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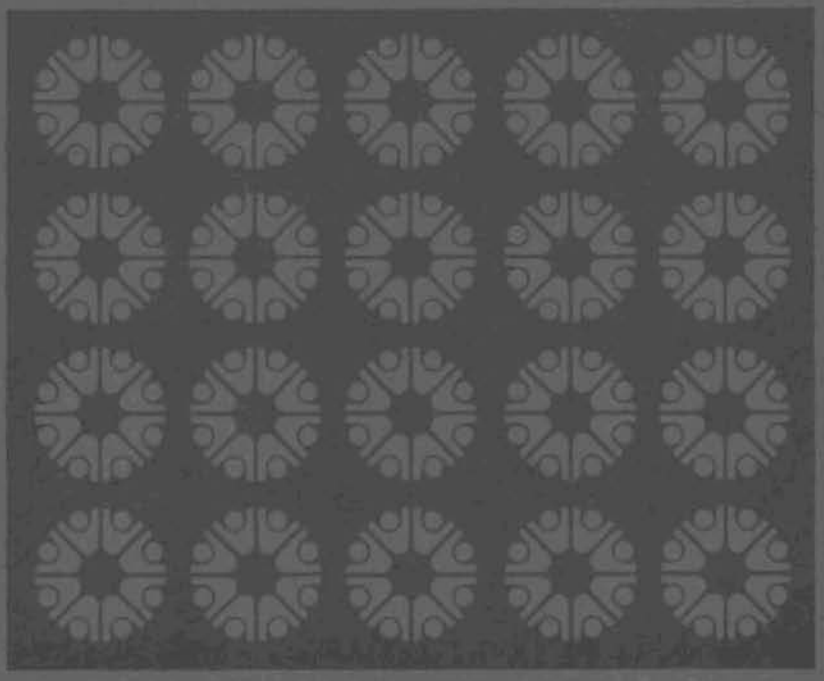
GRANIT: A CODE FOR CALCULATING POSITION DEPENDENT THERMAL NEUTRON SPECTRA IN DOUBLY HETEROGENEOUS SYSTEMS BY THE INTEGRAL TRANSPORT METHOD

DECEMBER 1971



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GRANIT: A CODE FOR CALCULATING POSITION DEPENDENT THERMAL NEUTRON SPECTRA IN DOUBLY HETEROGENEOUS SYSTEMS BY THE INTEGRAL TRANSPORT METHOD

C. L. Bennett

Reactor Physics Department

December 1971

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GRANIT: A Code for Calculating Position Dependent Thermal Neutron Spectra in Doubly Heterogeneous Systems by the Integral Transport Method

C. L. Bennett

COMPUTER CODE ABSTRACT

1. Name: GRANIT
2. Computer: The GRANIT Code was programmed to operate on the UNIVAC 1108 computer.
3. Problem Solved: The code computes the position dependent thermal neutron spectrum in doubly heterogeneous systems over the energy range 0 to 0.683 eV by the integral transport method, using 30 speed points and a maximum of 30 space points. Dilute granular composite (Particulate structured) material regions are allowed. Both diluent and particle spectra are computed as a function of the radial position of the granular material in the cylindrical system. The computed spectra is used to determine various one-thermal-group cross sections and reaction rates in the system for as many as five independent thermal energy ranges.
4. Method of Solution: The scalar thermal neutron spectrum is computed as a function of position in the system by solving the integral transport equation with isotropic scattering. The code uses a combination of Gauss iteration, overrelaxation, and extrapolation to accelerate convergence. Granular regions are handled by expanding the normal region-to-region collision probabilities, and using an extension

of the approximate method of Lane, Nordheim and Sampson, to explicitly include particle and diluent iteractions. Speed dependent macroscopic parameters are constructed separately for particle, diluent and homogeneous cell materials from input nuclide concentrations and the microscopic parameters either available on the library tape or input directly. Point, region, and cell avaeraging, over the energy range of interest of both microscopic and macroscopic parameters, are performed using the computed spectrum as a weighting function.

5. Restrictions on the Complexity of the Problem: Number of speed points $\leq$ 30. Number of particle types in a granular region $\leq$ 2. Particle shapes - spheres or infinite cylinders. Number of space points $\leq$ 30 (each granular point counts as two space points for one particle mixture and three space points for two particle mixtures). A position dependent seven-group distribution function can be specified to descrige particle size and/or shape variation for each of the two allowable particle compositions. Number of mixtures $\leq$ 10. The system geometry must be cylindrical. Either a vacuum, reflecting, or an isotropic albedo outer boundary condition may be specified. Number of isotopes used in the cell $\leq$ 20. Number of isotopes used in idit $\leq$ 20. Further restrictions on the type of granular mixtures are dictated by the various assumptions of the particle size methods used. These are as follows: (1) the particles must be blacker than the diluent; (2) the particles must be relatively dilute, less than or equal to about 10% by volume; (3) the particle must be small enough such that the flat flux and source approximation in the particle does not introduce appreciable errors.

6. Typical Running Time: Typical running times for 30 speed and space point problems are about 30 to 45 seconds per case on the UNIVAC 1108.

7. Unusual Features of the Program: The code explicitly computes position dependent diluent and particle spectra in granular regions, in addition to the position dependent spectra in homogeneous regions, for doubly heterogeneous systems by using the well known THERMOS method with a redistributed first flight collision matrix. The code is structured such that future improvements to the particle effect assumtions can easily be incorporated.

8. Related and Auxiliary Programs: The GRANIT code is a special use version of THERMOS. The auxiliary programs LIBP and RESUME, respectively, update or make a new library tape and produce a resume of the library data.

9. Status: GRANIT is in production use on the UNIVAC 1108 computer at Pacific Northwest Laboratory, Richland, Washington.

10. References:

- R. K. Lane, L. W. Nordheim, and J. B. Sampson. "Resonance Absorption in Particles," Nucl. Sci. and Eng., vol. 24, p. 18. 1966.
- L. W. Nordheim. "Resonance Absorption in Materials with Grain Structure (Addendum)," Nucl. Sci. and Eng., vol. 16, p. 337. 1963.
- R. A. Lewis and T. J. Connolly. "Resonance Absorption in Particles," Nucl. Sci. and Eng., vol. 24, p. 18. 1966.
- C. L. Bennett. "Multiple Region Interaction Probabilities for Particle Size Theory," Reactor Physics Quarterly Report, July, August, September, 1968, BNWL-921, Battelle-Northwest, Richland, WA.
- H. C. Honeck. THERMOS, A Thermalization Transport Theory Code for Reactor Lattice Calculations, BNL-5826. Brookhaven National Laboratory Upton, New York, September 1961.

11. Machine Requirements: 64K memory, normal input, output, and program units, 1 unit for library.

12. Programming Language Used: FORTRAN-IV.

13. Operating System: UNIVAC-1108 computer with FORTRAN-V compiler and CSCX operating systems.

14. User Information: The code may be obtained from Pacific Northwest Laboratory in Richland, Washington.

15. Material Available: Magnetic Tape Transmittal

    GRANIT Source deck (2180 cards)
    LIBP Source deck (504 cards)
    RESUME Source deck (64 cards)
    Sample Problem
    Library Data Tape

16. Acknowledgment: This code is based on work performed under U.S. Atomic Energy Commission Contract AT(45-1)-1830).

TABLE OF CONTENTS

INTRODUCTION

GRANIT is a one dimensional computer code for calculating position dependent thermal neutron spectra in doubly heterogeneous systems by the integral transport method. GRANIT differs from THERMOS[1] (from which it evolved) primarily in that dilute granular composite (particulate structured) material regions are allowed. The granular regions may be composed of diluent material plus either one or two types of particles. The particles can be shaped as either spheres or infinite cylinders. A seven group distribution function can be specified to describe particle size and/or shape variations for each of the two allowable particle compositions. Both particle and diluent spectra, in addition to the spectra in other homogeneous regions, are computed as a function of radial position in the heterogeneous system, which presently must be describable in cylindrical geometry. The second level of heterogeneity introduced by allowing granular material regions, is explicitly taken into account by appropriately modifying the first flight collision probabilities. This modification is accomplished by using an extension of the Lane, Norheim, and Sampson (LNS) method[2], and is described in detail in the Theory section.

Computer code GRANIT has been used to study the neutronic effects of PuO_2 particles in the UO_2 matrix of UO_2-PuO_2 fuel used in plutonium recycle. Because plutonium is concentrated in particulate form in this fuel, there is a self shielding effect which reduces the Pu^{239} fission reaction rate. GRANIT can be used to determine the reactivity effect of this phenomena for various particle sizes. Programming input and output information useful for preparation of cross section data tapes and application of the calculational method such as the Pu recycle follow the theory section.

THEORY

This section presents a formal extension of the first-flight collision and escape probability methods of References (2-4) to the general case of multiregion lattice cells containing both multiple granular and non-granular regions. Although directional dependence of the mean free path[5,6] in the granular material is neglected, this approach retains the simplicity of the original method[2] without the loss of detail resulting from a complete self-shielded homogenization of the particles and diluent.[6,7]

The mutual shielding effects of finite absorber grains or particles imbedded in a matrix of diluent material become increasingly important in resonance absorption theory as the grain diameter increases. The particle size theory of Lane, Nordheim, and Sampson[2,3] is based upon the isotropic integral transport theory approach (first-flight collision probability form). The heterogeneity effects involved in a system containing a single granular region and, at most, one other region are completely taken into account through the explicit definition of the interaction probabilities. This original development and a later experimental confirmation[4] of the theory for small particle volume fractions was specifically applied to the solution of the resonance absorption in the particles. Consideration of the grain effects is equally important at thermal energies. This is especially true for highly absorbing grains embedded in an essentially nonabsorbing moderator. With respect to most thermal lattices, the two-region flat flux limitation of the original method is untenable. Even in a simple two-region cell case such as a fuel rod surrounded by

moderator, each region must be divided into sufficient subregions to adequately account for the thermal flux spatial variation. The radial subdivision of the fuel may furthermore be dictated by composition or density variations inherent in the fuel design or caused by either a particular manufacturing process or fuel burnup. In order to apply this method to thermalization problems, which require more than two-region spatial detail, the interaction probability definitions have been improved somewhat and formally extended to the more general case of a multiregion system containing both multiple granular and nongranular regions. The following is a summary of the results and general method of this extension where, for notational convenience, the energy dependence of the probabilities and total cross sections has been suppressed.

Before treating the generalized system, only a single granular region will be considered, i.e., a region composed of a relatively small volume fraction of a single type of even-sized particles randomly dispersed in a matrix of diluent. When the Bell approximation[5] appropriate to the particle problem is used for the Dancoff correction in Nordheim's expression[6] for the generalized grain (or particle) escape probability, as suggested in Reference 4, the following is obtained

$$P_k^* = P_k \left[\frac{(V_d \Sigma_d)_k}{(V_d \Sigma_d)_k + P_k (V_o \Sigma_o)_k} \right] \qquad (1)$$

where P_k is the isolated particle escape probability, V_o and V_d are, respectively, the particle and diluent volume fractions, and Σ_o and Σ_d are, respectively, the particle and diluent total collision cross sections. Using the same physical reasoning as Lane, et al, Equation (1) is interpreted as follows: the first factor P_k, is the probability that a neutron

born in the grain will escape, and the remaining factor in brackets is the further probability that it next will collide with a diluent nucleus after a collision in region k. The factor in brackets is therefore the conditional probability of colliding in the diluent, given a collision in the mixture;

$$P_{d/k} = \frac{(V_d\Sigma_d)_k}{(V_d\Sigma_d)_k + P_k(V_o\Sigma_o)_k} \quad . \tag{2}$$

This interpretation leads to expressing the effective shielded cross section of the mixture as

$$\Sigma_k = (V_d\Sigma_d)_k + P_k(V_o\Sigma_o)_k \quad . \tag{3}$$

The complementary conditional probability of colliding in the grain after a mixture collision is

$$P_{o/k} = 1 - P_{d/k} \quad . \tag{4}$$

Now that the effective mixture cross section is known, the generalized probability of colliding in the mixture, P^*_{kk}, given uniform and isotropic birth can then be determined. The probability that a neutron born in a particle in region k will collide with a diluent nucleus in region k, $P(o_k \rightarrow d_k)$ is therefore,

$$P^*(o_k \rightarrow d_k) = P_k P^*_{kk} P_{d/k} \quad . \tag{5}$$

Assume the system under consideration has been subdivided into a total of NX = NG + NS physical regions of which NG regions are granular and NS are nongranular or homogeneous. A complete description of all the source to collision interactions requires a NT by NT collision probability matrix, where NT = NX + n · NG and n is the number of particle

types in each heterogeneous granular region. If the number of particle types per granular region is initially limited to one (n = 1) the following notation can be used: the indexes k and ℓ will refer to the granular regions only, the index j will refer only to the nongranular regions and μ and ν will be the general indexes referring to the NX physical regions (μ, ν = 1, NX).

By using arguments similar to the preceding for determining the particle to diluent collision probability in a single granular region, all of the uniform-isotropic-source density transfer probabilities $P(\alpha \rightarrow \beta)$ from α to β (o, particle; d, diluent; j, nongranular region) can be expressed for the generalized system as follows:

$$P^*(o_k \rightarrow o_\ell) = P_k P^*_{k\ell} P_{o/\ell} + (1 - P_k)\delta_{k\ell} \quad (6)$$

$$P^*(d_k \rightarrow d_\ell) = P^*_{k\ell} P_{d/\ell} \quad (7)$$

$$P^*(o_k \rightarrow d_\ell) = P_k P^*_{k\ell} P_{d/\ell} \quad (8)$$

$$P^*(d_k \rightarrow o_\ell) = P^*_{k\ell} P_{o/\ell} \quad (9)$$

$$P^*(o_k \rightarrow j) = P_k P^*_{kj} \quad (10)$$

$$P^*(j \rightarrow o_k) = P^*_{jk} P_{o/k} \quad (11)$$

$$P^*(d_k \rightarrow j) = P^*_{kj} \quad (12)$$

$$P^*(j \rightarrow d_k) = P^*_{jk} P_{d/k} \quad (13)$$

$$\delta_{k\ell} = \begin{bmatrix} 1, & k = \ell \\ 0, & k \neq \ell \end{bmatrix}$$

The $P^{*}_{\mu\nu}(\mu,\nu = 1,NT)$ for systems with a isotropically reflecting, closed and nonreentrant, outer-boundary can be found from[6]

$$P^{*}_{\mu\nu} = P_{\mu\nu} + \frac{P_{\mu B}P_{B\nu}}{1 - P_{BB}} \quad , \tag{14}$$

where the $P_{\mu\nu}$ are the normal isolated-system, region-to-region, collision probabilities. The expressions complementary to Equation 14 are

$$P_{\mu B} = 1 - \sum_{\nu=1}^{NT} P_{\mu\nu} \quad , \tag{15}$$

$$P_{B\nu} = \frac{4V_{\nu}\Sigma_{\nu}}{S_B}P_{\nu B} \quad , \tag{16}$$

$$\text{and} \quad 1 - P_{BB} = \sum_{\nu=1}^{NT} P_{B\nu} \quad , \tag{17}$$

where $P_{\mu B}$ is the probability that a neutron born in region μ will reach the system boundary without previous collision, $P_{B\nu}$ and P_{BB} are the probabilities that a neutron incident on the boundary will, respectively, collide in region ν and traverse the system without previous collision, S_B is the boundary surface area and V_{ν} and Σ_{ν} are, respectively, the volume and total (effective or regular) collision cross section of region ν.

Arbitrary Radial Leakage

Systems with arbitrary radial leakage are treated quite easily if the isotropic or "white" boundary assumption is made. If neutrons are returned from the system boundary independent of their initial direction, Equation 14 takes the following form[8,9]

$$P^{*}_{\mu\nu} = P_{\mu\nu} + \frac{A_B P_{\mu B} P_{B\nu}}{1 - A_B P_{BB}} \qquad (14')$$

where A_B is the albedo at the outer boundary B.

These results are quite general in that the particle size and the particle and diluent compositions and relative volume fractions can vary between granular regions and/or subregions, and cell-to-like cell interactions are handled explicitly. The limitation is essentially the same as in the original theory, i.e., two component granular regions of relatively high dilution.

The final generalization to granular regions containing n particle types is straightforward although notationally cumbersome. If it is further specified that the additional indexes r and s (r,s = 1,n) shall refer to the specific particle type within a particular granular region, then $P_{r/k}$, the conditional probability of colliding in particle type r in region k given a collision in that region, can be written as

$$P_{r/k} = P^{r}_{k}(V^{r}_{o}\Sigma^{r}_{o})_{k}/\Sigma_{k} \qquad (18)$$

where

$$\Sigma_{k} = (V_{d}\Sigma_{d})_{k} + \sum_{r=1}^{n} P^{r}_{k} \cdot (V^{r}_{o}\ \Sigma^{r}_{o})_{k} \ . \qquad (19)$$

The P^{r} is the ordinary escape probability from particle type r, V^{r}_{o} is the volume fraction of particle type r and Σ^{r}_{o} is the collision cross section;

all of which refer to granular region k. Note that

$$(V_d)_k + \sum_{r=1}^{n} (V_o^r)_k = 1.$$

With this notation, the final expressions required to complete the specification of the collision matrix for the completely generalized doubly heterogenious system under consideration are as follows:

$$P(o_k^r \rightarrow o_\ell^s) = P_k^r P_{k\ell}^* P_{s/\ell} + (1-P_k^r)\delta_{k\ell}\delta_{rs} \tag{20}$$

$$P(o_k^r \rightarrow d_\ell) = P_k^r P_{k\ell}^* P_{d/\ell} \tag{21}$$

$$P(d_k \rightarrow o_\ell^s) = P_{k\ell}^* P_{s/\ell} \tag{22}$$

$$P(d_\mu \rightarrow d_\ell) = P_{k\ell}^* P_{d/\ell} \tag{23}$$

$$P(o_k^r \rightarrow j) = P_k^r P_{kj}^* \tag{24}$$

$$P(j \rightarrow o_\ell^s) = P_{j\ell}^* P_{s/\ell} \tag{25}$$

$$P(j \rightarrow d_\ell) = P_{jk}^* P_{d/\ell} \tag{26}$$

$$P(d_k \rightarrow j) = P_{\mu j}^* \tag{27}$$

PROGRAMMING INFORMATION

The major programming differences in GRANIT as compared to the cylindrical geometry version of THERMOS is the addition of a TIJ subroutine and modifications to the editing routines to expand the output to include the additional descriptions required when considering granular material regions. These changes are covered in this section.

Subroutine TIJ

This subroutine takes the NT by NT by IX collision probability matrix determined by the ray tracing technique in subroutine GEOM using the "effective" or self-shielded granular region(s) cross sections and expands it into the final NX by NX by IX matrix using the expression given in the theory section.

The easiest way to describe the positioning of the various subsets of collision probabilities is to use a specific example. Consider a simple two region fuel plus surrounding moderator reactor cell as this example and suppose further that the fuel is composed of two different materials in particle form (n = 2), randomly dispersed in a homogeneous third material. If this cell is subdivided into 18 annular region (NT = 18) with 6 in the fuel (NG = 6) and 12 in the moderator (NS = 12) then NX = NT + n·NG = 30.

Figure 1 illustrates the positioning of the various probability subsets within the final matrix for this example. The definitions of the FORTRAN names in Figure 1 and the associated equation number which would be used in determing their values are tabulated in Table 1. The expressions determining the argument ranges are also included in Figure 1. NXG and NXS in these expressions are integer tables listing, respectively,

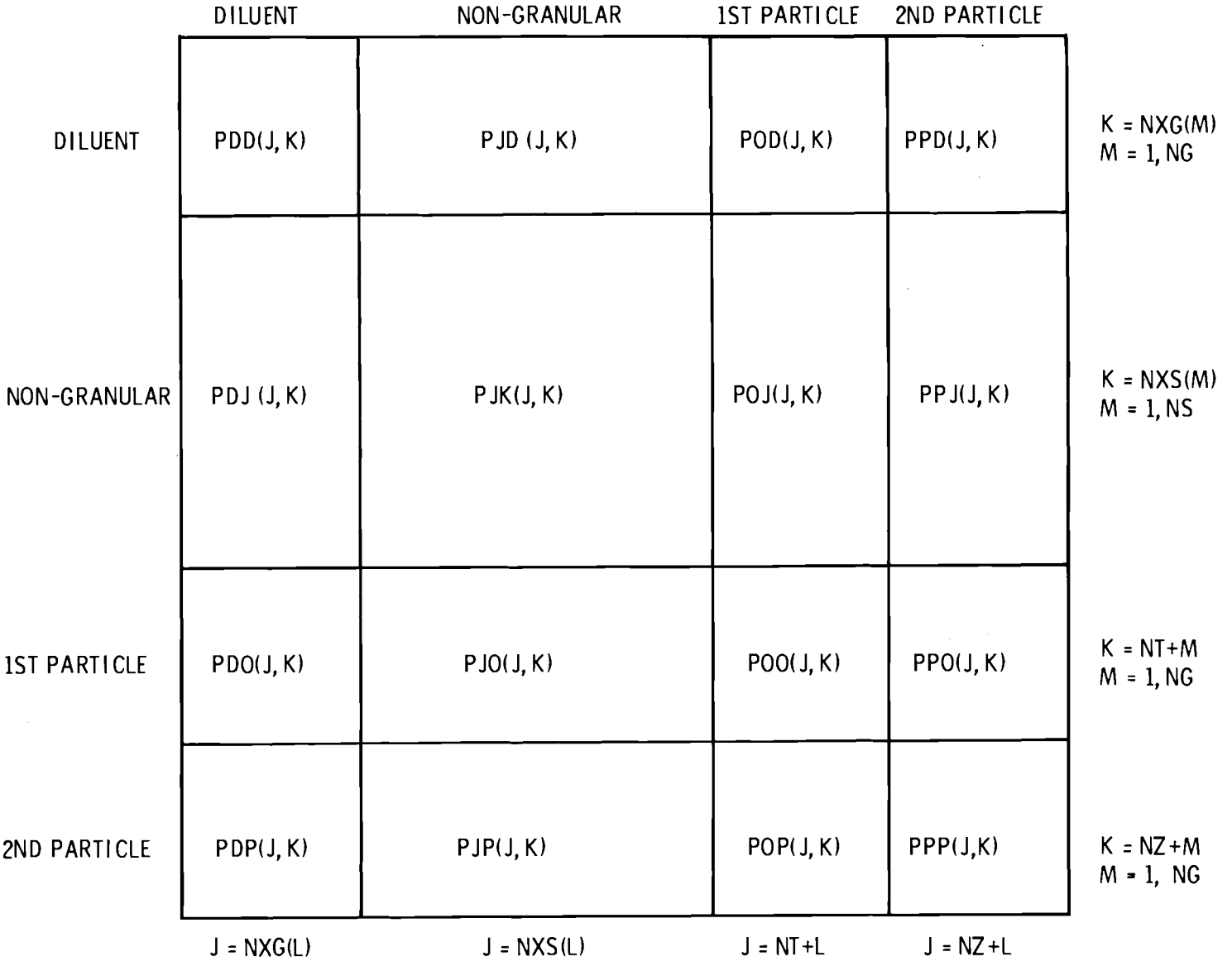
DILUENT
NON-GRANULAR
1ST PARTICLE
2ND PARTICLE
DILUENT
NON-GRANULAR
1ST PARTICLE
2ND PARTICLE
PDD(J, K)
PJD (J, K)
POD(J, K)
PPD(J, K)
PDJ (J, K)
PJK(J, K)
POJ(J, K)
PPJ(J, K)
PDO(J, K)
PJO(J, K)
POO(J, K)
PPO(J, K)
PDP(J, K)
PJP(J, K)
POP(J, K)
PPP(J,K)
K = NXG(M)
M = 1, NG
K = NXS(M)
M = 1, NS
K = NT+M
M = 1, NG
K = NZ+M
M = 1, NG
J = NXG(L)
J = NXS(L)
J = NT+L
J = NZ+L

FIGURE 1

The subregion number of the granular and nongranular spacial intervals respectively, in increasing order of occurrence. (See the description of cards 5 and 6 in the GRANIT input instructions).

TABLE 1

SUBROUTINE TIJ VARIABLE NAME DEFINITIONS

FORTRAN NAME	PROBABILITY SUBSET	EQUATION NO.
PJK	Nongranular to nongranular	14'
POO	1st particle to 1st particle	20
PPP	2nd particle to 2nd particle	20
POP	1st particle to 2nd particle	20
PPO	2nd particle to 1st particle	20
POD	1st particle to diluent	21
PPD	2nd particle to diluent	21
PDO	diluent to 1st particle	22
PDP	diluent to 2nd particle	22
PDD	diluent to diluent	23
POJ	1st particle to nongranular	24
PDJ	2nd particle to nongranular	24
PJO	nongranular to 1st particle	25
PJP	nongranular to 2nd particle	25
PJD	nongranular to diluent	26
PDJ	diluent to nongranular	27

GRANIT INPUT INSTRUCTIONS

A GRANIT run consists of one or more cases. A case is one computational run through the code. Multiple cases and spacial change cases, both logically independent are processed sequentially.

Data for each case must appear exactly as specified in the input instructions. The units used throughout the input are as follows:

Cross Sections	- barns
Dimensions	- centimeters
Nuclide Concentrations	- atoms per barn/cm
Speed	- unitless multiples of 2200 m/sec
Mass	- unitless multiples of the neutron mass
Temperature	- unitless multiples of 293.6° K.

GRANIT Input Instructions

Card 1 - Format (72H)

72 Hollerith character identification with a one in column 1 for program control of the printer.

Card 2 - Format (6I5, 3E10.5)-(IDENTA, IBY, MGEOM, NGEOM, NBETA, BLANK, PATHNO,P1,P2)

IDENTA	Case identification number. If negative or zero, program exits.
IBY	Bypass, normally zero. If >0, the cross sections used for the last case will be used again. If <0, the edit from the last case will be repeated with new parameters.
MGEOM	Particle geometry indicator. Used when granular structure is being handled explicitly. (0/1 = sphere/infinite cylinder) for all particles. If MGEOM is negative, the particle geometry is input for each granular subregion for each group of particle sizes via card 9.
NGEOM	Boundary geometry indicator (0/1/2 = Cyl/Rect/Hex) Used when non-zero or non-one boundary albedo's are input. Normally 0.
NBETA	Even number of angular intervals between zero and π to be used in the ray tracing technique of calculating the T matrix. Maximum 100. Suggested the larger of either 20 or NT if NT is even or NT + 1 if NT is odd. NT = NG + NS. (See Card 3 for definition of NG and NS)
BLANK	Not used.
PATHNO	Maximum number of total-mean-free-paths a neutron is followed for each angle before being neglected in the ray tracing technique of calculating the T matrix. PATHNO $\leq$10. Normally 5.0.
P1 and P2	Lattice pitch(s) in centimeters. Used only if NGEOM >0. P2 ignored if NGEOM = 2.

If IBY >0 and NG =0, skip to card 24.
If IBY >0 and NG$\neq$ 0, skip to card 7.
If IBY <0, skip to card 28.

Card 3 - Format (9I5)-(NX, IX, ISOX, ISOXE, ICX, ICXE, NG, NS)

NX	Total number of space points. NX = 2NG + NS $\leq$30 for one particle type in all granular subregions. NX = 3NG + NS $\leq$30 for two particle types in all granular regions.
IX	Number of speed groups. IX $\leq$35.
MX	Number of mixtures. MX $\leq$10.
ISOX	Number of isotopes used in cell from library tape. ISOX $\leq$20.
ISOXE	Number of isotopes used in edit from library tape. ISOXE $\leq$20.
ICX	Number of isotopes used in cell from card input. ICX $\leq$20 - ISOX.
ICXE	Number of isotopes used in edit from card input. ICXE $\leq$20 - ISOXE.
NG	Total number of space points in the granular regions. NG $\leq$15 for one particle type in all granular regions. NG $\leq$10 for two particle types in all granular regions.
NS	Total number of space points in the non-granular regions.

Card 4 - Format (24I3) - (MTBL(N),N = 1,NX)

MTBL(N)	Mixture number (1 to 10) assigned to each space point. In the case of granular structure the diluent and particle type(s) mixtures are formed separately and the special space point assignment of the particle(s) and diluent mixture numbers is made as follows: The diluent mixture numbers are assigned to the respective space point in which they actually occur, i.e., at each of the granular subregions. The particle mixture numbers are assigned consecutively (in order of the granular space point occurrence) to the NG or 2NG extra space points. In two particle type cases, the first particle types mixture numbers are assigned to the first NG extra space points and the second particle types mixture numbers are assigned to the second NG extra space points.

If NG = 0, skip to Card 10.

Card 5 - Format (24I3)-(NXG(N),N=1,NG)

NXG(N) — Space point number of the Nth consecutive granular space point-starting at the innermost granular subregion.

If NS = 0, skip to Card 7.

Card 6 - Format (24I3)-(NXS(N),N=1,NS)

NXS(N) — Space point number of the Nth consecutive non-granular space point-starting at the innermost non-granular subregion.

Card 7 - Format (7E10.5)-((VAK(N,M),M=1,7),N=1,NG or 2NG)

VAK(N,M) — Weight factor for the Mth group of particle sizes in the Nth consecutive granular subregion. In two particle cases the first NG cards are for the first particle type and the second NG cards are for the second particle type. The 7 weighting factors for each N are normalized such that their sum is equal to the total first or second particle type volume fraction.

$$VA(N) = \sum_{M=1}^{7} VAK(N,M) \quad \text{where}$$

VA(N),N=1,NG are the volume fractions of the first particle type in the NG granular subregions and VA(N),N=NG+1,2NG are the volume fractions of the second particle type in the same NG granular subregions.

Card 8 - Format (7E10.5)-((DIAK(N,M),M=1,7),N=1,NG or 2NG)

DIAK(N,M) — Mean particle diameter in centimeters of the Mth group of first particle type sizes in the Nth consecutive granular subregion. The mean diameter of the 2nd particle type follow the 1st particle cards in the same manner as the weighting factors.

If MGEOM >0, neglect card 9.

Card 9 - Format (24I3)-(NVPGM(K,M),K=1,NG or 2NG),M=1,7)

VNPGM(K,M)	Variable particle geometry index (0/1 = sphere/ cylinder) reads 7 cards, one for each particle size group. First NG positions on each card refer to the first particle and 2nd NG positions refer to the 2nd particle type (if any).

If IBY >0, skip to card 24.

If ISOX+ISOXE>0 skip to card 14.

Card 10 - Format (2I5,6E10.5)- (ISTBA(J),ISTBB(J),CONCTA(J,M),M=1,MX)

ISTBA(J)	First ident of Jth isotope used in cell.
ISTBB(J)	Second ident of Jth isotope used in cell.
(CONCTA(J,M), M=1,MX)	Concentration of the Jth isotope used in the Mth mixture of the cell.

If MX>6 two cards are needed for each isotope, where the second card contains both idents then it's concentration in the 7th, 8th, etc., mixtures.

Note: Repeat card 10 for J=1,ISOX

Card 11 - Format (2I5,E10.5)-(ISTBE(J),ISTBG(J),CONCTE(J)

ISTBE(J)	First ident of Jth isotope used in edit.
ISTBG(J)	Second ident of Jth isotope used in edit.
CONCTE(J)	Concentration of Jth isotope used in edit.

Note: Repeat Card 11 for J=1,ISOXE.

Card 12 - Format (7E10.5)-(V(I),I=1,IX)

V(I)	Speed mesh points in increasing order.

Card 13 - Format (7E10.5)-(DV(I),I=1,IX)

DV(I)	Integration weights for speed mesh.

If ICX=0, skip to cards 18, 19, and 20.

Card 14 - Format (2I5,6E10.5)-(ISTBA(LP),ISTEB(LP),CONCTA(LP,M),M=1,MX)

ISTBA(LP)	First ident of LPth isotope not in library used in cell
ISTBB(LP)	Second ident of LPth isotope used in cell.
CONSTA(LP,M)	Concentration of LPth isotope used in cell in the Mth mixture.

If Mx>6, two 14 cards are needed for the LPth isotope, where the second card contains both idents then it's concentration in the 7th, 8th, etc., mixtures.

Card 15 - Format (2I5,E10.5)-(NXAT,NKERT,TP)

NXAT	If zero, σ_a for the LPth isotope is tabular. If nonzero, σ_a is 1/v.
NKERT	Number of terms in sum for LPth scattering kernel. If NKERT <0, $\sigma_s(v)$ will be read from card 17a.
TP	Temperature for isotope LPth scattering kernel. XAT(L),I)

Card 16 - Format (7E10.5)-(VALXA(I),I=1,IX)

VALXA(I)	Microscopic absorption cross section for the LPth isotope. If NXAT≠0, only one number, $\sigma_a(KT_o)$, is read.

If NKERT 0, neglect card 17a

Card 17a- Format (3E10.5)- AT(N),AMT(N),AKT(N)

AT(N)	Cross section σ_n used in nth term of LPth isotopes scattering kernel.
AMT(N)	Mass used in nth term of Lpth isotopes scattering kernel.
AKT(N)	Value χ_n used in nth term of LPth isotopes scattering kernel.

Note: Card 17a is repeated for N=1,NKERT

Card 17b - neglect if NKERT ≥0

7E(10.5)(XST(LP,I),I=1,IX)	Microscopic scattering cross section for the Lpth isotope

Note: Cards 14 through 17b are repeated for LP=ISOX+1,ISOX+ICX

If ICXE=0, skip to card 21.

Card 18 - Format (2I5,E10.5)-ISTBE(LP),ISTBG(LP),CONCTE(LP))

ISTBE(LP)	First ident of LPth isotope not in library used in edit.
ISTBG(LP)	Second ident of LPTh isotope used in edit.
CONCTE(LP)	Concentration of LPth isotope used in edit.

Card 19 - Format (I5)-(NXAT)

NXAT	If zero, σ_a for the LPth isotope is tabular. If nonzero, σ_a is 1/v.

Card 20 - Format (7E10.5)-(VALXA(I), I=1,IX)

VALXA(I)	Microscopic absorption cross section for LPth isotope used in edit. If NXAT≠0, only one number, $\sigma_a(KT_o)$ is read.

Cards 18 through 20 are repeated for LP=ISOXE+1,ISOXE+ICXE.

Card 21 - Format (2I5)-(NSC,NST)

NSC	Number of source coards used of type 23.
NST	If ≤0, a spacially flat source is used. If >0, the distribution $Sd(r_i)$ is read.

If NST ≤0, neglect card 22.

Card 22 - Format (7E10.5)-(SD(N),N=1,NX)

SD(N)	Spatial source distribution.

Card 23 - Format (I5,4E10.5)-(M,AM,HXS,HCON,TP)

M	Mixture number (1-10)in which this source is used.
AM	Mass used in the calculation of this source.
HXS	Microscopic high energy scattering cross section for this source.
HCON	Concentration of isotope for this source.
TP	Effective temperature of protons. If the error function correction is not used, TP=0.

Note: Card 23 is repeated NSC times.

Card 24- Format (3I5,E10.5)-(LEAKT,NXA,NAX,CONA)

LEAKT	If <0, cylinder with vacuum boundary. If =0, either cylinder with vacuum boundary (NAX=0), or "white" boundary with arbitrary radial leakage (NAX≠0). If >0, cylinder with reflecting boundary.

Card 24 - Continued

NXA	Number of macro-regions.
NAX	If <0, speed dependent albedos to be used If =0, vacuum boundary If >0, constant albedo to be used. Ignored if LEAKT>0.
CONA	Value of constant albedo. (NAX>0).

Neglect card 25, unless NAX<0.

Card 25 - Format (7E10.5)-(ALBEDO(I),I=1,IX)

ALBEDO(I)	Speed dependent albedos, starting at lowest speed mesh.

Card 26 - Format (2I5,E10.5)-(NR,NP,TH)

NR	Macro-Region number in increasing order.
NP	Number of space points in this region.
TH	Thickness of this region. (cm)

There are NXA type 26 cards.

Card 27 - Format (5E10.5,4I5,I2)-(EPS,RELC,EPSG,OVERX,FACTOR,ITBG,LCMX, ITDM,ITMAX,IPT)

EPS	Neutron density convergence criteria, $\varepsilon_p(=10^{-5})$.
RELC	Initial overrelaxation factor, $\omega_o(=1.2)$.
EPSG	Extrapolation criteria, $\varepsilon_e(=0.05)$.
OVERX	Maximum extrapolation factor (=100.).
Factor	Under-extrapolation factor (=1.0).
ITBG	Minimum iteration before extrapolation, $\ell_b(=5)$.
LCMX	Number of overrelaxation factors tested, $\ell_c(=5)$.
ITDM	Minimum delay between extrapolations, $\ell_d(=5)$.
ITMAX	Maximum number of inner iterations allowed (100).
IPT	Iteration print record trigger (=1). If ≠0, record of each iteration is printed, if =0, print is omitted.

If the 27 card is left blank, the quantities in parentheses will be used.

Card 28 - Format (6I5)-(IXPCM,(NLOW(J),IXPT(J)),J=1, IXPCM)

IXPCM	Number of edit speed groups used ≤ 5.
NLOW(J)	Lower speed mesh index number of the J^{th} edit group.
IXPT(J)	Upper speed mesh index number of the J^{th} edit group.

Card 29 - Format (24I3)-(NRTBL(N), N=1, NX)

NRTBL(N)	An integer assigned to each space point, where a sequence of the same integer defines an edit region. The spatial averages are done over each edit region.

Termination

If more cases are to be done, return to card 1. If this is the last case, use the following:

Card 30 - Format (72H)

A 72 character card indicating that the cases are complete.

Card 31

A blank card.

THE AUXILIARY CODES LIBP AND RESUME

A. General Comments

LIBP[10] prepares a cross section data tape for GRANIT just as the original LIBP did for THERMOS. Since the version of LIBP included with GRANIT has been changed somewhat from the original, a complete set of input instructions is included.

RESUME[11] reads the GRANIT library tape and prepares a listing of the isotopes on the tape. For each isotope, this listing includes: The first and second identification number, the name, the atomic mass, the 2200 m/sec cross section, a label denoting the method by which the point absorption or fission cross sections were put on tape (1/v or tabular), the physical temperature used in the scattering model, the high energy scattering cross section, the type of scattering kernel used, the number of scattering kernel decks, and the date the data was added or last changed.

B. LIBP Input Instructions

The units used throughout LIBP input are:

Cross Section - barns

Speed - unitless multiples of 2200 m/sec.

Mass - unitless multiples of the neutron mass.

Temperature - unitless multiples of 293.6^{o}K.

Format	Variable	Description
Card 1		
72 H	--	Title
Card 2		
10I5	ITAG	If $\geq$ 0, make a new library tape.
		If < 0, update existing library tape.
	IX	Number of speed groups. IX $\leq$.01.
	NISA	Number of isotopes to be added to existing library tape or to be included in new library tape.
	NISD	Number of isotopes to be deleted from existing library tape.
	MONTH NDAY NYEAR	Date for the new or updated library tape.
	ITMOD	Labeling option for new or updated library tape.
		If = 1, tape will be labeled THERML. If = 2, tape will be labeled EPI-TH. If = 3, EXP-TH.
	NTI	Neglect unless ITAG $\geq$ 0.
		If > 0 reads V, DV, (XA(I), I=1,IX), and A from logical unit 14, where A = σ_x^0 and XA(I) = $\sigma_x(v_i)$.
		If $\leq$ 0 reads V,DV, from cards 4 and 5 and cross sections from cards 7 through 11 as applicable.

Format	Variable	Description
Card 3		
	(IGNORE IF NISD $\leq$ 0).	
2I5	NIDM(J)	1st ident of J^{th} isotope to be deleted.
	NIDMA(J)	2nd ident of J^{th} isotope to be deleted.
		SPEED MESH
Card 4		(IGNORE CARDS 4 and 5 IF ITAG < 0 or NTI >0)
7E10.5	V(I)	Speed of group I(I = 1, IX)
Card 5		
7E10.5	DV(I)	Delta speed of group I(I=1, IX).
	Input for each of the NISA isotopes	
Card 6		
4I5	IDM	1st ident of this isotope (may not be zero).
7I5	IDMA	2nd ident of this isotope (2 for fission).
	IDA	If = -2, computes scattering kernel, kernel written on tape and punched out on cards.
		If = -1, computes kernel and writes it on tape.
		If $\geq$ 0, kernel decks are read and put on tape.
	IDAP	Not applicable if NTI > 0.
		If $\neq$ 0, $\sigma_x = \sigma_x^o/v_i$.
		If = 0, σ_x is tabular.

(Note: The subscript x is used to denote either a for absorption or f for (IDMA = 2) for fission.

If NTI > 0 neglect cards 7 and 8.

Format	Variable	Description
Card 7	(Used only if IDAP ≠ 0)	
7E10.5	A	σ_x^o for this isotope.
	ATOM	Atom mass of this isotope.
	XXXS	High energy scatter cross section for this isotope recommended for use in GRANIT source calculation.
Card 8	(Used only if IDAP = 0)	
(7E10.5)	(XA(I), I = 1, IX)	Microscopic cross sections $\sigma_x(v_i)$ for this isotope.
	A	$\sigma_x^o \equiv \sigma_x$(2200 m/sec).
	B	ν constant value of the number of neutrons per fission for this isotope. Neglect unless IDMA = 2.

Scattering Kernel Input Directly by Cards

(Ignore Cards 9 and 10 unless IDA >0)
(Ignore Cards 9, 10, 11, 12 and 13 if IDA=0)

Format	Variable	Description
Card 9		
(6I5,	ICARD	Scattering kernel deck card requires number (ICARD = 1)
	IDM	1st identification (AZ) of this isotope. In the normal format, IDM = 23592 would be used for 92U28
	IDMA	2nd identification IDMA = 1 for nonfissile isotope with room temperature scatter, IDMA = 2 for fission isotope. IDMA = Temperature index of material/isotope (^oK)
	IX	Number of speed points.

Card 9 (continued)

	LX	Total number of elements of the scattering kernel to be read, LX = IX(IX+1)12
	IØ	Not used
1PE12.4)	T	Temperature used to generage the scattering kernel.

Card 10

(I5,	ICARD	Scattering kernel deck card sequence number (ICARD $\geq$ 2)
6ϕ12)	P(I,J)	The actual P matrix element - excluding the upscatter. These are read (6 per card) in the following order: ((P(I,J),I = 1,J),J = 1,IX)

Cards 9 and 10 are repeated IDA times.

Input Parameters for Computing Scattering Kernel

Format	Variable	Description
Card 11	(Ignore Cards 11 and 12 unless IDA < 0)	
(I5,	NK	Number of terms to be used in the sum in the BSJ scattering kernel computation. (NK $\leq$ 10)
E10.5)	T	Temperature to be used in gas kernel.
Card 12		
(3E10.5)	(ZAT(N),	Microscopic scattering cross section to be used in the Nth term of the gas kernel computation.
	ZAMT(N)	Mass used in the Nth term.
	ZAKT(N),	Value of κ used in the Nth term
	N = 1, NK)	

Card 13	(Ignore unless IDA = 5)	
(7E10.5)	(XS(L),I	Tabular scattering cross section values
	= 1, IX)	PA(I,I) to set equal to V(I)XS(I).

Note: Cards 6, 7, 8, 9, 10, 11, 12, and 13 are repeated NISA times.

Termination

Card 14	Blank card

C. LIBP Internal Logical Unit Designations

LIBP Logical Unit Assignments	Usage	Description
NTIN = 5	Card reader	
NTOUT = 6	Printer	
NTLIB = 8	Tape H	Old and/or New Library Tape.
NTEMP = 10		Scratch Drum.
NTQUN = 14	Tape G	Input Data Tape.

D. Structure of Binary Library Tape Prepared by LIBP

Logical Record	Symbol	Description
1	IX	Number of Speed Groups.
	Month	Date of library.
	NDAY	
	NYEAR	
	ITMOD	Library label index, if ITMOD = (1)/12), label = (THERML)/(EPI-TH).
2	V(I)	Speed, v_i, i = 1, IX.
3	DV(I)	Speed interval about v_i,dv_i, i = 1, IX.

The following group of records is repeated for each isotope:

4	IDM	First identification number.
	IDMA	Second identification number.
	IDB	Normally one. If negative, this is last isotope on tape.
	IDA	Number (0-4) of P decks for this isotope.
	T	Temperature of this isotope.

Logical Record	Symbol	Description
4 (continued)	ATOM	Atomic or molecular weight
	XXXS	Source scattering cross section or, if IDMA = 2, thermal ν.
	IM	Month }
	ID	Day } Date of addition or update for
	IY	Year } this isotope.
	IT	Label index IT=(1)/(2), cross sections are (1/v)/(Tab).
	IK	Label index IK=(1)/(2)/(3), kernel is (BSJ)/(NEL)/(Blank).

Structure of DBP Input Data Tape (Logical Unit 14)

Logical Record	Symbol	Description
1	V(I)	Speed at the center of group I(I=1,IX)
2	DV(1)	Delta speed of group I(I=1,IX)

The following record is repeated for each of the NISA isotopes making up the new GRANIT library tape.

3	XA(I)	Absorption or fission cross section of this isotope at speed point v_i = V(I), I=1,IX
5.	XA(I)	Absorption (or fission if IDMA=2) cross section at v_i, i=1,IX.
6	PA(I,J)	Isotopic scattering (zeroth legendre) component P deck. If IDA <1, ignore.

Logical Record	Symbol	Description
7	PB(I,J)	First legendre component P deck. If IDA < 2, ignore.
8	PC(I,J)	Second Legendre component P deck. If IDA < 3, ignore.
9	PD(I,J)	Third Legendre component P deck. If IDA < 4, ignore.

```
* XQT  CUR                                GRANIT OUTPUT SAMPLE GRANIT PROBLEM

  1. IN B

     END FILE --- UNIT B

  2. TRI B

  3. TOC

                                                        ELEMENT TABLE

  RESUME          ABSOLUTE                    08 JUL 70  13:14:57   1  00437654   3936     1
  GRANIT          ABSOLUTE                    30 SEP 70  17:04:37   1  00447414  16032     1
  LIBP            ABSOLUTE                    18 NOV 70  10:28:29   1  00506654   6900     1

     ENTRY POINT TABLE EMPTY

     BLOCK TABLE EMPTY

     COBOL LIBRARY TABLE EMPTY

     PROCEDURE NAME TABLE EMPTY

  18 TRACKS REQUIRED FOR BATCH FASTRAND FILE

     END CUR


* XQT GRANIT
```

```
 H-1 TYPE III FUEL COLD POISONED PIN NO VOID - 100 MICRON SPHERICAL P

00000131245

IDENT     3

SPACE POINTS= 23
GROUPS= 30
MIXTURES=  4
LIBRARY ISOTOPES IN CELL=  5
LIBRARY ISOTOPES IN EDIT=  6
ADDED ISOTOPES IN CELL=  1
ADDED ISOTOPES IN EDIT=  1
NO OF GRANULAR REGIONS=  8
NO OF NON-GRANULAR REGIONS=  7
NO OF ANNULAR REGIONS= 15
THERMOS DATA TAPE DATED  1/ 9/68       THERML

ADDED ISOTOPE  64000-   29  IN CELL   T=  1.00000+00

XA
 4.94000+05  1.88000+05  1.28000+05  9.80000+04  8.10000+04
 7.10000+04  6.23000+04  5.70000+04  5.22000+04  4.83000+04
 4.42000+04  4.00000+04  3.57000+04  3.10000+04  2.61000+04
 2.14000+04  1.66000+04  1.26000+04  9.30000+03  6.60000+03
 4.77000+03  3.23000+03  2.43000+03  1.48000+03  8.38000+02
 5.05000+02  2.98000+02  1.77000+02  1.03000+02  7.30000+01
  XS=  7.86000+00     M=  1.57250+02     KAPPA=  0.00000

XS
 1.19874+01  8.48464+00  8.13775+00  8.01624+00  7.96002+00
 7.92943+00  7.91101+00  7.89905+00  7.89086+00  7.88494+00
 7.88062+00  7.87736+00  7.87479+00  7.87275+00  7.87111+00
 7.86970+00  7.86845+00  7.86734+00  7.86637+00  7.86555+00
 7.86482+00  7.86415+00  7.86367+00  7.86308+00  7.86248+00
 7.86205+00  7.86168+00  7.86137+00  7.86111+00  7.86096+00

ADDED ISOTOPE  64000-   29  IN EDIT

XA
 4.94000+05  1.88000+05  1.28000+05  9.80000+04  8.10000+04
 7.10000+04  6.23000+04  5.70000+04  5.22000+04  4.83000+04
 4.42000+04  4.00000+04  3.57000+04  3.10000+04  2.61000+04
 2.14000+04  1.66000+04  1.26000+04  9.30000+03  6.60000+03
 4.77000+03  3.23000+03  2.43000+03  1.48000+03  8.38000+02
 5.05000+02  2.98000+02  1.77000+02  1.03000+02  7.30000+01
```

GRANIT CASE NO. 3 * PAGE 2

ISOTOPE	CONC MIX 1	CONC MIX 2	CONC MIX 3	CONC MIX 4	CONC MIX 5	CONC MIX 6	CONC MIX 7	CONC MIX 8	CONC MIX 9	CONC MIX10
USED IN CELL										
25592- 1	5.94843-04	0.00000	0.00000	0.00000	-0.00000	-0.00000	0.00000	0.00000	0.00000	0.00000
23892- 1	2.24611-02	0.00000	0.00000	0.00000	-0.00000	-0.00000	0.00000	0.00000	0.00000	0.00000
40- 10	0.00000	4.25220-02	0.00000	0.00000	-0.00000	-0.00000	0.00000	0.00000	0.00000	0.00000
101- 52	0.00000	0.00000	6.68620-02	0.00000	-0.00000	-0.00000	0.00000	0.00000	0.00000	0.00000
1608- 1	4.61119-02	0.00000	3.34310-02	3.69185-02	-0.00000	-0.00000	0.00000	0.00000	0.00000	0.00000
64000- 29	0.00000	0.00000	0.00000	2.46124-02	-0.00000	-0.00000	0.00000	0.00000	0.00000	0.00000
USED IN EDIT										
25592- 1	1.00000+00									
25592- 2	2.43000+00									
23892- 1	1.00000+00									
40- 10	1.00000+00									
101- 52	1.00000+00									
1608- 1	1.00000+00									
64000- 29	1.00000+00									

REGION NO	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23
MIXTURE NO	1	1	1	1	1	1	1	1	2	2	3	3	3	3	3	4	4	4	4	4	4	4	4

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ANNULAR REGION NO 1 2 3 4 5 6 7 8
GRANULAR REGION NO 1 2 3 4 5 6 7 8

ANNULAR REGION NO 9 10 11 12 13 14 15
NON-GRANULAR REGION NO 1 2 3 4 5 6 7

VOLUME FRACTIONS AND MEAN DIAMETERS FOR PARTICLE TYPES 1 AND 2

SPACE POINT	TYPE 1 K	TYPE 1 VA(K)	TYPE 1 DIA(K)	TYPE 2 M	TYPE 2 VA(M)	TYPE 2 DIA(M)
1	1	.01389800	.01000000	9	.00000000	.00000000
2	2	.01389800	.01000000	10	.00000000	.00000000
3	3	.01389800	.01000000	11	.00000000	.00000000
4	4	.01389800	.01000000	12	.00000000	.00000000
5	5	.01389800	.01000000	13	.00000000	.00000000
6	6	.01389800	.01000000	14	.00000000	.00000000
7	7	.01389800	.01000000	15	.00000000	.00000000
8	8	.01389800	.01000000	16	.00000000	.00000000

GRANIT CASE NO. 3 * PAGE 4

SOURCE DATA

NO. OF CARDS= 8

SPACE DIST

1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00
1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00
1.00000+00	1.00000+00	1.00000+00							

SOURCE CONSTANTS

MIX 1	MASS=	2.35044+02	XS=	1.03800+01	CON=	5.94843-04	TP=	0.00000
MIX 1	MASS=	2.38051+02	XS=	1.07000+01	CON=	2.24611-02	TP=	0.00000
MIX 1	MASS=	1.59994+01	XS=	3.72000+00	CON=	4.61119-02	TP=	0.00000
MIX 2	MASS=	9.12200+01	XS=	5.49000+00	CON=	4.25220-02	TP=	0.00000
MIX 3	MASS=	1.00797+00	XS=	2.01300+01	CON=	6.68620-02	TP=	1.00000+00
MIX 3	MASS=	1.59994+01	XS=	3.72000+00	CON=	3.34310-02	TP=	0.00000
MIX 4	MASS=	1.57250+02	XS=	7.86000+00	CON=	2.46124-02	TP=	0.00000
MIX 4	MASS=	1.59994+01	XS=	3.72000+00	CON=	3.69185-02	TP=	0.00000

I	S(1,I)	S(2,I)	S(3,I)	S(4,I)	S(5,I)	S(6,I)	S(7,I)	S(8,I)	S(9,I)	S(10,I)
1	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
2	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
5	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
6	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
7	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
8	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
9	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
10	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
11	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
12	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
13	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
14	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
15	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
16	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
17	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
18	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
19	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
20	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
21	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
22	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
23	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
24	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
25	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
26	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
27	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
28	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
29	1.93635-03	1.93635-03	1.93635-03	1.93635-03	1.93635-03	1.93635-03	1.93635-03	1.93635-03	0.00000	0.00000
30	6.52299-03	6.52299-03	6.52299-03	6.52299-03	6.52299-03	6.52299-03	6.52299-03	6.52299-03	2.54551-03	2.54551-03

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I	S(11,I)	S(12,I)	S(13,I)	S(14,I)	S(15,I)	S(16,I)	S(17,I)	S(18,I)	S(19,I)	S(20,I)
1	3.87457-03	3.87457-03	3.87457-03	3.87457-03	3.87457-03	0.00000	0.00000	0.00000	0.00000	0.00000
2	1.09879-02	1.09879-02	1.09879-02	1.09879-02	1.09879-02	0.00000	0.00000	0.00000	0.00000	0.00000
3	1.63265-02	1.63265-02	1.63265-02	1.63265-02	1.63265-02	0.00000	0.00000	0.00000	0.00000	0.00000
4	2.13198-02	2.13198-02	2.13198-02	2.13198-02	2.13198-02	0.00000	0.00000	0.00000	0.00000	0.00000
5	2.59071-02	2.59071-02	2.59071-02	2.59071-02	2.59071-02	0.00000	0.00000	0.00000	0.00000	0.00000
6	3.00584-02	3.00584-02	3.00584-02	3.00584-02	3.00584-02	0.00000	0.00000	0.00000	0.00000	0.00000
7	3.37421-02	3.37421-02	3.37421-02	3.37421-02	3.37421-02	0.00000	0.00000	0.00000	0.00000	0.00000
8	3.69521-02	3.69521-02	3.69521-02	3.69521-02	3.69521-02	0.00000	0.00000	0.00000	0.00000	0.00000
9	3.96965-02	3.96965-02	3.96965-02	3.96965-02	3.96965-02	0.00000	0.00000	0.00000	0.00000	0.00000
10	4.20167-02	4.20167-02	4.20167-02	4.20167-02	4.20167-02	0.00000	0.00000	0.00000	0.00000	0.00000
11	4.38987-02	4.38987-02	4.38987-02	4.38987-02	4.38987-02	0.00000	0.00000	0.00000	0.00000	0.00000
12	4.53933-02	4.53933-02	4.53933-02	4.53933-02	4.53933-02	0.00000	0.00000	0.00000	0.00000	0.00000
13	4.65786-02	4.65786-02	4.65786-02	4.65786-02	4.65786-02	0.00000	0.00000	0.00000	0.00000	0.00000
14	4.74875-02	4.74875-02	4.74875-02	4.74875-02	4.74875-02	0.00000	0.00000	0.00000	0.00000	0.00000
15	4.81699-02	4.81699-02	4.81699-02	4.81699-02	4.81699-02	0.00000	0.00000	0.00000	0.00000	0.00000
16	4.86933-02	4.86933-02	4.86933-02	4.86933-02	4.86933-02	0.00000	0.00000	0.00000	0.00000	0.00000
17	4.90936-02	4.90936-02	4.90936-02	4.90936-02	4.90936-02	0.00000	0.00000	0.00000	0.00000	0.00000
18	4.93811-02	4.93811-02	4.93811-02	4.93811-02	4.93811-02	0.00000	0.00000	0.00000	0.00000	0.00000
19	4.95749-02	4.95749-02	4.95749-02	4.95749-02	4.95749-02	0.00000	0.00000	0.00000	0.00000	0.00000
20	4.96960-02	4.96960-02	4.96960-02	4.96960-02	4.96960-02	0.00000	0.00000	0.00000	0.00000	0.00000
21	4.97697-02	4.97697-02	4.97697-02	4.97697-02	4.97697-02	0.00000	0.00000	0.00000	0.00000	0.00000
22	4.98134-02	4.98134-02	4.98134-02	4.98134-02	4.98134-02	0.00000	0.00000	0.00000	0.00000	0.00000
23	4.98326-02	4.98326-02	4.98326-02	4.98326-02	4.98326-02	0.00000	0.00000	0.00000	0.00000	0.00000
24	4.98465-02	4.98465-02	4.98465-02	4.98465-02	4.98465-02	0.00000	0.00000	0.00000	0.00000	0.00000
25	4.98530-02	4.98530-02	4.98530-02	4.98530-02	4.98530-02	0.00000	0.00000	0.00000	0.00000	0.00000
26	4.98549-02	4.98549-02	4.98549-02	4.98549-02	4.98549-02	0.00000	0.00000	0.00000	0.00000	0.00000
27	4.98558-02	4.98558-02	4.98558-02	4.98558-02	4.98558-02	0.00000	0.00000	0.00000	0.00000	0.00000
28	4.98562-02	4.98562-02	4.98562-02	4.98562-02	4.98562-02	0.00000	0.00000	0.00000	0.00000	0.00000
29	5.12603-02	5.12603-02	5.12603-02	5.12603-02	5.12603-02	1.55030-03	1.55030-03	1.55030-03	1.55030-03	1.55030-03
30	5.38354-02	5.38354-02	5.38354-02	5.38354-02	5.38354-02	5.62128-03	5.62128-03	5.62128-03	5.62128-03	5.62128-03

I	S(21,I)	S(22,I)	S(23,I)	S(
1	0.00000	0.00000	0.00000	
2	0.00000	0.00000	0.00000	
3	0.00000	0.00000	0.00000	
4	0.00000	0.00000	0.00000	
5	0.00000	0.00000	0.00000	
6	0.00000	0.00000	0.00000	
7	0.00000	0.00000	0.00000	
8	0.00000	0.00000	0.00000	
9	0.00000	0.00000	0.00000	
10	0.00000	0.00000	0.00000	
11	0.00000	0.00000	0.00000	
12	0.00000	0.00000	0.00000	
13	0.00000	0.00000	0.00000	
14	0.00000	0.00000	0.00000	
15	0.00000	0.00000	0.00000	
16	0.00000	0.00000	0.00000	
17	0.00000	0.00000	0.00000	
18	0.00000	0.00000	0.00000	
19	0.00000	0.00000	0.00000	
20	0.00000	0.00000	0.00000	
21	0.00000	0.00000	0.00000	
22	0.00000	0.00000	0.00000	
23	0.00000	0.00000	0.00000	
24	0.00000	0.00000	0.00000	
25	0.00000	0.00000	0.00000	
26	0.00000	0.00000	0.00000	
27	0.00000	0.00000	0.00000	
28	0.00000	0.00000	0.00000	
29	1.55030-03	1.55030-03	1.55030-03	
30	5.62128-03	5.62128-03	5.62128-03	

GRANIT CASE NO. 3 * PAGE 8

NGEOM=0/1/2=CLY/RECT/HEX (WHITE BNDRY ONLY) 0

NBETA=10,12,14,----98,100 (USUALLY=20) 20

PATHNO= 2.5 TO 10.0 (USUALLY=5.) 5.00000+00

P1=CELL PITCH (NGEOM NONZERO) 0.00000

P2=SECOND PITCH FOR RECT (NGEOM=2) 0.00000

ALBEDO(I),I=1,IX

1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00
1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00
1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00	1.00000+00

CYLINDRICAL GEOMETRY - NO LEAKAGE - WHITE BOUNDARY
CYLINDRICAL OUTER BOUNDARY

REGION	THICKNESS	POINT	VOLUME	R(CENTER)	R(INNER)	R(OUTER)
1	6.33730-01					
		1	5.60759-03	0.00000	0.00000	4.22487-02
		2	4.48607-02	8.44973-02	4.22487-02	1.26746-01
		3	8.97214-02	1.68995-01	1.26746-01	2.11243-01
		4	1.34582-01	2.53492-01	2.11243-01	2.95741-01
		5	1.79443-01	3.37989-01	2.95741-01	3.80238-01
		6	2.24303-01	4.22487-01	3.80238-01	4.64735-01
		7	2.69164-01	5.06984-01	4.64735-01	5.49233-01
		8	3.14025-01	5.91481-01	5.49233-01	6.33730-01
2	8.12800-02					
		9	1.67011-01	6.54050-01	6.33730-01	6.74370-01
		10	1.77388-01	6.94690-01	6.74370-01	7.15010-01
3	3.45440-01					
		11	3.25376-01	7.49554-01	7.15010-01	7.84098-01
		12	3.55366-01	8.18642-01	7.84098-01	8.53186-01
		13	3.85357-01	8.87730-01	8.53186-01	9.22274-01
		14	4.15348-01	9.56818-01	9.22274-01	9.91362-01
		15	4.45338-01	1.02591+00	9.91362-01	1.06045+00

EARLIEST EXTRAP=100
NO. TESTED= 0
INCREMENT=100
MAX ITS=100
CONV CRIT= 1.00000-05
OVERRELAXATION= 1.00000+00
EXTRAP CRIT= 5.00000-02
MAX EXTRAP= 1.00000+02
FACTOR= 1.00000+00

IT	RENORM	RMS RES	RATIO
1	6.00419	2.5457-02	.0000
2	.81492	7.2038-03	.2830
3	.93129	4.7195-03	.6551
4	.99872	3.4184-03	.7243
5	1.01084	1.9772-03	.5784
6	1.00801	1.0216-03	.5167
7	1.00491	5.4422-04	.5327
8	1.00303	3.1157-04	.5725
9	1.00194	1.8739-04	.6014
10	1.00126	1.1596-04	.6188
11	1.00082	7.2989-05	.6294
12	1.00053	4.6422-05	.6360
13	1.00035	2.9747-05	.6408
14	1.00022	1.9164-05	.6442
15	1.00015	1.2392-05	.6466
16	1.00010	8.0355-06	.6485
17	1.00006	5.2207-06	.6497
18	1.00004	3.3963-06	.6505
19	1.00003	2.2125-06	.6515
20	1.00002	1.4415-06	.6515
21	1.00001	9.4087-07	.6527
22	1.00001	6.1245-07	.6509
23	1.00001	4.0008-07	.6532
24	1.00000	2.6132-07	.6532
25	1.00000	1.7041-07	.6521
26	1.00000	1.1137-07	.6536
27	1.00000	7.2690-08	.6527
28	1.00000	4.7541-08	.6540
29	1.00000	3.0962-08	.6513
30	1.00000	2.0034-08	.6471
31	1.00000	1.3506-08	.6741
32	1.00000	8.8628-09	.6562

ITCNT= 32 RENORM= 1.00000+00 EPS= 4.53557-07
LARGEST RES= 4.24683-07 MEAN RES= 8.86279-09 N(V*)= 2.84617-02

I	N(1,I)	N(2,I)	N(3,I)	N(4,I)	N(5,I)	N(6,I)	N(7,I)	N(8,I)	N(9,I)	N(10,I)
1	3.99837-05	7.36394-05	1.31819-04	1.47267-04	1.61052-04	2.85897-04	5.66611-04	1.45627-03	4.16104-03	4.35036-03
2	1.41912-03	1.67378-03	2.17616-03	2.72311-03	3.43684-03	5.27359-03	8.45814-03	1.51527-02	2.82167-02	2.98140-02
3	5.22855-03	5.79476-03	6.98818-03	8.48001-03	1.04668-02	1.49205-02	2.21585-02	3.61402-02	6.07875-02	6.38987-02
4	1.15975-02	1.25309-02	1.45945-02	1.73338-02	2.10364-02	2.87511-02	4.09684-02	6.35973-02	1.01931-01	1.07345-01
5	1.98624-02	2.11789-02	2.41983-02	2.83533-02	3.39590-02	4.52426-02	6.27979-02	9.45647-02	1.46260-01	1.55078-01
6	2.91573-02	3.08626-02	3.48360-02	4.03999-02	4.79399-02	6.27329-02	8.55423-02	1.26178-01	1.91078-01	2.02415-01
7	3.85589-02	4.05949-02	4.54343-02	5.22868-02	6.16369-02	7.96322-02	1.07172-01	1.55779-01	2.32217-01	2.45954-01
8	4.71878-02	4.95043-02	5.50446-02	6.29949-02	7.39049-02	9.45557-02	1.26038-01	1.81144-01	2.67148-01	2.83158-01
9	5.44580-02	5.69726-02	6.30440-02	7.18507-02	8.39244-02	1.06572-01	1.40987-01	2.00918-01	2.93661-01	3.11210-01
10	5.99977-02	6.26315-02	6.90401-02	7.84022-02	9.12618-02	1.15188-01	1.51441-01	2.14396-01	3.11330-01	3.30018-01
11	6.35851-02	6.62568-02	7.27071-02	8.24053-02	9.56898-02	1.20117-01	1.57166-01	2.21247-01	3.19416-01	3.39046-01
12	6.53365-02	6.79648-02	7.44768-02	8.40695-02	9.73985-02	1.21701-01	1.58493-01	2.22094-01	3.19073-01	3.39586-01
13	6.54683-02	6.80073-02	7.43111-02	8.36892-02	9.67149-02	1.20321-01	1.56007-01	2.17619-01	3.11321-01	3.31868-01
14	6.42755-02	6.66866-02	7.26479-02	8.15965-02	9.40482-02	1.16471-01	1.50285-01	2.08522-01	2.96900-01	3.16619-01
15	6.21422-02	6.43652-02	6.98654-02	7.82494-02	8.98729-02	1.10673-01	1.41946-01	1.95602-01	2.76672-01	2.94954-01
16	5.90773-02	6.10796-02	6.60816-02	7.36519-02	8.41984-02	1.02927-01	1.31007-01	1.78859-01	2.50828-01	2.67158-01
17	5.59985-02	5.77386-02	6.21221-02	6.87847-02	7.80313-02	9.43264-02	1.18586-01	1.59559-01	2.20624-01	2.34800-01
18	5.34106-02	5.48720-02	5.86035-02	6.43010-02	7.22046-02	8.59584-02	1.06230-01	1.39992-01	1.89878-01	2.01915-01
19	5.20928-02	5.32980-02	5.63025-02	6.11561-02	6.77539-02	7.90169-02	9.54343-02	1.22307-01	1.61024-01	1.71332-01
20	5.32275-02	5.41934-02	5.67351-02	6.06769-02	6.60952-02	7.51903-02	8.82529-02	1.09139-01	1.38552-01	1.46816-01
21	5.50731-02	5.58545-02	5.79179-02	6.11247-02	6.55499-02	7.28189-02	8.30943-02	9.92136-02	1.21450-01	1.27962-01
22	5.55811-02	5.61475-02	5.76457-02	6.00122-02	6.32448-02	6.84586-02	7.57276-02	8.68104-02	1.01836-01	1.06519-01
23	5.46386-02	5.50761-02	5.62361-02	5.80660-02	6.05589-02	6.45498-02	7.00344-02	7.83115-02	8.94148-02	9.31169-02
24	5.57645-02	5.60573-02	5.68498-02	5.80996-02	5.97997-02	6.24704-02	6.61123-02	7.14663-02	7.84886-02	8.10851-02
25	5.40451-02	5.42406-02	5.47686-02	5.55981-02	5.67244-02	5.84806-02	6.08556-02	6.43070-02	6.87752-02	7.05619-02
26	4.87674-02	4.89816-02	4.92308-02	4.97702-02	5.04975-02	5.16266-02	5.31489-02	5.53377-02	5.81380-02	5.93140-02
27	4.36209-02	4.36906-02	4.38795-02	4.41802-02	4.45854-02	4.52123-02	4.60501-02	4.72432-02	4.87548-02	4.94199-02
28	3.82391-02	3.82788-02	3.83877-02	3.85613-02	3.87960-02	3.91565-02	3.96371-02	4.03195-02	4.11800-02	4.15814-02
29	3.24198-02	3.24437-02	3.25049-02	3.26017-02	3.27334-02	3.29369-02	3.32092-02	3.35971-02	3.40992-02	3.43187-02
30	2.96227-02	2.96281-02	2.96469-02	2.96768-02	2.97176-02	2.97806-02	2.98686-02	3.00046-02	3.02082-02	3.02614-02

ITCNT= 32 RENORM= 1.00000+00 EPS= 4.53557-07
LARGEST RES= 4.24683-07 MEAN RES= 8.86279-09 N(V*)= 2.84617-02

I	N(11,I)	N(12,I)	N(13,I)	N(14,I)	N(15,I)	N(16,I)	N(17,I)	N(18,I)	N(19,I)	N(20,I)
1	5.58222-03	6.99816-03	7.75261-03	8.14410-03	8.22228-03	5.01047-07	9.16965-07	1.63629-06	1.82927-06	2.00258-06
2	3.58347-02	4.52417-02	5.07687-02	5.37649-02	5.47006-02	4.60205-05	5.42712-05	7.05491-05	8.82740-05	1.11405-04
3	7.56429-02	9.37376-02	1.04989-01	1.11329-01	1.13325-01	2.48547-04	2.75455-04	3.32171-04	4.03073-04	4.97498-04
4	1.24606-01	1.52028-01	1.69636-01	1.79688-01	1.82782-01	7.18864-04	7.76719-04	9.04617-04	1.07439-03	1.30388-03
5	1.77758-01	2.14222-01	2.37971-01	2.51580-01	2.55561-01	1.48704-03	1.58560-03	1.81164-03	2.12270-03	2.54236-03
6	2.30525-01	2.74746-01	3.03827-01	3.20410-01	3.25107-01	2.48652-03	2.63195-03	2.97078-03	3.44526-03	4.08826-03
7	2.78612-01	3.28596-01	3.61638-01	3.80444-01	3.85321-01	3.73997-03	3.93746-03	4.40683-03	5.07148-03	5.97837-03
8	3.18847-01	3.72310-01	4.07700-01	4.27725-01	4.32473-01	4.99414-03	5.23931-03	5.82567-03	6.66708-03	7.82174-03
9	3.49163-01	4.03785-01	4.39899-01	4.60169-01	4.64445-01	6.28110-03	6.57108-03	7.27139-03	8.28714-03	9.67970-03
10	3.68778-01	4.22502-01	4.57881-01	4.77525-01	4.81025-01	7.46344-03	7.79107-03	8.58826-03	9.75286-03	1.13525-02
11	3.77483-01	4.28653-01	4.62145-01	4.80523-01	4.83128-01	8.61933-03	8.98148-03	9.86805-03	1.11705-02	1.29713-02
12	3.76386-01	4.24012-01	4.54900-01	4.71575-01	4.73276-01	9.74954-03	1.01417-02	1.11134-02	1.25448-02	1.45338-02
13	3.66646-01	4.10121-01	4.38073-01	4.52916-01	4.53736-01	1.08871-02	1.13093-02	1.23575-02	1.39171-02	1.60831-02
14	3.49234-01	3.88491-01	4.13485-01	4.26583-01	4.26781-01	1.22025-02	1.26602-02	1.37919-02	1.54908-02	1.78546-02
15	3.25126-01	3.60230-01	3.82470-01	3.93973-01	3.93826-01	1.38076-02	1.43015-02	1.55302-02	1.73864-02	1.99690-02
16	2.94257-01	3.25144-01	3.44555-01	3.54548-01	3.54241-01	1.56514-02	1.61818-02	1.75069-02	1.95124-02	2.23063-02
17	2.58147-01	2.84382-01	3.00765-01	3.09149-01	3.08766-01	1.83069-02	1.88755-02	2.03086-02	2.24866-02	2.55092-02
18	2.21173-01	2.42592-01	2.55840-01	2.62525-01	2.62077-01	2.14538-02	2.20407-02	2.35394-02	2.58277-02	2.90020-02
19	1.86881-01	2.03669-01	2.13929-01	2.19031-01	2.18499-01	2.54522-02	2.60410-02	2.75527-02	2.98799-02	3.31030-02
20	1.59439-01	1.72419-01	1.80240-01	1.84058-01	1.83495-01	3.11610-02	3.17264-02	3.32142-02	3.55215-02	3.86931-02
21	1.38277-01	1.48350-01	1.54352-01	1.57215-01	1.56700-01	3.68796-02	3.74027-02	3.87843-02	4.09314-02	4.38943-02
22	1.13998-01	1.21096-01	1.25274-01	1.27237-01	1.26827-01	4.20130-02	4.24411-02	4.35735-02	4.53621-02	4.78053-02
23	9.88167-02	1.04131-01	1.07214-01	1.08639-01	1.08281-01	4.41160-02	4.44692-02	4.54057-02	4.68830-02	4.88956-02
24	8.50184-02	8.85756-02	9.06114-02	9.15419-02	9.12801-02	4.88332-02	4.90896-02	4.97836-02	5.08780-02	5.23667-02
25	7.32077-02	7.54949-02	7.67872-02	7.73627-02	7.71682-02	5.00854-02	5.02660-02	5.07560-02	5.15245-02	5.25682-02
26	6.10969-02	6.25618-02	6.33761-02	6.37322-02	6.35979-02	4.65674-02	4.66860-02	4.70098-02	4.75248-02	4.82192-02
27	5.04465-02	5.12536-02	5.16984-02	5.18908-02	5.18101-02	4.24359-02	4.25036-02	4.26874-02	4.29799-02	4.33741-02
28	4.21731-02	4.26347-02	4.28837-02	4.29900-02	4.29413-02	3.75974-02	3.76363-02	3.77435-02	3.79142-02	3.81450-02
29	3.46431-02	3.48858-02	3.50160-02	3.50699-02	3.50407-02	3.21125-02	3.21362-02	3.21968-02	3.22927-02	3.24231-02
30	3.02628-02	3.02816-02	3.02965-02	3.03019-02	3.02937-02	2.94283-02	2.94336-02	2.94522-02	2.94820-02	2.95226-02

ITCNT= 32 RENORM= 1.00000+00 EPS= 4.53557-07
LARGEST RES= 4.24683-07 MEAN RES= 8.86279-09 N(V*)= 2.84617-02

I	N(21,I)	N(22,I)	N(23,I)	N(
1	3.54952-06	7.02326-06	1.80168-05	
2	1.70919-04	2.74095-04	4.90972-04	
3	7.09158-04	1.05314-03	1.71758-03	
4	1.78203-03	2.53924-03	3.94172-03	
5	3.38710-03	4.70135-03	7.07951-03	
6	5.34977-03	7.29489-03	1.07602-02	
7	7.72378-03	1.03950-02	1.51095-02	
8	1.00073-02	1.33392-02	1.91714-02	
9	1.22913-02	1.62611-02	2.31735-02	
10	1.43288-02	1.88385-02	2.66698-02	
11	1.62825-02	2.13046-02	2.99911-02	
12	1.81601-02	2.36502-02	3.31406-02	
13	2.00086-02	2.59429-02	3.61885-02	
14	2.21114-02	2.85306-02	3.95864-02	
15	2.45903-02	3.15387-02	4.34602-02	
16	2.72678-02	3.47063-02	4.73829-02	
17	3.08359-02	3.87661-02	5.21594-02	
18	3.45259-02	4.26676-02	5.62271-02	
19	3.86052-02	4.66254-02	5.97531-02	
20	4.40169-02	5.16630-02	6.38888-02	
21	4.87612-02	5.56418-02	6.64336-02	
22	5.17460-02	5.72399-02	6.56164-02	
23	5.21175-02	5.65454-02	6.32277-02	
24	5.47053-02	5.78943-02	6.25826-02	
25	5.41957-02	5.63964-02	5.95947-02	
26	4.92974-02	5.07505-02	5.28406-02	
27	4.39839-02	4.47983-02	4.59594-02	
28	3.84993-02	3.89713-02	3.96427-02	
29	3.26245-02	3.28942-02	3.32784-02	
30	2.95851-02	2.96725-02	2.98075-02	

NEUTRON SPECTRA
SPACIAL DISTRIBUTION

ENERGY	E*PHI(1,E)	E*PHI(2,E)	E*PHI(3,E)	E*PHI(4,E)	E*PHI(5,E)	E*PHI(6,E)	E*PHI(7,E)	E*PHI(8,E)	E*PHI(9,E)	E*PHI(10,E)
1.4250-04	1.12604-07	2.07387-07	3.71237-07	4.14741-07	4.53564-07	8.05156-07	1.59572-06	4.10122-06	1.17185-05	1.22517-05
1.0120-03	2.83823-05	3.34756-05	4.35233-05	5.44621-05	6.87367-05	1.05472-04	1.69163-04	3.03053-04	5.64333-04	5.96279-04
2.2765-03	2.35238-04	2.61712-04	3.14405-04	3.81524-04	4.70911-04	6.71288-04	9.96933-04	1.62598-03	2.73489-03	2.87487-03
4.0469-03	9.27552-04	1.06221-03	1.16725-03	1.38634-03	1.68247-03	2.29948-03	3.27661-03	5.08645-03	8.15234-03	8.58534-03
6.3217-03	2.48151-03	2.64598-03	3.02321-03	3.54232-03	4.24266-03	5.65238-03	7.84566-03	1.18144-02	1.82729-02	1.93747-02
9.1066-03	5.24749-03	5.55440-03	6.26948-03	7.27083-03	8.62782-03	1.12901-02	1.53952-02	2.27084-02	3.43885-02	3.64290-02
1.2397-02	9.44666-03	9.94547-03	1.11311-02	1.28089-02	1.51006-02	1.95093-02	2.62564-02	3.81649-02	5.68915-02	6.02570-02
1.6191-02	1.50996-02	1.58409-02	1.76137-02	2.01577-02	2.36488-02	3.02569-02	4.03308-02	5.79643-02	8.54847-02	9.06077-02
2.0492-02	2.20540-02	2.30722-02	2.55311-02	2.90976-02	3.39871-02	4.31589-02	5.70958-02	8.13664-02	1.18925-01	1.26032-01
2.5349-02	3.00568-02	3.13762-02	3.45867-02	3.92768-02	4.57190-02	5.77050-02	7.58666-02	1.07405-01	1.55966-01	1.65327-01
3.0669-02	3.85397-02	4.01590-02	4.41231-02	4.99468-02	5.79987-02	7.28042-02	9.52599-02	1.34100-01	1.93602-01	2.05500-01
3.6432-02	4.70423-02	4.89343-02	5.36233-02	6.05300-02	7.01269-02	8.76245-02	1.14115-01	1.59908-01	2.29733-01	2.44502-01
4.2757-02	5.53207-02	5.74662-02	6.27929-02	7.07174-02	8.17240-02	1.01671-01	1.31826-01	1.83888-01	2.63066-01	2.80428-01
4.9587-02	6.29884-02	6.53512-02	7.11931-02	7.99625-02	9.21650-02	1.14139-01	1.47275-01	2.04346-01	2.90955-01	3.10278-01
5.6922-02	6.99058-02	7.24065-02	7.86276-02	8.80253-02	1.01101-01	1.24499-01	1.59679-01	2.20039-01	3.11237-01	3.31804-01
6.5173-02	7.60923-02	7.86712-02	8.51139-02	9.48645-02	1.08449-01	1.32572-01	1.68738-01	2.30373-01	3.23070-01	3.44103-01
7.4849-02	8.23346-02	8.54078-02	9.18928-02	1.01748-01	1.15426-01	1.39530-01	1.75416-01	2.36024-01	3.26354-01	3.47323-01
8.6123-02	9.09068-02	9.33940-02	9.97453-02	1.09443-01	1.22895-01	1.46304-01	1.80808-01	2.38271-01	3.23179-01	3.43667-01
9.9186-02	1.02112-01	1.04475-01	1.10540-01	1.19878-01	1.32811-01	1.54889-01	1.87070-01	2.39746-01	3.15638-01	3.35845-01
1.1398-01	1.19895-01	1.22071-01	1.27796-01	1.36675-01	1.48880-01	1.69367-01	1.98790-01	2.45838-01	3.12090-01	3.30704-01
1.3123-01	1.42834-01	1.44860-01	1.50212-01	1.58529-01	1.70006-01	1.88858-01	2.15508-01	2.57314-01	3.14984-01	3.31874-01
1.5246-01	1.67492-01	1.69198-01	1.73713-01	1.80845-01	1.90586-01	2.06298-01	2.28202-01	2.61600-01	3.06880-01	3.20992-01
1.7217-01	1.85909-01	1.87396-01	1.91344-01	1.97571-01	2.06053-01	2.19632-01	2.38294-01	2.66456-01	3.04236-01	3.16832-01
2.0495-01	2.25864-01	2.27049-01	2.30259-01	2.35322-01	2.42208-01	2.53025-01	2.67775-01	2.89461-01	3.17903-01	3.28420-01
2.5464-01	2.71976-01	2.72857-01	2.75618-01	2.79792-01	2.85460-01	2.94298-01	3.06250-01	3.23619-01	3.46104-01	3.55096-01
3.0816-01	2.96998-01	2.97755-01	2.99820-01	3.03105-01	3.07534-01	3.14411-01	3.23682-01	3.37012-01	3.54066-01	3.61228-01
3.7598-01	3.24125-01	3.24643-01	3.26046-01	3.28281-01	3.31292-01	3.35950-01	3.42175-01	3.51041-01	3.62272-01	3.67215-01
4.6183-01	3.49009-01	3.49371-01	3.50366-01	3.51950-01	3.54093-01	3.57383-01	3.61770-01	3.67998-01	3.75852-01	3.79515-01
5.7023-01	3.65348-01	3.65618-01	3.66307-01	3.67399-01	3.68882-01	3.71175-01	3.74244-01	3.78616-01	3.84274-01	3.86747-01
6.5751-01	3.84923-01	3.84993-01	3.85236-01	3.85626-01	3.86157-01	3.86976-01	3.88120-01	3.89886-01	3.92532-01	3.93223-01

NEUTRON SPECTRA
SPACIAL DISTRIBUTION

ENERGY	E*PHI(11,E)	E*PHI(12,E)	E*PHI(13,E)	E*PHI(14,E)	E*PHI(15,E)	E*PHI(16,E)	E*PHI(17,E)	E*PHI(18,E)	E*PHI(19,E)	E*PHI(20,E)
1.4250-04	1.57209-05	1.97086-05	2.18333-05	2.29358-05	2.31560-05	1.41107-09	2.58240-09	4.60821-09	5.15168-09	5.63977-09
1.0120-03	7.18694-04	9.04834-04	1.01537-03	1.07530-03	1.09401-03	9.20409-07	1.08542-06	1.41098-06	1.76548-06	2.22809-06
2.2765-03	3.40325-03	4.21735-03	4.72355-03	5.00880-03	5.09862-03	1.11824-05	1.23930-05	1.49447-05	1.81346-05	2.23829-05
4.0469-03	9.96587-03	1.21590-02	1.35673-02	1.43712-02	1.46187-02	5.74940-05	6.21212-05	7.23504-05	8.59290-05	1.04283-04
6.3217-03	2.22083-02	2.67638-02	2.97310-02	3.14312-02	3.19285-02	1.85783-04	1.98097-04	2.26337-04	2.65200-04	3.17630-04
9.1066-03	4.14880-02	4.94464-02	5.46803-02	5.76647-02	5.85100-02	4.47504-04	4.73676-04	5.34657-04	6.20049-04	7.35770-04
1.2397-02	6.82581-02	8.05037-02	8.85987-02	9.32062-02	9.44010-02	9.16268-04	9.64649-04	1.07964-03	1.24248-03	1.46466-03
1.6191-02	1.02028-01	1.19135-01	1.30460-01	1.36668-01	1.38387-01	1.59808-03	1.67653-03	1.86415-03	2.13340-03	2.50288-03
2.0492-02	1.41402-01	1.63522-01	1.78147-01	1.86356-01	1.88088-01	2.54368-03	2.66111-03	2.94472-03	3.35607-03	3.92001-03
2.5349-02	1.84745-01	2.11659-01	2.29383-01	2.39224-01	2.40977-01	3.73892-03	3.90306-03	4.30242-03	4.88584-03	5.68722-03
3.0669-02	2.28797-01	2.59812-01	2.80111-01	2.91250-01	2.92829-01	5.22427-03	5.44378-03	5.98114-03	6.77056-03	7.86203-03
3.6432-02	2.70998-01	3.08289-01	3.27528-01	3.39534-01	3.40759-01	7.01967-03	7.30199-03	8.00167-03	9.03228-03	1.04643-02
4.2757-02	3.09816-01	3.48552-01	3.70172-01	3.82714-01	3.83407-01	9.19957-03	9.55635-03	1.04421-02	1.17599-02	1.35902-02
4.9587-02	3.42241-01	3.86719-01	4.09205-01	4.18041-01	4.18235-01	1.19582-02	1.24067-02	1.35158-02	1.51806-02	1.74971-02
5.6922-02	3.65744-01	4.08235-01	4.30253-01	4.43193-01	4.43028-01	1.55326-02	1.60883-02	1.74705-02	1.95585-02	2.24637-02
6.5173-02	3.79007-01	4.18790-01	4.43791-01	4.56662-01	4.56267-01	2.01592-02	2.08423-02	2.25491-02	2.51322-02	2.87308-02
7.4849-02	3.81859-01	4.20666-01	4.44901-01	4.57303-01	4.56736-01	2.70801-02	2.79213-02	3.00412-02	3.32628-02	3.77340-02
8.6123-02	3.78484-01	4.17901-01	4.35449-01	4.46626-01	4.46064-01	3.65151-02	3.75140-02	4.00649-02	4.39596-02	4.93624-02
9.9186-02	3.66325-01	3.99232-01	4.19343-01	4.29344-01	4.28301-01	4.98914-02	5.10455-02	5.40088-02	5.85705-02	6.48885-02
1.1398-01	3.59136-01	3.86373-01	4.05993-01	4.14593-01	4.13324-01	7.01903-02	7.14639-02	7.48151-02	8.00125-02	8.71565-02
1.3123-01	3.58626-01	3.84750-01	4.00317-01	4.07742-01	4.06406-01	9.56484-02	9.70051-02	1.00588-01	1.06157-01	1.13841-01
1.5248-01	3.43532-01	3.64918-01	3.77510-01	3.83423-01	3.82190-01	1.26605-01	1.27895-01	1.31307-01	1.36697-01	1.44060-01
1.7217-01	3.36233-01	3.54307-01	3.64798-01	3.69648-01	3.68428-01	1.50105-01	1.51308-01	1.54494-01	1.59521-01	1.66368-01
2.0495-01	3.44351-01	3.58759-01	3.67004-01	3.70773-01	3.69713-01	1.97790-01	1.98828-01	2.01639-01	2.06072-01	2.12101-01
2.5464-01	3.68411-01	3.79921-01	3.86424-01	3.89320-01	3.88342-01	2.52050-01	2.52959-01	2.55425-01	2.59292-01	2.64544-01
3.0816-01	3.72098-01	3.81006-01	3.85966-01	3.88135-01	3.87317-01	2.83600-01	2.84322-01	2.86294-01	2.89431-01	2.93660-01
3.7598-01	3.74843-01	3.80840-01	3.84145-01	3.85574-01	3.84975-01	3.15320-01	3.15823-01	3.17189-01	3.19362-01	3.22291-01
4.6183-01	3.84916-01	3.89126-01	3.91402-01	3.92371-01	3.91927-01	3.43153-01	3.43508-01	3.44487-01	3.46044-01	3.48151-01
5.7023-01	3.90403-01	3.93139-01	3.94605-01	3.95213-01	3.94884-01	3.61885-01	3.62152-01	3.62835-01	3.63916-01	3.65385-01
6.5751-01	3.93241-01	3.95489-01	3.93679-01	3.93749-01	3.93643-01	3.82397-01	3.82467-01	3.82708-01	3.83095-01	3.83622-01

NEUTRON SPECTRA
SPACIAL DISTRIBUTION

ENERGY	E*PHI(21,E)	E*PHI(22,E)	E*PHI(23,E)	E*PHI(
1.4250-04	9.99634-09	1.97793-08	5.07398-08	
1.0120-03	3.41837-06	5.48190-06	9.81943-06	
2.2765-03	3.19057-05	4.73816-05	7.72757-05	
4.0469-03	1.42525-04	2.03085-04	3.15255-04	
6.3217-03	4.23167-04	5.87363-04	8.84479-04	
9.1066-03	9.62806-04	1.31287-03	1.93652-03	
1.2397-02	1.89227-03	2.54669-03	3.70172-03	
1.6191-02	3.20224-03	4.26841-03	6.13464-03	
2.0492-02	4.97786-03	6.58532-03	9.38463-03	
2.5349-02	7.17821-03	9.43741-03	1.33606-02	
3.0669-02	9.86899-03	1.29130-02	1.81779-02	
3.6432-02	1.30753-02	1.70281-02	2.38612-02	
4.2757-02	1.69073-02	2.19217-02	3.05793-02	
4.9587-02	2.16687-02	2.79593-02	3.87937-02	
5.6922-02	2.76624-02	3.54789-02	4.88897-02	
6.5173-02	3.51213-02	4.47022-02	6.10298-02	
7.4849-02	4.56134-02	5.73440-02	7.71557-02	
8.6123-02	5.87643-02	7.26218-02	9.57005-02	
9.9186-02	7.56739-02	9.13951-02	1.17128-01	
1.1398-01	9.91484-02	1.16371-01	1.43910-01	
1.3123-01	1.26464-01	1.44307-01	1.72298-01	
1.5248-01	1.55935-01	1.72490-01	1.97732-01	
1.7217-01	1.77331-01	1.92397-01	2.15133-01	
2.0495-01	2.21574-01	2.34490-01	2.53479-01	
2.5464-01	2.72734-01	2.83809-01	2.99905-01	
3.0816-01	3.00225-01	3.09077-01	3.21804-01	
3.7598-01	3.26822-01	3.32878-01	3.41502-01	
4.6183-01	3.51385-01	3.55698-01	3.61821-01	
5.7023-01	3.67656-01	3.70695-01	3.75024-01	
6.5751-01	3.84435-01	3.85571-01	3.87325-01	

NEUTRON SPECTRA
SPACIAL DISTRIBUTION
GRANULAR COMPOSITE AVERAGE

ENERGY	E*PHI(1,E)	E*PHI(2,E)	E*PHI(3,E)	E*PHI(4,E)	E*PHI(5,E)	E*PHI(6,E)	E*PHI(7,E)	E*PHI(8,E)	E*PHI(
1.4250-04	1.11059-07	2.04541-07	3.66141-07	4.09048-07	4.47339-07	7.94105-07	1.57382-06	4.04492-06	
1.0120-03	2.80006-05	3.30255-05	4.29380-05	5.37298-05	6.78124-05	1.04053-04	1.66888-04	2.98978-04	
2.2765-03	2.32124-04	2.57261-04	3.10243-04	3.76474-04	4.64677-04	6.62402-04	9.83736-04	1.60446-03	
4.0469-03	9.15460-04	9.89146-04	1.15204-03	1.36826-03	1.66053-03	2.26950-03	3.23390-03	5.02014-03	
6.3217-03	2.44960-03	2.61196-03	2.98434-03	3.49678-03	4.18811-03	5.57971-03	7.74478-03	1.16625-02	
9.1066-03	5.18078-03	5.48378-03	6.18978-03	7.17840-03	8.51813-03	1.11466-02	1.51995-02	2.24197-02	
1.2397-02	9.32810-03	9.82066-03	1.09914-02	1.26491-02	1.49111-02	1.92645-02	2.59269-02	3.76859-02	
1.6191-02	1.49120-02	1.56440-02	1.73948-02	1.99072-02	2.33549-02	2.98809-02	3.98296-02	5.72440-02	
2.0492-02	2.17829-02	2.27885-02	2.52172-02	2.87398-02	3.35692-02	4.26282-02	5.63939-02	8.03660-02	
2.5349-02	2.96910-02	3.09944-02	3.41658-02	3.87988-02	4.51626-02	5.70028-02	7.49434-02	1.06098-01	
3.0669-02	3.80767-02	3.96765-02	4.35930-02	4.93467-02	5.73019-02	7.19295-02	9.41155-02	1.32489-01	
3.6432-02	4.64861-02	4.83557-02	5.29892-02	5.98143-02	6.92977-02	8.65884-02	1.12766-01	1.58017-01	
4.2757-02	5.46797-02	5.68003-02	6.20653-02	6.98980-02	8.07771-02	1.00493-01	1.30298-01	1.81757-01	
4.9587-02	6.22791-02	6.46154-02	7.03916-02	7.90622-02	9.11272-02	1.12854-01	1.45617-01	2.02045-01	
5.6922-02	6.91501-02	7.16238-02	7.77776-02	8.70738-02	1.00008-01	1.23153-01	1.57953-01	2.17660-01	
6.5173-02	7.53150-02	7.78675-02	8.42444-02	9.38954-02	1.07341-01	1.31218-01	1.67014-01	2.28019-01	
7.4849-02	8.20597-02	8.46089-02	9.10332-02	1.00797-01	1.14346-01	1.38225-01	1.73775-01	2.33816-01	
8.6123-02	9.01508-02	9.26174-02	9.89158-02	1.08532-01	1.21873-01	1.45088-01	1.79304-01	2.36290-01	
9.9186-02	1.01387-01	1.03732-01	1.09755-01	1.19026-01	1.31867-01	1.53788-01	1.85741-01	2.38042-01	
1.1398-01	1.19204-01	1.21368-01	1.27060-01	1.35888-01	1.48022-01	1.68391-01	1.97645-01	2.44421-01	
1.3123-01	1.42178-01	1.44195-01	1.49522-01	1.57801-01	1.69225-01	1.87991-01	2.14518-01	2.56132-01	
1.5248-01	1.66923-01	1.68624-01	1.73124-01	1.80231-01	1.89939-01	2.05598-01	2.27428-01	2.60712-01	
1.7217-01	1.85411-01	1.86896-01	1.90832-01	1.97042-01	2.05501-01	2.19044-01	2.37656-01	2.65743-01	
2.0495-01	2.25473-01	2.26657-01	2.29862-01	2.34915-01	2.41789-01	2.52588-01	2.67313-01	2.88961-01	
2.5464-01	2.71699-01	2.72679-01	2.75338-01	2.79507-01	2.85169-01	2.93998-01	3.05938-01	3.23289-01	
3.0816-01	2.96812-01	2.97568-01	2.99632-01	3.02915-01	3.07342-01	3.14214-01	3.23479-01	3.36800-01	
3.7598-01	3.24003-01	3.24520-01	3.25923-01	3.28157-01	3.31167-01	3.35823-01	3.42046-01	3.50908-01	
4.6183-01	3.48928-01	3.49289-01	3.50285-01	3.51868-01	3.54010-01	3.57300-01	3.61685-01	3.67912-01	
5.7023-01	3.65300-01	3.65570-01	3.66259-01	3.67350-01	3.68834-01	3.71126-01	3.74195-01	3.78566-01	
6.5751-01	3.84888-01	3.84958-01	3.85201-01	3.85591-01	3.86122-01	3.86941-01	3.88084-01	3.89850-01	

NEUTRON SPECTRA
REGION AVERAGED

ENERGY	E*PHI(1,E)	E*PHI(2,E)	E*PHI(3,E)	E*PHI(4,E)	E*PHI(
1.4250-04	1.64733-06	1.19931-05	2.09526-05	2.04027-08	
1.0120-03	1.50262-04	5.80787-04	9.75642-04	4.86935-06	
2.2765-03	8.77051-04	2.80699-03	4.55541-03	4.16840-05	
4.0469-03	2.88369-03	8.37536-03	1.31157-02	1.78732-04	
6.3217-03	6.92043-03	1.88404-02	2.87878-02	5.18097-04	
9.1066-03	1.36126-02	3.54395-02	5.30157-02	1.16086-03	
1.2397-02	2.32697-02	5.86249-02	8.60051-02	2.25700-03	
1.6191-02	3.58060-02	8.81234-02	1.26783-01	3.78953-03	
2.0492-02	5.07757-02	1.22585-01	1.73312-01	5.85637-03	
2.5349-02	6.75759-02	1.60788-01	2.23377-01	8.40610-03	
3.0669-02	8.49543-02	1.99730-01	2.73042-01	1.15160-02	
3.6432-02	1.01914-01	2.37340-01	3.19526-01	1.52075-02	
4.2757-02	1.17886-01	2.72009-01	3.61386-01	1.96037-02	
4.9587-02	1.31873-01	3.00908-01	3.95835-01	2.50353-02	
5.6922-02	1.43208-01	3.21830-01	4.20487-01	3.18192-02	
6.5173-02	1.51634-01	3.33903-01	4.33898-01	4.01710-02	
7.4849-02	1.58180-01	3.37154-01	4.35194-01	5.17096-02	
8.6123-02	1.63855-01	3.33731-01	4.26232-01	6.58131-02	
9.9186-02	1.70819-01	3.26046-01	4.10907-01	8.34561-02	
1.1398-01	1.83418-01	3.21678-01	3.98379-01	1.07373-01	
1.3123-01	2.01148-01	3.23684-01	3.93414-01	1.34692-01	
1.5248-01	2.15977-01	3.14149-01	3.71806-01	1.63250-01	
1.7217-01	2.27675-01	3.10724-01	3.59924-01	1.83825-01	
2.0495-01	2.59150-01	3.23320-01	3.63097-01	2.26937-01	
2.5464-01	2.99155-01	3.50736-01	3.83250-01	2.77235-01	
3.0816-01	3.18123-01	3.57755-01	3.83489-01	3.03769-01	
3.7598-01	3.38395-01	3.64818-01	3.82465-01	3.29200-01	
4.6183-01	3.59092-01	3.77739-01	3.90218-01	3.53066-01	
5.7023-01	3.72383-01	3.86548-01	3.93821-01	3.68852-01	
6.5751-01	3.87480-01	3.92888-01	3.93577-01	3.84936-01	

NEUTRON SPECTRA
REGION AVERAGED
GRANULAR COMPOSITE AVERAGE

ENERGY	E*PHI(1,E)	E*PHI(
1.4250-04	1.62471-06	
1.8120-03	1.48241-04	
2.2765-03	8.65441-04	
4.8469-03	2.84610-03	
6.3217-03	6.83145-03	
9.1066-03	1.34395-02	
1.2397-02	2.29777-02	
1.6191-02	3.53610-02	
2.0492-02	5.01514-02	
2.5349-02	6.67536-02	
3.0669-02	8.39337-02	
3.6432-02	1.00709-01	
4.2757-02	1.16520-01	
4.9587-02	1.30388-01	
5.6922-02	1.41660-01	
6.5173-02	1.50085-01	
7.4849-02	1.56700-01	
8.6123-02	1.62492-01	
9.9186-02	1.69605-01	
1.1398-01	1.82361-01	
1.3123-01	2.00224-01	
1.5248-01	2.15244-01	
1.7217-01	2.27066-01	
2.0495-01	2.58703-01	
2.5464-01	2.98850-01	
3.0816-01	3.17923-01	
3.7598-01	3.38267-01	
4.6183-01	3.59009-01	
5.7023-01	3.72334-01	
6.5751-01	3.87445-01	

DYOS AND POMRANING'S SELF SHIELDING FACTORS FOR PARTICLE TYPE 1

I	P(1,I)	P(2,I)	P(3,I)	P(4,I)	P(5,I)	P(6,I)	P(7,I)	P(8,I)	P(
1	1.23345-02	1.23345-02	1.23345-02	1.23345-02	1.23345-02	1.23345-02	1.23345-02	1.23345-02	
2	3.23841-02	3.23841-02	3.23841-02	3.23841-02	3.23841-02	3.23841-02	3.23841-02	3.23841-02	
3	4.75115-02	4.75115-02	4.75115-02	4.75115-02	4.75115-02	4.75115-02	4.75115-02	4.75115-02	
4	6.19656-02	6.19656-02	6.19656-02	6.19656-02	6.19656-02	6.19656-02	6.19656-02	6.19656-02	
5	7.48489-02	7.48489-02	7.48489-02	7.48489-02	7.48489-02	7.48489-02	7.48489-02	7.48489-02	
6	8.52590-02	8.52590-02	8.52590-02	8.52590-02	8.52590-02	8.52590-02	8.52590-02	8.52590-02	
7	9.69714-02	9.69714-02	9.69714-02	9.69714-02	9.69714-02	9.69714-02	9.69714-02	9.69714-02	
8	1.05809-01	1.05809-01	1.05809-01	1.05809-01	1.05809-01	1.05809-01	1.05809-01	1.05809-01	
9	1.15308-01	1.15308-01	1.15308-01	1.15308-01	1.15308-01	1.15308-01	1.15308-01	1.15308-01	
10	1.24360-01	1.24360-01	1.24360-01	1.24360-01	1.24360-01	1.24360-01	1.24360-01	1.24360-01	
11	1.35514-01	1.35514-01	1.35514-01	1.35514-01	1.35514-01	1.35514-01	1.35514-01	1.35514-01	
12	1.49170-01	1.49170-01	1.49170-01	1.49170-01	1.49170-01	1.49170-01	1.49170-01	1.49170-01	
13	1.66232-01	1.66232-01	1.66232-01	1.66232-01	1.66232-01	1.66232-01	1.66232-01	1.66232-01	
14	1.89765-01	1.89765-01	1.89765-01	1.89765-01	1.89765-01	1.89765-01	1.89765-01	1.89765-01	
15	2.22084-01	2.22084-01	2.22084-01	2.22084-01	2.22084-01	2.22084-01	2.22084-01	2.22084-01	
16	2.64777-01	2.64777-01	2.64777-01	2.64777-01	2.64777-01	2.64777-01	2.64777-01	2.64777-01	
17	3.26699-01	3.26699-01	3.26699-01	3.26699-01	3.26699-01	3.26699-01	3.26699-01	3.26699-01	
18	4.01361-01	4.01361-01	4.01361-01	4.01361-01	4.01361-01	4.01361-01	4.01361-01	4.01361-01	
19	4.88151-01	4.88151-01	4.88151-01	4.88151-01	4.88151-01	4.88151-01	4.88151-01	4.88151-01	
20	5.84857-01	5.84857-01	5.84857-01	5.84857-01	5.84857-01	5.84857-01	5.84857-01	5.84857-01	
21	6.69058-01	6.69058-01	6.69058-01	6.69058-01	6.69058-01	6.69058-01	6.69058-01	6.69058-01	
22	7.55296-01	7.55296-01	7.55296-01	7.55296-01	7.55296-01	7.55296-01	7.55296-01	7.55296-01	
23	8.06689-01	8.06689-01	8.06689-01	8.06689-01	8.06689-01	8.06689-01	8.06689-01	8.06689-01	
24	8.75437-01	8.75437-01	8.75437-01	8.75437-01	8.75437-01	8.75437-01	8.75437-01	8.75437-01	
25	9.26438-01	9.26438-01	9.26438-01	9.26438-01	9.26438-01	9.26438-01	9.26438-01	9.26438-01	
26	9.54615-01	9.54615-01	9.54615-01	9.54615-01	9.54615-01	9.54615-01	9.54615-01	9.54615-01	
27	9.72583-01	9.72583-01	9.72583-01	9.72583-01	9.72583-01	9.72583-01	9.72583-01	9.72583-01	
28	9.82979-01	9.82979-01	9.82979-01	9.82979-01	9.82979-01	9.82979-01	9.82979-01	9.82979-01	
29	9.90258-01	9.90258-01	9.90258-01	9.90258-01	9.90258-01	9.90258-01	9.90258-01	9.90258-01	
30	9.92878-01	9.92878-01	9.92878-01	9.92878-01	9.92878-01	9.92878-01	9.92878-01	9.92878-01	

ESCAPE PROBABILITIES FOR PARTICLE TYPE 1

I	PO(1,I)	PO(2,I)	PO(3,I)	PO(4,I)	PO(5,I)	PO(6,I)	PO(7,I)	PO(8,I)	PO(
1	1.23345-02	1.23345-02	1.23345-02	1.23345-02	1.23345-02	1.23345-02	1.23345-02	1.23345-02	
2	3.23841-02	3.23841-02	3.23841-02	3.23841-02	3.23841-02	3.23841-02	3.23841-02	3.23841-02	
3	4.75115-02	4.75115-02	4.75115-02	4.75115-02	4.75115-02	4.75115-02	4.75115-02	4.75115-02	
4	6.19656-02	6.19656-02	6.19656-02	6.19656-02	6.19656-02	6.19656-02	6.19656-02	6.19656-02	
5	7.48489-02	7.48489-02	7.48489-02	7.48489-02	7.48489-02	7.48489-02	7.48489-02	7.48489-02	
6	8.52590-02	8.52590-02	8.52590-02	8.52590-02	8.52590-02	8.52590-02	8.52590-02	8.52590-02	
7	9.69714-02	9.69714-02	9.69714-02	9.69714-02	9.69714-02	9.69714-02	9.69714-02	9.69714-02	
8	1.05809-01	1.05809-01	1.05809-01	1.05809-01	1.05809-01	1.05809-01	1.05809-01	1.05809-01	
9	1.15308-01	1.15308-01	1.15308-01	1.15308-01	1.15308-01	1.15308-01	1.15308-01	1.15308-01	
10	1.24360-01	1.24360-01	1.24360-01	1.24360-01	1.24360-01	1.24360-01	1.24360-01	1.24360-01	
11	1.35514-01	1.35514-01	1.35514-01	1.35514-01	1.35514-01	1.35514-01	1.35514-01	1.35514-01	
12	1.49170-01	1.49170-01	1.49170-01	1.49170-01	1.49170-01	1.49170-01	1.49170-01	1.49170-01	
13	1.66232-01	1.66232-01	1.66232-01	1.66232-01	1.66232-01	1.66232-01	1.66232-01	1.66232-01	
14	1.89765-01	1.89765-01	1.89765-01	1.89765-01	1.89765-01	1.89765-01	1.89765-01	1.89765-01	
15	2.22084-01	2.22084-01	2.22084-01	2.22084-01	2.22084-01	2.22084-01	2.22084-01	2.22084-01	
16	2.64777-01	2.64777-01	2.64777-01	2.64777-01	2.64777-01	2.64777-01	2.64777-01	2.64777-01	
17	3.26699-01	3.26699-01	3.26699-01	3.26699-01	3.26699-01	3.26699-01	3.26699-01	3.26699-01	
18	4.01361-01	4.01361-01	4.01361-01	4.01361-01	4.01361-01	4.01361-01	4.01361-01	4.01361-01	
19	4.88151-01	4.88151-01	4.88151-01	4.88151-01	4.88151-01	4.88151-01	4.88151-01	4.88151-01	
20	5.84857-01	5.84857-01	5.84857-01	5.84857-01	5.84857-01	5.84857-01	5.84857-01	5.84857-01	
21	6.68950-01	6.68950-01	6.68950-01	6.68950-01	6.68950-01	6.68950-01	6.68950-01	6.68950-01	
22	7.55061-01	7.55061-01	7.55061-01	7.55061-01	7.55061-01	7.55061-01	7.55061-01	7.55061-01	
23	8.06537-01	8.06537-01	8.06537-01	8.06537-01	8.06537-01	8.06537-01	8.06537-01	8.06537-01	
24	8.74692-01	8.74692-01	8.74692-01	8.74692-01	8.74692-01	8.74692-01	8.74692-01	8.74692-01	
25	9.25608-01	9.25608-01	9.25608-01	9.25608-01	9.25608-01	9.25608-01	9.25608-01	9.25608-01	
26	9.53721-01	9.53721-01	9.53721-01	9.53721-01	9.53721-01	9.53721-01	9.53721-01	9.53721-01	
27	9.71622-01	9.71622-01	9.71622-01	9.71622-01	9.71622-01	9.71622-01	9.71622-01	9.71622-01	
28	9.81954-01	9.81954-01	9.81954-01	9.81954-01	9.81954-01	9.81954-01	9.81954-01	9.81954-01	
29	9.89247-01	9.89247-01	9.89247-01	9.89247-01	9.89247-01	9.89247-01	9.89247-01	9.89247-01	
30	9.92016-01	9.92016-01	9.92016-01	9.92016-01	9.92016-01	9.92016-01	9.92016-01	9.92016-01	

GRANIT CASE NO. 3 * PAGE 21
AVERAGES FOR I= 0 TO I=30 V= 0.00000 TO V= 5.19577+00
E= 0.00000 TO E= 6.83001-01

POINT	REG	MIx	VOLUME	NDEN*VOL	NFLX*VOL	ABSORPTION	SCATTERING	AVE V	AVE V**2	AVE V**3	NDEN	NFLX
1	1	1	5.52965-03	1.26479-03	3.32985-03	5.35710-04	1.22185-03	2.63273	8.55606	31.45895	2.28729-01	6.02181-01
2	1	1	4.42372-02	1.03023-02	2.69004-02	4.36807-03	9.87144-03	2.61111	8.44920	30.99915	2.32887-01	6.08094-01
3	1	1	8.84744-02	2.15150-02	5.51265-02	9.14294-03	2.02326-02	2.56224	8.20528	29.94357	2.43178-01	6.23079-01
4	1	1	1.32712-01	3.42985-02	8.57021-02	1.46175-02	3.14612-02	2.49871	7.88496	28.54962	2.58444-01	6.45777-01
5	1	1	1.76949-01	4.94500-02	1.19799-01	2.11472-02	4.39899-02	2.42263	7.50080	26.87710	2.79460-01	6.77028-01
6	1	1	2.21186-01	7.01821-02	1.61773-01	3.01764-02	5.94300-02	2.30505	6.91654	24.35820	3.17299-01	7.31389-01
7	1	1	2.65423-01	9.92246-02	2.15287-01	4.29323-02	7.91373-02	2.16970	6.24925	21.49627	3.73835-01	8.11110-01
8	1	1	3.09660-01	1.45566-01	2.92032-01	6.34678-02	1.07441-01	2.00618	5.45382	18.11437	4.70084-01	9.43071-01
SUM	1	1	1.24417+00	4.31804-01	9.59950-01	1.86388-01	3.52785-01					
V AVE	1	1		N=3.47061-01	F=7.71558-01	A=1.49809-01	S=2.83550-01	2.22312	6.51951	22.67461		
9	2	2	1.67011-01	1.02893-01	1.89946-01	8.22540-04	4.98737-02	1.84605	4.68992	14.90375	6.16085-01	1.13733+00
10	2	2	1.77388-01	1.14970-01	2.10239-01	9.19083-04	5.52039-02	1.82865	4.59699	14.48560	6.48125-01	1.18519+00
SUM	2	2	3.44399-01	2.17863-01	4.00185-01	1.74162-03	1.05078-01					
V AVE	2	2		N=6.32588-01	F=1.16198+00	A=5.05699-03	S=3.05104-01	1.83687	4.64088	14.68308		
11	3	3	3.25376-01	2.30492-01	4.12399-01	5.11788-03	7.09358-01	1.78921	4.41223	13.70897	7.08387-01	1.26745+00
12	3	3	3.55366-01	2.79068-01	4.84424-01	6.19647-03	8.52805-01	1.73586	4.17809	12.76975	7.85297-01	1.36317+00
13	3	3	3.85357-01	3.21528-01	5.48424-01	7.13926-03	9.78674-01	1.70568	4.04636	12.24498	8.34364-01	1.42316+00
14	3	3	4.15348-01	3.57505-01	6.04065-01	7.93810-03	1.08590+00	1.68967	3.97775	11.97563	8.60738-01	1.45436+00
15	3	3	4.45338-01	3.84645-01	6.48034-01	8.54071-03	1.16756+00	1.68476	3.96043	11.91800	8.63714-01	1.45515+00
SUM	3	3	1.92679+00	1.57324+00	2.69735+00	3.49324-02	4.79430+00					
V AVE	3	3		N=8.16510-01	F=1.39992+00	A=1.81299-02	S=2.48824+00	1.71452	4.08673	12.41140		
16	4	4	7.79342-05	1.13501-05	3.72775-05	1.97902-03	1.24060-05	3.28433	11.88545	46.02177	1.45637-01	4.78321-01
17	4	4	6.23474-04	9.15311-05	2.99711-04	1.62421-02	9.97456-05	3.27442	11.82991	45.76260	1.46808-01	4.80712-01
18	4	4	1.24695-03	1.86813-04	6.07213-04	3.45272-02	2.02091-04	3.25038	11.69413	45.12591	1.49816-01	4.86960-01
19	4	4	1.87042-03	2.88828-04	9.28922-04	5.63738-02	3.09176-04	3.21618	11.49975	44.21077	1.54419-01	4.96638-01
20	4	4	2.49389-03	4.00880-04	1.27165-03	8.36057-02	4.23274-04	3.17214	11.24957	43.03361	1.60745-01	5.09905-01
21	4	4	3.11737-03	5.34702-04	1.65817-03	1.23371-01	5.51991-04	3.10111	10.85078	41.17254	1.71524-01	5.31914-01
22	4	4	3.74084-03	6.99998-04	2.10682-03	1.81830-01	7.01448-04	3.00975	10.34147	38.80818	1.87123-01	5.63194-01
23	4	4	4.36432-03	9.27150-04	2.67336-03	2.79035-01	8.90278-04	2.88342	9.64493	35.60117	2.12439-01	6.12550-01
SUM	4	4	1.75352-02	3.14125-03	9.58312-03	7.76963-01	3.19041-03					
V AVE	4	4		N=1.79140-01	F=5.46508-01	A=4.43088+01	S=1.81943-01	3.05073	10.57436	39.90450		

GRANIT CASE NO. 3 * PAGE 22
AVERAGES FOR I= 0 TO I=30 V= 0.00000 TO V= 5.19577+00
 E= 0.00000 TO E= 6.83001-01

MATERIALS USED IN CELL

ISOTOPE			25592- 1		23892- 1		40- 10		101- 52	
POINT	REG	MIX	SIGMA A	SIGMA S	SIGMA A	SIGMA S	SIGMA A	SIGMA S	SIGMA A	SIGMA S
CONC	1	1	5.94843-04		2.24611-02		0.00000		0.00000	
1	1	1	1.36758-01	5.95100-03	2.41198-02	1.86507-01	0.00000	0.00000	0.00000	0.00000
2	1	1	1.38070-01	5.95106-03	2.43063-02	1.86508-01	0.00000	0.00000	0.00000	0.00000
3	1	1	1.41111-01	5.95119-03	2.47392-02	1.86512-01	0.00000	0.00000	0.00000	0.00000
4	1	1	1.45232-01	5.95136-03	2.53268-02	1.86518-01	0.00000	0.00000	0.00000	0.00000
5	1	1	1.50447-01	5.95157-03	2.60710-02	1.86524-01	0.00000	0.00000	0.00000	0.00000
6	1	1	1.59212-01	5.95194-03	2.73192-02	1.86536-01	0.00000	0.00000	0.00000	0.00000
7	1	1	1.70490-01	5.95243-03	2.89245-02	1.86551-01	0.00000	0.00000	0.00000	0.00000
8	1	1	1.86173-01	5.95314-03	3.11546-02	1.86573-01	0.00000	0.00000	0.00000	0.00000
EVENTS	1	1	1.59248-01	5.71386-03	2.71365-02	1.79074-01	0.00000	0.00000	0.00000	0.00000
AVE	1	1	1.65892-01	5.95225-03	2.82687-02	1.86545-01	0.00000	0.00000	0.00000	0.00000
CONC	2	2	0.00000		0.00000		4.25220-02		0.00000	
9	2	2	0.00000	0.00000	0.00000	0.00000	4.33039-03	2.62568-01	0.00000	0.00000
10	2	2	0.00000	0.00000	0.00000	0.00000	4.37162-03	2.62577-01	0.00000	0.00000
EVENTS	2	2	0.00000	0.00000	0.00000	0.00000	1.74162-03	1.05078-01	0.00000	0.00000
AVE	2	2	0.00000	0.00000	0.00000	0.00000	4.35205-03	2.62573-01	0.00000	0.00000
CONC	3	3	0.00000		0.00000		0.00000		6.68620-02	
11	3	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.24067-02	1.59256+00
12	3	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.27880-02	1.63282+00
13	3	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.30143-02	1.65682+00
14	3	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.31376-02	1.66991+00
15	3	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.31759-02	1.67394+00
EVENTS	3	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	3.49231-02	4.44989+00
AVE	3	3	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	1.29472-02	1.64973+00
CONC	4	4	0.00000		0.00000		0.00000		0.00000	
16	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
17	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
18	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
19	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

20	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
21	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
22	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
23	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
EVENTS	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000
AVE	4	4	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000

GHANIT CASE NO. 3 * PAGE 23
AVERAGES FOR I= 0 TO I=30 V= 0.00000 TO V= 5.19577+00
 E= 0.00000 TO E= 6.83001-01

MATERIALS USED IN CELL

ISOTOPE			1608- 1		64000- 29					
POINT	REG	MIX	SIGMA A	SIGMA S	SIGMA A	SIGMA S	SIGMA A	SIGMA S	SIGMA A	SIGMA S
CONC	1	1	4.61110-02		0.00000					
1	1	1	3.11765-06	1.74479-01	0.00000	0.00000				
2	1	1	3.14346-06	1.74503-01	0.00000	0.00000				
3	1	1	3.20342-06	1.74558-01	0.00000	0.00000				
4	1	1	3.28486-06	1.74630-01	0.00000	0.00000				
5	1	1	3.38801-06	1.74720-01	0.00000	0.00000				
6	1	1	3.56084-06	1.74879-01	0.00000	0.00000				
7	1	1	3.78298-06	1.75086-01	0.00000	0.00000				
8	1	1	4.09133-06	1.75383-01	0.00000	0.00000				
EVENTS	1	1	3.54421-06	1.67997-01	0.00000	0.00000				
AVE	1	1	3.69208-06	1.75006-01	0.00000	0.00000				
CONC	2	2	0.00000		0.00000					
9	2	2	0.00000	0.00000	0.00000	0.00000				
10	2	2	0.00000	0.00000	0.00000	0.00000				
EVENTS	2	2	0.00000	0.00000	0.00000	0.00000				
AVE	2	2	0.00000	0.00000	0.00000	0.00000				
CONC	3	3	3.34316-02		0.00000					
11	3	3	3.32589-06	1.27516-01	0.00000	0.00000				
12	3	3	3.42811-06	1.27635-01	0.00000	0.00000				
13	3	3	3.48877-06	1.27704-01	0.00000	0.00000				
14	3	3	3.52183-06	1.27743-01	0.00000	0.00000				
15	3	3	3.53209-06	1.27757-01	0.00000	0.00000				
EVENTS	3	3	9.36190-06	3.44409-01	0.00000	0.00000				
AVE	3	3	3.47078-06	1.27684-01	0.00000	0.00000				
CONC	4	4	3.69185-02		2.46124-02					
16	4	4	2.00086-06	1.39282-01	5.30887+01	1.93520-01				
17	4	4	2.00692-06	1.39286-01	5.41924+01	1.93520-01				
18	4	4	2.02176-06	1.39296-01	5.68617+01	1.93522-01				
19	4	4	2.04326-06	1.39310-01	6.06874+01	1.93524-01				

20	4	4	2.07163-06	1.39328-01	6.57459+01	1.93526-01
21	4	4	2.11908-06	1.39361-01	7.44021+01	1.93531-01
22	4	4	2.18340-06	1.39405-01	8.63053+01	1.93537-01
23	4	4	2.27906-06	1.39472-01	1.04376+02	1.93547-01
EVENTS	4	4	2.06427-08	1.33575-03	7.76963-01	1.85467-03
AVE	4	4	2.15407-06	1.39385-01	8.10762+01	1.93535-01

AVERAGES FOR I= 0 TO I=30 V= 0.00000 TO V= 5.19577+00
E= 0.00000 TO E= 6.8[illegible]001-01

MATERIALS USED IN EDIT

ISOTOPE			25592- 1		25592- 2		23892- 1		40- 10	
POINT	REG	MIX	SIGMA A	REL ACT	SIGMA A	REL ACT	SIGMA A	REL ACT	SIGMA A	REL ACT
CONC	1	1	1.0000[illegible]+00		2.43000+00		1.00000+00		1.00000+00	
1	1	1	2.29906+02	1.00000+00	4.73102+02	1.00000+00	1.07385+00	1.00000+00	7.14088-02	1.00000+00
2	1	1	2.32112+02	1.01950+00	4.77676+02	1.01958+00	1.08215+00	1.01763+00	7.20000-02	1.01818+00
3	1	1	2.37224+02	1.06764+00	4.88278+02	1.06790+00	1.10142+00	1.06128+00	7.33734-02	1.06317+00
4	1	1	2.44152+02	1.13884+00	5.02639+02	1.13935+00	1.12759+00	1.12606+00	7.52388-02	1.12991+00
5	1	1	2.52919+02	1.23663+00	5.20814+02	1.23768+00	1.16072+00	1.21524+00	7.76015-02	1.22179+00
6	1	1	2.67654+02	1.41398+00	5.51380+02	1.41552+00	1.21629+00	1.37568+00	8.15601-02	1.38723+00
7	1	1	2.86614+02	1.67918+00	5.90719+02	1.68182+00	1.28776+00	1.61527+00	8.66480-02	1.63440+00
8	1	1	3.12979+02	2.13197+00	6.45452+02	2.13662+00	1.38705+00	2.02286+00	9.37106-02	2.05520+00
AVE	1	1	2.78883+02	1.55422+00	5.74694+02	1.55641+00	1.25856+00	1.50167+00	8.45659-02	1.51735+00
CONC	2	2	1.0000[illegible]+00		2.43000+00		1.00000+00		1.00000+00	
9	2	2	3.43409+02	2.82110+00	7.08655+02	2.82904+00	1.50144+00	2.64073+00	1.01839-01	2.69352+00
10	2	2	3.46986+02	[illegible].97045+00	7.16058+02	2.[illegible]7889+00	1.51500+00	2.77672+00	1.02808-01	2.83359+00
AVE	2	2	3.45288+02	2.89803+00	7.12544+02	2.90622+00	1.50856+00	2.71077+00	1.02348-01	2.76566+00
CONC	3	3	1.0000[illegible]+00		2.43000+00		1.00000+00		1.00000+00	
11	3	3	3.55547+02	[illegible].25500+00	7.33827+02	3.26470+00	1.54692+00	3.03200+00	1.05074-01	3.09706+00
12	3	3	3.67861+02	3.62204+00	7.59424+02	3.63372+00	1.59254+00	3.35715+00	1.08304-01	3.43331+00
13	3	3	3.75174+02	[illegible].85663+00	7.74632+02	3.86960+00	1.61963+00	3.56451+00	1.10220-01	3.64783+00
14	3	3	3.79171+02	[illegible].98317+00	7.82945+02	3.99689+00	1.63440+00	3.67588+00	1.11265-01	3.76313+00
15	3	3	3.80445+02	[illegible].99872+00	7.85603+02	4.01263+00	1.63902+00	3.68828+00	1.11589-01	3.77615+00
AVE	3	3	3.73021+02	3.77189+00	7.70160+02	3.78445+00	1.61161+00	3.48896+00	1.09652-01	3.56977+00
CONC	4	4	1.0000[illegible]+00		2.43000+00		1.00000+00		1.00000+00	
16	4	4	1.77625+02	[illegible].13683-01	3.64731+02	6.12365-01	8.75369-01	6.47502-01	5.72415-02	6.36724-01
17	4	4	1.78252+02	[illegible].18929-01	3.66022+02	6.17604-01	8.77771-01	6.52525-01	5.74147-02	6.41843-01
18	4	4	1.79790+02	6.32384-01	3.69185+02	6.31037-01	8.83657-01	6.65438-01	5.78394-02	6.54994-01
19	4	4	1.82016+02	[illegible].52937-01	3.73759+02	6.51553-01	8.92176-01	6.85206-01	5.84545-02	6.75116-01
20	4	4	1.84949+02	[illegible].81183-01	3.79788+02	6.79749-01	9.03414-01	7.12372-01	5.92659-02	7.02773-01
21	4	4	1.89854+02	7.29428-01	3.89884+02	7.27938-01	9.22240-01	7.58606-01	6.06234-02	7.49899-01
22	4	4	1.96496+02	7.99343-01	4.03567+02	7.97797-01	9.47780-01	8.25461-01	6.24636-02	8.18099-01
23	4	4	2.06360+02	9.13038-01	4.23917+02	9.11466-01	9.85807-01	9.33823-01	6.52004-02	9.28780-01
AVE	4	4	1.93460+02	7.63677-01	3.97328+02	7.62191-01	9.36158-01	7.91182-01	6.16245-02	7.83197-01

AVERAGES FOR I= 0 TO I=30 V= 0.00000 TO V= 5.19577+00
E= 0.00000 TO E= 6.83001-01

MATERIALS USED IN EDIT

ISOTOPE			101- 52		1608- 1		64000- 29			
POINT	REG	MIX	SIGMA A	REL ACT	SIGMA A	REL ACT	SIGMA A	REL ACT	SIGMA A	REL ACT
CONC	1	1	1.00000+00		1.00000+00		1.00000+00			
1	1	1	1.26105-01	1.00000+00	6.76105-05	1.00000+00	6.46646+03	1.00000+00		
2	1	1	1.27149-01	1.01818+00	6.81702-05	1.01818+00	6.64439+03	1.03760+00		
3	1	1	1.29574-01	1.06317+00	6.94705-05	1.06317+00	7.05735+03	1.12925+00		
4	1	1	1.32869-01	1.12991+00	7.12368-05	1.12991+00	7.61831+03	1.26342+00		
5	1	1	1.37041-01	1.22179+00	7.34738-05	1.22179+00	8.33012+03	1.44832+00		
6	1	1	1.44032-01	1.38723+00	7.72218-05	1.38723+00	9.52699+03	1.78941+00		
7	1	1	1.53017-01	1.63440+00	8.20391-05	1.63440+00	1.10704+04	2.30594+00		
8	1	1	1.65489-01	2.05520+00	8.87260-05	2.05520+00	1.32208+04	3.20190+00		
AVE	1	1	1.49340-01	1.51735+00	8.00678-05	1.51735+00	1.04439+04	2.06936+00		
CONC	2	2	1.00000+00		1.00000+00		1.00000+00			
9	2	2	1.79843-01	2.69352+00	9.64218-05	2.69352+00	1.56955+04	4.58422+00		
10	2	2	1.81555-01	2.83359+00	9.73398-05	2.83359+00	1.59850+04	4.86526+00		
AVE	2	2	1.80742-01	2.76566+00	9.69041-05	2.76566+00	1.58476+04	4.72898+00		
CONC	3	3	1.00000+00		1.00000+00		1.00000+00			
11	3	3	1.85557-01	3.09706+00	9.94852-05	3.09706+00	1.66514+04	5.41986+00		
12	3	3	1.91260-01	3.43331+00	1.02543-04	3.43331+00	1.76126+04	6.16565+00		
13	3	3	1.94644-01	3.64783+00	1.04357-04	3.64783+00	1.81885+04	6.64747+00		
14	3	3	1.96488-01	3.76313+00	1.05346-04	3.76313+00	1.85036+04	6.91090+00		
15	3	3	1.97061-01	3.77615+00	1.05653-04	3.77615+00	1.86007+04	6.95095+00		
AVE	3	3	1.93641-01	3.56977+00	1.03819-04	3.56977+00	1.80197+04	6.47823+00		
CONC	4	4	1.00000+00		1.00000+00		1.00000+00			
16	4	4	1.01086-01	6.36724-01	5.41968-05	6.36724-01	2.15699+03	2.64956-01		
17	4	4	1.01392-01	6.41843-01	5.43608-05	6.41843-01	2.20183+03	2.71816-01		
18	4	4	1.02142-01	6.54994-01	5.47628-05	6.54994-01	2.31029+03	2.88912-01		
19	4	4	1.03228-01	6.75116-01	5.53452-05	6.75116-01	2.46572+03	3.14478-01		
20	4	4	1.04661-01	7.02773-01	5.61135-05	7.02773-01	2.67125+03	3.49792-01		
21	4	4	1.07058-01	7.49899-01	5.73988-05	7.49899-01	3.02295+03	4.12932-01		
22	4	4	1.10308-01	8.18099-01	5.91411-05	8.18099-01	3.50658+03	5.07163-01		
23	4	4	1.15141-01	9.28780-01	6.17323-05	9.28780-01	4.24078+03	6.67105-01		
AVE	4	4	1.08826-01	7.83197-01	5.83466-05	7.83197-01	3.29412+03	4.62319-01		

AVERAGES FOR I= 0 TO I=30 V= 0.00000 TO V= 5.19577+00
E= 0.00000 TO E= 6.63001-01

VOL.AND FLUX WEIGHTED X-SECTIONS=(N(I)*VOL(I)*PHI(I)*MIC.SIGMA)/(VOL(CELL)*PHI(CELL))

ISOTOPE	25592- 1	25592- 2	23892- 1	40- 10	101- 52
POINT REG MIX	SIGMA	SIGMA	SIGMA	SIGMA	SIGMA
CELL DENSITY	2.09485-04	2.09485-04	7.91008-03	0.00000	0.00000
8 1 1	3.91555-02	8.06876-02	6.67226-03	0.00000	0.00000
CELL DENSITY	0.00000	0.00000	0.00000	4.14520-03	0.00000
10 2 2	0.00000	0.00000	0.00000	4.28226-04	0.00000
CELL DENSITY	0.00000	0.00000	0.00000	0.00000	3.64655-02
15 3 3	0.00000	0.00000	0.00000	0.00000	8.58680-03
CELL DENSITY	0.00000	0.00000	0.00000	0.00000	0.00000
23 4 4	0.00000	0.00000	0.00000	0.00000	0.00000

VOLUME TOTAL= 3.53289+01 PHI TOTAL CELL= 4.06706+00 PHI AVG. CELL= 1.15120+00

GRANIT CASE NO. 3 * PAGE 27
AVERAGES FOR I= 0 TO I=30 V= 0.00000 TO V= 5.19577+00
E= 0.00000 TO E= 6.83001-01

VOL.AND FLUX WEIGHTED X-SECTIONS=(N(I)*VOL(I)*PHI(I)*MIC.SIGMA)/(VOL(CELL)*PHI(CELL))

ISOTOPE	1608- 1	64000- 29	0- 0	0- 0	0- 0
POINT REG MIX	SIGMA	SIGMA	SIGMA	SIGMA	SIGMA
CELL DENSITY	1.62391-02	0.00000			
8 1 1	8.71442-07	0.00000			
CELL DENSITY	0.00000	0.00000			
10 2 2	0.00000	0.00000			
CELL DENSITY	1.82328-02	0.00000			
15 3 3	2.30188-06	0.00000			
CELL DENSITY	1.83242-04	1.22162-04			
23 4 4	5.07558-09	1.91038-01			

VOLUME TOTAL= 3.53289+00 PHI TOTAL CELL= 4.06706+00 PHI AVG. CELL= 1.15120+00

REGION
VOLUME FRACTIONS

VF(1)=	0.00000	VF(2)=	0.00000	VF(3)=	0.00000	VF(4)=	0.00000	VF(5)=	0.00000
VF(6)=	0.00000	VF(7)=	0.00000	VF(8)=	3.52168-01	VF(9)=	0.00000	VF(10)=	9.74836-02
VF(11)=	0.00000	VF(12)=	0.00000	VF(13)=	0.00000	VF(14)=	0.00000	VF(15)=	5.45385-01
VF(16)=	0.00000	VF(17)=	0.00000	VF(18)=	0.00000	VF(19)=	0.00000	VF(20)=	0.00000
VF(21)=	0.00000	VF(22)=	0.00000	VF(23)=	4.96341-03	VF(24)=	0.00000	VF(25)=	0.00000
VF(26)=	0.00000	VF(27)=	0.00000	VF(28)=	0.00000	VF(29)=	0.00000	VF(30)=	0.00000
VF(31)=	3.57132-01	VF(							

REGION AVERAGED FLUX
(NORMALIZED TO A CELL AVERAGE FLUX OF 1.0)

F(1)=	0.00000	F(2)=	0.00000	F(3)=	0.00000	F(4)=	0.00000	F(5)=	0.00000
F(6)=	0.00000	F(7)=	0.00000	F(8)=	6.70221-01	F(9)=	0.00000	F(10)=	1.00936+00
F(11)=	0.00000	F(12)=	0.00000	F(13)=	0.00000	F(14)=	0.00000	F(15)=	1.21605+00
F(16)=	0.00000	F(17)=	0.00000	F(18)=	0.00000	F(19)=	0.00000	F(20)=	0.00000
F(21)=	0.00000	F(22)=	0.00000	F(23)=	4.74729-01	F(24)=	0.00000	F(25)=	0.00000
F(26)=	0.00000	F(27)=	0.00000	F(28)=	0.00000	F(29)=	0.00000	F(30)=	0.00000
F(31)=	6.67504-01	F(							

SPACIAL FLUX DISTRIBUTION
(NORMALIZED TO A CELL AVERAGE FLUX OF 1.0)

PHI(1)=	5.23090-01	PHI(2)=	5.28226-01	PHI(3)=	5.41243-01	PHI(4)=	5.60960-01	PHI(5)=	5.88106-01
PHI(6)=	6.35328-01	PHI(7)=	7.04578-01	PHI(8)=	8.19207-01	PHI(9)=	9.87949-01	PHI(10)=	1.02953+00
PHI(11)=	1.10098+00	PHI(12)=	1.18413+00	PHI(13)=	1.23624+00	PHI(14)=	1.26334+00	PHI(15)=	1.26403+00
PHI(16)=	4.15497-01	PHI(17)=	4.17575-01	PHI(18)=	4.23002-01	PHI(19)=	4.31409-01	PHI(20)=	4.42933-01
PHI(21)=	4.62052-01	PHI(22)=	4.89223-01	PHI(23)=	5.32097-01	PHI(24)=	5.21595-01	PHI(25)=	5.26688-01
PHI(26)=	5.39600-01	PHI(27)=	5.59159-01	PHI(28)=	5.86089-01	PHI(29)=	6.32919-01	PHI(30)=	7.01585-01
PHI(31)=	8.15217-01	PHI(							

CELL

ABSORPTION	FISSION
2.45884-01	8.06876-02

THE END

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* XQT CUR
  1. TRI H
     END CUR


CSCX RL483J  29 FEB 72  10:29: 1  USER CUB661  8B0217
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