WPEC Subgroup Proposal

Title

Use of Shielding Integral Benchmark Archive and Database for Nuclear Data Validation

Justification for a Subgroup

Nuclear cross-sections are being re-evaluated repeatedly since decades, and integral benchmark experiments proved to be valuable for validation of these cross section data. In the recent years, the evaluations have been most predominantly validated against the criticality benchmarks, and in many cases even "tuned" to match better the measurements. However, the effective multiplication factor (k_{eff}) is a very global parameter, simply dependent on too many "free" parameters. Diversification of the validation practice by including more extensively other types of integral measurements, such as shielding benchmarks, in the validation and evaluation procedure is expected to provide a complementary view and would allow to judge on a wider-scope performance of the evaluated nuclear data. This would ultimately contribute to a production of general-purpose cross-section evaluations.

Subgroup Monitor(s)

O. Cabellos, L. Leal

Subgroup Coordinator

I. Kodeli

Subgroup Participants

TBD among experimentalists and nuclear physics and nuclear data experts

Project Definition and Proposed Activities

The latest version of Shielding Integral Benchmark Archive and Database (SINBAD) distributed by the NEA and RSICC includes over 100 shielding benchmark experiments covering fission reactor shielding (48 benchmarks), fusion blanket neutronics (31), and accelerator shielding (23) applications.

Interest in using SINBAD shielding benchmarks was expressed by nuclear data communities in the scope of several WPEC Subgroups, and within the JEFF and EFF projects. Progress in SINBAD compilations slowed down in the recent years and a new "kick-off" of this activity would be beneficial to assess and respond to the expectations and needs of different nuclear data communities. Multiple challenges and objectives will be considered, including:

- To provide feedback on the existing database and contribute in this way to the quality review as started about 10 years ago at the NEA. The feedback would consist of developing and contributing input models for different transport codes, judging the completeness and consistency of the available benchmark information, identifying the missing or inconsistent data, in particular concerning the evaluation of the sources of experimental uncertainty. The quality review, which covers now about 50% of the SINBAD benchmarks, concentrates on the verification of the description of the experimental setup, the neutron source specifications, the detector characteristics, the geometry and precise material composition of the components. The main criteria for judging the quality of the experiment are its completeness and the consistency of the experimental information (on the geometry, materials, the procedure to derive data-unfolding, etc.), with a particular emphasis on the evaluation of the different sources of uncertainties, be it experimental, engineering and modelling;
- Provide recommendations on the SINBAD evaluations based on the experience, needs and expectations of the nuclear data community;
- To participate in establishing the priority list of relevant benchmarks according to the needs of the nuclear data community, in particular among new and more recent benchmarks; promote including the selected benchmarks in SINBAD; contribute the available sensitivity profiles to be included in the database;
- To participate, in coordination with the EGRTS WPRS, in establishing the review group and organisation of pilot exercise of SINBAD evaluations. The recent evaluations of the FNG benchmarks which are underway in the scope of the Fusion for Energy (F4E) project of the European Commission represent good candidates to be used for pilot exercises.

The proposed SG would work in close coordination with other NEA activities such as EGRTS, WPEC SG45, SG46, CIELO and JEFF project, where this work could be used to guide the evaluations. Feedback from these groups on the specific needs and the use of SINBAD data is expected. SINBAD evaluation work shall be tightly coordinated with the interest of SG46 on "Efficient and Effective Use of Integral Experiments for Nuclear Data Validation". Past experience in integral benchmark evaluations from the ICSBEP, IRPhE and SINBAD projects will be valuable.

Relevance to Evaluated Data Files

Providing means for validation of general-purpose Evaluated Data Files

Time Schedule and Deliverables

It is anticipated that the experts of this SG should complete and document the activities (mandate) listed above within 3 years.

Date Deliverables

Year 1:

- In coordination with other SGs and EGRTS identify potential SINBAD benchmarks to serve as pilot exercises for nuclear data evaluation;
- Identify other potential benchmarks which are not included in SINBAD to be used in this work (old Benchmarks, e.g. LLNL pulsed spheres, and recent benchmarks, e.g. FNG, FNS); Establish a priority list of relevant benchmarks according to the needs of the nuclear data community and promote including the selected benchmarks in SINBAD;
- Organise the working group participants to perform benchmark analysis using the data available; participants are encouraged to use different nuclear data and transport codes; define the criteria and specification for the review and distribute the tasks.

Year 2:

- Benchmark analysis of the subset of shielding benchmarks and collection of the experience and results from the participants;
- Contribute the available sensitivity profiles to be included in the database;
- Distribute and discuss the review of the selected shielding benchmarks serving as a prototype for future work;
- Select benchmarks from the priority list to promote the evaluation in the SINBAD database.

Year 3:

- Coordinate with EGRTS new benchmark evaluations and benchmark reviews, for the integration in SINBAD and release of the evaluation to be used by other SGs;
- Draw conclusions on the evaluation process and provide recommendation of good practices useful for future nuclear data validations using Shielding and Transmission Benchmarks. Of particular interest is the feedback on the completeness and consistency of the available uncertainties and correlations, which shall contribute to the revision and consolidation of uncertainties, including those in neutron sources, engineering and others.