ENSDF Modernization

Chris Morse

Not export controlled

Outline

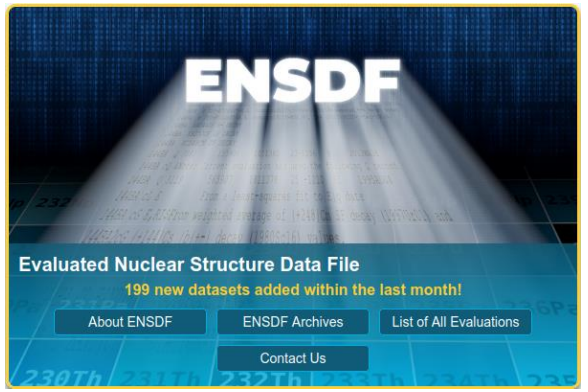
- Review of the modernization project
- Updates on the JSON format
- Other thoughts on modernization

How it started

The design of ENSDF effectively envisions two kinds of users:

1. Evaluators
2. Journal readers

Here be evaluators




```
143BA  L 0.0         5/2-             14.5 S    3                        A
143BAX L XREF=ABC
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143BA cL J$hfs (1988We07,1983Mu12,1981Ne06), |p from analysis of |m and
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```
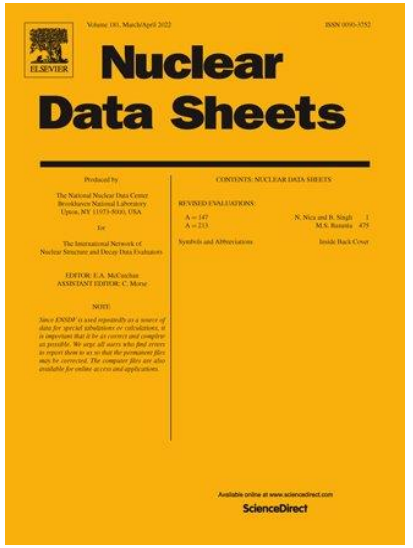
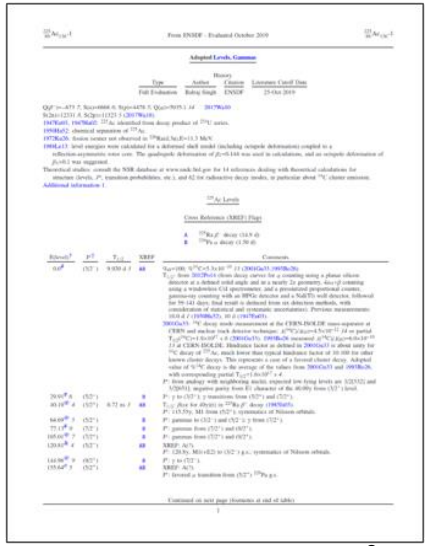

Everyone else





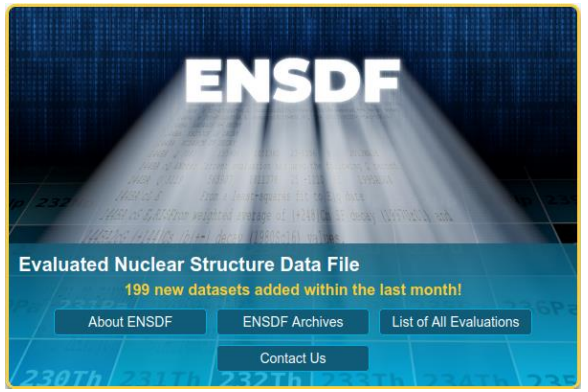
How it's going

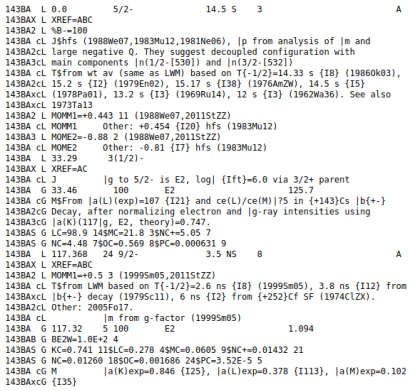
The design of ENSDF effectively envisions two kinds of users:
1. Evaluators
2. Journal readers

But there is a third class of users which is effectively unsupported: computational users

Computers...?

Here be evaluators





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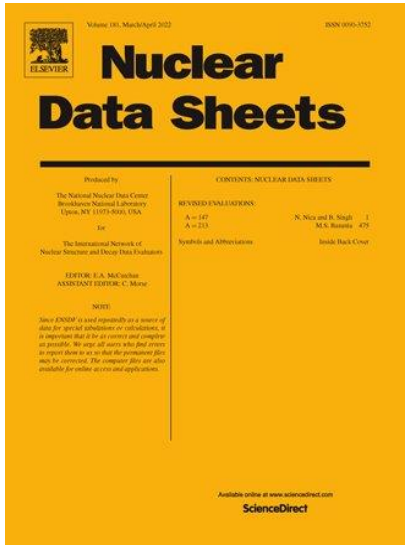
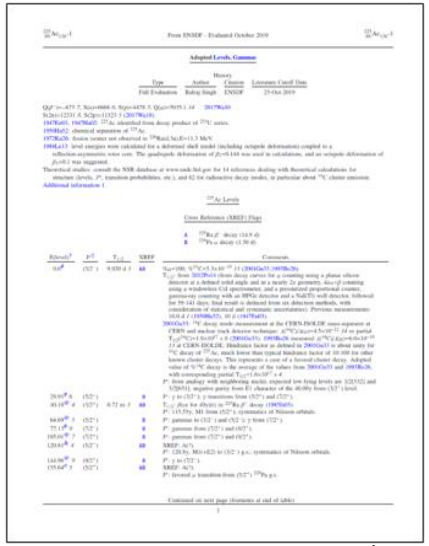
Humans





Problems for non-experts

The 80-column ENSDF format is hard to use

- For the standard one-card records:
  - No delimiters - must remember field widths
  - No labels - must remember field locations
  - Inconsistent units - must remember what/where
  - Asymmetric errors almost never supported
- For the continuation items:
  - Labels can be confusing, often used inconsistently
  - Units are not allowed
  - Multiple ways to indicate limits or approximations

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New paradigm

1. Evaluators interact with ENSDF via an editor (c.f. upcoming talk by D. Mason)
2. Human readers interact with ENSDF via PDFs
3. Computational users interact with ENSDF via new JSON format

Benefits:

- The representation of the data is decoupled from the data itself
  - E.g. evaluators do not have to worry about format changes, the editor handles those details
- JSON enjoys widespread adoption in computing
  - Much of the tool-development work is done for us

What is JSON?

- A highly structured data interchange format
- Governed by a simple set of rules:
  - Data entries are key-value pairs
  - Keys are (unique) strings
  - Values can have three types:
    - Basic: string, integer, number, boolean, NULL
    - Object: A collection of key-value pairs enclosed in { }
    - Array: An ordered list of values enclosed in [ ]
- Trivially easy to deserialize

affiliations.json

```
[
    {
        "institution": "University of Nowhere",
        "address": {
            "street": "University Ave",
            "number": 1,
            "zip": 12345
        },
        "presentAddress": true
    }
]
```

JSON with Python

deserialize.py

```
import json

with open("affiliations.json") as jsonfile
    jsondata = json.load(jsonfile)
    for item in jsondata:
        print(item["institution"])
```

```
ensdf@nndc:~$ python deserialize.py
University of Nowhere
```

affiliations.json

```
[
    {
        "institution": "University of Nowhere",
        "address": {
            "street": "University Ave",
            "number": 1,
            "zip": 12345
        },
        "presentAddress": true
    }
]
```

Updates on the new format

The new files are available at https://www.nndc.bnl.gov/ensdf-json

NB: These are still considered a beta release

Organization

- Adopted dataset
  - All other datasets (decays, reactions, comments)
  - Header (Z, A, ...)
  - Comments
  - Various info (e.g. Q-values)
  - Levels table
    - Level properties (energy, spin-parity, ...)
    - Cross-link to radiation tables (alpha, beta, gamma...)
  - Radiation (alpha, beta, gamma...) tables
    - Radiation properties (multipolarity, hindrance factor, …)
    - Cross link to levels table

Datasets

There are currently 14 defined types of datasets in the JSON format

The number of datasets in each category is given in parentheses

adopted (3411)	general reaction (7001)
alpha decay (831)	isomer decay (589)
beta decay (2369)	neutron capture (608)
charge exchange (140)	prompt-particle decay (49)
coulomb excitation (391)	general decay (266)
delayed-particle decay (280)	transfer (2570)
fluorescence (200)	comments (276)

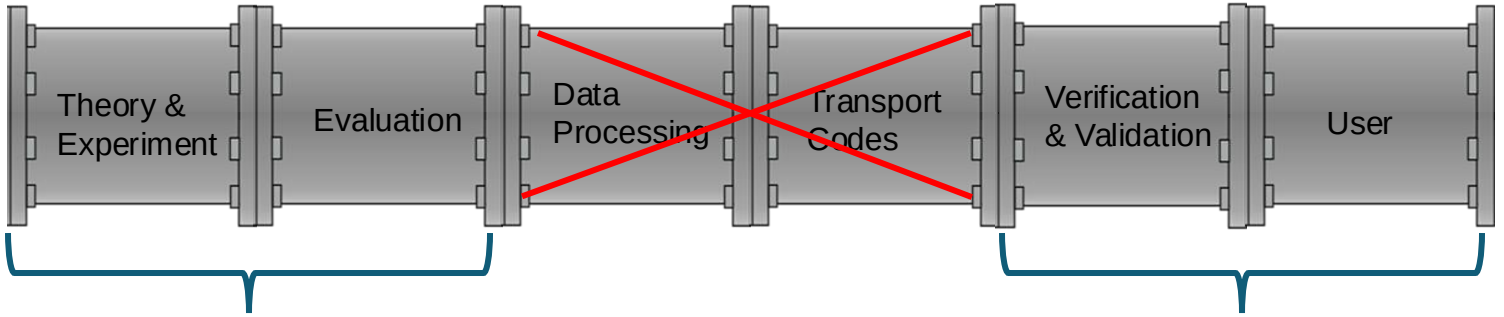
Other updates

- Addressing feedback from NSDD meeting
  - For each nuclide, the Adopted dataset holds all other datasets in a single file
  - For error checking, individual quantities hold a string version of their numerical values
- XUNDL has been converted (11,066 datasets)
  - Big thanks to Ben Shu for this effort
- Unit tests are being developed for the JSON schema validator

Other thoughts on modernization

Disclaimer: These aren't proposals, just brainstorming

Evaluating the ENSDF evaluation pipeline



Graphic shamelessly stolen from Gustavo Nobre

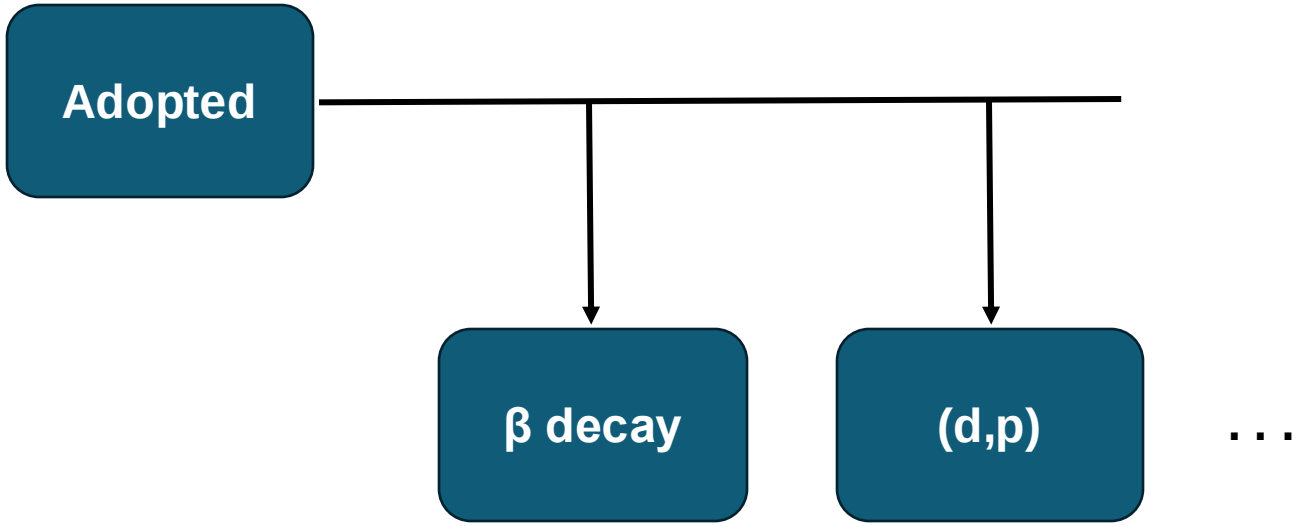
Other opportunities?

- More thorough documentation of individual data sources?
- Backporting/preserving "bibliographic" info relevant to ENSDF?

ENSDF modernization goals

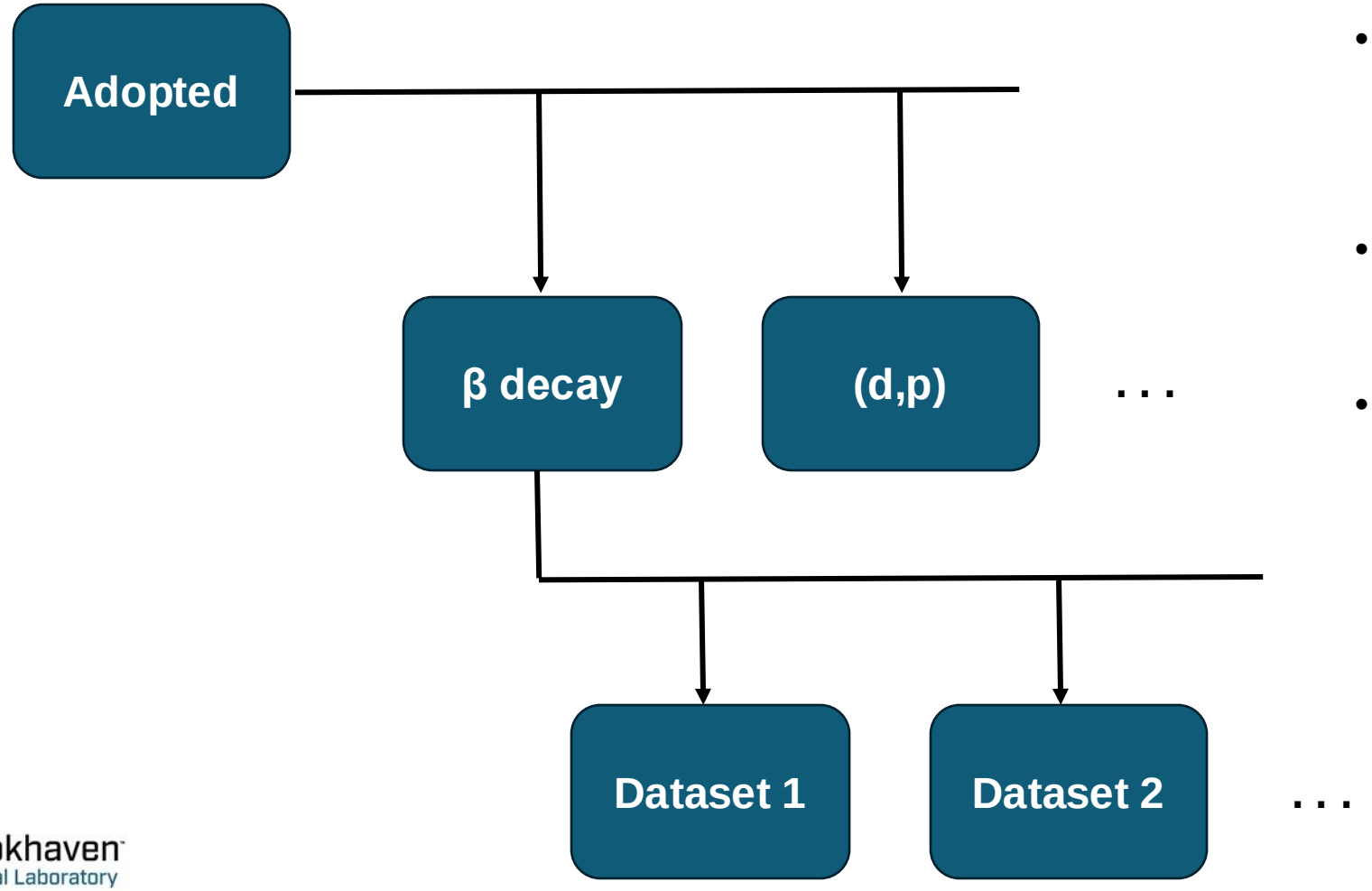
- Adopt a modern format for easy tooling
- Convenient for users
- Enable expansion of the format for emerging needs

Documenting data sources



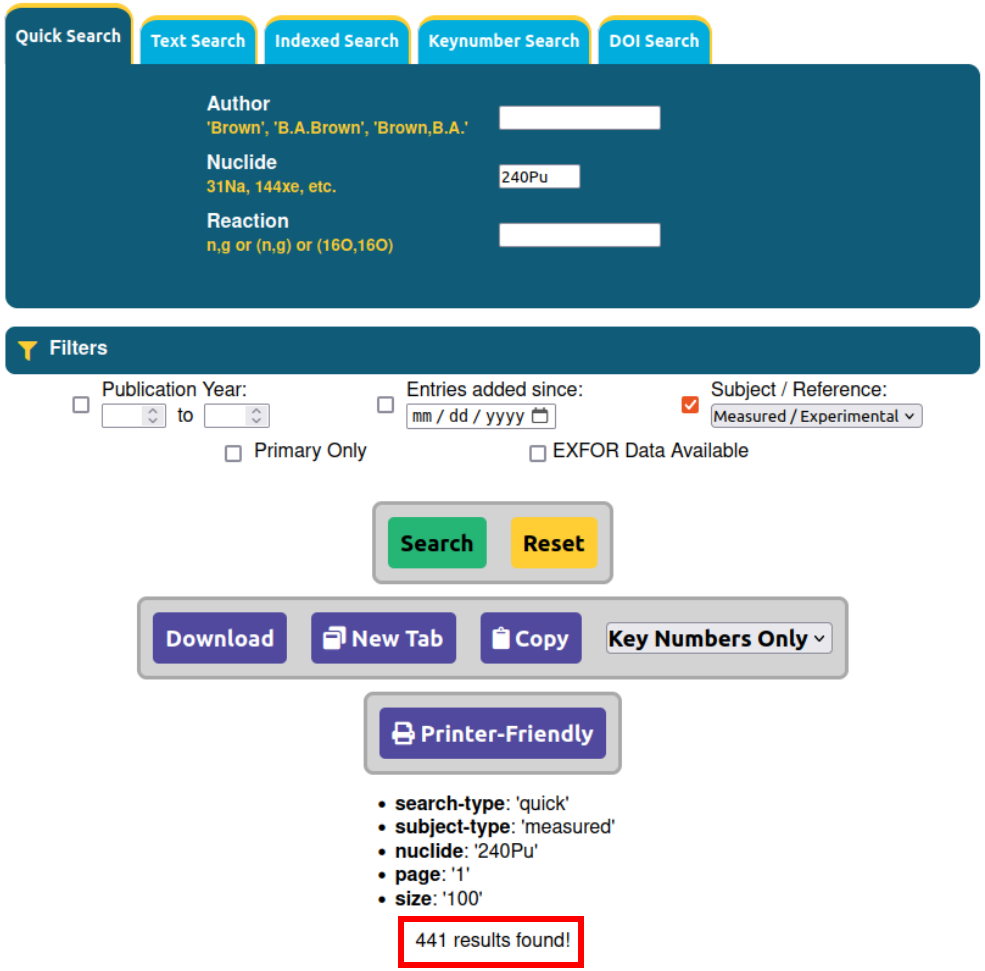
- Currently, ENSDF is a two-level system
  - Adopted
  - All other datasets

Documenting data sources



- Currently, ENSDF is a two-level system
  - Adopted
  - All other datasets
- We could add another layer for individual publications
  - Similar to XUNDL
- Potential benefits
  - Data encapsulation
  - Simple to import new XUNDL datasets

Better bibliographies



Some nuclei generate *many* publications
How to review all this literature?

- Ideal case, you have records from last evaluation. Not true for newer evaluators.
- Assume previous evaluation caught everything relevant? Dangerous.
- Read everything; very inefficient!

Many references in an NSR search are not relevant to ENSDF for a given nuclide. It would be helpful to capture this information as part of a mass-chain evaluation.

- One possibility: add new field to NSR entries to mark a key number as (ir)relevant for a given ENSDF evaluation

The end!

Questions? Comments?