

## Peak Fitting

In this folder, you will find 3 sets of fake data and a script for fitting them in Python / Spinmob using Spyder. You may write your own scripts for this, but it will take a good deal of time, so please try out the supplied script.

1. Run the script, selecting “fake-peaks1.txt”, clicking the two peaks to supply guess parameters, and look at the results. The gray curve shows the guess, and the red curve shows the fit. Parameters are listed above, and in the console.
  - (a) Why are the error bars in the residuals plot all the same size ( $\pm 1$ ), while the error bars in the main plot are all different sizes?
  - (b) Roughly what fraction of the data points are within one standard deviation of the fit?
  - (c) Are there any outliers you suspect are “bad” data points? If so, how often do you expect such fluctuations to happen? Is this reasonable?
  - (d) Is the reduced chi squared value  $\chi_r^2$  for this plot “good”? How can you quantify “good”? Hint: run / play with the script “Chi2 Distribution Playtime.py”.
  - (e) Do you see any structure in the residuals suggesting the model is not correct?
  - (f) Open the file “fake-peaks1.txt” and compare your fit results to “reality” used to generate this fake data.
2. Run the same script on “fake-peaks2.txt”, and answer the same questions.
3. Modify the fit function to include a constant background (additional fit parameter), and answer the same questions.
4. (Optional) See if you can figure out what’s up with “fake-peaks3.txt”, then check against “reality”.
  - (a) Without knowing “reality”, is there enough data to make a compelling case for it?
  - (b) What if some theorist told you the ratio of peak heights must be 3/2?