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5 November 2020

**NUCLEAR ENERGY AGENCY
NUCLEAR SCIENCE COMMITTEE**

Working Party on International Nuclear Data Evaluation Co-operation

**Meeting of the WPEC Subgroup 44 on the Investigation of Covariance Data in
General Purpose Nuclear Data Libraries**

SUMMARY RECORD

11 May 2020
WebEx remote meeting

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JT03468026

OECD/NEA Nuclear Science Committee

**Working Party on International Nuclear Data Evaluation Co-operation (WPEC)
Meeting of Subgroup 44 on the Investigation of Covariance Data in General Purpose
Nuclear Data Libraries**

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SUMMARY RECORD

1. Welcome

The Chair, **V. Sobes**, welcomed the participants (see *Appendix I*) and the WPEC Secretariat, **M. Fleming**.

2. Adoption of the agenda

The agenda as described in *Appendix 2* was adopted, except that **A. Sonzogni** was unable to attend and his presentation was cancelled.

3. Multivariate statistical reduction of cross section uncertainties in neutron reactions

C. Opera and **I.-A. Opera** presented the findings from work on multivariate analysis and data reduction for quantification of cross section uncertainties. The cross section data in these studies were generated through a set of sampled parameters of Wood-Saxon potentials for incident and outgoing reaction channels. Cross section sensitivities to the real WS volume were identified as the greatest. Principal component analysis was used on the $^{143}\text{Nd}(n,\alpha)$ channel for incident neutrons between 300 keV and 25 MeV by sampling the optical model parameters. The real part of the WS volume and the imaginary part of the surface WS potential were identified as the most sensitive and these will continue to be studied in follow-up work.

4. An update on the SG44 computational inter-comparison study

V. Sobes discussed the status of the inter-comparison study, referencing the recent work that was done, including that of JAEA/Yokoyama, PSI/Rochman, UPM/Cabellos and UTK/Sobes. The general conditions originally agreed were to use any nuclear data library, any set of integral benchmarks, any assimilation technique and a 3-group structure with cutoffs at 10 μeV , 0.625 eV, 50 keV and 20 MeV. The hypothesis was that some ‘stable’ correlations would be observed for specific correlations (e.g. between fission, capture and nubar). After the November 2019 meeting, it was agreed that this need to be relaxed so that

the correlations will depend on the integral systems being considered. Results from each of the participants showed correlations between the MT 18, 102 and 452 data, but while the values for fission and nubar correlations were consistent, there were significant differences in other quantities. In the discussion, it was clear that some quantities such as fission cross section and average neutron production per fission are more naturally correlated due to the importance of the combined quantity. Others will have more application-dependent significance. As an example, post-irradiation isotopic densities may depend on total transmutation of an isotope (e.g. capture and fission have the same effect), while criticality naturally depends on capture and fission differently. As a result, the correlations between fission and capture may be completely different if assimilation of criticality or nuclide inventory are taken as the integral experiment. Even with different criticality safety benchmarks with the same materials and average neutron spectra, different suites generate different correlations, so each application-specific covariance library could or should be targeted at a carefully selected set of representative systems.

5. Discussion on the SG44 draft summary report

V. Sobes and **M. Fleming** reviewed the contributions that had been identified in previous meetings (c.f. [NEA/NSC/WPEC/DOC\(2019\)12](#) Appendix 3 and [NEA/NSC/WPEC/DOC\(2019\)7](#) Appendix 3). Those that were still incomplete were discussed sequentially with re-commitment except in the case of 3.a.(iii) on recommendations for EXFOR, which was agreed to be better placed within the scope of the proposed new Subgroup 50. Material on fission yields was not committed as **R. Mills** was not present and this will be confirmed by the NEA Secretariat. The inter-comparison study continues and conclusions will form a distinct section. The status is summarised in *Appendix 3*.

6. Any other business

As the last meeting of the WPEC Subgroup 44, the Secretariat thanked the Co-ordinator, **V. Sobes**, and Monitor, **C. de Saint Jean**, for their efforts and dedication to this work. Several participants expressed their gratitude to the Co-ordinator. **V. Sobes** thanked the participants for their delivered and committed contributions to the report and expressed support for the proposed new subgroup on *Developing an Automatically Readable, Comprehensive and Curated Experimental Reaction Database*, which was due to be reviewed at the WPEC-31 meeting on 15 May 2020.

APPENDIX 1

List of registrants to the 11 May 2020 Meeting of Subgroup 44 on the Investigation of Covariance Data in General Purpose Nuclear Data Libraries

WebEx Meeting

11 May 2020

	Name	Surname	Representing	Notes
1	Goran	ARBANAS	UNITED STATES	
2	Eric	BAUGE	FRANCE	
3	Bret	BECK	UNITED STATES	
4	Doug	BOWEN	UNITED STATES	
5	David	BROWN	UNITED STATES	
6	Oscar	CABELLOS	SPAIN	
7	Roberto	CAPOTE	IAEA	
8	Theresa	CUTLER	UNITED STATES	
9	Cyrille	DE SAINT JEAN	FRANCE	Co-chair
10	Isabelle	DUHAMEL	FRANCE	
11	Michael	FLEMING	NEA	Secretariat
12	Daniela	FOLIGNO	NEA	
13	Zhigang	GE	CHINA	
14	Godfree	GERT	UNITED STATES	
15	Ian	HILL	NEA	
16	Andrew	HOLCOMB	UNITED STATES	
17	Jesse	HOLMES	UNITED STATES	
18	Raphaelle	ICHOU	FRANCE	
19	Evgeny	IVANOV	FRANCE	
20	Nobuyuki	IWAMOTO	JAPAN	
21	Osamu	IWAMOTO	JAPAN	
22	Ivan-Alexander	KODELI	SLOVENIA	
23	Arjan	KONING	AUSTRIA	
24	Stefan	KOPECKY	BELGIUM	
25	Luiz Carlos	LEAL	FRANCE	
26	Amanda	LEWIS	UNITED STATES	
27	Caleb	MATTOON	UNITED STATES	
28	Jordan	MCDONNELL	UNITED STATES	

29	George	MCKENZIE	UNITED STATES	
30	Robert	MILLS	UNITED KINGDOM	
31	Benjamin	MURPHY	UNITED STATES	
32	Denise	NEUDECKER	UNITED STATES	
33	Cristiana	OPREA	RUSSIA	
34	Chris	PERFETTI	UNITED STATES	
35	Gerald	RIMPAULT	FRANCE	
36	Danila	ROUBTSOV	CANADA	
37	Evgeny	ROZHIKHIN	RUSSIA	
38	Henrik	SJOSTRAND	SWEDEN	
39	Vladimir	SOBES	UNITED STATES	Co-chair
40	Ian	THOMPSON	UNITED STATES	
41	Nicholas	THOMPSON	UNITED STATES	
42	Dorothea	WIARDA	UNITED STATES	
43	Haicheng	WU	CHINA	

APPENDIX 2

OECD/NEA Nuclear Science Committee

**Working Party on International Nuclear Data Evaluation Co-operation (WPEC)
Meeting of Subgroup 44 on the Investigation of Covariance Data in General Purpose
Nuclear Data Libraries**

WebEx Meeting

11 May 2020

AGENDA

Duration	PDT (CA, USA)	CEST (Paris)	JST (Tokyo)	Topic	
00:15	05:00	14:00	21:00	Welcome	V. Sobes, C. de Saint Jean
00:25	05:15	14:15	21:15	Multivariate statistical reduction of cross section uncertainties in neutron reactions	C. Opera
00:25	05:40	14:40	21:40	TBC	A. Sonzogni
00:30	06:05	15:05	22:05	An update on the SG44 computational inter-comparison study	V. Sobes
00:20	06:35	15:35	22:35	Short break	
01:00	06:55	15:55	22:55	Discussion on draft report	V. Sobes
00:10	07:55	16:55	23:55	AOB	
	08:05	17:05	00:05	Close	

APPENDIX 3

List of Summary Report Contributions and Status on 11 May 2020

Section	Responsible	Status	Topic
1*	V. Sobes	Complete	Introduction
2.a	C. de Saint Jean	Committed	Summary of main evaluation techniques used
2.b	D. Neudecker	Complete	Summary of known problems due to defects, biases, resonance range
3.a	V. Zerkin	Not planned	IAEA contribution on evaluated EXFOR
3.b	H. Sjöstrand	Committed	Methods for autonomous interpretation of experimental data
3.c	H. Sjöstrand	Committed	Methods to address discrepant data sets
4.a	V. Sobes	Complete	Use of integral experiments in evaluations
4.b.i	V. Sobes	Complete	Other probability distributions for uncertainties
4.b.ii	C. Mattoon	Complete	Additional contribution with GNDS comments
4.c	V. Sobes	Complete	Analysis of consistency of covariance data
4.d	I. Hill	Complete	Integral experiment cross-correlation
5.a	V. Sobes	Complete	Cross-isotope correlations
5.a+	D. Rochman	Committed	Additional contribution from PSI on cross-isotope data
5.b	R. Mills	SG37 incomplete	Fission yield , or relations
6*	V. Sobes	Study in progress	Inter-comparison study
7.a	D. Neudecker	Complete	Documentation of covariance evaluation techniques
7.b	L. Fiorito	Committed	Comments on angular distribution covariance format and use
7.c	C. Mattoon	Complete	Verification of eigenvalues and decompositions
7.d	V. Sobes	Committed	TSL covariances
8.a	D. Neudecker	Complete	PFNS covariances
8.b	A. Trkov	Committed	Legendre coefficient covariances and processing
8.d	A. Koning, G. Schnabel	Committed	Bayesian Monte-Carlo and random files