

First attempt, during the run:

I used blow-up versions of the graphs for xRMSDN on p. 60 and 62 from Log X, and I drew by hand smooth curves through the data points. I then used a ruler to measure points on the graph. For each spot size, I measured both the GADC values on one graph, and the delay values on the other one. I then used an expression that includes both recombination, with an equation for the plasma density of the type:

$$\frac{n}{t} = -n^2$$

which has a particular solution:

$$\frac{1}{n(t)} = \frac{1}{n_0} + t,$$

and a diffusion term of the form:

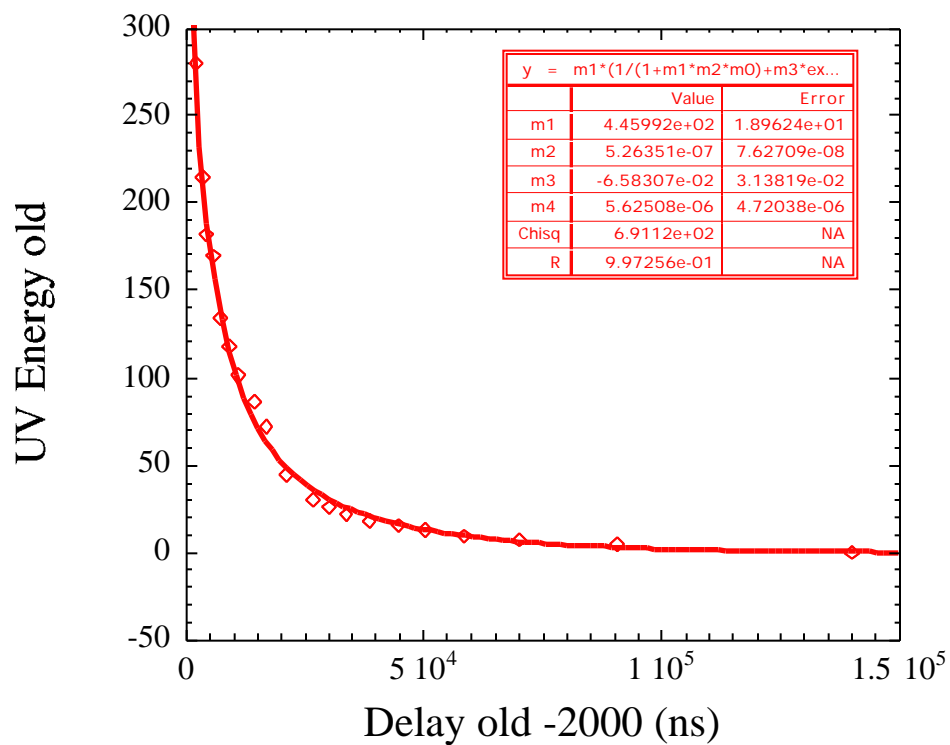
$$n(t) = n_0 e^{-Dt}.$$

The fit thus has three or four parameters:

The initial density  $n_0$ , or in this case the GADC at the true zero delay, the recombination parameter  $\alpha$ , the diffusion parameter  $D$ , and a coefficient to allow for individual contributions from both effects ( $\beta$ ). The expression to fit to the data is thus:

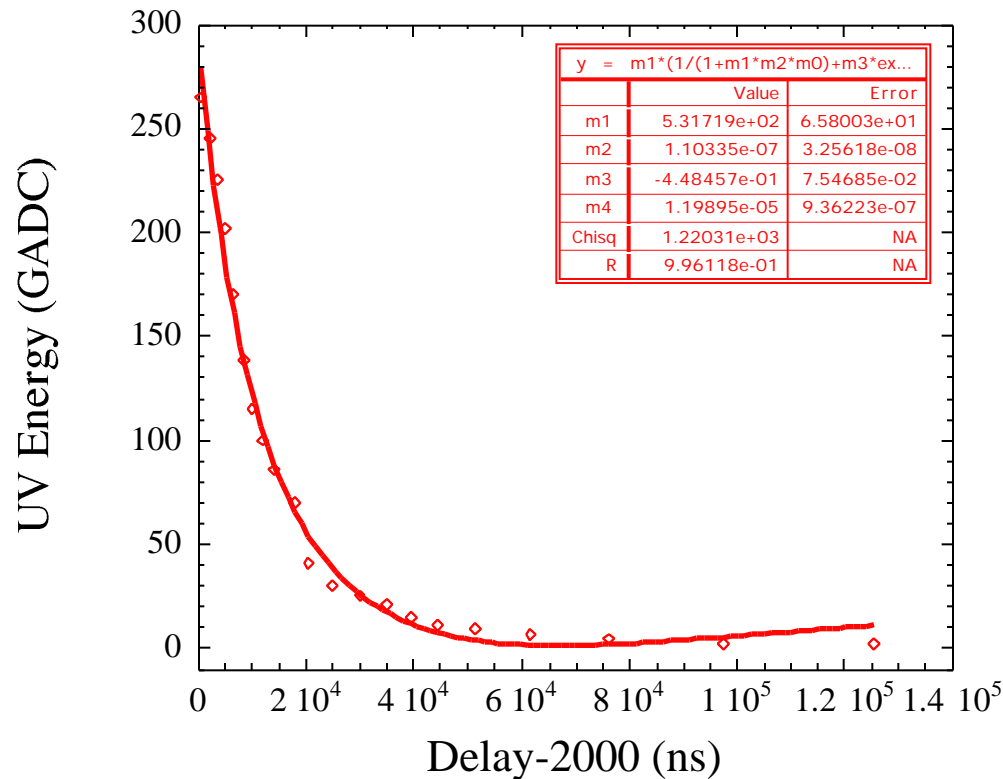
$$n(t) = n_0 \frac{(1 - \alpha)}{1 + n_0 \alpha t} + \beta e^{-Dt}$$

in the Log I considered the first measured point to be at zero delay, with a density (GADC) value of 285 (p.93), and  $m1 = n_0$ ,  $m2 = \alpha$ , and  $m3 = D$ . Using the measured “zero delay” at -2042 ns, and letting the initial density free gives the following result, which is similar to the one in Log X, with  $m1 = n_0$ ,  $m2 = \alpha$ ,  $m3 = D$ , and  $m4 = D$ .



Second attempt, yesterday:

I used a more modern approach. I used a curve fit option of KaleidaGraph called “weighted” to obtain a more objective smooth curve through the figures of p. 60 and 62. Then I repeated the same procedure to get the GDAC(delay) curve. Here is the same graph as before, with the same parameters for the fit.



The fit does not look as good as before, and the density increases again at large time delays. This comes from the fact that  $m_3$  is negative, and thus allows for the derivative of the curve to become positive when diffusion dominates over recombination. In this case  $m_3$  is much larger (0.45 in absolute value) than in the other case (0.06). There is a “discontinuity” around GADC=50, and the first part of the curve is linear (more so than in the other case, and may be a feature of the “weighted” fits that were used).

There are obviously some issues about these results. First, is the hand fit better than the KaleidaGraph fit? What does the “weighted” fit do? Second,  $m_3$  is negative, should it be? Third, the slope of the curve is large near the zero delay, which gives a large uncertainty for the initial plasma density.