Preliminary calculation of the core of the RMB-brazilian multipurpose reactor

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This paper shows some results of the neutronic calculation of the Project of RMB - Multipurpose Brazilian Reactor with thermal power of 30MW [1], a project of the CNEN/Brazil, under the leadership of the IPEN/ São Paulo. In this study, the reactor multiplication effective factor and the fast and thermal neutron flux **are calculated in the steady-state regime**. A computer program based on the multigroup diffusion theory was used, considering two energy groups and Two-Dimensional X-Y in the space [2]. The reactor core is cooled by light water, moderated and reflected by a combination of D_2O tank and beryllium elements, as shown in Fig. 1. The D_2O tank has a region with a thermal neutron flux magnitude of 10^{14} n/cm^{2}s, which is very appropriate for producing radioisotopes, for obtaining neutron spectra for boron neutron capture therapy, for obtaining neutron spectra for cold neutron experiments as well as for many other applications. The beryllium reflector improves the fuel utilization and yields neutron fluxes adequate for materials and fuel irradiation.

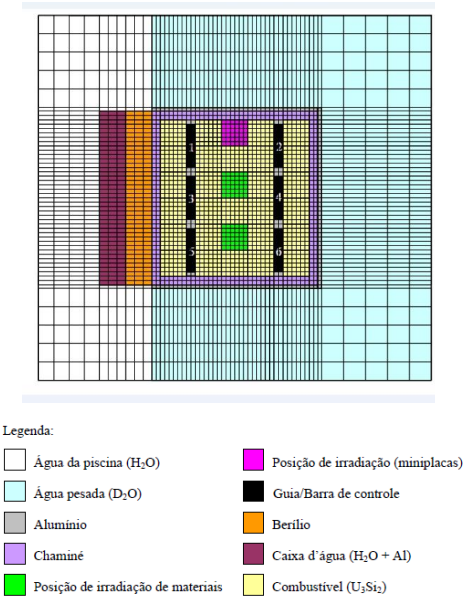

Figure 1: RMB core and the spatial mesh.

Tab. 1 shows the two group parameters for using in the core calculations, for an effective multiplication factor given by $k_{eff} = 1.115191$. Fig. 2 shows the fast flux and Fig. 3 shows the thermal flux.

Table 2: Two-group constants.

CONSTANTES MACROSCOPICAS DOS GRUPOS DE ENERGIA

GRUPO 1

I	S-CAPTURA	S-FISSAO	C-DIFUSAO	S-REMOCAO	MATERIAL(I)
1	.4310E-03	.0000E+00	.1948E+01	.1077E+00	H2O - Piscina
2	-.6937E-04	.0000E+00	.1867E+01	.9282E-01	D2O
3	.2469E-03	.0000E+00	.2473E+01	.3134E-01	GUIA ALUMINIO
4	.3513E-02	.0000E+00	.1572E+01	.4033E-01	Be - Berilio
5	.1077E-02	.0000E+00	.2015E+01	.7822E-01	BC
6	.3871E-03	.0000E+00	.2310E+01	.3123E-01	Ir mini PL ou Alumin
7	.4126E-03	.3717E-03	.2137E+01	.7288E-01	REGIAO COMBUSTIVEL -
8	.3871E-03	.0000E+00	.2310E+01	.3123E-01	Al - Placa Matriz
9	.3871E-03	.0000E+00	.2310E+01	.3123E-01	Ir MT ou Aluminio Du
10	.4310E-03	.0000E+00	.1948E+01	.1077E+00	H2O - Caixa de Agua
11	.3871E-03	.0000E+00	.2310E+01	.3123E-01	Al - Chamine
12	.3970E-03	.0000E+00	.2056E+01	.8900E-01	H2O SEGUIMENTO BC

GRUPO 2

I	S-CAPTURA	S-FISSAO	C-DIFUSAO	S-REMOCAO	MATERIAL(I)
1	.1874E-01	.0000E+00	.1507E+00	.0000E+00	H2O - Piscina
2	.2958E-04	.0000E+00	.8766E+00	.0000E+00	D2O
3	.8117E-02	.0000E+00	.1280E+01	.0000E+00	GUIA ALUMINIO
4	.3907E-02	.0000E+00	.6177E+00	.0000E+00	Be - Berilio
5	.4217E+00	.0000E+00	.2995E+00	.0000E+00	BC
6	.5354E-02	.0000E+00	.8861E+00	.0000E+00	Ir mini PL ou Alumin
7	.2355E-01	.4793E-01	.3005E+00	.0000E+00	REGIAO COMBUSTIVEL -
8	.5354E-02	.0000E+00	.8861E+00	.0000E+00	Al - Placa Matriz
9	.5354E-02	.0000E+00	.8861E+00	.0000E+00	Ir MT ou Aluminio Du
10	.1874E-01	.0000E+00	.1507E+00	.0000E+00	H2O - Caixa de Agua
11	.5354E-02	.0000E+00	.8861E+00	.0000E+00	Al - Chamine
12	.1562E-01	.0000E+00	.2263E+00	.0000E+00	H2O SEGUIMENTO BC

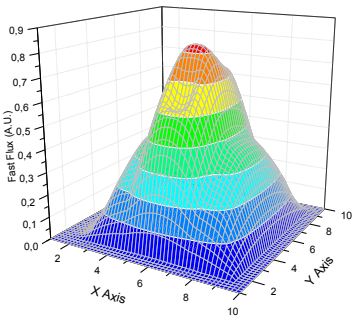

Figure 2: Fast flux illustration.

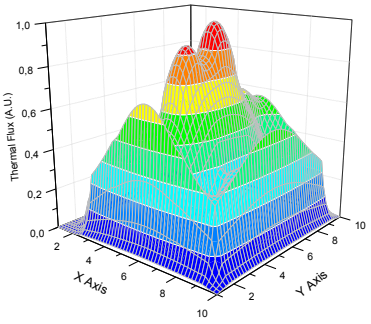

Figure 3: Thermal flux illustration.

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