Grupo de usuarios

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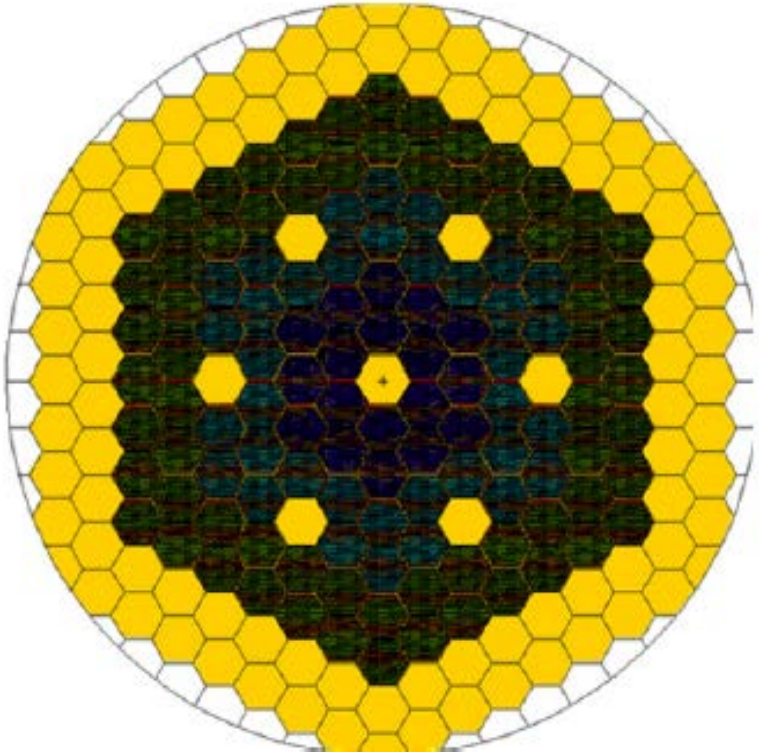
- Guillermo Elías Bastida Ortiz
- Juan Galicia Aragón
- Julio Amhed Vallejo Quintero

AZNHEX

DESCRIPCIÓN DEL NÚCLEO SIMULADO



- Reactor rápido homogéneo refrigerado con sodio.
- Tres zonas de enriquecimiento (zona 1.- 9.5% at U-235, zona 2.- 14.25% at U-235, zona 3 (cobertor) .- 3.32% at U-235) [2].
- Reflectores de acero radiales y axiales.
- Altura del núcleo activo.- 99 cm.
- Pitch entre ensambles.- 17.54 cm.

Tabla I. Temperatura de los materiales del núcleo del reactor

Material	Temperatura (K)
combustibles tipo 1	1200
combustibles tipo 2	1200
cobija	1200
encamisado	300
sodio	300

CÁLCULOS DE CRITICIDAD

Tabla II. Resultados obtenidos de la k_{eff}

Código	k_{eff}	Dif. con respecto a MCNP5 (pcm)	Dif. con respecto a SERPENT2 (pcm)	Tiempo aprox. de ejecución (min.)
MCNP5 (20000 hist., 200 cycles)	1.03736 +- 0.00040	---	---	155
SERPENT2 (20000 hist., 200 cycles)	1.03824 +- 0.00040	---	---	5
AZNHEX v.1.0	1.03812	-73.263	11.558	12

Tabla III. Valores obtenidos del factor de multiplicación de neutrones con AZNHEX v.1.0

Simulación	Factor de multiplicación de neutrones	Dif. (pcm)	Número de iteraciones	Tiempo aprox. de ejecución (min.)
1/4 núcleo	1.03771	39.494	8	4
1/2 núcleo	1.03849	-35.641	8	9
Núcleo completo	1.03812	---	8	12

COMPARACIÓN DE LA POTENCIA RADIAL

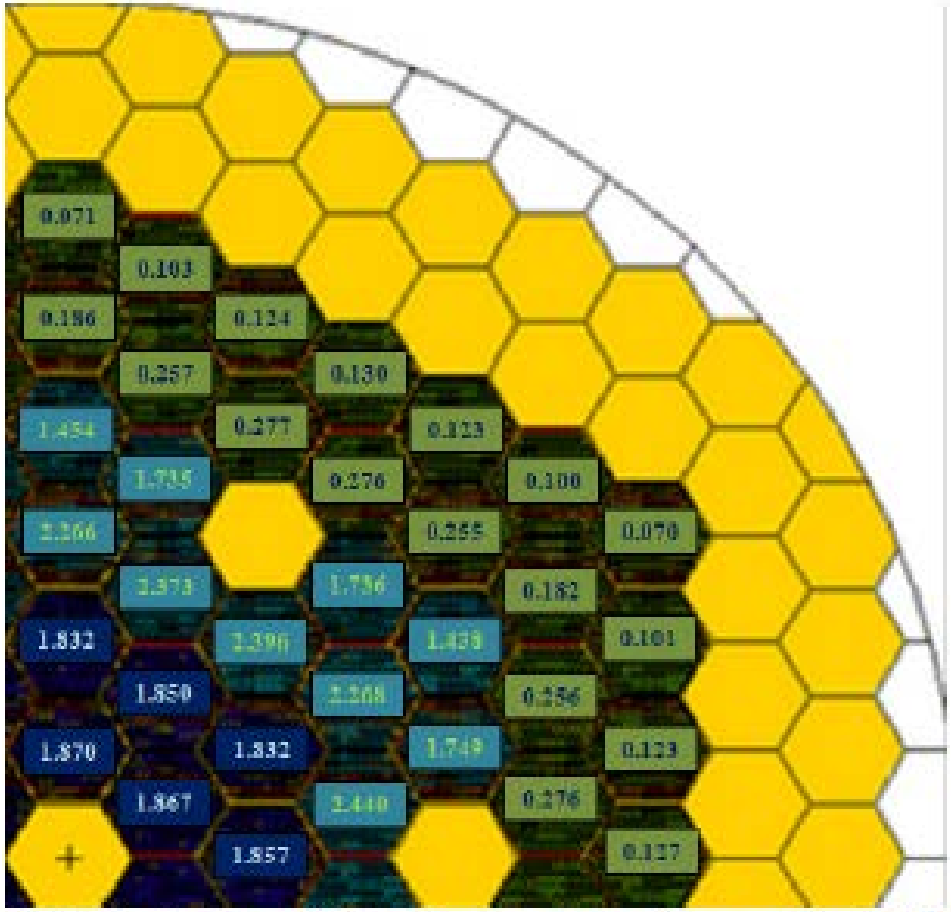


Figura 2. Distribución de potencia radial (MCNP5)

COMPARACIÓN DE LA POTENCIA RADIAL

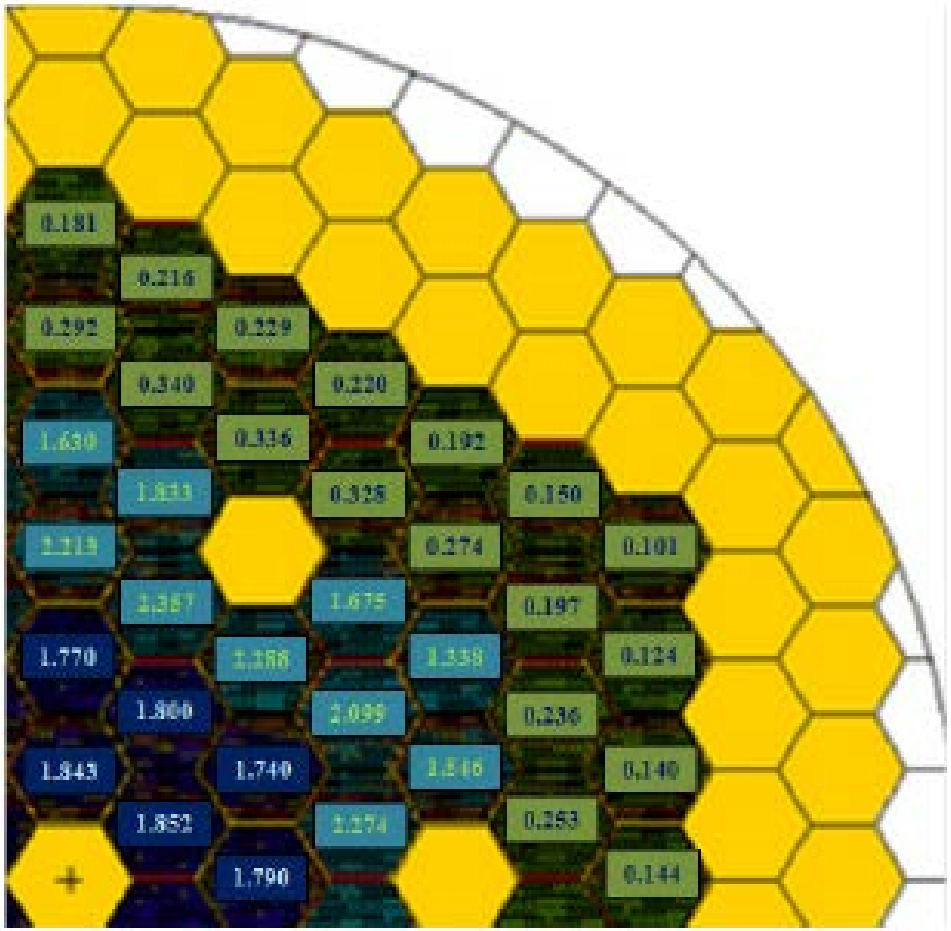


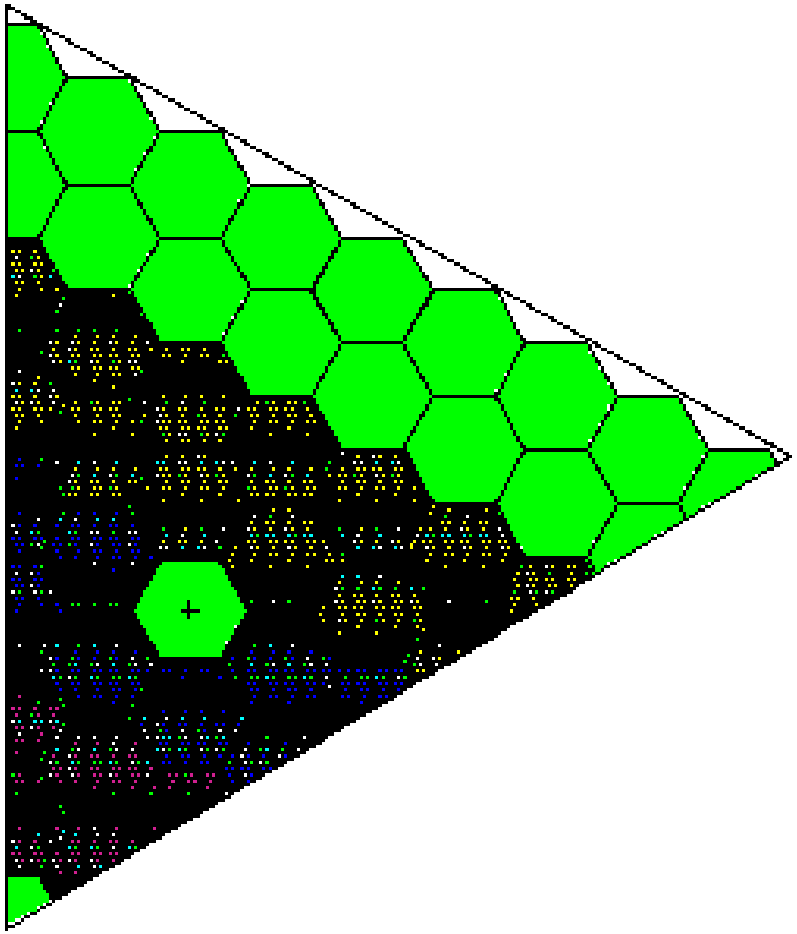
Figura 3. Distribución de la potencia radial (AZNHEX)

COMPARACIÓN DE LA POTENCIA RADIAL

Tabla VII. Errores relativos respecto a MCNP (%)

-13.454	-13.436	8.382	-22.684	7.666	11.638	6.788
3.605	-43.501	-8.307	6.903	7.444	5.000	0.826
-50.131	-7.470	3.564	4.518	2.733	1.419	-56.152
-18.853	…	0.674	3.389	-69.272	-21.267	-5.605
2.320	-84.303	-32.273	-12.089	-110.669	-57.210	-155.047

COMPARACIÓN DE LA POTENCIA AXIAL



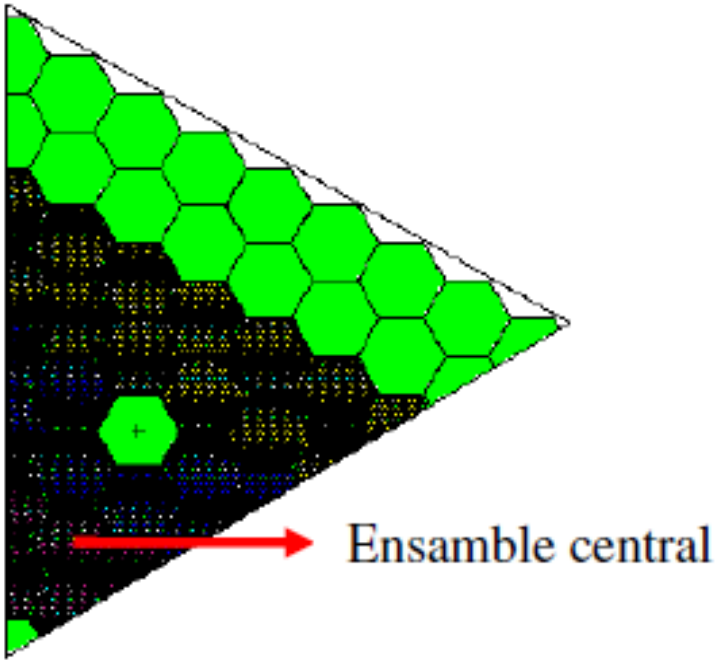
- Comparación de la potencia axial simulando un sexto del núcleo gracias a la simetría existente.

- Potencia axial calculada con MCNP empleando la tarjeta FMESH en conjunto con una tarjeta multiplicadora (FMn card) en cada uno de los ensambles [4].

- Factor de multiplicación de neutrones = 1.04020 +- 0.00040

COMPARACIÓN DE LA POTENCIA AXIAL

Ensamble zona 1



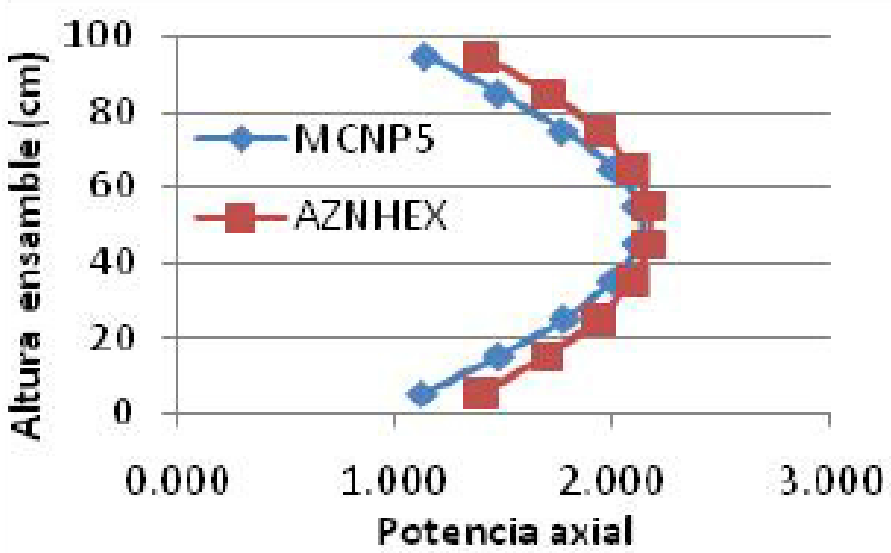
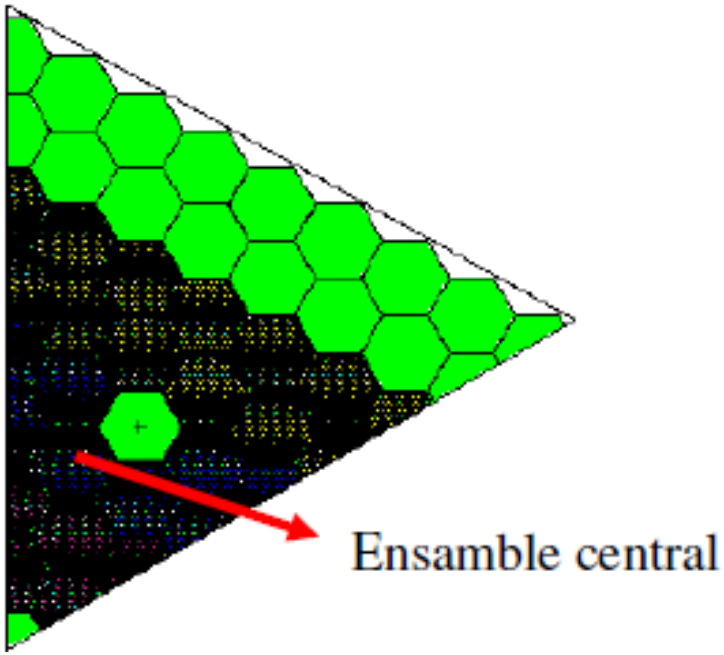


Figura 5. Comportamiento de la potencia axial

COMPARACION DE LA POTENCIA AXIAL

Ensamble zona 2



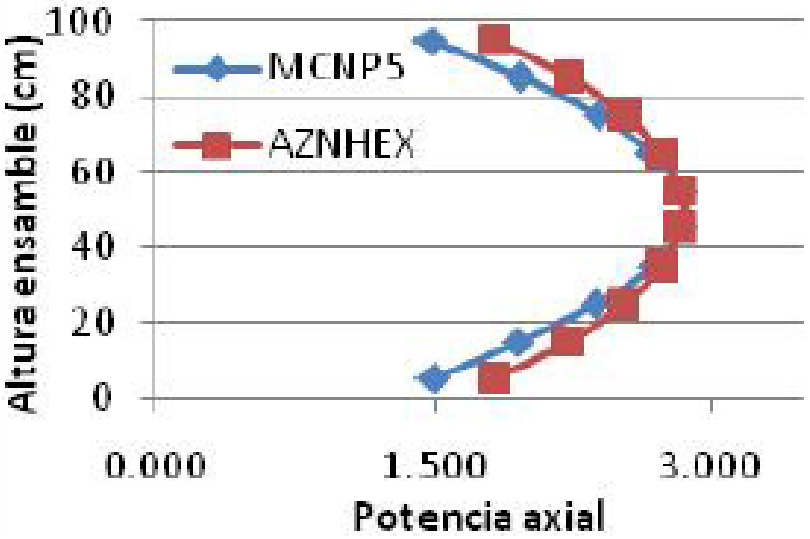
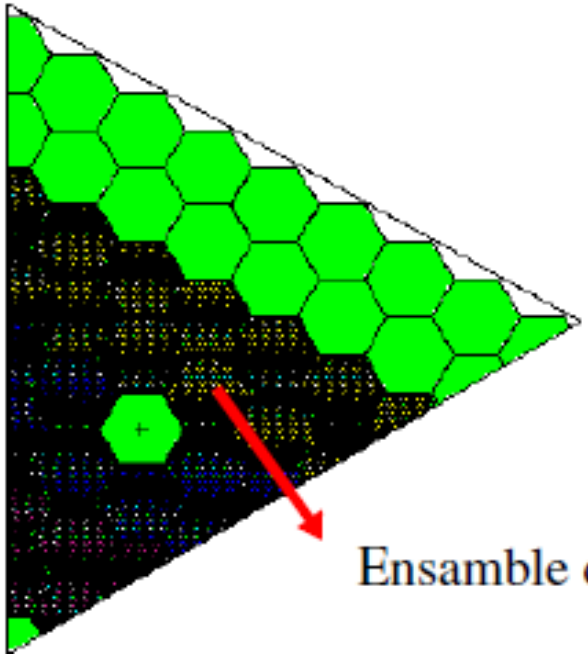


Figura 11. Comportamiento de la potencia axial

COMPARACIÓN DE LA POTENCIA AXIAL

Ensamble zona 3 (cobertor)



Ensamble derecho 1

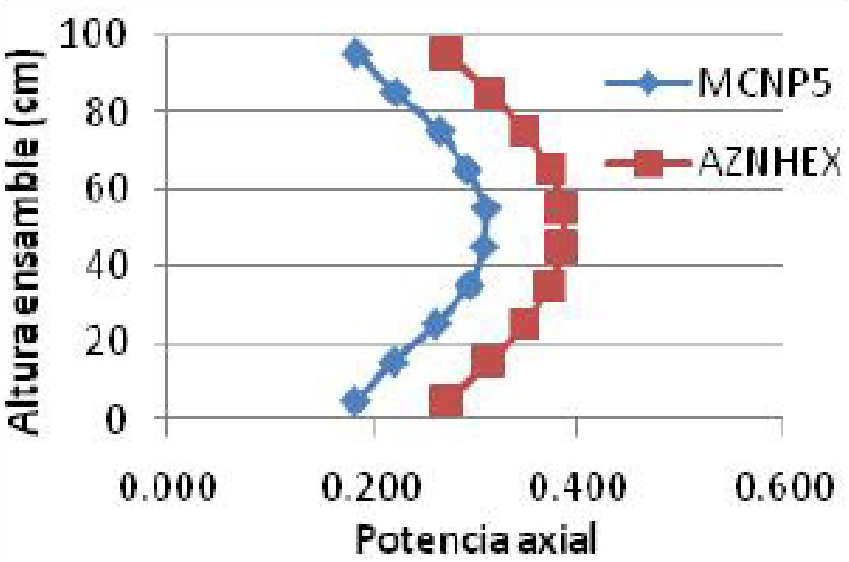


Figura 20. Comportamiento de la potencia axial

POTENCIA AXIAL PROMEDIO

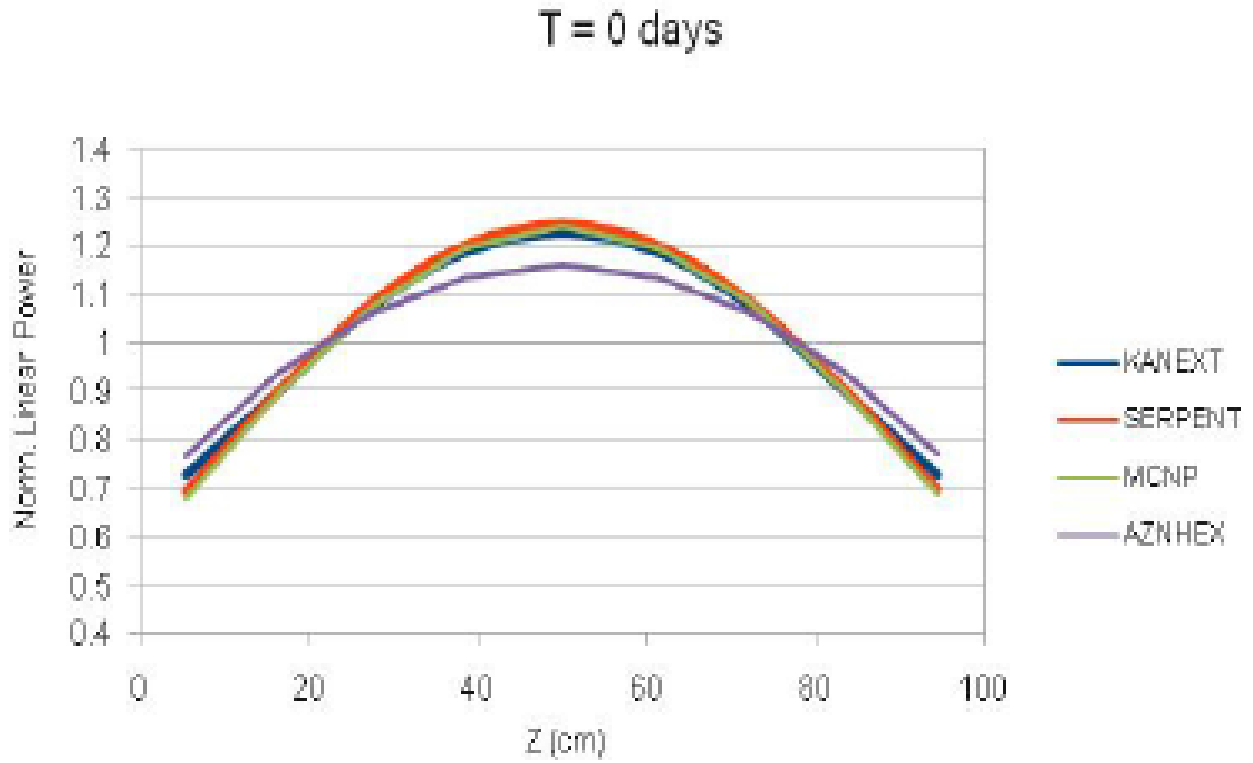


Figura 25. Potencia axial promedio en el núcleo

CONCLUSIONES

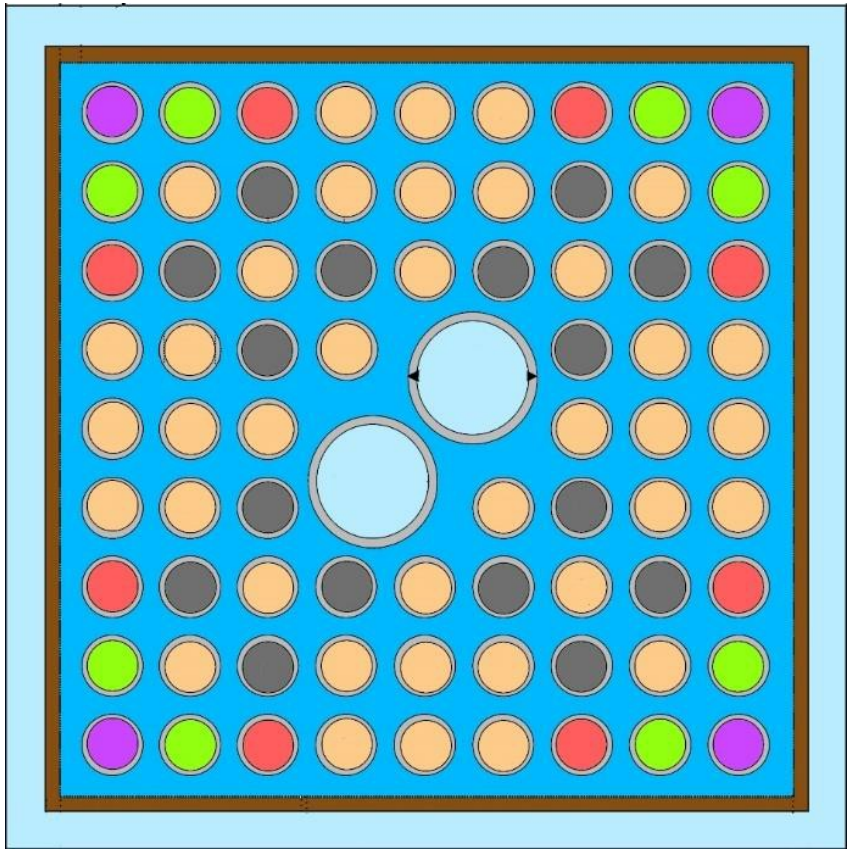
AZNHEX

- Resultado muy preciso del factor de multiplicación efectivo de neutrones tras un proceso de iteración realmente corto.
- El código responde favorablemente cuando se manejan condiciones de reflexión en las fronteras deseadas arrojando resultados satisfactorios del factor de multiplicación de neutrones.
- Respecto al cálculo de la potencia radial y axial, aún se tienen aspectos que necesitan verificarse y mejorarse ya que los valores que se tienen en algunos ensambles difieren en gran manera de los calculados con MCNP5, aunque otros presentan aproximaciones muy exactas.

AZTRAN

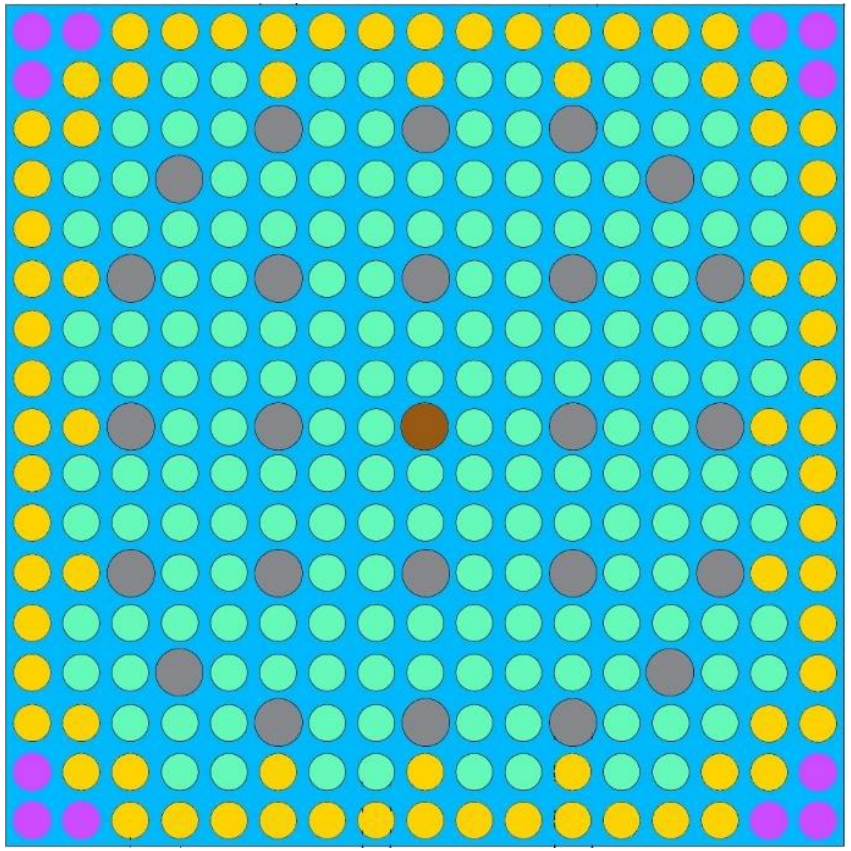
Benchmark Yamamoto 2006

Ensamble BWR UO2



Enriquecimiento promedio 5.5%

Ensamble PWR MOX



Plutonio físil promedio 11%

Códigos con los que se comparó

SERPENT 2

- Método de Monte Carlo para solución de transporte de neutrones en 3D
- Librería ENDF/B-VII para BWR
- Librería JEFF-3.1 para PWR

CASMO-4

- Método de Probabilidad de Colisión, etapa de colapsamiento de XS por tipo de barra de combustible
- Método de las Características, solución de transporte de neutrones en multigrupos en 3D
- Librería ENDF/B-V

Resultados AZTRAN para BWR UO_2

K-infinita 900 y 300 [K] con 0% de vacíos

	AZTRAN	CASMO- 4	SERPENT 2	Diferencia [pcm]	
Temperatura [k]	K-inf	K-inf	K-inf	AZTRAN - CASMO-4	AZTRAN – SERPENT2
900	1.04891	1.04958	1.05731	-67.49	–840.49
300	1.11605	1.10351	1.10420	1253.93	1184.93
%ΔK (HX)	6.71	5.39	4.69	-	–
%ΔK/KK'	5.74	4.66	4.02		

K-infinita 900 K con 40% de vacíos

	AZTRAN	CASMO- 4	SERPENT 2	Diferencia [pcm]	
Temperatura [K]	K-inf	K-inf	K-inf	AZTRAN - CASMO	AZTRAN - SERPENT
900	1.02751	1.03469	1.03872	-718.40	-1121.40
%ΔK/KK'	**-1.98**	**-1.37**	**-1.69**		

Distribución de Potencia 900 [K], 40% de vacíos

19.6%	4.8%	5.4%	9.5%	10.6%	9.4%	5.2%	4.6%	19.4%
4.8%	5.5%	4.1%	6.4%	5.8%	6.4%	4.3%	15.9%	4.7%
5.4%	4.1%	5.3%	4.5%	7.7%	4.7%	7.1%	4.3%	5.3%
9.5%	6.4%	4.5%	8.8%	0.0%	0.0%	4.7%	6.4%	9.6%
10.6%	5.8%	7.7%	0.0%	0.0%	0.0%	7.7%	5.7%	10.8%
9.4%	6.4%	4.7%	0.0%	0.0%	8.8%	4.5%	6.3%	9.7%
5.2%	4.3%	7.1%	4.7%	7.7%	4.5%	5.3%	4.1%	5.7%
4.6%	15.9%	4.3%	6.4%	5.7%	6.3%	4.1%	15.3%	5.1%
19.4%	4.7%	5.3%	9.6%	10.8%	9.7%	5.7%	5.1%	19.9%

Promedio 6.9%, Desviación Estándar 4.4%

Resultados AZTRAN para PWR MOX

K-infinita 900 y 300 [K]

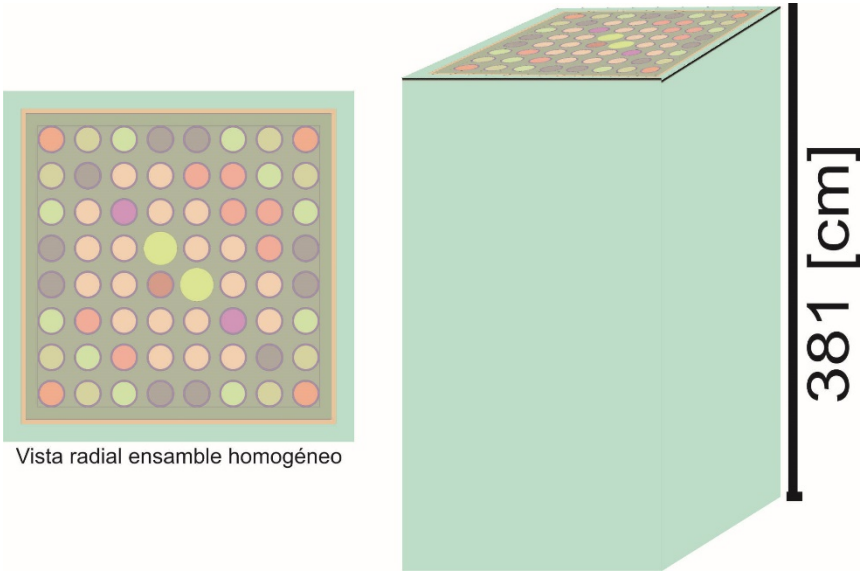
	AZTRAN	CASMO	SERPENT	Diferencia [pcm]	
Temperatura [K]	K-inf	K-inf	K-inf	AZTRAN - CASMO	AZTRAN - SERPENT
900	1.21027	1.16381	1.20869	4646	158
300	1.2709	1.24568	1.27268	2524.50	-175.50
%ΔK (HX)	6.06	8.18	6.40	-	-
%ΔK/KK'	3.94	5.65	4.16		

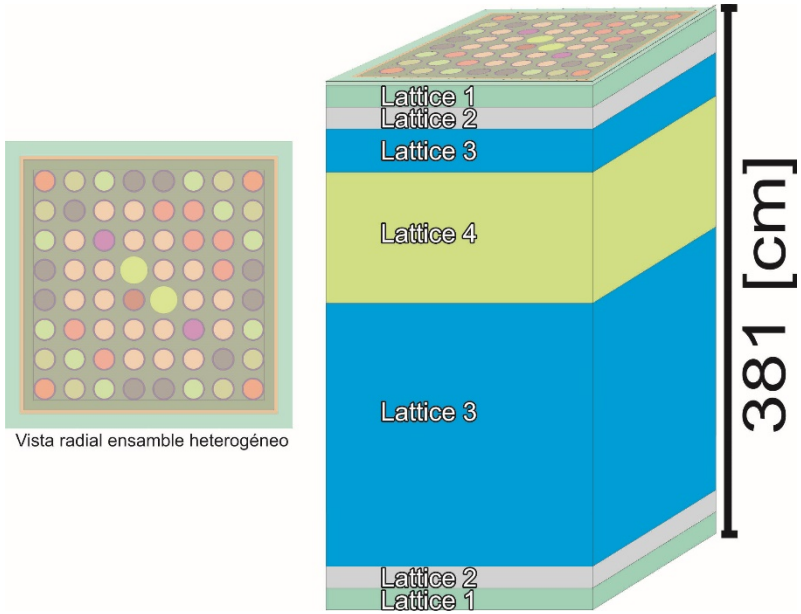
Distribución de Potencia 900 [K]

6.2%	4.4%	4.7%	3.4%	2.6%	1.9%	1.7%	1.8%	1.3%	1.8%	1.7%	2.0%	2.7%	3.5%	4.8%	4.5%	6.4%
4.4%	3.4%	2.4%	1.1%	0.6%	0.0%	0.3%	0.3%	0.2%	0.3%	0.3%	0.1%	0.7%	1.1%	2.5%	3.5%	4.5%
4.7%	2.4%	1.2%	0.3%	0.2%	0.0%	1.1%	1.6%	0.0%	1.6%	1.1%	0.0%	0.1%	0.4%	1.3%	2.5%	4.8%
3.4%	1.1%	0.3%	0.0%	0.6%	1.2%	1.8%	1.6%	1.8%	1.6%	1.7%	1.1%	0.5%	0.0%	0.4%	1.1%	3.5%
2.6%	0.6%	0.2%	0.6%	0.8%	2.2%	2.0%	2.2%	2.6%	2.1%	1.9%	2.2%	0.7%	0.5%	0.1%	0.7%	2.7%
1.9%	0.0%	0.0%	1.2%	2.2%	0.0%	2.6%	2.9%	0.0%	2.9%	2.6%	0.0%	2.2%	1.1%	0.0%	0.1%	2.0%
1.7%	0.3%	1.1%	1.8%	2.0%	2.6%	2.8%	2.6%	2.9%	2.6%	2.8%	2.6%	1.9%	1.7%	1.1%	0.3%	1.7%
1.8%	0.3%	1.6%	1.6%	2.2%	2.9%	2.6%	2.8%	3.6%	2.8%	2.6%	2.9%	2.1%	1.6%	1.6%	0.3%	1.8%
1.3%	0.2%	0.0%	1.8%	2.6%	0.0%	2.9%	3.6%	0.0%	3.6%	2.9%	0.0%	2.6%	1.8%	0.0%	0.2%	1.3%
1.8%	0.3%	1.6%	1.6%	2.1%	2.9%	2.6%	2.8%	3.6%	2.8%	2.6%	2.9%	2.2%	1.6%	1.6%	0.3%	1.8%
1.7%	0.3%	1.1%	1.7%	1.9%	2.6%	2.8%	2.6%	2.9%	2.6%	2.8%	2.6%	2.0%	1.8%	1.1%	0.3%	1.7%
2.0%	0.1%	0.0%	1.1%	2.2%	0.0%	2.6%	2.9%	0.0%	2.9%	2.6%	0.0%	2.2%	1.2%	0.0%	0.0%	1.9%
2.7%	0.7%	0.1%	0.5%	0.7%	2.2%	1.9%	2.1%	2.6%	2.2%	2.0%	2.2%	0.8%	0.6%	0.2%	0.7%	2.6%
3.5%	1.1%	0.4%	0.0%	0.5%	1.1%	1.7%	1.6%	1.8%	1.6%	1.8%	1.2%	0.6%	0.0%	0.3%	1.1%	3.4%
4.8%	2.5%	1.3%	0.4%	0.1%	0.0%	1.1%	1.6%	0.0%	1.6%	1.1%	0.0%	0.2%	0.3%	1.2%	2.4%	4.7%
4.5%	3.5%	2.5%	1.1%	0.7%	0.1%	0.3%	0.3%	0.2%	0.3%	0.3%	0.0%	0.7%	1.1%	2.4%	3.4%	4.4%
6.4%	4.5%	4.8%	3.5%	2.7%	2.0%	1.7%	1.8%	1.3%	1.8%	1.7%	1.9%	2.6%	3.4%	4.7%	4.4%	6.2%

Promedio 1.7%, Desviación Estándar 1.4%

Modelo de ensamble completo.





Valores de k_{inf} SERPENT y AZTRAN S_2 y S_4.

	SERPENT	AZTRAN			
Método		S_2	%EE	S_4	%EE
Ensamble homogéneo	1.11991	1.0824	3.3	1.0907	2.6
Ensamble heterogeneo	1.09758	1.0223	6.9	1.0545	3.9

AZKIND

Modelo de núcleo completo.

				1A224	1A205	1A249	1A250	1A237	1A262	1A213	1A228	1A208	1A209	1A231	1A210	1A266	1A268				
			1A253	1C453	1C459	1C505	1C509	1C484	1C486	1C420	1C436	1C543	1C529	1C532	1C533	1C425	1C432	1A251			
		1A232	1C418	1C563	1C378	1C524	1C603	1C423	1C521	1C589	1C594	1C445	1C393	1C430	1C534	1C421	1C419	1C559	1A234		
	1A259	1C498	1C460	1C377	1C557	1C602	1C470	1C476	1C406	1C575	1C527	1C370	1C417	1C561	1C457	1C441	1C443	1C555	1C497	1A255	
1A269	1C472	1C515	1C519	1C547	1C544	1C576	1C552	1C536	1C560	1C376	1C595	1C645	1C646	1C626	1C609	1C639	1C643	1C642	1C628	1C496	1A245
1A271	1C478	1C513	1C518	1C435	1B343	1C541	1B282	1C558	1B276	1B341	1B329	1B340	1C554	1B306	1C611	1B279	1C621	1C604	1C647	1C494	1A272
1A236	1C431	1C488	1C553	1C624	1C633	1B299	1C600	1B339	1C648	1B321	1B314	1C538	1B309	1C638	1B298	1C566	1C546	1C372	1C579	1C487	1A225
1A215	1C446	1C545	1C539	1C637	1B330	1C537	1B295	1C399	1B331	1B335	1B324	1B313	1C614	1B328	1C635	1B274	1C599	1C569	1C493	1C433	1A211
1A216	1C514	1C395	1C426	1C598	1C570	1B308	1C379	1B354	1C499	1B344	1B323	1C607	1B302	1C610	1B312	1C580	1C564	1C615	1C606	1C510	1A246
1A229	1C516	1C449	1C392	1C593	1B318	1C630	1B307	1C627	1B345	1B315	1B283	1B297	1C631	1B310	1C574	1B311	1C583	1C605	1C620	1C506	1A261
1A219	1C386	1C480	1C571	1C623	1B316	1B353	1B290	1B355	1B352	1B359	1B273	1B346	1B366	1B301	1B342	1B275	1C456	1C490	1C502	1C523	1A233
1A221	1C391	1C591	1C407	1C412	1B320	1B292	1B348	1B351	1B327	1B358	1B365	1B364	1B349	1B304	1B277	1B284	1C422	1C501	1C512	1C520	1A263
1A218	1C500	1C452	1C424	1C374	1B334	1C622	1B326	1C517	1B325	1B367	1B347	1B350	1C613	1B333	1C585	1B317	1C590	1C375	1C551	1C383	1A238
1A230	1C508	1C438	1C416	1C495	1C540	1B280	1C369	1B300	1C562	1B361	1B360	1C522	1B368	1C587	1B289	1C567	1C573	1C530	1C565	1C382	1A214
1A241	1C409	1C489	1C507	1C466	1B287	1C371	1B356	1C617	1B291	1B293	1B357	1B281	1C597	1B322	1C584	1B338	1C442	1C389	1C473	1C550	1A260
1A244	1C411	1C511	1C474	1C568	1C549	1B363	1C535	1B296	1C596	1B362	1B294	1C528	1B288	1C450	1B286	1C455	1C444	1C469	1C396	1C548	1A257
1A226	1C440	1C644	1C380	1C577	1B303	1C434	1B319	1C491	1B285	1B337	1B336	1B278	1C403	1B305	1C582	1B332	1C618	1C414	1C404	1C461	1A270
1A223	1C477	1C381	1C636	1C616	1C572	1C588	1C581	1C601	1C578	1C526	1C629	1C467	1C373	1C586	1C592	1C612	1C608	1C405	1C384	1C447	1A212
	1A242	1C492	1C465	1C398	1C413	1C400	1C454	1C385	1C387	1C390	1C448	1C619	1C481	1C531	1C525	1C640	1C632	1C463	1C462	1A252	
		1A258	1C410	1C408	1C388	1C429	1C451	1C397	1C402	1C464	1C428	1C485	1C625	1C542	1C556	1C634	1C641	1C458	1A240		
			1A256	1C475	1C439	1C471	1C468	1C437	1C415	1C482	1C394	1C504	1C503	1C483	1C479	1C427	1C401	1A254			
				1A267	1A265	1A235	1A264	1A227	1A217	1A206	1A220	1A207	1A247	1A243	1A239	1A222	1A248				

	Tipo				
Nodo	1A	1B	1C	Altura [in]	Altura [cm]
25	1	1	1	150	381
24		2	5	144	365.76
23				138	350.52
22		3	6	132	335.28
21				126	320.04
20				120	304.8
19				114	289.56
18				108	274.32
17				102	259.08
16				96	243.84
15				90	228.6
14				84	213.36
13				78	198.12
12				72	182.88
11				66	167.64
10		4	7	60	152.4
9				54	137.16
8				48	121.92
7				42	106.68
6				36	91.44
5				30	76.2
4		3	6	24	60.96
3				18	45.72
2		2	5	12	30.48
1		1	1	6	15.24
0				0	0

Valores de k_{eff} para el modelo de núcleo completo.

	SIMULATE-3	SERPENT	AZTRAN	AZKIND 1.0	AZKIND 1.1
k_{eff}	1.0879	1.09472	1.10428	1.09281	1.08013
%EE	0	0.63	1.051	0.45	0.71

AZTLAN Platform

SIMULATE-3

				0.068	0.096	0.117	0.131	0.141	0.147	0.15	0.15	0.147	0.141	0.131	0.117	0.096	0.068			
			0.101	0.27	0.364	0.433	0.484	0.518	0.54	0.551	0.551	0.54	0.518	0.484	0.433	0.364	0.27	0.101		
		0.11	0.326	0.482	0.615	0.718	0.794	0.847	0.881	0.897	0.897	0.881	0.847	0.794	0.718	0.615	0.482	0.326	0.11	
	0.101	0.326	0.518	0.702	0.857	0.981	1.076	1.142	1.182	1.201	1.201	1.182	1.142	1.076	0.981	0.857	0.702	0.518	0.326	0.101
0.068	0.27	0.482	0.702	0.901	1.07	1.204	1.31	1.379	1.423	1.441	1.441	1.423	1.379	1.31	1.204	1.07	0.901	0.702	0.482	0.27	0.068
0.096	0.364	0.615	0.857	1.07	1.191	1.383	1.427	1.562	1.534	1.55	1.55	1.534	1.562	1.427	1.383	1.191	1.07	0.857	0.615	0.364	0.096
0.117	0.433	0.718	0.981	1.204	1.383	1.46	1.633	1.633	1.74	1.682	1.682	1.74	1.633	1.633	1.46	1.383	1.204	0.981	0.718	0.433	0.117
0.131	0.484	0.794	1.076	1.31	1.427	1.633	1.667	1.811	1.768	1.782	1.782	1.768	1.811	1.667	1.633	1.427	1.31	1.076	0.794	0.484	0.131
0.141	0.518	0.847	1.142	1.379	1.562	1.633	1.811	1.803	1.913	1.85	1.85	1.913	1.803	1.811	1.633	1.562	1.379	1.142	0.847	0.518	0.141
0.147	0.54	0.881	1.182	1.423	1.534	1.74	1.768	1.913	1.87	1.885	1.885	1.87	1.913	1.768	1.74	1.534	1.423	1.182	0.881	0.54	0.147
0.15	0.551	0.897	1.201	1.441	1.55	1.682	1.782	1.85	1.885	1.898	1.898	1.885	1.85	1.782	1.682	1.55	1.441	1.201	0.897	0.551	0.15
0.15	0.551	0.897	1.201	1.441	1.55	1.682	1.782	1.85	1.885	1.898	1.898	1.885	1.85	1.782	1.682	1.55	1.441	1.201	0.897	0.551	0.15
0.147	0.54	0.881	1.182	1.423	1.534	1.74	1.768	1.913	1.87	1.885	1.885	1.87	1.913	1.768	1.74	1.534	1.423	1.182	0.881	0.54	0.147
0.141	0.518	0.847	1.142	1.379	1.562	1.633	1.811	1.803	1.913	1.85	1.85	1.913	1.803	1.811	1.633	1.562	1.379	1.142	0.847	0.518	0.141
0.131	0.484	0.794	1.076	1.31	1.427	1.633	1.667	1.811	1.768	1.782	1.782	1.768	1.811	1.667	1.633	1.427	1.31	1.076	0.794	0.484	0.131
0.117	0.433	0.718	0.981	1.204	1.383	1.46	1.633	1.633	1.74	1.682	1.682	1.74	1.633	1.633	1.46	1.383	1.204	0.981	0.718	0.433	0.117
0.096	0.364	0.615	0.857	1.07	1.191	1.383	1.427	1.562	1.534	1.55	1.55	1.534	1.562	1.427	1.383	1.191	1.07	0.857	0.615	0.364	0.096
0.068	0.27	0.482	0.702	0.901	1.07	1.204	1.31	1.379	1.423	1.441	1.441	1.423	1.379	1.31	1.204	1.07	0.901	0.702	0.482	0.27	0.068
	0.101	0.326	0.518	0.702	0.857	0.981	1.076	1.142	1.182	1.201	1.201	1.182	1.142	1.076	0.981	0.857	0.702	0.518	0.326	0.101	
		0.11	0.326	0.482	0.615	0.718	0.794	0.847	0.881	0.897	0.897	0.881	0.847	0.794	0.718	0.615	0.482	0.326	0.11		
			0.101	0.27	0.364	0.433	0.484	0.518	0.54	0.551	0.551	0.54	0.518	0.484	0.433	0.364	0.27	0.101			
				0.068	0.096	0.117	0.131	0.141	0.147	0.15	0.15	0.147	0.141	0.131	0.117	0.096	0.068			

AZKIND 1.1

				0.078	0.105	0.127	0.142	0.153	0.159	0.162	0.162	0.159	0.153	0.142	0.127	0.105	0.078			
			0.109	0.305	0.400	0.473	0.526	0.562	0.584	0.595	0.595	0.584	0.562	0.526	0.473	0.400	0.305	0.109		
		0.119	0.364	0.514	0.648	0.751	0.827	0.880	0.913	0.928	0.928	0.913	0.880	0.827	0.751	0.648	0.514	0.364	0.119	
	0.109	0.364	0.551	0.733	0.887	1.010	1.102	1.165	1.203	1.220	1.220	1.203	1.165	1.102	1.010	0.887	0.733	0.551	0.364	0.109
0.078	0.305	0.514	0.733	0.929	1.098	1.226	1.329	1.391	1.432	1.448	1.448	1.432	1.391	1.329	1.226	1.098	0.929	0.733	0.514	0.305	0.078
0.105	0.400	0.648	0.887	1.098	1.172	1.410	1.387	1.575	1.482	1.502	1.502	1.482	1.575	1.387	1.410	1.172	1.098	0.887	0.648	0.400	0.105
0.127	0.473	0.751	1.010	1.226	1.410	1.416	1.644	1.562	1.734	1.610	1.610	1.734	1.562	1.644	1.416	1.410	1.226	1.010	0.751	0.473	0.127
0.142	0.526	0.827	1.102	1.329	1.387	1.644	1.592	1.797	1.674	1.694	1.694	1.674	1.797	1.592	1.644	1.387	1.329	1.102	0.827	0.526	0.142
0.153	0.562	0.880	1.165	1.391	1.575	1.562	1.797	1.697	1.875	1.738	1.738	1.875	1.697	1.797	1.562	1.575	1.391	1.165	0.880	0.562	0.153
0.159	0.584	0.913	1.203	1.432	1.482	1.734	1.674	1.875	1.752	1.768	1.768	1.752	1.875	1.674	1.734	1.482	1.432	1.203	0.913	0.584	0.159
0.162	0.595	0.928	1.220	1.448	1.502	1.610	1.694	1.738	1.768	1.776	1.776	1.768	1.738	1.694	1.610	1.502	1.448	1.220	0.928	0.595	0.162
0.162	0.595	0.928	1.220	1.448	1.502	1.610	1.694	1.738	1.768	1.776	1.776	1.768	1.738	1.694	1.610	1.502	1.448	1.220	0.928	0.595	0.162
0.159	0.584	0.913	1.203	1.432	1.482	1.734	1.674	1.875	1.752	1.768	1.768	1.752	1.875	1.674	1.734	1.482	1.432	1.203	0.913	0.584	0.159
0.153	0.562	0.880	1.165	1.391	1.575	1.562	1.797	1.697	1.875	1.738	1.738	1.875	1.697	1.797	1.562	1.575	1.391	1.165	0.880	0.562	0.153
0.142	0.526	0.827	1.102	1.329	1.387	1.644	1.592	1.797	1.674	1.694	1.694	1.674	1.797	1.592	1.644	1.387	1.329	1.102	0.827	0.526	0.142
0.127	0.473	0.751	1.010	1.226	1.410	1.416	1.644	1.562	1.734	1.610	1.610	1.734	1.562	1.644	1.416	1.410	1.226	1.010	0.751	0.473	0.127
0.105	0.400	0.648	0.887	1.098	1.172	1.410	1.387	1.575	1.482	1.502	1.502	1.482	1.575	1.387	1.410	1.172	1.098	0.887	0.648	0.400	0.105
0.078	0.305	0.514	0.733	0.929	1.098	1.226	1.329	1.391	1.432	1.448	1.448	1.432	1.391	1.329	1.226	1.098	0.929	0.733	0.514	0.305	0.078
	0.109	0.364	0.551	0.733	0.887	1.010	1.102	1.165	1.203	1.220	1.220	1.203	1.165	1.102	1.010	0.887	0.733	0.551	0.364	0.109	
		0.119	0.364	0.514	0.648	0.751	0.827	0.880	0.913	0.928	0.928	0.913	0.880	0.827	0.751	0.648	0.514	0.364	0.119		
			0.109	0.305	0.400	0.473	0.526	0.562	0.584	0.595	0.595	0.584	0.562	0.526	0.473	0.400	0.305	0.109			
				0.078	0.105	0.127	0.142	0.153	0.159	0.162	0.162	0.159	0.153	0.142	0.127	0.105	0.078			

Porcentajes de error entre las distribuciones de potencia SIMULATE-3 y AZKIND. Promedio = -3.36%, desviación estándar = 1.32.

				-14.12	-9.69	-8.63	-8.63	-8.30	-8.30	-8.20	-8.20	-8.30	-8.30	-8.63	-8.63	-9.69	-14.12			
			-7.525	-12.81	-9.97	-9.26	-8.60	-8.44	-8.19	-7.99	-7.99	-8.19	-8.44	-8.60	-9.26	-9.97	-12.81	-7.52		
		-7.73	-11.56	-6.70	-5.35	-4.64	-4.19	-3.88	-3.58	-3.44	-3.44	-3.58	-3.88	-4.19	-4.64	-5.35	-6.70	-11.56	-7.73	
	-7.52	-11.56	-6.33	-4.36	-3.55	-2.94	-2.40	-1.97	-1.75	-1.57	-1.57	-1.75	-1.97	-2.40	-2.94	-3.55	-4.36	-6.33	-11.56	-7.52	
-14.12	-12.81	-6.70	-4.36	-3.13	-2.63	-1.82	-1.44	-0.84	-0.65	-0.46	-0.46	-0.65	-0.84	-1.44	-1.82	-2.63	-3.13	-4.36	-6.70	-12.81	-14.12
-9.69	-9.97	-5.35	-3.55	-2.63	1.60	-1.95	2.80	-0.85	3.38	3.10	3.10	3.38	-0.85	2.80	-1.95	1.60	-2.63	-3.55	-5.35	-9.97	-9.69
-8.63	-9.26	-4.64	-2.94	-1.82	-1.95	2.99	-0.69	4.32	0.35	4.30	4.30	0.35	4.32	-0.69	2.99	-1.95	-1.82	-2.94	-4.64	-9.26	-8.63
-8.63	-8.60	-4.19	-2.40	-1.44	2.80	-0.69	4.49	0.80	5.35	4.94	4.94	5.35	0.80	4.49	-0.69	2.80	-1.44	-2.40	-4.19	-8.60	-8.63
-8.30	-8.44	-3.88	-1.97	-0.84	-0.85	4.32	0.80	5.91	1.98	6.05	6.05	1.98	5.91	0.80	4.32	-0.85	-0.84	-1.97	-3.88	-8.44	-8.30
-8.30	-8.19	-3.58	-1.75	-0.65	3.38	0.35	5.35	1.98	6.33	6.19	6.19	6.33	1.98	5.35	0.35	3.38	-0.65	-1.75	-3.58	-8.19	-8.30
-8.20	-7.99	-3.44	-1.57	-0.46	3.10	4.30	4.94	6.05	6.19	6.42	6.42	6.19	6.05	4.94	4.30	3.10	-0.46	-1.57	-3.44	-7.99	-8.20
-8.20	-7.99	-3.44	-1.57	-0.46	3.10	4.30	4.94	6.05	6.19	6.42	6.42	6.19	6.05	4.94	4.30	3.10	-0.46	-1.57	-3.44	-7.99	-8.20
-8.30	-8.19	-3.58	-1.75	-0.65	3.38	0.35	5.35	1.98	6.33	6.19	6.19	6.33	1.98	5.35	0.35	3.38	-0.65	-1.75	-3.58	-8.19	-8.30
-8.30	-8.44	-3.88	-1.97	-0.84	-0.85	4.32	0.80	5.91	1.98	6.05	6.05	1.98	5.91	0.80	4.32	-0.85	-0.84	-1.97	-3.88	-8.44	-8.30
-8.63	-8.60	-4.19	-2.40	-1.44	2.80	-0.69	4.49	0.80	5.35	4.94	4.94	5.35	0.80	4.49	-0.69	2.80	-1.44	-2.40	-4.19	-8.60	-8.63
-8.63	-9.26	-4.64	-2.94	-1.82	-1.95	2.99	-0.69	4.32	0.35	4.30	4.30	0.35	4.32	-0.69	2.99	-1.95	-1.82	-2.94	-4.64	-9.26	-8.63
-9.69	-9.97	-5.35	-3.55	-2.63	1.60	-1.95	2.80	-0.85	3.38	3.10	3.10	3.38	-0.85	2.80	-1.95	1.60	-2.63	-3.55	-5.35	-9.97	-9.69
-14.12	-12.81	-6.70	-4.36	-3.13	-2.63	-1.82	-1.44	-0.84	-0.65	-0.46	-0.46	-0.65	-0.84	-1.44	-1.82	-2.63	-3.13	-4.36	-6.70	-12.81	-14.12
	-7.52	-11.56	-6.33	-4.36	-3.55	-2.94	-2.40	-1.97	-1.75	-1.57	-1.57	-1.75	-1.97	-2.40	-2.94	-3.55	-4.36	-6.33	-11.56	-7.52	
		-7.73	-11.56	-6.70	-5.35	-4.64	-4.19	-3.88	-3.58	-3.44	-3.44	-3.58	-3.88	-4.19	-4.64	-5.35	-6.70	-11.56	-7.73		
			-7.52	-12.81	-9.97	-9.26	-8.60	-8.44	-8.19	-7.99	-7.99	-8.19	-8.44	-8.60	-9.26	-9.97	-12.81	-7.52			
				-14.12	-9.69	-8.63	-8.63	-8.30	-8.30	-8.20	-8.20	-8.30	-8.30	-8.63	-8.63	-9.69	-14.12				

Conclusiones

Tomando en cuenta que los valores reportados fueron calculados con ordenadas discretas S_2 y S_4, los resultados muestran un buen comportamiento de los códigos AZTRAN y AZKIND, debido a que los resultados obtenidos en los cálculos de criticidad de los diferentes modelos, así como el comportamiento la distribución de potencia, integrados con diferentes composiciones en el combustible, fueron comparables con los resultados obtenidos y/o reportados con otros códigos.

GRACIAS POR SU ATENCIÓN