

NEUTRON REFERENCE BENCHMARK FIELD SPECIFICATION: ACRR 44 INCH LEAD-BORON (LB44) BUCKET ENVIRONMENT (ACRR-LB44-CC-32-CL)

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ABSTRACT

This report was put together to support the International Atomic Energy Agency (IAEA) REAL-2016 activity to validate the dosimetry community's ability to use a consistent set of activation data and to derive consistent spectral characterizations. The report captures details of integral measurements taken in the Annular Core Research Reactor (ACRR) central cavity with the 44 inch Lead-Boron (LB44) bucket, reference neutron benchmark field. The field is described and an "a priori" calculated neutron spectrum is reported, based on MCNP6 calculations, and a subject matter expert (SME) based covariance matrix is given for this "a priori" spectrum. The results of 31 integral dosimetry measurements in the neutron field are reported.

Key Words: Spectrum Adjustment, Spectrum Unfolding, Reactor Dosimetry

1 FIELD DESCRIPTION

The ACRR is a pulse and steady-state, pool-type research reactor that maintains a large, dry irradiation cavity at the center of its core. The ACRR is typically used to perform irradiation testing where a high neutron fluence is required for a short period of time. Historically, the ACRR has been used for a wide variety of experiment campaigns including electronics damage testing, nuclear fuels testing, space nuclear thermal propulsion testing, and medical isotope production. The ACRR is currently fully operational. The ACRR's main attributes include a large, dry central irradiation cavity, epithermal neutron fluence, and large pulsing capabilities.

Figure 1 shows the ACRR looking into the pool during a 2 MW steady-state power operation. The ACRR core is shown on the left in the figure. The 23.3 cm diameter dry cavity extends from above the pool through the center of the core. The reactor facility also accommodates the fueled ring external cavity-II (FREC-II), shown on the right in the figure, which maintains a larger dry cavity and uses uranium/zirconium-hydride (U-ZrH) TRIGA fuel as a subcritical multiplier. FREC-II provides the user with a larger experimental volume and the fuel arrangement limits the neutron fluence gradient across the test volume.

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Figure 1. The ACRR and FREC-II operating at 2-MW steady-state power.

The ACRR maintains an epithermal neutron fluence spectrum in the core and central cavity. This allows for the neutron energy fluence spectrum to be tailored to the desired specifications of an experiment by introducing various spectrum modifying buckets. Moderators can be used within the cavity to thermalize the neutron spectrum. Boron and lead can be used to increase the fast neutron fluence ratio and decrease the gamma-ray fluence, respectively. For an unmoderated condition, the neutron fluence at the center of the central cavity, at the core axial center-line, is $\approx 2.0 \times 10^{13}$ n/cm² per MJ of reactor energy. About 46% of the neutron fluence is above 100 keV and 58% above 10 keV. The 1 MeV damage-equivalent silicon fluence is $\approx 7.6 \times 10^{12}$ n/cm² per MJ of reactor energy. The prompt gamma-ray dose at the same position is $\approx 7.9 \times 10^3$ rad(Si) per MJ. The delayed gamma-ray dose is $\approx 3.4 \times 10^3$ rad(Si) per MJ.

The ACRR can operate in a steady-state, transient, or pulse mode. In the steady-state mode, the operating power level is limited to 4 MW. In the pulse mode, a maximum pulse size of 250 MJ with a full-width half-maximum (FWHM) of 6 ms can be attained. In the transient mode, the reactor power shape can be tailored to the desired requirements for a total reactor energy deposition of 300 MJ. The transient mode can be used to increase the reactor power quickly; for example a ramp increase in power level linear with time from low power to high power. The ACRR is fueled by a 236 element array of UO₂-BeO fuel elements. The fuel is uranium enriched to 35 weight percent ²³⁵U, with 21.5 weight percent UO₂ and 78.5 weight percent BeO. The ACRR fuel elements are stainless steel clad, 3.747 cm in outer diameter and 52.25 cm in fuel length. Within the elements are niobium cups that hold the UO₂BeO fuel pieces. The ACRR is controlled by two fuel-followed safety rods, three poison (void-followed) transient rods, and six fuel-followed control rods. The

control rods make up part of the 236 elements for the normal core configuration. Further information regarding the ACRR can be found in SAND2006-3067 [1].

The purpose of the LB44 bucket is to fit within the 23.3 cm diameter ACRR central cavity and filter out thermal neutrons and gamma rays from the internal experiment volume, producing an epithermal neutron environment with a high neutron-to-gamma ray ratio. This type of environment allows for a high 1-MeV damage equivalent in silicon neutron fluence with a low total dose in silicon. This environment is in high demand by facility experimenters. It is anticipated that more buckets of the LB44 type will be built over the next several years. The LB44 bucket configuration is a relatively new design and was constructed in CY2010. In order to filter out the thermal neutrons, the bucket has an outer annular volume filled with B_4C powder. To filter out the gamma rays, the bucket has an inner Pb annular liner. The bucket also has B_4C and Pb on the bottom so that the bucket can be used at elevated positions within the cavity with the same filter effectiveness. A drawing of the LB44 bucket is shown in Figure 2. The bucket weighs approximately 230 kg and can support an additional experiment payload of up to 114 kg. A thermocouple (TC) fixture can be inserted into the Pb region of the bucket to measure temperature as a function of time at power, thus permitting use during long steady-state irradiations. The bucket can be operated at up to 500 MJ in an un-instrumented (no TC) condition. An unlimited number of maximum pulse operations can be performed on the bucket. The measured reactivity worth of LB44, compared to the free-field condition, is $-\$6.07$.

This document presents the benchmark data necessary to perform a spectrum adjustment for the ACRR LB44 environment. The designation for this environment is ACRR-LB44-CC-32-cl. The necessary data includes an “a priori” spectrum with associated uncertainties and correlations, and the measured activities of neutron activation foils irradiated in the environment. Table I details the set of spectrum characterization irradiations that were performed in 2011 and 2012 in order to characterize this neutron field for electronics damage testing. When gathering spectrum characterization data, a series of separate reactor operations were used. High purity germanium (HPGe) detectors were used for reading the dosimetry foils. Typically the detectors will yield values for the activity of the same foil that are reproducible to within 1-3%. If detector counts total more than 10^4 and background counts are low so that statistical uncertainties are small, then the uncertainty of an activity measurement is less than $\approx 5\%$. Cadmium and boron covers were used to alter the region of energy response for some of the activation foils. The boron balls were large enough to alter the neutron field in the surrounding region, so each boron-covered activation foil was exposed on a separate operation. Fission foils were not stacked in the boron ball since previous testing had shown that the neutron scattering between adjacent fission foils thermalized enough neutrons to alter the dosimeter response of ^{235}U and ^{239}Pu foils. The $^{58}Ni(n,p)$ reaction was used to normalize the separate reactor operations to a uniform neutron fluence. Hence, every irradiation contained at least one Ni foil for the purpose of normalization.

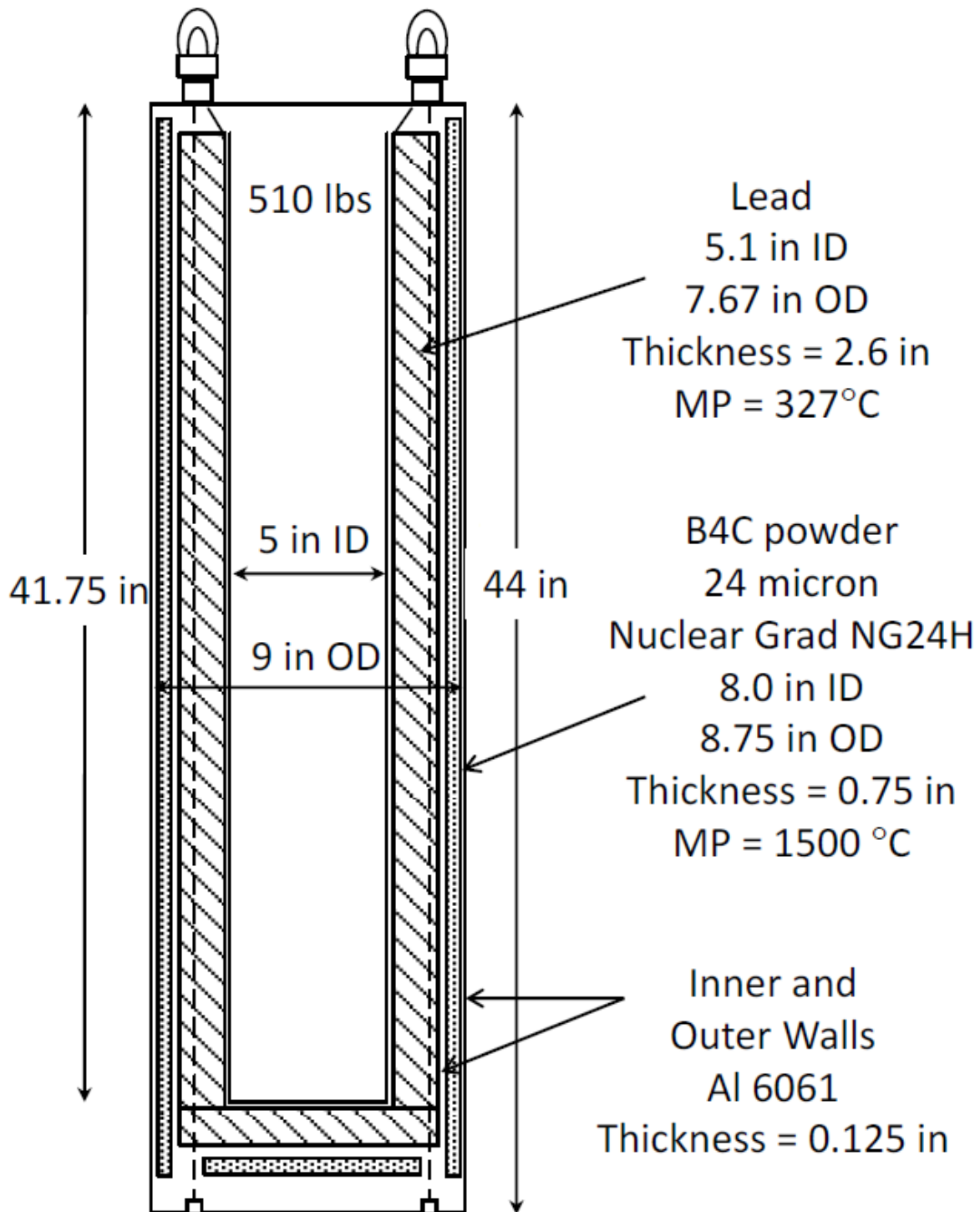


Figure 2. Details of the LB44 bucket.

Table I. Irradiations performed to characterize the ACRR LB44 environment for experimenters.

Date	Shot number	Type	Reactor energy	Description
2/24/2011	9725	Steady State	≈ 300 MJ	Axial flux mapping via sulfur tablets at 1 cm increments along the axis of the central cavity
2/24/2011	9726	Steady State	≈ 300 MJ	Axial gamma flux mapping via TLDs at 1 cm increments along the axis of the central cavity
2/24/2011	9727	Steady State	≈ 150 MJ	Radial flux mapping using sulfur and dilute gold tablets at the axial fuel centerline
1/26/2011	9728	Pulse	286.1 MJ	Activation foil set 1: Sc, Fe, Zr, Ti, Ni, S, Nb, Co, and Na
8/10/2012	10343	Pulse	326.0 MJ	Activation foil set 2: Au, Co, Fe
3/7/2012	10206	Pulse	300.2 MJ	Activation foil set 3: Mg, Cu, Mn, In, and Al
1/26/2011	9729	Steady State	≈ 50 MJ	Pu activation foil in Cd cover and B ₄ C ball
1/26/2011	9730	Steady State	≈ 50 MJ	Enriched U activation foil in Cd cover and B ₄ C ball
1/27/2011	9731	Steady State	≈ 50 MJ	Np activation foil in Cd cover and B ₄ C ball
1/27/2011	9732	Steady State	≈ 50 MJ	Depleted U activation foil in Cd cover and B ₄ C ball

2 MCNP MODEL OF THE REACTOR ENVIRONMENT

High fidelity calculations were performed to provide the best possible calculated neutron spectrum. This is the spectrum that should be used as input to various spectrum adjustment codes, or as the trial spectrum in iterative unfolding codes. The radiation transport was performed with the continuous energy, three dimensional Monte Carlo particle transport code MCNP [2]. The MCNP model of the ACRR with the LB44 bucket on the 32-inch pedestal is shown in Figure 3. The MCNP input file is included in Appendix A of this document.

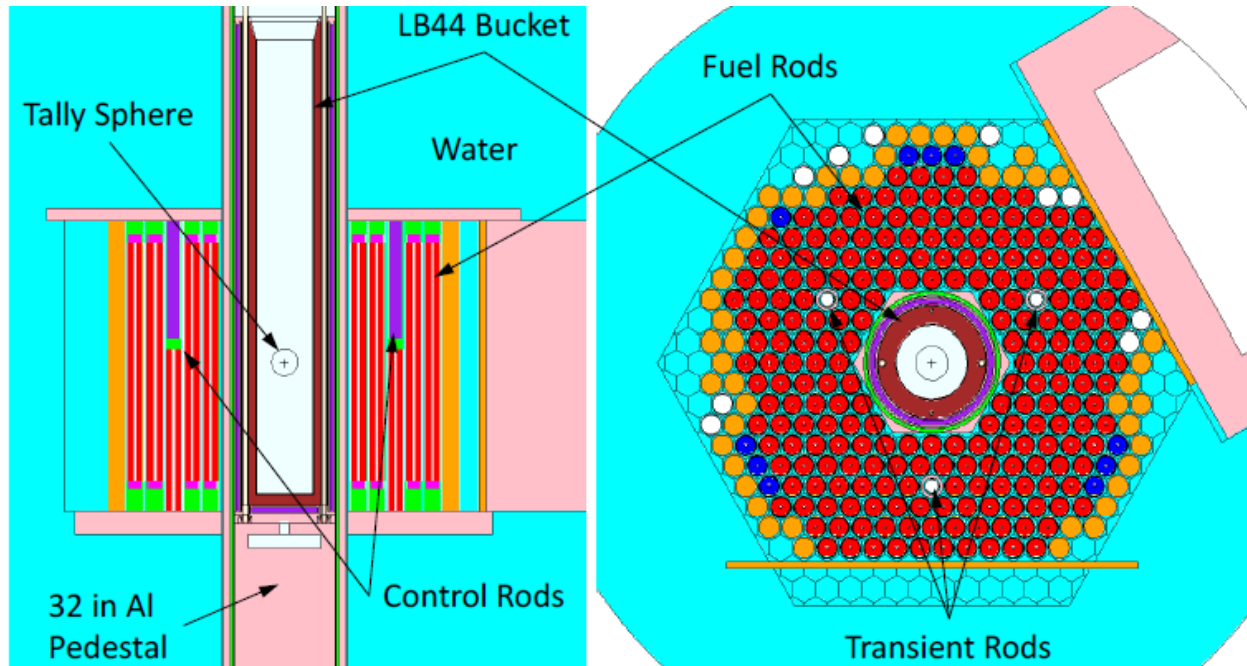


Figure 3. MCNP model of the ACRR and the central cavity with the LB44 bucket on the 32-inch pedestal.

The model does not include the FREC-II. The reason for this is that, although the FREC-II is located within the core tank, the normal operating mode is to have it tilted back and decoupled from the core using a nickel plate. In this position the FREC-II has only a small effect on the neutronic behavior of the ACRR. The MCNP model of the ACRR includes all of the fuel elements and the control, safety, and transient rods that make up the core. The control, safety, and transient rods can be adjusted in the vertical direction in the model to whatever position is desired. Typically, the model is run with the safety and transient rods in the full-out position and the control rods in the full-out, full-in, or delayed critical (dc) position. The calculated dc position can be found for the model by iterating on the control rod position until the multiplication factor is equal to unity.

Neutron, prompt gamma-ray, and delayed gamma-ray energy spectra and fluence per fission were calculated using a 6 cm diameter tally sphere. For the ACRR-LB44-CC-32-cl position, the sphere was positioned at the radial center of the cavity and at the axial center-line of the core. Calculations were performed using the MCNP k-code mode for the neutron and prompt gamma-ray environments, and in the source mode for the delayed gamma-ray environment.

3 CALCULATED TRIAL SPECTRUM

Included in Appendix B is a 640 group representation of the calculated ACRR LB44 neutron spectrum normalized to a fluence of 1 n/cm^2 . The energy grid is the SAND 640 group structure. This spectrum was calculated using the MCNP input model given in Appendix A. The statistical uncertainties in the Monte Carlo calculation were less than 10% for energies between $1.8 \times 10^{-8} \text{ MeV}$ and $2 \times 10^{-7} \text{ MeV}$ and again between $1.2 \times 10^{-6} \text{ MeV}$ and 13.6 MeV . They were less than 1% for energies above $1.2 \times 10^{-5} \text{ MeV}$ and below 7.3 MeV . The number fractions in column 5 of the table sum to unity. The differential number spectrum is shown in Figure 4a. These quantities, appearing in column 7 of the spectrum table in Appendix B, when integrated over energy, give unity. Figure 4b shows the differential energy spectrum, also known as a lethargy plot. In a lethargy plot, equal areas under the curve correspond to equal neutron number fractions when plotted with a linear scale for the ordinate and a logarithmic scale for the abscissa.

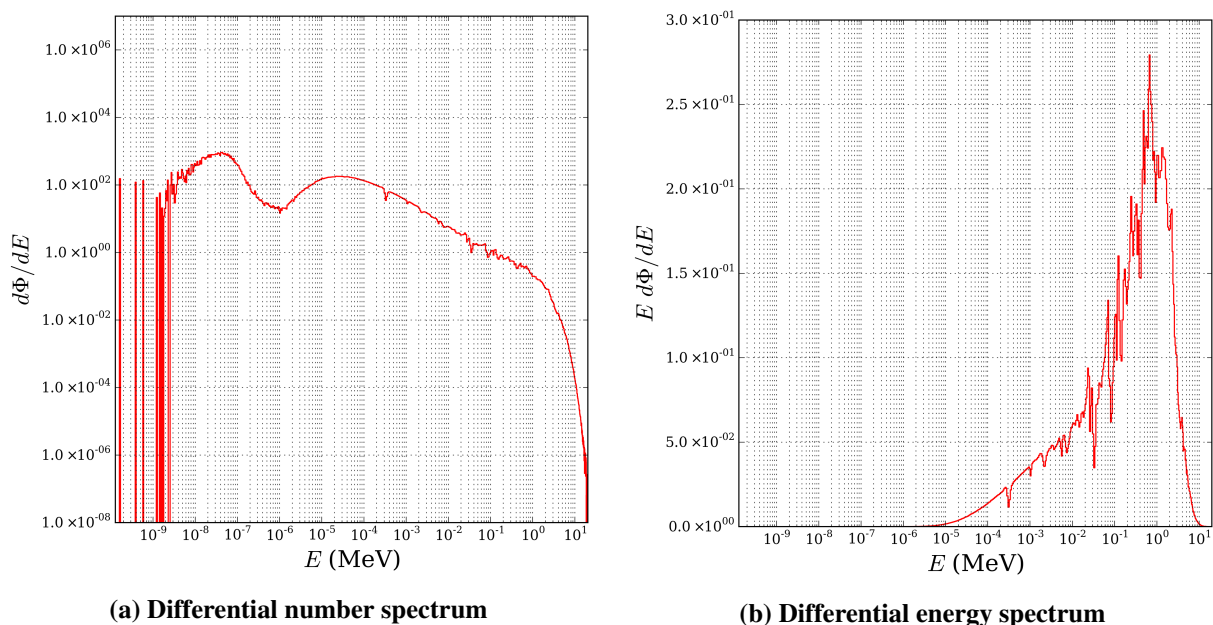


Figure 4. Calculated spectrum in the ACRR LB44 bucket environment.

4 “A PRIORI” SPECTRUM COVARIANCE

An “a priori” spectrum covariance matrix was derived using the methods detailed in reference [3] and subject-matter expertise. The data needed to construct the covariance matrix is given in Appendix C. The representation is consistent with the format used in the LSL-M2 code [4]. To capture the covariance matrix, the number of energy groups is given, followed by the energy bin boundaries, the number fraction representation of the spectrum in this energy group structure, the standard deviations of the “a priori” spectral representation given as relative percentages, and finally an upper triangular representation of the relative correlation matrix. This information is given in Appendix C for an energy group structure containing 89 groups. This 89 group structure is used in the NuGET code [5]. From these inputs a covariance matrix can be constructed. Figure 5 shows the relative correlation matrix indexed by the energy bin number.

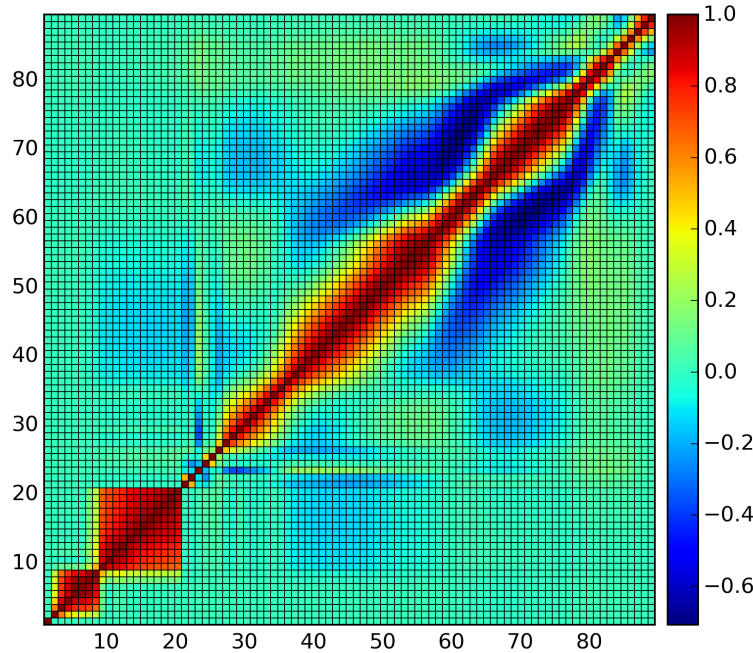


Figure 5. “A priori” energy dependent relative correlation matrix.

The correlation matrix given in Appendix C, which is plotted above is positive definite. The eigenvalues for this matrix in decreasing order are: 14.8981300, 12.2849300, 10.0621200, 7.7950160, 5.9110270, 5.3517120, 4.8017120, 3.3126650, 2.6560090, 2.5149120, 2.0359850, 1.6995120, 1.5272690, 1.1547350, 1.0825790, 0.9996860, 0.9817168, 0.8736243, 0.8227887, 0.7263104, 0.5934130, 0.5249314, 0.5058728, 0.4294668, 0.3796267, 0.3622244, 0.3112166, 0.2968668, 0.2799906, 0.2513204, 0.2475556, 0.2170641, 0.2003623, 0.1774060, 0.1735353, 0.1559922, 0.1546250, 0.1415990, 0.1251129, 0.1224620, 0.1130707, 0.1044534, 0.1036463, 0.0964680, 0.0908926, 0.0906644, 0.0846754, 0.0782366, 0.0708390, 0.0648958, 0.0631134, 0.0563052, 0.0518462, 0.0508790, 0.0471177, 0.0453902, 0.0419312, 0.0381065, 0.0353970, 0.0346231, 0.0323773, 0.0304041, 0.0302616, 0.0283036, 0.0271123, 0.0266694, 0.0247934, 0.0245922, 0.0237395, 0.0234506, 0.0221410, 0.0213517, 0.0202276, 0.0191136, 0.0178306, 0.0168899, 0.0166768, 0.0150095, 0.0146645, 0.0130603, 0.0103949, 0.0088689, 0.0081492, 0.0062384, 0.0047913, 0.0032360, 0.0023521, 0.0016471, 0.0000007.

5 MEASURED ACTIVITIES WITH UNCERTAINTIES

Table III lists a set of 31 reactions and associated covers where good measurements were made during this spectral characterization effort. In general, the saturated activity is given in units of Bq per atom of the target isotope or as fissions per atom of the target fissionable isotope. Any special considerations are addressed in the next section. The uncertainty is given as a fractional uncertainty, e.g. an entry of “0.045” means that this activity measurement had an uncertainty of 4.5% due to systematic and random considerations. Uncertainty considerations included the calibration of the energy-dependent HPGe detector, reproducibility of the foil placement on the counter, counting statistics, and the peak fitting algorithm.

Table III. Measured activities for 31 reactions resulting from 18 different activation foils irradiated in the LB44 environment of the ACRR central cavity.

Number	Reaction	Cover	Activity (Bq/atom) or (fissions/atom)	Relative uncertainty
1	$^{58}\text{Ni}(n,p)^{58}\text{Co}$	Bare	9.5960×10^{-18}	0.016
2	$^{59}\text{Co}(n,p)^{59}\text{Fe}$	Bare	1.6482×10^{-19}	0.024
3	$^{27}\text{Al}(n,\alpha)^{24}\text{Na}$	Bare	5.2690×10^{-18}	0.037
4	$^{27}\text{Al}(n,p)^{27}\text{Mg}$	Bare	3.3250×10^{-15}	0.021
5	$^{46}\text{Ti}(n,p)^{46}\text{Sc}$	Bare	6.7205×10^{-19}	0.008
6	$^{47}\text{Ti}(n,p)^{47}\text{Sc}$	Bare	3.6124×10^{-17}	0.026
7	$^{48}\text{Ti}(n,p)^{48}\text{Sc}$	Bare	7.7602×10^{-19}	0.006
8	$^{54}\text{Fe}(n,p)^{54}\text{Mn}$	Bare	1.4959×10^{-18}	0.011
9	$^{56}\text{Fe}(n,p)^{56}\text{Mn}$	Bare	4.7933×10^{-17}	0.009
10	$^{93}\text{Nb}(n,2n)^{92\text{m}}\text{Nb}$	Bare	2.0258×10^{-19}	0.010
11	$^{115}\text{In}(n,n')^{115\text{m}}\text{In}$	Bare	9.8199×10^{-15}	0.056
12	$^{55}\text{Mn}(n,2n)^{54}\text{Mn}$	Bare	3.5010×10^{-21}	0.160
13	$^{59}\text{Co}(n,2n)^{58}\text{Co}$	Bare	1.2528×10^{-20}	0.120
14	$^{60}\text{Ni}(n,p)^{60}\text{Co}$	Bare	5.4018×10^{-21}	0.060
15	$^{58}\text{Fe}(n,\gamma)^{59}\text{Fe}$	Bare	1.2442×10^{-17}	0.023
16	$^{23}\text{Na}(n,\gamma)^{24}\text{Na}$	Bare	1.2826×10^{-16}	0.008
17	$^{45}\text{Sc}(n,\gamma)^{46}\text{Sc}$	Bare	1.6744×10^{-17}	0.007
18	$^{55}\text{Mn}(n,\gamma)^{56}\text{Mn}$	Bare	4.0558×10^{-14}	0.020
19	$^{59}\text{Co}(n,\gamma)^{60}\text{Co}$	Bare	6.2470×10^{-18}	0.008
20	$^{63}\text{Cu}(n,\gamma)^{64}\text{Cu}$	Bare	6.6548×10^{-15}	0.057
21	$^{98}\text{Mo}(n,\gamma)^{99}\text{Mo}$	Bare	1.6478×10^{-15}	0.018
22	$^{115}\text{In}(n,\gamma)^{116\text{m}}\text{In}$	Bare	4.4211×10^{-13}	0.016
23	$^{197}\text{Au}(n,\gamma)^{198}\text{Au}$	Bare	2.4293×10^{-14}	0.028
24	$^{58}\text{Fe}(n,\gamma)^{59}\text{Fe}$	BB	2.7876×10^{-18}	0.072
25	$^{59}\text{Co}(n,\gamma)^{60}\text{Co}$	BB	2.0990×10^{-19}	0.008
26	$^{98}\text{Mo}(n,\gamma)^{99}\text{Mo}$	BB	3.9782×10^{-16}	0.022
27	$^{197}\text{Au}(n,\gamma)^{198}\text{Au}$	BB	2.7153×10^{-15}	0.042
28	$^{235}\text{U}(n,f)\text{FF}$	BB	3.8036×10^{-9}	0.021
29	$^{238}\text{U}(n,f)\text{FF}$	BB	2.8865×10^{-10}	0.020
30	$^{237}\text{Np}(n,f)\text{FF}$	BB	1.9753×10^{-9}	0.030
31	$^{239}\text{Pu}(n,f)\text{FF}$	BB	4.5468×10^{-9}	0.020

6 FOIL COVERS AND SELF-SHIELDING CONSIDERATIONS

The covers used for some of the foils are shown in Figure 6. Included in this figure is the stand that was used to hold the boron balls at the axial core center-line during irradiation. The notation for the covers as indicated in Table III is explained in the following list:

- The configuration notated as “Bare” represents a foil with no cover material, with a thickness between 5 and 10 mils.
- The configuration notated as “Cd” consists of a cylindrical Cadmium cover with an areal thickness of 2.587×10^{-3} atoms/barn.
- The configuration notated as “BB” consists of an inner thick Cadmium cover with an areal thickness of 4.705×10^{-3} atoms/barn and an outer spherical boron ball. The boron ball is a spherical shell with an outer diameter of 4.76 cm and thickness of 1.03 cm. The B_4C has a density of 2.5 g/cm^3 with enriched Boron (91.67% ^{10}B and 8.33% ^{11}B).

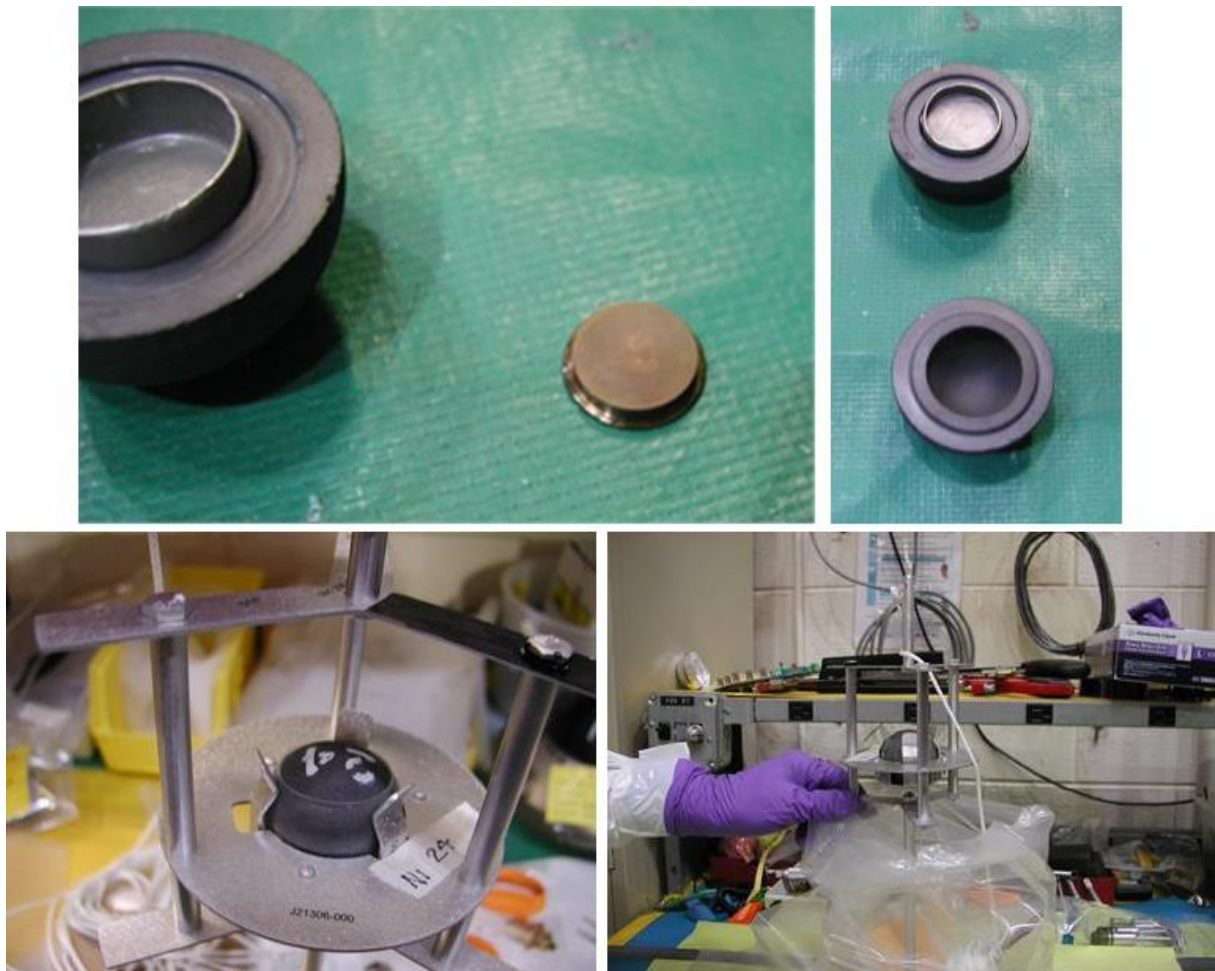


Figure 6. Boron ball and cadmium cover configuration with irradiation stand.

A detailed description of the covers and a discussion of how self-shielding effects are rigorously addressed in Sandia's use of activation measurements to characterize the spectra in our facilities can be found in reference [6]. The energy dependent cover corrections and self-shielding factors are available from the authors in the form of a spreadsheet for each of the reactions listed in Table III.

Some foils may have more than one reaction path that results in the same residual product. The following items provide detail that support taking this into consideration in any analysis:

- The $^{46}\text{Ti}(n,p)^{46}\text{Sc}$ entry measured the ^{46}Sc product and represents the $^{\text{nat}}\text{Ti}(n,X)^{46}\text{Sc}$ reaction. The activity is reported per atom of the ^{46}Ti in the foil.
- The $^{47}\text{Ti}(n,p)^{47}\text{Sc}$ entry measured the ^{47}Sc product and represents the $^{\text{nat}}\text{Ti}(n,X)^{47}\text{Sc}$ reaction. The activity is reported per atom of the ^{47}Ti in the foil.
- The $^{48}\text{Ti}(n,p)^{48}\text{Sc}$ entry measured the ^{48}Sc product and represents the $^{\text{nat}}\text{Ti}(n,X)^{48}\text{Sc}$ reaction. The activity is reported per atom of the ^{48}Ti in the foil.
- The $^{63}\text{Cu}(n,\gamma)^{64}\text{Cu}$ entry measured the ^{64}Cu product and represents the combination of the $^{63}\text{Cu}(n,\gamma)$ and $^{65}\text{Cu}(n,2n)$ reactions in a copper foil with the natural abundances of the isotopes. The activity is reported per atom of the ^{63}Cu in the foil.
- The $^{238}\text{U}(n,f)\text{FF}$ entry measured the total fissions in a depleted uranium oxide foil, a sintered UO_2 foil measuring 0.5 inch by 0.03 inch. The activity is reported per atom of the ^{238}U in the foil. The foil had a nominal mass of 1.3 gram (total pellet mass). The oxide/metal ratio in the foil was 1.995. The isotopic mix in the depleted uranium foil is given in Table IV.

Table IV. Isotopic mix of depleted uranium foil.

Isotope	Atom Fraction
^{238}U	0.99790
^{234}U	0.00001
^{235}U	0.00205
^{236}U	0.00004

- The $^{235}\text{U}(n,f)\text{FF}$ entry measured the total fissions in an enriched uranium oxide foil, a sintered UO_2 foil measuring 0.5 inch by 0.03 inch. The activity is reported per atom of the ^{235}U in the foil. The foil had a nominal mass of 1.0 gram (total pellet mass). The oxide/metal ratio in the foil was 1.990. The isotopic mix in the enriched uranium foil is given in Table V.

Table V. Isotopic mix of enriched uranium foil.

Isotope	Atom Fraction
^{235}U	0.93000
^{234}U	0.00981
^{236}U	0.00359
^{238}U	0.05660

- The $^{239}\text{Pu}(\text{n},\text{f})\text{FF}$ entry measured the total fissions in a plutonium oxide foil. The activity is reported per atom of the ^{239}Pu in the foil. The foil had a nominal mass of 1.2 gram (total pellet mass). The oxide/metal ratio in the foil was 1.886. The isotopic mix of metal (fissionable isotopes) in the plutonium foil is given in Table VI.

Table VI. Isotopic mix of plutonium foil.

Isotope	Atom fraction
^{239}Pu	0.869965000
^{238}Pu	0.000679800
^{240}Pu	0.115968688
^{241}Pu	0.010797000
^{242}U	0.002359360
^{235}U	0.000199946
^{237}Np	0.000029990

Note: Atom fractions sum so that the number of atoms of the prime sensor element, plutonium, is unity. Due to the contaminants, the total sum above is greater than 1.0.

- The $^{237}\text{Np}(\text{n},\text{f})\text{FF}$ entry measured the total fissions in a neptunium oxide foil. The activity is reported per atom of the ^{237}Np in the foil. The foil had a nominal total mass of 0.58 g. The isotopic mix of the neptunium foil is given in Table VII.

Table VII. Isotopic mix of neptunium foil.

Isotope	Mass fraction	Mass (g)
^{237}Np	0.8811	0.510
^{16}O	0.1189	0.070

7 CORRELATION BETWEEN MEASURED ACTIVITIES

At this time there has been no analysis to identify a correlation between activity measurements. While the energy-dependent calibration and the use of the same foil for reading several activity products will introduce some correlation in the uncertainty contributions, the dominant uncertainty contribution is in the counting statistics, peak fitting and the background. The current recommendation is that these activity measurements can be treated as being uncorrelated. Future work at the facility will focus on a better characterization of any correlation between activity measurements.

8 SUMMARY

This report has documented a set of data that can be used as part of the REAL-2016 IAEA-sponsored exercise to examine the consistency of state-of-the-art approaches to spectrum adjustment when applied to the LB44 environment in the ACRR central cavity reference neutron field. Other validation data exists for this benchmark neutron field [7], but this report captures all the field characterization data relevant to this IAEA exercise.

9 REFERENCES

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APPENDIX A MCNP INPUT FILE FOR THE ACRR LB44 ENVIRONMENT

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STANDARD ACRR Model (Extended Cavity, 32" Pedestal, Pb-B4C Bucket)
C
C Origanl Model Developed by W. Fan
C Modified by P. Cooper and E. Parma with new cavity
C Macrobody Model Developed by R. DePriest
C New 44" Pb-B4C Bucket LB44 Model Developed by T. Trinh
C
C
C standard 236-element core configuration with new cavity
C no FREC
C room temp 70c cross sections with S(a,b)
C LB-44-cl-32 - 44inch lead/boron bucket on 32inch pedestal
C tally is a 6cm diameter sphere at fuel centerline
C 89 and 640 neutron energy groups
C 48 gamma energy groups
C
C control rods : variable
C safety rods : variable
C transient rods : variable
C
C
C
C 1 2 3 4 5 6 7 8
C 3456789012345678901234567890123456789012345678901234567890
C *****
C * CELL CARDS *
C *****
C
C Universe definitions for the standard 236-element core.
C
C U=1:fuel rods U=2:water rods
C U=3:control rods U=4:safety rods
C U=5:transient rods U=6:nickel rods
C U=7:90% fuel rods U=9:al rods (empty)
C
C ***** U=8 is the reactor core fill. *****
C
C
C Regular Fuel Elements
C
10 0 -10 U=1 IMP:N,P=1 $Void
11 1 -3.3447 10 -11 U=1 IMP:N,P=1 $UO2-BeO fuel
14 0 11 -14 U=1 IMP:N,P=1 $Void
15 2 -8.4000 14 -15 U=1 IMP:N,P=1 $Niobium
16 0 15 -16 U=1 IMP:N,P=1 $Void Gap
17 4 -2.8000 -17 U=1 IMP:N,P=1 $Lower BeO Plug
18 4 -2.8000 -18 U=1 IMP:N,P=1 $Upper BeO Plug
19 3 -8.0300 17 -19 U=1 IMP:N,P=1 $Lower SS Plug
20 3 -8.0300 18 -20 U=1 IMP:N,P=1 $Upper SS Plug
21 3 -8.0300 19 20 16 -21 U=1 IMP:N,P=1 $SS304
22 5 -1.0000 21 -22 U=1 IMP:N,P=1 $Water
C
C
C Water Rods
C
23 5 -1.0000 -22 U=2 IMP:N,P=1 $Water
C
C
C Control Rods: Poison section
C
25 8 -2.4800 -25 U=3 IMP:N,P=1 $B4C poison
26 0 25 -26 U=3 IMP:N,P=1 $Void Cap
27 3 -8.0300 26 -27 U=3 IMP:N,P=1 $Poison sleeve
28 3 -8.0300 -28 U=3 IMP:N,P=1 $Magnaform plug
29 5 -1.0000 27 28 -29 U=3 IMP:N,P=1 $Water
C
C Control Rods: Fuel follower
C
30 0 -30 U=3 IMP:N,P=1 $Void
31 1 -3.3447 30 -31 U=3 IMP:N,P=1 $UO2-BeO fuel
32 0 31 -32 U=3 IMP:N,P=1 $Void
33 2 -8.4000 32 -33 U=3 IMP:N,P=1 $Niobium
34 0 33 -34 U=3 IMP:N,P=1 $Void gap
35 4 -2.8000 -35 U=3 IMP:N,P=1 $BeO plug
36 0 -36 U=3 IMP:N,P=1 $Void
37 3 -8.0300 34 35 36 -37 U=3 IMP:N,P=1 $SS304

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38 5 -1.0000 37 -38 U=3 IMP:N,P=1 $Water
C
C
C Safety Rods: Poison section
C
39 8 -2.4800 -39 U=4 IMP:N,P=1 $B4C poison
40 0 39 -40 U=4 IMP:N,P=1 $Void cap
41 3 -8.0300 40 -41 U=4 IMP:N,P=1 $Poison sleeve
42 3 -8.0300 -42 U=4 IMP:N,P=1 $Magnaform plug
43 5 -1.0000 41 42 -43 U=4 IMP:N,P=1 $Water
C
C Safety Rods: Fuel follower
C
44 0 -44 U=4 IMP:N,P=1 $Void
45 1 -3.3447 44 -45 U=4 IMP:N,P=1 $UO2-BeO fuel
46 0 45 -46 U=4 IMP:N,P=1 $Void
47 2 -8.4000 46 -47 U=4 IMP:N,P=1 $Niobium
48 0 47 -48 U=4 IMP:N,P=1 $Void gap
49 4 -2.8000 -49 U=4 IMP:N,P=1 $BeO plug
50 0 -50 U=4 IMP:N,P=1 $Void
51 3 -8.0300 48 49 50 -51 U=4 IMP:N,P=1 $SS304
52 5 -1.0000 51 -52 U=4 IMP:N,P=1 $Water
C
C
C Transient Rods: Void section
C
53 0 -53 U=5 IMP:N,P=1 $Void
54 7 -2.7000 53 -54 58 60 61 U=5 IMP:N,P=1 $Al tubing
55 5 -1.0000 54 -55 U=5 IMP:N,P=1 $Water
56 7 -2.7000 55 -56 U=5 IMP:N,P=1 $Al guidex
57 5 -1.0000 56 -57 U=5 IMP:N,P=1 $Water
58 7 -2.7000 -58 U=5 IMP:N,P=1
C
C Transient Rods: Poison section
C
59 8 -2.4800 -59 U=5 IMP:N,P=1 $Poison
60 7 -2.7000 59 -60 U=5 IMP:N,P=1 $Inner sleeve
61 0 -61 U=5 IMP:N,P=1 $Void
62 7 -2.7000 -62 54 U=5 IMP:N,P=1 $End plug
C
C
C Nickel Rods
C
65 6 -8.9000 -21 U=6 IMP:N,P=1 $Nickel
66 5 -1.0000 21 -22 U=6 IMP:N,P=1 $Water
C
C
C 90% Fuel Element
C
70 0 -10 U=7 IMP:N,P=1 $Void
71 11 -3.0102 10 -11 U=7 IMP:N,P=1 $UO2-BeO fuel
74 0 11 -14 U=7 IMP:N,P=1 $Void
75 2 -8.4000 14 -15 U=7 IMP:N,P=1 $Niobium
76 0 15 -16 U=7 IMP:N,P=1 $Void Gap
77 4 -2.8000 -17 U=7 IMP:N,P=1 $Lower BeO Plug
78 4 -2.8000 -18 U=7 IMP:N,P=1 $Upper BeO Plug
79 3 -8.0300 17 -19 U=7 IMP:N,P=1 $Lower SS Plug
80 3 -8.0300 18 -20 U=7 IMP:N,P=1 $Upper SS Plug
81 3 -8.0300 19 20 16 -21 U=7 IMP:N,P=1 $SS304
82 5 -1.0000 21 -22 U=7 IMP:N,P=1 $Water
C
C
C Empty Aluminum Rod
C
600 0 -90 U=25 IMP:N,P=1 $Void
601 7 -2.7000 90 -21 U=25 IMP:N,P=1 $Al Rod
602 5 -1.0000 21 -22 U=25 IMP:N,P=1 $Water
C
C
C Empty Aluminum Rod
C
90 0 -90 U=9 IMP:N,P=1 $Void
91 7 -2.7000 90 -21 U=9 IMP:N,P=1 $Al Rod
92 5 -1.0000 21 -22 U=9 IMP:N,P=1 $Water
C
C
C Core (UNIVERSE = 8)
C
1 0 -300 311 210 211 213 220 fill=8 IMP:N,P=1
C

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2 5 -1.0000 -320 lat=2 U=8 IMP:N,P=1
fill -12:12 -12:12 0:0
C
C
C This fuel loading reflects the board as of May 2003.
C
C      1      2      3      4      5      6      7      8
C 3456789012345678901234567890123456789012345678901234567890
C
      2 24r
      2 24r
      2 24r
      2 9r 2 6 1 1 1 1 1 1 1 1 1 1 1 6 2 2 $ interface with frec
      2 8r 6 6 1 1 1 1 1 1 1 1 1 1 1 6 6 2
      2 7r 6 1 1 1 1 1 1 1 1 1 1 1 1 1 6 2
      2 6r 6 7 1 1 1 3 1 1 5 1 1 3 1 1 7 6 2
      2 5r 6 7 1 1 1 1 1 1 1 1 1 1 1 1 7 6 2
      2 4r 6 7 1 1 1 1 1 1 1 1 1 1 1 1 7 6 2
      2 3r 9 6 1 1 1 4 1 1 2 2 2 2 1 1 1 1 6 2 2
      2 2r 2 9 6 1 1 1 1 1 2 2 2 2 2 1 1 1 1 6 6 2 2
      2 2 2 6 6 1 1 1 1 1 2 2 2 2 2 2 1 1 1 1 6 2 2 2
      2 2 2 6 1 1 3 1 1 2 2 2 2 2 2 2 1 1 3 1 1 6 2 2 2 $ center line
      2 2 6 6 1 1 1 1 1 2 2 2 2 2 2 1 1 1 1 1 9 6 2 2 2
      2 2 6 1 1 1 1 1 1 2 2 2 2 2 1 1 1 1 1 1 9 2 2 2r
      2 6 1 1 1 1 5 1 1 2 2 2 2 1 1 5 1 1 1 1 2 2 3r
      2 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 4r
      2 6 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 5r
      2 6 1 1 1 1 3 1 1 4 1 1 3 1 1 1 1 1 2 2 6r
      2 6 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 2 7r
      2 6 6 6 1 1 1 1 1 1 1 1 1 9 9 2 2 8r
      2 2 9 6 6 6 1 1 1 1 6 6 6 6 2 2 9r
      2 2 2 9 2 6 7 7 7 6 2 6 2 2 2 10r
      2 2 2 25 6 6 6 6 9 2 2 2 2 11r
      2 24r
C
C
C ***** END OF UNIVERSE DEFINITIONS AND CORE FILL *****
C
C NEW CENTRAL CAVITY
C
C To add 32-in pedestal, remove C from line 2.
C To add 8-in pedestal, remove C from line 2 and 3.
C You must also remove the C's from the cells in the pedestal
C descriptions (Cells 110-116).
C
C Use Line 4 of Cell 100 to exclude surface of buckets and experiments.
C Exclude surface 706 for Pb-B4C; Exclude surface 711 for Al dosimetry bucket;
C Exclude surface 725 for LP-1
C Exclude surfaces 730, 731, and 734 for Boom Box
C
100 702 -1.0245e-3 -100
      110
C      113 114 116
      899 IMP:N,P=1 $Void
101 3 -8.0300 100 -101 IMP:N,P=1 $Stainless liner
102 7 -2.7000 -311 101 -102 IMP:N,P=1 $Aluminum
103 5 -1.0000 -311 102 IMP:N,P=1 $Water
C
C Central Cavity Additions (32" and 8" Pedestals)
C
C 32-in pedestal
C
110 7 -2.7000 -110 111 112 IMP:N,P=1 $32-in pedestal
111 702 -1.0245e-3 -111 IMP:N,P=1 $32-in pedestal inset
112 702 -1.0245e-3 -112 IMP:N,P=1 $Inset Notch
C
C
C 8-in pedestal
C
C 113 7 -2.7000 -113 IMP:N,P=1 $Bottom plate
C 114 7 -2.7000 -114 IMP:N,P=1 $Top plate
C 115 702 -1.0245e-3 -115 IMP:N,P=1 $Center Void
C 116 7 -2.7000 -116 115 IMP:N,P=1 $Support Tube
C
C End of Central Cavity Additions
C
C

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C Top and Bottom Grid Plates
C
200 7 -2.7000 -200 311 201 IMP:N,P=1 $Top plate
201 5 -1.0000 -200 220 -201 IMP:N,P=1 $Water
202 7 -2.7000 -202 311 IMP:N,P=1 $Bottom plate
C
C
C Nickel Plate and Window to the Radiography Lab
C
210 6 -8.9000 -210 IMP:N,P=1 $Nickel Plate
211 5 -1.0000 -211 210 -900 IMP:N,P=1 $Water
212 0 -212 -900 IMP:N,P=1 $Void
213 7 -2.7000 -213 212 -900 IMP:N,P=1 $Aluminum
C
C
C FREC-II Side Ni Plate
C
220 6 -8.9000 -220 IMP:N,P=1
C
C
C Surrounding Water
C
230 5 -1.0000 -900 220 213 212 211 202 200
300 311 IMP:N,P=1
C
C
C EXPERIMENTAL or SPECTRUM MODIFYING BUCKETS (700's)
C
C Pb-B4C Bucket (700-706)
C Weight of Bucket per L. Martin (8/21/2003) - 446 lbs
C Weight of Model Bucket - 450.81
C Density of B4C layer changed to 2.12 g/cc to make weight 446.19 lbs
C
C
C 700 702 -1.0245e-3 -700 IMP:N,P=1 $Inside Bucket
C 701 7 -2.7100 -701 700 IMP:N,P=1 $1/16" Al liner
C 702 700 -11.350 -702 701 7091 7092 IMP:N,P=1 $1" Pb on bottom
C 703 701 -2.5300 -703 7091 7092 IMP:N,P=1 $Boral on bottom
C 707 0 -707 702 IMP:N,P=1 $Slop between Cannister and Pb
C 708 8 -2.1200 -708 IMP:N,P=1 $B4C layer on the bottom
C
C 704 7 -2.7100 -704 703 707 708
7091 7092 IMP:N,P=1 $Al layer
C 705 8 -2.1200 -705 704 IMP:N,P=1 $B4C layer
C 706 7 -2.7100 -706 705 7091 7092 IMP:N,P=1 $Al exterior
C 7091 3 -8.0300 -7091 IMP:N,P=1 $Dowel 1
C 7092 3 -8.0300 -7092 IMP:N,P=1 $Dowel 2
C
C
C
C Standard Aluminum Experiment Bucket (710-711)
C Add -900 to 710 and 711 if using 24" Bucket
C
C 710 702 -1.0245e-3 -710 IMP:N,P=1 $Inside Bucket
C 711 7 -2.7000 -711 710 IMP:N,P=1 $Aluminum Bucket
C
C
C
C Pb-Poly Bucket (720-725) -- Designated as LP-1
C
C 720 702 -1.0245e-3 -720 IMP:N,P=1 $Bottom of Inside
C 721 7 -2.7000 -721 720 726 IMP:N,P=1 $1/16" Al Liner
C 722 700 -11.350 -722 721 724 726 IMP:N,P=1 $0.4" Pb Layer
C 723 704 -0.9450 -723 722 726 IMP:N,P=1 $0.8" HDPE
C 724 704 -0.9450 -724 IMP:N,P=1 $HDPE fill-in
C 725 7 -2.7000 -725 721 723 726 IMP:N,P=1 $Al Container
C 726 702 -1.0245e-3 -726 IMP:N,P=1 $Top of Inside
C
C
C
C Boombox for NG testing (730-738)
C
C 730 765 -7.28 -730 736 737 738 IMP:N,P=1 $Lower Boom Box
C 731 765 -7.28 -731 733 IMP:N,P=1 $Upper part of clamping ring
C 732 765 -7.28 -732 733 IMP:N,P=1 $Lower part of clamping ring

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C 733 702 -1.0245e-3 -733 IMP:N,P=1 $"Void" in clamping ring
C 734 702 -1.0245e-3 -734 732 IMP:N,P=1 $"Void" at ring lip
C 735 765 -7.28 -735 IMP:N,P=1 $Plug
C 736 702 -1.0245e-3 -736 735 IMP:N,P=1 $"Void" around the plug
C 737 702 -1.0245e-3 -737 IMP:N,P=1 $Lower "void"
C 738 702 -1.0245e-3 -738 IMP:N,P=1 $Lip "void"
C
C
C
C
C
C
C New 44" Pb-B4C Bucket
C Base Plate w/ B4C Volume
C From Ktech drawing labeled "PbB BASEII"
800 8 -1.274704138 (-802):(817 -815):(818 -816) IMP:N,P=1 $ B4C Cavity
801 766 -7.83 -803:-809 IMP:N,P=1 $ All-threads
C From McMaster-Carr catalog, Item # 98914A033, Threaded Rods and Studs, General Purpose Steel
802 767 -7.82 (805 -806):(811 -812) IMP:N,P=1 $ Washers
C From McMaster-Carr catalog, Item #94744A285, Zinc-Plated Steel Washer for Soft Materials (Type
803 767 -7.82 (803 -807):(809 -813) IMP:N,P=1 $ All-thread nuts
C From McMaster-Carr catalog, Item # 93939A823, Hex Nut, Grade 8 Steel
804 702 -1.0245e-3 (803 -804):(809 -810):(803 -805):(809 -811):
(806 807 803 -808):(812 813 809 -814) IMP:N,P=1 $ Void inside this thread, washe
805 7 -2.704 (-817 819):(-818 820) IMP:N,P=1 $ Al6061 plugs
C From McMaster-Carr catalog, Item # 44705K334, Low-Pressure Aluminum Threaded Square-Socket Plug
806 702 -1.0245e-3 (-819):(-820) IMP:N,P=1 $ Void in this area
807 7 -2.704 (-800:-801) 802 804 808 810 814 815 816
IMP:N,P=1 $ Al6061 Base Plate

C Containment Base
C From Ktech drawing labeled "CONTAINMENT BASE II"
830 702 -1.0245e-3 801 -830 IMP:N,P=1 $ Void
831 7 -2.704 (830 833 834 -831):(831 -832) IMP:N,P=1 $ Al6061 Containment Base
832 766 -7.83 -833:-834 IMP:N,P=1 $ All-threads, General Purpose St
C Lead Material
C Unchamfered lead rings
840 702 -1.0245e-3 -853 IMP:N,P=1 $ Void inside lead rings
841 766 -7.83 -847:-848 IMP:N,P=1 $ All-threads, General Purpose St
842 702 -1.0245e-3 (847 -843):(848 -844) IMP:N,P=1 $ Void between All-threads and Pb
843 702 -1.0245e-3 -849:-851 IMP:N,P=1 $ Void inside Al6061 tubing
844 7 -2.704 (849 -850):(851 -852) IMP:N,P=1 $ Al6061 tubing
845 702 -1.0245e-3 (850 -845):(852 -846) IMP:N,P=1 $ Void between tubing and Pb hole
846 700 -11.35 (862 863 860 843 844 845 846 -842):(-840 843 844 845 846):
(853 -854 843 844 845 846) IMP:N,P=1 $ Unchamfered lead rings
C Inner Aluminum 6061 Sleeves (Items #14 and 15 in DWG titled "LEAD BORON BUCKET ASSEMBLY II")
860 7 -2.704 -860 IMP:N,P=1 $ Al6061 bottom plate
861 702 -1.0245e-3 (-861 1001):-863 IMP:N,P=1 $ Aluminum sleeve void
862 7 -2.704 861 -862 IMP:N,P=1 $ Al6061 sleeve
C Al6061 Double Wall Weldment (Item #9 in DWG titled "LEAD BORON BUCKET ASSEMBLY II")
870 702 -1.0245e-3 (840 842 831 854 -868):
(840 842 831 854 -870):
(840 842 831 854 -872) IMP:N,P=1 $ Void Between Pb Ring and Double
871 7 -2.704 (868 -869):(870 -871):(872 -873):
(874 -875):(876 -877):(878 -879) IMP:N,P=1 $ Al6061 Inner and Outer Skins
872 8 -1.449249072 (869 -874):(871 -885):(886 -876):
(873 -883):(-878 884) IMP:N,P=1 $ B4C Powder
C PbB Top: Top Plate (Item #1 in DWG titled "LEAD BORON BUCKET ASSEMBLY II")
880 702 -1.0245e-3 -880:-881:(-887 848):(-888 847):
-891:-892:-893:-894 IMP:N,P=1 $ Voids
881 7 -2.704 (880 881 -882 887 888 889 890 891 892 893 894):
(883 -884):(885 -886) IMP:N,P=1 $ Top Plate
C Modified Hex Head Plugs, 1/4 NPT, AL6061-T6 (Item #16 in DWG titled "LEAD BORON BUCKET ASSEMBLY")
C From McMaster-Carr catalog, Item # 3867T65, High-Pressure Aluminum Pipe Fitting
882 7 -2.704 (-821 852):(-822 852):(-823 850):(-824 850)
IMP:N,P=1 $ Modified Hex Head Plugs
C Outside World
889 702 -1.0245e-3 -899 800 831 832 875 877 879 821 822 823 824
882 847 848 850 852 IMP:N,P=1 $ Enclosing surface
C EXPERIMENT PACKAGES (1000's)
C 1001 702 -1.0245e-3 -1001 1002 IMP:N,P=1 $ 6 cm dia scoring sphere
C 1002 6 -8.902 -1002 IMP:N,P=1 $ Ni Foil
1001 702 -1.0245e-3 -1001 IMP:N,P=1 $ 6 cm dia scoring sphere
C
C
C
C
C
C
C EXTERNAL WORLD
C
C
C
C

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900 0          900          IMP:N,P=0 $Outside world

C          1          2          3          4          5          6          7          8
C 34567890123456789012345678901234567890123456789012345678901234567890
C *****
C *          SURFACE CARDS          *
C *****
C
C Fuel Elements
C
10 RCC 0.000 0.000 23.32 0.000 0.000 52.25 0.2413 $Void
11 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.6840 $Fuel
14 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.72025 $Void
15 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.77125 $Niobium
16 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.82225 $Void gap
17 RCC 0.000 0.000 21.415 0.000 0.000 1.905 1.48700 $Lower plug
18 RCC 0.000 0.000 75.57 0.000 0.000 1.905 1.48700 $Upper plug
19 RCC 0.000 0.000 16.32 0.000 0.000 7.000 1.82225 $Lower plug
20 RCC 0.000 0.000 75.57 0.000 0.000 5.000 1.82225 $Upper plug
21 RCC 0.000 0.000 16.32 0.000 0.000 98.89 1.87325 $
22 RCC 0.000 0.000 16.32 0.000 0.000 98.89 5.00000 $Water
C
C Control Rods
C
25 3 RCC 0.000 0.000 78.11 0.000 0.000 52.25 1.46050 $B4C poison
26 3 RCC 0.000 0.000 78.11 0.000 0.000 98.89 1.50495 $Void cap
27 3 RCC 0.000 0.000 78.11 0.000 0.000 98.89 1.74625 $Poison sleeve
28 3 RCC 0.000 0.000 75.57 0.000 0.000 2.54 1.74625 $Magnaform plug
29 3 RCC 0.000 0.000 75.57 0.000 0.000 101.43 5.00000 $Water
30 3 RCC 0.000 0.000 23.32 0.000 0.000 52.25 0.24130 $Void
31 3 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.68400 $Fuel
32 3 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.72025 $Void
33 3 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.77125 $Niobium
34 3 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.82225 $Void gap
35 3 RCC 0.000 0.000 20.78 0.000 0.000 2.54 1.82225 $BeO plug
36 3 RCC 0.000 0.000 -79.22 0.000 0.000 100.00 1.82225 $Void
37 3 RCC 0.000 0.000 -79.22 0.000 0.000 154.79 1.87325 $$$S304
38 3 RCC 0.000 0.000 -79.22 0.000 0.000 154.79 5.00000 $Water
C
C Safety Rods
C
39 4 RCC 0.000 0.000 78.11 0.000 0.000 52.25 0.57150 $B4C poison
40 4 RCC 0.000 0.000 78.11 0.000 0.000 98.89 0.83185 $Void cap
41 4 RCC 0.000 0.000 78.11 0.000 0.000 98.89 1.74625 $Poison sleeve
42 4 RCC 0.000 0.000 75.57 0.000 0.000 2.54 1.74625 $Magnaform plug
43 4 RCC 0.000 0.000 75.57 0.000 0.000 101.43 5.00000 $Water
44 4 RCC 0.000 0.000 23.32 0.000 0.000 52.25 0.24130 $Void
45 4 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.68400 $Fuel
46 4 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.72025 $Void
47 4 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.77125 $Niobium
48 4 RCC 0.000 0.000 23.32 0.000 0.000 52.25 1.82225 $Void gap
49 4 RCC 0.000 0.000 20.78 0.000 0.000 2.54 1.82225 $BeO plug
50 4 RCC 0.000 0.000 -79.22 0.000 0.000 100.00 1.82225 $Void
51 4 RCC 0.000 0.000 -79.22 0.000 0.000 154.79 1.87325 $$$S304
52 4 RCC 0.000 0.000 -79.22 0.000 0.000 154.79 5.00000 $Water
C
C Transient Rods
C
53 5 RCC 0.000 0.0 -76.2762 0.000 0.0 73.1012 1.20000 $Void
54 RCC 0.000 0.000 -79.22 0.000 0.000 200.00 1.27000 $Al tubing
55 RCC 0.000 0.000 -79.22 0.000 0.000 200.00 1.49860 $Water
56 RCC 0.000 0.000 -79.22 0.000 0.000 200.00 2.02438 $Al guidex
57 RCC 0.000 0.000 -79.22 0.000 0.000 200.00 5.00000 $Water
58 5 RCC 0.000 0.000 -3.175 0.000 0.000 3.174 1.20000
59 5 RCC 0.000 0.000 -0.001 0.000 0.000 76.201 0.88000 $Poison
60 5 RCC 0.000 0.000 -0.001 0.000 0.000 76.201 1.20000 $Inner sleeve
61 5 RCC 0.000 0.000 76.20 0.000 0.000 123.80 1.20000 $Void
62 5 RCC 0.000 0.000 -100.0 0.000 0.00 23.7238 1.20000 $End plug
C
C Aluminum Rods
C
90 RCC 0.000 0.000 15.41 0.000 0.000 66.14 1.77125 $Void in Al rod
C
C Central Cavity Surfaces
C
100 RCC 0.000 0.000 -67.395 0.000 0.000 202.395 11.6450 $Void
101 RCC 0.000 0.000 -67.395 0.000 0.000 202.395 12.2800
102 RCC 0.000 0.000 -67.395 0.000 0.000 202.395 13.9700
C
C Cavity Additions

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C
110 RCC 0.000 0.000 -67.395 0.000 0.000 81.28 11.4300 $32-in pedestal
111 RCC 0.000 0.000 8.4748 0.000 0.000 2.8702 8.2550 $32-in inset
112 RPP -0.9525 0.9525 -8.255 8.255 11.345 13.885 $Inset Notch
113 RCC 0.000 0.000 13.885 0.000 0.000 1.270 10.3188 $Bottom plate (8-in)
114 RCC 0.000 0.000 32.935 0.000 0.000 1.270 10.3188 $Top plate (8-in)
115 RCC 0.000 0.000 15.155 0.000 0.000 17.78 5.7150 $Center void (8-in)
116 RCC 0.000 0.000 15.155 0.000 0.000 17.78 6.3500 $Support tube (8-in)
C
C Top and Bottom Grid Plates
C
200 RCC 0.000 0.000 80.55 0.000 0.000 2.54 53.3500 $Top plate
201 PY -34.925 $Cutoff of top plate
202 RCC 0.000 0.000 11.33 0.000 0.000 5.08 47.0000 $Bottom plate
C
C Window to Radiography Lab
C
210 1 RPP 38.100 39.370 -26.670 26.670 16.41 80.55 $Ni plate
211 1 RPP 38.100 39.370 -38.100 38.100 16.41 80.55 $Water
212 1 RPP 48.895 100.00 -26.670 26.670 16.41 80.55 $Void
213 1 RPP 39.370 100.00 -38.100 38.100 16.41 80.55 $Aluminum
C
C Nickel Plate near FREC-II
C
220 RPP -36.830 36.830 -36.195 -34.925 16.41 83.09 $Nickel Plate
C
C Hexes for the lattice, inner and outer core, and core boundary
C
320 RHP 0.0 0.0 -132.0 0.0 0.0 400.0 2.0855 0.0 0.0 $Lattice element
300 1 RHP 0.0 0.0 16.41 0.0 0.0 64.14 42.7 0.0 0.0 $outer core bound
310 1 RHP 0.0 0.0 -67.395 0.000 0.000 202.395 11.65 0.0 0.0 $Inner liner of cavity
311 1 RHP 0.0 0.0 -67.395 0.000 0.000 202.395 12.285 0.0 0.0 $Outer liner of cavity
C
C Buckets (700's)
C
C Pb-B4C Bucket
C
700 7 RCC 0.0 0.0 6.35 0.0 0.0 85.09 6.27380 $Void
701 7 RCC 0.0 0.0 6.26872 0.0 0.0 85.17128 6.35508 $0.032" Al liner
702 7 RCC 0.0 0.0 3.65125 0.0 0.0 87.78875 9.76630 $Pb layers
703 7 RCC 0.0 0.0 3.01625 0.0 0.0 0.63500 9.17575 $Boral
704 7 RCC 0.0 0.0 1.90500 0.0 0.0 89.53500 10.1600 $Al layer
705 7 RCC 0.0 0.0 1.90500 0.0 0.0 89.53500 11.1125 $B4C
706 7 RCC 0.0 0.0 0.00000 0.0 0.0 91.44000 11.4300 $Al layer
707 7 RCC 0.0 0.0 3.65125 0.0 0.0 87.78875 9.84250
708 7 RCC 0.0 0.0 1.90500 0.0 0.0 0.63500 7.62000 $B4C bottom
7091 7 RCC 0.0 -8.890 0.00 0.0 0.0 91.44000 0.31750 $Dowel 1
7092 7 RCC 0.0 8.890 0.00 0.0 0.0 91.44000 0.31750 $Dowel 2
C
C 14" Aluminum Bucket
C
710 7 RCC 0.0 0.0 0.15875 0.0 0.0 35.40125 11.27125 $Void
711 7 RCC 0.0 0.0 0.00000 0.0 0.0 35.56000 11.43000 $Al bucket
C
C USE these for a 24" Aluminum Bucket
C
C 710 7 RCC 0.0 0.0 0.15875 0.0 0.0 60.80125 11.27125 $Void
C 711 7 RCC 0.0 0.0 0.00000 0.0 0.0 60.96000 11.43000 $Al bucket
C
C LP-1 Surfaces
C
720 7 RCC 0.0 0.0 5.74675 0.0 0.0 62.18825 7.46125 $Inside
721 7 RCC 0.0 0.0 5.58800 0.0 0.0 73.15200 7.62000 $Al liner
722 7 RCC 0.0 0.0 3.55600 0.0 0.0 64.37900 8.63600 $Pb
723 7 RCC 0.0 0.0 2.54000 0.0 0.0 65.39500 10.66800 $HDPE
724 7 RCC 0.0 0.0 3.55600 0.0 0.0 1.01600 7.62000 $HDPE fill-in
725 7 RCC 0.0 0.0 0.00000 0.0 0.0 78.74000 11.43000 $Al Container
726 7 RCC 0.0 0.0 67.9350 0.0 0.0 10.80500 7.46125
C
C Boom Box Surfaces
C
730 7 RCC 0.0 0.0 0.0 0.0 0.0 65.786 9.8425
731 7 RCC 0.0 0.0 65.913 0.0 0.0 3.048 9.8425
732 7 RCC 0.0 0.0 65.786 0.0 0.0 0.127 8.1280
733 7 RCC 0.0 0.0 65.786 0.0 0.0 3.175 5.0800
734 7 RCC 0.0 0.0 65.786 0.0 0.0 0.127 9.8425
735 7 RCC 0.0 0.0 59.436 0.0 0.0 6.350 6.6675
736 7 RCC 0.0 0.0 59.436 0.0 0.0 6.350 6.7945

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Neutron Reference Benchmark: ACRR-LB44-CC-32-cl

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737 7 RCC 0.0 0.0 2.540 0.0 0.0 54.864 7.9375
738 7 RCC 0.0 0.0 57.404 0.0 0.0 2.032 5.0800
C
C
C New 44" Pb-B4C Bucket
C Base Plate w/ B4C Volume
C From Ktech drawing labeled "PbB BASEII"
C
800 7 RCC 0.000 0.000 0.000 0.000 0.000 1.905 11.43 $ Base Plate Bottom
801 7 RCC 0.000 0.000 1.905 0.000 0.000 1.905 7.9375 $ Base Plate Top
802 7 RCC 0.000 0.000 2.2225 0.000 0.000 1.27 7.62 $ B4C Cavity
C Bolts/Bolt Holes
C Big Bolts/Bolt Holes
C From McMaster-Carr catalog, Item # 98914A033, Threaded Rods and Studs
803 7 RCC 8.890 0.000 0.000 0.000 0.000 1.905 0.53594 $ All-Thread #1
804 7 RCC 8.890 0.000 1.524 0.000 0.000 0.381 0.65151 $ All-Thread Hole #1
805 7 RCC 8.890 0.000 1.2954 0.000 0.000 0.2286 0.674688 $ All-Thread Washer Void #1
806 7 RCC 8.890 0.000 1.2954 0.000 0.000 0.2286 1.27 $ All-Thread Washer #1
807 7 RCC 8.890 0.000 0.50165 0.000 0.000 0.79375 0.9525 $ All-Thread Nut #1
808 7 RCC 8.890 0.000 0.000 0.000 0.000 1.524 1.5875 $ All-Thread Nut Hole #1
809 7 RCC -8.890 0.000 0.000 0.000 0.000 1.905 0.53594 $ All-Thread #2
810 7 RCC -8.890 0.000 1.524 0.000 0.000 0.381 0.65151 $ All-Thread Hole #2
811 7 RCC -8.890 0.000 1.2954 0.000 0.000 0.2286 0.674688 $ All-Thread Washer Void #2
812 7 RCC -8.890 0.000 1.2954 0.000 0.000 0.2286 1.27 $ All-Thread Washer #2
813 7 RCC -8.890 0.000 0.50165 0.000 0.000 0.79375 0.9525 $ All-Thread Nut #2
814 7 RCC -8.890 0.000 0.000 0.000 0.000 1.524 1.5875 $ All-Thread Nut Hole #2
C Small Bolts/Bolt Holes
C From McMaster-Carr catalog, Item # 44705K334, Low-Pressure Aluminum Threaded Square-Socket Plug
815 7 RCC 0.000 5.3975 0.000 0.000 0.000 2.2225 0.71374 $ Small Hole #1
816 7 RCC 0.000 -5.3975 0.000 0.000 0.000 2.2225 0.71374 $ Small Hole #2
817 7 RCC 0.000 5.3975 0.000 0.000 0.000 1.2192 0.71374 $ Plug #1
818 7 RCC 0.000 -5.3975 0.000 0.000 0.000 1.2192 0.71374 $ Plug #2
819 7 RPP -0.357188 0.357188 5.040313 5.754688 0.000 0.862648 $ Plug #1 9/32" Hole
820 7 RPP -0.357188 0.357188 -5.754688 -5.040313 0.000 0.862648 $ Plug #2 9/32" Hole
C
C Containment Base
C From Ktech drawing labeled "CONTAINMENT BASE II"
C
830 7 RCC 0.000 0.000 1.905 0.000 0.000 1.905 7.9883 $ Inner void
831 7 RCC 0.000 0.000 1.905 0.000 0.000 1.905 9.779 $ Inner Disc Region
832 7 RCC 0.000 0.000 1.905 0.000 0.000 0.635 11.43 $ Outer Disc Region
833 7 RCC 8.890 0.000 1.905 0.000 0.000 1.905 0.53594 $ All-thread #1, General purpose steel
834 7 RCC -8.890 0.000 1.905 0.000 0.000 1.905 0.53594 $ All-thread #2, General purpose steel
C
C Lead Bottom, Floor, and Rings (Items #4, 5, and 6 in DWG titled "LEAD BORON BUCKET ASSEMBLY II")
C Drawn March 22, 2010 by S. Padias
C Unchamfered lead components
C
840 7 RCC 0.000 0.000 3.810 0.000 0.000 2.540 9.7663 $ Lead bottom disc
C 841 7 RCC 0.000 0.000 6.350 0.000 0.000 100.33 6.477 $ Inner lead void
842 7 RCC 0.000 0.000 6.350 0.000 0.000 100.33 9.7663 $ Lead ring
843 7 RCC 8.89 0.000 3.810 0.000 0.000 106.68 0.65532 $ Right-side big lead hole
844 7 RCC -8.89 0.000 3.810 0.000 0.000 106.68 0.65532 $ Left-side big lead hole
845 7 RCC 0.000 8.89 3.810 0.000 0.000 106.68 0.32639 $ Top-side small lead hole
846 7 RCC 0.000 -8.89 3.810 0.000 0.000 106.68 0.32639 $ Bottom-side small lead hole
C From McMaster-Carr catalog, Item # 98914A033, Threaded Rods and Studs
847 7 RCC 8.89 0.000 3.810 0.000 0.000 113.665 0.53594 $ Right-side All-Thread
848 7 RCC -8.89 0.000 3.810 0.000 0.000 113.665 0.53594 $ Left-side All-Thread
C General Purpose Aluminum Tubing
C From McMaster-Carr catalog, Item # 89965K42, General Purpose Aluminum Tubing
849 7 RCC 0.000 8.89 3.810 0.000 0.000 111.76 0.2286 $ Top-side inner radius Al6061 Tubing
850 7 RCC 0.000 8.89 3.810 0.000 0.000 111.76 0.3175 $ Top-side outer radius Al6061 Tubing
851 7 RCC 0.000 -8.89 3.810 0.000 0.000 111.76 0.2286 $ Bottom-side inner radius Al6061 Tub
852 7 RCC 0.000 -8.89 3.810 0.000 0.000 111.76 0.3175 $ Bottom-side outer radius Al6061 Tub
C Chamfered lead components
853 7 TRC 0.000 0.000 106.68 0.000 0.000 3.81 6.477 7.62 $ Chamfered lead ring void
854 7 RCC 0.000 0.000 106.68 0.000 0.000 3.81 9.7663 $ Chamfered lead ring radius
C
C Inner Aluminum 6061 Sleeves (Items #14 and 15 in DWG titled "LEAD BORON BUCKET ASSEMBLY II")
C
860 7 RCC 0.000 0.000 6.35 0.000 0.000 0.08255 6.477 $ Al6061 Base Plate
861 7 RCC 0.000 0.000 6.43255 0.000 0.000 100.1776 6.39445 $ Al6061 Sheet void
862 7 RCC 0.000 0.000 6.43255 0.000 0.000 100.1776 6.477 $ Al6061 Sheet
863 7 RCC 0.000 0.000 106.6102 0.000 0.000 0.0698 6.477 $ Void
C
C PbB base II Double Wall Weldment (Item #9 in DWG titled "LEAD BORON BUCKET ASSEMBLY II")
C
868 7 RCC 0.000 0.000 2.54 0.000 0.000 107.315 9.8425 $ Inner Surface of Inner Skin II L1
869 7 RCC 0.000 0.000 2.54 0.000 0.000 107.315 10.16 $ Inner Skin II L1
870 7 RCC 0.000 0.000 109.855 0.000 0.000 0.254 9.8425 $ Inner Surface of Inner Skin II L2

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871 7 RCC 0.000 0.000 109.855 0.000 0.000 0.254 10.16 $ Inner Skin II L2
872 7 RCC 0.000 0.000 110.109 0.000 0.000 0.381 9.8425 $ Inner Surface of Inner Skin II L3
873 7 RCC 0.000 0.000 110.109 0.000 0.000 0.381 10.16 $ Inner Skin II L3
874 7 RCC 0.000 0.000 2.54 0.000 0.000 107.315 11.1125 $ B4C Powder Region L1
875 7 RCC 0.000 0.000 2.54 0.000 0.000 107.315 11.43 $ Outer Skin II L1
876 7 RCC 0.000 0.000 109.855 0.000 0.000 0.254 11.1125 $ B4C Powder Region L2
877 7 RCC 0.000 0.000 109.855 0.000 0.000 0.254 11.43 $ Outer Skin II L2
878 7 RCC 0.000 0.000 110.109 0.000 0.000 0.381 11.1125 $ B4C Powder Region L3
879 7 RCC 0.000 0.000 110.109 0.000 0.000 0.381 11.43 $ Outer Skin II L3
C
C PbB Top: Top Plate (Item #1 in DWG titled "LEAD BORON BUCKET ASSEMBLY II")
C
880 7 RCC 0.000 0.000 110.49 0.000 0.000 0.4318 7.62 $ Lower void
881 7 TRC 0.000 0.000 110.9218 0.000 0.000 0.8382 7.62 8.103935 $ Upper void
882 7 RCC 0.000 0.000 110.49 0.000 0.000 1.27 11.43 $ Al6061 Disc
883 7 RCC 0.000 0.000 110.49 0.000 0.000 -0.381 10.1727 $ Lower B4C Cap void
884 7 RCC 0.000 0.000 110.49 0.000 0.000 -0.381 11.0998 $ B4C Cap
885 7 TRC 0.000 0.000 109.855 0.000 0.000 0.254 10.4267 10.1727 $ Inner chamfer
886 7 TRC 0.000 0.000 109.855 0.000 0.000 0.254 10.8458 11.0998 $ Outer chamfer
C Top Plate holes
887 7 RCC -8.89 0.000 110.49 0.000 0.000 1.27 0.65151 $ Left Large hole
888 7 RCC 8.89 0.000 110.49 0.000 0.000 1.27 0.65151 $ Right Large hole
889 7 RCC 0.000 -8.89 110.49 0.000 0.000 1.27 0.65151 $ Bottom Large hole
890 7 RCC 0.000 8.89 110.49 0.000 0.000 1.27 0.65151 $ Top Large hole
891 7 RCC -2.54 8.89 110.49 0.000 0.000 1.27 0.3175 $ Small Hole #1
892 7 RCC 2.54 8.89 110.49 0.000 0.000 1.27 0.3175 $ Small Hole #2
893 7 RCC -2.54 -8.89 110.49 0.000 0.000 1.27 0.3175 $ Small Hole #1
894 7 RCC 2.54 -8.89 110.49 0.000 0.000 1.27 0.3175 $ Small Hole #2
C Modified Hex Head Plugs, 1/4 NPT, AL6061-T6 (Item #16 in DWG titled "LEAD BORON BUCKET ASSEMBLY")
C From McMaster-Carr catalog, Item # 3867T65, High-Pressure Aluminum Pipe Fitting
821 7 RCC 0.000 -8.89 111.76 0.000 0.000 -1.27 0.65151 $ Bottom Hex Thread
822 7 RCC 0.000 -8.89 111.76 0.000 0.000 0.635 0.79375 $ Bottom Hex Head
823 7 RCC 0.000 8.89 111.76 0.000 0.000 -1.27 0.65151 $ Top Hex Thread
824 7 RCC 0.000 8.89 111.76 0.000 0.000 0.635 0.79375 $ Top Hex Head
C
C Enclosing surface for the 44" Pb-B4C bucket
C
899 7 RCC 0.000 0.000 0.000 0.000 0.000 117.475 11.43 $ Enclosing surface
C
C
C EXPERIMENT SURFACES
C
1001 6 SO 3. $ 6 cm dia scoring sphere
1002 6 rcc 0. -0.013301675 0. 0. 0.026603351 0. 0.635 $ Nickel Foil
C
C External Cutoff
C
900 RCC 0.000 0.000 -67.395 0.000 0.000 202.395 72.0000
C
C *****
C * TRANSFORMATIONS *
C *****
C
C TR1 rotates the hexes for the outer core bound and the cavity liner
C
*TR1 0 0 0 30 60 90 120 30 90
C
C TR3-->Movement of control rods -0.001 (full up) to -55.001 (full down)
C
C
C Measured Up DC with 32-in pedestal is -39.731 (03/03/2004)
C Measured Down DC is -30.851 (03/03/2004)
C -->Up DC position of 1527 Rod Units
C -->Down DC position of 2415 Rod Units
C Measured Up DC with 8-in + 32-in pedestal is -40.421 (03/01/2004)
C Measured Down DC with 8-in + 32-in pedestal is -31.291 (03/01/2004)
C -->Up DC position of 1428 Rod Units
C -->Down DC position of 2371 Rod Units
C Measured Up DC with Pb-B4C on 32-in pedestal is -22.951 (03/09/2004)
C Measured Down DC with Pb-B4C on 32-in pedestal is -10.741 (03/09/2004)
C -->Up DC position of 3205 Rod Units
C -->Down DC position of 4426 Rod Units
C Measured DC with LP-1 on 32-in pedestal is -31.941 (03/11/2004)
C Measured Down DC with LP-1 on 32-in pedestal is -23.721 (03/11/2004)
C -->Up DC position of 2306 Rod Units
C -->Down DC position of 3128 Rod Units
C
*TR3 0 0 -23.50
C
C TR4-->Movement of safety rods 0.001 (full up) to -54.999 (full down)

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Neutron Reference Benchmark: ACRR-LB44-CC-32-cl

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C
C   Measured worth of safety rods:  -$2.12                      (03/30/2004)
C
*TR4   0 0 0.001
C
C   TR5-->Movement of transient rods 0 (full down) to 90 (full up)
C
C   Measured worth of transient rods:  -$4.14                  (03/30/2004)
C
*TR5   0 0 90
C
C   TR6-->Moves experiment package from origin (0 0 0) to fuel centerline
C
*TR6   0 0 49.445
C
C   TR7-->Puts buckets on 8" (34.205) or 32" (13.885) pedestals
C   Use 32" pedestal for LP-1
C   Use 8" for Standard Al buckets
C
*TR7   0 0 13.885
C
C *****
C * MATERIAL CARDS *
C *****
C Materials cards use the latest available cross sections
C
C   UO2-BeO fuel (3.3447 g/cc) (XSEC Temp - 293.6 K)
C
C
M1      4009.70c -0.2827602  8016.70c -0.5277690  92235.70c -0.0662957
        92238.70c -0.1222844  92234.70c -0.0004547  92236.70c -0.0004358
MT1     beo.60t      $ S(alpha, beta) for UO2-BeO (Temp - 294 K)
C
C
C   UO2-BeO fuel (3.0102 g/cc) -- This is the 90% fuel
C                                   (XSEC Temp - 293.6 K)
C   Included as a separate material to avoid warning message
C
C
M11     4009.70c -0.2827602  8016.70c -0.5277690  92235.70c -0.0662957
        92238.70c -0.1222844  92234.70c -0.0004547  92236.70c -0.0004358
MT11    beo.60t      $ S(alpha, beta) for BeO (Temp - 294 K)
C
C   NIOBIUM (8.4 g/cc)
C
M2      41093.70c 1.0000
C
C
C   SS-304L from Ktech Materials Database Rev. 118
C   Material Number: 3410
C   Values are weight %
C   Si: 0.0100 Cr: 0.1900 Mn: 0.0200 Fe: 0.6800 Ni: 0.1000
C
C   FM multiplier (neutrons): 1.76109641E-10 3410 -4 1
C   FM multiplier (photons):  1.76109641E-10 3410 -5 -6
C
C   Density: 7.896 g/cc
C
M3      14028.70c -0.009187  14029.70c -0.000483  14030.70c -0.000329
        24050.70c -0.007930  24052.70c -0.159029  24053.70c -0.018380
        24054.70c -0.004661  25055.70c -0.020000  26054.70c -0.038390
        26056.70c -0.624930  26057.70c -0.014691  26058.70c -0.001989
        28058.70c -0.067198  28060.70c -0.026776  28061.70c -0.001183
        28062.70c -0.003834  28064.70c -0.001009
C
C
C   BeO (2.8 g/cc)
C
M4      4009.70c 0.5000      8016.70c 0.4998096  8017.70c 0.0001904
MT4     beo.60t      $ S(alpha, beta) for BeO (Temp - 294 K)
C
C   Water (1 g/cc)
C
M5      1001.70c 0.6665667  1002.70c 0.000100
        8016.70c 0.3332063  8017.70c 0.000127
MT5     lwtr.60t     $ S(alpha, beta) for water (Temp - 294 K)
C
C
C   Ni reflector
C   Values are weight %

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C      Ni-58: 67.19780  Ni-60: 26.77586  Ni-61:  1.18346
C      Ni-62:  3.83429  Ni-64:  1.00859
C      Converted Data from Nuclear Wallet Card to w/o with "Weight_Frac" program
C      Density:  8.9020 g/cc
C
C
M6      28058.70c -0.6719780 28060.70c -0.2677586 28061.70c -0.0118346
      28062.70c -0.0383429 28064.70c -0.0100859
C
C
C      Al-6061 from Ktech Materials Database Rev. 118
C      Material Number: 3110
C      Values are weight %
C      Mg: 0.0110  Al: 0.9670  Si: 0.0080  Ti: 0.0007
C      Cr: 0.0020  Mn: 0.0013  Fe: 0.0056  Ni: 0.0004
C      Cu: 0.0030  Zn: 0.0010
C
C      FM multiplier (neutrons):  3.55249469E-10  3110  -4  1
C      FM multiplier (photons):  3.55249469E-10  3110  -5  -6
C
C      Density:  2.704 g/cc
C
M7      12000.66c -0.011000  13027.70c -0.967000  14028.70c -0.007350
      14029.70c -0.000387  14030.70c -0.000263  22000.66c -0.000700
      24050.70c -0.000084  24052.70c -0.001674  24053.70c -0.000193
      24054.70c -0.000049  25055.70c -0.001300  26054.70c -0.000316
      26056.70c -0.005147  26057.70c -0.000121  26058.70c -0.000016
      28058.70c -0.000269  28060.70c -0.000107  28061.70c -0.000005
      28062.70c -0.000015  28064.70c -0.000004  29063.70c -0.002055
      29065.70c -0.000945  30000.42c -0.001000
C
C
C      B4C poison (2.48 g/cc)
C      Composition data taken from Jeff Wemple (KTech) Memo dated June 18, 2010
C      and titled "Re: Drawing of new Lead-boron bucket"
C      Manufacturer of powder is READE ADVANCED MATERIALS
C      Density of packed powder in the 44" Pb-B4C bucket is 1.2505 (half of 2.51 g/cc)
C
M8      6000.70c  0.20000  5010.70c  0.159200  5011.70c  0.640800
C
C
C      Natural Lead
C      True Weight %:  Pb-204:  1.37808  Pb-206: 23.95550
C                      Pb-207: 22.07430  Pb-208: 52.59212
C      Weight % based on Available MCNP XSEC:
C                      Pb-206: 24.29024  Pb-207: 22.38275
C                      Pb-208: 53.32701
C
C      Converted Data from Nuclear Wallet Card to w/o with "Weight_Frac" program
C      Density is 11.35 g/cc from Nuclear Wallet Cards.
C
C
M700    82206.70c -0.2429024  82207.70c -0.2238275
      82208.70c -0.5332701
C
C
C      Boral Plate Composition
C
C      Composition found in Nuclear Science and Engineering
C      Vol. 65, No. 1, pgs. 41-48, January 1978.
C      Values are weight %
C      B: 27.40  C:  7.61  Al: 63.68
C      Cu:  0.09  Zn:  0.16  Fe:  0.45
C      Cr:  0.10  Mn:  0.10  Mg:  0.05
C      Ti:  0.10  Li:  0.26
C
C      Density:  2.53 g/cc
C
C
M701    5010.70c -0.050242  5011.70c -0.223758  6000.70c -0.076100
      13027.70c -0.636800  29063.70c -0.000616  29065.70c -0.000284
      30000.42c -0.001600  26056.70c -0.004500  24050.70c -0.000042
      24052.70c -0.000837  24053.70c -0.000097  24054.70c -0.000024
      25055.70c -0.001000  12000.66c -0.000500  22000.66c -0.001000
      3006.70c -0.000171  3007.70c -0.002429
C
C
C
C      Air
C      Standard Density:  1.205e-3 g/cc @ 20 deg C, 1 atm

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Neutron Reference Benchmark: ACRR-LB44-CC-32-cl

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C   Albuquerque:      1.0245e-3 g/cc in ABQ
C   See Attix p.531-532
C
M702   7014.70c -0.752308   7015.70c -0.002960   8016.70c -0.231687
        8017.70c -0.000094   6000.70c -0.000124   18000.42c -0.012827
C
C
C   HELIUM For Leak Test
C   @ 2 atm density = 3.57e-4 g/cc
C
M703   2003.70c 0.00000137   2004.70c  0.99999863
C
C
C   HDPE-> (C2H4)n      --          --
C           |   H       H   |
C           |   |       |   |
C           -|-  C  --  C  -|-
C           |   |       |   |
C           |   H       H   |
C           --          --
C
M704   1001.70c 0.666667   6000.70c  0.333333
MT704   poly.60t
C
C
C   A517 Carbon Steel (den = 7.28 g/cc)
C   Modified to match the mill test cert.
C   from Tubos de Acero de Mexico, S.A.
C
C   Summary of MatMCNP Calculations:
C
C   Isotope   Number Fraction   Weight Fraction   Atoms/b-cm
C   C-12      0.0118115        0.0025688        0.0009385
C   C-13      0.0001326        0.0000312        0.0000105
C   Si-28     0.0048924        0.0024807        0.0003887
C   Si-29     0.0002484        0.0001305        0.0000197
C   Si-30     0.0001638        0.0000890        0.0000130
C   Cr-50     0.0000184        0.0000167        0.0000015
C   Cr-52     0.0003557        0.0003348        0.0000283
C   Cr-53     0.0000403        0.0000387        0.0000032
C   Cr-54     0.0000100        0.0000098        0.0000008
C   Mn-55     0.0078340        0.0078003        0.0006225
C   Fe-54     0.0568920        0.0556172        0.0045205
C   Fe-56     0.8930822        0.9053674        0.0709617
C   Fe-57     0.0206252        0.0212829        0.0016388
C   Fe-58     0.0027448        0.0028820        0.0002181
C   Cu-63     0.0007628        0.0008700        0.0000606
C   Cu-65     0.0003400        0.0004001        0.0000270
C   Mo-92     0.0000068        0.0000114        0.0000005
C   Mo-94     0.0000043        0.0000072        0.0000003
C   Mo-95     0.0000073        0.0000126        0.0000006
C   Mo-96     0.0000077        0.0000133        0.0000006
C   Mo-97     0.0000044        0.0000077        0.0000003
C   Mo-98     0.0000111        0.0000197        0.0000009
C   Mo-100    0.0000044        0.0000080        0.0000004
C
C   The total compound atom density (atom/b-cm):  0.07945702
C
M765   06000.70c 0.0119440   14028.70c 0.0048924   14029.70c 0.0002484
        14030.70c 0.0001638   24050.70c 0.0000184   24052.70c 0.0003557
        24053.70c 0.0000403   24054.70c 0.0000100   25055.70c 0.0078340
        26054.70c 0.0568920   26056.70c 0.8930822   26057.70c 0.0206252
        26058.70c 0.0027448   29063.70c 0.0007628   29065.70c 0.0003400
        42000.66c 0.0000460
C
C
C
C   General Purpose Steel, Grade B7
C   7 Comment Cards
C
C   1
C   2 The weight fraction for elements of General Purpose Steel, Grade B7 is
C   3 The weight fractions are used for each element.
C   4 The density of natural cadmium is 7.83 g/cc,
C   5 The MCNP material number is found after the material.
C   6 The line below "7" gives the density.
C   7
C
C   Summary of MatMCNP Calculations:
C

```

Isotope	Number	Fraction	Weight Fraction	Atoms/b-cm
C-12	0.0194064		0.0042483	0.0016694
C-13	0.0002178		0.0000517	0.0000187
Mn-55	0.0087306		0.0087500	0.0007510
P-31	0.0006194		0.0003500	0.0000533
S-32	0.0006498		0.0003790	0.0000559
S-33	0.0000051		0.0000031	0.0000004
S-34	0.0000288		0.0000178	0.0000025
S-36	0.0000001		0.0000001	0.0000000
Si-28	0.0045003		0.0022968	0.0003871
Si-29	0.0002285		0.0001208	0.0000197
Si-30	0.0001506		0.0000824	0.0000130
Cr-50	0.0004466		0.0004069	0.0000384
Cr-52	0.0086125		0.0081607	0.0007409
Cr-53	0.0009766		0.0009432	0.0000840
Cr-54	0.0002431		0.0002392	0.0000209
Mo-92	0.0001696		0.0002843	0.0000146
Mo-94	0.0001057		0.0001811	0.0000091
Mo-95	0.0001819		0.0003150	0.0000157
Mo-96	0.0001906		0.0003335	0.0000164
Mo-97	0.0001091		0.0001929	0.0000094
Mo-98	0.0002758		0.0004925	0.0000237
Mo-100	0.0001101		0.0002006	0.0000095
Fe-54	0.0557637		0.0548720	0.0047968
Fe-56	0.8753707		0.8932369	0.0753001
Fe-57	0.0202161		0.0209977	0.0017390
Fe-58	0.0026904		0.0028434	0.0002314

C The total compound atom density (atom/b-cm): 0.08602087
 C
 C This material contains an isotope that is often
 C modified by an S(alpha,beta). Check MCNP
 C Manual Appendix G to see if an
 C S(alpha,beta) is required.
 C
 C MCNP Material 766
 C
 M766 06000.70c 0.0196242
 25055.70c 0.0087306
 15031.70c 0.0006194
 16000.66c 0.0006838
 14028.70c 0.0045003
 14029.70c 0.0002285
 14030.70c 0.0001506
 24050.70c 0.0004466
 24052.70c 0.0086125
 24053.70c 0.0009766
 24054.70c 0.0002431
 42000.66c 0.0011428
 26054.70c 0.0557637
 26056.70c 0.8753707
 26057.70c 0.0202161
 26058.70c 0.0026904

C
 C Caution: The natural zaid is used for Carbon.
 C
 C Caution: The natural zaid is used for Sulfur.
 C
 C Caution: The natural zaid is used for Molybdenum.
 C
 C If the natural zaid is used for any element, the atom fractions of each isotope
 C of that element are added together and listed with the natural zaid just once.
 C
 C To convert a particle flux to rad[Material]
 C use FM 1.76023016E-10 766 -4 1 for neutrons
 C or FM 1.76023016E-10 766 -5 -6 for photons.
 C
 C
 C Carbon Steel
 C 8 Comment Cards
 C
 C 1
 C 2 The weight fraction for elements of carbon steel is used.
 C 3 The weight fractions are used for each element.
 C 4 Data obtained from MCNP Primer by C.D. Harmon and R.D. Busch (1994)
 C 5 The density of natural cadmium is 7.82 g/cc,
 C 6 The MCNP material number is found after the material.
 C 7 The line below "8" gives the density.
 C 8
 C

Neutron Reference Benchmark: ACRR-LB44-CC-32-cl

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C Summary of MatMCNP Calculations:
C
C Isotope Number Fraction Weight Fraction Atoms/b-cm
C C-12 0.0225772 0.0049399 0.0019386
C C-13 0.0002534 0.0000601 0.0000218
C Fe-54 0.0571155 0.0561733 0.0049043
C Fe-56 0.8965919 0.9144202 0.0769875
C Fe-57 0.0207062 0.0214957 0.0017780
C Fe-58 0.0027556 0.0029108 0.0002366
C
C The total compound atom density (atom/b-cm): 0.08586678
C
C This material contains an isotope that is often
C modified by an S(alpha,beta). Check MCNP
C Manual Appendix G to see if an
C S(alpha,beta) is required.
C
C MCNP Material 767
C
M767 06000.70c 0.0228306
      26054.70c 0.0571155
      26056.70c 0.8965919
      26057.70c 0.0207062
      26058.70c 0.0027556
C
C Caution: The natural zaid is used for Carbon.
C
C If the natural zaid is used for any element, the atom fractions of each isotope
C of that element are added together and listed with the natural zaid just once.
C
C To convert a particle flux to rad[Material]
C use FM 1.75917531E-10 767 -4 1 for neutrons
C or FM 1.75917531E-10 767 -5 -6 for photons.
C
C *****
C * TALLIES *
C *****
C
F14:P 1001
FC14 gamma fluence g/cm**2/source neutron - 48 group
E14 1.38880e-10
      1.00E-03 1.00E-02 2.00E-02 3.00E-02 4.50E-02
      6.00E-02 8.00E-02 1.00E-01 1.50E-01 2.00E-01
      3.00E-01 4.00E-01 4.50E-01 5.00E-01 5.25E-01
      6.00E-01 7.00E-01 8.00E-01 9.00E-01 1.00E+00
      1.13E+00 1.20E+00 1.33E+00 1.50E+00 1.66E+00
      1.88E+00 2.00E+00 2.33E+00 2.50E+00 2.67E+00
      3.00E+00 3.50E+00 4.00E+00 4.50E+00 5.00E+00
      5.50E+00 6.00E+00 6.50E+00 7.00E+00 7.50E+00
      8.00E+00 9.00E+00 1.00E+01 1.20E+01 1.40E+01
      1.70E+01 2.00E+01 3.00E+01 5.00E+01
C
F24:N 1001
FC24 neutron fluence n/cm**2/source neutron - 640 group
E24 1.000e-10 1.050e-10 1.100e-10 1.150e-10 1.200e-10 1.275e-10
      1.350e-10 1.425e-10 1.500e-10 1.600e-10 1.700e-10 1.800e-10
      1.900e-10 2.000e-10 2.100e-10 2.200e-10 2.300e-10 2.400e-10
      2.550e-10 2.700e-10 2.800e-10 3.000e-10 3.200e-10 3.400e-10
      3.600e-10 3.800e-10 4.000e-10 4.250e-10 4.500e-10 4.750e-10
      5.000e-10 5.250e-10 5.500e-10 5.750e-10 6.000e-10 6.300e-10
      6.600e-10 6.900e-10 7.200e-10 7.600e-10 8.000e-10 8.400e-10
      8.800e-10 9.200e-10 9.600e-10 1.000e-09 1.050e-09 1.100e-09
      1.150e-09 1.200e-09 1.275e-09 1.350e-09 1.425e-09 1.500e-09
      1.600e-09 1.700e-09 1.800e-09 1.900e-09 2.000e-09 2.100e-09
      2.200e-09 2.300e-09 2.400e-09 2.550e-09 2.700e-09 2.800e-09
      3.000e-09 3.200e-09 3.400e-09 3.600e-09 3.800e-09 4.000e-09
      4.250e-09 4.500e-09 4.750e-09 5.000e-09 5.250e-09 5.500e-09
      5.750e-09 6.000e-09 6.300e-09 6.600e-09 6.900e-09 7.200e-09
      7.600e-09 8.000e-09 8.400e-09 8.800e-09 9.200e-09 9.600e-09
      1.000e-08 1.050e-08 1.100e-08 1.150e-08 1.200e-08 1.275e-08
      1.350e-08 1.425e-08 1.500e-08 1.600e-08 1.700e-08 1.800e-08
      1.900e-08 2.000e-08 2.100e-08 2.200e-08 2.300e-08 2.400e-08
      2.550e-08 2.700e-08 2.800e-08 3.000e-08 3.200e-08 3.400e-08
      3.600e-08 3.800e-08 4.000e-08 4.250e-08 4.500e-08 4.750e-08
      5.000e-08 5.250e-08 5.500e-08 5.750e-08 6.000e-08 6.300e-08
      6.600e-08 6.900e-08 7.200e-08 7.600e-08 8.000e-08 8.400e-08
      8.800e-08 9.200e-08 9.600e-08 1.000e-07 1.050e-07 1.100e-07
      1.150e-07 1.200e-07 1.275e-07 1.350e-07 1.425e-07 1.500e-07
      1.600e-07 1.700e-07 1.800e-07 1.900e-07 2.000e-07 2.100e-07

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[illegible]

Neutron Reference Benchmark: ACRR-LB44-CC-32-cl

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1.900e+01  1.910e+01  1.920e+01  1.930e+01  1.940e+01  1.950e+01
1.960e+01  1.970e+01  1.980e+01  1.990e+01  2.000e+01
C
F34:N 1001
FC34 neutron fluence n/cm**2/source neutron - 89 group
E34 1.39E-10 1.00E-09 5.00E-09 1.00E-08 3.00E-08 7.00E-08 1.00E-07
1.52E-07 2.00E-07 4.14E-07 6.00E-07 8.00E-07 1.13E-06 3.06E-06
5.04E-06 8.32E-06 1.37E-05 2.26E-05 3.73E-05 6.14E-05 1.01E-04
1.67E-04 2.75E-04 3.54E-04 4.54E-04 5.83E-04 7.49E-04 9.61E-04
1.09E-03 1.23E-03 1.40E-03 1.58E-03 1.80E-03 2.03E-03 2.31E-03
2.61E-03 2.96E-03 3.35E-03 3.80E-03 4.31E-03 4.88E-03 5.53E-03
6.27E-03 7.10E-03 8.05E-03 9.12E-03 1.03E-02 1.17E-02 1.33E-02
1.50E-02 1.70E-02 1.93E-02 2.19E-02 2.48E-02 2.61E-02 2.81E-02
3.18E-02 4.09E-02 5.25E-02 6.74E-02 8.65E-02 1.11E-01 1.43E-01
1.83E-01 2.35E-01 3.02E-01 3.88E-01 4.39E-01 4.98E-01 5.64E-01
6.39E-01 7.24E-01 8.21E-01 9.30E-01 1.05E+00 1.19E+00 1.35E+00
1.74E+00 2.23E+00 2.87E+00 3.68E+00 4.72E+00 6.07E+00 7.79E+00
1.00E+01 1.19E+01 1.35E+01 1.49E+01 1.69E+01 2.00E+01
C
F44:N 1001
FC44 total neutron fluence n/cm**2/source neutron
C
C
MODE N P
C 20B
KCODE 10000000 1.0 3 2000
c KCODE 100000 1.0 3 2000
C KCODE 10000 1.0 3 200
KSRC 20 0 50 0 20 60 30 0 40 0 30 60
C PRINT 10 60 100 110
RAND GEN=2 SEED=19073486328125 STRIDE=152917
PRDMP 50 50 0 1 0

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APPENDIX B CALCULATED SPECTRUM

Table VIII. 640 group representation of the calculated spectrum.

Group number	Lower energy (MeV)	Upper energy (MeV)	Midpoint energy (MeV)	Φ (n/cm ²) [†]	Relative statistical uncertainty [§]	$d\Phi/dE$	$E d\Phi/dE$
1	1.000E-10	1.050E-10	1.0250E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
2	1.050E-10	1.100E-10	1.0750E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
3	1.100E-10	1.150E-10	1.1250E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
4	1.150E-10	1.200E-10	1.1750E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
5	1.200E-10	1.275E-10	1.2375E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
6	1.275E-10	1.350E-10	1.3125E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
7	1.350E-10	1.425E-10	1.3875E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
8	1.425E-10	1.500E-10	1.4625E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
9	1.500E-10	1.600E-10	1.5500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
10	1.600E-10	1.700E-10	1.6500E-10	1.54225E-09	1.0000	1.54225E+02	2.54471E-08
11	1.700E-10	1.800E-10	1.7500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
12	1.800E-10	1.900E-10	1.8500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
13	1.900E-10	2.000E-10	1.9500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
14	2.000E-10	2.100E-10	2.0500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
15	2.100E-10	2.200E-10	2.1500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
16	2.200E-10	2.300E-10	2.2500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
17	2.300E-10	2.400E-10	2.3500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
18	2.400E-10	2.550E-10	2.4750E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
19	2.550E-10	2.700E-10	2.6250E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
20	2.700E-10	2.800E-10	2.7500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
21	2.800E-10	3.000E-10	2.9000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
22	3.000E-10	3.200E-10	3.1000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
23	3.200E-10	3.400E-10	3.3000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00

[†] Integral fluence in each bin, normalized so that the sum of all integral bin fluences equals unity.[§] These are the uncertainties associated with the statistical Monte Carlo transport method, and not the uncertainties associated with the spectrum itself.

24	3.400E-10	3.600E-10	3.5000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
25	3.600E-10	3.800E-10	3.7000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
26	3.800E-10	4.000E-10	3.9000E-10	2.42443E-09	1.0000	1.21222E+02	4.72765E-08
27	4.000E-10	4.250E-10	4.1250E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
28	4.250E-10	4.500E-10	4.3750E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
29	4.500E-10	4.750E-10	4.6250E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
30	4.750E-10	5.000E-10	4.8750E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
31	5.000E-10	5.250E-10	5.1250E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
32	5.250E-10	5.500E-10	5.3750E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
33	5.500E-10	5.750E-10	5.6250E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
34	5.750E-10	6.000E-10	5.8750E-10	3.38625E-09	1.0000	1.35450E+02	7.95768E-08
35	6.000E-10	6.300E-10	6.1500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
36	6.300E-10	6.600E-10	6.4500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
37	6.600E-10	6.900E-10	6.7500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
38	6.900E-10	7.200E-10	7.0500E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
39	7.200E-10	7.600E-10	7.4000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
40	7.600E-10	8.000E-10	7.8000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
41	8.000E-10	8.400E-10	8.2000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
42	8.400E-10	8.800E-10	8.6000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
43	8.800E-10	9.200E-10	9.0000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
44	9.200E-10	9.600E-10	9.4000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
45	9.600E-10	1.000E-09	9.8000E-10	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
46	1.000E-09	1.050E-09	1.0250E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
47	1.050E-09	1.100E-09	1.0750E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
48	1.100E-09	1.150E-09	1.1250E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
49	1.150E-09	1.200E-09	1.1750E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
50	1.200E-09	1.275E-09	1.2375E-09	3.20126E-09	1.0000	4.26835E+01	5.28208E-08
51	1.275E-09	1.350E-09	1.3125E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
52	1.350E-09	1.425E-09	1.3875E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
53	1.425E-09	1.500E-09	1.4625E-09	4.35428E-09	0.7847	5.80570E+01	8.49084E-08
54	1.500E-09	1.600E-09	1.5500E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
55	1.600E-09	1.700E-09	1.6500E-09	2.08869E-09	1.0000	2.08869E+01	3.44634E-08

56	1.700E-09	1.800E-09	1.7500E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
57	1.800E-09	1.900E-09	1.8500E-09	1.19216E-09	1.0000	1.19216E+01	2.20550E-08
58	1.900E-09	2.000E-09	1.9500E-09	2.01699E-09	1.0000	2.01699E+01	3.93313E-08
59	2.000E-09	2.100E-09	2.0500E-09	6.79088E-09	0.7475	6.79088E+01	1.39213E-07
60	2.100E-09	2.200E-09	2.1500E-09	3.41578E-09	1.0000	3.41578E+01	7.34392E-08
61	2.200E-09	2.300E-09	2.2500E-09	1.39993E-08	0.7169	1.39993E+02	3.14983E-07
62	2.300E-09	2.400E-09	2.3500E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
63	2.400E-09	2.550E-09	2.4750E-09	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
64	2.550E-09	2.700E-09	2.6250E-09	1.50757E-08	0.5580	1.00505E+02	2.63824E-07
65	2.700E-09	2.800E-09	2.7500E-09	2.35077E-08	0.5776	2.35077E+02	6.46461E-07
66	2.800E-09	3.000E-09	2.9000E-09	1.08624E-08	0.6774	5.43119E+01	1.57505E-07
67	3.000E-09	3.200E-09	3.1000E-09	2.08038E-08	0.4410	1.04019E+02	3.22459E-07
68	3.200E-09	3.400E-09	3.3000E-09	5.91186E-09	0.7352	2.95593E+01	9.75457E-08
69	3.400E-09	3.600E-09	3.5000E-09	1.08274E-08	0.6327	5.41369E+01	1.89479E-07
70	3.600E-09	3.800E-09	3.7000E-09	2.05551E-08	0.5162	1.02775E+02	3.80269E-07
71	3.800E-09	4.000E-09	3.9000E-09	4.84710E-08	0.3746	2.42355E+02	9.45184E-07
72	4.000E-09	4.250E-09	4.1250E-09	3.87706E-08	0.3833	1.55082E+02	6.39715E-07
73	4.250E-09	4.500E-09	4.3750E-09	4.35973E-08	0.3353	1.74389E+02	7.62953E-07
74	4.500E-09	4.750E-09	4.6250E-09	3.98327E-08	0.3395	1.59331E+02	7.36905E-07
75	4.750E-09	5.000E-09	4.8750E-09	7.24719E-08	0.2776	2.89888E+02	1.41320E-06
76	5.000E-09	5.250E-09	5.1250E-09	5.66452E-08	0.3778	2.26581E+02	1.16123E-06
77	5.250E-09	5.500E-09	5.3750E-09	3.89377E-08	0.4108	1.55751E+02	8.37161E-07
78	5.500E-09	5.750E-09	5.6250E-09	3.13586E-08	0.4050	1.25434E+02	7.05569E-07
79	5.750E-09	6.000E-09	5.8750E-09	4.58384E-08	0.3229	1.83354E+02	1.07720E-06
80	6.000E-09	6.300E-09	6.1500E-09	3.53441E-08	0.4122	1.17814E+02	7.24554E-07
81	6.300E-09	6.600E-09	6.4500E-09	8.08485E-08	0.2678	2.69495E+02	1.73824E-06
82	6.600E-09	6.900E-09	6.7500E-09	6.54122E-08	0.2792	2.18041E+02	1.47177E-06
83	6.900E-09	7.200E-09	7.0500E-09	9.36781E-08	0.2335	3.12260E+02	2.20144E-06
84	7.200E-09	7.600E-09	7.4000E-09	7.97241E-08	0.2494	1.99310E+02	1.47490E-06
85	7.600E-09	8.000E-09	7.8000E-09	8.46353E-08	0.2504	2.11588E+02	1.65039E-06
86	8.000E-09	8.400E-09	8.2000E-09	1.62032E-07	0.1805	4.05079E+02	3.32165E-06
87	8.400E-09	8.800E-09	8.6000E-09	1.60290E-07	0.1967	4.00724E+02	3.44623E-06

88	8.800E-09	9.200E-09	9.0000E-09	9.74936E-08	0.2227	2.43734E+02	2.19361E-06
89	9.200E-09	9.600E-09	9.4000E-09	1.36426E-07	0.2078	3.41065E+02	3.20601E-06
90	9.600E-09	1.000E-08	9.8000E-09	1.72928E-07	0.1864	4.32320E+02	4.23674E-06
91	1.000E-08	1.050E-08	1.0250E-08	2.04832E-07	0.1756	4.09665E+02	4.19906E-06
92	1.050E-08	1.100E-08	1.0750E-08	1.88759E-07	0.1777	3.77518E+02	4.05831E-06
93	1.100E-08	1.150E-08	1.1250E-08	2.51310E-07	0.1580	5.02620E+02	5.65448E-06
94	1.150E-08	1.200E-08	1.1750E-08	1.92805E-07	0.1734	3.85610E+02	4.53092E-06
95	1.200E-08	1.275E-08	1.2375E-08	2.97782E-07	0.1408	3.97043E+02	4.91341E-06
96	1.275E-08	1.350E-08	1.3125E-08	3.94862E-07	0.1156	5.26483E+02	6.91009E-06
97	1.350E-08	1.425E-08	1.3875E-08	3.14820E-07	0.1281	4.19760E+02	5.82417E-06
98	1.425E-08	1.500E-08	1.4625E-08	4.76836E-07	0.1101	6.35782E+02	9.29831E-06
99	1.500E-08	1.600E-08	1.5500E-08	6.61760E-07	0.0955	6.61760E+02	1.02573E-05
100	1.600E-08	1.700E-08	1.6500E-08	6.40468E-07	0.0966	6.40468E+02	1.05677E-05
101	1.700E-08	1.800E-08	1.7500E-08	5.80546E-07	0.1007	5.80546E+02	1.01596E-05
102	1.800E-08	1.900E-08	1.8500E-08	6.49330E-07	0.0935	6.49330E+02	1.20126E-05
103	1.900E-08	2.000E-08	1.9500E-08	6.82076E-07	0.0913	6.82076E+02	1.33005E-05
104	2.000E-08	2.100E-08	2.0500E-08	7.79647E-07	0.0878	7.79647E+02	1.59828E-05
105	2.100E-08	2.200E-08	2.1500E-08	6.67604E-07	0.0933	6.67604E+02	1.43535E-05
106	2.200E-08	2.300E-08	2.2500E-08	7.87324E-07	0.0861	7.87324E+02	1.77148E-05
107	2.300E-08	2.400E-08	2.3500E-08	6.67497E-07	0.0937	6.67497E+02	1.56862E-05
108	2.400E-08	2.550E-08	2.4750E-08	1.19846E-06	0.0699	7.98970E+02	1.97745E-05
109	2.550E-08	2.700E-08	2.6250E-08	1.18182E-06	0.0740	7.87877E+02	2.06818E-05
110	2.700E-08	2.800E-08	2.7500E-08	7.91732E-07	0.0903	7.91732E+02	2.17726E-05
111	2.800E-08	3.000E-08	2.9000E-08	1.58977E-06	0.0615	7.94886E+02	2.30517E-05
112	3.000E-08	3.200E-08	3.1000E-08	1.67023E-06	0.0595	8.35115E+02	2.58886E-05
113	3.200E-08	3.400E-08	3.3000E-08	1.62123E-06	0.0617	8.10616E+02	2.67503E-05
114	3.400E-08	3.600E-08	3.5000E-08	1.78940E-06	0.0588	8.94702E+02	3.13146E-05
115	3.600E-08	3.800E-08	3.7000E-08	1.70999E-06	0.0611	8.54996E+02	3.16349E-05
116	3.800E-08	4.000E-08	3.9000E-08	1.50173E-06	0.0605	7.50863E+02	2.92836E-05
117	4.000E-08	4.250E-08	4.1250E-08	2.27583E-06	0.0521	9.10332E+02	3.75512E-05
118	4.250E-08	4.500E-08	4.3750E-08	2.31909E-06	0.0520	9.27638E+02	4.05841E-05
119	4.500E-08	4.750E-08	4.6250E-08	2.13340E-06	0.0539	8.53358E+02	3.94678E-05

120	4.750E-08	5.000E-08	4.8750E-08	2.03916E-06	0.0549	8.15664E+02	3.97636E-05
121	5.000E-08	5.250E-08	5.1250E-08	2.15316E-06	0.0555	8.61263E+02	4.41397E-05
122	5.250E-08	5.500E-08	5.3750E-08	1.99218E-06	0.0569	7.96873E+02	4.28319E-05
123	5.500E-08	5.750E-08	5.6250E-08	1.90409E-06	0.0577	7.61638E+02	4.28421E-05
124	5.750E-08	6.000E-08	5.8750E-08	2.08883E-06	0.0565	8.35533E+02	4.90875E-05
125	6.000E-08	6.300E-08	6.1500E-08	2.21253E-06	0.0543	7.37509E+02	4.53568E-05
126	6.300E-08	6.600E-08	6.4500E-08	2.32033E-06	0.0535	7.73443E+02	4.98870E-05
127	6.600E-08	6.900E-08	6.7500E-08	1.93349E-06	0.0578	6.44495E+02	4.35034E-05
128	6.900E-08	7.200E-08	7.0500E-08	2.15023E-06	0.0574	7.16743E+02	5.05304E-05
129	7.200E-08	7.600E-08	7.4000E-08	2.46718E-06	0.0521	6.16796E+02	4.56429E-05
130	7.600E-08	8.000E-08	7.8000E-08	2.22897E-06	0.0534	5.57241E+02	4.34648E-05
131	8.000E-08	8.400E-08	8.2000E-08	2.43687E-06	0.0541	6.09217E+02	4.99558E-05
132	8.400E-08	8.800E-08	8.6000E-08	1.84128E-06	0.0595	4.60321E+02	3.95876E-05
133	8.800E-08	9.200E-08	9.0000E-08	1.88553E-06	0.0588	4.71383E+02	4.24245E-05
134	9.200E-08	9.600E-08	9.4000E-08	1.69695E-06	0.0641	4.24237E+02	3.98783E-05
135	9.600E-08	1.000E-07	9.8000E-08	1.65310E-06	0.0651	4.13274E+02	4.05009E-05
136	1.000E-07	1.050E-07	1.0250E-07	1.95928E-06	0.0600	3.91856E+02	4.01653E-05
137	1.050E-07	1.100E-07	1.0750E-07	1.89074E-06	0.0607	3.78147E+02	4.06508E-05
138	1.100E-07	1.150E-07	1.1250E-07	1.58354E-06	0.0680	3.16709E+02	3.56297E-05
139	1.150E-07	1.200E-07	1.1750E-07	1.42791E-06	0.0711	2.85582E+02	3.35559E-05
140	1.200E-07	1.275E-07	1.2375E-07	1.91691E-06	0.0627	2.55587E+02	3.16289E-05
141	1.275E-07	1.350E-07	1.3125E-07	1.57030E-06	0.0677	2.09373E+02	2.74802E-05
142	1.350E-07	1.425E-07	1.3875E-07	1.47882E-06	0.0718	1.97176E+02	2.73582E-05
143	1.425E-07	1.500E-07	1.4625E-07	1.35548E-06	0.0778	1.80731E+02	2.64319E-05
144	1.500E-07	1.600E-07	1.5500E-07	1.41288E-06	0.0766	1.41288E+02	2.18996E-05
145	1.600E-07	1.700E-07	1.6500E-07	1.12486E-06	0.0854	1.12486E+02	1.85602E-05
146	1.700E-07	1.800E-07	1.7500E-07	1.21683E-06	0.0815	1.21683E+02	2.12945E-05
147	1.800E-07	1.900E-07	1.8500E-07	9.69667E-07	0.0901	9.69667E+01	1.79388E-05
148	1.900E-07	2.000E-07	1.9500E-07	9.94630E-07	0.0949	9.94630E+01	1.93953E-05
149	2.000E-07	2.100E-07	2.0500E-07	7.59133E-07	0.1060	7.59133E+01	1.55622E-05
150	2.100E-07	2.200E-07	2.1500E-07	6.33143E-07	0.1183	6.33143E+01	1.36126E-05
151	2.200E-07	2.300E-07	2.2500E-07	5.99230E-07	0.1256	5.99230E+01	1.34827E-05

152	2.300E-07	2.400E-07	2.3500E-07	5.65477E-07	0.1305	5.65477E+01	1.32887E-05
153	2.400E-07	2.550E-07	2.4750E-07	8.04343E-07	0.1073	5.36229E+01	1.32717E-05
154	2.550E-07	2.700E-07	2.6250E-07	1.00235E-06	0.0972	6.68235E+01	1.75412E-05
155	2.700E-07	2.800E-07	2.7500E-07	5.24309E-07	0.1347	5.24309E+01	1.44185E-05
156	2.800E-07	3.000E-07	2.9000E-07	8.52042E-07	0.1031	4.26021E+01	1.23546E-05
157	3.000E-07	3.200E-07	3.1000E-07	8.67701E-07	0.1028	4.33851E+01	1.34494E-05
158	3.200E-07	3.400E-07	3.3000E-07	7.32576E-07	0.1198	3.66288E+01	1.20875E-05
159	3.400E-07	3.600E-07	3.5000E-07	6.90126E-07	0.1201	3.45063E+01	1.20772E-05
160	3.600E-07	3.800E-07	3.7000E-07	7.29641E-07	0.1218	3.64821E+01	1.34984E-05
161	3.800E-07	4.000E-07	3.9000E-07	6.46629E-07	0.1222	3.23314E+01	1.26093E-05
162	4.000E-07	4.250E-07	4.1250E-07	7.03024E-07	0.1187	2.81210E+01	1.15999E-05
163	4.250E-07	4.500E-07	4.3750E-07	6.14401E-07	0.1222	2.45760E+01	1.07520E-05
164	4.500E-07	4.750E-07	4.6250E-07	7.36157E-07	0.1167	2.94463E+01	1.36189E-05
165	4.750E-07	5.000E-07	4.8750E-07	7.43413E-07	0.1166	2.97365E+01	1.44966E-05
166	5.000E-07	5.250E-07	5.1250E-07	6.74040E-07	0.1253	2.69616E+01	1.38178E-05
167	5.250E-07	5.500E-07	5.3750E-07	7.16756E-07	0.1211	2.86703E+01	1.54103E-05
168	5.500E-07	5.750E-07	5.6250E-07	6.25841E-07	0.1213	2.50337E+01	1.40814E-05
169	5.750E-07	6.000E-07	5.8750E-07	5.84032E-07	0.1325	2.33613E+01	1.37247E-05
170	6.000E-07	6.300E-07	6.1500E-07	7.12935E-07	0.1200	2.37645E+01	1.46152E-05
171	6.300E-07	6.600E-07	6.4500E-07	6.50404E-07	0.1282	2.16801E+01	1.39837E-05
172	6.600E-07	6.900E-07	6.7500E-07	6.66444E-07	0.1257	2.22148E+01	1.49950E-05
173	6.900E-07	7.200E-07	7.0500E-07	7.34450E-07	0.1180	2.44817E+01	1.72596E-05
174	7.200E-07	7.600E-07	7.4000E-07	9.10251E-07	0.1108	2.27563E+01	1.68396E-05
175	7.600E-07	8.000E-07	7.8000E-07	7.97534E-07	0.1205	1.99384E+01	1.55519E-05
176	8.000E-07	8.400E-07	8.2000E-07	8.55090E-07	0.1145	2.13772E+01	1.75293E-05
177	8.400E-07	8.800E-07	8.6000E-07	8.64740E-07	0.1144	2.16185E+01	1.85919E-05
178	8.800E-07	9.200E-07	9.0000E-07	8.01122E-07	0.1175	2.00281E+01	1.80252E-05
179	9.200E-07	9.600E-07	9.4000E-07	9.15266E-07	0.1096	2.28817E+01	2.15088E-05
180	9.600E-07	1.000E-06	9.8000E-07	7.12982E-07	0.1214	1.78245E+01	1.74680E-05
181	1.000E-06	1.050E-06	1.0250E-06	7.34150E-07	0.1213	1.46830E+01	1.50501E-05
182	1.050E-06	1.100E-06	1.0750E-06	9.88301E-07	0.1070	1.97660E+01	2.12485E-05
183	1.100E-06	1.150E-06	1.1250E-06	8.83707E-07	0.1105	1.76741E+01	1.98834E-05

184	1.150E-06	1.200E-06	1.1750E-06	1.05128E-06	0.1027	2.10256E+01	2.47050E-05
185	1.200E-06	1.275E-06	1.2375E-06	1.56088E-06	0.0853	2.08117E+01	2.57544E-05
186	1.275E-06	1.350E-06	1.3125E-06	1.53415E-06	0.0873	2.04554E+01	2.68476E-05
187	1.350E-06	1.425E-06	1.3875E-06	1.56046E-06	0.0868	2.08062E+01	2.88685E-05
188	1.425E-06	1.500E-06	1.4625E-06	1.46116E-06	0.0872	1.94822E+01	2.84927E-05
189	1.500E-06	1.600E-06	1.5500E-06	2.56488E-06	0.0699	2.56488E+01	3.97556E-05
190	1.600E-06	1.700E-06	1.6500E-06	2.79844E-06	0.0663	2.79844E+01	4.61742E-05
191	1.700E-06	1.800E-06	1.7500E-06	3.02154E-06	0.0617	3.02154E+01	5.28769E-05
192	1.800E-06	1.900E-06	1.8500E-06	3.22993E-06	0.0598	3.22993E+01	5.97537E-05
193	1.900E-06	2.000E-06	1.9500E-06	3.58606E-06	0.0567	3.58606E+01	6.99281E-05
194	2.000E-06	2.100E-06	2.0500E-06	3.58029E-06	0.0577	3.58029E+01	7.33960E-05
195	2.100E-06	2.200E-06	2.1500E-06	3.27856E-06	0.0609	3.27856E+01	7.04891E-05
196	2.200E-06	2.300E-06	2.2500E-06	3.83008E-06	0.0545	3.83008E+01	8.61769E-05
197	2.300E-06	2.400E-06	2.3500E-06	4.53939E-06	0.0508	4.53939E+01	1.06676E-04
198	2.400E-06	2.550E-06	2.4750E-06	6.45088E-06	0.0421	4.30059E+01	1.06440E-04
199	2.550E-06	2.700E-06	2.6250E-06	7.34110E-06	0.0403	4.89406E+01	1.28469E-04
200	2.700E-06	2.800E-06	2.7500E-06	5.33540E-06	0.0468	5.33540E+01	1.46723E-04
201	2.800E-06	3.000E-06	2.9000E-06	1.07541E-05	0.0332	5.37704E+01	1.55934E-04
202	3.000E-06	3.200E-06	3.1000E-06	1.21279E-05	0.0316	6.06394E+01	1.87982E-04
203	3.200E-06	3.400E-06	3.3000E-06	1.24439E-05	0.0308	6.22197E+01	2.05325E-04
204	3.400E-06	3.600E-06	3.5000E-06	1.37428E-05	0.0290	6.87138E+01	2.40498E-04
205	3.600E-06	3.800E-06	3.7000E-06	1.36716E-05	0.0293	6.83580E+01	2.52925E-04
206	3.800E-06	4.000E-06	3.9000E-06	1.52674E-05	0.0282	7.63368E+01	2.97713E-04
207	4.000E-06	4.250E-06	4.1250E-06	1.97918E-05	0.0243	7.91671E+01	3.26564E-04
208	4.250E-06	4.500E-06	4.3750E-06	2.07997E-05	0.0241	8.31987E+01	3.63994E-04
209	4.500E-06	4.750E-06	4.6250E-06	2.03277E-05	0.0242	8.13108E+01	3.76063E-04
210	4.750E-06	5.000E-06	4.8750E-06	2.24813E-05	0.0233	8.99253E+01	4.38386E-04
211	5.000E-06	5.250E-06	5.1250E-06	2.36741E-05	0.0226	9.46962E+01	4.85318E-04
212	5.250E-06	5.500E-06	5.3750E-06	2.40017E-05	0.0222	9.60069E+01	5.16037E-04
213	5.500E-06	5.750E-06	5.6250E-06	2.54621E-05	0.0217	1.01849E+02	5.72898E-04
214	5.750E-06	6.000E-06	5.8750E-06	2.59466E-05	0.0215	1.03786E+02	6.09745E-04
215	6.000E-06	6.300E-06	6.1500E-06	3.23285E-05	0.0194	1.07762E+02	6.62735E-04

216	6.300E-06	6.600E-06	6.4500E-06	3.26651E-05	0.0191	1.08884E+02	7.02299E-04
217	6.600E-06	6.900E-06	6.7500E-06	3.45268E-05	0.0186	1.15089E+02	7.76852E-04
218	6.900E-06	7.200E-06	7.0500E-06	3.72796E-05	0.0180	1.24265E+02	8.76070E-04
219	7.200E-06	7.600E-06	7.4000E-06	5.10351E-05	0.0154	1.27588E+02	9.44149E-04
220	7.600E-06	8.000E-06	7.8000E-06	5.22149E-05	0.0152	1.30537E+02	1.01819E-03
221	8.000E-06	8.400E-06	8.2000E-06	5.38101E-05	0.0150	1.34525E+02	1.10311E-03
222	8.400E-06	8.800E-06	8.6000E-06	5.43484E-05	0.0148	1.35871E+02	1.16849E-03
223	8.800E-06	9.200E-06	9.0000E-06	5.73162E-05	0.0144	1.43291E+02	1.28962E-03
224	9.200E-06	9.600E-06	9.4000E-06	5.83920E-05	0.0144	1.45980E+02	1.37221E-03
225	9.600E-06	1.000E-05	9.8000E-06	6.05351E-05	0.0141	1.51338E+02	1.48311E-03
226	1.000E-05	1.050E-05	1.0250E-05	8.02209E-05	0.0123	1.60442E+02	1.64453E-03
227	1.050E-05	1.100E-05	1.0750E-05	7.68036E-05	0.0125	1.53607E+02	1.65128E-03
228	1.100E-05	1.150E-05	1.1250E-05	7.75892E-05	0.0124	1.55178E+02	1.74576E-03
229	1.150E-05	1.200E-05	1.1750E-05	7.92626E-05	0.0123	1.58525E+02	1.86267E-03
230	1.200E-05	1.275E-05	1.2375E-05	1.21002E-04	0.0101	1.61336E+02	1.99653E-03
231	1.275E-05	1.350E-05	1.3125E-05	1.23559E-04	0.0099	1.64745E+02	2.16228E-03
232	1.350E-05	1.425E-05	1.3875E-05	1.26203E-04	0.0098	1.68271E+02	2.33476E-03
233	1.425E-05	1.500E-05	1.4625E-05	1.27770E-04	0.0097	1.70360E+02	2.49151E-03
234	1.500E-05	1.600E-05	1.5500E-05	1.69815E-04	0.0085	1.69815E+02	2.63214E-03
235	1.600E-05	1.700E-05	1.6500E-05	1.71607E-04	0.0084	1.71607E+02	2.83151E-03
236	1.700E-05	1.800E-05	1.7500E-05	1.73362E-04	0.0084	1.73362E+02	3.03384E-03
237	1.800E-05	1.900E-05	1.8500E-05	1.74431E-04	0.0083	1.74431E+02	3.22698E-03
238	1.900E-05	2.000E-05	1.9500E-05	1.74275E-04	0.0083	1.74275E+02	3.39837E-03
239	2.000E-05	2.100E-05	2.0500E-05	1.74391E-04	0.0083	1.74391E+02	3.57502E-03
240	2.100E-05	2.200E-05	2.1500E-05	1.80509E-04	0.0082	1.80509E+02	3.88094E-03
241	2.200E-05	2.300E-05	2.2500E-05	1.82119E-04	0.0082	1.82119E+02	4.09767E-03
242	2.300E-05	2.400E-05	2.3500E-05	1.80942E-04	0.0082	1.80942E+02	4.25215E-03
243	2.400E-05	2.550E-05	2.4750E-05	2.71207E-04	0.0067	1.80804E+02	4.47491E-03
244	2.550E-05	2.700E-05	2.6250E-05	2.70692E-04	0.0067	1.80461E+02	4.73710E-03
245	2.700E-05	2.800E-05	2.7500E-05	1.80682E-04	0.0082	1.80682E+02	4.96875E-03
246	2.800E-05	3.000E-05	2.9000E-05	3.60314E-04	0.0058	1.80157E+02	5.22455E-03
247	3.000E-05	3.200E-05	3.1000E-05	3.58774E-04	0.0058	1.79387E+02	5.56099E-03

248	3.200E-05	3.400E-05	3.3000E-05	3.52367E-04	0.0059	1.76184E+02	5.81406E-03
249	3.400E-05	3.600E-05	3.5000E-05	3.46352E-04	0.0059	1.73176E+02	6.06116E-03
250	3.600E-05	3.800E-05	3.7000E-05	3.50213E-04	0.0059	1.75107E+02	6.47894E-03
251	3.800E-05	4.000E-05	3.9000E-05	3.52555E-04	0.0059	1.76278E+02	6.87483E-03
252	4.000E-05	4.250E-05	4.1250E-05	4.39439E-04	0.0053	1.75776E+02	7.25075E-03
253	4.250E-05	4.500E-05	4.3750E-05	4.35008E-04	0.0053	1.74003E+02	7.61265E-03
254	4.500E-05	4.750E-05	4.6250E-05	4.23211E-04	0.0054	1.69284E+02	7.82941E-03
255	4.750E-05	5.000E-05	4.8750E-05	4.23478E-04	0.0054	1.69391E+02	8.25782E-03
256	5.000E-05	5.250E-05	5.1250E-05	4.17595E-04	0.0054	1.67038E+02	8.56070E-03
257	5.250E-05	5.500E-05	5.3750E-05	4.10865E-04	0.0054	1.64346E+02	8.83360E-03
258	5.500E-05	5.750E-05	5.6250E-05	4.08047E-04	0.0055	1.63219E+02	9.18106E-03
259	5.750E-05	6.000E-05	5.8750E-05	4.05065E-04	0.0055	1.62026E+02	9.51902E-03
260	6.000E-05	6.300E-05	6.1500E-05	4.83157E-04	0.0050	1.61052E+02	9.90472E-03
261	6.300E-05	6.600E-05	6.4500E-05	4.72050E-04	0.0051	1.57350E+02	1.01491E-02
262	6.600E-05	6.900E-05	6.7500E-05	4.61755E-04	0.0051	1.53918E+02	1.03895E-02
263	6.900E-05	7.200E-05	7.0500E-05	4.63072E-04	0.0051	1.54357E+02	1.08822E-02
264	7.200E-05	7.600E-05	7.4000E-05	6.00167E-04	0.0045	1.50042E+02	1.11031E-02
265	7.600E-05	8.000E-05	7.8000E-05	5.91030E-04	0.0045	1.47757E+02	1.15251E-02
266	8.000E-05	8.400E-05	8.2000E-05	5.71808E-04	0.0046	1.42952E+02	1.17221E-02
267	8.400E-05	8.800E-05	8.6000E-05	5.67435E-04	0.0046	1.41859E+02	1.21999E-02
268	8.800E-05	9.200E-05	9.0000E-05	5.57791E-04	0.0047	1.39448E+02	1.25503E-02
269	9.200E-05	9.600E-05	9.4000E-05	5.51849E-04	0.0047	1.37962E+02	1.29684E-02
270	9.600E-05	1.000E-04	9.8000E-05	5.42287E-04	0.0047	1.35572E+02	1.32860E-02
271	1.000E-04	1.050E-04	1.0250E-04	6.60771E-04	0.0043	1.32154E+02	1.35458E-02
272	1.050E-04	1.100E-04	1.0750E-04	6.54083E-04	0.0043	1.30817E+02	1.40628E-02
273	1.100E-04	1.150E-04	1.1250E-04	6.45133E-04	0.0044	1.29027E+02	1.45155E-02
274	1.150E-04	1.200E-04	1.1750E-04	6.24887E-04	0.0044	1.24977E+02	1.46848E-02
275	1.200E-04	1.275E-04	1.2375E-04	9.28124E-04	0.0036	1.23750E+02	1.53141E-02
276	1.275E-04	1.350E-04	1.3125E-04	8.99680E-04	0.0037	1.19957E+02	1.57444E-02
277	1.350E-04	1.425E-04	1.3875E-04	8.75664E-04	0.0037	1.16755E+02	1.61998E-02
278	1.425E-04	1.500E-04	1.4625E-04	8.54429E-04	0.0038	1.13924E+02	1.66614E-02
279	1.500E-04	1.600E-04	1.5500E-04	1.11014E-03	0.0033	1.11014E+02	1.72072E-02

280	1.600E-04	1.700E-04	1.6500E-04	1.07193E-03	0.0034	1.07193E+02	1.76869E-02
281	1.700E-04	1.800E-04	1.7500E-04	1.04383E-03	0.0034	1.04383E+02	1.82670E-02
282	1.800E-04	1.900E-04	1.8500E-04	1.01413E-03	0.0035	1.01413E+02	1.87614E-02
283	1.900E-04	2.000E-04	1.9500E-04	9.78257E-04	0.0035	9.78257E+01	1.90760E-02
284	2.000E-04	2.100E-04	2.0500E-04	9.57316E-04	0.0036	9.57316E+01	1.96250E-02
285	2.100E-04	2.200E-04	2.1500E-04	9.36248E-04	0.0036	9.36248E+01	2.01293E-02
286	2.200E-04	2.300E-04	2.2500E-04	9.10371E-04	0.0037	9.10371E+01	2.04833E-02
287	2.300E-04	2.400E-04	2.3500E-04	8.91097E-04	0.0037	8.91097E+01	2.09408E-02
288	2.400E-04	2.550E-04	2.4750E-04	1.31533E-03	0.0031	8.76889E+01	2.17030E-02
289	2.550E-04	2.700E-04	2.6250E-04	1.29451E-03	0.0031	8.63004E+01	2.26538E-02
290	2.700E-04	2.800E-04	2.7500E-04	8.46513E-04	0.0038	8.46513E+01	2.32791E-02
291	2.800E-04	3.000E-04	2.9000E-04	1.55922E-03	0.0028	7.79611E+01	2.26087E-02
292	3.000E-04	3.200E-04	3.1000E-04	1.17459E-03	0.0032	5.87296E+01	1.82062E-02
293	3.200E-04	3.400E-04	3.3000E-04	7.01864E-04	0.0042	3.50932E+01	1.15808E-02
294	3.400E-04	3.600E-04	3.5000E-04	9.11111E-04	0.0037	4.55556E+01	1.59444E-02
295	3.600E-04	3.800E-04	3.7000E-04	1.17531E-03	0.0032	5.87653E+01	2.17432E-02
296	3.800E-04	4.000E-04	3.9000E-04	1.25062E-03	0.0031	6.25311E+01	2.43871E-02
297	4.000E-04	4.250E-04	4.1250E-04	1.55767E-03	0.0028	6.23067E+01	2.57015E-02
298	4.250E-04	4.500E-04	4.3750E-04	1.51919E-03	0.0029	6.07674E+01	2.65857E-02
299	4.500E-04	4.750E-04	4.6250E-04	1.47470E-03	0.0029	5.89881E+01	2.72820E-02
300	4.750E-04	5.000E-04	4.8750E-04	1.43872E-03	0.0029	5.75489E+01	2.80551E-02
301	5.000E-04	5.250E-04	5.1250E-04	1.38968E-03	0.0030	5.55873E+01	2.84885E-02
302	5.250E-04	5.500E-04	5.3750E-04	1.34979E-03	0.0030	5.39915E+01	2.90204E-02
303	5.500E-04	5.750E-04	5.6250E-04	1.31321E-03	0.0031	5.25285E+01	2.95473E-02
304	5.750E-04	6.000E-04	5.8750E-04	1.27828E-03	0.0031	5.11312E+01	3.00396E-02
305	6.000E-04	6.300E-04	6.1500E-04	1.48808E-03	0.0029	4.96027E+01	3.05056E-02
306	6.300E-04	6.600E-04	6.4500E-04	1.44345E-03	0.0029	4.81150E+01	3.10342E-02
307	6.600E-04	6.900E-04	6.7500E-04	1.40145E-03	0.0030	4.67151E+01	3.15327E-02
308	6.900E-04	7.200E-04	7.0500E-04	1.35841E-03	0.0030	4.52803E+01	3.19226E-02
309	7.200E-04	7.600E-04	7.4000E-04	1.74737E-03	0.0027	4.36842E+01	3.23263E-02
310	7.600E-04	8.000E-04	7.8000E-04	1.69105E-03	0.0027	4.22763E+01	3.29755E-02
311	8.000E-04	8.400E-04	8.2000E-04	1.63318E-03	0.0027	4.08294E+01	3.34801E-02

312	8.400E-04	8.800E-04	8.6000E-04	1.58236E-03	0.0028	3.95589E+01	3.40207E-02
313	8.800E-04	9.200E-04	9.0000E-04	1.53112E-03	0.0028	3.82779E+01	3.44501E-02
314	9.200E-04	9.600E-04	9.4000E-04	1.48208E-03	0.0029	3.70521E+01	3.48290E-02
315	9.600E-04	1.000E-03	9.8000E-04	1.44260E-03	0.0029	3.60651E+01	3.53438E-02
316	1.000E-03	1.050E-03	1.0250E-03	1.68159E-03	0.0027	3.36319E+01	3.44727E-02
317	1.050E-03	1.100E-03	1.0750E-03	1.39829E-03	0.0029	2.79657E+01	3.00631E-02
318	1.100E-03	1.150E-03	1.1250E-03	1.50810E-03	0.0028	3.01620E+01	3.39323E-02
319	1.150E-03	1.200E-03	1.1750E-03	1.58788E-03	0.0028	3.17576E+01	3.73152E-02
320	1.200E-03	1.275E-03	1.2375E-03	2.31379E-03	0.0023	3.08505E+01	3.81775E-02
321	1.275E-03	1.350E-03	1.3125E-03	2.21257E-03	0.0024	2.95010E+01	3.87200E-02
322	1.350E-03	1.425E-03	1.3875E-03	2.12803E-03	0.0024	2.83737E+01	3.93685E-02
323	1.425E-03	1.500E-03	1.4625E-03	2.02885E-03	0.0025	2.70513E+01	3.95626E-02
324	1.500E-03	1.600E-03	1.5500E-03	2.59231E-03	0.0022	2.59231E+01	4.01807E-02
325	1.600E-03	1.700E-03	1.6500E-03	2.48700E-03	0.0022	2.48700E+01	4.10355E-02
326	1.700E-03	1.800E-03	1.7500E-03	2.41616E-03	0.0023	2.41616E+01	4.22829E-02
327	1.800E-03	1.900E-03	1.8500E-03	2.33896E-03	0.0023	2.33896E+01	4.32708E-02
328	1.900E-03	2.000E-03	1.9500E-03	2.21642E-03	0.0024	2.21642E+01	4.32202E-02
329	2.000E-03	2.100E-03	2.0500E-03	2.01741E-03	0.0025	2.01741E+01	4.13569E-02
330	2.100E-03	2.200E-03	2.1500E-03	1.79414E-03	0.0026	1.79414E+01	3.85740E-02
331	2.200E-03	2.300E-03	2.2500E-03	1.58467E-03	0.0028	1.58467E+01	3.56551E-02
332	2.300E-03	2.400E-03	2.3500E-03	1.52534E-03	0.0028	1.52534E+01	3.58455E-02
333	2.400E-03	2.550E-03	2.4750E-03	2.36283E-03	0.0023	1.57522E+01	3.89867E-02
334	2.550E-03	2.700E-03	2.6250E-03	2.40811E-03	0.0023	1.60541E+01	4.21420E-02
335	2.700E-03	2.800E-03	2.7500E-03	1.60962E-03	0.0028	1.60962E+01	4.42646E-02
336	2.800E-03	3.000E-03	2.9000E-03	3.11583E-03	0.0020	1.55792E+01	4.51796E-02
337	3.000E-03	3.200E-03	3.1000E-03	2.97810E-03	0.0020	1.48905E+01	4.61606E-02
338	3.200E-03	3.400E-03	3.3000E-03	2.82683E-03	0.0021	1.41341E+01	4.66427E-02
339	3.400E-03	3.600E-03	3.5000E-03	2.75299E-03	0.0021	1.37649E+01	4.81773E-02
340	3.600E-03	3.800E-03	3.7000E-03	2.58557E-03	0.0022	1.29279E+01	4.78330E-02
341	3.800E-03	4.000E-03	3.9000E-03	2.34051E-03	0.0023	1.17025E+01	4.56399E-02
342	4.000E-03	4.250E-03	4.1250E-03	2.82323E-03	0.0021	1.12929E+01	4.65833E-02
343	4.250E-03	4.500E-03	4.3750E-03	2.71962E-03	0.0021	1.08785E+01	4.75933E-02

344	4.500E-03	4.750E-03	4.6250E-03	2.6400E-03	0.0022	1.05600E+01	4.88401E-02
345	4.750E-03	5.000E-03	4.8750E-03	2.60127E-03	0.0022	1.04051E+01	5.07248E-02
346	5.000E-03	5.250E-03	5.1250E-03	2.55453E-03	0.0022	1.02181E+01	5.23679E-02
347	5.250E-03	5.500E-03	5.3750E-03	2.34002E-03	0.0023	9.36009E+00	5.03105E-02
348	5.500E-03	5.750E-03	5.6250E-03	2.05926E-03	0.0024	8.23704E+00	4.63334E-02
349	5.750E-03	6.000E-03	5.8750E-03	1.77921E-03	0.0026	7.11685E+00	4.18115E-02
350	6.000E-03	6.300E-03	6.1500E-03	2.51411E-03	0.0022	8.38036E+00	5.15392E-02
351	6.300E-03	6.600E-03	6.4500E-03	2.50740E-03	0.0022	8.35800E+00	5.39091E-02
352	6.600E-03	6.900E-03	6.7500E-03	2.40639E-03	0.0023	8.02129E+00	5.41437E-02
353	6.900E-03	7.200E-03	7.0500E-03	2.15918E-03	0.0024	7.19726E+00	5.07407E-02
354	7.200E-03	7.600E-03	7.4000E-03	2.53475E-03	0.0022	6.33688E+00	4.68929E-02
355	7.600E-03	8.000E-03	7.8000E-03	2.24615E-03	0.0023	5.61536E+00	4.37998E-02
356	8.000E-03	8.400E-03	8.2000E-03	2.25167E-03	0.0023	5.62917E+00	4.61592E-02
357	8.400E-03	8.800E-03	8.6000E-03	2.26749E-03	0.0023	5.66872E+00	4.87510E-02
358	8.800E-03	9.200E-03	9.0000E-03	2.32347E-03	0.0023	5.80867E+00	5.22781E-02
359	9.200E-03	9.600E-03	9.4000E-03	2.38965E-03	0.0023	5.97414E+00	5.61569E-02
360	9.600E-03	1.000E-02	9.8000E-03	2.37912E-03	0.0023	5.94779E+00	5.82884E-02
361	1.000E-02	1.050E-02	1.0250E-02	2.88100E-03	0.0021	5.76201E+00	5.90606E-02
362	1.050E-02	1.100E-02	1.0750E-02	2.82123E-03	0.0021	5.64247E+00	6.06565E-02
363	1.100E-02	1.150E-02	1.1250E-02	2.72981E-03	0.0021	5.45961E+00	6.14206E-02
364	1.150E-02	1.200E-02	1.1750E-02	2.59849E-03	0.0022	5.19698E+00	6.10645E-02
365	1.200E-02	1.275E-02	1.2375E-02	3.64121E-03	0.0018	4.85495E+00	6.00800E-02
366	1.275E-02	1.350E-02	1.3125E-02	3.59517E-03	0.0019	4.79355E+00	6.29154E-02
367	1.350E-02	1.425E-02	1.3875E-02	3.58531E-03	0.0019	4.78041E+00	6.63282E-02
368	1.425E-02	1.500E-02	1.4625E-02	3.21902E-03	0.0020	4.29203E+00	6.27709E-02
369	1.500E-02	1.600E-02	1.5500E-02	3.80453E-03	0.0018	3.80453E+00	5.89703E-02
370	1.600E-02	1.700E-02	1.6500E-02	3.73923E-03	0.0018	3.73923E+00	6.16974E-02
371	1.700E-02	1.800E-02	1.7500E-02	3.82215E-03	0.0018	3.82215E+00	6.68877E-02
372	1.800E-02	1.900E-02	1.8500E-02	3.66888E-03	0.0018	3.66888E+00	6.78743E-02
373	1.900E-02	2.000E-02	1.9500E-02	3.32260E-03	0.0019	3.32260E+00	6.47907E-02
374	2.000E-02	2.100E-02	2.0500E-02	3.34350E-03	0.0019	3.34350E+00	6.85418E-02
375	2.100E-02	2.200E-02	2.1500E-02	3.36604E-03	0.0019	3.36604E+00	7.23698E-02

376	2.200E-02	2.300E-02	2.2500E-02	3.38862E-03	0.0019	3.38862E+00	7.62439E-02
377	2.300E-02	2.400E-02	2.3500E-02	3.49723E-03	0.0019	3.49723E+00	8.21850E-02
378	2.400E-02	2.550E-02	2.4750E-02	5.69345E-03	0.0015	3.79563E+00	9.39419E-02
379	2.550E-02	2.700E-02	2.6250E-02	5.09333E-03	0.0016	3.39555E+00	8.91333E-02
380	2.700E-02	2.800E-02	2.7500E-02	2.04962E-03	0.0024	2.04962E+00	5.63645E-02
381	2.800E-02	3.000E-02	2.9000E-02	4.93545E-03	0.0016	2.46772E+00	7.15640E-02
382	3.000E-02	3.200E-02	3.1000E-02	5.29658E-03	0.0015	2.64829E+00	8.20970E-02
383	3.200E-02	3.400E-02	3.3000E-02	3.32762E-03	0.0019	1.66381E+00	5.49057E-02
384	3.400E-02	3.600E-02	3.5000E-02	1.99205E-03	0.0025	9.96027E-01	3.48610E-02
385	3.600E-02	3.800E-02	3.7000E-02	2.56822E-03	0.0022	1.28411E+00	4.75120E-02
386	3.800E-02	4.000E-02	3.9000E-02	3.70309E-03	0.0018	1.85154E+00	7.22102E-02
387	4.000E-02	4.250E-02	4.1250E-02	4.39950E-03	0.0017	1.75980E+00	7.25917E-02
388	4.250E-02	4.500E-02	4.3750E-02	4.34034E-03	0.0017	1.73614E+00	7.59559E-02
389	4.500E-02	4.750E-02	4.6250E-02	4.59853E-03	0.0016	1.83941E+00	8.50727E-02
390	4.750E-02	5.000E-02	4.8750E-02	4.30267E-03	0.0017	1.72107E+00	8.39021E-02
391	5.000E-02	5.250E-02	5.1250E-02	4.03379E-03	0.0018	1.61352E+00	8.26927E-02
392	5.250E-02	5.500E-02	5.3750E-02	4.14287E-03	0.0017	1.65715E+00	8.90717E-02
393	5.500E-02	5.750E-02	5.6250E-02	4.14505E-03	0.0017	1.65802E+00	9.32637E-02
394	5.750E-02	6.000E-02	5.8750E-02	4.14140E-03	0.0017	1.65656E+00	9.73228E-02
395	6.000E-02	6.300E-02	6.1500E-02	4.88852E-03	0.0016	1.62951E+00	1.00215E-01
396	6.300E-02	6.600E-02	6.4500E-02	5.01307E-03	0.0016	1.67102E+00	1.07781E-01
397	6.600E-02	6.900E-02	6.7500E-02	5.12970E-03	0.0016	1.70990E+00	1.15418E-01
398	6.900E-02	7.200E-02	7.0500E-02	5.26758E-03	0.0015	1.75586E+00	1.23788E-01
399	7.200E-02	7.600E-02	7.4000E-02	7.24639E-03	0.0013	1.81160E+00	1.34058E-01
400	7.600E-02	8.000E-02	7.8000E-02	4.49416E-03	0.0017	1.12354E+00	8.76361E-02
401	8.000E-02	8.400E-02	8.2000E-02	4.04850E-03	0.0017	1.01213E+00	8.29943E-02
402	8.400E-02	8.800E-02	8.6000E-02	2.88436E-03	0.0021	7.21090E-01	6.20137E-02
403	8.800E-02	9.200E-02	9.0000E-02	2.97875E-03	0.0020	7.44687E-01	6.70218E-02
404	9.200E-02	9.600E-02	9.4000E-02	3.62636E-03	0.0018	9.06589E-01	8.52194E-02
405	9.600E-02	1.000E-01	9.8000E-02	3.86399E-03	0.0018	9.65997E-01	9.46677E-02
406	1.000E-01	1.050E-01	1.0250E-01	5.45680E-03	0.0015	1.09136E+00	1.11864E-01
407	1.050E-01	1.100E-01	1.0750E-01	5.78158E-03	0.0015	1.15632E+00	1.24304E-01

408	1.100E-01	1.150E-01	1.1250E-01	5.58796E-03	0.0015	1.11759E+00	1.25729E-01
409	1.150E-01	1.200E-01	1.1750E-01	4.19684E-03	0.0017	8.39368E-01	9.86257E-02
410	1.200E-01	1.275E-01	1.2375E-01	8.87395E-03	0.0012	1.18319E+00	1.46420E-01
411	1.275E-01	1.350E-01	1.3125E-01	9.16173E-03	0.0012	1.22156E+00	1.60330E-01
412	1.350E-01	1.425E-01	1.3875E-01	6.59901E-03	0.0014	8.79868E-01	1.22082E-01
413	1.425E-01	1.500E-01	1.4625E-01	5.19924E-03	0.0016	6.93233E-01	1.01385E-01
414	1.500E-01	1.600E-01	1.5500E-01	6.32704E-03	0.0014	6.32704E-01	9.80691E-02
415	1.600E-01	1.700E-01	1.6500E-01	7.41999E-03	0.0013	7.41999E-01	1.22430E-01
416	1.700E-01	1.800E-01	1.7500E-01	8.34482E-03	0.0012	8.34482E-01	1.46034E-01
417	1.800E-01	1.900E-01	1.8500E-01	8.24431E-03	0.0012	8.24431E-01	1.52520E-01
418	1.900E-01	2.000E-01	1.9500E-01	7.29188E-03	0.0013	7.29188E-01	1.42192E-01
419	2.000E-01	2.100E-01	2.0500E-01	6.43077E-03	0.0014	6.43077E-01	1.31831E-01
420	2.100E-01	2.200E-01	2.1500E-01	6.54036E-03	0.0014	6.54036E-01	1.40618E-01
421	2.200E-01	2.300E-01	2.2500E-01	6.49138E-03	0.0014	6.49138E-01	1.46056E-01
422	2.300E-01	2.400E-01	2.3500E-01	6.67897E-03	0.0014	6.67897E-01	1.56956E-01
423	2.400E-01	2.550E-01	2.4750E-01	1.05265E-02	0.0011	7.01764E-01	1.73687E-01
424	2.550E-01	2.700E-01	2.6250E-01	1.11742E-02	0.0011	7.44949E-01	1.95549E-01
425	2.700E-01	2.800E-01	2.7500E-01	6.35310E-03	0.0014	6.35310E-01	1.74710E-01
426	2.800E-01	3.000E-01	2.9000E-01	1.10623E-02	0.0011	5.53117E-01	1.60404E-01
427	3.000E-01	3.200E-01	3.1000E-01	1.12923E-02	0.0011	5.64614E-01	1.75030E-01
428	3.200E-01	3.400E-01	3.3000E-01	1.11796E-02	0.0011	5.58979E-01	1.84463E-01
429	3.400E-01	3.600E-01	3.5000E-01	1.09179E-02	0.0011	5.45897E-01	1.91064E-01
430	3.600E-01	3.800E-01	3.7000E-01	8.70682E-03	0.0012	4.35341E-01	1.61076E-01
431	3.800E-01	4.000E-01	3.9000E-01	9.30872E-03	0.0012	4.65436E-01	1.81520E-01
432	4.000E-01	4.250E-01	4.1250E-01	8.95285E-03	0.0012	3.58114E-01	1.47722E-01
433	4.250E-01	4.500E-01	4.3750E-01	8.40924E-03	0.0012	3.36370E-01	1.47162E-01
434	4.500E-01	4.750E-01	4.6250E-01	1.00225E-02	0.0011	4.00901E-01	1.85417E-01
435	4.750E-01	5.000E-01	4.8750E-01	1.08534E-02	0.0011	4.34135E-01	2.11641E-01
436	5.000E-01	5.250E-01	5.1250E-01	1.20179E-02	0.0010	4.80716E-01	2.46367E-01
437	5.250E-01	5.500E-01	5.3750E-01	9.43957E-03	0.0012	3.77583E-01	2.02951E-01
438	5.500E-01	5.750E-01	5.6250E-01	9.97638E-03	0.0011	3.99055E-01	2.24469E-01
439	5.750E-01	6.000E-01	5.8750E-01	9.83766E-03	0.0011	3.93506E-01	2.31185E-01

440	6.000E-01	6.300E-01	6.1500E-01	1.11375E-02	0.0011	3.71250E-01	2.28319E-01
441	6.300E-01	6.600E-01	6.4500E-01	1.04280E-02	0.0011	3.47601E-01	2.24202E-01
442	6.600E-01	6.900E-01	6.7500E-01	1.15202E-02	0.0011	3.84008E-01	2.59205E-01
443	6.900E-01	7.200E-01	7.0500E-01	1.18871E-02	0.0010	3.96237E-01	2.79347E-01
444	7.200E-01	7.600E-01	7.4000E-01	1.39278E-02	0.0010	3.48196E-01	2.57665E-01
445	7.600E-01	8.000E-01	7.8000E-01	1.28130E-02	0.0010	3.20325E-01	2.49854E-01
446	8.000E-01	8.400E-01	8.2000E-01	1.17024E-02	0.0011	2.92561E-01	2.39900E-01
447	8.400E-01	8.800E-01	8.6000E-01	1.00914E-02	0.0011	2.52286E-01	2.16966E-01
448	8.800E-01	9.200E-01	9.0000E-01	9.87114E-03	0.0011	2.46778E-01	2.22101E-01
449	9.200E-01	9.600E-01	9.4000E-01	8.93631E-03	0.0012	2.23408E-01	2.10003E-01
450	9.600E-01	1.000E+00	9.8000E-01	7.83795E-03	0.0013	1.95949E-01	1.92030E-01
451	1.000E+00	1.100E+00	1.0500E+00	1.98422E-02	0.0008	1.98422E-01	2.08344E-01
452	1.100E+00	1.200E+00	1.1500E+00	1.91189E-02	0.0008	1.91189E-01	2.19867E-01
453	1.200E+00	1.300E+00	1.2500E+00	1.65320E-02	0.0009	1.65320E-01	2.06650E-01
454	1.300E+00	1.400E+00	1.3500E+00	1.56184E-02	0.0009	1.56184E-01	2.10848E-01
455	1.400E+00	1.500E+00	1.4500E+00	1.54757E-02	0.0009	1.54757E-01	2.24398E-01
456	1.500E+00	1.600E+00	1.5500E+00	1.41223E-02	0.0010	1.41223E-01	2.18896E-01
457	1.600E+00	1.700E+00	1.6500E+00	1.31907E-02	0.0010	1.31907E-01	2.17646E-01
458	1.700E+00	1.800E+00	1.7500E+00	1.17657E-02	0.0010	1.17657E-01	2.05900E-01
459	1.800E+00	1.900E+00	1.8500E+00	1.03428E-02	0.0011	1.03428E-01	1.91342E-01
460	1.900E+00	2.000E+00	1.9500E+00	9.09811E-03	0.0012	9.09811E-02	1.77413E-01
461	2.000E+00	2.100E+00	2.0500E+00	8.56930E-03	0.0012	8.56930E-02	1.75671E-01
462	2.100E+00	2.200E+00	2.1500E+00	8.20256E-03	0.0013	8.20256E-02	1.76355E-01
463	2.200E+00	2.300E+00	2.2500E+00	8.22917E-03	0.0013	8.22917E-02	1.85156E-01
464	2.300E+00	2.400E+00	2.3500E+00	8.00088E-03	0.0013	8.00088E-02	1.88021E-01
465	2.400E+00	2.500E+00	2.4500E+00	6.65084E-03	0.0014	6.65084E-02	1.62946E-01
466	2.500E+00	2.600E+00	2.5500E+00	5.63061E-03	0.0015	5.63061E-02	1.43581E-01
467	2.600E+00	2.700E+00	2.6500E+00	4.96866E-03	0.0016	4.96866E-02	1.31670E-01
468	2.700E+00	2.800E+00	2.7500E+00	4.08421E-03	0.0018	4.08421E-02	1.12316E-01
469	2.800E+00	2.900E+00	2.8500E+00	3.76827E-03	0.0019	3.76827E-02	1.07396E-01
470	2.900E+00	3.000E+00	2.9500E+00	3.46734E-03	0.0019	3.46734E-02	1.02287E-01
471	3.000E+00	3.100E+00	3.0500E+00	3.32964E-03	0.0020	3.32964E-02	1.01554E-01

472	3.100E+00	3.200E+00	3.1500E+00	3.00003E-03	0.0021	3.00003E-02	9.45009E-02
473	3.200E+00	3.300E+00	3.2500E+00	2.44495E-03	0.0023	2.44495E-02	7.94608E-02
474	3.300E+00	3.400E+00	3.3500E+00	2.15230E-03	0.0024	2.15230E-02	7.21019E-02
475	3.400E+00	3.500E+00	3.4500E+00	1.99571E-03	0.0025	1.99571E-02	6.88520E-02
476	3.500E+00	3.600E+00	3.5500E+00	1.82258E-03	0.0027	1.82258E-02	6.47014E-02
477	3.600E+00	3.700E+00	3.6500E+00	1.68648E-03	0.0028	1.68648E-02	6.15564E-02
478	3.700E+00	3.800E+00	3.7500E+00	1.54850E-03	0.0029	1.54850E-02	5.80686E-02
479	3.800E+00	3.900E+00	3.8500E+00	1.61404E-03	0.0028	1.61404E-02	6.21406E-02
480	3.900E+00	4.000E+00	3.9500E+00	1.56581E-03	0.0028	1.56581E-02	6.18495E-02
481	4.000E+00	4.100E+00	4.0500E+00	1.59674E-03	0.0028	1.59674E-02	6.46678E-02
482	4.100E+00	4.200E+00	4.1500E+00	1.43705E-03	0.0030	1.43705E-02	5.96377E-02
483	4.200E+00	4.300E+00	4.2500E+00	1.31066E-03	0.0031	1.31066E-02	5.57030E-02
484	4.300E+00	4.400E+00	4.3500E+00	1.02979E-03	0.0035	1.02979E-02	4.47959E-02
485	4.400E+00	4.500E+00	4.4500E+00	1.06466E-03	0.0035	1.06466E-02	4.73772E-02
486	4.500E+00	4.600E+00	4.5500E+00	1.00491E-03	0.0036	1.00491E-02	4.57236E-02
487	4.600E+00	4.700E+00	4.6500E+00	9.78604E-04	0.0036	9.78604E-03	4.55051E-02
488	4.700E+00	4.800E+00	4.7500E+00	9.65012E-04	0.0036	9.65012E-03	4.58381E-02
489	4.800E+00	4.900E+00	4.8500E+00	8.11139E-04	0.0040	8.11139E-03	3.93403E-02
490	4.900E+00	5.000E+00	4.9500E+00	8.08852E-04	0.0040	8.08852E-03	4.00382E-02
491	5.000E+00	5.100E+00	5.0500E+00	7.09033E-04	0.0042	7.09033E-03	3.58062E-02
492	5.100E+00	5.200E+00	5.1500E+00	6.12385E-04	0.0046	6.12385E-03	3.15378E-02
493	5.200E+00	5.300E+00	5.2500E+00	6.40231E-04	0.0045	6.40231E-03	3.36121E-02
494	5.300E+00	5.400E+00	5.3500E+00	5.63645E-04	0.0048	5.63645E-03	3.01550E-02
495	5.400E+00	5.500E+00	5.4500E+00	5.57992E-04	0.0048	5.57992E-03	3.04106E-02
496	5.500E+00	5.600E+00	5.5500E+00	4.91476E-04	0.0051	4.91476E-03	2.72769E-02
497	5.600E+00	5.700E+00	5.6500E+00	4.16364E-04	0.0055	4.16364E-03	2.35246E-02
498	5.700E+00	5.800E+00	5.7500E+00	4.14458E-04	0.0055	4.14458E-03	2.38313E-02
499	5.800E+00	5.900E+00	5.8500E+00	3.93740E-04	0.0057	3.93740E-03	2.30338E-02
500	5.900E+00	6.000E+00	5.9500E+00	3.56039E-04	0.0060	3.56039E-03	2.11843E-02
501	6.000E+00	6.100E+00	6.0500E+00	3.46543E-04	0.0061	3.46543E-03	2.09658E-02
502	6.100E+00	6.200E+00	6.1500E+00	3.38417E-04	0.0061	3.38417E-03	2.08127E-02
503	6.200E+00	6.300E+00	6.2500E+00	3.08221E-04	0.0064	3.08221E-03	1.92638E-02

504	6.300E+00	6.400E+00	6.3500E+00	2.79907E-04	0.0067	2.79907E-03	1.77741E-02
505	6.400E+00	6.500E+00	6.4500E+00	2.72690E-04	0.0068	2.72690E-03	1.75885E-02
506	6.500E+00	6.600E+00	6.5500E+00	2.58464E-04	0.0070	2.58464E-03	1.69294E-02
507	6.600E+00	6.700E+00	6.6500E+00	2.29512E-04	0.0075	2.29512E-03	1.52625E-02
508	6.700E+00	6.800E+00	6.7500E+00	2.05626E-04	0.0079	2.05626E-03	1.38798E-02
509	6.800E+00	6.900E+00	6.8500E+00	1.89656E-04	0.0082	1.89656E-03	1.29914E-02
510	6.900E+00	7.000E+00	6.9500E+00	1.89007E-04	0.0082	1.89007E-03	1.31360E-02
511	7.000E+00	7.100E+00	7.0500E+00	1.70144E-04	0.0087	1.70144E-03	1.19951E-02
512	7.100E+00	7.200E+00	7.1500E+00	1.50991E-04	0.0092	1.50991E-03	1.07958E-02
513	7.200E+00	7.300E+00	7.2500E+00	1.31882E-04	0.0098	1.31882E-03	9.56141E-03
514	7.300E+00	7.400E+00	7.3500E+00	1.24178E-04	0.0101	1.24178E-03	9.12707E-03
515	7.400E+00	7.500E+00	7.4500E+00	1.20364E-04	0.0103	1.20364E-03	8.96710E-03
516	7.500E+00	7.600E+00	7.5500E+00	1.13087E-04	0.0106	1.13087E-03	8.53806E-03
517	7.600E+00	7.700E+00	7.6500E+00	1.03463E-04	0.0111	1.03463E-03	7.91489E-03
518	7.700E+00	7.800E+00	7.7500E+00	8.98853E-05	0.0119	8.98853E-04	6.96611E-03
519	7.800E+00	7.900E+00	7.8500E+00	8.24511E-05	0.0124	8.24511E-04	6.47241E-03
520	7.900E+00	8.000E+00	7.9500E+00	8.56757E-05	0.0122	8.56757E-04	6.81122E-03
521	8.000E+00	8.100E+00	8.0500E+00	8.02416E-05	0.0126	8.02416E-04	6.45945E-03
522	8.100E+00	8.200E+00	8.1500E+00	6.98323E-05	0.0135	6.98323E-04	5.69133E-03
523	8.200E+00	8.300E+00	8.2500E+00	6.10517E-05	0.0145	6.10517E-04	5.03677E-03
524	8.300E+00	8.400E+00	8.3500E+00	5.80447E-05	0.0148	5.80447E-04	4.84673E-03
525	8.400E+00	8.500E+00	8.4500E+00	5.45185E-05	0.0153	5.45185E-04	4.60681E-03
526	8.500E+00	8.600E+00	8.5500E+00	5.15301E-05	0.0157	5.15301E-04	4.40583E-03
527	8.600E+00	8.700E+00	8.6500E+00	4.83260E-05	0.0162	4.83260E-04	4.18020E-03
528	8.700E+00	8.800E+00	8.7500E+00	4.37427E-05	0.0170	4.37427E-04	3.82749E-03
529	8.800E+00	8.900E+00	8.8500E+00	4.02798E-05	0.0176	4.02798E-04	3.56476E-03
530	8.900E+00	9.000E+00	8.9500E+00	3.88426E-05	0.0180	3.88426E-04	3.47642E-03
531	9.000E+00	9.100E+00	9.0500E+00	3.61023E-05	0.0187	3.61023E-04	3.26725E-03
532	9.100E+00	9.200E+00	9.1500E+00	3.38881E-05	0.0193	3.38881E-04	3.10076E-03
533	9.200E+00	9.300E+00	9.2500E+00	3.38210E-05	0.0194	3.38210E-04	3.12844E-03
534	9.300E+00	9.400E+00	9.3500E+00	2.94229E-05	0.0207	2.94229E-04	2.75104E-03
535	9.400E+00	9.500E+00	9.4500E+00	2.61259E-05	0.0219	2.61259E-04	2.46889E-03

536	9.500E+00	9.600E+00	9.5500E+00	2.43293E-05	0.0228	2.43293E-04	2.32345E-03
537	9.600E+00	9.700E+00	9.6500E+00	2.23775E-05	0.0238	2.23775E-04	2.15943E-03
538	9.700E+00	9.800E+00	9.7500E+00	1.93705E-05	0.0254	1.93705E-04	1.88862E-03
539	9.800E+00	9.900E+00	9.8500E+00	1.92270E-05	0.0255	1.92270E-04	1.89386E-03
540	9.900E+00	1.000E+01	9.9500E+00	1.80604E-05	0.0263	1.80604E-04	1.79701E-03
541	1.000E+01	1.010E+01	1.0050E+01	1.61403E-05	0.0279	1.61403E-04	1.62210E-03
542	1.010E+01	1.020E+01	1.0150E+01	1.59872E-05	0.0280	1.59872E-04	1.62270E-03
543	1.020E+01	1.030E+01	1.0250E+01	1.37277E-05	0.0302	1.37277E-04	1.40709E-03
544	1.030E+01	1.040E+01	1.0350E+01	1.29790E-05	0.0312	1.29790E-04	1.34333E-03
545	1.040E+01	1.050E+01	1.0450E+01	1.29133E-05	0.0311	1.29133E-04	1.34944E-03
546	1.050E+01	1.060E+01	1.0550E+01	1.21594E-05	0.0322	1.21594E-04	1.28282E-03
547	1.060E+01	1.070E+01	1.0650E+01	1.18515E-05	0.0328	1.18515E-04	1.26218E-03
548	1.070E+01	1.080E+01	1.0750E+01	1.10016E-05	0.0338	1.10016E-04	1.18268E-03
549	1.080E+01	1.090E+01	1.0850E+01	9.24763E-06	0.0369	9.24763E-05	1.00337E-03
550	1.090E+01	1.100E+01	1.0950E+01	8.72116E-06	0.0381	8.72116E-05	9.54967E-04
551	1.100E+01	1.110E+01	1.1050E+01	8.69709E-06	0.0381	8.69709E-05	9.61028E-04
552	1.110E+01	1.120E+01	1.1150E+01	6.72686E-06	0.0428	6.72686E-05	7.50045E-04
553	1.120E+01	1.130E+01	1.1250E+01	6.66860E-06	0.0433	6.66860E-05	7.50217E-04
554	1.130E+01	1.140E+01	1.1350E+01	6.47177E-06	0.0441	6.47177E-05	7.34546E-04
555	1.140E+01	1.150E+01	1.1450E+01	5.24943E-06	0.0483	5.24943E-05	6.01060E-04
556	1.150E+01	1.160E+01	1.1550E+01	5.34205E-06	0.0484	5.34205E-05	6.17006E-04
557	1.160E+01	1.170E+01	1.1650E+01	4.67237E-06	0.0515	4.67237E-05	5.44331E-04
558	1.170E+01	1.180E+01	1.1750E+01	4.67997E-06	0.0513	4.67997E-05	5.49897E-04
559	1.180E+01	1.190E+01	1.1850E+01	4.20549E-06	0.0546	4.20549E-05	4.98351E-04
560	1.190E+01	1.200E+01	1.1950E+01	3.95086E-06	0.0555	3.95086E-05	4.72127E-04
561	1.200E+01	1.210E+01	1.2050E+01	3.69476E-06	0.0588	3.69476E-05	4.45219E-04
562	1.210E+01	1.220E+01	1.2150E+01	3.30408E-06	0.0616	3.30408E-05	4.01446E-04
563	1.220E+01	1.230E+01	1.2250E+01	3.24297E-06	0.0625	3.24297E-05	3.97264E-04
564	1.230E+01	1.240E+01	1.2350E+01	3.05498E-06	0.0640	3.05498E-05	3.77291E-04
565	1.240E+01	1.250E+01	1.2450E+01	3.01510E-06	0.0643	3.01510E-05	3.75379E-04
566	1.250E+01	1.260E+01	1.2550E+01	2.38556E-06	0.0730	2.38556E-05	2.99388E-04
567	1.260E+01	1.270E+01	1.2650E+01	2.25074E-06	0.0746	2.25074E-05	2.84719E-04

568	1.270E+01	1.280E+01	1.2750E+01	2.05057E-06	0.0761	2.05057E-05	2.61448E-04
569	1.280E+01	1.290E+01	1.2850E+01	2.15881E-06	0.0767	2.15881E-05	2.77407E-04
570	1.290E+01	1.300E+01	1.2950E+01	1.75065E-06	0.0827	1.75065E-05	2.26709E-04
571	1.300E+01	1.310E+01	1.3050E+01	1.57742E-06	0.0900	1.57742E-05	2.05853E-04
572	1.310E+01	1.320E+01	1.3150E+01	1.57219E-06	0.0886	1.57219E-05	2.06742E-04
573	1.320E+01	1.330E+01	1.3250E+01	1.44971E-06	0.0925	1.44971E-05	1.92087E-04
574	1.330E+01	1.340E+01	1.3350E+01	1.37025E-06	0.0946	1.37025E-05	1.82928E-04
575	1.340E+01	1.350E+01	1.3450E+01	1.38015E-06	0.0950	1.38015E-05	1.85630E-04
576	1.350E+01	1.360E+01	1.3550E+01	1.36484E-06	0.0964	1.36484E-05	1.84936E-04
577	1.360E+01	1.370E+01	1.3650E+01	1.08829E-06	0.1067	1.08829E-05	1.48551E-04
578	1.370E+01	1.380E+01	1.3750E+01	1.04198E-06	0.1094	1.04198E-05	1.43272E-04
579	1.380E+01	1.390E+01	1.3850E+01	8.93311E-07	0.1196	8.93311E-06	1.23724E-04
580	1.390E+01	1.400E+01	1.3950E+01	7.49276E-07	0.1289	7.49276E-06	1.04524E-04
581	1.400E+01	1.410E+01	1.4050E+01	8.18249E-07	0.1252	8.18249E-06	1.14964E-04
582	1.410E+01	1.420E+01	1.4150E+01	7.58206E-07	0.1273	7.58206E-06	1.07286E-04
583	1.420E+01	1.430E+01	1.4250E+01	8.88769E-07	0.1196	8.88769E-06	1.26650E-04
584	1.430E+01	1.440E+01	1.4350E+01	7.30322E-07	0.1326	7.30322E-06	1.04801E-04
585	1.440E+01	1.450E+01	1.4450E+01	4.51352E-07	0.1612	4.51352E-06	6.52204E-05
586	1.450E+01	1.460E+01	1.4550E+01	5.96960E-07	0.1449	5.96960E-06	8.68577E-05
587	1.460E+01	1.470E+01	1.4650E+01	4.88230E-07	0.1633	4.88230E-06	7.15256E-05
588	1.470E+01	1.480E+01	1.4750E+01	3.99903E-07	0.1739	3.99903E-06	5.89857E-05
589	1.480E+01	1.490E+01	1.4850E+01	5.28278E-07	0.1542	5.28278E-06	7.84493E-05
590	1.490E+01	1.500E+01	1.4950E+01	3.59741E-07	0.1805	3.59741E-06	5.37812E-05
591	1.500E+01	1.510E+01	1.5050E+01	2.52409E-07	0.2269	2.52409E-06	3.79876E-05
592	1.510E+01	1.520E+01	1.5150E+01	3.46051E-07	0.1878	3.46051E-06	5.24268E-05
593	1.520E+01	1.530E+01	1.5250E+01	3.78479E-07	0.1824	3.78479E-06	5.77181E-05
594	1.530E+01	1.540E+01	1.5350E+01	2.09976E-07	0.2470	2.09976E-06	3.22314E-05
595	1.540E+01	1.550E+01	1.5450E+01	2.14393E-07	0.2234	2.14393E-06	3.31237E-05
596	1.550E+01	1.560E+01	1.5550E+01	2.77338E-07	0.2160	2.77338E-06	4.31261E-05
597	1.560E+01	1.570E+01	1.5650E+01	3.35289E-07	0.1982	3.35289E-06	5.24728E-05
598	1.570E+01	1.580E+01	1.5750E+01	1.84024E-07	0.2670	1.84024E-06	2.89837E-05
599	1.580E+01	1.590E+01	1.5850E+01	2.07244E-07	0.2553	2.07244E-06	3.28482E-05

600	1.590E+01	1.600E+01	1.5950E+01	1.64942E-07	0.2791	1.64942E-06	2.63082E-05
601	1.600E+01	1.610E+01	1.6050E+01	2.64893E-07	0.2206	2.64893E-06	4.25154E-05
602	1.610E+01	1.620E+01	1.6150E+01	1.61172E-07	0.2758	1.61172E-06	2.60293E-05
603	1.620E+01	1.630E+01	1.6250E+01	1.98102E-07	0.2599	1.98102E-06	3.21915E-05
604	1.630E+01	1.640E+01	1.6350E+01	1.01157E-07	0.3631	1.01157E-06	1.65392E-05
605	1.640E+01	1.650E+01	1.6450E+01	6.81616E-08	0.3998	6.81616E-07	1.12126E-05
606	1.650E+01	1.660E+01	1.6550E+01	1.68652E-07	0.2733	1.68652E-06	2.79120E-05
607	1.660E+01	1.670E+01	1.6650E+01	1.71088E-07	0.2641	1.71088E-06	2.84861E-05
608	1.670E+01	1.680E+01	1.6750E+01	1.06845E-07	0.3631	1.06845E-06	1.78966E-05
609	1.680E+01	1.690E+01	1.6850E+01	2.86609E-08	0.5573	2.86609E-07	4.82936E-06
610	1.690E+01	1.700E+01	1.6950E+01	1.53793E-07	0.2705	1.53793E-06	2.60680E-05
611	1.700E+01	1.710E+01	1.7050E+01	3.68745E-08	0.5829	3.68745E-07	6.28711E-06
612	1.710E+01	1.720E+01	1.7150E+01	8.19509E-08	0.4108	8.19509E-07	1.40546E-05
613	1.720E+01	1.730E+01	1.7250E+01	3.97062E-08	0.5337	3.97062E-07	6.84931E-06
614	1.730E+01	1.740E+01	1.7350E+01	9.47525E-08	0.3857	9.47525E-07	1.64396E-05
615	1.740E+01	1.750E+01	1.7450E+01	4.95613E-08	0.4832	4.95613E-07	8.64845E-06
616	1.750E+01	1.760E+01	1.7550E+01	7.20971E-08	0.4078	7.20971E-07	1.26530E-05
617	1.760E+01	1.770E+01	1.7650E+01	1.15024E-07	0.3565	1.15024E-06	2.03017E-05
618	1.770E+01	1.780E+01	1.7750E+01	5.34789E-08	0.4667	5.34789E-07	9.49251E-06
619	1.780E+01	1.790E+01	1.7850E+01	2.38622E-08	0.7444	2.38622E-07	4.25940E-06
620	1.790E+01	1.800E+01	1.7950E+01	6.36145E-08	0.4354	6.36145E-07	1.14188E-05
621	1.800E+01	1.810E+01	1.8050E+01	5.91774E-08	0.4578	5.91774E-07	1.06815E-05
622	1.810E+01	1.820E+01	1.8150E+01	6.72573E-08	0.4196	6.72573E-07	1.22072E-05
623	1.820E+01	1.830E+01	1.8250E+01	8.32541E-08	0.4129	8.32541E-07	1.51939E-05
624	1.830E+01	1.840E+01	1.8350E+01	7.19111E-08	0.4636	7.19111E-07	1.31957E-05
625	1.840E+01	1.850E+01	1.8450E+01	6.13557E-08	0.4227	6.13557E-07	1.13201E-05
626	1.850E+01	1.860E+01	1.8550E+01	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
627	1.860E+01	1.870E+01	1.8650E+01	6.48617E-09	1.0000	6.48617E-08	1.20967E-06
628	1.870E+01	1.880E+01	1.8750E+01	8.98233E-09	0.7881	8.98233E-08	1.68419E-06
629	1.880E+01	1.890E+01	1.8850E+01	2.69762E-08	0.5997	2.69762E-07	5.08501E-06
630	1.890E+01	1.900E+01	1.8950E+01	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
631	1.900E+01	1.910E+01	1.9050E+01	1.22504E-08	1.0000	1.22504E-07	2.33370E-06

632	1.910E+01	1.920E+01	1.9150E+01	1.54666E-08	1.0000	1.54666E-07	2.96185E-06
633	1.920E+01	1.930E+01	1.9250E+01	1.72569E-08	0.8880	1.72569E-07	3.32196E-06
634	1.930E+01	1.940E+01	1.9350E+01	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
635	1.940E+01	1.950E+01	1.9450E+01	1.71762E-08	1.0000	1.71762E-07	3.34078E-06
636	1.950E+01	1.960E+01	1.9550E+01	0.00000E+00	0.0000	0.00000E+00	0.00000E+00
637	1.960E+01	1.970E+01	1.9650E+01	1.60753E-08	1.0000	1.60753E-07	3.15879E-06
638	1.970E+01	1.980E+01	1.9750E+01	1.70795E-08	1.0000	1.70795E-07	3.37319E-06
639	1.980E+01	1.990E+01	1.9850E+01	1.82962E-08	0.7367	1.82962E-07	3.63179E-06
640	1.990E+01	2.000E+01	1.9950E+01	1.44373E-08	1.0000	1.44373E-07	2.88024E-06

APPENDIX C SPECTRUM UNCERTAINTIES AND CORRELATIONS

Number of Energy Groups

89

Energy Grid (low to high in units of eV)

1.00000E-04	1.00000E-03	5.00000E-03	1.00000E-02	3.00000E-02	7.00000E-02	1.00000E-01	1.52300E-01
2.00000E-01	4.14000E-01	6.00000E-01	8.00000E-01	1.12500E+00	3.05900E+00	5.04300E+00	8.31500E+00
1.37100E+01	2.26000E+01	3.72700E+01	6.14400E+01	1.01300E+02	1.67000E+02	2.75400E+02	3.53600E+02
4.54000E+02	5.83000E+02	7.48500E+02	9.61100E+02	1.08900E+03	1.23400E+03	1.39800E+03	1.58500E+03
1.79600E+03	2.03500E+03	2.30600E+03	2.61300E+03	2.96000E+03	3.35500E+03	3.80100E+03	4.30700E+03
4.88100E+03	5.53100E+03	6.26700E+03	7.10200E+03	8.04700E+03	9.11900E+03	1.03300E+04	1.17100E+04
1.32700E+04	1.50300E+04	1.70400E+04	1.93000E+04	2.18800E+04	2.47900E+04	2.60600E+04	2.80900E+04
3.18300E+04	4.08700E+04	5.24800E+04	6.73800E+04	8.65200E+04	1.11100E+05	1.42600E+05	1.83200E+05
2.35200E+05	3.02000E+05	3.87700E+05	4.39400E+05	4.97900E+05	5.64200E+05	6.39300E+05	7.24400E+05
8.20800E+05	9.30100E+05	1.05400E+06	1.19400E+06	1.35300E+06	1.73800E+06	2.23100E+06	2.86500E+06
3.67900E+06	4.72400E+06	6.06500E+06	7.78800E+06	1.00000E+07	1.19100E+07	1.35000E+07	1.49200E+07
1.69000E+07	2.00000E+07						

Number Fraction Representation

9.82092E-08	4.72061E-07	1.56499E-06	1.48862E-05	3.70955E-05	1.60472E-05	1.27720E-05	5.18881E-06
1.00063E-05	5.23690E-06	4.32070E-06	6.13424E-06	7.26962E-05	2.52950E-04	4.80265E-04	8.22142E-04
1.57465E-03	2.66867E-03	4.14239E-03	5.86521E-03	5.54769E-03	6.44332E-03	3.14351E-03	4.69831E-03
6.35841E-03	9.21746E-03	8.46897E-03	5.78392E-03	6.12460E-03	5.78708E-03	5.34833E-03	5.78967E-03
5.61878E-03	4.56566E-03	4.12575E-03	4.14253E-03	5.17402E-03	5.48861E-03	4.97575E-03	5.24918E-03
5.40877E-03	5.13468E-03	6.17146E-03	5.41489E-03	5.63675E-03	5.92651E-03	6.33911E-03	7.01145E-03
7.54259E-03	7.48051E-03	7.99971E-03	8.53612E-03	1.02897E-02	4.14161E-03	5.04467E-03	8.48414E-03
1.32207E-02	1.95792E-02	2.45907E-02	2.38059E-02	2.49402E-02	3.18528E-02	3.09775E-02	3.57857E-02
4.22565E-02	4.58652E-02	1.85559E-02	2.56011E-02	2.73895E-02	2.81566E-02	3.32509E-02	3.12757E-02
2.80844E-02	2.67417E-02	3.01480E-02	2.95869E-02	6.10909E-02	4.88235E-02	3.60330E-02	1.98343E-02
1.43535E-02	8.77771E-03	3.57310E-03	9.87337E-04	1.95537E-04	4.05579E-05	1.17350E-05	4.78672E-06
1.56559E-06							

Standard deviation (%)

1.26890E+02	8.66160E+01	7.46200E+01	6.92284E+01	6.82591E+01	7.11047E+01	7.61774E+01	7.34224E+01
5.85030E+01	5.72649E+01	5.53492E+01	5.05319E+01	3.94359E+01	3.70610E+01	3.38539E+01	2.96237E+01
2.63054E+01	2.37904E+01	2.19240E+01	2.04267E+01	1.85799E+01	1.57487E+01	1.07799E+01	1.24463E+01
1.37113E+01	1.38471E+01	1.44641E+01	1.42807E+01	1.42350E+01	1.41969E+01	1.39565E+01	1.35245E+01
1.29687E+01	1.22221E+01	1.13254E+01	1.05724E+01	1.07318E+01	1.11420E+01	1.15611E+01	1.18703E+01
1.21836E+01	1.23120E+01	1.23054E+01	1.23036E+01	1.22583E+01	1.23642E+01	1.24232E+01	1.26025E+01
1.27497E+01	1.29198E+01	1.30928E+01	1.33236E+01	1.36093E+01	1.38300E+01	1.39947E+01	1.42425E+01
1.47127E+01	1.52331E+01	1.55322E+01	1.55590E+01	1.53453E+01	1.49184E+01	1.44785E+01	1.40699E+01
1.37054E+01	1.32665E+01	1.27579E+01	1.22529E+01	1.16007E+01	1.09078E+01	1.01666E+01	9.50377E+00
9.02061E+00	8.67301E+00	8.39116E+00	8.17781E+00	7.55289E+00	6.75618E+00	6.52862E+00	6.63356E+00
6.86553E+00	6.78687E+00	5.86931E+00	6.83243E+00	6.30578E+00	8.71462E+00	1.26289E+01	1.73785E+01
2.64556E+01							

Correlation matrix (upper triangular)

1.00000E+00	7.96230E-04	9.31477E-04	1.00469E-03	1.01858E-03	9.78335E-04	7.09340E-04	4.89397E-04
1.13936E-04	-4.84334E-06	-2.25794E-05	3.01630E-05	3.33780E-04	4.09859E-04	5.54092E-04	8.06168E-04
1.05815E-03	1.29635E-03	1.51745E-03	1.75179E-03	3.11580E-03	3.90220E-03	6.68180E-03	5.78882E-03
5.27697E-03	4.77291E-03	3.49248E-03	3.10729E-03	2.73222E-03	2.63643E-03	2.58109E-03	2.62817E-03
2.84900E-03	3.36392E-03	3.91810E-03	4.66611E-03	4.94589E-03	5.06327E-03	5.16813E-03	5.33263E-03
5.49317E-03	5.73406E-03	6.04552E-03	6.30616E-03	6.56640E-03	6.72975E-03	6.87413E-03	6.92086E-03
6.95090E-03	6.97233E-03	6.94349E-03	6.82935E-03	6.63580E-03	6.42160E-03	6.30447E-03	6.05780E-03
5.48927E-03	4.47209E-03	3.19394E-03	1.62808E-03	-2.37784E-04	-2.35336E-03	-4.60989E-03	-6.87642E-03
-8.78706E-03	-1.00117E-02	-1.03522E-02	-1.02382E-02	-9.80511E-03	-9.04900E-03	-7.93584E-03	-6.51181E-03
-5.08330E-03	-3.53911E-03	-2.11278E-03	-6.51377E-04	2.01053E-03	5.86277E-03	9.02889E-03	1.09846E-02
1.11021E-02	1.08434E-02	1.15876E-02	9.75714E-03	1.05108E-02	7.24790E-03	4.53705E-03	2.96404E-03
1.56599E-03							
1.00000E+00	6.14484E-01	4.58239E-01	3.55121E-01	3.36336E-01	3.21918E-01	2.91162E-01	4.46825E-02
-1.37291E-02	1.83644E-02	1.03563E-02	-3.37840E-04	-2.46500E-04	-5.03849E-05	3.03971E-04	6.58963E-04
9.98278E-04	1.32214E-03	1.68212E-03	2.95452E-03	4.79293E-03	1.03240E-02	9.47406E-03	8.57637E-03
8.36671E-03	5.72944E-03	4.77726E-03	4.15744E-03	3.88486E-03	3.71443E-03	3.64428E-03	3.76652E-03
4.19060E-03	4.39852E-03	4.78755E-03	4.56906E-03	4.37825E-03	4.30413E-03	4.36618E-03	4.45853E-03
4.65792E-03	4.96278E-03	5.22864E-03	5.52523E-03	5.76868E-03	6.03846E-03	6.24755E-03	6.46980E-03
6.72590E-03	6.93909E-03	7.06518E-03	7.09460E-03	6.99786E-03	6.98619E-03	6.87574E-03	6.50410E-03
5.59102E-03	4.26517E-03	2.49056E-03	2.55061E-04	-2.38146E-03	-5.28722E-03	-8.34132E-03	-1.09966E-02
-1.27412E-02	-1.32825E-02	-1.31683E-02	-1.26157E-02	-1.16191E-02	-1.01246E-02	-8.19739E-03	-6.28451E-03
-4.20622E-03	-2.29995E-03	-3.31781E-04	3.34814E-03	8.77632E-03	1.33000E-02	1.61880E-02	1.64522E-02
1.61611E-02	1.73205E-02	1.45710E-02	1.56504E-02	1.08215E-02	6.80186E-03	4.46712E-03	2.38517E-03
1.00000E+00	8.54402E-01	7.70505E-01	7.47679E-01	7.15208E-01	6.43050E-01	8.75056E-02	-2.02559E-02
3.42651E-02	1.83531E-02	-9.73825E-04	-8.84332E-04	-6.68665E-04	-2.67396E-04	1.35775E-04	5.23866E-04
9.01052E-04	1.33102E-03	2.29383E-03	4.91029E-03	1.23585E-02	1.16901E-02	1.05451E-02	1.06756E-02
7.08097E-03	5.69603E-03	4.88651E-03	4.52282E-03	4.25988E-03	4.07919E-03	4.07929E-03	4.34139E-03
4.16122E-03	4.11252E-03	3.42057E-03	2.94096E-03	2.69364E-03	2.64205E-03	2.65099E-03	2.77508E-03
3.02251E-03	3.24986E-03	3.53413E-03	3.82064E-03	4.17552E-03	4.51712E-03	4.89916E-03	5.35341E-03
5.78028E-03	6.13364E-03	6.39050E-03	6.43158E-03	6.52999E-03	6.57806E-03	6.46928E-03	5.81206E-03
4.65630E-03	2.95921E-03	7.12902E-04	-2.02261E-03	-5.11471E-03	-8.47207E-03	-1.14536E-02	-1.34451E-02
-1.41036E-02	-1.40084E-02	-1.34248E-02	-1.23465E-02	-1.07075E-02	-8.58234E-03	-6.48842E-03	-4.20530E-03
-2.12101E-03	4.26619E-05	4.16042E-03	1.03099E-02	1.54811E-02	1.88497E-02	1.92197E-02	1.89428E-02
2.03382E-02	1.70978E-02	1.83334E-02	1.26965E-02	7.99978E-03	5.26895E-03	2.82938E-03	

1.00000E+00	9.04502E-01	8.78091E-01	8.39976E-01	7.55178E-01	1.02553E-01	-2.35139E-02	4.01628E-02
2.15013E-02	-1.14220E-03	-1.04307E-03	-8.10729E-04	-3.81638E-04	4.95142E-05	4.66289E-04	8.74141E-04
1.34019E-03	2.29913E-03	5.19281E-03	1.33767E-02	1.27047E-02	1.14554E-02	1.16534E-02	7.69561E-03
6.16312E-03	5.27629E-03	4.87302E-03	4.58473E-03	4.37279E-03	4.35268E-03	4.60097E-03	4.33609E-03
4.21876E-03	3.39377E-03	2.84439E-03	2.55877E-03	2.47863E-03	2.47034E-03	2.58580E-03	2.84563E-03
3.07292E-03	3.37581E-03	3.68078E-03	4.06423E-03	4.45325E-03	4.88325E-03	5.39792E-03	5.89089E-03
6.30046E-03	6.60483E-03	6.67162E-03	6.79583E-03	6.87583E-03	6.80572E-03	6.16148E-03	4.97741E-03
3.19814E-03	8.28272E-04	-2.06791E-03	-5.35896E-03	-8.95146E-03	-1.21452E-02	-1.42877E-02	-1.50053E-02
-1.49080E-02	-1.42866E-02	-1.31359E-02	-1.13843E-02	-9.11095E-03	-6.87351E-03	-4.43223E-03	-2.20486E-03
1.09081E-04	4.52488E-03	1.11301E-02	1.66898E-02	2.03221E-02	2.07350E-02	2.04453E-02	2.19533E-02
1.84551E-02	1.97841E-02	1.37043E-02	8.63721E-03	5.69163E-03	3.05835E-03		
1.00000E+00	9.77028E-01	9.34413E-01	8.38749E-01	1.10149E-01	-2.26353E-02	4.24965E-02	2.24076E-02
-1.16584E-03	-1.07079E-03	-8.36154E-04	-3.97343E-04	3.99103E-05	4.63428E-04	8.73241E-04	1.34404E-03
2.31088E-03	5.25365E-03	1.35708E-02	1.28946E-02	1.16261E-02	1.18340E-02	7.80918E-03	6.25192E-03
5.34872E-03	4.94093E-03	4.64402E-03	4.43143E-03	4.40743E-03	4.65214E-03	4.38209E-03	4.24512E-03
3.41125E-03	2.84608E-03	2.54690E-03	2.47070E-03	2.45804E-03	2.58916E-03	2.81381E-03	3.08396E-03
3.35679E-03	3.67818E-03	4.08928E-03	4.45273E-03	4.90961E-03	5.44258E-03	5.91879E-03	6.34353E-03
6.67821E-03	6.74213E-03	6.85953E-03	6.93576E-03	6.89047E-03	6.24102E-03	5.02328E-03	3.25088E-03
8.56662E-04	-2.09597E-03	-5.42221E-03	-9.04604E-03	-1.23068E-02	-1.44743E-02	-1.51878E-02	-1.50942E-02
-1.44743E-02	-1.33117E-02	-1.15341E-02	-9.22600E-03	-6.95690E-03	-4.48239E-03	-2.22708E-03	1.15364E-04
4.58649E-03	1.12797E-02	1.69235E-02	2.06162E-02	2.10186E-02	2.07344E-02	2.22636E-02	1.87151E-02
2.00630E-02	1.38973E-02	8.75858E-03	5.77188E-03	3.10190E-03			
1.00000E+00	9.56694E-01	8.60156E-01	1.16831E-01	-2.64701E-02	4.58843E-02	2.46517E-02	-1.16472E-03
-1.07495E-03	-8.50448E-04	-4.32034E-04	-1.06846E-05	3.93052E-04	7.87609E-04	1.24055E-03	2.12746E-03
4.99034E-03	1.30563E-02	1.24329E-02	1.12069E-02	1.14364E-02	7.52983E-03	6.01338E-03	5.13903E-03
4.74362E-03	4.45298E-03	4.24159E-03	4.20710E-03	4.42358E-03	4.13039E-03	3.95908E-03	3.12470E-03
2.56103E-03	2.26161E-03	2.17724E-03	2.16437E-03	2.25958E-03	2.50805E-03	2.70867E-03	3.00808E-03
3.30551E-03	3.67960E-03	4.07769E-03	4.50163E-03	5.01320E-03	5.51468E-03	5.93340E-03	6.24569E-03
6.33046E-03	6.46593E-03	6.56185E-03	6.51798E-03	5.92638E-03	4.81855E-03	3.11475E-03	8.43918E-04
-1.94051E-03	-5.11986E-03	-8.60721E-03	-1.17014E-02	-1.37839E-02	-1.44886E-02	-1.43959E-02	-1.37937E-02
-1.26804E-02	-1.09854E-02	-8.78436E-03	-6.61927E-03	-4.25589E-03	-2.09990E-03	1.41729E-04	4.42656E-03
1.08434E-02	1.62475E-02	1.97843E-02	2.01963E-02	1.99158E-02	2.13896E-02	1.79799E-02	1.92723E-02
1.33512E-02	8.41590E-03	5.54701E-03	2.98211E-03				
1.00000E+00	9.43919E-01	2.98465E-01	1.28984E-01	2.03936E-01	1.77215E-01	1.41272E-01	1.34617E-01
1.31347E-01	1.28846E-01	1.26877E-01	1.25305E-01	1.24088E-01	1.23182E-01	-1.04492E-03	-3.39530E-04
1.06025E-02	1.31602E-02	1.57767E-02	1.42571E-02	2.77169E-03	-1.44376E-03	6.53880E-03	5.33318E-04
-1.46520E-03	-6.89356E-04	2.60684E-04	2.80946E-03	-6.31107E-04	-8.67361E-03	-1.33508E-02	-1.60128E-02
-1.68618E-02	-1.82142E-02	-1.87987E-02	-1.88289E-02	-1.92702E-02	-1.90933E-02	-1.86612E-02	-1.82765E-02
-1.74103E-02	-1.60724E-02	-1.46973E-02	-1.28953E-02	-1.10963E-02	-9.26961E-03	-7.53495E-03	-6.54868E-03
-5.57547E-03	-4.29675E-03	-2.17490E-03	-2.38030E-04	1.05369E-03	1.59640E-03	1.50720E-03	1.60328E-03
-6.19428E-04	-2.91633E-03	-5.32007E-03	-7.13785E-03	-8.05757E-03	-8.26339E-03	-8.15874E-03	-7.73293E-03
-6.91331E-03	-5.72418E-03	-4.64554E-03	-3.40023E-03	-2.31616E-03	-1.08223E-03	1.62112E-03	6.14151E-03
1.04883E-02	1.39503E-02	1.49035E-02	1.49850E-02	1.59345E-02	1.32545E-02	1.39219E-02	9.57223E-03
5.88791E-03	3.78102E-03	1.88808E-03					
1.00000E+00	5.05094E-01	3.12870E-01	3.89722E-01	3.58770E-01	3.13587E-01	2.99658E-01	2.92638E-01
2.87027E-01	2.82495E-01	2.78823E-01	2.75874E-01	2.73524E-01	-4.10580E-03	-5.96267E-03	8.92889E-03
1.51515E-02	2.24017E-02	1.85649E-02	-2.41153E-03	-9.97940E-03	8.83891E-03	-4.08706E-03	-8.18727E-03
-6.17120E-03	-3.94048E-03	1.62489E-03	-5.49711E-03	-2.29750E-02	-3.22443E-02	-3.74179E-02	-3.88983E-02
-4.17473E-02	-4.30053E-02	-4.30785E-02	-4.43588E-02	-4.40469E-02	-4.34699E-02	-4.29200E-02	-4.13793E-02
-3.89741E-02	-3.63987E-02	-3.30041E-02	-2.97114E-02	-2.61897E-02	-2.27460E-02	-2.07353E-02	-1.88008E-02
-1.61727E-02	-1.15018E-02	-6.74569E-03	-2.88231E-03	8.15072E-05	2.23984E-03	3.44723E-03	3.78413E-03
2.48421E-03	4.57372E-04	-1.28465E-03	-2.50896E-03	-3.06061E-03	-3.48792E-03	-3.74487E-03	-3.74391E-03
-3.46989E-03	-3.40067E-03	-3.18480E-03	-3.10010E-03	-2.78355E-03	-1.45024E-03	1.56421E-03	5.29807E-03
9.09584E-03	1.06830E-02	1.11706E-02	1.16198E-02	9.46019E-03	9.52107E-03	6.42412E-03	3.71481E-03
2.21919E-03	8.62667E-04						
1.00000E+00	8.70553E-01	8.61493E-01	8.29615E-01	7.77799E-01	7.39968E-01	7.20698E-01	7.05042E-01
6.92301E-01	6.81934E-01	6.73492E-01	6.66573E-01	-9.20868E-03	-1.81408E-02	6.62681E-03	2.16098E-02
4.08633E-02	3.02600E-02	-1.51727E-02	-3.12239E-02	1.57847E-02	-1.51144E-02	-2.46148E-02	-1.92107E-02
-1.33632E-02	5.71757E-04	-1.53091E-02	-5.63539E-02	-7.68309E-02	-8.81302E-02	-9.09915E-02	-9.74972E-02
-1.00253E-01	-1.00288E-01	-1.03306E-01	-1.02643E-01	-1.01312E-01	-1.00326E-01	-9.71415E-02	-9.18989E-02
-8.64608E-02	-7.91993E-02	-7.21449E-02	-6.45931E-02	-5.71844E-02	-5.27675E-02	-4.84776E-02	-4.26362E-02
-3.21474E-02	-2.10185E-02	-1.13987E-02	-3.38307E-03	3.37208E-03	8.48789E-03	1.19462E-02	1.19856E-02
1.01691E-02	8.06900E-03	5.89502E-03	4.55861E-03	3.04530E-03	1.43859E-03	-1.35546E-04	-1.55175E-03
-3.38075E-03	-5.05385E-03	-6.82174E-03	-8.13369E-03	-9.07829E-03	-8.23708E-03	-4.76471E-03	6.08500E-04
3.89928E-03	5.19620E-03	4.57382E-03	3.11973E-03	1.91833E-03	8.56810E-04	-3.26812E-04	-8.16246E-04
-1.28998E-03							
1.00000E+00	9.23413E-01	8.92075E-01	8.45333E-01	7.99955E-01	7.76826E-01	7.58026E-01	7.42750E-01
7.30307E-01	7.20177E-01	7.11867E-01	-1.00676E-02	-2.00040E-02	5.36942E-03	2.14759E-02	4.21915E-02
3.08284E-02	-1.71980E-02	-3.41382E-02	1.61625E-02	-1.67635E-02	-2.68690E-02	-2.10666E-02	-1.48226E-02
1.99899E-05	-1.68962E-02	-6.07118E-02	-8.24575E-02	-9.64458E-02	-9.74741E-02	-1.04403E-01	-1.07339E-01
-1.07381E-01	-1.10644E-01	-1.09959E-01	-1.08581E-01	-1.07555E-01	-1.04189E-01	-9.86433E-02	-9.28922E-02
-8.52109E-02	-7.77432E-02	-6.97307E-02	-6.18558E-02	-5.71506E-02	-5.25900E-02	-4.63670E-02	-3.51625E-02
-2.32089E-02	-1.28030E-02	-4.02833E-03	3.46837E-03	9.27689E-03	1.33693E-02	1.38516E-02	1.22942E-02
1.03140E-02	8.08304E-03	6.64403E-03	4.95113E-03	3.09316E-03	1.19683E-03	-5.95666E-04	-2.82310E-03
-4.90947E-03	-7.06958E-03	-8.75353E-03	-1.03061E-02	-1.02222E-02	-7.19590E-03	-1.90307E-03	1.55609E-03
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-1.81059E-02	-3.59506E-02	1.68953E-02	-1.77105E-02	-2.83339E-02	-2.22655E-02	-1.57428E-02	-2.12791E-04
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Neutron Reference Benchmark: ACRR-LB44-CC-32-cl

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-7.23417E-03	-9.08333E-03	-1.08441E-02	-1.09277E-02	-7.87885E-03	-2.38344E-03	1.26164E-03	2.77851E-03
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2.03003E-01	2.06158E-01	2.03271E-01	1.97545E-01	1.91721E-01	1.82184E-01	1.70142E-01	1.54236E-01
1.40355E-01	1.27371E-01	1.14915E-01	1.03299E-01	9.22166E-02	8.20604E-02	7.25456E-02	6.59887E-02
6.21015E-02	5.61282E-02	4.62108E-02	3.38983E-02	2.20613E-02	9.05206E-03	-5.91483E-03	-2.24974E-02
-4.03505E-02	-5.86094E-02	-7.47359E-02	-8.59006E-02	-8.95837E-02	-8.90710E-02	-8.55378E-02	-7.89501E-02
-6.88059E-02	-5.55934E-02	-4.23164E-02	-2.78710E-02	-1.42876E-02	-8.93517E-05	2.77532E-02	7.06381E-02
1.08382E-01	1.34997E-01	1.40680E-01	1.39742E-01	1.48788E-01	1.20815E-01	1.28559E-01	8.92007E-02
5.83818E-02	4.05141E-02	2.41825E-02					
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2.45704E-02	1.90867E-02	1.49446E-02	1.32920E-02	9.0823E-03	6.65605E-03	1.83277E-03	7.62635E-04
1.29619E-03	2.90395E-03	5.43871E-03	8.50305E-03	1.14558E-02	1.42132E-02	1.54989E-02	1.70908E-02
1.90454E-02	2.18538E-02	2.23047E-02	1.92088E-02	1.17654E-02	-1.54157E-04	-1.55343E-02	-3.32649E-02
-5.30680E-02	-7.04241E-02	-8.08986E-02	-8.32793E-02	-8.13329E-02	-7.63331E-02	-6.82907E-02	-5.68520E-02
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-7.16068E-02	-6.22331E-02	-5.17591E-02	-4.13214E-02	-3.09168E-02	-2.44324E-02	-1.88927E-02	-1.09763E-02
2.38010E-03	1.49201E-02	2.20766E-02	2.31503E-02	1.81689E-02	7.85473E-03	-6.82783E-03	-2.62808E-02
-4.47858E-02	-5.67096E-02	-6.05656E-02	-5.95789E-02	-5.57589E-02	-4.91101E-02	-3.92988E-02	-2.68372E-02
-1.52479E-02	-2.74550E-03	8.01973E-03	1.90780E-02	4.02137E-02	7.08613E-02	9.39502E-02	1.06145E-01
1.03609E-01	1.01319E-01	1.11563E-01	9.90783E-02	1.07619E-01	7.50203E-02	4.58157E-02	2.85297E-02
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-6.10389E-02	-1.17049E-01	-1.59743E-01	-1.71782E-01	-1.83638E-01	-1.93957E-01	-1.99098E-01	-1.97649E-01
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-2.22509E-02	-8.52423E-03	5.41800E-03	3.00396E-02	6.37753E-02	8.81621E-02	9.91360E-02	9.44022E-02
9.03082E-02	9.88156E-02	8.92677E-02	9.79167E-02	6.76017E-02	4.00118E-02	2.37958E-02	9.89862E-03
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4.55251E-02	5.63489E-02	6.43785E-02	6.84550E-02	7.08908E-02	7.34328E-02	7.43016E-02	6.82354E-02
5.47929E-02	3.50892E-02	9.39248E-03	-2.13932E-02	-5.50470E-02	-8.86221E-02	-1.16999E-01	-1.36187E-01
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7.44919E-02	6.30718E-02	6.83208E-02	4.51787E-02	2.52569E-02	1.42194E-02	4.65800E-03	
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-6.56277E-02	-3.91303E-02	-1.07711E-02	1.45142E-02	3.51765E-02	5.44141E-02	7.04253E-02	8.39676E-02
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Neutron Reference Benchmark: ACRR-LB44-CC-32-cl

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-5.08318E-02	-2.16435E-02	5.24602E-03	2.80422E-02	4.94255E-02	6.75644E-02	8.28897E-02	9.40208E-02
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-1.71213E-01	-1.64610E-01	-1.53733E-01	-1.38752E-01	-1.22423E-01	-1.04049E-01	-8.64109E-02	-6.81029E-02
-3.78660E-02	4.28065E-03	4.17312E-02	6.62716E-02	6.92340E-02	6.43399E-02	6.16484E-02	4.89226E-02
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3.62713E-02	6.25691E-02	6.66306E-02	6.20639E-02	5.84101E-02	4.61341E-02	4.78882E-02	2.87148E-02
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2.33641E-02	4.20321E-02	5.82263E-02	7.25978E-02	8.35788E-02	9.11266E-02	9.46649E-02	9.60224E-02
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6.24069E-02	6.77934E-02	6.41051E-02	6.06659E-02	4.73020E-02	4.83646E-02	2.87594E-02	1.31563E-02
5.34274E-03	-1.34859E-03						
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2.28998E-02	-3.57317E-03	-2.05802E-02	-2.64603E-02	-2.40118E-02	-1.60672E-02	-5.54072E-03	5.72605E-02
1.87744E-02	3.07874E-02	4.22461E-02	5.15537E-02	5.84028E-02	6.20284E-02	6.34598E-02	6.46230E-02
6.23000E-02	5.27839E-02	3.50793E-02	1.17049E-02	-1.72505E-02	-5.02084E-02	-8.38269E-02	-1.15200E-01
-1.40157E-01	-1.56399E-01	-1.61712E-01	-1.61807E-01	-1.58652E-01	-1.52084E-01	-1.41906E-01	-1.28260E-01
-1.13771E-01	-9.75937E-02	-8.23371E-02	-6.64734E-02	-3.96831E-02	-7.49057E-04	3.62654E-02	6.42237E-02
7.16748E-02	6.97361E-02	6.74860E-02	5.16318E-02	5.18051E-02	3.10024E-02	1.54800E-02	7.76812E-03
1.09231E-03							
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-1.39459E-02	-1.03920E-02	-6.59889E-03	-3.20241E-03	-8.54468E-04	3.05232E-06	1.04468E-03	4.35017E-04
-3.33111E-03	-1.29579E-02	-2.65787E-02	-4.47336E-02	-6.61248E-02	-8.77795E-02	-1.07622E-01	-1.22589E-01
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8.10327E-02	8.15576E-02	6.15034E-02	6.06642E-02	3.72598E-02	2.14429E-02	1.34849E-02	6.48611E-03
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9.44409E-02	6.18855E-02	3.75978E-02	2.42252E-02	1.24275E-02			
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-1.68921E-01	-1.48295E-01	-1.27935E-01	-1.08437E-01	-8.95231E-02	-7.59794E-02	-6.65389E-02	-5.67118E-02
-4.65266E-02	-3.55794E-02	-2.41538E-02	-1.50812E-02	-6.35909E-03	-4.99934E-06	6.26061E-03	2.03484E-02
4.49017E-02	7.03843E-02	9.51325E-02	1.06261E-01	1.11198E-01	1.19407E-01	9.72217E-02	9.81913E-02
6.53976E-02	4.00736E-02	2.58013E-02	1.32200E-02				
1.00000E+00	9.23541E-01	8.52618E-01	7.82747E-01	7.10357E-01	6.32077E-01	5.48779E-01	4.60964E-01
3.70374E-01	2.80616E-01	1.93692E-01	1.12540E-01	3.81184E-02	-2.71139E-02	-8.25486E-02	-1.15145E-01
-1.36787E-01	-1.66160E-01	-2.07653E-01	-2.36791E-01	-2.44899E-01	-2.37946E-01	-2.21295E-01	-1.98340E-01

-1.70935E-01	-1.42857E-01	-1.15981E-01	-9.06695E-02	-7.31163E-02	-6.13977E-02	-4.96236E-02	-3.78513E-02
-2.56907E-02	-1.34618E-02	-3.99542E-03	4.75757E-03	1.08810E-02	1.66726E-02	2.97540E-02	5.23213E-02
7.49378E-02	9.67009E-02	1.06162E-01	1.10902E-01	1.20278E-01	9.94902E-02	1.01434E-01	6.83542E-02
4.21626E-02	2.71242E-02	1.39036E-02					
1.00000E+00	9.34999E-01	8.70814E-01	8.03512E-01	7.28817E-01	6.46862E-01	5.57926E-01	4.63567E-01
3.67521E-01	2.72081E-01	1.80977E-01	9.54210E-02	1.85462E-02	-4.84758E-02	-8.89570E-02	-1.15995E-01
-1.53578E-01	-2.08670E-01	-2.51978E-01	-2.69379E-01	-2.67507E-01	-2.52229E-01	-2.27680E-01	-1.96590E-01
-1.63194E-01	-1.30606E-01	-9.99115E-02	-7.86249E-02	-6.46231E-02	-5.07091E-02	-3.69679E-02	-2.30306E-02
-9.26629E-03	1.42448E-03	1.11194E-02	1.79064E-02	2.41107E-02	3.75178E-02	5.97580E-02	8.08020E-02
1.00185E-01	1.07828E-01	1.12017E-01	1.22339E-01	1.02690E-01	1.05752E-01	7.19033E-02	4.44458E-02
2.84516E-02	1.44336E-02						
1.00000E+00	9.42738E-01	8.82493E-01	8.14309E-01	7.37176E-01	6.50852E-01	5.56565E-01	4.57866E-01
3.57196E-01	2.58922E-01	1.64417E-01	7.73912E-02	-3.99800E-04	-4.86030E-02	-8.10130E-02	-1.27062E-01
-1.96942E-01	-2.56968E-01	-2.86734E-01	-2.93045E-01	-2.81961E-01	-2.58240E-01	-2.25315E-01	-1.87771E-01
-1.50047E-01	-1.14124E-01	-8.89641E-02	-7.25131E-02	-5.62128E-02	-4.01862E-02	-2.40936E-02	-8.36877E-03
4.01929E-03	1.51201E-02	2.30322E-02	3.00804E-02	4.63793E-02	6.68962E-02	8.67694E-02	4.34944E-02
1.09672E-01	1.13186E-01	1.24315E-01	1.05660E-01	1.09810E-01	7.51539E-02	4.65366E-02	2.96743E-02
1.49446E-02							
1.00000E+00	9.47687E-01	8.87945E-01	8.18249E-01	7.37596E-01	6.46722E-01	5.48748E-01	4.46043E-01
3.43448E-01	2.42363E-01	1.46972E-01	5.95783E-02	4.06307E-03	-3.34955E-02	-8.79761E-02	-1.73336E-01
-2.52150E-01	-2.97036E-01	-3.14425E-01	-3.10273E-01	-2.89713E-01	-2.56752E-01	-2.16257E-01	-1.73992E-01
-1.33014E-01	-1.03855E-01	-8.47783E-02	-6.58292E-02	-4.71701E-02	-2.85017E-02	-1.03295E-02	4.25657E-03
1.72619E-02	2.67785E-02	3.51285E-02	5.10255E-02	7.47194E-02	9.41308E-02	1.09425E-01	1.13373E-01
1.16140E-01	1.28108E-01	1.10001E-01	1.15296E-01	7.93123E-02	4.92127E-02	3.13173E-02	1.57286E-02
1.00000E+00	9.50305E-01	8.90329E-01	8.18325E-01	7.34152E-01	6.40259E-01	5.38830E-01	4.34944E-01
3.29937E-01	2.28295E-01	1.32830E-01	7.06901E-02	2.83241E-02	-3.43488E-02	-1.35602E-01	-2.35132E-01
-2.98015E-01	-3.29766E-01	-3.35764E-01	-3.21224E-01	-2.90564E-01	-2.48654E-01	-2.02726E-01	-1.57046E-01
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1.33435E-01	1.15458E-01	1.21997E-01	8.42506E-02	5.24271E-02	3.33765E-02	1.68168E-02	
1.00000E+00	9.51261E-01	8.90274E-01	8.15958E-01	7.29819E-01	6.33568E-01	5.32104E-01	4.26656E-01
3.21823E-01	2.20757E-01	1.53368E-01	1.06979E-01	3.70202E-02	-7.94770E-02	-2.00759E-01	-2.84330E-01
-3.34078E-01	-3.54296E-01	-3.49813E-01	-3.25043E-01	-2.84532E-01	-2.36869E-01	-1.87683E-01	-1.50824E-01
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3.95873E-02	6.12287E-02	9.03188E-02	1.11072E-01	1.23652E-01	1.23688E-01	1.24313E-01	1.37505E-01
1.19789E-01	1.27609E-01	8.83169E-02	5.48948E-02	3.48059E-02	1.73822E-02		
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3.18830E-01	2.47680E-01	1.98182E-01	1.22099E-01	-8.45484E-03	-1.51767E-01	-2.57985E-01	-3.28752E-01
-3.66696E-01	-3.75764E-01	-3.59965E-01	-3.23135E-01	-2.75166E-01	-2.23243E-01	-1.82900E-01	-1.55711E-01
-1.27813E-01	-9.95277E-02	-7.07499E-02	-4.22854E-02	-1.76872E-02	4.62232E-03	2.25656E-02	3.83275E-02
6.40094E-02	9.71124E-02	1.19485E-01	1.31026E-01	1.28917E-01	1.28100E-01	1.41515E-01	1.23896E-01
1.33029E-01	9.21744E-02	5.72417E-02	3.61928E-02	1.79711E-02			
1.00000E+00	9.52172E-01	8.90058E-01	8.13937E-01	7.27330E-01	6.31138E-01	5.29386E-01	4.25435E-01
3.52513E-01	3.01143E-01	2.20659E-01	7.82912E-02	-8.60695E-02	-2.16027E-01	-3.10447E-01	-3.69697E-01
-3.96202E-01	-3.93065E-01	-3.62813E-01	-3.16526E-01	-2.63084E-01	-2.19699E-01	-1.89976E-01	-1.59002E-01
-1.27163E-01	-9.44692E-02	-6.18459E-02	-3.29578E-02	-6.52974E-03	1.53078E-02	3.45813E-02	6.48426E-02
1.02410E-01	1.26620E-01	1.36997E-01	1.32545E-01	1.30033E-01	1.43295E-01	1.25918E-01	1.36307E-01
9.44583E-02	5.86059E-02	3.69757E-02	1.82899E-02				
1.00000E+00	9.53133E-01	8.91332E-01	8.16944E-01	7.30663E-01	6.35820E-01	5.35596E-01	4.63298E-01
4.11662E-01	3.29126E-01	1.78497E-01	-4.19504E-03	-1.57473E-01	-2.77057E-01	-3.60551E-01	-4.08259E-01
-4.21725E-01	-4.01556E-01	-3.59654E-01	-3.06595E-01	-2.61027E-01	-2.29154E-01	-1.95295E-01	-1.59938E-01
-1.23200E-01	-8.61499E-02	-5.25575E-02	-2.15319E-02	4.74229E-03	2.80785E-02	6.37072E-02	1.52347E-01
1.33511E-01	1.43094E-01	1.36294E-01	1.31869E-01	1.44673E-01	1.27292E-01	1.38921E-01	9.61871E-02
5.96414E-02	3.76078E-02	1.85994E-02					
1.00000E+00	9.54245E-01	8.94401E-01	8.20997E-01	7.36462E-01	6.43563E-01	5.74449E-01	5.24304E-01
4.42436E-01	2.88071E-01	9.14290E-02	-8.30668E-02	-2.27886E-01	-3.37480E-01	-4.09489E-01	-4.43207E-01
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1.47728E-01	1.38556E-01	1.32019E-01	1.43936E-01	1.26575E-01	1.39322E-01	9.62875E-02	5.96650E-02
3.76353E-02	1.86508E-02						
1.00000E+00	9.56050E-01	8.97657E-01	8.26186E-01	7.43803E-01	6.80326E-01	6.33357E-01	5.54921E-01
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-4.42461E-01	-3.96791E-01	-3.50324E-01	-3.15871E-01	-2.77503E-01	-2.35879E-01	-1.91441E-01	-1.45540E-01
-1.02080E-01	-6.11704E-02	-2.50845E-02	7.38450E-03	5.80895E-02	1.10432E-01	1.43772E-01	1.52346E-01
1.40868E-01	1.32099E-01	1.42904E-01	1.25353E-01	1.39173E-01	9.59485E-02	5.94356E-02	3.75567E-02
1.87081E-02							
1.00000E+00	9.58347E-01	9.02255E-01	8.33115E-01	7.77332E-01	7.35128E-01	6.62690E-01	5.15402E-01
3.07077E-01	1.00845E-01	-8.99159E-02	-2.53031E-01	-3.79417E-01	-4.62158E-01	-4.92195E-01	-4.80417E-01
-4.41239E-01	-3.95744E-01	-3.60659E-01	-3.20485E-01	-2.75973E-01	-2.27778E-01	-1.77421E-01	-1.28874E-01
-8.28055E-02	-4.15441E-02	-4.23268E-03	4.98887E-02	1.11808E-01	1.48670E-01	1.56823E-01	1.43045E-01
1.32075E-01	1.41776E-01	1.23779E-01	1.38562E-01	9.52162E-02	5.91131E-02	3.75908E-02	1.90564E-02
1.00000E+00	9.60767E-01	9.07115E-01	8.61022E-01	8.25048E-01	7.61205E-01	6.25064E-01	4.20558E-01
2.06111E-01	-2.83650E-03	-1.91094E-01	-3.45907E-01	-4.56494E-01	-5.09356E-01	-5.13450E-01	-4.83581E-01
-4.40729E-01	-4.05916E-01	-3.64645E-01	-3.17836E-01	-2.66293E-01	-2.11715E-01	-1.58181E-01	-1.06934E-01
-6.03946E-02	-1.80751E-02	4.27425E-02	1.11664E-01	1.52527E-01	1.60610E-01	1.44642E-01	1.31369E-01
1.39661E-01	1.21114E-01	1.36743E-01	9.35802E-02	5.82178E-02	3.72841E-02	1.92538E-02	
1.00000E+00	9.63111E-01	9.28152E-01	8.99498E-01	8.46392E-01	7.26175E-01	5.32530E-01	3.16472E-01
9.44556E-02	-1.15942E-01	-2.98445E-01	-4.38138E-01	-5.16551E-01	-5.39750E-01	-5.22205E-01	-4.83946E-01
-4.50485E-01	-4.09073E-01	-3.60712E-01	-3.06439E-01	-2.48110E-01	-1.89861E-01	-1.33585E-01	-8.17913E-02
-3.44066E-02	3.32286E-02	1.09399E-01	1.54655E-01	1.62999E-01	1.44984E-01	1.29315E-01	1.35811E-01

Neutron Reference Benchmark: ACRR-LB44-CC-32-cl

1.16717E-01	1.33026E-01	9.05593E-02	5.64374E-02	3.64212E-02	1.91718E-02		
1.00000E+00	9.76978E-01	9.56335E-01	9.15509E-01	8.15112E-01	6.38935E-01	4.28136E-01	1.99019E-01
-2.93463E-02	-2.37609E-01	-4.06698E-01	-5.12791E-01	-5.58126E-01	-5.55978E-01	-5.24392E-01	-4.93508E-01
-4.53020E-01	-4.04026E-01	-3.47760E-01	-2.86247E-01	-2.23677E-01	-1.62586E-01	-1.05641E-01	-5.31904E-02
2.13415E-02	1.05009E-01	1.55098E-01	1.64105E-01	1.44216E-01	1.26065E-01	1.30372E-01	1.10720E-01
1.27544E-01	8.62592E-02	5.38357E-02	3.50365E-02	1.88174E-02			
1.00000E+00	9.84866E-01	9.52937E-01	8.67931E-01	7.07605E-01	5.04945E-01	2.75308E-01	3.80222E-02
-1.85982E-01	-3.74913E-01	-5.01142E-01	-5.63732E-01	-5.74609E-01	-5.49422E-01	-5.21443E-01	-4.82653E-01
-4.34166E-01	-3.77360E-01	-3.14322E-01	-2.49246E-01	-1.85153E-01	-1.24807E-01	-6.88926E-02	1.04491E-02
9.95806E-02	1.53574E-01	1.63591E-01	1.42644E-01	1.22657E-01	1.24991E-01	1.05000E-01	1.22088E-01
8.21449E-02	5.12568E-02	3.35267E-02	1.81921E-02				
1.00000E+00	9.74978E-01	9.02076E-01	7.54528E-01	5.59127E-01	3.30346E-01	8.75246E-02	-1.47333E-01
-3.50505E-01	-4.91644E-01	-5.67159E-01	-5.87715E-01	-5.67236E-01	-5.41321E-01	-5.03663E-01	-4.55445E-01
-3.98091E-01	-3.33805E-01	-2.66808E-01	-2.00457E-01	-1.37616E-01	-7.91914E-02	3.64156E-03	9.66722E-02
1.53310E-01	1.63860E-01	1.42063E-01	1.20824E-01	1.21940E-01	1.01538E-01	1.18773E-01	7.95450E-02
4.97211E-02	3.27428E-02	1.80483E-02					
1.00000E+00	9.47060E-01	8.22431E-01	6.42325E-01	4.19011E-01	1.71062E-01	-7.84571E-02	-3.03139E-01
-4.68373E-01	-5.65972E-01	-6.04011E-01	-5.92700E-01	-5.71168E-01	-5.36354E-01	-4.89467E-01	-4.32069E-01
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1.63410E-01	1.40489E-01	1.17132E-01	1.15886E-01	9.48374E-02	1.12236E-01	7.45418E-02	4.66646E-02
3.10434E-02	1.74851E-02						
1.00000E+00	9.24593E-01	7.83271E-01	5.82212E-01	3.36318E-01	6.84506E-02	-1.91460E-01	-4.01578E-01
-5.44025E-01	-6.20191E-01	-6.30552E-01	-6.20092E-01	-5.93363E-01	-5.51461E-01	-4.96121E-01	-4.29740E-01
-3.56682E-01	-2.81775E-01	-2.08552E-01	-1.38945E-01	-3.97896E-02	7.29664E-02	1.45004E-01	1.61115E-01
1.36623E-01	1.09102E-01	1.02609E-01	1.02609E-01	9.71555E-02	6.33898E-02	3.98135E-02	2.71514E-02
1.60536E-02							
1.00000E+00	9.25602E-01	7.77015E-01	5.59667E-01	2.90952E-01	8.44914E-04	-2.62574E-01	-4.67921E-01
-6.04456E-01	-6.53351E-01	-6.64479E-01	-6.55307E-01	-6.26583E-01	-5.79933E-01	-5.17645E-01	-4.44004E-01
-3.65029E-01	-2.85004E-01	-2.06773E-01	-9.35982E-02	3.86032E-02	1.28758E-01	1.54472E-01	1.29637E-01
9.60773E-02	8.03555E-02	5.50980E-02	7.19906E-02	4.44524E-02	2.81157E-02	2.03151E-02	1.31741E-02
1.00000E+00	9.23941E-01	7.63657E-01	5.25288E-01	2.32198E-01	-6.77871E-02	-3.31845E-01	-5.34924E-01
-6.32067E-01	-6.72534E-01	-6.89444E-01	-6.82595E-01	-6.53088E-01	-6.02593E-01	-5.34983E-01	-4.57142E-01
-3.74179E-01	-2.89849E-01	-1.64288E-01	-1.10855E-02	1.02445E-01	1.43928E-01	1.21810E-01	8.20015E-02
5.43250E-02	2.46669E-02	4.01363E-02	2.12508E-02	1.40041E-02	1.21589E-02	9.73649E-03	
1.00000E+00	9.20228E-01	7.44787E-01	4.83450E-01	1.75171E-01	-1.31757E-01	-3.98634E-01	-5.49894E-01
-6.26356E-01	-6.77802E-01	-7.02559E-01	-7.00520E-01	-6.72076E-01	-6.19999E-01	-5.51468E-01	-4.72285E-01
-3.86863E-01	-2.53543E-01	-8.00557E-02	6.21632E-02	1.75495E-01	1.13159E-01	6.77138E-02	2.50723E-02
-1.15109E-02	1.19154E-03	-6.50598E-03	-2.37751E-03	3.02956E-03	6.16604E-03		
1.00000E+00	9.15082E-01	7.23036E-01	4.44804E-01	1.24632E-01	-1.89891E-01	-3.93196E-01	-5.08426E-01
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