

**EUR 3296.e**

EUROPEAN ATOMIC ENERGY COMMUNITY - EURATOM

**PROCOPE**  
**A CODE TO EVALUATE COLLISION**  
**PROBABILITIES IN PIN CLUSTERS AND**  
**INFINITE ROD LATTICES**

by

C. DAOLIO

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1967



**Joint Nuclear Research Center**  
**Ispra Establishment - Italy**

**Reactor Physics Department**  
**Reactor Theory and Analysis**

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## CONTENTS

	Page
I. GENERAL DESCRIPTION . . . . .	3
II. CODE LANGUAGE . . . . .	4
III. INPUT DATA . . . . .	4
IV. LIMITATIONS . . . . .	9
V. EXECUTION TIME . . . . .	9
VI. COMPOSITION OF PROGRAMME DECK . . . . .	10
VII. OUTPUT . . . . .	12
VIII. FLOW CHART . . . . .	13
IX. PROGRAMME LISTING . . . . .	16
X. EXAMPLE OF INPUT . . . . .	85
XI. EXAMPLE OF OUTPUT . . . . .	86
XII. REFERENCE . . . . .	100

### SUMMARY

The computer code PROCOPE, written in Fortran II for the IBM 7090, evaluates directional collision probabilities (normal and reduced) in pin clusters or infinite rod lattices. The theory has been extensively described in EUR 2751.e.

## I. GENERAL DESCRIPTION

PROCOPE may be used for fuel clusters of any geometrical configuration, provided the number of pins does not exceed 61, and for square or triangular lattices. In order to restrict, as far as possible, the quantity of input data - such as coordinates of pin centres referred to the centre of the cluster - several particular geometries, 4,7,12,19,31,37 pin clusters, have been directly incorporated in the code. For 19 and 37-rod clusters, two geometries, hexagonal and circular, are considered, as well as the case of  $D_c \neq D_{c2}$  (see Figs. 1-13).

The numerical designation of the fuel pencils (see Figs. 1-9) increases in a clockwise direction from the external annulus to the centre of the cluster. For the lattice, the system of numeration is shown in Figs. 12-13.

From inspection of the configurations given special treatment, it becomes immediately evident that not all possible combinations of two rodlets need be considered individually, since some degree of symmetry exists in every geometry included in the code. For this reason, provision was made for the construction of a matrix of groups of symmetry. To each combination of two rodlets a number is assigned which is repeated for every pair placed in a geometrically similar position. For instance, in the case of the 19-rod cluster in circular geometry it is obvious that the pair 2-6 is in exactly the same conditions as the pair 12-4, and therefore belongs to the same group of symmetry, as do the combinations 1-9, 8-12, etc. It now becomes a simple matter for the code to identify every separate group of symmetry and all calculations from this point on will be made only for pairs of rods placed in geometrically different positions (see example output).

For configurations not specifically included in the code (that is to say  $NC = 10, 11$  - see input data and Figs. 10, 11), the rodlet coordinates and the matrix of groups of symmetry cannot be calculated and constructed by the code and therefore must be supplied as input data.

In this case the rodlet coordinates and the matrix of symmetry will be printed as output. The matrix is entered row by row assigning number 1 to the group of symmetry of which rod pair 1-2 is a member, and proceeding in increasing order to the total number of groups, which must never exceed 300. In the matrix, the position corresponding to the rodlet paired with itself (e.g. 2-2, 25-25, etc.) are numbered 0 (zero) (see example output).

## II. CODE LANGUAGE

The code PROCOPE written in Fortran II, version 3, can be run on a normal IBM 7090 with a 32,000-word memory. It requires the use of eight magnetic tapes divided into two channels, following the Fortran-Monitor 7090 system.

## III. INPUT DATA

The input data for all the cases is as follows:

<u>Data No.</u>	<u>Card No.</u>	<u>Data</u>	<u>Symbol used in code</u>	<u>Description</u>	<u>Format</u>
1	1	Title	TITLE(I)	Any alpha-numerical information referring to the case being studied	xxx.....x
2	2	$N_c$	NC	Geometrical configuration number, that is: NC=1: cluster 4 fuel pencils 2: " 7 " " 3: " 12 " " 4: " 19 " " (hexagonal geometry) 5: " 19 " " (circular " ) 6: " 19 " " (circular " ) $D_c \neq D_{c2}$ : see Fig. 6) 7: " 31 " " 8: " 37 " " (hexagonal geometry) 9: " 37 " " (circular " ) 10: any configuration: identical fuel pencils 11: " " various " " 12: square lattice 13: triangular lattice	xxxxxx
3	2	$N_i$	NII	Number of Gaussian integration points (with 1 or 2 points the calculation is already accurate enough in most cases)	xxxxxx
4	2	$N_g$	NG	NG=1: cladding homogenized with fuel 2: " " " " coolant (or moderator)	xxxxxx
5	2	$N_p$	NP	NP=1: total and directional collision on probabilities will be calculated (normal and reduced) 2: total collision probabilities only calculation (normal and reduced)	
6	2	$N_{tc}$	NTC	NTC=1: accurate calculation of $P_{ij}$ 2: approximate " " " " $P_{ij}$	xxxxxx
7	2	$N_s$	NS	NS=1: uniform source distribution in fuel 2: non-uniform " " " "	xxxxxx
8	2	$N_b$	NB	Number of fuel pencils (to be supplied only if NC=10,11)	xxxxxx
9	3	$a_i$ (cm)	AP(I)	Radius of fuel pencil	x.xxxx <sup>†</sup> yb

<u>Data No.</u>	<u>Card No.</u>	<u>Data</u>	<u>Symbol used in code</u>	<u>Description</u>	<u>Format</u>
10	-	$d_i$ (cm)	D(I)	Cladding thickness	x.xxxx <sup>+</sup> y <sub>b</sub>
11	-	$r_1$ (cm)	R(1)	NC=1: distance between centre of the fuel pencils and centre of the cluster NC>1: centre-to-centre distance of neighbouring pencils	x.xxxx <sup>+</sup> y <sub>b</sub>
12	-	C (cm)	C	Radius of the cluster	x.xxxx <sup>+</sup> y <sub>b</sub>
13	-	$r_2$ (cm)	R(2)	NC=6 only: distance between centre of the fuel pencils in external ring and centre of the cluster	
14	-	$\Sigma_f$	SP(I)	Total fuel cross-section	x.xxxx <sup>+</sup> y <sub>b</sub>
15	-	$\Sigma_{cl}$	SCL(I)	Total cladding cross-section	x.xxxx <sup>+</sup> y <sub>b</sub>
16	-	$\Sigma_c$	SPC	Total coolant or moderator (for lattice) cross- section	x.xxxx <sup>+</sup> y <sub>b</sub>
17	-	$\phi_i$	FI(I)	Source factor	x.xxxx <sup>+</sup> y <sub>b</sub>
18	-	$\epsilon_i$	EPS	Accuracy desired for $P_{uu}$ in a lattice	x.xxxx <sup>+</sup> y <sub>b</sub>
19	-	$x_i$	X(I) )	Coordinates of fuel pencil centres with respect to centre of cluster or a lattice	x.xxxx <sup>+</sup> y <sub>b</sub>
20	-	$y_i$	Y(I) )		
21	-	$M_{si}$	MSI(I,J)	Matrix of groups of symmetry: row by row: new card for every new row	xxxxx



For the different values of NC the input data must be introduced in the following order:

NC = 1,2,3,4,5,7,8,9: Card No. 1: TITLE(I)  
" " 2: NC,NII,NG,NP,NTC,NS (general description)  
" " 3: AP(1),D(1),R(1),C (geometrical data)  
" " 4: SP(1),SCL(1),SPC,[FI(1) if NS=1] or [FI(I),I=1,NB if NS=2] (nuclear data)  
and foll.

NC = 6 Card No. 1: TITLE(I)  
" " 2: NC,NII,NG,NP,NTC,NS  
" " 3: AP(1),D(1),R(1),C,R(2)  
" " 4: SP(1),SCL(1),SPC,[FI(1) if NS=1] or [FI(I),I=1,NB if NS=2]  
and foll.

NC = 10 Card No. 1: TITLE(I)  
" " 2: NC,NII,NG,NP,NTC,NS,NB  
" " 3: AP(1),D(1),R(1),C  
" " 4: SP(1),SCL(1),SPC,[FI(1) if NS=1] or [FI(I),I=1,NB if NS=2]  
and foll.  
" follow: [X(I),I=1,NB]  
" " : [Y(I),I=1,NB]  
" " : [MSI(I,J),J=1,NB,I=1,NB] new card beginning new line of the matrix  
and read line for line

NC = 11 Card No. 1: TITLE(I)  
" " 2: NC,NII,NG,NP,NTC,NS,NB  
" " 3: [AP(I),I=1,NB]  
and foll.  
" follow: [D(I) " ]  
" " : [SP(I) " ]  
" " : [SCL(I) " ]  
" " : C,SPC,[FI(1) if NS=1] or [FI(I),I=1,NB if NS=2]  
" " : [X(I),I=1,NB]  
" " : [Y(I) " ]  
" " : [MSI(I,J),J=1,NB,I=1,NB] as for NC=10

NC = 12,13 Card No. 1: TITLE(I)  
" " 2: NC,NII,NG,NP,NTC  
" " 3: AP(1),D(1),R(1),EPS  
" " 4: SP(1),SCL(1),SPC

If it is desired to solve two or more consecutive problems, two cases must be distinguished:

- 1) The data are very or completely different from the input data of the previous problem, add:
  - a) a blank card
  - b) the appropriate input cards for the following problem.
- 2) The data do not differ greatly: to the input data of the previous problem, add:
  - a) a card with the data numbers that are to be changed in increasing order (format for every data number: xxxxx). Then it is possible to change a maximum of 14 data
  - b) cards with the data that are to be changed, with the same format and distribution as above (title, general description, geometrical data, nuclear data, etc.)

Examples:

col.	5	10	15	20	25
card a	1	3	4	11	12
" b	TITLE(I)				
" b <sub>1</sub>	NII,NG				
" b <sub>2</sub>	R(1),C				
col.	5	10	15	20	
card a	2	14	19	20	
" b	NC				
" b <sub>1</sub>	SP(1) or [SP(I),I=1,NB] if NC=11				
" b <sub>2</sub>	[X(I),I=1,NB]				
" b <sub>3</sub>	[Y(I),I=1,NB]				

IV. LIMITATIONS

- a) The number of fuel pencils must be comprised between 1 and 61.
- b) The maximum number of groups of symmetry must be 300.
- c) It is not possible to give an arbitrary configuration in the case of the lattice.

V. EXECUTION TIME

Three cases must be distinguished:

- a) Cluster geometry with exact calculation of  $P_{ij}$ .
- b) Cluster geometry with approximate calculation of  $P_{ij}$ .
- c) Lattice geometry.

Case a)

Obviously the execution time depends both on the number of integration points for each integral and the number of groups of symmetry. For the configurations numbered 1-9, the groups of symmetry are:

<u>NC</u>	<u>Groups of symmetry (NGS)</u>
1	2
2	4
3	7
4	10
5	21
6	29
7	22
8	18
9	73

The following approximate relationship may be used to estimate the execution time:

Total coll. prob. only calc.  $5 \cdot \text{NGS} \cdot \text{NII}^2 = \text{TIME}(\text{sec})$

Total and directional coll. prob. calc.  $20 \cdot \text{NGS} \cdot \text{NII}^2 = \text{TIME}(\text{sec})$

Case b)

As for case a), but the execution time is now given by:

Total coll. prob. only calc.  $3 \cdot \text{NGS} \cdot \text{NII}^2 = \text{TIME}(\text{sec})$

Total and directional coll. prob. calc.  $8 \cdot \text{NGS} \cdot \text{NII}^2 = \text{TIME}(\text{sec})$

Case c)

The execution time will depend on the number of rods which need be considered for a given accuracy. It will thus vary significantly with the geometrical and nuclear properties. As an indication, the execution time for the case given as an input-output example was found to be 15".

VI. COMPOSITION OF PROGRAMME DECK

The programme is composed as follows:

<u>Section of the code</u>	<u>Description</u>	<u>No. of cells occupied</u>
PROCOPE(MAIN)	The input data are read in and printed, the constants defined, the results printed and the calls for calculation are made in this section of the code	3906
CORD	Calculation of pin centre coordinates with respect to the centre of the cluster	647
SIMM	Construction of the matrix of the groups of symmetry	2436
SPOST	Displacement of indices for the sub-routine SIMM	142
RIEMU	Calculation, for every pin, of the cylindrical coordinates with respect to the centre of the cluster	62
TANG	Calculation of the arctang in the four quadrants	87
ASTER	Print the * beside the data changed in the successive cases	214
NUMBER	Print of the numerical configuration of the fuel pencils	531

<u>Section of the code</u>	<u>Description</u>	<u>No. of cells occupied</u>
RES	Calculation of pin centre coordinates with respect to centre of pin 1 and other initialization in the cases of the lattices	459
PRES	Iterative calculation of probabilities for the lattices	366
PIIK	Calculation of probabilities $P_{iik}$ and $p_{iik}$	284
PIJK	Calculation of probabilities $P_{ijk}$ and $p_{ijk}$	905
PIJKAP	Approximative calculation of probabilities $P_{ijk}$ and $p_{ijk}$	755
CONST	Vector construction for parabolic interpolation	89
GABIN	Parabolic interpolation	223
FEDIC	Elliptical integration in PIJAP	278
BIC3AP	Calculation of $K_{i3}$ approximate	212
BIC	Calculation of $K_{in}$ exactly	493
GAUSS1	Calculation of the variable for Gaussian integration	75
GAUSS2	Calculation of the integral with Gaussian method	45
PUUKR	Calculation of probabilities $P_{uuk}$ and $p_{uuk}$ for lattices only	83
PCUK	Calculation of probabilities $P_{cuk}$ and $p_{cuk}$	181
PSSK	Calculation of probabilities $P_{ssk}$ and $p_{ssk}$	698
PISK	Calculation of probabilities $P_{isk}$	401
PUSK	Calculation of probabilities $P_{usk}$	98
PUUKG	Calculation of probabilities $P_{uuk}$ for clusters only	181
PICK	Calculation of probabilities $P_{ick}$ and $p_{ick}$	142

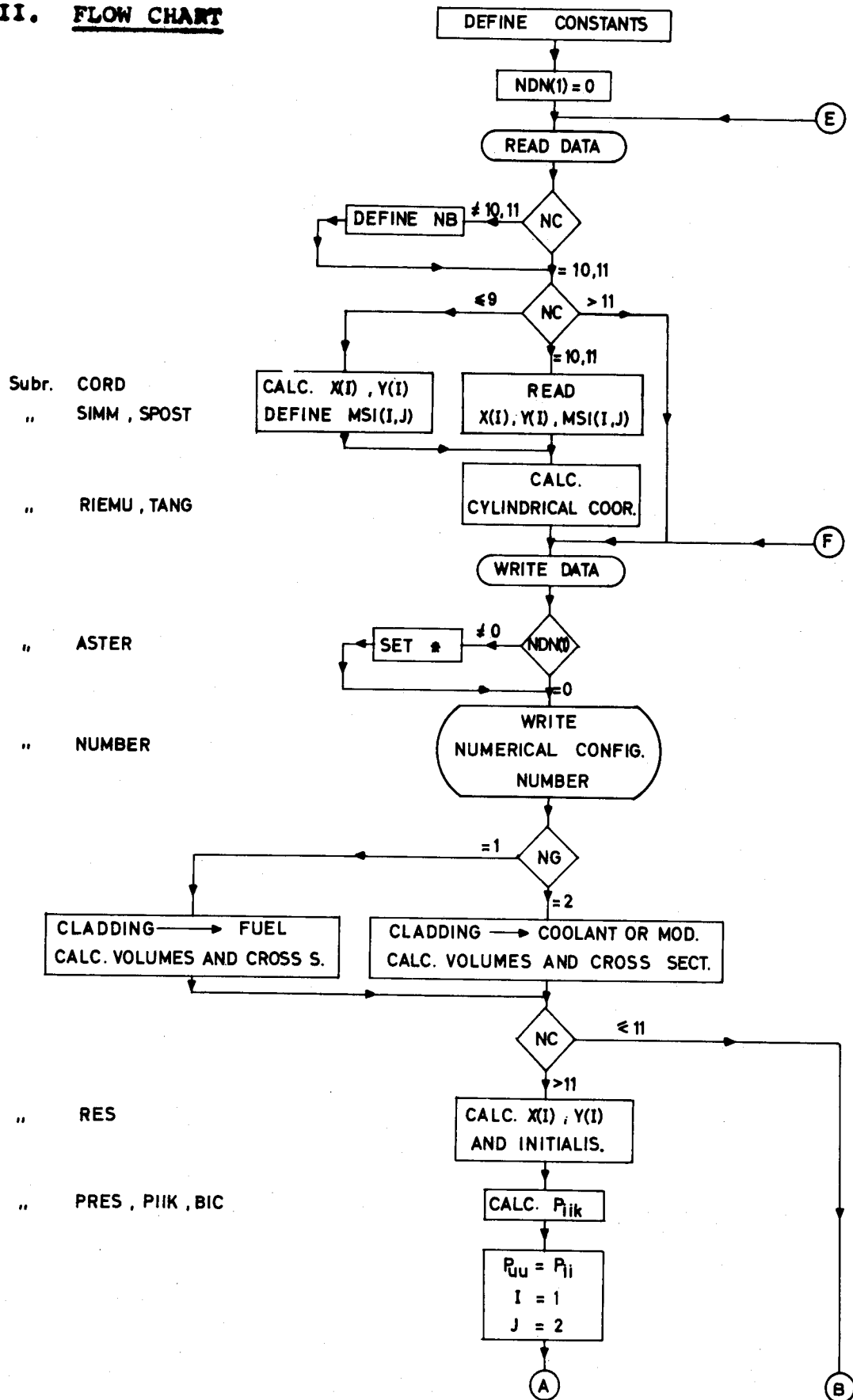
<u>Section of the code</u>	<u>Description</u>	<u>No. of cells occupied</u>
PCIK	Calculation of probabilities $P_{cik}$ and $p_{cik}$	75
PCSK	Calculation of probabilities $P_{csk}$	138
PCKK	Calculation of probabilities $P_{cck}$ and $p_{cck}$	108
WRITE	Print all probabilities	83
Special functions	Bessel functions	~ 700
Library subroutines	Input, output, elementary functions	~ 2700
COMMON		7980
<u>Total number of cells occupied</u>		~ 25'777

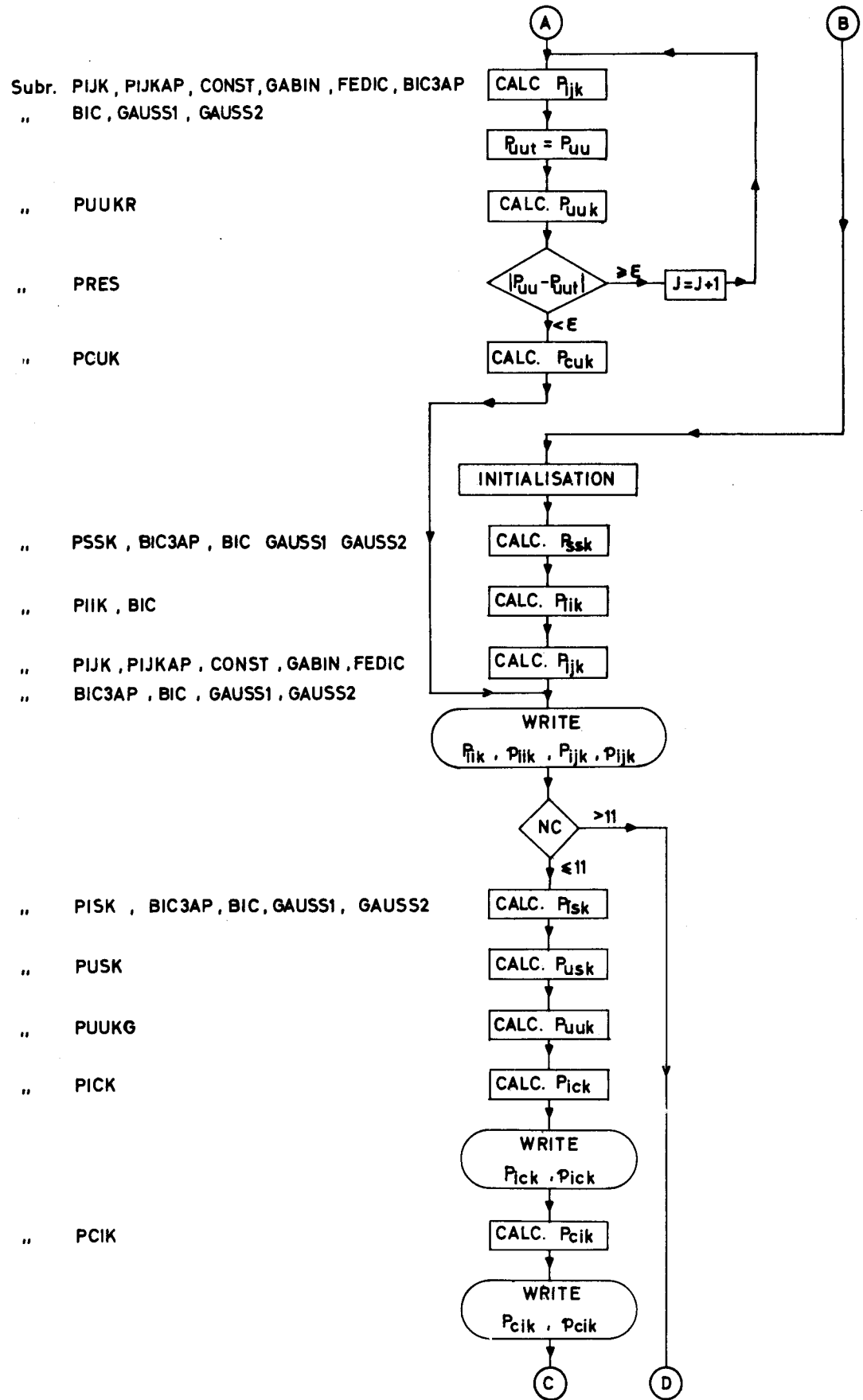
## VII. OUTPUT

The output is printed off-line in the following order:

- a) General description
- b) Numerical configuration of the fuel pencils
- c) Geometrical data
- d) Nuclear data
- e) Matrix of groups of symmetry (only if NC = 10,11)
- f) Detailed probabilities  $P_{iik}, P_{ijk}, P_{isk}$  always and  $P_{ick}, P_{cik}$  only if SPS  $\neq 0$
- g) Balance sheet:  $P_{uuk}, P_{cuk}, P_{uck}, P_{cck}, P_{usk}, P_{csk}, P_{ssk}$

VIII. FLOW CHART







Subr. PCSK

.. PCUK

.. PCCK

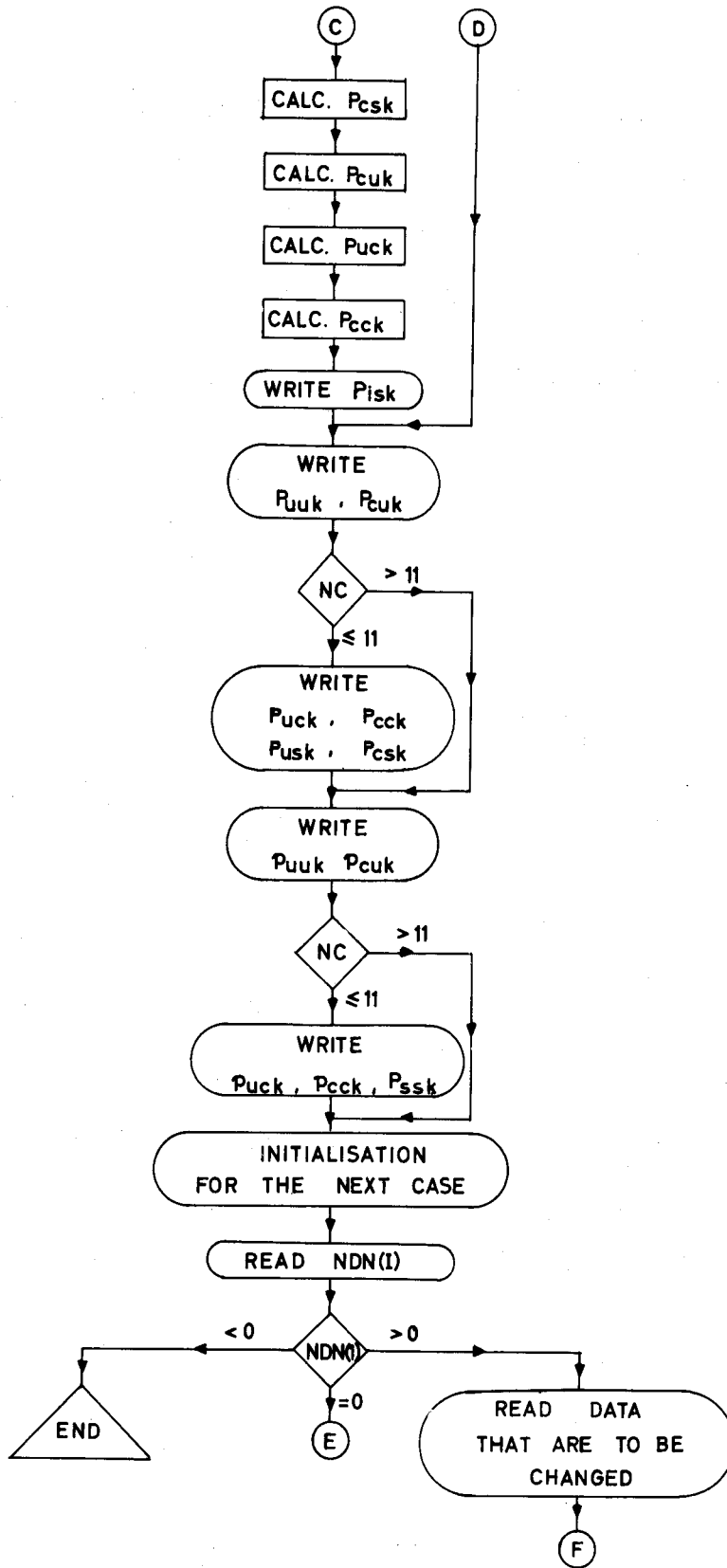
.. PCCK

.. WRITE

.. WRITE

.. WRITE

.. WRITE



IX. PROGRAMME LISTING

```

* LABEL
C PROCOPE PROC0001
C COLLISION PROBABILITIES IN PIN CLUSTERS OR INFINITE LATTICES PROC0002
C PROC0003
C DIMENSIONS PROC0004
C PROC0005
C PROC0006
  DIMENSION AP(61),AP2(61),AR(6),A1(12),A2(11),A3(10),BR(6),B1(12),B2(11),B3(10),CR(6),C1(12),CC(12),C3(12),D(61),DANU(80),DR(4),EMU(61),ETA(61),ER(4),FI(61),FR(16),INT(8),MSI(61,61),NBWG(49),NDN(14),NPS(61),NIW(61),PCI(61),PCIR(61),PCIZ(61),PIC(61),PICR(61),PICZ(61),PII(61),PIIR(61),PIIZ(61),PIJ(300),PIJR(300),PIJZ(300),PIS(61),PISR(61),PISZ(61),PPCI(61),PPCIR(61),PPCIZ(61),PPIC(61),PPICR(61),PPICZ(61),PPII(61),PPIIR(61),PPIIZ(61),PPIJ(300),PPIJR(300),PPIJZ(300),R(2),RGA(5),RI(61),SAP(61),SCL(61),SP(61),TITLE(12),U(5),X(61),Y(61),YAP(61),YFI(61),YSP(61)
C PROC0007
C PROC0008
C PROC0009
C PROC0010
C PROC0011
C PROC0012
C PROC0013
C PROC0014
C PROC0015
C COMMONS PROC0016
C PROC0017
C PROC0018
  COMMON PIG,PD2,PD2M,PIG2,X,Y,RI,EMU,MSI,AP,SP,NPS,FI,AP2,ETA,C2,DIPROCC0019
  1,NIP2,TITLE,DANU,NIW,NDN,NBWG,INT,U,RGA,AR,BR,CR,DR,ER,FR,A1,A2,A3PROC0020
  2,B1,B2,B3,C1,CC,C3,PII,PIIR,PIIZ,PPII,PPIIR,PPIIZ,PIJ,PIJR,PIJZ,PPROCC0021
  3,IJ,PPIJR,PPIJZ,PIS,PISR,PISZ,PIC,PICR,PICZ,PPIC,PPICR,PPICZ,PCI,PCPROC0022
  4,IR,PCIZ,PPCI,PPCIR,PPCIZ,YAP,YFI,YSP PROC0023
C PROC0024
C GAUSS CONSTANTS PROC0025
C PROC0026
C PROC0027
C PROC0028
C PROC0029
C PROC0030
C PROC0031
C PROC0032
C PROC0033
C PROC0034
C PROC0035
C PROC0036
C PROC0037
C PROC0038
C BICKLEY CONSTANTS (APPROX. CALC. ONLY FOR KI3) PROC0039
C PROC0040
C PROC0041
C PROC0042
C PROC0043
C PROC0044
C PROC0045
C PROC0046
C PROC0047
C PROC0048
C PROC0049
  AR(1)=9.3793888E-1
  AR(2)=1.1941916
  AR(3)=5.8824515E-1
  AR(4)=5.7033719E-1
  AR(5)=-1.5791166
  AR(6)=4.292469
  BR(1)=7.2767871E-1
  BR(2)=9.2546909E-1
  BR(3)=4.7415208E-1
  BR(4)=2.5082035E-1

```

BR(5) = -2.5930075E-2  
 BR(6) = -5.5707999E-2  
 CR(1) = 4.1667409E-1  
 CR(2) = 5.5295655E-1  
 CR(3) = 2.2754273E-1  
 CR(4) = 1.1283377E-1  
 CR(5) = 1.1919149E-2  
 CR(6) = 1.3392209E-2  
 DR(1) = 2.2159402E-1  
 DR(2) = -1.9338837E-2  
 DR(3) = 1.4738214E-2  
 DR(4) = -1.8576550E-4  
 ER(1) = 2.8226723E-1  
 ER(2) = 2.3356320E-1  
 ER(3) = 6.3340205E-2  
 ER(4) = 1.3360032E-2  
 FR(1) = -2.221E-7  
 FR(2) = 8.669397E-5  
 FR(3) = 2.5008392E-5  
 FR(4) = -3.9137103E-3  
 FR(5) = 10.365188E-3  
 FR(6) = -28.679968E-3  
 FR(7) = 69.717942E-3  
 FR(8) = -138.49548E-3  
 FR(9) = 219.43414E-3  
 FR(10) = -276.50296E-3  
 FR(11) = 277.89121E-3  
 FR(12) = -221.49757E-3  
 FR(13) = 135.95937E-3  
 FR(14) = -60.077303E-3  
 FR(15) = 16.788766E-3  
 FR(16) = -2.1974824E-3

C  
 C  
 C BICKLEY CONSTANTS (ACCUR. CALC.)

CC(1) = 0.99999569  
 CC(2) = 1.1234805  
 CC(3) = 2.6202714  
 CC(4) = 7.7586766  
 CC(5) = 22.332663  
 CC(6) = 52.778311  
 CC(7) = 93.988921  
 CC(8) = 120.37799  
 CC(9) = 106.55417  
 CC(10) = 61.597195  
 CC(11) = 20.875427  
 CC(12) = 3.1413368  
 C3(1) = 0.99998852  
 C3(2) = 1.6201736  
 C3(3) = 4.8929567

PROC0050  
 PROC0051  
 PROC0052  
 PROC0053  
 PROC0054  
 PROC0055  
 PROC0056  
 PROC0057  
 PROC0058  
 PROC0059  
 PROC0060  
 PROC0061  
 PROC0062  
 PROC0063  
 PROC0064  
 PROC0065  
 PROC0066  
 PROC0067  
 PROC0068  
 PROC0069  
 PROC0070  
 PROC0071  
 PROC0072  
 PROC0073  
 PROC0074  
 PROC0075  
 PROC0076  
 PROC0077  
 PROC0078  
 PROC0079  
 PROC0080  
 PROC0081  
 PROC0082  
 PROC0083  
 PROC0084  
 PROC0085  
 PROC0086  
 PROC0087  
 PROC0088  
 PROC0089  
 PROC0090  
 PROC0091  
 PROC0092  
 PROC0093  
 PROC0094  
 PROC0095  
 PROC0096  
 PROC0097  
 PROC0098  
 PROC0099

C3(4)=17.049488  
 C3(5)=53.639412  
 C3(6)=132.78739  
 C3(7)=242.41534  
 C3(8)=314.85412  
 C3(9)=291.02236  
 C3(10)=163.29331  
 C3(11)=55.523718  
 C3(12)=8.3734341  
 C1(1)=0.99999904  
 C1(2)=0.62472233  
 C1(3)=0.99416910  
 C1(4)=2.3115571  
 C1(5)=5.8177743  
 C1(6)=12.824037  
 C1(7)=22.012695  
 C1(8)=27.623315  
 C1(9)=24.160269  
 C1(10)=13.864375  
 C1(11)=4.6767040  
 C1(12)=0.70159160  
 B3(1)=0.  
 B3(2)=0.  
 B3(3)=0.  
 B3(4)=0.2666667  
 B3(5)=0.  
 B3(6)=0.00416667  
 B3(7)=0.  
 B3(8)=0.0000744  
 B3(9)=0.  
 B3(10)=0.0000086  
 A3(1)=0.78539816  
 A3(2)=-1.  
 A3(3)=0.78539816  
 A3(4)=-0.32487747  
 A3(5)=0.  
 A3(6)=-0.00791360  
 A3(7)=0.  
 A3(8)=-0.00015814  
 A3(9)=0.  
 A3(10)=-0.0000200  
 B2(1)=0.  
 B2(2)=0.  
 B2(3)=-0.5  
 B2(4)=0.  
 B2(5)=-0.02083333  
 B2(6)=0.  
 B2(7)=-0.00052083  
 B2(8)=0.  
 B2(9)=-0.0000775

PROC0100  
 PROC0101  
 PROC0102  
 PROC0103  
 PROC0104  
 PROC0105  
 PROC0106  
 PROC0107  
 PROC0108  
 PROC0109  
 PROC0110  
 PROC0111  
 PROC0112  
 PROC0113  
 PROC0114  
 PROC0115  
 PROC0116  
 PROC0117  
 PROC0118  
 PROC0119  
 PROC0120  
 PROC0121  
 PROC0122  
 PROC0123  
 PROC0124  
 PROC0125  
 PROC0126  
 PROC0127  
 PROC0128  
 PROC0129  
 PROC0130  
 PROC0131  
 PROC0132  
 PROC0133  
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B2(10)=0.
B2(11)=-0.00000008
A2(1)=1.
A2(2)=-1.57079633
A2(3)=0.80796575
A2(4)=0.
A2(5)=0.03540135
A2(6)=0.
A2(7)=0.00103260
A2(8)=0.
A2(9)=0.00001718
A2(10)=0.
A2(11)=0.00000018
B1(1)=0.
B1(2)=1.
B1(3)=0.
B1(4)=0.08333333
B1(5)=0.
B1(6)=0.003125
B1(7)=0.
B1(8)=0.00006200
B1(9)=0.
B1(10)=0.00000075
B1(11)=0.
B1(12)=0.
A1(1)=1.57079633
A1(2)=-1.11593151
A1(3)=0.
A1(4)=-0.12077206
A1(5)=0.
A1(6)=-0.00567479
A1(7)=0.
A1(8)=-0.00012972
A1(9)=0.
A1(10)=-0.00000174
A1(11)=0.
A1(12)=-0.00000003

```

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C
C BEGINNING
C

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    PIG=3.1415926
    PD2=PIG/2.
    PD2M=-PD2
    PIG2=PIG**2
    DO 187 I=1,61
187 NIW(I)=I
    DO 237 I=1,14
237 NDN(I)=0

```

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C
C READ AND WRITE DATA

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PROC0150
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		PROC0200
	WRITE OUTPUT TAPE 6,5	PROC0201
5	FORMAT (1H1,57X,15H* CCR EURATOM */50X,31H* REACTOR PHYSICS DEPART	PROC0202
	LEMENT */50X,31H* REACTOR THEORY AND ANALYSIS */44X,43H*****	PROC0203
2	*****7/44X,1H*,41X,1H*/44X,1H*,15X,11H*	PROC0204
3	PROCOPE *,15X,1H*/44X,43H* COLLISION PROBABILITIES IN PIN CLUSTERS	PROC0205
4	*/44X,1H*,10X,20HOR INFINITE LATTICES,11X,1H*/44X,1H*,41X,1H*/44X	PROC0206
5	1H*,3X,35HL. AMYOT(EURATOM) - P. BENOIST(CEA),3X,1H*/44X,1H*,11X,	PROC0207
6	18HC. DAELIO(EURATOM),12X,1H*/44X,1H*,41X,1H*/44X,1H*,13X,14HSEPT	PROC0208
7	MBER 1966,14X,1H*/44X,1H*,41X,1H*/44X,43H*****	PROC0209
8	*****7//)	PROC0210
236	READ INPUT TAPE 5,6,(TITLE(I),I=1,12)	PROC0211
6	FORMAT (12A6)	PROC0212
	WRITE OUTPUT TAPE 6,7,(TITLE(I),I=1,12)	PROC0213
7	FORMAT (1HC,2X,12A6)	PROC0214
	IF(NCN(1))102,240,241	PROC0215
241	WRITE OUTPUT TAPE 6,51	PROC0216
51	FORMAT (1H+,1H*)	PROC0217
	GO TO 238	PROC0218
240	READ INPUT TAPE 5,1,NC,NII,NG,NP,NTC,NS,NB	PROC0219
1	FORMAT (14I5)	PROC0220
285	GO TO (106,107,108,109,109,109,110,111,111,114,114,113,138),NC	PROC0221
106	NB=4	PROC0222
	GO TO 114	PROC0223
107	NB=7	PROC0224
	GO TO 114	PROC0225
108	NB=12	PROC0226
	GO TO 114	PROC0227
109	NB=19	PROC0228
	GO TO 114	PROC0229
110	NB=31	PROC0230
	GO TO 114	PROC0231
111	NB=37	PROC0232
	GO TO 114	PROC0233
113	NB=56	PROC0234
	GO TO 114	PROC0235
138	NB=55	PROC0236
114	IF(NC-12)142,143,143	PROC0237
142	EN=NB	PROC0238
143	IF(NCN(1))102,286,238	PROC0239
286	IF(NC-11)141,115,141	PROC0240
141	READ INPUT TAPE 5,2,AP(1),D(1),R(1),QUAT,CIN	PROC0241
2	FORMAT (8(E8.4,1X))	PROC0242
	GO TO (112,112,112,112,112,136,112,112,112,112,102,166,166),NC	PROC0243
112	C=QUAT	PROC0244
	GO TO 167	PROC0245
136	C=QUAT	PROC0246
	R(2)=CIN	PROC0247
	GO TO 167	PROC0248
166	EPS=QUAT	PROC0249

NS=1	PROC0250
GO TO 167	PROC0251
115 READ INPUT TAPE 5,2,(AP(I),I=1,NB)	PROC0252
IF(NDN(1))102,253,238	PROC0253
253 READ INPUT TAPE 5,2,(D(I),I=1,NB)	PROC0254
IF(NDN(1))102,264,238	PROC0255
264 READ INPUT TAPE 5,2,(SP(I),I=1,NB)	PROC0256
IF(NDN(1))102,265,238	PROC0257
265 READ INPUT TAPE 5,2,(SCL(I),I=1,NB)	PROC0258
IF(NDN(1))102,167,238	PROC0259
167 IF(NS-1)102,145,146	PROC0260
145 NFI=1	PROC0261
GO TO 116	PROC0262
146 NFI=NB	PROC0263
116 IF(NC-11)117,160,160	PROC0264
117 NFN=NFI+3	PROC0265
GO TO 168	PROC0266
160 NFN=NFI+2	PROC0267
168 IF(NDN(1))102,308,268	PROC0268
308 READ INPUT TAPE 5,2,(DANU(I),I=1,NFN)	PROC0269
IF(NC-11)119,169,119	PROC0270
119 SP(1)=DANU(1)	PROC0271
SCL(1)=DANU(2)	PROC0272
SPC=DANU(3)	PROC0273
GO TO 170	PROC0274
169 C=DANU(1)	PROC0275
SPC=DANU(2)	PROC0276
170 IF(NC-11)171,171,121	PROC0277
171 DO 173 I=1,NFI	PROC0278
II=NFN-NFI+I	PROC0279
173 FI(I)=DANU(II)	PROC0280
IF(NC-10)144,161,161	PROC0281
144 CALL CORC(NC,R)	PROC0282
GO TO 165	PROC0283
161 READ INPUT TAPE 5,2,(X(I),I=1,NB)	PROC0284
IF(NDN(1))102,280,238	PROC0285
280 READ INPUT TAPE 5,2,(Y(I),I=1,NB)	PROC0286
IF(NDN(1))102,281,238	PROC0287
281 DO 137 I=1,NB	PROC0288
137 READ INPUT TAPE 5,1,(MSI(I,K),K=1,NB)	PROC0289
IF(NDN(1))102,165,238	PROC0290
165 CALL SIMM(NB,NC)	PROC0291
CALL RIEMU(NB,NC)	PROC0292
121 WRITE OUTPUT TAPE 6,3,NC	PROC0293
3 FORMAT (1H,///1X,22H1) GENERAL DESCRIPTION//4X,34HGEOMETRICAL CO	PROC0294
FIGURATION NUMBER =,I4)	PROC0295
CALL ASTER(NC,NS,2)	PROC0296
WRITE OUTPUT TAPE 6,4,NII	PROC0297
4 FORMAT (1H,3X,30HNUMBER OF GAUSS INTEGR. POINTS,3X,1H=,I4)	PROC0298
CALL ASTER(NC,NS,3)	PROC0299

8	WRITE OUTPUT TAPE 6,8,NG	PROC0300
	FORMAT (1H,3X,30HHOMOGENIZATION OF THE CLADDING,3X,1H=,I4)	PROC0301
	CALL ASTER(NC,NS,4)	PROC0302
	WRITE OUTPUT TAPE 6,9,NP	PROC0303
9	FORMAT (1H,3X,30HTYPES OF COLLIS. PROB. CALCUL.,3X,1H=I4)	PROC0304
	CALL ASTER(NC,NS,5)	PROC0305
	WRITE OUTPUT TAPE 6,10,NTC	PROC0306
10	FORMAT (1H,3X,26HCALCULATION METHOD FOR PIJ,7X,1H=,I4)	PROC0307
	CALL ASTER(NC,NS,6)	PROC0308
	IF(NC-12)289,174,174	PROC0309
289	WRITE OUTPUT TAPE 6,11,NS	PROC0310
11	FORMAT (1H,3X,19HSOURCE DISTRIBUTION,14X,1H=,I4)	PROC0311
	CALL ASTER(NC,NS,7)	PROC0312
	IF(NC-10)174,175,175	PROC0313
175	WRITE OUTPUT TAPE 6,12,NB	PROC0314
12	FORMAT (1H,3X,22HNOMBER OF FUEL PENCILS,11X,1H=,I4)	PROC0315
	CALL ASTER(NC,NS,8)	PROC0316
174	WRITE OUTPUT TAPE 6,13	PROC0317
13	FORMAT (1H,///4X,43HNUMERICAL CONFIGURATION OF THE FUEL PENCILS//	PROC0318
	1//)	PROC0319
	CALL NUMBER(NC)	PROC0320
	WRITE OUTPUT TAPE 6,14	PROC0321
14	FORMAT (1H1,19H2) GEOMETRICAL DATA///)	PROC0322
	IF(NC-11)176,177,176	PROC0323
176	WRITE OUTPUT TAPE 6,15,AP(1)	PROC0324
15	FORMAT (1H,3X,18HRADIUS FUEL PENCIL,15X,1H=,F10.6)	PROC0325
	CALL ASTER(NC,NS,9)	PROC0326
	WRITE OUTPUT TAPE 6,16,D(1)	PROC0327
16	FORMAT (1H,3X,18HCLADDING THICKNESS,15X,1H=,F10.6)	PROC0328
	CALL ASTER(NC,NS,10)	PROC0329
	IF(NC-1)102,290,291	PROC0330
290	WRITE OUTPUT TAPE 6,52,R(1)	PROC0331
52	FORMAT (1H,3X,28HDISTANCE FROM CENTER CLUSTER,5X,1H=,F10.6)	PROC0332
	GO TO 292	PROC0333
291	WRITE OUTPUT TAPE 6,17,R(1)	PROC0334
17	FORMAT (1H,3X,24HDISTANCE BETWEEN CENTERS,9X,1H=,F10.6)	PROC0335
292	CALL ASTER(NC,NS,11)	PROC0336
	GO TO (181,181,181,181,181,183,181,181,181,181,102,184,184),NC	PROC0337
181	WRITE OUTPUT TAPE 6,20,C	PROC0338
20	FORMAT (1H,3X,21HRADIUS OF THE CLUSTER,12X,1H=,F10.6)	PROC0339
	CALL ASTER(NC,NS,12)	PROC0340
	IF(NC-10)185,179,178	PROC0341
179	WRITE OUTPUT TAPE 6,18	PROC0342
18	FORMAT (1H,///4X,33HCO-ORDINATES FUEL PENCILS CENTERS//5X,11I,6X,	PROC0343
	11HX,9X,1HY)	PROC0344
	CALL ASTER(NC,NS,19)	PROC0345
	CALL ASTER(NC,NS,20)	PROC0346
	WRITE OUTPUT TAPE 6,26	PROC0347
26	FORMAT (1H0)	PROC0348
	DO 180 I=1,NB	PROC0349



180	WRITE OUTPUT TAPE 6,19,I,X(I),Y(I)	PROC0350
19	FORMAT (1H,3X,12,4F10.4)	PROC0351
	GO TO 178	PROC0352
183	WRITE OUTPUT TAPE 6,22,R(2)	PROC0353
22	FORMAT (1H,3X,29HDISTANCE OF THE EXTERNAL RING,4X,1H=,F10.6)	PROC0354
	CALL ASTER(NC,NS,13)	PROC0355
	GO TO 181	PROC0356
177	WRITE OUTPUT TAPE 6,21	PROC0357
21	FORMAT (1H,4X,1HI,6X,2HAP,8X,1HD,9X,1HX,9X,1HY)	PROC0358
	CALL ASTER(NC,NS,9)	PROC0359
	CALL ASTER(NC,NS,10)	PROC0360
	CALL ASTER(NC,NS,19)	PROC0361
	CALL ASTER(NC,NS,20)	PROC0362
	WRITE OUTPUT TAPE 6,26	PROC0363
	DO 182 I=1,NB	PROC0364
182	WRITE OUTPUT TAPE 6,19,I,AP(I),D(I),X(I),Y(I)	PROC0365
	WRITE OUTPUT TAPE 6,26	PROC0366
	GO TO 181	PROC0367
178	WRITE OUTPUT TAPE 6,24	PROC0368
24	FORMAT (1H,///4X,27HMATRIX OF GROUP OF SIMMETRY)	PROC0369
	CALL ASTER(NC,NS,21)	PROC0370
	NBW=1	PROC0371
	IF(NB-37)188,188,189	PROC0372
189	NBWW=37	PROC0373
	GO TO 190	PROC0374
188	NBWW=NB	PROC0375
190	WRITE OUTPUT TAPE 6,25,(NIW(I),I=NBW,NBWW)	PROC0376
25	FORMAT (1H,///4X,5HRODS,37I3)	PROC0377
	WRITE OUTPUT TAPE 6,26	PROC0378
	DO 191 I=1,NB	PROC0379
191	WRITE OUTPUT TAPE 6,27,I,(MSI(I,J),J=NBW,NBWW)	PROC0380
27	FORMAT (1H,3X,13,2X,37I3)	PROC0381
	IF(NBWW-NB)192,193,193	PROC0382
192	NBW=NBW+37	PROC0383
	GO TO 188	PROC0384
193	WRITE OUTPUT TAPE 6,28	PROC0385
28	FORMAT (1H1)	PROC0386
	GO TO 185	PROC0387
184	WRITE OUTPUT TAPE 6,23,EPS	PROC0388
23	FORMAT (1H,3X,24HACCURACY DESIRED FOR PUU,9X,1H=,1PE10.2)	PROC0389
	CALL ASTER(NC,NS,18)	PROC0390
185	WRITE OUTPUT TAPE 6,29	PROC0391
29	FORMAT (1H,///1X,15H3) NUCLEAR DATA///)	PROC0392
	IF(NC-11)194,195,194	PROC0393
195	WRITE OUTPUT TAPE 6,30	PROC0394
30	FORMAT (1H,3X,39HTOTAL CROSS SECT. FOR EVERY FUEL PENCIL//5X,1HI,	PROC0395
	16X,2HSP,11X,3HSCL)	PROC0396
	CALL ASTER(NC,NS,14)	PROC0397
	CALL ASTER(NC,NS,15)	PROC0398
	WRITE OUTPUT TAPE 6,26	PROC0399

DO 196 I=1,NB	PROCO400
196 WRITE OUTPUT TAPE 6,31,I,SP(I),SCL(I)	PROCO401
31 FORMAT (1H,3X,I2,1P3E13.4)	PROCO402
WRITE OUTPUT TAPE 6,26	PROCO403
GO TO 197	PROCO404
194 WRITE OUTPUT TAPE 6,32,SP(1)	PROCO405
32 FORMAT (1H,3X,24HTOTAL FUEL CROSS SECTION,8X,1H=,1PE12.4)	PROCO406
CALL ASTER(NC,NS,14)	PROCO407
WRITE OUTPUT TAPE 6,33,SCL(1)	PROCO408
33 FORMAT (1H,3X,28HTOTAL CLADDING CROSS SECTION,4X,1H=,1PE12.4)	PROCO409
CALL ASTER(NC,NS,15)	PROCO410
IF(NC-12)197,198,198	PROCO411
198 WRITE OUTPUT TAPE 6,34,SPC	PROCO412
34 FORMAT (1H,3X,29HTOTAL MODERATOR CROSS SECTION,3X,1H=,1PE12.4)	PROCO413
CALL ASTER(NC,NS,16)	PROCO414
GO TO 199	PROCO415
197 WRITE OUTPUT TAPE 6,35,SPC	PROCO416
35 FORMAT (1H,3X,27HTOTAL COOLANT CROSS SECTION,5X,1H=,1PE12.4)	PROCO417
CALL ASTER(NC,NS,16)	PROCO418
IF(NS-1)102,200,201	PROCO419
200 WRITE OUTPUT TAPE 6,36,FI(1)	PROCO420
36 FORMAT (1H,3X,14HSOURCE UNIFORM,18X,1H=,1PE12.4)	PROCO421
CALL ASTER(NC,NS,17)	PROCO422
GO TO 199	PROCO423
201 WRITE OUTPUT TAPE 6,37	PROCO424
37 FORMAT (1H,7/4X,29HSOURCES FOR EVERY FUEL PENCIL//5X,1HI,6X,2HFI)	PROCO425
CALL ASTER(NC,NS,17)	PROCO426
WRITE OUTPUT TAPE 6,26	PROCO427
DO 202 I=1,NB	PROCO428
202 WRITE OUTPUT TAPE 6,31,I,FI(I)	PROCO429
199 ENII=NII	PROCO430
DI=PIG/ENII	PROCO431
NIP2=NII*2	PROCO432
AD=0.	PROCO433
SV=0.	PROCO434
PV=0.	PROCO435
YSPC=SPC	PROCO436
DO 122 I=1,NB	PROCO437
YAP(I)=AP(I)	PROCO438
YFI(I)=FI(I)	PROCO439
YSP(I)=SP(I)	PROCO440
APD=(AP(I)+D(I))**2	PROCO441
VP=PIG*AP(I)**2	PROCO442
VCL=PIG*APD-VP	PROCO443
IF(NG-1)102,123,124	PROCO444
123 AP(I)=AP(I)+D(I)	PROCO445
V1=VP+VCL	PROCO446
SP(I)=(SP(I)*VP+SCL(I)*VCL)/V1	PROCO447
IF(NC-11)139,122,125	PROCO448
125 VG=V1	PROCO449

	V1=PIG*AP(1)**2	PROC0450
	GO TO 126	PROC0451
124	IF(NC-11)127,128,129	PROC0452
127	VPC=PIG*(C**2-EN*APD)	PROC0453
	GO TO 130	PROC0454
128	AD=AD+APD	PROC0455
	SV=SV+SCL(I)*VCL	PROC0456
	PV=PV+VCL	PROC0457
	GO TO 122	PROC0458
129	V1=VP+VCL	PROC0459
	VG=VP	PROC0460
126	R12=R(1)**2	PROC0461
	IF(NC-12)102,131,132	PROC0462
131	VPC=R12-V1	PROC0463
	GO TO 133	PROC0464
132	VPC=0.86603*R12-V1	PROC0465
133	CALL RES(NC,R(1))	PROC0466
	IF(NG-1)102,162,134	PROC0467
162	VM=VPC	PROC0468
	GO TO 139	PROC0469
134	EN=1.	PROC0470
	VM=VPC+VCL	PROC0471
130	SPC=(SPC*VPC+EN*SCL(1)*VCL)/(VPC+EN*VCL)	PROC0472
	GO TO 139	PROC0473
122	CONTINUE	PROC0474
	IF(NG-1)102,147,135	PROC0475
135	VPC=PIG*(C**2-AD)	PROC0476
	SPC=(SPC*VPC+SV)/(VPC+PV)	PROC0477
	GO TO 147	PROC0478
139	IF(NB-1)102,147,163	PROC0479
163	DO 140 I=2,NB	PROC0480
	AP(I)=AP(1)	PROC0481
140	SP(I)=SP(1)	PROC0482
147	DO 148 I=1,NB	PROC0483
	AP2(I)=AP(I)**2	PROC0484
148	ETA(I)=AP(I)*SP(I)	PROC0485
	IF(NC-12)149,150,150	PROC0486
150	CALL PRES(EPS, JR, NB, NC, NGS, NII, NP, NTC, PCU, PCUR, PCUZ, PPCU, PPCUR, PPC	PROC0487
	1UZ, PPUU, PPUUR, PPUUZ, PUU, PUUR, PUUZ, SPC, VG, VM)	PROC0488
	NBW=1	PROC0489
	NBWW=JR	PROC0490
	GO TO 203	PROC0491
149	IF(NS-1)102,151,152	PROC0492
151	IF(NB-1)102,152,164	PROC0493
164	DO 153 I=2, NB	PROC0494
153	FI(I)=FI(1)	PROC0495
152	SA2=0.	PROC0496
	SA2E=0.	PROC0497
	SSA=0.	PROC0498
	SSA2=0.	PROC0499

```

DO 154 I=1,NB
SA2=SA2+AP2(I)
FI(I)=AP2(I)*FI(I)
SA2E=SA2E+FI(I)
SSA=SSA+ETA(I)
154 SAP(I)=AP2(I)*SP(I)
ESSA=EN/SSA
FM=1./SA2E
C2=C**2
IF(SPC)102,156,155
155 SA=0.
DO 157 I=1,NB
157 SA=SA+AP(I)
C2MSA2=C2-SA2
SCS=SPC*C2MSA2
CSS=C/SCS
AC=C2MSA2/(C+SA)
156 CALL PSSK(C,NB,NP,PSS,PSSR,PSSZ,SPC)
CALL PIJK(NB,NC,NGS,NII,NTC,SPC)
CALL PIJK(JR,NB,NC,NGS,NII,NTC,SPC)
NBW=NB
NBWW=NB
203 WRITE OUTPUT TAPE 6,38
38 FORMAT (1H1,25H4) DETAILED PROBABILITIES///4X,6HSOURCE,2X,6HTARGET
1,2X,8HSYMMETRY,18X,6HNORMAL,37X,7HREDUCED/4X,6HPIN(I),2X,6HPIN(J),
23X,5HGROUP,4X,38H=====,6X,38H=====
3===== /20X,2(13X,6HRADIAL,7X,5HAXIAL,8
4X,5HTOTAL)/4X,108H===== //1X,
5=====
640HPIN-TO-PIN COLLISION PROBABILITIES (PIJ)//)
DO 204 I=1,NBW
DO 205 J=1,NBWW
IF(NC-1)206,206,207
206 NGS=MSI(I,J)
JJ=J
GO TO 208
207 NGS=J-1
JJ=NBWG(J)
208 IF(I-J)209,210,209
210 IF(NP-1)102,218,219
219 WRITE OUTPUT TAPE 6,43,I,JJ,NGS,PII(I),PPII(I)
43 FORMAT (1H,5X,12,6X,12,7X,12,10X,1H-,12X,1H-,5X,1PE13.4,12X,1H-,1
12X,1H-,5X,1PE13.4)
GO TO 205
218 WRITE OUTPUT TAPE 6,39,I,JJ,NGS,PIIR(I),PIIZ(I),PII(I),PPIIR(I),PP
PIIZ(I),PPII(I)
39 FORMAT (1H,5X,12,6X,12,7X,12,3X,1P3E13.4,5X,1P3E13.4)
GO TO 205
209 IF(PIJ(NGS))295,296,297
295 PIJ(NGS)=0.

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296	PPIJ(NGS)=0.	PROC0550
	PIJR(NGS)=0.	PROC0551
	PIJZ(NGS)=0.	PROC0552
	PPIJR(NGS)=0.	PROC0553
	PPIJZ(NGS)=0.	PROC0554
297	IF(NP-1)102,220,221	PROC0555
221	WRITE OUTPUT TAPE 6,43,I, JJ,NGS,PIJ(NGS),PPIJ(NGS)	PROC0556
	GO TO 205	PROC0557
220	WRITE OUTPUT TAPE 6,39,I, JJ,NGS,PIJR(NGS),PIJZ(NGS),PIJ(NGS),PPIJR	PROC0558
	1(NGS),PPIJZ(NGS),PPIJ(NGS)	PROC0559
205	CONTINUE	PROC0560
204	CONTINUE	PROC0561
	IF(NC-1)211,211,212	PROC0562
211	CALL PISK(C,NB,NII, NP,SPC)	PROC0563
	CALL PUSK(FM,NB, NP, PUS, PUSR, PUSZ)	PROC0564
	CALL PUUKG(ESSA, FM, NB, NP, PPUU, PPUUR, PPUUZ, PUU, PUUR, PUUZ)	PROC0565
	IF(SPC)217,217,103	PROC0566
217	PCU=0.	PROC0567
	PCUR=0.	PROC0568
	PCUZ=0.	PROC0569
	PPCU=0.	PROC0570
	PPCUR=0.	PROC0571
	PPCUZ=0.	PROC0572
	PUC=0.	PROC0573
	PUCR=0.	PROC0574
	PUCZ=0.	PROC0575
	PPUC=0.	PROC0576
	PPUCR=0.	PROC0577
	PPUCZ=0.	PROC0578
	PCC=0.	PROC0579
	PCCR=0.	PROC0580
	PCCZ=0.	PROC0581
	PPCC=0.	PROC0582
	PPCCR=0.	PROC0583
	PPCCZ=0.	PROC0584
	PCS=0.	PROC0585
	PCSR=0.	PROC0586
	PCSZ=0.	PROC0587
	GO TO 230	PROC0588
103	CALL PICK(AC,NB, NP, SPC)	PROC0589
	WRITE OUTPUT TAPE 6,40	PROC0590
40	FORMAT (1H,///1X,42HFUEL-COOLANT COLLISION PROBABILITIES (PIC)///)	PROC0591
	DO 213 I=1,NB	PROC0592
	IF(NPS(I))102,213,214	PROC0593
214	IF(NP-1)102,222,223	PROC0594
223	WRITE OUTPUT TAPE 6,44,I, PIC(I),PPIC(I)	PROC0595
44	FORMAT (1H,5X,12,15X,2(12X,1H-),5X,1PE13.4,2(12X,1H-),5X,1PE13.4)	PROC0596
	GO TO 213	PROC0597
222	WRITE OUTPUT TAPE 6,41,I, PICR(I),PICZ(I),PIC(I),PPICR(I),PPICZ(I),	PROC0598
	1PPIC(I)	PROC0599

41	FORMAT (1H ,5X,I2,15X,2(5X,1P3E13.4))	PROC0600
213	CONTINUE	PROC0601
	CALL PCIK(NB,NP,SAP,SCS)	PROC0602
	WRITE OUTPUT TAPE 6,42	PROC0603
42	FORMAT (1H ,///1X,42HCOOLANT-FUEL COLLISION PROBABILITIES (PCI)///)	PROC0604
	DO 215 I=1,NB	PROC0605
	IF(NPS(I))102,215,216	PROC0606
216	IF(NP-1)102,224,225	PROC0607
225	WRITE OUTPUT TAPE 6,44,I,PCI(I),PPCI(I)	PROC0608
	GO TO 215	PROC0609
224	WRITE OUTPUT TAPE 6,41,I,PCIR(I),PCIZ(I),PCI(I),PPCIR(I),PPCIZ(I),	PROC0610
	1PPCI(I)	PROC0611
215	CONTINUE	PROC0612
	CALL PCSK(C,CSS,NB,NP,PCS,PCSR,PCSZ,PSS,PSSR,PSSZ,SAP)	PROC0613
	CALL PCUK(ESSA,NB,NC,NP,PCU,PCUR,PCUZ,PPCU,PPCUR,PPCUZ,PUU,PUUR,PU	PROC0614
	1UZ,SPC,VG,VM)	PROC0615
	CALL PCCK(AC,NP,PUC,PUCR,PUCZ,PUS,PUSR,PUSZ,PUU,PUUR,PUUZ,PPUC,PPU	PROC0616
	1CR,PPUCZ,SPC)	PROC0617
	CALL PCCK(AC,NP,PCC,PCCR,PCCZ,PCS,PCSR,PCSZ,PCU,PCUR,PCUZ,PPCC,PPC	PROC0618
	1CR,PPCCZ,SPC)	PROC0619
230	WRITE OUTPUT TAPE 6,50	PROC0620
50	FORMAT (1H ,///1X,62HESCAPE PROBABILITY FROM CLUSTER FOR NEUTRON B	PROC0621
	1ORN IN FUEL (PIS)///)	PROC0622
	DO 226 I=1,NB	PROC0623
	IF(NPS(I))102,226,227	PROC0624
227	IF(PIS(I))311,312,313	PROC0625
311	PIS(I)=0.	PROC0626
312	PISR(I)=0.	PROC0627
	PISZ(I)=0.	PROC0628
313	IF(NP-1)102,293,294	PROC0629
293	WRITE OUTPUT TAPE 6,41,I,PISR(I),PISZ(I),PIS(I)	PROC0630
	GO TO 226	PROC0631
294	WRITE OUTPUT TAPE 6,53,I,PIS(I)	PROC0632
53	FORMAT (1H ,5X,I2,15X,2(12X,1H-),5X,1PE13.4)	PROC0633
226	CONTINUE	PROC0634
212	WRITE OUTPUT TAPE 6,45	PROC0635
45	FORMAT (1H1,16H5) BALANCE SHEET/////4X,32HFATE OF NEUTRONS BORN IN	PROC0636
	1 CLUSTER/////12X,13HSOURCE MEDIUM,26X,4HFUEL,39X,7HCOOLANT/12X,105H	PROC0637
	2=====	PROC0638
	3=====	PROC0639
	4IAL,8X,5HTOTAL)/29X,2(6X,38H=====	PROC0640
	5)///20X,20HNORMAL PROBABILITIES//12X,17HCOLLISION IN FUEL,3X)	PROC0641
	CALL WRITE(NP,PUUR,PUUZ,PUU,PCUR,PCUZ,PCU)	PROC0642
	IF(NC-11)228,228,229	PROC0643
228	WRITE OUTPUT TAPE 6,46	PROC0644
46	FORMAT (1H ,11X,20HCOLLISION IN COOLANT)	PROC0645
	CALL WRITE(NP,PUCR,PUCZ,PUC,PCCR,PCCZ,PCC)	PROC0646
	WRITE OUTPUT TAPE 6,54	PROC0647
54	FORMAT (1H ,11X,19HESCAPE FROM CLUSTER,1X)	PROC0648
	CALL WRITE(NP,PUSR,PUSZ,PUS,PCSR,PCSZ,PCS)	PROC0649

```

229 WRITE OUTPUT TAPE 6,47
47 FORMAT (1H ,///20X,21HREDUCED PROBABILITIES//12X,17HCOLLISION IN F
1UEL,3X)
CALL WRITE(NP,PPUUR,PPUUR,PPUUR,PPUUR,PPCUR,PPCUZ,PPCU)
IF(NC-1)233,233,287
233 WRITE OUTPUT TAPE 6,46
CALL WRITE(NP,PPUCR,PPUCZ,PPUC,PPCCR,PPCCZ,PPCC)
WRITE OUTPUT TAPE 6,48
48 FORMAT (1H ,///4X,46HTRANSMISSION PROBABILITY THROUGH CLUSTER (PS
1S)//)
IF(NP-1)102,231,232
231 WRITE OUTPUT TAPE 6,55,PSSR,PSSZ,PSS
55 FORMAT (1H ,32X,1P3E13.4)
GO TO 287
232 WRITE OUTPUT TAPE 6,56,PSS
56 FORMAT (1H ,27X,2(12X,1H-),5X,1PE13.4)
287 DO 288 I=1,NB
AP(I)=YAP(I)
FI(I)=YFI(I)
288 SP(I)=YSP(I)
SPC=YSPC
READ INPUT TAPE 5,1,(NDN(I),I=1,14)
IF(NDN(1))102,234,235
234 WRITE OUTPUT TAPE 6,28
GO TO 236
235 WRITE OUTPUT TAPE 6,49
49 FORMAT (1H1,64HALL INPUT DATA AS IN PREVIOUS PROBLEM EXCEPT THOSE
1MARKED WITH */1X,64H=====
2=====)
NDPFI=0
LI=0
LFL=0
LFL11=0
M=1
283 L=NDN(M)
IF(L)102,238,239
239 GO TO (236,242,242,242,242,242,242,250,250,250,250,250,279,279
1,267,267,250,181,280,281),L
242 IF(LI)102,260,261
260 READ INPUT TAPE 5,1,(INT(I),I=M,8)
LI=1
261 GO TO (102,243,244,245,246,247,248,247),L
243 NC=INT(M)
GO TO 285
244 NII=INT(M)
GO TO 238
245 NG=INT(M)
GO TO 238
246 NP=INT(M)
GO TO 238

```

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PROC0650
PROC0651
PROC0652
PROC0653
PROC0654
PROC0655
PROC0656
PROC0657
PROC0658
PROC0659
PROC0660
PROC0661
PROC0662
PROC0663
PROC0664
PROC0665
PROC0666
PROC0667
PROC0668
PROC0669
PROC0670
PROC0671
PROC0672
PROC0673
PROC0674
PROC0675
PROC0676
PROC0677
PROC0678
PROC0679
PROC0680
PROC0681
PROC0682
PROC0683
PROC0684
PROC0685
PROC0686
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PROC0688
PROC0689
PROC0690
PROC0691
PROC0692
PROC0693
PROC0694
PROC0695
PROC0696
PROC0697
PROC0698
PROC0699

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247	NTC=INT(M)	PROC0700
	GO TO 238	PROC0701
248	NS=INT(M)	PROC0702
	GO TO 238	PROC0703
249	NB=INT(M)	PROC0704
	EN=NB	PROC0705
	GO TO 238	PROC0706
250	IF(NC-11)252,266,252	PROC0707
252	IF(LFL)102,262,263	PROC0708
262	MM=M+5	PROC0709
	READ INPUT TAPE 5,2,(DANU(I),I=M,MM)	PROC0710
	LFL=1	PROC0711
263	K=L-8	PROC0712
	GO TO (254,255,256,257,258,102,102,102,102,259),K	PROC0713
254	AP(1)=DANU(M)	PROC0714
	GO TO 238	PROC0715
255	D(1)=DANU(M)	PROC0716
	GO TO 238	PROC0717
256	R(1)=DANU(M)	PROC0718
	GO TO 238	PROC0719
257	C=DANU(M)	PROC0720
	IF(NC-11)238,299,238	PROC0721
299	NDPFI=NDPFI+1	PROC0722
	GO TO 238	PROC0723
258	R(2)=DANU(M)	PROC0724
	GO TO 238	PROC0725
259	EPS=DANU(M)	PROC0726
	GO TO 238	PROC0727
266	K=L-8	PROC0728
	GO TO (115,253,102,267,102,264,265),K	PROC0729
267	IF(LFL11)102,167,269	PROC0730
268	IF(NC-11)300,301,302	PROC0731
300	DO 303 I=14,16	PROC0732
	DO 304 K11=1,14	PROC0733
	IF(I-NDN(K11))304,305,304	PROC0734
305	NDPFI=NDPFI+1	PROC0735
304	CONTINUE	PROC0736
303	CONTINUE	PROC0737
310	MM=M+NF1+NDPFI	PROC0738
	GO TO 306	PROC0739
301	I=16	PROC0740
	DO 307 K11=1,14	PROC0741
	IF(I-NDN(K11))307,309,307	PROC0742
309	NDPFI=NDPFI+1	PROC0743
307	CONTINUE	PROC0744
	GO TO 310	PROC0745
302	MM=M+3	PROC0746
306	READ INPUT TAPE 5,2,(DANU(I),I=M,MM)	PROC0747
	LFL11=1	PROC0748
269	IF(NC-11)270,271,270	PROC0749



```

271 K=L-11
GO TO (257,102,102,102,274,275),K
270 K=L-13
GO TO (272,273,274,275),K
272 SP(1)=DANU(M)
GO TO 238
273 SCL(1)=DANU(M)
GO TO 238
274 SPC=DANU(M)
GO TO 238
275 IF(NS-1)102,276,277
276 FI(1)=DANU(M)
GO TO 238
277 MMM=M
DO 278 I=1,NB
FI(I)=DANU(MMM)
278 MMM=MMM+1
GO TO 238
279 IF(NC-11)267,266,267
238 IF(M-14)282,298,102
282 M=M+1
GO TO 283
298 GO TO (144,144,144,144,144,144,144,144,144,165,165,121,121),NC
102 CALL EXIT
END
LABEL

```

\*  
CCORD

```

SUBROUTINE CORD(NC,R)
DIMENSION DUMMY(4),R(2),X(61),Y(61)
COMMON DUMMY,X,Y
GO TO (100,101,102,101,101,101,101,101,101),NC
100 DC=R(1)*1.4142136
GO TO 103
101 DC=R(1)
RDC=SQRTF(DC**2-(DC/2.）**2)
GO TO 104
102 DC=R(1)*1.7320508
104 GO TO (103,103,105,105,106,103,105,105,106),NC
105 DC15=DC*1.5
IF(NC-3)103,103,107
107 DC2=DC*2.
RDC2=RDC*2.
IF(NC-4)103,103,108
108 DC25=DC*2.5
RDC3=RDC*3.
GO TO 103
106 DCU=DC*1.3660254
DCD=DC*1.8660254
103 DCD2=DC/2.
GO TO (109,110,111,110,110,111,111,111,111),NC

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PROC0750
PROC0751
PROC0752
PROC0753
PROC0754
PROC0755
PROC0756
PROC0757
PROC0758
PROC0759
PROC0760
PROC0761
PROC0762
PROC0763
PROC0764
PROC0765
PROC0766
PROC0767
PROC0768
PROC0769
PROC0770
PROC0771
PROC0772
PROC0773
PROC0774

```

```

CORD 001
CORD 002
CORD 003
CORD 004
CORD 005
CORD 006
CORD 007
CORD 008
CORD 009
CORD 010
CORD 011
CORD 012
CORD 013
CORD 014
CORD 015
CORD 016
CORD 017
CORD 018
CORD 019
CORD 020
CORD 021
CORD 022
CORD 023
CORD 024

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109	X(1)=DCD2	CORD 025
	X(2)=X(1)	CORD 026
	X(3)=-X(1)	CORD 027
	X(4)=-X(1)	CORD 028
	Y(1)=X(1)	CORD 029
	Y(2)=X(3)	CORD 030
	Y(3)=X(3)	CORD 031
	Y(4)=X(1)	CORD 032
	GO TO 112	CORD 033
110	I=1	CORD 034
111	GO TO (112,113,114,115,116,117,118,119,120),NC	CORD 035
113	X(I)=0.	CORD 036
	X(I+1)=RCC	CORD 037
	X(I+2)=X(I+1)	CORD 038
	X(I+3)=0.	CORD 039
	X(I+4)=-X(I+2)	CORD 040
	X(I+5)=X(I+4)	CORD 041
	X(I+6)=0.	CORD 042
	Y(I)=DC	CORD 043
	Y(I+1)=DCD2	CORD 044
	Y(I+2)=-Y(I+1)	CORD 045
	Y(I+3)=-Y(I)	CORD 046
	Y(I+4)=Y(I+2)	CORD 047
	Y(I+5)=Y(I+1)	CORD 048
	Y(I+6)=0.	CORD 049
	GO TO 112	CORD 050
114	X(1)=DCD2	CORD 051
	X(3)=DC15	CORD 052
	X(4)=DC	CORD 053
	X(5)=0.	CORD 054
	X(6)=-X(4)	CORD 055
	X(7)=-X(3)	CORD 056
	X(9)=-X(1)	CORD 057
	X(11)=X(1)	CORD 058
	Y(1)=R(1)*2.5	CORD 059
	Y(2)=R(1)	CORD 060
	Y(3)=-R(1)/2.	CORD 061
	Y(4)=-R(1)*2.	CORD 062
	Y(5)=Y(4)	CORD 063
	Y(6)=Y(4)	CORD 064
	Y(7)=Y(3)	CORD 065
	Y(8)=Y(2)	CORD 066
	Y(9)=Y(1)	CORD 067
	Y(10)=Y(2)	CORD 068
	Y(11)=Y(3)	CORD 069
	Y(12)=Y(3)	CORD 070
	GO TO 121	CORD 071
115	X(I)=0.	CORD 072
	X(I+1)=RDC	CORD 073
	X(I+2)=RCC2	CORD 074

```

X(I+3)=X(I+2)
X(I+4)=X(I+2)
X(I+5)=X(I+1)
X(I+6)=0.
X(I+10)=-X(I+2)
X(I+11)=-X(I+1)
Y(I)=DC2
Y(I+1)=DC15
Y(I+2)=DC
Y(I+3)=0.
Y(I+4)=-Y(I+2)
Y(I+5)=-Y(I+1)
Y(I+9)=0.
Y(I+10)=Y(I+2)
Y(I+11)=Y(I+1)
GO TO 122
116 X(I)=DCD2
X(I+1)=DCU
X(I+2)=DCD
X(I+4)=X(I+1)
X(I+5)=X(I)
X(I+6)=-X(I)
X(I+10)=-X(I+1)
X(I+11)=X(I+6)
Y(I)=X(I+2)
Y(I+1)=X(I+1)
Y(I+2)=X(I)
Y(I+3)=X(I+6)
Y(I+4)=X(I+10)
Y(I+5)=-Y(I)
Y(I+9)=Y(I+2)
Y(I+10)=Y(I+1)
Y(I+11)=Y(I)
122 X(I+3)=X(I+2)
X(I+7)=-X(I+1)
X(I+8)=-X(I+2)
X(I+9)=X(I+8)
Y(I+6)=-Y(I)
Y(I+7)=-Y(I+1)
Y(I+8)=-Y(I+2)
IF(I-1)112,123,124
124 IF(NC-7)112,135,136
135 I=25
GO TO 113
136 I=31
GO TO 113
117 PIG12=3.1415926/12.
X(1)=R(2)*SINF(PIG12)
X(2)=R(2)*0.70710678
X(3)=R(2)*COSF(PIG12)

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CORD 075
CORD 076
CORD 077
CORD 078
CORD 079
CORD 080
CORD 081
CORD 082
CORD 083
CORD 084
CORD 085
CORD 086
CORD 087
CORD 088
CORD 089
CORD 090
CORD 091
CORD 092
CORD 093
CORD 094
CORD 095
CORD 096
CORD 097
CORD 098
CORD 099
CORD 100
CORD 101
CORD 102
CORD 103
CORD 104
CORD 105
CORD 106
CORD 107
CORD 108
CORD 109
CORD 110
CORD 111
CORD 112
CORD 113
CORD 114
CORD 115
CORD 116
CORD 117
CORD 118
CORD 119
CORD 120
CORD 121
CORD 122
CORD 123
CORD 124

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Y(1)=X(3)
Y(2)=X(2)
Y(3)=X(1)
118 GO TO 121
X(1)=RDC
X(2)=RDC2
X(3)=RDC3
Y(1)=DC25
Y(2)=DC2
Y(3)=DCD2
GO TO 121
119 X(2)=RDC
X(3)=RDC2
X(4)=RDC3
X(5)=X(4)
X(6)=X(4)
X(14)=-X(4)
X(15)=X(14)
Y(1)=DC*3.
Y(2)=DC25.
Y(3)=DC2
Y(4)=DC15
GO TO 121
120 X(3)=DCD
X(4)=DC*2.3660254
X(5)=DC*2.8660254
X(6)=X(5)
X(14)=-X(5)
X(15)=X(14)
Y(1)=DC+2.*RDC
Y(2)=Y(1)
Y(3)=DC*2.2320508
Y(4)=DCU
121 GO TO (112,112,125,112,112,126,126,125,125),NC
125 X(10)=0.
IF(NC-8) 128,127,128
128 X(2)=DC
GO TO 127
126 X(4)=X(3)
X(5)=X(2)
X(6)=X(1)
X(7)=-X(1)
X(9)=-X(3)
X(10)=X(9)
Y(4)=-Y(3)
Y(5)=-Y(2)
Y(6)=-Y(1)
Y(7)=Y(6)
Y(8)=Y(5)
Y(9)=Y(4)

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CORD 125
CORD 126
CORD 127
CORD 128
CORD 129
CORD 130
CORD 131
CORD 132
CORD 133
CORD 134
CORD 135
CORD 136
CORD 137
CORD 138
CORD 139
CORD 140
CORD 141
CORD 142
CORD 143
CORD 144
CORD 145
CORD 146
CORD 147
CORD 148
CORD 149
CORD 150
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CORD 161
CORD 162
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CORD 164
CORD 165
CORD 166
CORD 167
CORD 168
CORD 169
CORD 170
CORD 171
CORD 172
CORD 173
CORD 174

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	Y(10)=Y(3)		
	Y(11)=Y(2)		
	Y(12)=Y(1)		
127	IF(NC-8) 129, 130, 130		CORD 175
129	X(8)=-X(2)		CORD 176
	X(12)=-X(1)		CORD 177
	GO TO 131		CORD 178
130	X(1)=0.		CORD 179
	X(7)=X(4)		CORD 180
	X(8)=X(3)		CORD 181
	X(9)=X(2)		CORD 182
	X(12)=-X(3)		CORD 183
	X(13)=-X(4)		CORD 184
	X(16)=X(13)		CORD 185
	X(17)=X(12)		CORD 186
	X(18)=-X(2)		CORD 187
	Y(5)=DCD2		CORD 188
	Y(6)=-Y(5)		CORD 189
	Y(7)=-Y(4)		CORD 190
	Y(8)=-Y(3)		CORD 191
	Y(9)=-Y(2)		CORD 192
	Y(10)=-Y(1)		CORD 193
	Y(11)=Y(9)		CORD 194
	Y(12)=Y(8)		CORD 195
	Y(13)=Y(7)		CORD 196
	Y(14)=Y(6)		CORD 197
	Y(15)=Y(5)		CORD 198
	Y(16)=Y(4)		CORD 199
	Y(17)=Y(3)		CORD 200
	Y(18)=Y(2)		CORD 201
131	IF(NC-3) 112, 112, 132		CORD 202
132	X(11)=-X(2)		CORD 203
	IF(NC-7) 123, 123, 133		CORD 204
123	I=13		CORD 205
	GO TO 134		CORD 206
133	I=19		CORD 207
134	GO TO (112, 112, 112, 113, 113, 113, 115, 115, 116), NC		CORD 208
112	RETURN		CORD 209
	END		CORD 210
	LABEL		CORD 211
* CSIMM			CORD 212
	SUBROUTINE SIMM(NB, NC)		CORD 213
	DIMENSION DUMMY(564), FILL(248), FILL1(122), I(19), MSI(61, 61), N(4), NPS		SIMM 001
	1S(61)		SIMM 002
	COMMON FILL, MSI, FILL1, NPS, DUMMY, I, N		SIMM 003
	IF(NC-10) 237, 238, 238		SIMM 004
238	DO 239 L=1, NB		SIMM 005
239	NPS(L)=1		SIMM 006
	GO TO 113		SIMM 007
237	DO 240 L=1, NB		SIMM 008
			SIMM 009
			SIMM 010

```

240 NPS(L)=0
    NR=1
    NG=1
    I(1)=0
100 GO TO (100,100,101,102,102,102,103,104,104),NC
    N(1)=1
    N(3)=1
    I(2)=1
    I(3)=2
105 IF(NC-1)105,105,106
    N(2)=4
    N(4)=4
    I(4)=1
    NPS(1)=4
106 GO TO 107
    N(2)=6
    N(4)=6
    I(4)=3
    I(5)=2
    I(6)=1
    NPS(1)=6
    NPS(7)=1
101 GO TO 107
    N(1)=10
    N(2)=12
    N(3)=10
    N(4)=12
    I(2)=6
    I(3)=6
    NPS(1)=6
    NPS(2)=3
    NPS(10)=3
102 GO TO 107
    N(1)=13
    N(2)=18
    N(3)=13
    N(4)=18
    NPS(13)=6
    NPS(19)=1
108 IF(NC-5)108,109,110
    I(2)=7
    I(3)=8
    I(4)=10
    I(5)=8
    I(6)=7
    NPS(1)=6
    NPS(2)=6
109 GO TO 107
    I(2)=11
    I(3)=19

```

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SIMM 011
SIMM 012
SIMM 013
SIMM 014
SIMM 015
SIMM 016
SIMM 017
SIMM 018
SIMM 019
SIMM 020
SIMM 021
SIMM 022
SIMM 023
SIMM 024
SIMM 025
SIMM 026
SIMM 027
SIMM 028
SIMM 029
SIMM 030
SIMM 031
SIMM 032
SIMM 033
SIMM 034
SIMM 035
SIMM 036
SIMM 037
SIMM 038
SIMM 039
SIMM 040
SIMM 041
SIMM 042
SIMM 043
SIMM 044
SIMM 045
SIMM 046
SIMM 047
SIMM 048
SIMM 049
SIMM 050
SIMM 051
SIMM 052
SIMM 053
SIMM 054
SIMM 055
SIMM 056
SIMM 057
SIMM 058
SIMM 059
SIMM 060

```

I(4) = 20  
 I(5) = 19  
 I(6) = 11  
 NPS(1) = 12  
 GO TO 107  
 110 I(2) = 25  
 I(3) = 26  
 I(4) = 27  
 I(5) = 26  
 I(6) = 25  
 NPS(1) = 12  
 GO TO 107  
 103 N(1) = 25  
 N(2) = 30  
 N(3) = 25  
 N(4) = 30  
 I(2) = 11  
 I(3) = 12  
 I(4) = 19  
 I(5) = 12  
 I(6) = 11  
 NPS(1) = 12  
 NPS(13) = 6  
 NPS(14) = 6  
 NPS(25) = 6  
 NPS(31) = 1  
 GO TO 107  
 104 N(1) = 31  
 N(2) = 36  
 N(3) = 31  
 N(4) = 36  
 NPS(1) = 6  
 NPS(2) = 12  
 NPS(31) = 6  
 NPS(37) = 1  
 IF(NC-8) 111, 111, 112  
 111 I(2) = 10  
 I(3) = 11  
 I(4) = 16  
 I(5) = 11  
 I(6) = 10  
 NPS(19) = 6  
 NPS(20) = 6  
 GO TO 107  
 112 I(2) = 1  
 I(3) = 15  
 I(4) = 71  
 I(5) = 15  
 I(6) = 1  
 NPS(19) = 12

SIMM 061  
 SIMM 062  
 SIMM 063  
 SIMM 064  
 SIMM 065  
 SIMM 066  
 SIMM 067  
 SIMM 068  
 SIMM 069  
 SIMM 070  
 SIMM 071  
 SIMM 072  
 SIMM 073  
 SIMM 074  
 SIMM 075  
 SIMM 076  
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 SIMM 092  
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 SIMM 094  
 SIMM 095  
 SIMM 096  
 SIMM 097  
 SIMM 098  
 SIMM 099  
 SIMM 100  
 SIMM 101  
 SIMM 102  
 SIMM 103  
 SIMM 104  
 SIMM 105  
 SIMM 106  
 SIMM 107  
 SIMM 108  
 SIMM 109  
 SIMM 110

```

107 CALL SPOST(NR,NC)
    GO TO (113,114,115,116,116,116,116,116,116),NC
116 NC=2
    IF(NC-7)117,118,119
117 N(1)=1
    N(2)=12
    N(3)=13
    N(4)=18
    IF(NC-5)120,121,122
120 I(1)=7
    I(2)=7
    I(3)=8
    I(4)=10
    I(5)=3
    I(6)=3
    I(7)=9
    I(8)=3
    I(9)=3
    I(10)=10
    I(11)=8
    I(12)=7
    GO TO 123
121 I(1)=11
    I(2)=12
    I(3)=2
    I(4)=16
    I(5)=17
    I(6)=18
    I(7)=18
    I(8)=17
    I(9)=16
    I(10)=2
    I(11)=12
    I(12)=11
    GO TO 123
122 I(1)=19
    I(2)=20
    I(3)=21
    I(4)=22
    I(5)=23
    I(6)=24
    I(7)=24
    I(8)=23
    I(9)=22
    I(10)=21
    I(11)=20
    I(12)=19
    GO TO 123
118 N(1)=13
    N(2)=24

```

```

S I M M 1 1 1
S I M M 1 1 2
S I M M 1 1 3
S I M M 1 1 4
S I M M 1 1 5
S I M M 1 1 6
S I M M 1 1 7
S I M M 1 1 8
S I M M 1 1 9
S I M M 1 2 0
S I M M 1 2 1
S I M M 1 2 2
S I M M 1 2 3
S I M M 1 2 4
S I M M 1 2 5
S I M M 1 2 6
S I M M 1 2 7
S I M M 1 2 8
S I M M 1 2 9
S I M M 1 3 0
S I M M 1 3 1
S I M M 1 3 2
S I M M 1 3 3
S I M M 1 3 4
S I M M 1 3 5
S I M M 1 3 6
S I M M 1 3 7
S I M M 1 3 8
S I M M 1 3 9
S I M M 1 4 0
S I M M 1 4 1
S I M M 1 4 2
S I M M 1 4 3
S I M M 1 4 4
S I M M 1 4 5
S I M M 1 4 6
S I M M 1 4 7
S I M M 1 4 8
S I M M 1 4 9
S I M M 1 5 0
S I M M 1 5 1
S I M M 1 5 2
S I M M 1 5 3
S I M M 1 5 4
S I M M 1 5 5
S I M M 1 5 6
S I M M 1 5 7
S I M M 1 5 8
S I M M 1 5 9
S I M M 1 6 0

```



N(3) = 25  
N(4) = 30  
I(1) = 11  
I(2) = 11  
I(3) = 12  
I(4) = 19  
I(5) = 13  
I(6) = 13  
I(7) = 20  
I(8) = 13  
I(9) = 13  
I(10) = 19  
I(11) = 12  
I(12) = 11

CALL SPOST(NR,NG)

N(1) = 1  
N(2) = 12  
N(3) = 25  
N(4) = 30  
I(1) = 12  
I(2) = 19  
I(3) = 13  
I(4) = 20  
I(5) = 21  
I(6) = 14  
I(7) = 14  
I(8) = 21  
I(9) = 20  
I(10) = 13  
I(11) = 19  
I(12) = 12

119 GO TO 123

N(1) = 19  
N(2) = 30  
N(3) = 31  
N(4) = 36

124 IF(NC-8) 124, 124, 125

I(1) = 10  
I(2) = 10  
I(3) = 11  
I(4) = 16  
I(5) = 12  
I(6) = 12  
I(7) = 18  
I(8) = 12  
I(9) = 12  
I(10) = 16  
I(11) = 11  
I(12) = 10  
GO TO 123

SIMM 161  
SIMM 162  
SIMM 163  
SIMM 164  
SIMM 165  
SIMM 166  
SIMM 167  
SIMM 168  
SIMM 169  
SIMM 170  
SIMM 171  
SIMM 172  
SIMM 173  
SIMM 174  
SIMM 175  
SIMM 176  
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SIMM 195  
SIMM 196  
SIMM 197  
SIMM 198  
SIMM 199  
SIMM 200  
SIMM 201  
SIMM 202  
SIMM 203  
SIMM 204  
SIMM 205  
SIMM 206  
SIMM 207  
SIMM 208  
SIMM 209  
SIMM 210

```

125 I(1)=1
    I(2)=36
    I(3)=21
    I(4)=16
    I(5)=70
    I(6)=34
    I(7)=34
    I(8)=70
    I(9)=16
    I(10)=21
    I(11)=36
    I(12)=1
123 CALL SPOST(NR,NG)
    IF(NC-8)126,115,115
115 NG=3
    N(1)=1
    IF(NC-8)127,128,128
127 N(2)=9
    N(3)=10
    N(4)=12
    I(1)=6
    I(2)=6
    I(3)=5
    I(4)=7
    I(5)=5
    I(6)=7
    I(7)=5
    I(8)=6
    I(9)=6
    GO TO 129
128 N(2)=18
    N(3)=31
    N(4)=36
    IF(NC-8)130,130,131
130 I(1)=16
    I(2)=11
    I(3)=16
    I(4)=12
    I(5)=12
    I(6)=18
    I(7)=4
    I(8)=13
    I(9)=4
    I(10)=17
    I(11)=4
    I(12)=13
    I(13)=4
    I(14)=18
    I(15)=12
    I(16)=12

```

```

SIMM 211
SIMM 212
SIMM 213
SIMM 214
SIMM 215
SIMM 216
SIMM 217
SIMM 218
SIMM 219
SIMM 220
SIMM 221
SIMM 222
SIMM 223
SIMM 224
SIMM 225
SIMM 226
SIMM 227
SIMM 228
SIMM 229
SIMM 230
SIMM 231
SIMM 232
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SIMM 241
SIMM 242
SIMM 243
SIMM 244
SIMM 245
SIMM 246
SIMM 247
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SIMM 249
SIMM 250
SIMM 251
SIMM 252
SIMM 253
SIMM 254
SIMM 255
SIMM 256
SIMM 257
SIMM 258
SIMM 259
SIMM 260

```

```

I(17)=16
I(18)=11
GO TO 129
131 I(1)=15
I(2)=35
I(3)=45
I(4)=37
I(5)=22
I(6)=66
I(7)=17
I(8)=67
I(9)=68
I(10)=69
I(11)=68
I(12)=67
I(13)=17
I(14)=66
I(15)=22
I(16)=37
I(17)=45
I(18)=35
129 CALL SPOST(NR,NG)
IF(NC-8) 132,126,126
126 NR=2
NG=1
IF(NC-7) 133,134,135
133 N(1)=13
N(2)=18
N(3)=1
N(4)=12
IF(NC-5) 136,137,138
136 I(1)=7
I(2)=8
I(3)=3
I(4)=9
I(5)=3
I(6)=8
GO TO 139
137 I(1)=11
I(2)=12
I(3)=13
I(4)=14
I(5)=15
I(6)=10
GO TO 139
138 I(1)=12
I(2)=13
I(3)=14
I(4)=15
I(5)=16

```

```

SIMM 261
SIMM 262
SIMM 263
SIMM 264
SIMM 265
SIMM 266
SIMM 267
SIMM 268
SIMM 269
SIMM 270
SIMM 271
SIMM 272
SIMM 273
SIMM 274
SIMM 275
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SIMM 294
SIMM 295
SIMM 296
SIMM 297
SIMM 298
SIMM 299
SIMM 300
SIMM 301
SIMM 302
SIMM 303
SIMM 304
SIMM 305
SIMM 306
SIMM 307
SIMM 308
SIMM 309
SIMM 310

```

```

I(6) = 17
GO TO 139
134 N(1) = 25
      N(2) = 30
      N(3) = 13
      N(4) = 24
      I(1) = 11
      I(2) = 12
      I(3) = 13
      I(4) = 20
      I(5) = 13
      I(6) = 12
GO TO 139
135 N(1) = 31
      N(2) = 36
      N(3) = 19
      N(4) = 30
      IF(NC-8) 140, 140, 141
140 I(1) = 10
      I(2) = 11
      I(3) = 12
      I(4) = 18
      I(5) = 12
      I(6) = 11
GO TO 139
141 I(1) = 1
      I(2) = 36
      I(3) = 37
      I(4) = 22
      I(5) = 65
      I(6) = 2
139 CALL SPOST(NR, NG)
GO TO (142, 142, 142, 142, 143, 144, 145, 146, 147), NC
142 I(1) = 7
      I(2) = 7
      I(3) = 10
      I(4) = 3
      I(5) = 3
      I(6) = 10
GO TO 148
143 I(1) = 12
      I(2) = 11
      I(3) = 10
      I(4) = 15
      I(5) = 14
      I(6) = 13
GO TO 148
144 I(1) = 13
      I(2) = 12
      I(3) = 17

```

```

SIMM 11
SIMM 12
SIMM 13
SIMM 14
SIMM 15
SIMM 16
SIMM 17
SIMM 18
SIMM 19
SIMM 20
SIMM 21
SIMM 22
SIMM 23
SIMM 24
SIMM 25
SIMM 26
SIMM 27
SIMM 28
SIMM 29
SIMM 30
SIMM 31
SIMM 32
SIMM 33
SIMM 34
SIMM 35
SIMM 36
SIMM 37
SIMM 38
SIMM 39
SIMM 40
SIMM 41
SIMM 42
SIMM 43
SIMM 44
SIMM 45
SIMM 46
SIMM 47
SIMM 48
SIMM 49
SIMM 50
SIMM 51
SIMM 52
SIMM 53
SIMM 54
SIMM 55
SIMM 56
SIMM 57
SIMM 58
SIMM 59
SIMM 60

```

```

I(4)=16
I(5)=15
I(6)=14
GO TO 148
145 I(1)=11
I(2)=11
I(3)=19
I(4)=13
I(5)=13
I(6)=19
GO TO 148
146 I(1)=10
I(2)=10
I(3)=16
I(4)=12
I(5)=12
I(6)=16
GO TO 148
147 I(1)=36
I(2)=1
I(3)=2
I(4)=65
I(5)=22
I(6)=37
148 CALL SPOST(NR,NG)
IF(NC=7) 149,150,149
150 N(3)=1
N(4)=12
I(1)=12
I(2)=19
I(3)=20
I(4)=14
I(5)=21
I(6)=13
CALL SPOST(NR,NG)
I(1)=19
I(2)=12
I(3)=13
I(4)=21
I(5)=14
I(6)=20
CALL SPOST(NR,NG)
149 NG=2
I(1)=0
IF(NC=8) 151,152,152
151 N(1)=1
N(2)=12
N(3)=1
N(4)=12
I(2)=1

```

```

SIMM 361
SIMM 362
SIMM 363
SIMM 364
SIMM 365
SIMM 366
SIMM 367
SIMM 368
SIMM 369
SIMM 370
SIMM 371
SIMM 372
SIMM 373
SIMM 374
SIMM 375
SIMM 376
SIMM 377
SIMM 378
SIMM 379
SIMM 380
SIMM 381
SIMM 382
SIMM 383
SIMM 384
SIMM 385
SIMM 386
SIMM 387
SIMM 388
SIMM 389
SIMM 390
SIMM 391
SIMM 392
SIMM 393
SIMM 394
SIMM 395
SIMM 396
SIMM 397
SIMM 398
SIMM 399
SIMM 400
SIMM 401
SIMM 402
SIMM 403
SIMM 404
SIMM 405
SIMM 406
SIMM 407
SIMM 408
SIMM 409
SIMM 410

```

```

I(3)=2
I(4)=3
I(5)=4
I(6)=5
I(7)=6
153 IF(NC-5) 153,154,154
I(8)=5
I(9)=4
I(10)=3
I(11)=2
I(12)=1
GO TO 155
154 I(8)=7
IF(NC-7) 156,157,157
156 I(9)=8
I(10)=9
I(11)=10
I(12)=11
GO TO 155
157 I(9)=4
I(10)=8
I(11)=9
I(12)=10
GO TO 155
152 N(1)=19
N(2)=30
N(3)=19
N(4)=30
I(12)=10
IF(NC-8) 158,158,159
158 I(2)=10
I(3)=16
I(4)=12
I(5)=13
I(6)=4
I(7)=17
I(8)=4
I(9)=13
I(10)=12
I(11)=16
GO TO 155
159 I(2)=20
I(3)=21
I(4)=60
I(5)=61
I(6)=23
I(7)=62
I(8)=63
I(9)=64
I(10)=3

```

```

SIMM 411
SIMM 412
SIMM 413
SIMM 414
SIMM 415
SIMM 416
SIMM 417
SIMM 418
SIMM 419
SIMM 420
SIMM 421
SIMM 422
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SIMM 424
SIMM 425
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SIMM 447
SIMM 448
SIMM 449
SIMM 450
SIMM 451
SIMM 452
SIMM 453
SIMM 454
SIMM 455
SIMM 456
SIMM 457
SIMM 458
SIMM 459
SIMM 460

```

```

155 I(11)=2
    CALL SPOST(NR,NG)
    IF(NC-8) 160,161,161
160 I(1)=1
    I(2)=0
    I(9)=5
    I(11)=3
    IF(NC-5) 162,163,163
162 I(3)=1
    I(4)=8
    I(5)=3
    I(6)=9
    I(7)=5
    I(8)=4
    I(10)=9
    I(12)=8
    GO TO 164
163 I(7)=7
    I(8)=6
    I(10)=4
    I(12)=2
    IF(NC-7) 165,166,166
165 I(3)=11
    I(4)=10
    I(5)=9
    I(6)=8
    GO TO 164
166 I(3)=10
    I(4)=9
    I(5)=8
    I(6)=4
    GO TO 164
161 I(2)=0
    I(3)=10
    IF(NC-8) 167,167,168
167 I(1)=10
    I(4)=11
    I(5)=12
    I(6)=18
    I(7)=4
    I(8)=13
    I(9)=4
    I(10)=18
    I(11)=12
    I(12)=11
    GO TO 164
168 I(1)=20
    I(4)=2
    I(5)=3
    I(6)=64

```

```

SIMM 461
SIMM 462
SIMM 463
SIMM 464
SIMM 465
SIMM 466
SIMM 467
SIMM 468
SIMM 469
SIMM 470
SIMM 471
SIMM 472
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SIMM 474
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SIMM 500
SIMM 501
SIMM 502
SIMM 503
SIMM 504
SIMM 505
SIMM 506
SIMM 507
SIMM 508
SIMM 509
SIMM 510

```

```

I(7) = 63
I(8) = 62
I(9) = 23
I(10) = 61
I(11) = 60
I(12) = 21
164 CALL SPOST(NR,NG)
IF(NC-7) 114,169,170
169 N(3) = 13
N(4) = 24
I(1) = 1
I(2) = 12
I(3) = 17
I(4) = 14
I(5) = 16
I(6) = 4
I(7) = 4
I(8) = 16
I(9) = 14
I(10) = 17
I(11) = 12
I(12) = 1
CALL SPOST(NR,NG)
I(1) = 11
I(2) = 11
I(3) = 22
I(4) = 13
I(5) = 14
I(6) = 15
I(7) = 16
I(8) = 16
I(9) = 15
I(10) = 14
I(11) = 13
I(12) = 22
CALL SPOST(NR,NG)
N(1) = 13
N(2) = 24
N(3) = 1
N(4) = 12
I(1) = 1
I(2) = 11
I(3) = 12
I(4) = 13
I(5) = 14
I(6) = 15
I(7) = 4
I(8) = 16
I(9) = 16
I(10) = 14

```

```

SIMM 511
SIMM 512
SIMM 513
SIMM 514
SIMM 515
SIMM 516
SIMM 517
SIMM 518
SIMM 519
SIMM 520
SIMM 521
SIMM 522
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SIMM 551
SIMM 552
SIMM 553
SIMM 554
SIMM 555
SIMM 556
SIMM 557
SIMM 558
SIMM 559
SIMM 560

```



```

I(11)=17
I(12)=18
CALL SPOST(NR,NG)
I(1)=12
I(2)=11
I(3)=1
I(4)=18
I(5)=17
I(6)=14
I(7)=16
I(8)=16
I(9)=4
I(10)=15
I(11)=14
I(12)=13
CALL SPOST(NR,NG)
N(3)=13
N(4)=24
I(1)=0
I(2)=11
I(3)=19
I(4)=13
I(5)=21
I(6)=14
I(7)=15
I(8)=14
I(9)=21
I(10)=13
I(11)=19
I(12)=11
CALL SPOST(NR,NG)
I(1)=11
I(2)=0
I(3)=11
I(4)=12
I(5)=13
I(6)=20
I(7)=14
I(8)=21
I(9)=14
I(10)=20
I(11)=13
I(12)=12
CALL SPOST(NR,NG)
GO TO 114
170 NG=3
N(1)=1
N(2)=18
N(3)=19
N(4)=30

```

```

SIMM 561
SIMM 562
SIMM 563
SIMM 564
SIMM 565
SIMM 566
SIMM 567
SIMM 568
SIMM 569
SIMM 570
SIMM 571
SIMM 572
SIMM 573
SIMM 574
SIMM 575
SIMM 576
SIMM 577
SIMM 578
SIMM 579
SIMM 580
SIMM 581
SIMM 582
SIMM 583
SIMM 584
SIMM 585
SIMM 586
SIMM 587
SIMM 588
SIMM 589
SIMM 590
SIMM 591
SIMM 592
SIMM 593
SIMM 594
SIMM 595
SIMM 596
SIMM 597
SIMM 598
SIMM 599
SIMM 600
SIMM 601
SIMM 602
SIMM 603
SIMM 604
SIMM 605
SIMM 606
SIMM 607
SIMM 608
SIMM 609
SIMM 610

```

```

171 I(1)=10
    IF(NC-8) 171,171,172
    I(2)=10
    I(3)=11
    I(4)=12
    I(5)=18
    I(6)=4
    I(7)=5
    I(8)=5
    I(9)=14
    I(10)=15
    I(11)=14
    I(12)=5
    I(13)=5
    I(14)=4
    I(15)=18
    I(16)=12
    I(17)=11
    I(18)=10
    GO TO 173
172 I(2)=1
    I(3)=36
    I(4)=21
    I(5)=50
    I(6)=51
    I(7)=52
    I(8)=53
    I(9)=54
    I(10)=55
    I(11)=56
    I(12)=57
    I(13)=58
    I(14)=59
    I(15)=4
    I(16)=11
    I(17)=16
    I(18)=15
173 CALL SPOST(NR,NG)
    IF(NC-8) 174,174,175
174 I(1)=11
    I(2)=10
    I(3)=10
    I(4)=11
    I(5)=16
    I(6)=12
    I(7)=13
    I(8)=4
    I(9)=17
    I(10)=14
    I(11)=5

```

```

SIMM 611
SIMM 612
SIMM 613
SIMM 614
SIMM 615
SIMM 616
SIMM 617
SIMM 618
SIMM 619
SIMM 620
SIMM 621
SIMM 622
SIMM 623
SIMM 624
SIMM 625
SIMM 626
SIMM 627
SIMM 628
SIMM 629
SIMM 630
SIMM 631
SIMM 632
SIMM 633
SIMM 634
SIMM 635
SIMM 636
SIMM 637
SIMM 638
SIMM 639
SIMM 640
SIMM 641
SIMM 642
SIMM 643
SIMM 644
SIMM 645
SIMM 646
SIMM 647
SIMM 648
SIMM 649
SIMM 650
SIMM 651
SIMM 652
SIMM 653
SIMM 654
SIMM 655
SIMM 656
SIMM 657
SIMM 658
SIMM 659
SIMM 660

```

```

I(12)=5
I(13)=14
I(14)=17
I(15)=4
I(16)=13
I(17)=12
I(18)=16
GO TO 176
175 I(1)=21
I(2)=36
I(3)=11
I(4)=10
I(5)=15
I(6)=16
I(7)=11
I(8)=4
I(9)=59
I(10)=538
I(11)=57
I(12)=56
I(13)=55
I(14)=54
I(15)=53
I(16)=52
I(17)=51
I(18)=50
176 CALL SPOST(NR,NG)
132 NR=3
NG=1
N(3)=1
IF(NC-8) 177,178,178
177 N(1)=10
N(2)=12
N(4)=9
I(1)=6
I(2)=5
I(3)=7
GO TO 179
178 N(1)=31
N(2)=36
N(4)=18
IF(NC-8) 180,180,181
180 I(1)=16
I(2)=12
I(3)=4
I(4)=17
I(5)=4
I(6)=12
GO TO 179
181 I(1)=15

```

```

SIMM 661
SIMM 662
SIMM 663
SIMM 664
SIMM 665
SIMM 666
SIMM 667
SIMM 668
SIMM 669
SIMM 670
SIMM 671
SIMM 672
SIMM 673
SIMM 674
SIMM 675
SIMM 676
SIMM 677
SIMM 678
SIMM 679
SIMM 680
SIMM 681
SIMM 682
SIMM 683
SIMM 684
SIMM 685
SIMM 686
SIMM 687
SIMM 688
SIMM 689
SIMM 690
SIMM 691
SIMM 692
SIMM 693
SIMM 694
SIMM 695
SIMM 696
SIMM 697
SIMM 698
SIMM 699
SIMM 700
SIMM 701
SIMM 702
SIMM 703
SIMM 704
SIMM 705
SIMM 706
SIMM 707
SIMM 708
SIMM 709
SIMM 710

```

```

I(2) = 16
I(3) = 17
I(4) = 18
I(5) = 17
I(6) = 16
179 CALL SPOST(NR,NG)
IF(NC-8) 182,183,184
182 I(1) = 6
I(2) = 6
I(3) = 5
GO TO 185
183 I(1) = 11
I(2) = 16
I(3) = 18
I(4) = 4
I(5) = 13
I(6) = 12
GO TO 185
184 I(1) = 35
I(2) = 45
I(3) = 46
I(4) = 47
I(5) = 48
I(6) = 34
185 CALL SPOST(NR,NG)
IF(NC-8) 186,187,188
186 I(1) = 5
I(2) = 6
I(3) = 7
GO TO 189
187 I(1) = 16
I(2) = 11
I(3) = 12
I(4) = 13
I(5) = 4
I(6) = 18
GO TO 189
188 I(1) = 45
I(2) = 35
I(3) = 34
I(4) = 48
I(5) = 47
I(6) = 46
189 CALL SPOST(NR,NG)
IF(NC-8) 190,191,191
191 NG=2
N(1) = 19
N(2) = 30
N(3) = 1
N(4) = 18

```

```

SIMM 711
SIMM 712
SIMM 713
SIMM 714
SIMM 715
SIMM 716
SIMM 717
SIMM 718
SIMM 719
SIMM 720
SIMM 721
SIMM 722
SIMM 723
SIMM 724
SIMM 725
SIMM 726
SIMM 727
SIMM 728
SIMM 729
SIMM 730
SIMM 731
SIMM 732
SIMM 733
SIMM 734
SIMM 735
SIMM 736
SIMM 737
SIMM 738
SIMM 739
SIMM 740
SIMM 741
SIMM 742
SIMM 743
SIMM 744
SIMM 745
SIMM 746
SIMM 747
SIMM 748
SIMM 749
SIMM 750
SIMM 751
SIMM 752
SIMM 753
SIMM 754
SIMM 755
SIMM 756
SIMM 757
SIMM 758
SIMM 759
SIMM 760

```

```

I(1)=10
192 IF(NC-8) 192,192,193
I(2)=11
I(3)=12
I(4)=13
I(5)=5
I(6)=14
I(7)=15
I(8)=14
I(9)=5
I(10)=13
I(11)=12
I(12)=11
GO TO 194
193 I(2)=2
I(3)=11
I(4)=12
I(5)=13
I(6)=14
I(7)=14
I(8)=13
I(9)=12
I(10)=11
I(11)=2
I(12)=10
194 CALL SPOST(NR,NG)
195 IF(NC-8) 195,195,196
I(1)=10
I(2)=10
I(3)=11
I(4)=12
I(5)=4
I(6)=17
I(7)=14
I(8)=5
I(9)=5
I(10)=4
I(11)=18
I(12)=16
GO TO 197
196 I(1)=1
I(2)=36
I(3)=37
I(4)=38
I(5)=39
I(6)=40
I(7)=41
I(8)=42
I(9)=43
I(10)=33

```

```

SIMM 761
SIMM 762
SIMM 763
SIMM 764
SIMM 765
SIMM 766
SIMM 767
SIMM 768
SIMM 769
SIMM 770
SIMM 771
SIMM 772
SIMM 773
SIMM 774
SIMM 775
SIMM 776
SIMM 777
SIMM 778
SIMM 779
SIMM 780
SIMM 781
SIMM 782
SIMM 783
SIMM 784
SIMM 785
SIMM 786
SIMM 787
SIMM 788
SIMM 789
SIMM 790
SIMM 791
SIMM 792
SIMM 793
SIMM 794
SIMM 795
SIMM 796
SIMM 797
SIMM 798
SIMM 799
SIMM 800
SIMM 801
SIMM 802
SIMM 803
SIMM 804
SIMM 805
SIMM 806
SIMM 807
SIMM 808
SIMM 809
SIMM 810

```

```

I(11)=44
I(12)=15
197 CALL SPOST(NR,NG)
IF(NC=8) 198,198,199
198 I(1)=11
I(2)=10
I(3)=10
I(4)=16
I(5)=18
I(6)=4
I(7)=5
I(8)=5
I(9)=14
I(10)=17
I(11)=4
I(12)=12
GO TO 200
199 I(1)=36
I(2)=1
I(3)=15
I(4)=44
I(5)=33
I(6)=43
I(7)=42
I(8)=41
I(9)=40
I(10)=39
I(11)=38
I(12)=37
200 CALL SPOST(NR,NG)
190 NG=3
N(1)=1
N(3)=1
I(1)=0
I(2)=1
I(3)=2
I(4)=3
IF(NC=8) 201,202,202
201 N(2)=9
N(4)=9
I(5)=3
I(6)=4
I(7)=3
I(8)=5
I(9)=1
GO TO 203
202 N(2)=18
N(4)=18
I(5)=4
I(6)=5

```

```

SIMM 811
SIMM 812
SIMM 813
SIMM 814
SIMM 815
SIMM 816
SIMM 817
SIMM 818
SIMM 819
SIMM 820
SIMM 821
SIMM 822
SIMM 823
SIMM 824
SIMM 825
SIMM 826
SIMM 827
SIMM 828
SIMM 829
SIMM 830
SIMM 831
SIMM 832
SIMM 833
SIMM 834
SIMM 835
SIMM 836
SIMM 837
SIMM 838
SIMM 839
SIMM 840
SIMM 841
SIMM 842
SIMM 843
SIMM 844
SIMM 845
SIMM 846
SIMM 847
SIMM 848
SIMM 849
SIMM 850
SIMM 851
SIMM 852
SIMM 853
SIMM 854
SIMM 855
SIMM 856
SIMM 857
SIMM 858
SIMM 859
SIMM 860

```

```

I(7)=6
I(8)=7
I(9)=8
I(10)=9
I(11)=8
I(12)=7
I(13)=6
I(14)=5
I(15)=4
I(16)=3
I(17)=2
I(18)=1
203 CALL SPOST(NR,NG)
I(1)=1
I(2)=0
204 IF(NC-8)204,205,206
I(3)=1
I(4)=5
I(5)=7
I(6)=3
I(7)=3
I(8)=7
I(9)=5
205 GO TO 207
I(3)=1
I(4)=2
I(5)=12
I(6)=13
I(7)=5
I(8)=14
I(9)=15
I(10)=8
I(11)=7
I(12)=6
I(13)=7
I(14)=14
I(15)=17
I(16)=4
I(17)=12
I(18)=11
206 GO TO 207
I(3)=20
I(4)=21
I(5)=22
I(6)=23
I(7)=24
I(8)=25
I(9)=26
I(10)=27
I(11)=28

```

```

SIMM 861
SIMM 862
SIMM 863
SIMM 864
SIMM 865
SIMM 866
SIMM 867
SIMM 868
SIMM 869
SIMM 870
SIMM 871
SIMM 872
SIMM 873
SIMM 874
SIMM 875
SIMM 876
SIMM 877
SIMM 878
SIMM 879
SIMM 880
SIMM 881
SIMM 882
SIMM 883
SIMM 884
SIMM 885
SIMM 886
SIMM 887
SIMM 888
SIMM 889
SIMM 890
SIMM 891
SIMM 892
SIMM 893
SIMM 894
SIMM 895
SIMM 896
SIMM 897
SIMM 898
SIMM 899
SIMM 900
SIMM 901
SIMM 902
SIMM 903
SIMM 904
SIMM 905
SIMM 906
SIMM 907
SIMM 908
SIMM 909
SIMM 910

```

```

I(12)=29
I(13)=30
I(14)=31
I(15)=32
I(16)=33
I(17)=34
I(18)=35
207 CALL SPOST(NR,NG)
I(3)=0
I(4)=1
208 IF(NC-8)208,209,210
I(1)=2
I(2)=1
I(5)=5
I(6)=3
I(7)=4
I(8)=3
I(9)=3
209 GO TO 211
I(1)=2
I(2)=1
I(5)=11
I(6)=12
I(7)=4
I(8)=17
I(9)=14
I(10)=7
I(11)=6
I(12)=7
I(13)=8
I(14)=15
I(15)=14
I(16)=5
I(17)=13
I(18)=12
210 GO TO 211
I(1)=21
I(2)=20
I(5)=35
I(6)=34
I(7)=33
I(8)=32
I(9)=31
I(10)=30
I(11)=29
I(12)=28
I(13)=27
I(14)=26
I(15)=25
I(16)=24

```

```

SIMM 911
SIMM 912
SIMM 913
SIMM 914
SIMM 915
SIMM 916
SIMM 917
SIMM 918
SIMM 919
SIMM 920
SIMM 921
SIMM 922
SIMM 923
SIMM 924
SIMM 925
SIMM 926
SIMM 927
SIMM 928
SIMM 929
SIMM 930
SIMM 931
SIMM 932
SIMM 933
SIMM 934
SIMM 935
SIMM 936
SIMM 937
SIMM 938
SIMM 939
SIMM 940
SIMM 941
SIMM 942
SIMM 943
SIMM 944
SIMM 945
SIMM 946
SIMM 947
SIMM 948
SIMM 949
SIMM 950
SIMM 951
SIMM 952
SIMM 953
SIMM 954
SIMM 955
SIMM 956
SIMM 957
SIMM 958
SIMM 959
SIMM 960

```



```

I(17)=23
I(18)=22
211 CALL SPOST(NR,NG)
114 IF(NC-3)212,113,212
212 MSI(NB,NB)=0
NR=NB-6
NG=NB-1
GO TO (213,213,213,214,215,216,217,218,218),NC
213 N(1)=4
GO TO 219
214 N(1)=7
GO TO 219
215 N(1)=21
GO TO 219
216 N(1)=28
GO TO 219
217 N(1)=11
GO TO 219
218 N(1)=10
219 DO 220 K=NR,NG
MSI(K,NB)=N(1)
220 MSI(NB,K)=N(1)
IF(NC-2)113,113,221
221 NR=NR-12
NG=NG-7
GO TO (222,222,222,222,223,224,225,226,227),NC
222 N(1)=10
N(2)=10
N(3)=8
N(4)=8
GO TO 228
223 N(1)=2
N(2)=10
N(3)=2
N(4)=10
GO TO 228
224 N(1)=18
N(2)=29
N(3)=18
N(4)=29
GO TO 228
225 N(1)=19
N(2)=19
N(3)=12
N(4)=12
GO TO 228
226 N(1)=16
N(2)=16
N(3)=11
N(4)=11

```

```

SIMM 961
SIMM 962
SIMM 963
SIMM 964
SIMM 965
SIMM 966
SIMM 967
SIMM 968
SIMM 969
SIMM 970
SIMM 971
SIMM 972
SIMM 973
SIMM 974
SIMM 975
SIMM 976
SIMM 977
SIMM 978
SIMM 979
SIMM 980
SIMM 981
SIMM 982
SIMM 983
SIMM 984
SIMM 985
SIMM 986
SIMM 987
SIMM 988
SIMM 989
SIMM 990
SIMM 991
SIMM 992
SIMM 993
SIMM 994
SIMM 995
SIMM 996
SIMM 997
SIMM 998
SIMM 999
SIMM 1000
SIMM 1001
SIMM 1002
SIMM 1003
SIMM 1004
SIMM 1005
SIMM 1006
SIMM 1007
SIMM 1008
SIMM 1009
SIMM 1010

```

227	GO TO 228	
	N(1)=21	SIMM1011
	N(2)=2	SIMM1012
	N(3)=21	SIMM1013
	N(4)=2	SIMM1014
228	DO 229 K=NR,NG,2	SIMM1015
	MSI(K,NB)=N(1)	SIMM1016
	MSI(NB,K)=N(2)	SIMM1017
	MSI(K+1,NB)=N(3)	SIMM1018
229	MSI(NB,K+1)=N(4)	SIMM1019
	IF(NC-7)113,230,230	SIMM1020
230	NG=NG-13	SIMM1021
	IF(NC-8)231,232,232	SIMM1022
231	NR=NR-12	SIMM1023
	N(1)=13	SIMM1024
	N(2)=13	SIMM1025
	N(3)=13	SIMM1026
	N(4)=13	SIMM1027
	GO TO 233	SIMM1028
232	NR=NR-18	SIMM1029
	IF(NC-8)234,234,235	SIMM1031
234	N(1)=18	SIMM1031
	N(2)=18	SIMM1032
	N(3)=12	SIMM1033
	N(4)=12	SIMM1034
	GO TO 233	SIMM1035
235	N(1)=19	SIMM1036
	N(2)=72	SIMM1037
	N(3)=49	SIMM1038
	N(4)=73	SIMM1039
233	DO 236 K=NR,NG,3	SIMM1040
	MSI(K,NB)=N(1)	SIMM1041
	MSI(NB,K)=N(2)	SIMM1042
	MSI(K+1,NB)=N(3)	SIMM1043
	MSI(NB,K+1)=N(4)	SIMM1044
	MSI(K+2,NB)=N(3)	SIMM1045
236	MSI(NB,K+2)=N(4)	SIMM1046
113	RETURN	SIMM1047
	END	SIMM1048
	LABEL	SIMM1049
* CSPOST		SPOST001
	SUBROUTINE SPOST(NR,NG)	SPOST002
	DIMENSION FILL(248),FILL1(747),I(19),MSI(61,61),N(4)	SPOST003
	COMMON FILL,MSI,FILL1,I,N	SPOST004
	N1=N(1)	SPOST005
	N2=N(2)	SPOST006
	N3=N(3)	SPOST007
	N4=N(4)-NR+1	SPOST008
	NCM1=N(2)-N(1)	SPOST009
	NCP1=NCM1+2	SPOST010

```

DO 100 N5=N3,N4,NR
M=1
DO 101 N6=N1,N2
MSI(N5,N6)=I(M)
101 M=M+1
DO 102 NG1=1,NG
NC=NCM1+1
104 I(NC+1)=I(NC)
IF(NC-1) 102,102,103
103 NC=NC-1
GO TO 104
102 I(1)=I(NCP1)
100 CONTINUE
N(3)=N(3)+1
N(4)=N(4)+1
RETURN
END
LABEL
*
CRIEMU SUBROUTINE RIEMU(NB,NC)
DIMENSION EMU(61),RI(61),X(61),Y(61)
COMMON PIG,PD2,PD2M,DUMMY,X,Y,RI,EMU
DO 100 I=1,NB
RI(I)=SQRT(X(I)**2+Y(I)**2)
IF(RI(I)) 101,102,101
101 EMU(I)=TANG(NC,PD2,PD2M,PIG,X(I),Y(I))
GO TO 100
102 EMU(I)=0.
100 CONTINUE
RETURN
END
LABEL
*
CTANG FUNCTION TANG(NC,PD2,PD2M,PIG,XN,YN)
IF(XN) 109,101,100
109 IF(YN) 100,110,100
110 TANG=-PIG
GO TO 103
100 TANG=ATANF(YN/XN)
IF(NC-12) 102,103,103
102 IF(XN) 104,103,103
104 IF(YN) 105,103,106
105 TANG=TANG-PIG
GO TO 103
106 TANG=TANG+PIG
GO TO 103
101 IF(YN) 108,103,107
107 TANG=PD2
GO TO 103
108 TANG=PD2M

```

```

SPOST011
SPOST012
SPOST013
SPOST014
SPOST015
SPOST016
SPOST017
SPOST018
SPOST019
SPOST020
SPOST021
SPOST022
SPOST023
SPOST024
SPOST025
SPOST026
SPOST027

```

```

RIEMU001
RIEMU002
RIEMU003
RIEMU004
RIEMU005
RIEMU006
RIEMU007
RIEMU008
RIEMU009
RIEMU010
RIEMU011
RIEMU012
RIEMU013

```

```

TANG 001
TANG 002
TANG 003
TANG 004
TANG 005
TANG 006
TANG 007
TANG 008
TANG 009
TANG 010
TANG 011
TANG 012
TANG 013
TANG 014
TANG 015
TANG 016
TANG 017
TANG 018

```

103 RETURN	TANG 019
END	TANG 020
* LABEL	
CASTER	ASTER001
SUBROUTINE ASTER(NC, NS, NDATA)	ASTER002
DIMENSION DUMMY(4491), NDN(14)	ASTER003
COMMON DUMMY, NDN	ASTER004
DO 100 I=1, 14	ASTER005
IF(NDN(I)) 101, 101, 102	ASTER006
102 IF(NDATA-NDN(I)) 100, 103, 100	ASTER007
103 GO TO (101, 104, 104, 104, 104, 104, 104, 104, 104, 104, 105, 106, 104, 104, 104, 107, 108	ASTER008
1, 104, 110, 104, 111, 112, 113), NDATA	ASTER009
104 WRITE OUTPUT TAPE 6, 1	ASTER010
1 FORMAT (1H+, 49X, 1H*)	ASTER011
GO TO 101	ASTER012
105 IF(NC-11) 104, 114, 104	ASTER013
114 WRITE OUTPUT TAPE 6, 2	ASTER014
2 FORMAT (1H+, 14X, 1H*)	ASTER015
GO TO 101	ASTER016
106 IF(NC-11) 104, 115, 104	ASTER017
115 WRITE OUTPUT TAPE 6, 3	ASTER018
3 FORMAT (1H+, 23X, 1H*)	ASTER019
GO TO 101	ASTER020
107 IF(NC-11) 104, 114, 104	ASTER021
108 IF(NC-11) 104, 116, 104	ASTER022
116 WRITE OUTPUT TAPE 6, 4	ASTER023
4 FORMAT (1H+, 28X, 1H*)	ASTER024
GO TO 101	ASTER025
110 IF(NS-1) 101, 104, 114	ASTER026
111 IF(NC-10) 101, 114, 109	ASTER027
109 WRITE OUTPUT TAPE 6, 5	ASTER028
5 FORMAT (1H+, 33X, 1H*)	ASTER029
GO TO 101	ASTER030
112 IF(NC-10) 101, 115, 117	ASTER031
117 WRITE OUTPUT TAPE 6, 6	ASTER032
6 FORMAT (1H+, 43X, 1H*)	ASTER033
GO TO 101	ASTER034
113 WRITE OUTPUT TAPE 6, 7	ASTER035
7 FORMAT (1H+, 31X, 1H*)	ASTER036
GO TO 101	ASTER037
100 CONTINUE	ASTER038
101 RETURN	ASTER039
END	ASTER040
* LABEL	
CNUMBER	NUMBE001
SUBROUTINE NUMBER(NC)	NUMBE002
DIMENSION DUMMY(4430), NIW(61)	NUMBE003
COMMON DUMMY, NIW	NUMBE004
GO TO (100, 102, 103, 104, 105, 106, 107, 108, 109, 110, 110, 111, 112), NC	NUMBE005
100 WRITE OUTPUT TAPE 6, 1	NUMBE006

1	FORMAT (1H ,4X,1H4,2X,1H1//5X,1H3,2X,1H2)	NUMBE007
	GO TO 101	NUMBE008
102	WRITE OUTPUT TAPE 6,2	NUMBE009
2	FORMAT (1H ,7X,1H1//5X,1H6,5X,1H2//8X,1H7//5X,1H5,5X,1H3//8X,1H4)	NUMBE010
	GO TO 101	NUMBE011
103	WRITE OUTPUT TAPE 6,3	NUMBE012
3	FORMAT (1H ,10X,1H9,5X,1H1//8X,1H8,4X,2H10,5X,1H2//5X,1H7,4X,2H12,	NUMBE013
	14X,2H11,5X,1H3//8X,1H6,5X,1H5,5X,1H4)	NUMBE014
	GO TO 101	NUMBE015
104	WRITE OUTPUT TAPE 6,4	NUMBE016
4	FORMAT (1H ,10X,1H1//7X,2H12,5X,1H2//4X,2H11,4X,2H13,5X,1H3//7X,2H	NUMBE017
	118,4X,2H14//4X,2H10,4X,2H19,5X,1H4//7X,2H17,4X,2H15//5X,1H9,4X,2H1	NUMBE018
	26,5X,1H5//8X,1H8,5X,1H6//11X,1H7)	NUMBE019
	GO TO 101	NUMBE020
105	WRITE OUTPUT TAPE 6,5	NUMBE021
5	FORMAT (1H ,13X,2H12,5X,1H1//7X,2H11,18X,1H2//17X,2H13//4X,2H10,5X	NUMBE022
	1,2H18,10X,2H14,6X,1H3//17X,2H19//5X,1H9,5X,2H17,10X,2H15,6X,1H4//1	NUMBE023
	27X,2H16//8X,1H8,18X,1H5//15X,1H7,5X,1H6)	NUMBE024
	GO TO 101	NUMBE025
106	WRITE OUTPUT TAPE 6,6	NUMBE026
6	FORMAT (1H ,12X,2H12,6X,1H1//7X,2H11,18X,1H2//,17X,2H13//4X,2H10,7	NUMBE027
	1X,2H18,5X,2H14,8X,1H3//17X,2H19//5X,1H9,7X,2H17,5X,2H15,8X,1H4//17	NUMBE028
	2X,2H16//8X,1H8,18X,1H5//14X,1H7,6X,1H6)	NUMBE029
	GO TO 101	NUMBE030
107	WRITE OUTPUT TAPE 6,7	NUMBE031
7	FORMAT (1H ,9X,2H12,5X,1H1//7X,2H11,4X,2H13,5X,1H2//10X,2H24,4X,2H	NUMBE032
	114//7X,2H23,4X,2H25,4X,2H15//4X,2H10,4X,2H30,4X,2H26,5X,1H3//7X,2H	NUMBE033
	222,4X,2H31,4X,2H16//5X,1H9,4X,2H29,4X,2H27,5X,1H4//7X,2H21,4X,2H28	NUMBE034
	3,4X,2H17//10X,2H20,4X,2H18//8X,1H8,4X,2H19,5X,1H5//11X,1H7,5X,1H6)	NUMBE035
	GO TO 101	NUMBE036
108	WRITE OUTPUT TAPE 6,8	NUMBE037
8	FORMAT (1H ,13X,1H1//10X,2H18,5X,1H2//7X,2H17,4X,2H19,5X,1H3//4X,2	NUMBE038
	1H16,4X,2H30,4X,2H20,5X,1H4//7X,2H29,4X,2H31,4X,2H21//4X,2H15,4X,2H	NUMBE039
	236,4X,2H32,5X,1H5//7X,2H28,4X,2H37,4X,2H22//4X,2H14,4X,2H35,4X,2H3	NUMBE040
	33,5X,1H6//7X,2H27,4X,2H34,4X,2H23//4X,2H13,4X,2H26,4X,2H24,5X,1H7/	NUMBE041
	4//7X,2H12,4X,2H25,5X,1H8//10X,2H11,5X,1H9//13X,2H10)	NUMBE042
	GO TO 101	NUMBE043
109	WRITE OUTPUT TAPE 6,9	NUMBE044
9	FORMAT (1H ,15X,2H18,5X,1H1,5X,1H2//10X,2H17,23X,1H3//19X,2H30,4X,	NUMBE045
	12H19//7X,2H16,4X,2H29,16X,2H20,5X,1H4//22X,2H31//4X,2H15,4X,2H28,4	NUMBE046
	2X,2H36,10X,2H32,4X,2H21,5X,1H5//22X,2H37//4X,2H14,4X,2H27,4X,2H35,	NUMBE047
	310X,2H33,4X,2H22,5X,1H6//22X,2H34//7X,2H13,4X,2H26,16X,2H23,5X,1H7	NUMBE048
	4//19X,2H25,4X,2H24//10X,2H12,23X,1H8//16X,2H11,4X,2H10,5X,1H9)	NUMBE049
	GO TO 101	NUMBE050
110	WRITE OUTPUT TAPE 6,10	NUMBE051
10	FORMAT (1H ,3X,39HANY NUMERICAL CONFIGURATION IS POSSIBLE)	NUMBE052
	GO TO 101	NUMBE053
111	WRITE OUTPUT TAPE 6,11,NIW(18),NIW(17),(NIW(I),I=48,49),NIW(16),(N	NUMBE054
	11W(I),I=45,47),NIW(15),(NIW(I),I=40,44),NIW(14),(NIW(I),I=34,39),N	NUMBE055
	21W(13),(NIW(I),I=27,33),NIW(12),(NIW(I),I=19,26),(NIW(I),I=1,11)	NUMBE056

11	FORMAT (1H,24X,12//21X,3I3//18X,4I3//15X,6I3//12X,7I3//9X,8I3//6X	NUMBE057
	1,9I3//3X,11I3)	NUMBE058
	GO TO 101	NUMBE059
112	WRITE OUTPUT TAPE 6,12,NIW(16),NIW(39),NIW(15),(NIW(I),I=36,38),NIW(14),	NUMBE060
	(NIW(I),I=31,35),NIW(13),(NIW(I),I=25,30),NIW(12),(NIW(I),I=	NUMBE061
	217,24),(NIW(I),I=1,11)	NUMBE062
12	FORMAT (1H,44X,2I6//36X,4I6//27X,6I6//18X,7I6//9X,9I6//11I6)	NUMBE063
101	RETURN	NUMBE064
	END	NUMBE065
	LABEL	
* CRES		
	SUBROUTINE RES(NC,P)	RES 001
	DIMENSION DUMMY(4),DUMMY1(535),FILL(3737),I(8),NBWG(49),NL(49),RA(	RES 002
	149),X(61),Y(61)	RES 003
	COMMON DUMMY,X,Y,NL,I,RA,FILL,AG,DUMMY1,NBWG	RES 004
	DO 130 K=1,49	RES 005
130	NBWG(K)=K	RES 006
	X(1)=0.	RES 007
	Y(1)=0.	RES 008
	NL(1)=1	RES 009
	RA(1)=AG	RES 010
	I(1)=2	RES 011
	IF(NC-12)100,101,102	RES 012
101	NN=49	RES 013
	N1=4	RES 014
	N2=8	RES 015
	N12=18	RES 016
	I(2)=19	RES 017
	I(3)=27	RES 018
	I(4)=34	RES 019
	I(5)=40	RES 020
	I(6)=45	RES 021
	I(7)=48	RES 022
	I(8)=50	RES 023
	GO TO 103	RES 024
102	NN=39	RES 025
	N1=6	RES 026
	N2=12	RES 027
	N12=16	RES 028
	PD2=P/2.	RES 029
	I(2)=17.	RES 030
	I(3)=25	RES 031
	I(4)=31	RES 032
	I(5)=36	RES 033
	I(6)=39	RES 034
	I(7)=46	RES 035
	I(8)=56	RES 036
103	DO 104 K=1,7	RES 037
	IX=I(K)	RES 038
	KX=I(K+1)-1	RES 039
		RES 040

```

CAP=K
CM1=CAP-1.
IF(NC-12)100,105,106
105 GO TO (107,108,109,110,111,112,113),K
106 GO TO (107,114,115,116,117,118,119),K
107 KX=11
GO TO 120
108 X(50)=0.
X(12)=P
Y(50)=P
Y(12)=P
GO TO 120
109 X(51)=P
X(13)=X(19)
Y(51)=X(19)
Y(13)=X(19)
GO TO 120
110 X(52)=X(19)
X(14)=X(20)
Y(52)=X(20)
Y(14)=X(20)
GO TO 120
111 X(53)=X(20)
X(15)=X(21)
Y(53)=X(21)
Y(15)=X(21)
GO TO 120
112 X(54)=X(21)
X(16)=X(22)
Y(54)=X(22)
Y(16)=X(22)
GO TO 120
113 X(55)=X(22)
X(17)=X(23)
Y(55)=X(23)
Y(17)=X(23)
X(56)=X(23)
X(18)=X(24)
Y(56)=X(24)
Y(18)=X(24)
120 SX=CAP*P
SY=CM1*P
GO TO 121
114 X(40)=PD2
X(12)=P*1.5
Y(40)=P*0.8660254
Y(12)=Y(40)
SX=P*2.5
GO TO 122
115 X(41)=X(3)

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RES 041
RES 042
RES 043
RES 044
RES 045
RES 046
RES 047
RES 048
RES 049
RES 050
RES 051
RES 052
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RES 055
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RES 087
RES 088
RES 089
RES 090

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X(13)=X(4)
Y(41)=Y(40)*2.
Y(13)=Y(41)
SX=P*4.
GO TO 122
116 X(42)=X(18)
X(14)=X(19)
Y(42)=Y(40)*3.
Y(14)=Y(42)
SX=P*5.5
GO TO 122
117 X(43)=X(6)
X(15)=X(7)
Y(43)=Y(40)*4.
Y(15)=Y(43)
SX=P*7.
GO TO 122
118 KX=39
X(44)=X(21)
X(16)=X(22)
Y(44)=Y(40)*5.
Y(16)=Y(44)
SX=P*8.5
122 SY=CM1*Y(40)
GO TO 121
119 X(45)=X(9)
Y(45)=Y(40)*6.
SX=PD2
SY=-Y(40)
121 DO 123 N=IX,KX
X(N)=SX
Y(N)=SY
123 SX=SX+P
104 CONTINUE
DO 124 N=2,NN
RA(N)=SQRTF(X(N)**2+Y(N)**2)+AG
IF(N-N12)125,125,126
125 NL(N)=N1
GO TO 124
126 NL(N)=N2
124 CONTINUE
KX=NN-1
DO 127 N=2,KX
N2=N+1
DO 128 IX=N2,NN
IF(RA(N)-RA(IX))128,128,129
129 SX=RA(IX)
RA(IX)=RA(N)
RA(N)=SX
SX=X(IX)

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RRR 091
RRR 092
RRR 093
RRR 094
RRR 095
RRR 096
RRR 097
RRR 098
RRR 099
RRR 100
RRR 101
RRR 102
RRR 103
RRR 104
RRR 105
RRR 106
RRR 107
RRR 108
RRR 109
RRR 110
RRR 111
RRR 112
RRR 113
RRR 114
RRR 115
RRR 116
RRR 117
RRR 118
RRR 119
RRR 120
RRR 121
RRR 122
RRR 123
RRR 124
RRR 125
RRR 126
RRR 127
RRR 128
RRR 129
RRR 130
RRR 131
RRR 132
RRR 133
RRR 134
RRR 135
RRR 136
RRR 137
RRR 138
RRR 139
RRR 140

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	X(IX)=X(N)	RES	141
	X(N)=SX	RES	142
	SX=Y(IX)	RES	143
	Y(IX)=Y(N)	RES	144
	Y(N)=SX	RES	145
	N1=NL(IX)	RES	146
	NL(IX)=NL(N)	RES	147
	NL(N)=N1	RES	148
	N1=NBWG(IX)	RES	149
	NBWG(IX)=NBWG(N)	RES	150
	NBWG(N)=N1	RES	151
128	CONTINUE	RES	152
127	CONTINUE	RES	153
100	RETURN	RES	154
	END	RES	155
	* LABEL		
* CPRES		PRES	001
	SUBROUTINE PRES(EPS, JR, NB, NC, NGS, NII, NP, NTC, PCU, PCUR, PCUZ, PPCU, PPCUR, PPCUZ, PPUU, PPUUR, PPUUZ, PUU, PUUR, PUUZ, SPC, VG, VM)	PRES	002
	DIMENSION AP(61), AP2(61), ETA(61), DUMMY(4), FILL(3794), FILL1(122), FIPRES	PRES	003
	1LL2(381), NL(49), PII(61), PIIR(61), PIIZ(61), PIJ(300), PIJR(300), PIJZ(PRES	PRES	004
	2300), PIS(61), PISR(61), PISZ(61), PPII(61), PPIIR(61), PPIIZ(61), PPIJ(3PRES	PRES	005
	300), PPIJR(300), PPIJZ(300), SP(61), X(61), Y(61)	PRES	006
	COMMON DUMMY, X, Y, NL, FILL, AP, SP, FILL1, AP2, ETA, FILL2, PII, PIIR, PIIZ, P	PRES	007
	1PII, PPIIR, PPIIZ, PIJ, PIJR, PIJZ, PPIJ, PPIJR, PPIJZ	PRES	008
	CALL PIIK(NB, NC, NP)	PRES	009
	PUU=PII(1)	PRES	010
	PUUR=PIIR(1)	PRES	011
	PUUZ=PIIZ(1)	PRES	012
	JR=2	PRES	013
102	CALL PIJK(JR, NB, NC, NGS, NII, NP, NTC, SPC)	PRES	014
	PUUT=PUU	PRES	015
	CALL PUUKR(JR, NGS, NP, PPUU, PPUUR, PPUUZ, PUU, PUUR, PUUZ)	PRES	016
	Z=PUU-PUUT	PRES	017
	IF(ABS(Z)-EPS)100, 101, 101	PRES	018
101	JR=JR+1	PRES	019
	GO TO 102	PRES	020
100	IF(SPC)103, 104, 105	PRES	021
104	PCU=0.	PRES	022
	PCUR=0.	PRES	023
	PCUZ=0.	PRES	024
	PPCU=0.	PRES	025
	PPCUR=0.	PRES	026
	PPCUZ=0.	PRES	027
	GO TO 103	PRES	028
105	CALL PCUK(ESSA, NB, NC, NP, PCU, PCUR, PCUZ, PPCU, PPCUR, PPCUZ, PUU, PUUR, PU	PRES	029
	1UZ, SPC, VG, VM)	PRES	030
103	RETURN	PRES	031
	END	PRES	032
	* LABEL	PRES	033

CPIIK	SUBROUTINE PIIK(NB,NC,NP)	PIIK 001
	DIMENSION ETA(61),FILL(4273),FILL1(381),FPZ2(11),PII(61),PIIR(61),	PIIK 002
	1PIIZ(61),PPII(61),PPIIR(61),PPIIZ(61)	PIIK 003
	COMMON PG,FILL,ETA,FILL1,PII,PIIR,PIIZ,PPII,PPIIR,PPIIZ	PIIK 004
	DELTA=0.15707963	PIIK 005
	DO 100 I=1,NB	PIIK 006
	IF(ETA(I)-6.)101,102,102	PIIK 007
101	BIOE=BIOF(ETA(I))	PIIK 008
	BKOE=BKOF(ETA(I))	PIIK 009
	BIE=BIIF(ETA(I))	PIIK 010
	BKIE=BKIF(ETA(I))	PIIK 011
	PII(I)=1.-((2.*ETA(I))/3.)*(2.*(ETA(I)*(BIOE*BKOE+BIE*BKIE)-1.))+B	PIIK 012
	1IOE*BKIE-BIE*BKOE+(BIE*BKIE)/ETA(I))	PIIK 013
	GO TO 103	PIIK 014
102	PII(I)=1.- (0.5/ETA(I)-3./ (32.*ETA(I)**3))	PIIK 015
103	PPII(I)=PII(I)/ETA(I)	PIIK 016
	IF(NP-1)104,105,106	PIIK 017
105	PPP=3./ (PG*ETA(I))	PIIK 018
	VL=0.	PIIK 019
	DO 107 L=1,11	PIIK 020
	COSVL=COSF(VL)	PIIK 021
	DEC=2.*ETA*COSVL	PIIK 022
	FPZ2(L)=COSVL*(0.5890486-BIC(5,DEC))	PIIK 023
107	VL=VL+DELTA	PIIK 024
	VF=0.	PIIK 025
	DO 108 L=1,9,2	PIIK 026
108	VF=VF+FPZ2(L)+4.*FPZ2(L+1)+FPZ2(L+2)	PIIK 027
	PIIR(I)=1.-PPP*(DELTA/3.)*VF	PIIK 028
	PIIZ(I)=3.*PII(I)-2.*PIIR(I)	PIIK 029
	PPIIR(I)=PIIR(I)/ETA(I)	PIIK 030
	PPIIZ(I)=PIIZ(I)/ETA(I)	PIIK 031
106	IF(NC-11)109,100,104	PIIK 032
100	CONTINUE	PIIK 033
	RETURN	PIIK 034
109	DO 110 I=2,NB	PIIK 035
	PII(I)=PII(1)	PIIK 036
	PPII(I)=PPII(1)	PIIK 037
	IF(NP-1)104,111,110	PIIK 038
111	PIIR(I)=PIIR(1)	PIIK 039
	PIIZ(I)=PIIZ(1)	PIIK 040
	PPIIR(I)=PPIIR(1)	PIIK 041
	PPIIZ(I)=PPIIZ(1)	PIIK 042
110	CONTINUE	PIIK 043
104	RETURN	PIIK 044
	END	PIIK 045
	LABEL	PIIK 046
*CPIJK	SUBROUTINE PIJK(JR,NB,NC,NGS,NII,NP,NTC,SPC)	PIJK 001
	DIMENSION AD(2),AP(61),AP2(61),CYT(59),DIS(59),ETA(61),FILL(122),FPIJK	PIJK 002
		PIJK 003

	1 ILL1(122), FILL2(745), FI1(5), FI2(5), FI3(5), FI4(5), MSI(61,61), NUI(59	PIJK	004
	2), PIJ(300), PIJR(300), PIJZ(300), PPIJ(300), PPIJR(300), PPIJZ(300), SP(	PIJK	005
	361), SYT(59), X(61), Y(61)	PIJK	006
	COMMON PIG, PD2, PD2M, DUMMY, X, Y, FILL, MSI, AP, SP, FILL1, AP2, ETA, DUMMY1,	PIJK	007
	1DI, FILL2, PIJ, PIJR, PIJZ, PPIJ, PPIJR, PPIJZ, DIS, SYT, CYT, NUI, FI1, FI2, FI	PIJK	008
	23, FI4	PIJK	009
	NGS=0	PIJK	010
	IF(NC-11)108,109,108	PIJK	011
108	NTT=0	PIJK	012
	GO TO 113	PIJK	013
109	NTT=1	PIJK	014
113	DO 100 I=1, NB	PIJK	015
	ET2=19.739209*ETA(I)	PIJK	016
	IF(NC-12)101,102,102	PIJK	017
102	J=JR	PIJK	018
	NGS=J-1	PIJK	019
	GO TO 103	PIJK	020
101	J=1	PIJK	021
121	IF(MSI(I,J)-NGS)104,104,105	PIJK	022
105	NGS=NGS+1	PIJK	023
103	XIJ=X(J)-X(I)	PIJK	024
	YIJ=Y(J)-Y(I)	PIJK	025
	SXY=SQRTF(XIJ**2+YIJ**2)	PIJK	026
	TER22=TANG(NC, PD2, PD2M, PIG, XIJ, YIJ)	PIJK	027
	AD(1)=AP(I)/SXY	PIJK	028
	AD(2)=AP(J)/SXY	PIJK	029
	NBI=0	PIJK	030
	DO 166 K=1, NB	PIJK	031
	IF(K-I)111,166,111	PIJK	032
111	IF(K-J)112,166,112	PIJK	033
112	XIK=X(K)-X(I)	PIJK	034
	YIK=Y(K)-Y(I)	PIJK	035
	DIS(K)=SQRTF(XIK**2+YIK**2)	PIJK	036
	YS=TANG(NC, PD2, PD2M, PIG, XIK, YIK)	PIJK	037
	YSMT=YS-TER22	PIJK	038
	SYT(K)=SINF(YSMT)	PIJK	039
	CYT(K)=COSF(YSMT)	PIJK	040
	IF(NTT)116,114,131	PIJK	041
114	NT=1	PIJK	042
	A2MA1=0.	PIJK	043
135	RUMA=SQRTF(1.-A2MA1**2)	PIJK	044
	PAR1=CYT(K)*RUMA	PIJK	045
	PAR2=SYT(K)*A2MA1	PIJK	046
	PAR3=DIS(K)*(PAR1-PAR2)	PIJK	047
	PAR4=SXY*RUMA	PIJK	048
132	IF(PAR3)127,127,117	PIJK	049
117	PAR8=PAR4-PAR3	PIJK	050
	IF(PAR8)125,118,118	PIJK	051
125	IF(ABSF(PAR8)-1.E-5)118,118,127	PIJK	052
127	NT=NT+1	PIJK	053

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128 GO TO (116,128,129,128,166),NT
PAR3=DIS(K)*(PAR1+PAR2)
GO TO 132
129 A2MA1=AD(2)+AD(1)
GO TO 135
118 PAR5=SYT(K)*RUMA
PAR6=CYT(K)*A2MA1
API=AP(I)
GO TO (122,123,124,124),NT
122 PAR7=ABSF(DIS(K)*(PAR5+PAR6)+API)
133 IF(AP(K)-PAR7)127,131,131
123 PAR7=ABSF(DIS(K)*(PAR5-PAR6)-API)
GO TO 133
124 API=-AP(I)
IF(NT-3)116,122,123
131 NBI=NBI+1
NUI(NBI)=K
DIS(NBI)=DIS(K)
SYT(NBI)=SYT(K)
CYT(NBI)=CYT(K)
166 CONTINUE
IF(NTT)116,138,139
138 IF(NTC-1)116,139,140
140 CALL PIJKAP(NBI,NGS,NP,SPC,SXY)
GO TO 141
139 DO 107 K=1,5
FI1(K)=0.
FI3(K)=0.
DO 106 M=1,2
DO 136 L=1,NII
CALL GAUSS1(PD2M,DI,M,K,L,VII)
SV1=SINF(VII)
CV1=COSF(VII)
DECF=2.*ETA(I)*CV1
ACOS1=AP(I)*CV1
DO 146 K1=1,5
FI2(K1)=0.
FI4(K1)=0.
DO 145 M1=1,2
DO 148 L1=1,NII
CALL GAUSS1(PD2M,DI,M1,K1,L1,VI2)
SV2=SINF(VI2)
CV2=COSF(VI2)
DECT=2.*ETA(J)*CV2
ACOS2=AP(J)*CV2
STSF=AD(2)*SV2-AD(1)*SV1
STSF2=STSF**2
SIAS=SQRTF(1.-STSF2)
DSAA=SXY*SIAS-ACOS1-ACOS2
FFT=(AD(2)*CV1*CV2)/SIAS

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PIJK 054
PIJK 055
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PIJK 095
PIJK 096
PIJK 097
PIJK 098
PIJK 099
PIJK 100
PIJK 101
PIJK 102
PIJK 103

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RN=0.
SRN=0.
IF(NBI)116,130,137
137 DO 110 KI=1,NBI
K2=NUI(KI)
SXSI=SYT(KI)*S1AS+CYT(KI)*STSF
CXSI=CYT(KI)*S1AS-SYT(KI)*STSF
TER1=DIS(KI)*CXSI
TER2=SXY*S1AS
IF(TER1)110,110,165
165 IF(TER1-TER2)126,110,110
126 HIS=ABSF(DIS(KI)*SXSI+AP(I)*SV1)
IF(HIS-AP(K2))115,110,110
115 RIS=2.*SQRTF(AP2(K2)-HIS**2)
RN=RN+RIS
SRN=SRN+SP(K2)*RIS
110 CONTINUE
130 X1=SPC*(DSAA-RN)+SRN
X2=X1+DECT
X3=X1+DECF
X4=X2+DECF
PK3=BIC3AP(X1)-BIC3AP(X2)-BIC3AP(X3)+BIC3AP(X4)
FI2(K1)=FI2(K1)+FFT*PK3
IF(NP-1)116,134,148
134 PK5=BIC(5,X1)-BIC(5,X2)-BIC(5,X3)+BIC(5,X4)
FI4(K1)=FI4(K1)+FFT*PK5
148 CONTINUE
145 CONTINUE
146 CONTINUE
CALL GAUSS2(DI,FI2,S)
FI1(K)=FI1(K)+S
IF(NP-1)116,144,136
144 CALL GAUSS2(DI,FI4,S)
FI3(K)=FI3(K)+S
136 CONTINUE
106 CONTINUE
107 CONTINUE
CALL GAUSS2(DI,FI1,S)
PIJ(NGS)=S/ET2
141 PPIJ(NGS)=PIJ(NGS)/ETA(J)
IF(NP-1)116,147,119
147 IF(NTC-1)142,142,143
142 CALL GAUSS2(DI,FI3,S)
PIJR(NGS)=(S*1.5)/ET2
143 PPIJR(NGS)=PIJR(NGS)/ETA(J)
PIJZ(NGS)=3.*PIJ(NGS)-2.*PIJR(NGS)
PPIJZ(NGS)=PIJZ(NGS)/ETA(J)
119 IF(NC-12)104,116,116
104 IF(J-NB)120,100,100
120 J=J+1

```

```

PIJK 104
PIJK 105
PIJK 106
PIJK 107
PIJK 108
PIJK 109
PIJK 110
PIJK 111
PIJK 112
PIJK 113
PIJK 114
PIJK 115
PIJK 116
PIJK 117
PIJK 118
PIJK 119
PIJK 120
PIJK 121
PIJK 122
PIJK 123
PIJK 124
PIJK 125
PIJK 126
PIJK 127
PIJK 128
PIJK 129
PIJK 130
PIJK 131
PIJK 132
PIJK 133
PIJK 134
PIJK 135
PIJK 136
PIJK 137
PIJK 138
PIJK 139
PIJK 140
PIJK 141
PIJK 142
PIJK 143
PIJK 144
PIJK 145
PIJK 146
PIJK 147
PIJK 148
PIJK 149
PIJK 150
PIJK 151
PIJK 152
PIJK 153

```

100	GO TO 121	PIJK 154
116	CONTINUE	PIJK 155
	RETURN	PIJK 156
	END	PIJK 157
	LABEL	
*CPIJKAP		
	SUBROUTINE PIJKAP(NBI,NGS,NP,SPC,SXY)	PIJKA001
	DIMENSION AKK(21),CYT(59),DIS(59),FILL(3965),FILL1(304),FILL2(807)	PIJKA002
1	,FILL3(1200),FILL4(59),PIJ(300),PIJR(300),RDC(21),RDD(3),SYT(59)	PIJKA003
	COMMON PIG,PD2,DUMMY,PIG2,FILL,RF,FILL1,A,FILL2,PIJ,PIJR,FILL3,DIS	PIJKA004
1	,SYT,CYT,FILL4,RDC,RDD,AKK	PIJKA005
	B=SPC*SXY	PIJKA006
	CAPPA=RF/SXY	PIJKA007
	BCA=B*CAPPA	PIJKA008
	AMBK=A-BCA	PIJKA009
	DCAP=2.*CAPPA	PIJKA010
	TAU1=0.	PIJKA011
	TAU2=0.	PIJKA012
	IF(A-1.)100,100,101	PIJKA013
100	NA=1	PIJKA014
	GO TO 102	PIJKA015
101	IF(A-3.)105,105,106	PIJKA016
105	NA=3	PIJKA017
	GO TO 102	PIJKA018
106	NA=5	PIJKA019
102	IF(NBI)107,108,109	PIJKA020
109	NA=NA+1	PIJKA021
108	IF(NA-5)110,111,114	PIJKA022
110	IF(NGS-1)107,134,135	PIJKA023
134	RDD(1)=0.1	PIJKA024
	RDD(2)=0.02	PIJKA025
	RDD(3)=0.5	PIJKA026
	CALL CONST(3,RDD,RDC)	PIJKA027
	AKK(1)=2.47363	PIJKA028
	AKK(2)=2.47641	PIJKA029
	AKK(3)=2.47972	PIJKA030
	AKK(4)=2.48359	PIJKA031
	AKK(5)=2.48802	PIJKA032
	AKK(6)=2.49306	PIJKA033
	AKK(7)=2.49872	PIJKA034
	AKK(8)=2.50503	PIJKA035
	AKK(9)=2.51204	PIJKA036
	AKK(10)=2.51979	PIJKA037
	AKK(11)=2.52834	PIJKA038
	AKK(12)=2.53775	PIJKA039
	AKK(13)=2.54811	PIJKA040
	AKK(14)=2.55951	PIJKA041
	AKK(15)=2.57206	PIJKA042
	AKK(16)=2.58594	PIJKA043
	AKK(17)=2.60133	PIJKA044
		PIJKA045

AKK(18)=2.61852	PIJKA046
AKK(19)=2.63791	PIJKA047
AKK(20)=2.66013	PIJKA048
AKK(21)=2.68652	PIJKA049
135 IF(CAPPA-0.1)132,133,133	PIJKA050
133 CALL GABIN(3,21,RDC,CAPPA,RDD,ACA,AKK)	PIJKA051
ACA=ACA*CAPPA	PIJKA052
GO TO 112	PIJKA053
132 CA2=CAPPA**2	PIJKA054
CAP2=1.-CA2	PIJKA055
TER1=CAP2/CA2+0.125	PIJKA056
TER2=0.52083333E-2*(CA2/CAP2**2)	PIJKA057
CALL FEDIC(CAPPA,FC,EC,NLAST)	PIJKA058
ACA=PIG*CAPPA*((EC*(TER1+TER2*(8.-7.*CAP2)))/CAP2-FC*(TER1+TER2*(4	PIJKA059
1.-3.*CAP2)))	PIJKA060
112 QACA=4.*ACA	PIJKA061
GO TO (113,114,111,114),NA	PIJKA062
114 SUM1=0.	PIJKA063
SUM2=0.	PIJKA064
DO 115 I=1,NBI	PIJKA065
CAS=RF/DIS(I)	PIJKA066
EMU=ABSF(SYT(I))/CAS	PIJKA067
UMUS=1.-EMU	PIJKA068
UMUM=1.-UMUS**2	PIJKA069
RUM=SQRTF(UMUM)	PIJKA070
ASUM=ASINF(UMUS)	PIJKA071
UMR=UMUS*RUM	PIJKA072
TER3=ASUM+PD2	PIJKA073
TER2=UMR+TER3	PIJKA074
IF(NA-6)117,118,107	PIJKA075
117 UMMQ=1.-EMU**2	PIJKA076
SUM1=SUM1+UMMQ*TER2-0.25*(TER3-0.25*SINF(4.*ASUM))+1.3333333*EMU*U	PIJKA077
1MUM**1.5	PIJKA078
IF(NA-4)115,118,107	PIJKA079
118 UMD2=1.-EMU/2.	PIJKA080
SUM2=SUM2+UMD2*TER2	PIJKA081
115 CONTINUE	PIJKA082
IF(NA-6)119,111,107	PIJKA083
119 TAU1=(AMBK*ASINF(DCAP)*SUM1)/ACA	PIJKA084
IF(NA-4)113,111,107	PIJKA085
111 IF(DCAP-1.)137,137,138	PIJKA086
138 DCAP=1.	PIJKA087
137 AS=ASINF(DCAP)	PIJKA088
ASD2=AS/2.	PIJKA089
EFFE=AS-SINF(ASD2)/COSF(ASD2)	PIJKA090
GO TO (107,107,120,121,120,121),NA	PIJKA091
121 TAU2=(DCAP*AMBK*SUM2)/EFFE	PIJKA092
120 ARGK=BCA*(1./EFFE-PD2)+TAU2	PIJKA093
COE=0.2026423*(EFFE/A)	PIJKA094
ARGK1=ARGK+PD2*A	PIJKA095

```

ARGK2=ARGK+PIG*A
PIJ(NGS)=COE*(BIC3AP(ARGK)-2.*BIC3AP(ARGK1)+BIC3AP(ARGK2))
IF(NP-1)107,122,125
122 COE=COE*1.5
PIJR(NGS)=COE*(BIC(5,ARGK)-2.*BIC(5,ARGK1)+BIC(5,ARGK2))
125 IF(NA-4)126,126,107
126 ARGK=BCA*(PIG2/QACA-1.69706)+TAU1
COE=(0.0703616*ACA)/A
ARGK1=ARGK+1.69706*A
ARGK2=ARGK+3.39412*A
PROB=COE*(BIC3AP(ARGK)-2.*BIC3AP(ARGK1)+BIC3AP(ARGK2))
PIJ(NGS)=(PROB+PIJ(NGS))/2.
IF(NP-1)107,127,107
127 COE=COE*1.5
PROB=COE*(BIC(5,ARGK)-2.*BIC(5,ARGK1)+BIC(5,ARGK2))
PIJR(NGS)=(PROB+PIJR(NGS))/2.
GO TO 107
113 ARGK=1.69706*AMBK+(PIG2*BCA)/QACA+TAU1
COE=0.2026423*A*ACA
DO 130 N=1,3,2
IF(N-1)107,131,136
131 CA1=BK1F(ARGK)
CA11=BIC(N,ARGK)
GO TO 141
136 CA1=BIC(1,ARGK)
CA11=BIC3AP(ARGK)
141 PROB=COE*EXP((0.61685025*CAPPA*A**2*CA1)/(ACA*CA11))*CA11
IF(N-1)107,144,145
144 PIJ(NGS)=PROB
IF(NP-1)107,130,107
130 COE=COE*1.5
145 PIJR(NGS)=PROB
107 RETURN
END
* LABEL
CCONST
SUBROUTINE CONST(NI,A,AR)
DIMENSION A(3),AR(21)
I=1
K=1
AR(K)=A(I)
40 IF(I-NI)20,25,25
20 PRE=AR(K)-A(I+2)
IF(ABS(F(PRE)-A(I+1)*0.5)35,30,30)
30 K=K+1
AR(K)=AR(K-1)+A(I+1)
GO TO 20
35 I=I+2
GO TO 40
25 RETURN

```

```

PIJKA096
PIJKA097
PIJKA098
PIJKA099
PIJKA100
PIJKA101
PIJKA102
PIJKA103
PIJKA104
PIJKA105
PIJKA106
PIJKA107
PIJKA108
PIJKA109
PIJKA110
PIJKA111
PIJKA112
PIJKA113
PIJKA114
PIJKA115
PIJKA116
PIJKA117
PIJKA118
PIJKA119
PIJKA120
PIJKA121
PIJKA122
PIJKA123
PIJKA124
PIJKA125
PIJKA126
PIJKA127
PIJKA128
PIJKA129

CONST001
CONST002
CONST003
CONST004
CONST005
CONST006
CONST007
CONST008
CONST009
CONST010
CONST011
CONST012
CONST013
CONST014
CONST015

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```

      END
      LABEL
*CGABIN SUBROUTINE GABIN(NI,NK,AR,A0,A,F,B)
      DIMENSION A(3),AR(21),B(21)
      M=0
      K=1
      75 IF(A0-AR(K))45,50,55
      50 F=B(K)
      GO TO 60
      55 IF(K-(NK-1))65,70,70
      65 K=K+1
      GO TO 75
      70 AR(NK)=A(NI)
      IF(A0-AR(NK))80,85,90
      85 F=B(NK)
      GO TO 60
      90 M=1
      GO TO 95
      45 IF(K-1)100,95,100
      100 K=K-1
      GO TO 105
      95 IF(M)105,105,80
      105 Y1=B(K)
      Y2=B(K+1)
      Y3=B(K+2)
      A1=AR(K)
      A2=AR(K+1)
      A3=AR(K+2)
      GO TO 110
      80 Y1=B(NK)
      Y2=B(NK-1)
      Y3=B(NK-2)
      A1=AR(NK)
      A2=AR(NK-1)
      A3=AR(NK-2)
      110 H=A0-A1
      H1=A1-A2
      H2=A0-A2
      H3=A2-A3
      H4=A1-A3
      O=H/H1
      P=(H*H2)/H4
      F=Y1+O*(Y1-Y2)+P*((Y1-Y2)/H1)-((Y2-Y3)/H3)
      60 RETURN
      END
      LABEL
*CFEDIC SUBROUTINE FEDIC(C,FC,EC,NLAST)
      DIMENSION FSUM(30),ESUM(30)

```

CONST016

GABIN001  
 GABIN002  
 GABIN003  
 GABIN004  
 GABIN005  
 GABIN006  
 GABIN007  
 GABIN008  
 GABIN009  
 GABIN010  
 GABIN011  
 GABIN012  
 GABIN013  
 GABIN014  
 GABIN015  
 GABIN016  
 GABIN017  
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 GABIN026  
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 GABIN028  
 GABIN029  
 GABIN030  
 GABIN031  
 GABIN032  
 GABIN033  
 GABIN034  
 GABIN035  
 GABIN036  
 GABIN037  
 GABIN038  
 GABIN039  
 GABIN040  
 GABIN041  
 GABIN042  
 GABIN043  
 GABIN044  
  
 FEDIC001  
 FEDIC002  
 FEDIC003

```

HALFPI=1.5707963
NLAST=1
UNO=1.
IF(C-UNO)2,1,1
1 EC=UNO
FC=1.E8
GO TO 200
2 A2=0.5
FALFA=A2
EALFA=-A2
BETA=A2
GAMMA=UNO
ZETA=C*C
FAPROD=FALFA
EAPROD=EALFA
BPROD=BETA
UNGAM=UNO/GAMMA
FACT=UNO
PROD=BPROD*UNGAM*ZETA
FSUM(1)=UNO+FAPROD*PROD
ESUM(1)=UNO+EAPROD*PROD
DO 100 N=2,30
NLAST=N
AN=N
NM1=N-1
FACT=AN*FACT
FALFA=FALFA+UNO
EALFA=EALFA+UNO
BETA=BETA+UNO
GAMMA=GAMMA+UNO
FAPROD=FAPROD*FALFA
EAPROD=EAPROD*EALFA
BPROD=BPROD*BETA
UNGAM=UNGAM/(FACT*GAMMA)
PROD=BPROD*UNGAM*ZETA**N
FSUM(N)=FSUM(NM1)+FAPROD*PROD
ESUM(N)=ESUM(NM1)+EAPROD*PROD
FTEST=FSUM(N)-FSUM(NM1)
ETEST=ESUM(N)-ESUM(NM1)
IF(ABS(FTEST)-0.00001)10,10,100
IF(ABS(ETEST)-0.00001)150,150,100
10 CONTINUE
100 FC=HALFPI*FSUM(NLAST)
150 EC=HALFPI*ESUM(NLAST)
200 RETURN
END
LABEL
*
CBIC3AP
FUNCTION BIC3AP(X)
DIMENSION AR(6),BR(6),CR(6),DR(4),DUMMY(4572),ER(4),FR(16)

```

```

FEDIC004
FEDIC005
FEDIC006
FEDIC007
FEDIC008
FEDIC009
FEDIC010
FEDIC011
FEDIC012
FEDIC013
FEDIC014
FEDIC015
FEDIC016
FEDIC017
FEDIC018
FEDIC019
FEDIC020
FEDIC021
FEDIC022
FEDIC023
FEDIC024
FEDIC025
FEDIC026
FEDIC027
FEDIC028
FEDIC029
FEDIC030
FEDIC031
FEDIC032
FEDIC033
FEDIC034
FEDIC035
FEDIC036
FEDIC037
FEDIC038
FEDIC039
FEDIC040
FEDIC041
FEDIC042
FEDIC043
FEDIC044
FEDIC045
FEDIC046
FEDIC047
FEDIC048
FEDIC049

```

```

BIC3A001
BIC3A002
BIC3A003

```

```

COMMON DUMMY, AR, BR, CR, DR, ER, FR
SUM=0.
SUM1=0.
IF(X)116,116,117
116 BIC3AP=0.78539815
GO TO 103
117 IF(X-0.1)100,100,101
100 DO 102 I=1,6
102 SUM=SUM+AR(I)*X**(I-1)
BIC3AP=7.3665545E-1/SUM
GO TO 103
101 IF(X-0.4)104,104,105
104 DO 106 I=1,6
106 SUM=SUM+BR(I)*X**(I-1)
BIC3AP=5.7149776E-1/SUM
GO TO 103
105 IF(X-1.)107,107,108
107 DO 109 I=1,6
109 SUM=SUM+CR(I)*X**(I-1)
BIC3AP=3.2724738E-1/SUM
GO TO 103
108 IF(X-2.5)110,110,111
110 DO 112 I=1,4
XI=X**(I-1)
SUM=SUM+DR(I)*XI
112 SUM1=SUM1+ER(I)*XI
BIC3AP=SUM/SUM1
GO TO 103
111 IF(X-15.)114,114,115
114 DO 113 I=1,16
113 SUM=SUM+FR(I)/X**(I-1)
BIC3AP=(EXPF(-X)*X**1.5*SUM)/2.
GO TO 103
115 BIC3AP=0.
103 RETURN
END

```

\*  
CBIC

```

LABEL
FUNCTION BIC(N,X)
DIMENSION A(5),A1(12),A2(11),A3(10),B1(12),B2(11),B3(10),C1(12),C2
1(12),C3(12),DUMMY(4613),Z(17),W(5)
COMMON P,DUMMY,A1,A2,A3,B1,B2,B3,C1,C2,C3
IF(X)30,31,30
31 IF(N-3)32,32,33
32 GO TO (33,34,35),N
33 BIC=1.5707963
A(1)=BIC
IF(N-3)23,23,34
34 BIC=1.
A(2)=BIC

```

- BIC3A004
- BIC3A005
- BIC3A006
- BIC3A007
- BIC3A008
- BIC3A009
- BIC3A010
- BIC3A011
- BIC3A012
- BIC3A013
- BIC3A014
- BIC3A015
- BIC3A016
- BIC3A017
- BIC3A018
- BIC3A019
- BIC3A020
- BIC3A021
- BIC3A022
- BIC3A023
- BIC3A024
- BIC3A025
- BIC3A026
- BIC3A027
- BIC3A028
- BIC3A029
- BIC3A030
- BIC3A031
- BIC3A032
- BIC3A033
- BIC3A034
- BIC3A035
- BIC3A036
- BIC3A037
- BIC3A038
- BIC3A039

- BIC 001
- BIC 002
- BIC 003
- BIC 004
- BIC 005
- BIC 006
- BIC 007
- BIC 008
- BIC 009
- BIC 010
- BIC 011
- BIC 012
- BIC 013

```

35 IF(N-3)23,23,35
   BIC=0.78539816
   A(3)=BIC
   IF(N-3)23,23,24
30 S=SQRTF(P/(2.*X))*EXPF(-X)
   IF(N-3)25,25,1
25 GO TO (1,2,3),N
   1 IF(X-1.)10,10,11
   A(1)=0.
   DO 12 K=1,12
   D=K-1
12 A(1)=X**D*(A1(K)+LOGF(X)*B1(K))+A(1)
   BIC=A(1)
   IF(N-3)23,23,14
11 A(1)=0.
   DO 13 K=1,12
   J=K-1
13 A(1)=S*((-1./X)**J*C1(K))+A(1)
   BIC=A(1)
   IF(N-3)23,23,15
   2 IF(X-1.)14,14,15
14 A(2)=0.
   DO 16 K=1,11
   D=K-1
16 A(2)=X**D*(A2(K)+LOGF(X)*B2(K))+A(2)
   BIC=A(2)
   IF(N-3)23,23,18
15 A(2)=0.
   DO 17 K=1,12
   J=K-1
17 A(2)=S*((-1./X)**J*C2(K))+A(2)
   BIC=A(2)
   IF(N-3)23,23,19
   3 IF(X-1.)18,18,19
18 A(3)=0.
   H5=1.5707963/16.
   BB=0.
   DO 20 I=1,17
   Z(I)=EXPF(-X/SINF(BB))*(SINF(BB))**2
   BB=BB+H5
20 CONTINUE
   S5=0.
   DO 40 J=5,17,4
   DO 41 K=1,5
   J5=K+J-5
41 W(K)=Z(J5)
40 S5=S5+(2./45.)*H5*(7.*W(1)+32.*W(2)+12.*W(3)+32.*W(4)+7.*W(5))
   A(3)=S5
   BIC=A(3)
   IF(N-3)23,23,24

```

```

BIC 014
BIC 015
BIC 016
BIC 017
BIC 018
BIC 019
BIC 020
BIC 021
BIC 022
BIC 023
BIC 024
BIC 025
BIC 026
BIC 027
BIC 028
BIC 029
BIC 030
BIC 031
BIC 032
BIC 033
BIC 034
BIC 035
BIC 036
BIC 037
BIC 038
BIC 039
BIC 040
BIC 041
BIC 042
BIC 043
BIC 044
BIC 045
BIC 046
BIC 047
BIC 048
BIC 049
BIC 050
BIC 051
BIC 052
BIC 053
BIC 054
BIC 055
BIC 056
BIC 057
BIC 058
BIC 059
BIC 060
BIC 061
BIC 062
BIC 063

```

19	A(3)=0.	BIC	064
	DO 21 K=1,12	BIC	065
	J=K-1	BIC	066
21	A(3)=S*((-1./X)**J*C3(K))+A(3)	BIC	067
	BIC=A(3)	BIC	068
	IF(N-3)23,23,24	BIC	069
24	DO 22 K=4,N	BIC	070
	G=K	BIC	071
22	A(K)={(G-2.)*A(K-2)+X*(A(K-3)-A(K-1))}/(G-1.)	BIC	072
	BIC=A(N)	BIC	073
23	RETURN	BIC	074
	END	BIC	075
	LABEL		
*CGAUSS1		GAUS1001	
	SUBROUTINE GAUSS1(A,FRAC,J,K,L,X)	GAUS1002	
	DIMENSION FILL(4562),U(5)	GAUS1003	
	COMMON FILL,U	GAUS1004	
	X=A+FRAC*((1.-U(K))*FLOATF(J-1)+U(K)*FLOATF(2-J)+FLOATF(L-1))	GAUS1005	
	RETURN	GAUS1006	
	END	GAUS1007	
	LABEL		
*CGAUSS2		GAUS2001	
	SUBROUTINE GAUSS2(FRAC,FX,ANS)	GAUS2002	
	DIMENSION FILL(4567),FX(5),R(5)	GAUS2003	
	COMMON FILL,R	GAUS2004	
	ANS=0.	GAUS2005	
	DO 5 K=1,5	GAUS2006	
5	ANS=ANS+R(K)*FX(K)	GAUS2007	
	ANS=ANS*FRAC	GAUS2008	
	RETURN	GAUS2009	
	END	GAUS2010	
	LABEL		
*CPUUKR		PUUKR001	
	SUBROUTINE PUUKR(JR,NGS,NP,PPUU,PPUR,PPUZ,PUU,PUUR,PUUZ)	PUUKR002	
	DIMENSION ETA(61),FILL(126),FILL1(4099),FILL2(747),NL(49),PIJ(300)	PUUKR003	
	1,PIJR(300),PIJZ(300)	PUUKR004	
	COMMON FILL,NL,FILL1,ETA,FILL2,PIJ,PIJR,PIJZ	PUUKR005	
	ENL=NL(JR)	PUUKR006	
	PUU=PUU+ENL*PIJ(NGS)	PUUKR007	
	PPUU=PUU/ETA(1)	PUUKR008	
	IF(NP-1)100,101,100	PUUKR009	
101	PUUR=PUUR+ENL*PIJR(NGS)	PUUKR010	
	PUUZ=PUUZ+ENL*PIJZ(NGS)	PUUKR011	
	PPUR=PUUR/ETA(1)	PUUKR012	
	PPUZ=PUUZ/ETA(1)	PUUKR013	
100	RETURN	PUUKR014	
	END	PUUKR015	
	LABEL		
*CPCUK		PCUK	001
	SUBROUTINE PCUK(ESSA,NB,NC,NP,PCU,PCUR,PCUZ,PPCU,PPCUR,PPCUZ,PUU,PPCUK	002	

	1UUR, PUUZ, SPC, VG, VM)	PCUK	003
	DIMENSION ETA(61), FILL(4030), FILL1(122), FILL2(3096), NPS(61), PCI(61	PCUK	004
	1), PCIR(61), PCIZ(61), SP(61)	PCUK	005
	COMMON FILL, SP, NPS, FILL1, ETA, FILL2, PCI, PCIR, PCIZ	PCUK	006
	IF(NC-12)100, 101, 101	PCUK	007
100	PCU=0.	PCUK	008
	PCUR=0.	PCUK	009
	PCUZ=0.	PCUK	010
	DO 105 I=1, NB	PCUK	011
	ENPS=NPS(I)	PCUK	012
	PCU=PCU+PCI(I)*ENPS	PCUK	013
	IF(NP-1)102, 103, 105	PCUK	014
103	PCUR=PCUR+PCIR(I)*ENPS	PCUK	015
	PCUZ=PCUZ+PCIZ(I)*ENPS	PCUK	016
105	CONTINUE	PCUK	017
	PPCU=ESSA*PCU	PCUK	018
	IF(NP-1)102, 106, 102	PCUK	019
106	PPCUR=ESSA*PCUR	PCUK	020
	PPCUZ=ESSA*PCUZ	PCUK	021
	GO TO 102	PCUK	022
101	SVSV=(SP(1)*VG)/(SPC*VM)	PCUK	023
	PCU=SVSV*(1.-PUU)	PCUK	024
	PPCU=PCU/ETA(1)	PCUK	025
	IF(NP-1)102, 104, 102	PCUK	026
104	PCUR=SVSV*(1.-PUUR)	PCUK	027
	PCUZ=SVSV*(1.-PUUZ)	PCUK	028
	PPCUR=PCUR/ETA(1)	PCUK	029
	PPCUZ=PCUZ/ETA(1)	PCUK	030
102	RETURN	PCUK	031
	END	PCUK	032
	LABEL		
* CPSSK		PSSK	001
	SUBROUTINE PSSK(C, NB, NP, PSS, PSSR, PSSZ, SPC)	PSSK	002
	DIMENSION AP(61), AP2(61), BA(122), DRC(61), DUMMY(378), EMU(61), FILL(6	PSSK	003
	11, 61), FILL1(122), FILL2(61), G(5), GR(5), G1(5), GR1(5), IDBA(122), IDEL(	PSSK	004
	2122), RC2(61), RCA2(61), RI(61), SP(61), X(61), Y(61)	PSSK	005
	COMMON PIG, PD2, PD2M, PIG2, X, Y, RI, EMU, FILL, AP, SP, FILL1, AP2, FILL2, C2,	PSSK	006
	ID1, NIP2, DUMMY, G, GR, G1, GR1, BA, DRC, IDBA, IDEL, RC2, RCA2	PSSK	007
	UP2=1./PIG2	PSSK	008
	QP3=1.33333333*UP2	PSSK	009
	DC=2.*C	PSSK	010
	NB2=NB*2	PSSK	011
	NB2M1=NB2-1	PSSK	012
	DO 112 I=1, NB	PSSK	013
	RC2(I)=RI(I)**2+C2	PSSK	014
	RCA2(I)=RC2(I)-AP2(I)	PSSK	015
112	DRC(I)=DC*RI(I)	PSSK	016
	ENIP2=NIP2	PSSK	017
	DO 108 K=1, 5	PSSK	018
	G1(K)=0.	PSSK	019

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GR1(K)=0.
DO 100 M=1,2
DO 109 L=1,NIP2
CALL GAUSS1(0.,D1,M,K,L,VI1)
DO 113 I=1,NB
AMMU=VI1-EMU(I)
SAM=SINF(AMMU)
CAM=COSF(AMMU)
DRCAM=DRC(I)*CAM
RRC=RC2(I)-DRCAM
RRCA=RCA2(I)-DRCAM
TER1=AP(I)*(RI(I)*CAM-C)
TER2=RI(I)*SAM*SQRTF(RRCA)
BA(I)=ASINF((TER1-TER2)/RRC)
INB=I+NB
BA(INB)=ASINF((-TER1-TER2)/RRC)
IDBA(I)=0
IDBA(INB)=1
IDEL(I)=0
113 IDEL(INB)=1
DO 114 I=1,NB2M1
IP1=I+1
DO 115 J=IP1,NB2
IF(BA(I)-BA(J))115,115,116
116 EASE=BA(J)
BA(J)=BA(I)
BA(I)=EASE
IEASE=IDBA(J)
IDBA(J)=IDBA(I)
IDBA(I)=IEASE
IEASE=IDEL(J)
IDEL(J)=IDEL(I)
IDEL(I)=IEASE
115 CONTINUE
114 CONTINUE
BAB=PD2M
IF(ABSF(BA(1)-PD2M)-1.E-6)117,117,118
117 BAA=PD2
DI=PIG/ENIP2
NI=2
IB=1
IA=NB2
124 NID2=NI/2
NIDM2=NID2*2
131 DO 110 K1=1,5
G(K1)=0.
GR(K1)=0.
DO 103 M1=1,2
DO 111 L1=1,NIP2
CALL GAUSS1(BAA,DI,M1,K1,L1,VI2)

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PSSK 020
PSSK 021
PSSK 022
PSSK 023
PSSK 024
PSSK 025
PSSK 026
PSSK 027
PSSK 028
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PSSK 064
PSSK 065
PSSK 066
PSSK 067
PSSK 068
PSSK 069

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VI2=-VI2
CV2=COSF(VI2)
IF(NI-NIDM2)105,120,121
121 YN=DC*SPC*CV2
GO TO 122
120 VI=VI1+VI2
SVI=SINF(VI)
CVI=COSF(VI)
SV2=SINF(VI2)
RN=0.
SR=0.
DO 101 IBA=IB,IA
IF(IDEL(IBA))105,101,123
123 I=IDEL(IBA)
H=ABSF(X(I)*SVI-Y(I)*CVI-C*SV2)
IF(H-AP(I))102,101,101
102 RO=2.*SQRTF(AP2(I)-H**2)
RN=RN+RO
SR=SR+SP(I)*RO
101 CONTINUE
RC=DC*CV2-RN
YN=SR+SPC*RC
122 G(K1)=G(K1)+UP2*CV2*BIC3AP(YN)
IF(NP-1)105,104,111
104 GR(K1)=GR(K1)+QP3*CV2*BIC(5,YN)
111 CONTINUE
103 CONTINUE
110 CONTINUE
CALL GAUSS2(DI,G,S)
G1(K)=G1(K)+S
IF(NP-1)105,106,119
106 CALL GAUSS2(DI,GR,S)
GR1(K)=GR1(K)+S
GO TO 119
118 NI=1
IB=0
IA=1
BAA=BA(1)
128 DI=(BAA-BAB)/ENIP2
GO TO 124
119 NI=NI+1
BAB=BAA
IF(ABSF(BAA-PD2)-1.E-6)109,109,125
125 IF(ABSF(BAA-BA(NB2))-1.E-6)126,126,127
126 BAA=PD2
GO TO 128
127 NID2=NI/2
NIDM2=NID2*2
IB=IA
IF(NI-NIDM2)105,129,130

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PSSK 070
PSSK 071
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PSSK 073
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PSSK 109
PSSK 110
PSSK 111
PSSK 112
PSSK 113
PSSK 114
PSSK 115
PSSK 116
PSSK 117
PSSK 118
PSSK 119

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130	IA=IB+1	PSSK	120
140	BAA=BA(IA)	PSSK	121
	DI=(BAA-BAB)/ENIP2	PSSK	122
	GO TO 131	PSSK	123
129	IB1=IB+1	PSSK	124
	NBAS=1	PSSK	125
	NAL=0	PSSK	126
	DO 132 I=IB1,NB2	PSSK	127
	IF(IDBA(I))105,136,133	PSSK	128
133	IF(I-NB2)134,135,105	PSSK	129
134	IF(IDBA(I+1))105,137,138	PSSK	130
137	NAL=NAL+1	PSSK	131
	IF(NBAS-NAL)132,135,132	PSSK	132
135	IA=I	PSSK	133
	GO TO 140	PSSK	134
138	NAL=NAL+1	PSSK	135
	GO TO 132	PSSK	136
136	NBAS=NBAS+1	PSSK	137
132	CONTINUE	PSSK	138
109	CONTINUE	PSSK	139
100	CONTINUE	PSSK	140
108	CONTINUE	PSSK	141
	CALL GAUSS2(D1,G1,PSS)	PSSK	142
	IF(NP-1)105,107,105	PSSK	143
107	CALL GAUSS2(D1,GR1,PSSR)	PSSK	144
	PSSZ=4.*PSS-3.*PSSR	PSSK	145
105	RETURN	PSSK	146
	END	PSSK	147
	LABEL		
*CPISK		PISK	001
	SUBROUTINE PISK(C,NB,NII,NP,SPC)	PISK	002
	DIMENSION AP(61),AP2(61),DUMMY(2),ETA(61),FILL(3843),FILL1(61),FIL	PISK	003
	1L2(2544),FI1(5),FI2(5),FI3(5),FI4(5),NPS(61),PIS(61),PISR(61),PISZ	PISK	004
	2(61),SP(61),X(61),Y(61)	PISK	005
	COMMON DUMMY,PD2M,DUMMY1,X,Y,FILL,AP,SP,NPS,FILL1,AP2,ETA,C2,DI,NI	PISK	006
	1P2,FILL2,PIS,PISR,PISZ,FI1,FI2,FI3,FI4	PISK	007
	DO 100 I=1,NB	PISK	008
	IF(NPS(I))109,100,116	PISK	009
116	DO 107 K=1,5	PISK	010
	FI3(K)=0.	PISK	011
	FI4(K)=0.	PISK	012
	DO 101 M=1,2	PISK	013
	DO 108 L=1,NII	PISK	014
	CALL GAUSS1(PD2M,DI,M,K,L,VII)	PISK	015
	SV1=SINF(VII)	PISK	016
	CV1=COSF(VII)	PISK	017
	ASV1=AP(I)*SV1	PISK	018
	ACV1=AP(I)*CV1	PISK	019
	DO 113 K1=1,5	PISK	020
	FI1(K1)=0.	PISK	021

	FI2(K1)=0.	PISK	022
	DO 111 M1=1,2	PISK	023
	DO 114 L1=1,NIP2	PISK	024
	CALL GAUSS1(0.,DI,M1,K1,L1,VI2)	PISK	025
	VI=VI1+VI2	PISK	026
	SVI=SINF(VI)	PISK	027
	CVI=COSF(VI)	PISK	028
	RUS=0.	PISK	029
	SRUS=0.	PISK	030
	DO 102 K2=1,NB	PISK	031
	IF(K2-1)103,102,103	PISK	032
103	XIS=X(K2)-X(I)	PISK	033
	YIS=Y(K2)-Y(I)	PISK	034
	TER1=XIS*CVI+YIS*SVI	PISK	035
	IF(TER1)102,102,105	PISK	036
105	HIS=ABSF(-XIS*SVI+YIS*CVI+ASVI)	PISK	037
	IF(HIS-AP(K2))106,102,102	PISK	038
106	RIS=2.*SQRTF(AP2(K2)-HIS**2)	PISK	039
	RUS=RUS+RIS	PISK	040
	SRUS=SRUS+SP(K2)*RIS	PISK	041
102	CONTINUE	PISK	042
	RCS=SQRTF(C2-(X(I)*SVI-Y(I)*CVI+ASV1)**2)-ACV1-X(I)*CVI-Y(I)*SVI-R	PISK	043
	1US	PISK	044
	Z1=SRUS+SPC*RCS	PISK	045
	Z2=Z1+2.*ACV1*SP(I)	PISK	046
	FI1(K1)=FI1(K1)+BIC3AP(Z1)-BIC3AP(Z2)	PISK	047
	IF(NP-1)109,110,114	PISK	048
110	FI2(K1)=FI2(K1)+BIC(5,Z1)-BIC(5,Z2)	PISK	049
114	CONTINUE	PISK	050
111	CONTINUE	PISK	051
113	CONTINUE	PISK	052
	CALL GAUSS2(DI,FI1,S)	PISK	053
	FI3(K)=FI3(K)+S*CV1	PISK	054
	IF(NP-1)109,104,108	PISK	055
104	CALL GAUSS2(DI,FI2,S)	PISK	056
	FI4(K)=FI4(K)+S*CV1	PISK	057
108	CONTINUE	PISK	058
101	CONTINUE	PISK	059
107	CONTINUE	PISK	060
	CALL GAUSS2(DI,FI3,S)	PISK	061
	ET2=19.739209*ETA(I)	PISK	062
	PIS(I)=S/ET2	PISK	063
	IF(NP-1)109,112,100	PISK	064
112	CALL GAUSS2(DI,FI4,S)	PISK	065
	PISR(I)=1.5*(S/ET2)	PISK	066
	PISZ(I)=3.*PIS(I)-2.*PISR(I)	PISK	067
100	CONTINUE	PISK	068
109	RETURN	PISK	069
	END	PISK	070
	LABEL		

CPUSK	SUBROUTINE PUSK(FM,NB,NP,PUS,PUSR,PUSZ)	PUSK 001
	DIMENSION FI(61),FILL(4091),FILL1(2669),NPS(61),PIS(61),PISR(61),PISZ(61)	PUSK 002
	COMMON FILL,NPS,FI,FILL1,PIS,PISR,PISZ	PUSK 003
	SFP=0.	PUSK 004
	SFPR=0.	PUSK 005
	SFPZ=0.	PUSK 006
	DO 100 I=1,NB	PUSK 007
	ENPS=NPS(I)	PUSK 008
	SFP=SFP+FI(I)*PIS(I)*ENPS	PUSK 009
	IF(NP-1)101,102,100	PUSK 010
102	SFPR=SFPR+FI(I)*PISR(I)*ENPS	PUSK 011
	SFPZ=SFPZ+FI(I)*PISZ(I)*ENPS	PUSK 012
100	CONTINUE	PUSK 013
	PUS=FM*SFP	PUSK 014
	IF(NP-1)101,103,101	PUSK 015
103	PUSR=FM*SFPR	PUSK 016
	PUSZ=FM*SFPZ	PUSK 017
101	RETURN	PUSK 018
	END	PUSK 019
	LABEL	PUSK 020
*CPUUKG		PUSK 021
	SUBROUTINE PUUKG(ESSA,FM,NB,NP,PPUU,PPUUR,PPUUZ,PUU,PUUR,PUUZ)	PUUKG001
	DIMENSION FI(61),FILL(248),FILL1(183),FILL2(503),FILL3(183),MSI(61),PII(61),PIIR(61),PIIZ(61),PIJ(300),PIJR(300),PIJZ(300)	PUUKG002
	COMMON FILL,MSI,FILL1,FI,FILL2,PII,PIIR,PIIZ,FILL3,PIJ,PIJR,PIJZ	PUUKG003
	SFPI=0.	PUUKG004
	SFPIR=0.	PUUKG005
	SFPIZ=0.	PUUKG006
	DO 100 I=1,NB	PUUKG007
	SFP=0.	PUUKG008
	SFPR=0.	PUUKG009
	SFPZ=0.	PUUKG010
	DO 101 J=1,NB	PUUKG011
	IF(J-1)102,101,102	PUUKG012
102	NGS=MSI(J,I)	PUUKG013
	SFP=SFP+FI(J)*PIJ(NGS)	PUUKG014
	IF(NP-1)103,104,101	PUUKG015
104	SFPR=SFPR+FI(J)*PIJR(NGS)	PUUKG016
	SFPZ=SFPZ+FI(J)*PIJZ(NGS)	PUUKG017
101	CONTINUE	PUUKG018
	SFPI=SFPI+FI(I)*PII(I)+SFP	PUUKG019
	IF(NP-1)103,105,100	PUUKG020
105	SFPIR=SFPIR+FI(I)*PIIR(I)+SFPR	PUUKG021
	SFPIZ=SFPIZ+FI(I)*PIIZ(I)+SFPZ	PUUKG022
100	CONTINUE	PUUKG023
	PUU=FM*SFP	PUUKG024
	PPUU=ESSA*PUU	PUUKG025
	IF(NP-1)103,106,103	PUUKG026
		PUUKG027
		PUUKG028

106	PUUR=FM*SFPIR	PUUKG029
	PUUZ=FM*SFPIZ	PUUKG030
	PPUUR=ESSA*PUUR	PUUKG031
	PPUUZ=ESSA*PUUZ	PUUKG032
103	RETURN	PUUKG033
	END	PUUKG034
	LABEL	
* CPICK		
	SUBROUTINE PICK(AC,NB,NP,SPC)	PICK 001
	DIMENSION FILL(248),FILL1(122),FILL2(564),FILL3(183),FILL4(900),MS	PICK 002
	1I(61,61),NPS(61),PIC(61),PICR(61),PICZ(61),PII(61),PIIR(61),PIIZ(61)	PICK 003
	21),PIJ(300),PIJR(300),PIJZ(300),PPIC(61),PPICR(61),PPICZ(61),PIS(61)	PICK 004
	31),PISR(61),PISZ(61)	PICK 005
	COMMON FILL,MSI,FILL1,NPS,FILL2,PII,PIIR,PIIZ,FILL3,PIJ,PIJR,PIJZ,	PICK 006
	1FILL4,PIS,PISR,PISZ,PIC,PICR,PICZ,PPIC,PPICR,PPICZ	PICK 007
	SAC=SPC*AC	PICK 008
	DO 100 I=1,NB	PICK 009
	IF(NPS(I)) 103,100,106	PICK 010
106	SPIJ=0.	PICK 011
	SPIJR=0.	PICK 012
	SPIJZ=0.	PICK 013
	DO 101 J=1,NB	PICK 014
	IF(J-1) 102,101,102	PICK 015
102	NGS=MSI(I,J)	PICK 016
	SPIJ=SPIJ+PIJ(NGS)	PICK 017
	IF(NP-1) 103,104,101	PICK 018
104	SPIJR=SPIJR+PIJR(NGS)	PICK 019
	SPIJZ=SPIJZ+PIJZ(NGS)	PICK 020
101	CONTINUE	PICK 021
	PIC(I)=1.-SPIJ-PIS(I)-PII(I)	PICK 022
	PPIC(I)=PIC(I)/SAC	PICK 023
	IF(NP-1) 103,105,100	PICK 024
105	PICR(I)=1.-SPIJR-PISR(I)-PIIR(I)	PICK 025
	PICZ(I)=1.-SPIJZ-PISZ(I)-PIIZ(I)	PICK 026
	PPICR(I)=PICR(I)/SAC	PICK 027
	PPICZ(I)=PICZ(I)/SAC	PICK 028
100	CONTINUE	PICK 029
103	RETURN	PICK 030
	END	PICK 031
	LABEL	PICK 032
* CPCIK		
	SUBROUTINE PCIK(NB,NP,SAP,SCS)	PCIK 001
	DIMENSION ETA(61),FILL(4091),FILL1(122),FILL2(2730),FILL3(183),NPS	PCIK 002
	1(61),PCI(61),PCIR(61),PCIZ(61),PIC(61),PICR(61),PICZ(61),PPCI(61),	PCIK 003
	2PPCIR(61),PPCIZ(61),SAP(61)	PCIK 004
	COMMON FILL,NPS,FILL1,ETA,FILL2,PIC,PICR,PICZ,FILL3,PCI,PCIR,PCIZ,	PCIK 005
	1PPCI,PPCIR,PPCIZ	PCIK 006
	DO 100 I=1,NB	PCIK 007
	IF(NPS(I)) 101,100,103	PCIK 008
103	COE=SAP(I)/SCS	PCIK 009
		PCIK 010

	PCI(I)=COE*PIC(I)	PCIK 011
	PPCI(I)=PCI(I)/ETA(I)	PCIK 012
	IF(NP-1)101,102,100	PCIK 013
102	PCIR(I)=COE*PICR(I)	PCIK 014
	PPCIR(I)=PCIR(I)/ETA(I)	PCIK 015
	PCIZ(I)=COE*PICZ(I)	PCIK 016
	PPCIZ(I)=PCIZ(I)/ETA(I)	PCIK 017
100	CONTINUE	PCIK 018
101	RETURN	PCIK 019
	END	PCIK 020
	LABEL	PCIK 020
* CPSK		
	SUBROUTINE PCSK(C,CSS,NB,NP,PCS,PCSR,PCSZ,PSS,PSSR,PSSZ,SAP)	PCSK 001
	DIMENSION FILL(4091),FILL1(2730),NPS(61),PIS(61),PISR(61),PISZ(61)	PCSK 002
	1,SAP(61)	PCSK 003
	COMMON FILL,NPS,FILL1,PIS,PISR,PISZ	PCSK 004
	SSVP=0.	PCSK 005
	SSVPR=0.	PCSK 006
	SSVPZ=0.	PCSK 007
	DO 100 I=1,NB	PCSK 008
	COE=(2.*SAP(I))/C	PCSK 009
	ENPS=NPS(I)	PCSK 010
	SSVP=SSVP+COE*PIS(I)*ENPS	PCSK 011
102	IF(NP-1)101,102,100	PCSK 012
	SSVPR=SSVPR+COE*PISR(I)*ENPS/1.125	PCSK 013
100	SSVPZ=SSVPZ+COE*PISZ(I)*ENPS/0.75	PCSK 014
	CONTINUE	PCSK 015
	COE=CSS/2.	PCSK 016
	PCS=COE*(1.-PSS-SSVP)	PCSK 017
	IF(NP-1)101,103,101	PCSK 018
103	PCSR=COE*(1.-PSSR-SSVPR)*1.125	PCSK 019
	PCSZ=COE*(1.-PSSZ-SSVPZ)*0.75	PCSK 020
101	RETURN	PCSK 021
	END	PCSK 022
	LABEL	PCSK 023
* CPCK		
	SUBROUTINE PCCK(AC,NP,PCC,PCCR,PCCZ,PCS,PCSR,PCSZ,PCU,PCUR,PCUZ,PP	PCCK 001
	1CC,PPCCR,PPCCZ,SPC)	PCCK 002
	PCC=1.-PCS-PCU	PCCK 003
	IF(PCC)102,103,103	PCCK 004
102	PCC=0.	PCCK 005
	PCCR=0.	PCCK 006
	PCCZ=0.	PCCK 007
	PPCCR=0.	PCCK 008
	PPCCZ=0.	PCCK 009
	GO TO 100	PCCK 010
103	SAC=SPC*AC	PCCK 011
	PPCC=PCC/SAC	PCCK 012
	IF(NP-1)100,101,100	PCCK 013
		PCCK 014
		PCCK 015

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101 PCCR=1.-PCSR-PCUR
    PCCZ=1.-PCSZ-PCUZ
    PPCCR=PCCR/SAC
    PPCCZ=PCCZ/SAC
100 RETURN
    END
    LABEL
*
CWRITE SUBROUTINE WRITE(NP,UNO,DUE,TRE,QUAT,CIN,SEI)
        IF(NP-1)100,101,102
101 WRITE OUTPUT TAPE 6,1,UNO,DUE,TRE,QUAT,CIN,SEI
    1 FORMAT (1H+,27X,2(5X,1P3E13.4))
    GO TO 100
102 WRITE OUTPUT TAPE 6,2,TRE,SEI
    2 FORMAT (1H+,27X,2(12X,1H-),5X,1PE13.4,2(12X,1H-),5X,1PE13.4)
100 RETURN
    END

```

```

PCK 016
PCK 017
PCK 018
PCK 019
PCK 020
PCK 021

```

```

WRITE001
WRITE002
WRITE003
WRITE004
WRITE005
WRITE006
WRITE007
WRITE008
WRITE009
WRITE010

```



\* CCR EURATOM \*  
\* REACTOR PHYSICS DEPARTEMENT \*  
\* REACTOR THEORY AND ANALYSIS \*

```
*****  
* *  
* * PROCOPE * *  
* COLLISION PROBABILITIES IN PIN CLUSTERS *  
* OR INFINITE LATTICES *  
* *  
* L. AMYOT(EURATOM) - P. BENOIST(CEA) *  
* C. DAOLIO(EURATOM) *  
* *  
* SEPTEMBER 1966 *  
* *  
*****
```

XI. Example of output

ISPRA SEPTEMBER 1966 - TEST FOR PROCOPE - CLUSTER 7 FUEL PENCILS

1) GENERAL DESCRIPTION

GEOMETRICAL CONFIGURATION NUMBER	=	2
NUMBER OF GAUSS INTEGR. POINTS	=	1
HOMOGENIZATION OF THE CLADDING	=	1
TYPES OF COLLIS. PROB. CALCUL.	=	1
CALCULATION METHOD FOR PIJ	=	1
SOURCE DISTRIBUTION	=	1

NUMERICAL CONFIGURATION OF THE FUEL PENCILS

1	
6	2
7	
5	3
4	



2) GEOMETRICAL DATA

RADIUS FUEL PENCIL	=	0.480000
CLADDING THICKNESS	=	0.020000
DISTANCE BETWEEN CENTERS	=	1.200000
RADIUS OF THE CLUSTER	=	2.000000

3) NUCLEAR DATA

TOTAL FUEL CROSS SECTION	=	1.2000E 00
TOTAL CLADDING CROSS SECTION	=	1.0000E 00
TOTAL COOLANT CROSS SECTION	=	1.0000E-01
SOURCE UNIFORM	=	1.0000E 00



FUEL-COOLANT COLLISION PROBABILITIES (PIC)

1	4.3350E-02	4.6530E-02	4.4410E-02	1.0597E 00	1.1374E 00	1.0856E 00
7	4.8763E-02	5.1065E-02	4.9530E-02	1.1920E 00	1.2483E 00	1.2107E 00

COOLANT-FUEL COLLISION PROBABILITIES (PCI)

1	5.7045E-02	6.1229E-02	5.8440E-02	9.6334E-02	1.0340E-01	9.8689E-02
7	6.4167E-02	6.7197E-02	6.5177E-02	1.0836E-01	1.1348E-01	1.1007E-01

ESCAPE PROBABILITY FROM CLUSTER FOR NEUTRON BORN IN FUEL (PIS)

1	3.5901E-01	2.5062E-01	3.2288E-01
7	2.4102E-01	1.3766E-01	2.0657E-01

5) BALANCE SHEET

FATE OF NEUTRONS BORN IN CLUSTER

SOURCE MEDIUM	FUEL			COOLANT		
	RADIAL	AXIAL	TOTAL	RADIAL	AXIAL	TOTAL
NORMAL PROBABILITIES						
COLLISION IN FUEL	6.1372E-01	7.1834E-01	6.4859E-01	4.0644E-01	4.3457E-01	4.1581E-01
COLLISION IN COOLANT	4.4123E-02	4.7178E-02	4.5141E-02	2.6999E-02	7.2059E-02	4.2019E-02
ESCAPE FROM CLUSTER	3.4216E-01	2.3448E-01	3.0627E-01	5.6656E-01	4.9337E-01	5.4217E-01
REDUCED PROBABILITIES						
COLLISION IN FUEL	1.0364E 00	1.2131E 00	1.0953E 00	6.8636E-01	7.3387E-01	7.0220E-01
COLLISION IN COOLANT	1.0786E 00	1.1532E 00	1.1035E 00	6.5998E-01	1.7614E 00	1.0271E 00
TRANSMISSION PROBABILITY THROUGH CLUSTER (PSS)						
	2.5634E-01	2.0401E-01	2.4326E-01			

ALL INPUT DATA AS IN PREVIOUS PROBLEM EXCEPT THOSE MARKED WITH \*  
=====

\* ANY CONFIGURATION. IDENTICAL FUEL PENCILS

1) GENERAL DESCRIPTION

GEOMETRICAL CONFIGURATION NUMBER	=	10	*
NUMBER OF GAUSS INTEGR. POINTS	=	1	
HOMOGENIZATION OF THE CLADDING	=	1	
TYPES OF COLLIS. PROB. CALCUL.	=	1	
CALCULATION METHOD FOR PIJ	=	1	
SOURCE DISTRIBUTION	=	1	
NUMBER OF FUEL PENCILS	=	4	*

NUMERICAL CONFIGURATION OF THE FUEL PENCILS

ANY NUMERICAL CONFIGURATION IS POSSIBLE

2) GEOMETRICAL DATA

RADIUS FUEL PENCIL = 0.480000  
CLADDING THICKNESS = 0.020000  
DISTANCE BETWEEN CENTERS = 0.848530 \*  
RADIUS OF THE CLUSTER = 2.000000

CO-ORDINATES FUEL PENCILS CENTERS

I	X *	Y *
1	0.6000	0.6000
2	0.6000	-0.6000
3	-0.6000	-0.6000
4	-0.6000	0.6000

MATRIX OF GROUP OF SIMMETRY \*

RODS	1	2	3	4
1	0	1	2	1
2	1	0	1	2
3	2	1	0	1
4	1	2	1	0

3) NUCLEAR DATA

TOTAL FUEL CROSS SECTION	=	1.2000E 00
TOTAL CLADDING CROSS SECTION	=	1.0000E 00
TOTAL COOLANT CROSS SECTION	=	1.0000E-01
SOURCE UNIFORM	=	1.0000E 00

4) DETAILED PROBABILITIES

SOURCE PIN(I)	TARGET PIN(J)	SYMMETRY GROUP	NORMAL			REDUCED		
			RADIAL	AXIAL	TOTAL	RADIAL	AXIAL	TOTAL
PIN-TO-PIN COLLISION PROBABILITIES (PIJ)								
1	1	0	4.0399E-01	5.3815E-01	4.4871E-01	6.8223E-01	9.0880E-01	7.5775E-01
1	2	1	5.1039E-02	4.5520E-02	4.9199E-02	8.6191E-02	7.6870E-02	8.3084E-02
1	3	2	3.2180E-02	2.7403E-02	3.0588E-02	5.4344E-02	4.6277E-02	5.1655E-02
1	4	1	5.1039E-02	4.5520E-02	4.9199E-02	8.6191E-02	7.6870E-02	8.3084E-02
2	1	1	5.1039E-02	4.5520E-02	4.9199E-02	8.6191E-02	7.6870E-02	8.3084E-02
2	2	0	4.0399E-01	5.3815E-01	4.4871E-01	6.8223E-01	9.0880E-01	7.5775E-01
2	3	1	5.1039E-02	4.5520E-02	4.9199E-02	8.6191E-02	7.6870E-02	8.3084E-02
2	4	2	3.2180E-02	2.7403E-02	3.0588E-02	5.4344E-02	4.6277E-02	5.1655E-02
3	1	2	3.2180E-02	2.7403E-02	3.0588E-02	5.4344E-02	4.6277E-02	5.1655E-02
3	2	1	5.1039E-02	4.5520E-02	4.9199E-02	8.6191E-02	7.6870E-02	8.3084E-02
3	3	0	4.0399E-01	5.3815E-01	4.4871E-01	6.8223E-01	9.0880E-01	7.5775E-01
3	4	1	5.1039E-02	4.5520E-02	4.9199E-02	8.6191E-02	7.6870E-02	8.3084E-02
4	1	2	3.2180E-02	2.7403E-02	3.0588E-02	5.4344E-02	4.6277E-02	5.1655E-02
4	2	1	5.1039E-02	4.5520E-02	4.9199E-02	8.6191E-02	7.6870E-02	8.3084E-02
4	3	0	4.0399E-01	5.3815E-01	4.4871E-01	6.8223E-01	9.0880E-01	7.5775E-01
4	4	1	5.1039E-02	4.5520E-02	4.9199E-02	8.6191E-02	7.6870E-02	8.3084E-02
FUEL-COOLANT COLLISION PROBABILITIES (PIC)								
1			6.6124E-02	7.1098E-02	6.7782E-02	8.8165E-01	9.4797E-01	9.0375E-01
2			6.6124E-02	7.1098E-02	6.7782E-02	8.8165E-01	9.4797E-01	9.0375E-01
3			6.6124E-02	7.1098E-02	6.7782E-02	8.8165E-01	9.4797E-01	9.0375E-01
4			6.6124E-02	7.1097E-02	6.7782E-02	8.8165E-01	9.4797E-01	9.0375E-01
COOLANT-FUEL COLLISION PROBABILITIES (PCI)								
1			6.5260E-02	7.0169E-02	6.6896E-02	1.1021E-01	1.1850E-01	1.1297E-01
2			6.5260E-02	7.0169E-02	6.6896E-02	1.1021E-01	1.1850E-01	1.1297E-01
3			6.5260E-02	7.0169E-02	6.6896E-02	1.1021E-01	1.1850E-01	1.1297E-01
4			6.5260E-02	7.0168E-02	6.6896E-02	1.1021E-01	1.1850E-01	1.1297E-01
ESCAPE PROBABILITY FROM CLUSTER FOR NEUTRON BORN IN FUEL (PIS)								
1			3.9563E-01	2.7231E-01	3.5452E-01			
2			3.9563E-01	2.7231E-01	3.5452E-01			
3			3.9563E-01	2.7231E-01	3.5452E-01			
4			3.9563E-01	2.7231E-01	3.5452E-01			



## 5) BALANCE SHEET

## FATE OF NEUTRONS BORN IN CLUSTER

SOURCE MEDIUM	FUEL			COOLANT		
	RADIAL	AXIAL	TOTAL	RADIAL	AXIAL	TOTAL
NORMAL PROBABILITIES						
COLLISION IN FUEL	5.3825E-01	6.5660E-01	5.7770E-01	2.6104E-01	2.8067E-01	2.6758E-01
COLLISION IN COOLANT	6.6124E-02	7.1098E-02	6.7782E-02	6.0337E-02	1.2508E-01	8.1917E-02
ESCAPE FROM CLUSTER	3.9563E-01	2.7231E-01	3.5452E-01	6.7863E-01	5.9425E-01	6.5050E-01
REDUCED PROBABILITIES						
COLLISION IN FUEL	9.0895E-01	1.1088E 00	9.7557E-01	4.4082E-01	4.7398E-01	4.5188E-01
COLLISION IN COOLANT	8.8165E-01	9.4797E-01	9.0376E-01	8.0449E-01	1.6677E 00	1.0922E 00
TRANSMISSION PROBABILITY THROUGH CLUSTER (PSS)						
	4.0254E-01	3.3230E-01	3.8498E-01			

SQUARE LATTICE

1) GENERAL DESCRIPTION

GEOMETRICAL CONFIGURATION NUMBER = 12  
NUMBER OF GAUSS INTEGR. POINTS = 2  
HOMOGENIZATION OF THE CLADDING = 1  
TYPES OF COLLIS. PROB. CALCUL. = 2  
CALCULATION METHOD FOR PIJ = 2

NUMERICAL CONFIGURATION OF THE FUEL PENCILS

18  
17 48 49  
16 45 46 47  
15 40 41 42 43 44  
14 34 35 36 37 38 39  
13 27 28 29 30 31 32 33  
12 19 20 21 22 23 24 25 26  
1 2 3 4 5 6 7 8 9 10 11

2) GEOMETRICAL DATA

RADIUS FUEL PENCIL	=	0.500000
CLADDING THICKNESS	=	0.020000
DISTANCE BETWEEN CENTERS	=	1.200000
ACCURACY DESIRED FOR PUU	=	1.00E-05

3) NUCLEAR DATA

TOTAL FUEL CROSS SECTION	=	1.2000E 00
TOTAL CLADDING CROSS SECTION	=	1.0000E 00
TOTAL MODERATOR CROSS SECTION	=	1.0000E-01

SOURCE PIN(I)	TARGET PIN(J)	SYMMETRY GROUP	NORMAL			REDUCED		
			RADIAL	AXIAL	TOTAL	RADIAL	AXIAL	TOTAL

PIN-TO-PIN COLLISION PROBABILITIES (PIJ)

1	1	0	-	-	4.5943E-01	-	-	7.4565E-01
1	2	1	-	-	4.9746E-02	-	-	8.0737E-02
1	3	2	-	-	2.7981E-02	-	-	4.5412E-02
1	4	3	-	-	5.3000E-03	-	-	8.6018E-03
1	5	4	-	-	6.3571E-03	-	-	1.0317E-02
1	6	5	-	-	2.6778E-03	-	-	4.3460E-03
1	7	6	-	-	8.9866E-04	-	-	1.4585E-03
1	8	7	-	-	1.6473E-03	-	-	2.6736E-03
1	9	8	-	-	9.0472E-04	-	-	1.4683E-03
1	10	9	-	-	1.7998E-04	-	-	2.9211E-04
1	11	10	-	-	4.5735E-04	-	-	7.4227E-04
1	12	11	-	-	3.9164E-04	-	-	6.3562E-04
1	13	12	-	-	2.7470E-04	-	-	4.4583E-04
1	14	13	-	-	3.9458E-05	-	-	6.4039E-05
1	15	14	-	-	1.5127E-04	-	-	2.4551E-04
1	16	15	-	-	1.3384E-04	-	-	2.1722E-04
1	17	16	-	-	9.4079E-05	-	-	1.5269E-04
1	18	17	-	-	6.7580E-05	-	-	1.0968E-04
1	19	18	-	-	5.4956E-05	-	-	8.9191E-05
1	20	19	-	-	9.1597E-06	-	-	1.4866E-05
1	21	20	-	-	4.0782E-05	-	-	6.6188E-05
1	22	21	-	-	2.9955E-05	-	-	4.8616E-05
1	23	22	-	-	2.7919E-05	-	-	4.5311E-05
1	24	23	-	-	1.7797E-05	-	-	2.8885E-05
1	8	24	-	-	2.2126E-06	-	-	3.5909E-06

5) BALANCE SHEET

FATE OF NEUTRONS BORN IN CLUSTER

SOURCE MEDIUM	FUEL			COOLANT		
	RADIAL	AXIAL	TOTAL	RADIAL	AXIAL	TOTAL
NORMAL PROBABILITIES						
COLLISION IN FUEL	-	-	8.9014E-01	-	-	8726E 00
REDUCED PROBABILITIES						
COLLISION IN FUEL	-	-	1.4447E 00	-	-	3.0391E 00

472 LINES OUTPUT THIS JOB.

JOB START AT 09.22(12/11/66).  
 COMP./LOAD TIME 00.008  
 EXECUTION TIME 00.070  
 TOTAL JOB TIME 00.078

XII. REFERENCE

- 1) L. Amyot and P. Benoist, "First flight collision probabilities in pin cluster and rod lattices", EUR 2751.e (1966).

fig. 1

4 ROD CLUSTER

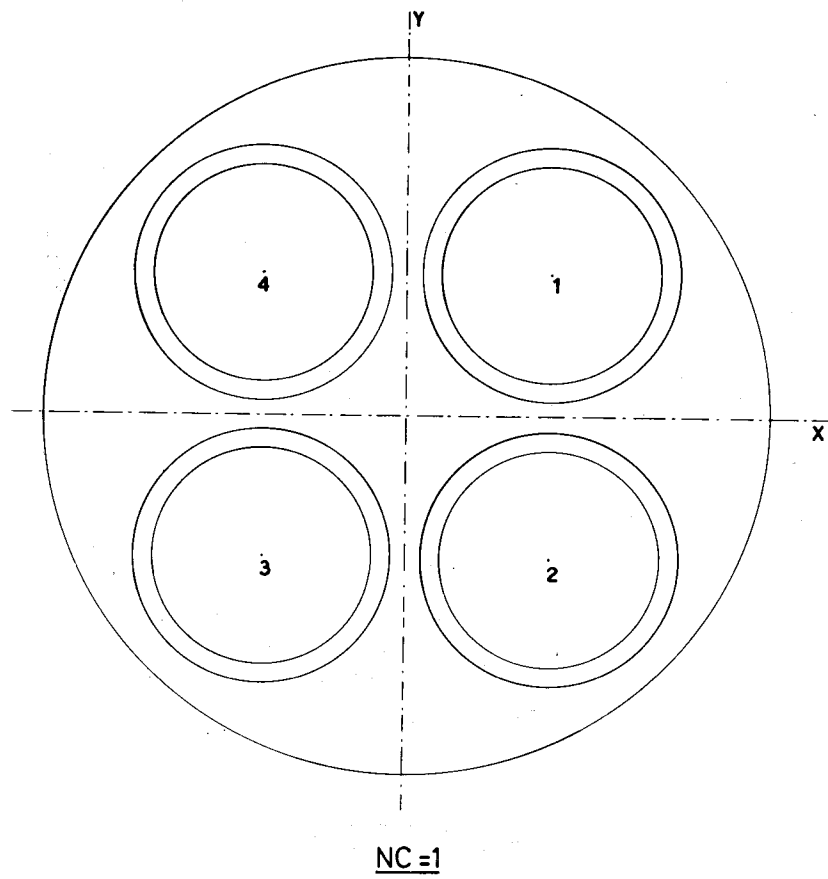


fig. 2

7 ROD CLUSTER

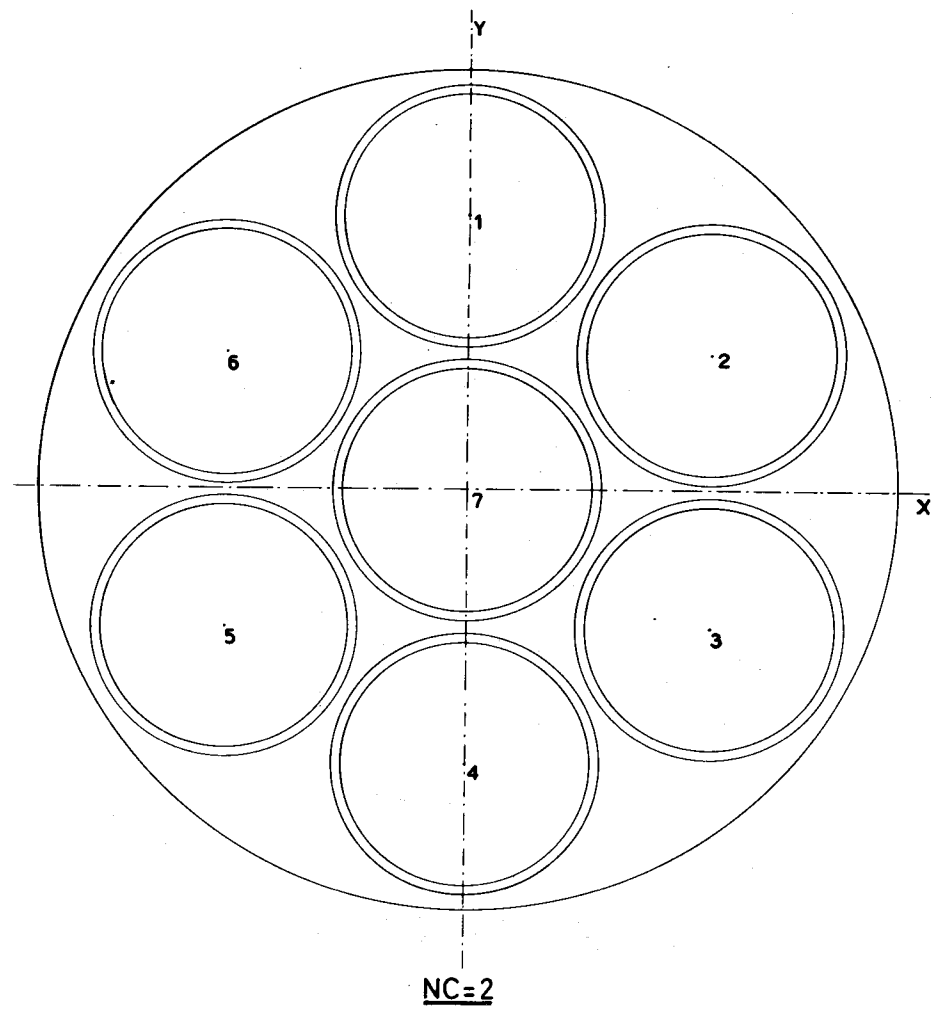


fig. 3

12 ROD CLUSTER

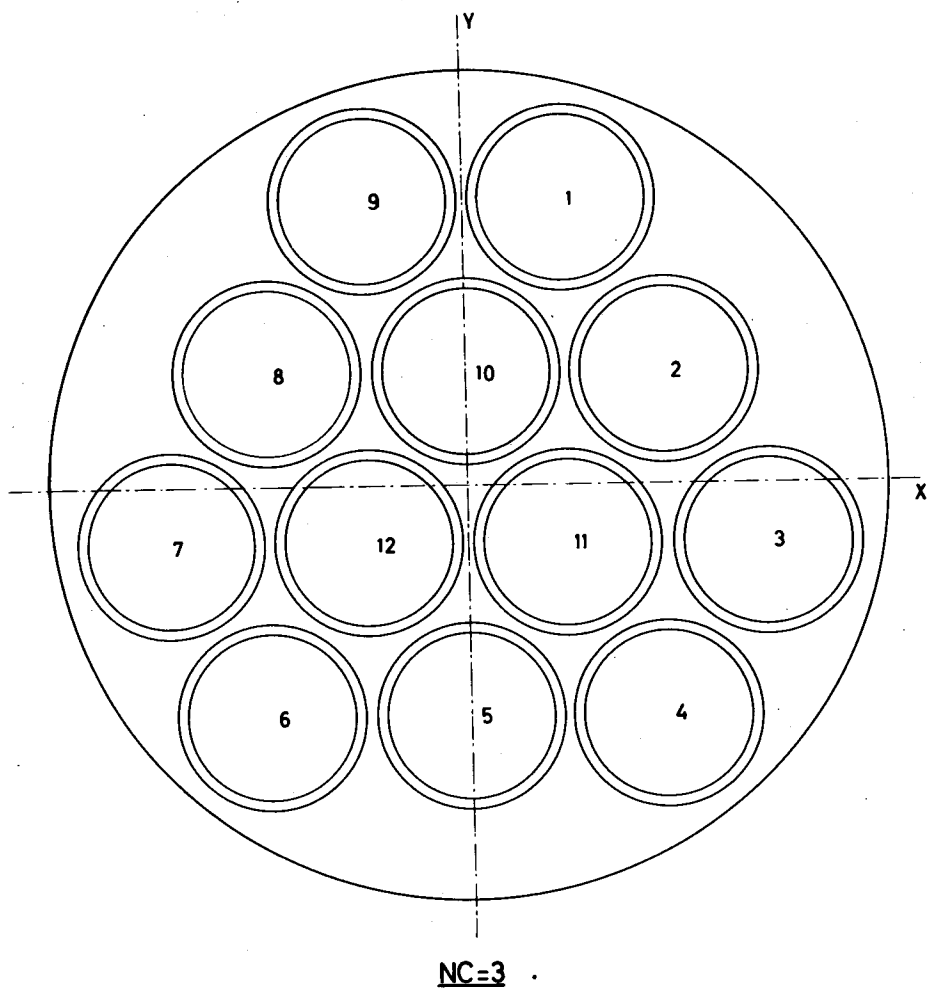


fig. 4

19 ROD CLUSTER(HEXAGONAL)

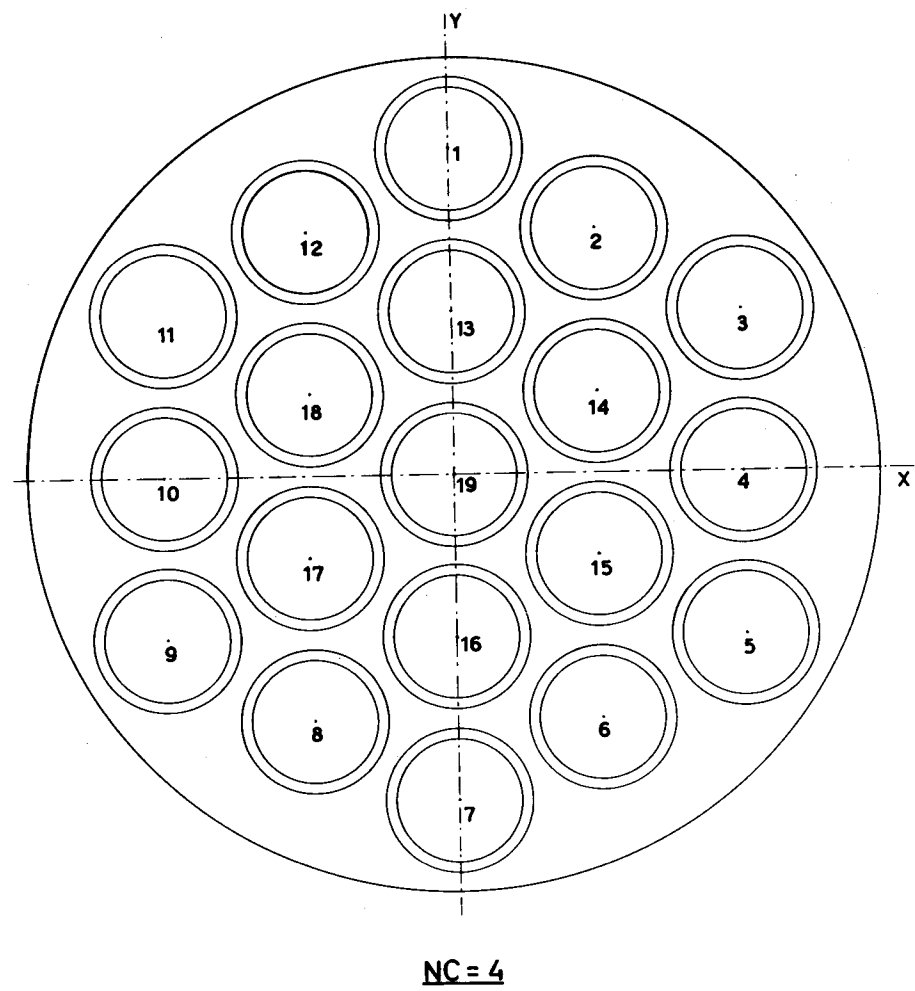




fig. 5

19 ROD CLUSTER (CIRCULAR)

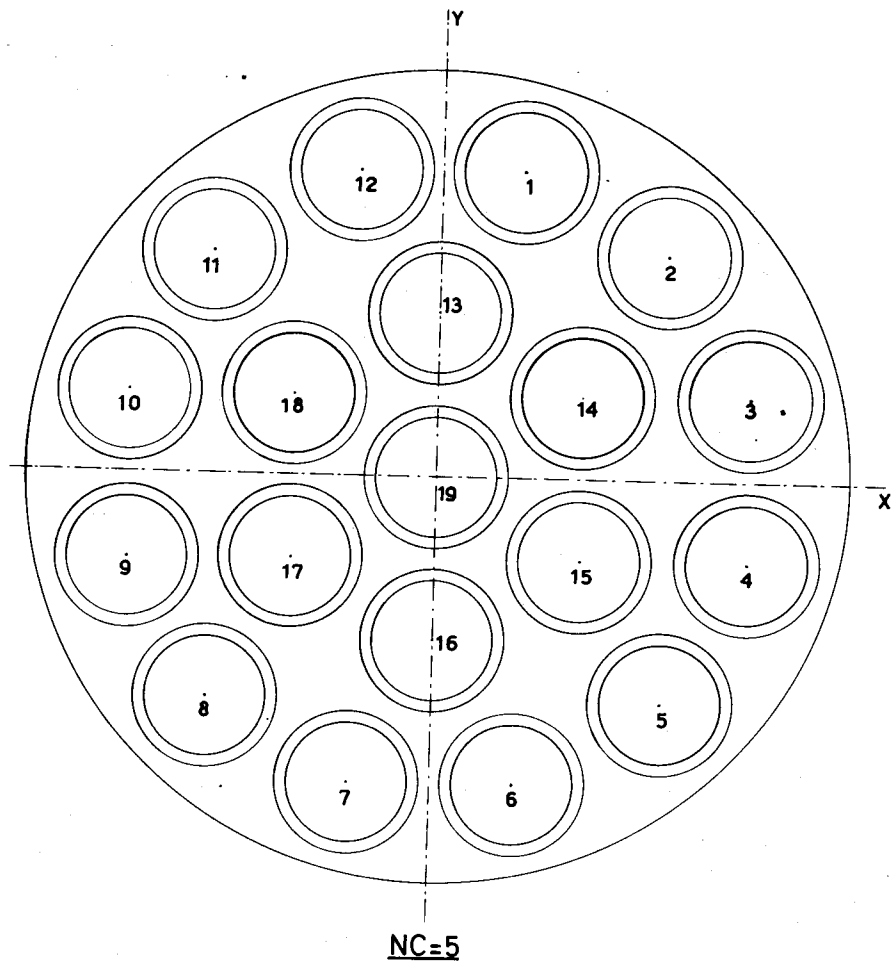


fig. 6

19 ROD CLUSTER (CIRCULAR :  $D_c \neq D_{c2}$ )

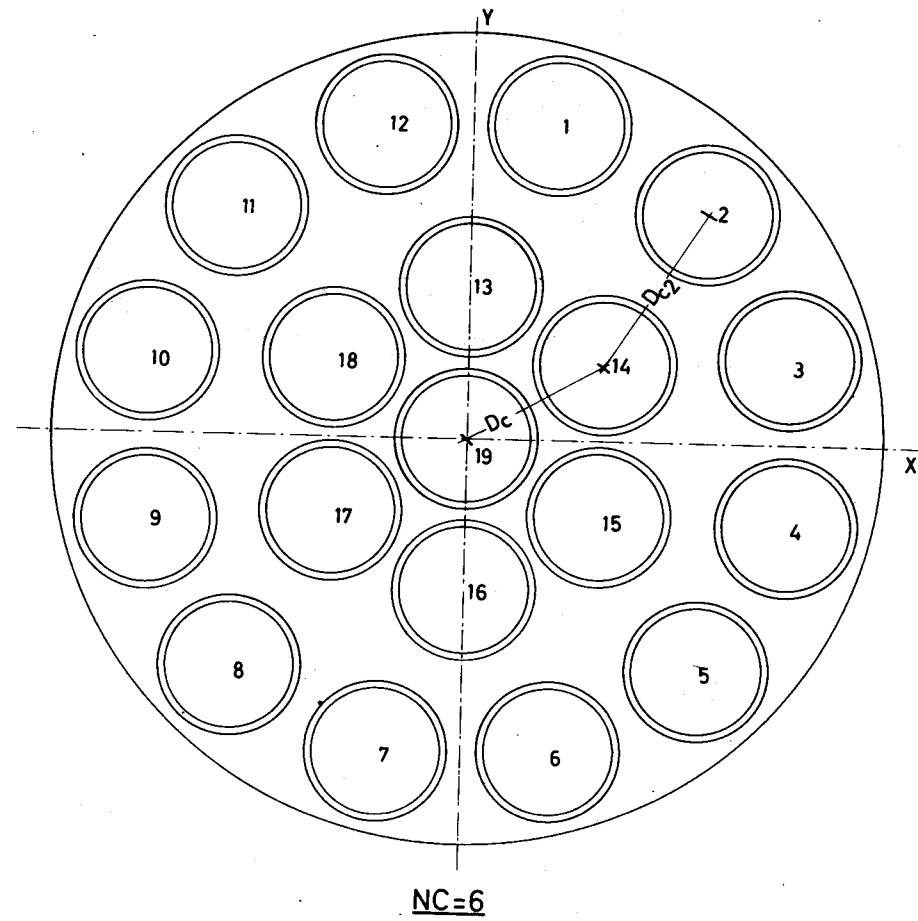


fig. 7

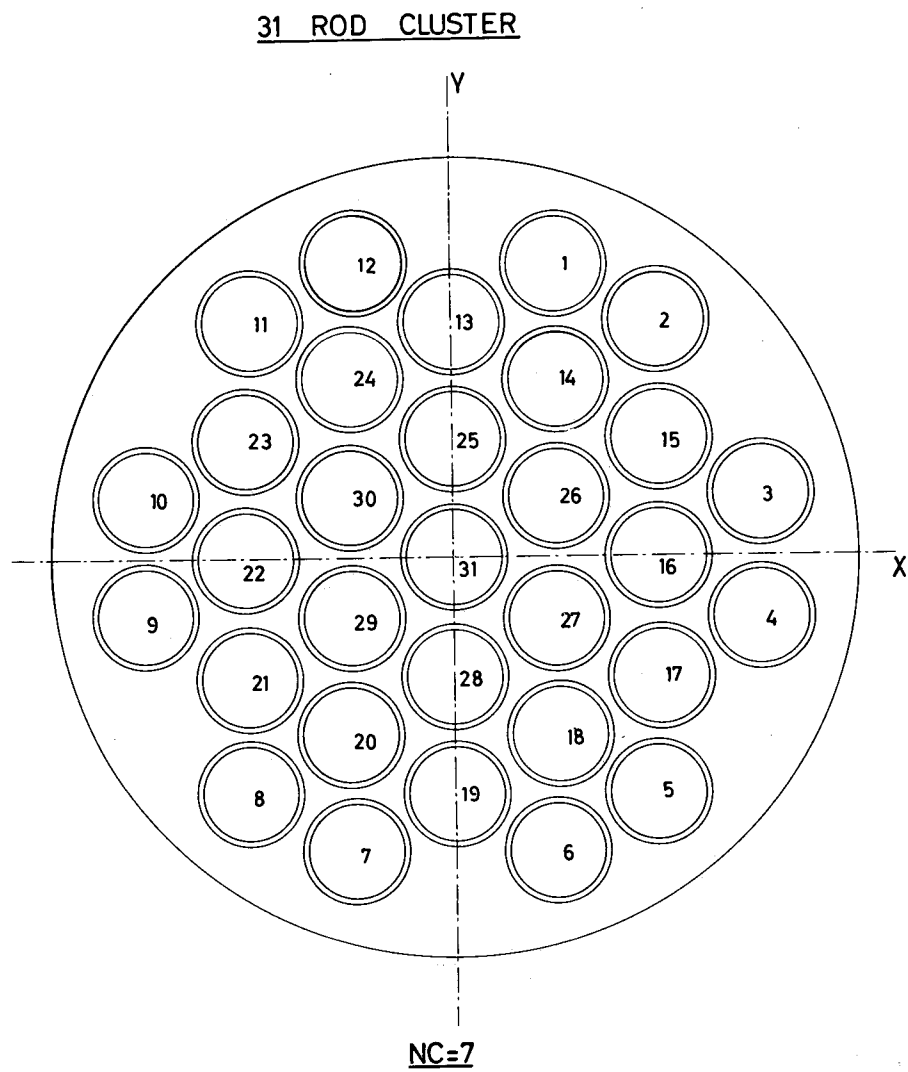


fig. 8

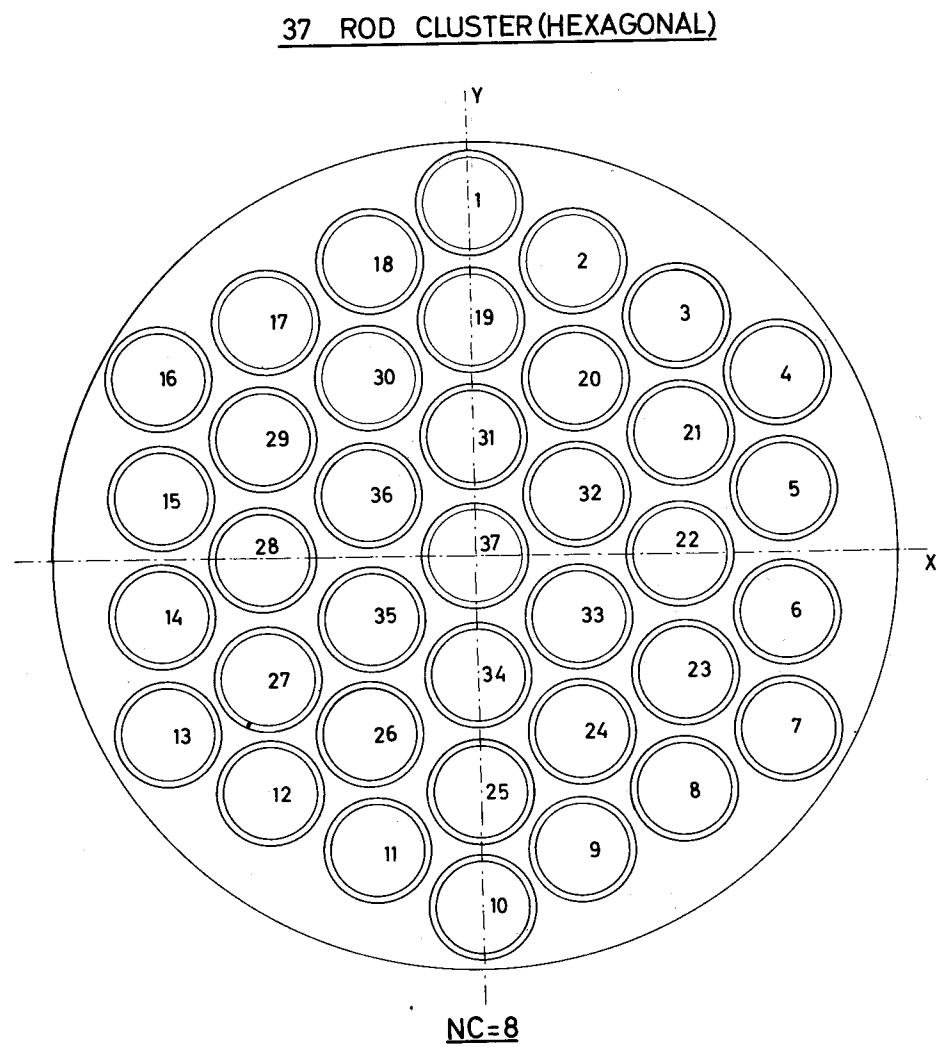


Fig. 9

37 ROD CLUSTER (CIRCULAR)

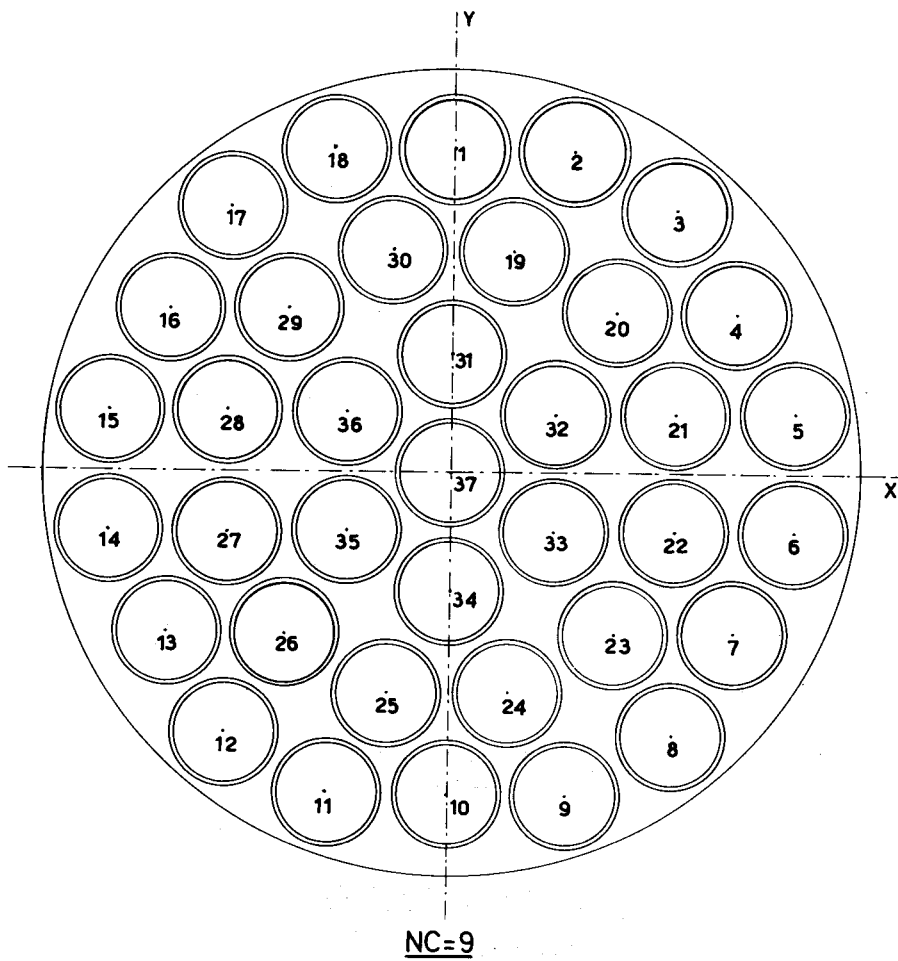


fig.10

ANY CONFIGURATION  
(IDENTICAL FUEL PENCILS)

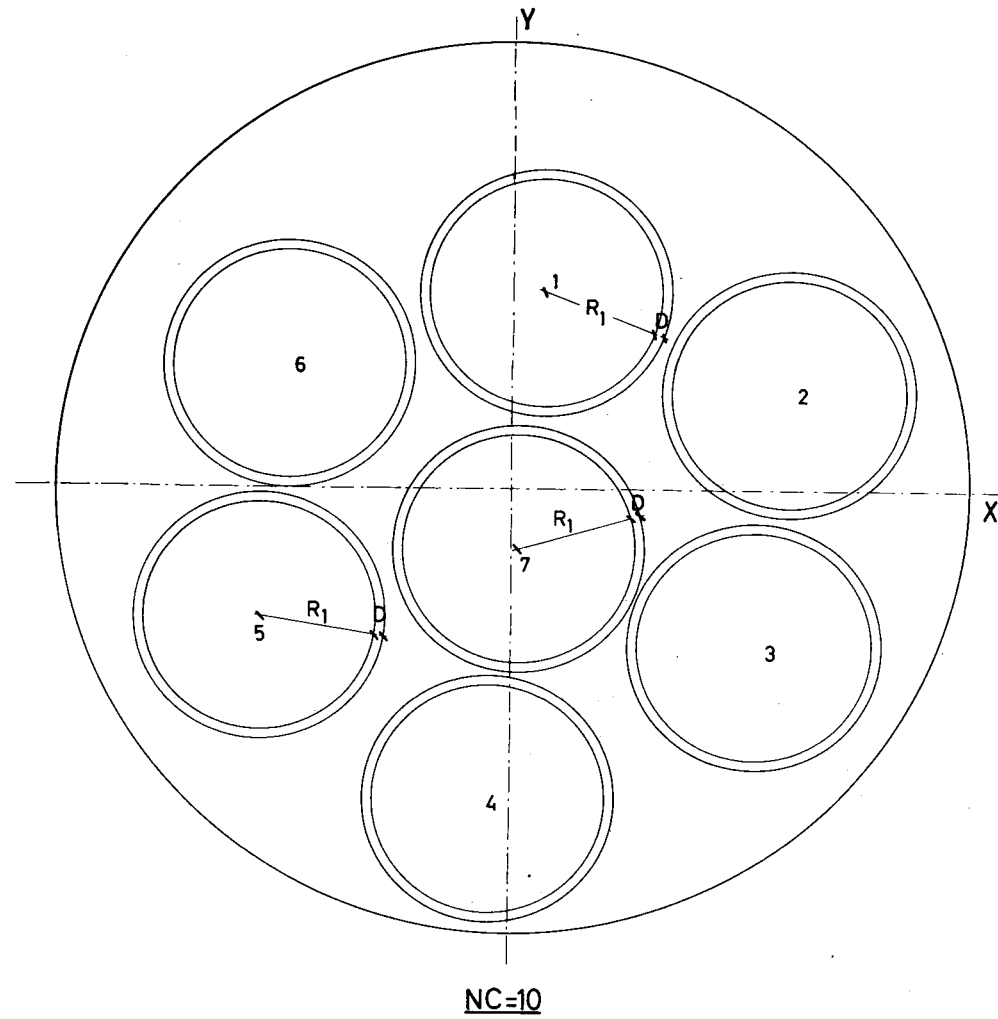
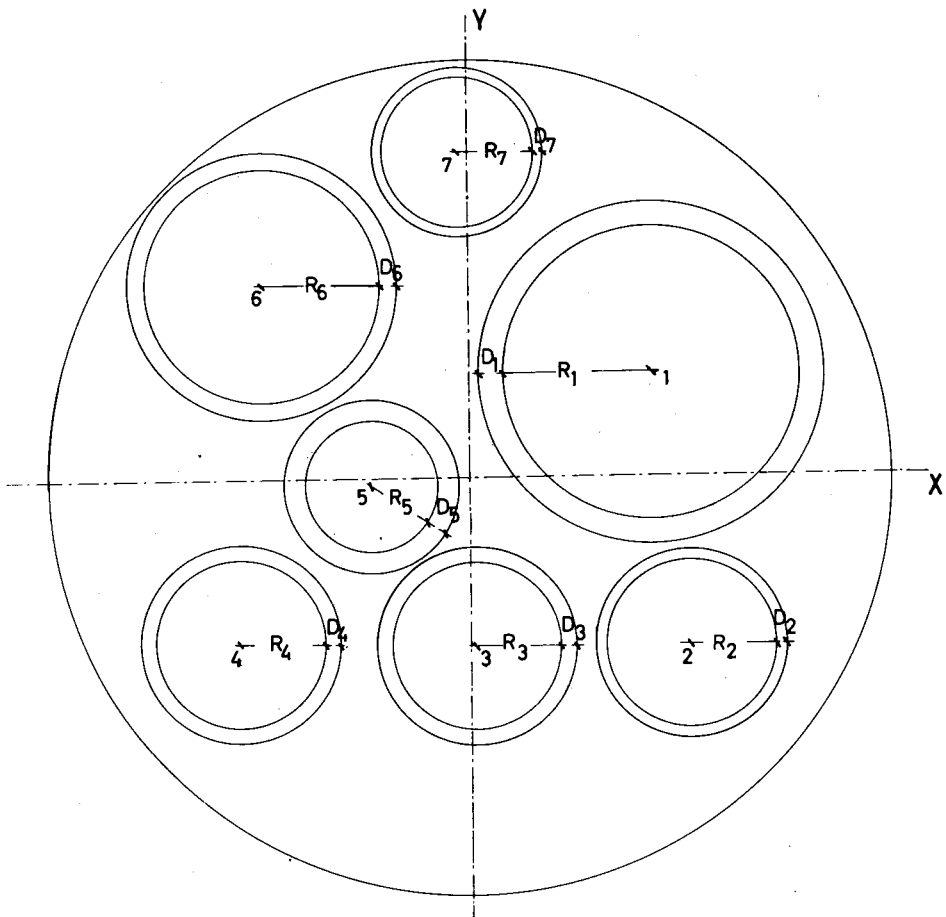


fig. 11

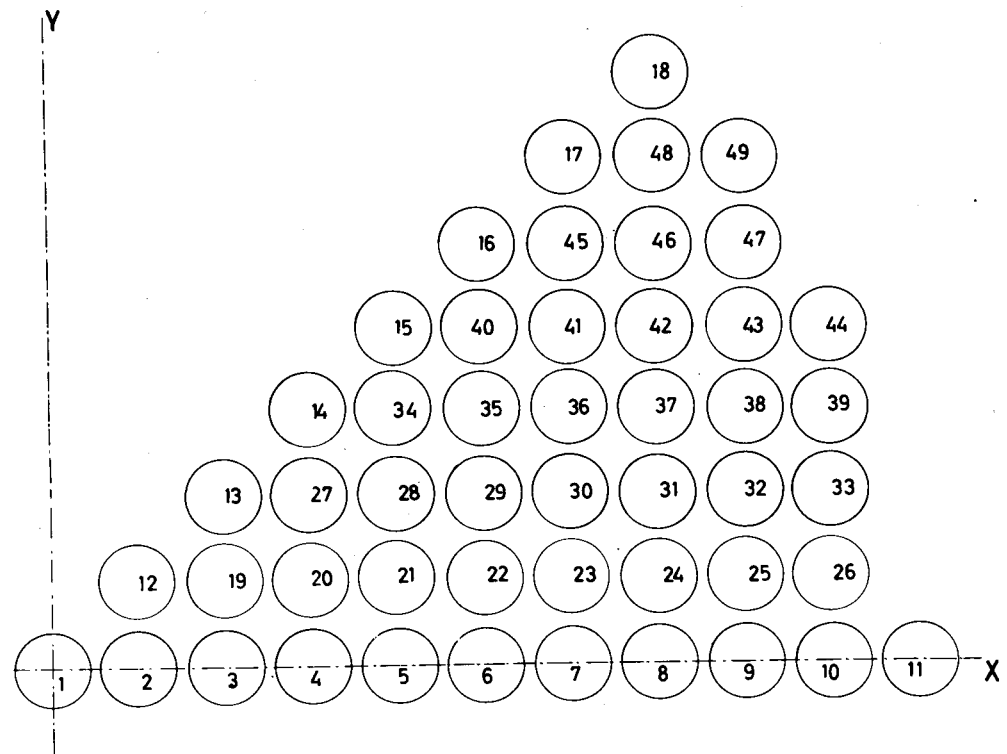
ANY CONFIGURATION  
(VARIOUS FUEL PENCILS)



NC=11

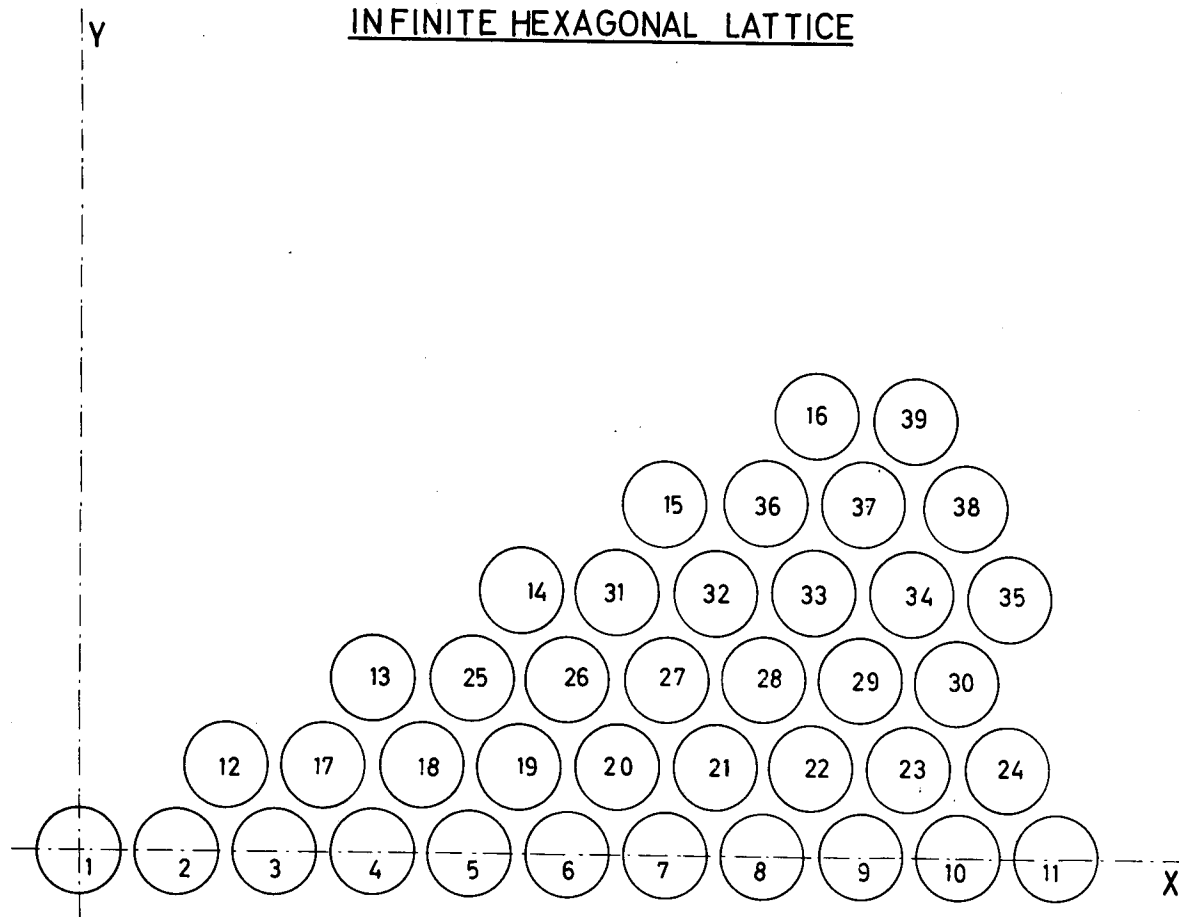
fig. 12

INFINITE SQUARE LATTICE



NC = 12

INFINITE HEXAGONAL LATTICE



NC = 13

