

# Status of the ENDF/B-VII Library

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# ENDF/B-VII release beta1

## New/Revised sublibraries in ENDF/B-VIIb1

Sublibrary	# materials	Released
Neutron*	387	Oct 19, 05
Thermal	20	Oct 19, 05
Photonuclear	163	Oct 24, 05
Protons	45	Oct 21, 05
Deuterons	5	Oct 21, 05
Tritons	3	Oct 21, 05
He-3	2	Oct 21, 05

\*Note patch of Oct 24 to the neutron sublibrary!

# ENDF/B-VII release beta1

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Sublibraries taken over from ENDF/B-VI.8

Sublibrary	# materials
Decay data	979
Photo-atomic	100
Spont. fission product yields	9
Atomic relaxation*	100
Neutron fission product yields	31
Electron-atomic*	100

\*Not available through the beta1 web interface

# Management of the library (new features)

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## ENDF/A re-established Scope:

- incomplete evaluations
- preliminary evaluations
- standards

## Current contents:

- 6 files with ENDF/B-VII standards
- LLNL evaluations for 489  $n$ ,  $p$ , and  $d$  induced reactions on 195 targets
- BNL modified evaluation for  $g+n_{14}$

## No more 'Tapes'

## Systematic verification

- STANEF
- CHECKR
- FIZCON
- PSYCHE
- MRGMAT (**new**)

## Phase-1 testing

- NJOY99.90+patches
- MCNP5

# Construction of ENDF/B-VIIb1 (neutrons)

Light Nuclei  
25 materials  
to replace 7  
elemental

ENDF/B-VIIb0  
released March 11, 2005,  
340 materials less 12 elemental

29 new evaluations in b0  
cleaned by Ch. Dunford

Heavy Nuclei  
8 materials from  
JEFF31 &  
JENDL33

SG23  
219 materials  
Z = 31-68

9 new/revised  
1-H (LANL),  
nat-V (BNL),  
74,75-As (LLNL),  
241,242gm-Am,  
235-U (LANL),  
232-Th (IAEA)

R.Q. Wright list  
24 JENDL33  
materials  
Z = 88-100

# Construction of ENDF/B-VIIb1 (neutrons)

## New/Revised

V.bnl  
Th232.iaea  
Am241.lanl  
Am242g.lanl  
Am242m.lanl  
As74.IInI2  
As75.IInI2  
H1.lanl1  
U235.la31b

## Light Nuclei

Mg24.jendl  
Mg25.jendl  
Mg26.jendl  
S32.jendl  
S33.jendl  
S34.jendl  
S36.jendl  
Ar36.jeff  
Ar38.jeff  
Ar40.jendl  
K39.jendl  
K40.jendl  
K41.jendl  
Ca40.jeff  
Ca42.jeff  
Ca43.jeff  
Ca44.jeff  
Ca46.jeff  
Ca48.jeff  
Ti46.jendl  
Ti47.jendl  
Ti48.jendl  
Ti49.jendl  
Ti50.jendl  
Ni59.jeff

## R.Q.W. list

Ra223.jendl  
Ra224.jendl  
Ra225.jendl  
Ra226.jendl  
Ac225.jendl  
Ac226.jendl  
Ac227.jendl  
Th227.jendl  
Th228.jendl  
Th229.jendl  
Th233.jendl  
Th234.jendl  
Np235.jendl  
Pu236.jendl  
Am244.jendl  
Am244m.jendl  
Cm247.jendl  
Cm249.jendl  
Cm250.jendl  
Bk250.jendl  
Cf254.jendl  
Es254.jendl  
Es255.jendl  
Fm255.jendl

## Heavy Nuclei

Cm244.jendl  
Cm245.jendl  
Np238.jendl  
Pa231.jendl  
Pa232.jendl  
Pa233.jendl  
Pb206.jeff  
Pb207.jeff

# ENDF/B-VIIb1 other sub-libraries

## Protons

H1.lanl  
H2.lanl  
H3.lanl  
He3.lanl  
Li6.lanl  
Li7.lanl  
C12.lanl  
N14.lanl  
O16.lanl  
Al27.lanl  
Si28.lanl  
Si29.lanl  
Si30.lanl  
P31.lanl  
Ca40.lanl  
Cr50.lanl  
Cr52.lanl  
Cr53.lanl  
Cr54.lanl  
Fe54.lanl  
Fe56.lanl  
Fe57.lanl  
Ni58.lanl  
Ni60.lanl  
Ni61.lanl  
Ni62.lanl  
Ni64.lanl  
Cu63.lanl  
Cu65.lanl  
Nb93.lanl  
W182.lanl  
W183.lanl  
W184.lanl  
W186.lanl  
Hg196.lanl  
Hg198.lanl  
Hg199.lanl  
Hg200.lanl  
Hg201.lanl  
Hg202.lanl  
Hg204.lanl  
Pb206.lanl  
Pb207.lanl  
Pb208.lanl  
Bi209.lanl

## Deuterons

H2.lanl  
H3.lanl  
He3.lanl  
Li6.lanl  
Li7.lanl

## Tritons

H3.lanl  
He3.lanl  
Li6.lanl

## He3

He3.lanl  
Li6.lanl

## Photo-nuclear

160 - 3 - from beta0  
+  
U235.lanl14  
U238.lanl14  
Np237.lanl14  
Pu239.lanl14  
Pu240.lanl4  
Am241.lanl3

## Thermal Scattering

H(H2O).ike  
para-H.lanl  
ortho-H.lanl  
H(ZrH).lanl  
D(D2O).ga  
para-d.lanl  
ortho-d.lanl  
Be metal.lanl  
Be(BeO).lanl  
O(BeO).lanl  
graphite.lanl  
l-ch4.lanl  
s-ch4.lanl  
H(CH2).ga  
BENZINE.g  
Al27.lanl  
Fe56.lanl  
Zr(ZrH).lanl  
O(UO2).lanl  
U(UO2).lanl

NEW/REVISED  
in beta1

NEW/REVISED  
in beta0

# CHECKR errors: 195

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- MT= 20\* ALLOWED ONLY IN DERIVED FILES 96
- INTERPOLATION TABLE INCORRECT (MF=5) 67
- MATP IS OBSOLETE 13
- MOD = \* OUT OF RANGE 8
- NK = \* MUST BE EQUAL TO \* AS IN FILE 12 OR 13 7
- ZSYNAM SHOULD BE 2
- EMAX = \*\*\* OUT OF RANGE 1
- AWR SHOULD BE SET TO \*\*\* 1



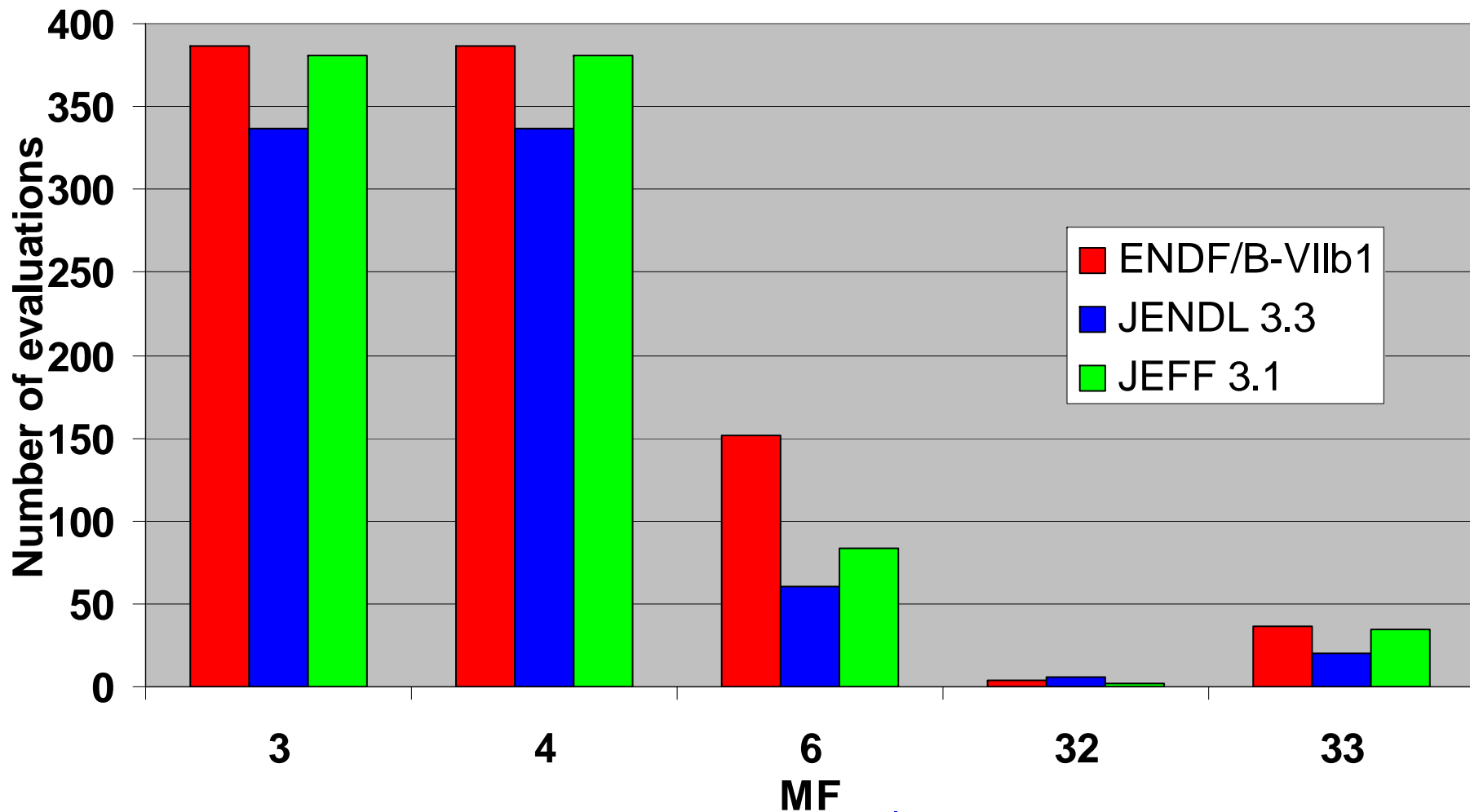
# FIZCON errors: 287

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- THE ENERGY OF HIGHEST LEVEL MUST BE \* 148 (As-74,75)
- SECTION DOES NOT SPAN THE SAME ENERGY RANGE AS FILE \* 24 (As-74,75)
- SUM OF TRANSITION PROBABILITIES= \* 16
- REQUIRED SUB-SUBSECTION WITH LB=8 IS MISSING 15
- FOR LF=1 EPMAX FOUND TO BE \* 11
- CONTENTS OF FILE 12 REQUIRE A SECTION MF=15 11
- NOT EXPECTING LB \* MATRIX IS SYMMETRIC 11
- Q/ELEVEL=\* IS NOT REASONABLE FOR THIS SECTION 9
- THE MAXIMUM INCIDENT ENERGY OF \* SHOULD BE GREATER THAN OR EQUAL TO \* 8
- LIST OUT OF ORDER NEAR N=\* 7
- CONTINUUM REACTION RECOMMENDS LCT 5
- IZAP SHOULD BE SET TO 4
- SECTIONS ARE NOT IN INCREASING LEVEL ENERGY ORDER 3
- NORMALIZATION CHECK INTEGRAL 3
- THE MINIMUM INCIDENT ENERGY OF \* 2
- PKE NOT IN RANGE 2
- THT NOT IN RANGE 2
- NEG OR ZERO ARG OF LOG BELOW POINT \* 1
- ISOTOPE # 2 ENERGY RANGE DIFFERS FROM THE FIRST 1

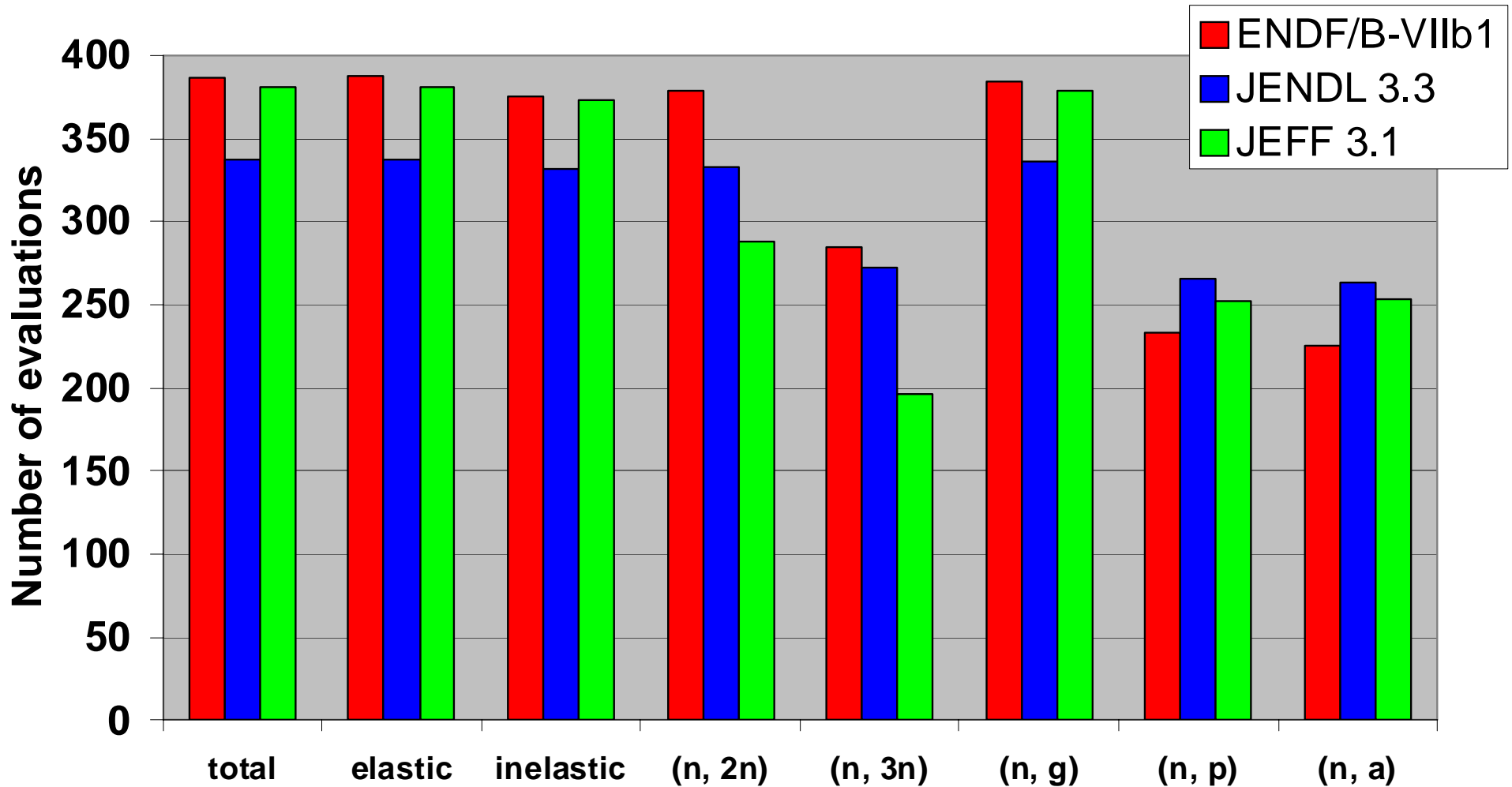
# Statistics (ENDF/B-VIIb1 neutrons)

## Comparison of libraries (MF's)

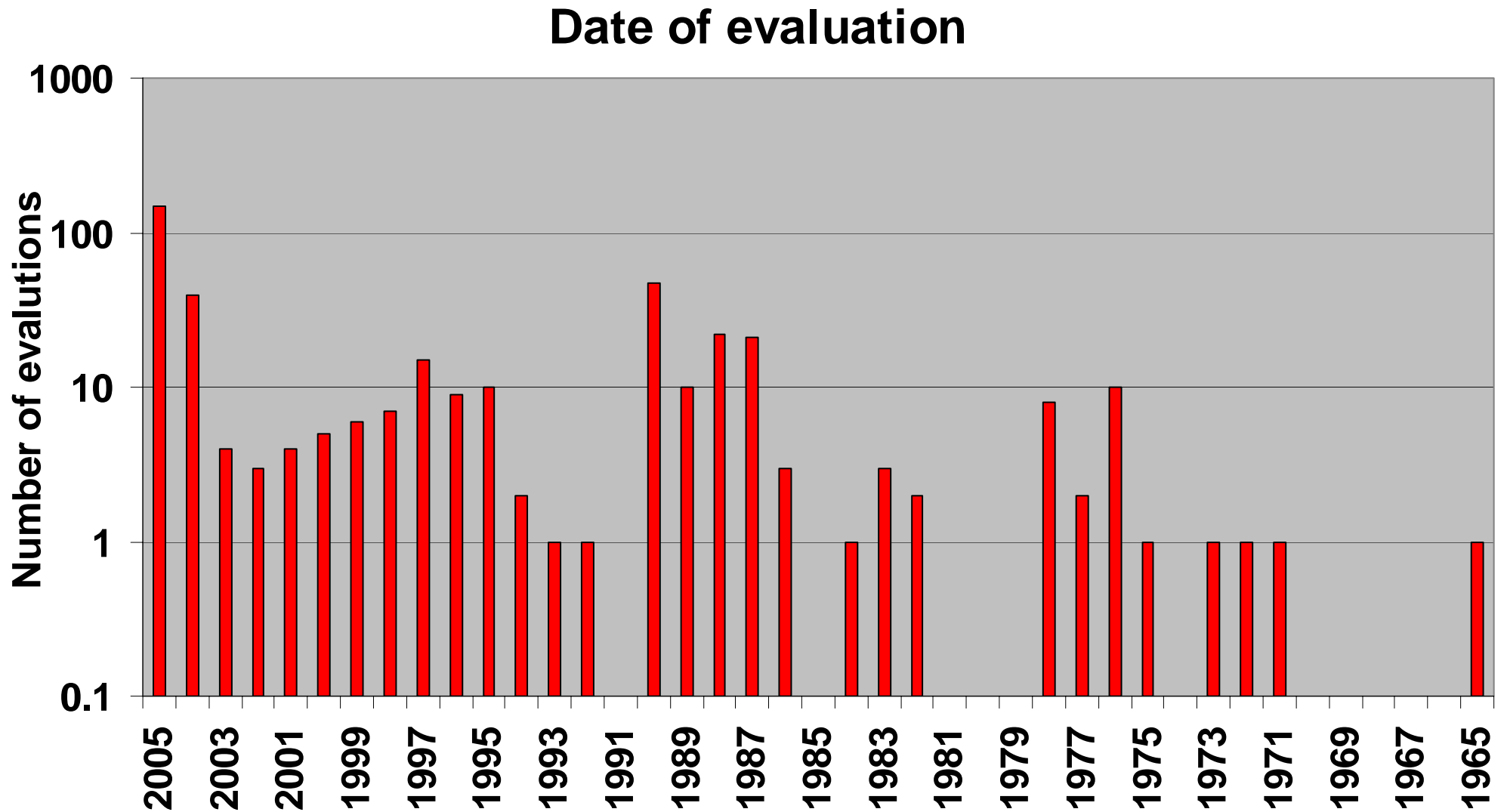


# Statistics (ENDF/B-VIIb1 neutrons)

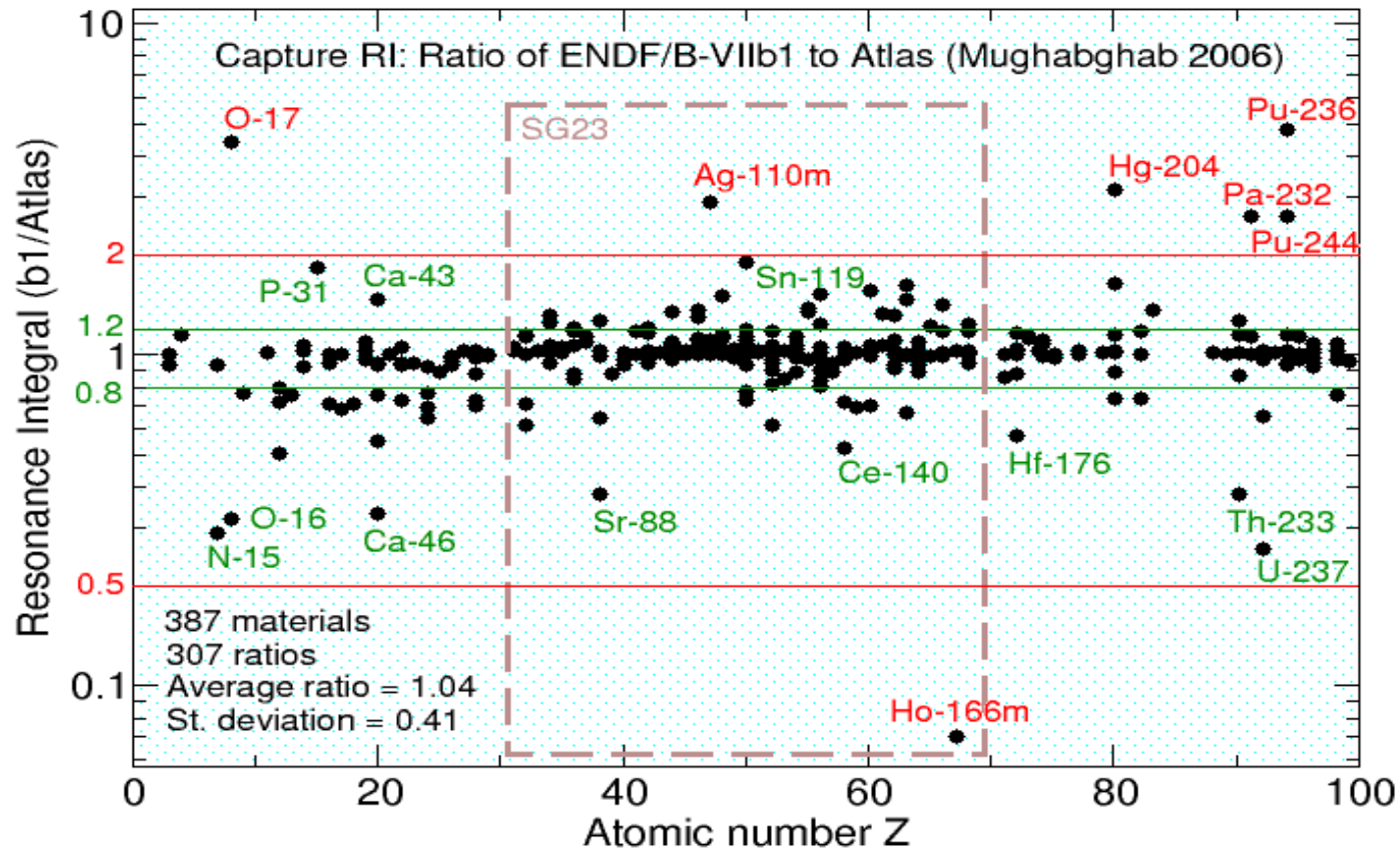
## Comparison of libraries (MT's)



# Statistics (ENDF/B-VIIb1 neutrons)



# Comparison of capture resonance integrals



# Web-interface([www.nndc.bnl.gov/endl7/endl00.htm](http://www.nndc.bnl.gov/endl7/endl00.htm))

Feature rich access to the relational database with most important ENDF libraries.

- complex retrieval requests
- view file structure/contents
- statistics
- comparison plots with other libraries and experimental data (MF=3 only)

The screenshot displays the 'Evaluated Nuclear Data File (ENDF)' web interface. The page header includes the IAEA-NDS logo and the NNDc logo. The main content area features the following text:

- ENDF/B-VIIb1 complete library included**
- ENDF/B-VIIb0 neutron sublibrary included**
- Database Version of October 26, 2005**

A descriptive paragraph states: 'Core nuclear reaction database containing evaluated (recommended) cross sections, spectra, angular distributions, fission product yields, photo-atomic and thermal scattering law data, with emphasis on neutron induced reactions. The data were analyzed by experienced nuclear physicists to produce recommended libraries for one of the national (USA, European, Japanese, Russian and Chinese) nuclear data projects. All data are stored in the internationally adopted format (ENDF-6) maintained by CSEWG.'

The 'Standard Request' section includes a form with the following parameters:

- Target:  Gd-<sup>153</sup>
- Reaction:  n,inel,n,2n
- Product:
- Quantity:

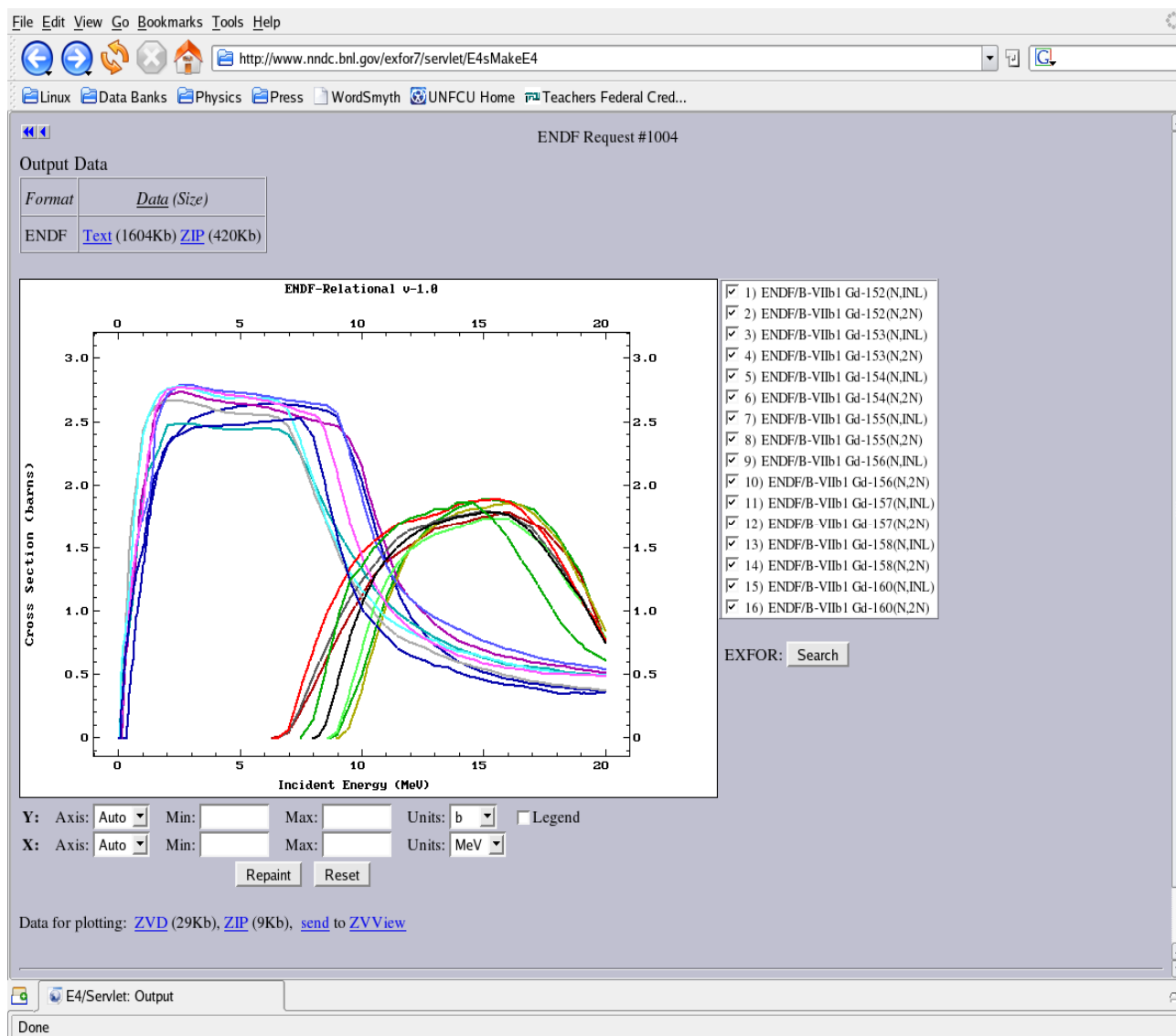
Buttons for 'Submit' and 'Reset' are present. A 'More Options...' link is also available. Below the form are buttons for 'Clone Request', 'EXFOR', and 'CINDA'.

The 'Libraries' section is divided into 'Major' and 'Special Purpose' categories:

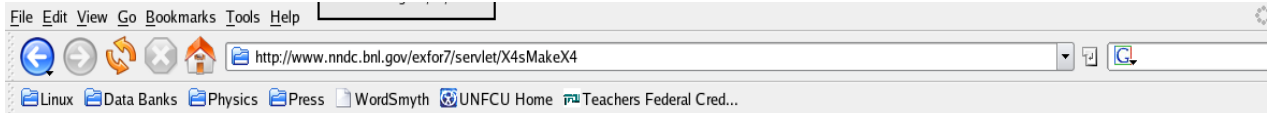
- Major:**  ENDF/B-VIIb1,  ENDF/B-VIIb0,  ENDF/B-VI.8,  JENDL-3.3,  JEFF-3.1,  CENDL-2,  BROND-2.2,  JEF-2.2,  JEFF-3.0
- Special Purpose:**  ENDF/HE-VI (High Energy),  JEFF-3.1/A (Activation),  IRDF-2002 (Dosimetry),  Derived,  ENDF/B-VIIb1 300° K (Pointwise),  ENDF/B-VI.8 300° K (Pointwise),  JENDL-3.3 300° K (Pointwise),  Archival,  IRDF-2002/G (Groupwise)

Buttons for 'Check' and 'Clean' are located above the library list. A 'Feedback' section at the bottom includes a 'Comments/Remarks?' input field.

# Web-interface([www.nndc.bnl.gov/endl7/endl00.htm](http://www.nndc.bnl.gov/endl7/endl00.htm))



# Web-interface([www.nndc.bnl.gov/exfor7/endlf00.htm](http://www.nndc.bnl.gov/exfor7/endlf00.htm))



EXFOR Request #11

Output Data

Format	Data (Size)
EXFOR	<a href="#">Text</a> (363Kb) <a href="#">ZIP</a> (69Kb)
Bibliography	<a href="#">html</a> (64Kb)

ENDF Request #1005  
EXFOR Request: 11/1, 2005-Nov-02 10:05:59

Y: Axis: Auto Min: Max: Units: b Legend Authors  
X: Axis: Auto Min: Max: Units: MeV

Repaint Reset

Data for plotting: [ZVD](#) (765Kb), [ZIP](#) (264Kb), [send to ZVVView](#)

EXFOR Request #13

Output Data

Format	Data (Size)
EXFOR	<a href="#">Text</a> (394Kb) <a href="#">ZIP</a> (70Kb)
Bibliography	<a href="#">html</a> (47Kb)

ENDF Request #1010

Y: Axis: Auto Min: Max: Units: b Legend Authors  
X: Axis: Lin Min: 1.2 Max: 2 Units: MeV

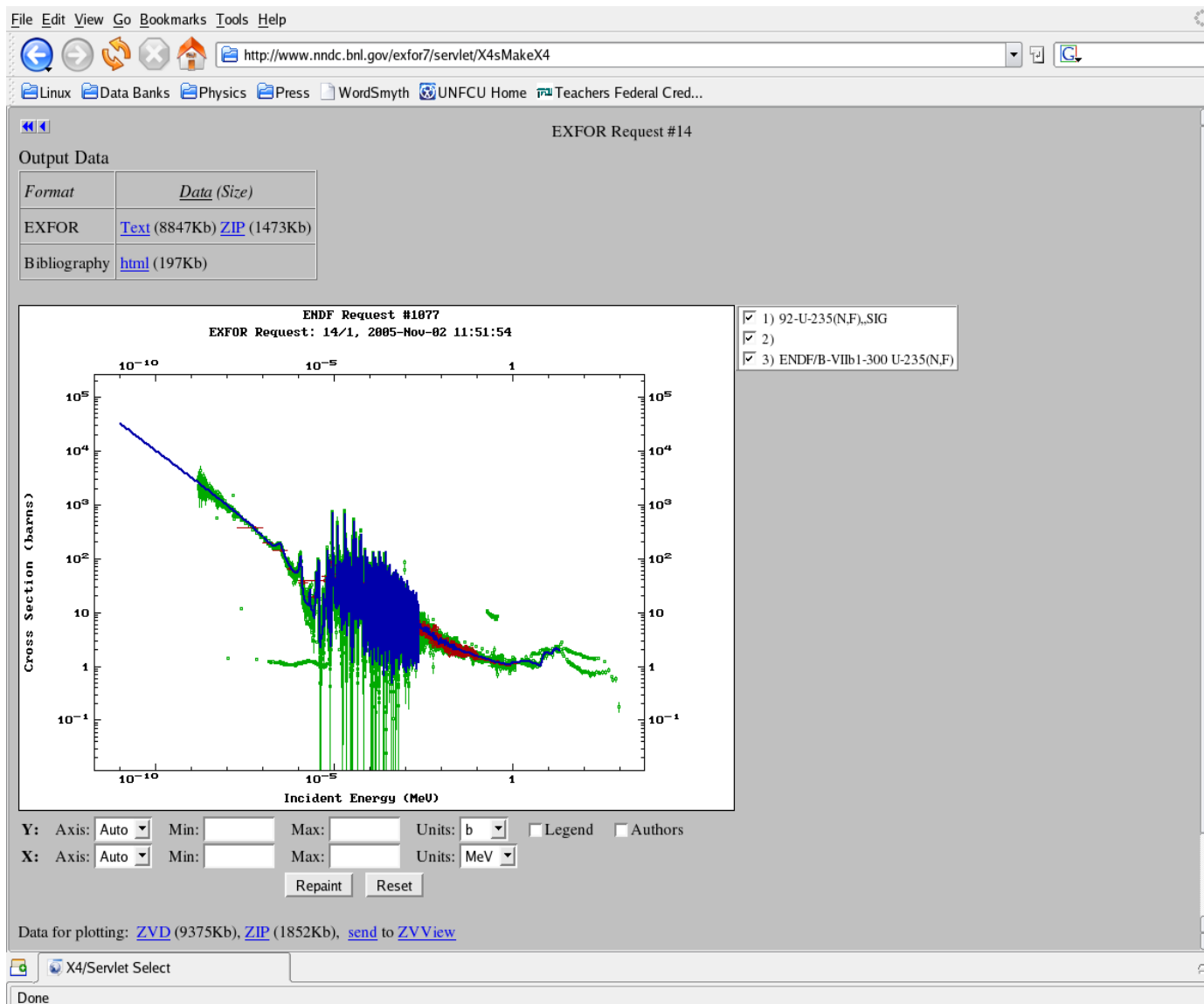
Repaint Reset

Data for plotting: [ZVD](#) (279Kb), [ZIP](#) (47Kb), [send to ZVVView](#)

- 1) 90-TH-232(N,F),SIG
- 2) 90-TH-232(N,F),SIG,AV
- 3) ENDF/B-VIIb1-300 Th-232(N,F)



# Web-interface([www.nndc.bnl.gov/endl7/endl00.htm](http://www.nndc.bnl.gov/endl7/endl00.htm))



# ToDo for ENDF/B-VIIb2

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- Fix format deficiencies
  - general cleaning of CHECKR and FIZCON errors
  - deficiencies reported by data testers (Van der Marck, Sublet, and others...)
  - clean As-74,75 and Am-240 evaluations (LLNL)
- Add missing evaluations
  - include n-Cm247+... revised by R.Q. Wright
  - include available evaluations for materials missing in b1 (Pb-204 from NRG, Na-22, Co-58, Co-58m, Pu-246, Cm-240, Bk-247 from JEFF-3.1, ...)
  - extend and include 4 dosimetry LANL evaluations
- Address covariances
  - include covariances in Gd
  - take all covariances from ENDF/B-VI.8 ???
- Add missing relaxation and electron sublibraries

# Conclusions

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- ENDF/B-VIIb1 is a major update with a number of evaluations adopted from other libraries
- ENDF/B-VIIb1 is **the biggest**
- ENDF/B-VIIb1 is in a reasonable shape
- ENDF/B-VIIb1 is processable with NJOY-99 (with patches) and acer files can be used in MCNP calculations
- Improvements, further testing, and beta2 needed before final release