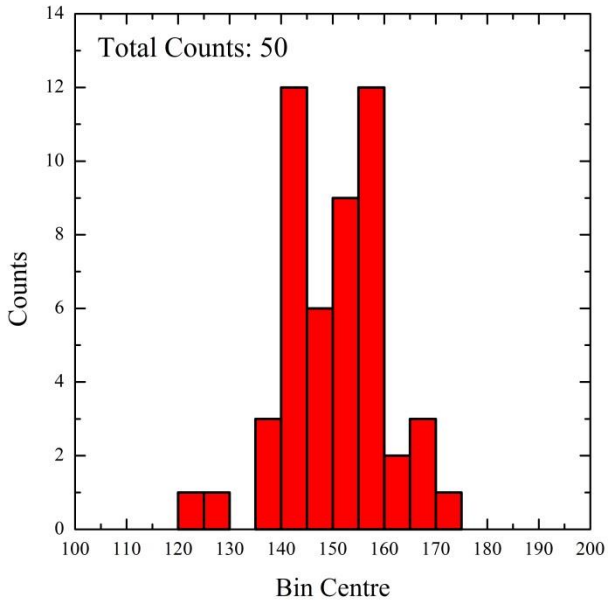
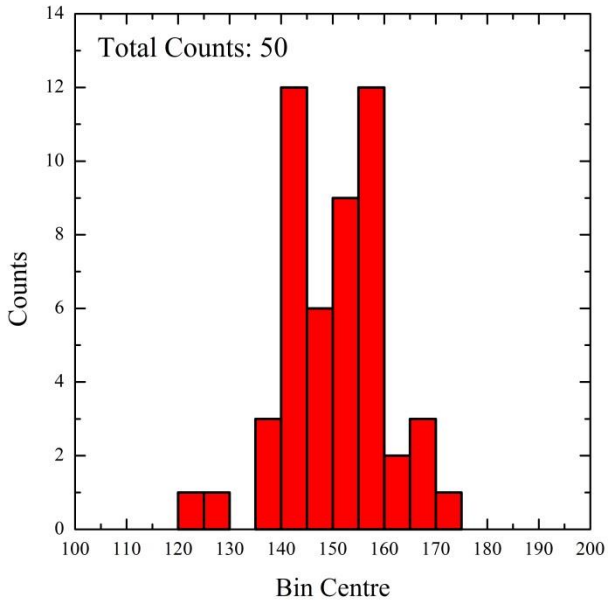
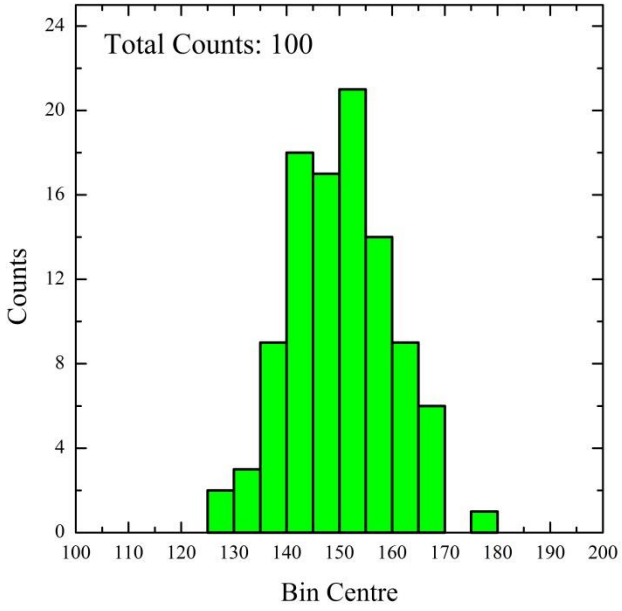

Total Counts: 50
Counts
Bin Centre
0
2
4
6
8
10
12
14
100
110
120
130
140
150
160
170
180
190
200


Total Counts: 50
Counts
Bin Centre
0
2
4
6
8
10
12
14
100
110
120
130
140
150
160
170
180
190
200


Total Counts: 100
Counts
Bin Centre
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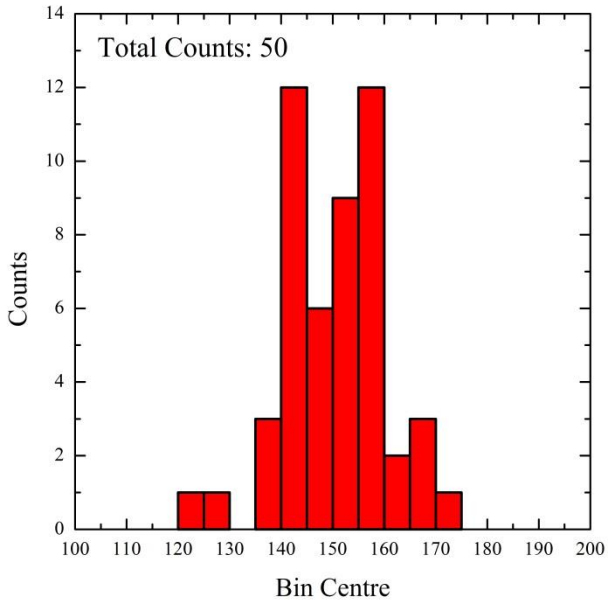
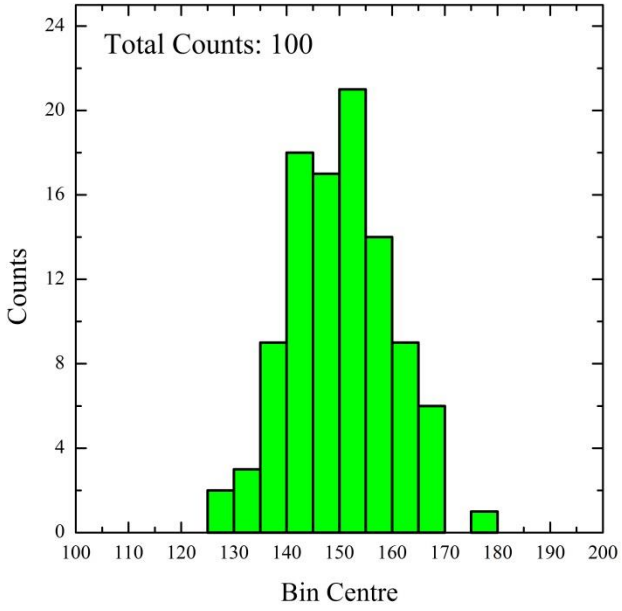
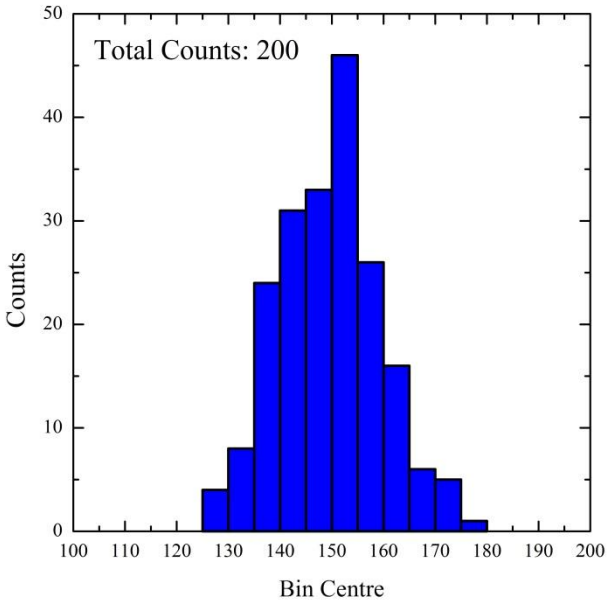
4
8
12
16
20
24
100
110
120
130
140
150
160
170
180
190
200


Total Counts: 50
Counts
Bin Centre
0
2
4
6
8
10
12
14
100
110
120
130
140
150
160
170
180
190
200


Total Counts: 100
Counts
Bin Centre
0
4
8
12
16
20
24
100
110
120
130
140
150
160
170
180
190
200


Total Counts: 200
Counts
Bin Centre
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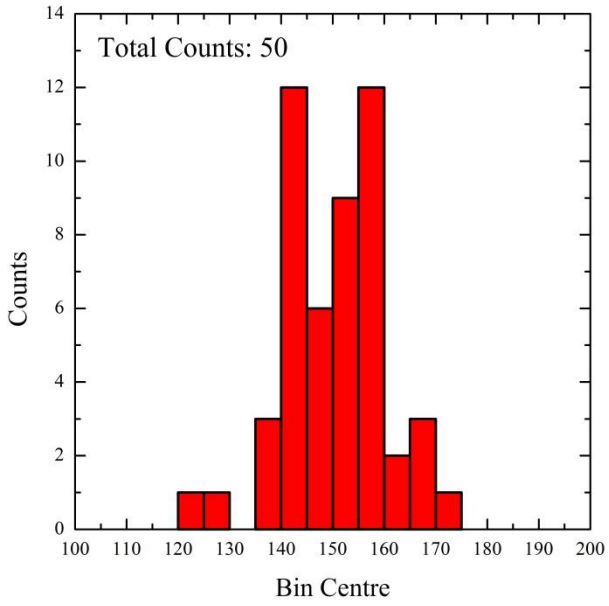
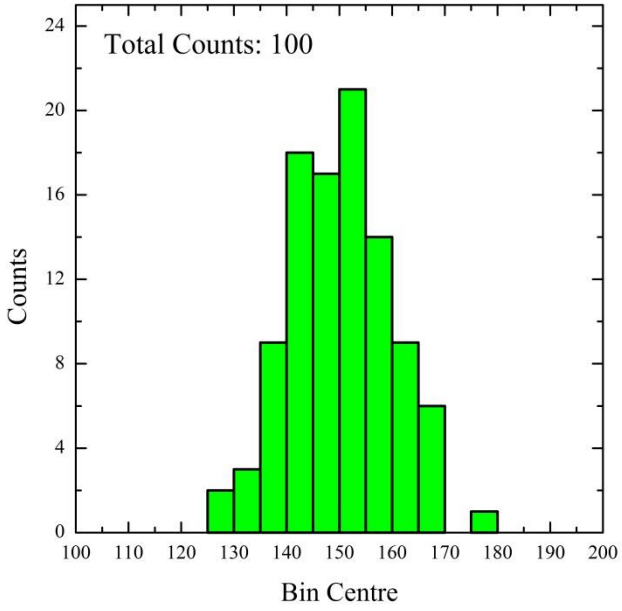
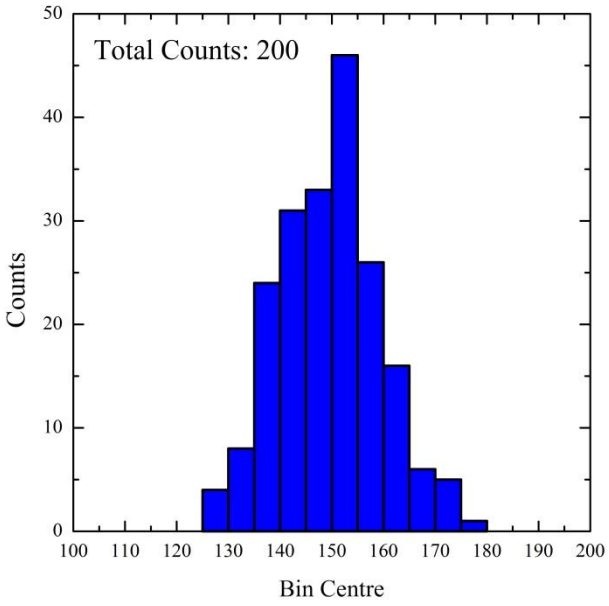
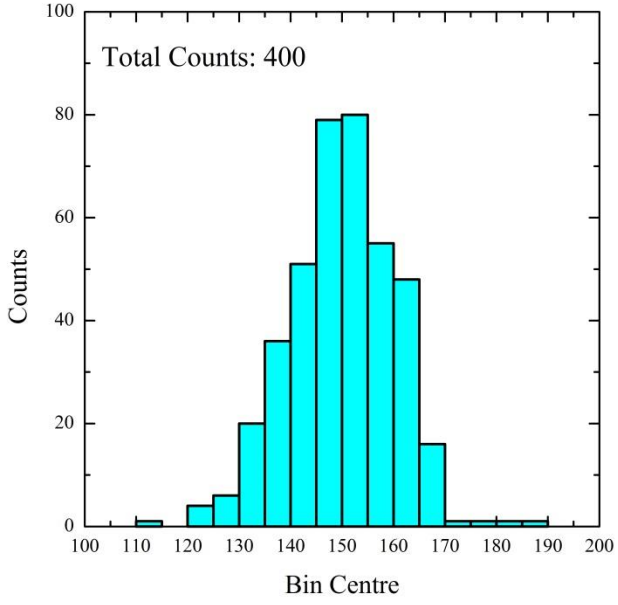
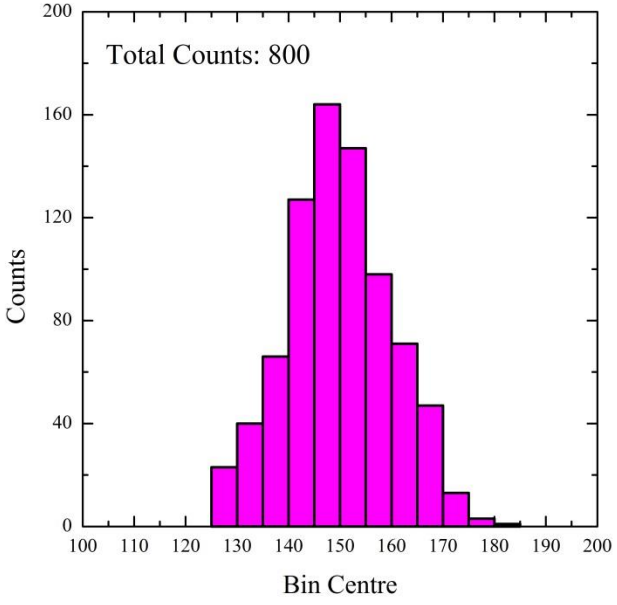
10
20
30
40
50
100
110
120
130
140
150
160
170
180
190
200

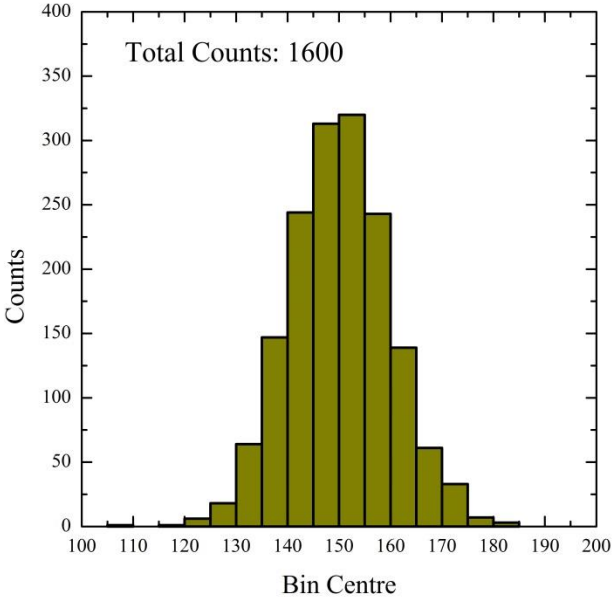

Total Counts: 50
Counts
Bin Centre

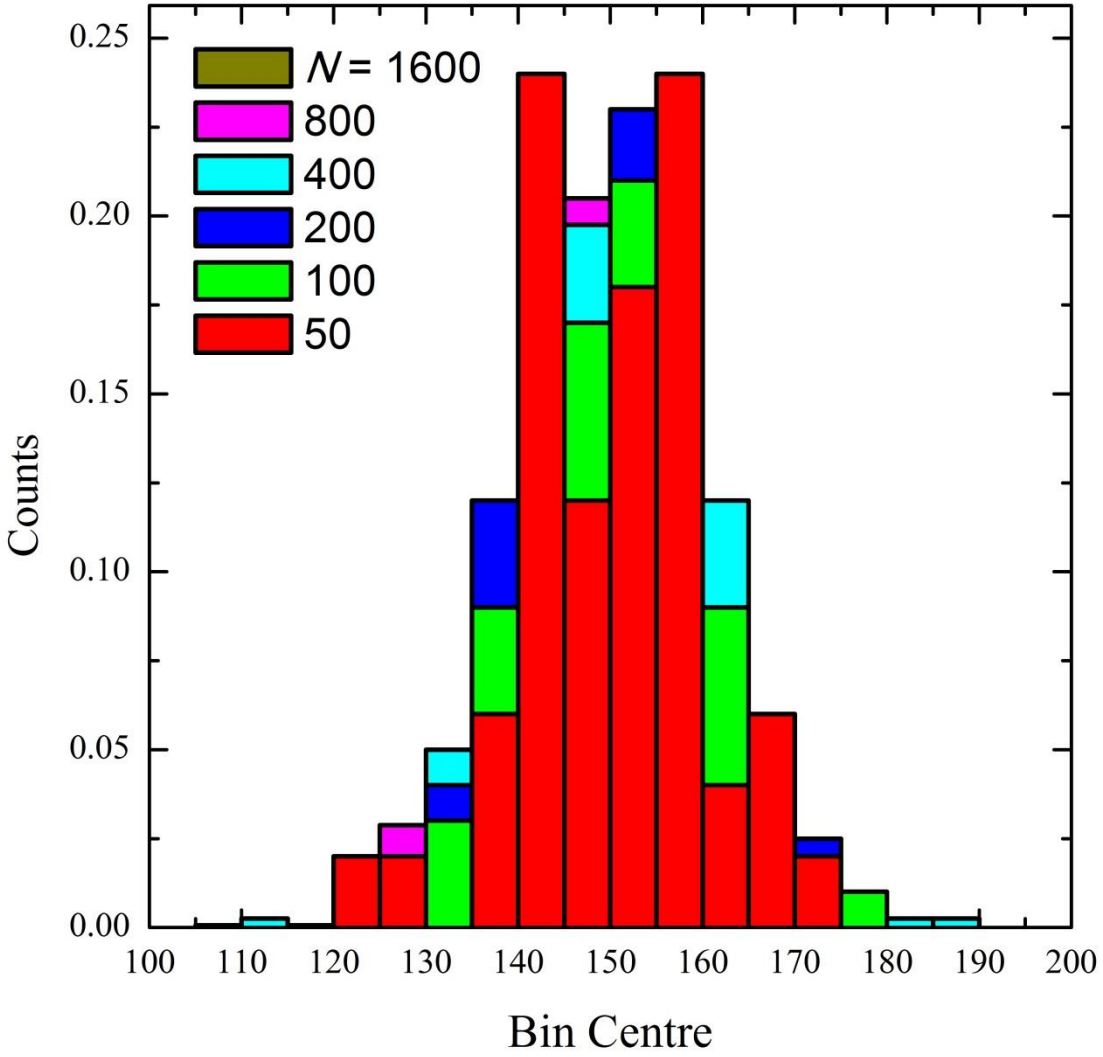

Total Counts: 100
Counts
Bin Centre


Total Counts: 200
Counts
Bin Centre


Total Counts: 400
Counts
Bin Centre

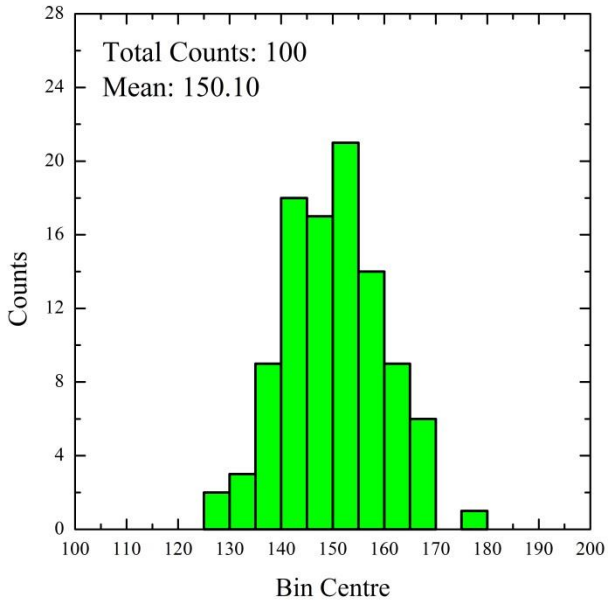

Total Counts: 800
Counts
Bin Centre

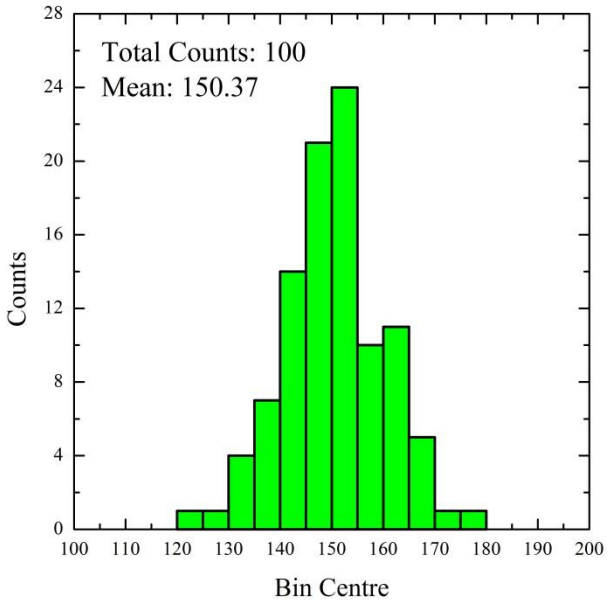

Total Counts: 1600
Counts
Bin Centre

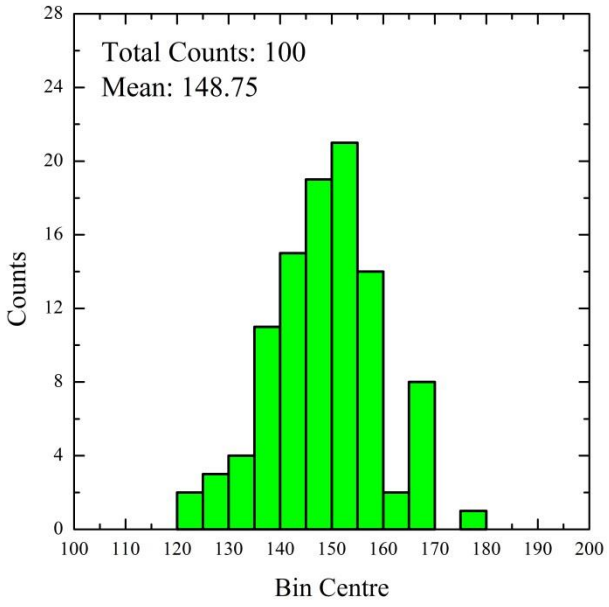


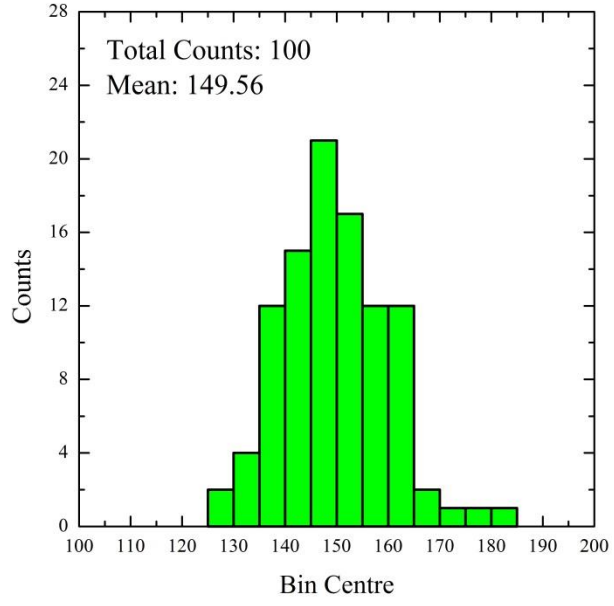
Standard Deviation (width of the distribution) is **independent** of the number of measurements!

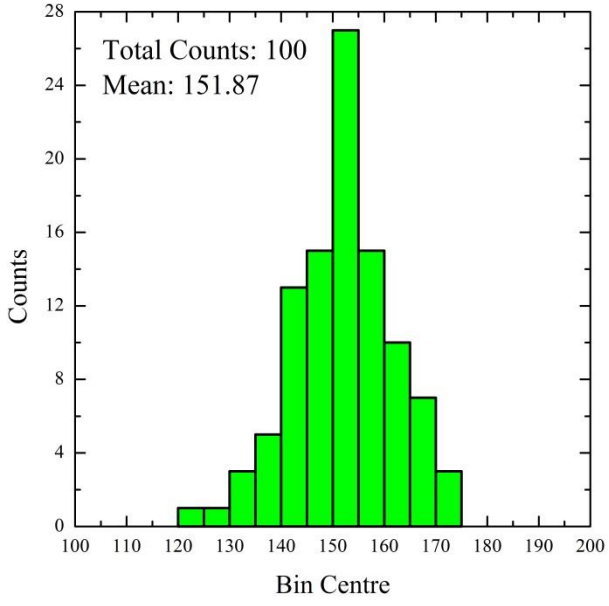
The Standard Deviation is a property of what is being measured and how the measurements are being made. To decrease the standard deviation of the distribution of measurements, need to improve measurement method.

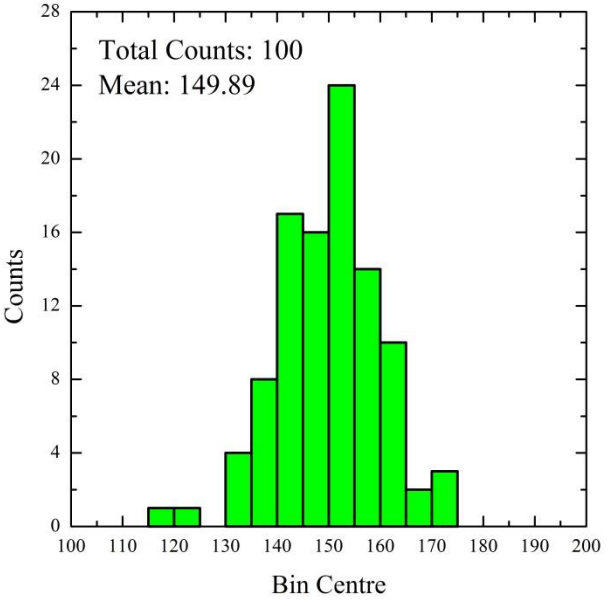

Total Counts: 100
Mean: 150.10
Counts
Bin Centre


Total Counts: 100
Mean: 150.37
Counts
Bin Centre

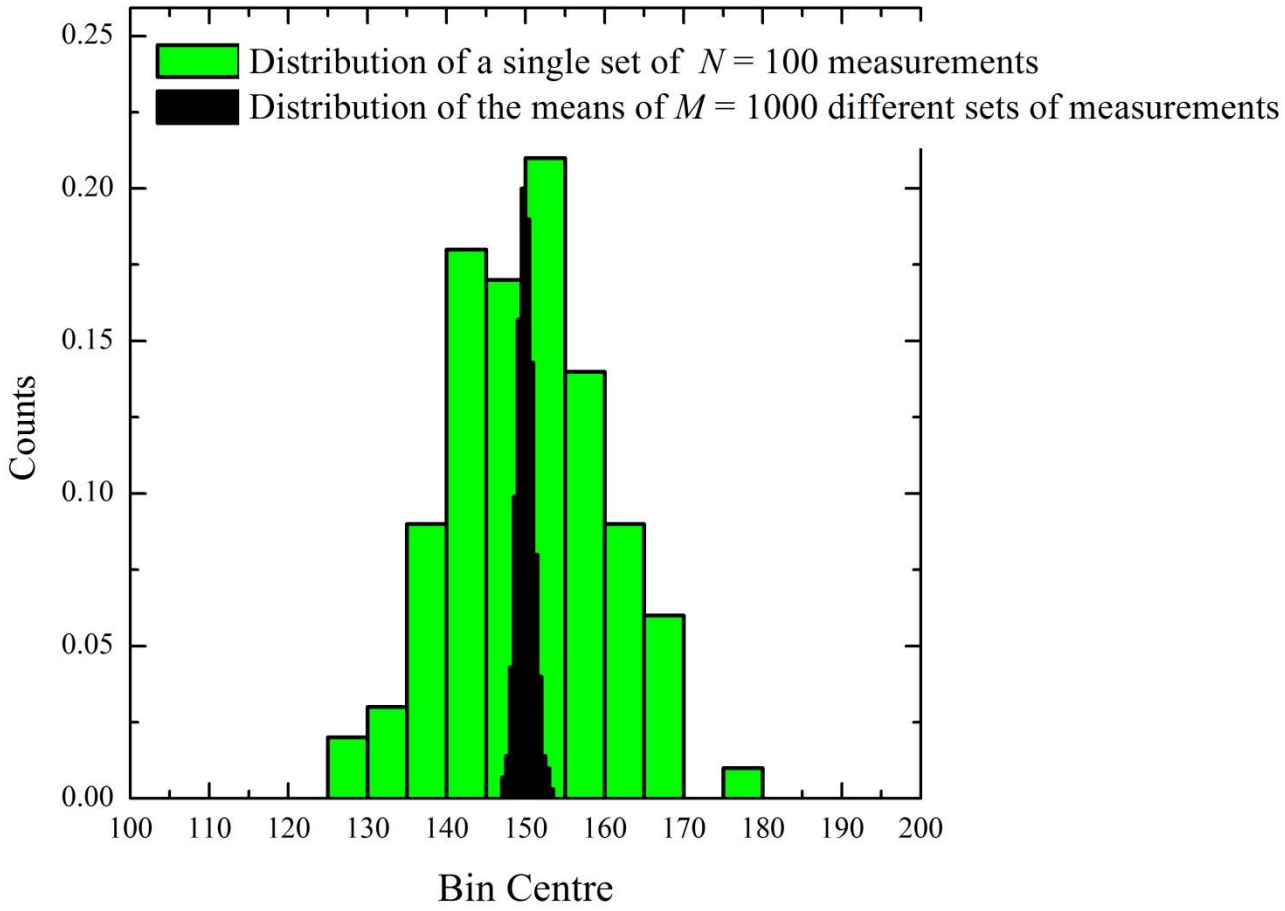

Total Counts: 100
Mean: 148.75
Counts
Bin Centre


Total Counts: 100
Mean: 149.56
Counts
Bin Centre


Total Counts: 100
Mean: 151.87
Counts
Bin Centre

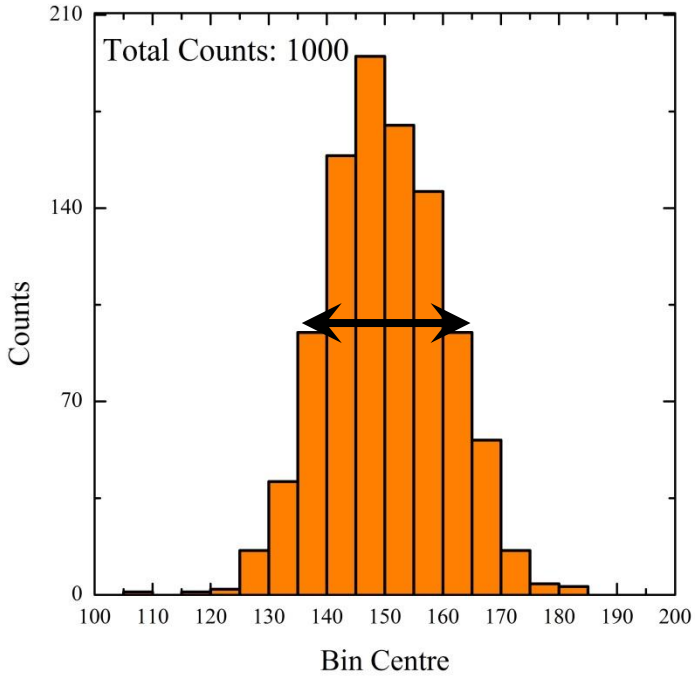

Total Counts: 100
Mean: 149.89
Counts
Bin Centre

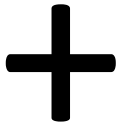
Standard deviation σ of a random set of measurements is **independent** of the number of measurements, *N.*

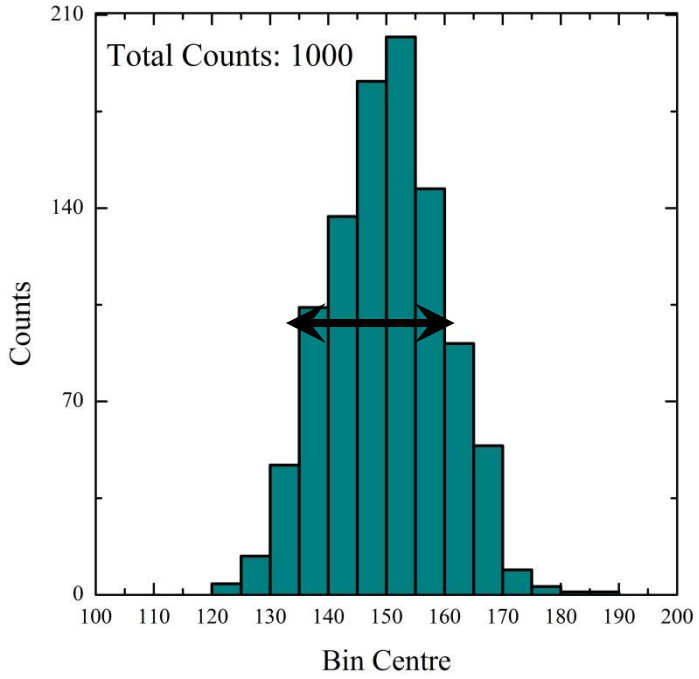


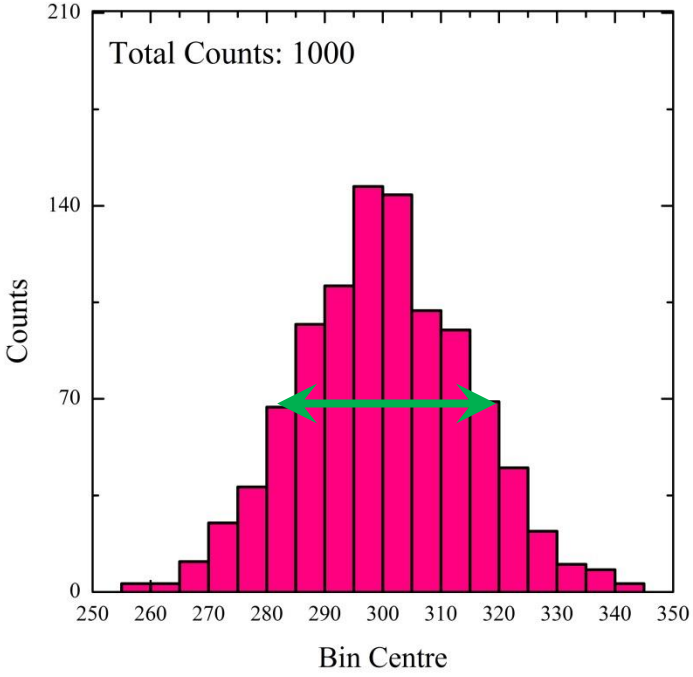
The accuracy with which we can determine the mean of a random set of measurements is **NOT** independent of the number of measurements, *N.*

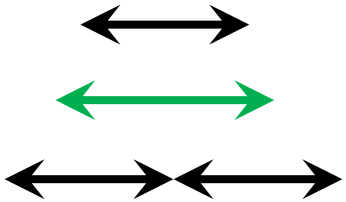
The uncertainty in the mean is given by the *standard error* which is $\sigma/\sqrt{N}$.

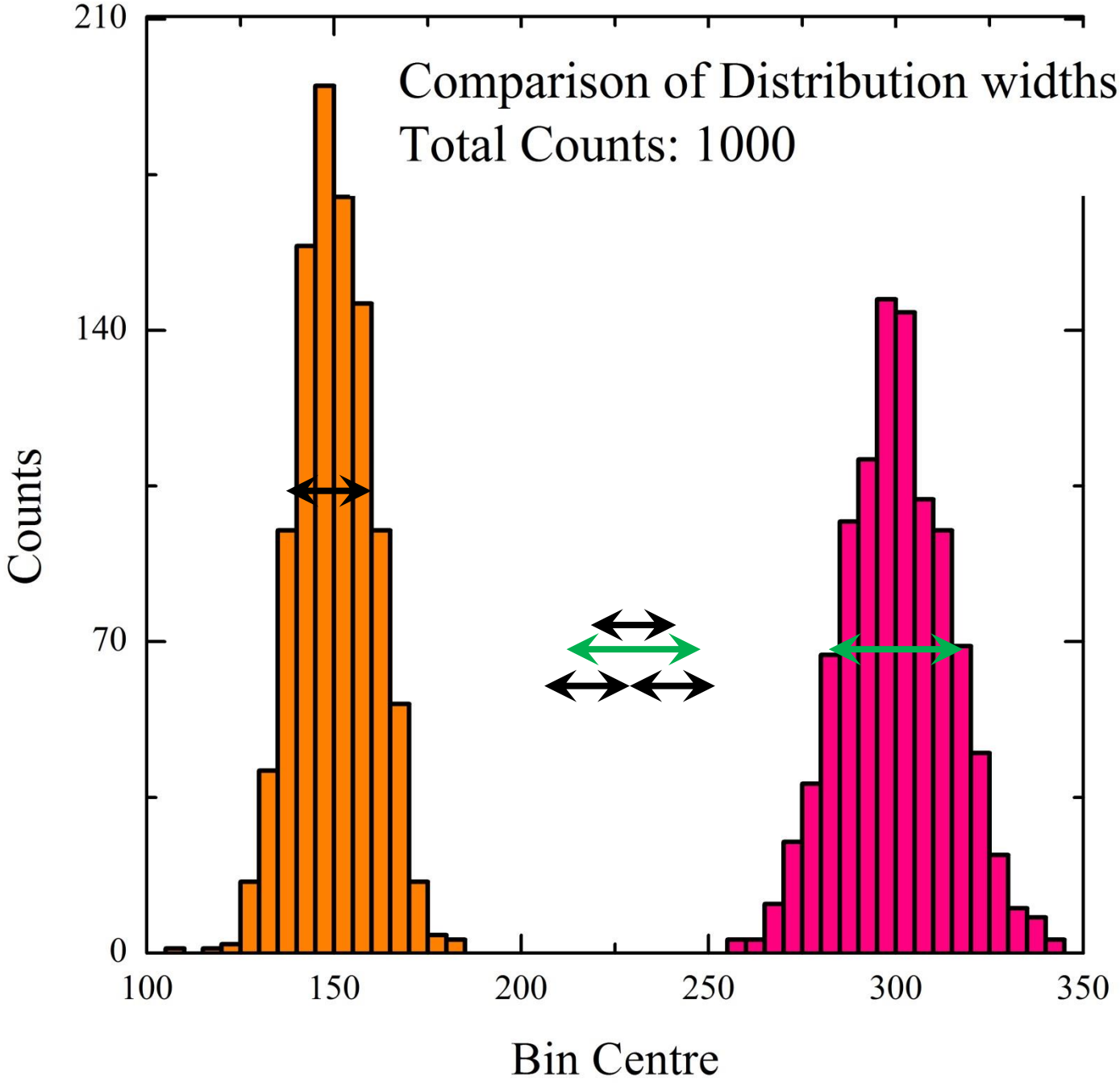

Total Counts: 1000
Counts
Bin Centre
210
140
70
0
100 110 120 130 140 150 160 170 180 190 200




Total Counts: 1000
Counts
Bin Centre
210
140
70
0
100 110 120 130 140 150 160 170 180 190 200


Total Counts: 1000
Counts
Bin Centre
210
140
70
0
250 260 270 280 290 300 310 320 330 340 350




Comparison of Distribution widths
Total Counts: 1000
Counts
Bin Centre
210
140
70
0
100
150
200
250
300
350