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WPEC long-term sub-group proposal: International standard for a general nuclear database structure

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Justification: A long-term sub-group is needed to serve as a governance body

Context

ENDF-6 has had a long and fruitful history as the preferred format for storing and exchanging evaluated nuclear data. Together with processing codes, it plays a pivotal role between nuclear physicists and reactor physicists, allowing the exchange of data between different computer codes. Today, however, it is showing signs of age. In particular, the ENDF-6 format places unnecessary limitations on the types of reactions and the precision at which data can be stored. Some features make it more difficult to assure quality and consistency of the data. Also, each new generation of nuclear scientists and engineers must overcome a steep learning curve (having nothing to do with physics, only with how data are stored in ENDF) before they are able to use the data. These users are applying nuclear data towards solving a broad range of problems (in medical physics, global security and advanced detector designs among others) that stretch the ENDF format beyond its original design. There is a strong desire, particularly among the younger generation, to adopt software concepts and technologies that are more modern, more familiar and more broadly utilized than the 1960's-vintage ENDF format.

The WPEC Subgroup 38 was formed to solicit feedback from international stakeholders and develop a new structure for storing nuclear data (NEA/NSC/WPEC/DOC(2012)438). The subgroup recognized that many decades and much effort have been invested in the ENDF format and the tools that use it. In order to be useful, the new structure must fit into the existing 'infrastructure' for nuclear data, continuing to meet the needs of evaluators, processors and users of the data. Part of the goal of SG38 was to ensure that these needs are met, and to promote a smooth transition (likely lasting a decade) from ENDF-6 to the new structure. The subgroup also recognized that Lawrence Livermore National Laboratory (LLNL) had developed an initial proposal for a Generalized Nuclear Data structure, GND, and the U.S. nuclear data community reviewed this structure as a possible successor to ENDF. Although the first steps had been taken toward developing and deploying a new, modern nuclear data structure to replace ENDF, it needed critical review and revision by the international nuclear data community in order to ensure that it will adequately address the needs of the different data projects.

With these needs in mind, SG38 solicited feedback from the community and developed first a vision and set of high-level requirements (NEA/NSC/WPEC/DOC(2013)441) for the new format and agreed on a set of goals for the community in the pursuit of this endeavor (NEA/NSC/WPEC/DOC(2014)450). The first order of business was the

development of a thorough set of requirements, specifications, and examples, which are available at https://ndclx4.bnl.gov/gf/project/sg38/. While SG38 was originally formed to develop the structure for storing nuclear data, a few other priorities were identified while developing the requirements and project plan that would be necessary after defining the structure to make it a broadly useful and widely adopted capability. First, a long-term governance structure would need to be instantiated to ensure that the standard continues to evolve to meet the needs of the international nuclear data community. That need is addressed in this proposal. Second, a set of infrastructure is required to work with the structure. The infrastructure identified as being fundamentally necessary includes the definition of an Application Programming Interface (API) for reading and writing data in the new structure, an initial set of infrastructure for plotting and processing the data, and some quality assurance standards with supporting infrastructure to help enforce those standards. A separate 3-year sub-group will be proposed to address these infrastructure needs.

Purpose, scope

The WPEC Subgroup 38 was formed to solicit feedback from international stakeholders and develop a new structure for storing nuclear data. SG38 has met its stated goal to develop a nuclear data structure standard that can meet the needs of a broad set of nuclear data users and providers. In order to take the next step, it has become necessary to establish an international governance body to endorse, promote, and maintain the new format as the future international standard. Ideally this group should be formed under the auspices of an international body committed to improving co-operation between nuclear data communities, particularly with respect to exchanging nuclear data. The Working Party on International Nuclear Data Evaluation Co-operation (WPEC) is clearly such an organization. It was established by the Nuclear Science Committee (NSC) of the Nuclear Energy Agency (NEA) to promote the exchange of information on nuclear data evaluations, measurements, nuclear model calculations, validation, and related topics, and to provide a framework for co-operative activities between the participating nuclear data projects. It is for this reason, that we propose that a new WPEC long-term subgroup become the stewards of a new international standard for a modern nuclear database structure. The subgroup will report to WPEC.

Membership

Chair

David Brown (BNL/ENDF)

Governance Board

Up to 2 official representatives from each WPEC nuclear data evaluation project or institution will form the Governance Board. Currently these entities include ENDF, JENDL, ROSFOND/BROND, JEFF, CENDL and the IAEA.

Other Participants

Representatives of the nuclear data evaluation projects or institutions from NEA member countries

Representatives of the CENDL project (China), by invitation

Open to other non-NEA member countries on a case-by-case basis, by invitation

Representatives of the EC, by agreement

Representatives of the IAEA, by agreement

Goals, activities and deliverables for the governance body

As with all major undertakings, the participants of the community that have worked so hard to get this standard in place are motivated not solely by professional recognition or by the practical value of establishing a modern capability to replace an existing on (ENDF-6). The participants have other worthy goals beyond the main motivations of making it easier for new users to contribute to the community and to encourage better quality assurance and documentation practices. It is hoped, for example, that the structure defined is general and useful enough that it could also be used to organize nuclear structure data, experimental data, and other nuclear data products. Other goals include the development of better open source infrastructure to manipulate, search, plot, process, translate and check nuclear data and the development of new nuclear data products heretofore not possible.

These issues have led the community to consider that the long-term governance body must not only be the stewards of a nuclear data format structure, but also the shepherds for new infrastructure and promoters for better evaluation practices. In that sense, the community hopes the governance body will become a forum for many discussions on these issues. We envision that the need and opportunity will arise for the formation of WPEC sub-groups to work on specific format structure or data infrastructure. These sub-groups will report directly to WPEC, but the results from these groups will be taken under consideration for adoption under the aegis of this long-term governance group.

A challenge for any international effort is to provide an effective platform for collaboration, e.g. the tools, websites, repositories, meetings and other forums. In particular, given that travel is expensive, it is desirable that meetings can be attended virtually with teleconferencing and videoconferencing capabilities.

In a practical sense, the governance must perform some specific actions associated with deliverables clearly identified. While ensuring that the standard meets the needs of major international nuclear data communities, this governance body must

1. Approve and release the initial version;
    a. Deliverable 1: Documentation of the initial version.
2. Provide a productive environment to modify and extend the standard;
    a. Deliverable 2: Collaborative platform and practices to maintain and discuss the standard

3. In close collaboration with the short-term subgroup on infrastructure ensure that important and useful tools for using the new standard are developed and maintained; and
4. Release new versions with appropriate documentation as necessary, without overburdening stakeholders.

Appendix: Governance model (for discussion – not for inclusion in mandate)

Outline of governance model

NB: In the following "Participants" refers to everyone in the nuclear data community who are actively involved in structure definition and its application. This includes participants from both Member and Observer institutions These Participants form the Collaboration.

The general principles guiding the governance of the new format standard is that

1. All Participants from the nuclear data community in good standing with an active interest in contributing to format definition and its application will be allowed an equal voice in the definition of the standard;
2. Consensus among Participants will be attempted for all decisions taken by the formats community when feasible; and
3. The Collaboration will promote and facilitate the transfer of technical expertise and general-purpose infrastructure in support of a successful format standard.

It is recognized that the proper functioning and organization of the community will require a Governance Board to represent WPEC interests, maintain membership and communication lists, organize/lead meetings, organize necessary votes, and provide for the dissemination of new versions of the standard and associated tools. Each participating nuclear data project should appoint up to two members to the Governance Board who will ensure that the appointment is conformed to the NEA rules of procedure. WPEC will also select a Chair, Vice-Chair and Secretary to the Governance Board.

The subgroup Governance Board will report to WPEC. In particular WPEC is required to review and accept new versions of the standard. The WPEC can also overrule any decision by the Governance Board and is expected monitor and provide guidance to the Governance Board. Any changes to this document outlining the operation of the long-term subgroup will be undertaken under the existing rules for such changes maintained by WPEC, NSC, and NEA.

Detailed definitions of roles and responsibilities

The Chair reports to WPEC and is responsible for organizing and leading meetings to discuss and develop the format and supporting infrastructure. There will be at least one meeting of the full Collaboration per year.

The Vice-Chair provides support to the Chair and may replace the Chair whenever necessary. Any member of the Governance Board can serve as Vice-Chair.

The Secretary is responsible for the adopted rules of procedure and for maintaining membership and communication/announcement lists for the Collaboration and executing any formal votes, if required. In addition, the Secretary will be responsible for maintaining a website which disseminates the documentation and infrastructure for the formats standards, as well as a collaborative platform to maintain and discuss the standard. It is ideal that the WPEC secretary also serves as the secretary of this long-term subgroup assuming adequate manpower and resources are available.

Members of the Governance Board are responsible for nominating new Participants in good standing who have both expertise and willingness to contribute. The Secretary will ensure that the nomination conforms to the NEA rules, notify members of the Governance Board and allow for discussion if needed. Concurrence from a simple majority shall suffice. Participants will be removed from the Collaboration when not active in community discussions and meetings for a period of three years or more. Any new institution participating in the subgroup activities can ask to be recognized by the Governance Board and propose new Participants, as long as allowed by NEA rules.

The Collaboration is responsible for improving the format and data quality, and generally encouraging and supporting the broad use of the new standard by the nuclear data community. The Collaboration members are expected to release their contributions with a relevant open source license that enables the community to make full use of their contributions. For computer codes, a public domain or open source attribution (e.g. BSD) copyright is recommended. For documentation or specifications, a public domain or agreed upon attribution share-alike license is recommended.

Since the nuclear database structure being proposed is inherently extensible, it is possible (and even likely), that institutions or parts of the community find it useful to extend the structure to meet their particular needs. It is the purpose of this subgroup, however, to agree on a core nuclear database structure that will be broadly supported by the main data projects that use the structure to disseminate and share data. For this purpose a consensus driven process is deemed most appropriate.

The community will need to decide the details of its operation as it evolves. Clearly, decisions cannot require unanimous agreement. At some point there is enough agreement amongst the community that moving forward makes sense. However, there will be moments where some formality will be required. For example, the decisions to freeze and release a new version of the structure are cases where formality is useful. And there may be situations where disagreements exist. In these situations the Chair can call for a vote either online or at an official meeting. Votes by the collaboration members on format specifications or other proposals, such as when to make a new release, will be structured to encourage productive, consensus-driven decisions. All votes are fully public. Collaboration members have 3 options during a vote:

1. Agree with the proposal as it stands

2. Abstain from voting due to a lack of informed knowledge (default)
3. Submit an argument against the proposal and provide a sensible counter-proposal

If a new vote is deemed necessary, it is expected that all counter-proposals will be discussed and considered by the community, with the goal of achieving a product approved by more than 75% of Participants. Indeed, once these discussions are completed, agreement by 75% of Participants will be enough for the Governance Board to adopt a new release. A new release will consist of an updated specification document, revised xml schema and new format version number.