

Run 12 RHIC Machine/Experiments Meeting

3 Apr 2012

Agenda:

- Status reports
- Other business

Run 12 Plan based on 20 weeks cryo operation
23 week schedule based on 3/28/12 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 – 3 April**
- 19 April (Thursday), end 4.9 week pp physics run at $\sqrt{s} = 500$ GeV




Tentative Cu-Au and Uranium-Uranium plan

- 19 April (Thursday), begin 1 week setup for UU (with overnight stores for experiments late in week)
- 26 April (Thursday), begin 2-3 week UU physics run...if 3 weeks...
- 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)

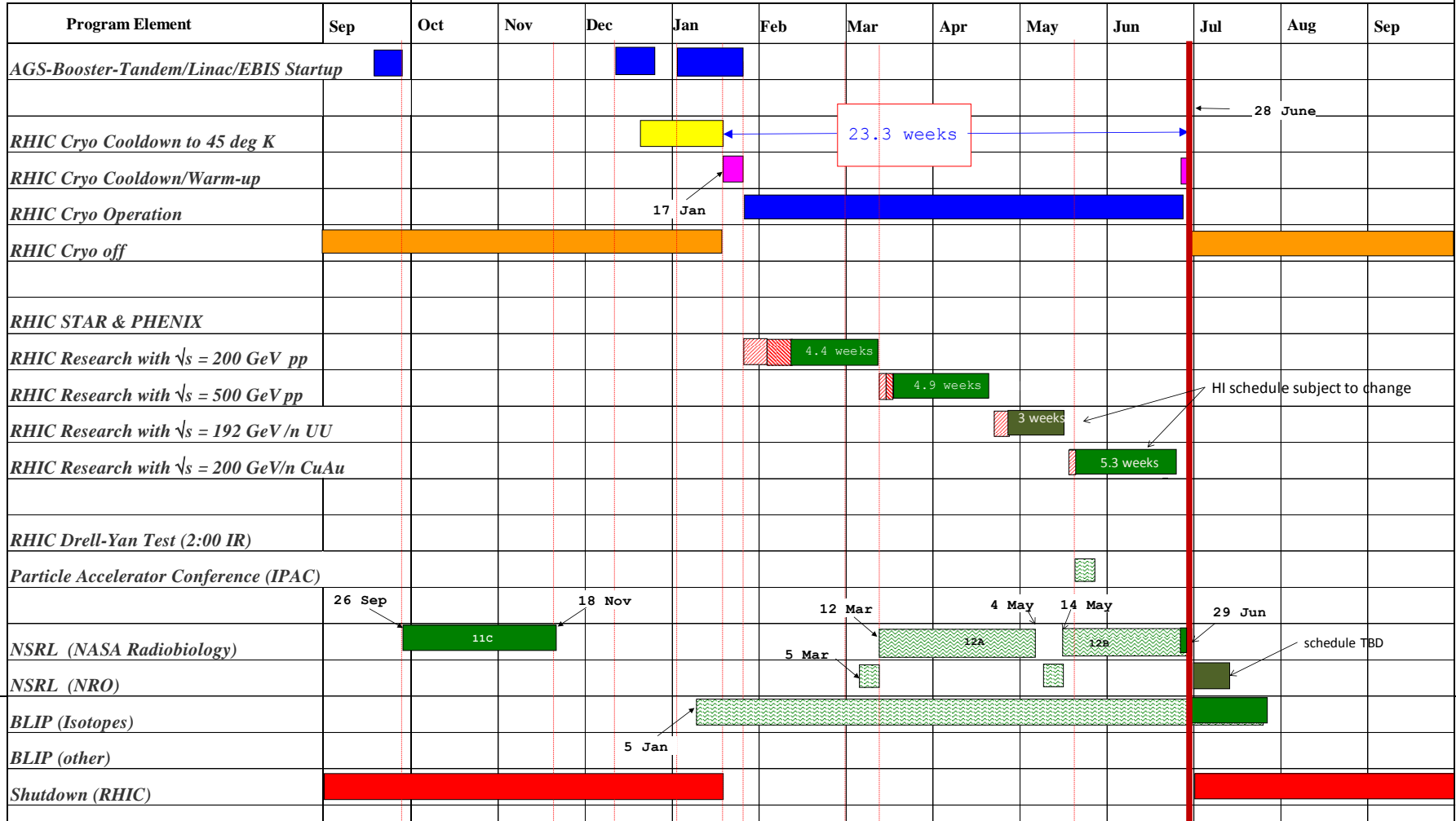
Total Physics Weeks = 17.6

C-A Operations-FY12

in progress/planned

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

FY 2012



23.3 weeks

28 June

HI schedule subject to change

schedule TBD

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

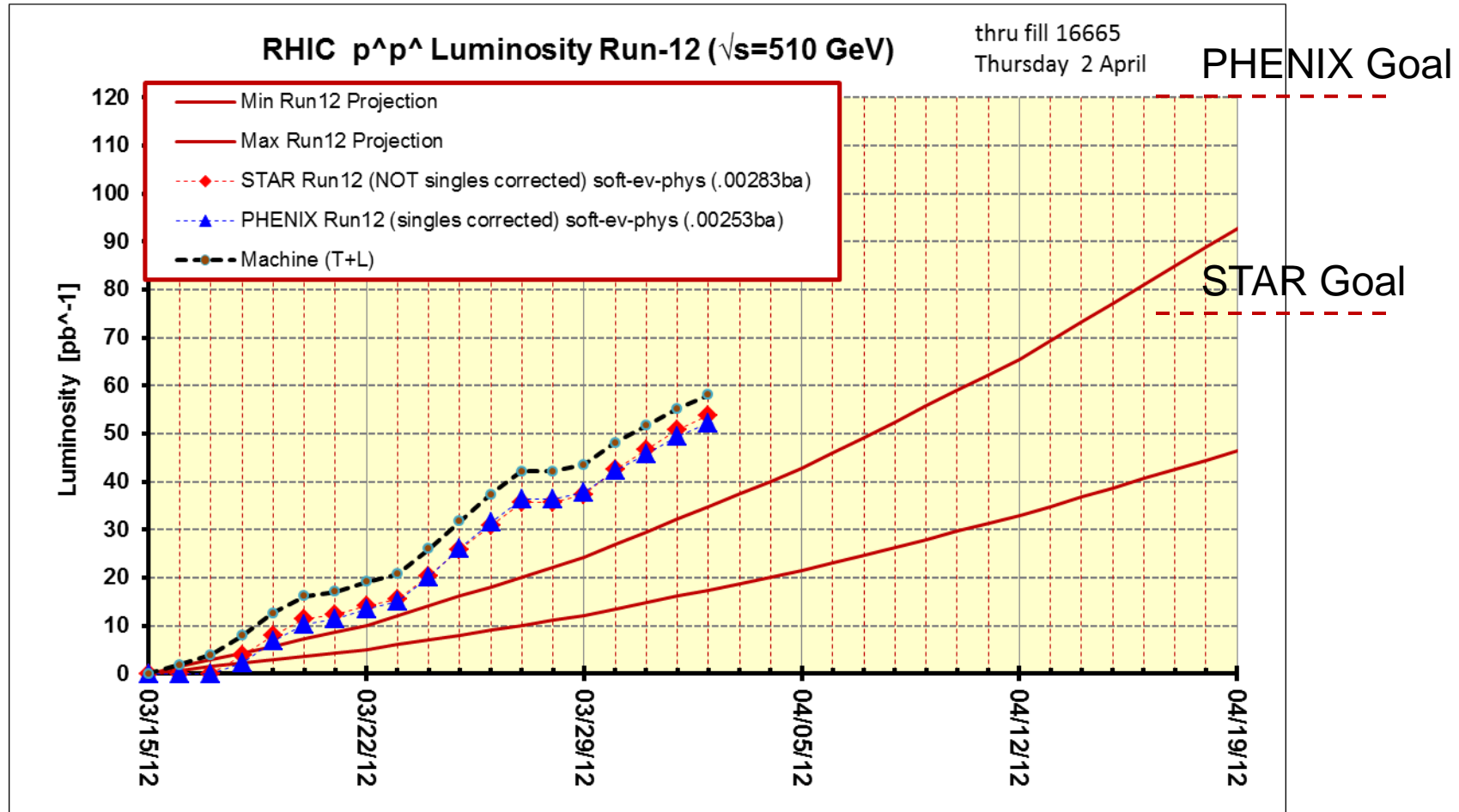
STAR Goal for 5 weeks longitudinal polarization (50% polarization):

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

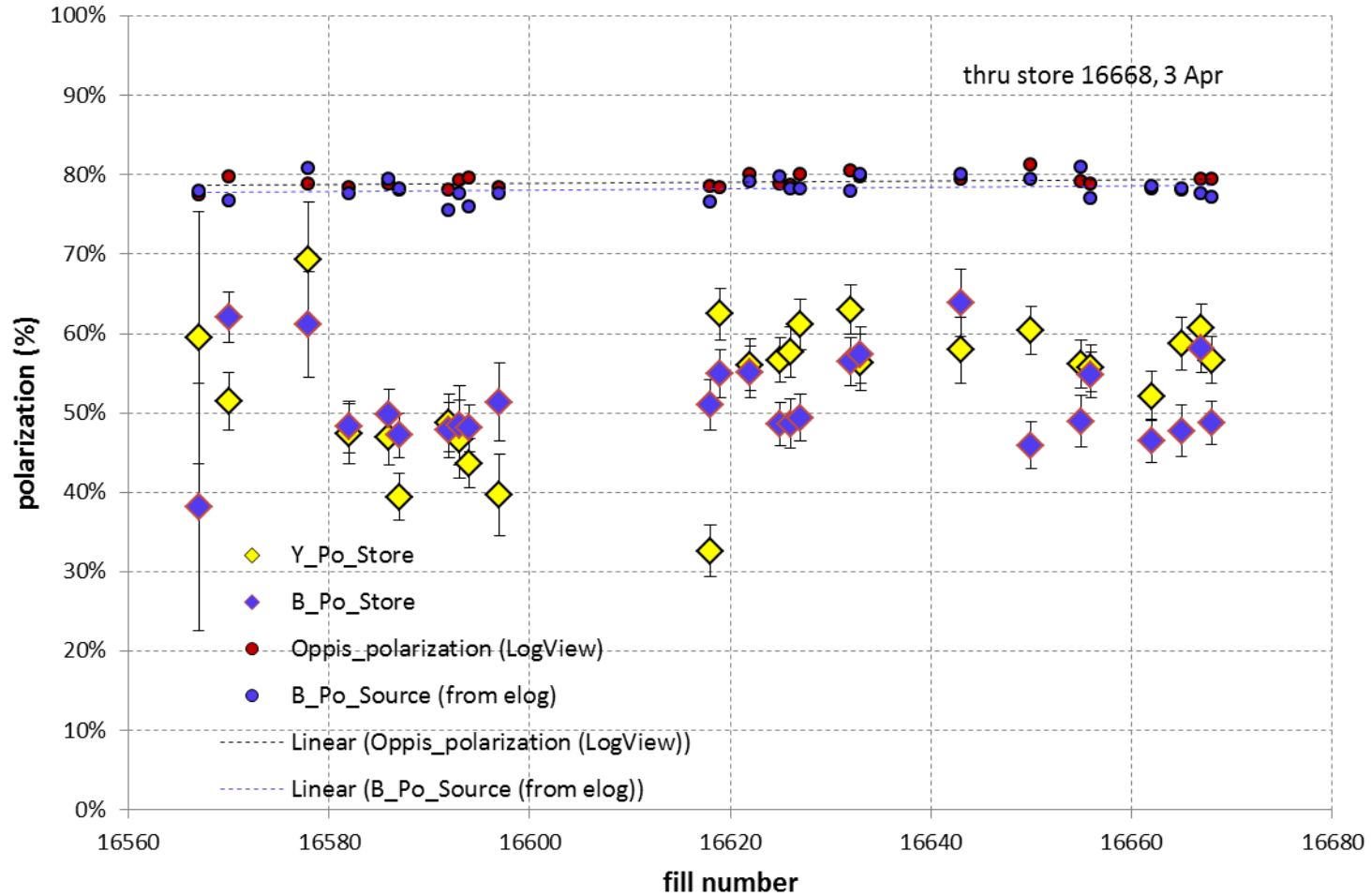
PHENIX Goal for 5 weeks longitudinal polarization (50% polarization):

- 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

Thru fill 16665, 2 Apr

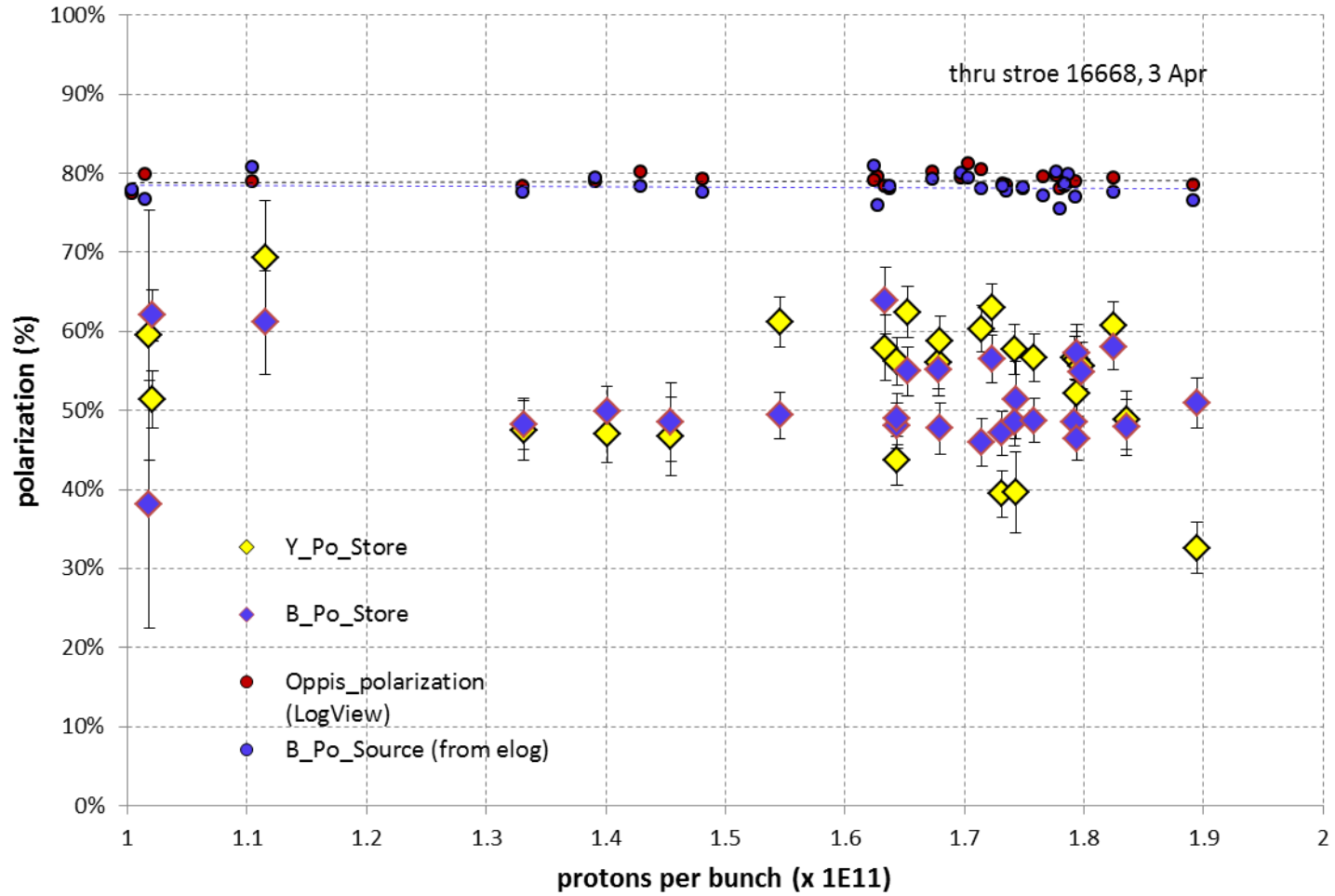


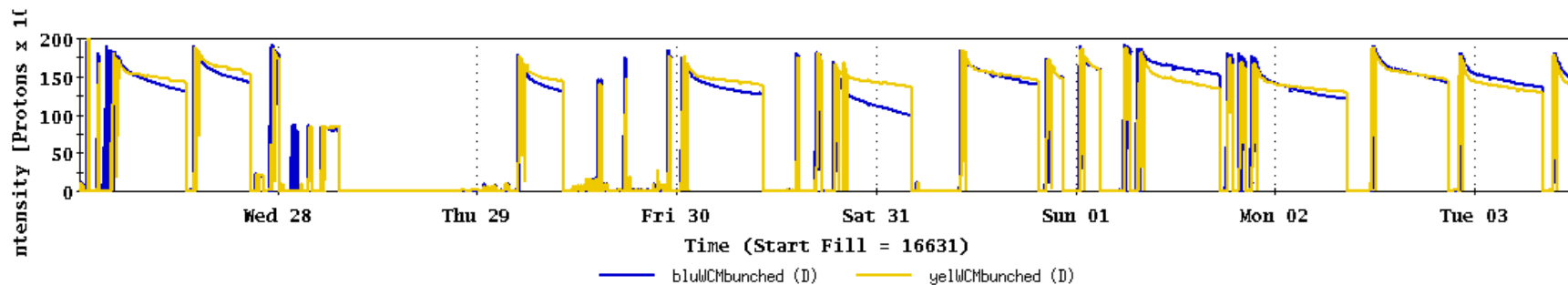
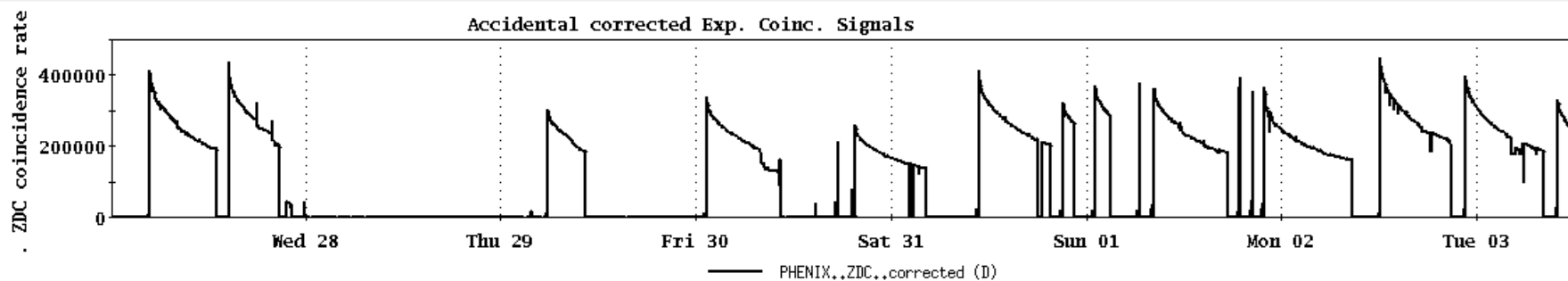
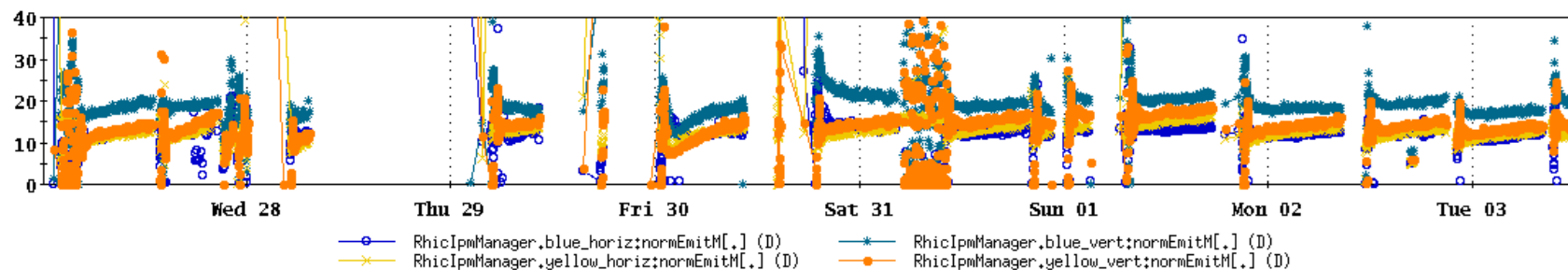
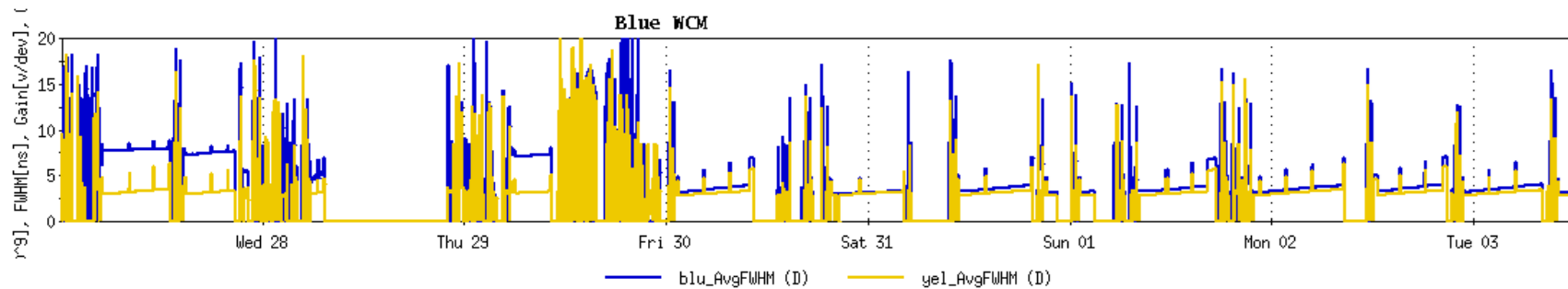
Run12 255 x 255 Gev pp Jet target Polarization results



Blue weighted average = $51.4\% \pm 0.6\%$, 35% below source pol
Yellow weighted average = $53.7\% \pm 0.7\%$, 32% below source pol

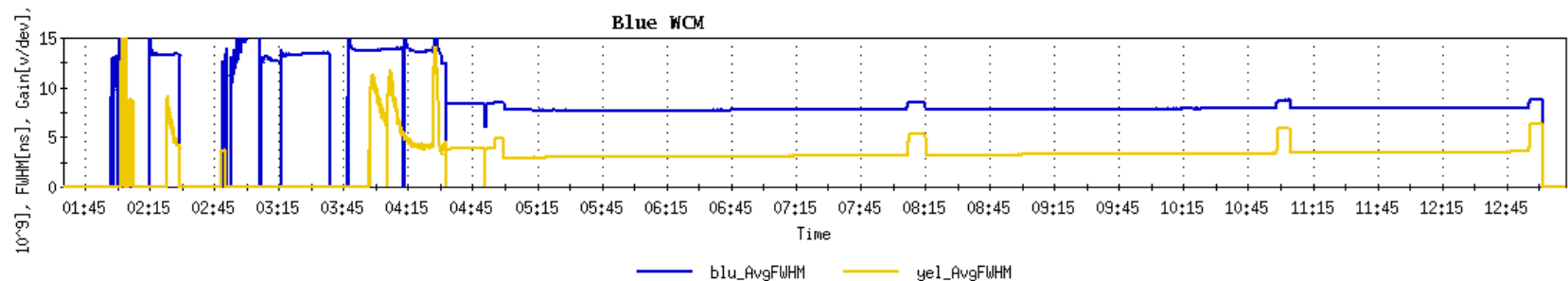
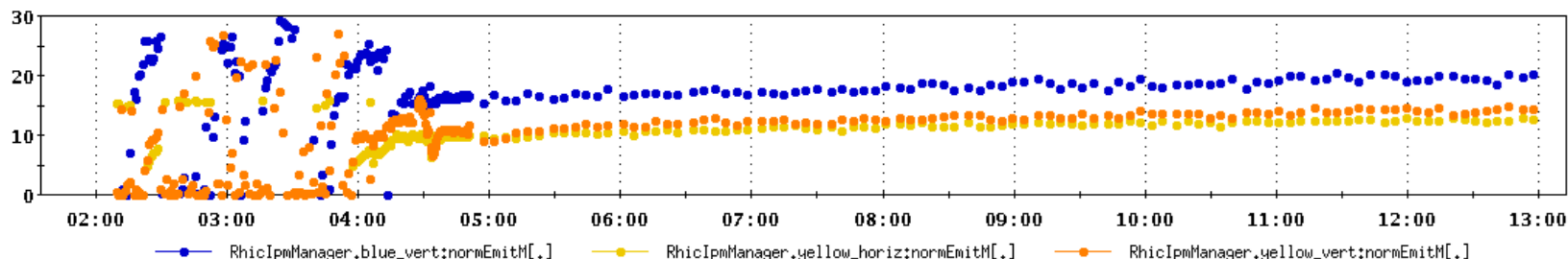
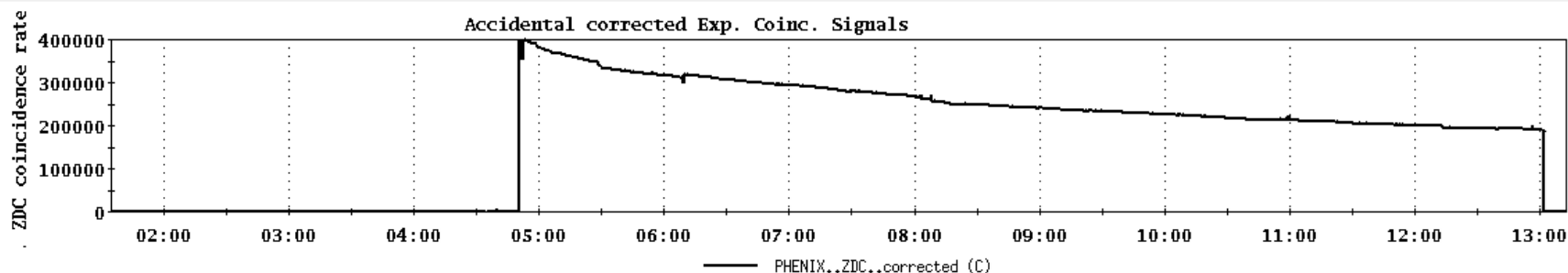
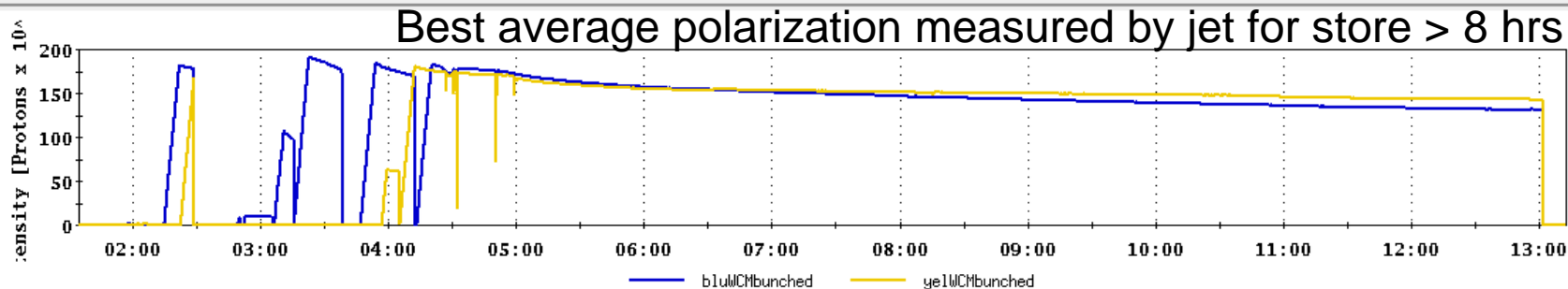
Run12 255 x 255 Gev pp Jet target Final Polarization results



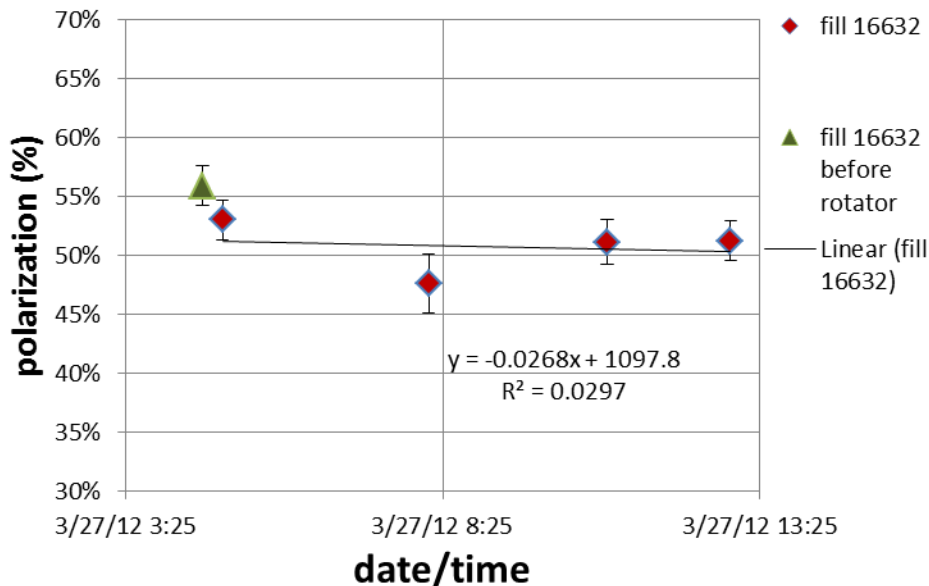


Store 16632, Blue jet = 56.5 +/- 3.0; Yellow jet = 63.0 +/- 3.1

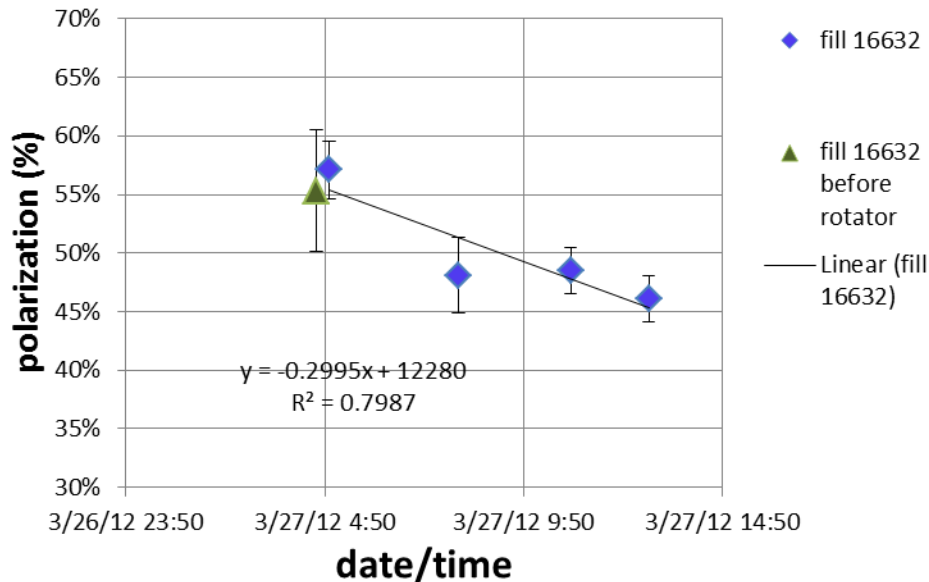
File Window Markers Analysis



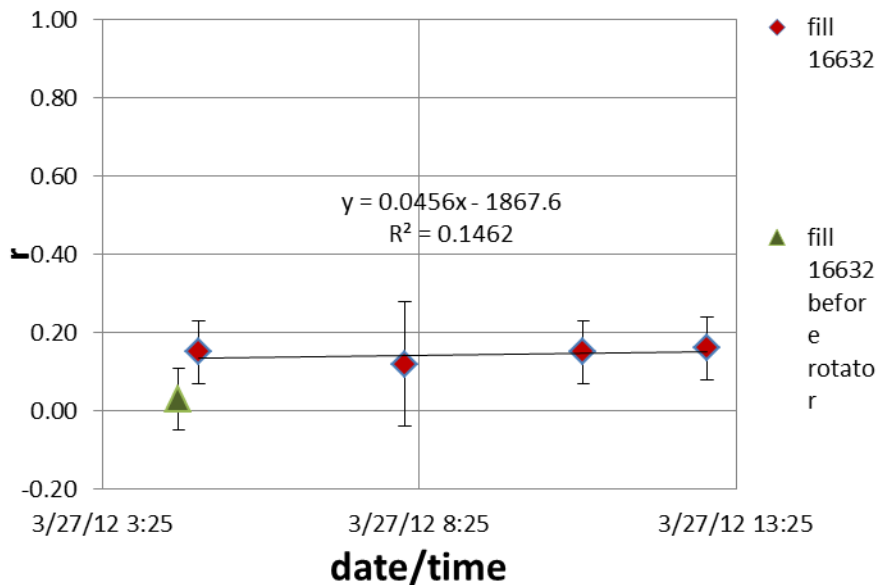
Yellow (Y1D) CNI results Run12, 510 GeV pp



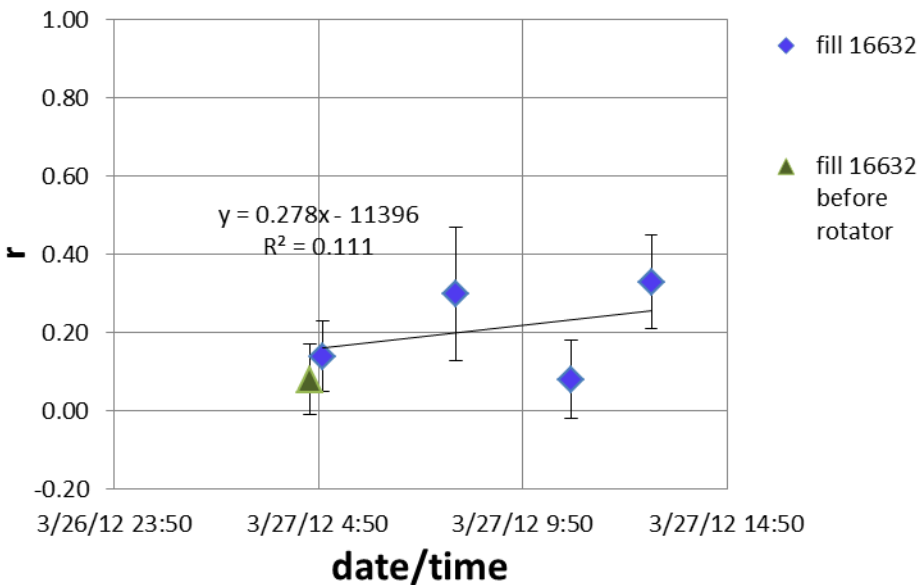
Blue (B1U) CNI results Run12, 510 GeV pp



Yellow (Y1D) CNI results Run12, 510 GeV pp



Blue (B1U) CNI results Run12, 510 GeV pp

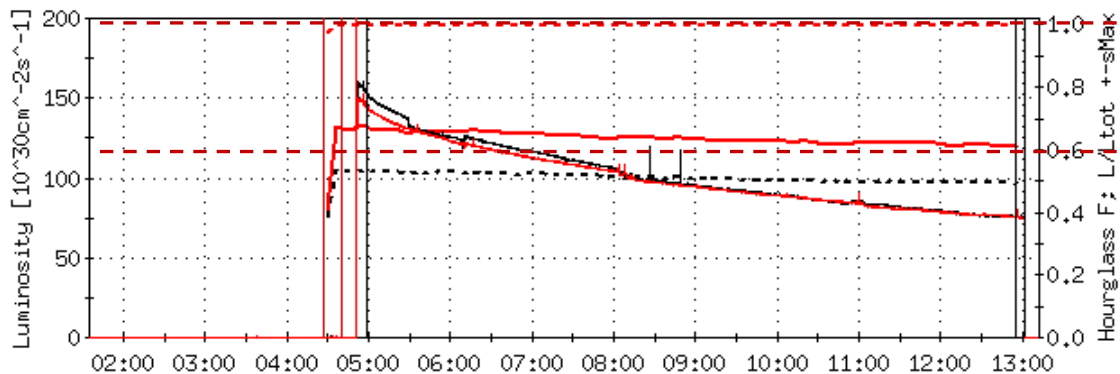
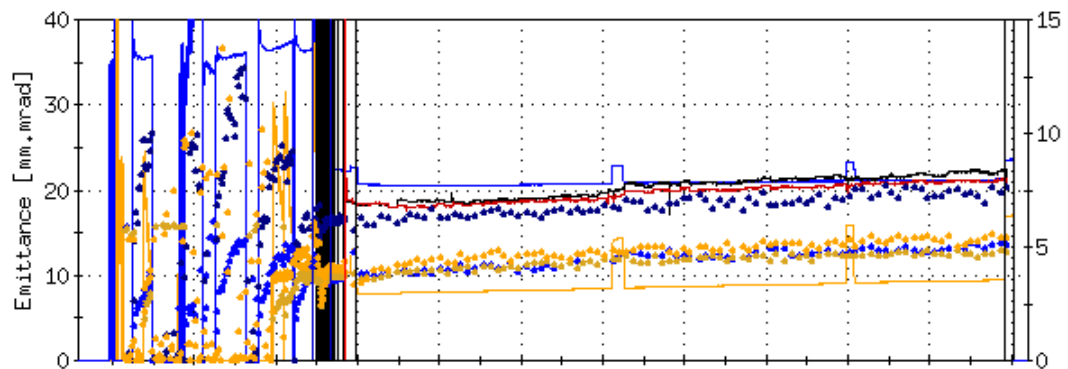
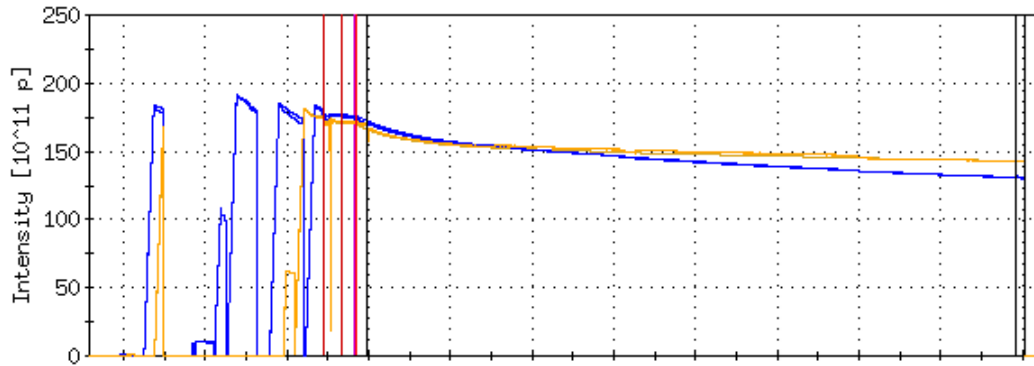


Store 16632

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

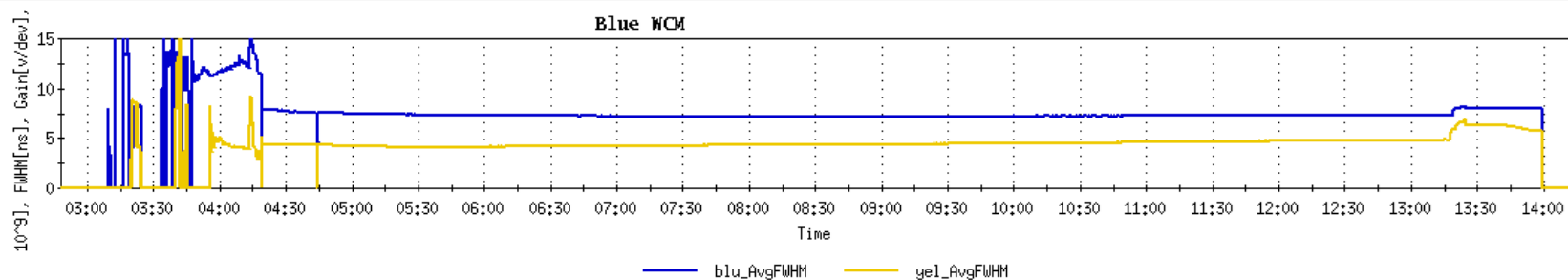
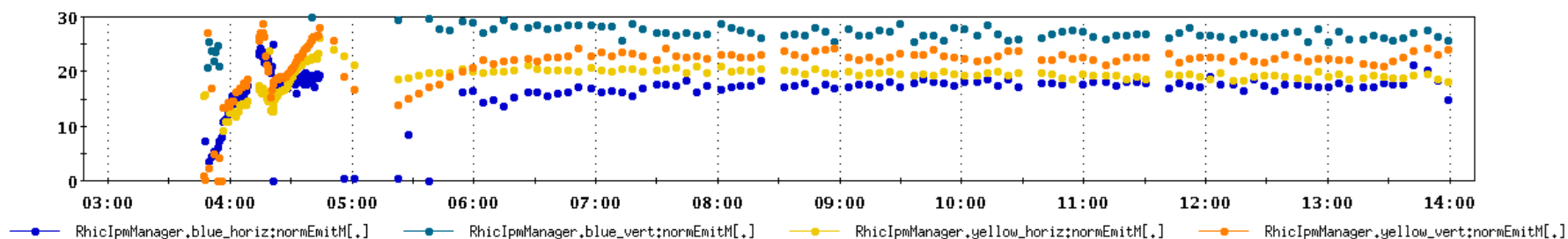
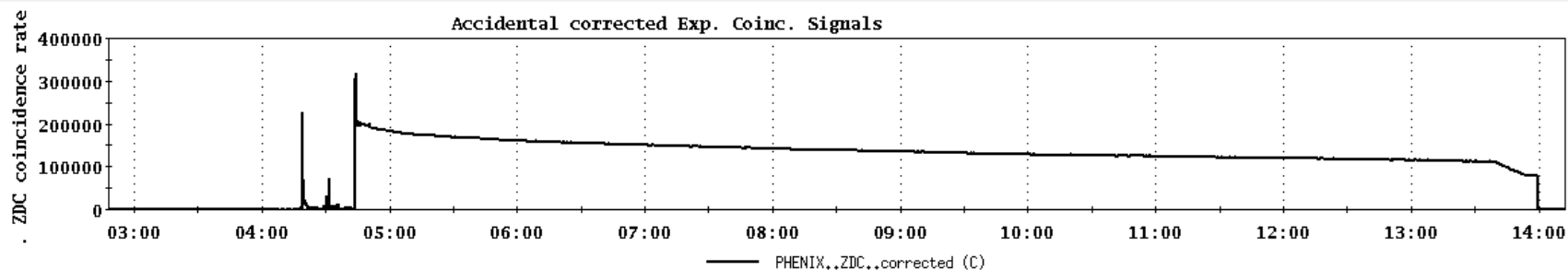
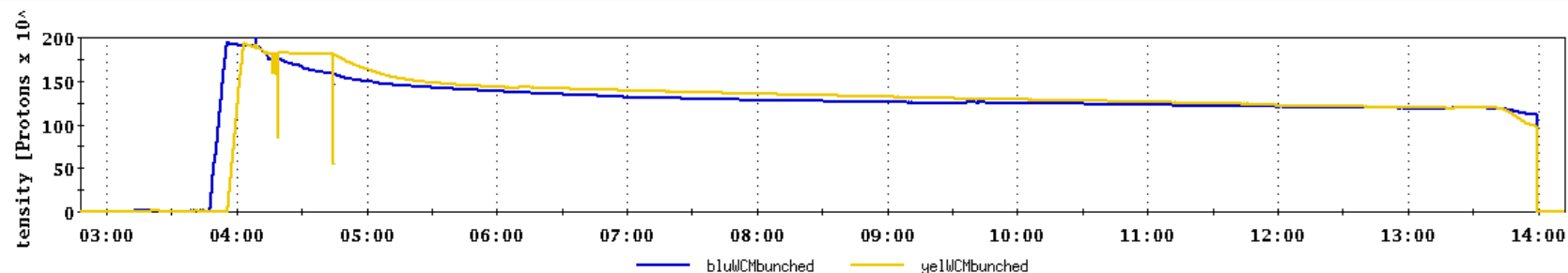
Peak lumi goal

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 Update Species
Run

Beam Parameters
Pattern gamma

Collision Parameters

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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

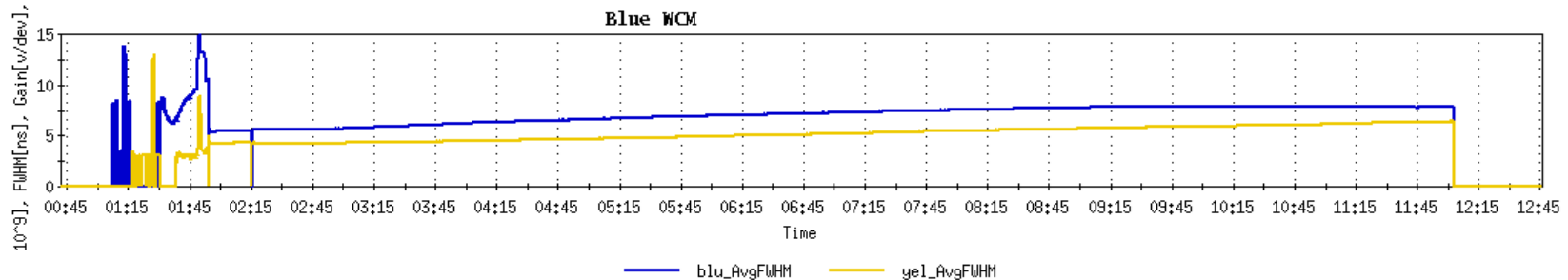
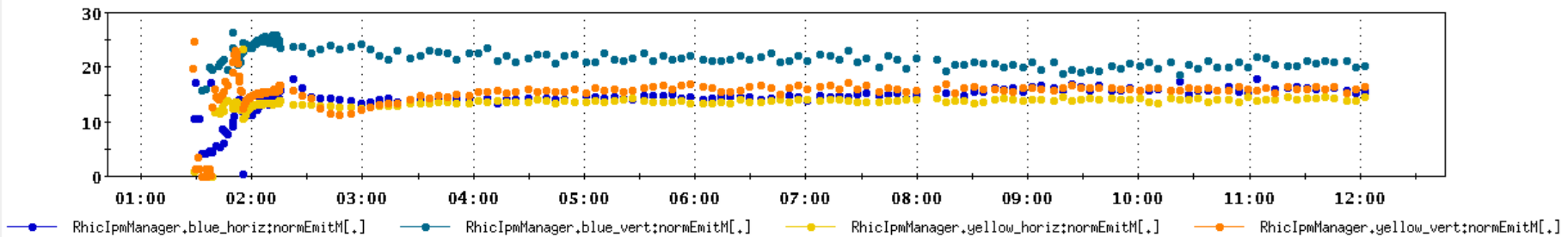
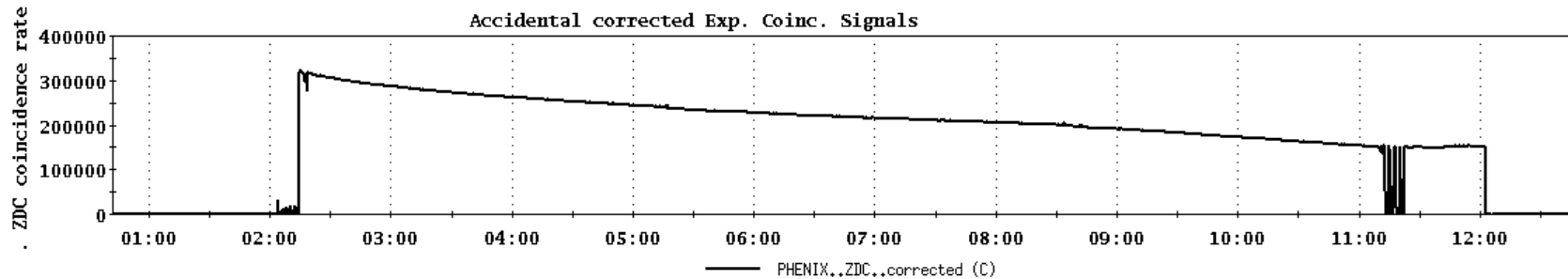
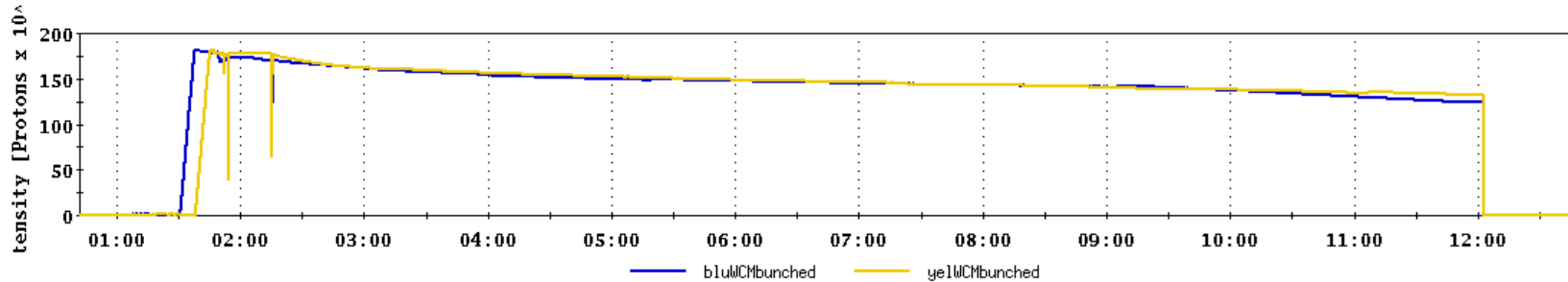
Fit

dcct wcm zdc Exp Fit

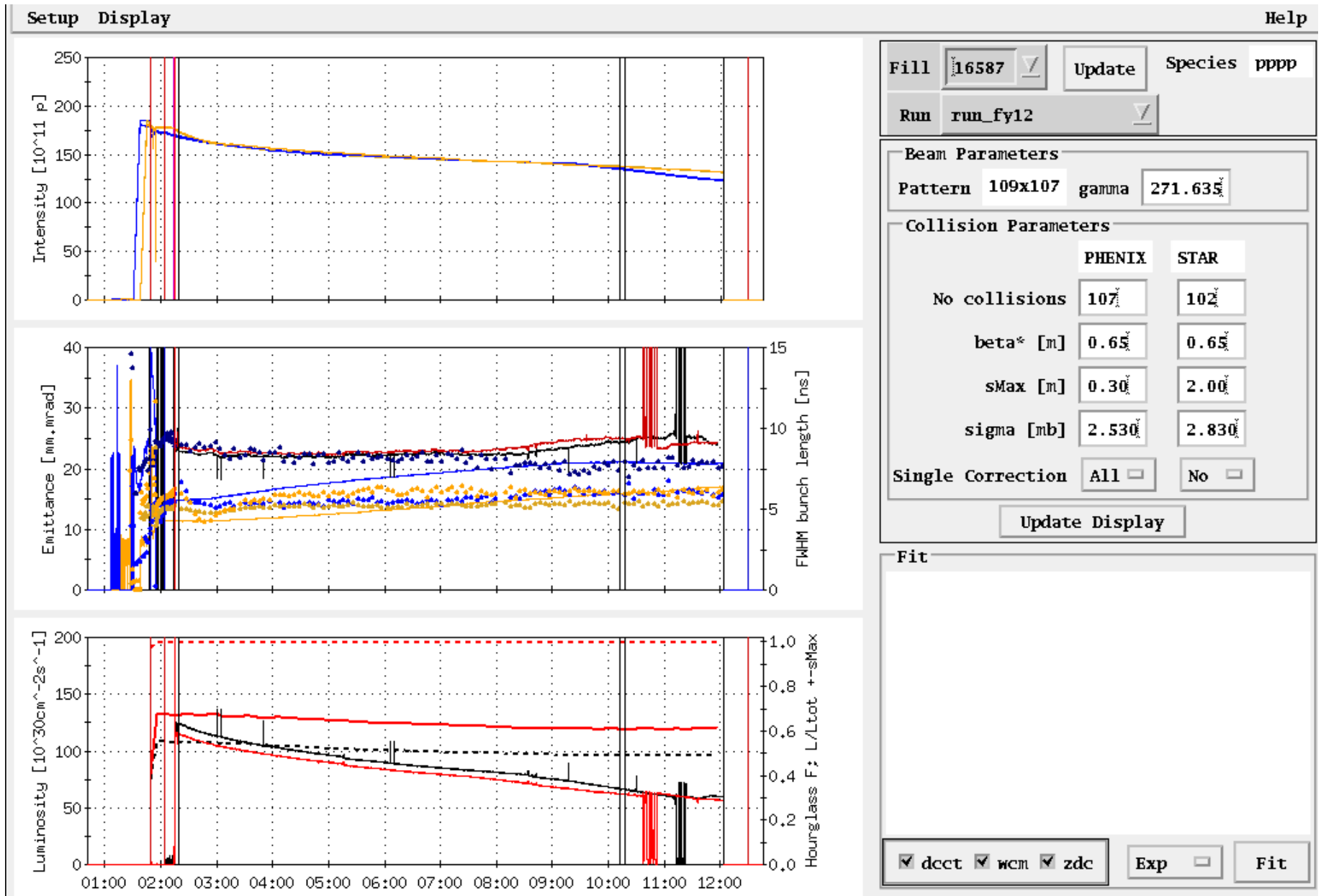
Store 16587, Blue jet = 47.2 +/- 2.8; Yellow jet = 39.4 +/- 2.9

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

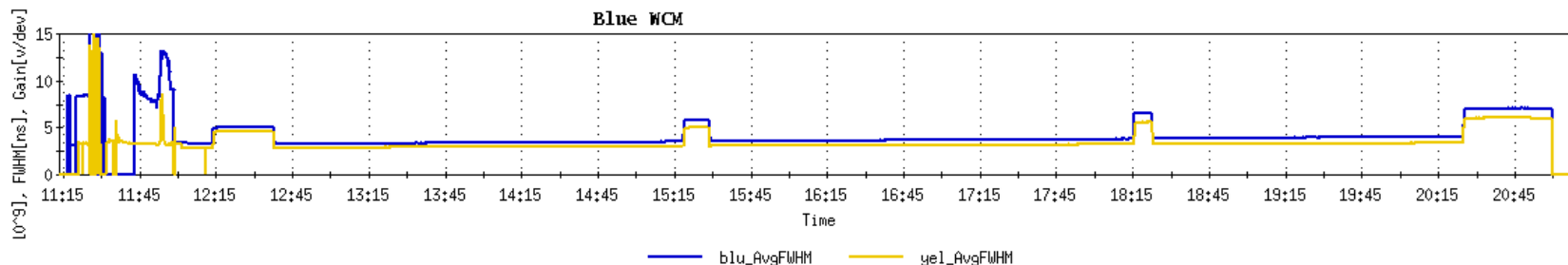
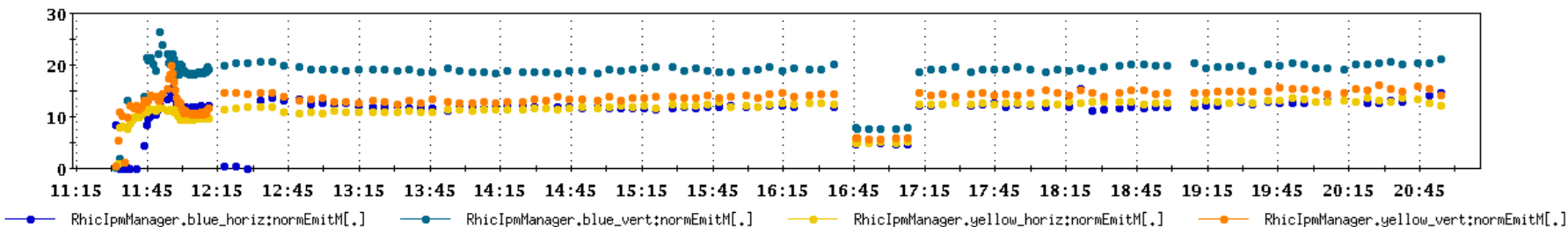
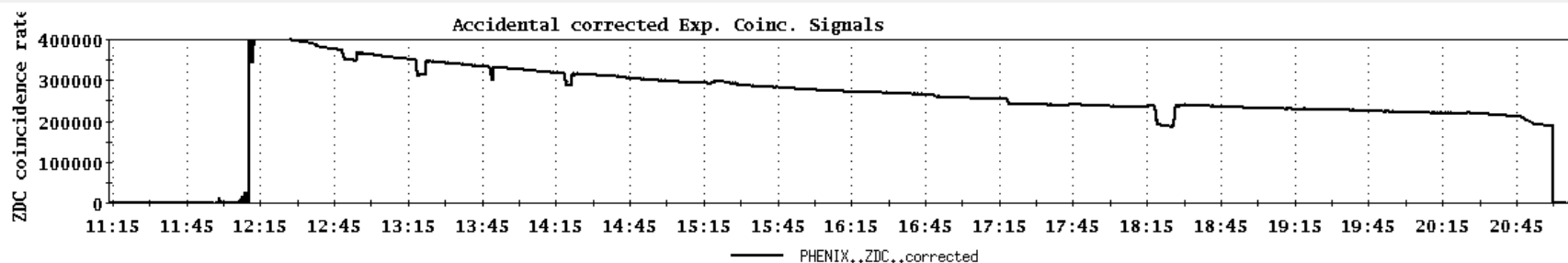
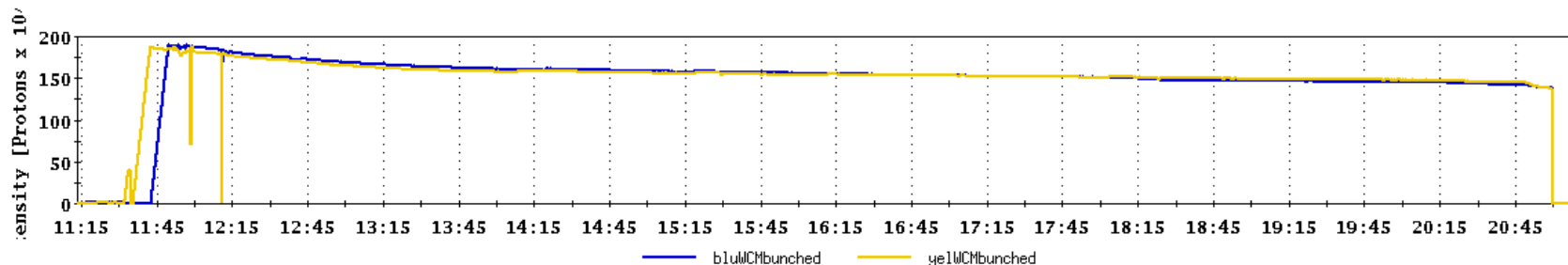


Other Slides

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

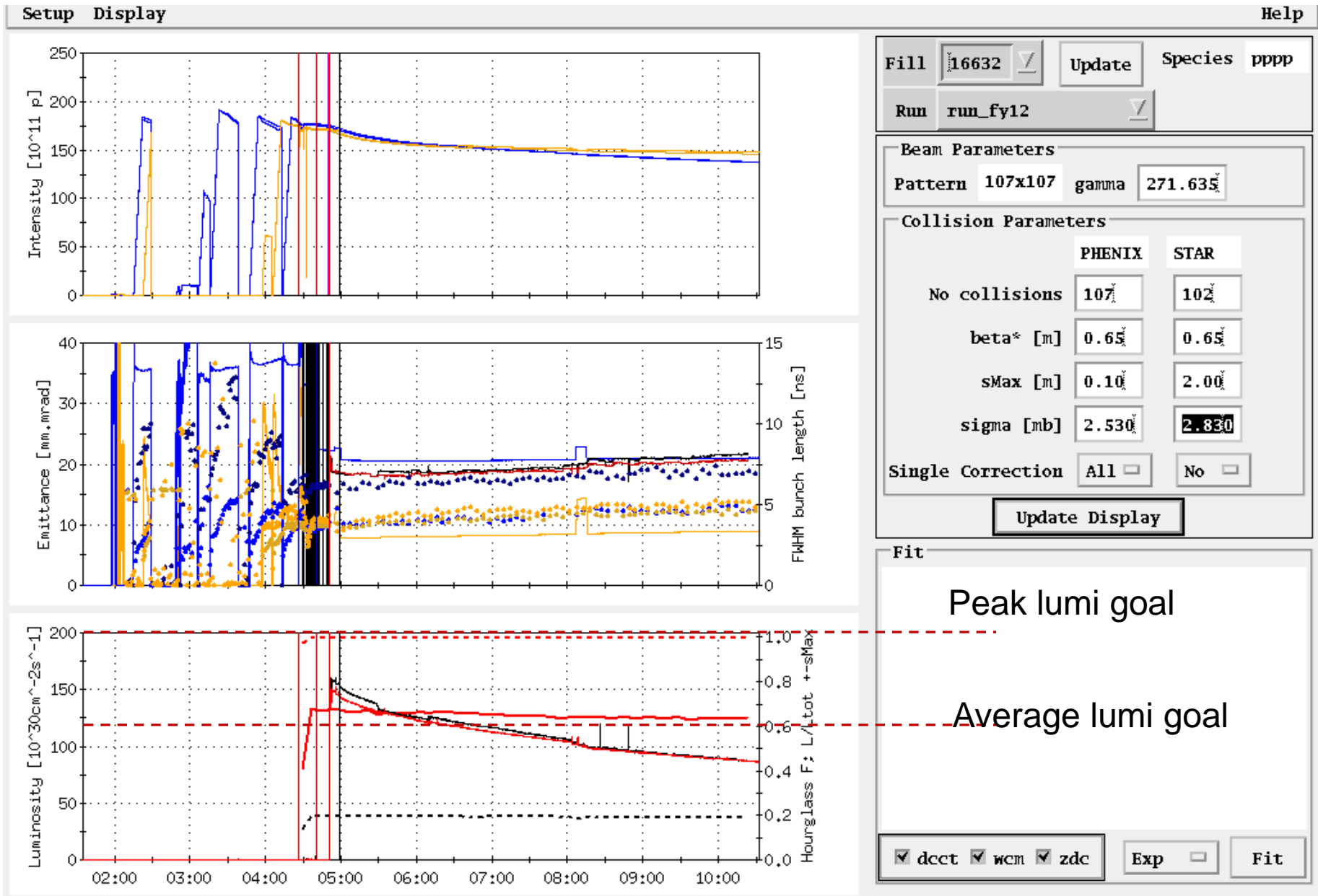
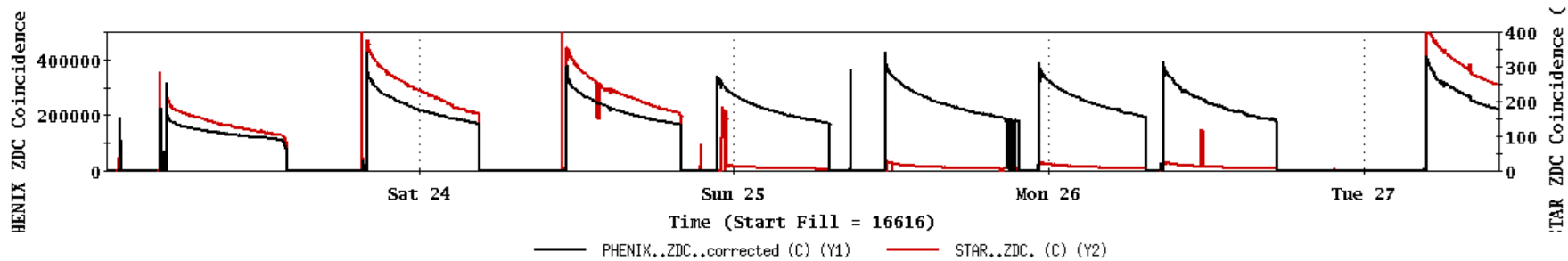
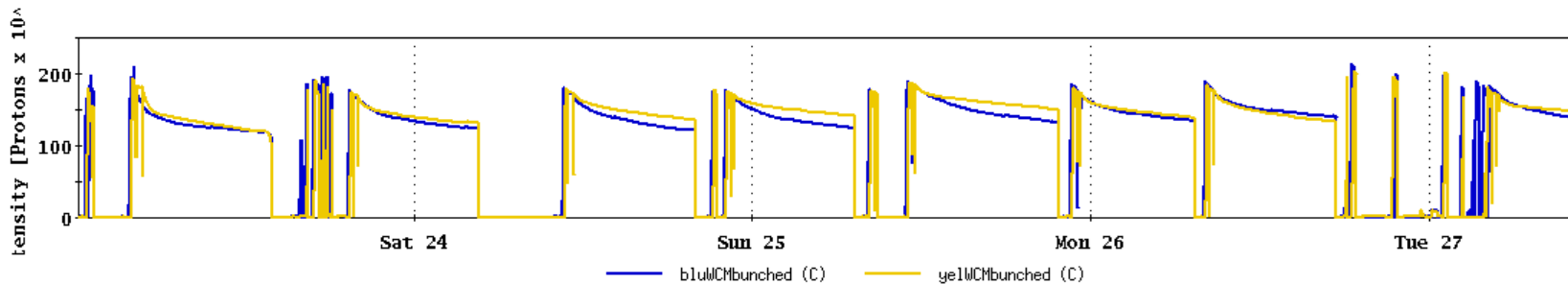
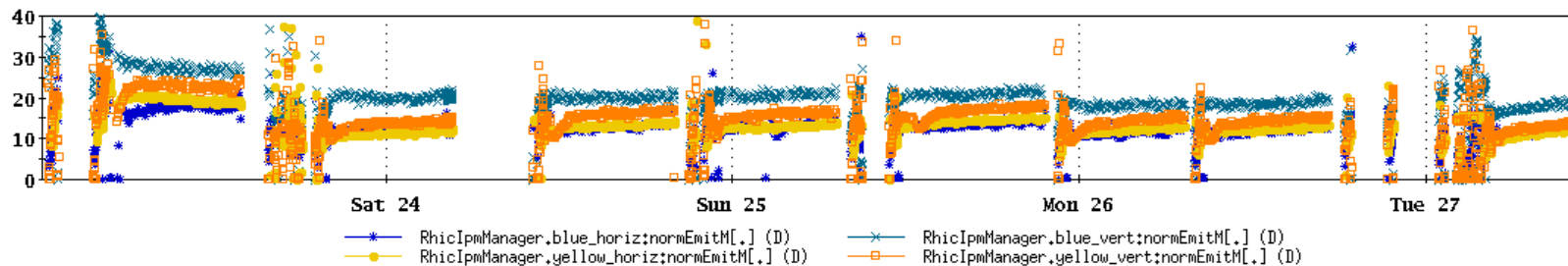
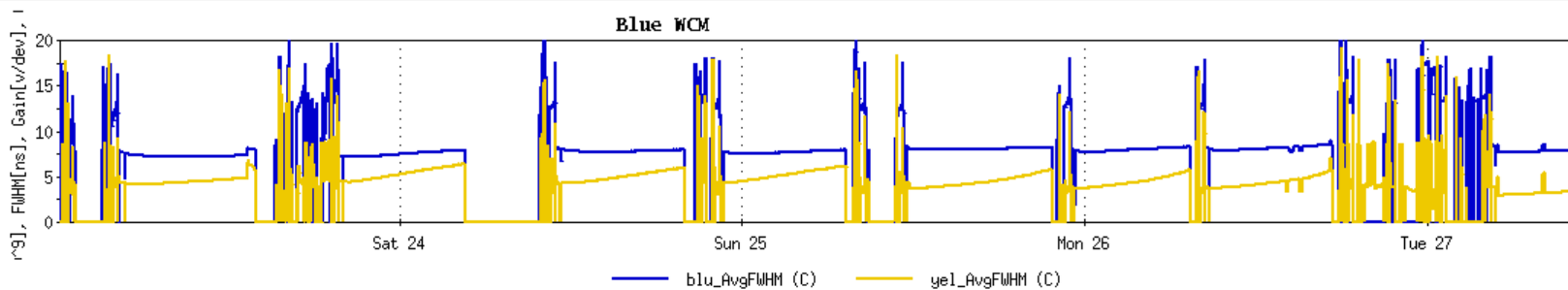
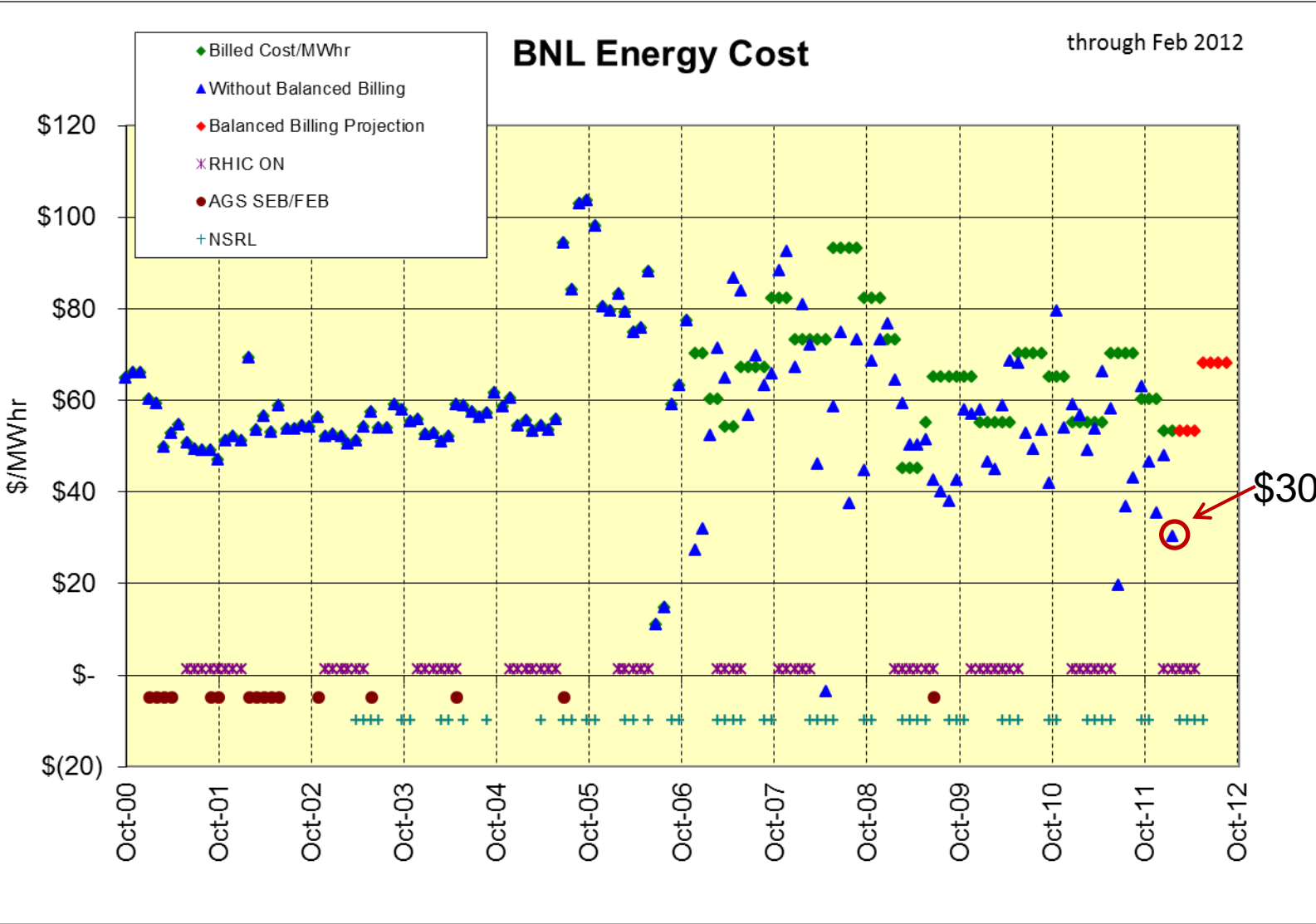


Table2: Max lumi parameters: 1.65×10^9 /bunch, $0.6 \beta^*$, 20-25 mmmr emitt \rightarrow peak = $200 \times 10^{30} \text{ cm}^{-2} \text{ s}^{-1}$

23 Mar – 27 Mar stores

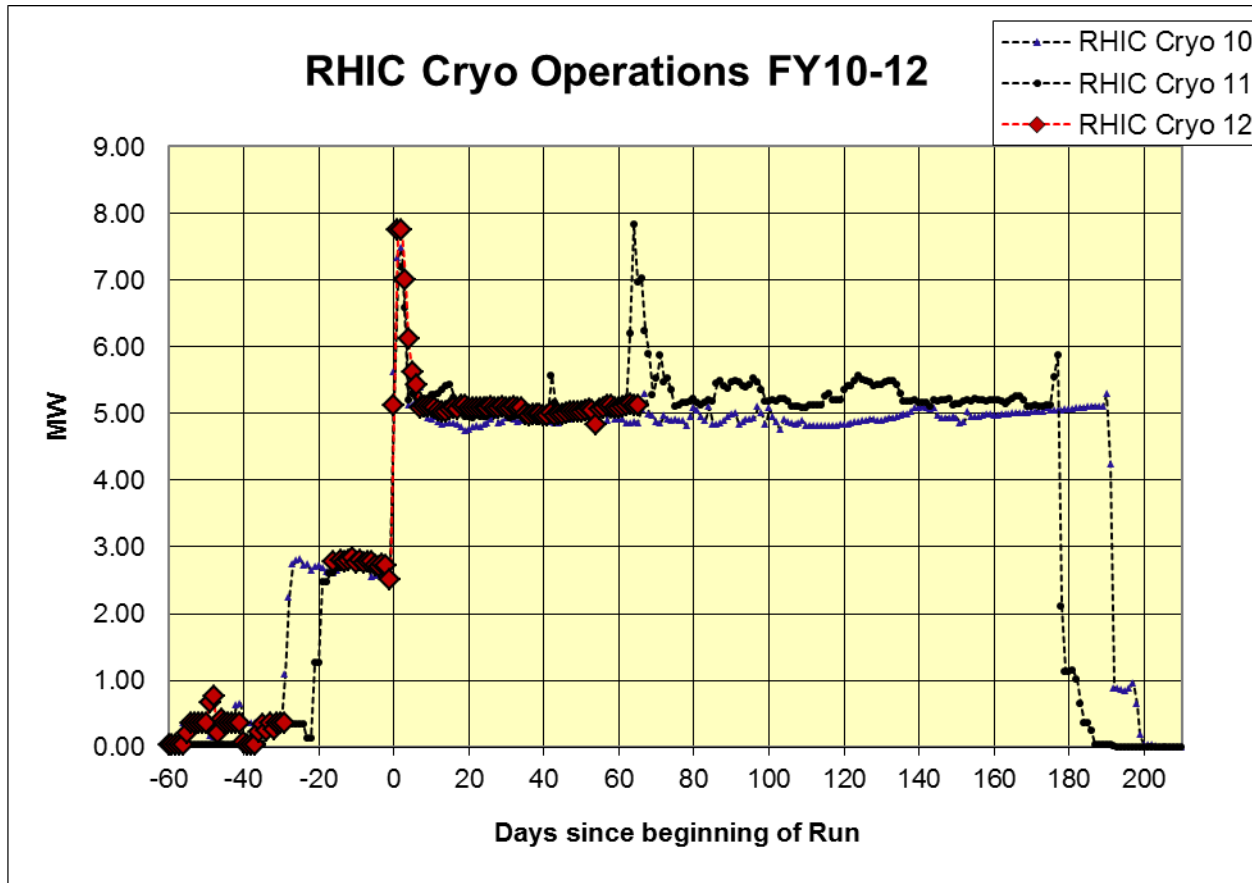


\$ in BNL Balanced Billing Bank for FY12 (through Feb) = +\$1,825K

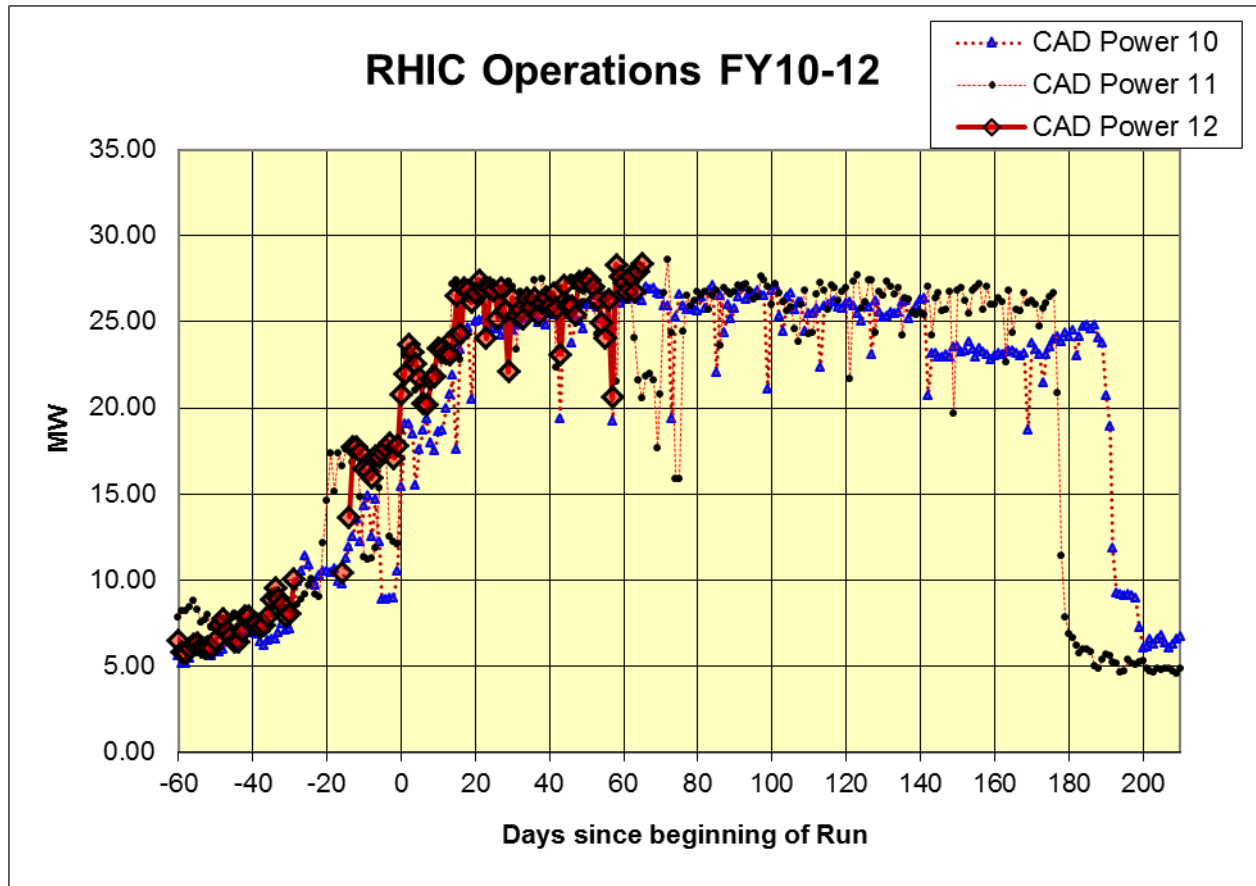


\$30/MWhr

As of 22 Mar 2012

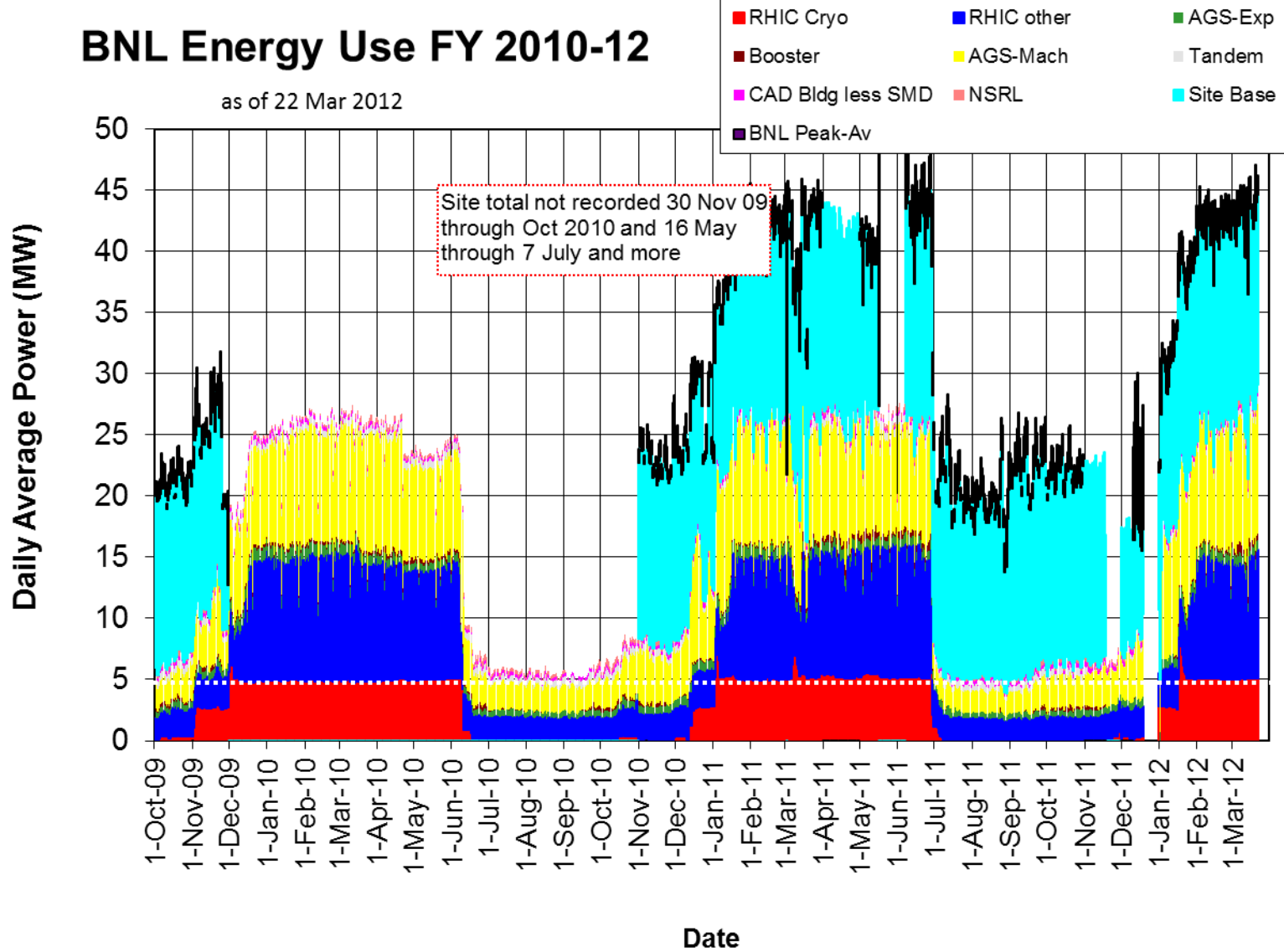


As of 22 Mar 2012

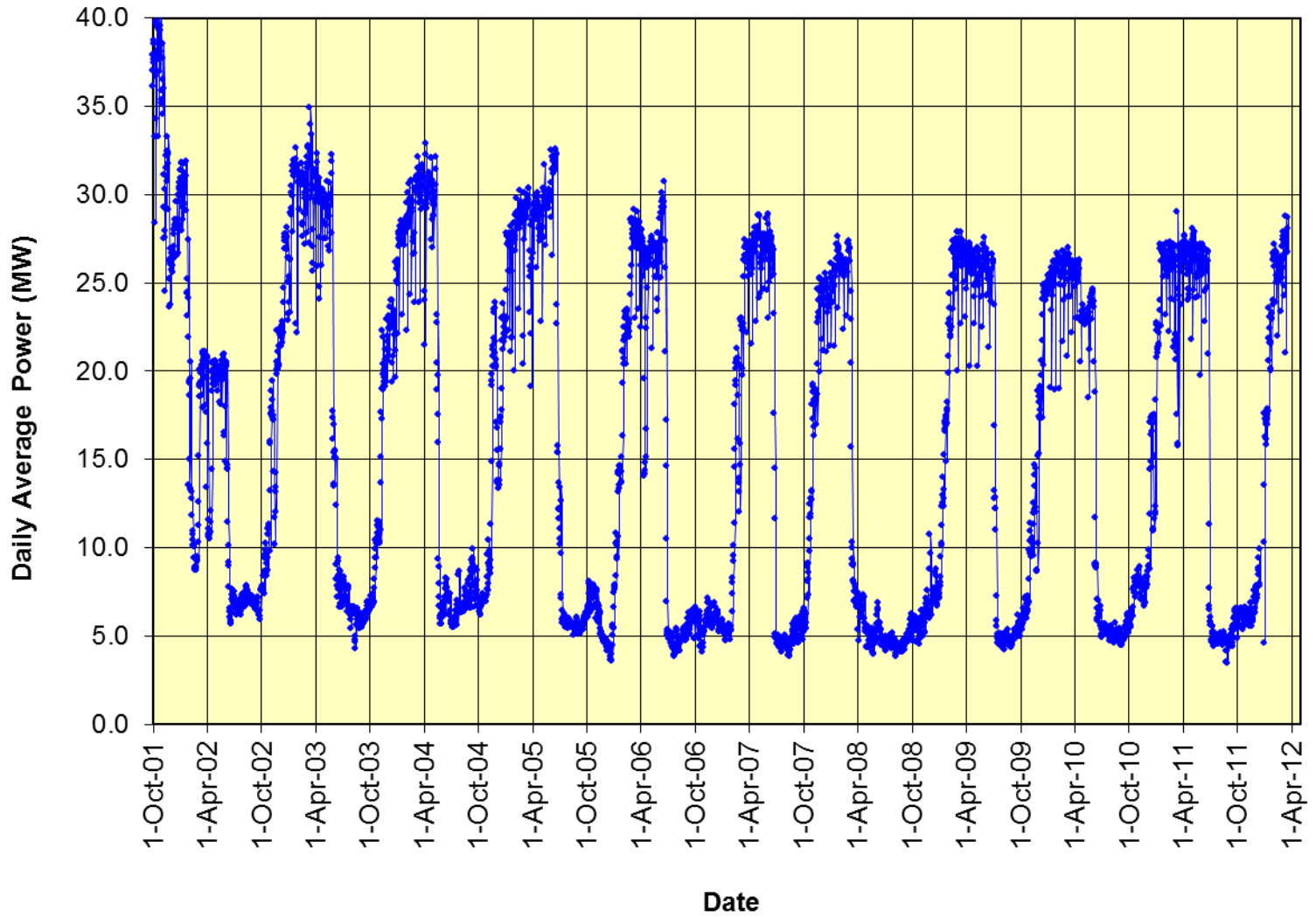


BNL Energy Use FY 2010-12

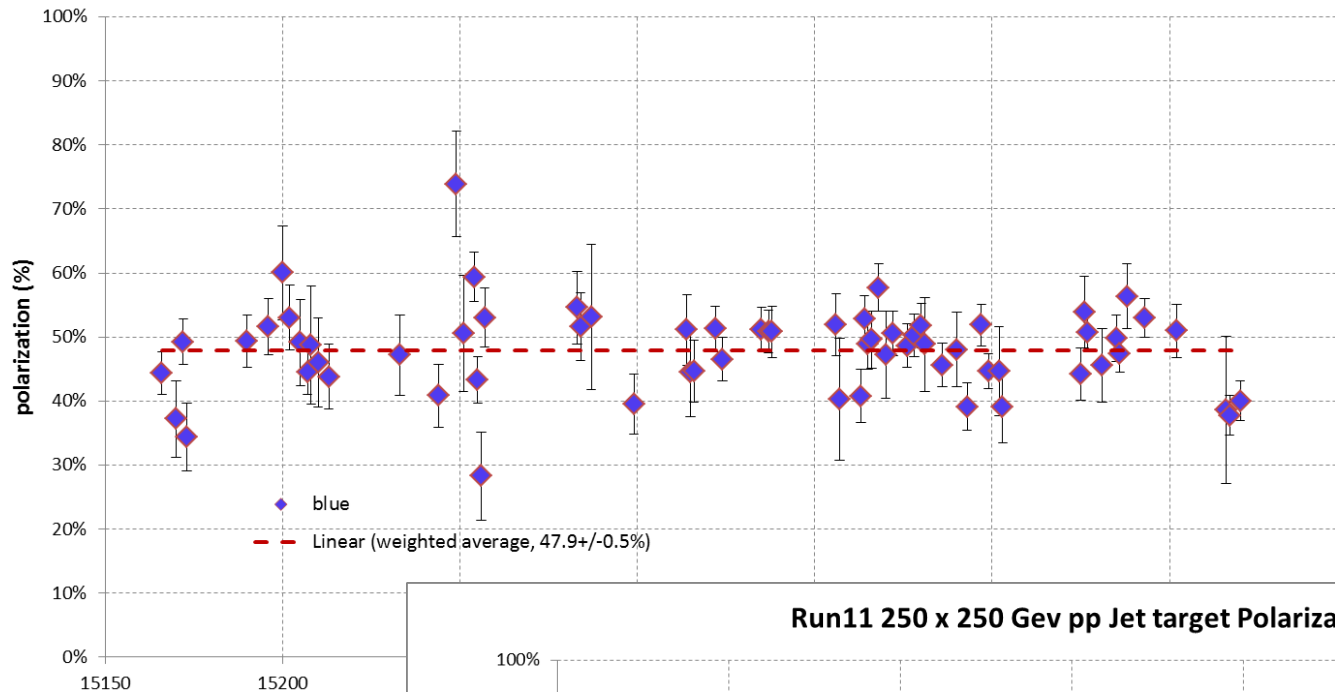
as of 22 Mar 2012



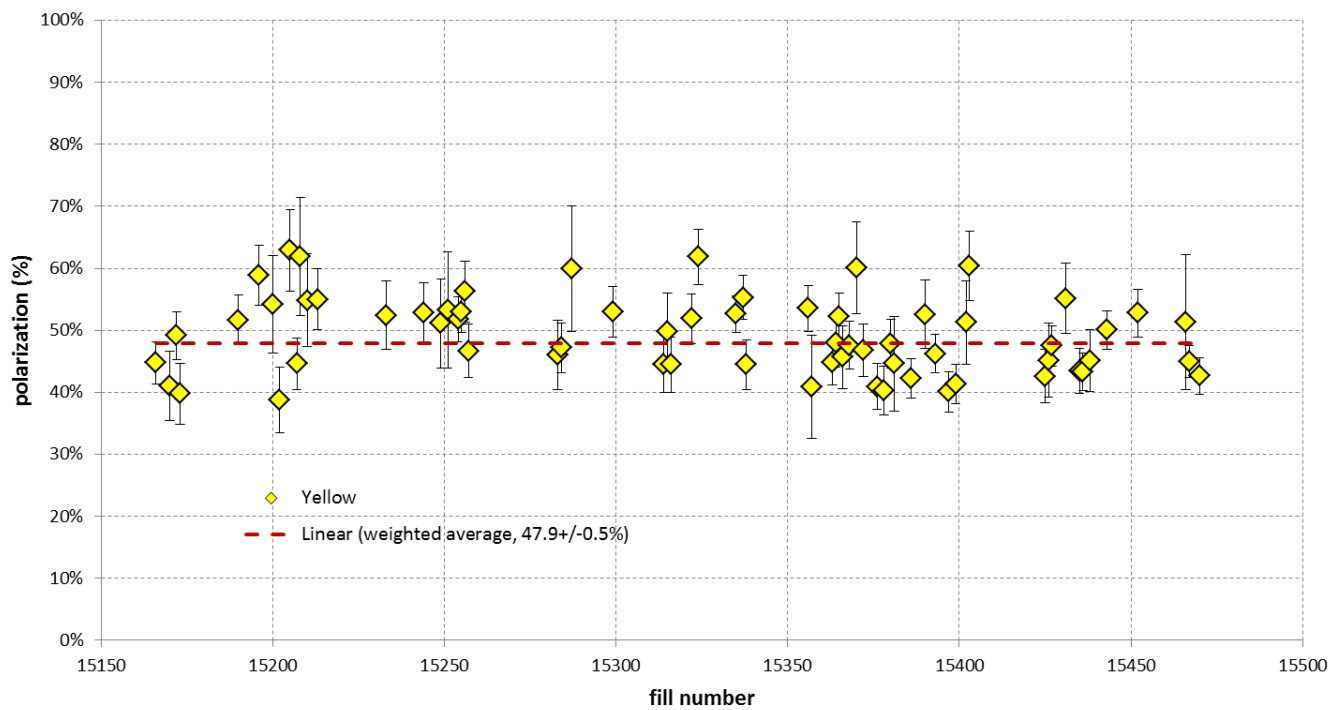
C-AD Energy Use FY 2002-12



Run11 250 x 250 Gev pp Jet target Polarization results

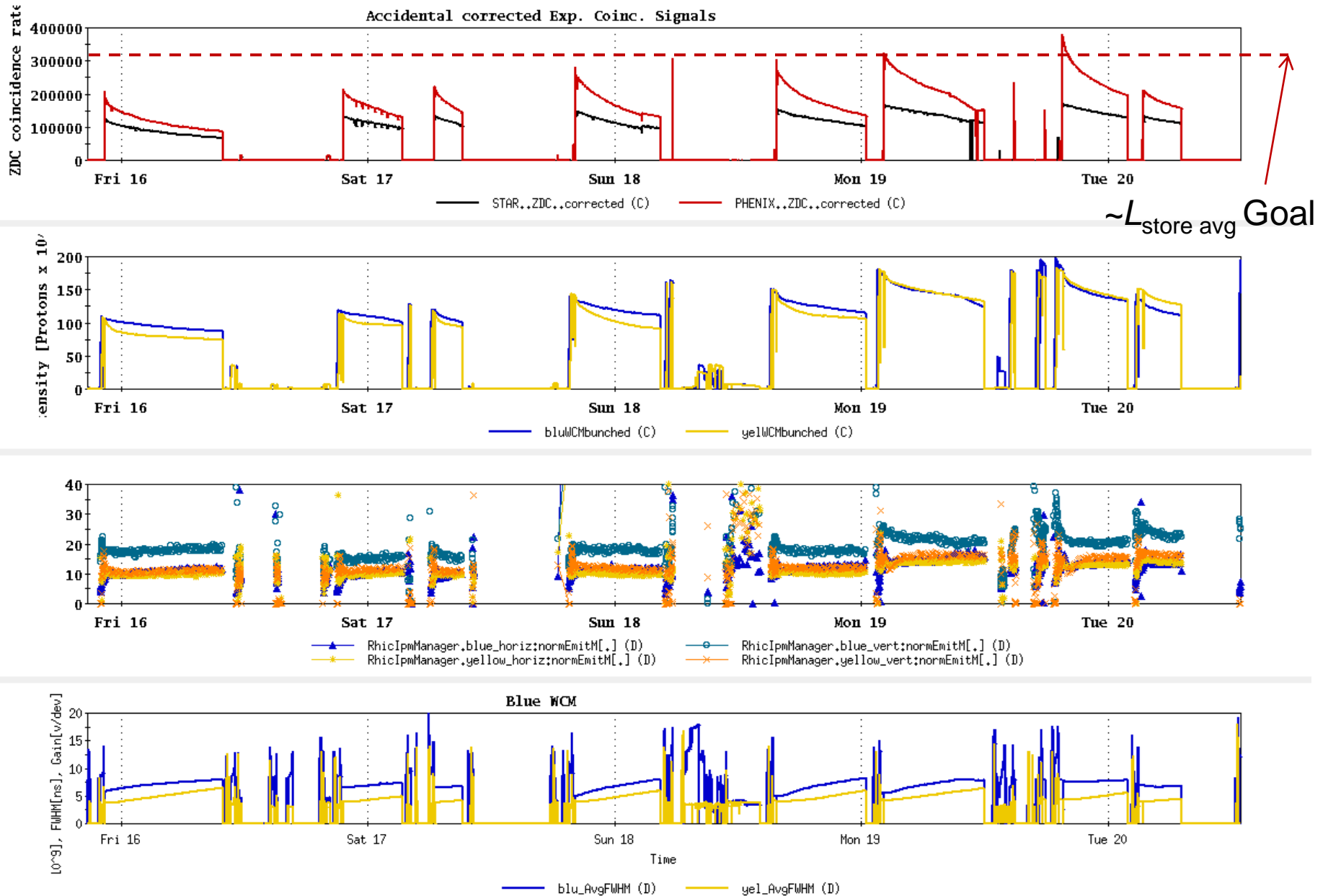


Run11 250 x 250 Gev pp Jet target Polarization results



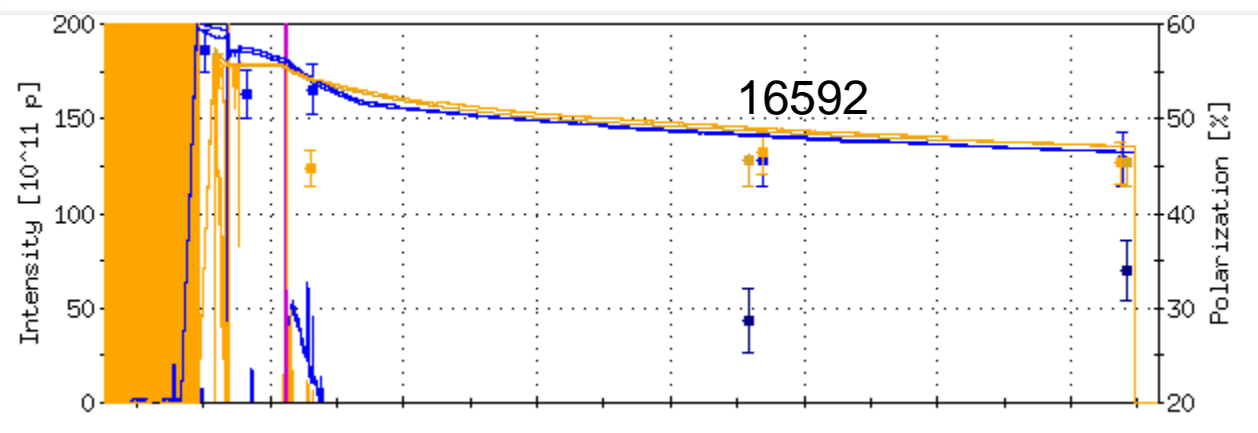
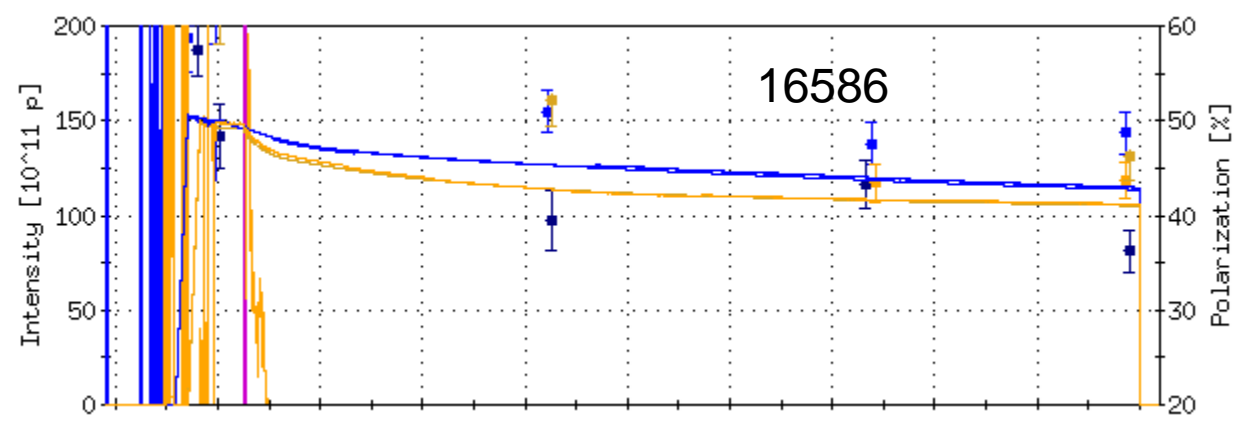
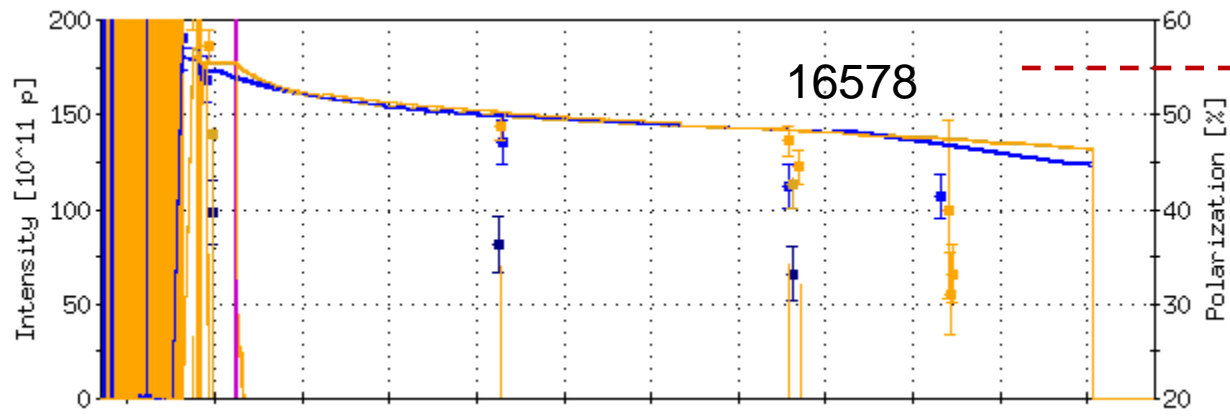
All "physics" stores beginning with 16570, 15 March

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

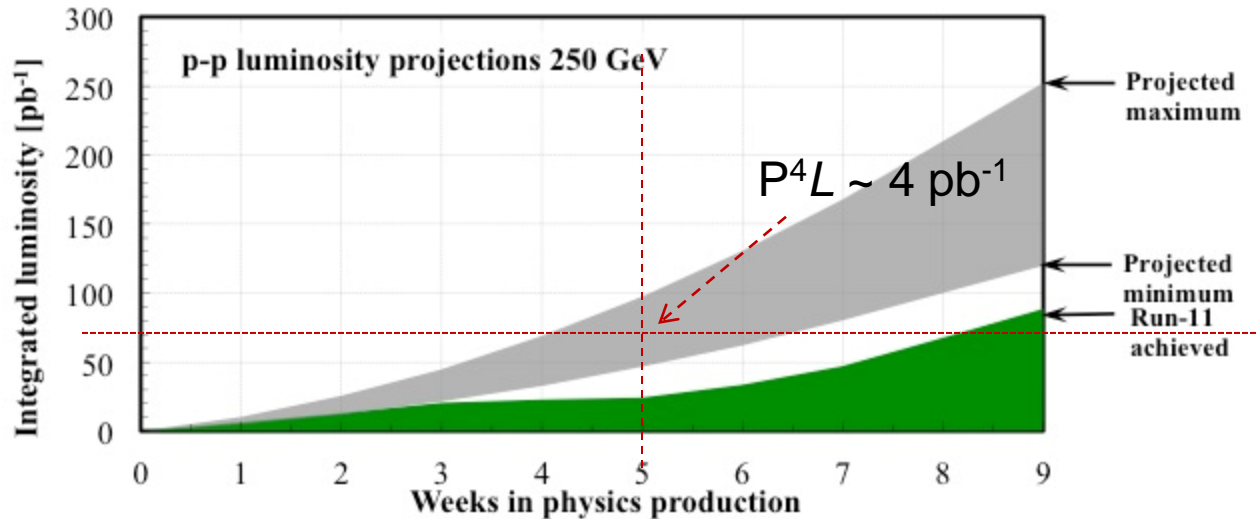
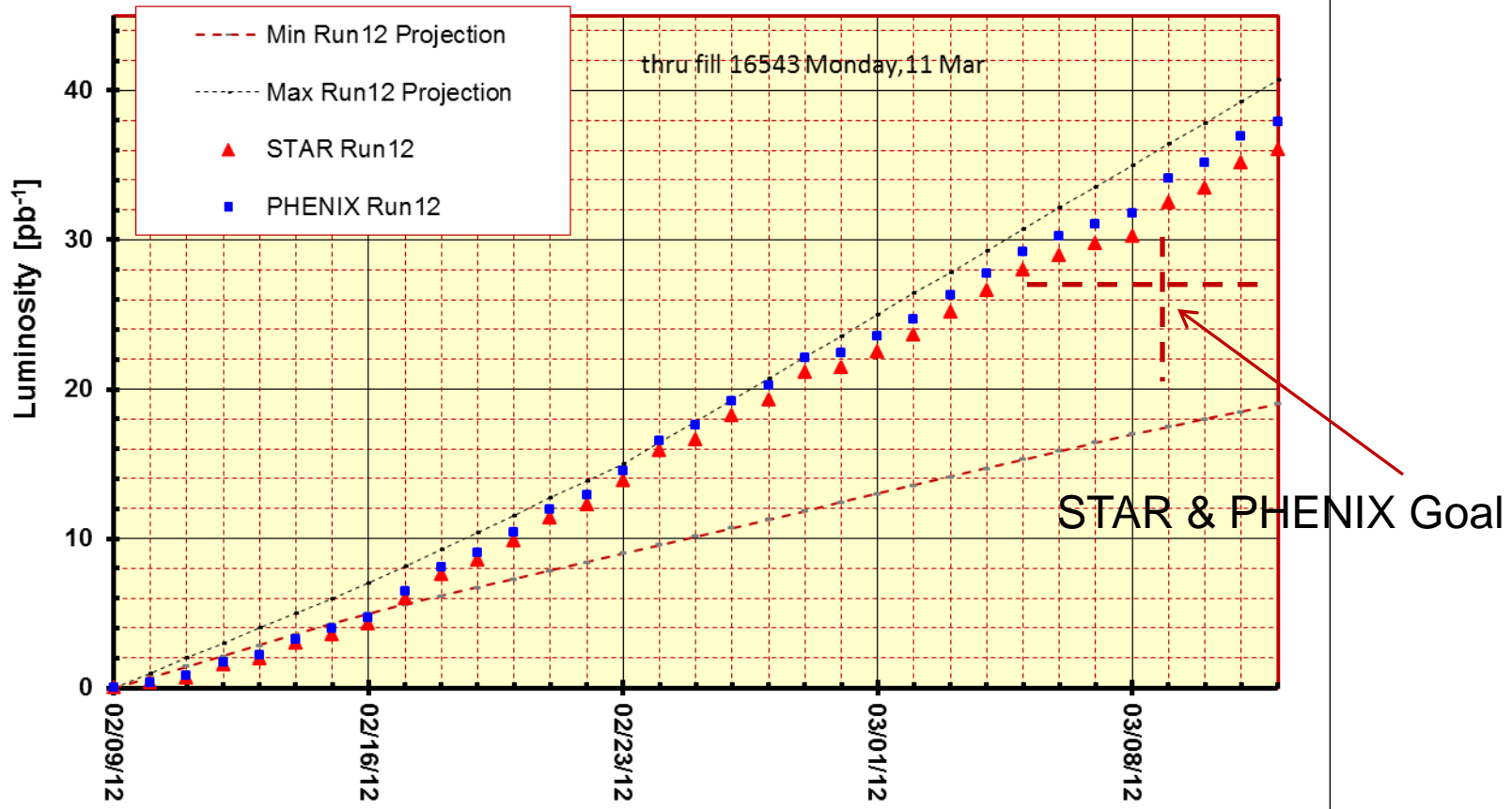


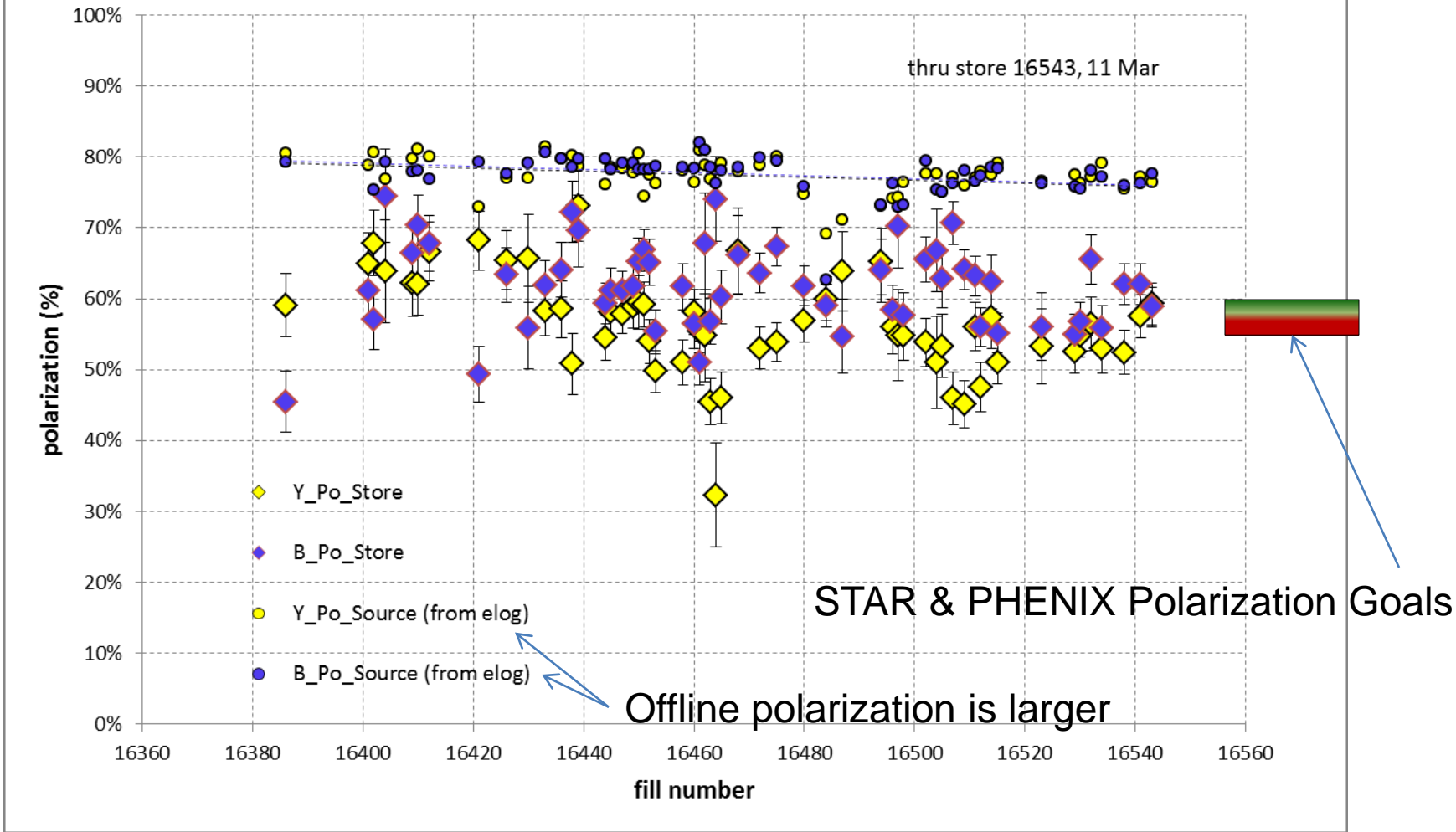
Figure 4: Projected minimum and maximum integrated luminosities for polarized proton collisions at 250 GeV beam energy, assuming linear weekly luminosity ramp-up in 8 weeks. An average store polarization between 45 and 50% is expected.

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

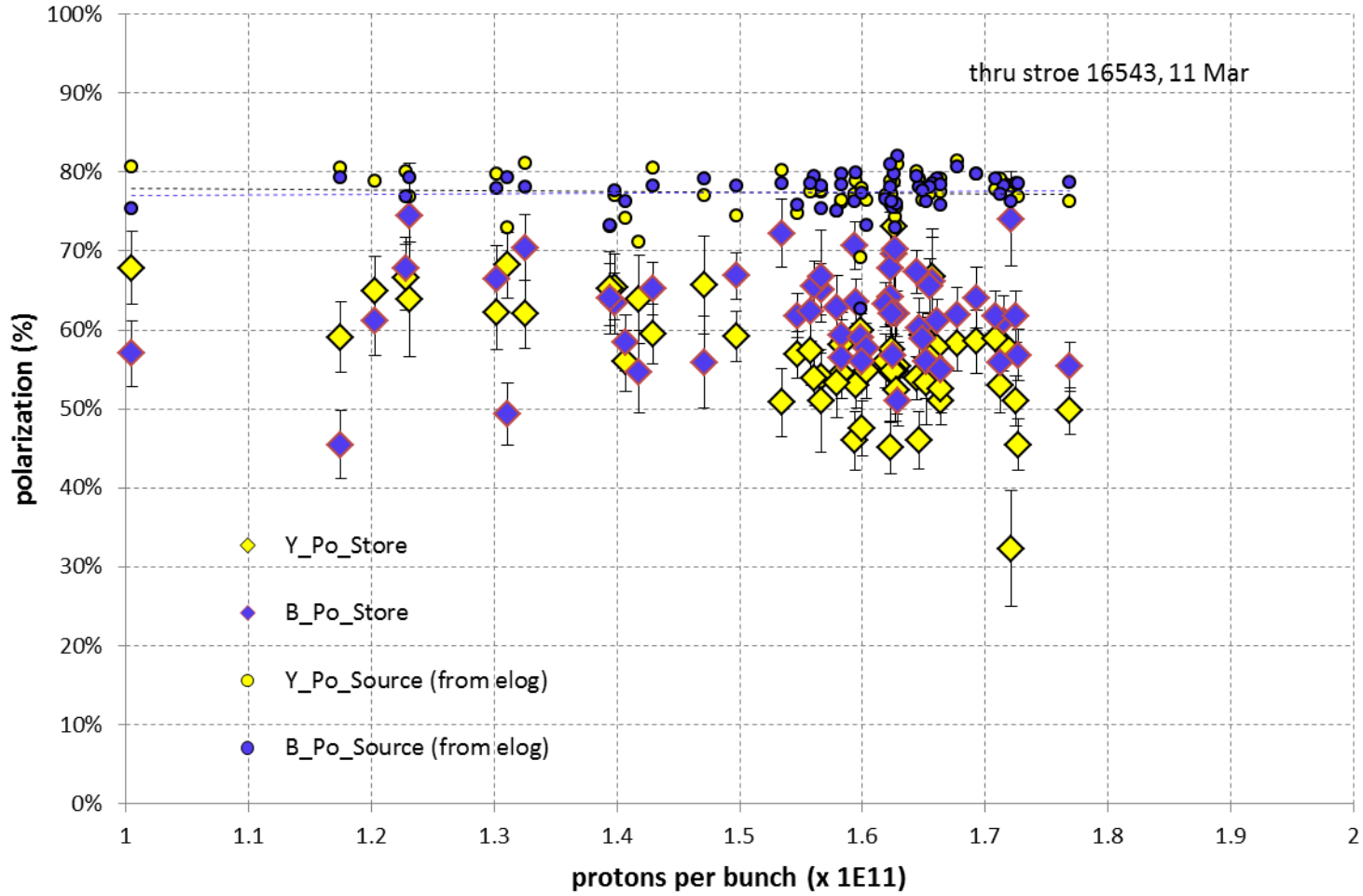


Blue Jet weighted average = $61.2\% \pm 0.5\%$;
 Yellow Jet weighted average = $55.8\% \pm 0.5\%$;

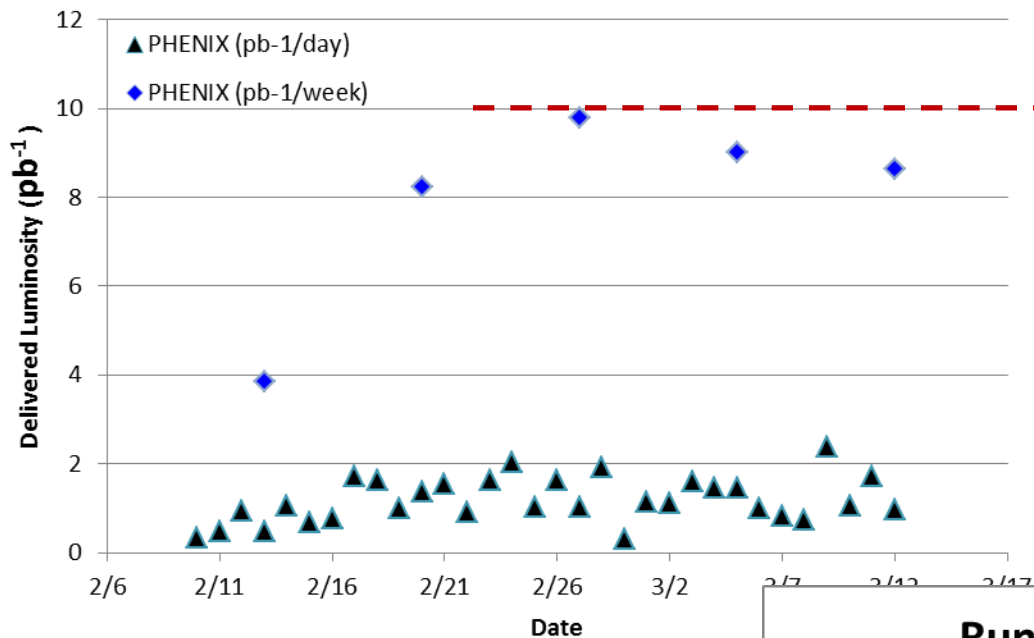
source blue average = 77.5% → **20% lost**
 source yellow average = 77.4% → **28% lost**

Run12 100 x 100 Gev pp Jet target Final Polarization results

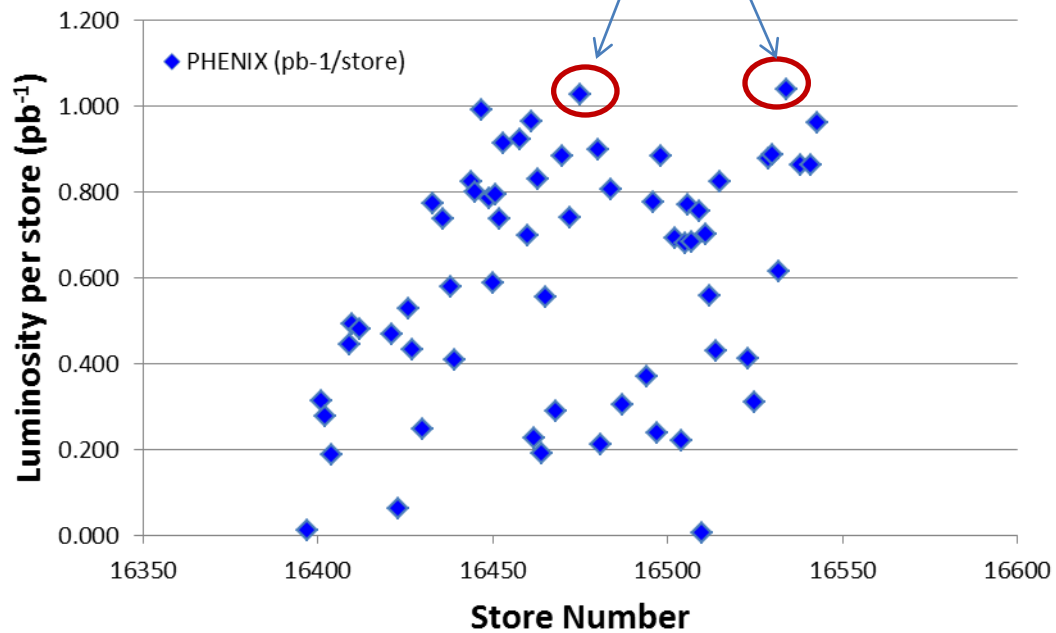
thru stroe 16543, 11 Mar



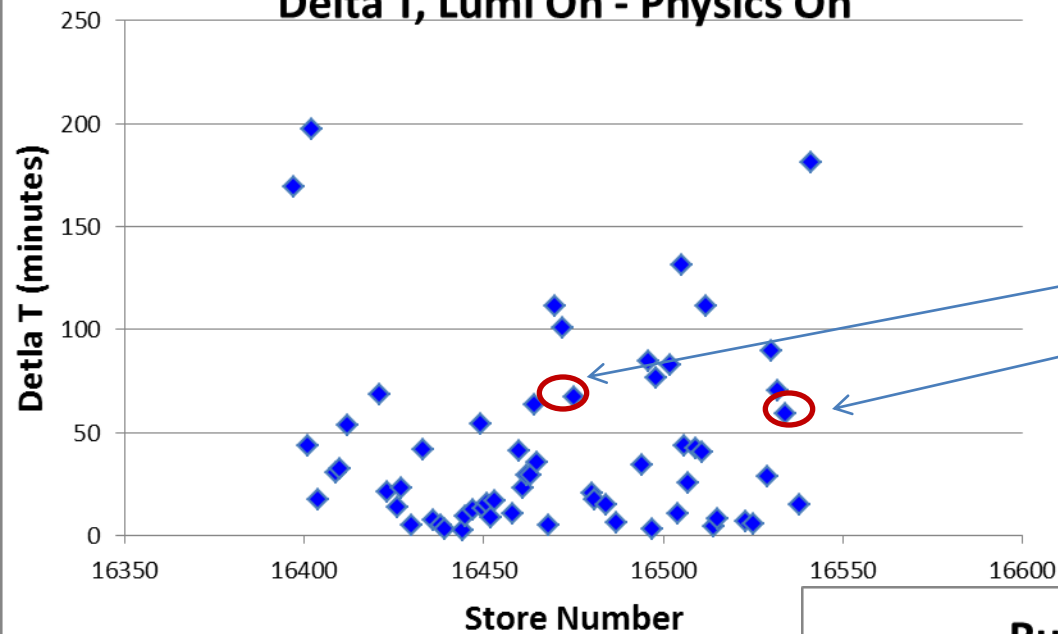
Run 12 100 x 100 GeV pp Lumi



Run 12 PHENIX Luminosity per Store

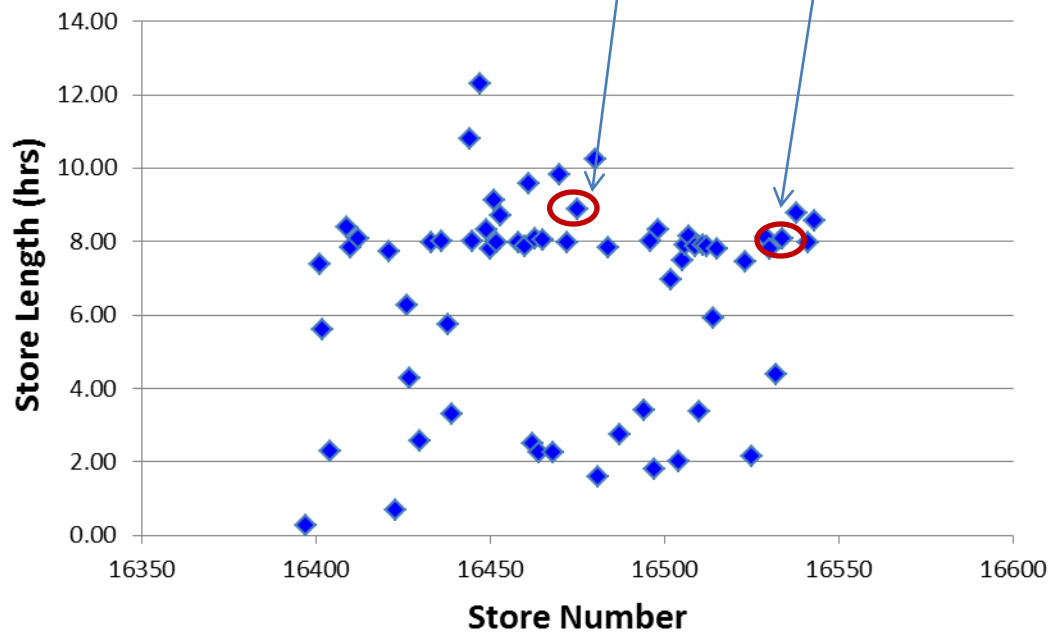


Run 12 100 x 100 GeV pp Delta T, Lumi On - Physics On

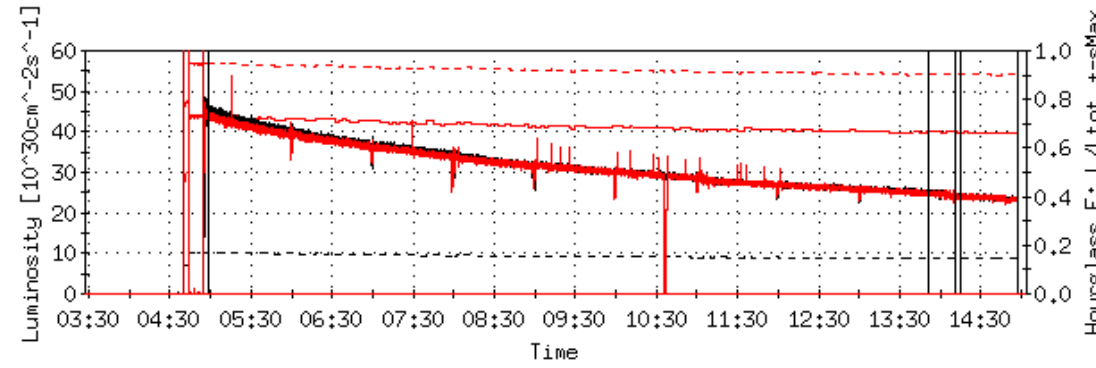
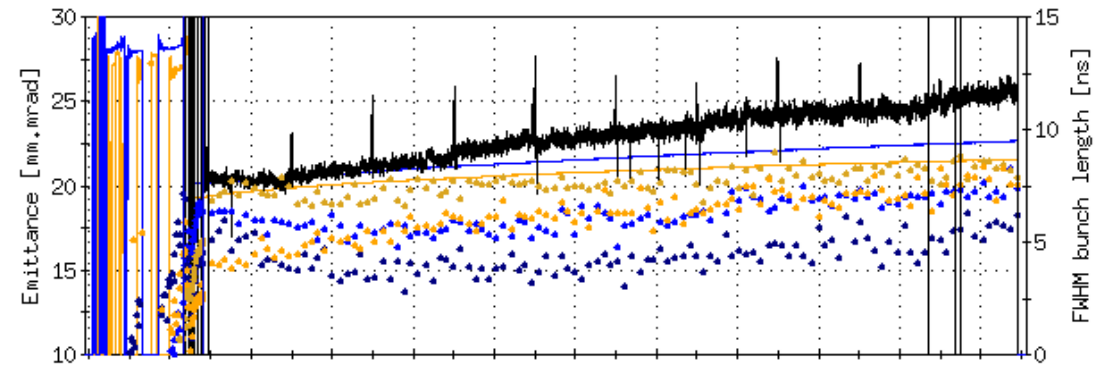
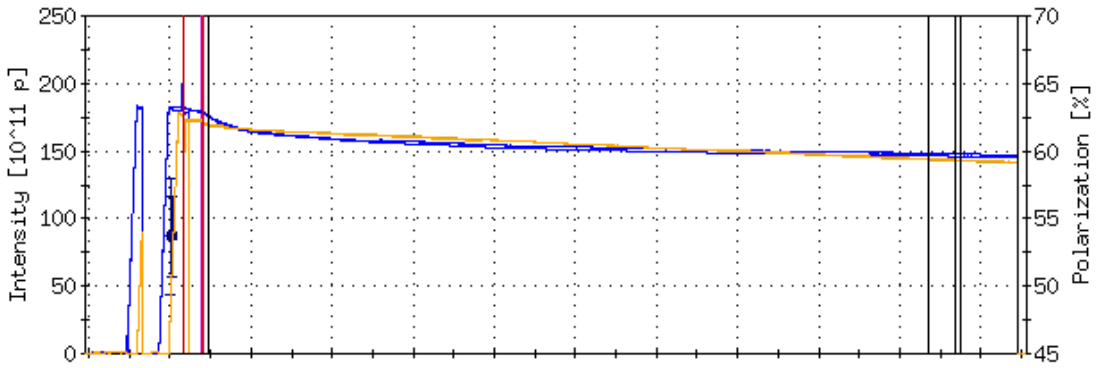
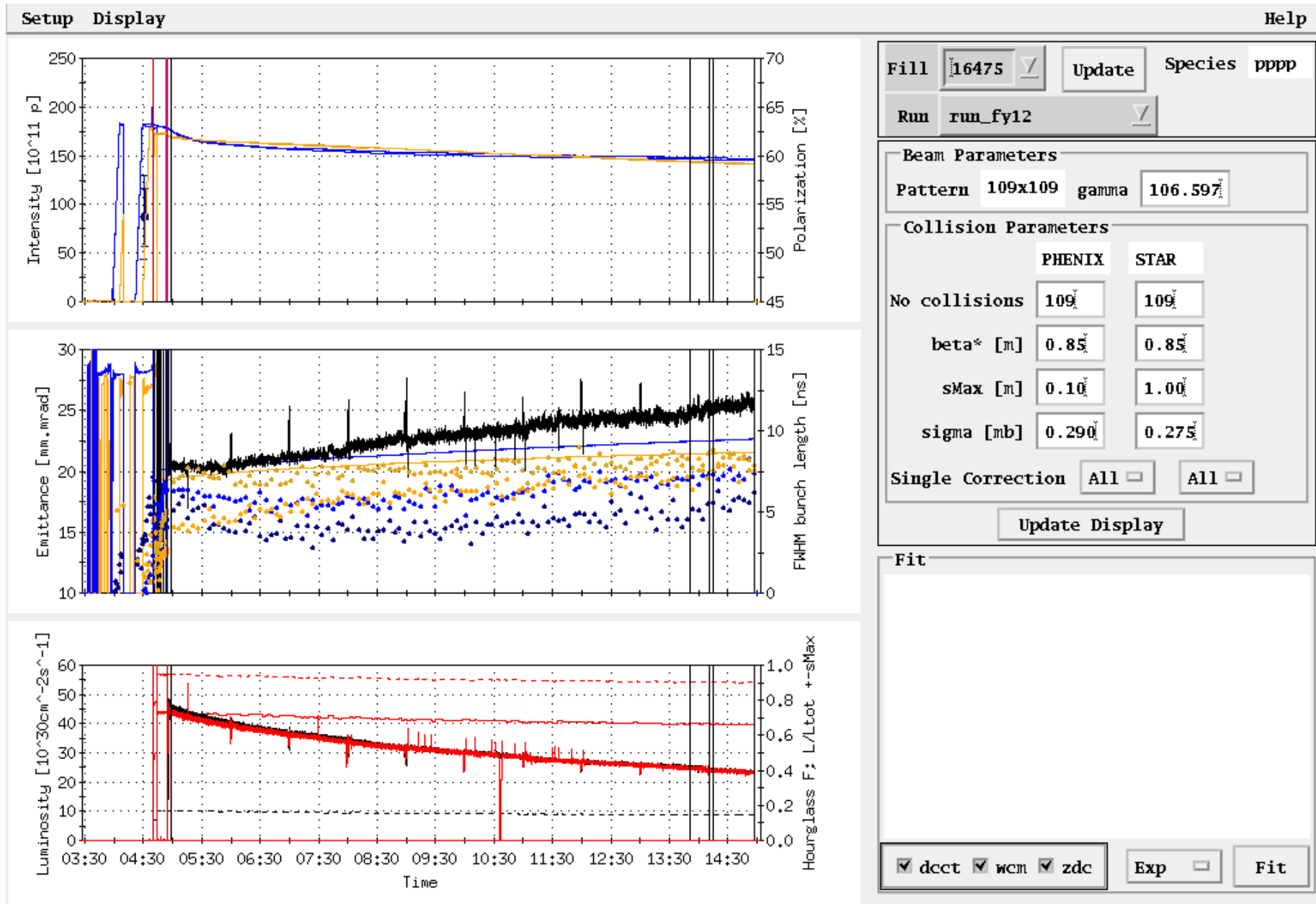


Best stores, 16475 and 16534

Run 12 PHENIX PhysicsStore Length

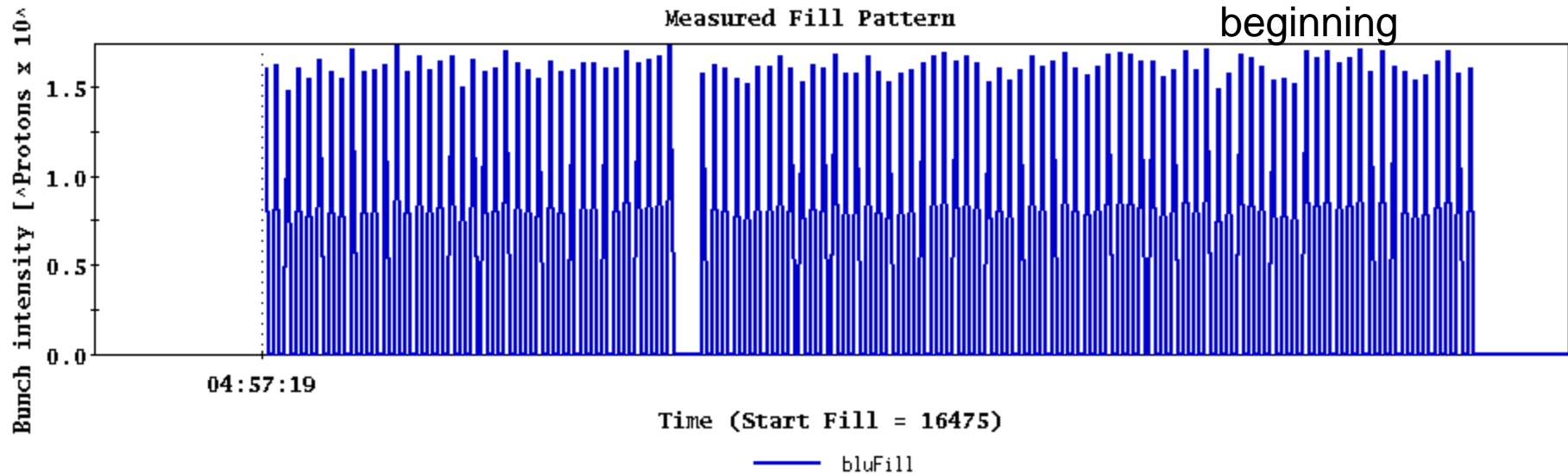


Fill 16475, 27 Feb, 8.9 hours physics store (10 hour Lumi on Store), PHENIX 1.03 pb⁻¹

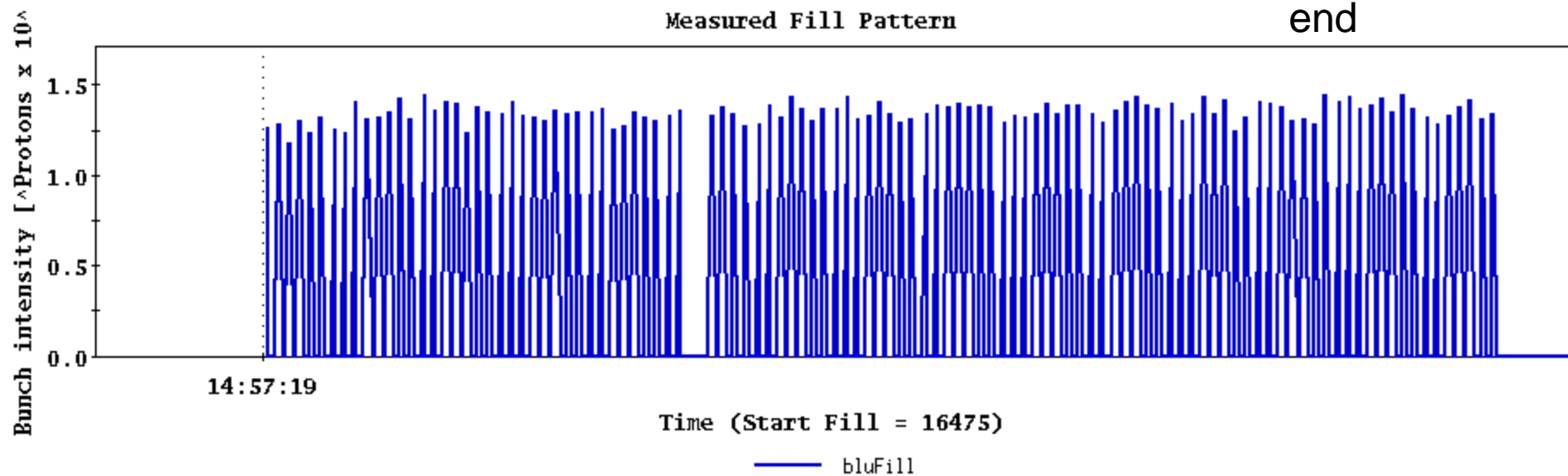


Fill 16475, 27 Feb, 8.9 hours physics store (10 hour Lumi on Store), PHENIX 1.03 pb⁻¹

File Window Markers Analysis

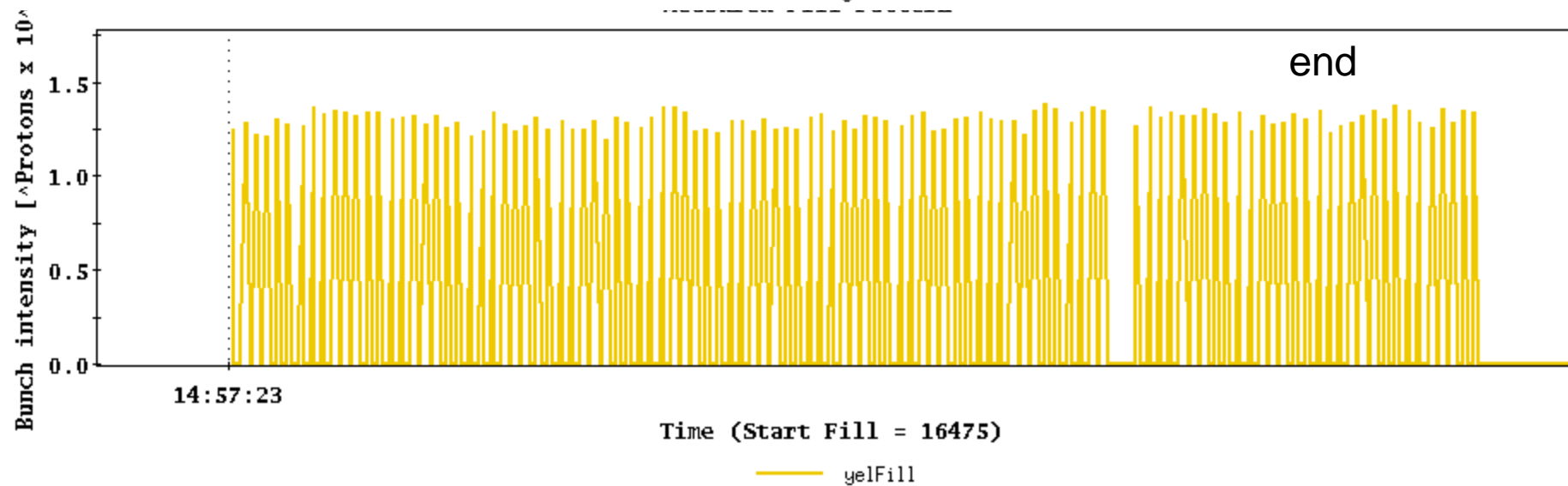
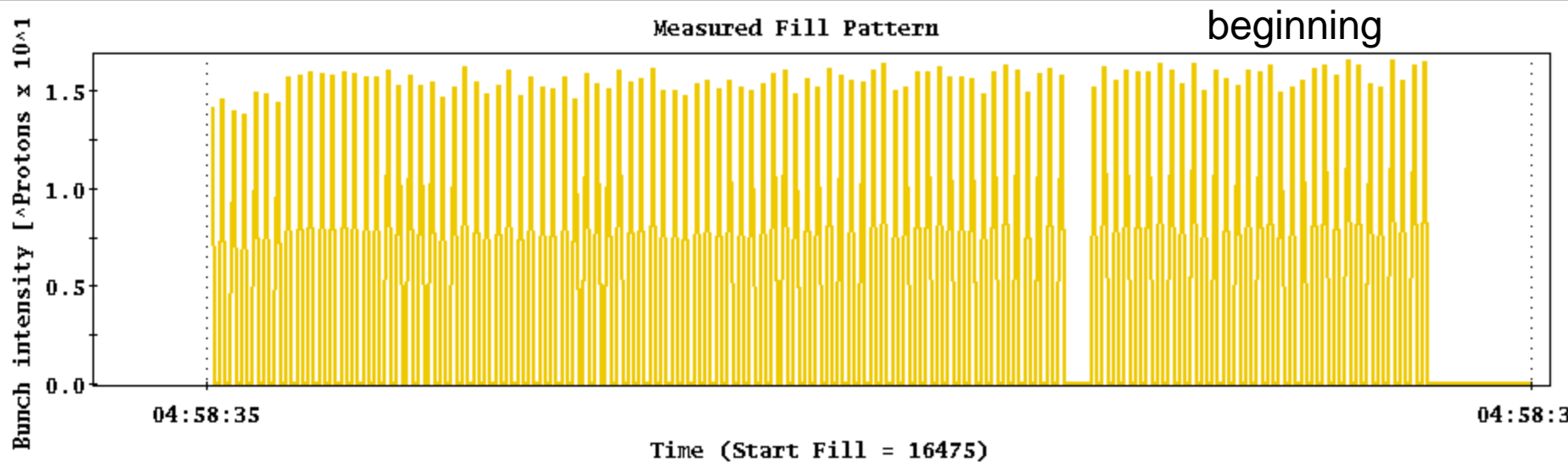


File Window Markers Analysis



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 [10^{11} p] on the left y-axis (0 to 250) and Polarization [%] on the right y-axis (45 to 70). The middle plot shows Emittance [mm.mrad] on the left y-axis (10 to 30) and FWHM bunch length [ns] on the right y-axis (0 to 15). The bottom plot shows Luminosity [10^{30} cm⁻² s⁻¹] on the left y-axis (0 to 60) and Hourglass F; L/Ltot +- sMax on the right y-axis (0.0 to 1.0).

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"/>

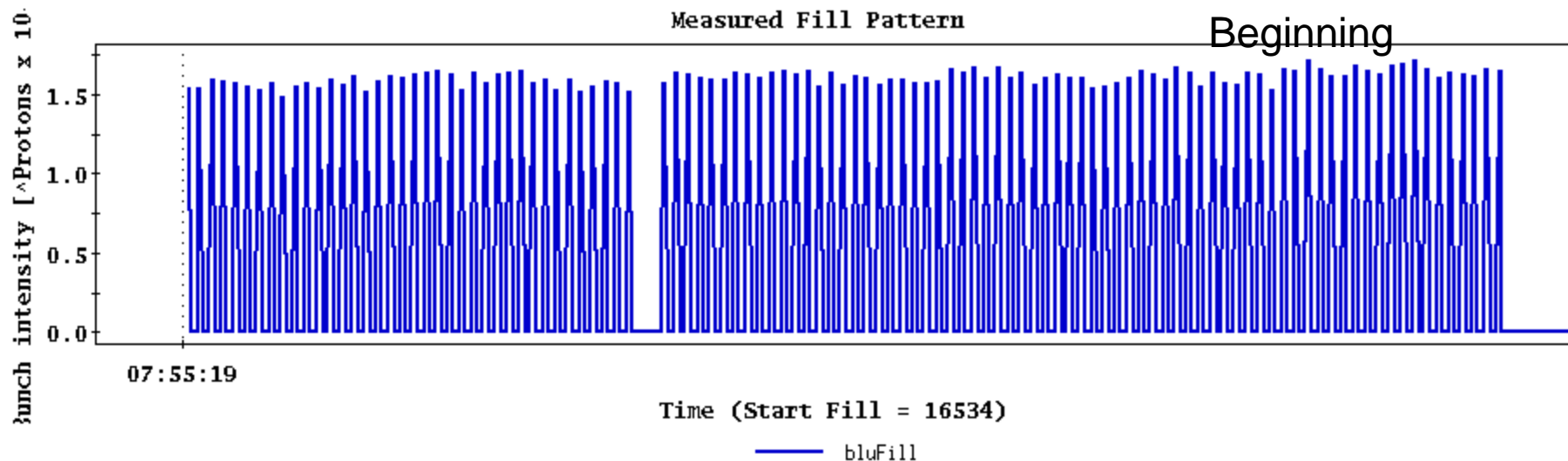
Single Correction All All

Fit

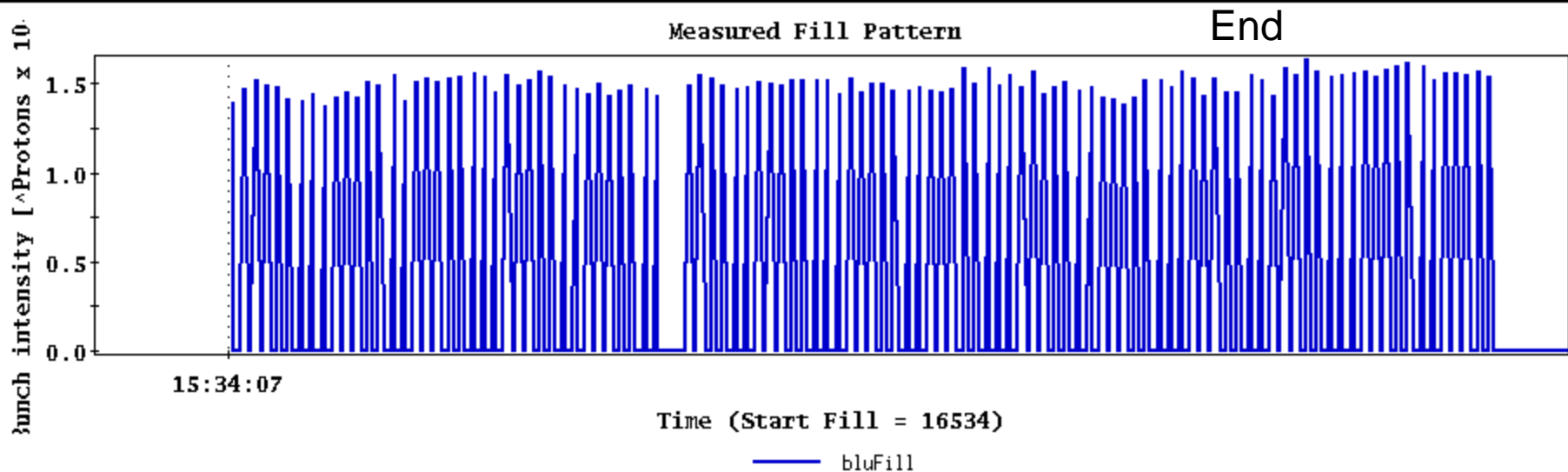
dcut wcm zdc

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

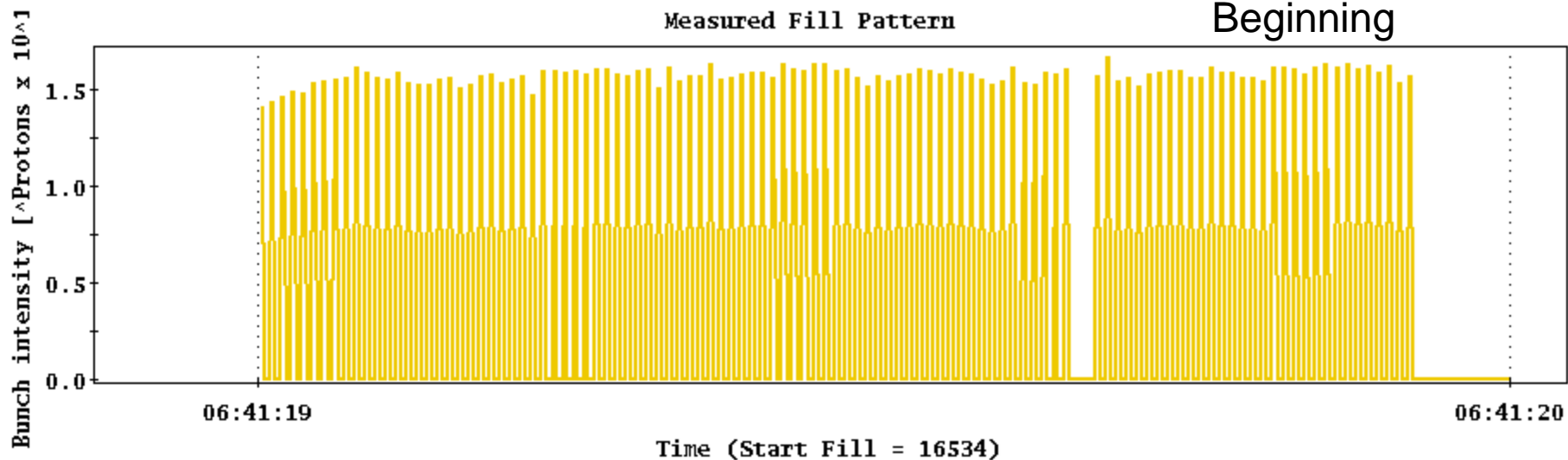
File Window Markers Analysis



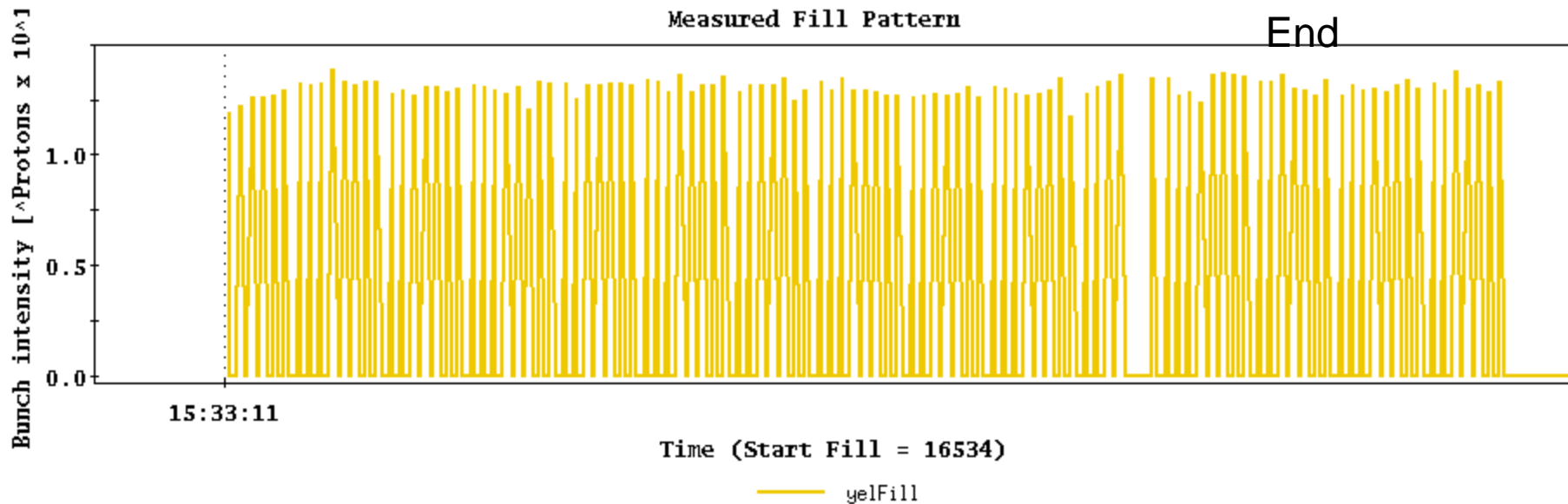
File Window Markers Analysis



File Window Markers Analysis

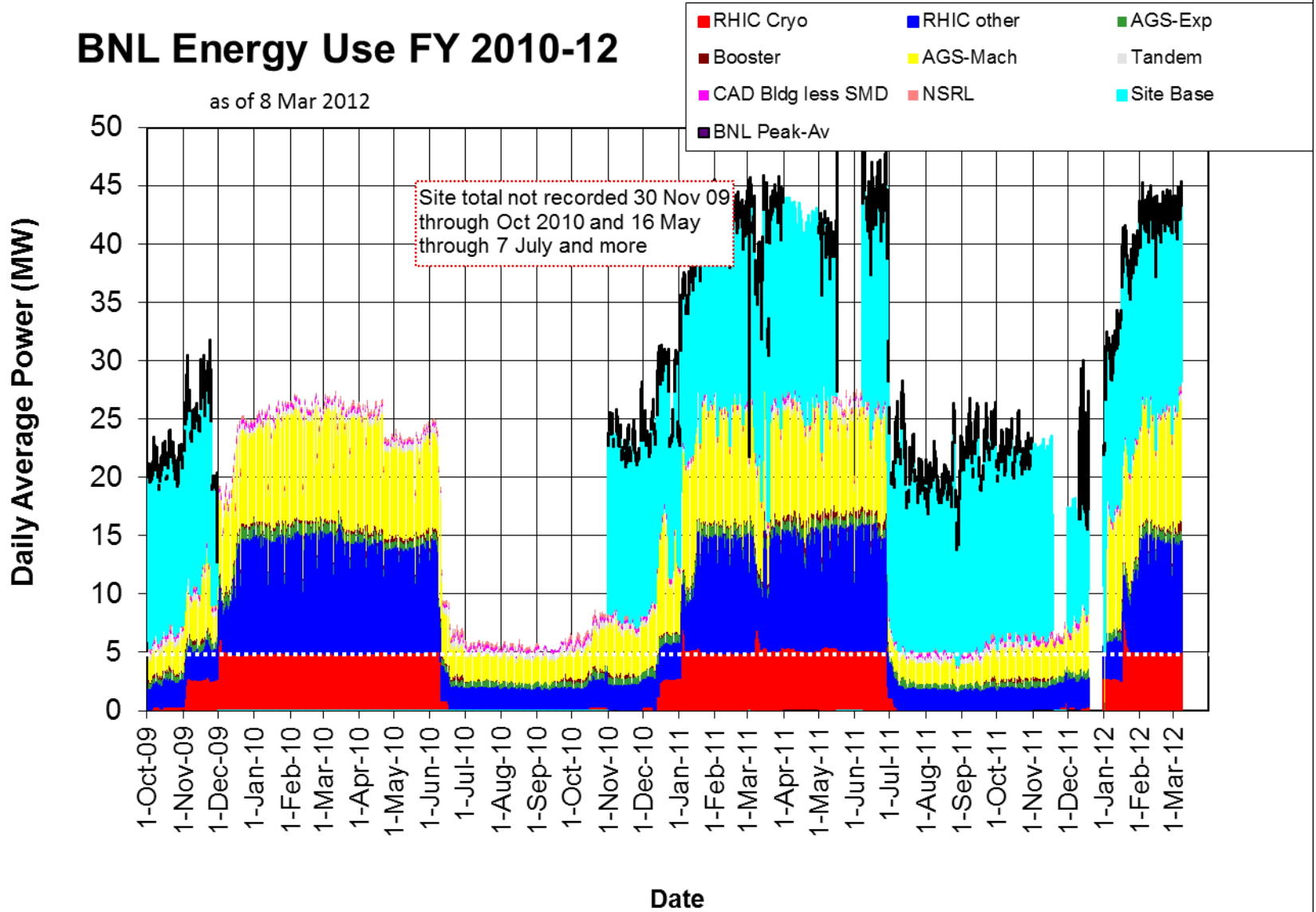


File Window Markers Analysis



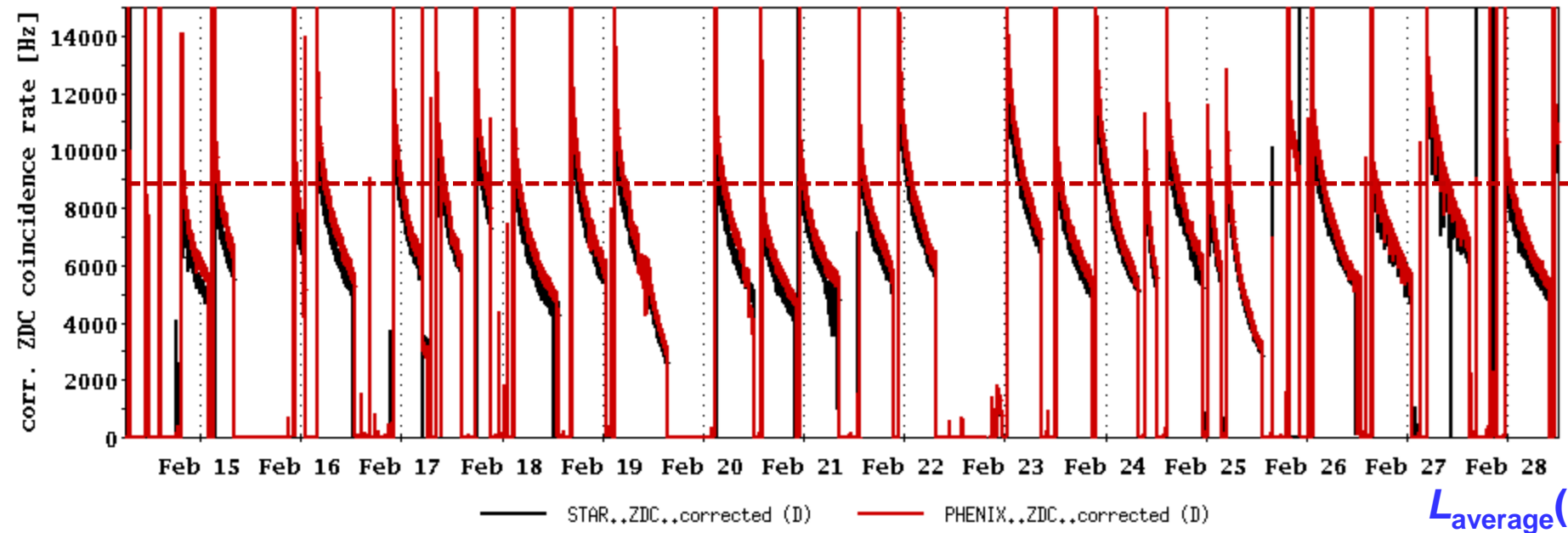
BNL Energy Use FY 2010-12

as of 8 Mar 2012

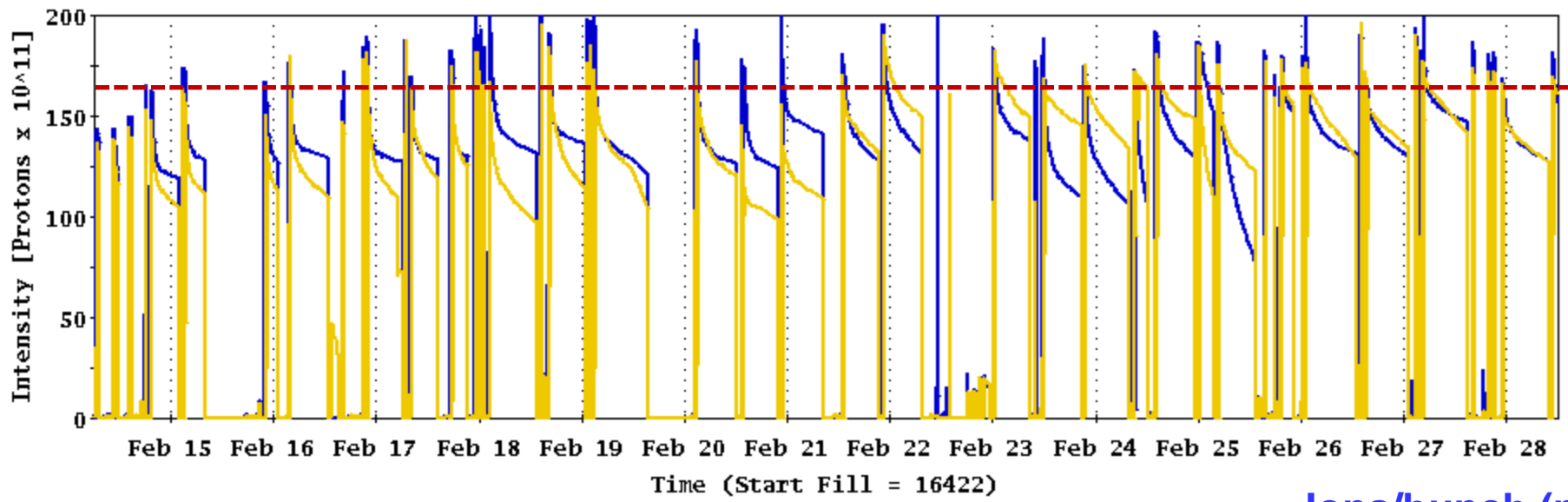


Accidental corrected Exp. Coinc. Signals

Past Week

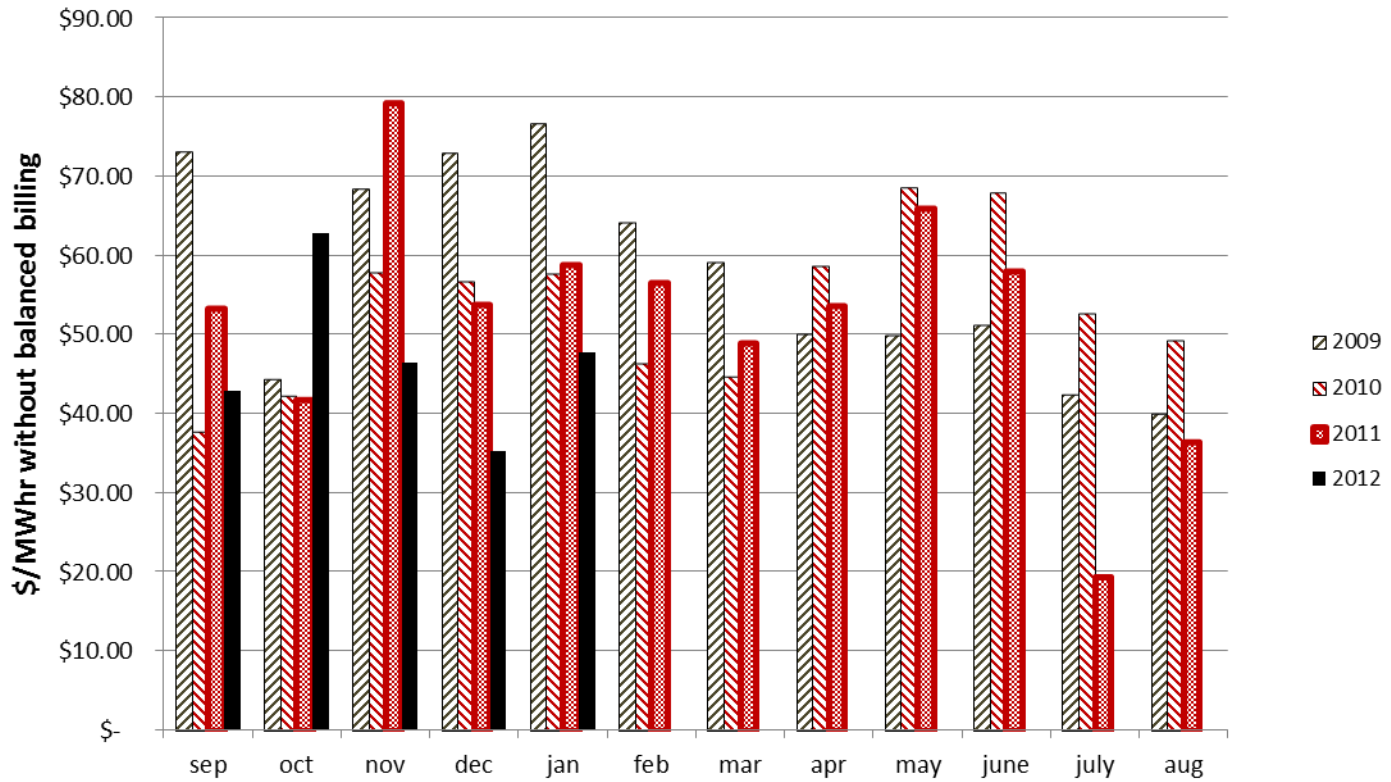


Lverage (m
(0.29 mb xsec

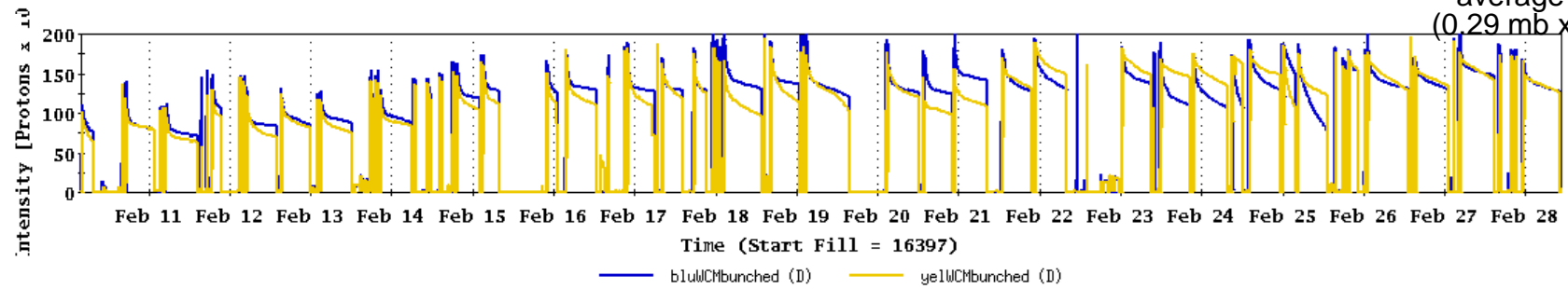
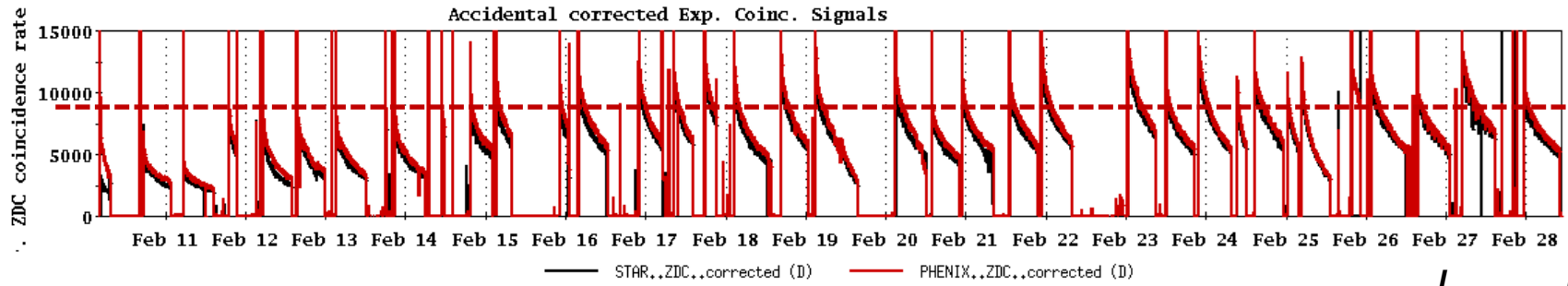
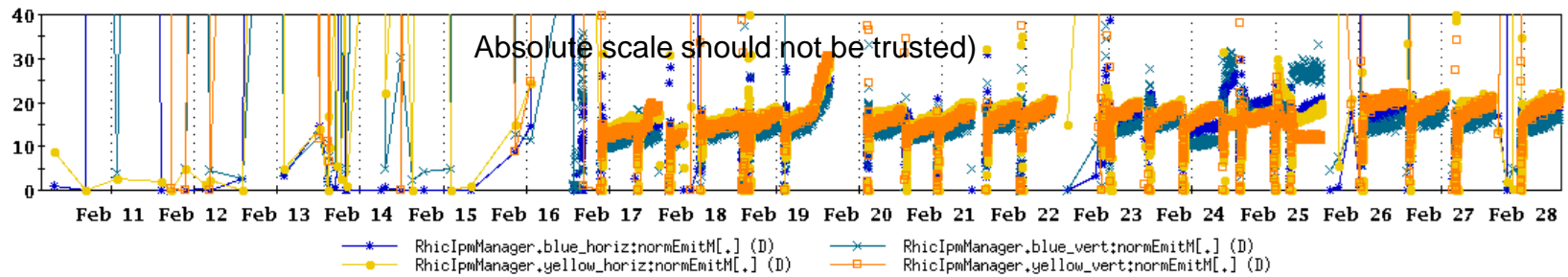
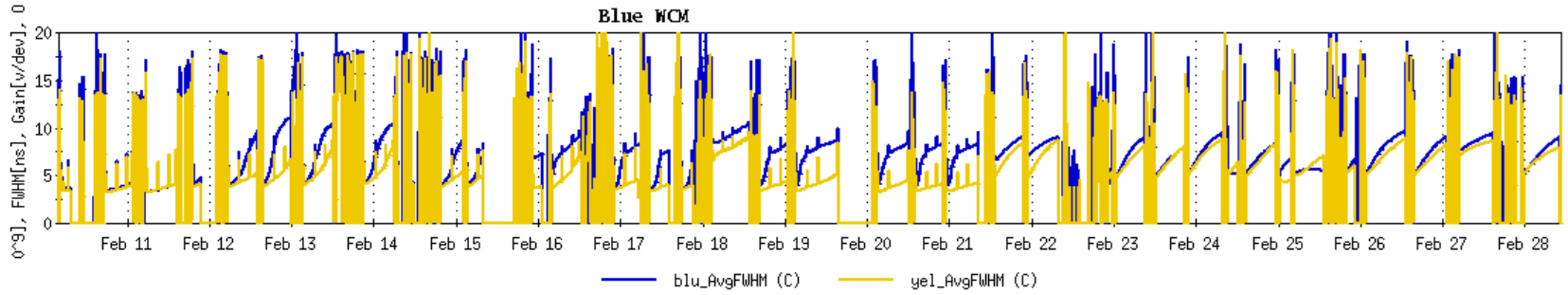


Ions/bunch (ma

BNL Electricity Cost

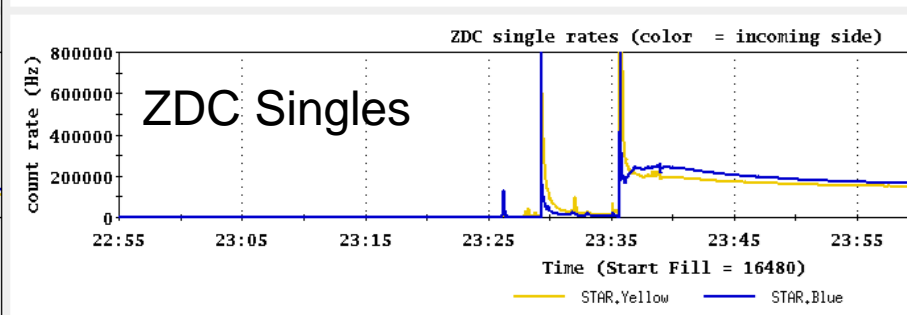
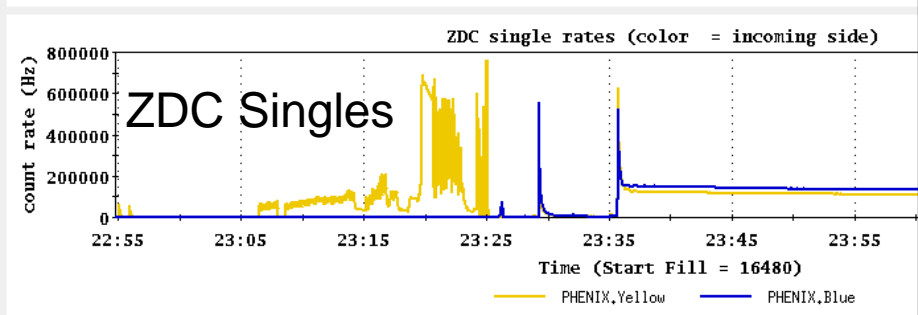
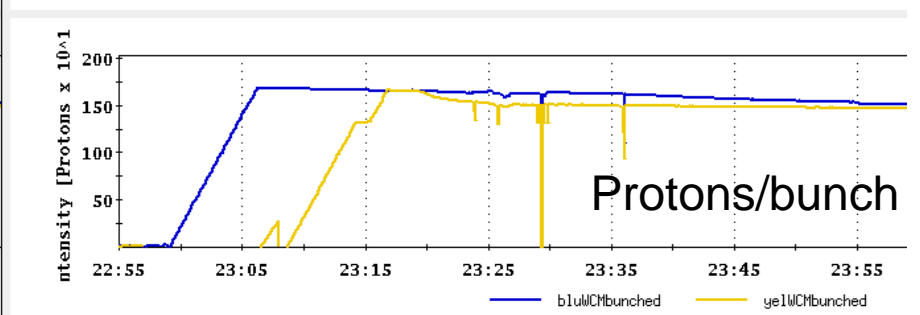
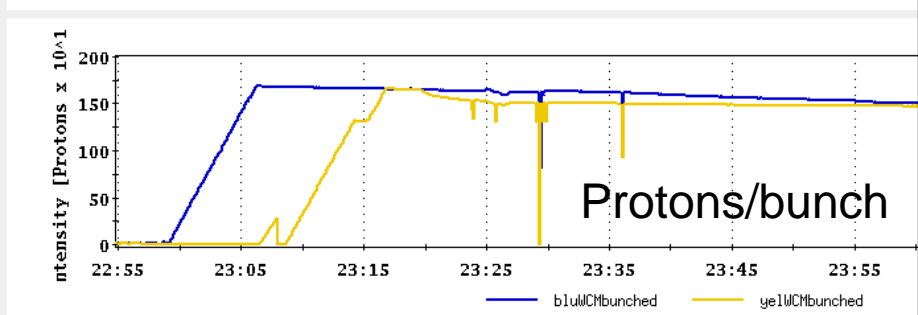
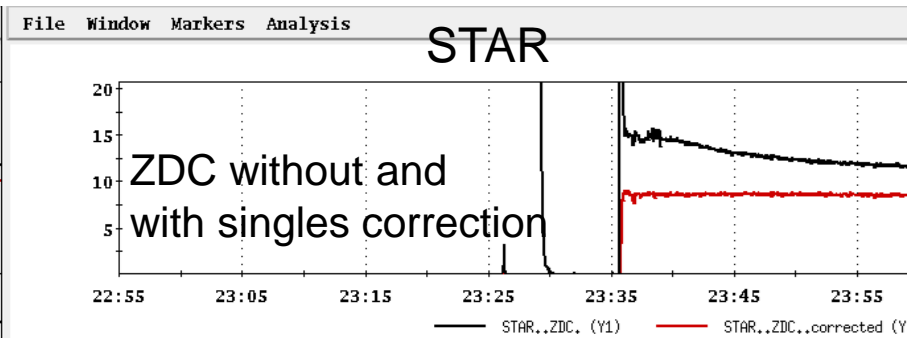
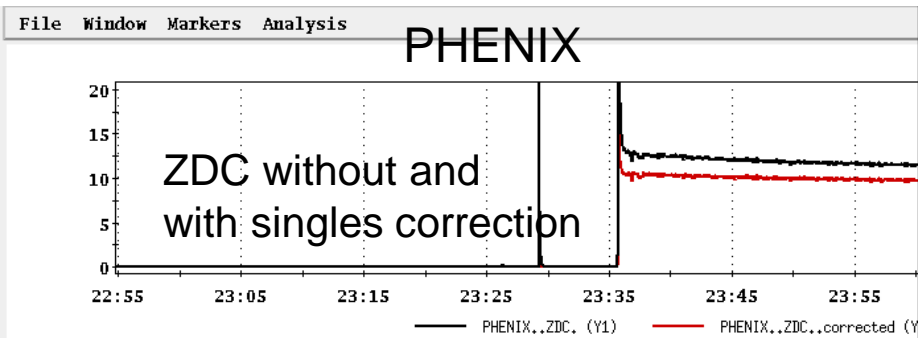


Run 12 Physics Stores to 28 Feb

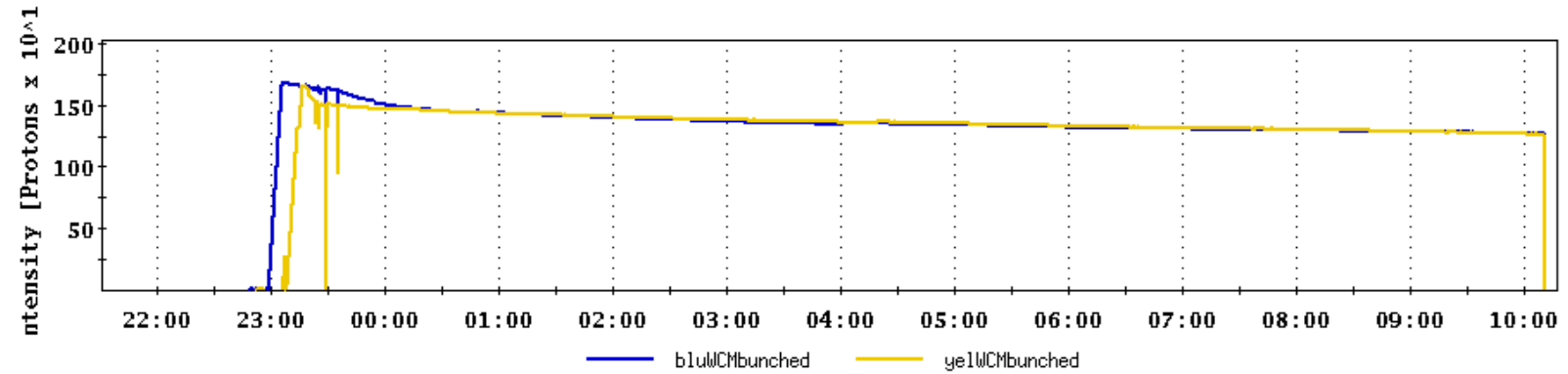
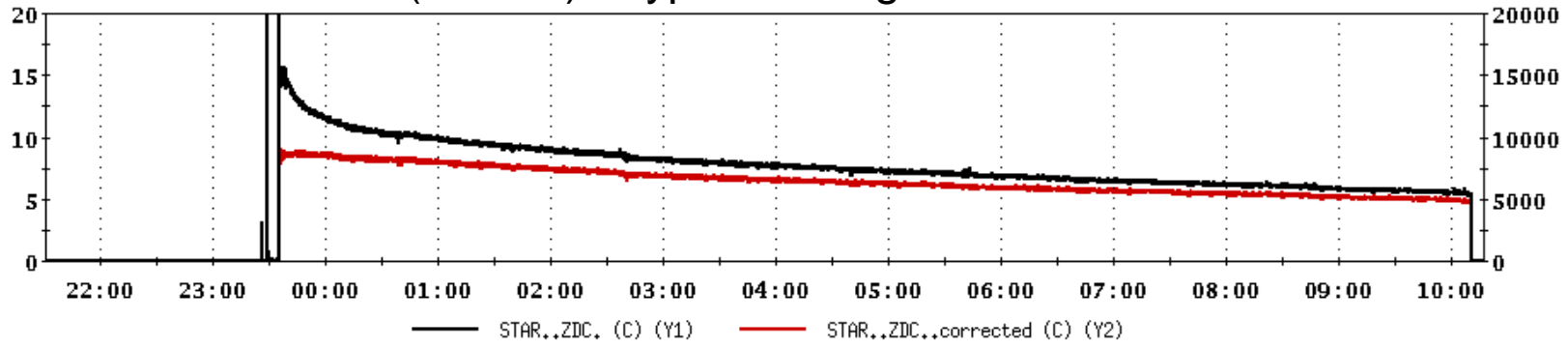


$L_{\text{average}}(\text{max})$
(0.29 mb xsection)

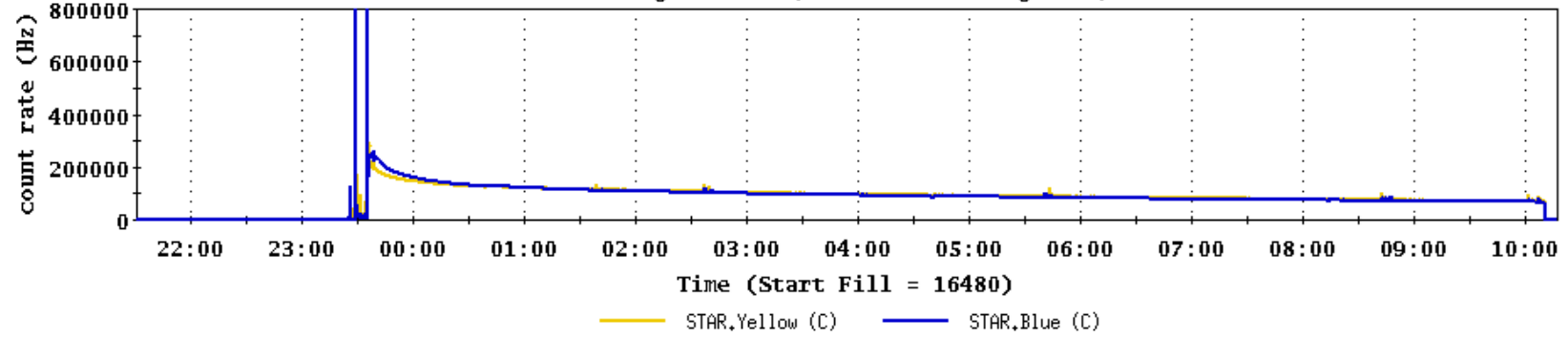
Store 16480 (27 Feb) – typical background issues



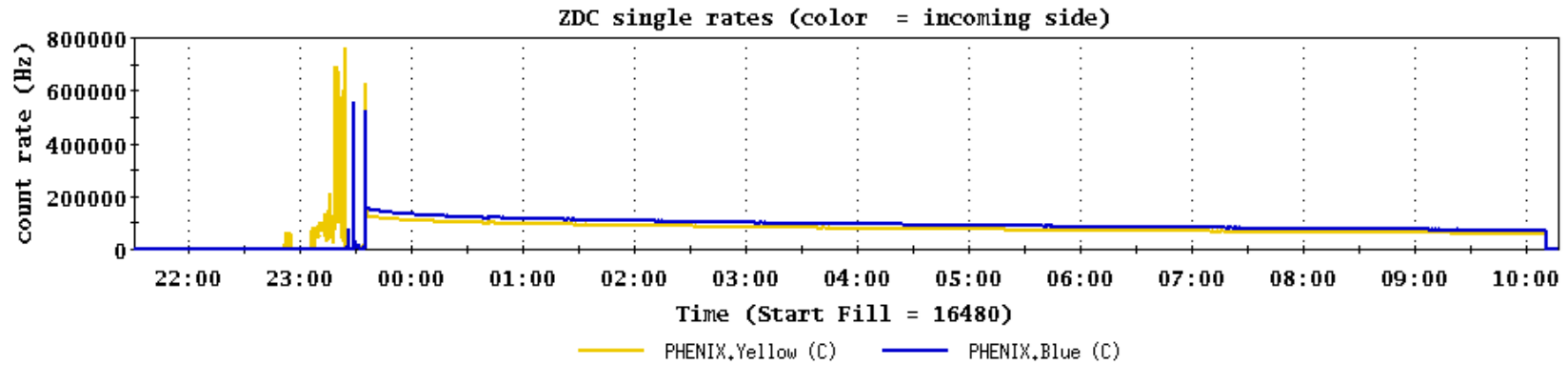
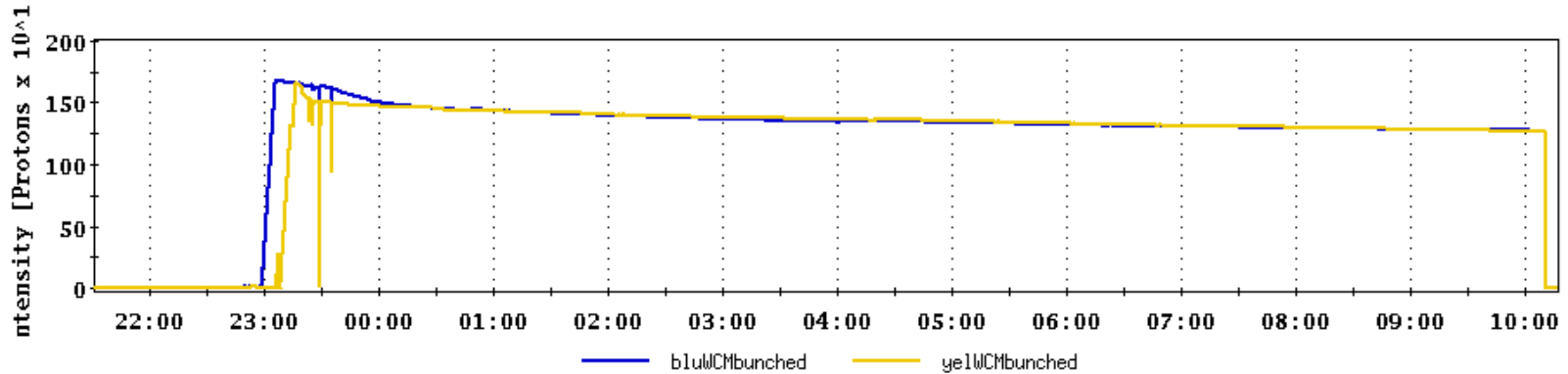
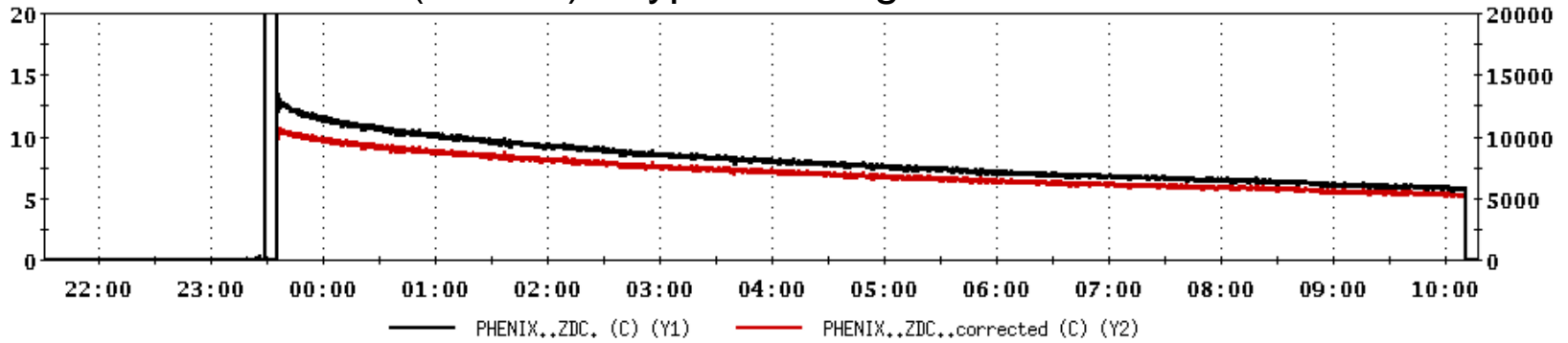
Store 16480 (27 Feb) – typical background issues



ZDC single rates (color = incoming side)



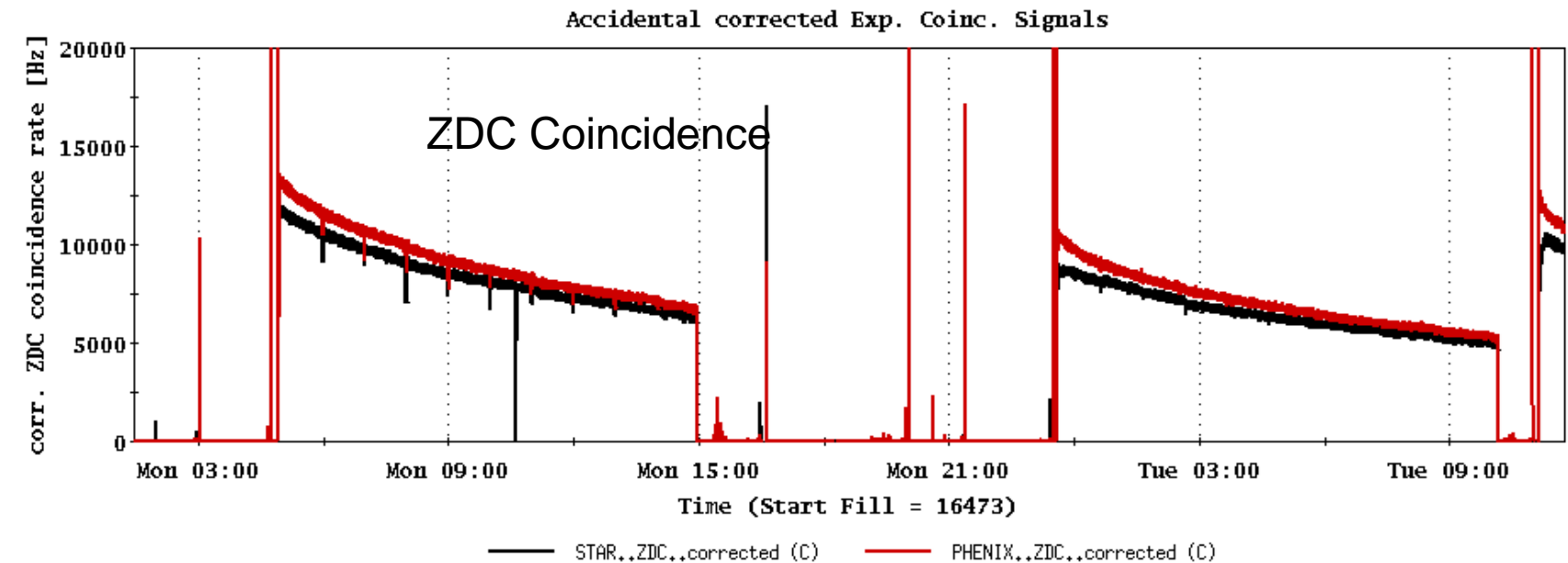
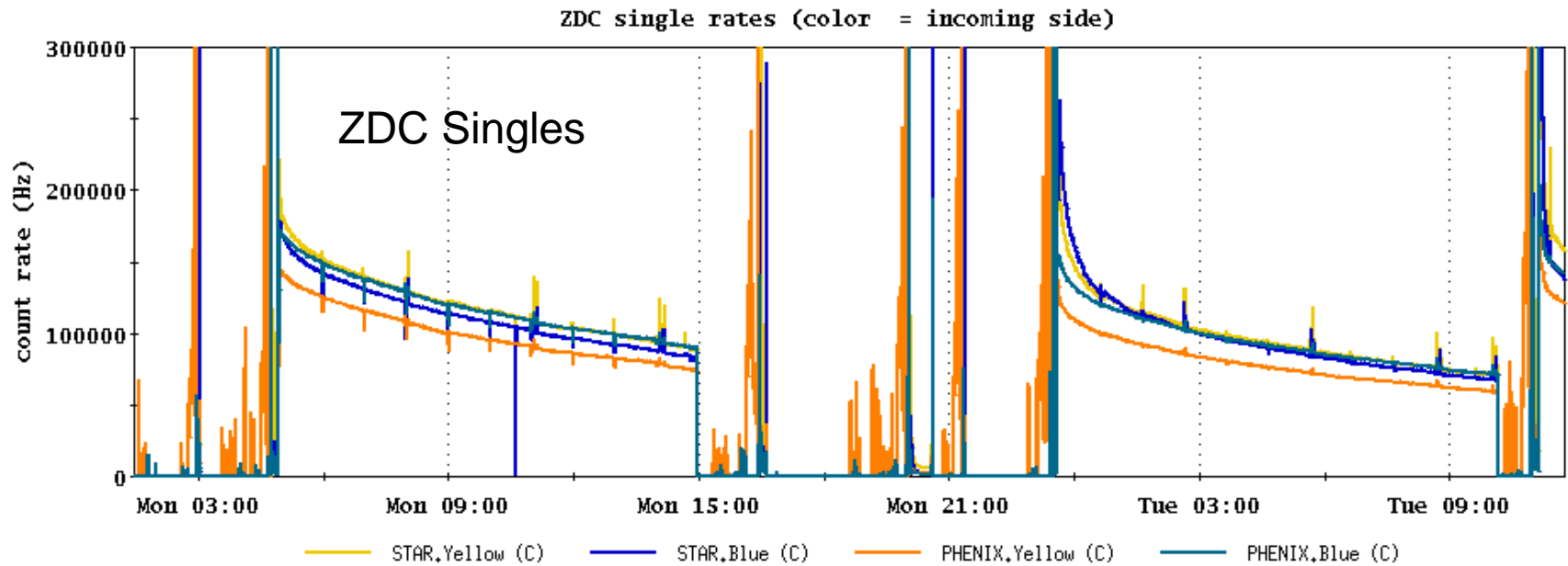
Store 16480 (27 Feb) – typical background issues



Collision steering corrections background issues 26-27 Feb

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

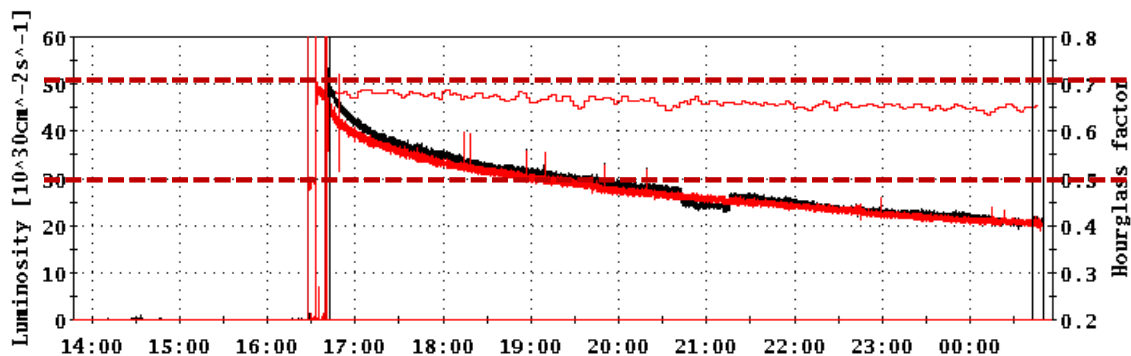
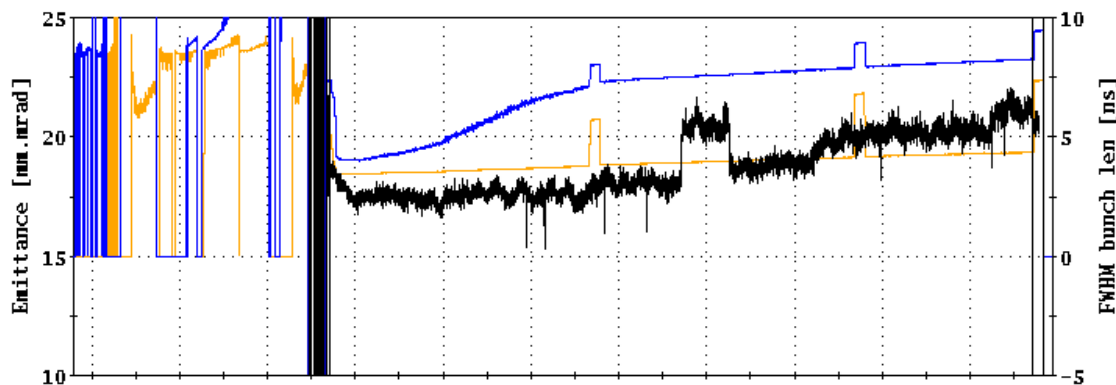
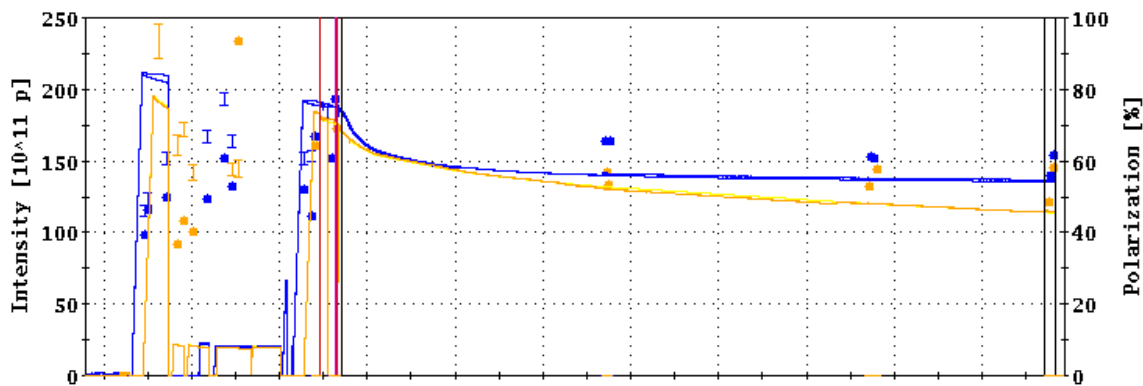
File Window Markers Analysis



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"/>

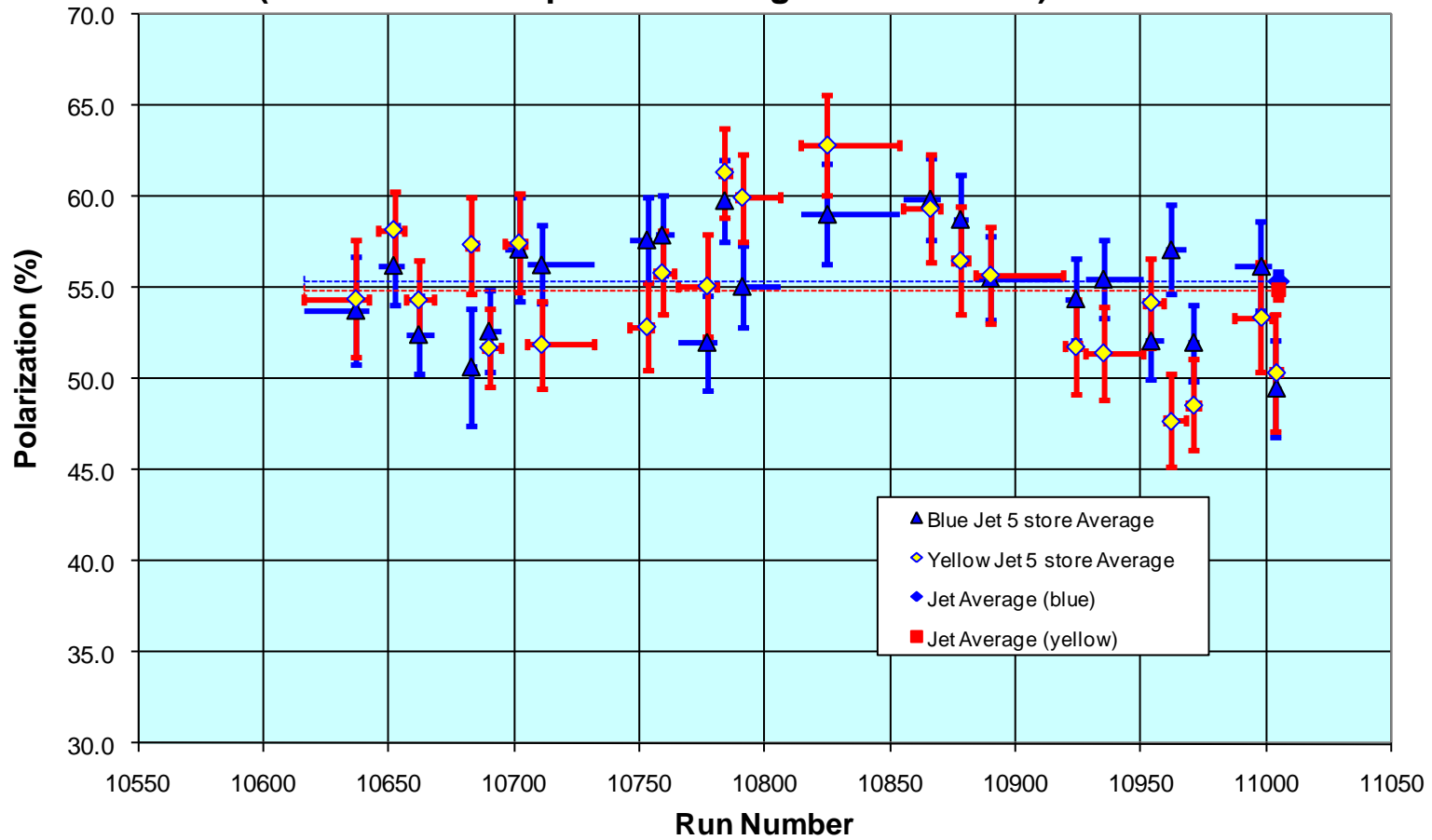
Fit

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

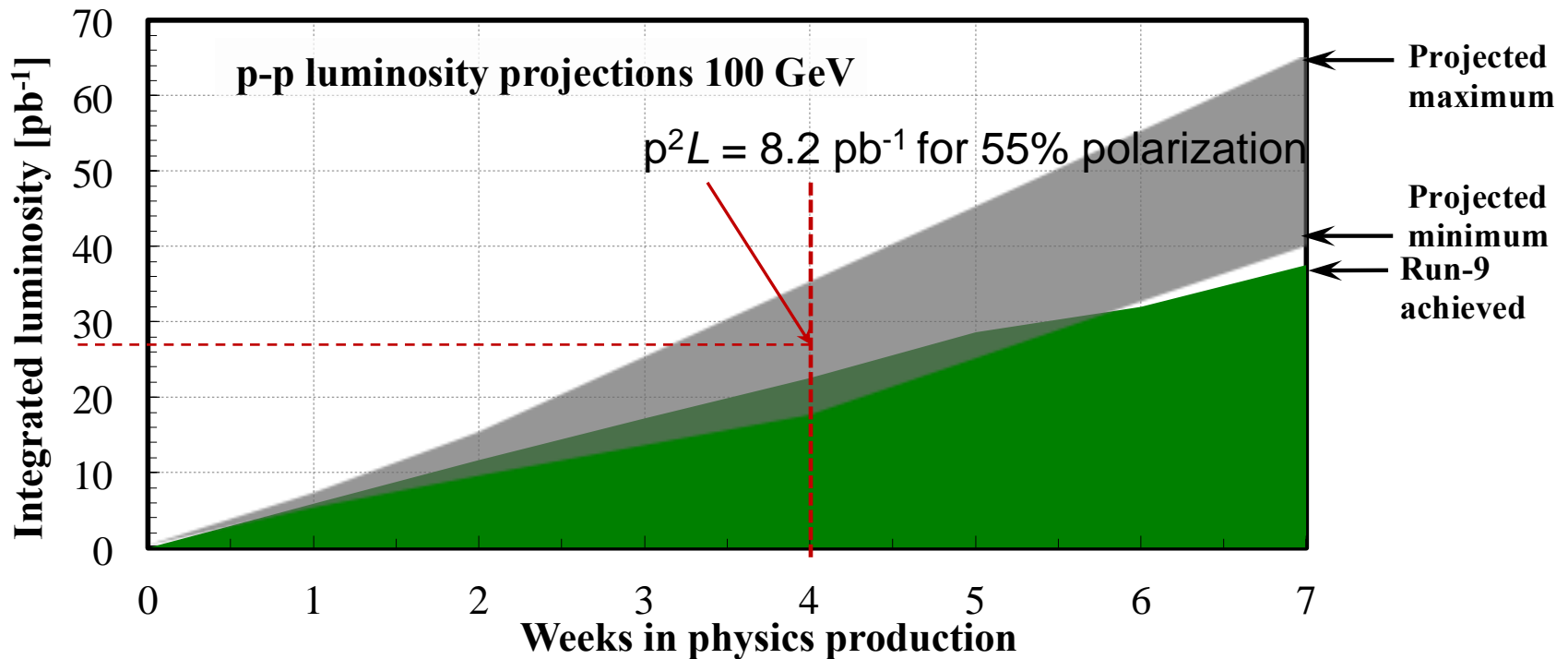


Figure 3: Projected minimum and maximum integrated luminosities for polarized proton collisions at 100 GeV beam energy, assuming a linear weekly luminosity ramp-up in 4 weeks. An average store polarization between 50 and 60% is expected.

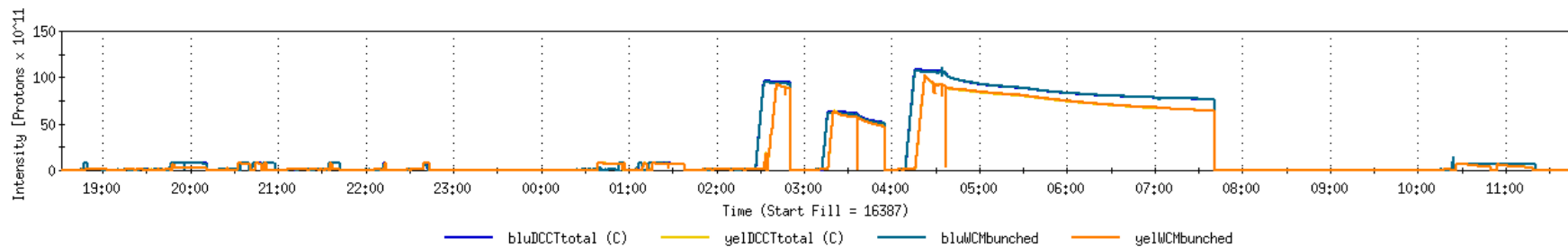
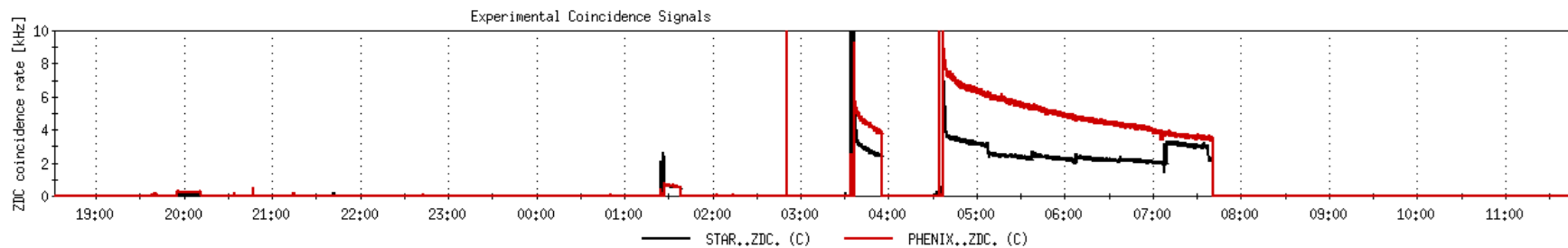
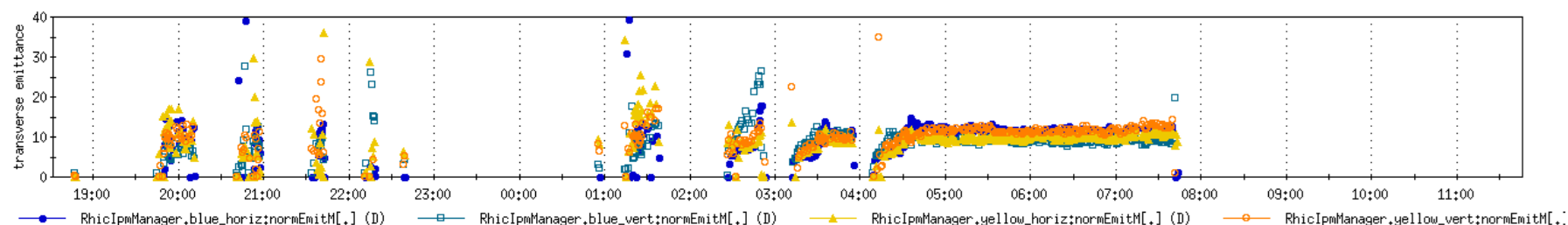
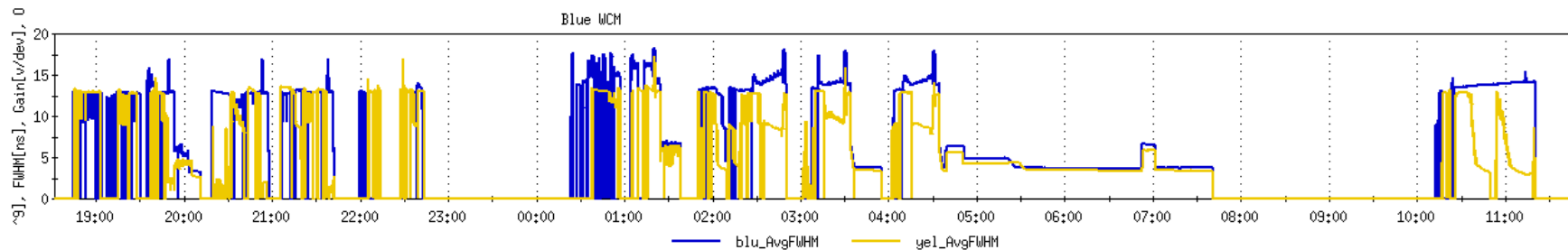
From Fischer et. Al. "RHIC Collider Projections (FY 2012 – FY 2016)"

14 October 2011

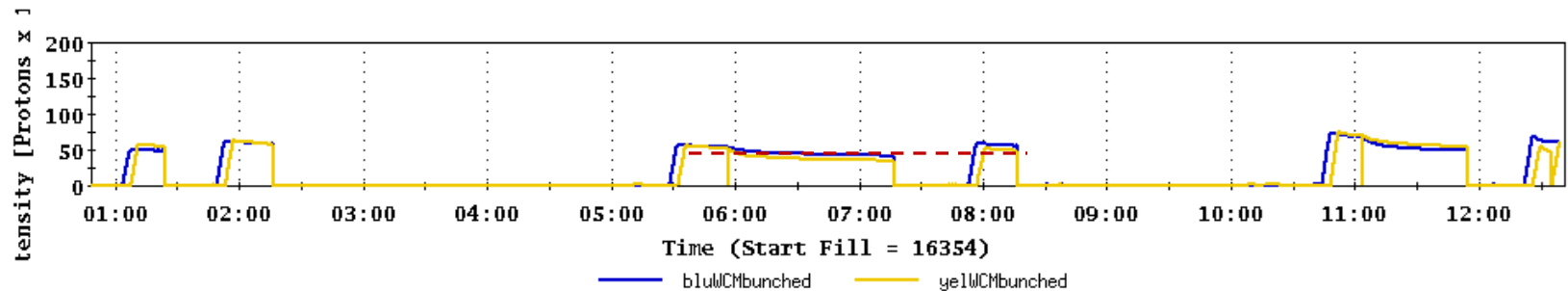
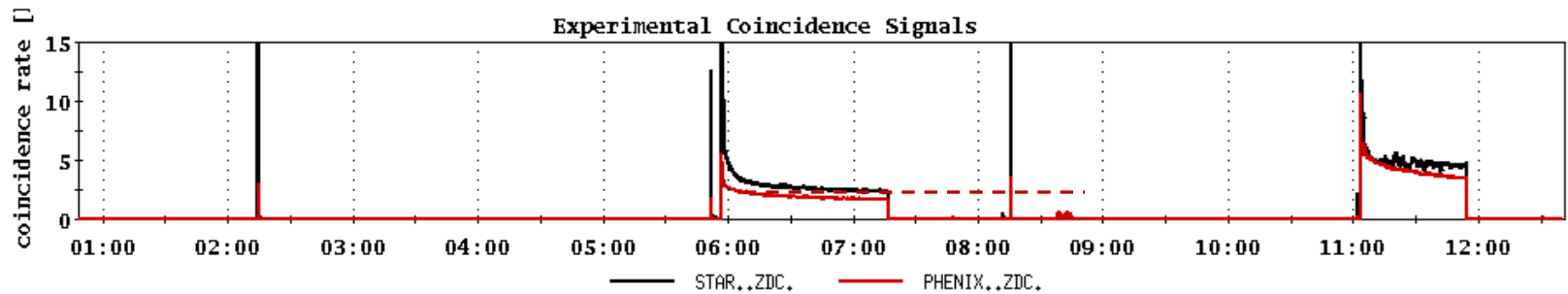
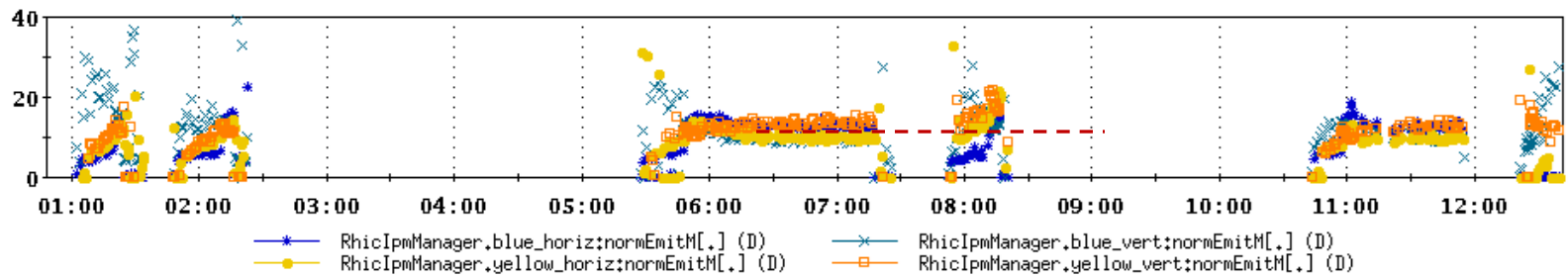
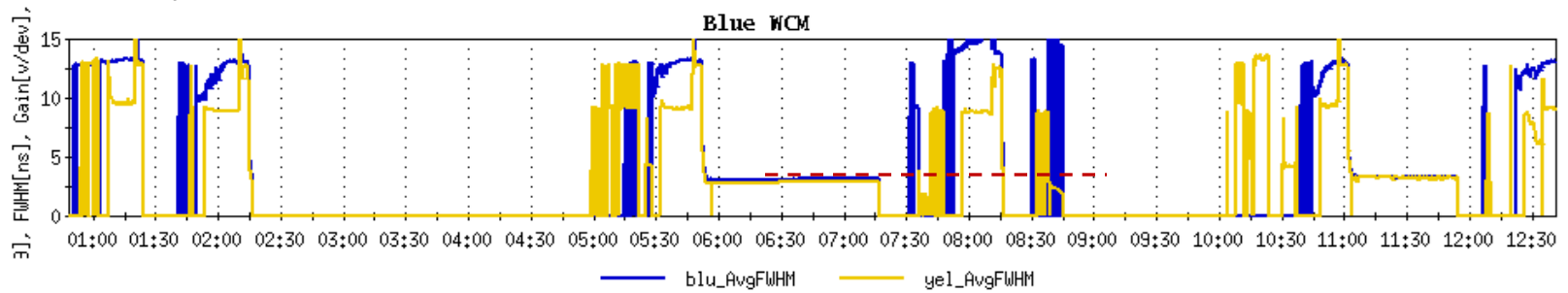
First Physics Store (#16397, 04:01, 10 Feb)

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

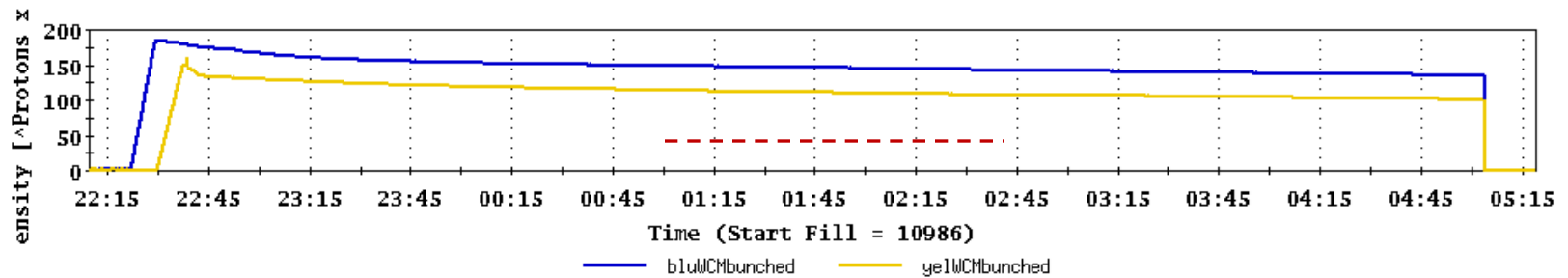
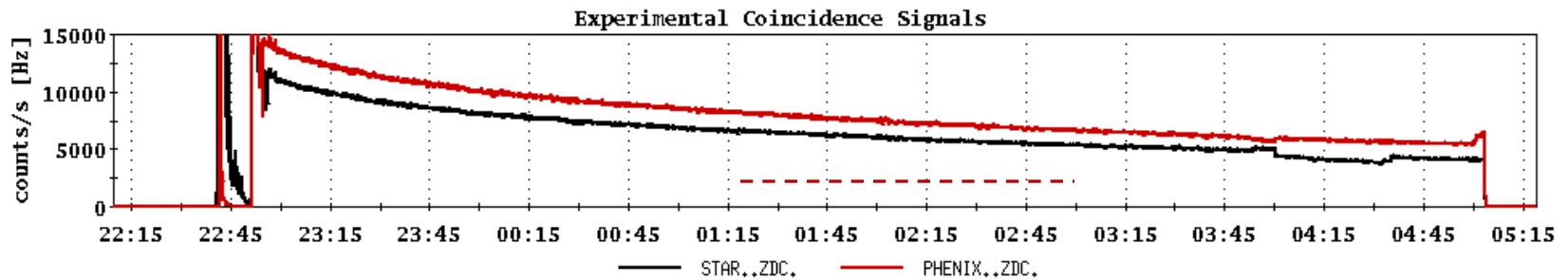
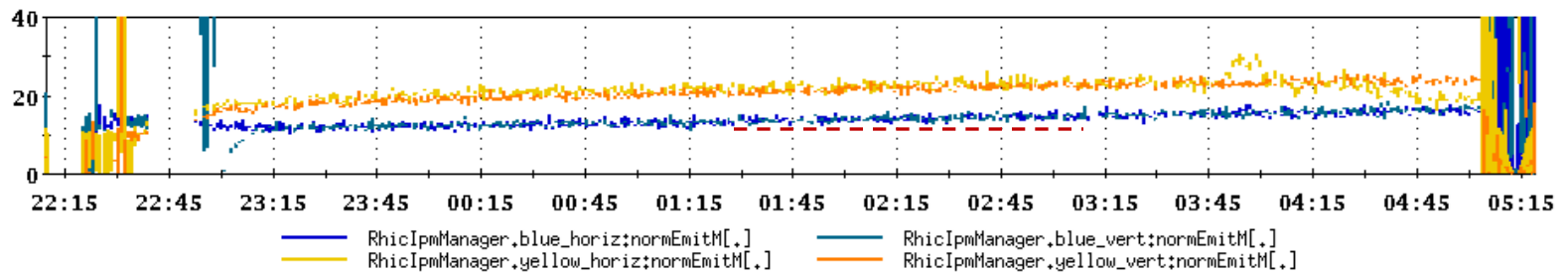
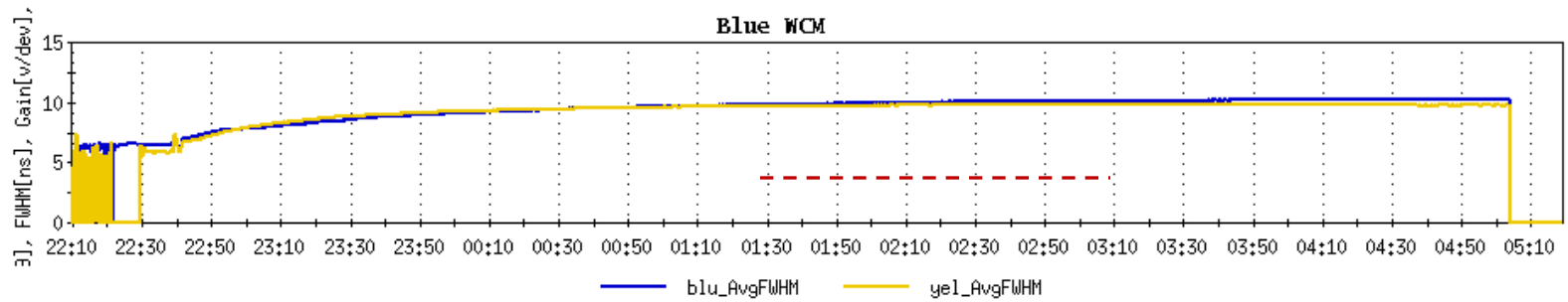
File Window Markers Analysis



Today, 7 Feb 2012

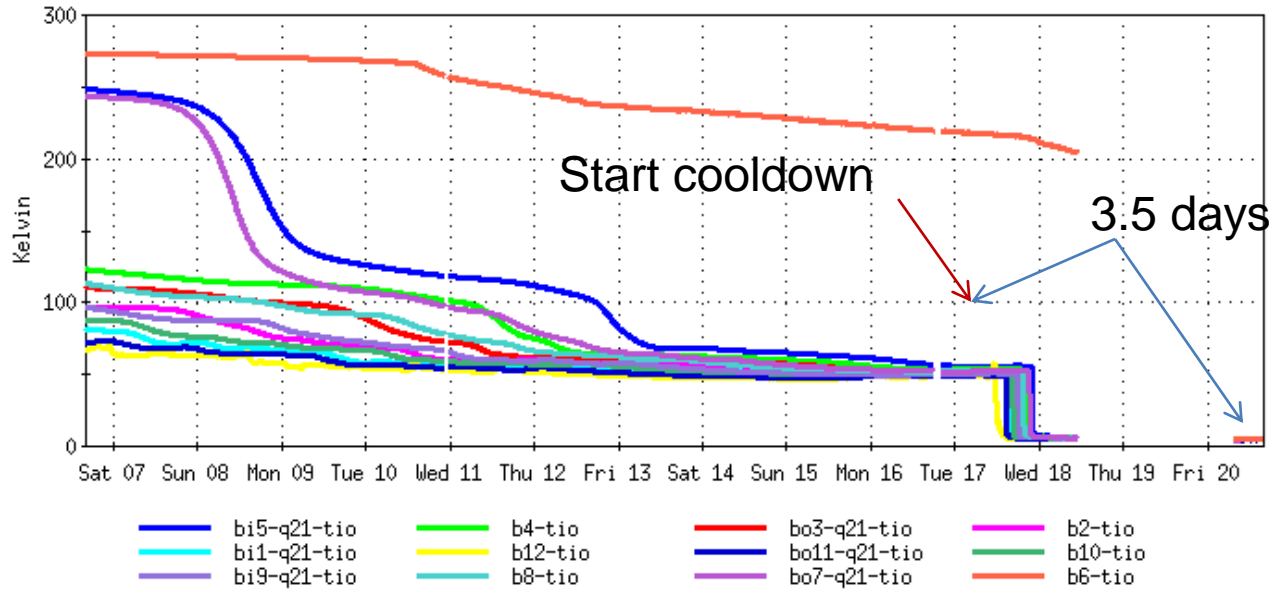


Typical Store from Run 9, 100 x 100 GeV pp

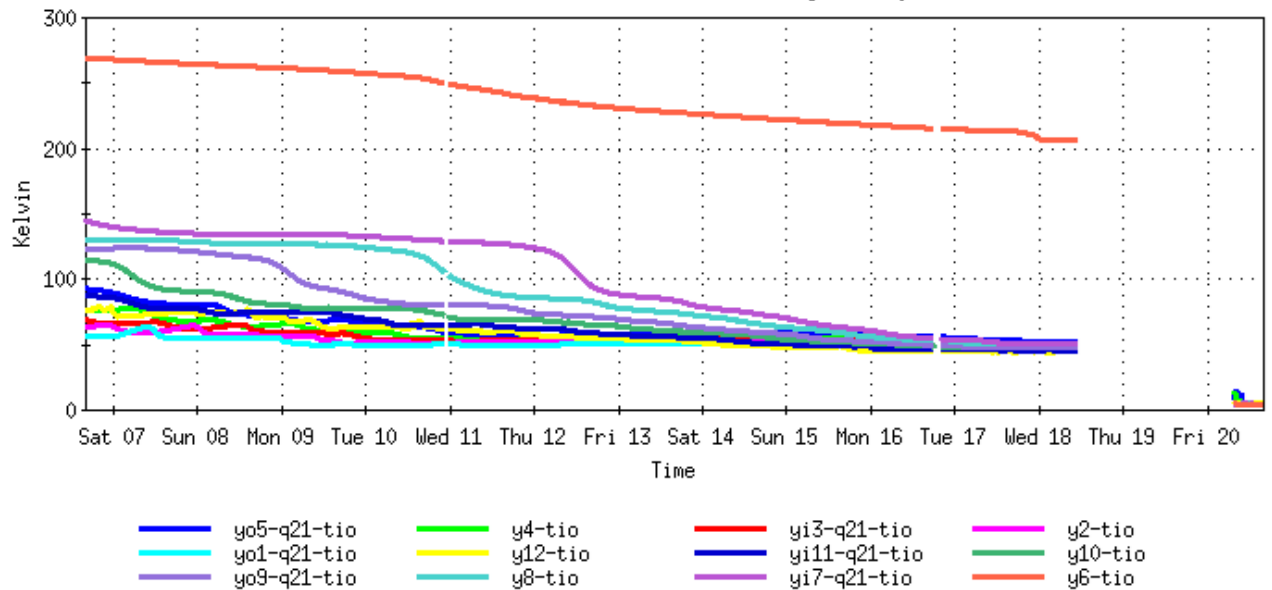


Blue Cryo Temperatures

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

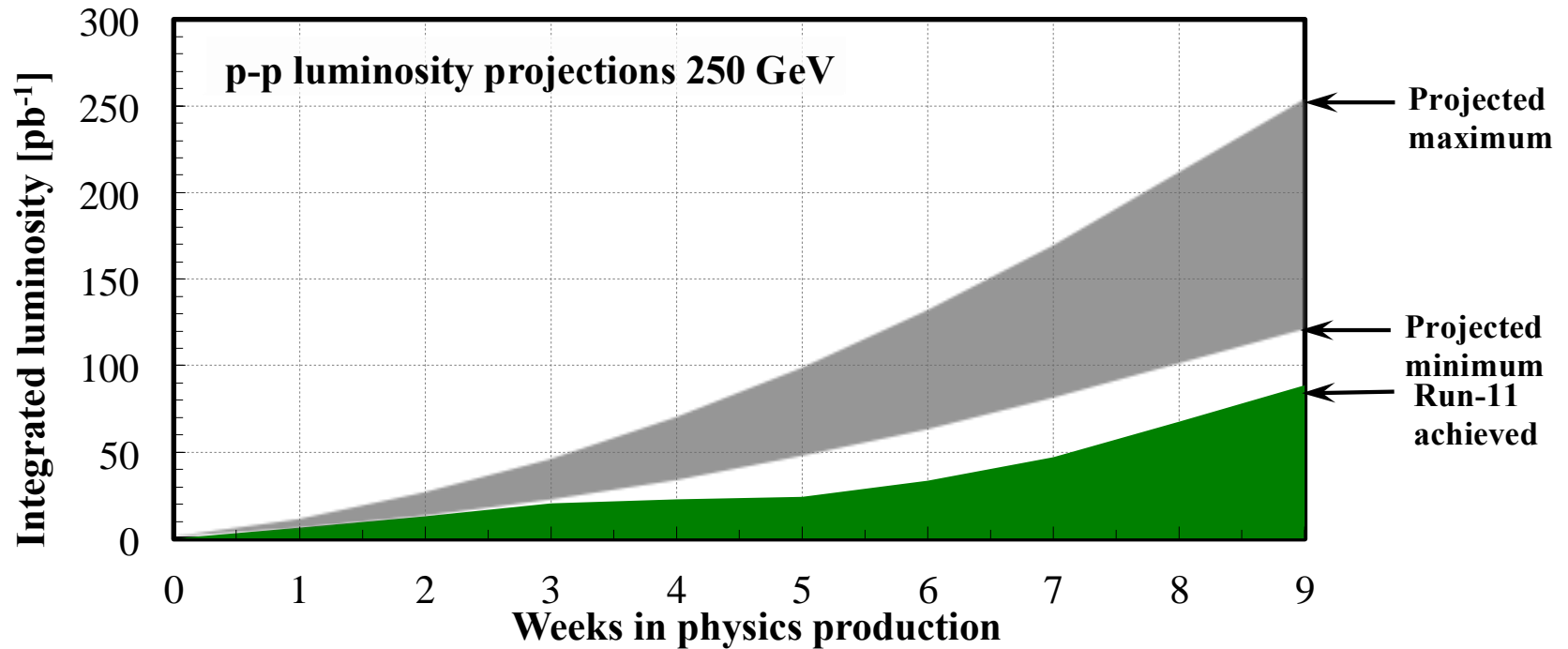


Figure 4: Projected minimum and maximum integrated luminosities for polarized proton collisions at 250 GeV beam energy, assuming linear weekly luminosity ramp-up in 8 weeks. An average store polarization between 45 and 50% is expected.

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

14 October 2011

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

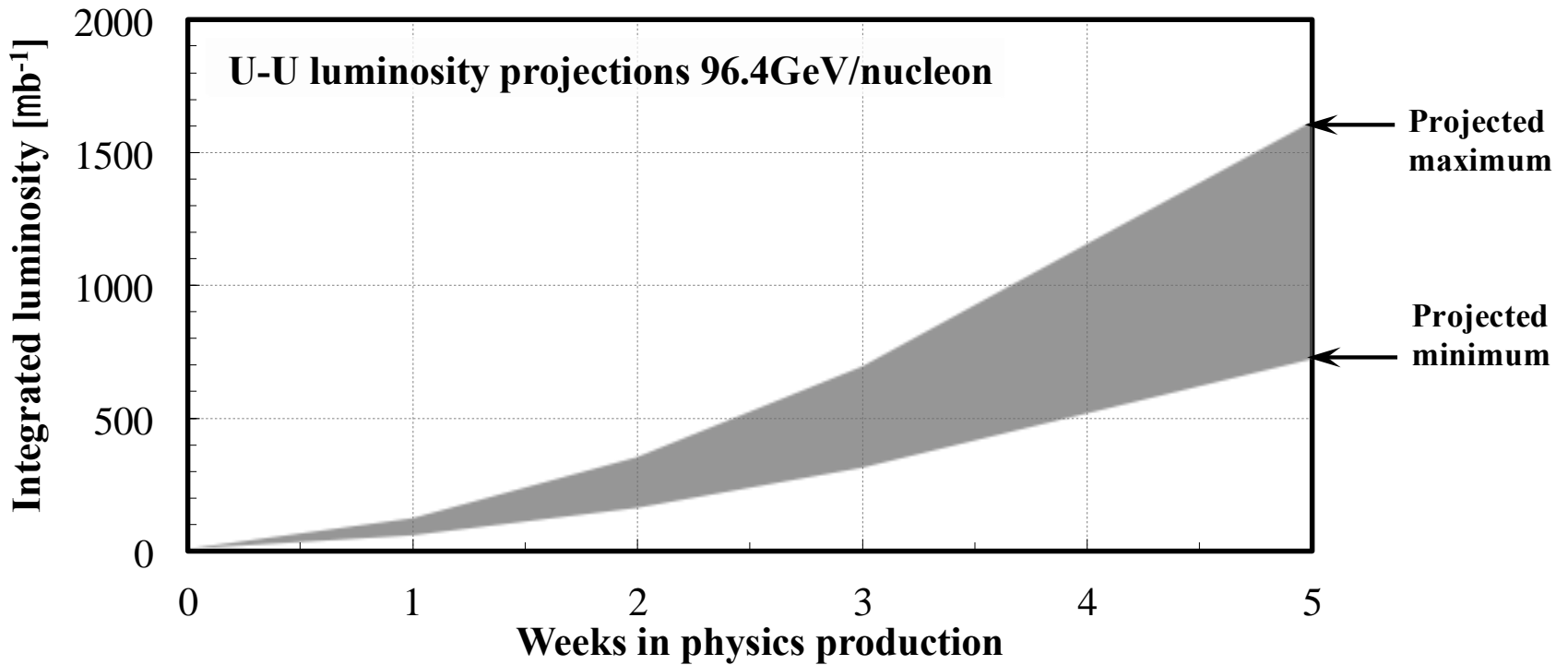


Figure 5: Projected minimum and maximum integrated luminosities for uranium-uranium at 96.4 GeV/nucleon, assuming linear weekly luminosity ramp-up in 48 weeks.

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

14 October 2011

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

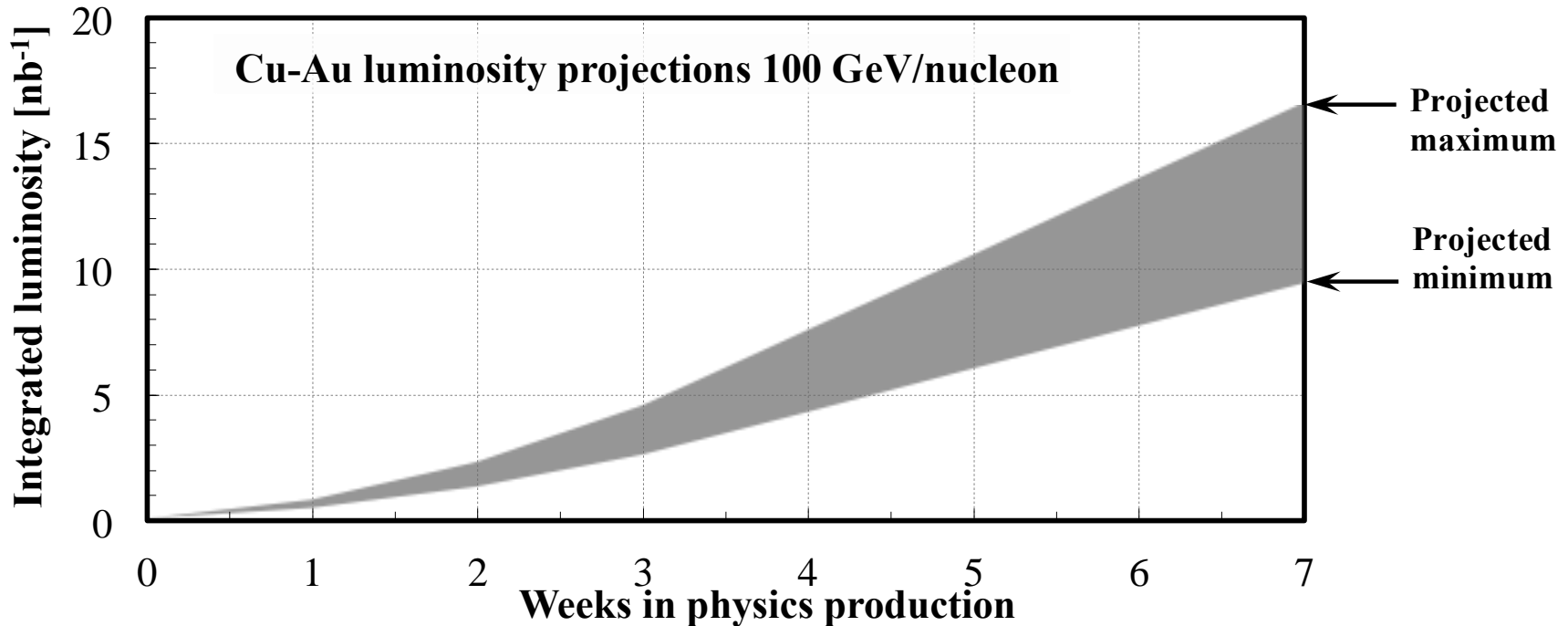


Figure 6: Projected minimum and maximum integrated luminosities for copper-gold collisions at 100 GeV/nucleon beam energy, assuming linear weekly luminosity ramp-up in 4 weeks.

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

14 October 2011