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MODIFICATIONS TO THE MONTE CARLO CODES USED
TO CALCULATE POWER DISTRIBUTION AND
NEUTRON LEAKAGE FROM THE
TSF-SNAP REACTOR†

K. D. Franz* and V. R. Cain

Abstract

Earlier calculations of power distribution and neutron leakage from the TSF-SNAP reactor assumed a small amount of beryllium uniformly distributed throughout the core and that the reactor control drums were fully inserted. These calculations were repeated with the distributed beryllium removed, a central cylinder of beryllium inserted and with two of the four control drums rotated out 30°. Listings are given of all the necessary changes in computer programs and their inputs.

†This work performed during 1966.

*Computing Technology Center, Union Carbide Corporation, Oak Ridge, Tennessee.

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I. INTRODUCTION

Since it was desired to reanalyze the shield source and core-mapping problems¹ with the homogenized beryllium removed from the reactor core and with one beryllium rod inserted at the center of the core, it was necessary to make changes to the geometry and O5R input to the problem, the systems data tape, and the macroscopic total cross-section tape and to redo many of the other calculations described in reference 1. The calculations described hereafter were done with the reactor control drums rotated out 30°.

II. THE MODIFIED CONFIGURATION

A cylinder of radius 1.5367 cm with center at $x = y = 0$ and containing medium 7¹ (beryllium) was placed in the z-zones containing the core in the geometry input.

The insertion of the beryllium rod into the core and the removal of the homogenized beryllium from medium 4 resulted in changing the densities of the elements in medium 4. The elements and their changed densities are given in Table I.

A new systems data tape for O5R² runs and a new macroscopic totals tape for ACTIFK³ runs were required as a result. Appendix A contains the input used to remake these tapes using the cross-section manipulation codes in the XSECT package.

Changes to the O5R input and the control subroutine NONELAS also resulted because two scatterers, beryllium elastic and beryllium (n,2n), had been removed from medium 4. The NONELAS subroutines used with the O5R power distribution calculation, the O5R shield source and core-mapping

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TABLE I. ELEMENTS AND CHANGED DENSITIES IN MEDIUM 4

Element	Atomic Density, Atoms/barn cm.
^{235}U	.0011878
^{238}U	.0000893
H	.054118
Zr	.029407
Ni	(.002708) not used as such
Na	.000543
K	.001133
Other	(.00094) not used as such
Ni+other	.00365

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problem, and the ACTIFK core-mapping analysis problem are listed in Appendix B. In addition, the changed thermal parameters for medium 4 are given below.

$$1/\Sigma_T = .25687$$

$$\Sigma_S/\Sigma_T = .89023$$

$$\nu\Sigma_F/\Sigma_T = .21081$$

III. POWER DISTRIBUTION

The first step in rerunning the shield source and core-mapping analyses with the changed reactor configuration was to recalculate the power distribution. The O5R calculation was rerun and the analysis program ANALYSIS was used to read the collision tapes and accumulate the fission weights in axial and radial bins. Program POWPOW was then run to perform axial and radial averaging designed to diminish statistical fluctuation. Slight changes were made in both ANALYSIS and POWPOW to account for the beryllium rod inserted into the core. Input data for the O5R power distribution calculation and ANALYSIS and POWPOW are given in Appendices C, D, and E, respectively, as well as listings of the changed ANALYSIS and POWPOW routines in Appendices D and E.

A cosine fitting program⁴ using the function $A \cos[B(X-C)]$ and the method of least squares was used to fit the fission distribution. The axial fit was so close to the original fit that the original was retained in later calculations. The following radial distribution was selected:

$$P(r) = .01052 \cos .107480 r; r \geq 1.5367, \\ = 0 \quad ; r < 1.5367.$$

IV. NEUTRON LEAKAGE FROM THE TSF-SNAP REACTOR

The biasing schemes discussed in reference 1 for the 05R calculations of neutron leakage from the TSF-SNAP reactor were employed in the calculations for the changed configuration. Program SORCPREP had to be rerun because of the changed radial distribution.

The preliminary 05R calculations for the shield source and the core-mapping problems had the following conditions imposed on them:

1. The drums-out configuration (30°) with one beryllium rod in the center of the core was used in all cases.
2. The neutron source was obtained from the 05R calculations of the fission distribution described in this report.
3. Biasing parameters obtained from S_n calculations (ANISN) were used.
4. The phi tape was used for elastic scattering.
5. Inelastic scattering was isotropic in the center-of-mass system and a multilevel inelastic scattering model was used where data were known.
6. The lowest energy of interest was 0.1 MeV.

One 05R calculation was made for the shield source problem. It consisted of 50 batches of 800 neutrons each and generated one collision tape. Input for this calculation is listed in Appendix F.

One 05R calculation was made for the core-mapping problem. It consisted of 60 batches of 800 neutrons each and generated four collision tapes. Input for this calculation is listed in Appendix G.

V. ANALYSIS OF O5R LEAKAGE CALCULATIONS

Using program SNARLS a source tape to be used in subsequent calculations was generated from the collision tape prepared by the O5R shield source calculation. Input is listed in Appendix H.

Before using program ACTIFK subroutine NONELAS was modified slightly to remove the homogenized beryllium from the core medium and the latest versions of subroutines INELAS and EVAP replaced those previously in ACTIFK. The flux spectra was then calculated using two of the collision tapes generated by the O5R core-mapping problem at two detector locations (two separate runs) with no collimation. The two detector locations for which calculations were carried out are

$$X = 304.8$$

$$Y = 0.0$$

$$Z = -19.557$$

and

$$X = 0.0$$

$$Y = 0.0$$

$$Z = 522.18 .$$

The inclusion of the collimator response function for a square collimator necessitated changes in the following ACTIFK user routines, STBATCH, SDATA, and RELCOL. Calculations and input necessary to the response function were added and the response function multiplied the estimator. The changed estimator is

$$wt \cdot RSPF(d, \sin \alpha) \cdot f(\mu) \cdot e^{arg/D^2} ,$$

where w_t = neutron weight after collision,

d = distance along collimator axis from the pseudo-detector to the plane perpendicular to the collimator axis and containing the collision point,

$\sin \alpha$ = the sine of the angle which can be constructed using the following lengths of the opposite and adjacent sides and their condition of perpendicularity. The side opposite is the larger of the perpendicular distances from the collision point to either the X - Y or Y - Z plane of the collimator axis. The side adjacent is defined above (d),

$f(\mu)$ = probability per steradian of scattering through the angle to the detector,

$\arg$ = negative of the number of mean free paths of material between the collision point and detector,

D = distance from the detector to the collision point.

Input instructions for STBATCH, as well as listings of STBATCH, SDATA, and RELCOL, are given in Appendix I. The function subroutine RSPF for interpolating linearly between calculated tabular values of the response function was added to the package. The tabular response function values used are given in Table II. A listing and program write-up of RSPF are given in Appendix J.

Using program ACTIFK with the inclusion of the collimator response function, the flux spectra were calculated at ten detector locations (two separate runs) using two of the 05R core-mapping collision tapes. Table III lists the ten detector locations for which the flux spectra were calculated.

TABLE II. RESPONSE FUNCTION VALUES

$\begin{array}{c} Z \\ \text{Sin } \alpha \end{array}$	75.85	91.1	106.34	121.6	136.85
0.0	1.015	1.015	1.005	0.995	0.98
0.0055	1.015	1.010	0.995	0.97	0.94
0.011	1.000	0.985	0.96	0.928	0.89
0.0165	0.975	0.945	0.915	0.87	0.825
0.0219	0.930	0.880	0.835	0.78	0.73
0.0274	0.860	0.780	0.70	0.657	0.585
0.0329	0.730	0.625	0.54	0.470	0.385
0.0384	0.530	0.420	0.35	0.291	0.22
0.0411	0.420	0.295	0.25	0.181	0.13
0.0439	0.250	0.170	0.145	0.093	0.07
0.0466	0.120	0.075	0.06	0.049	0.035
0.0493	0.015	0.0061	0.0035	0.0028	0.025
0.0548	0.076	0.0044	0.0025	0.0015	0.001
0.063	0.0052	0.0023	0.0012	0.0006	0.0003
0.0712	0.0035	0.0011	0.0003	0.0	0.0
0.079	0.001	0.0	0.0	0.0	0.0
0.083	0.0	0.0	0.0	0.0	0.0

TABLE III. CORE-MAPPING DETECTORS

Detector No.	X_D	Y_D	Z_D	U	V	W
1	0	0.0	142.2 cm	0	0.0	-1.0
2	0	44.40193	135.09	0	-.3122499	-0.95
3	0	61.983	127.98	0	-.4358899	-0.90
4	0	85.32	113.76	0	-.6	-0.8
5	0	7.0	142.2	0	0.0	-1.0
6	0	68.983	127.98	0	-.4358899	-0.9
7	0	92.32	113.76	0	-.6	-0.8
8	0	14.0	142.2	0	0.0	-1.0
9	0	75.983	127.98	0	-.4358899	-0.9
10	0	99.32	113.76	0	-.6	-0.8

X, Y, Z are coordinates of detector in reactor coordinate system.

U, V, W are direction cosines of collimator axis in reactor coordinate system.

a = 51.1 cm for all cases, where a is distance along collimator axis from the detector to the pseudo-detector.

Appendix K contains listing of the input for the ACTIFK calculations with no collimation and also with response function included.

References

1. R. S. Hubner, "Methods for Calculating Fast-Neutron Leakage From the TSF-SNAP Reactor and Preliminary Results," ORNL-TM-1666 (1967).
2. D. C. Irving, R. M. Freestone, and F. B. K. Kam, "O5R, A General-Purpose Monte Carlo Neutron Transport Code," ORNL-3622 (1965).
3. F. B. K. Kam and K. D. Franz, "ACTIFK, A General Analysis Code for O5R," ORNL-3856 (1966).
4. Lynn Stewart and Al Brooks, private communication.

APPENDIX A

APPENDIX A

1. Systems Data Tape Input

CODE 6	1	2	SNAP-TSF REACTOR (13 SCATTERERS IN CORE)				B
10	1.8+7	4.0-1					
10	64						1C
11000	1	2			.001247		ID01
11000	30				.001247		ID02
19000	1	2			.002600		ID03
19000	30				.002600		ID04
24000	1	2			.012520		ID05
24000	30				.012520		ID06
26000	1	2			.047240		ID07
26000	30				.047240		ID08
28000	1	2			.006469		ID09
28000	30				.006469		ID10
10	64						2C
11000	1	2			.003006		2D01
11000	30				.003006		2D02
19000	1	2			.006267		2D03
19000	30				.006267		2D04
24000	1	2			.003730		2D05
24000	30				.003730		2D06
26000	1	2			.007470		2D07
26000	30				.007470		2D08
28000	1	2			.022160		2D09
28000	30				.022160		2D10
10	64						3C
11000	1	2			.003750		3D01
11000	30				.003750		3D02
19000	1	2			.007818		3D03
19000	30				.007818		3D04
24000	1	2			.003964		3D05
24000	30				.003964		3D06
26000	1	2			.012167		3D07
26000	30				.012167		3D08
28000	1	2			.004786		3D09
28000	30				.004786		3D10
13	64						
1001	1	2			.054118		
11000	1	2			.000543		
11000	30				.000543		
19000	1	2			.001133		
19000	30				.001133		
28000	1	2			.00365		
28000	30				.00365		
40000	1	2			.029407		
40000	30				.029407		
40000	46				.029407		
92235	1	2	5		.0011878		
92235	3				.0011878		
92238	1	2	3	5	.0000893		

6	64	
4000	1	2
4000	46	
11000	1	2
11000	30	
19000	1	2
19000	30	
6	64	
24000	1	2
24000	30	

26000	1	2
26000	30	
28000	1	2
28000	30	
2	64	
4000	1	2
4000	46	
10	64	
11000	1	2
11000	30	
19000	1	2
19000	30	
24000	1	2
24000	30	
26000	1	2
26000	30	
28000	1	2
28000	30	
10	64	
11000	1	2
11000	30	
19000	1	2
19000	30	
24000	1	2
24000	30	
26000	1	2
26000	30	
28000	1	2
28000	30	
4	64	
11000	1	2
11000	30	
19000	1	2
19000	30	

•113480
•113480
•0002742
•0002742
•0005717
•0005717
•016740
•016740

•063159
•063159
•008651
•008651
•120140
•120140
•002967
•002967
•006186
•006186
•005163
•005163
•018267
•018267
•010930
•010930

•001712
•001712
•003570
•003570
•010270
•010270
•039610
•039610
•006740
•006740

•004945
•004945
•010310
•010310

5C
5D01
5D02
5D04
5D05
5D06
5D07
6C
6D01
6D02

6D03
6D04
6D05
6D06
7C
7D01
7D02
8C
8D01
8D02
8D03
8D04
8D05
8D06
8D07
8D08
8D09
8D10
9C
9D01
9D02
9D03
9D04
9D05
9D06
9D07
9D08
9D09
9D10

10C
10D01
10D02
10D03
10D04

10	
4000	64
11000	64
19000	64
24000	64
26000	64
28000	64
40000	64
92235	64
92238	64
4001	64

E
F01
F02
F03
F04
F05
F06
F07
F08
F09
F1J

CODE	5	10	20	SIGMA	TOTAL	CORE	INTERMEDIATE	CALCULATION							
1001	1	.054118	4000	1	0.0	0	0	3	018						
76001	1	0							19						
CODE 5	10	20							20						
INTERMEDIATE									21						
11000	1	.000543	76001	1	1.0	0	0	3	022						
76002	1	0							23						
CODE 5	10	20							24						
INTERMEDIATE									25						
19000	1	.001133	76002	1	1.0	0	0	3	026						
76003	1	0							27						
CODE 5	10	20							28						
INTERMEDIATE									29						
28000	1	.00365	76003	1	1.0	0	0	3	3						
76004	1	0							31						
CODE 5	10	20							32						
INTERMEDIATE									33						
40000	1	.02940	776004	1	1.0	0	0	3	034						
76005	1	0							35						
CODE 5	10	20							36						
INTERMEDIATE									37						
92235	1	.001187	876005	1	1.0	0	0	3	038						
76006	1	0							39						
CODE 5	10	20							40						
SIGMA TOTAL CORE									41						
92238	1	.0000893	76006	1	1.0	0	0	3	042						
77008	1	0							043						
CODE 4	10	20							44						
76001	1								45						
76002	1								46						
76003	1								47						
76004	1								48						
76005	1								49						
76006	1								50						
									51						

2. Macroscopic Totals Tape Input

CODE 7	10	15			121
SIG	TOTAL	TAPE	FOR	SNAP-TSF, 7 MEDIA	122
7	64	1.8+7		.1+6	123
77008	1	64			124
77002	1	64			125
77003	1	64			126
77004	1	64			127
77005	1	64			128
77006	1	64			129
77007	1	64			130

APPENDIX B

APPENDIX B

1. Subroutine NONELAS Used in Power Distribution 05R

```

SUBROUTINE NONELAS
COMMON/MED ELEM/ALPHA(16,16),BETA(16,16),LFI(16,16)
COMMON/SINGLES/BLZON,EBOT,ECUT,EGROUP,EINC,EMONO,ESOUR,
1 ETAPE,ETA,ETATH,ETAUSD,ETOP,FONE,FTOTL,FWATE,ITERS,ITSTR,
2 LELEM,LF,MARK,MAXGP,MEDIA,MGPREG,MFISTP,MXREG,N,NCOLPR,
3 NWPCOL,NCONT1,NCONT2,NCONTP,NEWM,NFISH,NFONE,NFPT,NGEOM,
4 NGROUP,NGWT,NHISM,NHISTR,NINC,NFINC,NPINC,NITS,NKILL,
5 NLAST,NGLAST,NSIGL,NPLAST,NLEFT,NMEM,NMOST,NOEL,NPCOF,
6 NPTAPE,NQUIT,NROOM,NSOUR,NSPLT,NSTAPE,NSTRT,NTHERM,NTHRML,
7 NTYPE,OLDWT,PSIE,SPOLD,THETM,TNUC,UINP,UOLD,VINP,VOLD,
8 WATEF,WINP,WOLD,WTAVR,WITHR,WTOR,WTRED,WTSTRT,XOLD,XSTRT,
9 YOLD,YSTRT,ZOLD,ZSTRT,UNUSED(10)
COMMON/NEUTRON/NAME,NAMEX,SB2,UO,VO,WO,X,Y,Z,WTO,MED,NREG,BLZNT
C ISO#1, ISOTROPIC DISTRIBUTION
ISO#1
GO TO (1,1,1,2,3,4,5,1,1,6) MED
1 GO TO (10,20,10,20,10,20,10,20,10,20) LELEM
2 GO TO (10,10,20,10,20,10,20,10,20,20,10,20,10) LELEM
3 GO TO (10,81,10,20,10,20) LELEM
4 GO TO (10,20,10,20,10,20) LELEM
5 GO TO (10,81) LELEM
6 GO TO (10,20,10,20) LELEM
10 WRITE(51,1000) MED,LELEM
1000 FORMAT(1H1,5HNMED#,15,3X,6HLELEM#,15)
CALL ERROR
81 CALL BEN2N(UO,VO,WO,SB2,WTO)
RETURN
20 ALP#ALPHA(LELEM,MED)
BET#-BETA(LELEM,MED)
XMASS#1./ALP-1.
EHO#0.0
EHI#0.0
SB2P#SB2*BET
IF(SB2-EHI) 55,50,50
55 CALL ERROR
50 CALL EVAP(SB2P,VA2P,XMASS,EHO)
Q#SB2P-VA2P
IF(SB2-Q/BET) 50,92,92
92 TEM1#SB2-Q/BET
SP#SQRTF(TEM1)*BET
CALL GTISO(EX,EY,EZ)
UO#ALP*UO+SP*EX
VO#ALP*VO+SP*EY
WO#ALP*WO+SP*EZ
SB2#UO*UO+VO*VO+WO*WO
RETURN
END

```

2. Subroutine NONELAS Used in 05R For the Shield
Source and Core Mapping Problems

SUBROUTINE NONELAS		10
COMMON/SINGLES/BLZON,EBOT,ECUT,EGROUP,EINC,EMONO,ESOUR,		
1ETAPE,ETA,ETATH,ETAUSD,ETOP,FONE,FTOTL,FWATE,ITERS,ITSTR,		
2LELEM,LF,MARK,MAXGP,MEDIA,MGPREG,MFISTP,MXREG,N,NCOLPR,		
3NWPCOL,NCONT1,NCONT2,NCONTP,NEWNM,NFISH,NFONE,NFPT,NGEOM,		
4NGROUP,NGWT,NHISMN,NHISTR,NINC,NFINC,NPINC,NITS,NKILL,		
5NLAST,NGLAST,NSIGL,NPLAST,NLEFT,NMEM,NMOST,NOEL,NPCOF,		
6NPFAPE,NQUIT,NROOM,NSOUR,NSPLT,NSTAPE,NSTRT,NTHERM,NTHRML,		
7NTYPE,OLDWT,PSIE,SPOLD,THETM,TNUC,UINP,UOLD,VINP,VOLD,		
8WATEF,WINP,WOLD,WTAVR,WITHR,WTLCR,WTRED,WTSTRT,XOLD,XSTRT,		
9YOLD,YSTRT,ZOLD,ZSTRT,UNUSED(10)		
	COMMON/NANNP/NNAEPT,NNAQ,SM2NA(38),QNA(5),PROBNA(38,5)	20
	COMMON/KNNP/NKEPT,NKQ,SM2K(30),QK(4),PROBK(30,4)	30
	COMMON/U235NNP/NU235EPT,NU235Q,SM2U235(1),QU235(1),PROBU235(1,1)	40
	COMMON/FENNP/NFEPT,NFEQ,SM2FE(35),QFE(6),PROEFE(35,6)	50
	COMMON/CRNNP/NCREPT,NCRQ,SM2CR(10),QCR(2),PROBCR(10,2)	60
	COMMON/NINNP/NNIEPT,NNIQ,SM2NI(9),QNI(2),PROBNI(9,2)	70
	COMMON/ZRNNP/NZREPT,NZRQ,SM2ZR(4),QZR(1),PROBZR(4,1)	80
	COMMON/NEUTRON/NAME,NAMEX,SPDSQ,U,V,W,X,Y,Z,WATE,NMED,NREG,BLZNT	200
C	ISO#0, LEGENDRE DIST	300
C	ISO#1, ISOTROPIC DIST	310
	ISO#1	320
	GO TO (1,1,1,2,3,4,5,1,1,6) NMED	330
1	GO TO (10,20,10,30,10,60,10,50,10,70) LELEM	340
2	GO TO (10,10,20,10,30,10,70,10,90,91,10,40,10) LELEM	350
3	GO TO (10,81,10,20,10,30) LELEM	360
4	GO TO (10,60,10,50,10,70) LELEM	370
5	GO TO (10,81) LELEM	380
6	GO TO (10,20,10,30) LELEM	390
10	WRITE(51,1000) NMED,LELEM	400
1000	FORMAT(1H1,5HNMED#,15,2X,6HLELEM#,15)	410
	CALL EXIT	420

20	CALL INELAS(NNAEPT,NNAQ,SM2NA,QNA,PROBNA,SPDSQ,U,V,W,WATE,NMED,LEL	430
	LEM,ISO)	440
100	RETURN	450
30	CALL INELAS(NKEPT,NKQ,SM2K,QK,PROBK,SPDSQ,U,V,W,WATE,NMED,LELEM,IS	460
	IO)	470
	GO TO 100	480
40	CALL INELAS(NU235EPT,NU235Q,SM2U235,QU235,PROBU235,SPDSQ,U,V,W,WAT	490
	IE,NMED,LELEM,ISO)	500
	GO TO 100	510
50	CALL INELAS(NFEEPT,NFEQ,SM2FE,QFE,PROBFE,SPDSQ,U,V,W,WATE,NMED,LEL	520
	LEM,ISO)	530
	GO TO 100	540
60	CALL INELAS(NCREPT,NCRO,SM2CR,QCR,PROBCR,SPDSQ,U,V,W,WATE,NMED,LEL	550
	LEM,ISO)	560
	GO TO 100	570
70	CALL INELAS(NNIEPT,NNIQ,SM2NI,QNI,PROBNI,SPDSQ,U,V,W,WATE,NMED,LEL	580
	LEM,ISO)	590
	GO TO 100	600
90	CALL INELAS(NZREPT,NZRQ,SM2ZR,QZR,PROBZR,SPDSQ,U,V,W,WATE,NMED,LEL	640
	LEM,ISO)	650
	GO TO 100	660
81	CALL PEN2N(U,V,W,SPDSQ,WATE)	670
	GO TO 100	680
91	CALL ZRN2N(U,V,W,SPDSQ,WATE)	690
	GO TO 100	700
	END	710

3. Subroutine NONELAS Used in ACTIFK Core Mapping Calculations

```

SUBROUTINE NONELAS(COSLB,VA2,FMU)
COMMON/CPLIST/NCOLL(8),NAME(8),SI2(8),X(8),Y(8),Z(8),WATE(8),SPOLD
1(8),UOLD(8),VOLD(8),WOLD(8),OLDWT(8),NGRP(8),NELEM(8),NMED(8),      7   030
2DUM(8)                                                                7   040
COMMON/ASINGLES/NSTRT,NITS,NBIN,NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP
1E,NFTAPE1,NFTAPE2,NFTAPEP,MEDIA,NHISTR,NHISMX,NWPCOL,NSGP,NCOLPR,N
2ANISOEL,NDSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,1B,NCPSB2,NCPNGP,
3NCPELEM,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTABLE,NGEOM,NM,MGZ,NO
4NEUT,NYSUM,NZR,IVAR
COMMON/NANNP/NNAEPT,NNAQ,SM2NA(38),QNA(5),PROBNA(38,5)                20
COMMON/KNNP/NKEPT,NKQ,SM2K(30),QK(4),PROBK(30,4)                     30
COMMON/U235NNP/NU235EPT,NU235Q,SM2U235(1),QU235(1),PROBU235(1,1)    40
COMMON/FENNP/NFEEPT,NFEQ,SM2FE(35),QFE(6),PROBFE(35,6)               50
COMMON/CRNNP/NCREPT,NCRQ,SM2CR(10),QCR(2),PROBCR(10,2)                60
COMMON/NINNP/NNIEPT,NNIQ,SM2NI(9),QNI(2),PROBNI(9,2)                  70
COMMON/ZRNNP/NZREPT,NZRQ,SM2ZR( 4),QZR(1),PROBZR( 4,1)                90
LELEM#NELEM(KTH)                                                        7   110
MED#NMED(KTH)                                                            7   120
GO TO (2,3,4,5,1,1,6),MED                                             7   130
1 GO TO (10,20,10,30,10,60,10,50,10,70) LELEM                        340
2 GO TO (10,          10,20,10,30,10,70,10,90,91,10,40,10) LELEM      350
3 GO TO (10,81,      10,20,10,30) LELEM                                360
4 GO TO (10,60,10,50,10,70) LELEM                                      370
5 GO TO (10,81      ) LELEM                                            380
6 GO TO (10,20,10,30) LELEM                                            390
10 WRITE(51,1000) NMED,LELEM                                           400
1000 FORMAT(1H1,5HNMED#,15,3X,6HLELEM#,15)                             410
CALL EXIT                                                                420
20 CALL INELAS(NNAEPT,NNAQ,SM2NA,QNA,PROBNA,COSLB,VA2,FMU)            7   140
100 RETURN                                                              450

```

30	CALL INELAS(NKEPT,NKQ,SM2K,QK,PROBK,COSLB,VA2,FMU)	7	160
	GO TO 100		480
40	CALL INELAS(NU235EPT,NU235Q,SM2U235,QU235,PROBU235,COSLB,VA2,FMU)	7	180
	GO TO 100		510
50	CALL INELAS(NFEEPT,NFEQ,SM2FE,QFE,PROBFE,COSLB,VA2,FMU)	7	200
	GO TO 100		540
60	CALL INELAS(NCREPT,NCRQ,SM2CR,QCR,PROBCR,COSLB,VA2,FMU)	7	220
	GO TO 100		570
70	CALL INELAS(NNIEPT,NNIQ,SM2NI,QNI,PROBNI,COSLB,VA2,FMU)	7	240
	GO TO 100		600
90	CALL INELAS(NZREPT,NZRQ,SM2ZR,QZR,PROBZR,COSLB,VA2,FMU)	7	260
	GO TO 100		660
81	VAI#SPOLD(KTH)	7	
	CALL BEN2N(COSLB,VA2,FMU,VAI)	7	
	GO TO 100		680
91	GO TO 90	7	300
	END		710

APPENDIX C

APPENDIX C

1. 05R Input For 05R Power Distribution Calculation

SNAP-TSF REACTOR POWER DISTRIBUTION										A			
800	1000	14	1	4.0-1	1					B			
10	1	2											
2	0	3	0	4	0	5	0	6	0	1D			
22.99	-22.99			39.1	-39.1			52.0	-52.0	55.85	1E01		
55.85	58.71			-58.71							1E02		
1.3025	.85613			0.0							1F		
2	0	3	0	4	0	5	0	6	0		2D		
22.99	-22.99			39.1	-39.1			52.0	-52.0	55.85	2E01		
55.85	58.71			-58.71							2E02		
1.8396	.85789			0.0							2F		
2	0	3	0	4	0	5	0	6	0		3D		
22.99	-22.99			39.1	-39.1			52.0	-52.0	55.85	3E01		
55.85	58.71			-58.71							3E02		
3.2821	.80416			0.0							3F		
0	2	0	3	0	6	0	7	0	0	8	0	9	4D01
1.00814	22.99	-22.99		39.1	-39.1			58.71	-58.71				4E01
91.22	-91.22	-91.22		235.0	-235.0			235.0					4E02
.25687	.89023	.21081											4F
1	0	2	0	3	0								5D
9.012	-9.012			22.99	-22.99			39.1	-39.1				5E
1.4834	.998057			0.0									5F
4	0	5	0	6	0								6D
52.0	-52.0			55.85	-55.85			58.71	-58.71				6E
.99001	.85730			0.0									6F
1	0												7D
9.012	-9.012												7E
1.40713	.999098			0.0									7F
2	0	3	0	4	0	5	0	6	0				8D
22.99	-22.99			39.1	-39.1			52.0	-52.0	55.85			8E01
55.85	58.71			-58.71									8E02
2.0463	.85440			0.0									8F

9D
9E01
9E02
9F
10D
10E
10F
G
H
I I
K
M01
M02
N
O
P

2. Geometry Input for 05R Power Distribution Calculation

2	MALE		10
X ZONE	-16.3525,	16.3525	20
Y ZONE	-23.5055,	23.5055	30
Z ZONE	-39.7455,	-36.9794,	40
	4.0,	-2.5146,	50
		1.4710	60
ZONE	1	1	70
X BLOCK	-16.3525,	16.3525	80
Y BLOCK	-23.5055,	23.5055	90
Z BLOCK	-39.7455,	-36.9794	100
BLOCK	1	1	110
MEDIA		1, 1000	120
SURFACES		1	130
SECTOR -1			140
SECTOR 1			150
ZONE	1	2	160
X BLOCK	-16.3525,	-9.73370,	170
		0.0,	180
Y BLOCK	-23.5055,	23.5055	190
Z BLOCK	-36.9794,	-35.1150	200
BLOCK	1	1	210
MEDIA		3, 6, 1000	220
SURFACES		6, 7	230
SECTOR -1	0		240
SECTOR 1	-1		250
SECTOR 0	1		260
BLOCK	2	1	270
MEDIA		2, 3, 3, 6, 1000	280
SURFACES		3, 4, 6, 7	290
SECTOR 1	1	0	300
SECTOR 0	-1	-1	310
SECTOR -1	0	-1	320
SECTOR 0	0	1	
SECTOR 0	0	0	

BLOCK 3 1 1
 MEDIA 2, 3, 3, 6, 1000
 SURFACES 2, 5, 6, 7
 SECTOR -1 -1 0 0
 SECTOR 0 1 -1 0
 SECTOR 1 0 -1 0
 SECTOR 0 0 1 -1
 SECTOR 0 0 0 1

BLOCK 4 1 1
 MEDIA 3, 6, 1000
 SURFACES 6, 7
 SECTOR -1 0
 SECTOR 1 -1
 SECTOR 0 1

ZONE 1 1 3
 X BLOCK -16.3525, -9.7337, -6.6599, 0.0, 6.6599,
 9.7337, 16.3525
 Y BLOCK -23.5055, -16.8656, 16.8656, 23.5055
 Z BLOCK -35.1150, -32.5750

BLOCK 1 2 1
 MEDIA 5, 6, 1000, 7, 1000, 1000
 SURFACES 6, 7, 18, 9, 12
 SECTOR -1 0 0 0 0
 SECTOR 1 -1 0 0 0
 SECTOR 0 1 0 0 -1
 SECTOR 0 0 1 1 1
 SECTOR 0 0 -1 0 0
 SECTOR 0 0 0 -1 0
 BLOCK 2 2 1

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 570
 580
 590
 600
 610

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MEDIA			4,	5,	5,	6, 1000,	7, 1000, 1000	620
SURFACES			3,	4,	6,	7, 18,	9, 12	630
SECTOR	1	1	0	0	0	0	0	640
SECTOR	0	-1	-1	0	0	0	0	650
SECTOR	-1	0	-1	0	0	0	0	660
SECTOR	0	0	1	-1	0	0	0	670
SECTOR	0	0	0	1	0	0	-1	680
SECTOR	0	0	0	0	1	1	1	690
SECTOR	0	0	0	0	-1	0	0	700
SECTOR	0	0	0	0	0	-1	0	710
BLOCK	3	2		1				720
MEDIA			4,	5,	5,	6, 1000,	7, 7	
SURFACES			3,	4,	6,	7, 12,	20	
SECTOR	1	1	0	0	0	1		
SECTOR	0	-1	-1	0	0	0		
SECTOR	-1	0	-1	0	0	0		
SECTOR	0	0	1	-1	0	0		
SECTOR	0	0	0	1	-1	0		
SECTOR	0	0	0	0	1	0		
SECTOR	0	0	0	0	0	-1		
BLOCK	4	2		1				
MEDIA			4,	5,	5,	6, 1000,	7, 7	
SURFACES			2,	5,	6,	7, 12,	20	
SECTOR	-1	-1	0	0	0	1		
SECTOR	0	1	-1	0	0	0		
SECTOR	1	0	-1	0	0	0		
SECTOR	0	0	1	-1	0	0		
SECTOR	0	0	0	1	-1	0		
SECTOR	0	0	0	0	1	0		
SECTOR	0	0	0	0	0	-1		

BLOCK	5	2	1							900
MEDIA		4,	5,	5,	6, 1000,	7, 1000, 1000				910
SURFACES		2,	5,	6,	7, 19,	11, 12				920
SECTOR	-1	-1	0	0	0	0	0			930
SECTOR	0	1	-1	0	0	0	0			940
SECTOR	1	0	-1	0	0	0	0			950
SECTOR	0	0	1	-1	0	0	0			960
SECTOR	0	0	0	1	0	0	-1			970
SECTOR	0	0	0	0	-1	-1	1			980
SECTOR	0	0	0	0	1	0	0			990
SECTOR	0	0	0	0	0	1	0			1000
BLOCK	6	2	1							1010
MEDIA		5,	6, 1000,	7, 1000, 1000						1020
SURFACES		6,	7, 19,	11, 12						1030
SECTOR	-1	0	0	0	0					1040
SECTOR	1	-1	0	0	0					1050
SECTOR	0	1	0	0	-1					1060
SECTOR	0	0	-1	-1	1					1070
SECTOR	0	0	1	0	0					1080
SECTOR	0	0	0	1	0					1090
BLOCK	1	1	1							1100
MEDIA		1000								1110
BLOCK	2	1	1							1120
MEDIA		1000								1130
BLOCK	3	1	1							1140
MEDIA		1000								1150
BLOCK	4	1	1							1160
MEDIA		1000								1170
BLOCK	5	1	1							1180
MEDIA		1000								1190
BLOCK	6	1	1							1200

MEDIA		1000								1210
BLOCK	1	3	1							1220
MEDIA		1000								1230
BLOCK	2	3	1							1240
MEDIA		1000								1250
BLOCK	3	3	1							1260
MEDIA		1000								1270
BLOCK	4	3	1							1280
MEDIA		1000								1290
BLOCK	5	3	1							1300
MEDIA		1000								1310
BLOCK	6	3	1							1320
MEDIA		1000								1330
ZONE	1	1	4							1340
X BLOCK		-16.3525,	-9.7337,	-6.6599,	0.0,	6.6599,			0000	1350
		9.7337,	16.3525							1360
Y BLOCK		-23.5055,	-16.8656,	16.8656,	23.5055				0000	1370
Z BLOCK		-32.5750,	-6.54							1380
BLOCK	1	1	1							1390
MEDIA		7,	1000							1400
SURFACES		8								1410
SECTOR	1									1420
SECTOR -1										1430
BLOCK	6	3	1							1440
MEDIA		7,	1000							1450
SURFACES		10								1460
SECTOR -1										1470
SECTOR	1									1480
BLOCK	2	1	1							1490

MEDIA		7, 1000, 1000
SURFACES		8, 17
SECTOR	-1	
SECTOR	-1	0
SECTOR	1	1
BLOCK	5	3 1
MEDIA		7, 1000, 1000
SURFACES		10, 16
SECTOR	-1	-1
SECTOR	1	0
SECTOR	-1	1
BLOCK	3	1 1
MEDIA		7, 1000
SURFACES		17
SECTOR	-1	
SECTOR	1	
BLOCK	4	3 1
MEDIA		7, 1000
SURFACES		16
SECTOR	-1	
SECTOR	1	
BLOCK	4	1 1
MEDIA		1000
BLOCK	5	1 1
MEDIA		1000
BLOCK	6	1 1
MEDIA		1000
BLOCK	1	3 1
MEDIA		1000
BLOCK	2	3 1
MEDIA		1000
BLOCK	3	3 1

1500
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 1800
 1810

MEDIA			1000							
BLOCK	1		2	1						
MEDIA			5,	6,	1000,	7,	7,	1000,	1000	
SURFACES			6,	7,	8,	9,	12,	17		
SECTOR	-1	0	0	0	0	0				
SECTOR	1	-1	0	0	0	0				
SECTOR	0	1	0	0	-1	0				
SECTOR	0	0	0	1	1	1				
SECTOR	0	0	1	0	0	-1				
SECTOR	0	0	-1	0	0	-1				
SECTOR	0	0	0	-1	0	0				
BLOCK	6		2	1						
MEDIA			5,	6,	1000,	7,	7,	1000,	1000	
SURFACES			6,	7,	10,	11,	12,	16		
SECTOR	-1	0	0	0	0	0				
SECTOR	1	-1	0	0	0	0				
SECTOR	0	1	0	0	-1	0				
SECTOR	0	0	0	-1	1	1				
SECTOR	0	0	-1	0	0	-1				
SECTOR	0	0	1	0	0	-1				
SECTOR	0	0	0	1	0	0				
BLOCK	2		2	1						
MEDIA			4,	5,	5,	6,	1000,	7,	1000	
SURFACES			3,	4,	6,	7,	9,	12		
SECTOR	1	1	0	0	0	0				
SECTOR	0	-1	-1	0	0	0				
SECTOR	-1	0	-1	0	0	0				
SECTOR	0	0	1	-1	0	0				

1820
 1830
 1840
 1850
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 2060
 2070
 2080
 2090

SECTOR 0 0 0 1 0 -1
 SECTOR 0 0 0 0 1 1
 SECTOR 0 0 0 0 -1 0
 BLOCK 5 2 1

MEDIA 4, 5, 5, 6, 1000, 7, 1000
 SURFACES 2, 5, 6, 7, 11, 12

SECTOR -1 -1 0 0 0 0
 SECTOR 0 1 -1 0 0 0
 SECTOR 1 0 -1 0 0 0
 SECTOR 0 0 1 -1 0 0
 SECTOR 0 0 0 1 0 -1
 SECTOR 0 0 0 0 -1 1
 SECTOR 0 0 0 0 1 0

BLOCK 3 2 1

MEDIA 4, 5, 5, 6, 1000, 7, 7
 SURFACES 3, 4, 6, 7, 12, 20

SECTOR 1 1 0 0 0 1
 SECTOR 0 -1 -1 0 0 0
 SECTOR -1 0 -1 0 0 0
 SECTOR 0 0 1 -1 0 0
 SECTOR 0 0 0 1 -1 0
 SECTOR 0 0 0 0 1 0
 SECTOR 0 0 0 0 0 -1

BLOCK 4 2 1

MEDIA 4, 5, 5, 6, 1000, 7, 7
 SURFACES 2, 5, 6, 7, 12, 20

SECTOR -1 -1 0 0 0 1
 SECTOR 0 1 -1 0 0 0
 SECTOR 1 0 -1 0 0 0
 SECTOR 0 0 1 -1 0 0
 SECTOR 0 0 0 1 -1 0
 SECTOR 0 0 0 0 1 0
 SECTOR 0 0 0 0 0 -1

2100
 2110
 2120
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 2140
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 2170
 2180
 2190
 2200
 2210
 2220
 2230

2320

ZONE	1	1	5							2410
X BLOCK		-16.3525,	-9.7337,	-6.6599,	0.0,	6.6599,				00002420
	9.7337,	16.3525								2430
Y BLOCK		-23.5055,	-16.8656,	16.8656,	23.5055					00002440
Z BLOCK		-6.54,	-4.0							2450
BLOCK	1	2	1							2460
MEDIA		5,	6,	1000,	7,	1000,	1000			2470
SURFACES		6,	7,	18,	9,	12				2480
SECTOR	-1	0	0	0	0					2490
SECTOR	1	-1	0	0	0					2500
SECTOR	0	1	0	0	-1					2510
SECTOR	0	0	1	1	1					2520
SECTOR	0	0	-1	0	0					2530
SECTOR	0	0	0	-1	0					2540
BLOCK	2	2	1							2550
MEDIA		4,	5,	5,	6,	1000,	7,	1000,	1000	0 2560
SURFACES		3,	4,	6,	7,	18,	9,	12		0 2570
SECTOR	1	1	0	0	0	0	0			2580
SECTOR	0	-1	-1	0	0	0	0			2590
SECTOR	-1	0	-1	0	0	0	0			2600
SECTOR	0	0	1	-1	0	0	0			2610
SECTOR	0	0	0	1	0	0	-1			2620
SECTOR	0	0	0	0	1	1	1			2630
SECTOR	0	0	0	0	-1	0	0			2640
SECTOR	0	0	0	0	0	-1	0			2650
BLOCK	3	2	1							2660
MEDIA		4,	5,	5,	6,	1000,	7,	7		
SURFACES		3,	4,	6,	7,	12,	20			

SECTOR 1 1 0 0 0 1
 SECTOR 0 -1 -1 0 0 0
 SECTOR -1 0 -1 0 0 0
 SECTOR 0 0 1 -1 0 0
 SECTOR 0 0 0 1 -1 0
 SECTOR 0 0 0 0 1 0
 SECTOR 0 0 0 0 0 -1

BLOCK 4 2 1

MEDIA 4, 5, 5, 6, 1000, 7, 7

SURFACES 2, 5, 6, 7, 12, 20

SECTOR -1 -1 0 0 0 1

SECTOR 0 1 -1 0 0 0

SECTOR 1 0 -1 0 0 0

SECTOR 0 0 1 -1 0 0

SECTOR 0 0 0 1 -1 0

SECTOR 0 0 0 0 1 0

SECTOR 0 0 0 0 0 -1

BLOCK 5 2 1

MEDIA 4, 5, 5, 6, 1000, 7, 1000, 1000

SURFACES 2, 5, 6, 7, 19, 11, 12

SECTOR -1 -1 0 0 0 0

SECTOR 0 1 -1 0 0 0

SECTOR 1 0 -1 0 0 0

SECTOR 0 0 1 -1 0 0

SECTOR 0 0 0 1 0 0

SECTOR 0 0 0 0 -1 -1

SECTOR 0 0 0 0 1 0

SECTOR 0 0 0 0 0 1

BLOCK 6 2 1

MEDIA 5, 6, 1000, 7, 1000, 1000

SURFACES 6, 7, 19, 11, 12

SECTOR -1 0 0 0 0

SECTOR 1 -1 0 0 0

2750

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2980

2990

2. Geometry Input for 05R Power Distribution Calculation

SECTOR	0	1	0	0	-1					3000
SECTOR	0	0	-1	-1	1					3010
SECTOR	0	0	1	0	0					3020
SECTOR	0	0	0	1	0					3030
BLOCK		1			1					3040
MEDIA			1000							3050
BLOCK		2			1					3060
MEDIA			1000							3070
BLOCK		3			1					3080
MEDIA			1000							3090
BLOCK		4			1					3100
MEDIA			1000							3110
BLOCK		5			1					3120
MEDIA			1000							3130
BLOCK		6			1					3140
MEDIA			1000							3150
BLOCK		1		3		1				3160
MEDIA			1000							3170
BLOCK		2		3		1				3180
MEDIA			1000							3190
BLOCK		3		3		1				3200
MEDIA			1000							3210
BLOCK		4		3		1				3220
MEDIA			1000							3230
BLOCK		5		3		1				3240
MEDIA			1000							3250
BLOCK		6		3		1				3260
MEDIA			1000							3270
ZONE		1				6				3280
XBLOCK			-16.3525,		-9.7337,		0.0,	9.7337,	16.3525	00003290

Y BLOCK		-23.5055,	23.5055	
ZBLOCK		-4.0,	-2.5146	
BLOCK	1	1	1	
MEDIA		9,	6,	1000
SURFACES		6,	13	
SECTOR	-1	0		
SECTOR	1	-1		
SECTOR	0	1		
BLOCK	2	1	1	
MEDIA		8,	9,	9, 6, 1000
SURFACES		3,	4,	6, 13
SECTOR	1	1	0	0
SECTOR	0	-1	-1	0
SECTOR	-1	0	-1	0
SECTOR	0	0	1	-1
SECTOR	0	0	0	1
BLOCK	3	1	1	
MEDIA		8,	9,	9, 6, 1000
SURFACES		2,	5,	6, 13
SECTOR	-1	-1	0	0
SECTOR	0	1	-1	0
SECTOR	1	0	-1	0
SECTOR	0	0	1	-1
SECTOR	0	0	0	1
BLOCK	4	1	1	
MEDIA		9,	6,	1000
SURFACES		6,	13	
SECTOR	-1	0		
SECTOR	1	-1		
SECTOR	0	1		
ZONE	1	1	7	

3300
 3310
 3320
 3330
 3340
 3350
 3360
 3370
 3380
 3390
 3400
 3410
 3420
 3430
 3440
 3450
 3460
 3470
 3480
 3490
 3500
 3510
 3520
 3530
 3540
 3550
 3560
 3570
 3580
 3590
 3600

X BLOCK	-16.3525,	16.3525			3610
Y BLOCK	-23.5055,	23.5055			3620
Z BLOCK	-2.5146,	1.471			3630
BLOCK	1	1	1		3640
MEDIA	6,	6,	10,	1000, 1000	3650
SURFACES	6,	13,	14,	15	3660
SECTOR	1	-1	0	1	3670
SECTOR	0	-1	1	-1	3680
SECTOR	-1	0	0	1	3690
SECTOR	0	1	1	0	3700
SFCTOR	0	0	-1	0	3710
20 QUADRIC SURFACES, DRUMS OUT 30 DEGREES					
1.0XSQ		1.0YSQ	-130.55782	\$	3730
1.0X	-1.73205Y		-19.4672	\$	3740
1.0X	1.73205Y		19.4672	\$	3750
1.0X	-1.73205Y		19.4672	\$	3760
1.0X	1.73205Y		-19.4672	\$	3770
1.0XSQ		1.0YSQ	-127.04108	\$	3780
1.0XSQ		1.0YSQ	-129.92010	\$	3790
1.0X	.26794Y		14.4186	\$	3800
1.0X	-1.0Y		23.52820	\$	3810
1.0X	.26794Y		-14.4186	\$	3820
1.0X	-1.0Y		-23.52820	\$	3830
1.0XSQ		1.0YSQ	-133.74044	\$	3840
1.0XSQ		1.0YSQ	-134.29913	\$	3850
1.0XSQ		1.0YSQ	1.0ZSQ	-93.98Z	\$ 00003860
1.0XSQ		1.0YSQ	1.0ZSQ	-93.98Z	\$ 00003870
29.93946	\$				3880
1.0XSQ		1.0YSQ	-29.16X	-28.916Y	00003890
339.7529	\$				3900
1.0XSQ		1.0YSQ	29.16X	28.916Y	00003910
339.7529	\$				3920
1.0X		1.0Y	23.5282	\$	3930
1.0X		1.0Y	-23.5282	\$	3940
1.0	XSQ	1.0	YSQ	-2.36145	\$

3. Input to Source Selection Routines For 05R Power Distribution Calculation

0.0	1.5367	2.2478	3.3717	4.4956	5.6195	2
6.7434	7.8673	8.9912	10.1151	11.2390		3
0.0	.014084	.055882	.123659	.215103	.326098	4
.452755	.589835	.869795	1.0			5
35.1115	-33.55925	-32.00350	-30.44775	-28.89200	-27.33625	6
25.78050	-24.22475	-22.66900	-21.11325	-19.55750	-18.00175	7
16.44600	-14.89025	-13.33450	-11.77875	-10.22300	-8.66725	8
7.11150	-5.55575	-4.00000				9
0.0	.030200	.066231	.107650	.154121	.204865	10
.259216	.316788	.376527	.437930	.500000	.562069	11
.623472	.683211	.740783	.795134	.845879	.892350	12
.933769	.969799	1.0				13
						14

APPENDIX D

APPENDIX D

1. Analysis Subroutines Changed Due to the Insertion of Be Rod in Core

SUBROUTINE RELCOL	40
COMMON/CPLIST/NCOLL(8),NAME(8),SI2(8),XI(8),YI(8),ZI(8),WTI(8),	50
ISO2(8),UO(8),VO(8),WO(8),NGRP(8),NELEM(8),NMED(8),WATEF(8),	60
2DUMMY(8)	70
COMMON/ASINGLES/NSTRT,NITS,NDIN,NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP	80
IE,NFTAPE1,NFTAPE2,NFTAPEP,MEDIA,NHISTR,NHISMN,NWPCOL,NSGP,NCOLPR,N	90
2ANISOEL,NDSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,IB,NCPSB2,NCPNBP,	100
3NCPELEM,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTAELE,NGEOM,NM,NGZ,NO	110
4NEUT,NYSUM,NZR,IVAR	120
COMMON/EXTRA1/ZZZ(31),RRR(25),KR,KZ,FWT(25,30,20),KZZ,RRR2(25),KR	130
IR,LBAT,LBATO,BCDID(12),VAR(25,30),FWTAVE(25,30),KZI,RINNER2	
COMMON/EXTRA9/IRSH	141
IF (LBATCH-LBAT) 100,100,101	150
100 RETURN	160
101 LBATO#LBATCH-LBAT	170
DO 1 KZZ#2,KZ	200
LRSH#1	201
IF (ZZZ(KZZ)-ZI(KTH)) 1,2,2	210
1 CONTINUE	220
KZZ#KZ	230
IRSH#IRSH-1	231
LRSH#0	232
2 KZZ#KZZ-1	240
IRSH#IRSH+1	241
RSQ#XI(KTH)**2+YI(KTH)**2	250
DO 3 KRR#1,KR	260
IF (RRR2(KRR)-RSQ) 3,4,4	270
3 CONTINUE	280
KRR#KR	290
IRSH#IRSH-LRSH	291
4 KRR#KRR	300
FWT(KRR,KZZ,LBATO)#FWT(KRR,KZZ,LBATO)+WATEF(KTH)	310
GO TO 100	320
END	330

SUBROUTINE FIXINPUT	1000
COMMON/ASINGLES/NSTRT,NITS,NBIN,NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP	1010
1E,NFTAPE1,NFTAPE2,NFTAPEP,MEDIA,NHISTR,NHISMx,NWPCOL,NSGP,NCOLPR,N	1020
2ANISOEL,NDSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,1B,NCP5B2,NCPNGP,	1030
3NCP5ELEM,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTABLE,NGEOM,NM,MGZ,NO	1040
4NEUT,NYSUM,NZR,IVAR	1050
COMMON/EXTRA1/ZZZ(31),RRR(25),KR,KZ,FWT(25,30,20),KZZ,RRR2(25),KR	1060
1R,LBAT,LBATO,BCDID(12),VAR(25,30),FWTAVE(25,30),KZI,RINNER2	
COMMON/EXTRA9/IRSH	1071
READ (50,1000) (BCDID(1),I#1,12)	1080
1000 FORMAT (12A6)	1090
READ (50,1001) NHISTR,NHISMx,NITS,LBAT,KR,KZ	1100
KZI#KZ-1	1110
DO 10 I#1,25	1120
DO 10 J#1,30	1130
DO 10 K#1,20	1140
10 FWT(I,J,K)#0.0	1150
READ(50,1002) (RRR(I),I#1,KR),RINNER2	
READ (50,1002) (ZZZ(I),I#1,KZ)	1170
1001 FORMAT (6I12)	1180
1002 FORMAT (6E12.4)	1190
DO 11 I#1,KR	1200
11 RRR2(I)#RRR(I)**2	1210
RINNER2#RINNER2**2	
IRSH#0	1211
RETURN	1220
END	1230

SUBROUTINE ENDRUN	400
COMMON/EXTRA1/ZZZ(31),RRR(25),KR,KZ,FWT(25,30,20), KZZ,RRR2(25),KR	410
IR,LBAT,LBATO,BCDID(12),VAR(25,30),FWTAVE(25,30),KZI,RINNER2	
RINNER#1.5367	
A#0.0	
DO 20 I#1,KR	500
DO 20 K#1,KZI	510
FWTSUM#0.0	520
VAR#0.0	530
FNITS#LBATO	540
DO 8 J#1,LBATO	550
FWTSUM#FWTSUM+FWT(I,K,J)	560
VAR#VAR+FWT(I,K,J)**2	570
8 CONTINUE	580
FWTAVE(I,K)#FWTSUM/FNITS	590
VAR#VAR/FNITS	600
VAR(I,K)#SQRTF((VAR-FWTAVE(I,K)**2)/(FNITS-1.0))	610
20 CONTINUE	620
DO 30 I#1,KR	630
DO 30 K#1,KZI	640
IF (FWTAVE(I,K)) 31,31,32	650
31 VAR(I,K)#0.0	660
GO TO 30	670
32 VAR(I,K)#100.0*VAR(I,K)/FWTAVE(I,K)	680
30 CONTINUE	690
DO 700 I#1,KR	
DO 700 K#1,KZI	
IF (I-1) 702,701,702	
701 RR#RINNER2	
GO TO 703	
702 RR#RRR2(I-1)	
703 ARR#2.14159*(RRR2(I)-RR)*(ZZZ(K+1)-ZZZ(K))	
700 FWTAVE(I,K)#FWTAVE(I,K)/ARR	

KPRINT#1	691
LPRINT#4	692
40 IF (KR-KPRINT) 99,41,41	700
C PUNCH DATA FOR POWPOW	
99 WRITE(52,2000) RRR,RINNER,A,A,A,A	
WRITE(52,2000) ZZZ,A,A,A,A,A	
WRITE(52,2000) ((FWTAVE(I,J),J#1,30),I#1,25)	
2000 FORMAT(6E12.5,8X)	
RETURN	
41 PRINT 1000,(BCDID(1),I#1,12)	702
1000 FORMAT (1H1,12A6)	710
PRINT 1001,LBATO	720
1001 FORMAT (1H0,34H FISSION DISTRIBUTION FOR THE LAST,13,9H BATCHES.)	730
1002 FORMAT (1H0,29X,37HOUTER BOUNDARY OF RADIAL INTERVAL, CM)	740
PRINT 1002	750
IF (KR-LPRINT) 43,42,42	760
42 LPRIN#LPRINT	770
GO TO 444	780
43 LPRIN#KR	790
444 PRINT 1003,(RRR(1),I#KPRINT,LPRIN)	800
1003 FORMAT (1H ,7X, 4E22.0)	810
PRINT 1004	820
1004 FORMAT (1H ,27X,7HPERCENT,15X,7HPERCENT,15X,7HPERCENT,15X,7HPERCENT	830
IT)	840
PRINT 1005	850
1005 FORMAT (1H ,12H LOWER Z, CM,5X,16HFISSION WT DEV,6X,16HFISSION W	860
IT DEV,6X,16HFISSION WT DEV,6X,16HFISSION WT DEV)	870
DO 44 K#1,KZ1	880

```

44 PRINT 1006,ZZZ(K),(FWTAVE(I,K),VAR(I,K),I#KPRINT,LPRIN)      890
1006 FORMAT(1H , E12.3,4(3X, E12.3,0PIF7.1))                    900
PRINT 1007,ZZZ(KZ)                                              910
1007 FORMAT (1H , E12.3)                                         920
KPRINT#KPRINT+4                                                  930
LPRINT#LPRINT+4                                                  940
GO TO 40                                                         950
END                                                                960

```

2. Input to Analysis

SNAP-TSF FISSION DISTRIBUTION--BE ROD IN CENTER

	1	7	14	5	25	31	20	
1.93	2.32	2.71	3.10	3.49	3.88			
4.27	4.66	5.05	5.44	5.83	6.22			
6.61	7.00	7.39	7.78	8.17	8.56			
8.95	9.34	9.73	10.12	10.51	10.90			
11.239	1.5367							
35.115	-34.073	-33.036	-31.999	-30.962	-29.925		41	
28.888	-27.851	-26.814	-25.777	-24.740	-23.703		42	
22.666	-21.629	-20.592	-19.555	-18.518	-17.481		43	
16.444	-15.407	-14.370	-13.333	-12.296	-11.259		44	
10.222	-9.185	-8.148	-7.111	-6.074	-5.037		45	
4.000							46	

APPENDIX E

APPENDIX E

1. POWPOW Routines Changed Due to the Insertion of Be Rod in Core

```

PROGRAM POWPOW
COMMON/MAIN/R(25),      Z(31),AR(25),AS(25),AC(25),P(25,30),F(25),
IPOW(30),IZ1,IZ2,R2(25),DR2(25),RIN
DATA (X#9.73325),(IX#22)
READ(50,1000)      (R(10),IO#1,25),RIN
READ (50,1000) Z
READ (50,1000)((P(I,J),J#1,30),I#1,25)
DO 4 I#IX,25
AR(I)#3.14159*(R(I)+R(I-1))*(R(I)-R(I-1))/6.0
AS(I)#(3.14159*R(I)**2/2.0)-X*SQRTF(R(I)**2-X**2)-R(I)**2*ASINF(X/
R(I))
IF (I-IX) 2,1,2
1 AS(I-1)#0.0
2 AC(I)#AR(I)+AS(I-1)-AS(I)
4 F(I)#AR(I)/AC(I)
DO 5 J#1,30
DO 5 I#IX,25
5 P(I,J)#P(I,J)*F(I)
CON2#R(9)**2-R(8)**2
CON1#R(8)**2-R(7)**2
CON#CON1+CON2
DO 6 J#1,30
6 P(9,J)#(P(9,J)*CON2+P(8,J)*CON1)/CON
CON2#R(7)**2-R(6)**2
CON1#R(6)**2-R(5)**2
CON#CON1+CON2
DO 7 J#1,30

```

```

7 P(8,J)#(P(7,J)*CON2+P(6,J)*CON1)/CON
  CON5#R(5)**2-R(4)**2
  CON4#R(4)**2-R(3)**2
  CON3#R(3)**2-R(2)**2
  CON2#R(2)**2-R(1)**2
  CON1#R(1)**2-RIN**2
  CON#CON5+CON4+CON3+CON2+CON1
  DO 8 J#1,30
8 P(7,J)#(P(5,J)*CON5+P(4,J)*CON4+P(3,J)*CON3+P(2,J)*CON2+P(1,J)*CON
  11)/CON
  R(8)#R(7)
  R(7)#R(5)
  R(6)#RIN
  IZ1#1
  IZ2#5
  ILOOP#1
9 FI#IZ2-IZ1+1
  DO 11 I#7,25
  GLOP#0.0
  DO 10 J#IZ1,IZ2
10 GLOP#GLOP+P(I,J)
11 POW(I)#GLOP/FI
  CALL PRINTERI
  GO TO (21,22,23,24,25,26,27,28,29,30,31,32,33,34,35),ILOOP
21 IZ1#6
  IZ2#9
  ILOOP#2
  GO TO 9
22 IZ1#10
  IZ2#12
  ILOOP#3
  GO TO 9
23 IZ1#13
  IZ2#15

```

```

      ILOOP#4
      GO TO 9
24  IZ1#16
      IZ2#18
      ILOOP#5
      GO TO 9
25  IZ1#19
      IZ2#21
      ILOOP#6
      GO TO 9
26  IZ1#22
      IZ2#25
      ILOOP#7
      GO TO 9
27  IZ1#26
      IZ2#30
      ILOOP#8
      GO TO 9
28  IZ1#1
      IZ2#9
      ILOOP#9
      GO TO 9
29  IZ1#10
      IZ2#15
      ILOOP#10
      GO TO 9
30  IZ1#16
      IZ2#21
      ILOOP#11
      GO TO 9
31  IZ1#22
      IZ2#30
      ILOOP#12
      GO TO 9

```

```

32  IZ1#1
      IZ2#15
      ILOOP#13
      GO TO 9
33  IZ1#16
      IZ2#30
      ILOOP#14
      GO TO 9
34  IZ1#1
      IZ2#30
      ILOOP#15
      GO TO 9
35  CONTINUE
      DO 36 I#6,25
36  R2(I)#R(I)**2
      DO 37 I#7,25
37  DR2(I)#R2(I)-R2(I-1)
      IZ1#7
      IZ2#9
      ILOOP#1
39  CONTINUE
1000 FORMAT(6E12.5)
      DO 42 J#1,30
      FI#0.0
      GLOP#0.0
      DO 41 I#IZ1,IZ2
      FI#FI+DR2(I)

```



```
41 GLOP#GLOP+P(I,J)*DR2(I)
42 POW(J)#GLOP/FI
   CALL PRINTER2
   GO TO (51,52,53,54,55,56,57,58,59,60,61),ILOOP
51 IZ1#10
   IZ2#13
   ILOOP#2
   GO TO 39
52 IZ1#14
   IZ2#17
   ILOOP#3
   GO TO 39
53 IZ1#18
   IZ2#21
   ILOOP#4
   GO TO 39
54 IZ1#22
   IZ2#25
   ILOOP#5
   GO TO 39
55 IZ1#7
   IZ2#13
   ILOOP#6
   GO TO 39
56 IZ1#14
   IZ2#19
   ILOOP#7
   GO TO 39
57 IZ1#20
   IZ2#25
   ILOOP#8
   GO TO 39
```

```
58 IZ1#7
   IZ2#16
   ILOOP#9
   GO TO 39
59 IZ1#17
   IZ2#25
   ILOOP#10
   GO TO 39
60 IZ1#7
   IZ2#25
   ILOOP#11
   GO TO 39
61 CONTINUE
   CALL EXIT
   END
```

```

SUBROUTINE PRINTER1
COMMON/MAIN/R(25),Z(31),AR(25),AS(25),AC(25),P(25,30),F(25),
IPOW(30),IZ1,IZ2,R2(25),DR2(25),RIN
PRINT 1000,Z(IZ1),Z(IZ2+1)
1000 FORMAT (1H,7SNAP-TSF FISSION DISTRIBUTION PROGRAM POWPOW7//1H ,
17RADIAL DISTRIBUTION FOR Z INTERVAL7,F8.3,3H TO,F8.3//1H ,
27OUTER RADIUS OF FISSION WEIGHT7/1H ,7INTERVAL, CM7,6X,
37PERVOLUME7)
PRINT 1001,(R(I),POW(I),I#7,25)
1001 FORMAT (1H ,F13.3,E16.3)
GLOP#0.0
DO 1 I#7,25
1 GLOP#GLOP+POW(I)*(R(I)**2-R(I-1)**2)
DO 2 I#7,25
2 POW(I)#POW(I)/GLOP
PRINT 1000,Z(IZ1),Z(IZ2+1)
PRINT 2000
2000 FORMAT (1H ,7*****NORMALIZED*****7)
PRINT 1001,(R(I),POW(I),I#7,25)
RETURN
END PRINTER1

```

```

SUBROUTINE PRINTER2
COMMON/MAIN/R(25),Z(31),AR(25),AS(25),AC(25),P(25,30),F(25),
IPOW(30),IZ1,IZ2,R2(25),DR2(25),RIN
PRINT 1000,R(IZ1-1),R(IZ2)
1000 FORMAT(1H,7SNAP-TSF FISSION DISTRIBUTION PROGRAM POWPOW7//1H ,
17AXIAL DISTRIBUTION FOR R INTERVAL7,F8.3,3H TO,F8.3//1H ,
27LOWER Z OF7,8X,7FISSION WEIGHT7/1H ,7INTERVAL, CM7,6X,
37PERVOLUME7)
PRINT 1001,(Z(I),POW(I),I#1,30)
PRINT 1002,Z(31)
1001 FORMAT (1H ,F13.3,E16.3)
1002 FORMAT (1H ,F13.3)
GLOP#0.0
DO 1 I#2,31
1 GLOP#GLOP+POW(I-1)*(Z(I)-Z(I-1))
DO 2 I#1,30
2 POW(I)#POW(I)/GLOP
PRINT 1000,R(IZ1-1),R(IZ2)
PRINT 2000
2000 FORMAT (1H ,7*****NORMALIZED*****7)
PRINT 1001,(Z(I),POW(I),I#1,30)
PRINT 1002,Z(31)
RETURN
END PRINTER2

```

APPENDIX F

APPENDIX F

1. 05R Input For the Shield Source Problem

SNAP-TSF LEAKAGE (XNU FROM FORWARD ADJOINT) BL ROD IN CORE, DRUMS OUT										
800	900	50	1	1.0+5	0					
10	1	2								C
2	0	-3	0	-4	0	-5	0	-6	0	ID
22.99		-22.99		39.1		-39.1		52.0	-52.0	1E01
55.85		58.71		-58.71					55.85	1E02
2	0	-3	0	-4	0	-5	0	-6	0	2D
22.99		-22.99		39.1		-39.1		52.0	-52.0	2E01
55.85		58.71		-58.71					55.85	2E02
2	0	-3	0	-4	0	-5	0	-6	0	3D
22.99		-22.99		39.1		-39.1		52.0	-52.0	3E01
55.85		58.71		-58.71					55.85	3E02
0	-2	0	-3	0	-6	0	-7	0	0	4D
1.00814		22.99		-22.99		39.1		-39.1	58.71	4E01
91.22		-91.22		-91.22		235.0		-235.0	238.0	4E02
1	0	-2	0	-3	0					5D
9.012		-9.012		22.99		-22.99		39.1	-39.1	5E
4	0	-5	0	-6	0					6D
52.0		-52.0		55.85		-55.85		58.71	-58.71	6E
1	0									7D
9.012		-9.012								7E
2	0	-3	0	-4	0	-5	0	-6	0	8D
22.99		-22.99		39.1		-39.1		52.0	-52.0	8E01
55.85		58.71		-58.71					55.85	8E02
2	0	-3	0	-4	0	-5	0	-6	0	9D
22.99		-22.99		39.1		-39.1		52.0	-52.0	9E01
55.85		58.71		-58.71					55.85	9E02
2	0	-3	0							10D
22.99		-22.99		39.1		-39.1				10E
0.0		0.0		0.0		0.0		1.0		G
0.0		0.0		-19.5575		4		1		H
10	12	1110001111111000100011010000000000							100000	I2

1262443532133165

0 0 0 0
0 0
3 0

K
N
P

2. Geometry Input For Shield Source Problem

I	MALE						
X ZONE		-16.3525,	16.3525				20
Y ZONE		-23.5055,	23.5055				30
Z ZONE		-39.7455,	-36.9794,	-35.1150,	-32.5750,	-6.54,	00000040
	4.0,	-2.5146,	1.4710				50
ZONE	I	I	I				60
X BLOCK		-16.3525,	16.3525				70
Y BLOCK		-23.5055,	23.5055				80
Z BLOCK		-39.7455,	-36.9794				90
BLOCK	I	I	I				100
MEDIA		1,	1000				110
SURFACES		I					120
SECTOR -I							130
SECTOR I							140
REGIONS		I					
ZONE	I	I	2				150
X BLOCK		-16.3525,	-9.73370,	0.0,	9.7337,	16.3525	00000160
Y BLOCK		-23.5055,	23.5055				170
Z BLOCK		-36.9794,	-35.1150				180
BLOCK	I	I	I				190
MEDIA		3,	6,	1000			200
SURFACES		6,	7				210
SECTOR -I	0						220
SECTOR I -I							230
SECTOR 0 I							240
REGIONS		I					

BLOCK	2	1	1						250
MEDIA		2,	3,	3,	6,	1000			260
SURFACES		3,	4,	6,	7				270
SECTOR	1	1	0	0					280
SECTOR	0	-1	-1	0					290
SECTOR	-1	0	-1	0					300
SECTOR	0	0	1	-1					310
SECTOR	0	0	0	1					320
REGIONS		1							
BLOCK	3	1	1						330
MEDIA		2,	3,	3,	6,	1000			340
SURFACES		2,	5,	6,	7				350
SECTOR	-1	-1	0	0					360
SECTOR	0	1	-1	0					370
SECTOR	1	0	-1	0					380
SECTOR	0	0	1	-1					390
SECTOR	0	0	0	1					400
REGIONS		1							
BLOCK	4	1	1						410
MEDIA		3,	6,	1000					420
SURFACES		6,	7						430
SECTOR	-1	0							440
SECTOR	1	-1							450
SECTOR	0	1							460
REGIONS		1							
ZONE	1	1	3						470
X BLOCK		-16.3525,	-9.7337,	-6.6599,	0.0,	6.6599,	00000		480
		9.7337,	16.3525						490
Y BLOCK		-23.5055,	-16.8656,	16.8656,	23.5055				500
Z BLOCK		-35.1150,	-32.5750						510
BLOCK	1	2	1						520
MEDIA		5,	6,	1000,	7,	1000,	1000		530
SURFACES		6,	7,	18,	9,	12			540
SECTOR	-1	0	0	0	0				550
SECTOR	1	-1	0	0	0				560

SECTOR	0	1	-1	0	0	0	
SECTOR	1	0	-1	0	0	0	
SECTOR	0	0	1	-1	0	0	
SECTOR	0	0	0	1	-1	0	
SECTOR	0	0	0	0	1	0	
SECTOR	0	0	0	0	0	-1	
REGIONS			1				
BLOCK	5		2		1		900
MEDIA			4,		5,	5,	6, 1000, 7, 1000, 1000
SURFACES			2,		5,	6,	7, 19, 11, 12
SECTOR	-1	-1	0	0	0	0	930
SECTOR	0	1	-1	0	0	0	940
SECTOR	1	0	-1	0	0	0	950
SECTOR	0	0	1	-1	0	0	960
SECTOR	0	0	0	1	0	0	970
SECTOR	0	0	0	0	-1	-1	980
SECTOR	0	0	0	0	1	0	990
SECTOR	0	0	0	0	0	1	1000
REGIONS			1				
BLOCK	6		2		1		1010
MEDIA			5,		6,	1000,	7, 1000, 1000
SURFACES			6,		7,	19,	11, 12
SECTOR	-1	0	0	0	0		1040
SECTOR	1	-1	0	0	0		1050
SECTOR	0	1	0	0	-1		1060
SECTOR	0	0	-1	-1	1		1070
SECTOR	0	0	1	0	0		1080
SECTOR	0	0	0	1	0		1090
REGIONS			1				

BLOCK	1	1	1	1100
MEDIA		1000		1110
REGIONS		1		
BLOCK	2	1	1	1120
MEDIA		1000		1130
REGIONS		1		
BLOCK	3	1	1	1140
MEDIA		1000		1150
REGIONS		1		
BLOCK	4	1	1	1160
MEDIA		1000		1170
REGIONS		1		
BLOCK	5	1	1	1180
MEDIA		1000		1190
REGIONS		1		
BLOCK	6	1	1	1200
MEDIA		1000		1210
REGIONS		1		
BLOCK	1	3	1	1220
MEDIA		1000		1230
REGIONS		1		
BLOCK	2	3	1	1240
MEDIA		1000		1250
REGIONS		1		
BLOCK	3	3	1	1260
MEDIA		1000		1270
REGIONS		1		
BLOCK	4	3	1	1280
MEDIA		1000		1290
REGIONS		1		

BLOCK	5	3	1						1300
MEDIA		1000							1310
REGIONS		1							
BLOCK	6	3	1						1320
MEDIA		1000							1330
REGIONS		1							
ZONE	1	1	4						1340
X BLOCK		-16.3525,	-9.7337,	-6.6599,	0.0,	6.6599,	0000		1350
		9.7337,	16.3525						1360
Y BLOCK		-23.5055,	-16.8656,	16.8656,	23.5055		0		1370
Z BLOCK		-32.5750,	-6.54						1380
BLOCK	1	1	1						1390
MEDIA		7,	1000						1400
SURFACES		8							1410
SECTOR	1								1420
SECTOR	-1								1430
REGIONS		1							
BLOCK	6	3	1						1440
MEDIA		7,	1000						1450
SURFACES		10							1460
SECTOR	-1								1470
SECTOR	1								1480
REGIONS		1							
BLOCK	2	1	1						1490
MEDIA		7,	1000,	1000					1500
SURFACES		8,	17						1510
SECTOR	1	-1							1520
SECTOR	-1	0							1530
SECTOR	1	1							1540
REGIONS		1							
BLOCK	5	2	1						1550

MEDIA		7, 1000, 1000		1560
SURFACES		10, 16		1570
SECTOR -1 -1				1580
SECTOR 1 0				1590
SECTOR -1 1				1600
REGIONS		1		
BLOCK	3	1 1		1610
MEDIA		7, 1000		1620
SURFACES		17		1630
SECTOR -1				1640
SECTOR 1				1650
REGIONS		1		
BLOCK	4	3 1		1660
MEDIA		7, 1000		1670
SURFACES		16		1680
SECTOR -1				1690
SECTOR 1				1700
REGIONS		1		
BLOCK	4	1 1		1710
MEDIA		1000		1720
REGIONS		1		
BLOCK	5	1 1		1730
MEDIA		1000		1740
REGIONS		1		
BLOCK	6	1 1		1750
MEDIA		1000		1760
REGIONS		1		
BLOCK	1	3 1		1770
MEDIA		1000		1780
REGIONS		1		
BLOCK	2	3 1		1790

SECTOR	-1	-1	0	0	0	1	
SECTOR	0	1	-1	0	0	0	
SECTOR	1	0	-1	0	0	0	
SECTOR	0	0	1	-1	0	0	
SECTOR	0	0	0	1	-1	0	
SECTOR	0	0	0	0	1	0	
SECTOR	0	0	0	0	0	-1	
REGIONS			1				
ZONE	1		1		5		2410
X BLOCK			-16.3525,		-9.7337,	-6.6599,	0.0, 6.6599, 00002420
			9.7337,		16.3525		2430
Y BLOCK			-23.5055,		-16.8656,	16.8656,	23.5055 000 2440
Z BLOCK			-6.54,		-4.0		2450
BLOCK	1		2		1		2460
MEDIA			5,		6, 1000,	7, 1000, 1000	2470
SURFACES			6,		7, 18,	9, 12	2480
SECTOR	-1	0	0	0	0		2490
SECTOR	1	-1	0	0	0		2500
SECTOR	0	1	0	0	-1		2510
SECTOR	0	0	1	1	1		2520
SECTOR	0	0	-1	0	0		2530
SECTOR	0	0	0	-1	0		2540
REGIONS			1				
BLOCK	2		2		1		2550
MEDIA			4,		5,	5,	6, 1000, 7, 1000, 1000 2560
SURFACES			3,		4,	6,	7, 18, 9, 12 2570
SECTOR	1	1	0	0	0	0	0 2580
SECTOR	0	-1	-1	0	0	0	0 2590

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SECTOR	-1	-1	0	0	0	0	0	2870
SECTOR	0	1	-1	0	0	0	0	2880
SECTOR	1	0	-1	0	0	0	0	2890
SECTOR	0	0	1	-1	0	0	0	2900
SECTOR	0	0	0	1	0	0	-1	2910
SECTOR	0	0	0	0	-1	-1	1	2920
SECTOR	0	0	0	0	1	0	0	2930
SECTOR	0	0	0	0	0	1	0	2940
REGIONS			1					
BLOCK	6		2		1			2950
MEDIA			5,		6, 1000,		7, 1000, 1000	2960
SURFACES			6,		7, 19,		11, 12	2970
SECTOR	-1	0	0	0	0			2980
SECTOR	1	-1	0	0	0			2990
SECTOR	0	1	0	0	-1			3000
SECTOR	0	0	-1	-1	1			3010
SECTOR	0	0	1	0	0			3020
SECTOR	0	0	0	1	0			3030
REGIONS			1					
BLOCK	1		1		1			3040
MEDIA			1000					3050
REGIONS			1					
BLOCK	2		1		1			3060
MEDIA			1000					3070
REGIONS			1					
BLOCK	3		1		1			3080
MEDIA			1000					3090
REGIONS			1					
BLOCK	4		1		1			3100

MEDIA		1000								3110
REGIONS		1								
BLOCK	5	1	1							3120
MEDIA		1000								3130
REGIONS		1								
BLOCK	6	1	1							3140
MEDIA		1000								3150
REGIONS		1								
BLOCK	1	3	1							3160
MEDIA		1000								3170
REGIONS		1								
BLOCK	2	3	1							3180
MEDIA		1000								3190
REGIONS		1								
BLOCK	3	3	1							3200
MEDIA		1000								3210
REGIONS		1								
BLOCK	4	3	1							3220
MEDIA		1000								3230
REGIONS		1								
BLOCK	5	3	1							3240
MEDIA		1000								3250
REGIONS		1								
BLOCK	6	3	1							3260
MEDIA		1000								3270
REGIONS		1								
ZONE	1	1	6							3280
XBLOCK		-16.3525,	-9.7337,	0.0,	9.7337,	16.3525			0000	3290
Y BLOCK		-23.5055,	23.5055							3300
ZBLOCK		-4.0,	-2.5146							3310
BLOCK	1	1	1							3320
MEDIA		9,	6,	1000						3330
SURFACES		6,	13							3340

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REGIONS		2				
ZONE	1	1	7			3600
X BLOCK		-16.3525,	16.3525			3610
Y BLOCK		-23.5055,	23.5055			3620
Z BLOCK		-2.5146,	1.471			3630
BLOCK	1	1	1			3640
MEDIA		6,	6,	10,	1000,	1000
SURFACES		6,	13,	14,	15	
SECTOR	1	-1	0	1		3670
SECTOR	0	-1	1	-1		3680
SECTOR	-1	0	0	1		3690
SECTOR	0	1	1	0		3700
SECTOR	0	0	-1	0		3710
REGIONS		2				

20 QUADRIC SURFACES, DRUMS OUT 30 DEGREES

1.0XSQ	1.0YSQ	-130.55782	\$	3730
1.0X	-1.73205Y	-19.4672	\$	3740
1.0X	1.73205Y	19.4672	\$	3750
1.0X	-1.73205Y	19.4672	\$	3760
1.0X	1.73205Y	-19.4672	\$	3770
1.0XSQ	1.0YSQ	-127.04108	\$	3780
1.0XSQ	1.0YSQ	-129.92010	\$	3790
1.0X	.26794Y	14.4186	\$	3800
1.0X	-1.0Y	23.52820	\$	3810
1.0X	.26794Y	-14.4186	\$	3820
1.0X	-1.0Y	-23.52820	\$	3830
1.0XSQ	1.0YSQ	-133.74044	\$	3840
1.0XSQ	1.0YSQ	-134.29913	\$	3850
1.0XSQ	1.0YSQ	1.0ZSQ	-93.98Z	\$ 00003860
1.0XSQ	1.0YSQ	1.0ZSQ	-93.98Z	\$ 00003870

29.93946	\$					3880
1.0XSQ		1.0YSQ	-29.16X	-28.916Y		00003890
339.7529	\$					3900
1.0XSQ		1.0YSQ	29.16X	28.916Y		00003910
339.7529	\$					3920
1.0X		1.0Y	23.5282	\$		3930
1.0X		1.0Y	-23.5282	\$		3940
1.0	XSQ	1.0	YSQ	-2.36145	\$	

3. Subroutine Source Input for the Shield Source Problem

2	11	21			
1.5370	3.4489	4.6691	5.6637	6.5443	7.3602
8.1391	8.9000	9.6589	10.4320	11.2390	
.010462	.010193	.009764	.009408	.008922	.008401
.007842	.007243	.006597	.005894	-0	
-35.1150	-23.2133	-20.0671	-17.9773	-16.4148	-15.1481
14.0609	-13.0696	-12.1937	-11.3809	-10.6249	-9.9066
9.2312	-8.5633	-7.9333	-7.3034	-6.6740	-6.0448
5.3998	-4.6999	-4.0000			
.217090	.949678	.998644	.990243	.962496	.927140
.887831	.844954	.801775	.757673	.712271	.668210
.623427	.577031	.531493	.484384	.435881	.386105
.333877	.275973	.217090			
2	2	11			
35.1150	-4.0000				
1.000000	.957927	.918913	.880743	.839117	.775810
.712504	.630228	.524818	.351618	-1.000000	
7 12	14 16	18 21	24 28	32 38	9
.0072	.0313	.043	.0797	.1287	.187
.2102	.1795	.1334			
2	7				
18.0	8.18	5.49	3.01	1.35	.407
.111					
.727	.784	.842	.843	.865	.776
.754	.708	.729	.800	.863	.705

APPENDIX G

APPENDIX G

1. 05R Input to the Core-Mapping Problem

SNAP-TSF LEAKAGE			REACTOR ONLY ADJOINT SN BIAS			5/9/66 60 BATCHES			B
800	800	60	1	1.0+5	0				
10	1	2							
2	0	-3	0	-4	0	-5	0	-6	0
22.99		-22.99		39.1		-39.1		52.0	-52.0
55.85		58.71		-58.71					55.85
2	0	-3	0	-4	0	-5	0	-6	0
22.99		-22.99		39.1		-39.1		52.0	-52.0
55.85		58.71		-58.71					55.85
2	0	-3	0	-4	0	-5	0	-6	0
22.99		-22.99		39.1		-39.1		52.0	-52.0
55.85		58.71		-58.71					55.85
0	-2	0	-3	0	-6	0	-7	0	0
1.00814		22.99		-22.99		39.1		-39.1	58.71
91.22		-91.22		-91.22		235.0		-235.0	238.0
1	0	-2	0	-3	0				
9.012		-9.012		22.99		-22.99		39.1	-39.1
4	0	-5	0	-6	0				
52.0		-52.0		55.85		-55.85		58.71	-58.71
1	0								
9.012		-9.012							
2	0	-3	0	-4	0	-5	0	-6	0
22.99		-22.99		39.1		-39.1		52.0	-52.0
55.85		58.71		-58.71					55.85
2	0	-3	0	-4	0	-5	0	-6	0
22.99		-22.99		39.1		-39.1		52.0	-52.0
55.85		58.71		-58.71					55.85
2	0	-3	0						
22.99		-22.99		39.1		-39.1			
0.0		0.0		0.0		0.0		1.0	
0.0		0.0		-19.5575		4		1	

10	13	111000111111100010001101000000000000	110100000	12
1625174262323665				
0	0	0	0	K
0	0			N
3	0			P

2. Geometry Input for 05R Core-Mapping Problem

I	MALE						
X ZONE		-16.3525,	16.3525				20
Y ZONE		-23.5055,	23.5055				30
Z ZONE		-39.7455,	-36.9794,	-35.1150,	-32.5750,	-6.54,	00000040
	4.0,	-2.5146,	1.4710				50
ZONE	I	I	I				60
X BLOCK		-16.3525,	16.3525				70
Y BLOCK		-23.5055,	23.5055				80
Z BLOCK		-39.7455,	-36.9794				90
BLOCK	I	I	I				100
MEDIA		1,	1000				110
SURFACES		I					120
SECTOR -I							130
SECTOR I							140
REGIONS		I					
ZONE	I	I	2				150
X BLOCK		-16.3525,	-9.73370,	0.0,	9.7337,	16.3525	00000160
Y BLOCK		-23.5055,	23.5055				170
Z BLOCK		-36.9794,	-35.1150				180
BLOCK	I	I	I				190
MEDIA		3,	6,	1000			200
SURFACES		6,	7				210
SECTOR -I	0						220
SECTOR I	-I						230
SECTOR 0	I						240
REGIONS		I					

BLOCK	2	1	1						250
MEDIA		2,	3,	3,	6,	1000			260
SURFACES		3,	4,	6,	7				270
SECTOR	1	1	0	0					280
SECTOR	0	-1	-1	0					290
SECTOR	-1	0	-1	0					300
SECTOR	0	0	1	-1					310
SECTOR	0	0	0	1					320
REGIONS		1							
BLOCK	3	1	1						330
MEDIA		2,	3,	3,	6,	1000			340
SURFACES		2,	5,	6,	7				350
SECTOR	-1	-1	0	0					360
SECTOR	0	1	-1	0					370
SECTOR	1	0	-1	0					380
SECTOR	0	0	1	-1					390
SECTOR	0	0	0	1					400
REGIONS		1							
BLOCK	4	1	1						410
MEDIA		3,	6,	1000					420
SURFACES		6,	7						430
SECTOR	-1	0							440
SECTOR	1	-1							450
SECTOR	0	1							460
REGIONS		1							
ZONE	1	1	3						470
X BLOCK		-16.3525,	-9.7237,	-6.6599,	0.0,	6.6599,	00000	480	
		9.7237,	16.2525					490	
Y BLOCK		-23.5055,	-16.8656,	16.8656,	23.5055			500	
Z BLOCK		-35.1150,	-32.5750					510	
BLOCK	1	2	1						520
MEDIA		5,	6,	1000,	7,	1000,	1000		530
SURFACES		6,	7,	13,	9,	12			540
SECTOR	-1	0	0	0	0				550
SECTOR	1	-1	0	0	0				560

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SECTOR	-1	-1	0	0	0	1	
SECTOR	0	1	-1	0	0	0	
SECTOR	1	0	-1	0	0	0	
SECTOR	0	0	1	-1	0	0	
SECTOR	0	0	0	1	-1	0	
SECTOR	0	0	0	0	1	0	
SECTOR	0	0	0	0	0	-1	
REGIONS				1			
BLOCK	5		2		1		900
MEDIA			4,	5,	5,	6, 1000,	7, 1000, 1000
SURFACES			2,	5,	6,	7, 10,	11, 12
SECTOR	-1	-1	0	0	0	0	0
SECTOR	0	1	-1	0	0	0	0
SECTOR	1	0	-1	0	0	0	0
SECTOR	0	0	1	-1	0	0	0
SECTOR	0	0	0	1	0	0	-1
SECTOR	0	0	0	0	-1	-1	1
SECTOR	0	0	0	0	1	0	0
SECTOR	0	0	0	0	0	1	0
REGIONS				1			
BLOCK	6		2		1		1010
MEDIA			5,	6,	1000,	7,	1000, 1000
SURFACES			6,	7,	10,	11,	12
SECTOR	-1	0	0	0	0		
SECTOR	1	-1	0	0	0		
SECTOR	0	1	0	0	-1		
SECTOR	0	0	-1	-1	1		
SECTOR	0	0	1	0	0		
SECTOR	0	0	0	1	0		
REGIONS				1			

BLOCK	1	1	1	1100
MEDIA		1000		1110
REGIONS		1		
BLOCK	2	1	1	1120
MEDIA		1000		1130
REGIONS		1		
BLOCK	3	1	1	1140
MEDIA		1000		1150
REGIONS		1		
BLOCK	4	1	1	1160
MEDIA		1000		1170
REGIONS		1		
BLOCK	5	1	1	1180
MEDIA		1000		1190
REGIONS		1		
BLOCK	6	1	1	1200
MEDIA		1000		1210
REGIONS		1		
BLOCK	1	3	1	1220
MEDIA		1000		1230
REGIONS		1		
BLOCK	2	3	1	1240
MEDIA		1000		1250
REGIONS		1		
BLOCK	3	3	1	1260
MEDIA		1000		1270
REGIONS		1		
BLOCK	4	3	1	1280
MEDIA		1000		1290
REGIONS		1		
BLOCK	5	3	1	1300
MEDIA		1000		1310
REGIONS		1		
BLOCK	6	3	1	1320
MEDIA		1000		1330

REGIONS	1							
ZONE	1	1	4					1340
X BLOCK		-16.3525,	-9.7337,	-6.6599,	0.0,	6.6599,	0000	1350
		9.7337,	16.3525					1360
Y BLOCK		-23.5055,	-16.8656,	16.8656,	23.5055		00	1370
Z BLOCK		-32.5750,	-6.54					1380
BLOCK	1	1	1					1390
MEDIA		7,	1000					1400
SURFACES		8						1410
SECTOR	1							1420
SECTOR	-1							1430
REGIONS		1,	2,	3				
SURFACES		21,	22					
SECTOR	-1	0						
SECTOR	+1	-1						
SECTOR	0	+1						
BLOCK	6	3	1					1440
MEDIA		7,	1000					1450
SURFACES		10						1460
SECTOR	-1							1470
SECTOR	1							1480
REGIONS		1,	2,	3				
SURFACES		21,	22					
SECTOR	-1	0						
SECTOR	+1	-1						
SECTOR	0	+1						

BLOCK	2	1	1	1490
MEDIA		7,	1000, 1000	1500
SURFACES		8,	17	1510
SECTOR	1 -1			1520
SECTOR	-1 0			1530
SECTOR	1 1			1540
REGIONS		1,	2, 3	
SURFACES		21,	22	
SECTOR	-1 0			
SECTOR	+1 -1			
SECTOR	0 +1			
BLOCK	5	3	1	1550
MEDIA		7,	1000, 1000	1560
SURFACES		10,	16	1570
SECTOR	-1 -1			1580
SECTOR	1 0			1590
SECTOR	-1 1			1600
REGIONS		1,	2, 3	
SURFACES		21,	22	
SECTOR	-1 0			
SECTOR	+1 -1			
SECTOR	0 +1			
BLOCK	3	1	1	1610
MEDIA		7,	1000	1620
SURFACES		17		1630
SECTOR	-1			1640
SECTOR	1			1650
REGIONS		1,	2, 3	
SURFACES		21,	22	
SECTOR	-1 0			
SECTOR	+1 -1			
SECTOR	0 +1			
BLOCK	4	3	1	1660
MEDIA		7,	1000	1670

SURFACES	16			1680
SECTOR -1				1690
SECTOR 1				1700
REGIONS	1,	2,	3	
SURFACES	21,	22		
SECTOR -1 0				
SECTOR +1 -1				
SECTOR 0 +1				
BLOCK	4	1	1	1710
MEDIA		1000		1720
REGIONS		1		
BLOCK	5	1	1	1730
MEDIA		1000		1740
REGIONS		1		
BLOCK	6	1	1	1750
MEDIA		1000		1760
REGIONS		1		
BLOCK	1	3	1	1770
MEDIA		1000		1780
REGIONS		1		
BLOCK	2	3	1	1790
MEDIA		1000		1800
REGIONS		1		
BLOCK	3	3	1	1810
MEDIA		1000		1820
REGIONS		1		
BLOCK	1	2	1	1830

MEDIA		5,	6,	1000,	7,	7,	1000,	1000	1840
SURFACES		6,	7,	8,	9,	12,	17		1850
SECTOR	-1 0 0 0 0								1860
SECTOR	1 -1 0 0 0								1870
SECTOR	0 1 0 0 -1 0								1880
SECTOR	0 0 0 1 1 1								1890
SECTOR	0 0 1 0 0 -1								1900
SECTOR	0 0 -1 0 0 -1								1910
SECTOR	0 0 0 -1 0 0								1920
REGIONS		1,	2,	3					
SURFACES		21,	22						
SECTOR	-1 0								
SECTOR	+1 -1								
SECTOR	0 +1								
BLOCK	6 2 1								1930
MEDIA		5,	6,	1000,	7,	7,	1000,	1000	1940
SURFACES		6,	7,	10,	11,	12,	16		1950
SECTOR	-1 0 0 0 0								1960
SECTOR	1 -1 0 0 0								1970
SECTOR	0 1 0 0 -1 0								1980
SECTOR	0 0 0 -1 1 1								1990
SECTOR	0 0 -1 0 0 -1								2000
SECTOR	0 0 1 0 0 -1								2010
SECTOR	0 0 0 1 0 0								2020
REGIONS		1,	2,	3					
SURFACES		21,	22						
SECTOR	-1 0								
SECTOR	+1 -1								
SECTOR	0 +1								
BLOCK	2 2 1								2030
MEDIA		4,	5,	5,	6,	1000,	7,	1000	2040
SURFACES		3,	4,	6,	7,	9,	12		2050

SECTOR	1	1	0	0	0	0						2060
SECTOR	0	-1	-1	0	0	0						2070
SECTOR	-1	0	-1	0	0	0						2080
SECTOR	0	0	1	-1	0	0						2090
SECTOR	0	0	0	1	0	-1						2100
SECTOR	0	0	0	0	1	1						2110
SECTOR	0	0	0	0	-1	0						2120
REGIONS				1,	2,		3					
SURFACES				21,	22							
SECTOR	-1	0										
SECTOR	+1	-1										
SECTOR	0	+1										
BLOCK	5	2	1									2130
MEDIA			4,	5,	5,	6,	1000,	7,	1300			2140
SURFACES			2,	5,	6,	7,	11,	12				2150
SECTOR	-1	-1	0	0	0	0						2160
SECTOR	0	1	-1	0	0	0						2170
SECTOR	1	0	-1	0	0	0						2180
SECTOR	0	0	1	-1	0	0						2190
SECTOR	0	0	0	1	0	-1						2200
SECTOR	0	0	0	0	-1	1						2210
SECTOR	0	0	0	0	1	0						2220
REGIONS				1,	2,		3					
SURFACES				21,	22							
SECTOR	-1	0										
SECTOR	+1	-1										
SECTOR	0	+1										
BLOCK	3	2	1									2230
MEDIA			4,	5,	5,	6,	1000,	7,	7			

SURFACES	3,	4,	6,	7,	12,	20	
SECTOR	1	1	0	0	0	1	
SECTOR	0	-1	-1	0	0	0	
SECTOR	-1	0	-1	0	0	0	
SECTOR	0	0	1	-1	0	0	
SECTOR	0	0	0	1	-1	0	
SECTOR	0	0	0	0	1	0	
SECTOR	0	0	0	0	0	-1	
REGIONS	1,	2,	3				
SURFACES	21,	22					
SECTOR	-1	0					
SECTOR	+1	-1					
SECTOR	0	+1					
BLOCK	4	2	1				2320
MEDIA	4,	5,	5,	6,	1000,	7,	7
SURFACES	2,	5,	6,	7,	12,	20	
SECTOR	-1	-1	0	0	0	1	
SECTOR	0	1	-1	0	0	0	
SECTOR	1	0	-1	0	0	0	
SECTOR	0	0	1	-1	0	0	
SECTOR	0	0	0	1	-1	0	
SECTOR	0	0	0	0	1	0	
SECTOR	0	0	0	0	0	-1	
REGIONS	1,	2,	3				
SURFACES	21,	22					
SECTOR	-1	0					
SECTOR	+1	-1					
SECTOR	0	+1					
ZONE	1	1	5				2410
X BLOCK	-16.3525,	-9.7337,	-6.6599,	0.0,	6.6599,	0000	2420
	9.7337,	16.3525					2430
Y BLOCK	-23.5055,	-16.8656,	16.8656,	23.5055		000	2440
Z BLOCK	-6.54,	-4.0					2450

BLOCK	1	2	1							2460
MEDIA			5,	6,	1000,	7,	1000,	1000		2470
SURFACES			6,	7,	13,	9,	12			2480
SECTOR	-1	0	0	0	0					2490
SECTOR	1	-1	0	0	0					2500
SECTOR	0	1	0	0	-1					2510
SECTOR	0	0	1	1	1					2520
SECTOR	0	0	-1	0	0					2530
SECTOR	0	0	0	-1	0					2540
REGIONS		3								
BLOCK	2	2	1							2550
MEDIA			4,	5,	5,	6,	1000,	7,	1000,	1000
SURFACES			3,	4,	6,	7,	18,	9,	12	2560
SECTOR	1	1	0	0	0	0	0			2570
SECTOR	0	-1	-1	0	0	0	0			2580
SECTOR	-1	0	-1	0	0	0	0			2590
SECTOR	0	0	1	-1	0	0	0			2600
SECTOR	0	0	0	1	0	0	-1			2610
SECTOR	0	0	0	0	1	1	1			2620
SECTOR	0	0	0	0	-1	0	0			2630
SECTOR	0	0	0	0	0	-1	0			2640
SECTOR	0	0	0	0	0	-1	0			2650
REGIONS		3								
BLOCK	3	2	1							2660
MEDIA			4,	5,	5,	6,	1000,	7,	7	
SURFACES			3,	4,	6,	7,	12,	20		
SECTOR	1	1	0	0	0	1				
SECTOR	0	-1	-1	0	0	0				
SECTOR	-1	0	-1	0	0	0				

SECTOR	0	0	1	-1	0	0														
SECTOR	0	0	0	1	-1	0														
SECTOR	0	0	0	0	1	0														
SECTOR	0	0	0	0	0	-1														
REGIONS						3														
BLOCK		4		2		1														2750
MEDIA					4,		5,		5,		6,	1000,		7,		7				
SURFACES					2,		5,		6,		7,	12,		20						
SECTOR	-1	-1	0	0	0	1														
SECTOR	0	1	-1	0	0	0														
SECTOR	1	0	-1	0	0	0														
SECTOR	0	0	1	-1	0	0														
SECTOR	0	0	0	1	-1	0														
SECTOR	0	0	0	0	1	0														
SECTOR	0	0	0	0	0	-1														
REGIONS						3														
BLOCK		5		2		1														2840
MEDIA					4,		5,		5,		6,	1000,		7,	1000,	1000				2850
SURFACES					2,		5,		6,		7,	19,		11,	12					2860
SECTOR	-1	-1	0	0	0	0	0													2870
SECTOR	0	1	-1	0	0	0	0													2880
SECTOR	1	0	-1	0	0	0	0													2890
SECTOR	0	0	1	-1	0	0	0													2900
SECTOR	0	0	0	1	0	0	-1													2910
SECTOR	0	0	0	0	-1	-1	1													2920
SECTOR	0	0	0	0	1	0	0													2930
SECTOR	0	0	0	0	0	1	0													2940
REGIONS						3														
BLOCK		6		2		1														2950
MEDIA					5,		6,	1000,		7,	1000,	1000								2960
SURFACES					6,		7,	19,		11,	12									2970
SECTOR	-1	0	0	0	0	0														2980
SECTOR	1	-1	0	0	0	0														2990

SECTOR	0	1	0	0	-1	3000
SECTOR	0	0	-1	-1	1	3010
SECTOR	0	0	1	0	0	3020
SECTOR	0	0	0	1	0	3030
REGIONS			3			
BLOCK	1		1		1	3040
MEDIA			1000			3050
REGIONS			1			
BLOCK	2		1		1	3060
MEDIA			1000			3070
REGIONS			1			
BLOCK	3		1		1	3080
MEDIA			1000			3090
REGIONS			1			
BLOCK	4		1		1	3100
MEDIA			1000			3110
REGIONS			1			
BLOCK	5		1		1	3120
MEDIA			1000			3130
REGIONS			1			
BLOCK	6		1		1	3140
MEDIA			1000			3150
REGIONS			1			
BLOCK	1		3		1	3160
MEDIA			1000			3170
REGIONS			1			
BLOCK	2		3		1	3180
MEDIA			1000			3190

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REGIONS		4							
BLOCK	3	1	1						3460
MEDIA		8,	9,	9,	6,	1000			3470
SURFACES		2,	5,	6,	13				3480
SECTOR	-1	-1	0	0					3490
SECTOR	0	1	-1	0					3500
SECTOR	1	0	-1	0					3510
SECTOR	0	0	1	-1					3520
SECTOR	0	0	0	1					3530
REGIONS		4							
BLOCK	4	1	1						3540
MEDIA		9,	6,	1000					3550
SURFACES		6,	13						3560
SECTOR	-1	0							3570
SECTOR	1	-1							3580
SECTOR	0	1							3590
REGIONS		4							
ZONE	1	1	7						3600
X BLOCK		-16.3525,	16.3525						3610
Y BLOCK		-23.5055,	23.5055						3620
Z BLOCK		-2.5146,	1.471						3630
BLOCK	1	1	1						3640
MEDIA		6,	6,	10,	1000,	1000			3650
SURFACES		6,	13,	14,	15				3660
SECTOR	1	-1	0	1					3670
SECTOR	0	-1	1	-1					3680
SECTOR	-1	0	0	1					3690
SECTOR	0	1	1	0					3700
SECTOR	0	0	-1	0					3710

REGIONS

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22 QUADRIC SURFACES, DRUMS OUT, 4 BIASING REGIONS

1.0XSQ	1.0YSQ	-130.55782	\$		3730
1.0X	-1.73205Y	-19.4672	\$		3740
1.0X	1.73205Y	19.4672	\$		3750
1.0X	-1.73205Y	19.4672	\$		3760
1.0X	1.73205Y	-19.4672	\$		3770
1.0XSQ	1.0YSQ	-127.04108	\$		3780
1.0XSQ	1.0YSQ	-129.92010	\$		3790
1.0X	.26794Y	14.4186	\$		3800
1.0X	-1.0Y	23.52820	\$		3810
1.0X	.26794Y	-14.4186	\$		3820
1.0X	-1.0Y	-23.52820	\$		3830
1.0XSQ	1.0YSQ	-133.74044	\$		3840
1.0XSQ	1.0YSQ	-134.29913	\$		3850
1.0XSQ	1.0YSQ	1.0ZSQ	-93.98Z	\$	00003860
1.0XSQ	1.0YSQ	1.0ZSQ	-93.98Z		00003870
29.93946	\$				3880
1.0XSQ	1.0YSQ	-29.16X	-28.916Y		00003890
339.7529	\$				3900
1.0XSQ	1.0YSQ	29.16X	28.916Y		00003910
339.7529	\$				3920
1.0X	1.0Y	23.5282	\$		3930
1.0X	1.0Y	-23.5282	\$		3940
1.0	XSQ	1.0	YSQ	-2.36145	\$
1.0	Z	+23.4469	\$		
1.0	Z	+14.1124	\$		

3. Input to Source Routine for Core-Mapping Problem

2	11	21										
1.5370	3.4489	4.6691	5.6637	6.5443	7.3602							
8.1391	8.9000	9.6589	10.4320	11.2390								
.010462	.010193	.009764	.009408	.008922	.008401							
.007842	.007243	.006597	.005894	-0								
-35.1150	-19.3483	-16.4308	-14.6577	-13.2966	-12.2599							
-11.3509	-10.5525	-9.8507	-9.2167	-8.5981	-8.0790							
-7.5599	-7.0499	-6.5973	-6.1447	-5.6921	-5.2618							
-4.8412	-4.4206	-4.0000										
.217090	.999443	.962873	.910659	.855469	.805214							
.755987	.708920	.664638	.622449	.579482	.542195							
.503929	.465076	.429858	.394170	.357643	.322493							
.287788	.252476	.217090										
2	5	11										
35.1150	-24.2250	-16.4460	-8.6670	-4.0000								
1.000000	.949557	.895898	.842228	.774077	.704751							
.611731	.506629	.339123	.019763	-1.000000								
1.000000	.943056	.883712	.821359	.749103	.675011							
.573246	.455743	.285995	-.041101	-1.000000								
1.000000	.931528	.861541	.785151	.705558	.610992							
.509876	.371070	.183987	-.175798	-1.000000								
1.000000	.909689	.817622	.721452	.618734	.511330							
.384659	.236128	.026786	-.336458	-1.000000								
4	6	8	9	11	12	14	18	24	38	9		
	.0685		.1108		.0876		.1084		.1224		.2417	.091
	.1773		.0708		.0125							.101
												.102
4	7											.111
	18.0		8.18		4.5		2.02		1.35		.608	.121
	.4076											.122
	.6246		.7056		.7624		.7885		.8191		.8713	.131
	.5534		.6350		.6990		.7342		.7825		.8657	.132
	.4023		.4847		.5526		.5938		.6706		.8253	.133
	.3432		.2307		.2526		.2857		.3034		.4613	.134

APPENDIX H

APPENDIX H

SNARLS Input for Source Tape Preparation

SNARLS FULL ADJOINT SN BIAS 50 BATCHES OF 800 NEUTS. SOURCE TAPE BIAS						
1	1	3	5	0	50	2
		9	1	1	7	3
0	2	1	4	1	1	4
		40.0	1.48	60.96		5
12.2	10.0	8.18	6.70	5.49	4.5	61
3.68	2.02	.1				62
.7	.7	.7	.7	.7	.7	71
.7	.7	.7				72
.333	.333	.333	.333	.333	.333	81
.333	.333	.333				82
.333	.333	.333	.333	.333	.333	91
.333	.333	.333				92
3.0	3.0	3.0	3.0	3.0	3.0	101
3.0	3.0	3.0				102
11.239	60.96					121
1753050573664455	1					
.789-4	2.61-4	8.15-4	2.40-3	6.63-3	1.71-2	141
4.34-2	1.73-1	4.64+0				142
2.77-4	.917-3	2.86-3	8.42-3	2.33-2	6.00-2	151
1.52-1	6.07-1	16.3+0				152

APPENDIX I

Appendix I

1. Input Instructions - ACTIFK User Subroutine STBATCH

This input is for the analysis of O5R collision tapes prepared for the SNAP-TSF core mapping problem with collimator response function used. The space-energy detector index is defined by card 5 instructions.

This input follows the ACTIFK geometry input.

Card 1. FORMAT(I5)

NODET: the number of detector locations; ≤ 10 .

Card 2. FORMAT(7E10.5) for I = 1, NODEL

XSR(I): x-coordinate of the detector

YSR(I): y-coordinate of the detector

ZST(I): z-coordinate of the detector

A(I): distance along collimator axis from (XSR, YSR, ZSR) at
which the pseudo-detector lies

UDET(I): x-direction cosine of the collimator axis

VDET(I): y-direction cosine of the collimator axis

WDET(I): z-direction cosine of the collimator axis

Card 3. FORMAT(I12)

NESPEC: number of energy group boundaries for all detectors;

NESPEC ≤ 20 .

Card 4. FORMAT(6E12.5)

ESPEC(I), I = 1, NESPEC: energy group boundaries, in MeV, from
low to high energy

Card 5. FORMAT (6I12)

NRSH: number of space-energy detectors for the full analysis
of statistics ($\text{NRSH} \leq 10$).

NRSH1(I), I = 1, NRSH: the space-energy detector index for the
full analysis of statistics; the maximum value for NRSH1(I)
is $\text{NODET} * (\text{NESPEC} - 1)$; if II is the space detector index
and JJ is the energy index, then $\text{NRSH1}(I) = (\text{NESPEC} - 1) * (II - 1) + JJ$.

2. Modified Version of User Subroutine STBATCH For
ACTIFK Core Mapping with Response Function

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SUBROUTINE STBATCH
COMMON/UNCOL/UNCFLUX(100),FLUX(100),FLUX1(100),VAR(100),FBAT,FBATI 6 010
COMMON/COLLI/XSR(10),YSR(10),ZSR(10),A(10),UDET(10),VDET(10),WDET(
10)
COMMON/DET/NODET,XDET(10),YDET(10),ZDET(10)
COMMON/CONSTS/CONU(10),CONW(10),CONIV(10),CONIW(10)
COMMON/SPEC/NESPEC,NESPEC1,ESPEC(20),NRSH,NRSH1(10) 6 040
COMMON/CPLIST/NCOLL(8),NAME(8),SI2(8),X(8),Y(8),Z(8),WATE(8),SPOLD
1(8),UOLD(8),VOLD(8),WOLD(8),OLDWT(8),NGRP(8),LELEM(8),NMED(8), 6 070
2DUM(8) 6 080
COMMON/ASINGLES/NSTRT,NITS,NBIN,NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP
1E,NFTAPE1,NFTAPE2,NFTAPEP,MEDIA,NHISTR,NHISMx,NWPCOL,NSGP,NCOLPR,N
2ANISOEL,NDSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,IB,NCPSB2,NCPNGP,
3NCPELEM,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTABLE,NGEOM,NM,MGZ,NO
4NEUT,NYSUM,NZR,IVAR
DATA(IFIRST#0)
IF(IFIRST) 1,1,2
1 IFIRST#1
CALL O5RSET(NHISTR,NHISMx,NREC,NTYPE,NCOLL,NAME,SI2,X,Y,Z,WATE,SPO
ILD,UOLD,VOLD,WOLD,OLDWT,NGRP,LELEM,NMED)
READ(50,1000)NODET,(XSR(10),YSR(10),ZSR(10),A(10),UDET(10),VDET 30420504
1(10),WDET(10),IO#1,NODET) 30420505
1000 FORMAT(I5/(7E10.5)) 30420507
100 FORMAT(I12/(6E12.5)) 6 220
DO 150 IO#1,NODET 30420509
ABCDE#A(10)
U#UDET(10)
V#VDET(10)
W#WDET(10)

```

```

CON#1.0/SQRTF(W*W+U*U)
CONI#1.0/SQRTF(W*W+V*V)
CONU(IO)#U*CON
CONW(IO)#-W*CON
CONIV(IO)#V*CONI
CONIW(IO)#-W*CONI
XDET(IO)#XSR(IO)+ABCDE*U
YDET(IO)#YSR(IO)+ABCDE*V
150 ZDET(IO)#ZSR(IO)+ABCDE*W
WRITE(51,2000) (XDET(IO),YDET(IO),ZDET(IO),A(IO),XSR(IO),YSR(IO), 30420517
IZSR(IO),
IUDET(IO),VDET(IO),WDET(IO),IO#1,NODET) 30420518
2000 FORMAT(105HIPSEUDO-DETECTORS XDET,YDET,ZDET LOCATED AT DISTANCE A 30420603
IFROM XSR,YSR,ZSR IN DIRECTION U,V,W ARE AS FOLLOWS/1H0,8X,3HXDT, 30420604
210X,3HYDT, 10X,3HZDT, 12X,1HA,10X,3HXS,10X,3HYSR,10X,3HZSR,8X, 30420605
31HU,8X,1HV,8X,1HW/1H /(1H ,E11.4,6E13.4,3F9.5)) 30420606
READ 100,NESPEC,(ESPEC(I),I#1,NESPEC) 6 300
C ESPEC VALUES FROM LOW TO HIGH ENERGY, MEV 6 310
PRINT 104,(ESPEC(I),I#1,NESPEC) 6 320
104 FORMAT (1H0,7DETECTOR ENERGY BOUNDARIES, MEV7//(1H ,8E12.3)) 6 330
NESPECI#NESPEC-1 6 340
PRINT 105,NESPECI 6 350
105 FORMAT (1H0,7NUMBER OF DETECTOR ENERGY BINS7//1H ,I12) 6 360
DO 20 I#1,NESPEC 6 370
20 ESPEC(I)#1.91322E+18*ESPEC(I) 6 380
READ 106,NRSH,(NRSHI(I),I#1,NRSH) 6 390
106 FORMAT (6I12) 6 400
PRINT 107,(NRSHI(I),I#1,NRSH) 6 410
107 FORMAT (1H0,7DETECTOR-ENERGY INDEX FOR STATISTICAL ANALYSIS7//1H , 6 420
110I6) 6 430
DO 10 I#1,100 6 440
FLUX(I)#0.0 6 450

```



```

FLUX1(I)#0.0
VAR(I)#0.0
19 UNCFUX(I)#0.0
FBAT#0.0
2 CONTINUE
RETURN
END

```

```

6 460
6 470
6 480
6 490

```

3. Modified Version of User Subroutine SDATA For ACTIFK Core Mapping With Response Function

```

SUBROUTINE SDATA
COMMON/CPLIST/NCOLL(8),NAME(8),SI2(8),X(8),Y(8),Z(8),WATE(8),SPOLD
1(8),UOLD(8),VOLD(8),WOLD(8),OLDWT(8),NGRP(8),LELEM(8),NMED(8),
2DUM(8)
COMMON/DET/NODET,XDET(10),YDET(10),ZDET(10)
COMMON/COLL1/XSR(10),YSR(10),ZSR(10),D(10),UDET(10),VDET(10),WDET(
110)
COMMON/CONSTS/CONU(10),CONW(10),CONIV(10),CONIW(10)
COMMON/ASINGLES/NSTRT,NITS,NBIN,NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP
1E,NFTAPE1,NFTAPE2,NFTAPEP,MEDIA,NHISTR,NHISMV,NWPCOL,NSGP,NCOLPR,N
2ANISOEL,NDSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,IB,NCPSB2,NCPNGP,
3NCPELEM,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTABLE,NGEOM,NM,MGZ,NO
4NEUT,NYSUM,NZR,IVAR
NMED(KTH)#NMED(KTH)-3
SPD2#SI2(KTH)
IF(SPD2-ECUT) 2,1,1
1 XA#X(KTH)
YA#Y(KTH)
ZA#Z(KTH)
DO 19 I#1,NODET
XD#XDET(I)
YD#YDET(I)
ZD#ZDET(I)

```

```

4 010
4 020

```

8

```

4 070

```

```

A#XA-XD
B#YA-YD
C#ZA-ZD
U#UDET(I)
V#VDET(I)
W#WDET(I)
S#ABSF(A*U+V*B+C*W)
XAMXP#A-S*U
YAMYP#B-S*V
ZAMZP#C-S*W
XDIST#ABSF(CONW(I)*XAMXP+CONU(I)*ZAMZP)
YDIST#ABSF(CONIW(I)*YAMYP+CONIV(I)*ZAMZP)
SN#MAXIF(XDIST,YDIST)
SNN#SN/SQRTF(SN**2+S**2)
C .083 IS THE MAX SIN(ALPHA) IN THE TABLE
IF(SNN-.083) 15,15,19
15 XD#XSR(I)
YD#YSR(I)
ZD#ZSR(I)
A#XD-XA
B#YD-YA
C#ZD-ZA
SD2#A*A+B*B+C*C
SD#SQRTF(SD2)
CALL EUCLID(XA,YA,ZA,XD,YD,ZD,SD,SPD2,ARG,0)
C .07957753#1.0/(4.0*3.14159)
IDET#I
CONT#WATE(KTH)*EXPF(ARG)*RSPF(S,SNN)*
I .07957753/SD2
IDOS#0
CALL SCORE(IDET,IDOS,CONT,SPD2)
19 CONTINUE
2 RETURN
END

```

4	260
4	270
4	280
4	300
4	310
4	320

4. Modified Version of User Subroutine RELCOL for ACTIFK
Core Mapping with Response Function

```

SUBROUTINE RELCOL
COMMON/CPLIST/NCOLL(8),NAME(8),SI2(8),X(8),Y(8),Z(8),WATE(8),SPOLD
1(8),UOLD(8),VOLD(8),WOLD(8),OLDWT(8),NGRP(8),LELEM(8),NMED(8),      5  030
2DUM(8)                                                                5  040
COMMON/CONSTS/CONU(10),CONW(10),CONIV(10),CONIW(10)
COMMON/COLLI/XSR(10),YSR(10),ZSR(10),D(10),UDET(10),VDET(10),WDET(
110)
COMMON STORAG(1)
COMMON/DET/NODET,XDET(10),YDET(10),ZDET(10)
COMMON/AMEDELEM/ALFA(32,8),BETA(32,8),ALFABETA(32,8),
ILFI(32,8),ASSES(32,8)
COMMON/ASINGLES/NSTRT,NITS,NBIN,NETAPE,ETOP,EBOT,ECUT,NXTAPE,NYTAP
1E,NFTAPE1,NFTAPE2,NFTAPEP,MEDIA,NHISTR,NHISMx,NWPCOL,NSGP,NCOLPR,N
2ANISOEL,NDSGP,NLAST,KTH,NGROUP,LBATCH,NVAR,NF,NL,IB,NCPSB2,NCPNGP,
3NCPPELEM,NCPMED,NTYPE,DOSE,NRSUM,NZRO,NBSUM,NYTABLE,NGEOM,NM,MGZ,NO
4NEUT,NYSUM,NZR,IVAR
NMED(KTH)#NMED(KTH)-3      5  151
IF (NMED(KTH)) 2,2,1      5  152
1 CONTINUE                5  153
NN#NAME(KTH)
XA#X(KTH)
YA#Y(KTH)
ZA#Z(KTH)
SB#SQRTF(SPOLD(KTH))
JELEM#LELEM(KTH)
MED#NMED(KTH)
WTI#WATE(KTH)
XMASS#ASSES(JELEM,MED)
UOL#UOLD(KTH)
VOL#VOLD(KTH)
WOL#WOLD(KTH)
DO 100 I#1,NODET

```

```

XD#XDET(I)
YD#YDET(I)
ZD#ZDET(I)
A#XA-XD
B#YA-YD
C#ZA-ZD
U#UDET(I)
V#VDET(I)
W#WDET(I)
S#ABSF(A*U+V*B+C*W)
XAMXP#A-S*U
YAMYP#B-S*V
ZAMZP#C-S*W
XDIST#ABSF(CONW(I)*XAMXP+CONU(I)*ZAMZP)
YDIST#ABSF(CONIW(I)*YAMYP+CONIV(I)*ZAMZP)
SN#MAXIF(XDIST,YDIST)
SNN#SN/SQRTF(SN**2+S**2)
C .083 IS THE MAX SIN(ALPHA) IN THE TABLE
IF(SNN-.083) 15,15,180
15 XD#XSR(I)
YD#YSR(I)
ZD#ZSR(I)
A#XD-XA
B#YD-YA
C#ZD-ZA
SD2#A*A+B*B+C*C
SD#SQRTF(SD2)
COSLB#(A*UOL+B*VOL+C*WOL)/(SD*SB)
IF(ABSF(XMASS)-1.008140) 20,20,25

```

20	IF(COSLB) 180,25,25		
25	IF(XMASS) 35,35,30		
30	CALL ELAS(COSLB,VA2,FMU)		
	GO TO 45		
35	CALL NONELAS(COSLB,VA2,FMU)		
40	IF(FMU) 180,180,45		
45	IF(VA2-ECUT) 180,50,50		
50	CALL EUCLID(XA,YA,ZA,XD,YD,ZD,SD,VA2,ARG,0)	5	500
	CONT#WT1*EXP(ARG)*FMU*RSPF(S,SNN)/SD2		
	IDET#1	5	510
	IDOS#1	5	530
	CALL SCORE(IDET,IDOS,CONT,VA2)	5	540
180	CONTINUE		
2	CONTINUE	5	560
	RETURN		
	END		

APPENDIX J

Appendix J

1. Write-up of ACTIFK user subroutine RSPF(ZIN,SNN)

Purpose: RSPF calculates the response function of the square collimator by linear interpolation between values of a table of function values calculated for discrete values of two independent variables. The independent variables are

- (1) the distance along the collimator axis from the pseudo-detector to the plane perpendicular to the collimator axis and containing the collision point
- (2) the sine of the angle which can be constructed using the following lengths of the opposite and adjacent sides and their condition of perpendicularity. The side opposite is the larger of the perpendicular distances from the collision point to either the X - Z or Y - Z plane of the collimator axis. The side adjacent is (1) defined above.

Calculation of Arguments ZIN and SNN: The following knowledge is made use of by the calling program to calculate the input arguments to the interpolating routine.

U, V, W - direction cosines of the collimator axis

X_D, Y_D, Z_D - coordinates of a pseudo-point detector

X_A, Y_A, Z_A - coordinates of a collision point in the reactor

(real or source)

The unit vector from the pseudo-point detector to the collision point is

$$\underline{L} = \frac{(X_A - X_D)\underline{i}}{|\underline{L}|} + \frac{(Y_A - Y_D)\underline{j}}{|\underline{L}|} + \frac{(Z_A - Z_D)\underline{k}}{|\underline{L}|} .$$

where $|\underline{L}| = ((X_A - X_D)^2 + (Y_A - Y_D)^2 + (Z_A - Z_D)^2)^{1/2}$.

Then the distance from the pseudo detector along the collimator axis to the plane $\perp$ to collimator axis and in which the collision point lies is

$$S = |\underline{L} \cos \theta| = |(X_A - X_D)u + (Y_A - Y_D)v + (Z_A - Z_D)w| . \quad (1)$$

The coordinates at which the collimator axis intersects this plane are

$$\begin{aligned} X_P &= X_D + S * U, \\ Y_P &= Y_D + S * V, \\ \text{and } Z_P &= Z_D + S * W. \end{aligned}$$

In order to calculate the sine of the angle of interest, it is necessary to know the lengths of the two line segments having constant height Y_P and constant height Z_P which are projections of the vector from (X_P, Y_P, Z_P) to (X_A, Y_A, Z_A) in the perpendicular plane. This is equivalent to finding the perpendicular distance d_1 , from (X_A, Y_A, Z_A) to the plane passing through the collimator axis and extending infinitely in the Y-direction and to finding the perpendicular distance d_2 , from (X_A, Y_A, Z_A) to the plane passing through the collimator axis and extending infinitely in the X-direction. The equations of the two planes are respectively

$$\frac{Z - Z_P}{W} = \frac{X - X_P}{U} \quad (2)$$

and

$$\frac{Z - Z_P}{W} = \frac{Y - Y_P}{V} . \quad (3)$$

Thus, $0 = U(Z - Z_p) - W(X - X_p),$

and $d_1 = \frac{|W(Z_A - Z_p) - W(X_A - X_p)|}{(U^2 + W^2)^{1/2}} .$

Similarly, $0 = V(Z - Z_p) - W(Y - Y_p) ,$

and $d_2 = \frac{|V(Z_A - Z_p) - W(Y_A - Y_p)|}{(V^2 + W^2)^{1/2}} .$

Since we are dealing with a square collimator, i.e., the locus of points having equal response functions is the sides of a square, the maximum of d_1, d_2 is used to compute the sine of the angle of interest so that

$$\sin \alpha = \frac{\max\{d_1, d_2\}}{((\max\{d_1, d_2\})^2 + S^2)^{1/2}} . \quad (4)$$

Equations 1 and 4, calculating S and $\sin \alpha$, represent the arguments ZIN and SNN which are input from the calling routine via the function argument list.

Labeled Common FUNCRR:

Form: COMMON/FUNCRR/FCTS(20,10),Z(10),SINALP(20)

Array Definitions:

((FCTS(I,J) I = 1, 20, J = 1, 10)

FCTS_{i,j} are calculated tabular values of the response function. The index i is on sine values, and the index j is on distance values. The definitions of the sine and distance to be used in the interpolation are given in the paragraph describing the purpose of the routine RSPF.

(Z(J), J = 1, 10)

Z_j are distance values in centimeters for which the calculated tabular values of the response function are given. The original Z values have had 91.1 cm. added to them in order to take into account the geometry with which they are being used. The value are stored in ascending order of magnitude.

(SINALP(I), I = 1, 20)

SINALP are sine values for which the calculated tabular values of the response function are given. The values are stored in ascending order of magnitude.

Array Values: The data used in common FUNCRR are given in Appendix J, section 3.

Discussion: In order to get values for the arrays FCTS, Z, and SINALP into common INTERP without reading the data from cards, a CODAP subroutine identified as FUNCRRS was assembled giving a binary deck containing the data listed above.

Labeled Common COUNT:

Form: COMMON/COUNT/JZKNT1,JZKNT2

Variable Definitions:

JZKNT1 - counts the number of times in a run that the argument

ZIN is less than Z(1).

JZKNT2 - counts the number of times in a run that the argument

ZIN is greater than Z(5).

Discussion: JZKNT1 and JZKNT2 are placed in labeled common to facilitate debugging of this routine.

Variables Initialized by Data Statement:

Form: DATA(ISIN=17)(IZIN=5)(JZKNT1=0)(JZKNT2=0)

Variable Definitions Not Made Previously:

ISIN - the number of non-zero values in the array SINALP. $ISIN \leq 19$

IZIN - the number of non-zero values in the array Z. $IZIN \leq 9$.

Method of Interpolation:

1. Find i such that

$$SINALP_i < SNN \leq SINALP_{i+1}$$

Find j such that

$$Z_j < ZIN \leq Z_{j+1}$$

2. Compute

$$FSI = [FCTS_{i,j}(ZIN - Z_{j+1}) - FCT_{i,j+1}(ZIN - Z_j)] / (Z_j - Z_{j+1})$$

$$FSIP1 = [FCTS_{i+1,j}(ZIN - Z_{j+1}) - FCT_{i+1,j+1}(ZIN - Z_j) / Z_j - Z_{j+1})$$

3. Compute FUNCRR

$$FUNCRR = \frac{FSI(SIN - SINALP_{i+1}) - FSIP1(SIN - SINALP_i)}{(SINALP_i - SINALP_{i+1})}$$

Step 2 is linear interpolation for function values with the interpolation based on Z-values in the table and the value of ZIN.

Step 3 is linear interpolation between the function values found in Step 2 with the interpolation based on SINALP-values in the table and the value of SNN.

It should be noted that interpolating first on SINALP rather than ZIN could give different response values.

If SNN is greater than SINALP(ISIN), FUNCRR is set to zero. If $ZIN < Z(1)$, or if $ZIN > Z(IZIN)$, the function value with index $J = 1$ or index $J = IZIN$ respectively is used in Step 2. Messages are printed whenever ZIN is outside the range of the table of Z values and counts are kept of the number of times this happens.

2. Response Function Interpolation Routine Written
For ACTIFK Core-Mapping Problem

FUNCTION RSPF(ZIN,SNN)	
COMMON/COUNT/JZKNT1,JZKNT2,JZFLG	30420102
COMMON/FUNCRR/FCTS(20,10),Z(10),SINALP(20)	30420103
COMMON/TEST/II,JJ	
DATA(ISIN#17)(IZIN#5)(JZKNT1#0)(JZKNT2#0)(IZINMI#4)(JZFLG#0)	30420105
IF(SNN-SINALP(1)) 30,30,40	
30 II#1	
GO TO 85	
40 DO 50 I#2,ISIN	
IF(SNN-SINALP(I)) 55,56,50	
50 CONTINUE	30420116
RSPF#0.0	
RETURN	30420119
55 II#I-1	
GO TO 85	
56 II#I	
85 IF(ZIN-Z(1)) 90,95,100	
90 JZKNT1#JZKNT1+1	30420205
WRITE(51,2000) ZIN,JZKNT1	30420207
2000 FORMAT(1H ,10HSHORT ZS #E11.5,2X,13HSHORT COUNT #17)	30420209
95 JJ#1	30420213
ZIN#Z(1)	
GOTO200	30420215
100 DO 150 J#2,IZIN	
IF(ZIN-Z(J)) 160,165,150	
150 CONTINUE	30420310
JZKNT2#JZKNT2+1	30420311
WRITE(51,2001) ZIN,JZKNT2	30420312
2001 FORMAT(1H ,9HLONG ZS #E11.5,2X,12HLONG COUNT #17)	30420314
ZIN#Z(IZIN)	
JJ#IZIN	
GO TO 200	

```

160 JJ#J-1
    GO TO 200
165 JJ#J
200 FSI#(FCTS(II,JJ)*(ZIN-Z(JJ+1))-FCTS(II,JJ+1)*(ZIN-Z(JJ)))/(Z(JJ)-Z
    I(JJ+1)) 304204
    FSIPI#(FCTS(II+1,JJ)*(ZIN-Z(JJ+1))-FCTS(II+1,JJ+1)*(ZIN-Z(JJ)))/(Z
    I(JJ)-Z(JJ+1)) 30420406
    RSPF *(FSI*(SNN-SINALP(II+1))-FSIPI*(SNN-SINALP(II)))/(SINALP(II)
    I-SINALP(II+1)) 30420411
    RETURN 30420412
    END 30420417
        30420418
        30420422
        30420424

```

3. Assembled Common FUNCRR Containing Tabular Response Function
Values Used by Function RSPF For ACTIFK Core-Mapping Problem

	IDENT	FUNCRRS	1
FUNCRR	BLOCK	230	2
	COMMON	FCTS(20,10)	3
	COMMON	Z(10)	4
	COMMON	SINALP(20)	5
	ORGR	FCTS	6
	REM	FCTS	7
	DEC	1.015	FCTS(1,1)
	DEC	1.015	FCTS(2,1)
	DEC	1.000	FCTS(3,1)
	DEC	0.975	FCTS(4,1)
	DEC	0.930	FCTS(5,1)
	DEC	0.860	FCTS(6,1)
	DEC	0.730	FCTS(7,1)
	DEC	0.530	FCTS(8,1)
	DEC	0.420	FCTS(9,1)
	DEC	0.250	FCTS(10,1)
	DEC	0.120	FCTS(11,1)
	DEC	0.015	FCTS
	DEC	0.0076	FCTS(13,1)
	DEC	0.0052	FCTS(14,1)

DEC	.0035	FCTS(15,1)
DEC	.001	FCTS(16,1)
DEC	0.0	FCTS(17,1)
DEC	0.0	FCTS(18,1)
DEC	0.0	FCTS(19,1)
DEC	0.0	FCTS(20,1)
DEC	1.015	FCTS(1,2)
DEC	1.010	FCTS(2,2)
DEC	0.985	FCTS(3,2)
DEC	0.945	FCTS(4,2)
DEC	0.880	FCTS(5,2)
DEC	0.780	FCTS(6,2)
DEC	0.625	FCTS(7,2)
DEC	0.420	FCTS(8,2)
DEC	0.295	FCTS(9,2)
DEC	0.170	FCTS(10,2)
DEC	0.075	FCTS(11,2)
DEC	0.0061	FCTS(12,2)
DEC	0.0044	FCTS(13,2)
DEC	0.0023	FCTS(14,2)
DEC	0.0011	FCTS(15,2)
DEC	0.0	FCTS(16,2)
DEC	0.0	FCTS(17,2)
DEC	0.0	FCTS(18,2)
DEC	0.0	FCTS(19,2)
DEC	0.0	FCTS(20,2)
DEC	1.005	FCTS(1,3)
DEC	0.995	FCTS(2,3)
DEC	0.96	FCTS(3,3)
DEC	0.915	FCTS(4,3)
DEC	0.835	FCTS(5,3)
DEC	0.70	FCTS(6,3)
DEC	0.54	FCTS(7,3)
DEC	0.35	FCTS(8,3)
DEC	0.25	FCTS(9,3)
DEC	0.145	FCTS(10,3)

DEC	0.06	FCTS(11,3)
DEC	0.0035	FCTS(12,3)
DEC	0.0025	FCTS(13,3)
DEC	0.0012	FCTS(14,3)
DEC	0.0003	FCTS(15,3)
DEC	0.0	FCTS(16,3)
DEC	0.0	FCTS(17,3)
DEC	0.0	FCTS(18,3)
DEC	0.0	FCTS(19,3)
DEC	0.0	FCTS(20,3)
DEC	0.995	FCTS(1,4)
DEC	0.97	FCTS(2,4)
DEC	0.928	FCTS(32,4)
DEC	0.87	FCTS(42,4)
DEC	0.78	FCTS(5,4)
DEC	0.657	FCTS(6,4)
DEC	0.470	FCTS(7,4)
DEC	0.291	FCTS(8,4)
DEC	0.181	FCTS(9,4)
DEC	0.093	FCTS(10,4)
DEC	.049	FCTS(11,4)
DEC	.0028	FCTS(12,4)
DEC	.0015	FCTS(13,4)
DEC	.0006	FCTS(14,4)
DEC	0.0	FCTS(15,4)
DEC	0.0	FCTS(16,4)
DEC	0.0	FCTS(17,4)
DEC	0.0	FCTS(18,4)
DEC	0.0	FCTS(19,4)
DEC	0.0	FCTS(20,4)
DEC	.98	FCTS(1,5)
DEC	.94	FCTS(2,5)
DEC	.89	FCTS(3,5)
DEC	.825	FCTS(4,5)
DEC	.73	FCTS(5,5)

DEC	.585	FCTS(6,5)
DEC	.385	FCTS(7,5)
DEC	.22	FCTS(8,5)
DEC	.13	FCTS(9,5)
DEC	.07	FCTS(10,5)
DEC	.035	FCTS(11,5)
DEC	.025	FCTS(12,5)
DEC	.001	FCTS(13,5)
DEC	.0003	FCTS(14,5)
DEC	0.0	FCTS(15,5)
DEC	0.0	FCTS(16,5)
DEC	0.0	FCTS(17,5)
DEC	0.0	FCTS(18,5)
DEC	0.0	FCTS(19,5)
DEC	0.0	FCTS(20,5)
DEC	0.0	1,6
DEC	0.0	2,6
DEC	0.0	3,6
DEC	0.0	4,6
DEC	0.0	5,6
DEC	0.0	6,6
DEC	0.0	7,6
DEC	0.0	8,6
DEC	0.0	9,
DEC	0.0	10,6
DEC	0.0	11,6
DEC	0.0	12,6
DEC	0.0	13,6
DEC	0.0	14,6
DEC	0.0	15,6

DEC	0.0	16.6
DEC	0.0	17.6
DEC	0.0	18.6
DEC	0.0	19.6
DEC	0.0	20.6
BSS	80	
REM	Z(10)	9
DEC	75.85	Z(1)
DEC	91.1	Z(2)
DEC	106.34	Z(3)
DEC	121.6	Z(4)
DEC	136.85	Z(5)
DEC	0.0	Z(6)
BSS	4	
REM	SINALP(20)	11
DEC	0.0	SINALP(1)
DEC	.0055	SINALP 21
DEC	.011	SINALP 31
DEC	.0165	SINALP 41
DEC	.0219	SINALP 51
DEC	.0274	SINALP 61
DEC	.0329	SINALP 71
DEC	.0384	SINALP 81
DEC	.0411	SINALP 91
DEC	.0439	SINALP101
DEC	.0466	SINALP111
DEC	.0493	SINALP121
DEC	.0548	SINALP131
DEC	.063	SINALP141
DEC	.0712	SINALP151
DEC	.079	SINALP161
DEC	.083	SINALP171
DEC	0.0	SINALP(18)
BSS	2	
END		13

APPENDIX K

2. ACTIFK Geometry Input

2	MALE		20
X ZONE	-16.3525,	16.3525	30
Y ZONE	-23.5055,	23.5055	00000040
Z ZONE	-39.7455,	-36.9794,	50
	4.0,	-2.5146,	60
		1.4710	70
ZONE	1	1	80
X BLOCK	-16.3525,	16.3525	90
Y BLOCK	-23.5055,	23.5055	100
Z BLOCK	-39.7455,	-36.9794	120
BLOCK	1	1	130
MEDIA		5,	140
SURFACES		500	150
SECTOR -1		1	160
SECTOR 1			170
ZONE	1	1	180
X BLOCK	-16.3525,	-9.73370,	190
Y BLOCK	-23.5055,	23.5055	210
Z BLOCK	-36.9794,	-35.1150	220
BLOCK	1	1	230
MEDIA		6,	240
SURFACES		3,	250
SECTOR -1	0	500	270
SECTOR 1	-1	6,	280
SECTOR 0	1	7	290
BLOCK	2	1	300
MEDIA		5,	310
SURFACES		3,	320
SECTOR 1	1	0	330
SECTOR 0	-1	-1	
SECTOR -1	0	-1	
SECTOR 0	0	1	
SECTOR 0	0	0	
BLOCK	3	1	

MEDIA 5, 6, 6, 3, 500
 SURFACES 2, 5, 6, 7
 SECTOR -1 -1 0 0
 SECTOR 0 1 -1 0
 SECTOR 1 0 -1 0
 SECTOR 0 0 1 -1
 SECTOR 0 0 0 1

350
 360
 370
 380
 390
 400
 410

BLOCK 4 1 1
 MEDIA 6, 3, 500
 SURFACES 6, 7
 SECTOR -1 0
 SECTOR 1 -1
 SECTOR 0 1

430
 440
 450
 460
 470

ZONE 1 1 3
 X BLOCK -16.3525, -9.7337, -6.6599, 0.0, 6.6599,
 9.7337, 16.3525
 Y BLOCK -23.5055, -16.8656, 16.8656, 23.5055
 Z BLOCK -35.1150, -32.5750

00000480
 490
 00000500
 510
 520

BLOCK 1 2 1
 MEDIA 2, 3, 500, 4, 500, 500
 SURFACES 6, 7, 18, 9, 12
 SECTOR -1 0 0 0 0
 SECTOR 1 -1 0 0 0
 SECTOR 0 1 0 0 -1
 SECTOR 0 0 1 1 1
 SECTOR 0 0 -1 0 0
 SECTOR 0 0 0 -1 0
 BLOCK 2 2 1

540
 550
 560
 570
 580
 590
 600
 610

MEDIA			1,	2,	2,	3,	500,	4,	500,	500
SURFACES			3,	4,	6,	7,	18,	9,	12	
SECTOR	1	1	0	0	0	0	0	0	0	
SECTOR	0	-1	-1	0	0	0	0	0	0	
SECTOR	-1	0	-1	0	0	0	0	0	0	
SECTOR	0	0	1	-1	0	0	0	0	0	
SECTOR	0	0	0	1	0	0	-1			
SECTOR	0	0	0	0	1	1	1			
SECTOR	0	0	0	0	-1	0	0			
SECTOR	0	0	0	0	0	-1	0			
BLOCK		3	2	1						

0000 630
640
650
660
670
680
690
700
710
720

MEDIA			1,	2,	2,	3,	500,	4,	4
SURFACES			3,	4,	6,	7,	12,	20	
SECTOR	1	1	0	0	0	1			
SECTOR	0	-1	-1	0	0	0			
SECTOR	-1	0	-1	0	0	0			
SECTOR	0	0	1	-1	0	0			
SECTOR	0	0	0	1	-1	0			
SECTOR	0	0	0	0	1	0			
SECTOR	0	0	0	0	0	-1			
BLOCK		4	2	1					

810

MEDIA			1,	2,	2,	3,	500,	4,	4
SURFACES			2,	5,	6,	7,	12,	20	
SECTOR	-1	-1	0	0	0	1			
SECTOR	0	1	-1	0	0	0			
SECTOR	1	0	-1	0	0	0			
SECTOR	0	0	1	-1	0	0			
SECTOR	0	0	0	1	-1	0			
SECTOR	0	0	0	0	1	0			
SECTOR	0	0	0	0	0	-1			
BLOCK		5	2	1					

900

MEDIA			1,	2,	2,	3,	500,	4,	500,	500	
SURFACES			2,	5,	6,	7,	19,	11,	12		0000 920
SECTOR	-1	-1	0	0	0	0	0				930
SECTOR	0	1	-1	0	0	0	0				940
SECTOR	1	0	-1	0	0	0	0				950
SECTOR	0	0	1	-1	0	0	0				960
SECTOR	0	0	0	1	0	0	-1				970
SECTOR	0	0	0	0	-1	-1	1				980
SECTOR	0	0	0	0	1	0	0				990
SECTOR	0	0	0	0	0	1	0				1000
BLOCK		6	2	1							1010
MEDIA			2,	3,	500,	4,	500,	500			
SURFACES			6,	7,	19,	11,	12				1030
SECTOR	-1	0	0	0	0						1040
SECTOR	1	-1	0	0	0						1050
SECTOR	0	1	0	0	-1						1060
SECTOR	0	0	-1	-1	1						1070
SECTOR	0	0	1	0	0						1080
SECTOR	0	0	0	1	0						1090
BLOCK		1	1	1							1100
MEDIA			500								
BLOCK		2	1	1							1120
MEDIA			500								
BLOCK		3	1	1							1140
MEDIA			500								
BLOCK		4	1	1							1160
MEDIA			500								
BLOCK		5	1	1							1180
MEDIA			500								
BLOCK		6	1	1							1200

MEDIA		4,	500,	500	
SURFACES		10,	16		1570
SECTOR -1	-1				1580
SECTOR 1	0				1590
SECTOR -1	1				1600
BLOCK	3	1	1		1610
MEDIA		4,	500		
SURFACES		17			1630
SECTOR -1					1640
SECTOR 1					1650
BLOCK	4	3	1		1660
MEDIA		4,	500		
SURFACES		16			1680
SECTOR -1					1690
SECTOR 1					1700
BLOCK	4	1	1		1710
MEDIA		500			
BLOCK	5	1	1		1730
MEDIA		500			
BLOCK	6	1	1		1750
MEDIA		500			
BLOCK	1	3	1		1770
MEDIA		500			
BLOCK	2	3	1		1790
MEDIA		500			
BLOCK	3	3	1		1810

MEDIA 1, 2, 2, 3, 500, 4, 500
 SURFACES 2, 5, 6, 7, 11, 12
 SECTOR -1 -1 0 0 0 0
 SECTOR 0 1 -1 0 0 0
 SECTOR 1 0 -1 0 0 0
 SECTOR 0 0 1 -1 0 0
 SECTOR 0 0 0 1 0 -1
 SECTOR 0 0 0 0 -1 1
 SECTOR 0 0 0 0 1 0
 BLOCK 3 2 1

0 0 2150
 2160
 2170
 2180
 2190
 2200
 2210
 2220
 2230

MEDIA 1, 2, 2, 3, 500, 4, 4
 SURFACES 3, 4, 6, 7, 12, 20
 SECTOR 1 1 0 0 0 1
 SECTOR 0 -1 -1 0 0 0
 SECTOR -1 0 -1 0 0 0
 SECTOR 0 0 1 -1 0 0
 SECTOR 0 0 0 1 -1 0
 SECTOR 0 0 0 0 1 0
 SECTOR 0 0 0 0 0 -1
 BLOCK 4 2 1

2320

MEDIA 1, 2, 2, 3, 500, 4, 4
 SURFACES 2, 5, 6, 7, 12, 20
 SECTOR -1 -1 0 0 0 1
 SECTOR 0 1 -1 0 0 0
 SECTOR 1 0 -1 0 0 0
 SECTOR 0 0 1 -1 0 0
 SECTOR 0 0 0 1 -1 0
 SECTOR 0 0 0 0 1 0
 SECTOR 0 0 0 0 0 -1

ZONE	1	1	5								2410
X BLOCK		-16.3525,	-9.7337,	-6.6599,	0.0,	6.6599,					00002420
		9.7337,	16.3525								2430
Y BLOCK		-23.5055,	-16.8656,	16.8656,	23.5055						00002440
Z BLOCK		-6.54,	-4.0								2450
BLOCK	1	2	1								2460
MEDIA		2,	3,	500,	4,	500,	500				
SURFACES		6,	7,	18,	9,	12					2480
SECTOR	-1	0	0	0	0						2490
SECTOR	1	-1	0	0	0						2500
SECTOR	0	1	0	0	-1						2510
SECTOR	0	0	1	1	1						2520
SECTOR	0	0	-1	0	0						2530
SECTOR	0	0	0	-1	0						2540
BLOCK	2	2	1								2550
MEDIA		1,	2,	2,	3,	500,	4,	500,	500		
SURFACES		3,	4,	6,	7,	18,	9,	12			00002570
SECTOR	1	1	0	0	0	0	0				2580
SECTOR	0	-1	-1	0	0	0	0				2590
SECTOR	-1	0	-1	0	0	0	0				2600
SECTOR	0	0	1	-1	0	0	0				2610
SECTOR	0	0	0	1	0	0	-1				2620
SECTOR	0	0	0	0	1	1	1				2630
SECTOR	0	0	0	0	-1	0	0				2640
SECTOR	0	0	0	0	0	-1	0				2650
BLOCK	3	2	1								2660
MEDIA		1,	2,	2,	3,	500,	4,	4			
SURFACES		3,	4,	6,	7,	12,	20				
SECTOR	1	1	0	0	0	1					
SECTOR	0	-1	-1	0	0	0					
SECTOR	-1	0	-1	0	0	0					
SECTOR	0	0	1	-1	0	0					
SECTOR	0	0	0	1	-1	0					
SECTOR	0	0	0	0	1	0					
SECTOR	0	0	0	0	0	-1					

BLOCK	4	2	1									2750
MEDIA			1,	2,	2,	3,	500,	4,	4			
SURFACES			2,	5,	6,	7,	12,	20				
SECTOR	-1	-1	0	0	0	1						
SECTOR	0	1	-1	0	0	0						
SECTOR	1	0	-1	0	0	0						
SECTOR	0	0	1	-1	0	0						
SECTOR	0	0	0	1	-1	0						
SECTOR	0	0	0	0	1	0						
SECTOR	0	0	0	0	0	-1						
BLOCK	5	2	1									2840
MEDIA			1,	2,	2,	3,	500,	4,	500,	500		
SURFACES			2,	5,	6,	7,	19,	11,	12			00002860
SECTOR	-1	-1	0	0	0	0	0	0				2870
SECTOR	0	1	-1	0	0	0	0	0				2880
SECTOR	1	0	-1	0	0	0	0	0				2890
SECTOR	0	0	1	-1	0	0	0	0				2900
SECTOR	0	0	0	1	0	0	-1					2910
SECTOR	0	0	0	0	-1	-1	1					2920
SECTOR	0	0	0	0	1	0	0					2930
SECTOR	0	0	0	0	0	1	0					2940
BLOCK	6	2	1									2950
MEDIA			2,	3,	500,	4,	500,	500				
SURFACES			6,	7,	19,	11,	12					2970
SECTOR	-1	0	0	0	0							2980
SECTOR	1	-1	0	0	0							2990

SECTOR	0	1	0	0	-1							3000
SECTOR	0	0	-1	-1	1							3010
SECTOR	0	0	1	0	0							3020
SECTOR	0	0	0	1	0							3030
BLOCK		1		1	1							3040
MEDIA				500								
BLOCK		2		1	1							3060
MEDIA				500								
BLOCK		3		1	1							3080
MEDIA				500								
BLOCK		4		1	1							3100
MEDIA				500								
BLOCK		5		1	1							3120
MEDIA				500								
BLOCK		6		1	1							3140
MEDIA				500								
BLOCK		1		3	1							3160
MEDIA				500								
BLOCK		2		3	1							3180
MEDIA				500								
BLOCK		3		3	1							3200
MEDIA				500								
BLOCK		4		3	1							3220
MEDIA				500								
BLOCK		5		3	1							3240
MEDIA				500								
BLOCK		6		3	1							3260
MEDIA				500								
ZONE		1		1	6							3280
XBLOCK				-16.3525,	-9.7337,	0.0,	9.7337,	16.3525			0000	3290
Y BLOCK				-23.5055,	23.5055							3300
ZBLOCK				-4.0,	-2.5146							3310
BLOCK		1		1	1							3320

MEDIA	6,	3,	500		
SURFACES	6,	13		3340	
SECTOR -1	0			3350	
SECTOR 1	-1			3360	
SECTOR 0	1			3370	
BLOCK	2	1	1	3380	
MEDIA	5,	6,	6,	3,	500
SURFACES	3,	4,	6,	13	
SECTOR 1	1	0	0		3400
SECTOR 0	-1	-1	0		3410
SECTOR -1	0	-1	0		3420
SECTOR 0	0	1	-1		3430
SECTOR 0	0	0	1		3440
BLOCK	3	1	1		3450
MEDIA	5,	6,	6,	3,	500
SURFACES	2,	5,	6,	13	
SECTOR -1	-1	0	0		3480
SECTOR 0	1	-1	0		3490
SECTOR 1	0	-1	0		3500
SECTOR 0	0	1	-1		3510
SECTOR 0	0	0	1		3520
BLOCK	4	1	1		3530
MEDIA	6,	3,	500		3540
SURFACES	6,	13			3560
SECTOR -1	0				3570
SECTOR 1	-1				3580
SECTOR 0	1				3590
ZONE	1	1	7		3600

X BLOCK	-16.3525,	16.3525		3610
Y BLOCK	-23.5055,	23.5055		3620
Z BLOCK	-2.5146,	1.471		3630
BLOCK	I	I	I	3640
MEDIA	3,	3,	7,	500, 500
SURFACES	6,	13,	14,	15
SECTOR	I	-I	0	I
SECTOR	0	-I	I	-I
SECTOR	-I	0	0	I
SECTOR	0	I	I	0
SECTOR	0	0	-I	0
20 QUADRIC SURFACES, DRUMS OUT 30 DEGREES				
I.OXSQ	I.OYSQ	-130.55782	\$	0 3730
I.OX	-1.73205Y	-19.4672	\$	0 003740
I.OX	1.73205Y	19.4672	\$	0 0 3750
I.OX	-1.73205Y	19.4672	\$	0-003760
I.OX	1.73205Y	-19.4672	\$	000 3770
I.OXSQ	I.OYSQ	-127.04108	\$	0 0 3780
I.OXSQ	I.OYSQ	-129.92010	\$	0 0 3790
I.OX	.26794Y	14.4186	\$	00003800
I.OX	-1.OY	23.52820	\$	000 3810
I.OX	.26794Y	-14.4186	\$	0 0 3820
I.OX	-1.OY	-23.52820	\$	0 0 3830
I.OXSQ	I.OYSQ	-133.74044	\$	0 0 3840
I.OXSQ	I.OYSQ	-134.29913	\$	0 0 3850
I.OXSQ	I.OYSQ	I.OZSQ	-93.98Z	\$ 00003860
I.OXSQ	I.OYSQ	I.OZSQ	-93.98Z	00003870
29.93946	\$			3880
I.OXSQ	I.OYSQ	-29.16X	-28.916Y	00003890
339.7529	\$			3900
I.OXSQ	I.OYSQ	29.16X	28.916Y	00003910
339.7529	\$			3920
I.OX	I.OY	23.5282	\$	0 0 3930
I.OX	I.OY	-23.5282	\$	00003940
I.O	XSQ	I.O	YSQ	-2.36145

3. Input to STBATCH For ACTIFK Core Mapping with No Collimation

.0	0.0	522.18	0.0	0.0	100.0	
.0	0.0	-1.0	0.0			
12						10200
.5	1.0	1.5	2.0	2.5	3.0	10301
3.5	4.0	5.0	6.0	10.0	18.0	10302
10	4	10	15	25	29	10401
37	48	59	70	81		10402

4. Input to ACTIFK Core-Mapping Calculation with Response Function

SNAP ACTIVE CORE MAPPING ANALYSIS WITH RESPONSE FUNCTION INCLUDED--30 BATCHES

[illegible]

132

2	0	-3	0	-4	0	-5	0					6561
6	0											6562
22.99		-22.99		39.1		-39.1		52.0		-52.0	55.85	6661
55.85		58.71		-58.71								6662
2	0	-3	0									7571
22.99		-22.99		39.1		-39.1						7671
10	12	15	8									
101110001111111000100011010000000000												8800
9	3	8	3	8	8	6	14	14				8900
6												9000
1		1.0-3	1		1.5-3	7		2.5-3				9101
4		2.0-2	4		1.0-1	1		5.0-1				9102

Note: ACTIFK geometry input is listed in Appendix K, Section 2.

5. Input to STBATCH For ACTIFK Core Mapping With Response Function

5												
.0	85.32	113.76	51.1	0.0	-.6		-.8					
.0	68.983	127.98	51.1	0.0	-.4358899		-.9					
.0	92.32	113.76	51.1	0.0	-.6		-.8					
.0	75.983	127.98	51.1	0.0	-.4358899		-.9					
.0	99.32	113.76	51.1	0.0	-.6		-.8					
12												10200
.5		1.0		1.5		2.0		2.5		3.0		10301
3.5		4.0		5.0		6.0		10.0		18.0		10302
10		4		10		15		25		29		10401
37		48		59		70		81				10402

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