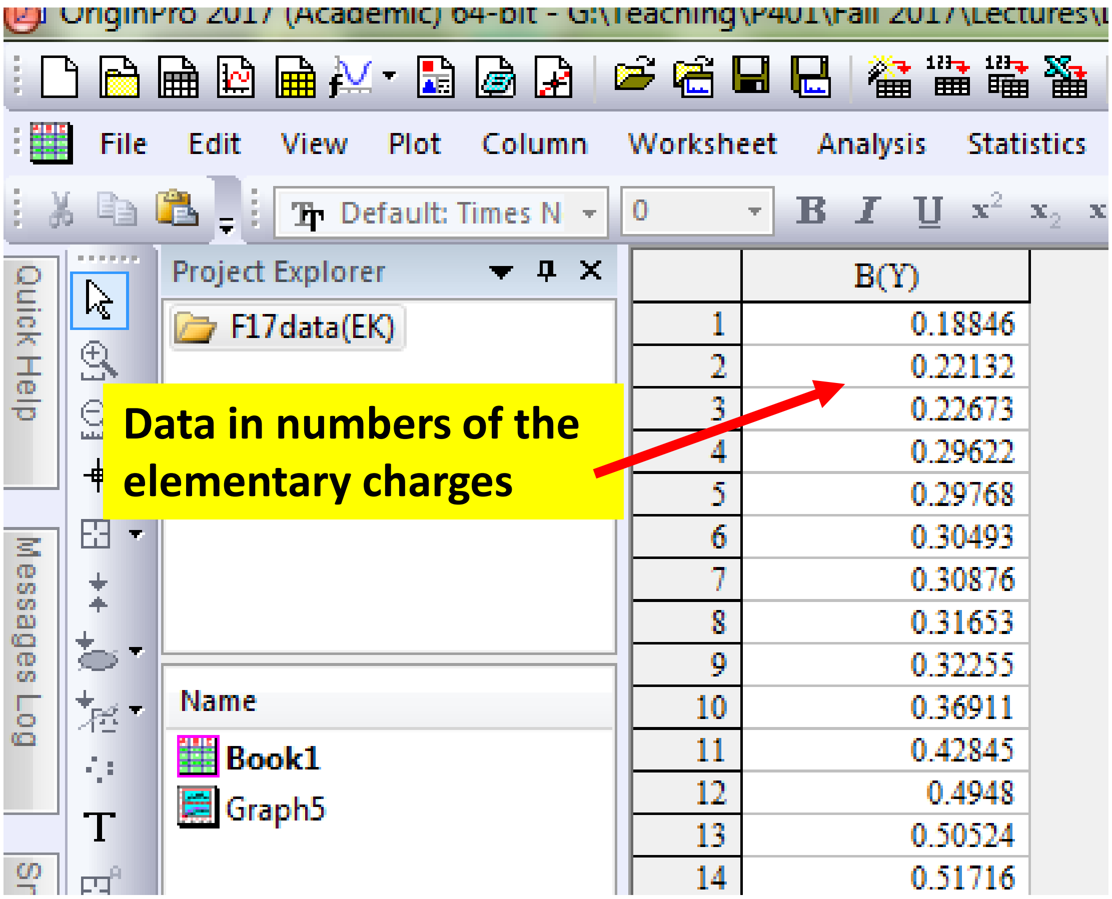
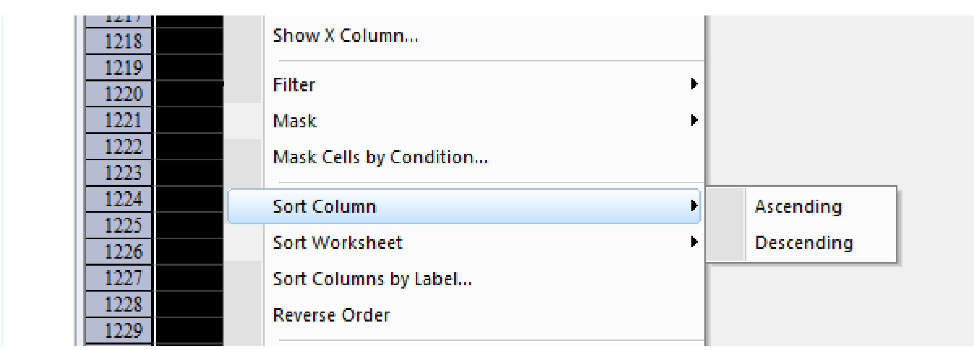
Working with Histogram Graph. Millikan Oil Drop Experiment.

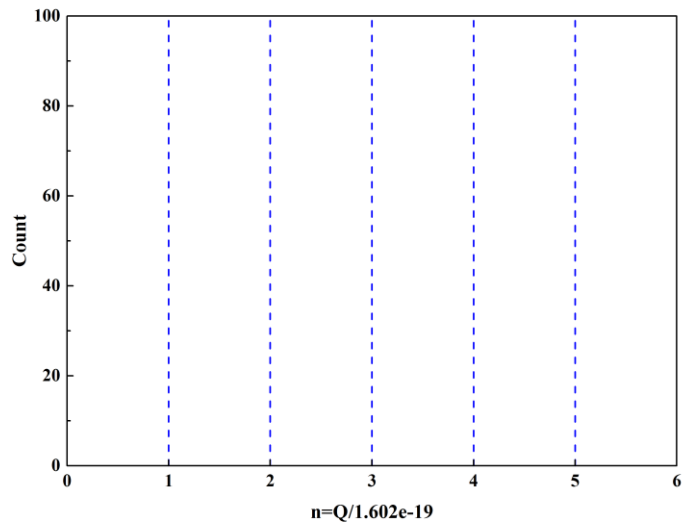
1. After calculating the charges plug in the data in Origin worksheet. Data could be in electrical charge units or as a numbers of elementary charges. Try to use maximum of available data points.



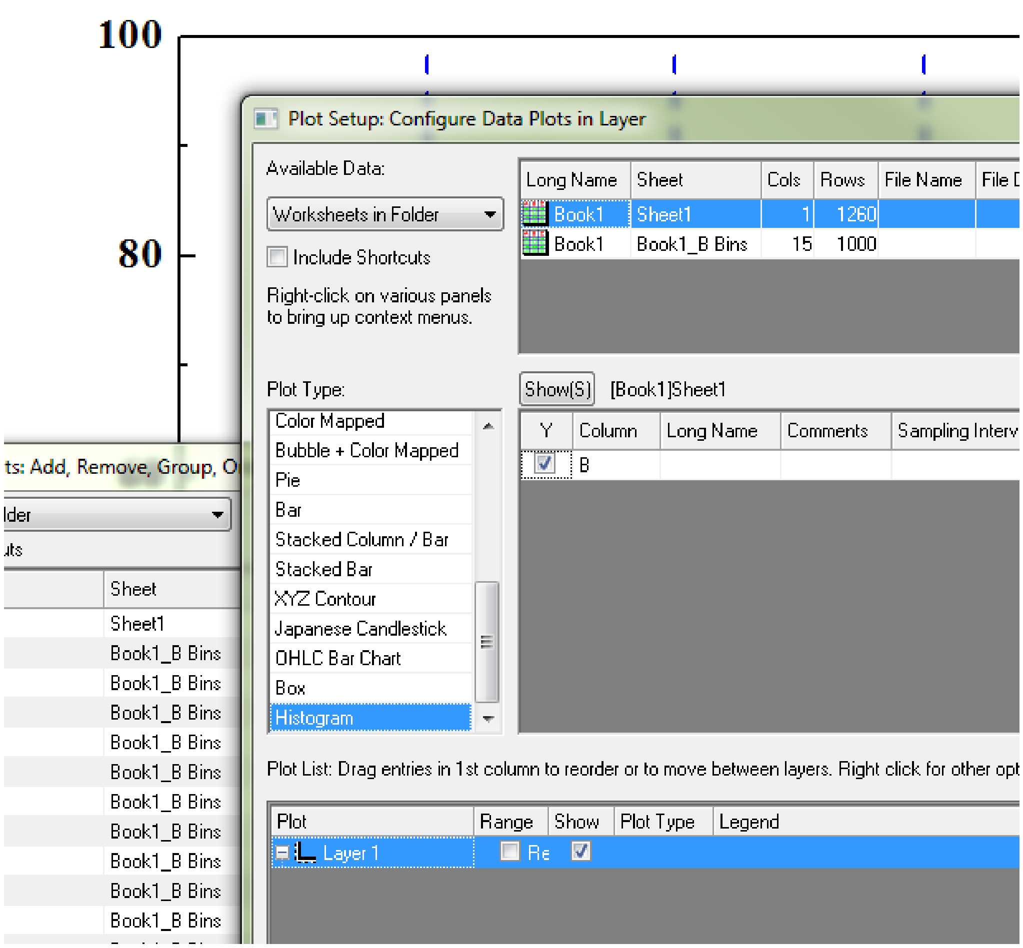
2. I would recommend you to check if the your data set contains some “nonrealistic” numbers of elementary charges (n>10) and remove them from worksheet. In Origin you can sort data in column and then remove the “bad” data

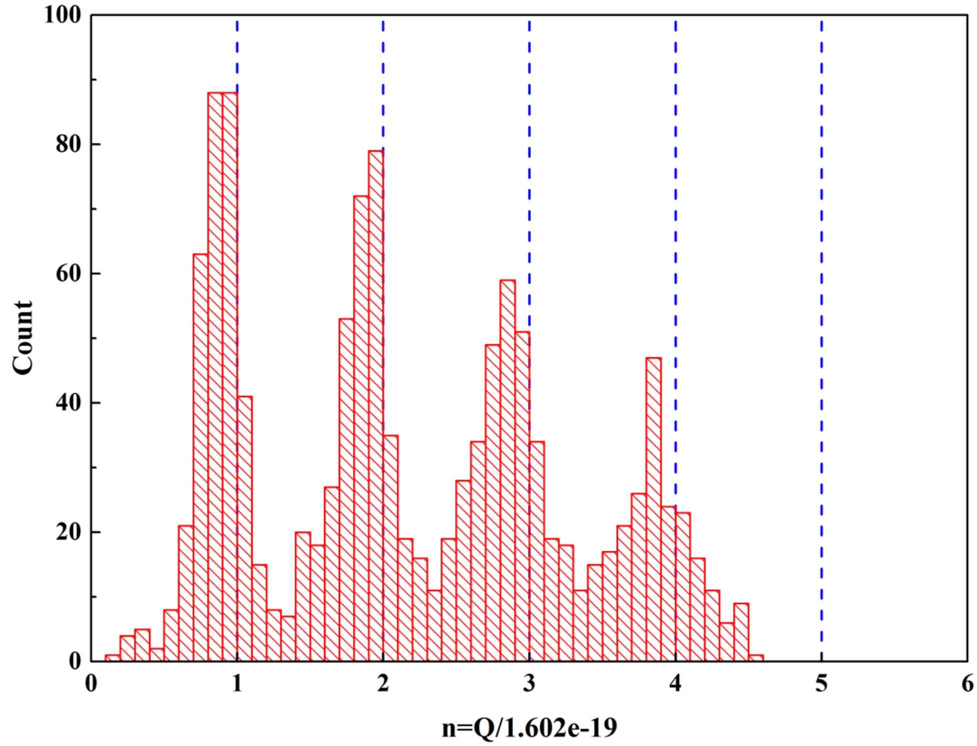


3. For plotting your data you can use the prepared template: ***HIST.otp***, located in: [\\engr-file-03\PHYINST\APL Courses\PHYCS401\Common\Origin templates\Oil drop experiment]()

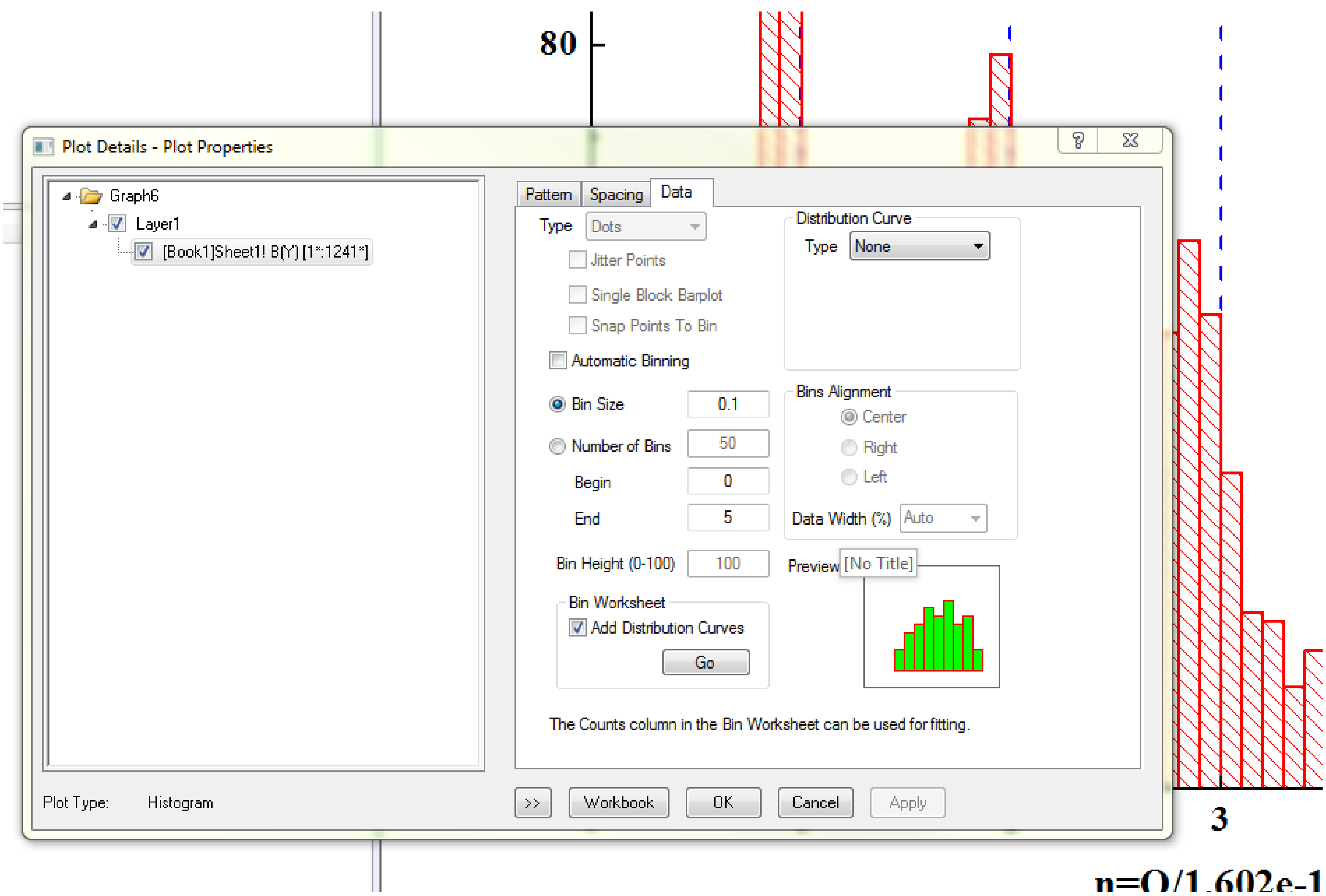


4. Plot your data as a histogram

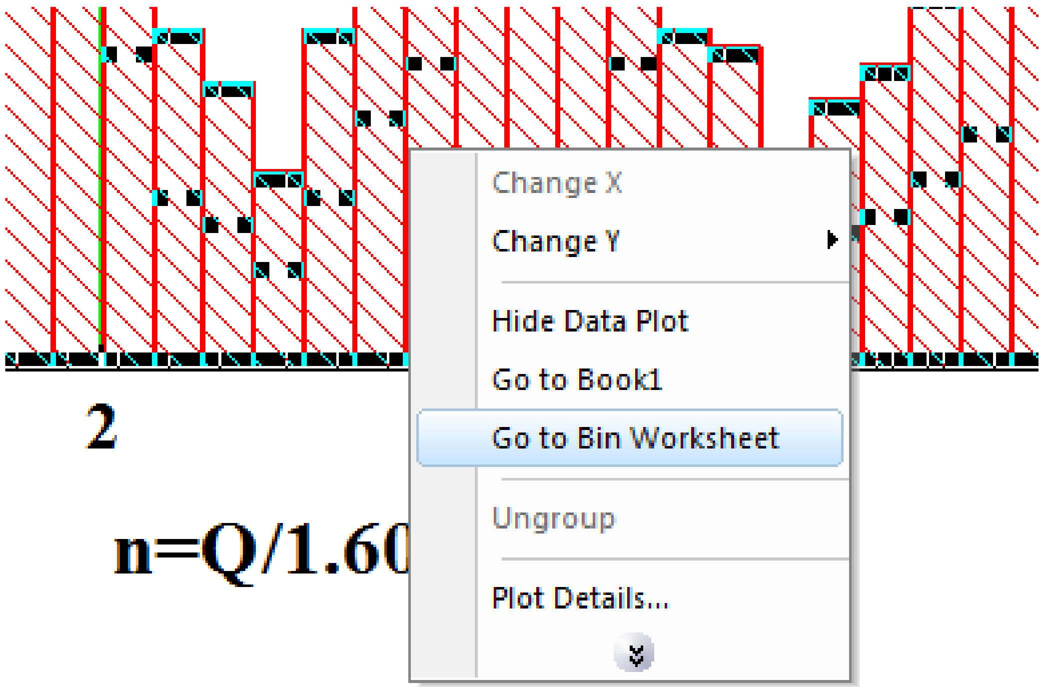




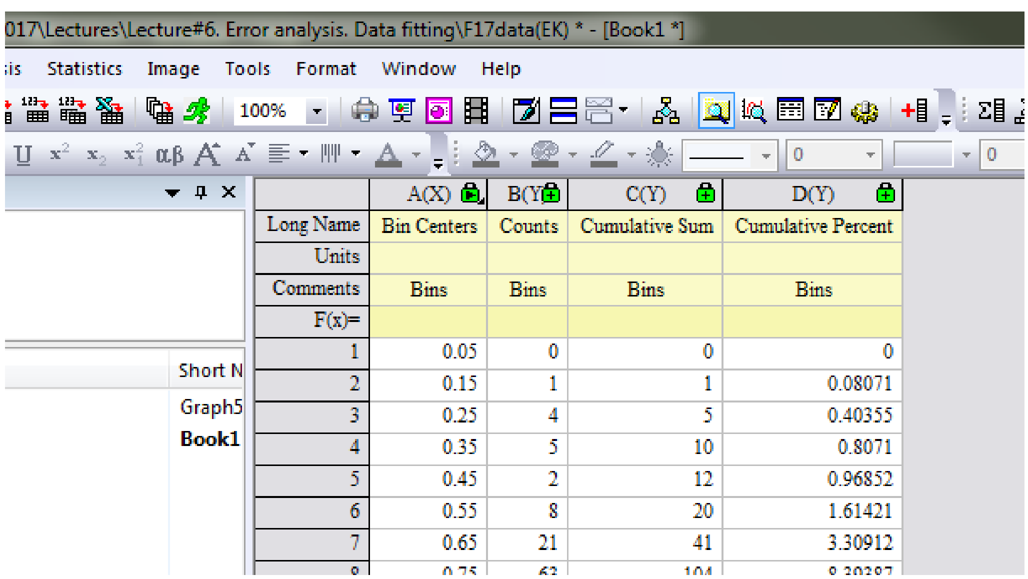
5. Template is saved with bin size as 0.1 but you can change it by clicking on the graph

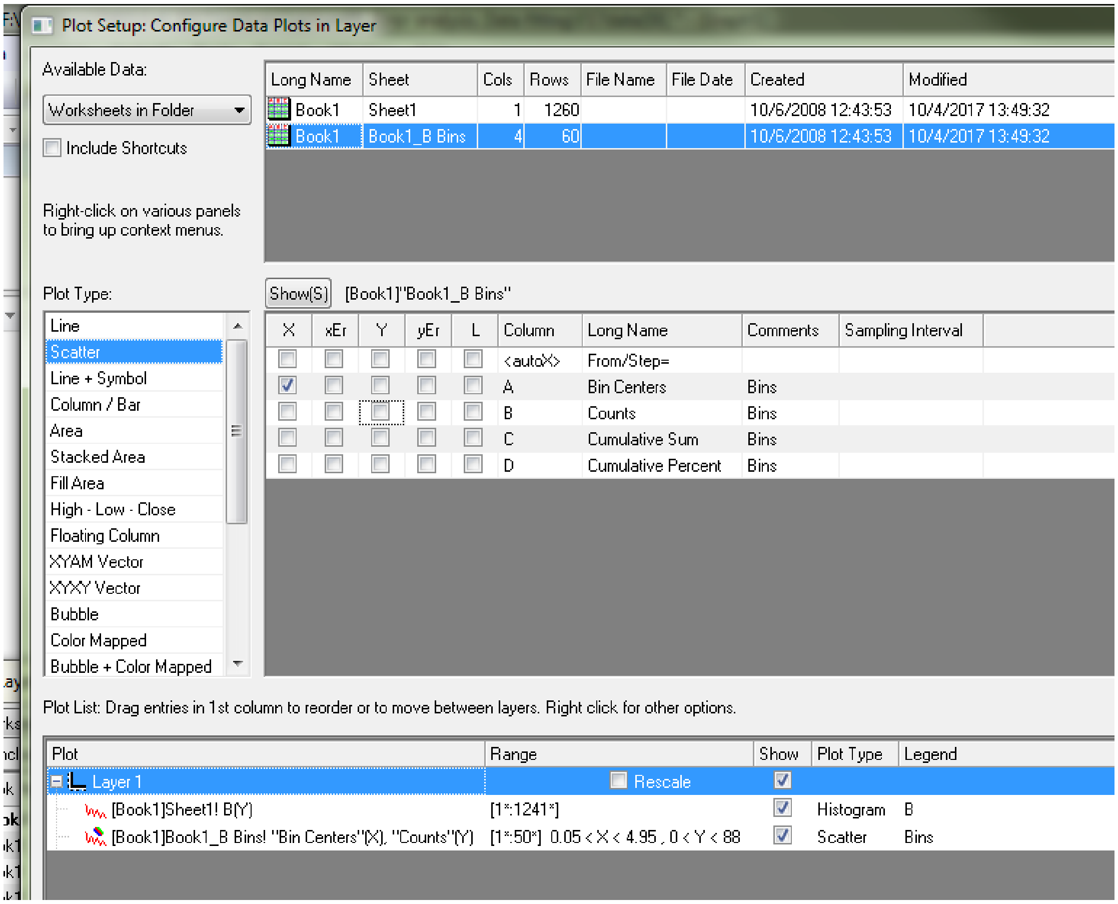


6. Now you need to add an X-Y plot of Counts vs Bin center. Right click on the graph and “Go to Bin Worksheet”

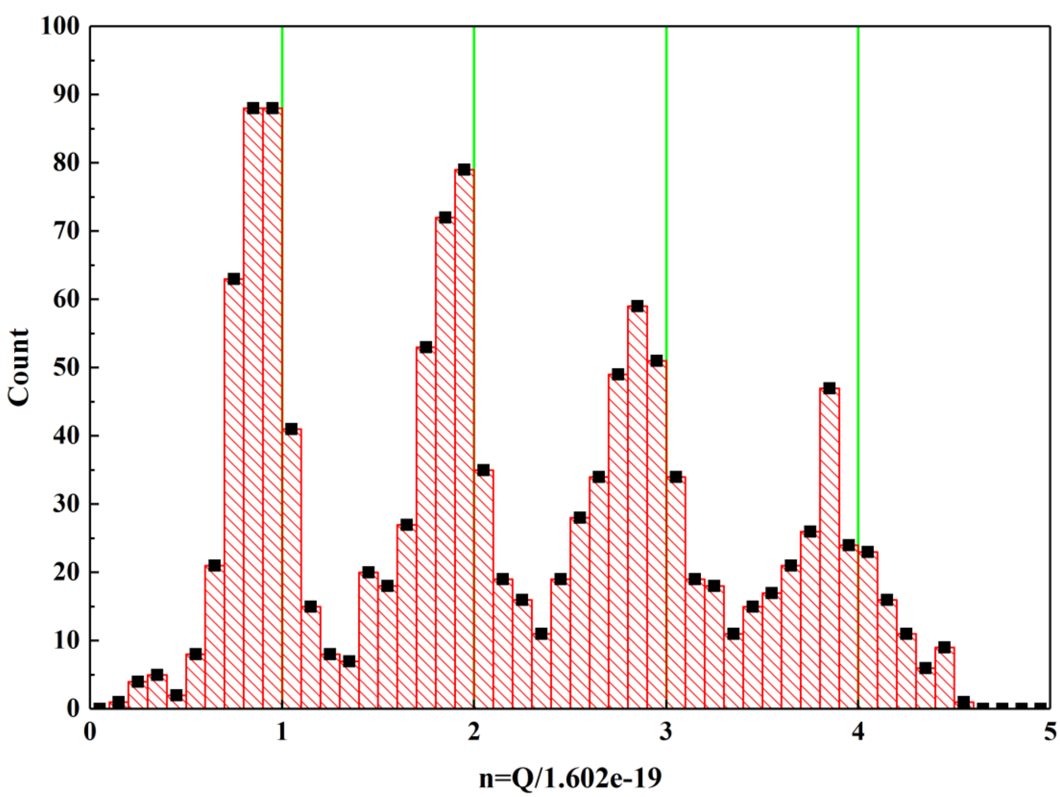


7. Now the Bin worksheet is unhidden and you can use for adding the plot on the graph

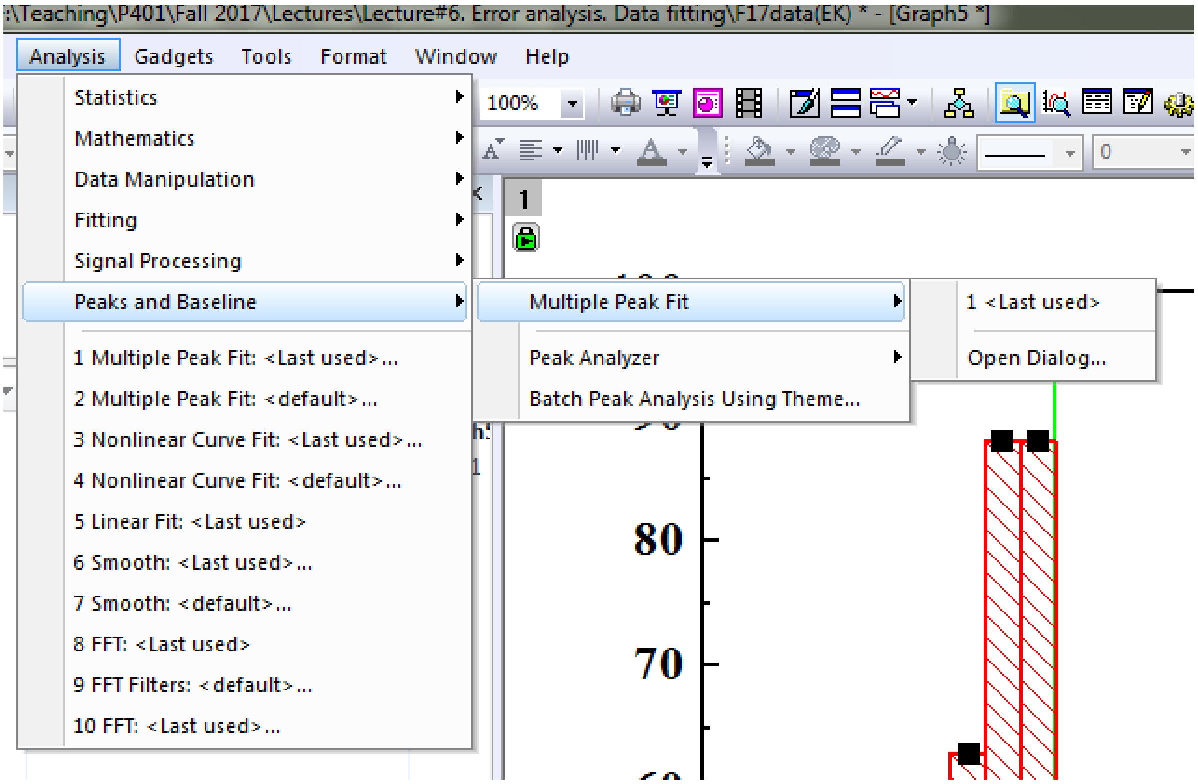


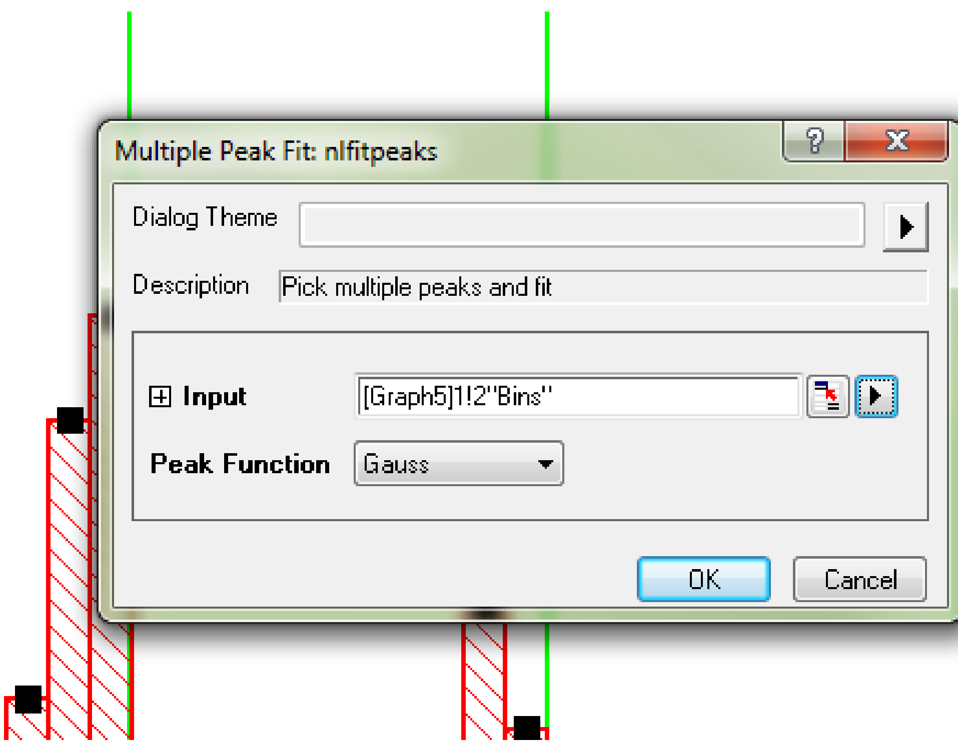


And new plot will appear on the graph

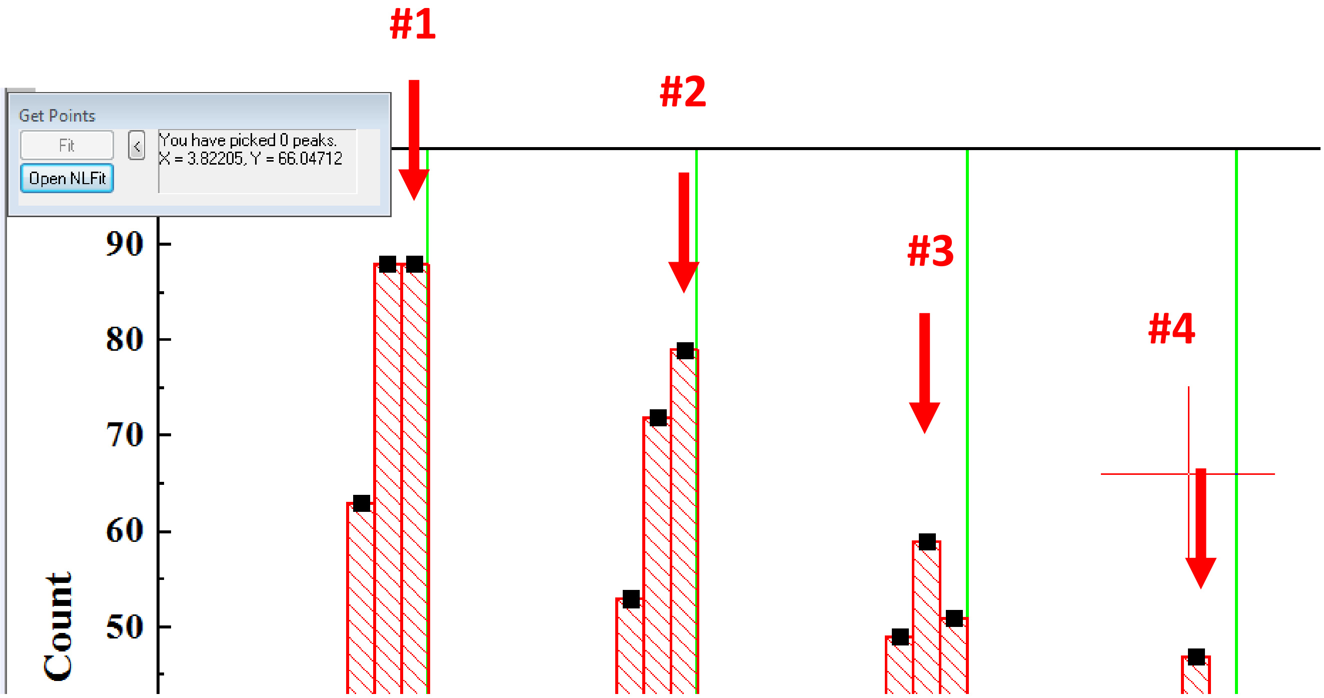


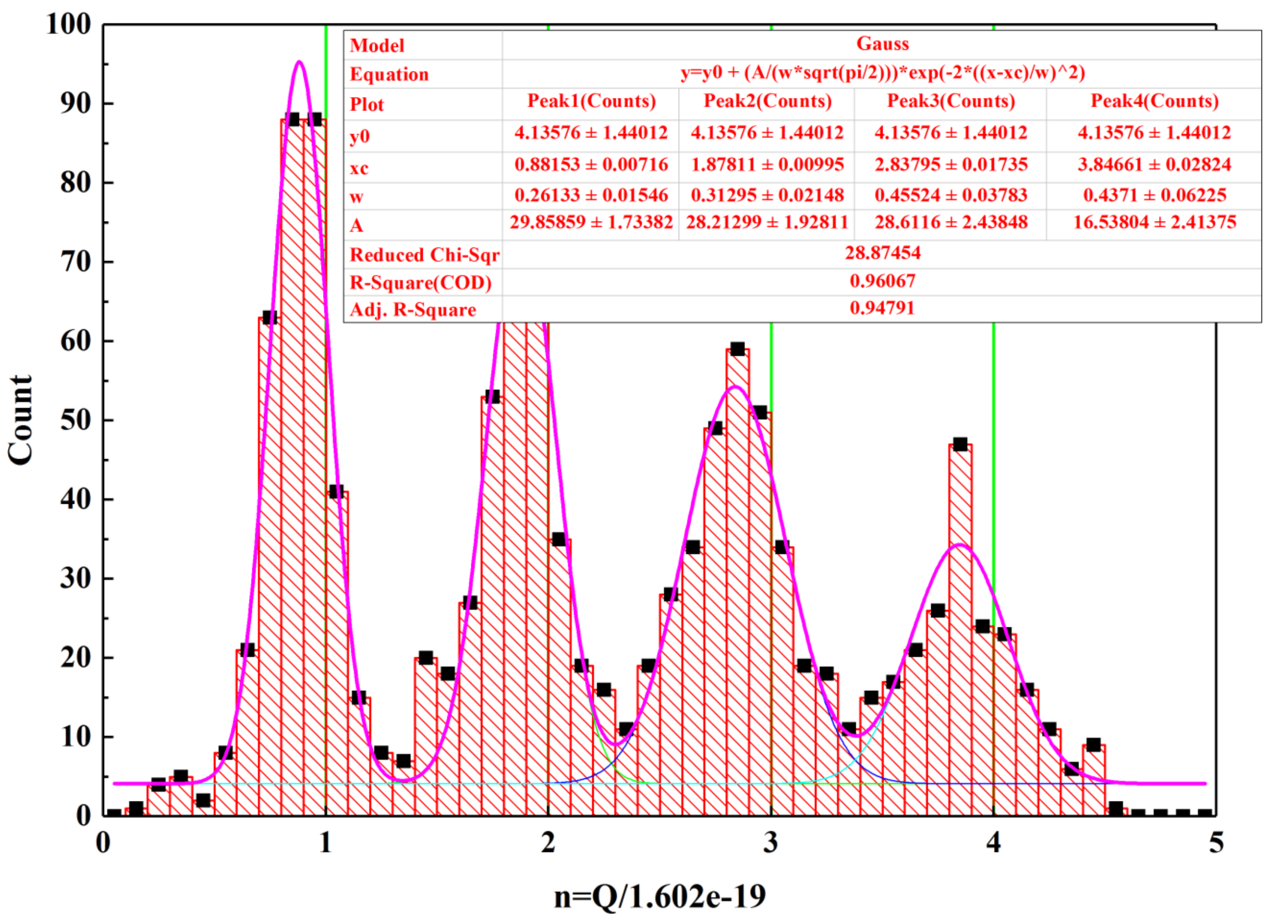
8. Now you need to do the multipeak fitting using Gaussian model as a peak shape





9. Click on all expected peaks and the on “Open NLFit” and preform the fitting





10. The positions of the peaks and uncertainties calculated by fitting procedure you can find from the Table of the fitting results. These uncertainties reflect only random errors and don't take in account the systematic errors. To calculate the systematic error you need to use the error propagation equation – see the Lecture notes.

	A	B1	B2	B3	B4
1	**Model**	**Gauss**			
2	**Equation**	**y=y0 + (A/(w*sqrt(pi/2)))*exp(-2*((x-xc)/w)^2)**			
3	**Plot**	**Peak1(Counts)**	**Peak2(Counts)**	**Peak3(Counts)**	**Peak4(Counts)**
4	**y0**	**4.13576 ± 1.44012**	**4.13576 ± 1.44012**	**4.13576 ± 1.44012**	**4.13576 ± 1.44012**
5	**xc**	**0.88153 ± 0.00716**	**1.87811 ± 0.00995**	**2.83795 ± 0.01735**	**3.84661 ± 0.02824**
6	**w**	**0.26133 ± 0.01546**	**0.31295 ± 0.02148**	**0.45524 ± 0.03783**	**0.4371 ± 0.06225**
7	**A**	**29.85859 ± 1.73382**	**28.21299 ± 1.92811**	**28.6116 ± 2.43848**	**16.53804 ± 2.41375**
8	**Reduced Chi-Sq**	**28.87454**			
9	**R-Square(COD)**	**0.96067**			
10	**Adj. R-Square**	**0.94791**			

11. For each peak to calculate the statistical error you need to take the standard deviation for corresponding peak (w_i) and divide it by the square root of the number of data points corresponding this peak ($\sqrt{N_i}$). N_i cold be calculated from area parameters (Ai) for normal distribution assuming that $\sum_i A_i$ corresponds total number of points N and the fraction corresponding each peak will be proportional to A_i:

$$N_i \approx \frac{A_i}{\sum_i A_i}$$