

Spin QA updates – Run 2013

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outline

- introduction
- run 13 spin patterns
- spin QA steps
 - run List
 - extracting spin info
 - good/bad fills
 - fixing bad fills
- determining beam cogging
- summary/outlook/plans

introduction

- 1) spin QA - process which we query the STAR data base after a run and determine if the spin information is correct and the spin pattern is maintain throughout an entire RHIC fill (done before MuDst production).
- 2) bXing QA - beam crossing analysis which determine if the beams are offset one another at the collision point at STAR (done after MuDst production).



RHIC beam polarization: Fill patterns

```
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 1 0 0
1 0 0 1 0 0 1 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0
0 0 0 0 0 0 0 0 0 0 0 0
```

- At a given time both blue and yellow RHIC beams consist of 360 RF time buckets (bucket ID => 0-359).
- Out of these 360 only 120 (every 3rd bucket) are filled.
- These filled buckets are called as bunches (bunch ID => 0-119).
- There are always few buckets which are empty towards end of a fill, called as abort gaps .

run 13 spin patterns

- before March 21st 2013 spin patterns were modulo 14

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

- After March 21st 2013 spin patterns were modulo 8

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

More info @ Elke's slides:

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

spin QA

★ QA process

- prepare run lists
- extract spin info from cdev
- determine good/bad fills
- examine and fix bad fills
- determine beam cogging
- upload correct/fixed spin info to DB

Fill List/run List

- Used loopMainAll.tcl script to produce run list
- Prepared first,second and third priority run list of "successful" , "questionable" "pp500_prouduction-2013" and "pp500_prouduction-2013_noendcap" runs which include all subsystems during the run period March 15 - June 10.
- excluded all runs where running time less than 180 s.
- # of fills : 163 , # of runs : 2398

F17232	F17293	F17340	F17403	F17438	F17488	F17527	F17568
F17236	F17297	F17341	F17405	F17439	F17491	F17529	F17570
F17237	F17301	F17345	F17406	F17440	F17492	F17530	F17571
F17238	F17302	F17346	F17407	F17443	F17494	F17533	F17572
F17239	F17304	F17347	F17408	F17447	F17495	F17534	F17573
F17240	F17305	F17352	F17409	F17451	F17499	F17538	F17576
F17241	F17306	F17359	F17410	F17452	F17500	F17543	F17579
F17244	F17308	F17367	F17414	F17453	F17502	F17544	F17580
F17247	F17311	F17368	F17415	F17454	F17503	F17545	F17581
F17248	F17312	F17376	F17416	F17455	F17512	F17548	F17583
F17250	F17315	F17379	F17417	F17461	F17513	F17550	F17586
F17253	F17317	F17380	F17423	F17466	F17514	F17553	F17587
F17256	F17318	F17382	F17426	F17467	F17515	F17554	F17589
F17263	F17322	F17384	F17427	F17470	F17517	F17555	F17593
F17268	F17328	F17389	F17429	F17472	F17518	F17556	F17594
F17269	F17329	F17391	F17430	F17473	F17519	F17558	F17596
F17273	F17331	F17394	F17431	F17474	F17520	F17560	F17600
F17276	F17333	F17396	F17433	F17479	F17521	F17561	F17601
F17281	F17335	F17399	F17434	F17485	F17524	F17562	
F17284	F17338	F17402	F17436	F17486	F17526	F17566	

extracting spin info from cdev

- script used sbbitSeeker.tcl
- provide run list prepared by loopMailAll.tcl as the input.
- script run through each fill in the run list and extract spin info at the beginning and end of each fill by querying the star db 2 times per fill.

```
mysql -h dbbak.starp.bnl.gov --port 3412 Conditions_rhic -e "select dataS from kretDbBlobS where nodeID=9 and beginTime>'2013-03-24 04:09:35' order by beginTime limit 1" -s -E
```

- Two out put files: v124 files and spinTime.txt file

F17502.v124

#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 is in negative spin
3	fired if the bunch is in positive spin
4	fired if the bucket was intended to filled

spinTime.txt

Fill #	F17502
1st run	14134062
last run	14135009
# of runs	9
fill start time	1368584052
fill stop time	1368601133
start diff	251
stop diff	162
1st run time	2013-05-14 22:34:12
# of filled B bunches	B111
# of filled Y bunches	Y111
spin patterns	B++--++-- Y++-----++
pattern index	P22

good/bad fills

- To determine good/bad fills (fills which spin patterns is not consistent throughout the entire fill) use the script: `begEndComp.tcl`
- This script compare spin patterns in the beginning and end v124 files of each fill.
- If the spin spin patterns is stable/consistent throughout the fill it will write to a `goodList OW` to a `badList`.

Bad fills

F17434

F17538

F17600

Examining/Fixing bad fills

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

- Time difference between fill start time in star DB and CDEV is longer.

Examining/fixing

- found that CDEV record the start time of the fill after much delay
- no effect for the spin pattern

conclusion

this is a good fill

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

- spbitSeeker script stop running and broke just after getting the spin info at the beginning of the fill

Examining/fixing

- checked cdev output interactively and Found broken cdev outputs after the 1st run until the end of the fill.
- Out put is broken after displaying the spin pattern. Update script to ignore the error and continue.

conclusion

?

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 through out the entire fill

Examining/fixing

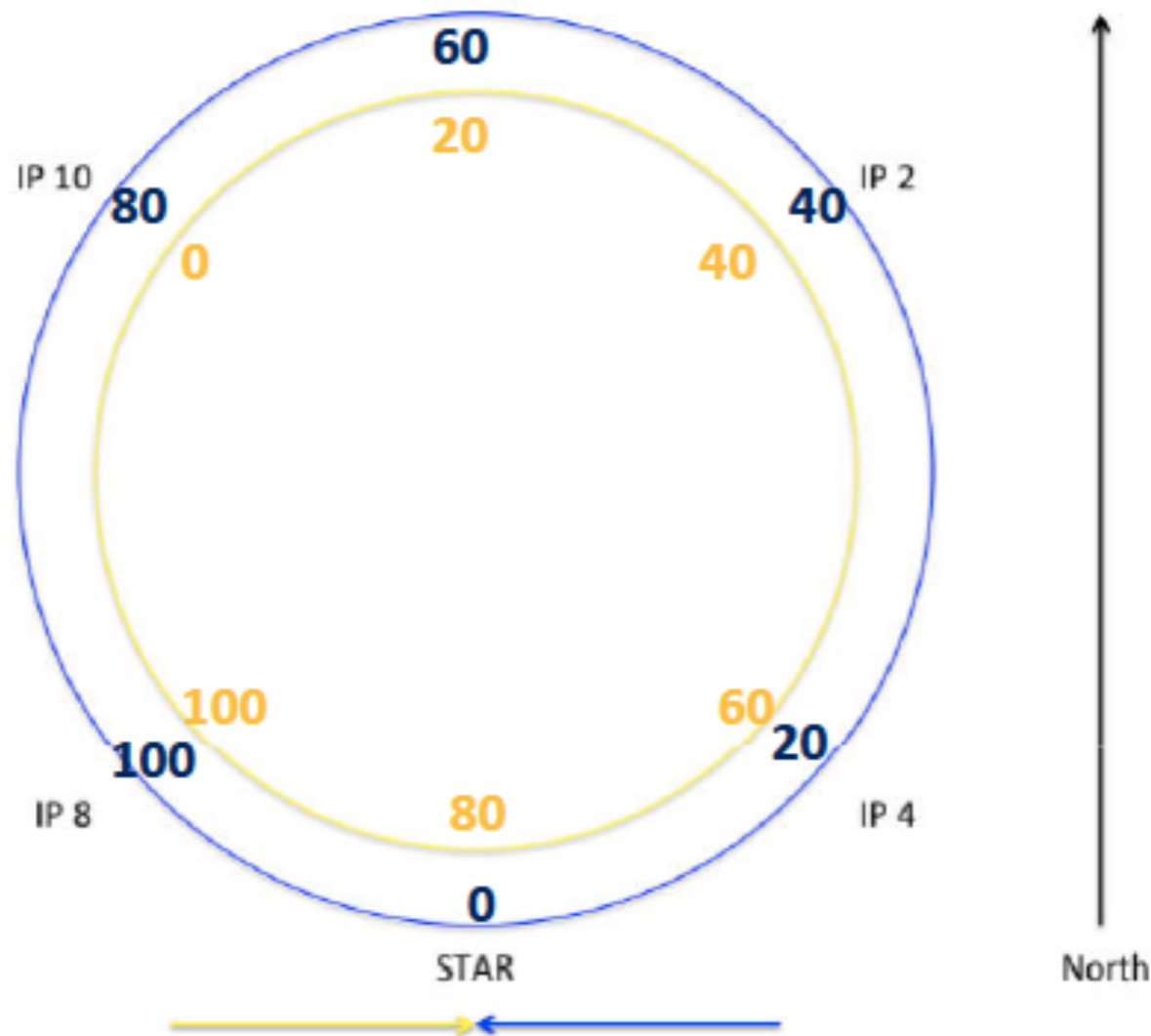
- check cdev out put at the 1st run , last and and fill stop.
- spin patterns of 1st run and last run do not match. 1st run: B++-----++ Y--++--++
last run: B++---++-- Y ---++++--
- found starting run 14160010 spin pattern change

conclusion

last 14 runs have different spin pattern.
need to introduce a new fill number???

Beam cogging determination

Once RHIC beams are injected in to rings they are cogged meaning beams are set such that the first bunches collide at specific points. Blue beam bunch 0 collide 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)



How To:=>

- Compare fill patterns when bunch 0 of both beams colliding each other with fill pattern at STAR
- To see the Fill patterns at STAR need to produce bx7 spectrum using MuDsts.

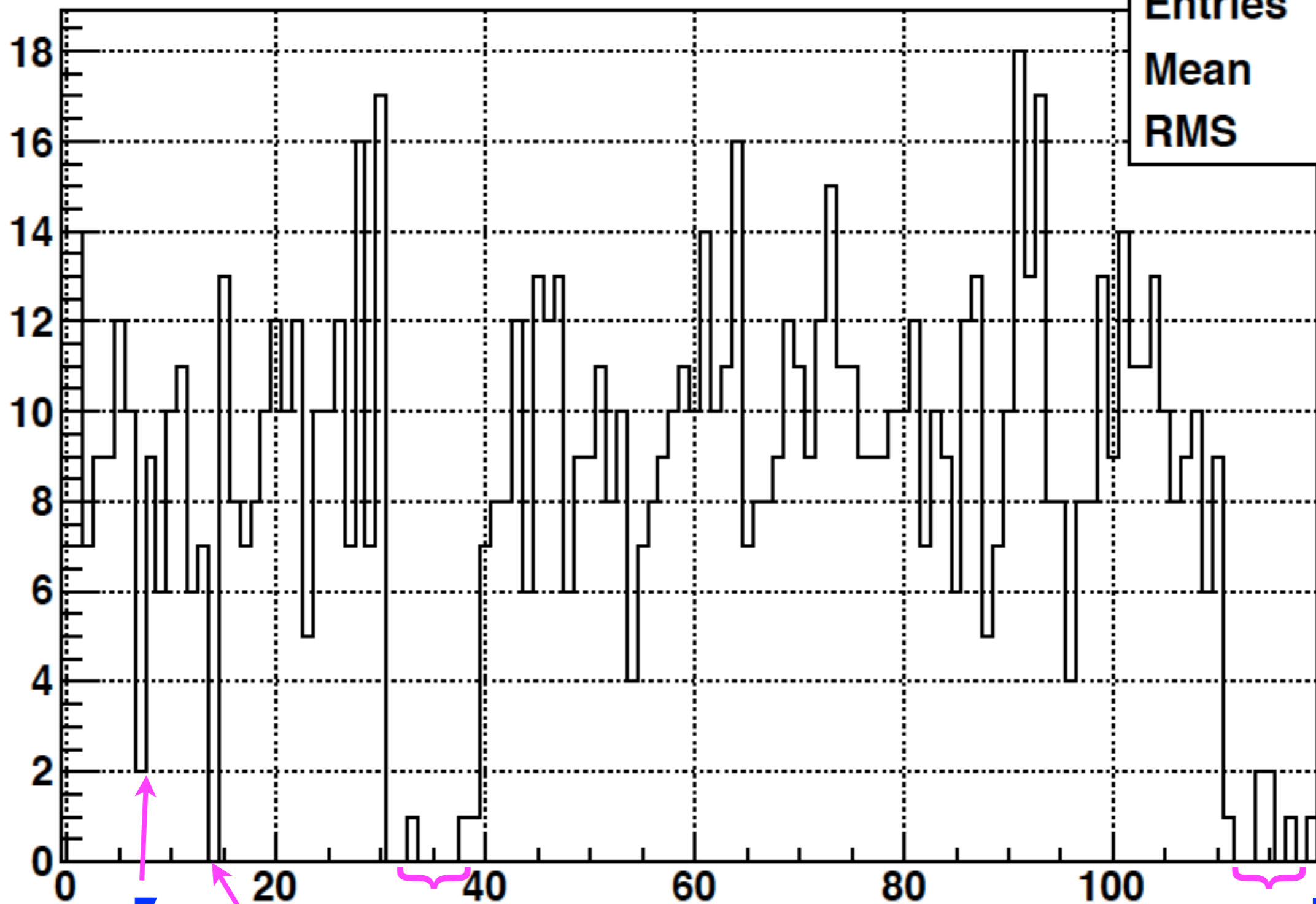
Missing bunches of Fill 17554

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

RI4146026

Rate vs. true bXing from bx7

bX7	
Entries	1000
Mean	58.21
RMS	32.73

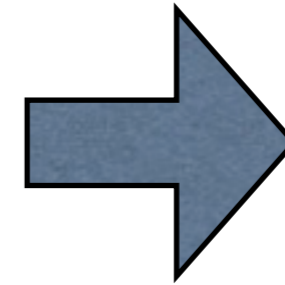


Thu Nov 21 14:06:34 2013

bXing at STAR IP

Beam cogging using R14140046

- One gap in the interval 111-119
- Another gap 31-39
- two missing bunches at 7, 14



bx7 is tied to the
Blue beam

Yellow beam shift

- $111 - 31 = 80$
- $119 - 39 = 80$

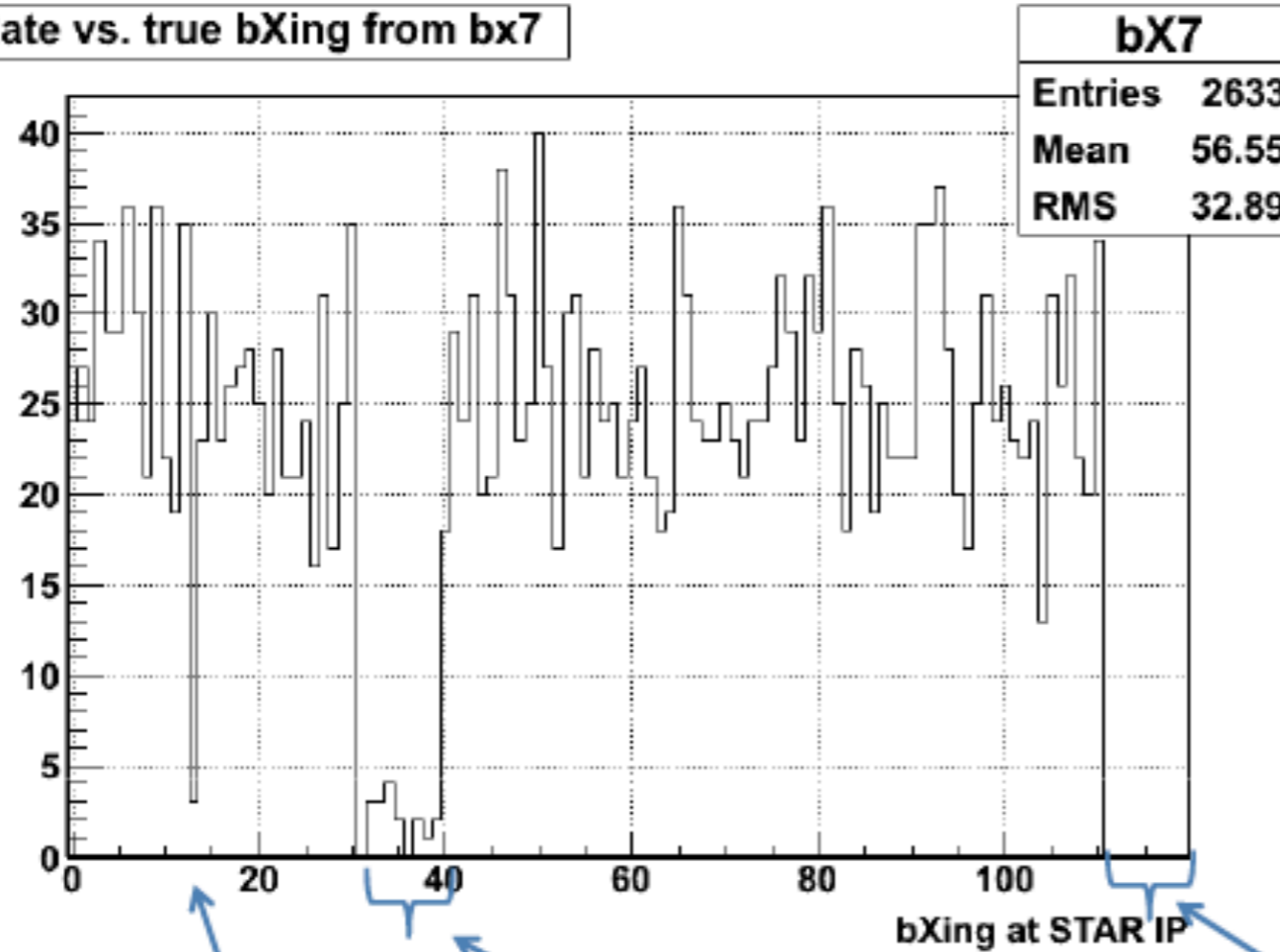
Double check with missing bunches

- missing bunch ID 87 appearing at 7 $\Rightarrow 87 - 7 = 80$
- missing bunch ID 94 appearing at 14 $\Rightarrow 94 - 14 = 80$

STAR blue beam bunch 0 collide with
yellow beam bunch 80 at $bx7=0$

14115015 of F17423

Rate vs. true bXing from bx7



bX7 is tied to the Blue beam
Yellow beam shift :
 $93 - 13 = 80$
 $111 - 31 = 80$

At STAR:
Blue beam bunch 0 collides
with yellow beam bunch 80

13

31-39

111-119

STAR blue beam bunch 0 collide with
yellow beam bunch 80 at $bx7=0$

Summary/Plans/outlook

- summary

- Out of 163 fills 156 fills have stable spin patterns through out the fill
- In the first priority list out of 1846 runs 1816 has good spin pattern.
- 2 bad fills examined and final check is ongoing

- Plans

- repeat the spin QA procedure for second and third priority runs
- determine beam cogging
- upload corrected spin info to database.

- outlook

- should spin QA do for "ZDC polarimetry" and "emc check" runs
- comments/suggestions??????