

INL Adjustment Results Based on ENDF/B-VII and COMMARA 2.0

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Calculation Data

- **Cross Section Used: ENDF/B-VII data**
- **Covariance Used: COMMARA 2.0**
- **20 experiments used (no covariance among them). MCNP solutions for JEZEBEL, FLATTOP, ZPR6-7. Deterministic S_4P_1 with JAEA corrective factors for ZPPR-9 and JOYO**
- **Sensitivity coefficients calculated in S_4P_1 with ERANOS and ENDF/B-VII data**
- **Isotopes considered: U235, U238, Pu239, Pu240, Pu241, Fe56, Cr52, Ni58, O16, Na23, B10**
- **Reaction considered: Capture, Fission, Nu, Elastic, Inelastic**
- **368 cross sections were selected using the following criteria on uncertainty produced by a single cross section:**
 - **0.01% for K_{eff}**
 - **0.1% for spectral indices**
 - **0.1% for sodium void**

C/E Before and After Adjustment Normalized $\chi^2=0.29$

Experiment	old C/E $\pm \sigma$	new C/E $\pm \sigma$	Experiment	old C/E $\pm \sigma$	new C/E $\pm \sigma$
JEZEBEL_Pu239 Keff	0.9999 \pm 0.002	0.9992 \pm 0.002	ZPR6-7 Pu239 F28/F25	1.0045 \pm 0.035	1.0002 \pm 0.006
JEZEBEL_Pu239 F28/F25	0.9770 \pm 0.014	0.9982 \pm 0.009	ZPR6-7 Pu239 C28/F25	1.0098 \pm 0.027	1.0109 \pm 0.009
JEZEBEL_Pu239 F37/F25	0.9870 \pm 0.014	0.9948 \pm 0.005	ZPR6-7 Pu240 Keff	0.9994 \pm 0.002	0.9997 \pm 0.001
JEZEBEL_Pu239 F49/F25	0.9753 \pm 0.009	0.9902 \pm 0.006	ZPPR9 Keff	0.9992 \pm 0.001	1.0002 \pm 0.001
JEZEBEL_Pu240 Keff	0.9998 \pm 0.002	1.0001 \pm 0.002	ZPPR9 F28/F25	0.9710 \pm 0.029	0.9950 \pm 0.017
FLATTOP Keff	1.00097 \pm 0.003	1.0000 \pm 0.003	ZPPR9 F49/F25	0.9808 \pm 0.021	0.9853 \pm 0.006
FLATTOP F28/F25	0.9822 \pm 0.018	1.0005 \pm 0.007	ZPPR9 C28/F25	1.0093 \pm 0.020	1.0106 \pm 0.009
FLATTOP F37/F25	0.9956 \pm 0.015	1.0093 \pm 0.006	ZPPR9 Na Void Step 3	1.0192 \pm 0.077	1.0309 \pm 0.036
ZPR6-7 Pu239 Keff	1.0004 \pm 0.002	1.0006 \pm 0.001	ZPPR9 Na Void Step 5	0.9732 \pm 0.075	0.9889 \pm 0.044
ZPR6-7 Pu239 F49/F25	0.9638 \pm 0.025	0.9857 \pm 0.015	JOYO Keff	0.9975 \pm 0.002	0.9998 \pm 0.002

C/E After Adjustment with and without experiment correlations

With: $\chi^2=0.34$ Without: $\chi^2=0.29$

Experiment	With: C/E $\pm \sigma$	Without: C/E $\pm \sigma$	Experiment	old C/E $\pm \sigma$	new C/E $\pm \sigma$
JEZEBEL_Pu239 Keff	0.9991 \pm 0.002	0.9992 \pm 0.002	ZPR6-7 Pu239 F28/F25	1.0090 \pm 0.006	1.0002 \pm 0.006
JEZEBEL_Pu239 F28/F25	0.9969 \pm 0.009	0.9982 \pm 0.009	ZPR6-7 Pu239 C28/F25	1.0101 \pm 0.009	1.0109 \pm 0.009
JEZEBEL_Pu239 F37/F25	0.9940 \pm 0.005	0.9948 \pm 0.005	ZPR6-7 Pu240 Keff	0.9998 \pm 0.001	0.9997 \pm 0.001
JEZEBEL_Pu239 F49/F25	0.9894 \pm 0.006	0.9902 \pm 0.006	ZPPR9 Keff	1.0002 \pm 0.001	1.0002 \pm 0.001
JEZEBEL_Pu240 Keff	1.0001 \pm 0.002	1.0001 \pm 0.002	ZPPR9 F28/F25	0.9961 \pm 0.017	0.9950 \pm 0.017
FLATTOP Keff	0.9999 \pm 0.003	1.0000 \pm 0.003	ZPPR9 F49/F25	0.9851 \pm 0.006	0.9853 \pm 0.006
FLATTOP F28/F25	0.9996 \pm 0.008	1.0005 \pm 0.007	ZPPR9 C28/F25	1.0099 \pm 0.009	1.0106 \pm 0.009
FLATTOP F37/F25	1.0087 \pm 0.006	1.0093 \pm 0.006	ZPPR9 Na Void Step 3	1.0337 \pm 0.039	1.0309 \pm 0.036
ZPR6-7 Pu239 Keff	1.0007 \pm 0.001	1.0006 \pm 0.001	ZPPR9 Na Void Step 5	0.9925 \pm 0.048	0.9889 \pm 0.044
ZPR6-7 Pu239 F49/F25	0.9866 \pm 0.015	0.9857 \pm 0.015	JOYO Keff	0.9998 \pm 0.002	0.9998 \pm 0.002

Major Contributors to Improved C/E

ZPR6-7 F49/F25

Cross Section	Contribution (%)
U238 σ^{inel} gr. 4.	0.5
U238 σ^{inel} gr. 5	0.5
U238 σ^{inel} gr. 3	0.2
Fe56 σ^{inel} gr. 5	0.2
Pu239 σ^{inel} gr. 4.	0.1
Pu239 σ^{inel} gr. 5	0.1
Total	2.4

JEZEBEL F28/F25

Cross Section	Contribution (%)
Pu239 σ^{inel} gr. 5	0.6
Pu239 σ^{inel} gr. 4	0.5
Pu239 σ^{inel} gr. 3	0.2
Pu239 σ^{inel} gr. 7	0.2
Pu239 σ^{inel} gr. 8	0.1
Pu239 σ^{elas} gr. 6	-0.1
Total	2.0

Major Contributors to Improved C/E

ZPPR9 F28/F25

Cross Section	Contribution (%)
U238 σ^{inel} gr. 4.	0.7
U238 σ^{inel} gr. 5	0.6
U238 σ^{inel} gr. 3	0.3
Fe56 σ^{inel} gr. 5	0.1
Pu239 σ^{inel} gr. 4	0.1
Pu239 σ^{inel} gr. 5	0.1
Total	2.6

ZPPR9 Na Void Step 3

Cross Section	Contribution (%)
U238 σ^{inel} gr. 4.	0.5
U238 σ^{inel} gr. 5	0.3
Pu239 σ^{cap} gr. 16	0.2
Pu239 σ^{cap} gr. 18	-0.2
U238 σ^{inel} gr. 3	0.2
U238 σ^{inel} gr. 6	0.1
Total	1.4

Major Contributors to Improved C/E

ZPPR9 Na Void Step 5

Cross Section	Contribution (%)
U238 σ^{inel} gr. 4.	0.6
U238 σ^{inel} gr. 5	0.4
Pu239 σ^{cap} gr. 16	0.3
Pu239 σ^{cap} gr. 18	-0.3
U238 σ^{inel} gr. 3	0.2
U238 σ^{inel} gr. 6	0.1
Total	2.0

JOYO Keff

Cross Section	Contribution (pcm)
U235 σ^{cap} gr. 11.	40
U235 σ^{cap} gr. 10	39
U235 σ^{cap} gr. 12	37
U235 σ^{cap} gr. 13	32
U235 σ^{cap} gr. 14	31
U235 σ^{cap} gr. 9	29
Total	232

Major Cross Section Adjustments

U238

U235

Cross Sect.	Adjus. %	Stand. Deviat. %	
		Initial	Adj.
σ^{inel} gr. 3	-4.0	20.1	8.3
σ^{inel} gr. 4	-4.0	19.4	5.3
σ^{inel} gr. 5	-4.3	20.6	8.1
σ^{inel} gr. 6	-2.6	16.9	6.8

Param.	Adjus. %	Stand. Deviat. %	
		Initial	Adj.
σ^{cap} gr. 9	-8.8	20.0	9.7
σ^{cap} gr. 10	-8.8	20.0	9.7
σ^{cap} gr. 11	-8.8	20.0	9.7
σ^{cap} gr. 12	-8.8	20.0	9.7
σ^{cap} gr. 13	-8.8	20.0	9.7
σ^{cap} gr. 14	-8.8	20.0	9.7

Major Cross Section Adjustments

Pu239

Fe56

Cross Sect.	Adjus. %	Stand. Deviat. %	
		Initial	Adj.
σ^{inel} gr. 3	-9.4	25.6	19.1
σ^{inel} gr. 4	-10.2	19.6	10.7
σ^{inel} gr. 5	-11.3	19.0	7.4
σ^{inel} gr. 6	-15.1	27.0	11.0
σ^{inel} gr. 7	-16.6	32.6	16.1
σ^{inel} gr. 8	-14.9	32.7	18.9
σ^{cap} gr. 16	8.6	16.5	14.8
σ^{cap} gr. 17	8.6	16.5	14.8
σ^{cap} gr. 18	5.6	10.7	9.6

Param.	Adjus. %	Stand. Deviat. %	
		Initial	Adj.
σ^{inel} gr. 5	-2.2	12.0	11.5

Uncertainty Evaluation

- **Reactors:** ABR oxide and JAEA FBR as target, ABR metal and oxide recycled for extrapolability.
- **Calculational data:** provided RZ models, ENDF/B-VII 33 group cross sections, and COMMARA 2.0 covariance data.
- **Integral parameters:** K_{eff} and sodium void only in core regions
- **Calculated Uncertainties:** no correlation (only standard deviations), full covariance, no correlation with adjusted standard deviations, adjusted standard deviations and original correlations, and full adjusted covariance.

Reactor	K_{eff}	Core Sodium Void (pcm)
ABR Oxide	1.05418	1362
JAEA FBR	0.99927	1109
ABR Metal	1.02675	1531
ABR Recycled Oxide	1.02749	2356

Assimilated Representativity Factor

- **Uncertainty:** $\Delta R_0^2 = S_R^+ D S_R$
- **Representativity Factor:** $r_{RE} = \frac{(S_R^+ D S_E)}{\left[(S_R^+ D S_R) (S_E^+ D S_E) \right]^{1/2}}$
- **Uncertainty Reduction on Target System:** $\Delta R_0'^2 = \Delta R_0^2 \cdot (1 - r_{RE}^2)$
- **Uncertainty After Adjustment:** $\Delta R_0'^2 = S_R^+ D' S_R$
- **Adjustment Uncertainty Reduction Factor:** $UR = \frac{\Delta R_0}{\Delta R_0'}$
- **Assimilated Representativity Factor:** $r_{RE}^A = \sqrt{1 - \frac{1}{UR^2}}$

ABR Ox. Uncertainty on K_{eff} (pcm) No Correlation

Original Stand. Dev.

Adjusted Stand. Dev.

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	134	18	69	13	308	344
PU239	143	127	55	3	33	202
FE56	93	0	0	71	103	156
PU240	24	22	37	0	7	50
NA23	7	0	0	29	45	54
CR52	9	0	0	16	15	24
O16	4	0	0	24	1	25
PU241	3	4	1	0	1	5
Total	219	130	95	83	330	436

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	117	17	65	12	112	176
PU239	130	122	54	2	17	187
FE56	92	0	0	68	99	152
PU240	24	22	31	0	7	46
NA23	7	0	0	28	40	49
CR52	9	0	0	16	15	24
O16	4	0	0	23	1	24
PU241	3	4	1	0	1	5
Total	200	125	91	80	157	308

UR=1.42

ABR Ox. Uncertainty on K_{eff} (pcm) With Correlation

Original Covariance

Adjusted Stand. Dev. and Orig. Correlations

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	277	29	112	26	537	616
PU239	309	225	71	8	75	396
FE56	170	0	0	166	140	276
PU240	60	44	82	1	15	112
NA23	8	0	0	21	79	82
CR52	20	0	0	38	17	46
O16	5	0	0	45	1	45
PU241	10	6	3	0	2	13
Total	454	231	156	179	566	798

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	244	27	106	24	200	335
PU239	278	216	71	7	38	362
FE56	168	0	0	159	135	269
PU240	59	43	70	1	14	103
NA23	8	0	0	20	70	74
CR52	20	0	0	38	17	46
O16	5	0	0	44	1	44
PU241	10	6	3	0	2	13
Total	412	222	146	173	255	580

UR=1.38

ABR Ox. Uncertainty on K_{eff} (pcm) With Correlation

Original Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	277	29	112	26	537	616
PU239	309	225	71	8	75	396
FE56	170	0	0	166	140	276
PU240	60	44	82	1	15	112
NA23	8	0	0	21	79	82
CR52	20	0	0	38	17	46
O16	5	0	0	45	1	45
PU241	10	6	3	0	2	13
Total	454	231	156	179	566	798

Adjusted Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	-73	-5	-58	-32	-93	-136
PU239	121	72	28	-5	19	145
FE56	125	0	0	127	98	204
PU240	29	24	29	-1	12	49
NA23	5	0	0	10	29	32
CR52	20	0	0	30	9	38
O16	5	0	0	42	1	42
PU241	10	6	3	0	2	12
Total	162	76	-40	133	49	226

	Orig. Stand. Dev. (No Correl.)	Original Covariance	Adj. Stand. Dev. (No Correl.)	Adj. Stand. Dev. and Orig. Correl.	Adjusted Covariance	Adj. Reduction Factor	Assimilated Represent. Factor
Uncertainty	436	798	308	580	226	3.53	0.96

ABR Ox. Uncertainty on Sodium Void (%) With Correlation

Original Covariance

Adjusted Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	3.5	0.1	0.4	0.5	3.5	5.0
NA23	0.5	0.0	0.0	2.0	4.4	4.9
PU239	1.2	2.9	0.9	0.2	0.7	3.3
FE56	1.8	0.0	0.0	2.5	0.8	3.2
PU240	0.6	0.3	0.5	0.0	0.1	0.8
CR52	0.1	0.0	0.0	0.8	0.1	0.8
O16	0.0	0.0	0.0	0.4	0.0	0.4
PU241	0.1	0.2	0.0	0.0	0.0	0.2
Total	4.2	2.9	1.1	3.4	5.8	8.5

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	2.3	-0.1	0.3	0.5	1.1	2.6
NA23	0.4	0.0	0.0	1.3	3.3	3.6
PU239	1.0	2.3	0.8	-0.1	0.3	2.6
FE56	1.6	0.0	0.0	2.4	0.6	3.0
PU240	0.5	0.2	0.2	-0.0	0.1	0.6
CR52	0.1	0.0	0.0	0.8	0.1	0.8
O16	0.0	0.0	0.0	0.2	0.0	0.2
PU241	0.1	0.2	0.0	0.0	0.0	0.2
Total	3.0	2.3	0.9	2.9	3.5	6.0

	Orig. Stand. Dev. (No Correl.)	Original Covariance	Adj. Stand. Dev. (No Correl.)	Adj. Stand. Dev. and Orig. Correl.	Adjusted Covariance	Adj. Reduction Factor	Assimilated Represent. Factor
Uncertainty	5.7	8.5	5.0	7.2	6.0	1.41	0.71

FBR Uncertainty on K_{eff} (pcm) With Correlation

Original Covariance

Adjusted Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	310	39	144	52	776	851
PU239	230	180	55	7	63	304
PU240	125	108	194	4	41	258
FE56	86	0	0	60	105	149
PU241	93	61	37	1	18	119
PU242	88	36	30	2	5	100
NA23	7	0	0	17	85	87
O16	6	0	0	35	2	36
Total	434	225	253	90	792	969

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	44	-4	24	7	-12	49
PU239	-29	-50	-8	-8	-15	-61
PU240	94	76	120	-7	49	178
FE56	38	0	0	25	36	58
PU241	93	61	37	1	20	119
PU242	88	36	30	2	5	100
NA23	5	0	0	-3	34	34
O16	6	0	0	22	2	24
Total	167	91	132	32	71	245

	Orig. Stand. Dev. (No Correl.)	Original Covariance	Adj. Stand. Dev. (No Correl.)	Adj. Stand. Dev. and Orig. Correl.	Adjusted Covariance	Adj. Reduction Factor	Assimilated Represent. Factor
Uncertainty	536	969	316	603	245	3.95	0.97

FBR Uncertainty on Sodium Void (%) With Correlation

Original Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	3.7	0.2	0.6	1.0	5.8	7.0
NA23	0.5	0.0	0.0	1.4	5.7	5.9
PU241	0.7	1.8	0.2	0.0	0.2	1.9
PU239	1.0	2.4	0.8	0.2	0.6	2.8
PU240	1.2	0.8	1.2	0.1	0.3	1.9
FE56	1.5	0.0	0.0	1.0	0.6	1.8
O16	0.1	0.0	0.0	0.3	0.0	0.3
PU242	0.5	0.2	0.2	0.0	0.0	0.6
Total	4.4	3.1	1.6	2.0	8.2	10.1

Adjusted Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	2.4	-0.1	0.5	1.0	1.7	3.1
NA23	0.4	0.0	0.0	0.7	4.5	4.6
PU241	0.7	1.8	0.2	0.0	0.3	1.9
PU239	0.8	1.7	0.6	-0.1	0.2	2.0
PU240	1.1	0.7	0.9	-0.1	0.4	1.6
FE56	1.2	0.0	0.0	1.0	0.2	1.6
O16	0.1	0.0	0.0	-0.3	0.0	-0.3
PU242	0.5	0.2	0.2	0.0	0.0	0.6
Total	3.2	2.6	1.2	1.5	4.8	6.6

	Orig. Stand. Dev. (No Correl.)	Original Covariance	Adj. Stand. Dev. (No Correl.)	Adj. Stand. Dev. and Orig. Correl.	Adjusted Covariance	Adj. Reduction Factor	Assimilated Represent. Factor
Uncertainty	6.4	10.1	5.2	7.8	6.6	1.53	0.756

ABR Met. Uncertainty on K_{eff} (pcm) With Correlation

Original Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	217	38	142	45	706	755
PU239	233	243	74	13	98	359
FE56	170	0	0	261	149	345
NA23	8	0	0	47	78	92
PU240	31	37	66	1	12	83
CR52	21	0	0	68	16	73
FE54	25	0	0	25	3	36
ZR90	22	0	0	9	11	26
Total	365	248	173	279	733	917

Adjusted Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	-63	-11	18	-31	57	-39
PU239	57	108	36	-10	35	132
FE56	131	0	0	227	93	278
NA23	6	0	0	49	45	68
PU240	-16	13	-14	-1	-1	-17
CR52	21	0	0	59	-1	63
FE54	25	0	0	25	3	36
ZR90	22	0	0	9	11	26
Total	133	108	38	239	124	322

	Orig. Stand. Dev. (No Correl.)	Original Covariance	Adj. Stand. Dev. (No Correl.)	Adj. Stand. Dev. and Orig. Correl.	Adjusted Covariance	Adj. Reduction Factor	Assimilated Represent. Factor
Uncertainty	520	917	343	613	322	2.85	0.94

ABR Met. Uncertainty on Sodium Void (%) With Correlation

Original Covariance

Adjusted Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
NA23	0.3	0.0	0.0	3.0	3.5	4.6
U238	2.9	0.1	0.3	0.8	2.1	3.7
FE56	1.0	0.0	0.0	3.2	0.7	3.4
PU239	2.1	1.6	0.6	0.2	0.5	2.7
CR52	0.1	0.0	0.0	1.1	0.1	1.1
PU240	0.3	0.2	0.4	0.0	0.0	0.5
FE54	0.1	0.0	0.0	0.3	0.0	0.3
ZR90	0.1	0.0	0.0	0.3	0.1	0.3
Total	3.7	1.6	0.8	4.6	4.2	7.5

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
NA23	0.3	0.0	0.0	2.5	2.7	3.7
U238	1.5	-0.1	0.4	0.7	1.0	2.0
FE56	1.0	0.0	0.0	3.1	0.5	3.3
PU239	1.7	1.1	0.5	-0.0	0.3	2.1
CR52	0.1	0.0	0.0	1.0	0.0	1.0
PU240	0.2	0.1	0.2	-0.0	0.0	0.3
FE54	0.1	0.0	0.0	0.3	0.0	0.3
ZR90	0.1	0.0	0.0	0.3	0.1	0.3
Total	2.5	1.1	0.7	4.2	2.9	5.9

	Orig. Stand. Dev. (No Correl.)	Original Covariance	Adj. Stand. Dev. (No Correl.)	Adj. Stand. Dev. and Orig. Correl.	Adjusted Covariance	Adj. Reduction Factor	Assimilated Represent. Factor
Uncertainty	5.2	7.5	4.6	6.7	5.9	1.28	0.62

ABR Recycled Ox. Uncertainty on K_{eff} (pcm) With Correlation

Original Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	219	27	104	20	699	741
PU240	179	161	292	5	75	386
FE56	155	0	0	144	204	294
CM245	5	282	37	0	1	284
PU239	200	169	51	5	76	278
CM244	107	76	59	0	3	144
PU242	119	50	42	2	8	136
NA23	7	0	0	30	121	125
PU238	62	74	63	1	12	116
PU241	62	43	25	0	17	82
Total	422	388	332	149	747	1010

Adjusted Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
U238	-77	-18	-41	-22	-78	-121
PU240	142	118	195	-11	92	284
FE56	117	0	0	109	151	220
CM245	5	282	37	0	1	284
PU239	-53	-43	-7	-10	-14	-71
CM244	107	76	59	0	3	144
PU242	119	50	42	2	8	136
NA23	5	0	0	27	71	77
PU238	62	74	63	1	12	116
PU241	62	43	25	0	21	82
Total	242	327	218	109	176	506

	Orig. Stand. Dev. (No Correl.)	Original Covariance	Adj. Stand. Dev. (No Correl.)	Adj. Stand. Dev. and Orig. Correl.	Adjusted Covariance	Adj. Reduction Factor	Assimilated Represent. Factor
Uncertainty	537	1010	369	733	506	1.99	0.87

ABR Recycled Ox. Uncertainty on Sodium Void (%) With Correlation

Original Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
NA23	0.3	0.0	0.0	1.6	5.0	5.3
U238	2.1	0.0	0.2	0.3	3.0	3.7
FE56	1.2	0.0	0.0	1.8	0.8	2.3
PU240	1.1	0.7	1.0	0.1	0.4	1.7
PU239	0.5	1.5	0.5	0.1	0.5	1.7
PU238	0.3	0.8	0.1	0.0	0.1	0.9
CM245	0.0	0.7	0.2	0.0	0.0	0.8
PU241	0.3	0.8	0.1	0.0	0.2	0.8
CM244	0.6	0.2	0.2	0.0	0.0	0.7
PU242	0.5	0.1	0.2	0.0	0.0	0.5
Total	2.8	2.1	1.2	2.4	6.0	7.4

Adjusted Covariance

Isotope	σ_{cap}	σ_{fiss}	ν	σ_{el}	σ_{inel}	Total
NA23	0.3	0.0	0.0	0.9	4.1	4.2
U238	1.0	-0.0	0.1	0.3	0.9	1.4
FE56	1.0	0.0	0.0	1.8	0.6	2.1
PU240	1.1	0.6	0.7	-0.1	0.4	1.5
PU239	0.3	1.0	0.3	-0.1	0.1	1.1
PU238	0.3	0.8	0.1	0.0	0.1	0.9
CM245	0.0	0.7	0.2	0.0	0.0	0.8
PU241	0.3	0.8	0.1	0.0	0.2	0.8
CM244	0.6	0.2	0.2	0.0	0.0	0.7
PU242	0.5	0.1	0.2	0.0	0.0	0.5
Total	2.0	1.8	0.9	2.0	4.3	5.5

	Orig. Stand. Dev. (No Correl.)	Original Covariance	Adj. Stand. Dev. (No Correl.)	Adj. Stand. Dev. and Orig. Correl.	Adjusted Covariance	Adj. Reduction Factor	Assimilated Represent. Factor
Uncertainty	4.7	7.4	4.1	6.3	5.5	1.35	0.67

Conclusions

- **An adjustment was performed using COMMARA 2.0 covariance data and ENDF/B-VII cross sections.**
- **The major modifications indicated regard the U238 and Fe56 inelastic, and the U235 and Pu239 capture.**
- **The adjustment provide a good consistency test, and all the adjustment on cross sections are within the 1 sigma standard deviation range.**
- **The inclusion of experimental correlations, at least in this specific case, does not seem to have any significant impact.**
- **The issue of the uncertainties associated to the C/E should also be revisited.**
- **An uncertainty evaluation was performed on target reactors and shows significant reductions (mostly related to correlations) for Keff, and a lot less for sodium void reactivity coefficients. This indicates the necessity of including specific experiments aimed at the integral parameter of interest.**
- **The same conclusion is true for not targeted reactors (need to improve structural materials and minor actinides).**