III.C.2.c. Convolution of the components of the ORR resolution function

Mathematical details of the process of convoluting the four components of the resolution function is non-trivial; only a summary is presented here.

The convolution of the electron-burst resolution function with the resolution function representing the channel width is straightforward and yields a trapezoidal function whose exact shape depends upon the relative magnitudes of the parameters *p* and *c*. Combining that result with the detector resolution function (either NE110 or lithium glass) gives a continuous function of the form

$$I_{134}(t) = \frac{D}{pcf^{\,2}} \left\{ A_{ei}\, e^{-f\,t} + A_{2i}\, f^{\,2} t^2 + A_{1i}\, f\, t \; + A_{0i} \right\} \quad , \qquad \text{(III C2 c.1)}$$

which is valid in the region defined by $t_{i-1} < t < t_i$. Here t_i is the *i*th member of the ordered set of times $\{ 0, p, c, d, p+c, c+d, p+c+d \}$ with t_0 defined as 0. Algebraic expressions for the A_{ji} $(j = e, 2, 1, 0)$ in terms of the model parameters depend very strongly on the relative sizes of the parameter values; the specific formulae are too numerous and too complicated to list here, but are implemented within the code. Note that while the function is continuous, it is not smooth; the first derivative of this function is piecewise continuous, with discontinuities at the t_i.

Combining the above result with the resolution function for either the water moderator or the tantalum target gives a result which is a combination of polynomials and exponentials in $(t - t_i)$. The final resolution function is continuous but again not smooth; the first derivative has discontinuities at each of the t_i; for the tantalum target, the derivative has additional discontinuities at $x_1, x_2, x_3,$ and at $t_i + x_j$. Nevertheless, the resolution function generally *appears* smooth.