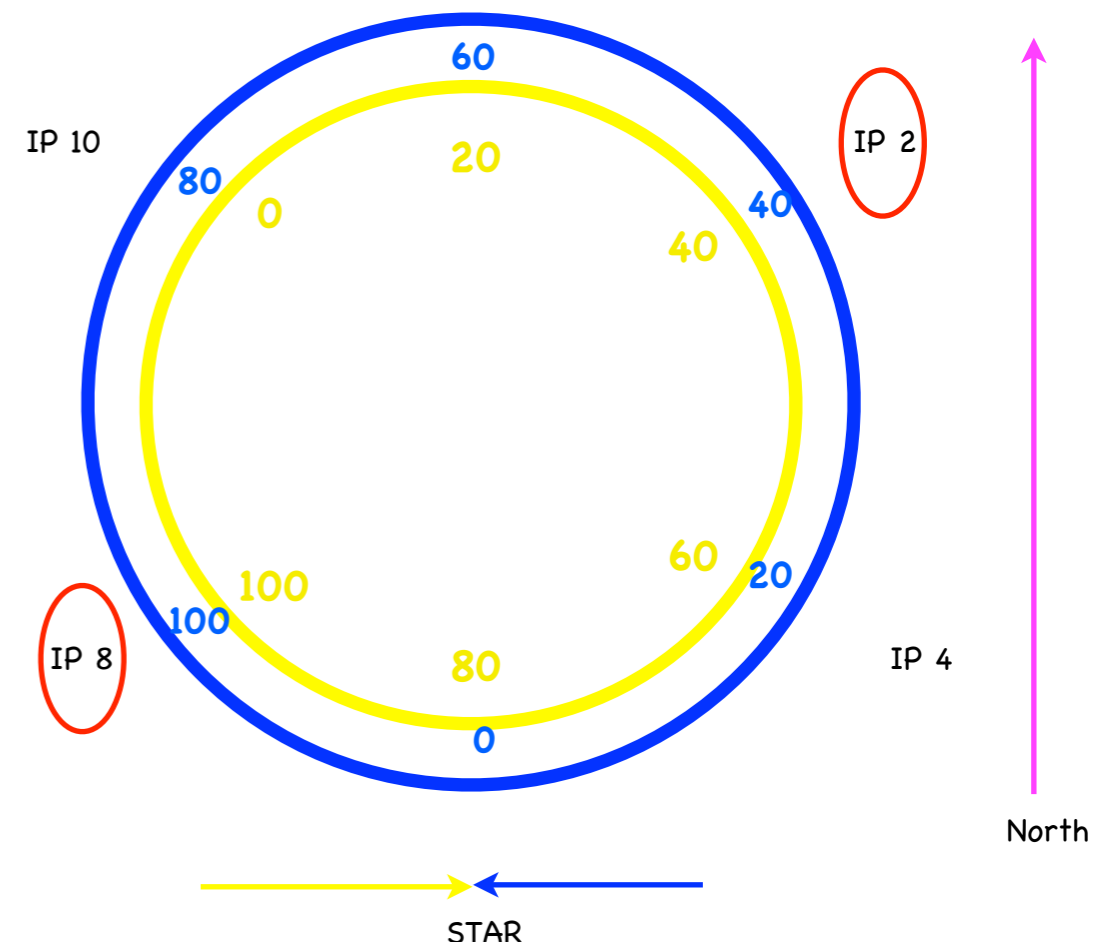


# Beam Crossing QA - run 13 period 2 (p14ig-production)

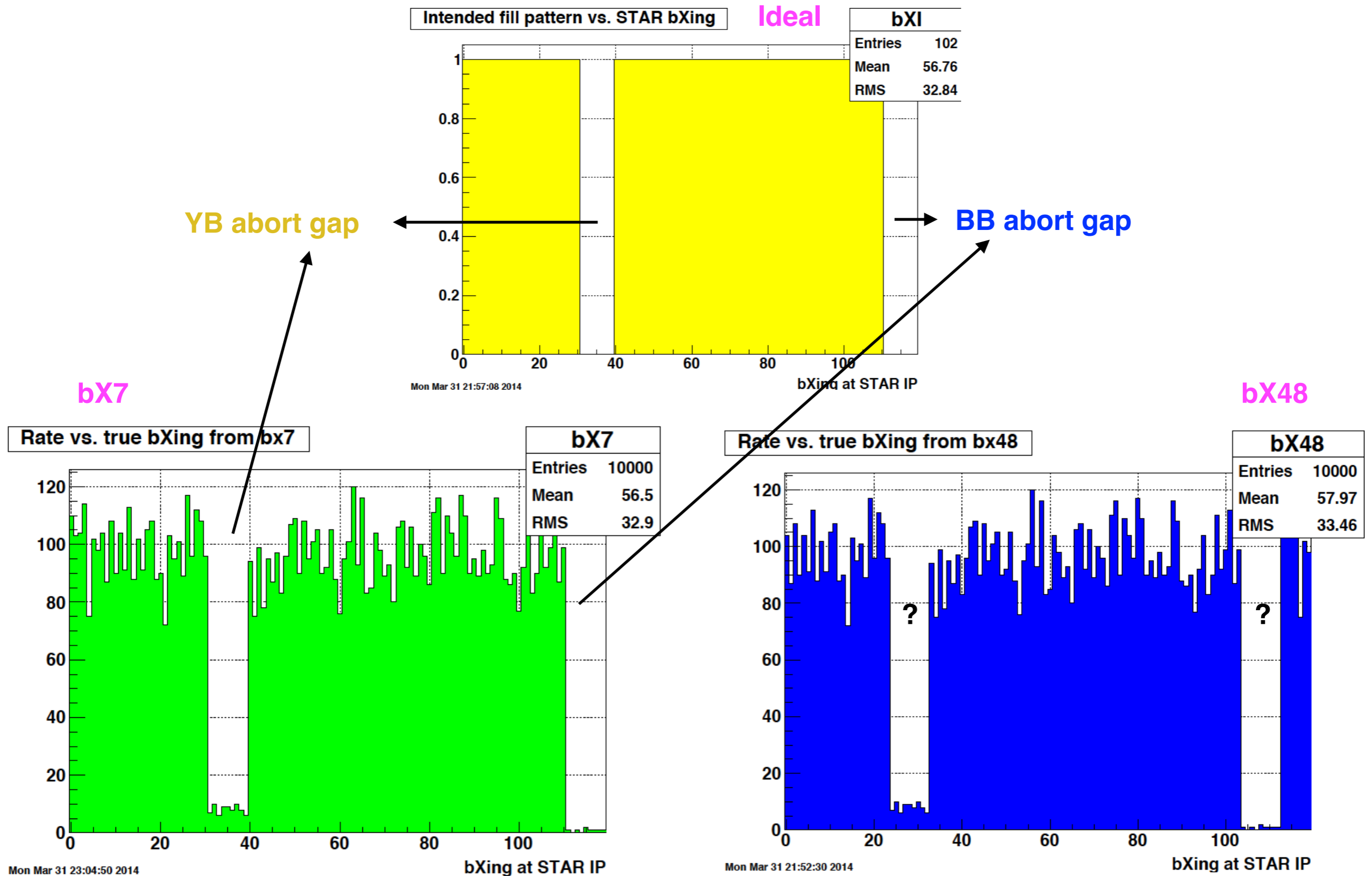
Run 13 W Analysis Group

# Introduction

- Once RHIC beams are injected into rings they are clogged meaning beams are set such that the **first bunches collide at specific points.**
- Yellow beam bunch 0 collides with blue beam bunch 0 at **IP 8** and **IP 2**
- 2 beams are shifted by **80** at **STAR collision point.**
- Bunch crossing spectrums reflects this shift.
- This analysis is to confirm this known shift and to further check for **additional offsets.**



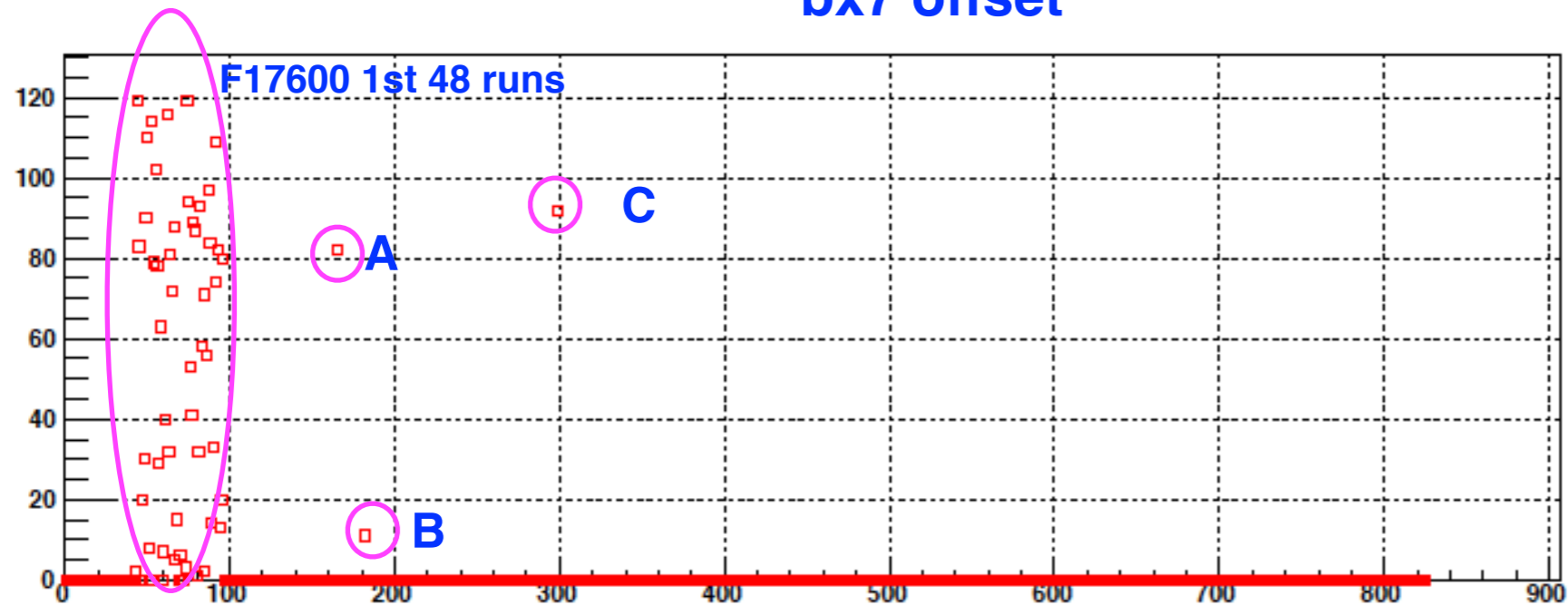
# Bunch crossing spectrums



# Beam crossing offset

- Total No of runs used — 822

**bx7 offset**



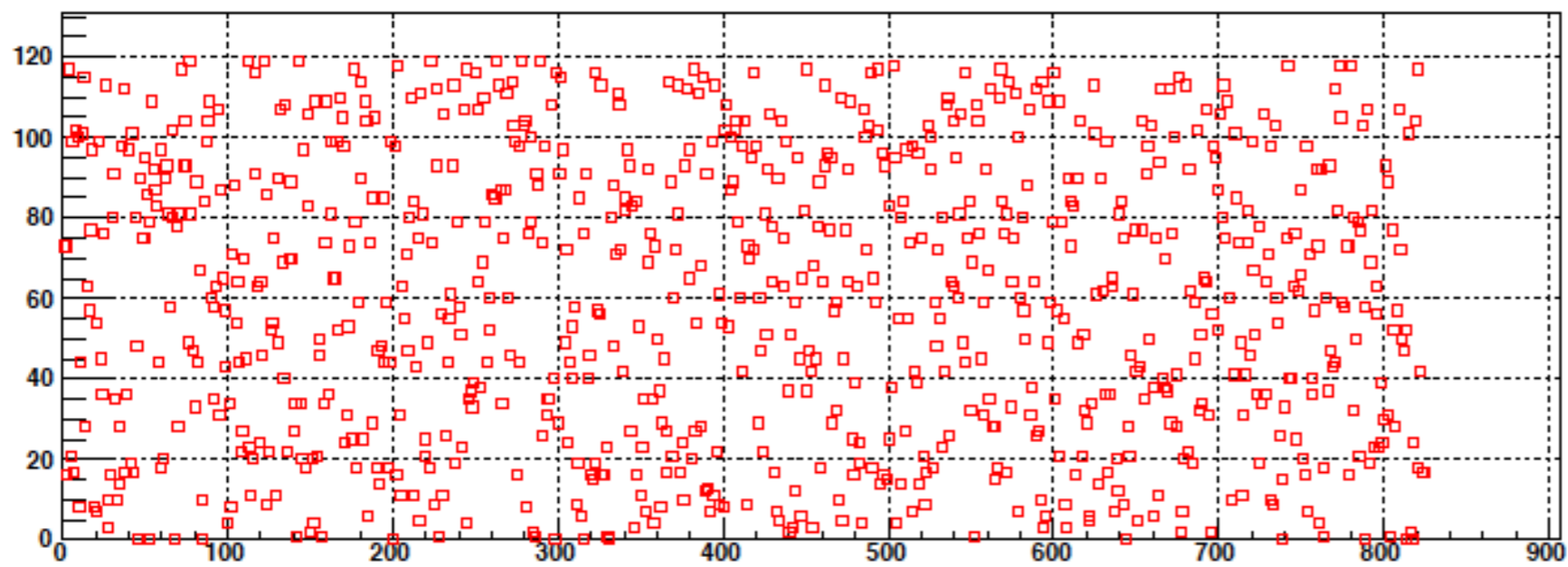
**A : R14149035** ❌😭

- low lumi.

**B : R14153063** ❌😭

- low lumi.

**bx48 offset**

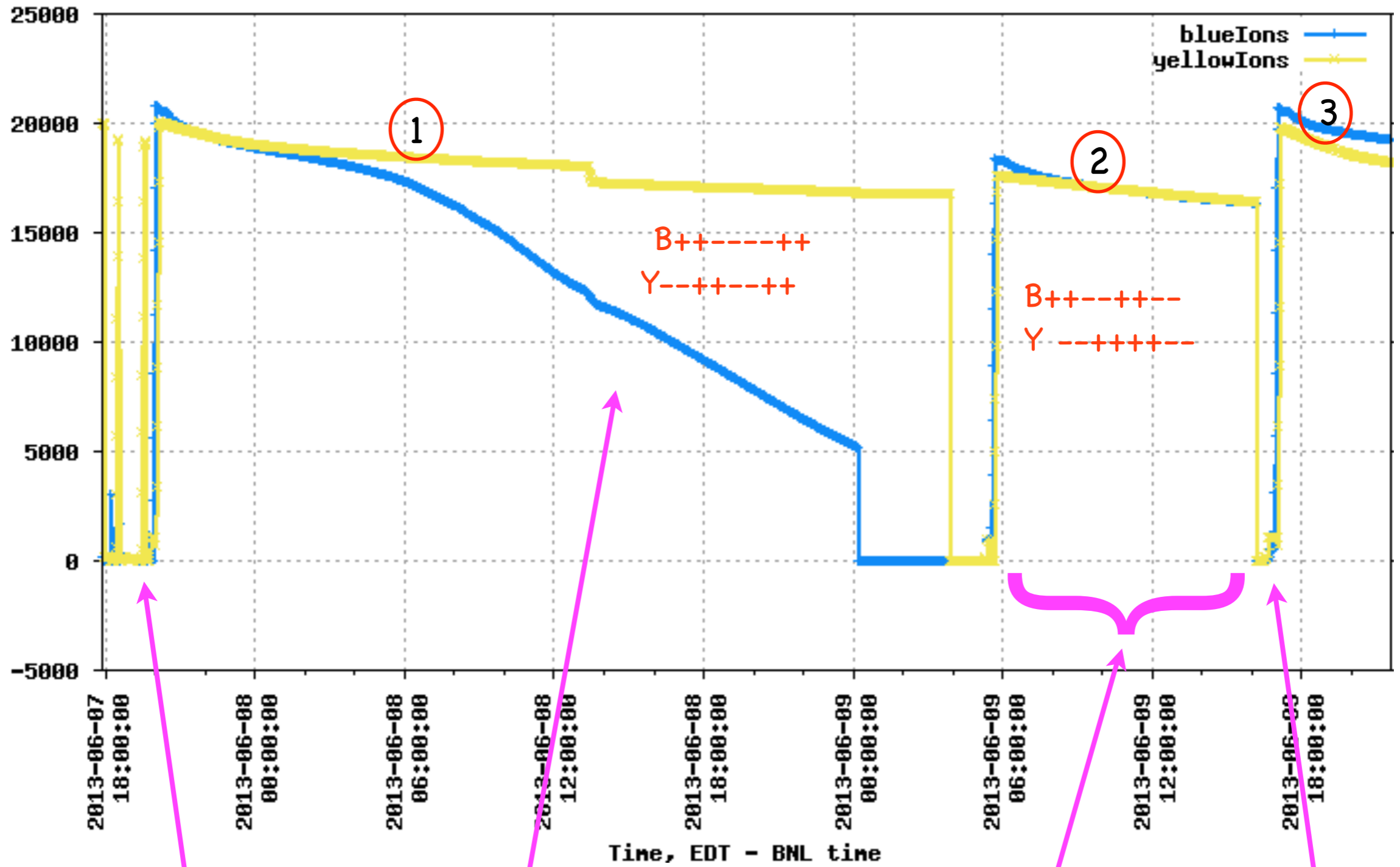


**c R14154031** ❌😭

- low lumi.

• 771 runs have 0 offset : BunchX QA Pass ✅😊

# Fill 17600



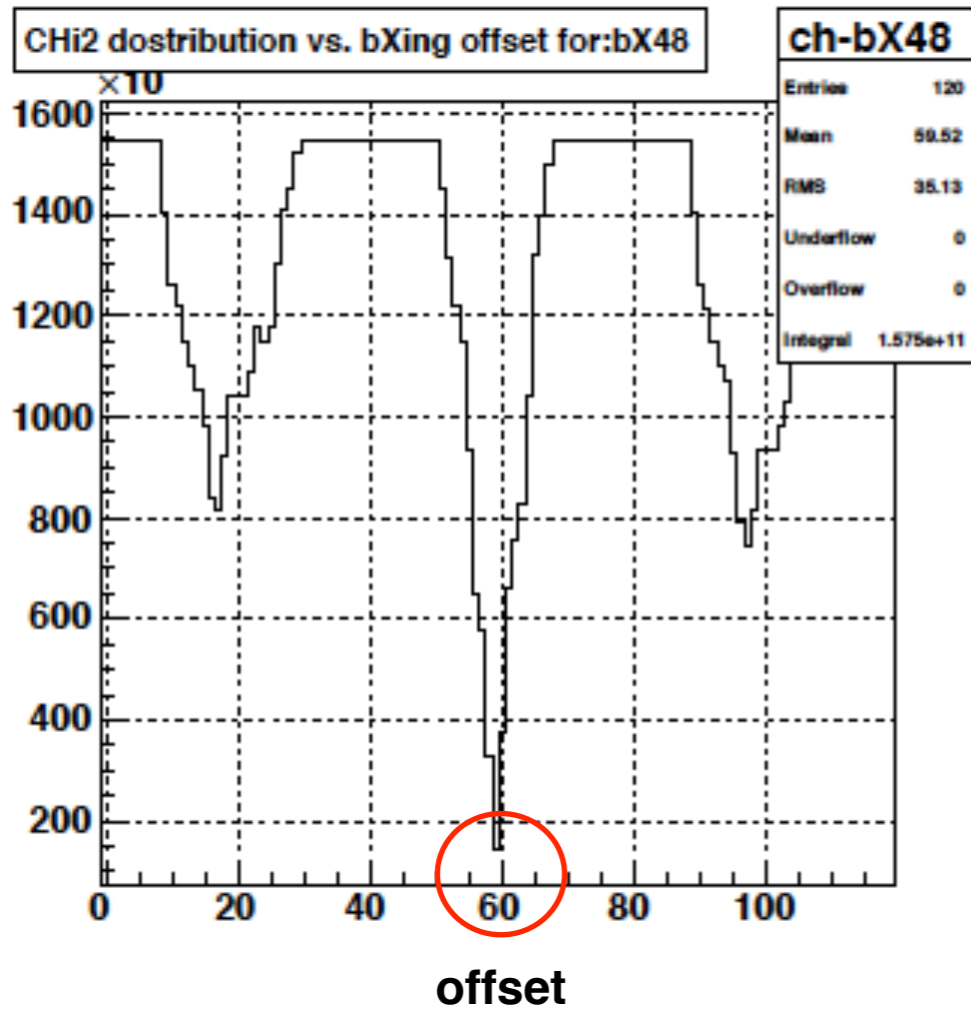
F17600 start

First 53 runs,  
Blue beam ion intensity dropping

Last 14 runs of F17600

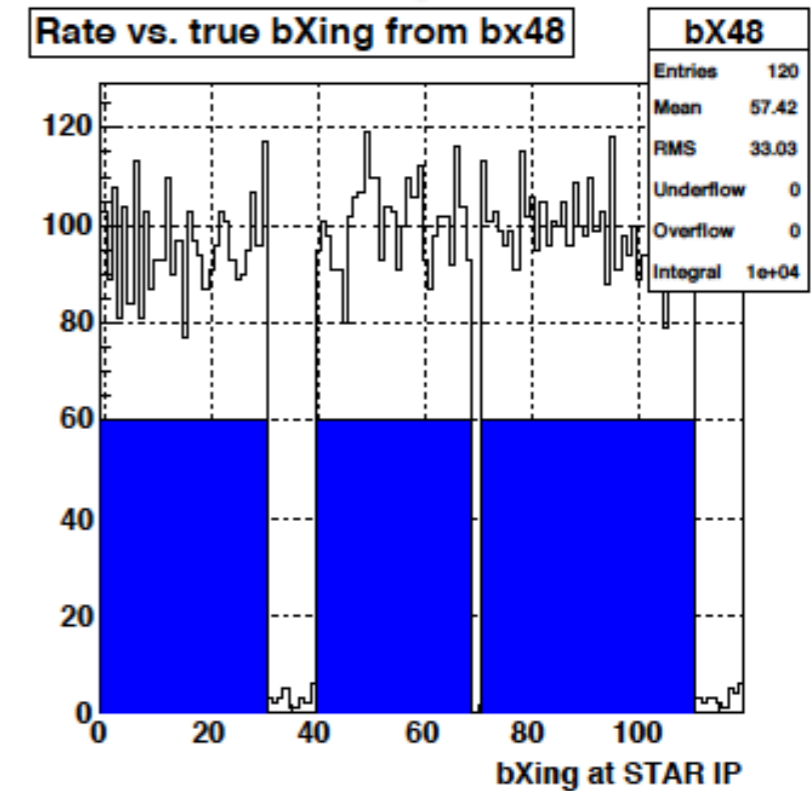
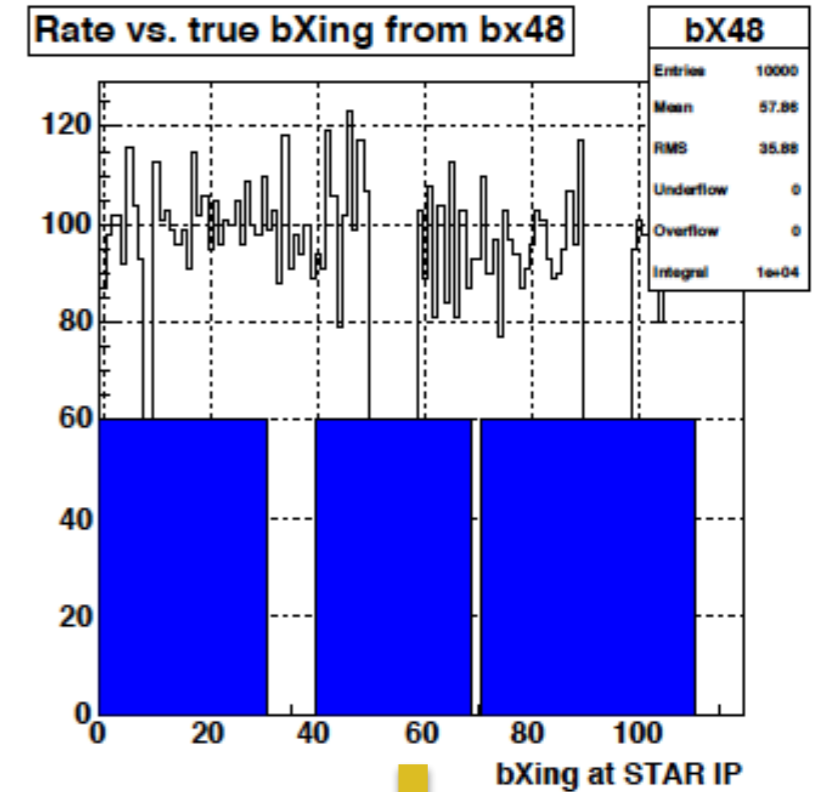
F17601 start

# Chi2 method



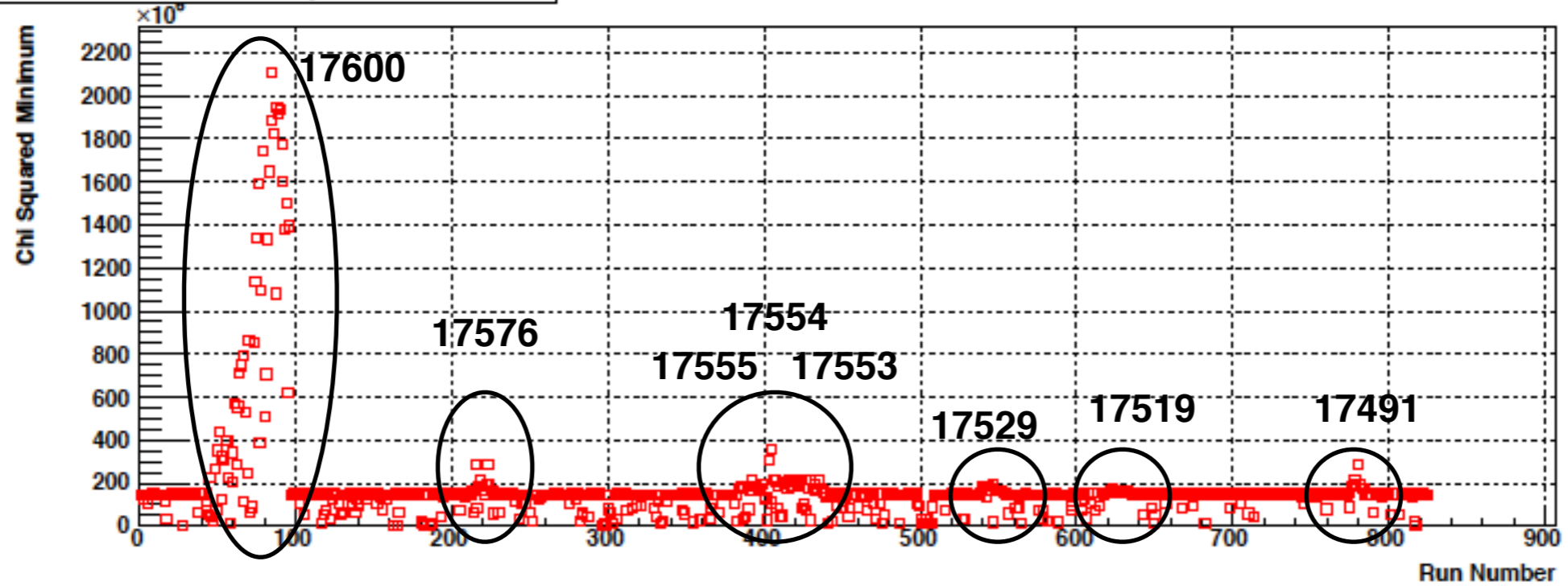
$$\chi^2 = \sum \frac{(N_{bx48(i+offset)} - N_{bxideal(i)})^2}{\sigma^2_{bx48(i+offset)}}$$

loop offset [0,119] and find the position of minimum chi2 where the bx48 spectrum is best fitting with ideal spectrum

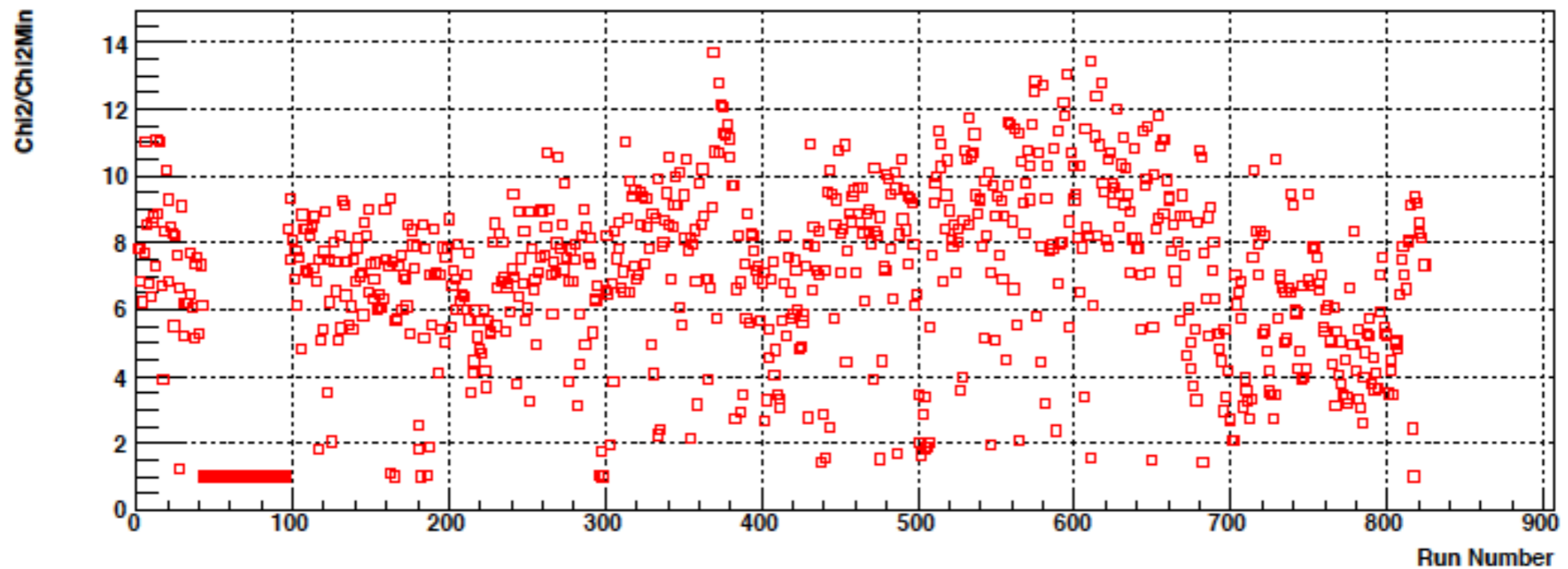


# Chi2 minimum

Run Number Vs Chi Squared Minimum



Run Number Vs Chi2 / Chi2 Minimum

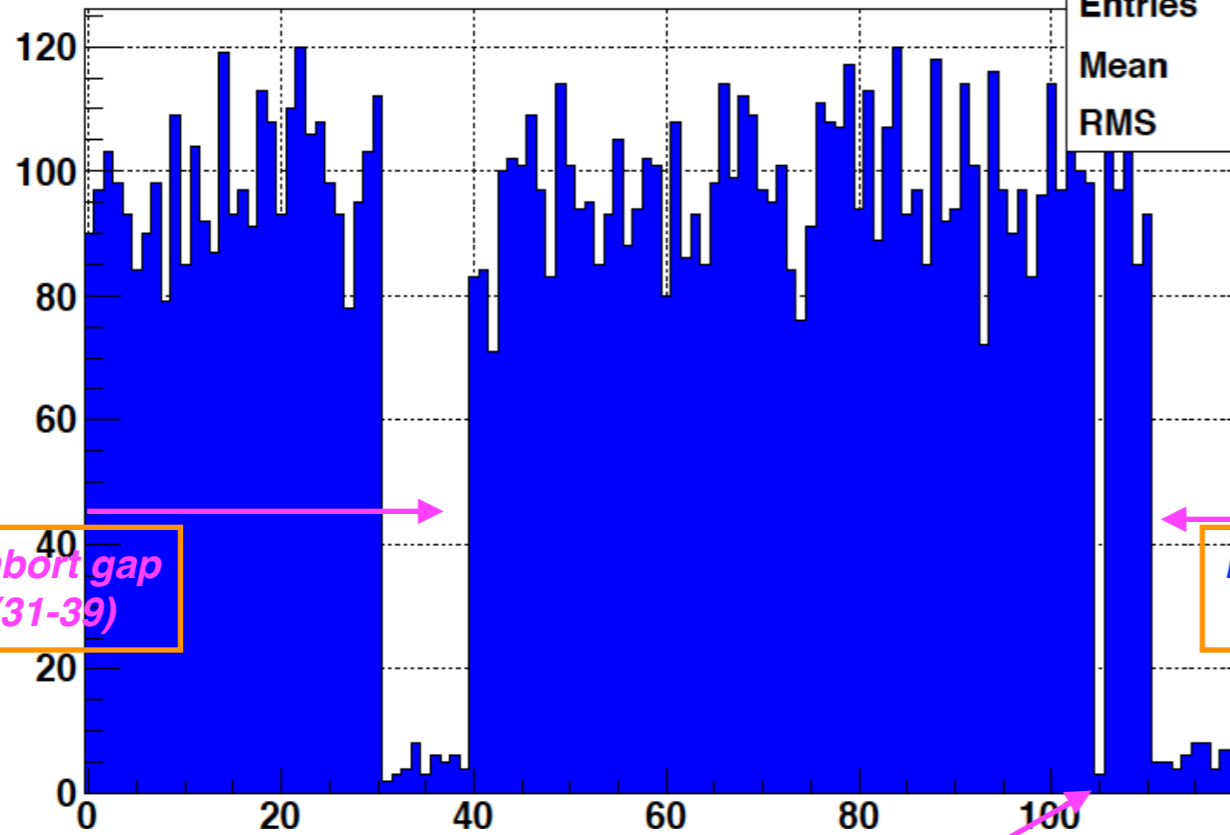


# Search for missing bunches

**F17491**

Rate vs. true bXing from bx7

bX7	
Entries	10000
Mean	56.86
RMS	32.8



cdev record of Measured Fill Patterns

Y

B

1 0 0 1 0 0 1 0 0 1 0 0	3	1 0 0 1 0 0 1 0 0 1 0 0	3
1 0 0 1 0 0 1 0 0 1 0 0	7	1 0 0 1 0 0 1 0 0 1 0 0	7
1 0 0 1 0 0 1 0 0 1 0 0	11	1 0 0 1 0 0 1 0 0 1 0 0	11
1 0 0 1 0 0 1 0 0 1 0 0	15	1 0 0 1 0 0 1 0 0 1 0 0	15
1 0 0 1 0 0 1 0 0 1 0 0	19	1 0 0 1 0 0 1 0 0 1 0 0	19
1 0 0 1 0 0 1 0 0 1 0 0	23	1 0 0 1 0 0 1 0 0 1 0 0	23
1 0 0 1 0 0 1 0 0 1 0 0	27	1 0 0 1 0 0 1 0 0 1 0 0	27
1 0 0 1 0 0 1 0 0 1 0 0	31	1 0 0 1 0 0 1 0 0 1 0 0	31
1 0 0 1 0 0 1 0 0 1 0 0	35	1 0 0 1 0 0 1 0 0 1 0 0	35
1 0 0 1 0 0 1 0 0 1 0 0	39	1 0 0 1 0 0 1 0 0 1 0 0	39
1 0 0 1 0 0 1 0 0 1 0 0	43	1 0 0 1 0 0 1 0 0 1 0 0	43
1 0 0 1 0 0 1 0 0 1 0 0	47	1 0 0 1 0 0 1 0 0 1 0 0	47
1 0 0 1 0 0 1 0 0 1 0 0	51	1 0 0 1 0 0 1 0 0 1 0 0	51
1 0 0 1 0 0 1 0 0 1 0 0	55	1 0 0 1 0 0 1 0 0 1 0 0	55
1 0 0 1 0 0 1 0 0 1 0 0	59	1 0 0 1 0 0 1 0 0 1 0 0	59
1 0 0 1 0 0 1 0 0 1 0 0	63	1 0 0 1 0 0 1 0 0 1 0 0	63
1 0 0 0 0 0 1 0 0 1 0 0	67	1 0 0 1 0 0 1 0 0 1 0 0	67
1 0 0 1 0 0 1 0 0 1 0 0	71	1 0 0 1 0 0 1 0 0 1 0 0	71
1 0 0 1 0 0 1 0 0 1 0 0	75	1 0 0 1 0 0 1 0 0 1 0 0	75
1 0 0 1 0 0 1 0 0 1 0 0	79	1 0 0 1 0 0 1 0 0 1 0 0	79
1 0 0 1 0 0 1 0 0 1 0 0	83	1 0 0 1 0 0 1 0 0 1 0 0	83
1 0 0 1 0 0 1 0 0 1 0 0	87	1 0 0 1 0 0 1 0 0 1 0 0	87
1 0 0 1 0 0 1 0 0 1 0 0	91	1 0 0 1 0 0 1 0 0 1 0 0	91
1 0 0 1 0 0 1 0 0 1 0 0	95	1 0 0 1 0 0 1 0 0 1 0 0	95
1 0 0 1 0 0 1 0 0 1 0 0	99	1 0 0 1 0 0 1 0 0 1 0 0	99
1 0 0 1 0 0 1 0 0 1 0 0	103	1 0 0 1 0 0 1 0 0 1 0 0	103
1 0 0 1 0 0 1 0 0 1 0 0	107	1 0 0 1 0 0 1 0 0 1 0 0	107
1 0 0 1 0 0 1 0 0 0 0 0	111	1 0 0 1 0 0 1 0 0 0 0 0	111
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 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0	

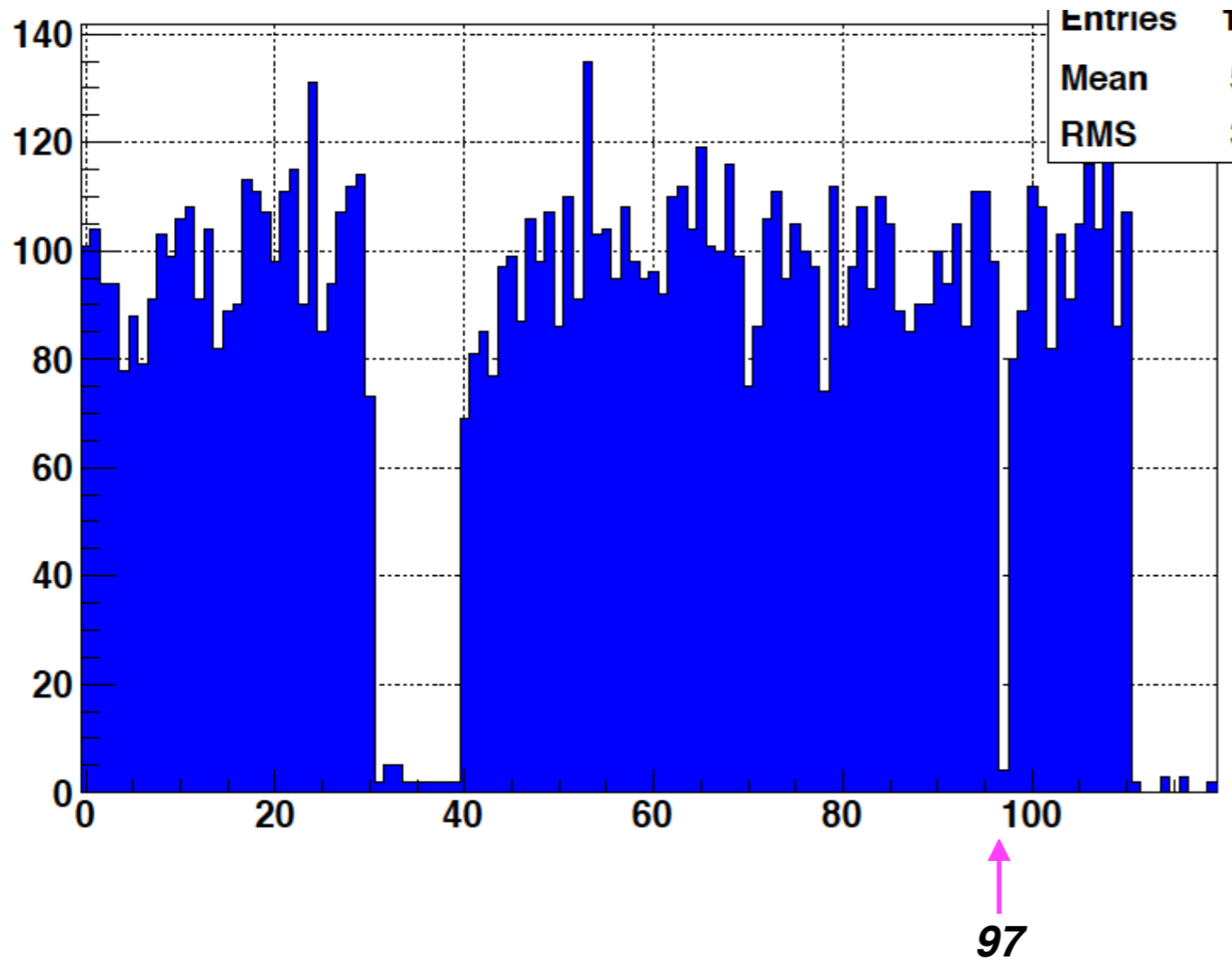
Y bunch 65  
 $120 - (80 - 65) = 105$

**F17491 have 1 missing bunch : Y beam bunch 65 !!!**



# Search for missing bunches

F17529



Y bunches 57  
 $120 - (80 - 57) = 97$

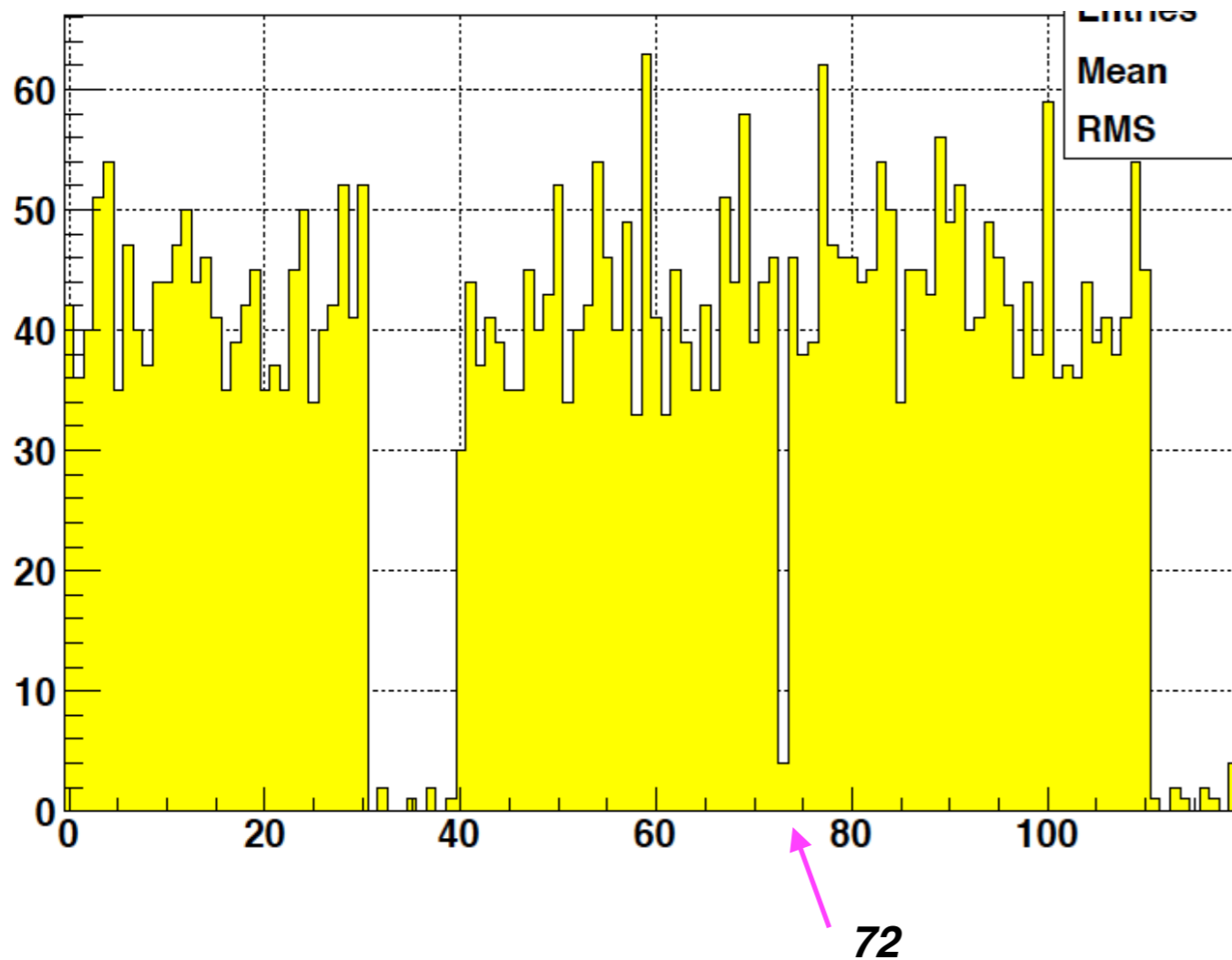
cdev record of Measured Fill Patterns

Y	B
1 0 0 1 0 0 1 0 0 1 0 0	3 1 0 0 1 0 0 1 0 0 1 0 0 3
1 0 0 1 0 0 1 0 0 1 0 0	7 1 0 0 1 0 0 1 0 0 1 0 0 7
1 0 0 1 0 0 1 0 0 1 0 0	11 1 0 0 1 0 0 1 0 0 1 0 0 11
1 0 0 1 0 0 1 0 0 1 0 0	15 1 0 0 1 0 0 1 0 0 1 0 0 15
1 0 0 1 0 0 1 0 0 1 0 0	19 1 0 0 1 0 0 1 0 0 1 0 0 19
1 0 0 1 0 0 1 0 0 1 0 0	23 1 0 0 1 0 0 1 0 0 1 0 0 23
1 0 0 1 0 0 1 0 0 1 0 0	27 1 0 0 1 0 0 1 0 0 1 0 0 27
1 0 0 1 0 0 1 0 0 1 0 0	31 1 0 0 1 0 0 1 0 0 1 0 0 31
1 0 0 1 0 0 1 0 0 1 0 0	35 1 0 0 1 0 0 1 0 0 1 0 0 35
1 0 0 1 0 0 1 0 0 1 0 0	39 1 0 0 1 0 0 1 0 0 1 0 0 39
1 0 0 1 0 0 1 0 0 1 0 0	43 1 0 0 1 0 0 1 0 0 1 0 0 43
1 0 0 1 0 0 1 0 0 1 0 0	47 1 0 0 1 0 0 1 0 0 1 0 0 47
1 0 0 1 0 0 1 0 0 1 0 0	51 1 0 0 1 0 0 1 0 0 1 0 0 51
1 0 0 1 0 0 1 0 0 1 0 0	55 1 0 0 1 0 0 1 0 0 1 0 0 55
1 0 0 0 0 0 1 0 0 1 0 0	59 1 0 0 1 0 0 1 0 0 1 0 0 59
1 0 0 1 0 0 1 0 0 1 0 0	63 1 0 0 1 0 0 1 0 0 1 0 0 63
1 0 0 1 0 0 1 0 0 1 0 0	67 1 0 0 1 0 0 1 0 0 1 0 0 67
1 0 0 1 0 0 1 0 0 1 0 0	71 1 0 0 1 0 0 1 0 0 1 0 0 71
1 0 0 1 0 0 1 0 0 1 0 0	75 1 0 0 1 0 0 1 0 0 1 0 0 75
1 0 0 1 0 0 1 0 0 1 0 0	79 1 0 0 1 0 0 1 0 0 1 0 0 79
1 0 0 1 0 0 1 0 0 1 0 0	83 1 0 0 1 0 0 1 0 0 1 0 0 83
1 0 0 1 0 0 1 0 0 1 0 0	87 1 0 0 1 0 0 1 0 0 1 0 0 87
1 0 0 1 0 0 1 0 0 1 0 0	91 1 0 0 1 0 0 1 0 0 1 0 0 91
1 0 0 1 0 0 1 0 0 1 0 0	95 1 0 0 1 0 0 1 0 0 1 0 0 95
1 0 0 1 0 0 1 0 0 1 0 0	99 1 0 0 1 0 0 1 0 0 1 0 0 99
1 0 0 1 0 0 1 0 0 1 0 0	103 1 0 0 1 0 0 1 0 0 1 0 0 103
1 0 0 1 0 0 1 0 0 1 0 0	107 1 0 0 1 0 0 1 0 0 1 0 0 107
1 0 0 1 0 0 1 0 0 0 0 0	111 1 0 0 1 0 0 1 0 0 0 0 0 111
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 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0

F17329 has 1 missing bunch : Y beam bunch 57 !!!

# Search for missing bunches

**F17553**



Y bunches 33  
 $120 - (80 - 33) = 73$

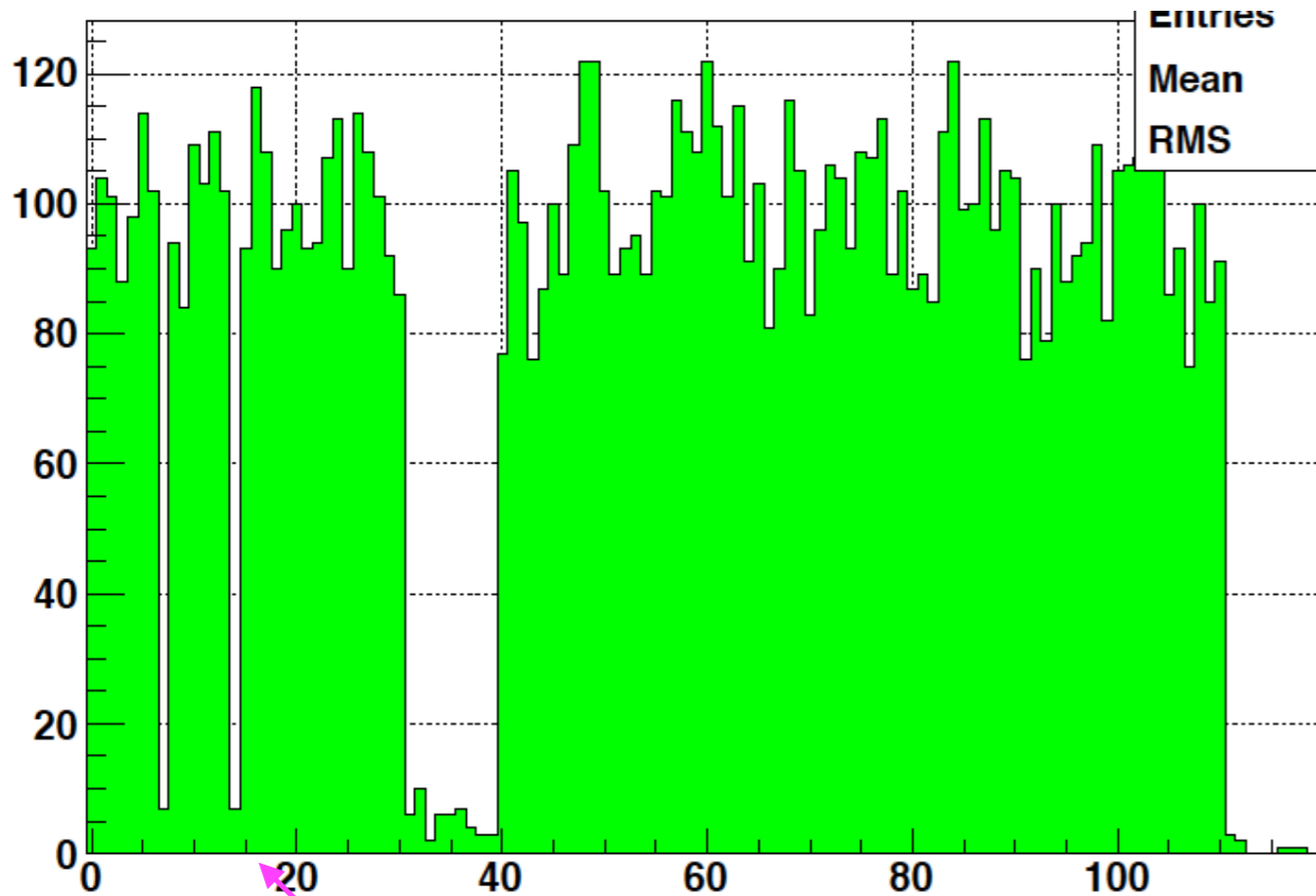
**cdev record of Measured Fill Patterns**

Y				B								
1	0	0	1	0	0	1	0	0	1	0	0	3
1	0	0	1	0	0	1	0	0	1	0	0	7
1	0	0	1	0	0	1	0	0	1	0	0	11
1	0	0	1	0	0	1	0	0	1	0	0	15
1	0	0	1	0	0	1	0	0	1	0	0	19
1	0	0	1	0	0	1	0	0	1	0	0	23
1	0	0	1	0	0	1	0	0	1	0	0	27
1	0	0	1	0	0	1	0	0	1	0	0	31
1	0	0	1	0	0	1	0	0	1	0	0	35
1	0	0	0	0	0	1	0	0	1	0	0	39
1	0	0	1	0	0	1	0	0	1	0	0	43
1	0	0	1	0	0	1	0	0	1	0	0	47
1	0	0	1	0	0	1	0	0	1	0	0	51
1	0	0	1	0	0	1	0	0	1	0	0	55
1	0	0	1	0	0	1	0	0	1	0	0	59
1	0	0	1	0	0	1	0	0	1	0	0	63
1	0	0	1	0	0	1	0	0	1	0	0	67
1	0	0	1	0	0	1	0	0	1	0	0	71
1	0	0	1	0	0	1	0	0	1	0	0	75
1	0	0	1	0	0	1	0	0	1	0	0	79
1	0	0	1	0	0	1	0	0	1	0	0	83
1	0	0	1	0	0	1	0	0	1	0	0	87
1	0	0	1	0	0	1	0	0	1	0	0	91
1	0	0	1	0	0	1	0	0	1	0	0	95
1	0	0	1	0	0	1	0	0	1	0	0	99
1	0	0	1	0	0	1	0	0	1	0	0	103
1	0	0	1	0	0	1	0	0	1	0	0	107
1	0	0	1	0	0	1	0	0	0	0	0	111
0	0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	

**F17553 has 1 missing bunch : Y beam bunch 33!!!**

# Search for missing bunches

F17554



7 14

Y bunches 87,94

$87-80 = 7$

$94-80 = 14$

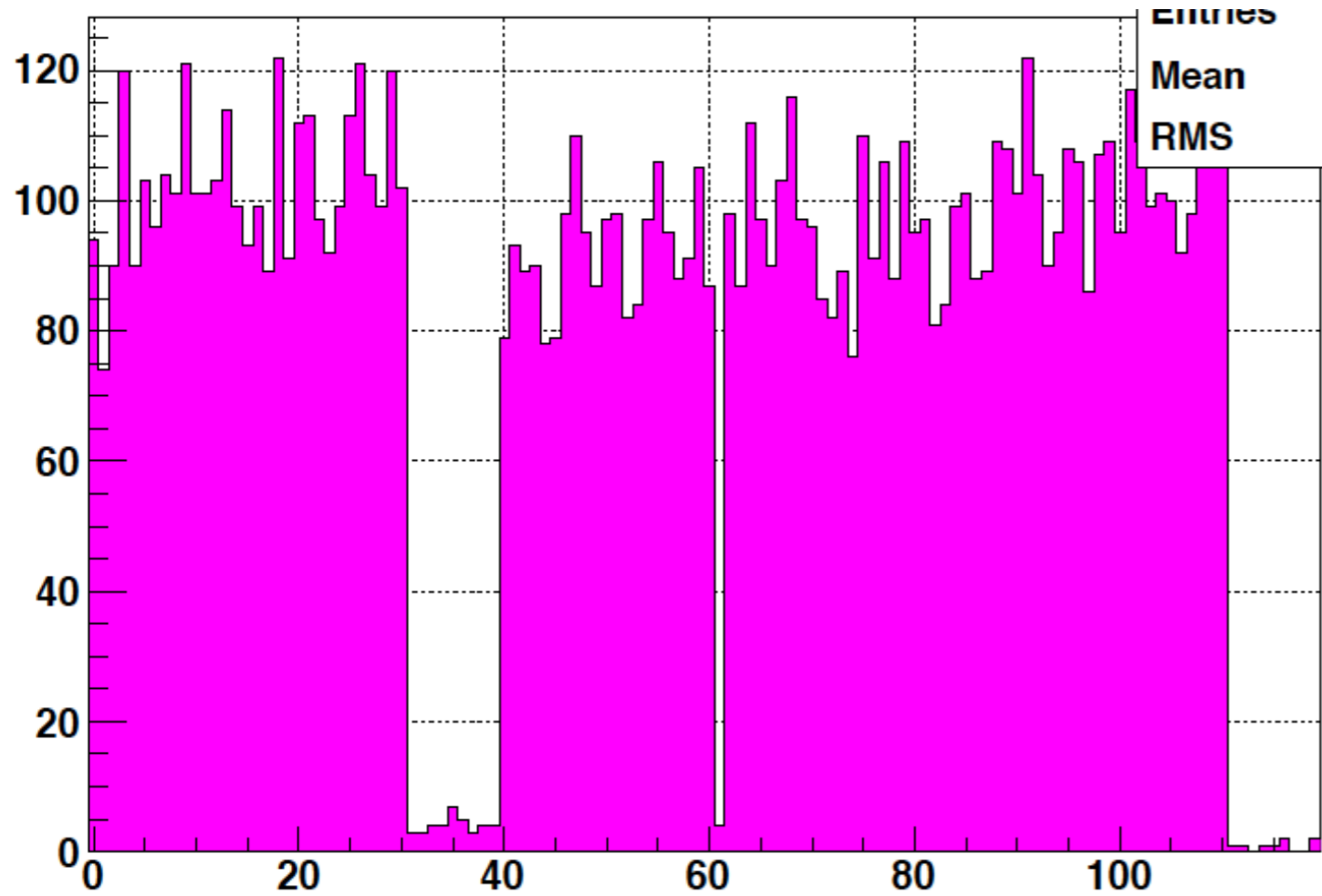
## cdev record of Measured Fill Patterns

Y	B
1 0 0 1 0 0 1 0 0 1 0 0	3 1 0 0 1 0 0 1 0 0 1 0 0 3
1 0 0 1 0 0 1 0 0 1 0 0	7 1 0 0 1 0 0 1 0 0 1 0 0 7
1 0 0 1 0 0 1 0 0 1 0 0	11 1 0 0 1 0 0 1 0 0 1 0 0 11
1 0 0 1 0 0 1 0 0 1 0 0	15 1 0 0 1 0 0 1 0 0 1 0 0 15
1 0 0 1 0 0 1 0 0 1 0 0	19 1 0 0 1 0 0 1 0 0 1 0 0 19
1 0 0 1 0 0 1 0 0 1 0 0	23 1 0 0 1 0 0 1 0 0 1 0 0 23
1 0 0 1 0 0 1 0 0 1 0 0	27 1 0 0 1 0 0 1 0 0 1 0 0 27
1 0 0 1 0 0 1 0 0 1 0 0	31 1 0 0 1 0 0 1 0 0 1 0 0 31
1 0 0 1 0 0 1 0 0 1 0 0	35 1 0 0 1 0 0 1 0 0 1 0 0 35
1 0 0 1 0 0 1 0 0 1 0 0	39 1 0 0 1 0 0 1 0 0 1 0 0 39
1 0 0 1 0 0 1 0 0 1 0 0	43 1 0 0 1 0 0 1 0 0 1 0 0 43
1 0 0 1 0 0 1 0 0 1 0 0	47 1 0 0 1 0 0 1 0 0 1 0 0 47
1 0 0 1 0 0 1 0 0 1 0 0	51 1 0 0 1 0 0 1 0 0 1 0 0 51
1 0 0 1 0 0 1 0 0 1 0 0	55 1 0 0 1 0 0 1 0 0 1 0 0 55
1 0 0 1 0 0 1 0 0 1 0 0	59 1 0 0 1 0 0 1 0 0 1 0 0 59
1 0 0 1 0 0 1 0 0 1 0 0	63 1 0 0 1 0 0 1 0 0 1 0 0 63
1 0 0 1 0 0 1 0 0 1 0 0	67 1 0 0 1 0 0 1 0 0 1 0 0 67
1 0 0 1 0 0 1 0 0 1 0 0	71 1 0 0 1 0 0 1 0 0 1 0 0 71
1 0 0 1 0 0 1 0 0 1 0 0	75 1 0 0 1 0 0 1 0 0 1 0 0 75
1 0 0 1 0 0 1 0 0 1 0 0	79 1 0 0 1 0 0 1 0 0 1 0 0 79
1 0 0 1 0 0 1 0 0 1 0 0	83 1 0 0 1 0 0 1 0 0 1 0 0 83
1 0 0 1 0 0 1 0 0 1 0 0	87 1 0 0 1 0 0 1 0 0 1 0 0 87
1 0 0 1 0 0 1 0 0 1 0 0	91 1 0 0 1 0 0 1 0 0 1 0 0 91
1 0 0 1 0 0 0 0 0 1 0 0	95 1 0 0 1 0 0 1 0 0 1 0 0 95
1 0 0 1 0 0 1 0 0 1 0 0	99 1 0 0 1 0 0 1 0 0 1 0 0 99
1 0 0 1 0 0 1 0 0 1 0 0	103 1 0 0 1 0 0 1 0 0 1 0 0 103
1 0 0 1 0 0 1 0 0 1 0 0	107 1 0 0 1 0 0 1 0 0 1 0 0 107
1 0 0 1 0 0 1 0 0 0 0 0	111 1 0 0 1 0 0 1 0 0 0 0 0 111
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 0 0 0 0 0 0 0	0 0 0 0 0 0 0 0 0 0 0 0

F17554 have 2 missing bunches : Y beam bunches 87 and 94 !!!

# Search for missing bunches

F17555



61

Y bunches 21

$$120 - (80 - 21) = 61$$

cdev record of Measured Fill Patterns

Y

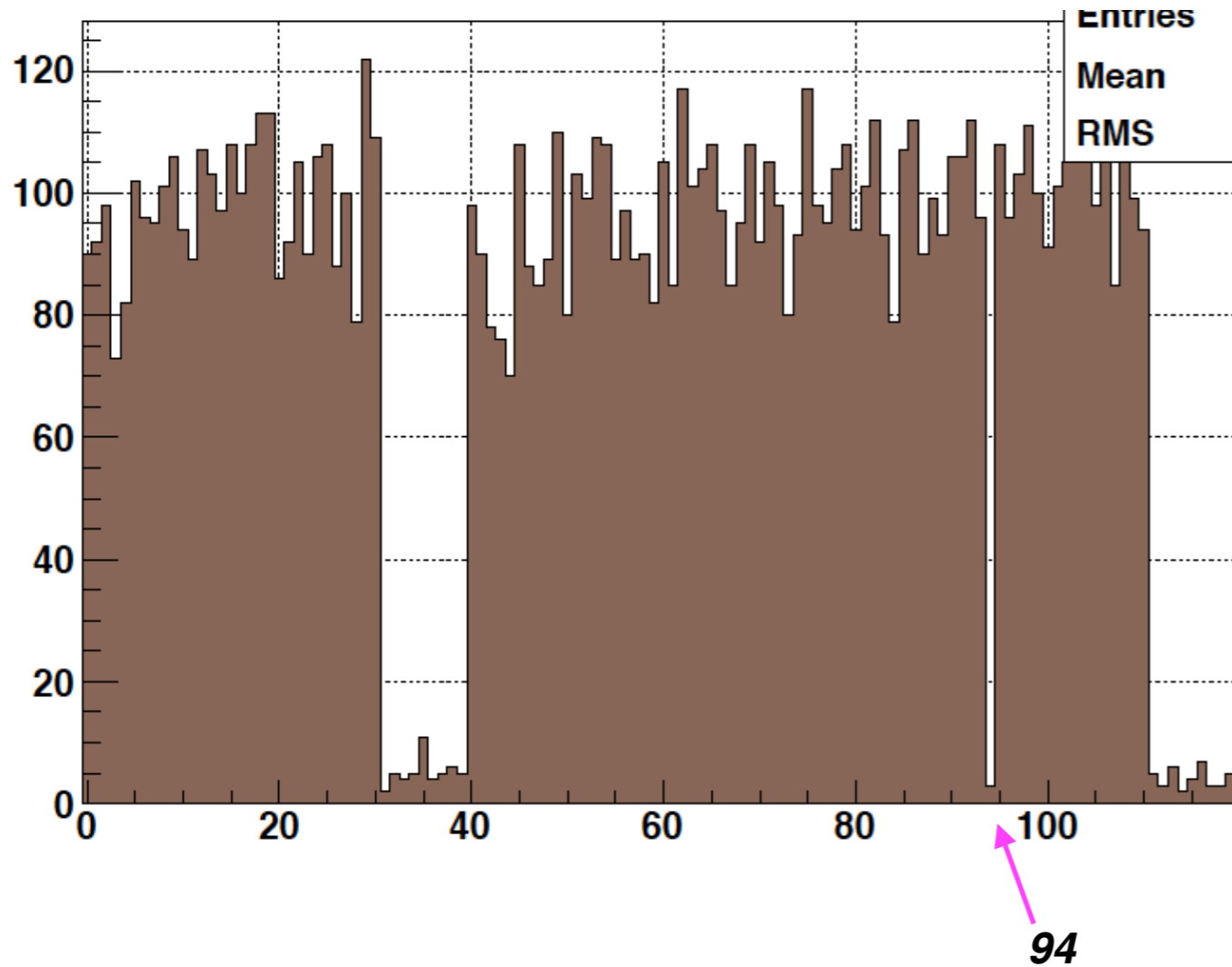
B

1 0 0 1 0 0 1 0 0 1 0 0	3	1 0 0 1 0 0 1 0 0 1 0 0	3
1 0 0 1 0 0 1 0 0 1 0 0	7	1 0 0 1 0 0 1 0 0 1 0 0	7
1 0 0 1 0 0 1 0 0 1 0 0	11	1 0 0 1 0 0 1 0 0 1 0 0	11
1 0 0 1 0 0 1 0 0 1 0 0	15	1 0 0 1 0 0 1 0 0 1 0 0	15
1 0 0 1 0 0 1 0 0 1 0 0	19	1 0 0 1 0 0 1 0 0 1 0 0	19
1 0 0 0 0 0 1 0 0 1 0 0	23	1 0 0 1 0 0 1 0 0 1 0 0	23
1 0 0 1 0 0 1 0 0 1 0 0	27	1 0 0 1 0 0 1 0 0 1 0 0	27
1 0 0 1 0 0 1 0 0 1 0 0	31	1 0 0 1 0 0 1 0 0 1 0 0	31
1 0 0 1 0 0 1 0 0 1 0 0	35	1 0 0 1 0 0 1 0 0 1 0 0	35
1 0 0 1 0 0 1 0 0 1 0 0	39	1 0 0 1 0 0 1 0 0 1 0 0	39
1 0 0 1 0 0 1 0 0 1 0 0	43	1 0 0 1 0 0 1 0 0 1 0 0	43
1 0 0 1 0 0 1 0 0 1 0 0	47	1 0 0 1 0 0 1 0 0 1 0 0	47
1 0 0 1 0 0 1 0 0 1 0 0	51	1 0 0 1 0 0 1 0 0 1 0 0	51
1 0 0 1 0 0 1 0 0 1 0 0	55	1 0 0 1 0 0 1 0 0 1 0 0	55
1 0 0 1 0 0 1 0 0 1 0 0	59	1 0 0 1 0 0 1 0 0 1 0 0	59
1 0 0 1 0 0 1 0 0 1 0 0	63	1 0 0 1 0 0 1 0 0 1 0 0	63
1 0 0 1 0 0 1 0 0 1 0 0	67	1 0 0 1 0 0 1 0 0 1 0 0	67
1 0 0 1 0 0 1 0 0 1 0 0	71	1 0 0 1 0 0 1 0 0 1 0 0	71
1 0 0 1 0 0 1 0 0 1 0 0	75	1 0 0 1 0 0 1 0 0 1 0 0	75
1 0 0 1 0 0 1 0 0 1 0 0	79	1 0 0 1 0 0 1 0 0 1 0 0	79
1 0 0 1 0 0 1 0 0 1 0 0	83	1 0 0 1 0 0 1 0 0 1 0 0	83
1 0 0 1 0 0 1 0 0 1 0 0	87	1 0 0 1 0 0 1 0 0 1 0 0	87
1 0 0 1 0 0 1 0 0 1 0 0	91	1 0 0 1 0 0 1 0 0 1 0 0	91
1 0 0 1 0 0 1 0 0 1 0 0	95	1 0 0 1 0 0 1 0 0 1 0 0	95
1 0 0 1 0 0 1 0 0 1 0 0	99	1 0 0 1 0 0 1 0 0 1 0 0	99
1 0 0 1 0 0 1 0 0 1 0 0	103	1 0 0 1 0 0 1 0 0 1 0 0	103
1 0 0 1 0 0 1 0 0 1 0 0	107	1 0 0 1 0 0 1 0 0 1 0 0	107
1 0 0 1 0 0 1 0 0 0 0 0	111	1 0 0 1 0 0 1 0 0 0 0 0	111
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 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0	

F17555 has 1 missing bunch : Y beam bunch 21 !!!

# Search for missing bunches

F17576



Y bunches 54  
 $120 - (80 - 54) = 94$

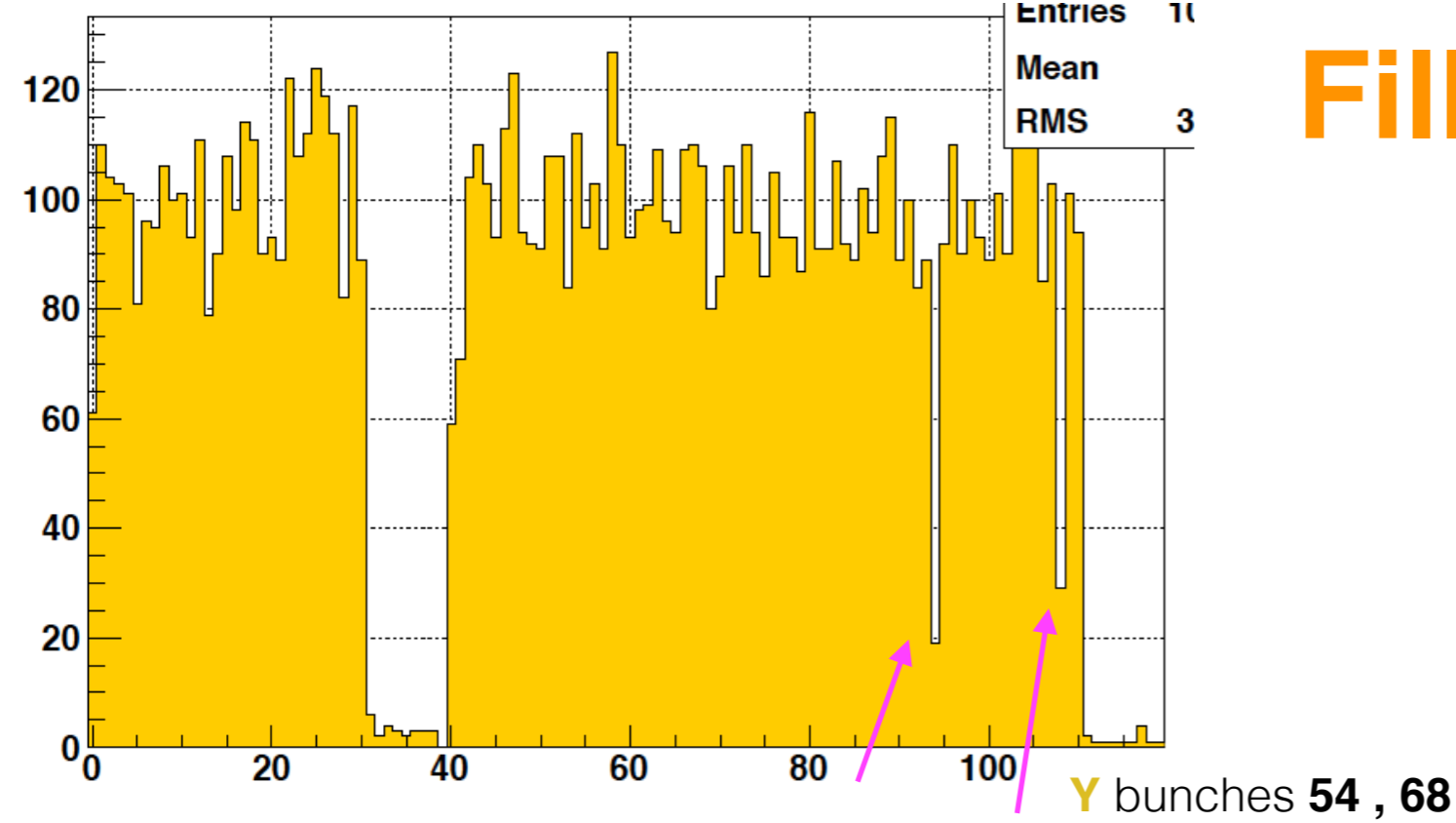
cdev record of Measured Fill Patterns

Y				B			
1	0	0	3	1	0	0	3
1	0	0	7	1	0	0	7
1	0	0	11	1	0	0	11
1	0	0	15	1	0	0	15
1	0	0	19	1	0	0	19
1	0	0	23	1	0	0	23
1	0	0	27	1	0	0	27
1	0	0	31	1	0	0	31
1	0	0	35	1	0	0	35
1	0	0	39	1	0	0	39
1	0	0	43	1	0	0	43
1	0	0	47	1	0	0	47
1	0	0	51	1	0	0	51
1	0	0	55	1	0	0	55
1	0	0	59	1	0	0	59
1	0	0	63	1	0	0	63
1	0	0	67	1	0	0	67
1	0	0	71	1	0	0	71
1	0	0	75	1	0	0	75
1	0	0	79	1	0	0	79
1	0	0	83	1	0	0	83
1	0	0	87	1	0	0	87
1	0	0	91	1	0	0	91
1	0	0	95	1	0	0	95
1	0	0	99	1	0	0	99
1	0	0	103	1	0	0	103
1	0	0	107	1	0	0	107
1	0	0	111	1	0	0	111
0	0	0		0	0	0	
0	0	0		0	0	0	

F17576 has 1 missing bunch : Y beam bunch 54 !!!

# Fill 17519

Entries 11  
Mean  
RMS 3



<wcm>

1 0 0 1 0 0 1 0 0 1 0 0	3	1 0 0 1 0 0 1 0 0 1 0 0	3
1 0 0 1 0 0 1 0 0 1 0 0	7	1 0 0 1 0 0 1 0 0 1 0 0	7
1 0 0 1 0 0 1 0 0 1 0 0	11	1 0 0 1 0 0 1 0 0 1 0 0	11
1 0 0 1 0 0 1 0 0 1 0 0	15	1 0 0 1 0 0 1 0 0 1 0 0	15
1 0 0 1 0 0 1 0 0 1 0 0	19	1 0 0 1 0 0 1 0 0 1 0 0	19
1 0 0 1 0 0 1 0 0 1 0 0	23	1 0 0 1 0 0 1 0 0 1 0 0	23
1 0 0 1 0 0 1 0 0 1 0 0	27	1 0 0 1 0 0 1 0 0 1 0 0	27
1 0 0 1 0 0 1 0 0 1 0 0	31	1 0 0 1 0 0 1 0 0 1 0 0	31
1 0 0 1 0 0 1 0 0 1 0 0	35	1 0 0 1 0 0 1 0 0 1 0 0	35
1 0 0 1 0 0 1 0 0 1 0 0	39	1 0 0 1 0 0 1 0 0 1 0 0	39
1 0 0 1 0 0 1 0 0 1 0 0	43	1 0 0 1 0 0 1 0 0 1 0 0	43
1 0 0 1 0 0 1 0 0 1 0 0	47	1 0 0 1 0 0 1 0 0 1 0 0	47
1 0 0 1 0 0 1 0 0 1 0 0	51	1 0 0 1 0 0 1 0 0 1 0 0	51
1 0 0 1 0 0 1 0 0 1 0 0	55	1 0 0 1 0 0 1 0 0 1 0 0	55
1 0 0 1 0 0 1 0 0 1 0 0	59	1 0 0 1 0 0 1 0 0 1 0 0	59
1 0 0 1 0 0 1 0 0 1 0 0	63	1 0 0 1 0 0 1 0 0 1 0 0	63
1 0 0 1 0 0 1 0 0 1 0 0	67	1 0 0 1 0 0 1 0 0 1 0 0	67
1 0 0 1 0 0 1 0 0 1 0 0	71	1 0 0 1 0 0 1 0 0 1 0 0	71
1 0 0 1 0 0 1 0 0 1 0 0	75	1 0 0 1 0 0 1 0 0 1 0 0	75
1 0 0 1 0 0 1 0 0 1 0 0	79	1 0 0 1 0 0 1 0 0 1 0 0	79
1 0 0 1 0 0 1 0 0 1 0 0	83	1 0 0 1 0 0 1 0 0 1 0 0	83
1 0 0 1 0 0 1 0 0 1 0 0	87	1 0 0 1 0 0 1 0 0 1 0 0	87
1 0 0 1 0 0 1 0 0 1 0 0	91	1 0 0 1 0 0 1 0 0 1 0 0	91
1 0 0 1 0 0 1 0 0 1 0 0	95	1 0 0 1 0 0 1 0 0 1 0 0	95
1 0 0 1 0 0 1 0 0 1 0 0	99	1 0 0 1 0 0 1 0 0 1 0 0	99
1 0 0 1 0 0 1 0 0 1 0 0	103	1 0 0 1 0 0 1 0 0 1 0 0	103
1 0 0 1 0 0 1 0 0 1 0 0	107	1 0 0 1 0 0 1 0 0 1 0 0	107
1 0 0 1 0 0 1 0 0 0 0 0	111	1 0 0 1 0 0 1 0 0 0 0 0	111
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 0 0 0 0 0 0 0		0 0 0 0 0 0 0 0 0 0 0 0	

**cdev  
record  
of  
Measured  
Fill  
Patterns does  
not indicate  
missing  
bunches**

116.52	0	0	161.507	0	0	171.109	0	0	175.588	0	0	3
178.387	0	0	174.188	0	0	181.624	0	0	181.733	0	0	7
179.665	0	0	173.324	0	0	175.198	0	0	175.588	0	0	11
171.401	0	0	179.555	0	0	177.182	0	0	179.36	0	0	15
180.516	0	0	181.624	0	0	174.663	0	0	181.624	0	0	19
180.431	0	0	177.839	0	0	173.348	0	0	178.849	0	0	23
181.989	0	0	180.699	0	0	176.792	0	0	173.774	0	0	27
173.653	0	0	176.184	0	0	174.748	0	0	178.314	0	0	31
174.164	0	0	179.616	0	0	172.788	0	0	174.042	0	0	35
173.141	0	0	177.486	0	0	177.06	0	0	178.959	0	0	39
180.882	0	0	176.427	0	0	175.661	0	0	174.103	0	0	43
181.916	0	0	177.656	0	0	180.492	0	0	184.812	0	0	47
184.313	0	0	174.407	0	0	175.016	0	0	180.322	0	0	51
181.673	0	0	178.35	0	0	13.034	0	0	175.369	0	0	55
179.591	0	0	182.537	0	0	180.821	0	0	175.04	0	0	59
182.877	0	0	181.174	0	0	181.49	0	0	177.973	0	0	63
184.885	0	0	181.101	0	0	172.752	0	0	183.242	0	0	67
29.3052	0	0	180.151	0	0	177.364	0	0	181.879	0	0	71
184.764	0	0	181.77	0	0	180.212	0	0	177.291	0	0	75
181.453	0	0	181.867	0	0	181.356	0	0	180.224	0	0	79
177.815	0	0	183.522	0	0	179.738	0	0	183.437	0	0	83
175.502	0	0	182.597	0	0	181.648	0	0	184.678	0	0	87
177.51	0	0	181.539	0	0	187.039	0	0	186.614	0	0	91
185.835	0	0	175.344	0	0	174.614	0	0	178.253	0	0	95
178.314	0	0	184.727	0	0	186.711	0	0	182.098	0	0	99
180.906	0	0	183.632	0	0	180.662	0	0	188.147	0	0	103
184.033	0	0	184.326	0	0	187.624	0	0	182.512	0	0	107
184.119	0	0	187.502	0	0	184.192	0	0	0	0	0	111
0	0	0	0	0	0	0	0	0	0	0	0	
0	0	0	0	0	0	0	0	0	0	0	0	

# Summary

- Out of 822 , 771 runs passed the beam crossing QA.
- 6 fills contains unintended missing bunches, should mask them. Fill 17519 contain partially filled bunches.
- bx7 and bx48 offset table for 771 runs need to upload to DB.