

WPEC sub-group proposal

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Title:

Investigation of Covariance Data in General Purpose Nuclear Data Libraries

Justification for a Subgroup

The motivation for the subgroup is to bring together the international covariance community to understand how the covariance data can be so different between the different evaluated nuclear data files, ENDF, JEFF, JENDL, CENDL, etc., while the mean values (cross sections, ν -bar, etc.) are generally very similar. Many questions have emerged from the groups applying covariance data for analysis, such as the Working Party on Nuclear Criticality Safety (WPNCs) Expert Group on Uncertainty Analysis for Criticality Safety Assessment (UACSA), on how the use of different covariance libraries (e.g. ENDF, JEFF, JENDL, etc.) affects uncertainty quantification and similarity assessment. Further, significant differences in covariance libraries lead to differences in the adjustment of parameters for fast reactors, which is an important topic for WPEC sub-group (SG) 39.

The CIELO project, WPEC SG-40, established an international effort of nuclear data evaluators from different nuclear data projects to provide nuclear data evaluations that may be consistently accepted by all major nuclear data projects. This work has certainly driven the progress towards minimizing the disagreement in the mean values (cross sections, ν -bar, etc.) between different nuclear data libraries. However, with that project coming to a close in the coming year, there has not yet been a concentrated effort on providing consistent covariance evaluations across the different nuclear data libraries. The maturity of the nuclear data evaluation process is such, at this time, that it is warranted to create an international collaboration on cross section covariance evaluation methodologies.

This sub-group will be tasked with the goal to investigate covariance data for a broad range of system types, not just fast reactors as is the focus of WPEC SG-39. This sub-group will leverage the work of previous sub-groups which investigated the generation of covariance data for specific physical regions, such as WPEC SG-24 and SG-36, which focused on evaluations of fast neutron region and the resolved resonance region, as well as WPEC SG-42 which focused on the evaluation and covariance generation for thermal scattering. This sub-group will focus its attention on providing guidance to the international community on methods for systematic and consistent evaluation of covariance data for the whole energy range, paying special attention to energy domain interface (resolved resonance/unresolved resonance/continuum). The group will also deliver examples of the application of the proposed methodology on a few selected isotopes. The ultimate goal of the subgroup is to provide an overview of the best practices of how to generate more consistent covariance data sets.

Subgroup Monitor:

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Subgroup Coordinator:

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Subgroup Participants

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Project Definition and proposed activities

The implications for the propagation of nuclear data uncertainty through current modelling and simulation capabilities to the safety of nuclear installations around the world justify the creation of a new sub-group. An international collaboration through a NEA/WPEC subgroup will be essential for leveraging efforts allowing the sharing of information needed for achieving the project goal.

The project will be divided in the following phases:

- I) Evaluation of the differences between discrepant covariance data evaluations in different evaluated nuclear data libraries
- II) Assessment of the methodologies for generating covariance data utilized by the different nuclear data projects;
- III) Documentation and evaluation of the current state-of-the-art methodologies for covariance data generation;
- IV) Demonstration of the state-of-the-art covariance evaluation methodologies on a limited set of input data (microscopic/integral measurements) with detailed uncertainties description for one isotope to be defined (e.g. ^{239}Pu , ^{235}U , ^{238}U);
- V) Discussion of the representation and interpretation of nuclear data uncertainty (covariance) in evaluated nuclear data files.

Relevance to Evaluated Data Files

Recommendations for generating nuclear data covariance evaluations.

Time Schedule and Deliverables

2018-2019: The first period will be devoted to collect and review existing evaluations and to identify the major discrepancies between different projects as well as the major issues driving the discrepancies in the propagated nuclear data uncertainties in applications.

Deliverable: Review of discrepant covariance data across major nuclear data projects and establishment of a high priority list for nuclear data covariance evaluation.

2019-2020: The second period will be devoted to the exploration of systematic and consistent methodologies for generating covariance data.

Deliverable: Draft version of Best Practices Document for General Purpose Nuclear Data Library covariance evaluations.

2020-2021: The third period will address the representation of nuclear data covariance in evaluated nuclear data files and their interpretation. Of particular interest will be the representation and interpretation of covariance data for non-cross section data (i.e. prompt neutron fission spectra, angular distributions, cross-correlations).

Deliverable: Final version of Best Practices Document for General Purpose Nuclear Data Library covariance evaluations complete with examples.