

VI.C.3.c. Implicit data covariance for normalization and background

To determine the covariance matrix due to the background and normalization corrections, SAMMY assumes that the “corrected” data D and the “original” data R are related via

$$D(E) = \frac{R(E) - b(E)}{a}, \quad (\text{VI C3 c.1})$$

in which a and b are defined as in Section III.E.3.a (*Explicit Normalization and/or Background Functions*). Note that for the IDC, corrections are applied to the experimental data and therefore are opposite to those applied to the theory as in Section III.E.3.a.

Values and uncertainties (as well as possible correlations) for the normalization and background parameters should be determined by the experimentalist. However, the analyst may find it necessary to apply further corrections to the data. In this case, the analyst can run SAMMY, including normalization and/or background functions in the parameter file with the parameters flagged (varied) in order to determine the correct values for the parameters. The next step would be to produce a modified data file; this step can be accomplished with SAMMY by including a command line “REFORMULATE DATA FOR implicit data covariance” in the INPUT file. SAMMY will then produce a file SAMMY.DA2 in the same format as the analyst’s DATA file, with the data values corrected according to Eq. (VI C3 c.1). Note that uncertainties in this data file will not be changed (except to divide by the normalization a , if the uncertainties in the file are absolute rather than relative): This file, like the original, contains only statistical, but not systematic, errors. SAMMY will also produce a file SAMMY.IDC that contains the normalization and broadening information, and a new parameter file SAMMY.PA2 identical to the analyst’s PAR file except for the absence of the normalization and broadening information. The uncertainties in SAMMY.IDC can then be modified (or added) to be the proper experimental uncertainties on the normalization and broadening parameters, to be used in further SAMMY runs.

In subsequent SAMMY runs for that data set, the INPUT file contains the command line “IMPLICIT DATA COVARIance matrix is to be used.” SAMMY then looks for the IDC file, which uses the same formats as portions of the PARAMETER file. In particular, card set 6 (NORMALization and background) and card set 13 (BACKGround functions) can be included in this file; see Section III.E.3.a for a description of these functions. Any correlations between values should also be given here, using again the formats of the PARAMETER file for EXPLICIT uncertainties (card set Last, alternative B).

NOTE: This use of the implicit data covariance (IDC) with normalization and background parameters was the earliest implementation of the more general IDC construction, as outlined in Section IV.D.3. The PUP concept (Section IV.D.2) is applicable to more parameter types, and is easier for the analyst to use but (when used with the same parameters) gives identical results to the original normalization-and-background IDC described in this section. It is likely, therefore, that this original version will eventually be phased out. Analysts are encouraged to use the PUP option instead.