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UNIVERSIDAD DE SEVILLA



**PROPAGATION OF ERRORS IN  
NUCLEAR DATA TO REACTOR  
PARAMETERS**

Additional information

**CIEMAT**

Unidad de Innovación Nuclear

División de Fisión Nuclear - Dpto. Energía

*Master thesis*

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June 2022



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## A Values of $k_{eff}$ , $\beta_{eff}$ and their uncertainties.

Table A.1: Multiplication factor  $k_{eff}$  and total uncertainties for each reactor.

Benchmark	$k_{eff}^{exp}$	$k_{eff}^{MCNP} \pm$ Stat. Unc.	Unc. to Data $\pm$ Stat. Unc.		
			JEFF-3.3	JENDL-4.0u	ENDF/B-VIII.0
HEU-MET	0.997	1.01018	0.018268	0.00935	0.013770
-INTER-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
001	0.003	0.00002	0.000019	0.00005	0.000011
MIX-COMP	0.9913	0.99255	0.009689	0.008910	0.006152
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
005	0.0023	0.00001	0.000011	0.000015	0.000006
PU-MET	0.9878	1.00259	0.01309	0.00806	0.005552
-INTER-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
002	0.0023	0.00002	0.00011	0.00004	0.000022
PU-MET	0.9723	0.97378	0.009692	0.006823	0.006380
-INTER-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
004	0.0025	0.00002	0.000011	0.000015	0.000020
IEU-MET	0.9954	0.99735	0.018810	0.01437	0.006380
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
010	0.0024	0.00002	0.000021	0.00003	0.000020
IEU-MET	1.002	1.00562	0.015714	0.008200	0.010980
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
020	0.0013	0.00001	0.000008	0.000012	0.000004
IEU-MET	1.00839	1.01149	0.016834	0.010713	0.012207
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
021	0.00145	0.00001	0.000009	0.000019	0.000011
IEU-MET	1.00077	1.00233	0.016435	0.007472	0.011107
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
022	0.00134	0.00001	0.000007	0.000010	0.000003
LEU-COMP	1.0000	1.00072	0.008652	0.007082	0.0091990
-THERM-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
006	0.0025	0.00001	0.000004	0.000003	0.0000011
LEU-COMP	1.0005	1.00163	0.00907	0.00771	0.01007
-THERM-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
067	0.0005	0.00004	0.00008	0.00009	0.00006
PU-MET	1.0002	0.99929	0.006881	0.0073271	0.013770
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
001	0.0037	0.00001	0.000004	0.0000019	0.000011
IEU-MET	1.0045	1.00493	0.018049	0.013764	0.011716
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
007	0.0007	0.00001	0.000010	0.000017	0.000006
PU-MET	1.000	1.00335	0.009819	0.008137	0.007409
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
006	0.003	0.00002	0.000011	0.000009	0.000009

Table A.2: Multiplication factor  $k_{eff}$  and total uncertainties for each reactor.

Benchmark	$k_{eff}^{exp}$	$k_{eff}^{MCNP} \pm$ Stat. Unc.	Unc. to Data $\pm$ Stat. Unc.		
			JEFF-3.3	JENDL-4.0u	ENDF/B-VIII.0
U233-MET	1.0000	1.00337	0.010679	0.011407	0.011621
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
006	0.0014	0.00002	0.000008	0.000007	0.000006
HEU-MET	1.000	1.00013	0.013189	0.010413	0.012084
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
001	0.001	0.00001	0.000010	0.000012	0.000003
HEU-MET	1.000	1.00412	0.014152	0.008806	0.012332
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
028	0.003	0.00001	0.000009	0.000011	0.000006
FCA		1.00761	0.014593	0.008627	0.013061
-XIX-	-	$\pm$	$\pm$	$\pm$	$\pm$
1		0.00002	0.000007	0.000009	0.000004
FCA		1.21884	0.008631	0.007346	0.005784
-XIX-	-	$\pm$	$\pm$	$\pm$	$\pm$
2		0.00002	0.000009	0.000013	0.000008
FCA		0.99441	0.007109	0.00669	0.005306
-XIX-	-	$\pm$	$\pm$	$\pm$	$\pm$
3		0.00002	0.000013	0.00003	0.000022
		1.0095	0.008618	0.007185	0.005619
SNEAK-7A	-	$\pm$	$\pm$	$\pm$	$\pm$
		0.00002	0.000010	0.000015	0.000008
		1.00488	0.010033	0.009633	0.006579
SNEAK-7B	-	$\pm$	$\pm$	$\pm$	$\pm$
		0.00001	0.000011	0.000019	0.000007
MASUR-		0.99246	0.01658	0.00703	0.01207
CA_	-	$\pm$	$\pm$	$\pm$	$\pm$
R2		0.00002	0.00011	0.00008	0.00008
MASUR-		1.00309	0.00813	0.00689	0.00522
CA_	-	$\pm$	$\pm$	$\pm$	$\pm$
ZONA2		0.00002	0.00009	0.00007	0.00005
HEU-MET	0.9987	1.00338	0.013792	0.008211	0.011923
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
062	0.001	0.00002	0.000012	0.000013	0.000008
HEU-MET	1.0026	1.00412	0.013210	0.010373	0.012097
-FAST-	$\pm$	$\pm$	$\pm$	$\pm$	$\pm$
100	0.0007	0.00001	0.000010	0.000012	0.000004

Table A.3: Delayed neutron fraction  $\beta_{eff}$  and total uncertainties for each reactor. In the top of each row is the  $\beta_{eff}$  and uncertainty calculated by Bretscher's method, and in the bottom by Chiba's method.

Benchmark	$\beta_{eff}^{exp}$ (pcm)	$\beta_{eff}^{eval} \pm$ Stat. Unc. (pcm)	Unc. to Data $\pm$ Stat. Unc. (pcm)		
			JEFF-3.3	JENDL-4.0u	ENDF/B-VIII.0
HEU-MET -INTER- 001	$659 \pm 13$	$682 \pm 3$	32	27	34.7
			$\pm$	$\pm$	$\pm$
			6	5	1.9
		$684.20 \pm 0.10$	4.47	18.22	31.208
			$\pm$	$\pm$	$\pm$
			0.12	0.04	0.021
MIX-COMP -FAST- 005	$381 \pm 8$	$387.9 \pm 1.4$	9.3	15.9	8
			$\pm$	$\pm$	$\pm$
			1.9	2.2	3
		$375.60 \pm 0.10$	5.1	10.86	4.34
			<i>pm</i>	$\pm$	$\pm$
			0.1	0.07	0.05
PU-MET -INTER- 002	$222 \pm 4$	$234 \pm 3$	22	29	18
			$\pm$	$\pm$	$\pm$
			4	8	4
		$233.10 \pm 0.10$	1.79	11.32	1.35
			$\pm$	$\pm$	$\pm$
			0.15	0.07	0.22
PU-MET -INTER- 004	$223 \pm 10$	$250 \pm 3$	10.7	14.2	15
			$\pm$	$\pm$	$\pm$
			1.8	1.7	4
		$248.60 \pm 0.10$	1.88	10.386	1.35
			$\pm$	$\pm$	$\pm$
			0.10	0.017	0.09
IEU-MET -FAST- 010	$725 \pm 15$	$738 \pm 3$	11	21	22.1
			$\pm$	$\pm$	$\pm$
			3	3	2.4
		$713.60 \pm 0.20$	6.06	18.21	19.95
			$\pm$	$\pm$	$\pm$
			0.21	0.07	0.03

Table A.4: Delayed neutron fraction  $\beta_{eff}$  and total uncertainties for each reactor. In the top of each row is the  $\beta_{eff}$  and uncertainty calculated by Bretscher's method, and in the bottom by Chiba's method.

Benchmark	$\beta_{eff}^{exp}$ (pcm)	$\beta_{eff}^{eval} \pm$ Stat. Unc. (pcm)	Unc. to Data $\pm$ Stat. Unc. (pcm)		
			JEFF-3.3	JENDL-4.0u	ENDF/B-VIII.0
IEU-MET -FAST- 020	$(7.7 \pm 0.5) \cdot 10^1$	$746.8 \pm 1.4$	7.8	22.4	23.4
			$\pm$	$\pm$	$\pm$
			1.5	1.9	1.0
		$728.20 \pm 0.10$	5.02	18.04	22.954
			$\pm$	$\pm$	$\pm$
			0.07	0.03	0.012
IEU-MET -FAST- 021	$(7.7 \pm 0.5) \cdot 10^1$	$750.3 \pm 1.4$	6.7	21.0	22.6
			$\pm$	$\pm$	$\pm$
			1.4	2.0	0.4
		$732.20 \pm 0.10$	5.54	18.53	21.977
			$\pm$	$\pm$	$\pm$
			0.08	0.05	0.011
IEU-MET -FAST- 022	$(7.7 \pm 0.5) \cdot 10^1$	$750.3 \pm 1.4$	9.0	19.7	23.8
			$\pm$	$\pm$	$\pm$
			2.0	1.2	0.3
		$728.40 \pm 0.10$	5.15	17.66	23.768
			$\pm$	$\pm$	$\pm$
			0.07	0.03	0.012
LEU-COMP -THERM- 006	$771 \pm 19$	$795.4 \pm 1.4$	5.3	22.24	30.15
			$\pm$	$\pm$	$\pm$
			0.7	0.16	0.06
		$787.60 \pm 0.10$	4.96	21.928	30.021
			$\pm$	$\pm$	$\pm$
			0.04	0.009	0.009
LEU-COMP -THERM- 067	$750 \pm 19$	$774.7 \pm 4.4$	6	23	31
			$\pm$	$\pm$	$\pm$
			6	5	11
		$767.3 \pm 0.3$	4.6	22.13	30.47
			$\pm$	$\pm$	$\pm$
			0.3	0.19	0.19



Table A.5: Delayed neutron fraction  $\beta_{eff}$  and total uncertainties for each reactor. In the top of each row is the  $\beta_{eff}$  and uncertainty calculated by Bretscher's method, and in the bottom by Chiba's method.

Benchmark	$\beta_{eff}^{exp}$ (pcm)	$\beta_{eff}^{eval} \pm$ Stat. Unc. (pcm)	Unc. to Data $\pm$ Stat. Unc. (pcm)		
			JEFF-3.3	JENDL-4.0u	ENDF/B-VIII.0
PU-MET -FAST- 001	194 $\pm$ 10	188.1 $\pm$ 1.4	1.8	4.58	1.14
			$\pm$	$\pm$	$\pm$
			0.4	0.07	0.12
		188.50 $\pm$ 0.10	1.53	4.529	1.150
			$\pm$	$\pm$	$\pm$
IEU-MET -FAST- 007	720 $\pm$ 7	739.4 $\pm$ 1.4	0.04	0.004	0.007
			6.9	21	20.5
			$\pm$	$\pm$	$\pm$
		714.90 $\pm$ 0.10	2.0	3	0.5
			5.69	18.21	20.058
PU-MET- -FAST- 006	276 $\pm$ 7	287 $\pm$ 3	$\pm$	$\pm$	$\pm$
			1.6	1.5	0.7
			3.15	7.74	2.02
		284.10 $\pm$ 0.10	$\pm$	$\pm$	$\pm$
			0.07	0.06	0.04
U233-MET -FAST- 006	360 $\pm$ 14	376 $\pm$ 3	25.6	21.6	20.5
			$\pm$	$\pm$	$\pm$
			0.6	0.6	0.3
		374.30 $\pm$ 0.10	24.853	20.94	19.965
			$\pm$	$\pm$	$\pm$
HEU-MET -FAST- 001	659 $\pm$ 10	650.9 $\pm$ 1.4	0.018	0.03	0.016
			8.9	19.2	29.46
			$\pm$	$\pm$	$\pm$
		648.00 $\pm$ 0.10	1.4	0.8	0.07
			9.14	19.02	29.748
			$\pm$	$\pm$	$\pm$
			0.09	0.03	0.014

Table A.6: Delayed neutron fraction  $\beta_{eff}$  and total uncertainties for each reactor. In the top of each row is the  $\beta_{eff}$  and uncertainty calculated by Bretscher's method, and in the bottom by Chiba's method.

Benchmark	$\beta_{eff}^{exp}$ (pcm)	$\beta_{eff}^{eval} \pm$ Stat. Unc. (pcm)	Unc. to Data $\pm$ Stat. Unc. (pcm)		
			JEFF-3.3	JENDL-4.0u	ENDF/B-VIII.0
HEU-MET -FAST- 028	675 $\pm$ 13	692.1 $\pm$ 1.4	9.4	22.2	27.1
			$\pm$	$\pm$	$\pm$
			1.8	1.7	0.3
		687.20 $\pm$ 0.10	6.99	18.41	27.353
			$\pm$	$\pm$	$\pm$
FCA -XIX- 1	742 $\pm$ 24	764.2 $\pm$ 2.8	0.07	0.03	0.013
			$\pm$	$\pm$	$\pm$
			14.4	22.3	34.1
		760.10 $\pm$ 0.20	2.3	1.7	0.5
			$\pm$	$\pm$	$\pm$
FCA -XIX- 2	364 $\pm$ 9	362.6 $\pm$ 2.3	4.45	18.591	32.760
			$\pm$	$\pm$	$\pm$
			0.05	0.021	0.022
		357.10 $\pm$ 0.10	13	16	11
			$\pm$	$\pm$	$\pm$
FCA -XIX- 3	251 $\pm$ 4	256 $\pm$ 3	3	4	3
			$\pm$	$\pm$	$\pm$
			17	16	9
		257.80 $\pm$ 0.10	4	4	3
			$\pm$	$\pm$	$\pm$
SNEAK-7A	(40 $\pm$ 3) $\cdot$ 10	387 $\pm$ 3	1.69	7.05	1.67
			$\pm$	$\pm$	$\pm$
			7	16	8.3
		372.40 $\pm$ 0.10	3	4	1.9
			$\pm$	$\pm$	$\pm$
			0.12	0.06	0.08
			5.46	10.84	3.80
			$\pm$	$\pm$	$\pm$
			0.14	0.08	0.05

Table A.7: Delayed neutron fraction  $\beta_{eff}$  and total uncertainties for each reactor. In the top of each row is the  $\beta_{eff}$  and uncertainty calculated by Bretscher's method, and in the bottom by Chiba's method.

Benchmark	$\beta_{eff}^{exp}$ (pcm)	$\beta_{eff}^{eval} \pm$ Stat. Unc. (pcm)	Unc. to Data $\pm$ Stat. Unc. (pcm)		
			JEFF-3.3	JENDL-4.0u	ENDF/B-VIII.0
SNEAK-7B	$(44.0 \pm 3.4) \cdot 10$	$437.9 \pm 1.4$	10.0	19	8.6
			$\pm$	$\pm$	$\pm$
			2.1	4	2.3
		$417.60 \pm 0.10$	5.53	11.95	5.14
			$\pm$	$\pm$	$\pm$
MASURCA R2	$721 \pm 11$	$740 \pm 3$	0.15	0.10	0.05
			$\pm$	$\pm$	$\pm$
			14	25	28
		$727.20 \pm 0.20$	$\pm$	$\pm$	$\pm$
			11	10	8
MASURCA ZONA2	$349 \pm 6$	$352.9 \pm 2.8$	4.5	17.7	26.4
			$\pm$	$\pm$	$\pm$
			12	10	8
		$345.40 \pm 0.10$	4.1	9.13	3.2
			$\pm$	$\pm$	$\pm$
HEU-MET -FAST- 062	$663 \pm 17$	$7'00 \pm 3$	0.6	0.18	0.7
			$\pm$	$\pm$	$\pm$
			12.7	19.5	27.31
		$687.50 \pm 0.20$	2.5	1.1	0.13
			$\pm$	$\pm$	$\pm$
HEU-MET -FAST- 100	$657 \pm 9$	$646.3 \pm 1.4$	6.71	18.36	27.295
			$\pm$	$\pm$	$\pm$
			11.0	18.9	29.41
		$648.60 \pm 0.10$	2.0	0.6	0.07
			$\pm$	$\pm$	$\pm$
			0.09	0.04	0.018
			9.00	18.98	29.710
			$\pm$	$\pm$	$\pm$
			0.09	0.03	0.013

## B Results of Chiba analysis

### B.1 MIX-COMP-FAST-005

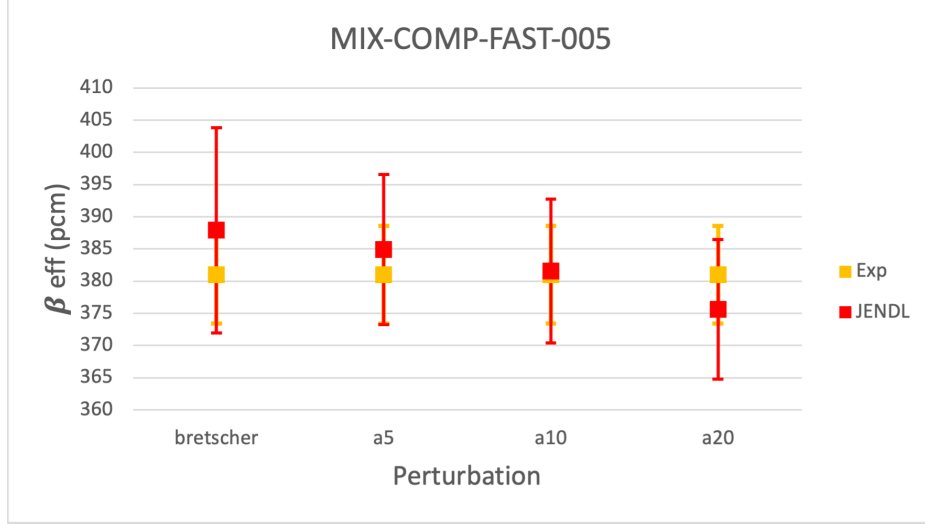


Figure B.1.1: Experimental and Chiba's method  $\beta_{eff}$  for different values of the perturbation.

Table B.1.1: Experimental and evaluated delayed neutron fraction of MIX-COMP-FAST-005 obtained for different cases. Uncertainty for the JENDL-4.0u library.

Case	MIX-COMP-FAST-005	
	$\beta_{eff} \pm \text{Stat. Unc. (pcm)}$	Unc. to Data $\pm \text{Stat. Unc. (pcm)}$
Experimental	381 $\pm$ 2	-
Brestcher	387.9 $\pm$ 1.4	16.0 $\pm$ 8.5
$a = 5$	384.9 $\pm$ 0.3	11.6 $\pm$ 1.2
$a = 10$	381.60 $\pm$ 0.20	11.1 $\pm$ 0.6
$a = 20$	375.60 $\pm$ 0.10	10.85 $\pm$ 0.19

Table B.1.2: Evaluated reaction uncertainties due to data (standard deviation) of delayed neutron fraction of MIX-COMP-FAST-005 obtained for different cases. Uncertainty for the JENDL-4.0u library.

Case	MIX-COMP-FAST-005 uncertainties (%)			
	$^{238}\text{U} (n,n')$	$^{238}\text{U} \bar{\nu}_d$	$^{56}\text{Fe} (n,n)$	$^{239}\text{Pu} \bar{\nu}_d$
Bretscher	2.1 $\pm$ 0.8	1.895 $\pm$ 0.005	1.7 $\pm$ 0.8	1.5127 $\pm$ 0.0022
$a = 5$	1.32 $\pm$ 0.04	1.849 $\pm$ 0.003	-	1.5242 $\pm$ 0.0018
$a = 10$	1.139 $\pm$ 0.005	1.8197 $\pm$ 0.0023	-	1.5391 $\pm$ 0.0016
$a = 20$	1.157 $\pm$ 0.004	1.7689 $\pm$ 0.0019	-	1.5671 $\pm$ 0.0015

## B.2 HEU-MET-INTER-001

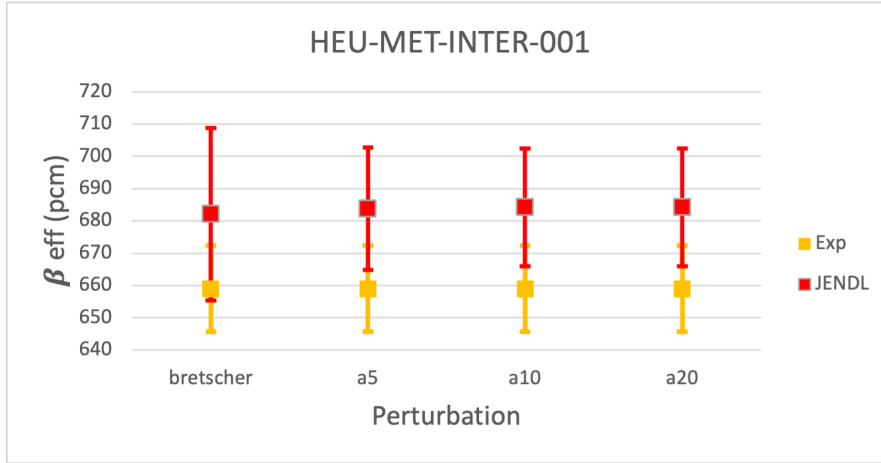


Figure B.2.1: Experimental and Chiba's method  $\beta_{eff}$  for different values of the perturbation.

Table B.2.1: Experimental and evaluated delayed neutron fraction of HEU-MET-INTER-001 obtained for different cases. Uncertainty for the JENDL-4.0u library. (\*) Experimental uncertainty

Case	HEU-MET-INTER-001	
	$\beta_{eff} \pm \text{Stat. Unc. (pcm)}$	Unc. due to Data $\pm \text{Stat. Unc. (pcm)}$
Experimental	659 ± 13.34*	-
Brestcher	682.1 ± 2.8	27 ± 14
$a = 5$	683.8 ± 0.6	19.0 ± 2.2
$a = 10$	684.2 ± 0.3	18.3 ± 0.8
$a = 20$	684.2 ± 0.1	18.2 ± 0.4

Table B.2.2: Evaluated reaction uncertainties due to data (standard deviation) of delayed neutron fraction of HEU-MET-INTER-001 obtained for different cases. Uncertainty for the JENDL-4.0u library.

Case	HEU-MET-INTER-001 uncertainties (%)	
	$^{235}\text{U } \bar{\nu}_d$	$^{56}\text{Fe (n,n)}$
Bretscher	2.627 ± 0.004	2.1 ± 1.2
$a = 5$	2.6214 ± 0.0024	0.76 ± 0.13
$a = 10$	2.6240 ± 0.0020	0.33 ± 0.04
$a = 20$	2.6274 ± 0.0018	-

### B.3 IEU-MET-FAST-007

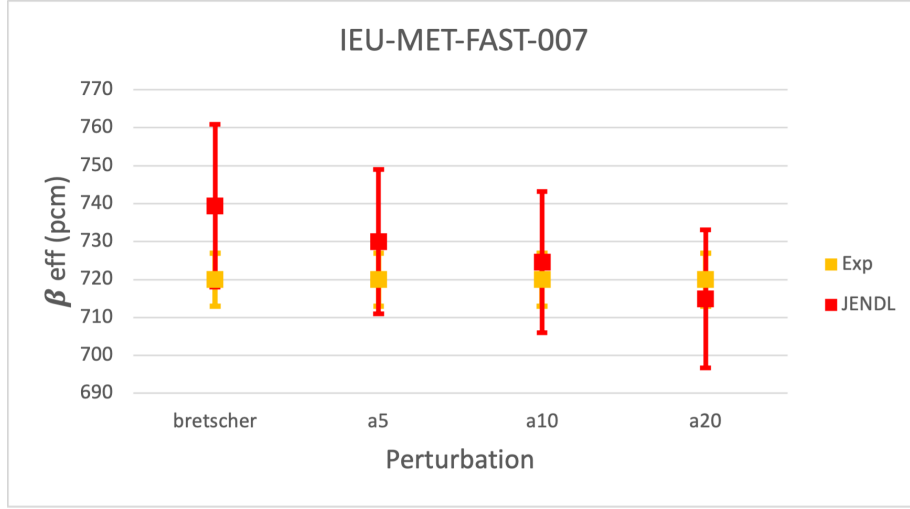


Figure B.3.1: Experimental and Chiba's method  $\beta_{eff}$  for different values of the perturbation.

Table B.3.1: Experimental and evaluated delayed neutron fraction of IEU-MET-FAST-007 obtained for different cases. Uncertainty for the JENDL-4.0u library. (\*) Experimental uncertainty

Case	IEU-MET-FAST-007	
	$\beta_{eff} \pm \text{Stat. Unc. (pcm)}$	Unc. due to Data $\pm \text{Stat. Unc. (pcm)}$
Experimental	720 $\pm$ 7*	-
Brestcher	739.4 $\pm$ 1.4	22 $\pm$ 8
$a = 5$	730 $\pm$ 0.3	19.0 $\pm$ 1.0
$a = 10$	724.6 $\pm$ 0.1	18.6 $\pm$ 0.6
$a = 20$	714.9 $\pm$ 0.1	18.2 $\pm$ 0.3

Table B.3.2: Evaluated reaction uncertainties due to data (standard deviation) of delayed neutron fraction of IEU-MET-FAST-007 obtained for different cases. Uncertainty for the JENDL-4.0u library.

Case	IEU-MET-FAST-007 uncertainties (%)		
	$^{235}\text{U } \bar{\nu}_d$	$^{238}\text{U } \bar{\nu}_d$	$^{238}\text{U (n,n)}$
Bretscher	1.8640 $\pm$ 0.0018	1.4815 $\pm$ 0.0021	1.3 $\pm$ 0.8
$a = 5$	1.8964 $\pm$ 0.0015	1.4271 $\pm$ 0.0016	-
$a = 10$	1.9258 $\pm$ 0.0013	1.3866 $\pm$ 0.0013	-
$a = 20$	1.9739 $\pm$ 0.0011	1.3102 $\pm$ 0.0011	-

## B.4 IEU-MET-FAST-010

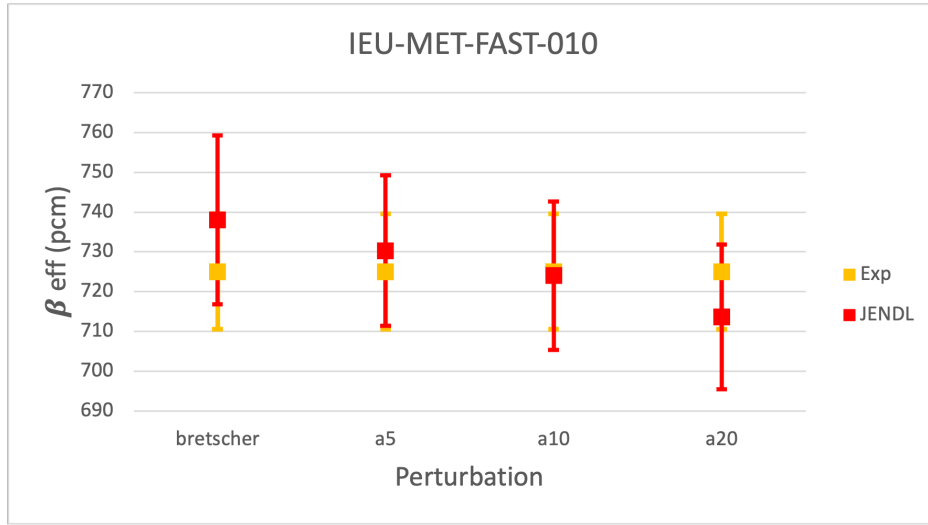


Figure B.4.1: Experimental and Chiba's method  $\beta_{eff}$  for different values of the perturbation.

Table B.4.1: Experimental and evaluated delayed neutron fraction of IEU-MET-FAST-010 obtained for different cases. Uncertainty for the JENDL-4.0u library. (\*) Experimental uncertainty

Case	IEU-MET-FAST-010	
	$\beta_{eff} \pm \text{Stat. Unc. (pcm)}$	Unc. due to Data $\pm \text{Stat. Unc. (pcm)}$
Experimental	$725 \pm 2^*$	-
Brestcher	$738 \pm 2.8$	$21 \pm 10$
$a = 5$	$730.3 \pm 0.6$	$18.9 \pm 1.8$
$a = 10$	$724 \pm 0.3$	$18.6 \pm 0.9$
$a = 20$	$713.6 \pm 0.2$	$18.2 \pm 0.3$

Table B.4.2: Evaluated reaction uncertainties due to data (standard deviation) of delayed neutron fraction of IEU-MET-FAST-010 obtained for different cases. Uncertainty for the JENDL-4.0u library.

Case	IEU-MET-FAST-010 uncertainties (%)		
	$^{235}\text{U } \bar{\nu}_d$	$^{238}\text{U } \bar{\nu}_d$	$^{238}\text{U (n,n)}$
Bretscher	$1.852 \pm 0.003$	$1.504 \pm 0.004$	$1.0 \pm 1.0$
$a = 5$	$1.885 \pm 0.003$	$1.448 \pm 0.003$	-
$a = 10$	$1.9106 \pm 0.0023$	$1.4031 \pm 0.0023$	-
$a = 20$	$1.9601 \pm 0.0021$	$1.3291 \pm 0.0018$	-

## C Integrated Sensitivity profiles and Data Uncertainties for each Benchmark Reactor.

### C.1 PU-MET-FAST-001

Table C.1.1: ISCs for the multiplication factor of PU-MET-FAST-001.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{239}\text{Pu } \bar{\nu}$	$0.96530 \pm 0.00009$
$^{239}\text{Pu } \bar{\nu}_p$	$0.96351 \pm 0.00009$
$^{239}\text{Pu (n,f)}$	$0.72813 \pm 0.00010$
$^{239}\text{Pu } \chi$	$(-0.15 \pm 8.7) \times 10^{-5}$

Table C.1.2: ISCs for the delayed neutron fraction.

Quantity	ISCs for the delayed neutron fraction of PU-MET-FAST-001.		
	Bretscher	Chiba	Kodeli, [1]
$^{239}\text{Pu } \bar{\nu}_d$	$0.945 \pm 0.003$	$0.9483 \pm 0.0007$	0.9480
$^{239}\text{Pu } \bar{\nu}_p$	$-0.95 \pm 0.07$	$-0.946 \pm 0.004$	-0.9470
$^{239}\text{Pu } \chi$	$0.00 \pm 0.07$	$0.000 \pm 0.006$	-

Table C.1.3: Reaction contribution to multiplication factor uncertainty of PU-MET-FAST-001. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (101%)	$0.4513 \pm 0.0006$
$^{239}\text{Pu } \chi/^{239}\text{Pu } \chi$	$0.40951 \pm 0.00004$
$^{239}\text{Pu } \bar{\nu}_p/^{239}\text{Pu } \bar{\nu}_p$	$0.30293 \pm 0.00005$
$^{239}\text{Pu (n,f)}/^{239}\text{Pu (n,f)}$	$0.43710 \pm 0.00006$
JENDL-4.0u (80.5%)	
$^{239}\text{Pu (n,f)}/^{239}\text{Pu (n,f)}$	$0.43710 \pm 0.00006$
$^{239}\text{Pu } \bar{\nu}/^{239}\text{Pu } \bar{\nu}_p$	$0.301085 \pm 0.000022$
$^{239}\text{Pu } \chi/^{239}\text{Pu } \chi$	$0.2899 \pm 0.0003$
ENDF/B-VIII.0 (99.9%)	
$^{239}\text{Pu } \bar{\nu}/^{239}\text{Pu } \bar{\nu}$	$0.31960 \pm 0.00003$
$^{239}\text{Pu } \bar{\nu}_p/^{239}\text{Pu } \bar{\nu}_p$	$0.31903 \pm 0.00003$
$^{239}\text{Pu } \chi/^{239}\text{Pu } \chi$	$0.19112 \pm 0.00022$



Table C.1.4: Reaction contribution to delayed neutron fraction uncertainty of PU-MET-FAST-001. All the reactions showed explain an 85% of the total uncertainty at least. The library used in [1] is JENDL-4.0m

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)		
	Bretscher	Chiba	Kodeli, [1]
JEFF-3.3			
239Pu $\chi$ /239Pu $\chi$	$0.8 \pm 0.4$	$0.699 \pm 0.008$	-
239Pu $\bar{\nu}_p$ /239Pu $\bar{\nu}_p$	$0.37 \pm 0.03$	$0.3673 \pm 0.0007$	-
JENDL-4.0u			
239Pu $\bar{\nu}_d$ /239Pu $\bar{\nu}_d$	$2.296 \pm 0.008$	$2.2735 \pm 0.0006$	2.274
ENDF/B-VIII.0			
239Pu $\bar{\nu}_p$ /239Pu $\bar{\nu}_p$	$0.47 \pm 0.03$	$0.47532 \pm 0.00013$	-
239Pu $\chi$ /239Pu $\chi$	$0.30 \pm 0.12$	$0.286 \pm 0.004$	-

## C.2 PU-MET-FAST-006

Table C.2.1: ISCs for the multiplication factor of PU-MET-FAST-006.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
239Pu $\bar{n}u$	$0.88307 \pm 0.00024$
239Pu $\bar{n}u_p$	$0.88141 \pm 0.00024$
239Pu (n,f)	$0.63230 \pm 0.00025$
239Pu $\chi$	$(0.0 \pm 2.2) \times 10^{-4}$
238U (n,n')	$0.06563 \pm 0.00017$
238U (n,f)	$0.05628 \pm 0.00007$
238U (n,n)	$0.1383 \pm 0.0004$

Table C.2.2: ISCs for the delayed neutron fraction of [name reactor].

Quantity	ISCs for the delayed neutron fraction.		
	Bretscher	Chiba	Kodeli, [1]
238U (n,n)	$-0.16 \pm 0.20$	$0.12 \pm 0.03$	0.1030
238U (n,n')	$-0.15 \pm 0.09$	$-0.159 \pm 0.007$	-0.1700
238U (n,f)	$0.29 \pm 0.04$	$0.246 \pm 0.004$	0.2610
238U $\bar{\nu}_d$	$0.3709 \pm 0.0021$	$0.3516 \pm 0.0011$	0.3610
238U $\bar{\nu}$	$0.29 \pm 0.04$	$0.256 \pm 0.004$	0.278
239Pu (n,f)	$-0.32 \pm 0.13$	$-0.286 \pm 0.012$	-0.3050
239Pu $\bar{\nu}_d$	$0.5779 \pm 0.0020$	$0.5790 \pm 0.0012$	0.5880
239Pu $\bar{\nu}_p$	$-0.86 \pm 0.12$	$-0.848 \pm 0.009$	-0.8790
239Pu $\bar{\nu}$	$-0.29 \pm 0.12$	$-0.269 \pm 0.012$	-0.2920
238U $\chi$	$0.00 \pm 0.03$	$0.000 \pm 0.003$	-
239Pu $\chi$	$0.00 \pm 0.11$	$0.000 \pm 0.008$	-
238U (n, $\gamma$ )	$-0.044 \pm 0.013$	$-0.04971 \pm 0.00011$	-
235U $\bar{\nu}_d$	$0.01919 \pm 0.00011$	$0.0204 \pm 0.0003$	-
238U $\bar{\nu}_p$	$-0.08 \pm 0.03$	$-0.09538 \pm 0.00008$	-

Table C.2.3: Reaction contribution to multiplication factor uncertainty of PU-MET-FAST-006. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (75.9%)	
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$0.4879 \pm 0.0015$
$^{238}\text{U (n,n')}/^{238}\text{U (n,n')}$	$0.4609 \pm 0.0012$
$^{239}\text{Pu } \bar{\nu}_p / ^{239}\text{Pu } \bar{\nu}_p$	$0.38213 \pm 0.00011$
JENDL-4.0u (79.3%)	
$^{238}\text{U (n,n')}/^{238}\text{U (n,n')}$	$0.4141 \pm 0.0014$
$^{238}\text{U (n,f)}/^{238}\text{U (n,f)}$	$0.37220 \pm 0.00015$
$^{238}\text{U (n,n)}/^{238}\text{U (n,n)}$	$0.3401 \pm 0.0011$
ENDF/B-VIII.0 (74.9%)	
$^{238}\text{U (n,n)}/^{238}\text{U (n,n')}$	$0.3871 \pm 0.0009$
$^{238}\text{U (n,n)}/^{238}\text{U (n,n)}$	$0.3412 \pm 0.0009$
$^{239}\text{Pu } \bar{\nu} / ^{239}\text{Pu } \bar{\nu}$	$0.26931 \pm 0.00008$

Table C.2.4: Reaction contribution to delayed neutron fraction uncertainty of PU-MET-FAST-006. All the reactions showed explain an 85% of the total uncertainty at least. The library used in [1] is JENDL-4.0m

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)		
	Bretscher	Chiba	Kodeli, [1]
JEFF-3.3			
238U (n,n')/238U (n,f)	$-1.0 \pm 0.3$	$-0.940 \pm 0.010$	-
238U (n,n')/238U (n,n')	$0.9 \pm 0.5$	$1.028 \pm 0.024$	-
238U (n,f)/238U (n,f)	$0.76 \pm 0.11$	$0.628 \pm 0.006$	-
238U $\chi$ /238U $\chi$	$0.6 \pm 0.3$	$0.399 \pm 0.012$	-
239Pu $\chi$ /239Pu $\chi$	$0.6 \pm 0.7$	-	-
238U (n,n)/238U (n,n')	-	$-0.66 \pm 0.03$	-
239Pu $\bar{\nu}_p$ /239Pu $\bar{\nu}_p$	$0.35 \pm 0.05$	$0.3407 \pm 0.0016$	-
238U (n,n)/238U (n,f)	-	$0.490 \pm 0.020$	-
238U (n,f)/238U (n, $\gamma$ )	-	$0.2739 \pm 0.0014$	-
JENDL-4.0u			
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$0.0637 \pm 0.0004$	$0.0684 \pm 0.0003$	0.066
238U $\bar{\nu}_d$ /238U $\bar{\nu}_d$	$1.241 \pm 0.007$	$1.1760 \pm 0.0017$	1.191
238U (n,n')/238U (n,n')	$2.3 \pm 0.6$	$1.802 \pm 0.009$	1.712
239Pu $\bar{\nu}_d$ /239Pu $\bar{\nu}_d$	$1.340 \pm 0.005$	$1.3439 \pm 0.0009$	1.347
ENDF/B-VIII.0			
238U (n,n)/238U (n,n')	$1.0 \pm 0.5$	$-0.70 \pm 0.03$	-
238U (n,n')/238U (n,n')	$0.7 \pm 0.3$	$0.451 \pm 0.005$	-
238U (n,n')/238U (n,f)	$-0.7 \pm 0.2$	$-0.633 \pm 0.008$	-
238U $\bar{\nu}_d$ /238U $\bar{\nu}_d$	$0.482 \pm 0.003$	$0.4563 \pm 0.0007$	-
238U $\chi$ /238U $\chi$	$0.48 \pm 0.15$	$0.369 \pm 0.005$	-
239Pu $\bar{\nu}_p$ /239Pu $\bar{\nu}_p$	$0.39 \pm 0.04$	$0.3652 \pm 0.0004$	-
238U $\bar{\nu}$ /238U $\bar{\nu}$	$0.36 \pm 0.04$	$0.3185 \pm 0.0024$	-
239Pu $\chi$ /239Pu $\chi$	-	$0.303 \pm 0.007$	-
238U (n,f)/238U (n,f)	$0.35 \pm 0.04$	$0.3008 \pm 0.0024$	-
238U $\bar{\nu}$ /238U $\bar{\nu}_p$	$-0.27 \pm 0.06$	$-0.2703 \pm 0.0010$	-
238U (n,n)/238U (n,n)	-	$0.263 \pm 0.023$	-
238U (n,n')/238U (n, $\gamma$ )	-	$0.2561 \pm 0.0005$	-
239Pu $\bar{\nu}$ /239Pu $\bar{\nu}$	$0.26 \pm 0.03$	$0.23285 \pm 0.00010$	-

### C.3 HEU-MET-FAST-028

Table C.3.1: ISCs for the multiplication factor of HEU-MET-FAST-028.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
235U $\bar{\nu}$	$0.91737 \pm 0.00024$
235U $\bar{\nu}_p$	$0.91160 \pm 0.00024$
235U (n,f)	$0.5745 \pm 0.0003$
235U (n,n')	$0.03372 \pm 0.00017$
235U (n, $\gamma$ )	$-0.052022 \pm 0.000023$
238U (n,n')	$0.06309 \pm 0.00018$
238U (n,n)	$0.1454 \pm 0.0004$

Table C.3.2: ISCs for the delayed neutron fraction of HEU-MET-FAST-028.

Quantity	ISCs for the delayed neutron fraction.		
	Bretscher	Chiba	Kodeli, [1]
235U $\bar{\nu}_d$	$0.8269 \pm 0.0007$	$0.8405 \pm 0.0015$	0.8360
235U $\bar{\nu}_p$	$-0.85 \pm 0.05$	$-0.8403 \pm 0.0024$	-0.8430
238U $\bar{\nu}_d$	$0.1601 \pm 0.0003$	$0.1391 \pm 0.0004$	0.1530
238U $\bar{\nu}_p$	$-0.130 \pm 0.013$	$-0.1329608 \pm 0.0000019$	-0.1400
235U $\chi$	$0.00 \pm 0.05$	$0.000 \pm 0.006$	-
235U (n,f)	$-0.09 \pm 0.05$	$-0.053 \pm 0.007$	-
238U (n,n)	$0.17 \pm 0.09$	$0.040 \pm 0.014$	-

Table C.3.3: Reaction contribution to multiplication factor uncertainty of [name reactor]. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (68.7%)	
235U (n,f)/235U (n,f)	$0.7117 \pm 0.0005$
235U (n,n')/235U (n,f)	$0.5356 \pm 0.0013$
235U (n, $\gamma$ )/235U (n, $\gamma$ )	$0.47924 \pm 0.00020$
JENDL-4.0u (71.1%)	
238U (n,n')/238U (n,n')	$0.4041 \pm 0.0016$
238U (n,n)/238U (n,n)	$0.3642 \pm 0.0013$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.33225 \pm 0.00007$
ENDF/B-VIII.0 (74.1%)	
235U (n,f)/235U (n,f)	$0.6917 \pm 0.0003$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.52640 \pm 0.00010$
238U (n,n)/238U (n,n')	$0.3942 \pm 0.0010$

Table C.3.4: Reaction contribution to delayed neutron fraction uncertainty of [name reactor]. All the reactions showed explain an 85% of the total uncertainty at least. The library used in [1] is JENDL-4.0m

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)		
	Bretscher	Chiba	Kodeli, [1]
JEFF-3.3			
235U $\chi$ /235U $\chi$	$0.9 \pm 0.3$	$0.454 \pm 0.007$	-
235U (n,f)/235U (n,f)	$0.59 \pm 0.10$	$0.659 \pm 0.005$	-
238U (n,n)/238U (n,n)	$0.58 \pm 0.15$	-	-
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.42 \pm 0.03$	$0.4185 \pm 0.0006$	-
JENDL-4.0u			
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$2.3856 \pm 0.0022$	$2.4829 \pm 0.0013$	2.403
238U (n,n)/238U (n,n)	$1.6 \pm 0.4$	-	-
ENDF/B-VIII.0			
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$3.886 \pm 0.003$	$3.9503561 \pm 0.0019$	-

## C.4 U233-MET-FAST-006

Table C.4.1: ISCs for the multiplication factor of U233-MET-FAST-006.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
233U $\bar{\nu}$	$0.91126 \pm 0.00025$
233U $\bar{\nu}_p$	$0.90864 \pm 0.00024$
233U (n,f)	$0.5910 \pm 0.0003$
235U (n,f)	$0.006918 \pm 0.000023$
238U (n,n')	$0.07156 \pm 0.00017$
238U (n,n)	$0.1317 \pm 0.0004$

Table C.4.2: ISCs for the delayed neutron fraction of U233-MET-FAST-006.

Quantity	ISCs for the delayed neutron fraction.		
	Bretscher	Chiba	Kodeli, [1]
233U (n,f)	$-0.20 \pm 0.10$	$-0.228 \pm 0.011$	-0.2310
233U $\bar{\nu}_d$	$0.6972 \pm 0.0019$	$0.6919 \pm 0.0014$	0.7000
233U $\bar{\nu}_p$	$-0.88 \pm 0.09$	$-0.868 \pm 0.006$	-0.8850
233U $\bar{\nu}$	$-0.19 \pm 0.09$	$-0.176 \pm 0.010$	-0.1850
238U (n,n')	$-0.19 \pm 0.06$	$-0.119 \pm 0.005$	-0.1290
238U (n,f)	$0.16 \pm 0.03$	$0.163 \pm 0.003$	0.1670
238U $\bar{\nu}_d$	$0.2886 \pm 0.0013$	$0.2666 \pm 0.0008$	0.2740
238U $\bar{\nu}_p$	$-0.136 \pm 0.025$	$-0.103651 \pm 0.000016$	-0.1040

Table C.4.3: Reaction contribution to multiplication factor uncertainty of U233-MET-FAST-006. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (74.1%)	
235U (n,f)/235U (n,f)	$0.5632 \pm 0.0003$
238U (n,n')/238U (n,n')	$0.5028 \pm 0.0012$
238U (n,n)/238U (n,n')	$0.3175 \pm 0.0011$
JENDL-4.0u (75.2%)	
233U $\bar{\nu}$ /233U $\bar{\nu}_p$	$0.62837 \pm 0.00013$
238U (n,n')/238U (n,n')	$0.4518 \pm 0.0013$
233U $\bar{\nu}$ /233U $\bar{\nu}$	$0.44474 \pm 0.00013$
ENDF/B-VIII.0 (%)	
233U $\bar{\nu}$ /233U $\bar{\nu}_p$	$0.62837 \pm 0.00013$
233U $\bar{\nu}$ /233U $\bar{\nu}$	$0.44474 \pm 0.00013$
233U $\bar{\nu}_p$ /233U $\bar{\nu}_p$	$0.44431 \pm 0.00013$

Table C.4.4: Reaction contribution to delayed neutron fraction uncertainty of U233-MET-FAST-006. All the reactions showed explain an 85% of the total uncertainty at least. The library used in [1] is JENDL-4.0m

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)		
	Bretscher	Chiba	Kodeli, [1]
JEFF-3.3			
233U $\bar{\nu}_d$ /233U $\bar{\nu}_d$	$6.597 \pm 0.018$	$6.576 \pm 0.004$	
JENDL-4.0u			
233U $\bar{\nu}_d$ /233U $\bar{\nu}_d$	$5.213 \pm 0.015$	$5.201 \pm 0.003$	5.097
ENDF/B-VIII.0			
233U $\bar{\nu}_d$ /233U $\bar{\nu}_d$	$5.213 \pm 0.015$	$5.2011 \pm 0.0031$	-

## C.5 IEU-MET-FAST-007

Table C.5.1: ISCs for the multiplication factor of IEU-MET-FAST-007.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
235U $\bar{\nu}$	$0.75371 \pm 0.00020$
235U $\bar{\nu}_p$	$0.74966 \pm 0.00020$
235U (n,f)	$0.50260 \pm 0.00022$
235U $\chi$	$0.00000 \pm 0.00020$
238U (n, $\gamma$ )	$-0.23059 \pm 0.00007$
238U (n,n')	$-0.0862 \pm 0.0004$
238U (n,n)	$0.1104 \pm 0.0009$

Table C.5.2: ISCs for the delayed neutron fraction of IEU-MET-FAST-007.

Quantity	ISCs for the delayed neutron fraction.		
	Bretscher	Chiba	Kodeli, [1]
235U $\bar{\nu}_d$	$0.54272 \pm 0.00048$	$0.5678 \pm 0.0011$	0.548
235U $\bar{\nu}_p$	$-0.51 \pm 0.04$	$-0.5301 \pm 0.0009$	-0.516
238U $\bar{\nu}_d$	$0.4420 \pm 0.0006$	$0.3907 \pm 0.0007$	0.443
238U $\bar{\nu}_p$	$-0.478 \pm 0.022$	$-0.426344 \pm 0.000004$	-0.473
238U (n,n')	$-0.07 \pm 0.07$	$-0.040 \pm 0.006$	-
235U (n,f)	$0.04 \pm 0.04$	$0.017 \pm 0.006$	-
235U $\chi$	$0.00 \pm 0.04$	$0.000 \pm 0.004$	-

Table C.5.3: Reaction contribution to multiplication factor uncertainty of IEU-MET-FAST-007. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (83.7%)	
235U (n,f)/235U (n,f)	$1.0732 \pm 0.0005$
235U $\chi$ /235U $\chi$	$0.8595 \pm 0.0015$
238U (n, $\gamma$ )/238U (n, $\gamma$ )	$0.61137 \pm 0.00014$
JENDL-4.0u (87.7%)	
238U (n,n')/238U (n,n')	$1.0055 \pm 0.0021$
235U $\chi$ /235U $\chi$	$0.5385 \pm 0.0009$
238U (n, $\gamma$ )/238U (n, $\gamma$ )	$0.40847 \pm 0.00016$
ENDF/B-VIII.0 (50.6%)	
235U (n,f)/235U (n,f)	$0.6073 \pm 0.0003$
238U (n,n)/238U (n,n')	$-0.444 \pm 0.003$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.43860 \pm 0.00008$

Table C.5.4: Reaction contribution to delayed neutron fraction uncertainty of IEU-MET-FAST-007. All the reactions showed explain an 85% of the total uncertainty at least. The library used in [1] is JENDL-4.0m

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)		
	Bretscher	Chiba	Kodeli, [1]
JEFF-3.3			
238U (n,n')/238U (n,n')	$0.5 \pm 0.5$	$0.311 \pm 0.019$	-
238U $\bar{\nu}_p$ /238U $\bar{\nu}_p$	$0.447 \pm 0.021$	$0.405068 \pm 0.000003$	-
235U (n,f)/235U (n,f)	$0.39 \pm 0.10$	$0.317 \pm 0.006$	-
235U $\chi$ /235U $\chi$	$0.22 \pm 0.25$	$0.406 \pm 0.009$	-
JENDL-4.0u			
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$1.8640 \pm 0.0018$	$1.9739 \pm 0.0011$	1.8570
238U $\bar{\nu}_d$ /238U $\bar{\nu}_d$	$1.4815 \pm 0.0021$	$1.3102 \pm 0.0011$	-
238U (n,n)/238U (n,n)	$1.3 \pm 0.8$	-	-
ENDF/B-VIII.0			
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$2.5508 \pm 0.0023$	$2.6686 \pm 0.0014$	-

## C.6 HEU-MET-INTER-001

Table C.6.1: ISCs for the multiplication factor of [name reactor].

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{235}\text{U } \bar{\nu}$	$0.9971 \pm 0.0004$
$^{235}\text{U } \bar{\nu}_p$	$0.9903 \pm 0.0004$
$^{235}\text{U (n,f)}$	$0.5177 \pm 0.0004$
$^{235}\text{U (n,n')}$	$0.00999 \pm 0.00016$
$^{235}\text{U (n,n)}$	$0.0124 \pm 0.0005$

Table C.6.2: ISCs for the delayed neutron fraction of [name reactor].

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{235}\text{U } \bar{\nu}_d$	$0.9904 \pm 0.0012$	$0.988 \pm 0.003$
$^{235}\text{U } \bar{\nu}_p$	$-0.99 \pm 0.07$	$0.986 \pm 0.000$
$^{57}\text{Fe (n,n)}$	$0.04 \pm 0.12$	$0.006 \pm 0.016$
$^{56}\text{Fe (n,n)}$	$0.4 \pm 0.5$	$-0.04 \pm 0.04$
$^{54}\text{Fe (n,n)}$	$0.01 \pm 0.18$	$0.013 \pm 0.024$
$^{235}\text{U } \chi$	$0.000 \pm 0.071$	$0.000 \pm 0.003$

Table C.6.3: Reaction contribution to multiplication factor uncertainty of [name reactor]. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (83.8%)	
$^{235}\text{U (n,n')}/^{235}\text{U (n,n')}$	$0.6995 \pm 0.0015$
$^{235}\text{U (n,n')}/^{235}\text{U (n,f)}$	$0.6982 \pm 0.0009$
$^{235}\text{U (n,f)}/^{235}\text{U (n,f)}$	$0.6578 \pm 0.0004$
JENDL-4.0u (79.7%)	
$^{235}\text{U (n,n')}/^{235}\text{U (n,n')}$	$0.4425 \pm 0.0015$
$^{235}\text{U (n,n)}/^{235}\text{U (n,n)}$	$0.38196 \pm 0.00007$
$^{235}\text{U } \bar{\nu}/^{235}\text{U } \bar{\nu}_p$	
ENDF/B-VIII.0 (73.4%)	
$^{235}\text{U (n,f)}/^{235}\text{U (n,f)}$	$0.7855 \pm 0.0003$
$^{235}\text{U } \bar{\nu}/^{235}\text{U } \bar{\nu}$	$0.56366 \pm 0.00010$
$^{235}\text{U } \bar{\nu}/^{235}\text{U } \bar{\nu}_p$	$0.39965 \pm 0.00010$



Table C.6.4: Reaction contribution to delayed neutron fraction uncertainty of [name reactor]. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
57Fe (n,n)/57Fe (n,n)	$1.8 \pm 1.0$	-
56Fe (n,n)/56Fe (n,n)	$1.7 \pm 1.2$	-
54Fe (n,n)/54Fe (n,n)	$1.2 \pm 0.4$	-
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.54 \pm 0.04$	$0.54 \pm 0.00$
235U $\chi$ /235U $\chi$	-	$0.178 \pm 0.007$
JENDL-4.0u		
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$2.627 \pm 0.004$	$2.6274 \pm 0.0018$
56Fe (n,n)/56Fe (n,n)	$2.1 \pm 1.2$	-
ENDF/B-VIII.0		
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$4.549 \pm 0.006$	$4.536 \pm 0.003$

## C.7 PU-MET-INTER-002

Table C.7.1: ISCs for the multiplication factor of PU-MET-INTER-002.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
239Pu $\bar{\nu}$	$0.9891 \pm 0.0004$
239Pu $\bar{\nu}_p$	$0.9868 \pm 0.0004$
239Pu (n,f)	$0.5811 \pm 0.0004$
239Pu (n, $\gamma$ )	$-0.18717 \pm 0.00007$
56Fe (n,n)	$0.0948 \pm 0.0019$
56Fe (n, $\gamma$ )	$-0.04259 \pm 0.00004$
52Cr(n,n)	$0.0320 \pm 0.0008$

Table C.7.2: ISCs for the delayed neutron fraction of PU-MET-INTER-002.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
56Fe (n,n)	$1.6 \pm 1.1$	$-0.13 \pm 0.09$
239Pu $\bar{\nu}_d$	$0.972 \pm 0.003$	$0.976 \pm 0.004$
58Ni (n,n)	$-1.5 \pm 0.5$	$0.07 \pm 0.10$
239Pu $\bar{\nu}_p$	$-1.0 \pm 0.2$	$-1.0 \pm 0.0$
57Fe (n,n)	$0.0 \pm 0.2$	$-0.013 \pm 0.013$
54Fe (n,n)	$0.2 \pm 0.4$	$0.02 \pm 0.03$
239Pu (n, $\gamma$ )	$-0.03 \pm 0.04$	$-0.0462 \pm 0.0002$
52Cr(n,n)	$0.2 \pm 0.5$	$0.04 \pm 0.09$
55Mn(n,n)	$-0.2 \pm 0.4$	$0.00 \pm 0.03$

Table C.7.3: Reaction contribution to multiplication factor uncertainty of PU-MET-INTER-002. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (92.2%)	
$^{239}\text{Pu} (n,\gamma)/^{239}\text{Pu} (n,\gamma)$	$0.8499 \pm 0.0005$
$^{239}\text{Pu} (n,f)/^{239}\text{Pu} (n,f)$	$0.7168 \pm 0.0008$
$^{239}\text{Pu} \bar{\nu}_p/^{239}\text{Pu} \bar{\nu}_p$	$0.46022 \pm 0.00017$
JENDL-4.0u (76.3%)	
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$0.392 \pm 0.007$
$^{56}\text{Fe} (n,\gamma)/^{56}\text{Fe} (n,\gamma)$	$0.3447 \pm 0.0003$
$^{239}\text{Pu} (n,\gamma)/^{239}\text{Pu} (n,\gamma)$	$0.32108 \pm 0.00006$
ENDF/B-VIII.0 (78.2%)	
$^{239}\text{Pu} \bar{\nu}/^{239}\text{Pu} \bar{\nu}$	$0.26807 \pm 0.00010$
$^{239}\text{Pu} \bar{\nu}_p/^{239}\text{Pu} \bar{\nu}_p$	$0.26745 \pm 0.00010$
$^{52}\text{Cr}(n,n)/^{52}\text{Cr}(n,n)$	$0.211 \pm 0.005$

Table C.7.4: Reaction contribution to delayed neutron fraction uncertainty of PU-MET-INTER-002. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$5.5 \pm 2.4$	$0.39 \pm 0.04$
$^{57}\text{Fe} (n,n)/^{57}\text{Fe} (n,n)$	$4.7 \pm 1.4$	-
$^{58}\text{Ni} (n,n)/^{58}\text{Ni} (n,n)$	$4.3 \pm 1.5$	-
$^{239}\text{Pu} \bar{\nu}_p/^{239}\text{Pu} \bar{\nu}_p$	$0.44 \pm 0.10$	$0.45 \pm 0.00$
$^{54}\text{Fe} (n,n)/^{54}\text{Fe} (n,n)$	-	$0.24 \pm 0.06$
$^{239}\text{Pu} (n,\gamma)/^{239}\text{Pu} (n,\gamma)$	-	$0.2278 \pm 0.0013$
JENDL-4.0u		
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$9.1 \pm 4.7$	-
$^{239}\text{Pu} \bar{\nu}_d/^{239}\text{Pu} \bar{\nu}_d$	$4.737 \pm 0.014$	$4.789 \pm 0.004$
$^{52}\text{Cr}(n,n)/^{52}\text{Cr}(n,n)$	$3.1 \pm 1.9$	-
ENDF/B-VIII.0		
$^{58}\text{Ni} (n,n)/^{58}\text{Ni} (n,n)$	$5.4 \pm 1.9$	$0.29 \pm 0.10$
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$3.1 \pm 1.6$	$0.255 \pm 0.024$
$^{239}\text{Pu} \bar{\nu}_p/^{239}\text{Pu} \bar{\nu}_p$	$0.28 \pm 0.06$	$0.26 \pm 0.00$
$^{55}\text{Mn} (n,n)/^{55}\text{Mn} (n,n)$	$2.8 \pm 1.7$	-
$^{52}\text{Cr}(n,n)/^{52}\text{Cr}(n,n)$	-	$0.24 \pm 0.14$

## C.8 PU-MET-INTER-004

Table C.8.1: ISCs for the multiplication factor of PU-MET-INTER-004.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{239}\text{Pu } \bar{\nu}$	$0.9830 \pm 0.0004$
$^{239}\text{Pu } \bar{\nu}_p$	$0.9806 \pm 0.0004$
$^{239}\text{Pu (n,f)}$	$0.5766 \pm 0.0004$
$^{239}\text{Pu (n,}\gamma)$	$-0.15062 \pm 0.00007$
$^{208}\text{Pb (n,n)}$	$0.1514 \pm 0.0010$

Table C.8.2: ISCs for the delayed neutron fraction of PU-MET-INTER-004.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{207}\text{Pb (n,n)}$	$1.0 \pm 0.4$	$-0.03 \pm 0.04$
$^{239}\text{Pu } \bar{\nu}_d$	$0.964 \pm 0.003$	$0.968 \pm 0.004$
$^{206}\text{Pb (n,n)}$	$-0.6 \pm 0.4$	$0.00 \pm 0.05$
$^{239}\text{Pu } \bar{\nu}_p$	$-0.97 \pm 0.21$	$-0.96938 \pm 0.00005$
$^{56}\text{Fe (n,n)}$	$-0.3 \pm 0.4$	$-0.0015 \pm 0.0024$
$^{54}\text{Fe (n,n)}$	$-0.15 \pm 0.15$	$0.000 \pm 0.016$
$^{57}\text{Fe (n,n)}$	$0.06 \pm 0.09$	$0.001 \pm 0.011$
$^{239}\text{Pu } \chi$	$0.00 \pm 0.20$	$0.000 \pm 0.011$
$^{58}\text{Ni (n,n)}$	$-0.33 \pm 0.18$	$0.02 \pm 0.03$
$^{206}\text{Pb (n,n)}$	$-0.6 \pm 0.4$	$0.00 \pm 0.05$
$^{239}\text{Pu (n,}\gamma)$	$-0.10 \pm 0.04$	$-0.06826 \pm 0.00006$
$^{239}\text{Pu (n,n)}$	$-0.4 \pm 0.3$	$0.02 \pm 0.04$
$^{52}\text{Cr (n,n)}$	$0.06 \pm 0.17$	$-0.027 \pm 0.009$

Table C.8.3: Reaction contribution to multiplication factor uncertainty of PU-MET-INTER-004. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (88.6%)	
$^{239}\text{Pu} (n,\gamma)/^{239}\text{Pu} (n,\gamma)$	$0.5815 \pm 0.0004$
$^{239}\text{Pu} (n,f)/^{239}\text{Pu} (n,f)$	$0.4796 \pm 0.0006$
$^{239}\text{Pu} \bar{\nu}_p/^{239}\text{Pu} \bar{\nu}_p$	$0.45104 \pm 0.00017$
JENDL-4.0u (79.7%)	
$^{208}\text{Pb} (n,n)/^{208}\text{Pb} (n,n)$	$0.339 \pm 0.003$
$^{239}\text{Pu} (n,\gamma)/^{239}\text{Pu} (n,\gamma)$	$0.33351 \pm 0.00007$
$^{239}\text{Pu} (n,f)/^{239}\text{Pu} (n,f)$	$0.29564 \pm 0.00021$
ENDF/B-VIII.0 (79.2%)	
$^{208}\text{Pb} (n,n)/^{208}\text{Pb} (n,n)$	$0.359 \pm 0.003$
$^{239}\text{Pu} \bar{\nu}/^{239}\text{Pu} \bar{\nu}$	$0.26492 \pm 0.00010$
$^{239}\text{Pu} \bar{\nu}_p/^{239}\text{Pu} \bar{\nu}_p$	$0.26427 \pm 0.00010$

Table C.8.4: Reaction contribution to delayed neutron fraction uncertainty of PU-MET-INTER-004. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$2.5 \pm 0.9$	-
$^{54}\text{Fe} (n,n)/^{54}\text{Fe} (n,n)$	$1.6 \pm 0.7$	-
$^{57}\text{Fe} (n,n)/^{57}\text{Fe} (n,n)$	$1.4 \pm 0.5$	-
$^{239}\text{Pu} \bar{\nu}_p/^{239}\text{Pu} \bar{\nu}_p$	$0.43 \pm 0.10$	$0.434739 \pm 0.000022$
$^{239}\text{Pu} \chi/^{239}\text{Pu} \chi$	-	$0.427 \pm 0.020$
$^{58}\text{Ni} (n,n)/^{58}\text{Ni} (n,n)$	$0.9 \pm 0.5$	-
$^{207}\text{Pb} (n,n)/^{207}\text{Pb} (n,n)$	$1.2 \pm 0.5$	-
$^{206}\text{Pb} (n,n)/^{206}\text{Pb} (n,n)$	$0.9 \pm 0.4$	-
$^{239}\text{Pu} (n,\gamma)/^{239}\text{Pu} (n,\gamma)$	-	$0.281800 \pm 0.000011$
JENDL-4.0u		
$^{239}\text{Pu} \bar{\nu}_d/^{239}\text{Pu} \bar{\nu}_d$	$4.054 \pm 0.012$	$4.133 \pm 0.004$
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$2.3 \pm 1.3$	-
$^{239}\text{Pu} (n,n)/^{239}\text{Pu} (n,n)$	$1.3 \pm 0.8$	-
$^{207}\text{Pb} (n,n)/^{207}\text{Pb} (n,n)$	$1.20 \pm 0.45$	-
ENDF/B-VIII.0		
$^{207}\text{Pb} (n,n)/^{207}\text{Pb} (n,n)$	$4.9 \pm 1.7$	$0.16 \pm 0.05$
$^{206}\text{Pb} (n,n)/^{206}\text{Pb} (n,n)$	$2.6 \pm 1.6$	-
$^{239}\text{Pu} \chi/^{239}\text{Pu} \chi$	$1.0 \pm 0.4$	$0.326 \pm 0.020$
$^{239}\text{Pu} \bar{\nu}_p/^{239}\text{Pu} \bar{\nu}_p$	$0.28 \pm 0.05$	$0.270467 \pm 0.000011$
$^{52}\text{Cr} (n,n)/^{52}\text{Cr} (n,n)$	-	$0.162 \pm 0.020$

## C.9 LEU-COMP-THERM-006

Table C.9.1: ISCs for the multiplication factor of LEU-COMP-THERM-006.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
235U $\bar{\nu}$	$0.94195 \pm 0.00010$
235U $\bar{\nu}_p$	$0.93508 \pm 0.00010$
235U (n,f)	$0.33033 \pm 0.00017$
1H (n, $\gamma$ )	$-0.13192 \pm 0.00004$
235U $\chi$	$0.00000 \pm 0.00016$

Table C.9.2: ISCs for the delayed neutron fraction of LEU-COMP-THERM-006.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
235U $\bar{\nu}_d$	$0.8590 \pm 0.0012$	$0.8656 \pm 0.0007$
235U $\bar{\nu}_p$	$-0.884 \pm 0.019$	$-0.875 \pm 0.000$
235U $\chi$	$0.000 \pm 0.028$	$0.0000 \pm 0.0033$

Table C.9.3: Reaction contribution to multiplication factor uncertainty of LEU-COMP-THERM-006. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (80.3%)	
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.52475 \pm 0.00006$
1H (n, $\gamma$ )/1H (n, $\gamma$ )	$0.33685 \pm 0.00011$
235U $\chi$ /235U $\chi$	$0.3203 \pm 0.0010$
JENDL-4.0u (75.6%)	
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.39669 \pm 0.00003$
235U $\bar{\nu}$ /235U $\bar{\nu}$	$0.28127 \pm 0.00003$
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.28039 \pm 0.00003$
ENDF/B-VIII.0 (88.3%)	
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.61254 \pm 0.00005$
235U $\bar{\nu}$ /235U $\bar{\nu}$	$0.43411 \pm 0.00005$
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.43300 \pm 0.00005$

Table C.9.4: Reaction contribution to delayed neutron fraction uncertainty of LEU-COMP-THERM-006. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{235}\text{U } \bar{\nu}_p / ^{235}\text{U } \bar{\nu}_p$	$0.496 \pm 0.011$	$0.491 \pm 0.000$
$^{235}\text{U } \chi / ^{235}\text{U } \chi$	$0.28 \pm 0.17$	$0.273 \pm 0.009$
JENDL-4.0u		
$^{235}\text{U } \bar{\nu}_d / ^{235}\text{U } \bar{\nu}_d$	$2.701 \pm 0.004$	$2.7234 \pm 0.0008$
ENDF/B-VIII.0		
$^{235}\text{U } \bar{\nu}_d / ^{235}\text{U } \bar{\nu}_d$	$3.753 \pm 0.006$	$3.7840 \pm 0.0011$

## C.10 LEU-COMP-THERM-067

Table C.10.1: ISCs for the multiplication factor of LEU-COMP-THERM-067.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{235}\text{U } \bar{\nu}$	$0.9611 \pm 0.0004$
$^{235}\text{U } \bar{\nu}_p$	$0.9541 \pm 0.0004$
$^{235}\text{U } (\text{n},\text{f})$	$0.3652 \pm 0.0005$
$^{235}\text{U } \chi$	$0.0000 \pm 0.0005$
$^1\text{H } (\text{n},\gamma)$	$-0.11617 \pm 0.00006$

Table C.10.2: ISCs for the delayed neutron fraction of LEU-COMP-THERM-067.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{235}\text{U } \bar{\nu}_d$	$0.897 \pm 0.004$	$0.9043 \pm 0.0010$
$^{235}\text{U } \bar{\nu}_p$	$-0.89 \pm 0.06$	$-0.91 \pm 0.00$
$^{56}\text{Fe } (\text{n},\text{n})$	$0.08 \pm 0.08$	$-0.006 \pm 0.012$
$^{16}\text{O } (\text{n},\text{n})$	$-0.13 \pm 0.16$	$-0.034 \pm 0.016$
$^{238}\text{U } (\text{n},\text{n})$	$-0.17 \pm 0.09$	$0.006 \pm 0.019$
$^1\text{H } (\text{n},\text{n})$	$-0.3 \pm 0.3$	$-0.12 \pm 0.03$
$^{235}\text{U } \chi$	$0.00 \pm 0.07$	$0.000 \pm 0.008$

Table C.10.3: Reaction contribution to multiplication factor uncertainty of LEU-COMP-THERM-067. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (79.0%)	
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.53539 \pm 0.00022$
235U $\chi$ /235U $\chi$	$0.365 \pm 0.003$
1H (n, $\gamma$ )/1H (n, $\gamma$ )	$0.3032 \pm 0.0003$
JENDL-4.0u (74.3%)	
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.40384 \pm 0.00012$
235U $\bar{\nu}$ /235U $\bar{\nu}$	$0.28635 \pm 0.00012$
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.28544 \pm 0.00012$
ENDF/B-VIII.0 (87.8%)	
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.62436 \pm 0.00018$
235U $\bar{\nu}$ /235U $\bar{\nu}$	$0.44249 \pm 0.00018$
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.44137 \pm 0.00018$

Table C.10.4: Reaction contribution to delayed neutron fraction uncertainty of LEU-COMP-THERM-067. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.50 \pm 0.03$	$0.51 \pm 0.00$
56Fe (n,n)/56Fe (n,n)	$0.25 \pm 0.12$	-
16O (n,n)/16O (n,n)	$0.2 \pm 0.3$	-
238U (n,n)/238U (n,n)	$0.22 \pm 0.13$	-
1H (n,n)/1H (n,n)	$0.18 \pm 0.14$	-
235U $\chi$ /235U $\chi$	$0.2 \pm 0.4$	-
JENDL-4.0u		
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$2.822 \pm 0.013$	$2.8475 \pm 0.0013$
ENDF/B-VIII.0		
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$3.911 \pm 0.018$	$3.9462 \pm 0.0018$

## C.11 HEU-MET-FAST-001

Table C.11.1: ISCs for the multiplication factor of HEU-MET-FAST-001.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
235U $\bar{\nu}$	$0.98291 \pm 0.00025$
235U $\bar{\nu}_p$	$0.97665 \pm 0.00025$
235U (n,f)	$0.6523 \pm 0.0003$
235U (n,n')	$0.08179 \pm 0.00017$
235U (n,n)	$0.1091 \pm 0.0003$

Table C.11.2: ISCs for the delayed neutron fraction of HEU-MET-FAST-001.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{235}\text{U } \bar{\nu}_d$	$0.9544 \pm 0.0009$	$0.9698 \pm 0.0016$
$^{235}\text{U } \bar{\nu}_p$	$-0.95 \pm 0.06$	$-0.966 \pm 0.004$
$^{235}\text{U (n,f)}$	$-0.07 \pm 0.06$	$-0.054 \pm 0.007$
$^{235}\text{U } \chi$	$0.00 \pm 0.05$	$0.000 \pm 0.005$
$^{235}\text{U (n,n')}$	$0.02 \pm 0.04$	$-0.008 \pm 0.003$

Table C.11.3: Reaction contribution to multiplication factor uncertainty of HEU-MET-FAST-001. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (87.5%)
JEFF-3.3 (%)	
$^{235}\text{U (n,n')}/^{235}\text{U (n,n')}$	$0.6995 \pm 0.0015$
$^{235}\text{U (n,n')}/^{235}\text{U (n,f)}$	$0.6982 \pm 0.0009$
$^{235}\text{U (n,f)}/^{235}\text{U (n,f)}$	$0.6578 \pm 0.0004$
JENDL-4.0u (82.9%)	
$^{235}\text{U (n,n')}/^{235}\text{U (n,n')}$	$0.6582 \pm 0.0015$
$^{235}\text{U (n,n)}/^{235}\text{U (n,n)}$	$0.4425 \pm 0.0015$
$^{235}\text{U } \bar{\nu}/^{235}\text{U } \bar{\nu}_p$	$0.38196 \pm 0.00007$
ENDF/B-VIII.0 (83.4%)	
$^{235}\text{U (n,f)}/^{235}\text{U (n,f)}$	$0.7855 \pm 0.0003$
$^{235}\text{U } \bar{\nu}/^{235}\text{U } \bar{\nu}_p$	$0.56366 \pm 0.00010$
$^{235}\text{U } \bar{\nu}/^{235}\text{U } \bar{\nu}$	$0.39965 \pm 0.00010$

Table C.11.4: Reaction contribution to delayed neutron fraction uncertainty of HEU-MET-FAST-001. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{235}\text{U (n,f)}/^{235}\text{U (n,f)}$	$0.81 \pm 0.10$	$0.839 \pm 0.005$
$^{235}\text{U } \chi/^{235}\text{U } \chi$	$0.7 \pm 0.4$	$0.918 \pm 0.007$
$^{235}\text{U (n,n')}/^{235}\text{U (n,f)}$	$0.8 \pm 0.3$	-
JENDL-4.0u		
$^{235}\text{U } \bar{\nu}_d/^{235}\text{U } \bar{\nu}_d$	$2.6258 \pm 0.0025$	$2.7300 \pm 0.0013$
ENDF/B-VIII.0		
$^{235}\text{U } \bar{\nu}_d/^{235}\text{U } \bar{\nu}_d$	$4.486 \pm 0.004$	$4.5580 \pm 0.0021$



## C.12 MIX-COMP-FAST-005

Table C.12.1: ISCs for the multiplication factor of MIX-COMP-FAST-005.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{239}\text{Pu } \bar{\nu}$	$0.7896 \pm 0.0003$
$^{239}\text{Pu } \bar{\nu}_p$	$0.7881 \pm 0.0003$
$^{239}\text{Pu (n,f)}$	$0.5703 \pm 0.0003$
$^{239}\text{Pu } \chi$	$(0.0000 \pm 0.0003)$
$^{238}\text{U (n,n')}$	$-0.0554 \pm 0.0003$
$^{238}\text{U (n,}\gamma)$	$-0.21390 \pm 0.00006$
$^{238}\text{U } \bar{\nu}$	$0.15585 \pm 0.00010$
$^{238}\text{U } \bar{\nu}_p$	$0.15366 \pm 0.00010$

Table C.12.2: ISCs for the delayed neutron fraction of MIX-COMP-FAST-005.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{238}\text{U } \bar{\nu}_d$	$0.5640 \pm 0.0014$	$0.5265 \pm 0.0012$
$^{239}\text{Pu } \bar{\nu}_d$	$\pm 0.3756 \pm 0.0005$	$0.3816 \pm 0.0012$
$^{239}\text{Pu } \bar{\nu}_p$	$-0.58 \pm 0.10$	$-0.62597 \pm 0.00007$
$^{56}\text{Fe (n,n)}$	$-0.36 \pm 0.23$	$0.00 \pm 0.03$
$^{238}\text{U } \bar{\nu}_p$	$-0.34 \pm 0.04$	$-0.278600 \pm 0.000006$
$^{238}\text{U (n,n)}$	$0.2 \pm 0.4$	$-0.02 \pm 0.03$
$^{238}\text{U (n,n')}$	$-0.27 \pm 0.12$	$-0.105 \pm 0.005$
$^{238}\text{U (n,f)}$	$0.27 \pm 0.04$	$0.289 \pm 0.005$
$^{57}\text{Fe (n,n)}$	$-0.05 \pm 0.05$	$0.004 \pm 0.005$
$^{239}\text{Pu } \chi$	$0.00 \pm 0.09$	$0.000 \pm 0.008$
$^{240}\text{Pu (n,n')}$	$-0.025 \pm 0.013$	$0.0000 \pm 0.0013$
$^{238}\text{U } \chi$	$0.00 \pm 0.03$	$0.000 \pm 0.004$
$^{23}\text{Na (n,n)}$	$0.00 \pm 0.23$	$-0.01 \pm 0.03$
$^{58}\text{Ni (n,n)}$	$-0.16 \pm 0.10$	$-0.002 \pm 0.013$
$^{238}\text{U } \bar{\nu}$	$0.22 \pm 0.04$	$0.2479 \pm 0.0044$

Table C.12.3: Reaction contribution to multiplication factor uncertainty of MIX-COMP-FAST-005. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (74.7%)	
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$0.5245 \pm 0.0017$
$^{239}\text{Pu } \bar{\nu}_p / ^{239}\text{Pu } \bar{\nu}_p$	$0.36367 \pm 0.00013$
$^{238}\text{U (n,n')}/^{238}\text{U (n,n')}$	$0.3565 \pm 0.0024$
JENDL-4.0u (79.2%)	
$^{238}\text{U (n,n')}/^{238}\text{U (n,n')}$	$0.5074 \pm 0.0022$
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$0.3612 \pm 0.0010$
$^{238}\text{U (n,}\gamma)/^{238}\text{U (n,}\gamma)$	$0.35855 \pm 0.00010$
ENDF/B-VIII.0 (73.5%)	
$^{238}\text{U (n,}\gamma)/^{238}\text{U (n,}\gamma)$	$0.28142 \pm 0.00007$
$^{238}\text{U } \bar{\nu} / ^{238}\text{U } \bar{\nu}_p$	$0.27004 \pm 0.00012$
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$0.2372 \pm 0.0007$

Table C.12.4: Reaction contribution to delayed neutron fraction uncertainty of MIX-COMP-FAST-005. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n')$	$-1.8784 \pm 0.8349$	-
$^{238}\text{U} (n,n')/^{238}\text{U} (n,n')$	$1.7 \pm 0.9$	$0.701 \pm 0.020$
$^{238}\text{U} (n,n')/^{238}\text{U} (n,f)$	$-1.2 \pm 0.3$	$-0.819 \pm 0.010$
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$1.1 \pm 0.5$	-
$^{238}\text{U} (n,n)/^{238}\text{U} (n,f)$	$1.1 \pm 0.4$	-
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n)$	$1.1 \pm 0.8$	-
$^{57}\text{Fe} (n,n)/^{57}\text{Fe} (n,n)$	$0.9 \pm 0.3$	-
$^{238}\text{U} (n,f)/^{238}\text{U} (n,f)$	$0.66 \pm 0.11$	$0.701 \pm 0.006$
$^{239}\text{Pu} \chi/^{239}\text{Pu} \chi$	$0.6 \pm 0.6$	$0.97 \pm 0.03$
$^{240}\text{Pu}(n,n')/^{240}\text{Pu}(n,n')$	$0.46 \pm 0.20$	-
JENDL-4.0u		
$^{238}\text{U} (n,n')/^{238}\text{U} (n,n')$	$2.2 \pm 0.8$	$1.157 \pm 0.004$
$^{238}\text{U} \bar{\nu}_d/^{238}\text{U} \bar{\nu}_d$	$1.895 \pm 0.005$	$1.7689 \pm 0.0019$
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$1.7 \pm 0.8$	-
$^{239}\text{Pu} \bar{\nu}_d/^{239}\text{Pu} \bar{\nu}_d$	$1.5127 \pm 0.0022$	$1.5671 \pm 0.0015$
ENDF/B-VIII.0		
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n')$	$-1.5 \pm 0.9$	-
$^{23}\text{Na} (n,n)/^{23}\text{Na} (n,n)$	$1.3 \pm 0.9$	-
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n)$	$1.0 \pm 0.4$	-
$^{238}\text{U} (n,n')/^{238}\text{U} (n,f)$	$-0.86 \pm 0.22$	$-0.553 \pm 0.009$
$^{238}\text{U} (n,n')/^{238}\text{U} (n,n')$	$0.8 \pm 0.6$	-
$^{58}\text{Ni} (n,n)/^{58}\text{Ni} (n,n)$	$0.8 \pm 0.3$	-
$^{238}\text{U} \bar{\nu}_d/^{238}\text{U} \bar{\nu}_d$	$0.7315 \pm 0.0018$	$0.6826 \pm 0.0008$
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$0.7 \pm 0.4$	-
$^{239}\text{Pu} \chi/^{239}\text{Pu} \chi$	$0.59 \pm 0.21$	$0.605 \pm 0.008$
$^{238}\text{U} \chi/^{238}\text{U} \chi$	$0.51 \pm 0.12$	$0.521 \pm 0.004$
$^{238}\text{U} \bar{\nu}/^{238}\text{U} \bar{\nu}_p$	$-0.49 \pm 0.05$	$-0.4674 \pm 0.0019$
$^{238}\text{U} (n,f)/^{238}\text{U} (n,f)$	$0.33 \pm 0.05$	$0.354 \pm 0.003$
$^{238}\text{U} \bar{\nu}_p/^{238}\text{U} \bar{\nu}_p$	$0.43 \pm 0.05$	$0.3462279200.000000027$
$^{238}\text{U} \bar{\nu}/^{238}\text{U} \bar{\nu}$	$0.29 \pm 0.04$	$0.318 \pm 0.003$

### C.13 IEU-MET-FAST-010

Table C.13.1: ISCs for the multiplication factor of IEU-MET-FAST-010.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
235U $\bar{\nu}$	$0.7513 \pm 0.0004$
235U $\bar{\nu}_p$	$0.7473 \pm 0.0004$
235U (n,f)	$0.5110 \pm 0.0004$
235U $\chi$	$0.0000 \pm 0.0004$
238U (n,n')	$-0.1102 \pm 0.0007$
238U (n, $\gamma$ )	$-0.26595 \pm 0.00012$

Table C.13.2: ISCs for the delayed neutron fraction of IEU-MET-FAST-010.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
235U $\bar{\nu}_d$	$0.5362 \pm 0.0009$	$0.5627 \pm 0.0019$
238U $\bar{\nu}_d$	$0.4483 \pm 0.0012$	$0.3960 \pm 0.0011$
235U $\bar{\nu}_p$	$-0.56 \pm 0.07$	$-0.5247 \pm 0.0012$
238U $\bar{\nu}_p$	$-0.42 \pm 0.04$	$-0.43221 \pm 0.0000021$
235U $\chi$	$0.00 \pm 0.07$	$0.000 \pm 0.007$
56Fe (n,n)	$0.04 \pm 0.09$	$-0.007 \pm 0.007$
238U (n,n')	$0.05 \pm 0.13$	$-0.048 \pm 0.003$
235U (n,f)	$-0.03 \pm 0.07$	$0.022 \pm 0.012$
238U (n,f)	$0.11 \pm 0.04$	$0.043 \pm 0.003$
238U (n,n)	$0.3 \pm 0.3$	$-0.02 \pm 0.03$

Table C.13.3: Reaction contribution to multiplication factor uncertainty of IEU-MET-FAST-010. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (84.4%)	
235U (n,f)/235U (n,f)	$1.1542 \pm 0.0010$
235U $\chi$ /235U $\chi$	$0.849 \pm 0.003$
238U (n,n')/238U (n,n')	$0.674 \pm 0.005$
JENDL-4.0u (90.0%)	
238U (n,n')/238U (n,n')	$1.092 \pm 0.004$
235U $\chi$ /235U $\chi$	$0.5425 \pm 0.0016$
238U (n, $\gamma$ )/238U (n, $\gamma$ )	$0.4715 \pm 0.0003$
ENDF/B-VIII.0 (71.3%)	
235U (n,f)/235U (n,f)	$0.6174 \pm 0.0005$
238U (n, $\gamma$ )/238U (n, $\gamma$ )	$0.44343 \pm 0.00019$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.44167 \pm 0.00016$

Table C.13.4: Reaction contribution to delayed neutron fraction uncertainty of IEU-MET-FAST-010. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{235}\text{U } \chi / ^{235}\text{U } \chi$	$0.9 \pm 0.5$	$0.436 \pm 0.017$
$^{56}\text{Fe (n,n)} / ^{56}\text{Fe (n,n)}$	$0.6 \pm 0.3$	-
$^{238}\text{U (n,n')} / ^{238}\text{U (n,n')}$	$0.5 \pm 0.6$	-
$^{238}\text{U } \bar{\nu}_p / ^{238}\text{U } \bar{\nu}_p$	$0.41 \pm 0.04$	$0.4119624 \pm 0.0000018$
$^{238}\text{U (n,n')} / ^{238}\text{U (n,f)}$	$0.4 \pm 0.4$	-
$^{235}\text{U } \bar{\nu}_p / ^{235}\text{U } \bar{\nu}_p$	$0.30 \pm 0.04$	$0.2815 \pm 0.0004$
$^{235}\text{U (n,f)} / ^{235}\text{U (n,f)}$	$0.19 \pm 0.16$	$0.279 \pm 0.010$
JENDL-4.0u		
$^{235}\text{U } \bar{\nu}_d / ^{235}\text{U } \bar{\nu}_d$	$1.852 \pm 0.004$	$1.9601 \pm 0.0021$
$^{238}\text{U } \bar{\nu}_d / ^{238}\text{U } \bar{\nu}_d$	$1.504 \pm 0.004$	$1.3291 \pm 0.0018$
$^{238}\text{U (n,n)} / ^{238}\text{U (n,n)}$	$1.0 \pm 1.0$	-
ENDF/B-VIII.0		
$^{235}\text{U } \bar{\nu}_d / ^{235}\text{U } \bar{\nu}_d$	$2.520 \pm 0.004$	$2.6444 \pm 0.0025$
$^{238}\text{U (n,n)} / ^{238}\text{U (n,n)}$	$1.0 \pm 0.7$	-

## C.14 IEU-MET-FAST-020

Table C.14.1: ISCs for the multiplication factor of IEU-MET-FAST-020.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{235}\text{U } \bar{\nu}$	$0.82055 \pm 0.00022$
$^{235}\text{U } \bar{\nu}_p$	$0.81576 \pm 0.00021$
$^{235}\text{U (n,f)}$	$0.51909 \pm 0.00023$
$^{235}\text{U } \chi$	$0.00000 \pm 0.00021$
$^{235}\text{U (n,}\gamma)$	$-0.061807 \pm 0.000021$
$^{238}\text{U (n,n')}$	$-0.0121 \pm 0.0003$

Table C.14.2: ISCs for the delayed neutron fraction of IEU-MET-FAST-020.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
235U $\bar{\nu}_d$	$0.6364 \pm 0.0005$	$0.6569 \pm 0.0012$
238U $\bar{\nu}_d$	$0.3498 \pm 0.0005$	$0.3074 \pm 0.0005$
235U $\bar{\nu}_p$	$-0.68 \pm 0.04$	$-0.6513 \pm 0.0003$
238U $\bar{\nu}_p$	$-0.346 \pm 0.015$	$-0.310 \pm 0.003$
238U (n,n)	$0.28 \pm 0.12$	$0.016 \pm 0.017$
238U (n,n')	$-0.07 \pm 0.05$	$-0.042 \pm 0.003$
235U $\chi$	$0.00 \pm 0.04$	$0.000 \pm 0.003$
235U (n,f)	$-0.02 \pm 0.04$	$-0.015 \pm 0.007$
65Cu (n,n)	$-0.07 \pm 0.07$	$-0.004 \pm 0.009$

Table C.14.3: Reaction contribution to multiplication factor uncertainty of IEU-MET-FAST-020. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (82.1%)	
235U (n,f)/235U (n,f)	$1.0083 \pm 0.0005$
235U $\chi$ /235U $\chi$	$0.6366 \pm 0.0015$
235U (n, $\gamma$ )/235U (n, $\gamma$ )	$0.54196 \pm 0.00017$
JENDL-4.0u (76.2%)	
238U (n,n')/238U (n,n')	$0.4221 \pm 0.0021$
235U $\chi$ /235U $\chi$	$0.3877 \pm 0.0009$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.27275 \pm 0.00006$
ENDF/B-VIII.0 (76.4%)	
235U (n,f)/235U (n,f)	$0.6240 \pm 0.0003$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.47772 \pm 0.00009$
235U (n, $\gamma$ )/235U (n, $\gamma$ )	$0.36823 \pm 0.00011$

Table C.14.4: Reaction contribution to delayed neutron fraction uncertainty of IEU-MET-FAST-020. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
238U (n,n)/238U (n,n')	$-0.7 \pm 0.3$	-
238U (n,n')/238U (n,n')	$0.69 \pm 0.23$	$0.305 \pm 0.012$
238U (n,n)/238U (n,n)	$0.46 \pm 0.22$	-
235U $\chi$ /235U $\chi$	$0.5 \pm 0.3$	-
235U (n,f)/235U (n,f)	$0.37 \pm 0.10$	$0.318 \pm 0.006$
65Cu (n,n)/65Cu (n,n)	$0.34 \pm 0.23$	-
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.334 \pm 0.022$	$0.34344 \pm 0.00017$
238U $\bar{\nu}_p$ /238U $\bar{\nu}_p$	$0.331 \pm 0.014$	$0.2954843 \pm 0.0000011$
JENDL-4.0u		
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$2.0427 \pm 0.0019$	$2.1378 \pm 0.0012$
238U (n,n')/238U (n,n')	$1.5 \pm 0.4$	-
238U $\bar{\nu}_d$ /238U $\bar{\nu}_d$	$1.1732 \pm 0.0017$	$1.0312 \pm 0.0008$
ENDF/B-VIII.0		
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$2.9898 \pm 0.0025$	$3.0862 \pm 0.0015$

## C.15 IEU-MET-FAST-021

Table C.15.1: ISCs for the multiplication factor of IEU-MET-FAST-021.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
235U $\bar{\nu}$	$0.79288 \pm 0.00022$
235U $\bar{\nu}_p$	$0.78835 \pm 0.00021$
235U (n,f)	$0.50595 \pm 0.00023$
235U $\chi$	$0.00000 \pm 0.00020$
235U (n, $\gamma$ )	$-0.056125 \pm 0.000020$
238U (n,n')	$0.0068 \pm 0.0003$
238U (n,n)	$0.1663 \pm 0.0007$

Table C.15.2: ISCs for the delayed neutron fraction of IEU-MET-FAST-021.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
235U $\bar{\nu}_d$	$0.5967 \pm 0.0005$	$0.6202 \pm 0.0011$
238U $\bar{\nu}_d$	$0.3891 \pm 0.0005$	$0.3417 \pm 0.0005$
235U $\bar{\nu}_p$	$-0.59 \pm 0.04$	$-0.6003 \pm 0.0010$
238U $\bar{\nu}_p$	$-0.391 \pm 0.017$	$-0.358922 \pm 0.0000019$
238U (n,n')	$-0.02 \pm 0.06$	$-0.061 \pm 0.004$
235U (n,n')	$0.029 \pm 0.025$	$-0.0073 \pm 0.0014$
235U (n,f)	$-0.03 \pm 0.04$	$-0.007 \pm 0.006$

Table C.15.3: Reaction contribution to multiplication factor uncertainty of IEU-MET-FAST-021. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (76.7%)	
235U (n,f)/235U (n,f)	$0.9753 \pm 0.0005$
235U $\chi$ /235U $\chi$	$0.7287 \pm 0.0016$
235U (n, $\gamma$ )/235U (n, $\gamma$ )	$0.50639 \pm 0.00017$
JENDL-4.0u (81.4%)	
238U (n,n')/238U (n,n')	$0.619 \pm 0.003$
235U $\chi$ /235U $\chi$	$0.4438 \pm 0.0009$
238U (n,n)/238U (n,n)	$0.4280 \pm 0.0023$
ENDF/B-VIII.0 (68.7%)	
235U (n,f)/235U (n,f)	$0.6108 \pm 0.0003$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.45887 \pm 0.00009$
238U (n,n)/238U (n,n)	$0.3974 \pm 0.0017$

Table C.15.4: Reaction contribution to delayed neutron fraction uncertainty of IEU-MET-FAST-021. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
238U (n,n')/238U (n,n')	$0.40 \pm 0.18$	$0.441 \pm 0.014$
238U $\bar{\nu}_p$ /238U $\bar{\nu}_p$	$0.374 \pm 0.016$	$0.3415542 \pm 0.0000012$
235U (n,n')/235U (n,f)	$0.35 \pm 0.17$	-
235U $\bar{\nu}_p$ /235U $\bar{\nu}_p$	$0.309 \pm 0.022$	$0.31494 \pm 0.00025$
235U (n,f)/235U (n,f)	$0.31 \pm 0.09$	$0.345 \pm 0.005$
JENDL-4.0u		
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$1.9651 \pm 0.0018$	$2.0725 \pm 0.0012$
238U $\bar{\nu}_d$ /238U $\bar{\nu}_d$	$1.3050 \pm 0.0018$	$1.1463 \pm 0.0009$
238U (n,n')/238U (n,n')	$1.2 \pm 0.6$	-
ENDF/B-VIII.0		
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$2.8046 \pm 0.0024$	$2.9148 \pm 0.0015$



## C.16 IEU-MET-FAST-022

Table C.16.1: ISCs for the multiplication factor of IEU-MET-FAST-022.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
235U $\bar{\nu}$	$0.83795 \pm 0.00022$
235U $\bar{\nu}_p$	$0.83295 \pm 0.00022$
235U (n,f)	$0.52239 \pm 0.00023$
235U (n, $\gamma$ )	$-0.075864 \pm 0.000019$
235U $\chi$	$0.00000 \pm 0.00021$
238U (n,n')	$-0.0131 \pm 0.0003$

Table C.16.2: ISCs for the delayed neutron fraction of IEU-MET-FAST-022.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
235U $\bar{\nu}_d$	$0.6601 \pm 0.0005$	$0.6824 \pm 0.0013$
238U $\bar{\nu}_d$	$0.3215 \pm 0.0005$	$0.2835 \pm 0.0005$
235U $\bar{\nu}_p$	$-0.67 \pm 0.04$	$-0.682292 \pm 0.000007$
238U $\bar{\nu}_p$	$-0.31 \pm 0.05$	$-0.28106570000 \pm 0.00000000009$
65Cu (n,n)	$0.01 \pm 0.07$	$-0.014 \pm 0.006$
235U (n,n')	$-0.048 \pm 0.022$	$-0.0061 \pm 0.0010$
238U (n,n')	$-0.08 \pm 0.05$	$-0.0399 \pm 0.0014$
235U (n,f)	$-0.01 \pm 0.04$	$-0.019 \pm 0.008$
235U $\chi$	$0.00 \pm 0.04$	$0.000 \pm 0.003$

Table C.16.3: Reaction contribution to multiplication factor uncertainty of IEU-MET-FAST-022. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (83.5%)	
235U (n,f)/235U (n,f)	$1.0932 \pm 0.0006$
235U (n, $\gamma$ )/235U (n, $\gamma$ )	$0.62791 \pm 0.00014$
235U (n,f)/235U (n, $\gamma$ )	$0.61915 \pm 0.00025$
JENDL-4.0u (71.2%)	
235U $\chi$ /235U $\chi$	$0.3458 \pm 0.0009$
238U (n,n')/238U (n,n')	$0.3187 \pm 0.0019$
235U (n,f)/235U (n,f)	$0.27067 \pm 0.00015$
ENDF/B-VIII.0 (78.8%)	
235U (n,f)/235U (n,f)	$0.6236 \pm 0.0003$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.51176 \pm 0.00010$
235U (n, $\gamma$ )/235U (n, $\gamma$ )	$0.41486 \pm 0.00009$

Table C.16.4: Reaction contribution to delayed neutron fraction uncertainty of IEU-MET-FAST-022. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{65}\text{Cu} (n,n)/^{65}\text{Cu} (n,n)$	$0.6 \pm 0.5$	-
$^{235}\text{U} (n,n')/^{235}\text{U} (n,n')$	$0.56 \pm 0.24$	-
$^{238}\text{U} (n,n')/^{238}\text{U} (n,n')$	$0.5 \pm 0.3$	$0.283 \pm 0.008$
$^{235}\text{U} \bar{\nu}_p/^{235}\text{U} \bar{\nu}_p$	$0.354 \pm 0.023$	$0.363191 \pm 0.000003$
$^{235}\text{U} (n,f)/^{235}\text{U} (n,f)$	$0.36 \pm 0.10$	$0.285 \pm 0.006$
$^{235}\text{U} \chi/^{235}\text{U} \chi$	-	$0.285 \pm 0.009$
JENDL-4.0u		
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$2.0330 \pm 0.0019$	$2.1247 \pm 0.0012$
$^{238}\text{U} \bar{\nu}_d/^{238}\text{U} \bar{\nu}_d$	$1.0797 \pm 0.0016$	$0.9521 \pm 0.0008$
ENDF/B-VIII.0		
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$3.1010 \pm 0.0024$	$3.2059 \pm 0.0016$

## C.17 FCA-XIX-1

Table C.17.1: ISCs for the multiplication factor of FCA-XIX-1.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{235}\text{U} \bar{\nu}$	$0.9760 \pm 0.0004$
$^{235}\text{U} \bar{\nu}_p$	$0.9688 \pm 0.0004$
$^{235}\text{U} (n,f)$	$0.4579 \pm 0.0004$
$^{235}\text{U} (n,\gamma)$	$-0.17544 \pm 0.00005$
$^{235}\text{U} \chi$	$0.0000 \pm 0.0004$

Table C.17.2: ISCs for the delayed neutron fraction of FCA-XIX-1.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{235}\text{U} \bar{\nu}_d$	$0.9370 \pm 0.0010$	$0.942 \pm 0.003$
$^{16}\text{O} (n,n)$	$-1.0 \pm 0.3$	$-0.05 \pm 0.05$
$^{235}\text{U} \bar{\nu}_p$	$-0.95 \pm 0.07$	$-0.94 \pm 0.00$
$^{235}\text{U} \chi$	$0.00 \pm 0.07$	$0.000 \pm 0.006$
$^{55}\text{Mn} (n,n)$	$0.09 \pm 0.04$	$-0.003 \pm 0.003$
$^{56}\text{Fe} (n,n)$	$-0.04 \pm 0.13$	$-0.008 \pm 0.011$
$^{54}\text{Fe} (n,n)$	$0.08 \pm 0.05$	$-0.002 \pm 0.006$
$^{235}\text{U} (n,n)$	$-0.12 \pm 0.09$	$0.002 \pm 0.010$

Table C.17.3: Reaction contribution to multiplication factor uncertainty of FCA-XIX-1. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (88.4%)	
$^{235}\text{U} (n,\gamma)/^{235}\text{U} (n,\gamma)$	$0.86065 \pm 0.00016$
$^{235}\text{U} (n,f)/^{235}\text{U} (n,f)$	$0.7891 \pm 0.0008$
$^{235}\text{U} (n,f)/^{235}\text{U} (n,\gamma)$	$0.6020 \pm 0.0007$
JENDL-4.0u (84.0%)	
$^{235}\text{U} (n,\gamma)/^{235}\text{U} (n,\gamma)$	$0.48213 \pm 0.00021$
$^{235}\text{U} (n,f)/^{235}\text{U} (n,f)$	$0.4770 \pm 0.0008$
$^{235}\text{U} \chi/^{235}\text{U} \chi$	$0.2656 \pm 0.0015$
ENDF/B-VIII.0 (82.9%)	
$^{235}\text{U} \bar{\nu}/^{235}\text{U} \bar{\nu}_p$	$0.81053 \pm 0.00025$
$^{235}\text{U} \bar{\nu}/^{235}\text{U} \bar{\nu}$	$0.57412 \pm 0.00025$
$^{235}\text{U} \bar{\nu}_p/^{235}\text{U} \bar{\nu}_p$	$0.57288 \pm 0.00025$

Table C.17.4: Reaction contribution to delayed neutron fraction uncertainty of FCA-XIX-1. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{235}\text{U} \chi/^{235}\text{U} \chi$	$1.0 \pm 0.4$	-
$^{55}\text{Mn} (n,n)/^{55}\text{Mn} (n,n)$	$0.8 \pm 0.3$	-
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$0.6 \pm 0.3$	-
$^{235}\text{U} \bar{\nu}_p/^{235}\text{U} \bar{\nu}_p$	$0.52 \pm 0.04$	$0.51 \pm 0.00$
$^{10}\text{C} (n,n)/^{10}\text{C} (n,n)$	$0.49 \pm 0.16$	-
$^{54}\text{Fe} (n,n)/^{54}\text{Fe} (n,n)$	$0.5 \pm 0.3$	-
JENDL-4.0u		
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$2.352 \pm 0.003$	$2.3983 \pm 0.0016$
$^{235}\text{U} (n,n)/^{235}\text{U} (n,n)$	$0.8 \pm 0.6$	-
ENDF/B-VIII.0		
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$4.261 \pm 0.005$	$4.283 \pm 0.003$

## C.18 FCA-XIX-2

Table C.18.1: ISCs for the multiplication factor of FCA-XIX-2.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{239}\text{Pu } \bar{\nu}$	$0.7968 \pm 0.0003$
$^{239}\text{Pu } \bar{\nu}_p$	$0.7952 \pm 0.0003$
$^{239}\text{Pu (n,f)}$	$0.5043 \pm 0.0003$
$^{239}\text{Pu } \chi$	$0.0000 \pm 0.0003$
$^{239}\text{Pu (n,}\gamma\text{)}$	$-0.053534 \pm 0.000025$
$^{238}\text{U (n,}\gamma\text{)}$	$-0.14009 \pm 0.00004$

Table C.18.2: ISCs for the delayed neutron fraction of FCA-XIX-2.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{238}\text{U (n,n)}$	$0.6 \pm 0.3$	$-0.047 \pm 0.007$
$^{239}\text{Pu } \bar{\nu}_d$	$0.4391 \pm 0.0008$	$0.4400 \pm 0.0014$
$^{238}\text{U } \bar{\nu}_d$	$0.3989 \pm 0.0016$	$0.3718 \pm 0.0009$
$^{239}\text{Pu } \bar{\nu}_p$	$-0.71 \pm 0.11$	$-0.71381 \pm 0.00019$
$^{239}\text{Pu } \chi$	$0.00 \pm 0.10$	$0.000 \pm 0.009$
$^{56}\text{Fe (n,n)}$	$0.1 \pm 0.3$	$-0.038 \pm 0.019$
$^{57}\text{Fe (n,n)}$	$0.04 \pm 0.06$	$0.002 \pm 0.007$
$^{27}\text{Al (n,n)}$	$-0.13 \pm 0.20$	$0.002 \pm 0.023$
$^{238}\text{U (n,n')}$	$0.06 \pm 0.12$	$-0.084 \pm 0.006$
$^{238}\text{U (n,f)}$	$0.25 \pm 0.03$	$0.229 \pm 0.003$
$^{52}\text{Cr (n,n)}$	$-0.26 \pm 0.13$	$0.009 \pm 0.017$
$^{58}\text{Ni (n,n)}$	$-0.07 \pm 0.12$	$-0.005 \pm 0.012$
$^{235}\text{U } \bar{\nu}_d$	$0.1385 \pm 0.0004$	$0.1415 \pm 0.0011$
$^{238}\text{U } \bar{\nu}$	$0.22 \pm 0.03$	$0.198 \pm 0.003$
$^{238}\text{U } \bar{\nu}_p$	$-0.18 \pm 0.03$	$-0.17388 \pm 0.00003$

Table C.18.3: Reaction contribution to multiplication factor uncertainty of FCA-XIX-2. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (73.7%)	
$^{239}\text{Pu } \bar{\nu}_p / ^{239}\text{Pu } \bar{\nu}_p$	$0.36529 \pm 0.00013$
$^{239}\text{Pu (n,f)} / ^{239}\text{Pu (n,f)}$	$0.27771 \pm 0.00018$
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$0.2692 \pm 0.0017$
JENDL-4.0u (69.8%)	
$^{239}\text{Pu (n,f)} / ^{239}\text{Pu (n,f)}$	$0.27318 \pm 0.00016$
$^{239}\text{Pu (n,\gamma)} / ^{239}\text{Pu (n,\gamma)}$	$0.23993 \pm 0.00006$
$^{238}\text{U (n,\gamma)} / ^{238}\text{U (n,\gamma)}$	$0.22751 \pm 0.00007$
ENDF/B-VIII.0 (74.8%)	
$^{239}\text{Pu } \bar{\nu} / ^{239}\text{Pu } \bar{\nu}$	$0.21612 \pm 0.00008$
$^{239}\text{Pu } \bar{\nu}_p / ^{239}\text{Pu } \bar{\nu}_p$	$0.21569 \pm 0.00008$
$^{238}\text{U (n,\gamma)} / ^{238}\text{U (n,\gamma)}$	$0.18848 \pm 0.00005$

Table C.18.4: Reaction contribution to delayed neutron fraction uncertainty of FCA-XIX-2. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$1.7 \pm 0.7$	$0.69 \pm 0.03$
$^{56}\text{Fe (n,n)} / ^{56}\text{Fe (n,n)}$	$1.5 \pm 0.9$	-
$^{238}\text{U (n,n)} / ^{238}\text{U (n,n)}$	$1.1 \pm 0.7$	-
$^{238}\text{U (n,n)} / ^{238}\text{U (n,f)}$	$1.1 \pm 0.4$	-
$^{57}\text{Fe (n,n)} / ^{57}\text{Fe (n,n)}$	$1.1 \pm 0.4$	-
$^{238}\text{U (n,n)} / ^{238}\text{U (n,n')} $	$1.0 \pm 0.9$	-
$^{27}\text{Al (n,n)} / ^{27}\text{Al (n,n)}$	$0.8 \pm 0.7$	-
$^{238}\text{U (n,n')} / ^{238}\text{U (n,f)}$	-	$-0.647 \pm 0.014$
$^{238}\text{U (n,n')} / ^{238}\text{U (n,n')} $	-	$0.56 \pm 0.03$
$^{238}\text{U (n,f)} / ^{238}\text{U (n,f)}$	$0.63 \pm 0.08$	$0.558 \pm 0.005$
$^{239}\text{Pu } \bar{\nu}_p / ^{239}\text{Pu } \bar{\nu}_p$	$0.32 \pm 0.05$	$0.31988 \pm 0.00007$
JENDL-4.0u		
$^{238}\text{U (n,n)} / ^{238}\text{U (n,n)}$	$2.9 \pm 1.5$	-
$^{239}\text{Pu } \bar{\nu}_d / ^{239}\text{Pu } \bar{\nu}_d$	$1.585 \pm 0.003$	$1.6233 \pm 0.0015$
$^{238}\text{U } \bar{\nu}_d / ^{238}\text{U } \bar{\nu}_d$	$1.341 \pm 0.005$	$1.2499 \pm 0.0015$
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$1.1 \pm 0.4$	-
$^{56}\text{Fe (n,n)} / ^{56}\text{Fe (n,n)}$	$1.1 \pm 0.6$	-
$^{238}\text{U (n,n')} / ^{238}\text{U (n,n')} $	-	$0.8967 \pm 0.0011$
ENDF/B-VIII.0		
$^{52}\text{Cr (n,n)} / ^{52}\text{Cr (n,n)}$	$1.5 \pm 0.8$	-
$^{238}\text{U (n,n)} / ^{238}\text{U (n,n)}$	$1.2 \pm 0.6$	-
$^{27}\text{Al (n,n)} / ^{27}\text{Al (n,n)}$	$1.1 \pm 1.0$	-
$^{56}\text{Fe (n,n)} / ^{56}\text{Fe (n,n)}$	$0.8 \pm 0.4$	-
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$0.8 \pm 0.3$	$0.432 \pm 0.009$
$^{58}\text{Ni (n,n)} / ^{58}\text{Ni (n,n)}$	$0.8 \pm 0.6$	-
$^{235}\text{U } \bar{\nu}_d / ^{235}\text{U } \bar{\nu}_d$	$0.6497 \pm 0.0017$	$0.6639 \pm 0.0012$
$^{238}\text{U } \bar{\nu}_d / ^{238}\text{U } \bar{\nu}_d$	$0.5176 \pm 0.0020$	$0.4822 \pm 0.0006$
$^{238}\text{U (n,n')} / ^{238}\text{U (n,f)}$	-	$-0.440 \pm 0.011$
$^{238}\text{U } \bar{\nu} / ^{238}\text{U } \bar{\nu}_p$	$-0.36 \pm 0.03$	$-0.3304 \pm 0.0012$
$^{238}\text{U (n,f)} / ^{238}\text{U (n,f)}$	$0.31 \pm 0.03$	$0.2805 \pm 0.0020$
$^{238}\text{U } \bar{\nu} / ^{238}\text{U } \bar{\nu}$	$0.27 \pm 0.03$	$0.2536 \pm 0.0019$
$^{238}\text{U (n,n')} / ^{238}\text{U (n,n')} $	-	$0.237 \pm 0.013$
$^{238}\text{U (n,n)} / ^{238}\text{U (n,n')} $	-	$0.237 \pm 0.003$

## C.19 FCA-XIX-3

Table C.19.1: ISCs for the multiplication factor of FCA-XIX-3.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{239}\text{Pu } \bar{\nu}$	$0.9160 \pm 0.0003$
$^{239}\text{Pu } \bar{\nu}_p$	$0.9140 \pm 0.0003$
$^{239}\text{Pu (n,f)}$	$0.6030 \pm 0.0003$
$^{56}\text{Fe (n,n)}$	$0.0798 \pm 0.0013$
$^{239}\text{Pu (n,}\gamma\text{)}$	$-0.06421 \pm 0.00003$
$^{52}\text{Cr (n,n)}$	$0.0343 \pm 0.0007$

Table C.19.2: ISCs for the delayed neutron fraction of FCA-XIX-3.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{239}\text{Pu } \bar{\nu}_d$	$0.774 \pm 0.003$	$0.7669 \pm 0.0025$
$^{52}\text{Cr (n,n)}$	$0.3 \pm 0.4$	$0.00 \pm 0.03$
$^{239}\text{Pu } \bar{\nu}_p$	$-0.96 \pm 0.18$	$-0.8995 \pm 0.0005$
$^{54}\text{Fe (n,n)}$	$-0.54 \pm 0.25$	$-0.007 \pm 0.022$
$^{56}\text{Fe (n,n)}$	$-0.4 \pm 0.7$	$0.06 \pm 0.11$
$^{57}\text{Fe (n,n)}$	$0.30 \pm 0.16$	$-0.011 \pm 0.013$
$^{239}\text{Pu } \chi$	$0.00 \pm 0.18$	$0.000 \pm 0.017$
$^{238}\text{U (n,n')}$	$0.03 \pm 0.09$	$-0.028 \pm 0.003$
$^{238}\text{U (n,f)}$	$0.120 \pm 0.024$	$0.066 \pm 0.003$
$^{53}\text{Cr (n,n)}$	$0.14 \pm 0.23$	$-0.005 \pm 0.012$
$^{58}\text{Ni (n,n)}$	$0.2 \pm 0.3$	$-0.049 \pm 0.019$
$^{235}\text{U } \bar{\nu}_d$	$0.1009 \pm 0.0005$	$0.1008 \pm 0.0013$

Table C.19.3: Reaction contribution to multiplication factor uncertainty of FCA-XIX-3. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (81.2%)	
$^{239}\text{Pu } \bar{\nu}_p / ^{239}\text{Pu } \bar{\nu}_p$	$0.42018 \pm 0.00015$
$^{239}\text{Pu (n,f)} / ^{239}\text{Pu (n,f)}$	$0.32627 \pm 0.00022$
$^{56}\text{Fe (n,n)} / ^{56}\text{Fe (n,n)}$	$0.248 \pm 0.003$
JENDL-4.0u (78.8%)	
$^{56}\text{Fe (n,n)} / ^{56}\text{Fe (n,n)}$	$0.349 \pm 0.005$
$^{239}\text{Pu (n,f)} / ^{239}\text{Pu (n,f)}$	$0.32553 \pm 0.00018$
$^{239}\text{Pu (n,}\gamma\text{)} / ^{239}\text{Pu (n,}\gamma\text{)}$	$0.25056 \pm 0.00007$
ENDF/B-VIII.0 (78.5%)	
$^{239}\text{Pu } \bar{\nu} / ^{239}\text{Pu } \bar{\nu}$	$0.24739 \pm 0.00009$
$^{239}\text{Pu } \bar{\nu}_p / ^{239}\text{Pu } \bar{\nu}_p$	$0.24685 \pm 0.00009$
$^{52}\text{Cr (n,n)} / ^{52}\text{Cr (n,n)}$	$0.234 \pm 0.004$

Table C.19.4: Reaction contribution to delayed neutron fraction uncertainty of FCA-XIX-3. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
56Fe (n,n)/56Fe (n,n)	$5.0 \pm 2.2$	$0.27 \pm 0.09$
54Fe (n,n)/54Fe (n,n)	$2.6 \pm 0.9$	-
57Fe (n,n)/57Fe (n,n)	$2.4 \pm 1.1$	-
239Pu $\bar{\nu}_p$ /239Pu $\bar{\nu}_p$	$0.44 \pm 0.08$	$0.40538 \pm 0.00015$
239Pu $\chi$ /239Pu $\chi$	-	$0.20 \pm 0.05$
238U (n,n')/238U (n,f)	-	$-0.189 \pm 0.006$
238U (n,n')/238U (n,n')	-	$0.189 \pm 0.016$
238U (n,f)/238U (n,f)	$0.29 \pm 0.06$	$0.156 \pm 0.003$
54Fe (n,n)/54Fe (n,n)	-	$0.150 \pm 0.010$
JENDL-4.0u		
56Fe (n,n)/56Fe (n,n)	$4.8 \pm 2.0$	-
239Pu $\bar{\nu}_d$ /239Pu $\bar{\nu}_d$	$2.608 \pm 0.009$	$2.6300 \pm 0.0024$
ENDF/B-VIII.0		
56Fe (n,n)/56Fe (n,n)	$2.4 \pm 1.4$	-
53Cr (n,n)/53Cr (n,n)	$1.2 \pm 0.7$	-
52Cr (n,n)/52Cr (n,n)	$1.1 \pm 1.7$	-
58Ni (n,n)/58Ni (n,n)	$1.1 \pm 1.0$	$0.18 \pm 0.03$
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$0.4721 \pm 0.0022$	$0.4714 \pm 0.0014$
239Pu $\bar{\nu}_p$ /239Pu $\bar{\nu}_p$	$0.27 \pm 0.05$	$0.24694 \pm 0.00008$

## C.20 SNEAK-7A

Table C.20.1: ISCs for the multiplication factor of SNEAK-7A.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)	
	MCNP	Kodeli, [1]
239Pu (n,f)	$0.5485 \pm 0.0003$	0.54
239Pu $\bar{\nu}_p$	$0.7955 \pm 0.0003$	0.779
238U $\bar{\nu}_p$	$0.13257 \pm 0.00009$	0.137
239Pu $\bar{\nu}$	$0.7971 \pm 0.0003$	-
239Pu $\chi$	$0.0000 \pm 0.0003$	-
238U (n, $\gamma$ )	$-0.16411 \pm 0.00006$	-
238U $\bar{\nu}$	$0.13450 \pm 0.00009$	-



Table C.20.2: ISCs for the delayed neutron fraction of SNEAK-7A.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)		
	Bretscher	Chiba	Kodeli, [1]
$^{238}\text{U}$ (n,n')	$-0.06 \pm 0.12$	$-0.1548 \pm 0.0017$	-0.151
$^{238}\text{U}$ (n,f)	$0.27 \pm 0.04$	$0.261 \pm 0.004$	0.276
$^{239}\text{Pu}$ (n,f)	$-0.21 \pm 0.11$	$-0.224 \pm 0.014$	-0.252
$^{238}\text{U}$ $\bar{\nu}_d$	$0.4967 \pm 0.0021$	$0.4683 \pm 0.0012$	0.488
$^{239}\text{Pu}$ $\bar{\nu}_d$	$0.4023 \pm 0.0008$	$0.4117 \pm 0.0014$	0.402
$^{238}\text{U}$ $\bar{\nu}_p$	$-0.25 \pm 0.03$	$-0.236308500 \pm 0.000000020$	-0.233
$^{239}\text{Pu}$ $\bar{\nu}_p$	$-0.66 \pm 0.10$	$-0.66953 \pm 0.00003$	-0.7
$^{238}\text{U}$ $\bar{\nu}$	$0.25 \pm 0.03$	$0.232 \pm 0.004$	0.255
$^{239}\text{Pu}$ $\bar{\nu}$	$-0.26 \pm 0.10$	$-0.258 \pm 0.016$	-0.298
$^{238}\text{U}$ (n,n)	$-0.5 \pm 0.3$	$0.00 \pm 0.03$	-
$^{57}\text{Fe}$ (n,n)	$0.06 \pm 0.04$	$0.000 \pm 0.004$	-
$^{56}\text{Fe}$ (n,n)	$0.12 \pm 0.17$	$-0.017 \pm 0.017$	-
$^{238}\text{U}$ $\chi$	$0.00 \pm 0.03$	$0.000 \pm 0.003$	-
$^{239}\text{Pu}$ (n,n)	$-0.14 \pm 0.13$	$-0.006 \pm 0.011$	-
$^{240}\text{Pu}$ (n,n)	$0.07 \pm 0.04$	$-0.0006 \pm 0.0008$	-
$^{240}\text{Pu}$ (n,n')	$0.014 \pm 0.013$	$-0.0020 \pm 0.0005$	-
$^{235}\text{U}$ $\bar{\nu}_d$	$0.05651 \pm 0.00019$	$0.0594 \pm 0.0006$	-
$^{239}\text{Pu}$ $\chi$	$0.0 \pm 0.1$	$0.000 \pm 0.008$	-

Table C.20.3: Reaction contribution to multiplication factor uncertainty of SNEAK-7A. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (72.1%)	
$^{239}\text{Pu}$ $\chi$ / $^{239}\text{Pu}$ $\chi$	$0.4055 \pm 0.0017$
$^{239}\text{Pu}$ $\bar{\nu}_p$ / $^{239}\text{Pu}$ $\bar{\nu}_p$	$0.36448 \pm 0.00013$
$^{239}\text{Pu}$ (n,f)/ $^{239}\text{Pu}$ (n,f)	$0.31548 \pm 0.00021$
JENDL-4.0u (67.3%)	
$^{239}\text{Pu}$ (n,f)/ $^{239}\text{Pu}$ (n,f)	$0.29512 \pm 0.00016$
$^{238}\text{U}$ (n, $\gamma$ )/ $^{238}\text{U}$ (n, $\gamma$ )	$0.27470 \pm 0.00012$
$^{239}\text{Pu}$ $\chi$ / $^{239}\text{Pu}$ $\chi$	$0.2708 \pm 0.0010$
ENDF/B-VIII.0 (68.7%)	
$^{238}\text{U}$ $\bar{\nu}$ / $^{238}\text{U}$ $\bar{\nu}_p$	$0.23237 \pm 0.00011$
$^{238}\text{U}$ (n, $\gamma$ )/ $^{238}\text{U}$ (n, $\gamma$ )	$0.22080 \pm 0.00008$
$^{239}\text{Pu}$ $\bar{\nu}$ / $^{239}\text{Pu}$ $\bar{\nu}$	$0.21631 \pm 0.00008$

Table C.20.4: Reaction contribution to delayed neutron fraction uncertainty of SNEAK-7A. All the reactions showed explain an 85% of the total uncertainty at least. The library used in [1] is JENDL-4.0m

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)		
	Bretscher	Chiba	Kodeli, [1]
JEFF-3.3			
238U (n,n)/238U (n,n)	$1.2 \pm 0.7$	-	-
238U (n,n)/238U (n,f)	$-1.2 \pm 0.4$	-	-
57Fe (n,n)/57Fe (n,n)	$0.93 \pm 0.24$	-	-
238U (n,f)/238U (n,f)	$0.70 \pm 0.11$	$0.634 \pm 0.006$	-
56Fe (n,n)/56Fe (n,n)	$0.7 \pm 0.3$	-	-
238U (n,n)/238U (n,n')	$0.6 \pm 1.5$	-	-
238U (n,n')/238U (n,f)	$-0.4 \pm 0.8$	-	-
238U $\chi$ /238U $\chi$	$0.39 \pm 0.25$	-	-
239Pu (n,n)/239Pu (n,n)	$0.31 \pm 0.12$	-	-
239Pu $\bar{\nu}_p$ /239Pu $\bar{\nu}_p$	$0.29 \pm 0.05$	$0.296461 \pm 0.000012$	-
240Pu (n,n)/240Pu (n,n')	$0.29 \pm 0.17$	-	-
238U (n,n')/238U (n,n')	-	$1.038 \pm 0.006$	-
239Pu $\chi$ /239Pu $\chi$	-	$0.94 \pm 0.03$	-
JENDL-4.0u			
238U (n,n')/238U (n,n')	$1.5 \pm 0.9$	$1.4751 \pm 0.0008$	1.425
235U $\bar{\nu}_d$ /235U $\bar{\nu}_d$	$0.1529 \pm 0.0006$	$0.1614 \pm 0.0004$	0.218
238U $\bar{\nu}_d$ /238U $\bar{\nu}_d$	$1.668 \pm 0.007$	$1.5729 \pm 0.0019$	1.61
239Pu $\bar{\nu}_d$ /239Pu $\bar{\nu}_d$	$1.561 \pm 0.004$	$1.6389 \pm 0.0016$	1.529
238U (n,n)/238U (n,n)	$2.4 \pm 1.5$	-	-
ENDF/B-VIII.0			
238U (n,n)/238U (n,n')	$1.3 \pm 0.5$	-	-
238U (n,n)/238U (n,n)	$1.1 \pm 0.6$	-	-
238U $\bar{\nu}_d$ /238U $\bar{\nu}_d$	$0.644 \pm 0.003$	$0.6075 \pm 0.0007$	-
238U (n,n')/238U (n,n')	$0.6 \pm 0.5$	$0.449 \pm 0.009$	-
238U (n,n')/238U (n,f)	-	$-0.644 \pm 0.004$	-
239Pu $\chi$ /239Pu $\chi$	-	$0.550 \pm 0.009$	-
238U $\bar{\nu}$ /238U $\bar{\nu}_p$	$-0.44 \pm 0.04$	$-0.4147 \pm 0.0017$	-
238U $\chi$ /238U $\chi$	-	$0.403 \pm 0.004$	-
238U (n,f)/238U (n,f)	$0.33 \pm 0.04$	$0.3188 \pm 0.0025$	-
238U $\bar{\nu}$ /238U $\bar{\nu}$	$0.31 \pm 0.04$	$0.2986 \pm 0.0025$	-

## C.21 SNEAK-7B

Table C.21.1: ISCs for the multiplication factor of SNEAK-7B.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{239}\text{Pu } \chi$	$0.0000 \pm 0.0003$
$^{238}\text{U (n,n')}$	$-0.0173 \pm 0.0003$
$^{238}\text{U (n,}\gamma)$	$-0.16411 \pm 0.00006$
$^{238}\text{U } \bar{\nu}$	$0.13450 \pm 0.00009$
$^{238}\text{U (n,n)}$	$0.1032 \pm 0.0009$
$^{238}\text{U } \bar{\nu}_p$	$0.13257 \pm 0.00009$
$^{238}\text{U (n,f)}$	$0.08529 \pm 0.00010$

Table C.21.2: ISCs for the delayed neutron fraction of SNEAK-7B.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)		
	Bretscher	Chiba	Kodeli, [1]
$^{238}\text{U (n,n')}$	$-0.17 \pm 0.12$	$-0.130 \pm 0.005$	-0.164
$^{238}\text{U (n,f)}$	$0.27 \pm 0.04$	$0.251 \pm 0.005$	0.267
$^{239}\text{Pu (n,f)}$	$-0.23 \pm 0.08$	$-0.217 \pm 0.007$	-0.233
$^{238}\text{U } \bar{\nu}_d$	$0.5618 \pm 0.0012$	$0.5270 \pm 0.0011$	0.564
$^{239}\text{Pu } \bar{\nu}_d$	$0.3002 \pm 0.0004$	$0.3091 \pm 0.0010$	0.3
$^{238}\text{U } \bar{\nu}_p$	$-0.36 \pm 0.04$	$-0.320129 \pm 0.000006$	-0.334
$^{239}\text{Pu } \bar{\nu}_p$	$-0.55 \pm 0.08$	$-0.5613 \pm 0.0003$	-0.579
$^{238}\text{U } \bar{\nu}$	$0.20 \pm 0.04$	$0.207 \pm 0.004$	0.23
$^{239}\text{Pu } \bar{\nu}$	$-0.25 \pm 0.08$	$-0.252 \pm 0.008$	-0.28
$^{56}\text{Fe (n,n)}$	$-0.07 \pm 0.16$	$-0.002 \pm 0.017$	-
$^{239}\text{Pu } \chi$	$0.00 \pm 0.08$	$0.000 \pm 0.007$	-
$^{238}\text{U } \chi$	$0.00 \pm 0.03$	$0.000 \pm 0.004$	-
$^{238}\text{U (n,2n)}$	$-0.019 \pm 0.007$	$-0.002 \pm 0.000$	-
$^{238}\text{U (n,}\gamma)$	$-0.095 \pm 0.021$	$-0.0114 \pm 0.0007$	-
$^{235}\text{U } \bar{\nu}_d$	$0.09964 \pm 0.00021$	$0.1044 \pm 0.0007$	-
$^{27}\text{Al (n,n)}$	$0.02 \pm 0.05$	$-0.001 \pm 0.005$	-
$^{52}\text{Cr (n,n)}$	$0.02 \pm 0.08$	$-0.002 \pm 0.004$	-

Table C.21.3: Reaction contribution to multiplication factor uncertainty of SNEAK-7B. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (52.4%)	
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$0.5081 \pm 0.0016$
$^{238}\text{U (n,n')}/^{238}\text{U (n,n')}$	$0.410 \pm 0.003$
$^{238}\text{U (n,n')}/^{238}\text{U (n,f)}$	$-0.3890 \pm 0.0012$
JENDL-4.0u (82%)	
$^{238}\text{U (n,n')}/^{238}\text{U (n,n')}$	$0.6033 \pm 0.0025$
$^{238}\text{U (n,\gamma)}/^{238}\text{U (n,\gamma)}$	$0.38189 \pm 0.00013$
$^{239}\text{Pu } \chi / ^{239}\text{Pu } \chi$	$0.3452 \pm 0.0009$
ENDF/B-VIII.0 (49.2%)	
$^{238}\text{U } \bar{\nu} / ^{238}\text{U } \bar{\nu}_p$	$0.30833 \pm 0.00013$
$^{238}\text{U (n,\gamma)}/^{238}\text{U (n,\gamma)}$	$0.30785 \pm 0.00009$
$^{238}\text{U (n,n)}/^{238}\text{U (n,n')}$	$-0.294 \pm 0.003$

Table C.21.4: Reaction contribution to delayed neutron fraction uncertainty of SNEAK-7B. All the reactions showed explain an 85% of the total uncertainty at least. The library used in [1] is JENDL-4.0m

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)		
	Bretscher	Chiba	Kodeli, [1]
JEFF-3.3			
$^{238}\text{U}(\text{n,n})/^{238}\text{U}(\text{n,n}')$	$-1.5 \pm 0.8$	-	-
$^{238}\text{U}(\text{n,n}')/^{238}\text{U}(\text{n,n}')$	$1.5 \pm 0.8$	$0.858 \pm 0.021$	-
$^{238}\text{U}(\text{n,n})/^{238}\text{U}(\text{n,n})$	$1.2 \pm 0.8$	-	-
$^{238}\text{U}(\text{n,n})/^{238}\text{U}(\text{n,f})$	$1.2 \pm 0.4$	-	-
$^{238}\text{U}(\text{n,n}')/^{238}\text{U}(\text{n,f})$	$-0.8 \pm 0.4$	$-0.845 \pm 0.009$	-
$^{238}\text{U}(\text{n,n}')/^{238}\text{U}(\text{n},2\text{n})$	$0.71 \pm 0.23$	-	-
$^{238}\text{U}(\text{n,n}')/^{238}\text{U}(\text{n},\gamma)$	$0.68 \pm 0.20$	-	-
$^{238}\text{U}(\text{n,f})/^{238}\text{U}(\text{n,f})$	$0.68 \pm 0.11$	$0.609 \pm 0.006$	-
$^{56}\text{Fe}(\text{n,n})/^{56}\text{Fe}(\text{n,n})$	$0.7 \pm 0.4$	-	-
$^{239}\text{Pu} \chi/^{239}\text{Pu} \chi$	-	$0.780 \pm 0.025$	-
$^{238}\text{U} \chi/^{238}\text{U} \chi$	-	$0.448 \pm 0.013$	-
JENDL-4.0u			
$^{238}\text{U}(\text{n,n}')/^{238}\text{U}(\text{n,n}')$	$2.4 \pm 1.1$	$1.479 \pm 0.003$	1.701
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$0.2890 \pm 0.0007$	$0.3047 \pm 0.0006$	0.329
$^{238}\text{U} \bar{\nu}_d/^{238}\text{U} \bar{\nu}_d$	$1.886 \pm 0.004$	$1.7697 \pm 0.0019$	1.848
$^{239}\text{Pu} \bar{\nu}_d/^{239}\text{Pu} \bar{\nu}_d$	$1.2004 \pm 0.0017$	$1.2660 \pm 0.0012$	1.162
$^{238}\text{U}(\text{n,n})/^{238}\text{U}(\text{n,n})$	$2.3 \pm 1.5$	-	-
ENDF/B-VIII.0			
$^{238}\text{U}(\text{n,n}')/^{238}\text{U}(\text{n,n}')$	$1.3 \pm 0.8$	-	-
$^{238}\text{U}(\text{n,n})/^{238}\text{U}(\text{n,n}')$	$-1.2 \pm 0.7$	$0.37 \pm 0.04$	-
$^{238}\text{U}(\text{n,n})/^{238}\text{U}(\text{n,n}) \chi$	$1.0 \pm 0.6$	-	-
$^{238}\text{U}(\text{n,n}')/^{238}\text{U}(\text{n,f})$	$-0.7 \pm 0.3$	$-0.575 \pm 0.008$	-
$^{238}\text{U} \bar{\nu}_d/^{238}\text{U} \bar{\nu}_d$	$0.7288 \pm 0.0016$	$0.6836 \pm 0.0007$	-
$^{238}\text{U} \chi/^{238}\text{U} \chi$	$0.70 \pm 0.11$	$0.540 \pm 0.004$	-
$^{238}\text{U} \bar{\nu}/^{238}\text{U} \bar{\nu}_p$	$-0.48 \pm 0.05$	$-0.4577 \pm 0.0021$	-
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$0.4682 \pm 0.0010$	$0.4904 \pm 0.0008$	-
$^{27}\text{Al}(\text{n,n})/^{27}\text{Al}(\text{n,n})$	$0.5 \pm 0.3$	-	-
$^{238}\text{U} \bar{\nu}_p/^{238}\text{U} \bar{\nu}_p$	$0.45 \pm 0.04$	$0.396288860 \pm 0.000000015$	-
$^{52}\text{Cr}(\text{n,n})/^{52}\text{Cr}(\text{n,n})$	$0.36 \pm 0.17$	-	-
$^{239}\text{Pu} \chi/^{239}\text{Pu} \chi$	-	$0.518 \pm 0.007$	-

## C.22 MASURCA\_R2

Table C.22.1: ISCs for the multiplication factor of MASURCA\_R2.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
235U $\bar{\nu}$	$0.8884 \pm 0.0003$
235U $\bar{\nu}_p$	$0.8828 \pm 0.0003$
235U (n,f)	$0.5289 \pm 0.0003$
235U (n, $\gamma$ )	$-0.09421 \pm 0.00003$
238U (n, $\gamma$ )	$-0.15225 \pm 0.00005$

Table C.22.2: ISCs for the delayed neutron fraction of MASURCA\_R2.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
235U $\bar{\nu}_d$	$0.7500058 \pm 0.0010$	$0.7646934 \pm 0.0020$
235U $\bar{\nu}_p$	$-0.77 \pm 0.06$	$-0.774411 \pm 0.000006$
238U (n,n')	$-0.16 \pm 0.06$	$-0.025 \pm 0.004$
235U $\chi$	$0.00 \pm 0.06$	$0.000 \pm 0.005$
56Fe (n,n)	$-0.09 \pm 0.13$	$0.014 \pm 0.023$
238U (n,n)	$0.14 \pm 0.17$	$0.007 \pm 0.022$
57Fe (n,n)	$-0.03 \pm 0.03$	$0.002 \pm 0.003$
235U (n,f)	$0.00 \pm 0.06$	$-0.033 \pm 0.011$
238U $\bar{\nu}_p$	$-0.220 \pm 0.016$	$-0.199411900 \pm 0.000000021$

Table C.22.3: Reaction contribution to multiplication factor uncertainty of MASURCA\_R2. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (87.6%)	
235U (n,f)/235U (n,f)	$1.0841 \pm 0.0008$
235U (n, $\gamma$ )/235U (n, $\gamma$ )	$0.71167 \pm 0.00018$
235U (n,f)/235U (n, $\gamma$ )	$0.6773 \pm 0.0004$
JENDL-4.0u (66.0%)	
235U (n,f)/235U (n,f)	$0.28555 \pm 0.00025$
238U (n, $\gamma$ )/238U (n, $\gamma$ )	$0.26321 \pm 0.00008$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.26017 \pm 0.00007$
ENDF/B-VIII.0 (78.2%)	
235U (n,f)/235U (n,f)	$0.6094 \pm 0.0004$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.56080 \pm 0.00015$
235U (n, $\gamma$ )/235U (n, $\gamma$ )	$0.46672 \pm 0.00012$

Table C.22.4: Reaction contribution to delayed neutron fraction uncertainty of MASURCA\_R2. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{238}\text{U} (n,n')/^{238}\text{U} (n,n')$	$1.1 \pm 0.4$	-
$^{235}\text{U} \chi/^{235}\text{U} \chi$	$0.7 \pm 0.4$	$0.216 \pm 0.012$
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$0.6 \pm 0.3$	-
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n')$	$0.4 \pm 0.8$	-
$^{57}\text{Fe} (n,n)/^{57}\text{Fe} (n,n)$	$0.44 \pm 0.20$	-
$^{235}\text{U} \bar{\nu}_p/^{235}\text{U} \bar{\nu}_p$	$0.41 \pm 0.03$	$0.415557 \pm 0.000003$
$^{235}\text{U} (n,f)/^{235}\text{U} (n,f)$	$0.37 \pm 0.14$	$0.231 \pm 0.008$
$^{238}\text{U} \bar{\nu}_p/^{238}\text{U} \bar{\nu}_p$	$0.211 \pm 0.016$	$0.193774540 \pm 0.000000024$
JENDL-4.0u		
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$2.197 \pm 0.003$	$2.2621 \pm 0.0016$
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n)$	$1.5 \pm 0.8$	-
$^{238}\text{U} (n,n')/^{238}\text{U} (n,n')$	$1.3 \pm 0.4$	-
ENDF/B-VIII.0		
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$3.519 \pm 0.005$	$3.5881 \pm 0.0023$

## C.23 MASURCA\_ZONA2

Table C.23.1: ISCs for the multiplication factor of MASURCA\_ZONA2.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{239}\text{Pu} \bar{\nu}$	$0.7852 \pm 0.0003$
$^{239}\text{Pu} \bar{\nu}_p$	$0.7837 \pm 0.0003$
$^{239}\text{Pu} (n,f)$	$0.5518 \pm 0.0003$
$^{240}\text{Pu} (n,f)$	$0.037236 \pm 0.000025$
$^{239}\text{Pu} \chi$	$0.0000 \pm 0.0003$
$^{238}\text{U} (n,\gamma)$	$-0.13807 \pm 0.00005$
$^{238}\text{U} \bar{\nu}$	$0.11530 \pm 0.00008$
$^{238}\text{U} \bar{\nu}_p$	$0.11362 \pm 0.00008$

Table C.23.2: ISCs for the delayed neutron fraction of MASURCA\_ZONA2.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{238}\text{U } \bar{\nu}_d$	$0.5640 \pm 0.0014$	$0.4422 \pm 0.0011$
$^{239}\text{Pu } \bar{\nu}_d$	$0.3756 \pm 0.0005$	$0.4295 \pm 0.0014$
$^{56}\text{Fe (n,n)}$	$-0.36 \pm 0.23$	$-0.023 \pm 0.018$
$^{238}\text{U } \bar{\nu}_p$	$-0.34 \pm 0.04$	$-0.211133 \pm 0.000025$
$^{238}\text{U (n,n)}$	$0.3 \pm 0.3$	$-0.01 \pm 0.03$
$^{54}\text{Fe (n,n)}$	$-0.13 \pm 0.07$	$0.000 \pm 0.009$
$^{238}\text{U (n,f)}$	$0.26 \pm 0.03$	$0.261 \pm 0.004$
$^{238}\text{U (n,n')}^*$	$0.01 \pm 0.11$	$-0.078 \pm 0.007$
$^{239}\text{Pu } \chi$	$0.00 \pm 0.10$	$0.000 \pm 0.009$
$^{52}\text{Cr (n,n)}$	$0.08 \pm 0.09$	$-0.001 \pm 0.010$
$^{23}\text{Na (n,n)}$	$-0.1 \pm 0.3$	$-0.01 \pm 0.03$
$^{28}\text{Si (n,n)}$	$0.26 \pm 0.10$	$-0.002 \pm 0.010$
$^{238}\text{U } \bar{\nu}$	$0.24 \pm 0.03$	$0.231 \pm 0.004$
$^{238}\text{U } \chi$	$0.00 \pm 0.03$	$0.000 \pm 0.003$

Table C.23.3: Reaction contribution to multiplication factor uncertainty of MASURCA\_ZONA2. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (77.1%)	
$^{239}\text{Pu (n,f)}/^{239}\text{Pu (n,f)}$	$0.3763 \pm 0.0016$
$^{239}\text{Pu } \bar{\nu}_p/^{239}\text{Pu } \bar{\nu}_p$	$0.35897 \pm 0.00013$
$^{240}\text{Pu (n,f)}/^{240}\text{Pu (n,f)}$	$0.34593 \pm 0.00023$
JENDL-4.0u (67.5%)	
$^{239}\text{Pu (n,f)}/^{239}\text{Pu (n,f)}$	$0.29623 \pm 0.00015$
$^{239}\text{Pu } \chi/^{239}\text{Pu } \chi$	$0.2690 \pm 0.0010$
$^{238}\text{U (n,}\gamma)/^{238}\text{U (n,}\gamma)$	$0.23429 \pm 0.00007$
ENDF/B-VIII.0 (69.6%)	
$^{239}\text{Pu } \bar{\nu}/^{239}\text{Pu } \bar{\nu}$	$0.21339 \pm 0.00007$
$^{239}\text{Pu } \bar{\nu}_p/^{239}\text{Pu } \bar{\nu}_p$	$0.21298 \pm 0.00007$
$^{238}\text{U } \bar{\nu}/^{238}\text{U } \bar{\nu}_p$	$0.20014 \pm 0.00010$



Table C.23.4: Reaction contribution to delayed neutron fraction uncertainty of MASURCA\_ZONA2. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$1.5 \pm 0.6$	-
$^{238}\text{U} (n,n)/^{238}\text{U} (n,f)$	$0.9 \pm 0.5$	-
$^{54}\text{Fe} (n,n)/^{54}\text{Fe} (n,n)$	$0.8 \pm 0.3$	-
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n)$	$0.7 \pm 0.7$	-
$^{238}\text{U} (n,f)/^{238}\text{U} (n,f)$	$0.66 \pm 0.09$	$0.641 \pm 0.005$
$^{238}\text{U} (n,n')/^{238}\text{U} (n,n')$	$0.6 \pm 0.5$	-
$^{239}\text{Pu } \chi/^{239}\text{Pu } \chi$	-	$0.91 \pm 0.03$
$^{238}\text{U} (n,n')/^{238}\text{U} (n,f)$	-	$-0.665 \pm 0.010$
JENDL-4.0u		
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n)$	$2.0 \pm 1.5$	-
$^{238}\text{U} (n,n')/^{238}\text{U} (n,n')$	$1.8 \pm 1.1$	$0.925 \pm 0.006$
$^{239}\text{Pu } \bar{\nu}_d/^{239}\text{Pu } \bar{\nu}_d$	$1.600 \pm 0.004$	$1.6550 \pm 0.0016$
$^{238}\text{U } \bar{\nu}_d/^{238}\text{U } \bar{\nu}_d$	$1.593 \pm 0.008$	$1.4864 \pm 0.0017$
$^{56}\text{Fe} (n,n)/^{56}\text{Fe} (n,n)$	$1.5 \pm 0.8$	-
ENDF/B-VIII.0		
$^{52}\text{Cr} (n,n)/^{52}\text{Cr} (n,n)$	$1.2 \pm 0.6$	-
$^{23}\text{Na} (n,n)/^{23}\text{Na} (n,n)$	$1.2 \pm 0.9$	-
$^{28}\text{Si} (n,n)/^{28}\text{Si} (n,n)$	$1.0 \pm 0.5$	-
$^{238}\text{U} (n,n')/^{238}\text{U} (n,n')$	$1. \pm 00.7$	-
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n')$	$-0.7 \pm 0.6$	-
$^{238}\text{U} (n,n)/^{238}\text{U} (n,n)$	$0.6 \pm 0.5$	-
$^{239}\text{Pu } \chi/^{239}\text{Pu } \chi$	$0.63 \pm 0.19$	$0.538 \pm 0.009$
$^{238}\text{U } \bar{\nu}_d/^{238}\text{U } \bar{\nu}_d$	$0.615 \pm 0.003$	$0.5737 \pm 0.0007$
$^{238}\text{U} (n,n')/^{238}\text{U} (n,f)$	-	$-0.449 \pm 0.010$
$^{238}\text{U } \bar{\nu}/^{238}\text{U } \bar{\nu}_p$	$-0.42 \pm 0.04$	$-0.3927 \pm 0.0015$
$^{238}\text{U } \chi/^{238}\text{U } \chi$	-	$0.354 \pm 0.004$
$^{238}\text{U} (n,f)/^{238}\text{U} (n,f)$	$0.32 \pm 0.04$	$0.3194 \pm 0.0023$
$^{238}\text{U } \bar{\nu}/^{238}\text{U } \bar{\nu}$	$0.30 \pm 0.04$	$0.2958 \pm 0.0022$
$^{238}\text{U } \bar{\nu}_p/^{238}\text{U } \bar{\nu}_p$	$0.29 \pm 0.04$	$0.26280292 \pm 0.00000006$

## C.24 HEU-MET-FAST-062

Table C.24.1: ISCs for the multiplication factor of HEU-MET-FAST-062.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
235U $\bar{\nu}$	$0.9185 \pm 0.0003$
235U $\bar{\nu}_p$	$0.9127 \pm 0.0003$
235U (n,f)	$0.5754 \pm 0.0003$
235U (n,n')	$0.03221 \pm 0.00022$
235U (n, $\gamma$ )	$-0.05259 \pm 0.00003$
238U (n,n)	$0.1288 \pm 0.0006$
238U (n,n')	$0.04981 \pm 0.00025$

Table C.24.2: ISCs for the delayed neutron fraction of HEU-MET-FAST-062.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
235U $\bar{\nu}_d$	$0.8175 \pm 0.0012$	$0.8387 \pm 0.0019$
235U $\bar{\nu}_p$	$-0.84 \pm 0.07$	$-0.842 \pm 0.003$
235U $\chi$	$0.00 \pm 0.06$	$0.000 \pm 0.008$
235U (n,f)	$-0.08 \pm 0.07$	$-0.056 \pm 0.010$
235U (n,n')	$0.03 \pm 0.04$	$-0.011 \pm 0.004$

Table C.24.3: Reaction contribution to multiplication factor uncertainty of HEU-MET-FAST-062. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (71.4%)
JEFF-3.3 (%)	
235U (n,f)/235U (n,f)	$0.7261 \pm 0.0007$
235U (n,n')/235U (n,f)	$0.5344 \pm 0.0018$
235U (n, $\gamma$ )/235U (n, $\gamma$ )	$0.4835 \pm 0.0003$
JENDL-4.0u (66.2%)	
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.33097 \pm 0.00009$
238U (n,n)/238U (n,n)	$0.3198 \pm 0.0018$
238U (n,n')/238U (n,n')	$0.3100 \pm 0.0021$
ENDF/B-VIII.0 (76.1%)	
235U (n,f)/235U (n,f)	$0.6927 \pm 0.0004$
235U $\bar{\nu}$ /235U $\bar{\nu}_p$	$0.52714 \pm 0.00013$
235U $\bar{\nu}$ /235U $\bar{\nu}$	$0.37376 \pm 0.00013$

Table C.24.4: Reaction contribution to delayed neutron fraction uncertainty of HEU-MET-FAST-062. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{235}\text{U } \chi / ^{235}\text{U } \chi$	$1.3 \pm 0.5$	$0.460 \pm 0.009$
$^{235}\text{U (n,f)} / ^{235}\text{U (n,f)}$	$0.78 \pm 0.14$	$0.626 \pm 0.007$
$^{235}\text{U (n,n')} / ^{235}\text{U (n,f)}$	$0.7 \pm 0.4$	-
$^{235}\text{U } \bar{\nu}_p / ^{235}\text{U } \bar{\nu}_p$	$0.41 \pm 0.03$	$0.4205 \pm 0.0007$
JENDL-4.0u		
$^{235}\text{U } \bar{\nu}_d / ^{235}\text{U } \bar{\nu}_d$	$2.363 \pm 0.004$	$2.4802 \pm 0.0017$
$^{235}\text{U } \chi / ^{235}\text{U } \chi$	$0.7 \pm 0.3$	-
ENDF/B-VIII.0		
$^{235}\text{U } \bar{\nu}_d / ^{235}\text{U } \bar{\nu}_d$	$3.842 \pm 0.006$	$3.9417 \pm 0.0025$

## C.25 HEU-MET-FAST-100

Table C.25.1: ISCs for the multiplication factor of HEU-MET-FAST-100.

Quantity	Integrated Sensitivity Coefficients for $k_{eff}$ (%/%)
$^{235}\text{U } \bar{\nu}$	$0.98181 \pm 0.00025$
$^{235}\text{U } \bar{\nu}_p$	$0.97556 \pm 0.00025$
$^{235}\text{U (n,f)}$	$0.6496 \pm 0.0003$
$^{235}\text{U (n,n')}$	$0.08067 \pm 0.00017$
$^{235}\text{U (n,n)}$	$0.1084 \pm 0.0003$

Table C.25.2: ISCs for the delayed neutron fraction of HEU-MET-FAST-100.

Quantity	Integrated Sensitivity Coefficients for $\beta_{eff}$ (%/%)	
	Bretscher	Chiba
$^{235}\text{U } \bar{\nu}_d$	$0.9600 \pm 0.0009$	$0.9676 \pm 0.0015$
$^{235}\text{U } \bar{\nu}_p$	$-0.96 \pm 0.05$	$-0.964 \pm 0.004$
$^{235}\text{U } \chi$	$0.00 \pm 0.05$	$0.000 \pm 0.006$
$^{235}\text{U (n,f)}$	$-0.04 \pm 0.06$	$-0.054 \pm 0.007$

Table C.25.3: Reaction contribution to multiplication factor uncertainty of HEU-MET-FAST-100. In brackets, % of the uncertainty explained by the showed reactions.

Quantity	$\Delta k_{eff}/k_{eff}$ (%)
JEFF-3.3 (87.3%)	
$^{235}\text{U} (n,n')/^{235}\text{U} (n,f)$	$0.6970 \pm 0.0009$
$^{235}\text{U} (n,n')/^{235}\text{U} (n,n')$	$0.6911 \pm 0.0016$
$^{235}\text{U} (n,f)/^{235}\text{U} (n,f)$	$0.6587 \pm 0.0004$
JENDL-4.0u (82.7%)	
$^{235}\text{U} (n,n')/^{235}\text{U} (n,n')$	$0.6472 \pm 0.0015$
$^{235}\text{U} (n,n)/^{235}\text{U} (n,n)$	$0.4413 \pm 0.0016$
$^{235}\text{U} \bar{\nu}/^{235}\text{U} \bar{\nu}_p$	$0.38096 \pm 0.00007$
ENDF/B-VIII.0 (83.4%)	
$^{235}\text{U} (n,f)/^{235}\text{U} (n,f)$	$0.7823 \pm 0.0003$
$^{235}\text{U} \bar{\nu}/^{235}\text{U} \bar{\nu}_p$	$0.56302 \pm 0.00010$
$^{235}\text{U} \bar{\nu}/^{235}\text{U} \bar{\nu}$	$0.39920 \pm 0.00010$

Table C.25.4: Reaction contribution to delayed neutron fraction uncertainty of HEU-MET-FAST-100. All the reactions showed explain an 85% of the total uncertainty at least.

Quantity	$\Delta\beta_{eff}/\beta_{eff}$ (%)	
	Bretscher	Chiba
JEFF-3.3		
$^{235}\text{U} \chi/^{235}\text{U} \chi$	$1.4 \pm 0.4$	$0.882 \pm 0.008$
$^{235}\text{U} (n,f)/^{235}\text{U} (n,f)$	$0.94 \pm 0.11$	$0.829 \pm 0.005$
JENDL-4.0u		
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$2.6443 \pm 0.0025$	$2.7271 \pm 0.0013$
ENDF/B-VIII.0		
$^{235}\text{U} \bar{\nu}_d/^{235}\text{U} \bar{\nu}_d$	$4.512 \pm 0.004$	$4.5477 \pm 0.0021$

## References

- [1] I. Kodeli. “Sensitivity and uncertainty in the effective delayed neutron fraction ( $\beta_{eff}$ )”. In: *Nuclear Instruments and Methods in Physics Research A* 715 (2013), pp. 70–78.