

LabVIEW problem:

You are provided with 240 measurements of Geiger counter counts as a function of time from a short-lived radioactive source. Counts are accumulated in consecutive 30 s intervals and recorded. The background has not been subtracted, so it will be treated as a parameter in the fit. The data are in the form of a single column of numbers in the file Decay_Data.txt.

Part 1: Fit the data to the function $y = a_0 \exp(a_1 t) + a_2$ where a_2 is the background counting rate. To do this, use the Lev-Mar VI in LabVIEW. Start with the supplied prototype VI and derivative VI.

You will need to modify the VI to calculate an array of t values for the data points (take t_i to be the time in the middle of the i^{th} interval: for example, the first point would correspond to $t_0 = 15$ s, the second to $t_1 = 45$ s, etc.). Also, you will need to calculate the array of standard deviations (the square root of the number of counts in each interval). These should then be fed into the two arrays labeled t and STD. These are controls in the prototype VI. Change them to indicators and connect them to the arrays you have calculated.

Part 2: Make a combined plot of the data points and fitted function. Again, part of the work has been done in the prototype VI. The x-y graph has been set up with a plot of the data. Use the best-fit coefficients a_0 , a_1 and a_2 (which are available in an array produced by the Lev-Mar fit) to calculate the yc array values (one for each measurement time t_i) for the fitted function in the combined plot (again change the yc control in the prototype VI to an indicator when you connect it to your array).

The prototype VI block diagram and the front panel of the completed problem are shown on the next page. The prototype VI and data are available on the web page next to this problem.

LabVIEW Problem for Midterm, Physics 116C, Spring, 2007

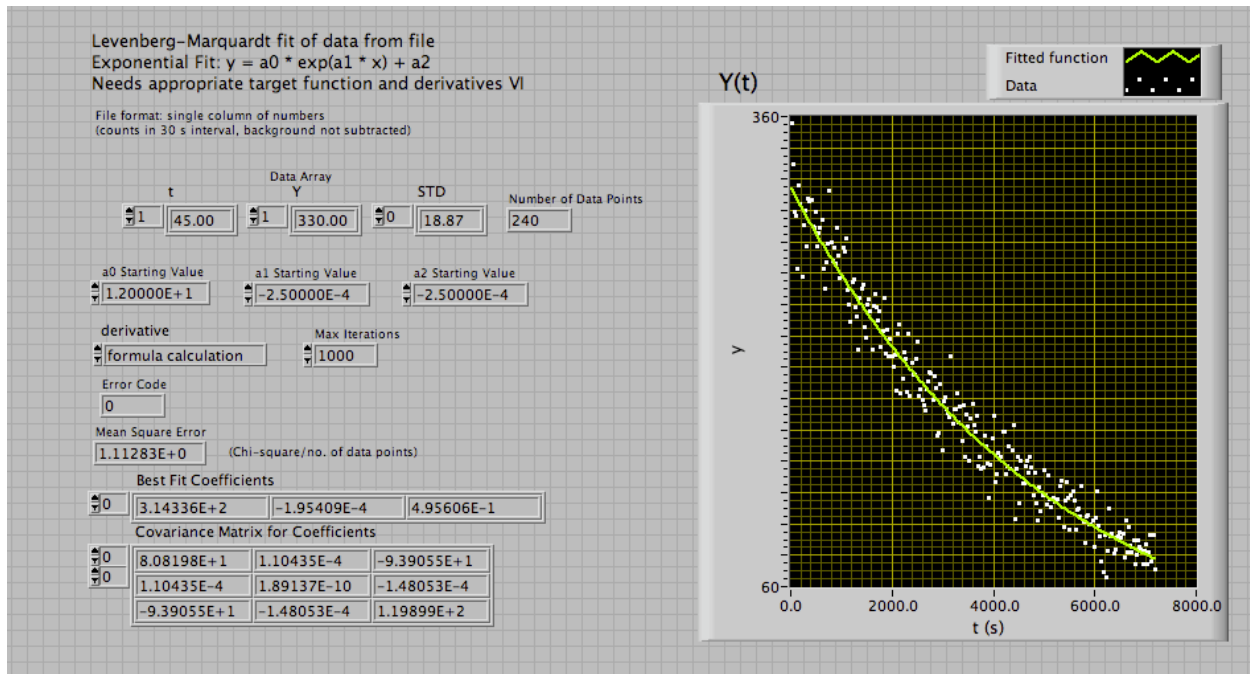


Figure 1: Completed VI front panel with results.

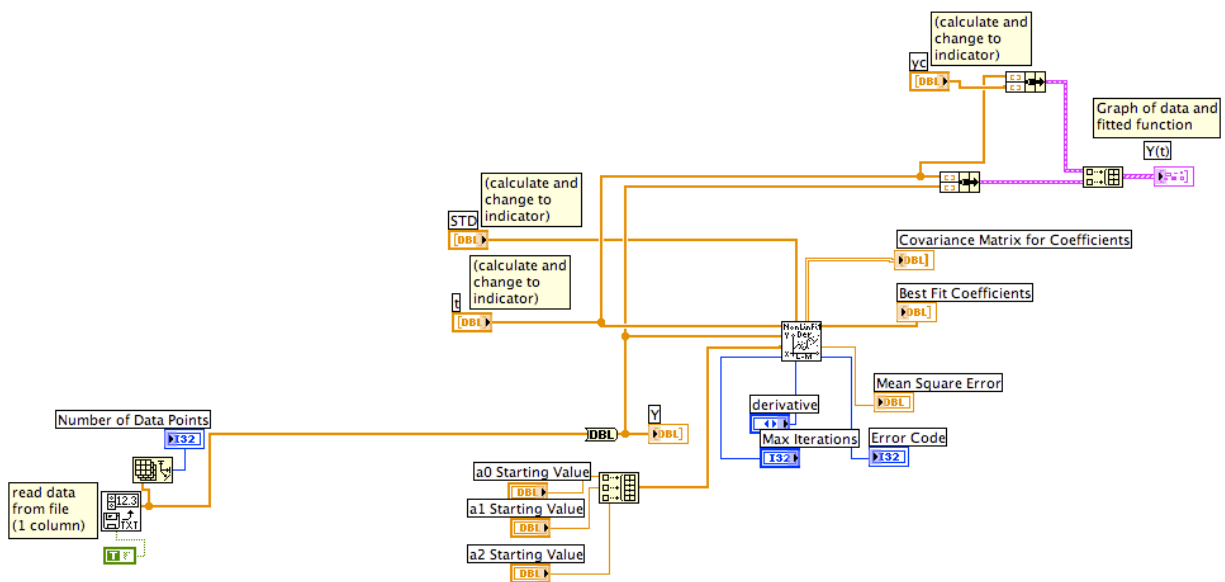


Figure 2. Prototype VI. Some additional construction is required!