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C/E-values for the proposed benchmark exercise using ERANOS in conjunction with different data libraries

Deterministic ERANOS (Version 2.2-N) in conjunction with the following basic data libraries: ENDF/B-VI.8, JEFF-3.1, JEF-2.2 (unadjusted), as well as ERALIB-1 (adjusted JEF-2.2).

Simplified calculations, namely:

Homogeneous compositions, 33 group discrete-ordinates transport-theory (BISTRO for cylindrical geometry) by means of P_1S_4 approximations with a symmetric weight set.

Same meshing as in the benchmark specifications (available on the Web).

Given correction factors (taken from the Web) are applied to the targeted results to get the calculated values (C).

Relative uncertainties of the C/E's are obtained by combining the available relative uncertainty of the experiment (E) taken from the Web with that of the correction factor (thus implicitly accounting for uncertainties of the reference Monte Carlo calculation), and these, as a result of simple algebra, without using cross correlations.

These relative C/E uncertainties are then converted to the tabulated (absolute) uncertainties.

JEZEBEL-Pu239/ Library	C/E	Uncertainty
k_{eff}		
ENDF/B-VI.8	0.99713	0.00223
JEFF-3.1	0.99941	0.00224
JEF-2.2	0.99613	0.00223
ERALIB-1	1.00214	0.00224
F28/F25 (at core center)		
ENDF/B-VI.8	0.961	0.014
JEFF-3.1	0.982	0.015
JEF-2.2	0.957	0.014
ERALIB-1	0.944	0.014

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

JEZEBEL-Pu239 (continued)

JEZEBEL-Pu239/ Library	C/E	Uncertainty
F37/F25 (at core center)		
ENDF/B-VI.8	0.963	0.017
JEFF-3.1	1.000	0.017
JEF-2.2	0.938	0.016
ERALIB-1	0.940	0.016
F49/F25 (at core center)		
ENDF/B-VI.8	0.975	0.013
JEFF-3.1	0.985	0.013
JEF-2.2	0.980	0.013
ERALIB-1	0.988	0.013

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

JEZEBEL-Pu240/ Library	C/E	Uncertainty
k_{eff}		
ENDF/B-VI.8	0.99764	0.00223
JEFF-3.1	1.00374	0.00225
JEF-2.2	0.99924	0.00224
ERALIB-1	1.00584	0.00225

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

FLATTOP-Pu239/ Library	C/E	Uncertainty
k_{eff}		
ENDF/B-VI.8	0.99769	0.00315
JEFF-3.1	0.99929	0.00316
JEF-2.2	0.98222	0.00311
ERALIB-1	0.99457	0.00314
F28/F25 (at core center)		
ENDF/B-VI.8	0.976	0.015
JEFF-3.1	0.986	0.015
JEF-2.2	0.979	0.015
ERALIB-1	0.963	0.014

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

FLATTOP-Pu239 (continued)

FLATTOP-Pu239/ Library	C/E	Uncertainty
F37/F25 (at core center)		
ENDF/B-VI.8	0.980	0.017
JEFF-3.1	1.007	0.017
JEF-2.2	0.954	0.016
ERALIB-1	0.953	0.016

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

ZPR6-7 (standard configuration)

ZPR6-7 (standard configuration) / Library	C/E	Uncertainty
k_{eff}		
ENDF/B-VI.8	1.00396	0.00251
JEFF-3.1	1.00144	0.00251
JEF-2.2	0.99395	0.00249
ERALIB-1	1.00190	0.00251
F49/F25 (at core center)		
ENDF/B-VI.8	0.968	0.023
JEFF-3.1	0.959	0.022
JEF-2.2	0.959	0.022
ERALIB-1	0.977	0.023

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

ZPR6-7 (standard configuration), continued

ZPR6-7 (standard configuration) / Library	C/E	Uncertainty
F28/F25 (at core center)		
ENDF/B-VI.8	1.041	0.033
JEFF-3.1	1.004	0.032
JEF-2.2	1.032	0.032
ERALIB-1	1.033	0.033
C28/F25 (at core center)		
ENDF/B-VI.8	1.008	0.026
JEFF-3.1	1.005	0.026
JEF-2.2	1.012	0.026
ERALIB-1	1.011	0.026

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

ZPR6-7 (high Pu240 content)

ZPR6-7 (high Pu240 content) / Library	C/E	Uncertainty
k_{eff}		
ENDF/B-VI.8	1.00317	0.00242
JEFF-3.1	1.00091	0.00241
JEF-2.2	0.99271	0.00239
ERALIB-1	1.00155	0.00241

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

ZPPR-9 / Library	C/E	Uncertainty
k_{eff}		
ENDF/B-VI.8	1.00546	0.00154
JEFF-3.1	0.99996	0.00153
JEF-2.2	0.99435	0.00152
ERALIB-1	1.00236	0.00153
F28/F25 (at core center)		
ENDF/B-VI.8	1.012	0.029
JEFF-3.1	0.961	0.028
JEF-2.2	1.005	0.029
ERALIB-1	1.000	0.029

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

ZPPR-9 (continued)

ZPPR-9 / Library	C/E	Uncertainty
F49/F25 (at core center)		
ENDF/B-VI.8	0.986	0.022
JEFF-3.1	0.976	0.022
JEF-2.2	0.976	0.022
ERALIB-1	0.993	0.022
C28/F25 (at core center)		
ENDF/B-VI.8	1.007	0.022
JEFF-3.1	1.004	0.022
JEF-2.2	1.011	0.022
ERALIB-1	1.011	0.022

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

ZPPR-9 (continued)

ZPPR-9 / Library	C/E	Uncertainty
Na void Step 3		
ENDF/B-VI.8	1.105	0.044
JEFF-3.1	1.027	0.041
JEF-2.2	1.106	0.044
ERALIB-1	0.962	0.038
Na void step 5		
ENDF/B-VI.8	1.082	0.041
JEFF-3.1	0.970	0.037
JEF-2.2	1.070	0.041
ERALIB-1	0.928	0.035

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

JOYO / Library	C/E	Uncertainty
k_{eff}		
ENDF/B-VI.8	0.99520	0.00205
JEFF-3.1	0.99944	0.00206
JEF-2.2	0.99808	0.00205
ERALIB-1	0.99639	0.00205

Red: The confidence interval (delimited by C/E +/- Uncertainty) does not include the value of one.

Among the four libraries used, the overall most consistent performance is achieved by JEFF-3.1, showing improvements as against JEF-2.2 (in particular the ZPPR9 Na void is within the experimental uncertainty).

The adjusted data (ERALIB-1) performs in most cases better than the corresponding unadjusted JEF-2.2 data.

As in the INL study: The adjustment is particularly efficient in the case of F49/F25 for ZPR6-7 (standard configuration).

C28/F25 well predicted in general, but several analytical reaction rate ratios outside the experimental range (\Rightarrow Justification for the adjustment exercise).