

**Summary Record of the 8th Meeting of WPEC Subgroup 39 on
Methods and approaches to provide feedback
from nuclear and covariance data adjustment
for improvement of nuclear data files**

OECD/NEA Headquarters, Boulogne-Billancourt, France

1-2 December 2016

The subgroup co-ordinators, **M. Salvatores** and **G. Palmiotti**, welcomed the participants to the meeting (see list in *Appendix 1*). **O. Cabellos** acts as Secretary. The proposed agenda was adopted (see *Appendix 2*).

1. REVIEW OF ACTIONS

M. Salvatores and **G. Palmiotti** welcomed the participants and reviewed the actions agreed at the previous meeting.

- **Finalise deliverables**

- **Action NEA:** To edit and publish by next meeting the report based on the last versions (“Summary of Methodology” and “Comments on Covariance Data”) provided by K. Yokohama and M. Ishikawa (JAEA).
> **Comments/Status-of-the-work:** First Intermediate report ready to be published in 2017.
- **Action E. Ivanov:** To finalise the report on MC sensitivity coefficients. Update some bibliographic references in the report. To be done by next meeting.
> **Comments/Status-of-the-work:** Draft is in progress. See presentation in this meeting.
- **Action S. Pelloni:** To complete the report on PIA method utilization (adjusted results for more reactions etc.) and possibly to contribute to propagation experiments analysis and sensitivity coefficient data bases implementation. To be done by next meeting.
> **Comments/Status-of-the-work:** Draft in progress. See presentation in this meeting.
- **Action H. Wu:** To finalise the report on “Stress Test on ^{235}U (n, f) in adjustment with HCI and HMI benchmarks” To be done by next meeting.
> **Comments/Status-of-the-work:** First draft received 08/12/2016, new version of the report prepared for ND2016. The comparison of ^{235}U alpha value was included.
- **Action A. Barnes/Others:** Produce report on the status of uncertainties of Am-241. Initiate by criticality safety problem for space application. Progress on this action should be reported at the next meeting.
> **Comments/Status-of-the-work:** On going.

- **Current activities: Methodologies and Experimental Benchmarks**

- **Action G. Palmiotti, Others:** Development of improved criteria for adjustment reliability (from methodology studies). Progress to be reported at next meeting.
> **Comments/Status-of-the-work:** On going.

- **Action M. Aufiero/G. Palmiotti:** Continue to develop continuous energy data assimilation techniques. Possible application to a simple, few isotope cases. To be reported at next meeting.
> Comments/Status-of-the-work: On going.
- **Action I. Kodeli:** Provide sensitivities of ASPIS experiment.
> Comments/Status-of-the-work: Done.
- **Action All:** Analysing and using new experiments of elemental and separation of effects type: PROTEUS, FCA-IX, SEG, ASPIS-88, SNEAK, and MANTRA. This is the key action for SG39. At present, commitment only by INL (G. Palmiotti).
> Comments/Status-of-the-work: Done. See presentation in this meeting.
- **Action All:** Providing support for new industrial emerging needs helping for data uncertainty reduction (e.g. TWR).
> Comments/Status-of-the-work: On going.
- **Action B.T. Rearden/ORNL:** Provide SCALE6.2 covariance data in 33 groups for SG39. By next meeting.
> Comments/Status-of-the-work: To be provided in May 2017.
- **Starting from CIELO new files (without uncertainties) attempt new adjustment:**
 - **Action S. Kahler, G. Palmiotti:** Processed CIELO (and ENDF/B-VII.0) infinite dilution cross sections in the standard 33 groups will be available for SG39. Provide feedback by energy range, reaction, and isotope using sensitivity database and C/E developed by SG39.
> Comments/Status-of-the-work: Done. See presentations in this meeting.
 - **Action G. Palmiotti, I Kodeli, Others:** Perform extended adjustment using more elemental type of integral experiments and new adjustment strategies using CIELO data.
> Comments/Status-of-the-work: Done. See presentations in this meeting.
 - **Action CIELO/SG39:** Expecting feedback from CIELO in terms of more complete and reliable covariance data in the next future. Possible first CIELO covariance data release by March 2017.
> Comments/Status-of-the-work: On going. See presentations in this meeting.

2. PRESENTATIONS

2.1 Session on Methods

- SG39-1: “Detailed comparison of Progressive Incremental Adjustment (PIA) sequence results involving adjustments of spectral indices and coolant density effects on the basis of the SG33 benchmark”

S. Pelloni presented results using different sequences of PIA methodology to test the impact of simultaneous assimilation versus the incremental adjustment, the importance of iterations and the effect of reversed order in the sequences. Clearly, this analysis will permit to reject the adjustment when it depends on the sequence. This inconsistency can be explained because there are conflicting effects between different steps, and/or the posteriori sensitivity coefficients are also dependent of the sequence.

G. Palmiotti remarked the importance of the order in the sequences. He also mentioned that the trend in χ^2 could show the reliability of the PIA technique, and the importance to see the change of the sensitivities in the iterative process.

- SG39-2: “ND assessment alternatives: Validation matrix vs XS adjustment”

First, **E. Ivanov** presented a general overview and general remarks on validation conceptual system. The traditional approach and data assimilation was discussed. It was remarked the importance of integral experiments (IEs) correlations and the progressive approach using dedicated IEs. It was shown how in the Bayesian methodology, the parameters to determine the Bias and the Uncertainty of the Bias are different. The inconsistency to predict the sensitivity coefficients with different computation approach would affect these calculations. Different metrics, such as the uncertainty reduction factors or the bias ranking factors, can be used to measure the uncertainty reduction of prior uncertainty giving enough information for validation of nuclear data and criteria of the selection of integral experiments.

M. Salvatores pointed out the importance of this work to provide guidelines or protocols to select benchmarks and how to use sensitivities.

- SG39-3: “Implementation of Resonance Parameter Sensitivity Coefficients Calculation in CE TSUNAMI-3D”

V. Sobes presented the implementation of the resonance parameter sensitivity coefficients in CE TSUNAMI-3D. The main advantages of this methodology lie in a continuous energy physics treatment and the calculation of resonance parameters on-the-fly. In addition, the Doppler broadening can be performed analytically allowing for on the fly temperature calculation.

2.2 Session on Experiment analysis, sensitivity calculations and benchmarks

- SG39-4: “Benchmark tests of ENDF/B-VIII.0 beta 1 using sodium void reactivity worth of FCA-XXVII-1 assembly”

K. Yokoyama, (in place of **M. Fukushima**, JAEA), presented the sodium-void reactivity worth of FCA XXVII-1 benchmark with high sensitivity to ^{235}U capture cross section around 3 keV. Replacement from ENDF/B-VII.1 to ENDF/B-VIII.0b1 increases void reactivity worth with a very high improvement mainly caused by lower ^{235}U capture around keV region, ~ 20% smaller.

2.3 Session on Adjustments

- SG39-5 “Cross-section adjustment based on JENDL-4.0 using new experiments on the basis of the SG33 benchmark”

K. Yokoyama presented the cross-section adjustment adding four additional integral experiments (PROTEUS 7 and 8, SNEAK 7A and 7B) on the basis of the twenty SG33 benchmarks. C/E values are converted into those with JENDL-4.0 using sensitivity coefficients. It can be seen that the addition of PROTEUS worsens the C/E values of ZPPR-9 sodium void worth. This effect is mainly caused by adjusting ^{238}U inelastic scattering cross-section. For the most important cross-sections, the change due to different evaluations (ENDF/B-VII.1, VIII.0b1, VIII.0b3 and CIELO) and the calculated adjustment are shown.

- SG39-6: “Comparison of adjustment trends with the CIELO evaluation”

S. Pelloni presented the results with asymptotic GLLS methodology using PIA sequence of 4 configurations and 14 integral experiments (spectral indexes and coolant density effects). The adjustment reproduces the data from CIELO, and shows consistency with the difference between evaluations. However, the ^{238}U inelastic cross-section does consistently not reproduce CIELO. Additional assimilations of SNEAK 7A and 7B spectral indexes were investigated.

- SG39-7: “Expanded adjustment in support of CIELO initiative”

G. Palmiotti presented the results of adjustment compared against CIELO (ENDF/B-VII0b3) and JEFF-3.3T2. The “classical” SG33 set of integral experiments in the fast energy range was enlarged with new more focused experiments (SEG, FCA-IX, PROTEUS, MANTRA, and ASPIS-88). Major findings and feedbacks were reported for these five isotopes (e.g. reduction of 5-10% for ^{238}U inelastic cross-section). Some discrepancies with the current proposed CIELO and JEFF-3.3 evaluations were also found and will be submitted to CIELO for comments.

- SG39-8: “First preliminary results of the adjustment exercise using ASPIS Fe88 and SNEAK-7A/7B keff & beff benchmarks”

I. Kodeli presented preliminary results of adjustment using keff, shielding and β_{eff} Benchmarks providing a complementary view and wider scope of validation. Adjustments for ^{56}Fe and ^{238}U were shown.

At the next meeting, it will be discussed on how to harmonise the efforts on the adjustments in order to provide a concerted feedback to the CIELO community.

2.4 Future Actions and Deliverables

- SG39-9: “Discussion on future of SG39 and possible new subgroup”

G. Palmiotti presented the future steps for ending SG39, with a tentative date for the final deliverable in May 2018. A new proposal of SG was presented entitled: “Efficient and effective use of integral experiments for nuclear data validation”. This new SG should focus on formalizing and applying a more robust methodology for ND validation using an appropriate selection of integral experiments to avoid compensations and providing guidelines on how to use sensitivities and covariances and to provide the background for an updated set of target accuracies.

- SG39-10: “WPEC sub-group proposal: “Investigation of Covariance Data in General Purpose Nuclear Data Libraries”

V. Sobes presented the proposal for the new WPEC/Subgroup. The main objectives of this SG will be the development of methods for systematic and consistent evaluation of covariance data for the entire energy range, deliver examples of the application of the proposed methodology on a few selected isotopes, and provide an overview of the best practices of how to generate more consistent covariance data sets. A tentative schedule and list of deliverables and participants were presented.

2.5 Collaboration with other SGs or EGs

A. Plompen, Chair of JEFF, presented the status of ^{238}U evaluation focusing on the new data in the RRR/JRC and URR/JRC. Regarding URR/JRC, between 20keV-149keV, he said that it would be the new Standard-2016 for ^{238}U capture cross-section. He also mentioned the status of the JEFF-3.3 evaluation and how the new URR/JRC has been discarded because it has a very negative reactivity impact in Big-ten and other IMF benchmarks, showing a large “compensating effect” between U5-U8 evaluations which may cause fictitious alterations of cross-sections by the cancellation of other effects. After the meeting, **O. Cabellos** suggested to use the “Adjustment Methodology” to re-evaluate both files and see how relevant is the cross-correlation between U5-U8 due to the U238-URR.

2.6 Perspectives and review of pending actions

- **Finalise deliverables**
 - **Action NEA:** To publish the intermediate report on “Summary of Methodology” and “Comments on Covariance Data” before next meeting. To advertise this report within the ND community interested in.
 - **Action NEA:** To prepare H. Wu’s report according with the OECD/NEA template.
 - **Action S. Pelloni:** To finalise the report on PIA method utilisation.
 - **Action E. Ivanov:** To finalise the report on MC sensitivity coefficients. To include in the report the importance of correlations.
- **Current activities: Methodologies and Experimental Benchmarks**
 - **Action NEA:** Rez’s Benchmark on neutron spectra measurement in iron assemblies that could be used in SG39 if the complete information of the Benchmark will be available by February 2017. NEA will follow the status of this work.
 - **Action M Hursin:** Update HCLWR-PROTEUS documents and data for SG39 (received 09/01/2017).
 - **Action I. Kodeli/E. Ivanov:** Provide MCNP inputs for SNEAK for intercomparison.
- **Starting from CIELO new files (without uncertainties) attempt new adjustment**
 - **Action K. Yokoyama/G. Palmiotti:** Review CIELO adjustments, and more complete feedback for CIELO.
 - **All:** Final adjustment for CIELO and comments/description to be included in the Final Report.
 - **All/NEA:** Checking/provide NJOY inputs for CIELO files.
 - **All/NEA:** Checking/provide inputs used in the SG39 benchmarks.
 - **All/NEA:** For any new adjustment it is underlined the importance of updated covariance data (including cross-correlation between isotopes). Update SG39 website with papers or reports on verifying covariance data.

3. NEXT MEETING

It is proposed to hold the next SG39 meeting in conjunction with WPEC meetings during the next WPEC Nuclear Data Week at the OECD Headquarters, **May 16-17, 2017**; and schedule a joint session with SG40/CIELO.

Finally, the participants in the meeting agree to extend the technical activities of SG39 during 2017, in close collaboration with SG40, and to present the Final Report in May 2018.

Appendix 1

Participants to the 8th meeting of WPEC subgroup 39

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Appendix 2

<p style="text-align: center;">Proposed Agenda</p> <p style="text-align: center;">SG-39</p> <p style="text-align: center;">NEA Headquarters 46 quai Alphonse Le Gallo, 92100 Boulogne-Billancourt, France</p> <p style="text-align: center;">Room BB 10</p>		
<i>Please note: Only registered participants with a valid ID card or passport will be allowed access to NEA premises</i>		
<p style="text-align: center;">Thursday, December 1, 2016</p>		
13:45 – 14:30	Welcome and actions review	Giuseppe PALMIOTTI Massimo SALVATOIRES Oscar CABELLOS
	Methods	
14:30 – 15:00	Detailed comparison of Progressive Incremental Adjustment (PIA) sequence results involving adjustments of spectral indices and coolant density effects on the basis of the SG33 benchmark.	Sandro PELLONI
15:00 – 15:30	ND assessment alternatives: Validation matrix vs XS adjustment	Evgeny IVANOV
15:30 – 16:00	"Implementation of Resonance Parameter Sensitivity Coefficients Calculation in CE TSUNAMI-3D"	Vladimir SOBES
16:00– 16:30	Coffee Break	
	Experiment analysis, sensitivity calculations and benchmarks	
16:30 – 17:00	Benchmark tests of ENDF/B-VIII.0 beta 1 using sodium void reactivity worth of FCA-XXVII-1 assembly	Kenji YOKOYAMA (in place of M. Fukushima, JAEA)
17:00 - 17:45	Discussion on future of SG39 and possible new subgroup	All
17:45	Adjourn	

Friday, December 2, 2016		
	Adjustments	
9:00 – 9:30	Cross-section adjustment based on JENDL-4.0 using new experiments on the basis of the SG33 benchmark	Kenji YOKOYAMA
9:30 – 10:00	Comparison of adjustment trends with the Cielo evaluation	Sandro PELLONI
10:00 – 10:45	Expanded adjustment in support of CIELO initiative	Giuseppe PALMIOTTI
10:45 – 11:15	Coffee Break	
	Discussion on perspectives and actions	
11:15 – 11:45	WPEC sub-group proposal: “Investigation of Covariance Data in General Purpose Nuclear Data Libraries”	Vladimir SOBES
11:45 - 13:15	Lunch Break	
13:15 – 14:00	Date and place of the next meeting, any other business	
14:00	Meeting closing	