Living without covariance files

D. Rochman and A.J. Koning
Nuclear Research and Consultancy Group NRG, Petten, The Netherlands

We have developed a new method to propagate the uncertainties of fundamental nuclear physics models and parameters to the design parameters of future, clean nuclear energy systems. Using Monte Carlo simulation, it is for the first time possible to couple these two fields at the extremes of nuclear science without any loss of information in between. With the help of a large database of nuclear reaction measurements, we have determined the uncertainties of theoretical nuclear reaction models such as the optical, compound nucleus, pre-equilibrium and fission models. Integrating this into one simulation program enables us to describe all open channels in a nuclear reaction, including a complete handling of uncertainties. Moreover, in one and the same process, values and uncertainties of nuclear reactor parameters are computed. This bypasses all the approximate intermediate steps which have been used so far in nuclear data and reactor physics. Two important results emerge from this work: (a) we are able to quantify the required quality of theoretical nuclear reaction models directly from the reactor design requirements, (b) our method leads to a deviation from the commonly assumed normal distribution for uncertainties of safety related reactor parameters, and this should be taken into account for future nuclear energy development.

E-mail: rochman@nrg.eu
Presentation type: *Talk*