

ENDF/B-VII Status

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ENDF/B-VII beta0

Neutron sublibrary released March 11, 2005

- 340 neutron evaluations (85 new/revised, 255 from ENDF/B-VI.8)
- revised LA150 files (March 10, 2005)
- revised actinides from LANL (March 9, 2005)
- new delayed-neutron time constants and fractions in actinides
- extensive benchmarking at Petten in March 2005,

www.nndc.bnl.gov/endf7/b0/ - single file

www.nndc.bnl.gov/exfor7/endf00.htm - retrieval

ENDF/B-VII beta0 Retrieval

Evaluated Nuclear Data File (ENDF) - Mozilla

File Edit View Go Bookmarks Tools Window Help

http://www.nndc.bnl.gov/exfor7/endf00.htm

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Evaluated Nuclear Data File (ENDF)

Preliminary ENDF/B-VIIb0 is included

Database Version of March 29, 2005

IAEA-NDS

NNDC

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

Standard Request (example); Go to: Advanced Request

Parameters: Submit Reset Libraries: All Selected Check Clean

Target: * ENDF/B-VIIb0 ENDF/B-VI 300 K
Reaction: * ENDF/B-VI 8 JENDL-3.3 300 K
Product: JENDL-3.3 JEFF-2.2
Quantity: JEFF-3.0 ENDF/HE-VI High Energy
 CENDL-2 BROND-2.2

More Options...

Submit

Clone Request: EXFOR CINDA

Note:

- all criteria are optional (selected by checking)
- selected criteria are combined for search with logical AND
- criteria separated in a field by **;** are combined with logical OR
- wildcards and intervals are available

See also a temperature dependent ENDFB-VI.8 Cross Section Library [Point-2004](#) by D.E. Cullen

Database Manager: Michal Herman, NNDCC, Brookhaven National Laboratory (mwherman@bnl.gov)
Web and Database Programming: Viktor Zerkin, NDS, International Atomic Energy Agency (V.Zerkin@iaea.org)
Data Source: Nuclear Energy Agency International Working Party on Evaluation Cooperation (<http://www.nea.fr/html/science/awpec>) and Cross Section Evaluation Working Group (<http://www.nndc.bnl.gov/csewg>)

Cross Section (channel)

Y: Axis: Auto Min: 1 Max: 20 Units: b Legend
X: Axis: Log Min: 1 Max: 20 Units: MeV

Incident Energy (MeV)

10⁻¹ 10⁻⁸ 10⁻⁶

1 10 100

Legend: JEF-3.0 TC-990, G ENDFB-7.00 Te-990

File Edit View Go Bookmarks Tools Window Help

http://www.nndc.bnl.gov/exfor7/servlet/E4sSearch0?rq=34&rxx=

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Mozilla

Results: Evaluations: 340 Sections: 20258 Output...

ENDF Data Selection

Submit Reset Data Selection: Selected Unselected All Output Formats: ENDF Plot (MF3 only; others under development)

Open all Close all

qe	1) MAT=125	qi	1-H-1	NSUB=10(N)	30MeV	ENDFB-7.00	LANL	G.M.HALE
	MAT=125	MF2	1	@s MT151	H-1(N,RES),RES		Lines:5	
	MAT=125	MF3	2	@s MT1	H-1(N,TOT),SIG		QM=0 QI=0 LR=0	
	MAT=125	MF3	3	@s MT2	H-1(N,EL)H-1-LO,SIG		QM=0 QI=0 LR=0	
	MAT=125	MF3	4	@s MT102	H-1(N,G)H-2,SIG		QM=2.2245e+6 QI=2.2245e+6 LR=0	
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+	2) MAT=128	qi	1-H-2	NSUB=10(N)	150MeV	ENDFB-7.00	LANL	P.G.YOUNG, G.M.HALE, M.B.CHADWICK
+	3) MAT=131	qi	1-H-3	NSUB=10(N)	20MeV	ENDFB-7.00	LANL	LEONA STEWART
+	4) MAT=225	qi	2-He-3	NSUB=10(N)	20MeV	ENDFB-7.00	LANL	G.HALE, D.DODDER, P.YOUNG
+	5) MAT=228	qi	2-He-4	NSUB=10(N)	20MeV	ENDFB-7.00	LANL	NISLEY, HALE, YOUNG
+	6) MAT=325	qi	3-Li-6	NSUB=10(N)	20MeV	ENDFB-7.00	LANL	G.M.HALE, P.G.YOUNG
+	7) MAT=328	qi	3-Li-7	NSUB=10(N)	20MeV	ENDFB-7.00	LANL	P.G.YOUNG
+	8) MAT=419	qi	4-Be-7	NSUB=10(N)	8MeV	ENDFB-7.00	LANL	P.R.PAGE
+	9) MAT=425	qi	4-Be-9	NSUB=10(N)	20MeV	ENDFB-7.00	LNL, LANL	PERKINS, PLECHATY, HOWERTON, FRANKLE
+	10) MAT=525	qi	5-B-10	NSUB=10(N)	20MeV	ENDFB-7.00	LANL	G.M.HALE, P.G.YOUNG
+	11) MAT=528	qi	5-B-11	NSUB=10(N)	20MeV	ENDFB-7.00	LANL	P.G.YOUNG
+	12) MAT=600	qi	6-C-0	NSUB=10(N)	150MeV	ENDFB-7.00	LANL, ORNL	M.B.CHADWICK, P.G.YOUNG, C.Y.FU
+	13) MAT=725	qi	7-N-14	NSUB=10(N)	150MeV	ENDFB-7.00	LANL	M.B.CHADWICK & P.G.YOUNG
+	14) MAT=728	qi	7-N-15	NSUB=10(N)	20MeV	ENDFB-7.00	LANL	E.ARTHUR, P.G.YOUNG, G.HALE
+	15) MAT=825	qi	8-O-16	NSUB=10(N)	30MeV	ENDFB-7.00	LANL	HALE, YOUNG, CHADWICK, CARO, LUBITZ
+	16) MAT=828	qi	8-O-17	NSUB=10(N)	20MeV	ENDFB-7.00	B.N.MAGURNO	
+	17) MAT=925	qi	9-F-19	NSUB=10(N)	20MeV	ENDFB-7.00	CNDC, ORNL	Z.X.ZHAO, C.Y.FU, D.C.LARSON
+	18) MAT=11205	qi	11-Na-23	NSUB=10(N)	20MeV	ENDFB-7.00	ORNL	D.C.LARSON
+	19) MAT=1200	qi	12-Mg-0	NSUB=10(N)	20MeV	ENDFB-7.00	ORNL	D.C.LARSON
+	20) MAT=1225	qi	12-Mg-24	NSUB=10(N)	20MeV	ENDFB-7.00	HEDL, ORNL	MANN, LARSON
+	21) MAT=1325	qi	13-Al-27	NSUB=10(N)	150MeV	ENDFB-7.00	LANL	M.B.CHADWICK & P.G.YOUNG
+	22) MAT=1400	qi	14-Si-0	NSUB=10(N)	20MeV	ENDFB-7.00	ORNL	LARSON, PEREY, DRAKE, YOUNG

Cross Section Evaluation Working Group

NNDC

BROOKHAVEN NATIONAL LABORATORY

ENDF/B-VII: Covariances

Most covariances taken over from ENDF/B-VI (47 materials)

- New covariances for ^{233}U , (ORNL, LANL - criticality safety and AFCI)
- Re isotopes from LANL (MF=33)
- $^{238,235}\text{U}$, ^{232}Th , ^{239}Pu under way
- New covariances expected for 7 isotopes of Gd (ORNL, LANL – criticality safety) Gd dilemma

Gd dilemma

Material	in ENDF/B-VI.8		in SG23	
	Resonances	Fast region	Resonances	Fast region
Gd-152	JENDL-3.2	JENDL-3.2	New eval	JENDL-3.3
Gd-154	JENDL-3.2	JENDL-3.2	New eval	CENDL-3.0
Gd-155	New eval	1977 eval	New eval	New eval
Gd-156	1977 eval	1977 eval	CENDL-3.0	CENDL-3.0
Gd-157	New eval	1977 eval	New eval	New eval
Gd-158	1977 eval	1977 eval	New eval	CENDL-3.0
Gd-160	1977 eval	1977 eval	New eval	CENDL-3.0



New covariances

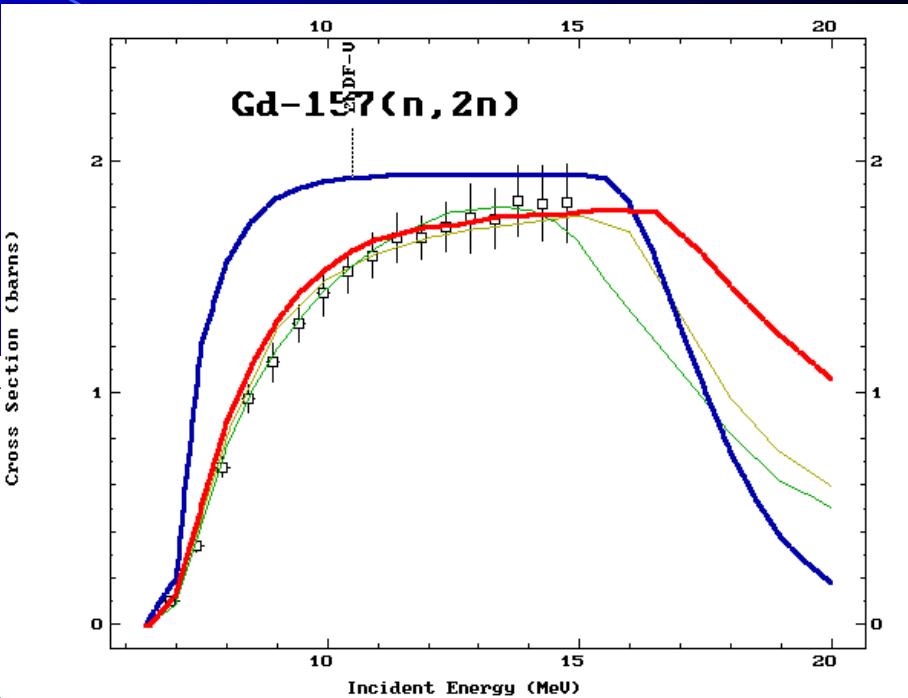
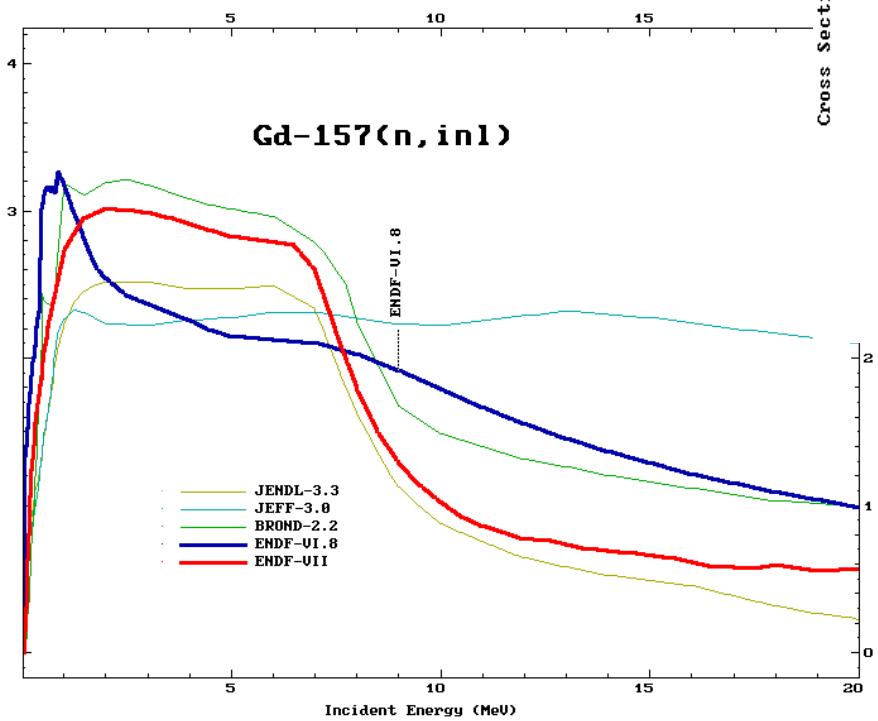
Gd dilemma

ENDF/B-VI.8

Wrong ($n,2n$)



Unphysical inelastic



LANL, ORNL and BNL are working on 155- and 157-Gd

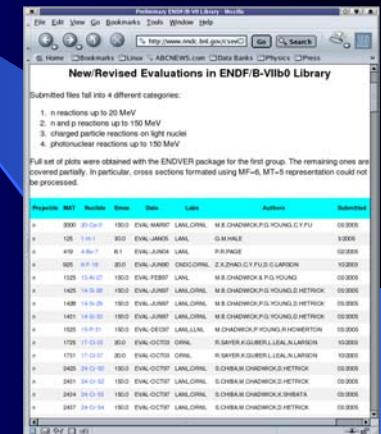
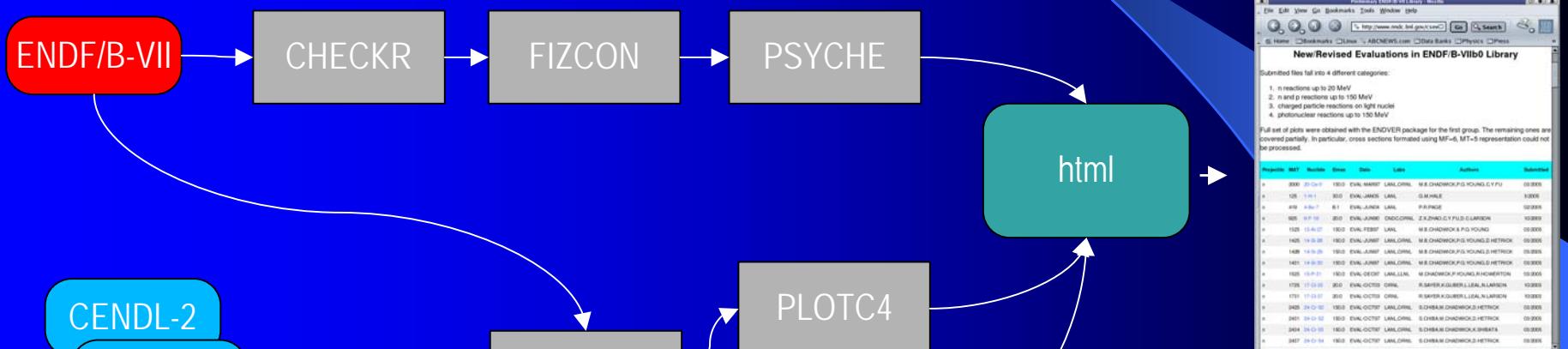
Data Testing

Phase 1: Data verification (NNDC)

Phase 2: Data validation (LANL, ANL,
KAPL, ORNL, Bechtel Bettis)

Data Verification

NNDC: New/revised files processed by checking codes, plotted against other evaluations and experimental data

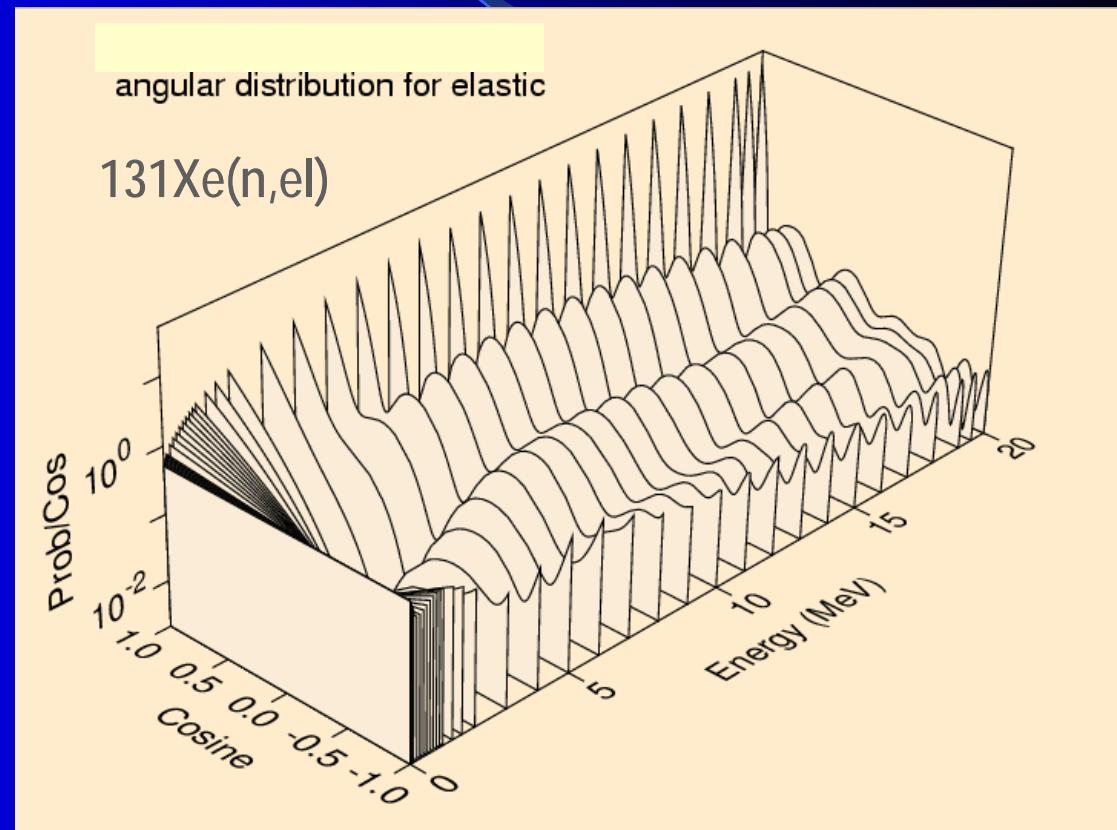


- ✓ check format
- ✓ compare with other libraries
- ✓ compare with experimental data
- ✓ provide easy access

Data Verification

NNDC: New/revised neutron evaluations processed by
NJOY-2003.0 modules:

- moder
- reconr
- broadr
- unresr
- heatr
- purr
- gaspr
- moder
- viewr
- acer
- viewr



acer files are tested in
simple MCNP runs (GODIVA)

Known deficiencies in ENDF/B-VIIb0

Need TLC:

- Cm-243, 245, Am-242, 242m - no fission neutrons produced by NJOY
- Ca-00 - Crashes in HEATR due to invalid interpolation code INT=0

Need replacement:

- Y-89, Ir-191,193, Tm-169 → use dosimetry part from LANL and produce complete evaluations
- Zr-90, 91, 92, 93, 94, 95, 96 → to be replaced by SG23 or JENDL-3.3
- Pa-231, 232, 233 → to be replaced by JENDL-3.3
- Np-237 → to be improved by LANL or replaced by JENDL-3.3
- Cu-63, 65 → ?
- Th-232 → to be replaced by IAEA CRP or Maslov (JEFF-3.1)

Known deficiencies in VIIb0

Known problems in ENDF/B-VI.8 (outside SG23 range):

MAT		MF	MT	Comment
0725	14N		28,32	Gamma production files exist, but there are no cross sections files
2200	Ti	3	104	Nonzero threshold
2425	50Cr	6	16	Residual nucleus incorrect
2437	54Cr	6	16	Residual nucleus incorrect
2525	55Mn	6	22	Residual nucleus incorrect
		6	107	Residual nucleus incorrect
2625	54Fe	6	16	Residual nucleus incorrect
		6	103	Residual nucleus incorrect
2631	56Fe	3	2	NJOY calculates negative cross section
2637	58Fe	6	16	Residual nucleus incorrect
2834	61Ni	3	2	NJOY calculates negative cross section
2837	62Ni	6	22	Residual nucleus incorrect
		6	28	Residual nucleus incorrect

Known deficiencies in VIIb0

Known problems in ENDF/B-VI.8 (outside SG23 range):

MAT		MF	MT	Comment
7125	175Lu	3	2	RESEND calculates negative cross section
7328	181Ta	3	103	Nonzero threshold
9034	230Th	2	151	Fission widths not given.
		2	151	RESEND calculates negative cross section
9137	233Pa	2	151	Fission widths not given.
9434	238Pu	3	2	NJOY calculates negative cross section
9446	242Pu	3	2	RESEND calculates negative cross section
9452	244Pu	1	458	Prompt KE of gammas = 6 eV
9631	242Cm	1	458	Prompt KE of gammas = 6 eV
		3	2	RESEND calculates negative cross section
9637	244Cm	3	2	NJOY and RESEND calculate negative cross section
9643	246Cm	3	2	NJOY calculates negative cross section
9638	248Cm	1	458	Prompt KE of gammas = 6 eV
		3	1	RESEND calculates negative cross section
		3	2	RESEND and NJOY calculate negative cross section
9752	249Bk	5	455	Missing; MF=1,MT=455 present.
9855	250Cf	3	2	RESEND calculates negative cross section
9861	252Cf	3	2	RESEND calculates negative cross section
		6	28	Residual nucleus incorrect

Known deficiencies in VIIb0

Missing (n,Xn) data in ENDF/B-VI.8 (outside SG23 range):

He-3	Ti-46
He-4	Ti-47
Li-6	Ti-48
B-10	Ti-50
C-nat	Ni-59
Mg-24	Np-238
Ar-40	Cf-253
K-41	Es-253

Zr isotopes

Zr-90, 91, 92, 93, 94, 95, 96 in ENDF/B-VI.8 hopelessly obsolete (original files 1976/1977)

- JEFF-3.1 adopted JENDL-3.3
(except 93,95-Zr of European origin)

- JENDL-3.3
 - Evaluation 1989/1990
 - Last review 2000/2001
 - Zr-90 contains covariance data
 - MF=6

SG21 recommendations

- Zr-90 BROND-2
- Zr-91 New-BNL + JENDL-3.3
- Zr-92 New-BNL + BROND-2
- Zr-93 BROND-2 + JENDL-3.
- Zr-94 ENDF/B-VI + JENDL-3.3
- Zr-95 JENDL-3.3
- Zr-96 New-BNL + JENDL-3.3

BROND-2

- Evaluation 1988/1989

Pa isotopes

JENDL-3.3

- Pa-231 – evaluated 1987/1988
- Pa-232 - evaluated 1988/1994
- Pa-233 - evaluated 1987

ENDF/B-VI.8

- Pa-231 – evaluated 1977 ENDF/B-V
- Pa-232 – JENDL-3.2 (1994)
modified/updated in 1999 by R.Q.
Wright (ORNL)
- Pa-233 - evaluated 1978 ENDF/B-V



JEFF-3.1

- Pa-231 - from ENDF/B-V (1977)
- Pa-232 - from ENDF/B-VI.8
- Pa-233 - from ENDF/B-V (1977)

Np-237

ENDF/B-VI.8

- Evaluation 1990 (Young et al.)
- RRR Derrien evaluation up to 150 eV
- Advanced modeling of fast neutron region (CC, DWBA, MF=6)

JENDL-3.3

- Evaluation 2001 (T.Nakagawa, O.Iwamoto)
- Fast neutron region draws from Ignatyuk and ENDF/B-VI
- MLBW formula below 500 eV
- URR up to 35 keV



JEFF-3.1

- adopted JENDL-3.3

Th-232

ENDF/B-VI.8

- Evaluation 1977
- Includes MF=31,33 (fission & capture)

JENDL-3.3

- Evaluation 1987/2001

JEFF-3.1

- adopted Maslov 2001

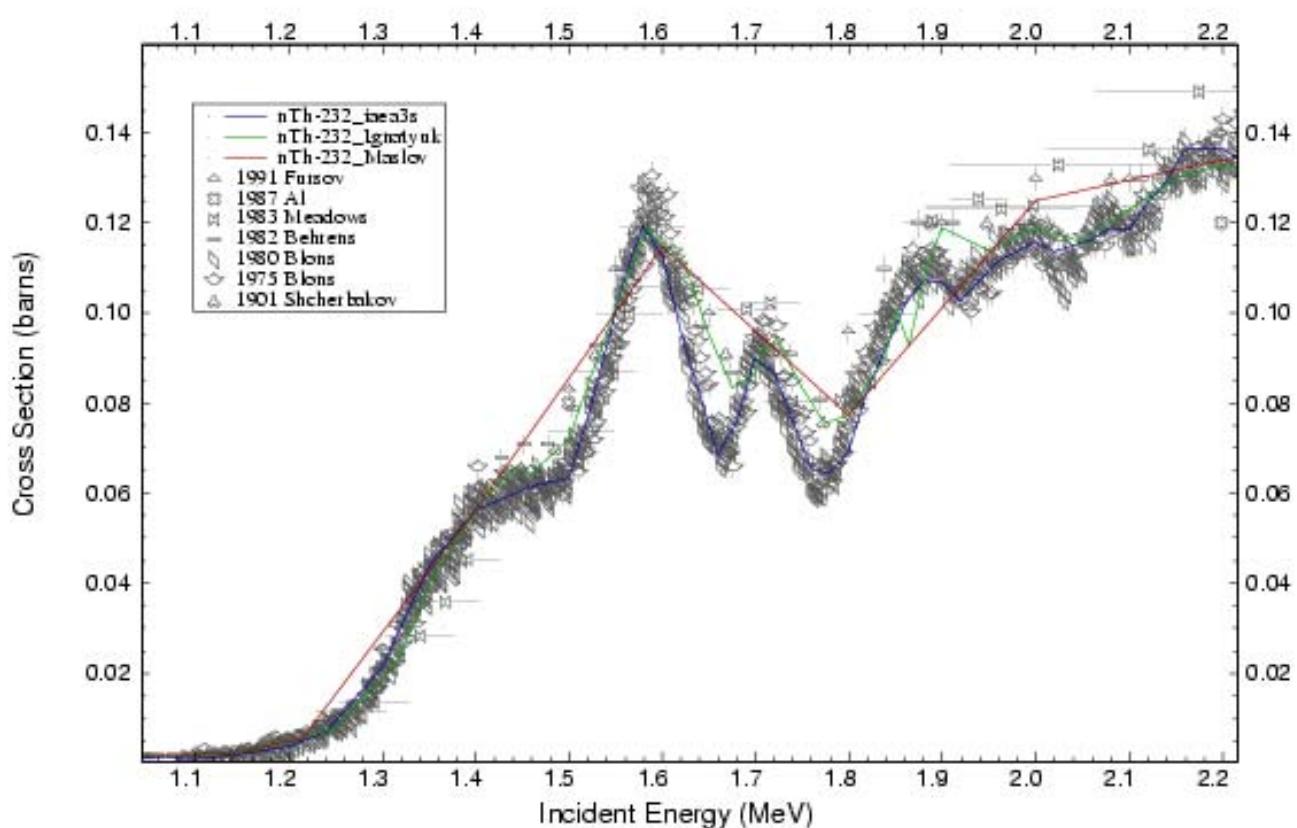
IAEA-CRP

- Evaluation 2005
- RR new evaluation from ORNL (preliminary available)
- Fast neutron region by EMPIRE
- Fission neutrons to be taken from Maslov
- Up to 150 MeV

Th-232(n,f)

11-Jul-2005 23:20

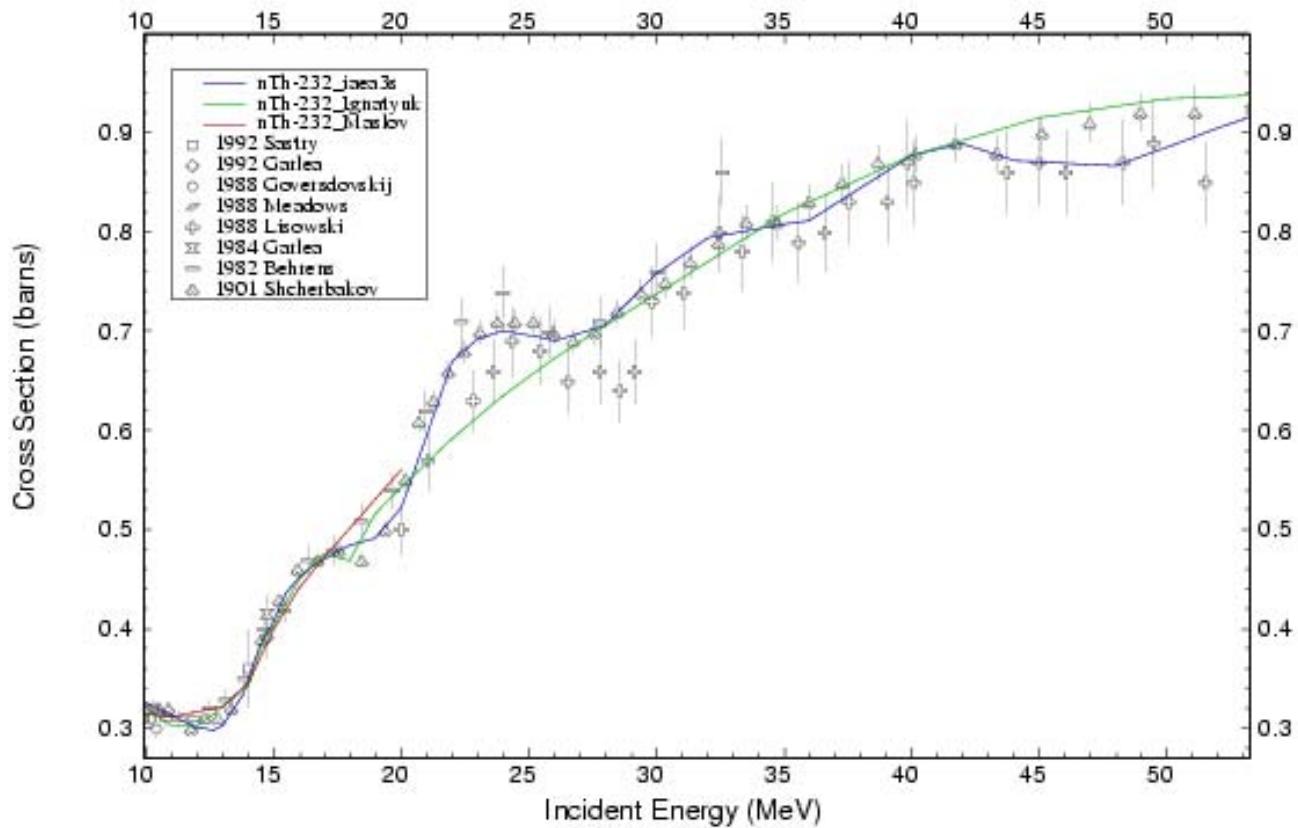
90-Th-232(N,F), SIG P 1 Out 1



Th-232(n,f)

11-Jul-2005 22:32

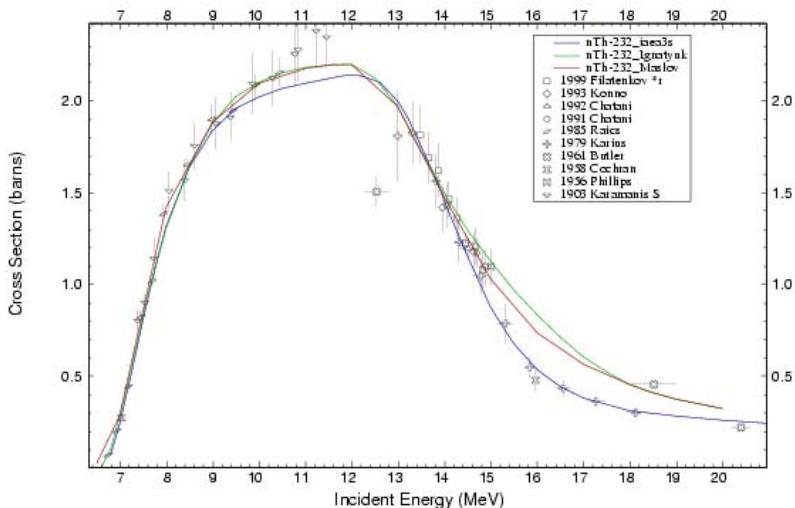
90-Th-232(N,F),SIG P 1 Out 1



Th-232(n,2n)

11 Jul 2008 22:26

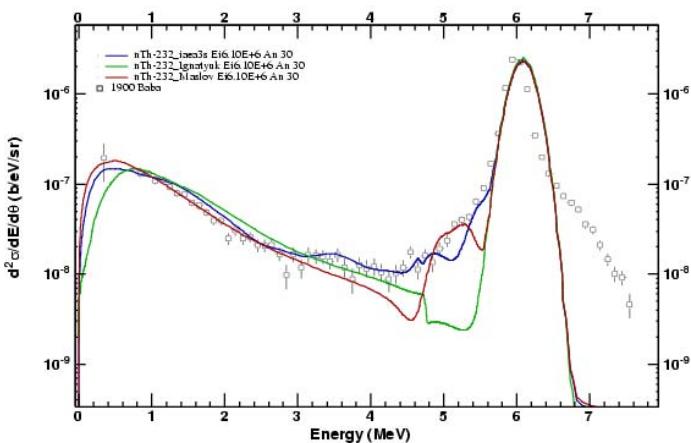
90-Th-232(N,2N),SIG P 1 Out 1



Th-232(n,Xn) neutron spectrum

12 Jul 2008 00:23

90-Th-232(N,X),DAE Ei6.10E+6 An 30 P 1



Current Activities at BNL

- All new ENDF/B-VII evaluations ‘cleaned up’ by Charlie Dunford
- Atlas of neutron resonances in a print phase (S. Mughabghab)
- Update of BNL/KAERI evaluations (inelastic scattering, capture photon production; EMPIRE-2.19)
- SG23 did a very good progress and might provide bulk of fission products (164 files so far)
- Covariance data for 155,157-Gd (with ORNL & LANL)
- 25 fission products being evaluated with EMPIRE-2.19 (SG23)
- Evaluations for 5 Ge isotopes by BNL-JAERI revised (RR and URR adjusted)

ENDF/B-VII schedule

- End of September 2005 – ENDF/B-VIIBeta1
- Nov 8-10, 2005 – CSEWG Meeting, BNL, Review
- December 2005 - Release

ENDF discussion forum

The Endf Archives

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March 2005:	[Thread] [Subject] [Author] [Date]	[Gzip'd Text 9 KB]
January 2005:	[Thread] [Subject] [Author] [Date]	[Gzip'd Text 17 KB]
December 2004:	[Thread] [Subject] [Author] [Date]	[Gzip'd Text 71 KB]
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July 2005 Archives by thread

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Starting: *Sat Jul 2 01:04:15 EDT 2005*

Ending: *Wed Jul 6 17:32:44 EDT 2005*

Messages: 6

- ♦ [\[Endf-list\] Standards: Covariances](#) *Mark B. Chadwick*
 - ◊ [\[Endf-list\] Your attendance at CSEWG meeting, July 13](#) *Oblozinsky, Pavel*
 - ◊ [\[Endf-list\] Agenda for CSEWG meeting, July 13, 2005](#) *Oblozinsky, Pavel*
 - ◊ [\[Endf-list\] Agenda for CSEWG meeting again](#) *Oblozinsky, Pavel*
- ♦ [\[Endf-list\] Setting MATP in MF 8 files](#) *David Brown*
- ♦ [\[Endf-list\] CSEWG Meeting Agenda July 13, 2005](#) *Dunn, Michael E.*

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