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P U F F 2

Determination of Multigroup Covariance Matrices
from ENDF/B-V Uncertainty Files

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MULTIGROUP COVARIANCE MATRICES FOR FAST REACTOR STUDIES

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ABSTRACT

This report presents the multigroup covariance matrices based on the ENDF/B-V nuclear data evaluations. The materials and reactions have been chosen according to the specifications of ORNL-5517. Several cross section covariances, other than those specified by that report, are included due to the derived nature of the uncertainty files in ENDF/B-V.

The materials represented are Ni, Cr, O-16, C-12, Fe, Na, U-235, U-238, Pu-239, Pu-240, Pu-241, and B-10 (present due to its correlation to U-238). The data have been originally processed into a 52-group energy structure by PUFF-II and subsequently collapsed to smaller subgroup structures. The results are illustrated in 52-group correlation matrix plots and tabulated into thirteen groups for convenience.

The multigroup covariance files are available from the Engineering Physics Information Center (EPIC) in a COVERX format. A service module to the COVERX format is also available.

Although ENDF/B-V uncertainty information represents much more material than the previous version, some valuable covariances may not be present. To fill this void, internally generated uncertainty information from ORNL may yet be added to the covariance library in order to satisfy the requirements of the cross section adjustment specifications of ORNL-5517.

I. DESCRIPTION OF COVARIANCE MATRIX GENERATION

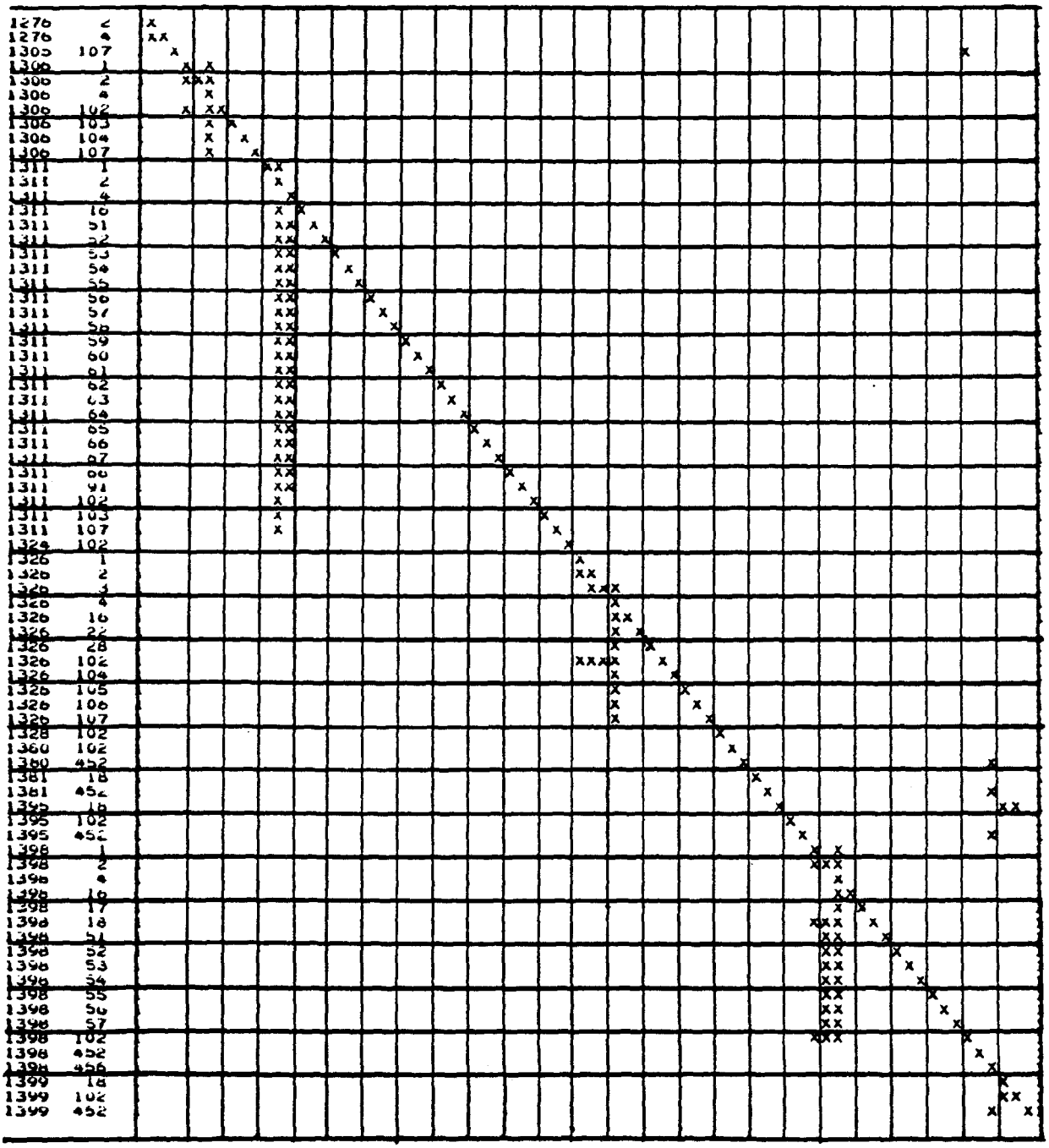
Standard formats and procedures have been established within the ENDF/B system[1,2] for the processing of evaluated and correlated energy-dependent uncertainty information into a multigroup covariance matrix formulation. These covariance matrices were established to be used in conjunction with sensitivity studies to: (1) propagate uncertainties to final calculated results, (2) adjust data sets by incorporating information from some integral measurements, and (3) determine data accuracies needed to meet targeted uncertainties in results taking into account the correlations in uncertainties in the present data sets.[2]

ENDF/B-IV contained uncertainties for N, O, and C only. Uncertainties for several other materials were generated for in-house use at ORNL.[3] ENDF/B-V (see Table 1) contains uncertainties for many more materials and also includes uncertainties in $\bar{\nu}(E)$ and in resolved resonance parameters.

This report contains uncertainties and correlations for materials needed as specified in ORNL/TM-5517[4] for cross section adjustment. These materials are Ni, Cr, O-16, C-12, Fe, Na, Pu-239, Pu-240, Pu-241, U-235, U-238 and B-10 (needed for correlation to U-238 (n,γ)). The covariance matrices that have been produced are summarized in Fig 1 by MAT-MT numbers with MAT and MT designations keyed in Tables 1 and 2.

The data have been processed into a 52-group energy structure by PUFF-II[5]. PUFF-II, which processes uncertainty data in ENDF/B-V formats, is the sequel to the ORNL uncertainty processor PUFF, which processes uncertainty data in ENDF/B-IV formats. The 52-group energies are a subset of the VITAMIN-E-174-group energies.[6] The 52-group structure was chosen to be large enough that little information currently present in ENDF/B-V would be lost yet small enough to not be cumbersome to handle. The 52-group energy structure is shown in Table 3.

PUFF-II (unlike PUFF) is not an integral part of the multigroup cross section processor MINX. Thus, an additional input of multigroup reactions is required (see Section III). The multigroup cross sections used in producing this multigroup covariance library were taken from a 100-group



(Note that the horizontal order of MAT-MT number pairs is the same as in the vertical listing)

Fig. 1. Covariance Matrices for Fast Reactor Studies

Table 1. Materials Present in Multigroup Covariance Library

Material	MAT, MOD	Authors	Institution
O-16	1276, 0	Young, P. Foster, D. Jr., Hale, G. Identical to Version IV except error files to ENDF-V form Eval - 8/73, Rev 0 - 6/75, Dist 12/78	LASL
B-10	1305, 0	Hale, G, Stewart, L., Young, P Eval - 12/76, Rev 1 - 1/77, Dist - 5/79	LASL
C-12	1306, 1	Fu, C. Y., Perey, F. G. Eval - 12/73, Rev 1 - 1/77, Dist - 5/79	ORNL
Na	1311, 0	Larson, D. C. Eval - 12/77, Dist - 12/78	ORNL
Cr	1324,	Prince, A., Burrows, T. W. Eval - 12/77, Dist - 1/79	BNL
Fe	1326, 1	Fu, C. Y., Perey, F. G. Eval - 10/77, Rev 1 - 10/77, Dist - 4/79	ORNL
Ni	1328, 0	Divadeenam, M. Eval - 3/77, Dist - 1/79	BNL
Pu-240	1380, 0	Weston, L. W. Eval - 4/77, Dist - 5/79	ORNL
Pu-241	1381, 0	Weston, L. W., Wright, R. Q. Howerton, R. Eval - 10/77, Dist - 5/79	ORNL
U-235	1395, 1	Bhat, M. R. Eval - 4/77, Rev 1 - 11/77, Dist - 5/79	BNL
U-238	1398,	Howerton, R (LLL) Gamma Prod. Files Pennington, E., Smith, A., Poenitz, H. Eval - 6/77, Rev 3 - 3/79, Dist - 5/79	ANL
Pu-239	1399,	Kujawski, E., Stewart, L. (LASL) Eval - 10/76, Rev 0 - 10/76, Dist - 5/79	GE-FBRD

Table 2. Reactions Present in Multigroup Covariance Library

MT	Description
1	Total cross section (total)
2	Elastic scattering cross section (elastic)
3	Nonelastic cross section (nonelastic)
4	Total inelastic cross section (n,n')
16	Direct (n,2n) cross section
17	(n,3n) cross section
18	Total fission cross section (n,f)
22	(n,n'α) cross section
28	(n,n'p) cross section
51	(n,n') to the first excited state (n,n', 1st)
52	(n,n') to the second excited state (n,n', 2nd)
∘	
∘	
∘	
68	(n,n') to the 18th excited state (n,n, 18th)
91	(n,n') to the continuum. (n,n', cont.)
102	(n,γ) radiative capture cross section
103	(n,p) cross section
104	(n,d) cross section
105	(n,t) cross section
106	(n,^{3}He) cross section
107	(n,α) cross section
452	$\bar{\nu}$, average total (prompt plus delayed) number of neutrons released per fission event ($\bar{\nu}$)
456	prompt neutrons from fission ($\bar{\nu}_p$)

Table 3. The 52-energy group structure on which the covariance matrices were produced. Also shown is the 13-group structure proposed by ORNL-5517 (where the highest energy boundary was changed to agree with VITAMIN-E).

Group	Upper Energy	Group	Upper Energy
1	1.9640E+07 *	27	2.4788E+04 *
2	1.3499E+07	28	2.3579E+04
3	1.0000E+07 *	29	1.5034E+04
4	7.7880E+06	30	1.1709E+04
5	6.0653E+06	31	9.1188E+03 *
6	4.7237E+06	32	7.1017E+03
7	3.6788E+06 *	33	5.5308E+03
8	2.8650E+06	34	4.3074E+03
9	2.2313E+06	35	3.3546E+03 *
10	1.6530E+06	36	2.6126E+03
11	1.3534E+06 *	37	2.0347E+03
12	1.0026E+06	38	1.5846E+03
13	8.2085E+05	39	1.2341E+03 *
14	6.0810E+05	40	9.6112E+02
15	4.9787E+05 *	41	7.4852E+02
16	3.8774E+05	42	5.8295E+02
17	3.0197E+05	43	4.5400E+02 *
18	2.3518E+05	44	3.5358E+02
19	1.8316E+05 *	45	2.7536E+02
20	1.4264E+05	46	1.6702E+02
21	1.1109E+05 *	47	1.0130E+02
22	8.6517E+04	48	6.1442E+01
23	6.7379E+04 *	49	3.7267E+01
24	5.2475E+04	50	2.2603E+01
25	4.0868E+04	51	1.3710E+01
26	3.1828E+04	52	8.3153E+00
		thermal	1.0000E-05 *

* indicates 13-group energy boundaries

fast reactor data testing library, requested by GE, appropriate for analysis of fast reactor benchmarks.[7] The 100-group energies are a subset of the VITAMINE-E 174-group energies (and the 52-group energies are a subset of the 100-group energies). The VITAMIN-E weighting function collapsed to 100 group was used as the weighting spectrum input to PUFF-II. The 100-group energy structure and weighting function can be seen in Table 4. The VITAMIN-E weighitng function is shown in Table 5.

The multigroup covariance matrices have been processed into a COVERX[8] format for easy use and manageability. The COVERX format is the format for multigroup covariance matrices used in the FORSS[9] system. COVERX has been proposed to the CCCC for acceptance and is described in Appendix A. A sample COVERX data file is tabulated in Appendix B. Auxiliary routines for reading, writing, editing and collapsing these data are available in a COVERX service module.[10]

References to the uncertainty and cross section data used in production of this multigroup covariance library are given in Appendices C, D, and E. All calculations were performed using a PDP-10 computer at the Oak Ridge National Laboratory. The PUFF-II code is also operational on IBM computers. The necessary user input to the IBM version is contained in Appendix F. The multigroup covariance library and IBM version of PUFF-II are available through the Radiation Shielding Information Center (RSIC) at ORNL.

II. EVALUATED COVARIANCE FORMULATION

The covariance representations permitted by ENDF/B-V formats:[2]

LB = 0 Absolute components only correlated within each E_k interval

$$COV(X_i,Y_j) = \sum_k p^{i;k}_{j;k} F_{xy,k} \qquad (1)$$

LB = 1 Fractional components only correlated within each E_k interval

$$COV(X_i,Y_j) = \sum_k p^{i;k}_{j;k} F_{xy,k} X_i Y_j \qquad (2)$$

Table 4. 100-Energy Group Structure and Corresponding Weighting Function

	Upper Energy	Weighting Function		Upper Energy	Weighting Function
1	1.964032E+07	2.199371E+01	36	2.984913E+05	4.299000E-03
2	1.349858E+07	1.417282E+00	37	2.972105E+05	9.098999E-03
3	1.000000E+07	1.842999E-02	38	2.945181E+05	2.500000E-02
4	7.788007E+06	4.979799E-02	39	2.872466E+05	5.000000E-02
5	6.065306E+06	1.000399E-01	40	2.732374E+05	9.999996E-02
6	4.723665E+06	1.529229E-01	41	2.472353E+05	5.000000E-02
7	3.678794E+06	2.109699E-01	42	2.351774E+05	5.000000E-02
8	2.865048E+06	1.431599E-01	43	2.237079E+05	9.999996E-02
9	2.465970E+06	3.276000E-02	44	2.024192E+05	9.999996E-02
10	2.385207E+06	8.305999E-03	45	1.831564E+05	9.999996E-02
11	2.365253E+06	8.214999E-03	46	1.657268E+05	9.999996E-02
12	2.345703E+06	4.972000E-02	47	1.499558E+05	5.000000E-02
13	2.231301E+06	9.993994E-02	48	1.426423E+05	5.000000E-02
14	2.018966E+06	9.999996E-02	49	1.356857E+05	9.999996E-02
15	1.826835E+06	9.999996E-02	50	1.227734E+05	9.999996E-02
16	1.652989E+06	9.999996E-02	51	1.110899E+05	2.500000E-01
17	1.495686E+06	9.999996E-02	52	8.651694E+04	4.750000E-02
18	1.353352E+06	9.999996E-02	53	8.250344E+04	3.710000E-02
19	1.224564E+06	9.999996E-02	54	7.949869E+04	9.909999E-02
20	1.108031E+06	9.999996E-02	55	7.199813E+04	6.629997E-02
21	1.002589E+06	4.170000E-02	56	6.737944E+04	2.499999E-01
22	9.616404E+05	5.830000E-02	57	5.247518E+04	2.500000E-01
23	9.071797E+05	9.999996E-02	58	4.086770E+04	2.499999E-01
24	8.208501E+05	9.999996E-02	59	3.182780E+04	1.104000E-01
25	7.427364E+05	9.999996E-02	60	2.850105E+04	5.410000E-02
26	6.720554E+05	9.999996E-02	61	2.700011E+04	3.550000E-02
27	6.081011E+05	9.999996E-02	62	2.605841E+04	5.000000E-02
28	5.502324E+05	9.999996E-02	63	2.478752E+04	2.500000E-02
29	4.978706E+05	9.999996E-02	64	2.417552E+04	2.500000E-02
30	4.504923E+05	9.999996E-02	65	2.357864E+04	2.000000E-01
31	4.076221E+05	5.000000E-02	66	1.930454E+04	2.500000E-01
32	3.877421E+05	5.000000E-02	67	1.503439E+04	2.500000E-01
33	3.688319E+05	9.999996E-02	68	1.170880E+04	2.500000E-01
34	3.337328E+05	9.999996E-02	69	9.118816E+03	2.500000E-01
35	3.019738E+05	1.160000E-02	70	7.101742E+03	2.500000E-01

(continued)

Table 4 (Cont'd)

	Upper Energy	Weighting Function
71	5.530840E+03	2.500000E-01
72	4.307422E+03	1.500000E-01
73	3.707437E+03	9.999996E-02
74	3.354626E+03	9.998996E-02
75	3.035392E+03	9.999996E-02
76	2.746535E+03	5.000000E-02
77	2.612535E+03	5.000000E-02
78	2.485169E+03	9.999996E-02
79	2.248674E+03	9.999996E-02
80	2.034684E+03	2.500000E-01
81	1.584613E+03	2.500000E-01
82	1.234098E+03	2.500000E-01
83	9.611165E+02	2.500000E-01
84	7.485183E+02	2.500000E-01
85	5.829465E+02	2.500000E-01
86	4.539990E+02	2.500000E-01
87	3.535750E+02	2.500000E-01
88	2.753643E+02	5.000000E-01
89	1.670170E+02	5.000000E-01
90	1.013009E+02	5.000000E-01
91	6.144212E+01	5.000000E-01
92	3.726653E+01	5.000000E-01
93	2.260329E+01	5.000000E-01
94	1.370959E+01	5.000000E-01
95	8.315287E+00	5.000000E-01
96	5.043476E+00	5.000000E-01
97	3.059023E+00	5.000000E-01
98	1.855391E+00	5.000000E-01
99	1.125351E+00	5.000000E-01
100	6.825604E-01	3.518850E+04
Thermal	1.000000E-05	

Table 5. Weighting Function Used for Processing VITAMIN-E Cross Sections

Functional Form	Energy Limits
1) Maxwellian Thermal Spectrum $W_1(E) = C_1 E e^{-E/kT}$	10^{-5} eV to 0.414 eV
2) "1/E" Slowing-Down Spectrum $W_2(E) = C_2/E$	0.414 eV to 2.12 MeV
3) Fission Spectrum (θ = 1.415 MeV) $W_3(E) = C_3 E^{1/2} e^{-E\theta}$	2.12 MeV to 10.0 MeV
4) "1/E" Spectrum $W_4(E) = C_4/E$	10.0 MeV to 12.52 MeV
5) Velocity Exponential Fusion Peak (E_p = 14.07 MeV) (kT = 0.025 MeV) $W_5(E) = C_5 \exp\left\{-\frac{5}{kT}(E^{1/2}-E_p^{1/2})^2\right\}$	12.52 MeV to 15.68 MeV
6) "1/E" Spectrum $W_6(E) = C_6/E$	15.68 MeV to 19.64 MeV

LB = 2 Fractional components correlated over all E_k intervals

$$COV(X_i,Y_j) = \sum_{k,k'} p_{j;k'}^{i;k} F_{xy,k} F_{xy,k'} X_i Y_j \qquad (3)$$

LB = 3 Fractional components correlated over E_k and E_ℓ intervals

$$COV(X_i,Y_j) = \sum_{k,\ell} p_{j;\ell}^{i;k} F_{x,k} F_{y,\ell} X_i Y_j \qquad (4)$$

LB = 4 Fractional components correlated over all E_ℓ intervals within each E_k interval

$$COV(X_i,Y_j) = \sum_{k,\ell,\ell'} p_{j,k,\ell}^{i;k,\ell} F_{xy,\ell'} X_i Y_j \qquad (5)$$

LB = 5 Relative covariance matrix components

$$COV(X_i, Y_j) = \sum_{k,k'} {}^{i;k}_{j;k'} p \; F_{xy;k,k'} X_i Y_j \qquad (6)$$

where X_i and Y_j represent reactions X and Y evaluated at energies i and j, respectively, and the F's ($F_{xy,k'}$, $F_{x,k'}$, etc.) represent uncertainty components, taken directly from the ENDF/B file describing the covariance of reactions X and/or Y for specific energy intervals. The dimensionless operators p in the above definitions are defined in terms of the operator s as follows:

$$p^{i;k,\ell\ldots}_{j;m,n,\ldots} \equiv S_i^{\,k} S_i^{\ell} \ldots S_j^{m} S_j^{n} \ldots , \qquad (7)$$

where

$S_i^{\,k} \equiv 1$ when the energy E_i is in the interval E_k to E_{i+1} of an E_k table (energy structure),

$S_k^{\,k} \equiv 0$ when the energy E_i is outside the range E_k to E_{k+1} of an E_k table.

In addition to these explicit relationships (the LB's), derived relationships are flagged in the ENDF/B file for the uncertainty processor. The relationships for the evaluated and multigroup results are essentially the same and will be described in the next section. Uncertainties for the resolved resonance parameters are also given in ENDF/B-V. The processing procedure for these data will be outlined in the next section.

III. COMPUTATION OF MULTIGROUP COVARIANCE MATRICES

The type of formulation described in the previous section (sums of quantities separable in X and Y) has the very desirable characteristic that, if one assumes a model in which the weighting function is uncorrelated to the cross section of interest, the multigroup covariance matrices are reduced to combinations of single integrals of the weighted cross sections which can be calculated easily.[3] In particular, for

LB = 0,

$$\mathrm{COV}(X_G, Y_H) = \frac{\sum_{k\varepsilon G,H} F_{xy,k}\phi_{G,k}\phi_{H,k}}{\phi_G\phi_H} \tag{8}$$

LB = 1,

$$\mathrm{COV}(X_G, Y_H) = \frac{\sum_{k\varepsilon G,H} F_{xy,k}\phi_{G,k}{}^{X}{}_{G,k}\phi_{H,k}{}^{Y}{}_{H,k}}{\phi_G\phi_H} \tag{9}$$

LB = 2,

$$\mathrm{COV}(X_G, Y_H) = \frac{\left(\sum_{k\varepsilon G} F_{xy,k}\phi_{G,k}{}^{X}{}_{H,k}\right)\left(\sum_{k'\varepsilon H} F_{xy,k'}\phi_{H,k'}{}^{Y}{}_{H,k'}\right)}{\phi_G\phi_H} \tag{10}$$

LB = 3,

$$\mathrm{COV}(X_G, Y_H) = \frac{\left(\sum_{k\varepsilon G} F_{x,k}\phi_{G,k}{}^{X}{}_{G,k}\right)\left(\sum_{\ell\varepsilon H} F_{y,\ell}\phi_{H,\ell}{}^{Y}{}_{H,\ell}\right)}{\phi_G\phi_H} \tag{11}$$

LB = 4,

$$\mathrm{COV}(X_G, Y_H) = \frac{\sum_{k\varepsilon G,H} F_K\left(\sum_{\ell\varepsilon G} F_{xy,\ell}\phi_{G,\ell}{}^{X}{}_{G,\ell}\right)\left(\sum_{\ell'\varepsilon H} F_{xy,\ell'}\phi_{H,\ell'}{}^{Y}{}_{H,\ell'}\right)}{\phi_G\phi_H} \tag{12}$$

and

LB = 5,

$$\mathrm{COV}(X_G, Y_H) = \frac{\sum_{k\varepsilon G,k'\varepsilon H} F_{xy;k,k'}\phi_{G,k}{}^{X}{}_{G,k}\phi_{H,k'}{}^{Y}{}_{H,k'}}{\phi_G\phi_H} \tag{13}$$

In general, the covariance matrix will be a sum of terms from any of the LB descriptions. The derivation of Eqs. (8-12) has been described previously,[1] while Eq. (13) can be derived directly from Eq. (6). The notation used here is:

$COV(X_G,Y_H)$ = multigroup covariance between reaction x, group G and reaction, Y, group H;

ϕ_G = weight for group G;

$X_{G,k}$ = multigroup cross section for reaction X for a supergrid (i,k) constructed from the union of energy boundaries of the uncertainty file and those from the user (e.g., 52-group) energy grid. $\phi_{G,k}$ is the weight for this group; and

F's = components of covariance taken directly from the uncertainty file.

The group G (or H) is appropriate to the type derived files to be processed and is explained in Ref. 5.

These explicitly given relationships (actually the multigroup covariance matrices formed from the LB's) form the basis for the derived uncertainties flagged in the ENDF/B file. Derived uncertainty is used here in one of two senses, either the cross section has been evaluated as a linear combination of other reactions or the cross section has been derived via a ratio measurement to some known reaction.

The "derived redundant cross section" covariances, for those cross sections evaluated as a linear combination of other reactions may be expressed as

$$COV(X_G,X_H) = \sum_{m=1}^{n} \sum_{m'=1}^{n} K_m K_{m'} COV(Y_{m,G},Y_{m',H}) \quad , \tag{14}$$

where K_m are constants relating reaction X to reaction(s) Y_m and where m may range up to n such reactions. This relationship is specified over a certain energy range, that is, the covariance matrix is bounded by energies E_1 and E_2 specified in the ENDF/B file.

Equation (14) implies that many other covariance relationships exist. These other relationships have been called off-diagonal sub-matrices and may be defined as

$$COV(X_G, Y_{m,H}) = \sum_{m'=1}^{n} K_{m'} COV(Y_{m;H}, Y_{m,G}) \qquad m=1,2,\ldots,n . \tag{15}$$

Equation (15) is the defining expression for the covariance between the derived reaction X and each of the reactions from which it is evaluated, Y_m. This covariance matrix is also bounded by the specified energy ranges, E_1 and E_2.

The second type of derived uncertainties is for a reaction which may have been wholly or partially derived from another reaction by a ratio measurement. The covariance matrix for the desired reaction, X is given in general as

$$\text{Rel. } COV(X_G, X_H) = \text{Rel. } COV(R_G, R_H) + \text{Rel. } COV(Z_G, Z_H) \tag{16}$$

where covariances are now given in terms of relative covariance matrices (see Section IV). R_G is the measured ratio of reaction X_G to the known reaction Z_G for group G.[2,5]

A covariance between reaction X and Z may also exist and is given as

$$\text{Rel. } COV(X_G, Z_H) = \text{Rel. } COV(Z_G, Z_H) \quad . \tag{17}$$

Equations (16) and (17) assume that the measured ratio, R, is uncorrelated to the reaction Z.[2,5]

Equations (8-17) illustrate the relationships used in processing ENDF/B-V uncertainty data from files 31 and 33. However, the uncertainties in the resolved resonance parameters in file 32 are given a somewhat limited treatment. The resolved resonance parameters uncertainties have been propagated through to uncertainties in the infinitely dilute resonance cross section using a Breit-Wigner formulism.[5] Uncertainties due to self-shielding effects have not been taken into account. In effect the resolved resonance parameter uncertainties have been propagated to infinitely dilute cross section uncertainties and summed to the previous results of file 33 of ENDF/B-V. Only three materials of the covariance library contain uncertainties due to the resolved resonance parameters; Fe, Na and Pu-240.

IV. RESULTS FOR PROCESSED UNCERTAINTY FILES

Several quantities related to uncertainties in multigroup cross sections are processed from the pointwise ENDF/B data covariance file using the PUFF-II covariance file processing code.[5] Clearly, of interest is the covariance matrix

$$\mathrm{Cov}(X_G,Y_H) = \langle (X_G - \bar{X}_G)\ (Y_H - \bar{Y}_H) \rangle \tag{18}$$

the covariance of reaction X, group G, and reaction Y, group H. (Angle brackets represent expectation values in this section.) The associated quantity, the relative covariance matrix, is defined:

$$\mathrm{Rel\ Cov}(X_G,Y_H) = \mathrm{Cov}(X_G,Y_H)/X_G Y_H \ . \tag{19}$$

In this notation, the standard deviation is given by

$$\mathrm{Std.\ Dev}(X_G) = \sqrt{\mathrm{Cov}(X_G,X_G)} \tag{20}$$

and the analogous relative quantity, the relative standard deviation is

$$\mathrm{Rel\ Std.\ Dev}(X_G) = \frac{\mathrm{Std.\ Dev}(X_G)}{X_G} \ . \tag{21}$$

It is reasonable to expect that in many cases the covariance matrix of energy-dependent cross sections is almost diagonal; i.e., the magnitude of the matrix element corresponding to distinct groups G and H tend to be small if groups G and H are widely displaced from each other in energy.

The correlation matrix is a quantity constructed by dividing the covariance matrix for X_G and Y_H by the respective standard deviations:

$$\mathrm{Corr}(X_G,Y_H) = \frac{\langle (X_G - \bar{X}_G)\ (Y_H - \bar{Y}_H)\rangle}{\sqrt{\langle (X_G - \bar{X}_G)^2\rangle \langle (Y_H - Y_H)^2\rangle}} \tag{22}$$

The correlation matrix is bounded by unity, i.e.,

$$|\mathrm{Corr}(X_G,Y_H)| \leq 1 \tag{23}$$

When $\mathrm{Corr}(X_G,Y_H) = 0$, the group cross sections are said to be totally uncorrelated; when $|\mathrm{Corr}(X_G,Y_H)| = 1$, the group cross sections are termed fully correlated (or anticorrelated).

V. SPECIAL CASES

The B-10(n,α) (MT = 107) covariance matrix was produced from an explicit uncertainty file. Although the B-10(n,α) uncertainty file is given in ENDF/B-V as a derived file, an explicit file was needed by the uncertainty processor, PUFF-II, in order to process the U-238(n,γ) uncertainty data. This action is explained in a letter in Appendix D.

Also concerning U-238, an estimate of the uncertainty in the capture cross section from 1 eV to 4 keV was included in the uncertainty file. This estimate was provided by G. de Saussure under the limiting conditions explained in the letter in Appendix D, (also see comments in Appendix E). Estimates for the fission and total elastic reactions were also provided, but are not yet included in the covariance file. These estimates are not believed to be of great importance to fast reactor applications, where as the capture uncertainty estimate is believed to be needed.

In an effort to cut down on the amount of preprocessed data needed to produce this multigroup covariance library, the total $\bar{\nu}(E)$ for U-238 was used as the prompt $\nu(E)$ of U-238 in processing the uncertainty file. The prompt $\bar{\nu}(E)$ ranged from 98.2% to 99.5% (low to high energy) of the total $\bar{\nu}(E)$ for U-238 in ENDF/B-V file 1. This means that neither the covariance matrices of U-238 total $\bar{\nu}(E)$ or U-238 prompt $\bar{\nu}(E)$ and its correlation are necessarily correct. The covariance matrix for the total $\bar{\nu}$ is the same as the prompt $\bar{\nu}$ covariance matrix with the MT value switched from 456 to 452.

VI. CONCLUSIONS

This report describes the covariance files created as a part of the ORNL effort to provide important group-structure uncertainty information for use in fast reactor sensitivity and uncertainty analysis. In particular, these data represent the uncertainties and correlations in the multigroup cross sections based on the uncertainty information estimated by the evaluators and expressed in ENDF/B-V.

This report presents the multigroup covariance matrices for many of the important reactions of B-10, C-12, O-16, Na, Cr, Fe, Ni, U-235, U-238, Pu-239, Pu-240, and Pu-241. Except for the special cases mentioned in the previous section, the uncertainty data has come wholly from ENDF/B-V uncertainty files.

Although the Version-V uncertainty files are the most complete ENDF/B effort to document the uncertainty information to date, some important covariances may be missing. Thus, additional covariance matrices may be added to the library as needed. This additional information may come from either ORNL internal generations or from ENDF/B-V modifications.

VII. 52-GROUP STANDARD DEVIATION AND CORRELATION MATRIX PLOTS

The following section contains correlation matrices illustrated in a 3-dimension plot with corresponding standard deviations in a 2-dimension plot. The cross material and/or cross reactions contain no standard deviation plot since they can be found elsewhere for each of the individual material and/or reaction. For such a cross-correlation plot the 'for' material corresponds to the front-to-back axis and the 'to' material corresponds to the left to right axis. For example, inf Fig. 175 the ^{239}Pu (n,f) axis is front to back and the ^{235}U (n,f) axis is left to right.

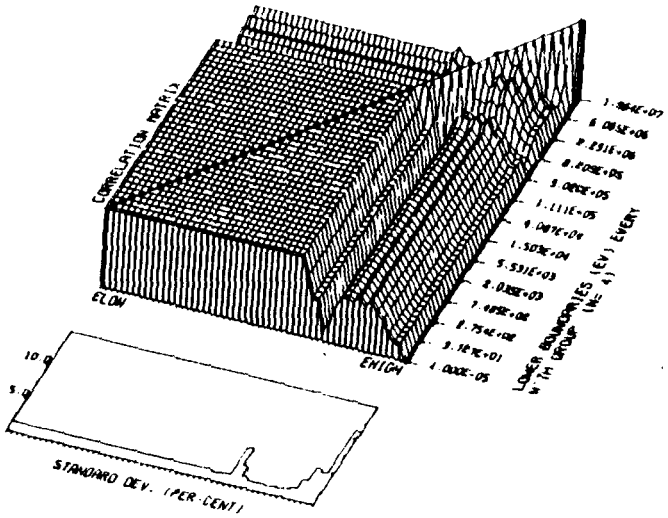


Fig. 2. Standard Deviation and Correlation Matrix for O Elastic Cross Sections.

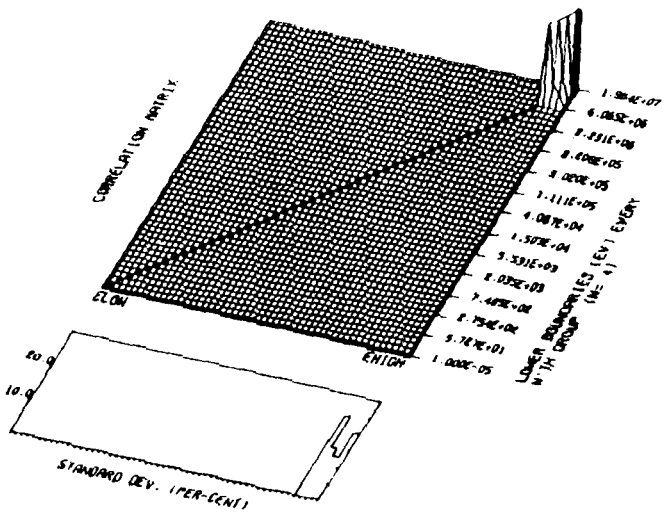


Fig. 3. Standard Deviation and Correlation Matrix for O Inelastic Cross Sections.

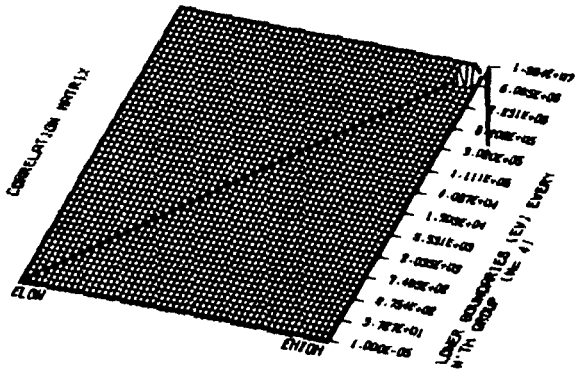


Fig. 4. Cross Correlation Matrix for O Elastic to O Inelastic Cross Sections.

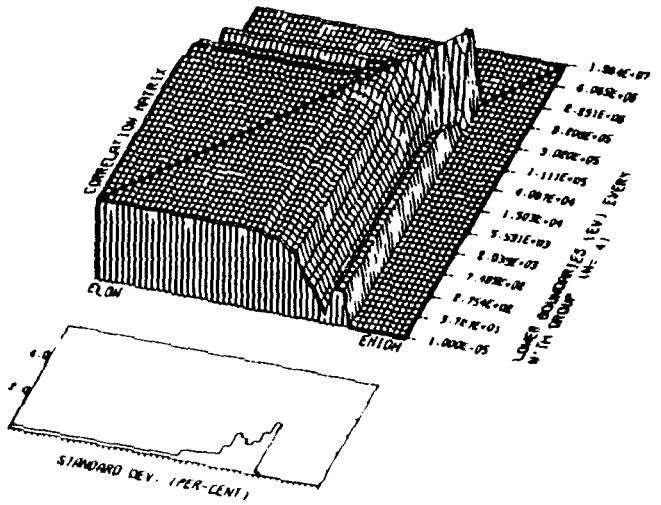


Fig. 5. Standard Deviation and Correlation Matrix for $^{10}B(n,\alpha)$ Cross Sections.

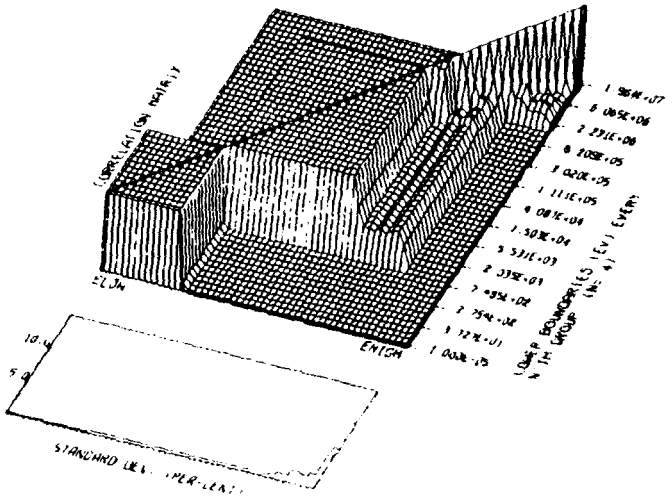


Fig. 6. Standard Deviation and Correlation Matrix for C Total Cross Sections.

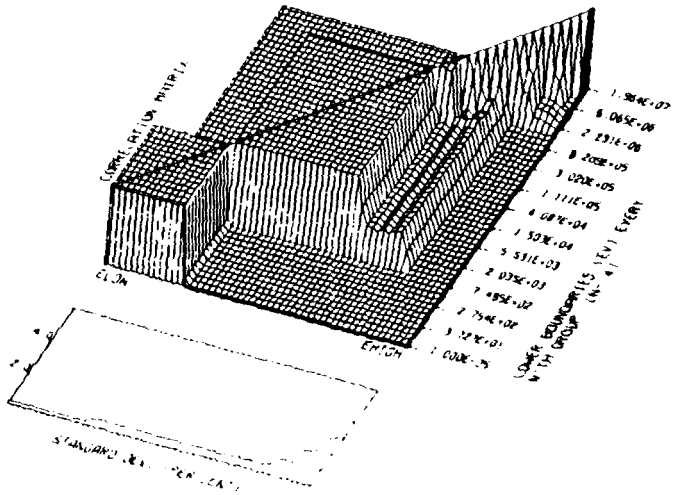


Fig. 7. Standard Deviation and Correlation Matrix for C Elastic Cross Sections.

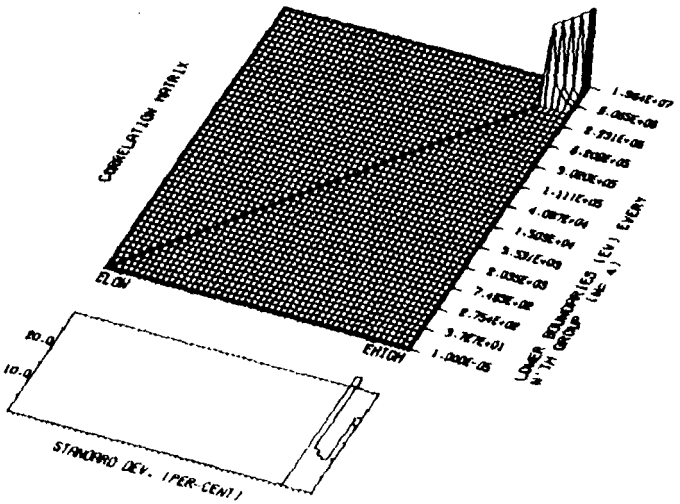


Fig. 8. Standard Deviation and Correlation Matrix for C Inelastic Cross Sections.

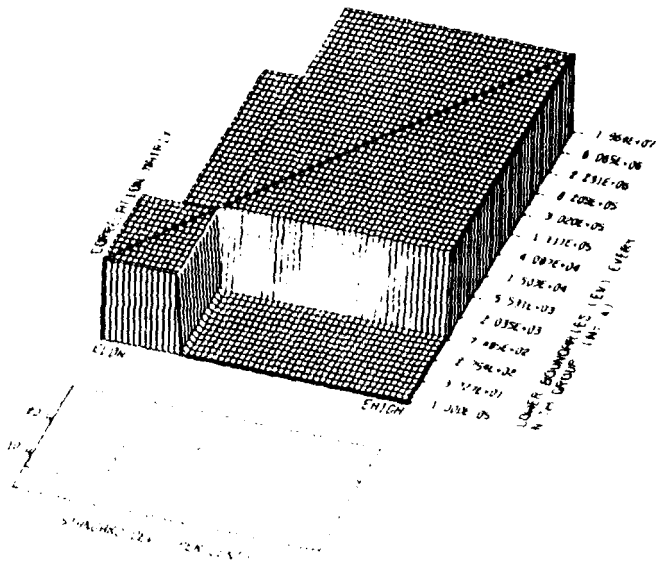


Fig. 9. Standard Deviation and Correlation Matrix for C(n,γ) Cross Sections.

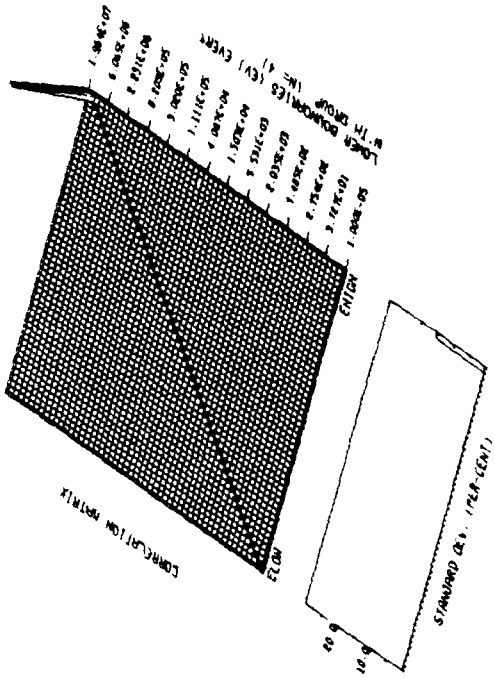


Fig. 11. Standard Deviation and Correlation Matrix for C(n,d) Cross Sections.

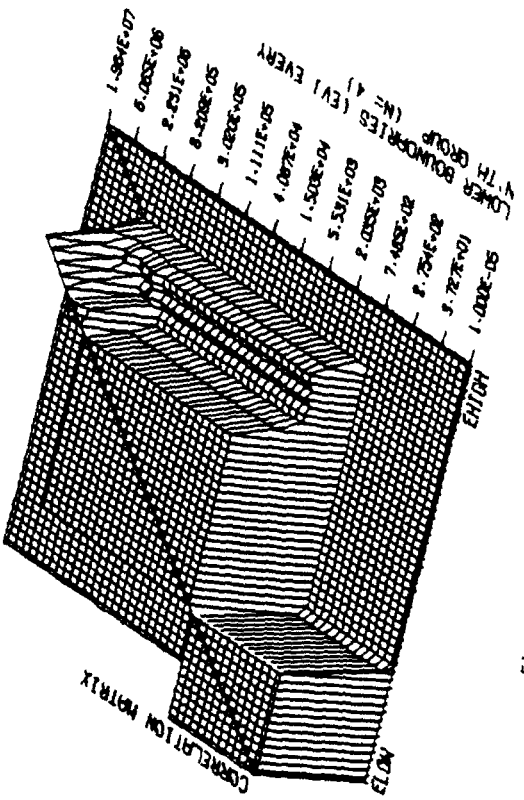


Fig. 13. Cross Correlation Matrix for C Total to C Elastic Cross Sections.

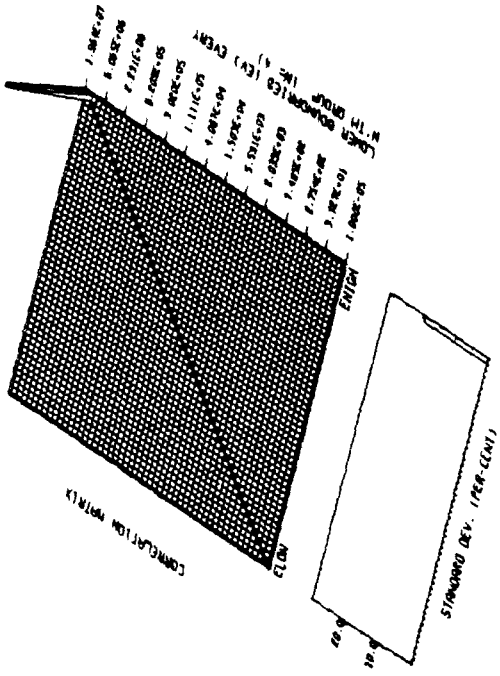


Fig. 10. Standard Deviation and Correlation Matrix for C(n,p) Cross Sections.

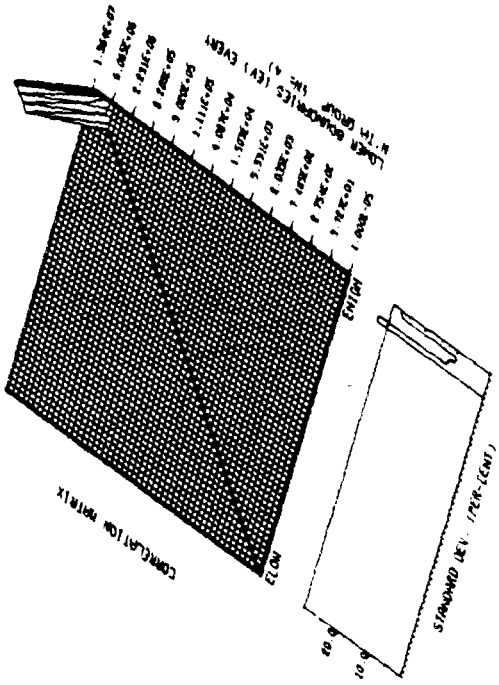


Fig. 12. Standard Deviation and Correlation Matrix for C(n,α) Cross Sections.

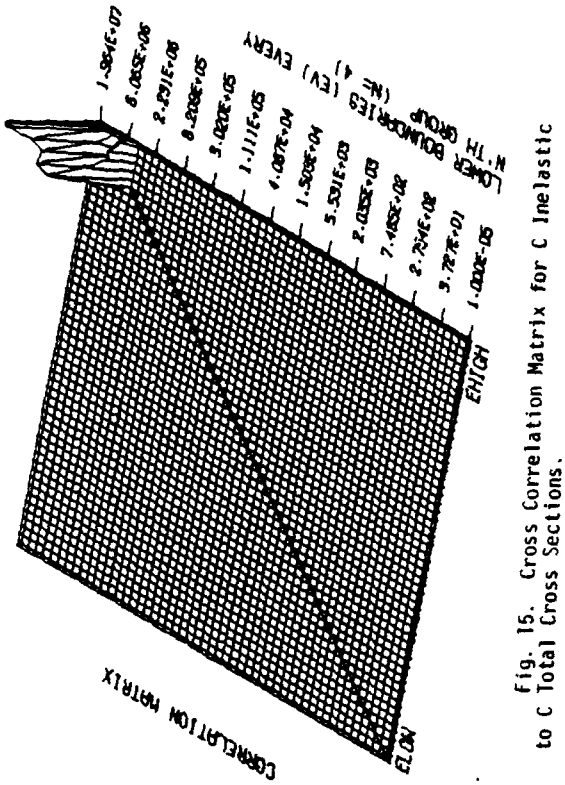


Fig. 15. Cross Correlation Matrix for C Inelastic to C Total Cross Sections.

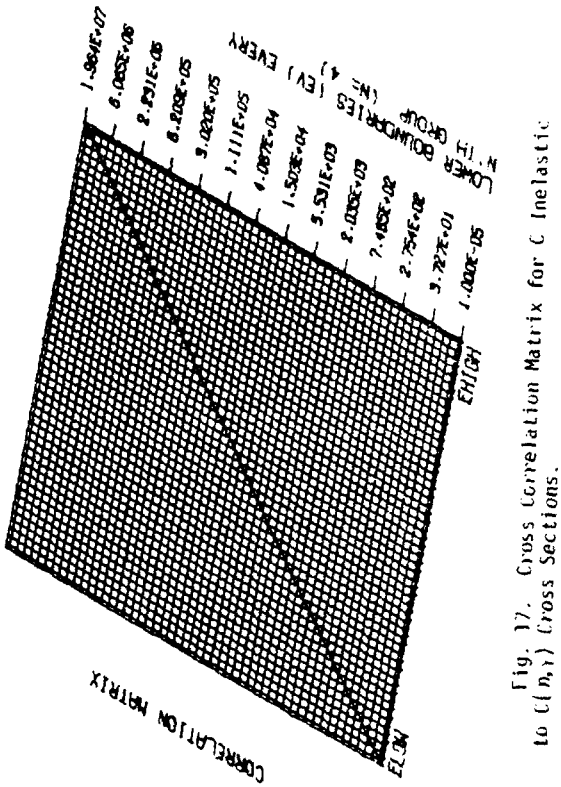


Fig. 17. Cross Correlation Matrix for C Inelastic to C(n,γ) Cross Sections.

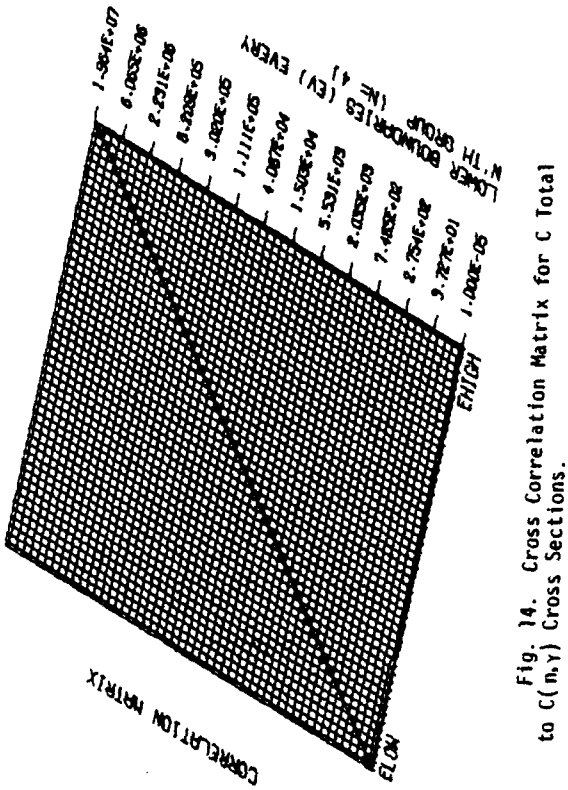


Fig. 14. Cross Correlation Matrix for C Total to C(n,γ) Cross Sections.

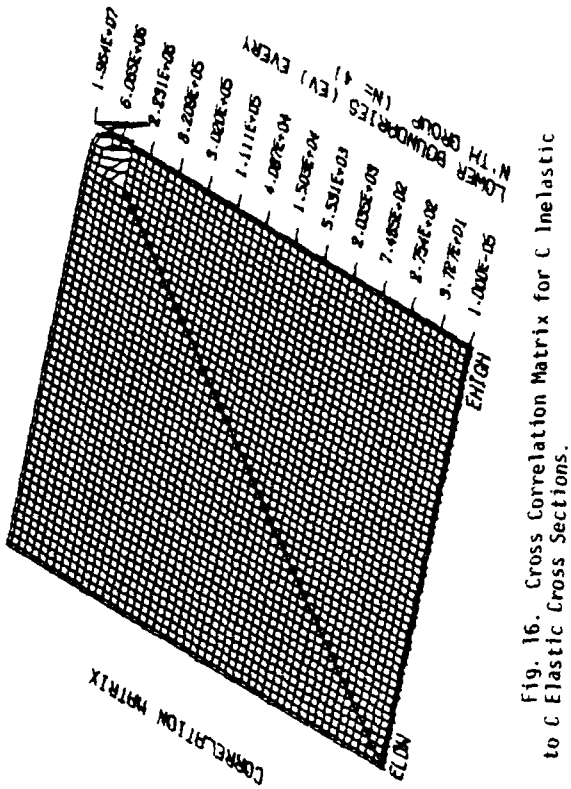


Fig. 16. Cross Correlation Matrix for C Inelastic to C Elastic Cross Sections.

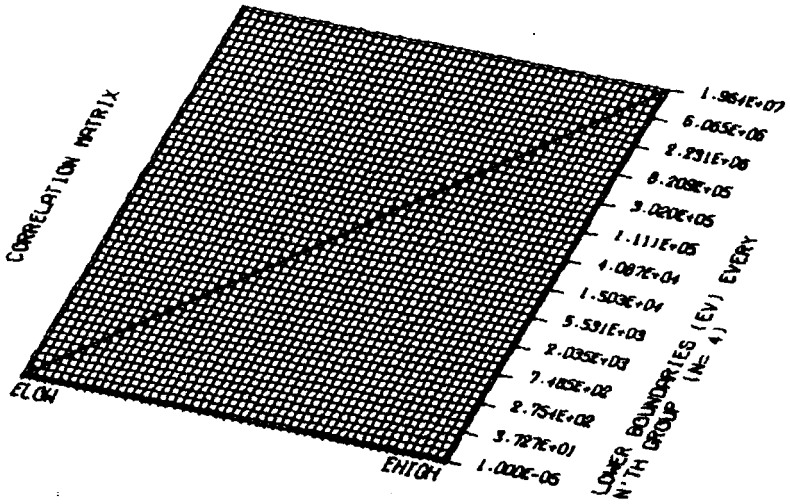


Fig. 18. Cross Correlation Matrix for C Inelastic to C(n,p) Cross Sections.

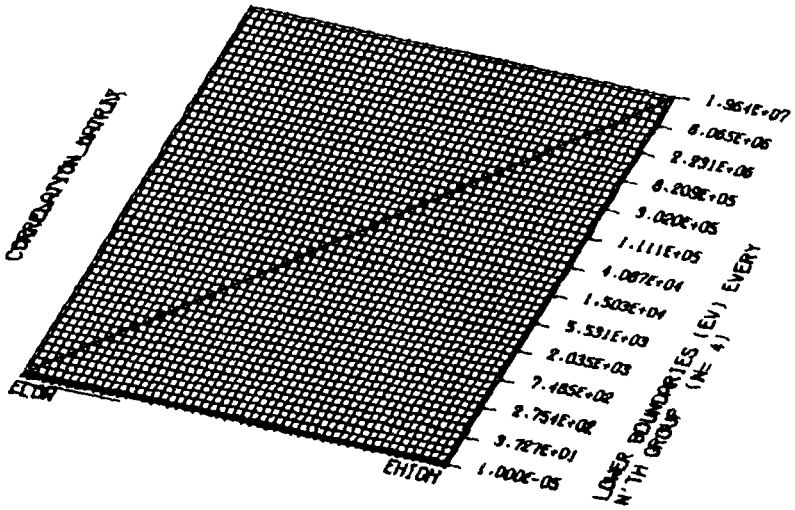


Fig. 19. Cross Correlation Matrix for C Inelastic to C(n,d) Cross Sections.

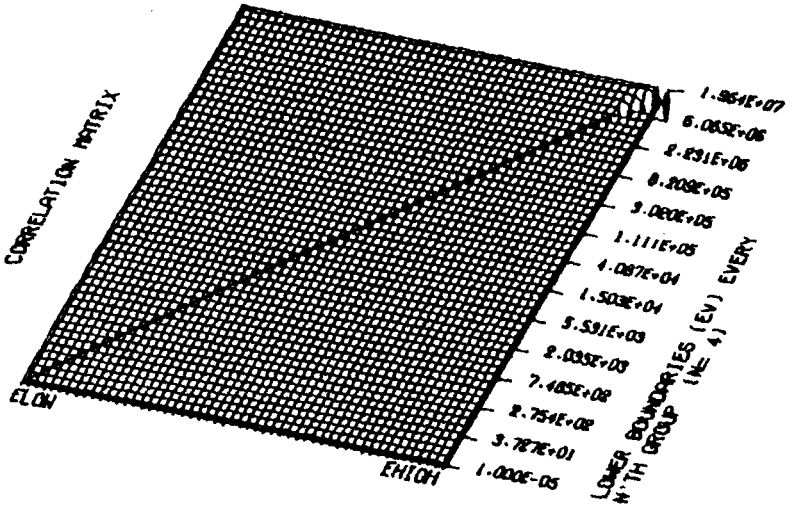


Fig. 20. Cross Correlation Matrix for C Inelastic to C(,α) Cross Sections.

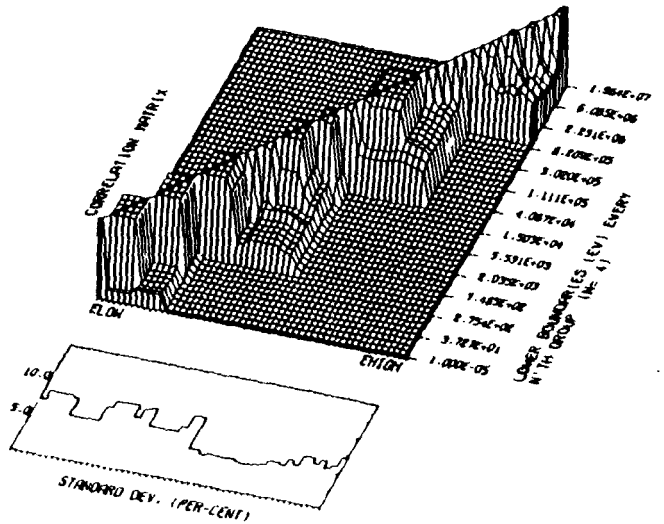


Fig. 21. Standard Deviation and Correlation Matrix for Na Total Cross Sections.

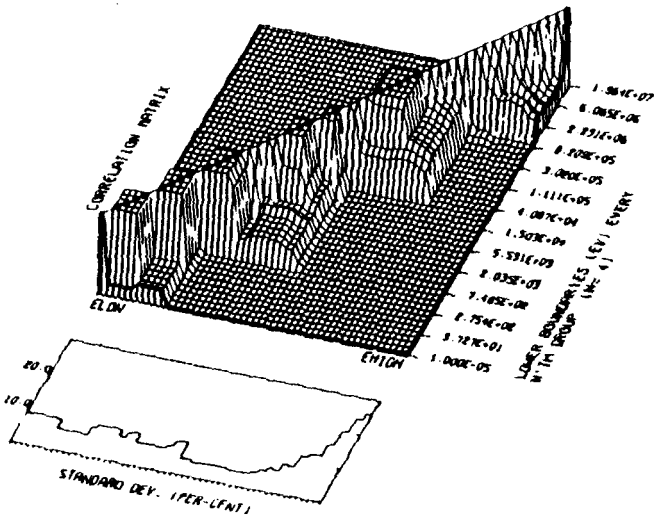


Fig. 22. Standard Deviation and Correlation Matrix for Na Elastic Cross Sections.

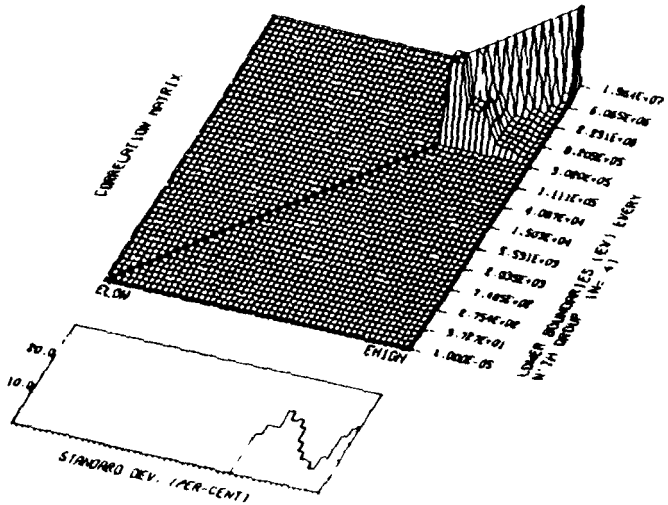


Fig. 23. Standard Deviation and Correlation Matrix for Na Inelastic Cross Sections.

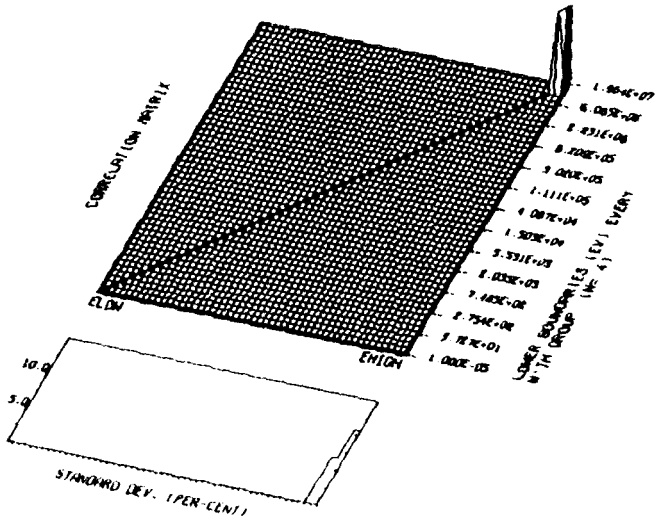


Fig. 24. Standard Deviation and Correlation Matrix for Na(n,2n) Cross Sections.

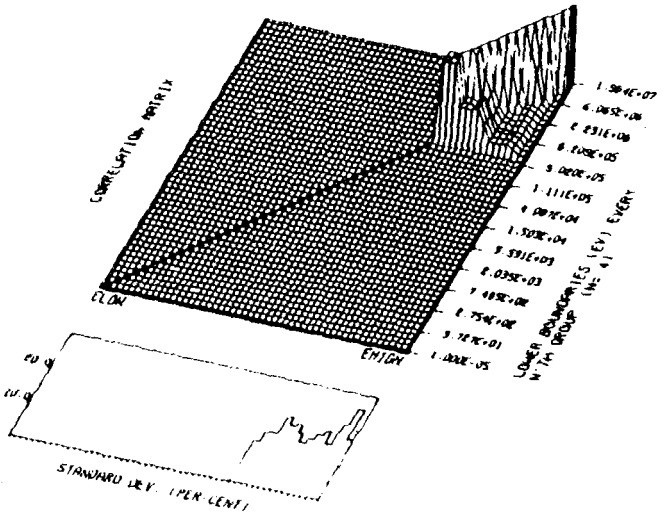


Fig. 25. Standard Deviation and Correlation Matrix for Na(n,n') Level 1 Cross Sections.

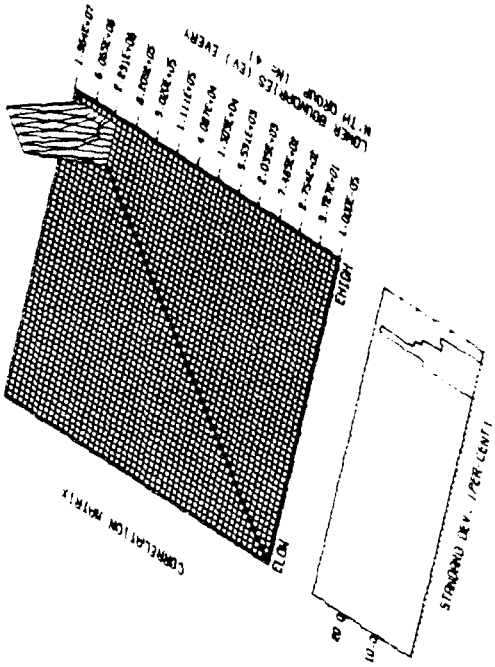


Fig. 27. Standard Deviation and Correlation Matrix for Na(n,n') Level 3 Cross Sections.

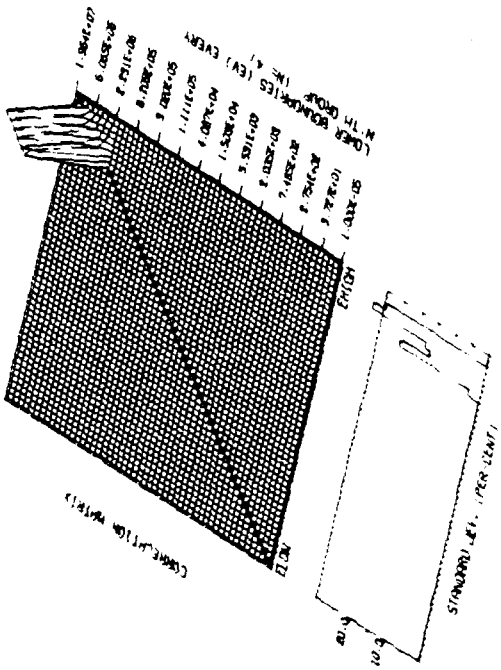


Fig. 29. Standard Deviation and Correlation Matrix for Na(n,n') Level 5 Cross Sections.

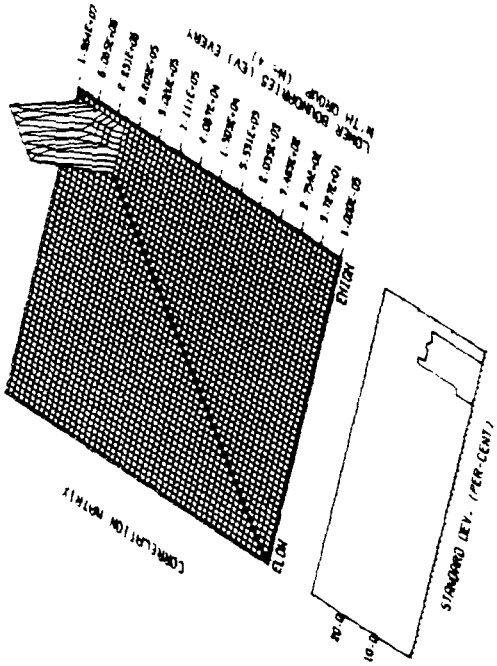


Fig. 26. Standard Deviation and Correlation Matrix for Na(n,n') Level 2 Cross Sections.

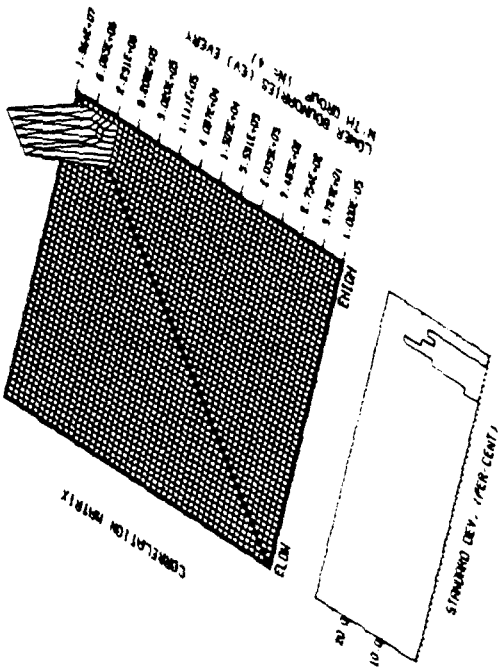


Fig. 28. Standard Deviation and Correlation Matrix for Na(n, ') Level 4 Cross Sections.

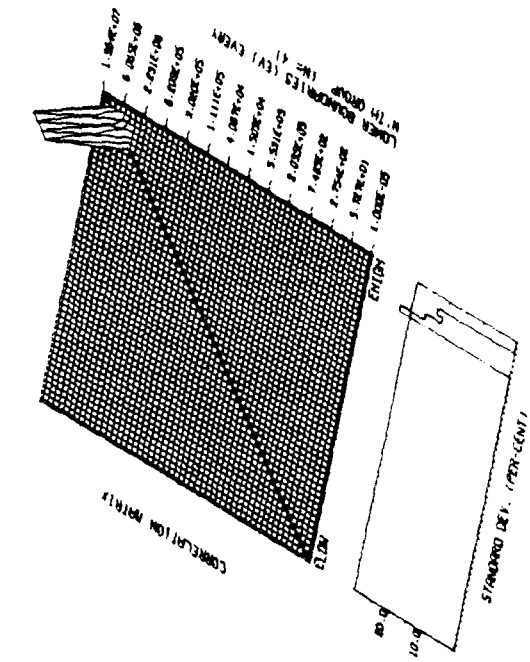


Fig. 30. Standard Deviation and Correlation Matrix for Na(n,n') Level 6 Cross Sections.

Fig. 31. Standard Deviation and Correlation Matrix for Na(n,n') Level 7 Cross Sections.

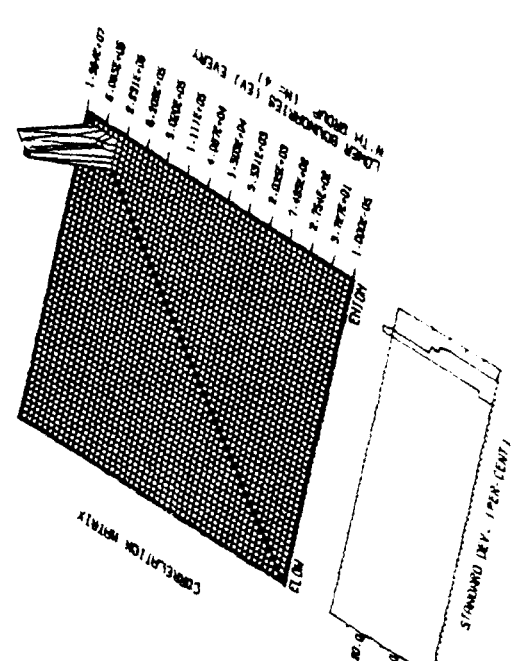


Fig. 32. Standard Deviation and Correlation Matrix for Na(n,n') Level 8 Cross Sections.

Fig. 33. Standard Deviation and Correlation Matrix for Na(n,n') Level 9 Cross Sections.

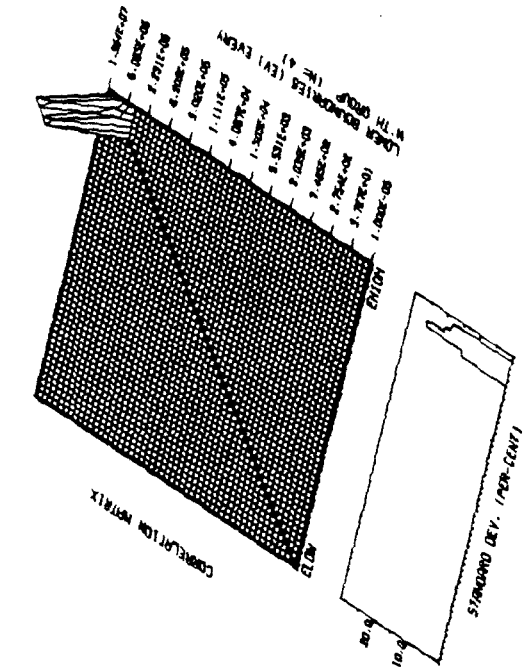


Fig. 35. Standard Deviation and Correlation Matrix for Na(n,n') Level 11 Cross Sections.

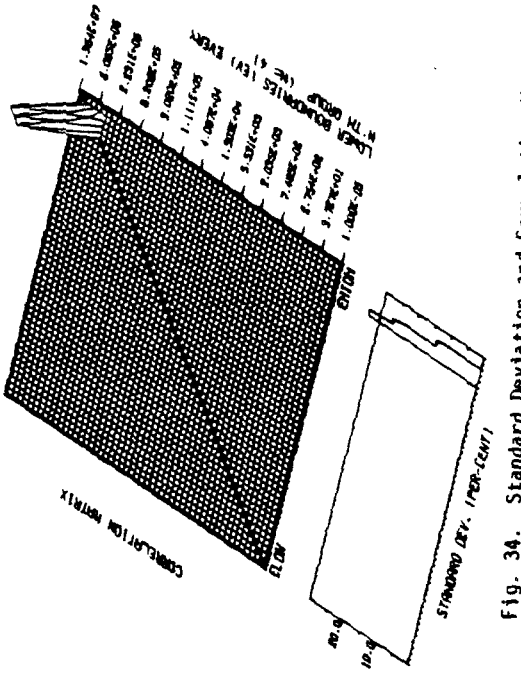


Fig. 34. Standard Deviation and Correlation Matrix for Na(n,n') Level 10 Cross Sections.

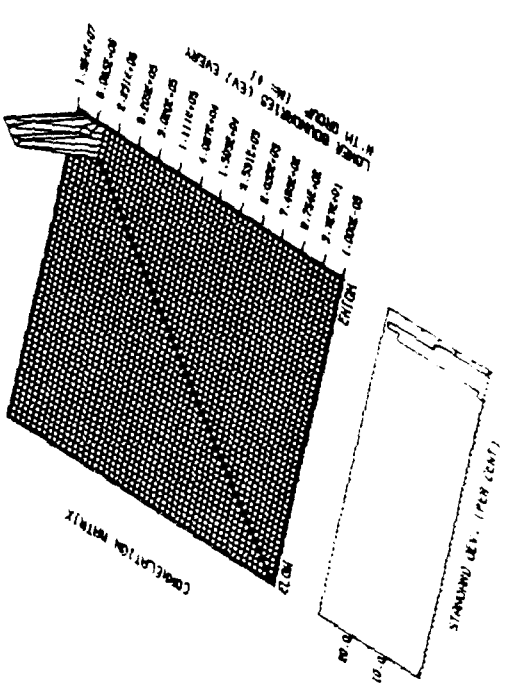


Fig. 37. Standard Deviation and Correlation Matrix for Na(n,n') Level 13 Cross Sections.

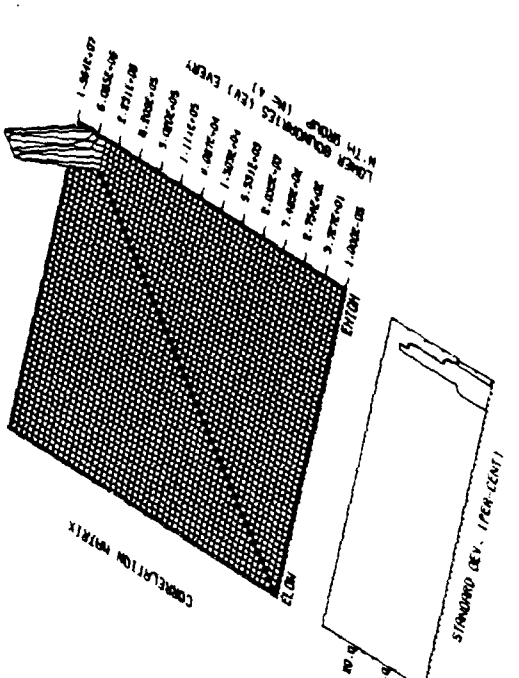


Fig. 36. Standard Deviation and Correlation Matrix for Na(n,n') Level 12 Cross Sections.

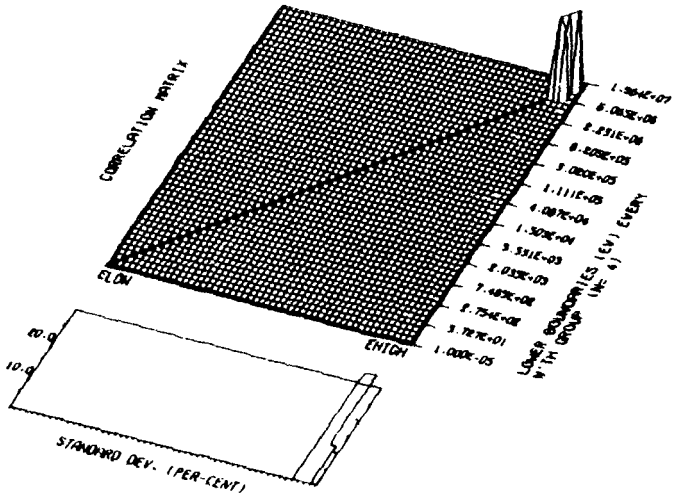


Fig. 38. Standard Deviation and Correlation Matrix for Na(n,n') Level 14 Cross Sections.

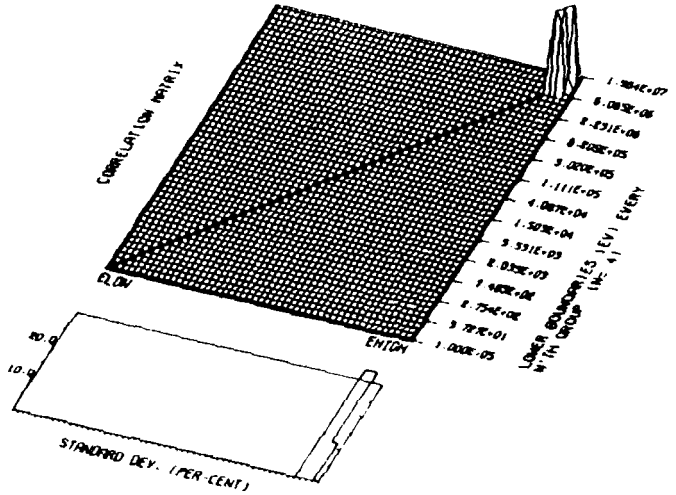


Fig. 39. Standard Deviation and Correlation Matrix for Na(n,n') Level 15 Cross Sections.

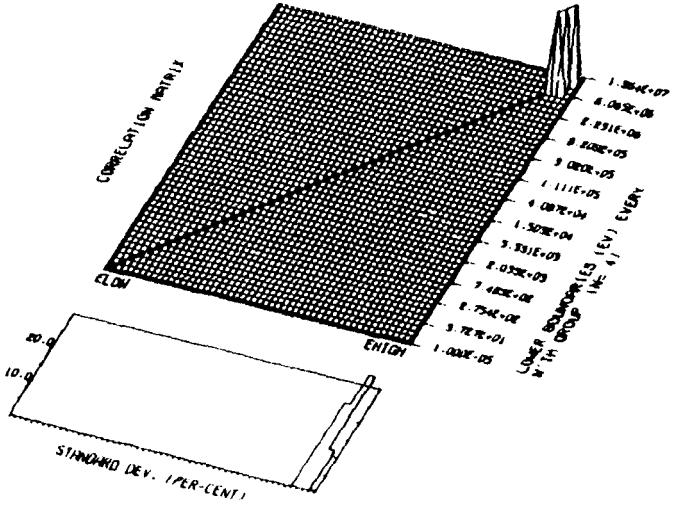


Fig. 40. Standard Deviation and Correlation Matrix for Na(n,n') Level 16 Cross Sections

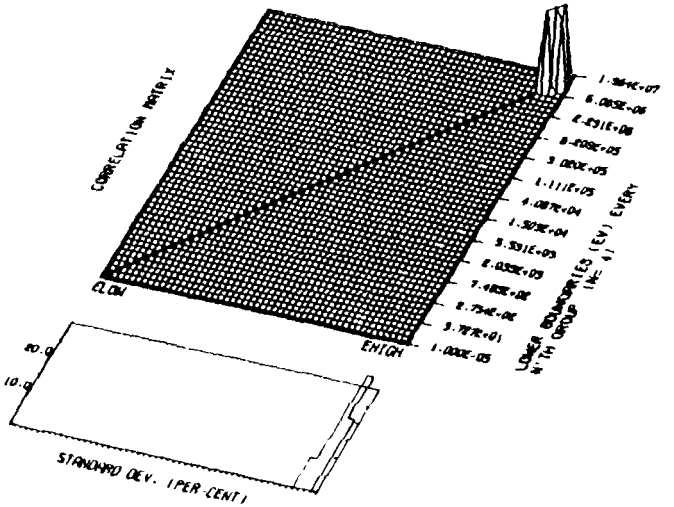


Fig. 41. Standard Deviation and Correlation Matrix for Na(n,n') Level 17 Cross Sections.

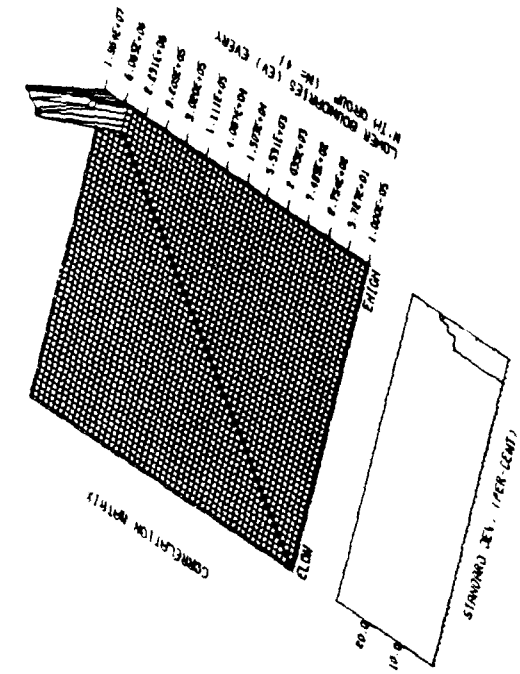


Fig. 43. Standard Deviation and Correlation Matrix for Na(n,n') Continuum Cross Sections.

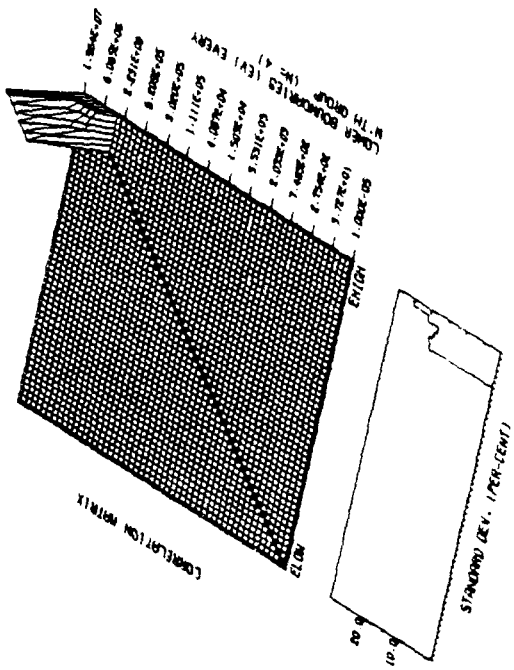


Fig. 45. Standard Deviation and Correlation Matrix for Na(n,p) Cross Sections.

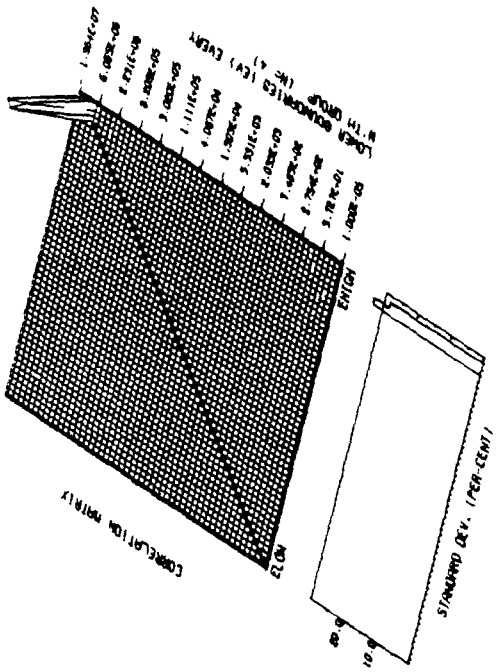


Fig. 42. Standard Deviation and Correlation Matrix for Na(n,n') Level 18 Cross Sections.

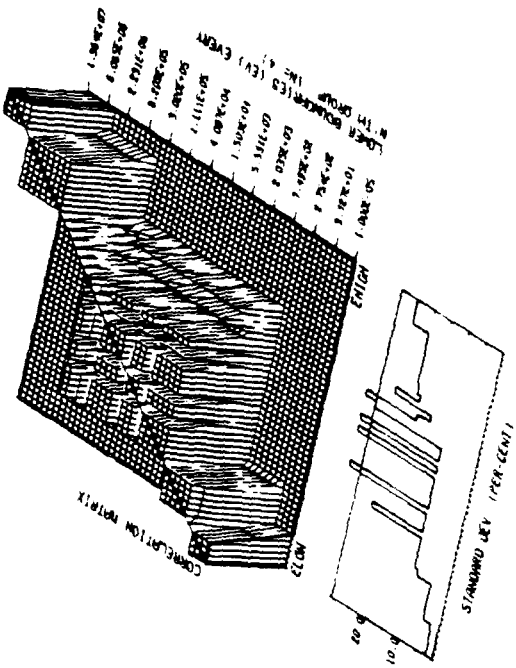


Fig. 44. Standard Deviation and Correlation Matrix for Na(n,γ) Cross Sections.

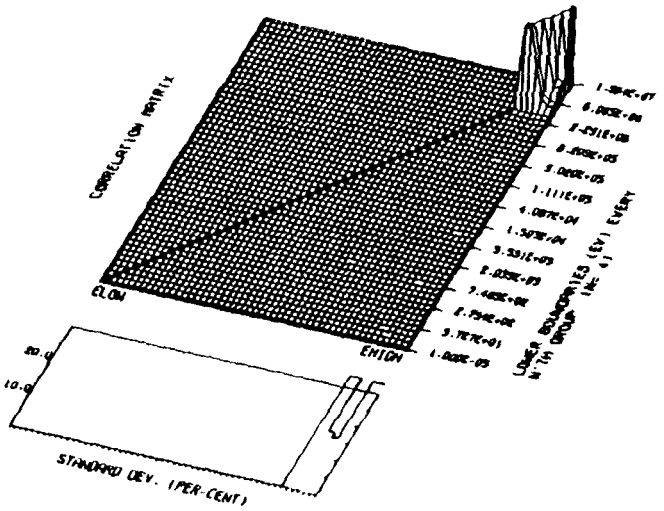


Fig. 46. Standard Deviation and Correlation Matrix for Na(n,u) Cross Sections.

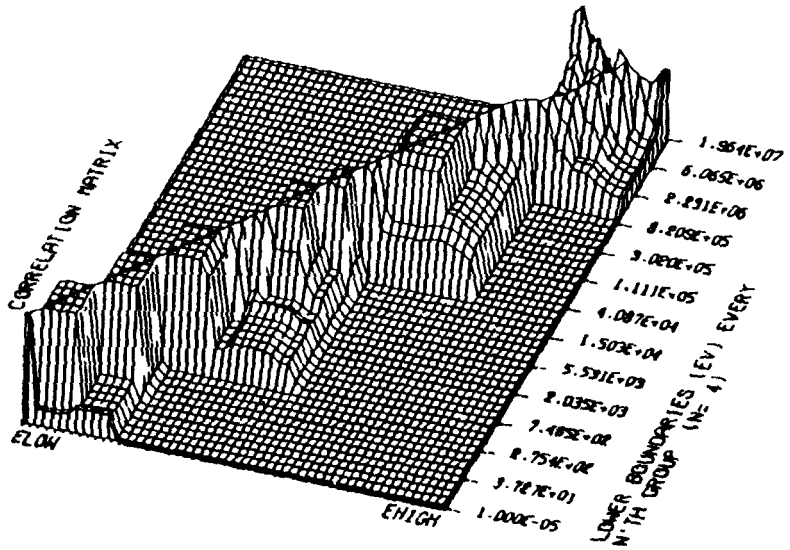


Fig. 47. Cross Correlation Matrix for Na elastic to Na Total Cross Sections.

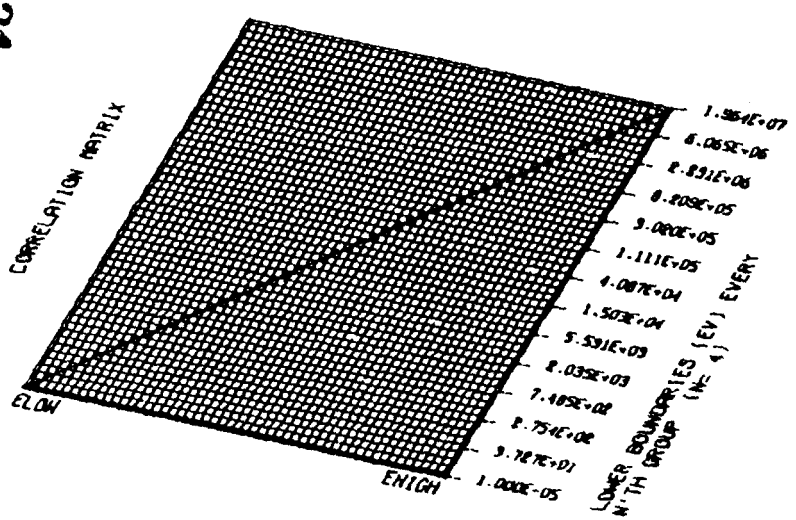


Fig. 48. Cross Correlation Matrix for Na Elastic to Na(n,2n) Cross Sections.

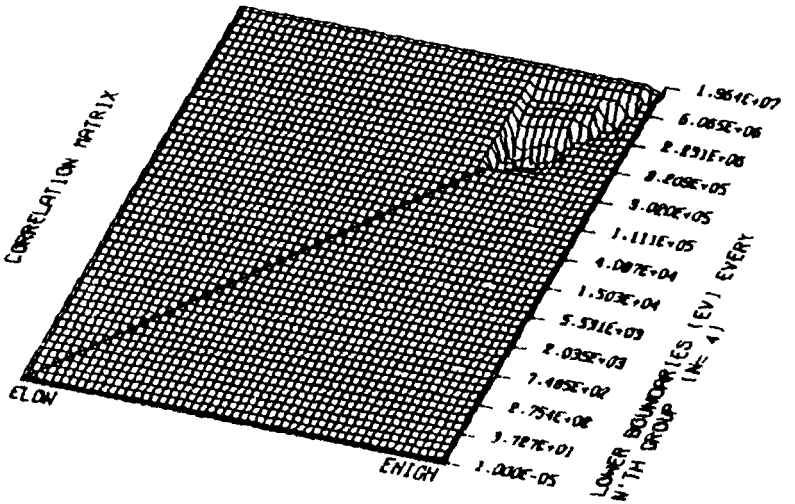


Fig. 49. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 1 Cross Sections.

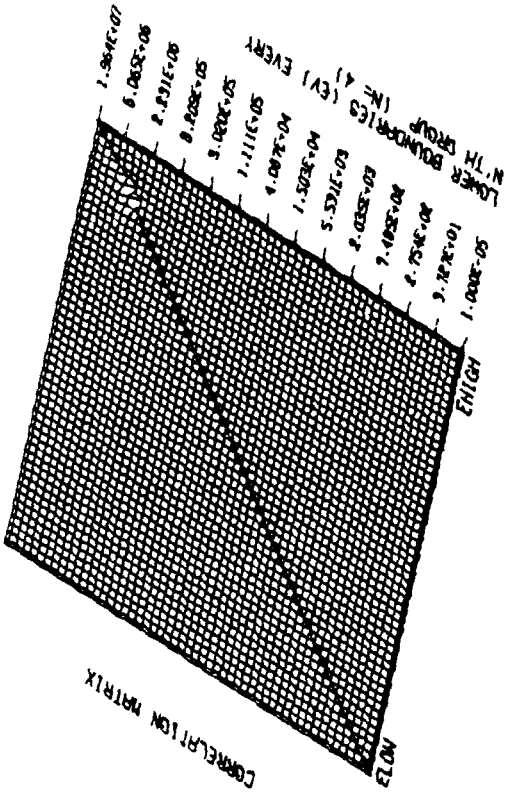


Fig. 51. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 3 Cross Sections.

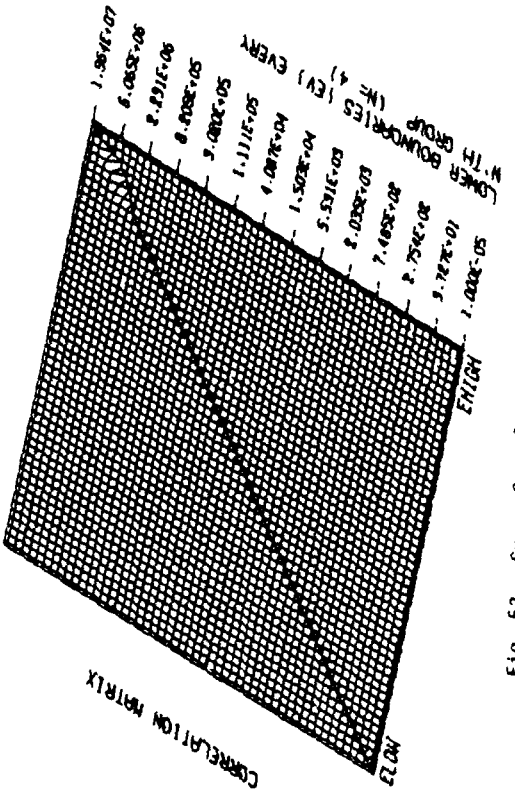


Fig. 53. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 5 Cross Sections.

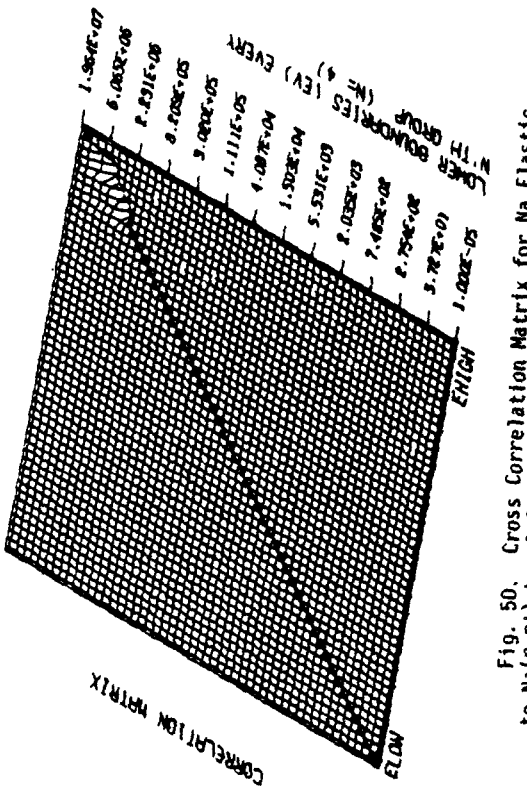


Fig. 50. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 2 Cross Sections.

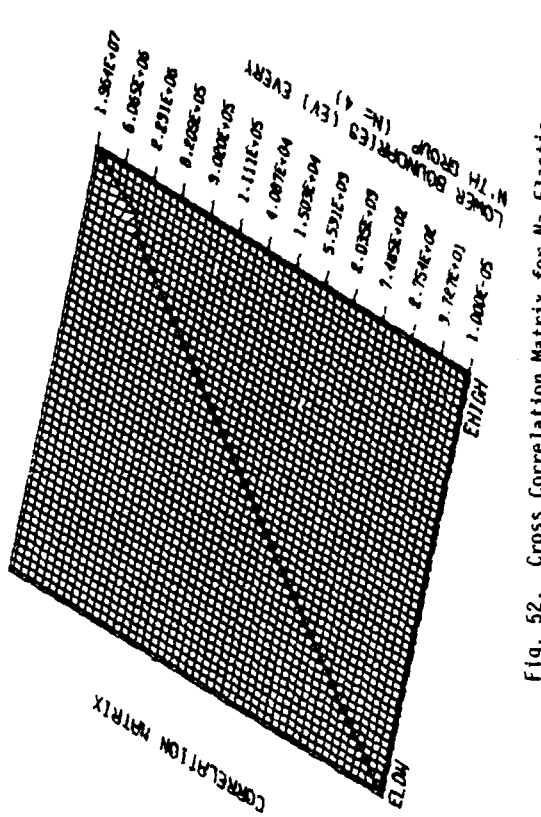


Fig. 52. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 4 Cross Sections.

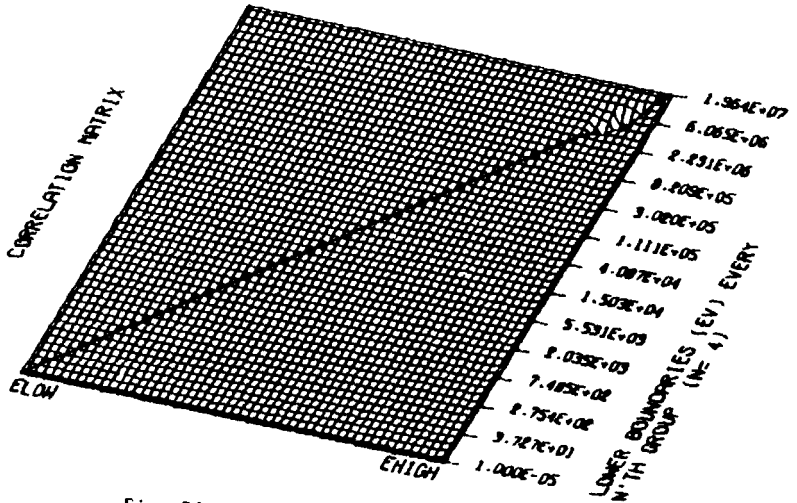


Fig. 54. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 6 Cross Sections.

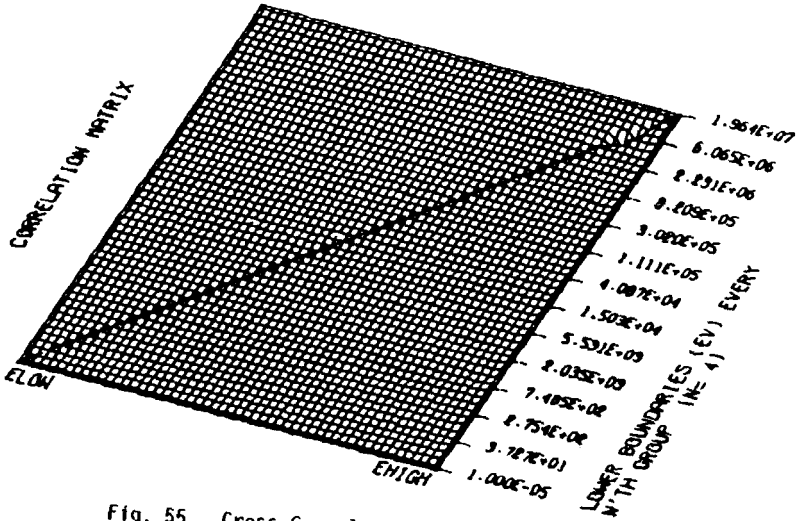


Fig. 55. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 7 Cross Sections.

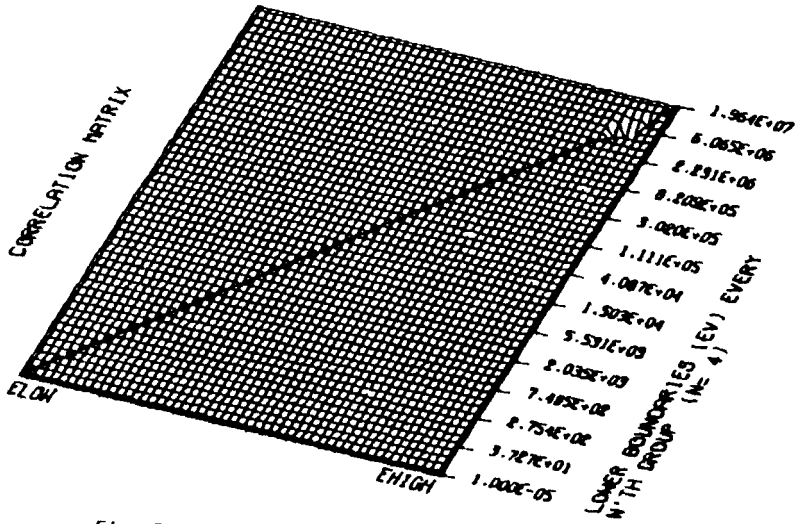


Fig. 56. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 8 Cross Sections.

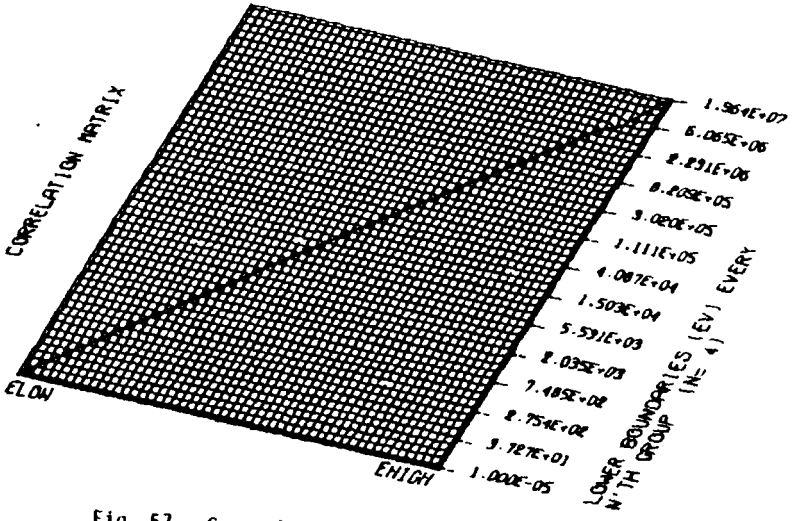


Fig. 57. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 9 Cross Sections.

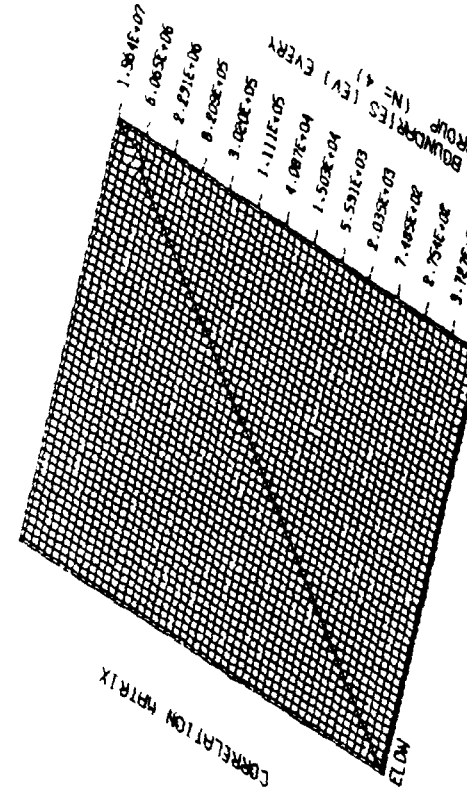


Fig. 59. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 11 Cross Sections.

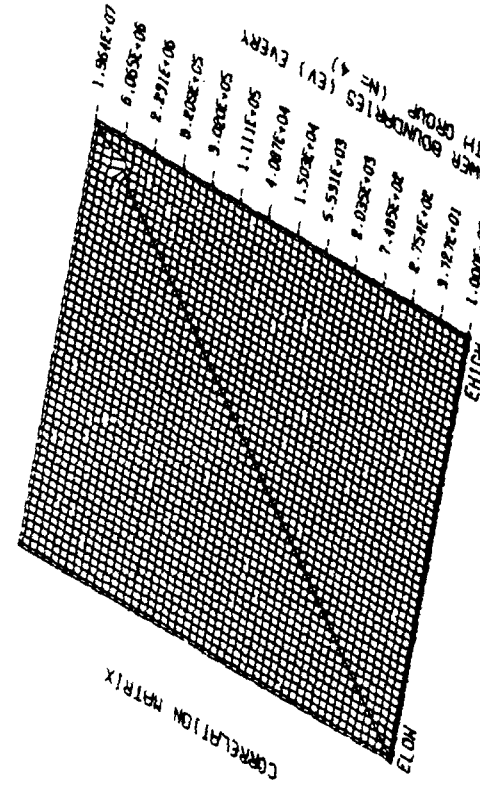


Fig. 58. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 10 Cross Sections.

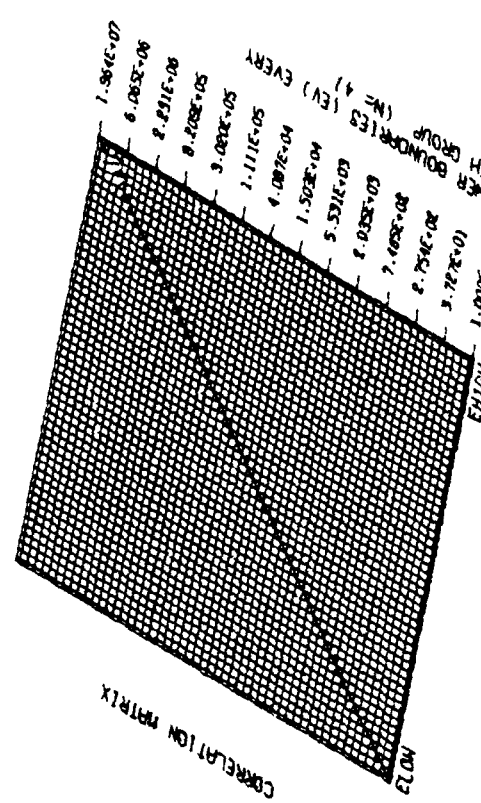


Fig. 61. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 13 Cross Sections.

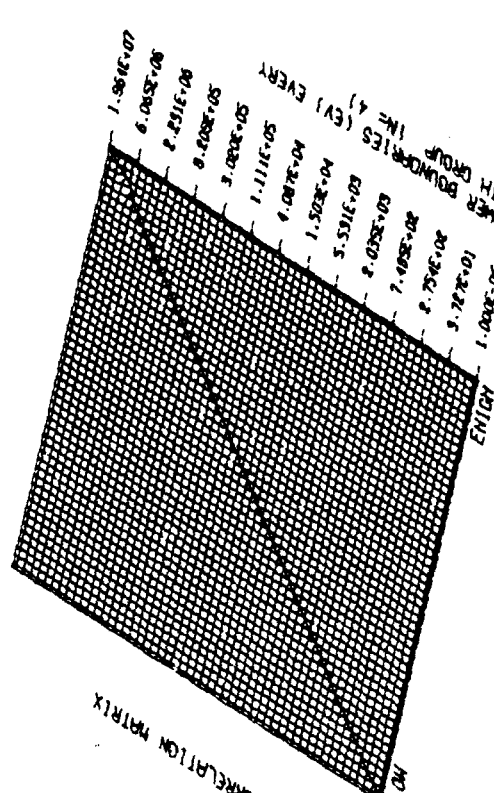


Fig. 60. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 12 Cross Sections.

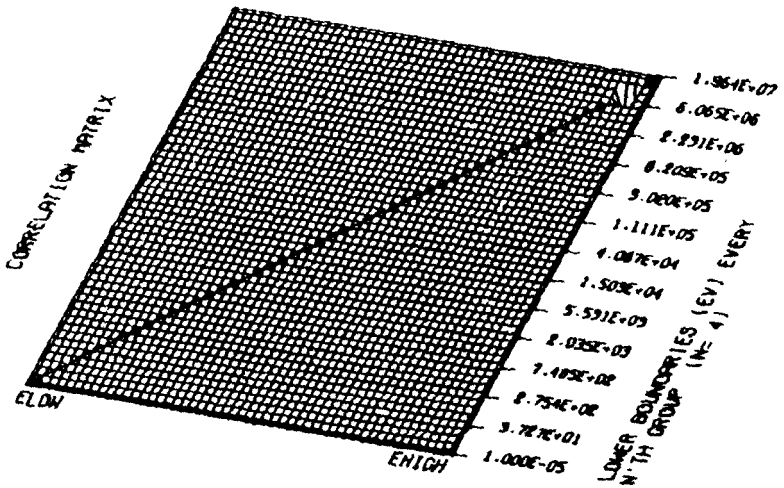


Fig. 62. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 14 Cross Sections.

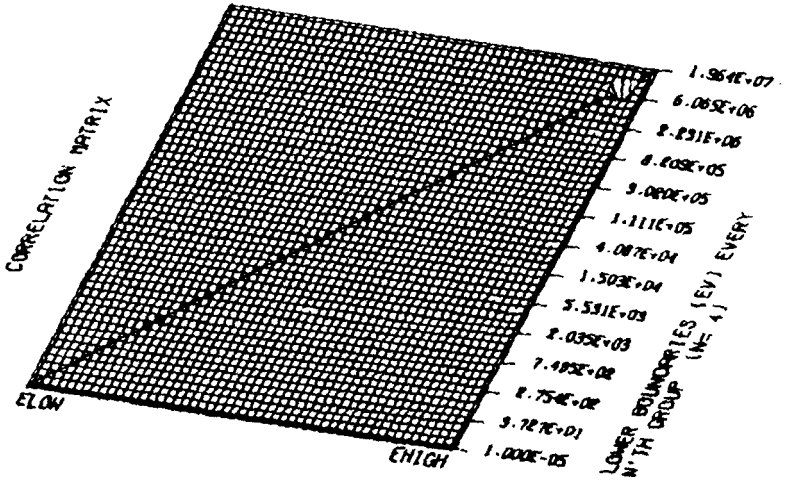


Fig. 63. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 15 Cross Sections.

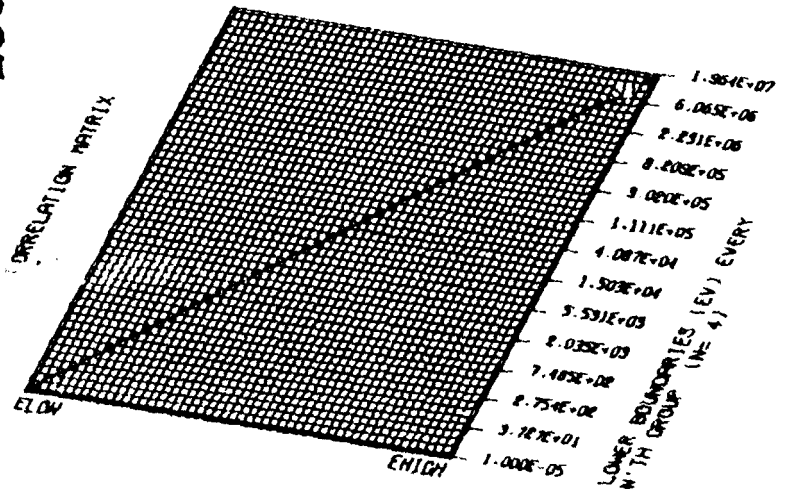


Fig. 64. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 16 Cross Sections.

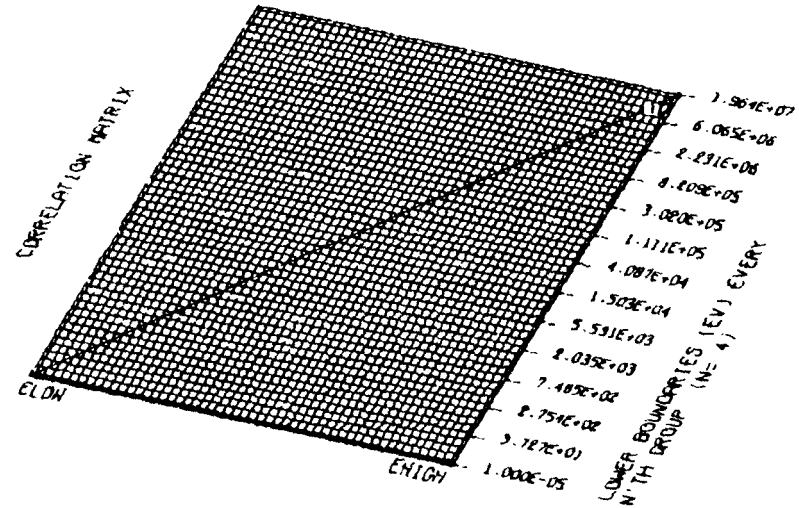


Fig. 65. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 17 Cross Sections.

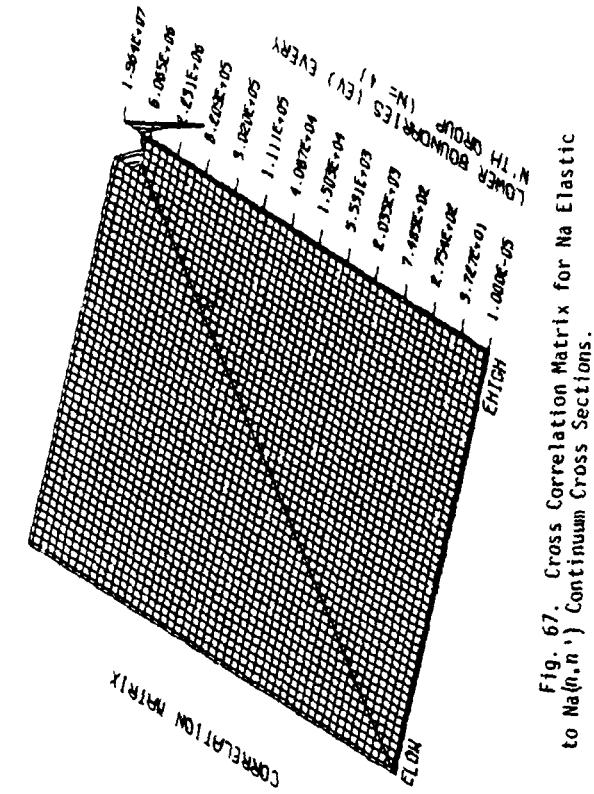


Fig. 67. Cross Correlation Matrix for Na Elastic to Na(n,n') Continuum Cross Sections.

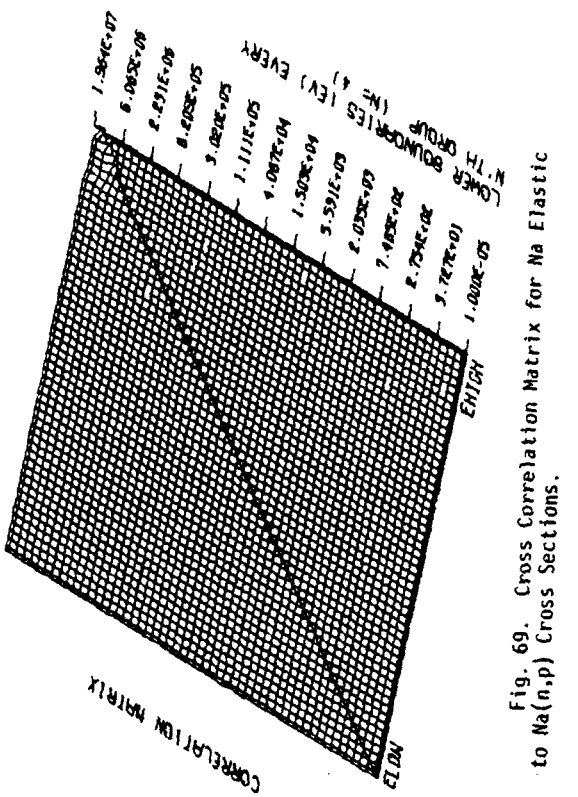


Fig. 69. Cross Correlation Matrix for Na Elastic to Na(n,p) Cross Sections.

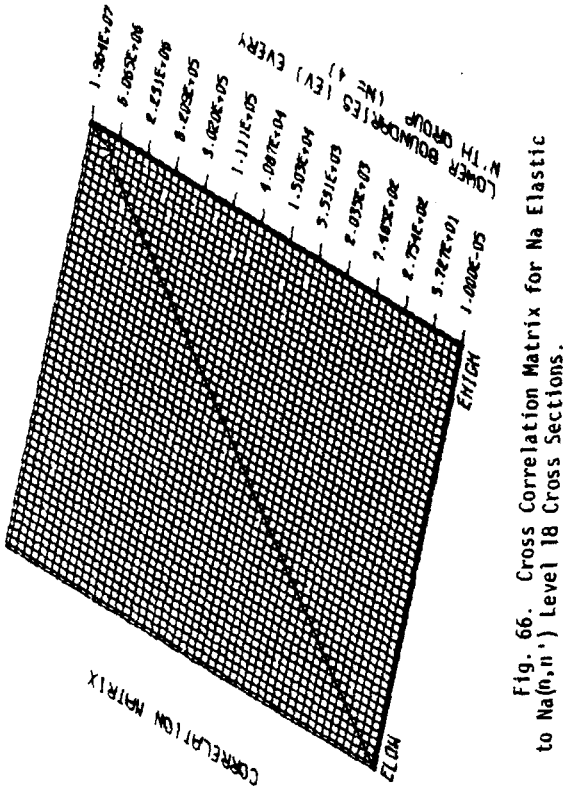


Fig. 66. Cross Correlation Matrix for Na Elastic to Na(n,n') Level 18 Cross Sections.

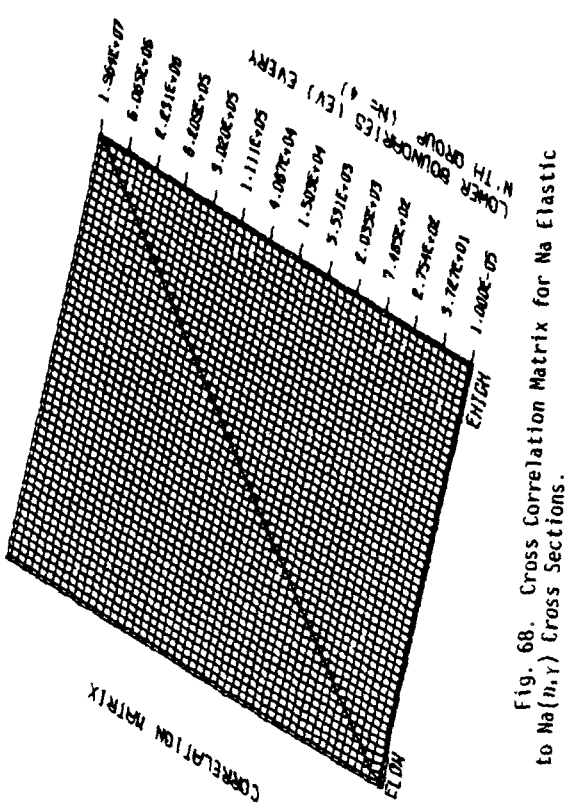


Fig. 68. Cross Correlation Matrix for Na Elastic to Na(n,γ) Cross Sections.

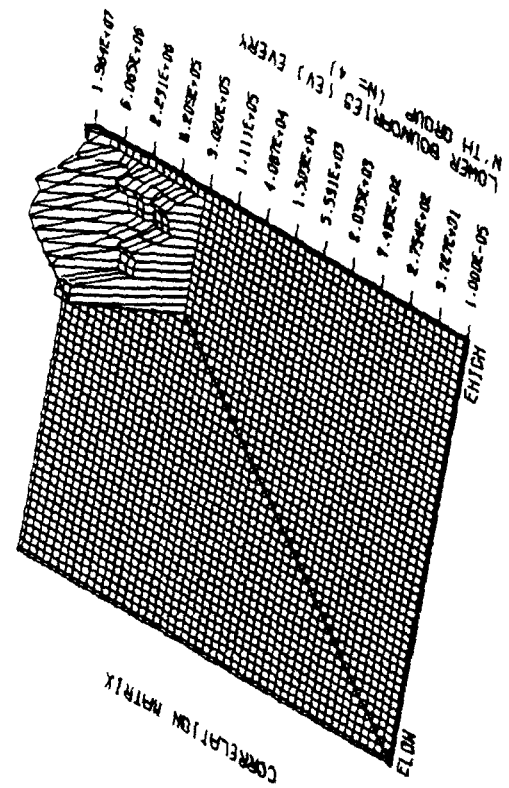


Fig. 70. Cross Correlation Matrix for Na Elastic to Na(n,α) Cross Sections.

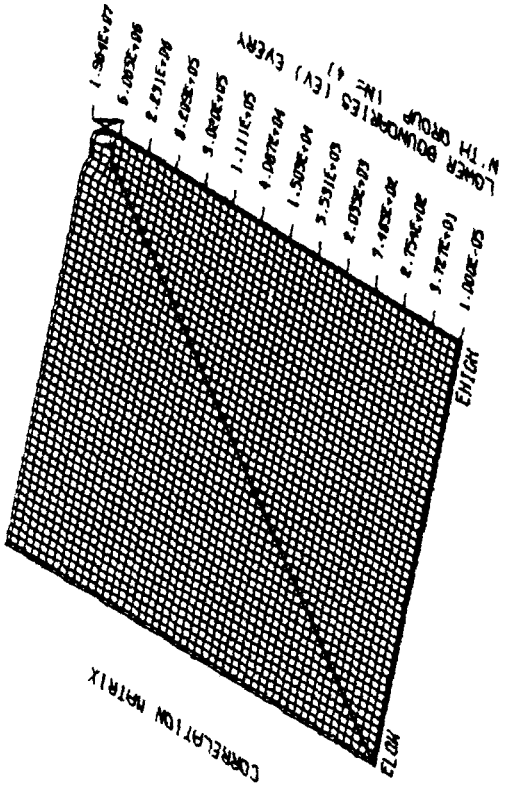


Fig. 71. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 1 Cross Sections.

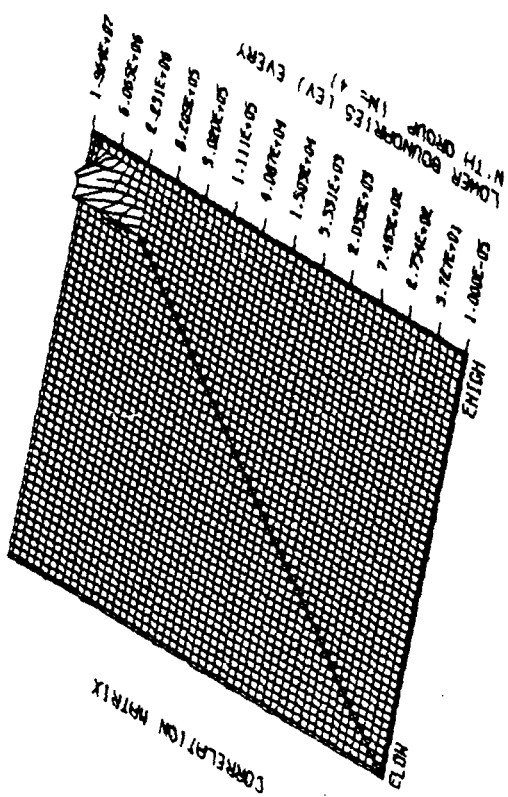


Fig. 72. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 2 Cross Sections.

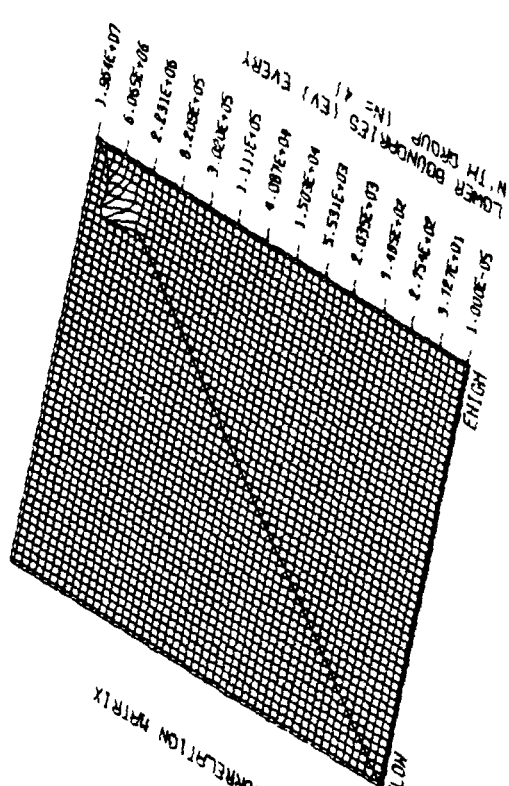


Fig. 73. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 3 Cross Sections.

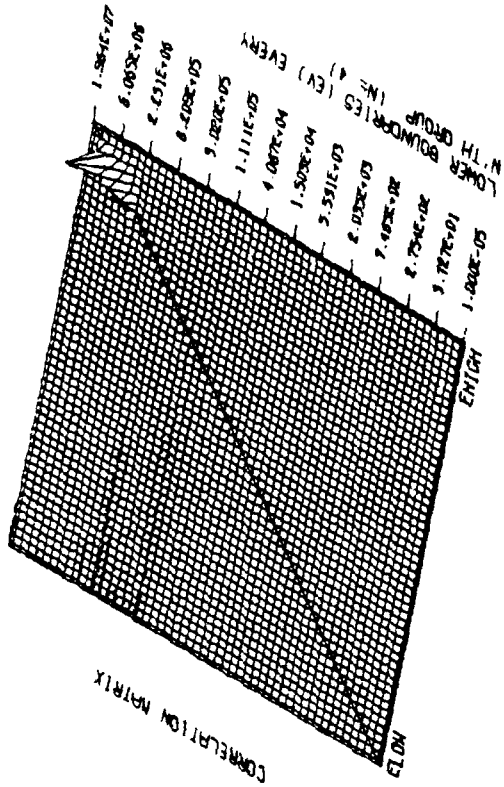


Fig. 75. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 5 Cross Sections.

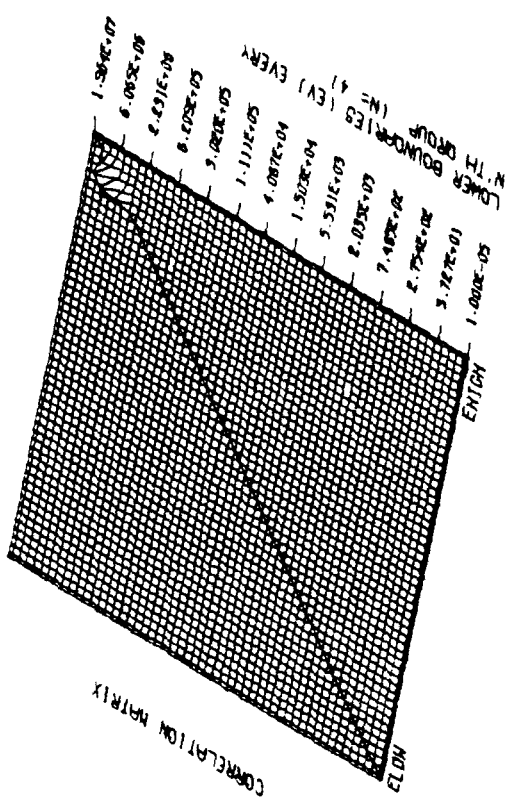


Fig. 77. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 7 Cross Sections.

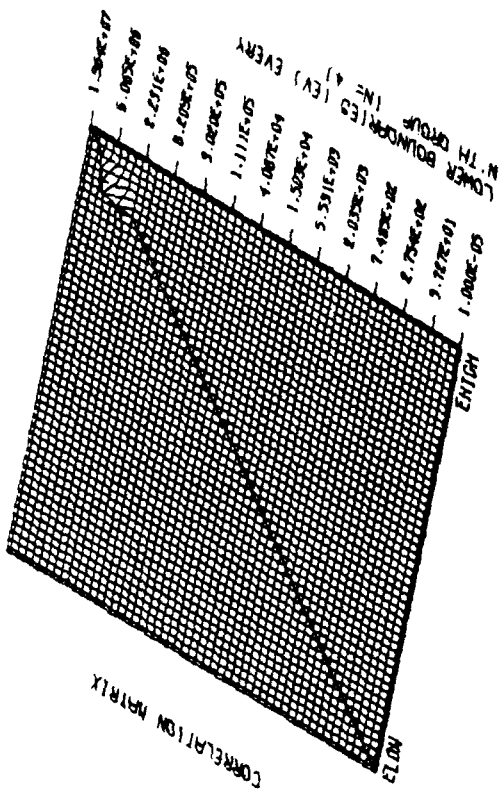


Fig. 74. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 4 Cross Sections.

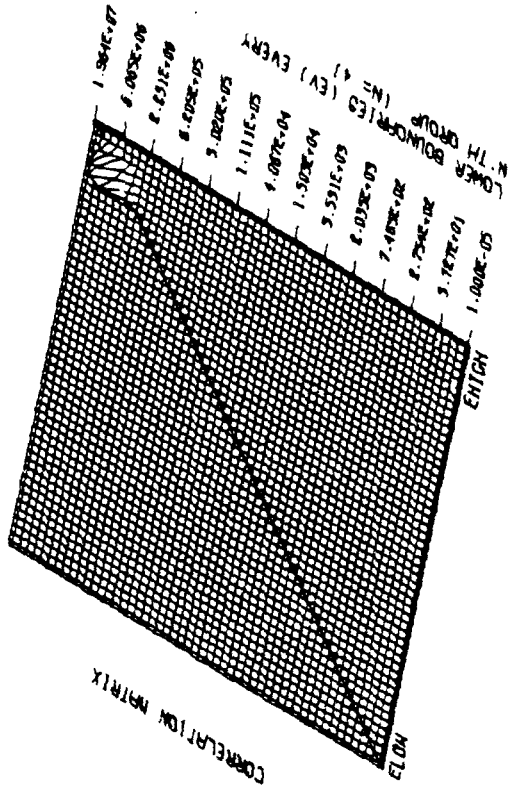


Fig. 76. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 6 Cross Sections.

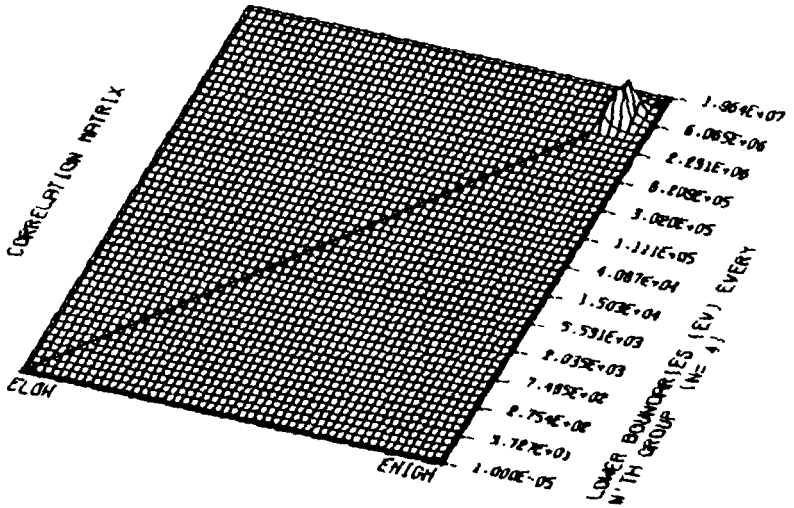


Fig. 78. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 8 Cross Sections.

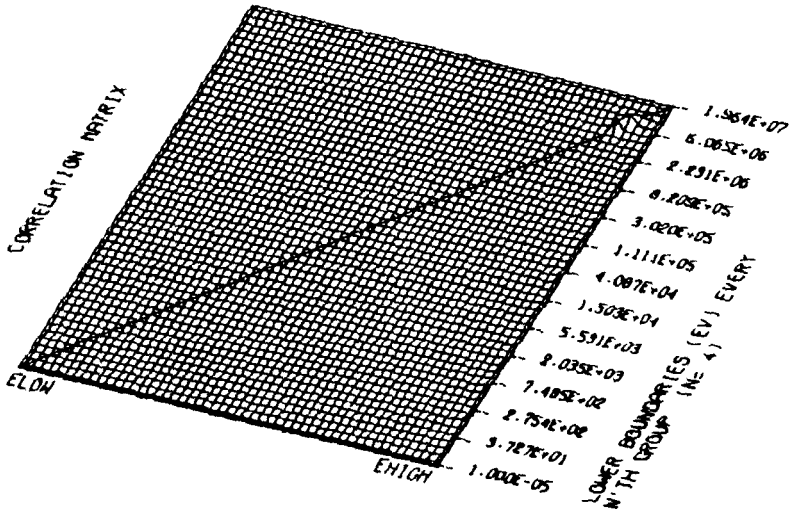


Fig. 79. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 9 Cross Sections.

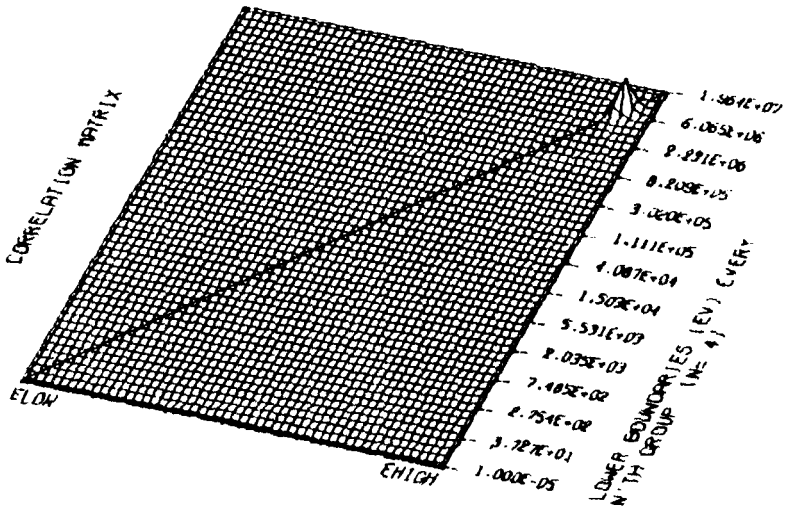


Fig. 80. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 10 Cross Sections.

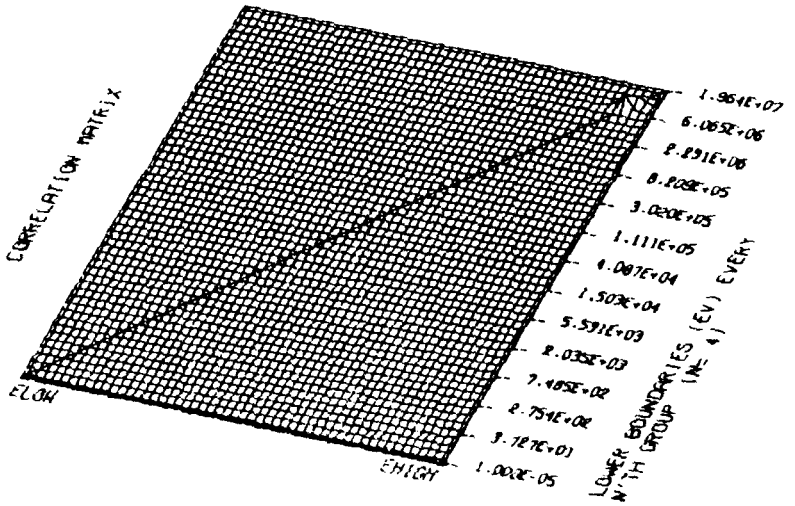


Fig. 81. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 11 Cross Sections.

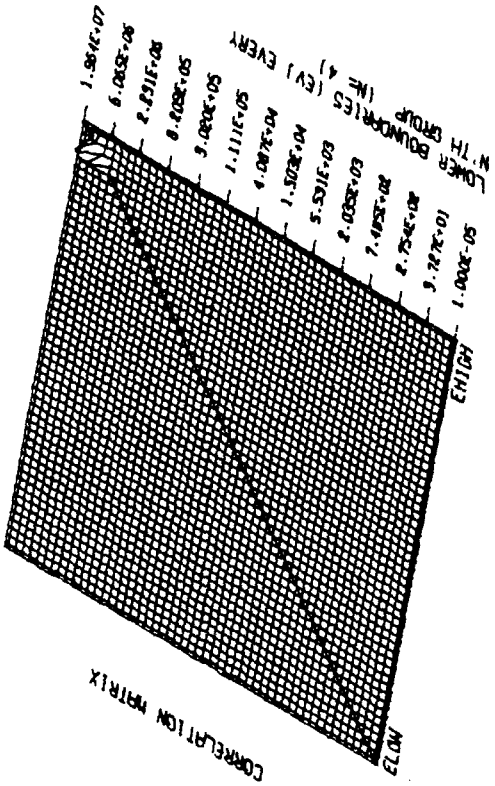


Fig. 83. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 13 Cross Sections.

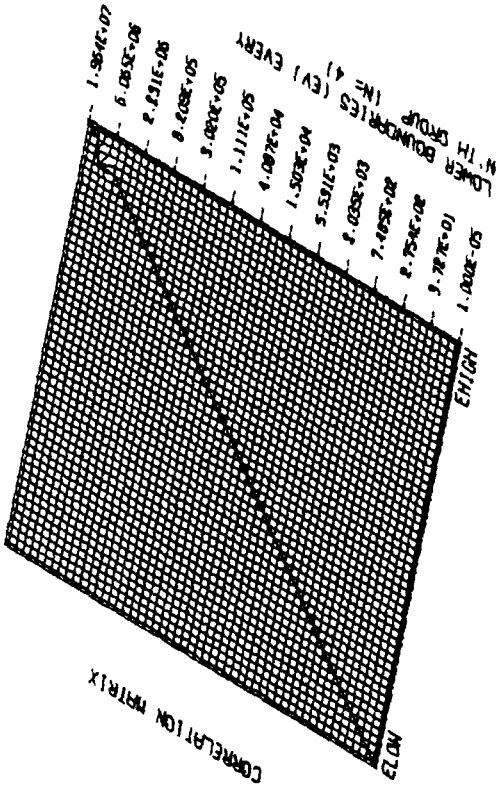


Fig. 82. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 12 Cross Sections.

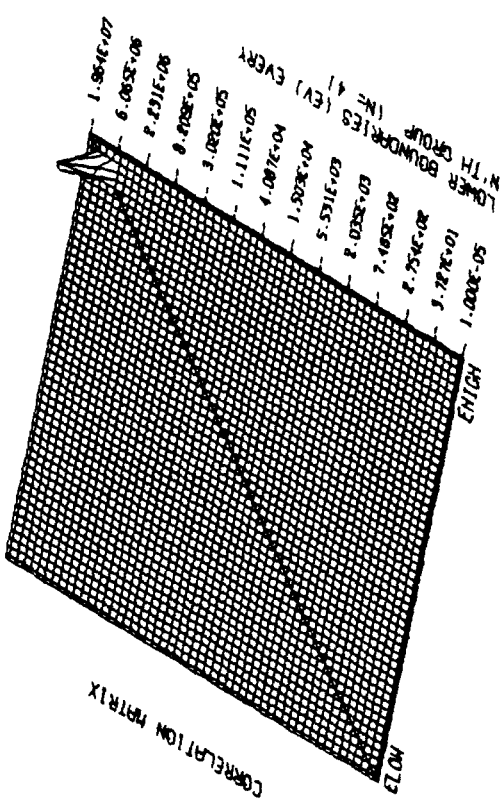


Fig. 85. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 15 Cross Sections.

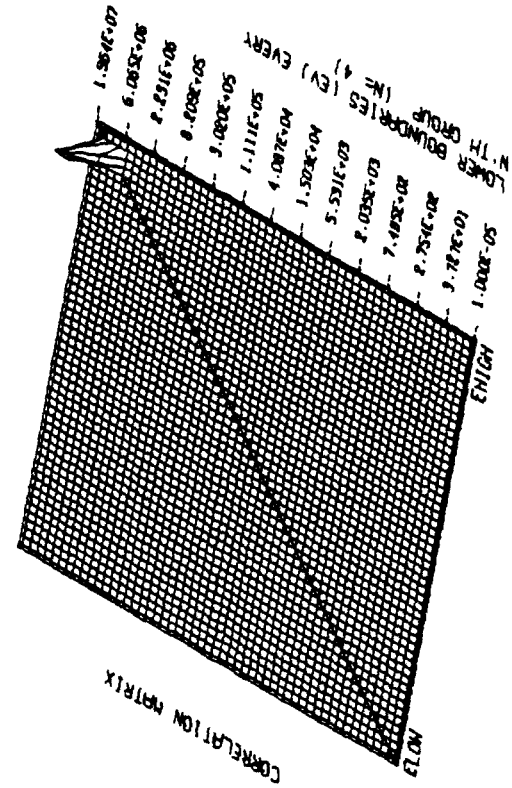


Fig. 84. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 14 Cross Sections.

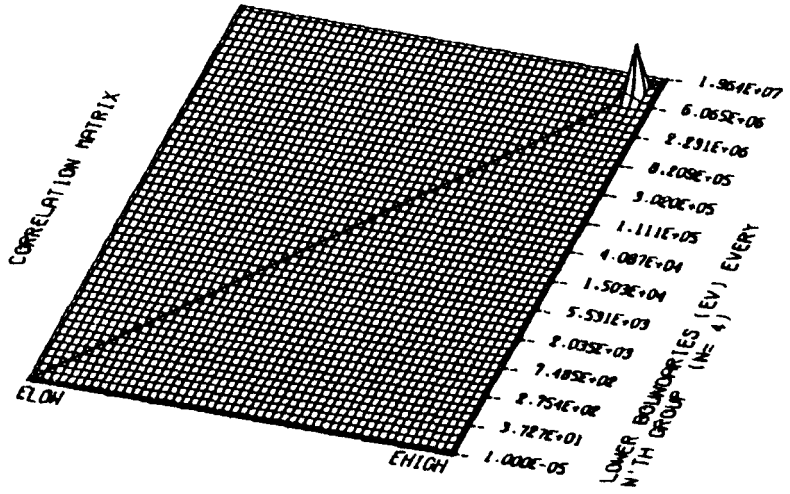


Fig. 86. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 16 Cross Sections.

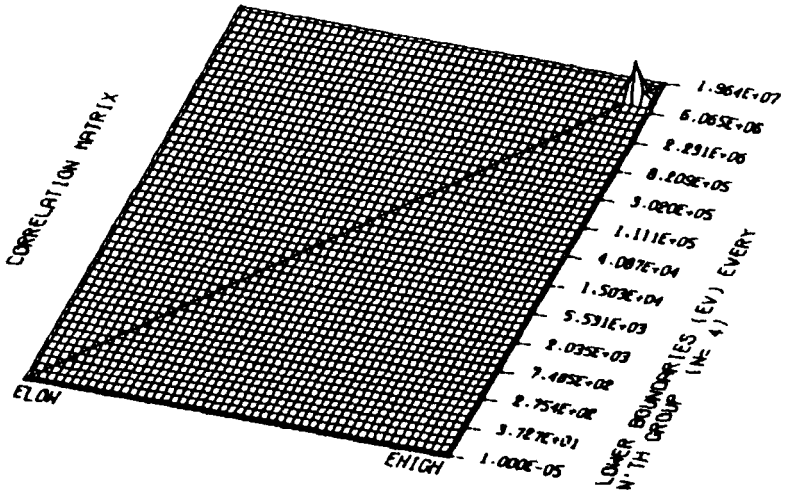


Fig. 87. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 17 Cross Sections.

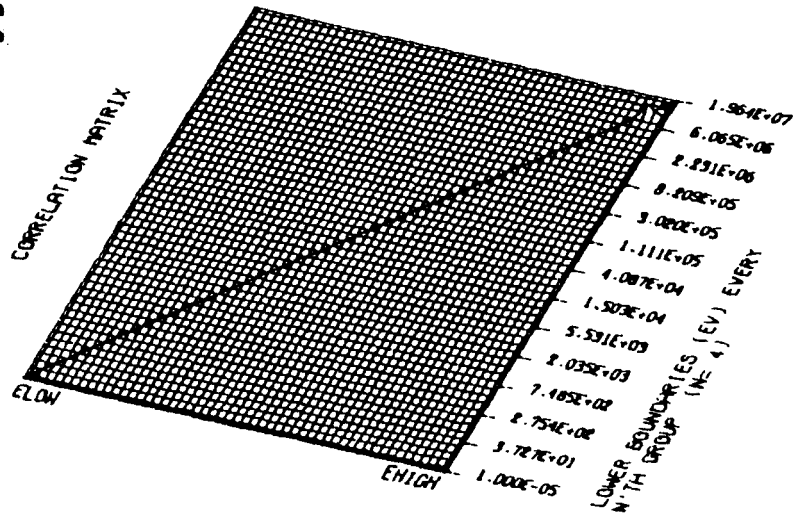


Fig. 88. Cross Correlation Matrix for Na Inelastic to Na(n,n') Level 18 Cross Sections.

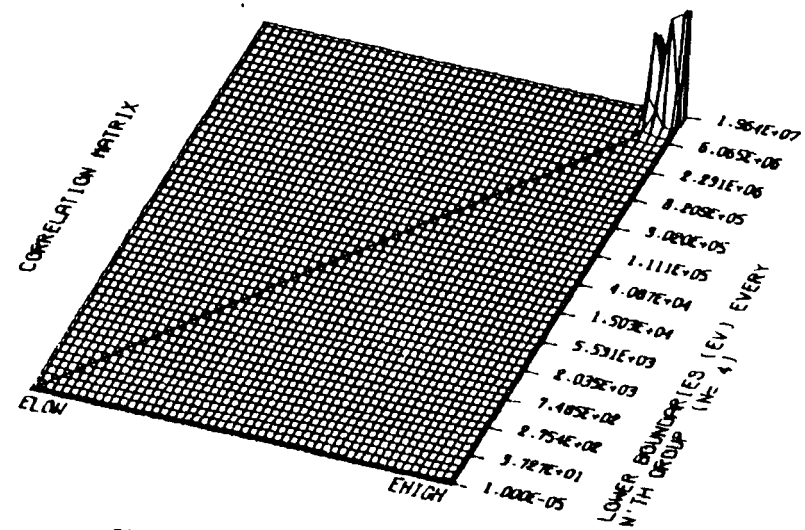


Fig. 89. Cross Correlation Matrix for Na Inelastic to Na(n,n') Continuum Cross Sections.

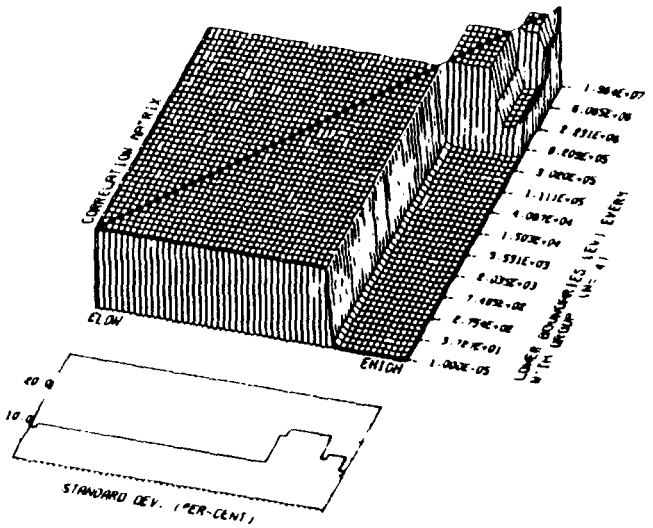


Fig. 90. Standard Deviation and Correlation Matrix for Cr(n,γ) Cross Sections.

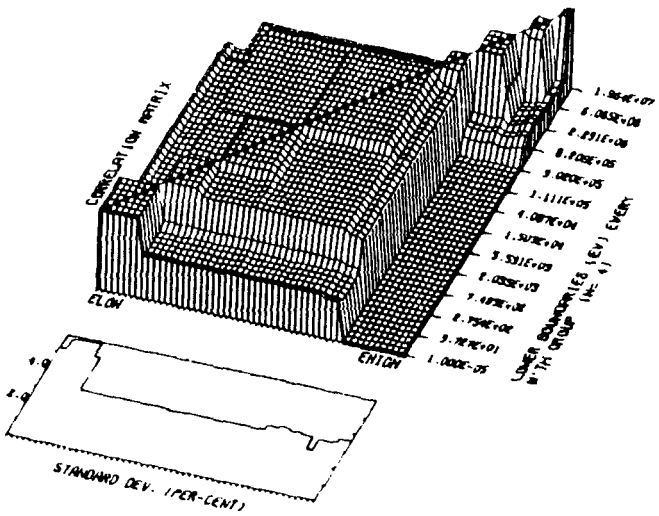


Fig. 91. Standard Deviation and Correlation Matrix for Fe Total Cross Sections.

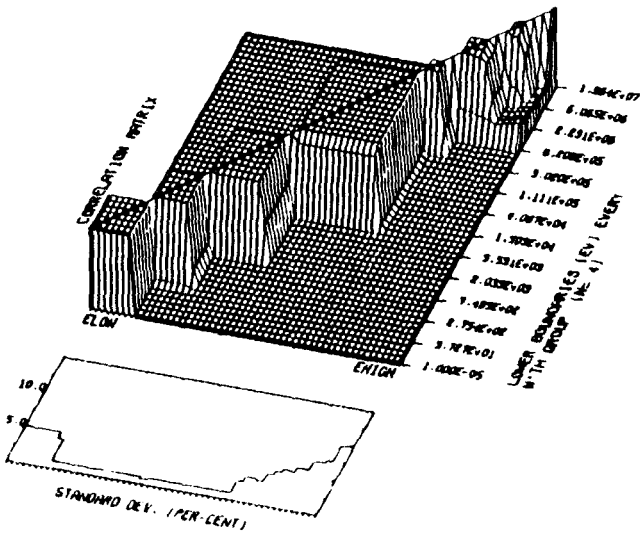


Fig. 92. Standard Deviation and Correlation Matrix for Fe Elastic Cross Sections.

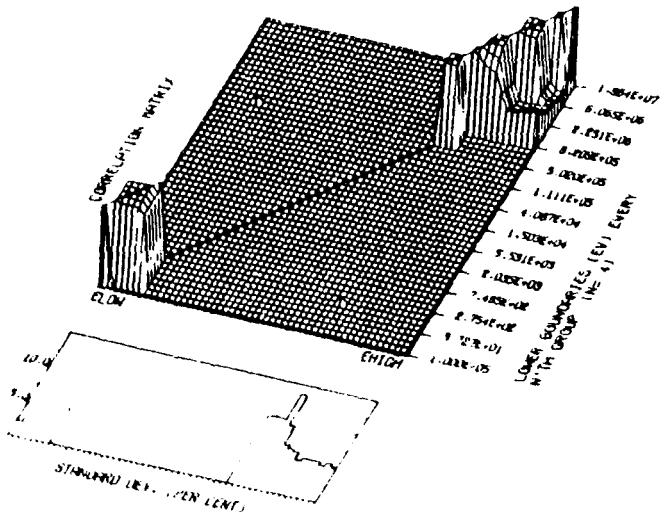


Fig. 93. Standard Deviation and Correlation Matrix for Fe Non-Elastic Cross Sections.

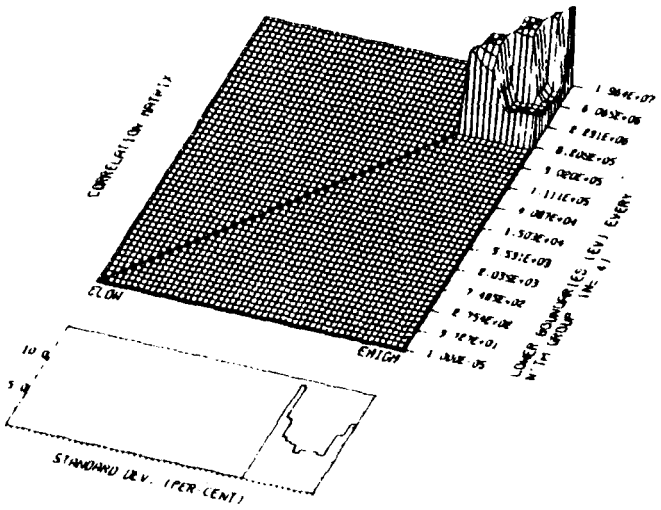


Fig. 94. Standard Deviation and Correlation Matrix for Fe Inelastic Cross Sections.

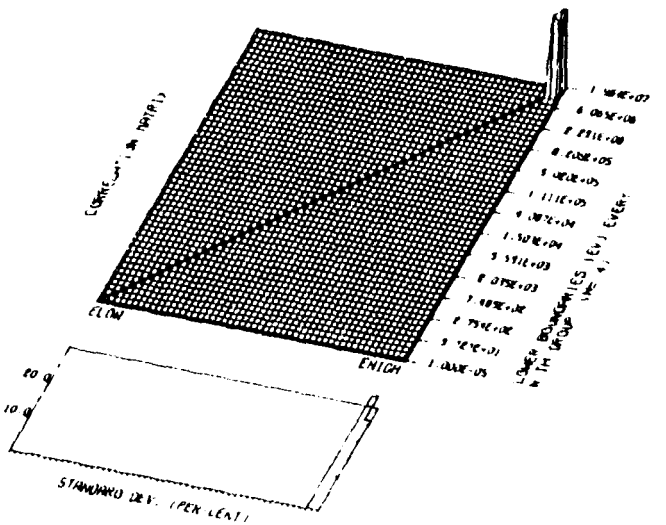


Fig. 96. Standard Deviation and Correlation Matrix for Fe(n,n'α) Cross Sections.

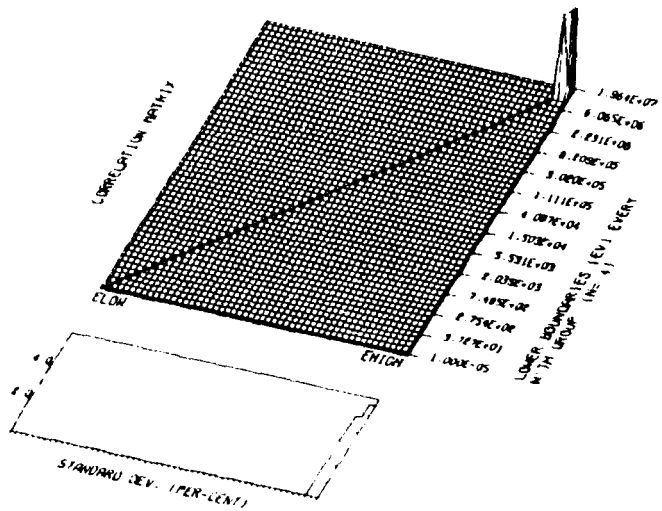


Fig. 95. Standard Deviation and Correlation Matrix for Fe(n,2n) Cross Sections.

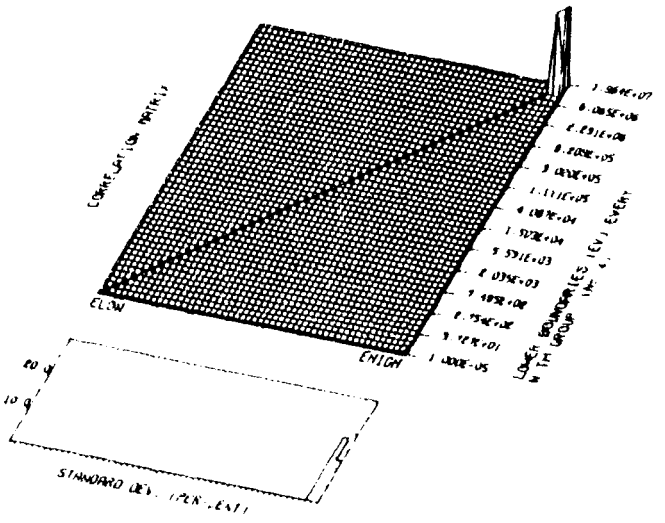


Fig. 97. Standard Deviation and Correlation Matrix for Fe(n,n'p) Cross Sections.

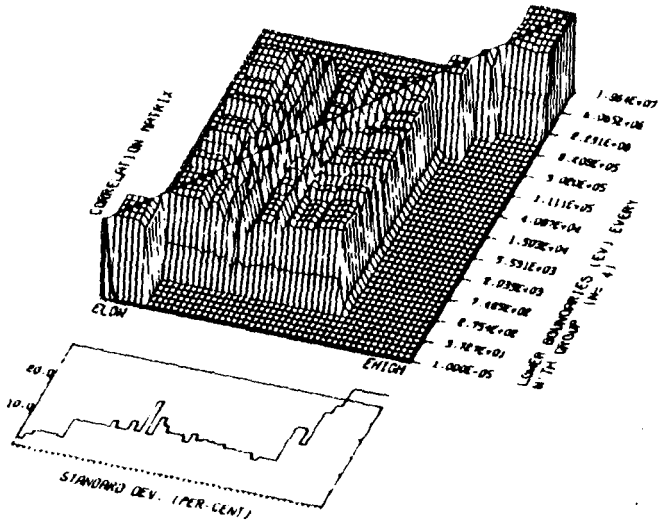


Fig. 98. Standard Deviation and Correlation Matrix for Fe(n,γ) Cross Sections.

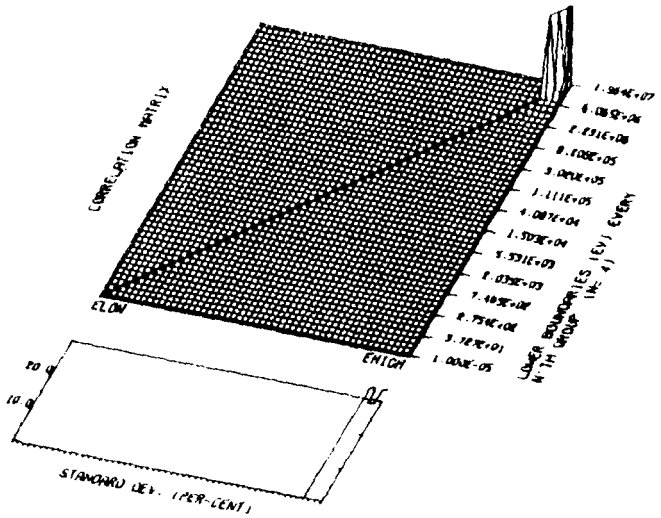


Fig. 99. Standard Deviation and Correlation Matrix for Fe(n,d) Cross Sections.

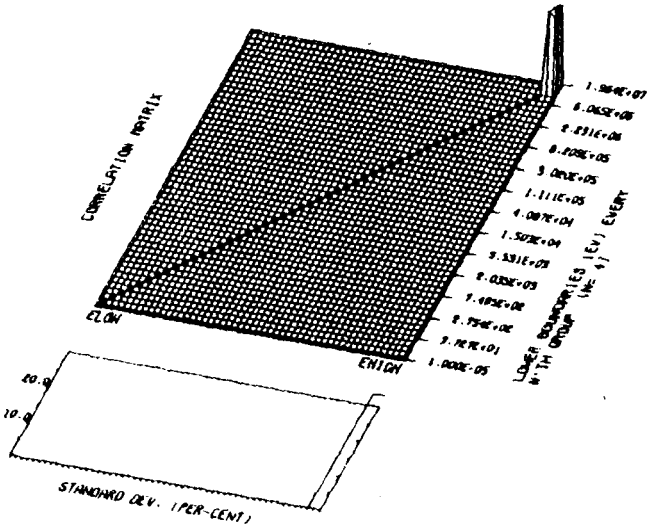


Fig. 100. Standard Deviation and Correlation Matrix for Fe(n,t) Cross Sections.

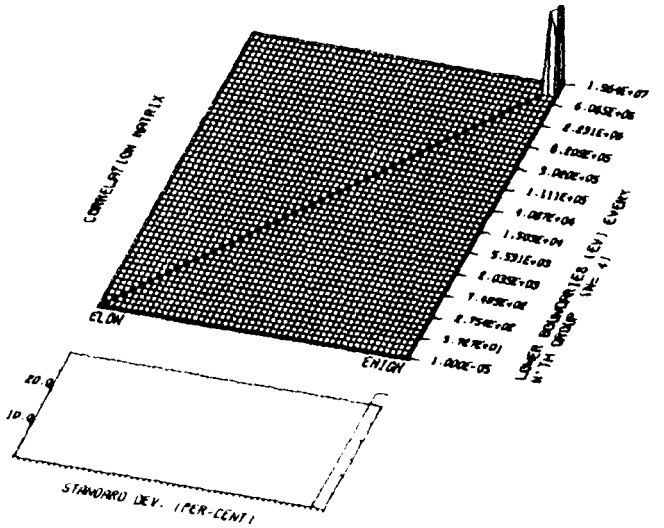


Fig. 101. Standard Deviation and Correlation Matrix for Fe(n,^{3}He) Cross Sections.

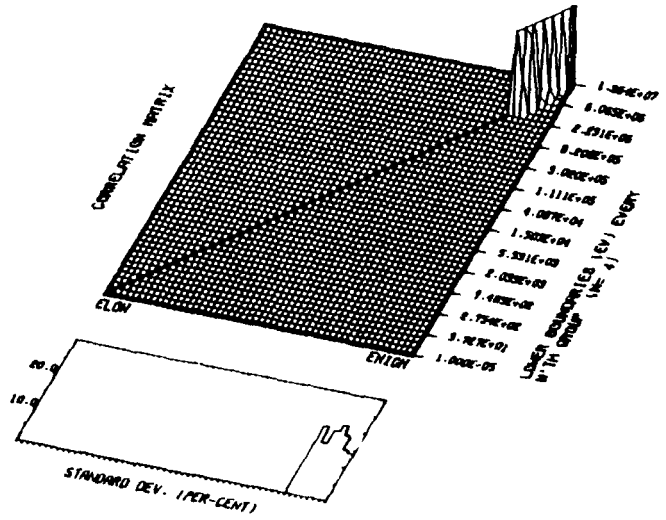


Fig. 102. Standard Deviation and Correlation Matrix for Fe(n,α) Cross Sections.

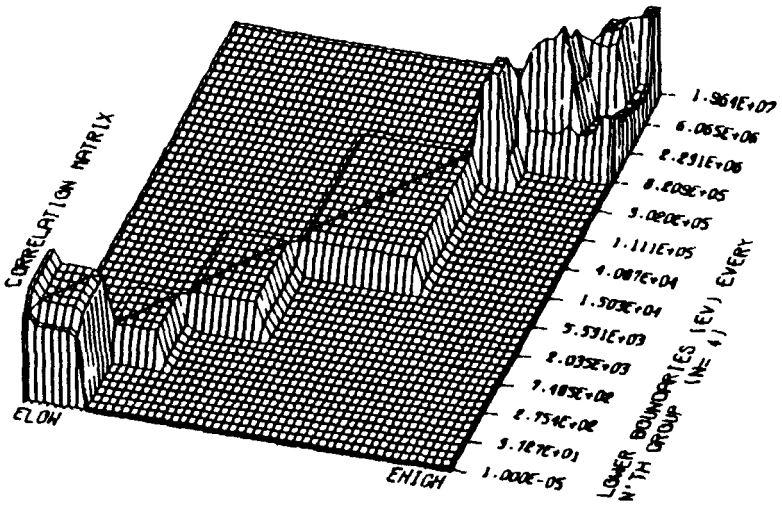


Fig. 103. Cross Correlation Matrix for Fe Total to Fe Elastic Cross Sections.

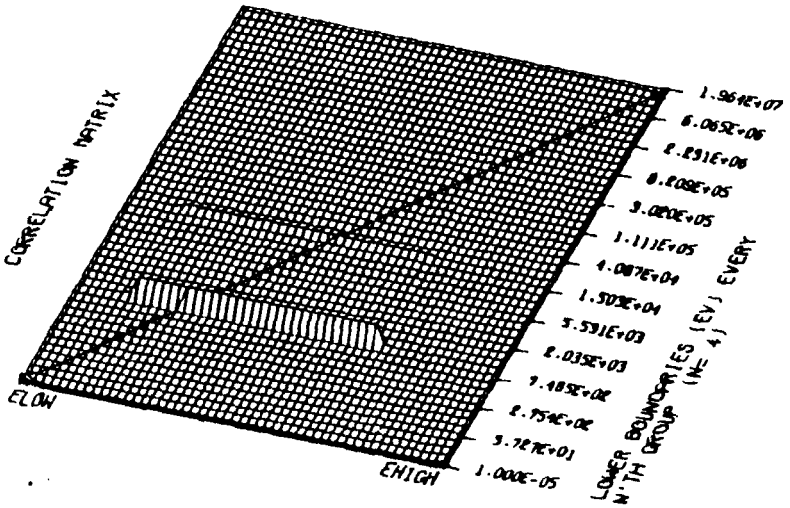


Fig. 104. Cross Correlation Matrix for Fe Total to Fe(n,γ) Cross Sections.

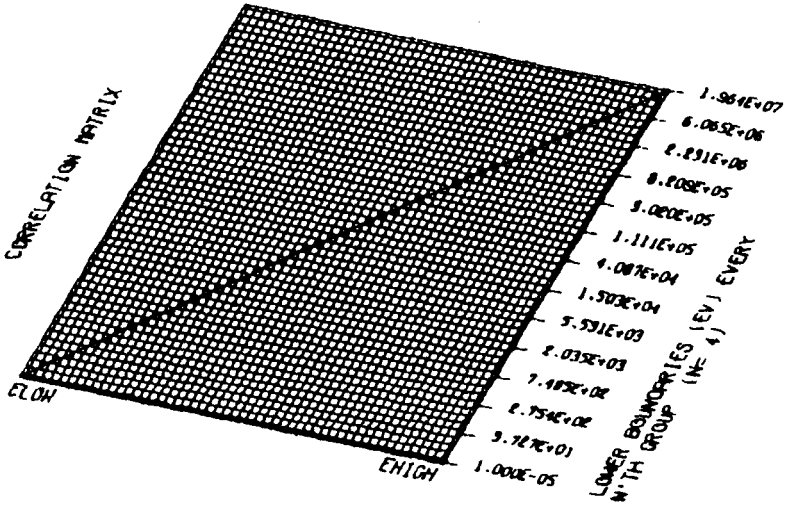


Fig. 105. Cross Correlation Matrix for Fe Elastic to Fe(n,γ) Cross Sections.

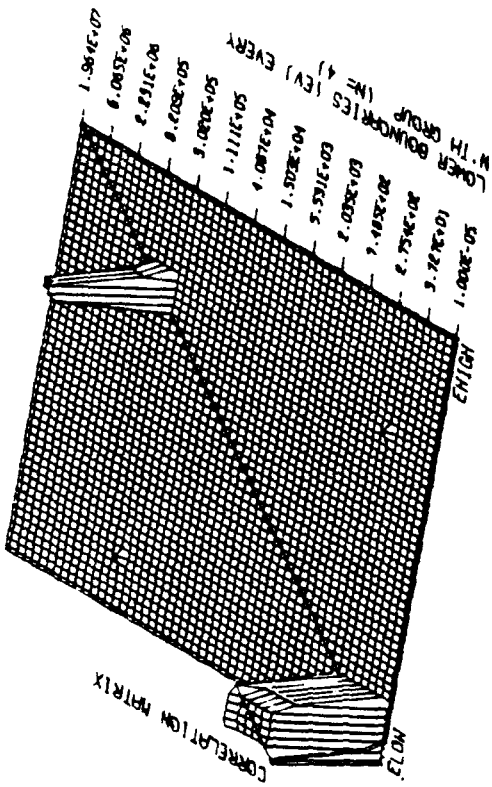


Fig. 107. Cross Correlation Matrix for Fe Non-Elastic to Fe(n,γ) Cross Sections.

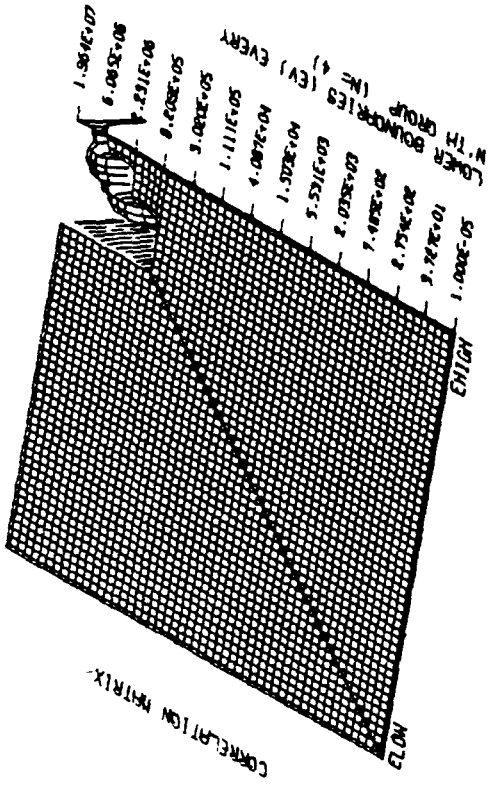


Fig. 106. Cross Correlation Matrix for Fe Elastic to Fe Non-Elastic Cross Sections.

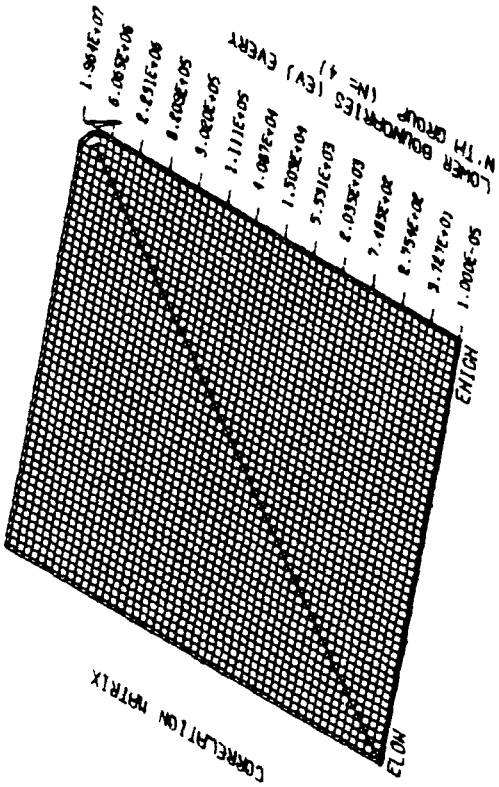


Fig. 109. Cross Correlation Matrix for Fe Inelastic to Fe(n,2n) Cross Sections.

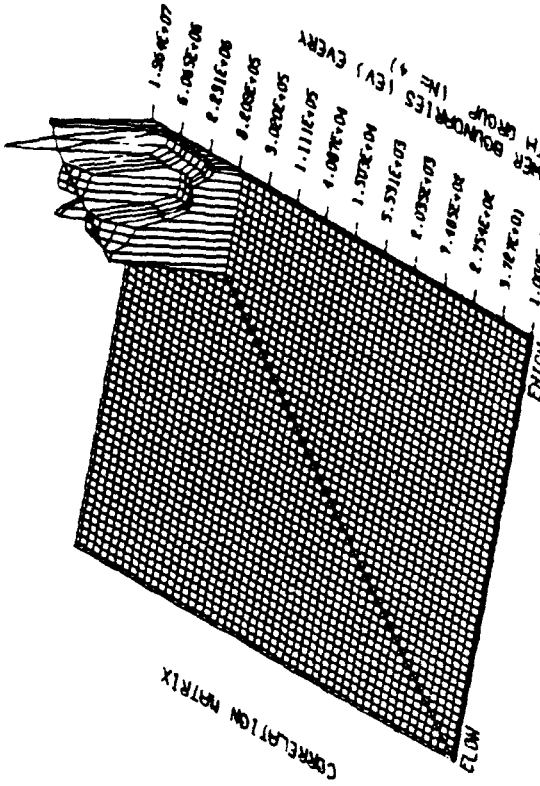


Fig. 108. Cross Correlation Matrix for Fe Inelastic to Fe Non-Elastic Cross Sections.

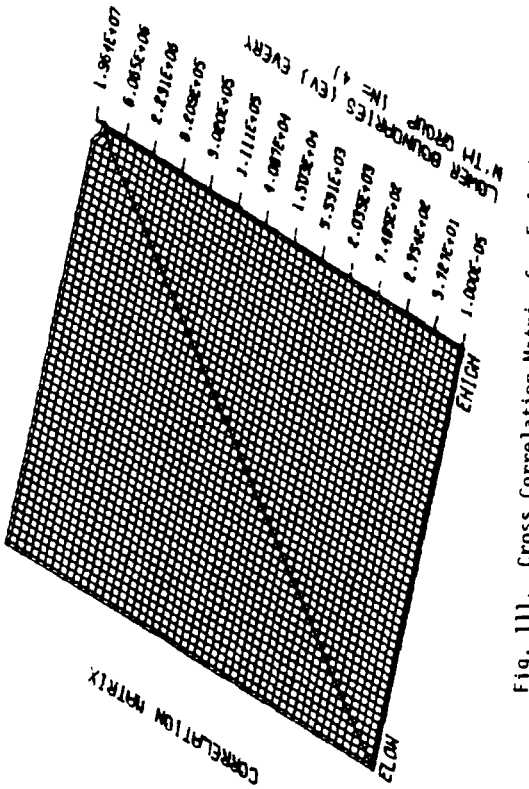


Fig. 111. Cross Correlation Matrix for Fe Inelastic to Fe(n,n'p) Cross Sections.

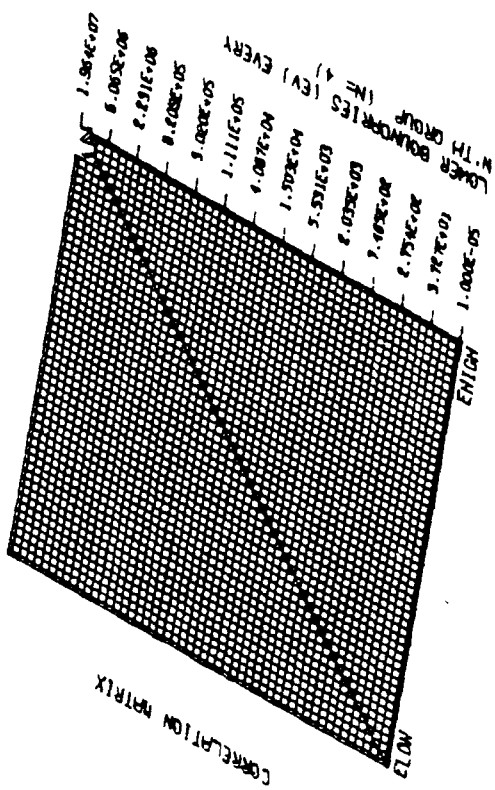


Fig. 113. Cross Correlation Matrix for Fe Inelastic to Fe(n,d) Cross Sections.

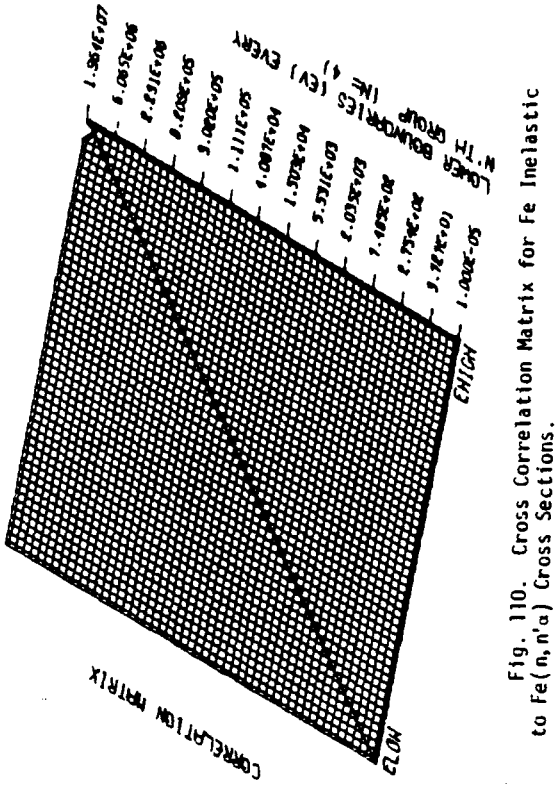


Fig. 110. Cross Correlation Matrix for Fe Inelastic to Fe(n,n'α) Cross Sections.

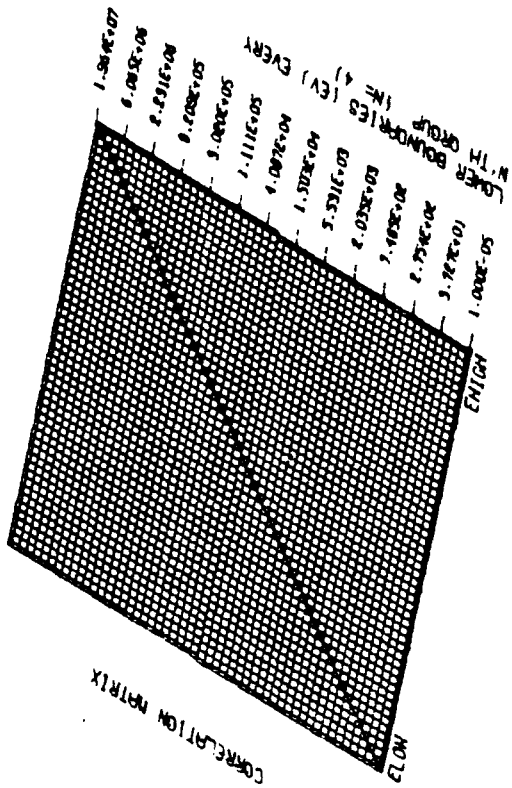


Fig. 112. Cross Correlation Matrix for Fe Inelastic to Fe(n,γ) Cross Sections.

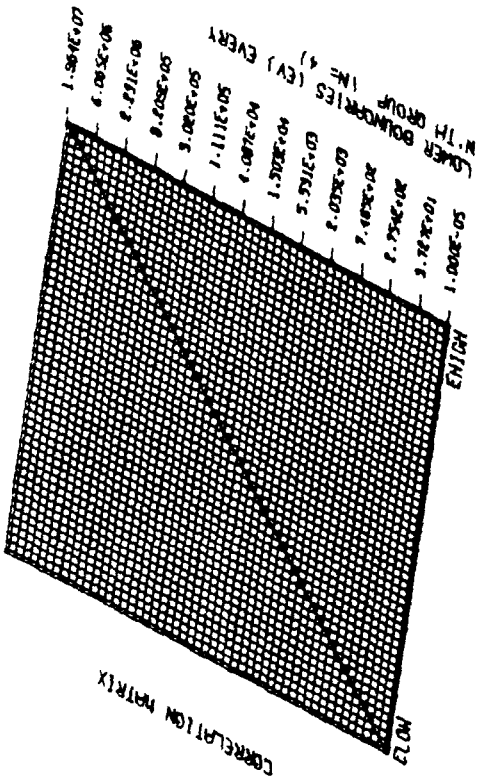


Fig. 113. Cross Correlation Matrix for Fe Inelastic to Fe(n,^{3}He) Cross Sections.

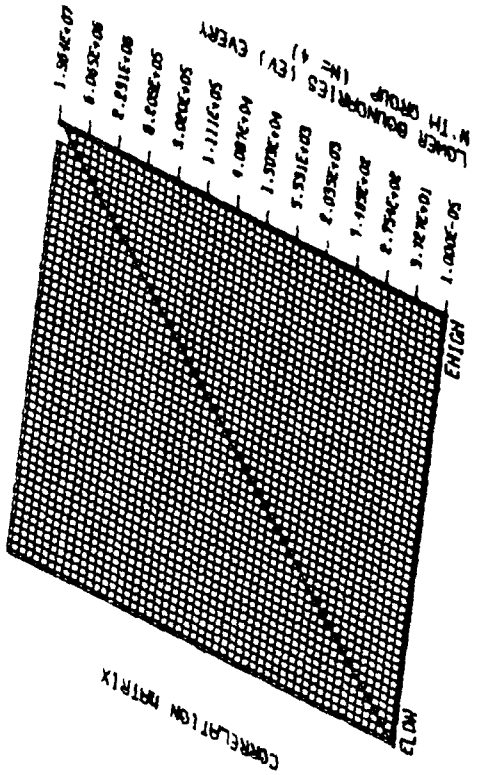


Fig. 114. Cross Correlation Matrix for Fe Inelastic to Fe(n,t) Cross Sections.

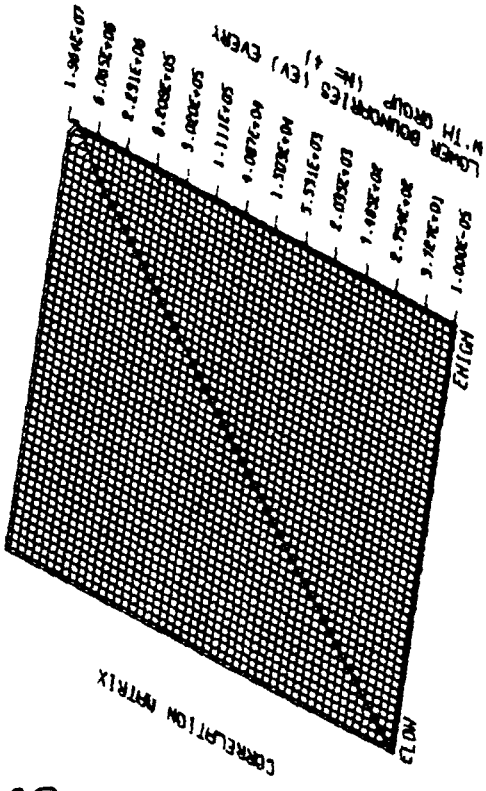


Fig. 116. Cross Correlation Matrix for Fe Inelastic to Fe(n,α) Cross Sections.

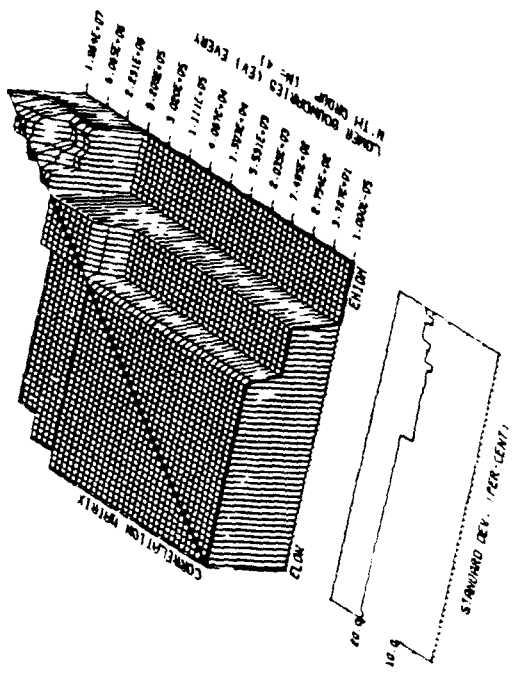


Fig. 117. Standard Deviation and Correlation Matrix for Ni(n,γ) Cross Sections.

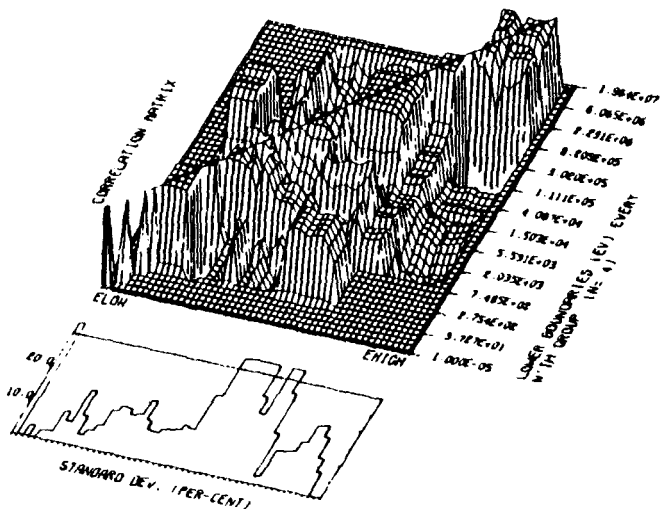


Fig. 118. Standard Deviation and Correlation Matrix for ^{240}Pu (n,γ) Cross Sections.

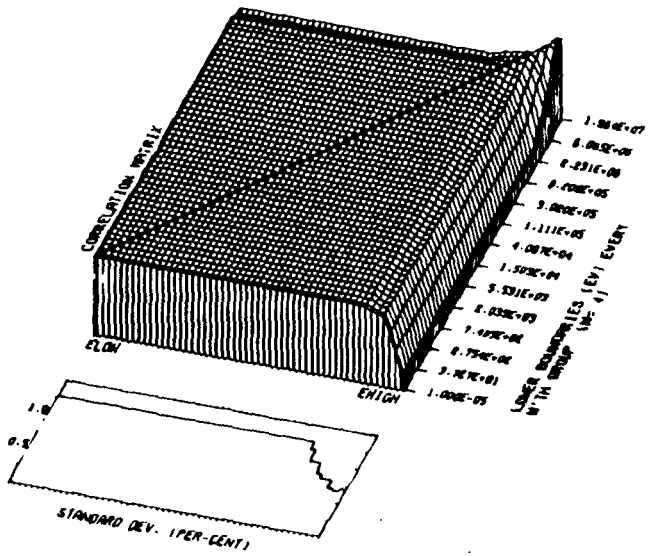


Fig. 119. Standard Deviation and Correlation Matrix for ^{240}Pu ($\bar{\nu}$) Cross Section.

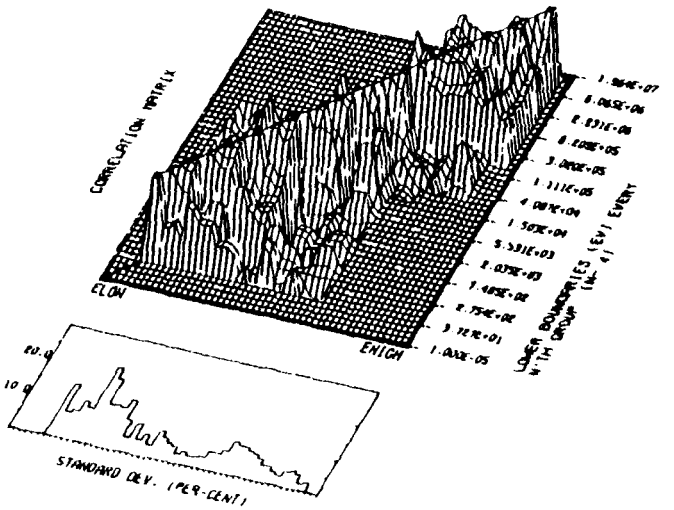


Fig. 120. Standard Deviation and Correlation Matrix for ^{241}Pu(n,f) Cross Sections.

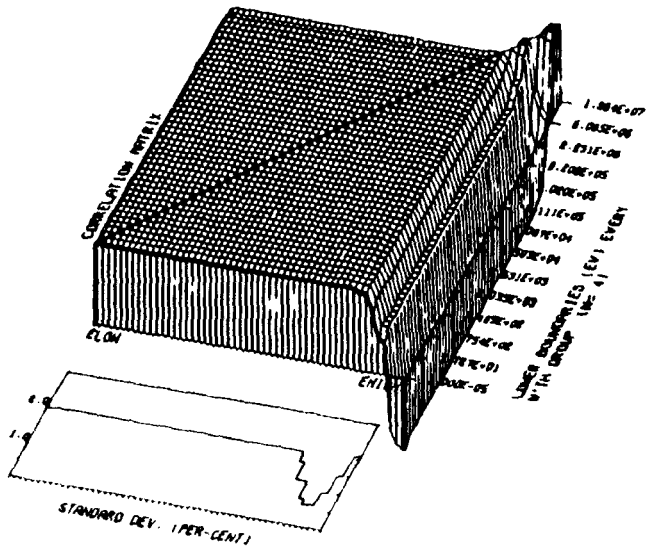


Fig. 121. Standard Deviation and Correlation Matrix for $^{241}Pu(\bar{\nu})$ Cross Section.

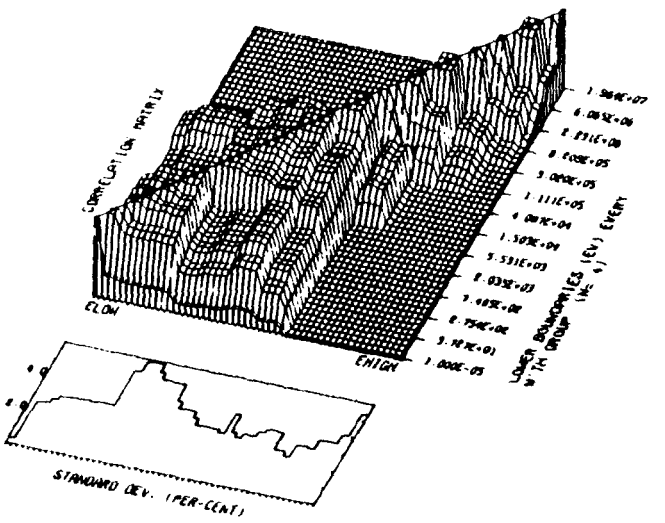


Fig. 122. Standard Deviation and Correlation Matrix for $^{235}U(n,f)$ Cross Sections.

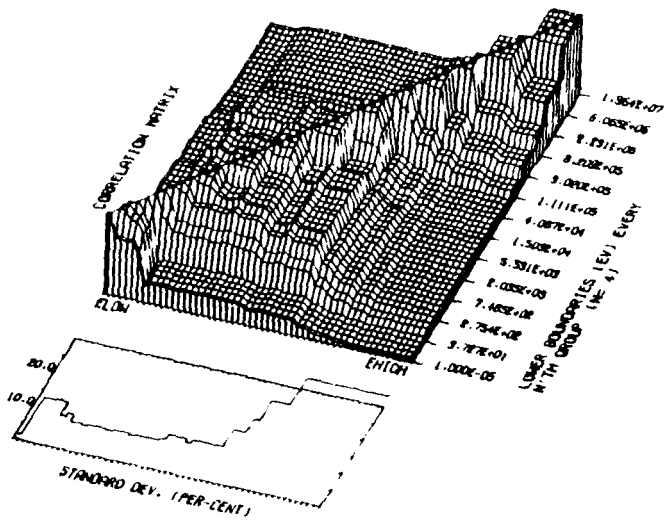


Fig. 123. Standard Deviation and Correlation Matrix for $^{235}U(n,\gamma)$ Cross Sections.

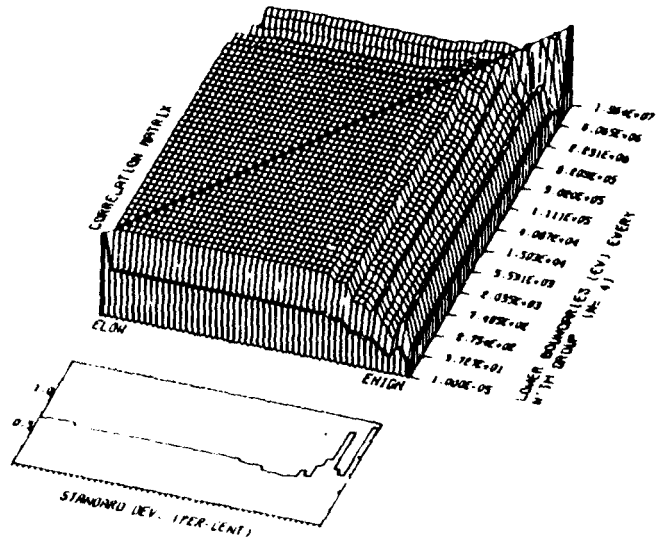


Fig. 124. Standard Deviation and Correlation Matrix for $^{235}U(\nu)$ Cross Section.

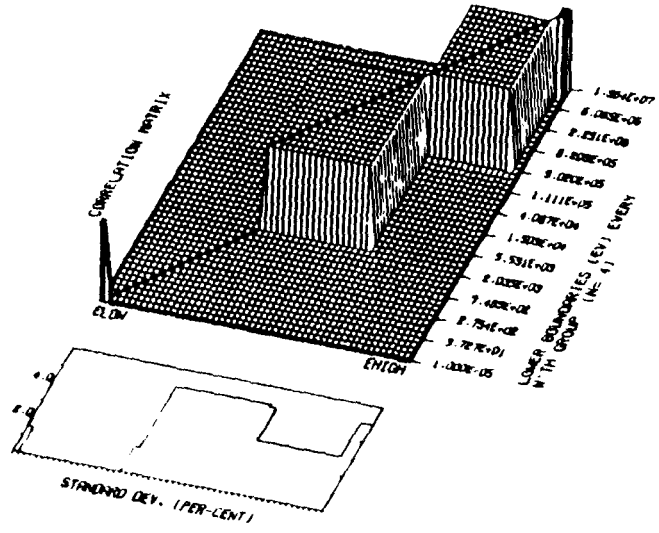


Fig. 125. Standard Deviation and Correlation Matrix for ^{238}U Total Cross Sections.

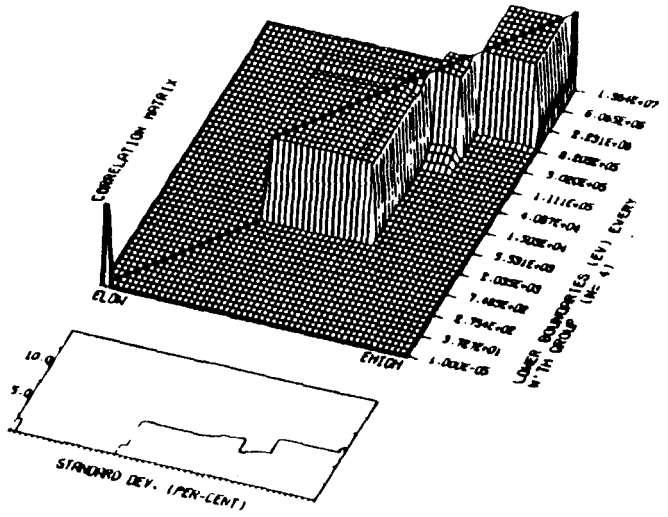


Fig. 126. Standard Deviation and Correlation Matrix for ^{238}U Elastic Cross Sections.

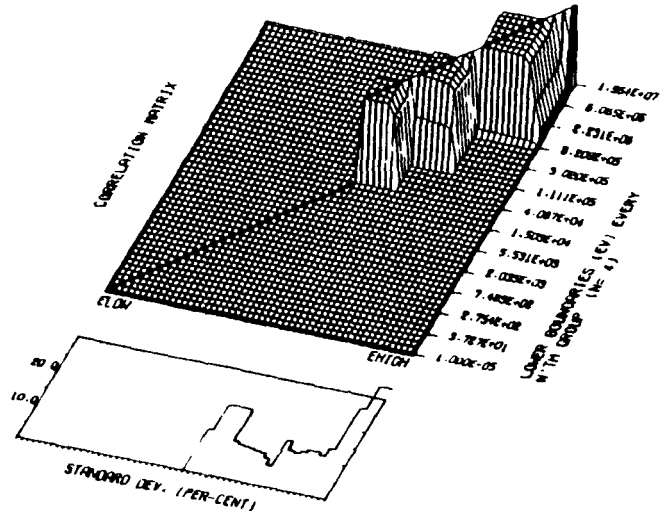


Fig. 127. Standard Deviation and Correlation Matrix for ^{238}U Inelastic Cross Sections.

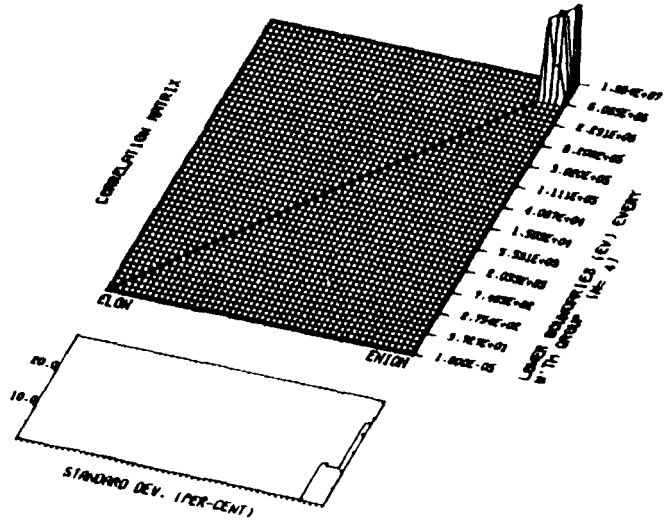


Fig. 128. Standard Deviation and Correlation Matrix for $^{238}U(n,2n)$ Cross Sections.

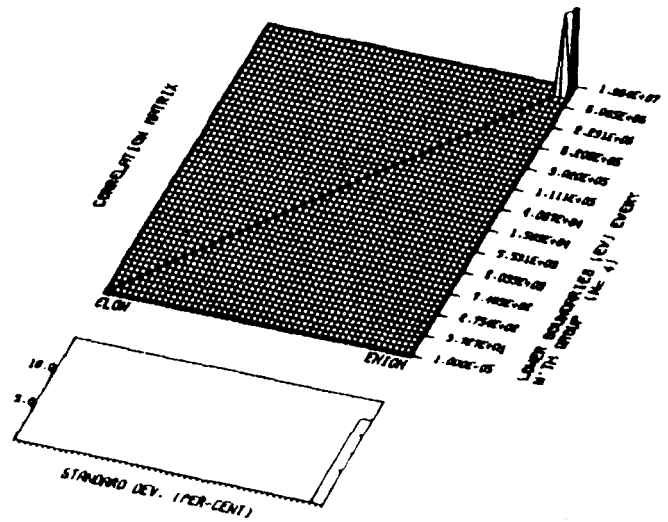


Fig. 129. Standard Deviation and Correlation Matrix for $^{238}U(n,3n)$ Cross Sections.

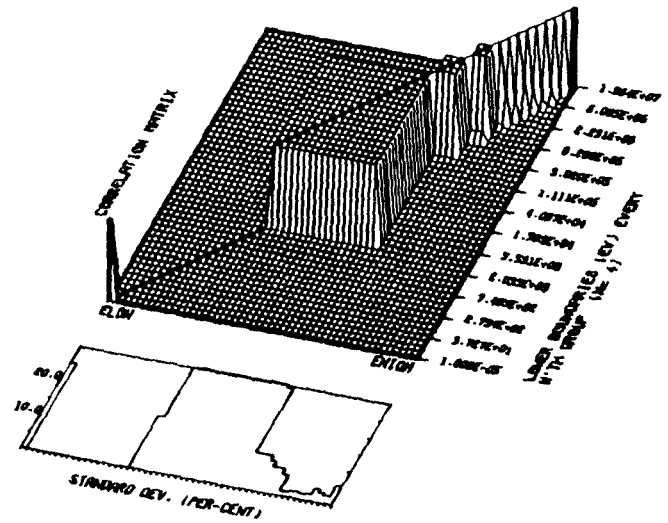


Fig. 130. Standard Deviation and Correlation Matrix for $^{238}U(n,f)$ Cross Sections.

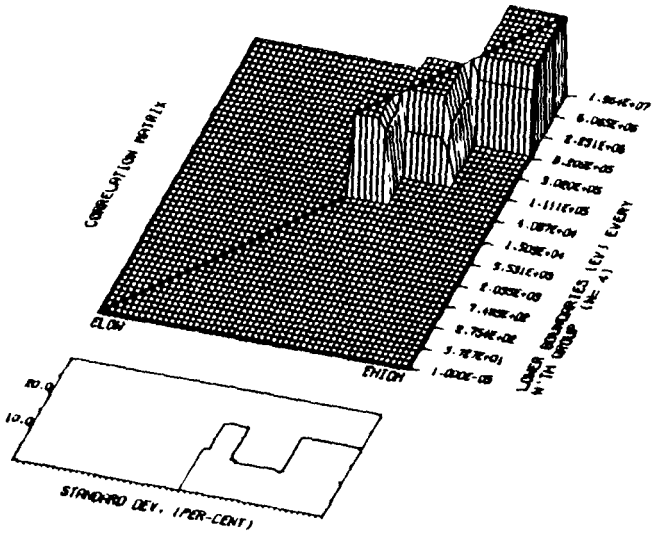


Fig. 131. Standard Deviation and Correlation Matrix for $^{238}U(n,n')$ Level 1 Cross Sections.

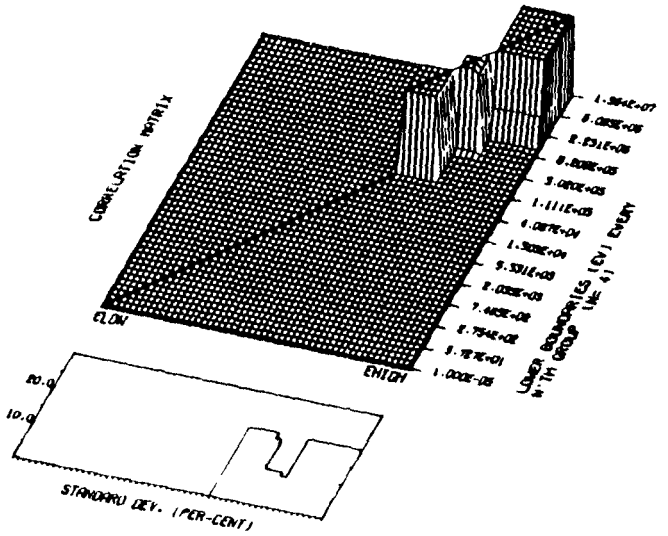


Fig. 132. Standard Deviation and Correlation Matrix for $^{238}U(n,n')$ Level 2 Cross Sections.

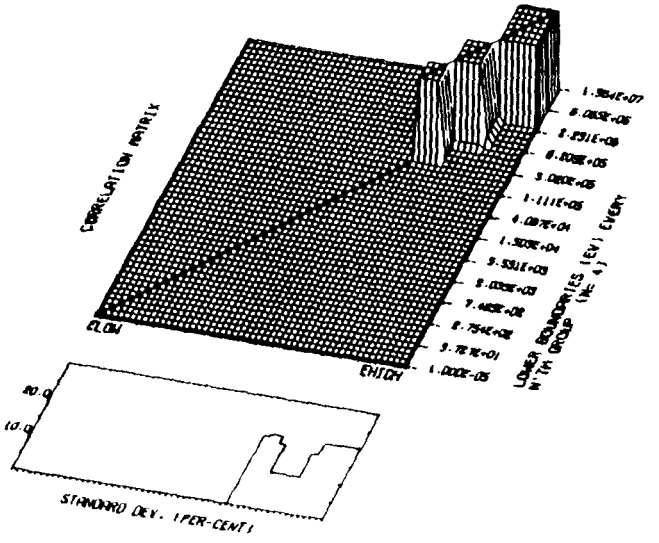


Fig. 133. Standard Deviation and Correlation Matrix for $^{238}U(n,n')$ Level 3 Cross Sections.

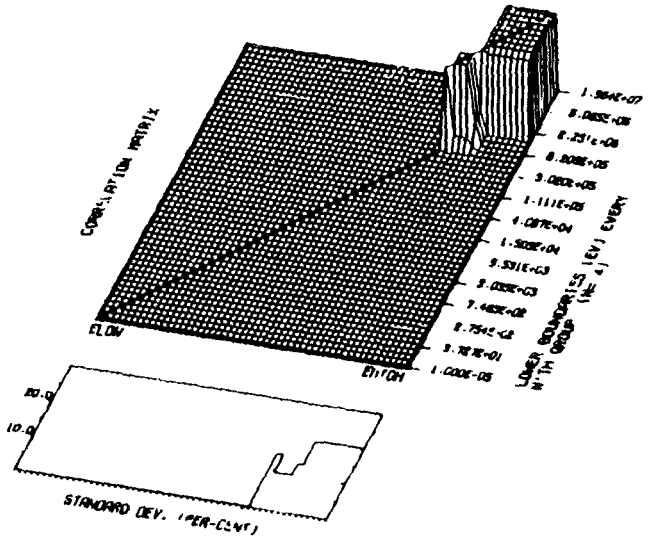


Fig. 134. Standard Deviation and Correlation Matrix for $^{238}U(n,n')$ Level 4 Cross Sections.

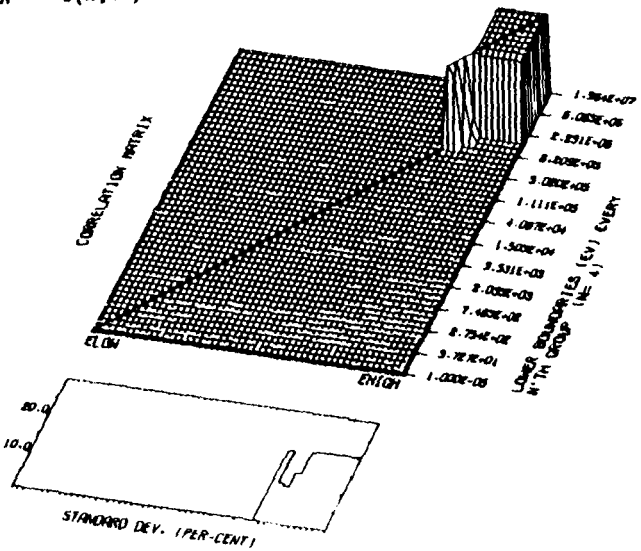


Fig. 136. Standard Deviation and Correlation Matrix for $^{238}U(n,n')$ Level 6 Cross Sections.

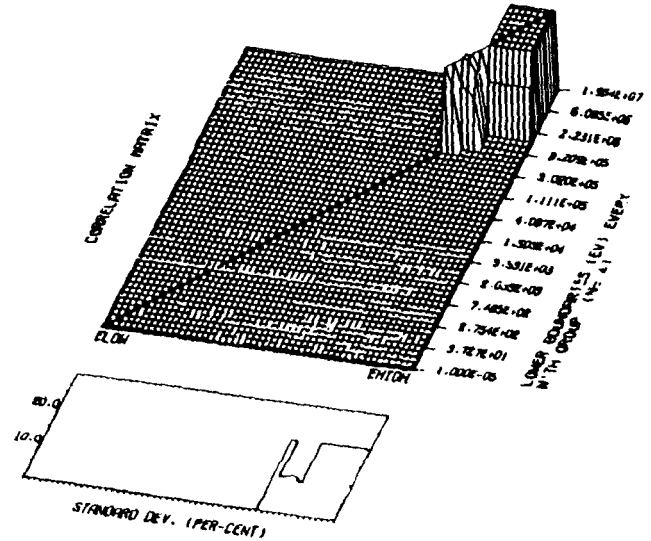


Fig. 135. Standard Deviation and Correlation Matrix for $^{238}U(n,n')$ Level 5 Cross Sections.

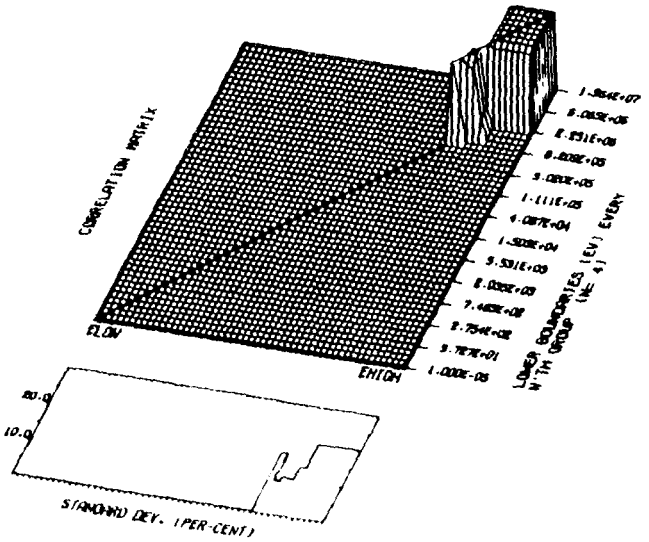


Fig. 137. Standard Deviation and Correlation Matrix for $^{238}U(n,n')$ Level 7 Cross Sections.

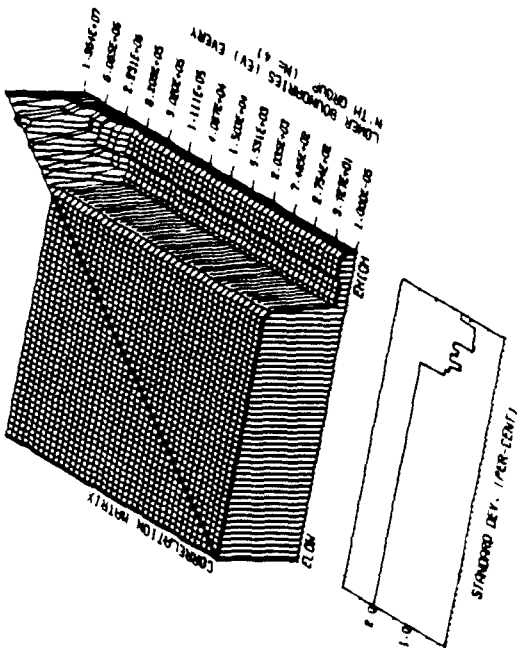


Fig. 138. Standard Deviation and Correlation Matrix for $^{238}U(n,\gamma)$ Cross Sections.

Fig. 139. Standard Deviation and Correlation Matrix for $^{238}U(\bar{\nu})$ Cross Sections.

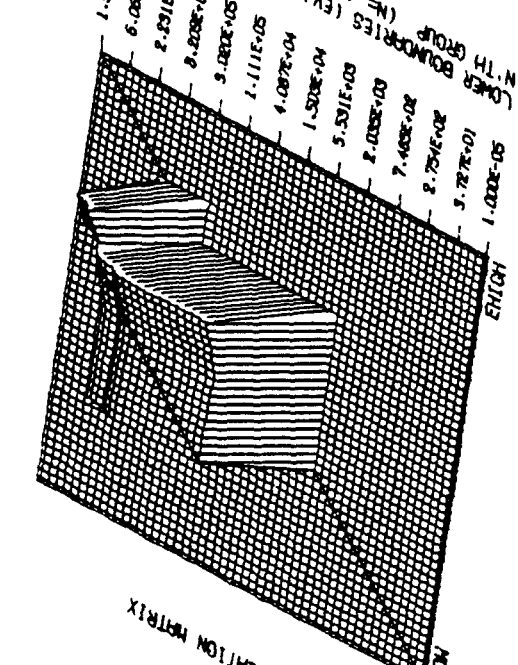


Fig. 140. Standard Deviation and Correlation Matrix for $^{238}U(\nu_p)$ Cross Sections.

Fig. 141. Cross Correlation Matrix for ^{238}U Total to ^{238}U Elastic Cross Sections.

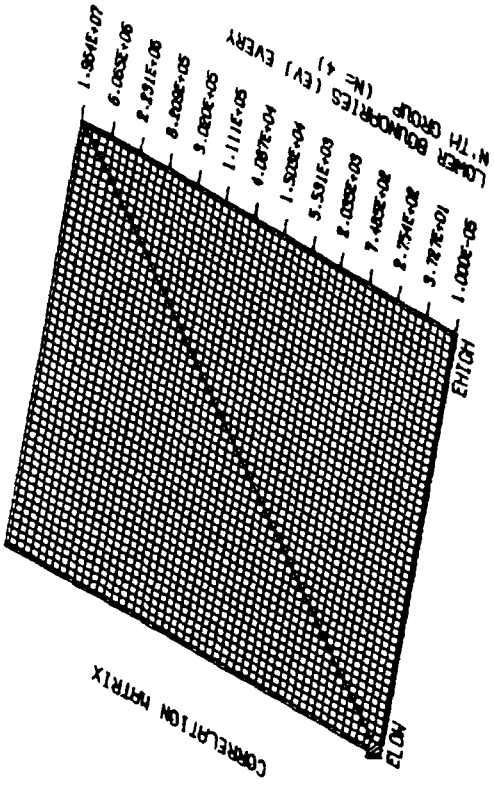


Fig. 143. Cross Correlation Matrix for ^{238}U Total to $^{238}U(n,\gamma)$ Cross Sections.

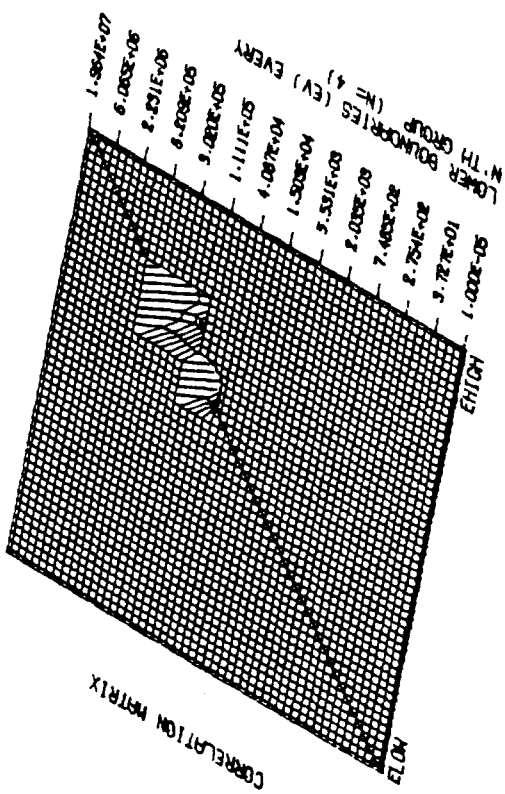


Fig. 145. Cross Correlation Matrix for ^{238}U Elastic to $^{238}U(n,n')$ Level 1 Cross Sections.

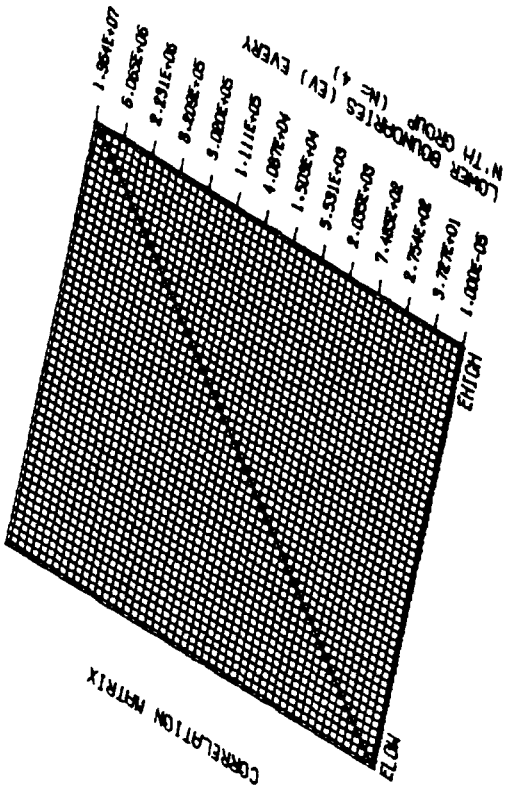


Fig. 142. Cross Correlation Matrix for ^{238}U Total to $^{238}U(n,f)$ Cross Sections.

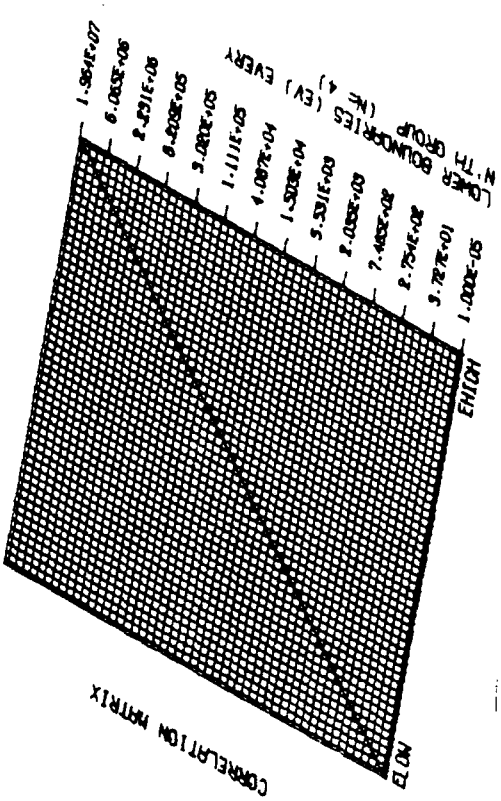


Fig. 144. Cross Correlation Matrix for ^{238}U Elastic to $^{238}U(n,f)$ Cross Sections.

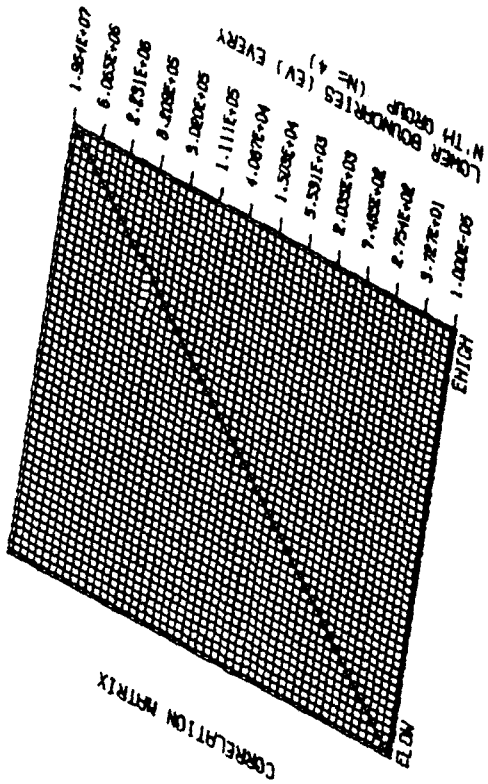


Fig. 147. Cross Correlation Matrix for ^{238}U Elastic to $^{238}U(n,n')$ Level 3 Cross Sections.

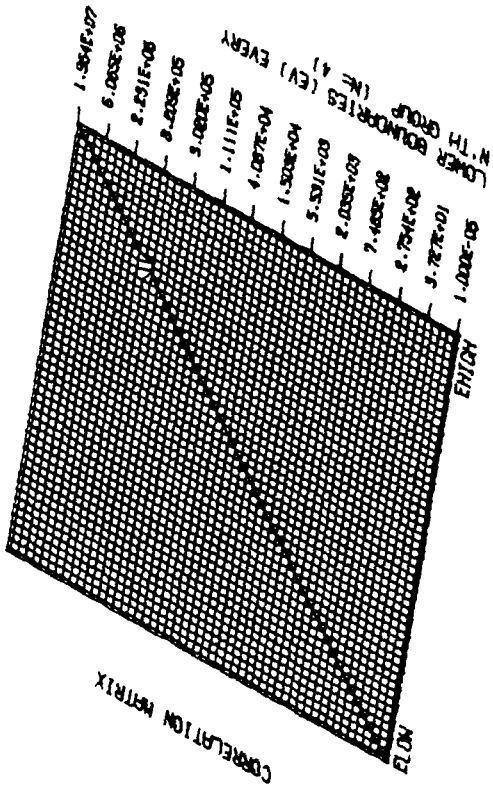


Fig. 149. Cross Correlation Matrix for ^{238}U Elastic to $^{238}U(n,n')$ Level 5 Cross Sections.

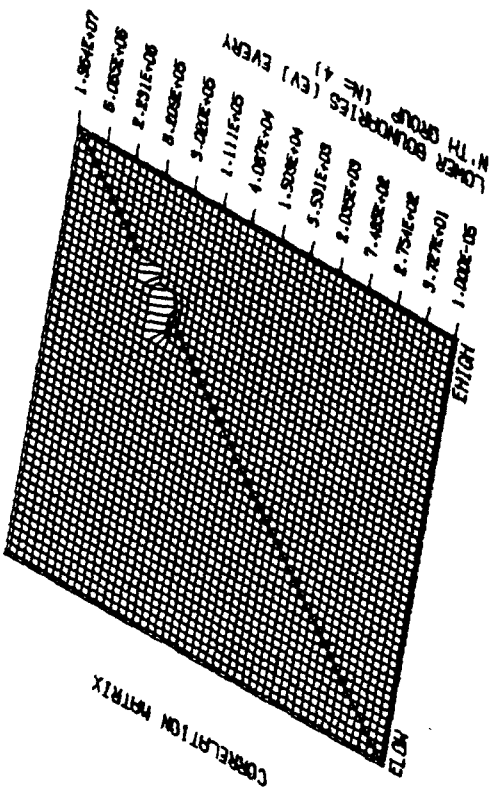


Fig. 146. Cross Correlation Matrix for ^{238}U Elastic to $^{238}U(n,n')$ Level 2 Cross Sections.

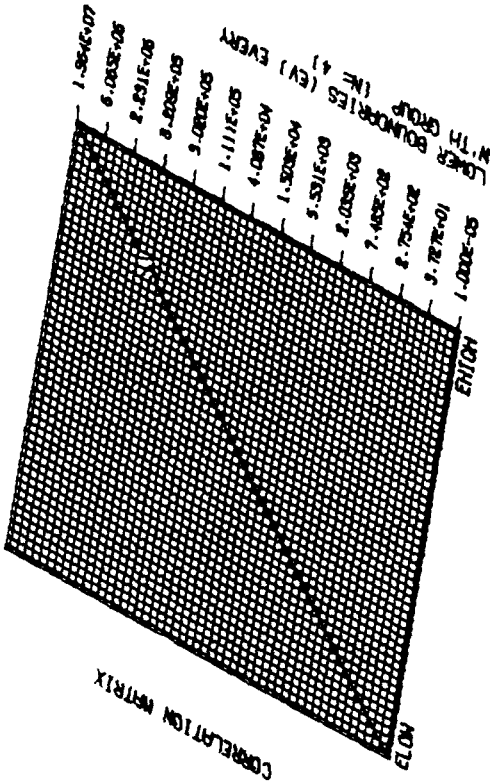


Fig. 148. Cross Correlation Matrix for ^{238}U Elastic to $^{238}U(n,n')$ Level 4 Cross Sections.

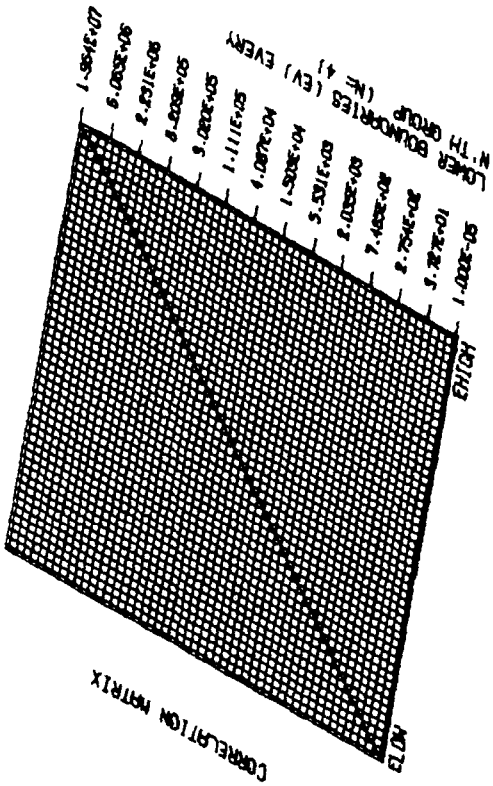


Fig. 151. Cross Correlation Matrix for ^{238}U Elastic to $^{238}U(n,n')$ Level 7 Cross Sections.

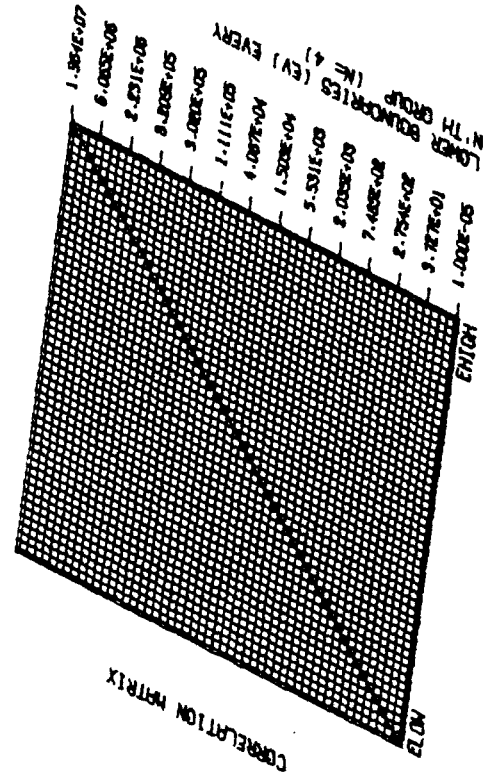


Fig. 150. Cross Correlation Matrix for ^{238}U Elastic to $^{238}U(n,n')$ Level 6 Cross Sections.

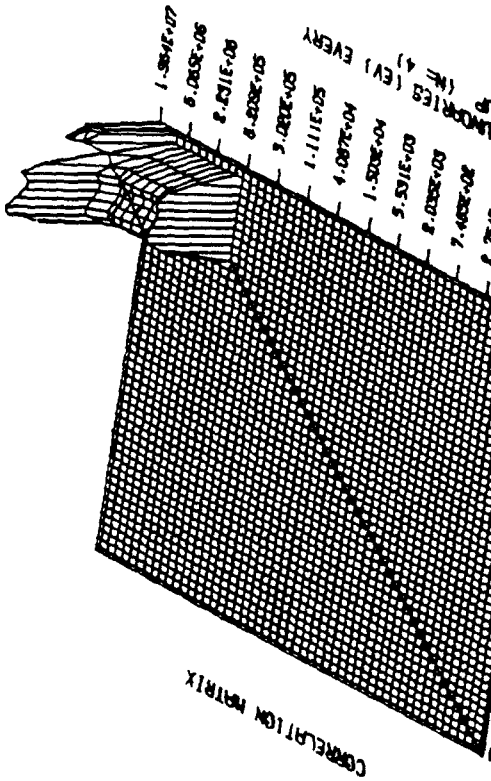


Fig. 153. Cross Correlation Matrix for ^{238}U Inelastic to ^{238}U Total Cross Sections.

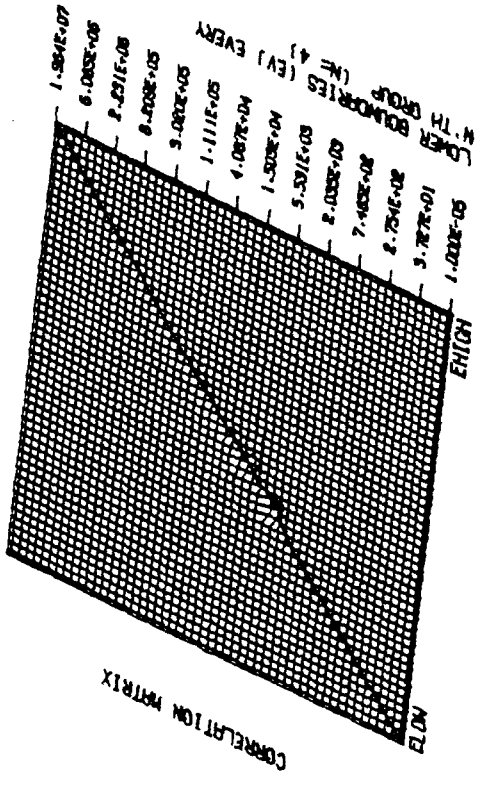


Fig. 152. Cross Correlation Matrix for ^{238}U Elastic to $^{238}U(n,\gamma)$ Cross Sections.

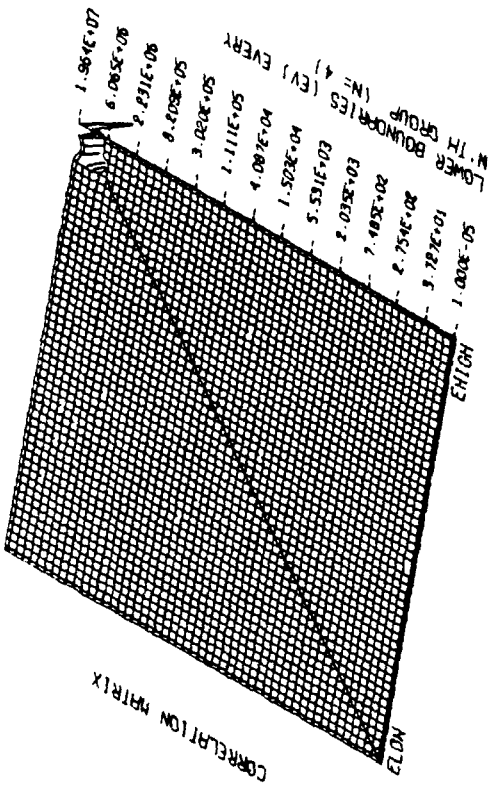


Fig. 155. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,2n)$ Cross Sections.

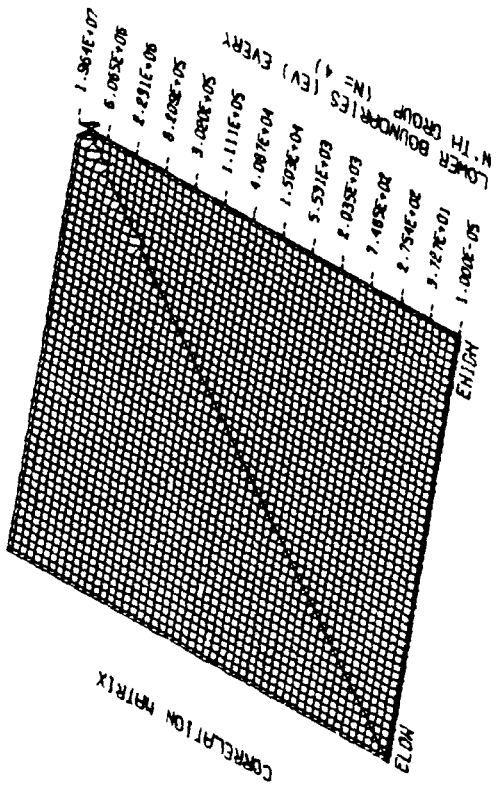


Fig. 157. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,f)$ Cross Sections.

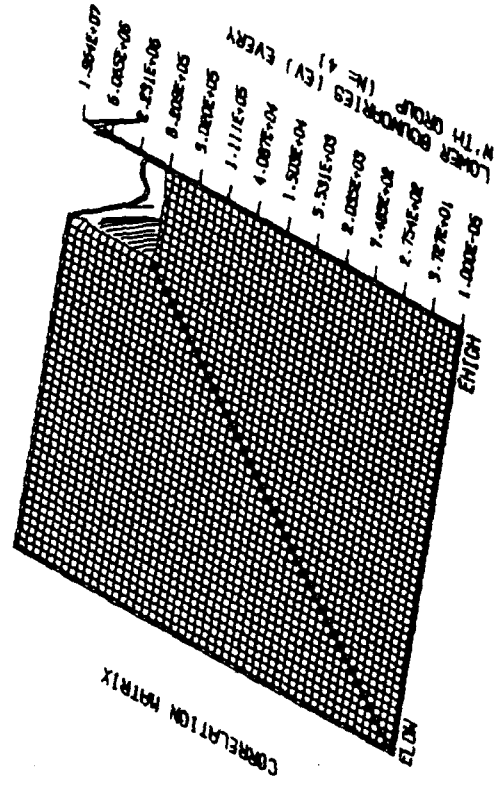


Fig. 154. Cross Correlation Matrix for ^{238}U Inelastic to ^{238}U Elastic Cross Sections.

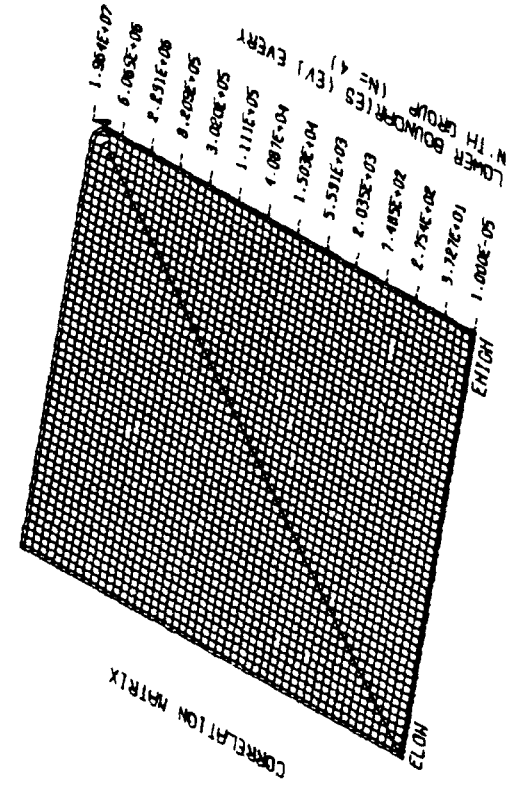


Fig. 156. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,3n)$ Cross Sections.

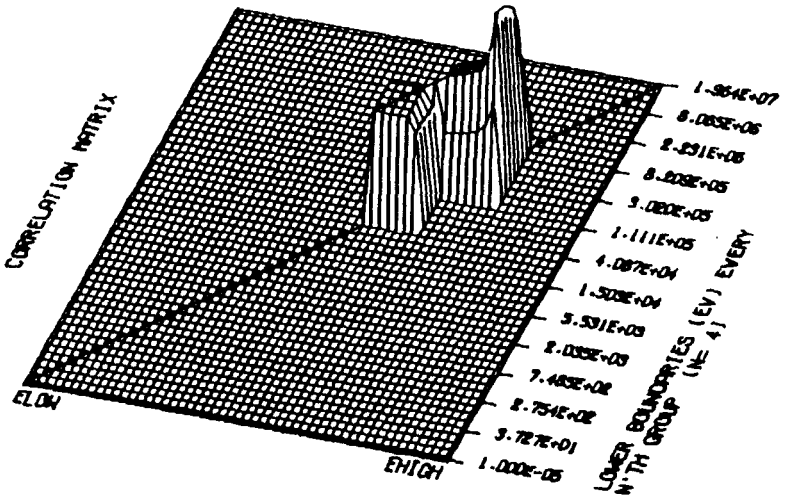


Fig. 158. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,n')$ Level 1 Cross Sections.

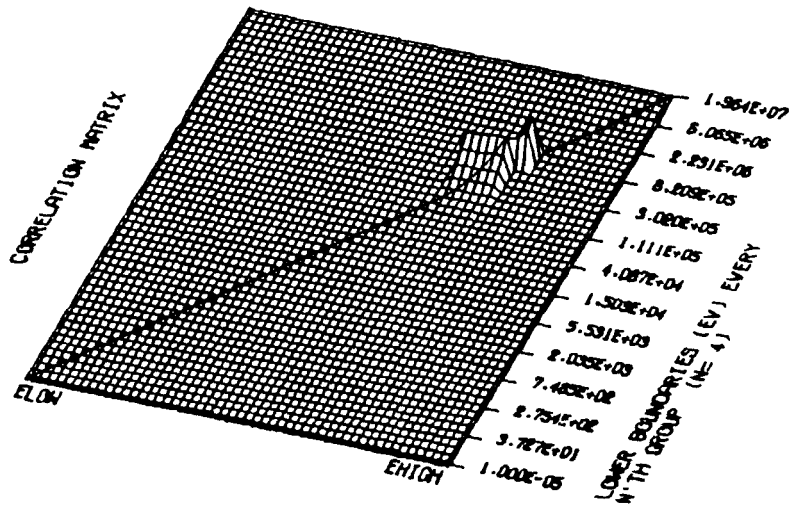


Fig. 159. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,n')$ Level 2 Cross Sections.

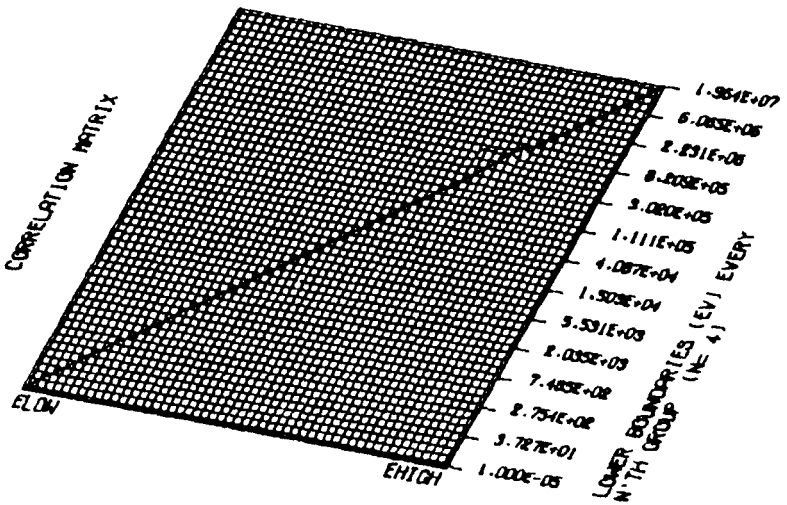


Fig. 160. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,n')$ Level 3 Cross Sections.

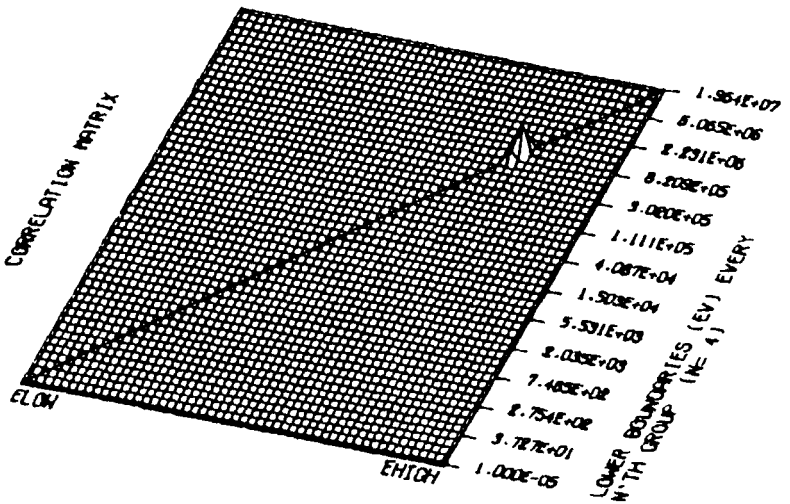


Fig. 161. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,n')$ Level 4 Cross Sections.

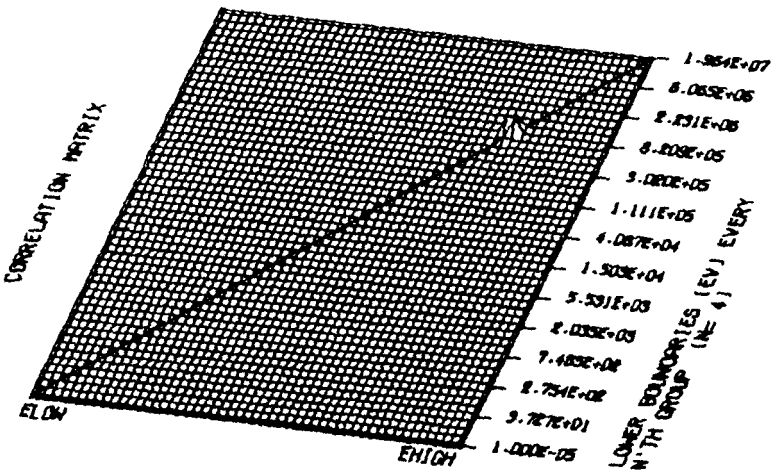


Fig. 162. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,n')$ Level 5 Cross Sections.

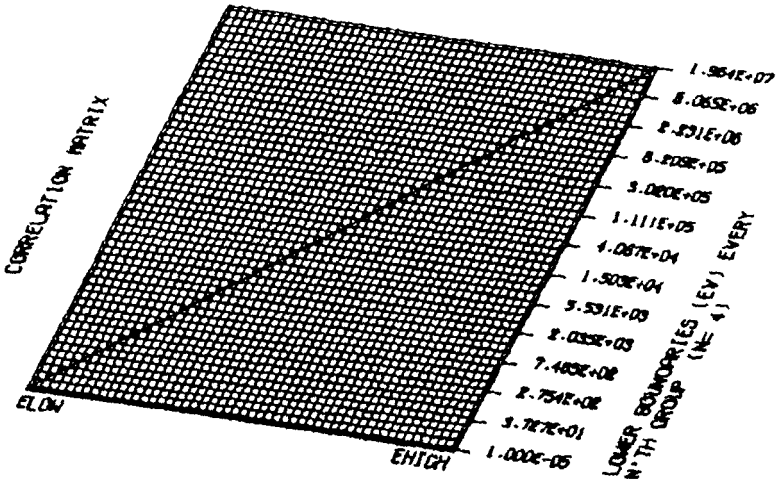


Fig. 163. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,n')$ Level 6 Cross Sections.

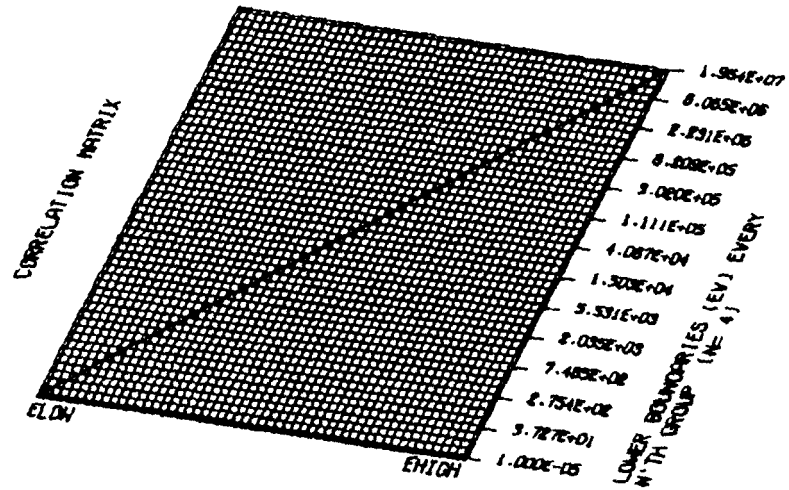


Fig. 164. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,n')$ Level 7 Cross Sections.

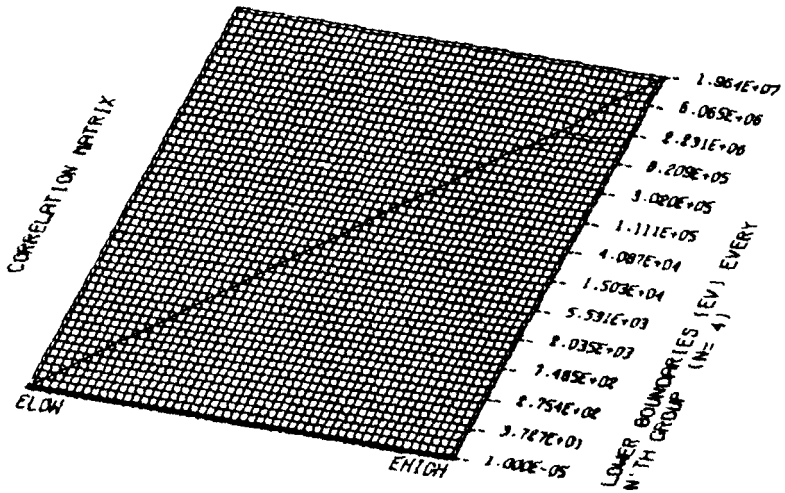


Fig. 165. Cross Correlation Matrix for ^{238}U Inelastic to $^{238}U(n,\gamma)$ Cross Sections.

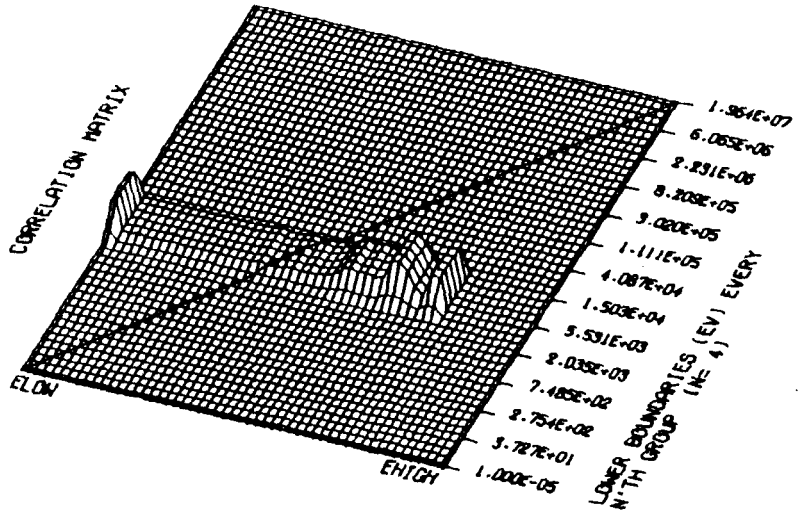


Fig. 166. Cross Correlation Matrix for ^{238}U (N,γ) to $^{10}B(n,\alpha)$ Cross Sections.

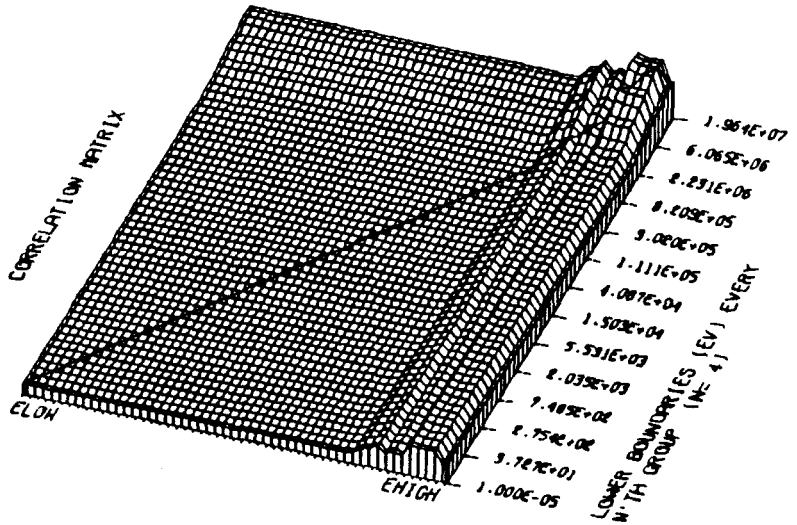


Fig. 167. Cross Correlation Matrix for $^{238}(\nu_p)$ to $^{240}Pu(\bar{\nu})$ Cross Sections.

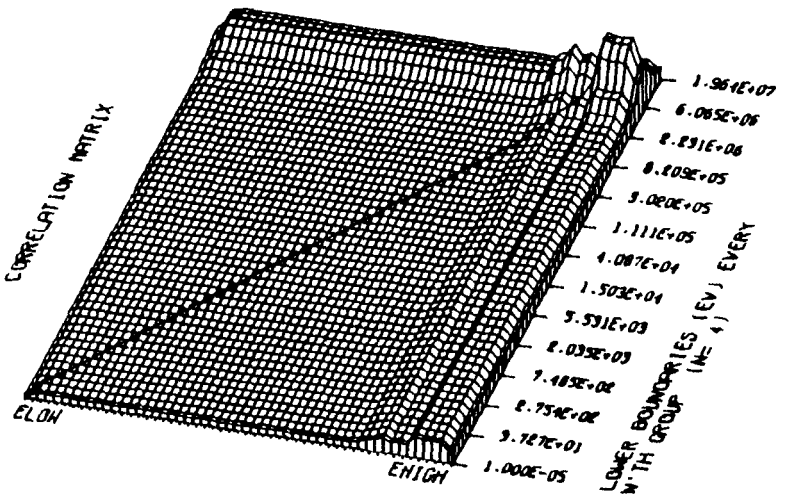


Fig. 168. Cross Correlation Matrix for $^{238}U(\nu_p)$ to $^{241}Pu(\bar{\nu})$ Cross Sections.

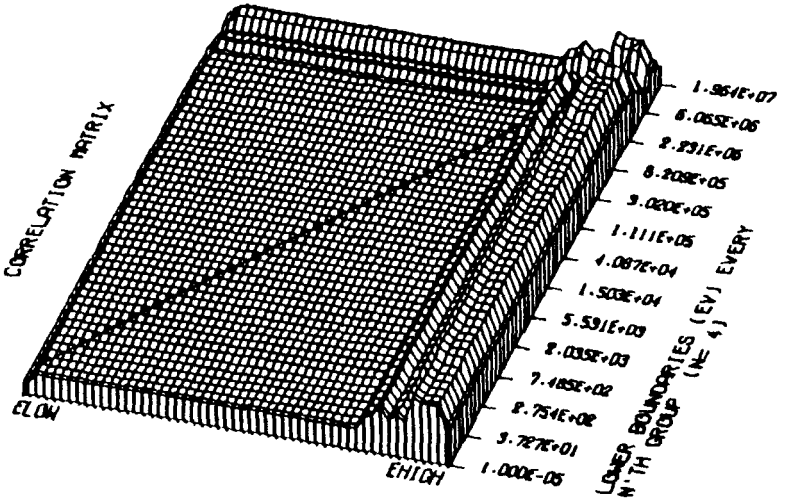


Fig. 169. Cross Correlation Matrix for $^{238}U(\nu_p)$ to $^{235}U(\bar{\nu})$ Cross Sections.

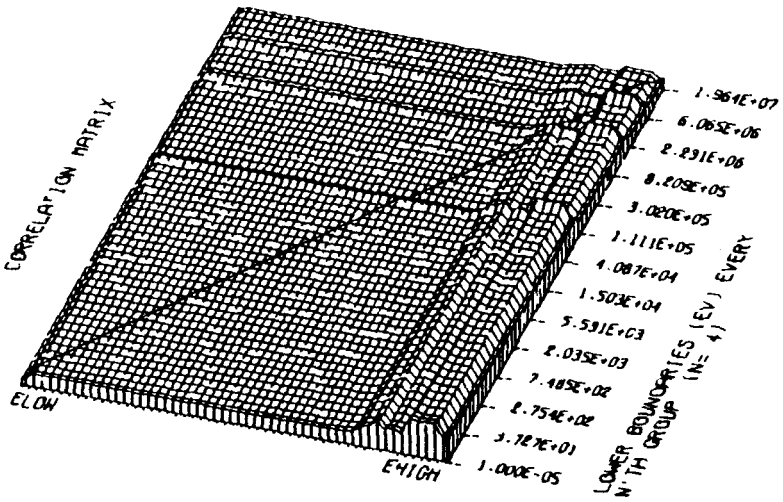


Fig. 170. Cross Correlation Matrix for $^{238}U(\nu_p)$ to $^{239}Pu(\bar{\nu})$ Cross Sections.

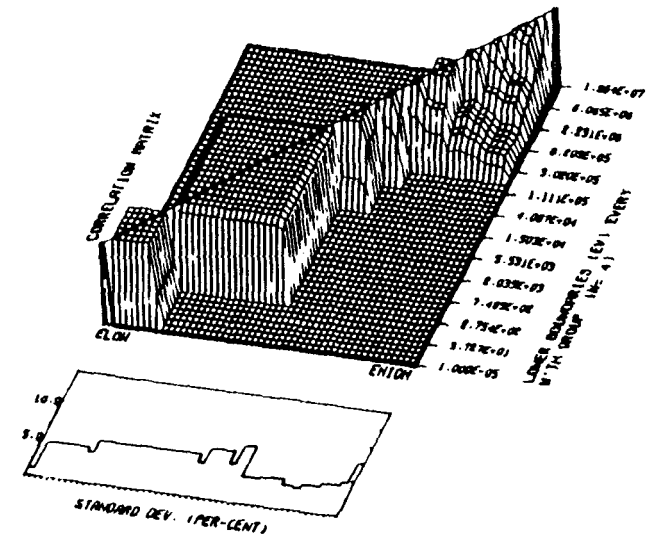


Fig. 171. Standard Deviation and Correlation Matrix for $^{239}Pu(n,f)$ Cross Sections.

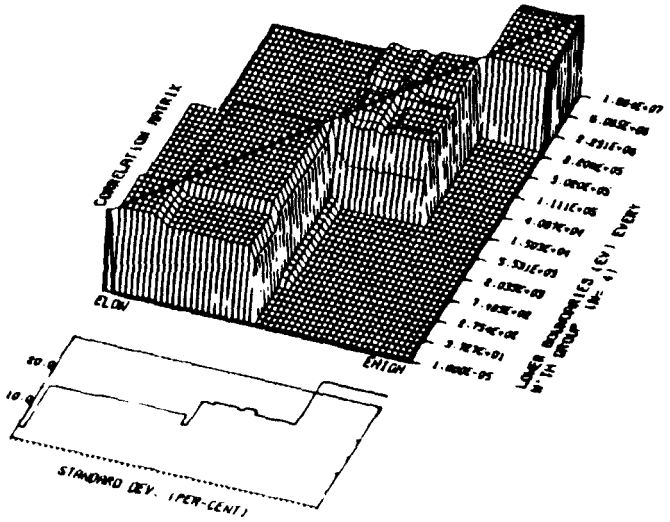


Fig. 172. Standard Deviation and Correlation Matrix for $^{239}Pu(n,\gamma)$ Cross Sections.

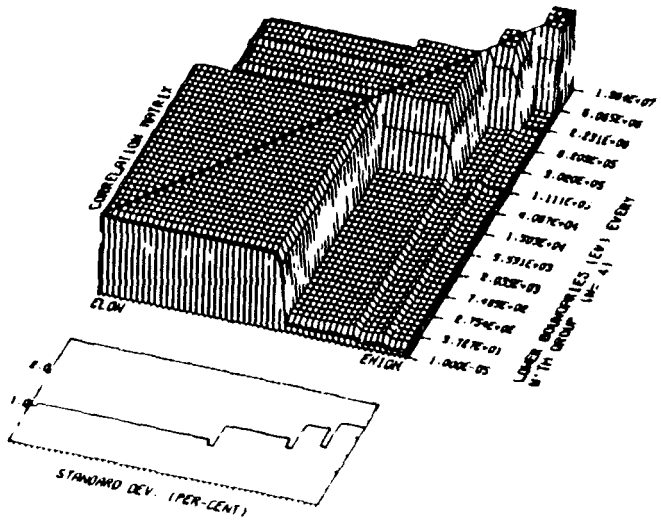


Fig. 173. Standard Deviation and Correlation Matrix for $^{239}Pu(\bar{\nu})$ Cross Sections.

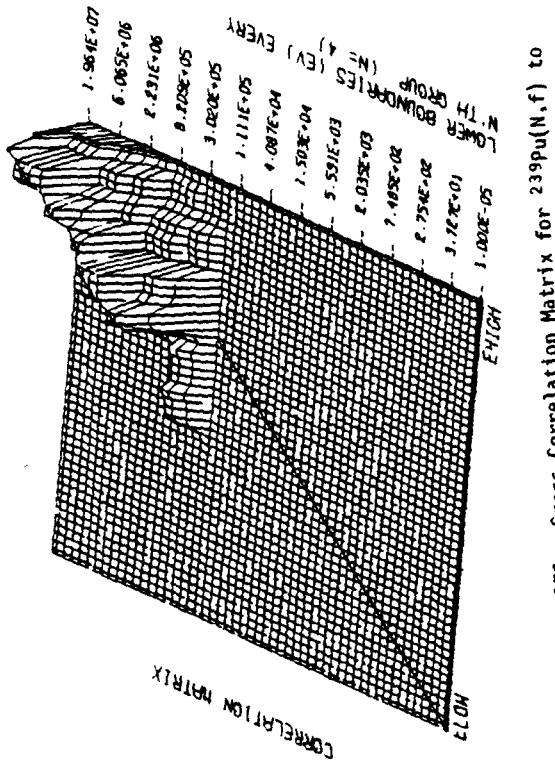


Fig. 175. Cross Correlation Matrix for $^{239}Pu(N,f)$ to $^{235}U(n,f)$ Cross Sections.

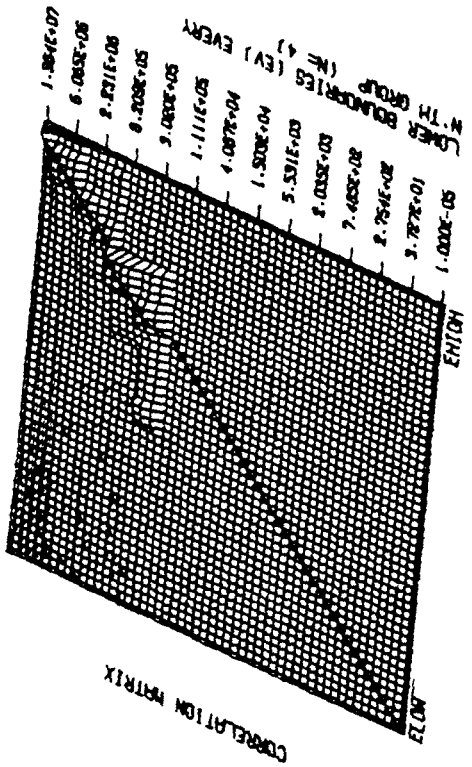


Fig. 176. Cross Correlation Matrix for $^{239}Pu(N,\gamma)$ to $^{235}U(n,f)$ Cross Sections.

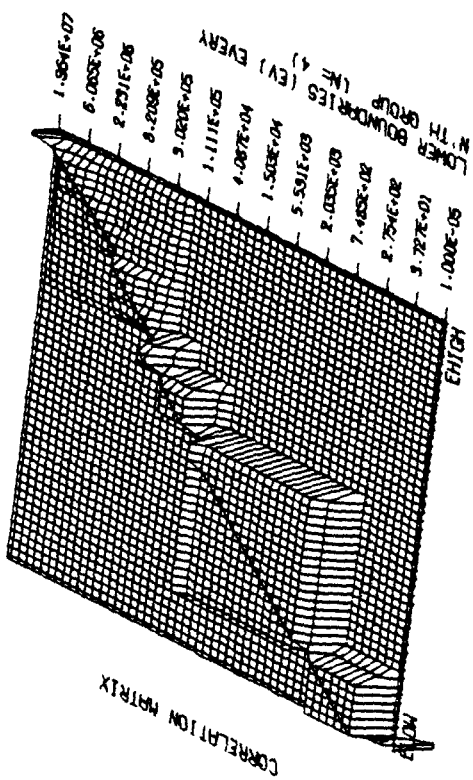


Fig. 174. Cross Correlation Matrix for $^{239}Pu(N,f)$ to $^{239}Pu(n,\gamma)$ Cross Sections.

VIII. 13-GROUP CORRELATION MATRIX TABULATIONS

The following tabulations have been collapsed from the 52-group covariance matrix library by the COVERX servic module[10] using the collapsed 100-group weighting function to 13 groups. Correlation matrix elements have been multiplied by 1000 for ease in reading. Only the lower half of symmetric matrices is given. For convenience the diagonal elements of the correlation matrices are given as zero when the corresponding standard deviations are zero. The row and column materials are reversed with respect to the conventiona used in the plots. Here, the 'for' material corresponds to the column and the 'to' material to the row.

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1276 REACTION 2 WITH RESPECT TO MATERIAL 1276 REACTION 2

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	16.6	1	1000												
1.000E 07-- 3.679E 06	1.4	2	7	1000											
3.679E 06-- 1.353E 06	1.0	3	7	778	1000										
1.353E 06-- 4.979E 05	1.2	4	6	677	806	1000									
4.979E 05-- 1.832E 05	2.8	5	3	259	343	319	1000								
1.832E 05-- 1.111E 05	1.4	6	5	572	680	592	267	1000							
1.111E 05-- 6.738E 04	1.4	7	5	572	680	592	267	1000	1000						
6.738E 04-- 2.479E 04	1.4	8	5	572	680	592	267	1000	1000	1000					
2.479E 04-- 9.119E 03	1.4	9	5	572	680	592	267	1000	1000	1000	1000				
9.119E 03-- 3.355E 03	1.4	10	5	572	680	592	267	1000	1000	1000	1000	1000			
3.355E 03-- 1.234E 03	1.4	11	5	572	680	592	267	1000	1000	1000	1000	1000	1000		
1.234E 03-- 4.540E 02	1.4	12	5	572	680	592	267	1000	1000	1000	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	1.4	13	5	572	680	592	267	1000	1000	1000	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1276 REACTION 4 WITH RESPECT TO MATERIAL 1276 REACTION 4

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	16.6	1	1000												
1.000E 07-- 3.679E 06	15.1	2	10	1000											
3.679E 06-- 1.353E 06	0.0	3	0	0	0										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1276 REACTION 2 WITH RESPECT TO MATERIAL 1276 REACTION 4

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-979	-2	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-4	-155	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1305 REACTION 107 WITH RESPECT TO MATERIAL 1305 REACTION 107

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	0												
1.000E 07-- 3.679E 06	0.0	2	0	0											
3.679E 06-- 1.353E 06	0.0	3	0	0	0										
1.353E 06-- 4.979E 05	1.6	4	0	0	0	1000									
4.979E 05-- 1.832E 05	1.5	5	0	0	0	-153	1000								
1.832E 05-- 1.111E 05	0.8	6	0	0	0	120	579	1000							
1.111E 05-- 6.738E 04	0.6	7	0	0	0	186	678	960	1000						
6.738E 04-- 2.479E 04	0.4	8	0	0	0	256	616	911	986	1000					
2.479E 04-- 9.119E 03	0.2	9	0	0	0	355	663	819	913	964	1000				
9.119E 03-- 3.355E 03	0.2	10	0	0	0	355	663	819	913	964	1000	1000			
3.355E 03-- 1.234E 03	0.2	11	0	0	0	355	663	819	913	964	1000	1000	1000		
1.234E 03-- 4.540E 02	0.2	12	0	0	0	365	663	819	913	964	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	0.2	13	0	0	0	365	663	819	913	964	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1306 REACTION 1 WITH RESPECT TO MATERIAL 1306 REACTION 1

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	5.7	1	1000												
1.000E 07-- 3.679E 06	0.8	2	54	1000											
3.679E 06-- 1.353E 06	0.4	3	60	434	1000										
1.353E 06-- 4.979E 05	0.4	4	0	0	217	1000									
4.979E 05-- 1.832E 05	0.4	5	0	0	194	570	1000								
1.832E 05-- 1.111E 05	0.5	6	0	0	166	483	687	1000							
1.111E 05-- 6.738E 04	0.5	7	0	0	166	483	687	1000	1000						
6.738E 04-- 2.479E 04	0.5	8	0	0	166	483	687	1000	1000	1000					
2.479E 04-- 9.119E 03	0.5	9	0	0	166	483	687	1000	1000	1000	1000				
9.119E 03-- 3.355E 03	0.5	10	0	0	166	483	687	1000	1000	1000	1000	1000			
3.355E 03-- 1.234E 03	0.5	11	0	0	166	483	687	1000	1000	1000	1000	1000	1000		
1.234E 03-- 4.540E 02	0.2	12	0	0	88	256	364	530	530	530	530	530	530	1000	
4.540E 02-- 1.000E-05	0.2	13	0	0	0	0	0	0	0	0	0	0	0	848	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1306 REACTION 1 WITH RESPECT TO MATERIAL 1306 REACTION 2

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	99	159	152	130	130	130	130	130	130	69	0
1.353E 06-- 4.979E 05	4	0	0	217	1000	570	483	483	483	483	483	483	256	0
4.979E 05-- 1.832E 05	5	0	0	194	570	1000	687	687	687	687	687	687	364	0
1.832E 05-- 1.111E 05	6	0	0	166	483	687	1000	1000	1000	1000	1000	1000	530	0
1.111E 05-- 6.738E 04	7	0	0	166	483	687	1000	1000	1000	1000	1000	1000	530	0
6.738E 04-- 2.479E 04	8	0	0	166	483	687	1000	1000	1000	1000	1000	1000	530	0
2.479E 04-- 9.119E 03	9	0	0	166	483	687	1000	1000	1000	1000	1000	1000	530	0
9.119E 03-- 3.355E 03	10	0	0	166	483	687	1000	1000	1000	1000	1000	1000	530	0
3.355E 03-- 1.234E 03	11	0	0	166	483	687	1000	1000	1000	1000	1000	1000	530	0
1.234E 03-- 4.540E 02	12	0	0	88	256	364	530	530	530	530	530	530	1000	848
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	848	1000

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1306 REACTION 1 WITH RESPECT TO MATERIAL 1306 REACTION 102

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07— 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07— 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06— 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06— 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05— 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05— 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05— 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04— 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04— 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03— 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03— 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03— 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	15
4.540E 02— 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	19

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1306 REACTION 2 WITH RESPECT TO MATERIAL 1306 REACTION 2

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07— 1.000E 07	9.2	1	1000												
1.000E 07— 3.679E 06	0.5	2	55	1000											
3.679E 06— 1.353E 06	0.5	3	52	533	1000										
1.353E 06— 4.979E 05	0.4	4	0	0	169	1000									
4.979E 05— 1.832E 05	0.4	5	0	0	152	578	1000								
1.832E 05— 1.111E 05	0.5	6	0	0	130	483	687	1000							
1.111E 05— 6.738E 04	0.5	7	0	0	130	483	687	1000	1000						
6.738E 04— 2.479E 04	0.5	8	0	0	130	483	687	1000	1000	1000					
2.479E 04— 9.119E 03	0.5	9	0	0	130	483	687	1000	1000	1000	1000				
9.119E 03— 3.355E 03	0.5	10	0	0	130	483	687	1000	1000	1000	1000	1000			
3.355E 03— 1.234E 03	0.5	11	0	0	130	483	687	1000	1000	1000	1000	1000	1000		
1.234E 03— 4.540E 02	0.2	12	0	0	69	256	364	530	530	530	530	530	530	1000	
4.540E 02— 1.000E-05	0.2	13	0	0	0	0	0	0	0	0	0	0	0	846	1000

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1306 REACTION 4 WITH RESPECT TO MATERIAL 1306 REACTION 1

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07— 1.000E 07	1	850	24	0	0	0	0	0	0	0	0	0	0	0
1.000E 07— 3.679E 06	2	17	405	0	0	0	0	0	0	0	0	0	0	0
3.679E 06— 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06— 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05— 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05— 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05— 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04— 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04— 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03— 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03— 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03— 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02— 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1306 REACTION 4 WITH RESPECT TO MATERIAL 1306 REACTION 2

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07— 1.000E 07	1	-473	-22	0	0	0	0	0	0	0	0	0	0	0
1.000E 07— 3.679E 06	2	-9	-439	0	0	0	0	0	0	0	0	0	0	0
3.679E 06— 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06— 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05— 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05— 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05— 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04— 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04— 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03— 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03— 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03— 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02— 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1306 REACTION 4 WITH RESPECT TO MATERIAL 1306 REACTION 4

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07— 1.000E 07	21.0	1	1000												
1.000E 07— 3.679E 06	13.4	2	31	1000											
3.679E 06— 1.353E 06	0.0	3	0	0	0										
1.353E 06— 4.979E 05	0.0	4	0	0	0	0									
4.979E 05— 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05— 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05— 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04— 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04— 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03— 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03— 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03— 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02— 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1306 REACTION 4 WITH RESPECT TO MATERIAL 1306 REACTION 107

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07— 1.000E 07	1	-232	-1	0	0	0	0	0	0	0	0	0	0	0
1.000E 07— 3.679E 06	2	-1	-123	0	0	0	0	0	0	0	0	0	0	0
3.679E 06— 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06— 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05— 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05— 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05— 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04— 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04— 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03— 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03— 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03— 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02— 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1306 REACTION 102 WITH RESPECT TO MATERIAL 1306 REACTION 102

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07--- 1.000E 07	20.0	1	1000												
1.000E 07--- 3.679E 06	20.0	2	1000	1000											
3.679E 06--- 1.353E 06	20.0	3	1000	1000	1000										
1.353E 06--- 4.979E 05	20.0	4	1000	1000	1000	1000									
4.979E 05--- 1.832E 05	20.0	5	1000	1000	1000	1000	1000								
1.832E 05--- 1.111E 05	20.0	6	1000	1000	1000	1000	1000	1000							
1.111E 05--- 6.738E 04	20.0	7	1000	1000	1000	1000	1000	1000	1000						
6.738E 04--- 2.479E 04	20.0	8	1000	1000	1000	1000	1000	1000	1000	1000					
2.479E 04--- 9.119E 03	20.0	9	1000	1000	1000	1000	1000	1000	1000	1000	1000				
9.119E 03--- 3.355E 03	20.0	10	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000			
3.355E 03--- 1.234E 03	20.0	11	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000		
1.234E 03--- 4.540E 02	6.1	12	592	592	592	592	592	592	592	592	592	592	592	1000	
4.540E 02--- 1.000E-05	6.0	13	0	0	0	0	0	0	0	0	0	0	0	806	1000

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1306 REACTION 103 WITH RESPECT TO MATERIAL 1306 REACTION 103

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07--- 1.000E 07	15.5	1	1000												
1.000E 07--- 3.679E 06	0.0	2	0	0											
3.679E 06--- 1.353E 06	0.0	3	0	0	0										
1.353E 06--- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05--- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05--- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05--- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04--- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04--- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03--- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03--- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03--- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02--- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1306 REACTION 104 WITH RESPECT TO MATERIAL 1306 REACTION 104

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07--- 1.000E 07	15.5	1	1000												
1.000E 07--- 3.679E 06	0.0	2	0	0											
3.679E 06--- 1.353E 06	0.0	3	0	0	0										
1.353E 06--- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05--- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05--- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05--- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04--- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04--- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03--- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03--- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03--- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02--- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1306 REACTION 107 WITH RESPECT TO MATERIAL 1306 REACTION 107

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07--- 1.000E 07	25.2	1	1000												
1.000E 07--- 3.679E 06	13.6	2	5	1000											
3.679E 06--- 1.353E 06	0.0	3	0	0	0										
1.353E 06--- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05--- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05--- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05--- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04--- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04--- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03--- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03--- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03--- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02--- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1311 REACTION 1 WITH RESPECT TO MATERIAL 1311 REACTION 1

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07--- 1.000E 07	7.1	1	1000												
1.000E 07--- 3.679E 06	8.3	2	424	1000											
3.679E 06--- 1.353E 06	4.9	3	466	779	1000										
1.353E 06--- 4.979E 05	3.2	4	172	231	265	1000									
4.979E 05--- 1.832E 05	3.5	5	0	0	0	0	1000								
1.832E 05--- 1.111E 05	4.2	6	0	0	0	0	503	920	1000						
1.111E 05--- 6.738E 04	4.2	7	0	0	0	0	503	920	1000	1000					
6.738E 04--- 2.479E 04	3.6	8	0	0	0	0	452	646	808	808	1000				
2.479E 04--- 9.119E 03	5.5	9	0	0	0	0	0	0	0	0	438	1000			
9.119E 03--- 3.355E 03	6.8	10	0	0	0	0	0	0	0	0	152	537	1000		
3.355E 03--- 1.234E 03	7.8	11	0	0	0	0	0	0	0	0	133	340	391	1000	
1.234E 03--- 4.540E 02	6.8	12	0	0	0	0	0	0	0	0	113	297	256	368	1000
4.540E 02--- 1.000E-05	7.4	13	0	0	0	0	0	0	0	0	0	0	0	0	46 1000

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 2

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07--- 1.000E 07	28.1	1	1000												
1.000E 07--- 3.679E 06	10.8	2	249	1000											
3.679E 06--- 1.353E 06	7.1	3	266	666	1000										
1.353E 06--- 4.979E 05	3.7	4	105	208	301	1000									
4.979E 05--- 1.832E 05	3.8	5	0	0	0	0	577	1000							
1.832E 05--- 1.111E 05	4.2	6	0	0	0	0	473	920	1000						
1.111E 05--- 6.738E 04	4.2	7	0	0	0	0	473	920	1000	1000					
6.738E 04--- 2.479E 04	3.6	8	0	0	0	0	425	646	808	808	1000				
2.479E 04--- 9.119E 03	5.5	9	0	0	0	0	0	0	0	0	438	1000			
9.119E 03--- 3.355E 03	6.8	10	0	0	0	0	0	0	0	0	152	537	1000		
3.355E 03--- 1.234E 03	7.8	11	0	0	0	0	0	0	0	0	133	340	391	1000	
1.234E 03--- 4.540E 02	6.8	12	0	0	0	0	0	0	0	0	113	297	256	368	1000
4.540E 02--- 1.000E-05	8.8	13	0	0	0	0	0	0	0	0	0	0	0	0	46 1000

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 4

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	18.4	1	1000												
1.000E 07-- 3.679E 06	5.9	2	7	1000											
3.679E 06-- 1.353E 06	9.7	3	0	181	1000										
1.353E 06-- 4.979E 05	15.3	4	0	87	519	1000									
4.979E 05-- 1.832E 05	12.2	5	0	48	494	700	1000								
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1311 REACTION 16 WITH RESPECT TO MATERIAL 1311 REACTION 16

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	10.6	1	1000												
1.000E 07-- 3.679E 06	0.0	2	0	0											
3.679E 06-- 1.353E 06	0.0	3	0	0	0										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1311 REACTION 51 WITH RESPECT TO MATERIAL 1311 REACTION 51

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	18.9	1	1000												
1.000E 07-- 3.679E 06	15.0	2	0	1000											
3.679E 06-- 1.353E 06	11.3	3	0	207	1000										
1.353E 06-- 4.979E 05	15.3	4	0	139	525	1000									
4.979E 05-- 1.832E 05	12.2	5	0	111	501	700	1000								
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1311 REACTION 52 WITH RESPECT TO MATERIAL 1311 REACTION 52

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	0												
1.000E 07-- 3.679E 06	11.7	2	0	1000											
3.679E 06-- 1.353E 06	14.9	3	0	250	1000										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1311 REACTION 53 WITH RESPECT TO MATERIAL 1311 REACTION 53

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	0												
1.000E 07-- 3.679E 06	14.9	2	0	1000											
3.679E 06-- 1.353E 06	25.0	3	0	206	1000										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1311 REACTION 54 WITH RESPECT TO MATERIAL 1311 REACTION 54

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	0												
1.000E 07-- 3.679E 06	17.8	2	0	1000											
3.679E 06-- 1.353E 06	14.6	3	0	237	1000										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1311 REACTION 55 WITH RESPECT TO MATERIAL 1311 REACTION 55

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07	0.0	1	0												
1.000E	07	3.679E	06	13.8	2	0	1000											
3.679E	06	1.353E	06	23.6	3	0	184	1000										
1.353E	06	4.979E	05	0.0	4	0	0	0	0									
4.979E	05	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1311 REACTION 56 WITH RESPECT TO MATERIAL 1311 REACTION 56

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07	4.4	1	1000												
1.000E	07	3.679E	06	15.5	2	34	1000											
3.679E	06	1.353E	06	18.4	3	0	436	1000										
1.353E	06	4.979E	05	0.0	4	0	0	0	0									
4.979E	05	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1311 REACTION 57 WITH RESPECT TO MATERIAL 1311 REACTION 57

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07	0.0	1	0												
1.000E	07	3.679E	06	19.3	2	0	1000											
3.679E	06	1.353E	06	0.0	3	0	0	0										
1.353E	06	4.979E	05	0.0	4	0	0	0	0									
4.979E	05	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1311 REACTION 58 WITH RESPECT TO MATERIAL 1311 REACTION 58

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07	3.8	1	1000												
1.000E	07	3.679E	06	17.1	2	160	1000											
3.679E	06	1.353E	06	0.0	3	0	0	0										
1.353E	06	4.979E	05	0.0	4	0	0	0	0									
4.979E	05	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1311 REACTION 59 WITH RESPECT TO MATERIAL 1311 REACTION 59

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07	0.0	1	0												
1.000E	07	3.679E	06	22.2	2	0	1000											
3.679E	06	1.353E	06	0.0	3	0	0	0										
1.353E	06	4.979E	05	0.0	4	0	0	0	0									
4.979E	05	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10003) FOR
MATERIAL 1311 REACTION 60 WITH RESPECT TO MATERIAL 1311 REACTION 60

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07	0.0	1	0												
1.000E	07	3.679E	06	22.8	2	0	1000											
3.679E	06	1.353E	06	0.0	3	0	0	0										
1.353E	06	4.979E	05	0.0	4	0	0	0	0									
4.979E	05	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10000) FOR
MATERIAL 1311 REACTION 61 WITH RESPECT TO MATERIAL 1311 REACTION 61

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.000E	07	17.9	1	1000												
1.000E	07--	3.679E	06	15.8	2	301	1000											
3.679E	06--	1.353E	06	0.0	3	0	0	0										
1.353E	06--	4.979E	05	0.0	4	0	0	0	0									
4.979E	05--	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05--	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04--	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04--	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10000) FOR
MATERIAL 1311 REACTION 62 WITH RESPECT TO MATERIAL 1311 REACTION 62

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.000E	07	13.4	1	1000												
1.000E	07--	3.679E	06	20.8	2	372	1000											
3.679E	06--	1.353E	06	0.0	3	0	0	0										
1.353E	06--	4.979E	05	0.0	4	0	0	0	0									
4.979E	05--	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05--	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04--	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04--	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10000) FOR
MATERIAL 1311 REACTION 63 WITH RESPECT TO MATERIAL 1311 REACTION 63

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.000E	07	15.4	1	1000												
1.000E	07--	3.679E	06	20.6	2	471	1000											
3.679E	06--	1.353E	06	0.0	3	0	0	0										
1.353E	06--	4.979E	05	0.0	4	0	0	0	0									
4.979E	05--	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05--	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04--	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04--	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10000) FOR
MATERIAL 1311 REACTION 64 WITH RESPECT TO MATERIAL 1311 REACTION 64

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.000E	07	11.4	1	1000												
1.000E	07--	3.679E	06	44.2	2	0	1000											
3.679E	06--	1.353E	06	0.0	3	0	0	0										
1.353E	06--	4.979E	05	0.0	4	0	0	0	0									
4.979E	05--	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05--	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04--	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04--	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10000) FOR
MATERIAL 1311 REACTION 65 WITH RESPECT TO MATERIAL 1311 REACTION 65

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.000E	07	11.4	1	1000												
1.000E	07--	3.679E	06	36.3	2	93	1000											
3.679E	06--	1.353E	06	0.0	3	0	0	0										
1.353E	06--	4.979E	05	0.0	4	0	0	0	0									
4.979E	05--	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05--	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04--	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04--	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10000) FOR
MATERIAL 1311 REACTION 66 WITH RESPECT TO MATERIAL 1311 REACTION 66

ENERGY RANGE (EV)				% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.000E	07	11.4	1	1000												
1.000E	07--	3.679E	06	41.8	2	0	1000											
3.679E	06--	1.353E	06	0.0	3	0	0	0										
1.353E	06--	4.979E	05	0.0	4	0	0	0	0									
4.979E	05--	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05--	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04--	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04--	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOOSE) FOR
MATERIAL 1311 REACTION 67 WITH RESPECT TO MATERIAL 1311 REACTION 67

ENERGY RANGE (EV)					Σ REL ERROR	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07		20.6	1	1000												
1.000E	07	3.679E	06		56.2	2	829	1000											
3.679E	06	1.353E	06		0.0	3	0	0	0										
1.353E	06	4.979E	05		0.0	4	0	0	0	0									
4.979E	05	1.832E	05		0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05		0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04		0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04		0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03		0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03		0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03		0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02		0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E	-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOOSE) FOR
MATERIAL 1311 REACTION 68 WITH RESPECT TO MATERIAL 1311 REACTION 68

ENERGY RANGE (EV)					Σ REL ERROR	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07		28.2	1	1000												
1.000E	07	3.679E	06		31.3	2	791	1000											
3.679E	06	1.353E	06		0.0	3	0	0	0										
1.353E	06	4.979E	05		0.0	4	0	0	0	0									
4.979E	05	1.832E	05		0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05		0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04		0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04		0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03		0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03		0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03		0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02		0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E	-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOOSE) FOR
MATERIAL 1311 REACTION 91 WITH RESPECT TO MATERIAL 1311 REACTION 91

ENERGY RANGE (EV)					Σ REL ERROR	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07		20.0	1	1000												
1.000E	07	3.679E	06		15.5	2	320	1000											
3.679E	06	1.353E	06		0.0	3	0	0	0										
1.353E	06	4.979E	05		0.0	4	0	0	0	0									
4.979E	05	1.832E	05		0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05		0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04		0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04		0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03		0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03		0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03		0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02		0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E	-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOOSE) FOR
MATERIAL 1311 REACTION 102 WITH RESPECT TO MATERIAL 1311 REACTION 102

ENERGY RANGE (EV)					Σ REL ERROR	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07		28.0	1	1000												
1.000E	07	3.679E	06		15.8	2	725	1000											
3.679E	06	1.353E	06		20.0	3	0	689	1000										
1.353E	06	4.979E	05		19.9	4	0	689	1000	1000									
4.979E	05	1.832E	05		12.4	5	0	0	0	0	2	1000							
1.832E	05	1.111E	05		24.7	6	0	0	0	0	1	323	1000						
1.111E	05	6.738E	04		10.0	7	0	0	0	0	2	791	405	1000					
6.738E	04	2.479E	04		27.7	8	0	0	0	0	1	286	146	361	1000				
2.479E	04	9.119E	03		10.0	9	0	0	0	0	2	791	405	1000	361	1000			
9.119E	03	3.355E	03		10.5	10	0	0	0	0	2	754	385	953	344	953	1000		
3.355E	03	1.234E	03		10.5	11	0	0	0	0	1	428	219	541	196	541	515	1000	
1.234E	03	4.540E	02		7.5	12	0	0	0	0	2	781	399	987	357	987	940	534	1000
4.540E	02	1.000E	-05		2.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOOSE) FOR
MATERIAL 1311 REACTION 103 WITH RESPECT TO MATERIAL 1311 REACTION 103

ENERGY RANGE (EV)					Σ REL ERROR	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07		23.6	1	1000												
1.000E	07	3.679E	06		18.1	2	278	1000											
3.679E	06	1.353E	06		0.0	3	0	0	0										
1.353E	06	4.979E	05		0.0	4	0	0	0	0									
4.979E	05	1.832E	05		0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05		0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04		0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04		0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03		0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03		0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03		0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02		0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E	-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOOSE) FOR
MATERIAL 1311 REACTION 107 WITH RESPECT TO MATERIAL 1311 REACTION 107

ENERGY RANGE (EV)					Σ REL ERROR	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07	1.000E	07		32.1	1	1000												
1.000E	07	3.679E	06		16.8	2	212	1000											
3.679E	06	1.353E	06		0.0	3	0	0	0										
1.353E	06	4.979E	05		0.0	4	0	0	0	0									
4.979E	05	1.832E	05		0.0	5	0	0	0	0	0								
1.832E	05	1.111E	05		0.0	6	0	0	0	0	0	0							
1.111E	05	6.738E	04		0.0	7	0	0	0	0	0	0	0						
6.738E	04	2.479E	04		0.0	8	0	0	0	0	0	0	0	0					
2.479E	04	9.119E	03		0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03	3.355E	03		0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03	1.234E	03		0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03	4.540E	02		0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02	1.000E	-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 1

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	648	380	415	182	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	275	895	705	218	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	297	697	906	249	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	111	207	240	941	614	503	503	452	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	577	1000	920	920	646	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	473	920	1000	1000	608	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	473	920	1000	1000	608	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	425	646	608	608	1000	438	152	133	114	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	430	1000	537	349	297	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	152	537	1000	391	256	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	133	349	391	1000	368	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	113	297	256	368	1000	46
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	46	569

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 16

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-15	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 51

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-56	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-353	-87	-37	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	-73	-419	-178	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	-39	-220	-343	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	-34	-210	-238	-1	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 52

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-173	-14	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	-43	-54	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 53

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-85	-8	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	-17	-38	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 54

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-96	-3	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	-16	-11	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 55

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-73	-2	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	-13	-11	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 56

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	-4	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-107	-3	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	-47	-7	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 57

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-31	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 58

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	-14	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-90	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 59

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-17	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 60

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-34	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 61

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	-3	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-11	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 62

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	-3	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-7	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 63

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	-6	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-16	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 64

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-34	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 65

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	-4	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-28	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 66

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-22	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**4) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 67

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	-12	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-14	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 68

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	-3	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-4	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 91

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-718	-3	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-230	-10	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 102

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	-1	-1	0	-1	0	-1	-1	-1	0
1.832E 05-- 1.111E 05	6	0	0	0	0	-1	-1	0	-1	0	-1	-1	-1	0
1.111E 05-- 6.738E 04	7	0	0	0	0	-1	-1	0	-1	0	-1	-1	-1	0
6.738E 04-- 2.479E 04	8	0	0	0	0	-1	-1	0	-1	0	-1	-1	-1	0
2.479E 04-- 9.119E 03	9	0	0	0	0	-1	-1	0	-1	0	-1	-1	-1	0
9.119E 03-- 3.355E 03	10	0	0	0	0	-1	-1	0	-1	0	-1	-1	-1	0
3.355E 03-- 1.234E 03	11	0	0	0	0	-1	-1	0	-1	0	-1	-1	-1	0
1.234E 03-- 4.540E 02	12	0	0	0	0	-1	-1	0	-1	0	-1	-1	-1	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 103

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-76	-1	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-21	-15	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 2 WITH RESPECT TO MATERIAL 1311 REACTION 107

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-236	-1	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-56	-3	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 51

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	78	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	793	204	109	111	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	164	987	525	501	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	87	519	1000	700	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	46	494	700	1000	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 52

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	389	32	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	97	128	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 53

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	193	19	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	39	90	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 54

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	148	6	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	35	26	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 55

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	163	5	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	30	25	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 56

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	8	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	241	7	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	105	16	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/0003) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 57

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	114	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/0003) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 58

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	32	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	203	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/0003) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 59

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	39	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/0003) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 60

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	76	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/0003) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 61

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	8	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	28	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/0003) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 62

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	6	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	17	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 63

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	17	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	36	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 64

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	76	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 65

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	84	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 66

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	54	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 67

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	26	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	31	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 68

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	7	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.579E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1311 REACTION 4 WITH RESPECT TO MATERIAL 1311 REACTION 91

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	997	7	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	319	42	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 102 WITH RESPECT TO MATERIAL 1326 REACTION 102

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	11.1	1	1000												
1.000E 07-- 3.679E 06	10.3	2	555	1000											
3.679E 06-- 1.353E 06	20.0	3	404	972	1000										
1.353E 06-- 4.979E 05	10.4	4	405	971	999	1000									
4.979E 05-- 1.832E 05	10.0	5	0	0	0	46	1000								
1.832E 05-- 1.111E 05	10.0	6	0	0	0	46	1000	1000							
1.111E 05-- 6.738E 04	10.0	7	0	0	0	46	1000	1000	1000						
6.738E 04-- 2.479E 04	10.0	8	0	0	0	46	1000	1000	1000	1000					
2.479E 04-- 9.119E 03	10.0	9	0	0	0	46	1000	1000	1000	1000	1000				
9.119E 03-- 3.355E 03	10.0	10	0	0	0	46	1000	1000	1000	1000	1000	1000			
3.355E 03-- 1.234E 03	10.0	11	0	0	0	46	1000	1000	1000	1000	1000	1000	1000		
1.234E 03-- 4.540E 02	10.0	12	0	0	0	46	1000	1000	1000	1000	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	8.9	13	0	0	0	46	997	997	997	997	997	997	997	997	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 1 WITH RESPECT TO MATERIAL 1326 REACTION 1

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	3.0	1	1000												
1.000E 07-- 3.679E 06	2.6	2	254	1000											
3.679E 06-- 1.353E 06	3.4	3	251	953	1000										
1.353E 06-- 4.979E 05	2.9	4	320	932	949	1000									
4.979E 05-- 1.832E 05	3.1	5	50	44	41	765	1000								
1.832E 05-- 1.111E 05	2.6	6	0	0	0	597	993	1000							
1.111E 05-- 6.738E 04	2.6	7	0	0	0	697	993	1000	1000						
6.738E 04-- 2.479E 04	2.6	8	0	0	0	697	993	1000	1000	1000					
2.479E 04-- 9.119E 03	3.1	9	0	0	0	706	994	998	998	998	1000				
9.119E 03-- 3.355E 03	3.2	10	0	0	0	697	996	999	999	999	998	1000			
3.355E 03-- 1.234E 03	3.2	11	0	0	0	697	996	999	999	999	998	1000	1000		
1.234E 03-- 4.540E 02	3.1	12	0	0	0	708	931	915	915	915	931	935	935	1000	
4.540E 02-- 1.000E-05	5.2	13	0	0	0	428	562	552	552	552	560	552	552	561	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 1 WITH RESPECT TO MATERIAL 1326 REACTION 2

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	805	204	202	123	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	200	807	285	142	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	231	424	918	362	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	180	212	475	787	292	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	482	348	222	222	222	190	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	245	316	316	316	269	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	245	316	316	316	269	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	245	316	316	316	269	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	241	313	313	310	274	58	58	12	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	50	316	316	64	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	50	316	316	64	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	12	77	77	260	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	810

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 1 WITH RESPECT TO MATERIAL 1326 REACTION 102

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	4	7	7	4	8	5	2	53	0
1.832E 05-- 1.111E 05	6	0	0	0	0	4	7	7	4	8	5	2	54	0
1.111E 05-- 6.738E 04	7	0	0	0	0	4	6	7	4	8	4	2	52	0
6.738E 04-- 2.479E 04	8	0	0	0	0	4	6	7	4	8	5	2	52	0
2.479E 04-- 9.119E 03	9	0	0	0	0	4	6	7	4	8	5	2	52	0
9.119E 03-- 3.355E 03	10	0	0	0	0	4	6	6	4	7	4	2	47	0
3.355E 03-- 1.234E 03	11	0	0	0	0	4	7	7	4	8	5	2	54	0
1.234E 03-- 4.540E 02	12	0	0	0	0	4	6	6	4	7	4	2	47	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	44

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1326 REACTION 2 WITH RESPECT TO MATERIAL 1326 REACTION 2

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	5.7	1	1000												
1.000E 07-- 3.679E 06	6.2	2	227	1000											
3.679E 06-- 1.353E 06	5.1	3	254	271	1000										
1.353E 06-- 4.979E 05	2.5	4	197	216	913	1000									
4.979E 05-- 1.832E 05	1.1	5	0	0	0	581	1000								
1.832E 05-- 1.111E 05	1.1	6	0	0	0	0	704	1000							
1.111E 05-- 6.738E 04	1.3	7	0	0	0	0	704	1000	1000						
6.738E 04-- 2.479E 04	1.1	8	0	0	0	0	704	1000	1000	1000					
2.479E 04-- 9.119E 03	0.9	9	0	0	0	0	692	983	983	983	1000				
9.119E 03-- 3.355E 03	1.0	10	0	0	0	0	0	0	0	0	183	1000			
3.355E 03-- 1.234E 03	1.0	11	0	0	0	0	0	0	0	0	183	1000	1000		
1.234E 03-- 4.540E 02	0.8	12	0	0	0	0	0	0	0	0	45	244	244	1000	
4.540E 02-- 1.000E-05	5.0	13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1326 REACTION 2 WITH RESPECT TO MATERIAL 1326 REACTION 3

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-594	-134	-113	-88	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-105	-191	-184	-77	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	-168	-274	-397	-207	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	-230	-233	-362	-227	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1326 REACTION 102 WITH RESPECT TO MATERIAL 1326 REACTION 2

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	-4	-2	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	-1	-1	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1326 REACTION 3 WITH RESPECT TO MATERIAL 1326 REACTION 3

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	4.5	1	1000												
1.000E 07-- 3.679E 06	5.1	2	176	1000											
3.679E 06-- 1.353E 06	5.2	3	203	464	1000										
1.353E 06-- 4.979E 05	10.1	4	387	338	912	1000									
4.979E 05-- 1.832E 05	9.9	5	0	0	0	22	1000								
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1326 REACTION 102 WITH RESPECT TO MATERIAL 1326 REACTION 2

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	16	784	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	5	317	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	115	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	111	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	111	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	112	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	102	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	117	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	100	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (10883) FOR
MATERIAL 1326 REACTION 3 WITH RESPECT TO MATERIAL 1326 REACTION 3

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	938	176	283	387	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	166	1000	464	338	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	266	464	1000	913	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	387	338	912	1000	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOCA3) FOR
MATERIAL 1326 REACTION 4 WITH RESPECT TO MATERIAL 1326 REACTION 4

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	100												
1.000E 07-- 3.679E 06	2	1000	1000											
3.679E 06-- 1.353E 06	3	1000	1000	1000										
1.353E 06-- 4.979E 05	4	1000	1000	1000	1000									
4.979E 05-- 1.832E 05	5	1000	1000	1000	1000	1000								
1.832E 05-- 1.111E 05	6	1000	1000	1000	1000	1000	1000							
1.111E 05-- 6.738E 04	7	1000	1000	1000	1000	1000	1000	1000						
6.738E 04-- 2.479E 04	8	1000	1000	1000	1000	1000	1000	1000	1000					
2.479E 04-- 9.119E 03	9	1000	1000	1000	1000	1000	1000	1000	1000	1000				
9.119E 03-- 3.355E 03	10	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000			
3.355E 03-- 1.234E 03	11	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000		
1.234E 03-- 4.540E 02	12	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	13	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LOCA3) FOR
MATERIAL 1326 REACTION 4 WITH RESPECT TO MATERIAL 1326 REACTION 16

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-125	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOCA3) FOR
MATERIAL 1326 REACTION 4 WITH RESPECT TO MATERIAL 1326 REACTION 22

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-11	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOCA3) FOR
MATERIAL 1326 REACTION 4 WITH RESPECT TO MATERIAL 1326 REACTION 28

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-60	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOCA3) FOR
MATERIAL 1326 REACTION 4 WITH RESPECT TO MATERIAL 1326 REACTION 102

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-4	-3	-4	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-4	-4	-4	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	-3	-2	-5	-5	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	-4	-1	-4	-4	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LOCA3) FOR
MATERIAL 1326 REACTION 4 WITH RESPECT TO MATERIAL 1326 REACTION 104

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-80	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-4	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 4 WITH RESPECT TO MATERIAL 1326 REACTION 105

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	1	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 6.738E 04	6	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	8	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	11	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	12	0	0	0	0	0	0	0	0	0	0	0	0	0
	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 4 WITH RESPECT TO MATERIAL 1326 REACTION 106

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-2	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 6.738E 04	6	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	8	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	11	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	12	0	0	0	0	0	0	0	0	0	0	0	0	0
	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 4 WITH RESPECT TO MATERIAL 1326 REACTION 107

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-70	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-2	-4	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 6.738E 04	6	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	8	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	11	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	12	0	0	0	0	0	0	0	0	0	0	0	0	0
	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 16 WITH RESPECT TO MATERIAL 1326 REACTION 16

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	5.0	1	1.00												
1.000E 07-- 3.679E 06	0.0	2	0	0											
3.679E 06-- 1.353E 06	0.0	3	0	0	0										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 6.738E 04	0.0	6	0	0	0	0	0	0							
6.738E 04-- 2.479E 04	0.0	7	0	0	0	0	0	0	0						
2.479E 04-- 9.119E 03	0.0	8	0	0	0	0	0	0	0	0					
9.119E 03-- 3.355E 03	0.0	9	0	0	0	0	0	0	0	0	0				
3.355E 03-- 1.234E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
1.234E 03-- 4.540E 02	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
4.540E 02-- 1.000E-05	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 22 WITH RESPECT TO MATERIAL 1326 REACTION 22

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	27.0	1	1.00												
1.000E 07-- 3.679E 06	0.0	2	0	0											
3.679E 06-- 1.353E 06	0.0	3	0	0	0										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 6.738E 04	0.0	6	0	0	0	0	0	0							
6.738E 04-- 2.479E 04	0.0	7	0	0	0	0	0	0	0						
2.479E 04-- 9.119E 03	0.0	8	0	0	0	0	0	0	0	0					
9.119E 03-- 3.355E 03	0.0	9	0	0	0	0	0	0	0	0	0				
3.355E 03-- 1.234E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
1.234E 03-- 4.540E 02	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
4.540E 02-- 1.000E-05	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1326 REACTION 28 WITH RESPECT TO MATERIAL 1326 REACTION 28

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	11.0	1	1.00												
1.000E 07-- 3.679E 06	0.0	2	0	0											
3.679E 06-- 1.353E 06	0.0	3	0	0	0										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 6.738E 04	0.0	6	0	0	0	0	0	0							
6.738E 04-- 2.479E 04	0.0	7	0	0	0	0	0	0	0						
2.479E 04-- 9.119E 03	0.0	8	0	0	0	0	0	0	0	0					
9.119E 03-- 3.355E 03	0.0	9	0	0	0	0	0	0	0	0	0				
3.355E 03-- 1.234E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
1.234E 03-- 4.540E 02	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
4.540E 02-- 1.000E-05	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/E**3) FOR
MATERIAL 1326 REACTION 102

ENERGY RANGE (EV)																	
				STD-DEV	% REL GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.00GE	07	35.7	1	1000												
1.00GE	07--	3.679E	06	22.7	2	1000	1000											
3.679E	06--	1.35GE	06	16.3	3	770	767	1000										
1.35GE	06--	4.979E	05	9.4	4			211	1000									
4.979E	05--	1.832E	05	8.0	5				192	1000								
1.832E	05--	1.111E	05	10.1	6					940	1000							
1.111E	05--	6.738E	04	12.1	7					938	915	1000						
6.738E	04--	2.479E	04	12.4	8					913	917	885	1000					
2.479E	04--	9.119E	03	12.6	9					914	921	889	891	1000				
9.119E	03--	3.355E	03	11.6	10					933	940	911	915	916	1000			
3.355E	03--	1.234E	03	12.1	11					956	963	930	932	936	854	1000		
1.234E	03--	4.540E	02	11.6	12					817	823	795	797	800	736	837	1000	
4.540E	02--	1.000E-05		7.6	13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (1/E**3) FOR
MATERIAL 1326 REACTION 104

ENERGY RANGE (EV)																	
				STD-DEV	% REL GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.00GE	07	35.7	1	1000												
1.00GE	07--	3.679E	06	22.7	2	22	1000											
3.679E	06--	1.35GE	06	16.3	3	0	0	0										
1.35GE	06--	4.979E	05	9.4	4			0	0									
4.979E	05--	1.832E	05	8.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	10.1	6			0	0	0	0							
1.111E	05--	6.738E	04	12.1	7			0	0	0	0	0						
6.738E	04--	2.479E	04	12.4	8			0	0	0	0	0	0					
2.479E	04--	9.119E	03	12.6	9			0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	11.6	10			0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	12.1	11			0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	11.6	12			0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		7.6	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/E**3) FOR
MATERIAL 1326 REACTION 105

ENERGY RANGE (EV)																	
				STD-DEV	% REL GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.00GE	07	51.7	1	1000												
1.00GE	07--	3.679E	06	0.0	2	0	0											
3.679E	06--	1.35GE	06	0.0	3	0	0	0										
1.35GE	06--	4.979E	05	0.0	4	0	0	0	0									
4.979E	05--	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05--	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04--	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04--	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/E**3) FOR
MATERIAL 1326 REACTION 106

ENERGY RANGE (EV)																	
				STD-DEV	% REL GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.00GE	07	42.6	1	1000												
1.00GE	07--	3.679E	06	0.0	2	0	0											
3.679E	06--	1.35GE	06	0.0	3	0	0	0										
1.35GE	06--	4.979E	05	0.0	4	0	0	0	0									
4.979E	05--	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05--	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04--	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04--	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/E**3) FOR
MATERIAL 1326 REACTION 107

ENERGY RANGE (EV)																	
				STD-DEV	% REL GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.00GE	07	16.5	1	1000												
1.00GE	07--	3.679E	06	13.0	2	24	1000											
3.679E	06--	1.35GE	06	20.0	3	0	11	1000										
1.35GE	06--	4.979E	05	0.0	4				0									
4.979E	05--	1.832E	05	0.0	5	0	0	0	0	0								
1.832E	05--	1.111E	05	0.0	6	0	0	0	0	0	0							
1.111E	05--	6.738E	04	0.0	7	0	0	0	0	0	0	0						
6.738E	04--	2.479E	04	0.0	8	0	0	0	0	0	0	0	0					
2.479E	04--	9.119E	03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E	03--	3.355E	03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E	03--	1.234E	03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E	03--	4.540E	02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E	02--	1.000E-05		0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (1/E**3) FOR
MATERIAL 1326 REACTION 102

ENERGY RANGE (EV)																	
				STD-DEV	% REL GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E	07--	1.00GE	07	21.2	1	1000												
1.00GE	07--	3.679E	06	20.3	2	251	1000											
3.679E	06--	1.35GE	06	16.5	3	930	688	1000										
1.35GE	06--	4.979E	05	14.2	4	187	198	299	1000									
4.979E	05--	1.832E	05	16.0	5	0	0	0	0	948	1000							
1.832E	05--	1.111E	05	15.1	6			0	0	948	1000	1000						
1.111E	05--	6.738E	04	19.2	7			0	0	675	712	712	1000					
6.738E	04--	2.479E	04	21.0	8			0	0	558	588	588	987	1000				
2.479E	04--	9.119E	03	21.2	9			0	0	558	588	588	987	1000	1000			
9.119E	03--	3.355E	03	21.2	10			0	0	558	588	588	987	1000	1000	1000		
3.355E	03--	1.234E	03	21.2	11			0	0	558	588	588	987	1000	1000	1000	1000	
1.234E	03--	4.540E	02	21.2	12			0	0	558	588	588	987	1000	1000	1000	1000	1000
4.540E	02--	1.000E-05		20.4	13	0	0	0	0	558	588	588	987	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1380 REACTION 102 WITH RESPECT TO MATERIAL 1380 REACTION 102

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	1												
1.000E 07-- 3.679E 06	17.7	2	0	1000											
3.679E 06-- 1.353E 06	16.2	3	0	1000	1000										
1.353E 06-- 4.979E 05	8.5	4	0	-208	-997	1000									
4.979E 05-- 1.832E 05	22.0	5	0	-804	-456	848	1000								
1.832E 05-- 1.111E 05	34.1	6	0	-216	-216	214	562	1000							
1.111E 05-- 6.738E 04	35.2	7	0	-238	-238	236	686	998	1000						
6.738E 04-- 2.479E 04	24.8	8	0	-216	-216	214	648	984	983	1000					
2.479E 04-- 9.119E 03	9.9	9	0	-163	-161	176	182	33	56	172	1000				
9.119E 03-- 3.355E 03	10.1	10	0	-379	-377	388	679	622	661	684	585	1000			
3.355E 03-- 1.234E 03	10.2	11	0	-367	-364	383	549	353	433	429	573	928	1000		
1.234E 03-- 4.540E 02	9.6	12	0	-251	-227	238	113	-357	-306	-308	458	426	660	1000	
4.540E 02-- 1.000E-05	61.2	13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1380 REACTION 452 WITH RESPECT TO MATERIAL 1380 REACTION 452

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	1000												
1.000E 07-- 3.679E 06	0.0	2	567	1000											
3.679E 06-- 1.353E 06	1.1	3	256	953	1000										
1.353E 06-- 4.979E 05	1.2	4	209	923	996	1000									
4.979E 05-- 1.832E 05	1.2	5	206	923	996	1000	1000								
1.832E 05-- 1.111E 05	1.2	6	208	923	996	1000	1000	1000							
1.111E 05-- 6.738E 04	1.2	7	208	923	996	1000	1000	1000	1000						
6.738E 04-- 2.479E 04	1.2	8	208	923	996	1000	1000	1000	1000	1000					
2.479E 04-- 9.119E 03	1.2	9	208	923	996	1000	1000	1000	1000	1000	1000				
9.119E 03-- 3.355E 03	1.2	10	208	923	996	1000	1000	1000	1000	1000	1000	1000			
3.355E 03-- 1.234E 03	1.2	11	208	923	996	1000	1000	1000	1000	1000	1000	1000	1000		
1.234E 03-- 4.540E 02	1.2	12	208	923	996	1000	1000	1000	1000	1000	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	1.2	13	208	923	996	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1381 REACTION 18 WITH RESPECT TO MATERIAL 1381 REACTION 18

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	1												
1.000E 07-- 3.679E 06	3.6	2	0	1000											
3.679E 06-- 1.353E 06	3.0	3	0	901	1000										
1.353E 06-- 4.979E 05	5.8	4	0	557	778	1000									
4.979E 05-- 1.832E 05	7.6	5	0	735	887	920	1000								
1.832E 05-- 1.111E 05	5.2	6	0	76	14	-56	72	1000							
1.111E 05-- 6.738E 04	3.1	7	0	176	33	-72	153	680	1000						
6.738E 04-- 2.479E 04	1.5	8	0	232	43	-153	81	553	498	1000					
2.479E 04-- 9.119E 03	3.5	9	0	0	0	-5	32	611	379	459	1000				
9.119E 03-- 3.355E 03	5.4	10	0	0	0	0	2	31	22	22	-608	1000			
3.355E 03-- 1.234E 03	10.0	11	0	0	0	0	-3	-38	-27	-17	-331	475	1000		
1.234E 03-- 4.540E 02	12.5	12	0	0	0	0	-5	-83	-56	-31	-215	251	846	1000	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	-26	-383	-270	-150	-164	-145	270	625	1000

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1381 REACTION 452 WITH RESPECT TO MATERIAL 1381 REACTION 452

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	2.1	1	1000												
1.000E 07-- 3.679E 06	0.6	2	-56	1000											
3.679E 06-- 1.353E 06	1.5	3	-776	675	1000										
1.353E 06-- 4.979E 05	2.2	4	-832	600	995	1000									
4.979E 05-- 1.832E 05	4.0	5	-832	600	995	1000	1000								
1.832E 05-- 1.111E 05	3.6	6	-832	600	995	1000	1000	1000							
1.111E 05-- 6.738E 04	2.0	7	-832	600	995	1000	1000	1000	1000						
6.738E 04-- 2.479E 04	2.0	8	-832	600	995	1000	1000	1000	1000	1000					
2.479E 04-- 9.119E 03	2.0	9	-832	600	995	1000	1000	1000	1000	1000	1000				
9.119E 03-- 3.355E 03	2.0	10	-832	600	995	1000	1000	1000	1000	1000	1000	1000			
3.355E 03-- 1.234E 03	2.0	11	-832	600	995	1000	1000	1000	1000	1000	1000	1000	1000		
1.234E 03-- 4.540E 02	2.0	12	-832	600	995	1000	1000	1000	1000	1000	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	1.9	13	-880	958	977	992	992	992	992	992	992	992	992	992	1000

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1395 REACTION 18 WITH RESPECT TO MATERIAL 1395 REACTION 18

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	5.2	1	1000												
1.000E 07-- 3.679E 06	3.2	2	423	1000											
3.679E 06-- 1.353E 06	2.4	3	177	822	1000										
1.353E 06-- 4.979E 05	2.7	4	12	165	485	1000									
4.979E 05-- 1.832E 05	2.8	5	0	37	328	725	1000								
1.832E 05-- 1.111E 05	3.5	6	0	12	92	409	497	1000							
1.111E 05-- 6.738E 04	2.7	7	0	2	21	134	435	653	1000						
6.738E 04-- 2.479E 04	2.5	8	0	0	0	0	389	415	941	1000					
2.479E 04-- 9.119E 03	2.8	9	0	0	0	0	273	291	633	838	1000				
9.119E 03-- 3.355E 03	5.0	10	0	0	0	0	0	0	0	686	887	940	1000		
3.355E 03-- 1.234E 03	5.7	11	0	0	0	0	0	0	0	598	784	868	955	1000	
1.234E 03-- 4.540E 02	3.4	12	0	0	0	0	0	0	0	507	707	871	746	701	1000
4.540E 02-- 1.000E-05	0.3	13	0	0	0	0	0	0	0	115	159	204	155	135	240	1000

ELEMENTS OF THE CORRELATION MATRIX (LOWER) FOR
MATERIAL 1395 REACTION 102 WITH RESPECT TO MATERIAL 1395 REACTION 102

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	65.3	1	1000												
1.000E 07-- 3.679E 06	63.5	2	990	1000											
3.679E 06-- 1.353E 06	60.0	3	577	648	1000										
1.353E 06-- 4.979E 05	35.4	4	472	549	782	1000									
4.979E 05-- 1.832E 05	23.1	5	230	258	303	499	1000								
1.832E 05-- 1.111E 05	15.0	6	115	137	200	305	560	1000							
1.111E 05-- 6.738E 04	9.4	7	99	112	137	208	369	613	1000						
6.738E 04-- 2.479E 04	9.1	8	79	86	92	139	238	366	941	1000					
2.479E 04-- 9.119E 03	9.5	9	76	83	88	133	228	353	557	692	1000				
9.119E 03-- 3.355E 03	8.0	10	90	98	104	159	271	417	663	687	675	1000			
3.355E 03-- 1.234E 03	7.9	11	92	100	106	161	275	424	674	698	669	812	1000		
1.234E 03-- 4.540E 02	7.7	12	93	102	108	164	280	431	686	711	680	809	862	1000	
4.540E 02-- 1.000E-05	1.4	13	28	31	33	50	85	131	209	216	207	246	250	254	1000

ELEMENTS OF THE CORRELATION MATRIX (LXXXXI) FOR
MATERIAL 1398 REACTION 452 WITH RESPECT TO MATERIAL 1395 REACTION 452

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1.3	1	1000												
1.000E 07-- 3.679E 06	0.0	2	342	1000											
3.679E 06-- 1.353E 06	0.0	3	159	803	1000										
1.353E 06-- 4.979E 05	0.0	4	373	812	961	1000									
4.979E 05-- 1.832E 05	0.0	5	320	725	782	938	1000								
1.832E 05-- 1.111E 05	0.0	6	317	680	727	896	994	1000							
1.111E 05-- 6.738E 04	0.0	7	317	662	727	896	994	1000	1000						
6.738E 04-- 2.479E 04	0.0	8	317	662	727	896	994	1000	1000	1000					
2.479E 04-- 9.119E 03	0.0	9	317	662	727	896	994	1000	1000	1000	1000				
9.119E 03-- 3.355E 03	0.0	10	317	662	727	896	994	1000	1000	1000	1000	1000			
3.355E 03-- 1.234E 03	0.0	11	317	662	727	896	994	1000	1000	1000	1000	1000	1000		
1.234E 03-- 4.540E 02	0.0	12	317	662	727	896	994	1000	1000	1000	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	0.0	13	171	367	394	501	572	578	578	578	578	578	578	578	1000

ELEMENTS OF THE CORRELATION MATRIX (LXXXXI) FOR
MATERIAL 1398 REACTION 1 WITH RESPECT TO MATERIAL 1395 REACTION 1

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	1000												
1.000E 07-- 3.679E 06	0.0	2	0	1000											
3.679E 06-- 1.353E 06	0.0	3	0	0	1000										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	1000	1000								
4.979E 05-- 1.832E 05	0.0	5	0	0	476	476	476	1000							
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	880	1000						
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	880	1000	1000					
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	880	1000	1000	1000				
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	880	1000	1000	1000	1000			
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	880	1000	1000	1000	1000	1000		
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0	0	
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (LXXXXI) FOR
MATERIAL 1398 REACTION 1 WITH RESPECT TO MATERIAL 1398 REACTION 2

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	557	369	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	339	906	797	797	797	797	797	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	456	973	973	973	973	973	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	871	990	990	990	990	990	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	880	1000	1000	1000	1000	1000	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	879	999	999	999	999	999	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	879	999	999	999	999	999	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	994

ELEMENTS OF THE CORRELATION MATRIX (LXXXXI) FOR
MATERIAL 1398 REACTION 1 WITH RESPECT TO MATERIAL 1398 REACTION 102

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	110

ELEMENTS OF THE CORRELATION MATRIX (LXXXXI) FOR
MATERIAL 1398 REACTION 2 WITH RESPECT TO MATERIAL 1398 REACTION 2

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	7.4	1	1000												
1.000E 07-- 3.679E 06	7.0	2	274	1000											
3.679E 06-- 1.353E 06	7.0	3	274	1000	1000										
1.353E 06-- 4.979E 05	6.6	4	117	429	429	1000									
4.979E 05-- 1.832E 05	5.9	5	0	0	0	525	1000								
1.832E 05-- 1.111E 05	5.7	6	0	0	0	23	797	1000							
1.111E 05-- 6.738E 04	5.3	7	0	0	0	0	788	995	1000						
6.738E 04-- 2.479E 04	5.2	8	0	0	0	0	797	974	991	1000					
2.479E 04-- 9.119E 03	5.2	9	0	0	0	0	796	972	984	1000	1000				
9.119E 03-- 3.355E 03	4.9	10	0	0	0	0	795	972	989	999	999	1000			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	1.8	13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (LXXXXI) FOR
MATERIAL 1398 REACTION 2 WITH RESPECT TO MATERIAL 1398 REACTION 51

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	-377	-355	-43	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	-448	-422	-51	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	-99	-93	-233	-139	-8	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	-227	-143	-8	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	-227	-143	-8	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	7	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LIB-3) FOR
MATERIAL 1398 REACTION WITH RESPECT TO MATERIAL 1398 REACTION 52

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	-69	-11	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	-143	-44	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	-43	-44	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LIB-3) FOR
MATERIAL 1398 REACTION WITH RESPECT TO MATERIAL 1398 REACTION 53

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	-8	-1	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	-10	-2	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LIB-3) FOR
MATERIAL 1398 REACTION WITH RESPECT TO MATERIAL 1398 REACTION 54

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	-17	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LIB-3) FOR
MATERIAL 1398 REACTION WITH RESPECT TO MATERIAL 1398 REACTION 55

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	-5	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LIB-3) FOR
MATERIAL 1398 REACTION WITH RESPECT TO MATERIAL 1398 REACTION 102

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	-5	-1	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	-1	-2	-1	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	-1	-19	-3	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	-3	-10	-2	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	-1	-12	1	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	-1	-29	-1	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	-7	-38	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LIB-3) FOR
MATERIAL 1398 REACTION WITH RESPECT TO MATERIAL 1398 REACTION 1

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	711	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	635	640	434	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	635	640	434	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	179	180	122	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=33) FOR
MATERIAL 1398 REACTION # WITH RESPECT TO MATERIAL 1398 REACTION 2

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-510	-211	-210	-184	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-139	-771	-769	-612	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	-139	-771	-768	-612	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	-60	-331	-330	-263	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=33) FOR
MATERIAL 1398 REACTION # WITH RESPECT TO MATERIAL 1398 REACTION 4

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	69.6	1	1000												
1.000E 07-- 3.679E 06	12.6	2	139	1000											
3.679E 06-- 1.353E 06	11.0	3	139	999	1000										
1.353E 06-- 4.979E 05	6.6	4	60	748	748	1000									
4.979E 05-- 1.832E 05	5.6	5	0	0	0	943	1000								
1.832E 05-- 1.111E 05	14.1	6	0	0	0	141	220	1000							
1.111E 05-- 6.738E 04	22.2	7	0	0	0	0	0	975	1000						
6.738E 04-- 2.479E 04	15.3	8	0	0	0	0	0	975	1000	1000					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=33) FOR
MATERIAL 1398 REACTION # WITH RESPECT TO MATERIAL 1398 REACTION 16

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-443	-4	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-58	-30	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=33) FOR
MATERIAL 1398 REACTION # WITH RESPECT TO MATERIAL 1398 REACTION 17

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-131	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=33) FOR
MATERIAL 1398 REACTION # WITH RESPECT TO MATERIAL 1398 REACTION 18

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-130	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	-24	-2	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	-2	-18	-6	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	-9	-6	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=33) FOR
MATERIAL 1398 REACTION # WITH RESPECT TO MATERIAL 1398 REACTION 51

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	0	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	539	837	186	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	640	995	221	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	141	220	1000	975	975	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	975	1000	1000	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	975	1000	1000	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR MATERIAL 1398 REACTION 4 WITH RESPECT TO MATERIAL 1398 REACTION 52

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	98	27	1	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	52	104	2	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	62	104	2	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR MATERIAL 1398 REACTION 4 WITH RESPECT TO MATERIAL 1398 REACTION 53

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	12	7	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	15	4	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR MATERIAL 1398 REACTION 4 WITH RESPECT TO MATERIAL 1399 REACTION 54

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	24	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR MATERIAL 1398 REACTION 4 WITH RESPECT TO MATERIAL 1398 REACTION 55

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	0	0	0	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	0	0	0	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	0	0	0	0	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	0	9	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR MATERIAL 1398 REACTION 4 WITH RESPECT TO MATERIAL 1399 REACTION 102

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	-1	-8	-13	0	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	-1	-8	-13	0	0	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	-1	-7	-15	-15	0	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	0	0	-6	-19	0	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	0	0	0	0	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	0	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	0	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (10**3) FOR MATERIAL 1398 REACTION 16 WITH RESPECT TO MATERIAL 1398 REACTION 16

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	21.4	1	1000												
1.000E 07-- 3.679E 06	6.7	2	124	1000											
3.679E 06-- 1.353E 06	0.0	3	0	0	0										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 1.111E 05	0.0	6	0	0	0	0	0	0							
1.111E 05-- 6.738E 04	0.0	7	0	0	0	0	0	0	0						
6.738E 04-- 2.479E 04	0.0	8	0	0	0	0	0	0	0	0					
2.479E 04-- 9.119E 03	0.0	9	0	0	0	0	0	0	0	0	0				
9.119E 03-- 3.355E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
3.355E 03-- 1.234E 03	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
1.234E 03-- 4.540E 02	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
4.540E 02-- 1.000E-05	0.0	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=31) FOR
MATERIAL 1398 REACTION 17 WITH RESPECT TO MATERIAL 1398 REACTION 17

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	11.0	1	1000												
1.000E 07-- 3.679E 06	0.0	2	0	0											
3.679E 06-- 1.353E 06	0.0	3	0	0	0										
1.353E 06-- 4.979E 05	0.0	4	0	0	0	0									
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0	0								
1.832E 05-- 6.738E 04	0.0	6	0	0	0	0	0	0							
6.738E 04-- 2.479E 04	0.0	7	0	0	0	0	0	0	0						
2.479E 04-- 9.119E 03	0.0	8	0	0	0	0	0	0	0	0					
9.119E 03-- 3.355E 03	0.0	9	0	0	0	0	0	0	0	0	0				
3.355E 03-- 1.234E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
1.234E 03-- 4.540E 02	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
4.540E 02-- 1.000E-05	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
		13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=31) FOR
MATERIAL 1398 REACTION 18 WITH RESPECT TO MATERIAL 1398 REACTION 18

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	5.6	1	1000												
1.000E 07-- 3.679E 06	1.4	2	0	1000											
3.679E 06-- 1.353E 06	1.2	3	0	41	1000										
1.353E 06-- 4.979E 05	7.2	4	0	0	610	1000									
4.979E 05-- 1.832E 05	11.0	5	0	0	0	41	1000								
1.832E 05-- 6.738E 04	30.0	6	0	0	0	0	764	1000							
6.738E 04-- 2.479E 04	30.0	7	0	0	0	0	764	1000	1000						
2.479E 04-- 9.119E 03	30.0	8	0	0	0	0	764	1000	1000	1000					
9.119E 03-- 3.355E 03	30.0	9	0	0	0	0	764	1000	1000	1000	1000				
3.355E 03-- 1.234E 03	25.0	10	0	0	0	0	0	0	0	0	0	0			
1.234E 03-- 4.540E 02	25.0	11	0	0	0	0	0	0	0	0	0	0	0		
4.540E 02-- 1.000E-05	25.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
		13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=31) FOR
MATERIAL 1398 REACTION 51 WITH RESPECT TO MATERIAL 1398 REACTION 51

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	2.0	1	1000												
1.000E 07-- 3.679E 06	2.0	2	1000	1000											
3.679E 06-- 1.353E 06	2.0	3	1000	1000	1000										
1.353E 06-- 4.979E 05	2.3	4	169	169	169	1000									
4.979E 05-- 1.832E 05	16.0	5	0	0	0	986	1000								
1.832E 05-- 6.738E 04	14.1	6	0	0	0	218	221	1000							
6.738E 04-- 2.479E 04	20.0	7	0	0	0	0	0	975	1000						
2.479E 04-- 9.119E 03	19.3	8	0	0	0	0	0	975	1000	1000					
9.119E 03-- 3.355E 03	0.0	9	0	0	0	0	0	0	0	0	0				
3.355E 03-- 1.234E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
1.234E 03-- 4.540E 02	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
4.540E 02-- 1.000E-05	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
		13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=31) FOR
MATERIAL 1398 REACTION 52 WITH RESPECT TO MATERIAL 1398 REACTION 52

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	2.0	1	1000												
1.000E 07-- 3.679E 06	2.0	2	1000	1000											
3.679E 06-- 1.353E 06	14.3	3	783	783	1000										
1.353E 06-- 4.979E 05	2.1	4	0	0	180	1000									
4.979E 05-- 1.832E 05	20.1	5	0	0	0	258	1000								
1.832E 05-- 6.738E 04	20.1	6	0	0	0	258	1000	1000							
6.738E 04-- 2.479E 04	0.0	7	0	0	0	0	0	0	0						
2.479E 04-- 9.119E 03	0.0	8	0	0	0	0	0	0	0	0					
9.119E 03-- 3.355E 03	0.0	9	0	0	0	0	0	0	0	0	0				
3.355E 03-- 1.234E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
1.234E 03-- 4.540E 02	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
4.540E 02-- 1.000E-05	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
		13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=31) FOR
MATERIAL 1398 REACTION 53 WITH RESPECT TO MATERIAL 1398 REACTION 53

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	2.0	1	1000												
1.000E 07-- 3.679E 06	2.0	2	1000	1000											
3.679E 06-- 1.353E 06	9.1	3	296	296	1000										
1.353E 06-- 4.979E 05	9.9	4	0	0	735	1000									
4.979E 05-- 1.832E 05	19.9	5	0	0	0	574	1000								
1.832E 05-- 6.738E 04	0.0	6	0	0	0	0	0	0							
6.738E 04-- 2.479E 04	0.0	7	0	0	0	0	0	0	0						
2.479E 04-- 9.119E 03	0.0	8	0	0	0	0	0	0	0	0					
9.119E 03-- 3.355E 03	0.0	9	0	0	0	0	0	0	0	0	0				
3.355E 03-- 1.234E 03	0.0	10	0	0	0	0	0	0	0	0	0	0			
1.234E 03-- 4.540E 02	0.0	11	0	0	0	0	0	0	0	0	0	0	0		
4.540E 02-- 1.000E-05	0.0	12	0	0	0	0	0	0	0	0	0	0	0	0	
		13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=31) FOR
MATERIAL 1398 REACTION 54 WITH RESPECT TO MATERIAL 1398 REACTION 54

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	2.0	1	1000												
1.000E 07-- 3.679E 06	2.0	2	1000	1000											
3.679E 06-- 1.353E 06	16.3	3	833	833	1000										
1.353E 06-- 4.979E 05	5.2	4	0	542	1000										
4.979E 05-- 1.832E 05	0.0	5	0	0	0	0									
1.832E 05-- 6.738E 04	0.0	6	0	0	0	0	0								
6.738E 04-- 2.479E 04	0.0	7	0	0	0	0	0	0							
2.479E 04-- 9.119E 03	0.0	8	0	0	0	0	0	0	0						
9.119E 03-- 3.355E 03	0.0	9	0	0	0	0	0	0	0	0					
3.355E 03-- 1.234E 03	0.0	10	0	0	0	0	0	0	0	0	0				
1.234E 03-- 4.540E 02	0.0	11	0	0	0	0	0	0	0	0	0	0			
4.540E 02-- 1.000E-05	0.0	12	0	0	0	0	0	0	0	0	0	0	0		
		13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1398 REACTION 55 WITH RESPECT TO MATERIAL 1398 REACTION 55

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	1000												
1.000E 07-- 3.679E 06	0.0	2	1000	1000											
3.679E 06-- 1.353E 06	0.0	3	1000	1000	1000										
1.353E 06-- 4.979E 05	0.0	4	1000	1000	1000	1000									
4.979E 05-- 1.832E 05	0.0	5	1000	1000	1000	1000	1000								
1.832E 05-- 6.738E 04	0.0	6	1000	1000	1000	1000	1000	1000							
6.738E 04-- 2.479E 04	0.0	7	1000	1000	1000	1000	1000	1000	1000						
2.479E 04-- 9.119E 03	0.0	8	1000	1000	1000	1000	1000	1000	1000	1000					
9.119E 03-- 3.355E 03	0.0	9	1000	1000	1000	1000	1000	1000	1000	1000	1000				
3.355E 03-- 1.234E 03	0.0	10	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000			
1.234E 03-- 4.540E 02	0.0	11	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000		
4.540E 02-- 1.000E-05	0.0	12	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
		13	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1398 REACTION 56 WITH RESPECT TO MATERIAL 1398 REACTION 56

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	1000												
1.000E 07-- 3.679E 06	0.0	2	1000	1000											
3.679E 06-- 1.353E 06	0.0	3	1000	1000	1000										
1.353E 06-- 4.979E 05	0.0	4	1000	1000	1000	1000									
4.979E 05-- 1.832E 05	0.0	5	1000	1000	1000	1000	1000								
1.832E 05-- 6.738E 04	0.0	6	1000	1000	1000	1000	1000	1000							
6.738E 04-- 2.479E 04	0.0	7	1000	1000	1000	1000	1000	1000	1000						
2.479E 04-- 9.119E 03	0.0	8	1000	1000	1000	1000	1000	1000	1000	1000					
9.119E 03-- 3.355E 03	0.0	9	1000	1000	1000	1000	1000	1000	1000	1000	1000				
3.355E 03-- 1.234E 03	0.0	10	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000			
1.234E 03-- 4.540E 02	0.0	11	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000		
4.540E 02-- 1.000E-05	0.0	12	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
		13	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1398 REACTION 57 WITH RESPECT TO MATERIAL 1398 REACTION 57

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	1000												
1.000E 07-- 3.679E 06	0.0	2	1000	1000											
3.679E 06-- 1.353E 06	0.0	3	1000	1000	1000										
1.353E 06-- 4.979E 05	0.0	4	1000	1000	1000	1000									
4.979E 05-- 1.832E 05	0.0	5	1000	1000	1000	1000	1000								
1.832E 05-- 6.738E 04	0.0	6	1000	1000	1000	1000	1000	1000							
6.738E 04-- 2.479E 04	0.0	7	1000	1000	1000	1000	1000	1000	1000						
2.479E 04-- 9.119E 03	0.0	8	1000	1000	1000	1000	1000	1000	1000	1000					
9.119E 03-- 3.355E 03	0.0	9	1000	1000	1000	1000	1000	1000	1000	1000	1000				
3.355E 03-- 1.234E 03	0.0	10	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000			
1.234E 03-- 4.540E 02	0.0	11	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000		
4.540E 02-- 1.000E-05	0.0	12	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
		13	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1398 REACTION 102 WITH RESPECT TO MATERIAL 1398 REACTION 102

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	0.0	1	1000												
1.000E 07-- 3.679E 06	0.0	2	1000	1000											
3.679E 06-- 1.353E 06	0.0	3	1000	1000	1000										
1.353E 06-- 4.979E 05	0.0	4	1000	1000	1000	1000									
4.979E 05-- 1.832E 05	0.0	5	1000	1000	1000	1000	1000								
1.832E 05-- 6.738E 04	0.0	6	1000	1000	1000	1000	1000	1000							
6.738E 04-- 2.479E 04	0.0	7	1000	1000	1000	1000	1000	1000	1000						
2.479E 04-- 9.119E 03	0.0	8	1000	1000	1000	1000	1000	1000	1000	1000					
9.119E 03-- 3.355E 03	0.0	9	1000	1000	1000	1000	1000	1000	1000	1000	1000				
3.355E 03-- 1.234E 03	0.0	10	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000			
1.234E 03-- 4.540E 02	0.0	11	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000		
4.540E 02-- 1.000E-05	0.0	12	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
		13	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LB=3) FOR
MATERIAL 1398 REACTION 452 WITH RESPECT TO MATERIAL 1398 REACTION 452

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1.2	1	1000												
1.000E 07-- 3.679E 06	0.9	2	288	1000											
3.679E 06-- 1.353E 06	0.9	3	262	531	1000										
1.353E 06-- 4.979E 05	1.8	4	127	176	212	1000									
4.979E 05-- 1.832E 05	2.1	5	113	156	153	996	1000								
1.832E 05-- 6.738E 04	2.1	6	113	156	153	996	1000	1000							
6.738E 04-- 2.479E 04	2.1	7	113	156	153	996	1000	1000	1000						
2.479E 04-- 9.119E 03	2.1	8	113	156	153	996	1000	1000	1000	1000					
9.119E 03-- 3.355E 03	2.1	9	113	156	153	996	1000	1000	1000	1000	1000				
3.355E 03-- 1.234E 03	2.1	10	113	156	153	996	1000	1000	1000	1000	1000	1000			
1.234E 03-- 4.540E 02	2.1	11	113	156	153	996	1000	1000	1000	1000	1000	1000	1000		
4.540E 02-- 1.000E-05	2.1	12	113	156	153	996	1000	1000	1000	1000	1000	1000	1000	1000	
		13	113	156	153	996	1000	1000	1000	1000	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LEGENDRE) FOR
MATERIAL 1398 REACTION 450 WITH RESPECT TO MATERIAL 1340 REACTION 452

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	241	405	486	235	209	207	207	207	207	207	207	207	207
1.000E 07-- 3.679E 06	2	241	404	491	174	171	171	171	171	171	171	171	171	171
3.679E 06-- 1.353E 06	3	235	396	490	143	124	124	123	123	123	123	123	123	123
1.353E 06-- 4.979E 05	4	176	293	291	121	107	107	107	107	107	107	107	107	107
4.979E 05-- 1.832E 05	5	177	296	292	122	108	108	108	108	108	107	107	108	107
1.832E 05-- 1.111E 05	6	177	296	293	122	108	108	108	108	108	108	108	108	108
1.111E 05-- 6.738E 04	7	177	296	293	122	108	108	108	108	108	108	108	108	108
6.738E 04-- 2.479E 04	8	177	296	293	122	104	104	104	108	108	108	108	108	108
2.479E 04-- 9.119E 03	9	177	296	293	122	104	104	104	108	108	108	108	108	108
9.119E 03-- 3.355E 03	10	177	296	293	122	104	104	104	108	108	108	108	108	108
3.355E 03-- 1.234E 03	11	177	296	293	122	104	104	104	108	108	108	108	108	108
1.234E 03-- 4.540E 02	12	177	296	293	122	104	104	104	108	108	108	108	108	108
4.540E 02-- 1.000E-05	13	177	296	293	122	104	104	104	108	108	108	108	108	108

ELEMENTS OF THE CORRELATION MATRIX (LEGENDRE) FOR
MATERIAL 1398 REACTION 450 WITH RESPECT TO MATERIAL 1381 REACTION 452

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	113	164	163	79	73	71	71	71	71	71	71	71	71
1.000E 07-- 3.679E 06	2	304	520	523	253	226	227	228	228	228	229	229	229	229
3.679E 06-- 1.353E 06	3	147	211	211	102	91	92	92	92	92	92	92	92	92
1.353E 06-- 4.979E 05	4	112	161	161	78	70	70	70	70	70	70	70	70	70
4.979E 05-- 1.832E 05	5	111	161	160	78	69	70	70	70	70	70	70	70	70
1.832E 05-- 1.111E 05	6	111	161	160	77	69	69	69	70	70	70	70	70	70
1.111E 05-- 6.738E 04	7	111	161	160	77	69	69	69	69	69	69	69	69	69
6.738E 04-- 2.479E 04	8	110	160	159	77	68	69	69	69	69	69	69	69	69
2.479E 04-- 9.119E 03	9	110	159	158	77	68	69	69	69	69	69	69	69	69
9.119E 03-- 3.355E 03	10	110	159	158	77	68	69	69	69	69	69	69	69	69
3.355E 03-- 1.234E 03	11	110	159	158	77	68	69	69	69	69	69	69	69	69
1.234E 03-- 4.540E 02	12	110	159	158	77	68	69	69	69	69	69	69	69	69
4.540E 02-- 1.000E-05	13	62	90	90	43	39	39	39	39	39	39	39	39	39

ELEMENTS OF THE CORRELATION MATRIX (LEGENDRE) FOR
MATERIAL 1398 REACTION 450 WITH RESPECT TO MATERIAL 1395 REACTION 452

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	170	243	235	115	102	102	102	102	102	102	102	102	102
1.000E 07-- 3.679E 06	2	370	513	502	245	219	219	219	219	219	219	219	219	219
3.679E 06-- 1.353E 06	3	401	557	545	266	237	237	237	237	237	238	238	238	238
1.353E 06-- 4.979E 05	4	419	582	569	279	248	248	248	248	248	248	248	248	248
4.979E 05-- 1.832E 05	5	423	588	574	280	247	220	220	220	221	221	221	221	221
1.832E 05-- 1.111E 05	6	356	496	476	232	207	207	207	207	207	207	207	207	207
1.111E 05-- 6.738E 04	7	350	486	476	232	207	207	207	207	207	207	207	207	207
6.738E 04-- 2.479E 04	8	350	486	475	232	207	207	207	207	207	207	207	207	207
2.479E 04-- 9.119E 03	9	350	486	475	232	207	207	207	207	207	207	207	207	207
9.119E 03-- 3.355E 03	10	350	486	475	232	207	207	207	207	207	207	207	207	207
3.355E 03-- 1.234E 03	11	350	486	475	232	207	207	207	207	207	207	207	207	207
1.234E 03-- 4.540E 02	12	350	486	475	232	207	207	207	207	207	207	207	207	207
4.540E 02-- 1.000E-05	13	180	251	250	125	111	111	111	111	111	111	111	111	111

ELEMENTS OF THE CORRELATION MATRIX (LEGENDRE) FOR
MATERIAL 1398 REACTION 450 WITH RESPECT TO MATERIAL 1398 REACTION 456

ENERGY RANGE (EV)	SYMMETRY	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1.0	1	1000												
1.000E 07-- 3.679E 06	0.0	2	1000	1000											
3.679E 06-- 1.353E 06	0.0	3	982	991	1000										
1.353E 06-- 4.979E 05	1.0	4	997	976	1000	1000									
4.979E 05-- 1.832E 05	2.1	5	1000	996	1000	1000	1000								
1.832E 05-- 1.111E 05	2.1	6	1000	996	1000	1000	1000	1000							
1.111E 05-- 6.738E 04	2.1	7	1000	996	1000	1000	1000	1000	1000						
6.738E 04-- 2.479E 04	2.1	8	1000	996	1000	1000	1000	1000	1000	1000					
2.479E 04-- 9.119E 03	2.1	9	1000	995	1000	1000	1000	1000	1000	1000	1000				
9.119E 03-- 3.355E 03	2.1	10	1000	996	1000	1000	1000	1000	1000	1000	1000	1000			
3.355E 03-- 1.234E 03	2.1	11	1000	996	1000	1000	1000	1000	1000	1000	1000	1000	1000		
1.234E 03-- 4.540E 02	2.1	12	1000	996	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	2.1	13	1000	996	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000

ELEMENTS OF THE CORRELATION MATRIX (LEGENDRE) FOR
MATERIAL 1398 REACTION 450 WITH RESPECT TO MATERIAL 1399 REACTION 452

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	101	131	142	72	64	64	63	64	64	64	64	64	64
1.000E 07-- 3.679E 06	2	136	231	199	96	85	85	85	85	85	85	85	85	85
3.679E 06-- 1.353E 06	3	115	173	168	81	72	72	72	72	72	72	72	72	72
1.353E 06-- 4.979E 05	4	136	241	199	96	85	85	85	85	85	85	85	85	85
4.979E 05-- 1.832E 05	5	136	242	200	96	85	85	85	85	85	85	85	85	86
1.832E 05-- 1.111E 05	6	136	242	200	96	85	85	85	85	85	85	85	85	86
1.111E 05-- 6.738E 04	7	185	275	272	131	116	116	116	116	116	116	116	116	117
6.738E 04-- 2.479E 04	8	192	284	281	136	120	120	120	120	120	120	120	120	121
2.479E 04-- 9.119E 03	9	192	284	281	136	120	120	120	120	120	120	120	120	121
9.119E 03-- 3.355E 03	10	192	284	281	136	120	120	120	120	120	120	120	120	121
3.355E 03-- 1.234E 03	11	192	284	281	136	120	120	120	120	120	120	120	120	120
1.234E 03-- 4.540E 02	12	192	284	281	136	120	120	120	120	120	120	120	120	121
4.540E 02-- 1.000E-05	13	114	170	168	81	72	72	72	72	72	72	72	72	72

ELEMENTS OF THE CORRELATION MATRIX (LEGENDRE) FOR
MATERIAL 1398 REACTION 18 WITH RESPECT TO MATERIAL 1395 REACTION 18

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	136	356	134	8	0	0	0	0	0	0	0	0	0
1.000E 07-- 3.679E 06	2	70	334	394	133	32	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	33	432	756	390	136	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	2	137	367	797	581	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	0	31	173	576	784	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	3	73	325	352	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	16	92	313	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	282	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	198	0	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (A**3) FOR
MATERIAL 1395 REACTION 18 WITH RESPECT TO MATERIAL 1395 REACTION 18

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	7.2	1	1000												
1.300E 07-- 3.679E 06	3.5	2	102	1000											
3.679E 06-- 1.353E 06	1.1	3	76	971	1000										
1.353E 06-- 4.979E 05	1.4	4	48	812	974	1000									
4.979E 05-- 1.832E 05	1.3	5	44	519	891	910	1000								
1.832E 05-- 1.111E 05	0.9	6	0	0	0	0	293	1000							
1.111E 05-- 6.738E 04	0.7	7	0	0	0	0	63	311	1000						
6.738E 04-- 2.479E 04	0.6	8	0	0	0	0	0	0	931	1000					
2.479E 04-- 9.119E 03	0.6	9	0	0	0	0	0	0	0	198	1000				
9.119E 03-- 3.355E 03	0.6	10	0	0	0	0	0	0	0	198	1000	1000			
3.355E 03-- 1.234E 03	0.6	11	0	0	0	0	0	0	0	198	1000	1000	1000		
1.234E 03-- 4.540E 02	0.6	12	0	0	0	0	0	0	0	198	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	1.1	13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (A**3) FOR
MATERIAL 1395 REACTION 102 WITH RESPECT TO MATERIAL 1395 REACTION 102

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	234	24	10	11	10	0	0	0	0	0	0	0	0
1.300E 07-- 3.679E 06	2	18	106	38	54	41	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	7	55	109	73	51	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	6	72	110	134	171	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	7	49	74	126	163	41	13	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	0	0	0	75	371	116	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	0	0	15	74	281	266	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	0	0	348	269	65	65	65	65	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	0	0	83	421	421	421	421	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	74	371	371	371	371	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	74	371	371	371	371	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	74	371	371	371	371	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	-375

ELEMENTS OF THE CORRELATION MATRIX (A**3) FOR
MATERIAL 1395 REACTION 102 WITH RESPECT TO MATERIAL 1395 REACTION 18

ENERGY RANGE (EV)	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	1	32	44	10	1	0	0	0	0	0	0	0	0	0
1.300E 07-- 3.679E 06	2	17	102	38	19	4	0	0	0	0	0	0	0	0
3.679E 06-- 1.353E 06	3	8	58	72	65	28	0	0	0	0	0	0	0	0
1.353E 06-- 4.979E 05	4	6	15	41	170	88	0	0	0	0	0	0	0	0
4.979E 05-- 1.832E 05	5	6	6	17	131	127	0	0	0	0	0	0	0	0
1.832E 05-- 1.111E 05	6	0	1	7	75	56	0	0	0	0	0	0	0	0
1.111E 05-- 6.738E 04	7	0	0	2	16	53	0	0	0	0	0	0	0	0
6.738E 04-- 2.479E 04	8	0	0	0	0	49	0	0	0	0	0	0	0	0
2.479E 04-- 9.119E 03	9	0	0	0	0	0	35	0	0	0	0	0	0	0
9.119E 03-- 3.355E 03	10	0	0	0	0	0	0	0	0	0	0	0	0	0
3.355E 03-- 1.234E 03	11	0	0	0	0	0	0	0	0	0	0	0	0	0
1.234E 03-- 4.540E 02	12	0	0	0	0	0	0	0	0	0	0	0	0	0
4.540E 02-- 1.000E-05	13	0	0	0	0	0	0	0	0	0	0	0	0	0

ELEMENTS OF THE CORRELATION MATRIX (A**3) FOR
MATERIAL 1395 REACTION 102 WITH RESPECT TO MATERIAL 1395 REACTION 102

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	30.9	1	1000												
1.300E 07-- 3.679E 06	30.2	2	967	1000											
3.679E 06-- 1.353E 06	30.2	3	969	995	1000										
1.353E 06-- 4.979E 05	18.3	4	192	237	211	1000									
4.979E 05-- 1.832E 05	20.3	5	0	0	0	972	1000								
1.832E 05-- 1.111E 05	21.0	6	0	0	0	849	931	1000							
1.111E 05-- 6.738E 04	20.8	7	0	0	0	719	750	718	1000						
6.738E 04-- 2.479E 04	20.8	8	0	0	0	922	950	894	995	1000					
2.479E 04-- 9.119E 03	14.3	9	0	0	0	225	212	219	225	254	1000				
9.119E 03-- 3.355E 03	14.3	10	0	0	0	0	0	0	0	24	970	1000			
3.355E 03-- 1.234E 03	14.3	11	0	0	0	0	0	0	0	24	970	1000	1000		
1.234E 03-- 4.540E 02	14.3	12	0	0	0	0	0	0	0	24	970	1000	1000	1000	
4.540E 02-- 1.000E-05	3.3	13	0	0	0	0	0	0	0	0	0	0	0	0	1000

ELEMENTS OF THE CORRELATION MATRIX (A**3) FOR
MATERIAL 1395 REACTION 452 WITH RESPECT TO MATERIAL 1395 REACTION 452

ENERGY RANGE (EV)	% REL STD-DEV	GROUP	1	2	3	4	5	6	7	8	9	10	11	12	13
1.964E 07-- 1.000E 07	2.2	1	1000												
1.300E 07-- 3.679E 06	1.6	2	959	1000											
3.679E 06-- 1.353E 06	1.5	3	85	880	1000										
1.353E 06-- 4.979E 05	1.6	4	77	111	172	1000									
4.979E 05-- 1.832E 05	1.6	5	77	110	172	1000	1000								
1.832E 05-- 1.111E 05	1.6	6	77	111	172	1000	1000	1000							
1.111E 05-- 6.738E 04	1.2	7	104	150	197	965	945	945	1000						
6.738E 04-- 2.479E 04	1.1	8	130	155	132	156	156	156	471	1000					
2.479E 04-- 9.119E 03	1.1	9	130	155	132	156	156	156	471	1000	1000				
9.119E 03-- 3.355E 03	1.1	10	130	154	132	156	156	156	471	1000	1000	1000			
3.355E 03-- 1.234E 03	1.1	11	130	154	132	156	156	156	471	1000	1000	1000	1000		
1.234E 03-- 4.540E 02	1.1	12	130	155	132	156	156	156	471	1000	1000	1000	1000	1000	
4.540E 02-- 1.000E-05	1.0	13	66	83	79	94	94	94	438	979	979	979	979	979	1000

IHC0021I STOP 0

ACKNOWLEDGEMENTS

This report represents a two-fold effort. (1) It demonstrates the processing capabilities of the authors' PUFF-II code and (2) multigroup covariance matrices from ENDF/B-V evaluations are now available for use.

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APPENDIX A

COVERX Format

```
C*****************************************************************
C                        REVISED 11/01/77                        -
C                                                                -
CP          COVERX                                               -
CE          THIS FILE CONTAINS CROSS SECTIONS,                   -
CE          STANDARD DEVIATIONS, AND                             -
CE          BY DESIGNATION EITHER COVARIANCE,                    -
CE          RELATIVE COVARIANCE,                                 -
CE          OR CORRELATION MATRICES.                             -
C                                                                -
CE              A FILE SUCH AS THIS IS NEEDED BY ORNL - PORSS     -
C                                                                -
C                                                 J. L. LUCIUS   -
C                                                                -
C*****************************************************************
```

```
C-----------------------------------------------------------------
CS          FILE STRUCTURE                                       -
CS                                                               -
CS             RECORD TYPE                          PRESENT IF   -
CS             ============================         ==========   -
CS             FILE IDENTIFICATION                  ALWAYS       -
CS             FILE CONTROL                         ALWAYS       -
CS             FILE DESCRIPTION                     NHOLL.GT.0   -
CS             NEUTRON GROUP BOUNDARIES             NNGRUP.GT.0  -
CS             GAMMA GROUP BOUNDARIES               NGGRUP.GT.0  -
CS             MAT - MT CONTROL                     ALWAYS       -
CS   **************(REPEAT FOR ALL MATERIAL-                     -
CS   *              REACTION TYPE PAIRS)                         -
CS   *          MAT-MT CROSS SECTION AND             ALWAYS       -
CS   *          STANDARD DEVIATIONS                              -
CS   **************                                              -
CS                                                               -
CS                                                               -
CS   **************(REPEAT FOR ALL MATRICES)                    -
CS   *          MATRIX CONTROL                       ALWAYS       -
CS   *          BLOCK CONTROL                        ALWAYS       -
CS   *  ************(REPEAT FOR ALL BLOCKS)                      -
CS   *  *       MATRIX DATA                          ALWAYS       -
CS   ****************                                            -
C-----------------------------------------------------------------
```

```
C-----------------------------------------------------------------------
CR           FILE IDENTIFICATION                                       -
C                                                                      -
CL     HNAME,(HUSE(I),I=1,2),IVERS                                     -
CW     1+3*MULT                                                        -
C                                                                      -
CB     FORMAT(11H 0V COVERX ,A6,1H*,2A6,1H*,I6)                        -
CD     HNAME          HOLLERITH FILE NAME-COVERX  (A6)                 -
CD     HUSE           HOLLERITH USER IDENTIFICATION (A6)               -
CD     IVERS          FILE VERSION NUMBER                              -
CD     MULT           1 - A6 IS SINGLE PRECISION WORD                  -
CD                    2 - A6 IS DOUBLE PRECISION WORD                  -
C-----------------------------------------------------------------------
```

```
C-----------------------------------------------------------------------
CR           FILE CONTROL                                              -
C                                                                      -
CL     NGROUP,NNGRUP,NGGRUP,NTYPE,NMMP,NMTRIX,NHOLL                    -
C                                                                      -
CW     7                                                               -
C                                                                      -
CB     FORMAT(4H 1D ,7I6)                                              -
C                                                                      -
CD     NGROUP         NUMBER OF ENERGY GROUPS                          -
CD     NNGRUP         NUMBER OF NEUTRON GROUPS                         -
CD     NGGRUP         NUMBER OF GAMMA GROUPS                           -
CD     NTYPE          TYPE OF DATA                                     -
CD                         1 - COVARIANCE MATRIX, STANDARD DEVIATION    -
CD                         2 - RELATIVE COVARIANCE MATRIX,              -
CD                             RELATIVE STANDARD DEVIATION              -
CD                         3 - CORRELATION MATRIX, STANDARD DEVIATION   -
CD     NMMP           NUMBER OF MAT - MT PAIRS                         -
CD     NMTRIX         NUMBER OF MATRICES                               -
CD     NHOLL          NUMBER OF HOLLERITH WORDS IN DESCRIPTION         -
C-----------------------------------------------------------------------
```

```
C-----------------------------------------------------------------------
CR           FILE DESCRIPTION                                          -
C                                                                      -
CL     (WORDS(J),J=1,NHOLL)                                            -
CW     MULT*NHOLL                                                      -
C                                                                      -
CB     FORMAT(4H 2D ,1H*,11A6/(11A6))                                  -
C                                                                      -
CD     WORDS(J)       HOLLERITH DESCRIPTION OF FILE                    -
C-----------------------------------------------------------------------
```

```
C-----------------------------------------------------------------------
CR          NEUTRON GROUP BOUNDARIES                                   -
C                                                                      -
CL    (GPBN(J),J=1,NNGRUP),ENMIN                                       -
C                                                                      -
CC          PRESENT IF NNGRUP.GT.0                                     -
CW    NNGRUP+1                                                         -
C                                                                      -
CB    FORMAT(4H 3D ,5E12.4/(6E12.4))                                   -
CD    GPBN(J)       MAXIMUM ENERGY BOUND OF NEUTRON GROUP(J)  (EV)     -
CD    ENMIN         MINIMUM ENERGY OF NEUTRON ENERGY RANGE             -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          MAT - MT CONTROL                                           -
C                                                                      -
CL    (MATID(I),MTID(I),MWGT(I),I=1,NMMP)                              -
C                                                                      -
CW    3*NMMP                                                           -
C                                                                      -
CB    FORMAT(4H 5D ,11I6/(12I6))                                       -
C                                                                      -
CD    MATID(I)      MATERIAL IDENTIFICATION NUMBER                     -
CD    MTID(I)       REACTION TYPE IDENTIFICATION NUMBER                -
CD    MWGT(I)       CROSS SECTION WEIGHTING OPTION                     -
CD                        1 - CONSTANT                                -
CD                        2 - 1/E                                     -
CD                        3 - THERMAL + 1/E + FISSION                 -
CD                        4 - ARBITRARY                               -
CD                        5 - COMBINED CTR CASE                       -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          MATERIAL - REACTION TYPE CROSS SECTIONS                    -
CR          AND ERROR FILES                                            -
CL    (CRS(J),J=1,NGROUP),(ERROR(J),J=1,NGROUP)                        -
CW    2*NGROUP                                                         -
C                                                                      -
CB    FORMAT(4H 6D ,5E12.4/(6E12.4))                                   -
C                                                                      -
CD    CRS           CROSS SECTION                                      -
CD    ERROR         STANDARD DEVIATION                                 -
C-----------------------------------------------------------------------
```

```
C-----------------------------------------------------------------------
CR          MATRIX CONTROL                                             -
CL     MAT1,MT1,MAT2,MT2,NBLOK                                         -
CW     5                                                               -
C                                                                      -
CB     FORMAT(4H 7D ,5I6)                                              -
C                                                                      -
CD     MAT1          MATERIAL 1 IDENTIFICATION NUMBER                 -
CD     MT1           REACTION TYPE 1 IDENTIFICATION NUMBER            -
CD     MAT2          MATERIAL 2 IDENTIFICATION NUMBER                 -
CD     MT2           REACTION TYPE 2 IDENTIFICATION NUMBER            -
CD     NBLOK         NUMBER OF BLOCKS INTO WHICH MATRIX IS SUBDIVIDED -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          GAMMA GROUP BOUNDARIES                                     -
C                                                                      -
CL     (GPBG(J),J=1,NGGRUP),EGMIN                                      -
C                                                                      -
CC          PRESENT IF NGGRUP.GT.0                                     -
CW     NGGRUP+1                                                        -
C                                                                      -
CB     FORMAT(4H 4D ,5E12.4/(6E12.4))                                  -
CD     GPBG(J)       MAXIMUM ENERGY BOUND OF GAMMA GROUP(J)  (EV)     -
CD     EGMIN         MINIMUM ENERGY OF GAMMA ENERGY RANGE             -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          BLOCK CONTROL                                              -
CL     (JBAND(J),IJJ(J),J=1,NGROUP),(LGPP(N),N=1,NBLOK)                -
C                                                                      -
CW     2*NGROUP +NBLOK                                                 -
C                                                                      -
CB     FORMAT(4H 8D ,11I6/(12I6))                                      -
C                                                                      -
CD     JBAND(J)      BANDWIDTH FOR GROUP J                            -
CD     IJJ(J)        POSITION OF DIAGONAL ELEMENT FOR GROUP J         -
CD     LGRP(N)       NUMBER OF GROUPS IN BLOCK(N)                     -
C-----------------------------------------------------------------------

C-----------------------------------------------------------------------
CR          MATRIX DATA                                                -
CL     (COV(K),K=1,KMAX)                                               -
C                                                                      -
CC     KMAX=SUM OVER JBAND(J) FOR ALL J IN BLOCK N                     -
CW     KMAX                                                            -
C                                                                      -
CB     FORMAT(4H 9D ,5E12.4/(6E12.4))                                  -
C                                                                      -
C                                                                      -
CD     COV           NTYPE MATRIX DATA                                -
C-----------------------------------------------------------------------
COEP
```

APPENDIX B

Sample Data Set in COVERX Format

The following page tabulates a six-group COVERX file for ^{239}Pu (n,f), ^{239}Pu (n,α), and their correlation to each other and ^{235}U (n,f).

```
0V CONVERX CONVERX*PRNL - FASS*           1
1D      6      6      0      2      2      5      5
2D *PU-239 WITH CROSS MATERIAL          *
3D   0.2000E+08   0.3679E+07   0.1353E+07   0.4979E+06   0.1832E+06
 4.0870E+04   1.0000E-05
5D   1399    16     4  1399    102      4
6D   0.2527E+01   0.1905E+01   0.1700E+01   0.1542E+01   0.1577E+01
 6.8943E+02   7.1807E-02   3.1328E-02   3.4220E-02   3.3301E-02   5.2803E-02
 1.1159E-02
6D   0.2409E-02   0.7369E-02   0.5042E-01   0.1661E+00   0.3110E+00
 2.7055E+02   3.0844E-01   3.0156E-01   1.8340E-01   2.0272E-01   2.0735E-01
 3.2777E-02
7D   1399    16   1395    18      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.5256E-03   0.5994E-04   0.5904E-05   0.3307E-06   0.3658E-07
 0.0000E-01   2.2059E-04   5.6112E-04   3.1519E-04   1.5050E-04   2.6206E-05
 0.0000E-01   1.5923E-05   3.1589E-04   7.4648E-04   5.4840E-04   1.3548E-04
 0.0000E-01   2.7077E-07   1.4659E-04   5.2944E-04   7.2653E-04   3.1184E-04
 5.0867E-11   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01
 0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01
 0.0000E-01
7D   1399    18   1399    18      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.5156E-02   0.1779E-03   0.1240E-03   0.1084E-03   0.0000E+00
 0.0000E-01   1.7792E-04   9.8144E-04   7.2275E-04   5.1274E-04   0.0000E-01
 0.0000E-01   1.2402E-04   7.2275E-04   1.1710E-03   9.2279E-04   0.0000E-01
 0.0000E-01   1.0839E-04   5.1274E-04   9.2279E-04   1.1090E-03   2.1610E-04
 0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   2.1610E-04   2.7881E-03
 6.1044E-11   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   6.1044E-11
 1.2452E-04
7D   1399   102   1395    18      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.5305E-03   0.6019E-04   0.5826E-05   0.3551E-06   0.4393E-07
 0.0000E-01   1.5549E-04   5.1331E-04   3.3768E-04   1.4556E-04   2.6384E-05
 0.0000E-01   6.4966E-06   2.8125E-04   8.5504E-04   6.6841E-04   1.6726E-04
 0.0000E-01   2.3163E-07   1.3554E-04   4.9092E-04   7.1516E-04   3.1742E-04
 5.4195E-11   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01
 0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01
 0.0000E-01
7D   1399   102   1399   102      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.9513E-01   0.9016E-01   0.1108E-01   0.1068E-03   0.0000E+00
 0.0000E-01   9.0162E-02   9.0936E-02   1.1649E-02   4.8904E-04   0.0000E-01
 0.0000E-01   1.1077E-02   1.1649E-02   3.3637E-02   3.6122E-02   3.5131E-02
 1.4304E-09   1.0677E-04   4.8904E-04   3.6122E-02   4.1097E-02   4.0196E-02
 1.6267E-09   0.0000E-01   0.0000E-01   3.5131E-02   4.0196E-02   4.2993E-02
 1.6808E-09   0.0000E-01   0.0000E-01   1.4304E-09   1.6257E-09   1.6808E-09
 1.0743E-03
7D   1399    18   1399   102      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.5144E-02   0.1616E-03   0.1208E-03   0.1060E-03   0.0000E+00
 0.0000E-01   1.7896E-04   9.3385E-04   6.8386E-04   4.9390E-04   0.0000E-01
 0.0000E-01   1.2473E-04   7.4912E-04   1.2815E-03   5.7607E-04   0.0000E-01
 0.0000E-01   1.0913E-04   5.0818E-04   1.0461E-03   1.1000E-03   1.5933E-04
 0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   2.6594E-04   2.8283E-03
 4.4394E-11   0.0000E-01   0.0000E-01   0.0000E-01   0.0000E-01   7.1726E-11
-1.3718E-04
```

Comments Concerning the Multigroup Cross Section Library

UNION CARBIDE

NUCLEAR DIVISION

INTERNAL CORRESPONDENCE

July 6, 1979

C. R. Weisbin, 6025, 18W, (4-6186)

100 group fast reactor data testing library appropriate for analysis of the elastic removal treatment and the carbide benchmarks

Several attempts have been made to assemble a fast reactor data testing library. Each effort was met with some shortcoming that limited the usefulness of the data. I now believe that we have a cross section tape which is suitable for the analysis of the benchmarks of interest to you. The preparation of the subject AMPX master resulted in a considerable amount of post-processing (MINX) data adjustment and manipulation. The purpose of this memo is to release the 100 group AMPX master to the data testing team for a continuation of the analysis project.

The resulting 100 group AMPX master tape has undergone the following (these items also refer to both the 174 group VITAMIN-E and 100 group preliminary tapes):

* the elastic removal cross section, which appears in the record preceding the f-factors and the 1-D array string, was redefined to correspond to a summation over outscatter groups for the elastic scattering matrix.

* an error in the MINX AMPX interface option, which produced extra data for the 2-D matrices, was corrected. B-11, which was processed on 79.045, was not affected by this program bug. Also, this correction disallows normalization problems in the COMET module.

* the elastic smooth group cross section was redefined to be a summation over all sink groups for a given source group.

* the total cross section was redefined to be the sum of all partial reactions.

* the discrete and continuum inelastic scattering matrices were normalized to the smooth averaged ENDF/B File 3 total inelastic cross section.

For the record, the input/output interface files and the various paths taken to produce the final master tape are provided in figures 1-4. These figures illustrate the 4-step approach used to correct, manipulate, collapse and normalize the AMPX interfaces produced by MINX-I.3(V).

The contents of the 100 group library containing 18 nuclides are given in Table 1. The following DD card is required to access the data on K-25 tape 022405:

```
//GO.FTNNF001  DD  UNIT=TAPE16,DISP=(OLD,KEEP),LABEL=(1,SL),
//VOL=SER=022405,DSN=X.JEWDE637.AMPX.LIB100.NUC18,
//DCB=(RECFM=VBS,LRECL=X,BLKSIZE=6447,BUFL=8148)
```

J. E. White, 6025, 3M, (4-5277)

JEW/tj

cc: File-NoRC
R. W. Wright, 6025, 5M, (4-5279)
J. L. Lucius, 6025, 21E, (4-5270)
W. E. Ford, III, 6025, 17E, (4-5272)
J. Barhen, 6002-A, 18W, (4-5264)
J. H. Marable, 6025, 18W, (4-6189)
Jim Smith, 3010, C009, (4-5585)

Table C-I. 100 Group Fast Reactor Data Testing Materials

ENTRY	DESCRIPTION	IDENTIFIER
1	Fe	1326
2	Pu-240	380
3	Pu-241	381
4	U-235	395
5	U-238	9398
6	Pu-239	399
7	B-11	1160
8	Al-27	1313
9	Cr	1324
10	Mn-55	1325
11	Na-23	1311
12	Ni	1328
13	O-16	1276
14	Si	1314
15	C-12	1306
16	U-234	1043
17	Pu-242	1161
18	Mo	1287

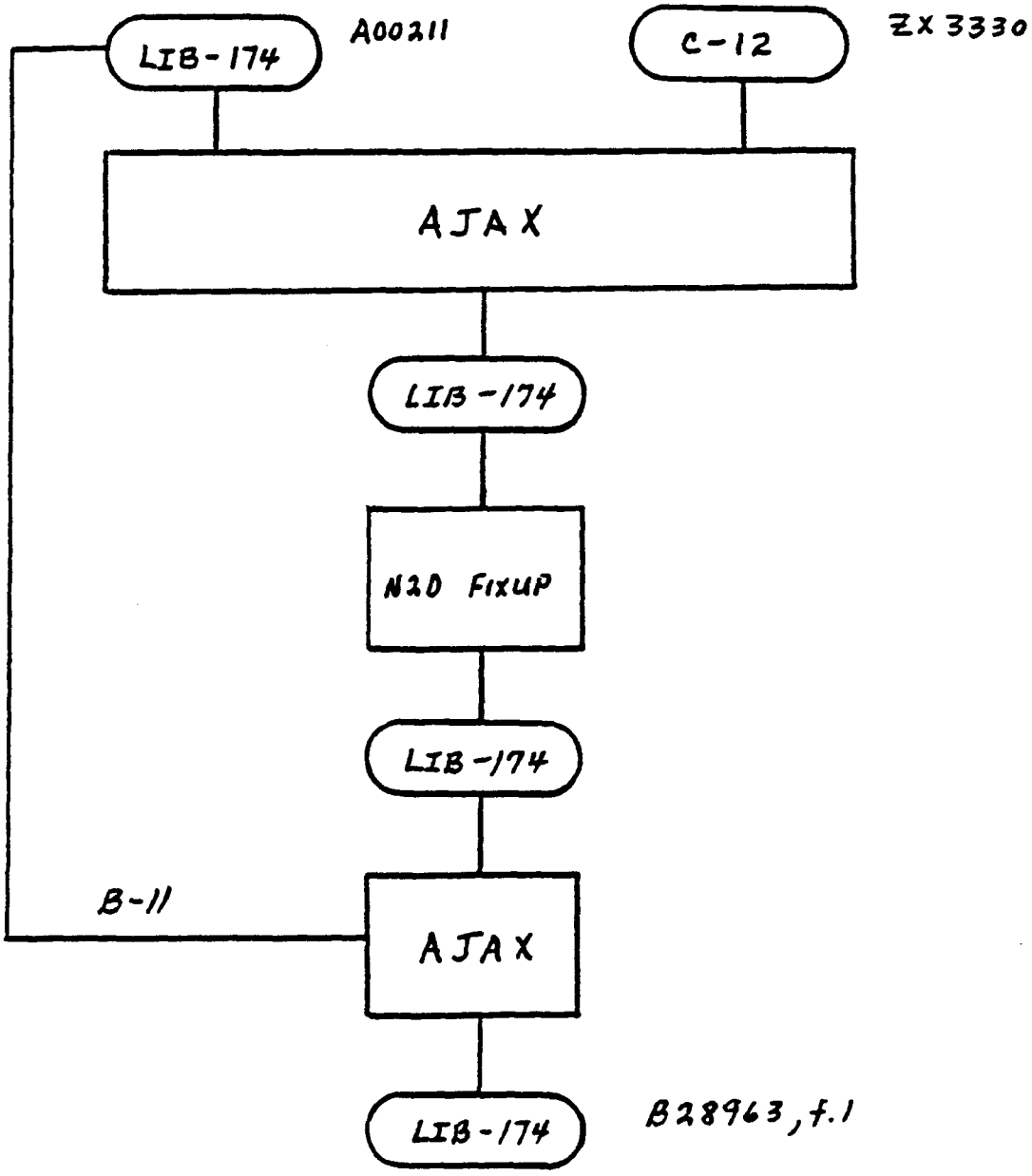


Fig. C-1. CORRECT N2D PROBLEM FOR VITAMIN-E NUCLIDES

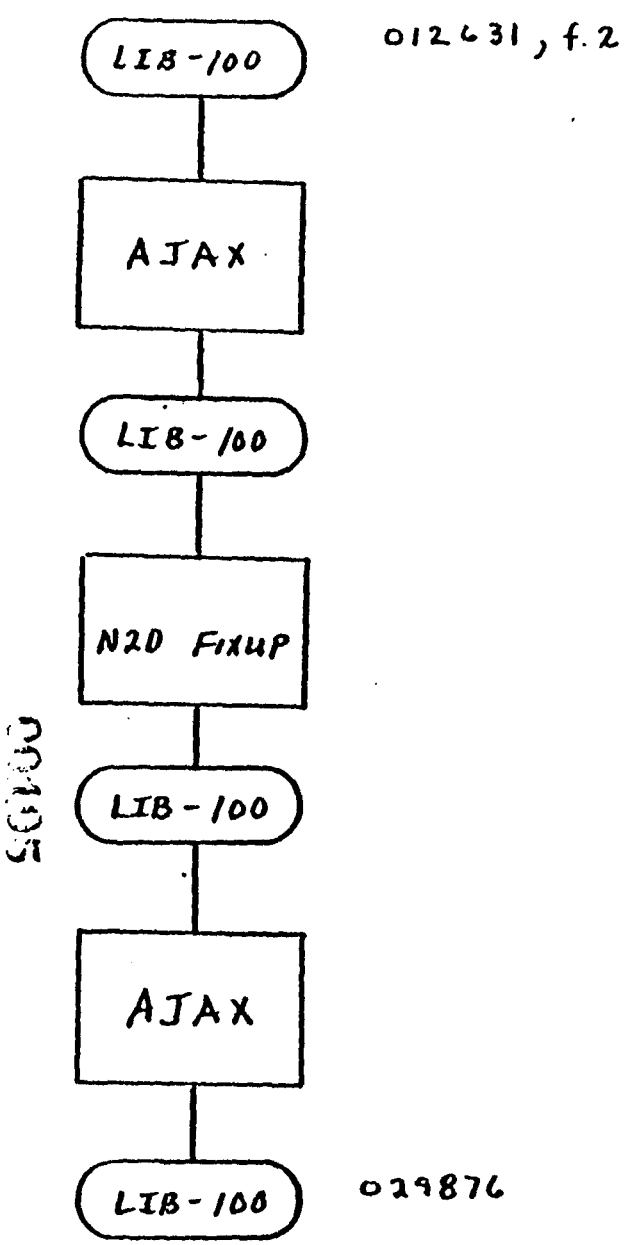
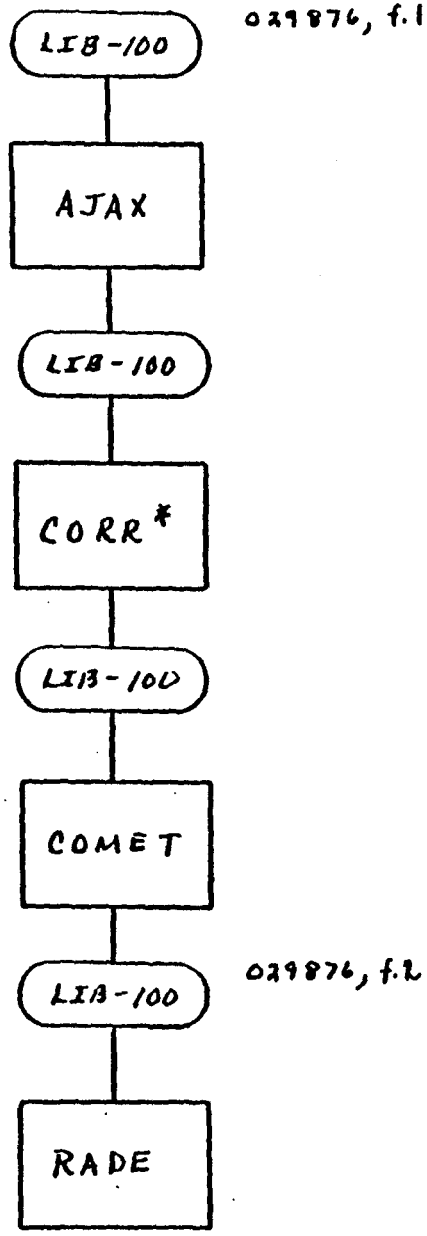


Fig. C-2.

CORRECT N2D PROBLEM FOR PRELIMINARY ENDF/B V NUCLIDES



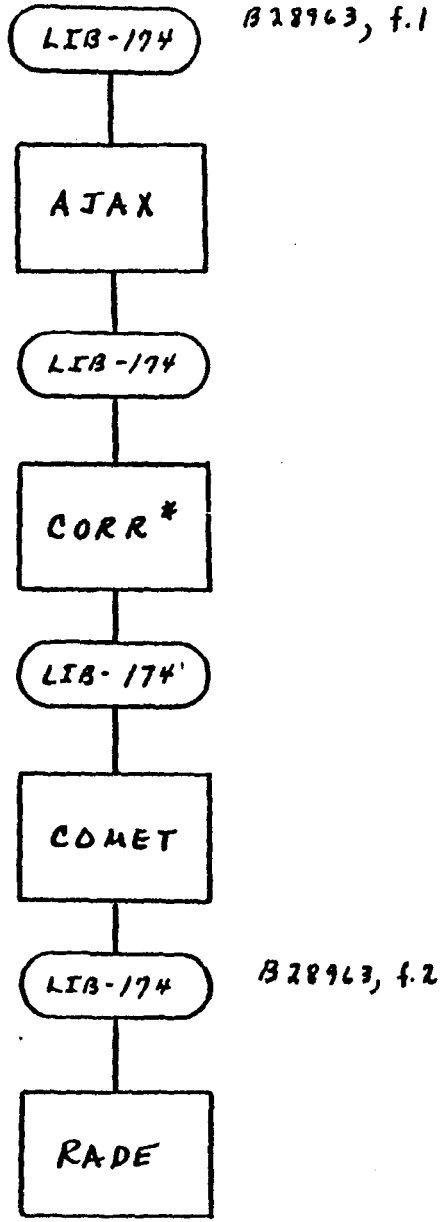


Fig. C-3. REDEFINE THE ELASTIC REMOVAL CROSS SECTION AND NORMALIZE THE INELASTIC MATRICES

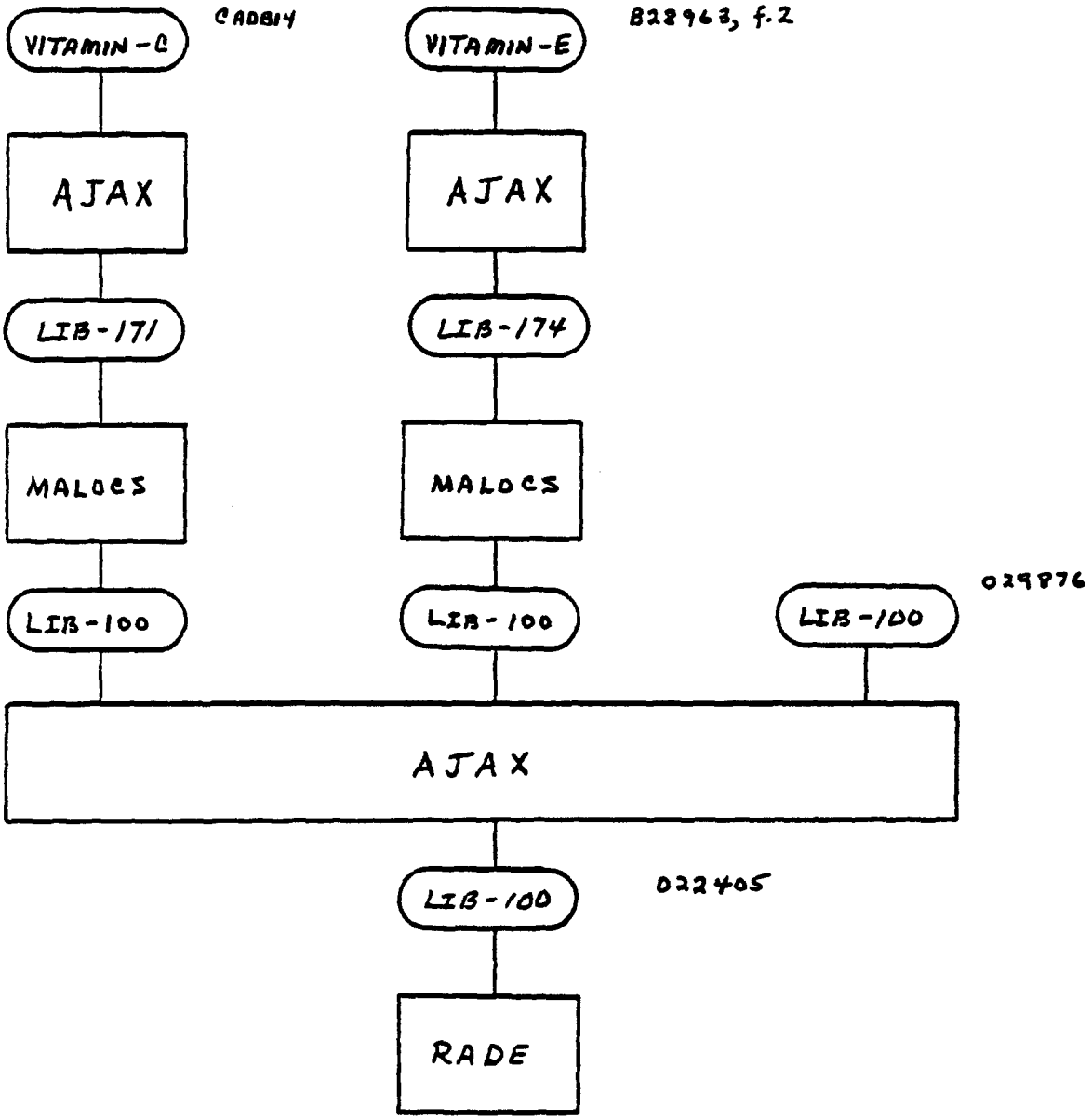


Fig. C-4. COLLAPSE VITAMIN-C AND VITAMIN-E FILES AND MERGE DATA

UNION CARBIDE

NUCLEAR DIVISION

INTERNAL CORRESPONDENCE

August 2, 1979

Y. Yeivin

100-Group AMPX Master Library for Fast-Reactor Data Testing--Mod. No. 1

John White's 100-group AMPX master library for fast-reactor data testing[1-4] has been modified by the addition of ^{10}B data. The ^{10}B master data set was obtained by using the weighting function described in Table 3 of Ref. 3 to collapse data set 1273 from the VITAMIN-C library[5,6] into the 100-group structure. The materials in "Mod 1 to the 100-group master library" are listed in Table 1. The library is on CTC tape 4577 and can be read with the following DD card:

```
//GØ.FT--FØØ1  DD  UNIT=TAPE16,LABEL=(1,SL),VØL=SER=004577,
  DISP=(ØLD,KEEP),DSN=X.JEWDE637.AMPX.LIB100.NUC19,
  DCB=(RECFM=VBS,LRECL=X,BLKSIZE=6447,BUFL=8148)
```

Enclosed is the printout from the AJAX-MALOCS-AJAX case required to prepare the library. Tape 4577 has been assigned to J. L. Lucius.

This work was charged to 18075.

Eddy Ford

W. E. Ford, III, 6025, 17E, (4-5272)

Betsy Diggs

B. R. Diggs, 6025, 9M, (4-5281)

WEF/BRD/tj

cc: J. Barhen, 6002A, A3, (4-5264)
J. L. Lucius, 6025, 21E, (4-5270)
J. H. Marable, 6025, K5, (4-6189)
J. D. Smith, 6010
J. E. White, 6025

TABLE -1. 100-GROUP AMPX MASTER LIBRARY FOR FAST-REACTOR DATA TESTING -- MOD. NO. 1

ENTRY	IDENTIFIER	TITLE	SCU
1	1326	ENDF/B V FE PRE-FINAL RELEASE MAT 1326 (PRI COMM)	
2	380	ENDF/B V PU-240 PRE-FINAL RELEASE MAT 380 (PRI COMM)	
3	381	ENDF/B V PU-241 PRE-FINAL RELEASE MAT 381 (PRI COMM)	
4	395	ENDF/B V U-235 PRE-FINAL RELEASE MAT 395 (PRI COMM)	
5	9398	ENDF/B V U-238 PRE-FINAL RELEASE MAT 9398 (PRI COMM)	
6	399	ENDF/B V PU-239 PRE-FINAL RELEASE MAT 399 (PRI COMM)	
7	1160	B11 MINX CASE (174 GRPS) FOR VITAMIN E	
8	1313	AL27 MINX CASE (174 GRPS) FOR VITAMIN E	
9	1324	CR MINX CASE (174 GRPS) FOR VITAMIN E	
10	1325	MN55 MINX CASE (174 GRPS) FOR VITAMIN E	
11	1311	NA-23 MINX CASE (174 GRPS) FOR VITAMIN E	
12	1328	NI MINX CASE (174 GRPS) FOR VITAMIN E	
13	1276	O16 MINX CASE (174 GRPS) FOR VITAMIN E	
14	1314	SI MINX CASE (174 GRPS) FOR VITAMIN E	
15	1306	ENDF/B V C-12 PRE-FINAL RELEASE MAT 1306 (PRI COMM)	
16	1043	U234 CASE FOR COMBINED CTR & CRBR PROCESSING DEC '77	
17	1161	PU242 CASE FOR COMBINED CTR & CRBR PROCESSING DEC '77	
18	1267	MO CASE FOR COMBINED CTR & CRBR PROCESSING	
19	1273	B-10 CASE FOR COMBINED CTR & CRBR PROCESSING	

REFERENCES

1. J. L. Lucius, J. E. White, and R. Q. Wright, "Fast Reactor Data Testing of ENDF/B-V - Status Report No. 1," UCC-ND IC (February 8, 1979).

2. J. L. Lucius, J. E. White, and R. Q. Wright, "Fast-Reactor Data Testing of ENDF/B-V - Status Report No. 2," UCC-ND IC (February 22, 1979).

3. R. Q. Wright, J. E. White, J. L. Lucius, W. E. Ford, III, "Fast-Reactor Data Testing of ENDF/B-V - Status Report No. 3," UCC-ND (May 11, 1979).

4. J. E. White to C. R. Weisbin, "100-Group Fast Reactor Data Testing Library Appropriate for Analysis of the Elastic Removal Treatment and the Carbide Benchmarks," UCC-ND (July 6, 1979).

5. R. W. Roussin, C. R. Weisbin, J. E. White, R. Q. Wright, N. M. Greene, W. E. Ford, III, J. B. Wright, and B. R. Diggs, "Experience in Developing and Using the VITAMIN-C 171- Neutron, 36-Gamma-Ray Group Cross-Section Library," A Review of Multigroup Nuclear Cross-Section Processing, Proceedings of a Seminar-Workshop, ORNL/RSIC-41, page 107 (October 1978).

6. C. R. Weisbin, R. W. Roussin, J. E. White, and R. Q. Wright, "Specification for Pseudo-Composition-Independent Fine-Group and Composition Dependent Fine- and Broad-Group LMFBR Neutron-Gamma Libraries at ORNL," ORNL/TM-5142 (ENDF-224) (December 1975).

APPENDIX D

Comments Concerning Uncertainty File Information

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

October 26, 1979

TO: J. J. Wagschal

FROM: J. D. Smith

SUBJECT: Documentation of Formation of B-10 (n,α) Uncertainty File

In ENDF/B-V, the U-238 capture covariance has been expressed as having been evaluated via a ratio measurement to B-10 (n,α). In order for PUFF-II to operate, the uncertainties of the standard or reference material from which another material is evaluated, must be given explicitly in its respective uncertainty file. This is not the case for B-10 (n,α). Instead, B-10 (n,α) uncertainty has been expressed as a "derived redundant cross section" uncertainty in which, from the energy range of 1.0×10^{-5} eV to 2.0×10^{7} eV, B-10 (n,α) is derived from the uncertainties in (n,α_0), (n,α_1) and (n,α_0) to (n,α_1). This may be expressed as

$$\langle 107 \cdot 107 \rangle = \langle 780 \cdot 780 \rangle + \langle 781 \cdot 781 \rangle + 2\langle 780 \cdot 781 \rangle \ , \quad (1)$$

where I am now using the respective MT numbers for the reactions and the diamond brackets indicate covariances.

What has been given to me in the uncertainty files is the relative covariance matrices (in a LB=5 format) for each of the covariances on the righthand side of Eq. (1). A relative covariance matrix for (n,α) in a LB = 5 format is the desired result. Thus to form this matrix one must first donvert each of the given relative covariances to absolute, sum each of these covariances as given in Eq. (1), and then divide by the (n,α) cross section to put the (n,α) covariance in relative form.

By appropriate input into the PUFF-II code, the relative covariance matrix for (n,α) has been formed. Also, a small code named FORM, FOR, which performs essentially the same operations as those needed in PUFF-II, was written to check the results. A hand check of the results was also performed.

One-hundred group cross sections from John White's GE library were used to form the matrices. The results have been recorded in a LB = 5 formatted uncertainty file for the single (n,α) reaction. This uncertainty file is on cards and may be obtained from either Bryan Broadhead or me.

October 26, 1979

As a side note, the B-10 (n,α) uncertainty file is in error in ENDF/B-V since, according to the data formats (F. G. Perey, "The Data Covariance Files for ENDF/B-V"), the standard or reference material uncertainties are to be expressed explicitly over the energy range from which other materials are derived.

sah

cc: B. L. Broadhead
H. L. Dodds
J. H. Marable
F. G. Perey
C. R. Weisbin
Y. Yeivin

INTRA-LABORATORY CORRESPONDENCE

OAK RIDGE NATIONAL LABORATORY

November 20, 1979

TO: J. D. Smith

FROM: G. de Saussure

SUBJECT: Your request for a provisional covariance file for ^{238}U, ENDF/B-V, in the resolved resonance region (1 eV to 4 keV).

The proper covariance file is that of the errors in the resonance parameters as given in Tables 22, 23, and 24 of Nuclear Energy, Vol. 3.87 (1979), and as confirmed in the memo of F. G. Perey to C. R. Weisbin dated May 24, 1979.

However, since that file cannot be processed properly at the present time, I have estimated roughly covariances for infinitely dilute cross sections as:

$$\left[\frac{\delta\sigma}{\sigma}\right]_{n,f} = 20\% \quad \left[\frac{\delta\sigma}{\sigma}\right]_{n,\gamma} = 5\% \text{ and } \left[\frac{\delta\sigma}{\sigma}\right]_{n,n} = 4\%$$

These errors must be interpreted as fully correlated over the range 1 eV to 4 keV and uncorrelated with each other and with other cross sections. These estimates are very rough and should be used only until the proper file is processed, for infinitely dilute cross sections and for assemblies with zero sensitivity below 4 keV! I hope this information will be helpful.

GdS/ep

cc: J. H. Marable

OAK RIDGE NATIONAL LABORATORY
OPERATED BY
UNION CARBIDE CORPORATION
NUCLEAR DIVISION

POST OFFICE BOX X
OAK RIDGE, TENNESSEE 37830

September 11, 1979

Dr. Robert R. Kinsey
Building 197
National Nuclear Data Center
Brookhaven National Laboratory
Upton, New York 11973

Dear Bob:

There is an error in the iron (MAT=1326) covariance file (MF=33) of ENDF/B-V. As Brian Broadhead has pointed out, the second energy point in the second NI sub-subsection of MT=1 needs to be 4.0E+5 instead of 4.0E-5. Also, for completeness, the NI sub-subsection of MT=2 should be extended to cover the full energy range. I have shown this to Peter Fu and he agrees. If there are any problems, let me know.

Sincerely,

J. D. Smith

sah

cc: H. L. Dodds
P. Fu
F. G. Perey
R. W. Roussin
C. R. Weisbin
B. L. Broadhead

APPENDIX E

Comments from file 1 of ENDF/B-V concerning the uncertainty information in file 31 through 33.

FILE 1 INFORMATION FOR ENDF/B-V OXYGEN MF=33	77 0	0	0 1276 1451
MT=1, 2, 4, 103, AND 107 SMOOTH X/S COVARIANCES			1276 1451
COVARIANCES ARE BASED UPON ESTIMATES OF THE UNCERTAINTY IN			1276 1451
THE EXPERIMENTAL MEASUREMENTS AND THEORETICAL CALCULATIONS			1276 1451
USED IN THE EVALUATION. FORMAT UPDATED FOR VERSION V.			1276 1451
			1276 1451

FILE 1 INFORMATION FOR ENDF/B-V PU-239 MF = 33	77 0	0	0 1399 1451
			1399 1451
COVARIANCE FILE			1399 1451
			1399 1451
- FISSION DATA FROM 200 KEV TO 20 MEV (MT=18),			1399 1451
CORRELATED TO FISSION CROSS SECTION OF U-235. NORMALIZATION			1399 1451
AND STATISTICAL ERRORS ARE INCLUDED.			1399 1451
- CAPTURE DATA (MT = 102) CORRELATED WITH PU-239 FISSION DATA			1399 1451
UNCERTAINTIES IN ALPHA ARE GIVEN.			1399 1451
- TOTAL NU-BAR (MT = 452) SIMPLIFIED REPRESENTATION OF LEAST			1399 1451
SQUARE FIT.			1399 1451
			1399 1451

FILE 1 INFORMATION FOR ENDF/B-V B-10 CHANGES FROM VERSION IV	77	0	0 1305 1451
			1305 1451
2. COVARIANCE FILE (33) ADDED FOR CROSS SECTIONS BELOW 1 MEV			1305 1451
			1305 1451
MF=33 ----------CROSS-SECTION COVARIANCES----------			1305 1451
			1305 1451
THE RELATIVE COVARIANCES FOR THE MOST IMPORTANT REACTIONS OPEN			1305 1451
BELOW 1 MEV ARE GIVEN IN FILE 33. THESE ARE CALCULATED DIRECTLY			1305 1451
FROM THE COVARIANCES OF THE S-MATRIX PARAMETERS, USING FIRST-			1305 1451
ORDER ERROR PROPAGATION.			1305 1451
			1305 1451
MT=2,780,701 (N,N), (N,ALPHA0), AND (N,ALPHA1) COVARIANCES			1305 1451
0 TO 1 MEV, RELATIVE COVARIANCES AMONG THESE THREE			1305 1451
REACTIONS ARE ENTERED EXPLICITLY USING NI-TYPE SUB-			1305 1451
SUBSECTIONS IN THE LB=5 (DIRECT) REPRESENTATION.			1305 1451
1 TO 20 MEV, ALL COVARIANCES SET EQUAL TO ZERO, NOT			1305 1451
INTENDED FOR USE IN THIS ENERGY RANGE.			1305 1451
			1305 1451
MT=1,107 (N,TOTAL) AND (N,ALPHA) COVARIANCES			1305 1451
0 TO 1 MEV, FOR COMPACTNESS, THESE COVARIANCES ARE CON-			1305 1451
STRUCTED FROM THOSE DESCRIBED ABOVE, USING NC-TYPE SUB-			1305 1451
SUBSECTIONS. THE CONSTRUCTED COVARIANCES FOR THE TOTAL			1305 1451
CROSS SECTION THEREFORE REFLECT CONTRIBUTIONS FROM THE			1305 1451
(N,GAMMA), (N,P), (N,T), AND (N,N1) REACTIONS WHICH ARE			1305 1451
ALL PRESUMED TO TO BE SMALL IN MAGNITUDE BELOW 1 MEV.			1305 1451
NOTE THAT ALTHOUGH THE TOTAL-CROSS-SECTION COVARIANCES			1305 1451
ARE ENTERED IN THE NC-TYPE (DERIVED) FORMAT, TOTAL-			1305 1451
CROSS-SECTION DATA WERE INCLUDED IN THE FIT, AND THEY			1305 1451
INFLUENCED ALL THE CALCULATED COVARIANCES.			1305 1451
1 TO 20 MEV, SET EQUAL TO ZERO, NOT INTENDED FOR USE IN			1305 1451
THIS ENERGY RANGE.			1305 1451
			1305 1451

FILE 1 INFORMATION FOR ENDF/B-V U-235 77 0 0
*** *** ***1324 1451
COVARIANCE FILES 1324 1451
THE REPRESENTATION OF DEPENDENT DATA(E.G. MT=4) REFLECTS THE 1324 1451
MANNER IN WHICH IT IS ACTUALLY DERIVED. THIS IN THE CASE OF SOME 1324 1451
CODES SUCH AS MOXY. THIS REPRESENTATION TENDS TO INCREASE 1324 1451
PROCESSING TIMES, PARTICULARLY WITH REGARD TO MT=4 AND MT=51-91. 1324 1451
AN ALTERNATIVE REPRESENTATION WHICH REDUCES PROCESSING TIME IS 1324 1451
MT=3(POSITIVE) AND MT=16,17,22,23,102-107(NEGATIVE) AND THE 1324 1451
ELIMINATION OF MT=51-91 IN THE COVARIANCE FILES. 1324 1451
HOWEVER, THE RESULTANT FILE WILL NO LONGER REPRESENT THE AUTHORS 1324 1451
BEST ESTIMATE OF THE UNCERTAINTIES. 1324 1451
*** *** ***1324 1451

FILE 1 INFORMATION FOR ENDF/B-V U-235 77 0 0
MF = 33 1395 1451
1395 1451
COVARIANCE FILE BY P.W.PEELLE FROM REF18 1395 1451
1395 1451
PRINCIPAL REFERENCES 1395 1451
1395 1451
18R.W.PEELLE(APP.F OF EPRI PROJ 612 REPORT)BY E.T.TOMLINSON ET.AL1395 1451

FILE 1 INFORMATION FOR ENDF/B-V PU-240 77 0 0
MF=32,MT=151 RES. PARAM. ERROR FILE FROM 0.5 TO 105 EV., 1380 1451
ERRORS BASED ON DIFFERENCE IN MEASUREMENTS BECAUSE 1380 1451
QUOTED ERRORS NOT CONSISTENT IN REF 4,5,6. 1380 1451
MF=33,MT=102 ERROR GROUP ERROR FILE. SUBJECTIVE BECAUSE OF 1380 1451
INSUFFICIENT DATA FOR STATISTICAL ANALYSIS. 1380 1451
1380 1451
REFERENCES 1380 1451
4.M.MEIGANN,G.RIMR,AND F.PORTMANS,PROC.CONF.RESONANCE PARAM.OF 1380 1451
FERTILE NUCLEI AND 239-PU,SACLAY,219,NEANDC(E) 163U (1974). 1380 1451
5.M.MOXON, SEE REF 4. 1380 1451
6.R.W.HOCKENBURY,W.R.MOYER,AND R.C.BLACK,NUCL.SCI.ENG.49, 1380 1451
193(1972). 1380 1451

FILE 1 INFORMATION FOR ENDF/B-V C-12 77 0 0
33-1 TO 33-107 UNCERTAINTY FILES FOR FILE 3 DATA. 1306 1451
1306 1451

FILE 1 INFORMATION FOR ENDF/B-V PU-241 77 0 0
MF=33 MT=18 ERROR GROUP ERROR FILE. SUBJECTIVE BECAUSE OF 1381 1451
INSUFFICIENT DATA FOR STATISTICAL ANALYSIS. 1381 1451
MF=33 MT=102 SAME AS ABOVE. 1381 1451
FILE 1 INFORMATION FOR ENDF/B-V FE 77 0 0
FILE 32 COVARIANCES FOR RESONANCE PARAMETERS PE77 1326 1451
FILE 33 COVARIANCES FOR FILE-3 DATA 1326 1451
1326 1451
REFERENCES 1326 1451
PE77 C.L.PEPEY,PRIVATE COMMUNICATION 1977(TO BE PUBLISHED) 1326 1451

FILE 1 INFORMATION FOR ENDF/B-V U-238	77	0	0
MF = 31	1398	1451	
MT = 455 BASED ON ERROR ESTIMATES IN REF.1 AND 2.	1398	1451	
MT = 456 BASED ON DATA OBTAINED FROM FITTING EXPT. NU BAR PROMPT	1398	1451	
MF = 33	1398	1451	
2 TO 4 KEV THE UNCERTAINTIES IN MTS = 2, 18, AND 102 HAVE BEEN	1398	1451	
SET TO ZERO. THE UNCERTAINTY INFORMATION SHOULD BE TAKEN FROM	1398	1451	
TABLES FROM TABLES 22, 23, AND 24 OF REF. 7. AT HIGHER ENERGIES	1398	1451	
REST OF FILE 33 WAS BASED ON DATA FROM ANL/NCM-32.	1398	1451	
	1398	1451	
REFERENCES	1398	1451	
1. A.B.KAISER AND S.G.CARPENTER (ANL-WEST) PRIV. COMM. (MAR.78)	1398	1451	
DATA INSERTED INTO FILE 4 T GWL BY R. KINSEY 4/18/78	1398	1451	
2. S.A.C.A. ANL/NCS (1974)	1398	1451	

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(ENDF-295)

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Engineering Physics Division

PROCESSING ENDF/B-V UNCERTAINTY DATA INTO MULTIGROUP COVARIANCE MATRICES*

J. D. Smith III*

Date Published: June 1980

*Submitted in partial fulfillment of the requirements for a Master of Science Degree in the Department of Nuclear Engineering, University of Tennessee

OAK RIDGE NATIONAL LABORATORY
Oak Ridge, Tennessee 37830
operated by
UNION CARBIDE CORPORATION
for the
DEPARTMENT OF ENERGY

PROCESSING ENDF/B-V UNCERTAINTY DATA INTO MULTIGROUP COVARIANCE MATRICES

J. D. Smith III

ABSTRACT

The purpose of this work is to develop and demonstrate the capability of processing Evaluated Nuclear Data File, system B, version five (ENDF/B-V) uncertainty data into multigroup covariance matrices. These covariances may then be folded with sensitivity coefficients to obtain uncertainties in selected integral parameters such as K-effective and breeding ratio.

The project consisted of separating the previous uncertainty processor (PUFF) from the basic nuclear data cross section processor (MINX), updating the uncertainty processor to the ENDF/B-V format, programming the processor for new uncertainty data, and demonstrating the processor capabilities by producing a multigroup covariance library. These capabilities were verified in various ways including hand calculations and comparisons with other known results.

A computer code named PUFF-II was written to perform the task described above. The code is capable of processing all uncertainty data currently entered in ENDF/B-V. The only limitation of the code is the treatment of uncertainties in resonance data.

CHAPTER I

INTRODUCTION

The basic nuclear data in the Evaluated Nuclear Data Files System B (ENDF/B) has been broadened and improved upon for many years, by new discoveries, better understanding, and improved technical capabilities. However, improvements in ENDF/B data are still needed.[1] Specifically, it is now evident that some means must be developed to indicate just how good the basic nuclear data are. This measure of the goodness of data has been to include estimated uncertainties in the evaluated microscopic data in ENDF/B files in a standard manner. These uncertainty files, after processing, may be used in conjunction with sensitivity analysis to allow for propagation of uncertainties in basic nuclear data (i.e., ENDF/B) to uncertainties in reactor performance parameters such as K-effective and breeding ratio, thus allowing for systematic adjustment processes. This uncertainty analysis will also allow for valuable feedback to the nuclear data community as to which measurements and/or evaluations most need further refinement.

The objective of this thesis project is to develop the capability of processing uncertainty data in ENDF/B version 5 (ENDF/B-V). Just as the microscopic nuclear data of ENDF/B is processed according to specified algorithms into multigroup form, so is the uncertainty data processed by specific algorithms into multigroup covariance matrices. A covariance shall be defined statistically as the expected value of the product of the deviations of two random variables (may be the same random variable) from their respective means. Each variable is allowed to have its own energy intervals which forms the two dimensions of a covariance matrix.

Previous work in this field consisted of processing limited ENDF/B-IV data (ENDF/B-IV contained uncertainties for nitrogen, oxygen, and carbon only) using an uncertainty processor, PUFF[2], developed by extending the MINX[3] cross section processor. Many additional unofficial cross section uncertainty evaluations were prepared at ORNL in an ENDF/B-IV format.[4] From this data and the PUFF code, three multigroup covariance libraries were produced, which are available through the Radiation Shielding Information Center (RSIC) at ORNL. These three libraries are the fission spectrum covariance matrix library (with GODIVA[5,6] weighting), the LMFBR core physics covariance matrix library (with ZPR-6/7[7] weighting), and the LMFBR shielding covariance library (with 1/E weighting). These libraries are in a standard format, COVERX,[8] for use in the FORSS[9] system. The FORSS system is a collection of codes used in sensitivity and uncertainty analysis.

In the present work, the capability of processing newly formatted ENDF/B-V data has been developed. Specifically, processing capabilities have been added for new uncertainty relationships, explicit cross reaction and cross material relationships (cross is used to indicate that the two random variables are not the same), and derived uncertainties. Derived is used here in the context that a reaction type (and therefore its uncertainties) may be determined by summing other reaction types (e.g., the total cross section is the sum of its partial cross sections). Derived is also used in the context that some reaction types are determined by ratio measurements to a reference reaction type (e.g., ^{239}Pu fission cross section is measured as a ratio to the ^{235}U fission cross section). Capabilities have also been added to produce the off-diagonal submatrices resulting from derived (in the context of summing) uncertainties. Processing uncertainties in the average number of neutrons per fission ($\bar{\nu}$) and in the

resolved resonance parameters (for infinitely dilute systems only) have also been included. Finally, an important accomplishment of this work has been to separate the uncertainty processing from the cross section processing, originally suggested by Las Alamos Scientific Laboratory (LASL), to provide not only for a modular code system, but to reduce computing costs.

This new processing capability has been implemented in a new version of the PUFF code named PUFF-II and requires that the user supply only the multigroup cross sections (e.g., VITAMIN-C or -E libraries[10,11]) with corresponding flux spectrum and, of course, the uncertainty file data of ENDF/B-V.

The text of this thesis is organized into six chapters. Chapter II includes definitions for some of the terminology used in the remainder of this thesis. Chapter III explains the basic formats for the uncertainty data expressed in ENDF/B-V. Chapter IV explains the specific processing techniques that are used to produce multigroup covariance matrices. Varification of PUFF-II is described in Chapter V. Chapter VI shows some typical results produced by PUFF-II. The conclusions of this work and recommendations for future work are given in the final chapter.

CHAPTER II

DEFINITIONS

Because ENDF/B is, in effect, breaking new ground in the computation and recording of uncertainty data, several new terms will appear which need to be clearly defined.

Given two variables, X_i and Y_j, which, for this case, represent the multigroup cross section of reaction type X, energy group i, and reaction type Y, energy group j, the covariance matrix (or absolute covarience matrix), COV of such may be described as

$$Cov(X_i,Y_j) \equiv \langle\!\langle (X_i-\hat{X}_i)\ (Y_j-\hat{Y}_j) \rangle\!\rangle, \tag{1}$$

where the diamond shaped bracket and the tilde indicate the expectation (mean) value. From this, several other qualities may be defined, namely the relative covariance matrix, Rel.Cov,

$$Rel.\ Cov(X_i,Y_j) = \frac{COV(X_i,Y_j)}{X_i\ Y_j}\ , \tag{2}$$

the standard deviation, Std.Dev,

$$Std.Dev.(X_i) = \sqrt{Cov(X_i,X_i)}, \tag{3}$$

and the relative standard deviation, Rel.Std.Dev.,

$$Rel.Std.Dev(X_i) = \frac{Std.Dev(X_i)}{X_i}\ . \tag{4}$$

Also, a correlation matrix, Corr, may be defined as:

$$Corr(X_i,Y_j) = \frac{Cov(X_i,Y_j)}{(Std.Dev(X_i))(Std.Dev(Y_j))}, \tag{5.1}$$

or

$$\text{Corr}(X_i,Y_j) = \frac{\text{Rel.Cov}(X_i,Y_j)}{(\text{Rel.Std.Dev.}(X_i))(\text{Rel.Std.Dev.}(Y_j))}. \tag{5.2}$$

The correlation matrix shows quantitatively the degree of correlation between X_i and Y_j. The correlation matrix is bounded by unity, i.e.,

$$| \text{Corr}(X_i,Y_j) | \leq 1. \tag{6}$$

When $\text{Corr}(X_i,Y_j) = 0$, the variables X_i and Y_j are said to be totally uncorrelated. When $\text{Corr}(X_i,Y_j) = +1$ or -1, the variables are said to be fully correlated or fully anti-correlated, respectively.

It should also be noted that the term covariance and uncertainty are used interchangeably.

CHAPTER III

ENDF/B-V UNCERTAINTY DATA FORMATS

In the ENDF/B system the microscopic data are grouped into files according to the type of data. For example, file 1 contains the microscopic data for $\bar{\nu}$, file 2 contains the resolved resonance parameters, and file 3 is for the "smooth" microscopic cross sections. The uncertainty file number is determined by adding 30 to the respective microscopic data file number. Thus, file 31 contains uncertainty data for $\bar{\nu}$, file 32 contains uncertainties in the resolved resonance parameters, and file 33 contains uncertainties for the smooth microscopic cross sections. As a side note, these three uncertainty files are the current extent of the uncertainty data in ENDF/B-V, although future plans are to include uncertainties in the fission spectrum χ, and in secondary energy and angular distributions.

Files 31 and 33 have identical formats in the ENDF/B-V system and may thus be described together.

Files 31 and 33 are broken down into sections, subsections and sub-subsections. A section completely describes a specific reaction type which is classified by an MT number (e.g., MT=1 is the total cross section, MT=2 is the elastic scattering cross section, etc.). Thus, for example, a section related to the total cross section, MT=1, completely describes the uncertainty related to MT=1.

A subsection completely describes a single covariance matrix. A sub-subsection describes the various components of the covariance matrix and are independent of each other.

Two different types of sub-subsections are used in ENDF/B-V and are

referred to as "NI-type" and "NC-type" sub-subsections. The "NI-type" is used to explicitly describe the various components of the covariance matrix of the subsection. The "NC-type" is used to indicate that some or all of the contributing components to the covariance matrix, described in the subsection, are to be found in a different subsection already in the ENDF/B-V data. The idea behind this is, of course, to eliminate the large portion of the uncertainty data that would otherwise have to be repeated as "NI-type" sub-subsections. In each "NI-type" sub-subsection there is a flag which indicates the type of correlations as a function of energy described in the sub-subsection. The flag is called a LB number of which six are permitted in ENDF/B-V:[12]

LB=0 Absolute components only correlated within each E_k interval

$$\mathrm{Cov}(X_i,Y_j) = \sum_k P^{i;k}_{j;k} F_{xy,k} \quad , \tag{7}$$

LB=1 Relative components only correlated within each E_k interval

$$\mathrm{Cov}(X_i,Y_j) = \sum_k P^{i;k}_{j;k} F_{xy,k} X_i Y_j \quad , \tag{8}$$

LB=2 Relative components correlated over all E_k intervals

$$\mathrm{Cov}(X_i,Y_j) = \sum_{k,k'} P^{i;k}_{j;k'} F_{xy,k} F_{xy,k'} X_i Y_j, \tag{9}$$

LB=3 Relative components correlated over E_k and E_ℓ intervals

$$\mathrm{Cov}(X_i,Y_j) = \sum_{k,\ell} P^{i;k}_{j;\ell} F_{x,k} F_{y,\ell} X_i Y_j, \tag{10}$$

LB=4 Relative components correlated over all E_ℓ intervals within each E_k interval

$$\mathrm{Cov}(X_i,Y_j) = \sum_{k,\ell,\ell'} P^{i;k,\ell}_{j;k,\ell'} F_k F_{xy,\ell} F_{xy,\ell'} X_i Y_j, \tag{11}$$

and

LB=5 Relative covariance matrix components

$$Cov(X_i,Y_j) = \sum_{k,k'} P^{i;k}_{j;k'} F_{xy;k,k'} X_i Y_j. \quad (12)$$

Here the X_i and Y_j are as previously defined, the F's are the uncertainty components which come directly from the uncertainty file data, and the dimensionless operator P is defined in terms of the operator S as

$$P^{i;k,\ell,\ldots}_{j;m,n,\ldots} \equiv S_i^k S_i^\ell \ldots S_j^m S_j^n \ldots, \quad (13)$$

where,

$S_i^k = 1$ when the energy E_i is in the interval E_k to E_{k+1} of an E_k energy "table."

or

$S_i^k = 0$ when the energy E_i is outside the range of E_k to E_{k+1} of an E_k energy "table."

Again, the "NC-type" sub-section is used to describe the covariance matrices in the energy ranges where the reaction type desired may be derived in terms of other evaluated reaction types in the same energy ranges. The evaluated cross section refered to here is one in which the covariance matrix is given explicitly ("NI-type") over the energy range of interest.

The "NC-type" sub-subsections are further broken down into two categories, as aluded to earlier. The first is the "derived redundant reaction types", indicated in ENDF/B-V by the flag LTY=0. Here the reaction type, MT, of a certain material, MAT (materials are designated by MAT numbers in ENDF/B), is obtained as a linear combination of other evaluated reaction types having the same MAT number but different MT values in the energy ranges given by E1 and E2 in the uncertainty file. That is

$$X_{MT}^{MAT}(E) = \sum_{i=1}^{NCI} C_i \, X_{MTi}^{MAT}(E), \qquad (14)$$

where the C_i's are constant over the whole energy range of E1 to E2, and NCI designates the number of "NC-type" sub-subsections of interest.

The second type of "NC-type" sub-subsection is referred to as "covariances of cross sections derived via ratio measurements", flagged in ENDF/B-V as either LTY=1,2,or 3. Cross section evaluation by means of ratio measurements is a standard method in ENDF/B and one of the main sources of cross material correlations. This relationship can be shown for the cross section X_{MT}^{MAT} derived, in the energy range E1 to E2, through the evaluation of ratio measurements of the "standard" cross section X_{MTR}^{MATR} as

$$X_{MT}^{MAT}(E) = R(E) \, X_{MTR}^{MATR}(E) \qquad (15)$$

where R(E) is the measured ratio at energy E. LTY=1 is then used in one subsection of X_{MT}^{MAT} to indicate a ratio measurement to X_{MTR}^{MATR}. LTY=2 is used to indicate a correlation between X_{MT}^{MAT} and X_{MTR}^{MATR}. LTY=3 is used in the reference materials subsection to indicate a correlation between X_{MTR}^{MATR} and X_{MT}^{MAT}.

The final type of uncertainty file to be described is file 32, the uncertainties in the resolved resonance parameters. In file 32, the data necessary for both multi- and single-level Breit-Wigner representations and the correlated uncertainties in these data are given. Covariances are given for the resonance energy, E_r, the total angular momentum of the resonance, J, the neutron width, Γn, the radiation width, $\Gamma\gamma$, and the fission width, Γf. This data is then propagated through to an uncertainty in a resonance cross section. These uncertainties are then added to the uncertainties formulated from file 33, the smooth cross section covariances, to form a complete covariance matrix.

CHAPTER IV

PROCESSING ENDF/B-V UNCERTAINTY DATA INTO MULTIGROUP FORMALISM

Processing ENDF/B-V uncertainty data is a straightforward but strict operation. The matrix operations necessary must follow certain mathematical relationships or errors are prone to occur. With this in mind, and before describing the computational procedures, a brief explanation of the various energy grids used is necessary.

The first energy grid is the cross section energy grid. This grid is, of course, associated with the energy structure on which the multigroup cross sections have been processed. The multigroup cross sections may be in any group structure desired and are not necessarily dependent upon any other grid to be described.

The second energy grid is the user energy grid. This is the energy structure on which the code user wants to have the final multigroup covariances.

A third energy structure is associated with the various energy levels on which the evaluator has expressed the uncertainties. This energy structure will be referred to as the uncertainty file energy structure or grid.

A fourth energy structure, necessary for a unified energy grid on which the cross sections (and flux) are expressed, is called the "supergrid." This grid is the union of the user grid and the uncertainty file energy grid. The supergrid is also necessary, as will be explained later, to process covariances due to ratio measurements.

The fifth and final energy grid is named the super-user grid. This grid is the union of the user energy grid and the energy boundaries of the "derived redundant reaction type" covariances; the E1's and E2's. The super-user grid is necessary, as will be explained later, to process covariances which are linear summing operations.

Another area that should be discussed before describing the covariance computational procedures is that of interpolation of the multigroup cross sections and corresponding flux. In order to use the multigroup processing algorithms, the multigroup cross sections and flux must be expressed on the supergrid. One of the most convenient methods of interpolating the multigroup cross sections on to the supergrid, and the method chosen in PUFF-II, is to energy weight the cross section and collapse (or expand) as described below

$$\bar{\sigma}_{sb} = \frac{\sum_i \sigma_{Mi}\phi_{Mi}\left(\frac{E_{sb} - E_{M,i}}{E_{M,i+1}-E_{M,i}}\right)}{\sum_i \phi_{Mi}\left(\frac{E_{sb} - E_{M,i}}{E_{M,i+1}-E_{M,i}}\right)} \quad i = 1, 2, \ldots, \text{Multi} \tag{16}$$

where $\bar{\sigma}_{sb}$ is the supergrid cross section for energy group b, $\sigma_{M,i}$ is the multigroup cross section for energy group i and ϕ_{Mi} is the corresponding flux, E_{sb} is a lower energy boundary for the supergrid, $E_{M,i}$ is the energy boundaries for the ith energy group in the multigroup cross section energy grid, and Multi is the number of groups in the multigroup energy grid.

The computation of multigroup covariances from files 31 and 33 using

covariances from the "NI-type" sub-subsections is performed according to the different LB flags and are given in multigroup formalism as shown below

$$\text{LB} = 0 \qquad \text{Cov}(X_i,Y_j) = \frac{\sum_{k\varepsilon i,j} F_{xy,k}\phi_{i,k}\phi_{j,k}}{\phi_i\ \phi_j} \tag{17}$$

$$\text{LB} = 1 \qquad \text{Cov}(X_i,Y_j) = \frac{\sum_{k\varepsilon i,j} F_{xy,k}\phi_{i,k}{}^{X}{}_{i,k}\phi_{j,k}{}^{Y}{}_{j,k}}{\phi_i\ \phi_j} \tag{18}$$

$$\text{LB} = 2 \qquad \text{Cov}(X_i,Y_j) = \frac{\left(\sum_{k\varepsilon i} F_{xy,k}\phi_{i,k}{}^{X}{}_{i,k}\right)\left(\sum_{k'\varepsilon j} F_{xy,k'}\phi_{j,k'}{}^{Y}{}_{j,k'}\right)}{\phi_i\ \phi_j} \tag{19}$$

$$\text{LB} = 3 \qquad \text{Cov}(X_i,Y_j) = \frac{\left(\sum_{k\varepsilon i} F_{x,k}\phi_{i,k}{}^{X}{}_{i,k}\right)\left(\sum_{\ell\varepsilon j} F_{y,\ell}\phi_{j,\ell}{}^{Y}{}_{j,\ell}\right)}{\phi_i\ \phi_j} \tag{20}$$

$$\text{LB} = 4 \qquad \text{Cov}(X_i,Y_j) = \frac{\sum_{k\varepsilon i,j} F_k\left(\sum_{\ell\varepsilon i,k} F_{xy,\ell}\phi_{i,\ell}{}^{X}{}_{i,\ell}\right)\left(\sum_{\ell'\varepsilon j,k} F_{xy,\ell'}\phi_{j,\ell'}{}^{Y}{}_{j,\ell'}\right)}{\phi_i\ \phi_j} \tag{21}$$

and

$$\text{LB} = 5 \qquad \text{Cov}(X_i,Y_j) = \frac{\sum_{k\varepsilon i}\sum_{k'\varepsilon j} F_{xy;k,k'}\phi_{i,k'}{}^{X}{}_{i,k}\phi_{j,k}{}^{Y}{}_{j,k'}}{\phi_i\ \phi_j} \ . \tag{22}$$

The derivation of Eqs. (17-21) is fully described in Ref. 13. Equation (22) is obvious from the definition of covariance given earlier and from equation (12). The notation used here is:

$Cov(X_i,Y_j)$ = multigroup covariance between reaction X group i and reaction Y, group j.

ϕ_i = multigroup flux per super-user group (or supergrid) i.

$X_{i,k}$ = multigroup cross section for reaction X for a supergrid (i,k) constructed from the union of energy boundaries of the uncertainty file and those from the the user grid. $\phi_{i,k}$ is the flux for this group.

F's = components of covariance taken directly from the uncertainty file.

The "NI-type" sub-subsections are the basis for construction of the "NC-type" sub-subsections and are therefore by necessity processed first. The use of the "NI-type" sub-subsections for the production of the "NC-type" derived redundant cross section covariances is demonstrated as follows: let X be the cross section of interest expressed as a linear combination of n evaluated cross sections, Y, in the energy range from E1 to E2

$$X_i = \sum_{M=1}^{n} Y_{M,i} K_M \tag{23}$$

where i is the energy group index and K_M's are constant values, usually +1 or -1. Then, to express the uncertainty in X we have

$$dX_i = \sum_{M=1}^{n} dY_{M,i} K_M, \tag{24}$$

where dX_i represents $(X_i-\hat{X}_i)$, the uncertainty in X_i; similarly for $Y_{M,i}$. To find the covariance of X_i, Eq. (24) is squared, changing the second index of i to j (where i and j represent the same group structure) and then expectation values are taken

$$\langle dX_i dX_j \rangle = \sum_{M=1}^{n} \sum_{M'=1}^{n} K_M K_{M'} \langle dY_{M,i} dY_{M,j} \rangle \quad . \tag{25}$$

The diamond bracketed items in Eq. (25) are the covariances and may be more conveniently expressed as

$$Cov(X_i, X_j) = \sum_{M=1}^{n} \sum_{M'=1}^{n} K_M K_{M'} Cov(Y_{M,i}, Y_{M',j}) \quad . \tag{26}$$

Similarly, taking the expected value of the product of X_i and the $Y_{M,i}$'s gives

$$\langle dX_i, dY_{M,j} \rangle = \sum_{M'=1}^{n} K_{M'} \langle dY_{M',i} dY_{Mj} \rangle \qquad M = 1,2\ldots,n \tag{27}$$

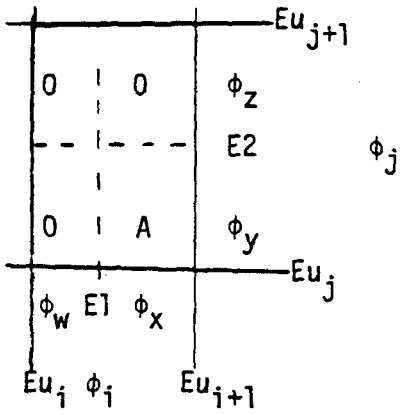
or

$$Cov(X_i, Y_{M,j}) = \sum_{M'=1}^{n} K_{M'} Cov(Y_{M',i}, Y_{M,j}) \quad M = 1,2,\ldots n \quad . \tag{28}$$

Equation (26) is the mathematical expression of the processing procedure to produce the multigroup covariances for the derived redundant cross section covariances. Equation (28) is the mathematical expression of the process to produce the multigroup covariances between the reaction of interest, X_i, and each of the reaction types, $Y_{M,i}$'s, from which X_i is evaluated.

Each of the derived redundant cross section covariances are derived for an explicit energy range, E1 to E2. Outside of this energy range the derived covariance matrix is zero. In effect, this requires that the multigroup covariances be produced on an energy grid that not only contains the desired energy boundaries of the user, but must also contain the E1's and E2's. This grid was defined as the super-user grid.

If the derived energy range points are not present numerical errors occur. This may best be explained pictorially as is shown in this partial covariance matrix



where Eu represents the user-energy boundaries for group i and j, El and E2 are as explained before, ϕ_w is the super-user grid flux, ϕ_i is the sum of ϕ_w and ϕ_x, likewise for ϕ_j, and A is the covariance element produced from Eq. (26) or (28) (all other elements are zero). If the derived redundant cross section energy boundaries were not present (in the energy grid scheme), the covariance element for user covariance group i,j would simply be A, which is incorrect. The correct covariance value for user group i,j is given in general as

$$\mathrm{Cov}(X_i,Y_j) = \frac{\phi_x \, A \, \phi_y}{(\phi_w+\phi_x)(\phi_y+\phi_z)} , \qquad (29)$$

where the covariance element A is flux weighted and collapsed to the user covariance group i,j.

In the second type of "NC-type" sub-subsection, covariances may be wholly or partially derived from measurements made on the relationship one cross section of a certain material has to a reference cross section of another material. This is known as a ratio measurement. To illustrate

this, let X_i be the cross section of interest and Z_i be the cross section from which X_i is evaluated, and then

$$X_i = R_i Z_i , \tag{30}$$

where R_i is the measured ratio of X_i to Z_i at energy group i. Then the uncertainty in X_i may be determined with use of the chain rule as

$$dX_i = dR_i Z_i + R_i dZ_i \quad . \tag{31}$$

With this, the covariance of X may be determined as

$$\begin{aligned} \langle dX_i dX_j \rangle \quad = \langle dR_i dR_j \rangle Z_i Z_j + 2R_i Z_j \langle dR_i dZ_j \rangle \\ + \langle dZ_i dZ_j \rangle R_i R_j \quad . \end{aligned} \tag{32}$$

Rearrangement of Eq. (32) gives

$$\begin{aligned} \frac{\langle dX_i dX_j \rangle}{R_i R_j Z_i Z_j} = \frac{\langle dR_i dR_j \rangle}{R_i R_j} + \frac{2\langle dR_i dZ_j \rangle}{R_j Z_i} \\ + \frac{\langle dZ_i dZ_j \rangle}{Z_i Z_j} \quad . \end{aligned} \tag{33}$$

R and Z (or R and any other cross section) are assumed to be uncorrelated (i.e., $\langle dR_i dZ_j \rangle = 0$) and the three remaining terms follow from the definition of a relative covariance matrix; thus

$$\text{Rel. Cov}(X_i, X_j) = \text{Rel. Cov}(R_i, R_j) + \text{Rel. Cov}(Z_i, Z_j) \quad . \tag{34}$$

Also, from Eq. (31) a covariance may be derived between X and Z, namely,

$$\text{Rel. Cov}(X_i, Z_j) = \text{Rel. Cov}(Z_i, Z_j) \quad . \tag{35}$$

Other relationships[12] exist due to ratio measurements, but Eqs. (34) and (35) represent the basic mathematical expressions for processing covariances due to ratio measurements. Equation (34) states that the relative covariance of X is determined by adding the relative covariance of the ratio, R, to the relative covariance of the reference cross section, Z. The uncertainties in R are given in "NI-type" sub-subsections in the subsection given for X. The uncertainties for the reference cross section are in the "NI-type" sub-subsections of Z.

Normal processing procedures of summing two collapsed multigroup covariance matrices cannot be followed in processing ratio measurements. This is because forming a collapsed multigroup covariance for the ratio, R, requires having the covariance matrix for X, which is the desired result. Instead, the covariance matrices of R and Z must be summed while in the supergrid structure. The covariance matrix of X is then collapsed to the user group structure.

This concludes a description of the processing procedures necessary to form multigroup covariances from files 31 or 33. The multigroup covariances due to the uncertainties in the resolved resonance parameters, file 32, must now be formed and added to the smooth cross section covariances of file 33.

The processing of the resolved resonance parameter uncertainties requires an uncertainty analysis approach. The basic equation is the single-level Breit-Wigner formula given as

$$\sigma_i = \frac{\pi}{k^2} g \frac{\Gamma_n \Gamma_i}{(E-E_r)^2+(1/4)\Gamma_T^2}, \quad (36)$$

where Γ_n is the neutron width, Γ_i is the radiation or fission width (i.e., i = γ or f), E_r is the resonance energy, and Γ_T is the resonance total width given by

$$\Gamma_T = \Gamma_n + \Gamma_f + \Gamma_\gamma . \quad (37)$$

σ_i is the capture or fission cross section, g is the statistical spin factor given as

$$g = \frac{2J+1}{2(2I+1)} , \quad (38)$$

where J is the spin of compound nucleus, or the total angular momentum and I is the spin of the target nucleus. K is given in ENDF/B as

$$K = (2.196771 \times 10^{-3}) \left(\frac{AWRI}{AWRI+1.0}\right) \sqrt{E_r} \quad (39)$$

where AWRI is the ratio of the mass of a particular isotope to that of a neutron. Only the single-level Breit-Wigner formulae is used because no data have been cast in multi-level form to date.

Equation (36) is then integrated from $-\infty$ + to + ∞ to obtain a representation for the resonance area given as

$$A_i = \frac{2\pi^2}{K^2} g \frac{\Gamma_n \Gamma_i}{\Gamma_T} \quad (40)$$

where A_i is the resonance area in barns -eV for capture or fission reactions (i.e., i = γ or f). Sensitivities are then taken with respect to each parameter for which uncertainties are expressed (see Chapter III).

For example, the sensitivity of A_i to Γ_n may be shown as

$$\frac{\partial A_i}{\partial \Gamma_n} = \frac{2\pi^2}{K^2} g \frac{\Gamma_i}{\Gamma_T} (1 - \Gamma_n/\Gamma_T) . \tag{41}$$

Similar expressions are derived for each of the other parameters which have uncertainties in file 32 and a matrix is formed which looks like

$$H \equiv \begin{bmatrix} \frac{\partial A_\gamma}{\partial \Gamma_\gamma} & \frac{\partial A_\gamma}{\partial \Gamma_n} & \frac{\partial A_\gamma}{\partial \Gamma_f} & \frac{\partial A_\gamma}{\partial J} & \frac{\partial A_\gamma}{\partial E_r} \\ \frac{\partial A_f}{\partial \Gamma_\gamma} & \frac{\partial A_f}{\partial \Gamma_n} & \frac{\partial A_f}{\partial \Gamma_f} & \frac{\partial A_f}{\partial J} & \frac{\partial A_f}{\partial E_r} \end{bmatrix} . \tag{42}$$

The covariance matrix of the resolved resonance parameters is defined as

$$D = \begin{bmatrix} DG^2 & - & - & - & - & - \\ DNDG & DN^2 & & & & \\ DGDF & DNDF & DF^2 & & & \\ DJDG & DJDN & DJDF & DJ^2 & & \\ 0 & 0 & 0 & 0 & DE^2 & \end{bmatrix} , \tag{43}$$

where

DG^2 is the variance of Γ_γ, [ev^2],

DN^2 is the variance of Γ_n, [ev^2],

DF^2 is the variance of Γ_f, [ev^2],

DJ^2 is the variance of J,

DE^2 is the variance of E_r [ev^2],

DNDG is the covariance of Γ_n and Γ_γ [ev^2],

DGDF is the covariance of Γ_γ and Γ_f [ev^2],

DNDF is the covariance of Γ_n and Γ_f [ev^2],

DJDG is the covariance of J and Γ_γ [ev],

DJDN is the covariance of J and Γ_n [ev],

and DJDF is the covariance of J and Γ_f [ev] .

The covariance of E_r and the other parameters is very small, in practice, and therefore set to zero.[12] Also, the D matrix is symmetric (i.e., DNDG = DGDN, etc.).

A covariance matrix for the resonance area is produced by folding the sensitivity matrix, H, with the covariance matrix, D, and is given as

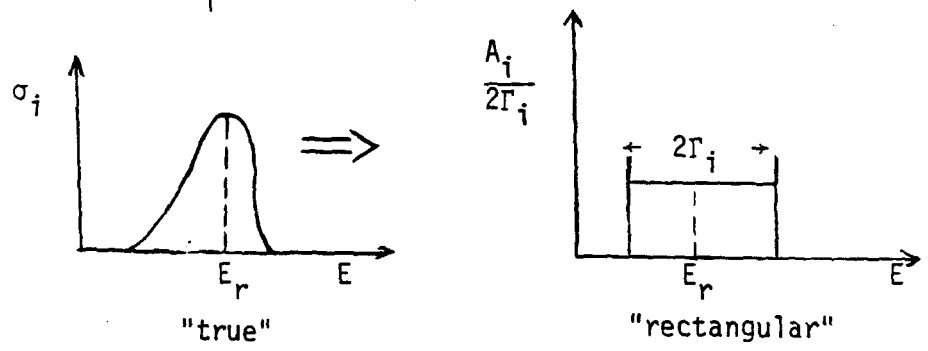
$$\langle dA dA^T \rangle = \begin{bmatrix} \langle dA_\gamma dA_\gamma \rangle & \langle dA_\gamma dA_f \rangle \\ \langle dA_f dA_\gamma \rangle & \langle dA_f dA_f \rangle \end{bmatrix}. \qquad (44)$$

As shown in Eq. (44), not only is a covariance matrix formed for the capture and fission area, but a cross reaction covariance is given between capture and fission. The matrix shown in equation (44) is also symmetric (i.e., $\langle dA_f dA_\gamma \rangle = \langle dA_\gamma dA_f \rangle$).

The matrix described in Eq. (44) is summed for each resonance, ℓ-state (neutron angular momentum quantum number), and isotope within each super-user grid (or supergrid) K (if more than one isotope exists, the abundance is used to weight the contribution). This expression is then divided by the square of the width of energy group K (i.e., $(E_{k+1} - E_k)^2$) to form the cross section covariances due to the resolved resonance parameters. These covariances are then summed to the proper absolute covariances of the smooth cross sections formed from file 33.

The approach described above assumes a constant or flat weighting for each resonance within energy group k. A second approach, suggested by Y. Yeivin and J. J. Wagschal[14] is to give each resonance an 1/E weighting. In this approach, the model for averaging a resonance cross

section, σ_i, consists of replacing the "true" cross section by a "rectangular" one of width $2\Gamma_i$, where $i = \gamma$ or f.



Letting E_{k+1} and E_k be the upper and lower kth group boundaries, the average cross section would be given by

$$\bar{\sigma}_i = \int_{E_k}^{E_{k+1}} \sigma_i(E)\,\frac{dE}{E} \Bigg/ \int_{E_k}^{E_{k+1}} \frac{dE}{E} \tag{45}$$

$$\simeq \frac{A_i}{2\Gamma_i} \ln\left(\frac{E_r+\Gamma_i}{E_r-\Gamma_i}\right) \Bigg/ \ln\left(\frac{E_{k+1}}{E_k}\right) \qquad i = \gamma \text{ or } f\ . \tag{46}$$

Sensitivities are formed from Eq. (46) in the same fashion as described in the first approach and folded with the covariance matrix, D, Eq. (43). This time the covariance matrix of the resonance cross section is formed directly. The rest of the processing is the same as for the constant weighting approach. Both processing modes are allowed in PUFF-II.

Several assumptions have been made in processing the resolved resonance data. One of the more important assumptions is that no uncertainties are due to self-shielding. Normally, self-shielding is accounted for by Bonderinko f-factors[15], which are functions that relate cross section behavior to temperature and material compositions. Inclusion for these f-factors would require not only some very complicated

analysis scheme, but would force the covariance calculations to become problem-dependent, which is not the intent for the processor.

Other assumptions are (1) only Breit-Weigner resonance representation (and of course the assumptions of a Breit-Weigner representation such as widely spaced resonances) are applicable, and (2) the resonance area is assumed to lie fully within the energy group k.

Using the procedures described above, the ENDF/B-V uncertainty data may be processed into multigroup covariances. However, due to situations which arise in the "NC-type" sub-subsections, the covariances are produced on an energy grid associated with either the super-user grid or super-grid. The matrices must then be collapsed to the user grid as described by Eq. (29). Finally, the collapsed matrices are prepared for output which usually consists of a COVERX file and correlation matrices.

CHAPTER V

VERIFICATION OF THE PUFF-II CODE

The objective in developing the PUFF-II code -- namely, to process ENDF/B-V uncertainty data into multigroup covariance matrices -- precludes "easy" evaluation and verification of the code because of the following two reasons. First, standard computational benchmark problems with known solutions, which could be solved by PUFF-II to check if the code is working properly, simply do not exist. Secondly, other codes which perform the same tasks as PUFF-II and, therefore, could be used to produce results for comparison with PUFF-II results, simply do not exist. In other words, standard techniques for verification of a newly developed code are not possible in this work.

However, it is possible to compare some PUFF-II results with results of hand calculations. This was done for the covariance of the Aluminum total elastic scattering cross section to the total inelastic scattering cross section. The hand calculated result and the PUFF-II result were identical.

It is also possible to evaluate LB=3 and LB=5 processing from the standpoint of internal consistency. Specifically, uncertainty files in LB=3 format, where E_k and E_ℓ energy intervals (see Chapter III, Eq. 10) are the same, were converted to LB=5 and then processed using PUFF-II. The results from both formats were compared and shown to be identical.

Finally ENDF/B-V results obtained with PUFF-II were compared with ENDF/B-IV results obtained with the old PUFF code. Differences between the two results should, of course, exist because the basic input data is different for the two cases. However, the two results should be at least

similar in appearance. This similarity is demonstrated in Figs. 1 and 2 which show a six group representation of the correlation matrix for the ^{239}Pu fission cross section based on ENDF/B-V and ENDF/B-IV, respectively. Note that the version V result is less correlated in the low energy range than the version IV result. In particular, version V exhibits little or no off-diagonal correlation in the low energy range while version IV's off-diagonal low energy correlation ranges from 27% to 50%. Also, the standard deviation of the version V ^{239}Pu fission cross section is ~4% higher in energy group 1 while it is ~2% lower in energy group 6 than the version IV results. The differences in the intermediate energy ranges are less significant than those of the extremes.

Some of the discrepancy in the standard deviations presented in Fig. 1 and 2 is due to the use of different weighting spectrums. Also, the discrepancy in the degree of correlation in the low energy range is due to the fact that the version IV result assumed a long range correlation (i.e., a correlation over a large energy range) at low energy whereas in the ENDF/B-V ^{239}Pu (n,f) uncertainty file, no such assumption was made.

In summary, the verification checks described in this chapter and the results presented in the next chapter, which appear quite reasonable from a physical point of view, lead us to conclude that the new code, PUFF-II, works properly.

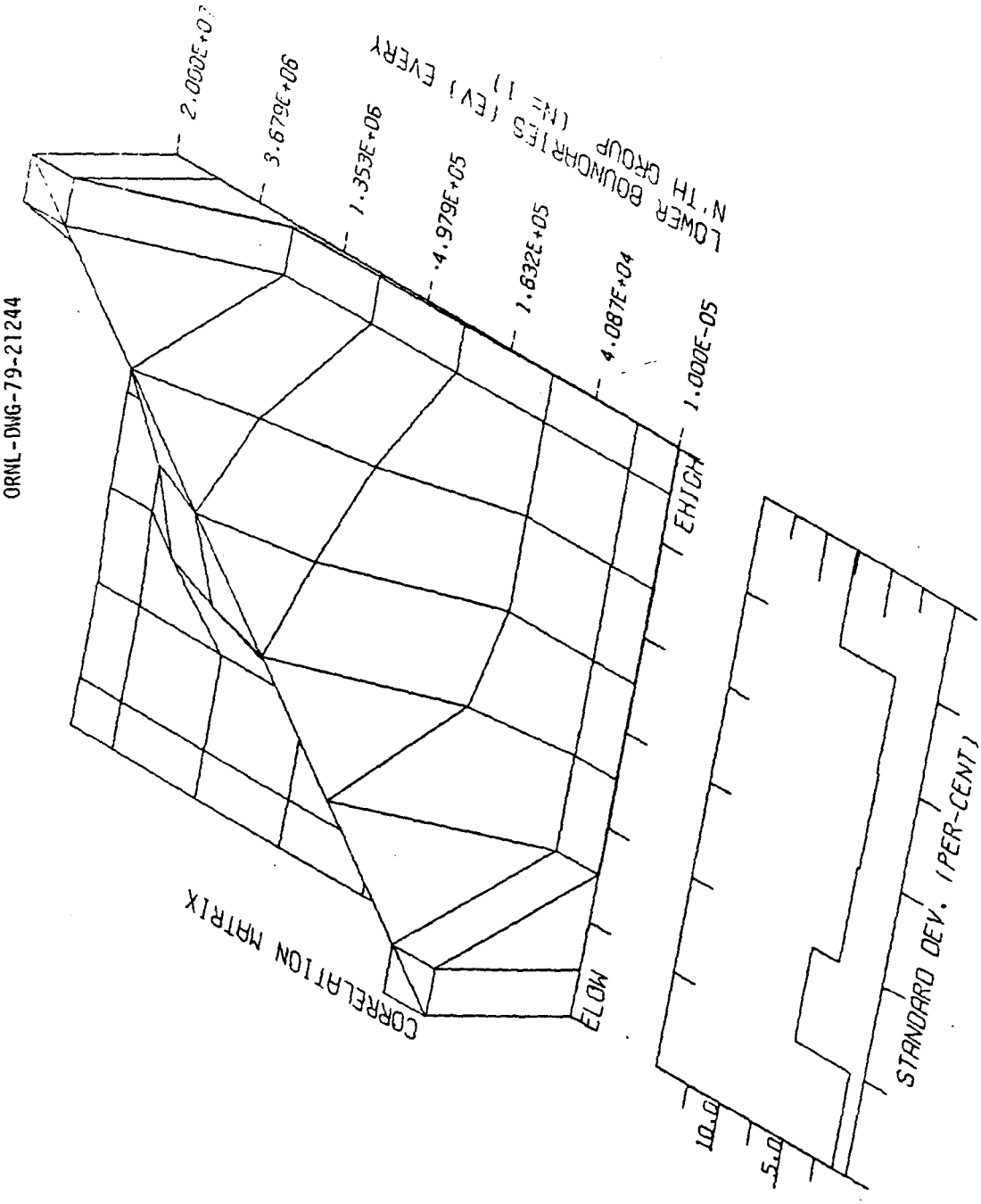


Fig. 1. Standard Deviation and Correlation Matrix of the $^{239}Pu(n,f)$ Cross Sections -- ENDF/B-V

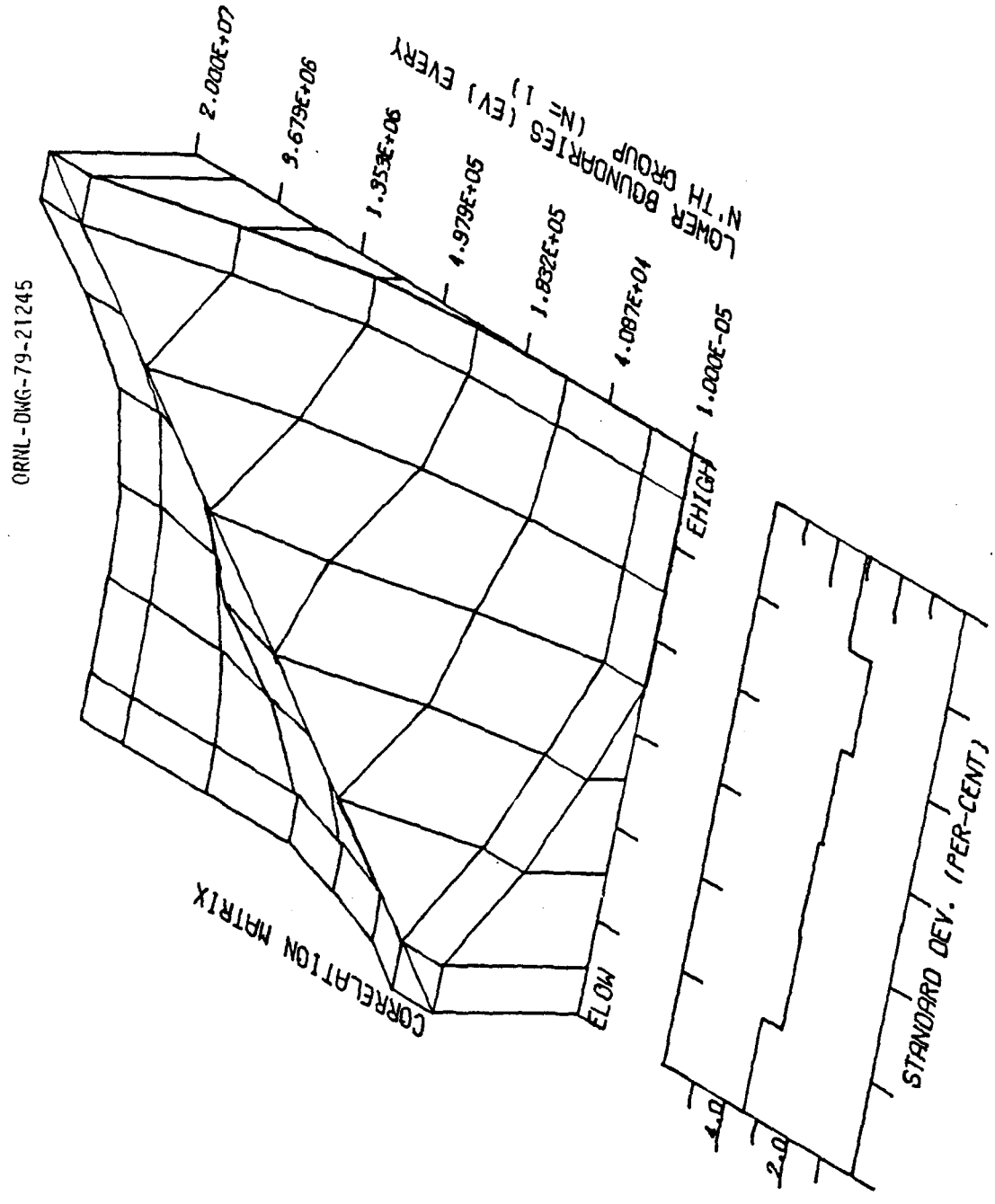


Fig. 2. Standard Deviation and Correlation Matrix of the $^{239}Pu(n,f)$ Cross Sections -- ENDF/B-IV

CHAPTER VI

RESULTS

One of the most illustrative ways of demonstrating the results of PUFF-II is by plotting the correlation matrices. These plots are produced by inputting the COVERX file into a program called PLTCOR, which was developed by Francis Perey and Jim Drischler. In these plots, the energy boundaries of the reaction (or reactions) of interest form the "X and Y" dimensions and the correlation coefficiencies are plotted in the "Z" direction. Also produced on the plots are the relative standard deviations for a correlation matrix of a specific material and reaction relative to itself (i.e., not for a cross material or cross reaction).

An illustration of this plotting and of the 52 group covariance matrix library[16] produced by PUFF-II is shown in Fig. 3. Fig. 3 is a correlation matrix plot for B-10 (MAT number 1305) (n,α) reaction (MT number 107). Note that it is fully correlated from 1.000×10^{-5} ev to about 6.738×10^{4} ev. From 6.738×10^{4} to about 1.353×10^{6} ev the off-diagonal elements are between 0 and 1. From $\sim 1.353 \times 10^{6}$ ev to higher energies, the uncertainty in the B-10 (n,α) reaction is zero in ENDF/B-V uncertainty file 33. Since, in ENDF/B-V, the B-10 (n,α) cross section is given over the full energy range (1.0×10^{-5} ev to 2.0×10^{7}ev) and is non-zero,[18] it is highly unlikely that there is no uncertainty in the cross section above 1.353×10^{6}ev. In other words, the covariance of B-10 (n,α) is incomplete, either because the uncertainty in this high ev region is difficult to determine or the evaluator was unsure of how to express the uncertainty.

Also note that the relative standard deviation indicates that the

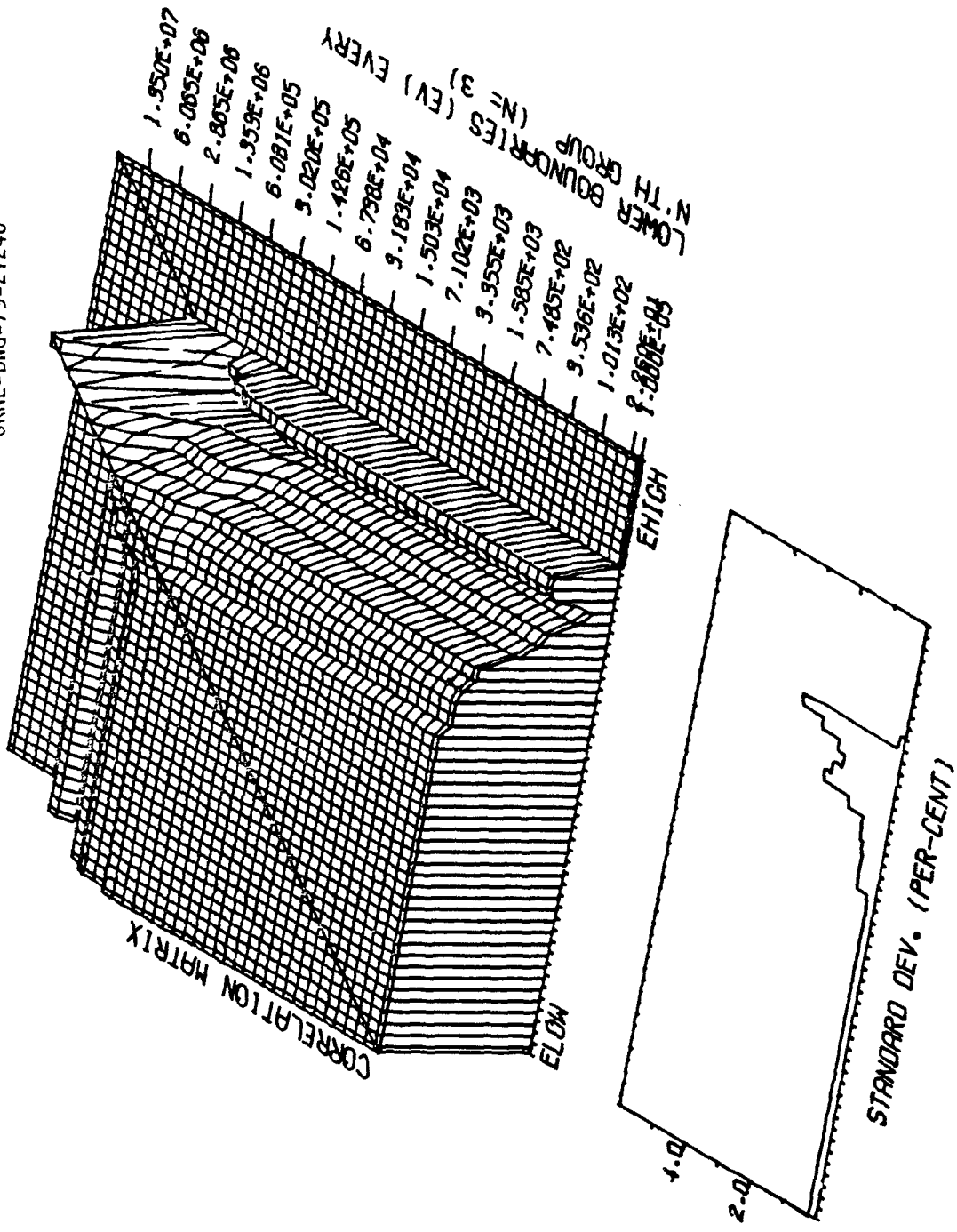


Fig. 3. Standard Deviation and Correlation Matrix of the $^{10}B(n,\alpha)$ Cross Section

cross section is fairly well known (less than 1% uncertainty) from 1.0×10^{-5}ev to about 6.738×10^{4}ev and is known to within 4% (relative standard deviation) for energies greater than 6.738×10^{4}ev but less than 1.353×10^{6}ev.

Figs. 4 and 5 represent the correlation matrix for Fe-56 (MAT number 1326) capture cross section (MT number 102) with and without the resolved resonance uncertainty data, respectively. As can be seen, the addition of the resolved resonance uncertainty increases the relative standard deviation in the resolved resonance uncertainty increases the relative standard deviation in the resolved resonance region. This also causes the off-diagonal elements not to be fully correlated (see equation 5.2). Also note that the relative standard deviation is off the chart in the Mev region. This merely indicates a relative standard deviation greater than 30%.

Fig. 6 is an illustration of a reaction which has been partially derived from ratio measurements; in particular, the capture covariance of U-238 (MAT number 1398). The U-238 capture cross section is derived via ratio measurements from B-10 (n,α) in the energy range of 4.0×10^{3}ev to 2.0×10^{4}ev. Also note the blank area of the U-238 capture covariance. In this case the uncertainty has been set to zero in the ENDF/B-V uncertainty file and referenced as to where this missing data may be found.[19]

Fig. 7 illustrates the correlation between U-238 capture (rows) and B-10 (n,α) (columns). Note here that while the U-238 capture uncertainty is for a fixed energy interval (4.0×10^{3}ev to 2.0×10^{4}ev), the uncertainty in B-10 (n,α) is for the entire energy range (1.0×10^{-5}ev to 1.964×10^{7}ev).

Figs. 8 and 9 illustrate two $\bar{\nu}$ relationships. Fig. 8 is the correlation matrix for U-238 prompt $\bar{\nu}$ (MT number 456). Fig. 9 is the correlation matrix between U-238 prompt $\bar{\nu}$ and Pu-240 (MAT number 1380) $\bar{\nu}$ (MT number 452). This is an explicit cross material relationship given in ENDF/B-V.

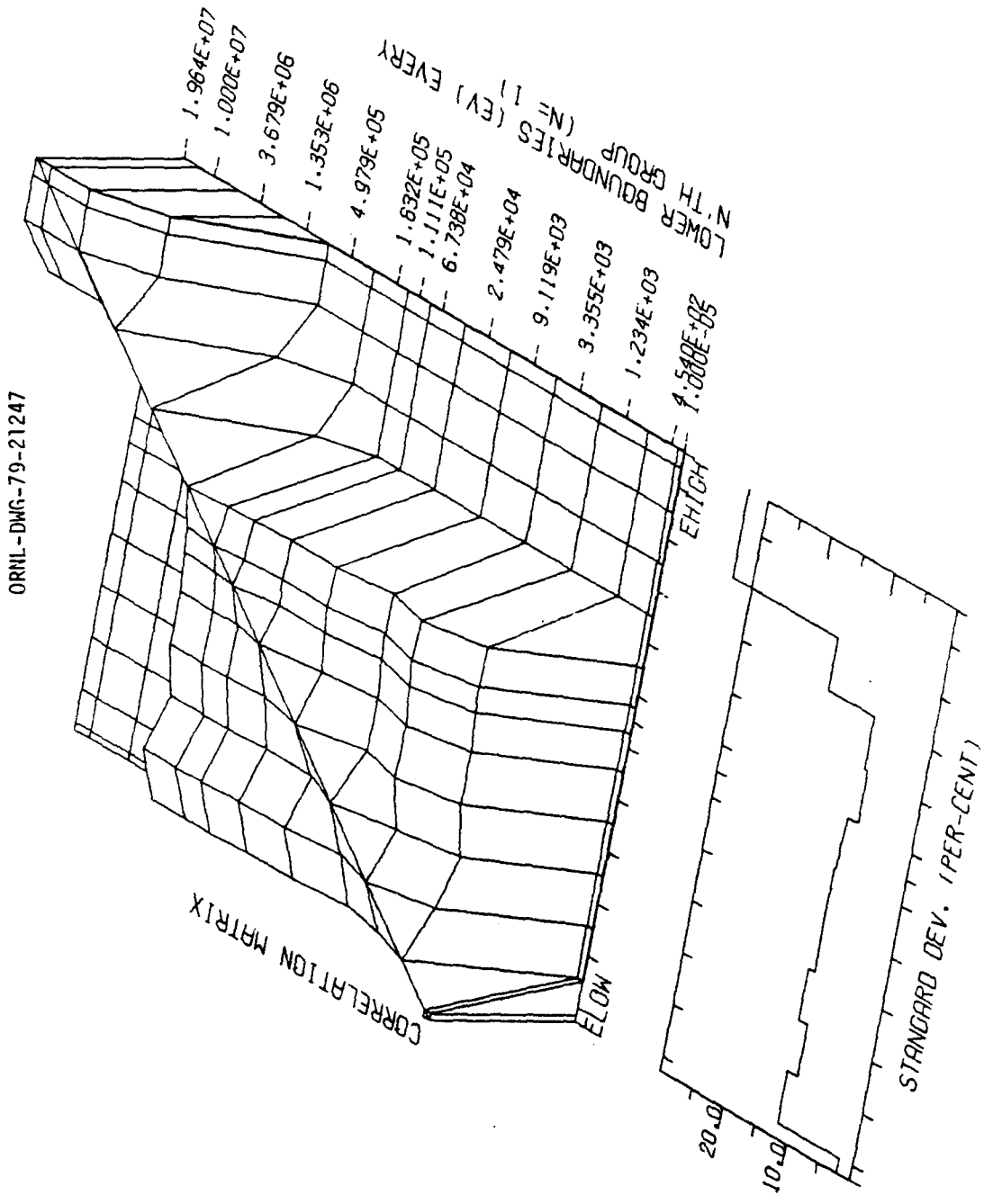


Fig. 4. Standard Deviation and Correlation Matrix of the $^{56}Fe(n,\gamma)$ Cross Section with Resonance Data

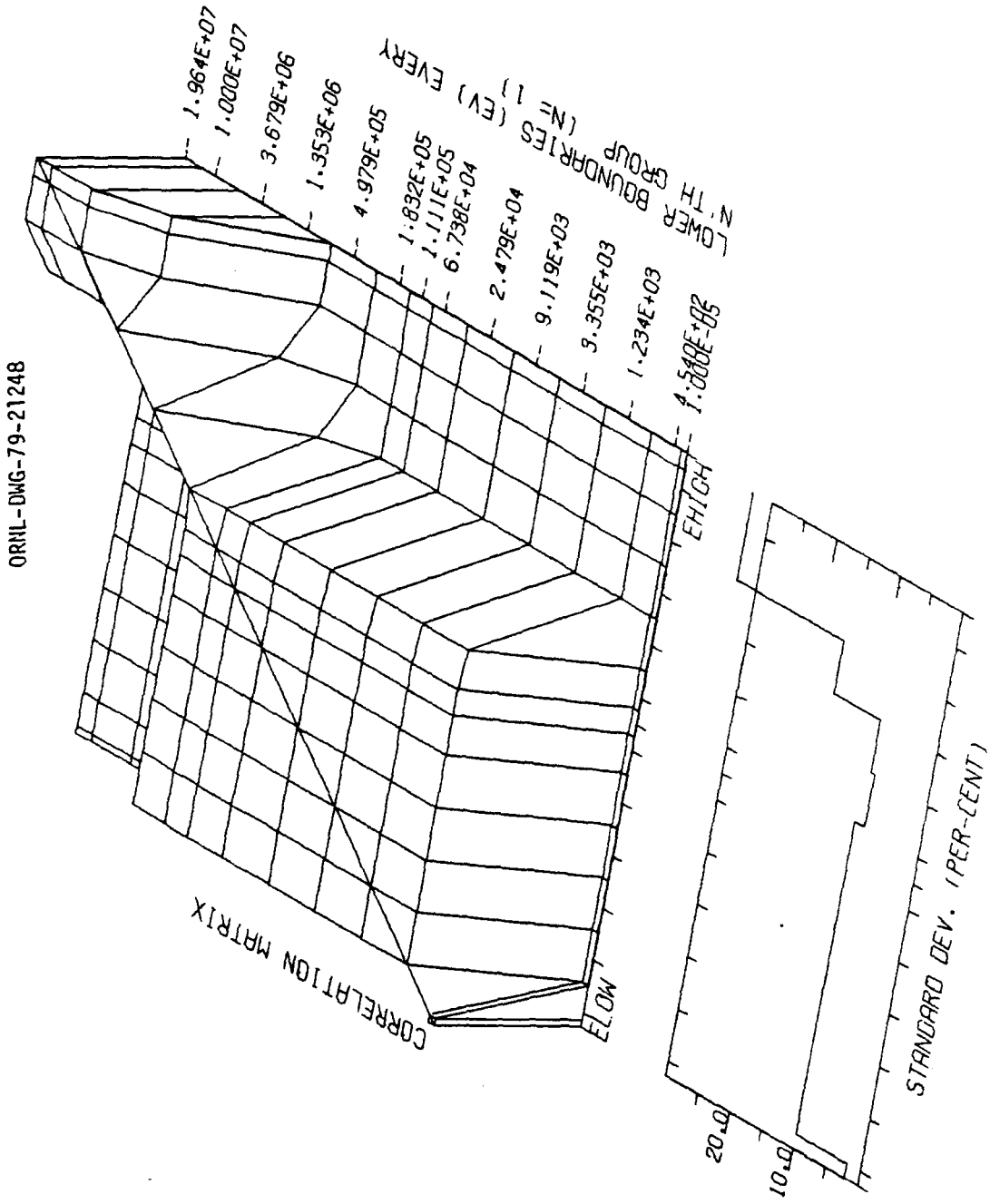


Fig. 5. Standard Deviation and Correlation Matrix of the $^{56}Fe(n,\gamma)$ Cross Section without Resonance Data

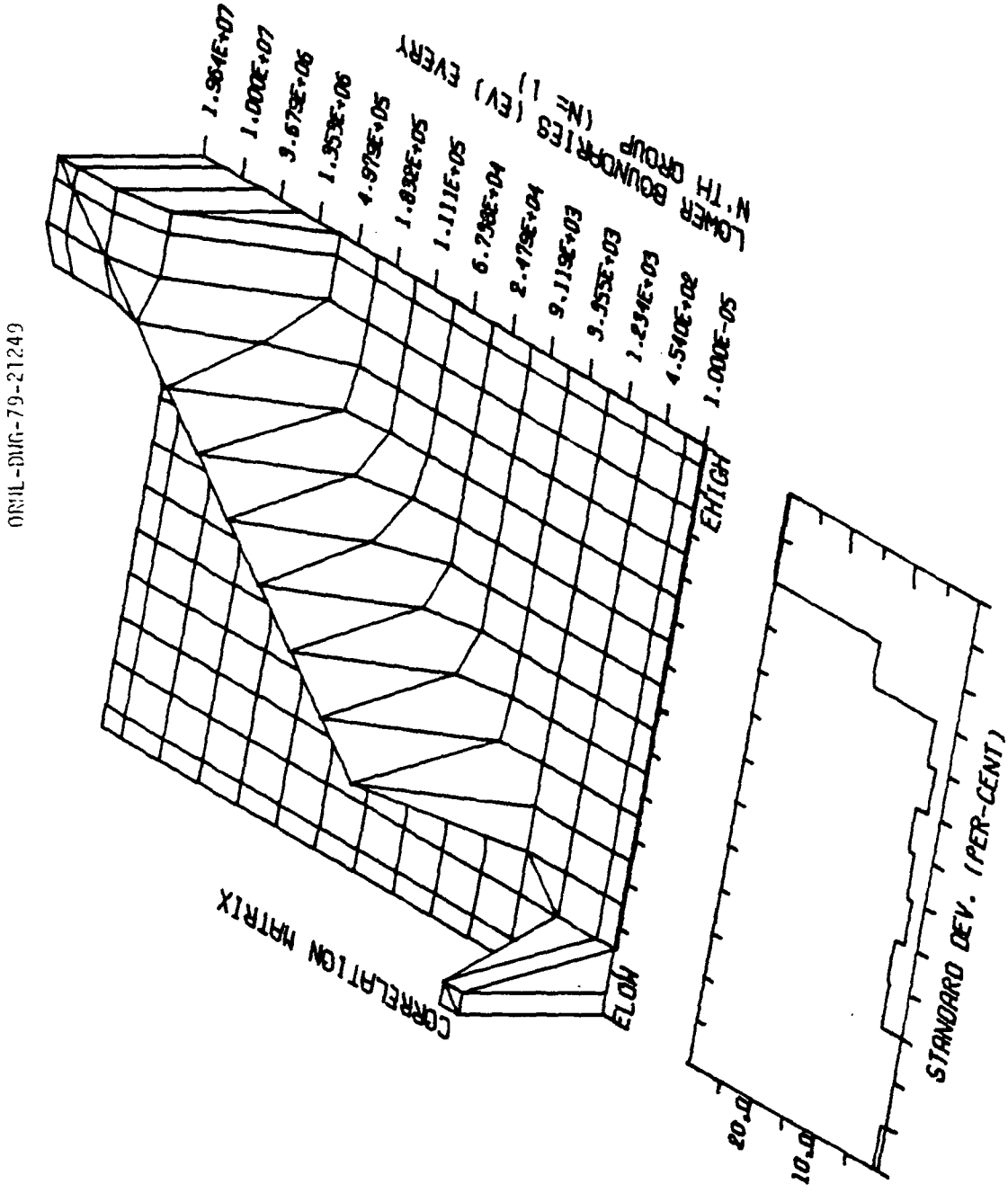


Fig. 6. Standard Deviation and Correlation Matrix of the $^{238}U(n,\gamma)$ Cross Section

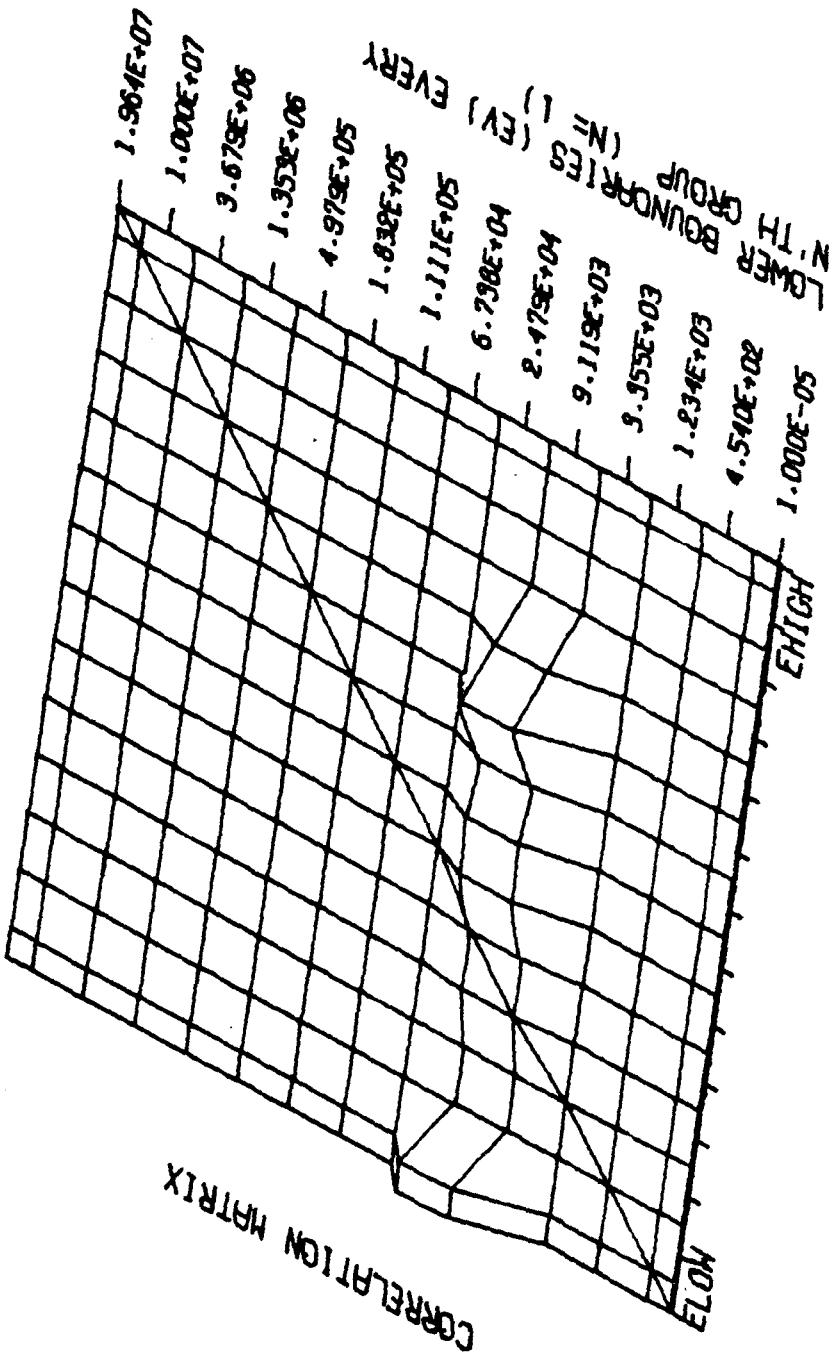


Fig. 7. Correlation Matrix Between $^{238}U(n,\gamma)$ and $^{10}B(n,\alpha)$ Cross Sections (row = $^{238}U(n,\gamma)$)

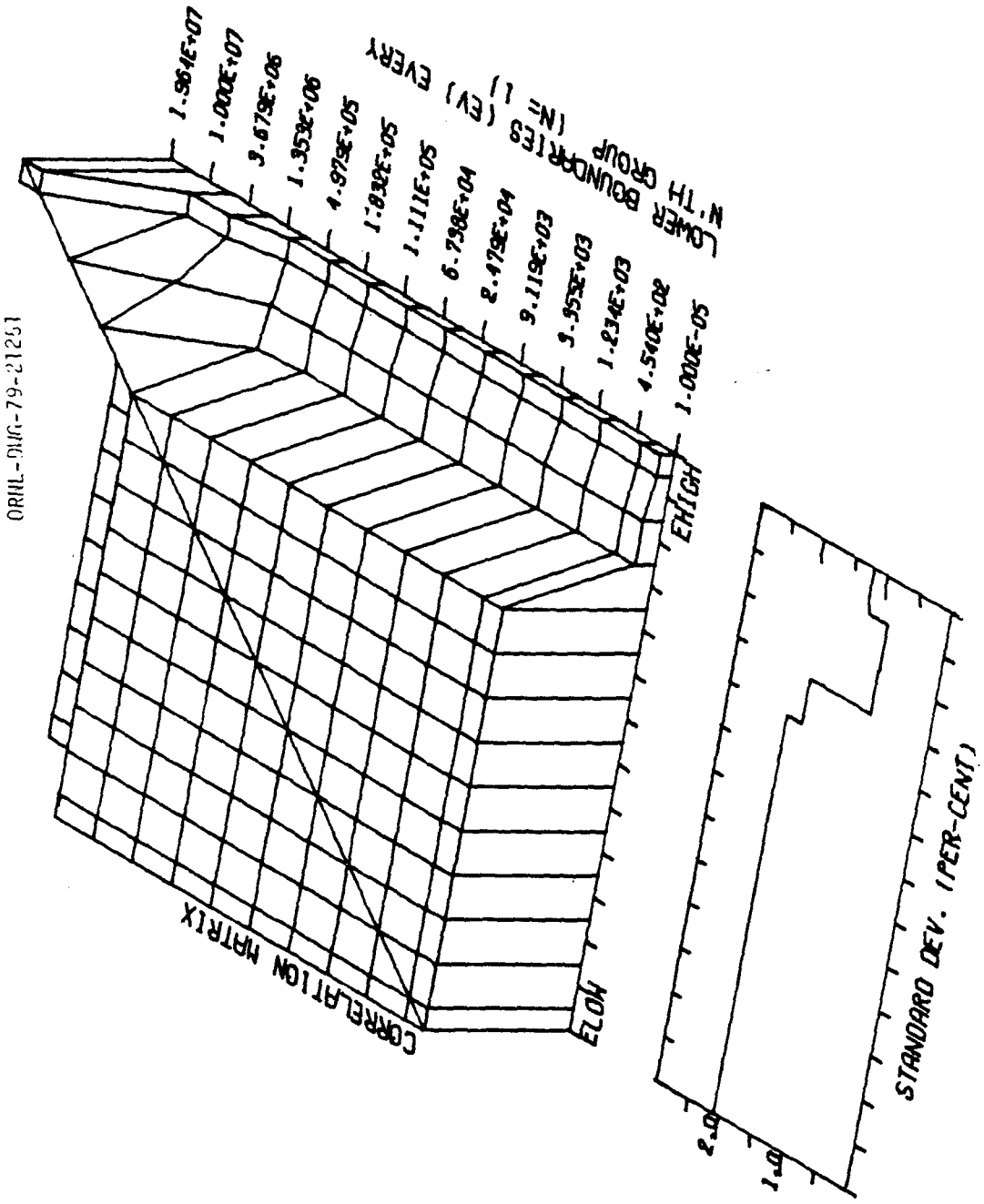


Fig. 8. Standard Deviation and Correlation Matrix of the ^{238}U prompt $\bar{\nu}$

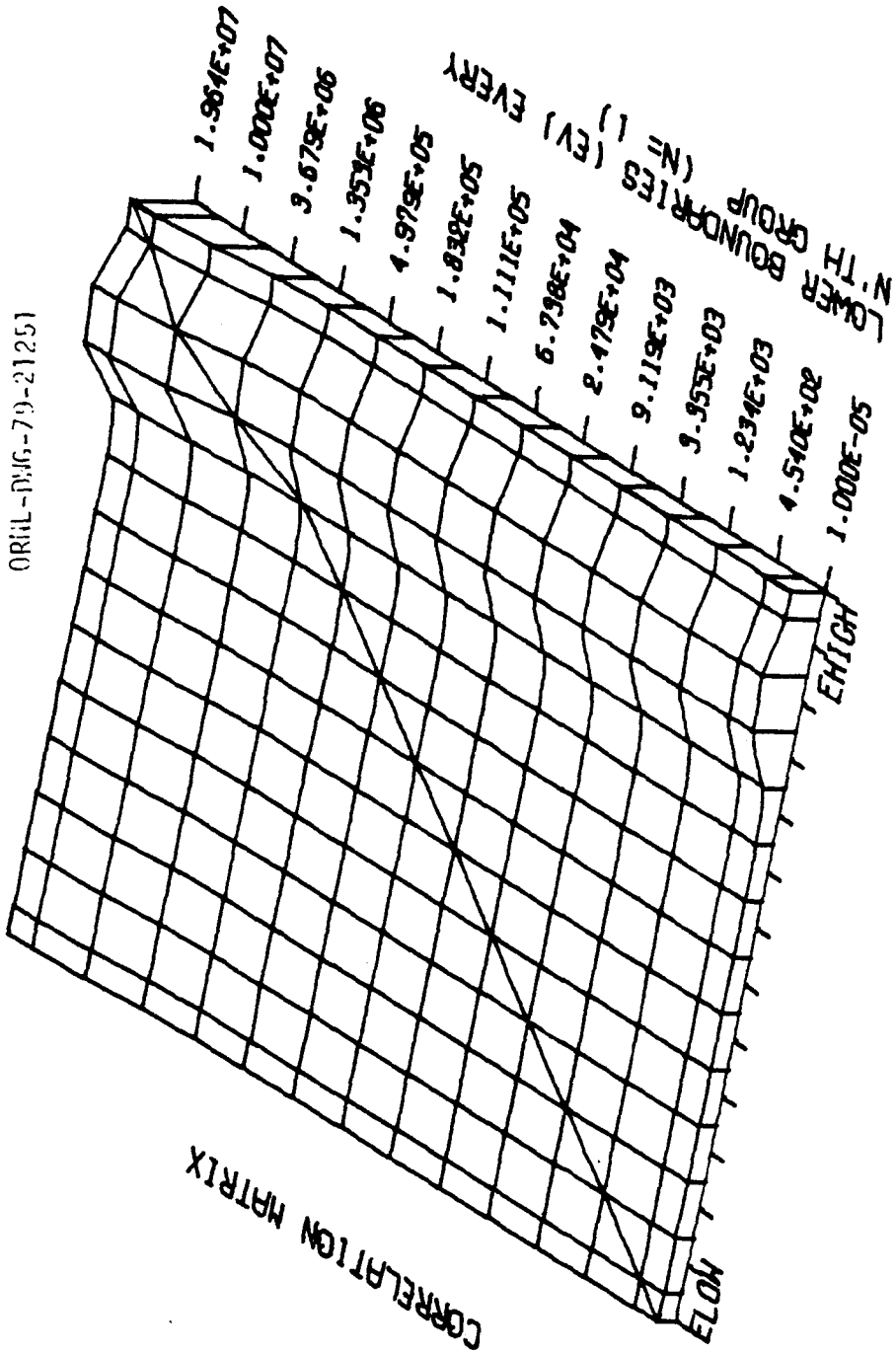


Fig. 9. Correlation Matrix Between ^{238}U prompt $\bar{\nu}$ and ^{240}Pu $\bar{\nu}$ (row = $^{238}U(\bar{\nu})$)

As a demonstration of the use of these covariance matrices, the 52 group covariance library was collapsed to 26 groups[16,20] and folded with sensitivity data[9] produced from ENDF/B-V cross sections to produce an uncertainty in K_{eff} for an experimental reactor (ZPR 6/7)[7]. The calculated K_{eff} is .985 with a standard deviation of 1.574%. The experimental value for K_{eff} is 1.0 with a standard deviation of .1%. Thus it is seen that the standard deviation of the calculated value due to uncertainties in cross sections can account for the entire discrepancy between the calculated and experimental value.

The results presented above from the PUFF-II code were obtained on a PDP-10 timesharing system requiring approximately 50K of core. Typical time requirements in cpu ranged from ∿1 minute for a single 52 group covariance matrix to ∿3 hours for a multiple 52 group covariance matrices. The coding language is FORTRAN IV.

CHAPTER VII

CONCLUSIONS AND RECOMMENDATIONS

PUFF-II is a stand alone module capable of processing all types of uncertainty data currently present in ENDF/B-V (i.e., files 31 through 33). Specifically, processing capabilities have been added for new uncertainty relationships, explicit cross reaction and cross material relationships, and derived uncertainties. Capabilities for processing uncertainties in $\bar{\nu}$ and in the resolved resonance parameters (for infinitely dilute system only) have also been included. A final important accomplishment of this work has been to separate the uncertainty processing from the cross section processing to provide for a modular code system and reduce computing costs. The actual processing time and core requirement has been kept to a minimum by minimizing the size of the energy grid on which the covariance matrices must first be processed.

The only current limitation of the code involves the treatment of uncertainties in resolved resonance data. Specifically, the code will process only infinitely dilute resonance data.

The code has been evaluated by hand calculations and by comparison to ENDF/B-IV results for reasonableness. Results of the evaluation indicate that the code works correctly.

It should be pointed out that a problem may result from the use of the multigroup covariance matrices produced by PUFF-II. In particular, a cross section may be present for each of the user energy groups while the standard deviation determined from the uncertainty data may be zero. This problem occurs in one of three instances: 1.) The uncertainty data is incomplete;

2.) The multigroup cross section is produced in an energy structure in which one group includes the threshold energy boundary of the reaction and a user group is specified such that its upper boundary is smaller than the threshold energy and is contained within the boundaries of the larger group; or 3.) There is not a resonance energy present for one or more of the user energy groups and no uncertainty is given for the smooth cross sections in file 33 for this energy range or ranges.

Thus, the following recommendations are made regarding future work: 1.) A more detailed analysis should be given to the resolved resonance data uncertainties; specifically, a multi-level Breit-Wigner formalism should be programmed assuming future data uses this form and a treatment should be given for the uncertainties in the Bordorenko f-factors in conjunction with the resonance cross section; and 2.) The problem described above regarding the use of the multigroup covariances should be solved by writing a subroutine in the COVERX service module[21] to eliminate discrepancies between cross sections and uncertainties.

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APPENDIX A

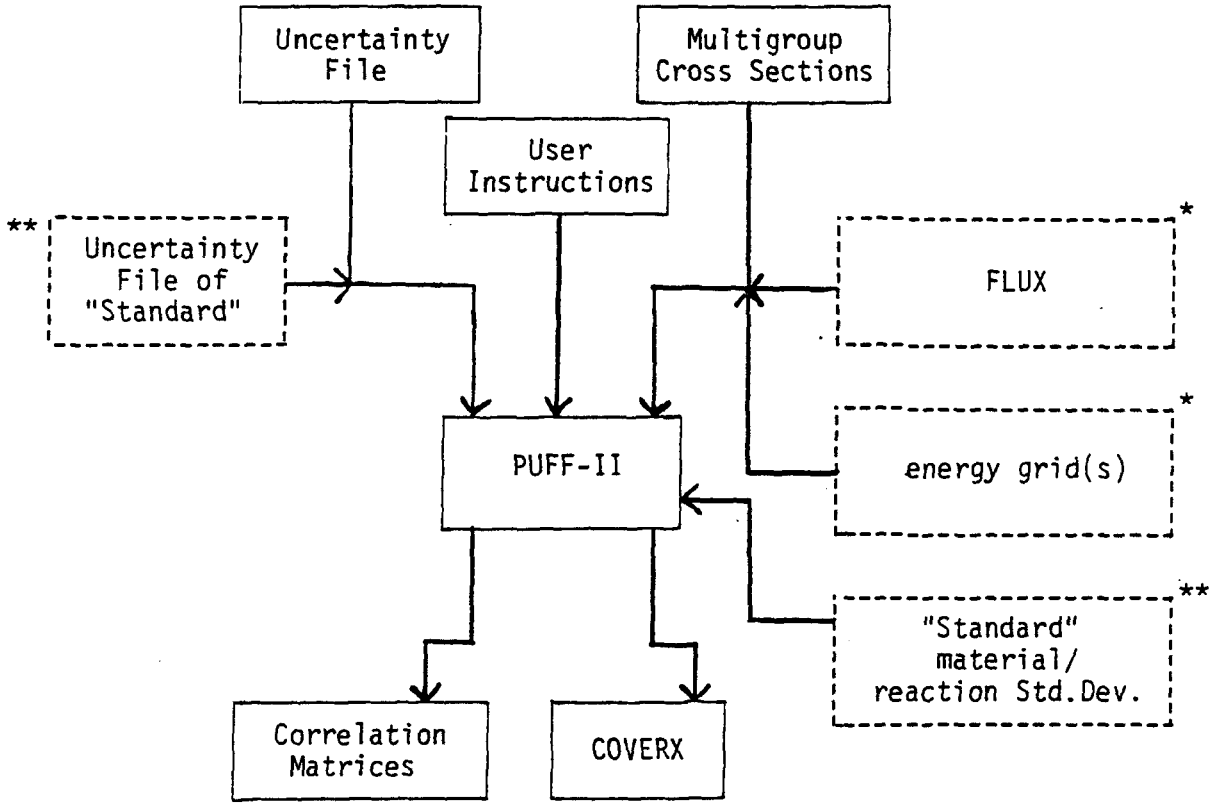
USER'S MANUAL FOR PUFF-II ON THE PDP-10

PUFF-II was written to process ENDF/B-V uncertainty files into multigroup covariance matrices. The multigroup covariance matrices are formed according to the procedures outlined in the body of this report.

Three basic types of input are required by PUFF-II; the ENDF/B-V uncertainty data, the multigroup cross sections, and the user instructions. The ENDF/B-V data may be obtained from the Radiation Shielding Information Center (RSIC) at ORNL and from many other locations. This data may be reduced to just the desired input results by RIGEL.[22] Multigroup cross sections are read in from a file containing cross sections punched by PAL[22] with the fixed format option. An option allowing for the reading of cross sections libraries in AMPX[22] master interface formats is also incorporated into PUFF-II; however, this is not considered practical while on the PDP-10 and will not be described. The user input instructions, as described below, are dependent upon the material to be processed.

Two basic types of output are also supplied by PUFF-II. The first, which may be used to check the results is a printout consisting of the user group structure, cross sections, standard deviations, and correlation matrices for each reaction(s) for which cross sections and uncertainties have been supplied. The second type of output is the COVERX formatted files. This data contains relative covariance matrices and is useful for sensitivity investigations in the FORSS system. The basic inputs and outputs are illustrated in Fig. A-1.

This description of how to use PUFF-II will be based on a batch



*Dashed lines indicate that the input is optional

**This input is needed only for cross material processing

Fig. A-1. Input and Output of PUFF-II

processing mode for the PDP-10. Batch processing is performed by creating a file consisting of the responses one would normally type in directly and then submitting this file to the queue. Also, for this time-sharing system certain liberties have been taken which are not currently possible on a non-interacting system.

The ENDF/B-V uncertainty file data is read in subroutine DELTA (see Fig. A-2) and is converted to binary with appropriate flags for subsequent processing. The input file is defined explicitly by an open statement in DELTA for unit IØ32 (IØ32=60). If the material to be processed has a reaction which is derived via ratio measurements to a referenced material's reaction, the reference material's reaction must be in a separate file in the user's area. This file is also defined explicitly by an open statement in DELTA for unit 19.

The energy grids are handled by subroutine RUSEGY. RUSEGY first forms the user grid. The user grid is formed in one of two ways. The user grid may be selected as one of nine grids stored in RUSEGY or may be read in from a separate file. If read in, the file is explicitly defined by an open statement in RUSEGY for unit 20. The energy grid may be either low to high or high to low energy in a 6E12.5 format. RUSEGY then continues to form the super-user grid and/or supergrid as flagged by the binary uncertainty file. Next, the cross section grid is formed. The cross section grid may again be chosen as one of nine optional grids or may be read in from a separate file as described above. If both the user grid and cross section grid are to be read in, then the user grid should be "stacked" on top of the cross section grid.

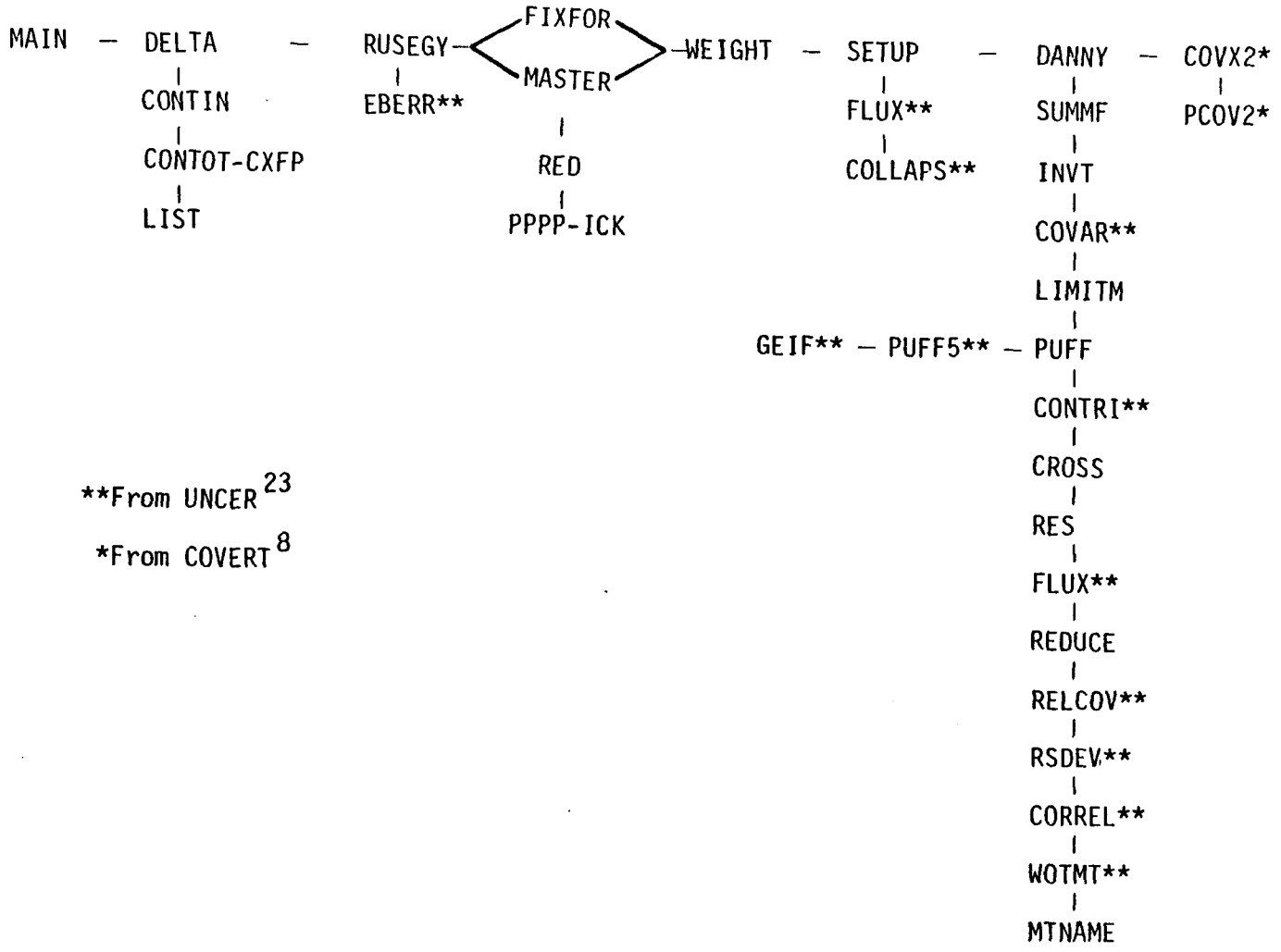


Fig. A-2. Flow Chart for PUFF-II

The multigroup cross sections are read in by subroutine FIXFOR. Here again the cross section file is defined explicitly by an open statement in FIXFOR for unit 10.

The flux may be read in and/or produced in subroutine WEIGHT. If read in, the file is defined explicitly by an open statement in WEIGHT for unit 50 and is given in a 6E12.5 format. Other options are explained below.

Two other input files may be required. The first is involved with cross material processing. If correlations exist between reactions of different materials, then the standard or reference material must be processed first and its standard deviation saved on unit 16. This file is then defined explicitly in subroutine DANNY by an open statement for unit 17. Note that the user grid must be the same for both the reference material processing and the material desired.

The second file is associated with resonance data uncertainty processing. If resonance data uncertainty processing is to take place, the file containing the data must be defined explicitly in subroutine RES for unit IØ32. Note that this is the same unit and usually the same file as that which was defined explicitly in subroutine DELTA.

The first of the output units containing the correlation matrices is unit IØ6 (IØ6=6). This unit is the line printer unit and creates a file named Q??.LPT for each run, where ? represents a letter or interger variable.

The second type of output is for the COVERX file. Both a card image and a binary file are created in COVERX format on units 26 and 27 respectively.

The user instructions depend upon the desired results and the type material to be processed. The first response is to give the number of

groups in the user group structure and the weighting option desired where the numerical response and the options are shown below as

1 : 1/E,

2 : $1/(E\ \sigma_T)$,

3 : input weighting/E,

or

4 : input weighting,

where E is the energy points associated with the cross sections and σ_T is the total corss section. The second response is the option to read an AMPX master library or not where 0=No and 1=Yes. The third response is to give the number of energy-groups associated with the cross sections. The fourth response is the option to read either file 31 or 33, where 0=file 33 and 1= file 31. The fifth response is the option to process file 32, where 0=No and 1=Yes. The sixth response is to give the MAT number of the material to be processed. The seventh response is to give the optional user energy grid desired where the numerical response and the associated energy grid is given as

1 : input grid,

2 : 240 group structure,

3 : GAM2 (99 groups),

4 : SAND2 (620 groups),

5 : LASL (30 groups),

6 : GAM1 (68 groups),

7 : Vitamin-C (171 groups),

8 : 26 groups (ORNL-TM 5517),

9 : 100 groups (GE Library),

and

10 : 6 groups (ENDF/B-IV cross section covariances)

where the actual group structures may be found in subroutine RUSEGY. The eighth response is to give the cross section energy grid where the options are the same as described above for the user grid. The ninth response is to tell the number of reactions to be read in from the cross section file. The tenth response is to give a title to the COVERX file (limited to 72 characters) and the final response is to give the weighting option used so that, when the COVERX file is formed, there is some reference to the weighting used in its production.

As an illustration of the user instructions and of a sample problem the following batch file is shown:

```
EX PUFF2.FOR
*6 4
*Ø
*1ØØ
*Ø
*Ø
*1399
*1Ø
*9
*3
*PU-239 WITH CROSS MATERIAL
*4
```

where it is seen that a six group user structure is desired using 100 group cross sections and a flux which is read in and that the material to be processed is Pu-239 (MAT#1399). Pu-239 is known from the uncertainty file to have a cross material relationship to U-235 so a set up run for U-235 was produced first.

For each run executed in the batch system a log is kept of the transactions between the batch file and the computer system. This log is created under the same file name as the batch file with an extension of .LOG. The log file for this sample problem is shown on the following page.

```
 TY BATCH.LOG

13:39:48 BAJOB  BATCON VERSION 13(1071)-2 RUNNING BATCH SEQUENCE 3585 IN
 STREAM 2
13:39:48 BAFIL  INPUT FROM OREL0:BATCH.[104,1134]
13:39:48 BAFIL  OUTPUT TO  OREL0:BATCH.LOG[104,1134]
13:39:48 BASUM  JOB PARAMETERS
                TIME:01:00:00   UNIQUE:YES      RESTART:NO

13:39:48 MONTR
13:39:48 MONTR  .LOGIN 104,1134 /CHARGE:18075 /SPOOL:ALL/TIME:3600/NAME:
"JDS   6010"
13:39:49 USER   JOB 16 ORELA/602.3 TTY63
13:39:49 USER   [LGNJSP OTHER JOBS SAME PPN:13]
13:39:49 USER   CHARGE = 18075
13:39:49 USER   1339    30-OCT-79       TUE
13:39:51 MONTR
13:39:51 MONTR  .EX PUFF2.FOR
13:39:53 USER   LINK:   LOADING
13:40:24 USER   [LNKXCT PUFF2 EXECUTION]
13:40:24 USER    GIVE # OF GROUPS IN USER GROUP STRUCTURE AND AND TYPE O
F WEIGHTING SPECTRUM DESIRED, WHERE 1=1/E, 2=1/(E*SIGMA TOTAL), 3=1/E*IN
PUT,AND 4=INPUT.>*6 4
13:40:26 USER    SPECIFY OPTION TO READ MASTER LIBRARY (0=NO,1= YES).>*0
13:40:27 USER    GIVE # OF X-SEC GROUPS>*100
13:40:27 USER   READ FILE 31(NUBAR) OR FILE 33?(0=33;1=31)>*0
13:40:28 USER   PROCESS FILE 32 ?(0=NO;1=YES)>*0
13:40:28 USER    MAT # OF MATERIAL PROCESSING>*1399
13:40:46 USER   SPECIFY TYPE OF USER GRID STRUCTURE(I FORMAT), 1-ARBITRA
RY,2-240 GROUP,3-GAM2(99 GRPS),4-SAND2(620 GRPS), 5-LASL(30 GRPS),6-GAM1
(68 GRPS),7-171 GROUPS,8-26 GROUPS, 9-100 GROUPS,10- 6 GROUPS.>*10
13:40:53 USER   SPECIFY THE TYPE GROUP STRUCTURE THE CROSS SECTIONS ARE
ONE SAME OPTIONS AS FOR USER GRID).>*9
13:40:55 USER    GIVE # OF MT >*3
13:43:59 USER   TYPE IN FILE DESCRIPTION, 1 CARD FORMAT(12A6)
13:43:59 USER   >*PU-239 WITH CROSS MATERIAL
13:44:00 USER   TYPE IN NUMBER CORRESPONDING TO WEIGHTING FUNCTION (I5)
>*4
13:44:04 USER   STOP
13:44:05 USER
13:44:05 USER   END OF EXECUTION
13:44:05 USER   CPU TIME: 2:4.58         ELAPSED TIME: 3:40.33
13:44:06 MONTR  EXIT
13:44:06 MONTR
13:44:06 MONTR  .KJOB OREL0:BATCH.LOG=/W/B/Z:4/VR:10/VS:3585/VL:200/VP:1
0/VD:D
13:44:07 KJOB   OTHER JOBS SAME PPN
13:44:07 LGOUT  JOB 16, USER [104,1134]  LOGGED OFF TTY63     1344  30-OC
T-79
13:44:07 LGOUT  ANOTHER JOB STILL LOGGED IN UNDER [104,1134]
13:44:07 LGOUT  CPU  TIME =  2.22 MINUTES
13:44:07 LGOUT  CON  TIME =  0.07 HOURS
13:44:07 LGOUT  KILO CORE =  2.12 HOURS
13:44:07 LGOUT  JOB  COST =  5.30 DOLLARS
13:44:07 LGOUT  PRIME RATES
```

Tables A-1 through A-5 illustrates the output from PUFF-II which contains the standard deviations and correlation matrices. Table A-6 illustrates the COVERX formatted output file from PUFF-II.

The computer code PUFF-II has been checked by hand calculations and by comparison of results to previous ENDF/B-IV results for reasonableness. Running time varies and is dependent upon the order of the matrices and on the amount of correlations between reactions. For the sample problem which has been used for illustration thus far, a cpu time of two minutes and ∿four seconds was recorded on the PDP-10. The coding language is Fortran IV. The only limitation of PUFF-II, at the present, is the limited treatment given to the resonance data uncertainty.

Table A-1. Correlation Matrix and Standard Deviations for $^{239}Pu(n,f)$ to $^{235}U(n,f)$

MATERIAL 1= 1399, REACTION 1= 18 , MATERIAL 2= 1395, REACTION 2= 18

GROUP	E HIGH	E LOW	X-ION(1)	X-ION(2)	REL.S.D.(1)	REL.S.D.(2)
1	2.0000E+07	3.6790E+06	2.5270E+00	2.0500E+00	7.1807E-02	5.2079E-02
2	3.6790E+06	1.3530E+06	1.9055E+00	1.2550E+00	3.1328E-02	2.3702E-02
3	1.3530E+06	4.9790E+05	1.6996E+00	1.1749E+00	3.4220E-02	2.7380E-02
4	4.9790E+05	1.8320E+05	1.5423E+00	1.2700E+00	3.3301E-02	2.7812E-02
5	1.8320E+05	4.0870E+04	1.5770E+00	1.6328E+00	5.2803E-02	2.6331E-02
6	4.0870E+04	1.0000E-05	6.8942E+02	4.9976E+02	1.1159E-02	3.3689E-03

*** CORRELATION MATRIX ***
COLUMN=MATERIAL 1 ROW=MATERIAL 2

ROW \ COLUMN	1	2	3	4	5	6
1	141	135	9	0	0	0
2	35	756	389	186	0	0
3	3	367	797	581	0	0
4	0	173	576	784	0	0
5	0	32	150	356	0	0
6	0	0	0	0	0	0

Table A-2. Correlation Matrix and Standard Deviation for $^{239}Pu(n,f)$

MATERIAL 1= 1399, REACTION 1= 18 , MATERIAL 2= 1399, REACTION 2= 18

GROUP	E HIGH	E LOW	X-ION(1)	X-ION(2)	REL.S.D.(1)	REL.S.D.(2)
1	2.0000E+07	3.6790E+06	2.5270E+00	2.5270E+00	7.1807E-02	7.1807E-02
2	3.6790E+06	1.3530E+06	1.9055E+00	1.9055E+00	3.1328E-02	3.1328E-02
3	1.3530E+06	4.9790E+05	1.6996E+00	1.6996E+00	3.4220E-02	3.4220E-02
4	4.9790E+05	1.8320E+05	1.5423E+00	1.5423E+00	3.3301E-02	3.3301E-02
5	1.8320E+05	4.0870E+04	1.5770E+00	1.5770E+00	5.2803E-02	5.2803E-02
6	4.0870E+04	1.0000E-05	6.8942E+02	6.8942E+02	1.1159E-02	1.1159E-02

*** CORRELATION MATRIX ***

COLUMN=MATERIAL 1 ROW=MATERIAL 2

ROW \ COLUMN	1	2	3	4	5	6
1	1000	79	50	45	0	0
2	79	1000	674	491	0	0
3	50	674	1000	810	0	0
4	45	491	810	1000	123	0
5	0	0	0	123	1000	0
6	0	0	0	0	0	1000

Table A-3. Correlation Matrix and Standard Deviations for $^{239}Pu(n,\gamma)$ to $^{235}U(n,f)$

MATERIAL 1= 1399, REACTION 1= 102 , MATERIAL 2= 1395, REACTION 2= 18

GROUP	E HIGH	E LOW	X-ION(1)	X-ION(2)	REL.S.D.(1)	REL.S.D.(2)
1	2.0000E+07	3.6790E+06	2.4085E-03	2.0500E+00	3.0843E-01	5.2079E-02
2	3.6790E+06	1.3530E+06	7.3689E-03	1.2550E+00	3.0156E-01	2.3702E-02
3	1.3530E+06	4.9790E+05	5.0417E-02	1.1749E+00	1.8340E-01	2.7380E-02
4	4.9790E+05	1.8320E+05	1.6607E-01	1.2700E+00	2.0272E-01	2.7812E-02
5	1.8320E+05	4.0870E+04	3.1099E-01	1.6328E+00	2.0735E-01	2.6331E-02
6	4.0870E+04	1.0000E-05	2.7055E+02	4.9976E+02	3.2777E-02	3.3689E-03

*** CORRELATION MATRIX ***
COLUMN=MATERIAL 1 ROW=MATERIAL 2

ROW \ COLUMN	1	2	3	4	5	6
1	33	10	1	0	0	0
2	8	72	65	28	0	0
3	1	41	170	88	0	0
4	0	17	131	127	0	0
5	0	3	35	59	0	0
6	0	0	0	0	0	0

Table A-4. Correlation Matrix and Standard Deviation for $^{239}Pu(n,\gamma)$

MATERIAL 1= 1399, REACTION 1= 102 , MATERIAL 2= 1399, REACTION 2= 102

GROUP	E HIGH	E LOW	X-ION(1)	X-ION(2)	REL.S.D.(1)	REL.S.D.(2)
1	2.0000E+07	3.6790E+06	2.4085E-03	2.4085E-03	3.0843E-01	3.0843E-01
2	3.6790E+06	1.3530E+06	7.3689E-03	7.3689E-03	3.0156E-01	3.0156E-01
3	1.3530E+06	4.9790E+05	5.0417E-02	5.0417E-02	1.8340E-01	1.8340E-01
4	4.9790E+05	1.8320E+05	1.6607E-01	1.6607E-01	2.0272E-01	2.0272E-01
5	1.8320E+05	4.0870E+04	3.1099E-01	3.1099E-01	2.0735E-01	2.0735E-01
6	4.0870E+04	1.0000E-05	2.7055E+02	2.7055E+02	3.2777E-02	3.2777E-02

*** CORRELATION MATRIX ***

COLUMN=MATERIAL 1 ROW=MATERIAL 2

ROW \ COLUMN	1	2	3	4	5	6
1	1000	969	196	2	0	0
2	969	1000	211	8	0	0
3	196	211	1000	972	924	0
4	2	8	972	1000	956	0
5	0	0	924	956	1000	0
6	0	0	0	0	0	1000

Table A-5. Correlation Matrix and Standard Deviations for $^{239}Pu(n,f)$ to $^{239}Pu(n,\gamma)$

MATERIAL 1 = 1399, REACTION 1= 18 , MATERIAL 2= 1399, REACTION 2= 102

GROUP	E HIGH	E LOW	X-ION(1)	X-ION(2)	REL.S.D.(1)	REL.S.D.(2)
1	2.0000E+07	3.6790E+06	2.5270E+00	2.4085E-03	7.1807E-02	3.0843E-01
2	3.6790E+06	1.3530E+06	1.9055E+00	7.3689E-03	3.1328E-02	3.0156E-01
3	1.3530E+06	4.9790E+05	1.6996E+00	5.0417E-02	3.4220E-02	1.8340E-01
4	4.9790E+05	1.8320E+05	1.5423E+00	1.6607E-01	3.3301E-02	2.0272E-01
5	1.8320E+05	4.0870E+04	1.5770E+00	3.1099E-01	5.2803E-02	2.0735E-01
6	4.0870E+04	1.0000E-05	6.8942E+02	2.7055E+02	1.1159E-02	3.2777E-02

*** CORRELATION MATRIX ***
COLUMN=MATERIAL 1 ROW=MATERIAL 2

ROW \ COLUMN	1	2	3	4	5	6
1	232	19	12	11	0	0
2	7	99	73	51	0	0
3	9	119	204	171	0	0
4	7	78	126	163	25	0
5	0	0	0	23	258	0
6	0	0	0	0	0	-375

PUFF PROCESSING COMPLETED

Table A-6. Sample COVERX file

```
0V COVERX COVERX.ORNL - FORSS.      1
1D      6      6      0      2      2      5      5
2D *PU-239 WITH CROSS MATERIAL                    *
3D   0.2000E+08  0.3679E+07  0.1353E+07  0.4979E+06  0.1832E+06
  4.0870E+04  1.0000E-05
5D   1399     18      4   1399    102      4
6D   0.2527E+01  0.1905E+01  0.1700E+01  0.1542E+01  0.1577E+01
  6.8943E+02  7.1807E-02  3.1328E-02  3.4220E-02  3.3301E-02  5.2803E-02
  1.1159E-02
6D   0.2409E-02  0.7369E-02  0.5042E-01  0.1661E+00  0.3110E+00
  2.7055E+02  3.0844E-01  3.0156E-01  1.8340E-01  2.0272E-01  2.0735E-01
  3.2777E-02
7D   1399     18   1395     18      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.5256E-03  0.5994E-04  0.5904E-05  0.3307E-06  0.3658E-07
  0.0000E-01  2.2059E-04  5.6112E-04  3.1519E-04  1.5050E-04  2.6206E-05
  0.0000E-01  1.5923E-05  3.1589E-04  7.4648E-04  5.4840E-04  1.3548E-04
  0.0000E-01  2.7077E-07  1.4659E-04  5.2944E-04  7.2653E-04  3.1184E-04
  5.0867E-11  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01
  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01
  0.0000E-01
7D   1399     18   1399     18      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.5156E-02  0.1779E-03  0.1240E-03  0.1084E-03  0.0000E+00
  0.0000E-01  1.7792E-04  9.8144E-04  7.2275E-04  5.1274E-04  0.0000E-01
  0.0000E-01  1.2402E-04  7.2275E-04  1.1710E-03  9.2279E-04  0.0000E-01
  0.0000E-01  1.0839E-04  5.1274E-04  9.2279E-04  1.1090E-03  2.1610E-04
  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  2.1610E-04  2.7881E-03
  6.1044E-11  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  6.1044E-11
  1.2452E-04
7D   1399    102   1395     18      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.5305E-03  0.6019E-04  0.5826E-05  0.3551E-06  0.4393E-07
  0.0000E-01  1.5549E-04  5.1331E-04  3.3768E-04  1.4556E-04  2.6384E-05
  0.0000E-01  6.4966E-06  2.8125E-04  8.5504E-04  6.6841E-04  1.6726E-04
  0.0000E-01  2.3163E-07  1.3554E-04  4.9092E-04  7.1516E-04  3.1742E-04
  5.4195E-11  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01
  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01
  0.0000E-01
7D   1399    102   1399    102      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.9513E-01  0.9016E-01  0.1108E-01  0.1068E-03  0.0000E+00
  0.0000E-01  9.0162E-02  9.0936E-02  1.1649E-02  4.8904E-04  0.0000E-01
  0.0000E-01  1.1077E-02  1.1649E-02  3.3637E-02  3.6122E-02  3.5131E-02
  1.4304E-09  1.0677E-04  4.8904E-04  3.6122E-02  4.1097E-02  4.0196E-02
  1.6287E-09  0.0000E-01  0.0000E-01  3.5131E-02  4.0196E-02  4.2993E-02
  1.6808E-09  0.0000E-01  0.0000E-01  1.4304E-09  1.6287E-09  1.6808E-09
  1.0743E-03
7D   1399     18   1399    102      1
8D      6      1      6      2      6      3      6      4      6      5      6
      6      6
9D   0.5144E-02  0.1616E-03  0.1208E-03  0.1060E-03  0.0000E+00
  0.0000E-01  1.7896E-04  9.3385E-04  6.8386E-04  4.9390E-04  0.0000E-01
  0.0000E-01  1.2473E-04  7.4912E-04  1.2815E-03  8.7607E-04  0.0000E-01
  0.0000E-01  1.0913E-04  5.0818E-04  1.0461E-03  1.1000E-03  1.5933E-04
  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  2.6594E-04  2.8283E-03
  4.4394E-11  0.0000E-01  0.0000E-01  0.0000E-01  0.0000E-01  7.1726E-11
 -1.3718E-04
```