Polarized Source Development Run Results

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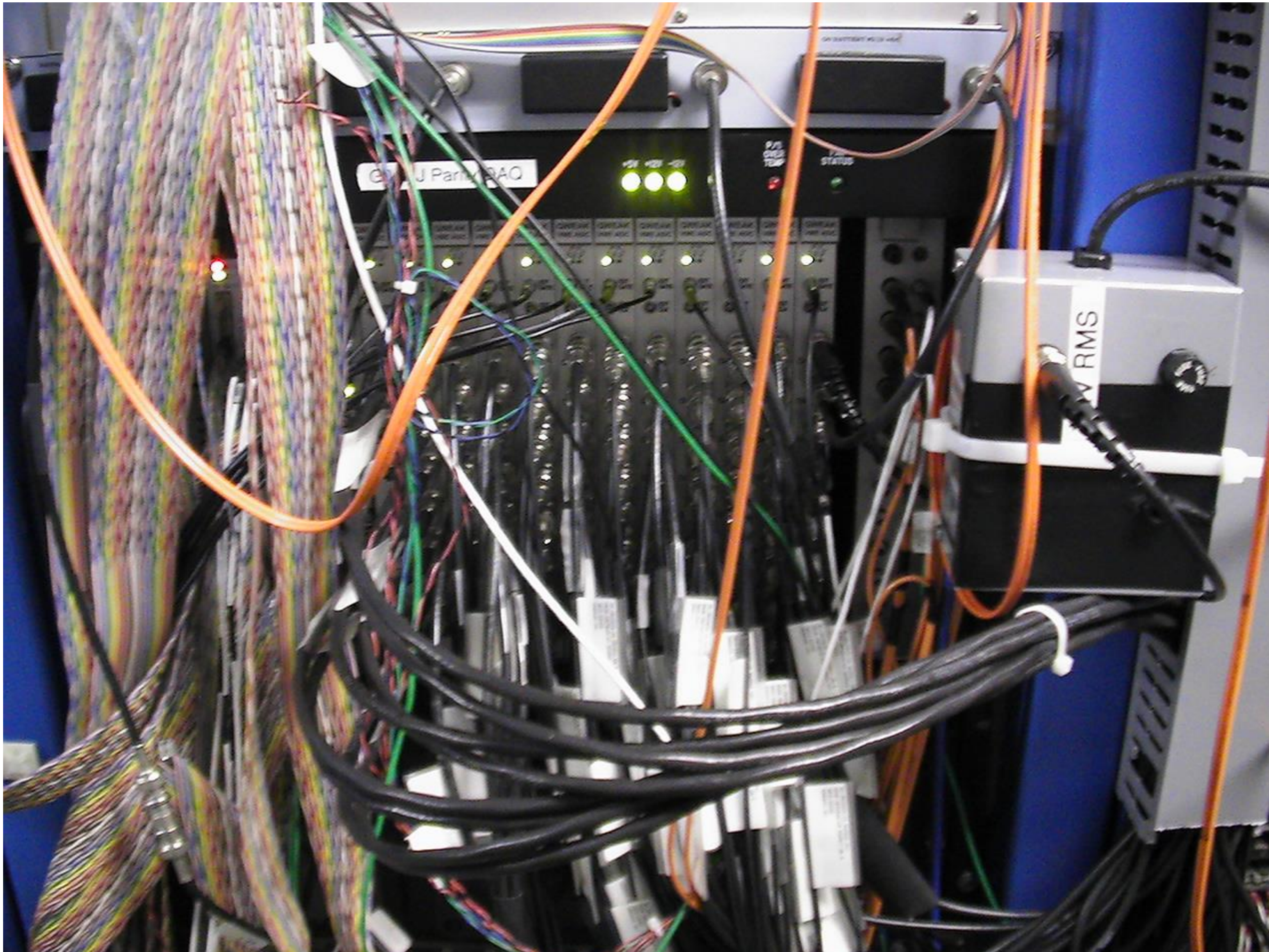
Outline

- Injector Parity DAQ and Helicity Board
- Pockels Cell Alignment
- Fast Helicity Reversal Studies:
  - 30 Hz, 250 Hz and 1 kHz

- BPMs Electronics
- Search for 60 Hz Noise
- Halls A & C Beams Crosstalk
- Summary and Future Parity Beam Studies

Thanks to: Roger Flood, Pete Francis, Paul King, Bob Michaels, Julie Roche


RMS

	Chan 1	Chan 2	Chan 3	Chan 4	Chan 5	Chan 6	Chan 7	Chan 8
ADC1	QPD pm	QPD pp	QPD mm	QPD mp			Battery 1	Battery 2
ADC2	1I02				1I04			
ADC3	1I06				0I02			
ADC4	0I02A				0I05			
ADC5	0I07				0L01			
ADC6	0L02				0L03			
ADC7	0L04				0L05			
ADC8	0L06				0L07			
ADC9	0L08				0L09			
ADC10	0L10				0R01			
ADC11	0R02				0R05			
ADC12	0R06				BCM 0L02	Battery 3	Battery 4	Phase Monitor

Notes:

1. For each BPM, the wires are: +X+, +X-, +Y+, +Y-.
2. BPM 0R06 is not connected yet.
3. There are only two injector BPMs we are not reading: 0R03 and 0R04.

Helicity Board

Outputs (Fiber-optic Signals):

1. Real time helicity → Helicity Magnets, Pockels Cell and IA's
2. QRT → Halls and Mott Polarimeters
3. MPS (T_Settle) → Halls and Mott Polarimeters
4. Reporting Helicity → Halls, Mott Polarimeters, iocse9 and iocse14
5. Pair Sync → Halls and Mott Polarimeters

Helicity Board Software

1. We only have two choices of helicity reversal rates at any given time:
   30 Hz and 250 Hz or 30 Hz and 1 kHz.

2. To change the helicity reversal rate, a new code must be uploaded in the field to the helicity ioc

3. For both helicity reversal rates, a common choice of T-Settle (4 options):
   500, 200, 100, and 60 μs or 500, 100, 60, and 10 μs

4. Reporting Delay: No Delay, 2, 4, or 8 Cycles

5. Helicity Pattern: Pair (+- or -+) or Quartet (-++- or +--+)

6. Helicity Generation: Toggle or Pseudorandom (24-Bit Shift Register that repeats every 13 days at 30 Hz)

7. Free running: for example at 30 Hz,
   f = 29.xx Hz = 1/(T_Settle+ Integration Window)

We are re-designing the Helicity Board

Cycle Rae (HZ)	MPS (µs)	MPS (Hz)	QRT (Hz)	Helicity (ms)	Helicity (Hz)
30	500	29.58	7.386	33.83	14.78
30	200	29.76	7.451	33.53	14.91
30	100	29.90	7.474	33.43	14.96
30	60	29.94	7.485	33.39	14.97
250	500	226.3	56.56	4.420	113.1
250	200	242.7	60.68	4.120	121.4
250	100	248.8	62.68	4.020	124.4
250	60	251.3	62.81	3.980	125.6

Notes:

1. These values as measured by a scope
2. Signals to Parity DAQ: MPS (T_Settle), QRT, Reporting Helicity, and Pair-Sync
3. The length and frequency of Pair-Sync are identical to Helicity
4. The length of QRT is identical to Helicity
5. The integration window is generated by MPS AND Pair-Sync
6. The integration window for 30 Hz is 33.33 ms and for 250 Hz it is 3.92 ms

Cycle Rae (HZ)	MPS (µs)	MPS (Hz)	QRT (Hz)	Helicity (ms)	Helicity (Hz)
30	500	29.58	7.386	33.83	14.78
30	100	29.90	7.474	33.43	14.96
30	60	29.94	7.485	33.39	14.97
30	10	29.99	7.496	33.34	14.99
1000	500	675.7	168.9	1.480	337.8
1000	100	925.9	231.5	1.080	463.0
1000	60	961.5	240.4	1.040	480.8
1000	10	1010	252.5	0.9900	505.1

Notes:

1. These values as measured by a scope
2. The integration window for 1 kHz is 0.980 ms

Parity ADC Internal Programming

(for this study)

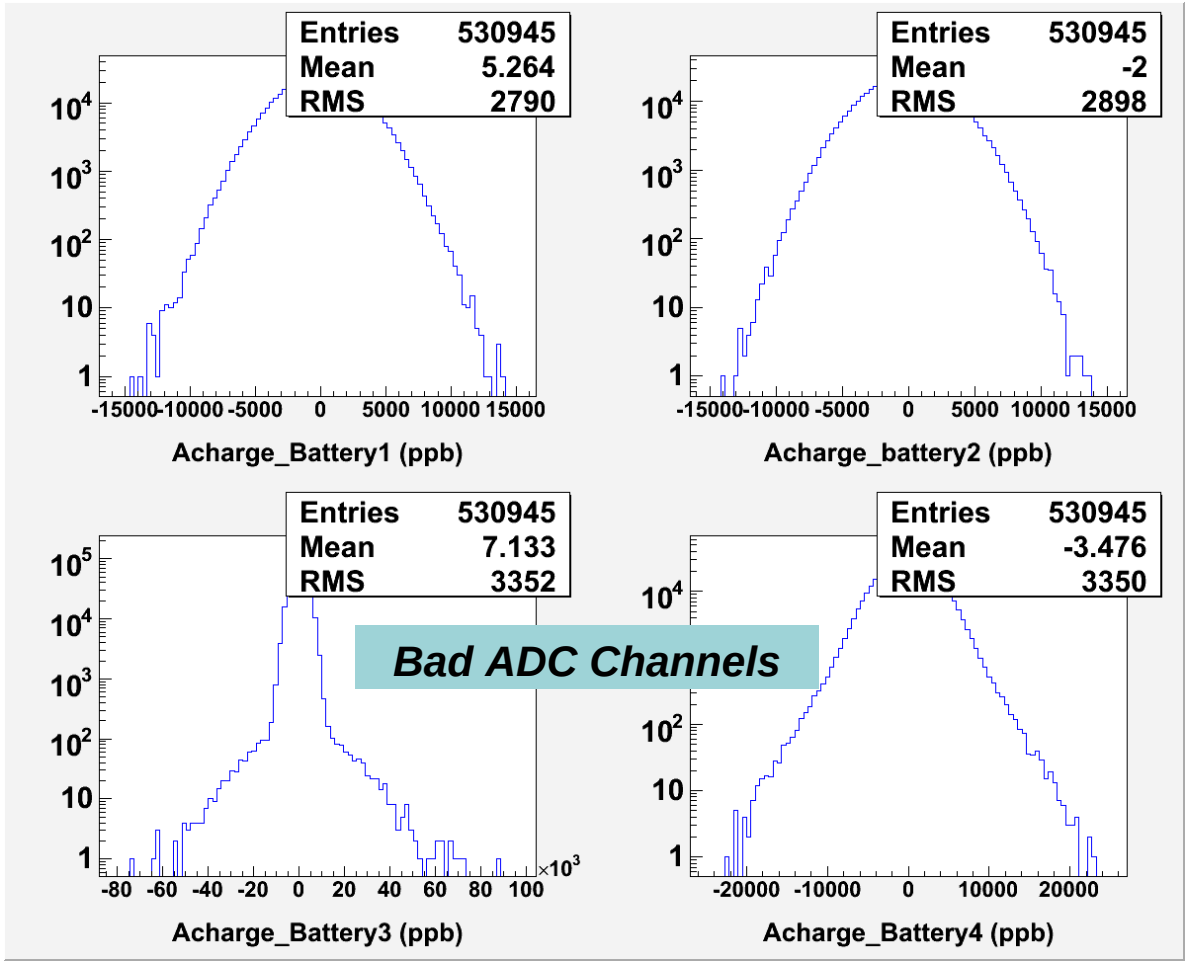
I. For 30 Hz helicity reversal:
   - ✓ Acquisition starts 40 μs after the gate begins
   - ✓ There are 4 blocks of 4161 samples/block for each gate.
   - ✓ The acquisition time is 33.328 ms

II. For 250 Hz helicity reversal:
   - ✓ Acquisition starts 40 μs after the gate begins
   - ✓ There are 4 blocks of 485 samples/block for each gate.
   - ✓ The acquisition time is 3.880 ms

III. For 1 kHz helicity reversal:
   - ✓ Acquisition starts 40 μs after the gate begins
   - ✓ There are 4 blocks of 117 samples/block for each gate.
   - ✓ The acquisition time is 936 μs

Battery Signals (3 V)

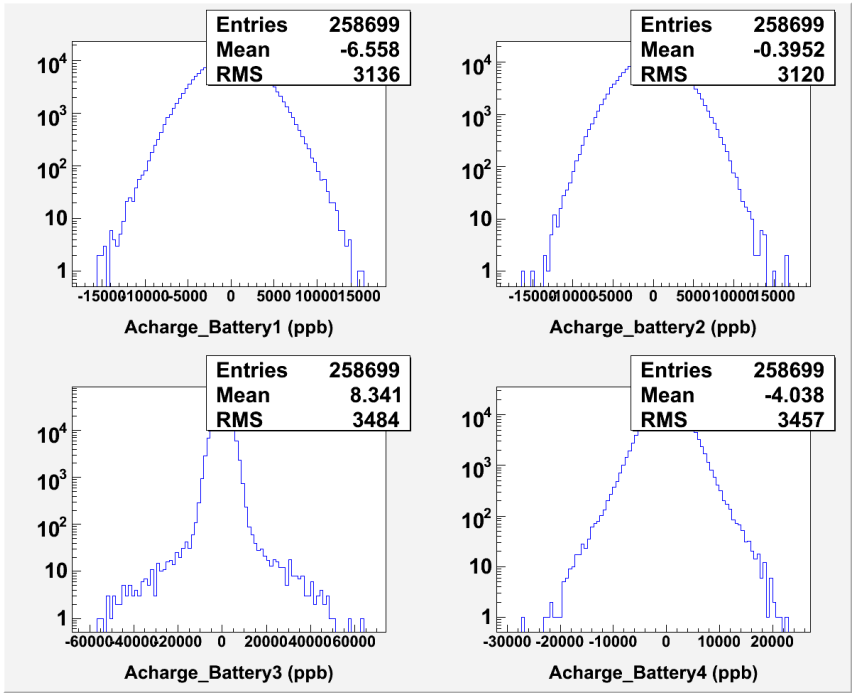
Random, 8-Cycles Delay, Run 361



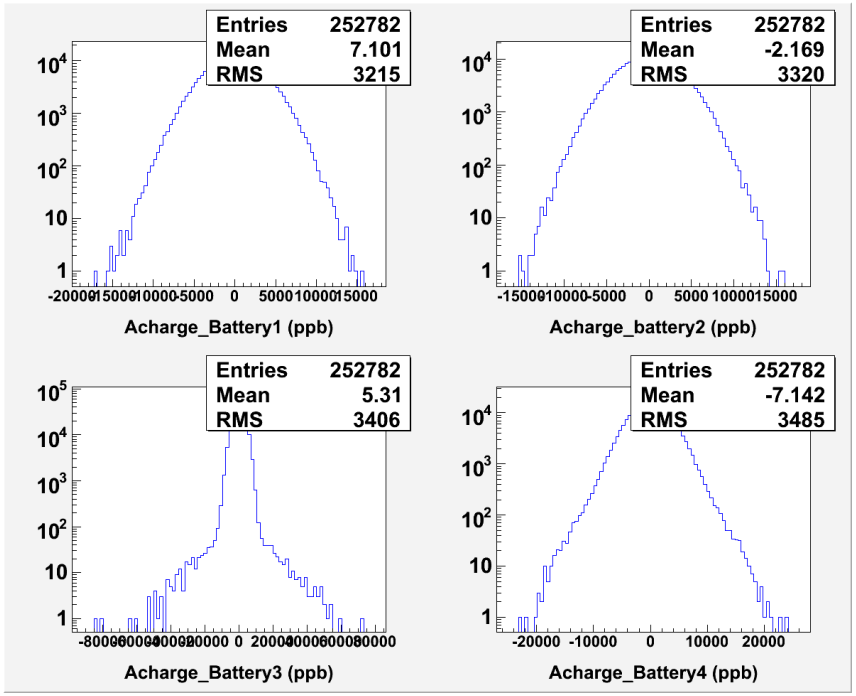
Battery Signals

Battery1 and Battery2 Round Trip to Laser Table

Random, 8-Cycles Delay, Run 398

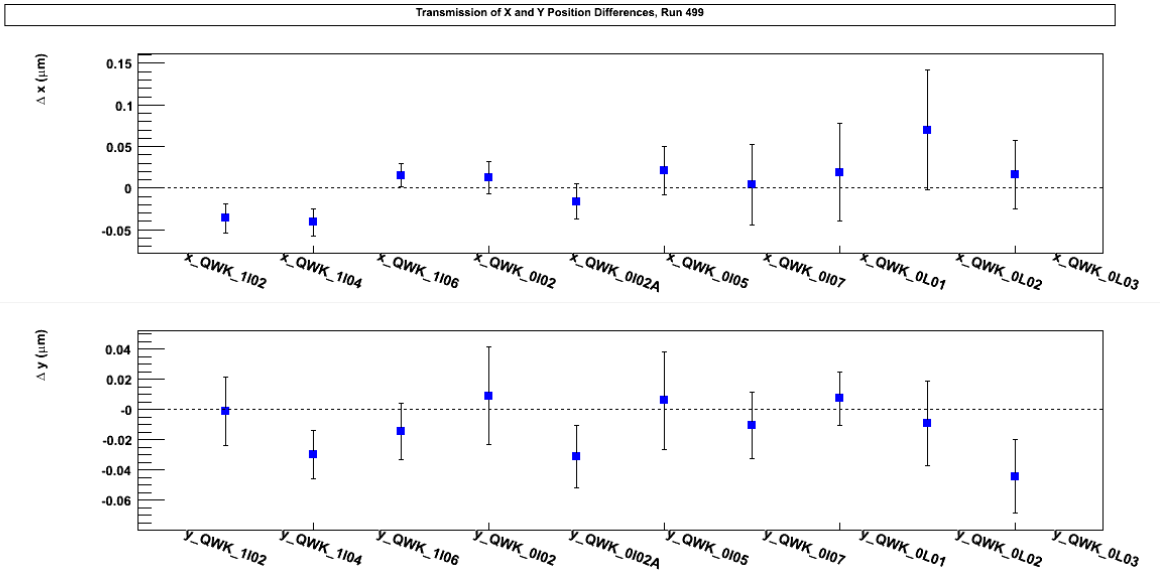


Random, No Delay, Run 406



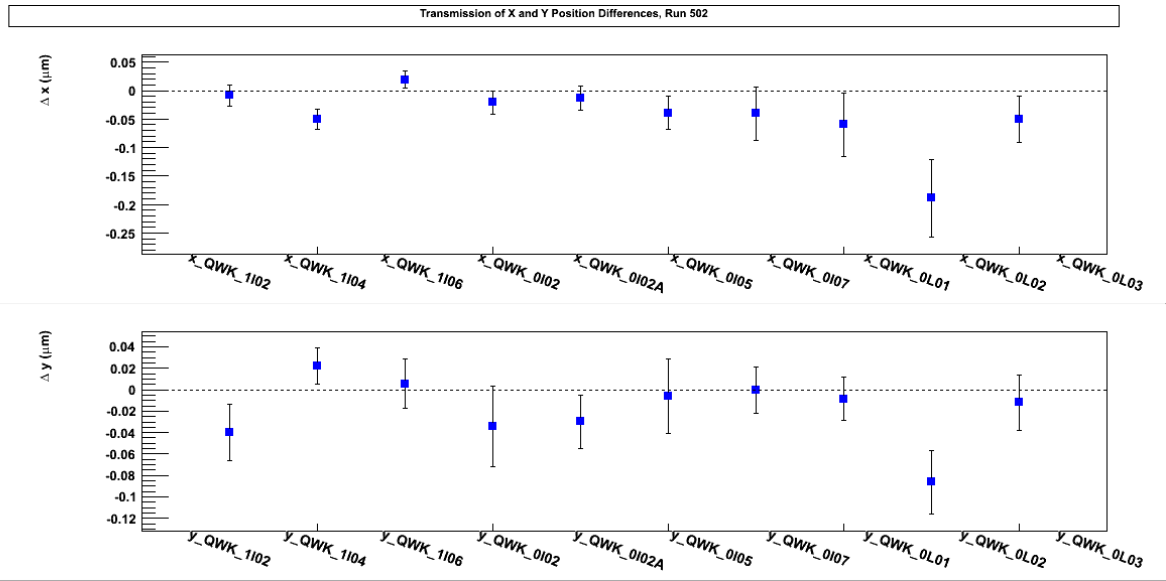
Pockels Cell OFF

Random, 8-Cycles
Delay, Run 499



No Helicity pickup

Random, No
Delay, Run 502



Pockels Cell Alignment

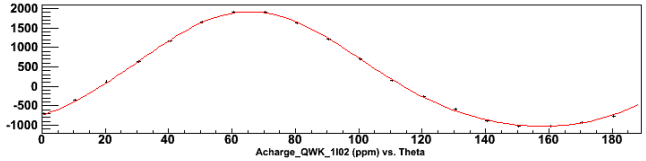
- The Pockels Cell rise time was measured with a laser beam to be about 80 μs

- With a Spinning Half Wave Plate or a Spinning Linear Polarizer and a Scope, the Circular polarization was maximized by checking:
    1. Laser isogyro pattern
    2. Pockels Cell Pitch, Yaw, Roll, X & Y
    3. Pockels Cell Voltages

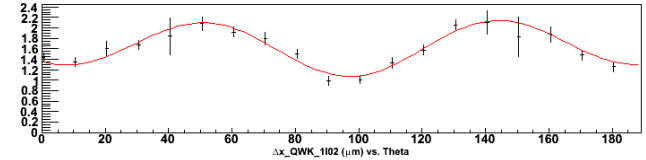
- The above was checked for IHWP IN and OUT and for 30 Hz and 250 Hz helicity reversal

- The Circular polarization = 99.97 %, and the Linear Polarization = 2.56 %

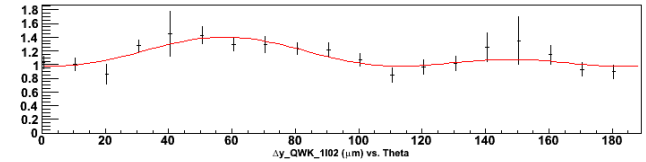
RHWP scan, Run 402, PITA = 0, IHWP IN, QWK_1I02



Aq = 290.84 + -1467.73 sin (2θ+ 137.42) + -157.97 sin (4θ+ 14.76)

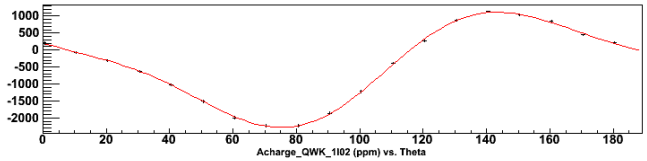


Δx = 1.65 + 0.11 sin (2θ+ 85.80) + -0.47 sin (4θ+ 60.41)

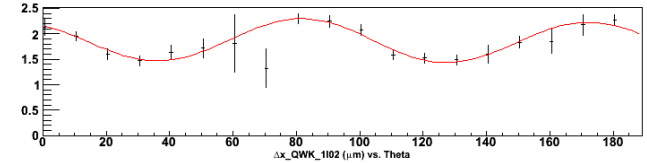


Δy = 1.12 + -0.16 sin (2θ+ 154.60) + -0.12 sin (4θ+ 39.36)

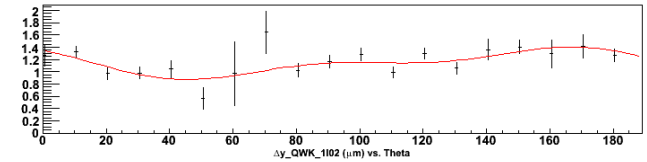
RHWP scan, Run 405, PITA = 0, IHWP OUT, QWK_1I02



Aq = -482.88 + 1542.49 sin (2θ+ 136.94) + -402.93 sin (4θ+ 114.20)

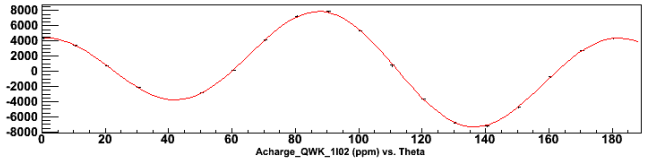


Δx = 1.86 + -0.04 sin (2θ+ 131.72) + 0.41 sin (4θ+ 122.94)

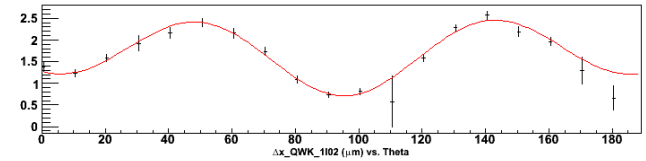


Δy = 1.14 + 0.20 sin (2θ+ 148.67) + 0.11 sin (4θ+ 114.61)

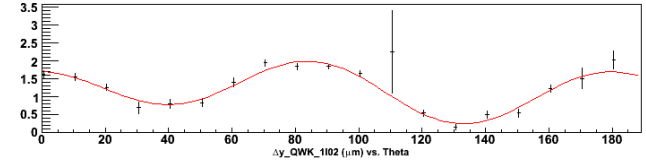
RHWP scan, Run 403, PITA = -180, IHWP IN, QWK_1I02



Aq = 292.53 + -2494.23 sin (2θ+ 136.13) + 5754.85 sin (4θ+ 92.33)

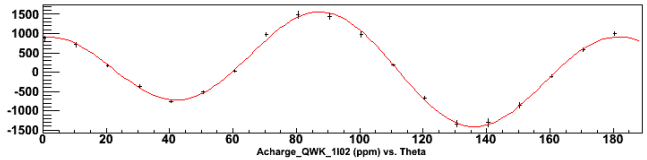


Δx = 1.70 + 0.25 sin (2θ+ 84.17) + -0.73 sin (4θ+ 67.87)

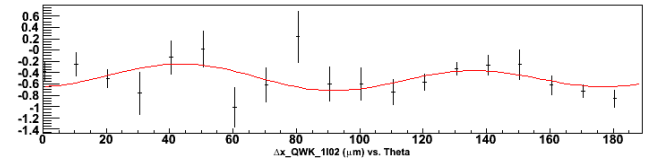


Δy = 1.17 + -0.31 sin (2θ+ 157.96) + 0.66 sin (4θ+ 103.73)

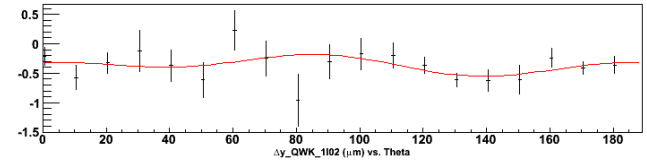
RHWP scan, Run 404, PITA = -180, IHWP OUT, QWK_1I02



Aq = 86.71 + -473.49 sin (2θ+ 138.49) + 1140.63 sin (4θ+ 92.69)



Δx = -0.49 + 0.07 sin (2θ+ 29.89) + -0.19 sin (4θ+ 91.57)

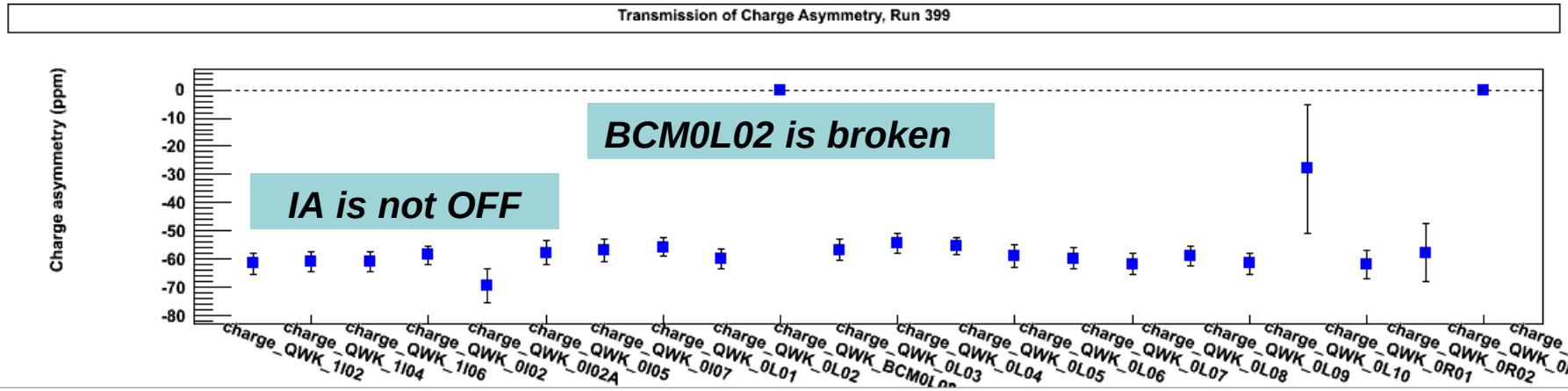


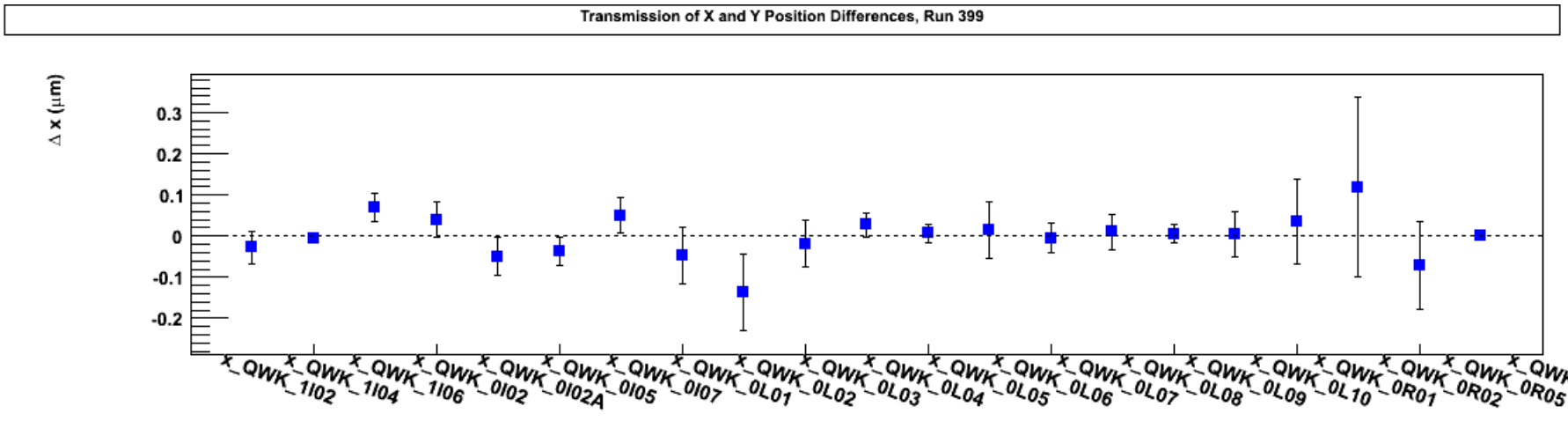
Δy = -0.36 + -0.11 sin (2θ+ 138.05) + 0.10 sin (4θ+ 90.00)

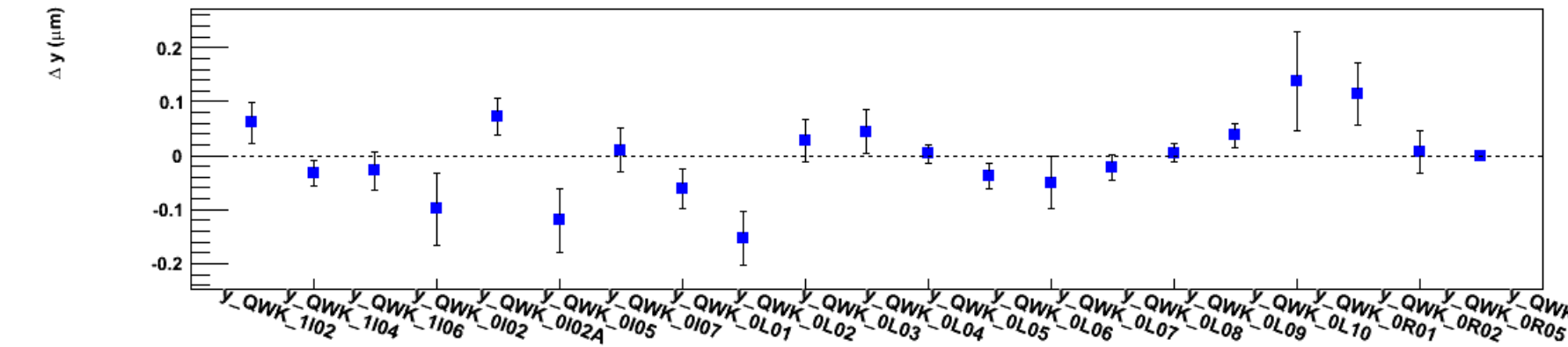
T-Settle Study (500, 200, 100, 60 µs)

- 30 Hz

    1. Run 399: PC OFF, IHWP IN, 500 µs
    2. Run 381: IHWP OUT, 500 µs
    3. Run 382: IHWP IN, 500 µs
    4. Run 383: IHWP IN, 200 µs
    5. Run 384: IHWP IN, 100 µs
    6. Run 385: IHWP IN, 60 µs


Transmission of Charge Asymmetry, Run 399
Charge asymmetry (ppm)
BCM0L02 is broken
IA is not OFF
charge_QWK_1I02
charge_QWK_1I04
charge_QWK_1I06
charge_QWK_0I02
charge_QWK_0I02A
charge_QWK_0I05
charge_QWK_0I07
charge_QWK_0L01
charge_QWK_0L02
charge_QWK_0L03
charge_QWK_0L04
charge_QWK_0L05
charge_QWK_0L06
charge_QWK_0L07
charge_QWK_0L08
charge_QWK_0L09
charge_QWK_0L10
charge_QWK_0R01
charge_QWK_0R02
charge_QWK_0R05


Transmission of X and Y Position Differences, Run 399
Δ x (μm)
x_QWK_1I02
x_QWK_1I04
x_QWK_1I06
x_QWK_0I02
x_QWK_0I02A
x_QWK_0I05
x_QWK_0I07
x_QWK_0L01
x_QWK_0L02
x_QWK_0L03
x_QWK_0L04
x_QWK_0L05
x_QWK_0L06
x_QWK_0L07
x_QWK_0L08
x_QWK_0L09
x_QWK_0L10
x_QWK_0R01
x_QWK_0R02
x_QWK_0R05


Δ y (μm)
y_QWK_1I02
y_QWK_1I04
y_QWK_1I06
y_QWK_0I02
y_QWK_0I02A
y_QWK_0I05
y_QWK_0I07
y_QWK_0L01
y_QWK_0L02
y_QWK_0L03
y_QWK_0L04
y_QWK_0L05
y_QWK_0L06
y_QWK_0L07
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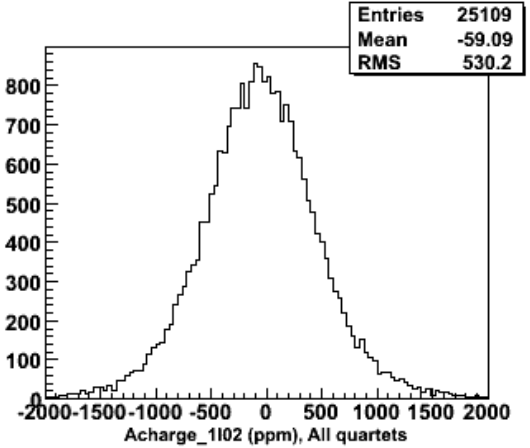
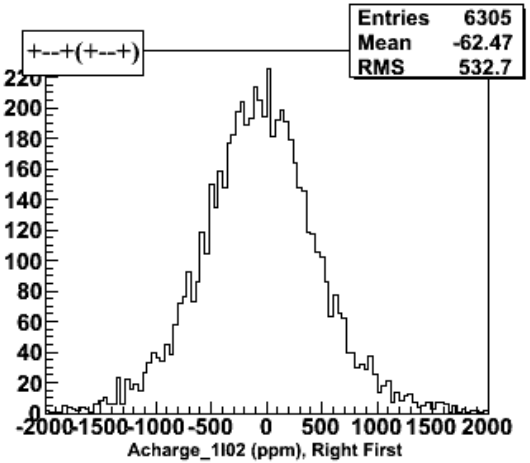
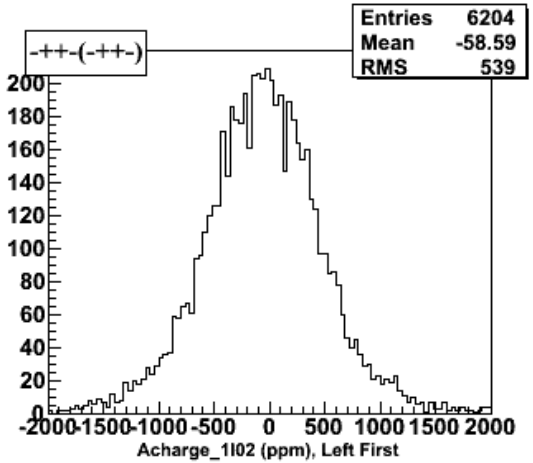
y_QWK_0R01
y_QWK_0R02
y_QWK_0R05



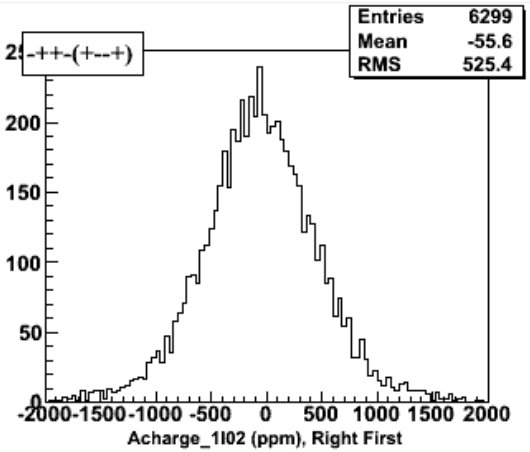
Run 399

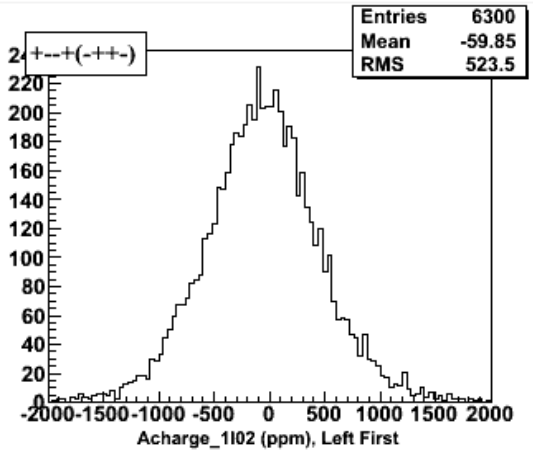
Charge Asymmetry

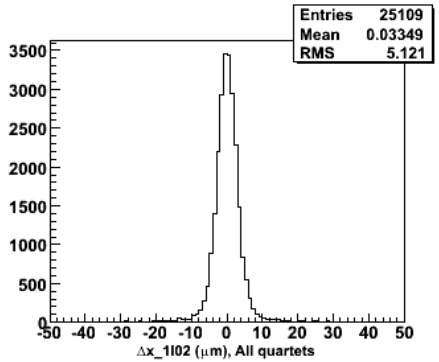




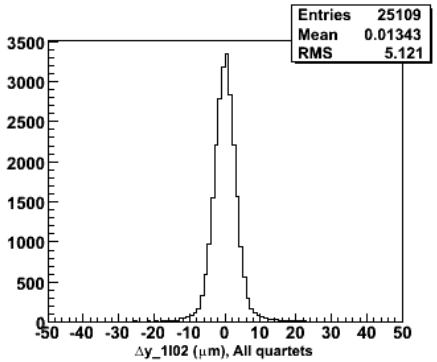
Watch the mean of the 4 distributions



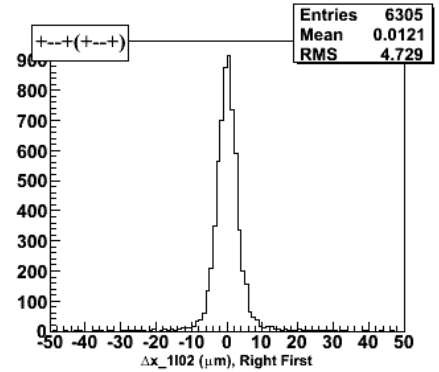


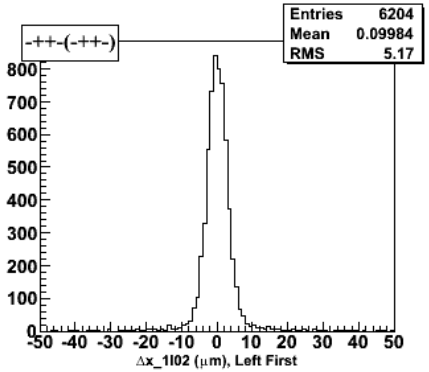


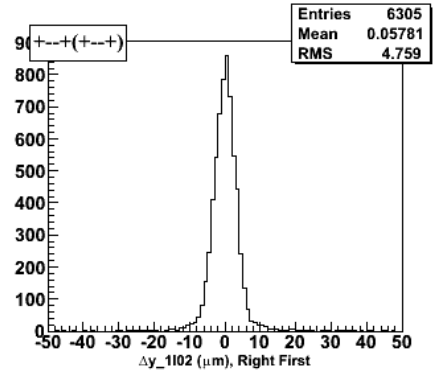
Run 399

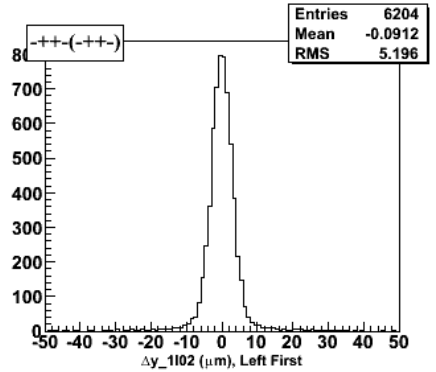


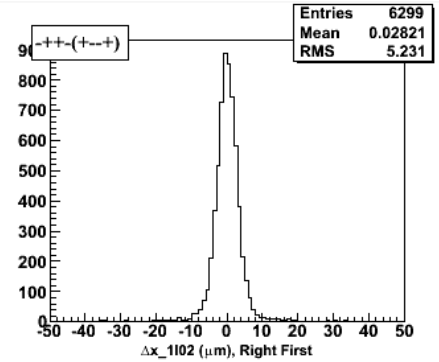
Run 399

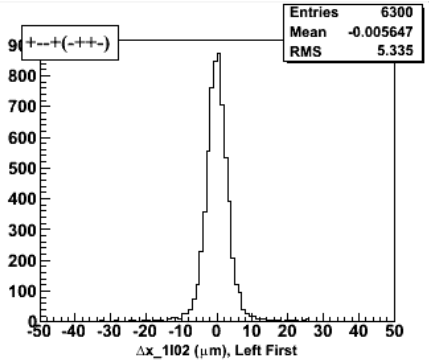


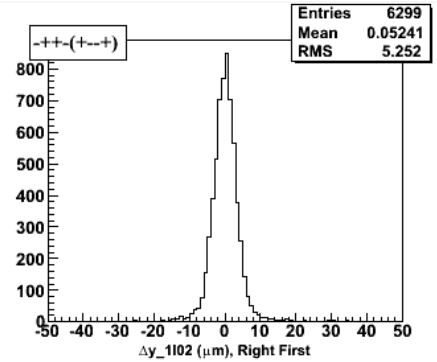


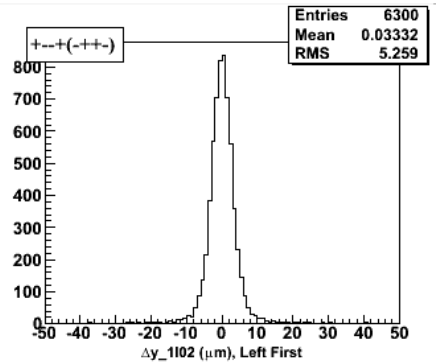












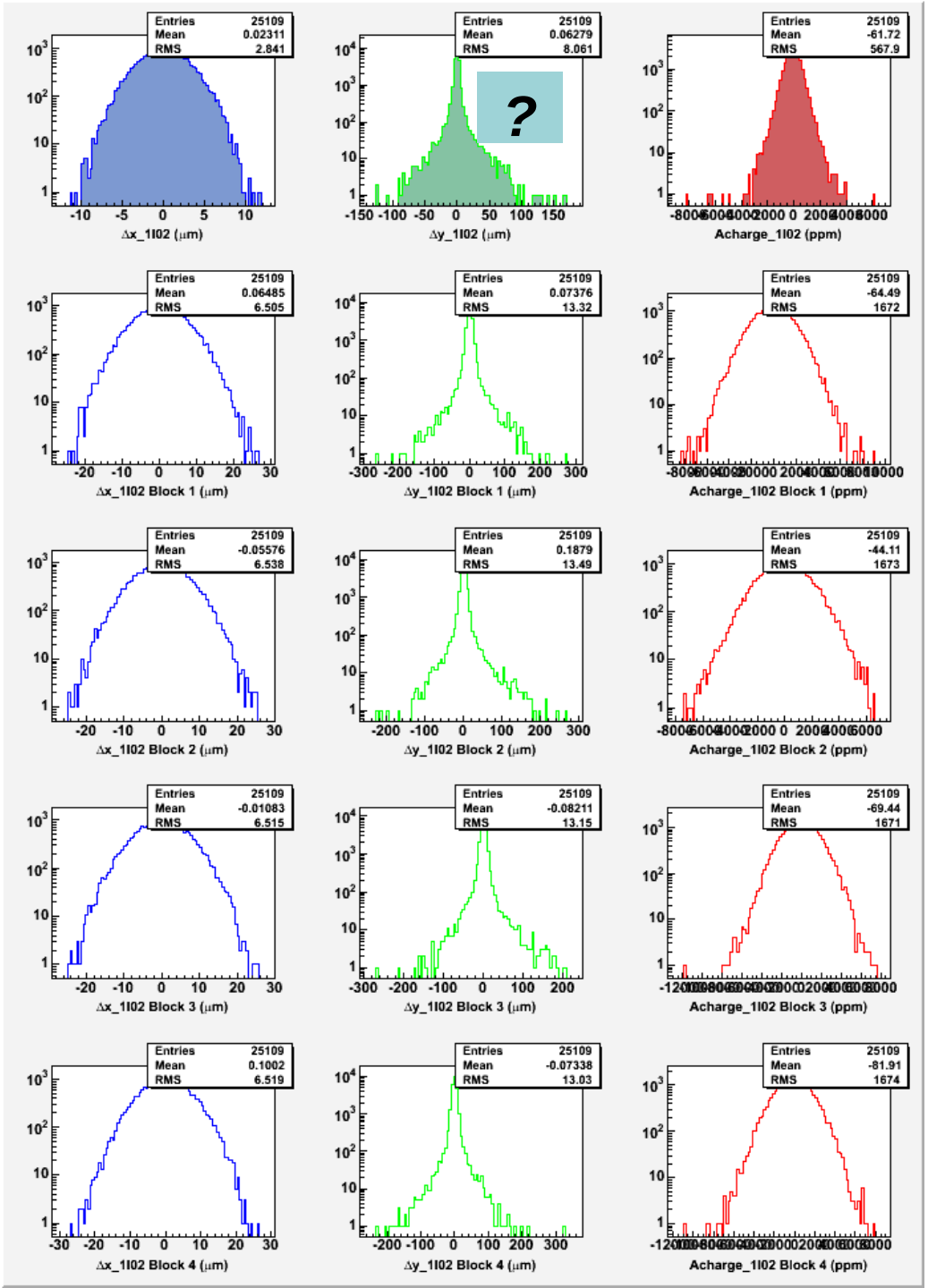
Total

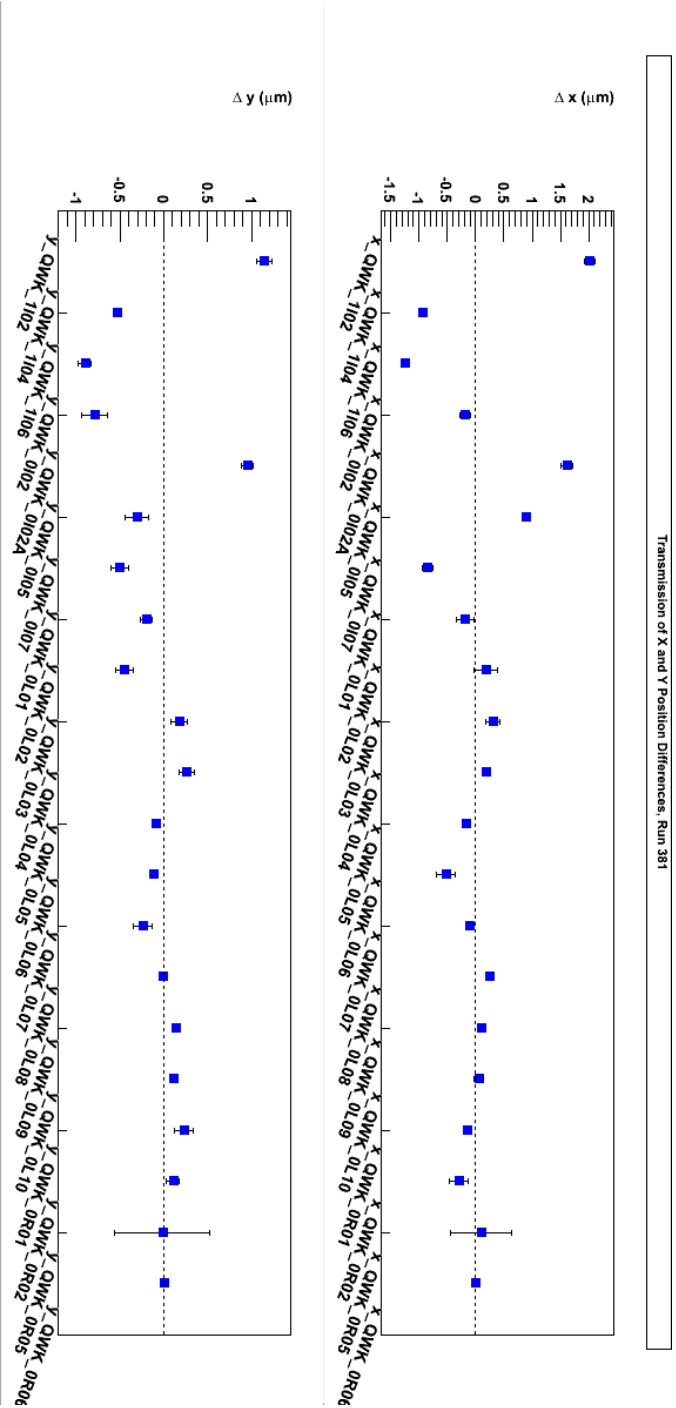
Block 1

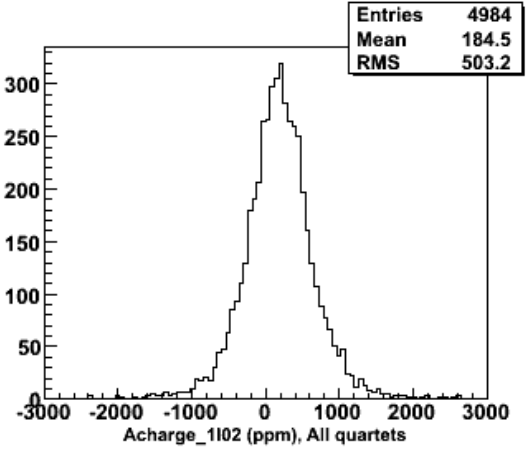
Block 2

Block 3

Block 4

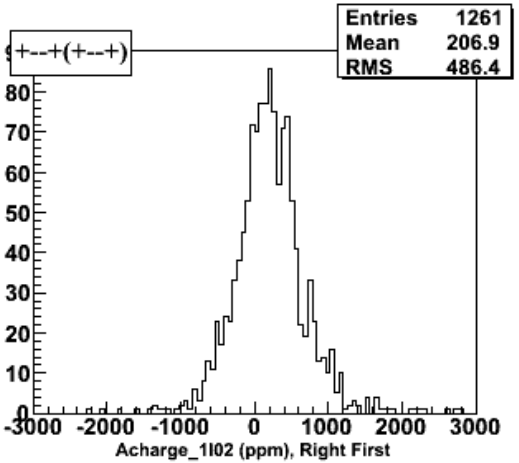


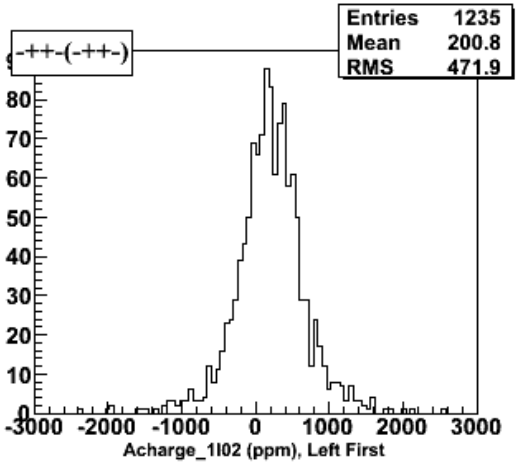


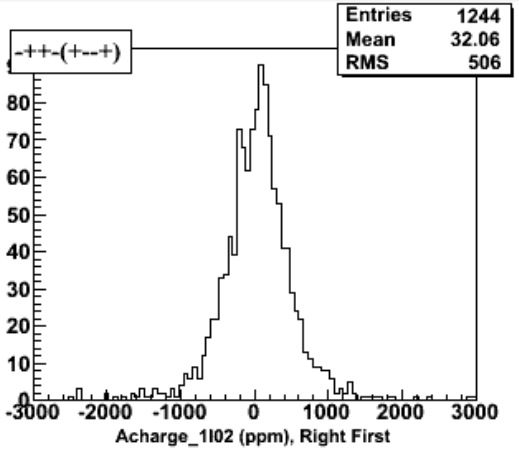


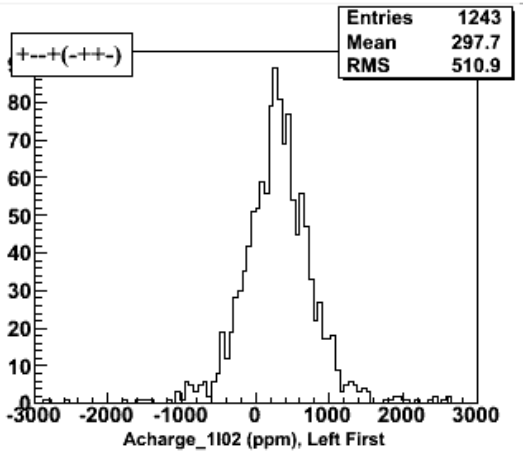
Run 381

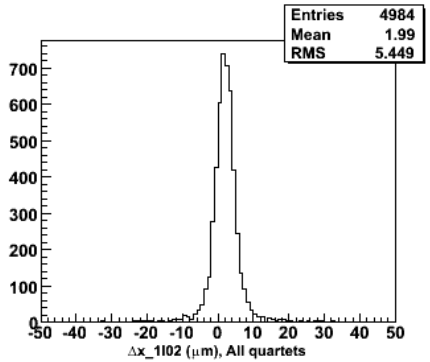
Charge Asymmetry



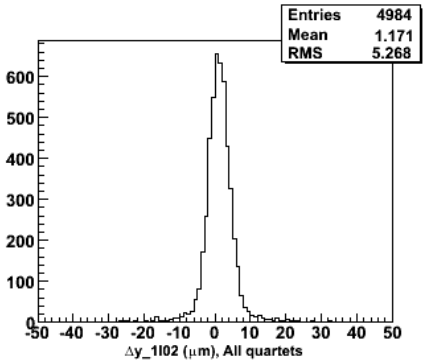




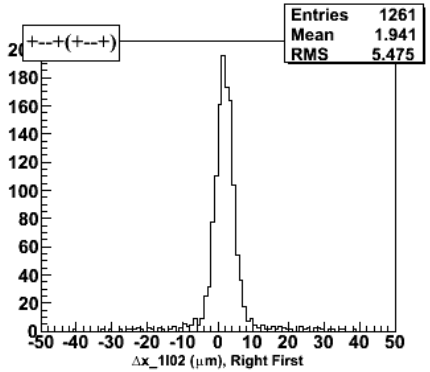


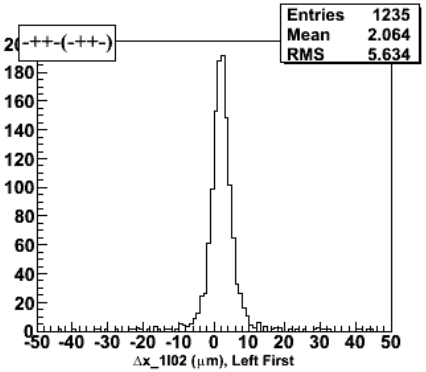


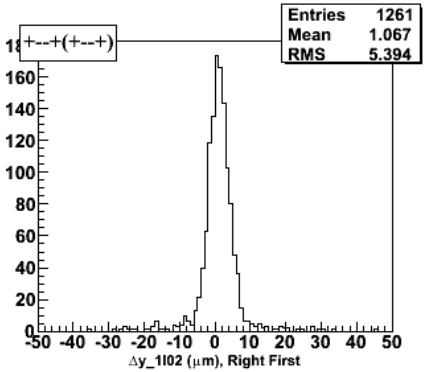
Run 381

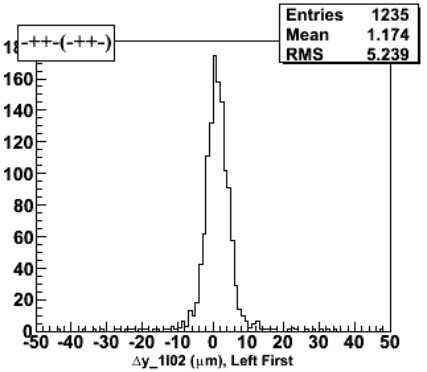


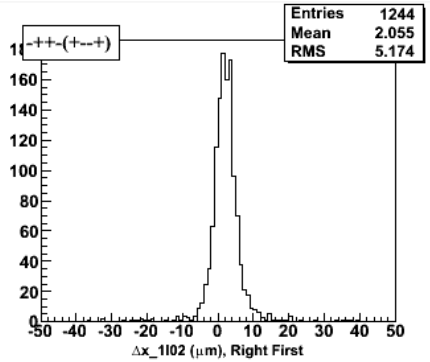
Run 381

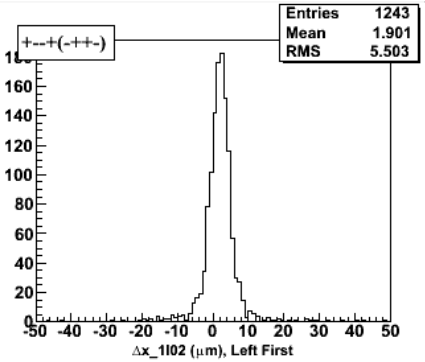


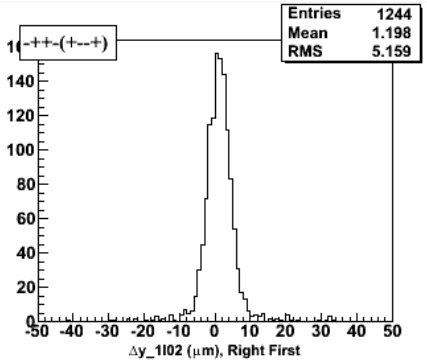


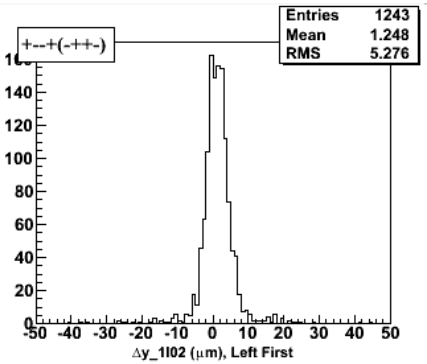


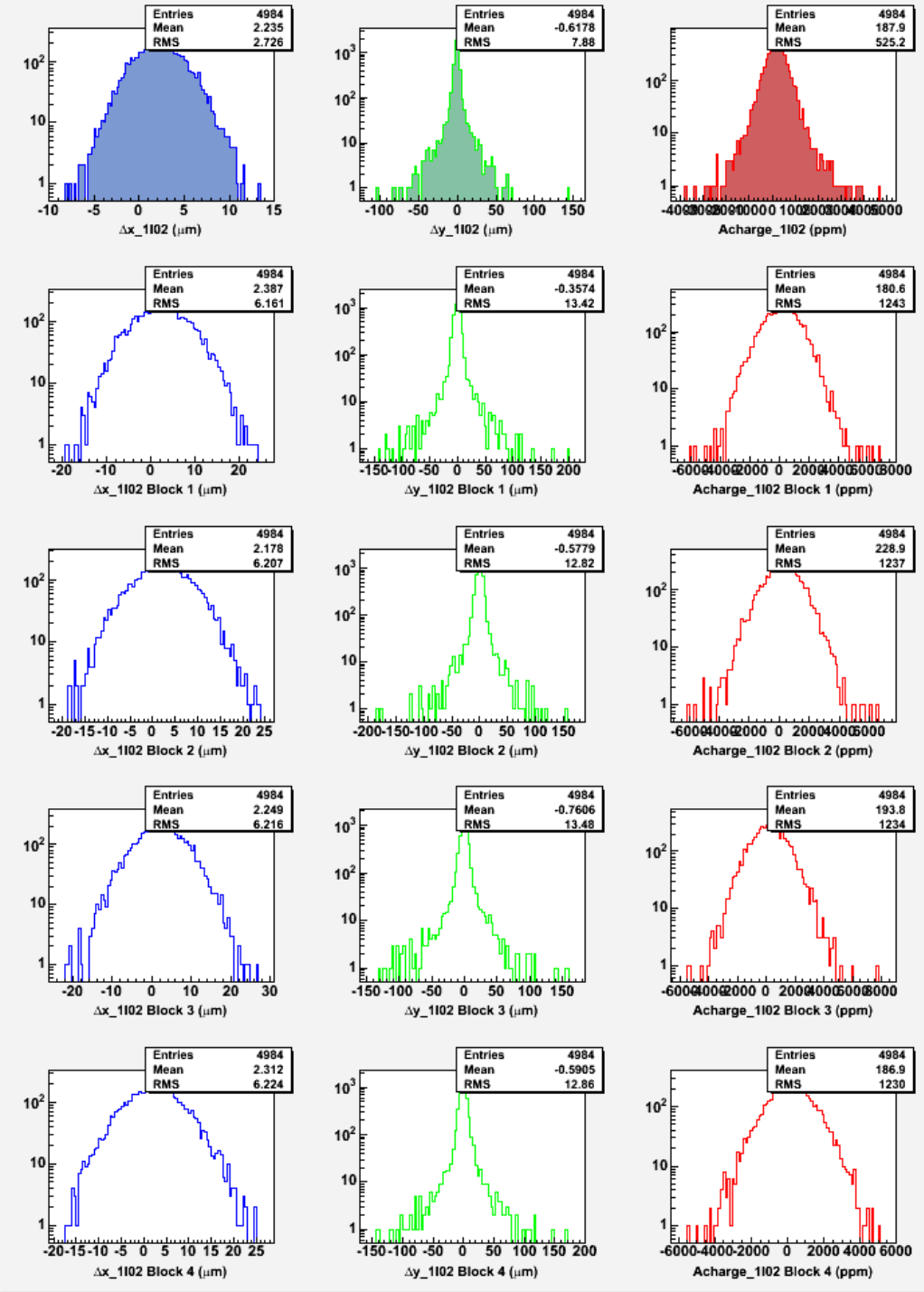


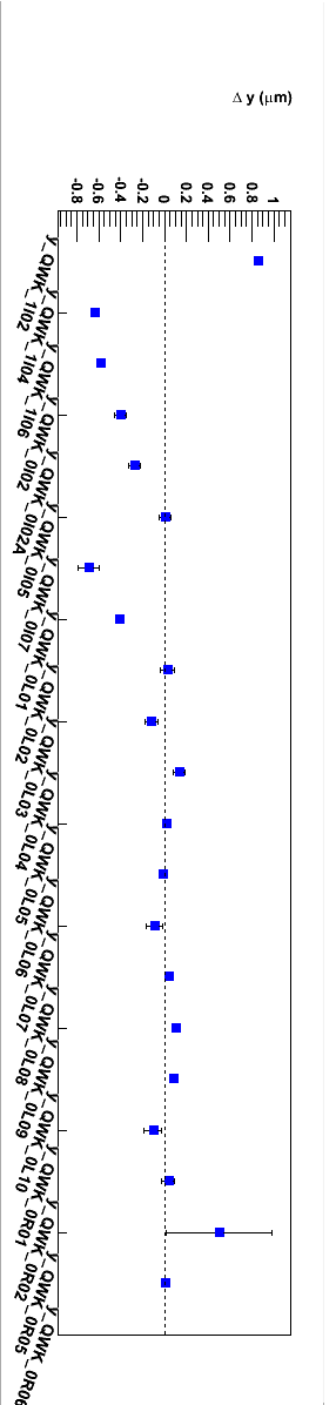


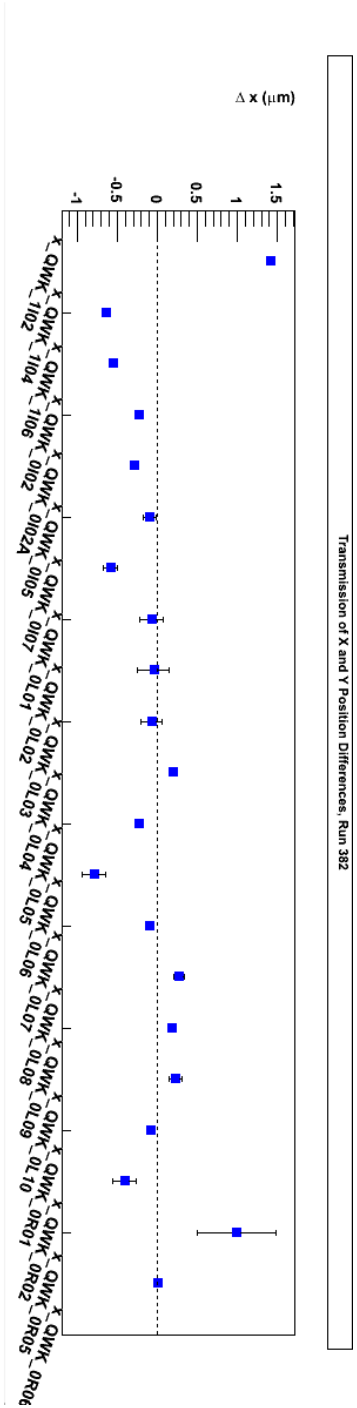


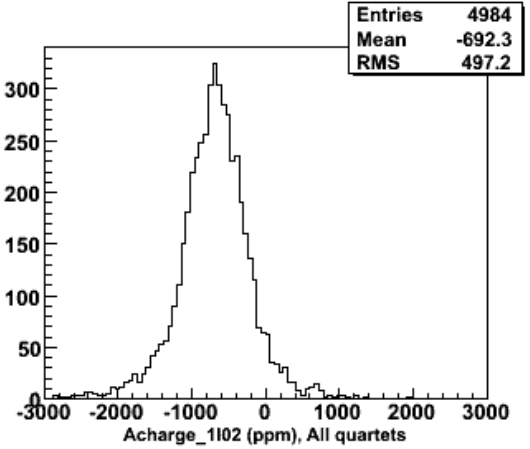





Entries 4984
Mean 2.235
RMS 2.726
Δx_1I02 (μm)
Entries 4984
Mean -0.6178
RMS 7.88
Δy_1I02 (μm)
Entries 4984
Mean 187.9
RMS 525.2
Acharge_1I02 (ppm)
Entries 4984
Mean 2.387
RMS 6.161
Δx_1I02 Block 1 (μm)
Entries 4984
Mean -0.3574
RMS 13.42
Δy_1I02 Block 1 (μm)
Entries 4984
Mean 180.6
RMS 1243
Acharge_1I02 Block 1 (ppm)
Entries 4984
Mean 2.178
RMS 6.207
Δx_1I02 Block 2 (μm)
Entries 4984
Mean -0.5779
RMS 12.82
Δy_1I02 Block 2 (μm)
Entries 4984
Mean 228.9
RMS 1237
Acharge_1I02 Block 2 (ppm)
Entries 4984
Mean 2.249
RMS 6.216
Δx_1I02 Block 3 (μm)
Entries 4984
Mean -0.7606
RMS 13.48
Δy_1I02 Block 3 (μm)
Entries 4984
Mean 193.8
RMS 1234
Acharge_1I02 Block 3 (ppm)
Entries 4984
Mean 2.312
RMS 6.224
Δx_1I02 Block 4 (μm)
Entries 4984
Mean -0.5905
RMS 12.86
Δy_1I02 Block 4 (μm)
Entries 4984
Mean 186.9
RMS 1230
Acharge_1I02 Block 4 (ppm)

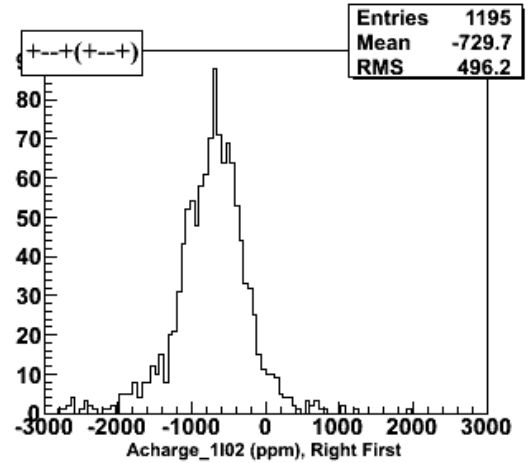


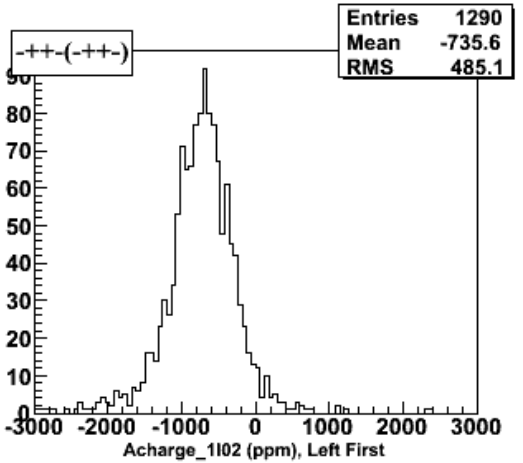


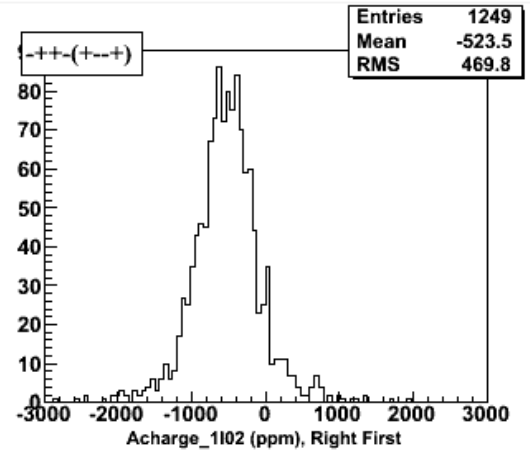


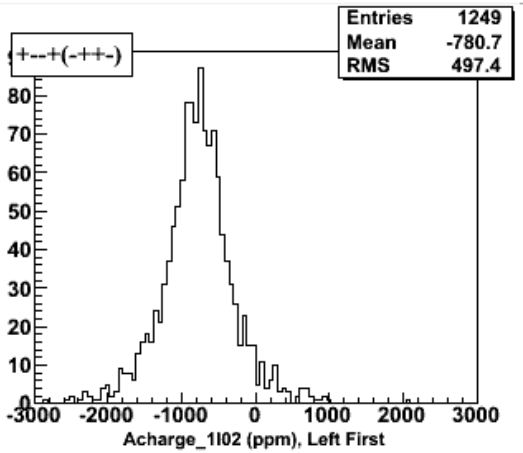
Run 382

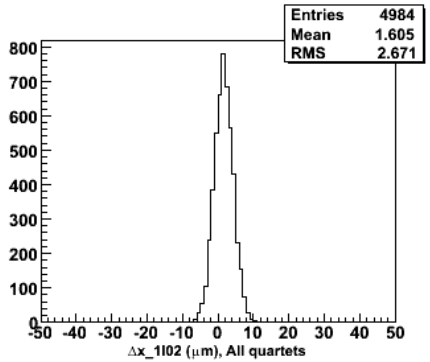
Charge Asymmetry



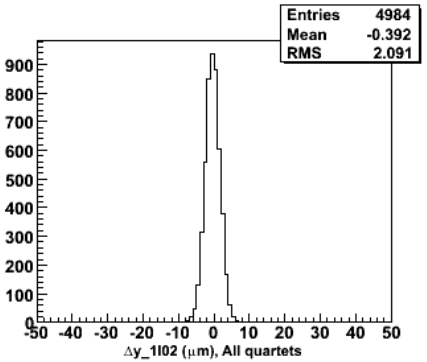




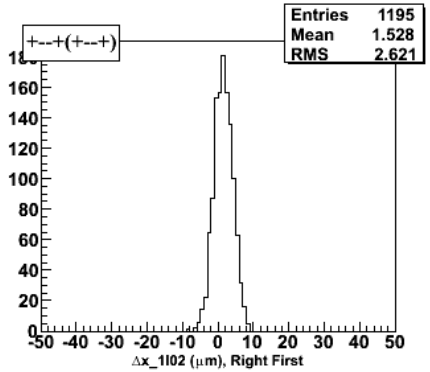


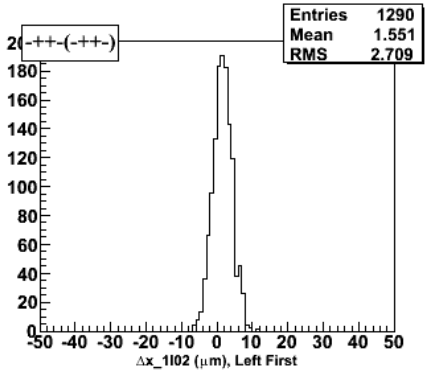


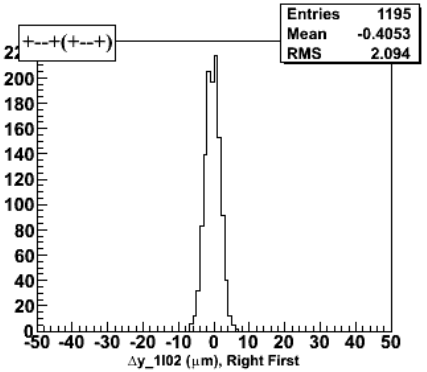
Run 382

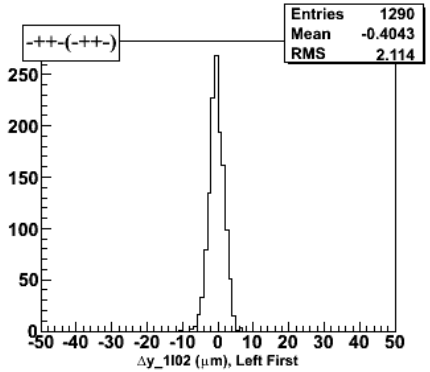


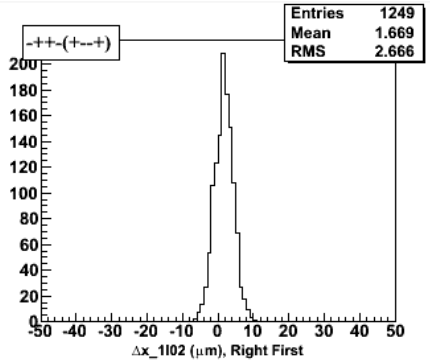
Run 382

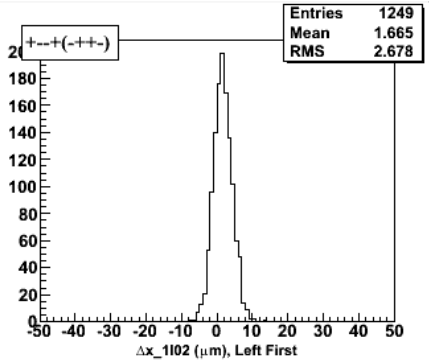


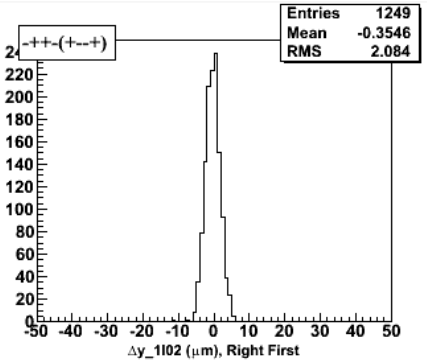


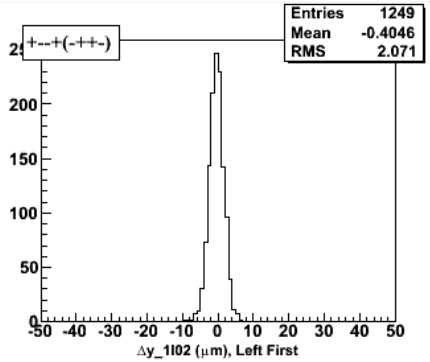


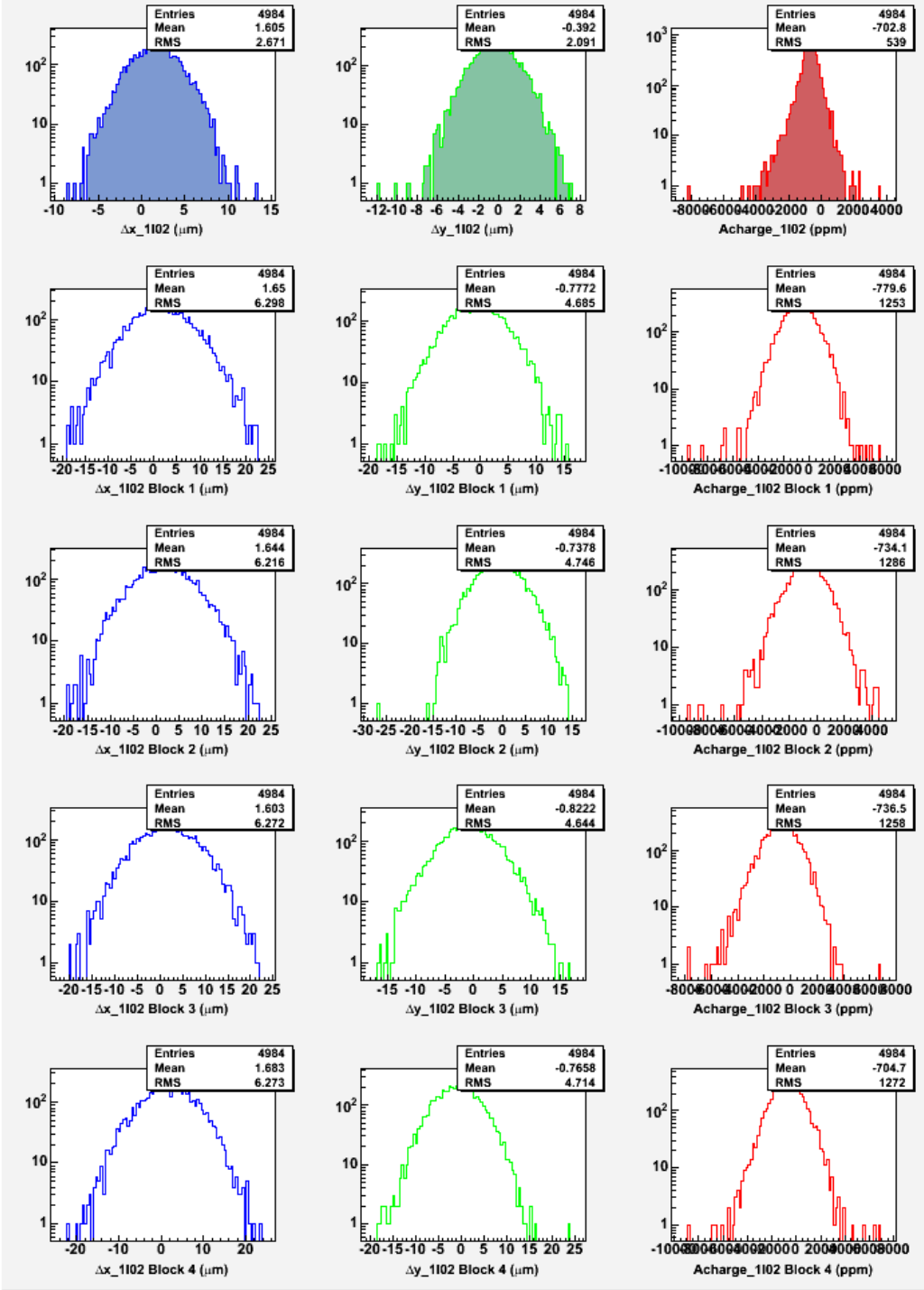


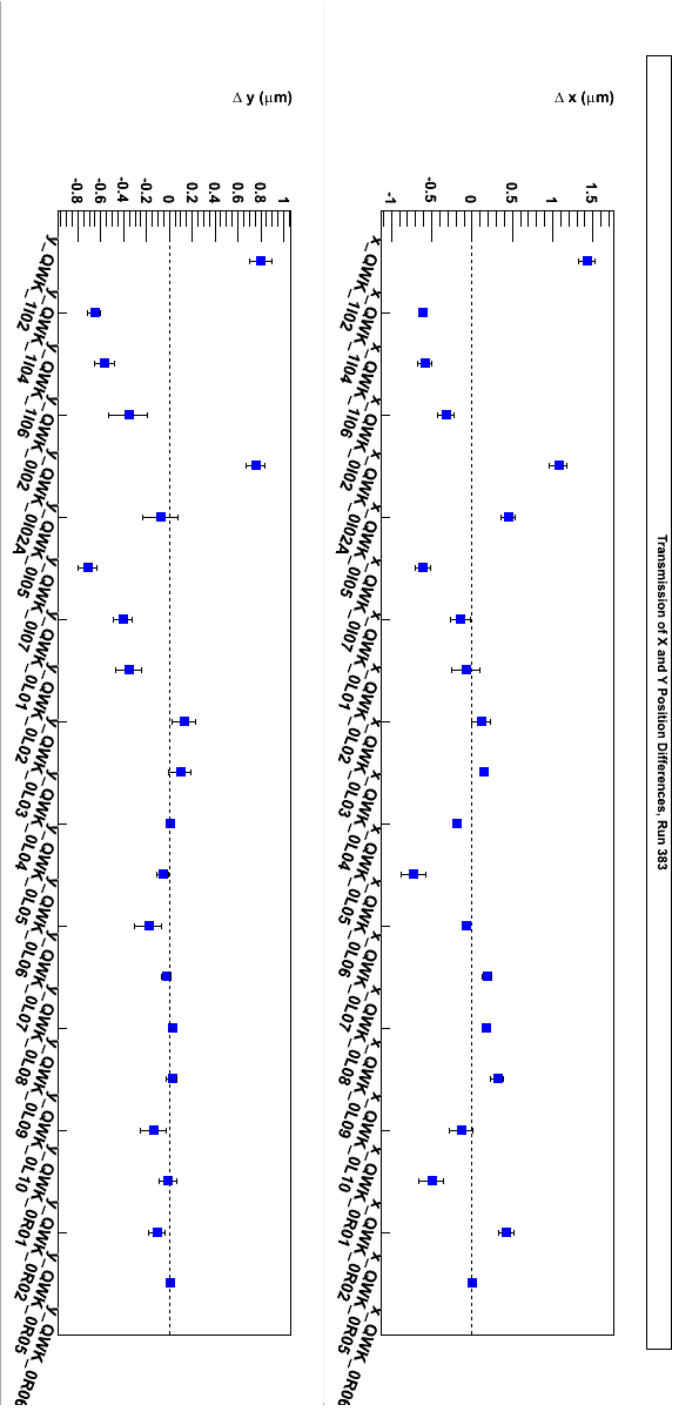


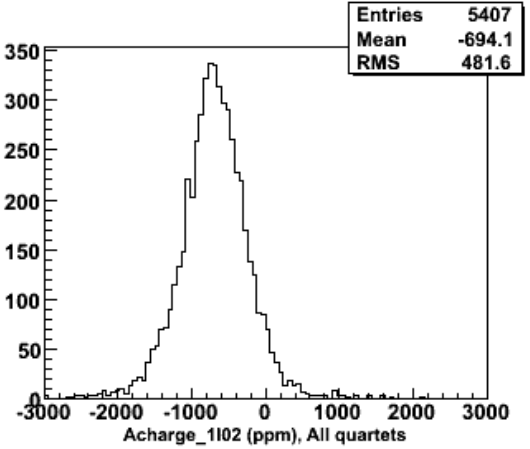






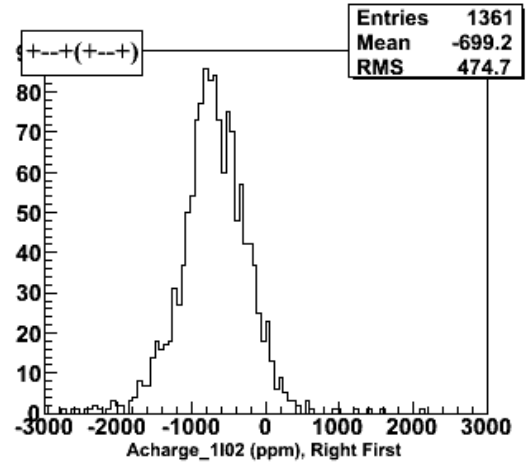

Entries 4984
Mean 1.605
RMS 2.671
Δx_1I02 (μm)
Entries 4984
Mean -0.392
RMS 2.091
Δy_1I02 (μm)
Entries 4984
Mean -702.8
RMS 539
Acharge_1I02 (ppm)
Entries 4984
Mean 1.65
RMS 6.298
Δx_1I02 Block 1 (μm)
Entries 4984
Mean -0.7772
RMS 4.685
Δy_1I02 Block 1 (μm)
Entries 4984
Mean -779.6
RMS 1253
Acharge_1I02 Block 1 (ppm)
Entries 4984
Mean 1.644
RMS 6.216
Δx_1I02 Block 2 (μm)
Entries 4984
Mean -0.7378
RMS 4.746
Δy_1I02 Block 2 (μm)
Entries 4984
Mean -734.1
RMS 1286
Acharge_1I02 Block 2 (ppm)
Entries 4984
Mean 1.603
RMS 6.272
Δx_1I02 Block 3 (μm)
Entries 4984
Mean -0.8222
RMS 4.644
Δy_1I02 Block 3 (μm)
Entries 4984
Mean -736.5
RMS 1258
Acharge_1I02 Block 3 (ppm)
Entries 4984
Mean 1.683
RMS 6.273
Δx_1I02 Block 4 (μm)
Entries 4984
Mean -0.7658
RMS 4.714
Δy_1I02 Block 4 (μm)
Entries 4984
Mean -704.7
RMS 1272
Acharge_1I02 Block 4 (ppm)

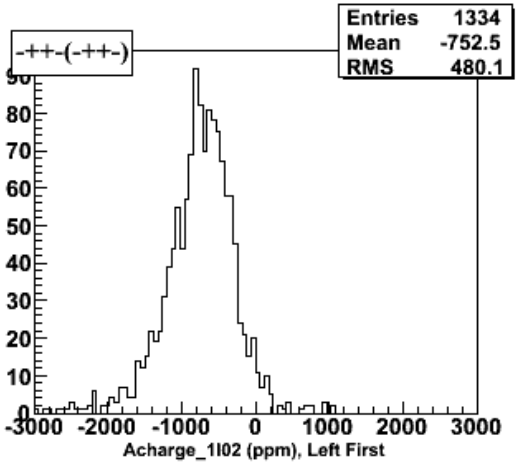


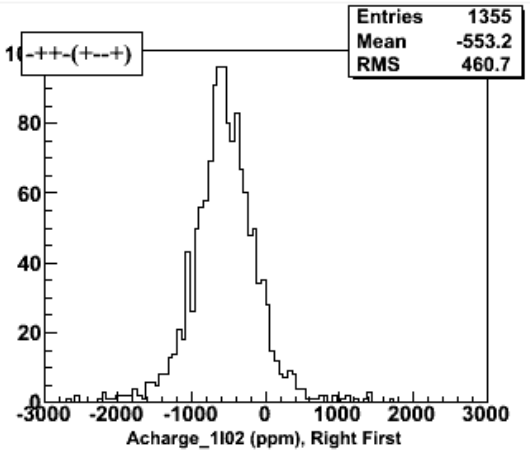


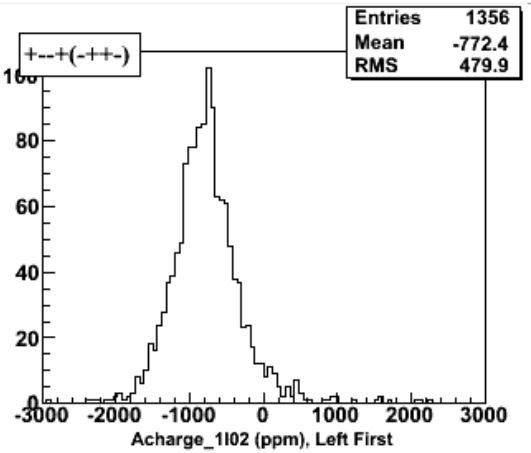
Run 383

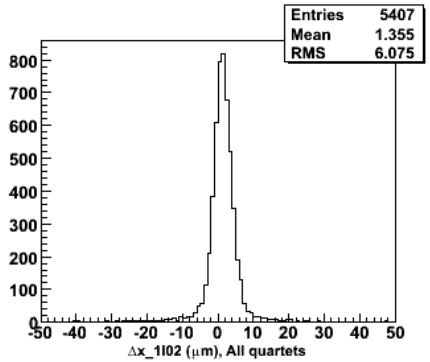
Charge Asymmetry



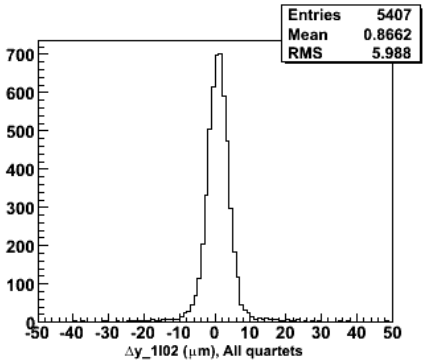




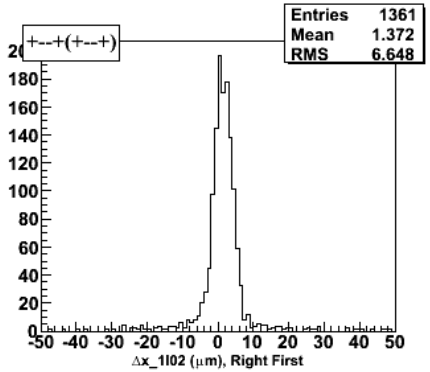


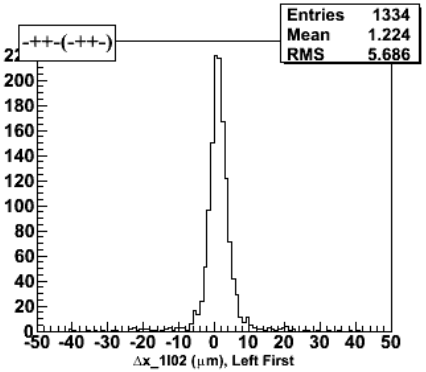


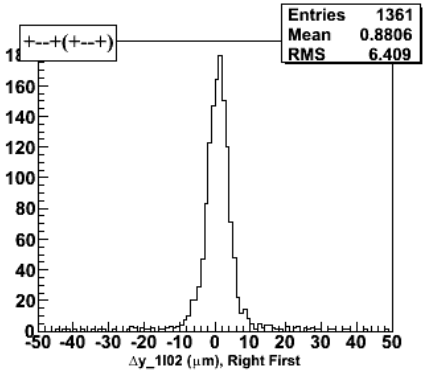
Run 383

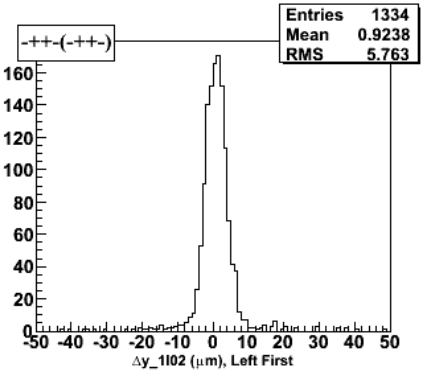


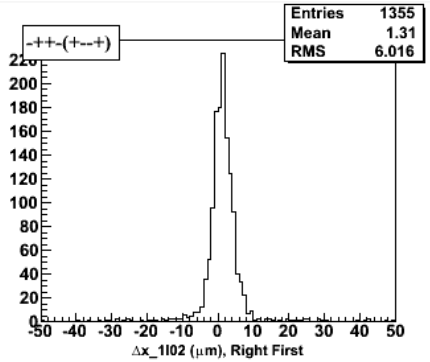
Run 383

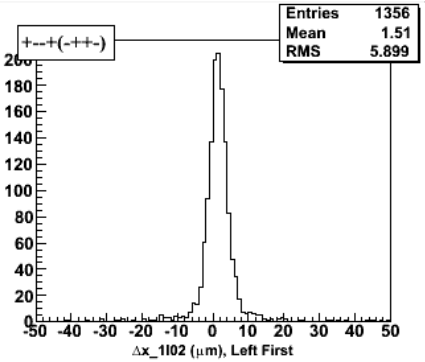


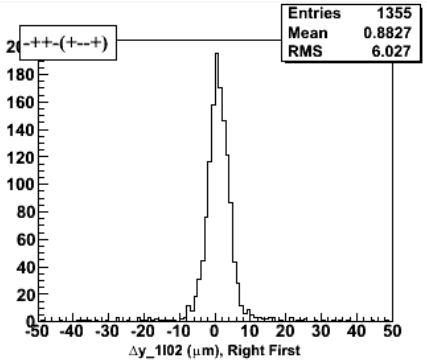


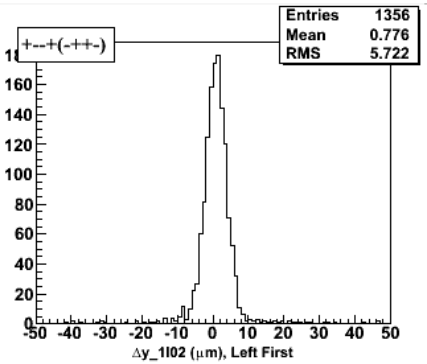


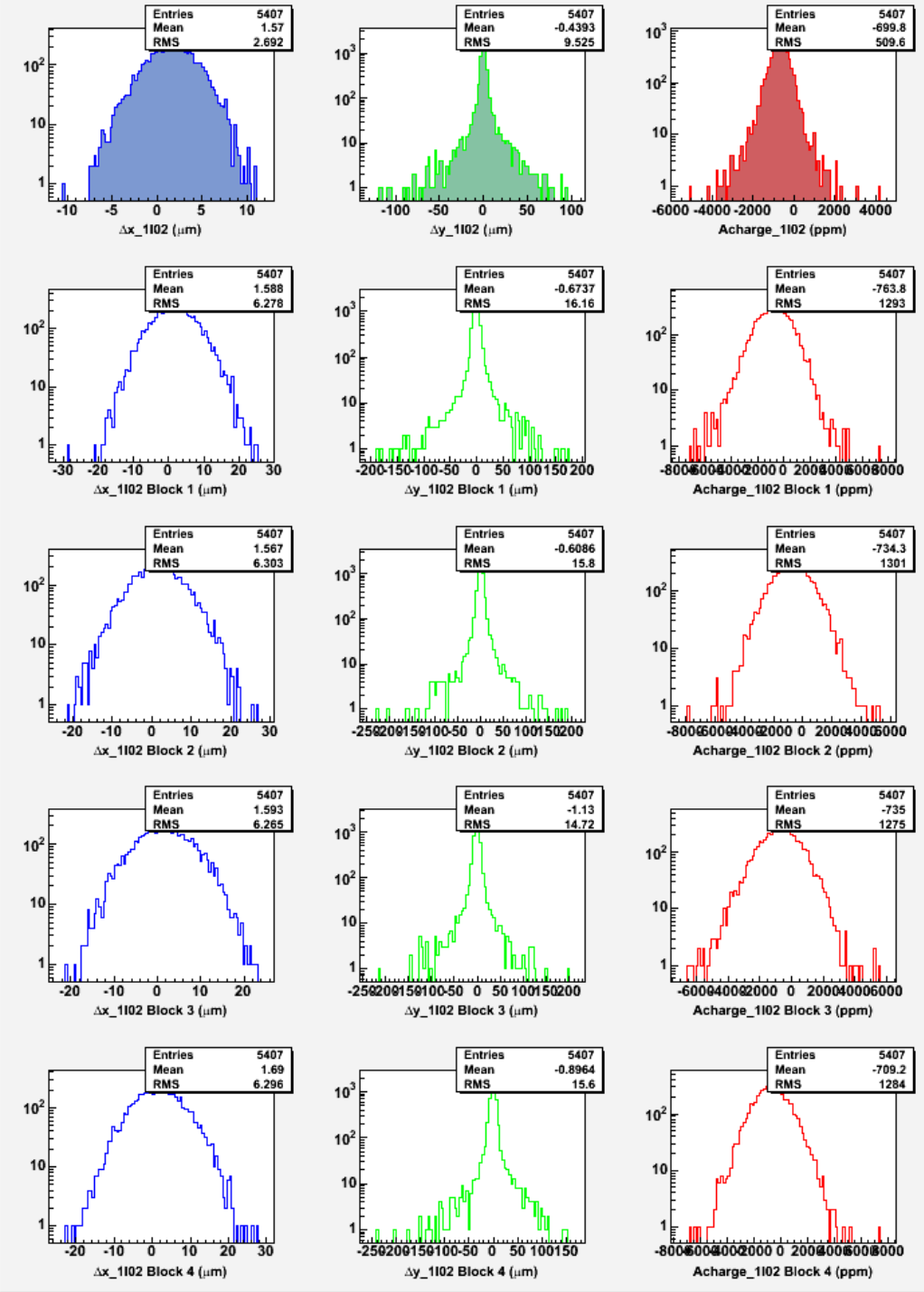


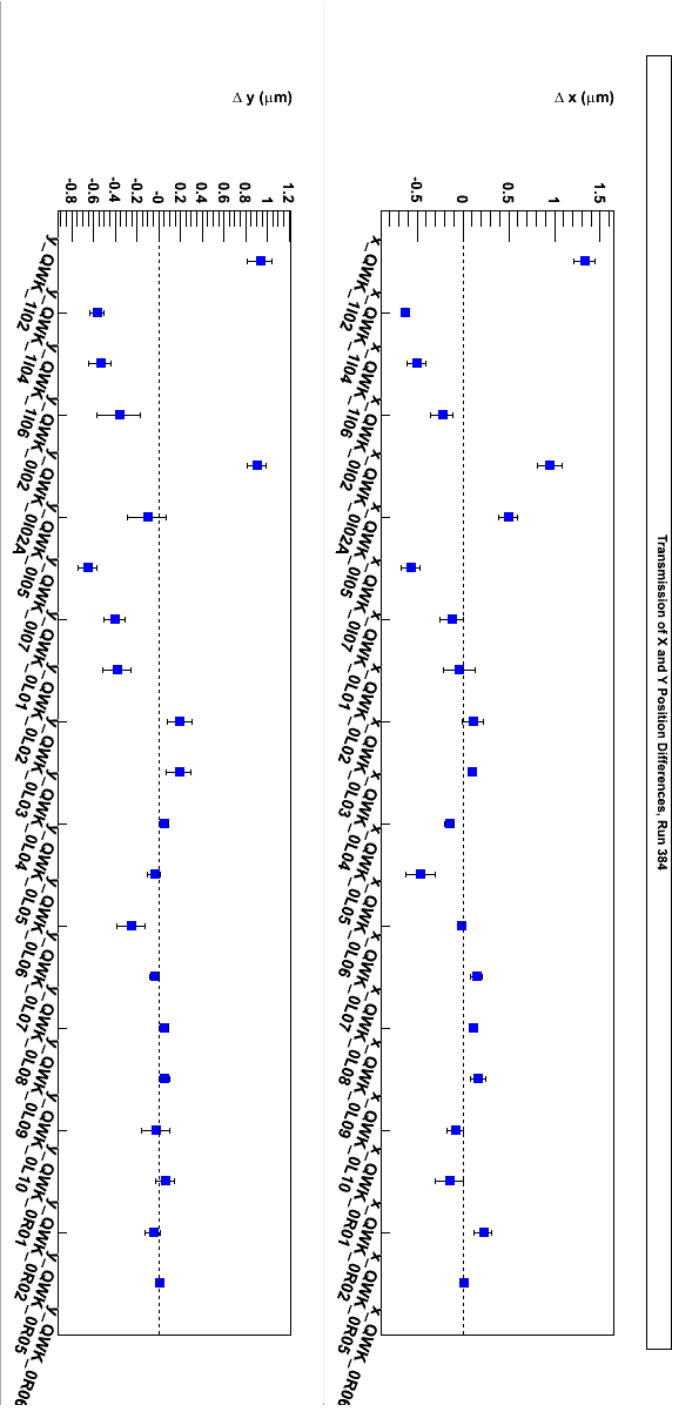


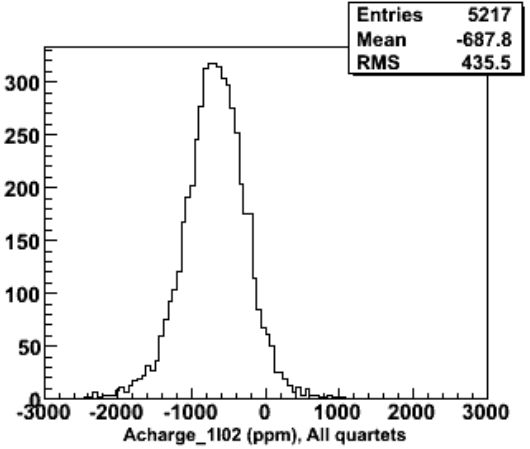






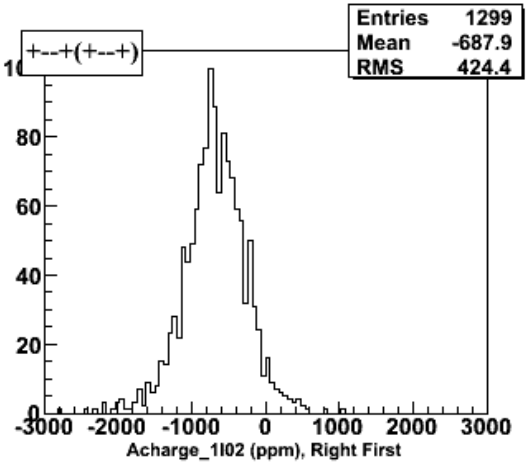

Entries 5407
Mean 1.57
RMS 2.692
Δx_1I02 (μm)
Entries 5407
Mean -0.4393
RMS 9.525
Δy_1I02 (μm)
Entries 5407
Mean -699.8
RMS 509.6
Acharge_1I02 (ppm)
Entries 5407
Mean 1.588
RMS 6.278
Δx_1I02 Block 1 (μm)
Entries 5407
Mean -0.6737
RMS 16.16
Δy_1I02 Block 1 (μm)
Entries 5407
Mean -763.8
RMS 1293
Acharge_1I02 Block 1 (ppm)
Entries 5407
Mean 1.567
RMS 6.303
Δx_1I02 Block 2 (μm)
Entries 5407
Mean -0.6086
RMS 15.8
Δy_1I02 Block 2 (μm)
Entries 5407
Mean -734.3
RMS 1301
Acharge_1I02 Block 2 (ppm)
Entries 5407
Mean 1.593
RMS 6.265
Δx_1I02 Block 3 (μm)
Entries 5407
Mean -1.13
RMS 14.72
Δy_1I02 Block 3 (μm)
Entries 5407
Mean -735
RMS 1275
Acharge_1I02 Block 3 (ppm)
Entries 5407
Mean 1.69
RMS 6.296
Δx_1I02 Block 4 (μm)
Entries 5407
Mean -0.8964
RMS 15.6
Δy_1I02 Block 4 (μm)
Entries 5407
Mean -709.2
RMS 1284
Acharge_1I02 Block 4 (ppm)

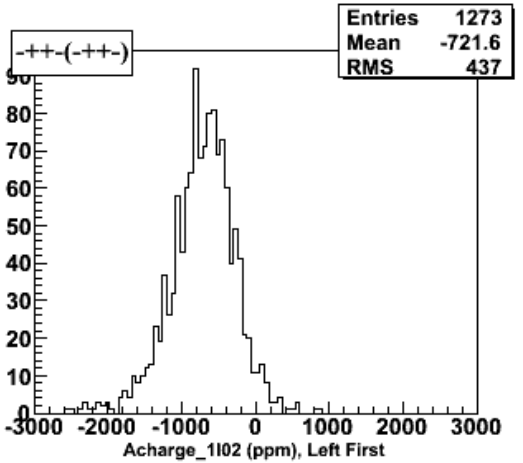


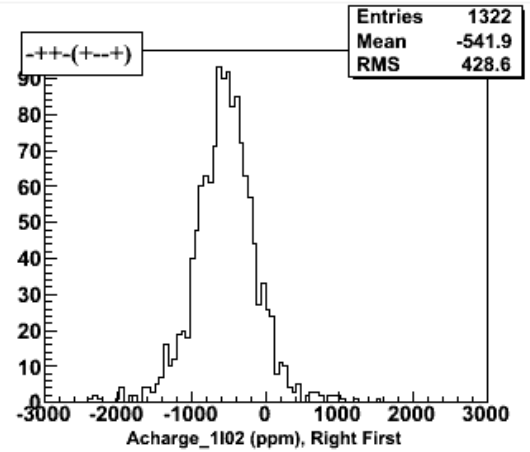


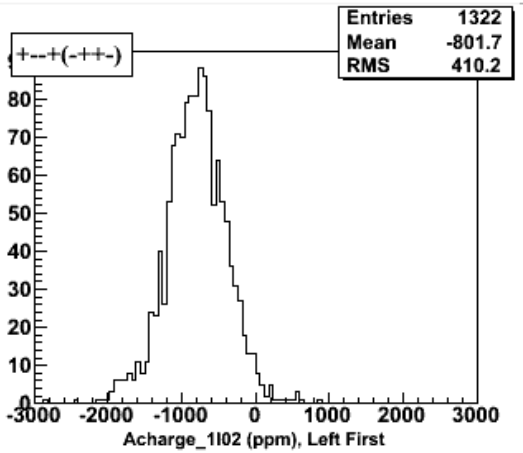
Run 384

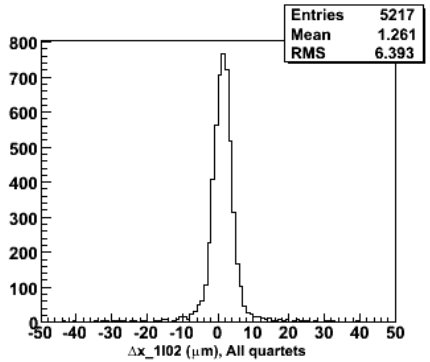
Charge Asymmetry



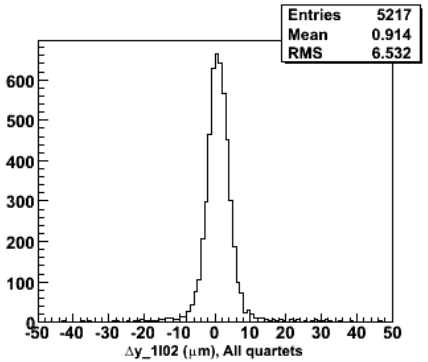




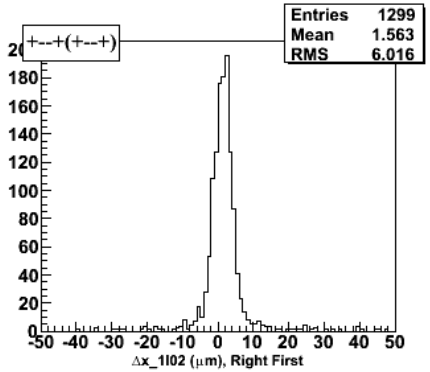


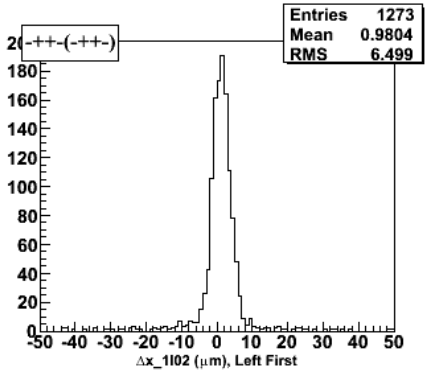


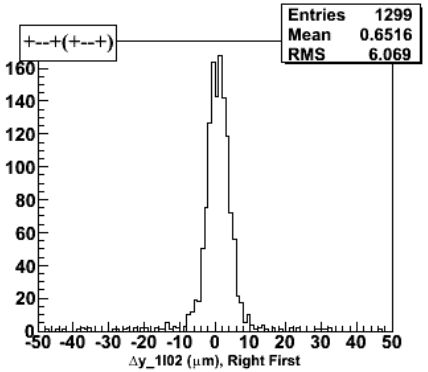
Run 384

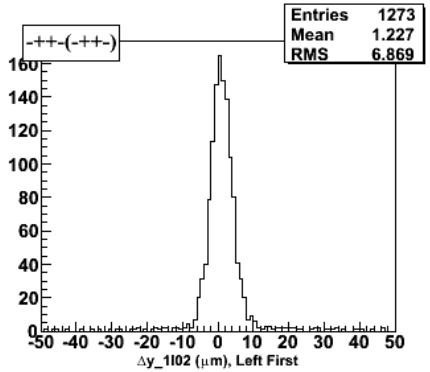


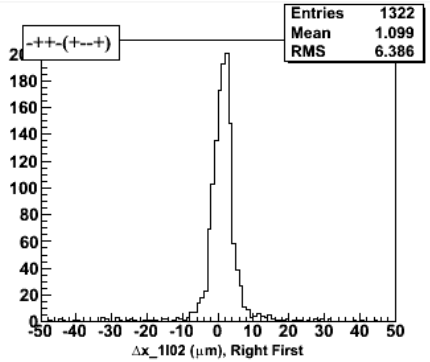
Run 384

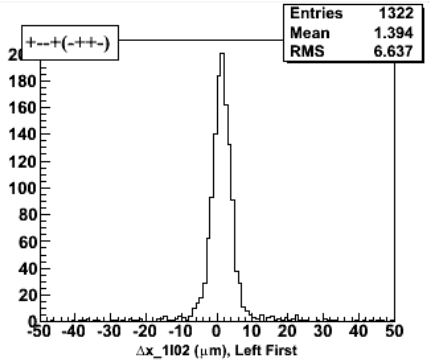


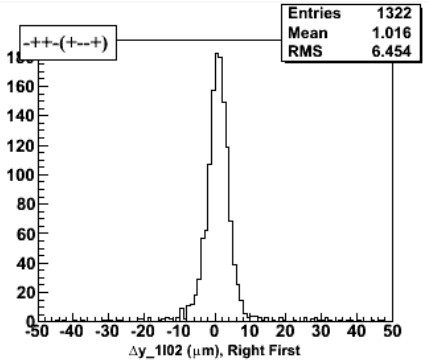


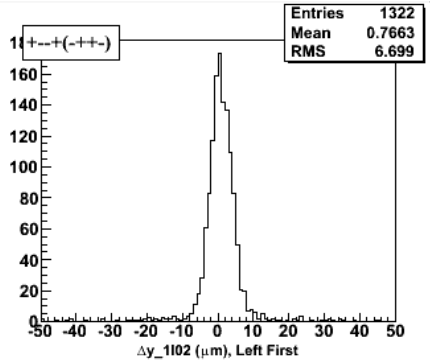


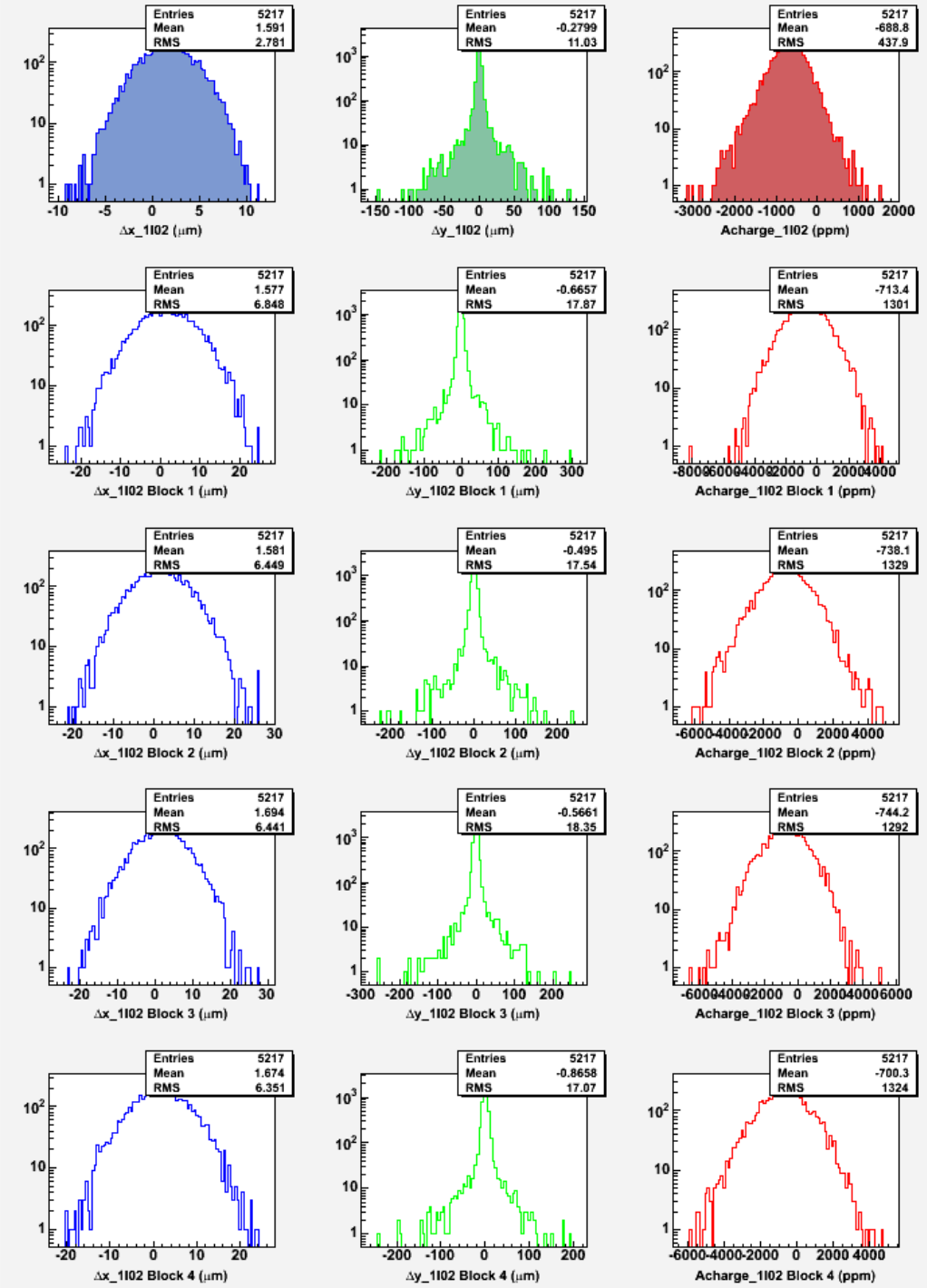


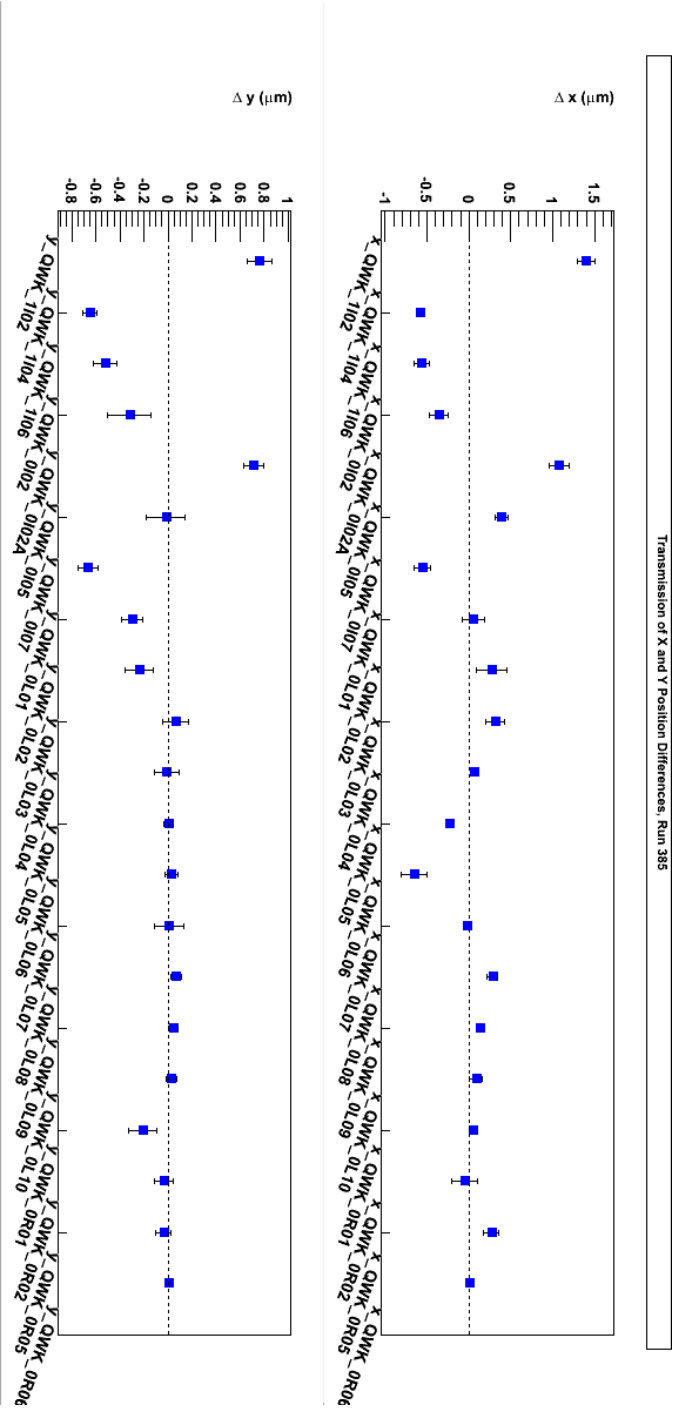


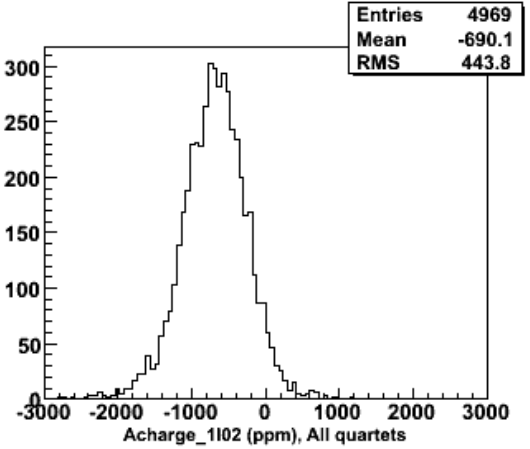






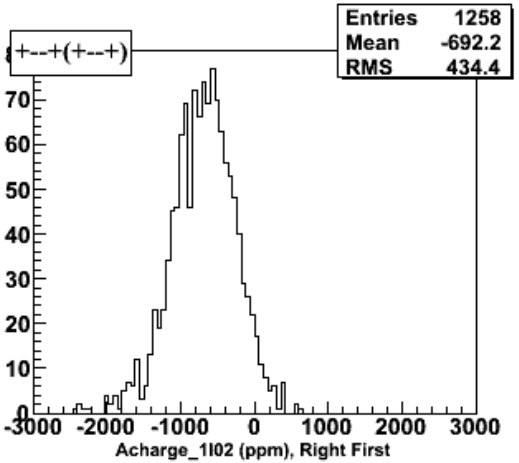

Entries 5217
Mean 1.591
RMS 2.781
Δx_1I02 (μm)
Entries 5217
Mean -0.2799
RMS 11.03
Δy_1I02 (μm)
Entries 5217
Mean -688.8
RMS 437.9
Acharge_1I02 (ppm)
Entries 5217
Mean 1.577
RMS 6.848
Δx_1I02 Block 1 (μm)
Entries 5217
Mean -0.6657
RMS 17.87
Δy_1I02 Block 1 (μm)
Entries 5217
Mean -713.4
RMS 1301
Acharge_1I02 Block 1 (ppm)
Entries 5217
Mean 1.581
RMS 6.449
Δx_1I02 Block 2 (μm)
Entries 5217
Mean -0.495
RMS 17.54
Δy_1I02 Block 2 (μm)
Entries 5217
Mean -738.1
RMS 1329
Acharge_1I02 Block 2 (ppm)
Entries 5217
Mean 1.694
RMS 6.441
Δx_1I02 Block 3 (μm)
Entries 5217
Mean -0.5661
RMS 18.35
Δy_1I02 Block 3 (μm)
Entries 5217
Mean -744.2
RMS 1292
Acharge_1I02 Block 3 (ppm)
Entries 5217
Mean 1.674
RMS 6.351
Δx_1I02 Block 4 (μm)
Entries 5217
Mean -0.8658
RMS 17.07
Δy_1I02 Block 4 (μm)
Entries 5217
Mean -700.3
RMS 1324
Acharge_1I02 Block 4 (ppm)

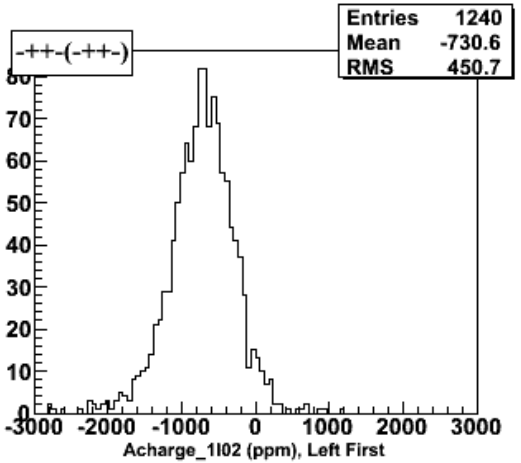


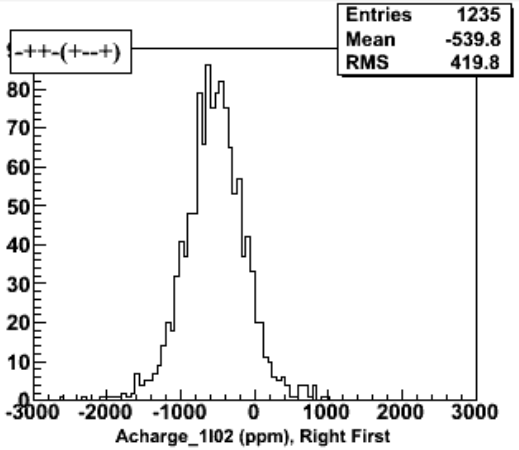


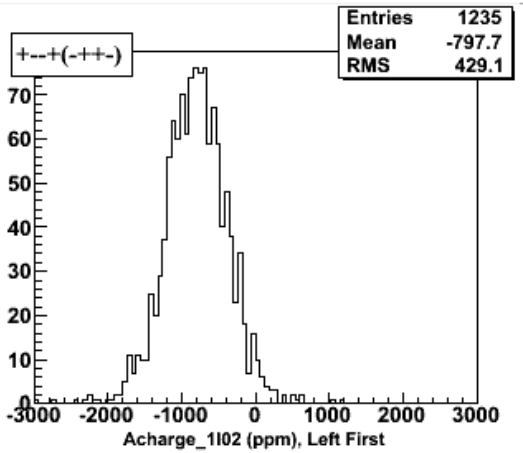
Run 385

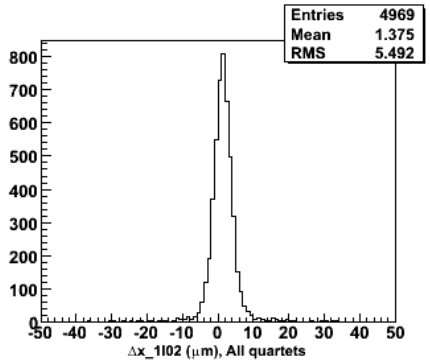
Charge Asymmetry



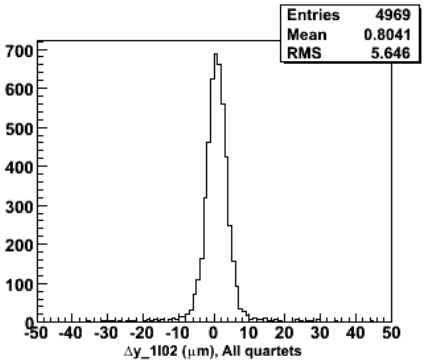




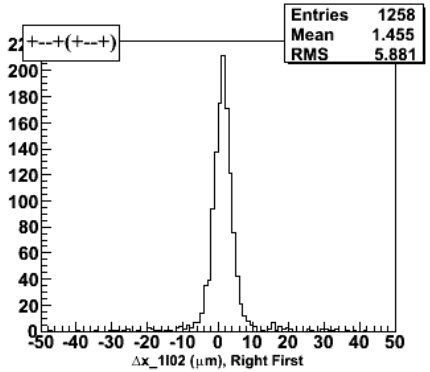


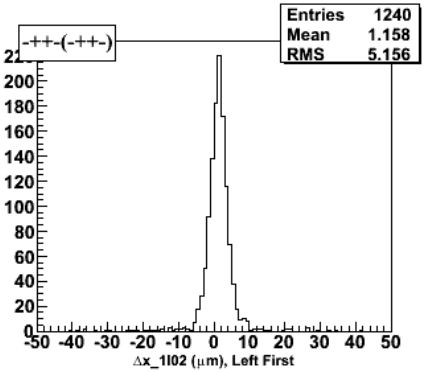


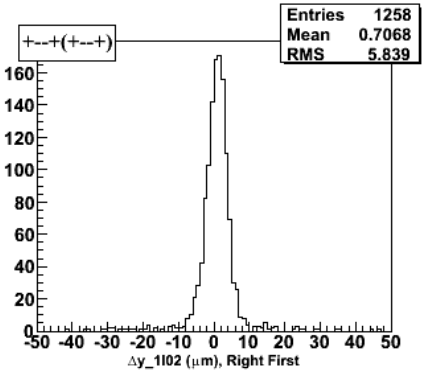
Run 385

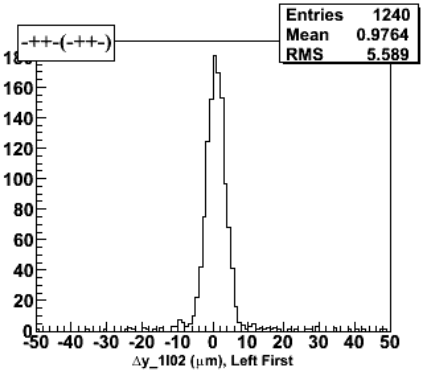


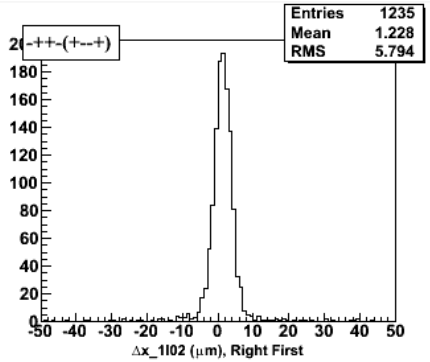
Run 385

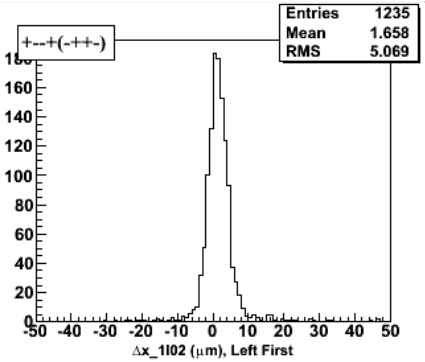


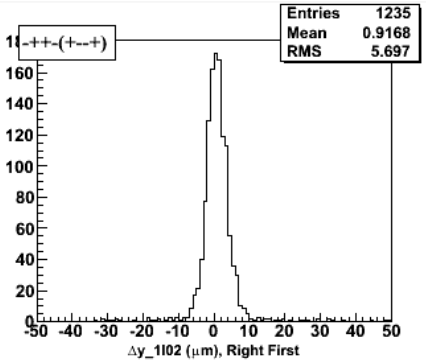


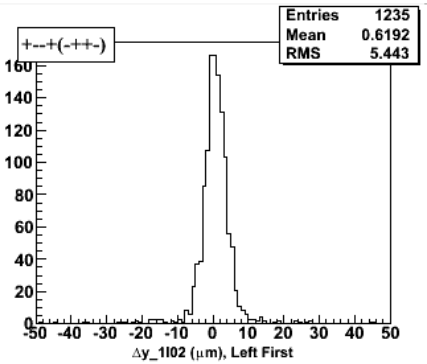


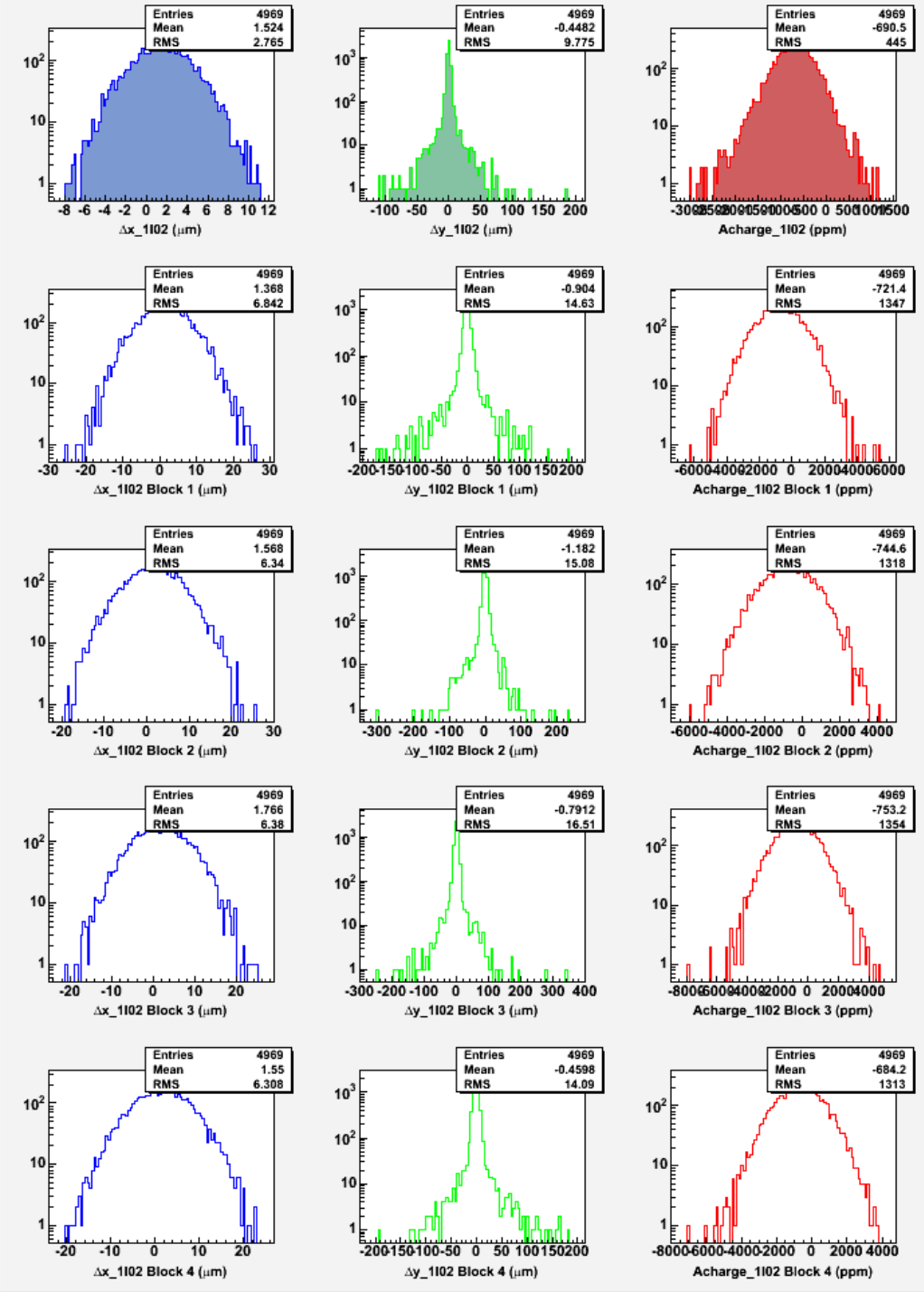








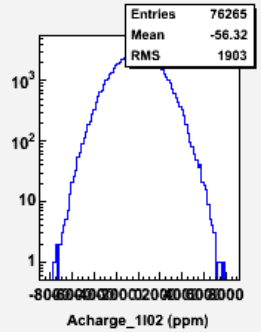


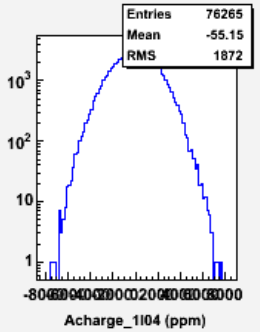

Entries 4969
Mean 1.524
RMS 2.765
Δx_1I02 (μm)
Entries 4969
Mean -0.4482
RMS 9.775
Δy_1I02 (μm)
Entries 4969
Mean -690.5
RMS 445
Acharge_1I02 (ppm)
Entries 4969
Mean 1.368
RMS 6.842
Δx_1I02 Block 1 (μm)
Entries 4969
Mean -0.904
RMS 14.63
Δy_1I02 Block 1 (μm)
Entries 4969
Mean -721.4
RMS 1347
Acharge_1I02 Block 1 (ppm)
Entries 4969
Mean 1.568
RMS 6.34
Δx_1I02 Block 2 (μm)
Entries 4969
Mean -1.182
RMS 15.08
Δy_1I02 Block 2 (μm)
Entries 4969
Mean -744.6
RMS 1318
Acharge_1I02 Block 2 (ppm)
Entries 4969
Mean 1.766
RMS 6.38
Δx_1I02 Block 3 (μm)
Entries 4969
Mean -0.7912
RMS 16.51
Δy_1I02 Block 3 (μm)
Entries 4969
Mean -753.2
RMS 1354
Acharge_1I02 Block 3 (ppm)
Entries 4969
Mean 1.55
RMS 6.308
Δx_1I02 Block 4 (μm)
Entries 4969
Mean -0.4598
RMS 14.09
Δy_1I02 Block 4 (μm)
Entries 4969
Mean -684.2
RMS 1313
Acharge_1I02 Block 4 (ppm)

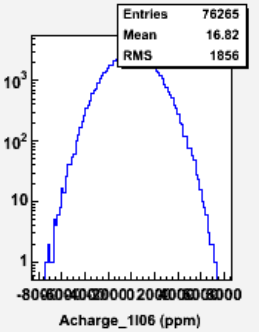
T-Settle Study (500, 200, 100, 60 µs)

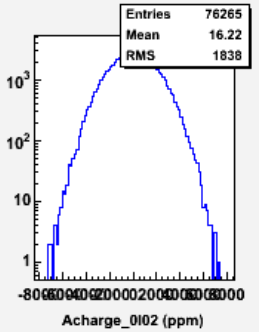
- 250 Hz

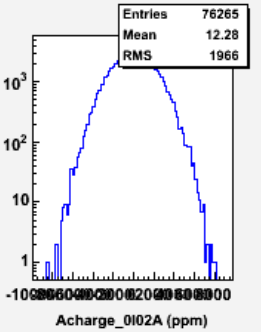
    1. Run 391: PC OFF, IHWP IN, 500 µs
    2. Run 394: IHWP OUT, 500 µs
    3. Run 392: IHWP IN, 500 µs
    4. Run 395: IHWP IN, 200 µs
    5. Run 396: IHWP IN, 100 µs
    6. Run 397: IHWP IN, 60 µs

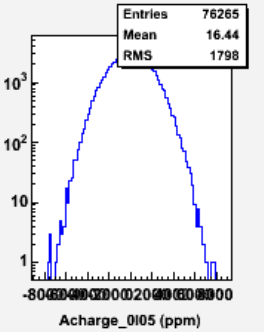

Entries 76265
Mean -56.32
RMS 1903
Acharge_1I02 (ppm)

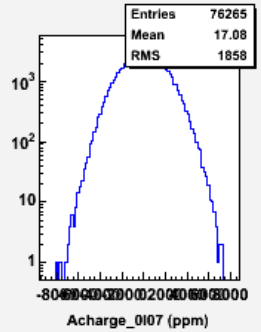

Entries 76265
Mean -55.15
RMS 1872
Acharge_1I04 (ppm)

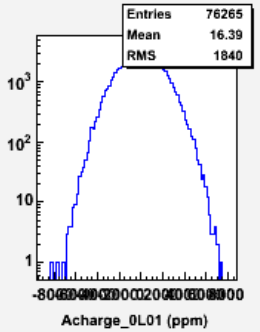

Entries 76265
Mean 16.82
RMS 1856
Acharge_1I06 (ppm)

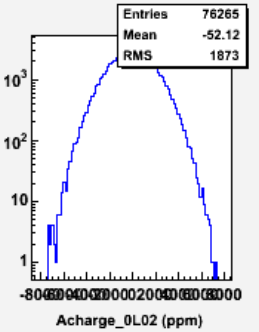

Entries 76265
Mean 16.22
RMS 1838
Acharge_0I02 (ppm)

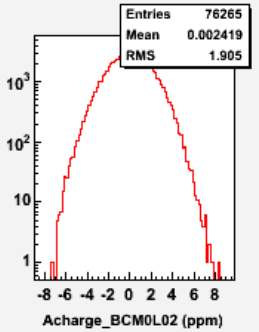

Entries 76265
Mean 12.28
RMS 1966
Acharge_0I02A (ppm)

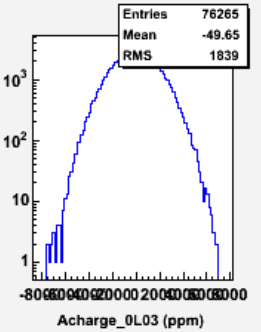

Entries 76265
Mean 16.44
RMS 1798
Acharge_0I05 (ppm)

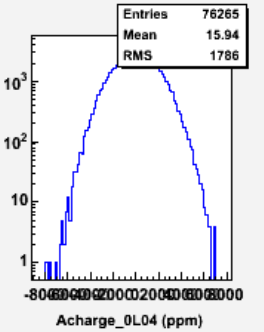

Entries 76265
Mean 17.08
RMS 1858
Acharge_0I07 (ppm)

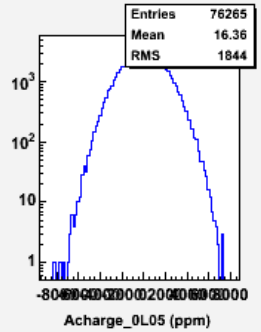

Entries 76265
Mean 16.39
RMS 1840
Acharge_0L01 (ppm)

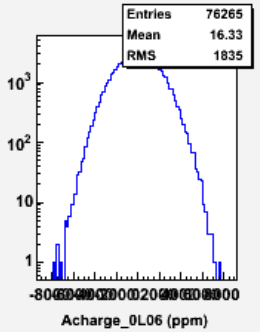

Entries 76265
Mean -52.12
RMS 1873
Acharge_0L02 (ppm)

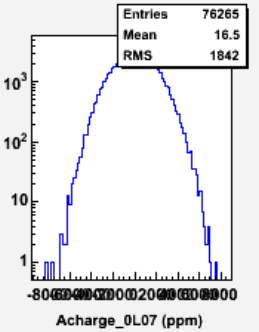

Entries 76265
Mean 0.002419
RMS 1.905
-8 -6 -4 -2 0 2 4 6 8
Acharge_BCM0L02 (ppm)

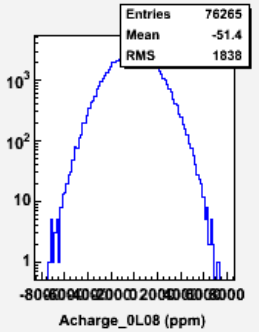

Entries 76265
Mean -49.65
RMS 1839
Acharge_0L03 (ppm)

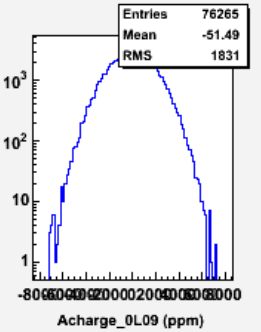

Entries 76265
Mean 15.94
RMS 1786
Acharge_0L04 (ppm)

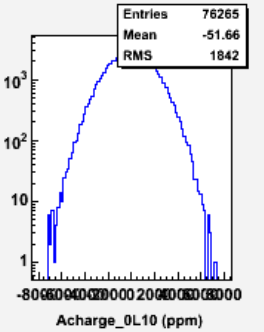

Entries 76265
Mean 16.36
RMS 1844
Acharge_0L05 (ppm)

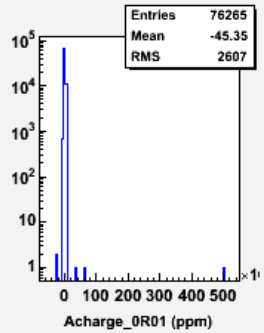

Entries 76265
Mean 16.33
RMS 1835
Acharge_0L06 (ppm)

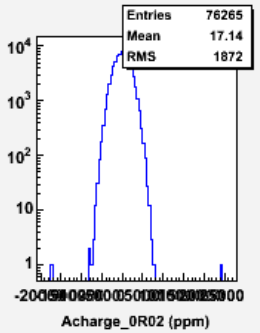

Entries 76265
Mean 16.5
RMS 1842
Acharge_0L07 (ppm)

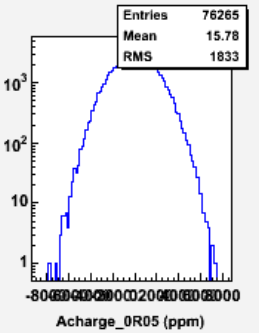

Entries 76265
Mean -51.4
RMS 1838
Acharge_0L08 (ppm)

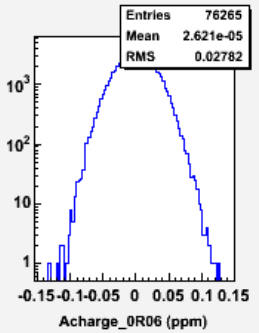

Entries 76265
Mean -51.49
RMS 1831
Acharge_0L09 (ppm)

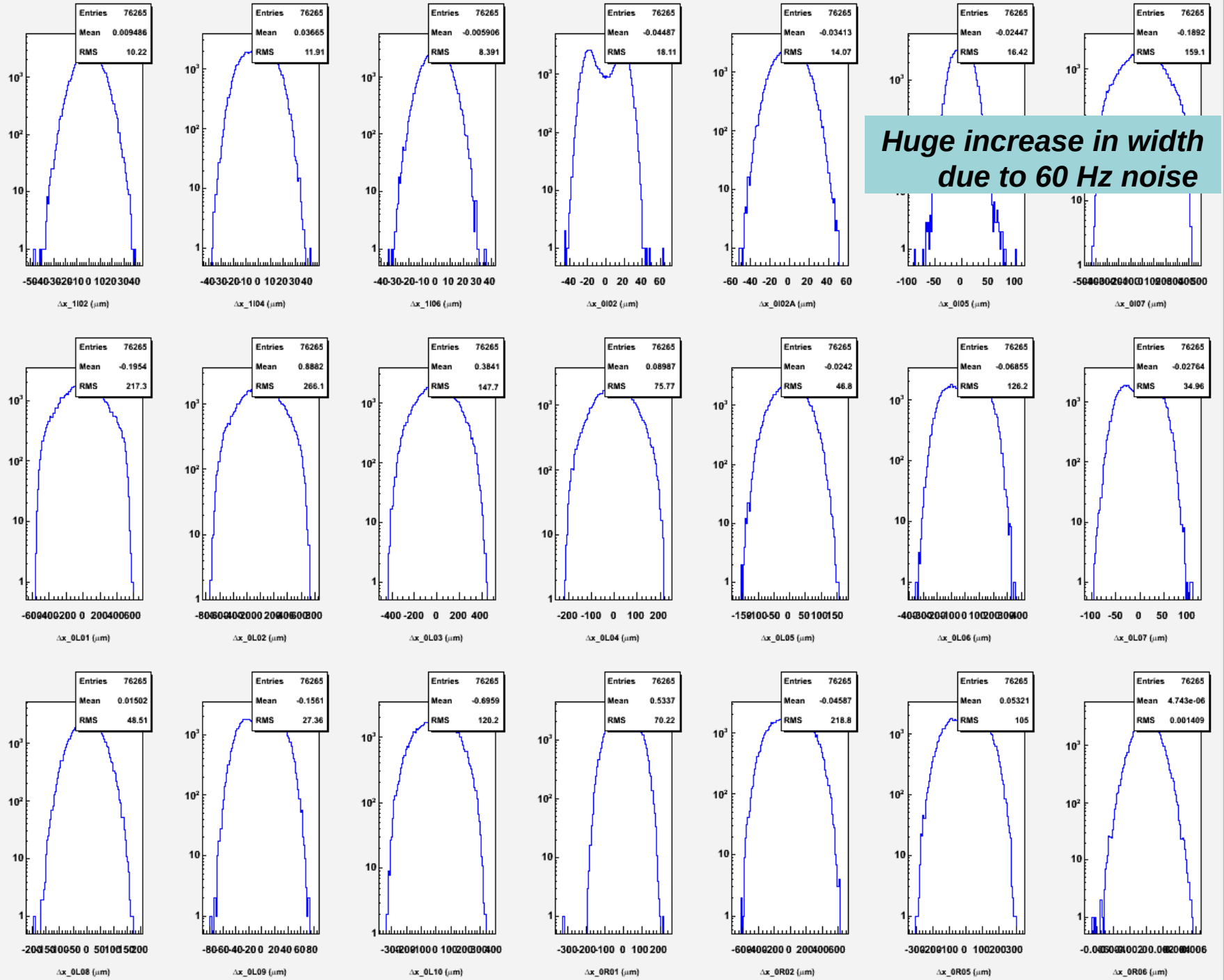

Entries 76265
Mean -51.66
RMS 1842
Acharge_0L10 (ppm)

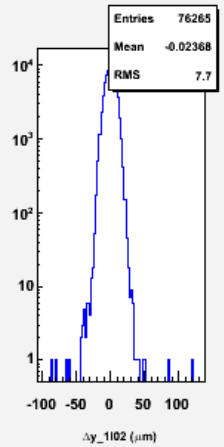

Entries 76265
Mean -45.35
RMS 2607
0 100 200 300 400 500
Acharge_0R01 (ppm)

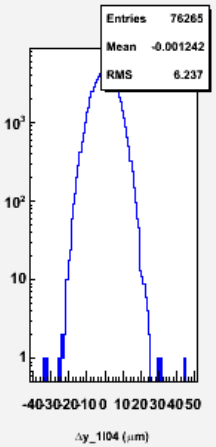

Entries 76265
Mean 17.14
RMS 1872
Acharge_0R02 (ppm)

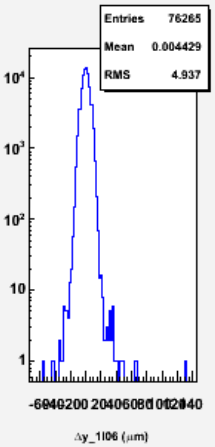

Entries 76265
Mean 15.78
RMS 1833
Acharge_0R05 (ppm)

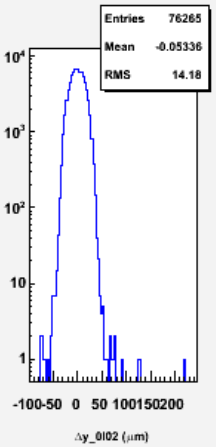

Entries 76265
Mean 2.621e-05
RMS 0.02782
-0.15 -0.1 -0.05 0 0.05 0.1 0.15
Acharge_0R06 (ppm)

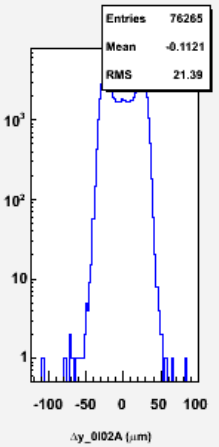

Entries 76265
Mean 0.009486
RMS 10.22
Δx_1I02 (μm)
Entries 76265
Mean 0.03665
RMS 11.91
Δx_1I04 (μm)
Entries 76265
Mean -0.005906
RMS 8.391
Δx_1I06 (μm)
Entries 76265
Mean -0.04487
RMS 18.11
Δx_0I02 (μm)
Entries 76265
Mean -0.03413
RMS 14.07
Δx_0I02A (μm)
Entries 76265
Mean -0.02447
RMS 16.42
Δx_0I05 (μm)
Entries 76265
Mean -0.1892
RMS 159.1
Δx_0I07 (μm)
Huge increase in width due to 60 Hz noise
Entries 76265
Mean -0.1954
RMS 217.3
Δx_0L01 (μm)
Entries 76265
Mean 0.8882
RMS 266.1
Δx_0L02 (μm)
Entries 76265
Mean 0.3841
RMS 147.7
Δx_0L03 (μm)
Entries 76265
Mean 0.08987
RMS 75.77
Δx_0L04 (μm)
Entries 76265
Mean -0.0242
RMS 46.8
Δx_0L05 (μm)
Entries 76265
Mean -0.06855
RMS 126.2
Δx_0L06 (μm)
Entries 76265
Mean -0.02764
RMS 34.96
Δx_0L07 (μm)
Entries 76265
Mean 0.01502
RMS 48.51
Δx_0L08 (μm)
Entries 76265
Mean -0.1561
RMS 27.36
Δx_0L09 (μm)
Entries 76265
Mean -0.6959
RMS 120.2
Δx_0L10 (μm)
Entries 76265
Mean 0.5337
RMS 70.22
Δx_0R01 (μm)
Entries 76265
Mean -0.04587
RMS 218.8
Δx_0R02 (μm)
Entries 76265
Mean 0.05321
RMS 105
Δx_0R05 (μm)
Entries 76265
Mean 4.743e-06
RMS 0.001409
Δx_0R06 (μm)

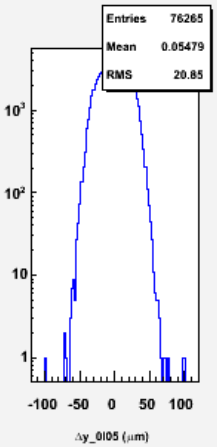

Entries 76265
Mean -0.02368
RMS 7.7
Δy_1I02 (μm)

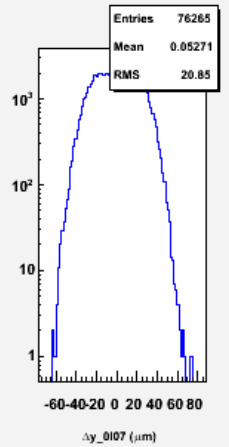

Entries 76265
Mean -0.001242
RMS 6.237
Δy_1I04 (μm)

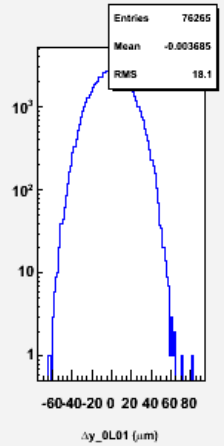

Entries 76265
Mean 0.004429
RMS 4.937
Δy_1I06 (μm)

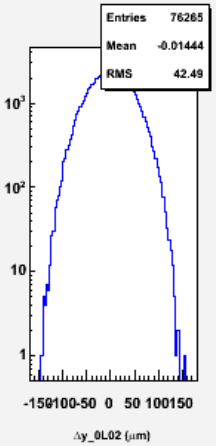

Entries 76265
Mean -0.05336
RMS 14.18
Δy_0I02 (μm)

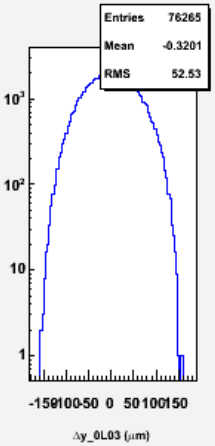

Entries 76265
Mean -0.1121
RMS 21.39
Δy_0I02A (μm)

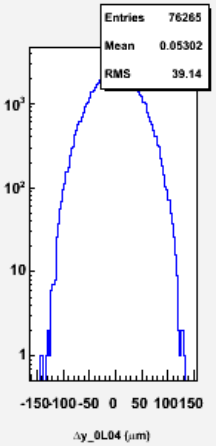

Entries 76265
Mean 0.05479
RMS 20.85
Δy_0I05 (μm)

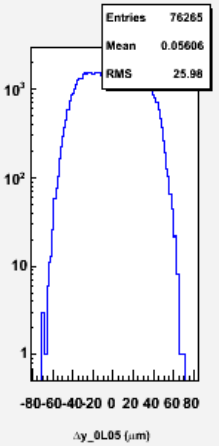

Entries 76265
Mean 0.05271
RMS 20.85
Δy_0I07 (μm)

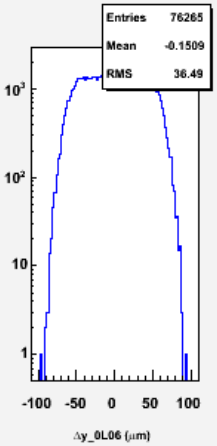

Entries 76265
Mean -0.003685
RMS 18.1
Δy_0L01 (μm)

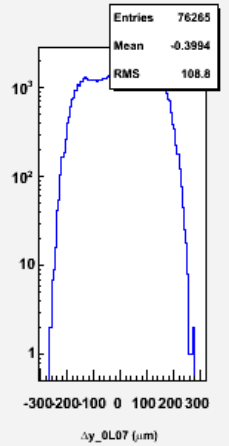

Entries 76265
Mean -0.01444
RMS 42.49
Δy_0L02 (μm)

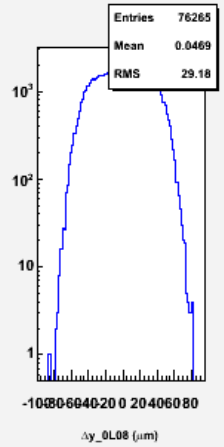

Entries 76265
Mean -0.3201
RMS 52.53
Δy_0L03 (μm)

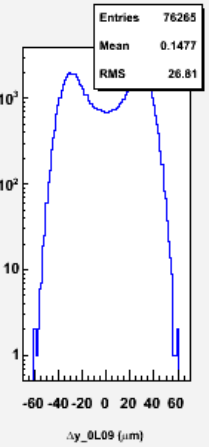

Entries 76265
Mean 0.05302
RMS 39.14
Δy_0L04 (μm)

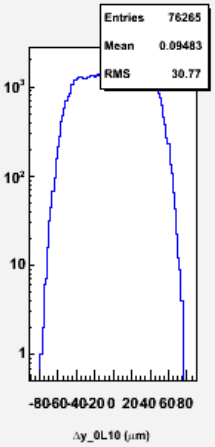

Entries 76265
Mean 0.05606
RMS 25.98
Δy_0L05 (μm)

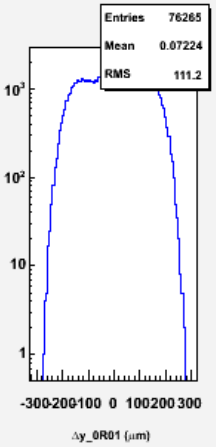

Entries 76265
Mean -0.1509
RMS 36.49
Δy_0L06 (μm)

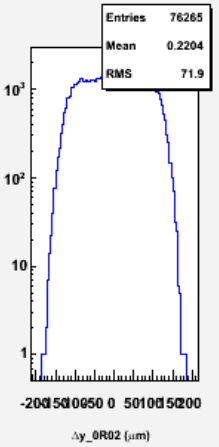

Entries 76265
Mean -0.3994
RMS 108.8
Δy_0L07 (μm)

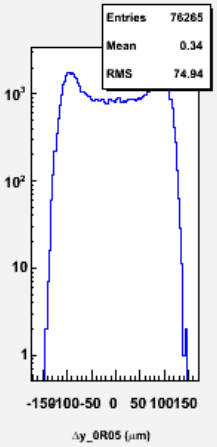

Entries 76265
Mean 0.0469
RMS 29.18
Δy_0L08 (μm)

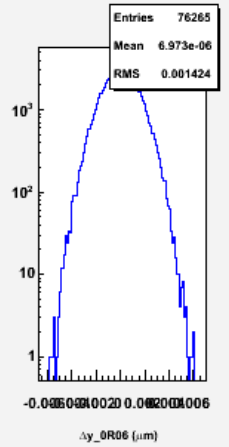

Entries 76265
Mean 0.1477
RMS 26.81
Δy_0L09 (μm)

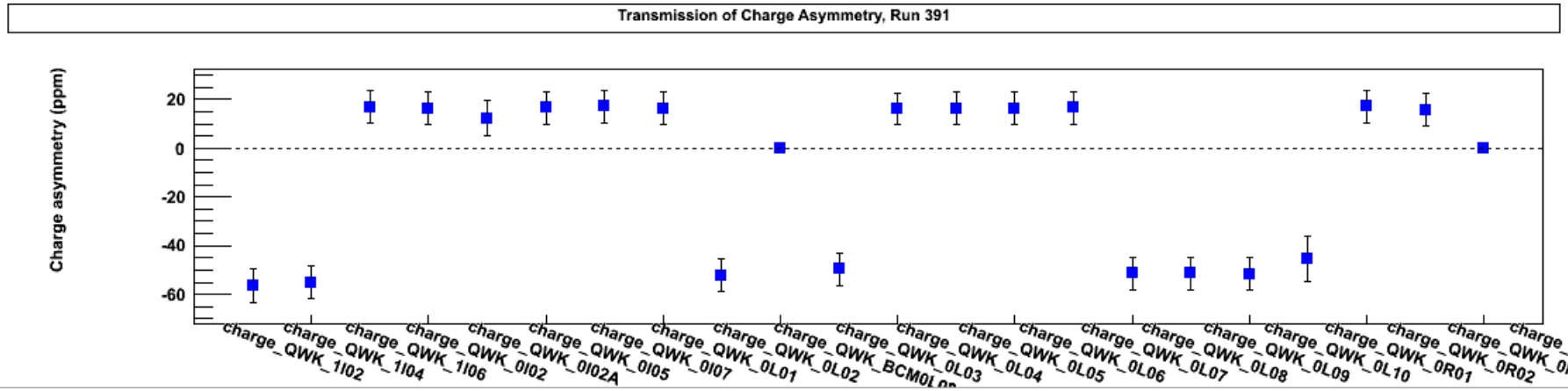

Entries 76265
Mean 0.09483
RMS 30.77
Δy_0L10 (μm)

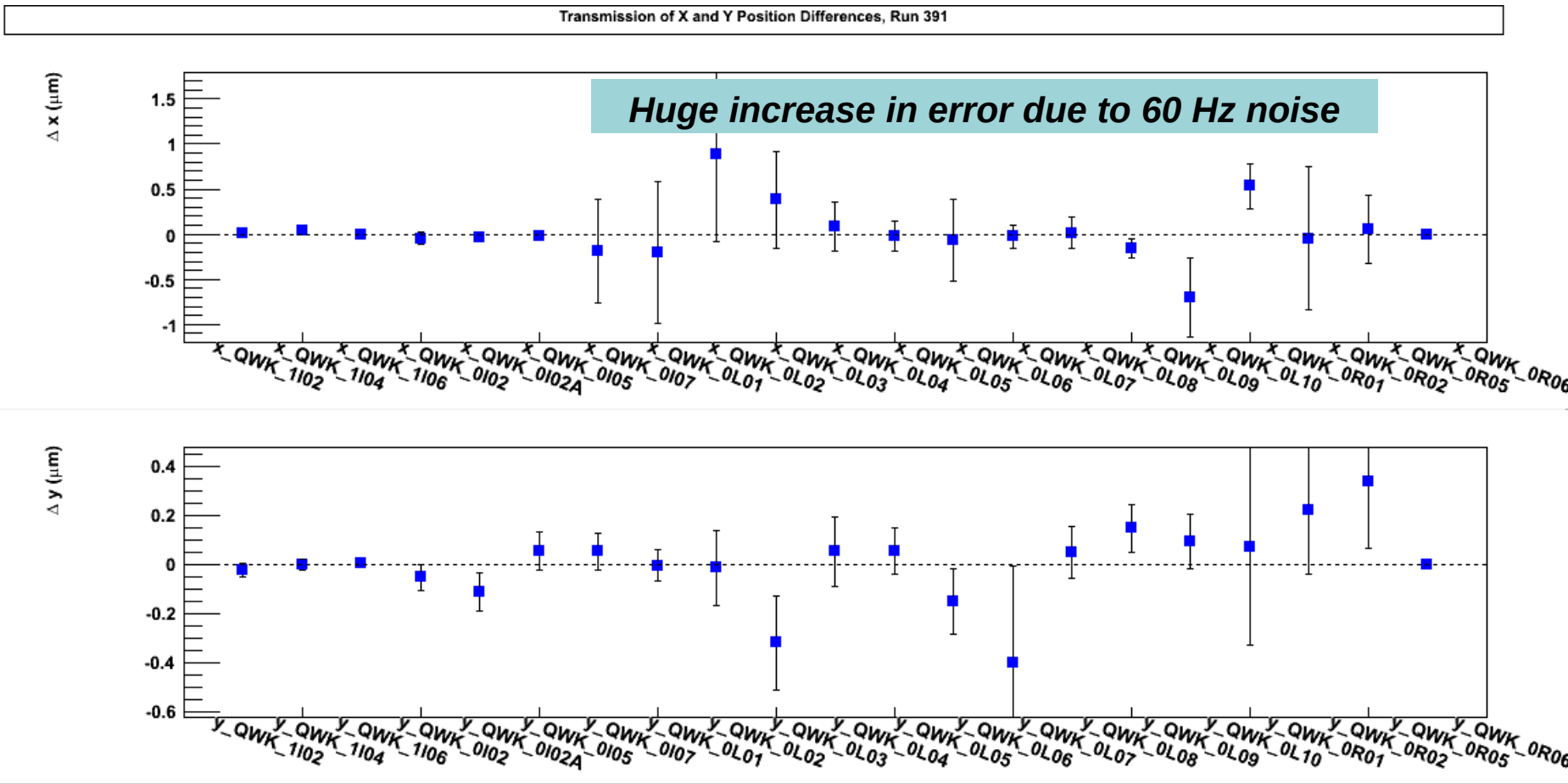

Entries 76265
Mean 0.07224
RMS 111.2
Δy_0R01 (μm)

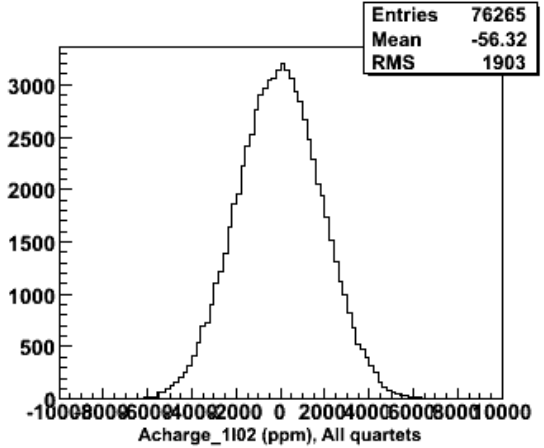

Entries 76265
Mean 0.2204
RMS 71.9
Δy_0R02 (μm)


Entries 76265
Mean 0.34
RMS 74.94
Δy_0R05 (μm)


Entries 76265
Mean 6.973e-06
RMS 0.001424
Δy_0R06 (μm)

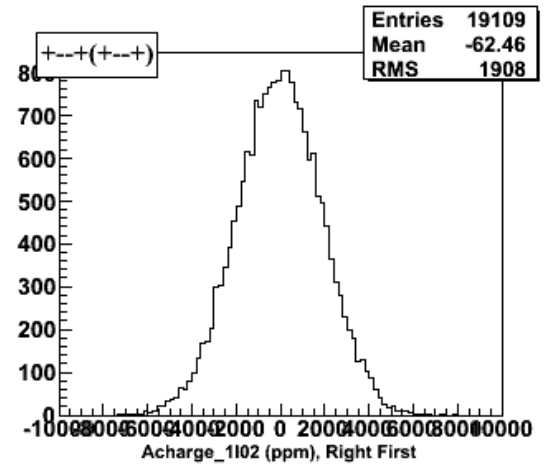

Transmission of Charge Asymmetry, Run 391
Charge asymmetry (ppm)
20
0
-20
-40
-60
charge_QWK_1I02
charge_QWK_1I04
charge_QWK_1I06
charge_QWK_0I02
charge_QWK_0I02A
charge_QWK_0I05
charge_QWK_0I07
charge_QWK_0L01
charge_QWK_0L02
charge_QWK_BCM0L02
charge_QWK_0L03
charge_QWK_0L04
charge_QWK_0L05
charge_QWK_0L06
charge_QWK_0L07
charge_QWK_0L08
charge_QWK_0L09
charge_QWK_0L10
charge_QWK_0R01
charge_QWK_0R02
charge_QWK_0R05

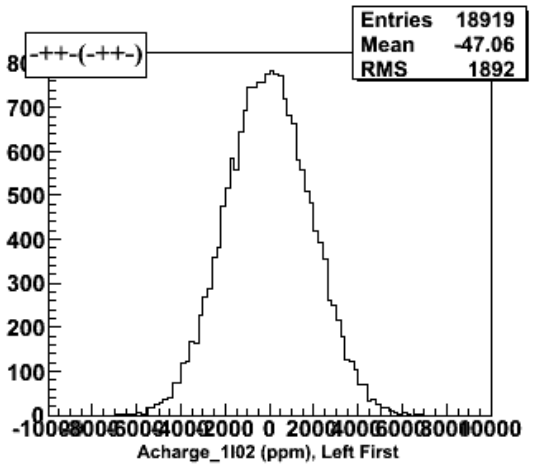

Transmission of X and Y Position Differences, Run 391
Δ x (μm)
1.5
1
0.5
0
-0.5
-1
Huge increase in error due to 60 Hz noise
x_QWK_1I02
x_QWK_1I04
x_QWK_1I06
x_QWK_0I02
x_QWK_0I02A
x_QWK_0I05
x_QWK_0I07
x_QWK_0L01
x_QWK_0L02
x_QWK_0L03
x_QWK_0L04
x_QWK_0L05
x_QWK_0L06
x_QWK_0L07
x_QWK_0L08
x_QWK_0L09
x_QWK_0L10
x_QWK_0R01
x_QWK_0R02
x_QWK_0R05
Δ y (μm)
0.4
0.2
0
-0.2
-0.4
-0.6
y_QWK_1I02
y_QWK_1I04
y_QWK_1I06
y_QWK_0I02
y_QWK_0I02A
y_QWK_0I05
y_QWK_0I07
y_QWK_0L01
y_QWK_0L02
y_QWK_0L03
y_QWK_0L04
y_QWK_0L05
y_QWK_0L06
y_QWK_0L07
y_QWK_0L08
y_QWK_0L09
y_QWK_0L10
y_QWK_0R01
y_QWK_0R02
y_QWK_0R05

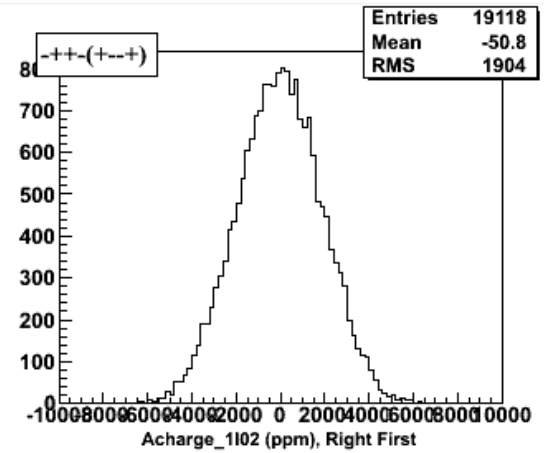


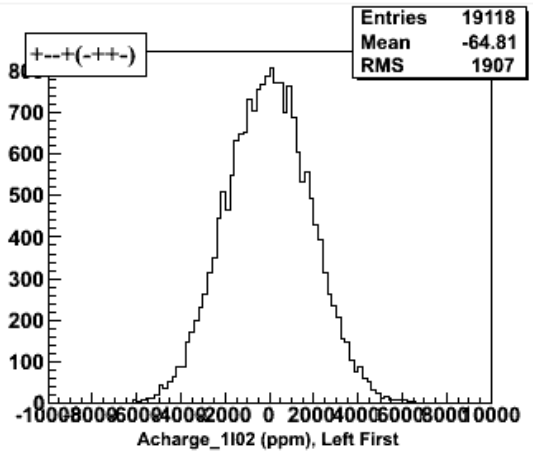
Run 391

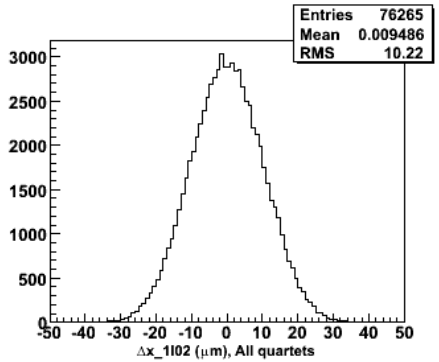
Charge Asymmetry



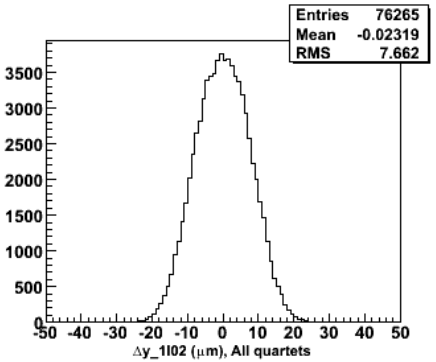




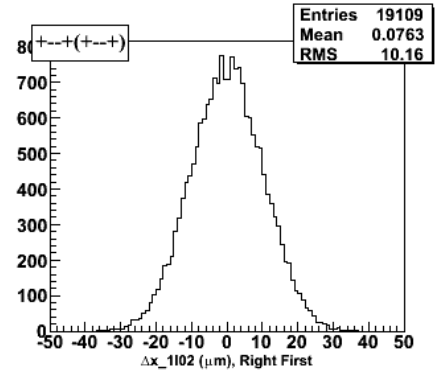


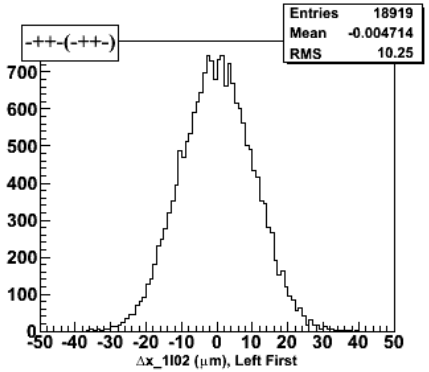


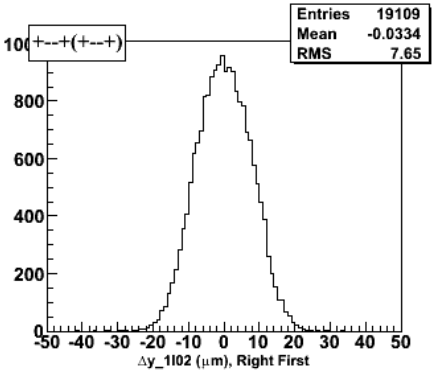
Run 391

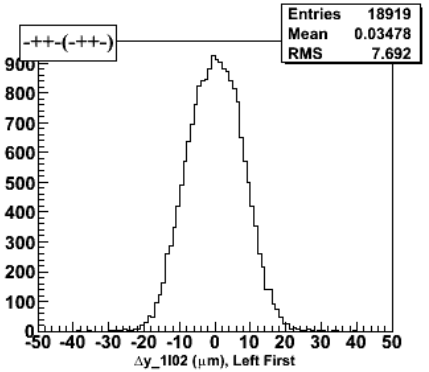


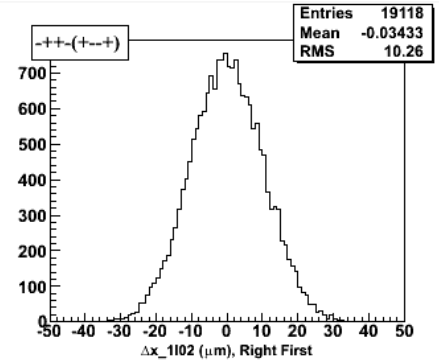
Run 391

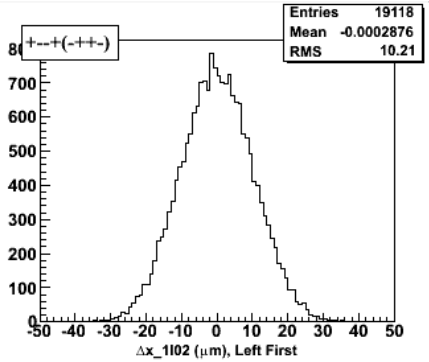


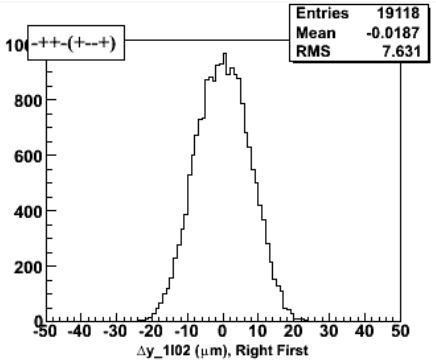


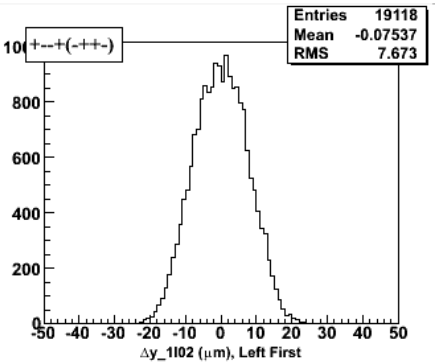


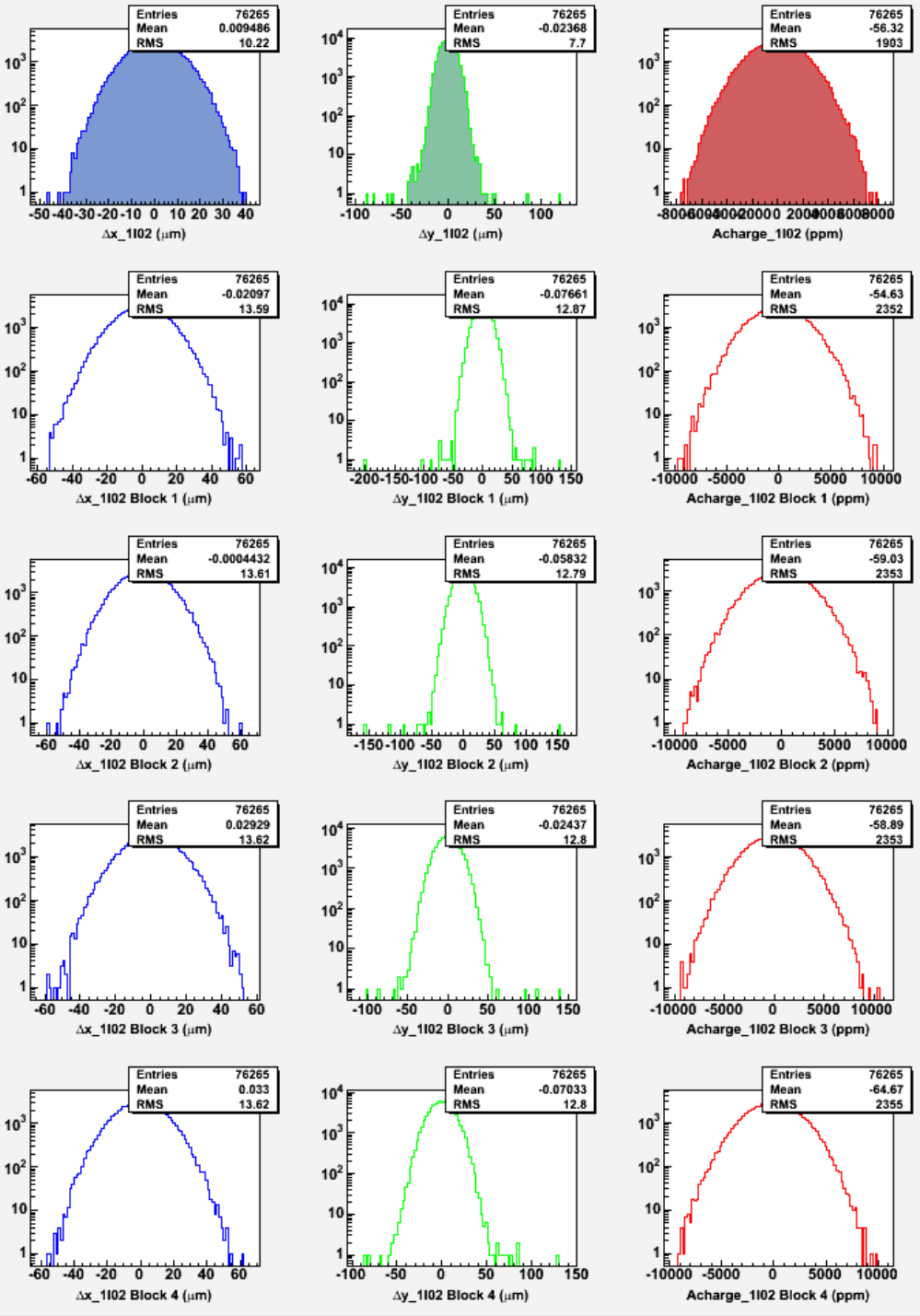


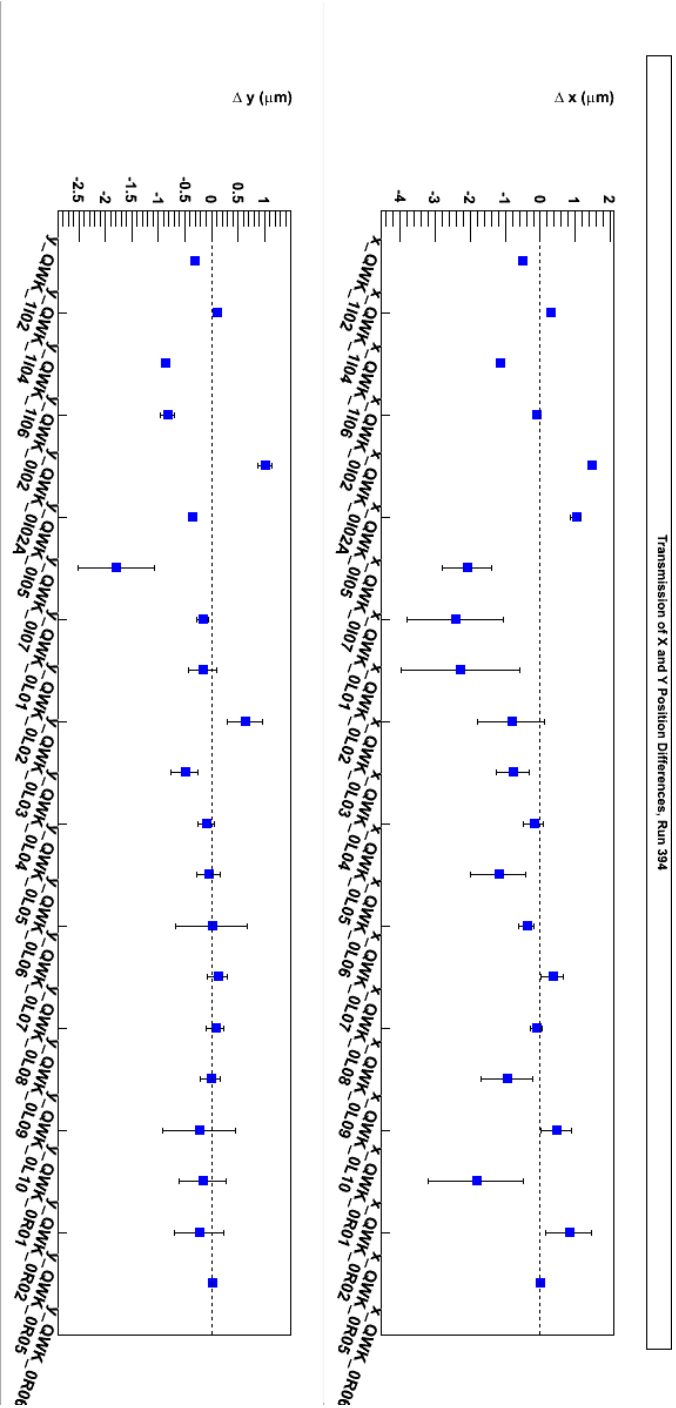


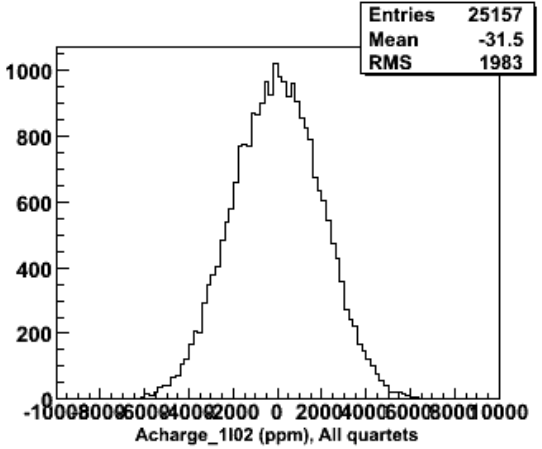






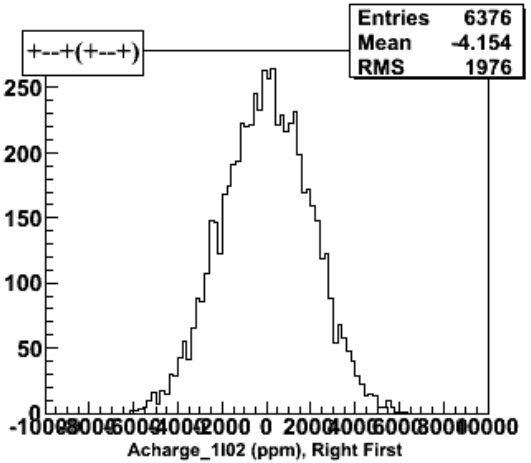

Entries 76265
Mean 0.009486
RMS 10.22
Δx_1I02 (μm)
Entries 76265
Mean -0.02368
RMS 7.7
Δy_1I02 (μm)
Entries 76265
Mean -56.32
RMS 1903
Acharge_1I02 (ppm)
Entries 76265
Mean -0.02097
RMS 13.59
Δx_1I02 Block 1 (μm)
Entries 76265
Mean -0.07661
RMS 12.87
Δy_1I02 Block 1 (μm)
Entries 76265
Mean -54.63
RMS 2352
Acharge_1I02 Block 1 (ppm)
Entries 76265
Mean -0.0004432
RMS 13.61
Δx_1I02 Block 2 (μm)
Entries 76265
Mean -0.05832
RMS 12.79
Δy_1I02 Block 2 (μm)
Entries 76265
Mean -59.03
RMS 2353
Acharge_1I02 Block 2 (ppm)
Entries 76265
Mean 0.02929
RMS 13.62
Δx_1I02 Block 3 (μm)
Entries 76265
Mean -0.02437
RMS 12.8
Δy_1I02 Block 3 (μm)
Entries 76265
Mean -58.89
RMS 2353
Acharge_1I02 Block 3 (ppm)
Entries 76265
Mean 0.033
RMS 13.62
Δx_1I02 Block 4 (μm)
Entries 76265
Mean -0.07033
RMS 12.8
Δy_1I02 Block 4 (μm)
Entries 76265
Mean -64.67
RMS 2355
Acharge_1I02 Block 4 (ppm)

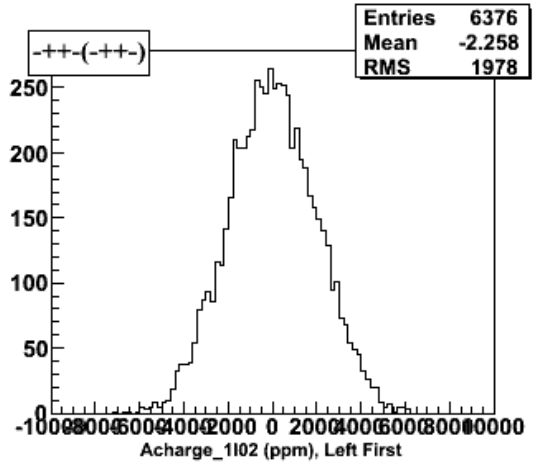


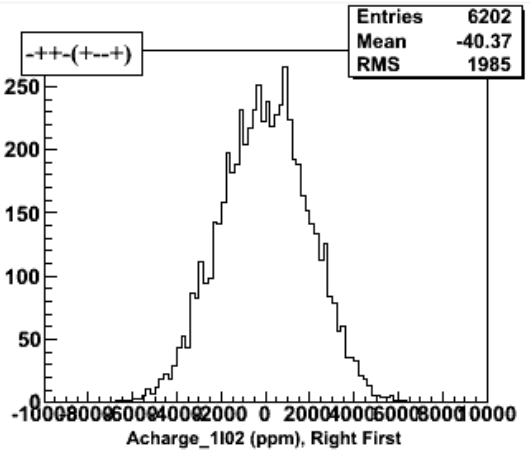


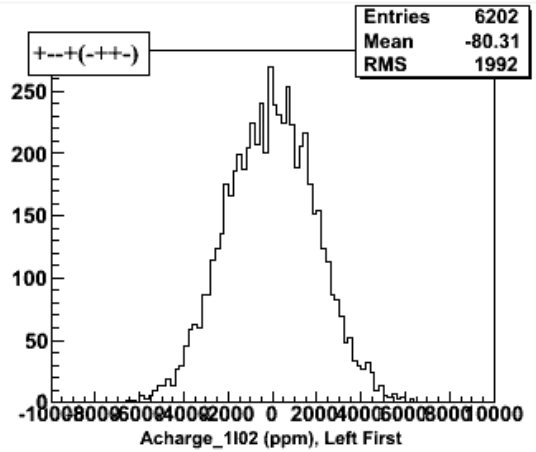
Run 394

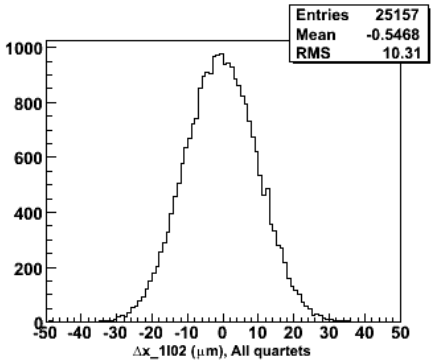
Charge Asymmetry



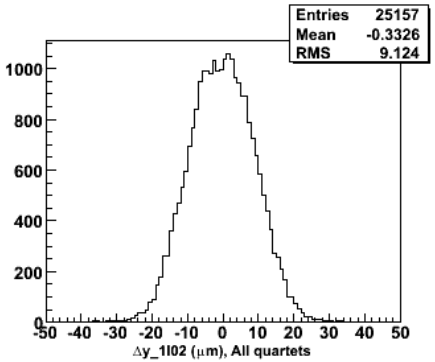




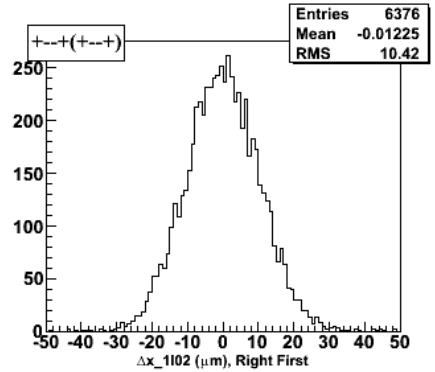


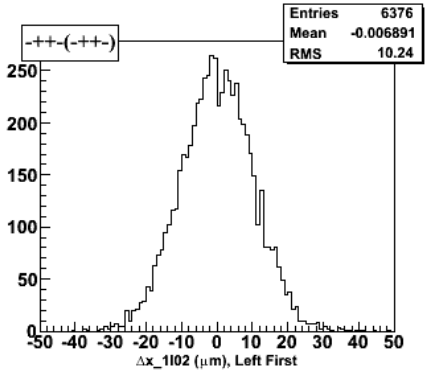


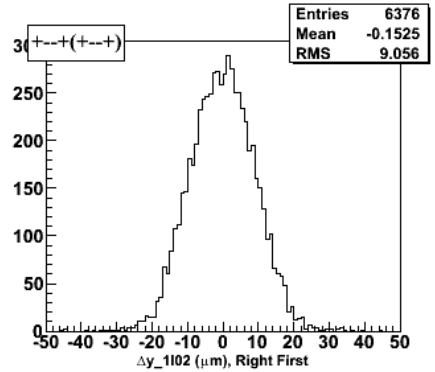
Run 394

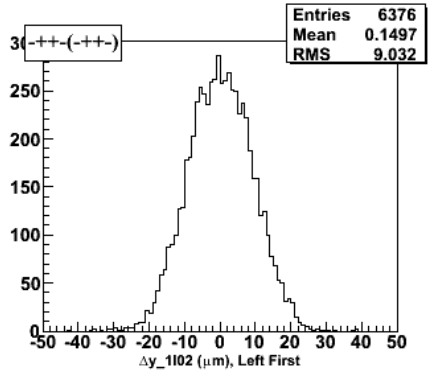


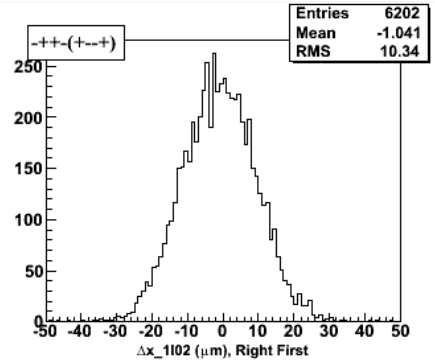
Run 394

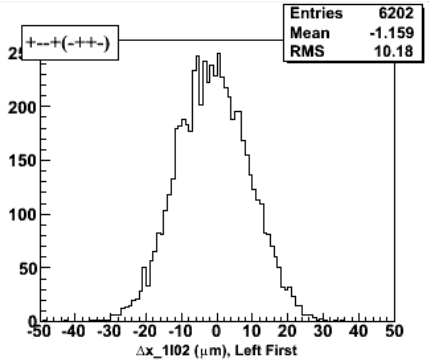


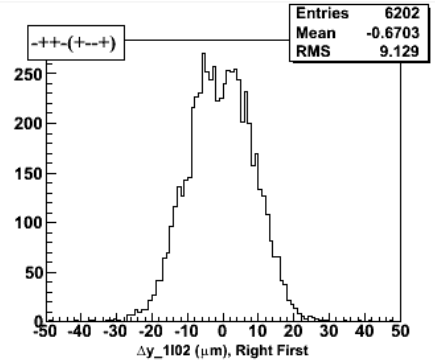


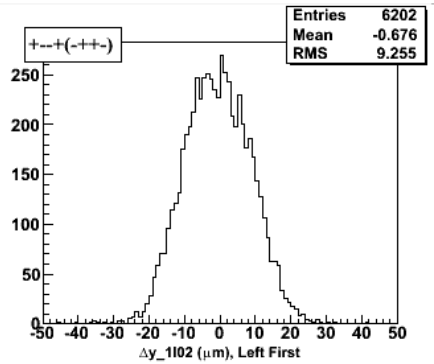


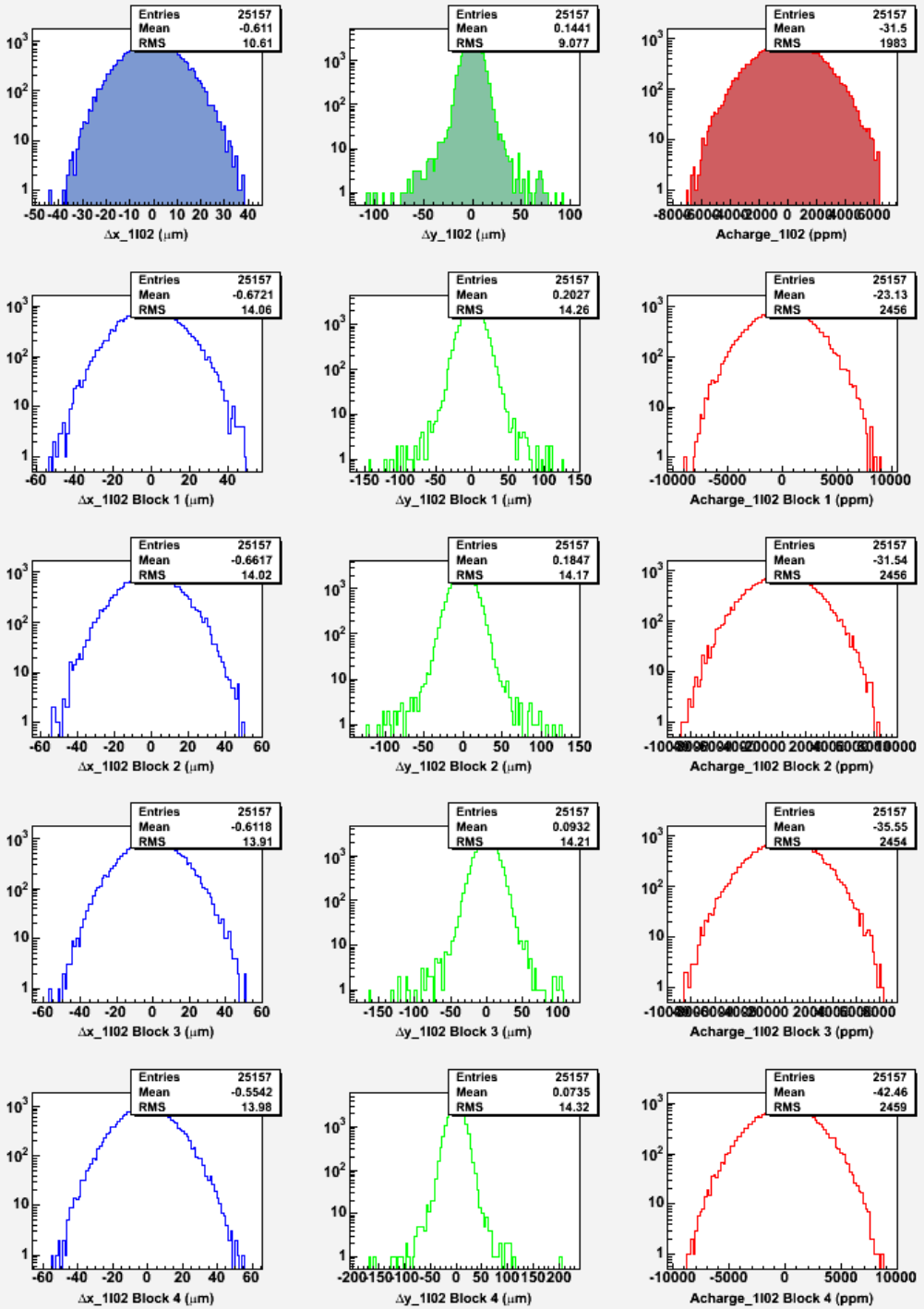


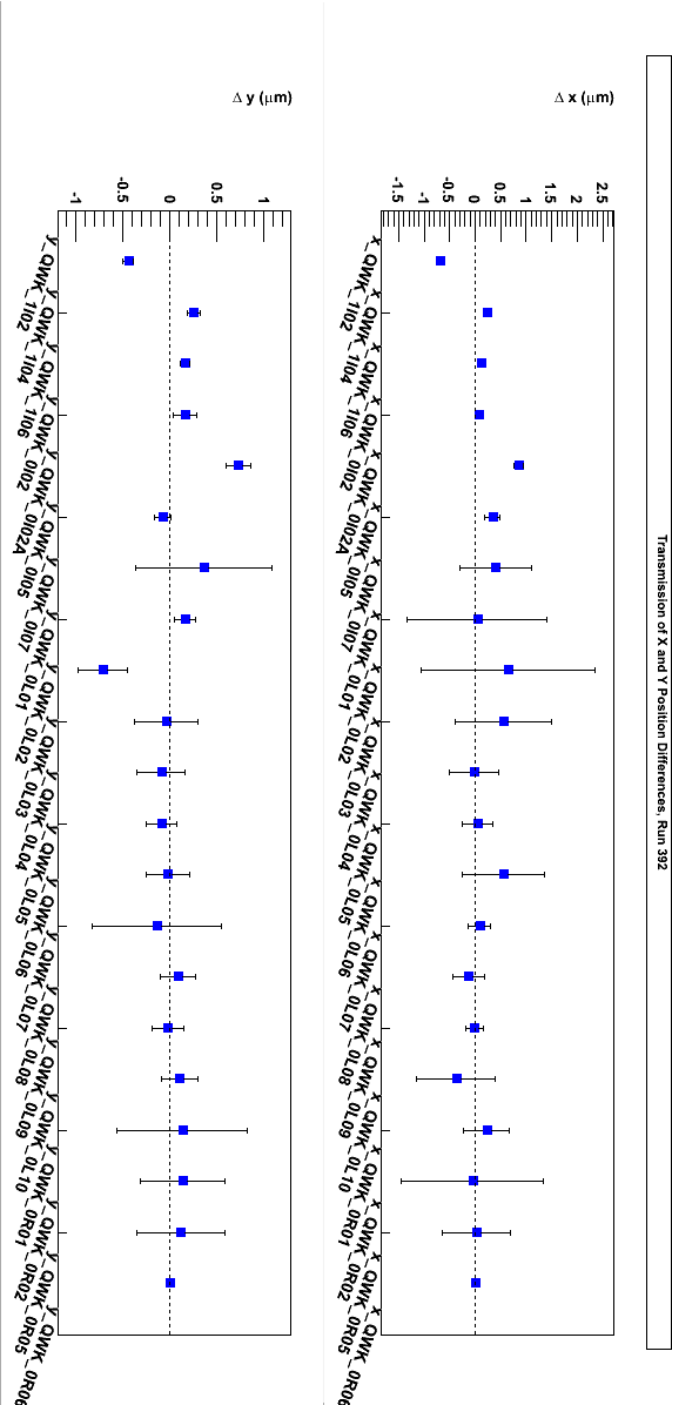


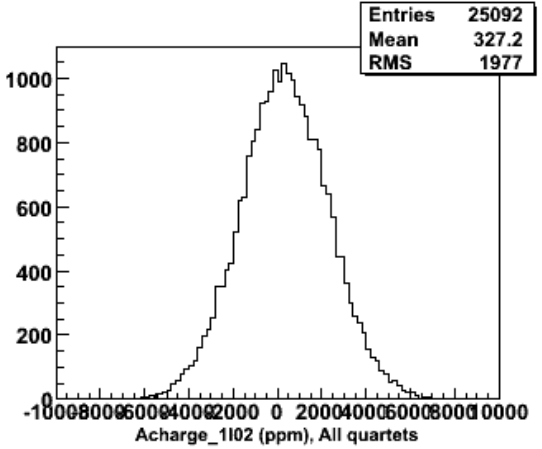






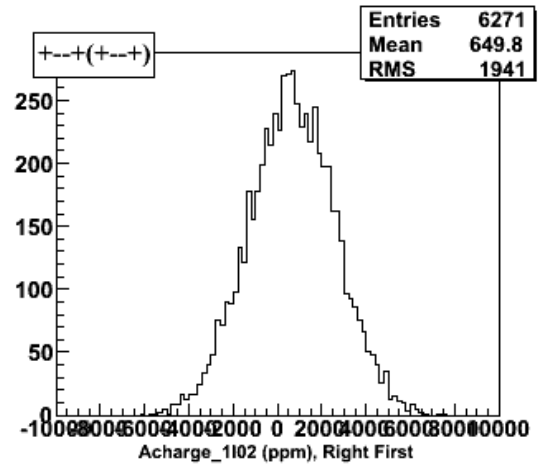

Entries 25157
Mean -0.611
RMS 10.61
Δx_1102 (μm)
Entries 25157
Mean 0.1441
RMS 9.077
Δy_1102 (μm)
Entries 25157
Mean -31.5
RMS 1983
Acharge_1102 (ppm)
Entries 25157
Mean -0.6721
RMS 14.06
Δx_1102 Block 1 (μm)
Entries 25157
Mean 0.2027
RMS 14.26
Δy_1102 Block 1 (μm)
Entries 25157
Mean -23.13
RMS 2456
Acharge_1102 Block 1 (ppm)
Entries 25157
Mean -0.6617
RMS 14.02
Δx_1102 Block 2 (μm)
Entries 25157
Mean 0.1847
RMS 14.17
Δy_1102 Block 2 (μm)
Entries 25157
Mean -31.54
RMS 2456
Acharge_1102 Block 2 (ppm)
Entries 25157
Mean -0.6118
RMS 13.91
Δx_1102 Block 3 (μm)
Entries 25157
Mean 0.0932
RMS 14.21
Δy_1102 Block 3 (μm)
Entries 25157
Mean -35.55
RMS 2454
Acharge_1102 Block 3 (ppm)
Entries 25157
Mean -0.5542
RMS 13.98
Δx_1102 Block 4 (μm)
Entries 25157
Mean 0.0735
RMS 14.32
Δy_1102 Block 4 (μm)
Entries 25157
Mean -42.46
RMS 2459
Acharge_1102 Block 4 (ppm)

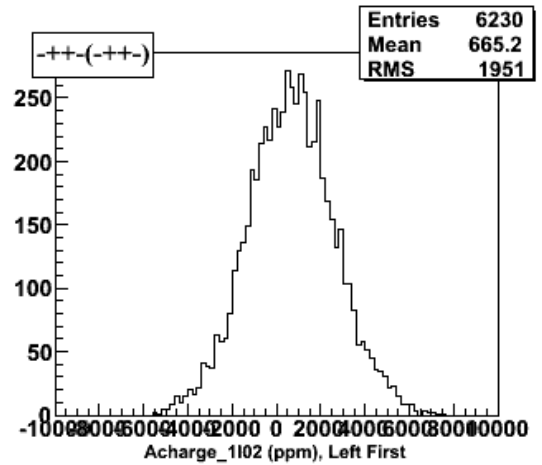


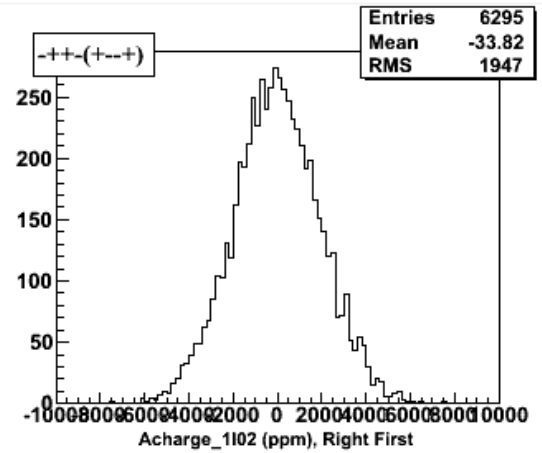


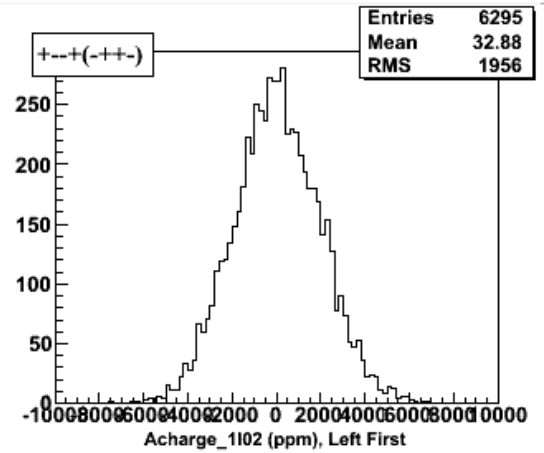
Run 392

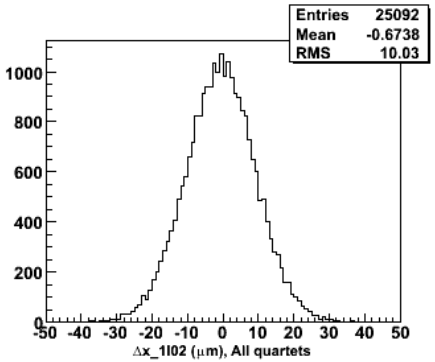
Charge Asymmetry



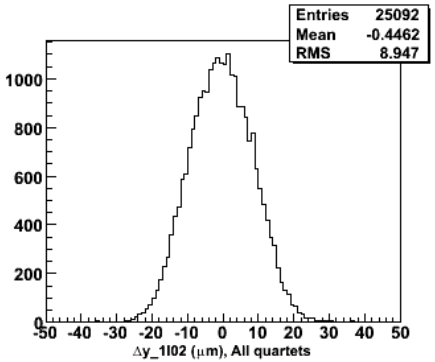




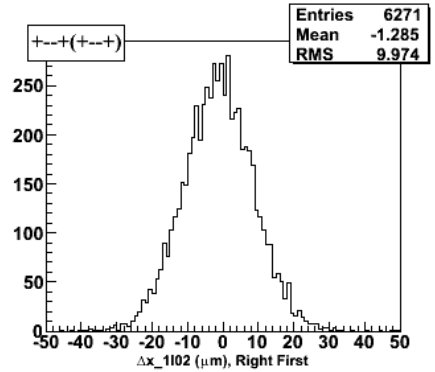


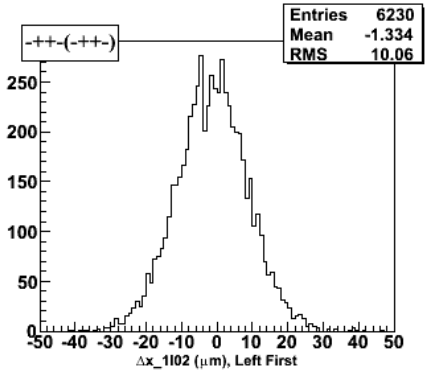


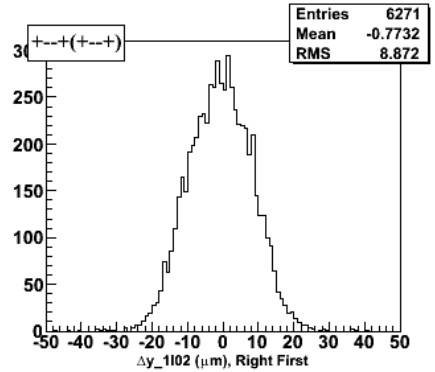
Run 392

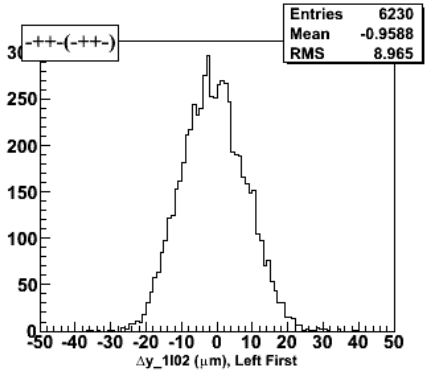


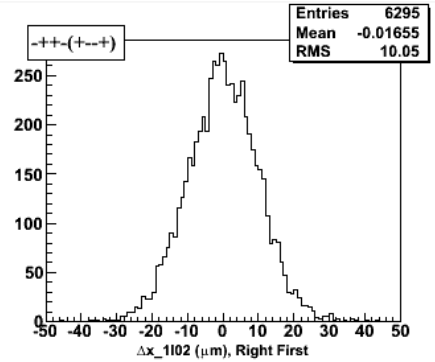
Run 392

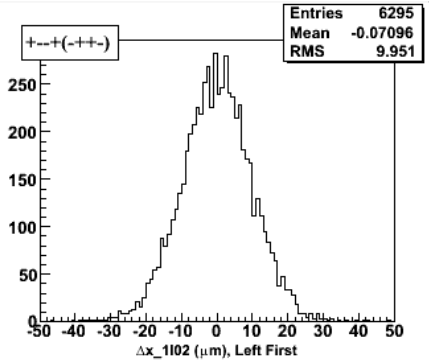


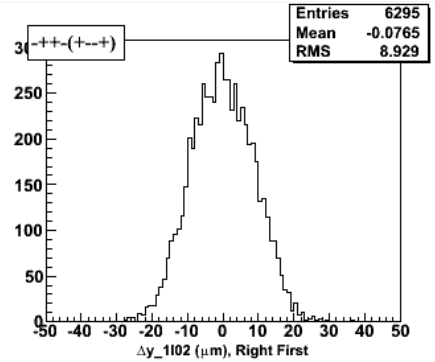


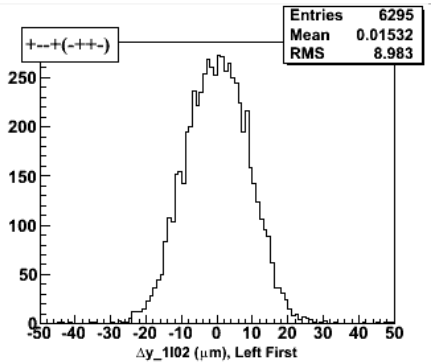


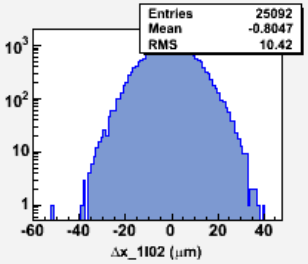


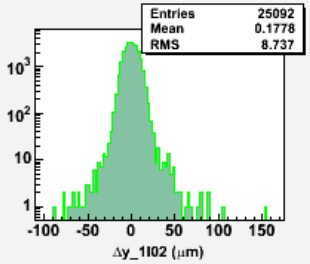


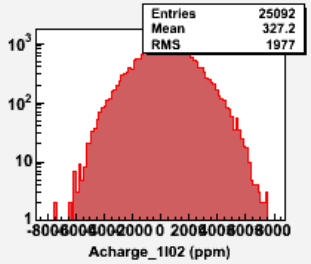


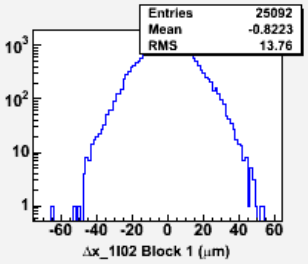


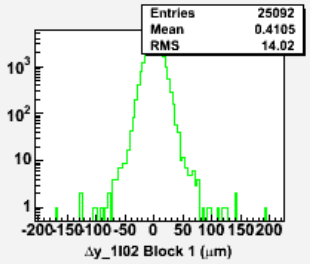


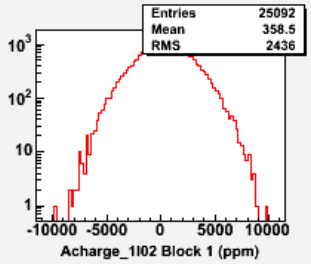

Entries 25092
Mean -0.8047
RMS 10.42
Δx_1I02 (μm)

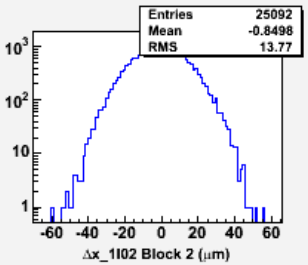

Entries 25092
Mean 0.1778
RMS 8.737
Δy_1I02 (μm)

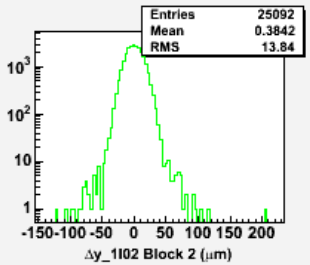

Entries 25092
Mean 327.2
RMS 1977
Acharge_1I02 (ppm)

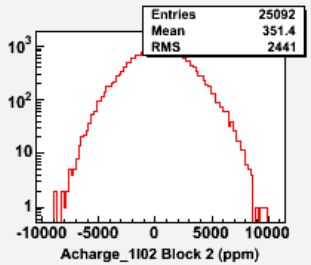

Entries 25092
Mean -0.8223
RMS 13.76
Δx_1I02 Block 1 (μm)

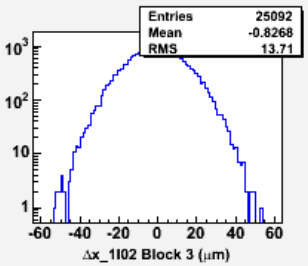

Entries 25092
Mean 0.4105
RMS 14.02
Δy_1I02 Block 1 (μm)

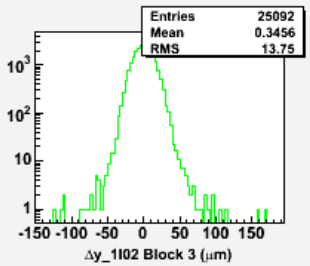

Entries 25092
Mean 358.5
RMS 2436
Acharge_1I02 Block 1 (ppm)

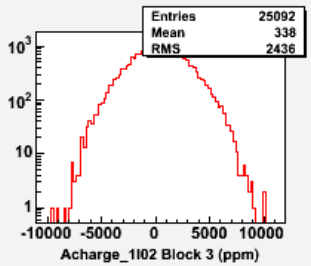

Entries 25092
Mean -0.8498
RMS 13.77
Δx_1I02 Block 2 (μm)

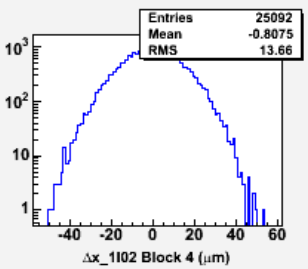

Entries 25092
Mean 0.3842
RMS 13.84
Δy_1I02 Block 2 (μm)

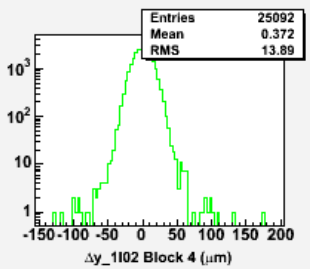

Entries 25092
Mean 351.4
RMS 2441
Acharge_1I02 Block 2 (ppm)

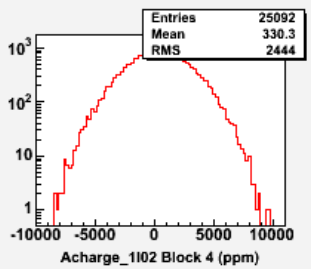

Entries 25092
Mean -0.8268
RMS 13.71
Δx_1I02 Block 3 (μm)

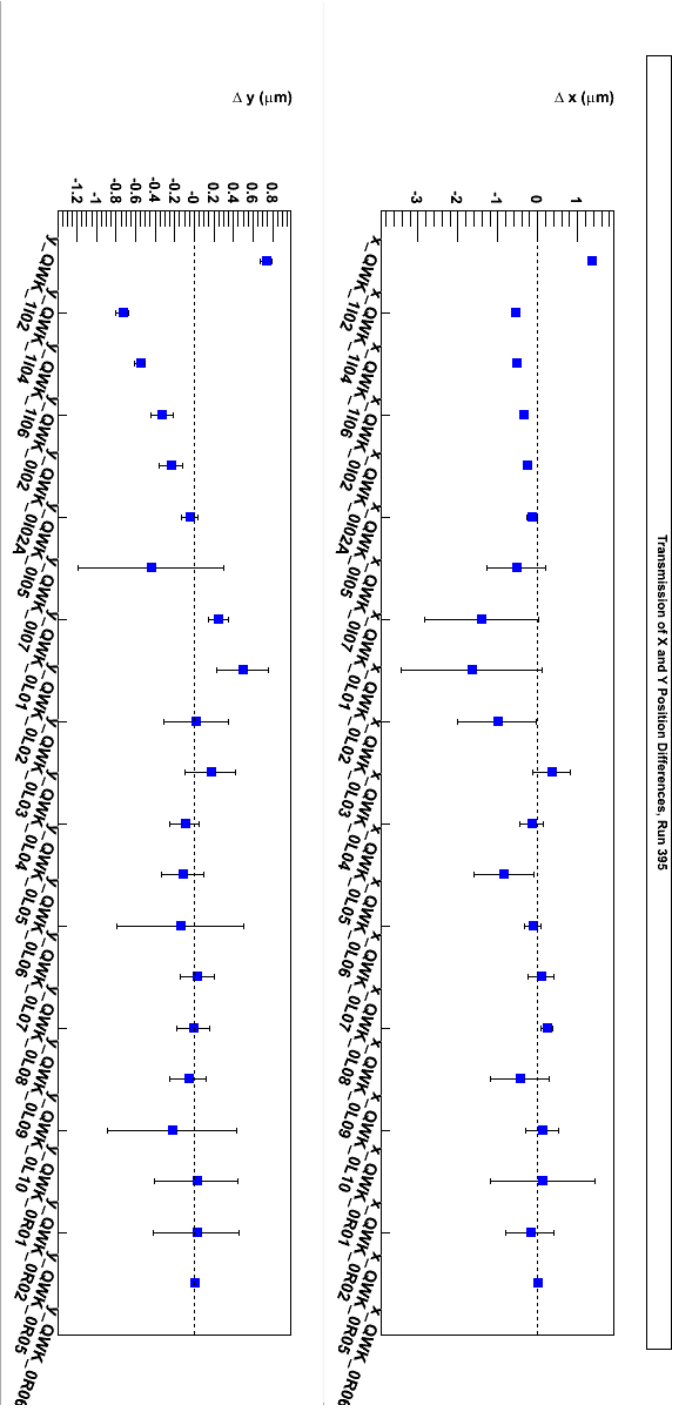

Entries 25092
Mean 0.3456
RMS 13.75
Δy_1I02 Block 3 (μm)

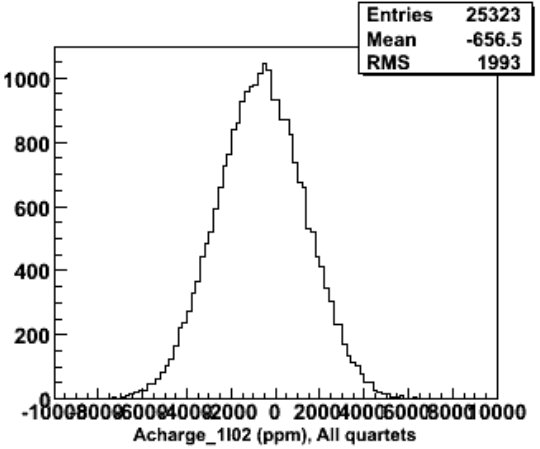

Entries 25092
Mean 338
RMS 2436
Acharge_1I02 Block 3 (ppm)


Entries 25092
Mean -0.8075
RMS 13.66
Δx_1I02 Block 4 (μm)


Entries 25092
Mean 0.372
RMS 13.89
Δy_1I02 Block 4 (μm)

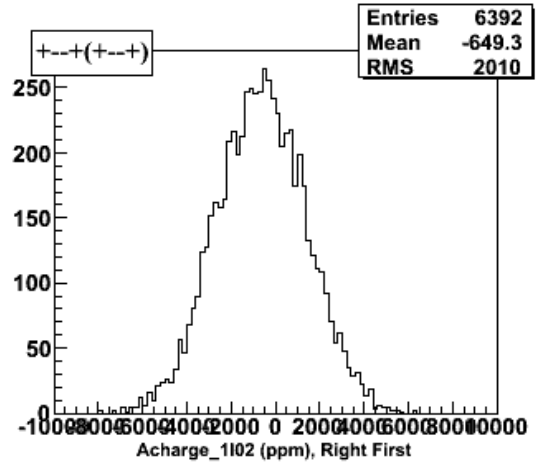

Entries 25092
Mean 330.3
RMS 2444
Acharge_1I02 Block 4 (ppm)

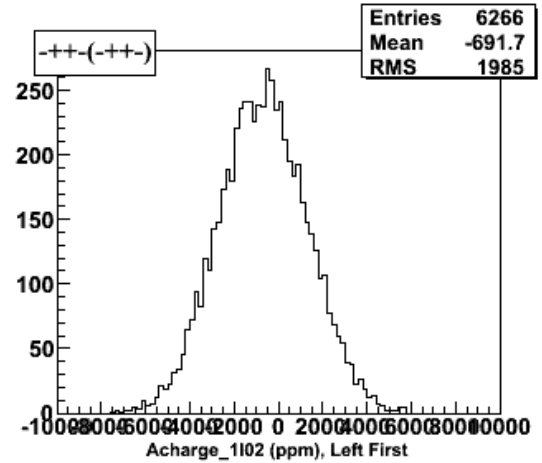


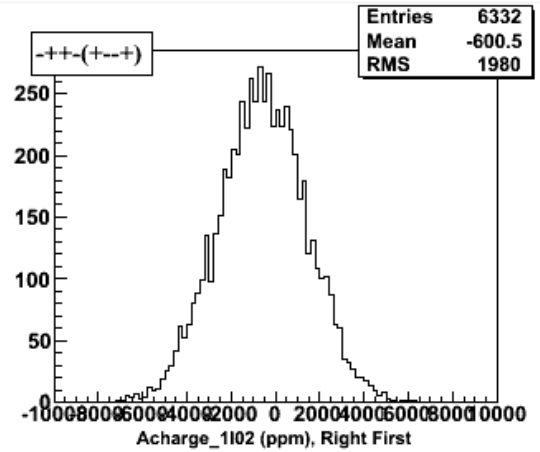


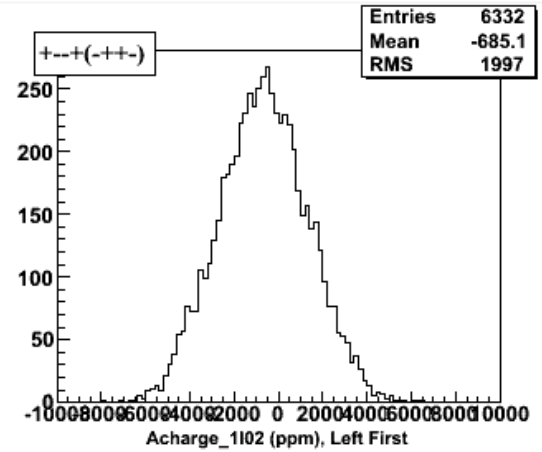
Run 395

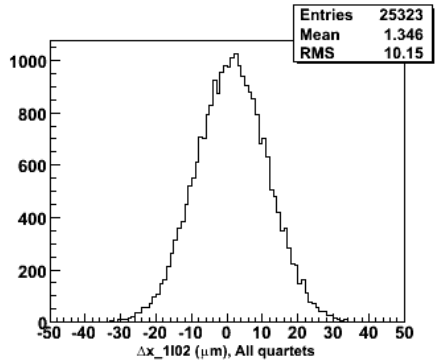
Charge Asymmetry



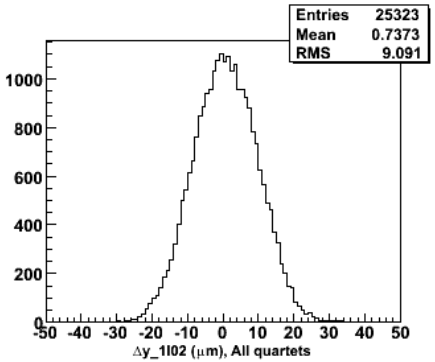




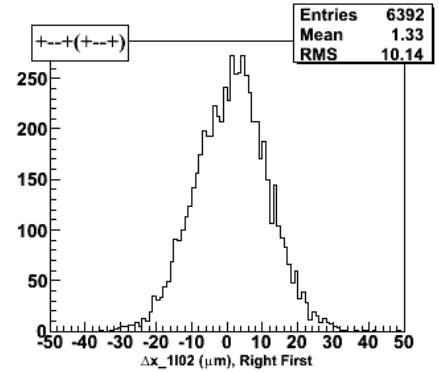


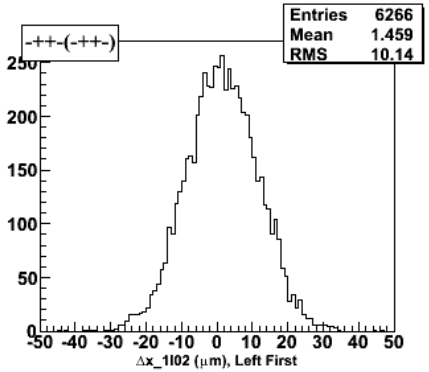


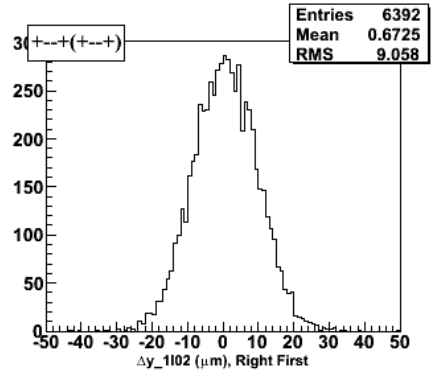
Run 395

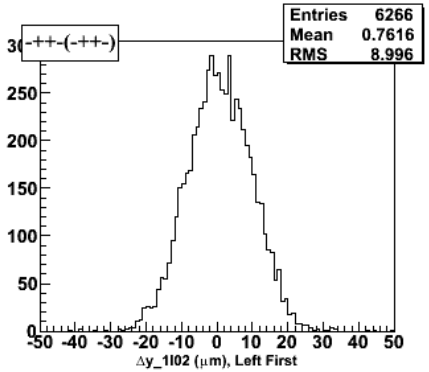


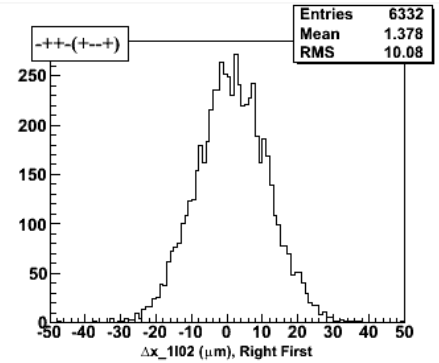
Run 395

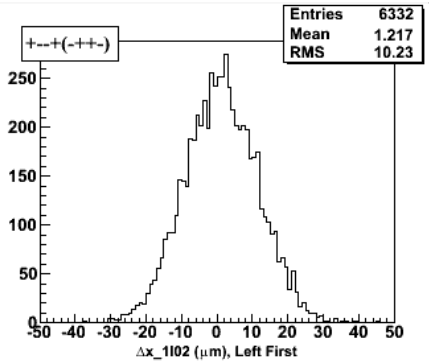


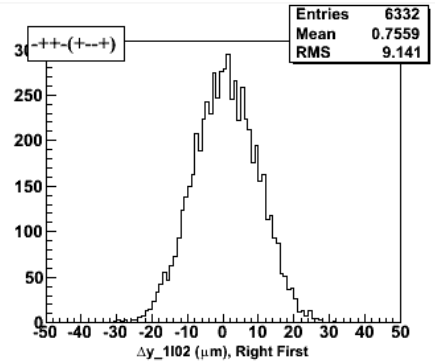


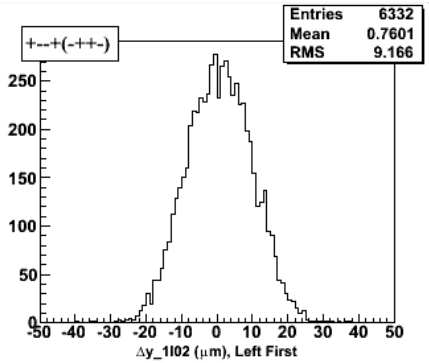


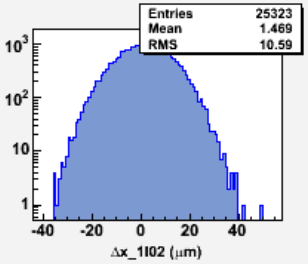


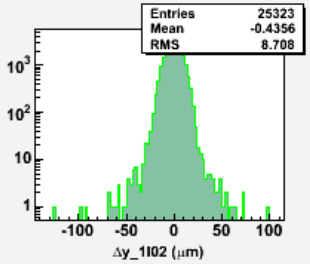


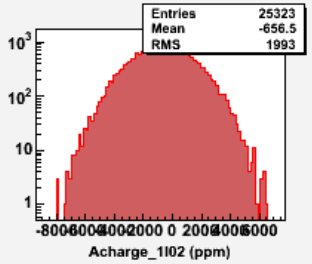


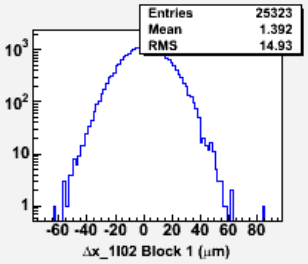


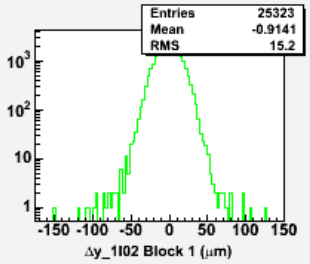


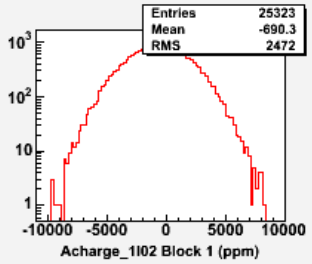

Entries 25323
Mean 1.469
RMS 10.59
Δx_1I02 (μm)

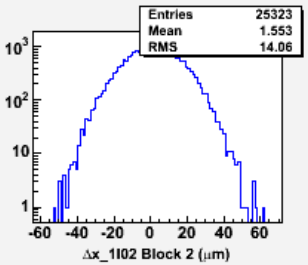

Entries 25323
Mean -0.4356
RMS 8.708
Δy_1I02 (μm)

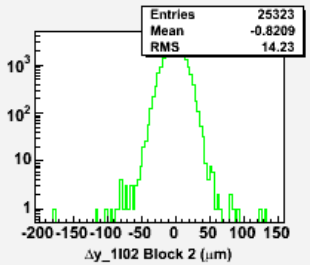

Entries 25323
Mean -656.5
RMS 1993
Acharge_1I02 (ppm)

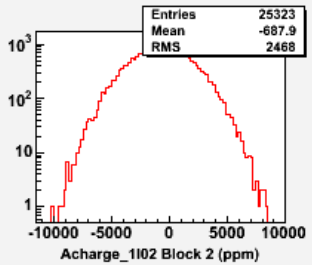

Entries 25323
Mean 1.392
RMS 14.93
Δx_1I02 Block 1 (μm)

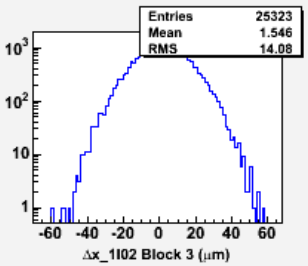

Entries 25323
Mean -0.9141
RMS 15.2
Δy_1I02 Block 1 (μm)

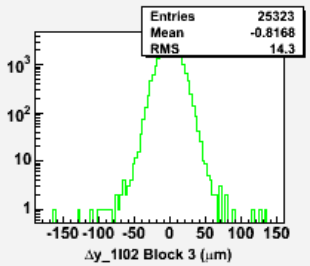

Entries 25323
Mean -690.3
RMS 2472
Acharge_1I02 Block 1 (ppm)

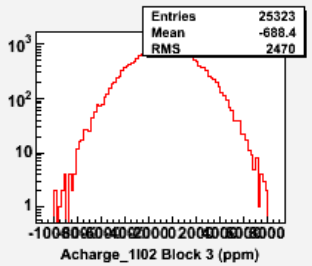

Entries 25323
Mean 1.553
RMS 14.06
Δx_1I02 Block 2 (μm)

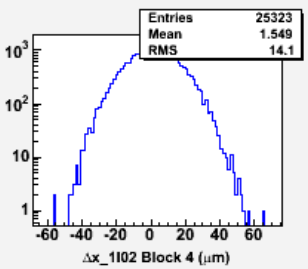

Entries 25323
Mean -0.8209
RMS 14.23
Δy_1I02 Block 2 (μm)

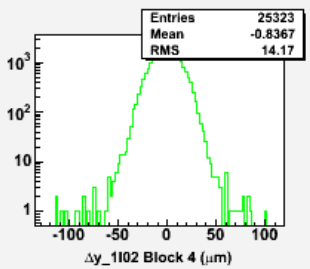

Entries 25323
Mean -687.9
RMS 2468
Acharge_1I02 Block 2 (ppm)

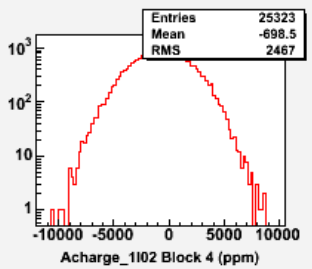

Entries 25323
Mean 1.546
RMS 14.08
Δx_1I02 Block 3 (μm)

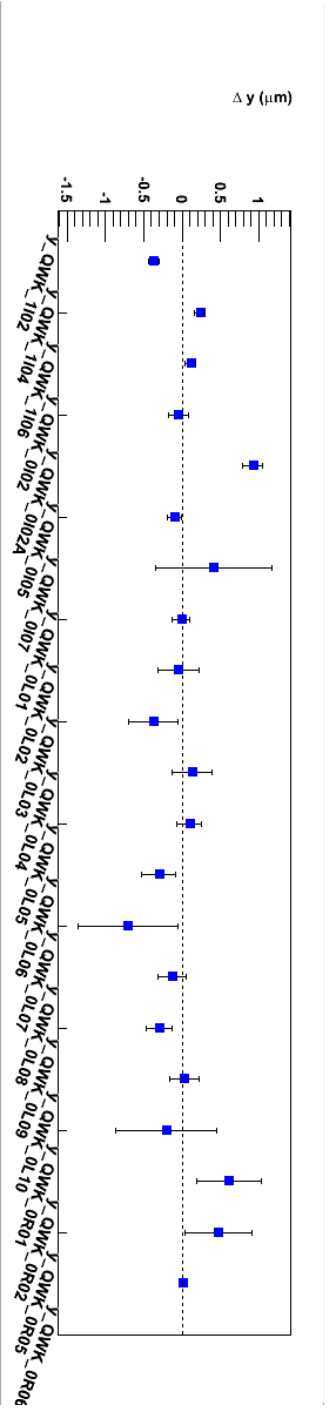

Entries 25323
Mean -0.8168
RMS 14.3
Δy_1I02 Block 3 (μm)

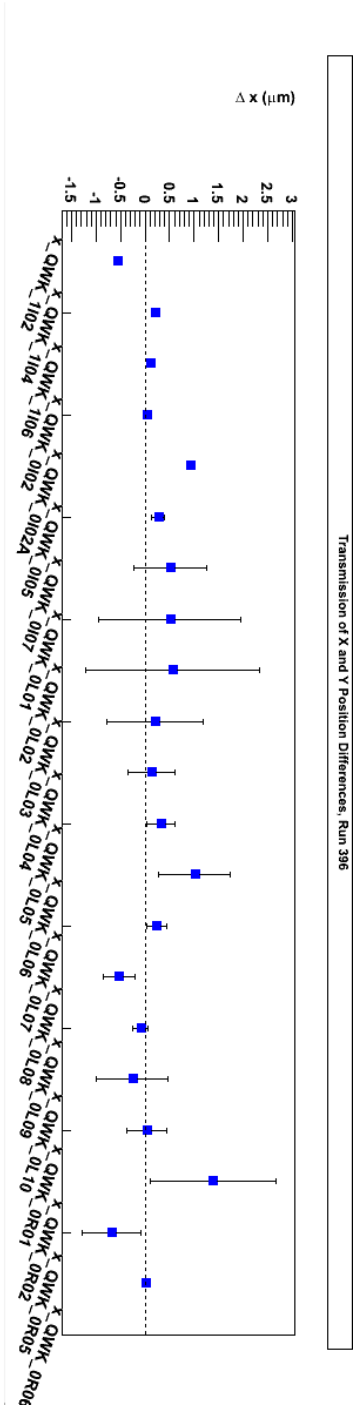

Entries 25323
Mean -688.4
RMS 2470
Acharge_1I02 Block 3 (ppm)


Entries 25323
Mean 1.549
RMS 14.1
Δx_1I02 Block 4 (μm)

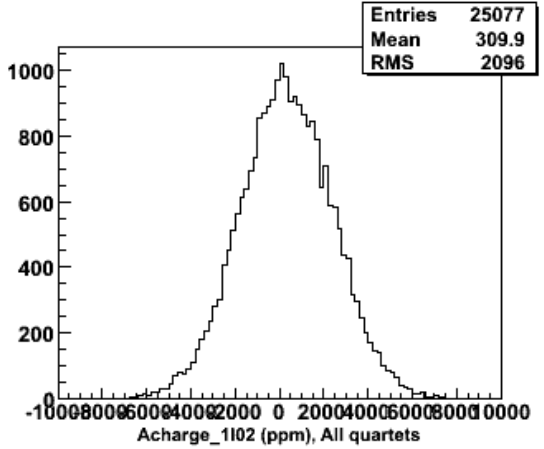

Entries 25323
Mean -0.8367
RMS 14.17
Δy_1I02 Block 4 (μm)


Entries 25323
Mean -698.5
RMS 2467
Acharge_1I02 Block 4 (ppm)



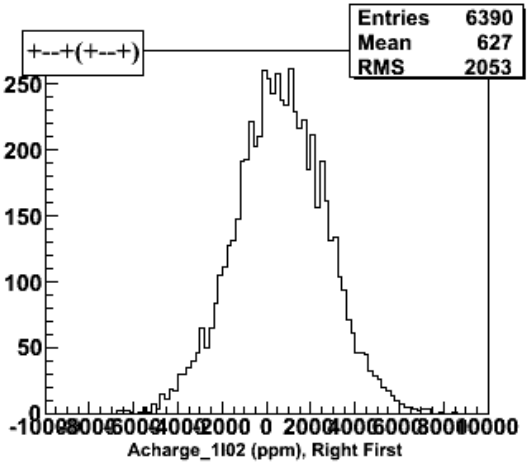


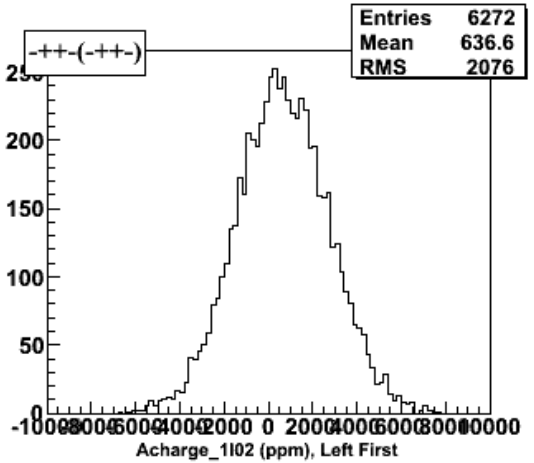
Transmission of X and Y Position Differences, Run 396

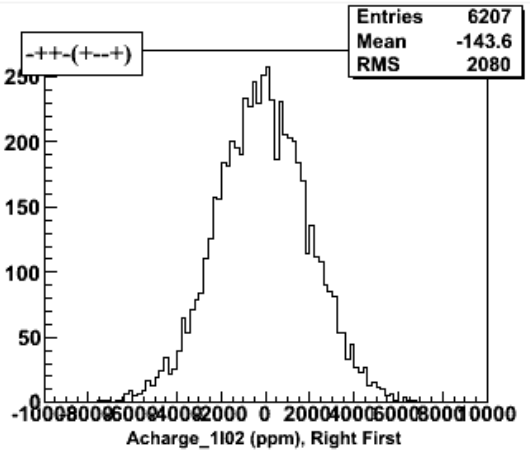


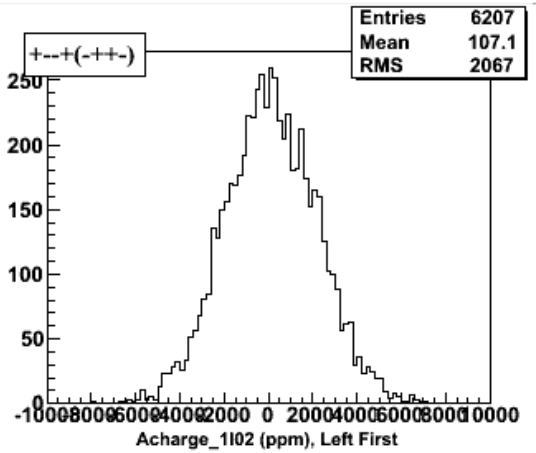
Run 396

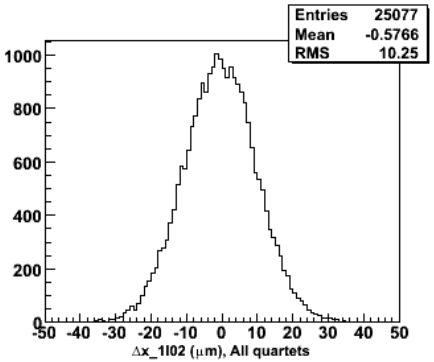
Charge Asymmetry



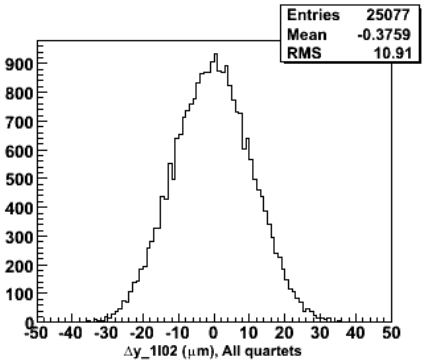




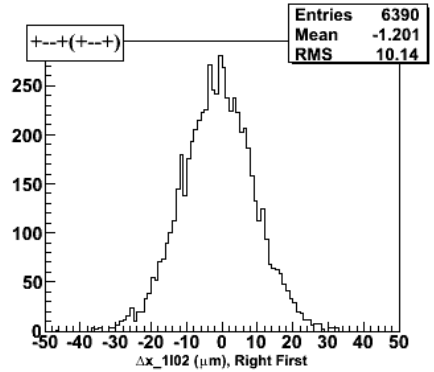


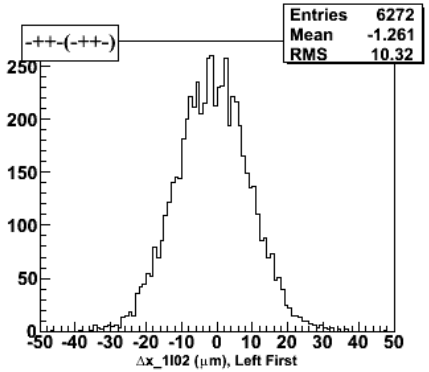


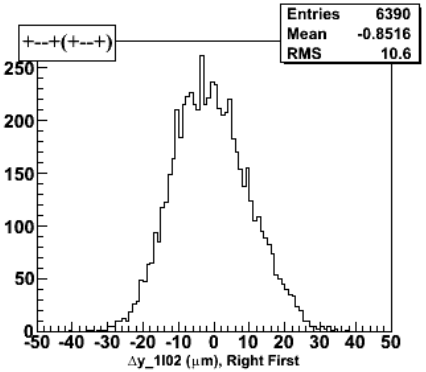
Run 396

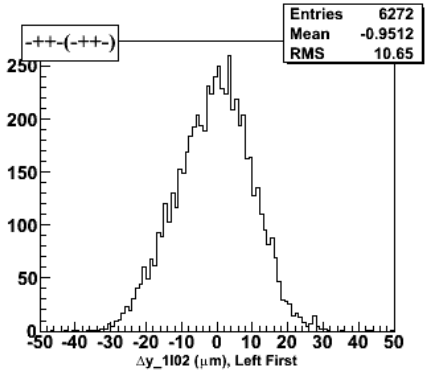


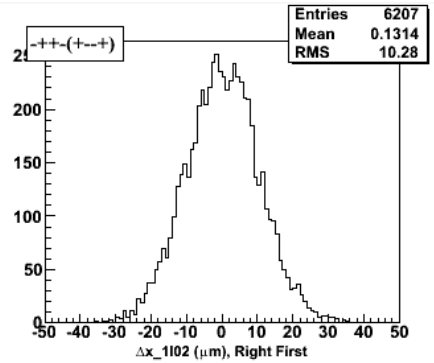
Run 396

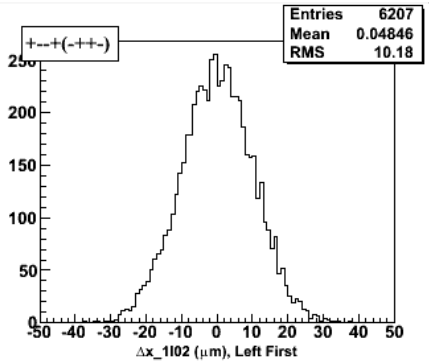


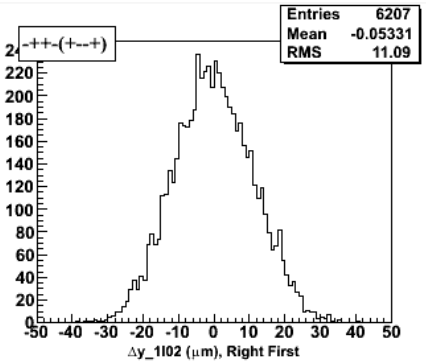


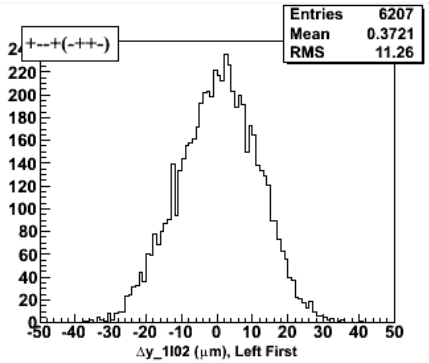


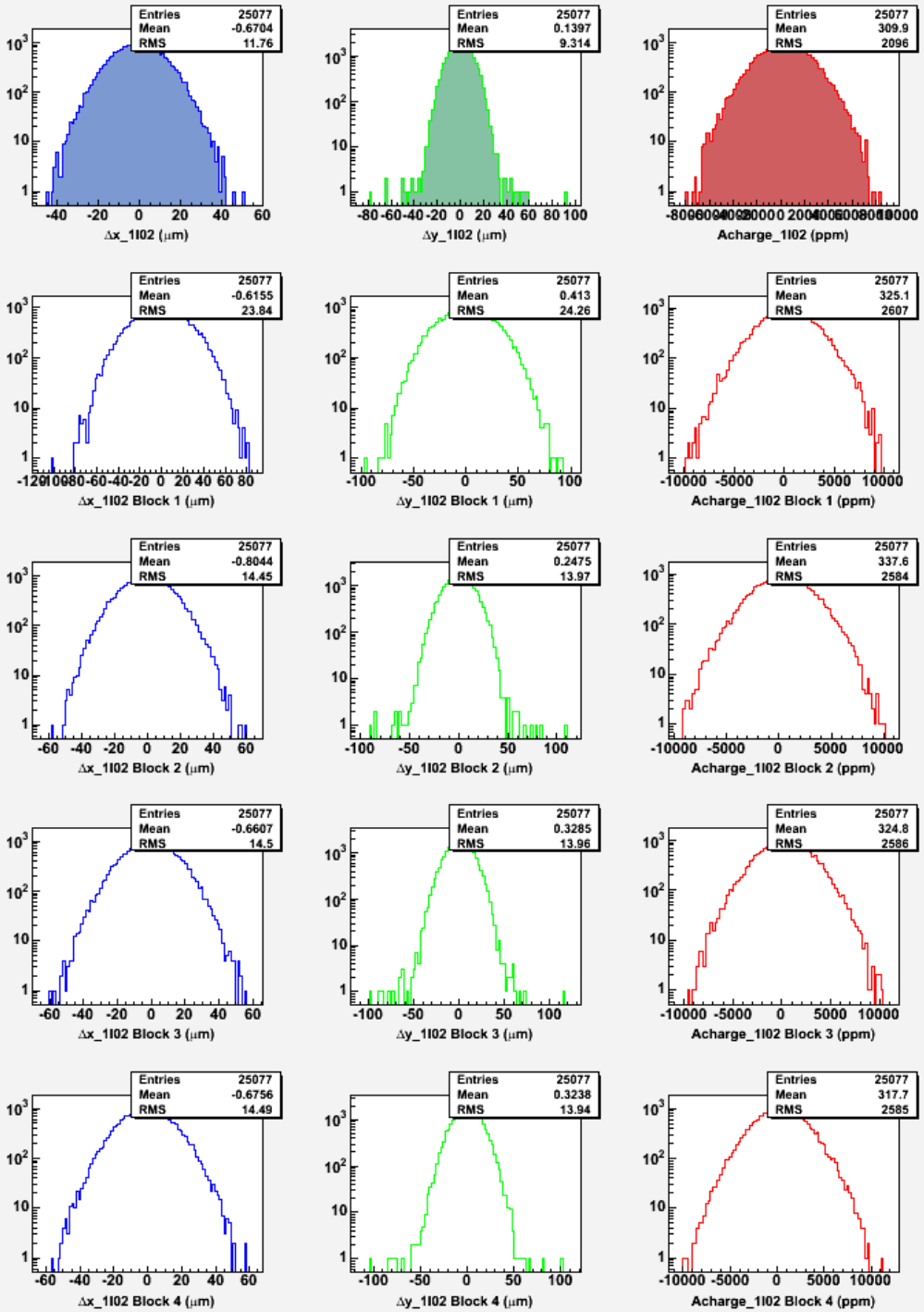


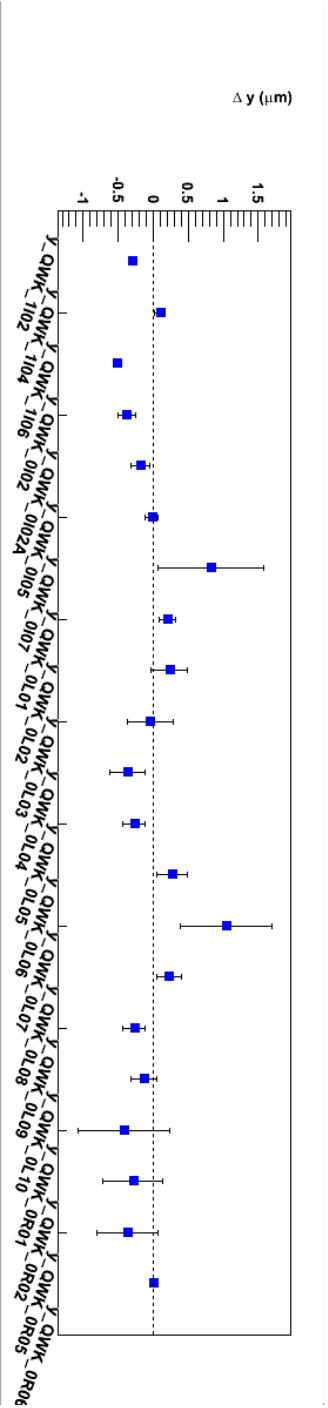


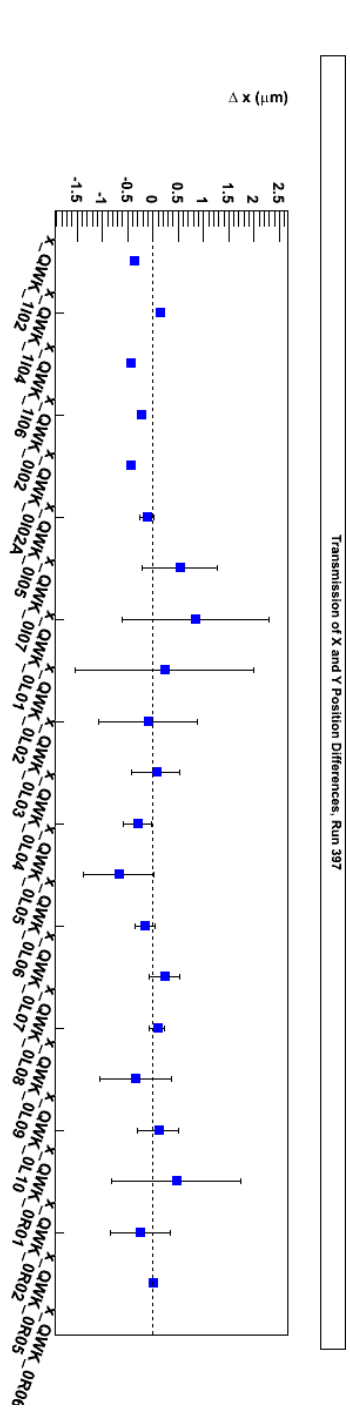


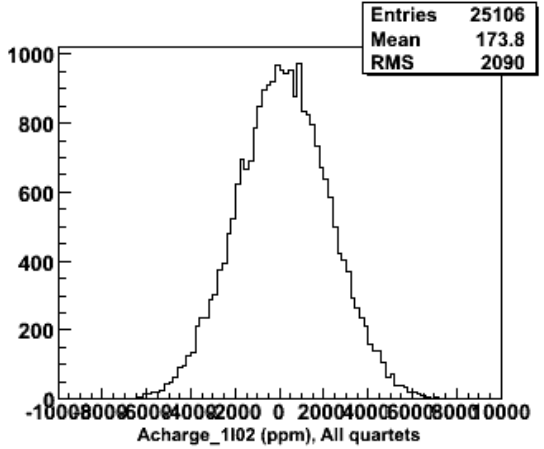





Entries 25077
Mean -0.6704
RMS 11.76
Δx_1I02 (μm)
Entries 25077
Mean 0.1397
RMS 9.314
Δy_1I02 (μm)
Entries 25077
Mean 309.9
RMS 2096
Acharge_1I02 (ppm)
Entries 25077
Mean -0.6155
RMS 23.84
Δx_1I02 Block 1 (μm)
Entries 25077
Mean 0.413
RMS 24.26
Δy_1I02 Block 1 (μm)
Entries 25077
Mean 325.1
RMS 2607
Acharge_1I02 Block 1 (ppm)
Entries 25077
Mean -0.8044
RMS 14.45
Δx_1I02 Block 2 (μm)
Entries 25077
Mean 0.2475
RMS 13.97
Δy_1I02 Block 2 (μm)
Entries 25077
Mean 337.6
RMS 2584
Acharge_1I02 Block 2 (ppm)
Entries 25077
Mean -0.6607
RMS 14.5
Δx_1I02 Block 3 (μm)
Entries 25077
Mean 0.3285
RMS 13.96
Δy_1I02 Block 3 (μm)
Entries 25077
Mean 324.8
RMS 2586
Acharge_1I02 Block 3 (ppm)
Entries 25077
Mean -0.6756
RMS 14.49
Δx_1I02 Block 4 (μm)
Entries 25077
Mean 0.3238
RMS 13.94
Δy_1I02 Block 4 (μm)
Entries 25077
Mean 317.7
RMS 2585
Acharge_1I02 Block 4 (ppm)

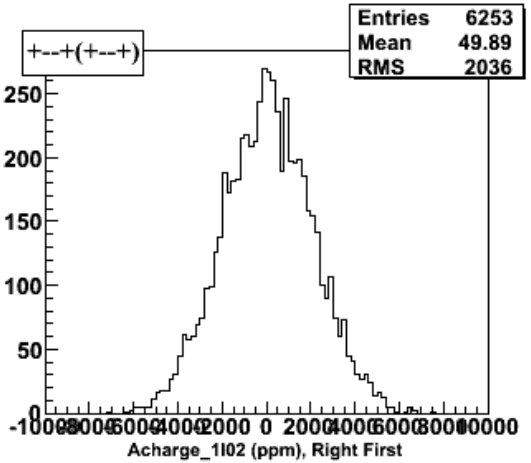


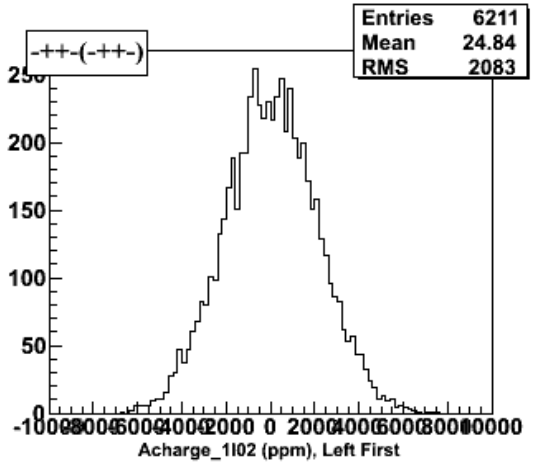


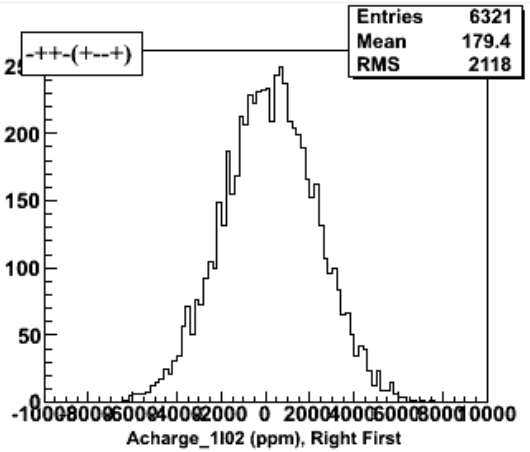


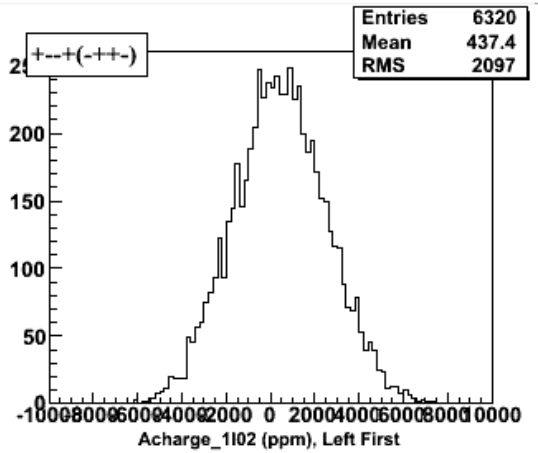
Run 397

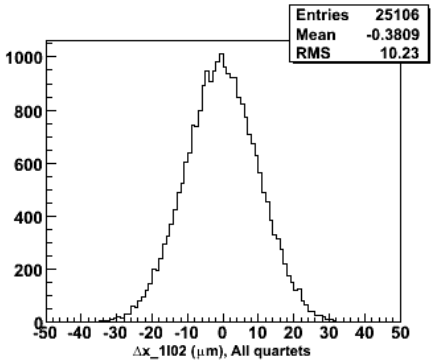
Charge Asymmetry



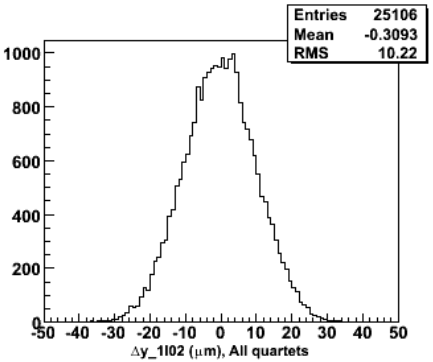




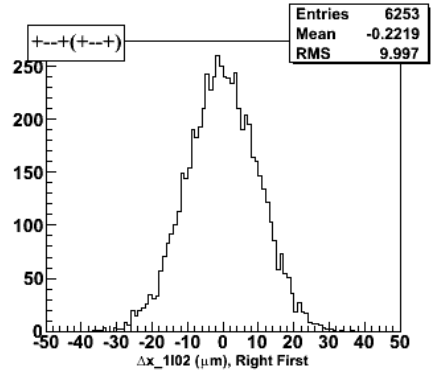


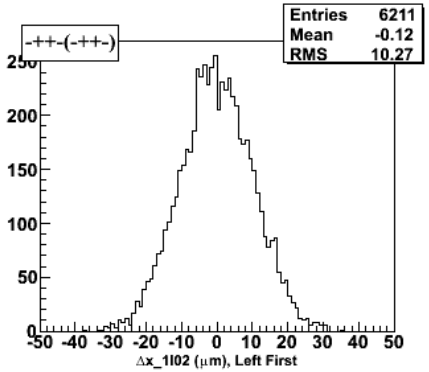


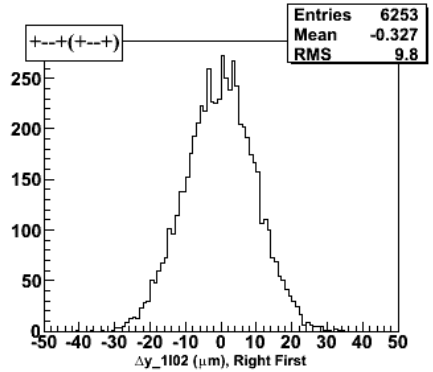
Run 397

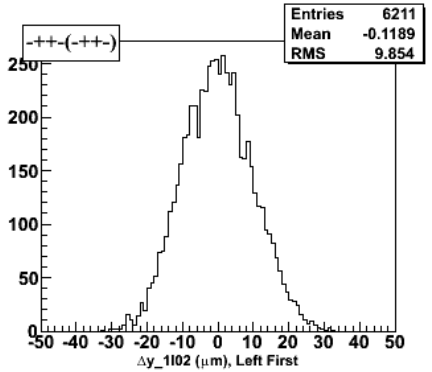


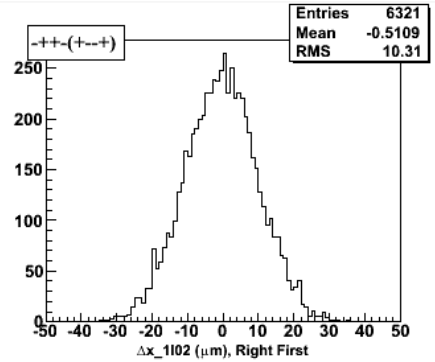
Run 397

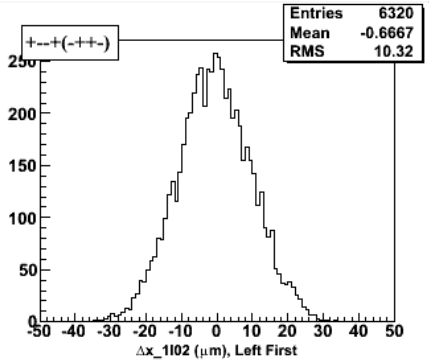


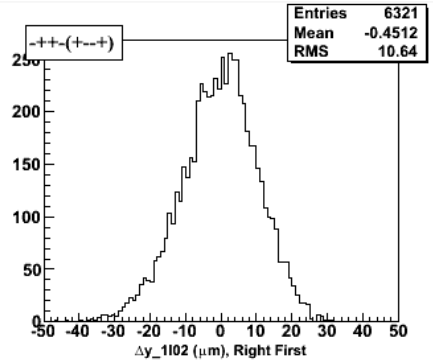


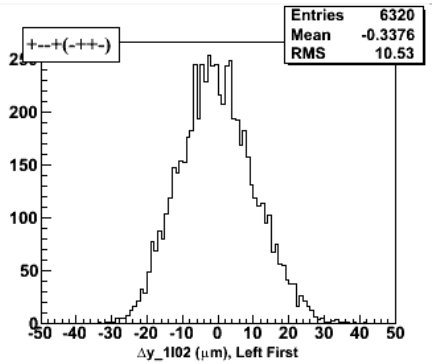


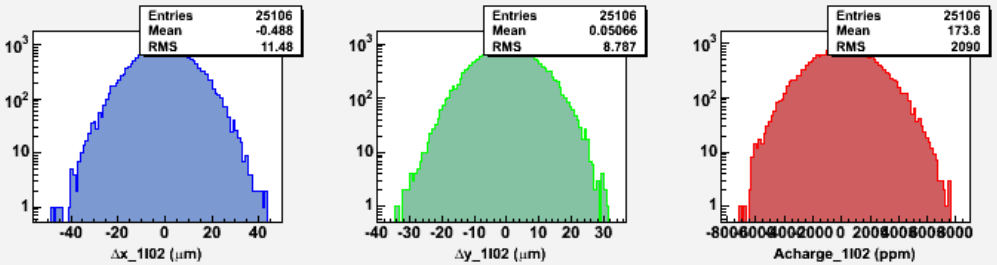






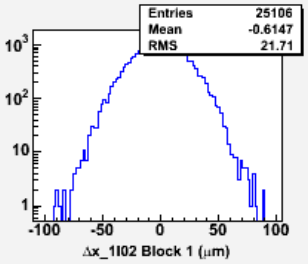


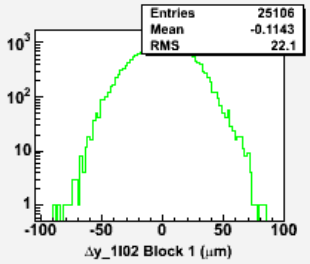


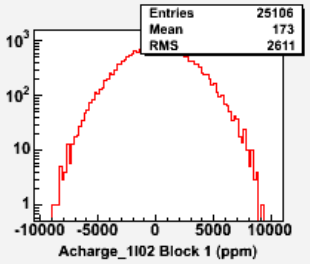

Entries 25106
Mean -0.488
RMS 11.48
Δx_1I02 (μm)

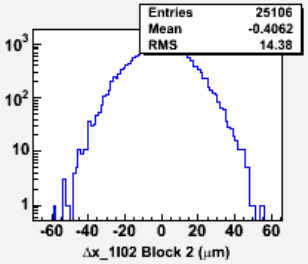
Entries 25106
Mean 0.05066
RMS 8.787
Δy_1I02 (μm)

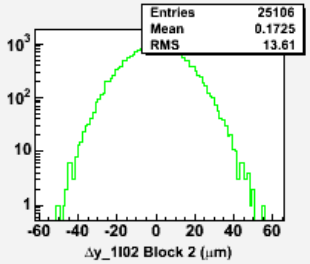
Entries 25106
Mean 173.8
RMS 2090
Acharge_1I02 (ppm)

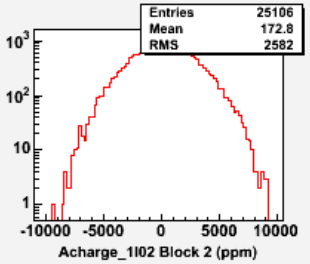

Entries 25106
Mean -0.6147
RMS 21.71
Δx_1I02 Block 1 (μm)

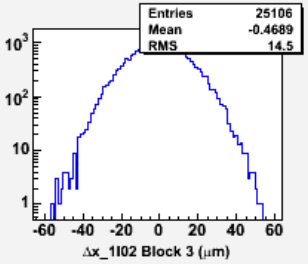

Entries 25106
Mean -0.1143
RMS 22.1
Δy_1I02 Block 1 (μm)

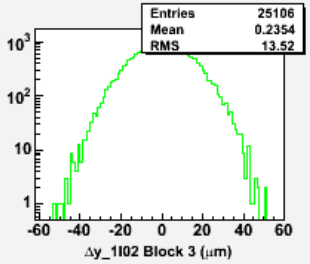

Entries 25106
Mean 173
RMS 2611
Acharge_1I02 Block 1 (ppm)

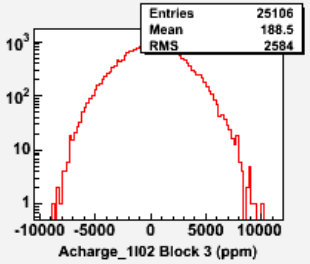

Entries 25106
Mean -0.4062
RMS 14.38
Δx_1I02 Block 2 (μm)

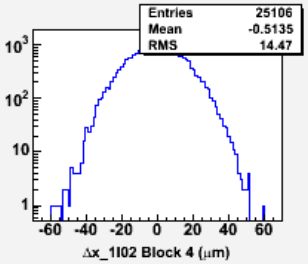

Entries 25106
Mean 0.1725
RMS 13.61
Δy_1I02 Block 2 (μm)

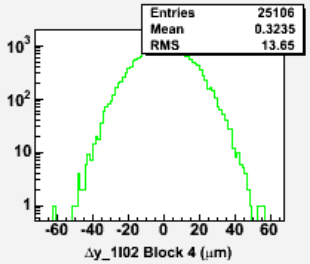

Entries 25106
Mean 172.8
RMS 2582
Acharge_1I02 Block 2 (ppm)

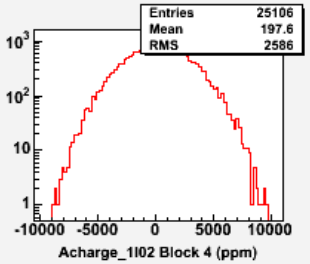

Entries 25106
Mean -0.4689
RMS 14.5
Δx_1I02 Block 3 (μm)


Entries 25106
Mean 0.2354
RMS 13.52
Δy_1I02 Block 3 (μm)


Entries 25106
Mean 188.5
RMS 2584
Acharge_1I02 Block 3 (ppm)


Entries 25106
Mean -0.5135
RMS 14.47
Δx_1I02 Block 4 (μm)


Entries 25106
Mean 0.3235
RMS 13.65
Δy_1I02 Block 4 (μm)

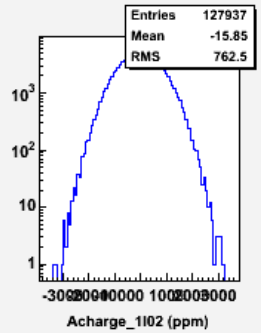

Entries 25106
Mean 197.6
RMS 2586
Acharge_1I02 Block 4 (ppm)

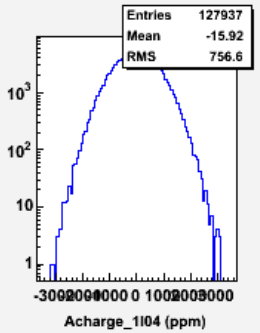
T-Settle Study (500, 100, 60, 10 µs)

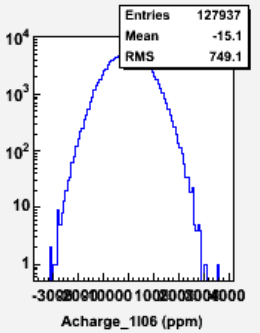
- 1 kHz

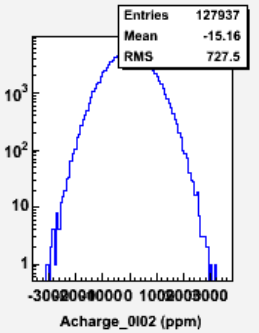
    1. Run 477: PC OFF, IHWP OUT, 100 µs
    2. Run 470: IHWP IN, 100 µs
    3. Run 471: IHWP OUT, 100 µs

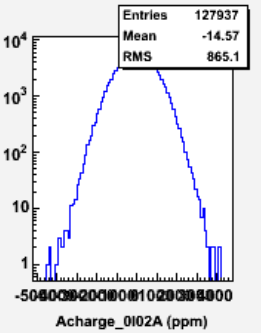
- Notes: CODA gave error messages with the other T_Settle choices. Problem fixed on November 15, 2008.

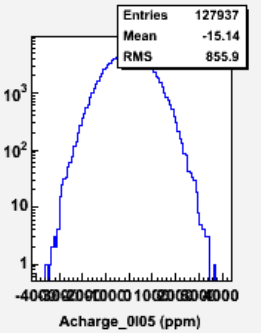

Entries 127937
Mean -15.85
RMS 762.5
Acharge_1I02 (ppm)

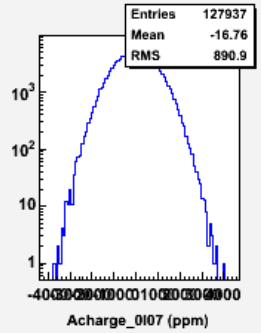

Entries 127937
Mean -15.92
RMS 756.6
Acharge_1I04 (ppm)

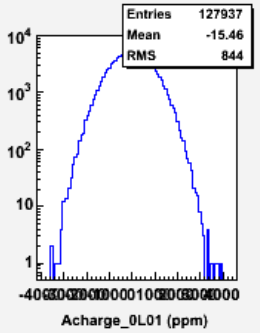

Entries 127937
Mean -15.1
RMS 749.1
Acharge_1I06 (ppm)

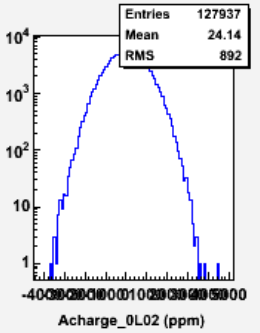

Entries 127937
Mean -15.16
RMS 727.5
Acharge_0I02 (ppm)

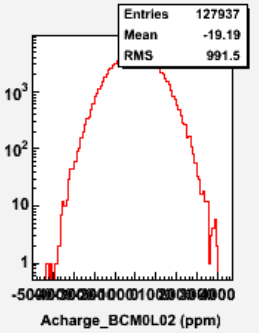

Entries 127937
Mean -14.57
RMS 865.1
Acharge_0I02A (ppm)

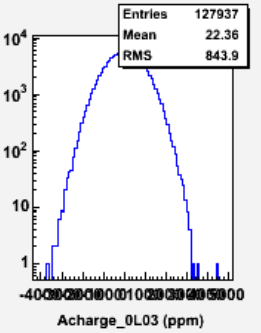

Entries 127937
Mean -15.14
RMS 855.9
Acharge_0I05 (ppm)

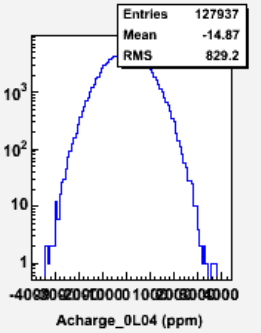

Entries 127937
Mean -16.76
RMS 890.9
Acharge_0I07 (ppm)

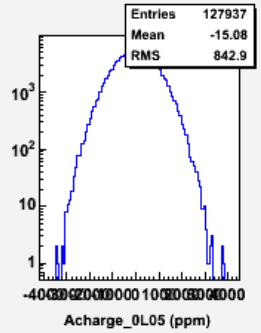

Entries 127937
Mean -15.46
RMS 844
Acharge_0L01 (ppm)

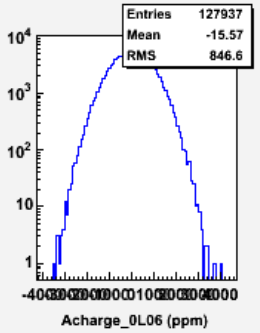

Entries 127937
Mean 24.14
RMS 892
Acharge_0L02 (ppm)

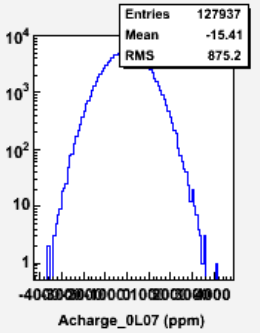

Entries 127937
Mean -19.19
RMS 991.5
Acharge_BCM0L02 (ppm)

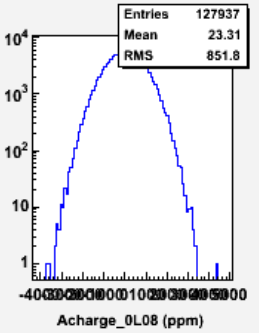

Entries 127937
Mean 22.36
RMS 843.9
Acharge_0L03 (ppm)

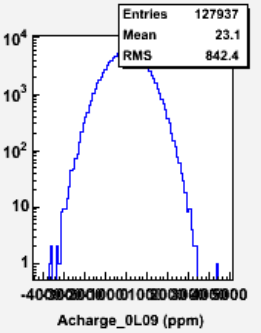

Entries 127937
Mean -14.87
RMS 829.2
Acharge_0L04 (ppm)

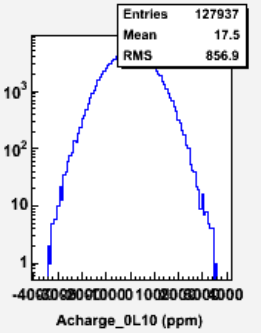

Entries 127937
Mean -15.08
RMS 842.9
Acharge_0L05 (ppm)

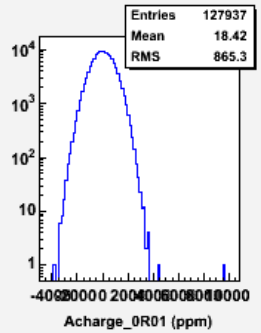

Entries 127937
Mean -15.57
RMS 846.6
Acharge_0L06 (ppm)

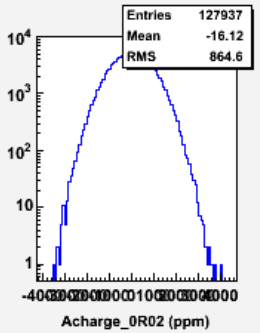

Entries 127937
Mean -15.41
RMS 875.2
Acharge_0L07 (ppm)

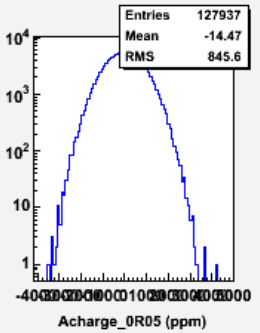

Entries 127937
Mean 23.31
RMS 851.8
Acharge_0L08 (ppm)

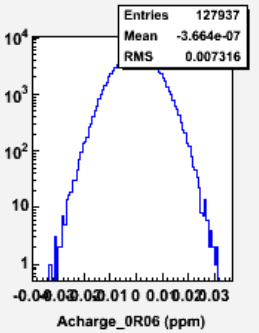

Entries 127937
Mean 23.1
RMS 842.4
Acharge_0L09 (ppm)

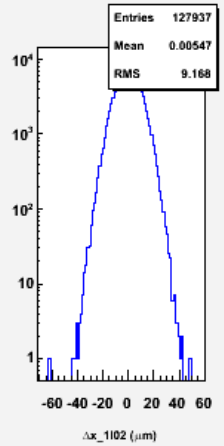

Entries 127937
Mean 17.5
RMS 856.9
Acharge_0L10 (ppm)

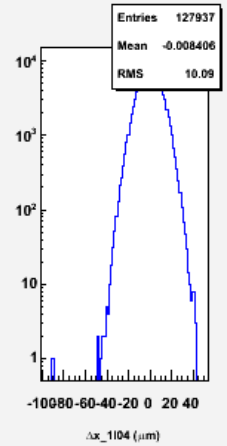

Entries 127937
Mean 18.42
RMS 865.3
Acharge_0R01 (ppm)

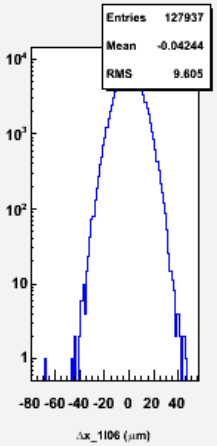

Entries 127937
Mean -16.12
RMS 864.6
Acharge_0R02 (ppm)

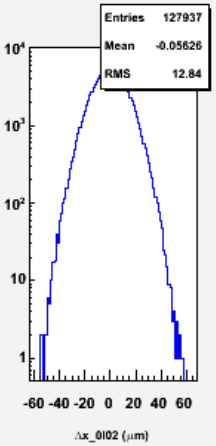

Entries 127937
Mean -14.47
RMS 845.6
Acharge_0R05 (ppm)

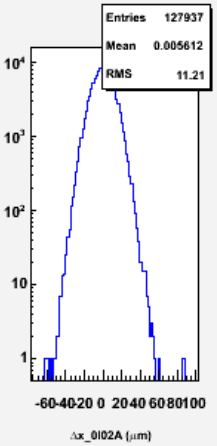

Entries 127937
Mean -3.664e-07
RMS 0.007316
Acharge_0R06 (ppm)

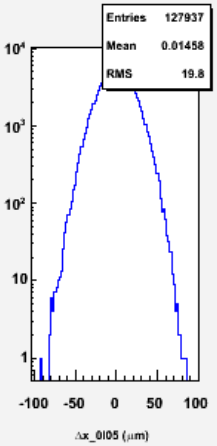

Entries 127937
Mean 0.00547
RMS 9.168
Δx_1102 (μm)

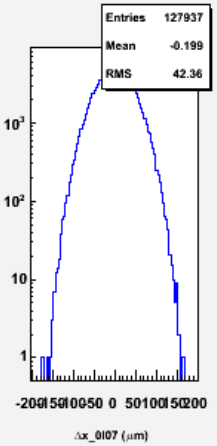

Entries 127937
Mean -0.008406
RMS 10.09
Δx_1104 (μm)

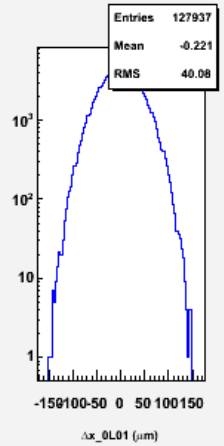

Entries 127937
Mean -0.04244
RMS 9.605
Δx_1106 (μm)

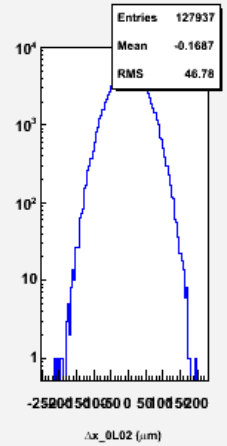

Entries 127937
Mean -0.05626
RMS 12.84
Δx_0102 (μm)

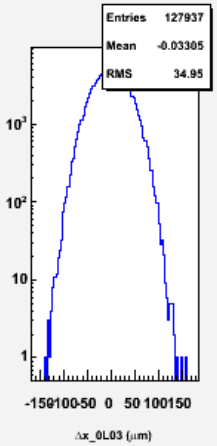

Entries 127937
Mean 0.005612
RMS 11.21
Δx_0102A (μm)

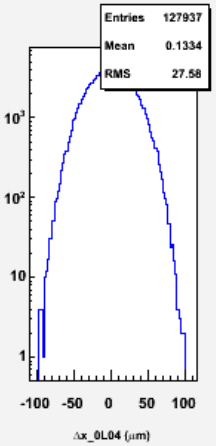

Entries 127937
Mean 0.01458
RMS 19.8
Δx_0105 (μm)

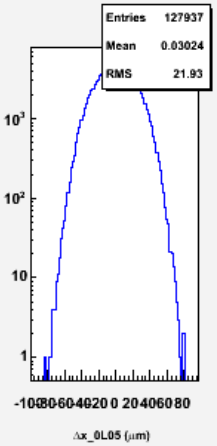

Entries 127937
Mean -0.199
RMS 42.36
Δx_0107 (μm)

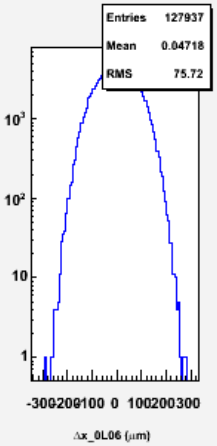

Entries 127937
Mean -0.221
RMS 40.08
Δx_0L01 (μm)

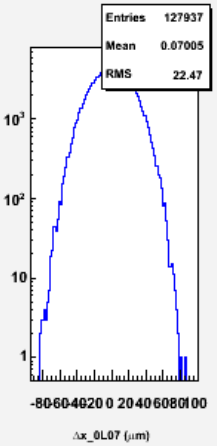

Entries 127937
Mean -0.1687
RMS 46.78
Δx_0L02 (μm)

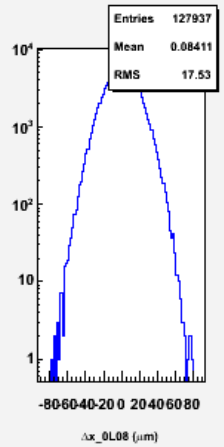

Entries 127937
Mean -0.03305
RMS 34.95
Δx_0L03 (μm)

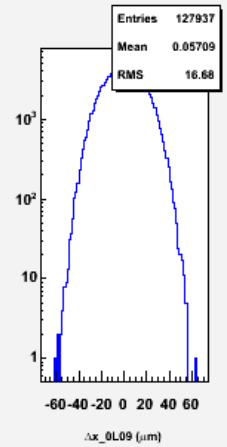

Entries 127937
Mean 0.1334
RMS 27.58
Δx_0L04 (μm)

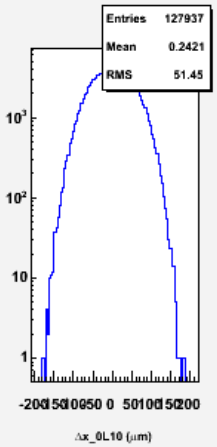

Entries 127937
Mean 0.03024
RMS 21.93
Δx_0L05 (μm)

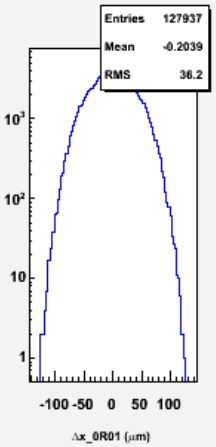

Entries 127937
Mean 0.04718
RMS 75.72
Δx_0L06 (μm)

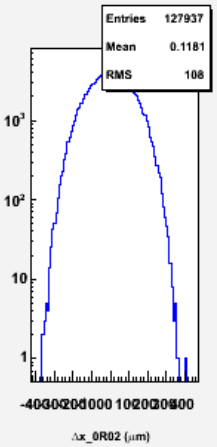

Entries 127937
Mean 0.07005
RMS 22.47
Δx_0L07 (μm)

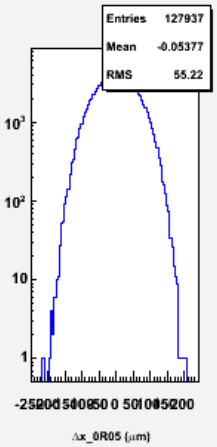

Entries 127937
Mean 0.08411
RMS 17.53
Δx_0L08 (μm)

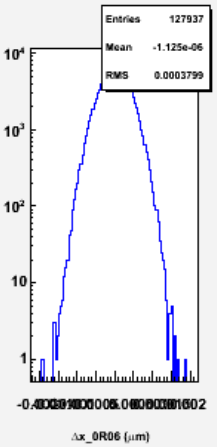

Entries 127937
Mean 0.05709
RMS 16.68
Δx_0L09 (μm)

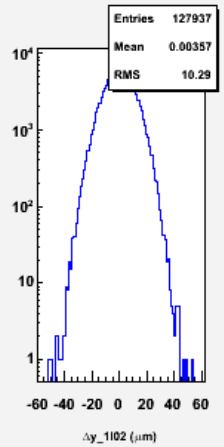

Entries 127937
Mean 0.2421
RMS 51.45
Δx_0L10 (μm)

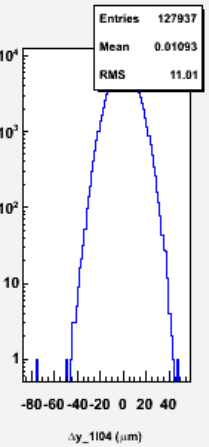

Entries 127937
Mean -0.2039
RMS 36.2
Δx_0R01 (μm)

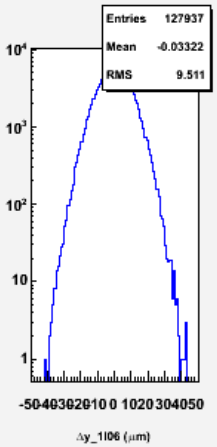

Entries 127937
Mean 0.1181
RMS 108
Δx_0R02 (μm)

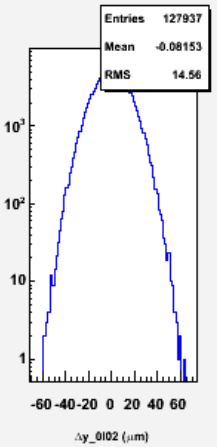

Entries 127937
Mean -0.05377
RMS 55.22
Δx_0R05 (μm)

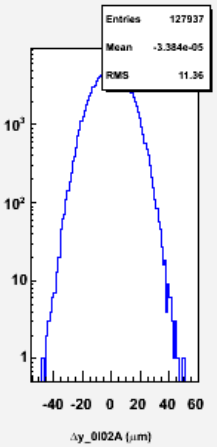

Entries 127937
Mean -1.125e-06
RMS 0.0003799
Δx_0R06 (μm)

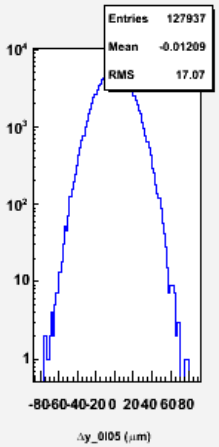

Entries 127937
Mean 0.00357
RMS 10.29
Δy_1I02 (μm)

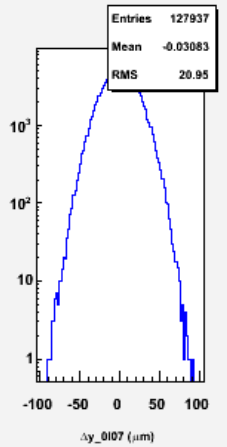

Entries 127937
Mean 0.01093
RMS 11.01
Δy_1I04 (μm)

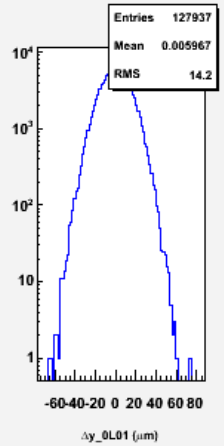

Entries 127937
Mean -0.03322
RMS 9.511
Δy_1I06 (μm)

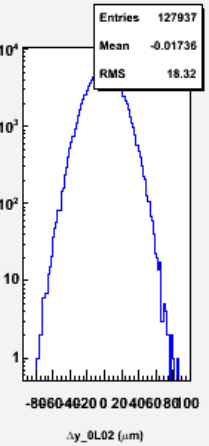

Entries 127937
Mean -0.08153
RMS 14.56
Δy_0I02 (μm)

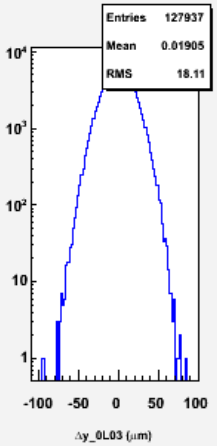

Entries 127937
Mean -3.384e-05
RMS 11.36
Δy_0I02A (μm)

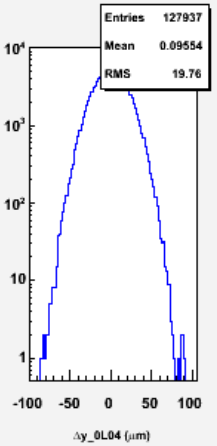

Entries 127937
Mean -0.01209
RMS 17.07
Δy_0I05 (μm)

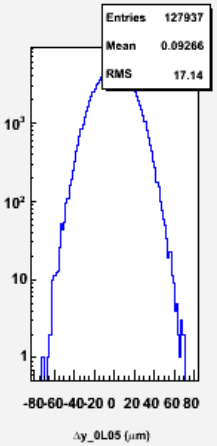

Entries 127937
Mean -0.03083
RMS 20.95
Δy_0I07 (μm)

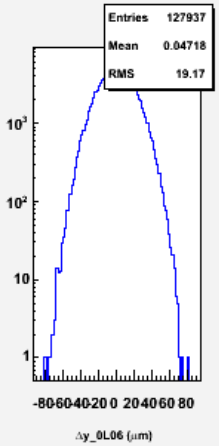

Entries 127937
Mean 0.005967
RMS 14.2
Δy_0L01 (μm)

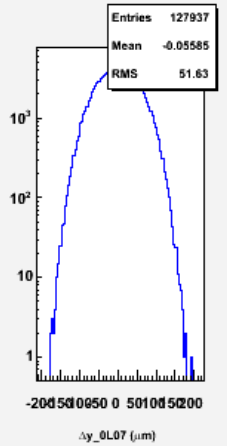

Entries 127937
Mean -0.01736
RMS 18.32
Δy_0L02 (μm)

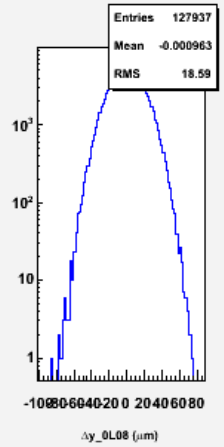

Entries 127937
Mean 0.01905
RMS 18.11
Δy_0L03 (μm)

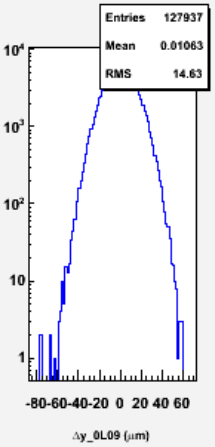

Entries 127937
Mean 0.09554
RMS 19.76
Δy_0L04 (μm)

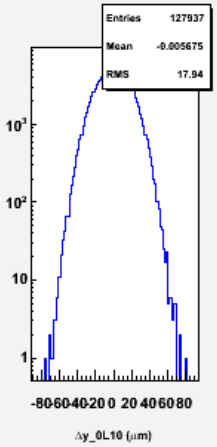

Entries 127937
Mean 0.09266
RMS 17.14
Δy_0L05 (μm)

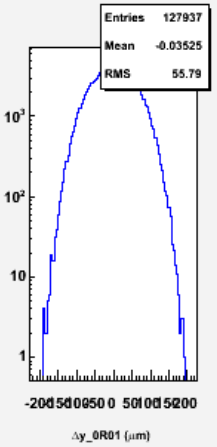

Entries 127937
Mean 0.04718
RMS 19.17
Δy_0L06 (μm)

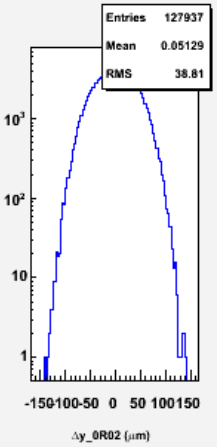

Entries 127937
Mean -0.05585
RMS 51.63
Δy_0L07 (μm)

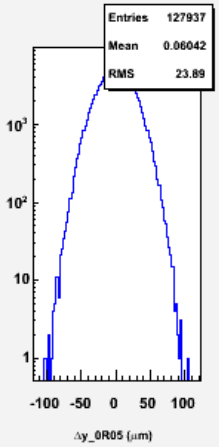

Entries 127937
Mean -0.000963
RMS 18.59
Δy_0L08 (μm)

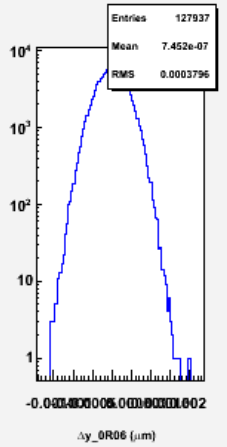

Entries 127937
Mean 0.01063
RMS 14.63
Δy_0L09 (μm)

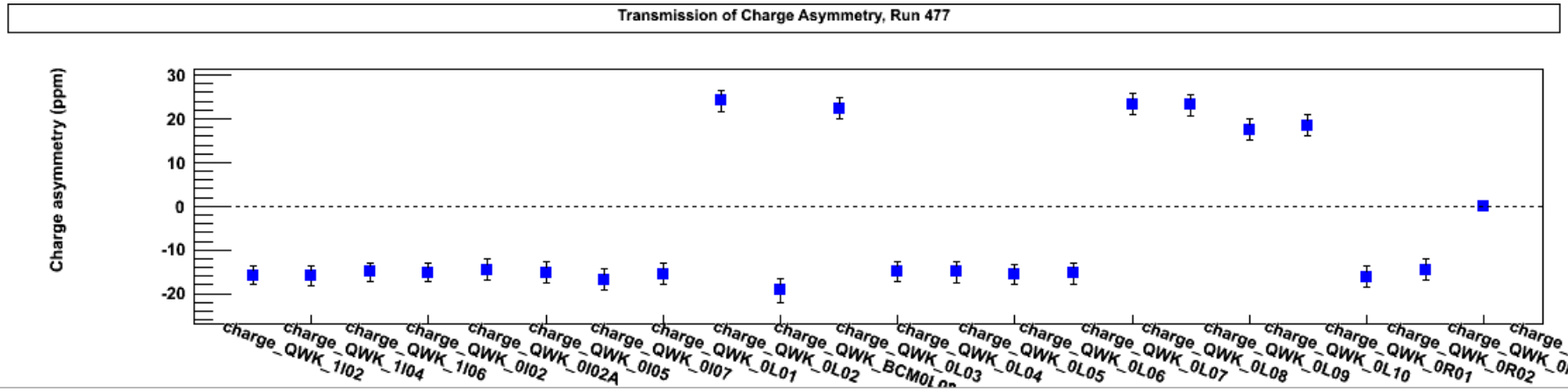

Entries 127937
Mean -0.005675
RMS 17.94
Δy_0L10 (μm)

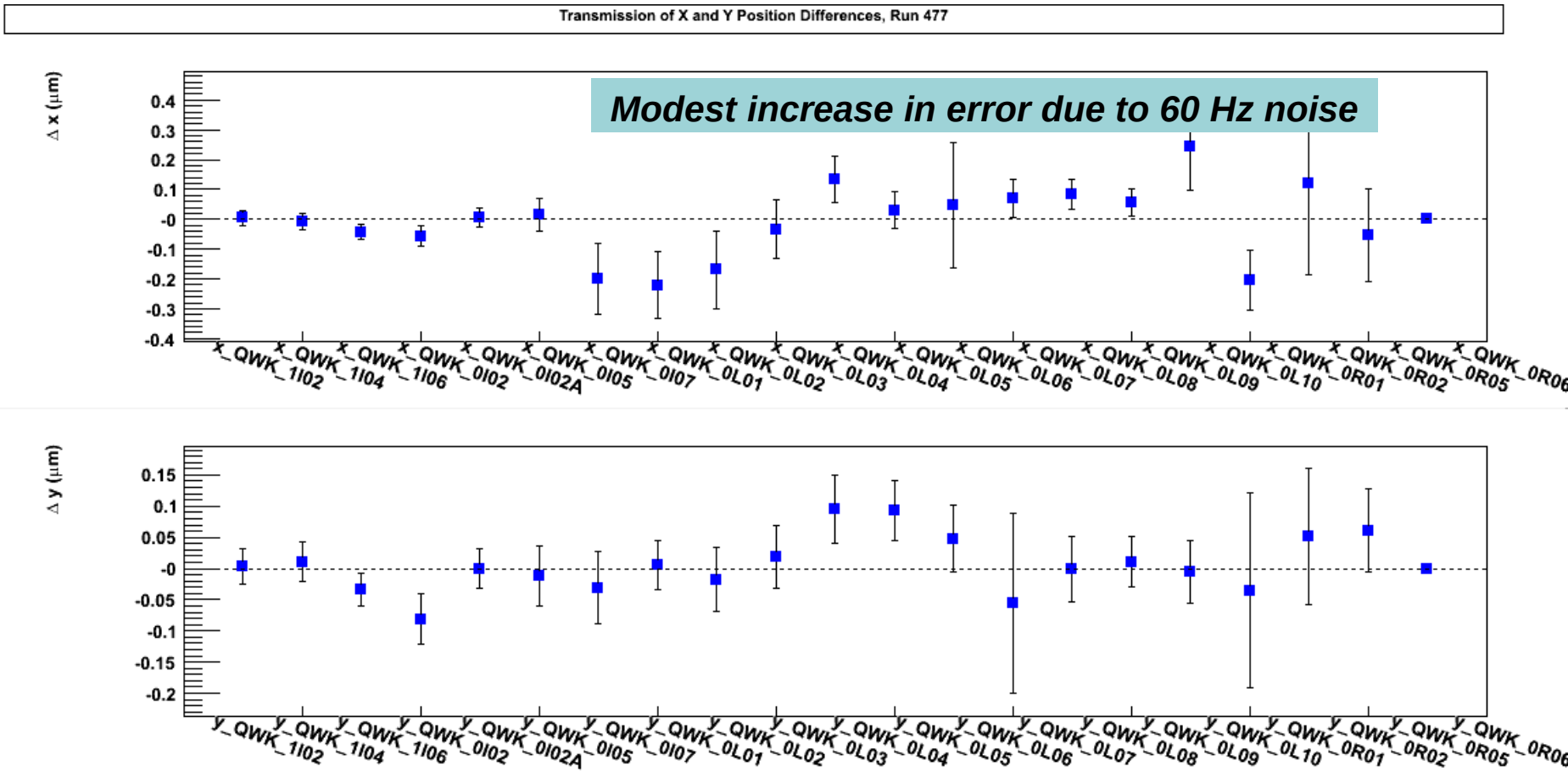

Entries 127937
Mean -0.03525
RMS 55.79
Δy_0R01 (μm)


Entries 127937
Mean 0.05129
RMS 38.81
Δy_0R02 (μm)

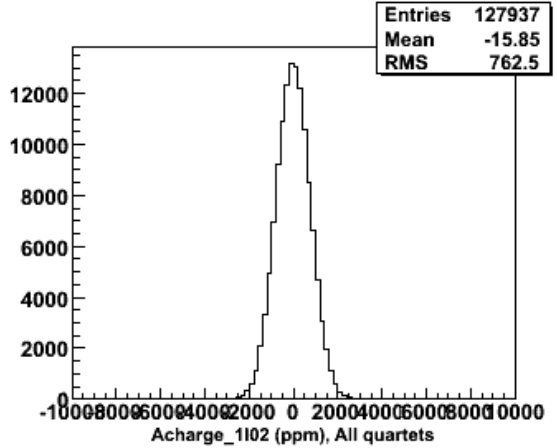

Entries 127937
Mean 0.06042
RMS 23.89
Δy_0R05 (μm)


Entries 127937
Mean 7.452e-07
RMS 0.0003796
Δy_0R06 (μm)



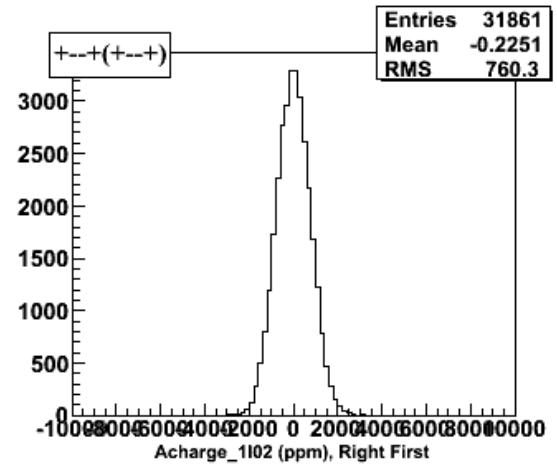


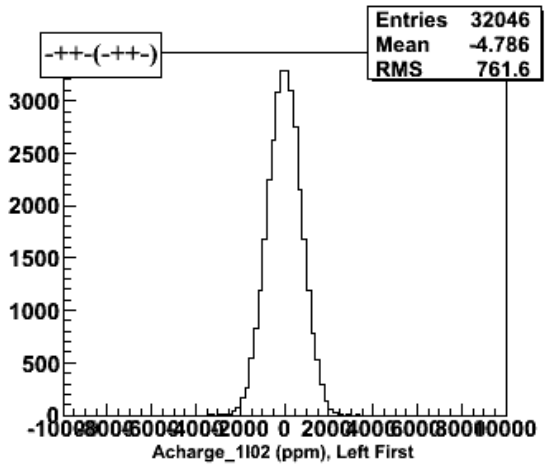
Modest increase in error due to 60 Hz noise

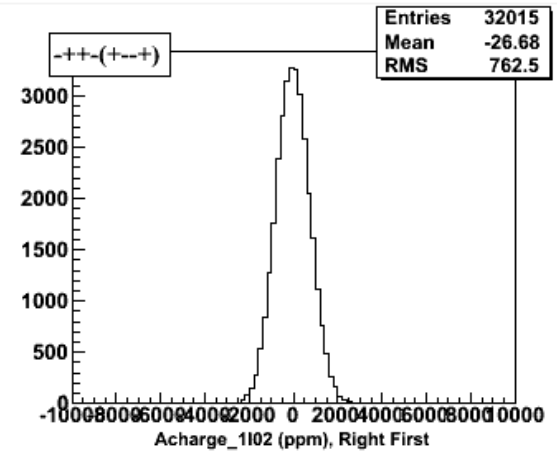


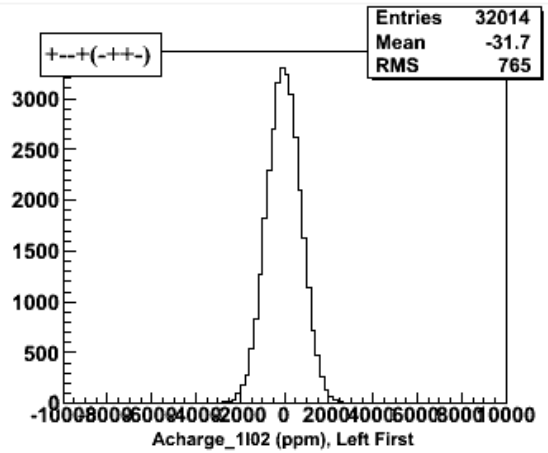
Run 477

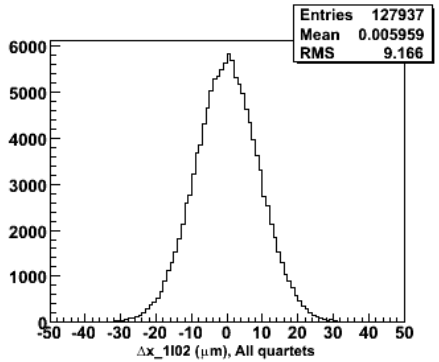
Charge Asymmetry



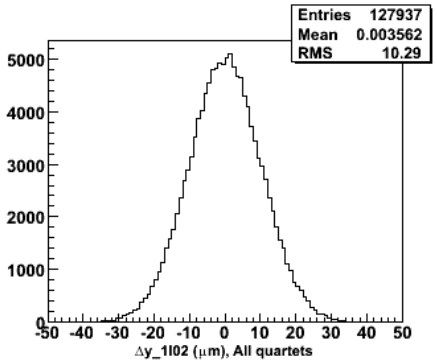




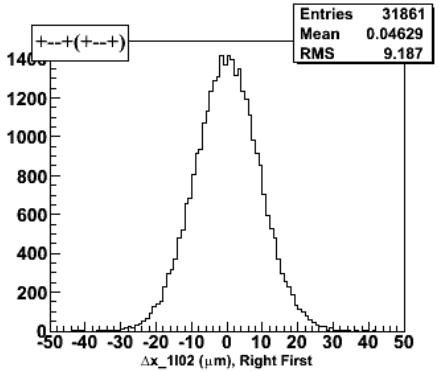


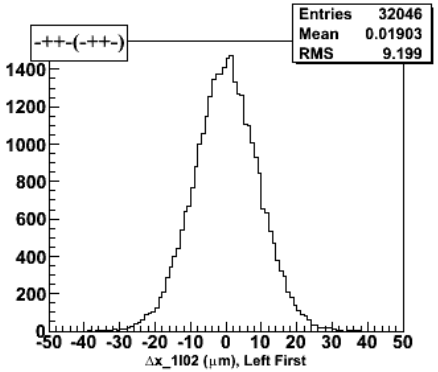


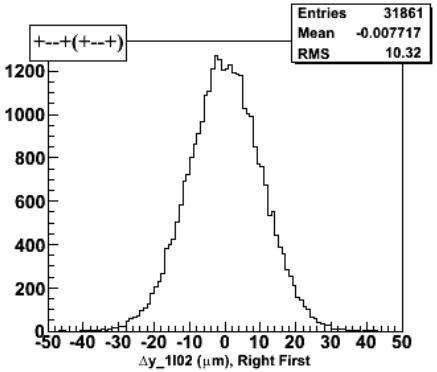
Run 477

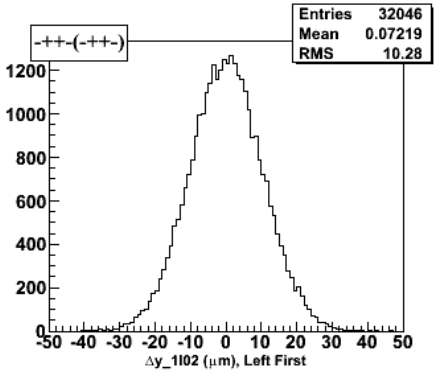


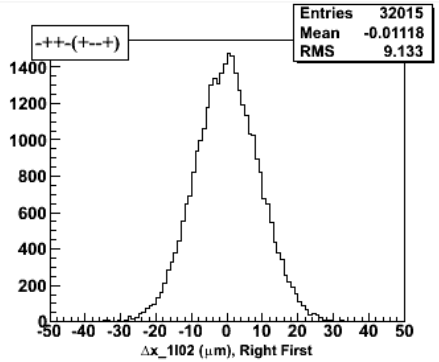
Run 477

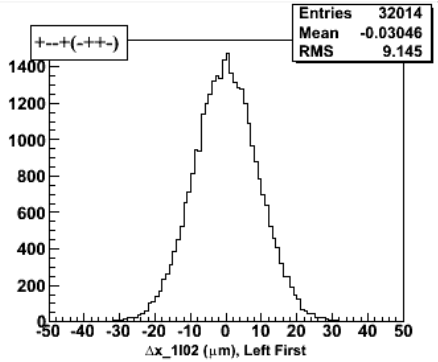


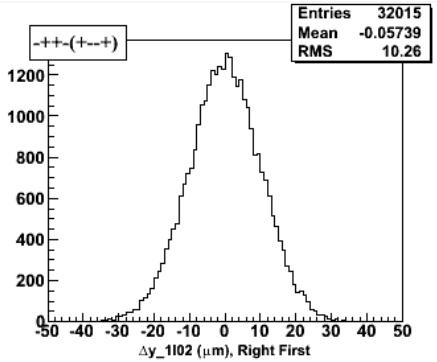


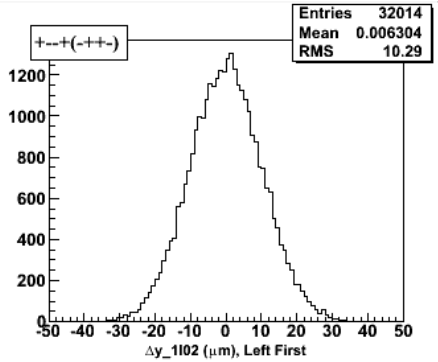


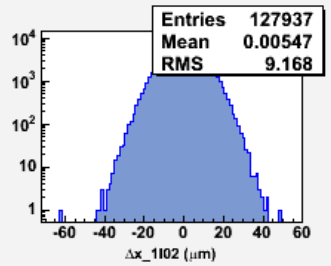


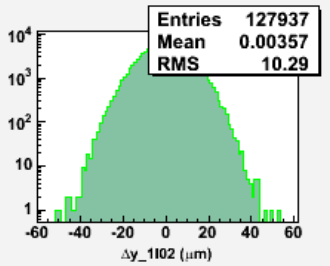


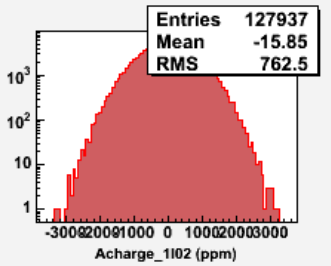


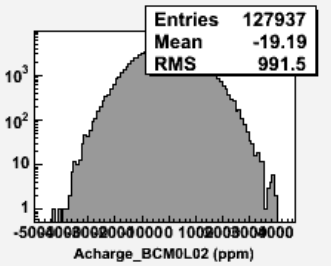


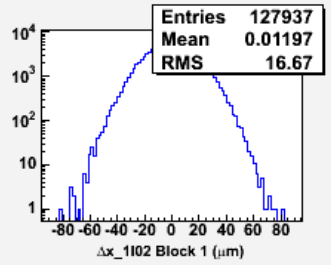


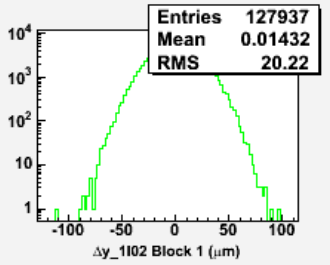

Entries 127937
Mean 0.00547
RMS 9.168
Δx_1I02 (μm)

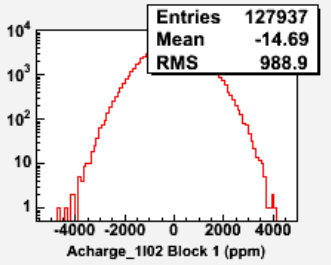

Entries 127937
Mean 0.00357
RMS 10.29
Δy_1I02 (μm)

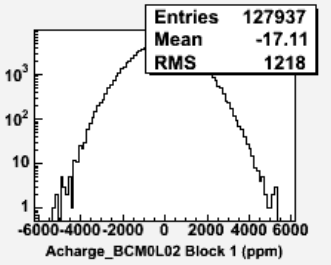

Entries 127937
Mean -15.85
RMS 762.5
Acharge_1I02 (ppm)

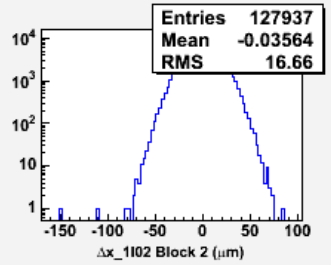

Entries 127937
Mean -19.19
RMS 991.5
Acharge_BCM0L02 (ppm)

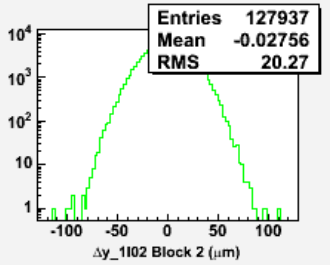

Entries 127937
Mean 0.01197
RMS 16.67
Δx_1I02 Block 1 (μm)

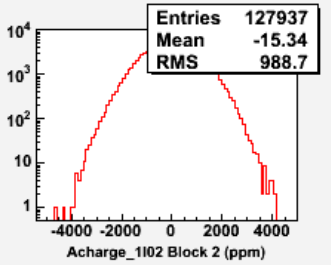

Entries 127937
Mean 0.01432
RMS 20.22
Δy_1I02 Block 1 (μm)

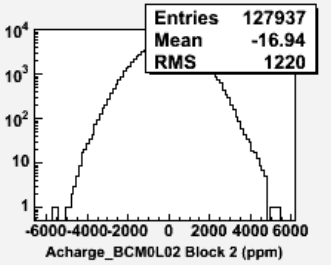

Entries 127937
Mean -14.69
RMS 988.9
Acharge_1I02 Block 1 (ppm)

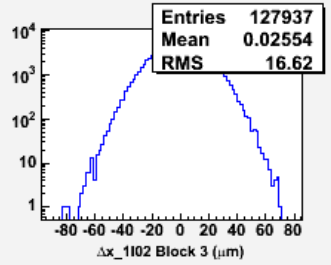

Entries 127937
Mean -17.11
RMS 1218
Acharge_BCM0L02 Block 1 (ppm)

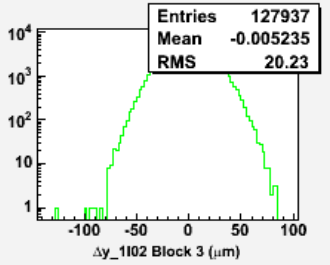

Entries 127937
Mean -0.03564
RMS 16.66
Δx_1I02 Block 2 (μm)

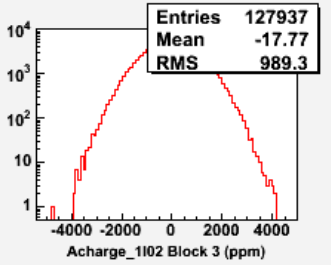

Entries 127937
Mean -0.02756
RMS 20.27
Δy_1I02 Block 2 (μm)

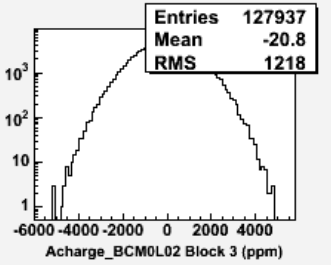

Entries 127937
Mean -15.34
RMS 988.7
Acharge_1I02 Block 2 (ppm)

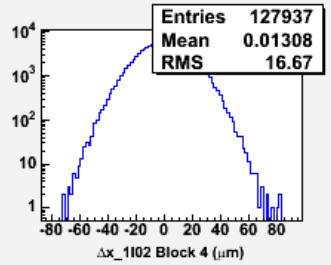

Entries 127937
Mean -16.94
RMS 1220
Acharge_BCM0L02 Block 2 (ppm)

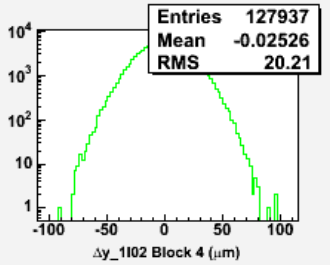

Entries 127937
Mean 0.02554
RMS 16.62
Δx_1I02 Block 3 (μm)

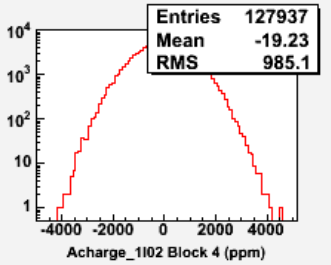

Entries 127937
Mean -0.005235
RMS 20.23
Δy_1I02 Block 3 (μm)

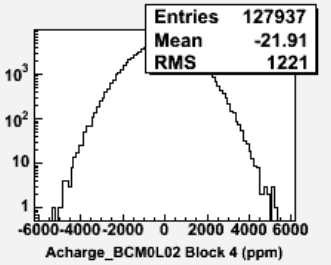

Entries 127937
Mean -17.77
RMS 989.3
Acharge_1I02 Block 3 (ppm)

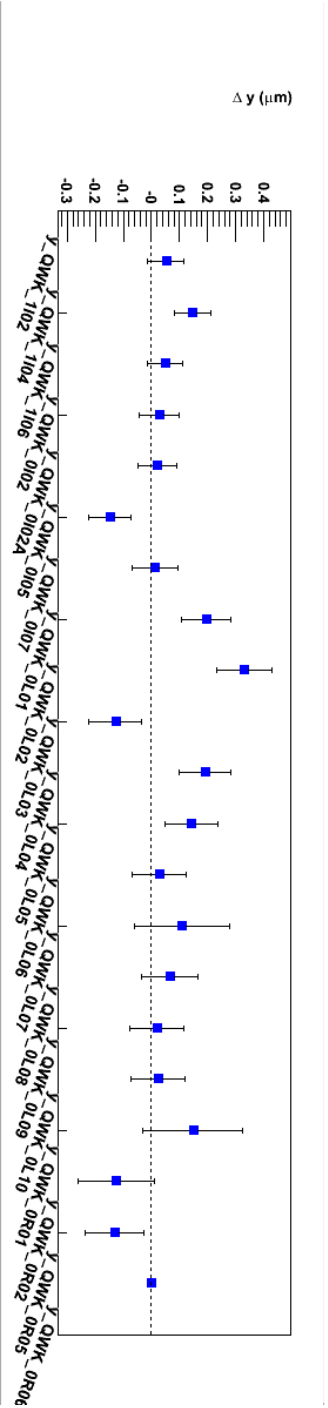

Entries 127937
Mean -20.8
RMS 1218
Acharge_BCM0L02 Block 3 (ppm)

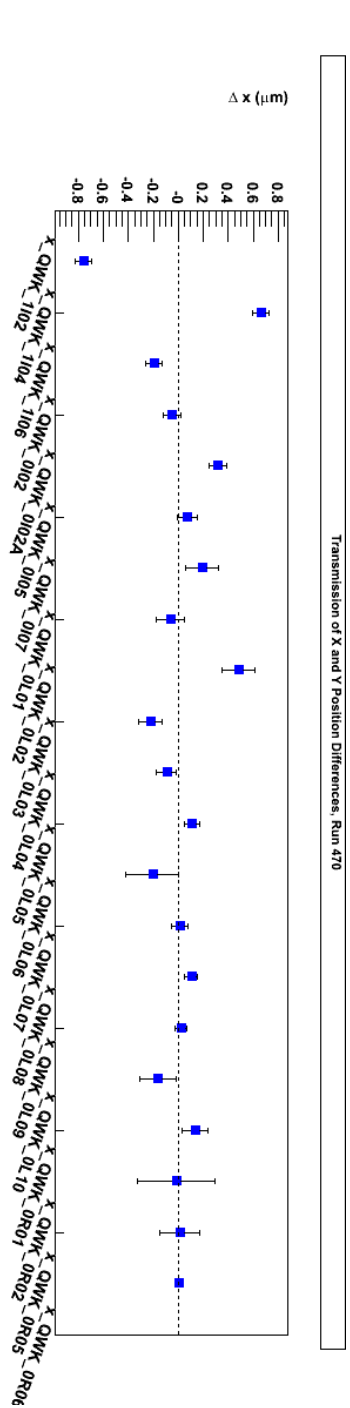

Entries 127937
Mean 0.01308
RMS 16.67
Δx_1I02 Block 4 (μm)

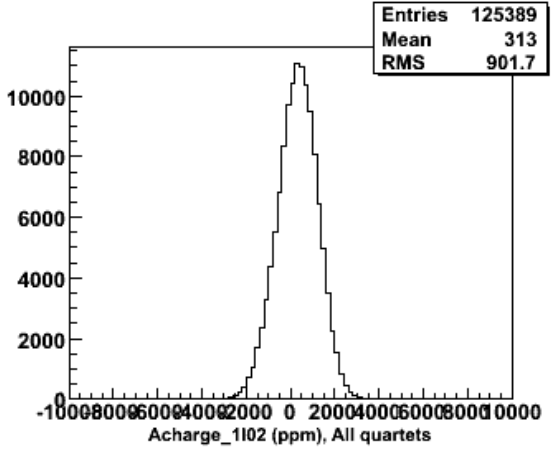

Entries 127937
Mean -0.02526
RMS 20.21
Δy_1I02 Block 4 (μm)


Entries 127937
Mean -19.23
RMS 985.1
Acharge_1I02 Block 4 (ppm)


Entries 127937
Mean -21.91
RMS 1221
Acharge_BCM0L02 Block 4 (ppm)

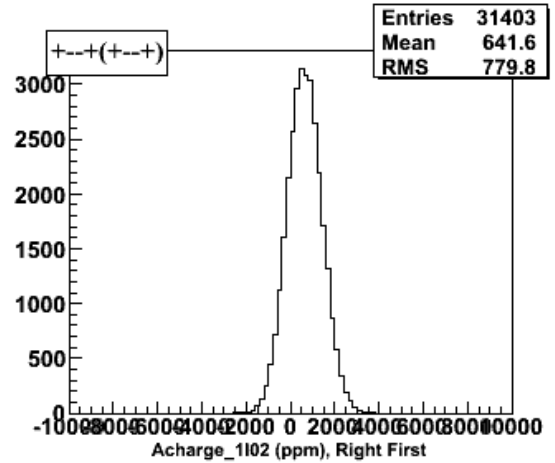


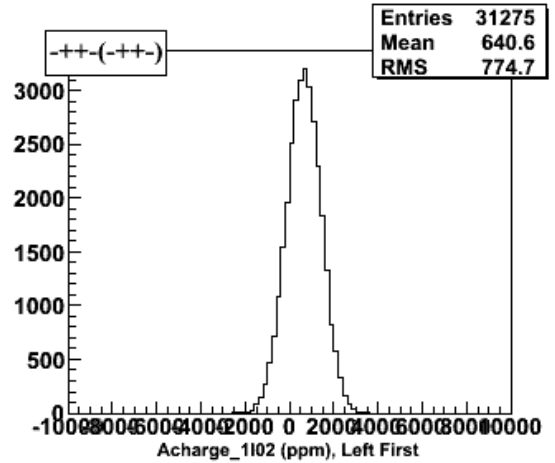


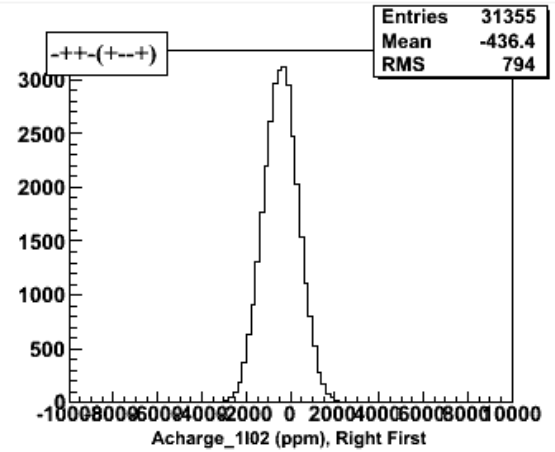


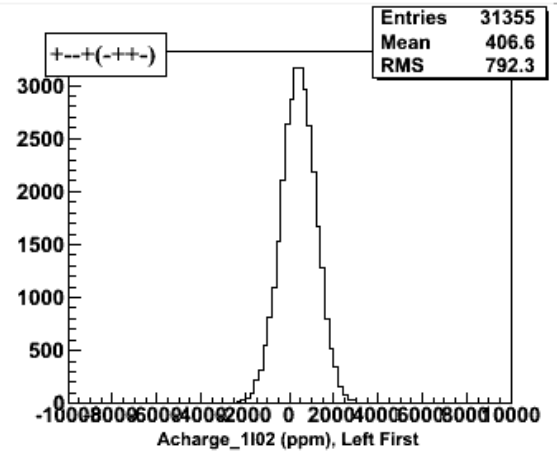
Run 470

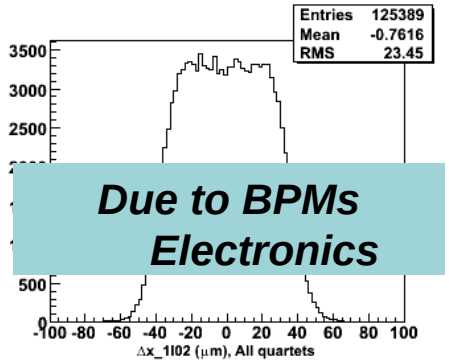
Charge Asymmetry





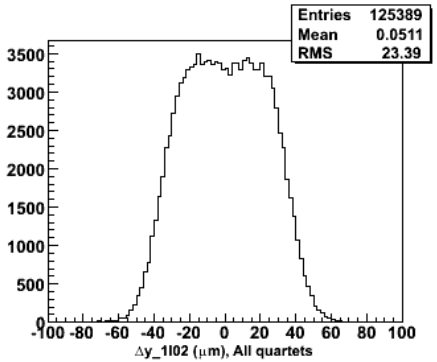




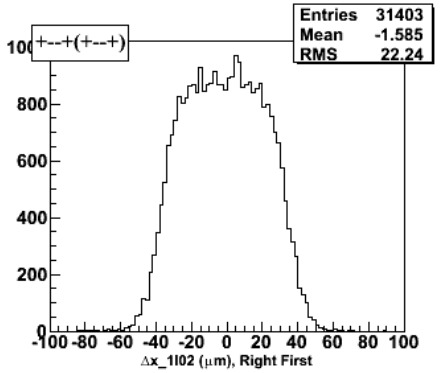


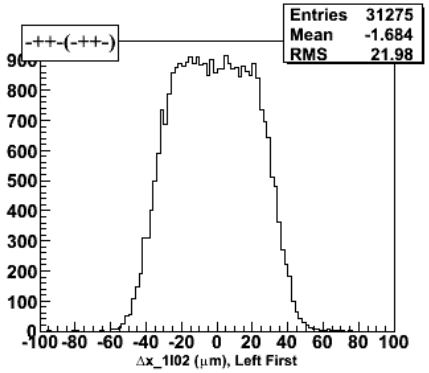
Due to BPMs Electronics

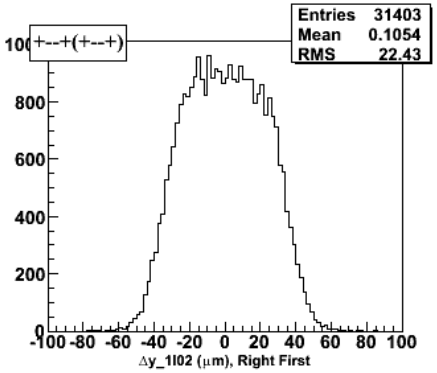
Run 470

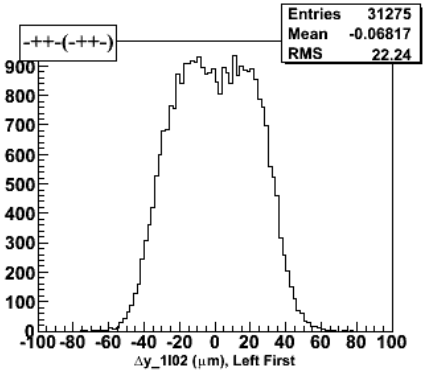


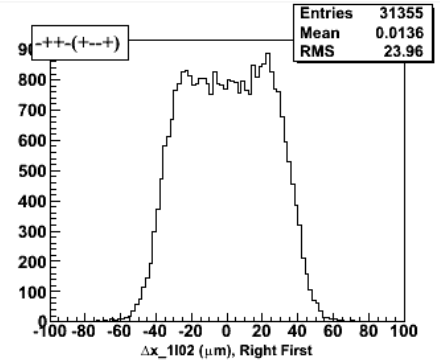
Run 470

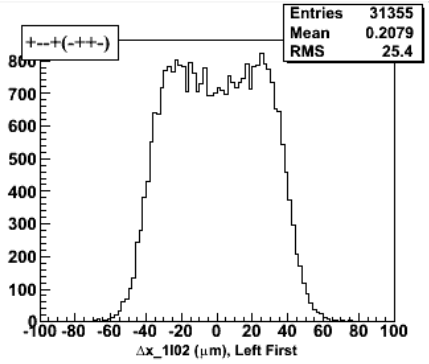


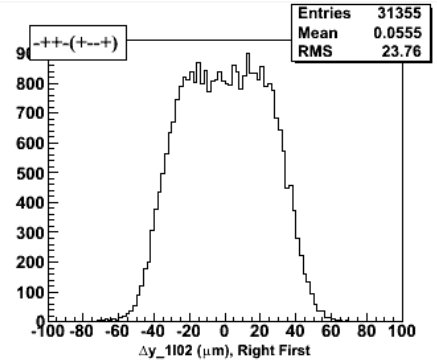


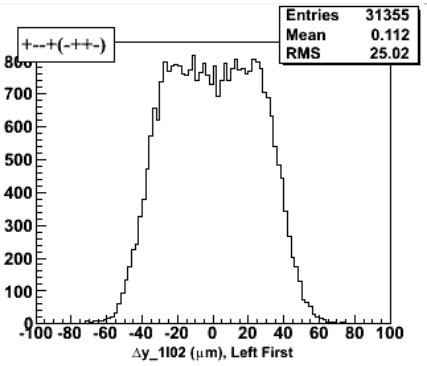


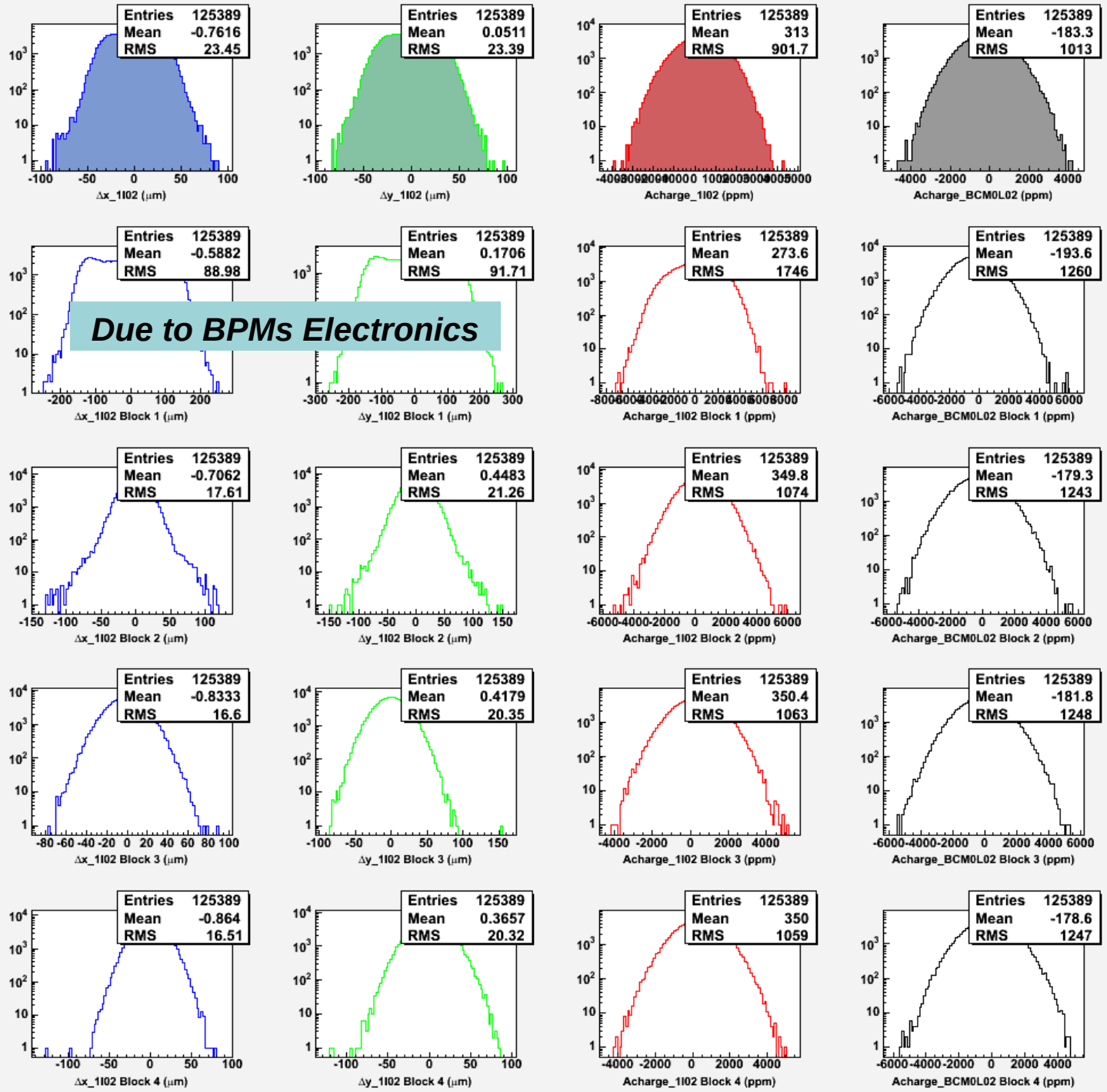




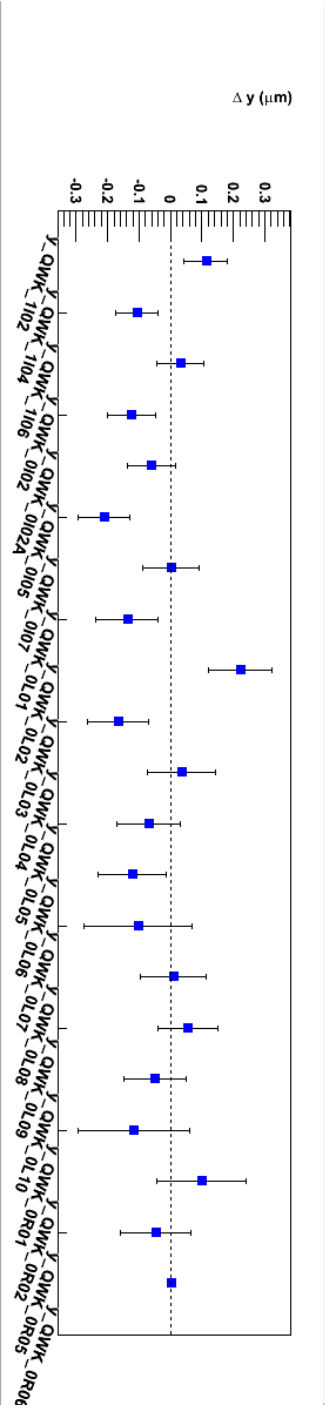


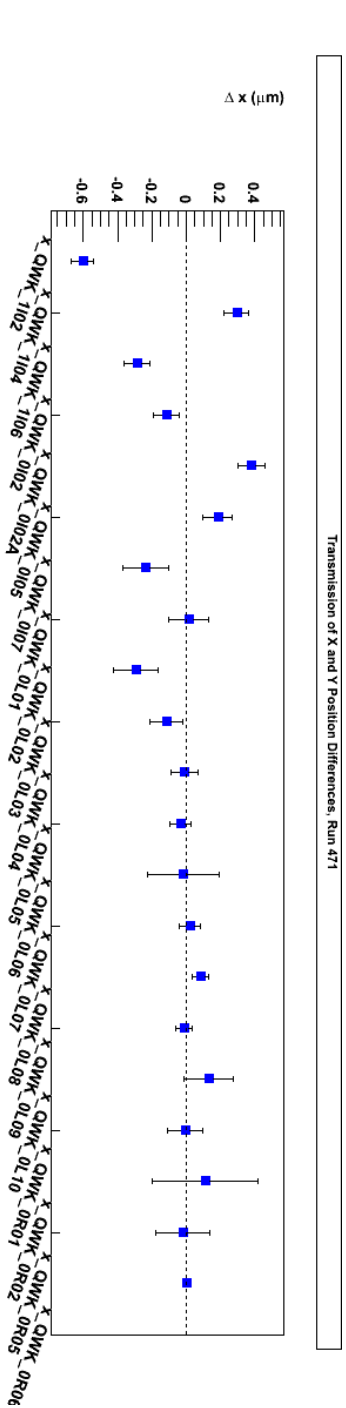


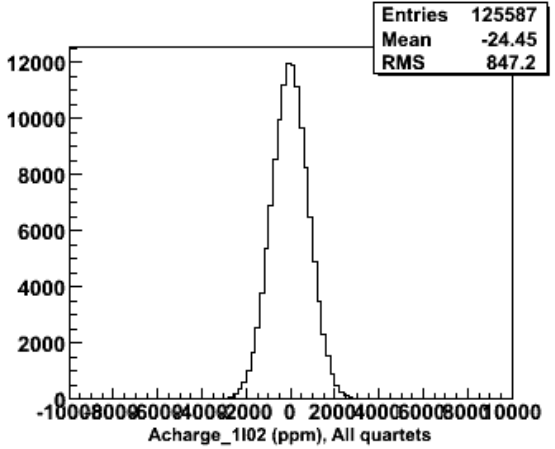




Due to BPMs Electronics

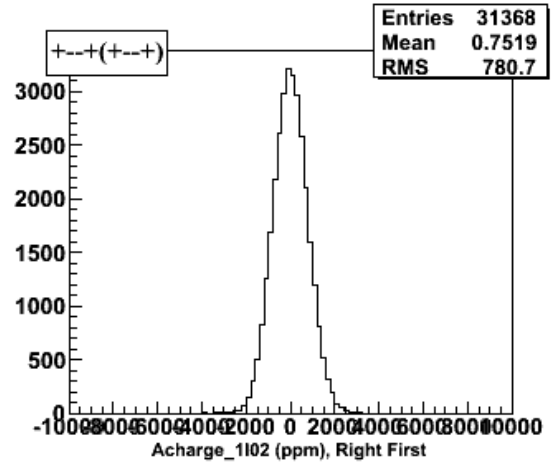


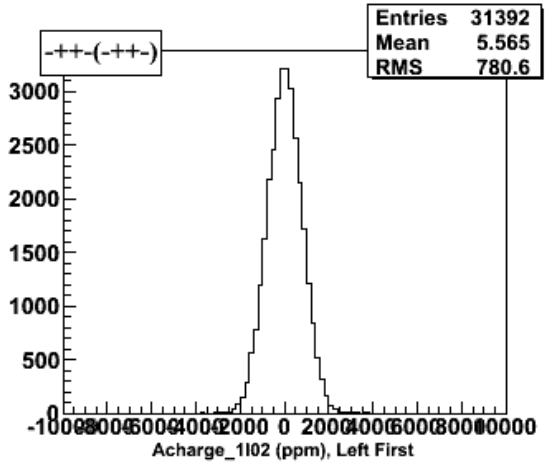


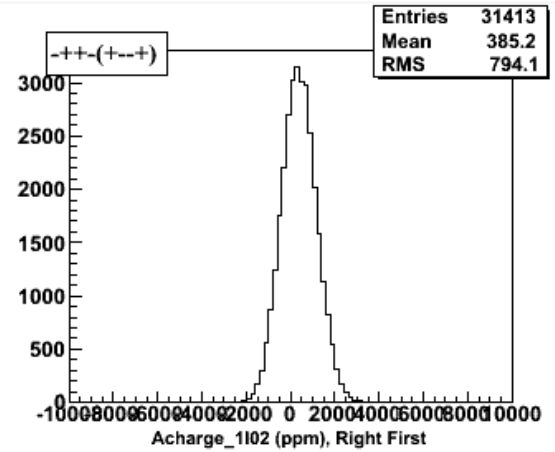


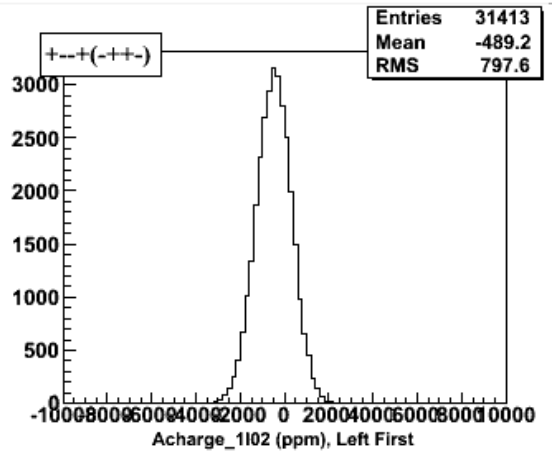
Run 471

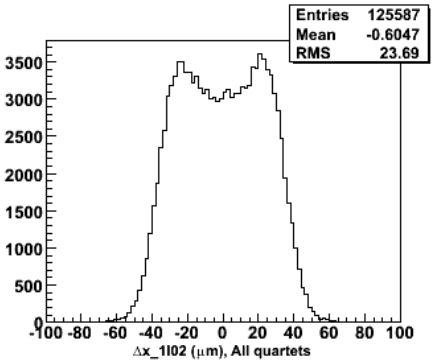
Charge Asymmetry



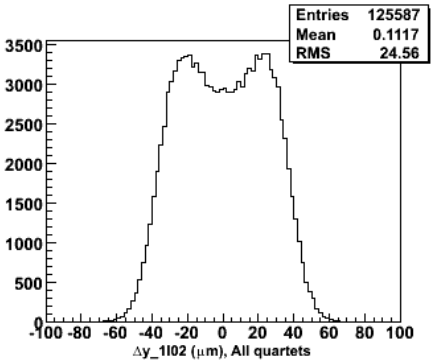




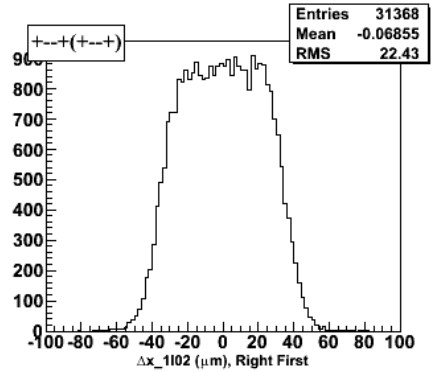


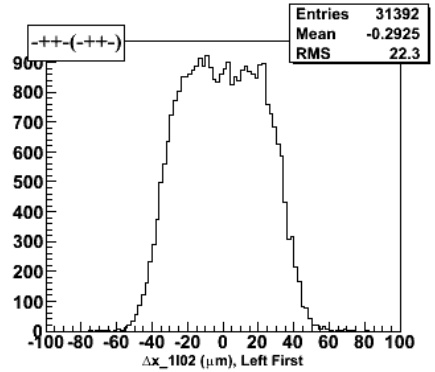


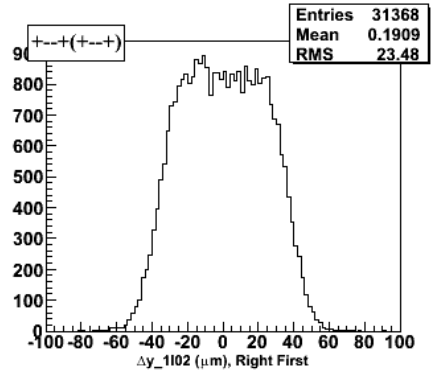
Run 471

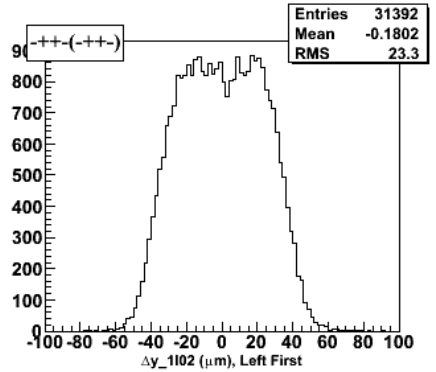


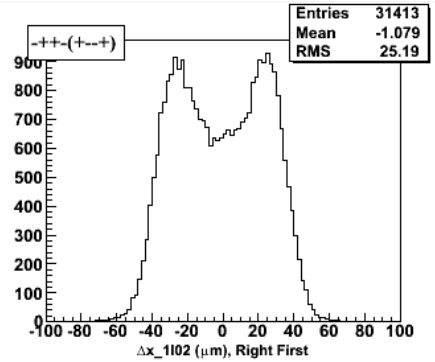
Run 471

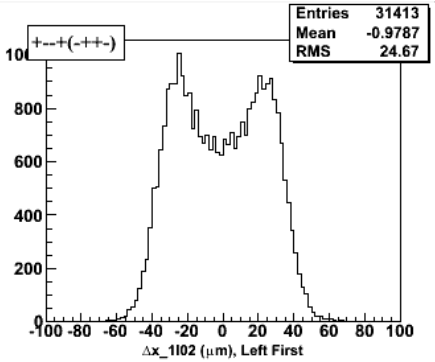


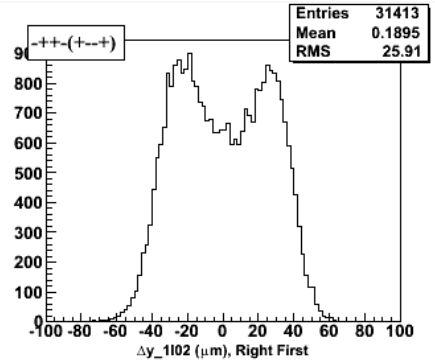


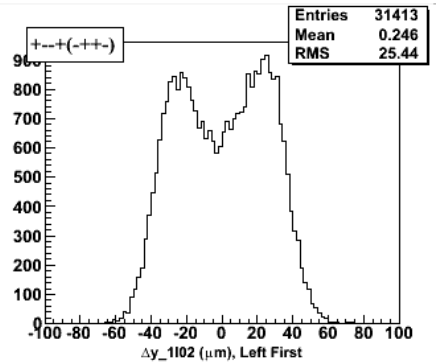


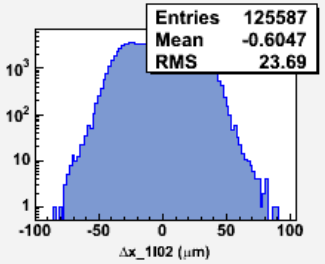


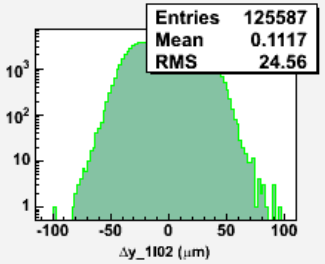


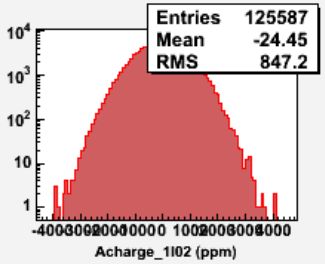


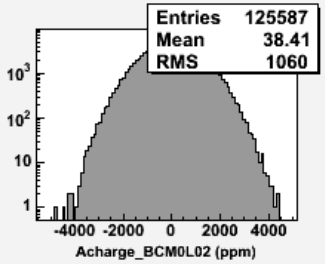


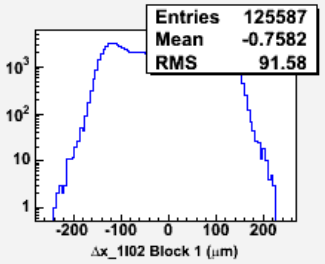


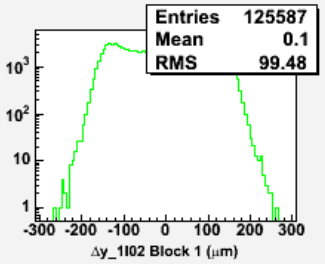

Entries 125587
Mean -0.6047
RMS 23.69
Δx_1I02 (μm)

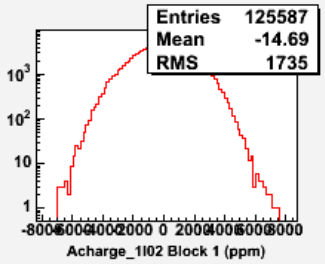

Entries 125587
Mean 0.1117
RMS 24.56
Δy_1I02 (μm)

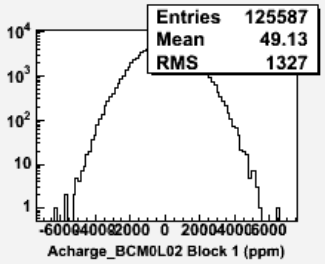

Entries 125587
Mean -24.45
RMS 847.2
Acharge_1I02 (ppm)

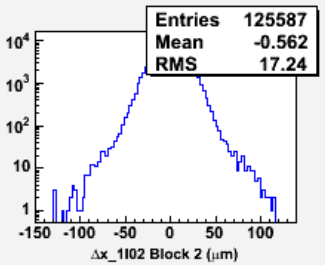

Entries 125587
Mean 38.41
RMS 1060
Acharge_BCM0L02 (ppm)

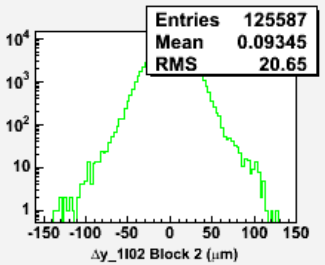

Entries 125587
Mean -0.7582
RMS 91.58
Δx_1I02 Block 1 (μm)

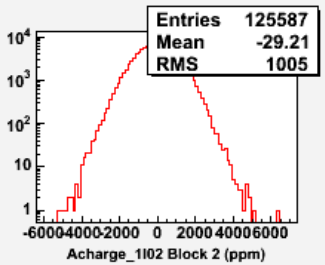

Entries 125587
Mean 0.1
RMS 99.48
Δy_1I02 Block 1 (μm)

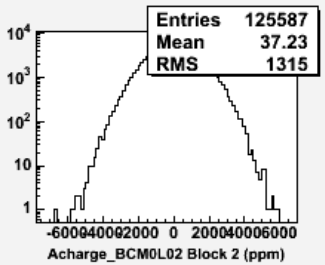

Entries 125587
Mean -14.69
RMS 1735
Acharge_1I02 Block 1 (ppm)

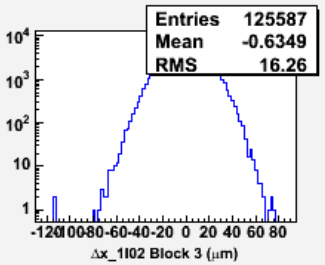

Entries 125587
Mean 49.13
RMS 1327
Acharge_BCM0L02 Block 1 (ppm)

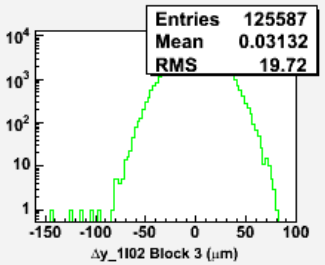

Entries 125587
Mean -0.562
RMS 17.24
Δx_1I02 Block 2 (μm)

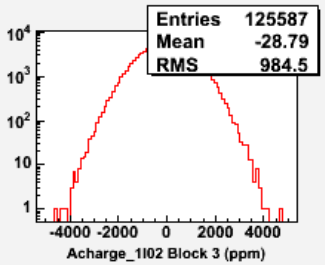

Entries 125587
Mean 0.09345
RMS 20.65
Δy_1I02 Block 2 (μm)

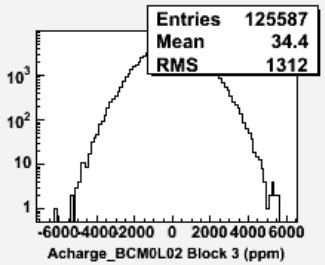

Entries 125587
Mean -29.21
RMS 1005
Acharge_1I02 Block 2 (ppm)

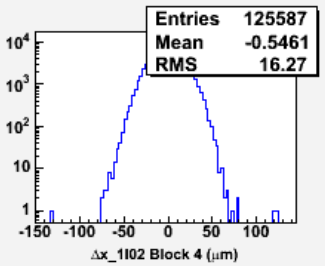

Entries 125587
Mean 37.23
RMS 1315
Acharge_BCM0L02 Block 2 (ppm)

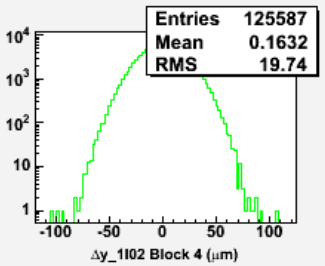

Entries 125587
Mean -0.6349
RMS 16.26
Δx_1I02 Block 3 (μm)

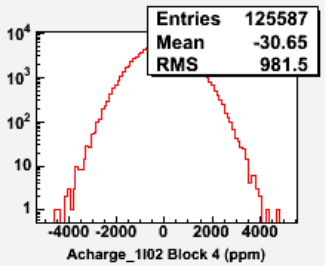

Entries 125587
Mean 0.03132
RMS 19.72
Δy_1I02 Block 3 (μm)

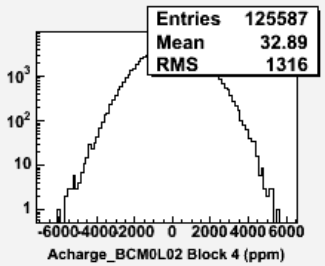

Entries 125587
Mean -28.79
RMS 984.5
Acharge_1I02 Block 3 (ppm)


Entries 125587
Mean 34.4
RMS 1312
Acharge_BCM0L02 Block 3 (ppm)


Entries 125587
Mean -0.5461
RMS 16.27
Δx_1I02 Block 4 (μm)


Entries 125587
Mean 0.1632
RMS 19.74
Δy_1I02 Block 4 (μm)


Entries 125587
Mean -30.65
RMS 981.5
Acharge_1I02 Block 4 (ppm)

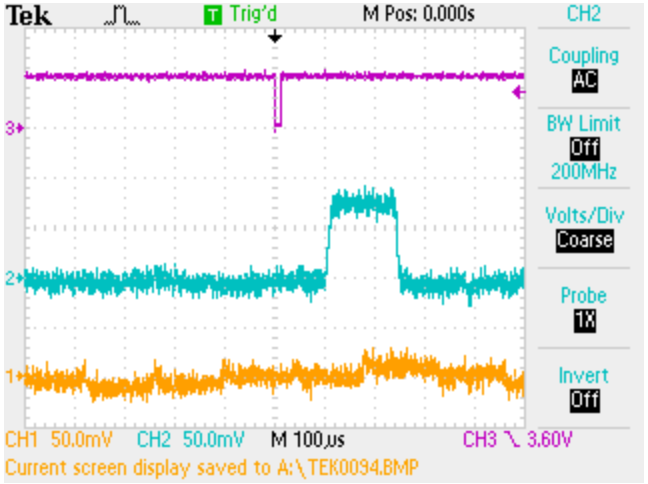

Entries 125587
Mean 32.89
RMS 1316
Acharge_BCM0L02 Block 4 (ppm)

BPMs Electronics

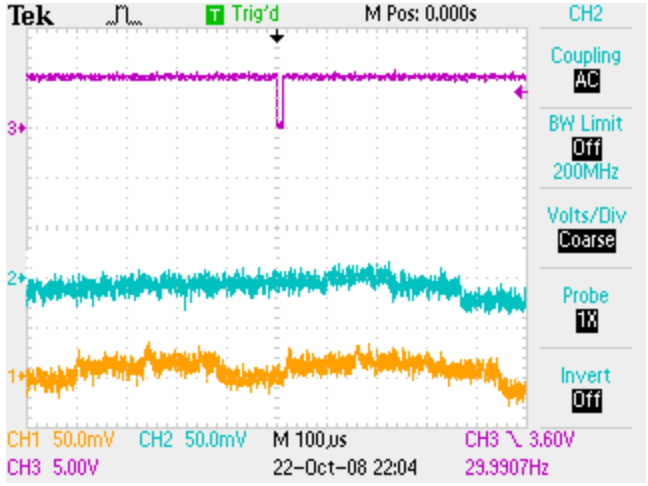
Notes:

1. Chan 1: X+, Chan 2: X-, Chan 3: MPS (Trigger)

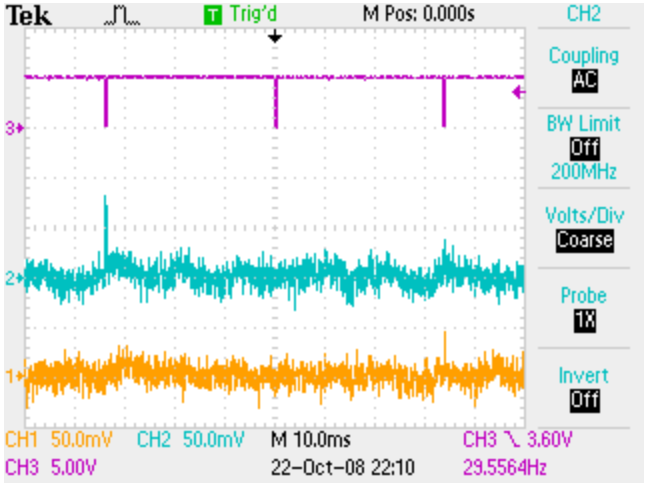
Pockels Cell ON



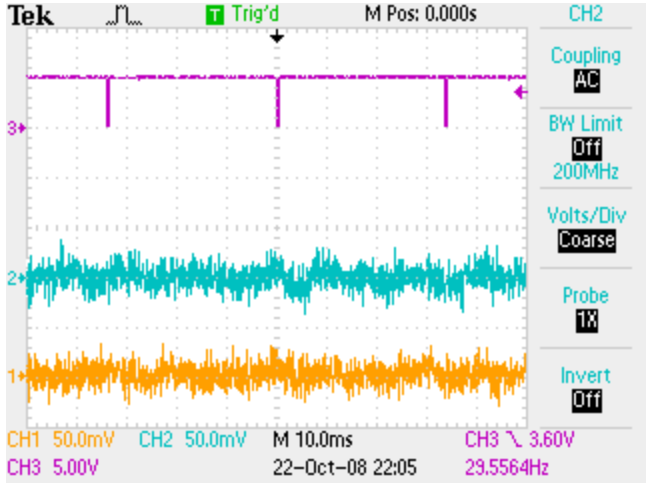
Pockels Cell OFF



Pockels Cell ON



Pockels Cell OFF



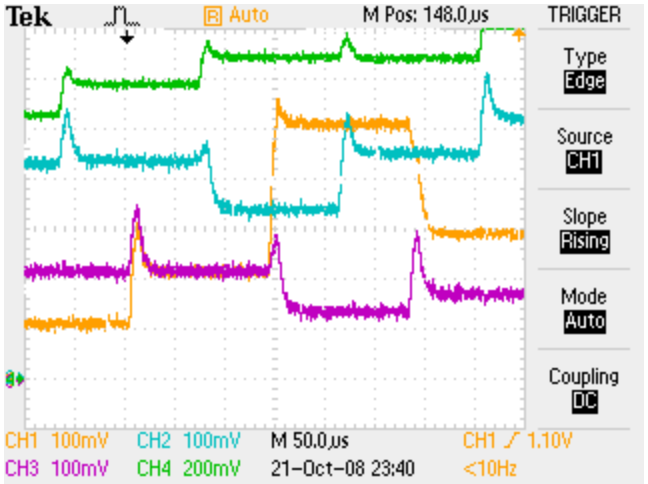
Notes:

1. Injector iocse11, iocse12, and iocse19 have “TRANSPORT” style IF cards

	TRANSPORT	LINAC
Sample Time	140 µs	8.6 µs
Fixed Delay	70 µs	4.3 µs
Dynamic Range	70 nA – 200 µA	700 nA – 2,000 µs

2. To study Pockels Cell Settling Time, should we: Change to LINAC? Use Hall BPMs? Use laser Quad Photodiode (QPD)?

1I02, no beam



Notes:

1. Hall C iocse18 and iocse14 have “TRANSPORT” style IF cards
2. Hall C iocse17 has “LINAC” style IF cards

Search for 60 Hz Noise

✓ Did 60 Hz Noise Search with Extech 480824 EMF Adapter and a Fluke 87

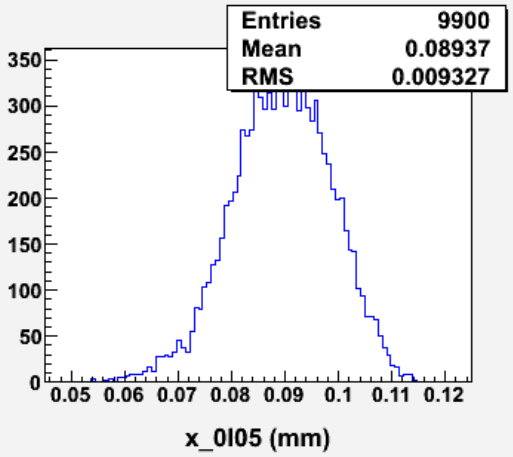
✓ High reading areas:

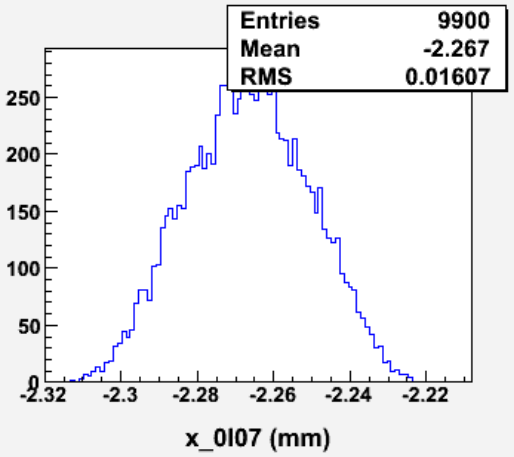
→ PSS 500 keV MBO0I06 Dipole current sensor

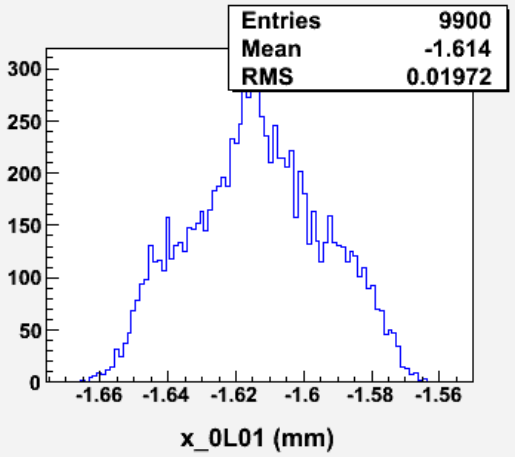
30 Hz

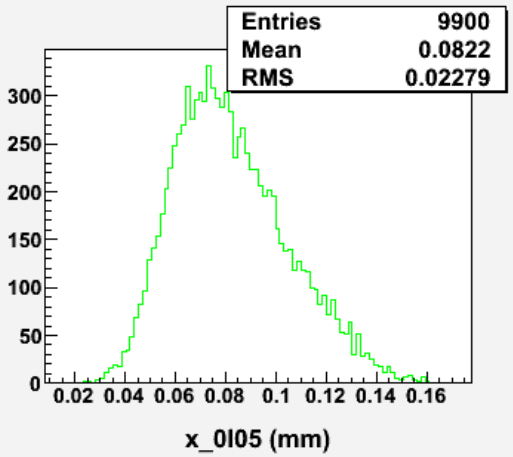
250 Hz

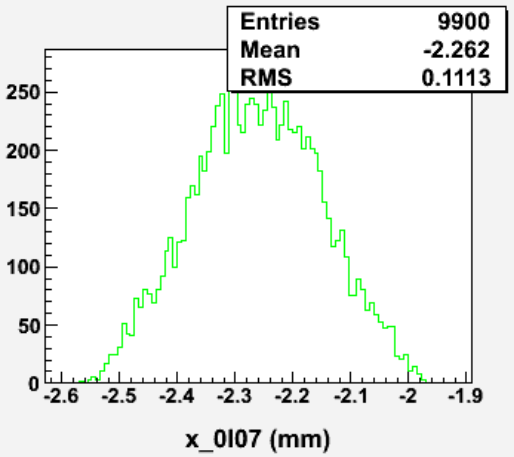
1 kHz

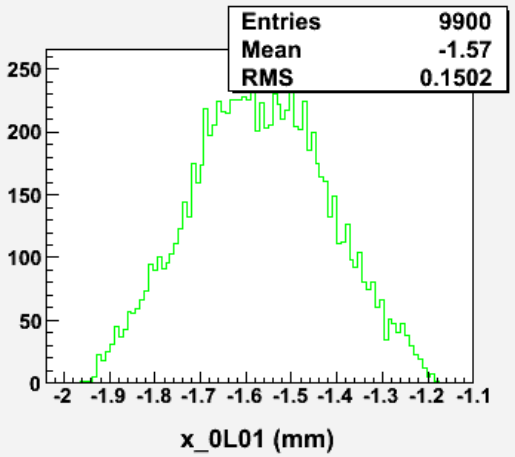


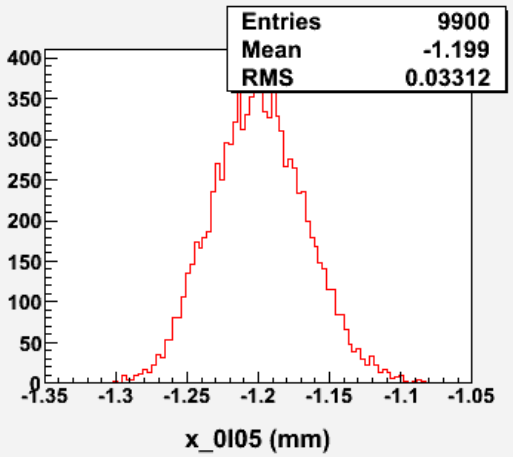


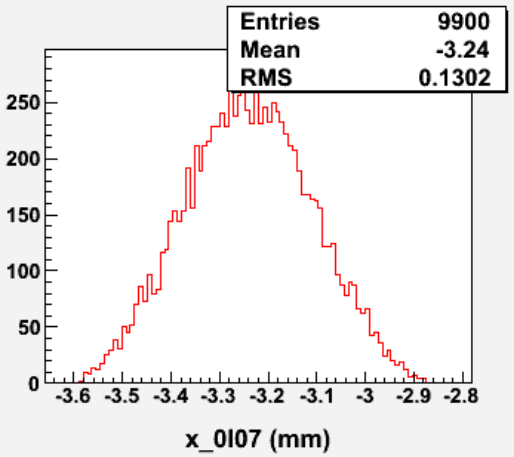


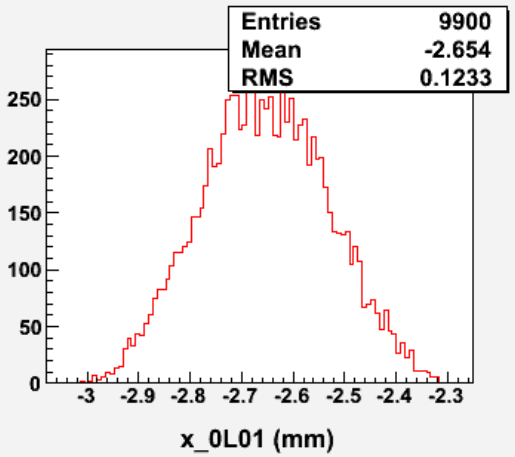






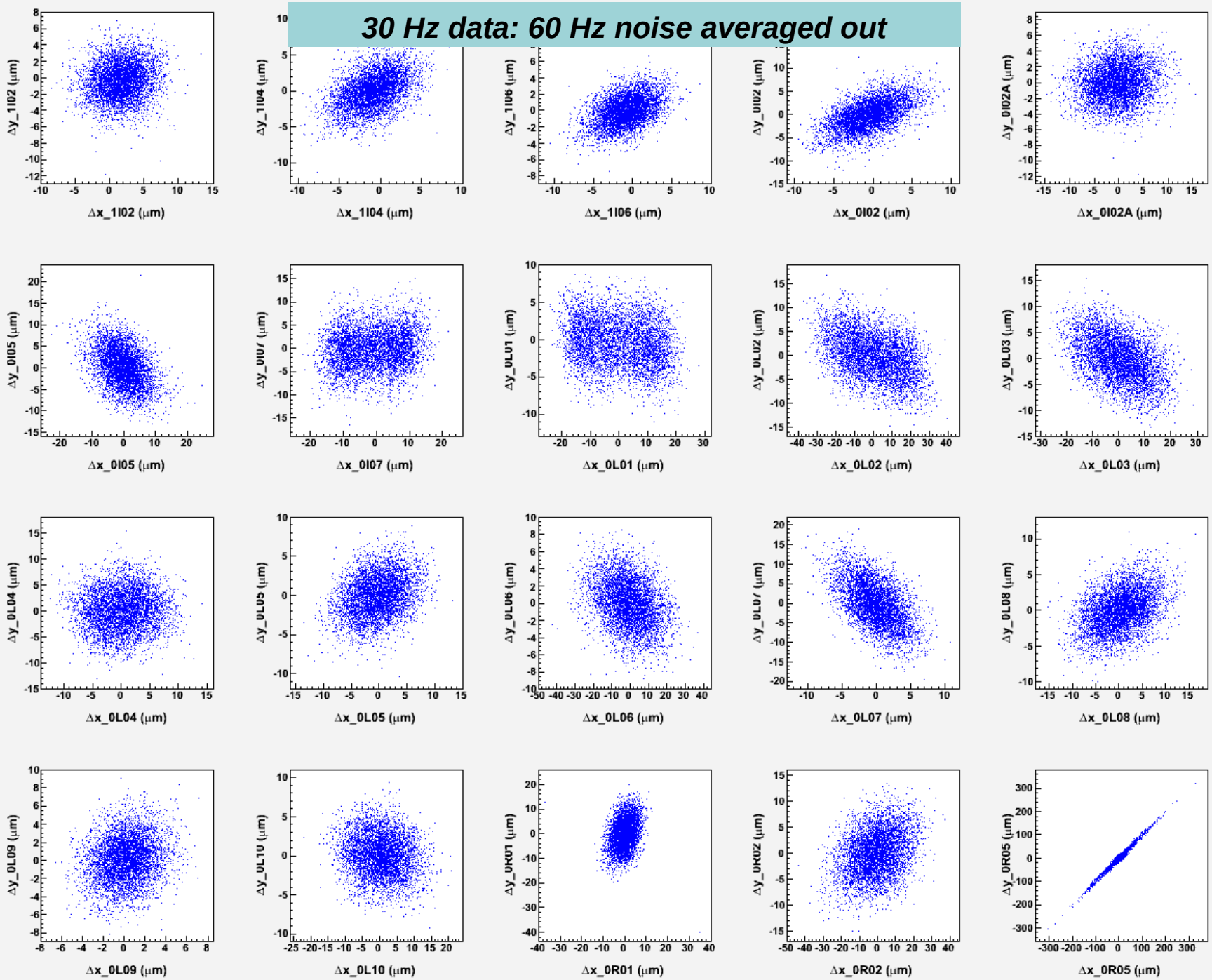




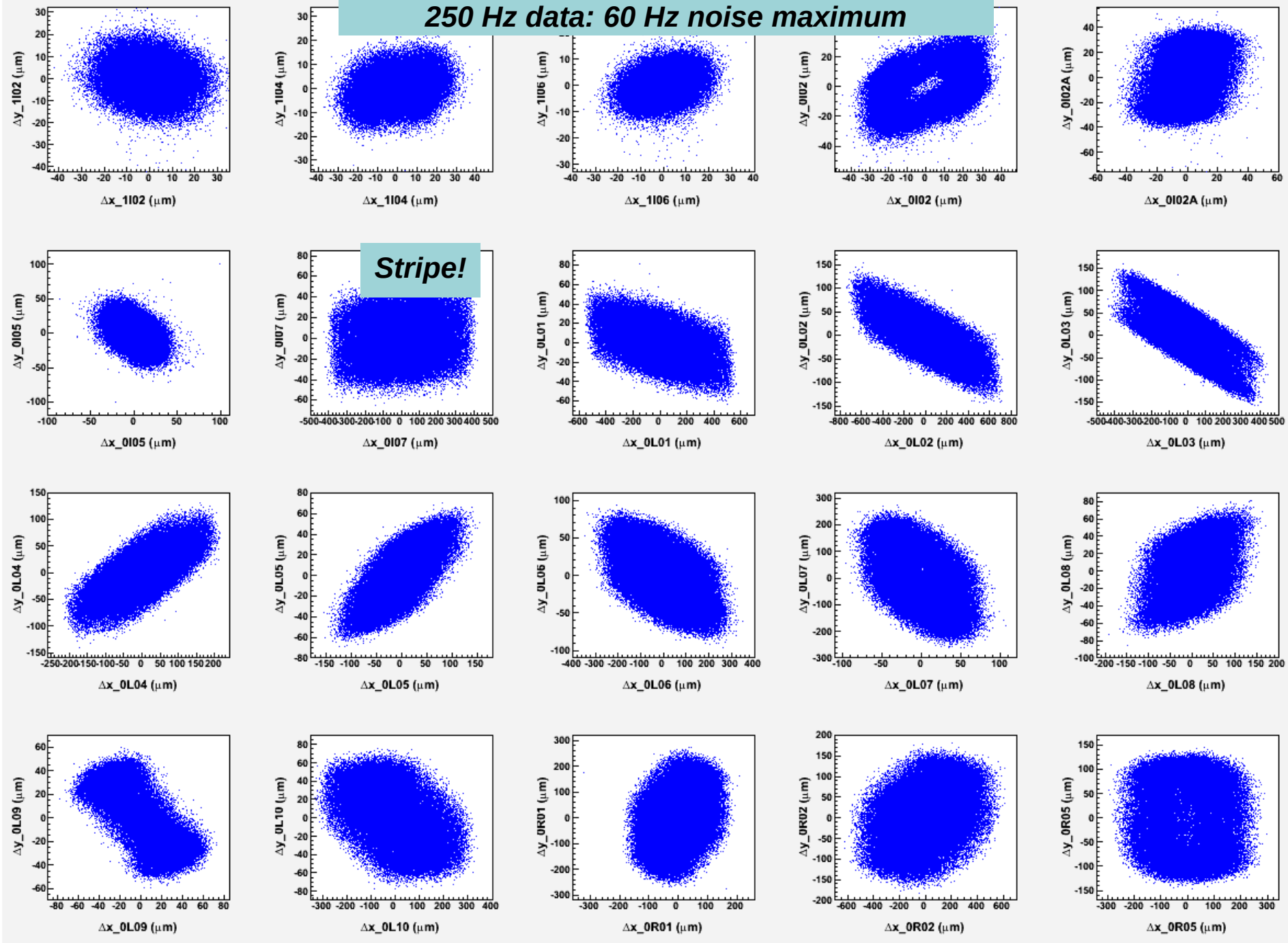


PSS Dipole Magnet

30 Hz data: 60 Hz noise averaged out

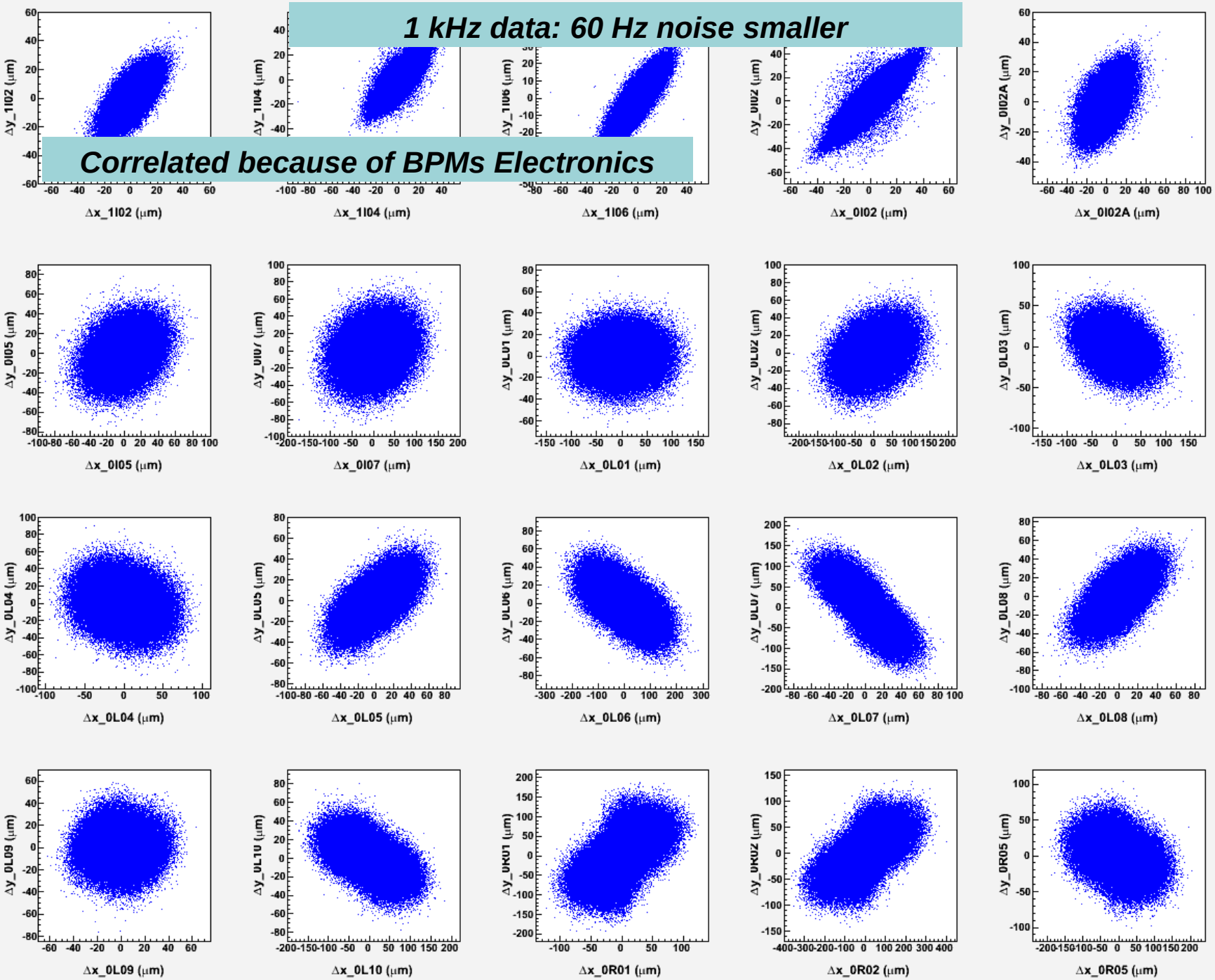


250 Hz data: 60 Hz noise maximum

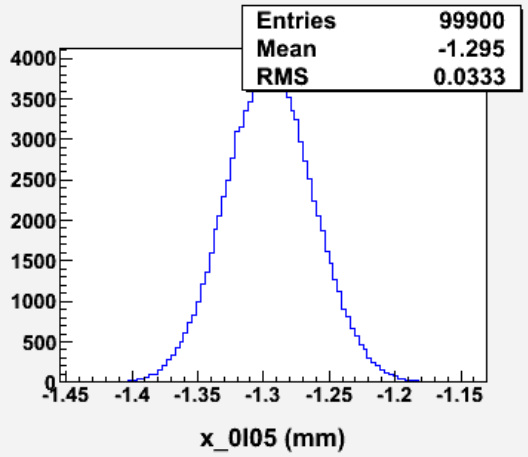


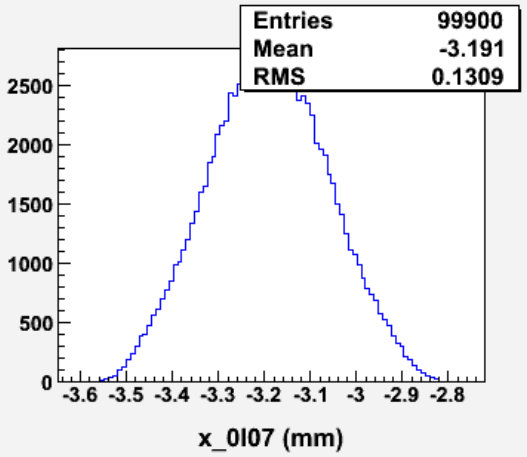
1 kHz data: 60 Hz noise smaller

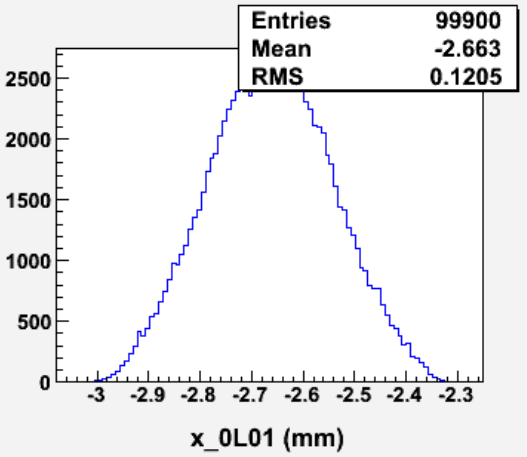
Correlated because of BPMs Electronics



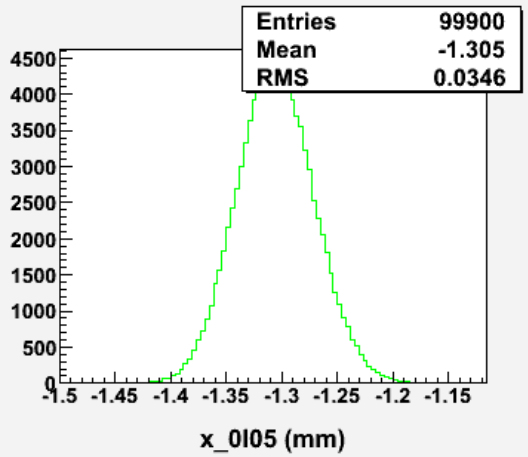
Sensor ON

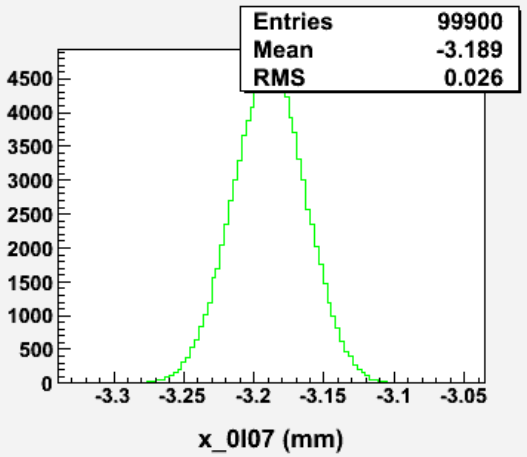


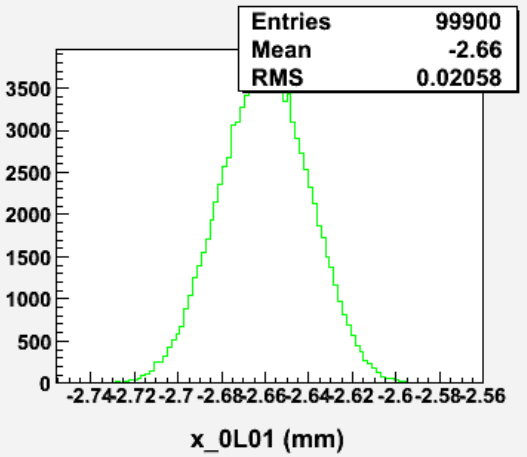




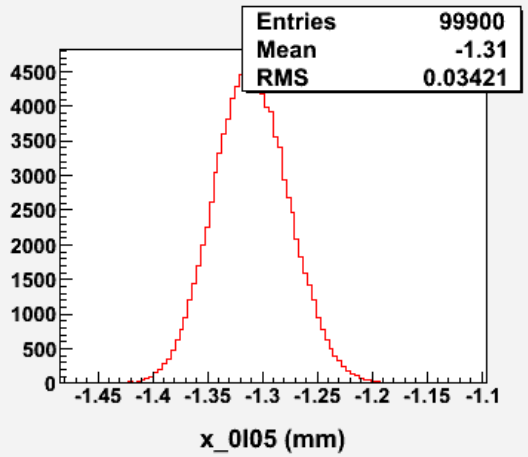
Sensor OFF

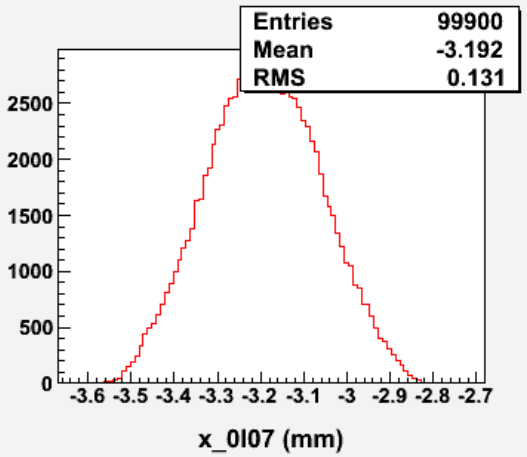


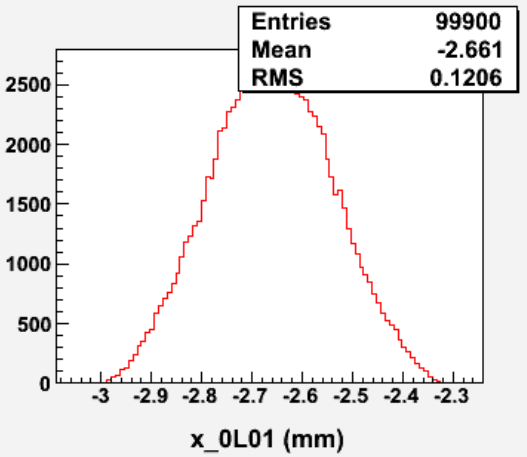




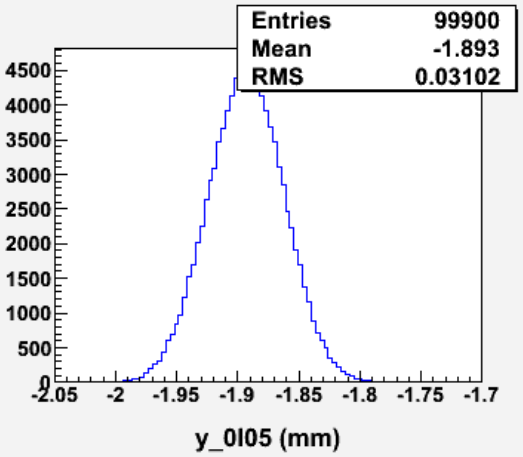
Sensor ON

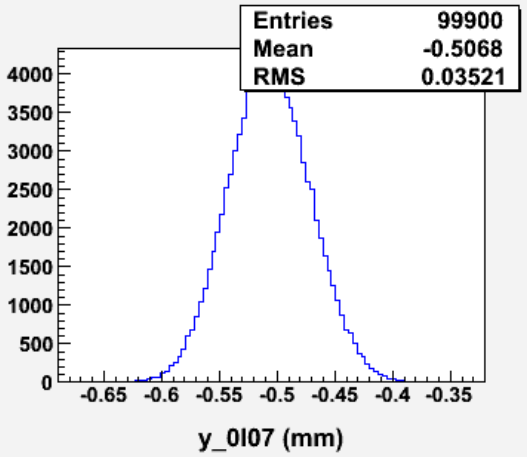


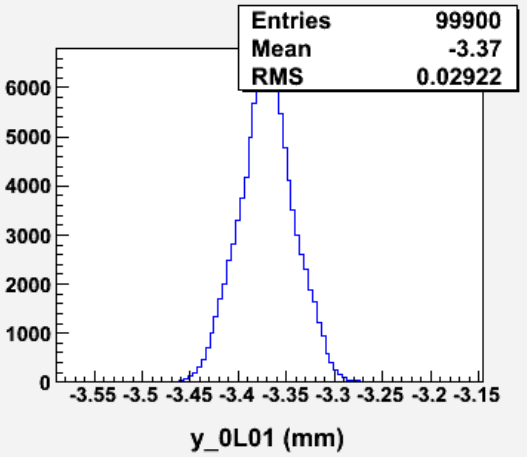




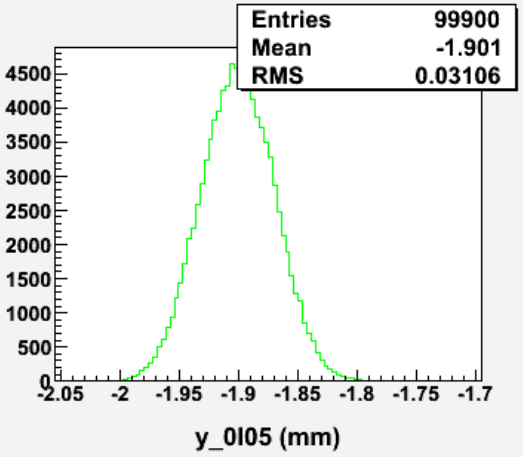
Sensor ON

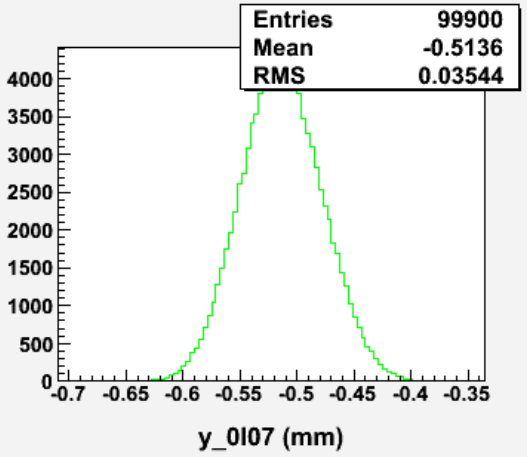


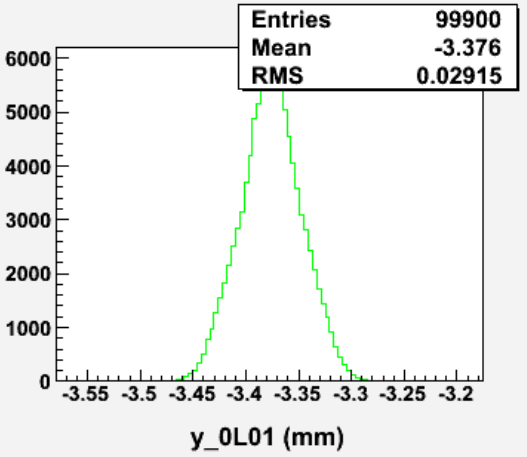




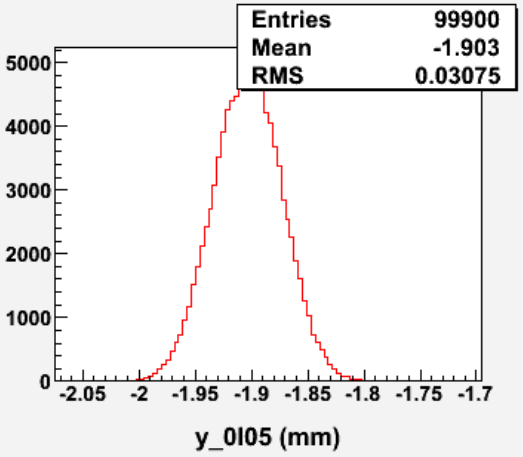
Sensor OFF

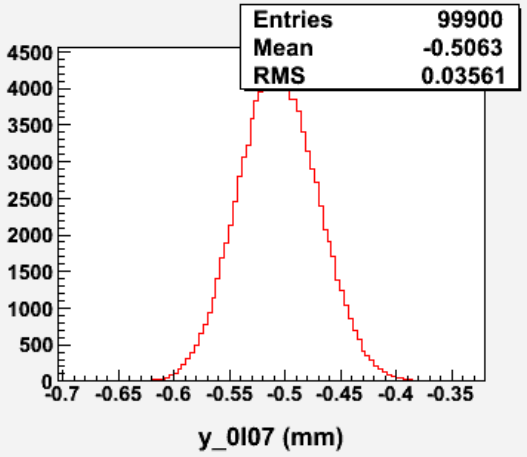


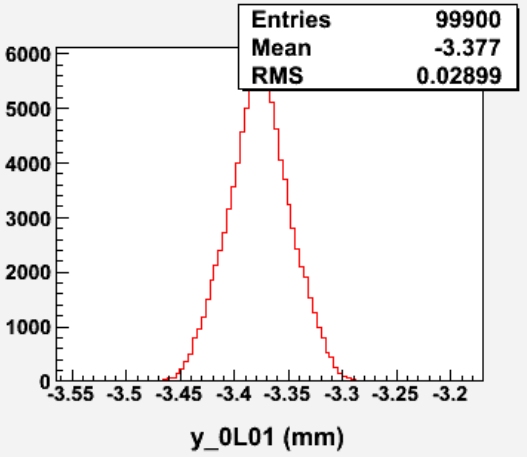




Sensor ON



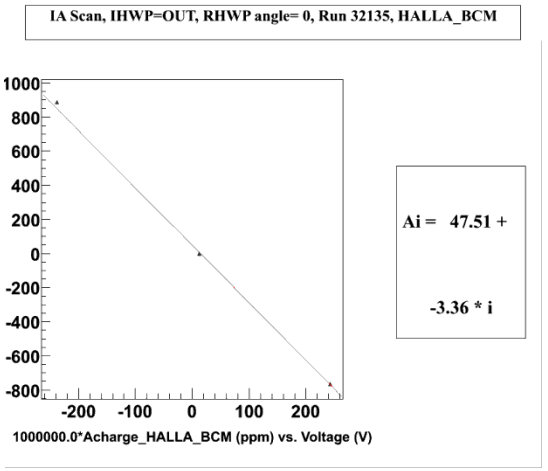


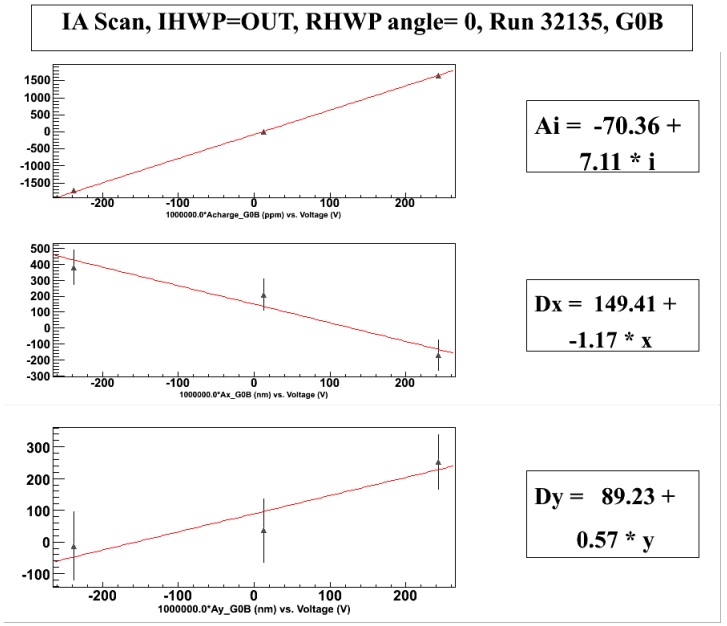


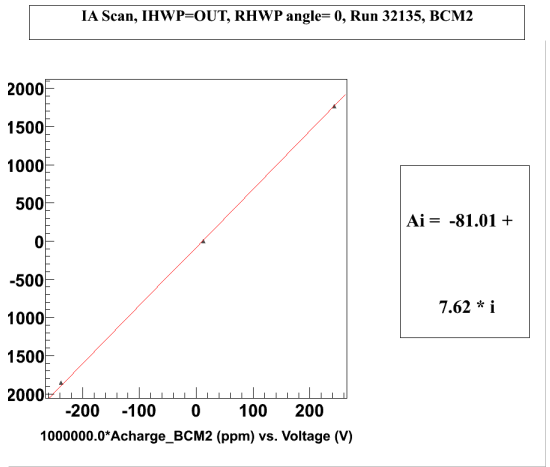
Hall A & G0 Cross-talk

1. Hall A IA Scan:

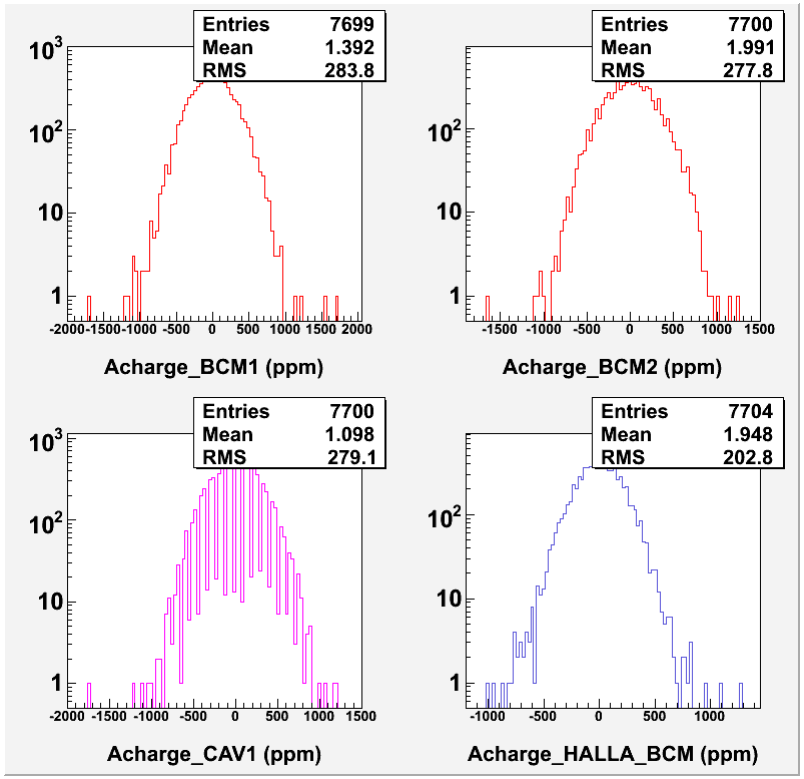
- Hall A IA Scan (80 uA)
- Hall C Charge asymmetry and position differences during the Hall A IA Scan (20 uA)





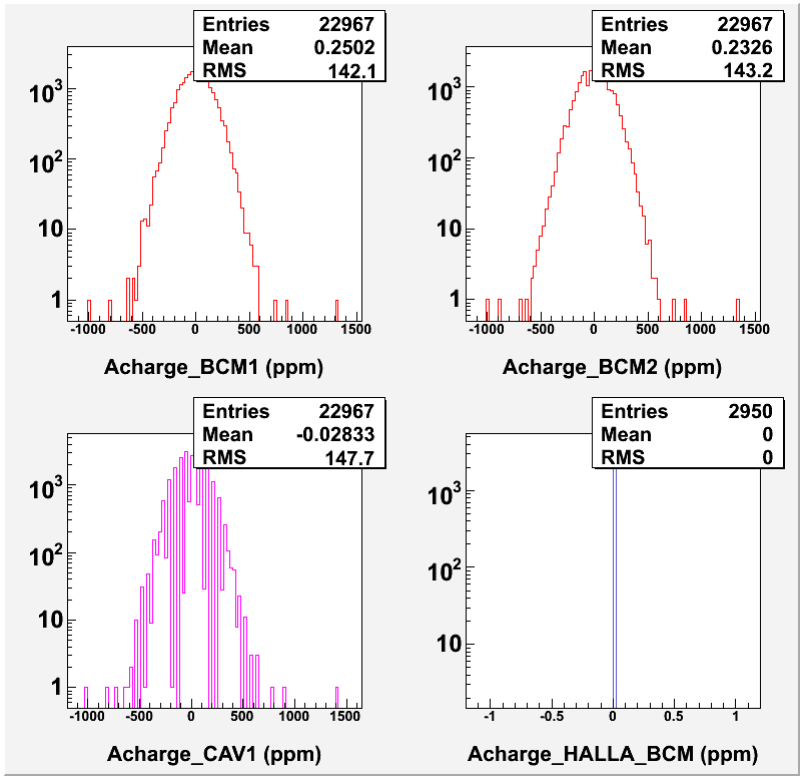


2. G0 Charge Asymmetry Width:



G0 @ 20 uA

Hall A @ 90 uA



G0 @ 20 uA

Hall A OFF

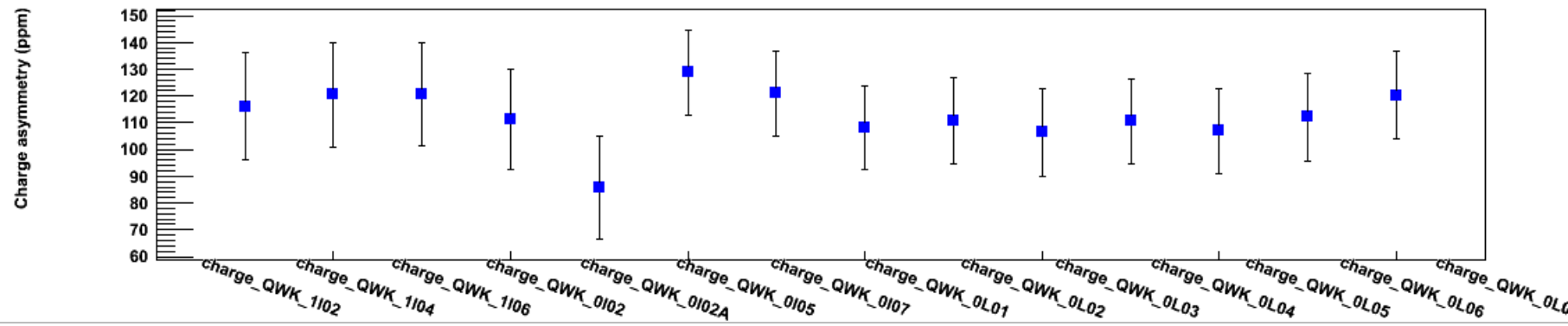
Halls A & C Beams Cross-talk

→ Could it be the Surface Charge Limit of the Photo-Cathode

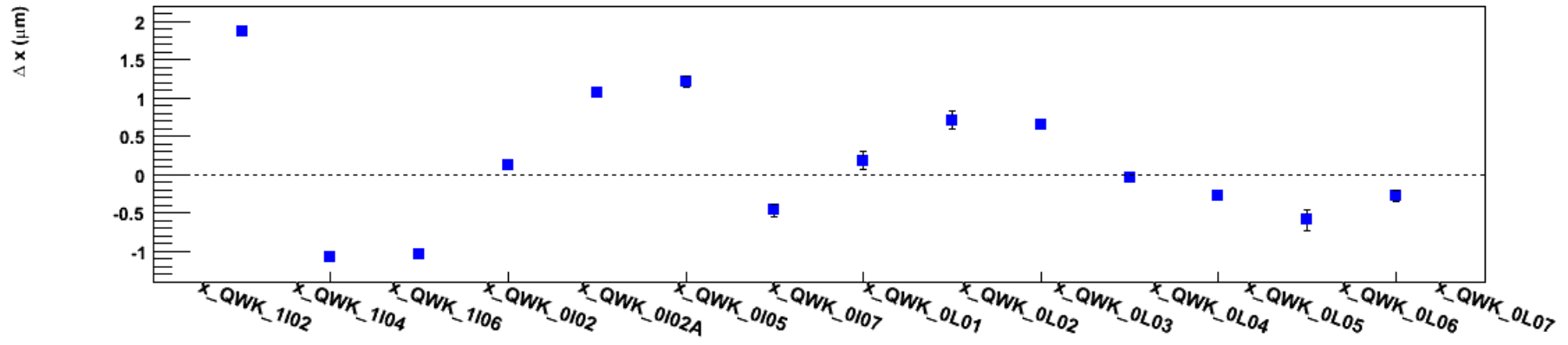
- ✓ Change current and phase of Hall C beam
- ✓ Stop Hall C beam on the Chopper, measure the parity quality of Hall A beam after the Chopper

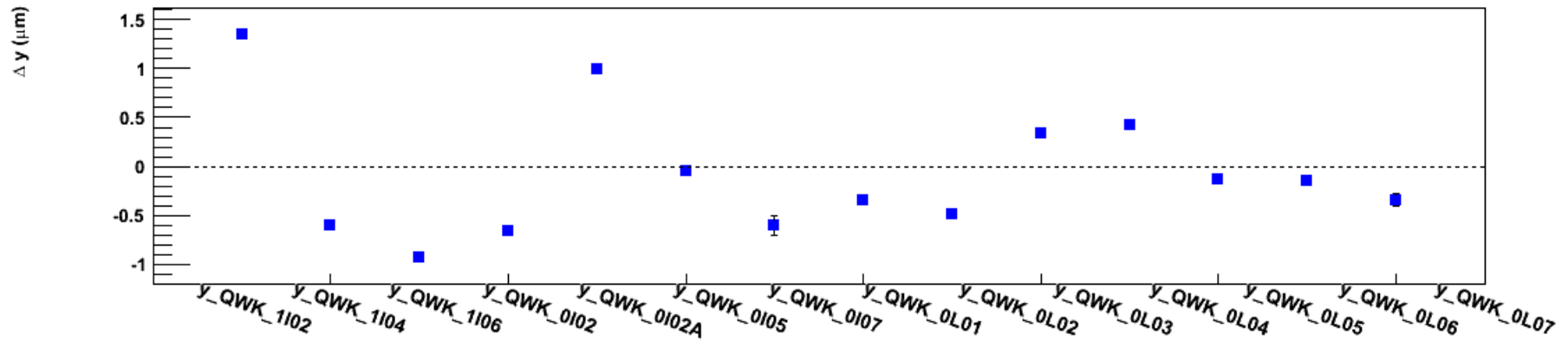
- Run 410: Hall A 120 μA, Hall C 0 μA
- Run 412: Hall A 0 μA, Hall C 110 μA
- Run 413: Hall A 120 μA, Hall C 0 -110 μA, Hall C laser phase 55 degree
- Run 414: Hall A 120 μA, Hall C 110 μA, changed Hall C laser phase

Transmission of Charge Asymmetry, Run 410

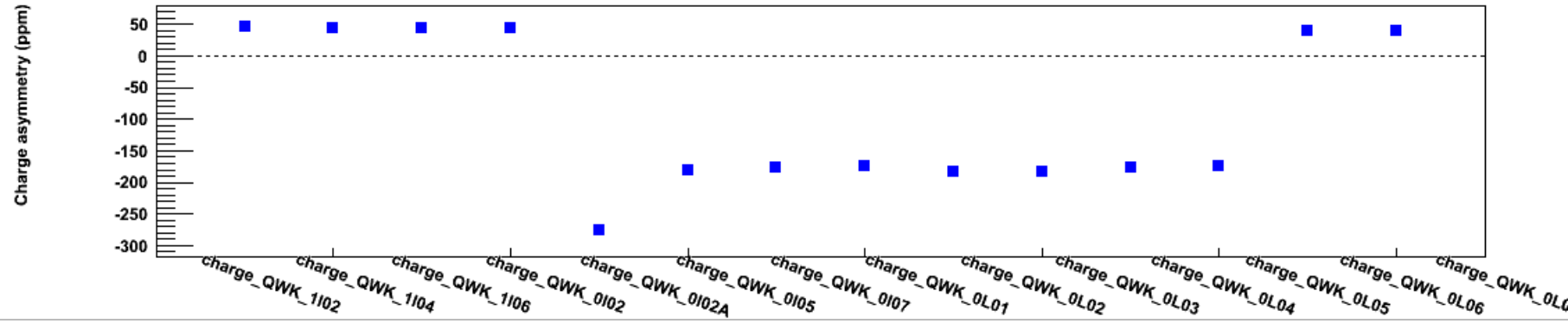


Transmission of X and Y Position Differences, Run 410

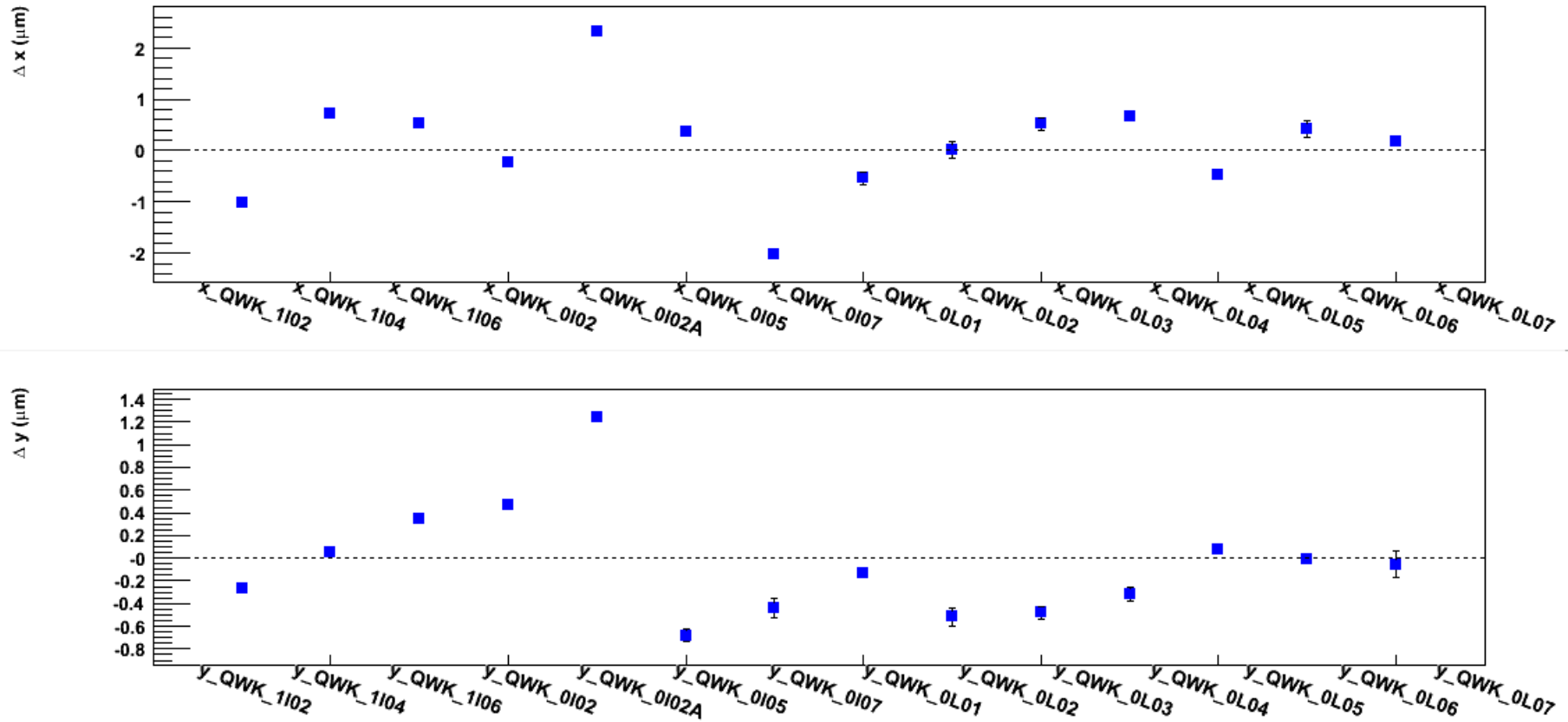




Transmission of Charge Asymmetry, Run 412

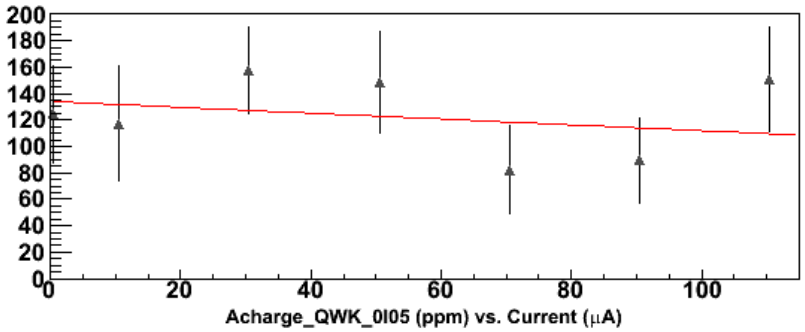


Transmission of X and Y Position Differences, Run 412

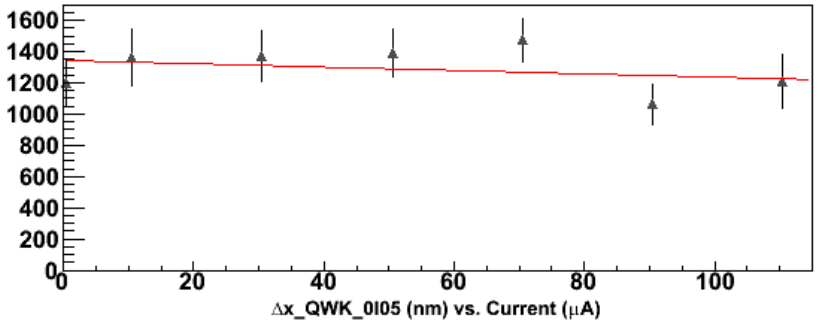


Hall C Current Scan

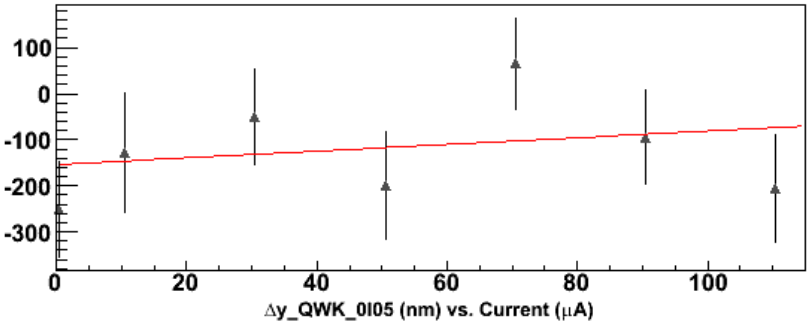
Hall C Current Scan, , Run 413, QWK_0I05



Aq = 134.00 + -0.22 × I



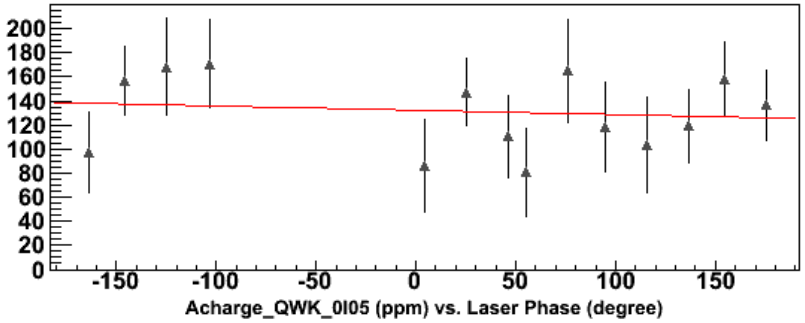
Δx = 1343.62 + -1.07 × I



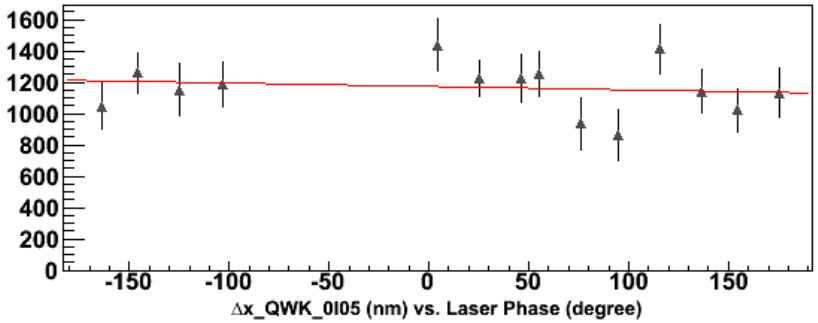
Δy = -153.69 + 0.73 × I

Hall C Laser Phase Scan

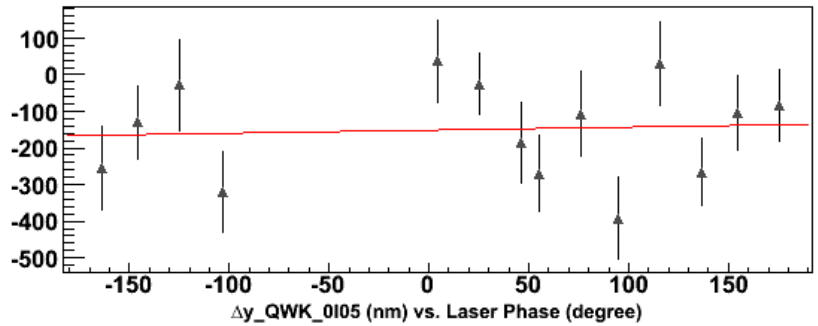
Hall C Laser Phase Scan, , Run 414, QWK_0I05



$Aq = 132.21 + -0.04 \times \phi$



$\Delta x = 1173.95 + -0.22 \times \phi$



$\Delta y = -151.33 + 0.08 \times \phi$

Summary

- The parity DAQ, BPMs, and Analysis are working fine
- 30 Hz: The standard PQB at 30 Hz was achieved
- 250 Hz: The PQB is very similar to 30 Hz otherwise for the 60 Hz noise
- 1 kHz: The PQB is very similar to 30 Hz, again issues with 60 Hz noise (less sensitive than at 250 Hz)
- BPMs Electronics are affecting T_Settle studies
- New charge feedback will be implemented: No slow controls (EPICS), zeroed the asymmetry for each of the 4 helicity sequences → New Helicity Board design
- What's next?
    1. Finish analysis: 4 blocks, Phase Monitor, Batteries, …
    2. Study 1 kHz for all T_Settle choices
    3. More Beams cross-talk studies: with bad QE, IA scans, …
    4. Eliminate the vacuum window birefringence by rotating the LLGun2 photocathode
    5. Check Helicity Magnets, Mott Polarimeters at 1 kHz