

Progress Report of  
Nuclear Data Center of Japan Atomic Energy Agency  
for April 2013 – March 2014

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## JNDC (chaired by N. Yamano, Univ. of Fukui)

### Subcommittee on Nuclear Data (H. Harada, JAEA)

- High Energy Nuclear Data Evaluation WG (S. Kunieda, JAEA)
- ENSDF Group (H. Iimura, JAEA)
- Japanese Nuclear Data Management Network (Y. Watanabe, Kyushu Univ.)
- Advisory Subcommittee on Development of JENDL(G. Chiba, Hokkaido Univ.), closed in March 2014.

### Subcommittee on Reactor Constants (N. Yamano, Univ. of Fukui)

- Reactor Integral Test WG (G. Chiba, Hokkaido Univ.)
- Shielding Integral Test WG (C. Konno, JAEA)
- WG on Evaluation of Nuclide Generation and Decay Heat (K. Okumura, JAEA)
- Covariance Utilization WG (T. Iwasaki, Tohoku Univ.)

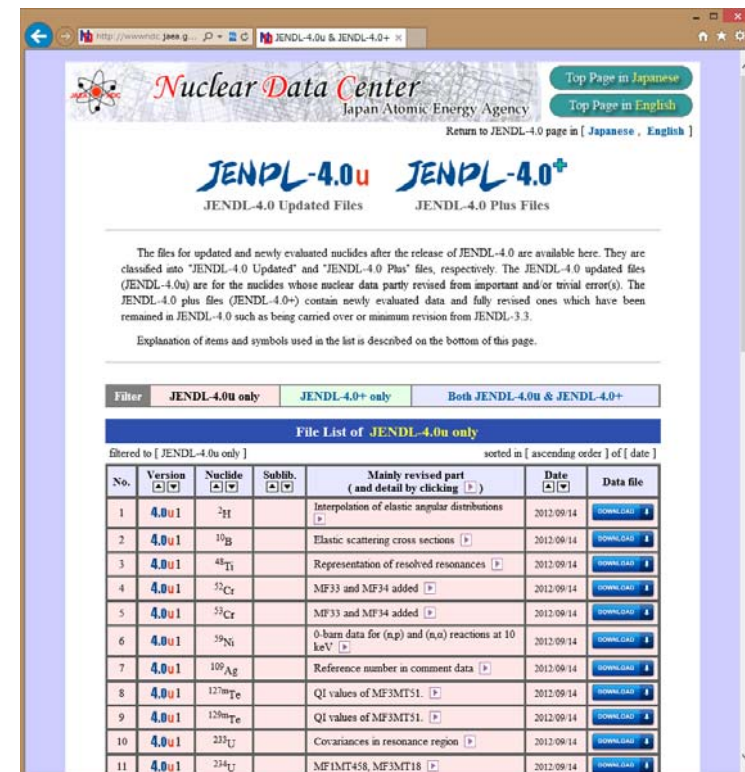
# JENDL-4.0 Updated Files

JENDL-4.0u

Japan Atomic Energy Agency 

<http://www.ndc.jaea.go.jp/jendl/j40/update/>

- 13 files were updated in 2013.
- Main update:
  - neutron spectra: K-36, Hg-196, 202, 204, Ra-224,225  
Strange dips were found on the kerma factors
  - RRP in MF32: U-234, Np-237, Pu-238, 242  
Inconsistencies of RRP between MF2 and MF32 were found.



The screenshot shows the JENDL-4.0u website interface. At the top, there are links for 'Top Page in Japanese' and 'Top Page in English'. Below that, the 'Nuclear Data Center Japan Atomic Energy Agency' logo is displayed. The main heading is 'JENDL-4.0u JENDL-4.0+' with sub-headings 'JENDL-4.0 Updated Files' and 'JENDL-4.0 Plus Files'. A paragraph explains that files for updated and newly evaluated nuclides are available, categorized into 'JENDL-4.0 Updated' and 'JENDL-4.0 Plus' files. A filter section allows users to select 'JENDL-4.0u only', 'JENDL-4.0+ only', or 'Both JENDL-4.0u & JENDL-4.0+'. Below the filter, a table titled 'File List of JENDL-4.0u only' is shown, sorted in ascending order by date. The table has columns for No., Version, Nuclide, Sublib., Mainly revised part (and detail by clicking), Date, and Data file.

No.	Version	Nuclide	Sublib.	Mainly revised part (and detail by clicking)	Date	Data file
1	4.0u1	<sup>2</sup> H		Interpolation of elastic angular distributions	2012/09/14	<a href="#">DOWNLOAD</a>
2	4.0u1	<sup>10</sup> B		Elastic scattering cross sections	2012/09/14	<a href="#">DOWNLOAD</a>
3	4.0u1	<sup>48</sup> Ti		Representation of resolved resonances	2012/09/14	<a href="#">DOWNLOAD</a>
4	4.0u1	<sup>52</sup> Cr		MF33 and MF34 added	2012/09/14	<a href="#">DOWNLOAD</a>
5	4.0u1	<sup>52</sup> Cr		MF33 and MF34 added	2012/09/14	<a href="#">DOWNLOAD</a>
6	4.0u1	<sup>59</sup> Ni		0-barn data for (n,p) and (n,α) reactions at 10 keV	2012/09/14	<a href="#">DOWNLOAD</a>
7	4.0u1	<sup>109</sup> Ag		Reference number in comment data	2012/09/14	<a href="#">DOWNLOAD</a>
8	4.0u1	<sup>127m</sup> Te		QI values of MF3MT51	2012/09/14	<a href="#">DOWNLOAD</a>
9	4.0u1	<sup>129m</sup> Te		QI values of MF3MT51	2012/09/14	<a href="#">DOWNLOAD</a>
10	4.0u1	<sup>233</sup> U		Covariances in resonance region	2012/09/14	<a href="#">DOWNLOAD</a>
11	4.0u1	<sup>234</sup> U		MF1MT458, MF3MT18	2012/09/14	<a href="#">DOWNLOAD</a>

# neutron spectra

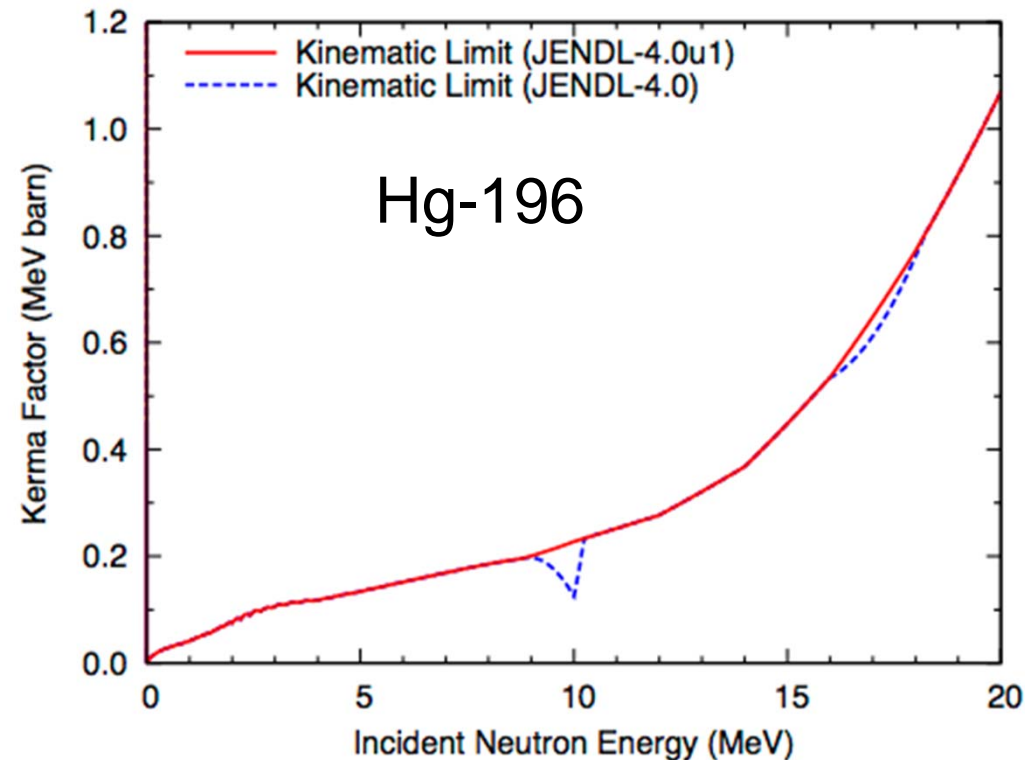
K-36, Hg-196, 202, 204, Ra-224,225

## Problem

A strange dip was found on the kerma factors calculated with the kinematic limit. This occurred by energy imbalance for the (n,2n) and (n,3n) reactions.

## Action

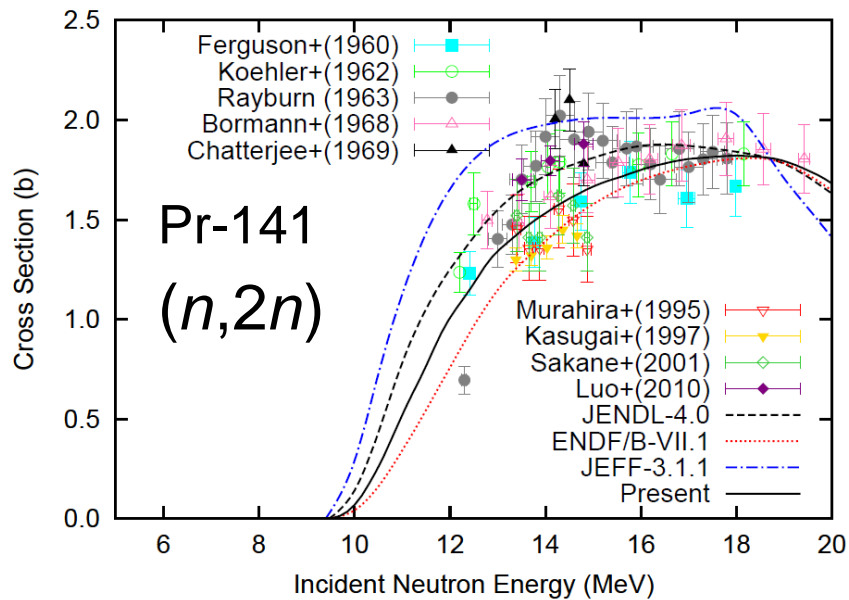
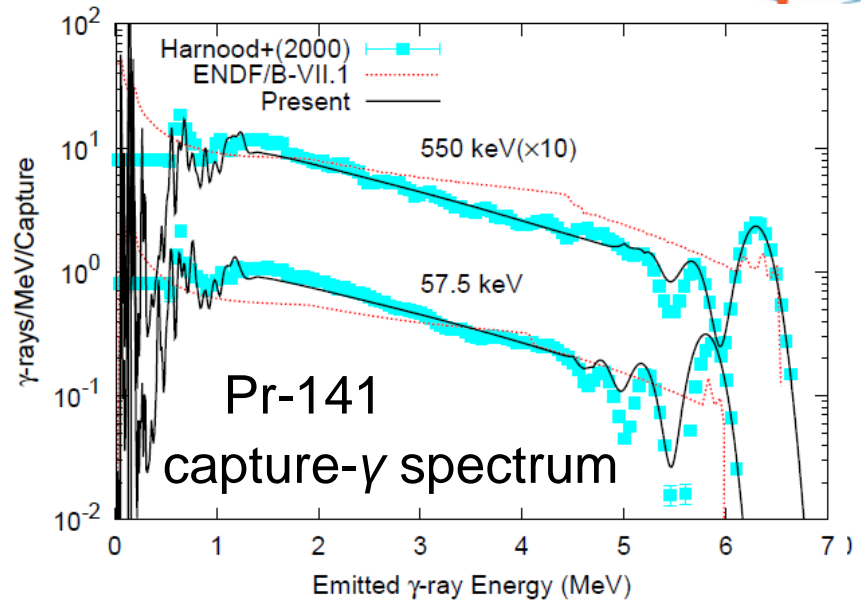
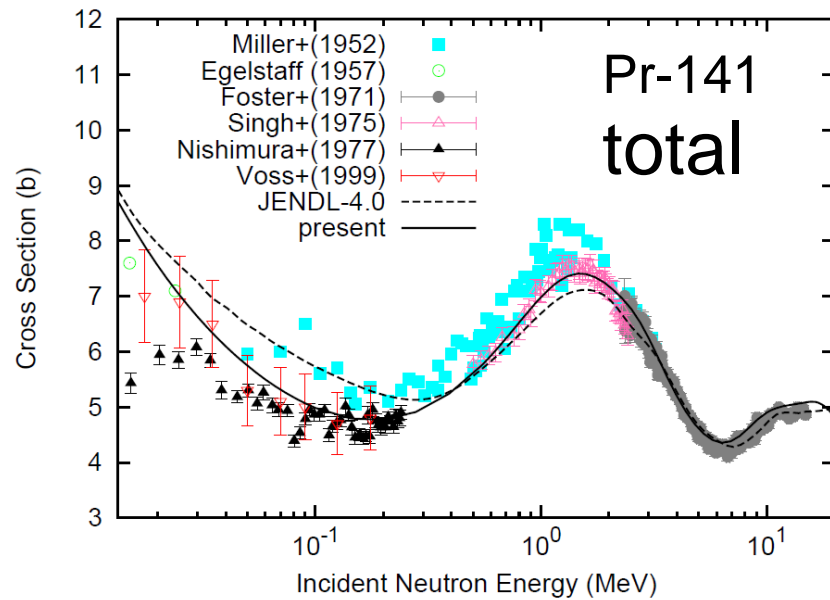
The neutron spectra were modified near the threshold energies.



# Evaluation of neutron nuclear data

- The data which are not updated in JENDL-4.0 are continuously considered to be revised, especially for FP region nuclides.
- The statistical model code CCONE was used to calculate fast-neutron cross sections.
  - F. Minato, “Evaluation of neutron nuclear data of praseodymium-141 and -143”, *J. Nucl. Sci. Technol.*, 50 (9), 873 (2013).
  - K. Shibata, “Evaluation of neutron nuclear data on antimony isotopes”, *J. Nucl. Sci. Technol.* **51**, 425 (2014).
  - K. Shibata, “Evaluation of neutron nuclear data on ruthenium isotopes”, *J. Nucl. Sci. Technol.* **50**, 1177 (2013).

# Evaluation of neutron nuclear data for Pr isotopes

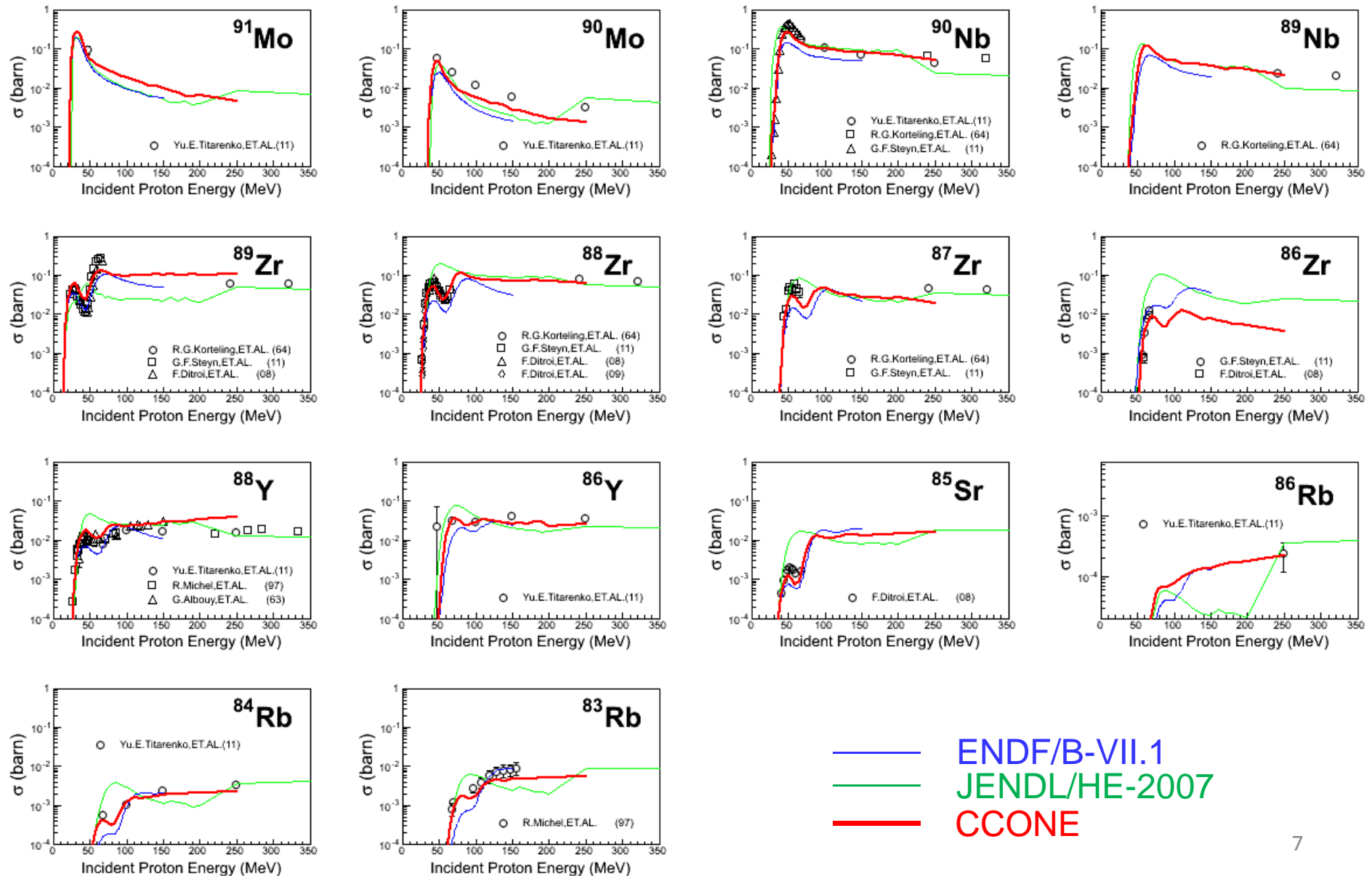


F. Minato, J. Nucl. Sci. Technol.,  
50 (9), 873 (2013).

# Evaluation of High Energy Nuclear Data

- Optical model analysis for neutrons and protons
  - DOMP + RRM-CC (OPTMAN ver. 10)
  - Isospin-dependent analysis
  - ${}^6,7\text{Li}$ ,  ${}^9\text{Be}$  and  ${}^{10,11}\text{B}$ , ...
  
- Evaluation for neutron and residual production c.s.
  - CCONE-0.9.2.0
  - IAS direct (p,n) cross-sections with OPTMAN
  - DWBA for inelastic scattering c.s.
  - Improved Iwamoto-Harada model (Kunieda-2012)

# $^{93}\text{Nb}(p,x)$ , Residual Production CS

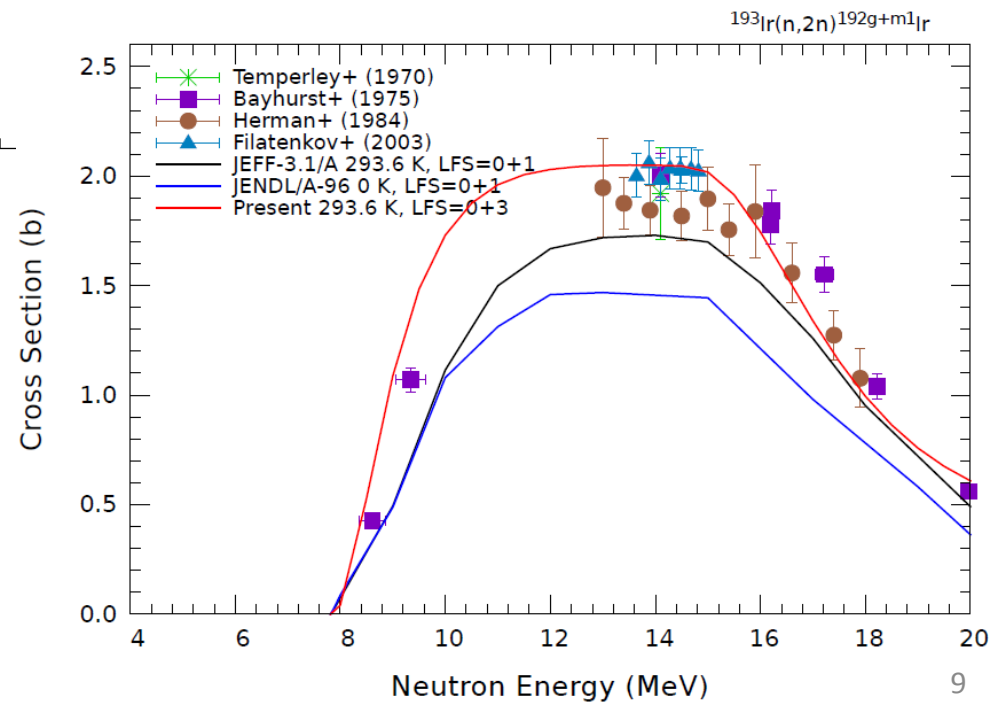
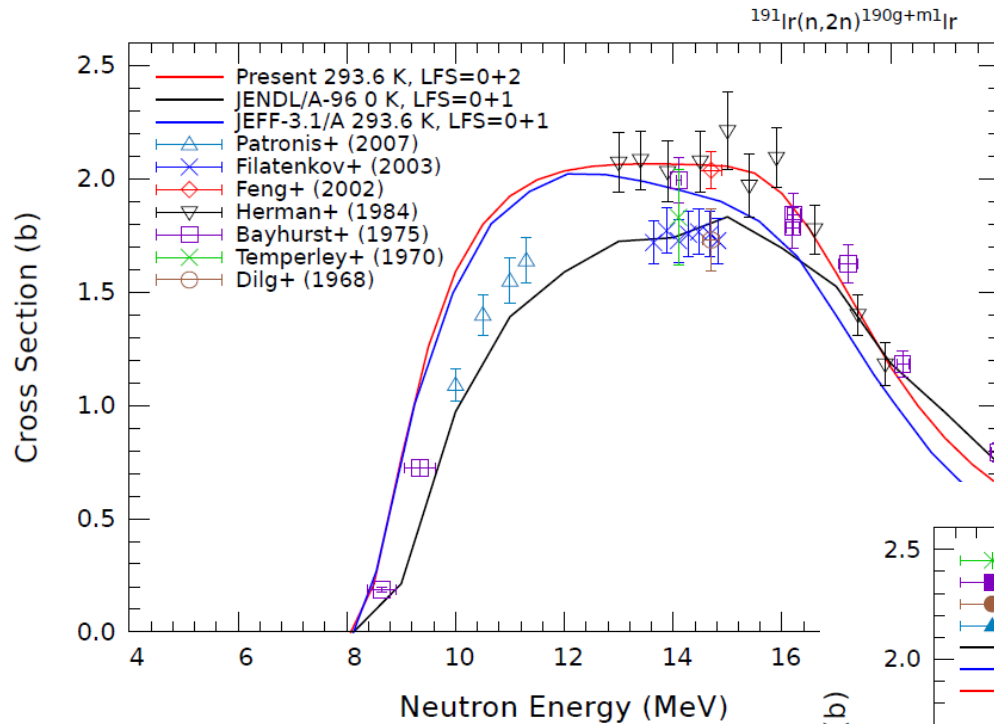




# Activation file

- neutron activation cross sections for the decommissioning of LWRs.
- about 300 target nuclei
- new evaluation, JENDL-4.0, JENDL/A-96
- Evaluated files for the 246 isotopes from H to Hf have been created.

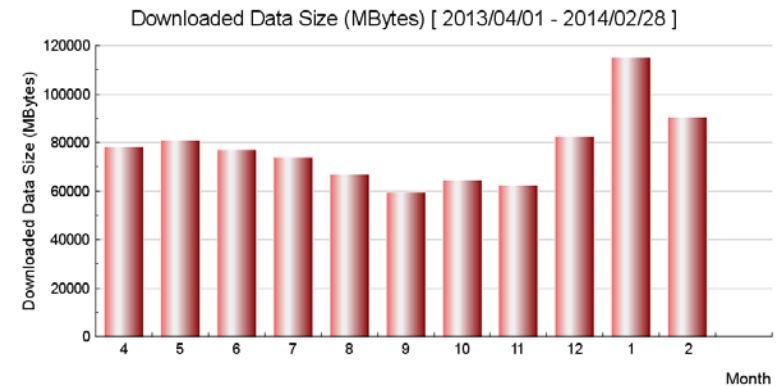
# Activation cross section for Ir-191, 193



# Data service by web

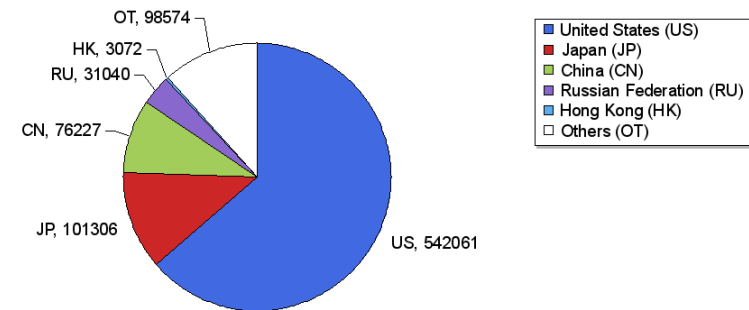
Nuclide	MAT	Numerical Data	Comments	Figures*)	Sig table
91-Pa-229	9125	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
91-Pa-230	9128	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
91-Pa-231	9131	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
91-Pa-232	9134	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
91-Pa-233	9137	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
92-U-230	9213	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
92-U-231	9216	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
92-U-232	9219	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
92-U-233	9222	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
[update 1] (2012/09/14)		<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	↑	↑
92-U-234	9225	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
[update 2] (2013/07/10)		<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	↑	↑
92-U-235	9228	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
[update 1] (2012/09/14)		<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	↑	↑
92-U-236	9231	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
92-U-237	9234	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
92-U-238	9237	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
[update 1] (2012/09/14)		<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	↑	↑
93-Np-234	9337	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
93-Np-235	9340	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
93-Np-236	9343	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
93-Np-237	9346	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
[update 1] (2013/07/10)		<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	↑	↑
93-Np-238	9349	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
93-Np-239	9352	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>
94-Pu-236	9428	<a href="#">original</a> , <a href="#">0K</a> , <a href="#">300K</a>	<a href="#">comment</a>	<a href="#">Fig1</a> <a href="#">Fig2</a> <a href="#">Fig3</a> <a href="#">Fig4</a>	<a href="#">table</a>

Down loaded data size in period of April 2013 to February 2014.



Downloaded data by countries.

Downloaded Data Size (MBytes) ( Top 5 ) [ 2013/04/01 - 2014/02/28 ]

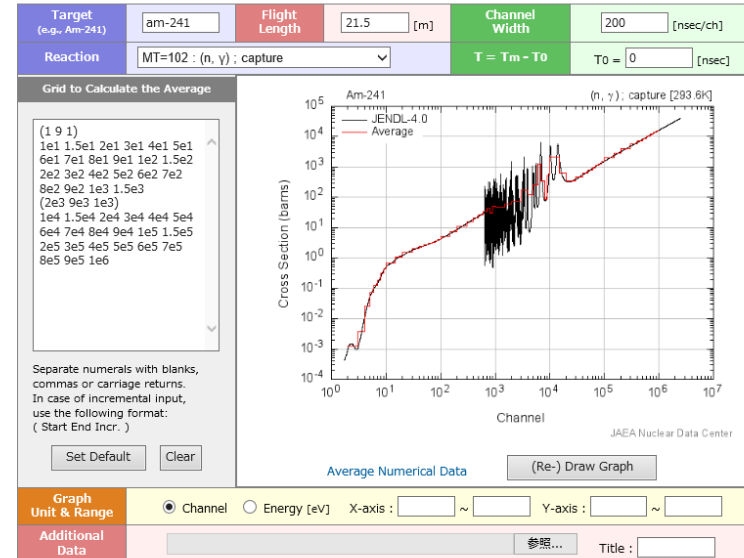


\* Top 5 of nationalities about access times

# Tools for drawing graphs, *etc.*

View of Average Resonance Cross Section (VARCS)

- [SPES \(Search and Plot Executive System\)](#) EXFOR data base and ENDF formatted data
- [Plotting Tool for ENDF \(Evaluated Nuclear Data File\)](#) Generating a cross section graph of JENDL-3.2, -3.3 and -4.0



- [Graph of Fission Product Yields](#)
- [View of Average Resonance Cross Section \(VARCS\)](#) (July 5, 2013)

Average cross sections are plotted on a graph.

- [Search for Resolved Resonances](#) (July 5, 2013) This tool is to retrieve information on resolved resonances

Search for Resolved Resonances

Search for Resolved Resonances

Res. Energy (Er) [10] [eV] ~ [20] [eV]    Atomic # (Z) [ ] ~ [ ]

Peak CS ( $\sigma$ -peak) [ ] [b] ~ [ ] [b]    Mass # (A) [ ] ~ [ ]

Sorting Er :  ascend.  descend.  $\sigma$ -peak :  ascend.  descend.       

Er [eV]	L	J	$\Gamma_n$ [eV]	$\Gamma_\gamma$ [eV]	$\Gamma_{f1}$ [eV]	$\Gamma_{f2}$ [eV]	$\sigma$ -peak [b]	$K_\gamma$ [eV]	Target
1.000000e+01	0	5.0	1.50e-04	4.00e-02	2.00e-01	0.00e+00	1.84e+01	8.22e-05	Cm247 Fig
1.005000e+01	0	3.0	3.60e-03	1.82e-01	0.00e+00	0.00e+00	2.15e+03	2.06e-03	Ru099 Fig
1.011600e+01	0	3.0	2.38e-05	4.42e-02	1.33e-04	0.00e+00	5.25e+01	1.39e-05	Am241 Fig
1.012000e+01	0	0.5	5.40e-02	9.05e-02	0.00e+00	0.00e+00	4.22e+04	3.38e-02	Xe124 Fig
1.016292e+01	0	4.0	4.47e-05	3.73e-02	3.97e-07	5.30e-02	2.47e+01	2.51e-05	U235 Fig
1.023100e+01	0	2.0	2.83e-05	4.00e-02	1.32e-06	0.00e+00	3.86e+01	1.18e-05	Np237 Fig
1.023936e+01	1	1.5	8.53e-07	2.30e-02	0.00e+00	0.00e+00	5.22e+00	1.71e-06	U238 Fig
1.025000e+01	0	3.0	5.40e-04	3.30e-02	4.00e-01	0.00e+00	1.20e+01	2.32e-04	Cm245 Fig
1.026000e+01	0	2.0	2.88e-04	1.13e-01	0.00e+00	0.00e+00	1.86e+02	1.20e-04	Dy161 Fig
1.030000e+01	0	4.5	1.38e-05	5.00e-02	8.90e-02	0.00e+00	7.92e+00	2.30e-05	Am242m Fig
1.031000e+01	0	1.0	5.47e-03	8.50e-02	0.00e+00	0.00e+00	3.32e+03	1.93e-03	Os189 Fig
1.031400e+01	0	2.0	5.46e-04	4.67e-02	1.07e-04	0.00e+00	5.37e+02	2.25e-04	Am243 Fig
1.032000e+01	0	3.0	2.23e-03	7.50e-02	0.00e+00	0.00e+00	2.16e+03	1.26e-03	Nd147 Fig
1.034000e+01	0	2.0	7.06e-04	3.92e-02	8.36e-06	0.00e+00	1.07e+03	4.33e-04	Pa231 Fig
1.035000e+01	0	1.0	1.74e-04	4.81e-02	0.00e+00	0.00e+00	1.58e+02	6.51e-05	Pa233 Fig
1.035100e+01	1	1.0	1.20e-05	9.00e-02	0.00e+00	0.00e+00	4.99e+00	3.00e-06	Il27 Fig
1.036000e+01	0	3.0	4.00e-03	6.50e-02	0.00e+00	0.00e+00	3.12e+03	1.65e-03	Ta181 Fig
1.036000e+01	0	5.0	2.34e-04	4.00e-02	1.73e-01	0.00e+00	2.84e+01	1.28e-04	CF249 Fig
1.037642e+01	0	3.0	1.41e-03	4.71e-02	2.57e-01	1.66e-05	1.04e+02	8.00e-04	U233 Fig
1.040400e+01	0	3.0	3.09e-04	4.50e-02	7.71e-05	0.00e+00	4.30e+02	1.79e-04	Am241 Fig
1.044800e+01	0	2.0	1.57e-02	1.15e-01	0.00e+00	0.00e+00	7.64e+03	5.76e-03	Sm151 Fig
1.045000e+01	0	0.5	1.65e-02	1.00e-01	0.00e+00	0.00e+00	2.02e+04	1.42e-02	Dy160 Fig
1.047000e+01	0	2.0	2.48e-03	9.10e-02	0.00e+00	0.00e+00	1.59e+03	1.01e-03	Eu151 Fig
1.051000e+01	0	3.0	8.76e-04	4.90e-02	6.38e-01	0.00e+00	1.37e+03	3.57e-04	Pa233 Fig

# WWW Chart of the Nuclides 2010(JavaScript-β)

- New version of “WWW Chart of the Nuclides” which utilizes JavaScript is under development.
- improve operability and visualization  
slide in all directions by dragging, zoomed in/out by wheel rolling with a mouse like some web maps

