§3. 3D Analysis of TBR and Shielding in FFHR

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The basic structure of blanket and shielding in FFHR is shown in Fig. 1. Tritium breeding ratio (TBR) and neutron shielding efficiency, which is the ratio of flux at the front of first wall to the front of SC coils, are calculated on 4 cases. We used the one-dimensional numerical transport code ANISN with the FUSION-40 nuclear data set and the 3-dimensional Monte Carlo code MCNP-4B with the ENDF/B-VI data set. Results are compared in Table 1.

Table 1 Result of calculation

Code	shape	TBR	Shielding eff.
ANISN	cylinder	1.169	2.8E+4
MCNP	cylinder	1.189	3.9E+4
MCNP	torus	1.183	1.5E+4
MCNP	LB model	1.019	3.5E+2

For the infinite cylindrical case and simple torus case with the standard blanket structure shown in Fig.1 and 2 [1], results are almost comparable, where TBR is about 1.2 and shielding efficiency is higher than 4 orders of magnitude. For the localized blanket (LB) model, which has the toroidally symmetric structure shown in Fig.3 as a first approximation of a helical system, the TBR is over unity but not sufficient. Since the shielding efficiency is about 2 order less than the fully closed case, it should be possible to improve TBR by reducing neutron leakage through divertor exhaust channels.

Reference

[1] H.Yamanishi et al., Fusion Eng, Des. 41 (1998) 583.

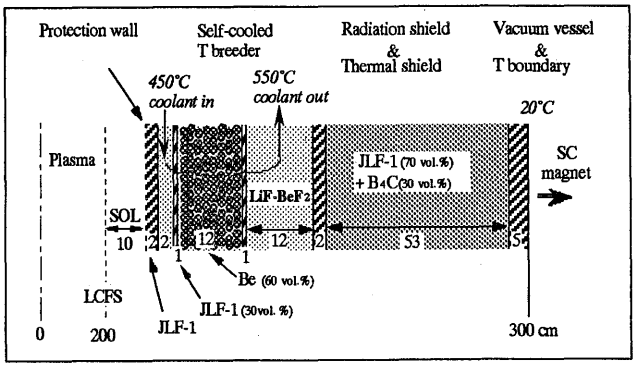

Fig. 1 The blanket and shielding stracture in FFHR

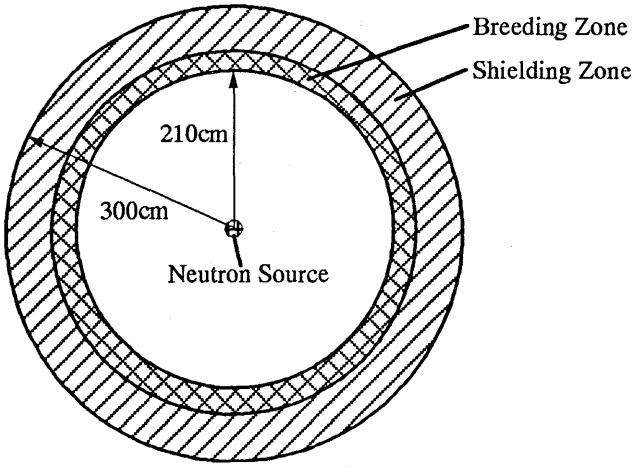

Fig. 2 Cross section of cylinder or torus.

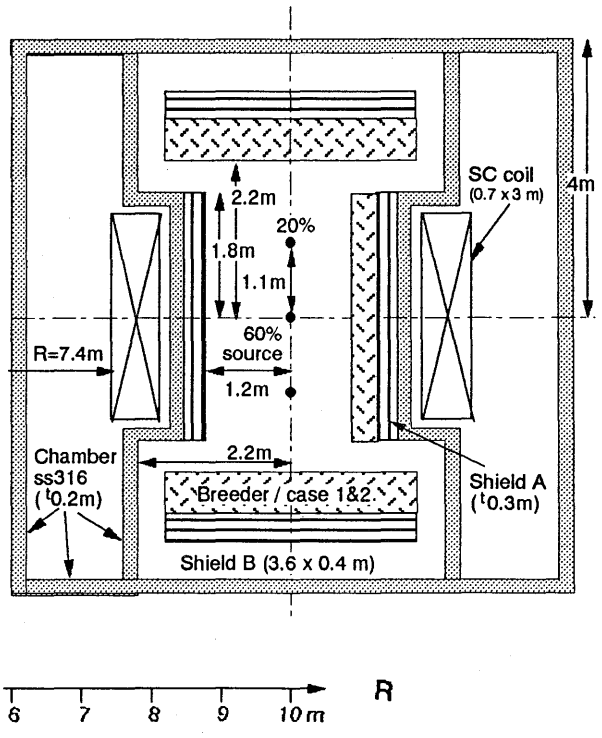

Fig. 3 Cross section of the LB model.