



# **ENSDF** Modernization

## Chris Morse

Not export controlled



### Outline

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

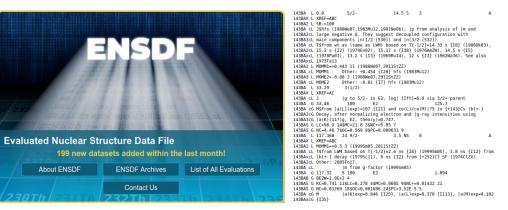


### How it started

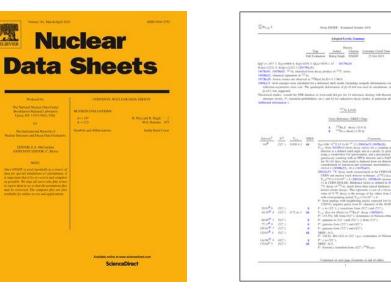
The design of ENSDF effectively envisions two kinds of users:

- 1. Evaluators
- 2. Journal readers

#### Here be evaluators



#### Everyone else



ELSEVIER



and the sector

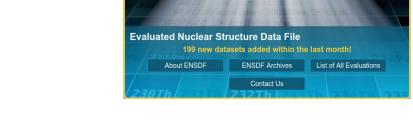
### How it's going

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

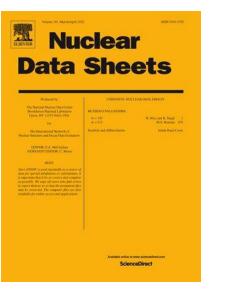
Computers...?



#### Here be evaluators



#### Humans



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				Continued on best page (footnetics at and of lable)	



### **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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143BA L 0.0
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143BAX L XREF=ABC
143BA2 L %B-=100
143BA cL J$hfs (1988We07,1983Mu12,1981Ne06), |p from analysis of |m and
143BA2cL large negative Q. They suggest decoupled configuration with
143BA3cL main components [n(1/2-[530]) and [n(3/2-[532])
143BA cL T$from wt av (same as LWM) based on T{-1/2}=14.33 s {I8} (19860k03),
143BA2cL 15.2 s {I2} (1979En02), 15.17 s {I38} (1976AmZW), 14.5 s {I5}
143BAxcL (1978Pa01), 13.2 s {I3} (1969Ru14), 12 s {I3} (1962Wa36). See also
143BAxcL 1973Ta13
143BA2 L MOMM1=+0.443 11 (1988We07,2011StZZ)
                   Other: +0.454 {I20} hfs (1983Mu12)
143BA cL MOMM1
      L MOME2=-0.88 2 (1988We07,2011StZZ)
                   Other: -0.81 {I7} hfs (1983Mu12)
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143BAX L XREF=AC
143BA cL J
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143BA G 33.46
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143BA cG M$From |a(L)(exp)=107 {I21} and ce(L)/ce(M)|?5 in {+143}Cs |b{+-}
143BA2cG Decay, after normalizing electron and |g-ray intensities using
143BA3cG |a(K)(117|g, E2, theory)=0.747.
143BAS G LC=98.9 14$MC=21.8 3$NC+=5.05 7
143BAS G NC=4.48 7$0C=0.569 8$PC=0.000631 9
143BA L 117.368
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                                       3.5 NS
143BAX L XREF=ABC
143BA2 L MOMM1=+0.5 3 (1999Sm05.2011StZZ)
143BA cL T$from LWM based on T{-1/2}=2.6 ns {I8} (1999Sm05), 3.8 ns {I12} from
143BAxcL |b{+-} decay (1979Scl1), 6 ns {I2} from {+252}Cf SF (1974ClZX).
143BA2cL Other: 2005Fo17.
143BA cL
                   |m from g-factor (1999Sm05)
143BA G 117.32
                  5 100
                                                       1.094
143BAB G BE2W=1.0E+2 4
143BAS G KC=0.741 11$LC=0.278 4$MC=0.0605 9$NC+=0.01432 21
143BAS G NC=0.01260 18$0C=0.001686 24$PC=3.52E-5 5
143BA cG M
                   |a(K)exp=0.846 {I25}, |a(L)exp=0.378 {I113}, |a(M)exp=0.102
143BAxcG {I35}
```



### 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





### **JSON** with Python

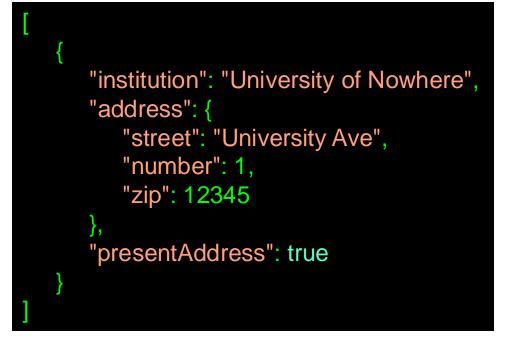
deserialize.py

#### 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





# 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

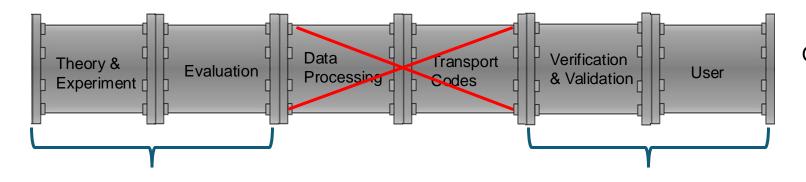


# Other thoughts on modernization

Disclaimer: These aren't proposals, just brainstorming



### **Evaluating the ENSDF evaluation pipeline**



Graphic shamelessly stolen from Gustavo Nobre

#### **Other opportunities?**

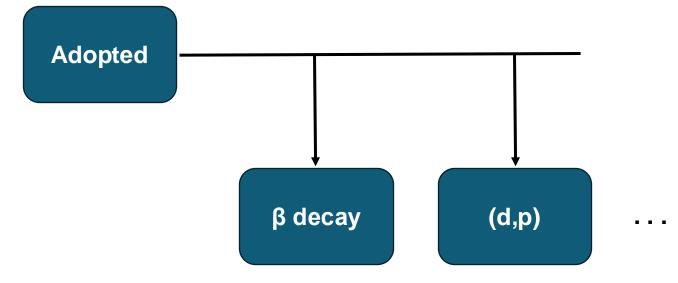
- More thorough documentation of individual data sources?
- Backporting/preserving "bibliographic" info relevant to ENSDF?

#### **ENSDF** modernization goals

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



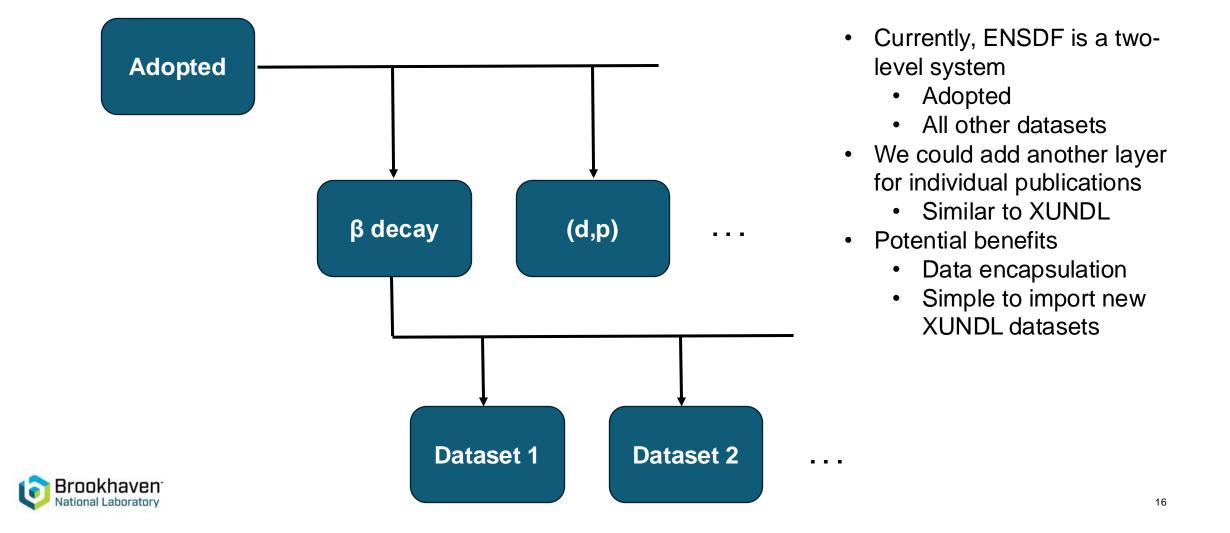
### **Documenting data sources**



- Currently, ENSDF is a twolevel system
  - Adopted
  - All other datasets



### **Documenting data sources**



### **Better bibliographies**

Quick Search	Text Search Indexed Search Keynumber Search DOI Search
	Author 'Brown', 'B.A.Brown', 'Brown,B.A.' Nuclide 31Na, 144xe, etc.
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<b>T</b> Filters	
	blication Year: Entries added since: Subject / Reference: ↓ to ↓ Primary Only ↓ EXFOR Data Available
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	<ul> <li>search-type: 'quick'</li> <li>subject-type: 'measured'</li> <li>nuclide: '240Pu'</li> <li>page: '1'</li> <li>size: '100'</li> <li>441 results found!</li> </ul>

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?

