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VALIDATION OF TENDL-2009 USING INTEGRAL MEASUREMENTS

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INTRODUCTION

TENDL-2009 [1] is a new library, which includes both transport and activation cross-section data. The activation cross-sections shall serve as the basis for the new generation of activation libraries (TAL), tailored for several high energy applications (fusion, accelerator design etc.). This report describes validation of TENDL-2009/A (activation reactions) data against the integral activation experiments. These data were successfully used for validation of four last EAF libraries (EAF-2001 [2], EAF-2003 [3] and EAF-2005 [4] and EAF-2007[5]) using the processing code Safepaq-II [6]. The results of this exercise include also the comparison with EAF-2010, the last from the series of EAF libraries.

[1] A. Koning and D. Rochman, private cvommunication (January 2010).

[2] R. A Forrest, M. Pillon, U. von Möllendorff and K. Seidel, *'Validation of EASY-2001 using integral measurements'*, **UKAEA FUS 467**, 2001.

[3] R. A Forrest, M. Pillon, U. von Möllendorff, K. Seidel, J. Kopecky and J-Ch Sublet, *'Validation of EASY-2003 using integral measurements'*, **UKAEA FUS 500**, 2003.

[4] R. A Forrest, J. Kopecky, M. Pillon, K. Seidel, S.P. Simakov, P. Bém, M. Honusek and E. Šimecková, *'Validation of EASY-2005 using integral measurements'*, **UKAEA FUS 526**, 2006.

[5] R. A Forrest, J. Kopecky, M. Pillon, K. Seidel, S.P. Simakov, P. Bém, M. Honusek and E. Šimecková, *'Validation of EASY-2007 using integral measurements'*, **UKAEA FUS 547**, 2008.

[6] R. A Forrest, *'SAFEPAQ-II: User manual'*, **UKAEA FUS 454**, Issue 7, 2007.

1. INTEGRAL ACTIVATION DATA BASE

1.1 Calculational method and effective cross-sections

For many of the product nuclides a single pathway dominates the production. In such cases it is possible to extract an effective cross section (cross section averaged in the neutron spectrum) that can be used directly in SAFEPAQ-II.

$$\sigma^{eff} = \int_0^E \sigma(E) * \Phi(E) dE$$

Generally an integral experiment measures activity (sometimes heat production) of the target material. The following description considers the measured quantities. At a time the experiment obtains a value of the activity or heat production (H_E). An inventory code calculates the same quantity (H_C) using library nuclear data. A comparison of the two values gives the C/E ratio (*r*). If only a single pathway is important at this time then:

$$H_C = \lambda N q = \lambda N_0 \phi \sigma^C q \qquad (1)$$

where q is the energy emitted per decay

λ is the decay constant

N_0 is the number of target atoms

ϕ is the neutron flux

σ^C is the cross section in the library

Equation (1) gives the calculated activity, a similar expression applies for the experimental activity (containing the *effective cross section* σ^E) and the C/E ratio (r) is given by equation (2).

$$r = H_C / H_E \qquad (2)$$

The ratio of the calculated to the effective cross section (k) is given by equation (3).

$$k = \sigma^C / \sigma^E$$

Then so long as the decay data (λ and q) are correct, then by using Equation (1) the two ratios are identical, $k = r$. It is then possible to alter the value of σ^C so that $r = 1$, this is termed *renormalisation*. (3)

If more than one pathway contributes to the heat production then if we make some additional assumptions or using full FISPACT calculation it is still possible to extract cross section *renormalisation* data from the experiment. The details description of this approach is given in Refs. [2,3].

1.2 Results of C/E calculations for TENDL-2009 and EAF-2010

The practical essence of the present approach is as follows : If there is only one pathway (reaction) producing the nuclide (our understanding of that is given by results from FISPACT) then the conversion is trivial. But if there are two pathways giving the same daughter then what we measure and what we calculate is the (weighted) sum of contributions from both reactions. What the formalism does is, by making the assumption that for the minor reaction the cross sections are known exactly, to calculate what the spectrum averaged cross section must be so as to give the measured data.

So this is a transformation from activities (as given by ALL experimentalists) to effective cross sections (only given by EASY team) so that we can directly compare with EAF data during the evaluation of a new library. This is a unique capability, if we didn't do this then we would have to wait until EAF-2010 was available and then rerun all the FISPACT cases and compare calculated activities with the measured ones. So our way is better (in real understanding of cross sections) and unique.

C/E values in Table 1 have been calculated with 'Integral Data' mode of the processing code Safepaq-II [6]. In this mode, the reaction effective cross sections are generated (**C-calculation**) and compared with the experimental ones (**E-experiment**), those inputted manually (as described above). They form the integral database of activation benchmarks and can be used for validation of any evaluation. For details see Refs. [2-5].

The C/E values are automatically generated for the 'Final' data (in Safepaq terminology this is the cross section database treated in the project), in our case EAF-2010. For the 'Final' data also the sum cross-section of split reactions are generated, and used for the analysis of the C/E behaviour of total cross sections. In order to compare the integral data with other library, in this case TENDL-2009, the effective cross-sections based on multi group data are generated only for studied reactions. Since in EAF format no FS=99 data are stored, and the summation for source libraries (outside 'Final') would create computer space problems, another way has to be used to get C/E values of total cross sections for split reactions in TENDL-2009.

The simplest way was to create a new project for which TENDL-2009 is taken an exclusive data source (for studied reactions only using the "Single reaction treatment"), which formed the 'Final' data set, and C/E values were calculated directly. There is a bug in Safepaq handling of this summation in case, that FS=2 is in TENDL missing and taken over from another data source (in Comments given as Summation problem).

Temporary remarks:

1.The capture data have not been analysed since the PENDF file of TENDL-2009 has not been generated yet.
2. Multiple channels data [(n,xpart) and (n,part+)] are not yet operating in the new version of Safepaq code and therefore not analysed, this is true for new EAF-2010 data and for TENDL-2009 C/E.
3. Data missing in TENDL-2009 (many isomeric states compared to EAF content) are shown with 'TENDL missing' (in yellow).
4. Strange C/E values (more study is needed and the explanation is pending) are given as C/E (green)
5. A temporary plot file (TENDL_IntVal_Plot.doc) is available, which includes all interesting cases to compare visually. Plots of all reactions will be included in the final TENDL-2009 validation documentation.

Important observations:

1. Mind Score 5_2, which describes satisfactory (or good) agreement with differential and unsatisfactory agreement with integral data. My experience shows, that this often indicates a suspicious result of the integral experiment.

2. Another observation is that the overall visual improvement of the data fit with differential data sometimes worsens C/E value, especially if the neutron spectrum ‘feels' only a small part of the excitation curve. This explains sometimes the better C/E(EAF-2005) value, however, with not good overall agreement.

Table 1. Summary of reactions with integral data

<u>Reaction</u> - Reaction* (with star) - plot of EAF-2010 and TENDL-2009 data stored in Appendix 1 **Reaction** (in bold) – new or modified data adopted in EAF-2010

(n,t) and (n,h) data - Data from all three d-Be spectra are treated as pure (n,t) and (n,h) reactions with corresponding (n,xt) for tritium counting and (n,t+) and (n,h+) for activation data. The latter C/E's are shown in the Comment column. For pairs of reactions, italics indicate the one that has cross section data shown.

(n,np) a nd (n,d) data – For most reactions σ(n,np) > σ(n,d) and (n,np) data are show. The (n,d+) C/E's are given in the Comment column. For pairs of reactions, the one with cross section data shown is printed in *italics*.

<u>QS</u> - the Quality Score, scores in (brackets) are not used as the total cross section (FS=99) is measured in the integral experiment and only partial data (FS=0,1or 2) exist in the EAF data file. QS* indicates that the score differs from the value given in the distributed EAF-2007 file due to new experimental data obtained after the library release or errors in EAF-2007.

Comments on QS = 5 assignments: $[5_0]$ = differential data are missing and unsatisfactory agreement with integral data. $[5_1]$ = unsatisfactory agreement with differential and integral data. $[5_2]$ = satisfactory agreement with differential and unsatisfactory agreement with integral data. $[5_3]$ = differential data are missing and satisfactory agreement with integral data. $[5_4]$ = unsatisfactory agreement with differential data and satisfactory agreement with integral data.

<u>Spectrum</u> - the irradiation spectrum. d_Be2a data - Cross sections measured with d_Be2 spectrum have been increased by a factor of 2.15, as described in the text.

- Energy classification of neutron spectra – range Φ(max) in <energy> and E[Φ(max)]

Maxw_300K-		thermal spectrum	
Sneg – (d,He3) monoenergetic source	>0.01 range	<14 MeV – 14.5MeV>	14 MeV
Fzk – (p,D2O) reaction	>0.01 range	<0.01 MeV – 18 MeV>	14 MeV
Rez DF - (p,D_2O) reaction (p,D)	>0.01 range	<0.004 MeV – 30 MeV>	20 MeV
Rez foils - (p,D_2O) reaction (p,O_{16})	>0.01 range	<1.5 MeV – 30 MeV>	flat curve
Spectra cf252 - spontaneous fission -	>0.1 range	<0.2 – 8 MeV>	2 MeV
Spectra fng, fns, tud – (d,T) reaction -	>0.01 range	<3 MeV – 14.5 MeV>	14 MeV
Spectra d-Be - (d,Be) reaction -	>0.01 range	<10 – 40 MeV>	22.5 MeV

C/E - C/E† indicates that the integral data should be disregarded (these assignments have been taken over from Ref. [4]). Usually C/E value of one the experiments (neutron spectrum), which strongly deviates form other values.

Comment - the earlier C/E values (from EAF-2005 or EAF-2207) are shown in the Comment column only if the previous EAF versions give a better C/E result and are shown in (**bold**). Further the absence of data in TENDL-2009 is indicated (yellow). Some explanatory comments on used EXFOR data or data observations are also included.

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
H-1(n, γ)	6	Maxw_300K		0.897	No TENDL data
H-2(n, γ)	6	Maxw_300K		0.883	No TENDL data
He-3(n, γ)	6	Maxw_300K		0.870	No TENDL data
Li-7(n,nα)	5_3	d-Be		0.418	No TENDL data
Be-9(n,t)/*(n,xt)*	5_2	d-Be	1.23	0.531	/0.616
B-10(n,t)	6	cf252_flux_1	1.18	1.093	
B-11(n,t)/*(n,xt)*	5_2	d-Be	0.25	0.131	/0.227
C-12(n,t)/*(n,xt)*	5_1	d-Be	0.36	0.562	/1.072
N-14(n,2n)*	6	fns_5min	4.09	1.053	
N-14(n,γ)	5_2	cf252_flux_1		26.92	
N-14(n,t)/*(n,xt)*	5_2	d-Be	0.49	0.311	
O-16(n,p)*	6	fns_5min	0.53	1.019	
O-16(n,t)/*(n,xt)*	5_2	d-Be	0.59	0.492	/0.79
F-19(n,2n)*	6	fns_5min cf252_flux_1 cf252_flux_1	1.39 2.19 1.43	0.917 1.639† 1.086	
F-19(n,p)*	6	fns_5min	0.60	1.010	
F-19(n,t)/*(n,xt)*	$5_0/5_3$	d-Be	0.08	0.255	/0.842
Ne-20(n,t)/*(n,xt)*	$5_0/5_3$	d-Be	0.35	0.457	/0.833
Ne-20(n,t)/*(n,t+)*	$5_0/5_3$	d-Be	0.32	0.414	/1.932
Na-23(n,2n)*	6	fns_7hour fzk_1	1.12 2.07	0.704† 1.080	
Na-23(n,γ)	(6)	cf252_flux_1 fns_7hour fns_5min		0.639 1.033 1.352	
Na-23(n,p)*	6	fns_5min	0.66	1.190	
Na-23(n,t)/*(n,xt)*	$5_2/6$	d-Be	0.16	0.649	/0.951
Mg-24(n,p)*	(5_2)	fns_5min cf252_flux_1 cf252_flux_1	1.04 1.34 1.29	1.165 1.347 1.300	
Mg-24(n,t)/*(n,xt)*	$5_0/5_3$	d-Be	0.56	0.447	/0.697
Mg-24(n,t)/*(n,t+)*	$5_0/5_3$	d-Be	0.35	0.279	/2.571
Mg-25(n,p)	6	fns_5min	1.27	1.000	
Mg-26(n,α)*	6	fns_5min	0.46	0.990	

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
		fng_heat	0.29	0.622†	
Al-27(n,p)	6	fns_5min	0.64	1.074	
		cf252_flux_1	1.19	0.962	
		cf252_flux_1	1.21	0.980	
Al-27(n,t)/*(n,xt)*	6	d-Be3	0.54	1.090	/1.189
		d-Be3	0.50	1.011	/1.103
		d-Be	0.35	0.557	/0.951
Al-27(n,h)/*(n,h+)*	$5_0/5_1$	d-Be2a	0.05	0.157	/0.560
	$5_0/5_1$	d-Be2a	0.06	0.178	/0.636
Al-27(n,α)	(6)	fzk_1	0.79	0.876	
		fng_vanad	0.73	0.869	
		sneg_1	0.73	0.874	
		sneg_2	0.73	0.870	
		fng_f82h	1.23	1.470†	
		cf252_flux_1	0.94	1.043	
		cf252_flux_1	1.10	1.220	
		rez_DF	1.13	1.260	
		d-Be2a	0.72	0.757	
		d-Be3	1.04	1.189	
		rez_DF	0.20	0.227†	
		fns_7hour	0.82	0.990	
Al-27(n,2nα)	5_3	rez_DF	0.45	0.331	
Si-28(n,p)*	6	fns_5min	1.40	1.099	
		fng_SiC	1.28	0.993	
		fzk_1	1.86	1.529	
		sneg_1	1.02	0.817	
		cf252_flux_1	1.15	1.035	
		cf252_flux_1	0.85	0.763†	
Si-28(n,t)/*(n,xt)*	$(5_0/5_3)$	d-Be	0.47	0.330	/0.582
Si-29(n,p)*	6	fns_5min	0.62	1.032	
		fng_SiC	0.59	0.989	
		fzk_1	1.27	1.213	
		sneg_1	0.57	0.970	
		cf252_flux_1	2.61	2.028	
Si-29(n,2p)	5_4	fzk_1	0.14	0.403	
Si-30(n,p)*	6	sneg_1	1.55	0.912	
Si-30(n,α)*	6	fns_5min	2.42	1.042	
		fng_SiC	2.59	1.114	
		sneg_1	2.17	0.949	
P-31(n,p)	6	cf252_flux_1	1.43	0.918	
P-31(n,t)/*(n,xt)*	$5_3/5_3$	d-Be	0.58	0.763	/1.208
P-31(n,h)/*(n,h+)*	$5_1/5_4$	d-Be2a	0.10	0.234	/1.186 **C/E(5) =2.049**
P-31(n,α)	6	fns_5min	1.08	0.870	
		d-Be2a	1.25	0.950	
P-31(n,2α)	(5_0)	d-Be2a	13.07	10.30	No TENDL FS=1 data
S-32(n,p)	6	fns_7hour	0.75	0.980	

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
		cf252_flux_1 cf252_flux_1 cf252_flux_1	1.43 1.35 1.27	1.164 1.037 1.099	
S-32(n,t)/*(n,xt)*	5_2/6	d-Be	0.83	0.608	/1.114
S-34(n,p)	6	fns_5min	0.99	0.971	
S-34(n,α)*	6	fns_5min	0.43	1.019	Interesting EXFOR impact
Cl-35(n,2n)m*	5_2	fns_5min	1.72	1.429	**C/E(5) =1.103**
Cl-35(n,t)/*(n,xt)*	5_3/5_3	d-Be	0.58	0.684	/1.104
Cl-37(n,p)*_	6	fns_5min	0.68	1.368	**C/E(7) = 1.250** **C/E(5) = 1.251** EXFOR(GE00) used !!!!!
Cl-37(n,α)*	6	fns_5min	1.47	0.980	
Ar-40(n,t)/*(n,xt)*	(5_0/5_3)	d-Be	0.48	0.425	/0.972
Ar-40(n,t)/*(n,t+)*	(5_0/5_3)	d-Be	0.13	0.116	/1.342
K-39(n,2n)g*	6	fns_5min	103.2	1.282	Bug in TENDL data !!!
K-39(n,2α)	5_1	d-Be2a	18.36	14.15	
K-41(n,γ)	6	fns_7hour		0.794	
K-41(n,h)/*(n,h+)*	5_1/5_4	d-Be2a	0.11	0.329	/0.583
K-41(n,p)	6	fns_5min	0.66	1.176	
K-41(n,α)*	(5_2)	fns_5min	0.57	1.214	**C/E(5)=1.095**
Ca-40(n,t)/*(n,xt)*	(5_1/5_4)	d-Be	0.57	0.338	/0.684
Ca-40(n,t)/*(n,t+)*	(5_1/5_4)	d-Be	0.30	0.176	/1.345
Ca-40(n,h)/*(n,h+)*	5_3/5_0	d-Be2a	0.19	0.460	/19.872
Ca-42(n,p)*	5_3	fns_7hour	0.43	0.829	
Ca-44(n,p)*	6	fns_5min	1.17	1.034	
Ca-44(n,t)/*(n,t+)*	5_0/5_3	d-Be	0.11	0.094	/1.376
Ca-48(n,2n)	6	fns_7hour	1.08	0.885	
Sc-45(n,2n)g	5_2	fns_5min fng_ScSmGd	1.36 2.44	1.075 1.630	
Sc-45(n,2n)m	6	fng_ScSmGd	1.26	1.090	
Sc-45(n,h)/*(n,h+)*	5_1/5_4	d-Be2a d-Be2a	0.15 0.09	0.390 0.230	/1.144 /0.673
Sc-45(n,α)	6	fng_ScSmGd d-Be2a	0.97 1.62	1.100 1.379†	
Ti-46(n,2n)*	6	sneg_1 cf252_flux_1	1.81 0.23	1.106 0.150†	
Ti-46(n,nt)	5_0	fzk_ss316	0.05	0.031	
Ti-46(n,p)g	6	fns_7hour	0.55	0.826	
Ti-46(n,p)	(6)	fzk_2 cf252_flux_1 cf252_flux_1 cf252_flux_1 cf252_flux_1 rez_DF sneg_1	0.69 0.80 0.80 0.81 0.89 1.22 0.40	0.909 0.976 0.990 1.086 0.969 1.713† 0.519	

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
		fng_vanad	1.30	1.673†	
		fzk_1	1.02	1.349	
		d-Be3	0.84	1.168	
		fns_7hour	0.72	0.914	
Ti-46(n,t)g	5_1	fzk_ss316	0.12	0.089	
Ti-46(n,t)m	5_1	fzk_ss316	0.07	0.042	
Ti-47(n,3n)	5_3	d-Be3	0.51	0.736	
Ti-47(n,p)*	6	cf252_flux_1	1.33	1.010	
		cf252_flux_1	1.43	1.085	
		cf252_flux_1	1.39	1.057	
		cf252_flux_1	1.23	0.932	
		cf252_flux_1	1.25	0.949	
Ti-48(n,p)*	6	fns_7hour	1.59	0.935	
		fns_5min	1.79	1.053	
		fng_heat	1.14	0.666	
		cf252_flux_1	1.30	0.959	
		cf252_flux_1	1.31	0.966	
		cf252_flux_1	1.43	1.060	
		fzk_ss316	3.07	2.099†	
		fzk_1	4.12	2.806†	
Ti-48(n,np)/ *(n,d+)*	$5_0/5_2$	fzk_ss316	0.39	0.296	/0.352
Ti-48(n,t)g/*(n,t+)g*	$5_0/5_3$	d-Be	0.16	0.126	/2.265
Ti-48(n,t)m/*(n,t+)m*	$5_0/5_3$	d-Be	0.07	0.058	/0.799
Ti-48(n,t)/*(n,xt)*	$(5_0/5_3)$	d-Be	3.68	2.939	/3.239
		d-Be3	3.22	2.896	/2.911
Ti-49(n,p)*	6	fng_heat	1.95	1.369	
Ti-50(n,p)*	(6)	fns_5min	1.54	0.971	
		fng_heat	1.60	1.004	
Ti-50(n,α)*	5_2	fng_vanad	0.28	0.714	
V-51(n,4n)	5_3	fzk_ss316	0.88	0.580	
		fzk_ss316	1.01	0.673	
V-51(n,n α)	6	fzk_ss316	1.49	1.333	
		d-Be2a	3.18	2.792†	
		d-Be3	1.20	1.144	
		rez_DF	1.46	1.300	
V-51(n,γ)	6	fng_vanad		1.045	
		sneg_1		0.376†	
		cf252_flux_1		0.748	
V-51(n,p)*	6	fns_5min	1.36	1.136	
		fng_vanad	1.31	1.094	
		sneg_1	1.27	1.071	
		cf252_flux_1	0.91	0.763	
		cf252_frlux_1	1.19	0.996	
V-51(n,t)/*(n,xt)*	6	d-Be3	0.71	0.839	/0.922
		d-Be	0.64	0.648	/1.092
V-51(n,h)/*(n,h+)*	$5_0/5_3$	d-Be2a	0.10	0.319	/0.469

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
		d-Be2a	0.12	0.378	/0.555
		d-Be3	0.02	0.085	/0.089
V-51(n,α)*	6	fns_7hour	1.09	0.909	
		fng_f82h	1.06	0.879	
		sneg_1	1.27	1.034	
		sneg_2	1.19	1.008	
		cf252_flux_1	1.29	1.015	
		fzk_ss316	1.16	0.847	
		fzk_ss316	1.24	0.902	
		fzk_ss316	1.34	0.976	
		fng_vanad	1.14	0.933	
		d-Be2a	1.23	0.839	
		rez_DF	1.20	0.881	
V-51(n,pα)	$5_0/5_3$	fzk_ss316	0.59	0.415	
		fzk_ss316	0.61	0.434	
V-51(n,2nα)	(5_3)	fzk_ss316	1.30	0.912	
		fzk_ss316	1.02	0.720	
<u>Cr-50(n,2n)</u>	5_2	fng_vanad	1.61	0.787	**C/E(5)=0.954**
		fng_Cr	1.50	0.731	**C/E(5)=0**.888
		fzk_ss316	1.20	0.761	
		fzk_ss316	0.62	0.393	RPL back to IEAF-2001 =
		fzk_ss316	1.17	0.738	EAF-2007
		rez_DF	1.48	0.977	
		rez_DF	1.20	0.793	
		fns_5min	1.05	0.513	
Cr-50(n,3n)	5_4	fzk_ss316	1.45	1.492	
		fzk_ss316	1.07	1.106	
		d-Be3	0.68	0.808	
		rez_DF	1.26	1.479	
		rez_DF	1.71	2.003	
		rez_DF	2.19	2.461	
Cr-50(n,t)	5_2	fzk_2	0.04	0.040	**C/E(5)=0.912**
		fzk_ss316	0.18	0.121	**C/E(5)=1.975**
		fzk_ss316	0.18	0.124	**C/E(5)=2.018**
		rez_DF	0.25	0.172	**C/E(5)=2.802**
		rez_DF	2.49	1.704	
Cr-50(n,pα)	(5_3)	fzk_ss316	0.19	0.265†	
		rez_DF	0.26	0.401	
		rez_DF	0.28	0.426	
Cr-52(n,2n)*	6	fns_7hour	1.40	1.075	
		fzk_2	1.50	1.241	
		fng_Cr	1.34	1.044	
		fng_cucrzr	0.97	0.760	
		tud_ cucrzr	1.50	1.160	
		fng_vanad	1.33	1.042	

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
		fng_f82h fng_eurofer sneg_1 fzk_ss316 fzk_ss316 fzk_ss316 rez_DF rez_DF rez_DF	1.32 1.25 1.03 1.12 1.14 1.02 1.24 1.33 1.16	1.024 0.977 0.812 1.003 1.015 0.908 1.108 1.185 1.032	
Cr-52(n,p)*	6	fns_5min sneg_1 fng_Cr	0.93 0.70 0.91	0.968 0.740 0.941	
		cf252_flux_1 rez_DF	1.01 1.27	1.218 1.317†	
Cr-52(n,t)/*(n,xt)*	$5_3/5_3$	d-Be3 d-Be3	1.28 1.56	1.106 1.341	/1.132 /1.372
Cr-52(n,t)/*(n,t+)*	$5_3/5_3$	d-Be	0.09	0.071†	/1.510
Cr-52(n,pα)	5_3	rez_DF rez_DF	1.19 0.98	0.749 0.616	
Cr-52(n,dα)	5_3	fzk_ss316	0.73	0.858	
Cr-53(n,3n)	5_3	d-Be3	0.72	0.769	
Cr-53(n,p)	6	sneg_1 cf252_flux_1 rez_DF	0.86 0.89 4.11	0.811 1.880† 3.256†	
Cr-53(n,h)/*(n,h+)*	$5_0/5_0$	d-Be3	0.02	0.073	/0.077
Cr-54(n,α)*	5_2	rez_DF	5.24	6.891	
Mn-55(n,2n)	6	fns_7hour cf252_flux_1 cf252_flux_1	1.01 0.95 1.35	1.023 0.977 1.390†	
Mn-55(n,γ)	6	fns_7hour fns_5min		0.980 1.010	
Mn-55(n,p)	6	fns_5min	0.82	1.099	
Mn-55(n,t)/*(n,xt)*	6	d-Be d-Be3 d-Be3	0.71 0.83 0.38	0.912 1.532 0.700	/1.474 /1.671 /0.764
Mn-55(n,h)/*(n,h+)*	$5_1/5_4$	d-Be2a d-Be2a	0.09 0.07	0.260 0.200	/0.474 /0.365
Mn-55(n,α)*	6	fns_5min d-Be2a	1.16 1.61	1.099 1.123	 Example of skewness
Mn-55(n,2α)	5_3	d-Be2a	0.57	0.421	
Fe-54(n,2n)*	(5_2)	sneg_1	2.26	2.039	**C/E(5)=1.124** No TENDL FS=0,1 data Interesting conflict of two EXFOR data sets
Fe-54(n,3n)g	5_2	fzk_ss316 fzk_ss316		4.314 3.978	No TENDL FS=0,1 data

Reaction	QS	**Spectrum**	**C/E TENDL-2009**	**C/E EAF-2010**	**Comment**
		rez_DF		3.923	
Fe-54(n,p)*	6	fns_7hour	0.88	0.967	
		sneg_1	0.87	0.950	
		sneg_2	0.95	1.044	
		fzk_2	0.94	0.972	
		fng_f82h	0.99	1.083	
		cf252_flux_1	0.92	1.030	
		cf252_flux_1	0.84	0.942	
		cf252_flux_1	0.89	0.993	
		cf252_flux_1	0.89	0.995	
		cf252_flux_1	0.98	1.103	
		fzk_1	0.94	0.981	
		fzk_ss316	1.05	1.115	
		fzk_ss316	1.10	1.164	
		rez_DF	1.21	1.278	
		fng_eurofer	0.97	1.057	
		fng_vanad	0.93	1.021	
Fe-54(n,t)g/*(n,t+)g*	$5_2/5_2$	d-Be	0.11	0.075	/1.970 **C/E(5)=0.089**
		rez_DF	1.03	0.714	/7.527 **C/E(5)=1.081**
		fzk_ss316	0.01	0.010†	/0.200
Fe-54(n,t)m/*(n,t+)m*	$5_1/5_2$	d-Be	0.21	0.136	/2.281 **C/E(5)=0.186**
Fe-54(n,t)	(6)	fzk_2	0.36	0.110†	**C/E(5)=0.781**
		fzk_ss316	1.08	0.734	**C/E(5)=1.117**
		fzk_ss316	1.22	0.824	
Fe-54(n,α)*	6	fng_SiC	0.62	0.923	
Fe-56(n,p)*	6	fns_5min	0.99	1.049	
		fns_7hour	0.93	0.971	
		fng_f82h	0.94	0.996	
		fng_SiC	0.92	0.973	
		fng_vanad	0.80	0.848	
		sneg_1	0.90	0.959	
		sneg_2	0.87	1.014	
		cf252_flux_1	1.25	1.259	
		cf252_flux_1	0.98	0.998	
		cf252_flux_1	0.99	0.998	
		cf252_flux_1	1.22	1.227	
		cf252_flux_1	1.03	1.034	
		fzk_ss316	1.02	1.043	
		fzk_ss316	1.04	1.067	
		rez_DF	1.36	1.372	
Fe-56(n,t)/*(n,xt)*	6	d-Be3	1.05	1.287	/1.339
		d-Be3	1.02	1.255	/1.307
Fe-56(n,t)/*(n,t+)*	6	d-Be	0.08	0.093	/1.875
Fe-56(n,h)/*(n,h+)*	$5_0/5_3$	d-Be2a	0.03	0.138	/1.138
Fe-57(n,p)	6	sneg_1	0.77	0.777	**C/E(5)=1.110**

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
Fe-58(n,γ)	6	fng_SiC		1.145	
		fng_eurofer		0.776	
		fng_f82h		0.920	
		rez_DF		1.027	
Co-59(n,2n)m	6	fns_7hour	0.89	1.370†	
		rez_DF	0.66	1.109	
Co-59(n,2n)	(5_2)	fns_7hour	1.03	0.917	
		cf252_flux_1	0.91	0.709	
		rez_DF	1.83	1.787	
Co-59(n,3n)	6	rez_DF	0.95	0.761	
		d-Be3	0.95	0.765	
Co-59(n,γ)	(6)	cf252_flux_1		0.685	
		fng_eurofer		0.863	
Co-59(n,p)*	6	cf252_flux_1	1.39	0.869	
		rez_DF	1.31	1.196	
Co-59(n,t)/*(n,xt)*	6	d-Be3	0.89	1.175	/1.348
		d-Be3	1.16	1.534	/1.761
		d-Be	1.15	1.044	/2.040
Co-59(n,h)/*(n,h+)*	5_1/5_4	d-Be2a	0.11	0.316	/0.986
		d-Be2a	0.11	0.309	/0.964
Co-59(n,α)*	6	fns_5min	1.29	1.099	
		cf252_flux_1	1.60	1.118	
		cf252_flux_1	1.47	1.031	
		cf252_flux_1	1.44	1.008	
		cf252_flux_1	1.59	1.118	
		rez_DF	1.56	1.132	
		d-Be2a	1.78	1.180	
Co-59(n,2α)	5_3	d-Be2a	0.40	0.633	
Ni-58(n,2n)*	6	fns_7hour	1.28	1.010	Shape > 14 MeV
		fng_f82h	1.01	0.891	
		fzk_2	0.99	0.964	
		sneg_1	1.16	0.964	
		sneg_2	1.25	0.958	
		cf252_flux_1	1.26	1.076	
		fzk_ss316	1.16	1.255	
		fzk_ss316	0.88	0.947	
		rez_DF	1.16	1.267	
Ni-58(n,3n)	5_3	fzk_ss316	0.33	0.284	
		d-Be3	0.37	1.219	
Ni-58*(n,n'p)*/(n,d+)	6	fns_7hour	0.98	0.946	/0.974
		fng_vanad	0.92	0.886	/0.913
		fzk_2	0.85	0.812	/0.843
		sneg_1	0.95	0.915	/0.943
		sneg_2	0.98	0.945	/0.972
		fng_f82h	1.13	1.085	/1.117

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
		fng_eurofer fzk_ss316 fzk_ss316 rez_DF	1.10 1.05 0.77 0.77	1.056 1.028 0.752 0.957	/1.089 /1.080 /0.791 /1.005
Ni-58(n,p)	(6)	fns_7hour fzk_2 fng_vanad sneg_1 cf252_flux_1 cf252_flux_1 cf252_flux_1 cf252_flux_1 cf252_flux_1 fzk_ss316 fzk_ss316 rez_DF	0.28 0.74 0.80 0.23 1.89 1.75 1.68 1.67 1.67 1.16 1.27 1.23	0.485 0.359 0.897 0.468 1.254 1.135 1.051 1.001 0.985 1.081 1.183 1.282	C/E(5)=0.998 C/E(7)=1.025 C/E(7)=0.777 C/E(7)=0.932 Strange difference C/E(7) and C/E(10)
Ni-58(n,t)* */(n,xt)* */(n,xt)*	6	fzk_2 fzk_ss316 fzk_ss316 d-Be3 d-Be3	0.90 3.84 0.02 2.50 3.39	0.407 1.290 0.008† 0.882 1.198	 /0.965 /1.310
Ni-58(n,t)*/(n,t+)*	6	d-Be rez_DF	0.12 0.27	0.041 0.091†	/1.641 /1.604
Ni-60(n,p)m	6	fns_5min fng_heat	1.11 1.47	0.917 1.214	
Ni-60(n,p)	(6)	fzk_2 sneg_1 sneg_2 fzk_ss316 fzk_ss316 d-Be3	0.81 0.95 1.02 0.91 0.03 0.91	0.771 0.857 0.902 0.865 0.025† 0.841	
Ni-60(n,t)*/(n,t+)*	(6)	d-Be	0.06	0.044	/1.560
Ni-60(n,2p)	5_3	fzk_ss316	1.04	0.926	
Ni-61(n,p)*	5_2	fzk_2	1.38	1.722	Shape improvement
Ni-62*(n,np)* /(n,d+)*	5_2	fzk_ss316	5.86	4.255	/4.887
Ni-62(n,p)g	6	fns_5min fng_heat	1.48 1.29	1.010 0.881	
Ni-62(n,p)m	6	fns_5min fng_heat	1.05 1.00	0.963 0.915	
Ni-62(n,α)*	6	fzk_2 sneg_1	0.68 0.54	0.974 0.646	
Cu-63(n,2n)*	6	fns_5min tud_cucrzr cf252_flux_1 cf252_flux_1	0.95 0.99 0.69 1.13	1.075 1.090 0.718† 1.177	
Cu-63(n,3n)	6	d-Be3	0.56	0.666	

Reaction	QS	**Spectrum**	**C/E TENDL-2009**	**C/E EAF-2010**	**Comment**
Cu-63(n,γ)	5_2	cf252_flux_1		0.591	
Cu-63(n,t)/*(n,xt)**	5_3	d-Be3	0.85	1.748	/1.923
		d-Be	0.79	1.068	/1.719
Cu-63(n,h)/*(n,h+)*	$5_1/5_4$	d-Be2a	0.19	0.490	/0.751
Cu-63(n,α)*	(6)	fns_7hour	0.42	0.935	
		fng_SiC	1.58	1.970†	
		fzk_2	0.56	0.843	
		fng_cucrzr	0.91	1.143	
		tud_cucrzr	1.03	1.299	
		cf252_flux_1	8.15	0.890	
		cf252_flux_1	7.71	0.843	
		fng_vanad	1.17	1.456	
Cu-65(n,2n)*	6	fns_7hour	0.89	1.010	
		fng_SiC	0.79	0.900	
		fzk_2	0.75	0.856	
		fng_cucrzr	0.77	0.876	
		tud_cucrzr	1.00	1.151	
		cf252_flux_1	0.98	1.088	
Cu-65(n,γ)	6	cf252_flux_1		0.863	
Cu-65(n,α)m	6	fng_cucrzr	0.76	1.161	
		tud_cucrzr	0.99	1.530†	
		fzk_2	0.62	0.996	
Cu-65(n,n α)	6	fng_SiC	1.23	1.439	
		fzk_2	0.96	1.092	
		fng_cucrzr	0.67	0.783	
		tud_cucrzr	0.94	1.090	
		d-Be3	0.90	1.038	
Cu-65(n,p)*	6	fng_SiC	1.00	0.935	HE data for ENDF/B-VII
		fzk_2	1.03	0.189	**C/E(7)=0.909**
		fng_cucrzr	1.00	0.933	
		tud_cucrzr	1.29	1.190	
		d-Be3	1.17	1.005	
Zn-64(n,2n)	6	fns_5min	1.12	1.000	
Zn-64(n,p)*	6	cf252_flux_1	0.87	0.938	
		cf252_flux_1	0.84	1.009	
		cf252_flux_1	0.77	0.831	
		cf252_flux_1	0.91	0.979	
		cf252_flux_1	0.86	0.922	
		cf252_flux_1	0.87	0.934	
Zn-64(n,t)/*(n,t+)*	6	d-Be	0.07	0.098	/1.592
Zn-64(n,h)/*(n,h+)*	$5_0/5_3$	d-Be2a	0.04	0.131	/2.314
Zn-66(n,2α)	5_3	d-Be2a	0.74	1.032	
Zn-67(n,h)/*(n,h+)*	$5_3/5_3$	d-Be2a	0.52	0.519	/0.769
Zn-68(n,γ)m	5_2	cf252_flux_1		0.246	
Zn-68(n,h)/*(n,h+)*	$5_3/5_3$	d-Be2a	0.48	0.477	/0.547
Zn-68(n,α)	6	d-Be2a	1.37	1.097	

Reaction	QS	**Spectrum**	**C/E TENDL-2009**	**C/E EAF-2010**	**Comment**
Ga-69(n,2n)*	6	fns_5min	0.85	1.099	
Ga-69(n,t)/*(n,xt)*	$5_3/5_3$	d-Be	0.80	1.180	/2.022
Ga-71(n,2n)	6	fns_5min	1.00	1.088	
Ge-74(n,p)	(5_1)	fns_5min	0.79	1.389	
Ge-74(n,t)/***(n,t+)***	$5_0/5_0$	d-Be	0.03	0.036	/0.278
Ge-76(n,2n)m	6	fns_5min	1.09	1.267	
Ge-76(n,2n)	(6)	fns_5min	1.00	1.112	
As-75(n,p)m	6	fns_5min	1.06	0.990	
As-75(n,p)	(6)	fns_5min	0.96	1.177	**C/E(5)=1.158**
As-75(n,t)/*(n,xt)*	$(5_3/5_3)$	d-Be	0.76	1.038	/1.914
As-75(n,h)/*(n,h+)*	$5_1/5_1$	d-Be2a d-Be2a	0.13 0.09	0.473 0.326	/0.587 /0.405
As-75(n,α)*	(6)	d-Be2a	1.66	1.146	No TENDL FS=0,1 data
Se-78(n,2n)m	6	fns_5min	1.17	1.186	
Se-80(n,t)/*(n,t+)*	$5_0/5_0$	d-Be	0.03	0.040	/0.246
Se-82(n,2n)	(5_2)	fns_5min	1.16	1.305	
Br-79(n,2n)	6	fns_5min	1.13	1.000	
Br-81(n,2n)g	6	fns_5min	1.39	1.177	**C/E(5)=1.069**
Rb-85(n,2n)	(6)	fns_5min	1.15	1.095	**C/E(7)=1.020**
Rb-87(n,2n)m	6	fns_5min	1.15	1.150	**C/E(5)=1.074**
Sr-84(n,2n)	(6)	fns_7hour	1.03	1.020	**C/E(5)=1.010**
Sr-84(n,γ)m	6	cf252_flux_1 cf252_flux_1		0.192† 1.312	
Sr-86(n,2n)	(6)	fns_7hour	0.89	1.067	**C/E(5)=1.020 C/E(7)=0.971**
Sr-86(n,γ)m	5_2	cf252_flux_1		0.093	
Sr-88(n,2n)m	6	fns_7hour	0.90	0.881	
Sr-88(n,p)	6	fns_5min	0.96	0.962	
Y-89(n,n)m	6	fns_5min fng_Y	1.12 1.17	1.000 1.042	
Y-89(n,2n)	6	fns_7hour fns_5min fng_Y tud_Y rez_DF	0.86 1.09 0.99 1.11 1.49	0.885 1.124 1.021 1.138 1.482†	
Y-89(n,3n)	(5_2)	rez_DF	0.71	0.562	
Y-89(n,γ)m	6	tud_Y fng_Y		1.137 1.239	
Y-89(n,t)/*(n,xt)*	(6)	d-Be	0.99	1.110	/1.370 **C/E(5)=1.060**
Y-89(n,α)m*	6	fns_5min fng_Y	0.03 0.82	1.010 0.903	
Y-89(n,α)	(5_2)	fng_Y	0.36	0.444	
Zr-90(n,2n)m	6	fns_5min fng_heat	0.93 0.83	1.220 1.273	
Zr-90(n,2n)	(6)	fns_7hour	1.07	0.965	

Reaction	QS	**Spectrum**	**C/E TENDL-2009**	**C/E EAF-2010**	**Comment**
		fng_cucrzr tud_cucrzr cf252_flux_1 cf252_flux_1 rez_DF fng_Y	0.81 1.22 1.14 0.94 1.42 1.22	0.750† 1.120 0.815 0.985 1.504† 1.133	
Zr-90(n,p)m	6	fng_heat cf252_flux_1	1.61 1.34	1.189 1.367†	
Zr-90(n,t)/*(n,t+)*	6	d-Be	0.06	0.105	/1.087
Zr-94(n,γ)	6	cf252_flux_1		0.722	
Zr-94(n,p)*	6	fns_5min	1.21	1.031	
Zr-96(n,2n)	6	fns_7hour fzk_1	0.87 0.58	0.926 0.605†	
Zr-96(n,γ)	5_2	cf252_flux_1		3.447	
Nb-93(n,2n)m	6	fns_7hour fng_SiC fzk_2 fzk_ss316 fzk_ss316 rez_DF fng_vanad fzk_1 d-Be3 d-Be3	1.04 1.14 0.33 0.99 1.46 1.06 0.77 0.46 1.20 1.14	0.962 1.059 0.295† 0.892 1.316 0.951 0.718 0.413† 1.176 1.036	
Nb-93(n,3n)m	5_4	rez_DF	1.42	0.803	
<u>Nb-93(n,4n)</u>	(5)	rez_DF		1.032	No FS=2 in TENDL Summation problem
Nb-93(n,n α)m	6	fns_5min	0.94	0.962	**C/E(5)=1.010**
Nb-93(n,γ)m	6	fns_5min fng_heat		1.042 0.199†	
Nb-93(n,t)**/*(n,xt)***	6	d-Be3 d-Be3 d-Be	0.86 0.46 0.27	0.626 0.780 0.332	/0.926 /1.153 /1.391
Nb-93(n,h)m/*(n,h+)m*	$5_4/5_4$	d-Be2a	0.56	1.712	/2.179
Nb-93(n,h)/*(n,h+)*	$(5_0/5_0)$	d-Be2a d-Be2a	0.11 0.12	0.337 0.353	/0.423 **C/E(5)=1.062** /0.443 **C/E(5)=1.112**
Nb-93(n,α)g	5_2	fng_heat	0.09	0.151	
Nb-93(n,α)m	6	fns_5min fng_SiC d-Be2a d-Be3	0.86 0.87 1.31 0.79	1.000 1.070 1.231 0.918	
Nb-93(n,α)	(6)	d-Be2a d-Be3	0.51 0.82	1.279 1.575†	
Nb-93(n,2α)	(5_0)	d-Be2a	0.02	0.020	**C/E(5)=0.046**
Mo-92(n,2n)m	5_2*	fns_5min	1.00	1.316	

Reaction	QS	**Spectrum**	**C/E TENDL-2009**	**C/E EAF-2010**	**Comment**
Mo-92(n,2n)	(5_2)	fns_5min fng_heat fng_Mo	1.09 1.19 1.08	1.334 1.461 1.321	**C/E(5)=1.003** **C/E(5)=1.080** **C/E(5)=0.977**
Mo-92(n,3n)	5_3	fzk_ss316	1.92	1.677	
Mo-92(n,np)m/ *(n,d+)m*	6	fns_7hour	1.24	0.710	/0.719 **C/E(5)=0.951**
Mo-92(n,n α)*	6	fzk_ss316	2.07	1.732	**C/E(5)=0.430**
Mo-92(n,p)m	6	fns_7hour	1.04	0.943	
		fzk_ss316 fng_Mo	1.19 1.11	1.228 0.999	
Mo-92(n,p)	(5_1)	cf252_flux_1	0.47	0.761	
Mo-92(n,t)* */(n,xt)*	(5_4/5_4)	fzk_ss316 d-Be	2.73 1.50	0.490 0.266	**C/E(7)=1.025** /0.854 **C/E(5)=0.703** C/E(7)=0.556 No TENDL FS=2 data Summation problem
Mo-92(n,t)/*(n,t+)*	(5_1/5_1)	d-Be	0.17	0.029	/3.841 **C/E(5)=0.077** C/E(7)=0.061
Mo-92(n,α)*	(6)	sneg_1 cf252_flux_1 fzk_ss316 fng_Mo	0.27 10.08 1.24 0.82	0.969 0.227 1.432 1.000	C/E(7)=1.314 C/E(7)=0.229
Mo-92(n,2α)m	5_0	d-Be2a	0.01	0.010	
Mo-92(n,pα)	5_3	fzk_ss316	0.55	0.553	
Mo-92(n,dα)m	5_0	fzk_ss316	0.12	0.119	
Mo-92(n,2nα)	(5_3)	fzk_ss316	0.51	0.409	
Mo-92(n,3nα)	5_0	fzk_ss316	0.03	0.026	
Mo-95(n,3n)m	5_3	fzk_ss316		0.988	No TENDL FS=0,1 data
Mo-95(n,p)g	6	fns_7hour fng_vanad sneg_1 fng_Mo	1.33 1.13 0.67 1.05	1.232 0.619 0.977 1.052	
Mo-95(n,p)m	6	cf252_flux_1 fng_Mo fzk_ss316	0.50 0.71 0.44	0.517† 0.997 0.642†	
Mo-95(n,p)*	(5_2)	cf252_flux_1	0.08	0.013	
Mo-96(n,np)/ *(n,d+)*	(6)	fzk_ss316	1.75	1.541	/1.925
Mo-96(n,p)	6	sneg_1 fng_Mo	1.19 1.11	1 .159 1.075	
Mo-98(n,γ)	6	cf252_flux_1		1.045	
Mo-98(n,p)m	5_2	fng_heat	0.56	0.610	**C/E(5)=0.898**
Mo-98(n,t)/*(n,xt)*	5_3	d-Be3	0.81	1.169	/1.262
Mo-98(n,α)*	6	fns_7hour	0.48	0.741	**C/E(5)=0.878** σ(max)??
Mo-100(n,2n)*	6	fns_7hour sneg_1 sneg_2	0.98 1.00 1.02	0.962 0.990 0.989	

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
		fng_vanad	1.00	0.988	
		fzk_ss316	1.12	1.063	
		fzk_ss316	1.40	1.337	
		fng_Mo	1.10	1.086	
Mo-100(n,γ)	6	cf252_flux_1		0.956	
Mo-100(n,α)*	5_2	fzk_ss316	0.01	0.018	
Ru-96(n,2n)*	6	fns_5min	1.22	0.940	**C/E(5)=1.010** C/E(7)=0.980
Ru-100(n,p)*	6	fns_5min	0.59	0.821	
Ru-102(n,p)m	6	fns_5min		1.020	No TENDL FS=0,1 data
Rh-103(n,n)m	5_2	fns_5min	4.75	3.846	**C/E(5)=2.222** Dosimetry reaction Strange shape in TENDL
Rh-103(n,2n)g	5_2	rez_DF	0.27	0.272	
Rh-103(n,3n)m	5_0	rez_DF	1.63	1.450	
Rh-103(n,4n)	(5_3)	rez_DF	2.10	2.366	
Rh-103(n,γ)	(5_2)	fns_5min		2.504	
Rh-103(n,p)	5_2	rez_DF	1.75	1.910	
Pd-106(n,t)/*(n,t+)*	(5_0/5_3)	d-Be	0.07	0.061	/0.630
Pd-108(n,2n)m*	5	fns_5min	1.28	1.271	[5_2] C/E(7)=1.283
Pd-108(n,p)m	6	fns_5min		1.316	No TENDL FS=0,1 data
Pd-110(n,2n)m	6	fns_5min	1.61	1.268	**C/E(5)=1.112**
Pd-110(n,2n)	(6)	fns_5min	0.93	1.156	
Ag-107(n,2n)g	6	fns_5min	0.84	0.901	
		fng_heat	0.81	0.870	
Ag-107(n,t)/*(n,xt)**	5_2/5_2	d-Be3	1.16	2.782†	/3.058
		d-Be	0.83	1.258	/2.079
Ag-107(n,h)/*(n,h+)*	(5_0/5_0)	d-Be2a	0.05	0.180	/0.209
		d-Be2a	0.08	0.265	/0.308
Ag-109(n,2n)g	6	fns_5min	1.24	1.117	**C/E(5)=1.067**
		fng_heat	1.01		
Cd-110(n,γ)	(5)	cf252_flux_1		0.194	[5_2]
Cd-112(n,2n)m	6	fns_5min	1.09	1.048	
		fng_heat	0.87	0.835	
Cd-114(n,p)*	(6)	fns_5min	0.52	1.053	No TENDL FS=0,1 data
Cd-116(n,γ)	(5)	cf252_flux_1		0.261	[5_2]
In-113(n,2n)m	5	cf252_flux_1	0.36	0.307	[5_2]
In-113(n,2n)	(5)	cf252_flux_1	0.18	0.150	[5_2]
In-115(n,2n)g	5	fns_5min	1.08	1.206	[5_2]
In-115(n,n α)	(5)	d-Be2a	2.79	3.179	[5_2]
In-115(n,γ)m	5_1	cf252_flux_1		0.612	
		cf252_flux_1		0.546	
In-115(n,γ)	(5_2)	fns_5min		3.328	C/E(5)=3.368
In-115(n,t)/*(n,xt)*	(6)	d-Be	0.78	1.032	/1.860
In-115(n,h)g/*(n,h+)g*	5_4/5_4	d-Be2a	0.07	0.376	/0.874
In-115(n,h)/*(n,h+)*	(5_1/5_1)	d-Be2a	0.06	0.258	/0.280

Reaction	QS	**Spectrum**	**C/E TENDL-2009**	**C/E EAF-2010**	**Comment**
In-115(n,α)	5_2	d-Be2a	1.99	1.615	
Sn-112(n,2n)	6	fng_heat fng_Sn	0.61 0.86	0.666† 0.947	
Sn-114(n,2n)	(5_2)	fng_Sn	0.61	0.620	
Sn-114(n,np)m/ *(n,d+)m*	$5_3/5_3$	fng_Sn	0.19	0.362	/0.514
Sn-116(n,p)	(5_3)	fng_Sn	0.70	0.997	
Sn-116(n,np)m/ *(n,d+)m*	$5_0/5_0$	fng_Sn	0.18	0.181	/0.487
Sn-117(n,p)m	5_2	fng_Sn	0.89	0.595	
Sn-117(n,p)	(5_1)	fng_Sn	0.83	0.705	
Sn-118(n,2n)m	5_2	fns_7hour fng_Sn	0.80 0.57	0.795 0.572	
Sn-118(n,p)m*	6	fns_5min	0.40	0.910	**C/E(5)=0.940**
Sn-118(n,α)g*	5_2	fng_Sn	0.20	0.582	
Sn-120(n,2n)m	6	fns_7hour	1.44	1.133	
Sn-120(n,p)m	5_2	fns_5min	0.46	0.680	**C/E(5)=0.952**
Sn-120(n,α)g*	5_2	fng_Sn	0.12	0.610	
Sn-120(n,α)m*	5_2	fng_Sn	0.37	0.661	
Sn-124(n,2n)g	6	fns_7hour fng_Sn	0.92 0.51	0.952 0.529†	
Sn-124(n,2n)m	6	fns_5min fng_Sn	1.10 0.85	1.150 0.881	
Sb-121(n,2n)g	6	fns_5min		1.205	No TENDL FS=0,1 data
Sb-121(n,t)/*(n,xt)*	($5_3/5_3$)	d-Be	0.77	1.057	/1.944
Te-128(n,t)/*(n,t+)*	($5_0/5_3$)	d-Be	0.07	0.069	/0.528 C/E(5)=0.094
Te-130(n,2n)g	6	fns_5min	1.09	1.042	
I-127(n,2n)	6	cf252_flux_1	0.86	1.085	
I-127(n,γ)	5_2	fns_5min		1.695	
I-127(n,h)/*(n,h+)*	$5_{03}5_3$	d-Be2a	0.13	0.588	/0.627
I-127(n,α)/*(n,α+)**	($5_0/5_3$)	d-Be2a	2.53	2.738	/2.924 RN-???
Cs-133(n,2n)	6	fns_5min	1.44	1.235	**C/E(5)=1.190**
Cs-133(n,h)/*(n,h+)*	$5_{04}5_4$	d-Be2a	0.13	0.611	/0.648
Ba-132(n,2n)	(6)	fns_7hour	0.90	0.943	**C/E(5)=1.042**
Ba-134(n,2n)m	6	fns_7hour	1.03	1.075	
Ba-134(n,γ)	(5_2)	cf252_flux_1		0.197	
Ba-134(n,t)/*(n,t+)*	$5_0/5_3$	d-Be	0.17	0.228	/1.269
Ba-136(n,2n)m	6	fns_7hour	1.15	1.095	**C/E(5)=1.076**
Ba-136(n,γ)	(5_2)	cf252_flux_1		0.049	**C/E(5)=0.197**
Ba-138(n,2n)m	6	fns_5min	1.27	1.183	**C/E(5)=1.099**
Ba-138(n,γ)	6*	cf252_flux_1 cf252_flux_1		0.416† 1.216	
Ba-138(n,p)	(6)	fns_5min	1.05	1.099	
La-139(n,γ)	6*	tud_Er		0.950	
La-139(n,p)	6	fns_5min	1.25	1.163	

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
		tud_Er	1.34	0.970	
La-139(n,t)/*(n,xt)*	(6)	d-Be	0.30	0.453	/0.909
La-139(n,h)/*(n,h+)*	$5_3/5_3$	d-Be2a d-Be2a	0.12 0.11	0.502 0.488	/0.525 /0.511
La-139(n,α)/*(n,α+)*	**(6)**	d-Be2a tud_Er	1.57 0.46	1.387 1.090	/1.520 **C/E(5)=1.205** No TENDL FS=0,1 data
Ce-140(n,2n)m	6	fns_5min	1.36	1.099	
Ce-140(n,α)m*	6	fns_5min	0.32	1.042	
Ce-142(n,p)	6*	fns_5min	0.81	1.053	
Pr-141(n,2n)	5_2	fns_5min	1.47	1.370	
Pr-141(n,t)/*(n,xt)*	(6)	d-Be	0.67	0.794	/1.135 **C/E(7)=0.894**
Pr-141(n,t)/*(n,t+)*	(6)	d-Be	0.28	0.325	/1.186 **C/E(7)=0.331**
Nd-142(n,2n)m	6	fns_5min		1.333	No TENDL FS=0,1 data
Nd-146(n,h)/*(n,h+)*	$5_3/5_3$	d-Be2a	0.10	0.719	/0.747
Nd-146(n,α)/*(n,α+)*	6	d-Be2a	1.38	1.350	/1.448
Nd-150(n,2n)	5_2	fns_5min	1.72	1.829	
Sm-144(n,2n)m*	6	fns_5min	0.97	1.263	**C/E(5)=0.984** C/E(7)=1.136
Sm-144(n,2n)*	(6)	fns_5min	0.84	1.165	C/E(5)=1.148 **C/E(7)=1.111**
Sm-150(n,p)	6	fng_ScSmGd	1.06	1.245	
Sm-152(n,α)	6	fng_ScSmGd	0.36	0.803	
Sm-154(n,2n)	6	fng_ScSmGd	0.97	0.939	
Eu-151(n,γ)m	5_2	fns_5min	1.91	3.452	**C/E(5)=2.609**
Gd-158(n,p)	6	fng_ScSmGd	1.29	1.170	
Gd-158(n,α)*	5_2	fng_ScSmGd	0.73	2.005	
Gd-160(n,2n)	5_2	fns_5min fng_ScSmGd	1.36 0.88	1.209 0.779	
Gd-160(n,γ)	6	fns_5min		1.818	**C/E(5)=1.563**
Gd-160(n,p)	5_3	fns_5min	0.83	0.885	**C/E(5)=0.942**
Tb-159(n,2n)m*	5_2	fns_5min	0.17	1.351	
Tb-159(n,p)	6*	fns_5min	1.11	1.042	
Tb-159(n,t)/*(n,xt)*	$5_3/5_3$	d-Be	0.33	0.628	/1.127
Tb-159(n,α)/*(n,α+)**	6*	d-Be2a	3.68	2.827	/2.948
Dy-156(n,2n)	6	fng_Dy	1.03	1.120	
Dy-158(n,2n)	6	fng_Dy	0.87	0.969	
Dy-162(n,p)	6	fns_5min fng_Dy	1.89 1.04	$1.811^{\dagger}$ 1.000	**C/E(5)=1.482**
Dy-162(n,t)/*(n,t+)*	$5_0/5_3$	d-Be	0.15	0.218	/1.039
Dy-163(n,p)	6	fng_Dy	1.21	0.957	
Dy-164(n,γ)g	5_4	fng_Dy		0.752	
Dy-164(n,γ)m	6	fns_5min		1.351	**C/E(5)=0.852**
Dy-164(n,γ)	(5_2)	fns_5min		2.783	
Dy-164(n,p)	5_2	fns_5min	1.58	1.515	**C/E(5)=1.432**
Ho-165(n,2n)m*	6*	fns_5min	1.59	1.654	C/E(5)=0.485 **C/E(7)=1.136**
Ho-165(n,2n)*	(6)	fns_5min	1.28	1.191	

Reaction	QS	**Spectrum**	**C/E** **TENDL-2009**	**C/E** **EAF-2010**	**Comment**
Ho-165(n,t)/*(n,xt)*	$5_0/5_3$	d-Be	0.24	0.484	/0.889
Ho-165(n,h)/*(n,h+)*	$5_3/5_3$	d-Be2a	0.16	0.694	/0.733
Ho-165(n,α)/*(n,α+)*	6	d-Be2a	1.60	1.026	/1.112
Er-162(n,2n)	6	tud_Er	1.02	1.080	
Er-164(n,2n)	5_2	tud_Er	0.84	0.770	
Er-166(n,2n)*	5/2	fns_5min	4.66	4.611	**C/E(5)=1.267 = WRONG**
Er-166(n,p)g	6	tud_Er	1.18	0.893	
Er-167(n,p)	6	tud_Er	1.70	0.942	
Er-168(n,p)*	(6)	fns_5min	1.71	1.020	
		tud_Er	1.63	0.970	
Er-170(n,p)g	5_4	tud_Er	0.92	0.640	
Er-170(n,d)/*(n,d+)*	6	tud_Er	0.31	0.703	/0.890
Tm-169(n,2n)	6	fns_5min	0.91	0.877	
Yb-168(n,2n)	6	fns_5min	1.09	1.124	
Yb-174(n,p)	6	fns_5min	1.52	1.235	
Yb-174(n,h)/*(n,h+)*	$5_0/5_3$	d-Be2a	0.06	0.411	/0.430
Yb-174(n,α)/*(n,α+)*	6	d-Be2a	1.18	1.686	/1.744
Lu-175(n,γ)m	6	fns_5min		1.220	
Lu-175(n,2n)g	5_2	rez_DF	0.51	0.634	
Lu-175(n,3n)	5_2	rez_DF	1.53	1.465	
Lu-175(n,4n)	(5_3)	rez_DF	1.25	1.362	**C/E(5)=1.184**
Hf-174(n,2n)	6	fng_hafnium	0.94	0.942	**C/E(5)=1.000**
Hf-176(n,2n)	6	fng_hafnium	1.04	1.024	
Hf-177(n,n)n	5_3	fng_heat		1.270	**C/E(5)=1.124** No TENDL FS=2 data
Hf-178(n,p)m*	6	fng_hafnium	1.61	1.039	
Hf-178(n,p)	(6)	fng_hafnium	0.96	0.781	
Hf-179(n,p)	5_2	fng_hafnium	0.52	0.599	
Hf-180(n,n)m	6	fng_hafnium	1.93	1.948	**C/E(5)=0.987**
Hf-180(n,2n)m*	6	fns_5min	0.25	0.988	Probably different isom. st.
		fng_heat	0.22	0.868	
Hf-180(n,γ)	5_2	fng_hafnium		0.507	
Hf-180(n,p)	6	fns_5min	1.91	1.961†	BR in EAF not in TENDL
		fng_hafnium	0.60	0.614	
		fng_heat	0.62	0.640	
Ta-181(n,2n)g	6	fns_7hour	1.40	1.409	
		fns_5min	0.98	0.990	
		fng_Ta	1.02	1.036	
		tud_Ta	1.22	1.227	
		rez_DF	1.01	1.024	
		rez_DF	0.90	0.906	
Ta-181(n,n α)m	5_3	rez_DF		3.138	**C/E(5)=0.660** No TENDL FS=0,1 data
Ta-181(n,n α)	(5_3	rez_DF	2.50	2.615	**C/E(5)=0.314**
Ta-181(n,4n)m	5_0	rez_DF		0.255	No TENDL FS=0,1 data

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
Ta-181(n,γ)n	6	fng_Ta		0.521	
Ta-181(n,γ)	(6)	fng_eurofer cf252_flux_1 cf252_flux_1 fng_Ta rez_DF rez_DF fns_7hour		1.118 0.835 1.122 0.876 0.296† 2.018† 0.734	
Ta-181(n,p)	6	fns_7hour fng_Ta tud_Ta rez_DF	0.93 1.24 1.28 1.59	0.735 0.978 1.010 1.126	
Ta-181*(n,np)m* /(n,d+)m	$5_4/5_0$	fng_Ta tud_Ta rez_DF rez_DF		1.030 0.948 0.447 0.559	/4.758 /4.831 /0.620 /0.776 No TENDL FS=0,1 data
Ta-181(n,t)n	5_3	rez_DF		0.846	No TENDL FS=2 data
Ta-181(n,t)/*(n,xt)*	(6)	d-Be3 d-Be		0.694 0.528	/0.859 **C/E(5)=1.531** /1.156 **C/E(5)=0.761** No TENDL FS=2 data Summation problem
Ta-181(n,h)/*(n,h+)*	$5_4/5_4$	d-Be2a	0.26	1.049	/1.119
Ta-181(n,α)g	5_2	fng_Ta	0.69	0.440	
Ta-181(n,α)m	6	fng_Ta tud_Ta	1.47 1.34	1.017 0.925	
W-180(n,2n)m*	6	fzk_2	0.47	1.117	
W-180(n,3n)	5_3	fzk_2	0.88	1.003	
W-182(n,2n)	6	fns_7hour fng_tung fzk_2 fng_eurofer	1.25 1.17 0.82 1.12	1.221 1.153 0.750 1.106	
W-182(n,p)	(6)	sneg_1 fng_tung		0.852 1.062	No TENDL FS=2 data Summation problem
		sneg_1 sneg_2 fzk_ss316 fzk_2 **rez_DF**		1.208 1.067 0.154† 1.201 1.318	
W-182(n,α)n/*(n,α+)n*	6	rez_DF		0.320	/0.320 No TENDL FS=2 data
W-183(n,p)	5_2	sneg_1 sneg_2 fng_f82h	1.59 1.20 1.79	1.465 1.119 1.647	
W-183(n,α)m* */(n,α+)m*	6	fzk_2 rez_DF	1.51 8.33	0.778 2.500†	 /2.502
W-184*(n,np)* /(n,d+)	$5_3/5_3$	fzk_ss316 rez_DF	0.53 1.36	0.473 1.226	/0.651 /1.739

Reaction	QS	**Spectrum**	**C/E TENDL-2009**	**C/E EAF-2010**	**Comment**
		rez_DF	1.37	1.239	/1.758
W-184(n,p)	6	fns_7hour fng_tung fng_f82h sneg_1 fzk_ss316 fzk_2 rez_DF	1.12 0.91 1.27 1.18 4.25 0.92 2.47	1.136 0.911 1.276 1.173 4.057† 0.902 2.361	**C/E(5)=1.064**
W-184(n,t)/*(n,t+)*	($5_0/5_3$)	d-Be		0.098	/0.623 **C/E(5)=0.141** No TENDL FS=2 data Summation problem
W-184(n,α)	6	fng_tung fzk_2 sneg_1 sneg_2 rez_DF	0.61 0.69 0.67 0.70 2.25	1.234 1.022 1.394 1.491 2.015†	σ(max) too large??
W-186(n,2n)m	6	fns_5min fng_tung sneg_1	1.42 0.75 0.70	1.853† 0.943 0.880	
W-186(n,2n)	(6)	fns_7hour fzk_2 fng_tung **rez_DF**	1.22 1.00 1.02 0.96	1.221 0.872 0.984 0.802	
W-186(n,np)/ ***(n,d+)***	$5_2/5_2$	fng_tung fzk_2 rez_DF	0.10 0.17 1.32	0.094 0.164 1.210	/0.427 /0.349 **C/E(5)=0.785** /1.615
W-186(n,n α)m	5_4	fzk_2 rez_DF	0.92 4.62	1.591 4.198†	**C/E(5) = 1.055**
W-186(n,γ)	6	fng_f82h fng_tung sneg_1 rez_DF rez_DF **fzk_ss316**		0.926 1.011 0.931 0.179† 0.762 0.668	
W-186(n,p)	6	fns_5min fng_tung fzk_2 sneg_1	1.71 0.88 0.87 0.98	2.041† 1.005 1.001 1.119	
W-186(n,h)/*(n,h+)*	$5_3/5_3$	d-Be2a	0.08	0.497	/0.519
W-186(n,α)* */(n,α+)* */(n,α+)*	6	fng_tung fzk_2 sneg_1 d-Be2a rez_DF	0.40 0.60 0.42 1.73 1.57	0.962 0.990 0.978 1.443 1.436†	σ(max) too large?? /1.488 /1.436
Re-185(n,2n)g	5_2	fns_7hour fng_heat	0.80 0.57	0.855 0.625	

Reaction	QS	**Spectrum**	**C/E TENDL-2009**	**C/E EAF-2010**	**Comment**
		fng_Re	0.67	0.735	
Re-185(n,2n)m*	6	fns_7hour fng_Re	1.85 2.25	0.917 1.103	
Re-185(n,3n)	5_3	fng_Re	0.80	0.643	
Re-185(n,p)m	6*	fns_5min fng_heat	0.77 0.36	1.155 0.546	
Re-187(n,2n)g*	6	fns_7hour fns_5min fng_heat fng_Re	0.78 0.79 0.61 0.65	1.112 1.158 0.893 0.961	C/E(7)=1.112 C/E(7)=1.258 C/E(7)=0.767 C/E(7)=0.885
Re-187(n,γ)m	6*	fng_heat fng_Re		0.500 0.948	
Re-187(n,γ)	(6)	fng_Re		0.635	
Re-187(n,p)	6*	fng_Re	1.00	0.919	
Re-187(n,t)/*(n,xt)*	(5_0/5_3)	d-Be	0.767	0.904	/2.223
Re-187(n,α)	6*	fng_Re	1.13	0.931	
Os-190(n,n)m	5_2	fns_5min		2.735	**C/E(5)=2.272** No TENDL FS=1 data
Ir-193(n,2n)m*	5_2	fns_5min		0.869	C/E(7)=2.498
Pt-198(n,2n)m*	6	fns_5min	1.08	1.307	**C/E(7)=1.164**
Au-197(n,n)m	5_2	fns_5min	0.76	1.667	
Au-197(n,2n)m*	6	fns_5min	12.08	1.099	
Au-197(n,2n)n	6	fns_5min rez_DF		1.370† 1.238	No TENDL FS=2 data
Au-197(n,2n)	(6)	cf252_flux_1 cf252_flux_1 cf252_flux_1 cf252_flux_1 cf252_flux_1 rez_DF		1.334† 1.089 1.093 0.989 1.043 1.086	No TENDL FS=2 data Summation problem
Au-197(n,3n)m	5_3	fns_5min	1.24	1.266	
Au-197(n,3n)	(6)	rez_DF	1.04	0.913	
Au-197(n,4n)	(6)	rez_DF	0.77	0.526	
Au-197(n,γ)	(6)	cf252_flux_1 cf252_flux_1 cf252_flux_1		0.673 0.962 0.950	
Au-197(n,t)/*(n,xt)*	($5_3 5_3$)	d-Be	0.55	0.726	/1.466 **C/E(5)=1.072**
Au-197(n,h)g/*(n,h+)g*	5_0/5_0	d-Be2a	0.04	0.195	/0.210
Au-197(n,h)/*(n,h+)*	(5_0/5_0)	d-Be2a	0.25	0.951	/1.010
Au-197(n,α)g/*(n,α+)g*	6	d-Be2a		1.631	/1.650 No TENDL FS=0,1 data
Au-197(n,α)m/*(n,α+)m*	6	d-Be2a		0.782	/1.433 No TENDL FS=0,1 data
Hg-198(n,γ)	(5_2)	cf252_flux_1		0.143	
Hg-200(n,2n)m	6	fns_5min	1.18	0.866	
Tl-203(n,2n)	6	fns_5min	1.37	1.205	
Tl-205(n,γ)	(6)	fns_5min		0.793	**C/E(5)=0.954**

Reaction	QS	**Spectrum**	**C/E TENDL-2009**	**C/E EAF-2010**	**Comment**
Tl-205(n,p)	6	fns_5min	1.35	0.787	**C/E(5)=1.010**
Tl-205(n,t)/*(n,xt)*	6	d-Be3 d-Be	0.37 0.42	1.137 1.189	/1.183 /1.640
Tl-205(n,t)/*(n,t+)*	6	d-Be	0.09	0.251	/0.780
Pb-204(n,n)m	6	fns_5min fng_heat tud_Pb		1.064 0.940 0.920	No TENDL FS=1 data
Pb-204(n,2n)m	5_2	fns_5min	0.50	0.656	**C/E(5)=0.679**
Pb-204(n,2n)	(6)	fns_7hour fng_heat tud_Pb		0.943 0.839 0.966	No TENDL FS=2 data Summation problem
Pb-206(n,p)*	(5_2)	fng_heat	0.36	0.256	No TENDL FS=0,1 data
Pb-206(n,α)*	6	tud_Pb fns_7hour	0.16 0.07	0.761 0.315†	New XS shape needed INTERESTING
Pb-208(n,p)*	5_2	fns_5min fng_heat tud_Pb	0.31 0.15 0.37	0.704 0.350 0.864	**C/E(5)=0.771**
Pb-208(n,t)/*(n,xt)*	(5_0/5_3)	d-Be3	0.39	0.360	/0.407 **C/E(5)=0.879**
Pb-208(n,t)/*(n,t+)*	(5_0/5_3)	d-Be	0.14	0.126	/0.697 **C/E(5)=0.193**
Bi-209(n,3n)	6	rez_DF	0.99	0.868	
Bi-209(n,4n)	6	rez_DF	0.97	0.775	
Bi-209(n,p)*	5_4	fns_5min	1.22	0.010	**C/E(7)=1.190** Strange, RN-EXP used
Bi-209(n,t)/*(n,xt)*	(5_4/5_4)	d-Be3 d-Be	0.86 1.04	0.775 0.891	/0.988 C/E(7)=1.258 /2.217 C/E(7)=1.380
Bi-209(n,h)/*(n,h+)*	(5_4/5_4)	d-Be2a	0.42	1.727	/1.800 **C/E(5)=0.688**
Bi-209(n,α)	(6)	fns_5min	1.22	0.093	C/E(7)=1.411 Problems with EAF FS=99 Probably bad channel taken No TENDL FS=0,1 data
Th-232(n,f)	6	cf252_flux_1 cf252_flux_1	0.88 0.93	0.915 0.965	
Pa-231(n,f)	6	cf252_flux_1	1.11	0.891	
U-233(n,f)	6	cf252_flux_1 cf252_flux_1	0.97 1.0	0.942 0.969	
U-234(n,f)	6	cf252_flux_1	1.00	0.992	
U-235(n,f)	6	cf252_flux_1 cf252_flux_1 cf252_flux_1 cf252_flux_1 cf252_flux_1	0.97 1.01 1.01 1.16 0.99	0.962 1.003 1.002 1.158 0.987	
U-236(n,f)	6	cf252_flux_1	0.98	0.987	
U-238(n,2n)*	5_2	cf252_flux_1 cf252_flux_1	0.11 1.77	0.106 1.670	C/E(7)=0.106 C/E(7)=1.670
U-238(n,f)	6	cf252_flux_1	0.97	0.960	

Reaction	QS	Spectrum	C/E TENDL-2009	C/E EAF-2010	Comment
		cf252_flux_1	0.99	0.975	
		cf252_flux_1	1.11	1.096	
		cf252_flux_1	1.04	1.025	
		cf252_flux_1	0.96	0.951	
		cf252_flux_1	1.03	1.016	
Np-237(n,2n)m	5_2	cf252_flux_1	0.42	0.621	
Np-237(n,f)	6	cf252_flux_1	1.08	1.044	
		cf252_flux_1	0.98	0.953	
		cf252_flux_1	0.99	0.963	
		cf252_flux_1	0.94	0.912	
Pu-239(n,f)	6	cf252_flux_1	1.00	0.999	
		cf252_flux_1	0.97	0.975	
		cf252_flux_1	0.96	0.966	
		cf252_flux_1	1.00	1.004	
Pu-240(n,f)	6	cf252_flux_1	1.02	1.025	
		cf252_flux_1	1.04	1.046	
Pu-241(n,f)	6	cf252_flux_1	0.98	1.004	
		cf252_flux_1	0.91	0.930	
Am-243(n,f)	6	cf252_flux_1	0.96	1.001	