DE LA RECHERCHE À L'INDUSTRIE

cea

www.cea.fr

WPEC Subgroup C
HPRL
High Priority Request List for Nuclear Data

www.oecd-nea.org/dbdata/hprl

Emmeric DUPONT
SG-C Coordinator

NEA
NUCLEAR ENERGY AGENCY

Irfu

High Priority Request List (HPRL)

① HPRL governance

② Current HP and General requests

③ Focus on fast reactors / SG-26 entries

④ Conclusion

High Priority Request List (HPRL)

① HPRL governance

- HPRL is managed by WPEC Subgroup C
  - Expert members: experimentalists, evaluators, users
  - Representatives of evaluation projects: JEFF, ENDF/B, JENDL, etc.
- A request for (evaluated) nuclear data improvement must contain,
  1. *Description of the impact of that improvement on the application*
  2. *Estimation of the accuracy necessary and sufficient for the application*
  3. *Justification for improvement wrt current evaluations/measurements*
- The request should be submitted by nuclear data users, but involvement of nuclear data producers (evaluators or experimentalists) is welcome.

High Priority Request List (HPRL)

① HPRL governance

- Follow-up of accepted requests
  - Monitoring is under the responsibility of the requesters and SG-C
  - Relevant publications are compiled in the fields of
    - experiments,
    - theory/evaluation,
    - and validation.
  - Information from ND users and producers are obviously welcome
  - The status of every request is reviewed on the basis of the above information and SG-C expertise (taking into account ongoing activities)

High Priority Request List (HPRL)

① HPRL governance

- Follow-up of entry status

1. *"Work in progress"*
   covers all ongoing experimental and theoretical activities
2. *"Pending new evaluation or validation"*
   for requests that have already stimulated a lot of activities, but are not completed yet because of the lack of new evaluation or validation
3. *"Completed" or "Archived"*
   for requests that have been satisfied or that are no longer relevant (SG-C consensus required)

High Priority Request List (HPRL)

① HPRL governance

- *"Work in progress"* is the default status for new entries
- Status for recent entries (2017-2019)
  - *Gd-155,157(n,g):* *"Pending new evaluation or validation"*
  - *Other entries:* *"Work in progress"*
- Status for the (37) older entries (< 2017)
  - ~ 20% *"Completed"*
  - ~ 80% *"Work in progress"* (most of them actually)
    "Pending new evaluation or validation" (for ^{206,207}Pb(n,inl))
- Feedback from requesters and users is always welcome

High Priority Request List (HPRL)

1. HPRL governance
2. Current HP and General requests
3. Focus on fast reactors / SG-26 entries
4. Conclusion

② Current High Priority and General requests

Fission cross section for nuclear reactors

Nuclide	Half-life	Energy range	Status
Np-237	2.1 My	200 keV-20 MeV	Completed
Pu-238	88 y	9 keV-6 MeV	In progress
Pu-240	6.6 ky	0.5 keV-5 MeV	In progress
Pu-241	14 y	0.5 eV-1.35 MeV	In progress
Pu-242	375 ky	200 keV-20 MeV	In progress
Am-241	432 y	180 keV-20 MeV	In progress
Am-242m	141 y	0.5 keV-6 MeV	In progress
Cm-244	18 y	65 keV-6 MeV	In progress
Cm-245	8.5 ky	0.5 keV-6 MeV	In progress

- Fission of minor actinides (Pu, Am, Cm isotopes)
- All put forward by SG26
- Fast range essentially
- Still work in progress

Colour code
✓ Light grey for completed entry

② Current High Priority and General requests

Capture cross section for nuclear reactors

Nuclide	Half-life	Energy range	Status
Cr-50,53	stable	1 keV-100 keV	New entry
Gd-155,157	stable	Therm.-100 eV	Pending new eval./valid.
Hf-nat	stable	0.5 eV-5 keV	Completed
U-233	159 ky	Therm.-10 keV	In progress
U-233	159 ky	10 keV-1 MeV	In progress
U-235	~stable	100 eV-1 MeV	In progress
U-238	~stable	20 eV-25 keV	Completed

Nuclide	Half-life	Energy range	Status
Pu-239	24 ky	1 meV-1.35 MeV	In progress
Pu-241	14 y	0.1 eV-1.35 MeV	In progress
Pu-242	375 ky	0.5 eV-2 keV	In progress
Am-241	432 y	Thermal. Fast	In progress

- Major actinides: Big-3, U-233, Pu-241
- Pu-242 and Am-241
- Structural material (Cr) and absorbers (Gd, Hf)
- Thermal to fast ranges

Colour code
- ✓ Red for recent entries
- ✓ Light grey for completed entries

② Current High Priority and General requests

Other cross sections (for fission, fusion, ADS)

Nuclide	Reaction	Energy range	Field
Na-23	(n,inl)	0.5 MeV-1.3 MeV	Fission
Si-28	(n,inl)	1.4 MeV-6 MeV	Fission
Fe-56	(n,inl)	0.5 MeV-20 MeV	Fission
Pb-206	(n,inl)	0.5 MeV-6 MeV	Fission
Pb-207	(n,inl)	0.5 MeV-6 MeV	Fission
U-238	(n,inl)	65 keV-20 MeV	Fission

Nuclide	Reaction	Energy range	Field
Si-28	(n,np)	Thres. -20 MeV	Fusion
K-39	**(n,p),(n,np)**	**10 MeV – 20 MeV**	**Fusion**
Cr-52	(n,x d,t)	Thres. -65 MeV	Fusion
O-16	(n,α)	2 MeV-20 MeV	Fission
Au-197	(n,tot)	5 keV-200 keV	Science
Pu-239	**(n,tot)**	**1st resonance**	**Fission**

Nuclide	Reaction	Energy range	Field
Bi-209	**(n,g) BR**	**500 eV-300 keV**	**ADS**

- (n,n') on U8, structures, coolant of FR
- Po-210 production in Pb-Bi eutectic
- Activation (NaK) and neutronics (O, Pu)

Colour code
- ✓ Red for recent entries
- ✓ Light grey for completed entries

② Current High Priority and General requests

Other quantities: DA, PFn/γS, nubar (for fission and ADS)

Nuclide	Reaction	Quantity	Energy range	Field
H-2	(n,el)	d/dθ	0.1 MeV-1 MeV	Fission
U-235	(n,f)	γ spectrum	Therm.-Fast	Fission
Pu-239	(n,f)	γ spectrum	Therm.-Fast	Fission
Am-243	(n,f)	n spectrum	Therm. -10 MeV	ADS
Cm-244	(n,f)	n spectrum	Therm. -10 MeV	ADS
U-233	(n,f)	nubar	Therm.-10 keV	Fission
Pu-239	**(n,f)**	**nubar**	**Therm.-5 eV**	**Fission**
Pu-240	(n,f)	nubar	200 keV-2 MeV	Fission

- Elastic scattering on D
- PFGS of U-235, Pu-239
- PFNS of minor actinides
- nubar of U-233 and Pu-239,240
- Thermal to fast ranges

Colour code
✓ Red for recent entries

High Priority Request List (HPRL)

1. HPRL governance
2. Current HP and General requests
3. Focus on fast reactors / SG-26 entries
4. Conclusion

③ Focus on fast reactors / SG-26 entries

Current status of the 22 requests put forward by SG26 in 2008

- Most of these entries are still "Work in progress"
  - *"Work in progress" (18):* $^{16}O(n,\alpha)$, $^{23}Na(n,n')$, $^{56}Fe(n,n')$, $^{238}U(n,n')$, ^{240}Pu nubar, $^{238,240,241,242}Pu(n,f)$, $^{241,242m}Am(n,f)$, $^{244,245}Cm(n,f)$, $^{235}U(n,\gamma)$, $^{239,241,242}Pu(n,\gamma)$, $^{241}Am(n,\gamma)$
  - *"Pending new evaluation or validation" (2):* $^{206,207}Pb(n,n')$
  - *"Completed" (2):* $^{238}U(n,\gamma)$, $^{28}Si(n,n')$
- See SG-C working document (also known as "Feedback table") (www.oecd-nea.org/science/wpec/hprl/meetings/2018_May)
- Input from SG46 is welcome to help identify completed requests

③ Focus on fast reactors / SG-26 entries

New SG-C proposals for some of these fast reactor entries
(just discussed yesterday during SG-C meeting)

- New status: *"Pending new evaluation or validation"* ?
  - Pu-239 and U-235 PFGS (not from SG-26)
  - Pu-242(n,g) (INDEN)
  - Na-23(n,n') (INDEN)
- New status: *"Completed"* ?
  - U-235(n,g)
  - Am-241(n,f)

INDEN list of nuclides with the highest priority (12/2017):

Light elements:
N-14,15; Be-9; Na-23

Structural elements:
Co-59; Ni-58 (to check other Ni isotopes)

Actinides:
Pu-238,240,241,242

Re-evaluations (due to identified issues):
Fe-56,57 (issues in elastic cross sections and angular distributions from 0.85 up to 6 MeV)
Pu-239 (use of newly recommended thermal PFNS, thermal nubar, resonance region)
U-238 (14 MeV leakage issues traceable to inelastic spectra, PFNS for En=5-8 MeV)

High Priority Request List (HPRL)

1. HPRL governance
2. Current HP and General requests
3. Focus on fast reactors / SG-26 entries
4. **Conclusion**

④ Conclusion (HPRL)

- In order to efficiently stimulate and guide nuclear data improvement,
  - The HPRL aims to be a reference tool in support to experimental, theoretical and evaluation projects aiming at improving nuclear data;
  - The HPRL aims to bridge the gap between nuclear data users and nuclear data producers (evaluators and experimentalists).
- To fulfil these key roles SG-C ensures that
  - HPRL is updated frequently,
  - reflects all needs in relevant areas,
  - and reflects advances aiming at answering those needs.
- We need contributions and feedback from both users and producers of nuclear data (see contact emails on the HPRL website)

④ Conclusion (SG-46)

New (or updated) priority requests for fission reactors

- An update of the global SG-26 exercise is obviously valuable for HPRL
- Integral parameters sensitive to few nuclear data (unlike keff) should be considered as well to avoid compensating effect
- Local S/U analyses are also useful to identify priority needs
  - Deficiencies in some nuclear data are known (although not always reflected in covariances, e.g. nubar) and sensitivities are available
  - Priority needs can be discussed on the basis of the impact of these deficiencies on key integral parameters

Thank you for your attention!

WPEC SG-C mandate

The expert group is responsible for managing the activities related to the HPRL, in particular for guaranteeing that the entries are up-to-date and well-motivated by current interests in the field of nuclear energy and other nuclear applications. The group is also responsible for stimulating follow-up to the entries and collecting the feedback provided by any of the related activities that may further the resolution of a request. The expert group will work mainly by electronic mail exchanges. Physical meetings will be held typically once a year.

The HPRL is organized as follows:

1. The List consists of one list with truly high priority requests, a list with general requests and a list with special purpose quantities divided in categories. This third list is an extension to the present List.
2. Stringent criteria are applied for entries on the lists. These will be evaluated by the Expert Group that will take the final decision for adopting a request.
3. A "high priority request" is justified by quantitative sensitivity studies (or the equivalent) and sufficiently documented.
4. A "general request" is well motivated for a specific quantity on a specific nucleus and is documented, but lacks a detailed backing by a sensitivity analysis or an impact study.
5. A "special purpose request" in a well-defined category is of interest to a recognized important subfield of applied nuclear science for which it is essential to stimulate new activity. Such a request may not satisfy the criteria as in the case of points 3. and 4.

The request lists will be subjected to periodic review to monitor progress and determine whether each individual request should continue to be included in these lists.

WPEC SG-C membership

- Expert members: experimentalists, evaluators, and (too few) users
- Representatives of nuclear data evaluation projects or countries
  - ENDF: Y. Danon (RPI)
  - JEFF: E. Dupont (CEA), A. Plompen (EC-JRC-Geel), G. Rimpault (CEA)
  - JENDL: O. Iwamoto (JAEA), N. Iwamoto (JAEA), T. Iwasaki (Tohoku), A. Kimura (JAEA), K. Yokoyama (JAEA)
  - BROND: V. Pronyaev (IPPE), V. Koscheev (IPPE)
  - CENDL: Zhigang Ge (CIAE), Xichao Ruan (CIAE), Weili Sun (IAPCM), Haicheng Wu (CIAE)
  - IAEA: R. Capote, A. Koning, A. Trkov
  - Korea: Young-Ouk Lee (KAERI)
  - Romania: A. Negret (IFIN-HH)
  - NEA: M. Fleming

Commissariat à l'énergie atomique et aux énergies alternatives
Centre de Paris-Saclay | 91191 Gif-sur-Yvette Cedex
T. +33 (0)1 69 08 xx xx | F. +33 (0)1 69 08 xx xx

Etablissement public à caractère industriel et commercial | RCS Paris B 775 685 019

Direction de la Recherche Fondamentale
Institut de Recherche sur les lois Fondamentales de l'Univers
Département de Physique Nucléaire