



HAL
open science

Comments on jeff-33t1 library

C. Jouanne, M. Coste-Delclaux

► **To cite this version:**

C. Jouanne, M. Coste-Delclaux. Comments on jeff-33t1 library. JEFF Processing and Verification Working Group, Apr 2016, Paris, France. cea-02435073

HAL Id: cea-02435073

<https://hal-cea.archives-ouvertes.fr/cea-02435073>

Submitted on 19 Feb 2020

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

DE LA RECHERCHE À L'INDUSTRIE

cea den

COMMENTS ON JEFF-3.3T1 LIBRARY

Cédric Jouanne / Mireille Coste-Delclaux

*Den-Service d'étude des réacteurs et de mathématiques appliquées (SERMA),
CEA, Université Paris-Saclay, F-91191, Gif-sur-Yvette, France*

JEFF-3.3T1 checking with GALILÉE-1 system

- File 1
- File 2
- File 3
- File 4
- File 5
- File 6
- File 8
- Files 12, 13, 15

Comparison between mass taken from NUBASE 2003 and mass taken from the evaluation

■ Absolute discrepancy greater than 1MeV for 13 nuclei

■ 48-Cd-113

■ 58-Ce-141

■ 63-Eu-155

■ 2-He-3

■ 53-I-135

■ 57-La-139

■ 41-Nb-93

■ 61-Pm-148

■ 44-Ru-103, 44-Ru-104, 44-Ru-105

■ 90-Th-230

■ 54-Xe-134

$$|\Delta| \leq 4.6196 \text{ MeV}$$

Spin value for compound nucleus ($J = L + S$)

■ Wrong spin value for 5 nuclei

■ 98-Cf-251

■ 93-Np-238

■ 61-Pm-148

■ 94-Pu-243

■ 92-U-241

Comparison between threshold taken from the evaluation (QM) and threshold calculated from NUBASE 2003 masses

■ Absolute discrepancy greater than 500 keV for **33 nuclei**

■ MT 22

■ MT 28

■ MT 32

■ MT 41

■ MT 103

■ MT 104

■ MT 105

■ MT 106

■ MT 107

■ MT 108

■ MT 111

■ MT 112

$$|\Delta| \leq 100\%$$

Negative angular distributions due to Legendre Polynomial truncation

■ 20 nuclei

- MT 2, MT 51 -> 86
- Legendre order truncation: 8, 14, 20, 36, 64

Wrong normalization for angular distributions given in (mu, p(mu))

■ 82-Pb-208

- MT 2
- $1 < Norm \leq 1.060579$

Sum of outgoing neutron energies > available energy

- Absolute discrepancy greater than 1 MeV for **5 nuclei**
 - 48-Cd-108 (MT 17)
 - 48-Cd-110 (MT 17)
 - 48-Cd-112 (MT 17)
 - 48-Cd-114 (MT 17)
 - 48-Cd-116 (MT 17)

$$|\Delta| \leq 1.9112 \text{ MeV}$$

Various problems

- Gamma yield < 1 (10^{-4}) for inelastic scattering (exception: inelastic scattering to metastable state)
 - 66 nuclei

- Gamma production for discrete inelastic described in File 6 (MT < 91)
 - 70 nuclei

**Correlation in inelastic gamma cascade (MT<91) lost when described in file 6
(ex: 13-AI-27, MT 52))**

Better to use MF 12 to keep the correlations

Various problems

- Kinematics data not available at the threshold of the reaction (MF 3) : (50 keV)
 - 17-CI-37 (MT 658)
 - 8-O-16 (MT 749)
 - 72-Hf-174 (MT 91)
 - 72-Hf-176 (MT 91)

Example

- $n + {}^{16}_8\text{O} \rightarrow {}^{14}_7\text{N} + {}^3_1\text{H}$
- Threshold 22.86444 MeV
- In File 6 ${}^{14}_7\text{N}$ produced above 23.86138 MeV

Various problems

- Total gamma energy less than threshold energy for inelastic scattering
 - 327 nuclei

- Gamma emission probability sum (continuous + discrete) not equal to 1 ($|\Delta| > 10^{-4}$)
 - 26-Fe-56 (MT 649)
 - 14-Si-29 (MT 91)
 - 50-Sn-116 (MT102)
 - 50-Sn-118 (MT102)
 - 50-Sn-120 (MT102)

Various problems

- Excited states with excited level (LFS) = 0 (found in FUDGE)
 - 84 nuclei

- Inconsistency between excited level in File 8 and in DD (LFS \neq LIS)
 - JEFF-3.1.1 DD: 100 nuclei
 - JEFF-3.2 DD: 94 nuclei
 - ENDSF : 29 nuclei

- Inconsistency between excited state energy in File 8 and in DD ($|\Delta| > 50$ keV)
 - JEFF-3.1.1 DD: 6 nuclei
 - JEFF-3.2 DD: 6 nuclei
 - ENDSF : 5 nuclei

Gamma production

- File 15: Gamma distribution goes up higher than the available energy (Tolerance 5%)
 - 9 nuclei
- File 15: Total gamma energy goes up higher than the available energy (Tolerance 5% and $|\Delta| > 500$ keV)
 - 27 nuclei
- File 12/13 and 15 + File 5: Sum of neutron and gamma energies differ from available energy (Tolerance 5% and $|\Delta| > 500$ keV)
 - 13 nuclei
- File 12: Gamma production are not well normalized ($|\Delta| > 1.E-4$)
 - 91-Pa-231
- No gamma production given for radiative capture (no MF 6, 12 or 13)
 - 64 nuclei

**SUMMARY FOR:
JENDL40, ENDFB7R1, JEFF32, JEFF33T1**

JENDL-4.0 : 406 nuclei
 ENDF/B-VII.1 : 423 nuclei
 JEFF-3.2 : 472 nuclei
 JEFF-33T1 : 559 nuclei

Pb	JENDL40	ENDFB7R1	JEFF32	JEFF33T1
MF1 Mass/Nubase2003	4	27	24	13
MF2 Spin Value $J=L+S$	0	3	9	5
MF3 Q_{reac} /Nubase 2003	5	92	53	33
MF4 Negative distribution (Legendre Polynomials)	5	39	35	20
MF4 Wrong normalization.	0	0	0	1

Pb	JENDL40	ENDFB7R1	JEFF32	JEFF33T1
MF5 $E_n > E_{\text{available}}$	1	6	5	5
MF6 Inelastic Scattering : Gamma yield < 1	129	63	205	66
MF6 Discrete Inelastic scattering (MT<91)	193	85	38	70
MF3/MF6 Threshold discrepancy	0	5	69	4
MF6 $E_{\text{gam}} < \text{Threshold}$ (inelastic)	10	31	188	327
MF6 Prob (cont + disc) $\neq 1$	8	7	3	5

JENDL-4.0 : 3 / 406 nuclei

ENDF/B-VII.1 : 41 / 423 nuclei

JEFF-3.2 : 169 / 472 nuclei

JEFF-33T1 : 322 / 559 nuclei

Pb	JENDL40	ENDFB7R1	JEFF32	JEFF33T1
MF8 Exc >0 for LFS=0	0	0	0	84
MF8 LFS ≠ LIS (JEFF-311/DD)	1	14	41	100
MF8 LFS ≠ LIS (JEFF-32/DD)	2	16	39	94
MF8 LFS ≠ LIS (ENSDF)	1	12	7	29
MF8 ΔExc (JEFF-3.11/DD)	0	0	1	6
MF8 ΔExc (JEFF-3.2/DD)	0	0	1	6
MF8 ΔExc (ENSDF)	0	0	0	5

Pb	JENDL40	ENDFB7R1	JEFF32	JEFF33T1
MF15 $\text{Max}(E_{\text{gamma}}) > E_{\text{available}}$	17	20	15	9
MF15 $\text{Sum } E_{\text{gamma}} > E_{\text{available}}$	5	39	30	27
MF12,13,15,5 $E_n + E_{\text{gamma}} > E_{\text{available}}$	28	35	23	13
No gamma for MT102 *	139	138	104	64

* : MF6, MF12, MF13