

**Summary Record of the 2nd Meeting of WPEC Subgroup 39 on
Methods and approaches to provide feedback
from nuclear and covariance data adjustment
for improvement of nuclear data files**

NEA, Issy-les-Moulineaux, France

13 May 2014

The subgroup co-ordinators, **M. Salvatores** and **G. Palmiotti**, welcomed the participants to the meeting (see list in Appendix 1). The proposed agenda was adopted with minor changes (see Appendix 2).

M. Salvatores reminded the participants of the subgroup objectives and reviewed the actions agreed at the previous meeting. These actions will be discussed and updated during the meeting (see section 5).

1. Computation and inter-comparison of sensitivity coefficients

T. Ivanova presented an overview of a benchmark exercise organised to test cross-section and angular distribution sensitivity capabilities implemented in Monte Carlo (MC) codes. The results were collected from seven organizations that generated sensitivities using six MC codes and three deterministic codes. Good agreement between deterministic and MC sensitivities is observed for nu-bar, fission, and capture profiles. Moreover, it was shown that statistics issues of MC scattering sensitivities can be addressed by using specific options of the codes.

I. Kodeli presented a specific sensitivity analysis of FLATTOP-Pu using SUS3D/PARTISN and SUS3D/ANISN with different methods and P_N orders. It was shown in this specific case that P_5 calculations are required to obtain an excellent agreement between SUS3D/PARTISN, SUS3D/ANISN and TSUNAMI results.

S. Pelloni presented a specific inter-comparison of FLATTOP-Pu, JEZEBEL and ZPR6-7 sensitivity profiles performed at PSI using the SERPENT and ERANOS codes.

I. Hill presented the status of the DICE and IDAT tools and associated databases. He highlighted the large increase of sensitivity profiles in the DICE database (from ~700 cases to ~3500 cases in the November 2013 release). Thanks to this additional information and to the associated software developments the evaluations can now be searched and sorted according to their sensitivity data.

2. Use of specific experiments

M. Hursin presented a summary of the PROTEUS FDWR-II experiments performed at PSI from 1985 to 1990 in support to the High Conversion Light Water Reactor (HCLWR) programme. The re-analysis of these experiments is planned using the ERANOS and SERPENT codes.

M. Salvatores presented some information on the STEK and SEG experiments, which have been re-analysed in the 90's in particular in France (CEA Cadarache) and in Japan (JNC). Both experiments are very interesting from the physics point of view thanks to variable neutron spectrum hardness (STEK) and tailored adjoint flux shapes to reduce/amplify reactivity effects due to scattering (SEG).

However, these experiments are difficult to analyse because of thermal-fast coupled regions, self-shielding effects, etc. Moreover, experimental uncertainties can be large because of statistics and/or normalisation issues. Nevertheless, the calculated-over-experimental results available could incite to revisit to some extent the analysis, in particular to provide feedback on oxygen and ^{238}U .

G. Palmiotti reviewed specific integral experiments that could provide valuable feedback on ^{235}U (ZPR9-34 and other ^{235}U cores from ICSBEP and/or IRPhEP), ^{238}U (ZPR3-53, CIRANO-2A, IPPE ^{238}U transmission sphere), ^{56}Fe (ZPR3-54, CIRANO-2B, EURACOS, ASPIS, OKTAVIAN and possibly others from SINBAD) and ^{23}Na (EURACOS, JANUS-8, sodium void reactivities from IRPhEP). Different protocols for sharing information on these experiments were proposed.

I. Kodeli presented the validation of ENDF/B-VI and JEF-2 iron cross-sections using ASPIS experiments, which could be used to constrain the adjustment and/or validate new prior data. Additional benchmarks experiments sensitive to iron data and available in the NEA databases (SINBAD, ICSBEP) were discussed.

K. Yokoyama (on behalf of M. Ishikawa) presented a survey of β_{eff} measurements performed in France (Masurca) and in Japan (FCA).

3. Adjustment results

K. Yokoyama presented the impact of nuclear data covariance on the cross-section adjustment and proposed a “physical” interpretation of the mechanisms guiding the adjustment with the objective to provide better feedback to evaluators. Revised recommendations from ADJ2010 adjustments were provided for CIELO isotopes (Big 3 and ^{56}Fe) and ^{23}Na data.

P. Archier presented the activities ongoing at CEA Cadarache in the areas of covariance evaluation and data assimilation. The recent work on the ^{239}Pu evaluation including trends on covariance data was more specifically detailed.

G. Palmiotti presented the results of a comprehensive adjustment (92 integral parameters) using as starting point ENDF/B-VII.0 cross sections and COMMARA 2.0 covariance data. Preliminary trends have been identified for some isotopes of interest for CIELO (Big 3 and ^{56}Fe). However, no recommendation could be formulated yet because of possible compensations in the adjustment due to missing integral information and missing or inaccurate covariance data.

E. Dupont presented the plots’ comparison prepared for the discussion of adjustment results provided by the participants (cf. www.oecd-nea.org/science/wpec/sg39/adjustment/results). M. Salvatores and G. Palmiotti proposed some changes in order to better characterise the convergence of participants’ results.

M. Salvatores presented some very preliminary indications from recent adjustment studies on four isotopes of interest for CIELO (Big 3 and ^{56}Fe). Some trends were detected but they need to be confirmed using specific integral experiments in order to eliminate the possibility of compensating effects. The need for covariance data as complete as possible was highlighted, including covariance for secondary neutron distributions (in angle and in energy).

4. Methodology issues

G. Palmiotti presented issues and challenges of using covariances in nuclear data adjustment. He made some proposals for the assessment of adjustments, the definition of criteria to accept new central values of cross-sections, the compensation in the adjustments, the validation of the prior and the use of the posterior covariance data, the presence of negative eigenvalues in the covariance matrix. He stressed that conclusions could be drawn on the reliability of the adopted covariance matrix and

that feedback could be provided on standard deviations, but only once the adjustment is deemed to be reliable.

K. Yokoyama (on behalf of M. Ishikawa) presented feedback from a comparison study of covariance data from JENDL-4.0 and ENDF/B-VII.1 for some CIELO isotopes (Big 3 and ^{56}Fe) and ^{23}Na .

5. Discussion, summary, next steps

The following list of actions was agreed.

A1. E. Ivanov et al.

Finalize analysis and report on FLATTOP-Pu, FLATTOP-25, ZPR-9/34, and ZPR-6/10 MC sensitivities.

A2. M. Salvatores and PSI

Indicate the most interesting PROTEUS measurements and availability of models for sensitivity and analysis.

A3. Integral experiments availability/modelling/analysis (Letter to NSC to be prepared):

- SINBAD (neutron propagation): ASPIS, JANUS, IPPE spheres, NESDP, FNG, etc. (I. Kodeli)
- STEK (variable spectrum hardness): contact Petten (E. Dupont)
- SEG (tailored adjoint flux shapes) (M. Ishikawa, G. Rimpault to be contacted, M. Salvatores, E. Dupont)
- IPPE transmission (Fe , ^{238}U) (E. Dupont, M. Salvatores to check)
- RPI semi-integral (Fe , ^{238}U) (E. Dupont, G. Palmiotti to check)

If available, how to share work: volunteers to make contributions? To be verified before next meeting (All)

A4. M. Salvatores, G. Palmiotti

Check the possibility to perform new experiments, e.g. in connection with the new NSC Expert Group on “Improvement of Integral Experiments Data for Minor Actinide Management”.

A5. INL, JAEA, CEA/JEFF (and Others)

New adjustment results and trends by next meeting, using updated covariance data if available (To be done in connection with CIELO).

A6. P. Archier (and JAEA, G. Palmiotti)

Validation of covariance data: proposal to be finalized.

A7. K. Yokoyama, G. Palmiotti

Finalise methodology studies to avoid compensations, to point out to systematic effects, etc.

A8. E. Dupont

Update online plots' comparison.

6. Next meeting

It is proposed to hold the next SG39 meeting in conjunction with JEFF meetings during the next Nuclear Data Week at the NEA, November 24-28, 2014.

Appendix 1

Participants to the 2nd meeting of WPEC subgroup 39

NEA, Issy-les-Moulineaux, France

13 May 2014

G. Aliberti	ANL, USA	
P. Archier	CEA, France	
M. Dunn	ORNL, USA	
E. Dupont	NEA, OECD	(Secretary)
A. Garcia	DOE, USA	
I. Hill	NEA, OECD	
M. Hursin	PSI, Switzerland	
T. Ivanova	IRSN, France	
I. Kodeli	JSI, Slovenia	
G. Palmiotti	INL, USA	(Coordinator)
S. Pelloni	PSI, Switzerland	
M. Salvatores	INL, USA	(Coordinator)
N. Touran	TerraPower, USA	
Wang Wenming	CIAE, China	
K. Yokoyama	JAEA, Japan	

Appendix 2

Agenda of the 2nd meeting of WPEC subgroup 39

NEA, Issy-les-Moulineaux, France

13 May 2014

9:00-9:15	Welcome, approval of Agenda, new members, etc
9:15-9:45	Review of actions
9:45-10:45	Computation of sensitivity coefficients with Monte Carlo tools and results of an inter-comparison for Flattop and ZPR benchmarks (T. Ivanova, I. Kodeli, S. Pelloni)
10:45-11:00	<i>Coffee break</i>
11:00-11:20	Update on ICSBEP and IRPhEP Database Tools, DICE and IDAT (I. Hill)
11:20-12:40	Use of specific new experiments: <ul style="list-style-type: none">- PROTEUS (M. Hursin)- STEK (M. Salvatores)- Experiments related to U-235, U-238, Fe, and Na (G. Palmiotti)- Role of shielding benchmarks e.g. ASPIS (I. Kodeli)- Comments on beta-eff measurements (K. Yokoyama on behalf of M. Ishikawa)
12:40-14:00	<i>Lunch</i>
14:00-14:30	New studies at JAEA on adjustment trends (K. Yokoyama)
14:30-15:30	Comparison of adjustment trends (K. Yokoyama, P. Archier, G. Palmiotti, E. Dupont, M. Salvatores)
15:30-15:45	<i>Coffee break</i>
15:45-16:15	Results to be presented at the joint meeting with CIELO: discussion (All)
16:15-17:00	Methodology issues (G. Palmiotti)
17:00-17:20	Covariance Data of JENDL-4.0 and ENDF/B-VII.1 (K. Yokoyama on behalf of M. Ishikawa)
17:20-17:30	Next steps and meeting