Assessment of the covariance matrix of neutronic cross sections using the Backward-Forward Monte-Carlo Method.

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Traditionally, users of nuclear data have been asking for the "best possible cross sections", however in order to assess safety margins, the "best possible cross sections" is no longer enough and nuclear data must be accompanied by an assessment of its associated uncertainties: the covariance matrix.
We will describe the Backward-Forward Monte-Carlo (BFMC) method that combines nuclear physics modeling of nuclear reactions with constraints from experimental data to derive the covariance matrix associated with the calculated cross sections. This method consists in obtaining the covariance matrix of the model parameters by a generalized Khi-squared method using the experimental data as constraints (the Backward Monte-Carlo step) and then propagating these uncertainties to calculated cross sections in the TALYS nuclear modeling code (the Forward Monte-Carlo step). These two steps use Monte-Carlo sampling of the parameter space. An example of the construction of a covariance matrix will be shown.