On Elastic Tail Subtraction

First, some definitions:

1. Σ : The unpolarized cross section.
2. Δ : The polarized cross section.
3. $A = \Delta/\Sigma$: The asymmetry.
4. $\Delta\sigma = 2\Sigma A = 2\Delta$: The polarized cross section difference.
5. In the following, subscripts and superscripts are used which signify:
   - T : Total measured quantity.
   - r : radiated
   - el : elastic
   - in : inelastic

   For example $A_T^{\rm r}$ represents the measured asymmetry, which has not been corrected for any radiative corrections.

The measured asymmetry contains a contribution from elastic tail as follows:

$$A_T^{\rm r} = \frac{\Delta_T^{\rm r}}{\Sigma_T^{\rm r}} = \frac{\Delta_{\rm in}^{\rm r} + \Delta_{\rm el}^{\rm r}}{\Sigma_{\rm in}^{\rm r} + \Sigma_{\rm el}^{\rm r}} \tag{1}$$

Please note that, in general:

$$A_T^{\rm r} \neq \frac{\Delta_{\rm in}^{\rm r}}{\Sigma_{\rm in}^{\rm r}} + \frac{\Delta_{\rm el}^{\rm r}}{\Sigma_{\rm el}^{\rm r}} = A_{\rm in}^{\rm r} + A_{\rm el}^{\rm r} \tag{2}$$

So that the elastic part of the asymmetry ($A_{\rm el}^{\rm r}$) can not be directly subtracted from $A_T^{\rm r}$. But, for Δ we do have the following simple relation:

$$\Delta_T^{\rm r} = \Delta_{\rm in}^{\rm r} + \Delta_{\rm el}^{\rm r} \tag{3}$$

So

$$\Delta^{\rm r}_{\rm in} = \Delta^{\rm r}_T - \Delta^{\rm r}_{\rm el} \tag{4}$$

Essentially, this is how I subtract out the elastic radiative tail contribution. It is done at the Δ level. Everything else is just redefinitions:

$$\begin{aligned} A^{\rm r}_{\rm in} &= \frac{\Delta^{\rm r}_{\rm in}}{\Sigma^{\rm r}_{\rm in}} && (5)\\ &= \frac{\Delta^{\rm r}_T - \Delta^{\rm r}_{\rm el}}{\Sigma^{\rm r}_{\rm in}} && (6)\\ &= \frac{\Sigma^{\rm r}_T A^{\rm r}_T - \Delta^{\rm r}_{\rm el}}{\Sigma^{\rm r}_{\rm in}} && (7)\\ &= \left(\frac{\Sigma^{\rm r}_T}{\Sigma^{\rm r}_{\rm in}}\right) A^{\rm r}_T - \frac{\Delta^{\rm r}_{\rm el}}{\Sigma^{\rm r}_{\rm in}} && (8)\\ &= \frac{1}{f} A^{\rm r}_T - A_{rc} && (9) \end{aligned}$$

where

$$f = \frac{\Sigma^{\rm r}_{\rm in}}{\Sigma^{\rm r}_T} \tag{10}$$

$$A_{rc} = \frac{\Delta^{\rm r}_{\rm el}}{\Sigma^{\rm r}_{\rm in}} \tag{11}$$