How to plot and fit Sonnet simulations

Instructions: Before running the program, export the data from Sonnet in CSV format (press Graph button the simulation) with the following settings:

- Output → S-Y-X Parameter File
- File format: Spreadsheet (CSV)
- De-Embedded: Yes
- S-Param
- DB-ANG
- Include adaptive data and high precision
- Do not include comments

Note: This program supports parameter sweeps from Sonnet.

Functionality of Buttons:

- **Fit:** Fits the resonance. The fit takes into account both the S_21 against frequency and Angle in degrees against frequency plots.
- **Start Again:** Simply starts the fitting process again with the initial seed values.
- **Reset:** Restarts the fitting process with the last parameters fitted. If nothing was fitted, this button functions the same as the Start Again button.
- **Get Parameters:** Retrieves all the parameters in a folder with the name of the file.

The four sliders correspond to the parameters for frequency, phase, and both quality factors - one related to the intrinsic quality factor, and the other related to the coupling to the transmission line. It's also possible to switch between all the resonances that you have.

The **Fit and Go** button initiates the fitting process automatically. It may take some time to calculate, but don't worry!

Fit function:

The fit function is the following:

$$|S_{21}(x)|^2 = \frac{2Q_e x}{(1+a)^2 + 4Q_e^2 x^2} + \left(1 - \frac{1+a}{(1+a)^2 + 4Q_e^2 x^2}\right)^2$$

$$\mathrm{Arg}(S_{21}(x)) = \arctan\left(\frac{2Q_e x}{a(a+1) + 4Q_e^2 x^2}\right)$$

where $a = Q_e/Q_i$ and $x = f/f_0 - f_0/f$. From this fitting, we obtain f_0, the