A SUGGESTED PROEDURE FOR RESOLVING AN ANOMALY IN
LEAST-SQUARES DATA ANALYSIS KNOWN AS "PEELLE'S PERTINENT PUZZLE"
AND THE GENERAL IMPLICATIONS FOR NUCLEAR DATA EVALUATION*

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ABSTRACT

Modern nuclear-data evaluation methodology is based largely on
statistical inference, with the least-squares technique being chosen
most often to generate best estimates for physical quantities and
their uncertainties. It has been observed that those least-squares
evaluations which employ covariance matrices based on absolute errors
that are derived directly from the reported experimental data often
tend to produce results which appear to be too low. This anomaly has
come to be known as "Peelle's Pertinent Puzzle" (PPP) because the
validity of certain evaluations afflicted in this manner has been
called into question by R.W. Peelle. The anomaly, as originally posed
by Peelle through a specific example, is discussed briefly in this
report, and a procedure for resolving it is suggested. The method
involves employing data uncertainties which are derived from errors
expressed in percent. These percent errors are used, in conjunction
with reasonable a priori estimates for the quantities to be evaluated
(rather than the individual experimental values), to derive the
covariance matrices which are required for applications of the
least-squares procedure. This approach appears to lead to more
rational weighting of the experimental data and, thus, to more
realistic evaluated results than are obtained when the errors are

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based on the actual data. The procedure is very straightforward when only one parameter must be estimated. However, for those evaluation exercises involving more than one parameter, this technique demands that a priori estimates be provided at the outset for all of the parameters in question. Then, the least-squares method is applied iteratively to produce a sequence of sets of estimated values which are anticipated to converge toward a particular set of parameters which one then designates as the "best" evaluated results from the exercise. It is found that convergence usually occurs very rapidly when the a priori estimates approximate the final solution reasonably well. In fact, the procedure is observed to be quite robust in that convergence is not too difficult to achieve even when the a priori estimates aren't very good. Some examples are given in this report to illustrate the problem and to demonstrate the approach suggested here for its resolution. Some general implications for the practice of nuclear data evaluation are also discussed.