

Spin QA - Run 2013

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Outline

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- Run 13 spin patterns
- Spin QA procedure
- Examining & fixing bad fills
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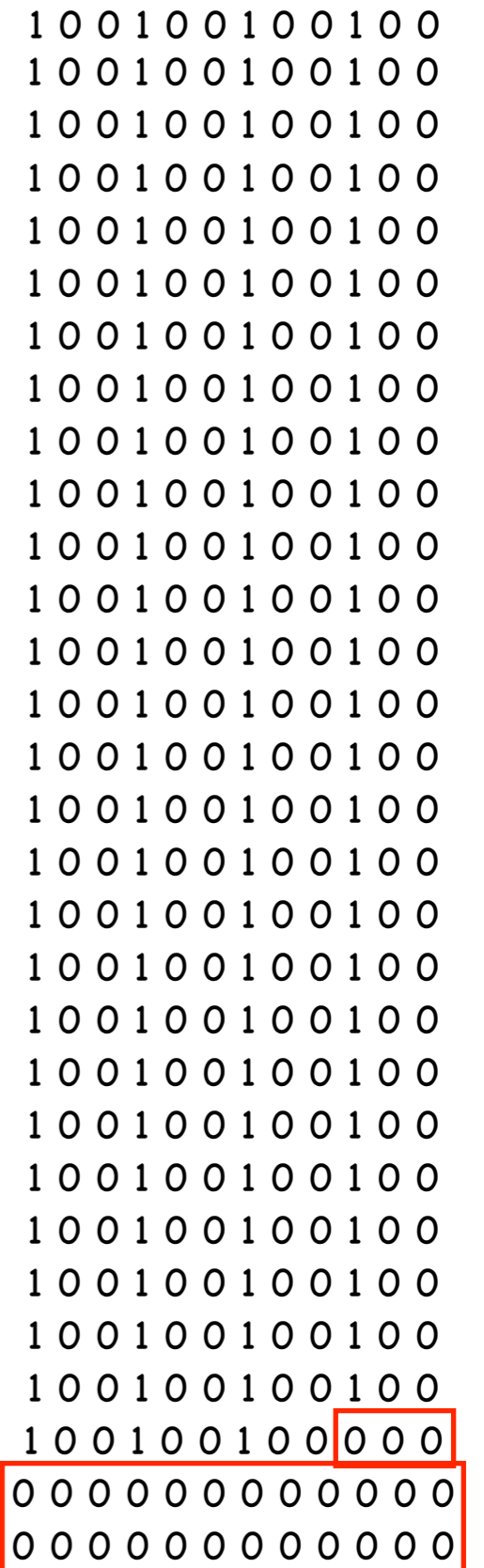
Introduction

1. spin QA - done before MuDst production
 - Determine if the spin information is correct (agree with the CDEV records) and the spin pattern is consistent (stable) throughout an entire RHIC fill.
2. bXing QA - done after MuDst production
 - Determine for both RHIC beams their offsets at the STAR collision point.

RHIC beam polarization: Fill patterns

- ◆ 360 RF time buckets in each ring, indexed as {0,359}
- ◆ 120 of 360 buckets are filled, called bunches indexed as {0,119}
- ◆ Bunches (111-119) are intentionally left empty as **abort gaps**
- ◆ Each filled bucket have either positive(+1) or negative(-1) helicity state.

Measured fill pattern of a RHIC beam at a given time



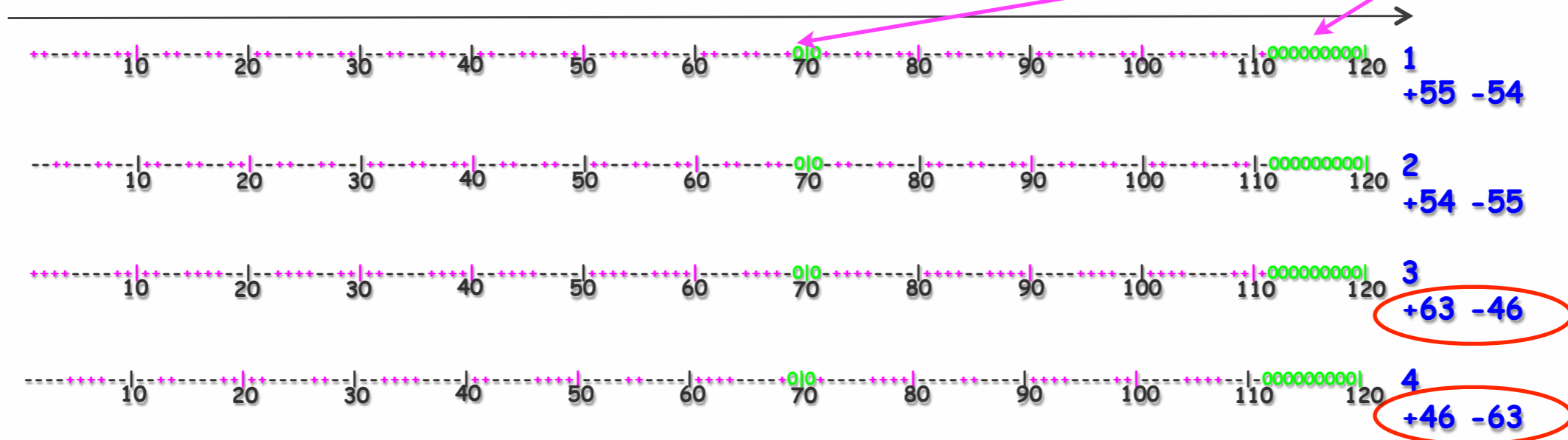
```
mysql -h dbbak.starp.bnl.gov --port 3412 Conditions_rhic -e "select dataS from kretDbBlobS where nodeID=9 and beginTime > 'YYYY-MM-DD HH:MM:SS' order by beginTime limit 1" -s -E
```


Run 13 spin patterns

- Before March 21st 2013 spin patterns were **modulo 14** (Repetition was **NOT** as expected!)

Blue beam pol. pattern	yellow beam pol. pattern	Pattern collided	Pattern collided
B1 : ++--++--++--++	Y4 : ----++++----++	B1xY3=P1	B3xY1=P5
B2 : --++--++--++--	Y3 : ++++----++++--	B1xY4=P2	B3xY2=P6
B3 : ++++----++++--	Y2 : ++--++--++--++	B2xY3=P3	B4xY1=P7
B4 : ----++++----++	Y1 : --++--++--++--	B2xY4=P4	B4xY2=P8

- ★ spin pattern does **NOT** continue through empty bunches (30,31) in **Y** and (70,71) in **B**. **Empty bunches**
- ★ Patterns 3&4 have huge asymmetries between N_+ and N_- .



More info @ Elke's slides:

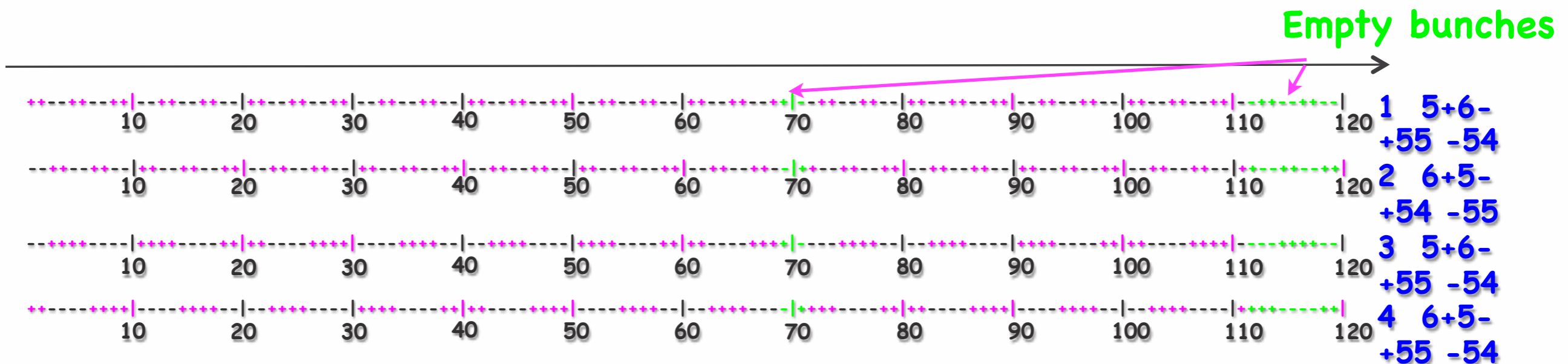
<https://www.phenix.bnl.gov/WWW/publish/elke/STAR/TALKS/eca-spinpatterns2013.correction.pptx>

Run 13 spin patterns

- After March 21st 2013 spin patterns were modulo 8 (Repetition was as expected!)

Blue beam pol. pattern	yellow beam pol. pattern	Pattern collided	Pattern collided
B1 : ++--++--	Y4 : ++-----++	B1xY3=P21	B3xY1=P25
B2 : --++--++	Y3 : --++++--	B1xY4=P22	B3xY2=P26
B3 : --++++--	Y2 : --++--++	B2xY3=P23	B4xY1=P27
B4 : ++-----++	Y1 : ++--++--	B2xY4=P24	B4xY2=P28

- ★ Bunches 30/31 in **Y** and 70/71 in **B** were left empty intentionally until Apr. 20 (Fill 17407)

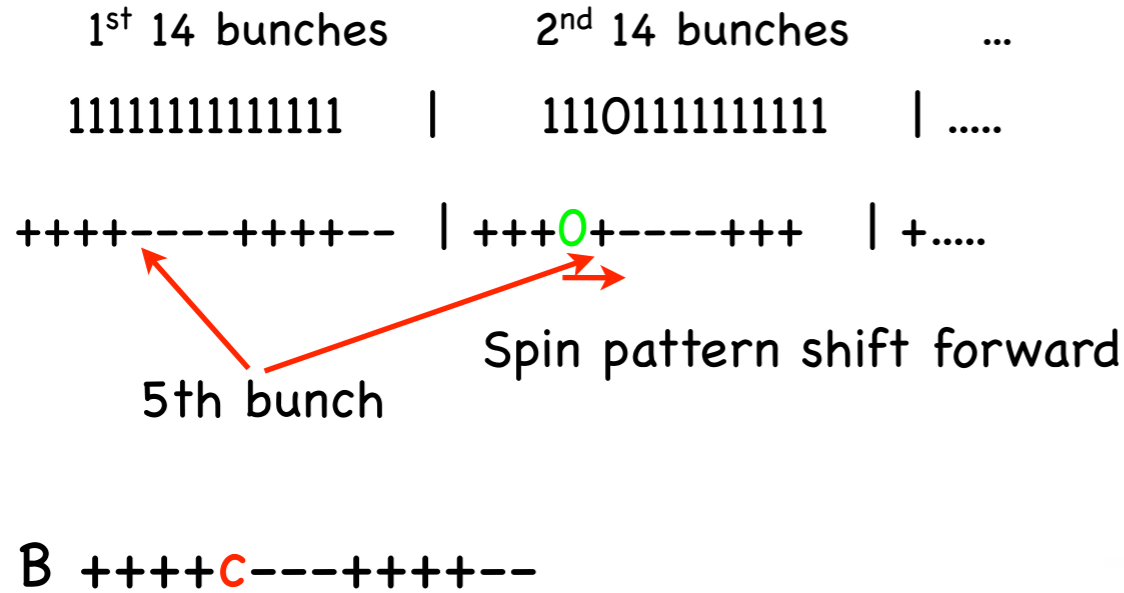


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<https://www.phenix.bnl.gov/WWW/publish/elke/STAR/TALKS/eca-spinpatterns2013.correction.pptx>

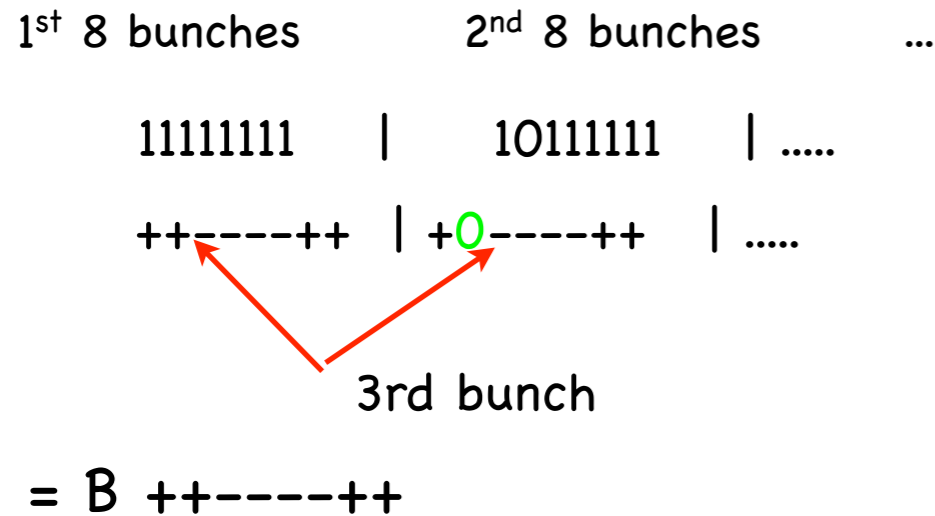
Before March 21st

spin pattern does **NOT** continues through the empty bunches



After March 21st

spin pattern continues through the empty bunches



Fill #	spin pattern
F17232	B-ccccccccc+---++ Ycc++cc--cc++cc
F17236	B+ccccccccc-+++-- Ycc++cc--cc++cc
F17237	B-ccccccccc+---++ Ycc--cc++cc--cc
F17238	B+ccccccccc-+++-- Ycc--cc++cc--cc
F17239	Bcc++cc--+++++-- Y++-ccccccccc+--
F17240	Bcc++cc--+++++-- Y--+ccccccccc-++
F17241	Bcc--cc++-----++ Y++-ccccccccc+--
F17244	Bcc--cc++-----++ Y--+ccccccccc-++
F17247	B-ccccccccc+---++ Ycc++cc--cc++cc
F17248	B+ccccccccc-+++-- Ycc++cc--cc++cc
F17250	B-ccccccccc+---++ Ycc--cc++cc--cc
F17253	B++-+++-- Y--+++++--
F17256	B++-+++-- Y++-----++
F17263	B--++-+++ Y++-----++
.....

Spin QA procedure

1. loopMainAll.tcl

- Generate the run list : **162 fills 2394 runs**

(trgSetUpName -> "pp500_production_2013" , "pp500_production_2013_noendcap"

ShiftStatus -> "successful" & Questionable

Min. subsystem -> tpc, emc

run time per run -> >180s)

2. spbitSeeker.tcl

- Collect spin info from the DB

- two outputs : v124 -> contains spin info of every single bunch of the fill.

- spinTime.txt -> contains info of each fill including spin pattern

3. begEndComp.tcl

- Compare beginning and end v124 files of each fill

- produce "good" & "bad" fill lists

4. Fix bad fills by hand

v124 file : what uploads to database at the end

#rhic/spinV124

0 240



B bunch 1 collide with Y bunch 1 at 2 or 8 o'clock

1 1



data analyzed are long. polarized



Time bucket

001 1001 1	1
^{1 2 3 4} 00000000	2
00000000	3
001 1001 1	4
00000000	5
00000000	6
01 010 101	7
00000000	8
00000000	9
01 01010 1	10
00000000	11
00000000	12
001 1010 1	13
00000000	14
00000000	15
001 1010 1	16
00000000	17

1	fired if the bunch is unpolarized
2	fired if the bunch has negative helicity
3	fired if the bunch has positive helicity
4	fired if the bucket should be filled

Fixing BAD fills

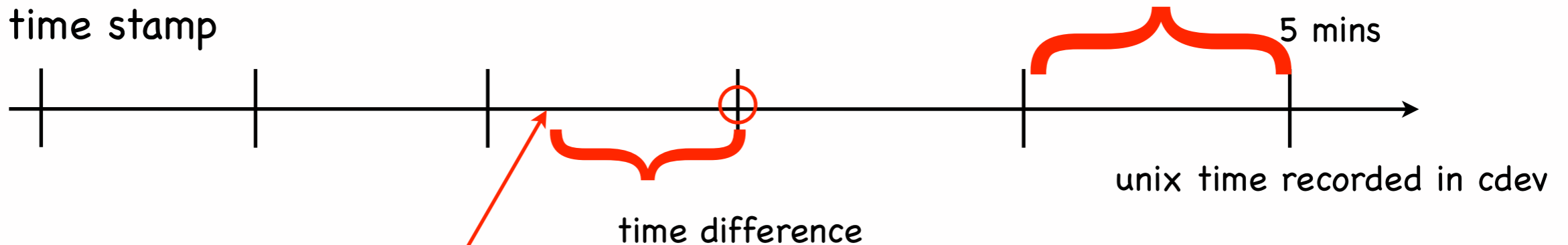
- Only 3 fills were recorded in the bad list :
F17434, F17538, F17600

Fill 17434

Fill #	F17434
1st run	14118048
last run	14118064
# of runs	12
fill start time	1367171873
fill stop time	1367201916
start diff	6614
stop diff	241
1st run time	2013-04-28 14:17:53
# of filled B	B111
# of filled Y	Y111
spin patterns	B---++++-- Y++---+
pattern index	P25

Issue
<ul style="list-style-type: none"> Time difference between fill start time in star DB and CDEV is longer than 5 minutes.
Examining/fixing
<ul style="list-style-type: none"> found that CDEV start time was not recorded as expected every 5 minutes no effect on the spin pattern
conclusion
this is a good fill

● RHIC time stamp



```
mysql -h dbbak.starp.bnl.gov --port 3412 Conditions_rhic -e "select dataS from kretDbBlobS where nodeID=9 and beginTime > 'YYYY-MM-DD HH:MM:SS' order by beginTime limit 1" -s -E
```

Fill 17538

Fill #	F17538
1st run	14142134
last run	14143093
# of runs	19
fill start time	1369277939
fill stop time	1369341307
start diff	17
stop diff	0
1st run time	2013-05-22 23:18:59
# of filled B	B111
# of filled Y	Y111
spin patterns	B---++--++ Y++-----++
pattern index	P24

Issue
<ul style="list-style-type: none"> spbitSeeker script stops running just after getting the spin info at the beginning of the fil
Examining/fixing
<ul style="list-style-type: none"> checked cdev output interactively and found broken cdev output after the 1st run until the end of the fill. Output is broken after displaying the spin pattern. Update script to ignore the error and continue.
conclusion
<p>This is a good fill????</p>

Fill 17600

Fill #	F17600
1st run	14158039
last run	14160033
# of runs	67
fill start time	1370650977
fill stop time	1370808446
start diff	195
stop diff	166
1st run time	2013-06-07 20:42:57
# of filled B	B111
# of filled Y	Y111
spin patterns	B++-----++ Y---++---++
pattern index	P28

Issue

- Spin Pattern is not consistent throughout the entire fill. Blue beam intensity dropping with time.

Examining/fixing

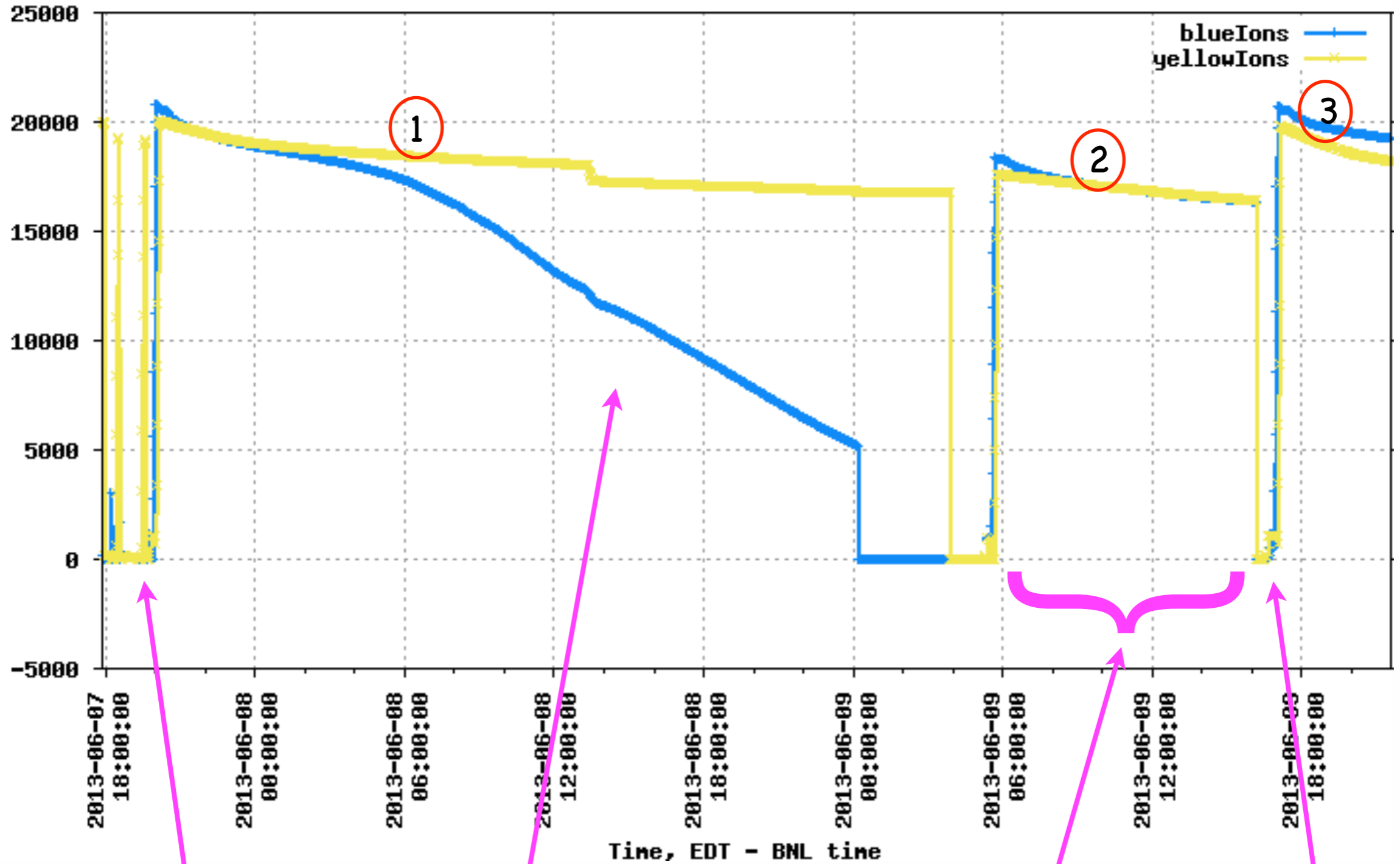
- checked cdev output at different time stamp during the fill
- found last 14 runs has different spin pattern compared to first 53 runs.

first 53 runs B++-----++ Y---++---++
 last 14 runs B++---++--- Y ---++++---

conclusion

last 14 runs have different spin pattern. This pattern does not match with the next fill either.
 Need to introduce a new fill number!

RHIC beam Ions during F17600- F17601



F17600 start

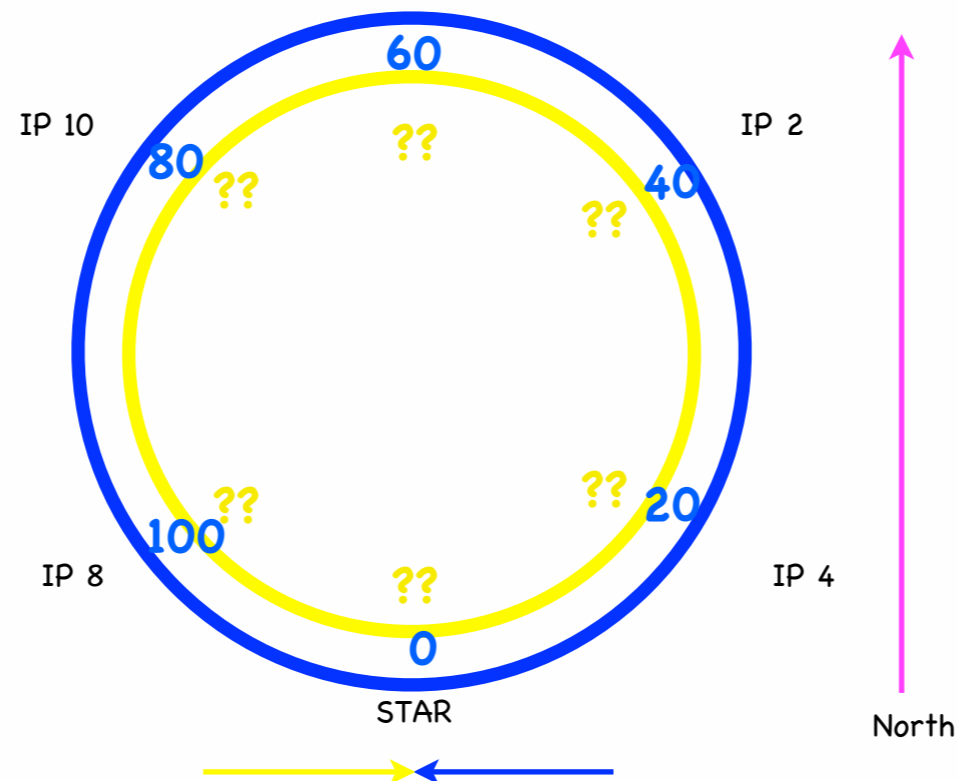
First 53 runs,
Blue beam ion intensity dropping

Last 14 runs of F17600

F17601 start

Beam cogging determination

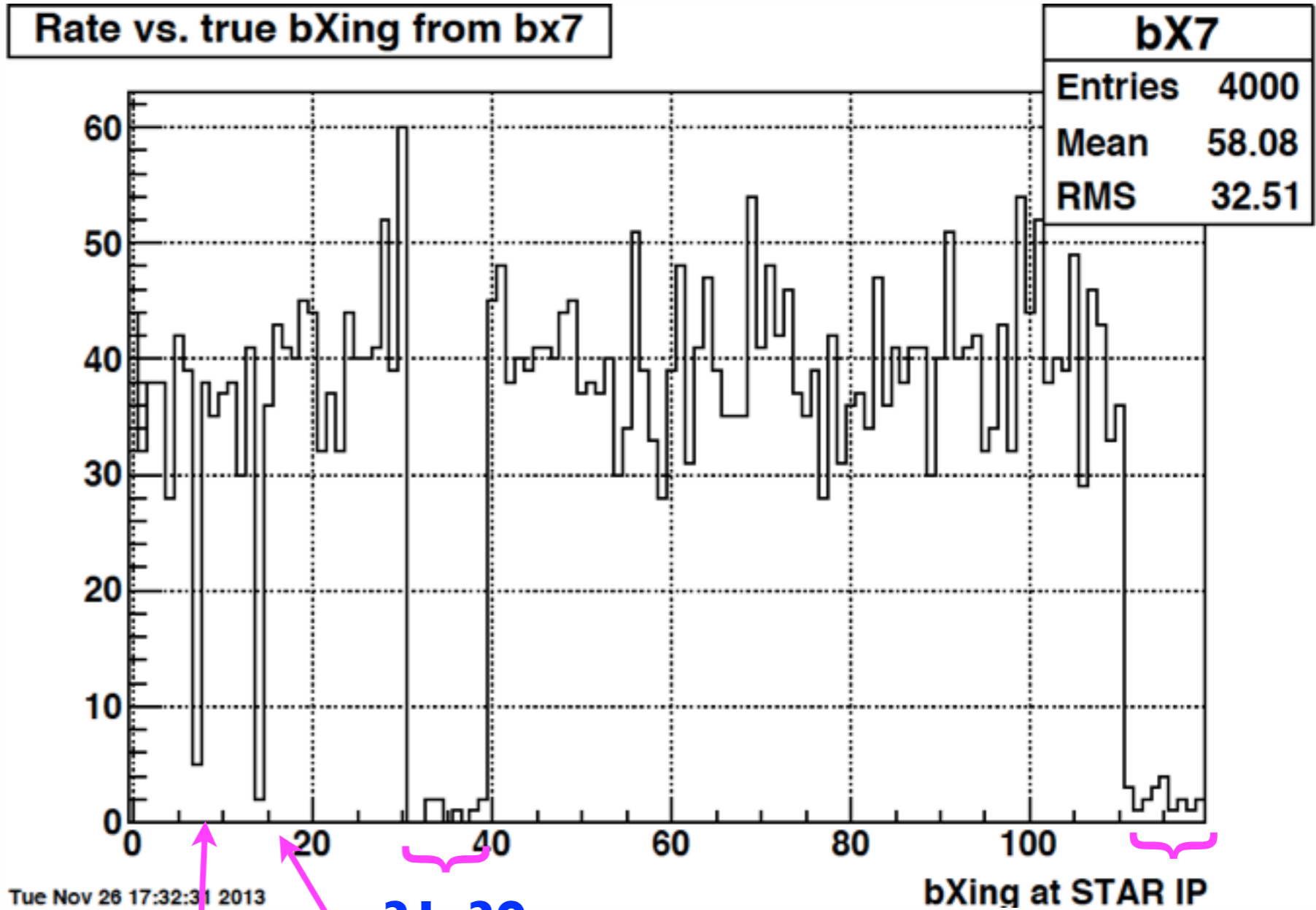
- Once RHIC beams are injected into rings they are cogged meaning beams are set such that the first bunches collide at specific points.
- Blue beam bunch 0 collides with Yellow beam bunch 0 at either IP2 and 8 o'clock or IP4 and 10 o'clock.
- Need to determine which bunches are colliding at STAR (6 o'clock)



Fill 17554

missing bunches

RF Bucket	Missing BB	Missing YB
262		87
283		94
334	111	111
337	112	112
340	113	113
343	114	114
346	115	115
349	116	116
352	117	117
355	118	118
358	119	119



● bx7 is tied to BLUE beam

● Yellow beam shift:

$$87 - 7 = 80$$

$$94 - 14 = 80$$

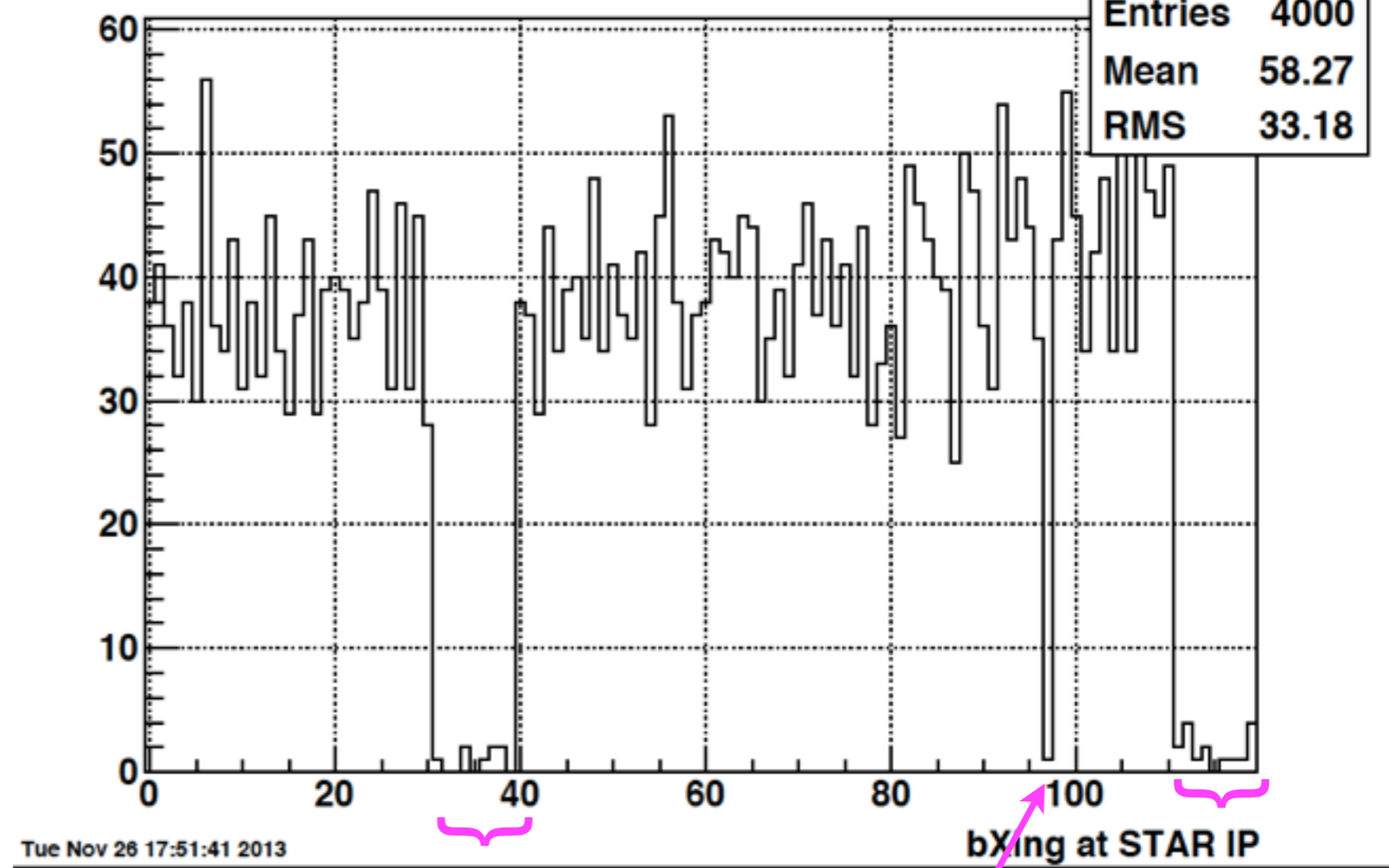
$$(111, 119) - (31, 39) = 80$$

Fill 17554

missing bunches

RF Bucket	Missing BB	Missing YB
172		57
334	111	111
337	112	112
340	113	113
343	114	114
346	115	115
349	116	116
352	117	117
355	118	118
358	119	119

Rate vs. true bXing from bx7



bX7	
Entries	4000
Mean	58.27
RMS	33.18

31-39

97

111-119

● bx7 is tied to BLUE beam

● Yellow beam shift:

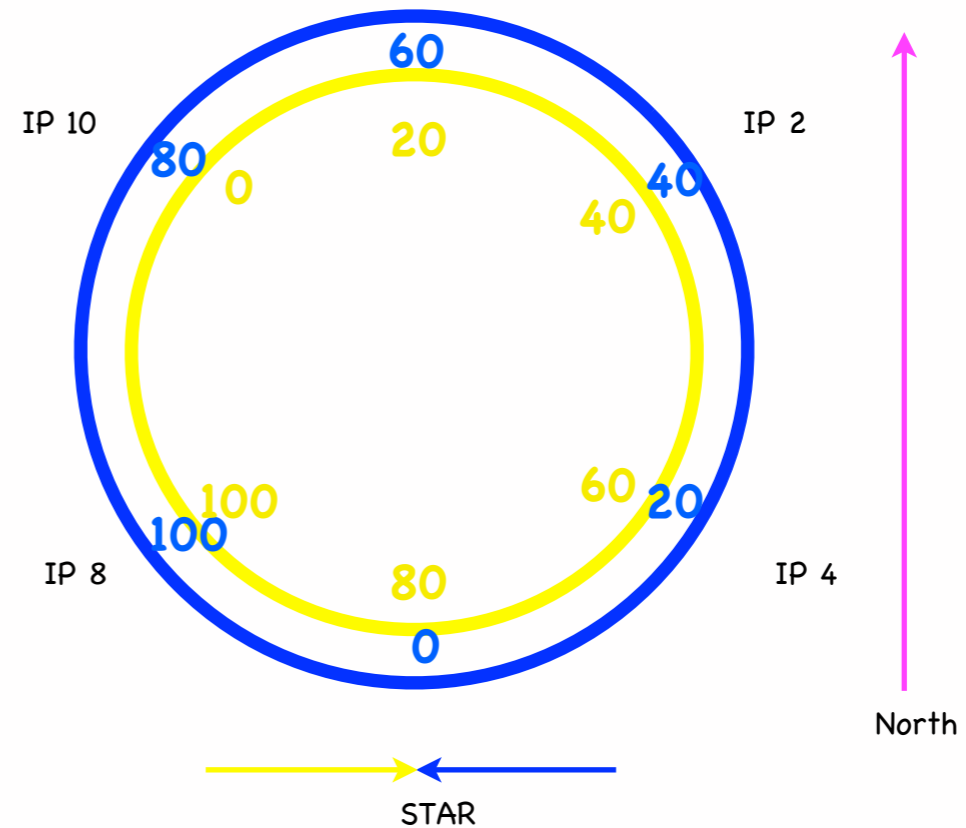
$$57-97(+120) = 80$$

$$(111,119)-(31,39) = 80$$

Beam Collision

- Yellow beam bunch 0 collides with blue beam bunch 0 at IP 8 and IP 2
- Consistent with the information recorded in v124 file.

```
1 #rhic/spinV124
2 0 240
3 1 1
4 00110101 1
5 00000000 2
6 00000000 3
7 00110101 4
8 00000000 5
```



Summary / Outlook

- Spin QA (before MuDsts) is done for 163 fills (2398 runs) during March 15 - June 11
- Spin patterns and their stability is checked for each fill
- Fills before march 21st (F17232-F17250) do not repeat as usual.
- “Bad fills” are checked and fixed. Concerning fill, F17600, discuss issue with CAD. Likely fix with new fill number.
- Had a glance at beam cogging, offset is 80, will check details after mudst production
- Ready for uploading spin patterns for Run 13 / Requesting approval by SPIN PWG!