
Subgroup 20:
Covariance Matrix Evaluation and Process
in the Resolved/Unresolved Resonance Regions

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Subgroup 20 Achievements

Retroactive Method

- The SAMMY code has a capability to generate resonance parameter covariances.
- Recommended procedure to use this capability is given in the subgroup report (to be distributed).

New Format

- We have proposed a new compact format to store the resonance parameter covariance in the ENDF format.
- The new format was approved by CSEWG in 2004.

Processing

- A new version of ERRORJ (ver.2.2.1) is available.

Report

- The draft of our final report will be distributed soon.

Resonance Parameter Covariances

- Few information about resonance analyses in ancient times is available.
- We simulate the old experiments to generate the covariance data for existing libraries.
 - Larson implemented “**Retroactive Method**” to estimate a covariance matrix of resonance parameters in SAMMY.

Retroactive Method

- Generate simulated experimental data — calculate cross sections with the resonance parameters provided.
- Realistic energy points / resolution / background *etc.*, assumed by taking old experiments (ORELA, for example) into account.
- Estimate / assume uncertainties for the simulated data
- Generate a resonance covariance so as to reproduce the simulated uncertainties.

Problems in Retroactive Method

- There was a problem to estimate uncertainties in the “old measurements,” which makes the estimated cross section uncertainty extremely small.
 - If the number of simulated data points are large, the uncertainty obtained becomes very small because of a very good statistics.
 - The number of data points must be determined by a realistic experimental condition.
 - We found that a systematic error in the experiments plays very important role.
- With the realistic energy resolution that is reasonably consistent with the experimental condition, we could obtain a reasonable size of uncertainty.
- Several practical examples of the retroactive method you can find in our final report.

Compact Format

- The new format to store the full covariance data in the ENDF-6 format.
 - SAMMY generates covariances of resonance parameters in this format.
 - ERRORJ can read this format to process.
- It is now possible to store the full covariance data of U-235 resonance parameters within a reasonable file size. The file size depends on the accuracy we need, but the typical size is in Mega Bytes order.

ERRORJ

- The ERRORJ code that processes Reich-Moore covariance data can be used with NJOY, AMPX, and PUFF-2 data processing systems.
- The ERRORJ code has been extensively improved by G.Chiba in 2004–2005.
 - Read the compact format
 - Speed-up — two times faster than the previous version.
- The calculated group covariances by ERRORJ have been compared with the covariances for group-averaged cross section by SAMMY.
- For more accurate sensitivity calculations and speed-up, a module from SAMMY will be implemented (plan).