IAEA
International Atomic Energy Agency

Software support for Structure & Decay

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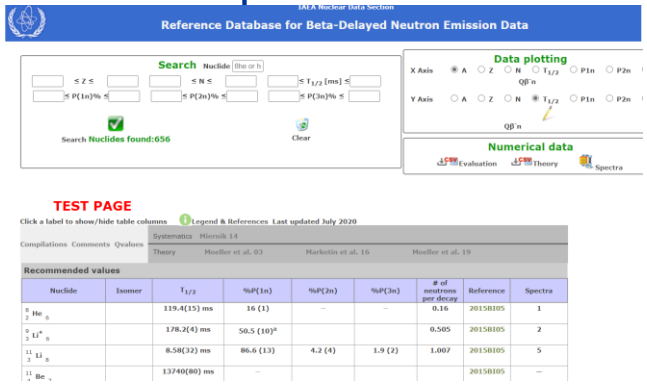
CRPs -TMs contributions

- **β^- delayed neutron emission**
  Database maintenance and Web application
- **RIPL discrete levels**
  Update with new ENSDF release
  Match with AME 2016, fix unknown energies
- **NSDD Analysis & Utility software**
  Web site to collect and disseminate

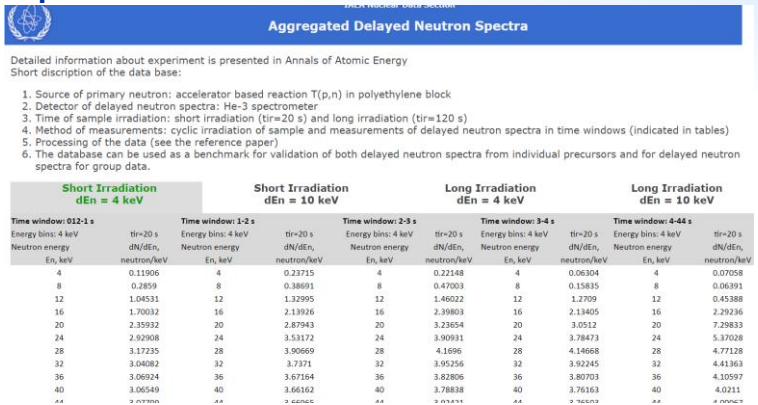
• β^- delayed neutron emission

Database maintenance and Web application

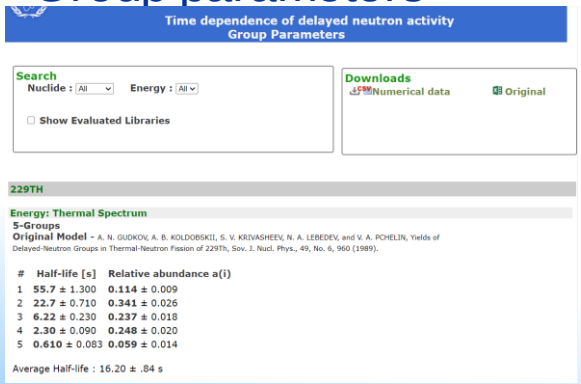
Individual precursors



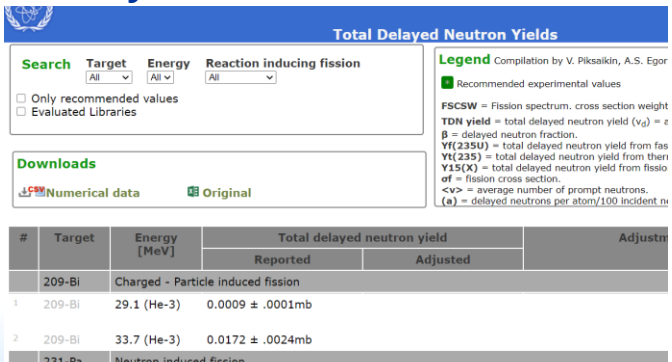
Spectra



Group parameters



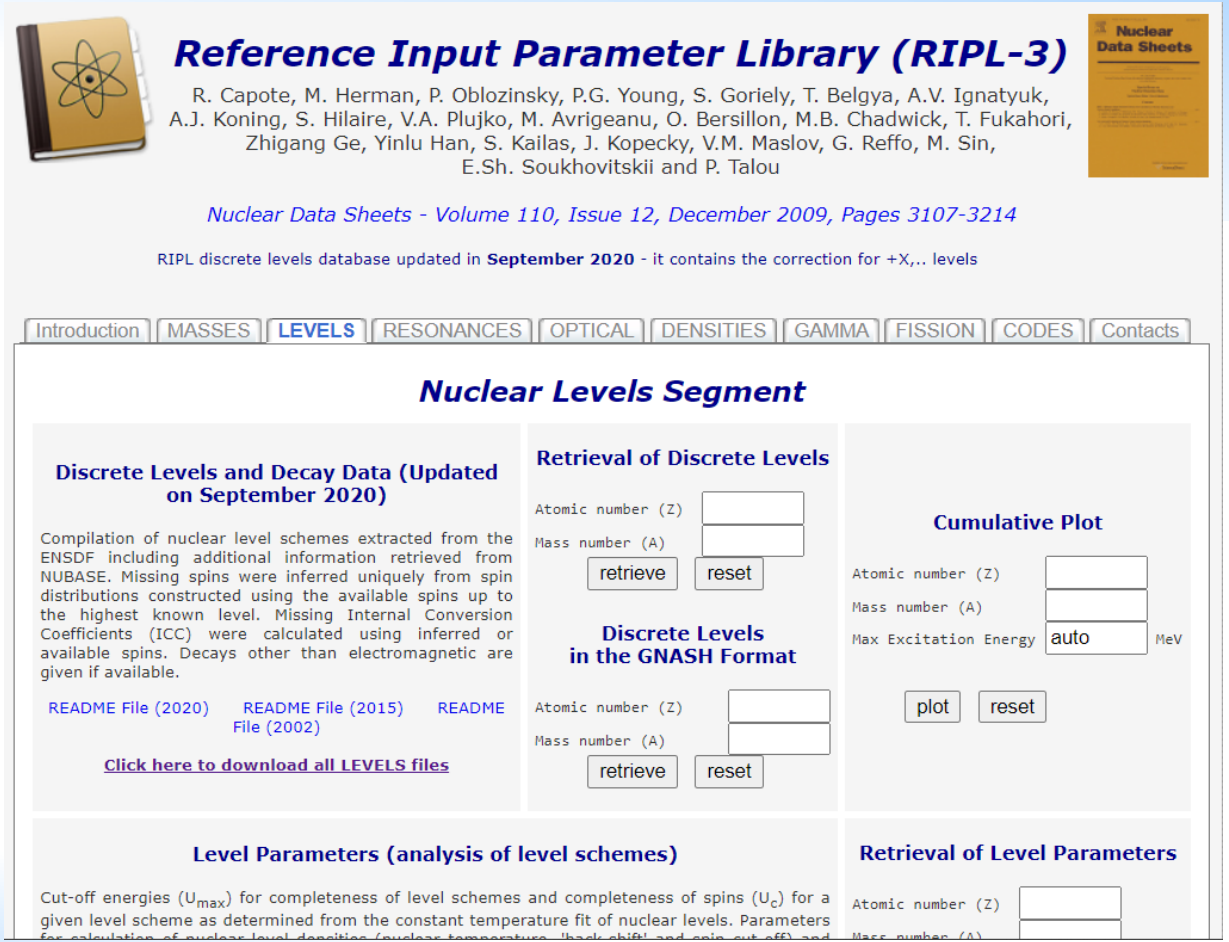
Total yields



• RIPL discrete levels

Update with new ENSDF release

Match with AME 2016 to assign unknown level energies



Reference Input Parameter Library (RIPL-3)

R. Capote, M. Herman, P. Oblozinsky, P.G. Young, S. Goriely, T. Belgya, A.V. Ignatyuk, A.J. Koning, S. Hilaire, V.A. Plujko, M. Avrigeanu, O. Bersillon, M.B. Chadwick, T. Fukahori, Zhigang Ge, Yinlu Han, S. Kailas, J. Kopecky, V.M. Maslov, G. Reffo, M. Sin, E.Sh. Soukhovitskii and P. Talou

Nuclear Data Sheets - Volume 110, Issue 12, December 2009, Pages 3107-3214

RIPL discrete levels database updated in **September 2020** - it contains the correction for +X,.. levels

Introduction | MASSES | LEVELS | RESONANCES | OPTICAL | DENSITIES | GAMMA | FISSION | CODES | Contacts

Nuclear Levels Segment

Discrete Levels and Decay Data (Updated on September 2020)

Compilation of nuclear level schemes extracted from the ENSDF including additional information retrieved from NUBASE. Missing spins were inferred uniquely from spin distributions constructed using the available spins up to the highest known level. Missing Internal Conversion Coefficients (ICC) were calculated using inferred or available spins. Decays other than electromagnetic are given if available.

README File (2020) README File (2015) README File (2002)

Click here to download all LEVELS files

Retrieval of Discrete Levels

Atomic number (Z)
Mass number (A)
retrieve reset

Discrete Levels in the GNASH Format

Atomic number (Z)
Mass number (A)
retrieve reset

Cumulative Plot

Atomic number (Z)
Mass number (A)
Max Excitation Energy auto MeV
plot reset

Level Parameters (analysis of level schemes)

Cut-off energies (U_{max}) for completeness of level schemes and completeness of spins (U_c) for a given level scheme as determined from the constant temperature fit of nuclear levels. Parameters

Retrieval of Level Parameters

Atomic number (Z)

- **NSDD Analysis & Utility software**

Collect

Disseminate

ENSDF Analysis and Utility Programs

The Brookhaven National Nuclear Data Center maintains and distributes various programs in support of the International Atomic Energy Agency sponsored Nuclear Structure and Decay Data Network. These programs generally use as input files in the Evaluated Nuclear Structur Data File (ENSDF) format.[1]

The tab '**Test and Validation**' contains new codes which are in beta versions or still under development and require further testing by the users. Bugs or other problems should be sent to the code developers at the email address indicated.

List of modifications:

Please address any issue regarding this page to nds.contact-point@iaea.org Last updating: 3 February 2021.

Analysis | Utility | Testing/Validation | PNPI Codes | NSDFLIB | SETMDC

ENSDF Analysis Programs
When present, documentation is included in the compressed files

#	Program	Version/Last Change	Notes	ANSI	Linux	Windows	MacOS
1	**ALPHAD** Calculates alpha HF's and theoretical half-lives.	12 Nov 2020	r_0 paper		compressed file with makefile	compressed file with executable	compressed file with makefile
2	**ALPHAD-RadD** ALPHAD extension, calculates radius parameter	12 Nov 2020	r_0 paper		Compressed file with source, NSDFLIB95, and makefile	Compressed file with executable, source, NSDFLIB95, and makefile	Compressed file with source, NSDFLIB95, and makefile
3	**BrIcc** Calculates the conversion electron, electron-positron pair conversion coeffcients and the E0 electronic factors		2020-08-17		Compressed file	Self-extracting archive	Compressed file

Livechart development

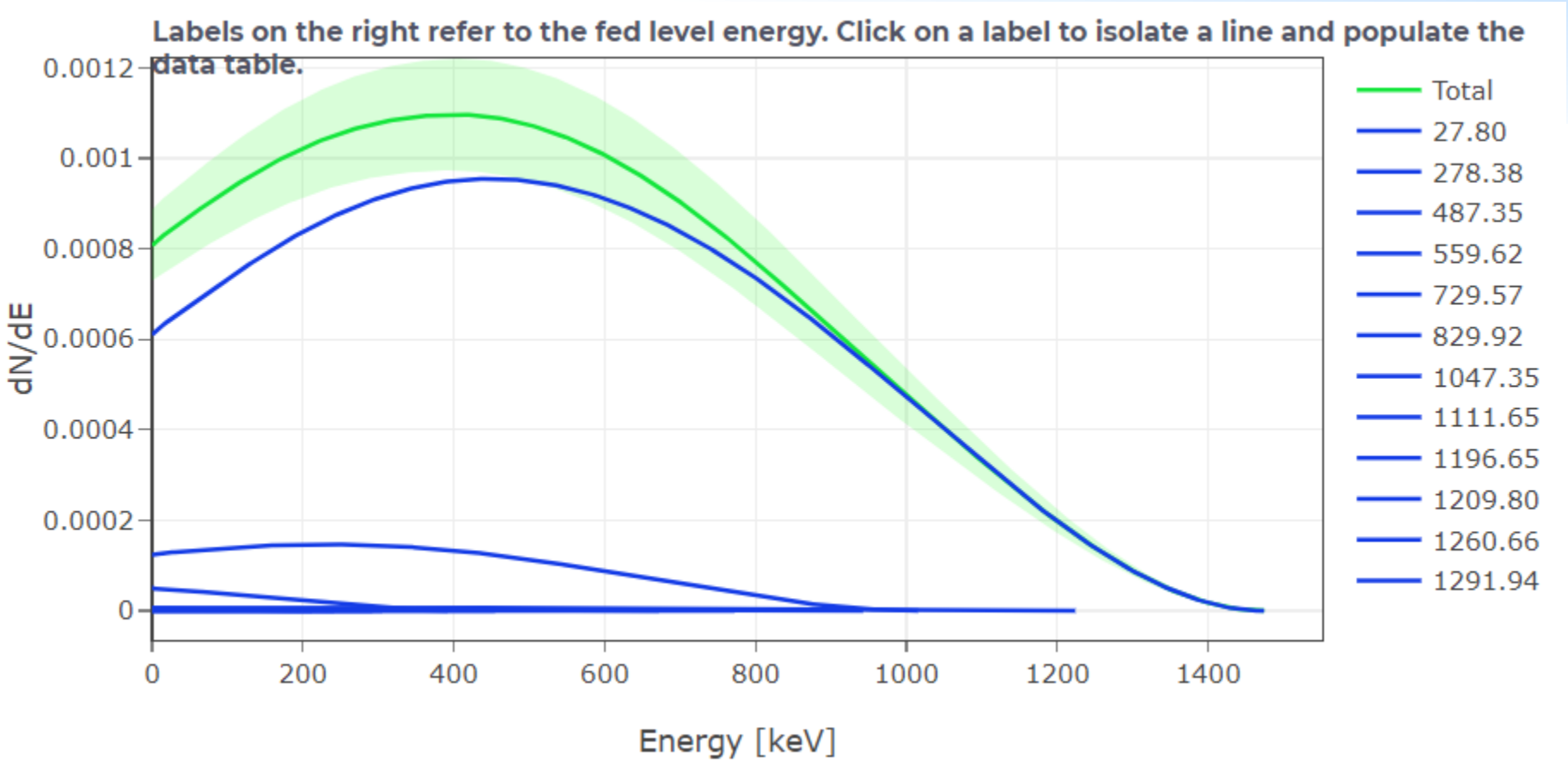
Users' requests mainly related to decay data

- β^+ and β^- spectra
- B+/EC : splitting γ intensities
- X-ray intensities from each γ

High Maintenance task

- Code for atomic radiations calculation

β^+ and β^- spectra



X-ray intensities from each γ

X-rays from each γ transition

#	E [keV]	I(abs) [%]	Line	γ Energy [keV]	α_{shell}
1	6.960	0.214 *6*	L3-M1	105.3589	
2	7.844	0.479 *14*	L3-M4	105.3589	
3	7.899	0.479 *14*	L3-M5	105.3589	
4	8.138	0.097 *3*	L2-M1	105.3589	
5	6.960 - 9.557	5.84 *16*	L_3	105.3589	0.072 5
6	8.906	0.307 *10*	L1-M2	105.3589	
7	9.022	3.54 *11*	L2-M4	105.3589	
8	9.022	4.22 *12*	L3-N1	105.3589	
9	6.960 - 11.268	11.8 *5*	L	105.3589	0.555 11
10	9.162	0.399 *13*	L1-M3	105.3589	
11	9.335 - 9.347	0.0514 *15*	L3-N45	105.3589	
12	8.138 - 10.735	4.35 *12*	L_2	105.3589	0.108 6
13	9.496	0.87 *3*	L3-O1	105.3589	

B+/EC disentanglement of γ intensities

medical radioisotopes scouting

Evaluation: J.H. KELLEY, C.G.SHEU AND J.L. GODWIN, ET AL. **Publication cut-off**: 31-Mar-

Parent	$T_{1/2}$	E_x [keV]	Jp order	Decay	Q decay note on Q value	Daughter
$^{10}_{6}C_{4}$	19.290 s *12*	0.0	0+	ec β+ 100 %	3648.06 *7*	$^{10}_{5}B_{5}$

Gamma CSV

#	E_γ [keV]	I_γ(abs) [%]	I_γ(abs) β^+ [%] ⚠	Initial level [keV]	J^π	Final level [keV]	J^π
1	718.353 *19*	**100** ***0***	99.967 *3*	718.380 *11*	1+	0.0	3+
2	1021.646 *14*	1.4615 *19*	1.4571 *19*	1740.05 *4*	0+	718.380	1+

Code for atomic radiation

replacing RADLST, no more maintained

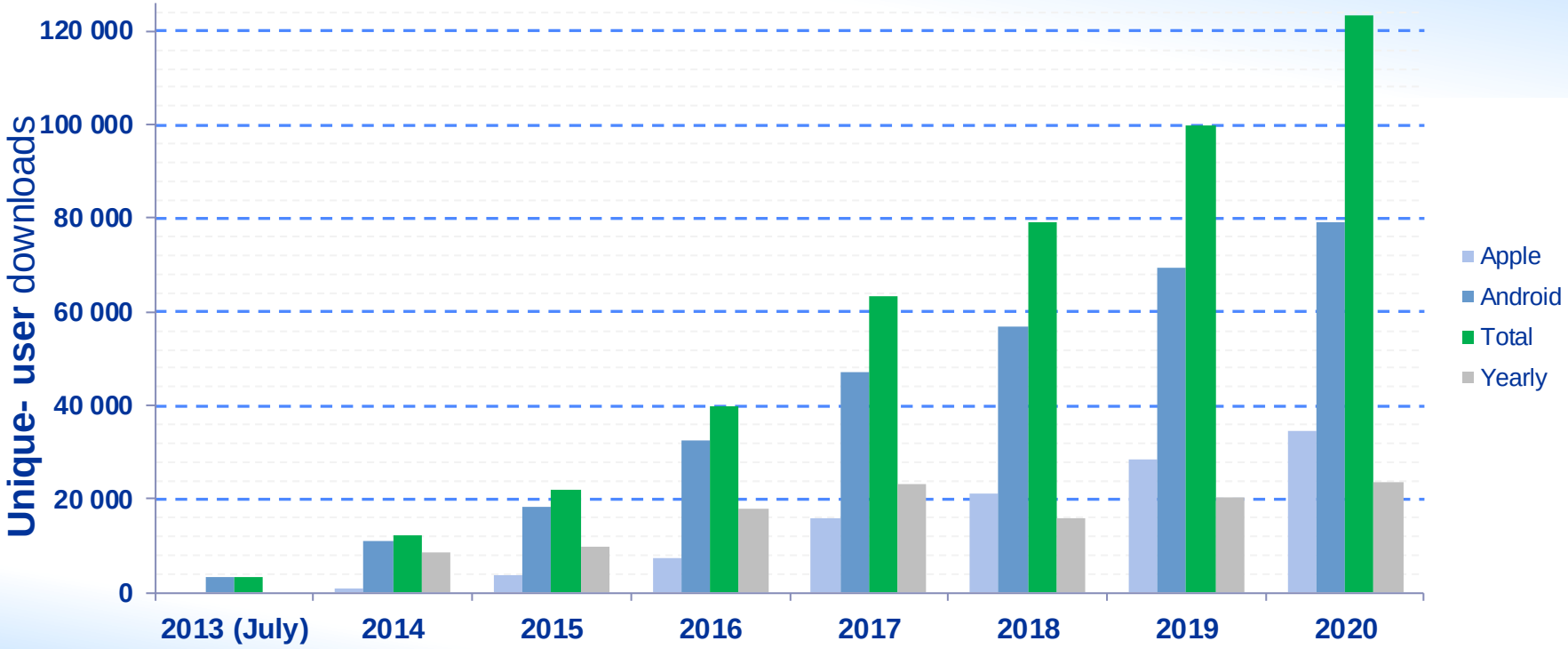
Calculates intensities of

- X rays
- Conversion electrons
- Auger electrons (K and L shells)

Notes

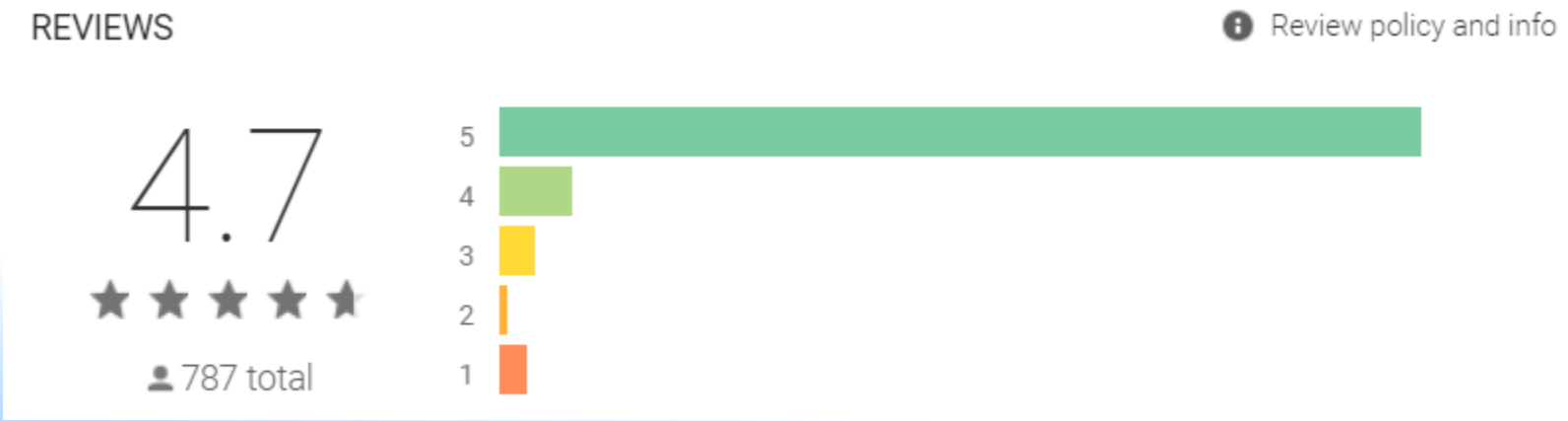
- Parts of the GUI need redesign
- Need to keep up with the evolving Web technologies

Isotope Browser statistics



13 releases in 2019

~ 30% my initiative
~ 70% users' requests & bugs



Notes

- Produces more feedback & requests than I can consume
- Technology is changing very fast
- The work has to be done for 2 Operating Systems

Other support to users' needs

- **Place & maintain various datasets on the Web**
  e.g. Nuclear Moments, Thermal n CS, Atomic Masses

- **Extract and filter data with ad hoc criteria**
  e.g. Logft review project, Atomic masses with covariance error matrix

Plans for the future

As before:

- CRPs support
- Livechart, Isotope Browser, …
- Structure & Decay data needs

(e.g covariance matrix for AME2020)

A bit more ambitious :
from Visualization to Interaction

(started with β spectra, Medical Isotope Browser)

Pocket Nuclear Database:

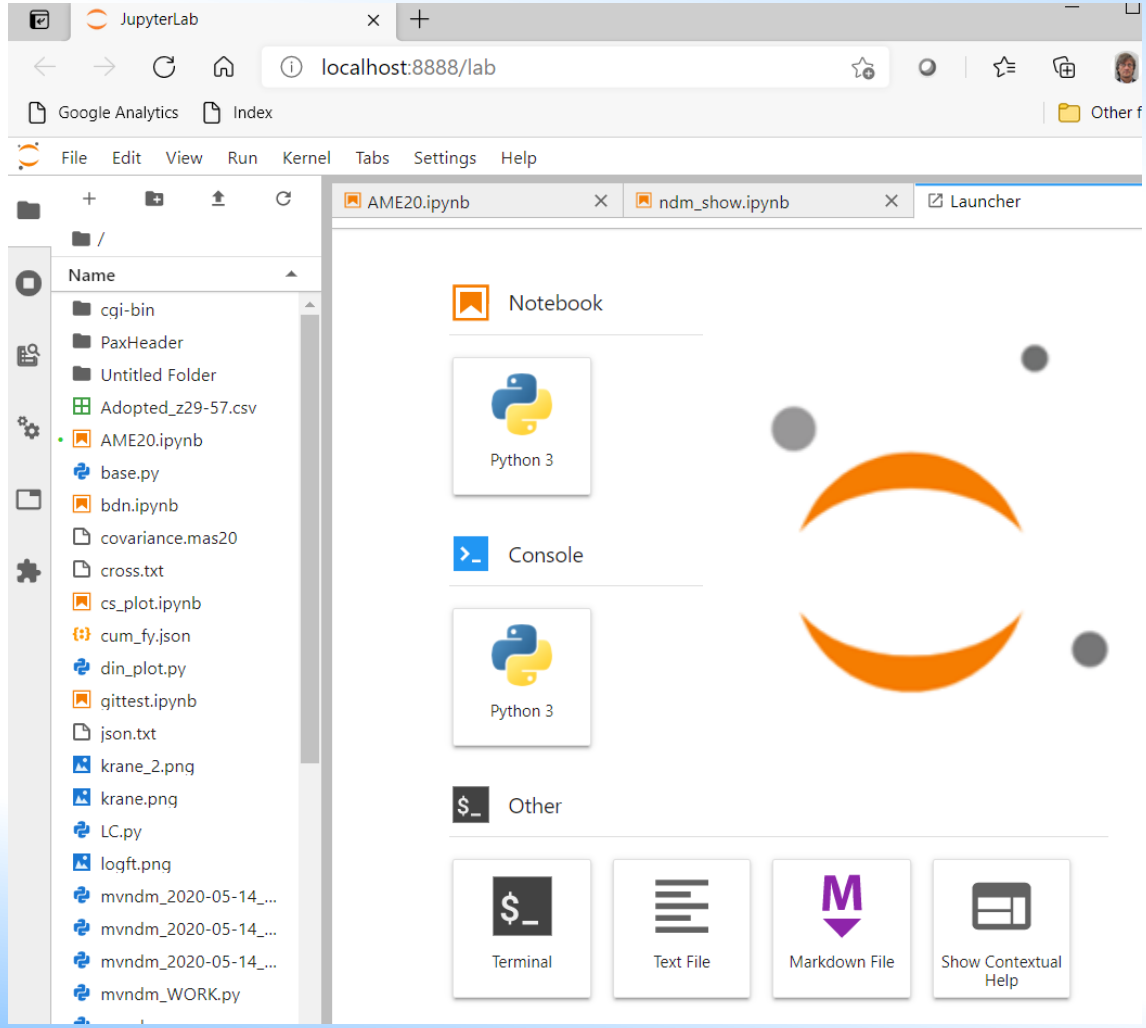
Data structure

+

Tool for extraction & manipulation

+

Visualization & Interaction



Can run in a browser

Coupled to Python's Machine Learning tools

Graphical engine

Logft vs Transition type

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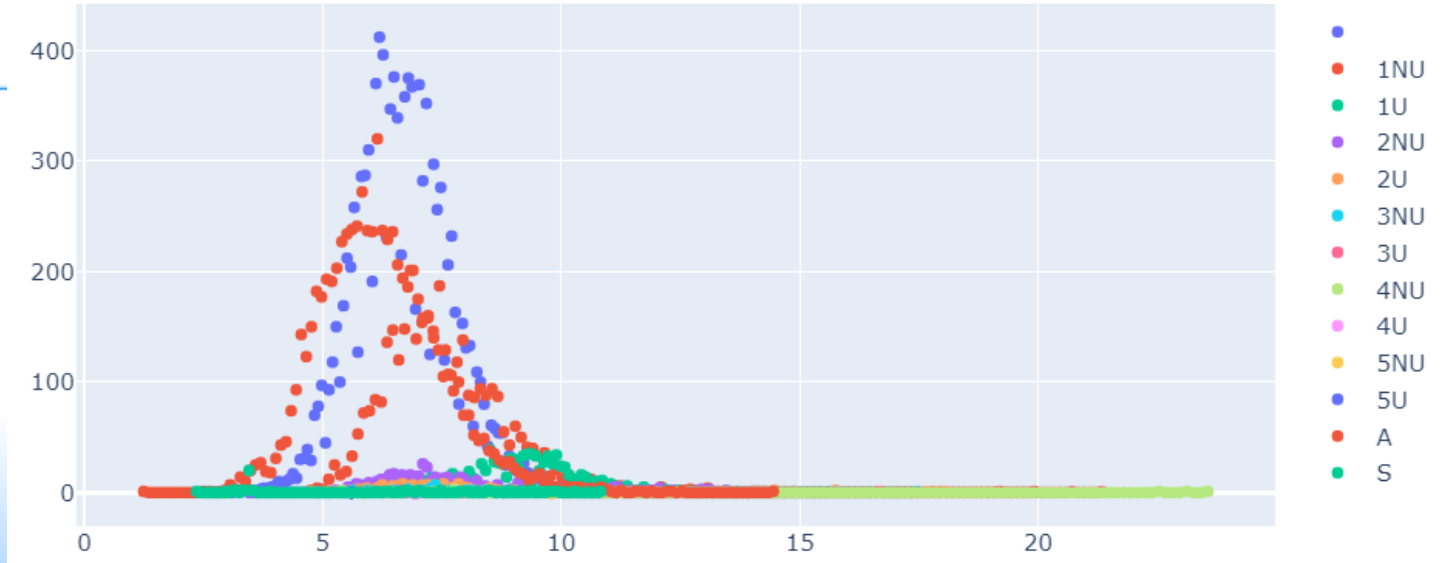
```
[ ]: # THIS EXTRACTS THE DATA
fields = "DECAY_RADIATION.B_TRANS_TYPE, DECAY_RADIATION.B_LOGFT_NUM"
ans = [pd.DataFrame(y) for x, y in build_df(fields), as_index=False)]

#THIS IS JUST PLOTTING
fig = go.Figure()
for a in ans:
    ct = pd.cut(a[a.columns[1]], bins=125)
    tst = ct.apply(lambda x: x.mid).value_counts(sort=False)
    fig.add_trace(go.Scatter(x=tst.index.values, y = tst)
fig.show()
```



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Thank you!