

Supplemental Online Material

Analysis of VIP-BWR reactor core physics experiments on UO₂ and MOX mockup fuel assemblies with CASMO5

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This Supplemental Online Material consists of 9 pages and includes 9 figures.

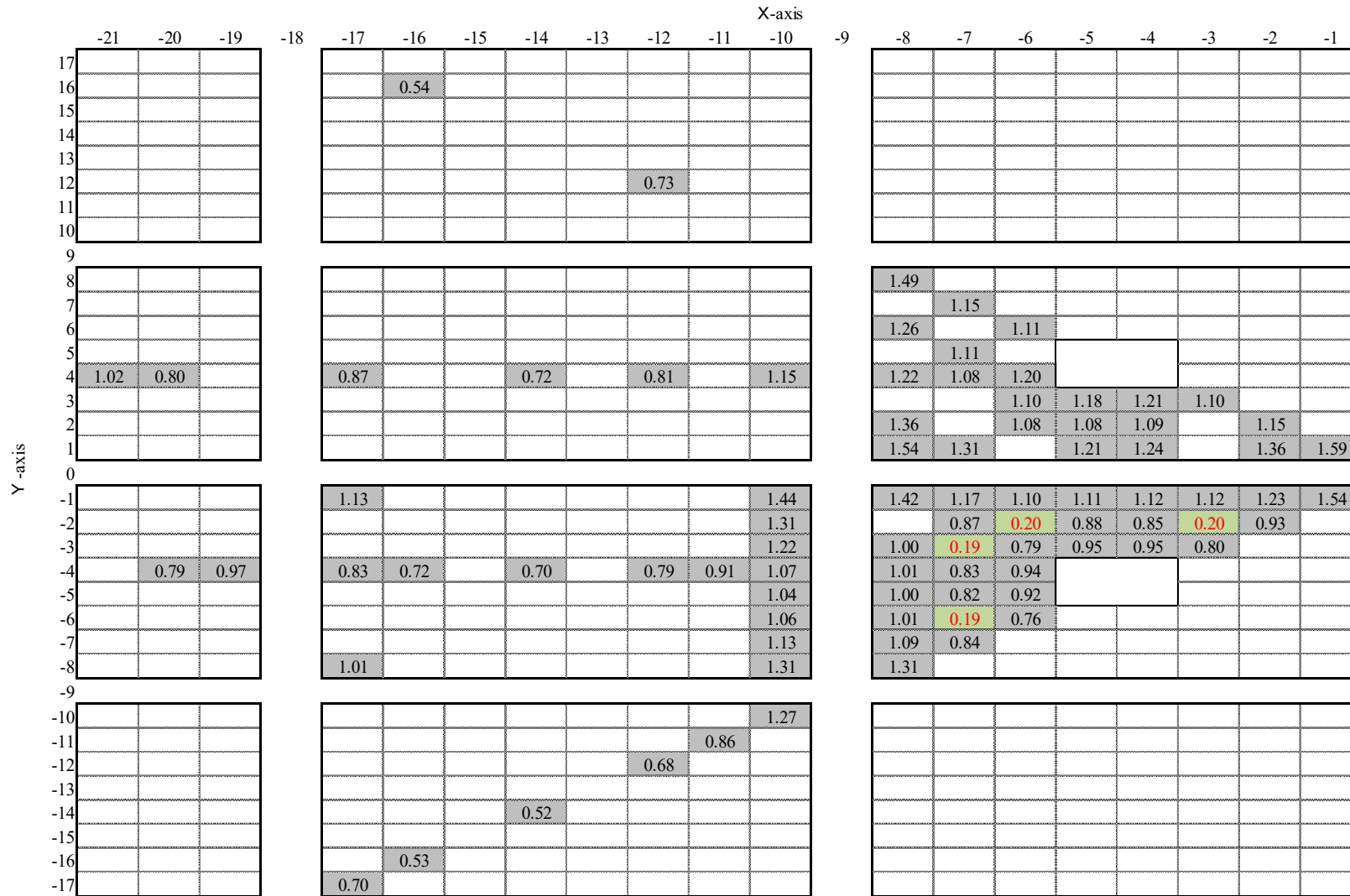


Figure S1. Relative fission rate distribution in the left half of the all-UO₂ core. They were defined by normalizing the relative fission rates reported in the Reference [10] so that the averages of the fission rates of all the measured fuel rods were 1.0. **x.xx** : Gd₂O₃-UO₂ fuel rods and others: UO₂ fuel rods.

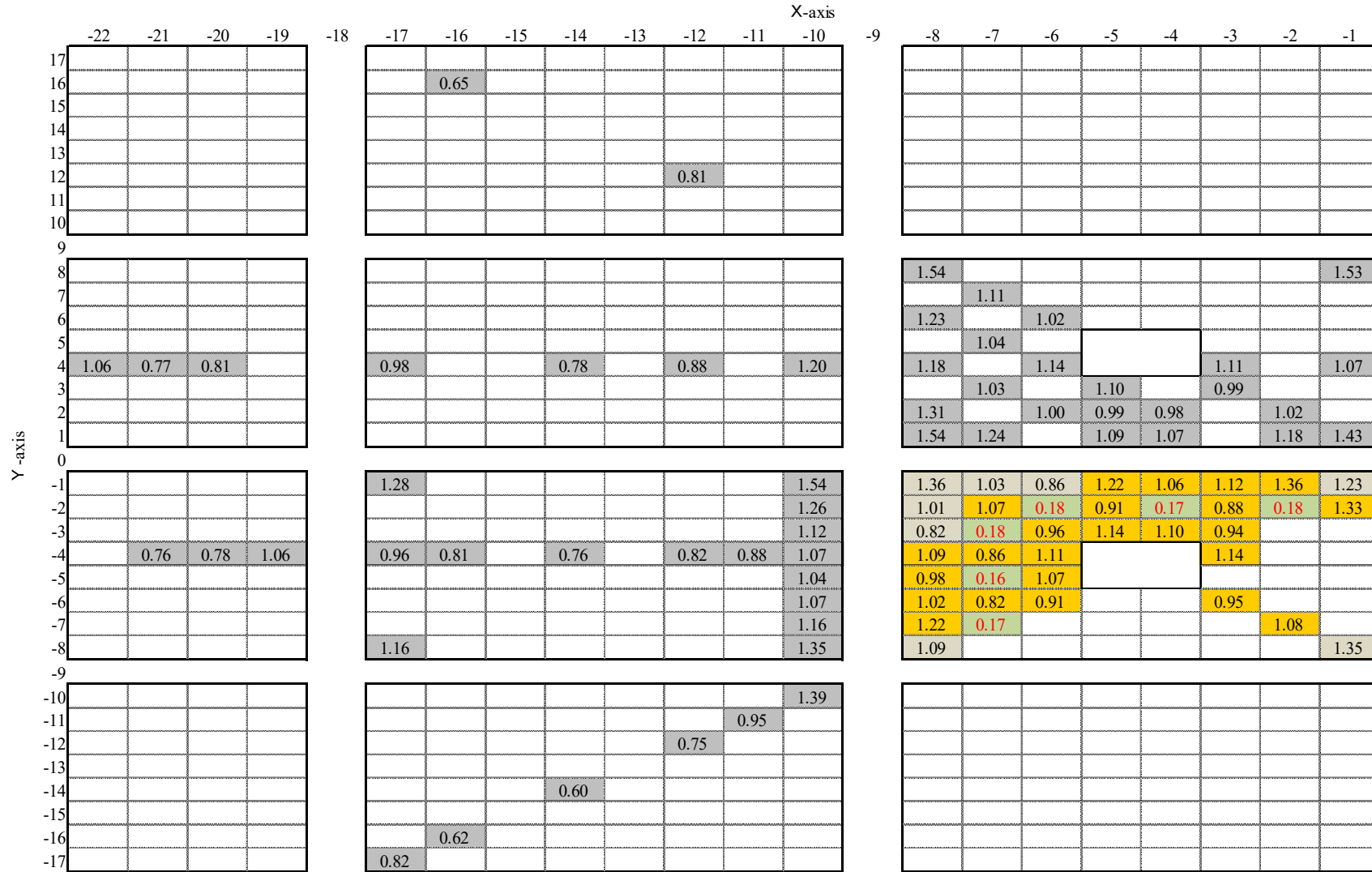


Figure S2. Relative fission rate distribution in the left half of the I-MOX core. They were defined by normalizing the relative fission rates reported in the Reference [11] so that the averages of the fission rates of all the measured fuel rods were 1.0. x.xx : Gd₂O₃-UO₂ fuel rods, x.xx : MOX fuel rods and others: UO₂ fuel rods.

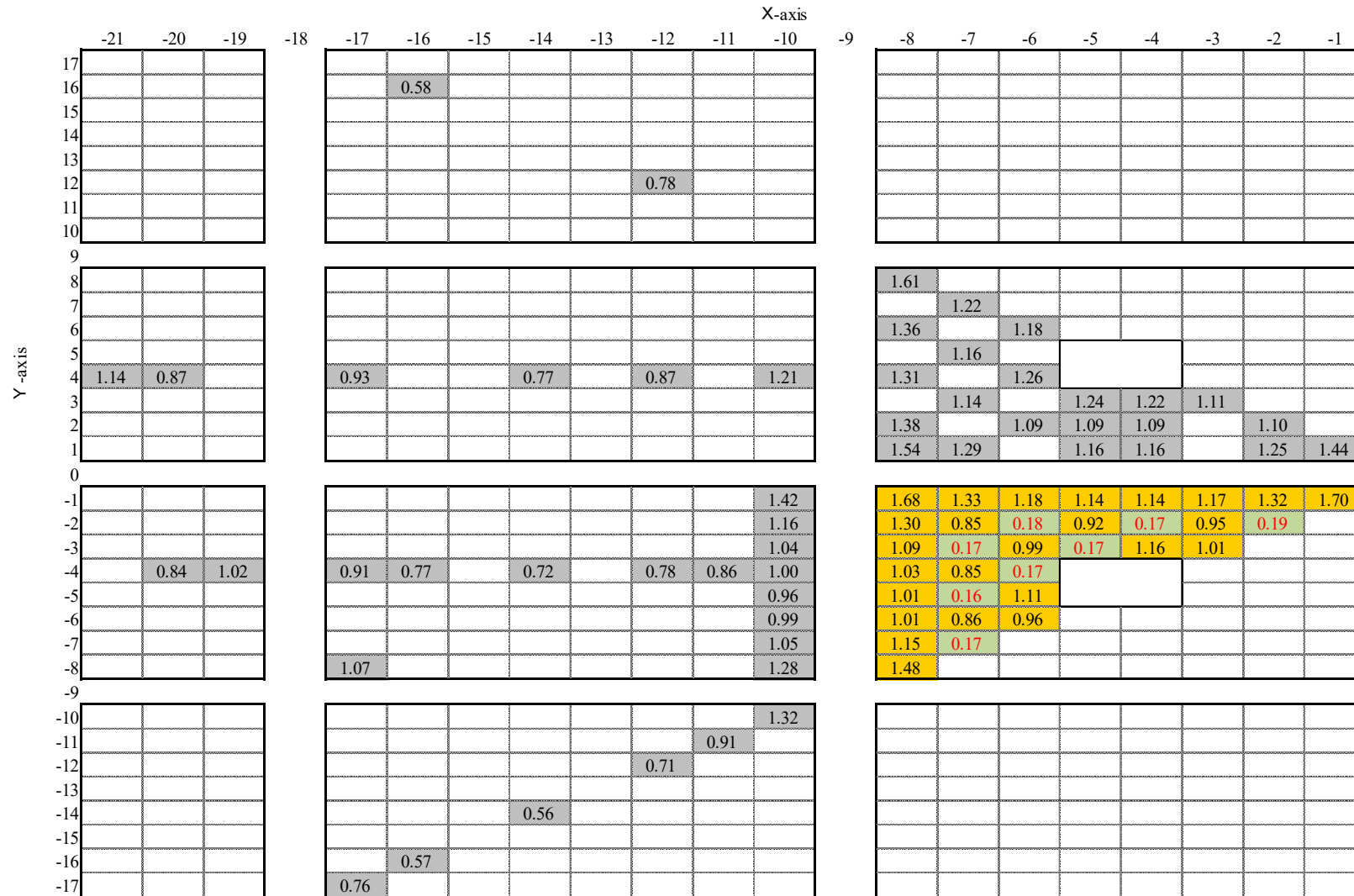


Figure S3. Relative fission rate distribution in the left half of the all-MOX core. They were defined by normalizing the relative fission rates reported in the Reference [12] so that the averages of the fission rates of all the measured fuel rods were 1.0. x.xx : $Gd_2O_3-UO_2$ fuel rods, x.x

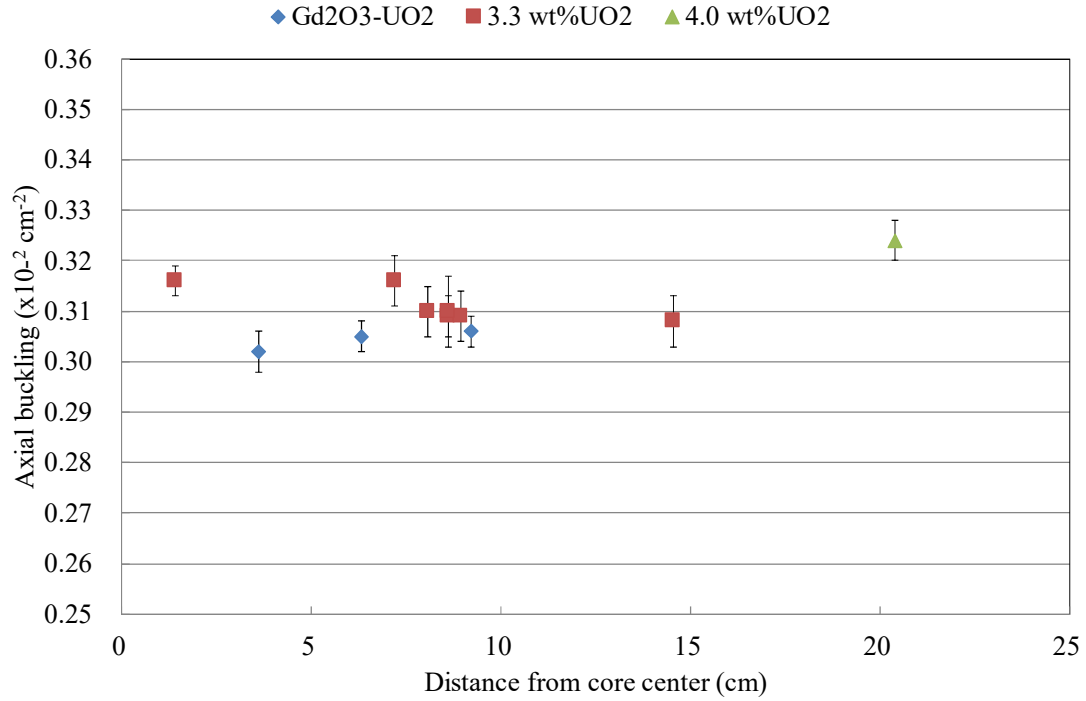


Figure S4. Measured results of axial buckling in the horizontal axis of the distance of the fuel rod from the core center for the all-UO₂ core [10].

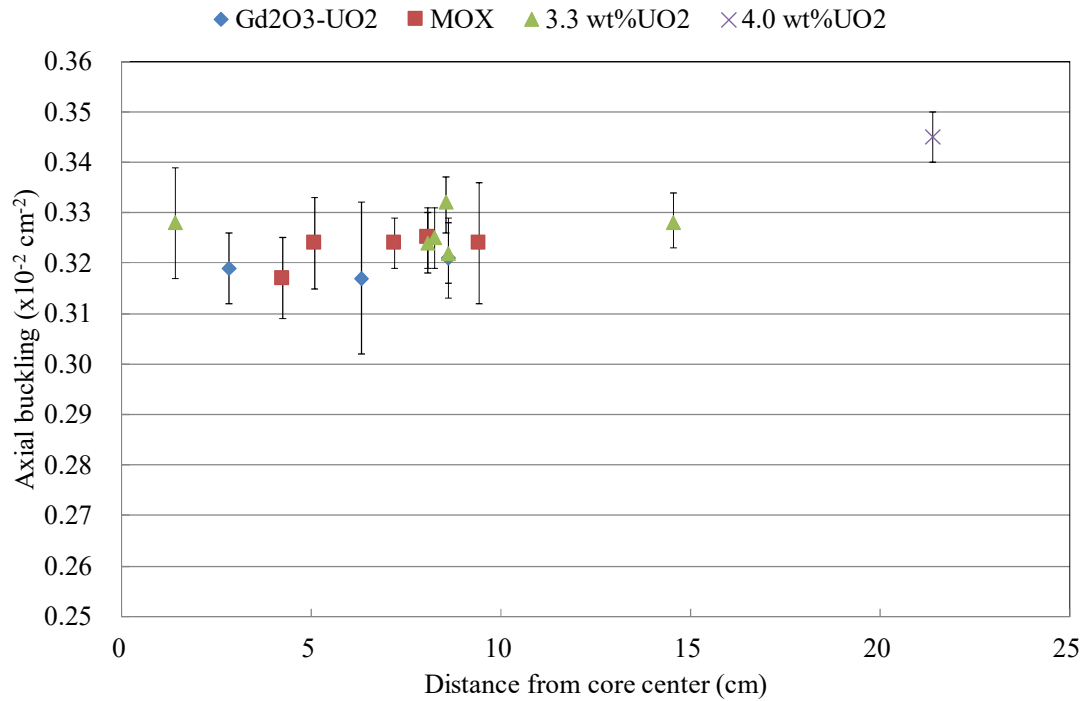


Figure S5. Measured results of axial buckling in the horizontal axis of the distance of the fuel rod from the core center for the I-MOX core [11].

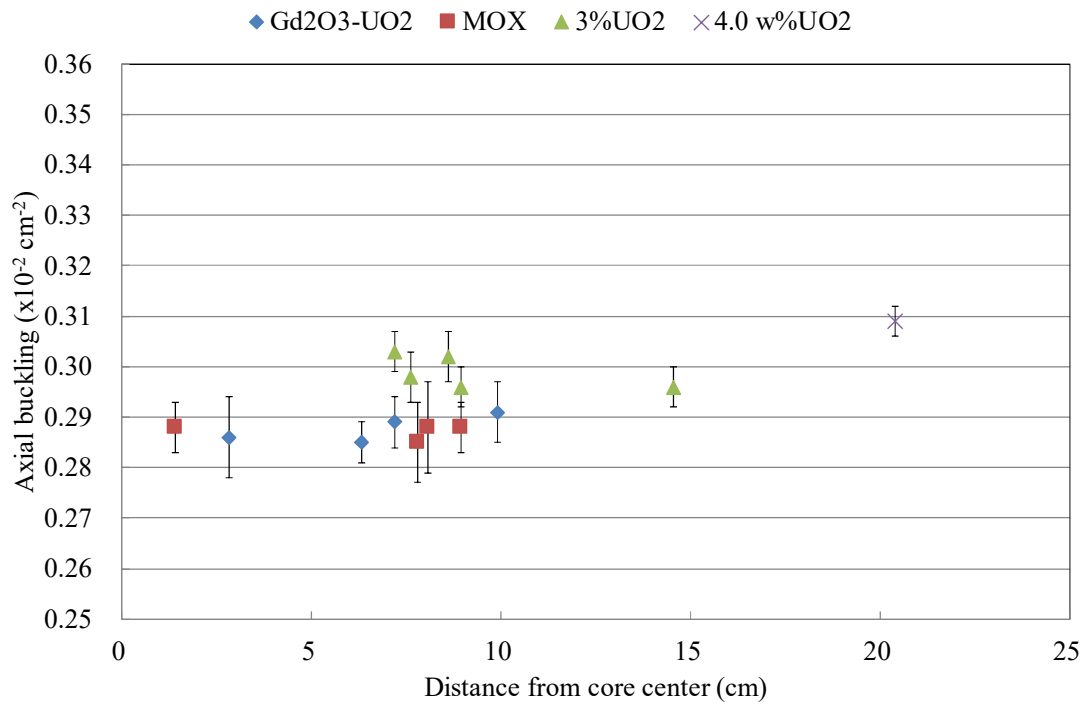


Figure S6. Measured results of axial buckling in the horizontal axis of the distance of the fuel rod from the core center for the all-MOX core [12].

0.952							
	-1.635						
-0.365		-1.052					
	-1.195						
1.719	1.712	1.392					
		0.421	2.690	0.913	0.606		
-1.861		1.043	1.862	1.743		0.906	
-0.600	1.225		2.048	0.543		-0.089	-1.179

1.28	2.63	-1.25	0.06	0.18	-0.74	1.13	-1.05
	-1.20	-2.42	-2.24	1.04	-1.48	-2.96	
2.92	-0.69	-4.82	0.88	1.53	-4.22		
1.48	-2.35	-0.67					
0.94	-1.82	0.77					
-2.87	-3.65	-4.38					
-0.57	-4.81						
-1.05							

Two fuel assemblies

0.488							
	-2.086						
-0.822		-1.506					
	-1.648						
1.252	1.245	0.927					
		-0.039	2.219	0.450	0.144		
-2.311		0.580	1.394	1.276		0.443	
-1.056	0.761		1.580	0.082		-0.548	-1.632

Reference fuel assembly

1.06	2.41	-1.46	-0.16	-0.04	-0.95	0.91	-1.26
	-1.41	-2.63	-2.46	0.82	-1.69	-3.17	
2.70	-0.91	-5.03	0.66	1.31	-4.43		
1.27	-2.56	-0.89					
0.73	-2.03	0.55					
-3.08	-3.86	-4.59					
-0.79	-5.01						
-1.27							

All-UO₂ fuel assembly

Figure S7. Comparison of the calculated core radial fission rate distribution of CASMO5 with the measurements in (C/E – 1.0)% in the two assembly, test assembly, and reference assembly regions for the all-UO₂ core. **x.xx**: Gd₂O₃-UO₂ fuel rods, and the others: UO₂ fuel rods.

-1.69							-2.88
	-2.01						
-1.42		-1.33					
	-1.32						
0.25		-2.08			-1.75		-1.38
	-2.46		-0.43		-2.64		
-2.07		-1.93	-1.69	-1.97		-2.89	
-3.39	-1.06		-1.87	-1.61		-1.78	-3.15

-1.68	-0.93	-1.75	-2.26	3.81	2.44	1.35	-3.35
0.52	3.01	-3.39	1.08	-1.73	3.20	-2.16	3.60
-0.92	-2.63	2.35	2.18	3.74	1.68		
3.66	3.47	3.23			-0.58		
5.51	-0.95	3.15					
5.07	2.81	0.15			3.21		
4.41	-1.93					2.56	
0.01							-1.03

Two fuel assemblies

0.21							-1.01
	-0.12						
0.49		0.58					
	0.59						
2.19		-0.19			0.15		0.52
	-0.57		1.50		-0.76		
-0.18		-0.04	0.21	-0.08		-1.02	
-1.53	0.84		0.03	0.29		0.11	-1.28

Reference fuel assembly

-3.14	-2.39	-3.21	-3.70	2.27	0.92	-0.16	-4.78
-0.97	1.48	-4.82	-0.42	-3.19	1.67	-3.61	2.06
-2.39	-4.08	0.83	0.67	2.20	0.18		
2.12	1.94	1.70			-2.05		
3.95	-2.42	1.62					
3.52	1.28	-1.33			1.68		
2.86	-3.39					1.04	
-1.47							-2.49

I-MOX fuel assembly

Figure S8. Comparison of the calculated core radial fission rate distribution of CASMO5 with the measurements in (C/E – 1.0)% in the two assembly, test assembly and reference assembly regions for the I-MOX core. x.xx : Gd₂O₃-UO₂ fuel rods, x.xx : MOX fuel rods, and the others: UO₂ fuel rods.

-1.86							
	-2.99						
-4.10		-3.50					
	-2.33						
-2.01		-1.08					
	-2.59		-1.30	-0.34	-2.08		
-3.11		-1.61	-1.47	-2.00		-1.36	
-3.87	-2.90		-1.80	-2.04		-2.70	-2.97

2.74	2.32	2.93	1.86	1.87	3.17	2.18	1.99
1.32	1.50	-2.90	1.15	-3.12	1.10	-2.79	
3.50	-2.36	0.66	-2.03	2.34	1.22		
3.16	2.81	-3.24					
3.07	-2.92	3.45					
6.11	1.41	0.72					
2.75	-3.02						
3.10							

Two fuel assemblies

0.47							
	-0.69						
-1.83		-1.21					
	-0.02						
0.31		1.26					
	-0.28		1.04	2.02	0.24		
-0.81		0.73	0.87	0.32		0.98	
-1.59	-0.60		0.53	0.28		-0.39	-0.67

Reference fuel assembly

0.59	0.18	0.78	-0.27	-0.26	1.01	0.05	-0.13
-0.79	-0.61	-4.93	-0.96	-5.14	-1.01	-4.82	
1.34	-4.39	-1.44	-4.08	0.21	-0.89		
1.01	0.67	-5.26					
0.92	-4.94	1.30					
3.90	-0.71	-1.38					
0.60	-5.05						
0.95							

All-MOX fuel assembly

Figure S9. Comparison of the calculated core radial fission rate distribution of CASMO5 with the measurements in (C/E – 1.0)% in the two assembly, test assembly and reference assembly regions for the all-MOX core. x.xx : Gd₂O₃-UO₂ fuel rods, x.xx : MOX fuel rods, and the others: UO₂ fuel rods.