JNC Results of BFS-62-3A Benchmark Calculation (CRP: Phase 5)

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1. Introduction

The present work is the results of JNC, Japan, for the Phase 5 of IAEA CRP benchmark problem (BFS-62-3A critical experiment). The benchmark specification is based on 1) G.Manturov, et al.: Technical report on the Research Contract No.10931/R0, "Development of a Three Dimensional Homogeneous Calculation Model for the BFS-62 Critical Experiment. Preparation of Adjusted Equivalent Measured Values for Sodium Void Reactivity Values", attached with the e-mail dated on July 5th, 2004, and 2) Young-In Kim: "Correction of Material Data", attached with the e-mail dated on July 6th, 2004 .

2. Analytical Method of JNC

1) Nuclear Data Library: JENDL-3.2,
2) Group Constant Set JFS-3-J3.2R: 70-group, ABBN-type self-shielding factor table based on JENDL-3.2,
3) Effective Cross-section: Current-weighted multi-group transport cross-section,
4) Cell model for the BFS as-built tube and pellets:
   (Case 1) Homogeneous Model based on IPPE definition,
   (Case 2) Homogeneous atomic density equivalent to JNC's heterogeneous calculation only to cross-check the adjusted correction factors,
   (Case 3) Heterogeneous model based on JNC's evaluation: One-dimensional plate-stretch model (see Fig.2-1) with Tone's background cross-section method (CASUP code),
5) Basic diffusion Calculation: 18-group and three-dimensional Hex-Z model (by the CITATION code),
   (Case 1 and 2) Isotropic diffusion coefficients,
   (Case 3) Benoist's anisotropic diffusion coefficients,
6) For sodium void reactivity, the exact perturbation theory was applied both to basic calculation and correction calculations,

7) Ultra-fine energy group correction - approx. 100,000 group constants below 50 keV, and ABBN-type 175 group constants with shielding factors above 50 keV,
8) Transport theory and mesh size correction: 18-group, three-dimensional Hex-Z model (the MINIHEX code based on the S4-P0 transport method, which was developed by JNC),
9) Effective delayed Neutron fraction as the reactivity scale: fixed at 0.00623 by IPPE evaluation. (cf. 0.00619 (-0.6% from the IPPE's value) by JNC's standard method, i.e., Tuttle (79), Yield Fraction and Decay constant: Keepin (65), Delayed Neutron Spectrum: Saphier (77) were used.

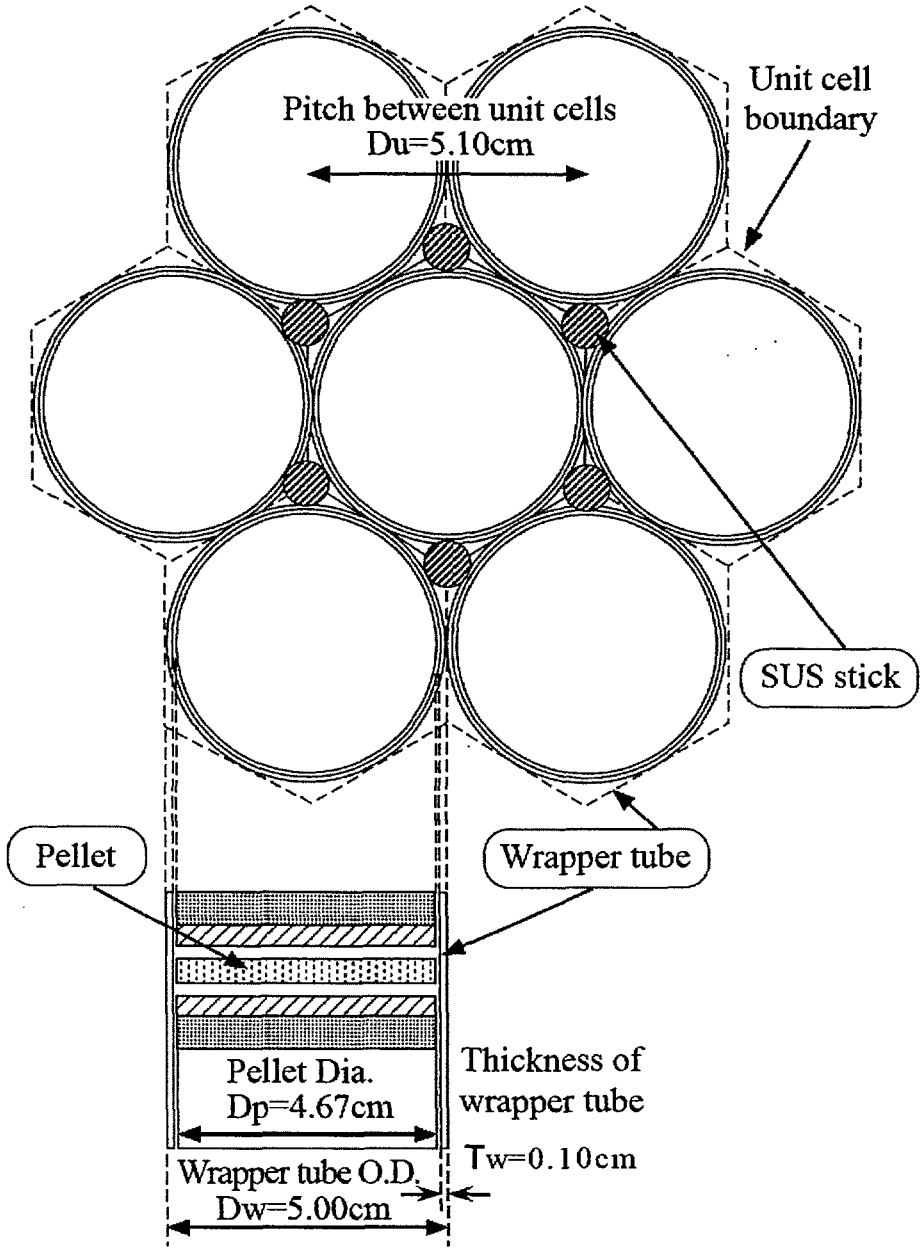

Fig. 2-1 Conceptual description of the BFS-2 fuels

3. Analytical Results by JNC

3.1 Criticality

The JNC results for the criticality of BFS-62-3A core are summarized in Table 3.1-1. First, from the result of Case 1 and Case 2, there was no effect of the arbitrariness to make the simplified homogeneous model from the complicated as-built experimental core. Second, from the comparison between the final analytical value of Case 2 and that of Case 3, the adjusted correction factor was -0.0090 dk by JNC's evaluation. However, the discrepancy with IPPE's evaluation, that is +0.0030 dk, would be tolerable considering the large difference such as calculation method (Monte Carlo vs. deterministic), energy group structure (299 gr + sub-group vs. ultra-fine and ABBN-900 group), etc. Finally, the C-E result of the criticality of the BFS-62-3 homogeneous benchmark by JNC system and JENDL-3.2 was found +129 pcm from Case 1.

Table 3.1-1 Criticality Results of BFS-62-3A experiment by JNC

	(Case 1) Homogeneous model by IPPE	(Case 2) Homogeneous model by JNC	(Case 3) Heterogeneous model by JNC
Basic calculation (3D Hex-Z, 70Gr, Diffusion)	0.9858	0.9859	0.9931
Correction by Ultra-fine energy group	+0.0006	+0.0006	+0.0025
Corecction by transport theory and mesh-size	+0.0036	+0.0036	+0.0035
Calculation value after correction	0.9900	0.9901	0.9991
Experimental value	*0.9887*	*0.9887*	*1.0007*
C-E value (pcm)	129	137	-159

(=0.9901-0.9991)

Ajusted correcition factor from As-built to Simplified homo. model by JNC = -0.0090

cf. Ajusted correcition factor from As-built to Simplified homo. model by IPPE = -0.0120

3.2 Sodium void reactivity

From Table 3.2-3, the adjusted correction factors to change from simplified homogeneous model to the as-built mode for the sodium void reactivity were different by 3 - 15 pcm between IPPE and JNC evaluation. Comparing the Table 3.2-1 and 3.2-2, the homogenization of the heterogeneous as-built structure

especially affected the non-leakage term of the ultra-fine energy group correction. Again, the discrepancy cannot be avoided by the large difference of both methods.

The JNC results and comparison with IPPE are summarized in Table 3.2-4. The differences between IPPE and JNC are within the experimental errors.

Table 3.2-1 Sodium void reactivty results of BFS-62-3A experiment by JNC (Case 1: IPPE Homogeneous m

Void Step	Basic calculation (pcm) (3D Hex-Z, 70gr, diffusion)		Correction by Ultra-fine energy group (factor)		Corecction by transport theory and mesh-size (factor)		Calculation value after correction (pcm)	Experimental value (pcm)
	Non-leakage	Leakage	Non-leakage	Leakage	Non-leakage	Leakage		
Inner Core	57	-85	0.865	1.017	1.024	0.969	-33	-20
Middle Coore	15	-27	0.870	1.016	1.042	0.959	-13	-11
MOX Core	30	-55	0.937	1.010	1.097	0.953	-22	-14
Outer Core	7	-62	0.853	0.977	1.048	0.999	-54	-57
Total Effect	109	-229	0.885	1.004	1.048	0.971	-122	-102

Table 3.2-4 Comparison of Sodium void reactivty results of BFS-62-3A experiment

Void Step	(Case 1) Homogeneous model by IPPE				(Case3) Heterogeneous model by JNC		
	Experimental value (pcm)	Experimental error*1) (pcm)	C-E value by JNC (pcm)	C-E value by IPPE (pcm)	Experimental value (pcm)	Experimental error*2) (pcm)	C-E value by JNC (pcm)
Inner Core	-20	9	-13	-10	-57	3	2
Middle Coore	-11	4	-2	0	-16	2	1
MOX Core	-14	6	-8	-7	-32	2	0
Outer Core	-57	6	3	4	-72	3	5
Total Effect	-102	10	-20	-14	-177	5	9

*1) by Ref.1)

*2) by "Technical Report, Results of measurements on BFS-62-3A and BFS-62-4 critical assemblies",p.11, IPPE, 2001

Table 3.2-3 Ajusted correction factor from Simplified homo. to As-built model

Void Step	Evaluated value by JNC (pcm)	Evaluated value by IPPE (pcm)
Inner Core	-22	-37
Middle Coore	-2	-5
MOX Core	-11	-18
Outer Core	-13	-15
Total Effect	-47	-75

Table 3.2-4 Comparison of Sodium void reactivty results of BFS-62-3A experiment

Void Step	(Case 1) Homogeneous model by IPPE				(Case3) Heterogeneous model by JNC		
	Experimental value (pcm)	Experimental error*1) (pcm)	C-E value by JNC (pcm)	C-E value by IPPE (pcm)	Experimental value (pcm)	Experimental error*2) (pcm)	C-E value by JNC (pcm)
Inner Core	-20	9	-13	-10	-57	3	2
Middle Coore	-11	4	-2	0	-16	2	1
MOX Core	-14	6	-8	-7	-32	2	0
Outer Core	-57	6	3	4	-72	3	5
Total Effect	-102	10	-20	-14	-177	5	9

*1) by Ref.1)
*2) by "Technical Report, Results of measurements on BFS-62-3A and BFS-62-4 critical assemblies",p.11, IPPE, 2001

4. Conclusions

a) JNC made a cross-check of the homogeneous model and the adjusted correction factors submitted by IPPE, and confirmed they are consistent.

b) JNC standard system showed quite satisfactory analytical results for the criticality and the sodium void reactivity of BFS-62-3A experiment.

c) JNC calculated the cross-section sensitivity coefficients of BFS-62-3A criticality and sodium void reactivity, and analyzed the affecting isotopes and reactions of difference between JENDL-3.2 and, JENDL-3.3 or JEF-2.2. See Appendix.

(all)

Appendix

A.1. Cross-section Sensitivity Coefficients of BFS-62-3A

A.1.1 Criticality

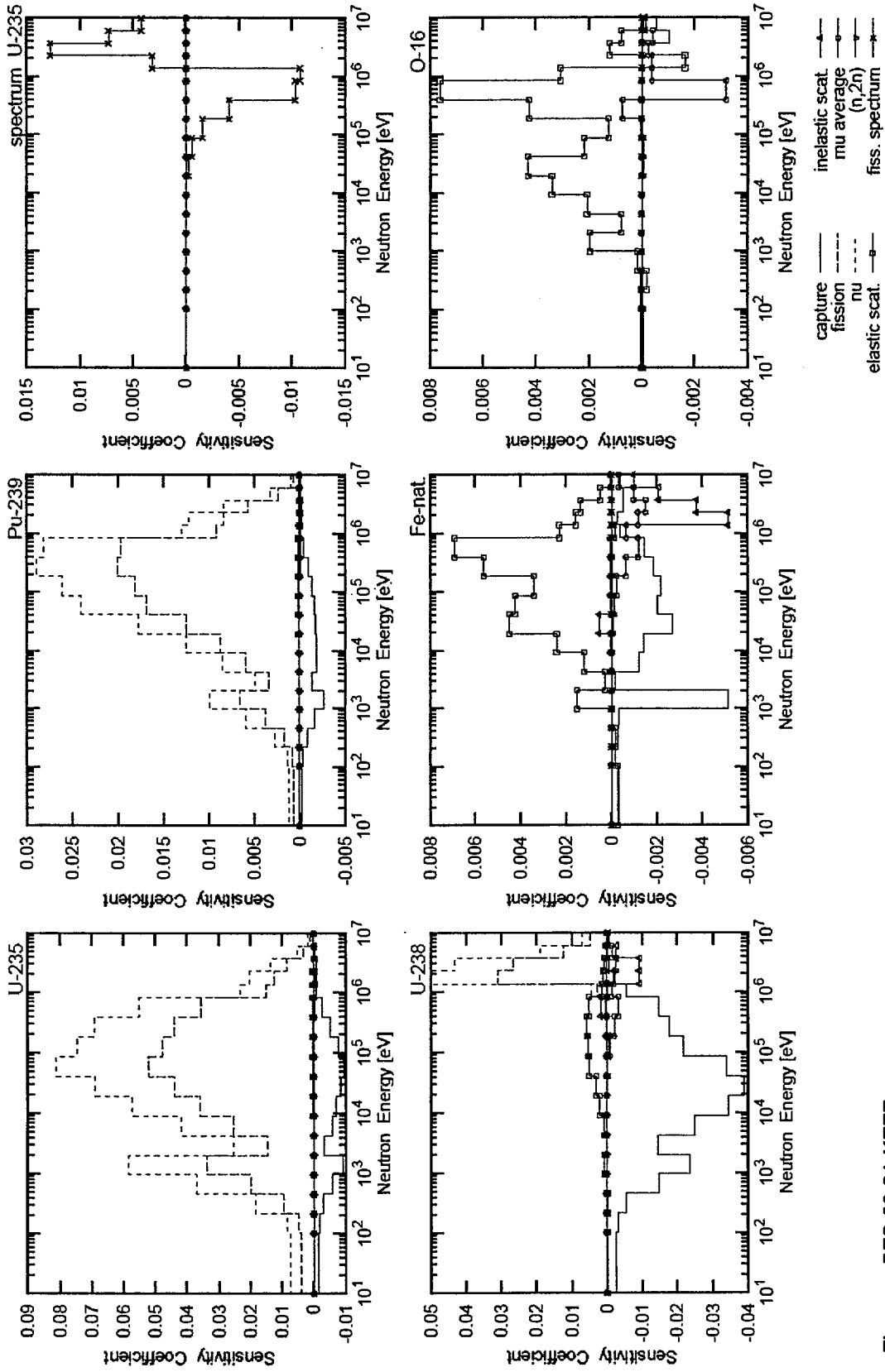

Fig. BFS-62-3A KEFF

TABLE BFS-62-3A KEFF (HEAVY METAL) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
U-235	CAPTURE	-735	-16	-19	-32	-60	-91	-35	-58	-72	-86	-98	-79	-51	-27	-7	-4	-1	0	0
U-235	NU	6666	74	85	182	369	585	254	419	573	688	813	747	691	550	231	201	135	51	16
U-235	FISSION	4109	39	46	96	199	336	148	254	358	439	520	476	441	354	149	125	84	34	11
U-235	ELAS. SCT	23	0	0	0	0	1	0	1	2	3	4	4	4	3	1	1	1	0	0
U-235	INEL. SCT	-19	0	0	0	0	0	0	0	0	0	1	0	0	1	0	-8	-9	-3	-1
U-235	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
U-235	MU-AVE.	-12	0	0	0	0	0	0	0	0	0	0	-1	-2	-2	-1	-2	-2	-1	0
U-238	CAPTURE	-2592	-26	-33	-55	-148	-235	-145	-251	-347	-388	-339	-217	-177	-147	-55	-21	-6	-1	0
U-238	NU	1237	0	0	0	0	0	0	0	0	0	0	0	1	4	43	496	431	190	71
U-238	FISSION	779	0	0	0	0	0	0	0	0	0	0	0	0	3	28	310	266	124	47
U-238	ELAS. SCT	311	-1	-1	-1	1	8	2	8	19	31	51	53	57	51	13	10	7	2	1
U-238	INEL. SCT	-206	0	0	0	0	0	0	0	0	0	0	-6	3	17	-1	-93	-93	-27	-6
U-238	(n, 2n)	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
U-238	MU-AVE.	-145	0	0	0	0	0	0	0	0	-1	-4	-9	-21	-33	-14	-20	-25	-14	-3
Pu-239	CAPTURE	-176	-3	-3	-9	-17	-27	-14	-19	-19	-18	-16	-13	-11	-5	-1	-1	0	0	0
Pu-239	NU	2101	12	14	27	60	99	49	86	125	178	240	261	290	282	130	122	84	33	9
Pu-239	FISSION	1452	7	8	17	38	66	33	59	88	126	169	182	201	197	91	83	57	23	6
Pu-239	ELAS. SCT	8	0	0	0	0	0	0	0	0	1	1	1	2	1	0	0	0	0	0
Pu-239	INEL. SCT	-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	-2	-1	0
Pu-239	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	MU-AVE.	-4	0	0	0	0	0	0	0	0	0	0	0	-1	-1	0	-1	-1	0	0

TABLE BFS-62-3A KEFF (FISSION SPECTRUM) UNIT:1.0E-4

FISSION SPECTRUM	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
SPEC. U-235 0.05	-1	0	0	0	0	0	0	0	0	-2	-6	-16	-41	-103	-108	32	128	73	42
SPEC. Pu-239 0.05	0	0	0	0	0	0	0	0	0	-1	-2	-5	-13	-33	-32	11	39	22	13

TABLE BFS-62-3A KEFF (STRUCTURE , COOLANT) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
H-1	CAPTURE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	ELAS. SCT	60	0	0	0	0	8	4	10	16	18	10	1	-2	0	0	-3	-2	0	0
H-1	INEL. SCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	MU-AVE.	-6	0	0	0	0	0	0	0	0	-1	-1	-1	-1	-1	0	0	0	0	0
C-12	CAPTURE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

C-12	ELAS. SCT	10	0	0	0	0	1	0	1	1	2	1	0	1	2	1	-1	0	0	0
C-12	INEL. SCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-12	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-12	MU-AVE.	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O-16	CAPTURE	-17	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-10	-5
O-16	ELAS. SCT	311	0	0	-2	2	20	8	21	34	43	22	12	43	76	31	-16	12	8	-1
O-16	INEL. SCT	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2
O-16	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O-16	MU-AVE.	-42	0	0	0	0	0	0	0	0	-1	-1	0	7	-32	-4	-4	-2	-4	-1
Na-23	CAPTURE	-17	0	0	0	-1	-3	-6	-1	0	-1	-1	0	-1	0	0	0	0	0	-2
Na-23	ELAS. SCT	162	0	0	0	0	8	16	23	18	20	15	8	18	31	7	-4	1	1	0
Na-23	INEL. SCT	-31	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-13	-11	-4	-3
Na-23	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-23	MU-AVE.	-23	0	0	0	0	0	0	0	0	0	0	-1	-2	-6	-4	-4	-4	-1	0
AL-27	CAPTURE	-14	0	0	0	0	0	0	-4	0	-2	-1	-2	-1	-1	0	0	0	-1	-1
AL-27	ELAS. SCT	60	0	0	0	0	1	0	1	2	6	7	5	12	19	5	-1	2	1	0
AL-27	INEL. SCT	-18	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-6	-7	-3	-2
AL-27	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AL-27	MU-AVE.	-23	0	0	0	0	0	0	0	0	0	0	-1	-2	-5	-3	-5	-4	-1	0
Cr	CAPTURE	-62	-1	0	-1	-1	-15	-4	-13	-2	-7	-4	-5	-4	-2	-1	-1	-1	-1	-1
Cr	ELAS. SCT	124	0	0	0	0	1	1	13	8	6	11	24	19	22	9	5	3	1	0
Cr	INEL. SCT	-31	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-8	-14	-5	-3
Cr	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	MU-AVE.	-20	0	0	0	0	0	0	0	0	0	0	-1	-1	-2	-2	-4	-6	-3	-1
Mn-55	CAPTURE	-29	0	0	-11	-1	-8	-1	-2	-1	-1	-1	-1	0	0	0	0	0	0	0
Mn-55	ELAS. SCT	17	0	0	-1	0	2	3	1	2	3	2	2	2	2	1	0	0	0	0
Mn-55	INEL. SCT	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1	-1	0	0
Mn-55	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-55	MU-AVE.	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe	CAPTURE	-214	-3	-2	-3	-3	-52	-2	-12	-14	-27	-21	-22	-19	-15	-4	-3	-5	-6	-4
Fe	ELAS. SCT	353	-3	-2	-2	0	15	3	12	24	45	43	34	56	69	23	16	14	5	0
Fe	INEL. SCT	-115	0	0	0	0	0	0	0	1	5	0	0	0	0	-2	-52	-38	-21	-10
Fe	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe	MU-AVE.	-70	0	0	0	0	0	0	0	0	-1	-1	-2	-7	-12	-7	-12	-15	-10	-3
Ni	CAPTURE	-79	-1	0	0	-1	-2	-2	-2	-14	-8	-7	-7	-5	-3	-2	-3	-9	-9	-3
Ni	ELAS. SCT	99	-1	0	0	0	4	1	6	14	16	13	9	16	12	5	3	2	1	0
Ni	INEL. SCT	-12	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-3	-6	-2	-1
Ni	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	MU-AVE.	-11	0	0	0	0	0	0	0	0	0	0	-1	-2	-2	-1	-2	-2	-1	0

A.1.2 Sodium Void Reactivity - Inner Core -

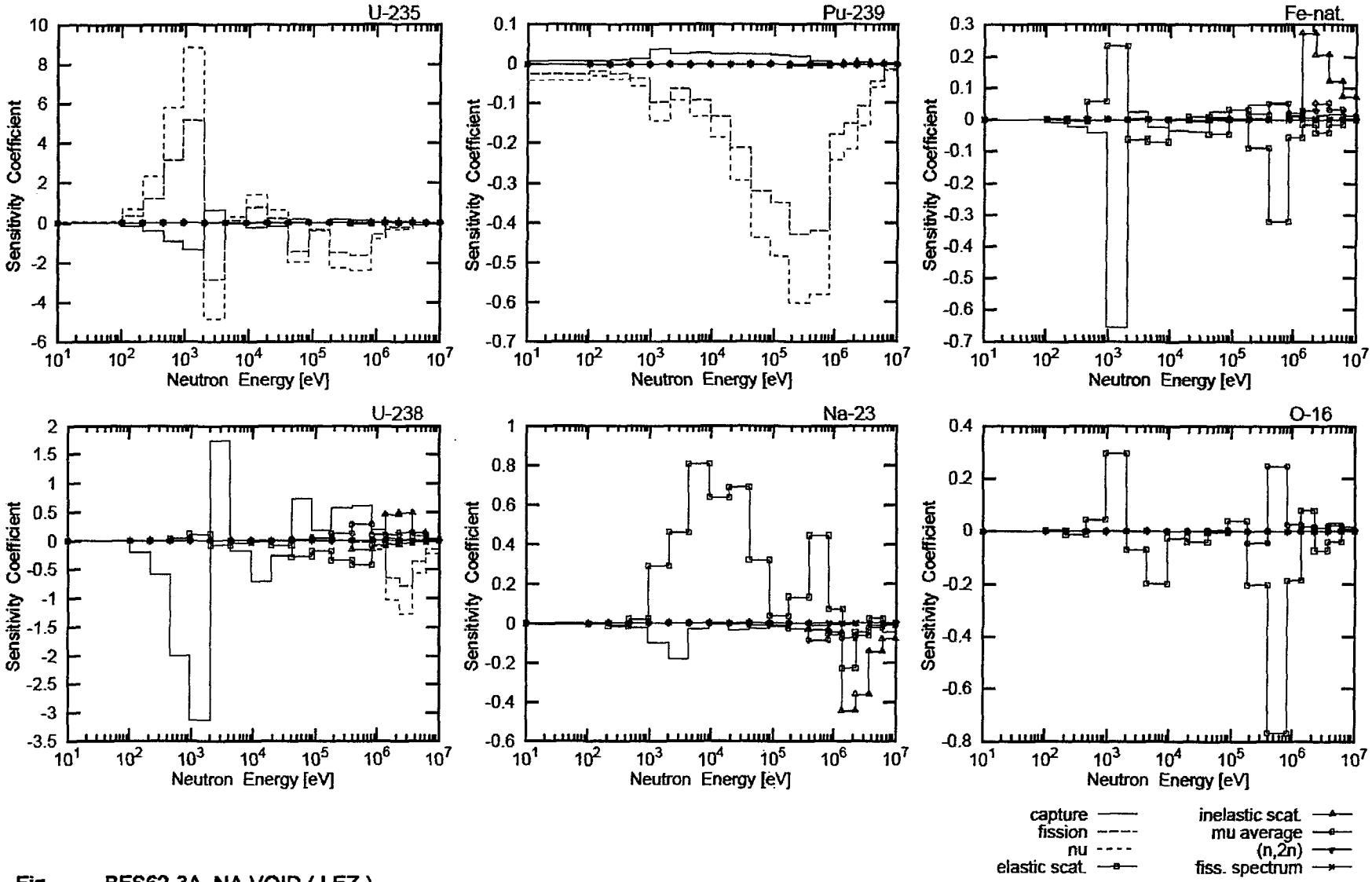

Fig. BFS62-3A NA VOID (LEZ)

TABLE BFS62-3A NA VOID (LEZ) (HEAVY METAL) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
U-235	CAPTURE	-22032	-124	-1466	-4012	-9438	-13790	6608	-803	-2238	-1459	1791	88	1506	996	227	58	25	1	0
U-235	NU	64361	546	6787	23259	58164	88677	-48761	3186	14361	6739	-20219	-3981	-22889	-24089	-8383	-3413	-3721	-1418	-484
U-235	FISSION	20282	280	3740	12313	31546	51453	-28639	1142	7674	2602	-14690	-3716	-15550	-16467	-5751	-2163	-2286	-918	-286
U-235	ELAS. SCT	-850	0	1	2	43	130	-65	-27	23	-11	-183	-75	-229	-296	-69	-42	-37	-12	-2
U-235	INEL. SCT	1051	0	0	0	0	0	0	0	0	0	-13	67	91	-198	-2	389	500	180	39
U-235	(n, 2n)	-4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-4
U-235	MU-AVE.	689	0	0	0	0	0	0	0	0	1	19	17	92	215	79	80	113	59	16
U-238	CAPTURE	-29462	32	-2017	-5877	-19903	-31255	17470	-1885	-6964	-2600	7376	1858	5732	6070	1861	415	188	33	5
U-238	NU	-32577	0	0	0	39	20	0	1	1	-1	-9	-3	-18	-266	-1508	-10236	-12763	-5615	-2220
U-238	FISSION	-20644	0	0	0	21	12	0	0	0	-1	-6	-2	-12	-180	-1042	-6543	-7860	-3671	-1360
U-238	ELAS. SCT	-14756	18	40	45	389	1114	-776	-435	-174	-699	-2883	-1817	-3485	-4175	-885	-502	-382	-122	-28
U-238	INEL. SCT	10151	0	0	0	0	0	0	0	0	0	203	505	7	-1595	-59	4530	4794	1366	401
U-238	(n, 2n)	-57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-57
U-238	MU-AVE.	8906	0	0	0	-1	-2	2	3	3	24	235	325	1274	2774	929	1011	1397	738	195
Pu-239	CAPTURE	2785	93	78	130	157	393	266	292	264	274	271	230	205	101	19	9	3	0	0
Pu-239	NU	-38096	-425	-309	-383	-568	-1448	-902	-1313	-1842	-2929	-4396	-4853	-6014	-5819	-2426	-2157	-1549	-604	-160
Pu-239	FISSION	-27018	-235	-185	-236	-358	-961	-609	-909	-1314	-2127	-3199	-3502	-4307	-4202	-1758	-1505	-1071	-429	-111
Pu-239	ELAS. SCT	-79	0	0	1	4	3	-1	0	1	-3	-12	-13	-27	-22	-4	-3	-2	-1	0
Pu-239	INEL. SCT	84	0	0	0	0	0	0	-1	-8	-4	-3	1	-2	-9	3	41	45	18	3
Pu-239	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	MU-AVE.	60	0	0	0	0	0	0	0	0	0	1	3	12	17	6	6	9	5	1

TABLE BFS62-3A NA VOID (LEZ) (FISSION SPECTRUM) UNIT:1.0E-4

FISSION SPECTRUM		TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
SPEC. U-235	0.05	12	0	0	0	0	-1	0	6	23	71	169	370	844	2966	2832	-1584	-2797	-1409	-1479
SPEC. Pu-239	0.05	-3	0	0	0	0	0	0	0	3	13	42	113	291	762	768	-221	-906	-535	-332

TABLE BFS62-3A NA VOID (LEZ) (STRUCTURE , COOLANT) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
H-1	CAPTURE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	ELAS. SCT	-2692	0	-11	6	-7	-221	-202	-441	-711	-848	-494	-58	67	-3	16	123	74	13	5
H-1	INEL. SCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	MU-AVE.	268	-1	-1	-1	-3	-2	3	4	9	20	45	41	52	51	18	17	11	4	1
C-12	CAPTURE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

C-12	ELAS. SCT	-46	0	2	-5	18	124	-29	-81	-11	-8	35	51	7	-141	-23	38	-11	-12	2
C-12	INEL. SCT	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
C-12	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-12	MU-AVE.	62	0	0	0	-1	-1	1	0	0	1	5	4	11	23	8	5	1	4	1
O-16	CAPTURE	529	0	0	0	0	0	0	0	0	0	2	1	6	10	3	2	2	312	192
O-16	ELAS. SCT	-11568	12	41	-132	451	2950	-710	-1985	-248	-396	-59	405	-2036	-7680	-1870	785	-736	-409	50
O-16	INEL. SCT	92	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	92
O-16	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O-16	MU-AVE.	2931	-1	-1	-2	-10	-17	16	5	5	16	49	-10	-438	2479	251	189	131	223	45
Na-23	CAPTURE	-5346	-7	-24	-78	-250	-978	-1838	-282	-17	-358	-305	-170	-262	-116	-25	-23	-14	-125	-474
Na-23	ELAS. SCT	36168	-21	1	-156	209	2863	4597	8071	6331	6871	3200	375	1325	4443	702	-2284	-483	220	-96
Na-23	INEL. SCT	-11115	0	0	0	0	0	0	0	0	0	0	0	0	-321	-461	-4449	-3621	-1446	-817
Na-23	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-23	MU-AVE.	-3685	1	1	1	-2	-13	-4	-13	-30	-46	-97	-116	-301	-844	-558	-736	-643	-232	-55
AL-27	CAPTURE	-21	0	-2	-6	-13	-20	13	-130	-5	-50	10	7	33	26	7	3	8	41	57
AL-27	ELAS. SCT	-2710	1	3	-10	40	246	-67	-137	-1	-66	-75	442	-628	-1962	-339	43	-144	-63	6
AL-27	INEL. SCT	1006	0	0	0	0	0	0	0	0	0	0	0	0	0	5	310	395	153	143
AL-27	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AL-27	MU-AVE.	1553	0	0	0	-1	-1	1	0	0	2	17	32	113	478	251	280	280	83	19
Cr	CAPTURE	-1224	-11	-24	-63	-140	-1645	551	-79	-42	-90	34	14	85	86	27	11	20	21	20
Cr	ELAS. SCT	-2818	-1	1	-4	42	227	-311	-956	-9	12	-187	-52	-267	-943	-225	-6	-100	-39	1
Cr	INEL. SCT	1699	0	0	0	0	0	0	0	0	0	0	0	0	3	7	426	780	293	189
Cr	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	MU-AVE.	576	0	0	0	0	-1	4	1	0	0	6	5	25	82	45	93	190	94	34
Mn-55	CAPTURE	-2180	-4	-21	-1113	-87	-975	39	-25	-24	-14	19	3	10	8	2	1	1	0	1
Mn-55	ELAS. SCT	-174	0	0	49	36	306	-434	-26	-10	7	4	8	-22	-66	-15	-2	-8	-3	0
Mn-55	INEL. SCT	141	0	0	0	0	0	0	0	0	0	0	1	9	-19	0	43	66	26	16
Mn-55	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-55	MU-AVE.	54	0	0	-1	0	-2	2	0	0	0	1	0	3	14	6	8	13	7	3
Fe	CAPTURE	-6210	-34	-90	-246	-402	-6542	227	-237	-338	-384	246	14	470	517	112	49	146	153	128
Fe	ELAS. SCT	-3938	-11	19	-44	556	2320	-622	-697	28	84	-471	322	-895	-3222	-584	-147	-423	-153	2
Fe	INEL. SCT	6819	0	0	0	0	0	0	0	-15	-42	48	6	6	-24	141	2739	2049	1198	714
Fe	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe	MU-AVE.	2108	0	0	-1	-6	-10	5	1	-2	-2	26	14	153	509	194	288	515	308	117
Ni	CAPTURE	467	-8	-17	-47	-101	-194	184	-19	-347	-106	117	23	143	120	49	52	244	260	114
Ni	ELAS. SCT	-983	-2	4	-8	128	560	-233	-461	144	31	-200	40	-287	-492	-116	-10	-59	-21	0
Ni	INEL. SCT	666	0	0	0	0	0	0	0	0	0	-1	2	1	-1	0	161	324	115	66
Ni	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	MU-AVE.	312	0	0	0	-1	-3	2	0	-2	-1	9	3	35	75	32	41	65	39	17

A.1.3 Sodium Void Reactivity - Middle Core -

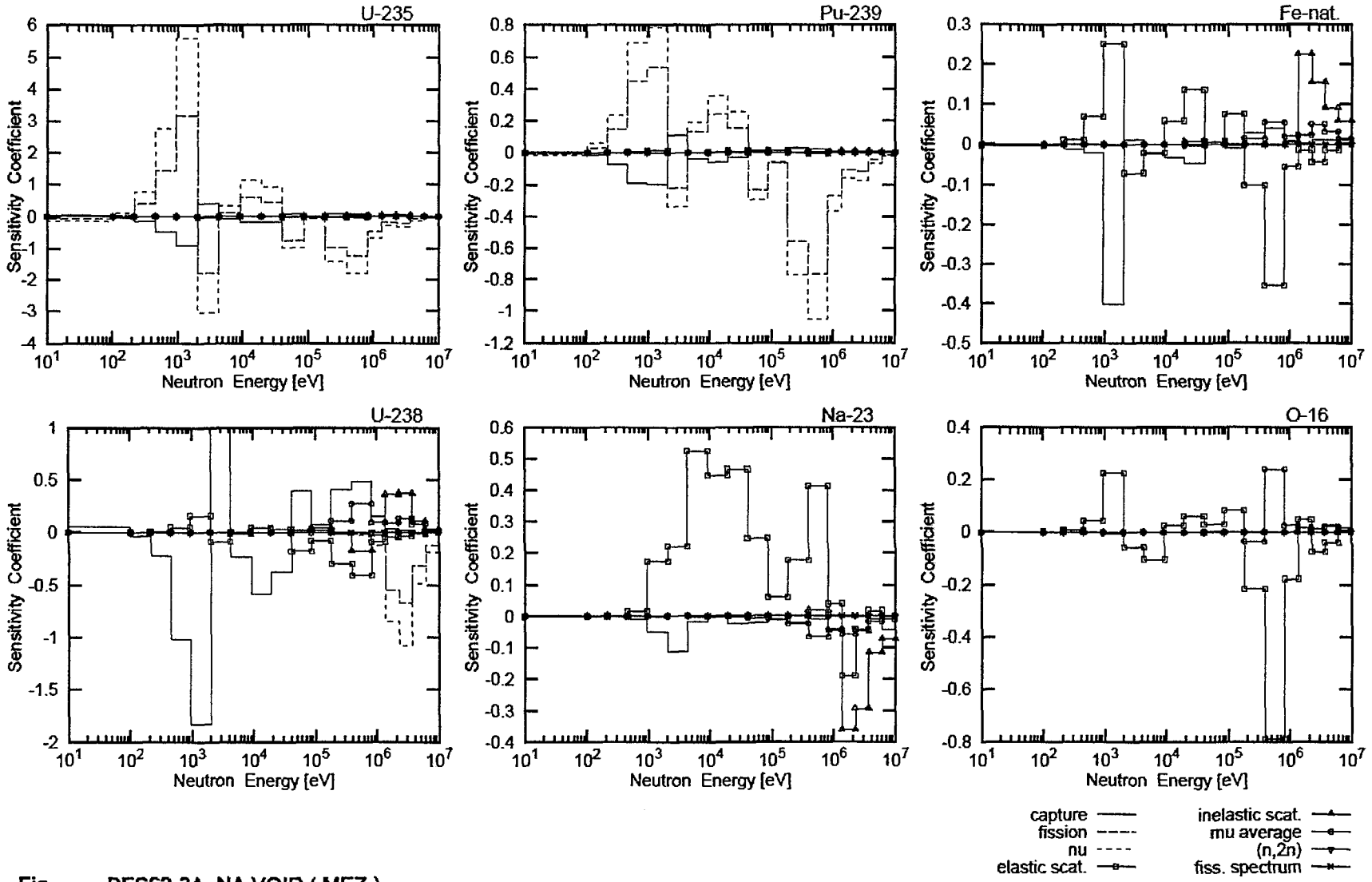

Fig. BFS62-3A NA VOID (MEZ)

TABLE BFS62-3A NA VOID (MEZ) (HEAVY METAL) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
U-235	CAPTURE	-12865	282	-271	-1447	-4689	-8986	4119	-825	-1789	-1596	740	-257	910	685	187	49	21	1	0
U-235	NU	28155	-1360	1109	7911	27646	56026	-30501	3413	11342	9138	-9917	175	-14284	-17816	-6896	-2932	-3212	-1260	-428
U-235	FISSION	3680	-764	528	3974	14515	31690	-17925	1266	5997	4591	-7552	-736	-9842	-12345	-4736	-1883	-2008	-829	-261
U-235	ELAS. SCT	-839	-1	1	6	50	177	-110	-8	59	50	-162	-66	-273	-366	-84	-52	-43	-14	-3
U-235	INEL. SCT	623	0	0	0	0	0	0	0	0	2	6	66	31	-272	-21	281	368	132	30
U-235	(n, 2n)	-5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-5
U-235	MU-AVE.	805	0	0	0	0	0	0	0	-1	-1	16	15	106	267	95	92	130	67	20
U-238	CAPTURE	-16979	531	-327	-2214	-10110	-18356	9993	-2317	-5915	-3809	3911	773	4019	4775	1539	340	156	28	4
U-238	NU	-27500	0	0	0	19	11	0	1	1	0	-5	-2	-13	-222	-1247	-8517	-10784	-4828	-1916
U-238	FISSION	-17597	0	0	0	10	7	0	0	1	0	-4	-1	-9	-151	-864	-5486	-6716	-3193	-1191
U-238	ELAS. SCT	-9788	11	23	79	469	1567	-928	-155	378	298	-1819	-792	-2993	-4080	-880	-453	-366	-118	-29
U-238	INEL. SCT	7099	0	0	0	0	0	0	0	0	0	197	442	-119	-1740	-272	3574	3672	1027	318
U-238	(n, 2n)	-59	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-59
U-238	MU-AVE.	8141	0	0	0	-1	-4	3	0	-7	-8	151	153	1082	2706	925	899	1328	713	200
Pu-239	CAPTURE	-4407	40	-132	-753	-1892	-2008	1066	-394	-587	-333	131	-14	253	177	28	7	3	0	0
Pu-239	NU	-7743	-176	537	2354	6902	7825	-3372	1872	3582	2519	-2977	-605	-7738	-10536	-3671	-1617	-1754	-685	-203
Pu-239	FISSION	-7490	-103	314	1467	4436	5335	-2185	1319	2403	1544	-2396	-689	-5629	-7688	-2703	-1114	-1188	-482	-131
Pu-239	ELAS. SCT	306	0	1	6	42	108	-26	8	60	87	29	96	-17	-62	-15	0	-7	-3	-1
Pu-239	INEL. SCT	148	0	0	0	0	0	0	0	-23	-4	1	16	6	-36	-1	76	78	29	6
Pu-239	(n, 2n)	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	MU-AVE.	93	0	0	0	0	0	0	0	-1	-4	-3	-20	9	47	19	3	24	14	6

TABLE BFS62-3A NA VOID (MEZ) (FISSION SPECTRUM) UNIT:1.0E-4

FISSION SPECTRUM		TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
SPEC. U-235	0.05	12	0	0	0	0	0	2	7	21	55	123	252	606	2367	2003	-1204	-2077	-1068	-1074
SPEC. Pu-239	0.05	-3	0	0	0	0	0	-1	-1	4	19	54	132	307	983	970	-400	-1037	-540	-493

TABLE BFS62-3A NA VOID (MEZ) (STRUCTURE , COOLANT) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
H-1	CAPTURE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	ELAS. SCT	-2563	0	-12	10	-7	-276	-150	-381	-652	-773	-463	-77	34	-17	12	109	65	12	4
H-1	INEL. SCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	MU-AVE.	235	-1	-1	-1	-1	-1	2	3	8	17	37	36	46	45	16	15	10	3	1
C-12	CAPTURE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2

C-12	ELAS. SCT	-9	0	1	3	19	112	-25	-50	15	37	42	57	-23	-174	-23	29	-18	-13	2
C-12	INEL. SCT	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	3
C-12	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-12	MU-AVE.	57	0	0	0	-1	-2	1	0	0	-1	3	1	10	25	8	5	1	4	1
O-16	CAPTURE	440	0	0	0	0	0	0	0	0	0	1	0	4	8	3	1	1	260	161
O-16	ELAS. SCT	-9329	7	18	66	455	2251	-585	-1041	254	601	306	848	-2166	-7903	-1793	487	-757	-407	31
O-16	INEL. SCT	74	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	74
O-16	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O-16	MU-AVE.	2805	0	0	-2	-12	-31	19	1	-8	-4	31	-4	-369	2386	248	167	125	215	46
Na-23	CAPTURE	-3438	1	-6	-27	-109	-512	-1141	-168	-10	-257	-216	-129	-204	-93	-21	-19	-12	-106	-409
Na-23	ELAS. SCT	25555	-14	-8	-23	167	1729	2228	5240	4447	4658	2476	594	1783	4114	399	-1888	-423	174	-97
Na-23	INEL. SCT	-8742	0	0	0	0	0	0	0	0	0	0	0	0	181	-455	-3634	-2946	-1157	-730
Na-23	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-23	MU-AVE.	-2852	0	0	0	-2	-14	9	-9	-21	-34	-70	-100	-239	-663	-436	-584	-482	-172	-40
AL-27	CAPTURE	66	1	0	-1	-4	-6	4	-43	-2	-17	6	11	22	17	5	2	6	28	37
AL-27	ELAS. SCT	-1217	0	1	4	28	116	-40	-40	11	95	26	536	-386	-1271	-203	36	-92	-41	3
AL-27	INEL. SCT	620	0	0	0	0	0	0	0	0	0	0	0	0	0	2	194	244	94	85
AL-27	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AL-27	MU-AVE.	947	0	0	0	-1	-1	1	0	0	-2	6	8	65	304	160	163	178	54	13
Cr	CAPTURE	-969	-7	-9	-27	-77	-1076	324	-139	-39	-112	4	-13	54	66	22	9	16	18	17
Cr	ELAS. SCT	-1719	-3	-1	8	54	263	-423	-410	164	161	-47	252	-314	-1042	-220	-10	-110	-40	-1
Cr	INEL. SCT	1346	0	0	0	0	0	0	0	0	0	0	0	0	-2	4	347	614	225	157
Cr	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	MU-AVE.	549	0	0	0	-1	-2	5	-1	-2	-2	2	-7	24	89	45	77	187	95	39
Mn-55	CAPTURE	-1199	-3	-8	-472	-47	-626	5	-31	-22	-19	9	-1	7	6	1	1	0	0	1
Mn-55	ELAS. SCT	92	0	0	71	44	389	-436	-2	28	73	27	27	-26	-73	-15	-2	-9	-3	0
Mn-55	INEL. SCT	103	0	0	0	0	0	0	0	0	0	0	1	5	-23	0	35	51	20	13
Mn-55	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-55	MU-AVE.	52	0	0	-1	0	-4	4	0	0	-1	0	0	3	15	6	7	13	7	3
Fe	CAPTURE	-4137	-21	-34	-107	-220	-4037	127	-242	-311	-463	66	-87	304	399	92	38	121	130	109
Fe	ELAS. SCT	-723	-33	-7	104	708	2532	-725	-208	599	1379	69	760	-1023	-3560	-572	-137	-448	-156	-6
Fe	INEL. SCT	5484	0	0	0	0	0	0	0	-4	82	46	11	2	-34	53	2253	1562	920	592
Fe	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe	MU-AVE.	2018	0	0	-1	-8	-19	8	-2	-6	-24	10	-17	140	552	197	239	507	309	133
Ni	CAPTURE	224	-5	-7	-20	-56	-128	98	-29	-320	-133	48	-10	94	92	40	41	202	221	97
Ni	ELAS. SCT	421	-7	-1	23	165	636	-288	-218	608	434	-35	156	-296	-544	-113	-11	-64	-21	-1
Ni	INEL. SCT	530	0	0	0	0	0	0	0	0	0	0	2	1	-2	0	131	256	89	55
Ni	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	MU-AVE.	287	0	0	0	-2	-5	3	0	-7	-5	4	-4	32	82	33	34	64	40	19

A.1.4 Sodium Void Reactivity - MOX Core -

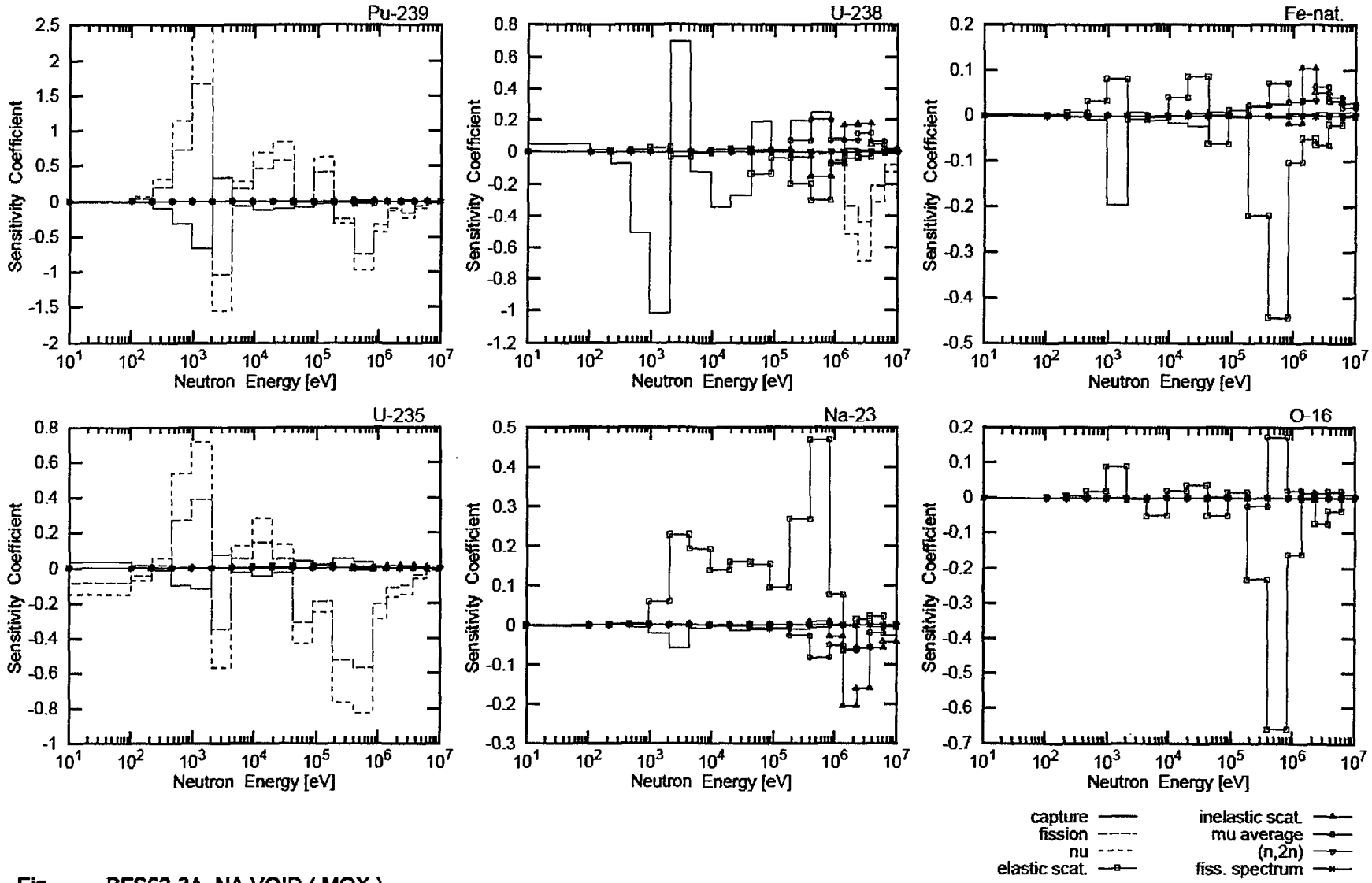

Fig. BFS62-3A NA VOID (MOX)

TABLE BFS62-3A NA VOID (MOX) (HEAVY METAL) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
U-235	CAPTURE	-485	320	143	-127	-960	-1156	733	-250	-454	-279	399	178	504	353	74	26	9	0	0
U-235	NU	-19134	-1531	-744	511	5351	7149	-5703	1249	2839	1355	-4299	-2508	-7688	-8245	-2926	-1649	-1519	-583	-194
U-235	FISSION	-16031	-850	-454	162	2691	3905	-3490	536	1482	551	-3102	-1893	-5230	-5690	-2044	-1098	-985	-397	-126
U-235	ELAS. SCT	175	-2	-1	1	15	21	-1	13	55	101	26	116	-21	-86	-28	-9	-18	-6	-2
U-235	INEL. SCT	182	0	0	0	0	0	0	0	0	0	-1	12	-8	-98	-23	104	138	47	10
U-235	(n, 2n)	-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-3
U-235	MU-AVE.	185	0	0	0	0	0	0	0	-1	-4	-2	-21	7	60	32	19	53	32	12
U-238	CAPTURE	-8398	506	114	-757	-5064	-10181	6983	-1286	-3467	-2757	1861	10	1962	2509	863	191	94	17	2
U-238	NU	-17244	0	0	0	11	7	0	1	1	1	-3	0	-6	-129	-722	-5141	-6858	-3155	-1250
U-238	FISSION	-11379	0	0	0	6	4	0	0	0	0	-2	0	-4	-89	-510	-3430	-4404	-2144	-806
U-238	ELAS. SCT	-7999	4	5	21	110	294	-274	-103	111	180	-1381	-370	-2001	-3038	-722	-383	-320	-104	-27
U-238	INEL. SCT	1701	0	0	0	0	0	0	0	0	0	70	128	-324	-1524	-686	1661	1740	473	163
U-238	(n, 2n)	-53	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-53
U-238	MU-AVE.	6335	0	0	0	0	-1	1	1	-2	-5	108	66	698	2021	754	736	1150	628	179
Pu-239	CAPTURE	-10285	28	-162	-1014	-3150	-6606	3341	-577	-1084	-893	-19	-353	80	82	34	5	4	0	0
Pu-239	NU	25983	-101	669	3134	11352	24937	-15465	2782	6891	8378	-799	6237	-3166	-9665	-4356	-1325	-2262	-968	-289
Pu-239	FISSION	14925	-72	388	1950	7270	16655	-10379	1866	4707	5728	-792	4153	-2504	-7380	-3255	-949	-1572	-699	-192
Pu-239	ELAS. SCT	-735	0	1	1	9	37	-37	-14	8	7	-144	-42	-170	-247	-60	-38	-33	-10	-2
Pu-239	INEL. SCT	-138	0	0	0	0	0	0	1	-5	3	-8	-1	-40	-180	-38	44	57	22	5
Pu-239	(n, 2n)	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-1
Pu-239	MU-AVE.	609	0	0	0	0	0	0	0	0	0	15	9	69	196	72	69	107	56	16

TABLE BFS62-3A NA VOID (MOX) (FISSION SPECTRUM) UNIT:1.0E-4

FISSION SPECTRUM		TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
SPEC. U-235	0.05	5	0	0	0	0	0	0	1	4	13	34	90	269	1128	1162	-314	-1194	-650	-538
SPEC. Pu-239	0.05	-3	0	0	0	0	0	-1	0	1	5	9	6	126	1061	732	-607	-624	-263	-447

TABLE BFS62-3A NA VOID (MOX) (STRUCTURE , COOLANT) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
H-1	CAPTURE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	ELAS. SCT	-2198	0	-9	9	-7	-239	-122	-304	-523	-626	-397	-95	-7	-34	6	86	52	9	3
H-1	INEL. SCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	MU-AVE.	179	0	0	0	0	1	1	2	6	13	28	27	34	33	12	12	8	3	1
C-12	CAPTURE	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

C-12	ELAS. SCT	-227	0	0	3	8	46	-2	-22	13	21	-9	10	-72	-167	-27	6	-24	-12	0
C-12	INEL. SCT	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
C-12	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-12	MU-AVE.	55	0	0	0	0	0	0	0	0	0	3	2	10	23	8	4	1	4	1
O-16	CAPTURE	272	0	0	0	0	0	0	0	0	0	1	0	2	4	2	1	1	163	99
O-16	ELAS. SCT	-10948	2	6	67	179	890	-29	-510	190	356	-505	148	-2339	-6611	-1636	-41	-744	-372	1
O-16	INEL. SCT	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41
O-16	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O-16	MU-AVE.	2183	0	0	0	-3	-4	7	1	-2	-3	23	-2	-240	1722	204	138	110	191	42
Na-23	CAPTURE	-1769	1	-2	-8	-42	-208	-584	-79	-5	-133	-119	-70	-116	-53	-12	-11	-7	-66	-255
Na-23	ELAS. SCT	18070	-19	-9	21	36	590	2279	1907	1377	1588	1525	938	2684	4673	765	-614	148	225	-43
Na-23	INEL. SCT	-4901	0	0	0	0	0	0	0	0	0	0	0	0	86	-298	-2057	-1614	-584	-433
Na-23	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-23	MU-AVE.	-3295	1	1	0	0	-3	-9	-7	-15	-29	-69	-101	-271	-813	-509	-651	-570	-203	-47
AL-27	CAPTURE	43	1	0	0	-1	-3	3	-19	-1	-9	3	5	11	9	3	1	3	17	22
AL-27	ELAS. SCT	-1856	0	0	3	11	39	-6	-19	8	75	-98	136	-455	-1081	-238	-61	-125	-43	-2
AL-27	INEL. SCT	262	0	0	0	0	0	0	0	0	0	0	0	0	0	-8	94	107	29	40
AL-27	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AL-27	MU-AVE.	857	0	0	0	0	0	0	0	0	-2	5	1	48	258	152	151	175	55	14
Cr	CAPTURE	-388	5	-1	-9	-34	-537	199	-64	-19	-59	6	-2	36	43	13	5	10	10	10
Cr	ELAS. SCT	-2961	0	0	6	24	81	-97	-117	113	94	-164	20	-745	-1374	-410	-161	-170	-52	-8
Cr	INEL. SCT	552	0	0	0	0	0	0	0	0	0	0	0	0	-5	-7	151	266	75	73
Cr	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	MU-AVE.	752	0	0	0	0	-1	1	-1	-1	-1	4	0	42	122	71	110	237	122	48
Mn-55	CAPTURE	-476	2	-1	-144	-20	-303	8	-15	-11	-10	6	0	5	4	1	0	0	0	0
Mn-55	ELAS. SCT	-18	0	0	26	21	112	-7	3	22	44	-27	2	-61	-97	-27	-12	-13	-4	0
Mn-55	INEL. SCT	13	0	0	0	0	0	0	0	0	0	0	0	-3	-24	-7	12	20	7	6
Mn-55	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-55	MU-AVE.	74	0	0	0	0	-1	1	0	0	0	1	0	6	21	10	9	16	9	4
Fe	CAPTURE	-1748	17	-4	-33	-96	-1957	80	-121	-154	-246	57	-34	201	259	56	23	70	76	62
Fe	ELAS. SCT	-7228	-5	7	76	320	816	-97	-31	391	873	-621	112	-2193	-4449	-1030	-512	-655	-202	-27
Fe	INEL. SCT	1962	0	0	0	0	0	0	0	1	42	6	1	-11	-40	-182	1044	517	315	267
Fe	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe	MU-AVE.	2751	0	0	0	-3	-4	2	-1	-4	-15	20	0	220	719	295	332	634	394	164
Ni	CAPTURE	238	4	-1	-6	-24	-62	64	-14	-162	-69	36	1	62	60	24	24	118	129	55
Ni	ELAS. SCT	-1191	-1	1	16	74	200	-50	-68	352	248	-220	16	-610	-724	-212	-85	-96	-28	-4
Ni	INEL. SCT	221	0	0	0	0	0	0	0	0	0	0	0	-1	-2	-1	55	113	31	25
Ni	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	MU-AVE.	425	0	0	0	-1	-1	1	0	-4	-4	7	0	59	112	52	49	81	51	23

A.1.5 Sodium Void Reactivity - Outer Core -

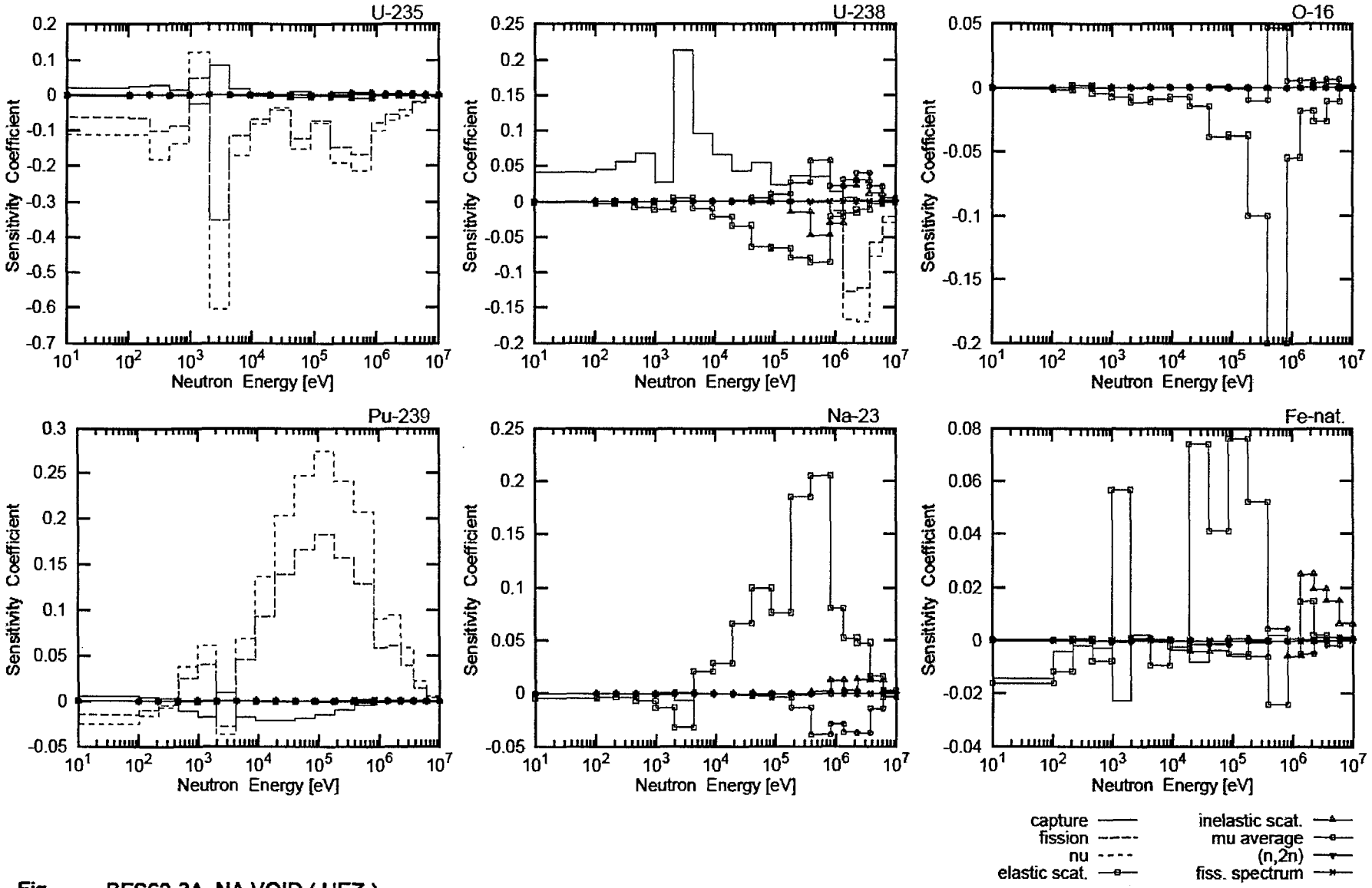

Fig. BFS62-3A NA VOID (HEZ)

TABLE BFS62-3A NA VOID (HEZ) (HEAVY METAL) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
U-235	CAPTURE	1962	224	232	287	159	-257	828	182	45	-22	96	13	83	59	21	8	3	0	0
U-235	NU	-22024	-1096	-1121	-1792	-1381	1218	-6039	-1705	-809	-349	-1518	-764	-1899	-2145	-1019	-719	-580	-231	-74
U-235	FISSION	-15491	-628	-647	-999	-879	479	-3525	-1161	-673	-406	-1214	-720	-1483	-1672	-777	-539	-421	-172	-54
U-235	ELAS. SCT	-307	-4	-3	-2	-6	13	15	-5	-5	-7	-52	-25	-65	-92	-26	-20	-16	-5	-1
U-235	INEL. SCT	-103	0	0	0	0	0	0	0	0	0	-3	-4	-29	-79	-28	8	21	9	2
U-235	(n, 2n)	-2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-2
U-235	MU-AVE.	242	0	0	0	0	0	0	0	0	0	5	4	24	69	28	33	47	24	7
U-238	CAPTURE	8255	411	448	557	681	272	2130	960	665	425	548	231	371	356	134	45	18	3	0
U-238	NU	-4631	0	0	0	-2	-1	0	0	-1	-1	-1	-1	-2	-21	-164	-1673	-1697	-775	-293
U-238	FISSION	-3440	0	0	0	-2	0	0	0	-1	0	-1	0	-1	-16	-130	-1274	-1229	-574	-212
U-238	ELAS. SCT	-4344	-16	-24	-17	-81	-116	55	-104	-221	-339	-649	-654	-787	-862	-209	-164	-112	-35	-8
U-238	INEL. SCT	-310	0	0	0	0	0	0	0	0	0	-16	-2	-150	-478	-305	212	292	112	26
U-238	(n, 2n)	-16	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-16
U-238	MU-AVE.	2209	0	0	0	0	0	0	1	4	12	49	108	273	574	215	307	399	212	54
Pu-239	CAPTURE	-1170	57	42	27	-108	-173	96	-173	-217	-218	-183	-155	-101	-48	-10	-5	-1	0	0
Pu-239	NU	16649	-258	-167	-69	383	614	-371	690	1365	2036	2476	2747	2410	2079	908	940	589	220	58
Pu-239	FISSION	10986	-145	-101	-42	245	405	-280	450	928	1397	1666	1837	1569	1293	578	605	387	152	42
Pu-239	ELAS. SCT	-18	0	-1	-1	-6	-14	5	-1	-5	-10	5	-12	2	11	4	1	2	1	0
Pu-239	INEL. SCT	-24	0	0	0	0	0	0	0	5	1	-1	-2	-4	-16	-1	-7	-2	1	0
Pu-239	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	MU-AVE.	-31	0	0	0	0	0	0	0	0	1	-1	3	-2	-10	-5	-3	-8	-5	-2

TABLE BFS62-3A NA VOID (HEZ) (FISSION SPECTRUM) UNIT:1.0E-4

FISSION SPECTRUM	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
SPEC. U-235 0.05	0	0	0	0	0	0	0	0	1	3	13	39	149	629	678	-147	-678	-423	-264
SPEC. Pu-239 0.05	-1	0	0	0	0	0	0	0	-2	-6	-14	-43	-82	19	-51	32	111	15	21

TABLE BFS62-3A NA VOID (HEZ) (STRUCTURE , COOLANT) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
H-1	CAPTURE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	ELAS. SCT	-2275	0	-10	6	-16	-256	-120	-297	-507	-610	-409	-119	-33	-47	4	80	48	9	3
H-1	INEL. SCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	MU-AVE.	160	0	0	0	1	3	0	2	7	13	24	25	29	27	10	10	7	2	0
C-12	CAPTURE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

C-12	ELAS. SCT	-85	-1	-1	1	-3	3	-2	-4	-3	-2	-7	-1	-13	-35	-7	-1	-7	-2	0
C-12	INEL. SCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-12	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-12	MU-AVE.	10	0	0	0	0	0	0	0	0	0	0	0	1	5	1	1	0	1	0
O-16	CAPTURE	52	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	32	18
O-16	ELAS. SCT	-5388	-10	-16	21	-45	-68	-116	-87	-72	-146	-380	-370	-996	-1999	-544	-183	-261	-109	-8
O-16	INEL. SCT	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8
O-16	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O-16	MU-AVE.	635	0	0	1	2	3	-2	2	6	8	10	-3	-94	475	57	57	36	64	12
Na-23	CAPTURE	-166	-2	0	0	-1	-12	-71	-6	0	-12	-12	-6	-11	-5	-1	-1	-1	-5	-20
Na-23	ELAS. SCT	8168	-48	-31	-30	-70	-137	-318	204	282	662	995	763	1852	2050	802	522	477	166	28
Na-23	INEL. SCT	444	0	0	0	0	0	0	0	0	0	0	0	0	17	125	32	131	122	18
Na-23	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-23	MU-AVE.	-1790	1	1	1	2	5	13	-1	-4	-9	-27	-37	-132	-390	-291	-369	-375	-142	-36
AL-27	CAPTURE	47	0	0	0	0	0	1	15	1	3	2	4	3	2	1	1	1	6	7
AL-27	ELAS. SCT	-962	-1	-2	1	-5	-2	-2	-9	-9	-29	-73	-110	-184	-352	-83	-41	-47	-14	-1
AL-27	INEL. SCT	77	0	0	0	0	0	0	0	0	0	0	0	0	0	-5	27	32	13	10
AL-27	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AL-27	MU-AVE.	313	0	0	0	0	0	0	0	0	1	2	6	16	83	47	67	66	20	4
Cr	CAPTURE	-159	-48	-11	-6	-11	-80	43	-6	-5	-21	-8	-15	-1	4	1	0	1	2	1
Cr	ELAS. SCT	768	-13	-9	1	-6	61	-57	-121	-32	79	127	519	205	-58	3	59	8	3	0
Cr	INEL. SCT	148	0	0	0	0	0	0	0	0	0	0	0	0	-2	-2	30	69	36	17
Cr	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	MU-AVE.	-57	0	0	0	0	-1	1	0	-1	-1	-3	-20	-13	7	-1	-18	-3	-6	2
Mn-55	CAPTURE	-144	-19	-9	-57	-7	-48	7	-1	-3	-5	-2	-2	0	0	0	0	0	0	0
Mn-55	ELAS. SCT	223	-1	-1	-27	-11	86	80	-4	-16	43	15	39	18	-4	0	4	1	0	0
Mn-55	INEL. SCT	14	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	6	3	1
Mn-55	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-55	MU-AVE.	-5	0	0	0	0	-1	1	0	0	-1	-1	-1	-2	1	0	-2	0	0	0
Fe	CAPTURE	-613	-145	-40	-21	-30	-230	19	-6	-37	-81	-36	-58	-6	21	5	2	9	11	9
Fe	ELAS. SCT	2480	-161	-118	5	-76	569	6	-94	-23	740	412	761	523	-240	-4	146	21	11	1
Fe	INEL. SCT	551	0	0	0	0	0	0	0	-2	-42	-12	9	2	-2	-57	252	192	148	63
Fe	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe	MU-AVE.	-163	2	1	0	-1	-5	2	0	-2	-14	-15	-49	-61	45	-1	-49	-5	-18	6
Ni	CAPTURE	-96	-33	-8	-4	-8	-12	17	-1	-37	-27	-15	-20	-2	5	2	2	15	19	8
Ni	ELAS. SCT	865	-33	-24	0	-16	147	-15	-57	126	196	142	217	177	-32	2	30	4	2	0
Ni	INEL. SCT	57	0	0	0	0	0	0	0	0	0	0	0	0	0	0	10	28	15	6
Ni	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	MU-AVE.	-48	0	0	0	0	-1	1	0	-2	-5	-5	-13	-18	6	-1	-8	-1	-3	1

A.1.6 Sodium Void Reactivity - Total Effect -

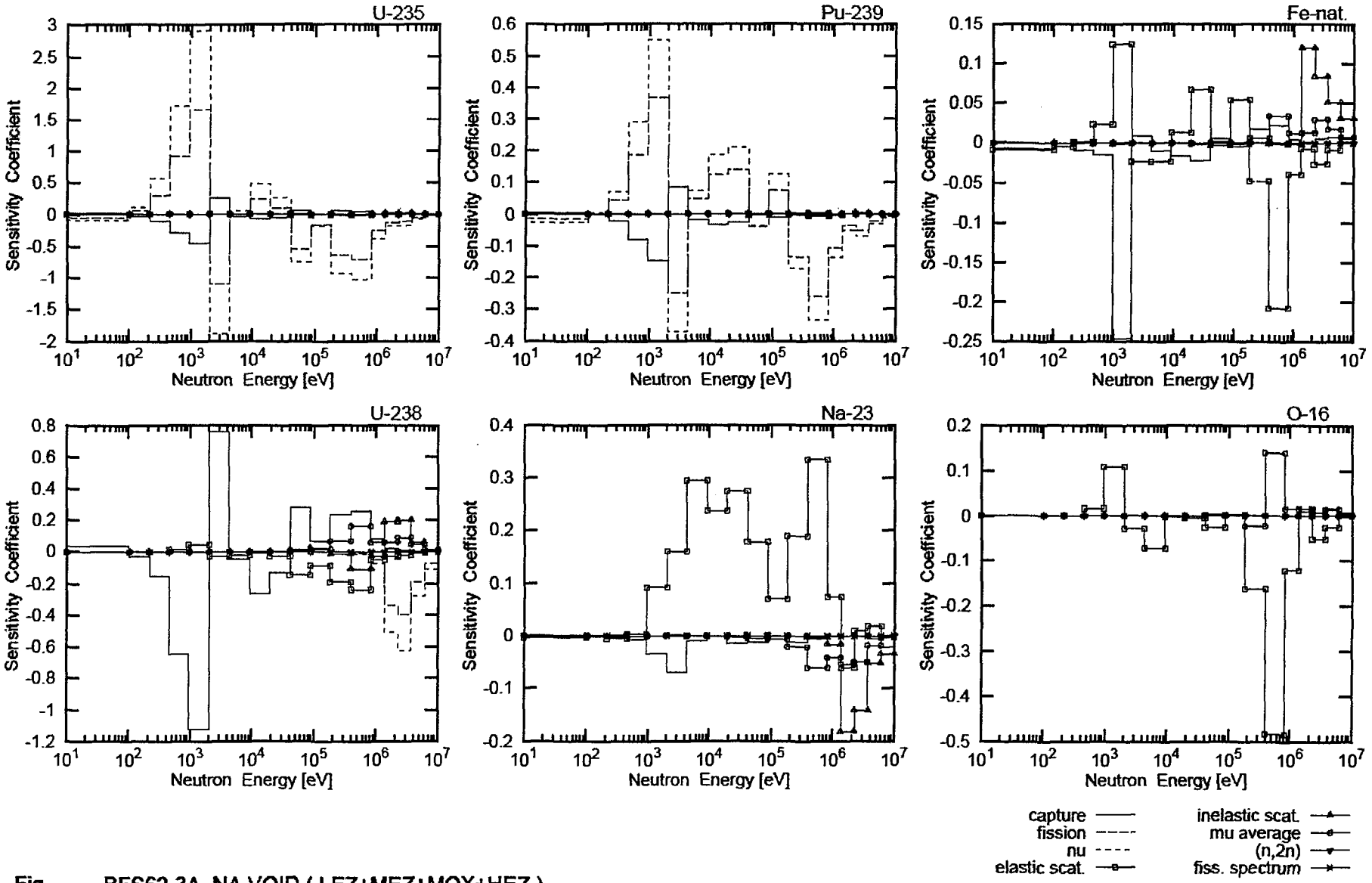

Fig. BFS62-3A NA VOID (LEZ+MEZ+MOX+HEZ)

TABLE BFS62-3A NA VOID (LEZ+MEZ+MOX+HEZ) (HEAVY METAL) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
U-235	CAPTURE	-5770	164	-245	-1003	-2858	-4575	2545	-237	-785	-576	630	36	591	405	98	28	11	0	0
U-235	NU	4298	-809	1081	5662	17189	28983	-18794	547	4767	2638	-7421	-1785	-9330	-10196	-3757	-1772	-1784	-689	-232
U-235	FISSION	-5099	-466	565	2931	9172	16580	-11048	-38	2423	1005	-5473	-1672	-6444	-7093	-2621	-1175	-1140	-462	-145
U-235	ELAS. SCT	-400	-2	-1	0	15	59	-18	-7	20	18	-80	-14	-118	-168	-43	-27	-24	-8	-2
U-235	INEL. SCT	302	0	0	0	0	0	0	0	0	0	-4	23	10	-131	-20	146	194	70	15
U-235	(n, 2n)	-3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-3
U-235	MU-AVE.	397	0	0	0	0	0	0	0	0	-1	8	3	46	123	48	48	73	38	11
U-238	CAPTURE	-6508	351	-287	-1524	-6470	-11215	7578	-479	-2624	-1336	2792	638	2340	2596	833	192	87	16	2
U-238	NU	-16117	0	0	0	12	7	0	0	0	0	-4	-1	-8	-121	-705	-5101	-6280	-2811	-1106
U-238	FISSION	-10553	0	0	0	7	4	0	0	0	0	-3	-1	-5	-84	-497	-3388	-3996	-1888	-702
U-238	ELAS. SCT	-8123	-1	2	14	124	428	-299	-190	-88	-265	-1450	-900	-1897	-2403	-539	-318	-243	-78	-19
U-238	INEL. SCT	3346	0	0	0	0	0	0	0	0	0	74	189	-143	-1075	-315	1870	1997	576	172
U-238	(n, 2n)	-37	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	-37
U-238	MU-AVE.	5224	0	0	0	0	-1	1	2	2	10	116	158	679	1598	563	621	880	471	127
Pu-239	CAPTURE	-2307	58	-6	-227	-810	-1460	858	-163	-307	-242	-12	-87	43	36	10	2	1	0	0
Pu-239	NU	2879	-260	30	716	2923	5525	-3707	733	1885	2118	-346	1262	-1704	-3346	-1364	-494	-707	-297	-87
Pu-239	FISSION	775	-149	15	447	1875	3700	-2498	484	1267	1402	-380	750	-1348	-2597	-1049	-372	-497	-214	-57
Pu-239	ELAS. SCT	-137	0	0	0	4	12	-8	-2	6	5	-25	-8	-40	-53	-12	-7	-6	-2	0
Pu-239	INEL. SCT	-1	0	0	0	0	0	0	0	-2	0	-3	1	-9	-47	-7	23	29	12	3
Pu-239	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pu-239	MU-AVE.	125	0	0	0	0	0	0	0	0	0	3	2	16	41	15	14	21	11	3

TABLE BFS62-3A NA VOID (LEZ+MEZ+MOX+HEZ) (FISSION SPECTRUM) UNIT:1.0E-4

FISSION SPECTRUM	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
SPEC. U-235 0.05	5	0	0	0	0	0	0	2	8	27	66	150	387	1469	1428	-633	-1433	-772	-694
SPEC. Pu-239 0.05	-2	0	0	0	0	0	0	0	0	3	11	22	87	490	397	-194	-389	-225	-205

TABLE BFS62-3A NA VOID (LEZ+MEZ+MOX+HEZ) (STRUCTURE , COOLANT) UNIT:1.0E-4

NUCL.	REACTION	TOTAL	18G	17G	16G	15G	14G	13G	12G	11G	10G	9G	8G	7G	6G	5G	4G	3G	2G	1G
H-1	CAPTURE	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	ELAS. SCT	-2398	0	-10	7	-11	-248	-144	-343	-576	-689	-434	-96	3	-31	8	94	57	10	3
H-1	INEL. SCT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
H-1	MU-AVE.	198	-1	0	-1	0	1	1	3	8	15	31	31	37	36	13	13	8	3	1
C-12	CAPTURE	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1

C-12	ELAS. SCT	-95	0	0	0	6	51	-10	-31	0	4	8	19	-20	-99	-16	13	-12	-7	1
C-12	INEL. SCT	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1
C-12	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
C-12	MU-AVE.	36	0	0	0	0	0	0	0	0	0	2	1	6	15	5	3	1	3	1
O-16	CAPTURE	249	0	0	0	0	0	0	0	0	0	1	0	3	4	1	1	1	148	90
O-16	ELAS. SCT	-8365	0	5	-3	168	1076	-284	-726	-34	-39	-260	34	-1627	-4845	-1202	143	-520	-263	12
O-16	INEL. SCT	41	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	41
O-16	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
O-16	MU-AVE.	1706	0	0	0	-3	-7	6	3	3	7	24	-5	-233	1391	152	116	82	142	29
Na-23	CAPTURE	-2054	-2	-7	-23	-80	-333	-704	-103	-6	-143	-124	-71	-111	-50	-11	-10	-6	-56	-214
Na-23	ELAS. SCT	18559	-33	-17	-50	41	914	1592	2940	2373	2744	1780	689	1883	3331	731	-614	93	192	-28
Na-23	INEL. SCT	-4297	0	0	0	0	0	0	0	0	0	0	0	0	-36	-156	-1820	-1419	-520	-345
Na-23	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Na-23	MU-AVE.	-2646	1	1	1	1	-3	5	-6	-14	-24	-56	-75	-210	-607	-412	-535	-489	-179	-43
AL-27	CAPTURE	32	0	0	-1	-4	-6	5	-32	-1	-14	5	6	14	11	3	1	4	19	25
AL-27	ELAS. SCT	-1585	0	0	-1	12	77	-22	-45	-2	-6	-69	134	-364	-973	-187	-17	-90	-34	1
AL-27	INEL. SCT	392	0	0	0	0	0	0	0	0	0	0	0	0	0	-2	125	156	58	55
AL-27	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AL-27	MU-AVE.	782	0	0	0	0	0	0	0	0	0	7	11	51	234	128	145	150	45	11
Cr	CAPTURE	-543	-26	-12	-22	-53	-646	224	-48	-20	-54	6	-6	32	37	12	5	9	10	9
Cr	ELAS. SCT	-1046	-7	-4	1	17	126	-159	-354	20	75	-20	264	-140	-620	-153	-5	-64	-22	-1
Cr	INEL. SCT	722	0	0	0	0	0	0	0	0	0	0	0	0	-1	0	181	334	125	83
Cr	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cr	MU-AVE.	310	0	0	0	0	-1	2	0	-1	-1	1	-9	10	55	28	43	108	53	22
Mn-55	CAPTURE	-808	-10	-10	-372	-33	-379	15	-13	-11	-9	6	0	4	3	1	0	0	0	0
Mn-55	ELAS. SCT	73	0	-1	11	12	176	-109	-8	-3	38	6	24	-11	-43	-10	-1	-5	-2	0
Mn-55	INEL. SCT	54	0	0	0	0	0	0	0	0	0	0	0	2	-11	-2	18	28	11	7
Mn-55	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Mn-55	MU-AVE.	30	0	0	0	0	-1	2	0	0	-1	0	-1	1	9	4	4	8	4	2
Fe	CAPTURE	-2543	-77	-45	-87	-152	-2470	92	-108	-160	-225	60	-39	180	225	49	21	65	70	58
Fe	ELAS. SCT	-1201	-84	-51	17	230	1243	-232	-241	129	678	-28	539	-486	-2090	-395	-77	-262	-86	-5
Fe	INEL. SCT	2835	0	0	0	0	0	0	0	-5	-14	12	7	0	-17	-22	1207	842	512	313
Fe	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Fe	MU-AVE.	1157	1	0	0	-3	-8	3	0	-3	-13	4	-22	64	336	122	133	294	172	76
Ni	CAPTURE	135	-17	-9	-17	-38	-77	75	-11	-164	-65	33	-4	55	52	21	22	109	119	52
Ni	ELAS. SCT	-5	-17	-11	4	54	308	-99	-175	223	192	-26	132	-130	-325	-79	-6	-37	-12	-1
Ni	INEL. SCT	283	0	0	0	0	0	0	0	0	0	0	1	0	-1	0	67	138	50	29
Ni	(n, 2n)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ni	MU-AVE.	162	0	0	0	-1	-2	1	0	-3	-4	1	-6	14	51	21	19	37	22	11

A.2. Comparison of Direct Calculation and Sensitivity Analysis for BFS-62-3A Experiment

Library		Difference of JENDL-3.3 Result from JENDL-3.2		Difference of JEF-2.2 Result from JENDL-3.2	
Core Parameter \ Method		Direct Calculation	Sensitivity Analysis	Direct Calculation	Sensitivity Analysis
Criticality		-0.50 dk	-0.45 dk	+0.35 dk	+0.54 dk
Sodium Void Reactivity	Inner Core	+22 pcm	+21 pcm	+13 pcm	+18 pcm
	Middle Core	+6 pcm	+5 pcm	+5 pcm	+5 pcm
	MOX Core	0 pcm	+2 pcm	+6 pcm	+7 pcm
	Outer Core	0 pcm	-2 pcm	+7 pcm	+3 pcm
	Total Effect	+28 pcm	+26 pcm	+31 pcm	+33 pcm

A.3. Sensitivity Analysis for BFS-62-3A Experiment

A.3.1 Criticality

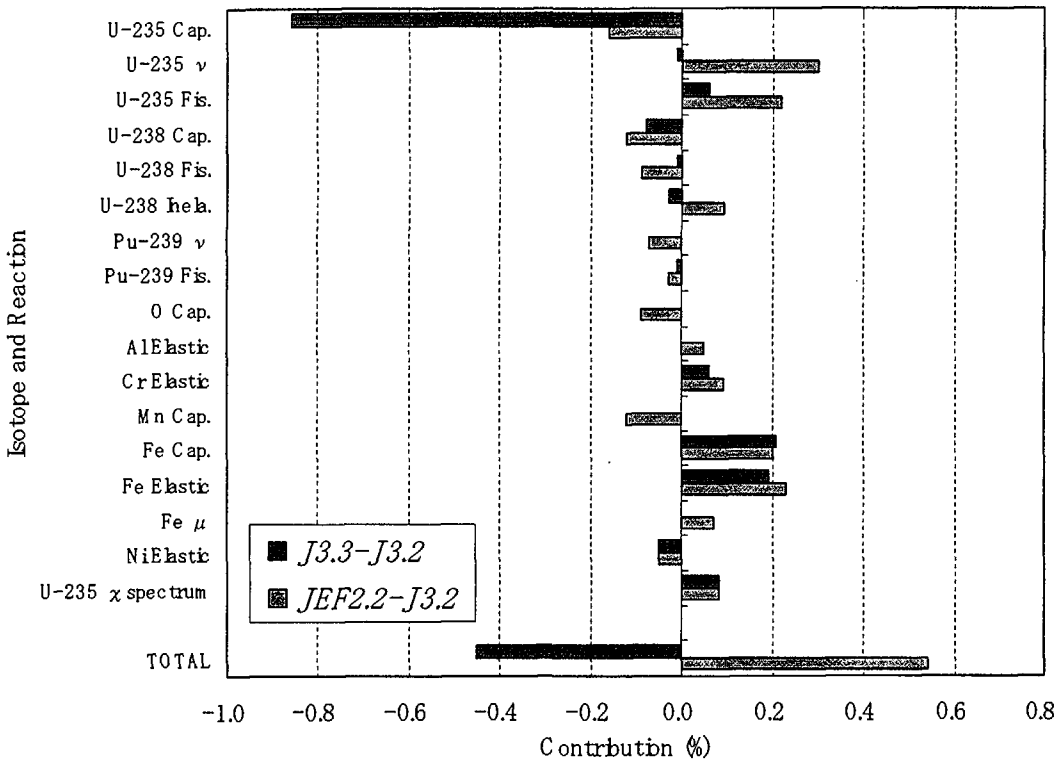

Fig. A.3.1 Sensitivity Analysis for BFS-62-3A Experiment - Criticality -

		J3.3-J3.2	JEF2.2-J3.2
1	*U-235 Cap.*	-0.86	-0.16
2	*U-235 ν*	-0.01	0.3
3	*U-235 Fis.*	0.06	0.22
8	*U-238 Cap.*	-0.08	-0.12
10	*U-238 Fis.*	-0.01	-0.09
12	*U-238 Inela.*	-0.03	0.09
16	*Pu-239 ν*	0	-0.07
17	*Pu-239 Fis.*	-0.01	-0.03
27	*O Cap.*	0	-0.09
43	*AlElastic*	0	0.05
48	*CrElastic*	0.06	0.09
52	*Mn Cap.*	0	-0.12
57	*Fe Cap.*	0.21	0.2
58	*Fe Elastic*	0.19	0.23
61	*Fe μ*	0	0.07
63	*NiElastic*	-0.05	-0.05
68	*U-235 χ spectrum*	0.08	0.08
	TOTAL	-0.45	0.54

A.3.2 Sodium Void Reactivity - Inner Core -

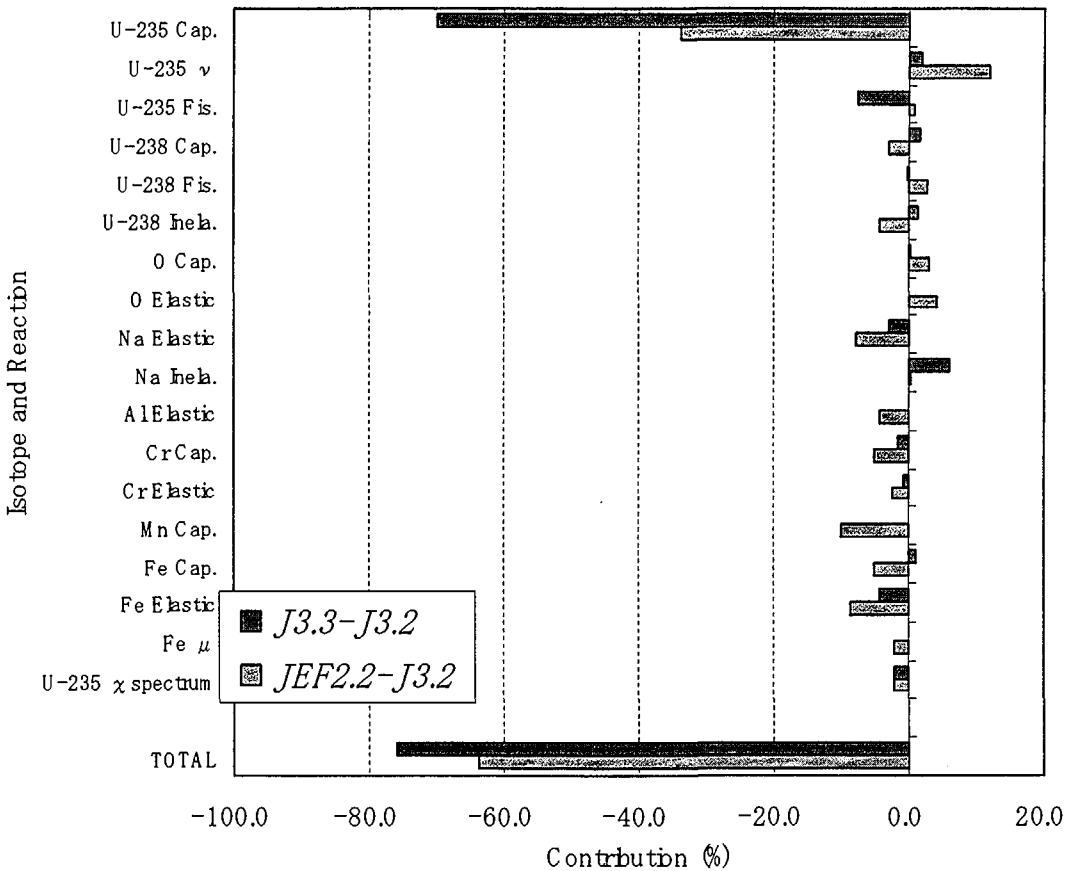

Fig. A.3.2 Sensitivity Analysis for BFS-62-3A Experiment
- Sodium Void Reactivity (Inner Core) -

NO.		J3.3-J3.2	JEF2.2-J3.2
1	*U-235 Cap.*	-70.0	-33.8
2	*U-235 ν*	1.9	12.0
3	*U-235 Fis.*	-7.6	0.9
8	*U-238 Cap.*	1.7	-3.1
10	*U-238 Fis.*	-0.3	2.7
12	*U-238 Inela.*	1.2	-4.4
27	*O Cap.*	0.2	2.9
28	*O Elastic*	-0.1	3.9
38	*Na Elastic*	-3.0	-7.9
39	*Na Inela.*	5.9	0.3
43	*AlElastic*	-0.1	-4.3
47	*CrCap.*	-1.7	-5.2
48	*CrElastic*	-0.7	-2.3
52	*Mn Cap.*	-0.1	-10.0
57	*Fe Cap.*	1.0	-5.2
58	*Fe Elastic*	-4.4	-8.7
61	*Fe μ*	0.0	-2.1
68	*U-235 χ spectru*	-2.1	-2.1
	TOTAL	-75.8	-63.7

A.3.3 Sodium Void Reactivity - Middle Core -

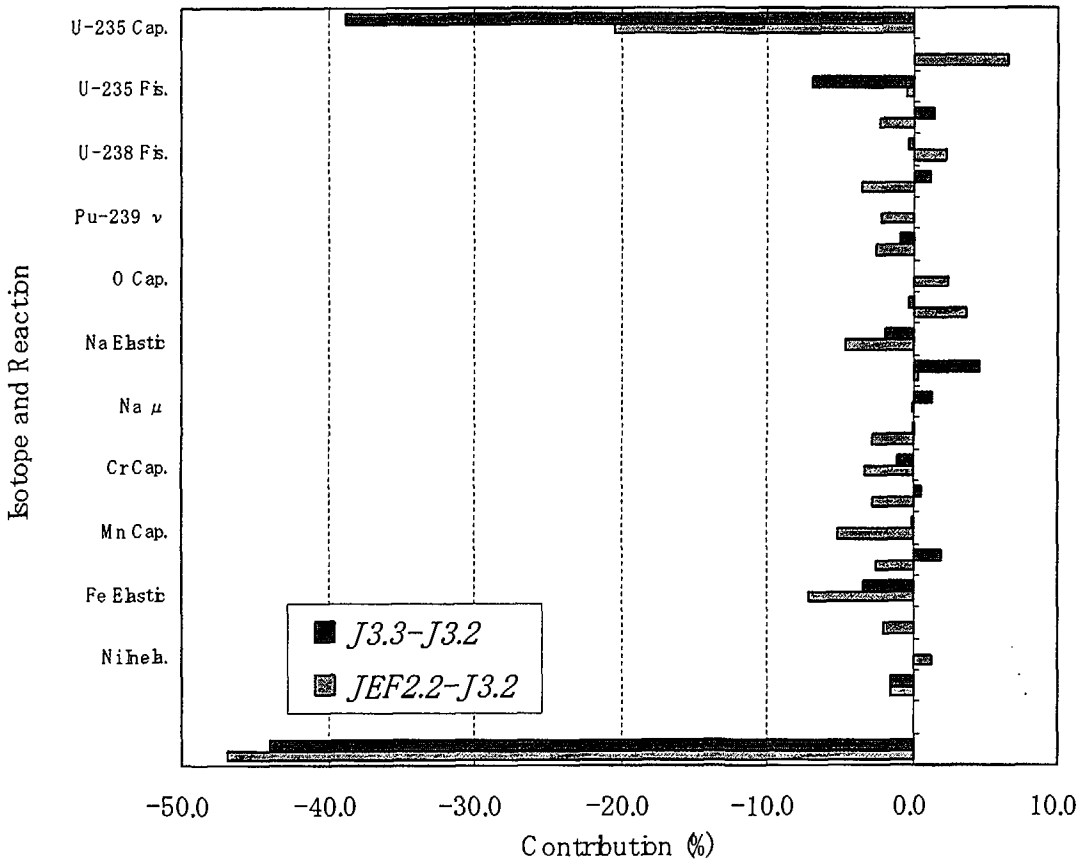

Fig. A.3.3 Sensitivity Analysis for BFS-62-3A Experiment
- Sodium Void Reactivity (Middle Core) -

		J3.3-J3.2	JEF2.2-J3.2
1	*U-235 Cap.*	-38.8	-20.4
2	*U-235 ν*	0.0	6.5
3	*U-235 Fis.*	-6.9	-0.4
8	*U-238 Cap.*	1.5	-2.4
10	*U-238 Fis.*	-0.3	2.3
12	*U-238 Inel.*	1.2	-3.6
16	*Pu-239 ν*	0.0	-2.1
17	*Pu-239 Fis.*	-1.0	-2.6
27	*O Cap.*	0.1	2.4
28	*O Elastic*	-0.3	3.6
38	*Na Elastic*	-2.0	-4.7
39	*Na Inel.*	4.6	0.4
41	*Na μ*	1.3	0.0
43	*Al Elastic*	-0.1	-2.8
47	*Cr Cap.*	-1.1	-3.3
48	*Cr Elastic*	0.6	-2.8
52	*Mn Cap.*	0.0	-5.1
57	*Fe Cap.*	2.0	-2.6
58	*Fe Elastic*	-3.4	-7.2
61	*Fe μ*	0.0	-2.1
64	*Ni Inel.*	0.1	1.3
68	*U-235 χ spectrum*	-1.6	-1.6
	TOTAL	-44.0	-46.9

A.3.4 Sodium Void Reactivity - MOX Core -

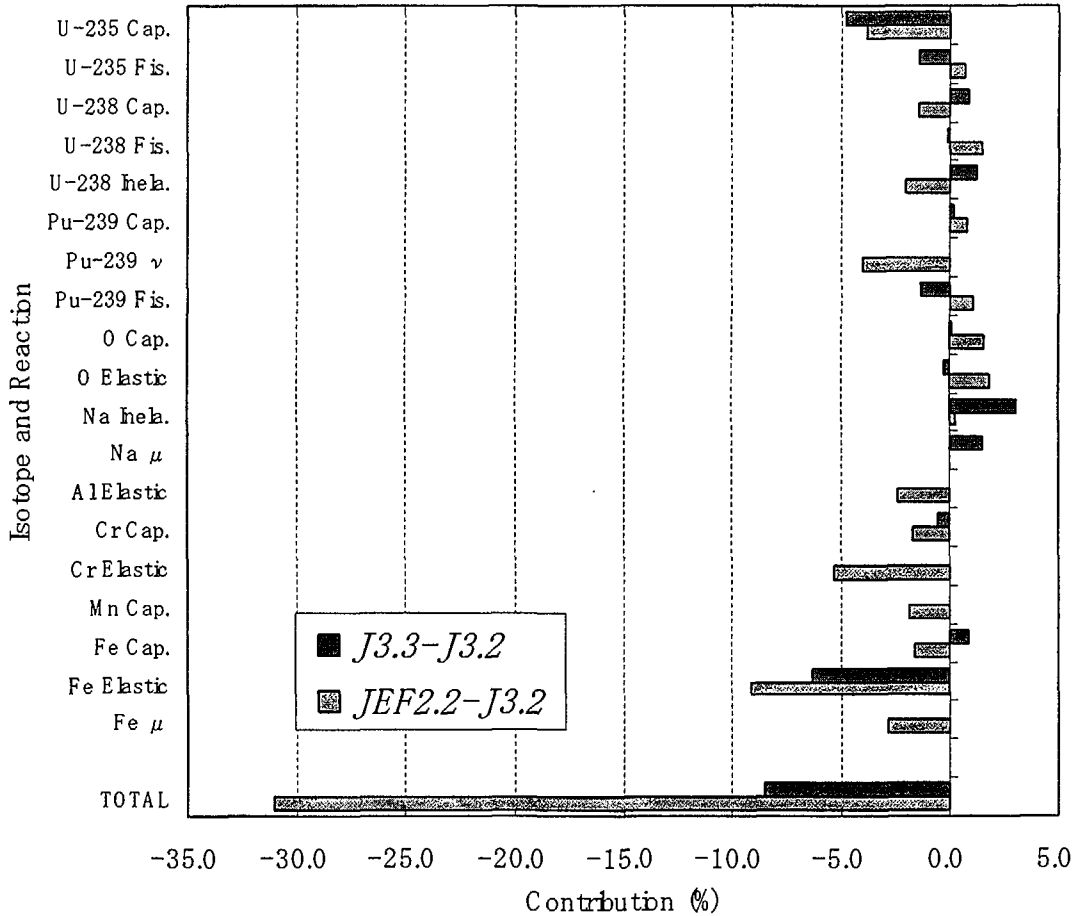

Fig. A.3.4 Sensitivity Analysis for BFS-62-3A Experiment
- Sodium Void Reactivity (MOX Core) -

		J3.3-J3.2	JEF2.2-J3.2
1	*U-235 Cap.*	-4.8	-3.8
3	*U-235 Fis.*	-1.5	0.7
8	*U-238 Cap.*	0.8	-1.4
10	*U-238 Fis.*	-0.2	1.5
12	*U-238 Inela.*	1.2	-2.1
15	*Pu-239 Cap.*	0.1	0.8
16	*Pu-239 ν*	0.0	-4.0
17	*Pu-239 Fis.*	-1.4	1.1
27	*O Cap.*	0.1	1.5
28	*O Elastic*	-0.3	1.8
39	*Na Inela.*	3.1	0.3
41	*Na μ*	1.5	0.0
43	*Al Elastic*	0.0	-2.4
47	*Cr Cap.*	-0.6	-1.7
48	*Cr Elastic*	-0.1	-5.3
52	*Mn Cap.*	0.0	-1.9
57	*Fe Cap.*	0.9	-1.6
58	*Fe Elastic*	-6.3	-9.1
61	*Fe μ*	0.0	-2.9
	TOTAL	-8.6	-31.1

A.3.5 Sodium Void Reactivity - Outer Core -

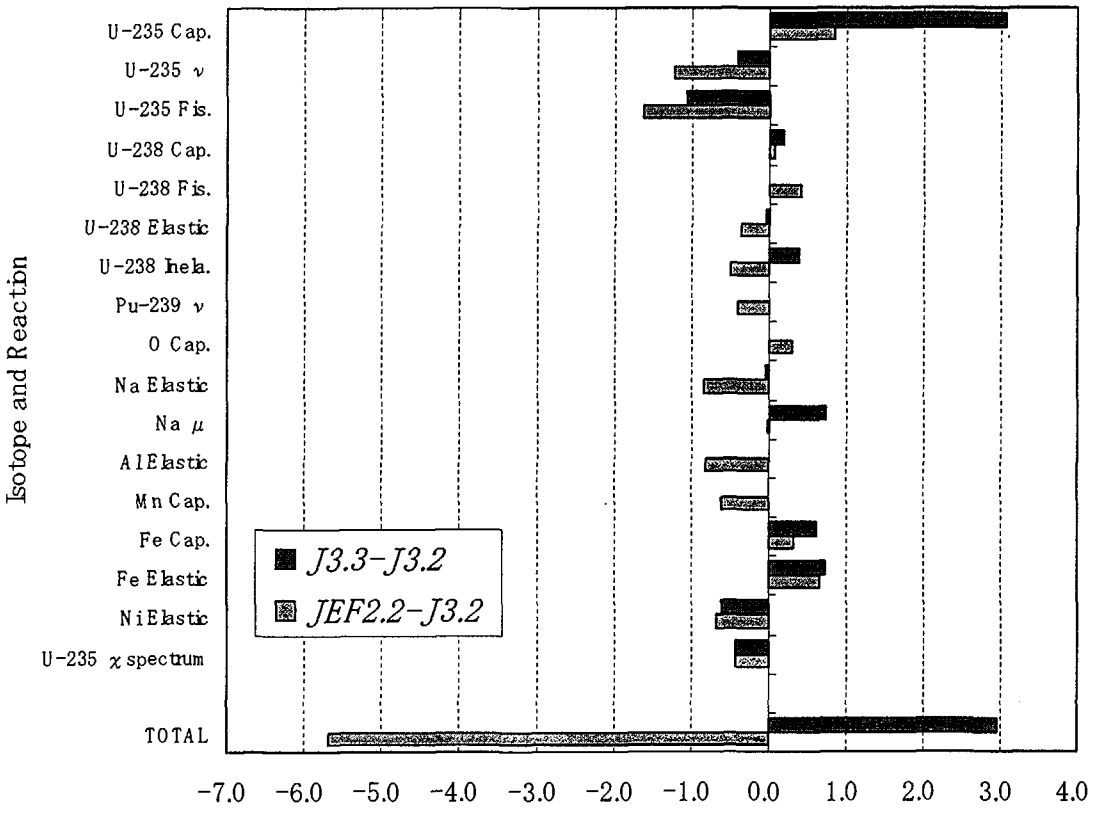

Fig. A.3.5 Sensitivity Analysis for BFS-62-3A Experiment
- Sodium Void Reactivity (Outer Core) -

		J3.3-J3.2	JEF2.2-J3.2
1	*U-235 Cap.*	3.1	0.9
2	*U-235 ν*	-0.4	-1.2
3	*U-235 Fis.*	-1.1	-1.6
8	*U-238 Cap.*	0.2	0.1
10	*U-238 Fis.*	0.0	0.4
11	*U-238 Elastic*	0.0	-0.4
12	*U-238 Inela.*	0.4	-0.5
16	*Pu-239 ν*	0.0	-0.4
27	*O Cap.*	0.0	0.3
38	*Na Elastic*	-0.1	-0.8
41	*Na μ*	0.7	0.0
43	*AlElastic*	0.0	-0.8
52	*Mn Cap.*	0.0	-0.6
57	*Fe Cap.*	0.6	0.3
58	*Fe Elastic*	0.7	0.7
63	*NiElastic*	-0.6	-0.7
68	*U-235 χ spectrum*	-0.4	-0.4
	TOTAL	3.0	-5.7

A.3.6 Sodium Void Reactivity - Total Effect -

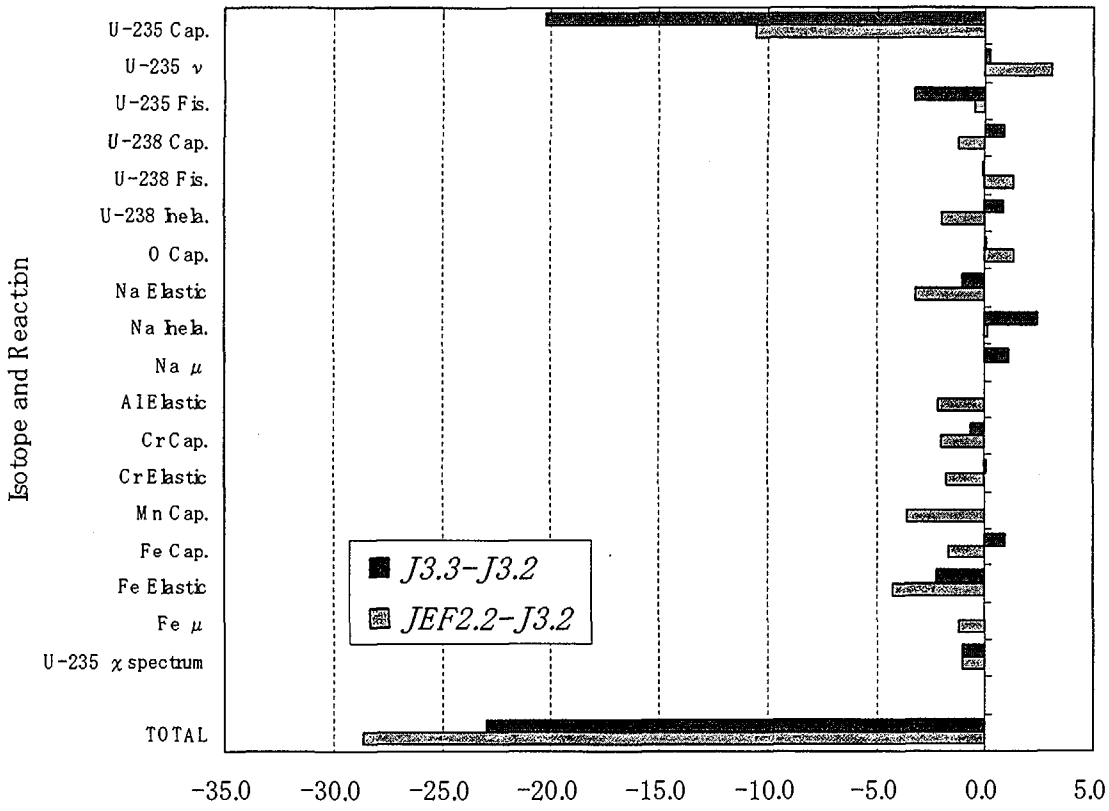

Fig. A.3.6 Sensitivity Analysis for BFS-62-3A Experiment
- Sodium Void Reactivity (Total Effect) -

		J3.3-J3.2	JEF2.2-J3.2
1	*U-235 Cap.*	-20.3	-10.5
2	*U-235 ν*	0.2	3.1
3	*U-235 Fis.*	-3.3	-0.5
8	*U-238 Cap.*	0.8	-1.2
10	*U-238 Fis.*	-0.1	1.4
12	*U-238 Inela.*	0.8	-2.0
27	*O Cap.*	0.1	1.4
38	*Na Elastic*	-1.1	-3.2
39	*Na Inela.*	2.5	0.1
41	*Na μ*	1.1	0.0
43	*Al Elastic*	0.0	-2.2
47	*Cr Cap.*	-0.7	-2.1
48	*Cr Elastic*	0.1	-1.8
52	*Mn Cap.*	0.0	-3.6
57	*Fe Cap.*	0.9	-1.7
58	*Fe Elastic*	-2.3	-4.2
61	*Fe μ*	0.0	-1.2
68	*U-235 χ spectrum*	-1.0	-1.0
	TOTAL	-22.9	-28.6

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