

May 9, 2000

WPEC subgroup proposal

Title:

Evaluation, Process, and Practical Use of Covariance Data for the Group-Constant Adjustment.

Short Justification for a Subgroup:

Covariance files of the evaluated nuclear data libraries are essential for practical applications of nuclear data such as an adjustment of group-constants, an evaluation of design accuracy, and so on. Although an importance of covariance data has been claimed for a long time, the covariance data for the evaluated nuclear data libraries are still incomplete, since their evaluation is extremely difficult. To generate a substantial data file, various requirements from users of the nuclear data should be considered. The purpose of this subgroup is to prepare a circumstance in which users of the nuclear data libraries can make use of the covariance files. The objectives are, to develop the methods of covariance evaluation, to investigate problems at the processing of the covariance files, and to perform an adjustment of nuclear data with the covariance data file.

Subgroup Monitor:

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List of Subgroup Participants:

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Definition of the Project:

The project will be separated into four phases — preparation of covariance files, generation of the covariance of the group-constants, adjustment of the cross sections with the covariance data, and feedback of the results to covariance evaluation.

At the first stage, covariance data of several nuclides of importance such as uranium and plutonium isotopes will be prepared. Currently the covariance evaluation projects are proceeding independently at each library. The covariance data of each project will be compared with each other. The covariances of resolved/unresolved resonance regions should be treated with great care because of their importance for nuclear technologies. Precise *R*-matrix analyses of the resonance parameters for many nuclides have been done at Oak Ridge. Many of these resonance parameters were adopted in the different libraries, so an evaluation of the covariance for resonance parameters can be done under the international cooperation.

Process of the evaluated covariance files may need to extend existent nuclear data processing code systems such as NJOY, in case we need some additional extensions of ENDF/B format in order to express uncertainty information appropriately. These problems we would face at the practical use of covariance data will be surveyed and discussed.

The covariance data obtained will be used for the adjustment of the group-constants. Both of JNC and CEA have that potential, so the adjustment will be done at the both institutes and the results will be compared. These results will be used to check whether the evaluated covariance data express the uncertainty information properly.

Justification of the Project:

In WPEC/SG2, methods to evaluate the covariance matrix of ^{56}Fe were investigated, and some examples were obtained there. After the SG2, an extensive progress was made by the JENDL group in order to construct a JENDL-3.2 covariance file of some important nuclides for a fast-reactor application. This covariance file would be practically used for some limited purposes, however there still remains plenty of problems to generate a general purpose covariance file.

To evaluate covariance data files for practical applications, feedback information by the users is essential. The first feedback can be expected at the processing of nuclear data libraries, and the second feedback is from application fields. This information confirms the properness of the covariance data represented in the ENDF/B format.

The objectives of this subgroup are:

- to develop the methods of covariance evaluation;
This purpose is similar to SG2, but a large number of nuclides would be included. It should be noted that the method depends on the energy regions — the resolved, unresolved, and smooth regions.
- to investigate the problems at the processing of the covariance files;
To deal with the covariance data, there are two aspects we have to pay attention, the data format and the process code.
- to perform the adjustment of nuclear data with the covariance file;
The only way to review the evaluated covariance file is to use it for practical applications. The reliability of the covariance data files would be confirmed in a reasonable way.

Relevance to Evaluated Data Files:

This project will generate covariance data, which would be practically used for the cross section data adjustment. Especially covariances for the resonance energy region would become the most important quantities. These covariance data will be provided in ENDF/B format so they can be employed in libraries.

Deliverables:

- covariance data files of important nuclides for each library.
- a number of tools to generate a covariance data file.
- a number of tools to process the covariance data file.
- recommendations for evaluation methods.
- recommendations for representation of the uncertainty information.
- a practical guideline to process the covariance data file.

Time-Schedule and Milestones:

2000 2001

Select target nuclides and types of nuclear data to which the covariance data are given in order for an adjustment.

Survey presently existent covariance data for each project. Those will be directly compared with each other immediately.

Investigate various evaluation methods. Those methods will be compared with each other to seek a proper way to represent uncertainty information.

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Process the evaluated covariance files to generate covariance matrices of the group-constants. The data process will be done at each project and the covariance matrices obtained will be compared with each other. The covariances of the group-constants will be also compared with the original data in order to check whether the obtained values are reasonable.

If there are some problems at the data processing, this feedback information is considered and reflected to the further evaluation works.

If some modifications to the ENDF/B format are needed, a recommendation report to the format will be prepared.

Perform group-constant adjustment and comparison of the results. The results are also discussed among the evaluators and the users in order to update the covariance files.

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Prepare a final formal report of the subgroup activities during the period 2000-2002.