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Reactor Physics Analysis of the Advanced Neutron Source Three-Element Core

J. C. Gehin

August 1995

Advanced Neutron Source

MANAGED BY
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REACTOR PHYSICS ANALYSIS OF THE ADVANCED NEUTRON SOURCE THREE-ELEMENT CORE

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Prepared by the
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ACRONYMS

ANS	Advanced Neutron Source
BOC	beginning of cycle
CCR	central control rod
CPBT	core pressure boundary tube
EOC	end of cycle
HFIR	High Flux Isotope Reactor
MOC	middle of cycle
ORNL	Oak Ridge National Laboratory

ABSTRACT

A reactor physics analysis was performed for the Advanced Neutron Source reactor with a three-element core configuration. The analysis was performed with a two-dimensional r-z 20-energy-group finite-difference diffusion theory model of the 17-d fuel cycle. The model included equivalent r-z geometry representations of the central control rods, the irradiation and production targets, and reflector components. Calculated quantities include fuel cycle parameters, fuel element power distributions, unperturbed neutron fluxes in the reflector and target regions, reactivity perturbations, and neutron kinetics parameters.

1. INTRODUCTION

The purpose of the proposed Advanced Neutron Source (ANS) neutron research facility is to provide unprecedented experimental capabilities in the areas of neutron scattering, materials research, and isotope production. The primary goals of the ANS project are to obtain neutron flux levels that are 5 to 10 times larger than any existing facility and to provide irradiation facilities that are at least as good as the High Flux Isotope Reactor (HFIR) at the Oak Ridge National Laboratory (ORNL).

This report presents the reactor physics analysis of the ANS three-element core configuration. Calculations have been performed using a two-dimensional 20-energy-group diffusion theory model. Calculated quantities include fuel cycle parameters, fuel element power distributions, unperturbed neutron fluxes in the reflector and target regions, reactivity perturbations, and neutron kinetics parameters.

A description of the ANS reactor is given in Sect. 2. The calculational models used in this work are described in Sect.3 and calculational results are presented in Sect. 4. Final conclusions are presented in Sect. 5.

2. DESCRIPTION OF THE ANS REACTOR

2.1 INTRODUCTION

The current ANS reactor core design consists of three annular fuel elements. Each element consists of involute-shaped fuel plates of medium-enriched uranium in the form of U_3Si_2 in an aluminum matrix. Heavy water is used as the coolant, moderator, and reflector. Primary control is by three hafnium rods located in the central hole of the annular fuel elements. Secondary shutdown capability is obtained with eight hafnium rods located in the reflector. The experiment facilities, including beam tubes, cold sources, and a hot source, are also located in the heavy water reflector.

In this section a description is given of the key components that are used in the modeling. A more detail description of the conceptual two-element core configuration is available in ref. 1.

2.2 COMPONENTS OF THE ANS REACTOR

2.2.1 Fuel Elements

The current reference ANS reactor core configuration has three fuel elements, as shown in Fig. 2.1. This overlapping configuration was chosen to maximize the thermal neutron flux in the reflector while providing volume for the possible reduction of the fuel enrichment.[2] The fuel element radial thicknesses are determined by fuel plate stability considerations. At the inlet of each fuel element is a 50-mm unheated region that provides room for flow redistribution in the event of a flow blockage. This region, along with a 10-mm unheated region at the top of each element, contains B_4C to be used as a burnable absorber to hold down the core reactivity at the beginning of cycle (BOC). The boron regions near the core midplane (bottom of inner and outer elements, top of middle element) contain 3 g of ^{10}B each, while each of the regions away from the core midplane (top of the inner and outer elements, bottom of the middle element) contain 2.5 g of ^{10}B. The heavy water coolant flows upward through the elements, with each element having a separate flow path.

2.2.2 Fuel Plates

Each of the elements is composed of involute-shaped fuel plates. The plates consist of U_3Si_2/Al fuel (50% enriched in ^{235}U) and an aluminum filler sandwiched between Al-6061 cladding. The fuel plates have a total thickness of 1.27 mm, which is the same thickness as the coolant channels. The fuel plate geometry is illustrated in Fig. 2.2.

The fuel meat within each plate is graded in both the radial and axial directions to optimize the power distribution. The current fuel grading is shown in Figs. 2.3–2.5 for each element. In addition, a tabulation of the fuel meat thickness for 800 regions in each element is given in Appendix A. A description of the fuel grading procedure is given in ref. 3.

2.2.3 Central Control Rods

The primary control system consists of three hafnium control rods located in the central hole of the reactor. A plan view of the control rod layout is shown in Fig. 2.6. The hafnium regions are 1060 mm long and have zircaloy-niobium followers. The central control rod drive

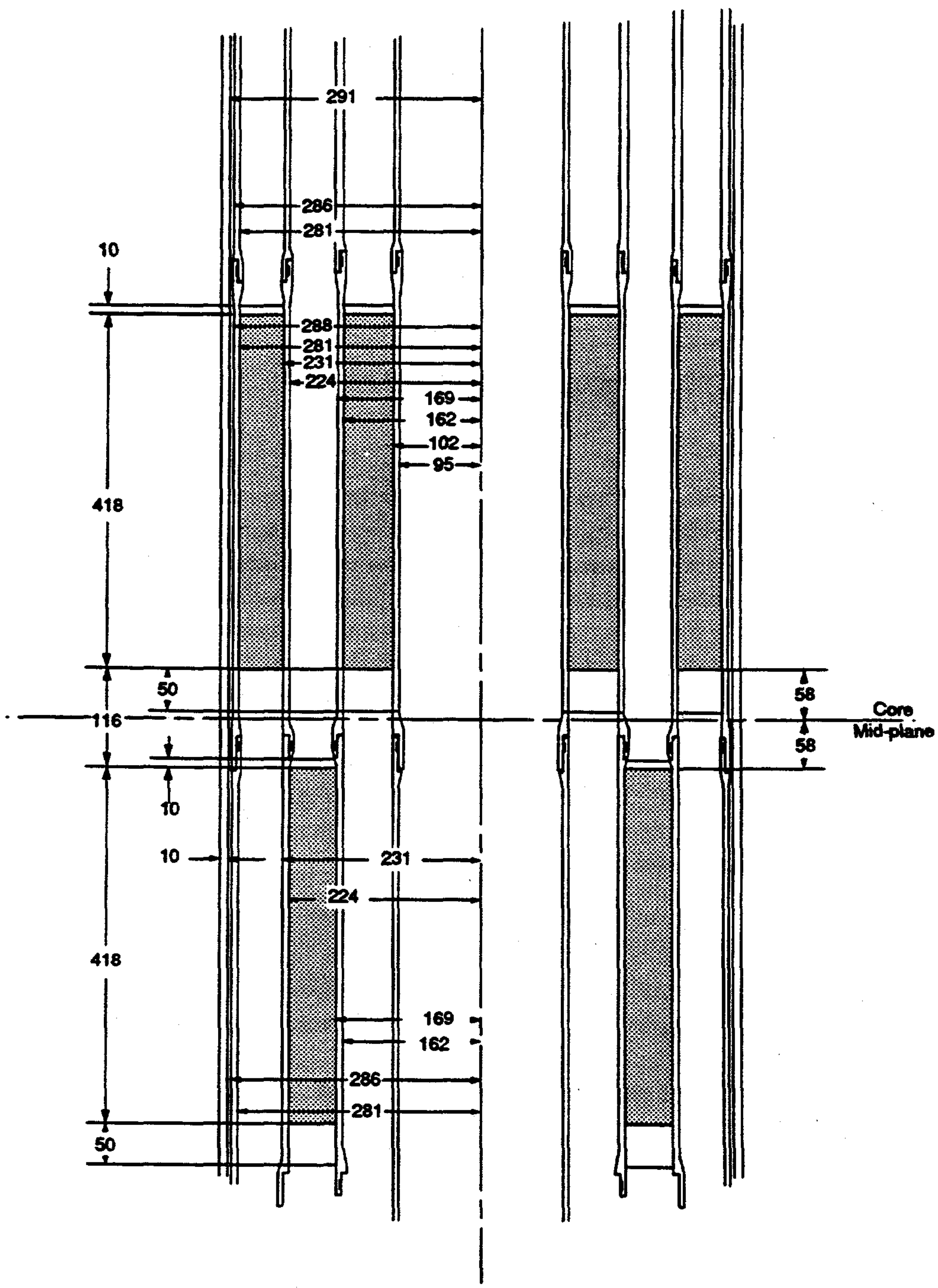

Fig. 2.1. Vertical section of the ANS reactor (dimensions in mm).

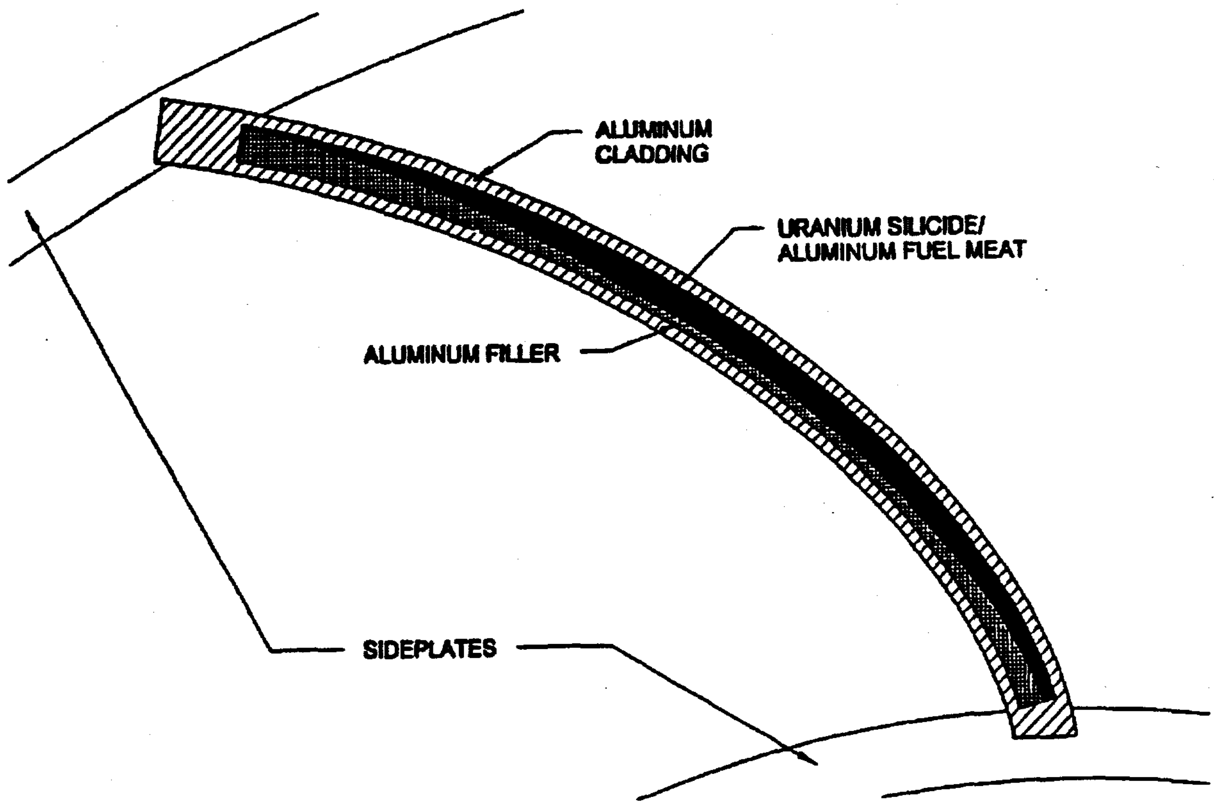

Fig. 2.2. Diagram of an ANS fuel plate (fuel plate width exaggerated).

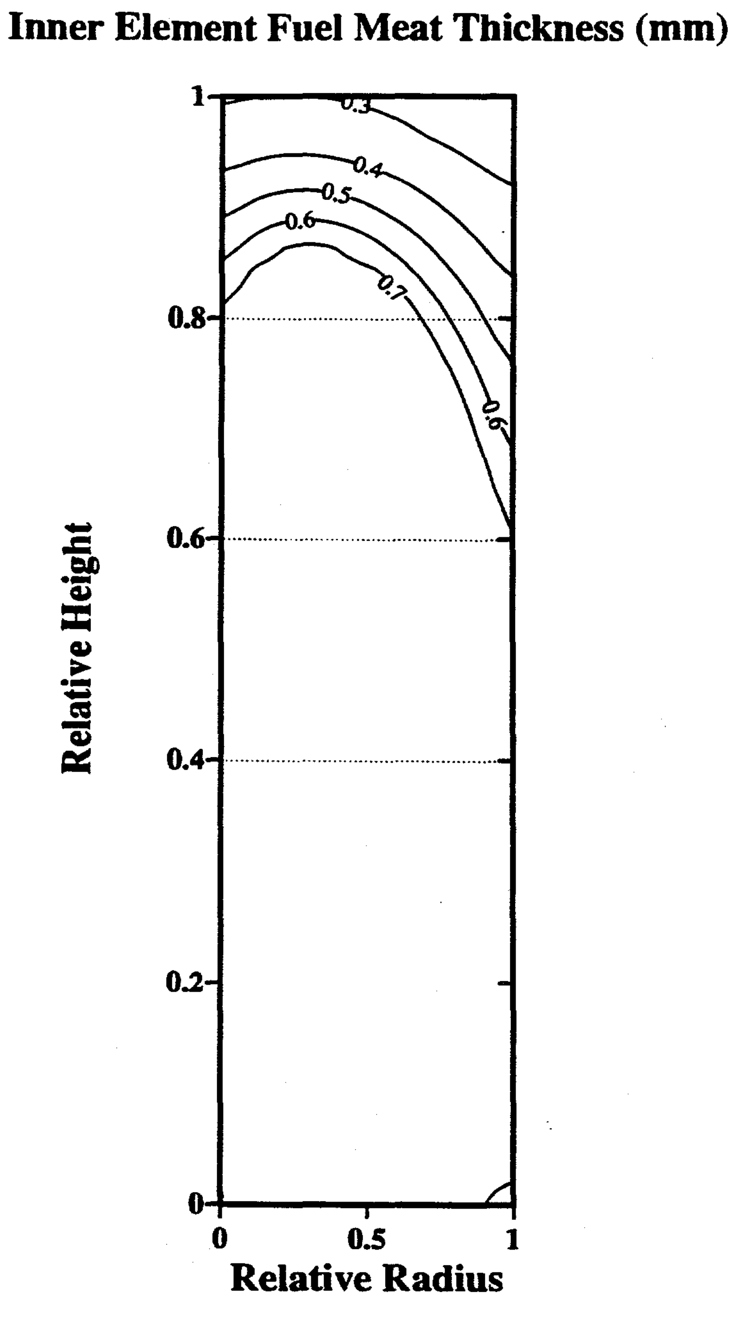

Fig. 2.3. ANS inner element fuel grading.

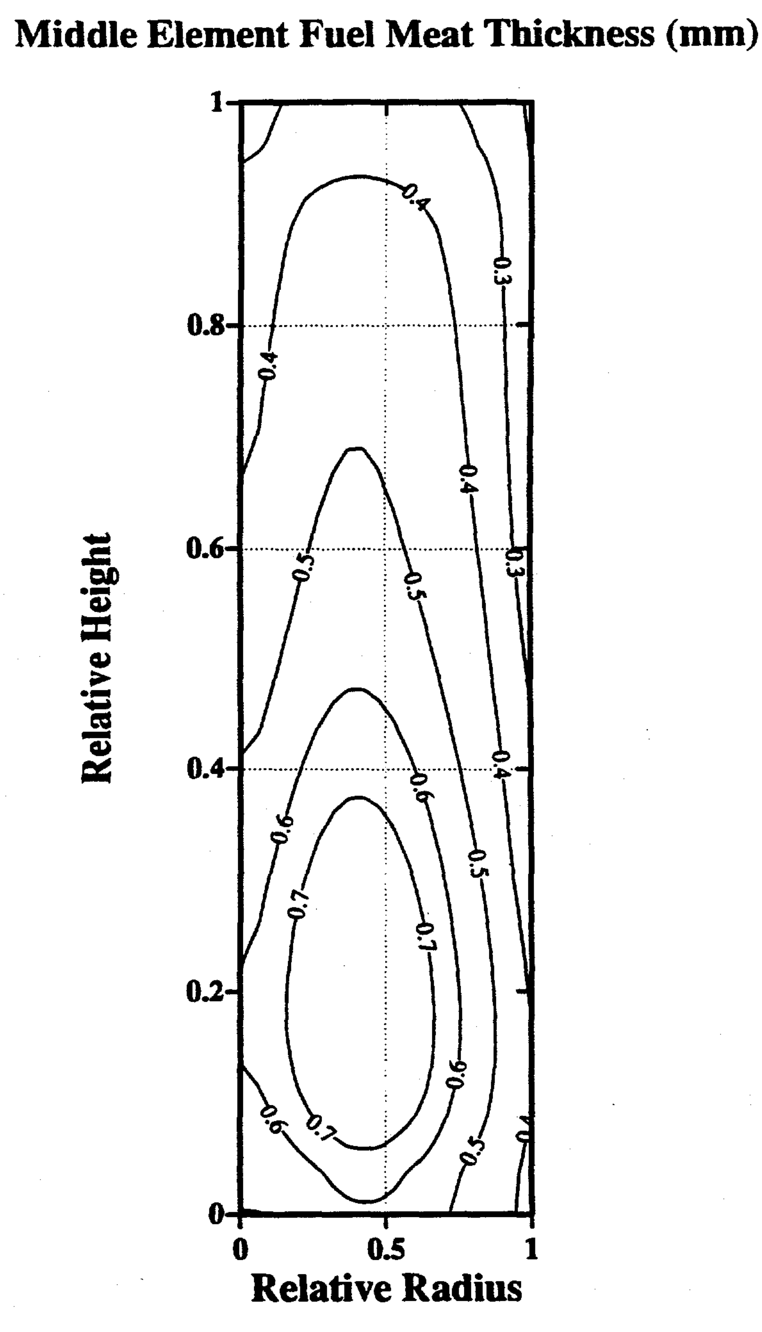

Fig. 2.4. ANS middle element fuel grading.

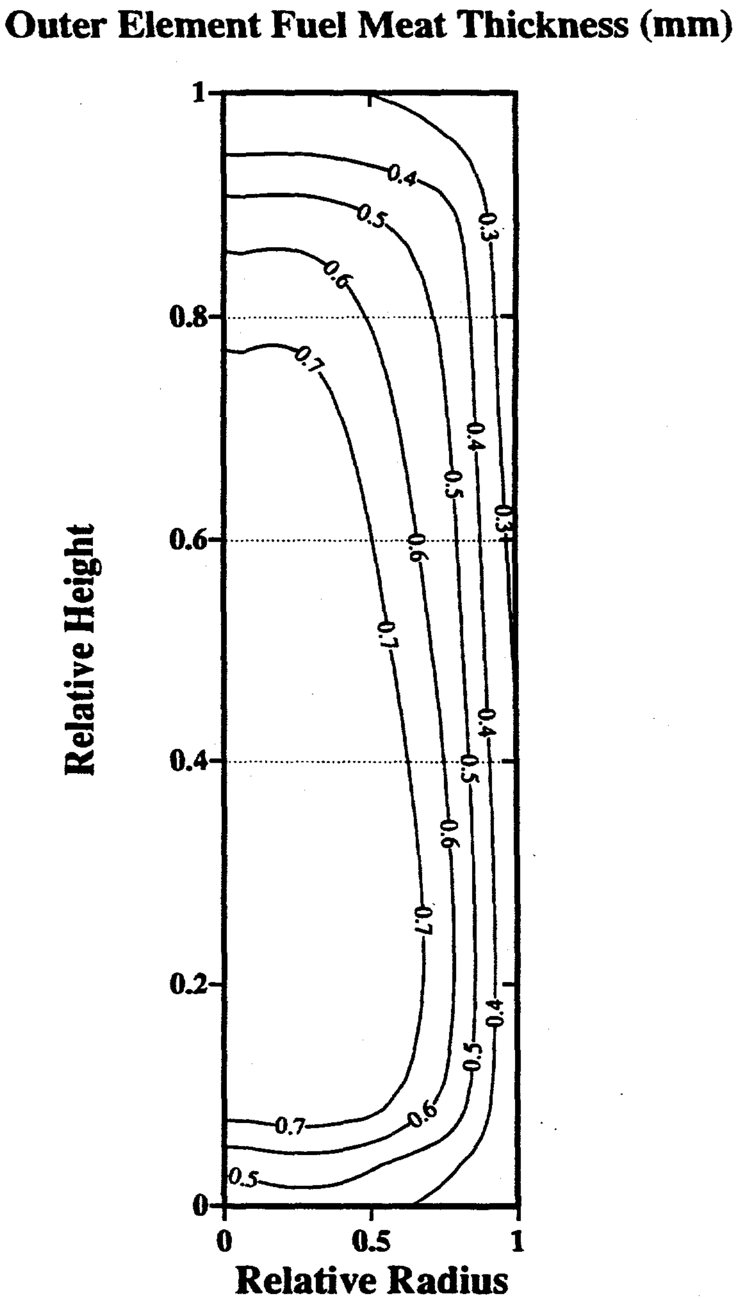

Fig. 2.5. ANS outer element fuel grading.

mechanisms are located below the reactor and push the control rods upward during the fuel cycle. At full insertion the control rod hafnium regions are centered about the midplane of the reactor core. A secondary shutdown system is provided by eight safety shutdown rods located in the heavy water reflector.

2.2.4 Irradiation and Production Targets

The region between the inner and outer elements contains both irradiation targets and transuranic isotope production targets. The layout of the targets is shown in Fig. 2.6.

There are a total of ten irradiation targets, five instrumented targets (43 mm diam) and five uninstrumented targets (16 mm diam). The irradiation targets consist of 87% aluminum and 13% stainless steel. The targets are 507 mm long with the bottom of the target located at the same elevation as the bottom of the fuel section of the inner and outer elements.

In additional to the irradiation targets, there are 30 transuranic isotope production rods. These rods consist of actinide oxide in an aluminum matrix in 4.95-mm-diam pellets. The pellets are clad in Al-1100.

2.2.5 Reflector Components

The experimental facilities are located in the heavy water reflector, which is separated from the high-pressure core region by the core pressure boundary tube (CPBT). The reflector is contained inside a 3.5-m-diam Al-6061 reflector vessel.

The ANS reflector contains a large number of experimental facilities. The major components include seven beam tubes, a through-tube, the large slant beam tube, two cold sources, a hot source, and several hydraulic tubes and rabbit tubes. A plan view through the midplane of the reactor is shown in Fig. 2.7. In addition to the experimental facilities, eight safety shutdown rods are located in the reflector.

2.3 SUMMARY

In this section a brief description of the key components of the ANS reactor has been presented. In Sect. 3 the manner in which these components are modeled is discussed.

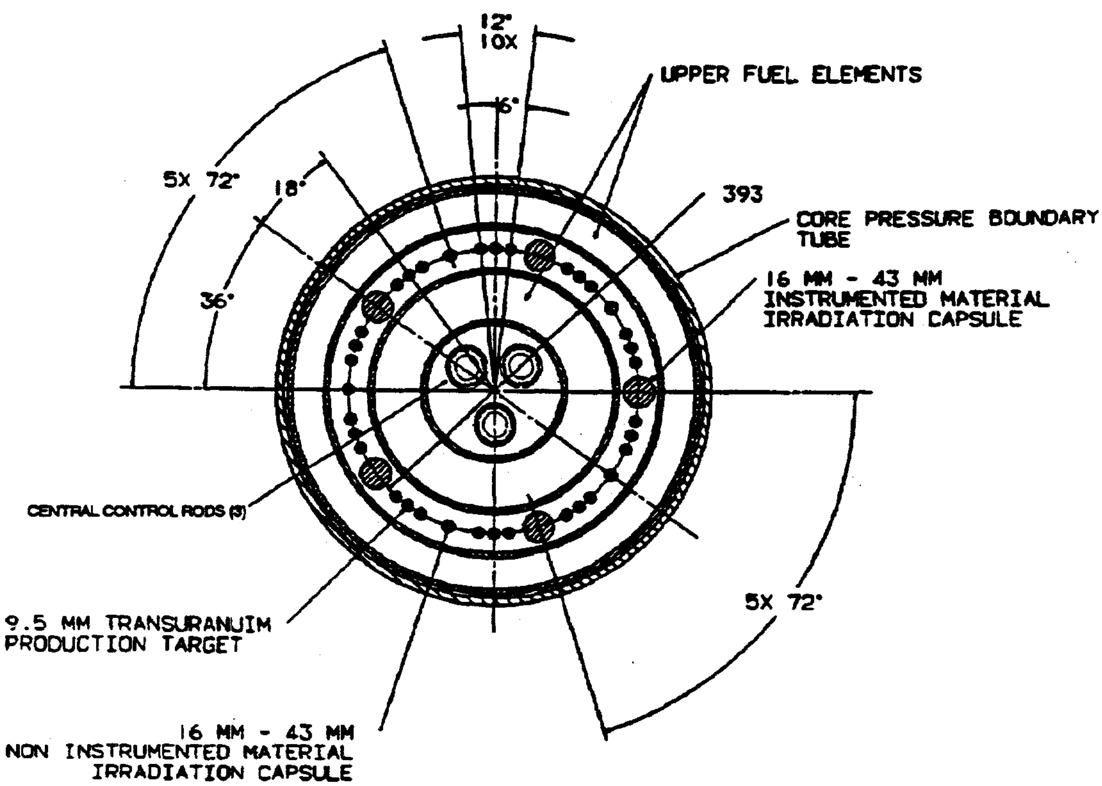

Fig. 2.6. Plan view through inner and outer fuel elements showing layout of the central control rods and the irradiation and production targets.

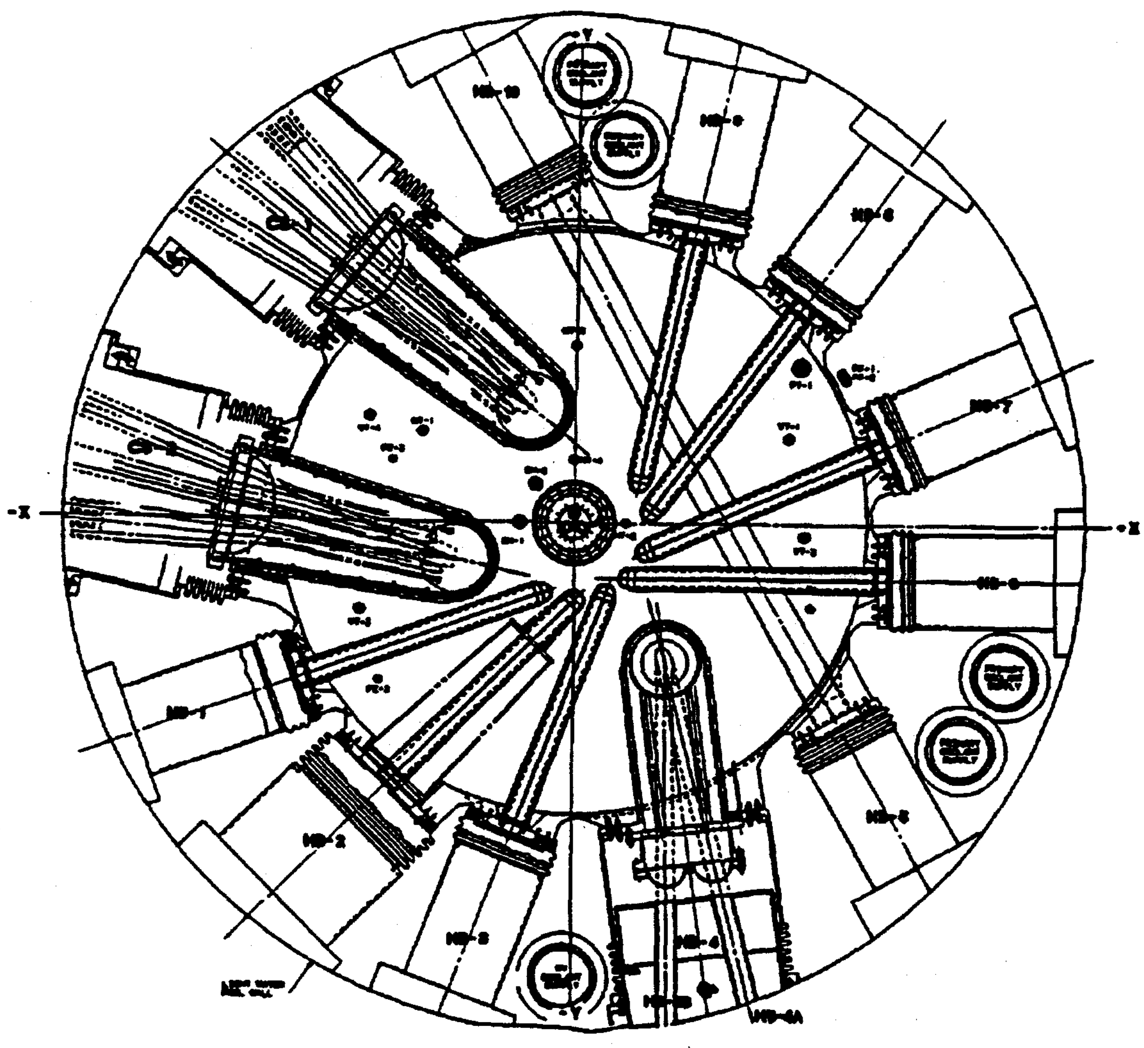

Fig. 2.7. Plan view through reactor at midplane showing layout of the reflector components.

3. DESCRIPTION OF THE ANS MODEL

3.1 INTRODUCTION

The ANS reactor has been modeled with the VENTURE[4] reactor analysis system. This system includes finite-difference, diffusion theory neutronics and fuel burnup modules, along with several other modules. The few-group cross sections required for the VENTURE calculations were created with the AMPX-77[5] cross-section generation system. This section discusses the modeling methods and assumptions incorporated into the ANS model.

3.2 NEUTRON CROSS SECTIONS

The VENTURE code system requires few-group neutron cross sections as input for calculations. These cross sections were created using the AMPX-77 cross-section generation system. A flow diagram of the cross-section generation process is presented in Fig. 3.1.

The initial cross-section input is obtained from the 99-group ANSL-V cross-section library,[6] which was developed from ENDF/B-V specifically for the analysis of ANS. The group boundaries are given in Table 3.1. This library is a problem-independent master cross-section library that must be further processed to correspond to particular reactor conditions. Modules from the AMPX-77 system are used to perform resonance processing, spatial homogenization, and energy condensation.

The resonance processing is performed by the BONAMI and NITAWL-II modules of the AMPX-77 system. The BONAMI module uses Bondarenko factor data[7] in a self-shielding calculation. In the AMPX system, this approach is used primarily for the unresolved energy range. In the ANSL-V library, two isotopes used in these calculations (^{238}U and ^{235}U) have Bondarenko factor data. A one-dimensional slab model of a fuel unit cell was used to allow BONAMI to calculate escape probabilities to account for the interaction between fuel lumps. The NITAWL-II module is used to process the resolved resonances. In the resolved resonance processing, NITAWL-II performs the Doppler broadening of each resonance and then determines the resonance shielding using the Nordheim Integral Treatment.[8]

After resonance processing, the XSDRNPM S_n transport code is used to calculate 99-group fluxes over the fuel unit cell consisting of a single fuel plate and its associated coolant. These fluxes were then used to create spatially homogenized 99-group unit cell cross sections. The weighted cross sections account for the flux depression in the fuel plate and can be used in homogeneous representations of the fuel region. Previous calculations, however, have shown that for highly enriched uranium fuel and heavy water coolant the local self-shielding in the fuel plates is rather small and that this step may not be necessary.[9]

The cell-weighted 99-group fuel cross sections were then used in an XSDRNPM model of radial transverses through the inner and outer elements (upper core region) and a radial trace through the middle element (lower core region). The calculated 99-group fluxes were used to collapse the 99-group cross sections to a 20-energy-group structure. The energy group boundaries of the 20-group cross sections are also shown in Table 3.1. Three cross section sets were used in each fuel region along with several cross section sets for the Al-6061 structures and the heavy water to account for the changing energy spectrum. Trace amounts of the nuclides that make up Al-6061 alloy were added to the reflector region to create 20-group cross sections for the reflector components.

Calculation Flow Diagram

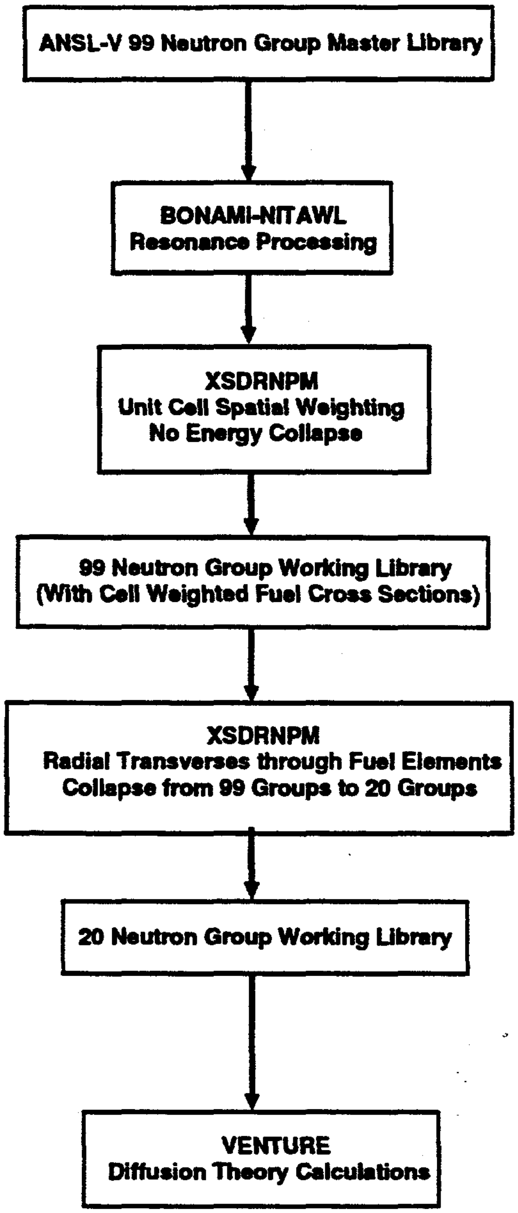

Fig. 3.1. Flow diagram of cross-section generation for the ANS analysis.

Table 3.1. Neutron group structures for ANS calculations

Number of energy groups 99	20	Upper energy boundary (eV)	Number of energy groups 99	20	Upper energy boundary (eV)
1	1	2.0000×10^{7}	51		5.5000×10^{2}
2		1.5941×10^{7}	52		3.9110×10^{2}
3		1.2706×10^{7}	53		2.7811×10^{2}
4		1.0127×10^{7}	54		1.9776×10^{2}
5		8.0722×10^{6}	55		1.4063×10^{2}
6		6.4340×10^{6}	56	7	1.0000×10^{2}
7		5.5234×10^{6}	57		7.8600×10^{1}
8		4.7417×10^{6}	58		6.1780×10^{1}
9		4.0707×10^{6}	59		4.8559×10^{1}
10		3.4946×10^{6}	60		3.8168×10^{1}
11	2	3.0000×10^{6}	61	8	3.0000×10^{1}
12		2.7235×10^{6}	62		2.4082×10^{1}
13		2.4725×10^{6}	63		1.9332×10^{1}
14		2.2447×10^{6}	64		1.5518×10^{1}
15		2.0378×10^{6}	65		1.2457×10^{1}
16	3	1.8500×10^{6}	66	9	1.0000×10^{1}
17		1.7497×10^{6}	67		7.8600×10^{0}
18		1.6548×10^{6}	68		6.1780×10^{0}
19		1.5651×10^{6}	69		4.8559×10^{0}
20		1.4803×10^{6}	70		3.8168×10^{0}
21		1.4000×10^{6}	71	10	3.0000×10^{0}
22		1.2816×10^{6}	72		2.6996×10^{0}
23		1.1732×10^{6}	73		2.4292×10^{0}
24		1.0740×10^{6}	74		2.1859×10^{0}
25		9.8315×10^{5}	75		1.9670×10^{0}
26	4	9.0000×10^{5}	76	11	1.7700×10^{0}
27		7.6525×10^{5}	77		1.3000×10^{0}
28		6.5068×10^{5}	78	12	1.0000×10^{0}
29		5.5326×10^{5}	79		7.6500×10^{-1}
30		4.7043×10^{5}	80	13	6.2500×10^{-1}
31		4.0000×10^{5}	81		4.7900×10^{-1}
32		3.0314×10^{5}	82	14	3.9700×10^{-1}
33		2.2974×10^{5}	83		3.3000×10^{-1}
34		1.7411×10^{5}	84	15	2.7000×10^{-1}
35		1.3195×10^{5}	85		2.1500×10^{-1}
36	5	1.0000×10^{5}	86	16	1.6200×10^{-1}
37		7.0160×10^{4}	87		1.0400×10^{-1}
38		4.9224×10^{4}	88	17	5.0000×10^{-2}
39		3.4536×10^{4}	89		3.0000×10^{-2}
40		2.4230×10^{4}	90	18	1.0000×10^{-2}
41		1.7000×10^{4}	91		4.4500×10^{-3}
42		1.2017×10^{4}	92	19	3.2500×10^{-3}
43		8.4941×10^{3}	93		2.6000×10^{-3}
44		6.0042×10^{3}	94	20	2.1500×10^{-3}
45		4.2441×10^{3}	95		1.8000×10^{-3}
46	6	3.0000×10^{3}	96		1.4500×10^{-3}
47		2.1368×10^{3}	97		1.1500×10^{-3}
48		1.5220×10^{3}	98		8.5000×10^{-4}
49		1.0841×10^{3}	99		5.5000×10^{-4}
50		7.7217×10^{2}			1.0000×10^{-5}

3.3 VENTURE MODEL

The ANS reactor is modeled using two-dimensional r-z geometry using the VENTURE reactor analysis system. The model has a mesh structure of 146 radial and 235 axial meshes. A brief description of the modeling of each component is discussed in the following sections. A diagram of the VENTURE ANS model, created from the VENTURE input, is given in Fig. 3.2; a closeup of the core region is given in Fig. 3.3. All calculations were performed with 20 energy groups.

3.3.1 Fuel Elements

Each fuel element is modeled as homogeneous regions representing fuel, filler, clad, and coolant. The fuel grading in each element is represented with 800 fuel zones, each of which has a uniform composition. Each of the 800 fuel grading zones also represents a depletion zone. The burnable absorber regions at the top and bottom of each element are represented as homogenized boron carbide, filler, clad, and coolant. Each boron region contains 15 zones for depletion purposes.

3.3.2 Central Control Rods

The central control rods (CCRs) are represented in the r-z model as a single cylinder of hafnium. The dimensions of the cylinder (radius and thickness) were determined by matching a single, annular control rod calculation to an explicit control rod calculation.

The equivalent model calculations were performed with one-dimensional models of radial traces through the upper and lower core regions using the XSDRNPM S_n code. The explicit rod calculations were performed with the KENO multigroup Monte Carlo code.[10] All of the calculations were performed with 99 energy groups. By using a one-dimensional representation, a substantial amount of computation time was saved. Treating the upper and lower regions separately requires an additional constraint that the control rod geometry for each trace be identical (i.e., same radius and thickness).

After performing the explicit calculations with KENO and performing several iterations on the equivalent CCR geometry with XSDRNPM to match the multiplication factors, the hafnium absorption rates and spectra, the final parameters were determined. The resulting equivalent rod has an inner radius of 56 mm and a thickness of 7 mm. A comparison of the multiplication factors and hafnium absorption rate is given in Table 3.2. The hafnium absorption rate as a function of energy is shown in Figs. 3.4 and 3.5 for the upper and lower traces, respectively.

3.3.3 Core Support Structure

Above and below the fuel elements are additional core support structures, consisting of Al-6061, in the form of ribs and vanes inside the core support tubes. In the VENTURE model, these ribs were homogenized based on their volume fractions. The volume fractions for the support structures below the inner, middle, and outer fuel elements are 0.121, 0.104, and 0.175, respectively. In addition, there are core support structures above the inner and outer fuel elements with volume fractions of 0.063 and 0.052, respectively.

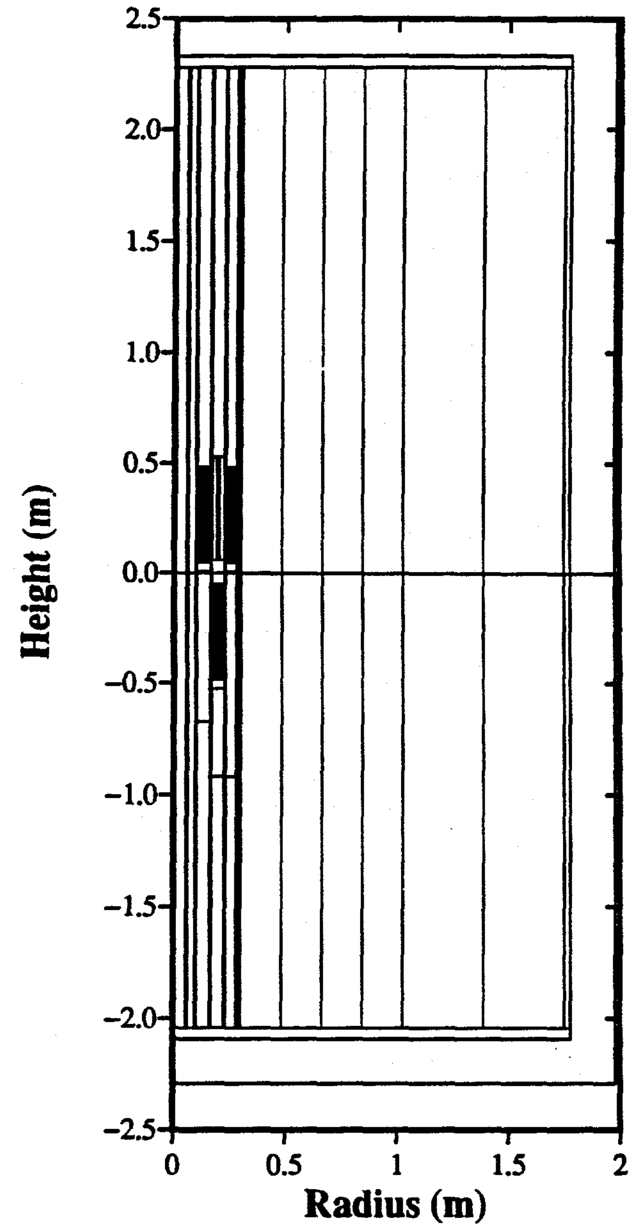

Fig. 3.2. VENTURE *r*-*z* model of the ANS three-element core reactor.

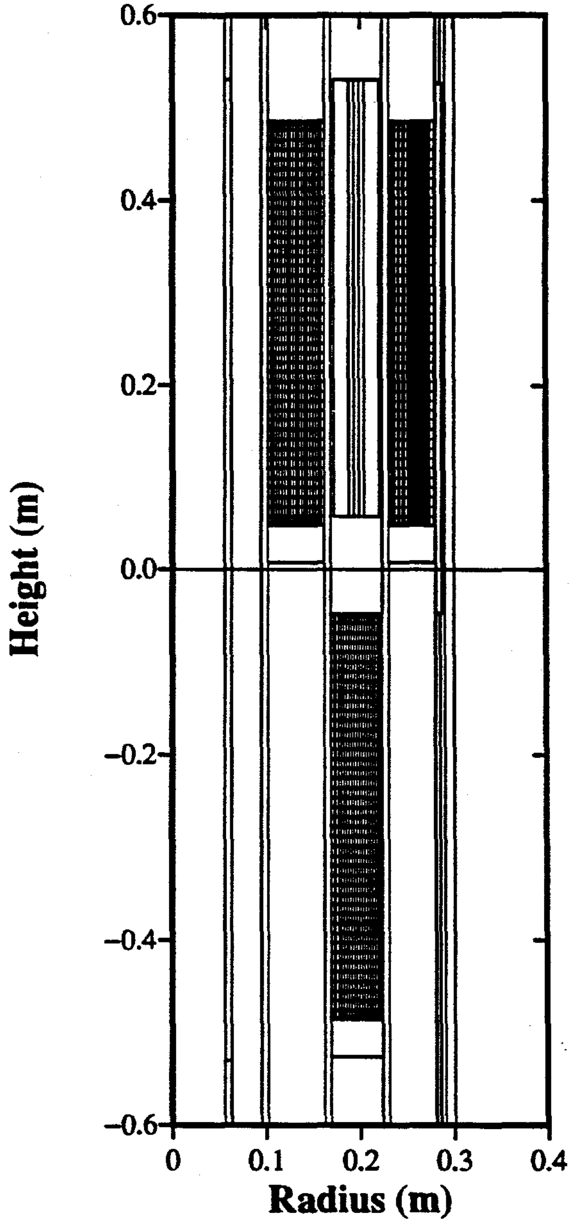

Fig. 3.3. VENTURE *r-z* model of the ANS three-element core reactor showing the core region.

Table 3.2. Comparison of multiplication factors (k_{eff}) and hafnium absorption rates between the explicit and equivalent central control rod models (normalized to a power level of 1 W)

	Upper trace		Lower trace	
	Explicit	**Equivalent**	**Explicit**	**Equivalent**
k_{eff}	1.3856 ± 0.0010	1.3845	1.1880 ± 0.0011	1.1896
Hf absorption rate (10^{12} s^{-1})	4.66 ± 0.02	4.71	5.13 ± 0.02	5.09

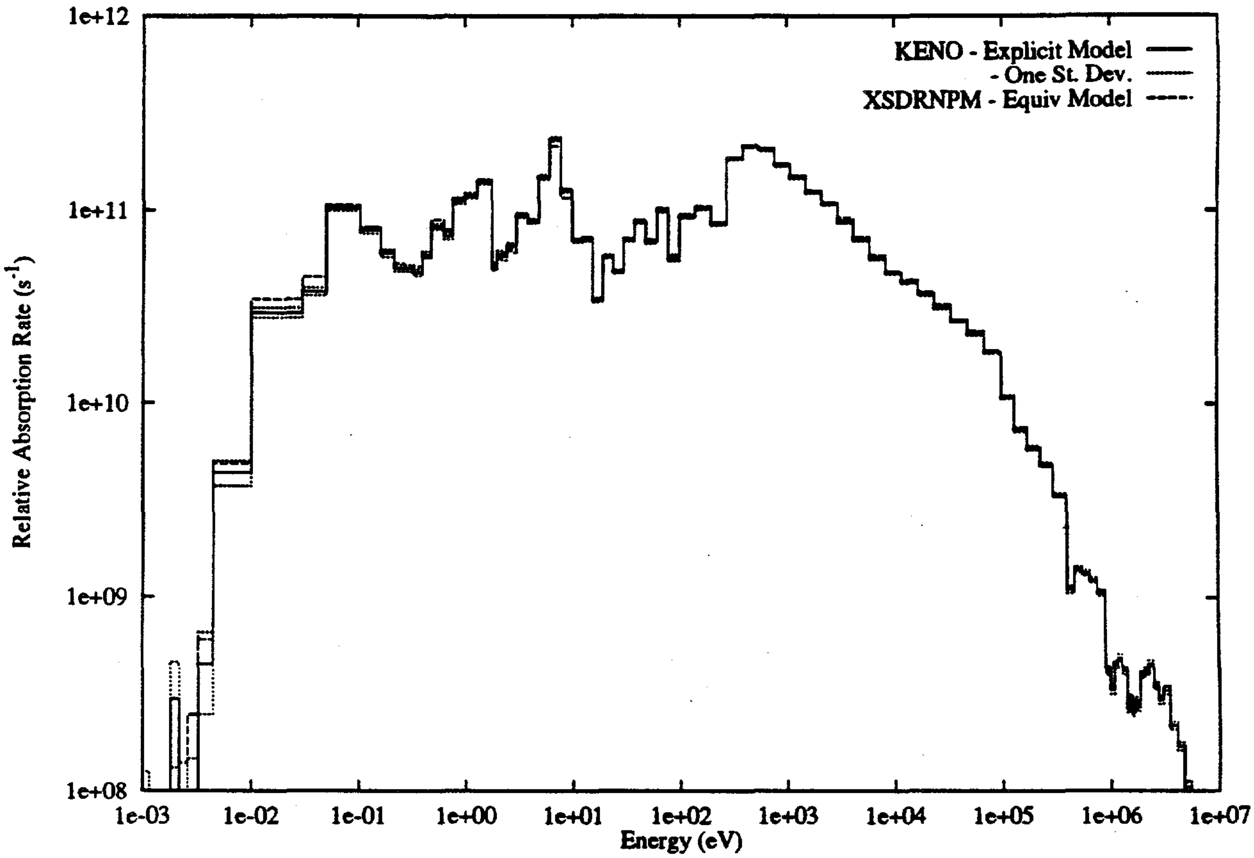

Fig. 3.4. The hafnium absorption rate as a function of energy for the explicit and equivalent models for the upper trace (normalized to a power level of 1 W).

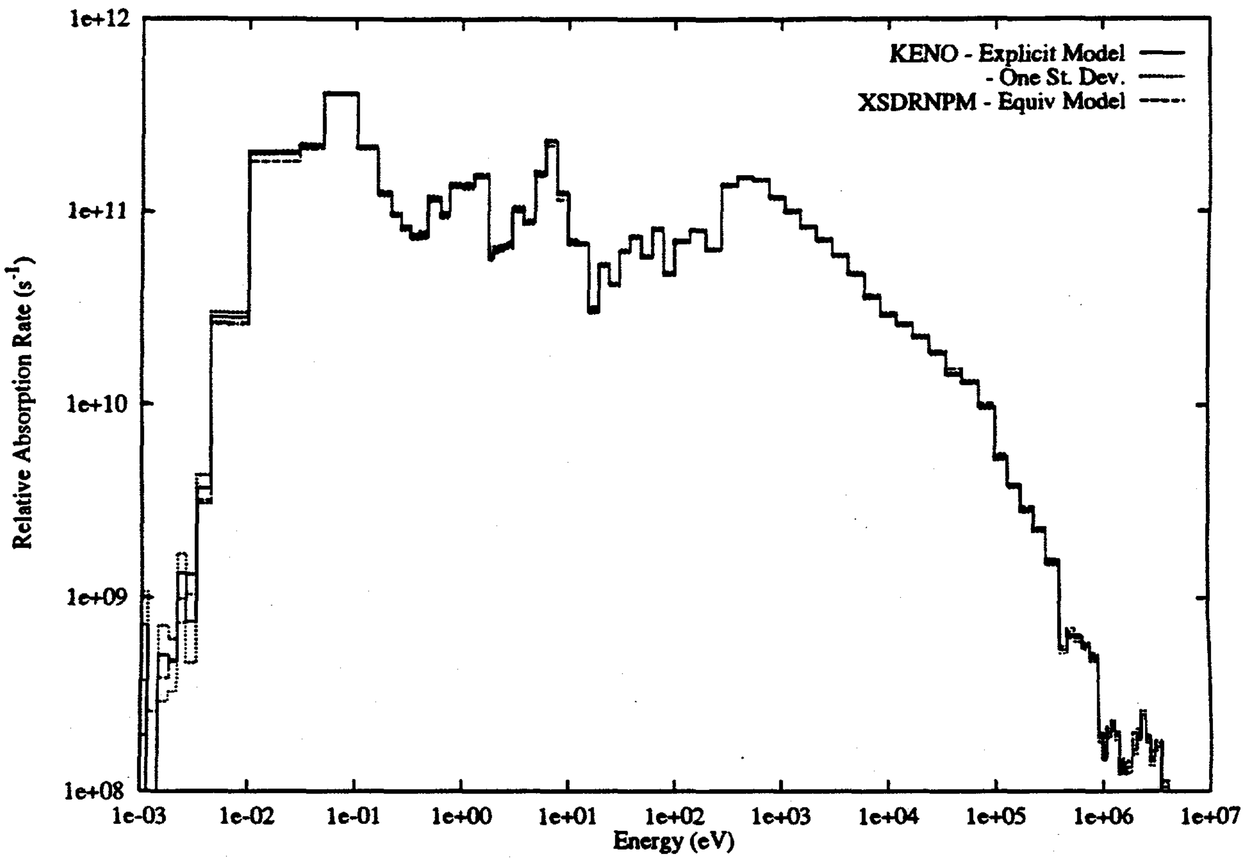

Fig. 3.5. The hafnium absorption rate as a function of energy for the explicit and equivalent models for the lower trace (normalized to a power level of 1 W).

3.3.4 Irradiation and Production Targets

The homogenized target model is based on a three-region homogenization, shown in Fig. 3.3. One region represents the transuranic production target and irradiation targets, another region represents the small and large irradiation target, and another region represents only the large target. A one-dimensional unit cell calculation was performed to homogenize the transuranium target and associated D_2O. Calculations of the effective multiplication factor were performed with explicit KENO and equivalent, one-dimensional XSDRNPM models of a radial trace through the upper fuel elements and targets. The target reactivity worth computed with the explicit model is 1140 $\pm$ 80 pcm and computed with the homogenized model is 1128 pcm.

3.3.5 Reflector Components

An equivalent reflector component model was obtained by adding Al-6061 to the upper region of the heavy water reflector (where most of the experimental facilities and shutdown rods are located) outside of a radius of 470 mm (the beam tube tip locations). The appropriate amount of Al-6061 was added until the effective multiplication factor computed with VENTURE was near unity. The CCRs were positioned at the axial position which yielded a near-unity multiplication factor in calculations with an MCNP model with a detailed representation of the reflector components.[11] The calculation resulted in an Al-6061 volume fraction of 0.166.

3.4 FUEL CYCLE MODEL

The 17-d ANS fuel cycle is modeled with five depletion steps with calculations at 0, 1, 4.25, 8.5, 12.75, and 17 d. The first time step is used to provide an accurate representation of the production of ^{135}Xe. All calculations at 1 d and thereafter assume an equilibrium xenon concentration to ensure that the effects of the xenon on the core fluxes and power distribution are taken into account.

In the fuel cycle calculations, 31 fission products are represented explicitly. Two effective fission product materials account for the remainder of the fission products. The selection of the explicit fission products and fission product lumps is described in ref. 12. The fission product chains represented in the burnup calculations are shown in Fig. 3.6.

3.5 COMPARISON OF VENTURE AND MCNP CALCULATIONS

A comparison of the power density calculations calculated with VENTURE and MCNP was performed for a simplified ANS model, at BOC. In this simplified model, the in-core targets and the reflector components were not modeled. The MCNP model contained an explicit representation of the CCRs, while the VENTURE model contained the equivalent control rod model model previously discussed. The fuel grading was represented by 16 regions in each fuel element. The CCRs were withdrawn to 47.4 mm below core midplane.

The resulting effective multiplication factor from the MCNP calculation is 1.0715 $\pm$ 0.0006, while that from the VENTURE calculation is 1.0748, which represents an error of 0.3% δk. The power densities were compared in 70 nearly equal-volume regions in each element. The results of the power density comparisons are presented in Figs. 3.7–3.9 for the inner, middle, and outer elements. The power density comparisons show that, in comparison with MCNP, the

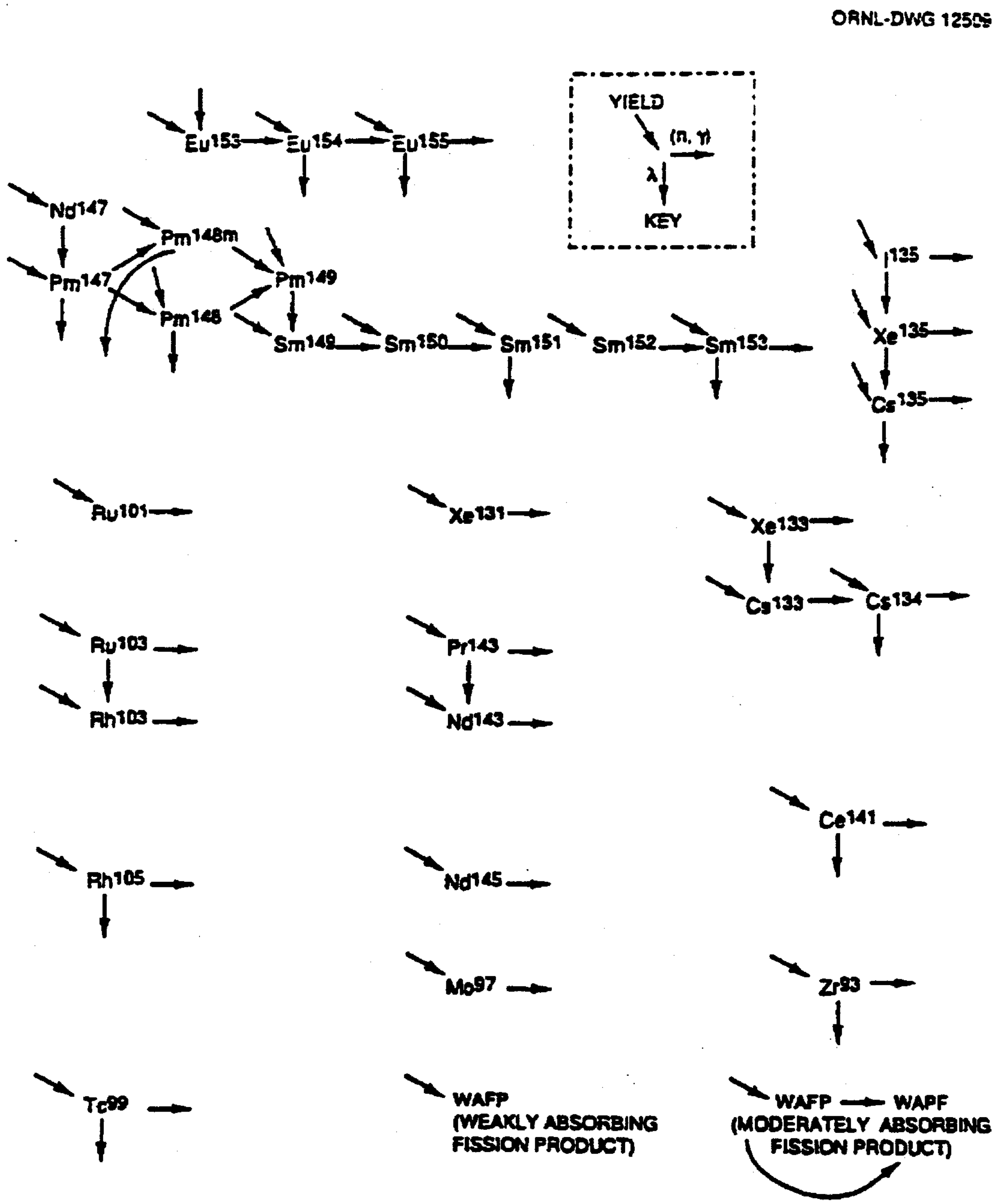

Fig. 3.6. Fission product chains used in the ANS fuel cycle calculations.

average error in the VENTURE power density is approximately 2.5%, with a maximum error of 11.3%. The largest errors occur along the outer edge of the inner fuel element and along the inner edge of the outer fuel element.

3.6 SUMMARY

In this section a discussion of the VENTURE ANS model has been presented. The development of 20-group weighted cross sections was discussed, along with the development of equivalent models of the CCRs, targets, and reflector components. Comparisons of effective multiplication factors and power densities from MCNP and VENTURE calculations for a simplified ANS model were also presented.

	1	2	3	4	5	6	7	
1	.370 +/-2.01 -6.94	.318 +/-1.82 -3.22	.311 +/-1.47 -5.69	.369 +/-1.32 -5.39	.400 +/-1.49 -3.64	.468 +/-1.45 -6.58	.581 +/-1.39 -9.22	MCNP RELATIVE POWER DENSITY MCNP ONE-STANDARD DEVIATION UNCERTAINTY (%) (VENTURE - MCNP)/MCNP x 100%
2	.441 +/-1.84 -6.31	.398 +/-1.66 -3.96	.385 +/-1.26 -2.16	.453 +/-1.21 -1.18	.452 +/-1.46 -2.85	.501 +/-1.38 -5.56	.599 +/-1.47 -11.13	
3	.522 +/-1.44 -7.66	.463 +/-1.24 -2.40	.446 +/- .98 -.13	.502 +/- .95 -1.11	.589 +/-1.13 -1.14	.689 +/-1.11 -1.86	.887 +/-1.15 -6.35	
4	.521 +/-1.24 -5.87	.476 +/-1.09 -1.85	.467 +/- .86 -.86	.515 +/- .81 -1.15	.589 +/- .92 -1.13	.679 +/- .95 -2.87	.851 +/-1.00 -8.00	
5	.563 +/-1.16 -7.72	.509 +/-1.00 -2.32	.499 +/- .81 -.94	.547 +/- .78 -1.11	.627 +/- .89 -2.36	.728 +/- .93 -5.94	.887 +/- .97 -9.83	
6	.585 +/-1.12 -7.30	.532 +/-1.01 -2.55	.516 +/- .79 -.21	.567 +/- .74 -.60	.652 +/- .88 -2.45	.747 +/- .89 -4.88	.920 +/- .96 -9.95	
7	.588 +/-1.13 -5.34	.534 +/- .98 -.74	.522 +/- .78 +.52	.574 +/- .77 +.33	.666 +/- .88 -1.65	.761 +/- .87 -3.12	.943 +/- .94 -7.75	
8	.613 +/-1.28 -5.02	.549 +/-1.14 -.44	.531 +/- .88 +.39	.585 +/- .85 +.56	.698 +/-1.04 -2.20	.802 +/- .99 -1.97	1.022 +/-1.08 -6.42	
9	.671 +/-1.51 -1.41	.578 +/-1.31 +2.63	.554 +/-1.03 +1.21	.614 +/- .97 +.85	.739 +/-1.14 -.05	.892 +/-1.14 -1.23	1.215 +/-1.16 -7.64	
10	.866 +/-1.56 +2.87	.697 +/-1.43 +5.62	.641 +/-1.09 +2.26	.706 +/-1.02 +.34	.867 +/-1.15 +.36	1.099 +/-1.13 -.69	1.592 +/-1.12 -6.39	

Fig. 3.7. Comparison of the MCNP and VENTURE calculated power densities in the ANS inner fuel element for the simplified ANS model at BOC.

	1	2	3	4	5	6	7
1	1.313 +/- .90 -3.82	1.027 +/- .86 -1.14	.964 +/- .77 -.85	.964 +/- .75 -1.21	1.174 +/- .69 -.51	1.291 +/- .71 -4.42	1.723 +/- .69 -6.95
2	1.279 +/- .91 -4.32	1.005 +/- .86 -1.64	.931 +/- .78 -.11	.931 +/- .75 -.16	1.168 +/- .70 -.84	1.251 +/- .71 -3.28	1.661 +/- .71 -6.13
3	1.544 +/- .78 -.93	1.168 +/- .76 +.75	1.025 +/- .68 +2.07	1.011 +/- .67 +1.11	1.218 +/- .63 +2.36	1.383 +/- .63 -.31	1.910 +/- .62 -3.74
4	1.546 +/- .78 -1.60	1.160 +/- .75 +.05	1.007 +/- .69 +1.16	.964 +/- .67 +2.04	1.165 +/- .64 +2.84	1.333 +/- .64 -.26	1.854 +/- .64 -4.14
5	1.475 +/- .81 -.57	1.093 +/- .77 +1.62	.947 +/- .70 +1.69	.914 +/- .69 +.86	1.113 +/- .65 +1.20	1.267 +/- .65 -.77	1.767 +/- .66 -4.06
6	1.731 +/- .89 +3.17	1.207 +/- .86 +4.38	.988 +/- .77 +4.11	.927 +/- .77 +3.13	1.149 +/- .74 +4.07	1.377 +/- .74 +2.89	2.030 +/- .73 -.87
7	1.659 +/- .90 +2.60	1.124 +/- .88 +5.12	.906 +/- .81 +3.71	.829 +/- .81 +4.02	1.033 +/- .76 +6.43	1.287 +/- .76 +3.09	1.916 +/- .74 -.68
8	1.650 +/- .92 +6.08	1.112 +/- .94 +7.14	.870 +/- .87 +5.64	.801 +/- .86 +3.56	1.013 +/- .79 +5.65	1.289 +/- .79 +3.83	1.887 +/- .76 -.10
9	1.639 +/-1.42 +6.39	1.094 +/-1.41 +9.88	.863 +/-1.33 +6.18	.763 +/-1.31 +6.17	.953 +/-1.22 +7.73	1.256 +/-1.19 +7.72	1.876 +/-1.16 +3.52
10	1.856 +/-1.37 +8.17	1.261 +/-1.38 +10.31	1.020 +/-1.28 +7.94	.931 +/-1.29 +5.69	1.076 +/-1.17 +7.61	1.361 +/-1.16 +7.60	1.996 +/-1.11 +5.39

MCNP RELATIVE POWER DENSITY
MCNP ONE-STANDARD DEVIATION UNCERTAINTY (%)
(VENTURE - MCNP)/MCNP x 100%

Fig. 3.8. Comparison of the MCNP and VENTURE calculated power densities in the ANS middle fuel element for the simplified ANS model at BOC.

	1	2	3	4	5	6	7
1	1.007 +/- .92 -2.82	.810 +/- .93 +.00	.746 +/- .91 +.35	.770 +/- .81 +.24	.959 +/- .74 +2.27	1.044 +/- .72 +2.01	1.491 +/- .67 -1.08
2	.780 +/-1.06 -5.82	.641 +/-1.05 -2.18	.618 +/-1.02 -1.09	.659 +/- .91 +1.48	.866 +/- .84 +2.94	.983 +/- .82 +.15	1.400 +/- .77 -2.57
3	.926 +/- .92 -6.13	.777 +/- .81 -2.88	.739 +/- .77 -.90	.813 +/- .69 -.02	1.055 +/- .65 +2.41	1.157 +/- .66 +.77	1.744 +/- .61 -3.00
4	.940 +/- .87 -10.18	.789 +/- .83 -4.83	.762 +/- .79 -3.11	.832 +/- .74 -.86	1.086 +/- .71 +1.22	1.191 +/- .70 -.28	1.782 +/- .66 -3.13
5	.937 +/- .92 -9.21	.811 +/- .79 -4.89	.788 +/- .78 -3.46	.857 +/- .72 -1.07	1.119 +/- .70 +.72	1.221 +/- .68 -.21	1.836 +/- .65 -3.44
6	.967 +/- .93 -8.04	.821 +/- .78 -3.91	.795 +/- .77 -3.73	.884 +/- .70 -1.75	1.226 +/- .68 +2.07	1.376 +/- .67 +.34	2.142 +/- .63 -3.18
7	.986 +/- .92 -7.42	.837 +/- .80 -3.95	.797 +/- .76 -2.63	.877 +/- .70 +.03	1.260 +/- .67 +1.59	1.409 +/- .67 +.09	2.175 +/- .62 -2.20
8	1.023 +/- .92 -5.48	.861 +/- .81 -3.08	.812 +/- .76 -1.81	.896 +/- .71 +.16	1.270 +/- .67 +2.83	1.432 +/- .67 +1.86	2.249 +/- .62 -1.80
9	1.193 +/- .93 -5.43	.935 +/- .80 -.09	.868 +/- .79 +.08	.958 +/- .71 +.50	1.341 +/- .66 +4.26	1.517 +/- .65 +2.99	2.405 +/- .60 -1.59
10	1.427 +/- .81 -1.90	1.094 +/- .81 +2.72	1.000 +/- .79 +1.96	1.052 +/- .70 +2.20	1.303 +/- .65 +4.60	1.548 +/- .63 +4.04	2.333 +/- .58 +.93

MCNP RELATIVE POWER DENSITY
MCNP ONE-STANDARD DEVIATION UNCERTAINTY (%)
(VENTURE - MCNP)/MCNP x 100%

Fig. 3.9. Comparison of the MCNP and VENTURE calculated power densities in the ANS outer fuel element for the simplified ANS model at BOC.

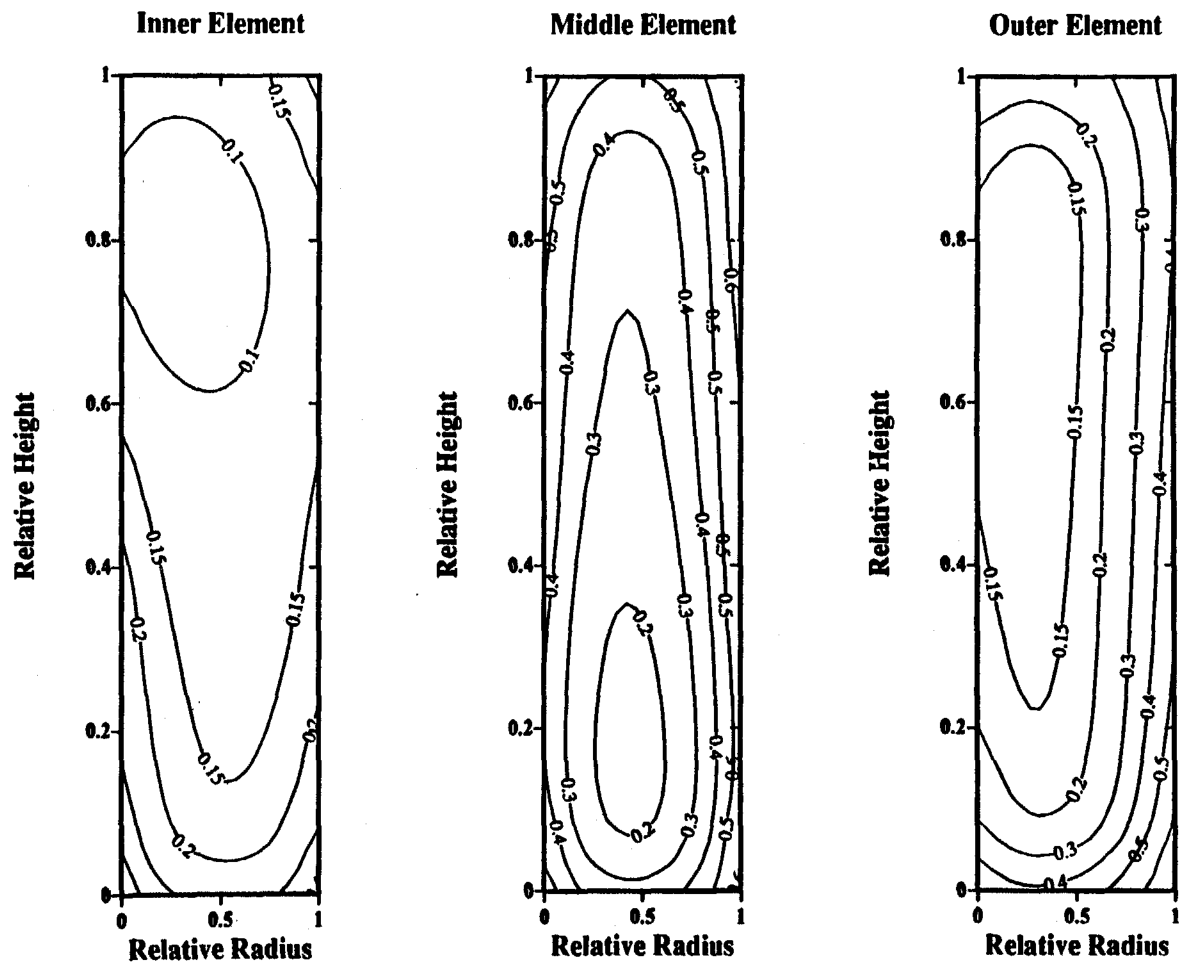

Fig. 4.1. Uranium-235 fractional burnup at EOC in each fuel element.

4.3 FUEL ELEMENT POWER DISTRIBUTIONS

The core power distribution was computed at each time step throughout the cycle. Power density contours at BOC, MOC, and EOC are shown in Figs. 4.2–4.4, respectively. Detailed power density tables are given in Appendix B for each element and at each time point in the fuel cycle calculation. Note that although the fission power level of the ANS reactor is 330 MW, roughly 10% of the energy is transported out of the fuel elements, resulting in a thermal power level inside of the CPBT of approximately 300 MW.[13]

The fuel grading in each element is designed to push the power production near the bottom of each element, where the coolant enters. Under ideal circumstances this results in axially uniform thermal-hydraulic conditions yielding the maximum thermal-hydraulic margins. The power density plots show that power is indeed peaked toward the inlet in the inner and outer elements. In the middle element, however, the power density does not have this desired behavior. This is a result of the large thermal neutron population at the core midplane, which results in a natural tendency for the largest fission rates to occur near the core midplane (the inlets of the inner and outer elements, the outlet of the middle element).

The largest power densities occur in the middle and outer element in the fuel regions that are adjacent to the heavy water reflector. This occurs despite the reduction in the fuel loading in those areas. Note also that since the inner element is shielded from the reflector, its power production is rather low in comparison to the other two elements. Figure 4.5 shows the power production in each element.

When considering the effectiveness of the current ANS fuel grading, it should be noted that the fuel grading, was developed with a simpler VENTURE model then used in this work. The simpler model did not include irradiation and production targets, which shift the power density from the inner and outer elements to the middle element. In addition, these previous VENTURE calculations were performed with four energy groups that, despite the use of spatially dependent cross sections in the fuel elements, may lead to errors of 20% along the edges of the fuel elements. Continued development of the fuel grading design would have addressed these issues and would have resulted in a slightly different grading that would have nearly the same thermal-hydraulic margins as the present fuel grading.

Table 4.2. Core reactivity balance at BOC, MOC, and EOC

	Reactivity worth (pcm)		
	BOC	MOC	EOC
Central control rods	6401	2530	203
Burnable absorber	8927	3215	692
Fission products	0	7565	9385
Fuel burnup	0	20180	5048
Total	15328	15328	15328

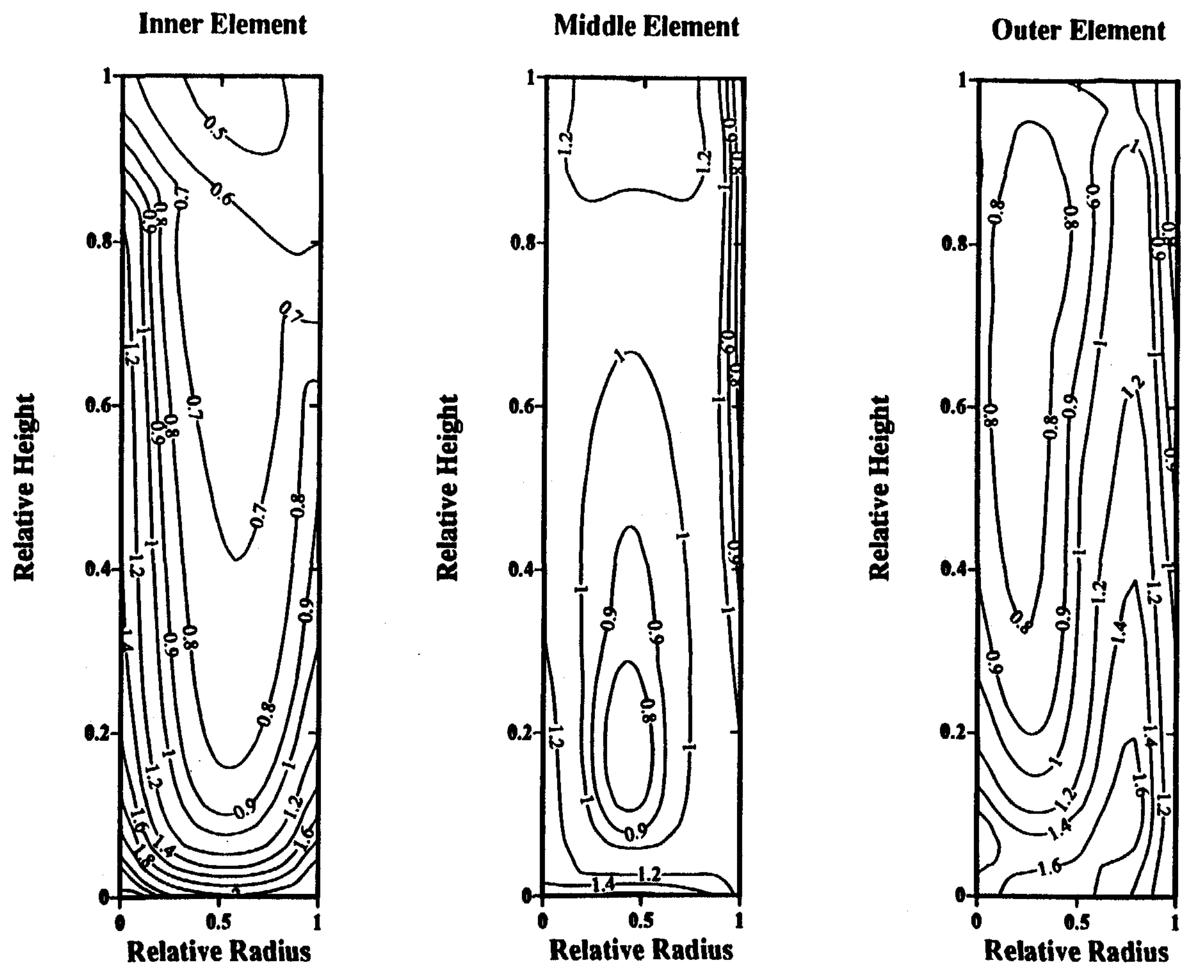

Fig. 4.4. Relative power densities at EOC.

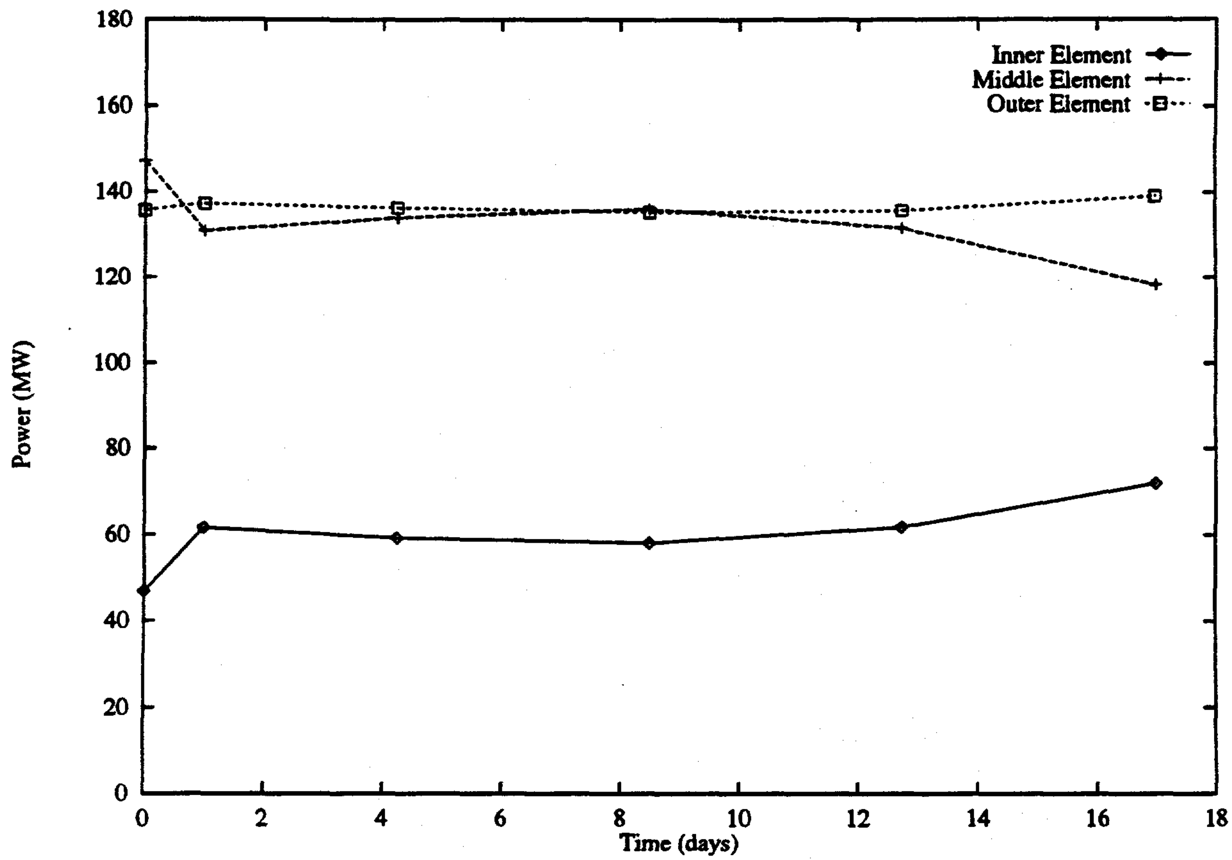

Fig. 4.5. Power production in each of the ANS fuel elements throughout the fuel cycle.

4.4 NEUTRON FLUXES

Unperturbed neutron fluxes were calculated for each of the time points in the fuel cycle calculation. In these unperturbed flux calculations, the irradiation and production targets and the homogenized reflector components are replaced with heavy water. The fuel element isotopics and the CCRs positions are maintained at their respective values from the original fuel cycle calculation, which had the targets and components present. This will, of course, result in an effective multiplication factor that is significantly greater than unity, typically by 7 to 8%. The effect of this greater-than-unity multiplication factor in the solution of the eigenvalue diffusion equations is a reduction of the neutron production per fission until it matches the neutron loss by absorption and leakage in a steady-state condition. Hence, the neutron source is less than it would be in a critical system by a factor equal to the effective multiplication factor. The proper unperturbed fluxes are therefore obtained by multiplying the calculated fluxes by the effective multiplication factor, which has been done for all neutron fluxes presented subsequently.

The unperturbed neutron fluxes are generally useful for making general design choices such as choosing the approximate location for beam tubes or irradiation facilities. They are also useful for comparison with other reactor systems since unperturbed fluxes are commonly reported. Detailed calculations of the perturbed fluxes in many regions of the ANS reactor have been performed using a very detailed three-dimensional model with the MCNP Monte Carlo code and are presented in ref. 14, which should be consulted when the perturbed fluxes are required.

Note that the production of neutrons from photonuclear reactions with deuterium have not been accounted for in the neutron fluxes presented in this section. Photoneutrons produced by gamma rays from ^{28}Al decay in the heavy water reflector tank make large contributions to the fast neutron flux, which is very low in this region. As a result, the fast neutron fluxes calculated with diffusion theory in these outer reflector regions are not accurate. The photoneutrons do not make significant contributions in the core region (except in the kinetic response, which is discussed later).

4.4.1 Neutron Fluxes in the Heavy Water Reflector

Contour plots of the neutron fluxes are presented in Figs. 4.6–4.17 at BOC, MOC, and EOC in the following energy ranges: $E < 0.625$ eV (thermal), $0.625 \text{ eV} < E < 100$ eV (epithermal), $100 \text{ eV} < E < 100$ keV, and $E > 100$ keV (fast).

4.4.2 Neutron Fluxes in the Target Region

The unperturbed neutron fluxes in the target region between the inner and outer fuel elements have also been computed. Axial plots of the thermal neutron flux, epithermal-to-thermal flux ratio, and fast-to-thermal flux ratio are presented in Figs. 4.18–4.22.

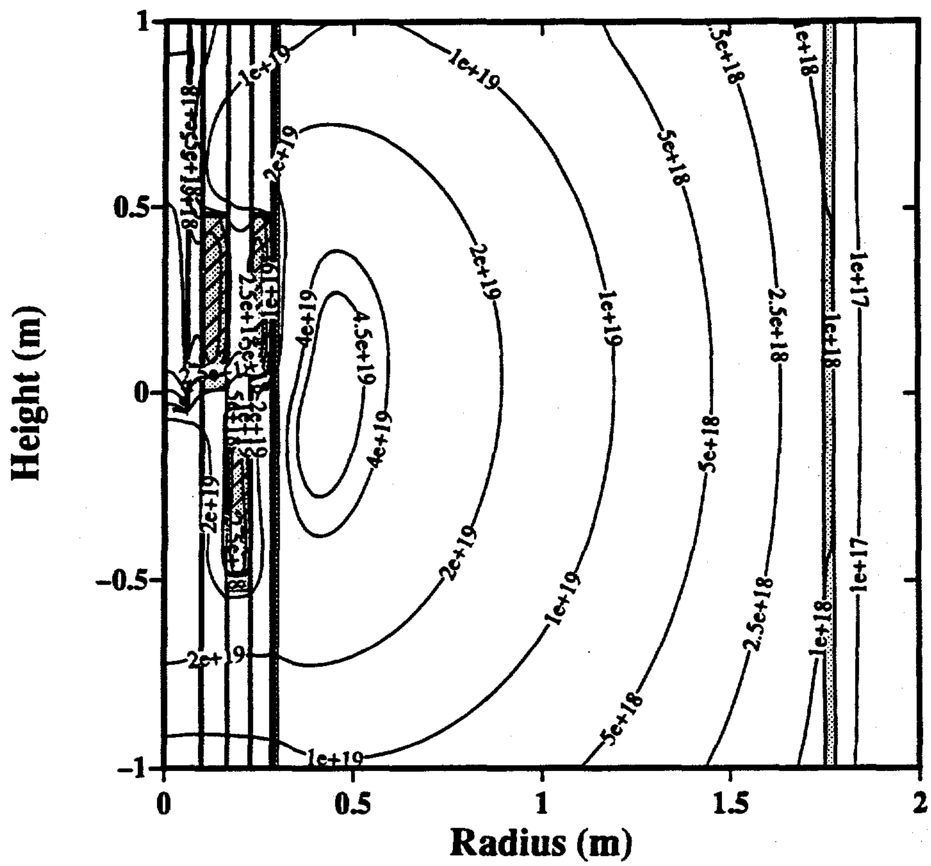

Fig. 4.6. Unperturbed thermal (E < 0.625 eV) neutron flux contours at BOC.

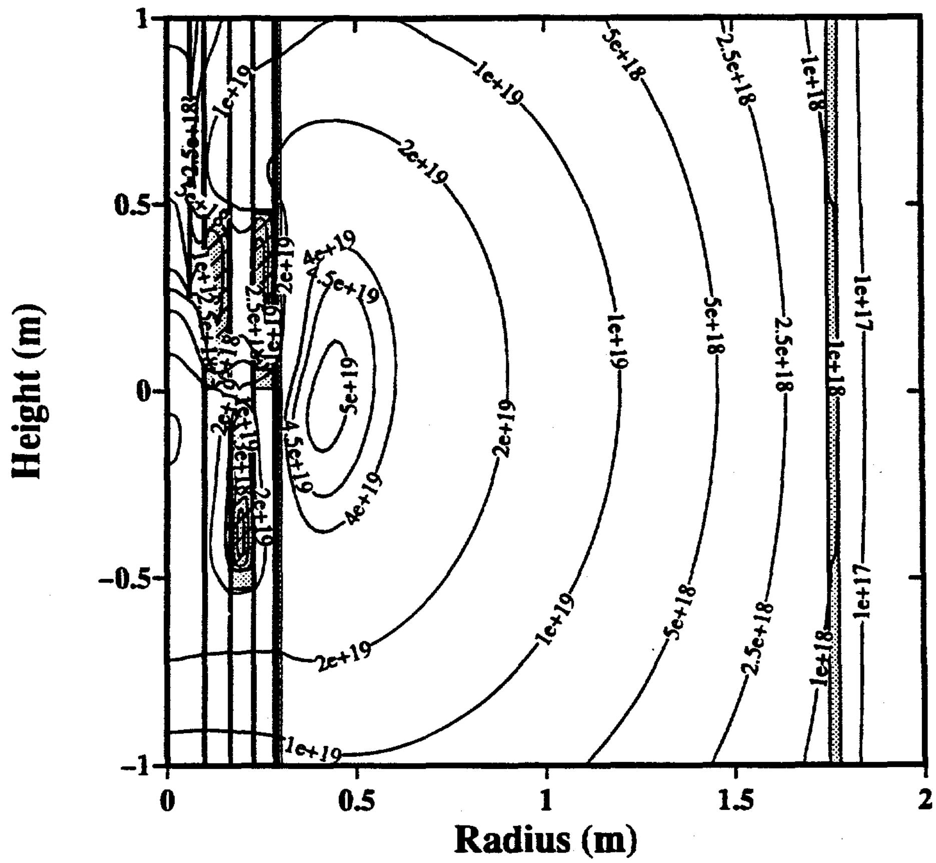

Fig. 4.7. Unperturbed thermal (E < 0.625 eV) neutron flux contours at MOC.

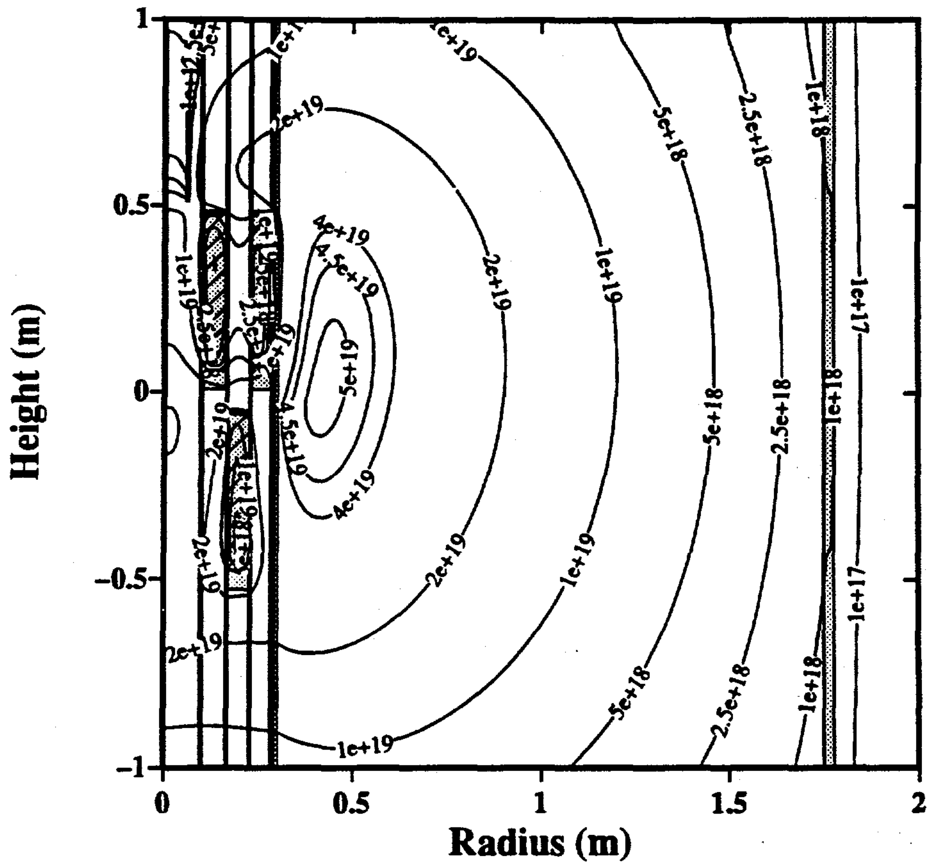

Fig. 4.8. Unperturbed thermal (E < 0.625 eV) neutron flux contours at EOC.

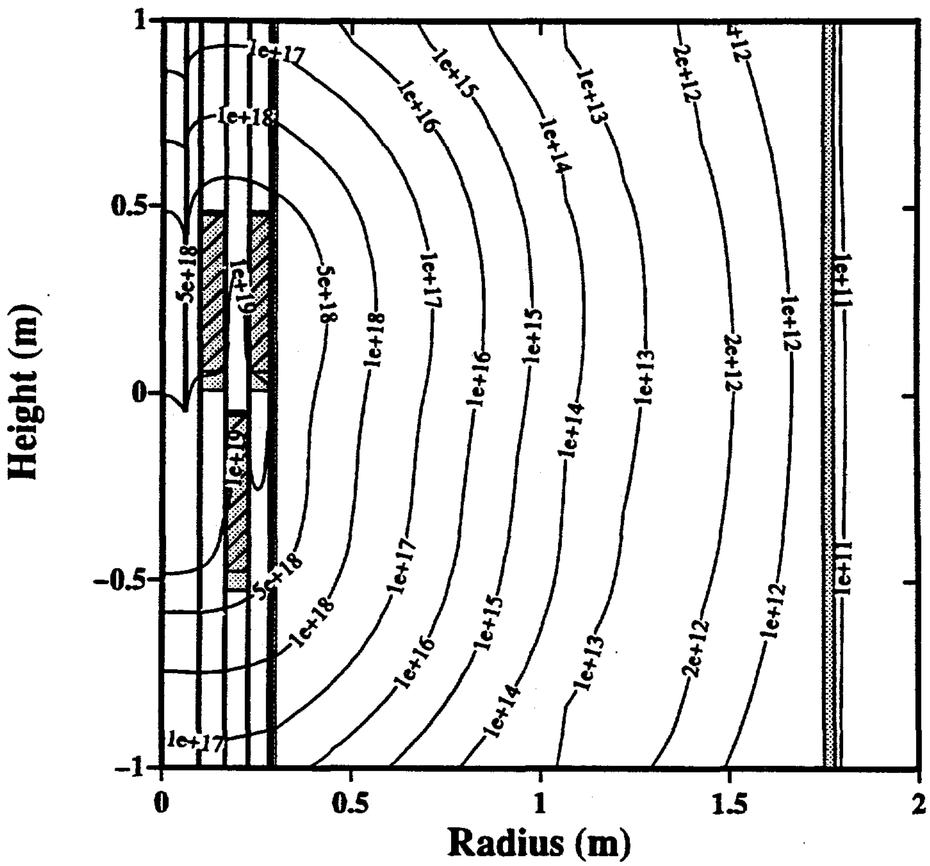

Fig. 4.9. Unperturbed epithermal (0.625 eV < E < 100 eV) neutron flux contours at BOC.

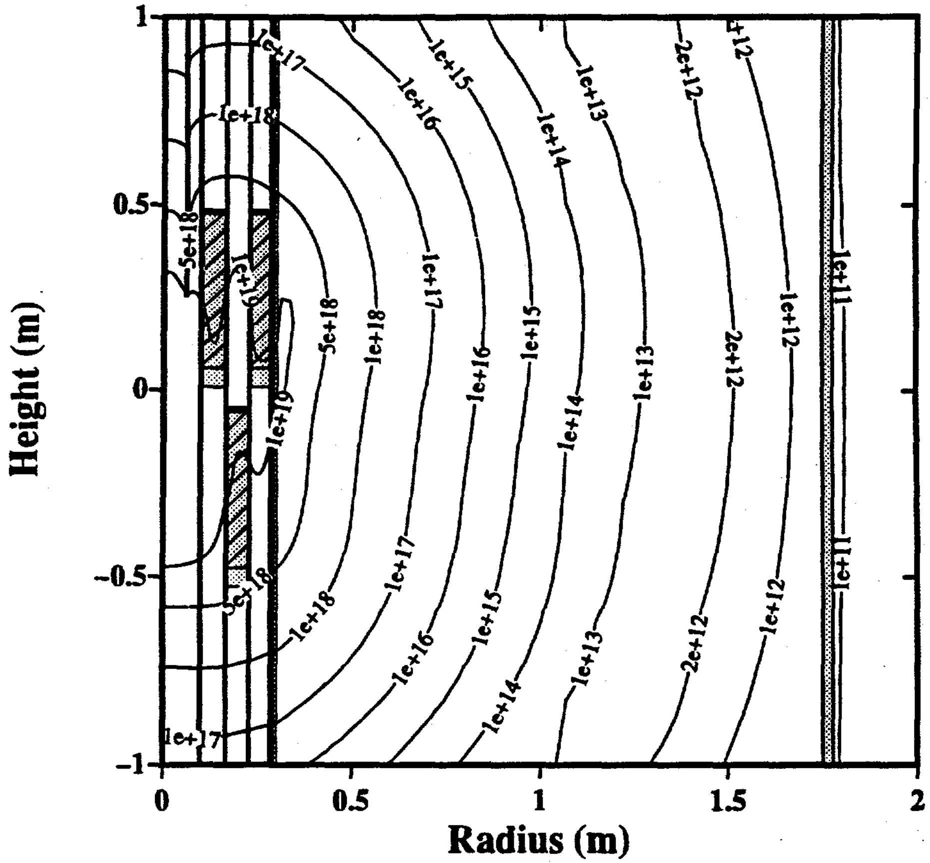

Fig. 4.10. Unperturbed epithermal (0.625 eV < E < 100 eV) neutron flux contours at MOC.

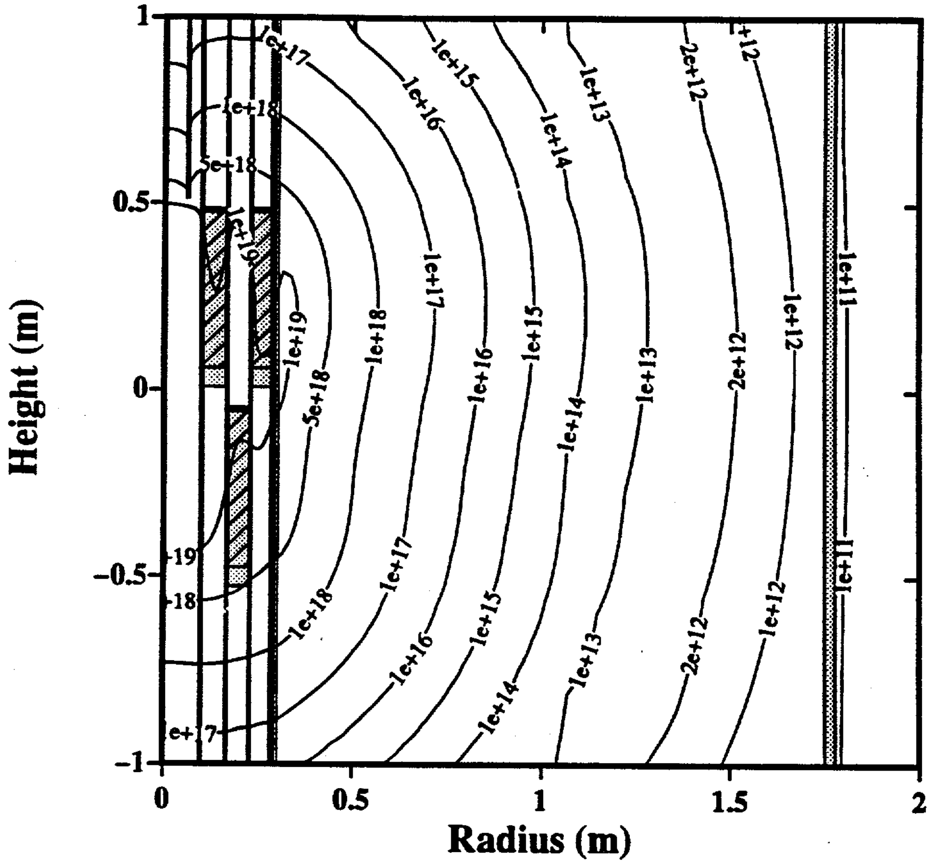

Fig. 4.11. Unperturbed epithermal (0.625 eV < E < 100 eV) neutron flux contours at EOC.

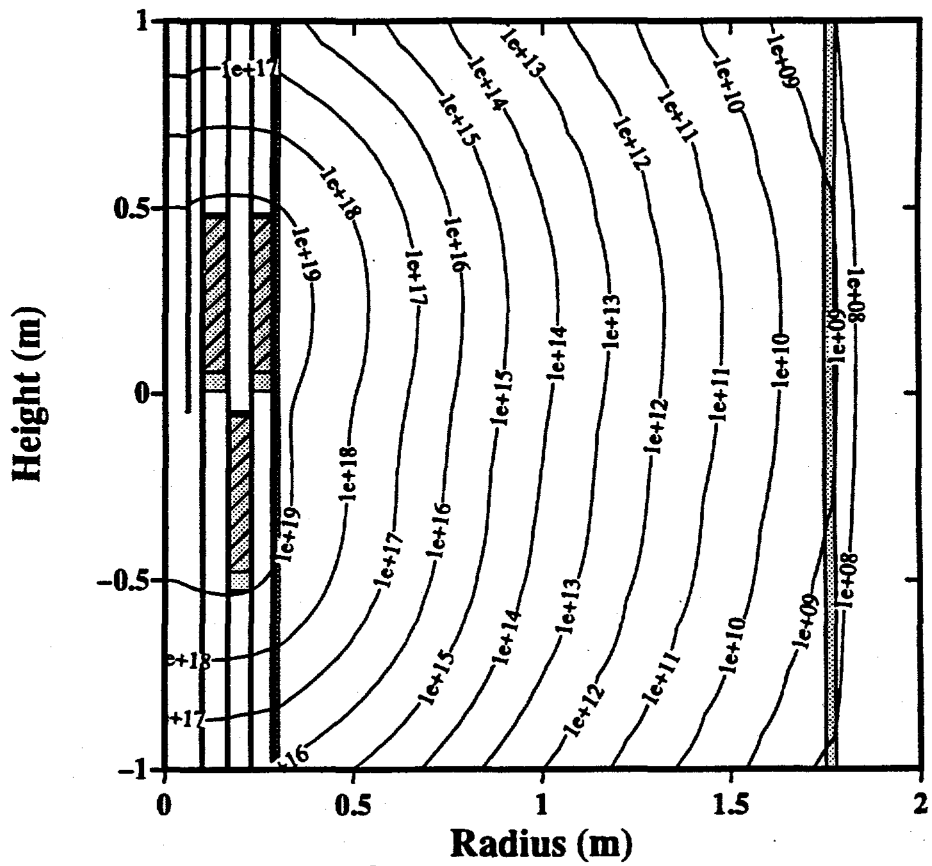

Fig. 4.12. Unperturbed upper-epithermal (100 eV < E < 100 keV) neutron flux contours at BOC.

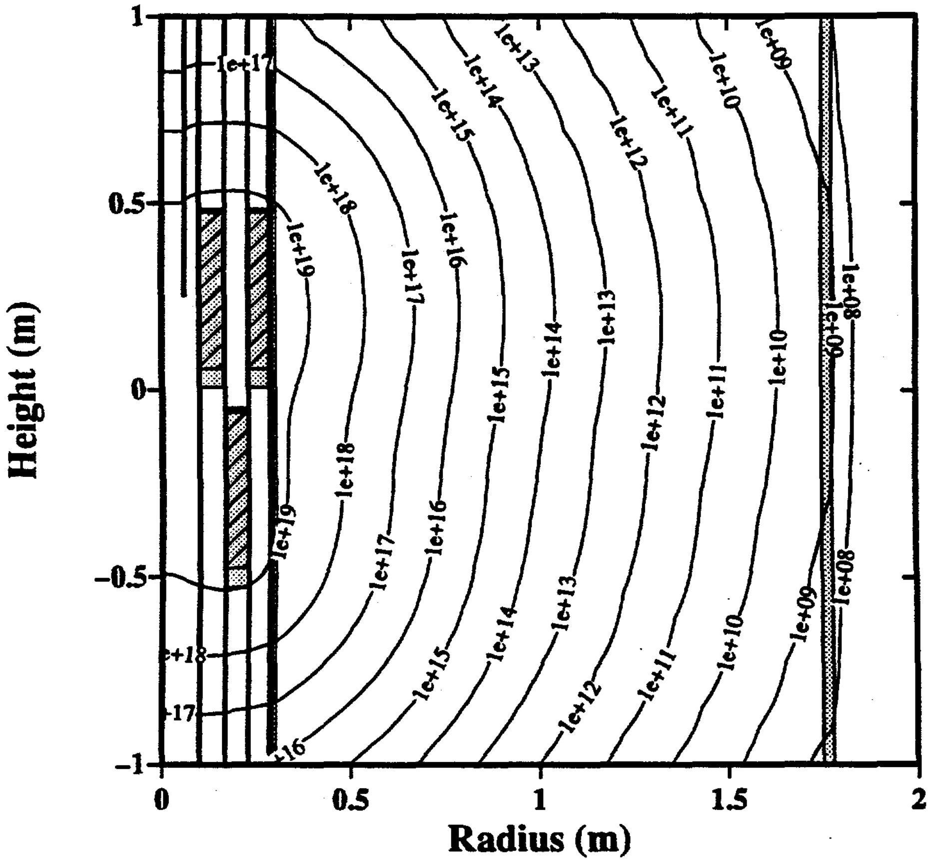

Fig. 4.13. Unperturbed upper-epithermal (100 eV < E < 100 keV) neutron flux contours at MOC.

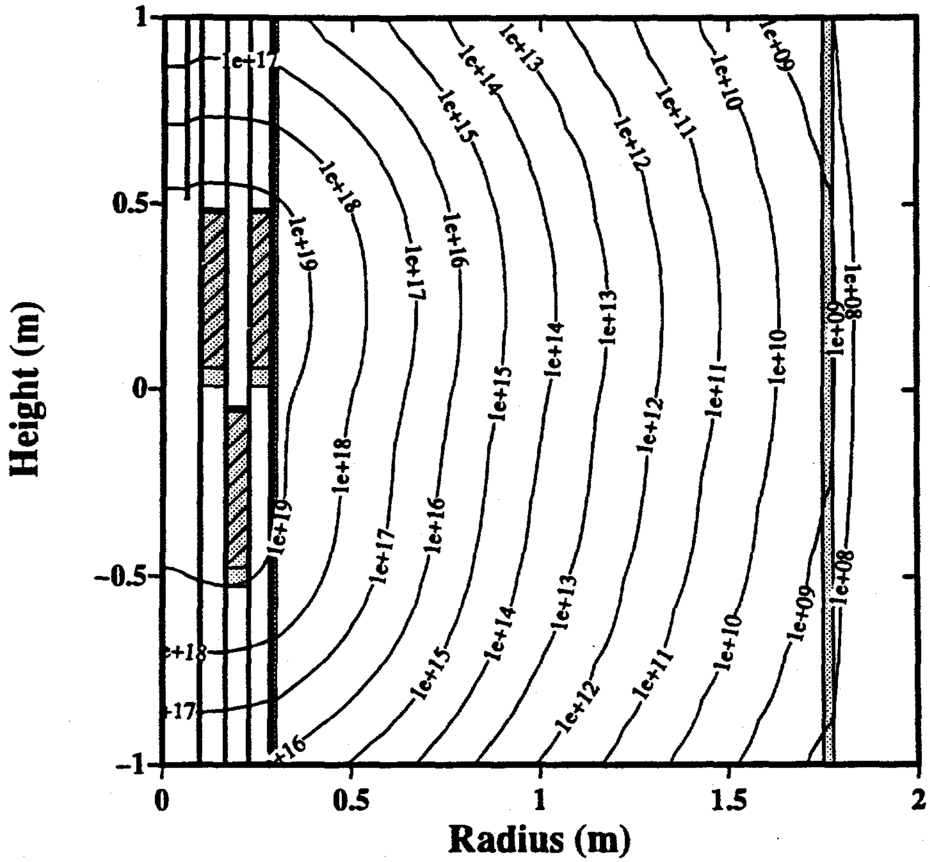

Fig. 4.14. Unperturbed upper-epithermal (100 eV < E < 100 keV) neutron flux contours at EOC.

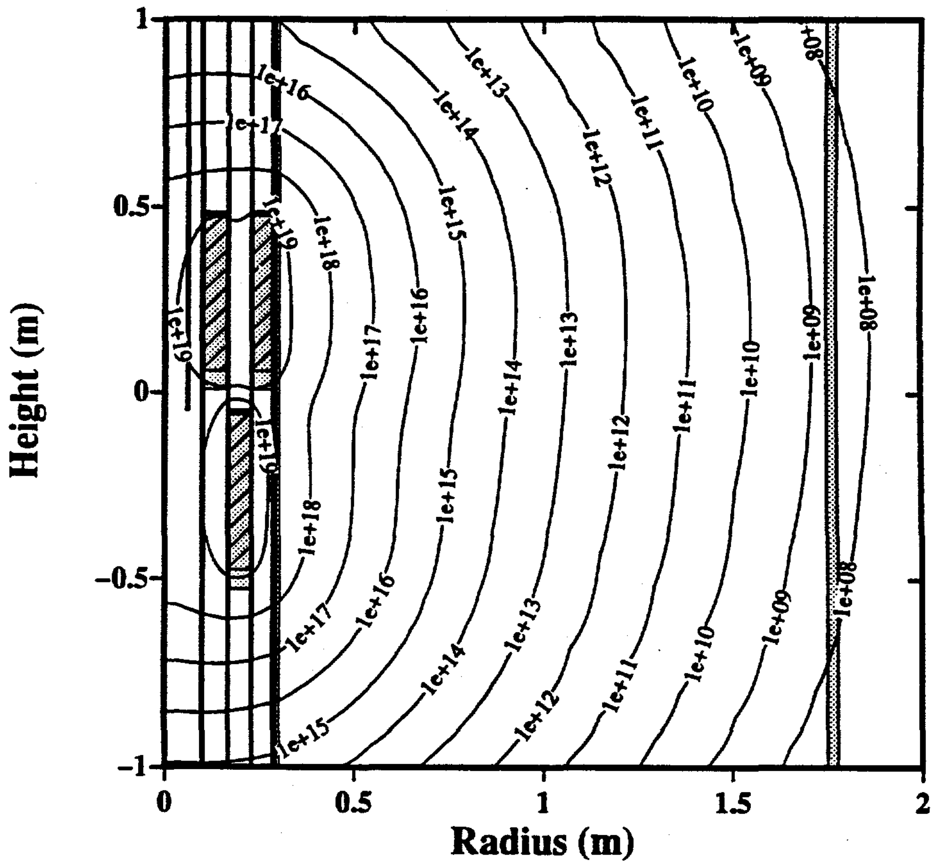

Fig. 4.15. Unperturbed fast (E > 100 keV) neutron flux contours at BOC.

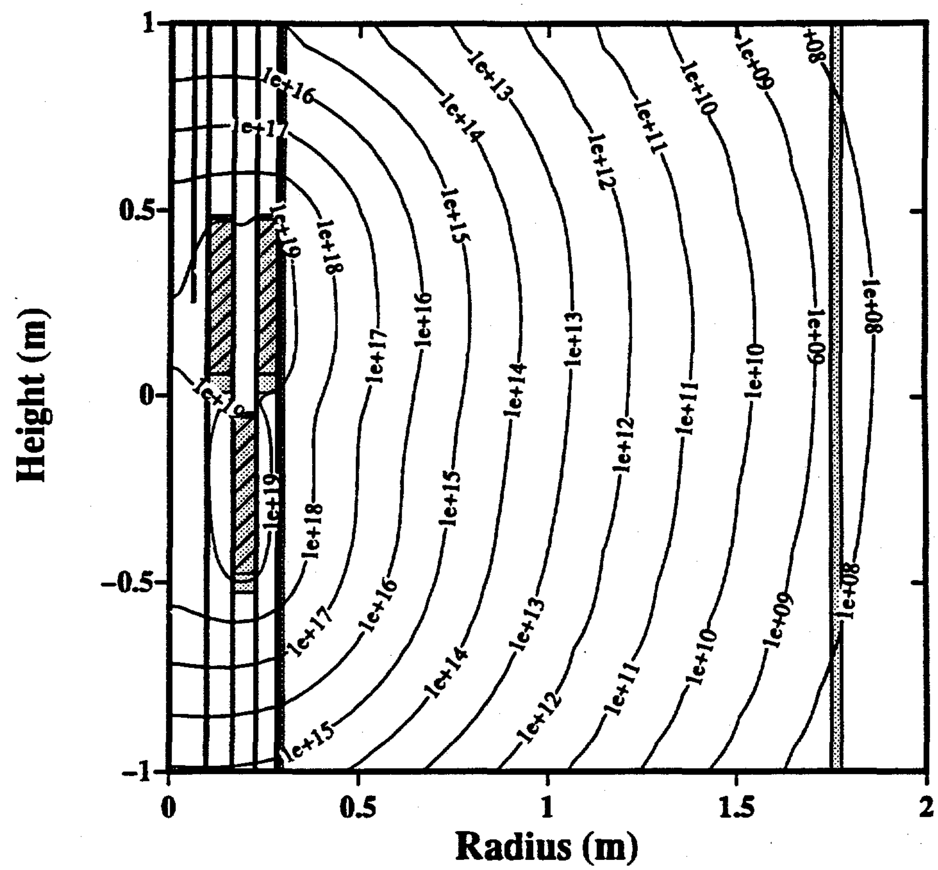

Fig. 4.16. Unperturbed fast (E > 100 keV) neutron flux contours at MOC.

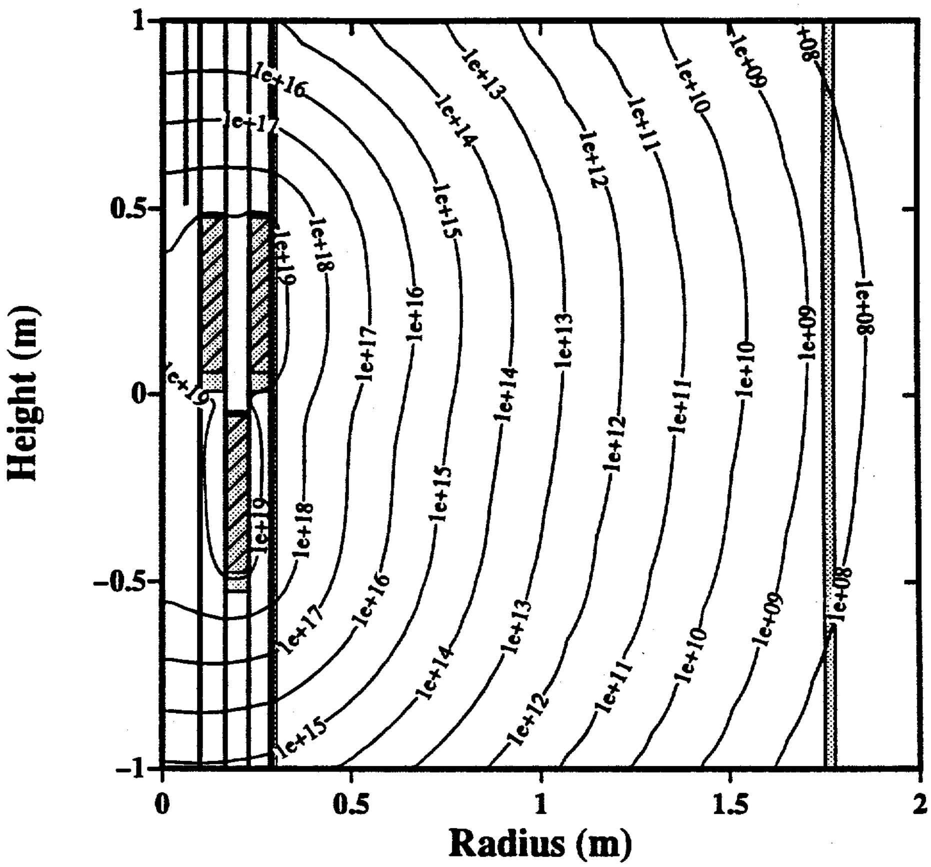

Fig. 4.17. Unperturbed fast (E > 100 keV) neutron flux contours at EOC.

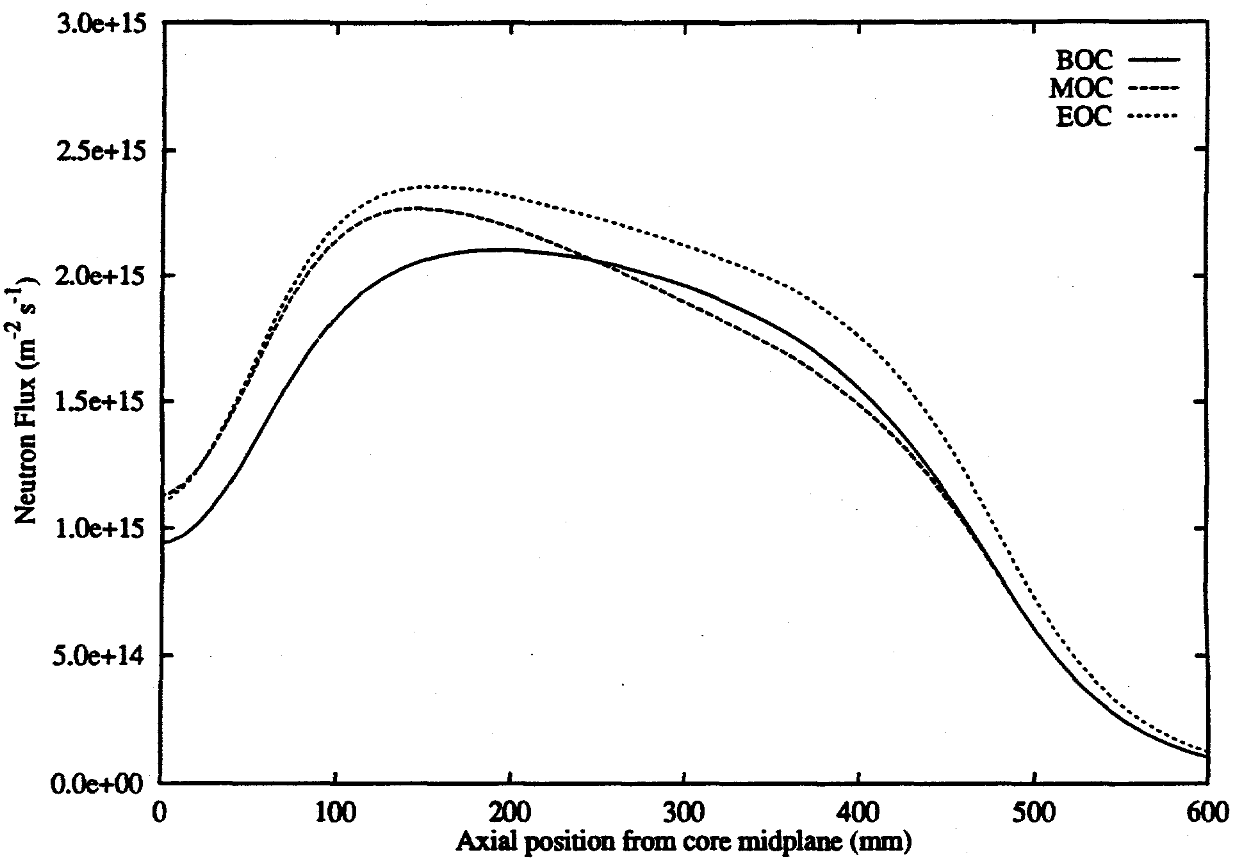

Fig. 4.18. Unperturbed fast (E > 100 keV) neutron fluxes in target region.

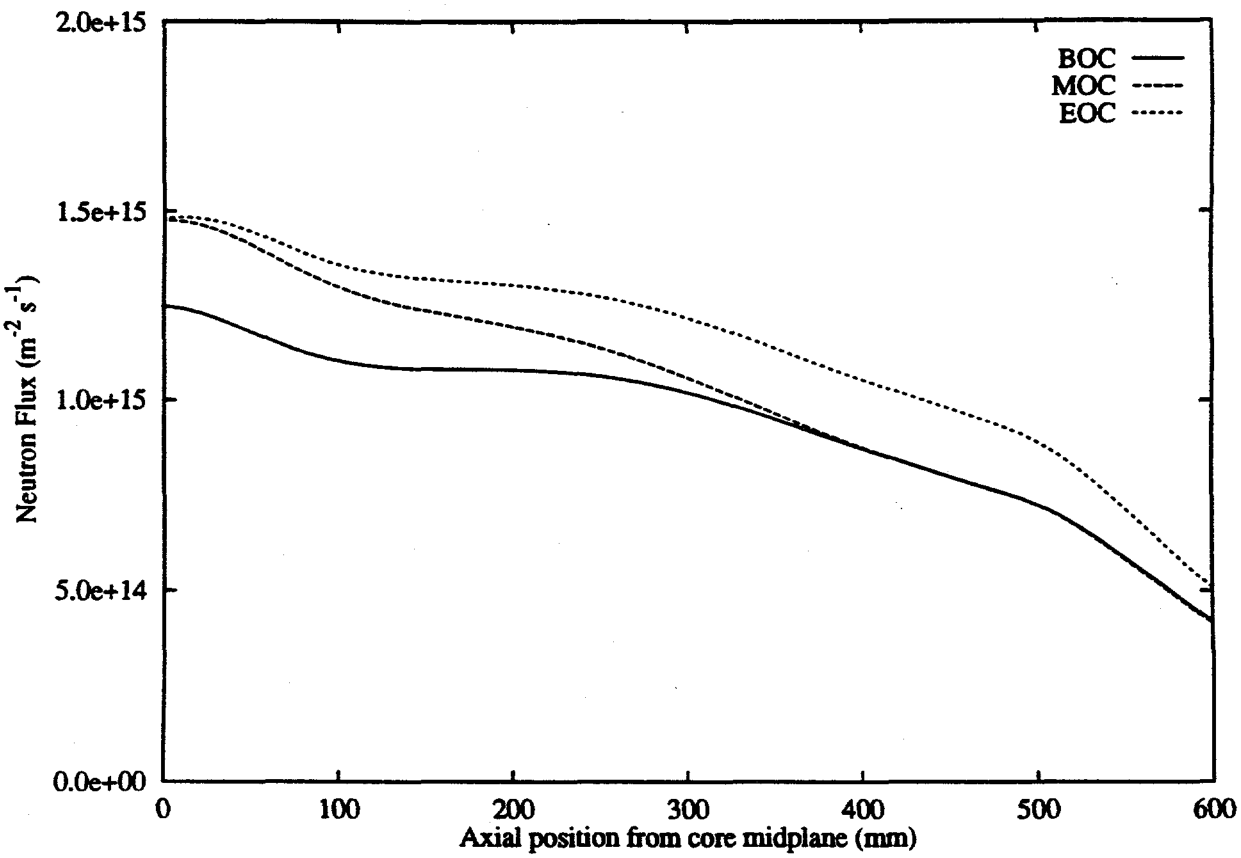

Fig. 4.19. Unperturbed epithermal (0.625 eV < E < 100 eV) neutron fluxes in target region.

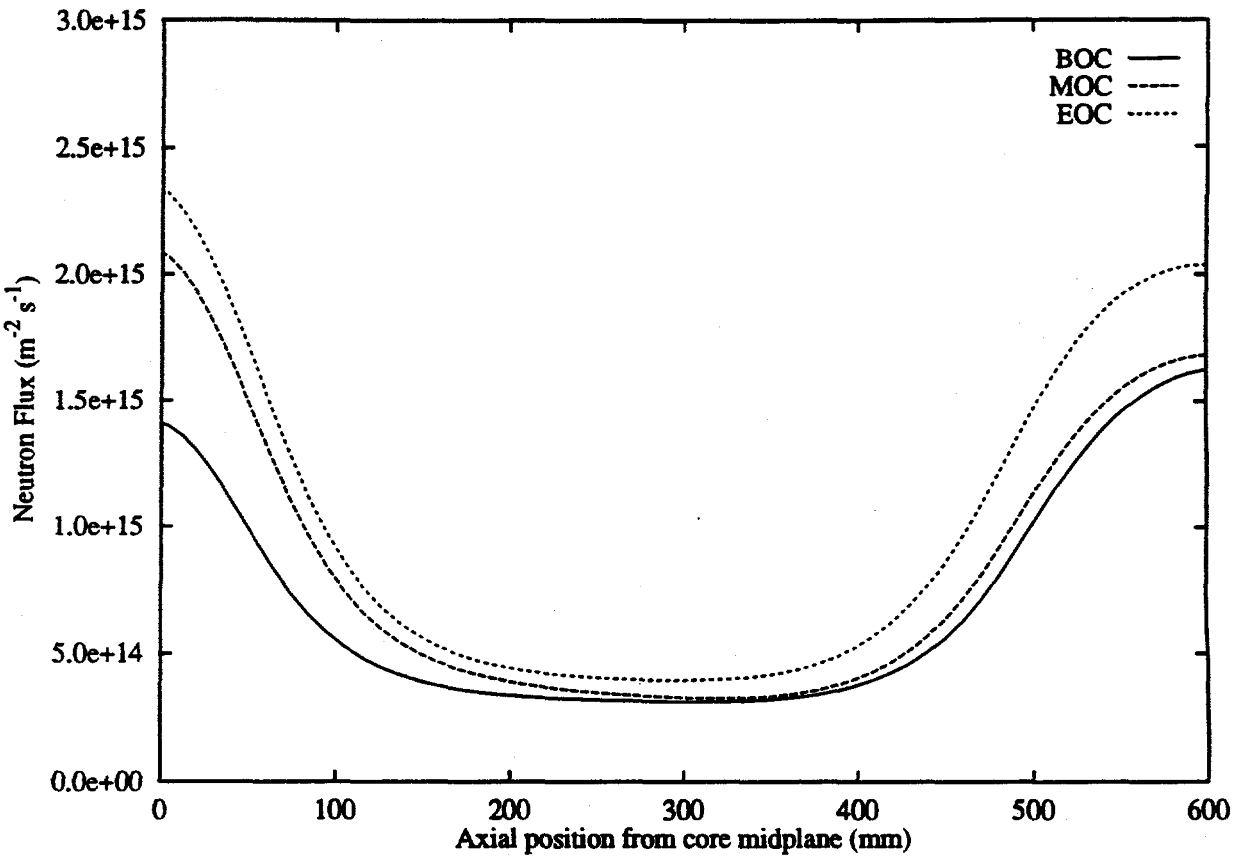

Fig. 4.20. Unperturbed thermal (E < 0.625 eV) neutron fluxes in target region.

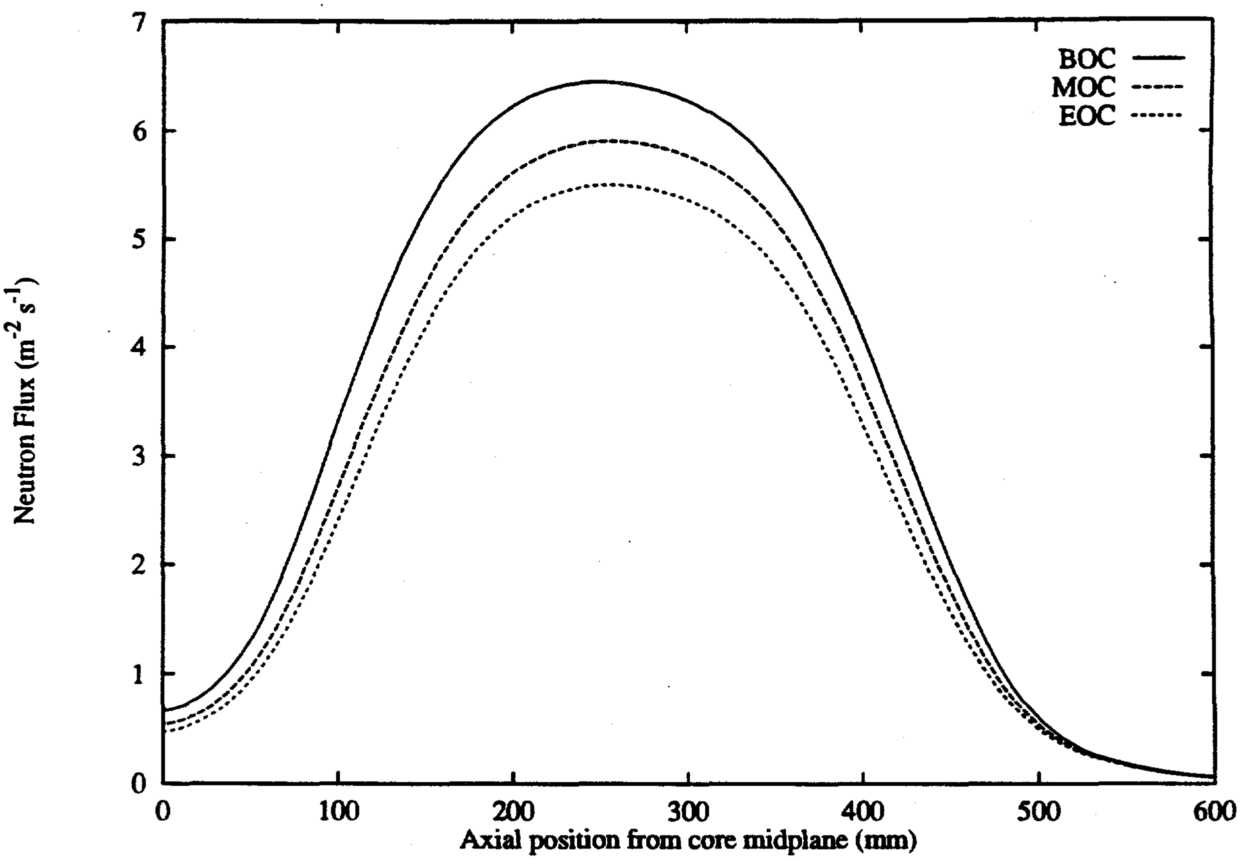

Fig. 4.21. Unperturbed fast-to-thermal neutron flux ratio in target region.

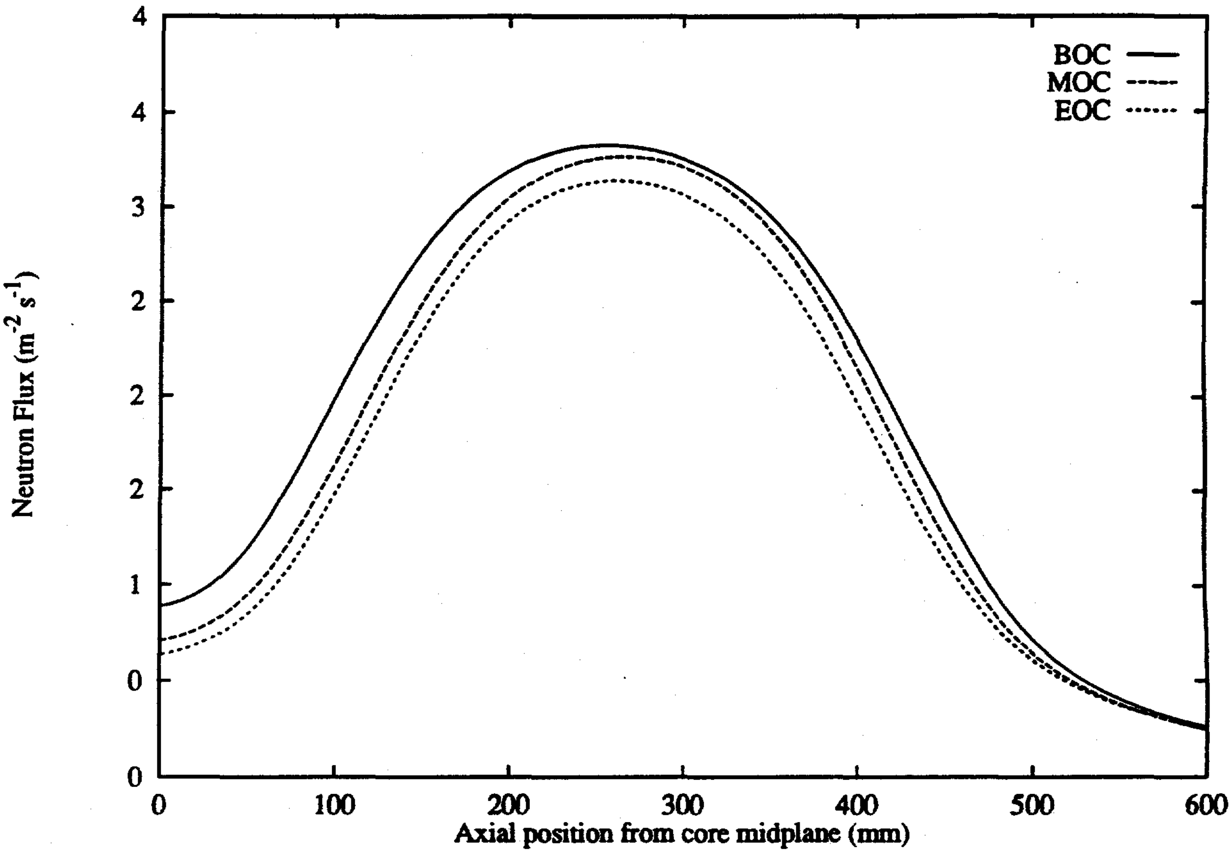

Fig. 4.22. Unperturbed epithermal-to-thermal neutron flux ratio in target region.

4.5 CENTRAL CONTROL ROD WORTH CURVES

By performing effective multiplication factor calculations at different rod positions, the reactivity versus control rod position can be determined for any specific time in the cycle. The integral and differential control rod reactivity worths are presented in Figs. 4.23 and 4.24, respectively, for BOC, MOC, and EOC conditions. The results are also provided in tabular form in Tables 4.3 and 4.4. The CCRs have the least differential worth when fully inserted or when fully withdrawn from the core. The maximum differential reactivity worth occurs when the rods are near midplane. At BOC, the burnable absorber causes a slight "dip" in the CCR rod worth when the rods are located near the core midplane. This effect does not occur later in the fuel cycle when much of the burnable absorber has been depleted.

4.6 REACTIVITY COEFFICIENTS

Calculations have been performed to estimate the impact that changes in fuel temperature, heavy water density, light water contamination, fuel loading, and boron loading have on the core reactivity. Direct effective multiplication factor calculations were performed for large changes in conditions, which also required recalculation of the nuclear cross sections. The effect on reactivity of small localized changes from the reference operating conditions were computed using the PERTURBAT module[15] of the VENTURE system, which is based on first-order perturbation theory. The use of perturbation theory allows the calculation of the small reactivity changes without performing an excessive number of eigenvalue calculations. In most cases, the total change in reactivity caused by the perturbation was also computed using direct eigenvalue calculations. The total computed from the direct eigenvalue calculation can be compared to the sum of the perturbations computed using first-order perturbation theory to determine the accuracy of the perturbation theory calculation. Note that since first-order perturbation theory is linear, the total perturbation is simply the sum of the smaller perturbations, which is valid only for small perturbations that do not effect one another.

4.6.1 Fuel Temperature

The isothermal Doppler coefficient was computed by creating an additional cross section set at fuel temperature of 550 K (the standard cross section set was created with a fuel temperature of 350 K) and evaluating the effective multiplication factor. Perturbation theory calculations were used to evaluate the effect of a temperature change in each fuel element. The resulting Doppler coefficients at BOC, MOC, and EOC are given in Table 4.5 for each fuel element and the entire core. As these results show, the Doppler coefficients are negative and rather small. This is a result of the medium enrichment fuel and the use of heavy water coolant that results in a hard spectrum in the fuel region. Most of the neutron thermalization occurs outside of the fuel elements and, therefore, many of the neutrons are not affected by changes in the resonance absorption of the fuel.

4.6.2 Heavy Water Density

Calculations were performed to evaluate the effect of decreasing heavy water density in the primary system (inside of the CPBT) and in the reflector. The results of the density

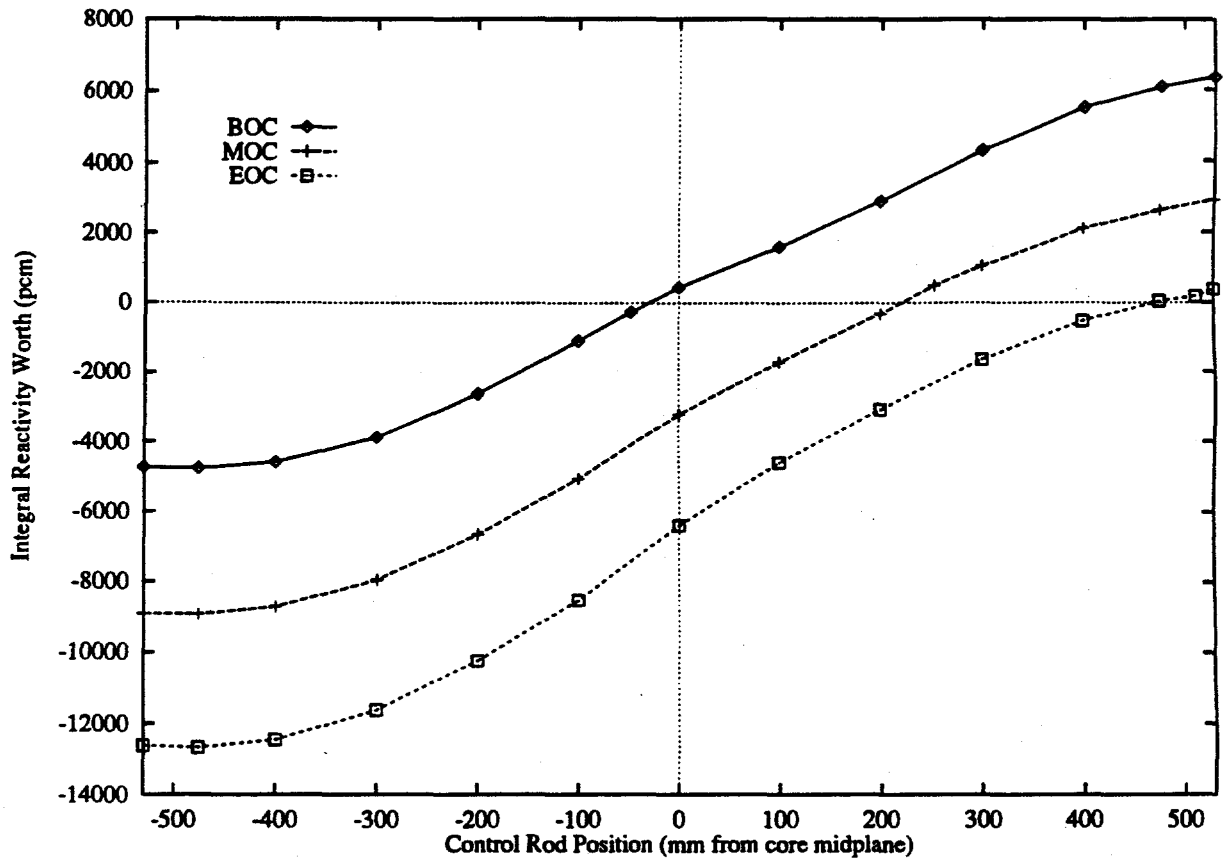

Fig. 4.23. Integral central control rod reactivity worth curves.

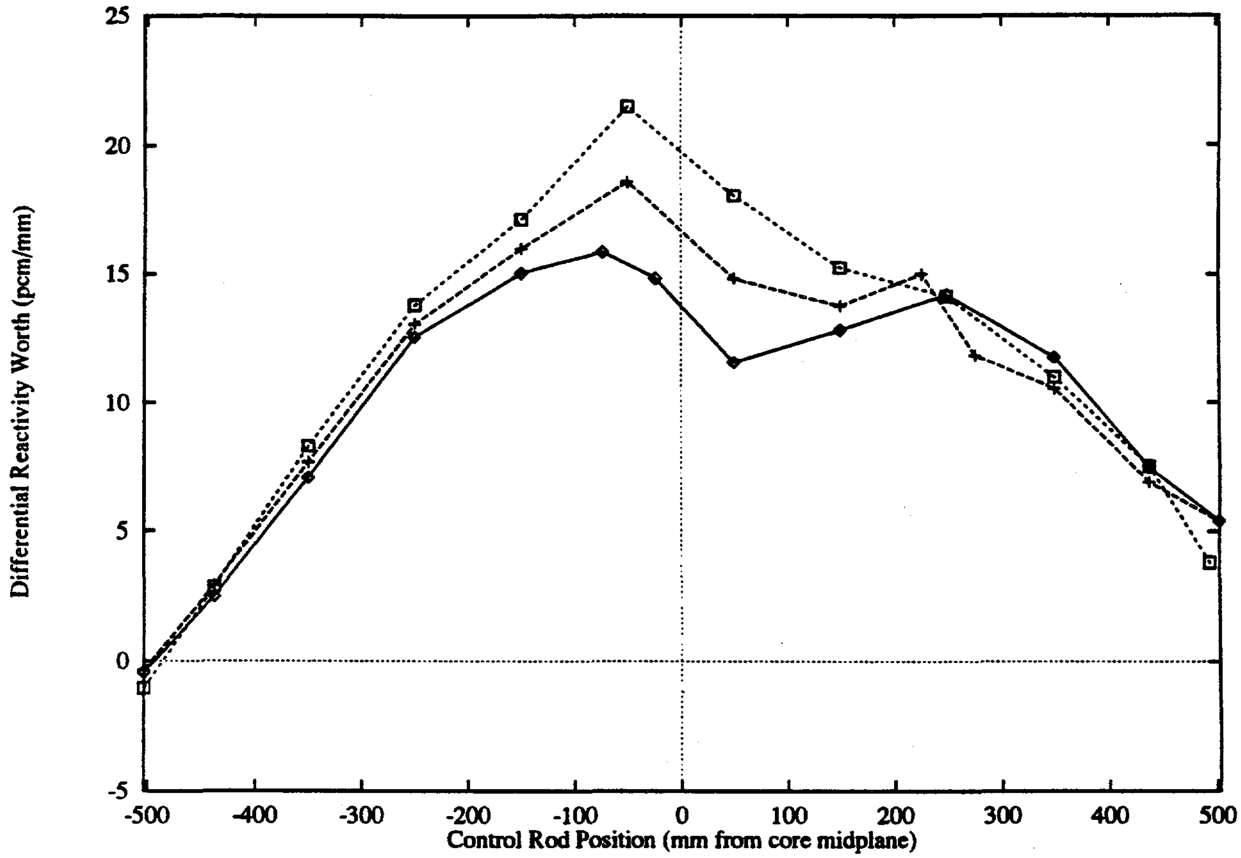

Fig. 4.24. Differential central control rod reactivity worth curves.

Table 4.3. Integral central control rod reactivity worths

Control rod position (mm from midplane)	Integral control rod worth (pcm) BOC	MOC	EOC
−530	−4740	−8927	−12620
−476	−4763	−8945	−12680
−400	−4575	−8724	−12460
−300	−3865	−7955	−11630
−200	−2607	−6647	−10250
−100	−1100	−5043	−8529
0	442	−3181	−6380
100	1602	−1695	−4572
200	2889	−3131	−3044
300	4314	1043	−1627
400	5493	2098	−527
476	6062	2624	46
530	6353	2914	385

Table 4.4. Differential central control rod reactivity worths

Control rod position (mm from midplane)	Diff. control rod worth (pcm/mm) BOC	MOC	EOC
−503	−0.4	−0.3	−1.0
−438	2.5	2.9	2.8
−350	7.1	7.7	8.3
−250	12.6	13.1	13.8
−150	15.1	16.0	17.2
−50	14.9	18.6	21.5
50	11.6	14.9	18.1
150	12.9	13.8	15.3
250	14.2	13.6	14.2
350	11.8	10.6	11.0
438	7.5	6.9	7.5
503	5.4	5.4	6.3

Table 4.5. Change in the effective multiplication factor as a result of a small increase in the fuel temperature (calculated with perturbation theory unless otherwise noted)

Location of perturbation	Reactivity coefficient (pcm/K)		
	BOC	MOC	EOC
Inner fuel element	−0.2	−0.3	−0.5
Middle fuel element	−0.6	−0.5	−0.4
Outer fuel element	−0.4	−0.4	−0.5
Total	−1.2	−1.2	−1.4
Total (from direct calculation)	−1.2	−1.1	−1.2

calculations are shown in Figs 4.25 and 4.26 for a uniform density change in the primary system and reflector, respectively. As expected, the calculations show that a decrease in the heavy water density results in a negative reactivity insertion.

The effect of localized changes in density in the core region were computed using perturbation theory and are summarized in Table 4.6. These calculations show that a decrease in density above or below the fuel elements can result in a very small increase in reactivity. This occurs because of the loss of absorption in the boron regions. As the boron is depleted throughout the cycle, the effect lessens. Also note that there is good agreement between the results of the direct calculation of the uniform density change as compared to the cumulative perturbation results.

4.6.3 Light Water Content

The heavy water cleanup system in the ANS maintains the light water contamination at a level of 0.2 mol %. Since hydrogen is a better moderator than deuterium, introduction of additional light water into the system may result in increases in reactivity. Calculations similar to those performed for the heavy water density were also performed for the light water content. Results of calculations for uniform changes in the light water content in the primary system and reflector are shown in Figs. 4.27 and 4.28. The perturbation results for the localized changes are given in Table 4.7. At BOC, the insertion of light water into the primary system always results in a positive reactivity insertion, whereas at MOC and EOC there is positive reactivity insertion for light water levels only up to about 5 and 20%, respectively.

4.6.4 Fuel Loading

Using perturbation theory, changes in the effective multiplication factor, as a result of small changes in the fuel loading, have been calculated. A summary of the results of changes in the fuel loading by fuel element at BOC, MOC, and EOC are summarized in Table 4.8. The results show that at BOC, changes in the fuel loading are most effective in the lower element. As the cycle progresses, the inner and outer fuel elements become more important and the middle element less important.

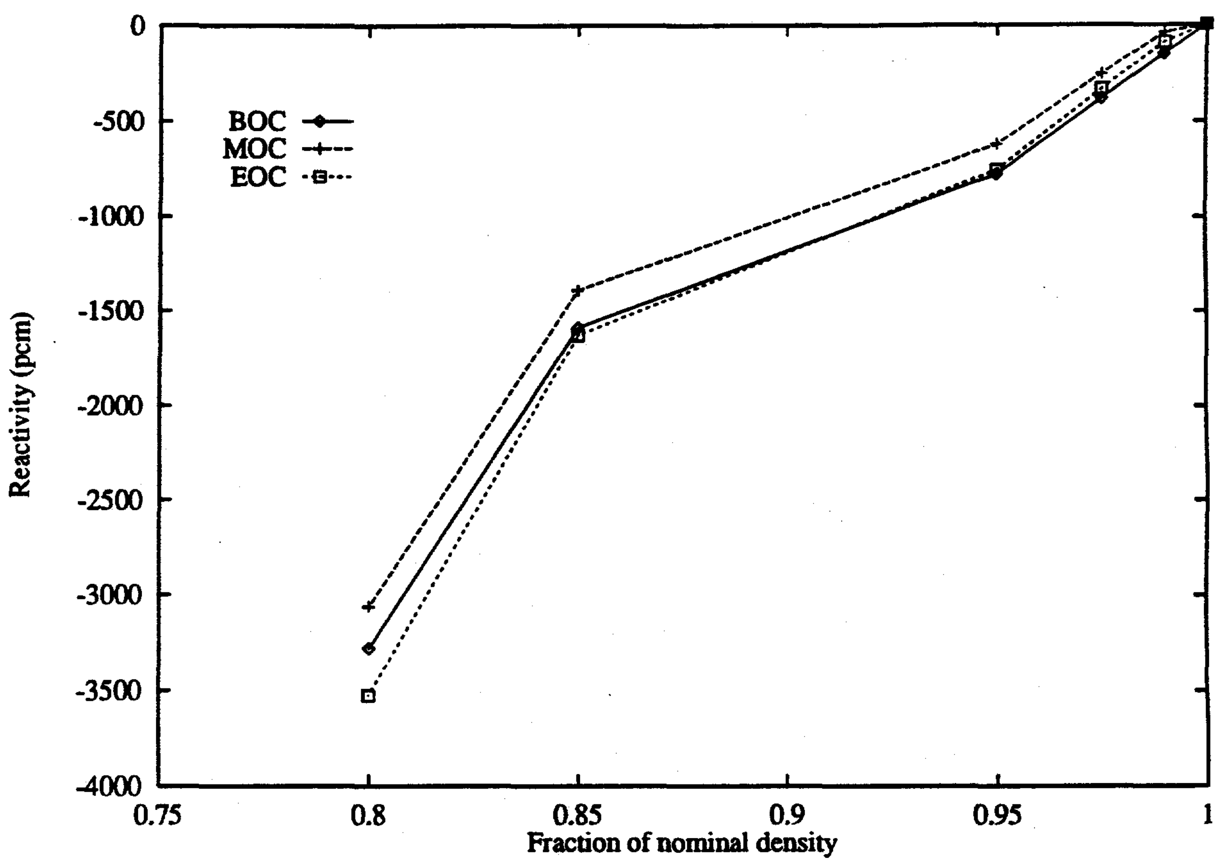

Fig. 4.25. Reactivity effect of a uniform change in heavy water density in the primary coolant.

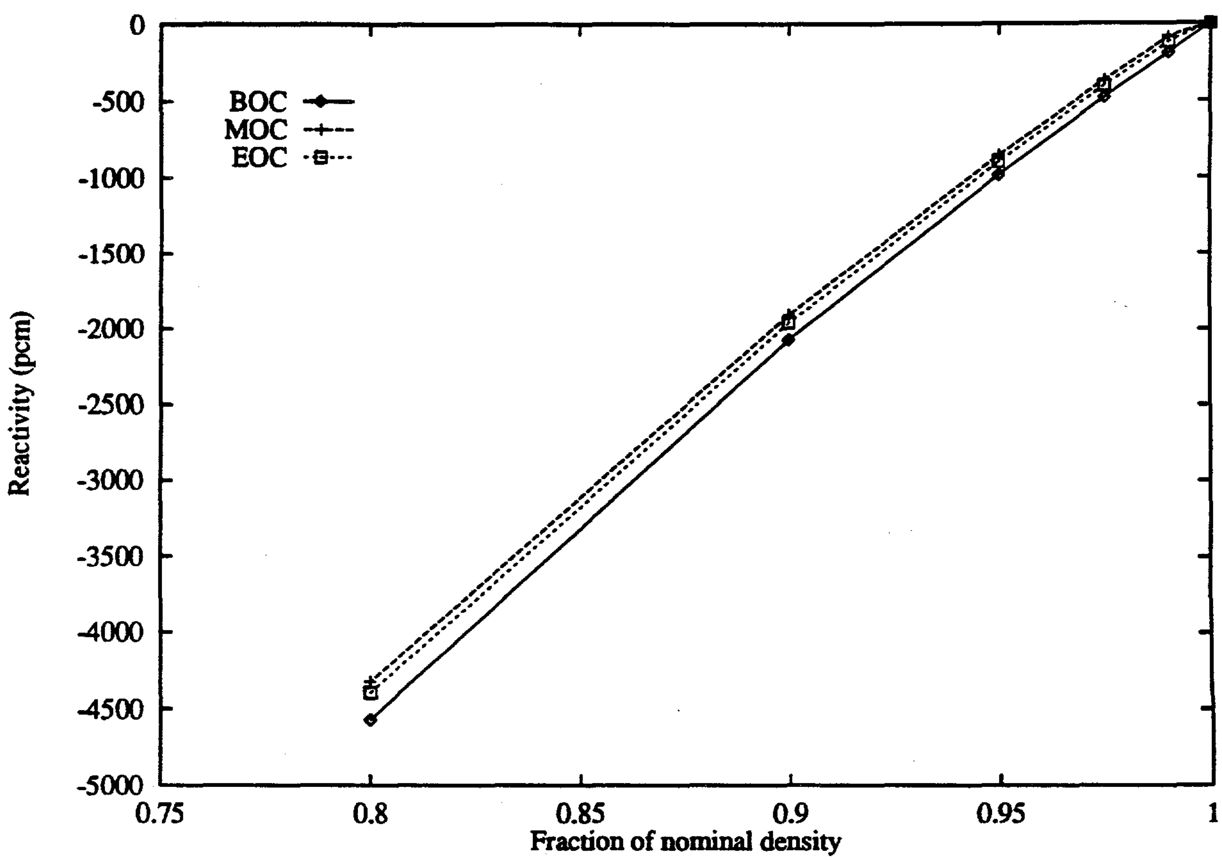

Fig. 4.26. Reactivity effect of a uniform change in heavy water density in the heavy water reflector.

Table 4.6. Change in the effective multiplication factor as a result of a small decrease in primary coolant density (computed with perturbation theory unless otherwise noted)

Location of perturbation	Reactivity coefficient (pcm/percent)		
	BOC	MOC	EOC
Central hole	−10.2	−16.2	−24.7
Inner fuel element	−7.4	−10.4	−16.4
Middle fuel element	−29.4	−22.1	−16.6
Outer fuel element	−14.8	−14.8	−17.4
Below inner element	−41.2	−34.8	−30.5
Above middle element	−16.7	−21.8	−29.7
Below outer element	−30.8	−24.6	−20.6
Bypass region	−1.7	−1.5	−1.2
Below core	0.1	0.1	0.0
Above core	0.5	0.5	0.6
Total	−152	−146	−158
Total (from direct calculation)	−149	−138	−143

Table 4.7. Change in the effective multiplication factor as a result of a small increase in the primary coolant light water content (calculated with perturbation theory unless otherwise noted)

Location of perturbation	Reactivity coefficient (pcm/percent)		
	BOC	MOC	EOC
Central hole	7.2	32.1	73.0
Inner fuel element	12.9	21.7	38.9
Middle fuel element	45.0	44.4	40.1
Outer fuel element	23.1	30.9	42.7
Below inner element	67.8	72.0	74.4
Above middle element	34.9	53.0	83.9
Below outer element	53.1	55.0	53.7
Bypass region	−3.7	−4.3	−4.7
Below core	−3.0	−0.4	−0.5
Above core	−1.5	−1.4	−1.2
Total	236	303	400
Total (from direct calculation)	215	288	386

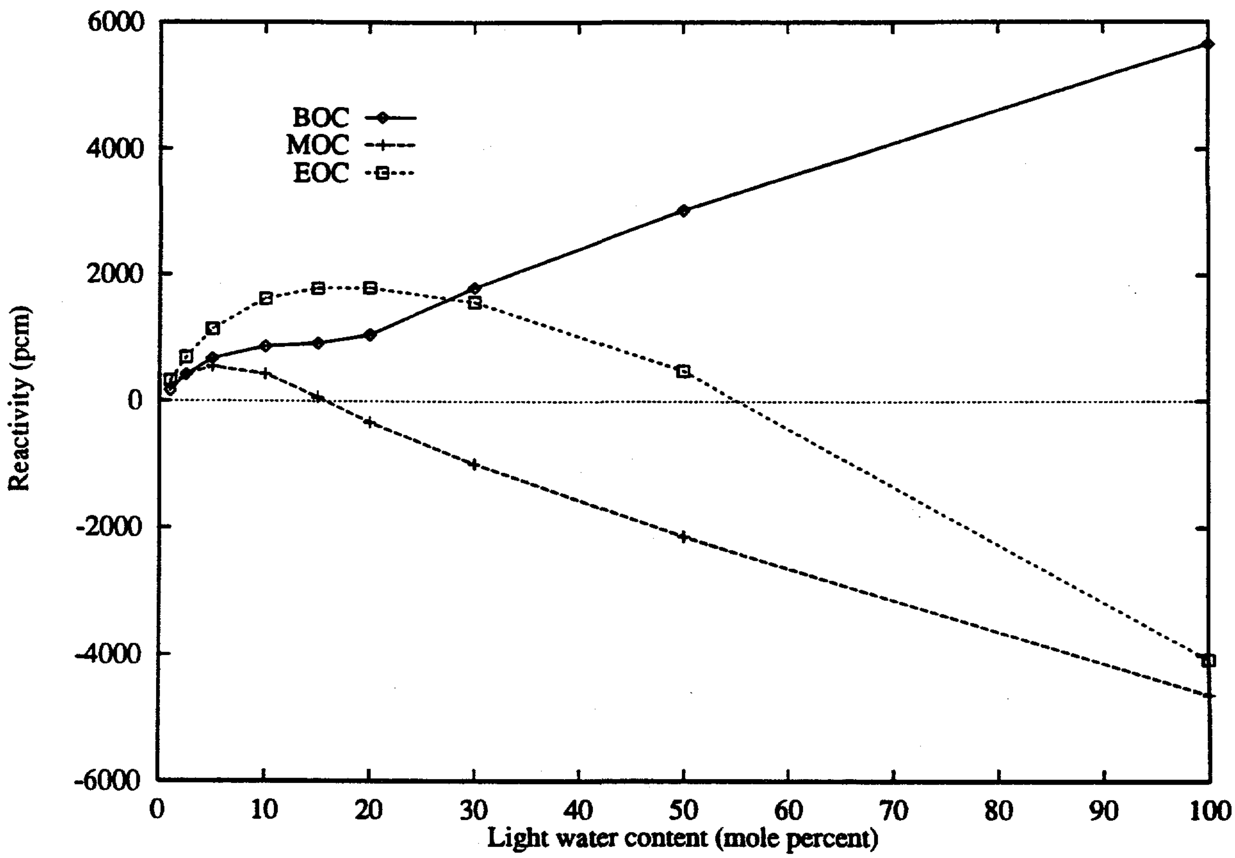

Fig. 4.27. Reactivity effect of a uniform change in light water content in the primary coolant.

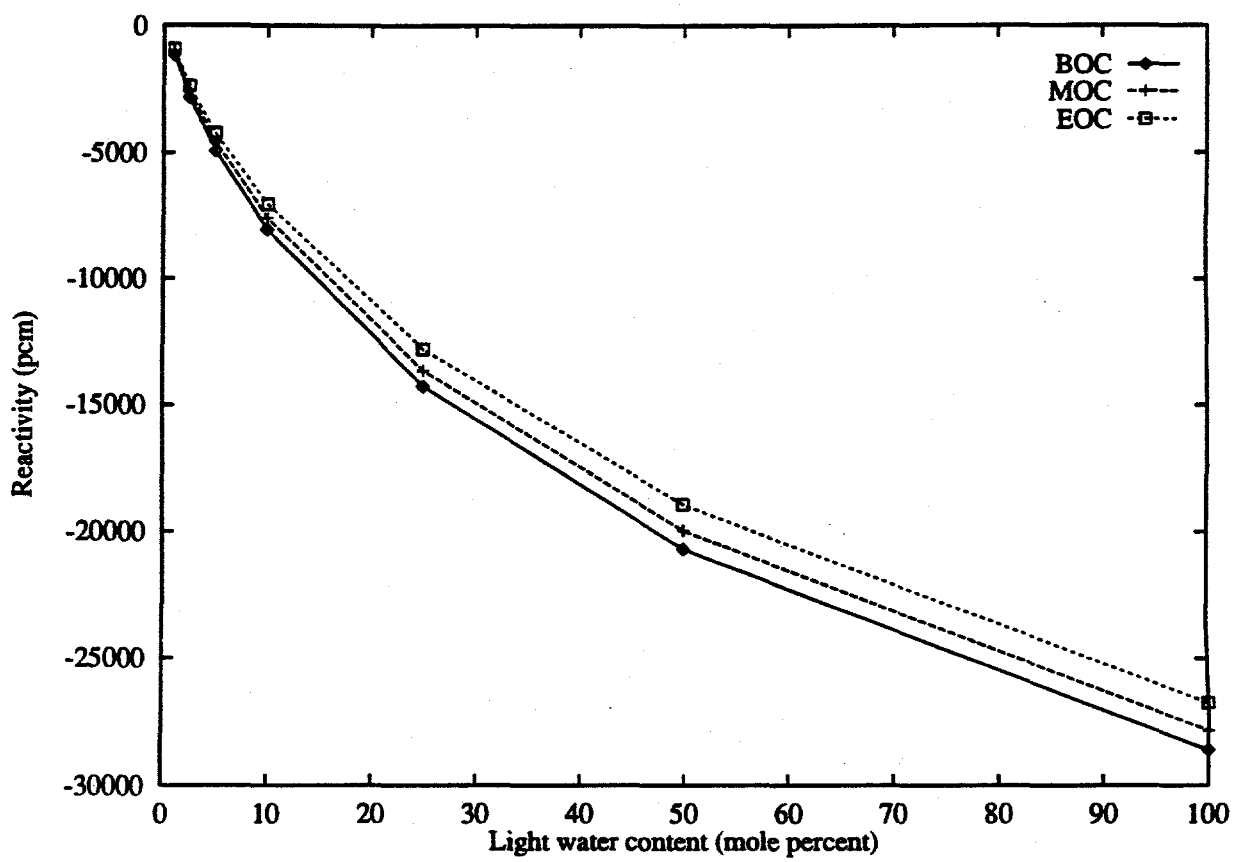

Fig. 4.28. Reactivity effect of a uniform change in light water content in the heavy water reflector.

4.6.5 Boron Loading

The impact on the effective multiplication factor caused by changes in the boron loading in each of the fuel element endcaps was computed. The results are presented in Table 4.9. The results show that changes in the boron loading result in the largest change in reactivity at BOC. Small changes in the loading in the upper endcap of the inner element result in very little reactivity change.

4.7 NEUTRON KINETICS PARAMETERS

Calculations of the delayed neutron fractions and the prompt neutron lifetime were performed at different times throughout the fuel cycle. The contribution of photoneutrons to the delayed neutron population were accounted for by using gamma flux distributions calculated in previous shielding studies[16] along with delayed photoneutron data in ref. 17. An additional calculation was performed at BOC without reflector components. The results of the calculations are summarized in Table 4.10.

The results show that both the prompt neutron lifetime and the delayed neutron fraction decrease slightly over the fuel cycle. The delayed neutron fraction is based on the typical value for thermal fission for ^{235}U of 0.0065.[17] The creation of the delayed neutrons at a lower energy than the prompt neutrons increases their importance resulting in an effective delayed neutron fraction of 0.00667. The production of photoneutrons results in an increase in the delayed neutron fraction by 0.0006. In addition, a calculation was performed to estimate the effect of the reflector components on the prompt neutron lifetime. When the reflector components were removed, the prompt neutron lifetime increased from about 0.5 ms to nearly 1 ms. This results because of the reduction of the neutron absorption in the heavy water reflector, where the neutrons have a very long lifetime.

4.8 SUMMARY

In this section the results of the analysis of the ANS three-element core design have been presented. Results included fuel cycle parameters, power distributions, neutron flux distributions, reactivity perturbations, and neutron kinetics parameters.

Table 4.8. Change in the effective multiplication factor as a result of a small increase in the ^{235}U loading (computed with perturbation theory)

Location of perturbation	Reactivity coefficient (pcm/percent)		
	BOC	MOC	EOC
Inner fuel element	28.1	46.1	60.1
Middle fuel element	94.3	107.7	85.7
Outer fuel element	52.5	74.8	85.2
Total	175	229	231

Table 4.9. Change in the effective multiplication factor as a result of a small decrease in the ^{10}B loading (computed with perturbation theory)

Location of perturbation		Reactivity coefficient (pcm/percent)		
		BOC	MOC	EOC
Inner fuel element	upper endcap	0.0	0.0	0.0
	lower endcap	4.9	7.1	1.5
Middle fuel element	upper endcap	12.3	6.0	0.2
	lower endcap	11.7	3.2	0.2
Outer fuel element	upper endcap	3.1	1.9	1.0
	lower endcap	13.2	4.6	0.2
Total		45.2	22.8	3.1

Table 4.10. Prompt neutron lifetime and effective delayed neutron fractions

Case	Prompt neutron (ms)	Delayed neutron fraction	
		without photoneutrons	with photoneutrons
BOC	0.541	0.00667	0.00727
MOC	0.525	0.00657	0.00717
EOC	0.499	0.00646	0.00706
BOC (no reflector components)	0.971	0.00663	0.00723

5. CONCLUSIONS

In this report the reactor physics analysis of the ANS three-element reactor core has been presented. The analysis included the development of ANS-specific, few-group cross sections and an *r-z* reactor model with equivalent models for the CCRs, targets, and reflector components. All calculations were performed with a 20-energy group, finite-difference diffusion theory model.

The results of several calculations were presented. These include fuel cycle parameters, fuel element power distributions, unperturbed neutron fluxes in the reflector and target regions, reactivity perturbations, and neutron kinetics parameters.

Some comparison can be made with the base-line ANS two-element core configuration with highly enriched fuel. The three-element core configuration, with medium enrichment fuel in these calculations, requires 31 kg of ^{235}U versus approximately 24 kg for the two-element configuration. The peak thermal flux in the three-element core is smaller, 5×10^{19} $m^{-2} \cdot s^{-1}$ versus 7×10^{19} $m^{-2} \cdot s^{-1}$, but just meets the minimum goals of the project.

6. REFERENCES

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APPENDIX A

ANS THREE-ELEMENT-CORE FUEL GRADING

Table A.1. Fuel meat thickness (mm) in inner element

Radius (mm)

Distance from top of element (mm)	1.2	3.6	6.4	9.4	12.4	15.4	18.4	21.4	24.4	27.4	30.4	33.4	36.4	39.4	42.4	45.4	48.4	51.4	54.1	56.5
5.2	.291	.295	.299	.301	.302	.301	.300	.297	.293	.288	.283	.277	.271	.265	.258	.252	.245	.239	.233	.228
15.7	.337	.344	.351	.356	.358	.359	.357	.353	.348	.341	.333	.324	.314	.305	.295	.285	.276	.267	.259	.253
26.1	.388	.400	.411	.419	.425	.427	.425	.420	.412	.402	.390	.377	.364	.350	.336	.323	.310	.298	.288	.279
36.6	.445	.462	.480	.494	.504	.508	.507	.500	.489	.475	.458	.439	.420	.401	.382	.364	.347	.332	.318	.307
47.0	.507	.532	.557	.580	.596	.604	.604	.596	.581	.561	.537	.511	.485	.459	.434	.410	.388	.368	.351	.337
57.5	.571	.605	.641	.675	.700	.715	.717	.708	.688	.660	.628	.593	.558	.523	.490	.459	.431	.406	.385	.367
67.9	.636	.679	.728	.737	.737	.737	.737	.737	.737	.737	.729	.683	.637	.592	.550	.512	.477	.445	.420	.399
78.4	.697	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.721	.665	.613	.566	.524	.486	.456	.431
88.8	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.678	.622	.572	.528	.492	.464
99.4	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.678	.620	.570	.529	.497
109.9	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.734	.669	.611	.565	.529
120.2	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.717	.653	.602	.562
130.6	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.695	.639	.595
141.1	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.676	.627
151.6	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.713	.660
162.1	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.693
172.4	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.726
182.9	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
193.3	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
203.8	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
214.2	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
224.7	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
235.1	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
245.6	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
256.0	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
266.4	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
276.9	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
287.4	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
297.8	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
308.1	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
318.6	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
329.2	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
339.6	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
350.1	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
360.5	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
371.0	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
381.4	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
391.9	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737
402.3	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.730
412.8	.700	.723	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.730	.704	.681	.661

Table A.2. Fuel meat thickness (mm) in middle element

Distance from top of element (mm)	Radius (mm)																			
	1.1	3.0	5.5	8.5	11.2	14.0	16.7	19.5	22.2	25.0	27.7	30.5	33.2	36.0	38.7	41.5	44.2	47.2	49.9	51.9
5.2	.264	.273	.290	.306	.320	.329	.334	.337	.338	.336	.333	.327	.321	.313	.304	.291	.273	.246	.214	.189
15.7	.283	.293	.310	.328	.342	.352	.358	.361	.362	.360	.356	.350	.342	.333	.323	.310	.290	.260	.224	.195
26.1	.307	.318	.337	.356	.372	.383	.390	.394	.394	.392	.388	.380	.371	.360	.348	.333	.312	.279	.236	.200
36.6	.328	.340	.360	.381	.398	.410	.418	.422	.423	.421	.415	.406	.395	.383	.369	.353	.331	.294	.246	.206
47.0	.341	.353	.374	.396	.414	.428	.436	.441	.441	.438	.432	.422	.410	.397	.382	.364	.341	.303	.253	.210
57.5	.349	.361	.383	.405	.424	.438	.447	.452	.453	.449	.442	.431	.418	.404	.388	.370	.346	.308	.257	.214
67.9	.356	.369	.390	.413	.432	.447	.456	.461	.462	.458	.451	.439	.425	.410	.393	.375	.350	.312	.261	.218
78.4	.363	.375	.397	.420	.439	.454	.465	.470	.470	.466	.458	.446	.432	.416	.398	.379	.355	.316	.265	.222
88.8	.370	.381	.403	.426	.446	.461	.472	.477	.477	.473	.465	.452	.437	.421	.403	.383	.358	.320	.269	.226
99.3	.376	.387	.409	.432	.452	.467	.478	.483	.483	.479	.470	.457	.442	.425	.407	.387	.362	.323	.272	.230
109.7	.381	.393	.414	.437	.457	.473	.483	.489	.489	.485	.476	.462	.447	.430	.411	.391	.366	.327	.276	.234
120.2	.387	.399	.420	.442	.463	.478	.489	.494	.495	.490	.481	.467	.451	.434	.415	.394	.369	.331	.280	.238
132.3	.393	.404	.425	.448	.468	.484	.495	.500	.501	.496	.486	.473	.456	.438	.419	.398	.373	.335	.285	.242
142.8	.400	.411	.431	.454	.474	.490	.501	.507	.507	.502	.493	.478	.462	.443	.423	.402	.377	.339	.289	.247
151.5	.407	.417	.438	.460	.481	.497	.509	.514	.515	.510	.500	.485	.468	.449	.428	.407	.382	.344	.294	.252
162.0	.414	.425	.445	.468	.488	.505	.517	.523	.523	.518	.507	.492	.474	.455	.434	.412	.387	.349	.299	.257
172.4	.422	.432	.453	.476	.497	.514	.526	.532	.533	.527	.516	.501	.482	.462	.440	.417	.392	.354	.305	.263
182.9	.431	.441	.461	.484	.506	.524	.537	.543	.544	.538	.527	.510	.491	.469	.447	.424	.398	.360	.311	.269
191.5	.440	.450	.471	.495	.517	.536	.549	.556	.557	.551	.539	.521	.501	.478	.454	.430	.404	.366	.318	.276
202.0	.450	.461	.481	.506	.529	.549	.563	.571	.571	.565	.552	.534	.512	.488	.463	.438	.411	.373	.325	.283
214.2	.462	.472	.493	.518	.543	.564	.579	.588	.588	.582	.568	.548	.524	.499	.472	.446	.419	.381	.332	.291
224.7	.473	.484	.505	.532	.558	.581	.598	.607	.608	.600	.585	.563	.538	.511	.482	.455	.427	.389	.340	.299
235.1	.486	.497	.519	.547	.575	.600	.619	.629	.630	.622	.605	.581	.554	.524	.494	.465	.436	.397	.348	.307
245.6	.500	.511	.534	.564	.594	.621	.642	.654	.656	.646	.628	.602	.571	.539	.506	.475	.445	.406	.357	.316
256.0	.514	.525	.550	.581	.614	.645	.668	.682	.684	.674	.653	.624	.590	.555	.519	.486	.455	.415	.367	.325
266.5	.528	.540	.566	.600	.636	.670	.697	.712	.715	.704	.680	.648	.611	.572	.533	.498	.465	.425	.376	.334
276.9	.543	.555	.583	.619	.659	.697	.727	.737	.737	.736	.710	.674	.632	.589	.547	.510	.476	.435	.386	.344
289.1	.558	.571	.600	.639	.682	.724	.737	.737	.737	.737	.737	.701	.655	.608	.562	.522	.487	.445	.395	.353
299.5	.572	.585	.616	.657	.705	.737	.737	.737	.737	.737	.737	.727	.677	.626	.577	.534	.497	.455	.405	.363
308.3	.584	.598	.630	.675	.725	.737	.737	.737	.737	.737	.737	.737	.698	.643	.590	.545	.507	.464	.414	.372
318.7	.595	.609	.642	.689	.737	.737	.737	.737	.737	.737	.737	.737	.717	.658	.603	.555	.515	.472	.423	.381
329.2	.602	.617	.651	.699	.737	.737	.737	.737	.737	.737	.737	.737	.732	.670	.612	.563	.522	.479	.430	.388
338.2	.607	.621	.655	.704	.737	.737	.737	.737	.737	.737	.737	.737	.737	.678	.619	.568	.527	.485	.436	.395
348.6	.607	.620	.654	.701	.737	.737	.737	.737	.737	.737	.737	.737	.737	.680	.620	.570	.529	.487	.440	.400
360.5	.600	.613	.644	.689	.737	.737	.737	.737	.737	.737	.737	.737	.733	.672	.614	.566	.527	.486	.441	.402
371.0	.587	.598	.625	.665	.713	.737	.737	.737	.737	.737	.737	.737	.710	.653	.600	.554	.519	.481	.437	.400
381.4	.567	.575	.597	.630	.671	.714	.737	.737	.737	.737	.737	.717	.671	.623	.576	.536	.505	.471	.430	.395
391.9	.541	.546	.562	.587	.619	.653	.683	.704	.713	.707	.688	.658	.621	.583	.544	.512	.486	.456	.420	.388
399.7	.514	.517	.527	.545	.568	.592	.614	.630	.637	.633	.619	.598	.571	.542	.512	.487	.466	.441	.409	.379
410.1	.498	.498	.505	.518	.534	.553	.570	.581	.586	.584	.574	.558	.538	.515	.491	.470	.453	.432	.402	.375

Table A.3. Fuel meat thickness (mm) outer element

Distance from top of element (mm)	Radius (mm) 1.0	2.9	4.6	7.1	9.6	12.1	15.1	17.6	20.1	22.6	25.1	27.6	30.1	32.6	35.1	37.6	40.1	42.1	44.3	46.8
5.2	.312	.311	.311	.312	.312	.312	.310	.308	.304	.300	.296	.291	.286	.280	.272	.262	.248	.233	.218	.205
15.7	.355	.353	.354	.355	.355	.354	.353	.349	.345	.340	.334	.328	.321	.313	.304	.290	.271	.249	.227	.210
26.1	.419	.416	.418	.419	.419	.418	.416	.411	.405	.398	.390	.382	.372	.362	.350	.331	.303	.270	.240	.217
36.6	.489	.487	.488	.490	.491	.489	.485	.479	.471	.461	.450	.439	.427	.414	.399	.375	.337	.293	.253	.223
47.0	.551	.548	.550	.552	.553	.550	.545	.537	.526	.514	.501	.486	.471	.456	.438	.409	.364	.311	.264	.229
57.5	.595	.592	.595	.597	.597	.594	.588	.578	.565	.550	.534	.517	.499	.482	.462	.430	.381	.323	.272	.235
67.9	.627	.623	.627	.630	.629	.625	.618	.606	.591	.574	.555	.536	.516	.497	.475	.441	.390	.331	.278	.239
78.4	.655	.652	.656	.659	.658	.653	.644	.631	.614	.594	.574	.552	.530	.509	.486	.451	.398	.337	.283	.244
88.8	.683	.680	.684	.687	.686	.681	.670	.655	.636	.614	.592	.568	.544	.521	.497	.460	.406	.344	.289	.248
99.4	.709	.706	.710	.713	.712	.706	.694	.677	.656	.632	.607	.582	.556	.532	.507	.468	.413	.349	.294	.252
109.9	.732	.729	.734	.737	.735	.728	.715	.696	.673	.648	.621	.595	.567	.542	.515	.476	.419	.355	.298	.256
120.2	.737	.737	.737	.737	.737	.737	.734	.715	.690	.663	.635	.606	.578	.551	.523	.483	.425	.360	.303	.260
130.6	.737	.737	.737	.737	.737	.737	.737	.732	.706	.677	.647	.617	.587	.559	.531	.490	.431	.365	.307	.263
141.1	.737	.737	.737	.737	.737	.737	.737	.737	.721	.690	.659	.628	.596	.567	.538	.496	.436	.370	.311	.267
151.6	.737	.737	.737	.737	.737	.737	.737	.737	.735	.703	.671	.638	.606	.575	.545	.502	.442	.374	.315	.271
162.1	.737	.737	.737	.737	.737	.737	.737	.737	.737	.716	.682	.648	.614	.583	.552	.509	.447	.379	.319	.274
172.4	.737	.737	.737	.737	.737	.737	.737	.737	.737	.729	.693	.658	.623	.591	.559	.515	.453	.383	.323	.278
182.9	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.705	.668	.632	.599	.566	.521	.458	.388	.328	.282
193.3	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.717	.678	.641	.606	.572	.527	.463	.393	.332	.285
203.8	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.729	.689	.650	.614	.580	.533	.469	.397	.336	.289
214.2	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.700	.660	.623	.587	.540	.474	.402	.340	.293
224.7	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.712	.670	.632	.595	.546	.480	.407	.344	.296
235.1	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.725	.680	.641	.602	.553	.486	.412	.349	.300
245.6	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.691	.650	.610	.560	.491	.417	.353	.304
256.0	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.701	.658	.618	.566	.497	.422	.357	.308
266.4	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.711	.667	.625	.572	.502	.426	.361	.311
276.9	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.721	.675	.632	.578	.507	.431	.365	.315
287.4	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.729	.683	.638	.584	.512	.435	.369	.318
297.8	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.689	.644	.589	.516	.438	.372	.321
308.1	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.694	.648	.592	.519	.441	.375	.324
318.6	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.697	.651	.595	.521	.443	.377	.326
329.2	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.697	.651	.595	.522	.444	.378	.328
339.6	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.692	.648	.593	.520	.443	.378	.329
350.1	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.727	.683	.640	.587	.516	.440	.376	.328
360.5	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.711	.670	.630	.579	.510	.436	.373	.327
371.0	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.729	.689	.651	.614	.567	.501	.429	.368	.324
381.4	.737	.737	.737	.737	.737	.737	.737	.737	.737	.737	.709	.677	.643	.610	.579	.537	.478	.414	.359	.319
391.9	.644	.647	.658	.670	.677	.680	.678	.669	.655	.636	.613	.588	.561	.536	.511	.478	.434	.386	.344	.313
402.3	.522	.525	.533	.541	.547	.549	.548	.542	.533	.519	.504	.486	.467	.448	.430	.408	.380	.351	.325	.306
412.8	.441	.443	.449	.455	.459	.461	.460	.456	.449	.440	.428	.415	.401	.387	.372	.358	.342	.326	.312	.301

APPENDIX B

ANS FUEL ELEMENT POWER DISTRIBUTIONS

Table B.4. Relative power density distribution in inner element at 0 d

Radius (mm)

Distance from top of element (mm)	1.2	3.6	6.4	9.4	12.4	15.4	18.4	21.4	24.4	27.4	30.4	33.4	36.4	39.4	42.4	45.4	48.4	51.4	54.1	56.5
5.2	.30	.28	.27	.26	.25	.25	.24	.24	.24	.25	.25	.25	.26	.27	.28	.30	.32	.34	.38	.41
15.7	.31	.30	.29	.28	.28	.28	.27	.27	.28	.28	.28	.29	.29	.30	.31	.33	.34	.36	.39	.41
26.1	.32	.32	.31	.31	.31	.31	.31	.31	.31	.31	.31	.31	.32	.32	.33	.34	.36	.37	.40	.42
36.6	.34	.34	.34	.34	.34	.34	.34	.34	.34	.34	.34	.34	.34	.35	.35	.36	.37	.38	.41	.42
47.0	.36	.36	.37	.37	.38	.38	.38	.38	.38	.38	.38	.37	.37	.37	.37	.38	.39	.40	.42	.43
57.5	.39	.40	.40	.41	.42	.43	.43	.43	.43	.42	.42	.41	.41	.40	.40	.40	.41	.41	.43	.44
67.9	.42	.43	.45	.44	.43	.43	.43	.44	.45	.46	.47	.45	.44	.44	.43	.43	.43	.43	.45	.46
78.4	.46	.46	.45	.44	.43	.43	.43	.43	.44	.45	.46	.48	.49	.47	.46	.46	.45	.45	.47	.48
88.8	.48	.46	.45	.44	.43	.43	.43	.44	.44	.45	.46	.47	.49	.51	.50	.49	.48	.48	.49	.50
99.4	.48	.46	.45	.44	.44	.44	.44	.44	.44	.45	.46	.47	.49	.51	.54	.52	.51	.51	.51	.52
109.9	.48	.47	.46	.45	.44	.44	.44	.44	.45	.46	.46	.48	.49	.51	.53	.56	.55	.54	.54	.55
120.2	.49	.48	.46	.45	.45	.45	.45	.45	.45	.46	.47	.48	.49	.51	.53	.56	.58	.57	.57	.58
130.6	.50	.48	.47	.46	.46	.45	.45	.46	.46	.47	.47	.49	.50	.52	.54	.56	.60	.60	.60	.61
141.1	.50	.49	.48	.47	.46	.46	.46	.46	.47	.47	.48	.49	.50	.52	.54	.57	.60	.64	.64	.64
151.6	.51	.50	.48	.48	.47	.47	.47	.47	.47	.48	.49	.50	.51	.53	.55	.57	.60	.64	.68	.67
162.1	.52	.50	.49	.48	.48	.48	.48	.48	.48	.49	.49	.50	.52	.53	.55	.58	.61	.65	.70	.71
172.4	.52	.51	.50	.49	.49	.48	.48	.48	.49	.49	.50	.51	.52	.54	.56	.58	.61	.65	.71	.75
182.9	.53	.52	.50	.50	.49	.49	.49	.49	.49	.50	.51	.52	.53	.55	.56	.59	.62	.66	.71	.77
193.3	.54	.52	.51	.50	.50	.50	.50	.50	.50	.51	.51	.52	.54	.55	.57	.60	.63	.66	.72	.77
203.8	.54	.53	.52	.51	.50	.50	.50	.50	.51	.51	.52	.53	.54	.56	.58	.60	.63	.67	.73	.78
214.2	.55	.54	.52	.51	.51	.51	.51	.51	.51	.52	.53	.54	.55	.56	.58	.61	.64	.68	.73	.79
224.7	.56	.54	.53	.52	.51	.51	.51	.51	.52	.52	.53	.54	.55	.57	.59	.61	.64	.68	.74	.80
235.1	.56	.55	.53	.52	.52	.52	.52	.52	.52	.53	.53	.55	.56	.57	.59	.62	.65	.69	.75	.80
245.6	.56	.55	.54	.53	.52	.52	.52	.52	.53	.53	.54	.55	.56	.58	.60	.62	.66	.70	.75	.81
256.0	.57	.55	.54	.53	.53	.52	.52	.52	.53	.53	.54	.55	.57	.58	.60	.63	.66	.70	.76	.82
266.4	.57	.56	.54	.53	.53	.53	.53	.53	.53	.54	.55	.56	.57	.59	.61	.63	.67	.71	.77	.83
276.9	.58	.56	.55	.54	.53	.53	.53	.53	.53	.54	.55	.56	.57	.59	.61	.64	.67	.72	.78	.84
287.4	.58	.57	.55	.54	.53	.53	.53	.53	.54	.54	.55	.56	.58	.60	.62	.65	.68	.73	.79	.86
297.8	.59	.57	.55	.54	.54	.53	.53	.54	.54	.55	.56	.57	.58	.60	.62	.65	.69	.74	.80	.87
308.1	.59	.58	.56	.55	.54	.54	.54	.54	.54	.55	.56	.57	.59	.60	.63	.66	.70	.75	.82	.89
318.6	.60	.58	.56	.55	.54	.54	.54	.54	.55	.55	.56	.57	.59	.61	.64	.67	.71	.76	.84	.92
329.2	.61	.59	.57	.56	.55	.55	.54	.55	.55	.56	.57	.58	.60	.62	.64	.68	.72	.78	.86	.95
339.6	.63	.60	.58	.57	.56	.55	.55	.55	.56	.56	.57	.59	.60	.63	.66	.69	.74	.81	.90	.99
350.1	.65	.62	.59	.58	.56	.56	.56	.56	.56	.57	.58	.59	.61	.64	.67	.71	.76	.83	.93	1.04
360.5	.68	.64	.61	.59	.58	.57	.57	.57	.57	.58	.59	.61	.63	.65	.69	.73	.79	.87	.99	1.11
371.0	.72	.67	.64	.61	.59	.58	.58	.58	.58	.59	.60	.62	.64	.67	.71	.76	.83	.92	1.05	1.19
381.4	.78	.72	.67	.64	.62	.61	.60	.60	.60	.61	.62	.64	.67	.70	.74	.80	.88	.98	1.13	1.30
391.9	.86	.79	.73	.68	.66	.64	.63	.63	.63	.64	.65	.67	.70	.74	.78	.85	.94	1.06	1.24	1.43
402.3	.98	.88	.80	.75	.71	.69	.68	.67	.68	.68	.70	.72	.75	.79	.84	.92	1.02	1.16	1.37	1.59
412.8	1.10	1.00	.92	.84	.80	.78	.76	.76	.76	.77	.78	.80	.83	.87	.93	1.01	1.12	1.24	1.43	1.65

Table B.5. Relative power density distribution in middle element at 0 d

Radius (mm)

Distance from top of element (mm)	1.1	3.0	5.5	8.5	11.2	14.0	16.7	19.5	22.2	25.0	27.7	30.5	33.2	36.0	38.7	41.5	44.2	47.2	49.9	51.9
5.2	1.14	1.09	1.03	.98	.94	.91	.89	.87	.87	.88	.89	.92	.96	1.02	1.09	1.16	1.23	1.28	1.30	1.27
15.7	1.20	1.15	1.09	1.04	1.01	.98	.95	.94	.93	.94	.97	1.00	1.05	1.11	1.19	1.27	1.34	1.37	1.37	1.29
26.1	1.28	1.22	1.16	1.11	1.07	1.03	1.01	.99	.99	1.00	1.03	1.06	1.11	1.18	1.26	1.35	1.42	1.45	1.43	1.32
36.6	1.35	1.29	1.22	1.16	1.11	1.08	1.05	1.03	1.03	1.04	1.06	1.10	1.15	1.22	1.30	1.40	1.48	1.51	1.47	1.35
47.0	1.40	1.33	1.25	1.18	1.14	1.10	1.07	1.05	1.04	1.05	1.08	1.11	1.17	1.24	1.32	1.42	1.50	1.54	1.50	1.37
57.5	1.44	1.36	1.27	1.20	1.15	1.11	1.07	1.06	1.05	1.06	1.08	1.12	1.17	1.24	1.32	1.42	1.51	1.55	1.52	1.38
67.9	1.47	1.39	1.29	1.22	1.16	1.12	1.08	1.06	1.06	1.07	1.09	1.12	1.17	1.24	1.33	1.43	1.52	1.56	1.53	1.40
78.4	1.50	1.41	1.31	1.23	1.18	1.13	1.09	1.07	1.06	1.07	1.09	1.13	1.18	1.25	1.33	1.43	1.52	1.57	1.55	1.42
88.8	1.54	1.44	1.34	1.25	1.19	1.14	1.10	1.08	1.07	1.08	1.10	1.13	1.18	1.25	1.33	1.43	1.53	1.58	1.56	1.44
99.3	1.57	1.47	1.36	1.26	1.20	1.15	1.11	1.08	1.07	1.08	1.10	1.13	1.18	1.25	1.34	1.44	1.53	1.59	1.58	1.46
109.7	1.60	1.49	1.37	1.28	1.21	1.16	1.12	1.09	1.08	1.08	1.10	1.13	1.18	1.25	1.34	1.44	1.54	1.60	1.59	1.48
120.2	1.63	1.52	1.39	1.29	1.22	1.16	1.12	1.09	1.08	1.09	1.10	1.14	1.19	1.25	1.34	1.44	1.54	1.61	1.60	1.50
132.3	1.66	1.54	1.41	1.30	1.23	1.17	1.12	1.10	1.08	1.09	1.10	1.13	1.18	1.25	1.34	1.44	1.54	1.61	1.62	1.52
142.8	1.69	1.56	1.42	1.31	1.23	1.17	1.13	1.10	1.08	1.09	1.10	1.13	1.18	1.25	1.34	1.44	1.54	1.62	1.63	1.54
151.5	1.71	1.58	1.44	1.32	1.24	1.18	1.13	1.10	1.09	1.09	1.10	1.14	1.18	1.25	1.34	1.44	1.55	1.63	1.65	1.56
162.0	1.74	1.60	1.45	1.33	1.25	1.18	1.13	1.10	1.09	1.09	1.10	1.13	1.18	1.25	1.33	1.44	1.55	1.63	1.66	1.58
172.4	1.76	1.62	1.46	1.34	1.25	1.19	1.14	1.10	1.09	1.09	1.10	1.13	1.18	1.25	1.33	1.43	1.55	1.64	1.67	1.60
182.9	1.79	1.64	1.47	1.34	1.26	1.19	1.14	1.10	1.09	1.09	1.10	1.13	1.18	1.24	1.33	1.43	1.55	1.64	1.69	1.62
191.5	1.82	1.66	1.49	1.35	1.26	1.19	1.14	1.11	1.09	1.09	1.10	1.13	1.18	1.24	1.33	1.43	1.55	1.65	1.70	1.65
202.0	1.84	1.67	1.50	1.36	1.27	1.20	1.14	1.11	1.09	1.09	1.10	1.13	1.17	1.24	1.32	1.43	1.55	1.65	1.72	1.67
214.2	1.86	1.69	1.51	1.36	1.27	1.19	1.14	1.11	1.09	1.08	1.10	1.12	1.17	1.23	1.31	1.42	1.54	1.65	1.73	1.69
224.7	1.89	1.71	1.52	1.37	1.27	1.20	1.14	1.11	1.09	1.08	1.09	1.12	1.16	1.23	1.31	1.41	1.54	1.66	1.74	1.71
235.1	1.91	1.72	1.52	1.37	1.27	1.20	1.15	1.11	1.09	1.08	1.09	1.12	1.16	1.22	1.30	1.41	1.53	1.66	1.75	1.73
245.6	1.94	1.74	1.53	1.38	1.28	1.20	1.15	1.11	1.09	1.08	1.09	1.12	1.16	1.22	1.30	1.40	1.53	1.66	1.77	1.76
256.0	1.96	1.76	1.54	1.38	1.28	1.20	1.15	1.11	1.09	1.08	1.09	1.11	1.15	1.21	1.29	1.40	1.53	1.66	1.78	1.78
266.5	1.98	1.77	1.55	1.39	1.28	1.21	1.15	1.11	1.09	1.08	1.09	1.11	1.15	1.21	1.28	1.39	1.52	1.67	1.79	1.80
276.9	2.01	1.79	1.56	1.39	1.28	1.21	1.16	1.11	1.08	1.09	1.09	1.11	1.15	1.20	1.28	1.38	1.52	1.67	1.80	1.82
289.1	2.02	1.79	1.56	1.39	1.28	1.21	1.13	1.06	1.04	1.04	1.08	1.10	1.14	1.19	1.26	1.37	1.51	1.66	1.81	1.84
299.5	2.05	1.81	1.57	1.39	1.29	1.19	1.09	1.03	1.00	1.01	1.05	1.11	1.14	1.19	1.26	1.36	1.50	1.66	1.82	1.86
308.3	2.07	1.82	1.57	1.40	1.29	1.16	1.06	1.00	.98	.98	1.02	1.09	1.14	1.18	1.26	1.36	1.50	1.66	1.83	1.88
318.7	2.08	1.83	1.58	1.39	1.28	1.13	1.04	.98	.95	.95	.99	1.05	1.13	1.18	1.25	1.35	1.49	1.66	1.84	1.90
329.2	2.09	1.83	1.58	1.39	1.26	1.11	1.01	.96	.93	.93	.96	1.03	1.12	1.17	1.24	1.34	1.48	1.66	1.84	1.91
338.2	2.10	1.84	1.57	1.39	1.24	1.09	1.00	.94	.91	.91	.94	1.01	1.11	1.16	1.23	1.33	1.47	1.66	1.85	1.93
348.6	2.10	1.83	1.57	1.37	1.23	1.08	.99	.93	.90	.90	.93	.99	1.09	1.15	1.21	1.32	1.46	1.65	1.85	1.94
360.5	2.11	1.83	1.56	1.36	1.24	1.08	.98	.92	.89	.89	.92	.98	1.08	1.13	1.20	1.30	1.45	1.64	1.86	1.95
371.0	2.11	1.83	1.55	1.35	1.22	1.10	1.00	.93	.90	.90	.93	.99	1.06	1.11	1.18	1.29	1.44	1.64	1.86	1.96
381.4	2.11	1.83	1.54	1.33	1.21	1.12	1.04	.96	.93	.93	.96	1.00	1.04	1.09	1.17	1.28	1.44	1.64	1.86	1.97
391.9	2.13	1.84	1.55	1.33	1.20	1.10	1.04	.99	.97	.96	.96	.99	1.03	1.08	1.17	1.28	1.44	1.65	1.87	1.99
399.7	2.14	1.86	1.55	1.33	1.19	1.09	1.03	.98	.95	.94	.95	.97	1.02	1.08	1.16	1.28	1.45	1.66	1.89	2.01
410.1	2.28	1.97	1.65	1.41	1.27	1.18	1.11	1.07	1.04	1.03	1.04	1.06	1.09	1.14	1.22	1.34	1.50	1.72	1.97	2.11

Table B.6. Relative power density distribution in outer element at 0 d

Radius (mm)

Distance from top of element (mm)	1.0	2.9	4.6	7.1	9.6	12.1	15.1	17.6	20.1	22.6	25.1	27.6	30.1	32.6	35.1	37.6	40.1	42.1	44.3	46.8
5.2	.67	.63	.60	.57	.55	.53	.53	.53	.54	.56	.58	.61	.65	.69	.74	.80	.85	.88	.94	1.00
15.7	.67	.62	.60	.57	.56	.54	.54	.55	.56	.58	.61	.65	.69	.75	.81	.86	.91	.92	.95	.99
26.1	.69	.64	.62	.59	.58	.57	.57	.58	.60	.62	.65	.70	.75	.81	.88	.94	.98	.97	.98	1.00
36.6	.72	.67	.64	.61	.60	.59	.59	.60	.62	.65	.69	.74	.79	.87	.95	1.02	1.05	1.02	1.00	1.00
47.0	.73	.68	.66	.62	.61	.60	.61	.62	.64	.67	.71	.76	.82	.90	.99	1.07	1.10	1.06	1.03	1.02
57.5	.73	.68	.66	.63	.61	.60	.61	.62	.65	.68	.72	.77	.84	.92	1.01	1.09	1.13	1.08	1.05	1.03
67.9	.73	.68	.66	.63	.62	.61	.62	.63	.65	.68	.72	.78	.84	.93	1.02	1.11	1.14	1.10	1.06	1.05
78.4	.73	.69	.66	.64	.62	.62	.63	.64	.66	.69	.73	.79	.85	.94	1.04	1.12	1.16	1.11	1.08	1.07
88.8	.74	.70	.67	.65	.64	.63	.64	.65	.67	.70	.75	.80	.87	.96	1.06	1.14	1.18	1.14	1.10	1.09
99.4	.75	.71	.69	.66	.65	.65	.65	.67	.69	.72	.76	.82	.88	.97	1.07	1.16	1.20	1.16	1.13	1.11
109.9	.77	.72	.70	.68	.67	.66	.67	.68	.70	.73	.78	.83	.90	.99	1.09	1.18	1.23	1.18	1.15	1.14
120.2	.77	.73	.70	.68	.67	.67	.69	.70	.72	.75	.79	.85	.92	1.01	1.11	1.20	1.25	1.20	1.17	1.16
130.6	.77	.73	.70	.68	.67	.67	.69	.72	.74	.77	.81	.86	.93	1.02	1.13	1.23	1.27	1.23	1.20	1.19
141.1	.77	.73	.71	.68	.68	.68	.70	.73	.75	.78	.82	.88	.95	1.04	1.15	1.25	1.30	1.25	1.23	1.22
151.6	.77	.74	.71	.69	.68	.68	.70	.73	.77	.80	.84	.90	.97	1.06	1.17	1.27	1.32	1.28	1.25	1.24
162.1	.78	.74	.72	.69	.69	.69	.70	.73	.78	.82	.86	.91	.98	1.08	1.19	1.29	1.35	1.30	1.28	1.27
172.4	.78	.75	.72	.70	.69	.69	.71	.74	.78	.83	.87	.93	1.00	1.10	1.21	1.32	1.37	1.33	1.31	1.30
182.9	.79	.75	.73	.70	.70	.70	.71	.74	.78	.85	.89	.95	1.02	1.11	1.23	1.34	1.39	1.35	1.33	1.33
193.3	.79	.76	.73	.71	.70	.70	.72	.75	.79	.85	.91	.96	1.04	1.13	1.25	1.36	1.42	1.38	1.36	1.36
203.8	.80	.77	.74	.72	.71	.71	.72	.75	.79	.85	.92	.98	1.05	1.15	1.27	1.38	1.44	1.41	1.39	1.39
214.2	.81	.77	.75	.72	.71	.71	.73	.75	.79	.85	.94	1.00	1.07	1.17	1.29	1.40	1.47	1.43	1.42	1.42
224.7	.81	.78	.75	.73	.72	.72	.73	.76	.80	.85	.94	1.01	1.09	1.18	1.31	1.43	1.49	1.46	1.44	1.45
235.1	.82	.78	.76	.73	.72	.72	.73	.76	.80	.86	.94	1.03	1.10	1.20	1.33	1.45	1.52	1.48	1.47	1.48
245.6	.83	.79	.76	.74	.73	.72	.74	.76	.80	.86	.94	1.05	1.12	1.22	1.35	1.47	1.54	1.51	1.50	1.51
256.0	.84	.80	.77	.74	.73	.73	.74	.77	.80	.86	.94	1.05	1.14	1.24	1.37	1.49	1.57	1.54	1.53	1.54
266.4	.85	.81	.78	.75	.74	.73	.75	.77	.81	.86	.94	1.05	1.15	1.25	1.39	1.51	1.59	1.56	1.56	1.58
276.9	.86	.82	.79	.75	.74	.74	.75	.77	.81	.86	.94	1.05	1.17	1.27	1.41	1.54	1.62	1.59	1.59	1.61
287.4	.87	.83	.79	.76	.75	.74	.75	.77	.81	.87	.94	1.05	1.18	1.29	1.42	1.56	1.64	1.62	1.62	1.64
297.8	.89	.84	.81	.77	.76	.75	.76	.78	.82	.87	.95	1.05	1.20	1.31	1.44	1.58	1.67	1.64	1.65	1.68
308.1	.91	.85	.82	.78	.76	.75	.76	.78	.82	.87	.95	1.06	1.21	1.32	1.46	1.60	1.69	1.67	1.68	1.71
318.6	.93	.88	.84	.80	.78	.76	.77	.79	.83	.88	.96	1.07	1.21	1.34	1.48	1.63	1.72	1.70	1.71	1.75
329.2	.97	.90	.86	.81	.79	.78	.78	.80	.84	.89	.97	1.08	1.23	1.36	1.50	1.65	1.74	1.73	1.74	1.78
339.6	1.01	.94	.89	.84	.81	.79	.80	.82	.85	.91	.99	1.10	1.25	1.37	1.52	1.67	1.77	1.76	1.77	1.82
350.1	1.07	.99	.93	.87	.84	.82	.82	.84	.87	.93	1.01	1.12	1.27	1.39	1.54	1.70	1.80	1.79	1.80	1.86
360.5	1.15	1.05	.99	.91	.88	.85	.85	.86	.90	.96	1.04	1.16	1.28	1.41	1.57	1.73	1.83	1.82	1.84	1.90
371.0	1.26	1.14	1.07	.98	.93	.90	.89	.91	.95	1.01	1.10	1.21	1.31	1.44	1.60	1.76	1.87	1.86	1.88	1.95
381.4	1.41	1.27	1.18	1.07	1.02	.98	.97	.99	1.03	1.10	1.15	1.23	1.32	1.45	1.61	1.77	1.88	1.88	1.91	2.00
391.9	1.43	1.30	1.23	1.13	1.08	1.04	1.03	1.03	1.05	1.09	1.14	1.21	1.30	1.42	1.56	1.71	1.82	1.85	1.93	2.05
402.3	1.38	1.26	1.20	1.11	1.06	1.02	1.01	1.01	1.03	1.06	1.10	1.16	1.24	1.34	1.46	1.59	1.72	1.79	1.93	2.11
412.8	1.41	1.29	1.22	1.14	1.09	1.05	1.03	1.03	1.04	1.06	1.09	1.14	1.20	1.27	1.37	1.49	1.64	1.76	1.95	2.21

Table B.7. Relative power density distribution in inner element at 1 d

Radius (mm)

Distance from top of element (mm)	1.2	3.6	6.4	9.4	12.4	15.4	18.4	21.4	24.4	27.4	30.4	33.4	36.4	39.4	42.4	45.4	48.4	51.4	54.1	56.5
5.2	.32	.30	.28	.27	.27	.26	.26	.26	.26	.26	.26	.27	.28	.29	.30	.32	.34	.36	.40	.43
15.7	.33	.32	.31	.30	.29	.29	.29	.29	.29	.29	.29	.30	.31	.31	.33	.34	.36	.38	.41	.43
26.1	.34	.34	.33	.33	.32	.32	.32	.32	.32	.32	.32	.33	.33	.34	.35	.36	.37	.39	.42	.44
36.6	.37	.36	.36	.36	.36	.36	.36	.35	.35	.35	.35	.35	.36	.36	.37	.37	.39	.40	.42	.44
47.0	.40	.40	.40	.40	.40	.40	.40	.40	.40	.39	.39	.39	.39	.39	.39	.39	.40	.41	.44	.45
57.5	.44	.44	.44	.45	.45	.46	.46	.46	.45	.44	.44	.43	.42	.42	.42	.42	.42	.43	.45	.47
67.9	.48	.49	.49	.48	.47	.47	.46	.47	.47	.48	.49	.48	.46	.46	.45	.45	.45	.45	.47	.48
78.4	.53	.53	.51	.49	.48	.47	.47	.47	.47	.48	.49	.51	.51	.50	.49	.48	.48	.48	.49	.50
88.8	.58	.55	.52	.50	.49	.48	.48	.48	.48	.48	.49	.51	.52	.55	.53	.52	.51	.51	.52	.53
99.4	.60	.57	.54	.52	.50	.49	.49	.49	.49	.49	.50	.51	.53	.55	.57	.56	.55	.54	.55	.56
109.9	.64	.60	.56	.54	.52	.51	.50	.50	.50	.50	.51	.52	.53	.55	.57	.60	.58	.58	.58	.59
120.2	.68	.64	.59	.56	.54	.53	.52	.52	.52	.52	.52	.53	.54	.56	.58	.61	.63	.61	.62	.62
130.6	.74	.68	.63	.60	.57	.55	.54	.54	.53	.53	.54	.54	.55	.57	.59	.61	.65	.66	.66	.66
141.1	.81	.73	.67	.63	.60	.58	.56	.56	.55	.55	.55	.56	.57	.58	.60	.62	.66	.70	.70	.70
151.6	.88	.79	.72	.67	.63	.61	.59	.58	.57	.57	.57	.57	.58	.59	.61	.63	.67	.71	.74	.74
162.1	.95	.85	.77	.70	.66	.63	.61	.60	.59	.59	.59	.59	.60	.61	.62	.65	.68	.72	.78	.79
172.4	1.02	.91	.81	.74	.69	.66	.63	.62	.61	.60	.60	.60	.61	.62	.64	.66	.69	.73	.79	.84
182.9	1.09	.96	.85	.78	.72	.68	.66	.64	.63	.62	.62	.62	.62	.63	.65	.67	.70	.74	.80	.86
193.3	1.16	1.01	.89	.81	.75	.71	.68	.66	.64	.63	.63	.63	.64	.65	.66	.68	.71	.75	.81	.87
203.8	1.22	1.06	.93	.84	.77	.73	.70	.67	.66	.65	.65	.65	.65	.66	.67	.70	.72	.77	.82	.89
214.2	1.27	1.10	.96	.87	.80	.75	.71	.69	.67	.66	.66	.66	.66	.67	.69	.71	.74	.78	.84	.90
224.7	1.32	1.14	1.00	.89	.82	.77	.73	.70	.69	.68	.67	.67	.67	.68	.70	.72	.75	.79	.85	.91
235.1	1.36	1.18	1.02	.91	.84	.78	.74	.72	.70	.69	.68	.68	.68	.69	.71	.73	.76	.80	.86	.93
245.6	1.41	1.21	1.05	.93	.85	.80	.76	.73	.71	.70	.69	.69	.69	.70	.72	.74	.77	.81	.87	.94
256.0	1.45	1.24	1.07	.95	.87	.81	.77	.74	.72	.71	.70	.70	.70	.71	.72	.75	.78	.82	.88	.95
266.4	1.48	1.27	1.10	.97	.88	.82	.78	.75	.73	.71	.71	.70	.71	.72	.73	.75	.79	.83	.90	.97
276.9	1.52	1.30	1.12	.99	.90	.83	.79	.76	.73	.72	.71	.71	.71	.72	.74	.76	.80	.84	.91	.98
287.4	1.55	1.32	1.14	1.00	.91	.84	.80	.76	.74	.73	.72	.72	.72	.73	.75	.77	.81	.85	.93	1.00
297.8	1.59	1.35	1.16	1.02	.92	.85	.80	.77	.75	.73	.72	.72	.73	.74	.75	.78	.82	.87	.94	1.02
308.1	1.63	1.38	1.18	1.03	.93	.86	.81	.78	.75	.74	.73	.73	.73	.74	.76	.79	.83	.88	.96	1.05
318.6	1.67	1.41	1.20	1.05	.95	.87	.82	.78	.76	.74	.74	.73	.74	.75	.77	.80	.84	.90	.98	1.08
329.2	1.72	1.44	1.23	1.07	.96	.88	.83	.79	.77	.75	.74	.74	.75	.76	.78	.81	.86	.92	1.01	1.12
339.6	1.77	1.48	1.26	1.09	.98	.90	.84	.80	.77	.76	.75	.75	.76	.77	.79	.83	.88	.95	1.05	1.17
350.1	1.83	1.53	1.29	1.12	1.00	.91	.85	.81	.78	.77	.76	.76	.77	.78	.81	.85	.90	.98	1.10	1.23
360.5	1.91	1.59	1.33	1.15	1.02	.93	.87	.82	.80	.78	.77	.77	.78	.80	.83	.87	.94	1.03	1.16	1.31
371.0	2.01	1.66	1.39	1.19	1.05	.96	.89	.84	.81	.79	.79	.79	.80	.82	.86	.91	.98	1.08	1.24	1.41
381.4	2.14	1.76	1.46	1.24	1.09	.99	.92	.87	.84	.82	.81	.81	.83	.85	.89	.95	1.04	1.16	1.34	1.54
391.9	2.30	1.89	1.56	1.32	1.15	1.04	.96	.91	.87	.85	.85	.85	.87	.90	.94	1.01	1.11	1.26	1.47	1.71
402.3	2.53	2.06	1.69	1.42	1.24	1.12	1.04	.98	.94	.92	.91	.92	.94	.97	1.03	1.11	1.22	1.39	1.65	1.92
412.8	2.70	2.26	1.88	1.59	1.39	1.27	1.18	1.12	1.09	1.07	1.06	1.06	1.08	1.12	1.17	1.26	1.38	1.52	1.76	2.02

Table B.8. Relative power density distribution in middle element at 1 d

Radius (mm)

Distance from top of element (mm)

	1.1	3.0	5.5	8.5	11.2	14.0	16.7	19.5	22.2	25.0	27.7	30.5	33.2	36.0	38.7	41.5	44.2	47.2	49.9	51.9
5.2	1.38	1.31	1.22	1.15	1.10	1.05	1.01	.98	.96	.96	.97	.99	1.03	1.08	1.14	1.21	1.27	1.30	1.31	1.26
15.7	1.42	1.35	1.27	1.19	1.14	1.08	1.04	1.01	.99	.99	1.00	1.03	1.07	1.13	1.20	1.27	1.33	1.36	1.34	1.27
26.1	1.48	1.40	1.31	1.24	1.17	1.12	1.07	1.04	1.02	1.02	1.04	1.06	1.11	1.17	1.24	1.32	1.39	1.42	1.38	1.28
36.6	1.53	1.45	1.35	1.26	1.19	1.13	1.09	1.05	1.04	1.04	1.05	1.08	1.13	1.19	1.27	1.35	1.43	1.46	1.41	1.29
47.0	1.55	1.46	1.36	1.26	1.19	1.13	1.08	1.05	1.03	1.03	1.05	1.08	1.12	1.19	1.27	1.36	1.44	1.47	1.42	1.29
57.5	1.56	1.46	1.35	1.25	1.18	1.12	1.07	1.04	1.02	1.02	1.04	1.07	1.11	1.18	1.26	1.35	1.43	1.47	1.43	1.30
67.9	1.56	1.46	1.35	1.25	1.17	1.11	1.06	1.03	1.01	1.01	1.03	1.06	1.10	1.17	1.25	1.34	1.42	1.46	1.43	1.31
78.4	1.57	1.46	1.34	1.24	1.17	1.11	1.06	1.02	1.01	1.01	1.02	1.05	1.10	1.16	1.24	1.33	1.42	1.46	1.43	1.32
88.8	1.58	1.47	1.34	1.24	1.16	1.10	1.05	1.02	1.00	1.00	1.01	1.04	1.09	1.15	1.23	1.33	1.41	1.46	1.44	1.33
99.3	1.58	1.47	1.34	1.23	1.16	1.09	1.04	1.01	.99	.99	1.01	1.04	1.08	1.14	1.22	1.32	1.41	1.46	1.44	1.34
109.7	1.59	1.47	1.34	1.23	1.15	1.09	1.04	1.00	.99	.98	1.00	1.03	1.07	1.14	1.22	1.31	1.40	1.46	1.45	1.35
120.2	1.59	1.47	1.34	1.23	1.15	1.08	1.03	1.00	.98	.98	.99	1.02	1.07	1.13	1.21	1.30	1.40	1.46	1.45	1.36
132.3	1.59	1.47	1.33	1.22	1.14	1.07	1.02	.99	.97	.97	.98	1.01	1.06	1.12	1.20	1.29	1.39	1.45	1.46	1.36
142.8	1.60	1.47	1.33	1.21	1.13	1.06	1.01	.98	.96	.96	.97	1.00	1.05	1.11	1.19	1.29	1.38	1.45	1.46	1.37
151.5	1.61	1.48	1.33	1.21	1.13	1.06	1.01	.97	.96	.96	.97	1.00	1.04	1.11	1.18	1.28	1.38	1.45	1.47	1.39
162.0	1.61	1.48	1.33	1.21	1.12	1.05	1.00	.97	.95	.95	.96	.99	1.03	1.10	1.18	1.27	1.37	1.45	1.47	1.40
172.4	1.62	1.48	1.33	1.20	1.11	1.05	1.00	.96	.94	.94	.95	.98	1.03	1.09	1.17	1.26	1.37	1.45	1.48	1.41
182.9	1.63	1.48	1.32	1.20	1.11	1.04	.99	.95	.93	.93	.95	.97	1.02	1.08	1.16	1.25	1.36	1.45	1.49	1.43
191.5	1.64	1.49	1.33	1.20	1.11	1.04	.99	.95	.93	.93	.94	.97	1.01	1.07	1.15	1.25	1.36	1.45	1.50	1.44
202.0	1.65	1.49	1.33	1.19	1.10	1.03	.98	.94	.93	.92	.93	.96	1.01	1.07	1.14	1.24	1.35	1.45	1.50	1.46
214.2	1.66	1.49	1.32	1.19	1.09	1.02	.97	.93	.92	.91	.92	.95	.99	1.05	1.13	1.23	1.34	1.44	1.50	1.47
224.7	1.67	1.50	1.32	1.18	1.09	1.02	.97	.93	.91	.91	.92	.94	.99	1.04	1.12	1.22	1.33	1.44	1.51	1.48
235.1	1.68	1.50	1.32	1.18	1.08	1.01	.96	.93	.91	.90	.91	.94	.98	1.04	1.11	1.21	1.32	1.44	1.52	1.50
245.6	1.69	1.51	1.32	1.18	1.08	1.01	.96	.92	.90	.90	.91	.93	.97	1.03	1.10	1.20	1.32	1.43	1.53	1.52
256.0	1.70	1.52	1.32	1.17	1.08	1.01	.95	.92	.90	.89	.90	.92	.96	1.02	1.09	1.19	1.31	1.43	1.53	1.53
266.5	1.71	1.52	1.32	1.17	1.07	1.00	.95	.91	.89	.89	.90	.92	.95	1.01	1.08	1.18	1.30	1.43	1.54	1.55
276.9	1.73	1.53	1.32	1.17	1.07	1.00	.95	.90	.88	.89	.89	.91	.95	1.00	1.07	1.17	1.29	1.43	1.54	1.56
289.1	1.73	1.53	1.32	1.16	1.06	.99	.92	.86	.84	.85	.88	.90	.94	.99	1.06	1.15	1.28	1.42	1.55	1.57
299.5	1.74	1.53	1.32	1.16	1.06	.98	.89	.83	.81	.82	.85	.90	.93	.98	1.05	1.15	1.27	1.41	1.55	1.59
308.3	1.76	1.54	1.32	1.16	1.06	.95	.86	.81	.79	.79	.82	.88	.93	.98	1.04	1.14	1.26	1.41	1.56	1.60
318.7	1.76	1.54	1.32	1.15	1.05	.92	.84	.79	.76	.77	.80	.85	.92	.97	1.03	1.13	1.25	1.41	1.56	1.62
329.2	1.77	1.54	1.31	1.15	1.03	.90	.82	.77	.74	.75	.77	.83	.91	.96	1.02	1.12	1.24	1.40	1.57	1.63
338.2	1.77	1.54	1.31	1.14	1.01	.89	.80	.75	.73	.73	.76	.81	.90	.95	1.02	1.11	1.24	1.40	1.57	1.64
348.6	1.77	1.54	1.30	1.13	1.00	.87	.79	.74	.72	.72	.74	.80	.89	.94	1.00	1.10	1.23	1.39	1.57	1.64
360.5	1.77	1.54	1.29	1.12	1.01	.87	.79	.74	.71	.71	.74	.79	.88	.92	.99	1.08	1.22	1.39	1.57	1.65
371.0	1.77	1.53	1.29	1.11	1.00	.89	.80	.74	.72	.72	.74	.80	.86	.91	.98	1.07	1.21	1.38	1.57	1.66
381.4	1.77	1.53	1.28	1.10	.99	.91	.83	.77	.74	.74	.77	.81	.85	.90	.97	1.07	1.21	1.38	1.57	1.67
391.9	1.79	1.55	1.29	1.10	.99	.90	.85	.81	.78	.78	.78	.80	.84	.90	.97	1.07	1.21	1.39	1.59	1.68
399.7	1.81	1.56	1.31	1.12	1.00	.91	.85	.81	.79	.78	.79	.81	.85	.91	.98	1.08	1.23	1.41	1.61	1.70
410.1	1.93	1.68	1.41	1.22	1.10	1.02	.97	.93	.91	.90	.91	.92	.95	1.00	1.07	1.17	1.30	1.48	1.69	1.79

Table B.9. Relative power density distribution in outer element at 1 d

Radius (mm)

Distance from top of element (mm)	1.0	2.9	4.6	7.1	9.6	12.1	15.1	17.6	20.1	22.6	25.1	27.6	30.1	32.6	35.1	37.6	40.1	42.1	44.3	46.8
5.2	.70	.66	.63	.59	.57	.56	.56	.56	.57	.59	.61	.64	.68	.72	.78	.83	.88	.91	.96	1.02
15.7	.69	.64	.62	.59	.57	.56	.56	.56	.58	.60	.63	.66	.71	.76	.82	.88	.93	.94	.97	1.00
26.1	.71	.66	.63	.60	.58	.57	.57	.58	.60	.62	.66	.70	.75	.82	.89	.95	.99	.98	.99	1.00
36.6	.74	.68	.65	.62	.60	.59	.59	.60	.62	.65	.68	.73	.79	.87	.95	1.02	1.06	1.03	1.01	1.01
47.0	.75	.69	.66	.62	.61	.60	.60	.61	.63	.66	.70	.75	.82	.90	.99	1.07	1.11	1.06	1.03	1.02
57.5	.75	.69	.66	.63	.61	.60	.60	.61	.64	.67	.71	.76	.83	.92	1.01	1.10	1.13	1.09	1.05	1.04
67.9	.75	.69	.66	.63	.61	.60	.61	.62	.64	.67	.71	.77	.84	.92	1.02	1.11	1.15	1.10	1.07	1.05
78.4	.75	.70	.67	.64	.62	.61	.62	.63	.65	.68	.72	.78	.85	.93	1.04	1.12	1.16	1.12	1.09	1.07
88.8	.76	.71	.68	.65	.63	.62	.63	.64	.66	.69	.74	.79	.86	.95	1.05	1.14	1.19	1.14	1.11	1.09
99.4	.77	.72	.69	.66	.65	.64	.65	.66	.68	.71	.75	.81	.88	.97	1.07	1.16	1.21	1.16	1.13	1.12
109.9	.79	.74	.71	.68	.67	.66	.66	.67	.69	.72	.77	.82	.89	.98	1.09	1.18	1.23	1.19	1.15	1.14
120.2	.79	.74	.71	.68	.67	.67	.68	.69	.71	.74	.78	.84	.91	1.00	1.11	1.21	1.25	1.21	1.18	1.17
130.6	.79	.75	.72	.69	.67	.67	.69	.71	.73	.76	.80	.85	.93	1.02	1.13	1.23	1.28	1.23	1.20	1.19
141.1	.80	.75	.72	.69	.68	.68	.69	.72	.75	.78	.82	.87	.94	1.04	1.15	1.25	1.30	1.26	1.23	1.22
151.6	.80	.76	.73	.70	.69	.68	.70	.72	.77	.79	.83	.89	.96	1.06	1.17	1.27	1.33	1.28	1.26	1.25
162.1	.81	.77	.74	.71	.69	.69	.70	.73	.77	.81	.85	.91	.98	1.07	1.19	1.30	1.35	1.31	1.28	1.28
172.4	.82	.77	.74	.71	.70	.70	.71	.74	.78	.83	.87	.92	1.00	1.09	1.21	1.32	1.38	1.34	1.31	1.30
182.9	.83	.78	.75	.72	.71	.70	.72	.74	.78	.84	.89	.94	1.01	1.11	1.23	1.34	1.40	1.36	1.34	1.33
193.3	.84	.79	.76	.73	.72	.71	.72	.75	.79	.85	.90	.96	1.03	1.13	1.25	1.36	1.42	1.39	1.37	1.36
203.8	.85	.80	.77	.74	.72	.72	.73	.75	.79	.85	.92	.97	1.05	1.15	1.27	1.39	1.45	1.41	1.39	1.39
214.2	.85	.81	.78	.74	.73	.72	.73	.76	.79	.85	.93	.99	1.07	1.17	1.29	1.41	1.47	1.44	1.42	1.42
224.7	.86	.82	.79	.75	.74	.73	.74	.76	.80	.85	.93	1.01	1.08	1.18	1.31	1.43	1.50	1.47	1.45	1.45
235.1	.87	.83	.79	.76	.74	.73	.74	.77	.80	.86	.93	1.03	1.10	1.20	1.33	1.45	1.52	1.49	1.48	1.48
245.6	.88	.84	.80	.77	.75	.74	.75	.77	.80	.86	.94	1.04	1.12	1.22	1.35	1.48	1.55	1.52	1.51	1.52
256.0	.90	.84	.81	.77	.75	.74	.75	.77	.81	.86	.94	1.04	1.13	1.24	1.37	1.50	1.57	1.54	1.53	1.55
266.4	.91	.85	.82	.78	.76	.75	.76	.78	.81	.86	.94	1.05	1.15	1.26	1.39	1.52	1.60	1.57	1.56	1.58
276.9	.92	.87	.83	.79	.77	.76	.76	.78	.81	.87	.94	1.05	1.17	1.27	1.41	1.54	1.62	1.60	1.59	1.61
287.4	.94	.88	.84	.80	.77	.76	.77	.78	.82	.87	.94	1.05	1.18	1.29	1.43	1.56	1.65	1.62	1.62	1.64
297.8	.96	.89	.85	.81	.78	.77	.77	.79	.82	.87	.95	1.05	1.20	1.31	1.45	1.58	1.67	1.65	1.65	1.68
308.1	.98	.91	.87	.82	.79	.78	.78	.80	.83	.88	.95	1.06	1.20	1.32	1.47	1.61	1.70	1.68	1.68	1.71
318.6	1.01	.94	.89	.83	.81	.79	.79	.80	.83	.89	.96	1.07	1.21	1.34	1.49	1.63	1.72	1.70	1.71	1.74
329.2	1.05	.97	.91	.85	.82	.80	.80	.81	.84	.90	.97	1.08	1.23	1.36	1.51	1.65	1.75	1.73	1.74	1.78
339.6	1.10	1.01	.95	.88	.84	.82	.81	.83	.86	.91	.99	1.10	1.25	1.37	1.52	1.68	1.78	1.76	1.77	1.82
350.1	1.17	1.06	.99	.91	.87	.84	.83	.85	.88	.93	1.01	1.12	1.27	1.39	1.54	1.70	1.80	1.79	1.80	1.85
360.5	1.26	1.14	1.06	.96	.91	.87	.86	.88	.91	.96	1.04	1.16	1.28	1.41	1.57	1.73	1.84	1.82	1.84	1.89
371.0	1.38	1.23	1.14	1.03	.97	.93	.91	.92	.95	1.01	1.10	1.21	1.31	1.44	1.60	1.77	1.87	1.86	1.88	1.94
381.4	1.55	1.38	1.26	1.13	1.06	1.01	.99	1.00	1.04	1.10	1.16	1.23	1.33	1.46	1.62	1.78	1.89	1.88	1.91	1.99
391.9	1.57	1.41	1.32	1.21	1.14	1.09	1.07	1.06	1.08	1.11	1.16	1.23	1.32	1.44	1.58	1.73	1.84	1.86	1.93	2.04
402.3	1.51	1.38	1.30	1.20	1.14	1.09	1.07	1.06	1.08	1.10	1.15	1.20	1.28	1.38	1.50	1.63	1.75	1.81	1.94	2.10
412.8	1.54	1.42	1.35	1.25	1.20	1.15	1.13	1.13	1.14	1.15	1.19	1.23	1.29	1.36	1.46	1.57	1.70	1.81	1.99	2.21

Table B.10. Relative power density distribution in inner element at 4.25 d

Radius (mm)

Distance from top of element (mm)	1.2	3.6	6.4	9.4	12.4	15.4	18.4	21.4	24.4	27.4	30.4	33.4	36.4	39.4	42.4	45.4	48.4	51.4	54.1	56.5
5.2	.31	.30	.28	.27	.27	.26	.26	.26	.26	.26	.27	.27	.28	.29	.30	.32	.34	.36	.40	.42
15.7	.32	.31	.30	.29	.29	.29	.28	.28	.29	.29	.29	.30	.30	.31	.32	.34	.36	.37	.40	.42
26.1	.33	.32	.32	.31	.31	.31	.31	.31	.31	.31	.31	.32	.32	.33	.34	.35	.37	.38	.41	.43
36.6	.35	.34	.34	.34	.34	.34	.34	.34	.34	.34	.34	.34	.35	.35	.36	.36	.38	.39	.41	.43
47.0	.37	.37	.37	.37	.38	.38	.38	.38	.38	.38	.37	.37	.37	.37	.38	.38	.39	.40	.42	.44
57.5	.40	.41	.41	.42	.42	.43	.43	.43	.42	.42	.41	.41	.40	.40	.40	.40	.41	.42	.43	.45
67.9	.44	.44	.45	.44	.44	.43	.43	.43	.44	.45	.46	.45	.44	.43	.43	.43	.43	.43	.45	.46
78.4	.48	.48	.46	.44	.44	.43	.43	.43	.44	.45	.46	.47	.48	.47	.46	.46	.45	.46	.47	.48
88.8	.51	.48	.46	.45	.44	.44	.44	.44	.44	.45	.46	.47	.49	.51	.50	.49	.48	.48	.49	.50
99.4	.52	.49	.47	.46	.45	.45	.44	.45	.45	.45	.46	.47	.49	.51	.54	.53	.52	.51	.52	.53
109.9	.53	.51	.49	.47	.46	.46	.45	.46	.46	.46	.47	.48	.49	.51	.54	.57	.55	.54	.55	.56
120.2	.55	.52	.50	.49	.48	.47	.47	.47	.47	.47	.48	.49	.50	.52	.54	.57	.59	.58	.58	.59
130.6	.57	.55	.52	.50	.49	.48	.48	.48	.48	.48	.49	.50	.51	.53	.55	.57	.61	.62	.62	.62
141.1	.60	.57	.54	.52	.51	.50	.50	.49	.49	.50	.50	.51	.52	.54	.55	.58	.61	.66	.66	.66
151.6	.64	.60	.57	.55	.53	.52	.51	.51	.51	.51	.52	.52	.53	.55	.57	.59	.62	.66	.70	.70
162.1	.68	.64	.60	.58	.56	.54	.53	.53	.53	.53	.53	.54	.55	.56	.58	.60	.63	.67	.73	.74
172.4	.74	.69	.64	.61	.58	.56	.55	.55	.54	.54	.54	.55	.56	.57	.59	.61	.64	.68	.74	.79
182.9	.80	.74	.68	.64	.61	.59	.58	.57	.56	.56	.56	.57	.57	.59	.60	.62	.65	.69	.75	.81
193.3	.87	.79	.73	.68	.64	.62	.60	.59	.58	.58	.58	.58	.59	.60	.62	.64	.67	.71	.76	.82
203.8	.94	.85	.77	.71	.67	.64	.62	.61	.60	.59	.59	.59	.60	.61	.63	.65	.68	.72	.78	.84
214.2	1.01	.91	.82	.75	.70	.67	.64	.63	.62	.61	.61	.61	.62	.63	.64	.66	.69	.73	.79	.85
224.7	1.08	.96	.86	.79	.73	.69	.66	.65	.63	.62	.62	.62	.63	.64	.65	.68	.71	.75	.81	.87
235.1	1.14	1.01	.90	.82	.76	.72	.68	.66	.65	.64	.64	.64	.64	.65	.67	.69	.72	.76	.82	.88
245.6	1.20	1.06	.94	.85	.78	.74	.70	.68	.66	.65	.65	.65	.65	.66	.68	.70	.73	.77	.84	.90
256.0	1.25	1.10	.97	.88	.81	.76	.72	.69	.68	.67	.66	.66	.66	.67	.69	.71	.74	.79	.85	.92
266.4	1.30	1.14	1.00	.90	.83	.77	.74	.71	.69	.68	.67	.67	.67	.68	.70	.72	.76	.80	.87	.93
276.9	1.35	1.18	1.03	.93	.85	.79	.75	.72	.70	.69	.68	.68	.68	.69	.71	.73	.77	.82	.88	.95
287.4	1.40	1.22	1.06	.95	.87	.81	.76	.73	.71	.70	.69	.69	.69	.70	.72	.75	.78	.83	.90	.98
297.8	1.44	1.25	1.09	.97	.89	.82	.78	.74	.72	.71	.70	.70	.70	.71	.73	.76	.80	.85	.92	1.00
308.1	1.49	1.29	1.12	.99	.90	.84	.79	.76	.73	.72	.71	.71	.71	.72	.74	.77	.81	.87	.95	1.03
318.6	1.54	1.33	1.15	1.02	.92	.85	.80	.77	.74	.73	.72	.72	.72	.73	.76	.79	.83	.89	.98	1.07
329.2	1.60	1.38	1.19	1.05	.94	.87	.82	.78	.75	.74	.73	.73	.73	.75	.77	.80	.85	.92	1.01	1.12
339.6	1.67	1.43	1.23	1.07	.97	.89	.83	.79	.77	.75	.74	.74	.75	.76	.79	.83	.88	.95	1.06	1.18
350.1	1.74	1.49	1.27	1.11	.99	.91	.85	.81	.78	.76	.75	.75	.76	.78	.81	.85	.91	1.00	1.12	1.25
360.5	1.83	1.56	1.32	1.15	1.03	.94	.87	.83	.80	.78	.77	.77	.78	.80	.84	.89	.95	1.05	1.19	1.34
371.0	1.95	1.64	1.39	1.20	1.07	.97	.90	.85	.82	.80	.79	.80	.81	.83	.87	.93	1.01	1.12	1.28	1.46
381.4	2.09	1.76	1.48	1.27	1.12	1.02	.94	.89	.86	.84	.83	.83	.85	.88	.92	.99	1.08	1.21	1.40	1.60
391.9	2.27	1.90	1.60	1.37	1.20	1.09	1.01	.95	.91	.89	.88	.89	.91	.94	.99	1.07	1.17	1.33	1.55	1.79
402.3	2.52	2.11	1.77	1.52	1.34	1.21	1.12	1.06	1.02	1.00	.99	1.00	1.02	1.05	1.11	1.20	1.32	1.50	1.76	2.03
412.8	2.74	2.40	2.07	1.80	1.61	1.48	1.38	1.32	1.28	1.25	1.24	1.25	1.26	1.30	1.36	1.45	1.57	1.71	1.92	2.15

Table B.11. Relative power density distribution in middle element at 4.25 d

Radius (mm)

Distance from top of element (mm)	1.1	3.0	5.5	8.5	11.2	14.0	16.7	19.5	22.2	25.0	27.7	30.5	33.2	36.0	38.7	41.5	44.2	47.2	49.9	51.9
5.2	1.42	1.39	1.35	1.31	1.28	1.25	1.22	1.20	1.19	1.19	1.20	1.22	1.25	1.29	1.34	1.38	1.40	1.38	1.32	1.23
15.7	1.43	1.39	1.34	1.29	1.26	1.22	1.18	1.16	1.14	1.14	1.16	1.18	1.22	1.26	1.32	1.37	1.40	1.38	1.32	1.21
26.1	1.48	1.43	1.37	1.31	1.26	1.22	1.18	1.15	1.14	1.14	1.15	1.18	1.21	1.27	1.33	1.39	1.43	1.42	1.34	1.21
36.6	1.52	1.46	1.39	1.32	1.26	1.21	1.17	1.14	1.13	1.13	1.14	1.17	1.21	1.27	1.33	1.40	1.45	1.44	1.35	1.21
47.0	1.53	1.46	1.38	1.31	1.25	1.20	1.15	1.12	1.11	1.11	1.12	1.15	1.19	1.25	1.32	1.39	1.45	1.45	1.36	1.21
57.5	1.52	1.45	1.37	1.29	1.23	1.18	1.13	1.10	1.09	1.09	1.10	1.13	1.17	1.23	1.30	1.38	1.44	1.44	1.35	1.21
67.9	1.52	1.45	1.36	1.28	1.22	1.16	1.12	1.09	1.07	1.07	1.09	1.11	1.16	1.22	1.29	1.36	1.42	1.43	1.35	1.21
78.4	1.52	1.44	1.35	1.27	1.21	1.15	1.10	1.07	1.06	1.06	1.07	1.10	1.15	1.20	1.27	1.35	1.41	1.42	1.35	1.22
88.8	1.52	1.44	1.35	1.26	1.20	1.14	1.09	1.06	1.05	1.05	1.06	1.09	1.13	1.19	1.26	1.34	1.41	1.42	1.35	1.22
99.3	1.52	1.44	1.34	1.25	1.19	1.13	1.08	1.05	1.04	1.04	1.05	1.08	1.12	1.18	1.25	1.33	1.40	1.41	1.36	1.23
109.7	1.53	1.44	1.34	1.25	1.18	1.12	1.07	1.04	1.03	1.03	1.04	1.07	1.11	1.17	1.24	1.32	1.39	1.41	1.36	1.24
120.2	1.53	1.44	1.33	1.24	1.17	1.11	1.06	1.03	1.02	1.02	1.03	1.06	1.10	1.16	1.23	1.31	1.38	1.41	1.36	1.24
132.3	1.53	1.43	1.32	1.23	1.16	1.10	1.05	1.02	1.00	1.00	1.02	1.05	1.09	1.15	1.22	1.30	1.37	1.40	1.37	1.25
142.8	1.53	1.43	1.32	1.22	1.15	1.09	1.04	1.01	.99	.99	1.01	1.04	1.08	1.14	1.21	1.29	1.37	1.40	1.37	1.26
151.5	1.54	1.44	1.32	1.22	1.15	1.09	1.04	1.01	.99	.99	1.00	1.03	1.08	1.13	1.21	1.29	1.37	1.40	1.38	1.28
162.0	1.55	1.44	1.32	1.21	1.14	1.08	1.03	1.00	.98	.98	.99	1.02	1.07	1.13	1.20	1.28	1.36	1.40	1.38	1.29
172.4	1.55	1.44	1.32	1.21	1.13	1.07	1.02	.99	.97	.97	.99	1.01	1.06	1.12	1.19	1.27	1.35	1.40	1.39	1.30
182.9	1.56	1.45	1.31	1.20	1.13	1.06	1.01	.98	.96	.96	.98	1.00	1.05	1.11	1.18	1.26	1.35	1.40	1.40	1.31
191.5	1.57	1.45	1.32	1.20	1.12	1.06	1.01	.98	.96	.96	.97	1.00	1.04	1.10	1.17	1.26	1.34	1.41	1.41	1.33
202.0	1.58	1.46	1.32	1.20	1.12	1.05	1.00	.97	.95	.95	.96	.99	1.04	1.09	1.16	1.25	1.34	1.40	1.42	1.35
214.2	1.59	1.46	1.31	1.19	1.11	1.04	.99	.96	.94	.94	.95	.98	1.02	1.08	1.15	1.24	1.33	1.40	1.42	1.36
224.7	1.60	1.47	1.31	1.19	1.11	1.04	.99	.95	.94	.93	.95	.97	1.02	1.07	1.14	1.23	1.32	1.40	1.43	1.38
235.1	1.62	1.47	1.32	1.19	1.10	1.03	.98	.95	.93	.93	.94	.97	1.01	1.06	1.13	1.22	1.32	1.40	1.44	1.39
245.6	1.63	1.48	1.32	1.19	1.10	1.03	.98	.95	.93	.92	.93	.96	1.00	1.06	1.13	1.21	1.31	1.40	1.45	1.41
256.0	1.64	1.49	1.32	1.19	1.10	1.03	.98	.94	.92	.92	.93	.95	.99	1.05	1.12	1.21	1.31	1.40	1.46	1.43
266.5	1.66	1.50	1.32	1.18	1.09	1.02	.97	.94	.92	.91	.92	.95	.99	1.04	1.11	1.20	1.30	1.40	1.47	1.44
276.9	1.67	1.51	1.33	1.18	1.09	1.02	.97	.93	.90	.91	.92	.94	.98	1.03	1.10	1.19	1.30	1.40	1.48	1.46
289.1	1.68	1.51	1.32	1.18	1.09	1.02	.94	.89	.86	.87	.91	.93	.97	1.02	1.09	1.18	1.29	1.40	1.48	1.48
299.5	1.70	1.52	1.33	1.18	1.09	1.00	.91	.86	.83	.84	.88	.93	.97	1.01	1.08	1.17	1.28	1.40	1.49	1.49
308.3	1.72	1.53	1.33	1.18	1.09	.97	.89	.83	.81	.82	.85	.92	.96	1.01	1.08	1.17	1.28	1.40	1.51	1.51
318.7	1.73	1.54	1.33	1.18	1.08	.95	.86	.81	.79	.79	.82	.89	.96	1.00	1.07	1.16	1.27	1.40	1.51	1.53
329.2	1.74	1.54	1.33	1.18	1.06	.93	.84	.79	.77	.77	.80	.86	.95	1.00	1.06	1.15	1.26	1.40	1.52	1.54
338.2	1.75	1.54	1.33	1.17	1.05	.92	.83	.78	.76	.76	.79	.85	.94	.99	1.05	1.14	1.26	1.40	1.53	1.56
348.6	1.75	1.55	1.33	1.17	1.04	.91	.82	.77	.74	.75	.78	.83	.93	.98	1.04	1.13	1.25	1.40	1.53	1.57
360.5	1.76	1.55	1.33	1.16	1.05	.91	.82	.77	.74	.74	.77	.83	.92	.97	1.04	1.13	1.25	1.40	1.54	1.59
371.0	1.77	1.55	1.33	1.16	1.05	.94	.84	.78	.76	.76	.79	.85	.91	.96	1.03	1.12	1.25	1.40	1.55	1.60
381.4	1.78	1.56	1.33	1.16	1.05	.97	.89	.83	.80	.80	.83	.87	.91	.96	1.03	1.13	1.25	1.41	1.56	1.61
391.9	1.80	1.59	1.36	1.18	1.06	.98	.92	.88	.86	.85	.86	.88	.92	.98	1.05	1.15	1.28	1.43	1.58	1.64
399.7	1.83	1.62	1.39	1.21	1.10	1.02	.96	.92	.90	.89	.90	.93	.96	1.02	1.09	1.18	1.31	1.46	1.61	1.67
410.1	1.98	1.78	1.56	1.39	1.29	1.22	1.17	1.14	1.12	1.12	1.12	1.14	1.17	1.21	1.27	1.35	1.46	1.60	1.73	1.77

Table B.12. Relative power density distribution in outer element at 4.25 d

Radius (mm)

Distance from top of element (mm)	1.0	2.9	4.6	7.1	9.6	12.1	15.1	17.6	20.1	22.6	25.1	27.6	30.1	32.6	35.1	37.6	40.1	42.1	44.3	46.8
5.2	.71	.67	.65	.63	.62	.61	.61	.62	.63	.65	.67	.70	.74	.78	.82	.86	.89	.89	.92	.94
15.7	.69	.65	.63	.60	.59	.58	.59	.59	.61	.63	.66	.69	.74	.78	.83	.88	.90	.90	.91	.92
26.1	.71	.66	.64	.61	.59	.58	.59	.60	.62	.64	.67	.71	.76	.82	.88	.93	.95	.93	.92	.92
36.6	.73	.68	.65	.62	.60	.59	.60	.61	.63	.65	.69	.74	.80	.86	.94	1.00	1.01	.97	.94	.92
47.0	.74	.69	.66	.62	.60	.59	.60	.61	.63	.66	.70	.75	.82	.89	.98	1.04	1.06	1.00	.96	.93
57.5	.74	.68	.65	.62	.60	.59	.60	.61	.63	.66	.71	.76	.82	.90	.99	1.06	1.08	1.02	.97	.94
67.9	.73	.68	.65	.61	.60	.59	.60	.61	.63	.66	.71	.76	.83	.91	1.00	1.07	1.09	1.04	.99	.95
78.4	.73	.68	.65	.62	.60	.60	.60	.62	.64	.67	.72	.77	.84	.92	1.01	1.09	1.11	1.05	1.00	.97
88.8	.73	.68	.66	.63	.62	.61	.62	.63	.65	.68	.73	.78	.85	.93	1.03	1.10	1.13	1.07	1.02	.99
99.4	.74	.70	.67	.64	.63	.62	.63	.64	.67	.70	.74	.80	.86	.95	1.05	1.12	1.15	1.09	1.04	1.01
109.9	.76	.71	.68	.66	.64	.64	.65	.66	.68	.71	.76	.81	.88	.97	1.06	1.14	1.17	1.11	1.06	1.03
120.2	.76	.72	.69	.66	.65	.64	.66	.68	.70	.73	.77	.83	.90	.98	1.08	1.16	1.19	1.13	1.08	1.05
130.6	.76	.72	.69	.66	.65	.65	.67	.69	.71	.74	.79	.84	.91	1.00	1.10	1.19	1.21	1.16	1.11	1.07
141.1	.76	.72	.69	.66	.66	.65	.67	.70	.73	.76	.80	.86	.93	1.02	1.12	1.21	1.24	1.18	1.13	1.09
151.6	.77	.73	.70	.67	.66	.66	.68	.71	.75	.78	.82	.88	.95	1.04	1.14	1.23	1.26	1.20	1.15	1.12
162.1	.78	.73	.71	.68	.67	.67	.68	.71	.76	.80	.84	.90	.97	1.06	1.16	1.25	1.29	1.23	1.18	1.14
172.4	.78	.74	.72	.69	.68	.67	.69	.72	.76	.82	.86	.91	.98	1.08	1.18	1.28	1.31	1.25	1.20	1.17
182.9	.79	.75	.72	.69	.68	.68	.70	.72	.77	.83	.87	.93	1.00	1.10	1.21	1.30	1.33	1.28	1.23	1.19
193.3	.80	.76	.73	.70	.69	.69	.70	.73	.77	.83	.89	.95	1.02	1.12	1.23	1.32	1.36	1.30	1.26	1.22
203.8	.81	.77	.74	.71	.70	.69	.71	.74	.78	.84	.91	.97	1.04	1.13	1.25	1.35	1.38	1.33	1.28	1.25
214.2	.82	.78	.75	.72	.71	.70	.72	.74	.78	.84	.92	.99	1.06	1.15	1.27	1.37	1.41	1.35	1.31	1.28
224.7	.83	.79	.76	.73	.71	.71	.72	.75	.79	.84	.93	1.00	1.08	1.17	1.29	1.39	1.44	1.38	1.34	1.30
235.1	.85	.80	.77	.74	.72	.72	.73	.75	.79	.85	.93	1.02	1.10	1.19	1.31	1.42	1.46	1.41	1.36	1.33
245.6	.86	.81	.78	.74	.73	.72	.73	.76	.80	.85	.93	1.04	1.12	1.22	1.34	1.44	1.49	1.43	1.39	1.36
256.0	.87	.82	.79	.75	.74	.73	.74	.76	.80	.86	.94	1.05	1.14	1.24	1.36	1.47	1.52	1.46	1.42	1.39
266.4	.89	.84	.80	.76	.75	.74	.75	.77	.80	.86	.94	1.05	1.16	1.26	1.38	1.49	1.54	1.49	1.45	1.42
276.9	.90	.85	.81	.77	.75	.74	.75	.77	.81	.87	.94	1.05	1.18	1.28	1.40	1.52	1.57	1.52	1.48	1.45
287.4	.92	.87	.83	.78	.76	.75	.76	.78	.82	.87	.95	1.06	1.19	1.30	1.43	1.54	1.60	1.55	1.51	1.48
297.8	.95	.89	.84	.80	.78	.76	.77	.79	.82	.88	.96	1.07	1.21	1.32	1.45	1.57	1.63	1.58	1.54	1.51
308.1	.98	.91	.87	.81	.79	.77	.78	.80	.83	.89	.97	1.07	1.22	1.34	1.48	1.60	1.66	1.61	1.57	1.55
318.6	1.01	.94	.89	.83	.81	.79	.79	.81	.84	.90	.98	1.09	1.24	1.36	1.50	1.63	1.69	1.64	1.60	1.58
329.2	1.06	.98	.92	.86	.83	.81	.81	.82	.86	.91	.99	1.11	1.26	1.39	1.53	1.66	1.72	1.67	1.63	1.62
339.6	1.12	1.03	.97	.89	.86	.83	.83	.84	.88	.93	1.01	1.13	1.29	1.41	1.56	1.69	1.75	1.70	1.67	1.65
350.1	1.20	1.09	1.02	.94	.89	.86	.85	.87	.90	.96	1.04	1.16	1.31	1.43	1.58	1.72	1.79	1.74	1.70	1.69
360.5	1.31	1.18	1.10	1.00	.94	.90	.89	.91	.94	1.00	1.09	1.21	1.34	1.47	1.62	1.76	1.83	1.78	1.74	1.73
371.0	1.45	1.30	1.20	1.08	1.02	.97	.95	.97	1.00	1.06	1.16	1.28	1.38	1.51	1.67	1.81	1.87	1.82	1.78	1.78
381.4	1.64	1.47	1.35	1.21	1.14	1.08	1.06	1.07	1.12	1.19	1.25	1.32	1.42	1.55	1.70	1.83	1.90	1.85	1.82	1.82
391.9	1.68	1.52	1.43	1.32	1.25	1.20	1.18	1.18	1.20	1.23	1.28	1.36	1.44	1.55	1.68	1.80	1.86	1.84	1.85	1.88
402.3	1.64	1.51	1.44	1.35	1.30	1.26	1.24	1.24	1.26	1.29	1.33	1.39	1.46	1.55	1.64	1.74	1.81	1.82	1.87	1.94
412.8	1.68	1.59	1.55	1.48	1.45	1.43	1.42	1.43	1.45	1.47	1.50	1.54	1.59	1.65	1.72	1.79	1.86	1.89	1.98	2.06

Table B.13. Relative power density distribution in inner element at 8.5 d

Distance from top of element (mm)	Radius (mm) 1.2	3.6	6.4	9.4	12.4	15.4	18.4	21.4	24.4	27.4	30.4	33.4	36.4	39.4	42.4	45.4	48.4	51.4	54.1	56.5
5.2	.31	.30	.29	.28	.27	.27	.27	.27	.28	.28	.28	.29	.30	.31	.32	.33	.35	.37	.40	.42
15.7	.31	.31	.30	.29	.29	.29	.29	.29	.29	.29	.30	.30	.31	.32	.33	.34	.36	.38	.40	.42
26.1	.32	.32	.31	.31	.31	.31	.31	.31	.31	.31	.32	.32	.33	.33	.34	.35	.36	.38	.40	.42
36.6	.34	.34	.33	.33	.33	.33	.33	.33	.33	.34	.34	.34	.34	.35	.35	.36	.37	.39	.41	.42
47.0	.36	.36	.36	.36	.36	.37	.37	.37	.37	.37	.36	.36	.36	.37	.37	.38	.38	.39	.41	.43
57.5	.38	.39	.39	.40	.41	.41	.41	.41	.41	.40	.40	.39	.39	.39	.39	.39	.40	.41	.42	.44
67.9	.41	.42	.43	.42	.42	.41	.41	.42	.42	.43	.44	.43	.43	.42	.41	.41	.42	.42	.44	.45
78.4	.45	.45	.43	.42	.41	.41	.41	.41	.42	.43	.44	.45	.47	.45	.44	.44	.44	.44	.46	.47
88.8	.47	.45	.43	.42	.42	.41	.41	.41	.42	.43	.44	.45	.47	.49	.48	.47	.46	.46	.48	.48
99.4	.48	.46	.44	.43	.42	.42	.42	.42	.42	.43	.44	.45	.47	.49	.51	.50	.49	.49	.50	.51
109.9	.49	.47	.45	.44	.43	.43	.43	.43	.43	.44	.44	.45	.47	.49	.51	.54	.53	.52	.53	.53
120.2	.50	.48	.46	.45	.44	.44	.44	.44	.44	.44	.45	.46	.47	.49	.51	.54	.56	.55	.56	.56
130.6	.51	.49	.47	.46	.45	.45	.45	.45	.45	.45	.46	.47	.48	.50	.52	.54	.58	.59	.59	.59
141.1	.53	.51	.49	.47	.47	.46	.46	.46	.46	.46	.47	.48	.49	.50	.52	.55	.58	.62	.62	.63
151.6	.55	.52	.50	.49	.48	.47	.47	.47	.47	.47	.48	.49	.50	.51	.53	.56	.59	.63	.66	.66
162.1	.57	.55	.52	.51	.50	.49	.48	.48	.48	.49	.49	.50	.51	.52	.54	.57	.60	.64	.69	.70
172.4	.60	.57	.55	.53	.51	.50	.50	.50	.50	.50	.50	.51	.52	.54	.55	.58	.61	.64	.70	.74
182.9	.64	.60	.57	.55	.53	.52	.52	.51	.51	.51	.52	.52	.53	.55	.56	.59	.62	.66	.71	.77
193.3	.68	.64	.60	.58	.56	.54	.53	.53	.53	.53	.53	.54	.55	.56	.58	.60	.63	.67	.72	.78
203.8	.73	.68	.64	.61	.58	.57	.55	.55	.54	.54	.55	.55	.56	.57	.59	.61	.64	.68	.74	.79
214.2	.80	.74	.68	.64	.61	.59	.58	.57	.56	.56	.56	.57	.57	.59	.60	.63	.66	.69	.75	.81
224.7	.86	.79	.73	.68	.64	.62	.60	.59	.58	.58	.58	.58	.59	.60	.62	.64	.67	.71	.77	.82
235.1	.94	.85	.77	.72	.67	.64	.62	.61	.60	.59	.59	.59	.60	.61	.63	.65	.68	.72	.78	.84
245.6	1.01	.91	.82	.75	.70	.67	.64	.63	.61	.61	.61	.61	.62	.63	.64	.67	.70	.74	.80	.86
256.0	1.07	.96	.86	.79	.73	.69	.67	.65	.63	.62	.62	.62	.63	.64	.66	.68	.71	.75	.81	.88
266.4	1.14	1.01	.91	.82	.76	.72	.69	.66	.65	.64	.63	.64	.64	.65	.67	.69	.73	.77	.83	.90
276.9	1.20	1.06	.95	.86	.79	.74	.71	.68	.66	.65	.65	.65	.65	.67	.68	.71	.74	.79	.85	.92
287.4	1.26	1.11	.99	.89	.82	.76	.72	.70	.68	.67	.66	.66	.67	.68	.70	.72	.76	.81	.88	.95
297.8	1.32	1.16	1.02	.92	.84	.78	.74	.71	.69	.68	.67	.67	.68	.69	.71	.74	.78	.83	.90	.98
308.1	1.38	1.21	1.06	.95	.87	.81	.76	.73	.71	.69	.69	.69	.69	.71	.73	.76	.80	.85	.93	1.02
318.6	1.44	1.26	1.10	.98	.89	.83	.78	.75	.72	.71	.70	.70	.71	.72	.74	.78	.82	.88	.97	1.06
329.2	1.51	1.32	1.15	1.02	.92	.85	.80	.76	.74	.72	.72	.72	.72	.74	.76	.80	.85	.92	1.02	1.12
339.6	1.59	1.38	1.20	1.06	.95	.88	.82	.78	.76	.74	.73	.73	.74	.76	.79	.83	.88	.96	1.07	1.19
350.1	1.68	1.45	1.25	1.10	.99	.91	.85	.81	.78	.76	.75	.75	.76	.78	.82	.86	.93	1.01	1.14	1.27
360.5	1.78	1.54	1.32	1.15	1.03	.94	.88	.83	.80	.78	.78	.78	.79	.81	.85	.90	.98	1.08	1.22	1.38
371.0	1.90	1.64	1.41	1.22	1.09	.99	.92	.87	.84	.82	.81	.81	.83	.86	.90	.96	1.05	1.16	1.33	1.51
381.4	2.06	1.77	1.51	1.31	1.16	1.06	.98	.92	.89	.87	.86	.86	.88	.91	.96	1.04	1.14	1.27	1.47	1.68
391.9	2.26	1.95	1.66	1.44	1.28	1.16	1.08	1.02	.98	.95	.95	.95	.97	1.01	1.07	1.15	1.26	1.42	1.65	1.89
402.3	2.53	2.20	1.90	1.66	1.48	1.36	1.27	1.20	1.16	1.14	1.13	1.13	1.15	1.19	1.25	1.34	1.47	1.65	1.90	2.15
412.8	2.78	2.58	2.35	2.12	1.95	1.83	1.73	1.66	1.62	1.59	1.57	1.57	1.59	1.62	1.68	1.77	1.88	1.98	2.14	2.29

Table B.14. Relative power density distribution in middle element at 8.5 d

Radius (mm)

Distance from top of element (mm)	1.1	3.0	5.5	8.5	11.2	14.0	16.7	19.5	22.2	25.0	27.7	30.5	33.2	36.0	38.7	41.5	44.2	47.2	49.9	51.9
5.2	1.41	1.43	1.45	1.48	1.50	1.51	1.50	1.50	1.50	1.50	1.50	1.51	1.52	1.53	1.54	1.53	1.48	1.37	1.24	1.11
15.7	1.41	1.41	1.40	1.40	1.40	1.38	1.37	1.35	1.35	1.35	1.36	1.37	1.39	1.41	1.44	1.45	1.43	1.35	1.22	1.09
26.1	1.44	1.43	1.41	1.39	1.37	1.34	1.32	1.30	1.29	1.29	1.30	1.32	1.34	1.38	1.41	1.44	1.43	1.36	1.23	1.08
36.6	1.47	1.44	1.41	1.38	1.35	1.31	1.28	1.26	1.25	1.25	1.26	1.28	1.31	1.35	1.40	1.43	1.44	1.38	1.24	1.07
47.0	1.47	1.44	1.40	1.36	1.32	1.28	1.25	1.22	1.21	1.21	1.22	1.24	1.28	1.32	1.37	1.41	1.43	1.37	1.24	1.07
57.5	1.45	1.42	1.37	1.33	1.29	1.25	1.21	1.18	1.17	1.17	1.19	1.21	1.25	1.29	1.34	1.39	1.41	1.36	1.23	1.06
67.9	1.44	1.40	1.35	1.31	1.26	1.22	1.18	1.16	1.14	1.15	1.16	1.18	1.22	1.27	1.32	1.36	1.39	1.34	1.22	1.06
78.4	1.44	1.39	1.34	1.29	1.24	1.20	1.16	1.14	1.12	1.12	1.14	1.16	1.20	1.25	1.30	1.35	1.37	1.34	1.22	1.07
88.8	1.43	1.39	1.33	1.27	1.23	1.18	1.15	1.12	1.11	1.11	1.12	1.15	1.18	1.23	1.28	1.33	1.36	1.33	1.22	1.07
99.3	1.43	1.38	1.32	1.26	1.21	1.17	1.13	1.10	1.09	1.09	1.11	1.13	1.17	1.22	1.27	1.32	1.35	1.32	1.22	1.07
109.7	1.43	1.37	1.31	1.25	1.20	1.15	1.12	1.09	1.08	1.08	1.09	1.12	1.16	1.20	1.26	1.31	1.34	1.32	1.22	1.08
120.2	1.43	1.37	1.30	1.24	1.19	1.14	1.10	1.08	1.06	1.06	1.08	1.10	1.14	1.19	1.24	1.30	1.34	1.32	1.22	1.09
132.3	1.42	1.37	1.29	1.23	1.17	1.13	1.09	1.06	1.05	1.05	1.06	1.09	1.13	1.18	1.23	1.29	1.33	1.31	1.22	1.09
142.8	1.43	1.36	1.29	1.22	1.16	1.12	1.08	1.05	1.03	1.04	1.05	1.08	1.12	1.17	1.22	1.28	1.32	1.31	1.23	1.10
151.5	1.43	1.37	1.29	1.22	1.16	1.11	1.07	1.04	1.03	1.03	1.04	1.07	1.11	1.16	1.21	1.27	1.32	1.31	1.24	1.12
162.0	1.44	1.37	1.29	1.21	1.15	1.10	1.06	1.03	1.02	1.02	1.03	1.06	1.10	1.15	1.20	1.26	1.31	1.31	1.24	1.13
172.4	1.44	1.37	1.28	1.20	1.14	1.09	1.05	1.02	1.01	1.01	1.02	1.05	1.09	1.14	1.20	1.26	1.31	1.31	1.25	1.14
182.9	1.45	1.37	1.28	1.20	1.14	1.08	1.04	1.01	1.00	1.00	1.01	1.04	1.08	1.13	1.19	1.25	1.30	1.31	1.26	1.15
191.5	1.46	1.38	1.28	1.20	1.13	1.08	1.04	1.01	.99	.99	1.01	1.03	1.07	1.12	1.18	1.25	1.30	1.32	1.27	1.17
202.0	1.47	1.39	1.29	1.20	1.13	1.07	1.03	1.00	.98	.98	1.00	1.03	1.07	1.12	1.17	1.24	1.30	1.32	1.28	1.19
214.2	1.48	1.39	1.28	1.19	1.12	1.06	1.02	.99	.97	.97	.99	1.01	1.05	1.10	1.16	1.23	1.29	1.32	1.29	1.20
224.7	1.49	1.40	1.28	1.19	1.12	1.06	1.01	.98	.96	.96	.98	1.00	1.04	1.10	1.15	1.22	1.29	1.32	1.30	1.22
235.1	1.51	1.41	1.29	1.19	1.11	1.05	1.01	.98	.96	.96	.97	1.00	1.04	1.09	1.15	1.22	1.29	1.33	1.31	1.23
245.6	1.52	1.42	1.29	1.19	1.11	1.05	1.00	.97	.95	.95	.96	.99	1.03	1.08	1.14	1.21	1.28	1.33	1.33	1.25
256.0	1.54	1.43	1.30	1.19	1.11	1.05	1.00	.97	.95	.95	.96	.98	1.02	1.07	1.13	1.21	1.28	1.33	1.34	1.27
266.5	1.56	1.44	1.30	1.19	1.11	1.04	1.00	.96	.95	.94	.95	.98	1.02	1.07	1.13	1.20	1.28	1.34	1.35	1.29
276.9	1.57	1.45	1.31	1.19	1.11	1.04	1.00	.95	.93	.94	.95	.97	1.01	1.06	1.12	1.19	1.28	1.34	1.36	1.31
289.1	1.59	1.46	1.31	1.19	1.10	1.04	.97	.91	.89	.90	.94	.97	1.00	1.05	1.11	1.19	1.27	1.34	1.37	1.33
299.5	1.61	1.47	1.31	1.19	1.11	1.02	.93	.88	.86	.87	.91	.97	1.00	1.05	1.11	1.18	1.27	1.35	1.39	1.35
308.3	1.63	1.48	1.32	1.19	1.11	1.00	.91	.86	.84	.84	.88	.95	1.00	1.05	1.11	1.18	1.27	1.35	1.40	1.37
318.7	1.64	1.50	1.33	1.20	1.10	.97	.89	.84	.81	.82	.85	.92	1.00	1.04	1.10	1.18	1.27	1.36	1.41	1.39
329.2	1.66	1.51	1.33	1.20	1.08	.96	.87	.82	.80	.80	.83	.90	.99	1.04	1.09	1.17	1.27	1.36	1.43	1.41
338.2	1.67	1.51	1.34	1.20	1.08	.95	.86	.81	.79	.79	.82	.88	.98	1.03	1.09	1.17	1.27	1.37	1.44	1.43
348.6	1.68	1.52	1.34	1.20	1.07	.94	.86	.80	.78	.78	.81	.87	.97	1.03	1.09	1.16	1.26	1.37	1.45	1.44
360.5	1.70	1.54	1.35	1.20	1.09	.96	.87	.81	.78	.79	.82	.88	.98	1.02	1.08	1.17	1.27	1.38	1.46	1.46
371.0	1.72	1.55	1.36	1.20	1.10	.99	.89	.83	.80	.81	.84	.91	.97	1.02	1.09	1.17	1.27	1.39	1.48	1.48
381.4	1.74	1.57	1.37	1.22	1.11	1.04	.96	.89	.86	.86	.90	.94	.98	1.03	1.10	1.18	1.29	1.41	1.50	1.50
391.9	1.77	1.60	1.41	1.26	1.15	1.08	1.02	.98	.96	.96	.96	.99	1.03	1.08	1.14	1.22	1.33	1.44	1.53	1.53
399.7	1.80	1.65	1.46	1.32	1.22	1.15	1.10	1.07	1.05	1.05	1.05	1.07	1.11	1.15	1.21	1.28	1.38	1.48	1.56	1.56
410.1	1.95	1.83	1.68	1.57	1.51	1.47	1.44	1.42	1.41	1.40	1.40	1.41	1.43	1.45	1.48	1.53	1.59	1.65	1.69	1.66

Table B.15. Relative power density distribution in outer element at 8.5 d

Distance from top of element (mm)	Radius (mm) 1.0	2.9	4.6	7.1	9.6	12.1	15.1	17.6	20.1	22.6	25.1	27.6	30.1	32.6	35.1	37.6	40.1	42.1	44.3	46.8
5.2	.72	.70	.69	.68	.67	.67	.68	.69	.71	.73	.75	.77	.80	.83	.85	.87	.87	.85	.84	.83
15.7	.70	.67	.66	.64	.63	.62	.63	.64	.65	.67	.70	.73	.76	.80	.84	.86	.87	.84	.83	.81
26.1	.72	.68	.66	.63	.62	.61	.62	.63	.65	.67	.70	.74	.78	.83	.88	.91	.91	.87	.84	.81
36.6	.74	.69	.66	.63	.62	.61	.61	.63	.65	.67	.71	.75	.81	.86	.93	.97	.96	.90	.85	.81
47.0	.74	.69	.66	.63	.61	.60	.61	.62	.64	.67	.71	.76	.82	.89	.96	1.01	1.00	.93	.87	.82
57.5	.73	.68	.65	.62	.60	.59	.60	.62	.64	.67	.71	.77	.83	.90	.98	1.03	1.02	.95	.88	.83
67.9	.72	.67	.64	.61	.60	.59	.60	.61	.64	.67	.71	.77	.83	.90	.98	1.03	1.03	.96	.89	.84
78.4	.71	.67	.64	.61	.60	.59	.60	.62	.64	.67	.72	.77	.83	.91	.99	1.05	1.05	.97	.91	.85
88.8	.72	.67	.64	.62	.61	.60	.61	.63	.65	.68	.73	.78	.85	.92	1.00	1.06	1.06	.99	.92	.86
99.4	.72	.68	.65	.63	.62	.61	.62	.64	.66	.70	.74	.79	.86	.94	1.02	1.08	1.08	1.01	.94	.88
109.9	.73	.69	.67	.64	.63	.62	.64	.65	.68	.71	.75	.81	.87	.95	1.04	1.10	1.10	1.02	.95	.90
120.2	.73	.69	.67	.64	.63	.63	.65	.67	.69	.72	.77	.82	.89	.97	1.05	1.12	1.12	1.04	.97	.91
130.6	.73	.69	.67	.64	.63	.63	.66	.68	.71	.74	.78	.84	.91	.99	1.07	1.14	1.14	1.06	.99	.93
141.1	.73	.70	.67	.64	.64	.64	.66	.69	.72	.76	.80	.86	.92	1.01	1.09	1.16	1.16	1.08	1.01	.95
151.6	.74	.70	.68	.65	.64	.64	.66	.70	.74	.77	.82	.87	.94	1.02	1.11	1.18	1.18	1.11	1.03	.97
162.1	.74	.71	.68	.66	.65	.65	.67	.70	.75	.79	.84	.89	.96	1.04	1.14	1.20	1.21	1.13	1.06	.99
172.4	.75	.72	.69	.66	.66	.66	.68	.71	.75	.81	.85	.91	.98	1.06	1.16	1.23	1.23	1.15	1.08	1.01
182.9	.76	.72	.70	.67	.66	.66	.68	.71	.76	.82	.87	.93	1.00	1.08	1.18	1.25	1.25	1.17	1.10	1.04
193.3	.77	.73	.71	.68	.67	.67	.69	.72	.76	.83	.89	.95	1.02	1.10	1.20	1.27	1.28	1.20	1.12	1.06
203.8	.78	.74	.72	.69	.68	.68	.70	.73	.77	.83	.91	.97	1.04	1.12	1.22	1.30	1.30	1.22	1.15	1.08
214.2	.79	.75	.73	.70	.69	.69	.70	.73	.78	.84	.92	.99	1.06	1.15	1.25	1.32	1.33	1.25	1.17	1.10
224.7	.80	.76	.74	.71	.70	.69	.71	.74	.78	.84	.93	1.01	1.08	1.17	1.27	1.35	1.36	1.27	1.20	1.13
235.1	.82	.78	.75	.72	.71	.70	.72	.75	.79	.85	.93	1.03	1.10	1.19	1.29	1.37	1.38	1.30	1.22	1.15
245.6	.83	.79	.76	.73	.72	.71	.73	.75	.79	.85	.94	1.05	1.12	1.21	1.32	1.40	1.41	1.33	1.25	1.18
256.0	.85	.80	.77	.74	.72	.72	.73	.76	.80	.86	.94	1.06	1.15	1.24	1.34	1.43	1.44	1.35	1.28	1.20
266.4	.87	.82	.78	.75	.73	.73	.74	.77	.81	.87	.95	1.06	1.17	1.26	1.37	1.46	1.47	1.38	1.30	1.23
276.9	.89	.84	.80	.76	.75	.74	.75	.77	.81	.87	.96	1.07	1.19	1.29	1.40	1.48	1.50	1.41	1.33	1.26
287.4	.91	.86	.82	.78	.76	.75	.76	.78	.82	.88	.97	1.08	1.22	1.31	1.43	1.51	1.53	1.44	1.36	1.29
297.8	.94	.88	.84	.80	.77	.76	.77	.79	.83	.89	.98	1.09	1.24	1.34	1.46	1.54	1.56	1.47	1.39	1.32
308.1	.97	.91	.87	.82	.79	.78	.78	.81	.85	.91	.99	1.10	1.26	1.37	1.49	1.58	1.59	1.50	1.42	1.34
318.6	1.02	.95	.90	.84	.81	.80	.80	.82	.86	.92	1.01	1.12	1.28	1.40	1.52	1.61	1.63	1.53	1.45	1.38
329.2	1.08	.99	.94	.87	.84	.82	.82	.84	.88	.94	1.03	1.15	1.30	1.43	1.55	1.65	1.66	1.57	1.48	1.41
339.6	1.15	1.05	.99	.92	.88	.85	.85	.87	.91	.97	1.06	1.18	1.34	1.46	1.58	1.68	1.70	1.60	1.52	1.44
350.1	1.24	1.13	1.06	.97	.92	.89	.89	.90	.94	1.00	1.10	1.22	1.37	1.49	1.62	1.72	1.74	1.64	1.55	1.47
360.5	1.37	1.24	1.15	1.05	.99	.95	.94	.95	.99	1.06	1.15	1.29	1.41	1.53	1.67	1.77	1.78	1.68	1.59	1.51
371.0	1.53	1.38	1.28	1.15	1.08	1.03	1.02	1.03	1.07	1.14	1.25	1.37	1.47	1.59	1.73	1.82	1.83	1.72	1.62	1.54
381.4	1.75	1.58	1.46	1.32	1.24	1.18	1.16	1.18	1.22	1.30	1.36	1.44	1.53	1.65	1.77	1.86	1.86	1.75	1.66	1.58
391.9	1.80	1.66	1.58	1.46	1.40	1.35	1.33	1.33	1.36	1.39	1.44	1.51	1.58	1.67	1.77	1.83	1.83	1.74	1.68	1.62
402.3	1.76	1.66	1.61	1.54	1.50	1.47	1.46	1.47	1.49	1.51	1.55	1.59	1.64	1.69	1.75	1.78	1.78	1.73	1.70	1.67
412.8	1.80	1.76	1.75	1.74	1.74	1.74	1.75	1.77	1.78	1.80	1.81	1.83	1.84	1.85	1.86	1.86	1.84	1.80	1.78	1.75

Table B.16. Relative power density distribution in inner element at 12.75 d

Radius (mm)

Distance from top of element (mm)	1.2	3.6	6.4	9.4	12.4	15.4	18.4	21.4	24.4	27.4	30.4	33.4	36.4	39.4	42.4	45.4	48.4	51.4	54.1	56.5
5.2	.33	.32	.31	.31	.31	.30	.31	.31	.31	.32	.32	.33	.34	.35	.36	.37	.38	.40	.42	.44
15.7	.34	.33	.32	.32	.32	.32	.32	.32	.32	.32	.33	.33	.34	.35	.36	.37	.38	.40	.42	.44
26.1	.34	.34	.33	.33	.33	.33	.33	.33	.33	.34	.34	.34	.35	.36	.37	.38	.39	.40	.42	.44
36.6	.36	.36	.35	.35	.35	.35	.35	.36	.36	.36	.36	.36	.36	.37	.37	.38	.39	.41	.43	.44
47.0	.38	.38	.38	.38	.38	.39	.39	.39	.39	.39	.38	.38	.38	.39	.39	.40	.40	.41	.43	.45
57.5	.41	.41	.41	.42	.43	.43	.43	.43	.43	.42	.42	.41	.41	.41	.41	.41	.42	.43	.44	.45
67.9	.44	.45	.46	.45	.44	.43	.43	.43	.44	.45	.46	.45	.44	.44	.43	.43	.43	.44	.46	.47
78.4	.48	.48	.46	.44	.43	.43	.43	.43	.44	.44	.46	.47	.48	.47	.46	.46	.46	.46	.47	.48
88.8	.51	.48	.46	.45	.44	.43	.43	.43	.44	.44	.45	.47	.49	.51	.50	.49	.48	.48	.49	.50
99.4	.52	.49	.47	.46	.45	.44	.44	.44	.44	.45	.46	.47	.48	.51	.53	.52	.51	.51	.52	.52
109.9	.53	.51	.48	.47	.46	.45	.45	.45	.45	.46	.46	.47	.49	.51	.53	.56	.55	.54	.54	.55
120.2	.55	.53	.50	.48	.47	.46	.46	.46	.46	.47	.47	.48	.49	.51	.53	.56	.58	.57	.57	.58
130.6	.58	.55	.52	.50	.49	.48	.48	.47	.47	.48	.48	.49	.50	.52	.54	.56	.60	.61	.61	.61
141.1	.62	.58	.55	.52	.51	.50	.49	.49	.49	.49	.49	.50	.51	.53	.55	.57	.60	.64	.64	.64
151.6	.66	.62	.58	.55	.53	.52	.51	.50	.50	.50	.51	.51	.52	.54	.55	.58	.61	.65	.68	.68
162.1	.71	.66	.61	.58	.56	.54	.53	.52	.52	.52	.52	.53	.54	.55	.57	.59	.62	.66	.71	.72
172.4	.77	.71	.65	.61	.58	.56	.55	.54	.54	.53	.54	.54	.55	.56	.58	.60	.63	.67	.72	.76
182.9	.84	.76	.70	.65	.61	.59	.57	.56	.55	.55	.55	.56	.56	.57	.59	.61	.64	.68	.73	.79
193.3	.91	.82	.74	.69	.65	.62	.59	.58	.57	.57	.57	.57	.58	.59	.60	.62	.65	.69	.75	.80
203.8	.97	.87	.79	.72	.68	.64	.62	.60	.59	.58	.58	.58	.59	.60	.62	.64	.67	.70	.76	.81
214.2	1.03	.92	.83	.76	.70	.67	.64	.62	.61	.60	.60	.60	.60	.61	.63	.65	.68	.72	.77	.83
224.7	1.08	.97	.87	.79	.73	.69	.66	.64	.62	.62	.61	.61	.62	.63	.64	.66	.69	.73	.79	.84
235.1	1.13	1.01	.90	.82	.76	.71	.68	.66	.64	.63	.63	.63	.63	.64	.65	.68	.71	.75	.80	.86
245.6	1.18	1.05	.94	.85	.78	.73	.70	.67	.65	.64	.64	.64	.64	.65	.67	.69	.72	.76	.82	.88
256.0	1.22	1.09	.97	.87	.80	.75	.72	.69	.67	.66	.65	.65	.65	.66	.68	.70	.73	.77	.83	.90
266.4	1.27	1.13	1.00	.90	.83	.77	.73	.70	.68	.67	.66	.66	.67	.67	.69	.71	.75	.79	.85	.92
276.9	1.31	1.16	1.03	.93	.85	.79	.75	.72	.70	.68	.67	.67	.68	.69	.70	.73	.76	.81	.87	.94
287.4	1.35	1.20	1.06	.95	.87	.81	.76	.73	.71	.69	.69	.68	.69	.70	.72	.74	.78	.83	.90	.97
297.8	1.40	1.24	1.09	.98	.89	.83	.78	.74	.72	.70	.70	.69	.70	.71	.73	.76	.80	.85	.92	1.00
308.1	1.44	1.28	1.12	1.00	.91	.84	.79	.76	.73	.72	.71	.71	.71	.72	.75	.78	.82	.87	.95	1.04
318.6	1.49	1.32	1.16	1.03	.94	.86	.81	.77	.75	.73	.72	.72	.73	.74	.76	.80	.84	.90	.99	1.08
329.2	1.55	1.37	1.20	1.06	.96	.89	.83	.79	.76	.75	.74	.74	.74	.76	.78	.82	.87	.94	1.04	1.14
339.6	1.62	1.42	1.25	1.10	.99	.91	.85	.81	.78	.76	.75	.75	.76	.78	.81	.85	.91	.99	1.10	1.21
350.1	1.70	1.49	1.30	1.15	1.03	.95	.88	.84	.80	.78	.77	.78	.79	.81	.84	.89	.96	1.05	1.17	1.30
360.5	1.79	1.58	1.37	1.20	1.08	.99	.92	.87	.83	.81	.80	.80	.82	.84	.88	.94	1.02	1.12	1.26	1.41
371.0	1.91	1.68	1.46	1.28	1.14	1.04	.96	.91	.87	.85	.84	.85	.86	.89	.94	1.00	1.09	1.21	1.38	1.55
381.4	2.06	1.82	1.58	1.38	1.23	1.12	1.04	.98	.94	.92	.91	.91	.93	.97	1.02	1.09	1.20	1.34	1.53	1.72
391.9	2.25	2.00	1.75	1.53	1.37	1.25	1.16	1.10	1.06	1.03	1.02	1.03	1.05	1.09	1.15	1.23	1.35	1.51	1.72	1.94
402.3	2.50	2.26	2.01	1.80	1.64	1.52	1.43	1.36	1.32	1.29	1.28	1.29	1.31	1.34	1.40	1.49	1.61	1.77	2.00	2.19
412.8	2.72	2.66	2.53	2.38	2.25	2.15	2.07	2.01	1.97	1.94	1.92	1.92	1.93	1.95	2.00	2.06	2.13	2.18	2.27	2.33

Table B.17. Relative power density distribution in middle element at 12.75 d

Radius (mm)

Distance from top of element (mm)	1.1	3.0	5.5	8.5	11.2	14.0	16.7	19.5	22.2	25.0	27.7	30.5	33.2	36.0	38.7	41.5	44.2	47.2	49.9	51.9
5.2	1.26	1.32	1.38	1.46	1.52	1.55	1.57	1.58	1.59	1.59	1.58	1.57	1.55	1.53	1.49	1.44	1.35	1.20	1.04	.91
15.7	1.28	1.31	1.35	1.39	1.42	1.43	1.44	1.43	1.43	1.43	1.43	1.43	1.43	1.42	1.41	1.38	1.32	1.20	1.04	.90
26.1	1.32	1.34	1.36	1.38	1.39	1.39	1.38	1.37	1.37	1.37	1.37	1.37	1.38	1.39	1.39	1.38	1.33	1.22	1.06	.90
36.6	1.34	1.35	1.37	1.37	1.37	1.36	1.34	1.33	1.32	1.32	1.32	1.33	1.35	1.37	1.38	1.38	1.34	1.24	1.07	.90
47.0	1.34	1.34	1.35	1.35	1.33	1.31	1.29	1.28	1.27	1.27	1.28	1.29	1.31	1.33	1.35	1.36	1.33	1.23	1.06	.90
57.5	1.32	1.32	1.32	1.31	1.30	1.27	1.25	1.23	1.22	1.22	1.23	1.25	1.27	1.29	1.32	1.33	1.31	1.22	1.06	.89
67.9	1.31	1.31	1.30	1.28	1.26	1.24	1.21	1.19	1.19	1.19	1.20	1.21	1.24	1.27	1.29	1.31	1.29	1.21	1.05	.89
78.4	1.30	1.29	1.28	1.26	1.24	1.21	1.19	1.17	1.16	1.16	1.17	1.19	1.21	1.24	1.27	1.29	1.28	1.20	1.05	.89
88.8	1.30	1.28	1.26	1.24	1.22	1.19	1.16	1.14	1.13	1.14	1.15	1.17	1.19	1.22	1.25	1.27	1.26	1.19	1.05	.90
99.3	1.29	1.27	1.25	1.23	1.20	1.17	1.14	1.12	1.11	1.12	1.13	1.15	1.17	1.21	1.24	1.26	1.25	1.18	1.05	.90
109.7	1.29	1.27	1.24	1.21	1.18	1.15	1.13	1.11	1.10	1.10	1.11	1.13	1.16	1.19	1.22	1.25	1.24	1.18	1.05	.91
120.2	1.28	1.26	1.23	1.20	1.17	1.14	1.11	1.09	1.08	1.08	1.09	1.11	1.14	1.18	1.21	1.23	1.24	1.18	1.05	.91
132.3	1.28	1.25	1.22	1.18	1.15	1.12	1.09	1.07	1.06	1.06	1.07	1.10	1.12	1.16	1.19	1.22	1.23	1.17	1.05	.92
142.8	1.28	1.25	1.21	1.17	1.14	1.11	1.08	1.05	1.04	1.05	1.06	1.08	1.11	1.15	1.18	1.21	1.22	1.17	1.06	.93
151.5	1.29	1.25	1.21	1.17	1.13	1.10	1.07	1.05	1.04	1.04	1.05	1.07	1.10	1.14	1.18	1.21	1.22	1.17	1.07	.94
162.0	1.29	1.25	1.21	1.16	1.12	1.09	1.06	1.03	1.02	1.02	1.04	1.06	1.09	1.13	1.17	1.20	1.21	1.18	1.07	.95
172.4	1.29	1.26	1.20	1.16	1.11	1.08	1.04	1.02	1.01	1.01	1.03	1.05	1.08	1.12	1.16	1.19	1.21	1.18	1.08	.96
182.9	1.30	1.26	1.20	1.15	1.11	1.07	1.03	1.01	1.00	1.00	1.02	1.04	1.07	1.11	1.15	1.19	1.21	1.18	1.09	.97
191.5	1.31	1.27	1.21	1.15	1.10	1.06	1.03	1.01	.99	1.00	1.01	1.03	1.07	1.11	1.15	1.18	1.21	1.19	1.10	.99
202.0	1.32	1.27	1.21	1.15	1.10	1.06	1.02	1.00	.98	.99	1.00	1.02	1.06	1.10	1.14	1.18	1.21	1.19	1.11	1.00
214.2	1.33	1.27	1.20	1.14	1.09	1.04	1.01	.98	.97	.97	.99	1.01	1.04	1.09	1.13	1.17	1.20	1.19	1.12	1.02
224.7	1.34	1.28	1.21	1.14	1.09	1.04	1.00	.98	.96	.96	.98	1.00	1.04	1.08	1.12	1.17	1.20	1.20	1.13	1.03
235.1	1.35	1.29	1.21	1.14	1.08	1.03	1.00	.97	.96	.96	.97	1.00	1.03	1.07	1.12	1.16	1.20	1.20	1.15	1.05
245.6	1.37	1.30	1.22	1.14	1.08	1.03	.99	.96	.95	.95	.96	.99	1.02	1.07	1.11	1.16	1.20	1.21	1.16	1.07
256.0	1.39	1.31	1.22	1.14	1.08	1.03	.99	.96	.95	.95	.96	.98	1.02	1.06	1.11	1.16	1.20	1.21	1.17	1.09
266.5	1.40	1.32	1.23	1.14	1.08	1.03	.99	.96	.94	.94	.95	.98	1.01	1.05	1.10	1.15	1.20	1.22	1.19	1.11
276.9	1.42	1.34	1.23	1.14	1.08	1.03	.99	.95	.93	.94	.95	.97	1.01	1.05	1.10	1.15	1.20	1.23	1.20	1.12
289.1	1.44	1.35	1.24	1.14	1.08	1.02	.96	.90	.88	.90	.94	.97	1.00	1.04	1.09	1.14	1.20	1.23	1.22	1.14
299.5	1.46	1.36	1.25	1.15	1.08	1.01	.92	.87	.86	.87	.91	.97	1.00	1.04	1.09	1.14	1.20	1.24	1.23	1.16
308.3	1.48	1.38	1.26	1.16	1.09	.98	.90	.85	.83	.84	.88	.95	1.00	1.04	1.09	1.14	1.21	1.25	1.25	1.18
318.7	1.49	1.39	1.27	1.16	1.08	.96	.88	.83	.81	.82	.86	.92	1.00	1.04	1.08	1.14	1.21	1.26	1.26	1.20
329.2	1.51	1.40	1.27	1.16	1.07	.95	.87	.82	.79	.80	.84	.90	.99	1.03	1.08	1.14	1.21	1.26	1.28	1.22
338.2	1.53	1.41	1.28	1.17	1.06	.94	.86	.81	.79	.79	.82	.89	.99	1.03	1.08	1.14	1.21	1.27	1.29	1.24
348.6	1.54	1.42	1.29	1.17	1.06	.94	.86	.80	.78	.79	.82	.88	.98	1.03	1.08	1.14	1.21	1.28	1.30	1.26
360.5	1.56	1.44	1.30	1.18	1.09	.96	.87	.81	.79	.79	.83	.89	.99	1.03	1.08	1.15	1.22	1.29	1.32	1.28
371.0	1.57	1.46	1.31	1.19	1.10	1.00	.91	.85	.82	.82	.86	.93	.99	1.04	1.09	1.15	1.23	1.30	1.33	1.29
381.4	1.59	1.48	1.33	1.21	1.12	1.06	.99	.92	.89	.89	.93	.98	1.01	1.06	1.11	1.17	1.25	1.32	1.35	1.31
391.9	1.62	1.51	1.38	1.26	1.18	1.11	1.07	1.03	1.01	1.01	1.02	1.04	1.07	1.11	1.16	1.22	1.29	1.35	1.37	1.33
399.7	1.64	1.55	1.43	1.33	1.26	1.21	1.17	1.15	1.13	1.13	1.13	1.15	1.17	1.20	1.24	1.29	1.35	1.39	1.40	1.35
410.1	1.76	1.70	1.63	1.58	1.55	1.54	1.53	1.53	1.53	1.52	1.52	1.52	1.52	1.51	1.51	1.52	1.54	1.54	1.50	1.42

Table B.18. Relative power density distribution in outer element at 12.75 d

Distance from top of element (mm)	Radius (mm)																			
	1.0	2.9	4.6	7.1	9.6	12.1	15.1	17.6	20.1	22.6	25.1	27.6	30.1	32.6	35.1	37.6	40.1	42.1	44.3	46.8
5.2	.76	.75	.74	.74	.74	.75	.76	.77	.78	.80	.81	.83	.84	.86	.86	.86	.85	.81	.78	.75
15.7	.74	.72	.70	.69	.68	.68	.69	.70	.71	.73	.75	.78	.80	.83	.85	.86	.84	.80	.77	.74
26.1	.76	.72	.70	.68	.67	.66	.67	.68	.70	.72	.75	.78	.82	.86	.89	.90	.89	.83	.78	.74
36.6	.78	.73	.71	.68	.66	.65	.66	.67	.69	.72	.76	.80	.84	.89	.94	.96	.94	.86	.80	.74
47.0	.78	.73	.70	.67	.65	.64	.65	.66	.69	.72	.76	.80	.86	.92	.98	1.00	.98	.89	.81	.75
57.5	.77	.71	.69	.65	.64	.63	.64	.65	.68	.71	.75	.80	.86	.93	.99	1.02	1.00	.91	.82	.75
67.9	.75	.70	.67	.64	.63	.62	.63	.65	.67	.71	.75	.80	.86	.93	.99	1.03	1.01	.92	.83	.76
78.4	.74	.69	.67	.64	.63	.62	.63	.65	.67	.71	.75	.81	.87	.93	1.00	1.04	1.02	.93	.84	.77
88.8	.74	.69	.67	.64	.63	.63	.64	.66	.68	.72	.76	.82	.88	.95	1.02	1.05	1.03	.94	.86	.78
99.4	.75	.70	.68	.65	.64	.64	.65	.67	.69	.73	.77	.83	.89	.96	1.03	1.07	1.05	.96	.87	.80
109.9	.76	.71	.69	.66	.65	.65	.66	.68	.71	.74	.79	.84	.90	.97	1.05	1.09	1.07	.97	.89	.81
120.2	.75	.71	.69	.66	.65	.65	.68	.69	.72	.76	.80	.86	.92	.99	1.06	1.11	1.08	.99	.90	.82
130.6	.75	.71	.69	.66	.65	.66	.68	.71	.74	.77	.82	.87	.93	1.01	1.08	1.12	1.10	1.01	.92	.84
141.1	.75	.71	.69	.66	.66	.66	.68	.72	.75	.79	.83	.89	.95	1.03	1.10	1.14	1.12	1.03	.94	.85
151.6	.75	.72	.69	.67	.66	.66	.69	.72	.77	.81	.85	.91	.97	1.04	1.12	1.17	1.14	1.05	.95	.87
162.1	.76	.72	.70	.67	.67	.67	.69	.73	.78	.82	.87	.92	.99	1.06	1.14	1.19	1.16	1.07	.97	.89
172.4	.77	.73	.71	.68	.68	.68	.70	.73	.78	.84	.89	.94	1.01	1.08	1.16	1.21	1.19	1.09	.99	.90
182.9	.78	.74	.71	.69	.68	.68	.71	.74	.79	.86	.91	.96	1.03	1.10	1.18	1.23	1.21	1.11	1.01	.92
193.3	.78	.75	.72	.70	.69	.69	.71	.74	.79	.86	.93	.98	1.05	1.13	1.21	1.25	1.23	1.13	1.03	.94
203.8	.79	.76	.73	.71	.70	.70	.72	.75	.80	.87	.95	1.00	1.07	1.15	1.23	1.28	1.25	1.15	1.05	.96
214.2	.81	.77	.74	.71	.71	.71	.73	.76	.80	.87	.96	1.02	1.09	1.17	1.25	1.30	1.28	1.17	1.07	.98
224.7	.82	.78	.75	.72	.71	.71	.73	.76	.81	.88	.96	1.04	1.11	1.19	1.28	1.33	1.30	1.19	1.09	1.00
235.1	.83	.79	.76	.73	.72	.72	.74	.77	.82	.88	.97	1.07	1.13	1.22	1.30	1.35	1.33	1.22	1.11	1.02
245.6	.84	.80	.77	.74	.73	.73	.75	.78	.82	.89	.97	1.09	1.16	1.24	1.33	1.38	1.35	1.24	1.14	1.04
256.0	.86	.82	.79	.75	.74	.74	.76	.78	.83	.89	.98	1.10	1.18	1.26	1.35	1.41	1.38	1.27	1.16	1.06
266.4	.88	.83	.80	.77	.75	.75	.76	.79	.84	.90	.99	1.10	1.21	1.29	1.38	1.43	1.41	1.29	1.18	1.08
276.9	.90	.85	.82	.78	.76	.76	.77	.80	.84	.91	1.00	1.11	1.23	1.32	1.41	1.46	1.44	1.32	1.21	1.10
287.4	.92	.87	.84	.80	.78	.77	.78	.81	.85	.92	1.01	1.12	1.26	1.34	1.44	1.49	1.47	1.35	1.23	1.12
297.8	.95	.90	.86	.81	.79	.78	.80	.82	.87	.93	1.02	1.13	1.28	1.37	1.47	1.52	1.50	1.37	1.26	1.15
308.1	.99	.93	.89	.84	.81	.80	.81	.84	.88	.94	1.03	1.15	1.30	1.40	1.50	1.56	1.53	1.40	1.28	1.17
318.6	1.04	.97	.92	.87	.84	.82	.83	.85	.90	.96	1.05	1.17	1.33	1.43	1.53	1.59	1.56	1.43	1.31	1.19
329.2	1.10	1.02	.97	.90	.87	.85	.85	.88	.92	.99	1.08	1.20	1.36	1.47	1.57	1.63	1.59	1.46	1.33	1.22
339.6	1.18	1.09	1.02	.95	.91	.88	.89	.91	.95	1.02	1.11	1.24	1.40	1.50	1.60	1.66	1.63	1.49	1.36	1.24
350.1	1.28	1.17	1.10	1.01	.96	.93	.93	.95	.99	1.06	1.16	1.29	1.44	1.54	1.64	1.70	1.66	1.52	1.38	1.26
360.5	1.41	1.28	1.20	1.09	1.04	1.00	.99	1.01	1.05	1.12	1.22	1.36	1.48	1.59	1.69	1.74	1.70	1.55	1.41	1.28
371.0	1.57	1.43	1.33	1.21	1.15	1.10	1.08	1.10	1.15	1.22	1.33	1.46	1.55	1.65	1.75	1.80	1.74	1.58	1.44	1.30
381.4	1.80	1.64	1.53	1.40	1.32	1.26	1.25	1.27	1.32	1.40	1.47	1.54	1.62	1.71	1.79	1.82	1.76	1.60	1.45	1.32
391.9	1.84	1.72	1.65	1.56	1.51	1.46	1.45	1.46	1.48	1.51	1.56	1.61	1.66	1.72	1.77	1.78	1.71	1.57	1.45	1.34
402.3	1.76	1.70	1.67	1.63	1.61	1.59	1.59	1.60	1.61	1.63	1.65	1.67	1.68	1.70	1.71	1.69	1.62	1.52	1.44	1.35
412.8	1.75	1.75	1.76	1.78	1.80	1.82	1.83	1.84	1.85	1.84	1.83	1.82	1.79	1.76	1.73	1.67	1.61	1.53	1.46	1.38

Table B.19. Relative power density distribution in inner element at 17 d

Distance from top of element (mm)	Radius (mm) 1.2	3.6	6.4	9.4	12.4	15.4	18.4	21.4	24.4	27.4	30.4	33.4	36.4	39.4	42.4	45.4	48.4	51.4	54.1	56.5
5.2	.63	.60	.57	.55	.53	.51	.50	.49	.48	.48	.48	.48	.48	.48	.49	.50	.51	.52	.53	.54
15.7	.69	.65	.61	.58	.55	.53	.51	.50	.49	.48	.48	.48	.48	.48	.49	.49	.50	.51	.53	.54
26.1	.75	.71	.66	.62	.59	.56	.54	.52	.51	.50	.49	.49	.48	.48	.49	.49	.50	.51	.53	.54
36.6	.83	.78	.72	.68	.64	.60	.58	.56	.54	.52	.51	.50	.50	.50	.50	.50	.51	.52	.53	.55
47.0	.92	.85	.79	.74	.69	.66	.63	.60	.58	.56	.54	.53	.52	.51	.51	.51	.52	.52	.54	.55
57.5	1.01	.94	.87	.81	.76	.72	.69	.66	.63	.60	.58	.56	.55	.54	.53	.53	.53	.54	.55	.56
67.9	1.11	1.03	.95	.85	.77	.71	.68	.65	.64	.64	.64	.61	.59	.57	.56	.55	.55	.55	.57	.57
78.4	1.22	1.10	.95	.84	.76	.70	.66	.64	.63	.62	.62	.63	.64	.61	.59	.58	.57	.57	.58	.59
88.8	1.29	1.10	.95	.84	.76	.70	.66	.64	.62	.61	.61	.62	.63	.66	.63	.61	.60	.60	.60	.61
99.4	1.30	1.11	.96	.84	.76	.71	.67	.64	.62	.61	.61	.62	.63	.64	.67	.65	.63	.62	.63	.63
109.9	1.31	1.12	.97	.85	.77	.72	.67	.65	.63	.62	.62	.62	.63	.64	.66	.69	.67	.65	.66	.66
120.2	1.32	1.14	.98	.87	.78	.72	.68	.65	.64	.62	.62	.62	.63	.64	.66	.69	.71	.69	.69	.69
130.6	1.33	1.15	.99	.88	.79	.74	.69	.66	.64	.63	.63	.63	.63	.64	.66	.69	.72	.72	.72	.72
141.1	1.35	1.16	1.01	.89	.81	.75	.70	.67	.65	.64	.63	.63	.64	.65	.66	.69	.72	.76	.76	.75
151.6	1.36	1.17	1.02	.90	.82	.76	.71	.68	.66	.65	.64	.64	.64	.65	.67	.69	.72	.76	.79	.79
162.1	1.36	1.19	1.03	.92	.83	.77	.72	.69	.67	.66	.65	.65	.65	.66	.67	.69	.72	.76	.82	.83
172.4	1.37	1.20	1.04	.93	.84	.78	.73	.70	.68	.66	.66	.65	.66	.66	.68	.70	.73	.77	.82	.87
182.9	1.38	1.20	1.05	.94	.85	.79	.74	.71	.69	.67	.66	.66	.66	.67	.68	.70	.73	.77	.83	.88
193.3	1.38	1.21	1.06	.95	.86	.80	.75	.72	.70	.68	.67	.67	.67	.68	.69	.71	.74	.78	.83	.89
203.8	1.39	1.22	1.07	.96	.87	.81	.76	.73	.70	.69	.68	.67	.68	.68	.70	.72	.75	.79	.84	.90
214.2	1.39	1.23	1.08	.97	.88	.82	.77	.74	.71	.69	.69	.68	.68	.69	.70	.72	.75	.79	.85	.90
224.7	1.40	1.24	1.09	.98	.89	.83	.78	.74	.72	.70	.69	.69	.69	.70	.71	.73	.76	.80	.86	.91
235.1	1.40	1.24	1.10	.98	.90	.83	.79	.75	.72	.71	.70	.69	.70	.70	.72	.74	.77	.81	.87	.92
245.6	1.41	1.25	1.11	.99	.91	.84	.79	.76	.73	.71	.70	.70	.70	.71	.72	.74	.77	.82	.87	.93
256.0	1.42	1.26	1.12	1.00	.92	.85	.80	.76	.74	.72	.71	.70	.71	.71	.73	.75	.78	.83	.89	.95
266.4	1.43	1.27	1.13	1.01	.92	.86	.81	.77	.74	.73	.71	.71	.71	.72	.74	.76	.79	.84	.90	.96
276.9	1.44	1.29	1.14	1.02	.93	.87	.81	.78	.75	.73	.72	.72	.72	.73	.74	.77	.80	.85	.91	.98
287.4	1.46	1.30	1.15	1.04	.94	.87	.82	.78	.76	.74	.73	.72	.73	.74	.75	.78	.81	.86	.93	1.00
297.8	1.48	1.32	1.17	1.05	.96	.88	.83	.79	.76	.74	.73	.73	.73	.74	.76	.79	.83	.88	.95	1.03
308.1	1.50	1.34	1.19	1.06	.97	.90	.84	.80	.77	.75	.74	.74	.74	.75	.77	.80	.84	.90	.98	1.06
318.6	1.53	1.37	1.21	1.08	.98	.91	.85	.81	.78	.76	.75	.75	.75	.76	.79	.82	.87	.93	1.01	1.10
329.2	1.57	1.40	1.24	1.11	1.01	.93	.87	.82	.79	.77	.76	.76	.76	.78	.81	.84	.89	.96	1.06	1.15
339.6	1.61	1.45	1.28	1.14	1.03	.95	.88	.84	.81	.78	.77	.77	.78	.80	.83	.87	.93	1.00	1.11	1.21
350.1	1.67	1.50	1.33	1.18	1.06	.97	.91	.86	.83	.80	.79	.79	.80	.83	.86	.91	.97	1.06	1.18	1.29
360.5	1.75	1.57	1.39	1.23	1.11	1.01	.94	.89	.85	.83	.82	.82	.84	.86	.90	.95	1.03	1.13	1.26	1.39
371.0	1.84	1.66	1.47	1.30	1.17	1.07	.99	.93	.90	.87	.86	.87	.88	.91	.96	1.02	1.11	1.22	1.37	1.52
381.4	1.96	1.78	1.58	1.40	1.26	1.15	1.07	1.01	.97	.94	.93	.94	.96	.99	1.04	1.12	1.21	1.34	1.51	1.67
391.9	2.11	1.94	1.74	1.56	1.41	1.29	1.21	1.15	1.10	1.08	1.07	1.07	1.09	1.13	1.19	1.27	1.37	1.51	1.70	1.86
402.3	2.31	2.17	1.99	1.83	1.69	1.58	1.50	1.44	1.40	1.37	1.36	1.36	1.38	1.42	1.47	1.54	1.65	1.78	1.95	2.08
412.8	2.43	2.47	2.44	2.36	2.28	2.22	2.16	2.12	2.08	2.06	2.04	2.04	2.04	2.06	2.08	2.12	2.16	2.15	2.17	2.15

Table B.20. Relative power density distribution in middle element at 17 d

Radius (mm)

Distance from top of element (mm)	1.1	3.0	5.5	8.5	11.2	14.0	16.7	19.5	22.2	25.0	27.7	30.5	33.2	36.0	38.7	41.5	44.2	47.2	49.9	51.9
5.2	1.01	1.07	1.15	1.24	1.31	1.35	1.38	1.40	1.41	1.40	1.39	1.37	1.34	1.30	1.25	1.18	1.08	.94	.79	.67
15.7	1.05	1.09	1.16	1.23	1.28	1.31	1.33	1.34	1.34	1.34	1.33	1.32	1.30	1.27	1.24	1.18	1.10	.96	.81	.69
26.1	1.10	1.14	1.20	1.25	1.29	1.31	1.32	1.32	1.32	1.32	1.31	1.30	1.29	1.28	1.25	1.21	1.13	1.00	.83	.69
36.6	1.13	1.17	1.21	1.26	1.28	1.29	1.29	1.29	1.29	1.29	1.29	1.28	1.28	1.27	1.26	1.22	1.16	1.03	.85	.70
47.0	1.13	1.17	1.20	1.24	1.25	1.26	1.25	1.24	1.24	1.24	1.24	1.24	1.25	1.25	1.24	1.21	1.15	1.03	.86	.70
57.5	1.12	1.15	1.18	1.21	1.22	1.21	1.21	1.20	1.19	1.19	1.20	1.20	1.21	1.21	1.21	1.19	1.14	1.02	.85	.70
67.9	1.11	1.14	1.16	1.18	1.18	1.18	1.17	1.16	1.16	1.16	1.16	1.17	1.18	1.18	1.18	1.17	1.12	1.01	.85	.70
78.4	1.11	1.12	1.14	1.16	1.16	1.15	1.14	1.13	1.13	1.13	1.13	1.14	1.15	1.16	1.16	1.15	1.11	1.00	.85	.71
88.8	1.10	1.11	1.13	1.14	1.14	1.13	1.11	1.10	1.10	1.10	1.11	1.12	1.13	1.14	1.14	1.13	1.10	1.00	.85	.71
99.3	1.09	1.10	1.11	1.12	1.12	1.10	1.09	1.08	1.07	1.08	1.08	1.09	1.11	1.12	1.13	1.12	1.09	.99	.85	.71
109.7	1.09	1.10	1.10	1.10	1.10	1.08	1.07	1.06	1.05	1.05	1.06	1.08	1.09	1.11	1.11	1.11	1.08	.99	.85	.72
120.2	1.08	1.09	1.09	1.09	1.08	1.07	1.05	1.04	1.03	1.04	1.04	1.06	1.07	1.09	1.10	1.10	1.07	.99	.85	.72
132.3	1.08	1.08	1.08	1.07	1.06	1.04	1.03	1.01	1.01	1.01	1.02	1.04	1.05	1.07	1.08	1.09	1.06	.98	.85	.73
142.8	1.08	1.08	1.07	1.06	1.05	1.03	1.01	1.00	.99	1.00	1.01	1.02	1.04	1.06	1.07	1.08	1.06	.98	.86	.73
151.5	1.08	1.08	1.07	1.06	1.04	1.02	1.00	.99	.98	.99	1.00	1.01	1.03	1.05	1.07	1.07	1.06	.99	.86	.74
162.0	1.08	1.08	1.06	1.05	1.03	1.01	.99	.97	.97	.97	.98	1.00	1.02	1.04	1.06	1.07	1.05	.99	.87	.75
172.4	1.09	1.08	1.06	1.04	1.02	1.00	.98	.96	.95	.96	.97	.99	1.01	1.03	1.05	1.06	1.05	.99	.88	.76
182.9	1.09	1.08	1.06	1.03	1.01	.99	.96	.95	.94	.95	.96	.98	1.00	1.02	1.04	1.05	1.05	.99	.89	.77
191.5	1.10	1.08	1.06	1.03	1.01	.98	.96	.94	.94	.94	.95	.97	.99	1.02	1.04	1.05	1.05	1.00	.90	.78
202.0	1.11	1.09	1.06	1.03	1.00	.97	.95	.93	.92	.93	.94	.96	.98	1.01	1.03	1.05	1.05	1.00	.91	.80
214.2	1.11	1.09	1.06	1.02	.99	.96	.94	.92	.91	.91	.93	.95	.97	1.00	1.02	1.04	1.04	1.00	.91	.81
224.7	1.12	1.10	1.06	1.02	.99	.96	.93	.91	.90	.90	.92	.94	.96	.99	1.02	1.04	1.05	1.01	.93	.82
235.1	1.14	1.11	1.06	1.02	.98	.95	.92	.90	.89	.90	.91	.93	.96	.99	1.01	1.04	1.05	1.02	.94	.84
245.6	1.15	1.11	1.07	1.02	.98	.95	.92	.90	.89	.89	.90	.92	.95	.98	1.01	1.03	1.05	1.02	.95	.85
256.0	1.16	1.12	1.07	1.02	.98	.94	.91	.89	.88	.88	.90	.92	.94	.98	1.01	1.03	1.05	1.03	.96	.87
266.5	1.18	1.14	1.08	1.02	.98	.94	.91	.89	.88	.88	.89	.91	.94	.97	1.00	1.03	1.05	1.04	.98	.89
276.9	1.19	1.15	1.08	1.02	.98	.94	.91	.88	.86	.88	.89	.91	.94	.97	1.00	1.03	1.05	1.05	.99	.90
289.1	1.21	1.16	1.09	1.03	.98	.94	.88	.84	.82	.83	.88	.90	.93	.96	.99	1.03	1.05	1.05	1.00	.92
299.5	1.22	1.17	1.10	1.03	.98	.92	.85	.81	.79	.80	.84	.90	.93	.96	.99	1.03	1.06	1.06	1.02	.94
308.3	1.24	1.18	1.11	1.04	.99	.90	.83	.79	.77	.78	.82	.89	.93	.96	.99	1.03	1.06	1.07	1.03	.96
318.7	1.26	1.20	1.12	1.04	.98	.88	.81	.77	.75	.76	.80	.86	.93	.96	.99	1.03	1.07	1.08	1.05	.97
329.2	1.27	1.21	1.12	1.05	.97	.87	.80	.75	.74	.75	.78	.84	.93	.96	.99	1.03	1.07	1.09	1.06	.99
338.2	1.29	1.22	1.13	1.05	.97	.86	.79	.75	.73	.74	.77	.83	.92	.96	.99	1.03	1.07	1.09	1.07	1.00
348.6	1.30	1.23	1.14	1.06	.97	.87	.79	.75	.73	.73	.76	.82	.92	.96	.99	1.03	1.08	1.10	1.08	1.02
360.5	1.31	1.24	1.15	1.07	1.00	.89	.81	.76	.74	.74	.78	.84	.93	.96	1.00	1.04	1.08	1.11	1.09	1.03
371.0	1.32	1.25	1.16	1.08	1.01	.93	.85	.79	.77	.78	.81	.87	.93	.97	1.00	1.05	1.09	1.12	1.10	1.04
381.4	1.33	1.27	1.18	1.10	1.04	.99	.93	.87	.84	.85	.88	.93	.96	.99	1.02	1.07	1.11	1.13	1.11	1.05
391.9	1.34	1.29	1.21	1.14	1.09	1.04	1.01	.99	.97	.97	.98	.99	1.02	1.04	1.07	1.10	1.14	1.15	1.13	1.06
399.7	1.35	1.31	1.25	1.19	1.16	1.13	1.11	1.09	1.08	1.08	1.09	1.09	1.11	1.12	1.14	1.16	1.18	1.18	1.14	1.07
410.1	1.41	1.40	1.38	1.38	1.38	1.39	1.40	1.41	1.41	1.41	1.40	1.39	1.37	1.36	1.33	1.32	1.30	1.26	1.19	1.10

Table B.21. Relative power density distribution in outer element at 17 d

Distance from top of element (mm)	Radius (mm) 1.0	2.9	4.6	7.1	9.6	12.1	15.1	17.6	20.1	22.6	25.1	27.6	30.1	32.6	35.1	37.6	40.1	42.1	44.3	46.8
5.2	.87	.86	.86	.86	.87	.87	.88	.89	.90	.91	.91	.92	.92	.92	.91	.89	.86	.81	.76	.72
15.7	.86	.84	.83	.81	.81	.81	.81	.82	.83	.85	.86	.88	.90	.91	.91	.90	.87	.81	.76	.71
26.1	.89	.85	.83	.81	.80	.79	.79	.80	.82	.84	.86	.89	.92	.94	.96	.96	.92	.84	.77	.71
36.6	.91	.86	.84	.80	.79	.78	.78	.79	.81	.84	.87	.91	.95	.99	1.02	1.02	.97	.88	.79	.72
47.0	.92	.86	.83	.79	.77	.76	.77	.78	.80	.83	.87	.92	.96	1.02	1.06	1.07	1.02	.91	.81	.72
57.5	.90	.84	.81	.77	.75	.74	.75	.76	.79	.82	.86	.91	.96	1.02	1.07	1.09	1.03	.92	.82	.73
67.9	.88	.82	.79	.75	.73	.72	.73	.75	.77	.81	.85	.90	.96	1.02	1.07	1.09	1.04	.93	.82	.73
78.4	.86	.81	.78	.74	.73	.72	.73	.75	.77	.81	.85	.90	.96	1.02	1.08	1.10	1.05	.94	.83	.74
88.8	.86	.80	.78	.74	.73	.72	.73	.75	.78	.81	.86	.91	.97	1.03	1.09	1.11	1.06	.95	.84	.75
99.4	.86	.81	.78	.75	.73	.73	.74	.76	.79	.82	.87	.92	.98	1.04	1.10	1.12	1.07	.96	.85	.76
109.9	.86	.81	.79	.75	.74	.74	.75	.77	.80	.83	.88	.93	.99	1.05	1.11	1.13	1.09	.97	.86	.77
120.2	.85	.81	.78	.75	.74	.74	.76	.78	.81	.85	.89	.95	1.00	1.07	1.13	1.15	1.10	.98	.87	.78
130.6	.85	.80	.77	.74	.74	.74	.76	.80	.82	.86	.91	.96	1.02	1.08	1.14	1.16	1.11	1.00	.89	.79
141.1	.84	.80	.77	.74	.73	.74	.76	.80	.84	.87	.92	.97	1.03	1.10	1.16	1.18	1.13	1.01	.90	.80
151.6	.84	.80	.77	.74	.74	.74	.76	.80	.85	.89	.94	.99	1.05	1.12	1.18	1.20	1.15	1.03	.91	.81
162.1	.84	.80	.77	.75	.74	.74	.77	.80	.86	.91	.95	1.01	1.07	1.13	1.20	1.22	1.16	1.04	.93	.82
172.4	.84	.80	.78	.75	.74	.74	.77	.81	.86	.92	.97	1.02	1.08	1.15	1.21	1.23	1.18	1.06	.94	.83
182.9	.85	.81	.78	.75	.75	.75	.77	.81	.86	.93	.99	1.04	1.10	1.17	1.23	1.25	1.20	1.07	.95	.85
193.3	.85	.81	.79	.76	.75	.75	.78	.81	.86	.94	1.00	1.06	1.12	1.19	1.25	1.27	1.22	1.09	.97	.86
203.8	.86	.82	.79	.76	.76	.76	.78	.81	.87	.94	1.02	1.08	1.14	1.21	1.27	1.29	1.24	1.11	.98	.87
214.2	.86	.82	.80	.77	.76	.76	.78	.82	.87	.94	1.03	1.09	1.16	1.23	1.29	1.31	1.25	1.12	1.00	.88
224.7	.87	.83	.80	.77	.77	.77	.79	.82	.87	.94	1.03	1.11	1.18	1.25	1.31	1.33	1.27	1.14	1.01	.90
235.1	.88	.84	.81	.78	.77	.77	.79	.82	.87	.94	1.04	1.14	1.20	1.27	1.33	1.35	1.30	1.16	1.03	.91
245.6	.89	.85	.82	.79	.78	.78	.80	.83	.88	.95	1.04	1.16	1.22	1.29	1.36	1.38	1.32	1.18	1.05	.93
256.0	.90	.86	.83	.79	.78	.78	.80	.83	.88	.95	1.04	1.16	1.24	1.31	1.38	1.40	1.34	1.20	1.06	.94
266.4	.91	.87	.84	.80	.79	.79	.81	.84	.89	.96	1.05	1.16	1.26	1.33	1.40	1.42	1.36	1.22	1.08	.95
276.9	.93	.88	.85	.81	.80	.80	.81	.84	.89	.96	1.05	1.17	1.29	1.36	1.43	1.45	1.38	1.24	1.10	.97
287.4	.95	.90	.87	.83	.81	.81	.82	.85	.90	.97	1.06	1.18	1.31	1.38	1.45	1.47	1.40	1.26	1.11	.98
297.8	.98	.92	.89	.84	.83	.82	.83	.86	.91	.98	1.07	1.19	1.33	1.41	1.48	1.50	1.43	1.28	1.13	1.00
308.1	1.01	.95	.91	.86	.84	.83	.85	.87	.92	.99	1.08	1.20	1.35	1.44	1.51	1.53	1.45	1.30	1.15	1.01
318.6	1.05	.99	.94	.89	.87	.85	.86	.89	.94	1.01	1.10	1.22	1.37	1.47	1.54	1.55	1.48	1.32	1.16	1.02
329.2	1.11	1.04	.98	.93	.90	.88	.89	.91	.96	1.03	1.13	1.25	1.40	1.50	1.57	1.58	1.50	1.34	1.18	1.04
339.6	1.18	1.10	1.04	.97	.94	.91	.92	.94	.99	1.06	1.16	1.29	1.44	1.53	1.60	1.61	1.52	1.35	1.19	1.05
350.1	1.27	1.18	1.11	1.03	.99	.96	.96	.99	1.03	1.11	1.21	1.34	1.48	1.56	1.63	1.64	1.55	1.37	1.21	1.06
360.5	1.39	1.29	1.21	1.12	1.07	1.03	1.03	1.05	1.10	1.17	1.28	1.41	1.52	1.60	1.67	1.67	1.57	1.39	1.22	1.06
371.0	1.55	1.43	1.34	1.24	1.18	1.13	1.13	1.15	1.20	1.28	1.39	1.51	1.58	1.66	1.71	1.71	1.59	1.40	1.23	1.07
381.4	1.74	1.62	1.53	1.42	1.36	1.31	1.30	1.33	1.38	1.47	1.53	1.58	1.64	1.70	1.73	1.71	1.58	1.40	1.22	1.07
391.9	1.75	1.67	1.63	1.57	1.54	1.51	1.50	1.51	1.53	1.56	1.59	1.62	1.65	1.67	1.67	1.62	1.51	1.34	1.19	1.06
402.3	1.62	1.60	1.60	1.58	1.58	1.58	1.59	1.60	1.60	1.61	1.61	1.61	1.60	1.58	1.55	1.48	1.38	1.26	1.15	1.04
412.8	1.54	1.56	1.59	1.62	1.65	1.67	1.69	1.69	1.69	1.67	1.64	1.61	1.56	1.51	1.45	1.38	1.29	1.20	1.11	1.02

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