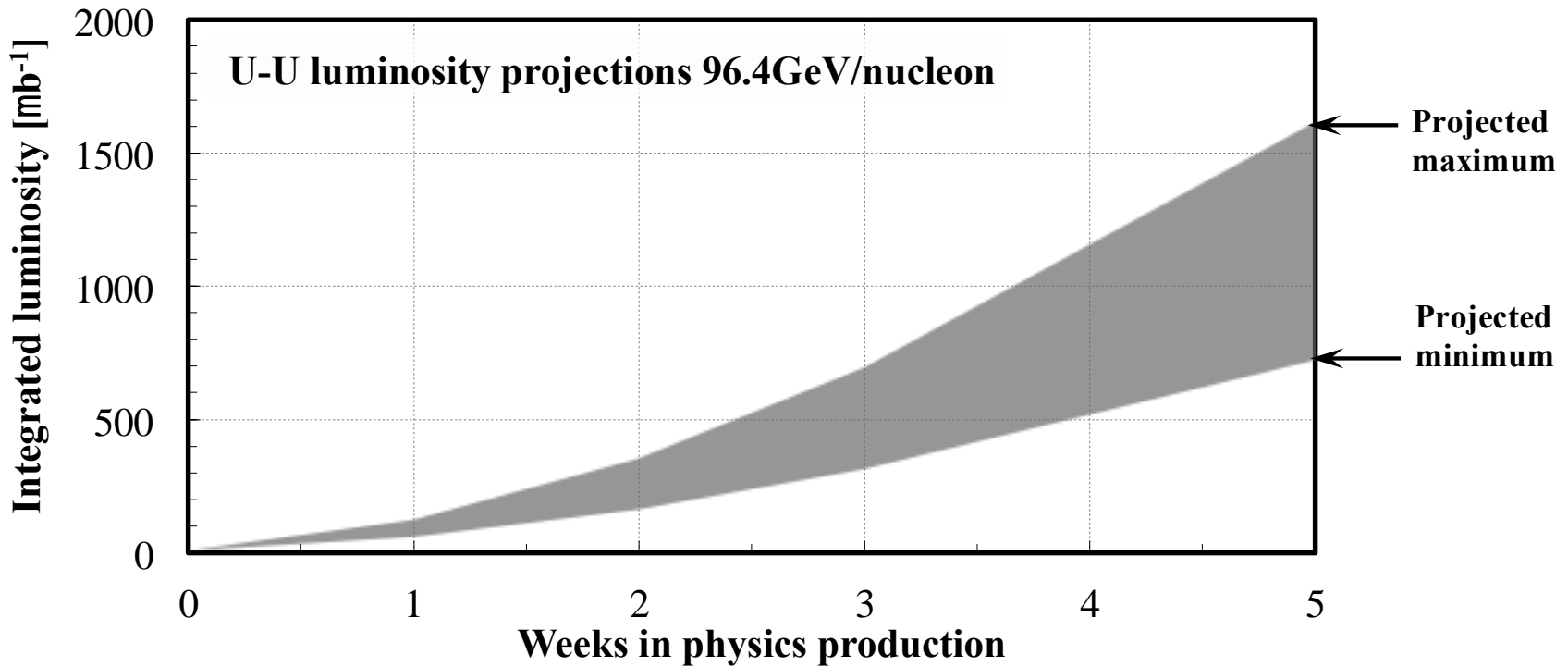


Figure 5: Projected minimum and maximum integrated luminosities for uranium-uranium at 96.4 GeV/nucleon, assuming linear weekly luminosity ramp-up in 48 weeks.

From Fischer et. Al. "RHIC Collider Projections (FY 2012 – FY 2016)"

14 October 2011

Run 12 projection for $\sqrt{s} = 200$ GeV/n CuAu

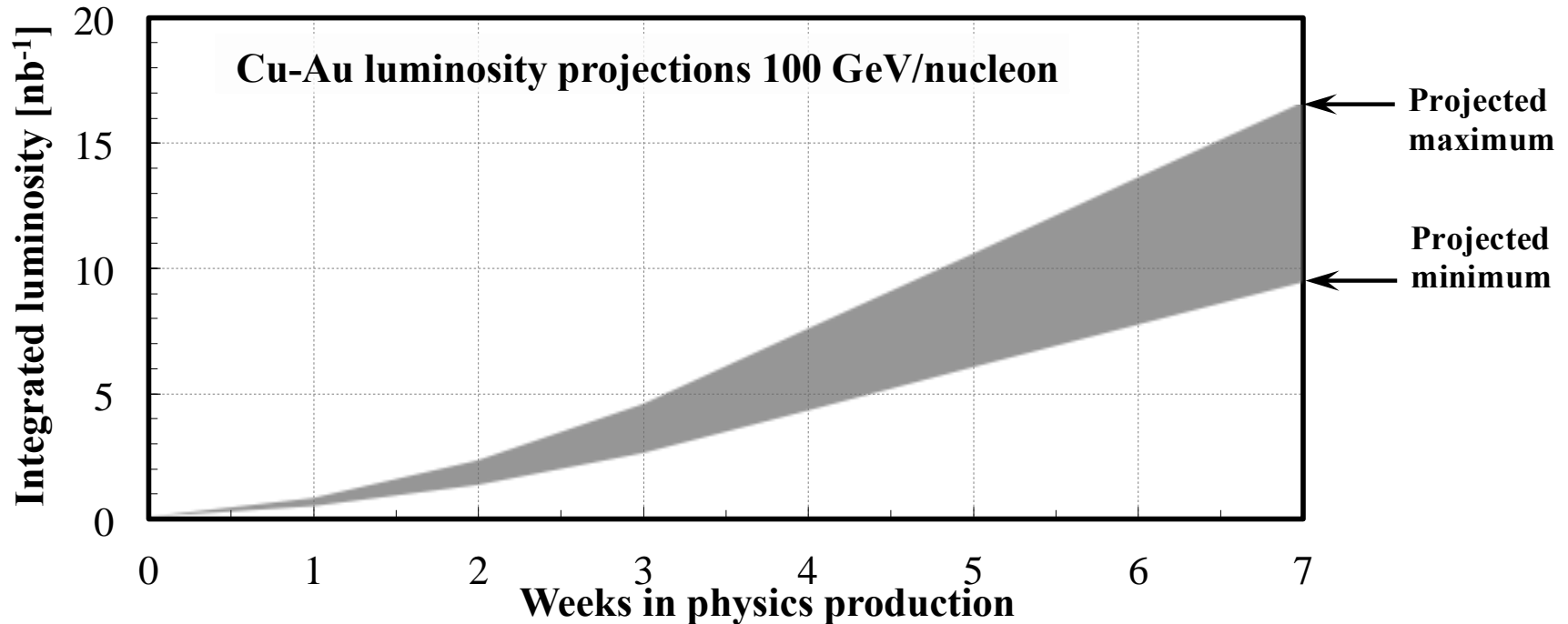


Figure 6: Projected minimum and maximum integrated luminosities for copper-gold collisions at 100 GeV/nucleon beam energy, assuming linear weekly luminosity ramp-up in 4 weeks.

From Fischer et. Al. "RHIC Collider Projections (FY 2012 – FY 2016)"

14 October 2011