
The ENDF libraries

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What are the ENDF libraries?

The **ENDF** (Evaluated Nuclear Data File) libraries are a collection of documented data evaluations stored in a defined computer-readable format that can be used as the main input to nuclear data processing programs.

- There are ENDF libraries for different incident particles (neutrons, protons, alpha, gamma, ...).
- There are different libraries: ENDF (USA), JEFF (EU), JENDL (Japan), BROND/ROSFOND (Russia), CENDL (China), ...

The manual can be found in:

http://www.nndc.bnl.gov/csewg_members/ENDF-102/BNL-90365-2009.pdf

What are the ENDF libraries?

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                                1 0 0
2.605600+4 5.545400+1          1      0      0      42631 1451  1
0.000000+0 0.000000+0          0      0      0      62631 1451  2
1.000000+0 1.500000+8          8      0     10      72631 1451  3
0.000000+0 0.000000+0          0      0     370     1282631 1451  4
26-Fe- 56 LANL,ORNL  EVAL-SEP96 M.B.Chadwick,P.G.Young,C.Y.Fu  2631 1451  5
CH99,FU86,Fu91      DIST-DEC06 REV3-                20011108  2631 1451  6
----ENDF/B-VII      MATERIAL 2631          REVISION 3      2631 1451  7
-----INCIDENT NEUTRON DATA                        2631 1451  8
-----ENDF-6 FORMAT                                  2631 1451  9
*****
Oct 22,2004, Holly Trelue remade mf6mt5 using corrected gnash  2631 1451 11
code, to fix an earlier bug. Impact is reduced sec. particle prod.2631 1451 12
for new ENDF/B-VII release except for the He4 production xs,  2631 1451 13
whose factors were increased in 8/06 to match Haight exp. data 2631 1451 14
*****
*****
ENDF/B-VI MOD 4 Revision, May 2000, S.C. Frankle, R.C. Reedy,  2631 1451 17
      P.G. Young (LANL)                                     2631 1451 18
The secondary gamma-ray spectrum for radiative capture (MF 12,  2631 1451 19
MT 102) has been updated for new experimental data at incident 2631 1451 20
neutron energies up to 1 keV.                               2631 1451 21
The MF=12, MT=102 yields above 1 keV were adjusted slightly to 2631 1451 22
force energy conservation.                                  2631 1451 23
The Q-value for radiative capture was also updated in File 3.  2631 1451 24
Details of these changes are described in Frankel et al. [Fr01]. 2631 1451 25
*****
*****
ENDF/B-VI MOD 3 Evaluation, September 1996, M.B. Chadwick,    2631 1451 29
      P.G. Young (LANL) and A.J. Koning (ECN)              2631 1451 30
*****
*****
Los Alamos LA150 Library, produced with FKK/GNASH/GSCAN code  2631 1451 32
in cooperation with ECN Petten.                               2631 1451 33
*****
*****
This evaluation provides a complete representation of the      2631 1451 35
nuclear data needed for transport, damage, heating,           2631 1451 36

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What are the ENDF libraries?

		14	70	1	12631	1451	495
		14	71	1	12631	1451	496
		14	72	1	12631	1451	497
		14	73	1	12631	1451	498
		14	74	1	12631	1451	499
		14	75	1	12631	1451	500
		14	102	1	42631	1451	501
		15	102	618	12631	1451	502
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0.000000+0	0.000000+0	0	0	0	02631	0	0
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2.605600+4	1.000000+0	0	0	1	02631	2151	2
1.000000-5	8.500000+5	1	3	0	12631	2151	3
0.000000+0	5.437300-1	1	0	4	42631	2151	4
5.545400+1	5.437300-1	0	0	240	402631	2151	5
-4.733600+5	5.000000-1	3.084600+5	1.000000+0	0.000000+0	0.000000+02631	2151	6
-2.421300+4	5.000000-1	2.707100+3	1.000000+0	0.000000+0	0.000000+02631	2151	7
-2.438100+3	5.000000-1	1.933400+2	8.600000-1	0.000000+0	0.000000+02631	2151	8
2.779100+4	5.000000-1	1.409300+3	8.600000-1	0.000000+0	0.000000+02631	2151	9
7.402900+4	5.000000-1	6.114601+2	5.900000-1	0.000000+0	0.000000+02631	2151	10
8.362800+4	5.000000-1	1.215100+3	5.400000-1	0.000000+0	0.000000+02631	2151	11
1.298600+5	5.000000-1	5.878200+2	5.700000-1	0.000000+0	0.000000+02631	2151	12
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1.692800+5	5.000000-1	9.618901+2	1.000000+0	0.000000+0	0.000000+02631	2151	14
1.877400+5	5.000000-1	3.620200+3	1.020000+0	0.000000+0	0.000000+02631	2151	15
2.205900+5	5.000000-1	1.266800+3	1.680000+0	0.000000+0	0.000000+02631	2151	16
2.449900+5	5.000000-1	4.870000+2	6.000000-1	0.000000+0	0.000000+02631	2151	17
2.772100+5	5.000000-1	3.649500+3	8.000000-1	0.000000+0	0.000000+02631	2151	18
3.179100+5	5.000000-1	7.118300+3	9.200000-1	0.000000+0	0.000000+02631	2151	19
3.314500+5	5.000000-1	3.275700+2	6.000000+0	0.000000+0	0.000000+02631	2151	20
3.572600+5	5.000000-1	2.205100+3	9.200000-1	0.000000+0	0.000000+02631	2151	21
3.610800+5	5.000000-1	7.775300+3	9.200000-1	0.000000+0	0.000000+02631	2151	22
3.813600+5	5.000000-1	1.232600+4	9.200000-1	0.000000+0	0.000000+02631	2151	23
4.054100+5	5.000000-1	2.328600+3	9.200000-1	0.000000+0	0.000000+02631	2151	24
4.383000+5	5.000000-1	1.918400+3	9.200000-1	0.000000+0	0.000000+02631	2151	25
4.699300+5	5.000000-1	2.566100+3	9.200000-1	0.000000+0	0.000000+02631	2151	26
5.001900+5	5.000000-1	1.726300+3	9.200000-1	0.000000+0	0.000000+02631	2151	27
5.359200+5	5.000000-1	2.555000+2	9.200000-1	0.000000+0	0.000000+02631	2151	28

What are the ENDF libraries?

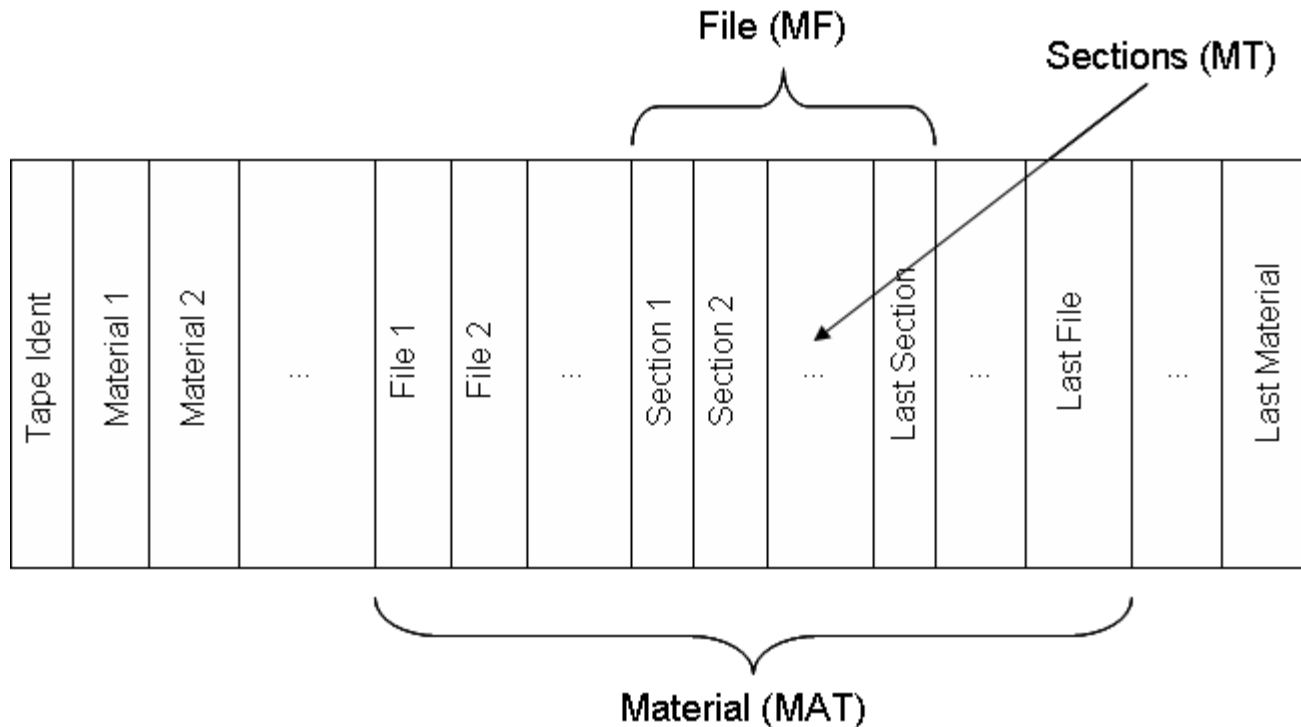
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1.000000-5 0.000000+0 2.000000+7 0.000000+0 2.000001+7 3.208968-22631 6 510279
2.200000+7 4.083675-2 2.400000+7 4.696705-2 2.600000+7 5.015761-22631 6 510280
2.800000+7 5.043279-2 3.000000+7 4.610382-2 3.500000+7 2.857725-22631 6 510281
4.000000+7 1.953135-2 4.500000+7 1.616496-2 5.000000+7 1.839713-22631 6 510282
5.500000+7 3.454090-2 6.000000+7 6.027525-2 6.500000+7 8.724458-22631 6 510283
7.000000+7 1.085188-1 7.500000+7 1.107652-1 8.000000+7 1.060321-12631 6 510284
8.500000+7 9.761193-2 9.000000+7 8.845374-2 9.500000+7 8.099737-22631 6 510285
1.000000+8 7.708133-2 1.100000+8 6.912763-2 1.200000+8 6.376613-22631 6 510286
1.300000+8 5.904952-2 1.400000+8 5.577288-2 1.500000+8 5.395038-22631 6 510287
0.000000+0 0.000000+0 1 1 1 272631 6 510288
27 2 2631 6 510289
0.000000+0 1.000000-5 0 0 4 22631 6 510290
0.000000+0 1.000000+5 1.000000-5 0.000000+0 2631 6 510291
0.000000+0 2.000000+7 0 0 4 22631 6 510292
0.000000+0 1.000000+5 1.000000-5 0.000000+0 2631 6 510293
0.000000+0 2.000001+7 0 0 22 112631 6 510294
0.000000+0 1.843560-7 2.331436+5 1.995193-7 4.662871+5 5.120426-72631 6 510295
6.994307+5 1.246252-6 9.325743+5 1.324884-6 1.165718+6 5.173375-72631 6 510296
1.398861+6 1.763195-7 1.632005+6 1.036913-7 1.865149+6 2.325480-82631 6 510297
2.098292+6 1.545878-9 2.331436+6 0.000000+0 2631 6 510298
0.000000+0 2.200000+7 0 0 22 112631 6 510299
0.000000+0 1.885768-7 2.652840+5 2.247217-7 5.305680+5 6.649640-72631 6 510300
7.958519+5 1.200727-6 1.061136+6 9.459430-7 1.326420+6 3.134959-72631 6 510301
1.591704+6 1.570108-7 1.856988+6 6.421205-8 2.122272+6 9.516448-92631 6 510302
2.387556+6 3.78137-10 2.652840+6 0.000000+0 2631 6 510303
0.000000+0 2.400000+7 0 0 22 112631 6 510304
0.000000+0 2.016663-7 2.968104+5 2.590916-7 5.936207+5 7.462951-72631 6 510305
8.904311+5 1.088944-6 1.187241+6 6.552582-7 1.484052+6 2.502502-72631 6 510306
1.780862+6 1.276358-7 2.077673+6 3.644585-8 2.374483+6 3.496303-92631 6 510307
2.671293+6 7.12175-11 2.968104+6 0.000000+0 2631 6 510308
0.000000+0 2.600000+7 0 0 22 112631 6 510309
0.000000+0 2.121899-7 3.278598+5 2.917999-7 6.557196+5 7.857665-72631 6 510310
9.835793+5 9.574601-7 1.311439+6 4.815124-7 1.639299+6 2.103729-72631 6 510311
1.967159+6 9.228058-8 2.295018+6 1.753553-8 2.622878+6 1.151816-92631 6 510312
2.950738+6 1.48089-11 3.278598+6 0.000000+0 2631 6 510313
0.000000+0 2.800000+7 0 0 22 112631 6 510314
0.000000+0 2.229291-7 3.584097+5 3.196348-7 7.168194+5 8.081601-72631 6 510315

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Structure of an ENDF tape

- Each material (MAT) is divided into several “files” (MF).
- Each “file” (MF) contains information of a specific type: cross section (MF=2,3), angular distributions (MF=4), energy distributions (MF=5), ...
- Each “file” is divided into “sections” (MT). Each MT is a specific reaction type: elastic (MT=2), fission (MT=18), capture (MT=102), ...



The MF files

- File 1: General information, some fission information (number of neutrons per fission, delayed neutron data, number of prompt neutrons per fission, fission energy release).
- File 2: Resonance parameters.
- File 3: Pointwise cross sections.
- File 4: Angular distribution of secondary particles.
- File 5: Energy distribution of secondary particles.
- File 6: Product energy-angle distributions.
- *File 7: Thermal neutron scattering law data.*
- *File 8: Radioactive decay and fission product yield data.*
- *File 9: Multiplicities for production of radioactive nuclides.*
- *File 10: Cross sections for production of radioactive nuclides.*
- *File 11: General comments for photon production.*
- File 12: Photon production multiplicities and transition probability arrays.
- File 13: photon production cross sections.
- File 14: photon angular distributions.
- File 15: continuous photon energy spectra.
- ...

The MF files

Table 4: Definitions of File Types (MF)

MF	Description
1	General information
2	Resonance parameter data
3	Reaction cross sections
4	Angular distributions for emitted particles
5	Energy distributions for emitted particles
6	Energy-angle distributions for emitted particles
7	Thermal neutron scattering law data
8	Radioactivity and fission-product yield data
9	Multiplicities for radioactive nuclide production
10	Cross sections for radioactive nuclide production
12	Multiplicities for photon production
13	Cross sections for photon production
14	Angular distributions for photon production
15	Energy distributions for photon production
23	Photo- or electro-atomic interaction cross sections
26	Electro-atomic angle and energy distribution
27	Atomic form factors or scattering functions for photo-atomic interactions
28	Atomic relaxation data
30	Data covariances obtained from parameter covariances and sensitivities
31	Data covariances for nu(bar)
32	Data covariances for resonance parameters
33	Data covariances for reaction cross sections
34	Data covariances for angular distributions
35	Data covariances for energy distributions
39	Data covariances for radionuclide production yields
40	Data covariances for radionuclide production cross sections

The MT reactions

MT		Description	Comments
1	(n,total)	Neutron total cross sections. Sum of MT=2, 4, 5, 11, 16-18, 22-26, 28-37, 41-42, , 44-45, 102-117.	Redundant. Undefined for incident charged particles.
2	(z,z ₀)	Elastic scattering cross section for incident particles.	
3	(z,nonelastic)	Nonelastic neutron cross section. Sum of MT=4, 5, 11, 16-18, 22-26, 28-37, 41-42, , 44-45, 102-117.	Redundant. For photon production only.
4	(z,n)	Production of one neutron in the exit channel. Sum of the MT=50-91.	Redundant. For incident neutrons, this is inelastic scattering (MT=50 is undefined).
5	(z,anything)	Sum of all reactions not given explicitly in another MT number. This is a partial reaction to be added to obtain MT=1.	Each particle can be identified and its multiplicity given in File 6. Not allowed in Files 4, 5.
6-9		Not allowed in version 6.	⁹ Be(n,2n) in version 5.
10	(z,continuum)	Total continuum reaction; includes all continuum reactions and excludes all discrete reactions.	Redundant; to be used for derived files only.
11	(z,2nd)	Production of two neutrons and a deuteron, plus a residual.	
12-15		Unassigned.	
16	(z,2n)	Production of two neutrons and a residual ¹ . Sum of MT=875-891, if they are present.	
17	(z,3n)		
18	(z,fission)		
19	(n,f)		
20	(n,nf)	Second-chance fission ² .	
21	(n,2nf)	Third-chance fission ³ .	
22	(z,n α)	Production of a neutron and an alpha particle, plus a residual.	
23	(n,n3 α)	Production of a neutron and three alpha particles, plus a residual.	
24	(z,2n α)	Production of two neutrons and an alpha particle, plus a residual.	

MT		Description	Comments
25	(z,3n α)	Production of three neutrons and an alpha particle, plus a residual.	
26		Not allowed in version 6.	Version 5: (n,2n) isomeric state; used in file 8 and 6, 9, or 10.
27	(n,abs)	Absorption; sum of MT=18 and MT=102 through MT=117	Rarely used.
28	(z,np)	Production of a neutron and a proton, plus a residual.	
29	(z,n2 α)	Production of a neutron and two alpha particles, plus a residual.	
30	(z,2n2 α)	Production of two neutrons and two alpha particles, plus a residual.	
31		Not allowed for version 6.	Used only as an LR flag.
32	(z,nd)	Production of a neutron and a deuteron, plus a residual.	
33	(z,nt)	Production of a neutron and a triton, plus a residual.	
34	(z,n ⁴ He)	Production of a neutron and a ⁴ He particle, plus a residual.	
35	(z,nd2 α)	Production of a neutron, a deuteron, and 2 alpha particles, plus a residual.	
36	(z,nt2 α)	Production of a neutron, a triton, and 2 alpha particles, plus a residual.	
37	(z,4n)	Production of 4 neutrons, plus a residual.	
38	(n,3nf)	Fourth-chance fission cross section ² .	
39		Not allowed for version 6.	Used only as an LR flag.
40		Not allowed for version 6.	Used only as an LR flag.
41	(z,2np)	Production of 2 neutrons and a proton, plus a residual.	
42	(z,3np)	Production of 3 neutrons and a proton, plus a residual.	
43		(Unassigned)	
44	(z,n2p)	Production of a neutron and 2 protons, plus a residual.	
45	(z,np α)	Production of a neutron, a proton, and an alpha particle, plus a residual.	
46-49		Not allowed in Version 6.	Version 5: description of 2 nd neutron from ⁹ Be(n,2n) reactions to excited states.
50	(y,n ₀)	Production of a neutron, leaving the residual nucleus in the ground state.	Not allowed for incident neutrons, use MT=2.

The MT reactions

MT		Description	Comments
51	(z,n1)	Production of a neutron, with residual in the 1st excited state.	
52	(z,n2)	Production of a neutron, with residual in the 2nd excited state.	
	...		
	...		
90	(z,n40)	Production of a neutron, with residual in the 40th excited state.	
91	(z,n _c)	Production of a neutron in the continuum not included in the above discrete representation.	
92-100		(Unassigned)	
101	(n,disap)	Neutron disappearance; equal to sum of MT=102-117.	Rarely used.
102	(z,γ)	Radiative capture.	
103	(z,p)	Production of a proton, plus a residual. Sum of MT=600-649, if they are present.	For incident protons, this is inelastic scattering (MT=600 is undefined).
104	(z,d)	Production of a deuteron, plus a residual. Sum of MT=650-699, if they are present.	For incident deuterons, this is inelastic scattering (MT=650 is undefined).
105	(z,t)	Production of a triton, plus a residual. Sum of MT=700-749, if they are present.	For incident tritons, this is inelastic scattering (MT=700 is undefined).
106	(z, ⁴ He)	Production of a ⁴ He particle plus a residual. Sum of MT=750-799, if they are present.	For incident ³ He particles, this is inelastic scattering (MT=750 is undefined).
107	(z,α)	Production of an alpha particle, plus a residual. Sum of MT=800-849, if they are present.	For incident alpha particles, this is inelastic scattering (MT=800 is undefined).
108	(z,2α)	Production of 2 alpha particles, plus a residual.	
109	(z,3α)	Production of 3 alpha particles, plus a residual.	
110		(Unassigned)	
111	(z,2p)	Production of 2 protons, plus a residual.	
112	(z,pα)	Production a proton and an alpha particle, plus a residual.	
113	(z,t2α)	Production of a triton and 2 alpha particles, plus a residual.	
114	(z,d2α)	Production of a deuteron and 2 alpha particles, plus a residual.	

MT		Description	Comments
115	(z,pd)	Production of proton and a deuteron, plus a residual.	
116	(z,pt)	Production of proton and a triton, plus a residual.	
117	(z,dα)	Production of deuteron and an alpha particle, plus a residual.	
118-119		(Unassigned)	
120		Not allowed for version 6.	Version 5: target destruction - nonelastic minus total (n,n'γ)
121-150		(Unassigned)	
151	(n,RES)	Resonance parameters that can be used to calculate cross sections at different temperatures in the resolved and unresolved energy regions.	Incident neutrons only.
152-200		(Unassigned)	
201	(z,Xn)	Total neutron production.	Redundant; use in derived files only.
202	(z,Xγ)	Total gamma production.	Redundant; use in derived files only.
203	(z,Xp)	Total proton production.	Redundant; use in derived files only.
204	(z,Xd)	Total deuteron production.	Redundant; use in derived files only.
205	(z,Xt)	Total triton production.	Redundant; use in derived files only.
206	(z,X ³ He)	Total ³ He production.	Redundant; use in derived files only.
207	(z,Xα)	Total alpha particle production.	Redundant; use in derived files only.
208	(z,Xπ ⁺)	Total π ⁺ production.	For use in high-energy evaluations.
209	(z,Xπ ⁰)	Total π ⁰ production.	For use in high-energy evaluations.
210	(z,Xπ ⁻)	Total π ⁻ production.	For use in high-energy evaluations.
211	(z,Xμ ⁺)	Total μ ⁺ production.	For use in high-energy evaluations.
212	(z,Xμ ⁻)	Total μ ⁻ production.	For use in high-energy evaluations.
213	(z,Xκ ⁺)	Total κ ⁺ production.	For use in high-energy evaluations.
214	(z,Xκ ^u _(long))	Total κ ^u _(long) production.	For use in high-energy evaluations.

The MT reactions

MT		Description	Comments
215	(z,X ⁰ κ ^(short))	Total κ ^(short) production.	For use in high-energy evaluations.
216	(z,Xκ)	Total κ' production.	For use in high-energy evaluations.
217	(z,Xp)	Total anti-proton production.	For use in high-energy evaluations.
218	(z,Xn)	Total anti-neutron production.	For use in high-energy evaluations.
219-250		(Unassigned)	
251	(n,...)	$\bar{\mu}_l$, average cosine of the scattering angle (laboratory system) for elastic scattering of neutrons.	Derived files only.
252	(n,...)	ξ , average logarithmic energy decrement for elastic scattering of neutrons.	Derived files only.
253	(n,...)	γ , average of the square of the logarithmic energy decrement divided by twice the average logarithmic energy decrement, for elastic scattering of neutrons.	Derived files only.
254-300		(Unassigned)	
301-450	(z,...)	Energy release parameters, \bar{E} , $\bar{\sigma}$, for total and partial cross sections; MT=300 plus the reaction MT number, e.g., MT=302 is the elastic scattering kerma.	Derived files only.
451	(z,...)	Heading or title information; given in File 1 only.	
452	(z,...)	$\bar{\nu}_r$, average total (prompt plus delayed) number of neutrons released per fission event.	
453		(Unassigned)	
454	(z,...)	Independent fission product yield data.	
455	(z,...)	$\bar{\nu}_d$, average number of delayed neutrons released per fission event.	
456	(z,...)	$\bar{\nu}_p$, average number of prompt neutrons released per fission event.	
457	(z,...)	Radioactive decay data.	
458	(n,...)	Energy release in fission for incident neutrons.	

MT		Description	Comments
459	(z,...)	Cumulative fission product yield data.	
460-464		(Unassigned)	
465-466		Not allowed in version 6.	Version 5: delayed and prompt neutrons from spontaneous fission.
467-499		(Unassigned)	
500		Total charged-particle stopping power.	
501		Total photon interaction.	
502		Photon coherent scattering.	
503		(Unassigned)	
504		Photon incoherent scattering.	
505		Imaginary scattering factor.	
506		Real scattering factor.	
507-514		(Unassigned)	
515		Pair production, electron field.	
516		Pair production; sum of MT=515, 517.	Redundant.
517		Pair production, nuclear field.	
518		Not allowed in version 6.	
519-521		(Unassigned)	
522		Photoelectric absorption.	Version 5: MT=602.
523		Photo-excitation cross section.	
524-525		(Unassigned)	
526		Electro-atomic scattering.	
527		Electro-atomic bremsstrahlung.	
528		Electro-atomic excitation cross section.	
529-531		(Unassigned)	
532		Not allowed in version 6.	Version 5: (γ,n).
533		Atomic relaxation data.	Version 5: total photonuclear
534	K	(1s ^{1/2}) subshell photoelectric or electro-atomic cross section.	
535	L1	(2s ^{1/2}) subshell photoelectric or electro-atomic cross section.	
536	L2	(2p ^{1/2}) subshell photoelectric or electro-atomic cross section.	
537	L3	(2p ^{3/2}) subshell photoelectric or electro-atomic cross section.	
538	M1	(3s ^{1/2}) subshell photoelectric or electro-atomic cross section.	

The MT reactions

MT		Description	Comments
539	M2	(3p ^{1/2}) subshell photoelectric or electro-atomic cross section.	
540	M3	(3p ^{3/2}) subshell photoelectric or electro-atomic cross section.	
541	M4	(3d ^{3/2}) subshell photoelectric or electro-atomic cross section.	
542	M5	(3d ^{5/2}) subshell photoelectric or electro-atomic cross section.	
543	N1	(4s ^{1/2}) subshell photoelectric or electro-atomic cross section.	
544	N2	(4p ^{1/2}) subshell photoelectric or electro-atomic cross section.	
545	N3	(4p ^{3/2}) subshell photoelectric or electro-atomic cross section.	
546	N4	(4d ^{3/2}) subshell photoelectric or electro-atomic cross section.	
547	N5	(4d ^{5/2}) subshell photoelectric or electro-atomic cross section.	
548	N6	(4f ^{5/2}) subshell photoelectric or electro-atomic cross section.	
549	N7	(4f ^{7/2}) subshell photoelectric or electro-atomic cross section.	
550	O1	(5s ^{1/2}) subshell photoelectric or electro-atomic cross section.	
551	O2	(5p ^{1/2}) subshell photoelectric or electro-atomic cross section.	
552	O3	(5p ^{3/2}) subshell photoelectric or electro-atomic cross section.	
553	O4	(5d ^{3/2}) subshell photoelectric or electro-atomic cross section.	
554	O5	(5d ^{5/2}) subshell photoelectric or electro-atomic cross section.	
555	O6	(5f ^{5/2}) subshell photoelectric or electro-atomic cross section.	
556	O7	(5f ^{7/2}) subshell photoelectric or electro-atomic cross section.	
557	O8	(5g ^{7/2}) subshell photoelectric or electro-atomic cross section.	
558	O9	(5g ^{9/2}) subshell photoelectric or electro-atomic cross section.	

MT		Description	Comments
559	P1	(6s ^{1/2}) subshell photoelectric or electro-atomic cross section.	
560	P2	(6p ^{1/2}) subshell photoelectric or electro-atomic cross section.	
561	P3	(6p ^{3/2}) subshell photoelectric or electro-atomic cross section.	
562	P4	(6d ^{3/2}) subshell photoelectric or electro-atomic cross section.	
563	P5	(6d ^{5/2}) subshell photoelectric or electro-atomic cross section.	
564	P6	(6f ^{5/2}) subshell photoelectric or electro-atomic cross section.	
565	P7	(6f ^{7/2}) subshell photoelectric or electro-atomic cross section.	
566	P8	(6g ^{7/2}) subshell photoelectric or electro-atomic cross section.	
567	P9	(6g ^{9/2}) subshell photoelectric or electro-atomic cross section.	
568	P10	(6h ^{9/2}) subshell photoelectric or electro-atomic cross section.	
569	P11	(6h ^{11/2}) subshell photoelectric or electro-atomic cross section.	
570	Q1	(7s ^{1/2}) subshell photoelectric or electro-atomic cross section.	
571	Q2	(7p ^{1/2}) subshell photoelectric or electro-atomic cross section.	
572	Q3	(7p ^{3/2}) subshell photoelectric or electro-atomic cross section.	
573-599		(Unassigned)	
600	(z,p ₀)	Production of a proton leaving the residual nucleus in the ground state.	Not allowed for incident protons, use MT=2.
601	(z,p ₁)	Production of a proton, with residual in the 1st excited state.	
602	(z,p ₂)	Production of a proton, with residual in the 2nd excited state.	Version 5: photoelectric absorption, see MT=522.
603	(z,p ₃)	Production of a proton, with residual in the 3rd excited state.	
604	(z,p ₄)	Production of a proton, with residual in the 4th excited state.	
	...		
	...		

The MT reactions

MT		Description	Comments
649	(z, p _c)	Production of a proton in the continuum not included in the above discrete representation.	
650	(z, d ₀)	Production of a deuteron leaving the residual nucleus in the ground state.	
651	(z, d ₁)	Production of a deuteron, with the residual in the 1st excited state.	
652	(z, d ₂)	Production of a deuteron, with the residual in the 2nd excited state.	
...	...		
699	(z, d _c)	Production of a deuteron in the continuum not included in the above discrete representation.	
700	(z, t ₀)	Production of a triton leaving the residual nucleus in the ground state.	
701	(z, t ₁)	Production of a triton, with residual in the 1st excited state.	
702	(z, t ₂)	Production of a triton, with residual in the 2nd excited state.	
...	...		
749	(z, t _c)	Production of a triton in the continuum not included in the above discrete representation.	
750	(n, ³ He ₀)	Production of a ³ He particle leaving the residual nucleus in the ground state.	
751	(n, ³ He ₁)	Production of a ³ He, with residual in the 1st excited state.	
...	...		
799	(n, ⁴ He _c)	Production of a ⁴ He in the continuum not included in the above discrete representation.	
800	(z, α ₀)	Production of an alpha particle leaving the residual nucleus in the ground state.	
801	(z, α ₁)	Production of an alpha particle, with residual in the 1st excited state.	
...	...		
...	...		

MT		Description	Comments
849	(z, α _c)	Production of an alpha particle in the continuum not included in the above discrete representation.	
850		(Unassigned)	
851-870		Lumped reaction covariances.	
871-874		(Unassigned)	
875	(z, 2n ₀)	Production of 2 neutrons with residual in the ground state.	
876	(z, 2n ₁)	Production of 2 neutrons with residual in the 1st excited state.	
...	...		
891	(z, 2n _c)	Production of 2 neutrons in the continuum not included in the above discrete representation.	
892-999		(Unassigned)	

The MT reactions

Channel	Folder	Structure of the files	MT
(n,n')	F01	B	50-90,91,4
(n,anything)	F02	A	5
(n,2nd)	F03	A	11
(n,2n)	F04	A	16
(n,3n)	F05	A	17
(n,na)	F06	A	22
(n,n3a)	F07	A	23
(n,2na)	F08	A	24
(n,3na)	F09	A	25
(n,np)	F10	A	28
(n,n2a)	F11	A	29
(n,2n2a)	F12	A	30
(n,nd)	F13	A	32
(n,nt)	F14	A	33
(n,n ³ He)	F15	A	34
(n,nd2a)	F16	A	35
(n,nt2a)	F17	A	36
(n,4n)	F18	A	37

The MT reactions

(n,2np)	F19	A	41
(n,3np)	F20	A	42
(n,n2p)	F21	A	44
(n,npa)	F22	A	45
(n,p)	F23	B	600-648,649,103
(n,d)	F24	B	650-698,699,104
(n,t)	F25	B	700-748,749,105
(n, ³ He)	F26	B	750-798,799,106
(n,a)	F27	B	800-848,849,107
(n,2a)	F28	A	108
(n,3a)	F29	A	109
(n,2p)	F30	A	111
(n,pa)	F31	A	112
(n,d2a)	F32	A	113
(n,t2a)	F33	A	114
(n,pd)	F34	A	115
(n,pt)	F35	A	116
(n,da)	F36	A	117