

Covariance Data In ENDF/B-VII.0

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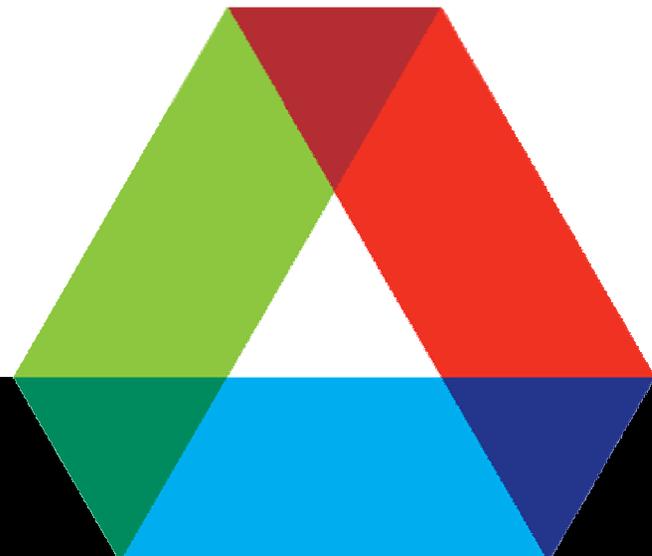
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Sources of covariance information for ENDF/B-VII.0

- Covariances that are migrated from ENDF/B-VI.8 along with their corresponding evaluated physical parameters (e.g., cross sections)
 - Only carefully reviewed covariances that have been judged to satisfy contemporary quality standards are being migrated to ENDF/B-VII.0
- Covariances associated with new evaluations not found in ENDF/B-VI.8
 - Newer covariances submitted by evaluators for inclusion in ENDF/B-VII.0 are being subjected to the same rigorous quality review process as older results migrated from ENDF/B-VI.8
- Good quality is being stressed for the covariance information that is to be included in ENDF/B-VII.0 even if it means rejecting many older results

When in doubt ... leave it out!

Factors considered in judging the quality of covariances

- Errors and correlations must be reasonable and should adequately represent the available information upon which these evaluations are based
 - Above all, accepted covariances should pass the “reality test”
- Covariance matrices need to satisfy all mathematical requirements and the corresponding ENDF files must be usable for applications (user processing)
- Covariances constructed from *ad hoc* estimates of errors and correlations decoupled from the core evaluation process are being avoided and strong preference is being given to covariances generated using contemporary evaluation procedures as outlined in a following slide
 - *Evaluation procedures have matured beyond the subjective stage*
- Covariances that are represented in the files by the simplest allowable ENDF formats, consistent with the need to adequately express the uncertainty information, are being favored to facilitate user access and file processing

Overview of covariances to be included in ENDF/B-VII.0

- The following table indicates the anticipated covariance content of ENDF/B-VII.0

MF	Description	ENDF/B-VI.8	ENDF/B-VII.0
31	Nu-bar	9 (2)	3 [1]
32	Resonance Parameters	4 (1)	10 [12]
33	Cross Sections	739 (26)	147 [142]
34	Angular Distributions	0	0
35	Secondary Particles	1 (1)	1 [0]
40	Radioactive Nuclei	2 (2)	2 [0]
Totals		755 (32)	187 [155]

(...) Candidate ENDF/B-VI.8 files to be migrated to ENDF/B-VII.0

[...] Candidate new files to be introduced in ENDF/B-VII.0

Insistence on good quality is leading to a significant reduction in content!

Status of candidate covariances for ENDF/B-VII.0 (1)

MF = 31 (Average number of neutrons per fission)

Isotope	Candidate Covariance Files for ENDF/B-VII by MT Number
Th-232	452
U-235	452,456

- Yellow highlight implies migration from ENDF/B-VI.8
- Black font indicates that file review process is incomplete

MF = 32 (Resonance parameters)

Isotope	Candidate Covariance Files for ENDF/B-VII by MT Number
Na-23	151
Tc-99	151
Gd-152	151
Gd-153	151
Gd-154	151
Gd-155	151
Gd-156	151
Gd-157	151
Gd-158	151
Gd-160	151
Ir-191	151
Ir-193	151
Th-232	151

- Red font indicates file could not be processed in its present form
- Green font indicates that file has satisfied all quality requirements

Status of candidate covariances for ENDF/B-VII.0 (2)

MF = 33 (Neutron cross sections **A = 1 to 100**)

Isotope	Candidate Covariance Files for ENDF/B-VII by MT Number
Li-6	105 ,105(Std)
Li-7	1,2,4,102,851
B-10	107,800,801
C-nat	2(Std)
F-19	4,16,22,28
Ti-48	1,4,16,28,102,103,107
V-nat	1
Co-59	1,16,103,107
Ni-58	16
Y-89	1
Nb-93	1
Tc-99	1,2,4,16,102,103,107

Status of candidate covariances for ENDF/B-VII.0 (3)

MF = 33 (Neutron cross sections A > 100)

Isotope	Candidate Covariance Files for ENDF/B-VII by MT Number
Gd-152	1,2,4,16,102,103
Gd-153	1,2,4,16,102,103
Gd-154	1,2,4,16,102,103,107
Gd-155	1,2,4,16,102,103
Gd-156	1,2,4,16,102,103,107
Gd-157	1,2,4,16,102,103
Gd-158	1,2,4,16,102,103,107
Gd-160	1,2,4,16,102,103,107
Ir-191	1,2,4,16,102,103,107
Ir-193	1,2,4,16,102,103,107
Au-197	1,102(Std)
Bi-209	1
Th-232	1,2,5,16,17,18,22,24,28,41,51,52-89(All),91,102,600,649,800,849, 851,852,853,854,855
U-235	18(Std)
U-238	18(Std)

Status of candidate covariances for ENDF/B-VII.0 (4)

MF = 35 (Distributions of secondary particles)

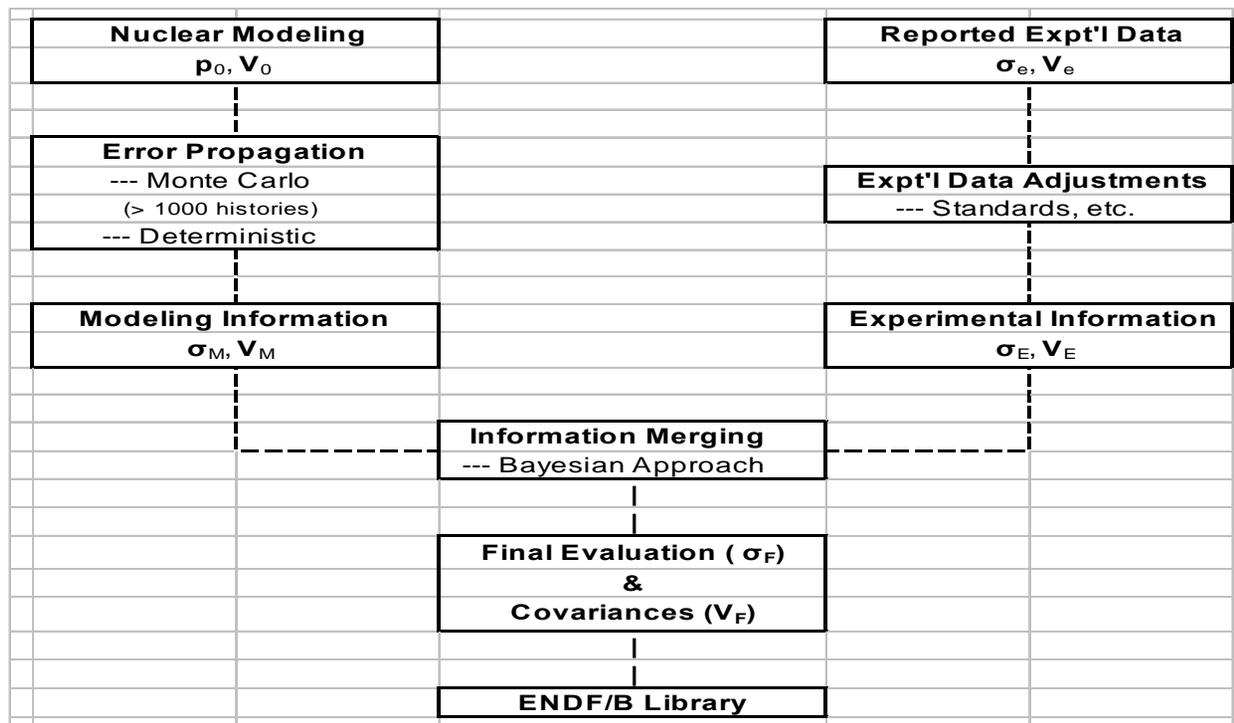
MAT	Isotope	Candidate Covariance Files for ENDF/B-VII by MT Number
9861	Cf-252	18

MF = 40 (Production of radioactive nuclei)

MAT	Isotope	Candidate Covariance Files for ENDF/B-VII by MT Number
4125	Nb-93	4
4931	In-115	4

Modern evaluation procedures

- Evaluated physical parameters and their covariances should be determined objectively by consistent merging of experimental and nuclear modeling values



These procedures will benefit from high performance computing capabilities

Concluding comments

- The imposition of rigorous quality requirements is leading to a significant reduction in the covariance content of ENDF/B-VII.0 relative to ENDF/B-VI.8
--- A thorough housecleaning is taking place in preparation for the future
- The covariance review process is ongoing, but an early Autumn cutoff date for this work is necessary to adhere to the ENDF/B-VII.0 library release schedule
- Extensive coordination with the data user communities will be necessary in the future to insure that the most critically needed covariance information will be available to them in a timely manner and in a usable form
--- The tasks of addressing user covariance needs must be prioritized
- Evaluators should devote considerable attention to the issue of uncertainties in the future to insure that all new evaluations include good quality covariances
- Modern evaluation procedures require high performance computing capabilities