

# Run 12 RHIC Machine/Experiments Meeting

1 May 2012

## Agenda:

- Status reports
- Other business

**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  $\frac{1}{2}$  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
  - 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
- Uranium-Uranium/Cu-Au/Au-Au plan (subject to change)

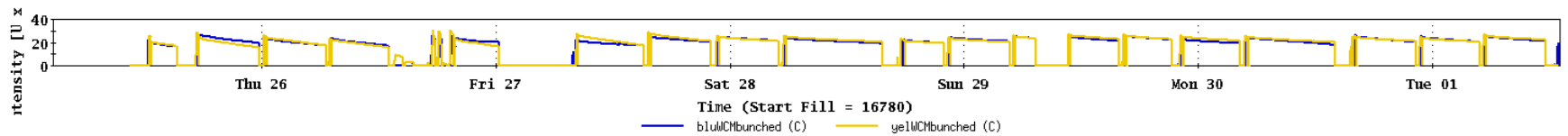
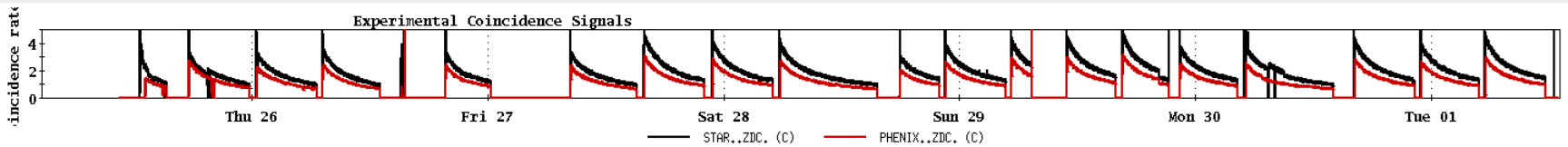
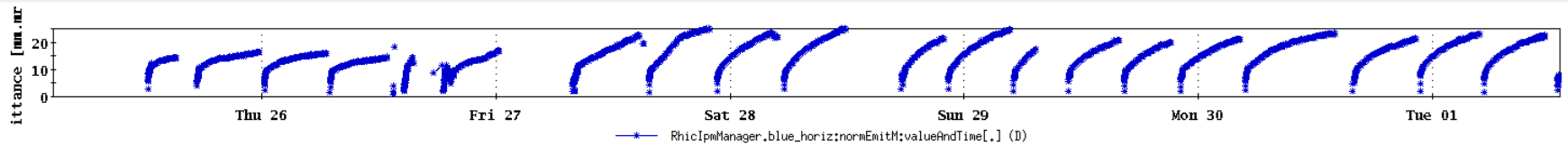
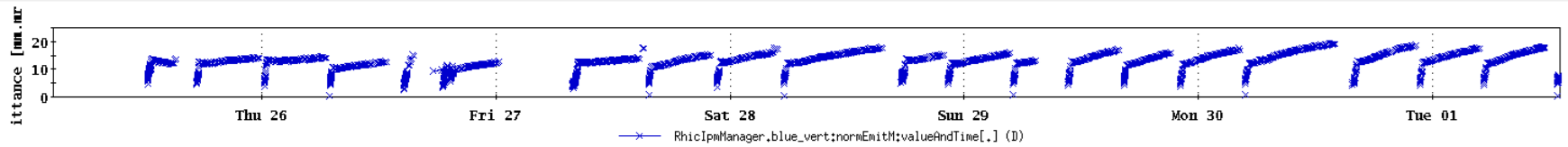
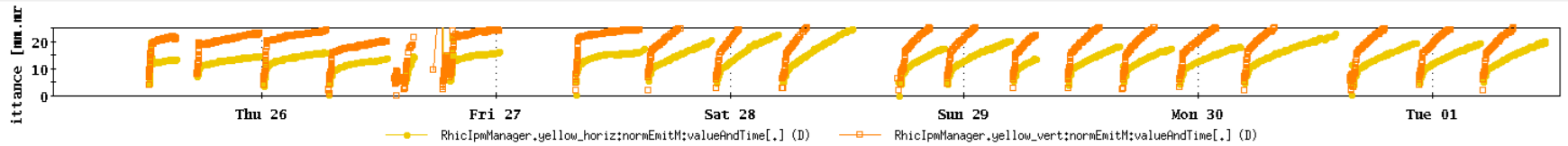
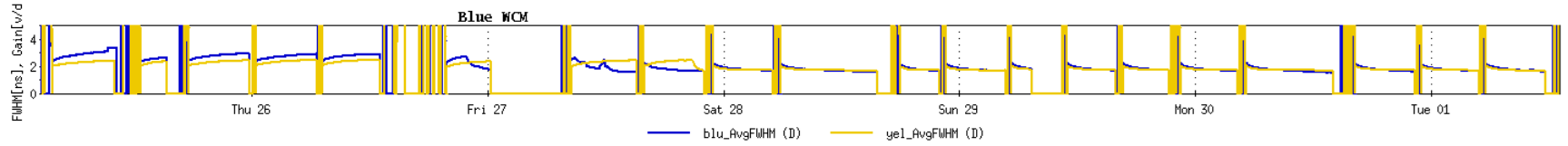
**STAR request for ~2 day  $\sqrt{s} = 5$  GeV/n AuAu development run is pending**

- 19 April (Thursday), begin 1 week setup for UU
- 22 April (evening) first overnight stores for experiments
- 25 April (Wednesday, store 16580), begin 3 week UU physics run
- **Today – 1 May**
- 16 May (Wednesday) 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 = 17.7**

# All UU physics stores, 16870 through 16807, 25 April – 1 May

File Window Markers Analysis



**Table 2: Maximum luminosities that can be reached after a sufficiently long running period. For ion operation numbers are given for a beam energy of 100 GeV/nucleon. For polarized proton operation the beam energy is stated.**

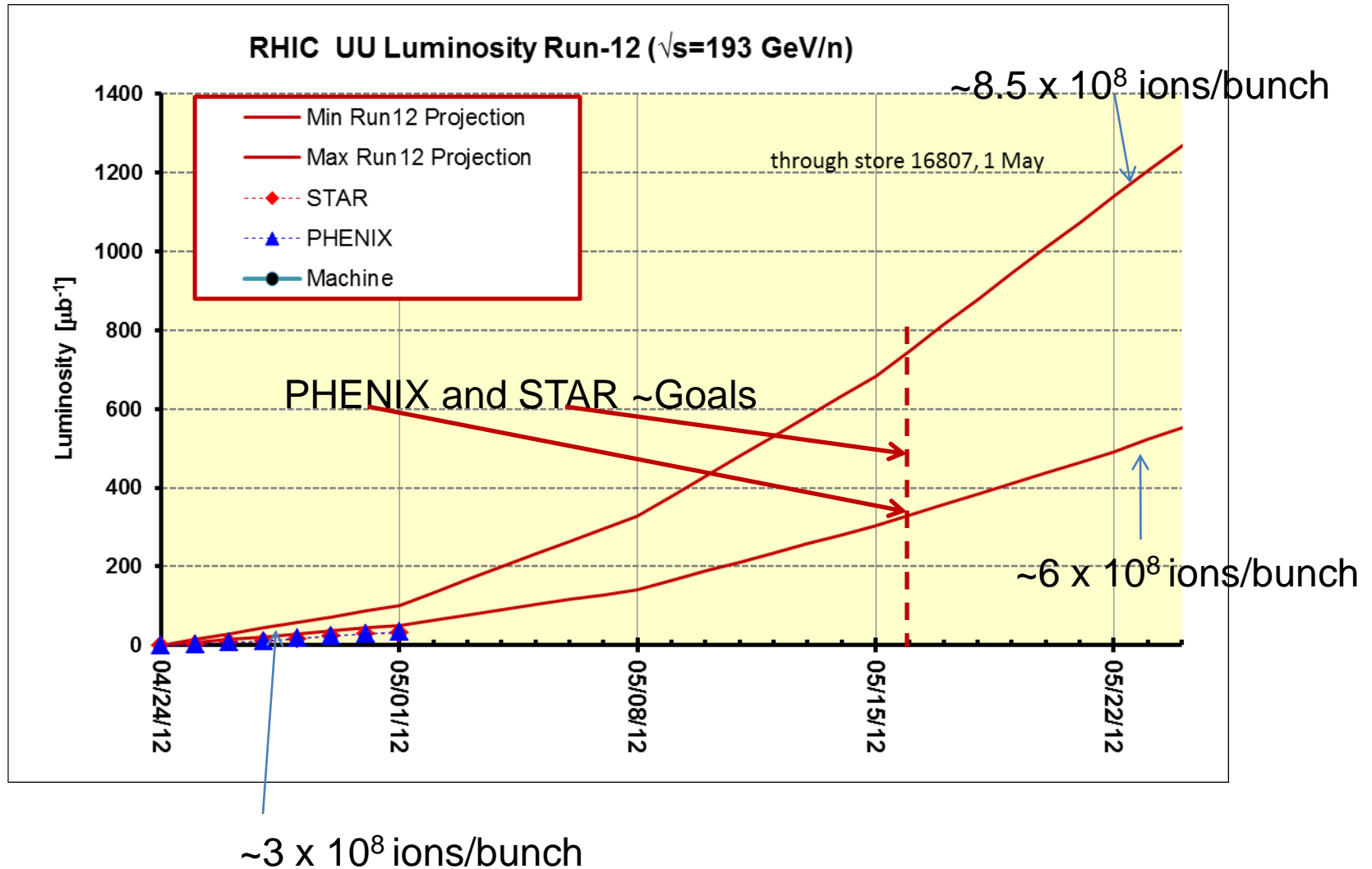
Mode	No of colliding bunches	Ions/bunch [10 <sup>9</sup> ]	$\beta^*$ [m]	Emittance [ $\mu\text{m}$ ]	$L_{\text{peak}}$ [ $\text{cm}^{-2}\text{s}^{-1}$ ]	$L_{\text{store avg}}$ [ $\text{cm}^{-2}\text{s}^{-1}$ ]	$L_{\text{week}}$
U-U	111	0.85	0.75	15-10	$20 \times 10^{26}$	$14 \times 10^{26}$	$0.5 \text{ nb}^{-1}$
Au-Au	111	1.3	0.75	15-10	$50 \times 10^{26}$	$35 \times 10^{26}$	$1.1 \text{ nb}^{-1}$
Cu-Cu	68	6.0	0.75	15-20	$8 \times 10^{28}$	$5 \times 10^{28}$	$16 \text{ nb}^{-1}$
Cu-Au	111	4.0Cu/1.3Au	0.85	15-20	$1.7 \times 10^{28}$	$1.0 \times 10^{28}$	$3.1 \text{ nb}^{-1}$
d-Au	111	110d/1.1Au	0.85	18-30	$30 \times 10^{28}$	$18 \times 10^{28}$	$60 \text{ nb}^{-1}$
$p \uparrow - p \uparrow^*$ 100 GeV	107	135	0.85	15-20	$50 \times 10^{30}$	$30 \times 10^{30}$	$10 \text{ pb}^{-1}$
$p \uparrow - p \uparrow^*$ 250 GeV	107	165	0.6	20-25	$200 \times 10^{30}$	$120 \times 10^{30}$	$40 \text{ pb}^{-1}$

\* We expect that an intensity-averaged store polarization  $P$  of up to about 60%, as measured by the H jet, can be reached at 100 GeV. At 250 GeV we expect the polarization  $P$  to reach about 55%. In Run-11 PHENIX had 107 and STAR 102 colliding bunches.

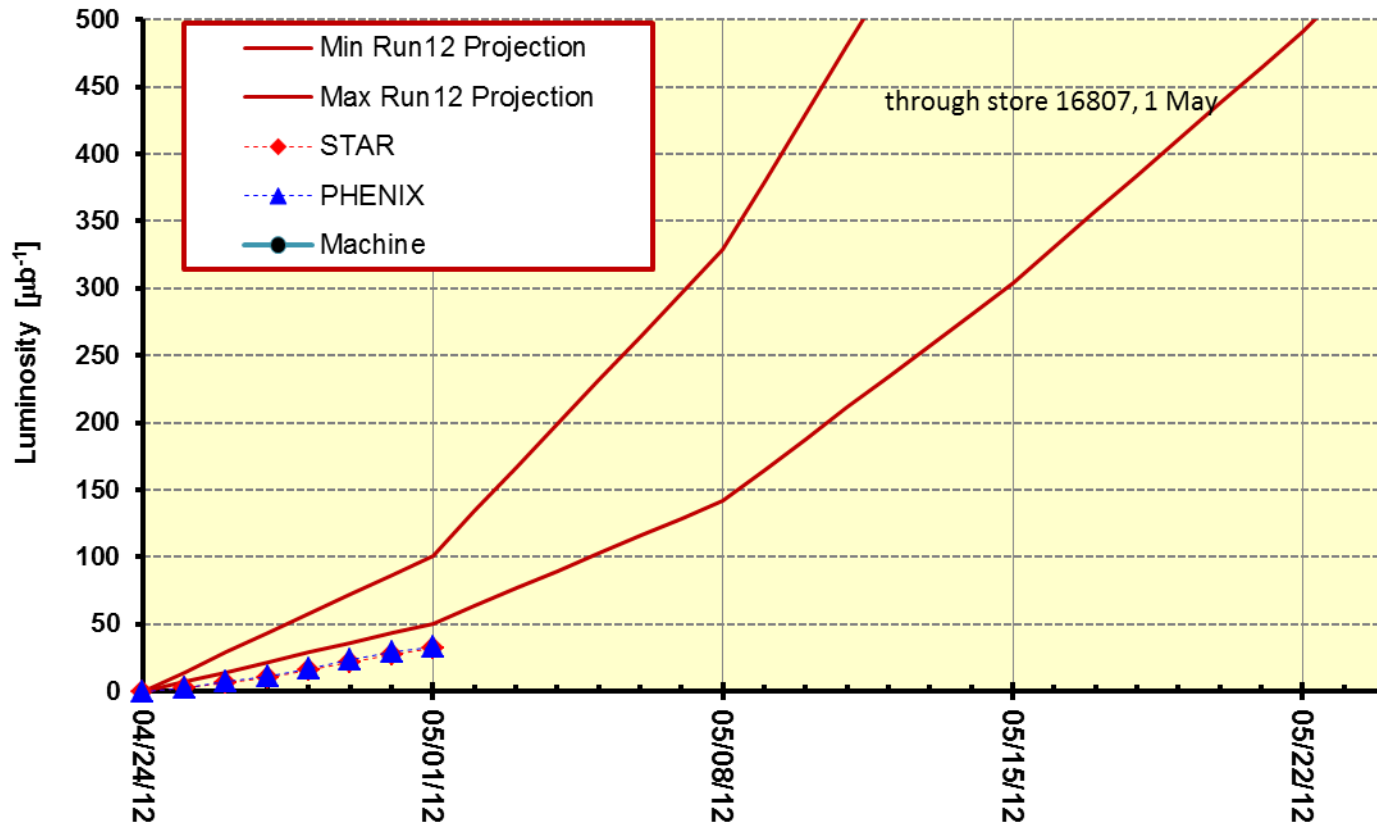


Minimum goal after 4 weeks of physics operations for UU in RHIC  
 →  $6 \times 10^8$  ions/bunch with above U-U parameters

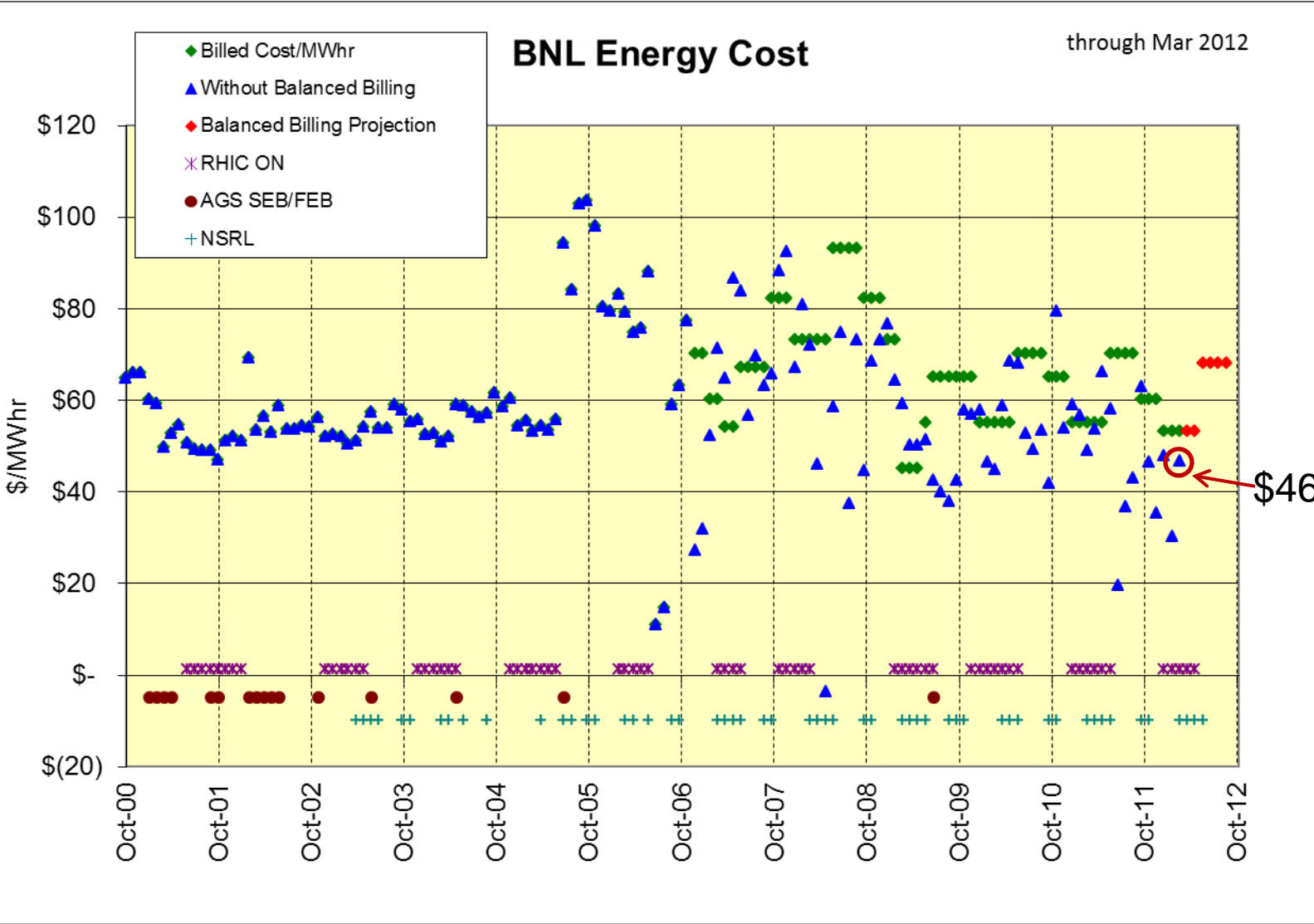
Best to date =  $\sim 2.3 \times 10^8$  ions/bunch, blue/yellow beginning of store (physics)



### RHIC UU Luminosity Run-12 ( $\sqrt{s}=193$ GeV/n)



\$ in BNL Balanced Billing Bank for FY12 (through Mar) = +\$2,034K



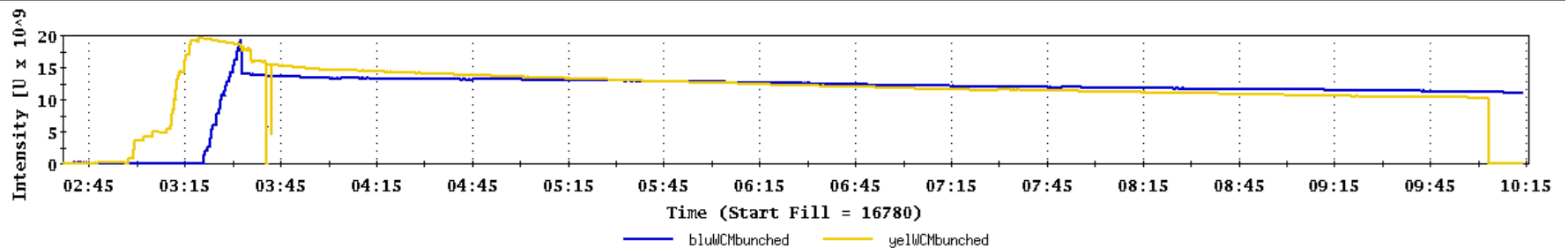
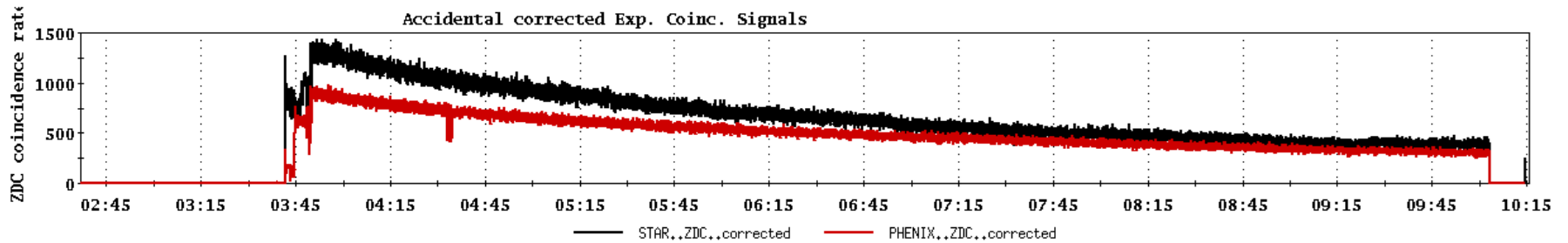
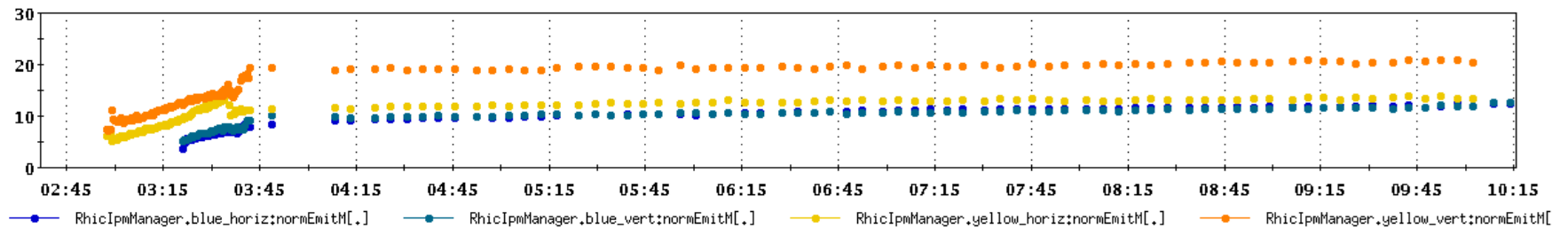
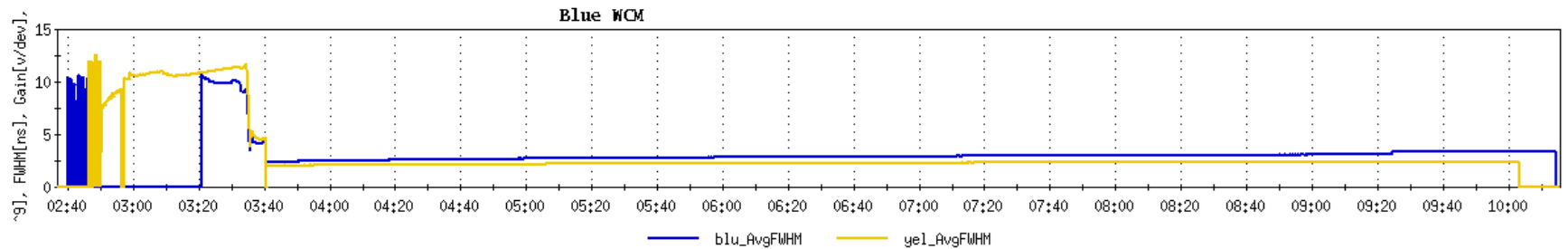
\$46/MWhr

Other Slides



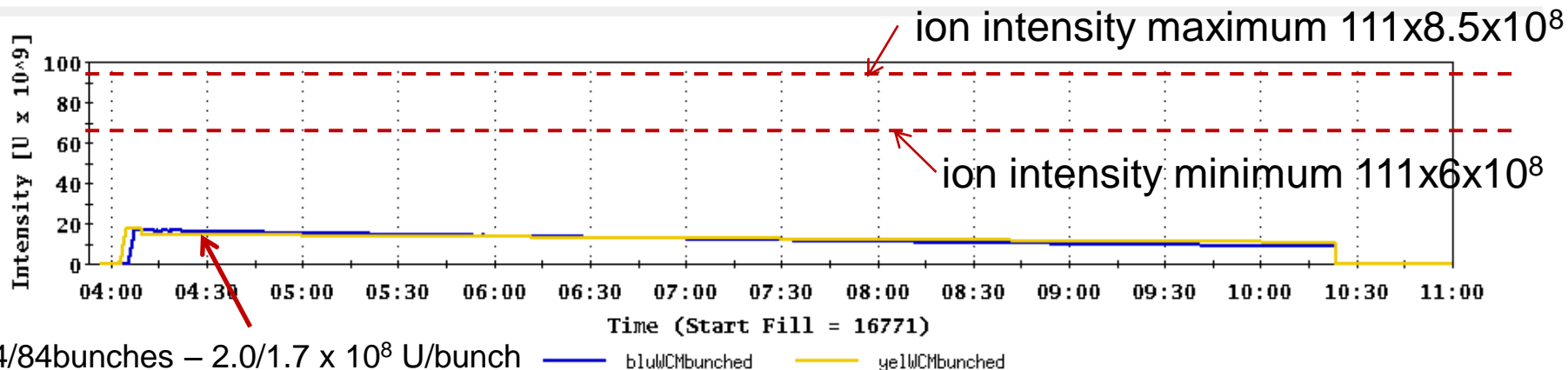
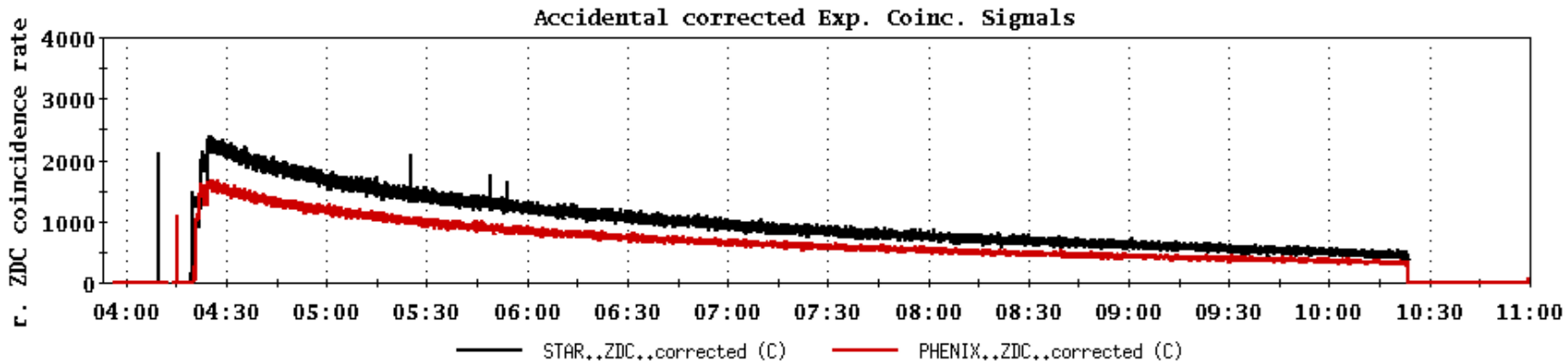
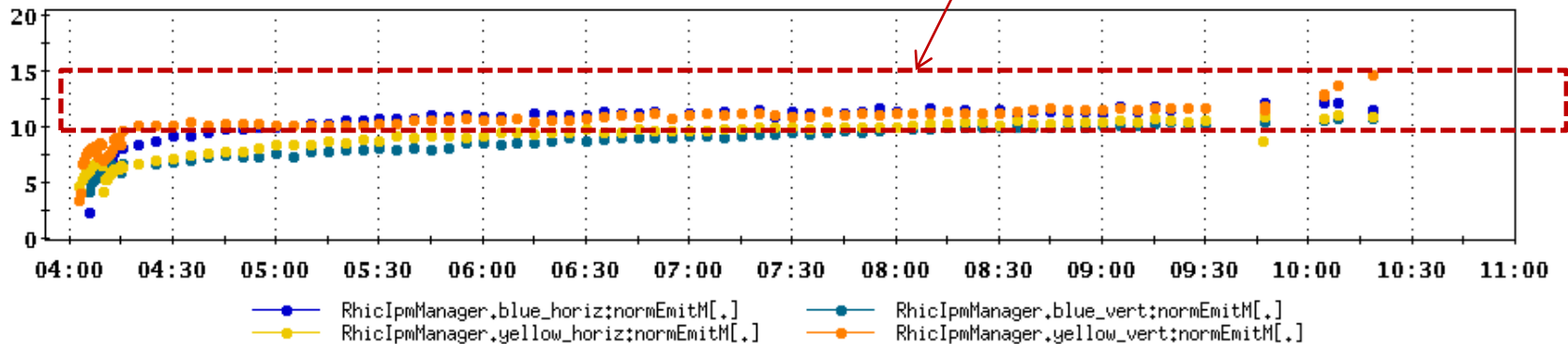
# First UU physics store, 16780, 25 April

File Window Markers Analysis



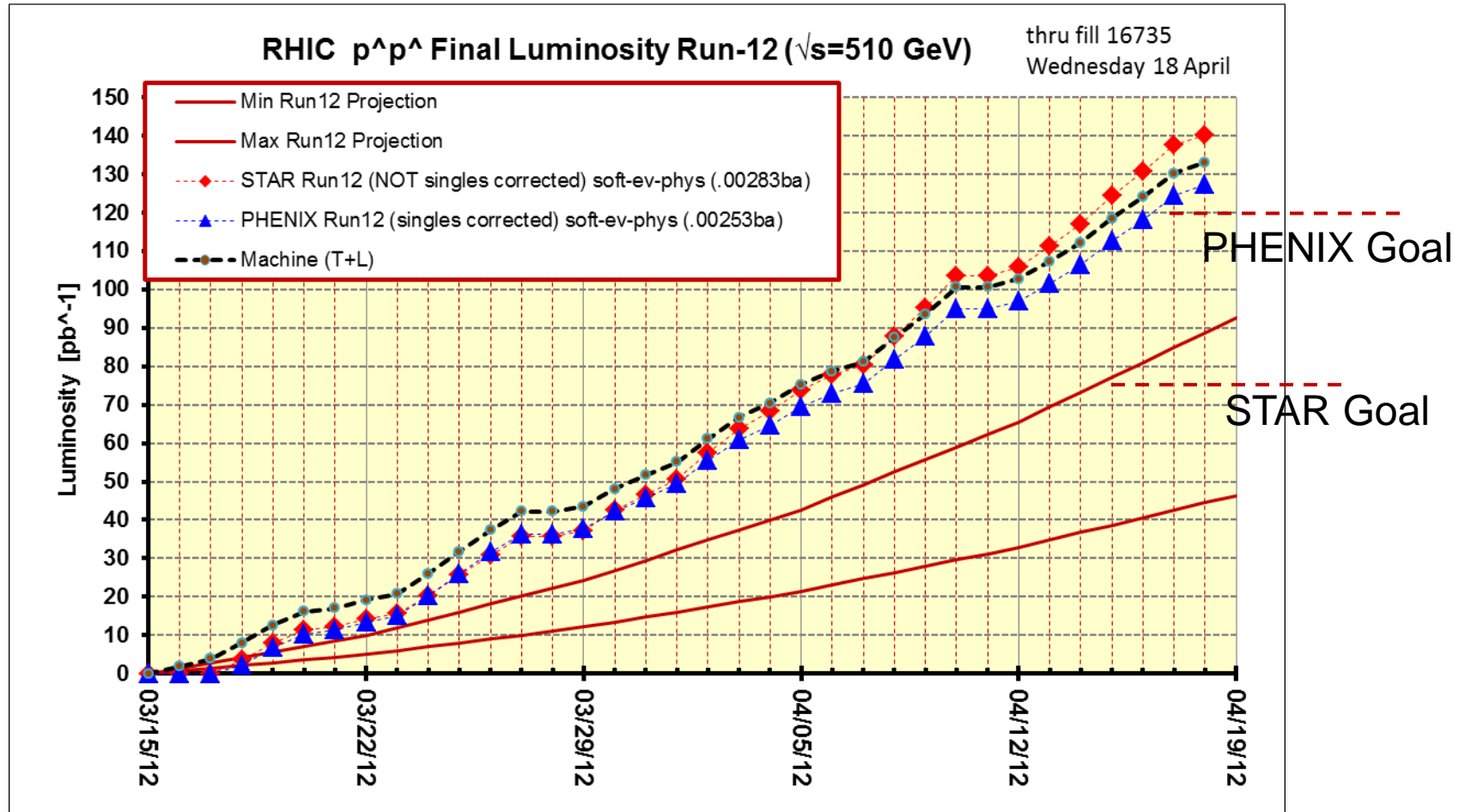
Setup Store, no rebucketing yet...

Transverse emittance projection

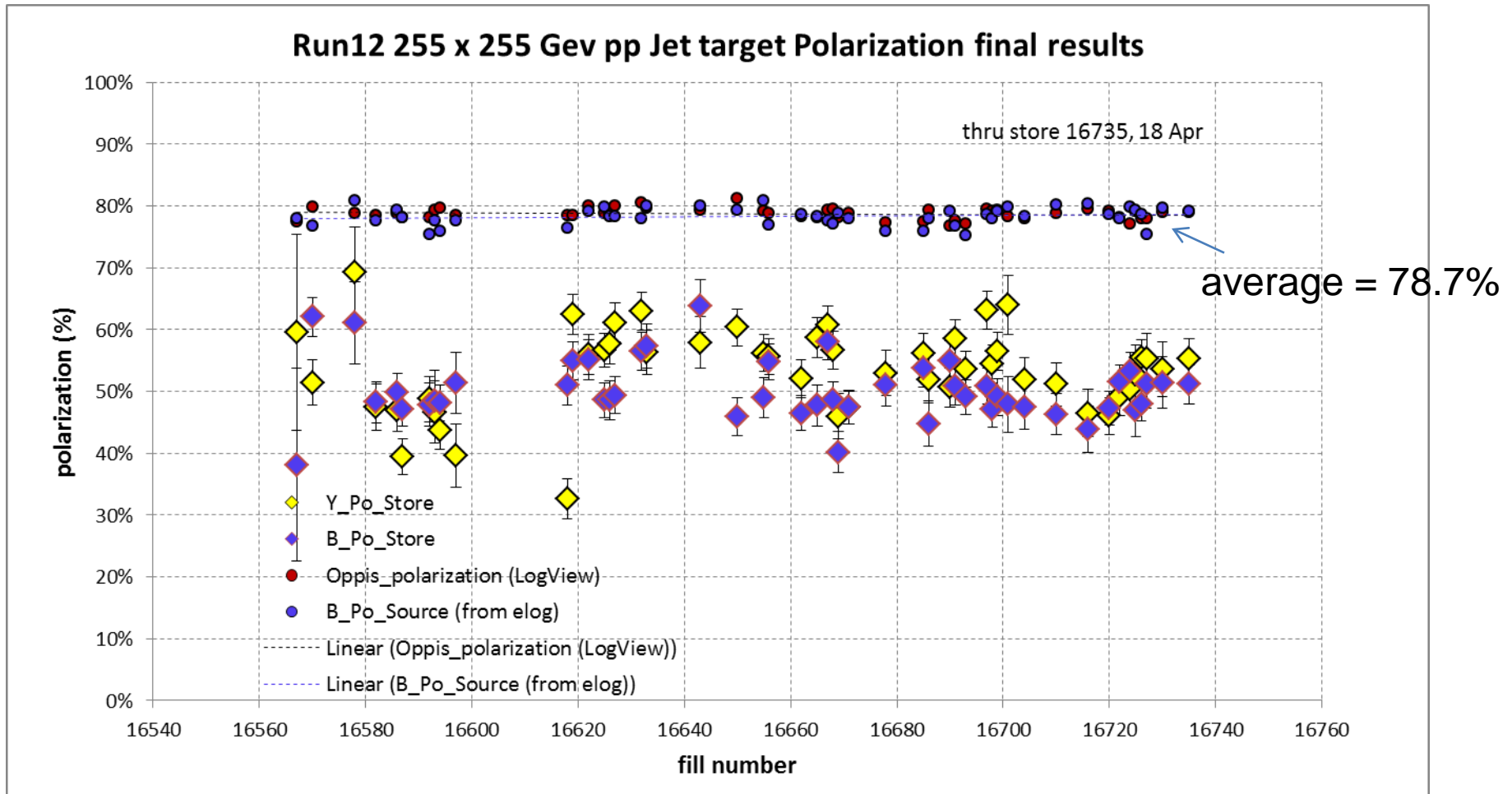


84/84bunches –  $2.0/1.7 \times 10^8 U/bunch$

Thru final store, 16735, 18 Apr



Blue beam at injection jet target result = ? %

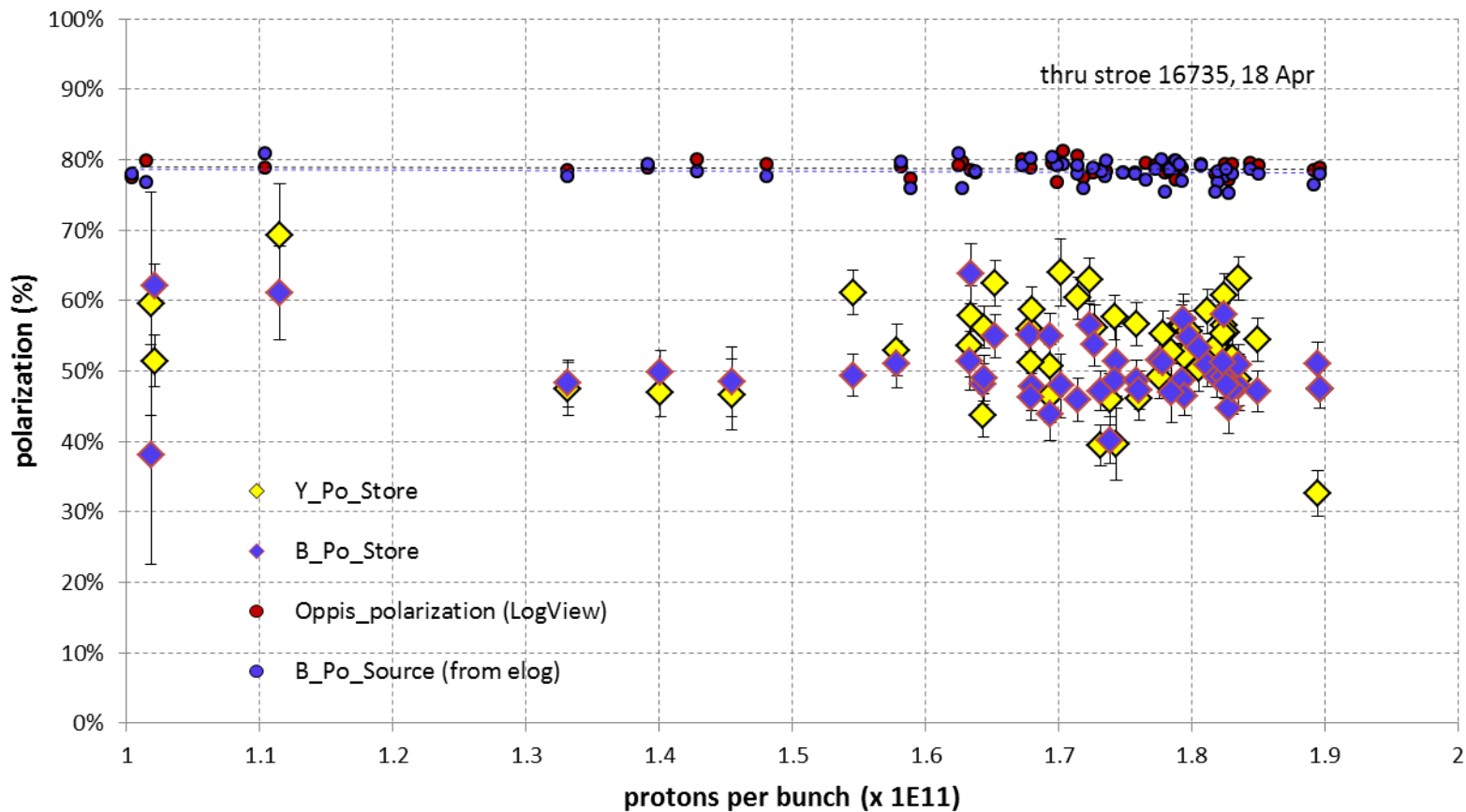


Blue weighted average =  $50.3\% \pm 0.5\%$

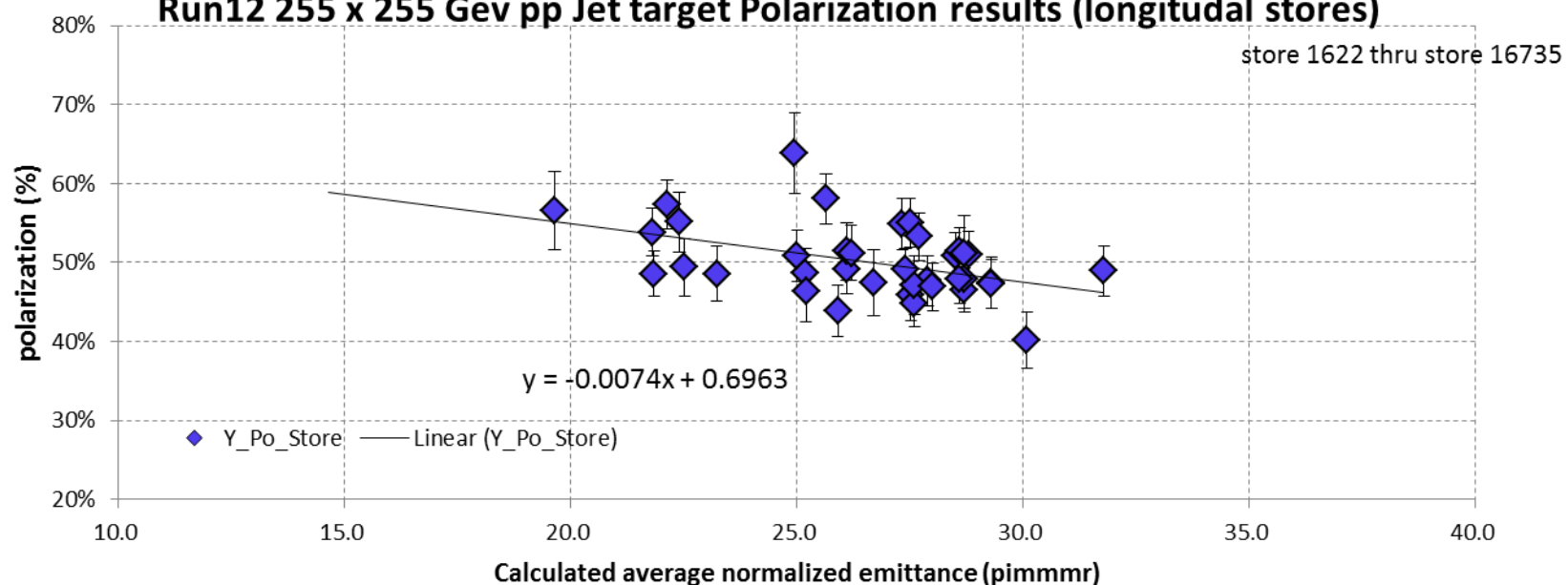
Yellow weighted average =  $53.4\% \pm 0.5\%$

# Run12 255 x 255 Gev pp Jet target Final Polarization final results

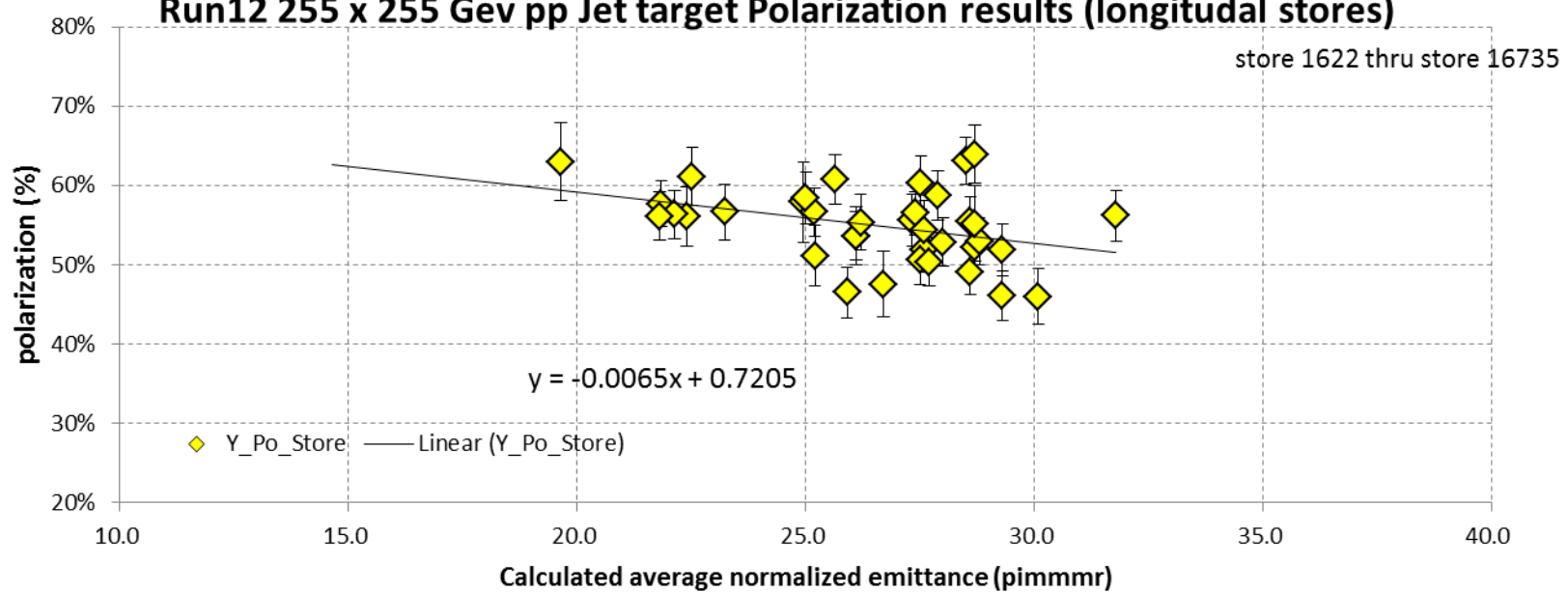
thru stroe 16735, 18 Apr



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



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



Where we are with Uranium (From K. Zeno)

Into the booster  $8 \times 10^8$  in 4 bunches

These are then combined into one bunch

Booster extraction  $6.5 \times 10^8$  / bunch

30% efficiency into the AGS

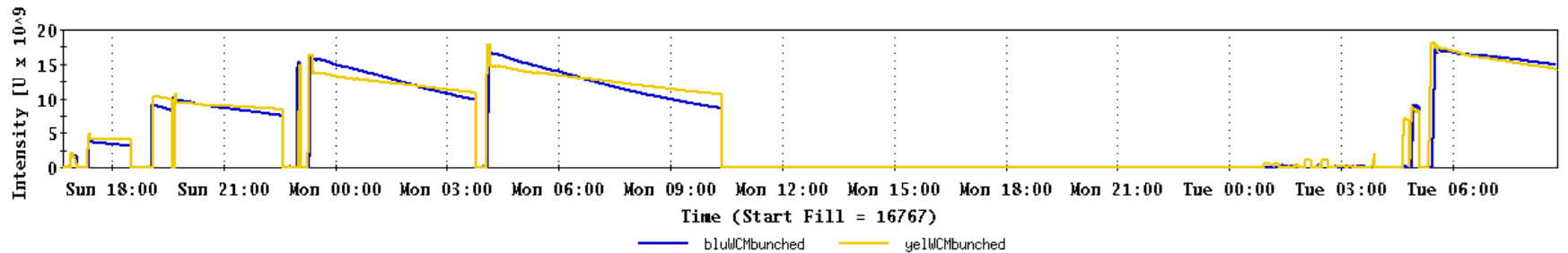
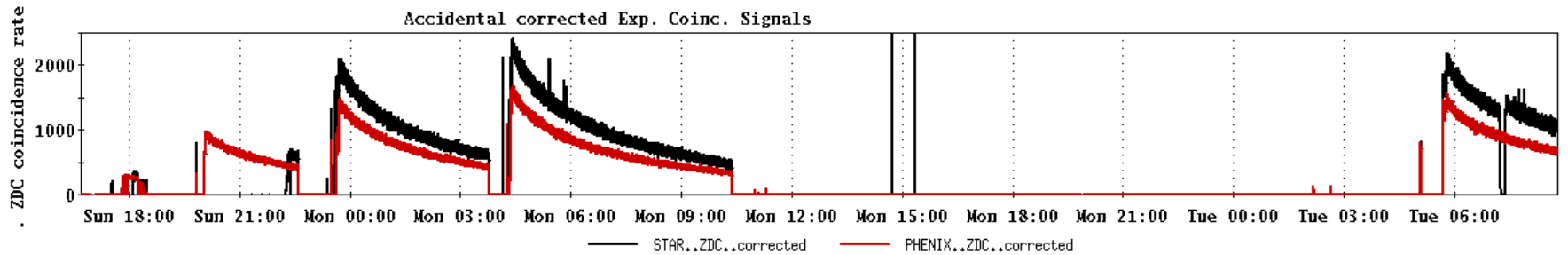
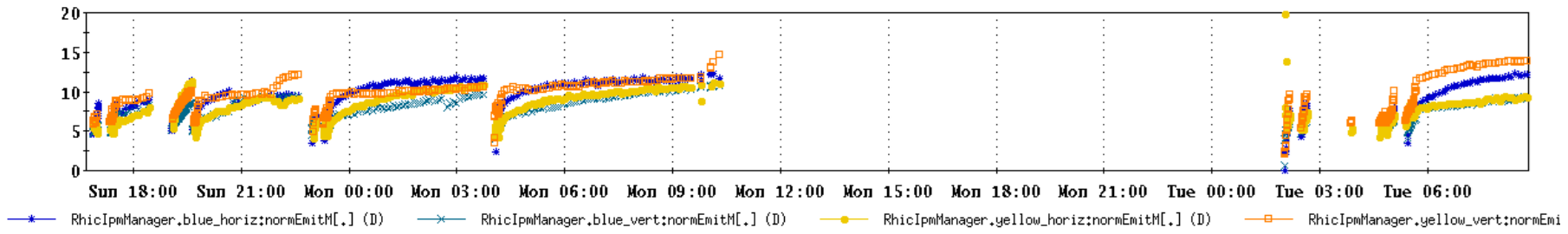
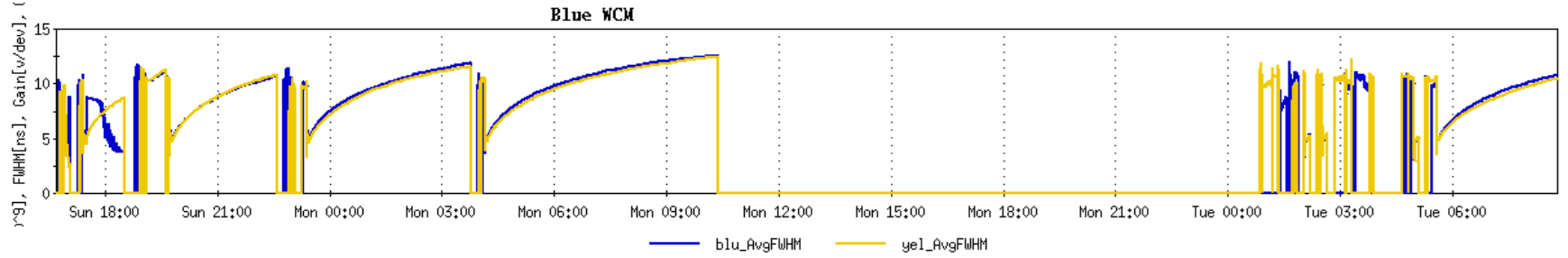
AGS extraction is at  $2 \times 10^8$  / bunch

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

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

# Setup Stores, no rebucketing yet... $\sqrt{s} = 193$ GeV/n UU – stores 16769 through 16775

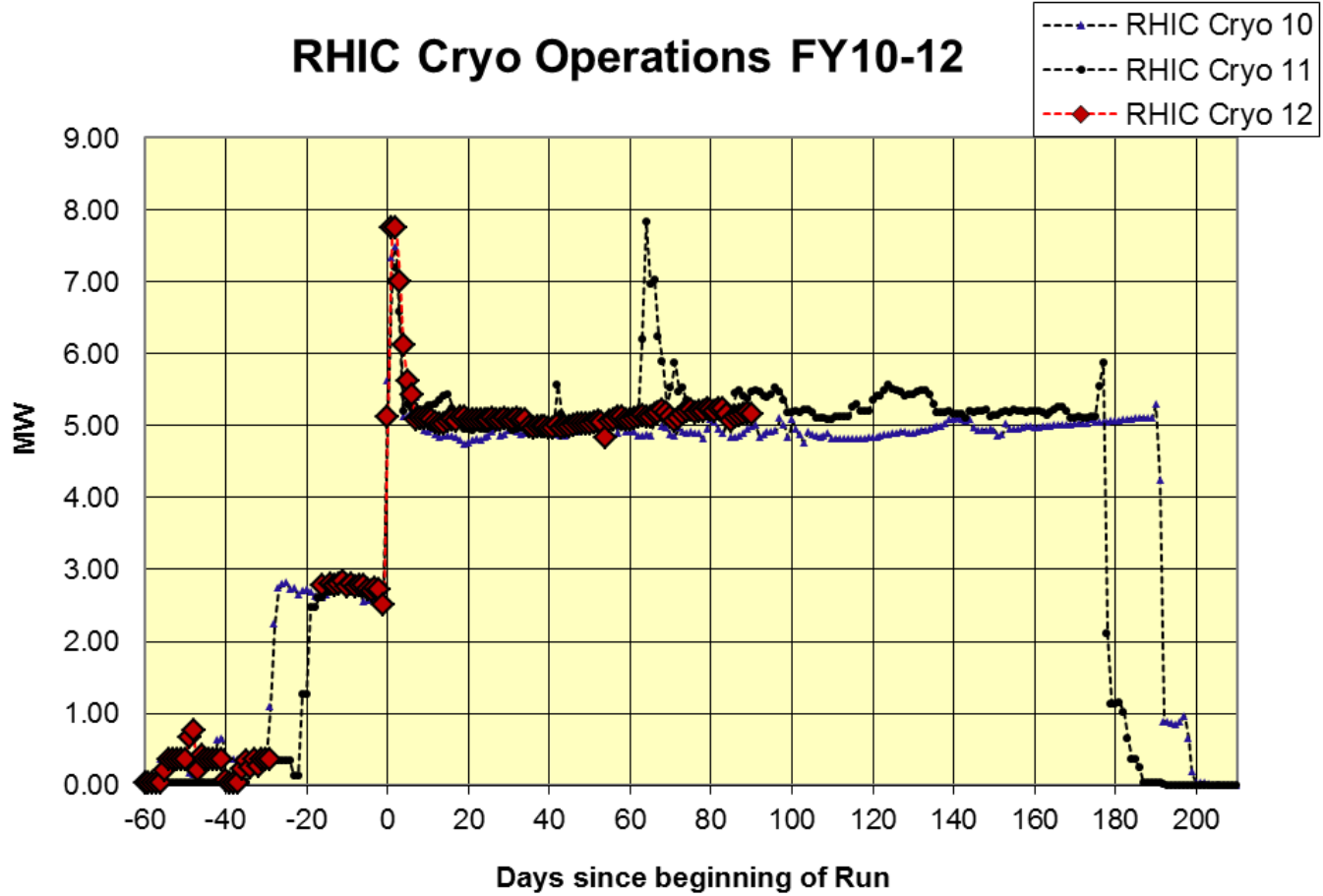
FILE WINDOW MARKERS ANALYSIS



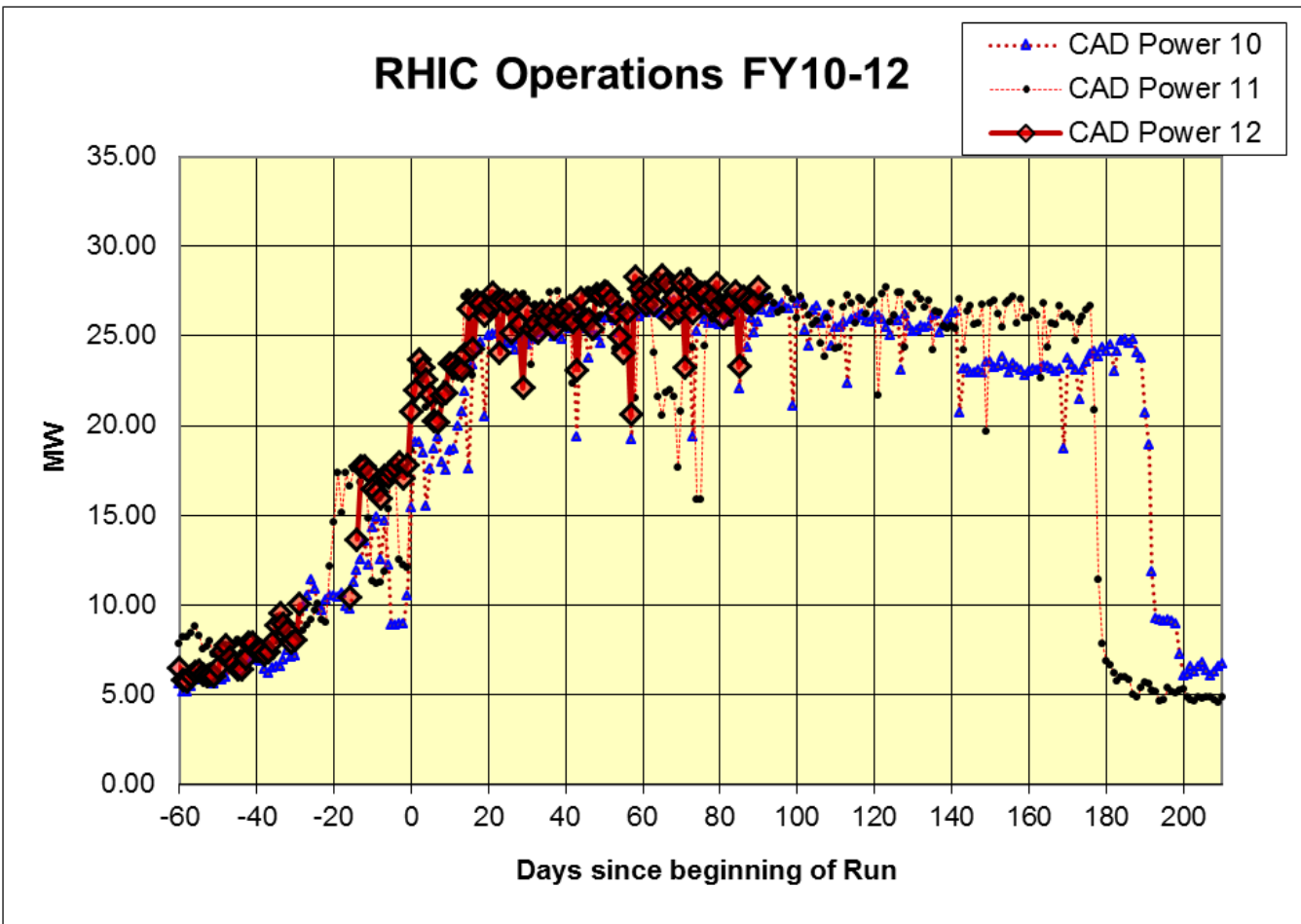


As of 16 Apr 2012

### RHIC Cryo Operations FY10-12

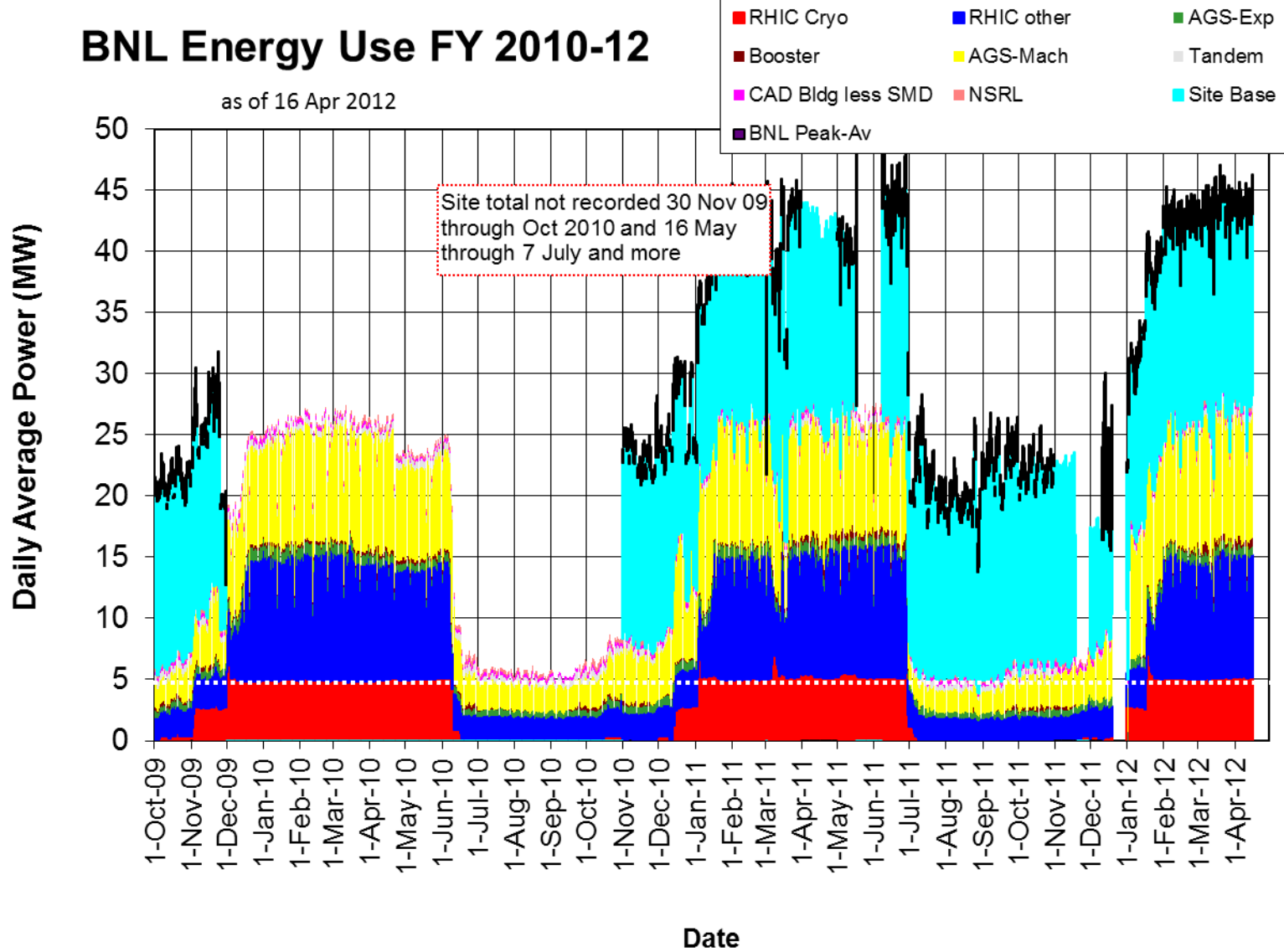


As of 16 Apr 2012



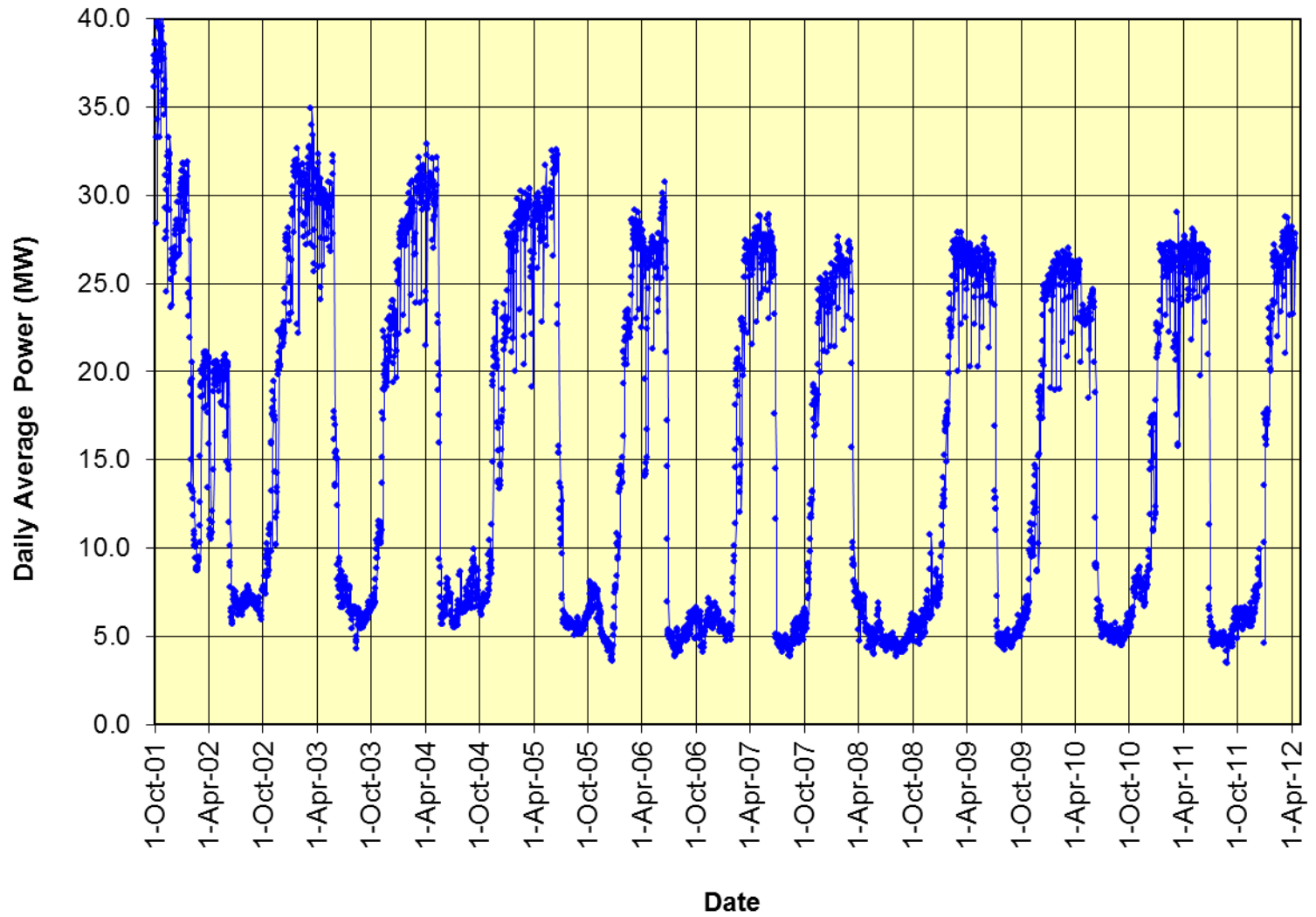
# BNL Energy Use FY 2010-12

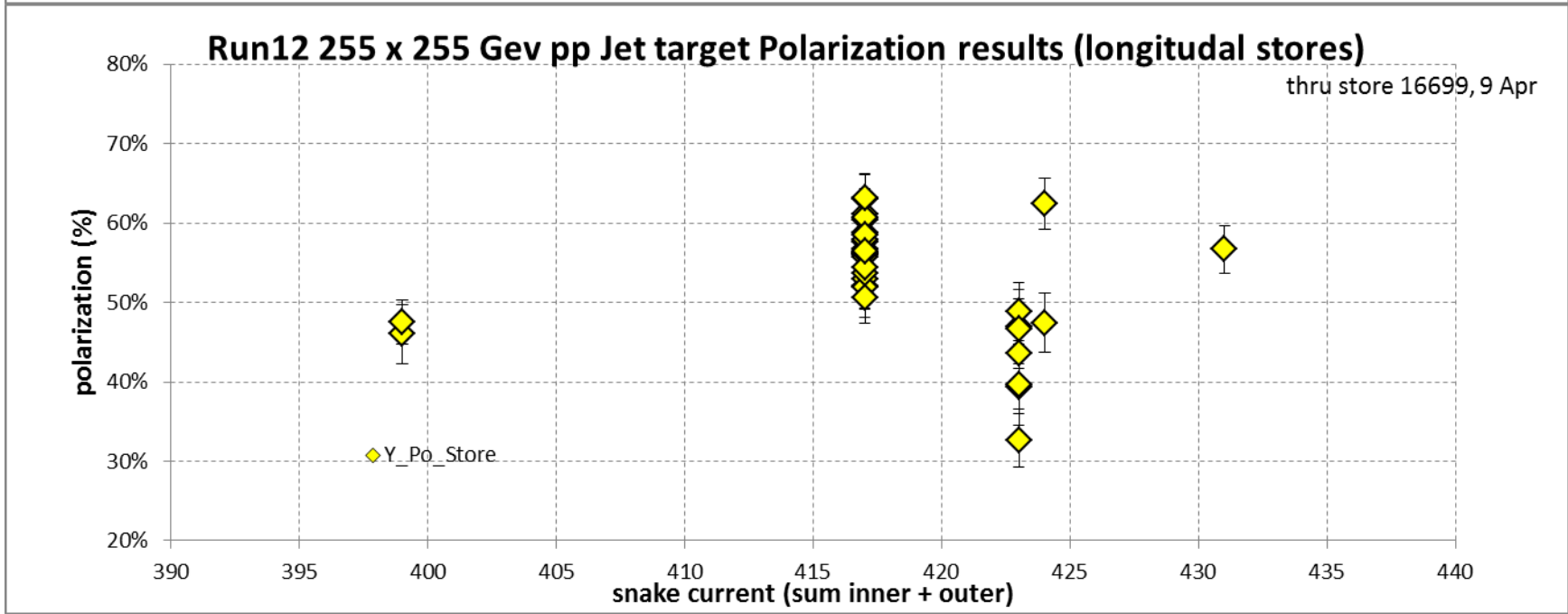
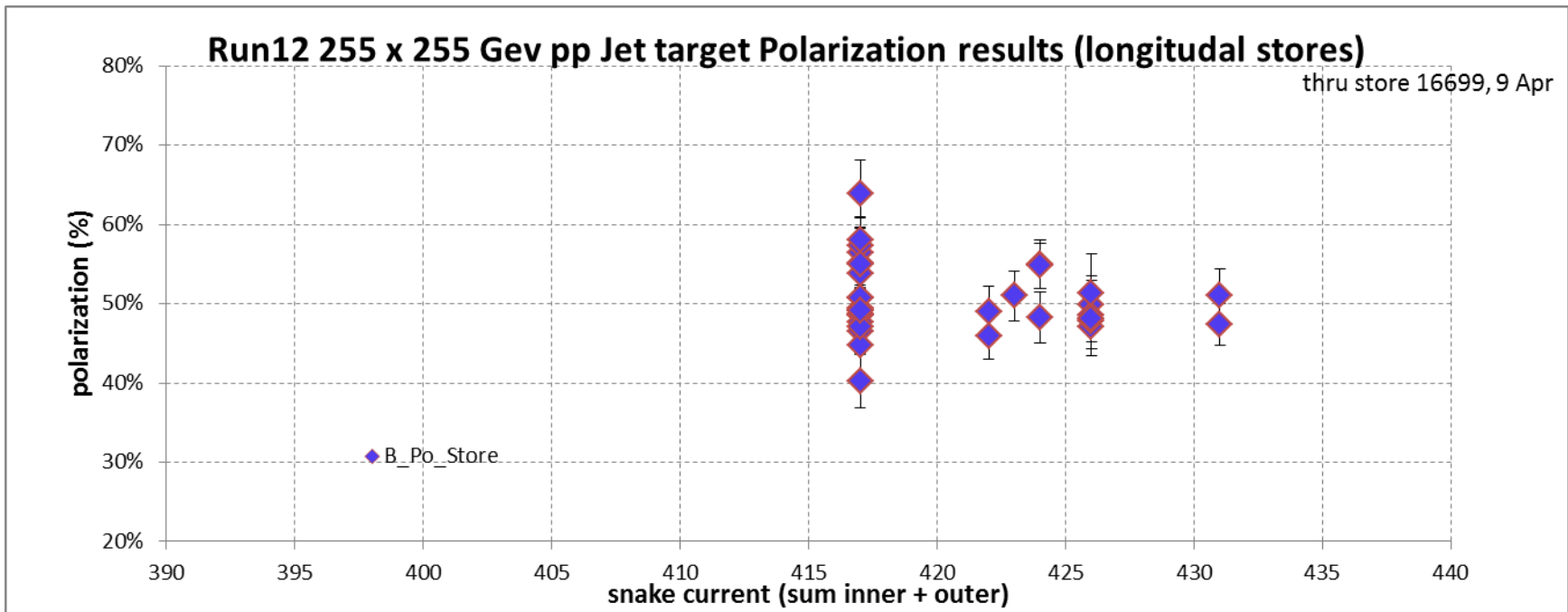
as of 16 Apr 2012



As of 16 Apr 2012

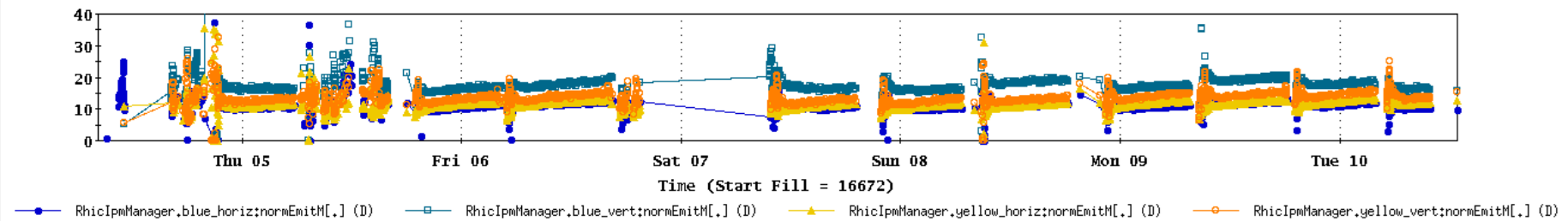
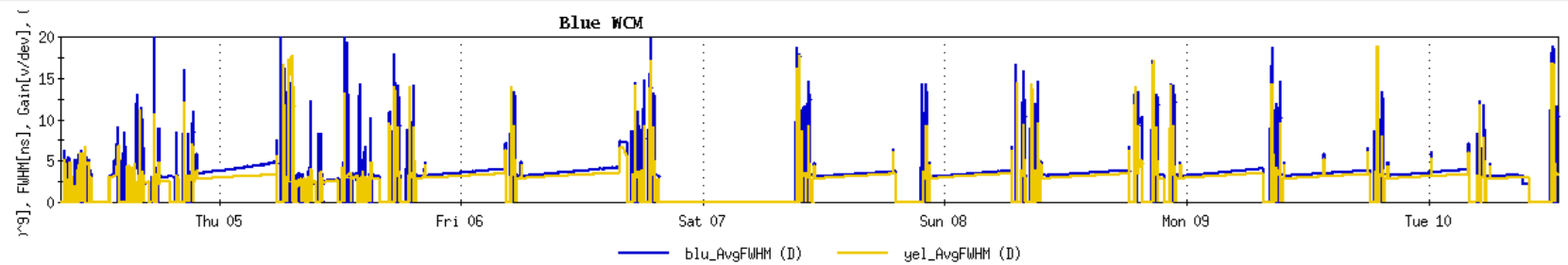
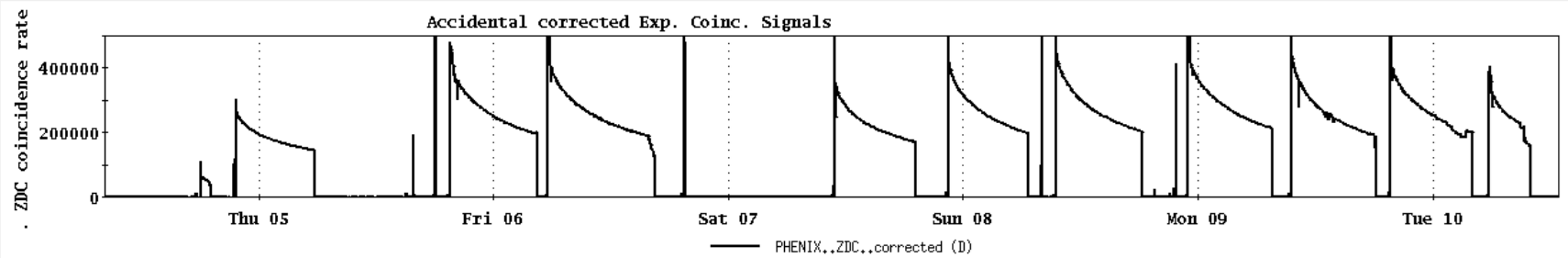
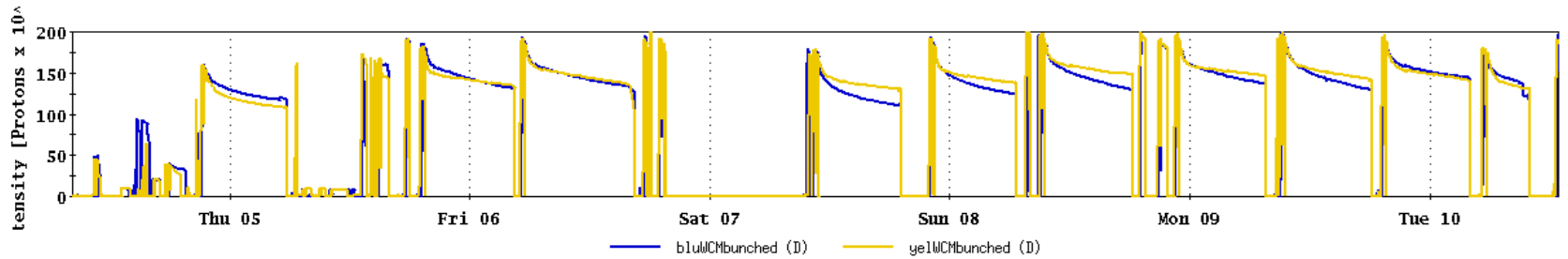
## C-AD Energy Use FY 2002-12








# 4 Apr – 10 Apr stores

File Window Markers Analysis

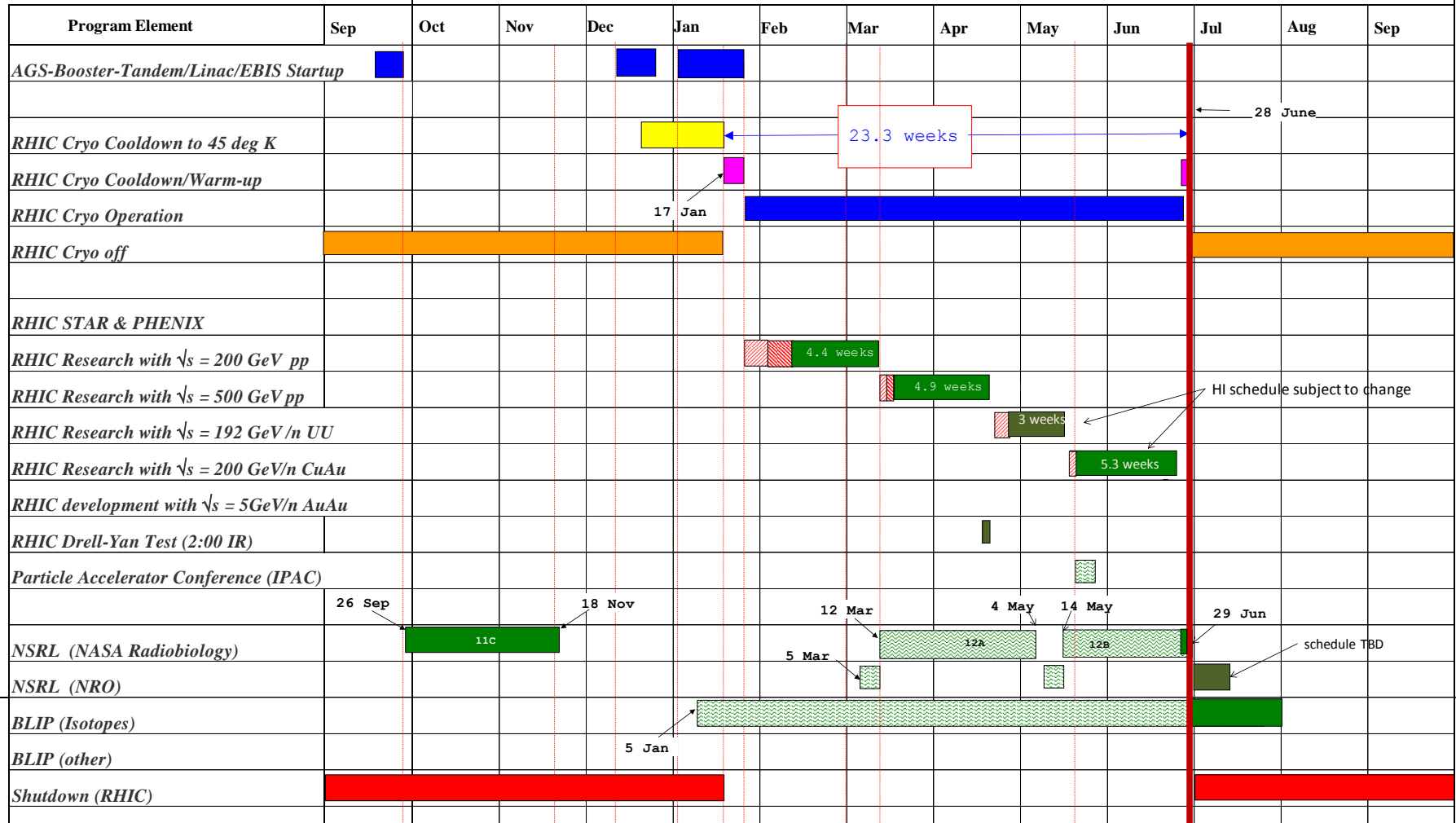


# C-A Operations-FY12

*in progress/planned*

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

FY 2012



23.3 weeks

28 June

HI schedule subject to change

schedule TBD

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

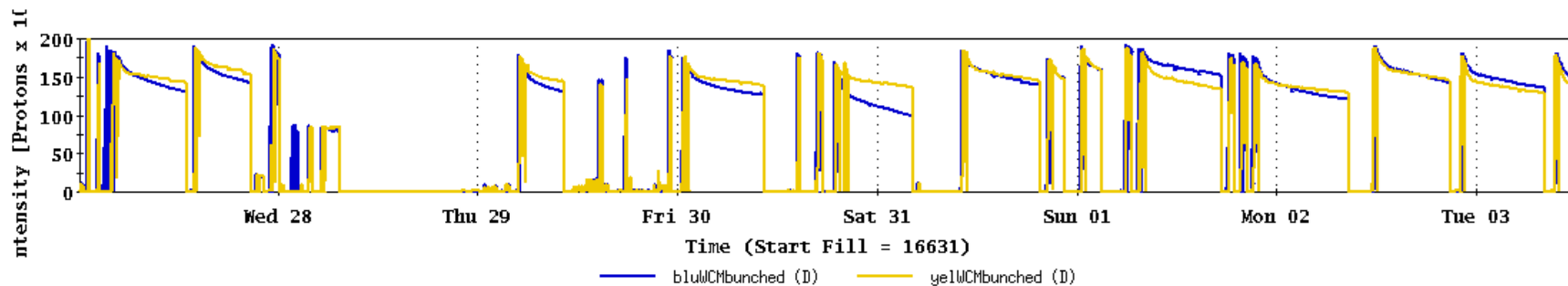
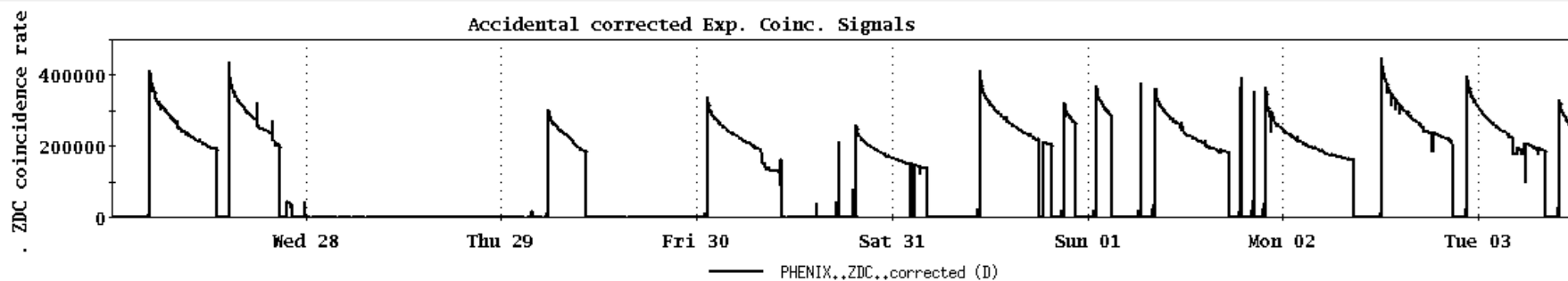
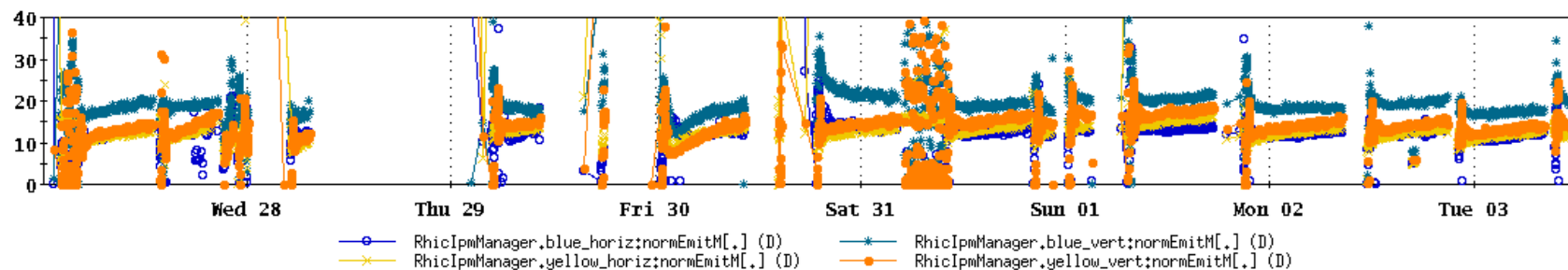
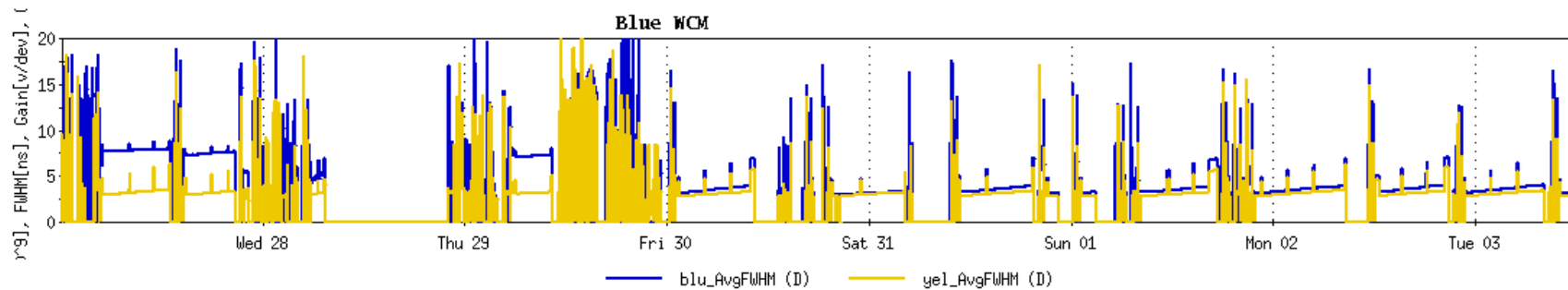
### **STAR Goal for 5 weeks longitudinal polarization (50% polarization):**

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

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

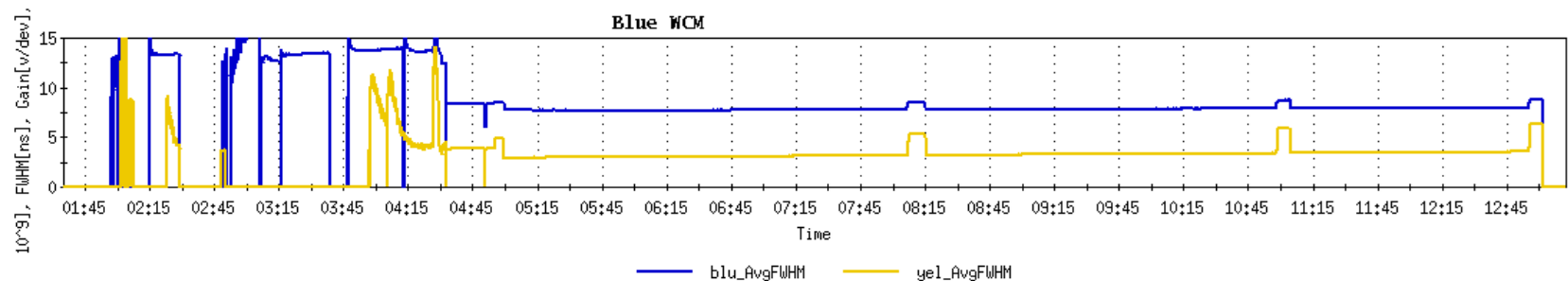
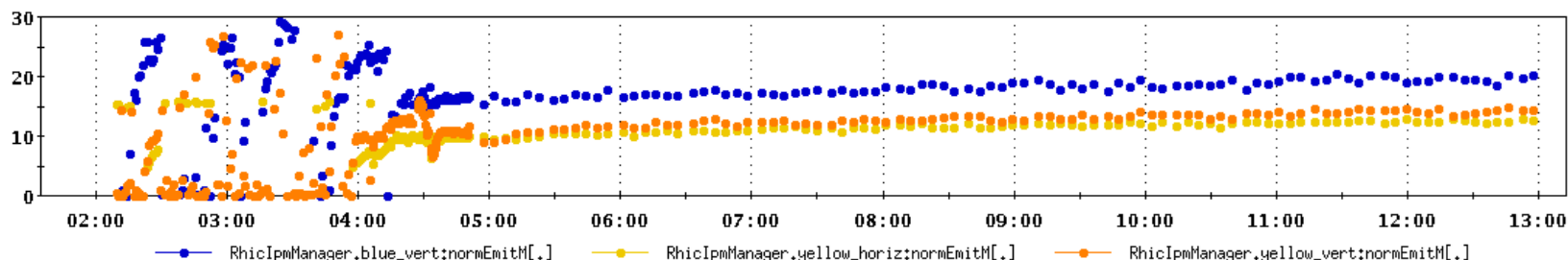
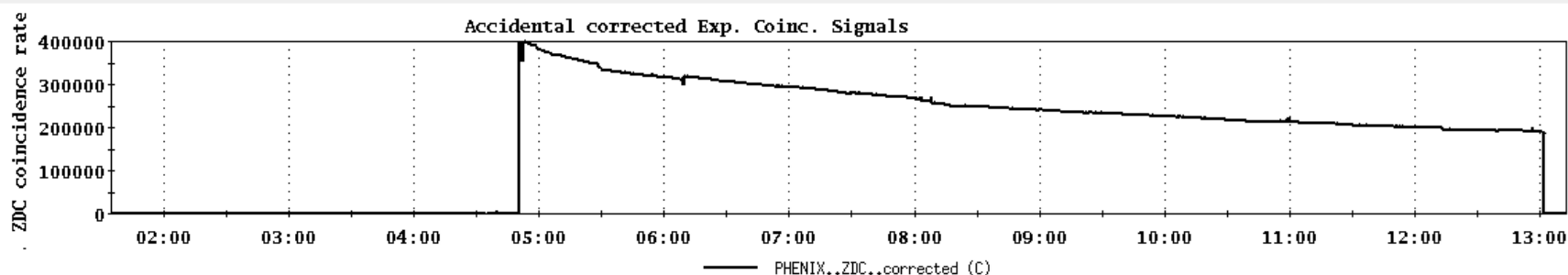
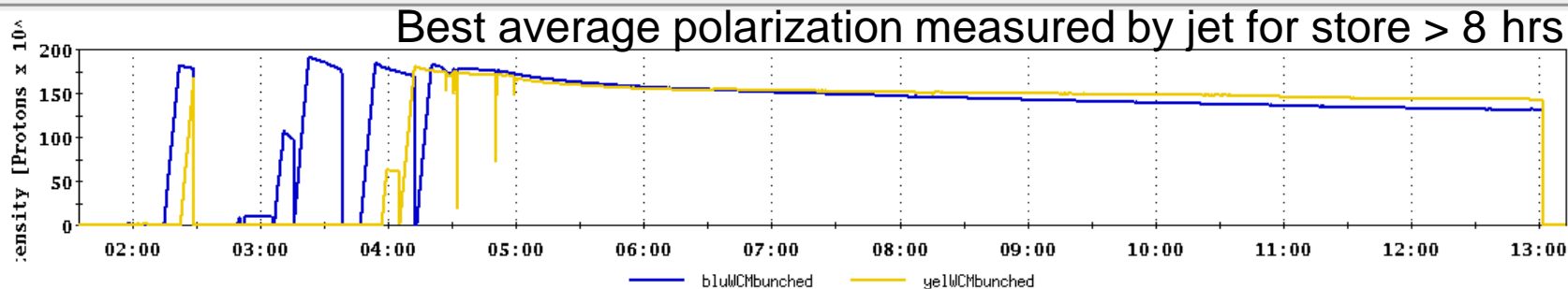
- Sampled Luminosity =  $30 \text{ pb}^{-1}$  with  $|z| < 30 \text{ cm}$   
=  $10 \text{ pb}^{-1}$  with  $|z| < 10 \text{ cm}$
- Delivered Luminosity =  ~~$75 \text{ pb}^{-1}$~~  changed to  $120 \text{ pb}^{-1}$ , 3/29/12, Ed O'Brien email



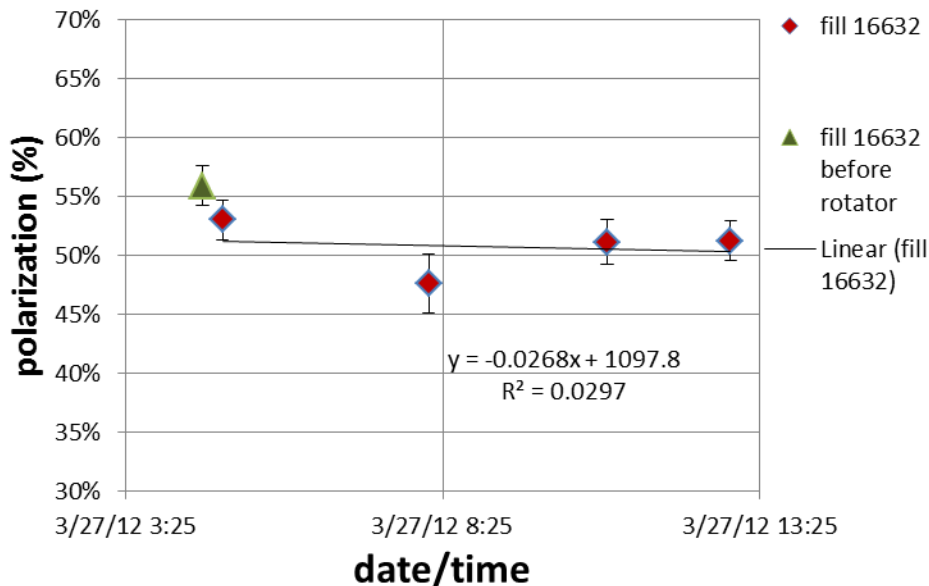


Store 16632, Blue jet = 56.5 +/- 3.0; Yellow jet = 63.0 +/- 3.1

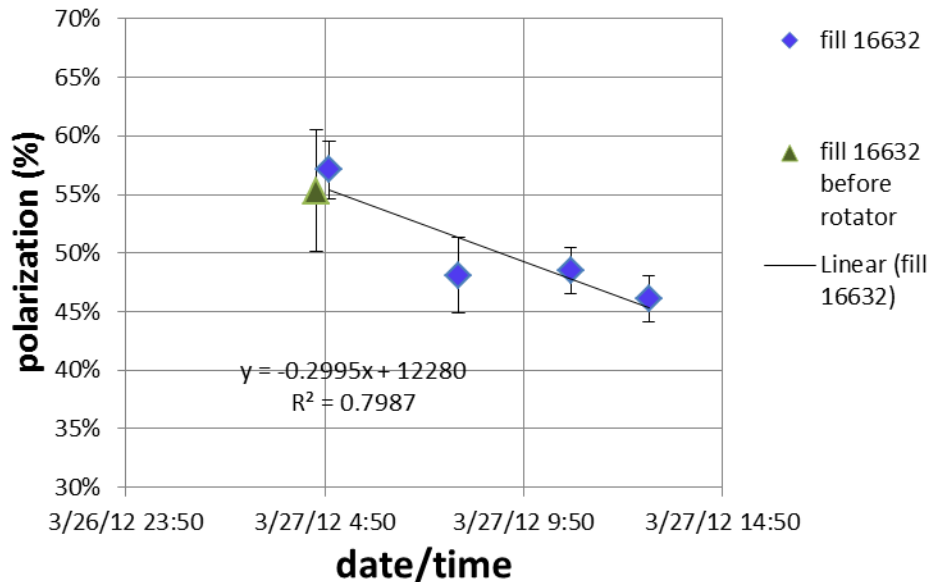
File Window Markers Analysis



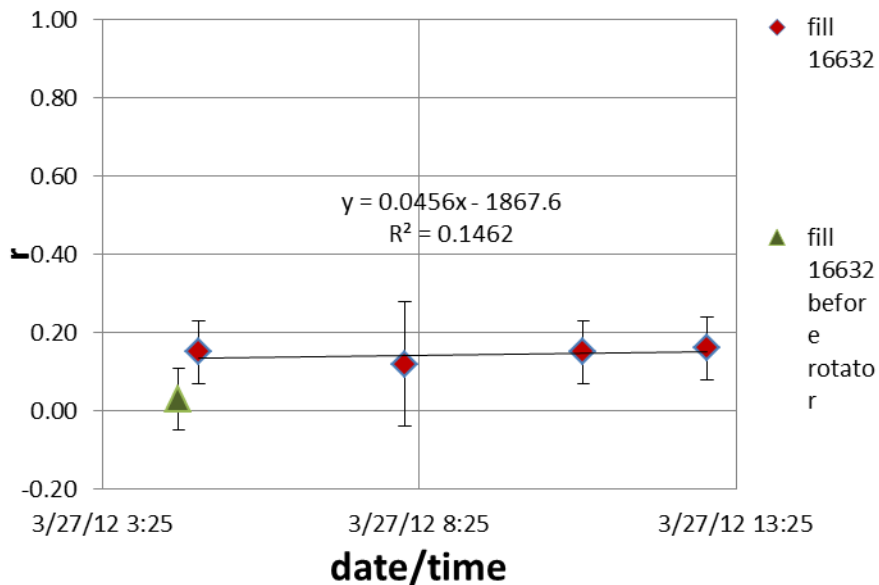
### Yellow (Y1D) CNI results Run12, 510 GeV pp



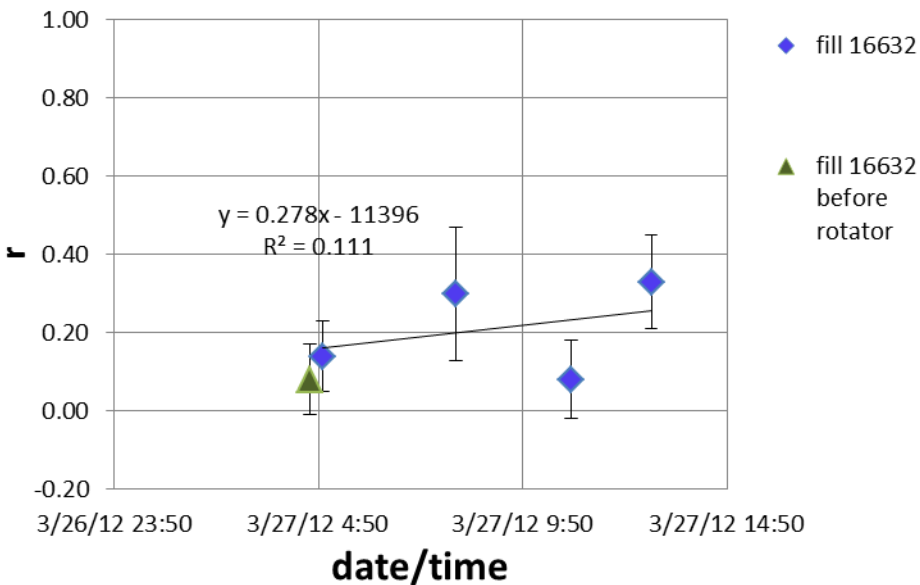
### Blue (B1U) CNI results Run12, 510 GeV pp



### Yellow (Y1D) CNI results Run12, 510 GeV pp



### Blue (B1U) CNI results Run12, 510 GeV pp

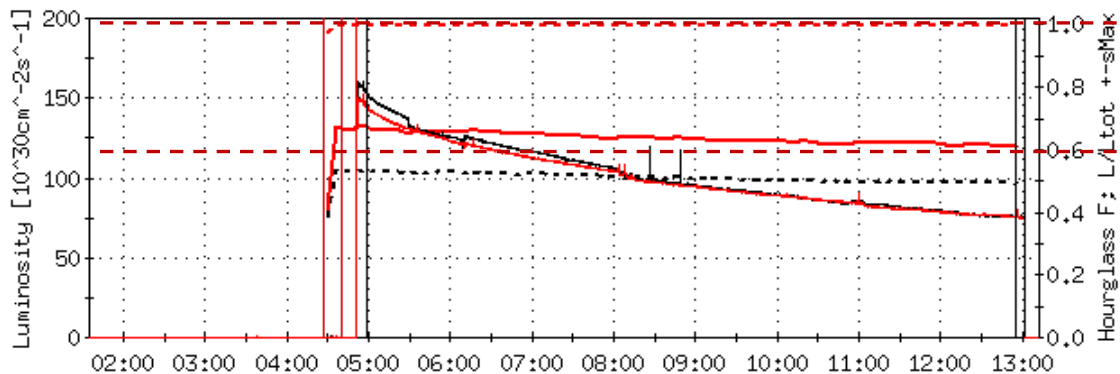
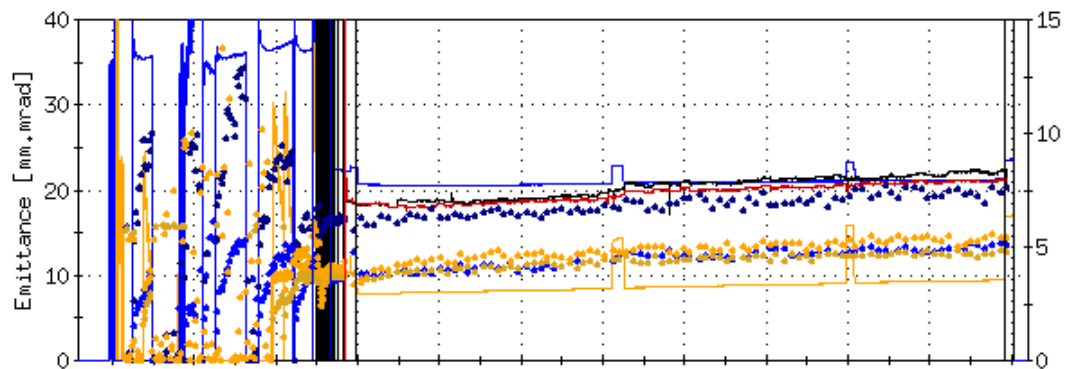
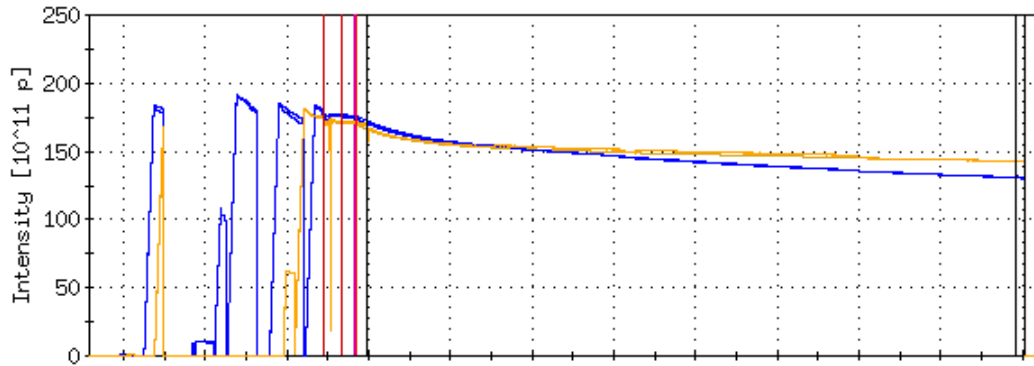


Store 16632

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

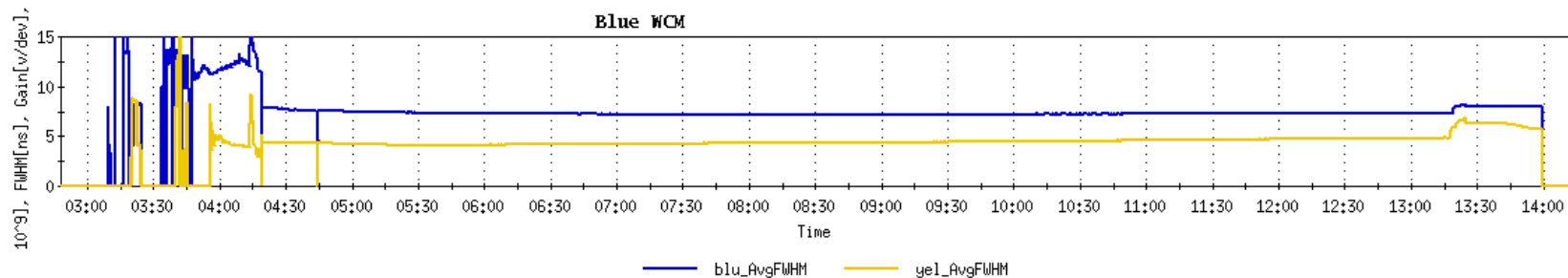
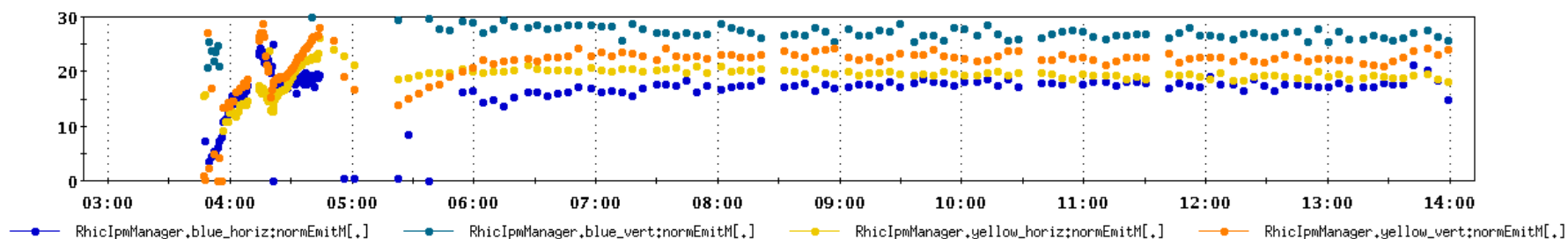
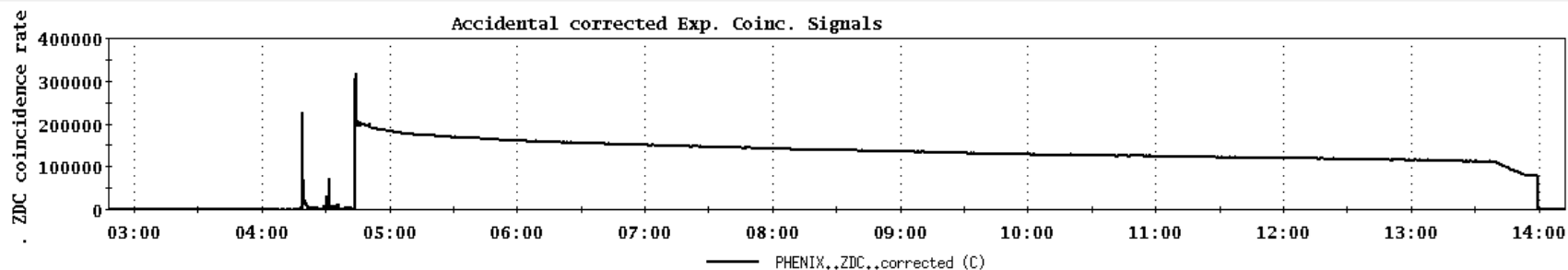
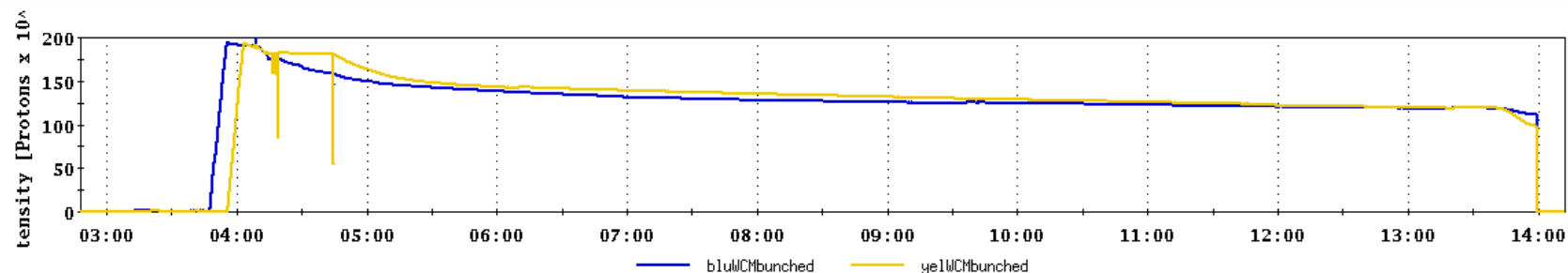
Peak lumi goal

Average lumi goal

dect  wcm  zdc Exp  Fit

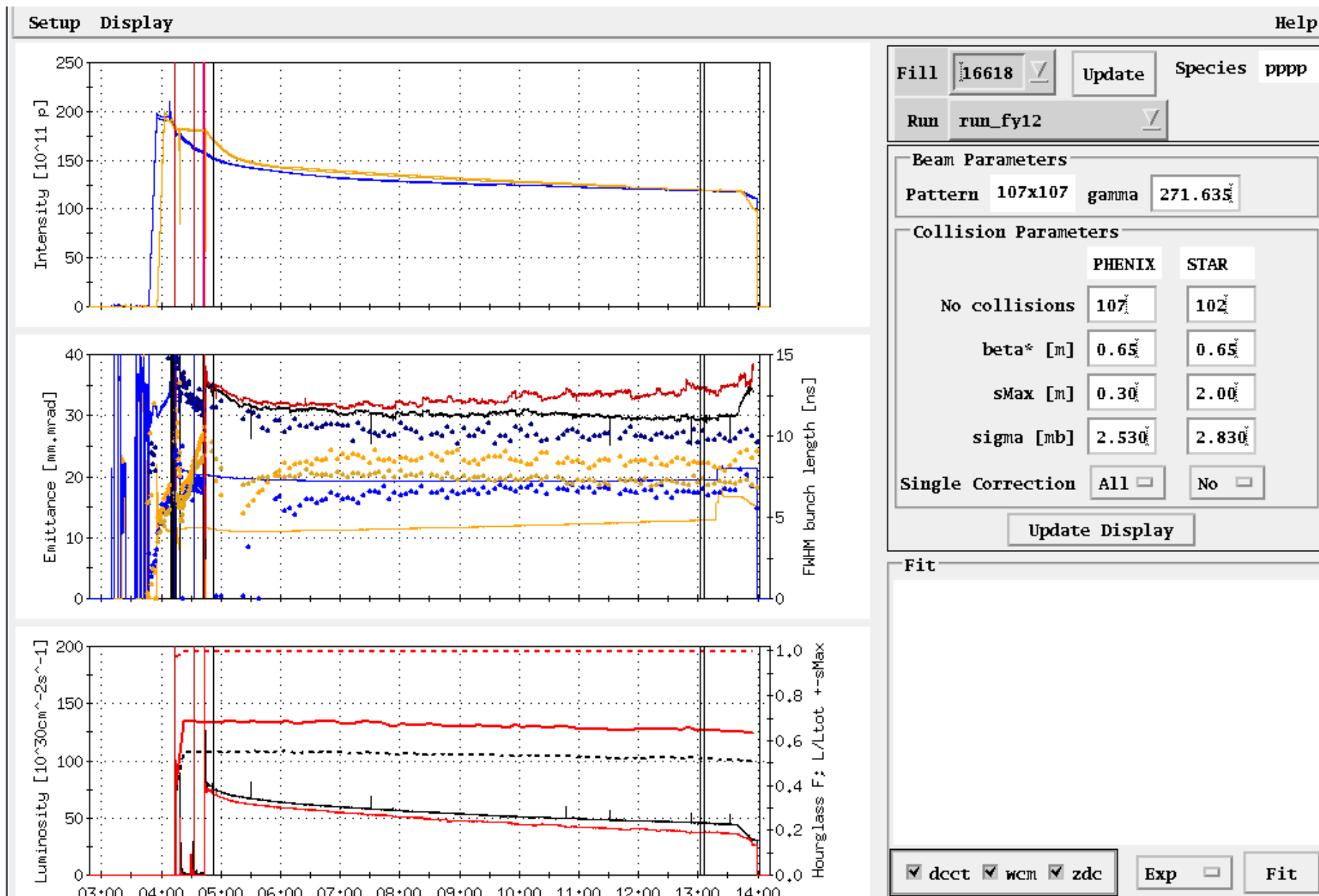
Store 16618, Blue jet = 51.0 +/- 3.2; Yellow jet = 32.6 +/- 3.3

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



Store 16618

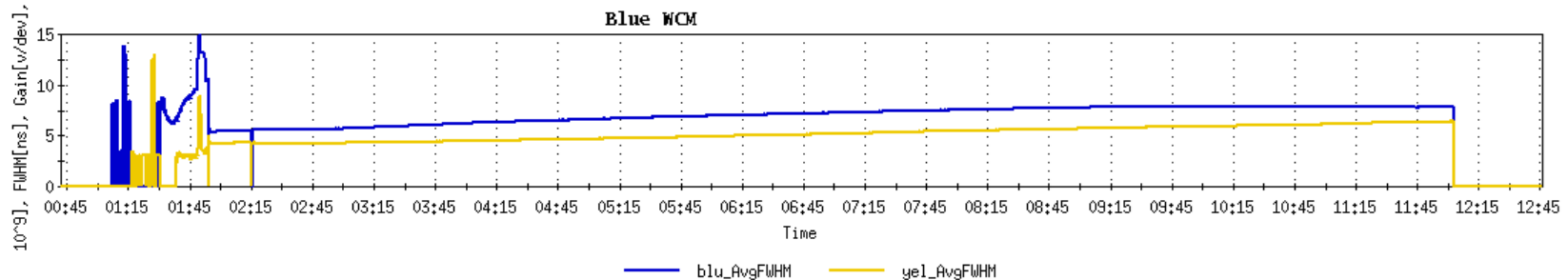
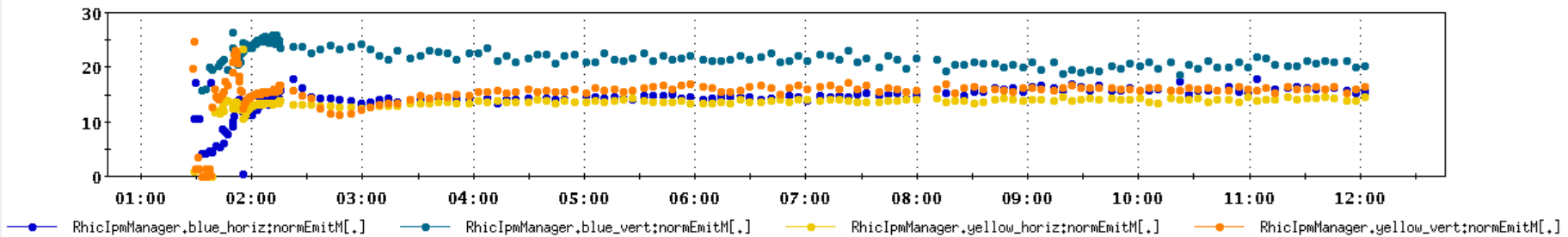
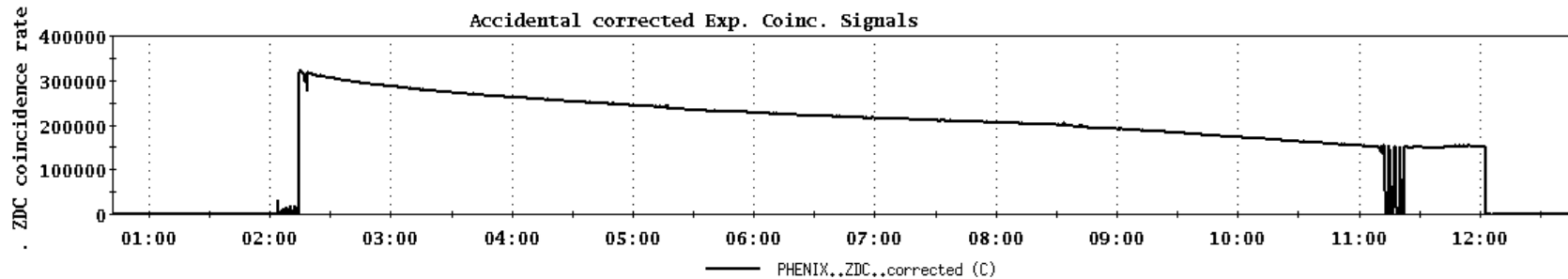
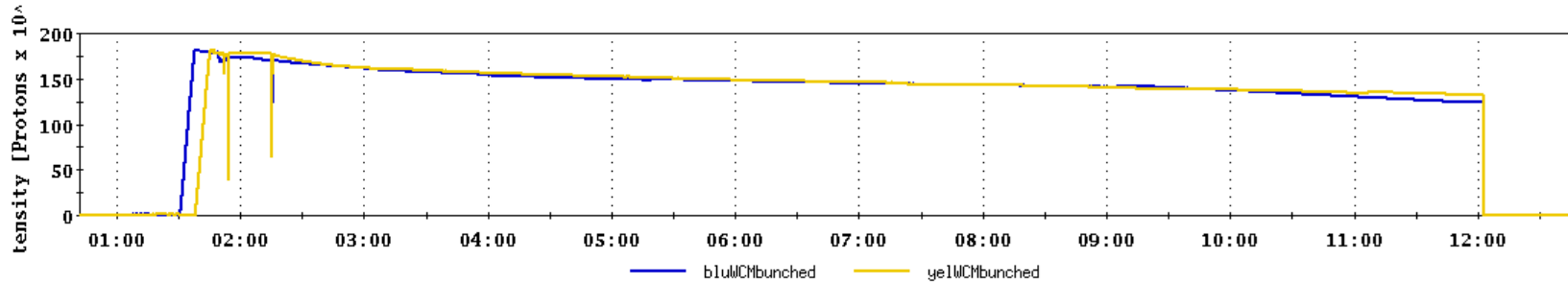
Worst average polarization measured by jet for store > 8 hrs



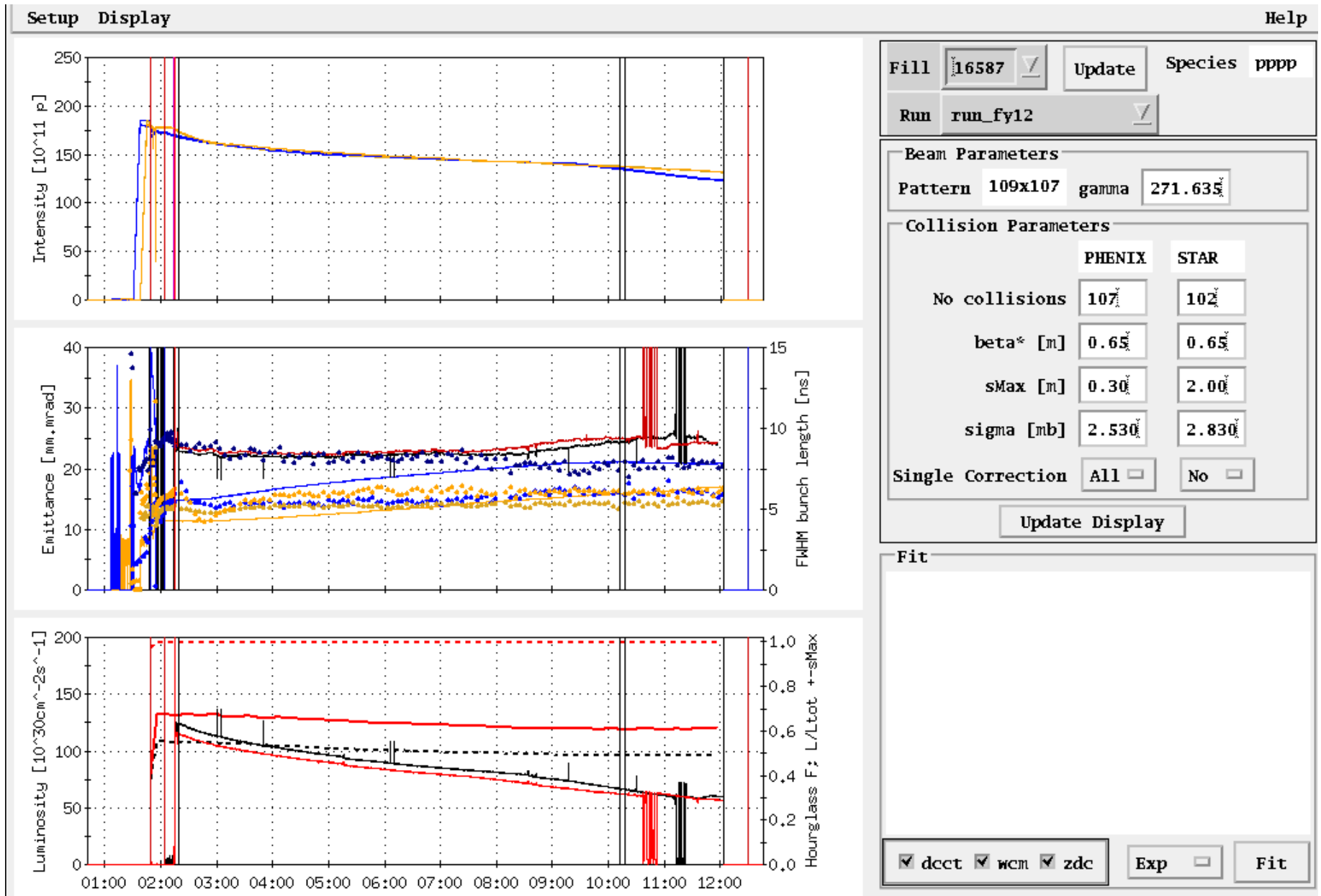
Store 16587, Blue jet = 47.2 +/- 2.8; Yellow jet = 39.4 +/- 2.9

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

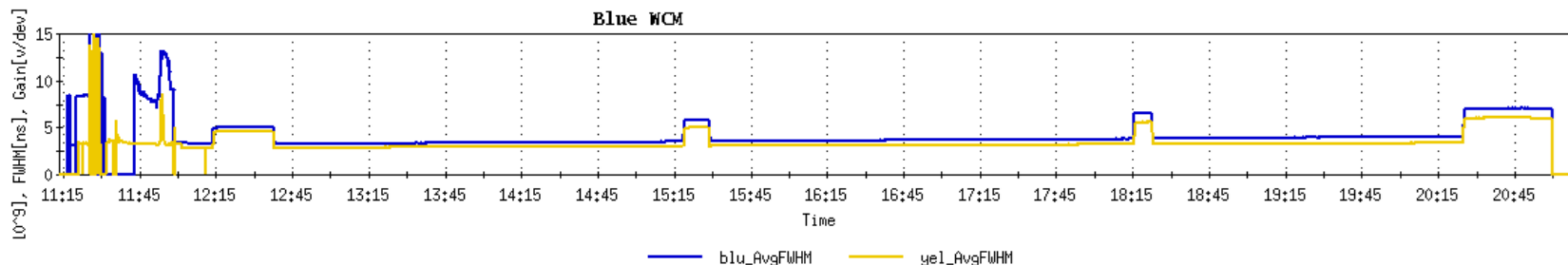
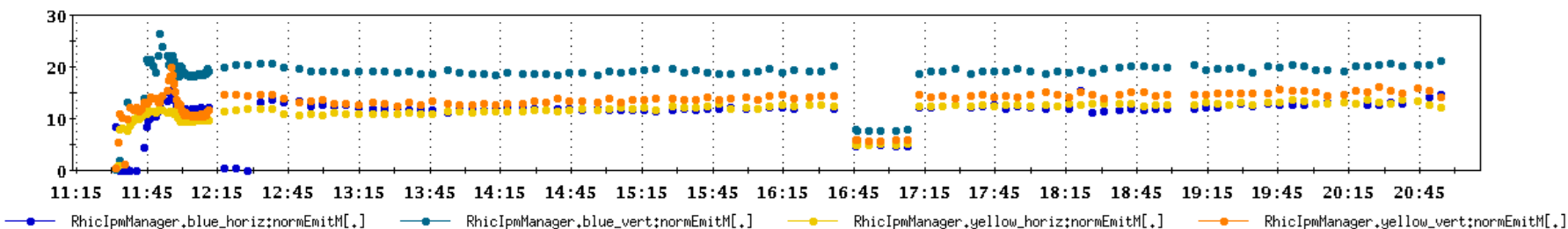
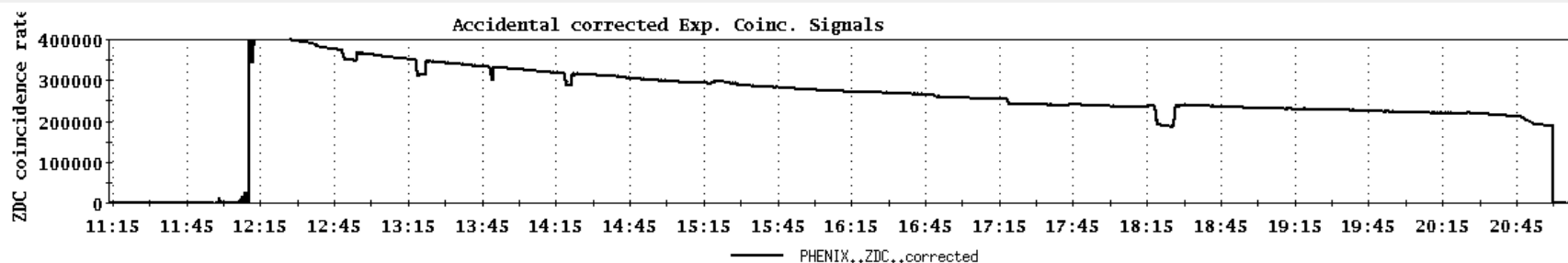
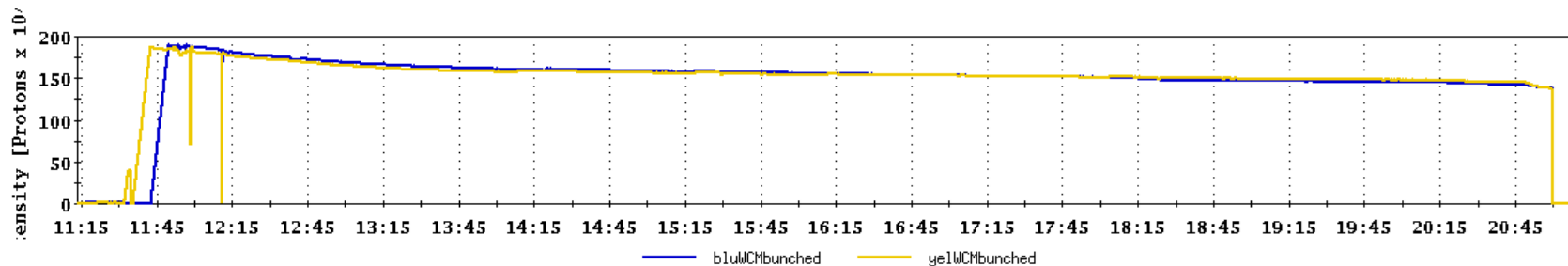




Store 16667, Blue jet = 58.1 +/- 2.9; Yellow jet = 60.7 +/- 3.1

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

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**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

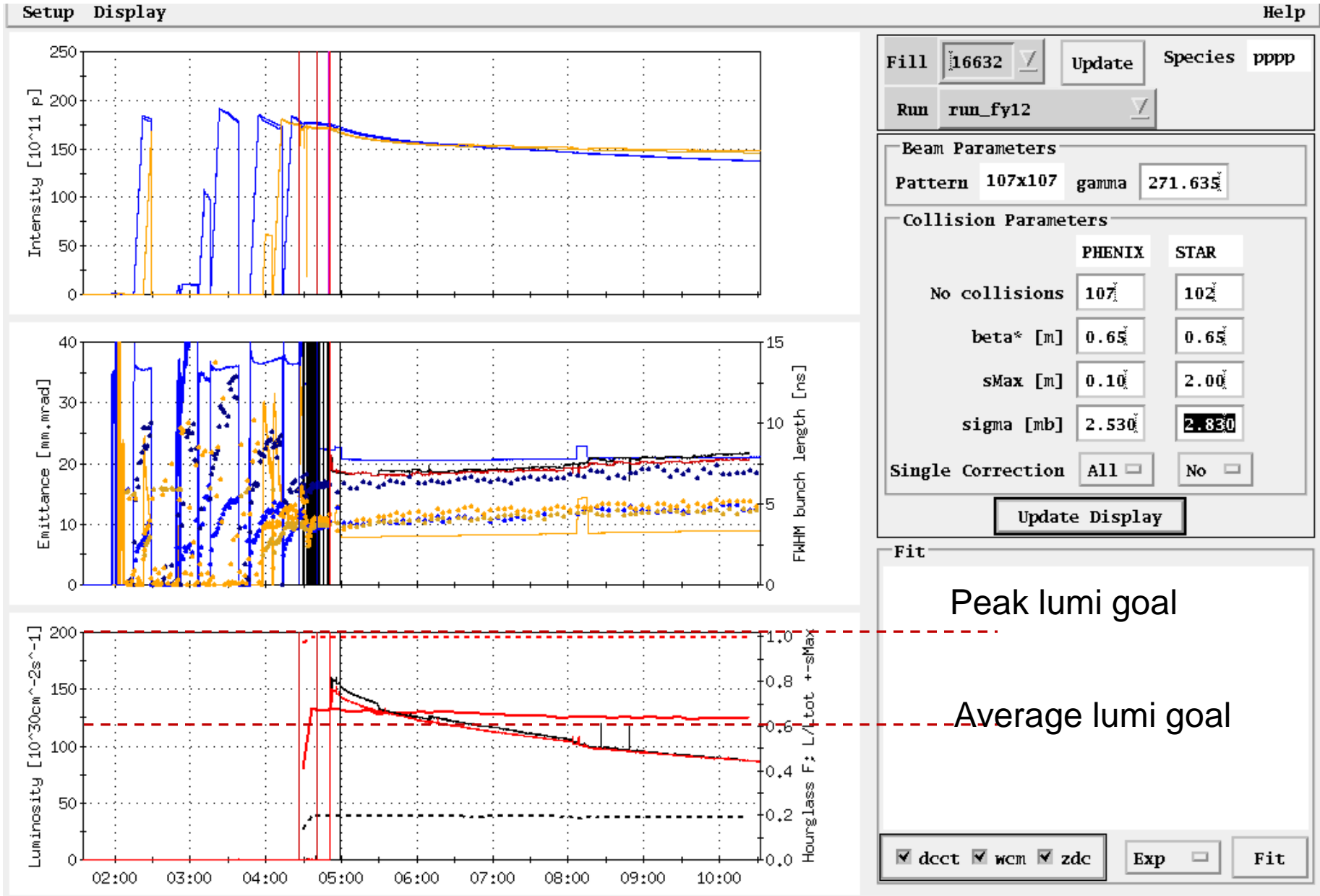
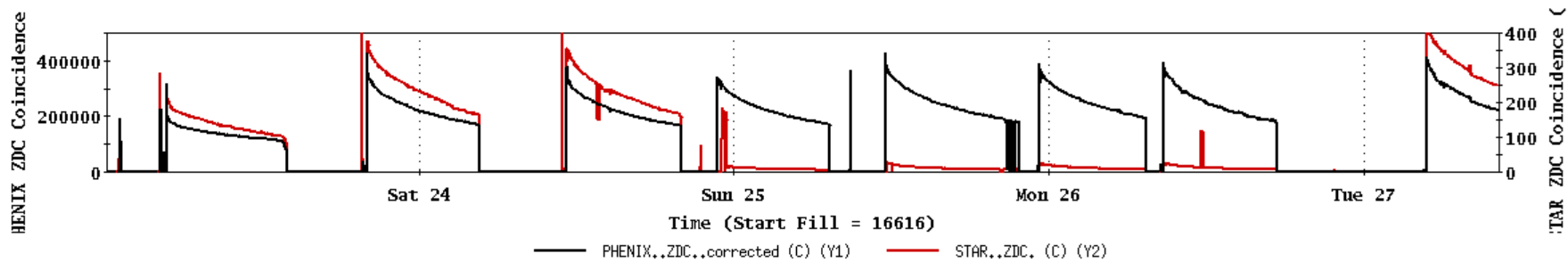
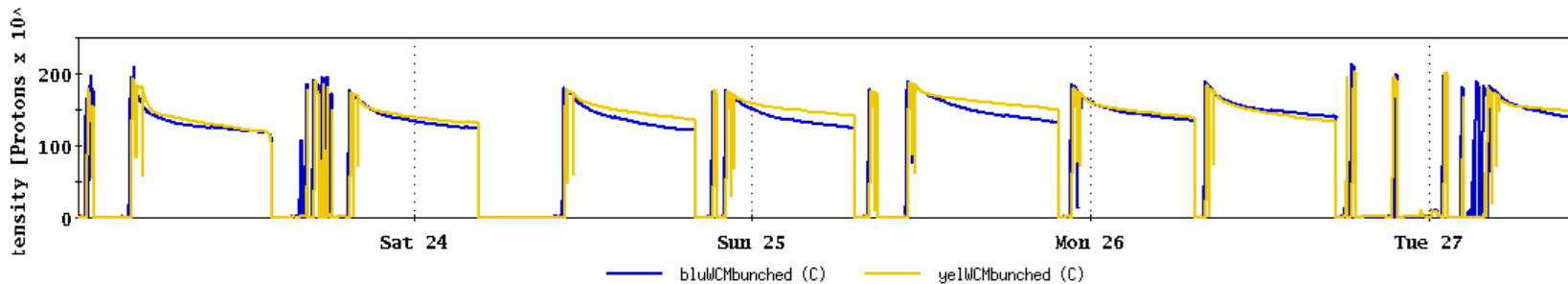
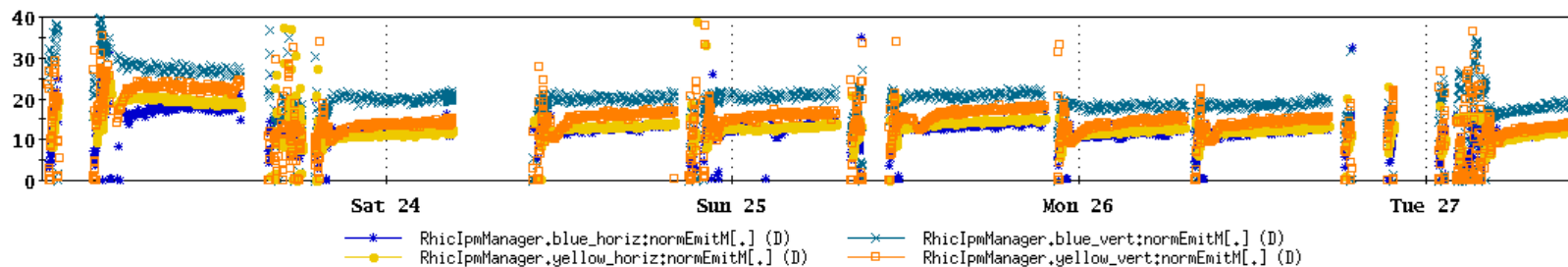
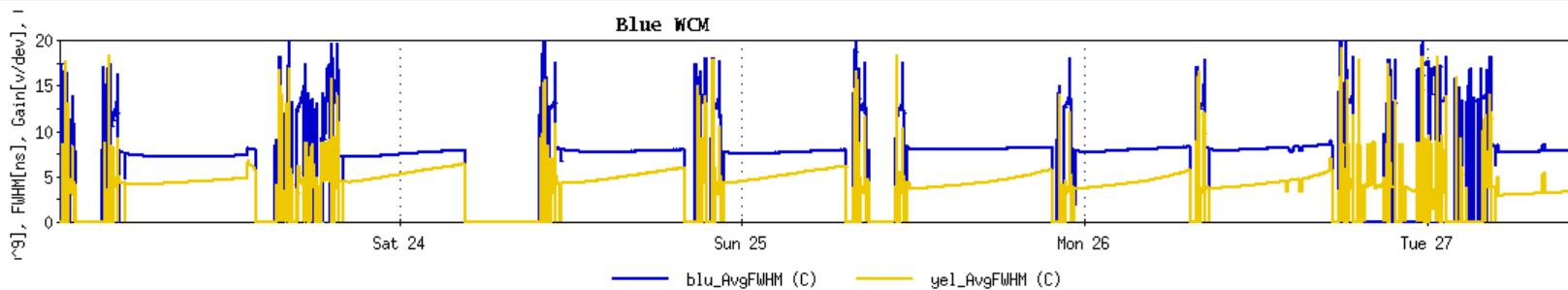
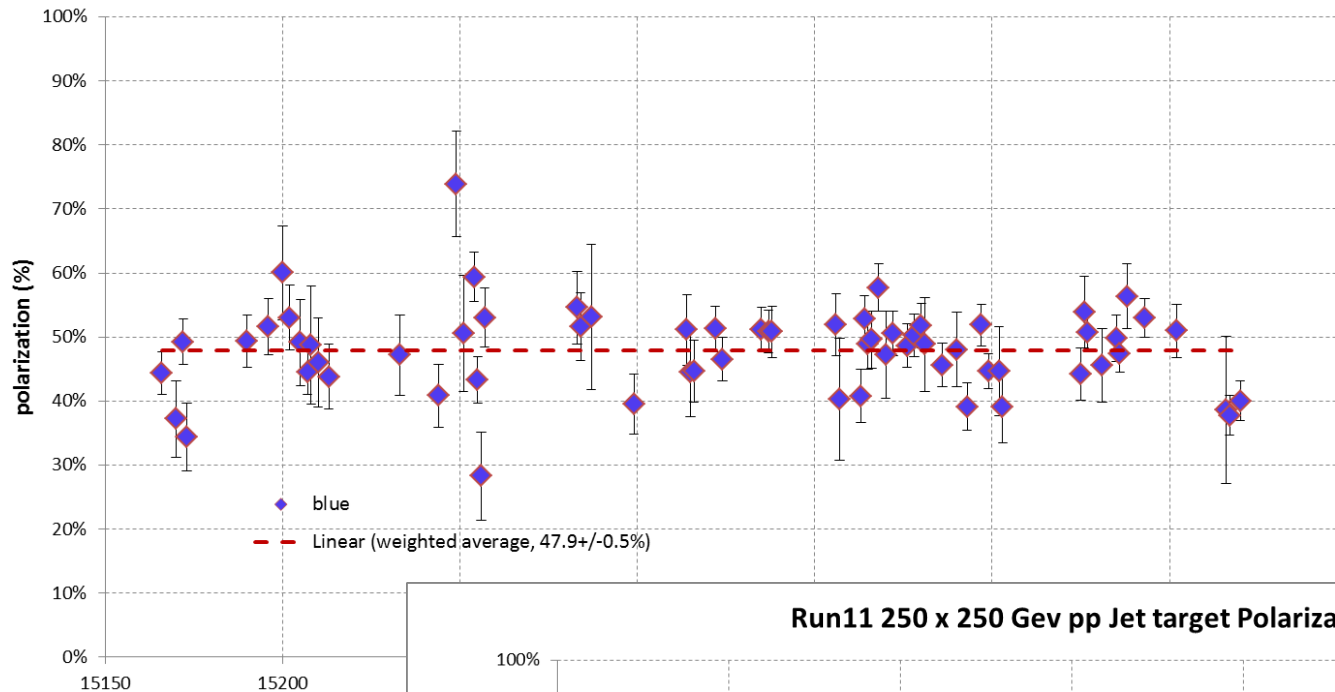


Table2: Max lumi parameters:  $1.65 \times 10^9$ /bunch,  $0.6 \beta^*$ , 20-25 mmmr emitt  $\rightarrow$  peak =  $200 \times 10^{30} \text{ cm}^{-2} \text{ s}^{-1}$

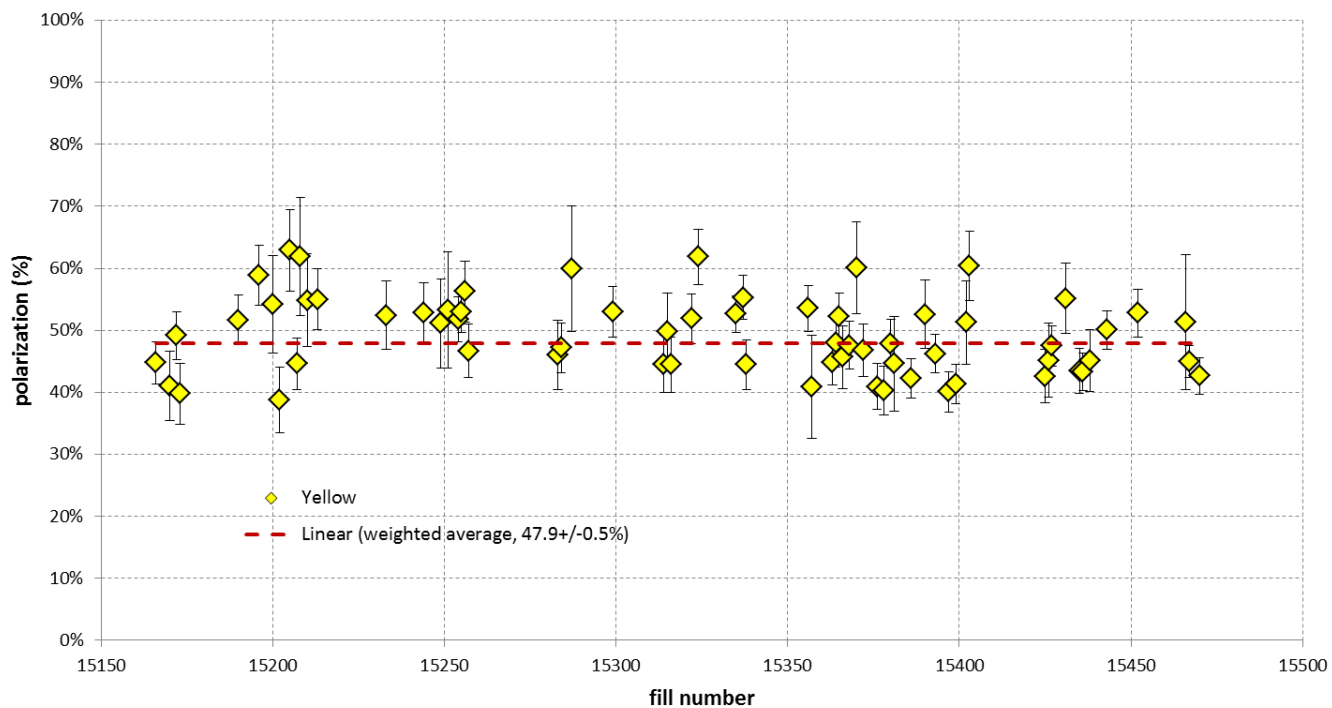
# 23 Mar – 27 Mar stores



### Run11 250 x 250 Gev pp Jet target Polarization results

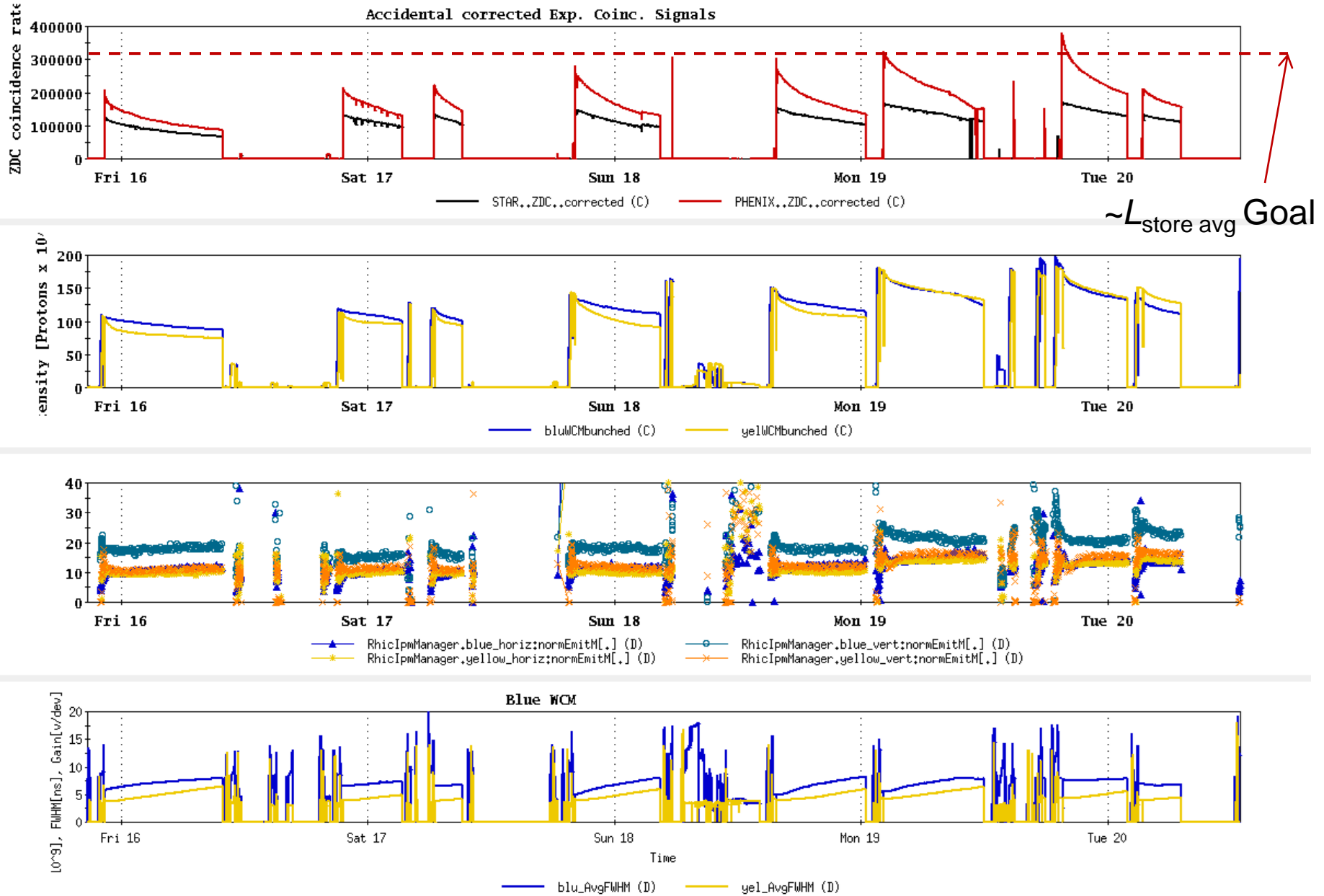


### Run11 250 x 250 Gev pp Jet target Polarization results



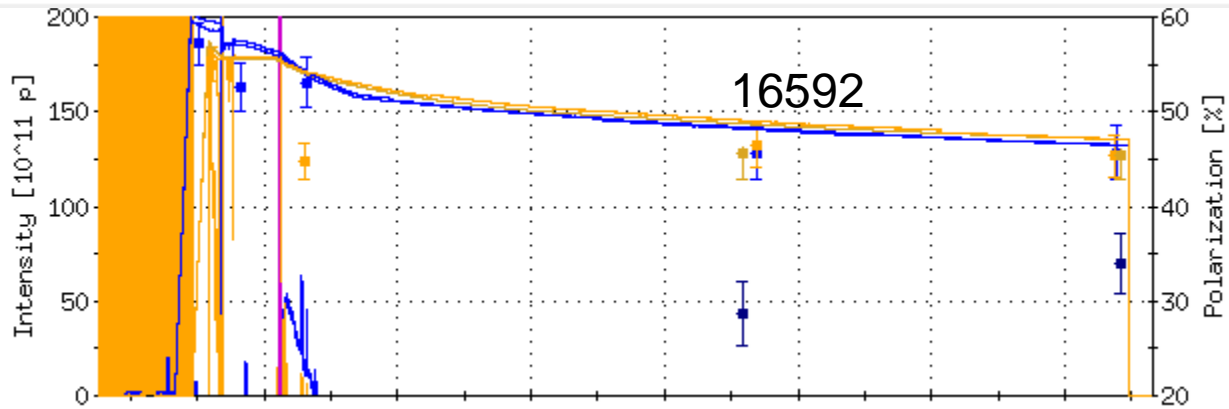
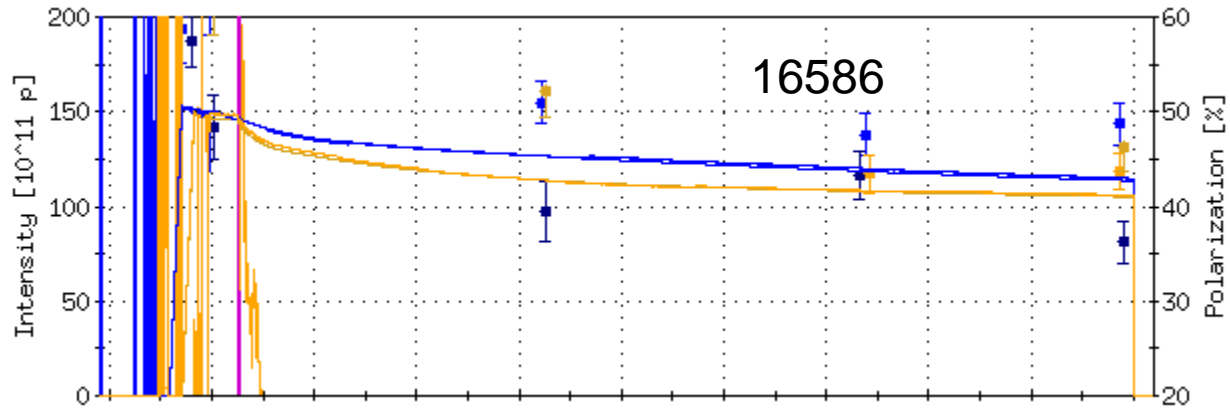
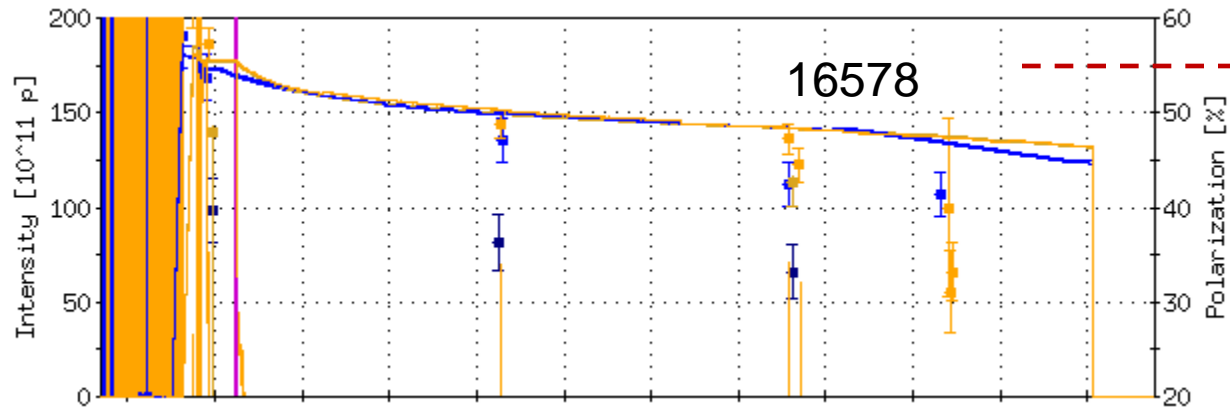
# All "physics" stores beginning with 16570, 15 March

File Window Markers Analysis



# From "StoreAnalysis" program in "StartUp"

Polarization Goal



Expectation for 5 weeks physics:  
45-95 pb<sup>-1</sup> delivered luminosity with 45-50% polarization

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

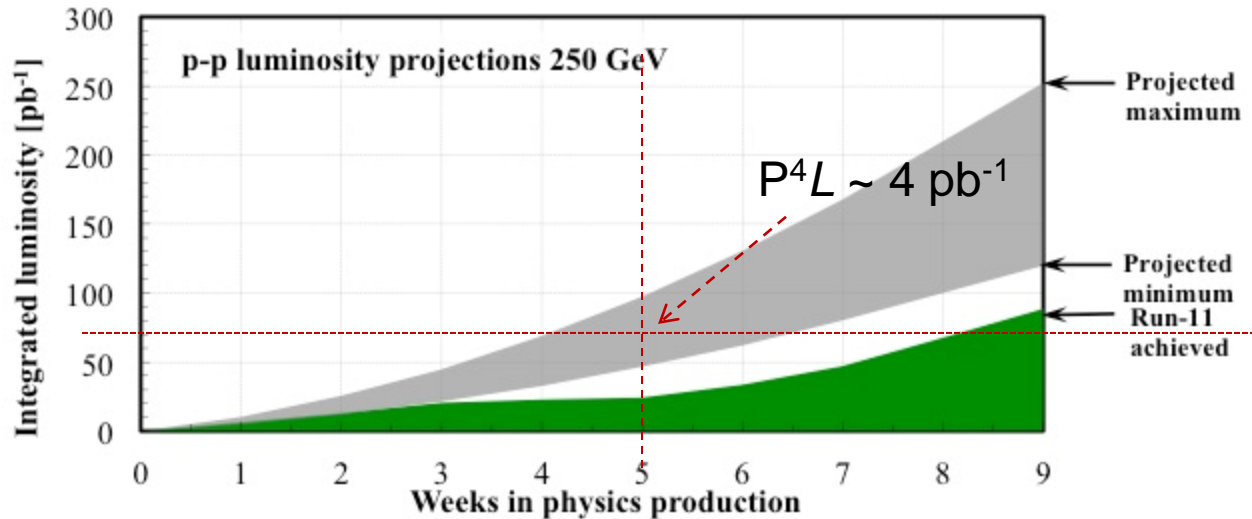
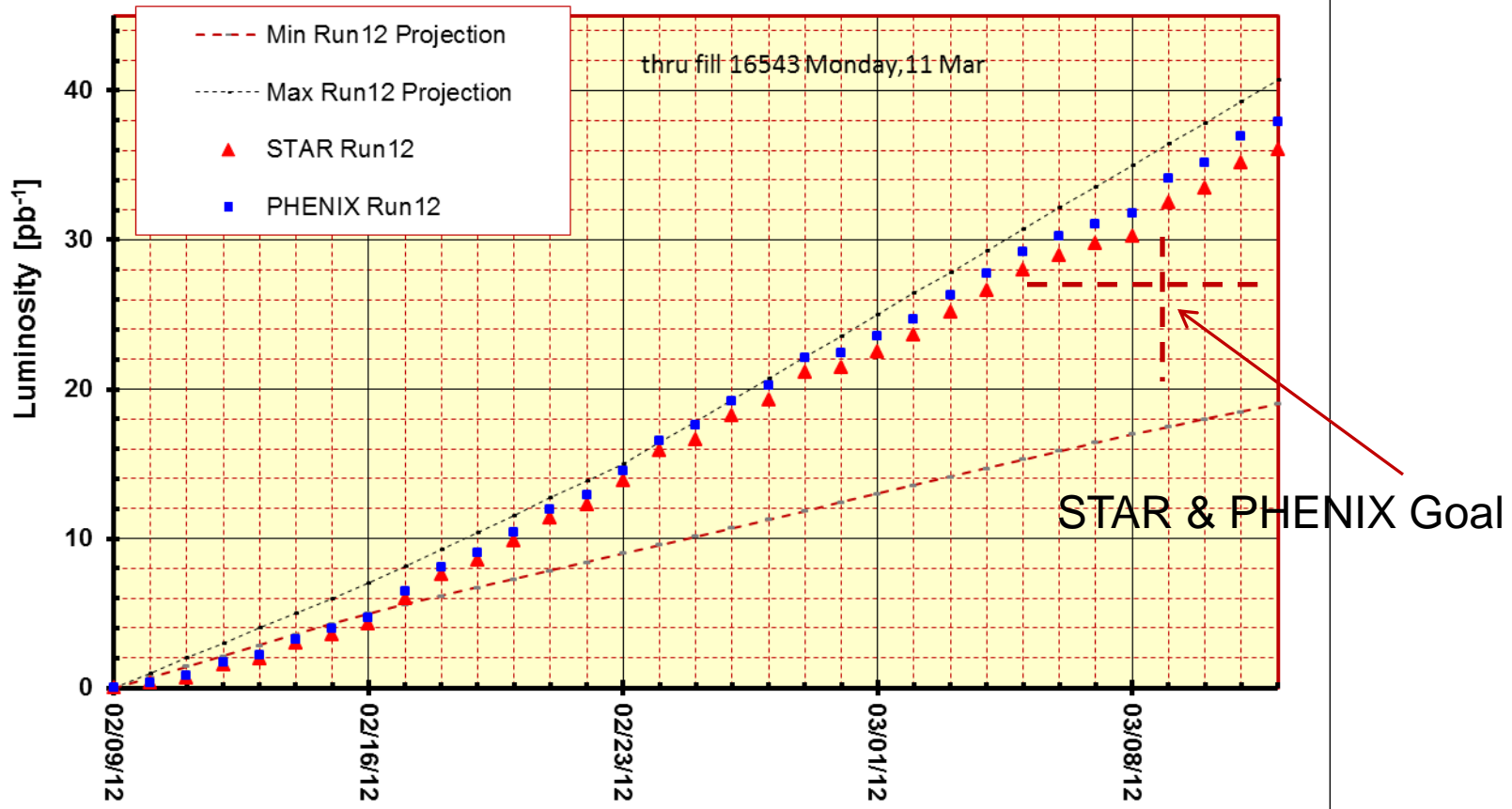


Figure 4: Projected minimum and maximum integrated luminosities for polarized proton collisions at 250 GeV beam energy, assuming linear weekly luminosity ramp-up in 8 weeks. An average store polarization between 45 and 50% is expected.

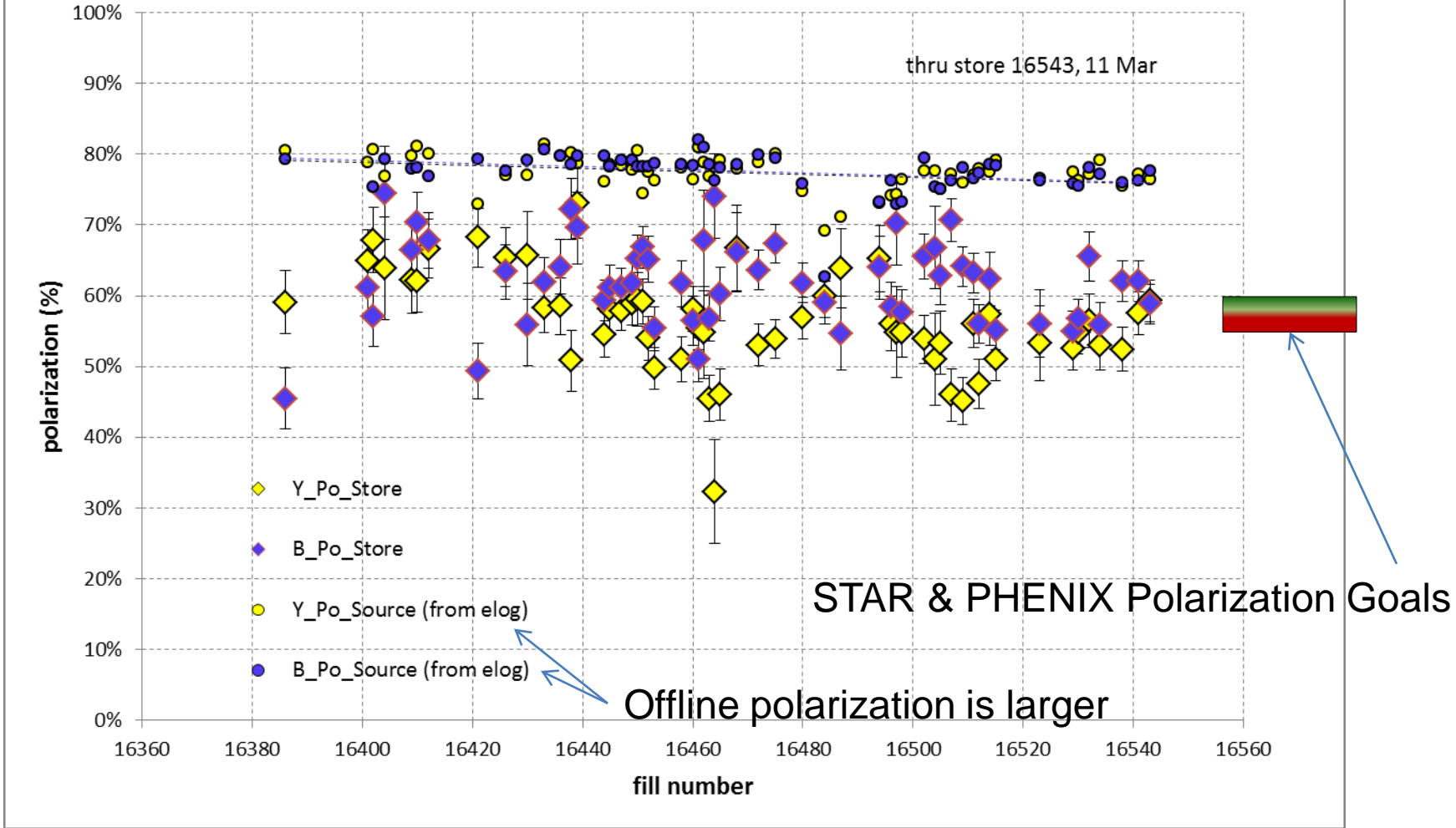
From Fischer et. Al. "RHIC Collider Projections (FY 2012 – FY 2016)"  
14 October 2011



**RHIC p<sup>+</sup>p<sup>+</sup> 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

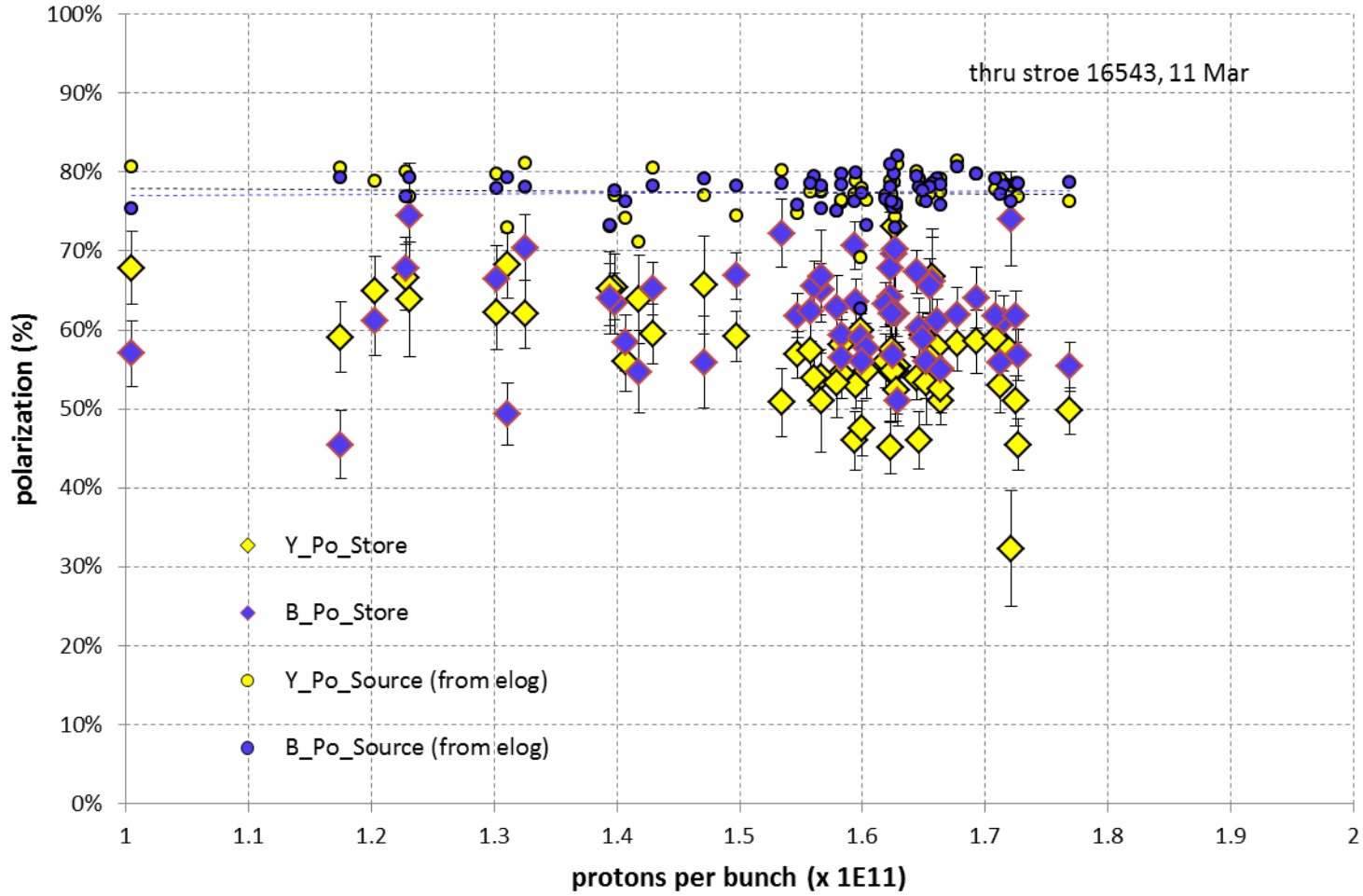


Blue Jet weighted average =  $61.2\% \pm 0.5\%$ ;  
 Yellow Jet weighted average =  $55.8\% \pm 0.5\%$ ;

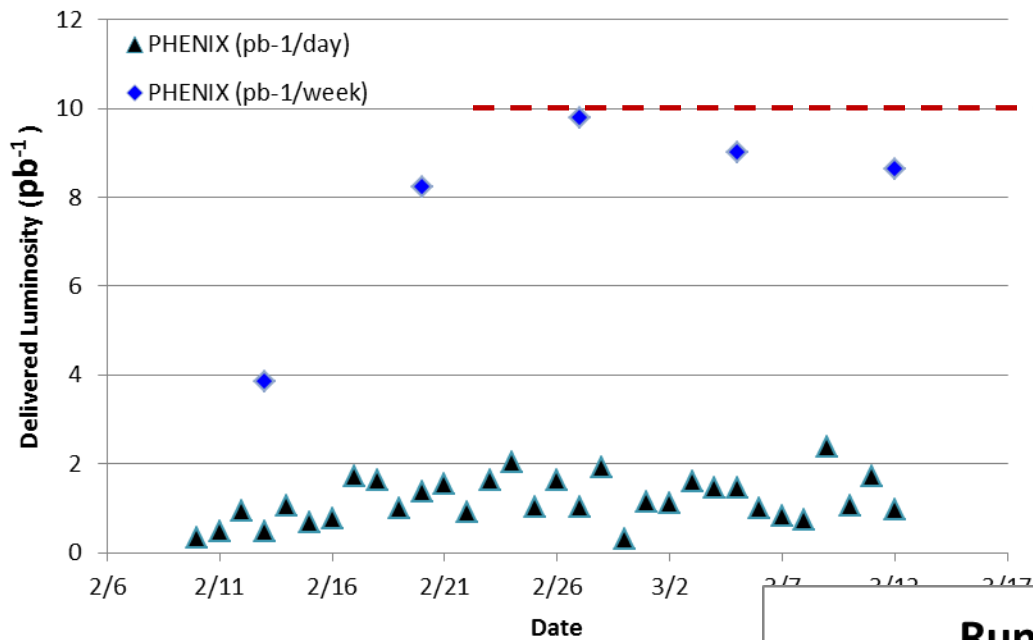
source blue average =  $77.5\%$  → **20% lost**  
 source yellow average =  $77.4\%$  → **28% lost**

# Run12 100 x 100 Gev pp Jet target Final Polarization results

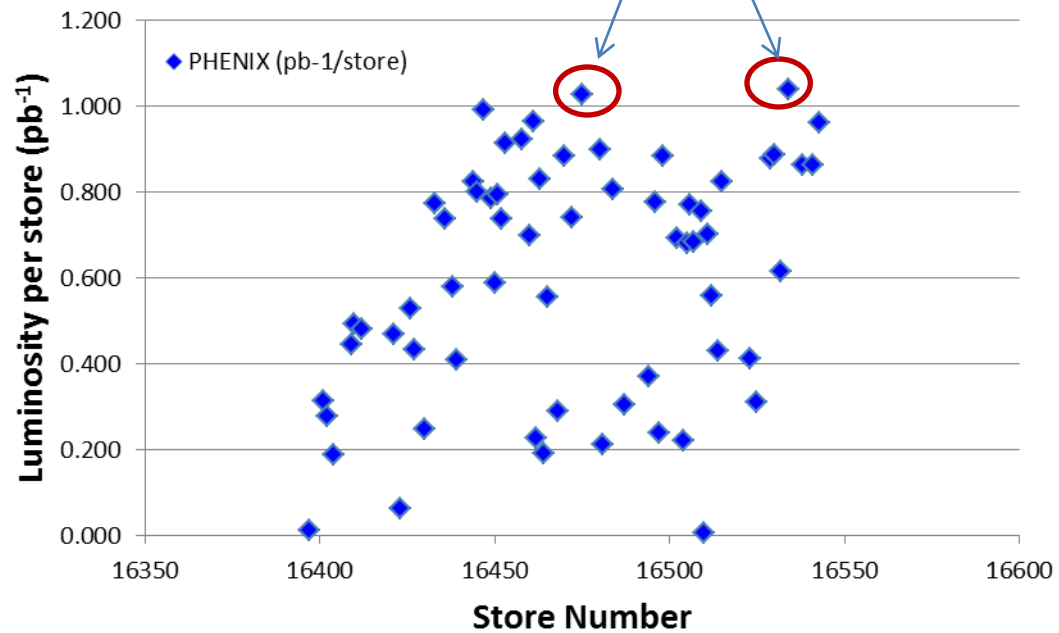
thru stroe 16543, 11 Mar



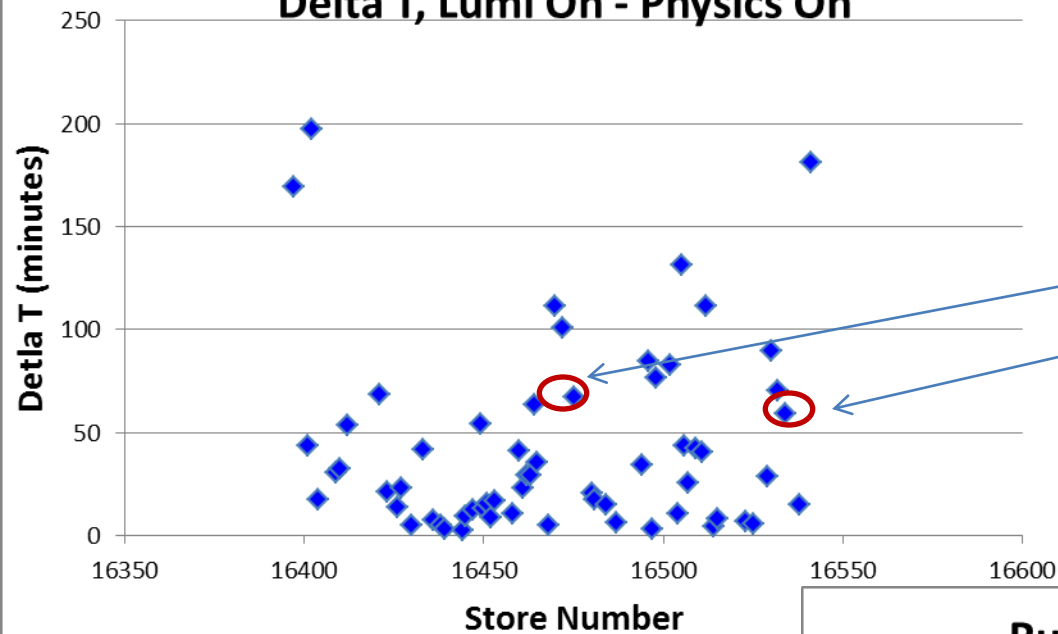
# Run 12 100 x 100 GeV pp Lumi



## Run 12 PHENIX Luminosity per Store

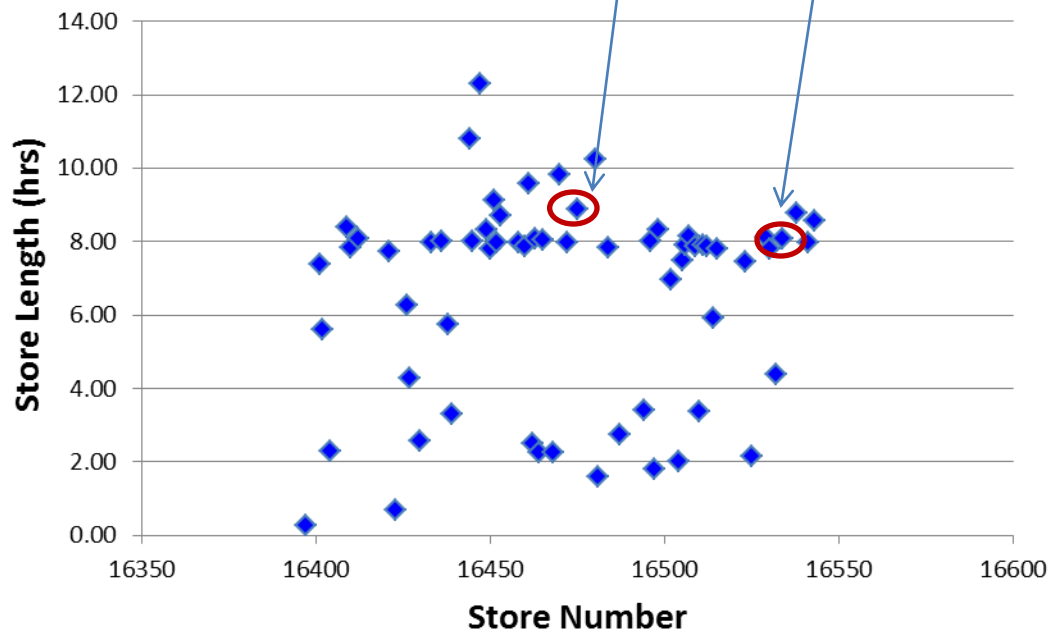


### Run 12 100 x 100 GeV pp Delta T, Lumi On - Physics On



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<sup>-1</sup>

Setup Display
Help

The figure consists of three vertically stacked plots sharing a common x-axis representing time from 03:30 to 14:30. The top plot shows Intensity (left y-axis, 0-250) and Polarization (right y-axis, 45-70%). The middle plot shows Emittance (left y-axis, 10-30) and FWHM bunch length (right y-axis, 0-15). The bottom plot shows Luminosity (left y-axis, 0-60) and Hourglass F: L/Ltot +- sMax (right y-axis, 0.0-1.0). All plots show a sharp initial rise 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 [mb]	<input type="text" value="0.290"/>	<input type="text" value="0.275"/>

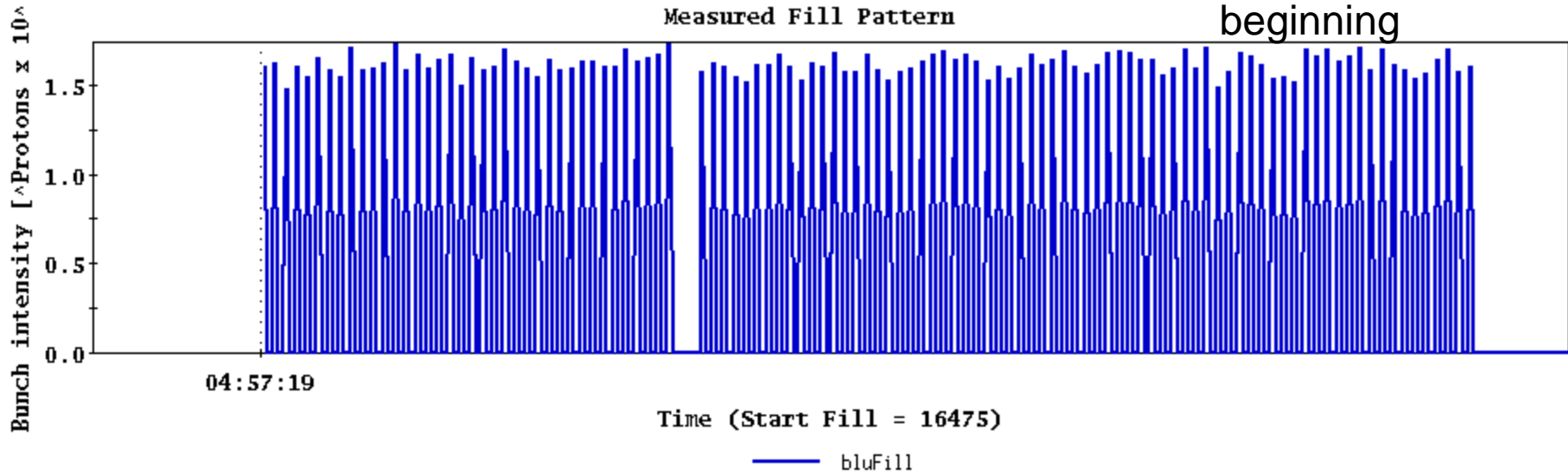
Single Correction  All   All

**Fit**

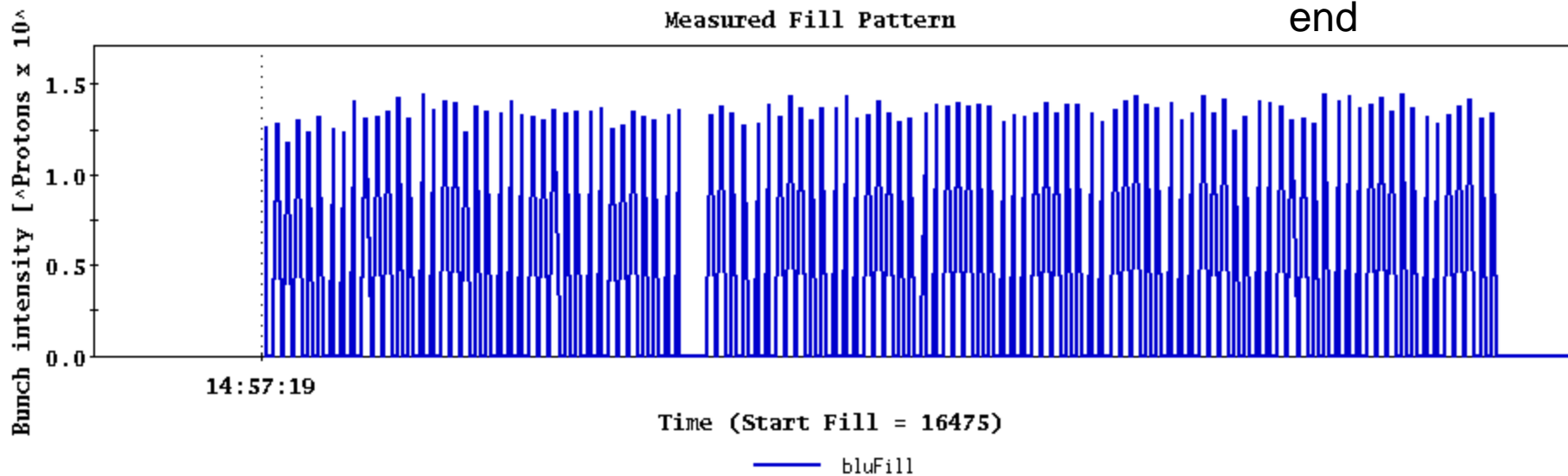
dcut  wcm  zdc  Exp

# Fill 16475, 27 Feb, 8.9 hours physics store (10 hour Lumi on Store), PHENIX 1.03 pb<sup>-1</sup>

File Window Markers Analysis

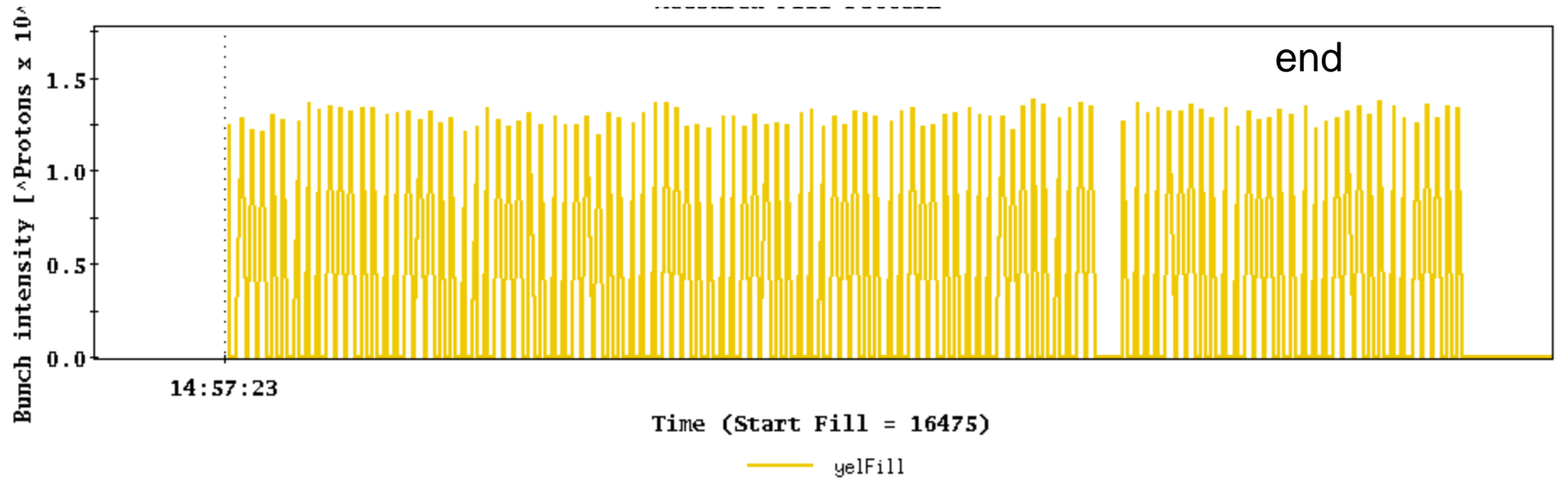
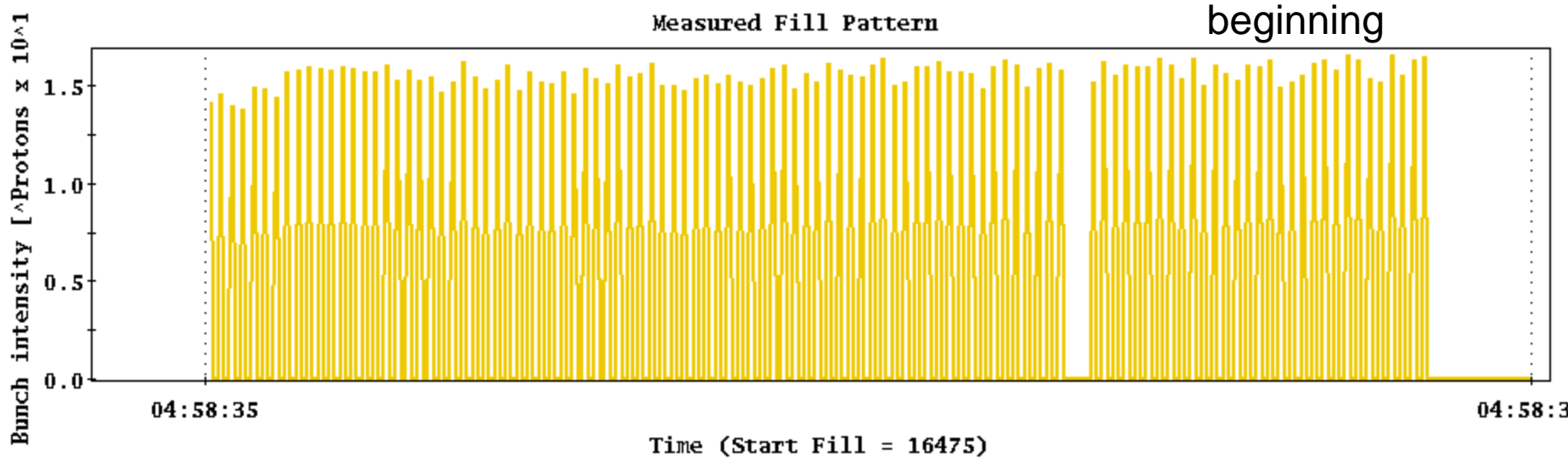


File Window Markers Analysis



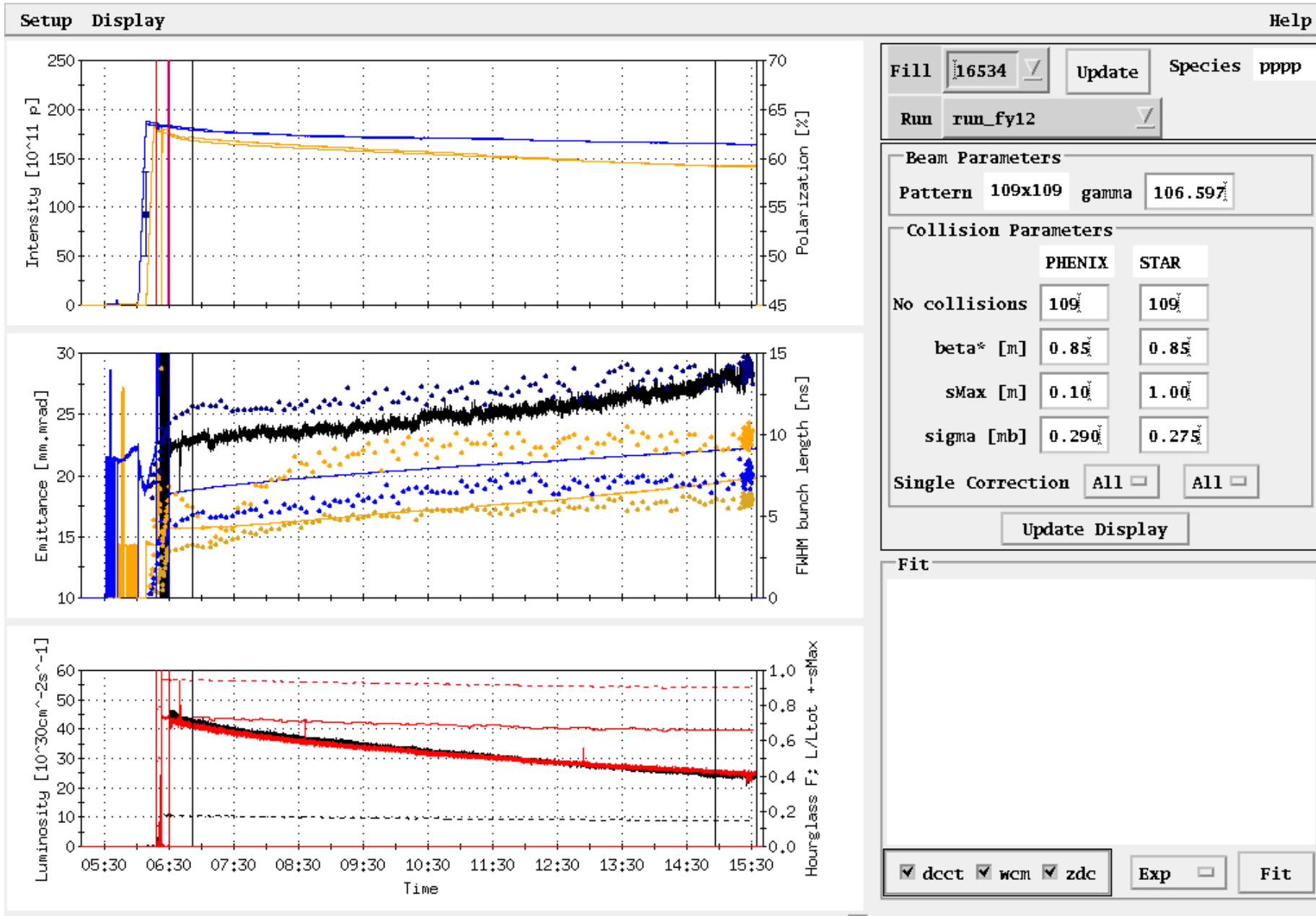
# Fill 16475, 27 Feb, 8.9 hours physics store (10 hour Lumi on Store), PHENIX 1.03 pb<sup>-1</sup>

File Window Markers Analysis



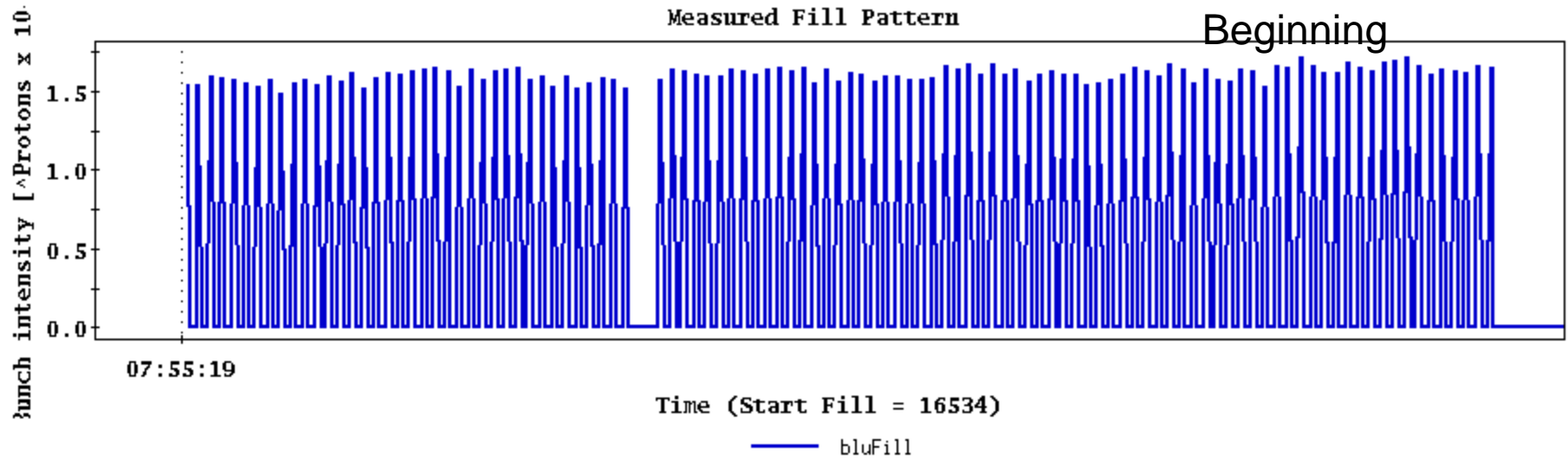


# Fill 16534, 9 Mar, 8.1 hours physics store (9.1 hr Lumi on store), PHENIX 1.04 pb<sup>-1</sup>

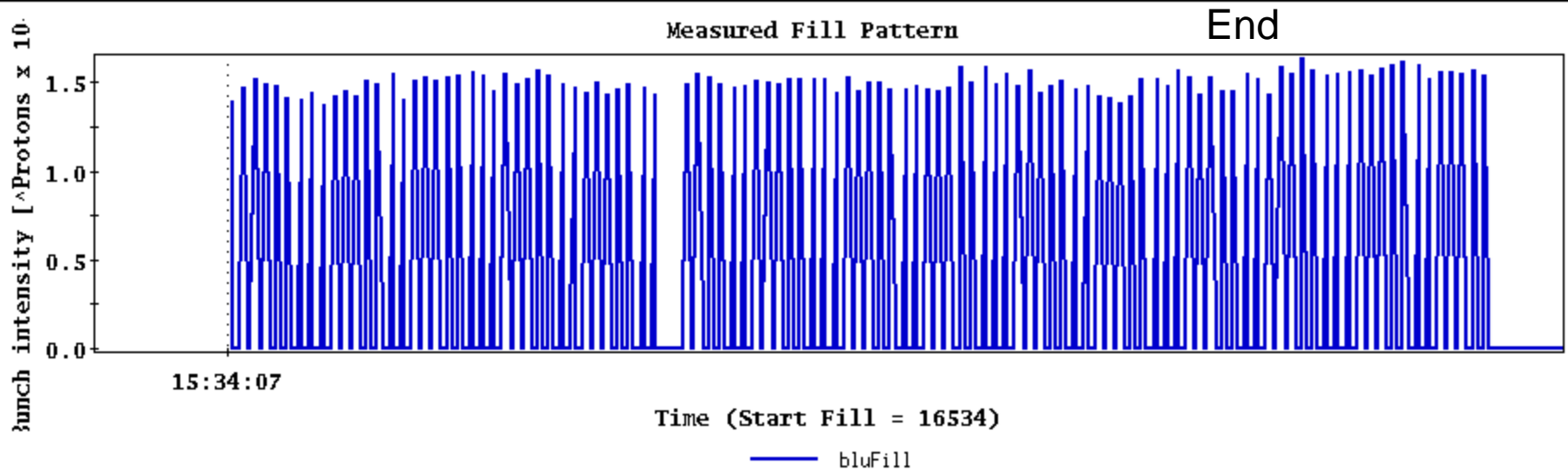


Fill 16534, 9 Mar, 8.1 hours physics store (9.1 hr Lumi on store), PHENIX 1.04 pb<sup>-1</sup>

File Window Markers Analysis

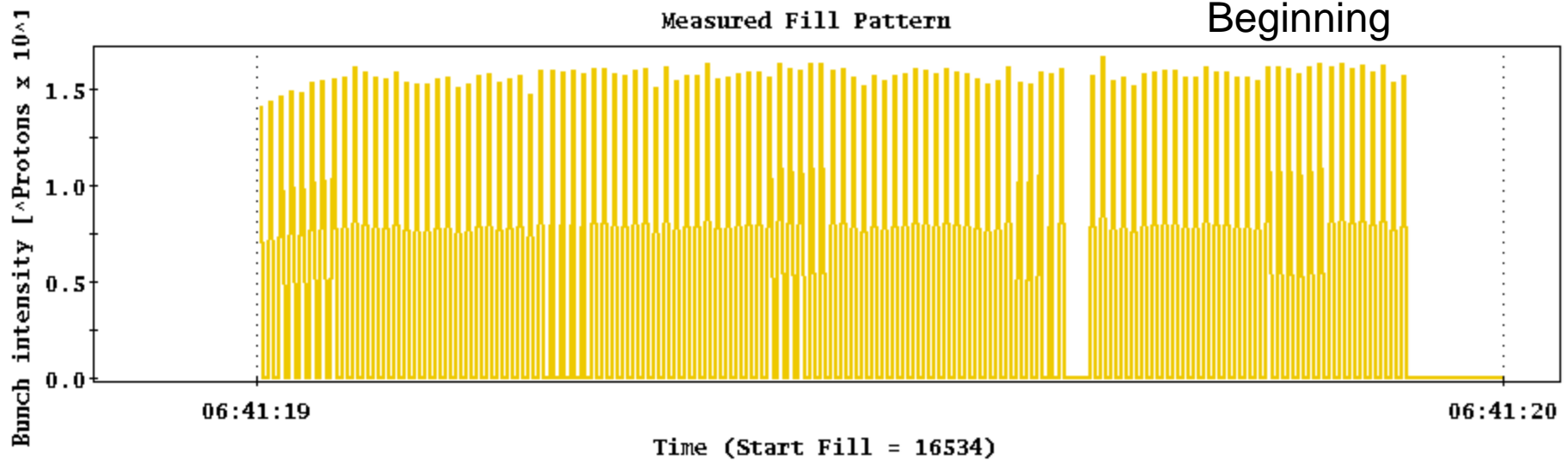


File Window Markers Analysis

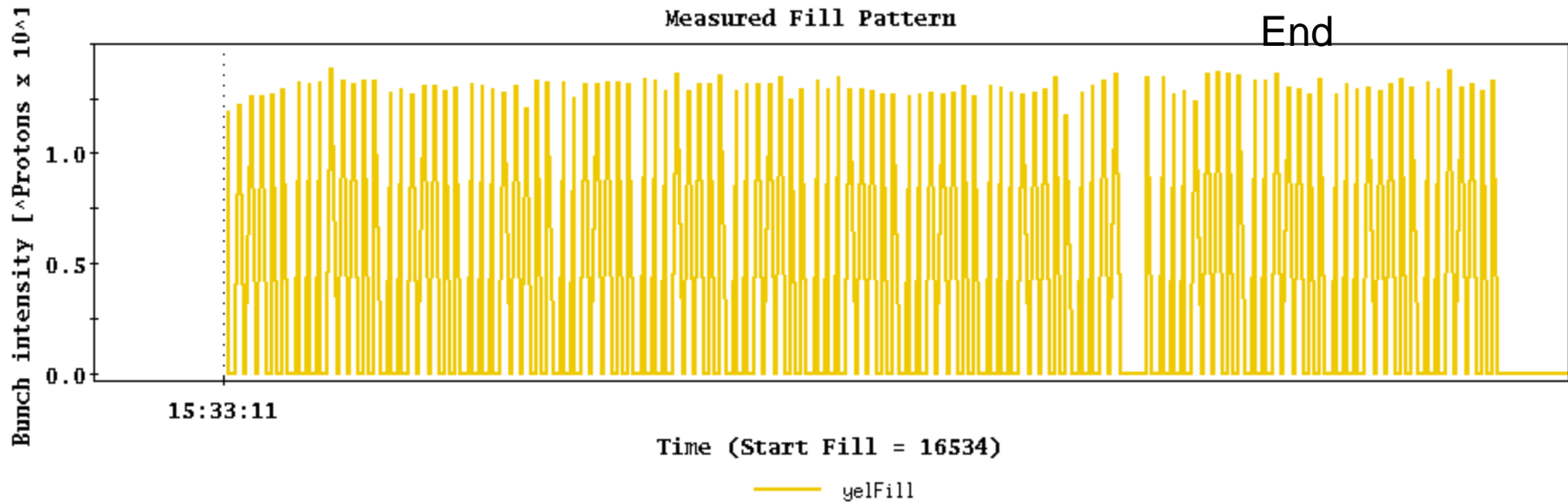


Fill 16534, 9 Mar, 8.1 hours physics store (9.1 hr Lumi on store), PHENIX 1.04 pb<sup>-1</sup>

File Window Markers Analysis

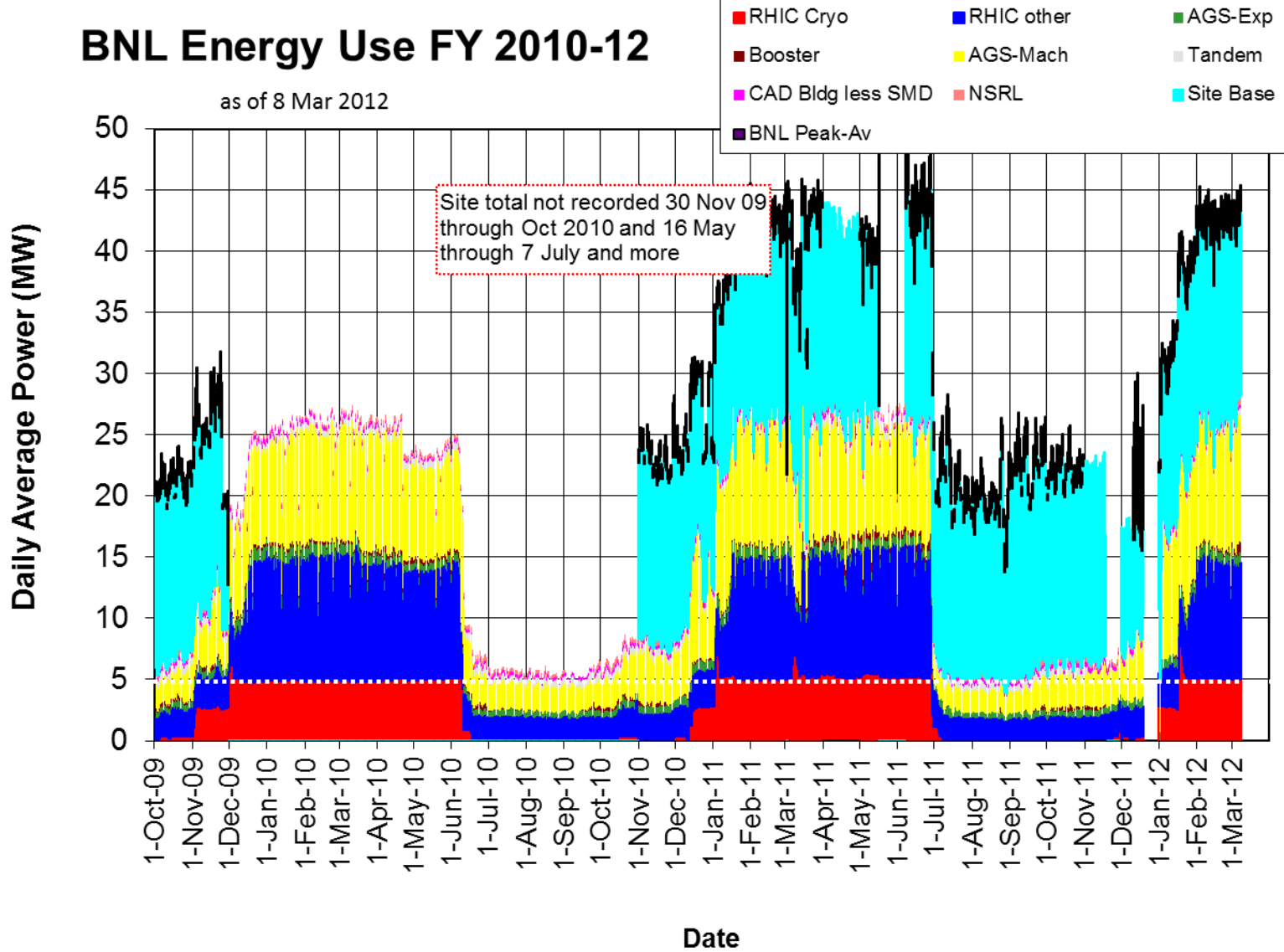


File Window Markers Analysis



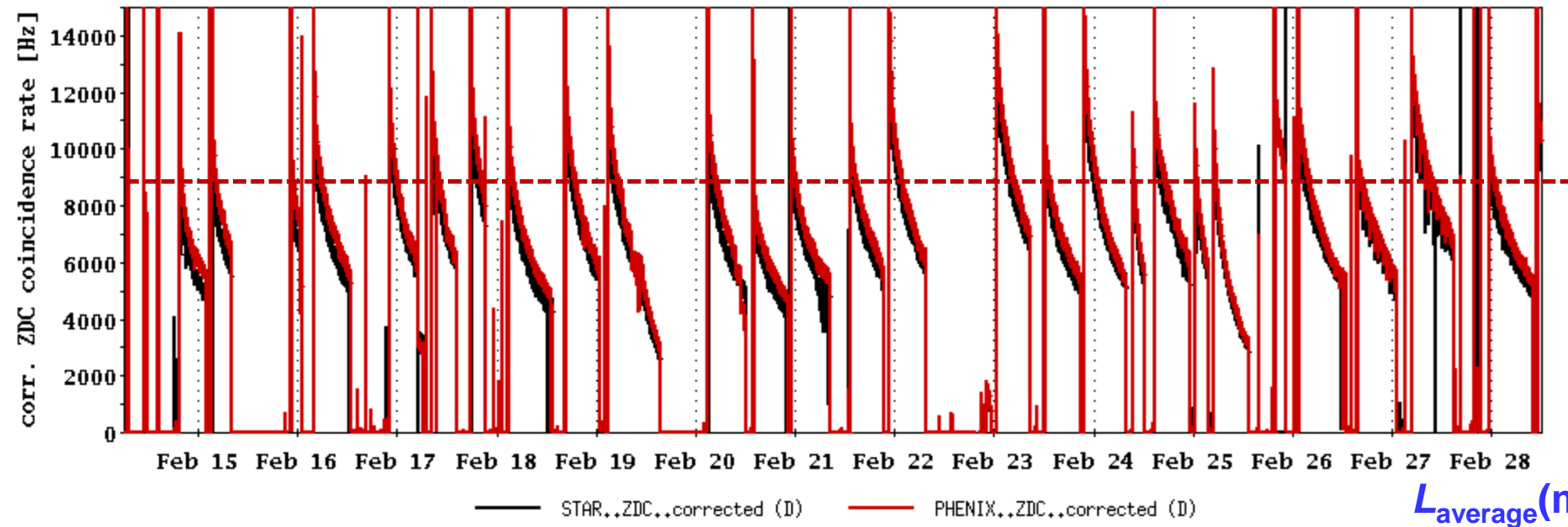
# BNL Energy Use FY 2010-12

as of 8 Mar 2012

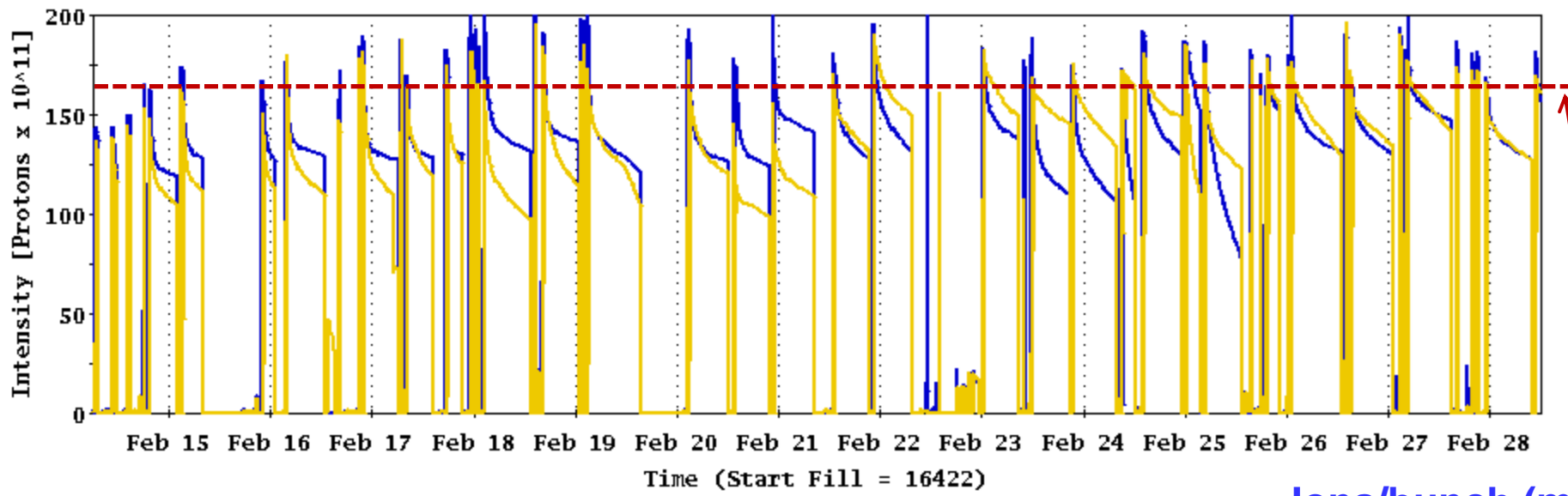


Accidental corrected Exp. Coinc. Signals

Past Week

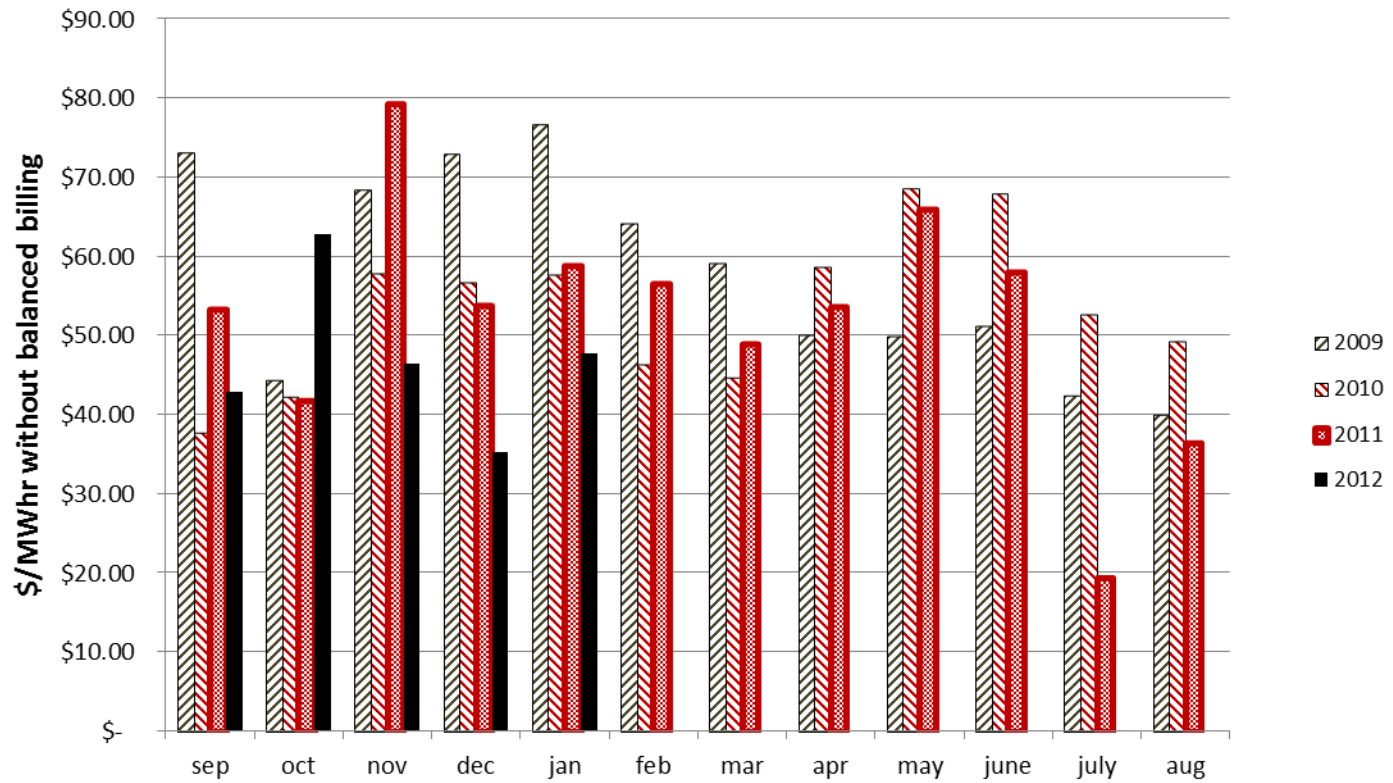


Lverage (m  
(0.29 mb xsec

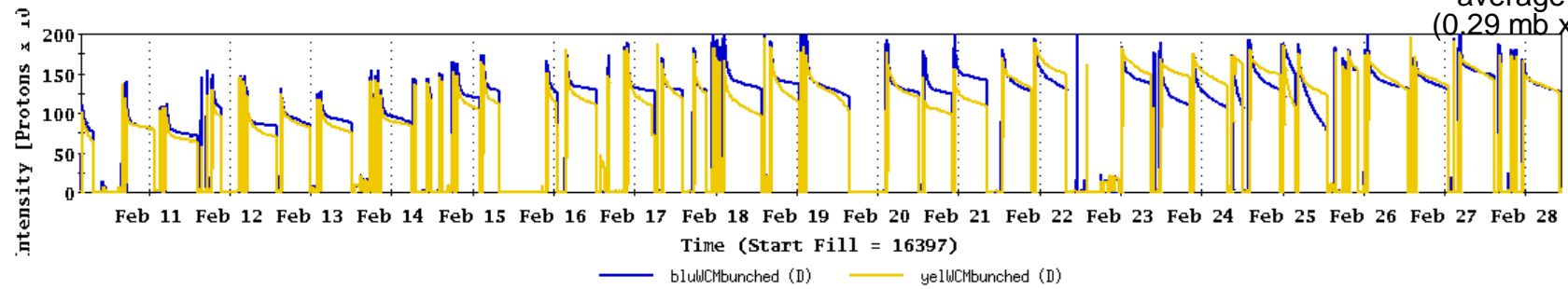
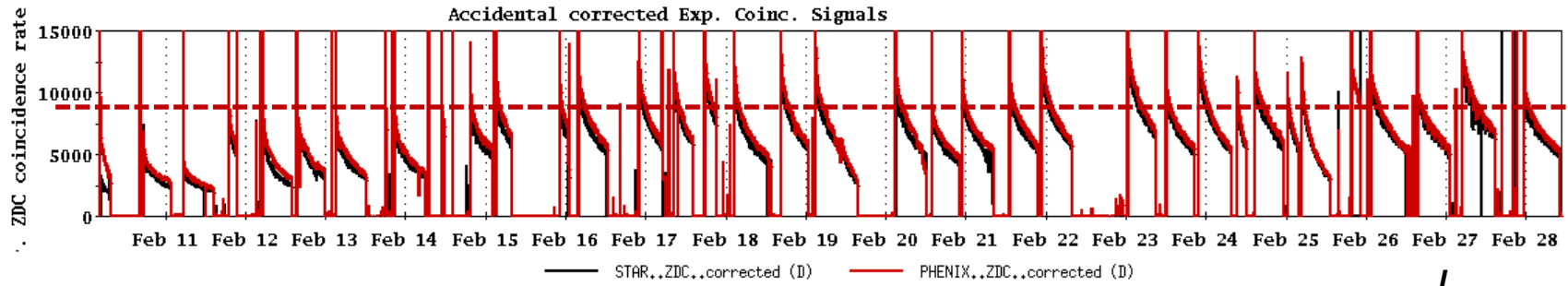
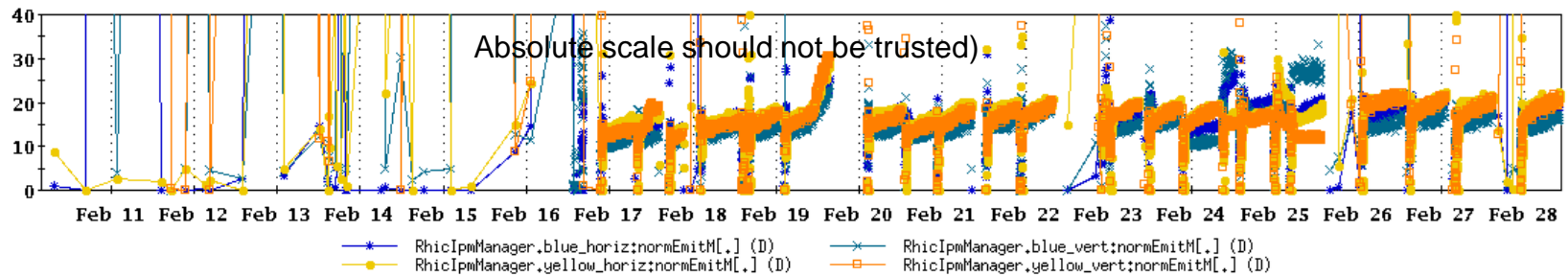
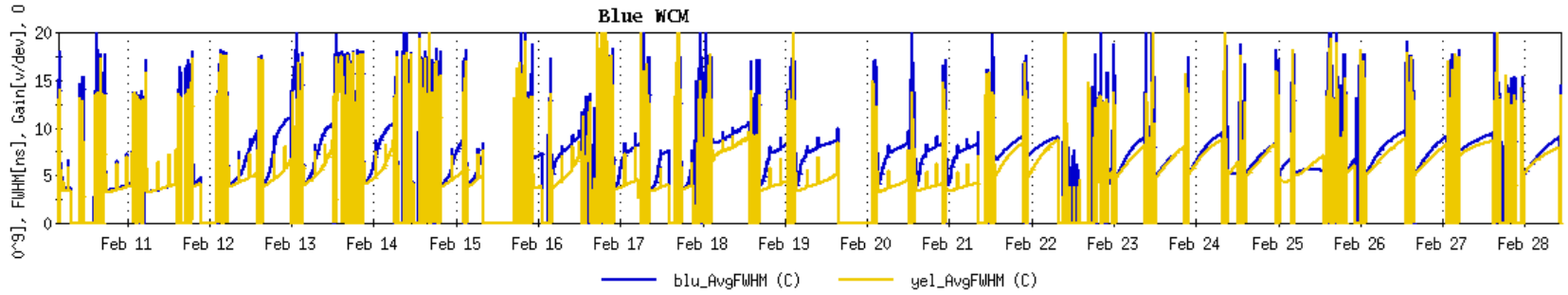


Ions/bunch (ma

## BNL Electricity Cost

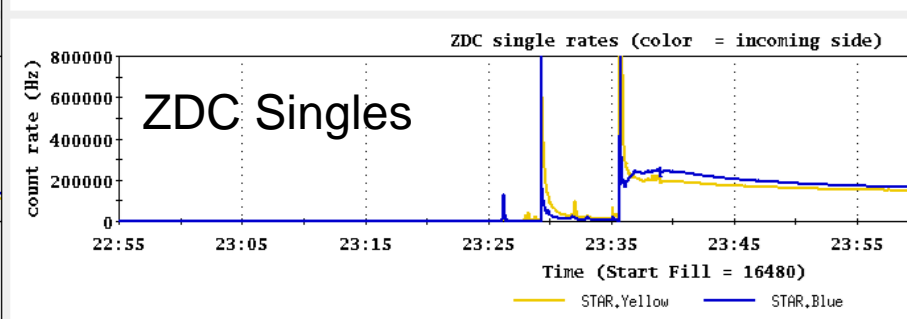
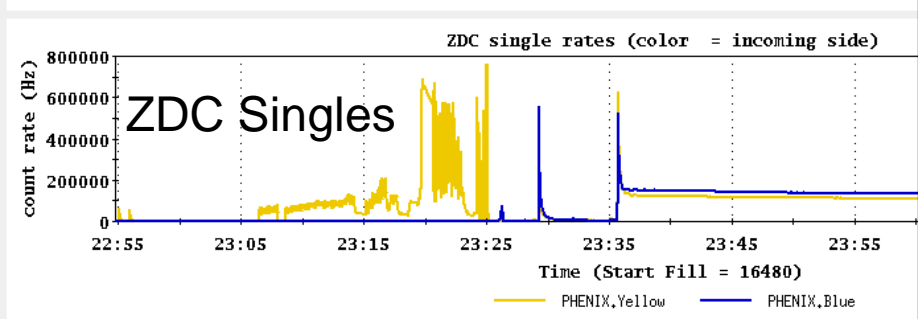
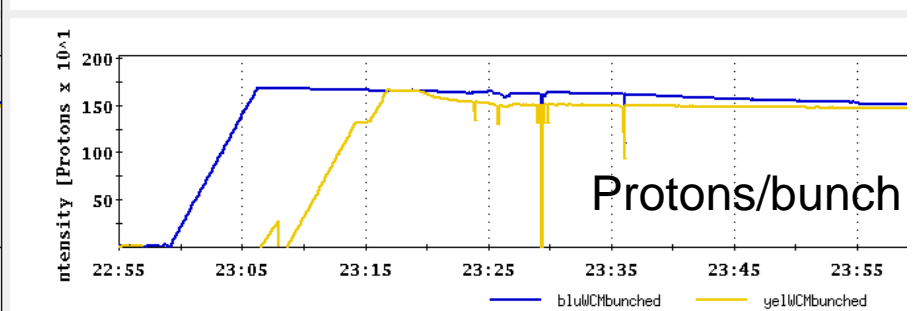
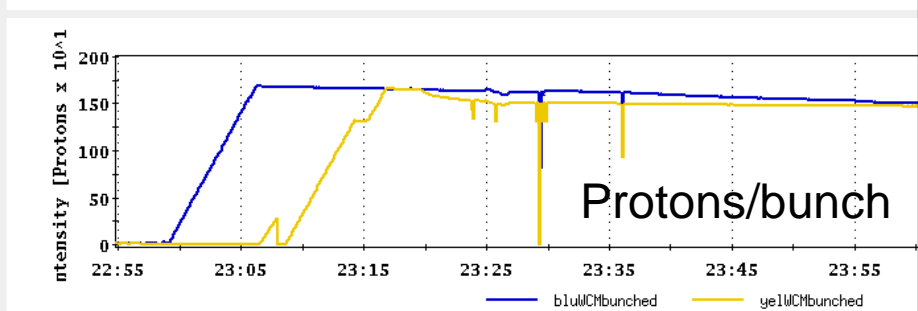
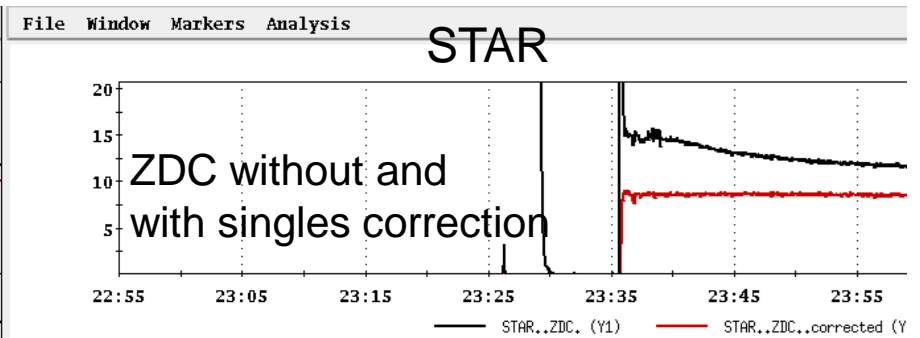
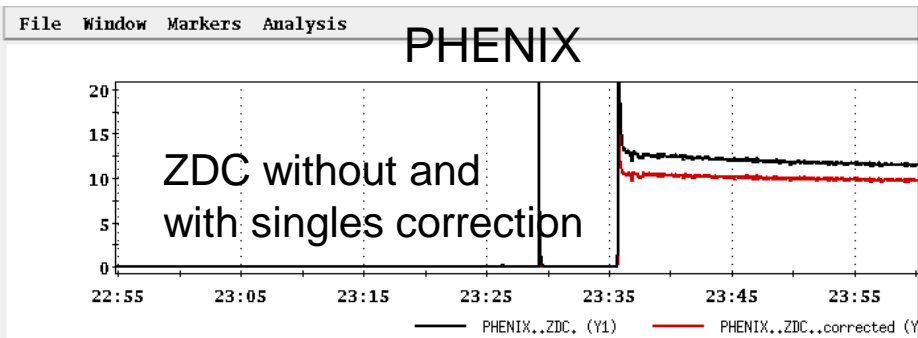


# Run 12 Physics Stores to 28 Feb



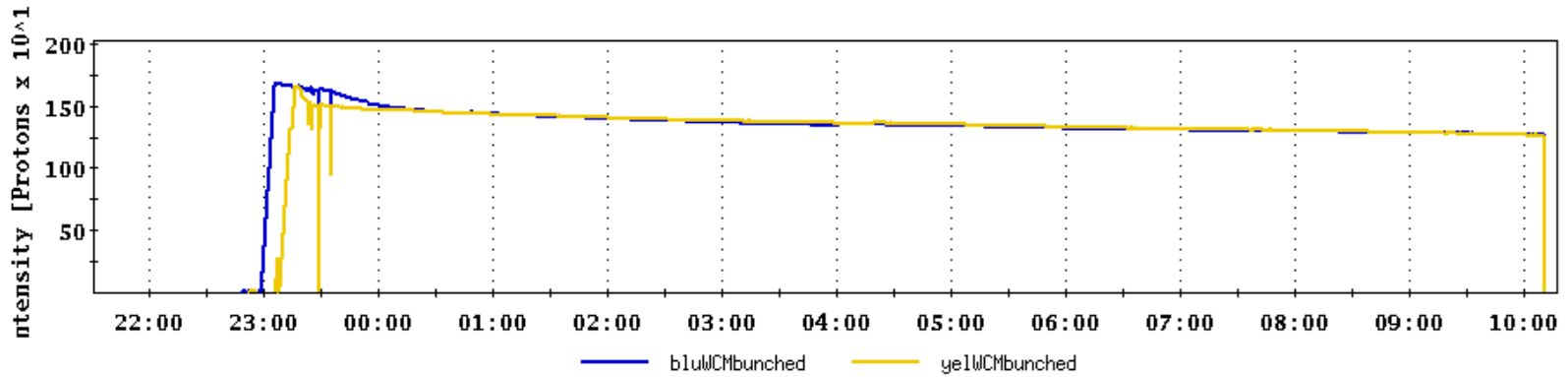
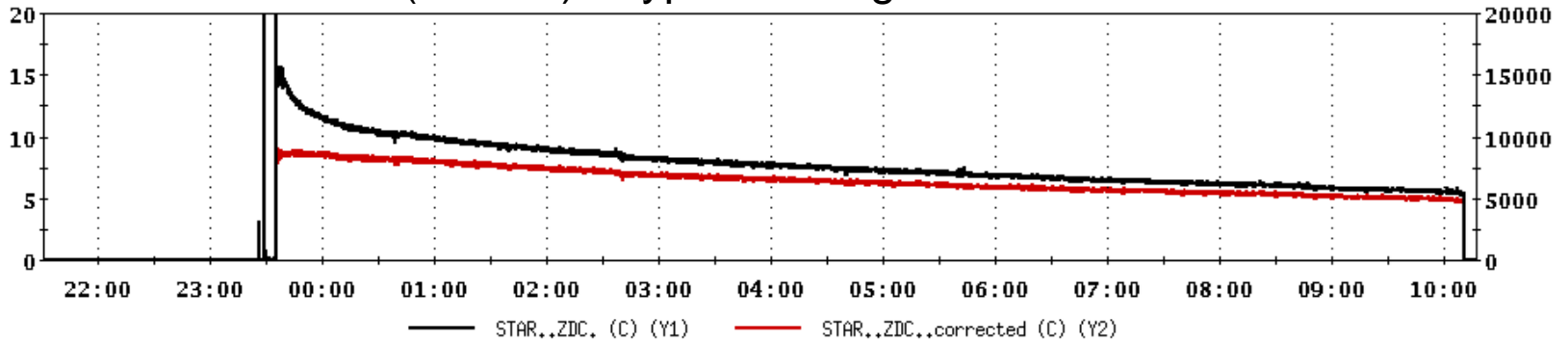
$L_{\text{average}}(\text{max})$   
(0.29 mb xsection)

# Store 16480 (27 Feb) – typical background issues

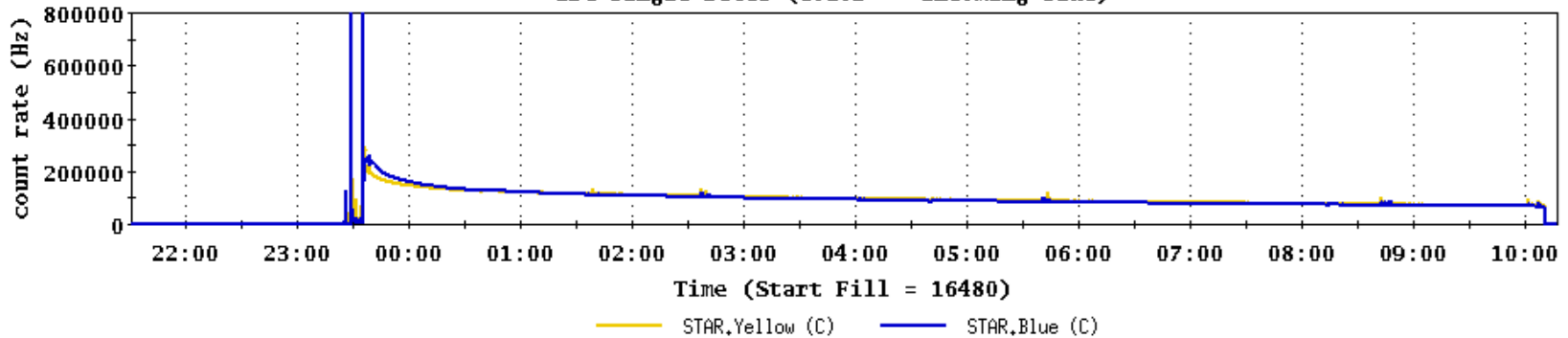




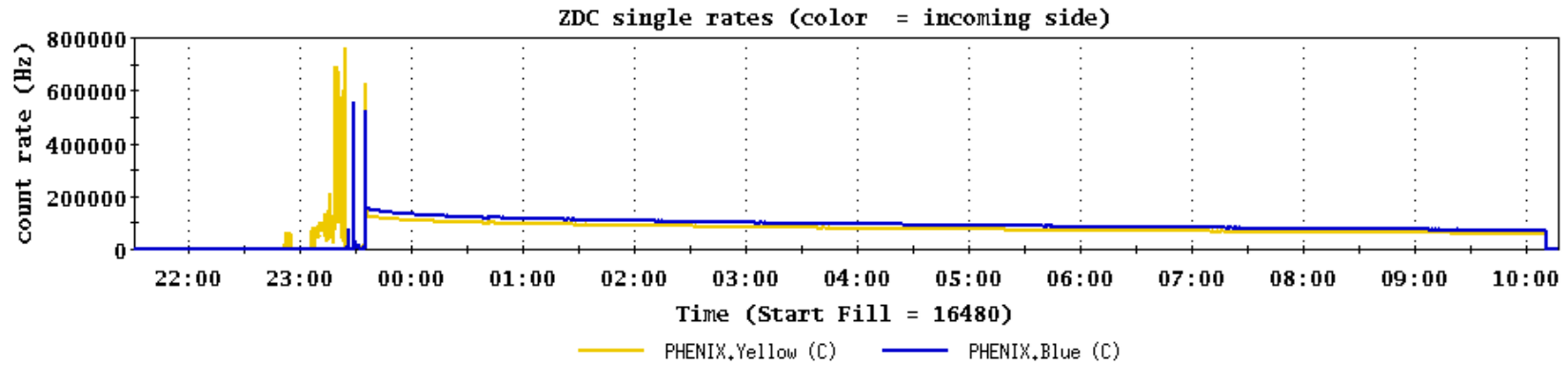
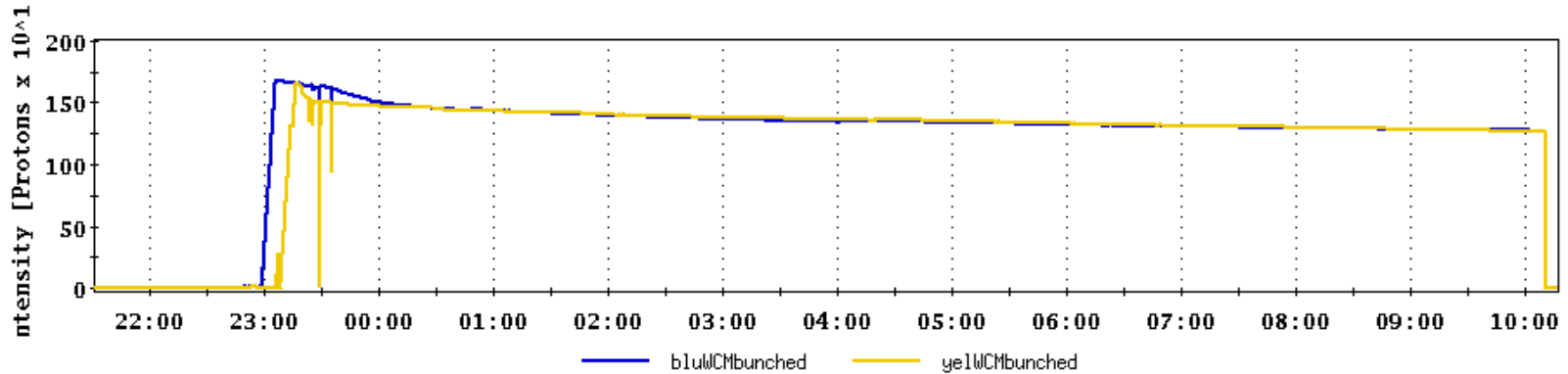
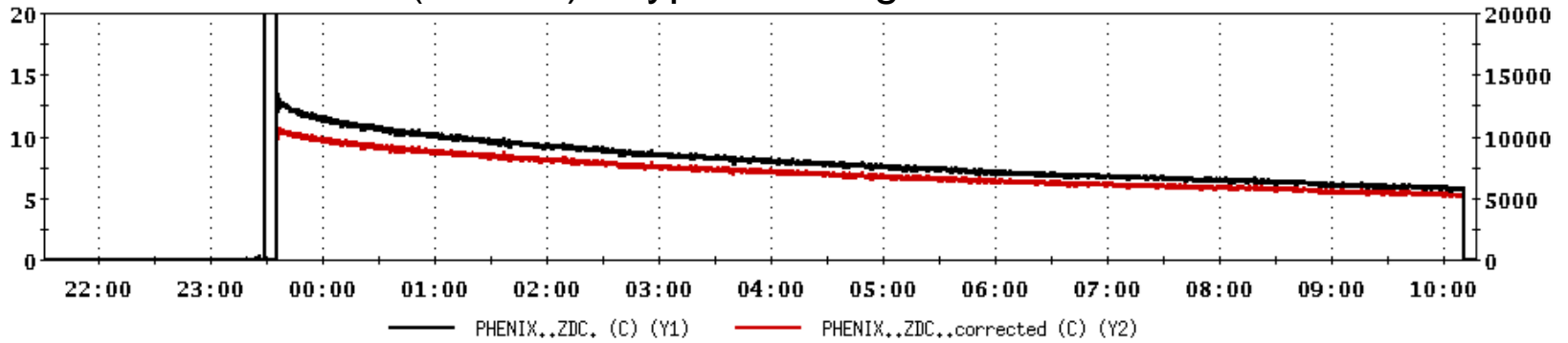
# Store 16480 (27 Feb) – typical background issues



## ZDC single rates (color = incoming side)



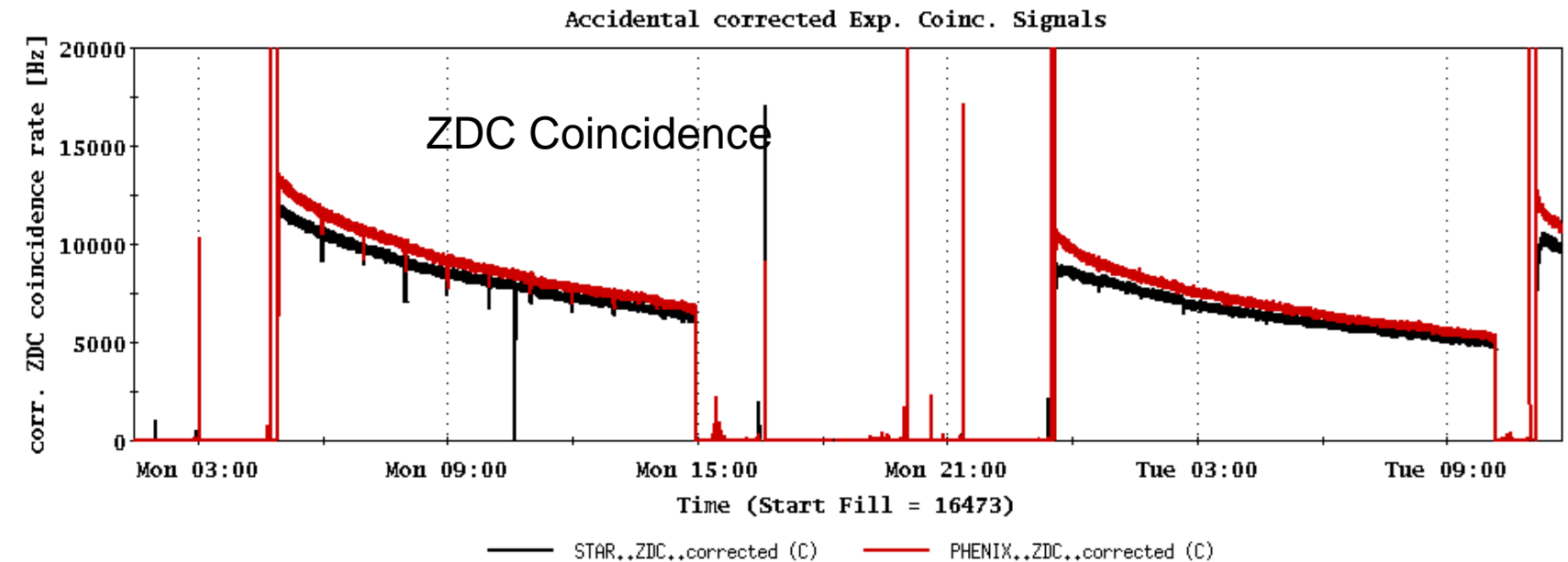
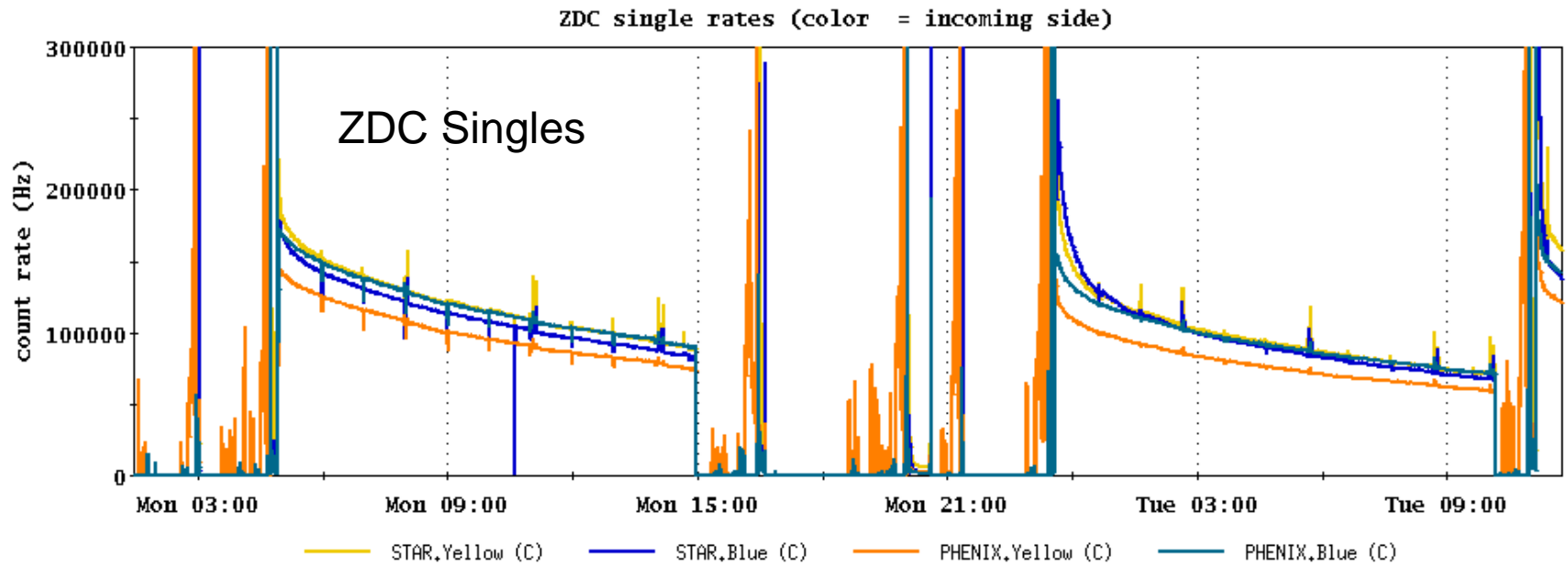
# Store 16480 (27 Feb) – typical background issues



# Collision steering corrections background issues 26-27 Feb

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

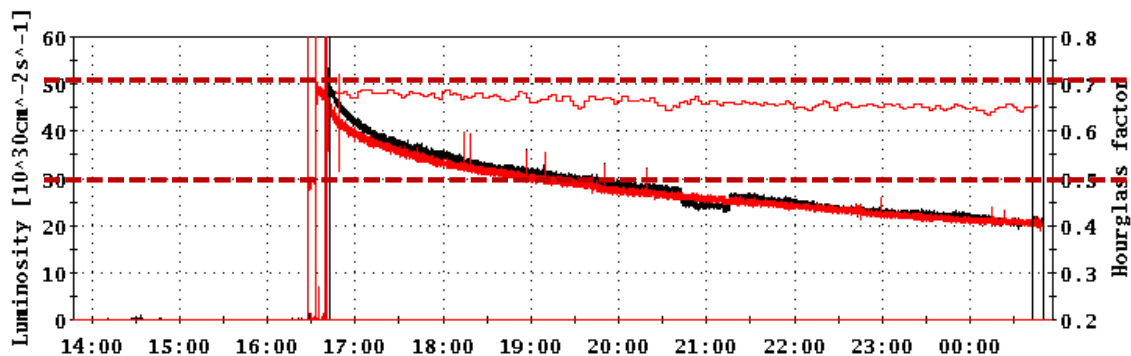
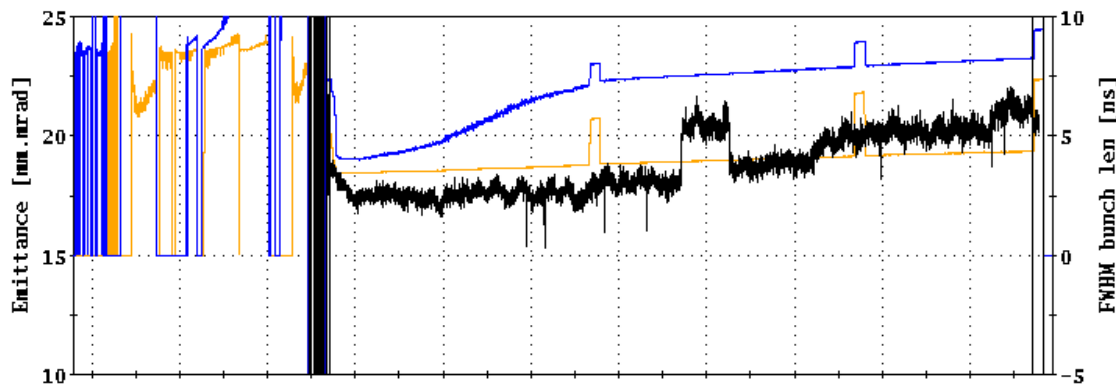
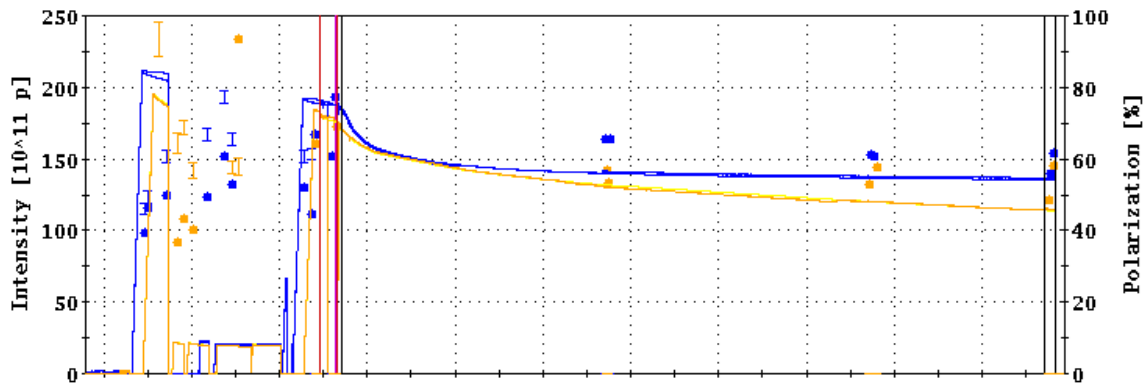
File Window Markers Analysis



# 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 All  All

sig(1n)/sig(2n)

Update Display

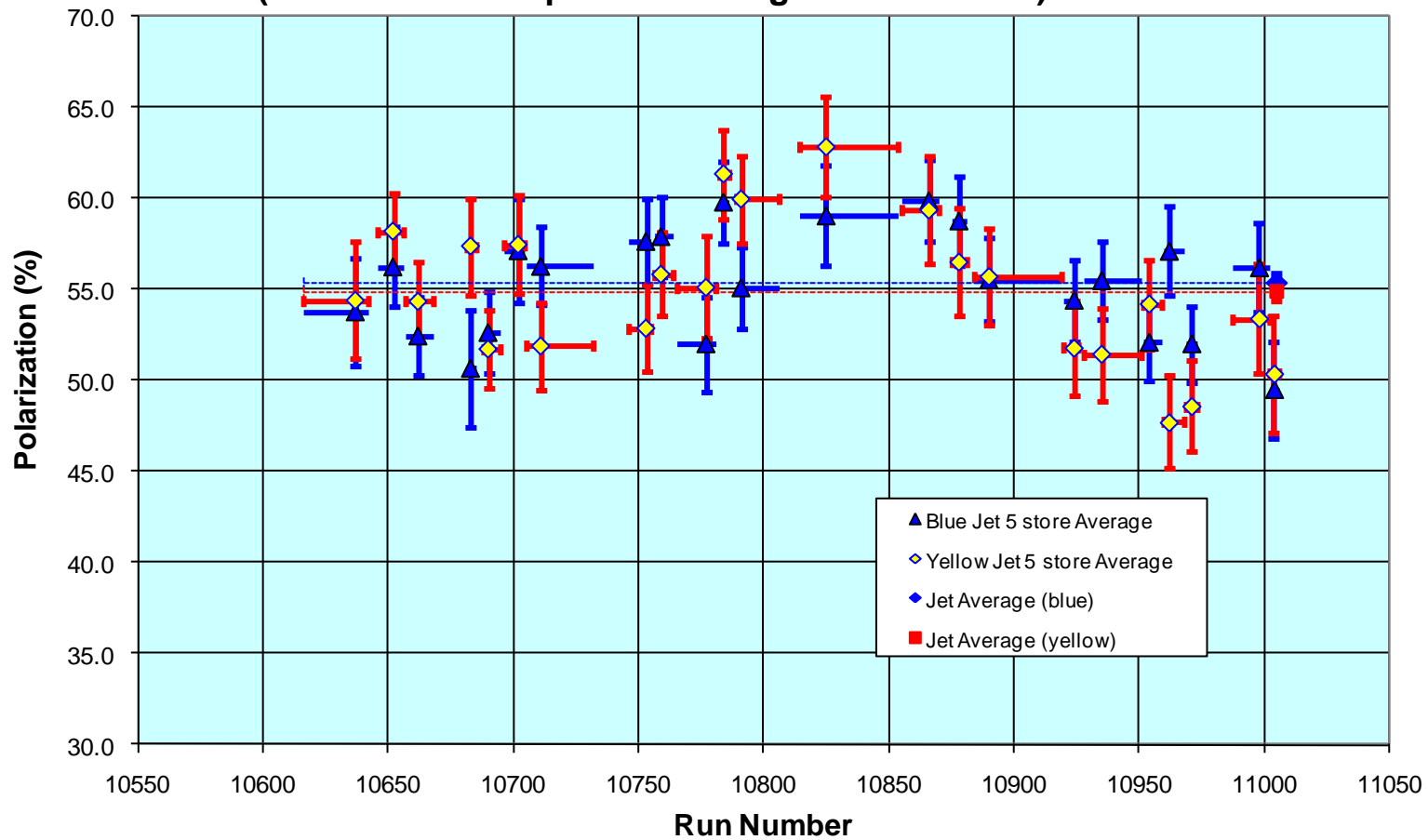
Fit

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 =  $55.4 \pm 0.5$

Yellow Jet weighted average =  $54.9 \pm 0.5$

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

STAR Goal: 27 pb<sup>-1</sup> delivered with 55-60 % polarization

PHENIX Goal: 27 pb<sup>-1</sup> delivered with 55-60 % polarization

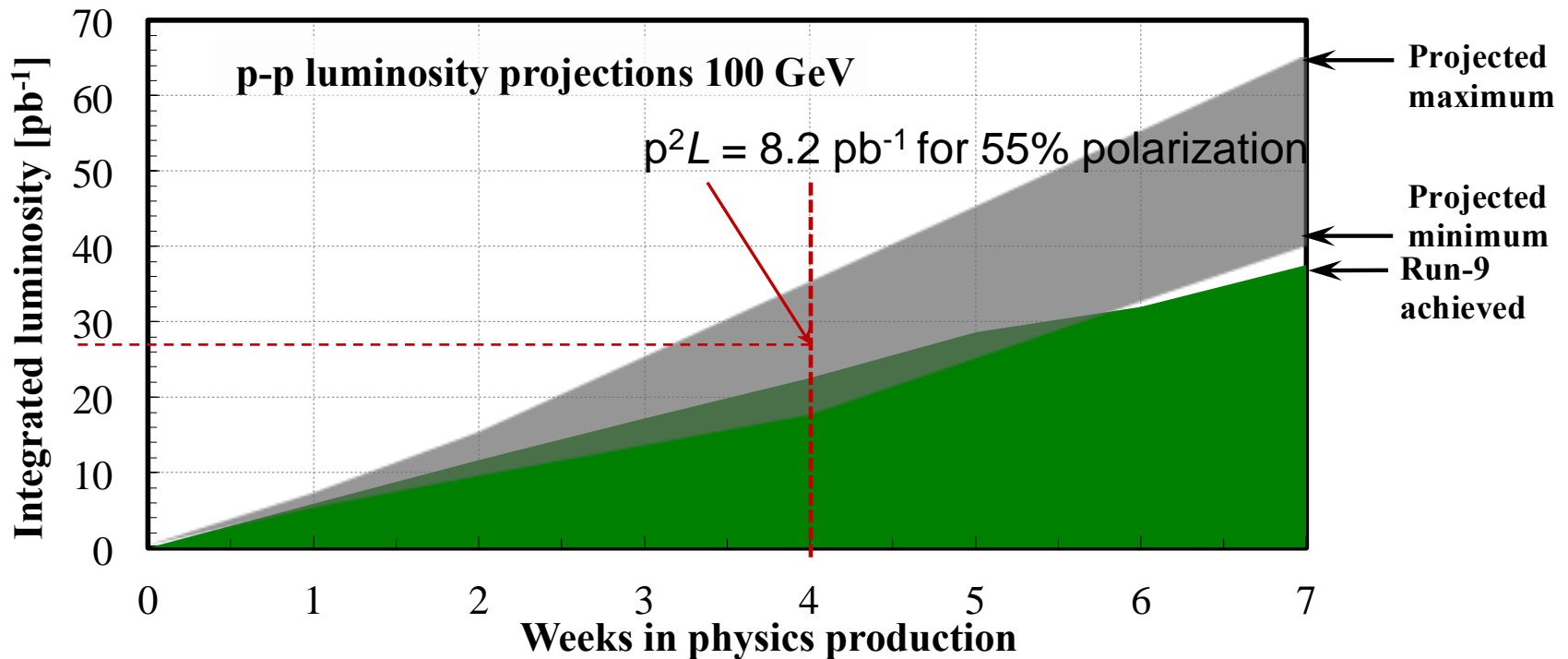


Figure 3: Projected minimum and maximum integrated luminosities for polarized proton collisions at 100 GeV beam energy, assuming a linear weekly luminosity ramp-up in 4 weeks. An average store polarization between 50 and 60% is expected.

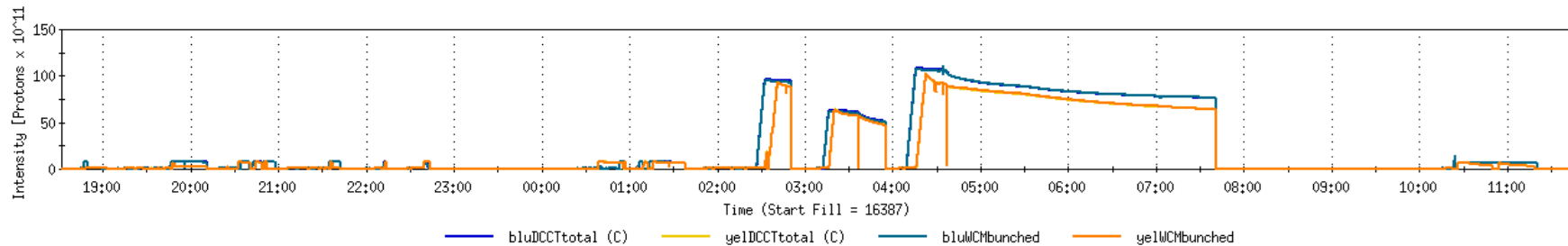
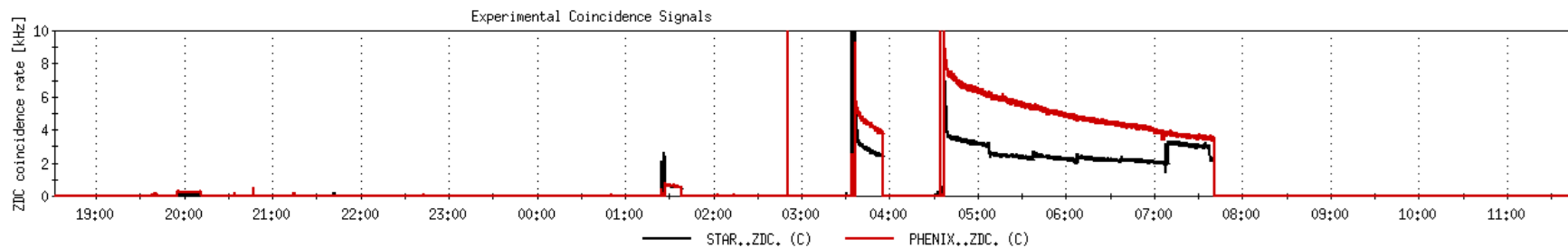
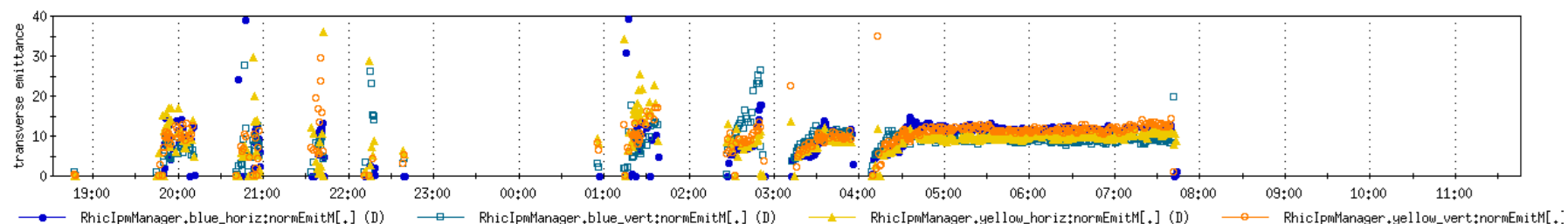
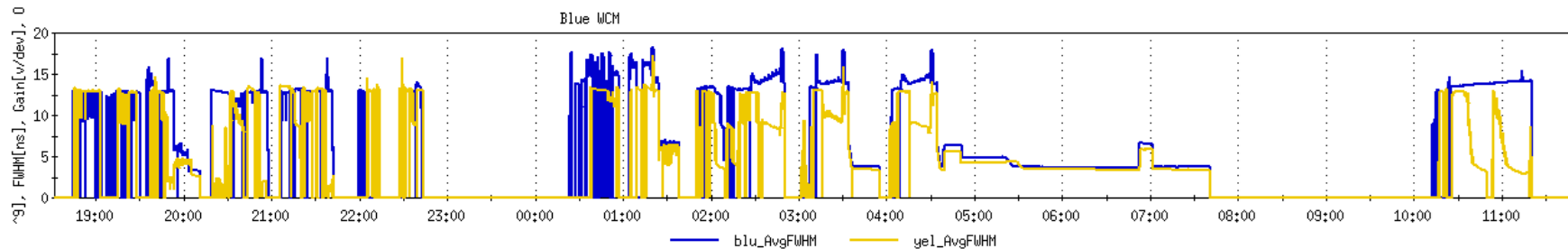
From Fischer et. Al. "RHIC Collider Projections (FY 2012 – FY 2016)"

14 October 2011

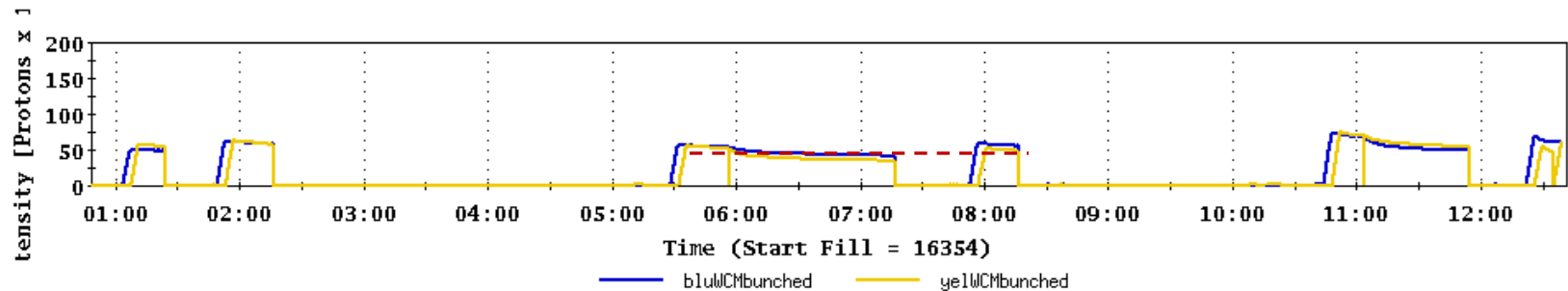
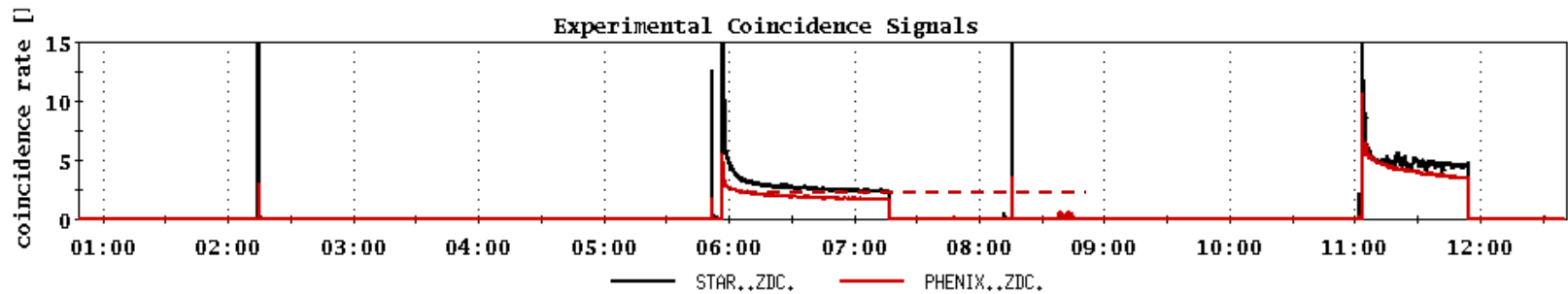
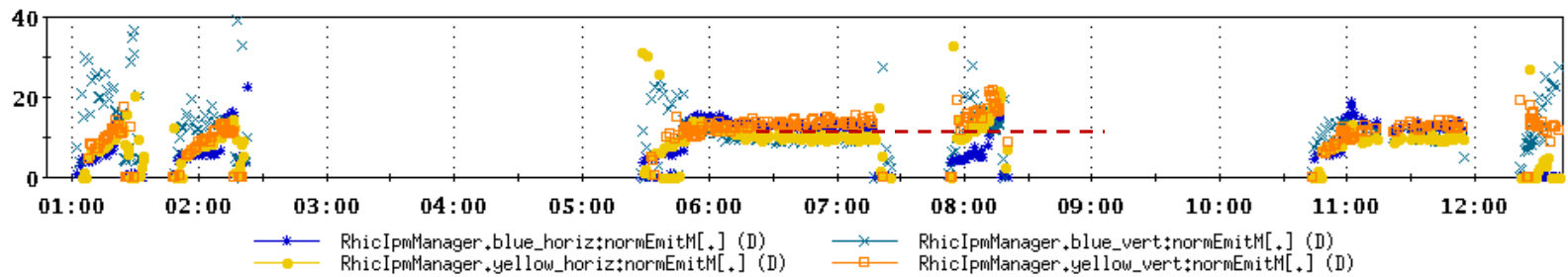
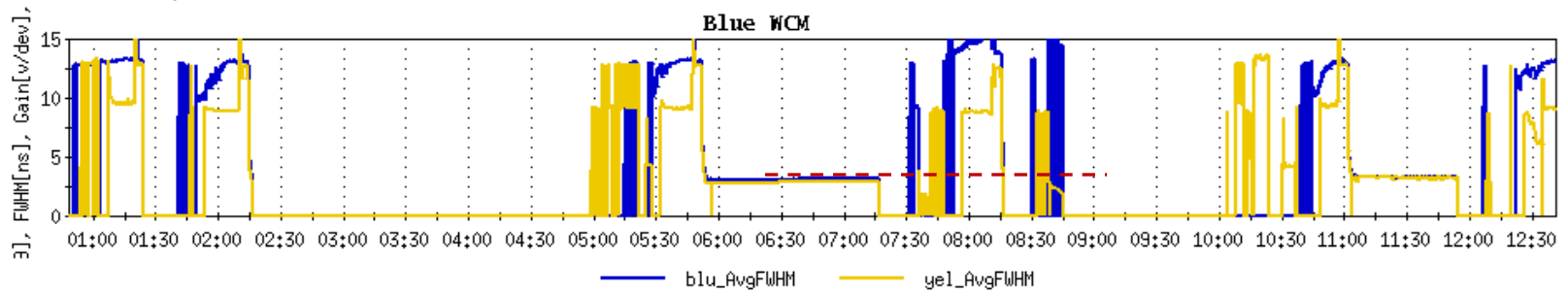
# First Physics Store (#16397, 04:01, 10 Feb)

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

File Window Markers Analysis

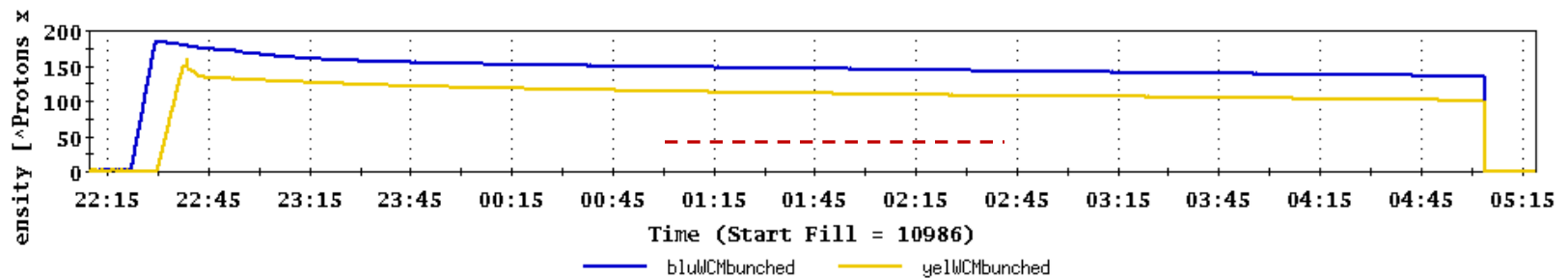
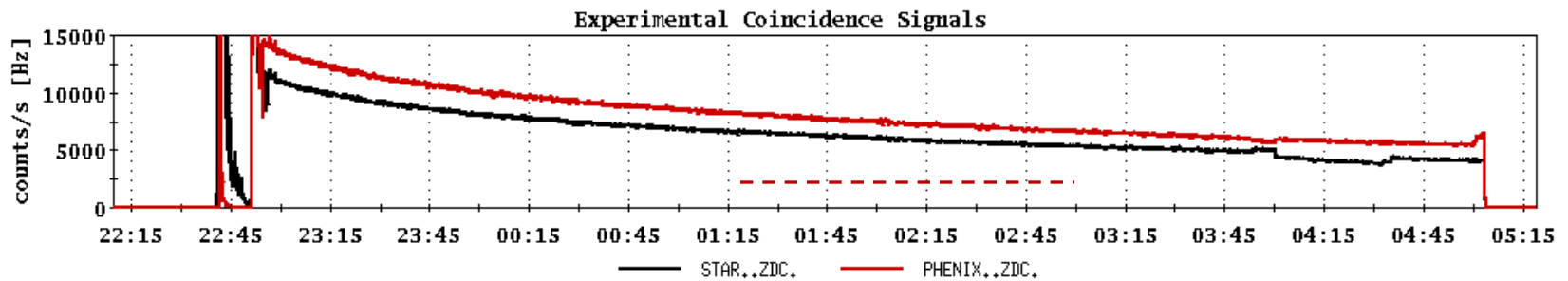
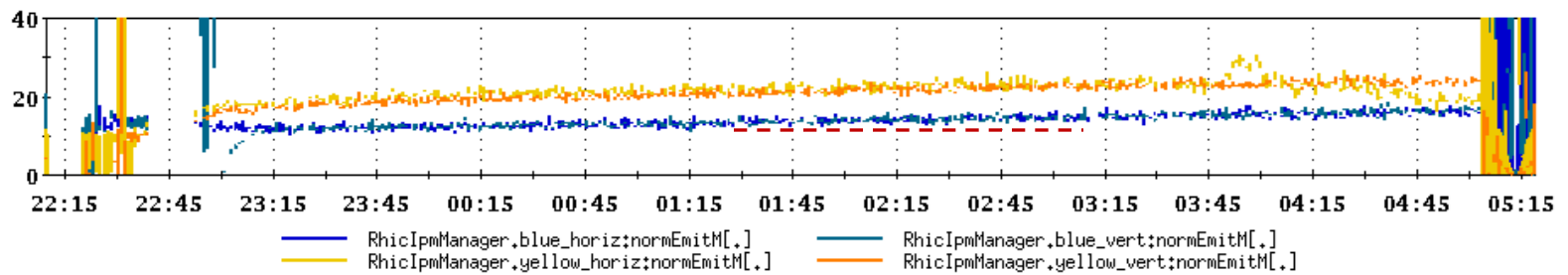
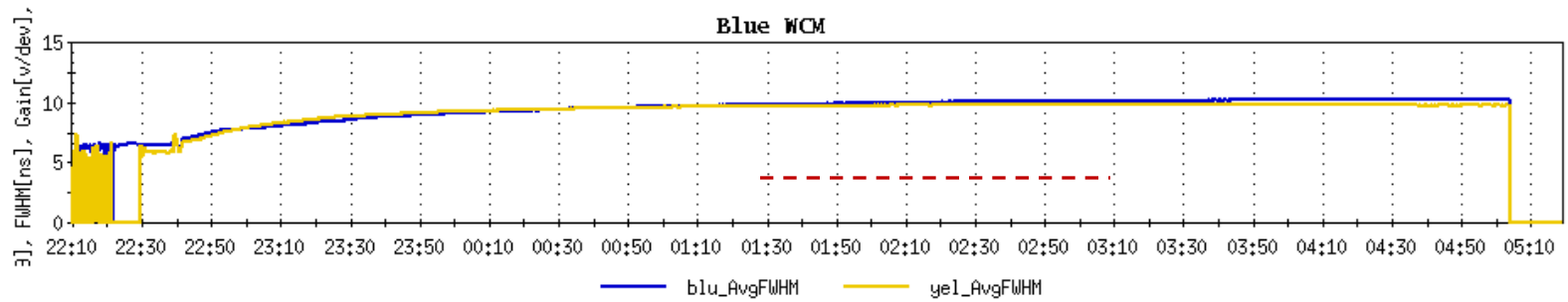


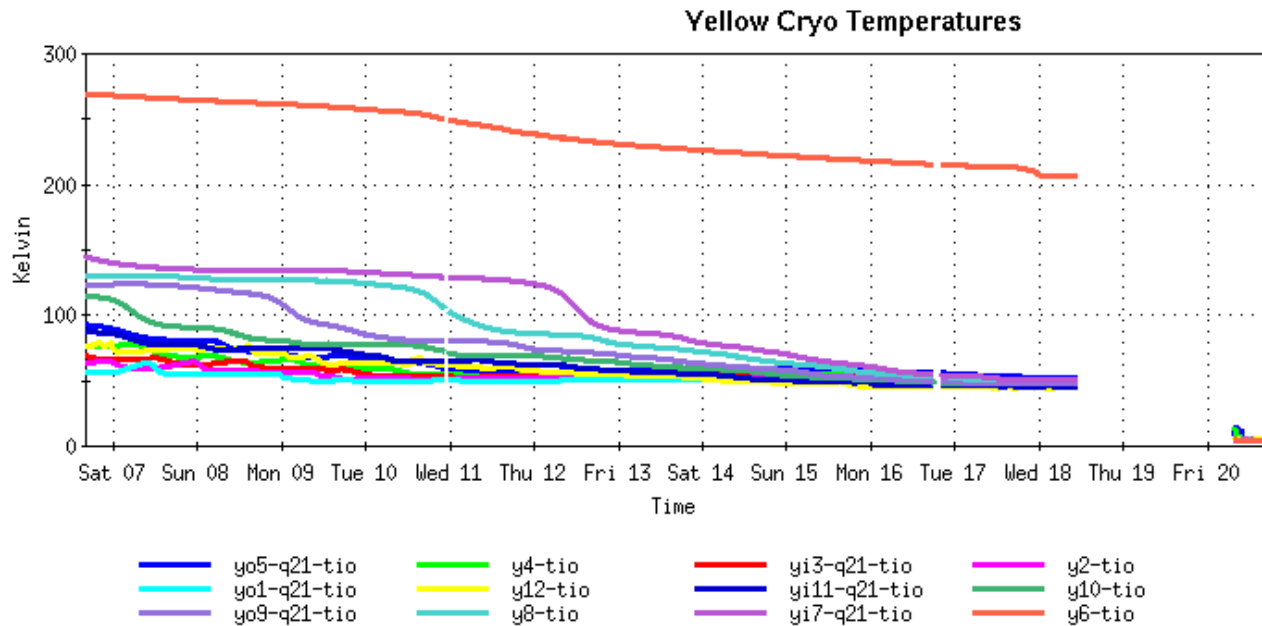
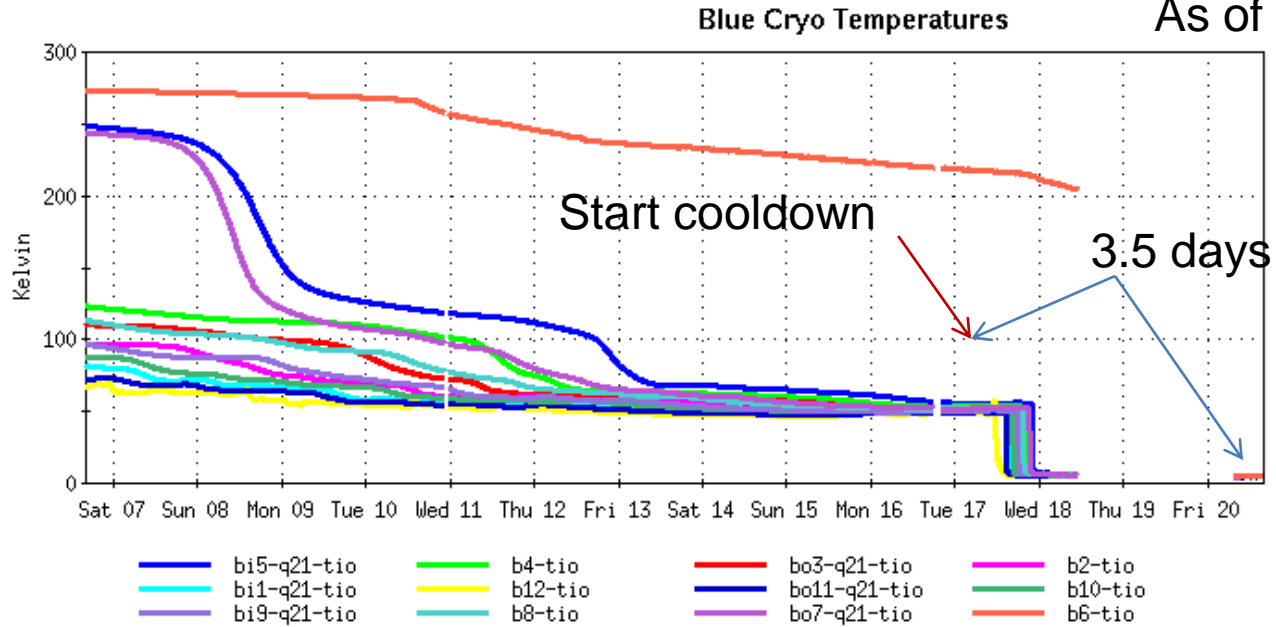
Today, 7 Feb 2012





# Typical Store from Run 9, 100 x 100 GeV pp





# 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
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## 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

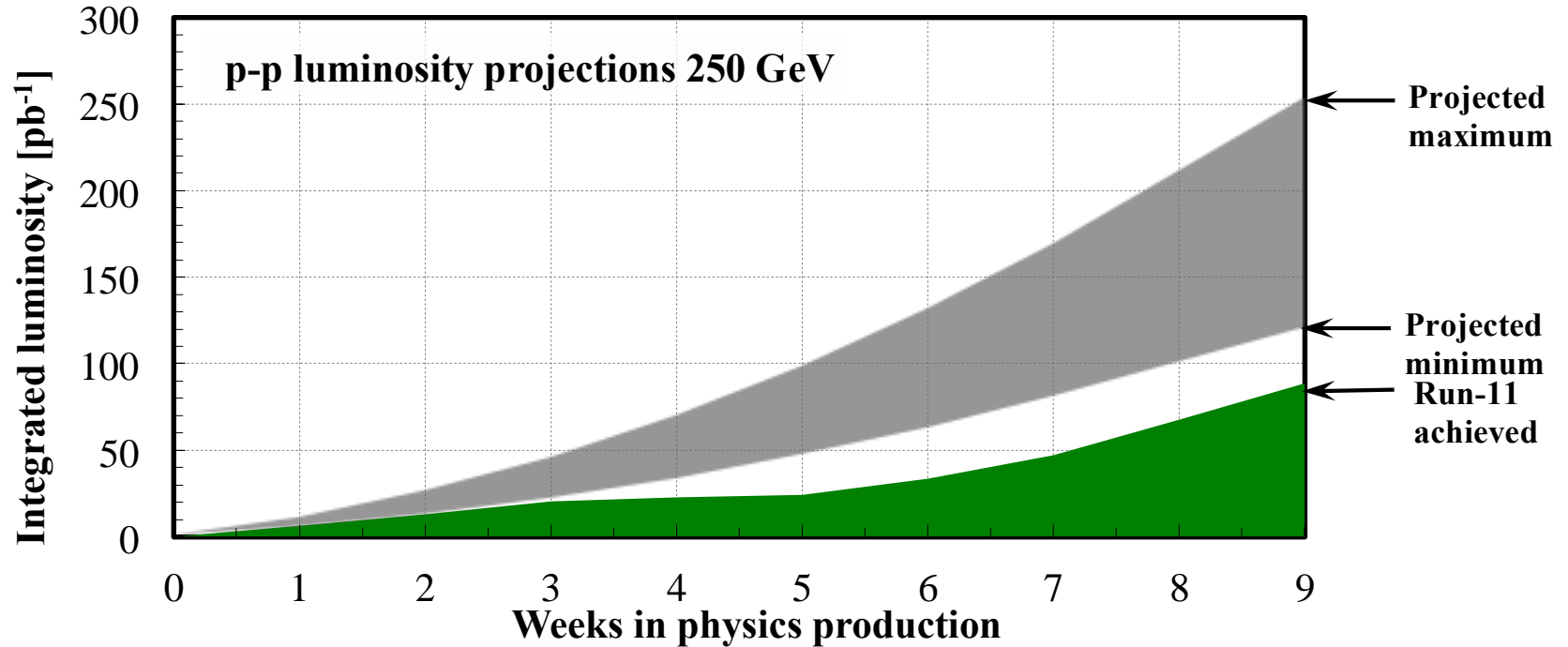


Figure 4: Projected minimum and maximum integrated luminosities for polarized proton collisions at 250 GeV beam energy, assuming linear weekly luminosity ramp-up in 8 weeks. An average store polarization between 45 and 50% is expected.

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

14 October 2011

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

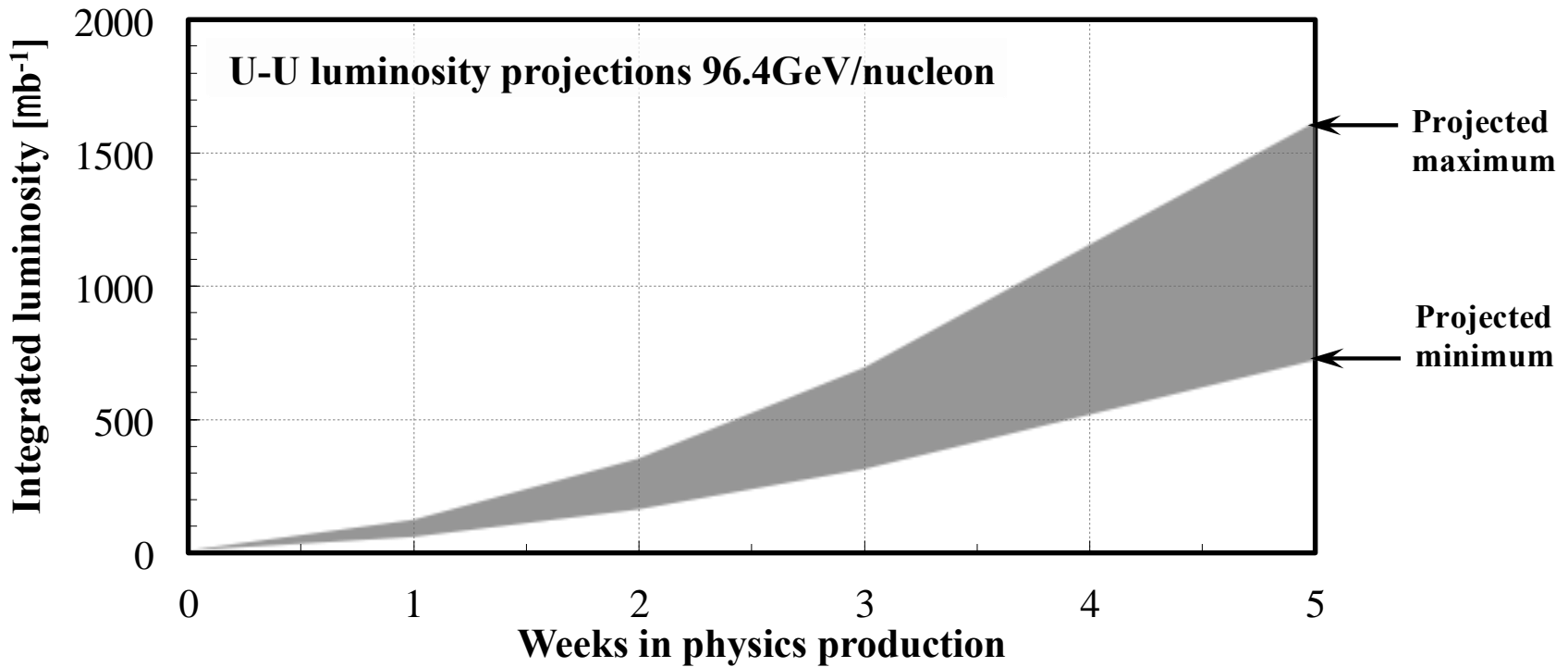


Figure 5: Projected minimum and maximum integrated luminosities for uranium-uranium at 96.4 GeV/nucleon, assuming linear weekly luminosity ramp-up in 48 weeks.

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

14 October 2011



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

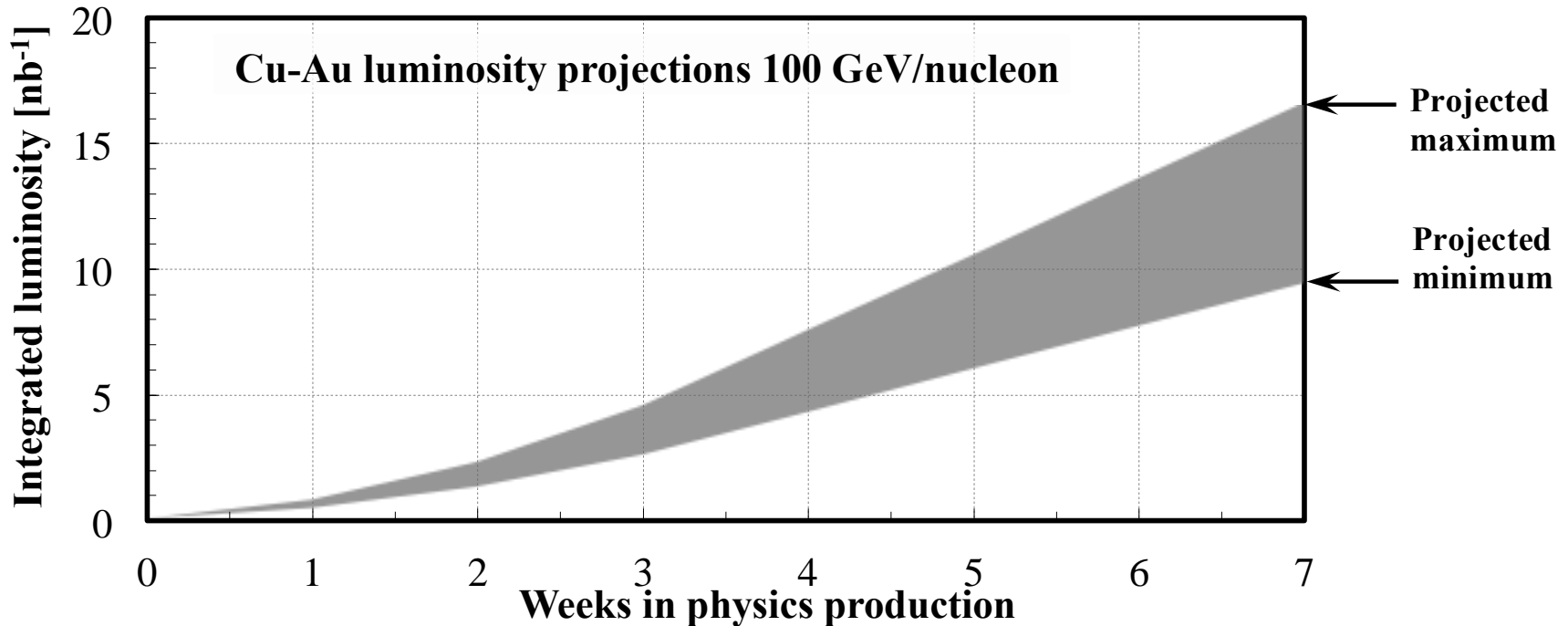


Figure 6: Projected minimum and maximum integrated luminosities for copper-gold collisions at 100 GeV/nucleon beam energy, assuming linear weekly luminosity ramp-up in 4 weeks.

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

14 October 2011