ANL-7416 Supplement 2
Mathematics and Computers
(UC-32)

ARGONNE CODE CENTER: BENCHMARK PROBLEM BOOK

Prepared by the
Computational Benchmark Problems Committee of the
MATHEMATICS AND COMPUTATION DIVISION
OF THE AMERICAN NUCLEAR SOCIETY

Revised June 1977

Benchmark Problems Included

11. Multi-dimensional (x-y-z) LWR Model
13. Neutron Transport in a BWR Rod Bundle
14. Multi-dimensional (x-y-z) BWR Model
15. Neutronic Depletion Benchmark Problems

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Argonne, Illinois 60439

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BENCHMARK SOURCE SITUATION

Identification: 11

Date Submitted: June 1976 By: R. R. Lee (CE)
D. A. Meneley (Ontario Hydro)
B. Micheelsen (Risø-Denmark)
D. R. Vondy (ORNL)
M. R. Wagner (KWU)
W. Werner (GRS-Munich)

Date Accepted: June 1977 By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Multi-dimensional (x-y-z) LWR Model

Suggested Functions: Designed to provide a severe test for the capabilities of coarse mesh methods and flux synthesis approximations

Configuration: Three-dimensional configuration including space dimensions and region numbers: 2 Figures

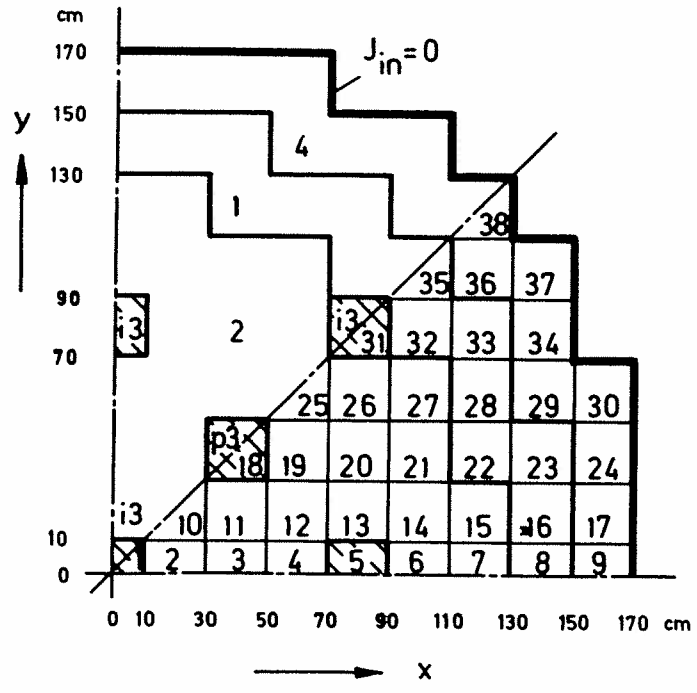


Fig. 1:
Horizontal Cross Section

Upper Octant:
Region Assignments

Lower Octant:
Fuel Assembly Identification

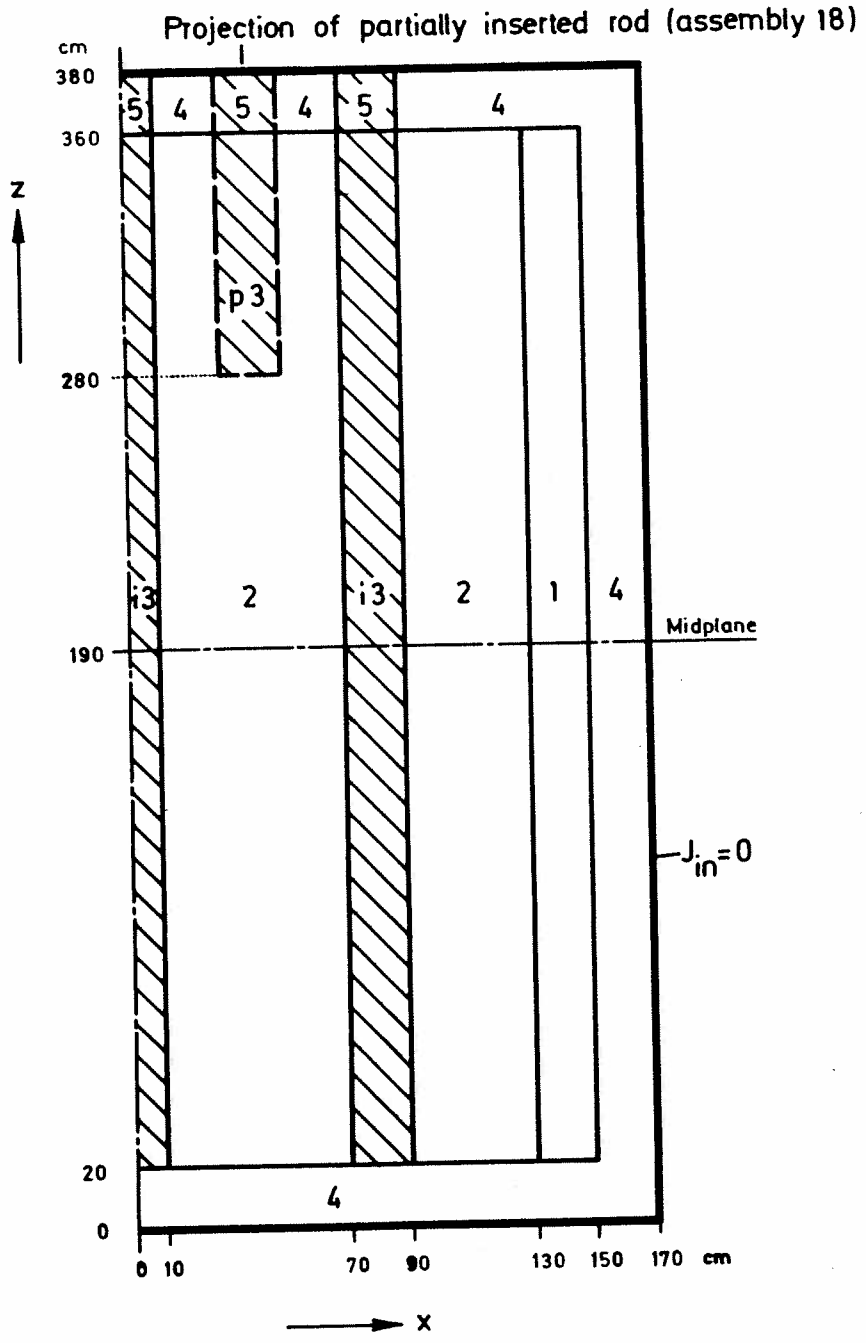


Fig. 2: Vertical Cross Section, y = 0

Boundary Conditions:

External Boundaries: Vacuum, no incoming current
Symmetry Boundaries: Reflection, no net current

BENCHMARK PROBLEM

Identification: 11-A1 Source Situation ID.11

Date Submitted: June 1976 By: R. R. Lee (CE)
D. A. Meneley (Ontario Hydro)
B. Micheelsen (Risø-Denmark)
D. R. Vondy (ORNL)
M. R. Wagner (KWU)
W. Werner (GRS-Munich)

Date Accepted: June 1977 By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Three-dimensional LWR Problem
(also 3D IAEA Benchmark Problem*)

Reduction of Source Situation:

Two-group diffusion theory

Two-Group Diffusion Equations:

$$-\nabla D_1 \nabla \phi_1 + (\Sigma_{a1} + \Sigma_{1\to 2})\,\phi_1 = \frac{1}{\lambda}\nu\Sigma_{f2}\phi_2$$

$$-\nabla D_2 \nabla \phi_2 + \Sigma_{a2}\phi_2 = \Sigma_{1\to 2}\phi_1$$

*) Benchmark Problem, originally defined by B. Micheelsen (RISØ) by letter of Dec. 14, 1971 to participants of the Panel on Reactor Burn-up Physics which was organized by the IAEA and held in Vienna, 12 - 16 July 1971

Data

Two-group Constants

Region	D_1	D_2	$\Sigma_{1\to2}$	Σ_{a1}	Σ_{a2}	$\nu\Sigma_{f2}$	Material
1	1.5	0.4	0.02	0.01	0.08	0.135	Fuel 1
2	1.5	0.4	0.02	0.01	0.085	0.135	Fuel 2
3	1.5	0.4	0.02	0.01	0.13	0.135	Fuel 2 + Rod
4	2.0	0.3	0.04	0	0.01	0	Reflector
5	2.0	0.3	0.04	0	0.055	0	Refl. + Rod

Boundary Conditions:

$J_g^{in} = 0$ No incoming current at external boundaries.

For finite difference diffusion theory codes the following form is considered equivalent

$$\frac{\partial \Phi_g}{\partial n} = -\frac{0.4692}{D_g}\,\Phi_g$$

where n the outward directed normal to the surface.
At symmetry boundaries:

$$\frac{\partial \Phi_g}{\partial n} = 0$$

Expected Primary Results:

1. Maximum eigenvalue

2. Fundamental flux distributions

2.1 Radial flux traverses in midplane z = 190 cm

ϕ_g (x, o, 190)

ϕ_g (x, x, 190)

2.2 Radial flux traverses in planes z = 275 cm and z = 285 cm

ϕ_g (x, o, 275), ϕ_g (x, o, 285)

ϕ_g (x, x, 275), ϕ_g (x, x, 285)

2.3 Axial flux traverses for partially rodded assembly

ϕ_g (40, 40, z)

Note: The fluxes ϕ_g shall be normalized such that

$$\frac{1}{V_{Core}} \int_{V_{Core}} \sum_g \nu\Sigma_{fg}\Phi_g \, dV = 1$$

2.4 Value and location of maximum power density. This corresponds to maximum of ϕ_2 in the core. It is recommended that the maximum values of ϕ_2 both in the inner core and at the core/reflector interface be given.

3. Average subassembly powers P_k

$$P_k = \frac{1}{V_k} \int_{V_k} \sum_g \nu\Sigma_{fg}\Phi_g \, dV \ ,$$

where V_k volume of the k-th subassembly and k designates the fuel subassemblies as shown in lower octant of Fig. 1

4. Number of unknowns in the problem.
Number of iterations, total and outer

5. Computing time, iteration time, IO-time, computer used

6. Type and numerical values of convergence criteria

7. Table of average group fluxes for a cubical mesh grid of 20 x 20 x 20 cm

8. Dependence of results on mesh spacing.

Best Solution Available: Extrapolated finite difference solution described in 11-A1-1

Solutions

1. Finite Difference Method: 11-A1-1
2. Finite Element Method: 11-A1-2
3. Nodal Expansion Method: 11-A1-3
4. Finite Difference Method: 11-A1-4

BENCHMARK PROBLEM SOLUTION

Identification: 11-A1-1 Benchmark Problem ID.11-A1

Date Submitted: June 1, 1976 By: D. R. Vondy, T. B. Fowler (ORNL)

Date Accepted: June 1, 1977 By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Three-Dimensional PWR Problem (IAEA)

Mathematical Model: Diffusion Theory, Various Difference Formulations

Computer: IBM-360/91 1974-76, ORNL
IBM-360/195, 1975-76, UC-CTC

Program: (1) VENTURE, ORNL-5062 Report
(2) VANCER, to be documented (ORNL)

Note: To produce acceptable solutions for benchmarking, a tighter convergence of the iterative process was used than is common practice in application, maximum relative flux change on outer iterations = 10^{-5}.

Primary Results:*

a. Primary results obtained in 1974-75 with the VENTURE code are shown in Table 1. The larger problems were initialized with the results from smaller ones and rather obsolete procedures were in use, so compute times are not representative. A number of reported results for the multiplication factor are shown in Figure 1.

b. Results have also been obtained with the VANCER code as summarized in Table 2.

c. Subassembly power density values, relative to the core average, are shown in Table 3 for the mesh-centered VENTURE cases (see the benchmark source situation for number references).

d. Subassembly power density values are shown in Table 4 for the linear finite-element case with 34x34x38 mesh intervals.

e. Table 5 is the continuing 57 pages of results. These tables of fluxes and power are for the mesh-centered VENTURE calculations, averaged over 20 centimeter cubes, one page to a plane normal to the reactor centerline, normalized to a ratio

* Extrapolation of results is done on the basis of error dependence on the square of the mesh spacing.

of productions to core volume of unity (one neutron generated per cc in the core on the average). Orientation is such that the reactor centerline is at the upper left hand corner so the first group of data is for the cube about the centerline of the core. For Power tables, the thermal flux was multiplied by $\nu\Sigma_f = 0.135$ producing results in the non-fueled zones which should be ignored. The numbers in each group are ordered as follows:

Order	Problem Meshpoints (XYZ)
1	17x17x19
2	34x34x38
3	68x68x76
4	102x102x114
5	Extrapolated for infinite points

Block 1 extends from 0-20 cm, Block 2 from 20-40 cm, etc.

ORNL-DWG 75-6720

Table 1

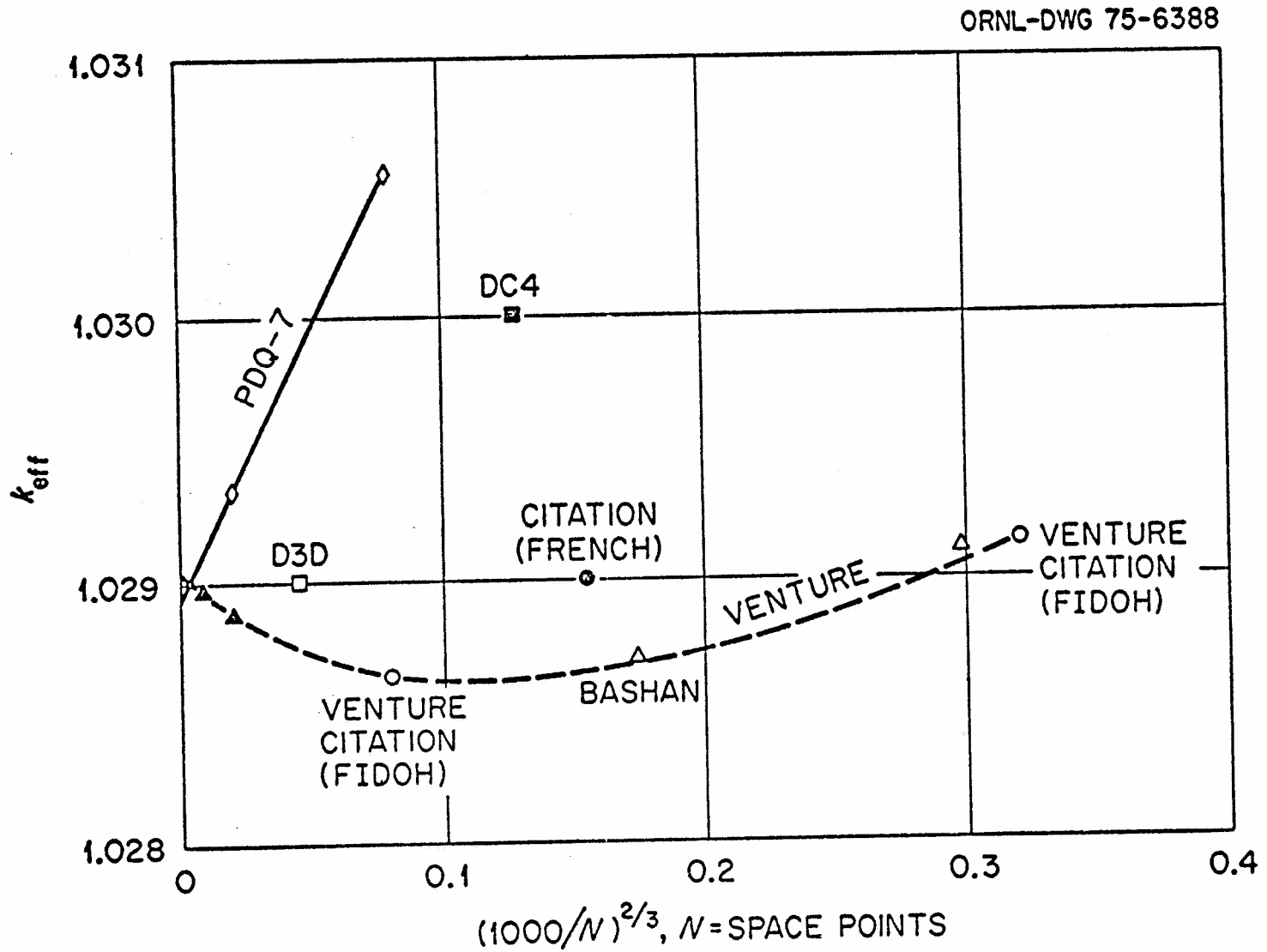
THREE-DIMENSIONAL, TWO-GROUP IAEA BENCHMARK PROBLEM RESULTS

(Non-Return External Boundary Conditions)

Meshpoints (Total Unknowns)	Multiplication Factor	Peak-to-Average Power Density*	IBM-360/91 (or 195) Processor Time (min)
9x9x10(1,620)	1.03176	2.3765	0.3 to 1.
17x17x19(10,982)	1.02913	2.5672	1.6 to 5.
34x34x38(87,856)	1.02864	2.5035	49
68x68x76(702,848)	1.02887	2.4081	192
102x102x114(2,372,112)	1.02896	2.3780	360 (195)
Extrapolated	1.02903	2.354	

*Based on neutrons produced by thermal fission, peak at a point (not interpreted between points); with mesh-center points, values at material interfaces are not estimated.

Figure 1. Three-Dimensional Finite-Difference Results



Three-Dimensional Finite-Difference Results.

Table 2. Results for Mesh-edge Point Location

Formulation (Near Neighbors)	k_{eff}	Peak Power Density	
		Internal	Reflector Edge
VENTURE, Mesh Centered (6)	1.02864	2.50	2.42
VANCER:			
Usual Finite-Difference (6)	1.03064	2.02	2.50
Linear Finite-Element (10)	1.02949	2.21	2.53
Linear Finite-Difference (10)	1.02968	2.18	2.54

Relative computation requirements are estimated at:

Formulation	Memory (Words)	Relative Computation Cost
Mesh Centered (VENTURE)	166,000	1.00
Mesh Edge (VANCER)		
Six Neighbors, Consistent Source	191,000	1.37
Ten Neighbors, Consistent Source	217,000	1.73

Table 3. Subassembly Power Densities (Axial Average)
(Non-Fuel Zone Values Given Also, Mesh Centered, VENTURE Code)

Location/Mesh Intervals	17x17x19	34x34x39	68x68x76	102x102x114	Extrapolated
1	0.7356	0.7500	0.7367	0.7325	0.729
2	1.4485	1.3780	1.3138	1.2957	1.281
3	1.5651	1.5080	1.4508	1.4347	1.422
4	1.3178	1.2657	1.2181	1.2044	1.193
5	0.5802	0.6058	0.6092	0.6098	0.610
6	0.9707	0.9631	0.9569	0.9548	0.953
7	0.9101	0.9317	0.9500	0.9551	0.959
8	0.6574	0.7056	0.7522	0.7659	0.777
(9)	0.9134	1.0125	1.0773	1.0954	1.110
10	1.5604	1.4903	1.4278	1.4109	1.397
11	1.5742	1.5158	1.4595	1.4441	1.432
12	1.4045	1.3557	1.3121	1.3002	1.291
13	1.1406	1.1119	1.0852	1.0779	1.072
14	1.0619	1.0575	1.0555	1.0553	1.055
15	0.9537	0.9438	0.9643	0.9707	0.976
16	0.6366	0.6850	0.7318	0.7460	0.757
(17)	0.8650	0.9595	1.0230	1.0413	1.056
18	1.4797	1.4369	1.3914	1.3786	1.368
19	1.4030	1.3657	1.3292	1.3192	1.311
20	1.2226	1.2067	1.1894	1.1847	1.181
21	1.0755	1.0810	1.0859	1.0877	1.089
22	0.9420	0.9602	0.9855	0.9935	1.000
23	0.5459	0.6138	0.6761	0.6953	0.711
(24)	0.6494	0.7255	0.7825	0.7993	0.813
25	1.2480	1.2180	1.1913	1.1841	1.178
26	1.0083	1.0252	0.9790	0.9753	0.972
27	0.8970	0.9062	0.9168	0.9204	0.923
28	0.7383	0.7898	0.8390	0.8541	0.866
(29)	1.4827	1.6009	1.6807	1.7039	1.722
(30)	0.2759	0.3289	0.3683	0.3802	0.390
31	0.4244	0.4542	0.4685	0.4727	0.476
32	0.6720	0.6783	0.6924	0.6969	0.700
33	0.4725	0.5284	0.5812	0.5976	0.611
(34)	0.6681	0.7462	0.8046	0.8220	0.836
35	0.4717	0.5210	0.5699	0.5852	0.597
(36)	0.9891	1.0610	1.1196	1.1373	1.151
(37)	0.2180	0.2599	0.2917	0.3015	0.309
(38)	0.2560	0.2996	0.3344	0.3451	0.354
18* Rodded Part	0.3042	0.3106	0.3095	0.3094	0.309
18** Unrodded Part	1.8414	1.7834	1.7242	1.7076	1.694

Table 4. Subassembly Power Densities (Axial Average), (Non-Fuel Zone Values Given Also, Linear Finite Element, VANCER Code)

Location/Mesh Intervals	34x34x38
1	0.7220
2	1.2652
3	1.3317
4	1.1351
5	0.6057
6	0.9450
7	0.9700
8	0.8089
(9)	1.1348
10	1.3404
11	1.3732
12	1.2408
13	1.0410
14	1.0500
15	0.9920
16	0.8000
(17)	1.1116
18	1.3174
19	1.2705
20	1.1615
21	1.0931
22	1.0260
23	0.7770
(24)	0.8752
25	1.1495
26	0.9583
27	0.9358
28	0.9203
(29)	1.8108
(30)	0.4325
31	0.4906
32	0.7186
33	0.6717
(34)	0.9038
35	0.6536
(36)	1.2214
(37)	0.3459
(38)	0.3918
18* Rodded Part	0.3162
18** Unrodded Part	1.6254

Start Table 5 (57 pages)

GROUP 1 BLOCK 1 FLUXES

0.491809							
0.581252							
0.649134							
0.680524							
0.705636							
0.583971	0.594469						
0.682275	0.693158						
0.779211	0.794509						
0.825847	0.843363						
0.863155	0.882446						
0.613919	0.568600	0.462309					
0.728490	0.669316	0.555361					
0.844799	0.770182	0.630505					
0.899898	0.818119	0.664297					
0.943976	0.856468	0.691330					
0.555433	0.562112	0.530850	0.517624				
0.660657	0.668454	0.638067	0.626610				
0.766918	0.780260	0.748714	0.743564				
0.816776	0.832811	0.800087	0.797623				
0.856662	0.874851	0.841184	0.840869				
0.446127	0.532850	0.556763	0.477717	0.343918			
0.550602	0.650789	0.689803	0.591222	0.436880			
0.639062	0.773117	0.831680	0.711253	0.521427			
0.677828	0.829231	0.896455	0.765772	0.557738			
0.708841	0.874121	0.948275	0.809386	0.586786			
0.507254	0.540605	0.540891	0.453779	0.327464	0.209493		
0.635891	0.680063	0.686835	0.578032	0.417952	0.273049		
0.771990	0.831707	0.846920	0.715725	0.520178	0.348337		
0.833461	0.900345	0.919081	0.777596	0.565760	0.381501		
0.882636	0.955255	0.976809	0.827093	0.602225	0.408032		
0.486448	0.488443	0.460142	0.344262	0.212694	0.072370	0.015321	
0.630169	0.633037	0.595724	0.451220	0.281629	0.102866	0.021879	
0.788923	0.794060	0.751906	0.575129	0.363149	0.133076	0.027831	
0.859901	0.866034	0.821690	0.629979	0.398960	0.144975	0.030053	
0.916683	0.923612	0.877516	0.673858	0.427608	0.154494	0.031830	
0.320521	0.309686	0.250241	0.109184	0.047193	0.013225	0.0	
0.422504	0.409444	0.334185	0.157344	0.068015	0.019355	0.0	
0.541035	0.525546	0.432559	0.203544	0.087984	0.024846	0.0	
0.593440	0.576833	0.475690	0.221676	0.095711	0.026887	0.0	
0.635363	0.617861	0.510195	0.236181	0.101893	0.028519	0.0	
0.067782	0.064206	0.047990	0.016969	0.0	0.0	0.0	
0.098201	0.093125	0.069499	0.024861	0.0	0.0	0.0	
0.126555	0.120286	0.090293	0.031864	0.0	0.0	0.0	
0.137531	0.130821	0.098363	0.034464	0.0	0.0	0.0	
0.146313	0.139248	0.104819	0.036545	0.0	0.0	0.0	

GROUP 1 BLOCK 2 FLUXES

5.229720							
4.876290							
4.714016							
4.699341							
4.687597							
7.068169	7.264626						
6.314484	6.470860						
6.069390	6.226661						
6.048328	6.207546						
6.031474	6.192250						
7.533952	6.883982	4.914222					
6.829825	6.191372	4.650915					
6.627941	5.992641	4.566707					
6.622412	5.984154	4.573670					
6.617984	5.977359	4.579236					
6.718606	6.859634	6.412583	6.311865				
6.097737	6.219120	5.879041	5.816854				
5.950730	6.088327	5.798501	5.784741				
5.957143	6.101273	5.823526	5.824737				
5.962269	6.111625	5.843542	5.856730				
4.729738	6.431657	6.817832	5.778264	3.669720			
4.585157	5.979685	6.424558	5.438983	3.657712			
4.596798	5.964885	6.467326	5.490326	3.770639			
4.633219	6.011244	6.534152	5.552841	3.832976			
4.662353	6.048327	6.587609	5.602849	3.882842			
6.110683	6.603089	6.648477	5.579135	4.066138	2.629845		
5.819603	6.303431	6.406042	5.397050	3.933128	2.606824		
5.927913	6.439398	6.586513	5.584503	4.109794	2.795335		
6.011868	6.535919	6.697352	5.689708	4.201124	2.878718		
6.079028	6.613131	6.786018	5.773868	4.274185	2.945422		
5.971705	6.018558	5.816412	4.344919	2.679133	0.536357	0.084783	
5.864732	5.913037	5.685014	4.311991	2.695662	0.647983	0.104392	
6.120921	6.182147	5.970173	4.586359	2.910228	0.768197	0.124815	
6.251222	6.317180	6.110500	4.710808	3.001954	0.811967	0.132157	
6.355458	6.425202	6.222757	4.810364	3.075332	0.846982	0.138031	
4.030659	3.898269	3.154867	0.807767	0.324551	0.073240	0.0	0.0
4.017229	3.897941	3.194575	0.988571	0.396238	0.092739	0.0	0.0
4.287787	4.170917	3.456249	1.169500	0.472038	0.111804	0.0	0.0
4.408357	4.291200	3.566901	1.234679	0.499421	0.118576	0.0	0.0
4.504810	4.387424	3.655421	1.286821	0.521327	0.123993	0.0	0.0
0.474359	0.450387	0.335861	0.093673	0.0	0.0	0.0	0.0
0.579692	0.550748	0.409621	0.118323	0.0	0.0	0.0	0.0
0.684175	0.651361	0.488269	0.142332	0.0	0.0	0.0	0.0
0.721501	0.687437	0.516715	0.150861	0.0	0.0	0.0	0.0
0.751362	0.716297	0.539472	0.157683	0.0	0.0	0.0	0.0

GROUP 1 BLOCK 3 FLUXES

10.640157								
10.342917								
9.949892								
9.846301								
9.763422								
14.320156	14.721536							
13.261953	13.583195							
12.631366	12.944482							
12.484147	12.797089							
12.366362	12.679166							
15.231454	13.943526	9.992692						
14.281724	12.992740	9.847260						
13.708546	12.455223	9.611246						
13.577841	12.333158	9.551445						
13.473267	12.235497	9.503597						
13.524257	13.800050	12.890597	12.629105					
12.711818	12.945987	12.230785	12.033804					
12.281475	12.537839	11.934143	11.830535					
12.189589	12.454546	11.879818	11.804875					
12.116072	12.387902	11.836349	11.784338					
9.463999	12.810762	13.559529	11.481140	7.294127				
9.543642	12.317812	13.186732	11.174188	7.564192				
9.501802	12.149380	13.103403	11.151026	7.745007				
9.499599	12.133391	13.113650	11.175657	7.809531				
9.497829	12.120592	13.121839	11.195354	7.861145				
12.048614	13.017533	13.106455	10.994577	8.003810	5.153759			
11.857074	12.822527	13.023960	10.981101	8.014895	5.285331			
11.933986	12.929055	13.211058	11.220655	8.290342	5.615988			
11.990616	12.997600	13.303586	11.324881	8.401200	5.737143			
12.035911	13.052426	13.377598	11.408254	8.489880	5.834062			
11.700757	11.795717	11.400548	8.510855	5.241037	1.043431	0.163607		
11.848229	11.950092	11.494193	8.716574	5.445371	1.306125	0.208420		
12.198562	12.325664	11.914407	9.161203	5.817193	1.537980	0.247738		
12.337196	12.472697	12.078737	9.325022	5.950086	1.613693	0.260601		
12.448095	12.590314	12.210193	9.456071	6.056397	1.674263	0.270891		
7.864830	7.607886	6.153328	1.569190	0.629551	0.141216	0.0	0.0	
8.082984	7.845747	6.428634	1.987680	0.795126	0.184904	0.0	0.0	
8.519551	8.291454	6.876891	2.332601	0.940221	0.221502	0.0	0.0	
8.678107	8.452088	7.035229	2.443312	0.987371	0.233340	0.0	0.0	
8.804945	8.580590	7.161894	2.531879	1.025089	0.242810	0.0	0.0	
0.918452	0.872165	0.650000	0.180239	0.0	0.0	0.0	0.0	
1.160316	1.102655	0.819655	0.235242	0.0	0.0	0.0	0.0	
1.357270	1.292635	0.969222	0.281010	0.0	0.0	0.0	0.0	
1.419676	1.353194	1.017788	0.295782	0.0	0.0	0.0	0.0	
1.469601	1.401639	1.056639	0.307600	0.0	0.0	0.0	0.0	

GROUP 1 BLOCK 4 FLUXES

16.793342
16.559952
15.897389
15.694469
15.532121

22.632385 23.341119
21.264527 21.857876
20.208272 20.784736
19.924055 20.497747
19.696667 20.268141

24.062081 22.143213 15.962351
22.880912 20.936286 15.949408
21.903503 20.018613 15.519597
21.638054 19.770672 15.379701
21.425679 19.572306 15.267773

21.177126 21.650793 20.247122 19.658149
20.166883 20.581989 19.460387 18.960850
19.416893 19.861238 18.910907 18.555542
19.216212 19.670914 18.765547 18.454162
19.055654 19.518641 18.649245 18.373045

14.552325 19.706391 20.856544 17.600751 11.093175
14.835445 19.153563 20.498377 17.309573 11.618643
14.700769 18.798496 20.262738 17.182928 11.833368
14.648810 18.710327 20.208098 17.160708 11.890151
14.607232 18.639778 20.164373 17.142919 11.935569

18.204268 19.692255 19.840064 16.624451 12.062430 7.742822
18.080384 19.574017 19.893820 16.755385 12.191525 8.013793
18.095324 19.623567 20.062060 17.022675 12.541560 8.470140
18.115398 19.655705 20.128432 17.118317 12.664226 8.622908
18.131443 19.681401 20.181515 17.194819 12.762350 8.745116

17.533464 17.685352 17.106201 12.775360 7.862754 1.564450 0.245025
17.907982 18.070867 17.395021 13.197833 8.242122 1.976067 0.315040
18.328993 18.528667 17.924664 13.790986 8.756419 2.314647 0.372626
18.468415 18.679989 18.104677 13.986509 8.924806 2.420274 0.390677
18.579940 18.801034 18.248674 14.142916 9.059509 2.504774 0.405118

11.736941 11.357537 9.193102 2.347457 0.942527 0.211325 0.0 0.0
12.165875 11.812864 9.686709 2.999027 1.200822 0.279201 0.0 0.0
12.748471 12.411585 10.302988 3.499692 1.412282 0.332762 0.0 0.0
12.937822 12.605501 10.501955 3.652703 1.477948 0.349369 0.0 0.0
13.089293 12.760624 10.661121 3.775110 1.530480 0.362654 0.0 0.0

1.368547 1.299941 0.969360 0.268919 0.0 0.0 0.0 0.0
1.743726 1.657506 1.232782 0.354017 0.0 0.0 0.0 0.0
2.028211 1.932173 1.449699 0.420648 0.0 0.0 0.0 0.0
2.113800 2.015410 1.516945 0.441231 0.0 0.0 0.0 0.0
2.182270 2.081998 1.570741 0.457698 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 5 FLUXES

23.980612
23.831962
22.875082
22.567827
22.322007

32.474549 33.856542
30.774210 32.071622
29.244054 30.521623
28.813326 30.084245
28.468723 29.734320

34.640052 32.547240 24.524913
33.221671 31.216968 25.016190
31.789069 29.895484 24.466059
31.378221 29.511274 24.250770
31.049520 29.203885 24.078522

30.081201 31.055876 29.439842 27.970158
28.856385 29.823547 28.664522 27.228027
27.745851 28.757036 27.848418 26.594844
27.428248 28.450721 27.603724 26.410179
27.174147 28.205649 27.407949 26.262428

20.113973 27.307025 28.965182 24.301178 15.112810
20.598408 26.670481 28.605546 24.006049 15.883591
20.353801 26.100551 28.188090 23.750882 16.118412
20.249188 25.935387 28.063291 23.677344 16.164980
20.165482 25.803238 27.963431 23.618497 16.202223

24.558953 26.621120 26.857890 22.466665 16.221827 10.370684
24.471710 26.544781 27.013480 22.711628 16.445412 10.765381
24.407851 26.518878 27.143729 22.988982 16.855509 11.337119
24.389603 26.512727 27.181908 23.073693 16.987505 11.519403
24.374987 26.507787 27.212431 23.141445 17.093090 11.665222

23.405121 23.626309 22.878780 17.096174 10.514462 2.090781 0.327155
23.979163 24.213971 23.333003 17.712195 11.054423 2.648437 0.421855
24.457880 24.740350 23.957383 18.440922 11.701866 3.091063 0.497204
24.597115 24.894843 24.151484 18.666221 11.903975 3.225937 0.520303
24.708487 25.018419 24.306748 18.846447 12.065654 3.333834 0.538783

15.591182 15.094390 12.231341 3.128908 1.257640 0.281917 0.0 0.0
16.211784 15.748059 12.926507 4.008321 1.606683 0.373514 0.0 0.0
16.929990 16.489257 13.700910 4.660677 1.882813 0.443590 0.0 0.0
17.148711 16.714935 13.938793 4.855075 1.966577 0.464845 0.0 0.0
17.323675 16.895466 14.129089 5.010591 2.033588 0.481848 0.0 0.0

1.815252 1.724897 1.287353 0.357485 0.0 0.0 0.0 0.0
2.319786 2.205793 1.641795 0.471863 0.0 0.0 0.0 0.0
2.688999 2.562458 1.923974 0.558706 0.0 0.0 0.0 0.0
2.797128 2.667749 2.009382 0.584927 0.0 0.0 0.0 0.0
2.883630 2.751979 2.077707 0.605904 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 6 FLUXES

31.956508
31.809071
30.540113
30.127386
29.797182

43.649274 46.666822
41.388584 44.195654
39.334298 42.058047
38.751045 41.453154
38.284415 40.969210

46.980801 47.048406 45.277808
44.954204 44.809402 43.052014
42.986849 42.822543 41.169672
42.419970 42.255025 40.631224
41.966436 41.800981 40.200436

40.094836 42.464124 42.380626 38.054806
38.441225 40.707921 40.865191 36.929094
36.922945 39.191024 39.532322 35.968168
36.482689 38.752431 39.143296 35.684379
36.130458 38.401529 38.832047 35.457322

25.961447 35.423637 37.795478 31.434641 19.217081
26.590854 34.577887 37.235683 31.016822 20.193472
26.223190 33.764399 36.591893 30.604300 20.435583
26.065277 33.519393 36.391467 30.475999 20.470392
25.938928 33.323364 36.231101 30.373336 20.498224

30.870422 33.545223 33.906102 28.305864 20.325337 12.937788
30.782912 33.460879 34.102046 28.617386 20.616248 13.438641
30.629352 33.345565 34.176891 28.888606 21.073181 14.114279
30.572643 33.300552 34.185507 28.960550 21.212374 14.323658
30.527255 33.264519 34.192376 29.018084 21.323714 14.491150

29.099955 29.399655 28.504175 21.311336 13.096187 2.602432 0.406837
29.842338 30.155861 29.089679 22.092552 13.778615 3.298589 0.524943
30.365697 30.736657 29.792924 22.941524 14.547349 3.839640 0.617080
30.503615 30.892910 29.999004 23.193936 14.780707 4.002296 0.644968
30.613927 31.017890 30.163846 23.395849 14.967382 4.132418 0.667277
0.0
0.0
0.0
0.0
0.0
0.0

19.290241 18.684717 15.157771 3.884538 1.562989 0.350288 0.0 0.0
20.080151 19.514031 16.033553 4.979320 1.997916 0.464386 0.0 0.0
20.920626 20.384075 16.952713 5.774875 2.335162 0.550079 0.0 0.0
21.166425 20.639088 17.226828 6.008543 2.436106 0.575742 0.0 0.0
21.363050 20.843083 17.446109 6.195473 2.516859 0.596271 0.0 0.0
0.0
0.0
0.0
0.0
0.0

2.242653 2.131832 1.592457 0.442648 0.0 0.0 0.0 0.0
2.868703 2.728608 2.032431 0.584609 0.0 0.0 0.0 0.0
3.317422 3.162248 2.375954 0.690477 0.0 0.0 0.0 0.0
3.446807 3.288343 2.478513 0.722027 0.0 0.0 0.0 0.0
3.550313 3.389216 2.560558 0.747267 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 7 FLUXES

39.412486							
39.416005							
37.883454							
37.378826							
36.975098							
53.989732	58.100077						
51.467362	55.444231						
48.970645	52.867245						
48.255315	52.128118						
47.683016	51.536779						
58.224405	59.031052	58.015407					
56.017341	56.788376	56.062747					
53.621097	54.428184	53.957884					
52.922982	53.739705	53.336542					
52.364451	53.188884	52.839431					
49.287977	52.526915	52.870105	46.847016				
47.468072	50.698902	51.457377	45.746375				
45.610775	48.862440	49.876283	44.572463				
45.065195	48.320681	49.399550	44.214594				
44.628700	47.887240	49.018128	43.928267				
31.354830	42.859093	45.801316	37.938833	22.976331			
32.185693	41.941442	45.238755	37.516215	24.171457			
31.714547	40.921652	44.415174	36.974188	24.422493			
31.510138	40.607314	44.151085	36.798927	24.447249			
31.346589	40.355814	43.939781	36.658691	24.467037			
36.649273	39.885639	40.355603	33.647528	24.073264	15.277292		
36.577292	39.818219	40.620834	34.040862	24.431656	15.874830		
36.341032	39.621264	40.645766	34.305523	24.928575	16.642285		
36.249723	39.541468	40.628144	34.366048	25.073984	16.875823		
36.176650	39.477603	40.614018	34.414443	25.190294	17.062642		
34.273175	34.647106	33.621608	25.148540	15.445897	3.067962	0.479286	
35.167375	35.556317	34.327668	26.080612	16.257316	3.889704	0.618578	
35.727483	36.182672	35.098571	27.035288	17.133576	4.519381	0.725820	
35.863965	36.340253	35.315150	27.311855	17.394864	4.707102	0.758023	
35.973125	36.466292	35.488388	27.533089	17.603881	4.857275	0.783785	
22.633933	21.931813	17.807690	4.570101	1.840396	0.412401	0.0	0.0
23.572824	22.916138	18.844033	5.859352	2.352974	0.546844	0.0	0.0
24.520359	23.899249	19.891173	6.783549	2.745176	0.646581	0.0	0.0
24.790173	24.180310	20.197617	7.052586	2.861601	0.676215	0.0	0.0
25.006007	24.405142	20.442758	7.267810	2.954739	0.699922	0.0	0.0
2.628351	2.499228	1.868205	0.519706	0.0	0.0	0.0	0.0
3.363231	3.199833	2.384883	0.686448	0.0	0.0	0.0	0.0
3.882983	3.702272	2.783296	0.809359	0.0	0.0	0.0	0.0
4.031414	3.847012	2.901241	0.845695	0.0	0.0	0.0	0.0
4.150156	3.962802	2.995595	0.874762	0.0	0.0	0.0	0.0

GROUP 1 BLOCK 8 FLUXES

45.539123
45.725571
43.995319
43.418612
42.957216

62.416862 67.247985
59.747004 64.457107
56.911855 61.535550
56.092842 60.690010
55.437591 60.013535

67.292767 68.358742 67.301522
65.004517 66.053091 65.323387
62.286031 63.380533 62.940878
61.486262 62.592603 62.229096
60.846403 61.962214 61.659626

56.751288 60.533813 60.967625 53.803335
54.846528 58.645095 59.560293 52.706887
52.732056 56.557459 57.763598 51.365012
52.104214 55.933936 57.213558 50.948463
51.601903 55.435078 56.773484 50.615188

35.794926 48.945370 52.307181 43.248818 26.076676
36.820739 48.002001 51.775796 42.848290 27.467157
36.274160 46.825282 50.819591 42.210679 27.730751
36.033342 46.456458 50.506326 41.999027 27.748250
35.840661 46.161366 50.255677 41.829675 27.762229

41.449276 45.143970 45.694986 38.073119 27.185955 17.223066
41.406880 45.111027 46.040474 38.551530 27.609343 17.905020
41.106951 44.852651 46.031281 38.816101 28.141998 18.749835
40.987970 44.745316 45.993407 38.868256 28.293086 19.003667
40.892756 44.659416 45.963075 38.909953 28.413936 19.206719

38.573745 39.008595 37.874289 28.338140 17.400132 3.455272 0.539574
39.600761 40.052559 38.689088 29.402262 18.322403 4.382244 0.696594
40.193353 40.718961 39.518593 30.446599 19.288985 5.085892 0.816433
40.329105 40.878150 39.744423 30.743630 19.573688 5.294523 0.852233
40.437677 41.005472 39.925059 30.981233 19.801436 5.461424 0.880872

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25.411128 24.629044 20.009480 5.139991 2.071133 0.464078 0.0 0.0
26.475144 25.743765 21.181095 6.591707 2.648659 0.615523 0.0 0.0
27.511940 26.821187 22.335011 7.623103 3.086682 0.726965 0.0 0.0
27.801800 27.123990 22.668422 7.921609 3.216010 0.759909 0.0 0.0
28.033667 27.366213 22.935135 8.160408 3.319471 0.786263 0.0 0.0

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2.948550 2.804273 2.097230 0.583731 0.0 0.0 0.0 0.0
3.773795 3.591131 2.677694 0.771098 0.0 0.0 0.0 0.0
4.352499 4.150683 3.121701 0.908174 0.0 0.0 0.0 0.0
4.516741 4.310906 3.252429 0.948487 0.0 0.0 0.0 0.0
4.648131 4.439081 3.357009 0.980737 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 9 FLUXES

49.962814
50.290832
48.426326
47.798620
47.296420

68.478260 73.784138
65.708455 70.891873
62.638496 67.728934
61.745718 66.807179
61.031451 66.069727

73.784716 74.965601 73.779980
71.439436 72.600408 71.759841
68.497395 69.707091 69.178206
67.625270 68.847453 68.400435
66.927522 68.159693 67.778168

62.108843 66.241073 66.685775 58.750369
60.144445 64.299375 65.263248 57.644133
57.851758 62.035326 63.312997 56.183928
57.165443 61.353145 62.709826 55.725169
56.616350 60.807356 62.227244 55.358122

39.009572 53.339985 56.989354 47.077696 28.326044
40.180994 52.380957 56.481111 46.693991 29.860695
39.585284 51.096987 55.435154 45.992372 30.137103
39.318922 50.689637 55.087204 45.755171 30.149965
39.105804 50.363720 54.808805 45.565378 30.160233

44.950929 48.975507 49.580803 41.295492 29.457089 18.645004
44.935193 48.973292 49.990336 41.840349 29.930776 19.390311
44.594315 48.676265 49.962623 42.110050 30.492974 20.293770
44.456072 48.549889 49.911083 42.157013 30.648820 20.562819
44.345446 48.448753 49.869815 42.194554 30.773476 20.778044

41.717214 42.195788 40.981001 30.668399 18.828590 3.738482 0.583671
42.843970 43.341196 41.878520 31.831650 19.833442 4.742764 0.753712
43.464441 44.041166 42.755177 32.944895 20.868133 5.501067 0.882851
43.600361 44.202267 42.988521 33.257487 21.170334 5.725110 0.921301
43.709067 44.331116 43.175165 33.507536 21.412080 5.904341 0.952060

27.441268 26.600712 21.619015 5.556610 2.239863 0.501876 0.0 0.0
28.597328 27.811466 22.890382 7.127498 2.865072 0.665800 0.0 0.0
29.701606 28.960058 24.124319 8.238021 3.336922 0.785879 0.0 0.0
30.006495 29.279133 24.477793 8.558233 3.475757 0.821260 0.0 0.0
30.250384 29.534373 24.760554 8.814396 3.586822 0.849564 0.0 0.0

3.182584 3.027240 2.264648 0.630539 0.0 0.0 0.0 0.0
4.073880 3.877162 2.891784 0.833006 0.0 0.0 0.0 0.0
4.695978 4.478760 3.369361 0.980513 0.0 0.0 0.0 0.0
4.871836 4.650360 3.509484 1.023750 0.0 0.0 0.0 0.0
5.012519 4.787636 3.621579 1.058339 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 10 FLUXES

52.513571
52.925710
50.995986
50.341084
49.817127

71.966517 77.535535
69.140968 74.585505
65.950964 71.299610
65.018423 70.336874
64.272343 69.566634

77.508679 78.741479 77.461837
75.130755 76.340891 75.415163
72.075837 73.336220 72.733823
71.164975 72.438232 71.920912
70.436234 71.719789 71.270531

65.177251 69.499916 69.936715 61.562711
63.177561 67.525357 68.501380 60.446407
60.794798 65.172693 66.475166 58.928352
60.077219 64.459254 65.843880 58.447397
59.503114 63.888456 65.338804 58.062591

40.848189 55.849928 59.657886 49.258498 29.607474
42.101704 54.879744 59.159646 48.881319 31.222324
41.485063 53.543494 58.071784 48.150530 31.510412
41.205509 53.115890 57.705888 47.900237 31.521547
40.981836 52.773769 57.413130 47.699968 31.530433

46.947963 51.160282 51.795190 43.131071 30.750404 19.454427
46.945023 51.172904 52.238360 43.711157 31.250676 20.234340
46.587362 50.861044 52.207388 43.989667 31.833634 21.173579
46.439459 50.725269 52.149552 44.034890 31.993015 21.451810
46.321103 50.616613 52.103245 44.071036 32.120497 21.674380

43.504051 44.007739 42.747647 31.993953 19.641286 3.899622 0.608758
44.684026 45.207355 43.688968 33.211163 20.691588 4.947512 0.786145
45.325655 45.931815 44.597694 34.367579 21.767451 5.737490 0.920664
45.462766 46.095124 44.836408 34.689868 22.080135 5.970450 0.960645
45.572423 46.225738 45.027347 34.947673 22.330267 6.156813 0.992630

0 28.592256 27.718840 22.532366 5.793271 2.335796 0.523371 0.0 0.0
0 29.797583 28.981263 23.858132 7.431200 2.987867 0.694334 0.0 0.0
0 30.943234 30.173267 25.140035 8.587495 3.479286 0.819400 0.0 0.0
0 31.257301 30.502221 25.505450 8.920243 3.623612 0.856188 0.0 0.0
0 31.508532 30.765362 25.797763 9.186435 3.739069 0.885617 0.0 0.0

0 3.315137 3.153558 2.359554 0.657092 0.0 0.0 0.0 0.0
0 4.243364 4.038759 3.012821 0.868033 0.0 0.0 0.0 0.0
0 4.890440 4.664561 3.509721 1.021542 0.0 0.0 0.0 0.0
0 5.072977 4.842702 3.655243 1.066461 0.0 0.0 0.0 0.0
0 5.219003 4.985211 3.771659 1.102395 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 11 FLUXES

53.121790
53.561368
51.640925
50.985732
50.461542

72.793697 78.420037
69.963500 75.464653
66.776418 72.183075
65.842259 71.219037
65.094884 70.447756

78.376922 79.615783 78.297979
75.998330 77.212984 76.248544
72.949695 74.214947 73.574749
72.038069 73.316367 72.761714
71.308717 72.597452 72.111234

65.869874 70.228377 70.649687 62.161960
63.864760 68.248054 69.210799 61.040435
61.486596 65.901430 67.192580 59.529930
60.768414 65.187759 66.561693 59.049637
60.193825 64.616776 66.056935 58.665361

41.234147 56.374253 60.208986 49.700274 29.856784
42.502183 55.397726 59.707412 49.318649 31.481986
41.894611 54.067644 58.628582 48.595526 31.779769
41.615938 53.640418 58.263826 48.346356 31.792717
41.392969 53.298599 57.971980 48.146985 31.803052

47.325188 51.575875 52.216716 43.477097 30.988503 19.600142
47.316083 51.581999 52.656758 44.055155 31.486715 20.381238
46.966233 51.279389 52.637309 44.344841 32.079549 21.330396
46.819576 51.145223 52.581727 44.392482 32.241366 21.611355
46.702218 51.037853 52.537223 44.430564 32.370797 21.836108

43.816385 44.326184 43.060691 32.230205 19.785784 3.928199 0.613181
44.994465 45.524007 43.998947 33.448734 20.838921 4.982505 0.791649
45.648267 46.261336 44.921530 34.618818 21.925634 5.778844 0.927229
45.788067 46.427553 45.163620 34.944646 22.241284 6.013660 0.967525
45.899873 46.560494 45.357260 35.205284 22.493788 6.201508 0.999761

28.783576 27.905678 22.686881 5.834089 2.352567 0.527130 0.0 0.0
29.988531 29.168429 24.015061 7.481450 3.008492 0.699128 0.0 0.0
31.145923 30.372410 25.308924 8.646719 3.503762 0.825164 0.0 0.0
31.463007 30.704474 25.677576 8.982032 3.649211 0.862236 0.0 0.0
31.716651 30.970102 25.972478 9.250276 3.765567 0.891894 0.0 0.0

3.336777 3.174278 2.375294 0.661549 0.0 0.0 0.0 0.0
4.269681 4.063979 3.031935 0.873634 0.0 0.0 0.0 0.0
4.921385 4.694274 3.532423 1.028258 0.0 0.0 0.0 0.0
5.105222 4.873689 3.678993 1.073504 0.0 0.0 0.0 0.0
5.252288 5.017216 3.796246 1.109700 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 12 FLUXES

51.787866
52.202704
50.367939
49.741797
49.240848

70.961705 76.442018
68.183794 73.539788
65.124902 70.392155
64.230369 69.469796
63.514697 68.731859

76.390857 77.593161 76.294288
74.049523 75.226970 74.270495
71.128644 72.355689 71.713196
70.257506 71.497533 70.938113
69.560546 70.810958 70.317997

64.179743 68.420186 68.818584 60.535188
62.203305 66.465415 67.388921 59.415873
59.926048 64.221025 65.463843 57.979055
59.240505 63.540834 64.864451 57.524406
58.692027 62.996636 64.384890 57.160645

0.149966 54.889787 58.618059 48.379628 29.054775
41.365104 53.913057 58.100825 47.983054 30.618874
40.796835 52.648059 57.082170 47.304332 30.923513
40.534552 52.243702 56.739545 47.071956 30.942526
40.324697 51.920179 56.465404 46.886022 30.957714

46.044867 50.182867 50.806562 42.300160 30.145030 19.064029
46.009128 50.159571 51.204843 42.836978 30.610742 19.811050
45.690981 49.889461 51.210562 43.138845 31.201056 20.742608
45.557678 49.769201 51.167018 43.193959 31.364662 21.019925
45.451002 49.672958 51.132147 43.238018 31.495525 21.241765

42.610584 43.107680 41.878947 31.346748 19.243170 3.820413 0.596336
43.728124 44.244136 42.764062 32.511003 20.254356 4.842616 0.769393
44.383228 44.980702 43.680070 33.663005 21.319775 5.618980 0.901541
44.527967 45.151263 43.924155 33.986517 21.630928 5.848440 0.940904
44.643727 45.287680 44.119392 34.245303 21.879834 6.032004 0.972395

27.983721 27.130967 22.058507 5.673100 2.287824 0.512624 0.0 0.0
29.135570 28.339596 23.334242 7.270116 2.923747 0.679436 0.0 0.0
30.272893 29.521899 24.601867 8.406020 3.406501 0.802259 0.0 0.0
30.587039 29.850477 24.965085 8.733704 3.548605 0.838467 0.0 0.0
30.838334 30.113317 25.255642 8.995844 3.662286 0.867432 0.0 0.0

3.243748 3.085855 2.309259 0.643198 0.0 0.0 0.0 0.0
4.147747 3.948017 2.945589 0.848807 0.0 0.0 0.0 0.0
4.782819 4.562215 3.433245 0.999450 0.0 0.0 0.0 0.0
4.962443 4.737502 3.576396 1.043633 0.0 0.0 0.0 0.0
5.106138 4.877729 3.690914 1.078979 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 13 FLUXES

48.575577
48.919352
47.244825
46.678079
46.224648

66.557704 71.695284
63.892390 68.908231
61.083578 66.020627
60.271060 65.184173
59.621002 64.514963

71.642203 72.766721 71.540347
69.380078 70.479743 69.574047
66.705083 67.851932 67.238904
65.916962 67.076487 66.541063
65.286417 66.456083 65.982743

60.178627 64.151146 64.517839 56.743570
58.267716 62.256080 63.113111 55.636187
56.184828 60.207167 61.363478 54.336747
55.566138 59.595209 60.827724 53.933596
55.071148 59.105600 60.399077 53.611037

37.632830 51.447264 54.938565 45.338765 27.223977
38.730909 50.478262 54.395545 44.918306 28.657547
38.230864 49.334999 53.485971 44.318862 28.965388
38.001138 48.976761 53.187315 44.119615 28.995180
37.817330 48.690136 52.948352 43.960185 29.018993

43.138888 47.016917 47.601261 39.629983 28.239708 17.857709
43.056986 46.942336 47.920542 40.087498 28.643147 18.535950
42.792690 46.726123 47.963330 40.401166 29.217648 19.422037
42.685446 46.632741 47.942327 40.469409 29.382842 19.689693
42.599619 46.558002 47.925491 40.523974 29.514977 19.903803

39.910389 40.376683 39.226831 29.362184 18.024753 3.578488 0.558563
40.909592 41.393069 40.009480 30.417415 18.949874 4.530665 0.719815
41.553783 42.113909 40.897269 31.518858 19.961548 5.260914 0.844070
41.706314 42.290863 41.142589 31.834728 20.261110 5.477976 0.881283
41.828309 42.432397 41.338816 32.087402 20.500745 5.651622 0.911053

26.206236 25.408050 20.658494 5.313362 2.142846 0.480141 0.0 0.0
27.252731 26.508627 21.827516 6.801089 2.735254 0.635635 0.0 0.0
28.337493 27.634966 23.030313 7.869527 3.189241 0.751093 0.0 0.0
28.643191 27.953903 23.379833 8.179623 3.323633 0.785311 0.0 0.0
28.887729 28.209032 23.659433 8.427694 3.431144 0.812685 0.0 0.0

3.037544 2.889729 2.162562 0.602361 0.0 0.0 0.0 0.0
3.879437 3.692680 2.755175 0.793967 0.0 0.0 0.0 0.0
4.476703 4.270279 3.213660 0.935562 0.0 0.0 0.0 0.0
4.646717 4.436152 3.349017 0.977318 0.0 0.0 0.0 0.0
4.782724 4.568847 3.457300 1.010723 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 14 FLUXES

```
43.610201
43.843701
42.398750
41.920714
41.538255

59.752880 64.363745
57.261583 61.755169
54.816193 59.244780
54.126502 58.536832
53.574710 57.970433

64.313347 65.321144 64.215748
62.174876 63.158366 62.341479
59.855478 60.882352 60.326368
59.191366 60.230372 59.743631
58.660035 59.708745 59.277398

54.016324 57.580119 57.905547 50.923541
52.209425 55.780851 56.544349 49.840348
50.407530 54.013721 55.046103 48.736786
49.888624 53.503456 54.604948 48.410018
49.473463 53.095206 54.251985 48.148568

33.771827 46.168231 49.299588 40.683012 24.426063
34.694800 45.217112 48.724073 40.232427 25.665006
34.289242 44.247549 47.968112 39.743761 25.971663
34.107679 43.957786 47.734459 39.593355 26.016828
33.962404 43.725945 47.547502 39.473002 26.052941

36.702946 42.182808 42.707064 35.554603 25.334461 16.019872
36.558194 42.038211 42.914179 35.898464 25.648537 16.597166
36.367218 41.894530 43.003657 36.222158 26.193588 17.410731
36.298251 41.840515 43.015346 36.309030 26.360243 17.663059
36.243050 41.797273 43.024667 36.378501 26.493549 17.864908

35.800757 36.219404 35.188505 26.339737 16.169316  3.210115 0.501059
36.628349 37.061608 35.823386 27.235232 16.967326  4.056638 0.644496
37.248588 37.751062 36.661011 28.254278 17.893862  4.715920 0.756620
37.411723 37.936459 36.906945 28.557531 18.175155  4.913940 0.790531
37.542204 38.084749 37.103666 28.800113 18.400176  5.072353 0.817660

0.0 23.505592 22.789879 18.530162  4.766127  1.922204 0.430703 0.0 0.0
0.0 24.398082 23.732151 19.541791  6.089122  2.448990 0.569112 0.0 0.0
0.0 25.398500 24.769070 20.642424  7.053841  2.858755 0.673262 0.0 0.0
0.0 25.690567 25.072570 20.970450  7.336950  2.981313 0.704428 0.0 0.0
0.0 25.924203 25.315352 21.232856  7.563433  3.079357 0.729360 0.0 0.0

0.0  2.724429  2.591874  1.939697 0.540296 0.0 0.0 0.0 0.0
0.0  3.472934  3.305774  2.466546 0.710808 0.0 0.0 0.0 0.0
0.0  4.012215  3.827241  2.880302 0.838533 0.0 0.0 0.0 0.0
0.0  4.167517  3.978700  3.003728 0.876575 0.0 0.0 0.0 0.0
0.0  4.291756  4.099865  3.102467 0.907008 0.0 0.0 0.0 0.0
```

GROUP 1 BLOCK 15 FLUXES

37.075704
37.168147
36.013788
35.650542
35.359919

50.798890 54.718047
48.542142 52.350516
46.560198 50.320682
46.029636 49.779118
45.605154 49.345831

54.673793 55.529646 54.587618
52.704621 53.537208 52.841891
50.837442 51.708317 51.232734
50.333756 51.215985 50.798656
49.930771 50.822082 50.451357

45.917026 48.945457 49.220191 43.283212
44.253316 47.279254 47.923990 42.239254
42.808540 45.869613 46.743452 41.382367
42.418604 45.490663 46.424233 41.153860
42.106625 45.187471 46.168825 40.971025

28.704355 39.240310 41.900938 34.576524 20.758714
29.402919 38.319799 41.290680 34.093210 21.747189
29.114232 37.568991 40.726541 33.742041 22.047574
28.994515 37.367337 40.576268 33.654116 22.111854
28.898720 37.205986 40.456021 33.583752 22.163261

32.890661 35.848234 36.293819 30.215205 21.529491 13.613662
32.670741 35.619692 36.361862 30.416872 21.731432 14.062030
32.568975 35.563524 36.504811 30.747317 22.233426 14.777778
32.548753 35.559537 36.557703 30.857185 22.400940 15.009307
32.532553 35.556321 36.599991 30.945057 22.534935 15.194519

30.421641 30.777596 29.901957 22.382886 13.740421 2.727919 0.425794
31.031907 31.399151 30.350424 23.074578 14.375335 3.436938 0.546039
31.614705 32.041319 31.116318 23.981114 15.187507 4.002635 0.642175
31.790349 32.236358 31.361645 24.266725 15.444137 4.175522 0.671730
31.930841 32.392366 31.557885 24.495196 15.649430 4.313829 0.695374

19.972925 19.364908 15.745626 4.050017 1.633434 0.366003 0.0 0.0
20.668922 20.104894 16.555247 5.158662 2.074821 0.482164 0.0 0.0
21.555056 21.020965 17.518980 5.986654 2.426299 0.571416 0.0 0.0
21.828328 21.303313 17.818059 6.234157 2.533243 0.598557 0.0 0.0
22.046930 21.529175 18.057309 6.432154 2.618797 0.620269 0.0 0.0

2.314942 2.202324 1.648193 0.459106 0.0 0.0 0.0 0.0
2.942036 2.800444 2.089531 0.602169 0.0 0.0 0.0 0.0
3.404945 3.247980 2.444386 0.711636 0.0 0.0 0.0 0.0
3.540850 3.380435 2.552087 0.744782 0.0 0.0 0.0 0.0
3.649572 3.486397 2.638246 0.771298 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 16 FLUXES

29.209624
29.139970
28.326066
28.098573
27.916559

40.020937 43.108125
38.056581 41.041615
36.620417 39.577284
36.278291 39.232633
36.004564 38.956884

43.072572 43.746315 43.002997
41.318308 41.970249 41.423426
39.982600 40.666575 40.290351
39.668620 40.362947 40.031774
39.417408 40.120016 39.824883

36.172506 38.557716 38.773187 34.095431
34.690985 37.062236 37.566134 33.108628
33.665625 36.071855 36.757049 32.539239
33.428047 35.847882 36.581457 32.426198
33.237962 35.668678 36.440957 32.335742

22.611087 30.910351 33.005780 27.236019 16.351572
23.047059 30.035999 32.363792 26.721752 17.044520
22.892669 29.540116 32.021606 26.528748 17.332816
22.845432 29.441974 31.968935 26.513684 17.418496
22.807626 29.363438 31.926774 26.501614 17.487028

25.906721 28.236412 28.587526 23.799902 16.958807 10.723906
25.604939 27.916102 28.497536 23.838276 17.031415 11.020820
25.603928 27.957995 28.697338 24.170478 17.476930 11.615803
25.640155 28.011783 28.797269 24.305772 17.643717 11.821048
25.669118 28.054794 28.877193 24.413990 17.777133 11.985236

23.961076 24.241589 23.552370 17.630556 10.823565 2.148913 0.335434
24.318261 24.606052 23.784358 18.082978 11.265980 2.693614 0.427953
24.849930 25.185080 24.457686 18.849266 11.937430 3.146080 0.504745
25.038399 25.389424 24.699955 19.111759 12.163106 3.288398 0.529002
25.189156 25.552880 24.893752 19.321739 12.343638 3.402249 0.548407

0.0
0.0 15.731450 15.252684 12.402321 3.190168 1.286714 0.288328 0.0 0.0
0.0 16.196598 15.754657 12.973249 4.042612 1.626024 0.377882 0.0 0.0
0.0 16.941137 16.521276 13.768826 4.705198 1.906990 0.449116 0.0 0.0
0.0 17.190167 16.776549 14.031659 4.909401 1.994949 0.471364 0.0 0.0
0.0 17.389378 16.980756 14.241914 5.072760 2.065314 0.489162 0.0 0.0

0.0
0.0 1.823383 1.734694 1.298263 0.361648 0.0 0.0 0.0 0.0
0.0 2.305429 2.194484 1.637422 0.471888 0.0 0.0 0.0 0.0
0.0 2.675998 2.552624 1.921057 0.559278 0.0 0.0 0.0 0.0
0.0 2.788325 2.661978 2.009647 0.586475 0.0 0.0 0.0 0.0
0.0 2.878185 2.749459 2.080519 0.608232 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 17 FLUXES

```
20.295270
20.053891
19.616741
19.539402
19.477517

27.807620 29.952089
26.189503 28.242337
25.360099 27.406229
25.226942 27.279858
25.120399 27.178741

29.926909 30.394464 29.877159
28.431845 28.879232 28.501195
27.685869 28.157961 27.895134
27.582009 28.063230 27.830545
27.498901 27.987425 27.778853

25.132500 26.789190 26.938061 23.688082
23.871414 25.501792 25.846545 22.779307
23.311206 24.975769 25.447609 22.526544
23.242147 24.923054 25.430383 22.540467
23.186883 24.880865 25.416583 22.551590

15.709194 21.475583 22.930848 18.922630 11.360855
15.858059 20.666315 22.266042 18.384348 11.726367
15.849689 20.451234 22.166661 18.363370 11.996197
15.881723 20.466838 22.220816 18.427635 12.103770
15.907338 20.479306 22.264124 18.479033 12.189820

17.998767 19.617103 19.861005 16.535959 11.784856 7.454301
17.615537 19.204561 19.603120 16.398579 11.717543 7.583522
17.722269 19.350381 19.859553 16.725881 12.093463 8.037076
17.819388 19.466297 20.009244 16.886764 12.256667 8.210200
17.897071 19.559017 20.128983 17.015459 12.387221 8.348693

16.646928 16.841894 16.364186 12.251707  7.523281 1.494125 0.233337
16.727110 16.924498 16.359248 12.439053  7.751327 1.853593 0.294559
17.194273 17.424998 16.920005 13.039681  8.258494 2.176402 0.349143
17.394097 17.636559 17.155189 13.272730  8.446674 2.283300 0.367235
17.553944 17.805795 17.343325 13.459160  8.597212 2.368818 0.381709

10.931497 10.599039  8.619552  2.217586 0.894674 0.200567 0.0 0.0
11.140928 10.836827  8.924112  2.781032 1.118851 0.260082 0.0 0.0
11.719477 11.428454  9.523659  3.254225 1.319026 0.310646 0.0 0.0
11.938276 11.650251  9.742693  3.408267 1.384968 0.327206 0.0 0.0
12.113307 11.827679  9.917914  3.531498 1.437720 0.340455 0.0 0.0

 1.267454  1.205838  0.902604  0.251527 0.0 0.0 0.0 0.0 0.0
 1.585991  1.509671  1.126539  0.324706 0.0 0.0 0.0 0.0 0.0
 1.850930  1.765526  1.328620  0.386766 0.0 0.0 0.0 0.0 0.0
 1.935966  1.848137  1.395068  0.407045 0.0 0.0 0.0 0.0 0.0
 2.003994  1.914225  1.448226  0.423269 0.0 0.0 0.0 0.0 0.0
```

GROUP 1 BLOCK 18 FLUXES

10.639729
10.211849
10.147739
10.215478
10.269662

14.584353 15.705715
13.336321 14.372508
13.115340 14.162073
13.184710 14.246072
13.240196 14.313262

15.690918 15.934602 15.662036
14.464173 14.688619 14.493321
14.300500 14.540531 14.401036
14.397704 14.644953 14.519599
14.475457 14.728481 14.614440

13.180178 14.046326 14.121871 12.419408
12.153329 12.975927 13.144572 11.588117
12.052575 12.903639 13.138684 11.634674
12.144139 13.012669 13.268523 11.764770
12.217381 13.099883 13.372385 11.868839

8.234985 11.262620 12.021896 9.922623 5.955418
8.073864 10.521729 11.324383 9.355596 5.965583
8.196764 10.573303 11.444697 9.487546 6.195106
8.300595 10.693051 11.593475 9.620671 6.315673
8.383653 10.788841 11.712490 9.727164 6.412121

9.439586 10.285547 10.411057 8.670343 6.184858 3.920502
8.968007 9.768652 9.962660 8.335809 5.962113 3.864096
9.160464 9.991075 10.241481 8.625363 6.238602 4.143529
9.307223 10.156116 10.425947 8.797834 6.385558 4.271084
9.424623 10.288142 10.573512 8.935804 6.503119 4.373125

8.727225 8.828638 8.580864 6.431795 3.955753 0.790045 0.124323
8.500401 8.597271 8.308408 6.323281 3.946516 0.946100 0.151684
8.864377 8.978032 8.710368 6.712644 4.253622 1.119715 0.181033
9.059834 9.180256 8.919849 6.898007 4.389953 1.184108 0.191772
9.216194 9.342028 9.087427 7.046292 4.499016 1.235622 0.200362

0.0 5.738583 5.564221 4.530313 1.171391 0.473736 0.106861 0.0 0.0
0.0 5.665181 5.509506 4.540314 1.417510 0.572115 0.133905 0.0 0.0
0.0 6.036745 5.884734 4.901775 1.672545 0.679803 0.161047 0.0 0.0
0.0 6.208984 6.056682 5.060229 1.766146 0.719422 0.170852 0.0 0.0
0.0 6.346769 6.194236 5.186989 1.841026 0.751116 0.178696 0.0 0.0

0.0 0.669969 0.637423 0.477635 0.133955 0.0 0.0 0.0 0.0
0.0 0.809814 0.770773 0.575713 0.167110 0.0 0.0 0.0 0.0
0.0 0.953723 0.909521 0.684530 0.200457 0.0 0.0 0.0 0.0
0.0 1.006007 0.960113 0.724543 0.212498 0.0 0.0 0.0 0.0
0.0 1.047833 1.000586 0.756552 0.222130 0.0 0.0 0.0 0.0

GROUP 1 BLOCK 19 FLUXES

1.009072							
1.255014							
1.479058							
1.583564							
1.667168							
1.216794	1.294537						
1.480917	1.575436						
1.752656	1.868810						
1.881975	2.008421						
1.985429	2.120108						
1.290484	1.309604	1.286779					
1.580335	1.603843	1.581828					
1.880543	1.910802	1.891479					
2.022698	2.056046	2.037356					
2.136422	2.172241	2.154057					
1.097710	1.157336	1.160541	1.022779				
1.347284	1.421705	1.435070	1.268835				
1.608169	1.701940	1.726277	1.533464				
1.730889	1.833679	1.862468	1.656616				
1.829064	1.939068	1.971420	1.755137				
0.780977	0.939620	0.988510	0.825394	0.560764			
0.992144	1.168216	1.236862	1.035571	0.727616			
1.194446	1.412596	1.504232	1.263656	0.895721			
1.286432	1.525922	1.627872	1.368678	0.971008			
1.360019	1.616582	1.726782	1.452695	1.031236			
0.789170	0.847377	0.852285	0.709606	0.501288	0.314103		
0.997454	1.069879	1.082811	0.906141	0.644920	0.411200		
1.225411	1.316727	1.338929	1.127699	0.812269	0.528500		
1.329638	1.429803	1.455949	1.228513	0.887877	0.580706		
1.413019	1.520262	1.549564	1.309163	0.948362	0.622472		
0.714550	0.720146	0.682350	0.512322	0.315702	0.107143	0.022600	
0.923588	0.930465	0.880098	0.669278	0.417381	0.152056	0.032193	
1.158140	1.168309	1.111142	0.853437	0.539014	0.197069	0.040995	
1.264171	1.275857	1.215613	0.935918	0.593018	0.215018	0.044325	
1.348994	1.361895	1.299190	1.001903	0.636220	0.229377	0.046988	
0.458385	0.444022	0.360967	0.159082	0.069209	0.019411	0.0	0.0
0.601374	0.584121	0.479441	0.227838	0.099223	0.028273	0.0	0.0
0.770034	0.749579	0.620219	0.294470	0.128287	0.036281	0.0	0.0
0.845356	0.823415	0.682581	0.320937	0.139675	0.039296	0.0	0.0
0.905613	0.882483	0.732470	0.342111	0.148786	0.041709	0.0	0.0
0.096149	0.091263	0.068543	0.024405	0.0	0.0	0.0	0.0
0.138382	0.131468	0.098543	0.035466	0.0	0.0	0.0	0.0
0.178200	0.169664	0.127883	0.045384	0.0	0.0	0.0	0.0
0.193785	0.184641	0.139395	0.049113	0.0	0.0	0.0	0.0
0.206252	0.196623	0.148605	0.052095	0.0	0.0	0.0	

GROUP 2 BLOCK 1 FLUXES

0.489074
0.598900
0.650410
0.665694
0.677921

1.899366 2.001086
1.953516 2.069368
1.929215 2.055268
1.927212 2.056881
1.925609 2.058171

2.086484 1.851758 0.459863
2.214946 1.918753 0.572516
2.230968 1.908616 0.632135
2.241266 1.910755 0.650258
2.249503 1.912464 0.664755

1.810772 1.893578 1.726303 1.744965
1.894888 1.997131 1.827634 1.873741
1.900585 2.020005 1.855436 1.926791
1.907444 2.032826 1.869203 1.948796
1.912930 2.043081 1.880215 1.966399

0.444362 1.736642 1.896037 1.563634 0.341218
0.568363 1.867571 2.101378 1.704125 0.449357
0.641590 1.918749 2.200670 1.772060 0.521814
0.664428 1.939951 2.237249 1.798077 0.545024
0.682698 1.956911 2.266511 1.818889 0.563591

1.651644 1.833651 1.841376 1.534003 1.046338 0.720626
1.824393 2.054758 2.091061 1.741215 1.178839 0.845058
1.917051 2.180774 2.239898 1.871419 1.272099 0.942834
1.951481 2.226453 2.292717 1.917564 1.305288 0.976458
1.979024 2.262995 2.334971 1.954478 1.331838 1.003356

1.656331 1.660752 1.554313 1.179079 0.738602 0.346653 0.086849
1.918960 1.925007 1.805690 1.392240 0.885891 0.440264 0.113646
2.086959 2.097965 1.983126 1.548503 0.999746 0.519539 0.136657
2.145543 2.158280 2.045233 1.602298 1.038438 0.549282 0.145255
2.192410 2.206530 2.094917 1.645333 1.069392 0.573076 0.152132

1.098742 1.060686 0.870573 0.522691 0.233587 0.074478 0.0 0.0
1.305848 1.263991 1.052614 0.670813 0.303734 0.099410 0.0 0.0
1.459176 1.415635 1.192411 0.790957 0.362221 0.120464 0.0 0.0
1.511881 1.467687 1.239885 0.835956 0.384025 0.128290 0.0 0.0
1.554043 1.509328 1.277863 0.871955 0.401468 0.134551 0.0 0.0

0.326456 0.308663 0.232882 0.095693 0.0 0.0 0.0 0.0
0.424665 0.401973 0.304610 0.128054 0.0 0.0 0.0 0.0
0.503388 0.477485 0.364522 0.155002 0.0 0.0 0.0 0.0
0.532874 0.505789 0.386858 0.165002 0.0 0.0 0.0 0.0
0.556462 0.528431 0.404726 0.173002 0.0 0.0 0.0 0.0

GROUP 2 BLOCK 2 FLUXES

0.853762							
0.819833							
0.820458							
0.830348							
0.838259							
1.671712	1.725899						
1.521356	1.571812						
1.499969	1.556677						
1.512243	1.571925						
1.522061	1.584123						
1.790595	1.628354	0.802261					
1.661583	1.491975	0.781985					
1.661825	1.481335	0.794925					
1.682620	1.496583	0.808276					
1.699255	1.508781	0.818957					
1.589359	1.629719	1.516513	1.499612				
1.469578	1.510867	1.416520	1.413310				
1.471151	1.522539	1.433474	1.446985				
1.489984	1.545582	1.456706	1.475991				
1.505050	1.564015	1.475290	1.499194				
0.772234	1.521292	1.620482	1.367421	0.600585			
0.771107	1.441222	1.563454	1.311908	0.617283			
0.800486	1.475257	1.622610	1.359199	0.659524			
0.819208	1.504400	1.661584	1.391102	0.680936			
0.834185	1.527714	1.692761	1.416624	0.698065			
1.445127	1.569223	1.581790	1.328183	1.014119	0.726963		
1.402591	1.533165	1.561503	1.316222	0.999500	0.784135		
1.466449	1.614082	1.656271	1.404631	1.071279	0.896452		
1.505050	1.660259	1.707344	1.450649	1.107668	0.943229		
1.535930	1.697200	1.748202	1.487463	1.136779	0.980650		
1.420692	1.433209	1.458777	1.142421	0.734029	1.544161	0.403304	
1.429550	1.443411	1.460571	1.198866	0.803506	1.597060	0.454675	
1.539316	1.557597	1.581352	1.338718	0.925534	1.728198	0.517964	
1.593754	1.613813	1.640049	1.399674	0.975633	1.782324	0.541629	
1.637302	1.658784	1.687005	1.448439	1.015712	1.825624	0.560560	
1.051000	1.015702	0.867460	2.341896	1.052805	0.344856	0.0	
1.107189	1.072636	0.955696	2.441916	1.135242	0.396407	0.0	
1.241034	1.204863	1.102926	2.632244	1.254689	0.454525	0.0	
1.298808	1.261772	1.163124	2.710859	1.300982	0.476003	0.0	
1.345027	1.307299	1.211283	2.773749	1.338015	0.493185	0.0	
1.475666	1.395194	1.044677	0.443416	0.0	0.0	0.0	
1.579768	1.494761	1.127648	0.510321	0.0	0.0	0.0	
1.724981	1.635491	1.247263	0.584128	0.0	0.0	0.0	
1.782339	1.691002	1.293560	0.611331	0.0	0.0	0.0	
1.828223	1.735410	1.330597	0.633094	0.0	0.0	0.0	

GROUP 2 BLOCK 3 FLUXES

1.726815
1.706811
1.671354
1.663657
1.657499

3.346049 3.454374
3.087574 3.184965
2.931379 3.033112
2.893929 2.997887
2.863967 2.969706

3.575168 3.258404 1.621637
3.352032 3.025277 1.626843
3.217520 2.890824 1.614398
3.186858 2.859220 1.613754
3.162326 2.833935 1.613238

3.160722 3.238148 3.011584 2.963405
2.960114 3.035549 2.847067 2.821697
2.850617 2.937820 2.769218 2.772141
2.826015 2.917636 2.753516 2.765504
2.806331 2.901486 2.740953 2.760193

1.536087 2.993455 3.182757 2.684055 1.186722
1.576957 2.867921 3.095038 2.603392 1.254342
1.596327 2.819743 3.075492 2.590070 1.307154
1.605340 2.812860 3.077915 2.592959 1.326259
1.612548 2.807351 3.079852 2.595268 1.341543

2.814771 3.055184 3.079554 2.585134 1.972850 1.407116
2.760075 3.008428 3.061991 2.584166 1.970434 1.539503
2.769342 3.032627 3.107790 2.642556 2.033338 1.702947
2.779431 3.048449 3.130177 2.667787 2.058435 1.759106
2.787501 3.061104 3.148085 2.687971 2.078510 1.804031

2.749072 2.774181 2.824760 2.210340 1.418204 2.980495 0.773785
2.785339 2.813830 2.851498 2.343127 1.570961 3.167836 0.897126
2.869391 2.905450 2.958462 2.517396 1.747448 3.381455 1.012432
2.902579 2.941193 2.999700 2.578045 1.807296 3.455592 1.051193
2.929128 2.969784 3.032689 2.626562 1.855173 3.514899 1.082200

2.025558 1.957917 1.671157 4.514534 2.026464 0.661110 0.0 0.0
2.153034 2.086633 1.861678 4.833469 2.243855 0.781081 0.0 0.0
2.319469 2.252994 2.073078 5.133616 2.447588 0.886707 0.0 0.0
2.376715 2.310143 2.144287 5.236332 2.515709 0.921843 0.0 0.0
2.422511 2.355860 2.201253 5.318500 2.570204 0.949952 0.0 0.0

2.835750 2.681467 2.006445 0.848428 0.0 0.0 0.0 0.0
3.115153 2.948135 2.222491 1.002954 0.0 0.0 0.0 0.0
3.351439 3.178499 2.424093 1.135997 0.0 0.0 0.0 0.0
3.429988 3.255278 2.491185 1.179990 0.0 0.0 0.0 0.0
3.492825 3.316698 2.544856 1.215184 0.0 0.0 0.0 0.0

GROUP 2 BLOCK 4 FLUXES

2.725430							
2.736019							
2.670475							
2.651860							
2.636965							
5.287992	5.476582						
4.950623	5.125051						
4.689792	4.870154						
4.618605	4.801817						
4.561652	4.747144						
5.647551	5.174050	2.589888					
5.370183	4.874468	2.634319					
5.140904	4.645857	2.606096					
5.078640	4.583052	2.597702					
5.028825	4.532805	2.590985					
4.949224	5.079973	4.729597	4.612453				
4.696447	4.825885	4.529250	4.445816				
4.507342	4.653753	4.387279	4.347879				
4.455663	4.608115	4.348600	4.323157				
4.414317	4.571601	4.317654	4.303377				
2.361940	4.604454	4.895222	4.114524	1.804752			
2.451364	4.459367	4.811009	4.032864	1.926623			
2.469786	4.362902	4.755809	3.991251	1.997099			
2.475525	4.337556	4.743029	3.981766	2.019185			
2.480114	4.317276	4.732801	3.974175	2.036853			
4.252324	4.621407	4.661368	3.908577	2.972907	2.113400		
4.208248	4.592313	4.676936	3.942845	2.996900	2.333384		
4.198590	4.602800	4.719308	4.008853	3.075640	2.567405		
4.198608	4.609961	4.735871	4.032419	3.102554	2.642887		
4.198619	4.615687	4.749117	4.051269	3.124083	2.703271		
4.119164	4.159047	4.238133	3.317092	2.127164	4.465670	1.158186	
4.209752	4.254916	4.315159	3.546702	2.377170	4.789794	1.355357	
4.311339	4.367572	4.450691	3.788418	2.629675	5.086522	1.522149	
4.345012	4.404878	4.496050	3.865560	2.710149	5.180453	1.575257	
4.371948	4.434719	4.532334	3.927270	2.774527	5.255595	1.617742	
3.022360	2.922467	2.496406	6.749430	3.031606	0.988798	0.0	0.0
3.240053	3.141196	2.804841	7.289183	3.386594	1.178895	0.0	0.0
3.470259	3.371995	3.105598	7.699317	3.674549	1.331644	0.0	0.0
3.542805	3.444824	3.200665	7.825679	3.763841	1.379819	0.0	0.0
3.600840	3.503086	3.276716	7.926763	3.835272	1.418358	0.0	0.0
4.223038	3.994324	2.990391	1.265328	0.0	0.0	0.0	0.0
4.679451	4.429657	3.341100	1.508874	0.0	0.0	0.0	0.0
5.006598	4.749521	3.624530	1.700128	0.0	0.0	0.0	0.0
5.105629	4.846935	3.711806	1.759936	0.0	0.0	0.0	0.0
5.184851	4.924863	3.781623	1.807780	0.0	0.0	0.0	0.0

GROUP 2 BLOCK 5 FLUXES

3.892212							
3.937934							
3.843098							
3.813751							
3.790270							
7.587765	7.943831						
7.164920	7.519954						
6.787184	7.151887						
6.679687	7.047882						
6.593685	6.964672						
8.130277	7.604370	3.997069					
7.797175	7.267641	4.161209					
7.461118	6.938852	4.153797					
7.364739	6.842602	4.151691					
7.287631	6.765597	4.150003					
7.030763	7.286702	6.875951	6.562710				
6.721023	6.992834	6.670502	6.384296				
6.442060	6.738395	6.460780	6.231821				
6.361166	6.665193	6.397391	6.187242				
6.296447	6.606627	6.346676	6.151575				
3.264816	6.380444	6.798390	5.681102	2.458750			
3.403849	6.209621	6.713778	5.593399	2.633877			
3.419774	6.057814	6.615947	5.517325	2.720299			
3.422207	6.012722	6.586713	5.494315	2.745153			
3.424151	5.976644	6.563320	5.475902	2.765033			
5.736260	6.247463	6.310116	5.282065	3.997748	2.830038		
5.695204	6.227700	6.350628	5.344340	4.042139	3.133459		
5.662458	6.220062	6.385033	5.413766	4.132995	3.434999		
5.651913	6.218101	6.395284	5.435105	4.161071	3.529135		
5.643473	6.216528	6.403479	5.452172	4.183529	3.604441		
5.498574	5.556153	5.668227	4.438152	2.844125	5.964903	1.545841	
5.636909	5.701320	5.788027	4.758413	3.187463	6.416283	1.814327	
5.752923	5.831743	5.948396	5.063906	3.513144	6.789335	2.030451	
5.786840	5.870335	5.997457	5.156942	3.613651	6.901493	2.097327	
5.813969	5.901205	6.036702	5.231368	3.694054	6.991215	2.150827	
4.014565	3.883720	3.321358	8.992239	4.042810	1.318689	0.0	0.0
4.316991	4.187034	3.742643	9.738290	4.528863	1.576728	0.0	0.0
4.607736	4.479045	4.129382	10.249391	4.896371	1.774761	0.0	0.0
4.695058	4.567015	4.247625	10.397548	5.005750	1.835486	0.0	0.0
4.764912	4.637389	4.342216	10.516066	5.093249	1.884065	0.0	0.0
5.599502	5.298093	3.969720	1.681745	0.0	0.0	0.0	0.0
6.223464	5.893033	4.448080	2.010947	0.0	0.0	0.0	0.0
6.635804	6.296894	4.808755	2.257932	0.0	0.0	0.0	0.0
6.754169	6.413799	4.915172	2.332913	0.0	0.0	0.0	0.0
6.848855	6.507318	5.000301	2.392897	0.0	0.0	0.0	0.0

GROUP 2 BLOCK 6 FLUXES

5.187528							
5.256816							
5.131679							
5.092102							
5.060437							
10.199213	10.951459						
9.636794	10.367773						
9.129760	9.863006						
8.984311	9.719996						
8.867946	9.605582						
11.026878	11.042186	10.610146					
10.550854	10.514643	10.069660					
10.089332	10.046019	9.603498					
9.956339	9.911549	9.462125					
9.849938	9.803966	9.349020					
9.372180	9.965320	9.946616	8.930713				
8.954822	9.549827	9.588996	8.663660				
8.574559	9.190950	9.273915	8.435578				
8.462961	9.087041	9.181383	8.368093				
8.373678	9.003906	9.107350	8.314099				
4.214361	8.277150	8.871003	7.349141	3.126616			
4.394492	8.050975	8.739305	7.227446	3.348650			
4.406364	7.836917	8.588386	7.110061	3.448982			
4.405604	7.771337	8.541414	7.072680	3.476374			
4.404993	7.718868	8.503830	7.042771	3.498285			
7.209822	7.872392	7.965964	6.654799	5.008638	3.529762		
7.163168	7.850241	8.016953	6.733890	5.066722	3.910194		
7.104787	7.821193	8.039274	6.802890	5.166432	4.274683		
7.083642	7.809973	8.042883	6.821558	5.195149	4.386380		
7.066721	7.800991	8.045764	6.836488	5.218119	4.475734		
6.836434	6.913834	7.061811	5.531354	3.541938	7.420699	1.921675	
7.015151	7.100333	7.215840	5.933417	3.971947	7.987387	2.257007	
7.142485	7.245123	7.397035	6.297487	4.366060	8.429346	2.519279	
7.176366	7.284649	7.449259	6.405376	4.485471	8.558141	2.599116	
7.203465	7.316264	7.491032	6.491682	4.580997	8.661171	2.662983	
4.966683	4.807138	4.115916	11.158905	5.021533	1.638012	0.0	0.0
5.346392	5.187613	4.641873	12.092477	5.628834	1.959862	0.0	0.0
5.692909	5.536068	5.108909	12.694579	6.069804	2.200319	0.0	0.0
5.794041	5.638196	5.248997	12.862636	6.197908	2.272871	0.0	0.0
5.874942	5.719894	5.361064	12.997073	6.300388	2.330911	0.0	0.0
6.915599	6.545669	4.908591	2.082040	0.0	0.0	0.0	0.0
7.693822	7.287514	5.504589	2.491202	0.0	0.0	0.0	0.0
8.184255	7.768437	5.936541	2.790237	0.0	0.0	0.0	0.0
8.320549	7.903429	6.060793	2.879487	0.0	0.0	0.0	0.0
8.429577	8.011416	6.160191	2.950886	0.0	0.0	0.0	0.0

GROUP 2 BLOCK 7 FLUXES

```
 6.398207
 6.514411
 6.366114
 6.318285
 6.280017

12.615576 13.634611
11.983855 13.006883
11.366879 12.398588
11.188335 12.223975
11.045491 12.084276

13.665875 13.855335 13.616804
13.147402 13.328398 13.158057
12.585273 12.774716 12.664323
12.421485 12.613194 12.518570
12.290447 12.483967 12.401959

11.521690 12.326902 12.409283 10.994153
11.058623 11.894003 12.077197 10.732561
10.593457 11.459821 11.706345 10.454279
10.455311 11.331634 11.594531 10.369372
10.344787 11.229076 11.505073 10.301439

 5.090078 10.014622 10.750062  8.870004  3.738298
 5.319377  9.765650 10.617647  8.742316  4.008359
 5.329393  9.498384 10.424569  8.590460  4.121902
 5.326218  9.414884 10.362665  8.540642  4.151774
 5.323674  9.348078 10.313134  8.500783  4.175668

 8.558984  9.360341  9.481149  7.910561  5.931904  4.167346
 8.510794  9.341687  9.549320  8.009944  6.003906  4.617798
 8.428752  9.293081  9.560764  8.078324  6.110978  5.038692
 8.398024  9.273567  9.558485  8.094608  6.140180  5.166191
 8.373436  9.257949  9.556654  8.107629  6.163537  5.268187

 8.051748  8.147840  8.329543  6.526386  4.176969  8.744734  2.263302
 8.266886  8.371857  8.514968  7.002844  4.685543  9.415055  2.658964
 8.403603  8.528782  8.714075  7.419090  5.140987  9.917675  2.962545
 8.437393  8.569090  8.769072  7.540313  5.277413 10.061204  3.054020
 8.464419  8.601330  8.813062  7.637286  5.386549 10.176020  3.127198

 5.827262  5.642211  4.835385 13.123931  5.910236  1.928036  0.0       0.0
 6.275654  6.091355  5.455194 14.225113  6.626510  2.307423  0.0       0.0
 6.671557  6.489834  5.993921 14.907076  7.132778  2.585861  0.0       0.0
 6.785016  6.604605  6.153608 15.092727  7.277614  2.669035  0.0       0.0
 6.875779  6.696417  6.281354 15.241238  7.393479  2.735573  0.0       0.0

 8.102814  7.671561  5.756752  2.444187  0.0       0.0       0.0       0.0
 9.017951  8.543851  6.457404  2.924948  0.0       0.0       0.0       0.0
 9.577232  9.092766  6.952487  3.270420  0.0       0.0       0.0       0.0
 9.729442  9.243824  7.092631  3.372452  0.0       0.0       0.0       0.0
 9.851203  9.364663  7.204741  3.454075  0.0       0.0       0.0       0.0
```

GROUP 2 BLOCK 8 FLUXES

7.392887
7.557334
7.393321
7.339359
7.296185

14.584752 15.781399
13.911798 15.121267
13.210265 14.431531
13.005627 14.231752
12.841908 14.071919

15.794316 16.044674 15.796543
15.256715 15.502861 15.331605
14.618997 14.875904 14.772715
14.431358 14.691046 14.605738
14.281237 14.543150 14.472147

13.266660 14.205960 14.309885 12.626693
12.778125 13.758230 13.978983 12.365614
12.248160 13.264622 13.557559 12.047519
12.089187 13.117087 13.428549 11.948709
11.962000 12.999050 13.325331 11.869654

5.810943 11.436788 12.277060 10.111590 4.242741
6.085510 11.176834 12.151908 9.985046 4.554884
6.095708 10.868739 11.927732 9.807370 4.680240
6.090893 10.771076 11.854295 9.747838 4.712352
6.087038 10.692939 11.795536 9.700206 4.738038

9.679648 10.594352 10.735538 8.950971 6.698711 4.697648
9.634052 10.583392 10.823315 9.071236 6.784466 5.207470
9.533499 10.520038 10.827449 9.140362 6.898261 5.675601
9.495051 10.493952 10.820642 9.154928 6.927987 5.816314
9.464286 10.473075 10.815188 9.166575 6.951764 5.928881

9.062054 9.173500 9.383055 7.353494 4.705130 9.846380 2.547584
9.309021 9.430484 9.596686 7.893525 5.280047 10.604571 2.993851
9.453992 9.598010 9.811265 8.353635 5.786785 11.157948 3.331885
9.487816 9.639087 9.868695 8.486052 5.937426 11.313783 3.433062
9.514869 9.671943 9.914632 8.591979 6.057934 11.438443 3.514000

6.542023 6.335857 5.433185 14.757429 6.649407 2.169330 0.0 0.0
7.047790 6.842438 6.131496 15.999698 7.457230 2.596891 0.0 0.0
7.484783 7.282556 6.729923 16.748355 8.017977 2.906988 0.0 0.0
7.608503 7.407853 6.905931 16.948697 8.176764 2.999012 0.0 0.0
7.707473 7.508085 7.046732 17.108959 8.303788 3.072629 0.0 0.0

9.088287 8.606261 6.461119 2.745076 0.0 0.0 0.0 0.0
10.117053 9.586893 7.248835 3.285468 0.0 0.0 0.0 0.0
10.733408 10.192194 7.796323 3.669532 0.0 0.0 0.0 0.0
10.898823 10.356582 7.949663 3.782187 0.0 0.0 0.0 0.0
11.031147 10.488085 8.072328 3.872309 0.0 0.0 0.0 0.0

GROUP 2 BLOCK 9 FLUXES

8.111038
8.311864
8.137942
8.079742
8.033177

16.001099 17.315269
15.299887 16.630827
14.539506 15.884022
14.316280 15.666220
14.137689 15.491967

17.318045 17.595390 17.317123
16.767007 17.039538 16.842263
16.076849 16.360795 16.236663
15.872235 16.159114 16.054206
15.708533 15.997759 15.908230

14.519259 15.545335 15.652009 13.787682
14.012716 15.084752 15.317485 13.523967
13.437702 14.549393 14.860045 13.177815
13.263906 14.387979 14.718572 13.069006
13.124859 14.258837 14.605384 12.981950

6.332829 12.463652 13.376017 11.006845 4.608719
6.640897 12.196434 13.256258 10.881325 4.951796
6.652153 11.860251 13.011037 10.686163 5.086351
6.646298 11.752546 12.929467 10.619782 5.120202
6.641610 11.666374 12.864202 10.566670 5.147279

10.497205 11.493526 11.648442 9.708521 7.258218 5.085209
10.454687 11.489490 11.751814 9.845051 7.354721 5.638911
10.341904 11.416821 11.752114 9.915946 7.474274 6.142221
10.298037 11.386187 11.742266 9.929476 7.504534 6.292723
10.262937 11.361672 11.734380 9.940294 7.528737 6.413120

9.800531 9.923010 10.152680 7.957784 5.091207 10.652049 2.755540
10.071388 10.204784 10.387732 8.544974 5.715071 11.475338 3.239043
10.223363 10.381070 10.614691 9.038072 6.259944 12.066957 3.602612
10.257379 10.422886 10.674087 9.178844 6.421104 12.231999 3.710954
10.284583 10.456330 10.721597 9.291455 6.550027 12.364024 3.797625

.0
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7.064512 6.842908 5.870187 15.951699 7.189978 2.345835 0.0 0.
7.612361 7.391652 6.626129 17.298019 8.065244 2.808807 0.0 0.
8.079986 7.862803 7.268796 18.096969 8.666599 3.142342 0.0 0.
8.211311 7.995900 7.456848 18.308328 8.835735 3.240899 0.0 0.
8.316364 8.102372 7.607285 18.477402 8.971038 3.319743 0.0 0.

.0
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.0
.0
.0
9.808539 9.289435 6.976005 2.965056 0.0 0.0 0.0 0.
10.920320 10.349269 7.827451 3.549133 0.0 0.0 0.0 0.
11.579119 10.996491 8.413819 3.961703 0.0 0.0 0.0 0.
11.754312 11.170749 8.576909 4.082186 0.0 0.0 0.0 0.
11.894459 11.310147 8.707375 4.178569 0.0 0.0 0.0 0.

GROUP 2 BLOCK 10 FLUXES

8.525119
8.747328
8.569744
8.509489
8.461279

16.816180 18.195626
16.099112 17.497331
15.308358 16.721424
15.075055 16.493928
14.888402 16.311920

18.192098 18.481637 18.181303
17.633370 17.917442 17.700180
16.916734 17.212578 17.071192
16.703037 17.001905 16.880497
16.532067 16.833354 16.727928

15.236656 16.310118 16.415046 14.447692
14.719537 15.841583 16.077486 14.181424
14.121510 15.285225 15.602229 13.821529
13.939741 15.116412 15.454165 13.707460
13.794316 14.981351 15.335703 13.616195

6.631317 13.050133 14.002350 11.516753 4.817209
6.958348 12.778247 13.884918 11.391103 5.177587
6.971409 12.428102 13.629872 11.187676 5.318117
6.965205 12.315067 13.544097 11.117735 5.353116
6.960237 12.224630 13.475468 11.061773 5.381112

10.963461 12.006243 12.168672 10.140048 7.576832 5.305814
10.922134 12.005525 12.280259 10.285226 7.678949 5.884062
10.803896 11.929233 12.280088 10.358513 7.802742 6.408093
10.757245 11.896350 12.268860 10.371742 7.833509 6.564328
10.719916 11.870034 12.259869 10.382317 7.858116 6.689312

10.220301 10.349112 10.590328 8.301511 5.310852 11.110409 2.873837
10.503920 10.644165 10.836757 8.914853 5.962110 11.969798 3.378254
10.661125 10.826704 11.072056 9.427770 6.529376 12.584507 3.756724
10.695507 10.869204 11.132844 9.573528 6.696682 12.755090 3.869237
10.723006 10.903196 11.181467 9.690126 6.830522 12.891548 3.959245

7.360723 7.130443 6.118167 16.630009 7.497261 2.446198 0.0 0.0
7.931632 7.702334 6.906165 18.033813 8.410152 2.929062 0.0 0.0
8.417438 8.191881 7.574668 18.863255 9.035505 3.276245 0.0 0.0
8.553251 8.329576 7.769725 19.081305 9.210740 3.378599 0.0 0.0
8.661896 8.439727 7.925765 19.255731 9.350922 3.460479 0.0 0.0

10.216374 9.676376 7.267808 3.089835 0.0 0.0 0.0 0.0
11.373866 10.779856 8.154484 3.698304 0.0 0.0 0.0 0.0
12.057774 11.451847 8.763674 4.127409 0.0 0.0 0.0 0.0
12.238751 11.631931 8.932477 4.252424 0.0 0.0 0.0 0.0
12.383523 11.775989 9.067513 4.352433 0.0 0.0 0.0 0.0

GROUP 2 BLOCK 11 FLUXES

8.623846
8.852372
8.678104
8.618440
8.570702

17.009457 18.403195
16.290621 17.703574
15.499937 16.928612
15.266049 16.700797
15.078928 16.518533

18.395884 18.686647 18.377556
17.836993 18.122127 17.895778
17.121834 17.418820 17.268563
16.907966 17.208017 17.077846
16.736859 17.039362 16.925260

15.398622 16.481074 16.582390 14.588327
14.879729 16.011134 16.243990 14.320796
14.282314 15.456145 15.770610 13.962637
14.100247 15.287267 15.622647 13.848716
13.954583 15.152154 15.504265 13.757569

6.693975 13.172645 14.131699 11.620058 4.857771
7.024539 12.898848 14.013481 11.493046 5.220643
7.040233 12.549753 13.760556 11.291109 5.363570
7.034584 12.436672 13.675054 11.221326 5.399160
7.030060 12.346199 13.606642 11.165491 5.427629

11.051496 12.103771 12.267696 10.221390 7.635468 5.345471
11.008375 12.101497 12.378603 10.366155 7.736893 5.926616
10.891637 12.027343 12.381194 10.442127 7.862939 6.455325
10.845167 11.994831 12.370518 10.455947 7.894233 6.612906
10.807983 11.968812 12.361968 10.466995 7.919262 6.738966

10.293672 10.423996 10.667870 8.362686 5.349865 11.191407 2.894641
10.576888 10.718715 10.913619 8.978378 6.004433 12.053949 3.401814
10.736996 10.904366 11.152413 9.496353 6.576636 12.674627 3.783407
10.772028 10.947583 11.214051 9.643480 6.745354 12.846810 3.896839
10.800047 10.982148 11.263353 9.761175 6.880324 12.984547 3.987582

7.409917 7.178447 6.160110 16.746573 7.550719 2.463710 0.0 0.0
7.982327 7.751948 6.951533 18.155047 8.467782 2.949223 0.0 0.0
8.472386 8.245762 7.625456 18.992543 9.098591 3.299216 0.0 0.0
8.609340 8.384610 7.822055 19.212666 9.275329 3.402391 0.0 0.0
8.718896 8.495683 7.979329 19.388750 9.416712 3.484929 0.0 0.0

10.282660 9.739557 7.315974 3.110747 0.0 0.0 0.0 0.0
11.443954 10.846728 8.205874 3.722132 0.0 0.0 0.0 0.0
12.133573 11.524304 8.819983 4.154506 0.0 0.0 0.0 0.0
12.316041 11.705864 8.990133 4.280471 0.0 0.0 0.0 0.0
12.462007 11.851104 9.126247 4.381241 0.0 0.0 0.0 0.0

GROUP 2 BLOCK 12 FLUXES

8.407288
8.627808
8.464170
8.408159
8.363344

16.581376 17.939003
15.876217 17.252011
15.116578 16.508597
14.892311 16.290606
14.712887 16.116202

17.929733 18.212111 17.907263
17.379605 17.656005 17.431525
16.694420 16.982438 16.831642
16.490059 16.781127 16.649837
16.326559 16.620066 16.504381

15.003541 16.056731 16.152606 14.206553
14.492676 15.592927 15.816391 13.939658
13.919887 15.062036 15.364863 13.598887
13.745796 14.901055 15.224294 13.491019
13.606513 14.772260 15.111829 13.404715

6.517969 12.825776 13.758291 11.311296 4.727282
6.836609 12.553153 13.636412 11.181820 5.077512
6.855756 12.220244 13.397602 10.991124 5.219054
6.851793 12.112837 13.317296 10.925562 5.254775
6.848618 12.026903 13.253041 10.873104 5.283348

10.752481 11.776860 11.936393 9.944689 7.427622 5.199213
10.704256 11.767783 12.037279 10.079512 7.521620 5.760724
10.595836 11.701337 12.045588 10.158134 7.647571 6.277316
10.552796 11.672117 12.037682 10.173645 7.679529 6.431803
10.518356 11.648733 12.031349 10.186046 7.705091 6.555388

10.010393 10.137443 10.375097 8.133389 5.203116 10.884099 2.815078
10.279205 10.417364 10.607301 8.726537 5.835929 11.715251 3.306127
10.439439 10.602500 10.844182 9.233977 6.394805 12.323686 3.678534
10.475577 10.646632 10.906274 9.378875 6.560136 12.493543 3.789566
10.504479 10.681930 10.955940 9.494787 6.692397 12.629419 3.878390

7.203973 6.979129 5.989483 16.284128 7.342720 2.395883 0.0 0.0
7.755213 7.531601 6.754428 17.641821 8.229023 2.866119 0.0 0.0
8.234797 8.014754 7.412370 18.463405 8.845762 3.207596 0.0 0.0
8.369534 8.151296 7.604956 18.681050 9.019355 3.308557 0.0 0.0
8.477318 8.260524 7.759020 18.855153 9.158223 3.389324 0.0 0.0

9.995754 9.468027 7.112407 3.024433 0.0 0.0 0.0 0.0
11.116884 10.536976 7.971989 3.616336 0.0 0.0 0.0 0.0
11.791660 11.199825 8.572137 4.038091 0.0 0.0 0.0 0.0
11.971317 11.378491 8.739213 4.161344 0.0 0.0 0.0 0.0
12.115034 11.521415 8.872867 4.259944 0.0 0.0 0.0 0.0

GROUP 2 BLOCK 13 FLUXES

```
 7.885798
 8.085146
 7.939334
 7.890275
 7.851022

15.552305 16.825064
14.876983 16.165475
14.178511 15.483372
13.974312 15.285636
13.810942 15.127437

16.815173 17.079282 16.791451
16.283676 16.541817 16.329255
15.656178 15.925372 15.781492
15.471302 15.743473 15.617814
15.323390 15.597943 15.486861

14.068199 15.054880 15.143165 13.316726
13.575754 14.605410 14.812845 13.052902
13.050895 14.120651 14.402477 12.744593
12.893261 13.975768 14.276842 12.648885
12.767146 13.859852 14.176324 12.572309

 6.109336 12.021380 12.894673 10.600338  4.429406
 6.401244 11.753391 12.766775 10.467630  4.752265
 6.424555 11.451240 12.553549 10.297465  4.888574
 6.423557 11.355388 12.483559 10.240330  4.924068
 6.422754 11.278699 12.427558 10.194614  4.952460

10.073854 11.033877 11.183343  9.316932  6.958149  4.870197
10.017399 11.012996 11.265200  9.432557  7.038131  5.389900
 9.923681 10.959389 11.281780  9.513472  7.161403  5.877607
 9.887447 10.936539 11.279031  9.531917  7.194265  6.024702
 9.858453 10.918252 11.276824  9.546666  7.220549  6.142373

 9.376042  9.495205  9.718057  7.618427  4.873655 10.194751  2.636743
 9.616649  9.746074  9.924041  8.164508  5.460029 10.960437  3.093061
 9.773919  9.926760 10.153302  8.645724  5.987353 11.538199  3.444009
 9.811759  9.972152 10.215608  8.784965  6.144646 11.701986  3.549409
 9.842024 10.008459 10.265445  8.896352  6.270476 11.833007  3.633726

 6.746369  6.535910  5.609337 15.251354  6.877308  2.244045  0.0        0.
 7.254005  7.044959  6.318268 16.503464  7.698377  2.681330  0.0        0.
 7.708273  7.502423  6.938843 17.284785  8.281455  3.003004  0.0        0.
 7.837578  7.633338  7.122022 17.495659  8.447413  3.098789  0.0        0.
 7.941016  7.738064  7.268560 17.664347  8.580174  3.175414  0.0        0.

 9.360204  8.866152  6.660492  2.832394  0.0       0.0       0.0        0.
10.397615  9.855364  7.456547  3.382676  0.0       0.0       0.0        0.
11.036800 10.482997  8.023759  3.779949  0.0       0.0       0.0        0.
11.209513 10.654562  8.183479  3.896913  0.0       0.0       0.0        0.
11.347676 10.791806  8.311249  3.990481  0.0       0.0       0.0        0.
```

GROUP 2 BLOCK 14 FLUXES

7.079712								
7.246265								
7.124963								
7.086106								
7.055016								
13.962243	15.104537							
13.333035	14.487408							
12.723744	13.894279							
12.549648	13.726844							
12.410361	13.592887							
15.095013	15.331709	15.072271						
14.592598	14.823467	14.631749						
14.048526	14.289560	14.159068						
13.892749	14.136631	14.022397						
13.768117	14.014278	13.913050						
12.627620	13.512802	13.591175	11.950866					
12.164251	13.086309	13.271137	11.693132					
11.708935	12.668078	12.919742	11.431135					
11.575906	12.547187	12.816302	11.353462					
11.469475	12.450465	12.733540	11.291315					
5.482539	10.787858	11.571144	9.511811	3.974179				
5.734177	10.528381	11.435666	9.375651	4.256013				
5.762180	10.270381	11.258469	9.234451	4.383313				
5.765424	10.191726	11.203726	9.189778	4.418273				
5.768014	10.128795	11.159924	9.154033	4.446237				
9.037958	9.899413	10.033508	8.358817	6.242303	4.368966			
8.970722	9.862454	10.088298	8.446879	6.302294	4.826115			
8.897389	9.826161	10.115180	8.529417	6.420178	5.268898			
8.871199	9.812643	10.119897	8.552005	6.454181	5.404549			
8.850241	9.801822	10.123663	8.570069	6.481380	5.513065			
8.410576	8.517555	8.717600	6.834192	4.371961	9.145236	2.365281		
8.610253	8.726223	8.885709	7.310323	4.888778	9.813612	2.769400		
8.761288	8.898384	9.101589	7.750184	5.367133	10.342831	3.087174		
8.801421	8.945388	9.163902	7.880546	5.512000	10.497006	3.183884		
8.833521	8.982984	9.213747	7.984830	5.627890	10.620338	3.261250		
6.051123	5.862409	5.031436	13.680495	6.169118	2.012981	0.0	0.0	
6.494147	6.307060	5.656625	14.775702	6.892620	2.400707	0.0	0.0	
6.908786	6.724350	6.219376	15.493064	7.423211	2.691809	0.0	0.0	
7.029623	6.846502	6.388053	15.693107	7.577288	2.779617	0.0	0.0	
7.126288	6.944219	6.522990	15.853130	7.700544	2.849861	0.0	0.0	
8.395278	7.952222	5.974040	2.540548	0.0	0.0	0.0	0.0	
9.308037	8.822681	6.675354	3.028374	0.0	0.0	0.0	0.0	
9.891573	9.395311	7.191380	3.387920	0.0	0.0	0.0	0.0	
10.053431	9.555790	7.339687	3.495209	0.0	0.0	0.0	0.0	
10.182910	9.684167	7.458328	3.581038	0.0	0.0	0.0	0.0	

GROUP 2 BLOCK 15 FLUXES

6.018895
6.142962
6.051990
6.026220
6.005600

11.869995 12.840936
11.302761 12.281131
10.807389 11.801371
10.672326 11.673168
10.564268 11.570598

12.832509 13.033518 12.812423
12.369906 12.565352 12.402165
11.931927 12.136344 12.024723
11.813790 12.020872 11.922929
11.719271 11.928487 11.841485

10.734216 11.486434 11.552609 10.157814
10.310568 11.091817 11.247912 9.909827
9.943812 10.758006 10.971048 9.706170
9.842614 10.668096 10.896212 9.651698
9.761648 10.596160 10.836335 9.608115

4.659882 9.169051 9.834601 8.084096 3.377492
4.859562 8.922406 9.691030 7.944988 3.606324
4.892539 8.720208 9.558820 7.839957 3.721033
4.901115 8.663713 9.523633 7.811262 3.755115
4.907973 8.618511 9.495477 7.788300 3.782379

7.680662 8.412822 8.526793 7.103534 5.304773 3.712736
7.600975 8.356625 8.547974 7.157064 5.339789 4.088939
7.552761 8.341254 8.586542 7.240227 5.449515 4.472083
7.539405 8.339597 8.600655 7.267910 5.484756 4.592526
7.528715 8.338266 8.611939 7.290051 5.512945 4.688878

7.146874 7.237829 7.407909 5.807527 3.715219 7.771507 2.009990
7.294693 7.392987 7.528182 6.193525 4.141943 8.314438 2.346328
7.436135 7.552528 7.725041 6.578016 4.555363 8.778419 2.620203
7.478945 7.601308 7.787014 6.696444 4.683739 8.919556 2.705397
7.513188 7.640327 7.836588 6.791183 4.786436 9.032458 2.773550

5.141693 4.981375 4.275360 11.624982 5.242322 1.710590 0.0 0.0
5.501529 5.343069 4.792128 12.517825 5.839498 2.033928 0.0 0.0
5.863290 5.706789 5.278299 13.149009 6.300222 2.284604 0.0 0.0
5.972789 5.817218 5.427751 13.334226 6.438424 2.361848 0.0 0.0
6.060384 5.905558 5.547309 13.482391 6.548981 2.423642 0.0 0.0

7.133432 6.757012 5.076227 2.158783 0.0 0.0 0.0 0.0
7.885108 7.473988 5.654991 2.565521 0.0 0.0 0.0 0.0
8.394379 7.973259 6.102969 2.875213 0.0 0.0 0.0 0.0
8.541644 8.118857 6.236046 2.969698 0.0 0.0 0.0 0.0
8.659449 8.235330 6.342503 3.045283 0.0 0.0 0.0 0.0

GROUP 2 BLOCK 16 FLUXES

4.741911
4.816104
4.760094
4.749665
4.741319

9.351553 10.116386
8.861257 9.628128
8.500201 9.281795
8.411400 9.200026
8.340354 9.134604

10.109586 10.267824 10.093366
9.697511 9.850551 9.722215
9.384215 9.544762 9.456460
9.310586 9.473564 9.395840
9.251677 9.416598 9.347336

8.456205 9.048661 9.100568 8.001606
8.082647 8.694883 8.816891 7.767675
7.820050 8.460095 8.627163 7.632029
7.756495 8.406751 8.586019 7.604826
7.705645 8.364070 8.553097 7.583058

3.670699 7.222642 7.746815 6.367867 2.660441
3.809098 6.993600 7.595867 6.227165 2.826483
3.847028 6.856610 7.515708 6.163953 2.925309
3.861698 6.826196 7.503411 6.153941 2.958071
3.873432 6.801860 7.493568 6.145928 2.984279

6.049766 6.626491 6.716296 5.595312 4.178579 2.924650
5.957084 6.549310 6.699222 5.609126 4.184913 3.204621
5.937555 6.557413 6.750093 5.691544 4.283670 3.515178
5.939127 6.569461 6.774914 5.724829 4.319965 3.616954
5.940381 6.579094 6.794767 5.751452 4.348999 3.698373

5.629113 5.700788 5.834866 4.574482 2.926554 6.122118 1.583474
5.716512 5.793540 5.899522 4.853706 3.246054 6.516269 1.838924
5.844983 5.936428 6.071943 5.170318 3.580513 6.899800 2.059451
5.890492 5.986805 6.132928 5.273878 3.688672 7.024424 2.130540
5.926894 6.027102 6.181712 5.356722 3.775197 7.124118 2.187410

4.049804 3.923565 3.367577 9.157077 4.129634 1.347593 0.0
4.311112 4.186951 3.755279 9.809688 4.576381 1.594043 0.0
4.608218 4.485192 4.148399 10.334337 4.951711 1.795626 0.0
4.703642 4.581086 4.274308 10.500553 5.070234 1.859944 0.0
4.779978 4.657798 4.375033 10.633518 5.165049 1.911397 0.0

5.618799 5.322355 3.998563 1.700556 0.0 0.0 0.0
6.178918 5.856781 4.431445 2.010477 0.0 0.0 0.0
6.597220 6.266226 4.796321 2.259639 0.0 0.0 0.0
6.726240 6.393251 4.910533 2.338460 0.0 0.0 0.0
6.829451 6.494866 5.001899 2.401515 0.0 0.0 0.0

GROUP 2 BLOCK 17 FLUXES

3.294952
3.314477
3.296544
3.302872
3.307932

6.498171 7.029491
6.098258 6.625690
5.886554 6.427465
5.849095 6.397149
5.819125 6.372892

7.024652 7.134471 7.013050
6.673226 6.778250 6.689524
6.498148 6.608961 6.547274
6.473791 6.586747 6.532137
6.454301 6.568971 6.520023

5.875751 6.287284 6.323153 5.559572
5.561965 5.982957 6.066448 5.344455
5.414922 5.857740 5.972812 5.283621
5.393042 5.844788 5.968793 5.286388
5.375534 5.834422 5.965574 5.288597

2.550398 5.018431 5.382495 4.424483 1.848554
2.620995 4.812101 5.226055 4.284368 1.944621
2.663498 4.747019 5.202733 4.266774 2.024646
2.684592 4.745316 5.215469 4.277166 2.055513
2.701465 4.743950 5.225655 4.285476 2.080206

4.203390 4.604044 4.666429 3.887844 2.903954 2.033185
4.098440 4.505657 4.608453 3.858687 2.879297 2.205252
4.109830 4.538585 4.671344 3.938566 2.964183 2.432160
4.127588 4.565359 4.707450 3.977425 3.000981 2.512034
4.141792 4.586776 4.736332 4.008509 3.030417 2.575931

3.911092 3.960910 4.054355 3.179163 2.034430 4.257956 1.101855
3.932171 3.985022 4.057910 3.338946 2.233522 4.484905 1.266039
4.044327 4.107324 4.200653 3.576738 2.477054 4.773300 1.424770
4.092130 4.158710 4.259600 3.662513 2.561535 4.877282 1.479179
4.130370 4.199816 4.306755 3.731131 2.629117 4.960464 1.522705

2.814392 2.726721 2.340709 6.367245 2.872305 0.937709 0.0 0.0
2.965566 2.880130 2.583362 6.749479 3.149536 1.097394 0.0 0.0
3.187872 3.102613 2.869384 7.147654 3.425167 1.242188 0.0 0.0
3.266563 3.181243 2.967745 7.289623 3.519945 1.291253 0.0 0.0
3.329514 3.244145 3.046432 7.403193 3.595765 1.330504 0.0 0.0
0.0
0.0
0.0
0.0
0.0

3.906857 3.700834 2.780816 1.183110 0.0 0.0 0.0 0.0
4.251440 4.029808 3.049393 1.383750 0.0 0.0 0.0 0.0
4.563378 4.334269 3.317397 1.562875 0.0 0.0 0.0 0.0
4.670118 4.438680 3.408881 1.623196 0.0 0.0 0.0 0.0
4.755507 4.522206 3.482066 1.671452 0.0 0.0 0.0 0.0
0.0
0.0
0.0
0.0
0.0

GROUP 2 BLOCK 18 FLUXES

1.753069							
1.762882							
1.846284							
1.899188							
1.941509							
3.452451	3.733197						
3.225063	3.499512						
3.263979	3.557355						
3.323613	3.627983						
3.371317	3.684482						
3.730089	3.787999	3.723178					
3.522848	3.577397	3.529750					
3.593961	3.654092	3.618886					
3.668681	3.731545	3.699408					
3.728454	3.793505	3.763822					
3.121393	3.338792	3.357068	2.952098				
2.940569	3.159494	3.201326	2.821596				
3.001316	3.241285	3.301756	2.922542				
3.063252	3.313922	3.380782	2.996131				
3.112800	3.372030	3.444001	3.054999				
1.356846	2.666090	2.857868	2.350154	0.983291			
1.393789	2.544365	2.758083	2.263924	1.032817			
1.491292	2.631245	2.876135	2.362902	1.131120			
1.543157	2.695453	2.954071	2.427121	1.178596			
1.584649	2.746819	3.016418	2.478494	1.216576			
2.233253	2.444860	2.477131	2.064377	1.543280	1.082732		
2.167094	2.378557	2.429712	2.034879	1.519405	1.161206		
2.277798	2.509626	2.578203	2.173732	1.635103	1.328120		
2.344074	2.586370	2.661474	2.248390	1.694414	1.399056		
2.397093	2.647762	2.728089	2.308114	1.741862	1.455804		
2.076410	2.102530	2.152132	1.689670	1.083113	2.268605	0.590364	
2.072982	2.099578	2.135212	1.756027	1.175328	2.325578	0.659597	
2.231383	2.264050	2.308752	1.957218	1.351751	2.512143	0.750095	
2.312506	2.347793	2.396144	2.047476	1.425816	2.592064	0.784729	
2.377402	2.414786	2.466056	2.119680	1.485067	2.655999	0.812435	
1.495869	1.449289	1.245594	3.388788	1.532265	0.502440	0.0	0.0
1.560780	1.515493	1.358190	3.494489	1.634744	0.571726	0.0	0.0
1.746797	1.699469	1.564296	3.757165	1.802225	0.654057	0.0	0.0
1.829017	1.780562	1.650319	3.870223	1.869195	0.685178	0.0	0.0
1.894791	1.845434	1.719136	3.960666	1.922770	0.710075	0.0	0.0
2.080448	1.970823	1.482549	0.633603	0.0	0.0	0.0	0.0
2.203465	2.088481	1.582153	0.720483	0.0	0.0	0.0	0.0
2.401030	2.280134	1.745789	0.822474	0.0	0.0	0.0	0.0
2.481501	2.358079	1.810942	0.860905	0.0	0.0	0.0	0.0
2.545877	2.420433	1.863063	0.891649	0.0	0.0	0.0	0.0

GROUP 2 BLOCK 19 FLUXES

3.621994
3.977359
4.041360
4.067709
4.088784

4.210581 4.448545
4.575986 4.838931
4.697730 4.983622
4.756288 5.051651
4.803132 5.106071

4.426973 4.489504 4.409653
4.844286 4.914110 4.845202
5.005800 5.084412 5.031638
5.078614 5.160401 5.112116
5.136862 5.221188 5.176495

3.794157 3.975772 3.978182 3.511908
4.159347 4.365503 4.396701 3.894506
4.307427 4.537542 4.593103 4.086901
4.371609 4.611101 4.674244 4.164396
4.422951 4.669944 4.739152 4.226389

2.803161 3.251260 3.390260 2.849988 2.004195
3.144140 3.609522 3.790672 3.194114 2.297378
3.263493 3.785939 4.003273 3.381786 2.439185
3.304265 3.856102 4.086401 3.453850 2.485879
3.336879 3.912229 4.152900 3.511500 2.523234

2.734099 2.910647 2.914022 2.427630 1.719770 1.100976
3.084716 3.284568 3.309741 2.771531 1.981289 1.303061
3.286314 3.509496 3.554855 2.995543 2.167299 1.464449
3.361933 3.594301 3.646279 3.078074 2.234602 1.521361
3.422427 3.662142 3.719416 3.144097 2.288443 1.566890

2.443768 2.456901 2.311972 1.760193 1.101726 0.514145 0.128161
2.822860 2.838158 2.674956 2.070547 1.317822 0.651562 0.167229
3.074233 3.095852 2.938253 2.303464 1.488862 0.769865 0.201248
3.165219 3.189121 3.033758 2.386322 1.548724 0.815073 0.214171
3.238006 3.263734 3.110160 2.452606 1.596613 0.851239 0.224509

1.575232 1.524510 1.258852 0.761922 0.342616 0.109344 0.0 0.0
0.0 1.862487 1.806882 1.513185 0.971634 0.443067 0.145233 0.0 0.0
0.0 2.080661 2.022818 1.712866 1.144387 0.527981 0.175907 0.0 0.0
0.0 2.157725 2.098975 1.782446 1.210321 0.560211 0.187497 0.0 0.0
0.0 2.219374 2.159900 1.838109 1.263067 0.585994 0.196769 0.0 0.0
0.0

0.463285 0.438905 0.332752 0.137672 0.0 0.0 0.0 0.0
0.0 0.598613 0.567640 0.432050 0.182745 0.0 0.0 0.0 0.0
0.0 0.708914 0.673566 0.516357 0.220832 0.0 0.0 0.0 0.0
0.0 0.750904 0.713920 0.548296 0.235190 0.0 0.0 0.0 0.0
0.0 0.784495 0.746203 0.573847 0.246677 0.0 0.0 0.0 0.0
0.0

BLOCK 1 POWER

0.066025
0.080852
0.087805
0.089869
0.091519

0.256414 0.270147
0.263725 0.279365
0.260444 0.277461
0.260174 0.277679
0.259957 0.277853

0.281675 0.249987 0.062082
0.299018 0.259032 0.077290
0.301181 0.257663 0.085338
0.302571 0.257952 0.087785
0.303683 0.258183 0.089742

0.244454 0.255633 0.233051 0.235570
0.255810 0.269613 0.246731 0.252955
0.256579 0.272701 0.250484 0.260117
0.257505 0.274431 0.252342 0.263087
0.258245 0.275816 0.253829 0.265464

0.059989 0.234447 0.255965 0.211091 0.046064
0.076729 0.252122 0.283686 0.230057 0.060663
0.086615 0.259031 0.297090 0.239228 0.070445
0.089698 0.261893 0.302029 0.242740 0.073578
0.092164 0.264183 0.305979 0.245550 0.076085

0.222972 0.247543 0.248586 0.207090 0.141256 0.097284
0.246293 0.277392 0.282293 0.235064 0.159143 0.114083
0.258802 0.294405 0.302386 0.252642 0.171733 0.127283
0.263450 0.300571 0.309517 0.258871 0.176214 0.131822
0.267168 0.305504 0.315221 0.263855 0.179798 0.135453

0.223605 0.224202 0.209832 0.159176 0.099711 0.046798 0.011725
0.259060 0.259876 0.243768 0.187952 0.119595 0.059436 0.015342
0.281739 0.283225 0.267722 0.209048 0.134966 0.070138 0.018449
0.289648 0.291368 0.276106 0.216310 0.140189 0.074153 0.019609
0.295975 0.297882 0.282814 0.222120 0.144368 0.077365 0.020538

0.148330 0.143193 0.117527 0.070563 0.031534 0.010055 0.0 0.0
0.176289 0.170639 0.142103 0.090560 0.041004 0.013420 0.0 0.0
0.196989 0.191111 0.160975 0.106779 0.048900 0.016263 0.0 0.0
0.204104 0.198138 0.167384 0.112854 0.051843 0.017319 0.0 0.0
0.209796 0.203759 0.172512 0.117714 0.054198 0.018164 0.0 0.0

0.044072 0.041670 0.031439 0.012919 0.0 0.0 0.0 0.0
0.057330 0.054266 0.041122 0.017287 0.0 0.0 0.0 0.0
0.067957 0.064460 0.049210 0.020925 0.0 0.0 0.0 0.0
0.071938 0.068281 0.052226 0.022275 0.0 0.0 0.0 0.0
0.075122 0.071338 0.054638 0.023355 0.0 0.0 0.0 0.0

BLOCK 2 POWER

0.115258								
0.110677								
0.110762								
0.112097								
0.113165								
0.225681	0.232996							
0.205383	0.212195							
0.202496	0.210151							
0.204153	0.212210							
0.205478	0.213857							
0.241730	0.219828	0.108305						
0.224314	0.201417	0.105568						
0.224346	0.199980	0.107315						
0.227154	0.202039	0.109117						
0.229399	0.203685	0.110559						
0.214563	0.220012	0.204729	0.202448					
0.198393	0.203967	0.191230	0.190797					
0.198605	0.205543	0.193519	0.195343					
0.201148	0.208654	0.196655	0.199259					
0.203182	0.211142	0.199164	0.202391					
0.104252	0.205374	0.218765	0.184602	0.081079				
0.104099	0.194565	0.211066	0.177108	0.083333				
0.108066	0.199160	0.219052	0.183492	0.089036				
0.110593	0.203094	0.224314	0.187799	0.091926				
0.112615	0.206241	0.228523	0.191244	0.094239				
0.195092	0.211845	0.213542	0.179305	0.136906	0.098140			
0.189350	0.206977	0.210803	0.177690	0.134932	0.105858			
0.197971	0.217901	0.223597	0.189625	0.144623	0.121021			
0.203182	0.224135	0.230491	0.195838	0.149535	0.127336			
0.207351	0.229122	0.236007	0.200808	0.153465	0.132388			
0.191793	0.193483	0.196935	0.154227	0.099094	0.208462	0.054446		
0.192989	0.194860	0.197177	0.161847	0.108473	0.215603	0.061381		
0.207808	0.210276	0.213483	0.180727	0.124947	0.233307	0.069925		
0.215157	0.217865	0.221407	0.188956	0.131710	0.240614	0.073120		
0.221036	0.223936	0.227746	0.195539	0.137121	0.246459	0.075676		
0.141885	0.137120	0.117107	0.316156	0.142129	0.046556	0.0	0.0	
0.149471	0.144806	0.129019	0.329659	0.153258	0.053515	0.0	0.0	
0.167540	0.162656	0.148895	0.355353	0.169383	0.061361	0.0	0.0	
0.175339	0.170339	0.157022	0.365966	0.175633	0.064260	0.0	0.0	
0.181579	0.176485	0.163523	0.374456	0.180632	0.066580	0.0	0.0	
0.199215	0.188351	0.141031	0.059861	0.0	0.0	0.0	0.0	
0.213269	0.201793	0.152232	0.068893	0.0	0.0	0.0	0.0	
0.232872	0.220791	0.168380	0.078857	0.0	0.0	0.0	0.0	
0.240616	0.228285	0.174631	0.082530	0.0	0.0	0.0	0.0	
0.246810	0.234280	0.179631	0.085468	0.0	0.0	0.0	0.0	

BLOCK 3 POWER

0.233120								
0.230690								
0.225633								
0.224594								
0.223762								
0.451717	0.466340							
0.416822	0.429970							
0.395736	0.409470							
0.390680	0.404715							
0.386636	0.400910							
0.482648	0.439884	0.218921						
0.452524	0.408412	0.219624						
0.434365	0.390261	0.217944						
0.430226	0.385995	0.217857						
0.426914	0.382581	0.217787						
0.426697	0.437150	0.406564	0.400060					
0.399615	0.409799	0.384354	0.380929					
0.384833	0.396606	0.373844	0.374239					
0.381512	0.393881	0.371725	0.373343					
0.378855	0.391701	0.370029	0.372626					
0.207372	0.404116	0.429672	0.362347	0.160207				
0.212889	0.387169	0.417830	0.351458	0.169336				
0.215504	0.380665	0.415191	0.349659	0.176466				
0.216721	0.379736	0.415519	0.350049	0.179045				
0.217694	0.378992	0.415780	0.350361	0.181108				
0.379994	0.412450	0.415740	0.348993	0.266335	0.189961			
0.372610	0.406138	0.413369	0.348862	0.266009	0.207833			
0.373861	0.409405	0.419552	0.356745	0.274501	0.229898			
0.375223	0.411541	0.422574	0.360151	0.277889	0.237479			
0.376313	0.413249	0.424991	0.362876	0.280599	0.243544			
0.371125	0.374514	0.381343	0.298396	0.191458	0.402367	0.104461		
0.376021	0.379867	0.384952	0.316322	0.212080	0.427658	0.121112		
0.387368	0.392236	0.399392	0.339848	0.235905	0.456496	0.136678		
0.391848	0.397061	0.404960	0.348036	0.243985	0.466505	0.141911		
0.395432	0.400921	0.409413	0.354586	0.250448	0.474511	0.146097		
0.273450	0.264319	0.225606	0.609462	0.273573	0.089250	0.0	0.0	
0.290660	0.281695	0.251326	0.652518	0.302920	0.105446	0.0	0.0	
0.313128	0.304154	0.279866	0.693038	0.330424	0.119705	0.0	0.0	
0.320857	0.311869	0.289479	0.706905	0.339621	0.124449	0.0	0.0	
0.327039	0.318041	0.297169	0.717998	0.346978	0.128243	0.0	0.0	
0.382826	0.361998	0.270870	0.114538	0.0	0.0	0.0	0.0	
0.420546	0.397998	0.300036	0.135399	0.0	0.0	0.0	0.0	
0.452444	0.429097	0.327253	0.153360	0.0	0.0	0.0	0.0	
0.463048	0.439462	0.336310	0.159299	0.0	0.0	0.0	0.0	
0.471531	0.447754	0.343556	0.164050	0.0	0.0	0.0	0.0	

BLOCK 4 POWER

0.367933								
0.369362								
0.360514								
0.358001								
0.355990								
0.713879	0.739338							
0.668334	0.691882							
0.633122	0.657471							
0.623512	0.648245							
0.615823	0.640864							
0.762419	0.698497	0.349635						
0.724975	0.658053	0.355633						
0.694022	0.627191	0.351823						
0.685616	0.618712	0.350690						
0.678891	0.611929	0.349783						
0.668145	0.685796	0.638496	0.622681					
0.634020	0.651494	0.611449	0.600185					
0.608491	0.628257	0.592283	0.586964					
0.601514	0.622096	0.587061	0.583626					
0.595933	0.617166	0.582883	0.580956					
0.318862	0.621601	0.660855	0.555461	0.243642				
0.330934	0.602015	0.649486	0.544437	0.260094				
0.333421	0.588992	0.642034	0.538819	0.269608				
0.334196	0.585570	0.640309	0.537538	0.272590				
0.334815	0.582832	0.638928	0.536514	0.274975				
0.574064	0.623890	0.629285	0.527658	0.401342	0.285309			
0.568113	0.619962	0.631386	0.532284	0.404582	0.315007			
0.566810	0.621378	0.637107	0.541195	0.415211	0.346600			
0.566812	0.622345	0.639342	0.544376	0.418845	0.356790			
0.566813	0.623118	0.641131	0.546921	0.421751	0.364942			
0.556087	0.561471	0.572148	0.447807	0.287167	0.602865	0.156355		
0.568316	0.574414	0.582546	0.478805	0.320918	0.646622	0.182973		
0.582031	0.589622	0.600843	0.511436	0.355006	0.686680	0.205490		
0.586577	0.594658	0.606967	0.521851	0.365870	0.699361	0.212660		
0.590213	0.598687	0.611865	0.530181	0.374561	0.709505	0.218395		
0.408019	0.394533	0.337015	0.911173	0.409267	0.133488	0.0	0.	
0.437407	0.424061	0.378653	0.984040	0.457190	0.159151	0.0	0.	
0.468485	0.455219	0.419256	1.039408	0.496064	0.179772	0.0	0.	
0.478279	0.465051	0.432090	1.056467	0.508119	0.186276	0.0	0.	
0.486113	0.472917	0.442357	1.070113	0.517762	0.191478	0.0	0.	
0.570110	0.539234	0.403703	0.170819	0.0	0.0	0.0	0.	
0.631726	0.598004	0.451049	0.203698	0.0	0.0	0.0	0.	
0.675891	0.641185	0.489312	0.229517	0.0	0.0	0.0	0.	
0.689260	0.654336	0.501094	0.237591	0.0	0.0	0.0	0.	
0.699955	0.664856	0.510519	0.244050	0.0	0.0	0.0	0.	

BLOCK 5 POWER

0.525449							
0.531621							
0.518818							
0.514856							
0.511686							
1.024348	1.072417						
0.967264	1.015194						
0.916270	0.965505						
0.901758	0.951464						
0.890147	0.940231						
1.097587	1.026590	0.539604					
1.052619	0.981132	0.561763					
1.007251	0.936745	0.560763					
0.994240	0.923751	0.560478					
0.983830	0.913356	0.560250					
0.949153	0.983705	0.928253	0.885966				
0.907338	0.944032	0.900518	0.861880				
0.869678	0.909683	0.872205	0.841296				
0.858757	0.899801	0.863648	0.835278				
0.850020	0.891895	0.856801	0.830463				
0.440750	0.861360	0.917783	0.766949	0.331931			
0.459520	0.838299	0.906360	0.755109	0.355573			
0.461669	0.817805	0.893153	0.744839	0.367240			
0.461998	0.811717	0.889206	0.741732	0.370596			
0.462260	0.806847	0.886048	0.739247	0.373279			
0.774395	0.843407	0.851866	0.713079	0.539696	0.382055		
0.768852	0.840740	0.857335	0.721486	0.545689	0.423017		
0.764432	0.839708	0.861979	0.730858	0.557954	0.463725		
0.763008	0.839444	0.863363	0.733739	0.561745	0.476433		
0.761869	0.839231	0.864470	0.736043	0.564776	0.486600		
0.742307	0.750081	0.765211	0.599151	0.383957	0.805262	0.208689	
0.760983	0.769678	0.781384	0.642386	0.430307	0.866198	0.244934	
0.776645	0.787285	0.803033	0.683627	0.474274	0.916560	0.274111	
0.781223	0.792495	0.809657	0.696187	0.487843	0.931702	0.283139	
0.784886	0.796663	0.814955	0.706235	0.498697	0.943814	0.290362	
0.541966	0.524302	0.448383	1.213952	0.545779	0.178023	0.0	0.0
0.582794	0.565249	0.505257	1.314669	0.611397	0.212858	0.0	0.0
0.622044	0.604671	0.557467	1.383668	0.661010	0.239593	0.0	0.0
0.633833	0.616547	0.573429	1.403669	0.675776	0.247791	0.0	0.0
0.643263	0.626047	0.586199	1.419669	0.687589	0.254349	0.0	0.0
0.755933	0.715243	0.535912	0.227036	0.0	0.0	0.0	0.0
0.840168	0.795559	0.600491	0.271478	0.0	0.0	0.0	0.0
0.895834	0.850081	0.649182	0.304821	0.0	0.0	0.0	0.0
0.911813	0.865863	0.663548	0.314943	0.0	0.0	0.0	0.0
0.924595	0.878488	0.675041	0.323041	0.0	0.0	0.0	0.0

BLOCK 6 POWER

0.700316								
0.709670								
0.692777								
0.687434								
0.683159								
1.376894	1.478447							
1.300967	1.399649							
1.232518	1.331506							
1.212882	1.312199							
1.197173	1.296753							
1.488628	1.490695	1.432370						
1.424365	1.419477	1.359404						
1.362060	1.356212	1.296472						
1.344106	1.338059	1.277387						
1.329742	1.323535	1.262118						
1.265244	1.345318	1.342793	1.205646					
1.208901	1.289226	1.294514	1.169594					
1.157565	1.240778	1.251978	1.138803					
1.142500	1.226750	1.239487	1.129693					
1.130446	1.215527	1.229492	1.122403					
0.568939	1.117415	1.197585	0.992134	0.422093				
0.593256	1.086882	1.179806	0.975705	0.452068				
0.594859	1.057984	1.159432	0.959858	0.465613				
0.594757	1.049130	1.153091	0.954812	0.469310				
0.594674	1.042047	1.148017	0.950774	0.472268				
0.973326	1.062773	1.075405	0.898398	0.676166	0.476518			
0.967028	1.059782	1.082289	0.909075	0.684007	0.527876			
0.959146	1.055861	1.085302	0.918390	0.697468	0.577082			
0.956292	1.054346	1.085789	0.920910	0.701345	0.592161			
0.954007	1.053134	1.086178	0.922926	0.704446	0.604224			
0.922918	0.933368	0.953344	0.746733	0.478162	1.001794	0.259426		
0.947045	0.958545	0.974138	0.801011	0.536213	1.078297	0.304696		
0.964235	0.978092	0.998600	0.850161	0.589418	1.137962	0.340103		
0.968809	0.983427	1.005650	0.864726	0.605539	1.155349	0.350881		
0.972468	0.987696	1.011289	0.876377	0.618435	1.169258	0.359503		
.0								
.0	0.670502	0.648964	0.555649	1.506452	0.677907	0.221132	0.0	0.0
.0	0.721763	0.700328	0.626653	1.632484	0.759893	0.264581	0.0	0.0
.0	0.768543	0.747369	0.689703	1.713768	0.819423	0.297043	0.0	0.0
.0	0.782195	0.761156	0.708615	1.736456	0.836718	0.306838	0.0	0.0
	0.793117	0.772186	0.723744	1.754605	0.850552	0.314673	0.0	0.0
.0								
.0	0.933606	0.883665	0.662660	0.281075	0.0	0.0	0.0	0.0
.0	1.038666	0.983814	0.743119	0.336312	0.0	0.0	0.0	0.0
.0	1.104874	1.048739	0.801433	0.376682	0.0	0.0	0.0	0.0
.0	1.123274	1.066963	0.818207	0.388731	0.0	0.0	0.0	0.0
	1.137993	1.081541	0.831626	0.398370	0.0	0.0	0.0	0.0

BLOCK 7 POWER

0.863758								
0.879445								
0.859425								
0.852968								
0.847802								
1.703103	1.840672							
1.617820	1.755929							
1.534529	1.673809							
1.510425	1.650237							
1.491141	1.631377							
1.844893	1.870470	1.838268						
1.774899	1.799334	1.776338						
1.699012	1.724587	1.709684						
1.676900	1.702781	1.690007						
1.659210	1.685335	1.674264						
1.555428	1.664132	1.675253	1.484211					
1.492914	1.605690	1.630422	1.448896					
1.430117	1.547076	1.580356	1.411328					
1.411467	1.529770	1.565262	1.399865					
1.396546	1.515925	1.553185	1.390694					
0.687161	1.351974	1.451258	1.197451	0.504670				
0.718116	1.318363	1.433382	1.180213	0.541128				
0.719468	1.282282	1.407317	1.159712	0.556457				
0.719039	1.271009	1.398960	1.152987	0.560489				
0.718696	1.261990	1.392273	1.147606	0.563715				
1.155463	1.263646	1.279955	1.067926	0.800807	0.562592			
1.148957	1.261128	1.289158	1.081342	0.810527	0.623403			
1.137881	1.254566	1.290703	1.090574	0.824982	0.680223			
1.133733	1.251931	1.290395	1.092772	0.828924	0.697436			
1.130414	1.249823	1.290148	1.094530	0.832077	0.711205			
1.086986	1.099958	1.124488	0.881062	0.563891	1.180539	0.305546		
1.116029	1.130201	1.149521	0.945384	0.632548	1.271032	0.358960		
1.134486	1.151386	1.176400	1.001577	0.694033	1.338886	0.399944		
1.139048	1.156827	1.183825	1.017942	0.712451	1.358262	0.412293		
1.142697	1.161180	1.189763	1.031034	0.727184	1.373763	0.422172		
0.786680	0.761698	0.652777	1.771730	0.797882	0.260285	0.0	0.0	
0.847213	0.822333	0.736451	1.920390	0.894579	0.311502	0.0	0.0	
0.900660	0.876128	0.809179	2.012455	0.962925	0.349091	0.0	0.0	
0.915977	0.891622	0.830737	2.037518	0.982478	0.360320	0.0	0.0	
0.928230	0.904016	0.847983	2.057567	0.998120	0.369302	0.0	0.0	
1.093880	1.035661	0.777161	0.329965	0.0	0.0	0.0	0.0	
1.217423	1.153420	0.871749	0.394868	0.0	0.0	0.0	0.0	
1.292926	1.227523	0.938586	0.441507	0.0	0.0	0.0	0.0	
1.313475	1.247916	0.957505	0.455281	0.0	0.0	0.0	0.0	
1.329912	1.264229	0.972640	0.466300	0.0	0.0	0.0		

BLOCK 8 POWER

0.998040
1.020240
0.998098
0.990813
0.984985

1.968941 2.130489
1.878093 2.041371
1.783386 1.948256
1.755760 1.921286
1.733657 1.899709

2.132232 2.166031 2.132533
2.059656 2.092886 2.069767
1.973564 2.008247 1.994316
1.948233 1.983291 1.971775
1.927967 1.963325 1.953740

1.790999 1.917804 1.931834 1.704603
1.725047 1.857361 1.887163 1.669358
1.653502 1.790724 1.830270 1.626415
1.632040 1.770807 1.812854 1.613076
1.614870 1.754872 1.798920 1.602403

0.784477 1.543966 1.657403 1.365064 0.572770
0.821544 1.508872 1.640507 1.347981 0.614909
0.822920 1.467280 1.610244 1.323995 0.631832
0.822271 1.454095 1.600330 1.315958 0.636167
0.821750 1.443547 1.592397 1.309528 0.639635

1.306752 1.430237 1.449298 1.208381 0.904326 0.634182
1.300597 1.428758 1.461147 1.224617 0.915903 0.703008
1.287022 1.420205 1.461705 1.233949 0.931265 0.766206
1.281832 1.416683 1.460787 1.235915 0.935278 0.785202
1.277679 1.413865 1.460050 1.237488 0.938488 0.800399

1.223377 1.238422 1.266712 0.992722 0.635192 1.329261 0.343924
1.256718 1.273115 1.295553 1.065626 0.712806 1.431617 0.404170
1.276289 1.295731 1.324521 1.127741 0.781216 1.506323 0.449805
1.280855 1.301277 1.332274 1.145617 0.801552 1.527361 0.463463
1.284507 1.305712 1.338475 1.159917 0.817821 1.544190 0.474390

0.883173 0.855341 0.733480 1.992253 0.897670 0.292859 0.0 0.0
0.951452 0.923729 0.827752 2.159959 1.006726 0.350580 0.0 0.0
1.010446 0.983145 0.908540 2.261028 1.082427 0.392443 0.0 0.0
0.0 1.027148 1.000060 0.932301 2.288074 1.103863 0.404867 0.0 0.0
0.0 1.040509 1.013591 0.951309 2.309709 1.121011 0.414805 0.0 0.0
0.0
0.0 1.226919 1.161845 0.872251 0.370585 0.0 0.0 0.0 0.0
0.0 1.365802 1.294230 0.978593 0.443538 0.0 0.0 0.0 0.0
1.449010 1.375946 1.052504 0.495387 0.0 0.0 0.0 0.0
0.0 1.471341 1.398138 1.073204 0.510595 0.0 0.0 0.0 0.0
0.0 1.489205 1.415891 1.089764 0.522762 0.0 0.0 0.0 0.0
0.0
0.0
0.0

BLOCK 9 POWER

1.094990							
1.122102							
1.098622							
1.090765							
1.084479							
2.160148	2.337561						
2.065485	2.245161						
1.962833	2.144343						
1.932698	2.114940						
1.908588	2.091415						
2.337936	2.375377	2.337811					
2.263546	2.300337	2.273705					
2.170374	2.208707	2.191949					
2.142752	2.181480	2.167318					
2.120652	2.159697	2.147611					
1.960100	2.098620	2.113021	1.861337				
1.891717	2.036441	2.067860	1.825735				
1.814090	1.964168	2.006106	1.779005				
1.790627	1.942377	1.987007	1.764316				
1.771856	1.924943	1.971727	1.752563				
0.854932	1.682593	1.805762	1.485924	0.622177			
0.896521	1.646518	1.789595	1.468979	0.668492			
0.898041	1.601134	1.756490	1.442632	0.686657			
0.897250	1.586594	1.745478	1.433671	0.691227			
0.896617	1.574960	1.736667	1.426500	0.694883			
1.417123	1.551626	1.572540	1.310650	0.979859	0.686503		
1.411383	1.551081	1.586495	1.329082	0.992887	0.761253		
1.396157	1.541271	1.586535	1.338653	1.009027	0.829200		
1.390235	1.537135	1.585206	1.340479	1.013112	0.849518		
1.385496	1.533826	1.584141	1.341940	1.016379	0.865771		
1.323072	1.339606	1.370612	1.074301	0.687313	1.438026	0.371998	
1.359637	1.377646	1.402344	1.153571	0.771534	1.549171	0.437271	
1.380154	1.401444	1.432983	1.220140	0.845092	1.629039	0.486353	
1.384746	1.407089	1.441002	1.239144	0.866849	1.651320	0.500979	
1.388419	1.411604	1.447415	1.254346	0.884254	1.669143	0.512679	
0.953709	0.923793	0.792475	2.153479	0.970647	0.316688	0.0	0.0
1.027669	0.997873	0.894527	2.335232	1.088808	0.379189	0.0	0.0
1.090798	1.061478	0.981287	2.443091	1.169991	0.424216	0.0	0.0
1.108527	1.079446	1.006674	2.471624	1.192824	0.437521	0.0	0.0
1.122709	1.093820	1.026983	2.494449	1.211090	0.448165	0.0	0.0
1.324153	1.254074	0.941761	0.400283	0.0	0.0	0.0	0.0
1.474243	1.397151	1.056706	0.479133	0.0	0.0	0.0	0.0
1.563181	1.484526	1.135865	0.534830	0.0	0.0	0.0	0.0
1.586832	1.508051	1.157883	0.551095	0.0	0.0	0.0	0.0
1.605752	1.526870	1.175496	0.564107	0.0	0.0	0.0	0.0

BLOCK 10 POWER

1.150891								
1.180889								
1.156915								
1.148781								
1.142273								
2.270184	2.456409							
2.173380	2.362140							
2.066628	2.257392							
2.035132	2.226680							
2.009934	2.202109							
2.455933	2.495021	2.454476						
2.380505	2.418855	2.389524						
2.283759	2.323698	2.304611						
2.254910	2.295257	2.278867						
2.231829	2.272503	2.258270						
2.056948	2.201866	2.216031	1.950438					
1.987137	2.138614	2.170460	1.914492					
1.906404	2.063505	2.106301	1.865906					
1.881865	2.040715	2.086312	1.850507					
1.862233	2.022482	2.070320	1.838186					
0.895228	1.761768	1.890317	1.554762	0.650323				
0.939377	1.725063	1.874464	1.537799	0.698974				
0.941140	1.677794	1.840033	1.510336	0.717946				
0.940303	1.662534	1.828453	1.500894	0.722671				
0.939632	1.650325	1.819188	1.493339	0.726450				
1.480067	1.620843	1.642771	1.368906	1.022872	0.716285			
1.474488	1.620746	1.657835	1.388505	1.036658	0.794348			
1.458526	1.610446	1.657812	1.398399	1.053370	0.865092			
1.452228	1.606007	1.656296	1.400185	1.057524	0.886184			
1.447189	1.602455	1.655082	1.401613	1.060846	0.903057			
1.379740	1.397130	1.429694	1.120704	0.716965	1.499905	0.387968		
1.418029	1.436962	1.462962	1.203505	0.804885	1.615923	0.456064		
1.439252	1.461605	1.494727	1.272749	0.881466	1.698908	0.507158		
1.443893	1.467342	1.502934	1.292426	0.904052	1.721937	0.522347		
1.447606	1.471931	1.509498	1.308167	0.922120	1.740359	0.534498		
0.993698	0.962610	0.825953	2.245051	1.012130	0.330237	0.0	0.0	
1.070770	1.039815	0.932332	2.434565	1.135370	0.395423	0.0	0.0	
1.136354	1.105904	1.022580	2.546539	1.219793	0.442293	0.0	0.0	
1.154689	1.124493	1.048913	2.575976	1.243450	0.456111	0.0	0.0	
1.169356	1.139363	1.069978	2.599524	1.262374	0.467165	0.0	0.0	
1.379210	1.306311	0.981154	0.417128	0.0	0.0	0.0	0.0	
1.535472	1.455280	1.100855	0.499271	0.0	0.0	0.0	0.0	
1.627799	1.545999	1.183096	0.557200	0.0	0.0	0.0	0.0	
1.652231	1.570311	1.205884	0.574077	0.0	0.0	0.0	0.0	
1.671776	1.589758	1.224114	0.587578	0.0	0.0	0.0	0.0	

BLOCK 11 POWER

1.164219								
1.195070								
1.171544								
1.163489								
1.157045								
2.296277	2.484431							
2.199234	2.389982							
2.092491	2.285362							
2.060916	2.254607							
2.035655	2.230002							
2.483444	2.522724	2.480970						
2.407994	2.446487	2.415930						
2.311447	2.351541	2.331256						
2.282575	2.323082	2.305509						
2.259476	2.300314	2.284910						
2.078814	2.224945	2.238622	1.969424					
2.008763	2.161503	2.192938	1.933307					
1.928112	2.086579	2.129032	1.884956					
1.903533	2.063781	2.109057	1.869576					
1.883869	2.045541	2.093076	1.857272					
0.903687	1.778307	1.907779	1.568708	0.655799				
0.948313	1.741344	1.891820	1.551561	0.704787				
0.950431	1.694217	1.857675	1.524300	0.724082				
0.949669	1.678951	1.846132	1.514879	0.728887				
0.949058	1.666737	1.836897	1.507341	0.732730				
1.491952	1.634009	1.656139	1.379888	1.030788	0.721639			
1.486131	1.633702	1.671111	1.399431	1.044480	0.800093			
1.470371	1.623691	1.671461	1.409687	1.061497	0.871469			
1.464097	1.619302	1.670020	1.411553	1.065721	0.892742			
1.459078	1.615789	1.668866	1.413044	1.069100	0.909760			
1.389646	1.407239	1.440162	1.128963	0.722232	1.510840	0.390777		
1.427880	1.447026	1.473339	1.212081	0.810598	1.627283	0.459245		
1.449494	1.472089	1.505576	1.282008	0.887846	1.711075	0.510760		
1.454224	1.477924	1.513897	1.301870	0.910623	1.734319	0.526073		
1.458006	1.482590	1.520553	1.317759	0.928844	1.752914	0.538323		
1.000339	0.969090	0.831615	2.260787	1.019347	0.332601	0.0	0.0	
1.077614	1.046513	0.938457	2.450931	1.143151	0.398145	0.0	0.0	
1.143772	1.113178	1.029437	2.563993	1.228310	0.445394	0.0	0.0	
1.162261	1.131922	1.055977	2.593710	1.252169	0.459323	0.0	0.0	
1.177051	1.146917	1.077209	2.617481	1.271256	0.470465	0.0	0.0	
1.388159	1.314840	0.987656	0.419951	0.0	0.0	0.0	0.0	
1.544934	1.464308	1.107793	0.502488	0.0	0.0	0.0	0.0	
1.638032	1.555781	1.190698	0.560858	0.0	0.0	0.0	0.0	
1.662665	1.580292	1.213668	0.577864	0.0	0.0	0.0	0.0	
1.682371	1.599899	1.232043	0.591467	0.0				

BLOCK 12 POWER

1.134984								
1.164754								
1.142663								
1.135101								
1.129051								
2.238486	2.421765							
2.143289	2.329021							
2.040738	2.228660							
2.010462	2.199232							
1.986240	2.175687							
2.420514	2.458635	2.417480						
2.346246	2.383560	2.353256						
2.253746	2.292629	2.272271						
2.226158	2.265452	2.247728						
2.204085	2.243709	2.228091						
2.025478	2.167659	2.180602	1.917884					
1.956511	2.105045	2.135213	1.881854					
1.879185	2.033375	2.074256	1.835850					
1.855682	2.011642	2.055280	1.821287					
1.836879	1.994255	2.040097	1.809636					
.879926	1.731480	1.857369	1.527025	0.638183				
0.922942	1.694676	1.840916	1.509546	0.685464				
0.925527	1.649733	1.808676	1.483802	0.704572				
0.924992	1.635233	1.797835	1.474951	0.709395				
0.924563	1.623632	1.789160	1.467869	0.713252				
1.451585	1.589876	1.611413	1.342533	1.002729	0.701894			
1.445074	1.588651	1.625033	1.360734	1.015419	0.777698			
1.430438	1.579680	1.626154	1.371348	1.032422	0.847438			
1.424627	1.575736	1.625087	1.373442	1.036736	0.868293			
1.419978	1.572579	1.624232	1.375116	1.040187	0.884977			
1.351403	1.368555	1.400638	1.098007	0.702421	1.469353	0.380036		
1.387693	1.406344	1.431986	1.178082	0.787850	1.581559	0.446327		
1.409324	1.431337	1.463964	1.246587	0.863299	1.663698	0.496602		
1.414203	1.437295	1.472347	1.266148	0.885618	1.686628	0.511591		
1.418105	1.442060	1.479052	1.281796	0.903473	1.704971	0.523583		
).0 0.972536	0.942182	0.808580	2.198357	0.991267	0.323444	0.0	0.0	
).0 1.046954	1.016766	0.911848	2.381646	1.110918	0.386926	0.0	0.0	
).0 1.111697	1.081992	1.000670	2.492559	1.194178	0.433025	0.0	0.0	
).0 1.129887	1.100425	1.026669	2.521942	1.217613	0.446655	0.0	0.0	
).0 1.144438	1.115171	1.047468	2.545445	1.236360	0.457559	0.0	0.0	
).0 1.349427	1.278184	0.960175	0.408298	0.0	0.0	0.0	0.0	
).0 1.500779	1.422492	1.076218	0.488205	0.0	0.0	0.0	0.0	
).0 1.591874	1.511976	1.157238	0.545142	0.0	0.0	0.0	0.0	
).0 1.616128	1.536096	1.179794	0.561781	0.0	0.0	0.0	0.0	
).0 1.635529	1.555391	1.197837	0.575092	0.0	0.0	0.0	0.0	

BLOCK 13 POWER

1.064583								
1.091495								
1.071810								
1.065187								
1.059868								
2.099561	2.271383							
2.008393	2.182339							
1.914099	2.090255							
1.886532	2.063561							
1.864477	2.042204							
2.270048	2.305703	2.266846						
2.198296	2.233145	2.204449						
2.113584	2.149925	2.130501						
2.088626	2.125369	2.108405						
2.068657	2.105722	2.090726						
1.899207	2.032409	2.044327	1.797758					
1.832727	1.971730	1.999734	1.762142					
1.761871	1.906288	1.944334	1.720520					
1.740590	1.886729	1.927374	1.707599					
1.723565	1.871080	1.913804	1.697262					
0.824760	1.622886	1.740781	1.431045	0.597970				
0.864168	1.586708	1.723514	1.413130	0.641556				
0.867315	1.545917	1.694729	1.390158	0.659957				
0.867180	1.532977	1.685280	1.382444	0.664749				
0.867072	1.522624	1.677720	1.376273	0.668582				
1.359970	1.489573	1.509751	1.257786	0.939350	0.657477			
1.352349	1.486754	1.520802	1.273395	0.950148	0.727636			
1.339697	1.479517	1.523040	1.284319	0.966789	0.793477			
1.334805	1.476433	1.522669	1.286809	0.971226	0.813335			
1.330891	1.473964	1.522371	1.288800	0.974774	0.829220			
1.265766	1.281853	1.311938	1.028488	0.657943	1.376291	0.355960		
1.298248	1.315720	1.339745	1.102209	0.737104	1.479659	0.417563		
1.319479	1.340113	1.370696	1.167173	0.808293	1.557657	0.464941		
1.324587	1.346240	1.379107	1.185970	0.829527	1.579768	0.479170		
1.328673	1.351142	1.385835	1.201007	0.846514	1.597456	0.490553		
0.910760	0.882348	0.757260	2.058933	0.928437	0.302946	0.0	0.0	
0.979291	0.951069	0.852966	2.227968	1.039281	0.361979	0.0	0.0	
1.040617	1.012827	0.936744	2.333446	1.117996	0.405406	0.0	0.0	
1.058073	1.030500	0.961473	2.361914	1.140401	0.418336	0.0	0.0	
1.072037	1.044639	0.981256	2.384687	1.158323	0.428681	0.0	0.0	
1.263628	1.196930	0.899166	0.382373	0.0	0.0	0.0	0.0	
1.403678	1.330474	1.006634	0.456661	0.0	0.0	0.0	0.0	
1.489968	1.415204	1.083207	0.510293	0.0	0.0	0.0	0.0	
1.513284	1.438366	1.104770	0.526083	0.0	0.0	0.0	0.0	
1.531936	1.456894	1.122019	0.538715	0.0	0.0	0.0		

BLOCK 14 POWER

0.955761							
0.978246							
0.961870							
0.956624							
0.952427							
1.884903	2.039112						
1.799960	1.955800						
1.717705	1.875728						
1.694202	1.853124						
1.675399	1.835040						
2.037827	2.069781	2.034756					
1.970001	2.001168	1.975286					
1.896551	1.929090	1.911474					
1.875521	1.908445	1.893023					
1.858696	1.891927	1.878262					
1.704729	1.824228	1.834808	1.613367				
1.642174	1.766652	1.791603	1.578573				
1.580706	1.710190	1.744165	1.543203				
1.562747	1.693870	1.730201	1.532717				
1.548379	1.680813	1.719028	1.524327				
0.740143	1.456361	1.562104	1.284094	0.536514			
0.774114	1.421331	1.543815	1.265713	0.574562			
0.777894	1.386501	1.519893	1.246651	0.591747			
0.778332	1.375883	1.512503	1.240620	0.596467			
0.778682	1.367387	1.506590	1.235794	0.600242			
1.220124	1.336421	1.354524	1.128440	0.842711	0.589810		
1.211047	1.331431	1.361920	1.140329	0.850810	0.651525		
1.201147	1.326532	1.365549	1.151471	0.866724	0.711301		
1.197612	1.324707	1.366186	1.154521	0.871314	0.729614		
1.194782	1.323246	1.366694	1.156959	0.874986	0.744264		
1.135428	1.149870	1.176876	0.922616	0.590215	1.234607	0.319313	
1.162384	1.178040	1.199571	0.986894	0.659985	1.324838	0.373869	
1.182774	1.201282	1.228714	1.046275	0.724563	1.396282	0.416768	
1.188192	1.207627	1.237127	1.063874	0.744120	1.417096	0.429824	
1.192525	1.212703	1.243856	1.077952	0.759765	1.433746	0.440269	
0.816902	0.791425	0.679244	1.846867	0.832831	0.271752	0.0	0.0
0.876710	0.851453	0.763644	1.994720	0.930504	0.324095	0.0	0.0
0.932686	0.907787	0.839616	2.091564	1.002133	0.363394	0.0	0.0
0.948999	0.924278	0.862387	2.118569	1.022934	0.375248	0.0	0.0
0.962049	0.937470	0.880604	2.140172	1.039573	0.384731	0.0	0.0
1.133362	1.073550	0.806495	0.342974	0.0	0.0	0.0	0.0
1.256585	1.191062	0.901173	0.408830	0.0	0.0	0.0	0.0
1.335362	1.268367	0.970836	0.457369	0.0	0.0	0.0	0.0
1.357213	1.290032	0.990858	0.471853	0.0	0.0	0.0	0.0
1.374693	1.307362	1.006874	0.483440	0.0	0.0	0.0	0.0

BLOCK 15 POWER

0.812551							
0.829300							
0.817019							
0.813540							
0.810756							
1.602449	1.733526						
1.525873	1.657953						
1.458997	1.593185						
1.440764	1.575878						
1.426176	1.562031						
1.732389	1.759525	1.729677					
1.669937	1.696322	1.674292					
1.610810	1.638406	1.623337					
1.594862	1.622818	1.609595					
1.582102	1.610346	1.598600					
1.449119	1.550668	1.559602	1.371305				
1.391927	1.497395	1.518468	1.337827				
1.342415	1.452331	1.481091	1.310333				
1.328753	1.440193	1.470988	1.302979				
1.317822	1.430481	1.462905	1.297095				
0.629084	1.237822	1.327671	1.091353	0.455961			
0.656041	1.204525	1.308289	1.072573	0.486854			
0.660493	1.177228	1.290441	1.058394	0.502339			
0.661651	1.169601	1.285690	1.054520	0.506941			
0.662576	1.163499	1.281889	1.051420	0.510621			
1.036889	1.135731	1.151117	0.958977	0.716144	0.501219		
1.026131	1.128144	1.153976	0.966204	0.720871	0.552007		
1.019623	1.126069	1.159183	0.977431	0.735685	0.603731		
1.017820	1.125846	1.161088	0.981168	0.740442	0.619991		
1.016376	1.125666	1.162612	0.984157	0.744248	0.632998		
0.964828	0.977107	1.000068	0.784016	0.501555	1.049153	0.271349	
0.984784	0.998053	1.016305	0.836126	0.559162	1.122449	0.316754	
1.003878	1.019591	1.042880	0.888032	0.614974	1.185087	0.353727	
1.009658	1.026177	1.051247	0.904020	0.632305	1.204140	0.365229	
1.014280	1.031444	1.057939	0.916810	0.646169	1.219382	0.374429	
0.694128	0.672486	0.577174	1.569372	0.707713	0.230930	0.0	0.0
0.742706	0.721314	0.646937	1.689906	0.788332	0.274580	0.0	0.0
0.791544	0.770416	0.712570	1.775116	0.850530	0.308422	0.0	0.0
0.806326	0.785324	0.732746	1.800120	0.869187	0.318850	0.0	0.0
0.818152	0.797250	0.748887	1.820123	0.884112	0.327192	0.0	0.0
0.963013	0.912197	0.685291	0.291436	0.0	0.0	0.0	0.0
1.064490	1.008988	0.763424	0.346345	0.0	0.0	0.0	0.0
1.133241	1.076390	0.823901	0.388154	0.0	0.0	0.0	0.0
1.153122	1.096046	0.841866	0.400909	0.0	0.0	0.0	0.0
1.169026	1.111769	0.856238	0.411113	0.0	0.0	0.0	0.0

BLOCK 16 POWER

0.640158								
0.650174								
0.642613								
0.641205								
0.640078								
1.262460	1.365712							
1.196270	1.299797							
1.147527	1.253042							
1.135539	1.242003							
1.125948	1.233171							
1.364794	1.386156	1.362604						
1.309164	1.329824	1.312499						
1.266869	1.288543	1.276622						
1.256929	1.278931	1.268438						
1.248976	1.271241	1.261890						
1.141588	1.221569	1.228577	1.080217					
1.091157	1.173809	1.190280	1.048636					
1.055707	1.142113	1.164667	1.030324					
1.047127	1.134911	1.159112	1.026651					
1.040262	1.129149	1.154668	1.023713					
0.495544	0.975057	1.045820	0.859662	0.359159				
0.514228	0.944136	1.025442	0.840667	0.381575				
0.519349	0.925642	1.014620	0.832134	0.394917				
0.521329	0.921536	1.012960	0.830782	0.399340				
0.522913	0.918251	1.011632	0.829700	0.402878				
0.816718	0.894576	0.906700	0.755367	0.564108	0.394828			
0.804206	0.884157	0.904395	0.757232	0.564963	0.432624			
0.801570	0.885251	0.911262	0.768358	0.578295	0.474549			
0.801782	0.886877	0.914613	0.772852	0.583195	0.488289			
0.801951	0.888178	0.917293	0.776446	0.587115	0.499280			
0.759930	0.769606	0.787707	0.617555	0.395085	0.826486	0.213769		
0.771729	0.782128	0.796435	0.655250	0.438217	0.879696	0.248255		
0.789073	0.801418	0.819712	0.697993	0.483369	0.931473	0.278026		
0.795216	0.808219	0.827945	0.711973	0.497971	0.948297	0.287623		
0.800131	0.813659	0.834531	0.723157	0.509652	0.961756	0.295300		
0.546724	0.529681	0.454623	1.236205	0.557501	0.181925	0.0	0.0	
0.582000	0.565238	0.506963	1.324308	0.617811	0.215196	0.0	0.0	
0.622109	0.605501	0.560034	1.395135	0.668481	0.242409	0.0	0.0	
0.634992	0.618447	0.577032	1.417575	0.684482	0.251092	0.0	0.0	
0.645297	0.628803	0.590629	1.435525	0.697282	0.258039	0.0	0.0	
0.758538	0.718518	0.539806	0.229575	0.0	0.0	0.0	0.0	
0.834154	0.790665	0.598245	0.271414	0.0	0.0	0.0	0.0	
0.890625	0.845940	0.647503	0.305051	0.0	0.0	0.0	0.0	
0.908042	0.863089	0.662922	0.315692	0.0	0.0	0.0	0.0	
0.921976	0.876807	0.675256	0.324204	0.0	0.0	0.0	0.0	

BLOCK 17 POWER

0.444818								
0.447454								
0.445033								
0.445888								
0.446571								
0.877253	0.948981							
0.823265	0.894468							
0.794685	0.867708							
0.789628	0.863615							
0.785582	0.860340							
0.948328	0.963154	0.946762						
0.900885	0.915064	0.903086						
0.877250	0.892210	0.883882						
0.873962	0.889211	0.881838						
0.871331	0.886811	0.880203						
0.793226	0.848783	0.853626	0.750542					
0.750865	0.807699	0.818970	0.721501					
0.731014	0.790795	0.806330	0.713289					
0.728061	0.789046	0.805787	0.713662					
0.725697	0.787647	0.805352	0.713961					
0.344304	0.677488	0.726637	0.597305	0.249555				
0.353834	0.649634	0.705517	0.578390	0.262524				
0.359572	0.640848	0.702369	0.576014	0.273327				
0.362420	0.640618	0.704088	0.577417	0.277494				
0.364698	0.640433	0.705463	0.578539	0.280828				
0.567458	0.621546	0.629968	0.524859	0.392034	0.274480			
0.553289	0.608264	0.622141	0.520923	0.388705	0.297709			
0.554827	0.612709	0.630631	0.531706	0.400165	0.328342			
0.557224	0.616323	0.635506	0.536952	0.405132	0.339125			
0.559142	0.619215	0.639405	0.541149	0.409106	0.347751			
0.527997	0.534723	0.547338	0.429187	0.274648	0.574824	0.148750		
0.530843	0.537978	0.547818	0.450758	0.301526	0.605462	0.170915		
0.545984	0.554489	0.567088	0.482860	0.334402	0.644395	0.192344		
0.552438	0.561426	0.575046	0.494439	0.345807	0.658433	0.199689		
0.557600	0.566975	0.581412	0.503703	0.354931	0.669663	0.205565		
0.379943	0.368107	0.315996	0.859578	0.387761	0.126591	0.0	0.0	
0.400351	0.388818	0.348754	0.911180	0.425187	0.148148	0.0	0.0	
0.430363	0.418853	0.387367	0.964933	0.462398	0.167695	0.0	0.0	
0.440986	0.429468	0.400646	0.984099	0.475193	0.174319	0.0	0.0	
0.449484	0.437960	0.411268	0.999431	0.485428	0.179618	0.0	0.0	
0.527426	0.499613	0.375410	0.159720	0.0	0.0	0.0	0.0	
0.573944	0.544024	0.411668	0.186806	0.0	0.0	0.0	0.0	
0.616056	0.585126	0.447849	0.210988	0.0	0.0	0.0	0.0	
0.630466	0.599222	0.460199	0.219131	0.0	0.0	0.0	0.0	
0.641993	0.610498	0.470079	0.225646	0.0	0.0	0.0	0.0	

BLOCK 18 POWER

0.236664
0.237989
0.249248
0.256390
0.262104

0.466081 0.503982
0.435384 0.472434
0.440637 0.480243
0.448688 0.489778
0.455128 0.497405

0.503562 0.511380 0.502629
0.475584 0.482949 0.476516
0.485185 0.493302 0.488550
0.495272 0.503759 0.499420
0.503341 0.512123 0.508116

0.421388 0.450737 0.453204 0.398533
0.396977 0.426532 0.432179 0.380915
0.405178 0.437573 0.445737 0.394543
0.413539 0.447379 0.456406 0.404478
0.420228 0.455224 0.464940 0.412425

0.183174 0.359922 0.385812 0.317271 0.132744
0.188161 0.343489 0.372341 0.305630 0.139430
0.201324 0.355218 0.388278 0.318992 0.152701
0.208326 0.363886 0.398800 0.327661 0.159110
0.213928 0.370820 0.407216 0.334597 0.164238

0.301489 0.330056 0.334413 0.278691 0.208343 0.146169
0.292558 0.321105 0.328011 0.274709 0.205120 0.156763
0.307503 0.338800 0.348057 0.293454 0.220739 0.179296
0.316450 0.349160 0.359299 0.303533 0.228746 0.188873
0.323608 0.357448 0.368292 0.311595 0.235151 0.196533

0.280315 0.283842 0.290538 0.228105 0.146220 0.306262 0.079699
0.279853 0.283443 0.288254 0.237064 0.158669 0.313953 0.089046
0.301237 0.305647 0.311681 0.264224 0.182486 0.339139 0.101263
0.312188 0.316952 0.323479 0.276409 0.192485 0.349929 0.105938
0.320949 0.325996 0.332918 0.286157 0.200484 0.358560 0.109679

0.201942 0.195654 0.168155 0.457486 0.206856 0.067829 0.0 0.0
0.210705 0.204592 0.183356 0.471756 0.220690 0.077183 0.0 0.0
0.235818 0.229428 0.211180 0.507217 0.243300 0.088298 0.0 0.0
0.246917 0.240376 0.222793 0.522480 0.252341 0.092499 0.0 0.0
0.255797 0.249134 0.232083 0.534690 0.259574 0.095860 0.0 0.0

0.280860 0.266061 0.200144 0.085536 0.0 0.0 0.0 0.0
0.297468 0.281945 0.213591 0.097265 0.0 0.0 0.0 0.0
0.324139 0.307818 0.235682 0.111034 0.0 0.0 0.0 0.0
0.335003 0.318341 0.244477 0.116222 0.0 0.0 0.0 0.0
0.343693 0.326758 0.251514 0.120373 0.0 0.0 0.0 0.0

BLOCK 19 POWER

0.488969								
0.536943								
0.545584								
0.549141								
0.551986								
0.568428	0.600554							
0.617758	0.653256							
0.634193	0.672789							
0.642099	0.681973							
0.648423	0.689319							
0.597641	0.606083	0.595303						
0.653979	0.663405	0.654102						
0.675783	0.686396	0.679271						
0.685613	0.696654	0.690136						
0.693476	0.704860	0.698827						
0.512211	0.536729	0.537054	0.474108					
0.561512	0.589343	0.593555	0.525758					
0.581503	0.612568	0.620069	0.551732					
0.590167	0.622499	0.631023	0.562193					
0.597098	0.630442	0.639786	0.570562					
0.378427	0.438920	0.457685	0.384748	0.270566				
0.424459	0.487285	0.511741	0.431205	0.310146				
0.440572	0.511102	0.540442	0.456541	0.329290				
0.446076	0.520574	0.551664	0.466270	0.335594				
0.450479	0.528151	0.560642	0.474052	0.340637				
0.369103	0.392937	0.393393	0.327730	0.232169	0.148632			
0.416437	0.443417	0.446815	0.374157	0.267474	0.175913			
0.443652	0.473782	0.479905	0.404398	0.292585	0.197701			
0.453861	0.485231	0.492248	0.415540	0.301671	0.205384			
0.462028	0.494389	0.502121	0.424453	0.308940	0.211530			
0.329909	0.331682	0.312116	0.237626	0.148733	0.069410	0.017302		
0.381086	0.383151	0.361119	0.279524	0.177906	0.087961	0.022576		
0.415021	0.417940	0.396664	0.310968	0.200996	0.103932	0.027168		
0.427305	0.430531	0.409557	0.322153	0.209078	0.110035	0.028913		
0.437131	0.440604	0.419872	0.331102	0.215543	0.114917	0.030309		
0.212656	0.205809	0.169945	0.102859	0.046253	0.014761	0.0	0.0	
0.251436	0.243929	0.204280	0.131171	0.059814	0.019606	0.0	0.0	
0.280889	0.273080	0.231237	0.154492	0.071277	0.023747	0.0	0.0	
0.291293	0.283362	0.240630	0.163393	0.075628	0.025312	0.0	0.0	
0.299616	0.291587	0.248145	0.170514	0.079109	0.026564	0.0	0.0	
0.062543	0.059252	0.044921	0.018586	0.0	0.0	0.0	0.0	
0.080813	0.076631	0.058327	0.024671	0.0	0.0	0.0	0.0	
0.095703	0.090931	0.069708	0.029812	0.0	0.0	0.0	0.0	
0.101372	0.096379	0.074020	0.031751	0.0	0.0	0.0	0.0	
0.105907	0.100737	0.077469	0.033301	0.0	0.0			

BENCHMARK PROBLEM SOLUTION

Identification: 11-A1-2 — Benchmark Problem ID.11-A1

Date Submitted: June 1976 — By: Ib Misfeldt (Risø-Denmark)

Date Accepted: June 1977 — By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Three-dimensional PWR Problem

Mathematical Model: FEM (2nd order Lagrange interpolation, box-shaped elements)

Pertinent features of solution method

The calculations were performed with a rather coarse grid (16 x 16 x 13 meshes; 33 x 33 x 27 flux-points). To obtain the required additional results interpolation was used.

Computer: B 6700 — Date solved: Spring 1975

at: Risø, Denmark

Program: FEM3D

Reference: Ib Misfeldt, "Solution of the multigroup neutron diffusion equations by the finite element method," Risø-M-1809 (1975).

Results

1. Maximum eigenvalue $k_{eff} = 1.0292$

2. Fundamental flux distributions

   2.1, 2.2, 2.3 See Tables 3A-G of flux traverses

   2.4 Maximum power density
   Uninterpolated values are given

   $(\phi_2)_{max,1} = 17.60$ at (x,y,z) = (130,55,190)

   $(\phi_2)_{max,2} = 16.80$ at (x,y,z) = (30,35,190)

3. Average subassembly powers

   See Table 3H

4. Number of unknowns and iteration-number

   33 x 33 x 27 x 2 unknowns; 71 iterations

5. Computing times

   23 hours cp-time, io-time 6 hours, on B 6700

6. Convergence criteria

   Maximal flux-error-estimate less than 0.1% of $\emptyset_{max}$ in each group

7. Average group fluxes for 20 x 20 x 20 cm grid

   See Table 3J

8. Dependence of results on mesh spacing

   No data available

Table 3A
z = 190 cm
FLUX ALONG X-AXIS

X	PHI1	PHI2
0.000	43.616	7.293
5.000	45.454	7.443
10.000	50.801	10.175
20.000	62.837	14.868
30.000	68.498	15.878
35.000	69.391	16.270
40.000	69.316	16.261
45.000	68.233	16.014
50.000	66.143	15.522
55.000	62.978	14.775
60.000	58.612	13.683
65.000	52.690	12.233
70.000	45.393	8.903
75.000	39.323	6.431
80.000	36.430	6.073
85.000	36.604	5.985
90.000	39.638	7.748
95.000	43.655	10.127
100.000	46.378	10.820
105.000	47.713	11.193
110.000	48.029	11.273
115.000	47.493	11.151
120.000	46.228	10.867
125.000	44.342	10.429
130.000	41.822	10.100
135.000	38.279	9.498
140.000	33.227	8.613
145.000	26.979	7.287
150.000	16.812	12.443
155.000	8.252	20.102
160.000	4.090	14.566
165.000	2.041	7.785
170.000	1.082	0.324

Table 3B
z = 190 cm
FLUX ALONG THE DIAGONAL X=Y

X	Y	PHI1	PHI2
0.000	0.000	43.616	7.293
5.000	5.000	47.151	7.463
10.000	10.000	55.944	12.195
20.000	20.000	68.322	16.028
30.000	30.000	71.653	16.800
35.000	35.000	71.455	16.759
40.000	40.000	70.383	16.510
45.000	45.000	68.542	16.076
50.000	50.000	65.926	15.470
55.000	55.000	62.409	14.648
60.000	60.000	57.761	13.552
65.000	65.000	51.559	12.079
70.000	70.000	43.017	9.168
75.000	75.000	33.780	5.344
80.000	80.000	28.426	4.741
85.000	85.000	27.423	4.341
90.000	90.000	28.739	6.350
95.000	95.000	27.729	6.896
100.000	100.000	23.086	6.346
105.000	105.000	16.539	4.911
110.000	110.000	6.969	9.840
115.000	115.000	2.264	8.707
120.000	120.000	0.788	3.862
125.000	125.000	0.275	1.069
130.000	130.000	0.091	0.012
135.000	135.000	0.000	0.000
140.000	140.000	0.000	0.000
145.000	145.000	0.000	0.000
150.000	150.000	0.000	0.000
155.000	155.000	0.000	0.000
160.000	160.000	0.000	0.000
165.000	165.000	0.000	0.000
170.000	170.000	0.000	0.000

Table 3C
z = 275 cm
FLUX ALONG X-AXIS

X	PHI1	PHI2
0.000	24.388	4.077
5.000	25.402	4.159
10.000	28.350	5.677
20.000	34.940	8.268
30.000	37.995	8.806
35.000	38.499	9.025
40.000	38.526	9.037
45.000	38.057	8.930
50.000	37.086	8.702
55.000	35.553	8.341
60.000	33.361	7.787
65.000	30.277	7.028
70.000	26.382	5.170
75.000	23.178	3.790
80.000	21.816	3.636
85.000	22.268	3.641
90.000	24.443	4.781
95.000	27.203	6.312
100.000	29.141	6.799
105.000	30.188	7.082
110.000	30.567	7.175
115.000	30.377	7.133
120.000	29.693	6.980
125.000	28.582	6.723
130.000	27.036	6.530
135.000	24.803	6.154
140.000	21.568	5.592
145.000	17.537	4.738
150.000	10.940	8.101
155.000	5.373	13.096
160.000	2.665	9.495
165.000	1.331	5.076
170.000	0.705	0.211

Table 3D
z = 275 cm
FLUX ALONG THE DIAGONAL X=Y

X	Y	PHI1	PHI2
0.000	0.000	24.388	4.077
5.000	5.000	26.335	4.168
10.000	10.000	31.140	6.786
20.000	20.000	37.364	8.765
30.000	30.000	37.260	8.641
35.000	35.000	35.874	8.018
40.000	40.000	34.891	7.824
45.000	45.000	34.736	7.762
50.000	50.000	34.993	8.096
55.000	55.000	34.584	8.114
60.000	60.000	33.036	7.750
65.000	65.000	30.203	7.075
70.000	70.000	25.692	5.473
75.000	75.000	20.540	3.249
80.000	80.000	17.586	2.933
85.000	85.000	17.210	2.724
90.000	90.000	18.207	4.024
95.000	95.000	17.666	4.394
100.000	100.000	14.763	4.060
105.000	105.000	10.604	3.150
110.000	110.000	4.475	6.322
115.000	115.000	1.455	5.600
120.000	120.000	0.507	2.486
125.000	125.000	0.177	0.689
130.000	130.000	0.059	0.008
135.000	135.000	0.000	0.000
140.000	140.000	0.000	0.000
145.000	145.000	0.000	0.000
150.000	150.000	0.000	0.000
155.000	155.000	0.000	0.000
160.000	160.000	0.000	0.000
165.000	165.000	0.000	0.000
170.000	170.000	0.000	0.000

Table 3E
z = 285 cm
FLUX ALONG X-AXIS

X	PHI1	PHI2
0.000	21.093	3.525
5.000	21.962	3.595
10.000	24.488	4.902
20.000	30.098	7.122
30.000	32.643	7.560
35.000	33.055	7.738
40.000	33.084	7.752
45.000	32.719	7.667
50.000	31.950	7.491
55.000	30.715	7.205
60.000	28.915	6.747
65.000	26.337	6.112
70.000	23.042	4.514
75.000	20.341	3.326
80.000	19.244	3.207
85.000	19.736	3.227
90.000	21.750	4.254
95.000	24.277	5.632
100.000	26.064	6.081
105.000	27.049	6.344
110.000	27.429	6.437
115.000	27.291	6.407
120.000	26.703	6.276
125.000	25.725	6.049
130.000	24.349	5.880
135.000	22.350	5.544
140.000	19.443	5.040
145.000	15.814	4.271
150.000	9.867	7.307
155.000	4.847	11.814
160.000	2.404	8.566
165.000	1.200	4.580
170.000	0.636	0.191

Table 3F
z = 285 cm
FLUX ALONG THE DIAGONAL X=Y

X	Y	PHI1	PHI2
0.000	0.000	21.093	3.525
5.000	5.000	22.759	3.602
10.000	10.000	26.848	5.843
20.000	20.000	31.748	7.443
30.000	30.000	29.525	6.504
35.000	35.000	26.448	4.497
40.000	40.000	24.924	4.410
45.000	45.000	25.628	4.355
50.000	50.000	27.851	6.010
55.000	55.000	29.012	6.796
60.000	60.000	28.397	6.658
65.000	65.000	26.314	6.163
70.000	70.000	22.579	4.808
75.000	75.000	18.173	2.875
80.000	80.000	15.649	2.609
85.000	85.000	15.381	2.434
90.000	90.000	16.314	3.606
95.000	95.000	15.854	3.942
100.000	100.000	13.262	3.646
105.000	105.000	9.531	2.831
110.000	110.000	4.024	5.685
115.000	115.000	1.309	5.037
120.000	120.000	0.456	2.236
125.000	125.000	0.159	0.620
130.000	130.000	0.053	0.007
135.000	135.000	0.000	0.000
140.000	140.000	0.000	0.000
145.000	145.000	0.000	0.000
150.000	150.000	0.000	0.000
155.000	155.000	0.000	0.000
160.000	160.000	0.000	0.000
165.000	165.000	0.000	0.000
170.000	170.000	0.000	0.000

Table 3G

AXIAL FLUX-DISTRIBUTION FOR (X.Y) = (40.000 40.000)

Z	PHI1	PHI2
380.000	0.151	0.014
375.000	0.279	0.263
370.000	0.530	0.481
365.000	0.995	0.845
360.000	1.833	0.673
355.000	3.067	0.522
350.000	4.169	0.722
325.000	9.577	1.584
300.000	16.735	2.857
290.000	21.264	3.460
280.000	29.515	5.793
270.000	39.539	9.351
260.000	46.650	10.888
225.000	62.711	14.727
190.000	70.383	16.510
155.000	70.217	16.482
120.000	62.311	14.625
85.000	47.642	11.181
50.000	27.822	6.537
40.000	21.502	5.037
30.000	14.924	3.641
25.000	11.577	2.936
20.000	7.053	5.023
15.000	3.451	8.316
10.000	1.706	6.035
5.000	0.849	3.227
0.000	0.450	0.134

Table 3H

Average subassembly powers

170.00									
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
150.00									
	0.8009	0.7809	0.7406	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
130.00									
	0.9703	0.9868	1.0131	0.8893	0.6350	0.0000	0.0000	0.0000	0.0000
110.00									
	0.9501	1.0543	1.0916	0.9288	0.7073	0.6204	0.0000	0.0000	0.0000
90.00									
	0.6119	1.0568	1.1701	0.9650	0.4812	0.7073	0.6350	0.0000	0.0000
70.00									
	1.1687	1.2682	1.2923	1.1652	0.9649	0.9286	0.8892	0.0000	0.0000
50.00									
	1.3891	1.4016	1.3448	1.2922	1.1699	1.0913	1.0127	0.7402	0.0000
30.00									
	1.2450	1.3636	1.4016	1.2681	1.0565	1.0538	0.9862	0.7802	0.0000
10.00									
	0.7236	1.2450	1.3890	1.1686	0.6118	0.9496	0.9695	0.8001	0.0000
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J
Flux averages

GROUP 1
340.00<Z< 360.00

170.00								
0.8293	0.7907	0.5981	0.1812	0.0140	0.0029	0.0001	0.0000	0.0000
150.00								
4.7282	4.6081	3.8544	1.3932	0.5746	0.1416	0.0065	0.0001	0.0000
130.00								
6.5806	6.6569	6.4660	5.0205	3.2295	0.9174	0.1567	0.0065	0.0001
110.00								
6.2107	6.7652	6.9601	5.9401	4.4247	3.0833	0.9166	0.1414	0.0029
90.00								
4.6794	6.0951	6.6669	5.6863	3.9627	4.4197	3.2235	0.5732	0.0139
70.00								
5.9155	6.0807	5.8430	5.8898	5.6801	5.9277	5.0062	1.3881	0.1804
50.00								
6.5214	5.8895	4.5251	5.8385	6.6554	6.9408	6.4419	3.8367	0.5949
30.00								
5.9089	6.0754	5.8874	6.0748	6.0830	6.7434	6.6283	4.5841	0.7860
10.00								
4.5685	5.9083	6.5188	5.9098	4.6695	6.1887	6.5501	4.7017	0.8239
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 1 (cont'd)

320.00<Z< 340.00

170.00								
1.6005	1.5269	1.1565	0.3491	0.0268	0.0055	0.0002	0.0000	0.0000
150.00								
9.1254	8.8995	7.4613	2.7073	1.1161	0.2740	0.0125	0.0002	0.0000
130.00								
12.7242	12.8781	12.5296	9.7515	6.2877	1.7924	0.3041	0.0125	0.0002
110.00								
12.1443	13.1881	13.5525	11.5946	8.6846	6.0399	1.7911	0.2737	0.0055
90.00								
9.4201	12.0735	13.1226	11.2287	7.9239	8.6769	6.2785	1.1141	0.0267
70.00								
11.8987	12.1875	11.6860	11.7086	11.2191	11.5755	9.7293	2.6994	0.3478
50.00								
13.1482	11.9219	9.2528	11.6789	13.1047	13.5223	12.4916	7.4331	1.1514
30.00								
12.0072	12.3195	11.9187	12.1781	12.0542	13.1535	12.8327	8.8609	1.5192
10.00								
9.4312	12.0063	13.1441	11.8896	9.4039	12.1091	12.6751	9.0823	1.5918
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 1 (cont'd)

300.00<Z< 320.00

170.00	2.3610	2.2532	1.7080	0.5162	0.0397	0.0081	0.0002	0.0000	0.0000
150.00	13.4772	13.1492	11.0355	4.0115	1.6562	0.4068	0.0186	0.0003	0.0000
130.00	18.8722	19.1105	18.6097	14.4957	9.3492	2.6661	0.4522	0.0186	0.0002
110.00	18.1938	19.7766	20.3334	17.3804	12.9844	9.0041	2.6650	0.4065	0.0081
90.00	14.4449	18.5091	20.1025	17.1350	11.9829	12.9770	9.3408	1.6544	0.0397
70.00	18.7114	19.2237	18.4579	18.2553	17.1249	17.3607	14.4731	4.0033	0.5148
50.00	20.9408	19.1558	15.0116	18.4501	20.0828	20.3002	18.5679	11.0042	1.7023
30.00	19.1535	19.7530	19.1524	19.2132	18.4872	19.7369	19.0577	13.1039	2.2442
10.00	15.0237	19.1526	20.9365	18.7013	14.4264	18.1527	18.8142	13.4258	2.3506
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

280.00<Z< 300.00

170.00	3.1082	2.9673	2.2510	0.6809	0.0525	0.0108	0.0003	0.0000	0.0000
150.00	17.7762	17.3510	14.5753	5.3055	2.1932	0.5388	0.0246	0.0003	0.0000
130.00	25.0137	25.3459	24.7049	19.2531	12.4125	3.5375	0.5997	0.0246	0.0003
110.00	24.3726	26.5438	27.3221	23.3113	17.3333	11.9752	3.5370	0.5387	0.0108
90.00	19.8591	25.5188	27.7593	23.5100	16.2033	17.3285	12.4075	2.1922	0.0525
70.00	26.5757	27.6400	26.9427	25.9487	23.5019	23.2961	19.2362	5.2992	0.6797
50.00	30.2291	28.4241	23.4369	26.9360	27.7422	27.2936	24.6690	14.5479	2.2459
30.00	27.5939	28.8630	28.4213	27.6307	25.4990	26.5075	25.2969	17.3083	2.9588
10.00	21.5251	27.5932	30.2254	26.5666	19.8421	24.3343	24.9584	17.7266	3.0981
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 1 (cont'd)

260.00<Z< 280.00

170.00									
	3.8154	3.6440	2.7665	0.8375	0.0647	0.0133	0.0004	0.0000	0.0000
150.00									
	21.8603	21.3471	17.9502	6.5438	2.7080	0.6652	0.0304	0.0004	0.0000
130.00									
	30.9100	31.3424	30.5806	23.8428	15.3622	4.3750	0.7410	0.0304	0.0004
110.00									
	30.4490	33.2290	34.2481	29.1623	21.5744	14.8439	4.3750	0.6652	0.0133
90.00									
	25.4995	32.8969	35.9005	30.1737	20.4571	21.5721	15.3601	2.7077	0.0647
70.00									
	35.3115	37.6279	38.1858	35.0010	30.1684	29.1528	23.8326	6.5398	0.8368
50.00									
	40.8837	40.7689	39.2855	38.1808	35.8883	34.2277	30.5549	17.9299	2.7627
30.00									
	37.1180	39.8158	40.7668	37.6210	32.8819	33.2014	31.3044	21.3132	3.6372
10.00									
	28.7379	37.1175	40.8811	35.3046	25.4863	30.4194	30.8661	21.8200	3.8074
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

240.00<Z< 260.00

170.00									
	4.4587	4.2595	3.2359	0.9803	0.0759	0.0156	0.0004	0.0000	0.0000
150.00									
	25.5826	24.9913	21.0319	7.6766	3.1795	0.7809	0.0357	0.0005	0.0000
130.00									
	36.3205	36.8488	35.9817	28.0630	18.0715	5.1435	0.8706	0.0357	0.0004
110.00									
	36.0936	39.4466	40.6912	34.5947	25.4932	17.4831	5.1440	0.7811	0.0156
90.00									
	30.8402	39.8645	43.5556	36.4306	24.4274	25.4937	18.0727	3.1799	0.0759
70.00									
	43.6762	46.9634	48.2105	43.3687	36.4284	34.5913	28.0595	7.6747	0.9799
50.00									
	51.1028	51.9433	51.6857	48.2077	43.5488	40.6707	35.9662	21.0188	3.2332
30.00									
	46.3326	50.1808	51.9424	46.9594	39.8552	39.4284	36.8222	24.9667	4.2543
10.00									
	35.7497	46.3323	51.1016	43.6722	30.8316	36.0729	36.2885	25.5523	4.4523
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 1 (cont'd)

220.00<Z< 240.00

170.00								
4.9816	4.7594	3.6172	1.0964	0.0850	0.0175	0.0005	0.0000	0.0000
150.00								
28.6083	27.9542	23.5383	8.5985	3.5633	0.8751	0.0400	0.0006	0.0000
130.00								
40.7292	41.3358	40.3834	31.5023	20.2789	5.7696	0.9762	0.0400	0.0005
110.00								
40.7056	44.5239	45.9474	39.0254	28.6894	19.6348	5.7706	0.8755	0.0175
90.00								
35.1987	45.5225	49.7359	41.4964	27.6604	28.6927	20.2840	3.5645	0.0850
70.00								
50.4507	54.3338	55.8300	49.9311	41.4973	39.0285	31.5057	8.5988	1.0963
50.00								
59.3457	60.5222	60.3913	55.8296	49.7346	45.9449	40.3777	23.5321	3.6157
30.00								
53.8322	58.4216	60.5225	54.3331	45.5191	44.5147	41.3200	27.9382	4.7558
10.00								
41.4999	53.8324	59.3462	50.4499	35.1951	40.6932	40.7080	28.5873	4.9762
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

200.00<Z< 220.00

170.00								
5.3559	5.1180	3.8908	1.1797	0.0915	0.0188	0.0005	0.0000	0.0000
150.00								
30.7805	30.0810	25.3382	9.2608	3.8393	0.9429	0.0431	0.0006	0.0000
130.00								
43.8981	44.5614	43.5478	33.9759	21.8671	6.2199	1.0521	0.0431	0.0005
110.00								
44.0252	48.1765	49.7259	42.2102	30.9883	21.1830	6.2215	0.9434	0.0188
90.00								
38.3279	49.5722	54.1441	45.1140	29.9796	30.9943	21.8752	3.8412	0.0915
70.00								
55.2861	59.5494	61.1664	54.5573	45.1178	42.2191	33.9858	9.2634	1.1799
50.00								
65.2207	66.5603	66.4184	61.1684	54.1482	49.7316	43.5525	25.3391	3.8905
30.00								
59.2056	64.2788	66.5620	59.5521	49.5745	48.1764	44.5573	30.0741	5.1160
10.00								
45.6383	59.2063	65.2231	55.2888	38.3288	44.0219	43.8892	30.7687	5.3525
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 1 (cont'd)

Table 3J, group 1 (cont'd)

180.00<Z< 200.00

170.00								
5.5777	5.3311	4.0536	1.2293	0.0954	0.0196	0.0006	0.0000	0.0000
150.00								
32.0747	31.3483	26.4115	9.6561	4.0046	0.9835	0.0449	0.0006	0.0000
130.00								
45.7928	46.4904	45.4404	35.4564	22.8185	6.4897	1.0976	0.0449	0.0006
110.00								
46.0172	50.3664	51.9876	44.1164	32.3657	22.1112	6.4918	0.9840	0.0197
90.00								
40.1994	51.9802	56.7471	47.2545	31.3631	32.3742	22.8294	4.0070	0.0954
70.00								
58.1499	62.5873	64.2110	57.2291	47.2612	44.1306	35.4731	9.6614	1.2299
50.00								
68.6936	70.0439	69.7809	64.2155	56.7569	52.0015	45.4565	26.4203	4.0547
30.00								
62.4153	67.7244	70.0470	62.5937	51.9883	50.3758	46.4990	31.3513	5.3310
10.00								
48.1317	62.4168	68.6981	58.1565	40.2050	46.0239	45.7974	32.0728	5.5771
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

160.00<Z< 180.00

170.00								
5.6131	5.3647	4.0795	1.2373	0.0960	0.0198	0.0006	0.0000	0.0000
150.00								
32.2856	31.5568	26.5892	9.7230	4.0326	0.9905	0.0452	0.0006	0.0000
130.00								
46.1257	46.8302	45.7747	35.7182	22.9869	6.5377	1.1056	0.0453	0.0006
110.00								
46.4001	50.7896	52.4233	44.4797	32.6219	22.2798	6.5402	0.9912	0.0198
90.00								
40.6069	52.5022	57.3038	47.7013	31.6384	32.6326	23.0015	4.0363	0.0961
70.00								
58.8332	63.3080	64.9215	57.8272	47.7104	44.4996	35.7428	9.7310	1.2384
50.00								
69.5572	70.9125	70.6140	64.9282	57.3181	52.4463	45.8014	26.6064	4.0823
30.00								
63.2297	68.5975	70.9168	63.3173	52.5155	50.8079	46.8489	31.5692	5.3668
10.00								
48.7684	63.2317	69.5634	58.8430	40.6174	46.4151	46.1399	32.2943	5.6144
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 1 (cont'd)

140.00<Z< 160.00

170.00								
5.4593	5.2176	3.9678	1.2035	0.0934	0.0192	0.0005	0.0000	0.0000
150.00								
31.4050	30.6972	25.8660	9.4595	3.9235	0.9636	0.0440	0.0006	0.0000
130.00								
44.8870	45.5736	44.5471	34.7601	22.3693	6.3619	1.0759	0.0440	0.0005
110.00								
45.1851	49.4619	51.0514	43.3101	31.7565	21.6842	6.3645	0.9645	0.0193
90.00								
39.5904	51.1854	55.8586	46.4862	30.8170	31.7675	22.3851	3.9276	0.0935
70.00								
57.4231	61.7853	63.3462	56.3969	46.4953	43.3311	34.7867	9.4681	1.2047
50.00								
67.9275	69.2509	68.9480	63.3530	55.8734	51.0760	44.5760	25.8855	3.9710
30.00								
61.7648	67.0057	69.2551	61.7946	51.1993	49.4812	45.5940	30.7121	5.2203
10.00								
47.6423	61.7668	67.9336	57.4329	39.6015	45.2008	44.9027	31.4168	5.4610
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

120.00<Z< 140.00

170.00								
5.1186	4.8922	3.7203	1.1284	0.0876	0.0180	0.0005	0.0000	0.0000
150.00								
29.4480	28.7839	24.2543	8.8701	3.6791	0.9035	0.0413	0.0006	0.0000
130.00								
42.0981	42.7426	41.7796	32.5995	20.9767	5.9654	1.0088	0.0413	0.0005
110.00								
42.3955	46.4090	47.8982	40.6296	29.7850	20.3347	5.9679	0.9043	0.0181
90.00								
37.1712	48.0549	52.4357	43.6298	28.9138	29.7946	20.9908	3.6826	0.0877
70.00								
53.9463	58.0392	59.4943	52.9529	43.6368	40.6466	32.6213	8.8774	1.1294
50.00								
63.8348	65.0739	64.7760	59.4990	52.4467	47.9161	41.8016	24.2692	3.7227
30.00								
58.0529	62.9750	65.0766	58.0455	48.0639	46.4207	42.7558	28.7938	4.8938
10.00								
44.7814	58.0543	63.8388	53.9531	37.1779	42.4038	42.1070	29.4542	5.1195
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 1 (cont'd)

100.00<Z< 120.00

170.00
4.5919 4.3888 3.3374 1.0122 0.0786 0.0162 0.0005 0.0000 0.0000
150.00
26.4181 25.8215 21.7576 7.9566 3.3000 0.8104 0.0370 0.0005 0.0000
130.00
37.7676 38.3455 37.4805 29.2431 18.8147 5.3498 0.9046 0.0370 0.0005
110.00
38.0405 41.6416 42.9759 36.4497 26.7156 18.2358 5.3514 0.8109 0.0162
90.00
33.3631 43.1295 47.0567 39.1482 25.9372 26.7202 18.8226 3.3021 0.0786
70.00
48.4318 52.1020 53.4001 47.5204 39.1493 36.4554 29.2526 7.9600 1.0126
50.00
57.3164 58.4243 58.1463 53.3997 47.0569 42.9779 37.4854 21.7611 3.3379
30.00
52.1286 56.5449 58.4237 52.1009 43.1271 41.6372 38.3411 25.8179 4.3879
10.00
40.2126 52.1286 57.3159 48.4308 33.3601 38.0336 37.7592 26.4099 4.5902
0.00 10.00 30.00 50.00 70.00 90.00 110.00 130.00 150.00 170.00

80.00<Z< 100.00

170.00
3.9166 3.7430 2.8462 0.8632 0.0670 0.0138 0.0004 0.0000 0.0000
150.00
22.5318 22.0224 18.5552 6.7853 2.8137 0.6909 0.0316 0.0004 0.0000
130.00
32.2128 32.7044 31.9652 24.9376 16.0427 4.5610 0.7711 0.0316 0.0004
110.00
32.4483 35.5196 36.6561 31.0861 22.7795 15.5453 4.5612 0.6911 0.0138
90.00
28.4655 36.7968 40.1440 33.3919 22.1172 22.7777 16.0429 2.8143 0.0670
70.00
41.3303 44.4596 45.5619 40.5372 33.3861 31.0785 24.9330 6.7840 0.8630
50.00
48.9155 49.8589 49.6166 45.5560 40.1320 36.6409 31.9507 18.5458 2.8446
30.00
44.4896 48.2569 49.8550 44.4503 36.7820 35.4985 32.6804 22.0033 3.7394
10.00
34.3202 44.4882 48.9102 41.3206 28.4526 32.4258 32.1844 22.5079 3.9118
0.00 10.00 30.00 50.00 70.00 90.00 110.00 130.00 150.00 170.00

Table 3J, group 1 (cont'd)

60.00<Z< 80.00

170.00								
3.1105	2.9724	2.2600	0.6853	0.0532	0.0109	0.0003	0.0000	0.0000
150.00								
17.8939	17.4882	14.7334	5.3871	2.2336	0.5484	0.0250	0.0004	0.0000
130.00								
25.5838	25.9726	25.3833	19.7998	12.7352	3.6200	0.6119	0.0250	0.0003
110.00								
25.7737	28.2120	29.1125	24.6850	18.0842	12.3374	3.6191	0.5482	0.0109
90.00								
22.6139	29.2314	31.8879	26.5202	17.5601	18.0774	12.7289	2.2326	0.0531
70.00								
32.8383	35.3227	36.1948	32.1973	26.5093	24.6670	19.7828	5.3816	0.6845
50.00								
38.8660	39.6138	39.4173	36.1845	31.8667	29.0833	25.3519	14.7122	2.2563
30.00								
35.3501	38.3417	39.6076	35.3077	29.2077	28.1775	25.9321	17.4559	2.9663
10.00								
27.2698	35.3476	38.8575	32.8228	22.5939	25.7385	25.5390	17.8566	3.1031
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

40.00<Z< 60.00

170.00								
2.1779	2.0809	1.5818	0.4795	0.0372	0.0077	0.0002	0.0000	0.0000
150.00								
12.5311	12.2451	10.3140	3.7696	1.5626	0.3835	0.0175	0.0002	0.0000
130.00								
17.9201	18.1899	17.7734	13.8599	8.9117	2.5320	0.4277	0.0175	0.0002
110.00								
18.0575	19.7637	20.3909	17.2854	12.6584	8.6312	2.5304	0.3831	0.0076
90.00								
15.8450	20.4810	22.3399	18.5760	12.2942	12.6485	8.9008	1.5602	0.0371
70.00								
23.0100	24.7493	25.3577	22.5534	18.5622	17.2611	13.8339	3.7610	0.4781
50.00								
27.2325	27.7543	27.6134	25.3450	22.3138	20.3530	17.7302	10.2837	1.5765
30.00								
24.7689	26.8633	27.7471	24.7317	20.4529	19.7213	18.1390	12.2040	2.0729
10.00								
19.1067	24.7659	27.2225	22.9919	15.8215	18.0149	17.8655	12.4852	2.1687
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 1 (cont'd)

20.00<Z< 40.00								
170.00								
1.1532	1.1014	0.8365	0.2546	0.0199	0.0041	0.0001	0.0000	0.0000
150.00								
6.6443	6.4895	5.4563	1.9888	0.8260	0.2036	0.0094	0.0001	0.0000
130.00								
9.5245	9.6609	9.4257	7.3408	4.7157	1.3358	0.2270	0.0094	0.0001
110.00								
9.6255	10.5230	10.8420	9.1873	6.7231	4.5699	1.3346	0.2033	0.0041
90.00								
8.4531	10.9200	11.8945	9.8957	6.5443	6.7160	4.7073	0.8242	0.0198
70.00								
12.2690	13.1865	13.5010	12.0114	9.8863	9.1700	7.3218	1.9824	0.2536
50.00								
14.5051	14.7789	14.6996	13.4924	11.8765	10.8154	9.3949	5.4346	0.8327
30.00								
13.2090	14.3141	14.7742	13.1746	10.9009	10.4940	9.6258	6.4610	1.0959
10.00								
10.1951	13.2070	14.4986	12.2569	8.4372	9.5965	9.4874	6.6132	1.1470
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Group 2

Table 3J, group 2

340.00<Z< 360.00

170.00								
1.9372	1.8395	1.4151	0.6774	0.0045	0.0009	0.0000	0.0000	0.0000
150.00								
1.4382	1.3988	1.3077	2.9051	1.4098	0.5270	0.0022	0.0000	0.0000
130.00								
1.7195	1.7428	1.7741	1.5404	1.0921	1.9119	0.5932	0.0022	0.0000
110.00								
1.5868	1.7587	1.8170	1.5514	1.1889	1.0514	1.9102	0.5262	0.0009
90.00								
0.8632	1.5547	1.7329	1.4534	0.7304	1.1876	1.0901	1.4064	0.0045
70.00								
1.5091	1.5758	1.4917	1.5270	1.4518	1.5482	1.5360	2.8949	0.6744
50.00								
1.6886	1.5015	0.8379	1.4905	1.7300	1.8121	1.7676	1.3018	1.4077
30.00								
1.5057	1.5736	1.5010	1.5743	1.5516	1.7531	1.7354	1.3916	1.8288
10.00								
0.8472	1.5055	1.6879	1.5077	0.8614	1.5813	1.7117	1.4302	1.9249
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

320.00<Z< 340.00

170.00								
3.6559	3.4735	2.6748	1.2862	0.0086	0.0017	0.0000	0.0000	0.0000
150.00								
2.5286	2.4610	2.3239	5.5056	2.6782	1.0046	0.0041	0.0000	0.0000
130.00								
2.9973	3.0405	3.1102	2.7293	1.9519	3.6405	1.1340	0.0041	0.0000
110.00								
2.8078	3.0926	3.1902	2.7341	2.1219	1.8937	3.6380	1.0034	0.0017
90.00								
1.6272	2.7882	3.0756	2.5978	1.3684	2.1200	1.9491	2.6731	0.0086
70.00								
2.7502	2.8536	2.7003	2.7418	2.5956	2.7297	2.7231	5.4900	1.2816
50.00								
3.0727	2.7526	1.5878	2.6987	3.0715	3.1833	3.1011	2.3155	2.6631
30.00								
2.7728	2.8843	2.7519	2.8514	2.7839	3.0847	3.0302	2.4506	3.4563
10.00								
1.6385	2.7726	3.0717	2.7481	1.6245	2.7999	2.9862	2.5170	3.6364
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 2 (cont'd)

Table 3J, group 2 (cont'd)

300.00<Z< 320.00

170.00								
5.3909	5.1236	3.9484	1.9009	0.0127	0.0026	0.0000	0.0000	0.0000
150.00								
3.7317	3.6334	3.4351	8.1539	3.9715	1.4908	0.0061	0.0000	0.0000
130.00								
4.4424	4.5089	4.6163	4.0533	2.8999	5.4116	1.6854	0.0061	0.0000
110.00								
4.2030	4.6343	4.7830	4.0955	3.1700	2.8202	5.4095	1.4898	0.0025
90.00								
2.4941	4.2717	4.7082	3.9619	2.0684	3.1682	2.8973	3.9669	0.0127
70.00								
4.3229	4.4983	4.2638	4.2721	3.9596	4.0909	4.0469	8.1378	1.8959
50.00								
4.8910	4.4224	2.6178	4.2620	4.7037	4.7753	4.6062	3.4257	3.9352
30.00								
4.4205	4.6219	4.4216	4.4959	4.2667	4.6253	4.4968	3.6212	5.1033
10.00								
2.6091	4.4203	4.8900	4.3206	2.4910	4.1937	4.4292	3.7177	5.3675
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

280.00<Z< 300.00

170.00								
7.0967	6.7469	5.2032	2.5078	0.0168	0.0034	0.0000	0.0000	0.0000
150.00								
4.9246	4.7970	4.5394	10.7825	5.2580	1.9746	0.0081	0.0000	0.0000
130.00								
5.8928	5.9848	6.1327	5.3850	3.8512	7.1786	2.2349	0.0081	0.0000
110.00								
5.6336	6.2249	6.4317	5.4970	4.2340	3.7515	7.1776	1.9742	0.0034
90.00								
3.4311	5.8939	6.5064	5.4404	2.7984	4.2327	3.8497	5.2553	0.0168
70.00								
6.1455	6.4724	6.2284	6.0770	5.4385	5.4934	5.3801	10.7701	2.5038
50.00								
7.0647	6.5676	4.1420	6.2268	6.5025	6.4251	6.1239	4.5311	5.1915
30.00								
6.3731	6.7583	6.5670	6.4703	5.8894	6.2165	5.9735	4.7853	6.7277
10.00								
3.7404	6.3729	7.0639	6.1435	3.4282	5.6250	5.8802	4.9111	7.0740
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 2 (cont'd)

260.00<Z< 280.00

170.00								
8.7084	8.2828	6.3927	3.0844	0.0207	0.0042	0.0000	0.0000	0.0000
150.00								
6.0540	5.8998	5.5891	13.2932	6.4889	2.4374	0.0100	0.0001	0.0000
130.00								
7.2807	7.3995	7.5898	6.6650	4.7642	8.8734	2.7610	0.0100	0.0000
110.00								
7.0359	7.7913	8.0607	6.8754	5.2682	4.6474	8.8734	2.4373	0.0042
90.00								
4.4056	7.5974	8.4137	6.9823	3.5327	5.2676	4.7634	6.4878	0.0207
70.00								
8.1685	8.8206	8.9519	8.2057	6.9811	6.8731	6.6620	13.2854	3.0816
50.00								
9.5800	9.5574	9.0866	8.9507	8.4109	8.0559	7.5835	5.5830	6.3837
30.00								
8.5745	9.3328	9.5569	8.8190	7.5940	7.7850	7.3907	5.8906	8.2674
10.00								
4.9946	8.5743	9.5794	8.1669	4.4034	7.0292	7.2707	6.0431	8.6906
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

240.00<Z< 260.00

170.00								
10.1743	9.6793	7.4754	3.6101	0.0243	0.0049	0.0000	0.0000	0.0000
150.00								
7.0837	6.9058	6.5480	15.5892	7.6156	2.8609	0.0118	0.0001	0.0000
130.00								
8.5550	8.6993	8.9299	7.8420	5.6027	10.4277	3.2432	0.0118	0.0000
110.00								
8.3389	9.2490	9.5768	8.1558	6.2242	5.4716	10.4286	2.8614	0.0049
90.00								
5.3287	9.2067	10.2078	8.4308	4.2183	6.2242	5.6030	7.6163	0.0243
70.00								
10.1053	11.0102	11.3126	10.1685	8.4303	8.1549	7.8408	15.5857	3.6085
50.00								
11.9766	12.1883	12.0981	11.3119	10.2062	9.5741	8.9261	6.5440	7.4691
30.00								
10.7037	11.7635	12.1881	11.0093	9.2046	9.2449	8.6932	6.8991	9.6678
10.00								
6.2139	10.7036	11.9763	10.1043	5.3272	8.3343	8.5477	7.0755	10.1603
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 2 (cont'd)

220.00<Z< 240.00

170.00									
	11.3664	10.8134	8.3546	4.0372	0.0272	0.0055	0.0000	0.0000	0.0000
150.00									
	7.9207	7.7236	7.3277	17.4577	8.5326	3.2056	0.0132	0.0001	0.0000
130.00									
	9.5935	9.7586	10.0221	8.8011	6.2859	11.6939	3.6359	0.0132	0.0000
110.00									
	9.4037	10.4394	10.8138	9.2001	7.0040	6.1436	11.6958	3.2068	0.0055
90.00									
	6.0819	10.5135	11.6562	9.6036	4.7766	7.0047	6.2874	8.5353	0.0272
70.00									
	11.6737	12.7384	13.1028	11.7075	9.6037	9.2008	8.8019	17.4584	4.0369
50.00									
	13.9090	14.2040	14.1772	13.1027	11.6559	10.8131	10.0207	7.3260	8.3512
30.00									
	12.4364	13.6955	14.2040	12.7382	10.5127	10.4374	9.7550	7.7193	10.8053
10.00									
	7.2135	12.4364	13.9090	11.6735	6.0813	9.4010	9.5887	7.9150	11.3540
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

200.00<Z< 220.00

170.00									
	12.2190	11.6268	8.9855	4.3439	0.0292	0.0059	0.0000	0.0000	0.0000
150.00									
	8.5216	8.3107	7.8878	18.7997	9.1923	3.4536	0.0142	0.0001	0.0000
130.00									
	10.3400	10.5202	10.8074	9.4909	6.7775	12.6047	3.9184	0.0142	0.0000
110.00									
	10.1702	11.2960	11.7030	9.9509	7.5649	6.6271	12.6077	3.4552	0.0059
90.00									
	6.6227	11.4489	12.6894	10.4411	5.1771	7.5663	6.7799	9.1965	0.0292
70.00									
	12.7932	13.9614	14.3558	12.7924	10.4419	9.9529	9.4935	18.8052	4.3448
50.00									
	15.2861	15.6216	15.5992	14.3562	12.6904	11.7043	10.8085	7.8882	8.9849
30.00									
	13.6779	15.0687	15.6220	13.9620	11.4494	11.2959	10.5193	8.3089	11.6223
10.00									
	7.9330	13.6780	15.2866	12.7938	6.6229	10.1695	10.3380	8.5184	12.2112
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 2 (cont'd)

180.00<Z< 200.00

170.00								
12.7236	12.1103	9.3610	4.5266	0.0305	0.0061	0.0001	0.0000	0.0000
150.00								
8.8796	8.6606	8.2218	19.6005	9.5871	3.6023	0.0148	0.0001	0.0000
130.00								
10.7863	10.9757	11.2771	9.9038	7.0720	13.1502	4.0877	0.0148	0.0001
110.00								
10.6302	11.8095	12.2354	10.4003	7.9010	6.9170	13.1543	3.6042	0.0062
90.00								
6.9462	12.0051	13.2996	10.9366	5.4161	7.9030	7.0752	9.5927	0.0305
70.00								
13.4562	14.6737	15.0696	13.4189	10.9382	10.4036	9.9083	19.6116	4.5288
50.00								
16.0999	16.4383	16.3736	15.0706	13.3018	12.2386	11.2810	8.2246	9.3633
30.00								
14.4194	15.8765	16.4390	14.6751	12.0070	11.8117	10.9779	8.6614	12.1100
10.00								
8.3664	14.4197	16.1009	13.4577	6.9471	10.6318	10.7875	8.8791	12.7228
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

160.00<Z< 180.00

170.00								
12.8040	12.1860	9.4204	4.5560	0.0307	0.0062	0.0001	0.0000	0.0000
150.00								
8.9376	8.7179	8.2769	19.7358	9.6538	3.6277	0.0149	0.0001	0.0000
130.00								
10.8646	11.0558	11.3600	9.9765	7.1239	13.2469	4.1176	0.0149	0.0001
110.00								
10.7184	11.9086	12.3378	10.4859	7.9634	6.9694	13.2517	3.6303	0.0062
90.00								
7.0164	12.1255	13.4299	11.0400	5.4635	7.9659	7.1282	9.6623	0.0307
70.00								
13.6143	14.8425	15.2363	13.5590	11.0420	10.4904	9.9831	19.7519	4.5599
50.00								
16.3021	16.6421	16.5718	15.2378	13.4331	12.3431	11.3664	8.2823	9.4266
30.00								
14.6073	16.0809	16.6431	14.8446	12.1285	11.9128	11.0602	8.7213	12.1908
10.00								
8.4768	14.6077	16.3035	13.6165	7.0182	10.7219	10.8680	8.9401	12.8073
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 2 (cont'd)

Table 3J, group 2 (cont'd)

140.00<Z< 160.00

170.00									
	12.4531	11.8515	9.1621	4.4314	0.0299	0.0060	0.0001	0.0000	0.0000
150.00									
	8.6938	8.4804	8.0518	19.2005	9.3922	3.5295	0.0145	0.0001	0.0000
130.00									
	10.5730	10.7593	11.0554	9.7087	6.9325	12.8905	4.0067	0.0145	0.0001
110.00									
	10.4377	11.5974	12.0151	10.2103	7.7522	6.7830	12.8955	3.5324	0.0060
90.00									
	6.8409	11.8216	13.0914	10.7589	5.3217	7.7548	6.9372	9.4017	0.0299
70.00									
	13.2882	14.4857	14.8669	13.2238	10.7610	10.2150	9.7160	19.2180	4.4358
50.00									
	15.9203	16.2525	16.1845	14.8685	13.0947	12.0207	11.0624	8.0579	9.1695
30.00									
	14.2690	15.7079	16.2535	14.4878	11.8247	11.6019	10.7641	8.4845	11.8578
10.00									
	8.2812	14.2694	15.9217	13.2904	6.8428	10.4414	10.5768	8.6972	12.4572
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

120.00<Z< 140.00

170.00									
	11.6759	11.1124	8.5906	4.1551	0.0280	0.0056	0.0000	0.0000	0.0000
150.00									
	8.1523	7.9521	7.5503	18.0039	8.8073	3.3094	0.0136	0.0001	0.0000
130.00									
	9.9166	10.0915	10.3691	9.1056	6.5011	12.0869	3.7569	0.0136	0.0000
110.00									
	9.7938	10.8822	11.2735	9.5789	7.2713	6.3611	12.0918	3.3121	0.0057
90.00									
	6.4234	11.0991	12.2898	10.0984	4.9935	7.2735	6.5053	8.8153	0.0280
70.00									
	12.4844	13.6081	13.9636	12.4169	10.0999	9.5827	9.1114	18.0187	4.1586
50.00									
	14.9618	15.2729	15.2049	13.9646	12.2923	11.2776	10.3744	7.5550	8.5961
30.00									
	13.4121	14.7637	15.2735	13.6095	11.1011	10.8849	10.0946	7.9548	11.1162
10.00									
	7.7845	13.4124	14.9627	12.4859	6.4245	9.7957	9.9188	8.1541	11.6780
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 2 (cont'd)

100.00<Z< 120.00

170.00								
10.4741	9.9688	7.7063	3.7273	0.0251	0.0051	0.0000	0.0000	0.0000
150.00								
7.3130	7.1331	6.7726	16.1494	7.8997	2.9681	0.0122	0.0001	0.0000
130.00								
8.8958	9.0526	9.3014	8.1675	5.8306	10.8395	3.3689	0.0122	0.0000
110.00								
8.7870	9.7635	10.1142	8.5928	6.5215	5.7042	10.8427	2.9698	0.0051
90.00								
5.7646	9.9607	11.0282	9.0604	4.4789	6.5225	5.8330	7.9044	0.0251
70.00								
11.2073	12.2150	12.5322	11.1422	9.0606	8.5940	8.1700	16.1566	3.7287
50.00								
13.4330	13.7111	13.6464	12.5321	11.0282	10.1147	9.3026	6.7739	7.7074
30.00								
12.0425	13.2552	13.7110	12.2148	9.9601	9.7626	9.0517	7.1322	9.9669
10.00								
6.9894	12.0424	13.4328	11.2071	5.7641	8.7855	8.8940	7.3109	10.4706
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

80.00<Z< 100.00

170.00								
8.9333	8.5016	6.5718	3.1784	0.0214	0.0043	0.0000	0.0000	0.0000
150.00								
6.2366	6.0830	5.7753	13.7715	6.7354	2.5306	0.0104	0.0001	0.0000
130.00								
7.5866	7.7201	7.9320	6.9643	4.9712	9.2409	2.8716	0.0104	0.0000
110.00								
7.4945	8.3273	8.6260	7.3276	5.5601	4.8622	9.2415	2.5311	0.0043
90.00								
4.9177	8.4973	9.4072	7.7275	3.8187	5.5597	4.9713	6.7365	0.0214
70.00								
9.5631	10.4223	10.6918	9.5040	7.7262	7.3259	6.9631	13.7693	3.1776
50.00								
11.4630	11.7000	11.6444	10.6904	9.4046	8.6226	7.9286	5.7727	6.5682
30.00								
10.2768	11.3114	11.6991	10.4203	8.4941	8.3226	7.7147	6.0780	8.4938
10.00								
5.9644	10.2765	11.4619	9.5609	4.9156	7.4896	7.5803	6.2303	8.9231
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

60.00<Z< 80.00

Table 3J, group 2 (cont'd)

Table 3J, group 2 (cont'd)

60.00<Z< 80.00

170.00									
	7.0946	6.7511	5.2182	2.5234	0.0170	0.0034	0.0000	0.0000	0.0000
150.00									
	4.9538	4.8315	4.5865	10.9335	5.3466	2.0085	0.0083	0.0000	0.0000
130.00									
	6.0268	6.1324	6.3001	5.5305	3.9469	7.3342	2.2786	0.0083	0.0000
110.00									
	5.9544	6.6157	6.8525	5.8202	4.4151	3.8595	7.3326	2.0079	0.0034
90.00									
	3.9083	6.7520	7.4744	6.1388	3.0331	4.4135	3.9451	5.3441	0.0170
70.00									
	7.6002	8.2826	8.4958	7.5506	6.1364	5.8161	5.5259	10.9230	2.5204
50.00									
	9.1104	9.2982	9.2533	8.4935	7.4696	6.8459	6.2926	4.5803	5.2099
30.00									
	8.1678	8.9896	9.2968	8.2792	6.7468	6.6079	6.1233	4.8229	6.7377
10.00									
	4.7411	8.1673	9.1084	7.5967	3.9050	5.9466	6.0167	4.9439	7.0784
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

40.00<Z< 60.00

170.00									
	4.9665	4.7253	3.6515	1.7652	0.0119	0.0024	0.0000	0.0000	0.0000
150.00									
	3.4665	3.3804	3.2083	7.6486	3.7396	1.4043	0.0058	0.0000	0.0000
130.00									
	4.2178	4.2912	4.4078	3.8684	2.7599	5.1284	1.5927	0.0058	0.0000
110.00									
	4.1680	4.6306	4.7955	4.0720	3.0879	2.6981	5.1254	1.4030	0.0024
90.00									
	2.7348	4.7266	5.2319	4.2962	2.1208	3.0855	2.7566	3.7340	0.0119
70.00									
	5.3209	5.7984	5.9470	5.2845	4.2931	4.0665	3.8613	7.6318	1.7603
50.00									
	6.3780	6.5091	6.4765	5.9441	5.2260	4.7869	4.3974	3.1993	3.6395
30.00									
	5.7180	6.2931	6.5074	5.7944	4.7204	4.6210	4.2796	3.3694	4.7077
10.00									
	3.3175	5.7173	6.3757	5.3168	2.7309	4.1585	4.2054	3.4542	4.9462
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 3J, group 2 (cont'd)

20.00<Z< 40.00								
170.00								
2.6899	2.5587	1.9762	0.9517	0.0064	0.0013	0.0000	0.0000	0.0000
150.00								
2.0216	1.9705	1.8523	4.1390	2.0217	0.7571	0.0031	0.0000	0.0000
130.00								
2.4934	2.5338	2.5900	2.2510	1.5944	2.7761	0.8581	0.0031	0.0000
110.00								
2.4777	2.7451	2.8364	2.4074	1.8207	1.5588	2.7737	0.7560	0.0013
90.00								
1.6534	2.8104	3.1010	2.5513	1.2781	1.8188	1.5916	2.0172	0.0064
70.00								
3.1634	3.4402	3.5245	3.1338	2.5489	2.4029	2.2452	4.1261	0.9480
50.00								
3.7820	3.8582	3.8376	3.5223	3.0964	2.8297	2.5818	1.8452	1.9674
30.00								
3.4007	3.7343	3.8570	3.4372	2.8056	2.7378	2.5249	1.9621	2.5463
10.00								
2.0057	3.4002	3.7804	3.1604	1.6504	2.4705	2.4840	2.0124	2.6759
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

BENCHMARK PROBLEM SOLUTION

Identification: 11-A1-3

Benchmark Problem ID.11-A1

Date Submitted: June 1976

By: H. Finnemann (KWU)

Date Accepted: June 1977

By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Fifth Order Nodal Solution with IQSBOX

Mathematical Model

The IQSBOX program solves the time-dependent two-group neutron diffusion equation in one, two or three dimensions by the nodal expansion method (NEM).

NEM is a consistent nodal technique that converges towards the exact solution of the diffusion equation for small mesh sizes. Subsidiary 1-D diffusion equations are solved in each box by polynomial expansion to obtain spatial coupling coefficients. Polynomials up to fifth order can be used.

Computer: CDC 6600

References

H. Finnemann
A Consistent Nodal Method for the Analysis of Space-Time Effects in Large LWR's.
Proc. of the Joint NEACRP/CSNI Specialists' Meeting on New Developments in Three-Dimensional Neutron Kinetics and Review of Kinetics Benchmark Calculations
Munich, January 22-24 (1975), MRR 145

F. Bennewitz, H. Finnemann, H. Moldaschl
Solution of the Multidimensional Neutron Diffusion Equation by Nodal Expansion
CONF-750413, Proc. Conf. on Comput. Methods in Nucl. Eng., April 15 - 17, 1975
Charleston, South Carolina

F. Bennewitz, H. Finnemann, M. R. Wagner
Higher Order Corrections in Nodal Reactor Calculations.
Trans. Am. Nucl. Soc. 22, 250 (1975).

Results

1 Maximum Eigenvalue

1.1	Solution 1	k_{eff} = 1.02911
	Mesh size	20 cm
	Number of Unknowns	5054 per group
	44 iterations were required for a pointwise flux convergence of	$\varepsilon < 10^{-5}$
	Computing time	50 s
1.2	Solution 2	k_{eff} = 1.02904
	Mesh size in the x-y plane and in the axial reflector	10 cm
	Axial mesh size in the core	20 cm
	Number of Unknowns	18669 per group
	74 iterations were required for a pointwise flux convergence of	$\varepsilon < 10^{-5}$
	Computing time	4.6 min

2 Power and Flux Distributions

2.1 Average Subassembly Powers

Table I : Axial Average

Table II: Average Subassembly Powers for layers 2 to 18 where 2 is lowest and 18 the highest layer in the core consisting of cubical boxes with a sidelength of 20 cm.

2.2 Average Subassembly Thermal Core Fluxes
Table III: Axial Average
Table IV : Thermal Core Fluxes
for layers 2 to 18 defined above.

2.3 Average Subassembly Fast Core Fluxes
Table V : Axial Average
Table VI: Fast Core Fluxes
for layers 2 to 18 defined above.

Table I

Average Subassembly Powers
Axial average

					.598	20 x 20 x 20	mesh
					.597	10 x 10 x 20 (10)	mesh
				.474	.703	.611	
				.475	.699	.608	
			1.179	.972	.926	.866	
			1.179	.972	.923	.864	
		1.366	1.311	1.181	1.087	.995	.707
		1.369	1.311	1.181	1.088	.997	.707
	1.398	1.431	1.291	1.072	1.054	.974	.752
	1.398	1.432	1.291	1.072	1.055	.974	.753
.726	1.282	1.423	1.194	.608	.953	.958	.770
.729	1.283	1.423	1.195	.610	.953	.958	.773

Table II

Average Subassembly Powers
Layer 2

				.199	20 x 20 x 20		mesh
				.197	10 x 10 x 20 (10)		mesh
				.166	.237	.202	
				.165	.253	.201	
			.416	.337	.315	.288	
			.413	.335	.312	.287	
		.511	.468	.410	.370	.334	.233
		.509	.466	.408	.369	.333	.232
	.501	.515	.459	.373	.360	.328	.250
	.499	.513	.456	.372	.358	.326	.249
.264	.458	.506	.423	.216	.326	.323	.256
.263	.456	.504	.421	.215	.324	.321	.255

Table II cont.

Average Subassembly Powers
Layer 3

				.349	20 x 20 x 20		mesh
				.347	10 x 10 x 20 (10)		mesh
			.281	.412	.356		
			.279	.408	.353		
		.717	.580	.545	.505		
		.713	.577	.540	.502		
	.882	.808	.708	.641	.581	.411	
	.878	.804	.704	.638	.579	.409	
.864	.890	.791	.643	.621	.568	.437	
.859	.885	.786	.639	.618	.565	.435	
.788	.874	.728	.364	.561	.559	.447	
.784	.870	.724	.363	.558	.555	.446	
.446							
.445							

Table II cont.

Average Subassembly Powers

Layer 4

					.501	20 x 20 x 20	mesh
					.499	10 x 10 x 20 (10)	mesh
				.402	.590	.511	
				.402	.587	.508	
			1.026	.831	.780	.724	
			1.025	.830	.777	.722	
		1.262	1.157	1.013	.917	.832	.589
		1.263	1.156	1.012	.918	.833	.589
	1.236	1.273	1.132	.920	.889	.814	.626
	1.235	1.273	1.131	.919	.889	.813	.626
.638	1.128	1.251	1.042	.521	.803	.800	.640
.640	1.127	1.250	1.042	.523	.802	.799	.642

Table II cont.

Average Subassembly Powers
Layer 5

				.634	20 x 20 x 20		mesh
				.632	10 x 10 x 20 (10)		mesh
			.509	.747	.647		
			.510	.744	.644		
		1.299	1.052	.988	.917		
		1.299	1.052	.984	.915		
	1.598	1.464	1.283	1.162	1.054	.746	
	1.600	1.464	1.283	1.163	1.056	.746	
1.564	1.611	1.433	1.164	1.125	1.031	.793	
1.564	1.612	1.432	1.165	1.126	1.031	.794	
.808	1.428	1.584	1.319	.660	1.017	1.014	.811
.810	1.428	1.584	1.319	.662	1.017	1.013	.814

Table II cont.

Average Subassembly Powers

Layer 6

					.745	20 x 20 x 20		mesh
					.743	10 x 10 x 20 (10)		mesh
				.598	.878	.761		
				.599	.874	.757		
			1.526	1.236	1.160	1.078		
			1.526	1.237	1.157	1.076		
		1.876	1.720	1.507	1.365	1.239	.877	
		1.880	1.721	1.508	1.367	1.242	.877	
	1.837	1.892	1.682	1.368	1.322	1.211	.932	
	1.837	1.894	1.683	1.369	1.324	1.211	.933	
.948	1.676	1.859	1.549	.775	1.195	1.191	.953	
.952	1.677	1.860	1.550	.778	1.195	1.191	.957	

Table II cont.

Average Subassembly Powers
Layer 7

					.830	20 x 20 x 20	mesh
					.828	10 x 10 x 20 (10)	mesh
				.666	.978	.847	
				.667	.974	.844	
			1.698	1.376	1.292	1.200	
			1.699	1.377	1.289	1.198	
		2.088	1.914	1.677	1.520	1.380	.977
		2.092	1.915	1.678	1.522	1.383	.977
	2.043	2.105	1.872	1.522	1.472	1.349	1.038
	2.044	2.107	1.873	1.524	1.474	1.350	1.039
1.055	1.865	2.069	1.723	.862	1.330	1.326	1.061
1.059	1.866	2.070	1.725	.866	1.331	1.327	1.066

Table II cont.

Average Subassembly Powers
Layer 8

				.885	20 x 20 x 20		mesh
				.884	10 x 10 x 20 (10)		mesh
				.710	1.043	.904	
				.712	1.039	.900	
			1.810	1.467	1.378	1.281	
			1.811	1.468	1.375	1.278	
		2.224	2.039	1.788	1.621	1.472	1.042
		2.229	2.041	1.790	1.624	1.476	1.043
	2.175	2.242	1.994	1.623	1.570	1.439	1.108
	2.178	2.245	1.996	1.624	1.573	1.440	1.109
1.123	1.985	2.203	1.835	.919	1.418	1.415	1.133
1.128	1.988	2.205	1.838	.923	1.420	1.416	1.138

Table II cont.

Average Subassembly Powers
Layer 9

					.910	20 x 20 x 20	mesh
					.908	10 x 10 x 20 (10)	mesh
				.729	1.072	.929	
				.731	1.067	.925	
			1.857	1.506	1,415	1,316	
			1.858	1.507	1,412	1.314	
		2.280	2.091	1,835	1.665	1,513	1,071
		2.285	2.094	1.837	1.668	1,517	1.072
	2.229	2.298	2.045	1.665	1,612	1.479	1.139
	2.231	2.301	2.047	1.667	1,615	1.480	1.141
1.150	2.034	2.257	1,882	.943	1,457	1,454	1.164
1.155	2,037	2.260	1.885	.947	.1458	1,455	1,170

Table II cont.

Average Subassembly Powers
Layer 10

					.903	20 x 20 x 20	mesh
					.901	10 x 10 x 20 (10)	mesh
				.722	1.063	.922	
				.725	1.059	.918	
			1.837	1.491	1.404	1.306	
			1.839	1.493	1.401	1.304	
		2.252	2.068	1.817	1.651	1.501	1.064
		2.258	2.070	1.819	1.654	1.505	1.065
	2.200	2.269	2.021	1.648	1.599	1.468	1.131
	2.203	2.273	2.023	1.650	1.602	1.469	1.133
1.153	2.008	2.229	1.859	.934	1.445	1.443	1.157
1.140	2.010	2.232	1.863	.938	1.446	1.445	1.162

Table II cont.

Average Subassembly Powers
Layer 11

				.865	20 x 20 x 20	mesh	
				.864	10 x 10 x 20 (10)	mesh	
				.691	1.018	.884	
				.693	1.014	.881	
			1.752	1.424	1.344	1.252	
			1.753	1.426	1.341	1.250	
		2.142	1.969	1.734	1.580	1.439	1.021
		2.147	1.972	1.736	1.583	1.443	1.022
	2.089	2.156	1.923	1.573	1.530	1.407	1.085
	2.092	2.160	1.925	1.575	1.533	1.409	1.087
1.078	1.906	2.118	1.769	.891	1.383	1.384	1.110
1.082	1.909	2.120	1.772	.895	1.384	1.385	1.116

Table II cont.

Average Subassembly Powers
Layer 12

					.800	20 x 20 x 20	mesh
					.799	10 x 10 x 20 (10)	mesh
				.636	.940	.817	
				.638	.936	.814	
			1.602	1.307	1.239	1.158	
			1.603	1.309	1.236	1.156	
		1.948	1.796	1.590	1.456	1.331	.946
		1.953	1.799	1.592	1.459	1.335	.947
	1.898	1.960	1.753	1.441	1.410	1.302	1.006
	1.900	1.963	1.755	1.443	1.413	1.303	1.008
.979	1.732	1.926	1.612	.816	1.275	1.281	1.029
.983	1.734	1.928	1.615	.820	1.277	1.282	1.034

Table II cont.

Average Subassembly Powers
Layer 13

					.711	20 x 20 x 20	mesh
					.710	10 x 10 x 20 (10)	mesh
				.560	.834	.727	
				.562	.830	.724	
			1.390	1.146	1.096	1.029	
			1.391	1.147	1.094	1.028	
		1.669	1.551	1.391	1.287	1.183	.843
		1.675	1.553	1.392	1.289	1.186	.844
	1.630	1.683	1.515	1.260	1.247	1.158	.897
	1.632	1.686	1.517	1.262	1.249	1.159	.899
.842	1.490	1.658	1.395	.714	1.128	1.139	.918
.846	1.491	1.659	1.397	.717	1.129	1.140	.922

Table II cont.

Average Subassembly Powers

Layer 14

					.604	20 x 20 x 20	mesh
					.603	10 x 10 x 20 (10)	mesh
				.470	.706	.618	
				.471	.703	.616	
			1.122	.950	.925	.875	
			1.123	.951	.922	.873	
		1.254	1.229	1.148	1.084	1.006	.720
		1.261	1.231	1.148	1.085	1.008	.720
	1.297	1.323	1.215	1.041	1.051	.985	.766
	1.298	1.325	1.216	1.042	1.052	.986	.768
.679	1.197	1.330	1.130	.591	.952	.970	.784
.682	1.198	1.330	1.131	.594	.953	.970	.788

Table II cont.

Average Subassembly Powers

Layer 15

					.487	20 x 20 x 20	mesh
					.486	10 x 10 x 20 (10)	mesh
				.371	.566	.499	
				.372	.564	.497	
			.831	.739	.738	.705	
			.831	.739	.735	.704	
		.558	.856	.885	.863	.811	.583
		.560	.856	.886	.864	.813	.583
	.941	.912	.893	.807	.838	.795	.622
	.941	.913	.893	.807	.839	.795	.622
.509	.891	.983	.850	.460	.761	.783	.636
.511	.891	.984	.850	.461	.761	.783	.639

Table II cont.

Average Subassembly Powers

Layer 16

					.365	20 x 20 x 20		mesh
					.364	10 x 10 x 20 (10)		mesh
				.274	.423	.375		
				.274	.421	.373		
			.582	.537	.549	.530		
			.581	.536	.546	.528		
		.349	.583	.639	.640	.609	.440	
		.349	.583	.639	.640	.610	.440	
	.642	.612	.618	.583	.623	.598	.470	
	.641	.612	.617	.583	.623	.597	.470	
.355	.617	.679	.597	.333	.566	.589	.481	
.356	.616	.679	.596	.334	.566	.589	.483	

Table II cont.

Average Subassembly Powers

Layer 17

					.244	20 x 20 x 20	mesh
					.243	10 x 10 x 20 (10)	mesh
				.181	.282	.251	
				.180	.279	.249	
			.374	.351	.365	.355	
			.372	.349	.362	.353	
		.217	.372	.417	.425	.408	.296
		.217	.369	.414	.423	.407	.295
	.403	.384	.393	.380	.414	.401	.317
	.400	.382	.391	.378	.412	.399	.315
.223	.388	.429	.380	.217	.377	.396	.324
.223	.386	.426	.378	.217	.375	.393	.324

Table II cont.

Average Subassembly Powers

Layer 18

				.134	20 x 20 x 20		mesh
				.133	10 x 10 x 20 (10)		mesh
			.094	.155	.138		
			.094	.153	.137		
		.204	.193	.203	.197		
		.203	.191	.201	.195		
	.110	.201	.230	.237	.228	.164	
	.111	.199	.229	.236	.227	.164	
.216	.205	.213	.208	.230	.225	.177	
.214	.204	.212	.206	.229	.224	.176	
.113 .207	.231	.205	.112	.209	.222	.181	
.113 .206	.230	.203	.113	.207	.221	.181	

Table III

Average Subassembly Thermal Fluxes

Axial Average

				4.430	20 x 20 x 20	mesh	
				4.419	10 x 10 x 20 (10)	mesh	
			3.511	5.205	4.526		
			3.519	5.179	4.507		
		8.734	7.199	6.856	6.413		
		8.732	7.201	6.834	6.398		
	10.12	9.711	8.747	8.054	7.372	5.239	
	10.14	9.714	8.747	8.061	7.387	5.240	
10.36	10.60	9.566	7.939	7.805	7.215	5.573	
10.36	10.61	9.566	7.941	7.812	7.214	5.579	
9.498	10.54	8.844	4.501	7.060	7.098	5.702	
9.500	10.54	8.849	4.517	7.060	7.097	5.726	

Table IV

Average Subassembly Thermal Fluxes

Layer 2

					1.471	20 x 20 x 20		mesh
					1.462	10 x 10 x 20 (10)		mesh
				1.227	1.758	1.500		
				1.222	1.742	1.489		
			3.079	2.495	2.331	2.136		
			3.062	2.483	2.313	2.123		
		3.784	3.467	3.036	2.744	2.471	1.729	
		3.771	3.451	3.022	2.732	2.465	1.722	
	3.711	3.817	3.397	2.765	2.664	2.429	1.849	
	3.693	3.801	3.380	2.752	2.653	2.417	1.843	
1.956	3.393	3.751	3.132	1.597	2.413	2.391	1.893	
1.951	3.378	3.736	3.119	1.593	2.401	2.379	1.892	

Table IV cont.
Average Subassembly Therm. Fluxes
Layer 3

					2.588	20 x 20 x 20	mesh
					2.570	10 x 10 x 20 (10)	mesh
				2.080	3.051	2.640	
				2.070	3.019	2.617	
			5.312	4.299	4.034	3.744	
			5.279	4.275	3.998	3.716	
		6.536	5.988	5.244	4.747	4.304	3.045
		6.506	5.953	5.214	4.723	4.288	3.030
	6.399	6.592	5.859	4.760	4.599	4.210	3.236
	6.362	6.556	5.824	4.733	4.575	4.184	3.222
3.306	5.840	6.477	5.393	2.700	4.155	4.139	3.310
3.293	5.807	6.441	5.365	2.689	4.130	4.114	3.306

Table IV cont.
Average Subassembly Therm. Fluxes
Layer 4

					3.708	20 x 20 x 20		mesh
					3.696	10 x 10 x 20 (10)		mesh
				2.976	4.371	3.784		
				2.981	4.346	3.765		
			7.602	6.154	5.776	5.364		
			7.593	6.151	5.754	5.347		
		9.351	8.568	7.506	6.796	6.165	4.363	
		9.357	8.562	7.500	6.797	6.172	4.360	
	9.154	9.430	8.383	6.812	6.583	6.028	4.637	
	9.148	9.427	8.376	6.809	6.583	6.023	4.637	
4.726	8.356	9.267	7.716	3.860	5.947	5.927	4.742	
4.739	8.351	9.262	7.715	3.871	5.943	5.922	4.757	

Table IV cont.
Average Subassembly Therm. Fluxes
Layer 5

					4.698	20 x 20 x 20	mesh
					4.685	10 x 10 x 20 (10)	mesh
				3.769	5.537	4.794	
				3.777	5.508	4.772	
			9.625	7.793	7.316	6.795	
			9.620	7.794	7.293	6.778	
		11.84	10.85	9.504	8.607	7.810	5.528
		11.85	10.85	9.502	8.613	7.823	5.527
	11.59	11.94	10.61	8.626	8.337	7.636	5.874
	11.59	11.94	10.61	8.627	8.342	7.634	5.878
5.982	10.58	11.73	9.768	4.887	7.532	7.508	6.007
6.001	10.58	11.73	9.773	4.903	7.531	7.506	6.031

Table IV cont.

Average Subassembly Therm. Fluxes
Layer 6

					5.521	20 x 20 x 20	mesh
					5.507	10 x 10 x 20 (10)	mesh
				4.428	6.506	5.634	
				4.439	6.474	5.610	
			11.30	9.155	8.596	7.985	
			11.30	9.160	8.572	7.968	
		13.90	12.74	11.16	10.11	9.177	6.496
		13.93	12.74	11.17	10.12	9.197	6.498
	13.60	14.02	12.46	10.13	9.794	8.973	6.903
	13.61	14.03	12.47	10.14	9.806	8.974	6.911
7.023	12.42	13.77	11.47	5.740	8.849	8.822	7.059
7.049	12.42	13.78	11.48	5.762	8.852	8.823	7.090

Table IV cont.

Average Subassembly Therm. Fluxes

Layer 7

					6.148	20 x 20 x 20	mesh
					6.135	10 x 10 x 20 (10)	mesh
				4.930	7.244	6.274	
				4.943	7.211	6.249	
			12.58	10.19	9.571	8.892	
			12.58	10.20	9.547	8.875	
		15.46	14.18	12.43	11.26	10.22	7.235
		15.50	14.19	12.43	11.28	10.24	7.239
	15.13	15.59	13.87	11.28	10.90	9.992	7.688
	15.14	15.61	13.87	11.29	10.92	9.997	7.700
7.811	13.81	15.32	12.76	6.389	9.852	9.825	7.863
7.843	13.82	15.33	12.78	6.415	9.858	9.829	7.899

Table IV cont.

Average Subassembly Therm. Fluxes
Layer 8

					6.558	20 x 20 x 20	mesh
					6.546	10 x 10 x 20 (10)	mesh
				5.257	7.727	6.693	
				5.273	7.693	6.668	
			13.41	10.86	10.21	9.486	
			13.41	10.88	10.18	9.470	
		16.47	15.10	13.25	12.01	10.90	7.720
		16.51	15.12	13.26	12.03	10.93	7.726
	16.11	16.61	14.77	12.02	11.63	10.66	8.204
	16.13	16.63	14.78	12.03	11.65	10.67	8.217
8.317	14.71	16.32	13.60	6.809	10.51	10.48	8.390
8.353	14.72	16.33	13.61	6.838	10.52	10.49	8.431

Table IV cont.

Average Subassembly Therm. Fluxes
Layer 9

					6.739	20 x 20 x 20	mesh
					6.727	10 x 10 x 20 (10)	mesh
				5.398	7.939	6.878	
				5.415	7.905	6.854	
			13.76	11.15	10.49	9.748	
			13.76	11.17	10.46	9.734	
		16.89	15.49	13.59	12.33	11.20	7.936
		16.93	15.51	13.61	12.35	11.24	7.943
	16.51	17.02	15.15	12.33	11.94	10.96	8.434
	16.53	17.04	15.16	12.35	11.97	10.96	8.449
8.520	15.07	16.72	13.94	6.987	10.79	10.77	8.626
8.558	15.09	16.74	13.96	7.018	10.80	10.78	8.669

Table IV cont.

Average Subassembly Therm. Fluxes
Layer 10

					6.688	20 x 20 x 20	mesh
					6.676	10 x 10 x 20 (10)	mesh
				5.351	7.875	6.827	
				5.368	7.843	6.803	
			13.61	11.05	10.40	9.675	
			13.62	11.06	10.38	9.661	
		16.68	15.32	13.46	12.23	11.12	7.880
		16.73	15.34	13.47	12.25	11.15	7.888
	16.30	16.81	14.97	12.21	11.84	10.87	8.376
	16.32	16.83	14.99	12.22	11.86	10.88	8.392
8.409	14.87	16.51	13.77	6.916	10.70	10.69	8.567
8.447	14.89	16.53	13.80	6.947	10.71	10.70	8.610

Table IV cont.

Average Subassembly Therm. Fluxes
Layer 11

					6.411	20 x 20 x 20	mesh
					6.400	10 x 10 x 20 (10)	mesh
				5.117	7.544	6.545	
				5.134	7.513	6.523	
			12.97	10.55	9.953	9.275	
			12.98	10.56	9.933	9.262	
		15.86	14.59	12.85	11.70	10.66	7.562
		15.91	14.60	12.86	11.72	10.69	7.570
	15.48	15.97	14.25	11.65	11.33	10.43	8.040
	15.50	16.00	14.26	11.66	11.35	10.44	8.055
7.982	14.12	15.69	13.10	6.598	10.24	10.25	8.223
8.018	14.14	15.71	13.13	6.628	10.25	10.26	8.266

Table IV cont.

Average Subassembly Therm. Fluxes
Layer 12

					5.926	20 x 20 x 20	mesh
					5.916	10 x 10 x 20 (10)	mesh
				4.710	6.965	6.053	
				4.725	6.936	6.032	
			11.86	9.684	9.178	8.576	
			11.87	9.697	9.159	8.564	
		14.43	13.31	11.78	10.78	9.857	7.005
		14.47	13.32	11.79	10.80	9.885	7.011
	14.06	14.52	12.99	10.68	10.45	9.643	7.449
	14.08	14.54	13.00	10.69	10.47	9.652	7.464
7.250	12.83	14.26	11.94	6.047	9.445	9.485	7.621
7.283	12.84	14.28	11.96	6.074	9.456	9.493	7.660

Table IV cont.

Average Subassembly Therm. Fluxes
Layer 13

					5.267	20 x 20 x 20	mesh
					5.257	10 x 10 x 20 (10)	mesh
				4.151	6.176	5.383	
				4.164	6.150	5.363	
			10.30	8.488	8.119	7.624	
			10.30	8.497	8.100	7.612	
		12.37	11.49	10.30	9.531	8.763	6.244
		12.41	11.51	10.31	9.547	8.787	6.250
	12.08	12.47	11.22	9.335	9.236	8.576	6.644
	12.09	12.49	11.23	9.347	9.251	8.583	6.656
6.240	11.03	12.28	10.33	5.289	8.357	8.439	6.799
6.269	11.05	12.29	10.35	5.312	8.365	8.445	6.833

Table IV cont.

Average Subassembly Therm. Fluxes
Layer 14

					4.476	20 x 20 x 20	mesh
					4.466	10 x 10 x 20 (10)	mesh
				3.479	5.230	4.579	
				3.489	5.207	4.561	
			8.314	7.035	6.849	6.482	
			8.319	7.014	6.831	6.470	
		9.289	9.105	8.500	8.026	7.450	5.330
		9.344	9.116	8.502	8.038	7.469	5.334
	9.606	9.801	9.004	7.712	7.785	7.296	5.677
	9.614	9.814	9.011	7.719	7.796	7.301	5.686
5.030	8.865	9.852	8.367	4.378	7.054	7.183	5.810
5.052	8.872	9.853	8.377	4.396	7.060	7.187	5.838

Table IV cont.

Average Subassembly Therm. Fluxes
Layer 15

					3.607	20 x 20 x 20	mesh
					3.597	10 x 10 x 20 (10)	mesh
				2.752	4.195	3.695	
				2.758	4.174	3.679	
			6.158	5.475	5.465	5.225	
			6.155	5.475	5.448	5.214	
		4.135	6.342	6.559	6.389	6.005	4.319
		4.146	6.343	6.562	6.397	6.019	4.320
	6.973	6.757	6.613	5.977	6.207	5.887	4.604
	6.972	6.763	6.612	5.977	6.213	5.888	4.610
3.773	6.600	7.285	6.299	3.406	5.636	5.800	4.714
3.786	6.598	7.290	6.300	3.418	5.638	5.801	4.735

Table IV cont.

Average Subassembly Therm. Fluxes

Layer 16

					2.707	20 x 20 x 20	mesh
					2.698	10 x 10 x 20 (10)	mesh
				2.028	3.135	2.777	
				2.032	3.118	2.763	
			4.310	3.976	4.064	3.925	
			4.304	3.973	4.048	3.915	
		2.585	4.320	4.734	4.742	4.512	3.261
		2.585	4.315	4.731	4.744	4.519	3.261
	4.757	4.534	4.579	4.320	4.612	4.427	3.480
	4.750	4.531	4.574	4.317	4.613	4.425	3.482
2.626	4.570	5.032	4.420	2.468	4.196	4.365	3.565
2.634	4.564	5.029	4.416	2.476	4.195	4.362	3.578

Table IV cont.

Average Subassembly Therm. Fluxes

Layer 17

					1.810	20 x 20 x 20	mesh
					1.798	10 x 10 x 20 (10)	mesh
				1.338	2.090	1.861	
				1.336	2.069	1.844	
			2.772	2.602	2.703	2.631	
			2.754	2.587	2.678	2.612	
		1.609	2.752	3.089	3.151	3.025	2.195
		1.610	2.735	3.069	3.135	3.015	2.186
	2.984	2.845	2.914	2.815	3.066	2.971	2.345
	2.964	2.828	2.895	2.799	3.050	2.955	2.336
1.653	2.875	3.174	2.816	1.607	2.791	2.931	2.403
1.653	2.857	3.153	2.799	1.607	2.777	2.914	2.402

Table IV cont.

Average Subassembly Therm. Fluxes

Layer 18

					.990	20 x 20 x 20	mesh
					.984	10 x 10 x 20 (10)	mesh
				.697	1.148	1.026	
				.699	1.136	1.017	
			1.513	1.428	1.502	1.457	
			1.502	1.418	1.488	1.448	
		.818	1.489	1.705	1.757	1.688	1.216
		.821	1.478	1.694	1.748	1.684	1.211
	1.600	1.522	1.579	1.540	1.707	1.666	1.308
	1.587	1.511	1.567	1.529	1.698	1.658	1.304
.837	1.536	1.713	1.518	.832	1.546	1.645	1.341
.840	1.524	1.701	1.507	.836	1.536	1.636	1.341

Table V

Average Subassembly Fast Fluxes

Axial Average

				14.27	20 x 20 x 20	mesh	
				14.27	10 x 10 x 20 (10)	mesh	
			20.65	21.18	14.76		
			20.61	21.14	14.71		
		37.13	30.93	28.96	23.04		
		37.13	30.97	28.92	23.03		
	43.90	41.31	37.18	34.13	29.65	17.01	
	43.99	41.33	37.17	34.16	29.70	17.03	
44.03	45.10	40.67	34.14	33.17	30.47	20.29	
44.05	45.14	40.68	34.18	33.21	30.50	20.32	
31.77	40.85	44.80	38.01	26.58	30.38	30.05	20.76
31.77	40.90	44.80	38.07	26.58	30.42	30.08	20.81

Table VI
Average Subassembly Fast Fluxes
Layer 2

					4.375	20 x 20 x 20	mesh
					4.366	10 x 10 x 20 (10)	mesh
				6.485	6.543	4.515	
				6.429	6.498	4.490	
			11.94	9.769	8.993	7.066	
			11.87	9.724	8.930	7.032	
		14.68	13.45	11.78	10.62	9.109	5.182
		14.61	13.37	11.71	10.57	9.073	5.172
	14.39	14.80	13.17	10.84	10.33	9.376	6.192
	14.31	14.73	13.10	10.79	10.28	9.328	6.174
10.37	13.30	14.56	12.27	8.467	9.464	9.246	6.339
10.30	13.24	14.47	12.22	8.408	9.418	9.201	6.323

Table VI cont.

Average Subassembly Fast Fluxes

Layer 3

					8.351	20 x 20 x 20	mesh
					8.342	10 x 10 x 20 (10)	mesh
				12.25	12.44	8.630	
				12.20	12.39	8.586	
			22.62	18.51	17.08	13.48	
			22.57	18.49	17.02	13.45	
		27.82	25.49	22.33	20.16	17.35	9.903
		27.81	25.44	22.28	20.13	17.34	9.897
	27.25	28.06	24.95	20.51	19.59	17.82	11.81
	27.21	28.02	24.91	20.50	19.56	17.79	11.80
19.55	25.16	27.59	23.22	15.96	17.92	17.56	12.08
19.51	25.15	27.53	23.21	15.93	17.90	17.54	12.08

Table VI cont.

Average Subassembly Fast Fluxes

Layer 4

					11.98	20 x 20 x 20		mesh
					11.97	10 x 10 x 20 (10)		mesh
				17.55	17.84	12.38		
				17.50	17.78	12.32		
			32.40	26.51	24.47	19.33		
			32.37	26.52	24.42	19.30		
		39.84	36.50	31.99	28.89	24.87	14.20	
		39.86	36.48	31.95	28.88	24.88	14.20	
	39.02	40.17	35.73	29.38	28.06	25.54	16.93	
	39.00	40.16	35.71	29.39	28.06	25.53	16.94	
27.99	36.03	39.50	33.25	22.86	25.67	25.17	17.32	
27.95	36.04	39.46	33.27	22.83	25.67	25.17	17.34	

Table VI cont.

Average Subassembly Fast Fluxes

Layer 5

					15.17	20 x 20 x 20	mesh
					15.17	10 x 10 x 20 (10)	mesh
				22.22	22.59	15.68	
				22.18	22.54	15.62	
			41.03	33.57	31.00	24.49	
			41.01	33.60	30.95	24.46	
		50.43	46.21	40.51	36.59	31.50	17.99
		50.50	46.21	40.49	36.61	31.54	18.01
	49.39	50.85	45.24	37.20	35.54	32.35	21.45
	49.40	50.87	45.24	37.24	35.57	32.37	21.47
35.42	45.61	50.01	42.10	28.94	32.51	31.88	21.94
35.41	45.65	49.98	42.15	28.93	32.54	31.90	21.98

Table VI cont.

Average Subassembly Fast Fluxes

Layer 6

					17.83	20 x 20 x 20		mesh
					17.84	10 x 10 x 20 (10)		mesh
				26.11	26.55	18.43		
				26.07	26.49	18.36		
			48.19	39.44	36.42	28.77		
			48.19	39.49	36.38	28.76		
		59.22	54.27	47.59	42.99	37.01	21.15	
		59.33	54.30	47.58	43.03	37.08	21.17	
	57.99	59.71	53.12	43.69	41.75	38.01	25.21	
	58.03	59.76	53.15	43.76	41.80	38.05	25.24	
41.59	53.55	58.71	49.43	33.99	38.19	37.46	25.78	
41.59	53.63	58.71	49.52	34.00	38.24	37.50	25.84	

Table VI cont.

Average Subassembly Fast Fluxes

Layer 7

					19.85	20 x 20 x 20	mesh
					19.87	10 x 10 x 20 (10)	mesh
				29.07	29.56	20.52	
				29.03	29.51	20.45	
			53.63	43.90	40.55	32.04	
			53.65	43.97	40.52	32.03	
		65.89	60.39	52.97	47.86	41.22	23.55
		66.03	60.44	52.97	47.92	41.30	23.59
	64.51	66.43	59.11	48.63	46.48	42.33	28.08
	64.57	66.51	59.15	48.72	46.56	42.39	28.12
46.26	59.56	65.31	55.00	37.83	42.52	41.72	28.72
46.27	49.67	65.33	55.11	37.85	42.59	41.78	28.79

Table VI cont.

Average Subassembly Fast Fluxes

Layer 8

					21.18	20 x 20 x 20		mesh
					21.20	10 x 10 x 20 (10)		mesh
				31.00	31.53	21.89		
				30.96	31.48	21.82		
			57.15	46.80	43.24	34.18		
			57.19	46.89	43.22	34.18		
		70.18	64.34	56.46	51.04	43.97	25.13	
		70.35	64.42	56.48	51.12	44.07	25.17	
	68.69	70.75	62.97	51.83	49.57	45.16	29.96	
	68.77	70.85	63.03	51.93	49.66	45.23	30.01	
49.25	63.43	69.56	58.59	40.33	45.35	44.51	30.64	
49.28	63.55	69.59	58.72	40.35	45.43	44.58	30.73	

Table VI cont.

Average Subassembly Fast Fluxes
Layer 9

					21.77	20 x 20 x 20	mesh
					21.79	10 x 10 x 20 (10)	mesh
				31.83	32.39	22.50	
				31.80	32.35	22.43	
			58.64	48.04	44.42	35.13	
			58.68	48.14	44.40	35.13	
		71.95	65.99	57.94	52.42	45.19	25.83
		72.13	66.07	57.97	52.51	45.30	25.88
	70.38	72.51	64.57	53.19	50.91	46.41	30.80
	70.47	72.62	64.64	53.30	51.01	46.49	30.86
50.46	64.98	71.28	60.07	41.38	46.58	45.74	31.50
50.49	65.11	71.32	60.21	41.41	46.67	45.82	31.59

Table VI cont.

Average Subassembly Fast Fluxes
Layer 10

					21.60	20 x 20 x 20		mesh
					21.62	10 x 10 x 20 (10)		mesh
				31.55	32.13	22.33		
				31.52	32.09	22.26		
			58.02	47.58	44.05	34.86		
			58.06	47.68	44.04	34.86		
		71.09	65.26	57.37	51.97	44.85	25.65	
		71.27	65.34	57.40	52.06	44.96	25.70	
	69.48	71.61	63.82	52.65	50.48	46.06	30.59	
	69.58	71.72	63.90	52.77	50.58	46.15	30.65	
49.80	64.14	70.39	59.36	40.95	46.19	45.40	31.29	
49.84	64.28	70.44	59.51	40.99	46.28	45.49	31.38	

Table VI cont.

Average Subassembly Fast Fluxes
Layer 11

					20.70	20 x 20 x 20		mesh
					20.72	10 x 10 x 20 (10)		mesh
				30.17	30.78	21.41		
				30.15	30.74	21.34		
			55.31	45.45	42.17	33.42		
			55.35	45.54	42.15	33.42		
		67.59	62.14	54.76	49.74	42.99	24.61	
		67.77	62.22	54.79	49.83	43.10	24.66	
	65.98	68.04	60.73	50.24	48.31	44.17	29.36	
	66.07	68.16	60.81	50.35	48.41	44.25	29.42	
47.27	60.90	66.87	56.47	39.07	44.21	43.54	30.03	
47.31	61.03	66.92	56.61	39.11	44.30	43.62	30.12	

Table VI cont.

Average Subassembly Fast Fluxes
Layer 12

					19.14	20 x 20 x 20		mesh
					19.16	10 x 10 x 20 (10)		mesh
				27.77	28.42	19.79		
				27.75	28.38	19.74		
			50.57	41.72	38.88	30.90		
			50.61	41.81	38.87	30.90		
		61.48	56.69	50.21	45.84	39.75	22.80	
		61.64	56.77	50.24	45.92	39.86	22.84	
	59.93	61.86	55.37	46.05	44.53	40.85	27.20	
	60.02	61.96	55.44	46.15	44.62	40.92	27.26	
42.93	55.32	60.80	51.47	35.81	40.76	40.28	27.83	
42.97	55.44	60.84	51.60	35.84	40.85	40.35	27.91	

Table VI cont.

Average Subassembly Fast Fluxes
Layer 13

					17.00	20 x 20 x 20		mesh
					17.02	10 x 10 x 20 (10)		mesh
				24.48	25.20	17.60		
				24.45	25.16	17.55		
			43.89	36.57	34.39	27.46		
			43.93	36.64	34.38	27.46		
		52.70	48.96	43.91	40.51	35.34	20.32	
		52.85	49.03	43.92	40.57	35.43	20.36	
	51.48	53.12	47.84	40.26	39.37	36.33	24.26	
	51.55	53.20	47.89	40.34	39.44	39.39	24.31	
36.95	47.59	52.34	44.52	31.32	36.06	35.83	24.83	
36.99	47.68	52.37	44.63	31.35	36.14	35.89	24.90	

Table VI cont.

Average Subassembly Fast Fluxes
Layer 14

					14.44	20 x 20 x 20	mesh
					14.45	10 x 10 x 20 (10)	mesh
				20.51	21.34	14.97	
				20.49	21.30	14.92	
			35.44	30.31	29.01	23.34	
			35.47	30.36	28.99	23.33	
		40.00	38.81	36.23	34.12	30.04	17.35
		40.18	38.86	36.22	34.16	30.11	17.38
	40.95	41.77	38.38	33.26	33.18	30.91	20.72
	40.99	41.83	38.42	33.32	33.23	30.95	20.76
29.79	38.23	42.00	36.07	25.93	30.44	30.50	21.21
29.81	38.30	41.98	36.14	25.94	30.50	30.55	21.27

Table VI cont.

Average Subassembly Fast Fluxes
Layer 15

					11.63	20 x 20 x 20	mesh
					11.63	10 x 10 x 20 (10)	mesh
				16.23	17.11	12.07	
				16.20	17.08	12.03	
			26.27	23.59	23.15	18.81	
			26.27	23.61	23.12	18.80	
		24.08	27.37	27.97	27.16	24.22	14.05
		24.09	27.40	27.96	27.19	24.26	14.07
	29.75	29.15	28.21	25.78	26.46	24.94	16.80
	29.75	29.20	28.21	25.80	26.48	24.97	16.83
22.35	28.47	31.08	27.16	20.17	24.32	24.63	17.21
22.34	28.48	31.06	27.18	20.17	24.35	24.65	17.25

Table VI cont.

Average Subassembly Fast Fluxes
Layer 16

					8.728	20 x 20 x 20		mesh
					8.723	10 x 10 x 20 (10)		mesh
				11.96	12.78	9.072		
				11.93	12.75	9.031		
			18.39	17.13	17.21	14.12		
			18.37	17.13	17.18	14.10		
		15.30	18.64	20.18	20.16	18.19	10.61	
		15.29	18.64	20.15	20.16	18.21	10.62	
	20.29	19.56	19.54	18.63	19.66	18.75	12.70	
	20.27	19.56	19.52	18.63	19.66	18.76	12.71	
15.56	19.71	21.46	19.06	14.62	18.10	18.53	13.01	
15.54	19.70	21.42	19.06	14.61	18.11	18.54	13.03	

Table VI cont.

Average Subassembly Fast Fluxes
Layer 17

					5.830	20 x 20 x 20	mesh
					5.822	10 x 10 x 20 (10)	mesh
				7.887	8.515	6.073	
				7.862	8.482	6.040	
			11.81	11.20	11.44	9.455	
			11.78	11.19	11.40	9.432	
		9.530	11.86	13.16	13.38	12.19	7.137
		9.522	11.84	13.11	13.36	12.19	7.135
	12.72	12.26	12.42	12.13	13.06	12.58	8.550
	12.68	12.24	12.39	12.12	13.04	12.56	8.547
9.788	12.39	13.53	12.13	9.517	12.03	12.43	8.764
9.773	12.37	13.47	12.12	9.503	12.02	12.42	8.767

Table VI cont.

Average Subassembly Fast Fluxes
Layer 18

					2.946	20 x 20 x 20	mesh
					2.937	10 x 10 x 20 (10)	mesh
				3.906	4.297	3.087	
				3.888	4.267	3.065	
			5.896	5.630	5.808	4.817	
			5.853	5.596	5.763	4.793	
		4.604	5.879	6.634	6.811	6.227	3.645
		4.591	5.841	6.579	6.772	6.203	3.639
	6.238	6.013	6.153	6.077	6.639	6.438	4.378
	6.190	5.976	6.109	6.042	6.600	6.406	4.366
4.712	6.068	6.675	5.996	4.684	6.098	6.370	4.491
4.697	6.028	6.613	5.959	4.670	6.068	6.336	4.481

BENCHMARK PROBLEM SOLUTION

Identification: 11-A1-4 Benchmark Problem ID.11-A1

Date Submitted: June 1976 By: D. A. Meneley (Ontario Hydro)

Date Accepted: June 1977 By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Three-dimensional PWR Problem

Mathematical Model: Seven-point central-difference formula with fluxes calculated at the center of the mesh cell. Two term Taylor series expansion to cell boundary in each direction to satisfy flux and current continuity at cell boundaries.

Special Acceleration Techniques: The code is based on I/O transfer of all data for one mesh plane in a single group. Line inversion with successive overrelaxation is used in each plane, with optimum overrelaxation factor calculated from data for all planes and groups. Inner iteration is continued for all points in a plane until the error norm is 10 percent of that found in the first iteration (arbitrary choice). The planar fluxes are overrelaxed using a second optimum overrelaxation factor calculated from the rate of relaxation of plane fluxes. A one-dimensional rebalance calculation is carried out in the direction perpendicular to the mesh planes. Asymptotic acceleration of all fluxes is carried out periodically when the convergence rate becomes asymptotic.

Initialization: Group one fluxes set to 1.0 and group two fluxes set to 0.25. Eigenvalue set to 1.0. Over relaxation factor for iterations in plane set to 1.2 and factor for overrelaxation of plane fluxes set to 1.4.

Convergence: Maximum value of flux change over two iterations relative to root mean square flux in the reactor less than 5×10^{-5}.

Primary Results:

1. Maximum Eigenvalue

Uniform Mesh	Eigenvalue
17 x 17 x 19	1.02913
34 x 34 x 38	1.02864

2. Fundamental flux distributions (Values for 34 x 34 x 38 mesh).

2.1 Radial Flux Traverses in Midplane

x(cm)	ϕ_1(x,2.5,185)	ϕ_2(x,2.5,185)	ϕ_1(x,x,195)	ϕ_2(x,x,85)
2.5	49.61	7.872	49.61	7.872
7.5	53.46	8.40	56.77	9.707
12.5	61.56	13.97	67.70	15.80
17.5	67.76	15.85	73.78	17.31
22.5	72.10	16.92	77.09	18.09
27.5	74.86	17.56	78.48	18.42
32.5	76.25	17.90	78.48	18.42
37.5	76.49	17.96	77.39	18.16
42.5	75.71	17.77	75.41	17.70
47.5	73.78	17.32	72.58	17.04
52.5	70.83	16.62	68.85	16.16
57.5	66.68	15.64	64.15	15.06
62.5	61.14	14.30	58.12	13.64
67.5	53.98	12.27	50.24	11.73
72.5	45.27	7.510	39.24	6.728
77.5	40.34	6.403	31.08	4.935
82.5	38.54	6.108	27.38	4.345
87.5	39.70	6.554	27.20	4.682
92.5	43.92	9.954	27.67	6.812
97.5	46.74	10.92	24.01	6.011
102.5	48.12	11.29	17.86	4.831
107.5	48.36	11.35	10.30	4.825
112.5	47.69	11.19	2.911	9.539
117.5	46.25	10.86	0.9978	4.870
122.5	44.17	10.38	0.3278	1.757
127.5	41.52	9.803	0.08347	0.2827
132.5	38.29	9.430		
137.5	33.71	8.383		
142.5	27.79	7.155		
147.5	20.27	6.993		
152.5	9.298	18.09		
157.5	4.598	14.99		
162.5	2.229	9.171		
167.5	.9918	3.633		

2.2 Radial Flux Traverses at z = 275

x(cm)	$\phi_1(x,2.5,275)$	$\phi_2(x,2.5,275)$	$\phi_1(x,x,275)$	$\phi_2(x,x,275)$
2.5	27.74	4.466	27.74	4.400
7.5	29.87	4.938	38.68	5.414
12.5	34.32	7.787	37.61	8.774
17.5	37.73	8.822	40.67	9.545
22.5	40.06	9.394	41.93	9.839
27.5	41.51	9.743	41.81	9.809
32.5	42.26	9.918	40.62	9.472
37.5	42.43	9.960	39.26	9.135
42.5	42.06	9.870	38.37	8.931
47.5	41.16	9.659	37.94	8.846
52.5	39.71	9.322	37.39	8.774
57.5	37.63	8.828	35.93	8.431
62.5	34.78	8.136	33.36	7.829
67.5	30.99	7.041	29.40	6.860
72.5	26.32	4.356	23.34	4.001
77.5	23.74	3.766	18.79	2.983
82.5	23.00	3.648	16.80	2.667
87.5	24.02	3.966	16.87	2.907
92.5	26.86	6.090	17.29	4.256
97.5	28.84	6.740	15.07	3.773
102.5	29.91	7.026	11.24	3.042
107.5	30.24	7.095	6.499	3.045
112.5	29.98	7.035	1.838	6.024
117.5	29.20	6.855	.6307	3.080
122.5	27.99	6.572	.2074	1.112
127.5	26.40	6.235	.05286	0.1790
132.5	24.40	6.011		
137.5	21.53	5.353		
142.5	17.78	4.576		
147.5	12.99	4.481		
152.5	5.966	11.60		
157.5	2.955	9.617		
162.5	1.430	5.886		
167.5	0.6367	2.333		

2.3 Radial Flux Traverses at z = 285

x(cm)	$\phi_1(x,2.5,285)$	$\phi_2(x,2.5,285)$	$\phi_1(x,x,285)$	$\phi_2(x,x,285)$
2.5	24.01	3.808	24.01	3.808
7.5	25.83	4.270	27.38	4.678
12.5	29.65	6.728	32.39	7.559
17.5	32.55	7.613	34.80	8.166
22.5	34.50	8.094	35.38	8.305
27.5	35.71	8.377	34.15	7.968
32.5	36.31	8.521	30.16	5.205
37.5	36.44	8.552	27.20	4.390
42.5	36.14	8.475	26.54	4.283
47.5	35.42	8.311	28.11	4.844
52.5	34.25	8.040	30.58	7.137
57.5	32.55	7.637	30.50	7.155
62.5	30.18	7.059	28.83	6.764
67.5	26.99	6.126	25.67	5.993
72.5	23.01	3.808	20.53	3.518
77.5	20.85	3.307	16.62	2.639
82.5	20.29	3.218	14.94	2.371
87.5	21.28	3.514	15.06	2.593
92.5	23.88	5.414	15.45	3.805
97.5	25.70	6.007	13.49	3.338
102.5	26.70	6.265	10.07	2.724
107.5	27.04	6.343	5.822	2.729
112.5	26.83	6.301	1.647	5.402
117.5	26.17	6.144	0.5655	2.762
122.5	25.11	5.898	0.1860	0.9978
127.5	23.70	5.595	0.04741	0.1606
132.5	21.92	5.399		
137.5	19.34	4.811		
142.5	15.98	4.114		
147.5	11.68	4.030		
152.5	5.358	10.44		
157.5	2.652	8.654		
162.5	1.287	5.295		
167.5	0.5727	2.098		

2.4 Axial Flux Traverses for Partially Rodded Assembly

z(cm)	$\phi_1(37.5,37.5,z)$	$\phi_2(37.5,37.5,z)$
5	0.6295	2.556
15	2.596	7.324
25	11.08	2.852
35	18.48	4.346
45	25.61	6.011
55	32.50	7.631
65	39.10	9.177
75	45.35	10.65
85	51.18	12.01
95	56.55	13.27
105	61.38	14.41
115	65.72	15.42
125	69.39	16.28
135	72.46	17.00
145	74.80	17.56
155	76.55	17.96
165	77.51	18.20
175	77.81	18.26
185	77.39	18.16
195	76.25	17.89
205	74.38	17.45
215	71.79	16.84
225	68.48	16.07
235	64.45	15.13
245	59.74	14.02
255	54.21	12.72
265	47.63	11.18
275	39.26	9.135
285	27.20	4.390
295	20.93	3.321
305	16.75	2.656
315	13.44	2.132
325	10.57	1.678
335	7.986	1.267
345	5.554	0.8816
355	3.172	0.5210
365	0.8491	0.6746
375	0.2221	0.2007

2.5 Value and Location of Maximum Power Density
(Values for 34 x 34 x 38 mesh)

Max/Avg in Core	Location
2.503	27.5,32.5,165
2.243*	57.5,130,165

* Interpolated between adjacent points using finite-difference equation.

4. Convergence Data (34 x 34 x 38 mesh)

Number of unknowns in problem	:	73,264
Number of outer iterations	:	73
Average number of iterations on each plane per outer iteration	:	3

5. Computer Data (34 x 34 x 38 mesh)

Machine	:	CDC6600
Field Length	:	34,368 words
Iteration Time	:	1037 CP seconds
Total Time	:	1200 CP seconds
		4470 PP seconds

BENCHMARK PROBLEM

Identification: 11-A2 Source Situation ID.11

Date Submitted: June 1976 By: R. R. Lee (CE)
D. A. Meneley (Ontario Hydro)
B. Micheelsen (Risø-Denmark)
D. R. Vondy (ORNL)
M. R. Wagner (KWU)
W. Werner (GRS-Munich)

Date Accepted: June 1977 By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Two-dimensional LWR Problem,
also 2D IAEA Benchmark Problem

Reduction of Source Situation

1. Two-group diffusion theory
2. Two-dimensional (x,y)-geometry

Two-Group Diffusion Equations:

$$-\nabla D_1 \nabla \phi_1 + (\Sigma_{a1} + \Sigma_{1\to 2} + D_1 B_{z1}^2)\,\phi_1 = \frac{1}{\lambda}\nu\Sigma_{f2}\phi_2$$

$$-\nabla D_2 \nabla \phi_2 + (\Sigma_{a2} + D_2 B_{z2}^2)\,\phi_2 = \Sigma_{1\to 2}\phi_1$$

Data

Two-group Constants

Region	D_1	D_2	$\Sigma_{1\to 2}$	Σ_{a1}	Σ_{a2}	$\nu\Sigma_{f2}$	Material
1	1.5	0.4	0.02	0.01	0.08	0.135	Fuel 1
2	1.5	0.4	0.02	0.01	0.085	0.135	Fuel 2
3	1.5	0.4	0.02	0.01	0.13	0.135	Fuel 2 + Rod
4	2.0	0.3	0.04	0	0.01	0	Reflector

Axial buckling $B^2_{z,g} = 0.8 \cdot 10^{-4}$ for all regions and energy groups.

Note: This 2D IAEA Benchmark Problem represents the midplane z = 190 cm of the 3D IAEA Benchmark Problem

Boundary Conditions:

$J_g^{in} = 0$ No incoming current at external boundaries.

For finite difference diffusion theory codes the following form is considered equivalent

$$\frac{\partial \Phi_g}{\partial n} = -\frac{0.4692}{D_g} \Phi_g ,$$

where n the outward directed normal to the surface. At symmetry boundaries:

$$\frac{\partial \Phi_g}{\partial n} = 0$$

Expected Primary Results:

1. Maximum eigenvalue
2. Fundamental flux distributions

   2.1 Radial flux traverses $\phi_g(x,o)$ and $\phi_g(x,x)$

Note: The fluxes shall be normalized such that

$$\frac{1}{V_{Core}} \int_{V_{Core}} \sum_g \nu\Sigma_{fg} \Phi_g \, dV = 1$$

   2.2 Value and location of maximum power density. This corresponds to maximum of ϕ_2 in the core. It is recommended that the maximum values of ϕ_2 both in the inner core and at the core/reflector interface be given.

3. Average subassembly powers P_k

$$P_k = \frac{1}{V_k} \int_{V_k} \sum_g \nu\Sigma_{fg}\Phi_g \, dV$$

where V_k volume of the k-th subassembly and k designates the fuel subassemblies as shown in lower octant of Fig. 1

4. Number of unknowns in the problem, number of iterations, total and outer

5. Total computing time, iteration time, IO-time, computer used

6. Type and numerical values of convergence criteria

7. Table of average group fluxes for a square mesh grid of 20 x 20 cm

8. Dependence of results on mesh spacing

Best Solution Available: Extrapolated finite difference solution described in 11-A2-1

Solutions

1. Finite Difference Method: 11-A2-1
2. Finite Element Method: 11-A2-2
3. Nodal Expansion Method: 11-A2-3
4. Finite Difference Method: 11-A2-4

BENCHMARK PROBLEM SOLUTION

Identification: 11-A2-1 — Benchmark Problem 11.A2

Date Submitted: June 1, 1976 — By: D. R. Vondy, T. B. Fowler (ORNL)

Date Accepted: June 1, 1977 — By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Two-dimensional PWR Problem (IAEA)

Mathematical Model: Diffusion theory, various difference formulations

Computer: IBM-369/91, 1973-76, ORNL
IBM-360/195, 1976 UC-CTC

Program: (1) VENTURE, ORNL-5062 Report
(2) EXTERMINATOR-2, ORNL-4078
(3) VANCER, to be documented (ORNL)

Note: To produce acceptable solutions for benchmarking, tighter convergence of the iterative process was required than is common practice in application, maximum relative flux change on outer iterations = 10^{-5}.

Primary Results:*

a. Primary results obtained in 1973-74 are shown in Table 1. The larger problems were initialized with the flux solution from the smaller problems, and an early version of the VENTURE code used obsolete procedures, so compute times are not representative. Apparent finite-difference error in the multiplication factor is displayed in Fig. 1. Tables 2 and 3 present zone average flux values. Normalization is to one neutron produced for the problem.+

b. Recent results with the VANCER code using the mesh-edge formulation parameterized to admit different approximations are shown in Table 4 from calculations on the IBM-360/91 done in 1976. These calculations were done with rather obsolete procedures oriented to use of an extended, slow memory, so representative computation times are not available.

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* Extrapolation of results is done on the basis of error dependence on the square of the mesh spacing.

\+ To obtain the proper normalization, results in Tables 2 and 3 should be multiplied by 1.78.

ORNL-DWG 74-10811

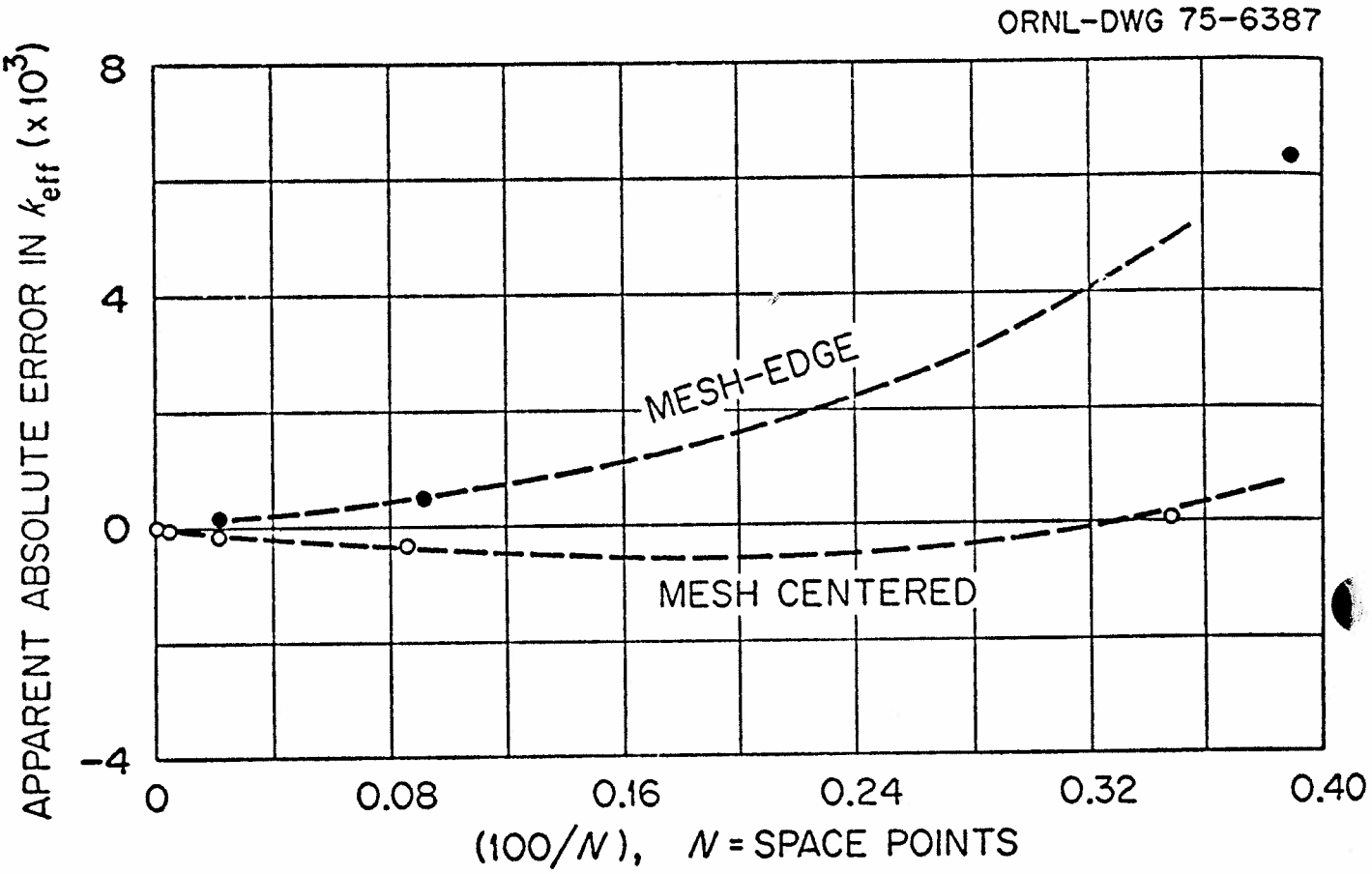
Table 1

IAEA BENCHMARK PROBLEM

(Two-Group, Two-Dimensional, $B_I^2=8\times10^{-5}$)

Meshpoints (Total Unknowns)	k_{eff}	Peak-to-Average Power Density	IBM-360/91 Processor Time (min)
Old Code Exterminator-2 (mesh-edge points, zero flux external boundary)			
16x16(512)	1.03651	2.2404	0.20
33x33(2,178)	1.03065	1.6538	1.0
67x67(8,978)	1.03033	1.5314	(10.)
Extrapolated	1.03022	1.491	
VENTURE (mesh-centered points, non-return external boundary)			
9x9(162)	1.03208	1.5493	0.05
17x17(578)	1.02965	1.6486	0.06
34x34(2,312)	1.02924	1.5985	0.32
68x68(9,248)	1.02944	1.5442	3.4
136x136(36,992)	1.02954	1.5217	13.5
272x272(147,968)	1.02958	1.5149	80
Extrapolated	1.02959	1.5126	

Figure 1. Two-Dimensional Finite-Difference Results



Two-Dimensional Finite-Difference Results.

Table 2. Zone Average Fast Group Flux - Mesh Centered VENTURE

(Results below should be multiplied by 1.78 for proper normalization)

Location/ Intervals	9x9	17x17	34x34	68x68	272x272	Extrapolated
1	17.35	19.28	19.37	18.77	18.37	18.34
2	25.20	26.42	25.30	24.27	23.71	23.67
3	27.12	28.43	27.46	26.49	25.96	25.92
4	23.48	23.87	23.06	22.30	21.89	21.86
5	13.14	14.92	15.32	15.16	15.02	15.01
6	17.53	17.09	17.01	16.95	16.92	16.92
7	16.19	15.80	16.15	16.45	16.61	16.62
8	11.55	10.37	10.76	11.21	11.47	11.49
9	0.954	1.202	1.531	1.772	1.898	1.906
10	27.14	28.46	27.28	26.23	25.65	25.61
11	27.61	28.87	27.90	26.94	26.42	26.39
12	24.73	25.45	24.63	23.90	23.49	23.46
13	19.56	20.39	19.96	19.56	19.35	19.34
14	18.77	18.62	18.54	18.51	18.49	18.49
15	16.45	15.98	16.34	16.67	16.85	16.86
16	11.23	10.06	10.46	10.93	11.20	11.22
17	0.921	1.144	1.458	1.690	1.813	1.821
18	27.28	28.38	27.53	26.99	26.23	26.18
19	24.82	25.59	24.96	24.35	24.01	23.99
20	21.14	21.77	21.50	21.20	21.04	21.03
21	19.02	18.85	18.93	19.00	19.03	19.03
22	16.96	15.53	15.80	16.19	16.42	16.43
23	9.222	8.176	8.616	9.114	9.394	9.413
24	0.733	0.856	1.088	1.272	1.373	1.380
25	22.21	22.50	22.00	21.55	21.30	21.28
26	17.86	17.97	17.75	17.57	17.46	17.45
27	16.14	15.70	15.83	16.00	16.09	16.10
28	12.77	11.62	12.01	12.48	12.74	12.76
29	1.682	2.104	2.686	3.115	3.346	3.361
30	0.188	0.239	0.3136	0.3704	0.4012	0.4033
31	9.374	10.79	11.32	11.48	11.52	11.52
32	12.26	11.18	11.31	11.57	11.72	11.73
33	8.075	7.136	7.482	7.903	8.141	8.157
34	0.712	0.849	1.080	1.263	1.362	1.369
35	8.206	7.071	7.320	7.690	7.904	7.918
36	1.217	1.417	1.789	2.083	2.244	2.255
37	0.150	0.190	0.2511	0.2975	0.3226	0.3243
38	0.190	0.221	0.2844	0.3343	0.3616	0.3634

Table 3. Zone Average Thermal Group Flux - Mesh Centered VENTURE

(Results below should be multiplied by 1.78 for proper normalization)

Location/ Intervals	9x9	17x17	34x34	68x68	272x272	Extrapolated
1	2.796	3.131	3.202	3.155	3.122	3.120
2	5.898	6.173	5.891	5.633	5.491	5.482
3	6.367	6.673	6.446	6.218	6.093	6.085
4	5.501	5.581	5.372	5.181	5.075	5.068
5	2.113	2.422	2.531	2.548	2.552	2.552
6	4.105	3.990	3.957	3.921	3.915	3.914
7	3.803	3.712	3.797	3.869	3.908	3.911
8	2.900	2.670	2.863	3.050	3.153	3.160
9	3.286	3.706	4.105	4.368	4.505	4.514
10	6.372	6.678	6.401	6.151	6.015	6.006
11	6.483	6.777	6.548	6.342	6.202	6.193
12	5.806	5.972	5.779	5.604	5.510	5.503
13	4.580	4.766	4.647	4.541	4.481	4.477
14	4.407	4.371	4.351	4.342	4.336	4.336
15	3.865	3.759	3.848	3.930	3.974	3.977
16	2.818	2.587	2.781	2.969	3.072	3.079
17	3.163	3.510	3.891	4.149	4.284	4.293
18	6.406	6.662	6.462	6.265	6.157	6.149
19	5.826	6.005	5.860	5.714	5.635	5.630
20	4.964	5.111	5.047	4.977	4.938	4.935
21	4.468	4.430	4.450	4.469	4.479	4.480
22	4.201	3.847	3.918	4.019	4.076	4.080
23	2.369	2.220	2.494	2.746	2.887	2.896
24	2.498	2.637	2.944	3.176	3.299	3.307
25	5.214	5.280	5.162	5.055	4.996	4.992
26	4.185	4.201	4.138	4.082	4.049	4.047
27	3.794	3.690	3.726	3.768	3.792	3.794
28	3.223	3.016	3.224	3.423	3.533	3.540
29	5.641	6.040	6.518	6.844	7.013	7.024
30	0.9503	1.122	1.336	1.497	1.584	1.590
31	1.506	1.755	1.878	1.937	1.967	1.969
32	3.031	2.756	2.780	2.836	2.867	2.869
33	2.071	1.930	2.156	2.371	2.490	2.498
34	2.543	2.724	3.041	3.280	3.406	3.414
35	2.115	1.929	2.129	2.327	2.440	2.448
36	4.045	4.038	4.330	4.570	4.698	4.707
37	0.7636	0.889	1.059	1.190	1.261	1.266
38	0.9518	1.045	1.222	1.364	1.443	1.448

Table 4. TWO-DIMENSIONAL, TWO-GROUP IAEA BENCHMARK PROBLEM RESULTS

Formulation (Near Neighbors)	Mesh Intervals	k_{eff}	Peak Relative Power Density: Internal	Peak Relative Power Density: Near Reflector
Meshpoint Centered, VENTURE (4)	9^2	1.03208	1.549	
	17^2	1.02965	1.649	
	34^2	1.02924	1.599	
	68^2	1.02944	1.544	
	136^2	1.02954	1.522	
	272^2	1.02958	1.515	
Extrapolated	(∞)	1.02959	1.513	
Mesh Edge, VANCER				
Usual Finite-Difference (4)	9^2	1.07647	none	4.28
	17^2	1.03733	0.962	2.231
	34^2	1.03077	1.364	1.660
	68^2	1.02983	1.475	1.546
	(∞)	1.02952	1.512	1.508
Taylor Series (8)	34^2	1.03080	1.364	1.652
Higher Order Taylor Series (8)	17^2	1.03442	1.095	2.043
	34^2	1.03036	1.405	1.629
	68^2	1.02975	1.485	1.544
	(∞)	1.02955	1.512	1.516
Linear Finite-Element (8)*	17^2	1.03109	1.309	1.779
	34^2	1.02985	1.462	1.605
	68^2	1.02965	1.499	1.545
	(∞)	1.02958	1.511	1.525
Linear Finite-Difference (8)*	17^2	1.03236	1.214	1.887
	34^2	1.03006	1.437	1.614
	68^2	1.02969	1.493	1.544
	(∞)	1.02957	1.512	1.521
Compromise (8)	17^2	1.03390	1.123	2.009
	34^2	1.03028	1.412	1.625
	68^2	1.02973	1.487	1.544
	(∞)	1.02955	1.512	1.517
Simple Compromise (4)	34^2	1.03051	1.389	1.645
	68^2	1.02978	1.481	1.544
	(∞)	1.02954	1.512	1.510
Compensated Difference (4)*	17^2	1.03206	1.228	1.900
	34^2	1.03002	1.438	1.628
	68^2	1.02968	1.493	1.547
	(∞)	1.02957	1.511	1.520
Local Source				
H-O Taylor Series (8)	34^2	1.03162	1.393	1.724
Linear Finite-Element (8)	34^2	1.03229	1.402	1.792
Linear Finite-Difference (8)	34^2	1.03280	1.422	1.860
Compromise (8)	34^2	1.03178	1.387	1.737
Simple Compromise (4)	34^2	1.03126	1.375	1.700
Compensated Difference (4)	34^2	1.03224	1.403	1.799
Apparent Solution		1.02958	1.51	1.52

*Results for 9^2 mesh inadequate, resulting flux skewed; the only clue of inadequate solution is a neutron balance k.

BENCHMARK PROBLEM SOLUTION

Identification: 11-A2-2

Benchmark Problem ID.11-A2

Date Submitted: June 1976

By: Ib Misfeldt (Risø-Denmark)

Date Accepted: June 1977

By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Two-dimensional PWR Problem

Mathematical Model: FEM (2nd order Lagrange interpolation, rectangular elements)

Pertinent Features of Solution Method: The grid had 36 x 36 meshes and 73 x 73 flux points.

Computer: B 6700

Date Solved: August 25, 1975
at: Risø, Denmark

Program: FEMB

References

1. Ib Misfeldt, "Solution of the multigroup neutron diffusion equations by the finite element method," Risø-M-1809 (1975).

2. G. K. Kristiansen, "Investigation of the accuracy of centerpoint-, cornerpoint-, and finite-element-methods for solution of the neutron diffusion equation," NEACRP-L-149 (1976).

Results

1. Maximum eigenvalue: $k_{eff} = 1.0296$

2. Fundamental flux distributions

   2.1. See Tables 2A and 2B of flux traverses.

   2.2. Maximum power density

   Uninterpolated values are given

   $(\phi_2)_{max,1} = 11.31$ at $(x,y) = (130,55)$

   $(\phi_2)_{max,2} = 11.18$ at $(x,y) = (30,30)$

3. Average subassembly powers

   See Table 2C.

4. Number of unknowns and iteration number

   73 x 73 x 2 unknowns; 120 iterations.

5. Computing times

   2½ hours cp=time; ½ hour io-time, on B 6700.

6. Convergence criteria

   Maximal flux-error-estimate less than 0.01% of ϕ_{max} in each group.

7. Average group-fluxes for 20 x 20 cm grid

   See Table 2D.

8. Dependence of results on mesh spacing

   See Refs. 1 and 2.

Table 2A

Flux along x-axis

X	PHI1	PHI2
0.000	29.350	4.620
1.250	29.422	4.633
2.500	29.641	4.675
3.750	30.009	4.750
5.000	30.531	4.868
6.250	31.211	5.049
7.500	32.052	5.336
8.750	33.046	5.809
10.000	34.166	6.646
12.500	36.512	8.164
15.000	38.666	8.945
17.500	40.501	9.468
20.000	42.030	9.853
22.500	43.280	10.155
25.000	44.282	10.393
27.500	45.061	10.577
30.000	45.635	10.712
32.500	46.019	10.802
35.000	46.223	10.850
37.500	46.255	10.857
40.000	46.120	10.826
42.500	45.819	10.755
45.000	45.355	10.646
47.500	44.725	10.498
50.000	43.926	10.310
52.500	42.950	10.081
55.000	41.788	9.808
57.500	40.426	9.486
60.000	38.845	9.107
62.500	37.021	8.656
65.000	34.934	8.085
67.500	32.576	7.289
70.000	30.063	5.846
72.500	27.763	4.618
75.000	25.984	4.157
77.500	24.760	3.909
80.000	24.042	3.787
82.500	23.801	3.756
85.000	24.035	3.840
87.500	24.765	4.107
90.000	25.939	5.020
92.500	27.277	6.087
95.000	28.463	6.579
97.500	29.398	6.871
100.000	30.097	7.055
102.500	30.582	7.176
105.000	30.879	7.247
107.500	31.010	7.279
110.000	30.991	7.274
112.500	30.836	7.238
115.000	30.557	7.173

Table 2A (cont'd)

117.500	30.164	7.081
120.000	29.664	6.964
122.500	29.064	6.827
125.000	28.371	6.676
127.500	27.585	6.525
130.000	26.689	6.434
132.500	25.629	6.300
135.000	24.355	6.025
137.500	22.854	5.677
140.000	21.128	5.292
142.500	19.178	4.920
145.000	16.945	4.746
147.500	14.273	5.182
150.000	10.430	7.976
152.500	7.301	12.063
155.000	5.107	12.443
157.500	3.565	11.132
160.000	2.480	9.136
162.500	1.711	6.976
165.000	1.162	4.838
167.500	0.762	2.743
170.000	0.459	0.580

Table 2B

Flux along the diagonal x = y

x	y	PHI1	PHI2
0.000	0.000	29.350	4.620
1.250	1.250	29.494	4.647
2.500	2.500	29.927	4.730
3.750	3.750	30.642	4.876
5.000	5.000	31.628	5.101
6.250	6.250	32.865	5.440
7.500	7.500	34.317	5.961
8.750	8.750	35.921	6.778
10.000	10.000	37.562	8.030
12.500	12.500	40.453	9.391
15.000	15.000	42.671	10.000
17.500	17.500	44.343	10.406
20.000	20.000	45.590	10.701
22.500	22.500	46.493	10.913
25.000	25.000	47.108	11.058
27.500	27.500	47.480	11.145
30.000	30.000	47.642	11.183
32.500	32.500	47.621	11.178
35.000	35.000	47.436	11.135
37.500	37.500	47.106	11.057
40.000	40.000	46.640	10.948
42.500	42.500	46.046	10.808
45.000	45.000	45.325	10.639
47.500	47.500	44.476	10.440
50.000	50.000	43.493	10.209
52.500	52.500	42.363	9.944
55.000	55.000	41.073	9.641
57.500	57.500	39.601	9.295
60.000	60.000	37.922	8.901
62.500	62.500	35.998	8.448
65.000	65.000	33.776	7.916
67.500	67.500	31.177	7.241
70.000	70.000	28.120	6.013
72.500	72.500	24.843	4.306
75.000	75.000	21.997	3.572
77.500	77.500	19.869	3.146
80.000	80.000	18.479	2.914
82.500	82.500	17.783	2.815
85.000	85.000	17.681	2.873
87.500	87.500	18.019	3.145
90.000	90.000	18.447	4.081
92.500	92.500	18.398	4.495
95.000	95.000	17.696	4.385
97.500	97.500	16.444	4.103
100.000	100.000	14.747	3.746
102.500	102.500	12.688	3.400
105.000	105.000	10.293	3.301
107.500	107.500	7.555	3.832
110.000	110.000	4.283	6.272
112.500	112.500	2.399	6.920

Table 2B (cont'd)

115.000	115.000	1.382	5.429
117.500	117.500	0.803	3.767
120.000	120.000	0.463	2.387
122.500	122.500	0.260	1.360
125.000	125.000	0.138	0.652
127.500	127.500	0.066	0.211
130.000	130.000	0.025	0.010
132.500	132.500	0.000	0.000

Table 2C

Average subassembly powers

170.00									
	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
150.00									
	0.7571	0.7379	0.6952	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
130.00									
	0.9350	0.9512	0.9761	0.8485	0.5997	0.0000	0.0000	0.0000	0.0000
110.00									
	0.9345	1.0359	1.0706	0.9068	0.6859	0.5874	0.0000	0.0000	0.0000
90.00									
	0.6099	1.0684	1.1783	0.9661	0.4712	0.6860	0.5998	0.0000	0.0000
70.00									
	1.2083	1.3128	1.3433	1.1916	0.9662	0.9070	0.8487	0.0000	0.0000
50.00									
	1.4509	1.4772	1.4671	1.3434	1.1785	1.0708	0.9764	0.6954	0.0000
30.00									
	1.3068	1.4323	1.4773	1.3130	1.0686	1.0362	0.9516	0.7382	0.0000
10.00									
	0.7443	1.3068	1.4510	1.2084	0.6100	0.9348	0.9354	0.7574	0.0000
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 2D, group 1

Flux averages

Group 1

170.00									
	3.3944	3.2431	2.4578	0.7188	0.0215	0.0040	0.0000	0.0000	0.0000
150.00									
	20.3675	19.8959	16.7075	5.9875	2.4387	0.5778	0.0100	0.0000	0.0000
130.00									
	29.4320	29.8661	29.1220	22.6278	14.4753	4.0186	0.6479	0.0100	0.0000
110.00									
	29.9296	32.7203	33.6976	28.5075	20.7859	14.0517	4.0194	0.5781	0.0040
90.00									
	26.5281	34.1781	37.1833	30.8752	20.3850	20.7890	14.4796	2.4397	0.0215
70.00									
	38.6266	41.4685	42.3909	37.6359	30.8782	28.5131	22.6343	5.9895	0.7190
50.00									
	45.7876	46.6162	46.2972	42.3941	37.1893	33.7055	29.1304	16.7128	2.4586
30.00									
	41.8016	45.2435	46.6185	41.4731	34.1849	32.7299	29.8766	19.9035	3.2444
10.00									
	32.3916	41.8032	45.7911	38.6309	26.5336	29.9397	29.4437	20.3760	3.3959
	0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

Table 2D, group 2

Group 2

170.00								
8.0138	7.6236	5.8770	2.8301	0.0293	0.0053	0.0000	0.0000	0.0000
150.00								
5.6078	5.4661	5.1497	12.4623	6.0648	2.2525	0.0143	0.0000	0.0000
130.00								
6.9263	7.0461	7.2307	6.2849	4.4419	8.3528	2.5767	0.0143	0.0000
110.00								
6.9224	7.6736	7.9302	6.7171	5.0810	4.3515	8.3545	2.2534	0.0054
90.00								
4.5176	7.9143	8.7280	7.1565	3.4904	5.0817	4.4432	6.0674	0.0293
70.00								
8.9502	9.7246	9.9503	8.8264	7.1572	6.7184	6.2867	12.4665	2.8309
50.00								
10.7476	10.9421	10.8673	9.9511	8.7293	7.9321	7.2328	5.1513	5.8789
30.00								
9.6798	10.6093	10.9427	9.7256	7.9158	7.6758	7.0485	5.4682	7.6265
10.00								
5.5137	9.6801	10.7484	8.9512	4.5185	6.9247	6.9290	5.6102	8.0174
0.00	10.00	30.00	50.00	70.00	90.00	110.00	130.00	150.00	170.00

BENCHMARK PROBLEM SOLUTION

Identification: 11-A2-3 Benchmark Problem ID.11-A2

Date Submitted: June 1976 By: K. Koebke (KWU)
M. R. Wagner (KWU)

Date Accepted: June 1977 By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Nodal Solutions for Two-dimensional LWR Problem (2D IAEA Benchmark Problem)

Mathematical Model

The nodal expansion method, a higher order nodal method as described in References 1 to 4, is used. Nodal balance equations are obtained by integrating the P1-form of the group diffusion equations over parallelepipeds (nodes). The spatial coupling between nodes is expressed in terms of interface current relations.

Pertinent Features of Solution Methods

A consistent scheme is used for the iterative self-generation of spatial coupling coefficients as an integral part of the overall calculational procedure. The nodal coefficients are computed from auxiliary one-dimensional diffusion equations for the transverse average of the group fluxes, for each space direction of every node.

The channel fluxes are represented by high order polynomial expansion and a Galerkin scheme is used to determine the free expansion coefficients. The spatial distribution of the transverse leakage is approximated by a second order polynomial based on information from adjacent nodes, see Refs. 3 and 4 for details.

After convergence local flux and power distributions may be computed a posteriori by a high order local interpolation method, Ref. 5. The point fluxes in Exhibits A1 and A2 and in Tables 1 and 2, as well as the maximum local power densities per assembly, shown in Table 3, were obtained in that way.

Solution Technique

A conventional outer fission source iteration is used with one inner per outer iteration. For convergence acceleration a combination of coarse mesh rebalancing and asymptotic source extrapolation is applied.

Program Name: MEDIUM-2 (KWU)

Type of Program: Multidimensional LWR depletion code

Results of two solutions for an octant with a square mesh of h = $3\ ^1/3$ and h = 10 cm are given below. The order of approximation is G_3B^2 (5^{th}-order polynomial expansion for the channel fluxes and second order approximation for the transverse neutron leakage).

1. k-effective: 1.029585 h = $3\ ^1/3$ cm
   1.029611 h = 10 cm

2. Fundamental Flux Distributions

   2.1 Radial flux traverses, see Exhibits A1 and A2. The pointwise flux values are given in Tables 1 and 2.

   2.2 Value and Location of Maximum Thermal Flux ϕ_2

h (cm)	Inner Core Value	Inner Core Location	at Core Boundary Value	at Core Boundary Location
$3\ ^1/3$	11.206	(31, 31)	11.317	(130, 55.35)
10	11.195	(30, 30)	11.335	(130, 56)

3. Average Subassembly Powers P_k, see Table 3

	$h = 3\,^1/3$ cm	10 cm
4. Number of Unknowns/Group	5481	609
Number of Iterations	42	26

Note: Number of unknowns per node and energy group: average node flux plus 4 partial out-currents

	$h = 3\,^1/3$ cm	10 cm
5. Iteration Time (CP)	15.12 sec	1.34 sec
Computer Used	CYBER 175	

6. Pointwise Convergence Criterium:

$$\max_m \left| \frac{Q_{fm}^n - Q_{fm}^{n-1}}{Q_{fm}^{n-1}} \right| < \varepsilon_{point}$$

where

$$Q_{fm}^n = \sum_g \nu\Sigma_{fg}{}^m \, \phi_g^{m,n}$$

$\phi_g^{m,n}$ average group flux for node m, outer iteration n.

Numerical value of $\varepsilon_{point} = 1.10^{-6}$ for $h = 3\,^1/3$ cm
$= 7.10^{-6}$ $h =$ 10 cm

7. Table of average group fluxes, see Tables 4 and 5.

References

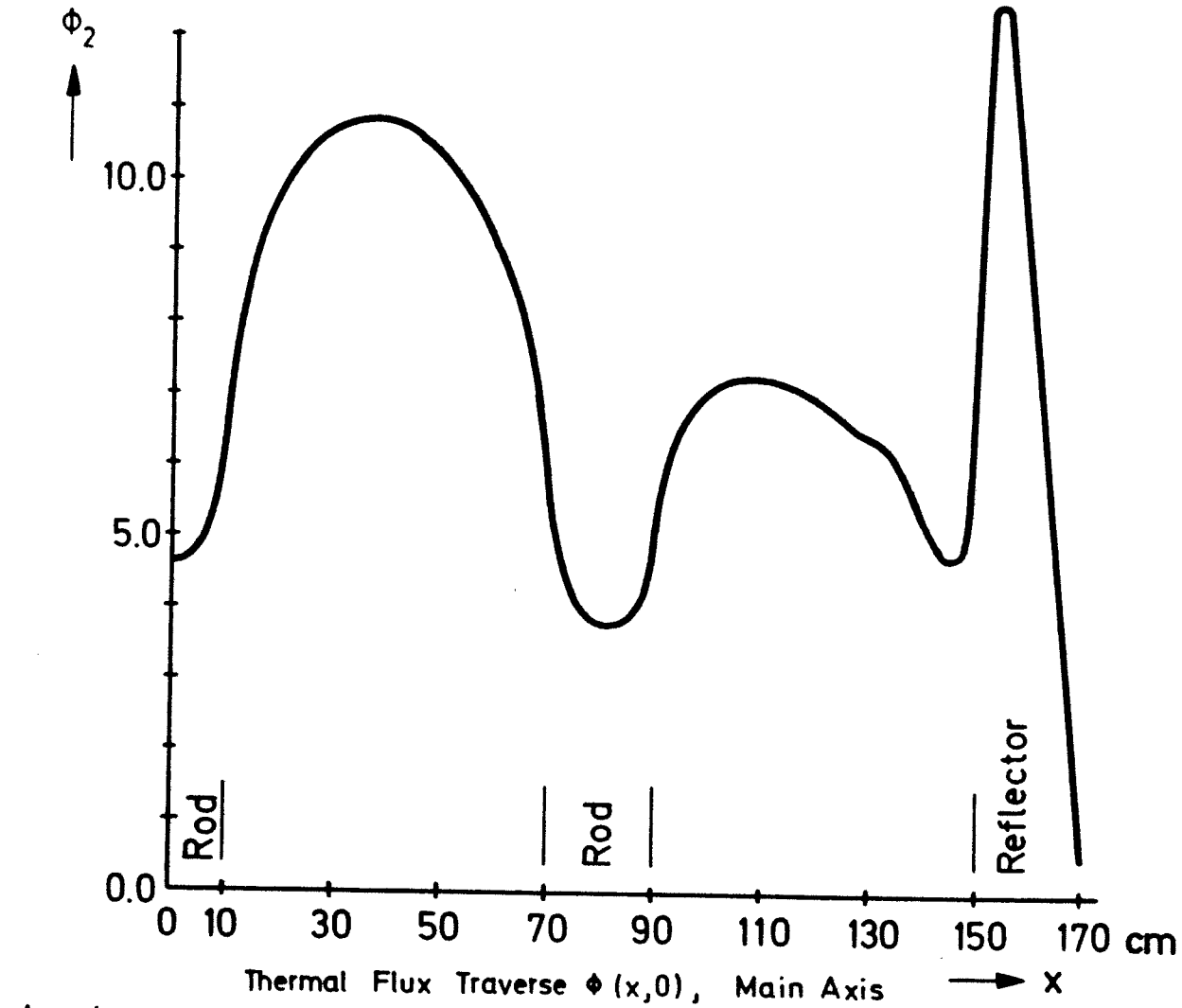
1. H. Finnemann, A Consistent Nodal Method for the Analysis of Space-Time Effects in Large LWR's Proc. of the Joint NEACRP/CSNI Specialists' Meeting on New Developments in Three-Dimensional Neutron Kinetics and Review of Kinetics Benchmark Calculations MRR 145. p. 131 (1975)

2. F. Bennewitz, H. Finnemann, H. Moldaschl, CONF-750413, Proc. Conf. on Comput. Methods in Nucl. Eng., April 15 - 17, 1975 Charleston, South Carolina

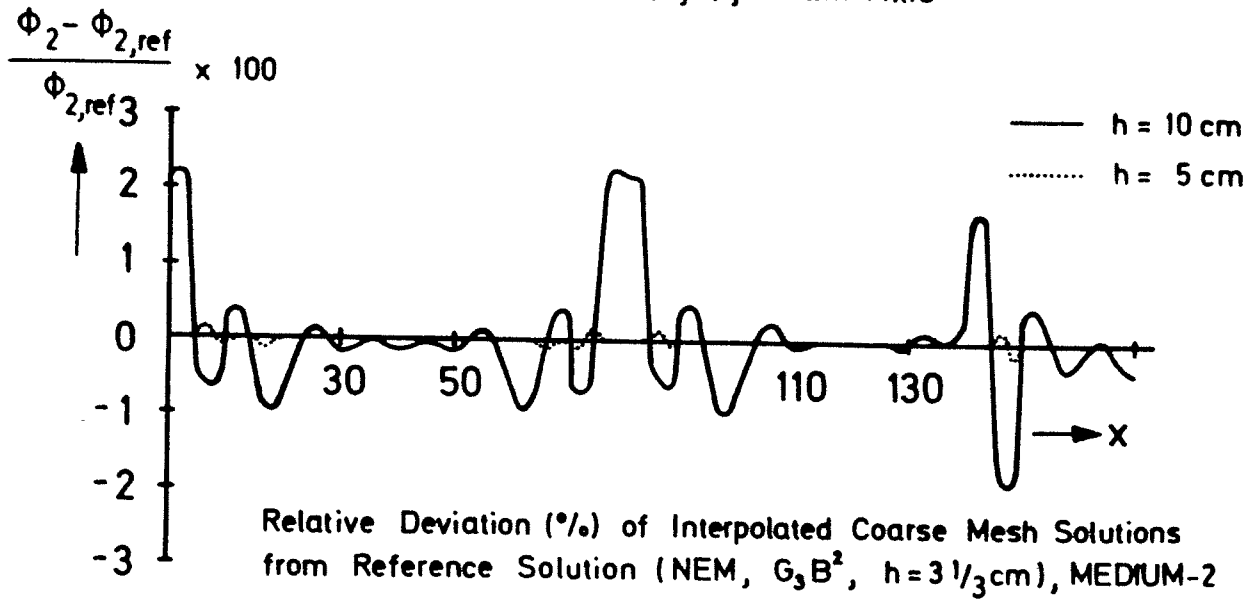
3. H. Finnemann, M.R. Wagner, The Nodal Expansion Method: A New Computational Technique for the Solution of Multidimensional Neutron Diffusion Problems, IAEA Specialists' Meeting on Methods of Neutron Transport Theory in Reactor Calculations, Bologna, Italy 3 - 5 Nov. 1975.

4. F. Bennewitz, H. Finnemann, M.R. Wagner, Higher Order Corrections in Nodal Reactor Calculations, Trans. Am. Nucl. Soc. 22, 250 (1975).

5. K. Koebke, Berechnung lokaler Fluß- und Leistungsverteilungen durch nachträgliche Interpolation nodaler Grobmaschenverfahren, Reactor-Congress Düsseldorf 1976, Paper No. 120, Proceedings p. 79 - 82.



Thermal Flux Traverse $\Phi(x,0)$, Main Axis



Relative Deviation (%) of Interpolated Coarse Mesh Solutions from Reference Solution (NEM, G_3B^2, $h = 3\,1/3$ cm), MEDIUM-2

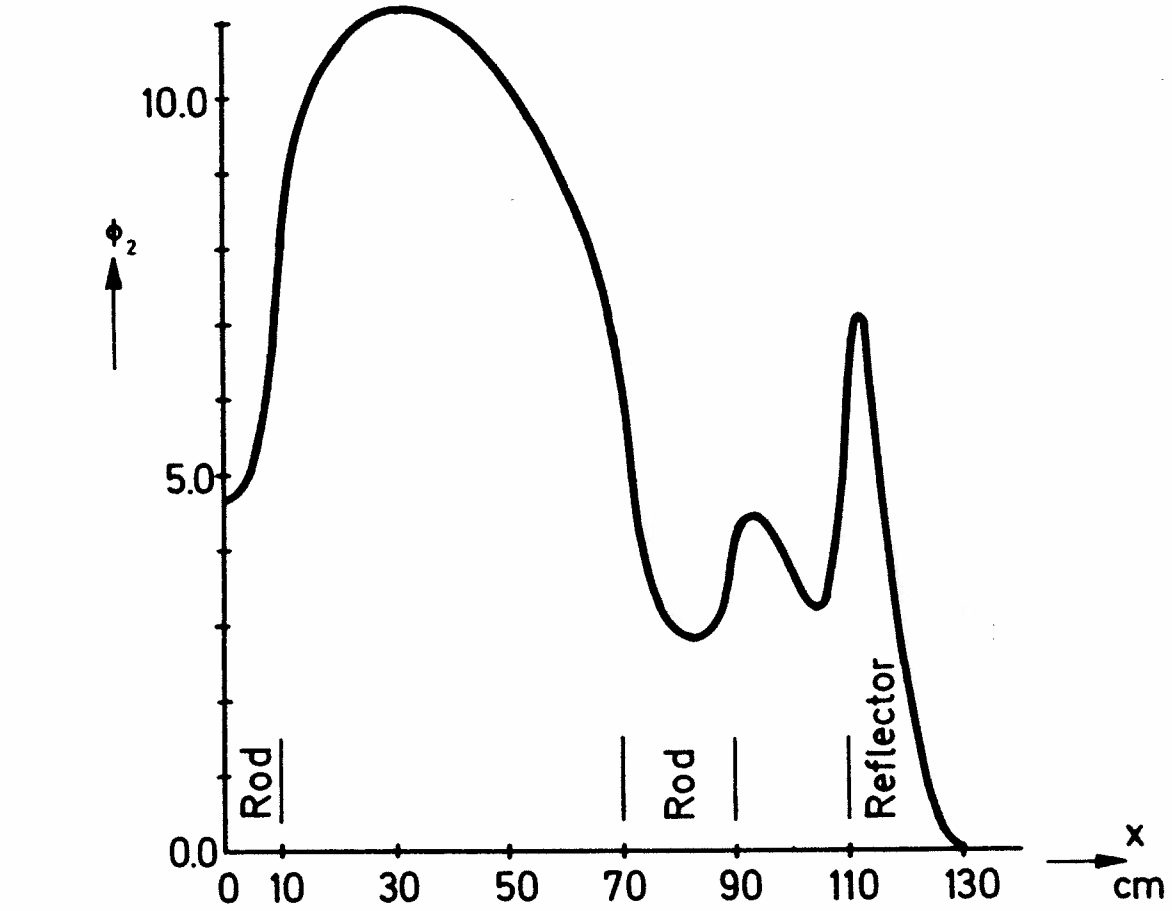
Exhibit A1

x(cm)	$\phi_1(x,0)$	$\phi_2(x,0)$	x(cm)	$\phi_1(x,0)$	$\phi_2(x,0)$
0	29.419	4.631	60	38.909	9.123
2	29.603	4.665	62	37.469	8.770
4	30.171	4.780	64	35.859	8.351
6	31.135	5.017	66	34.075	7.824
8	32.506	5.506	68	32.132	7.083
10	34.246	6.654	70	30.111	5.863
12	36.133	7.953	72	28.225	4.789
14	37.921	8.701	74	26.668	4.301
16	39.521	9.200	76	25.468	4.037
18	40.917	9.576	78	24.607	3.878
20	42.116	9.875	80	24.071	3.789
22	43.140	10.122	82	23.835	3.756
24	43.999	10.326	84	23.908	3.786
26	44.709	10.494	86	24.289	3.910
28	45.282	10.628	88	24.983	4.224
30	45.725	10.733	90	25.954	5.030
32	46.047	10.808	92	27.030	5.940
34	46.252	10.856	94	28.025	6.425
36	46.345	10.878	96	28.871	6.718
38	46.329	10.874	98	29.559	6.916
40	46.206	10.846	100	30.095	7.056
42	45.978	10.792	102	30.497	7.155
44	45.644	10.714	104	30.774	7.222
46	45.205	10.611	106	30.939	7.262
48	44.659	10.482	108	31.003	7.277
50	44.003	10.328	110	30.973	7.270
52	43.236	10.148	112	30.857	7.243
54	42.349	9.940	114	30.659	7.196
56	41.339	9.702	116	30.386	7.133
58	40.197	9.432	118	30.042	7.052

Table 1: Radial Flux Traverse $\phi_g(x,0)$ Along Main Axis

x(cm)	$\phi_1(x,0)$	$\phi_2(x,0)$
120	29.631	6.956
122	29.156	6.847
124	28.621	6.727
126	28.027	6.603
128	27.372	6.489
130	26.643	6.423
132	25.810	6.329
134	24.843	6.134
136	23.731	5.880
138	22.475	5.587
140	21.078	5.273
142	19.537	4.968
144	17.833	4.742
146	15.904	4.764
148	13.573	5.473
150	10.371	7.978
152	7.797	11.582
154	5.858	12.527
156	4.397	11.993
158	3.294	10.702
160	2.461	9.077
162	1.828	7.350
164	1.344	5.630
166	.971	3.946
168	.676	2.271
170	.437	.538

Table 1: (continued)



Thermal Flux Traverse $\Phi_2(x,x)$, Diagonal

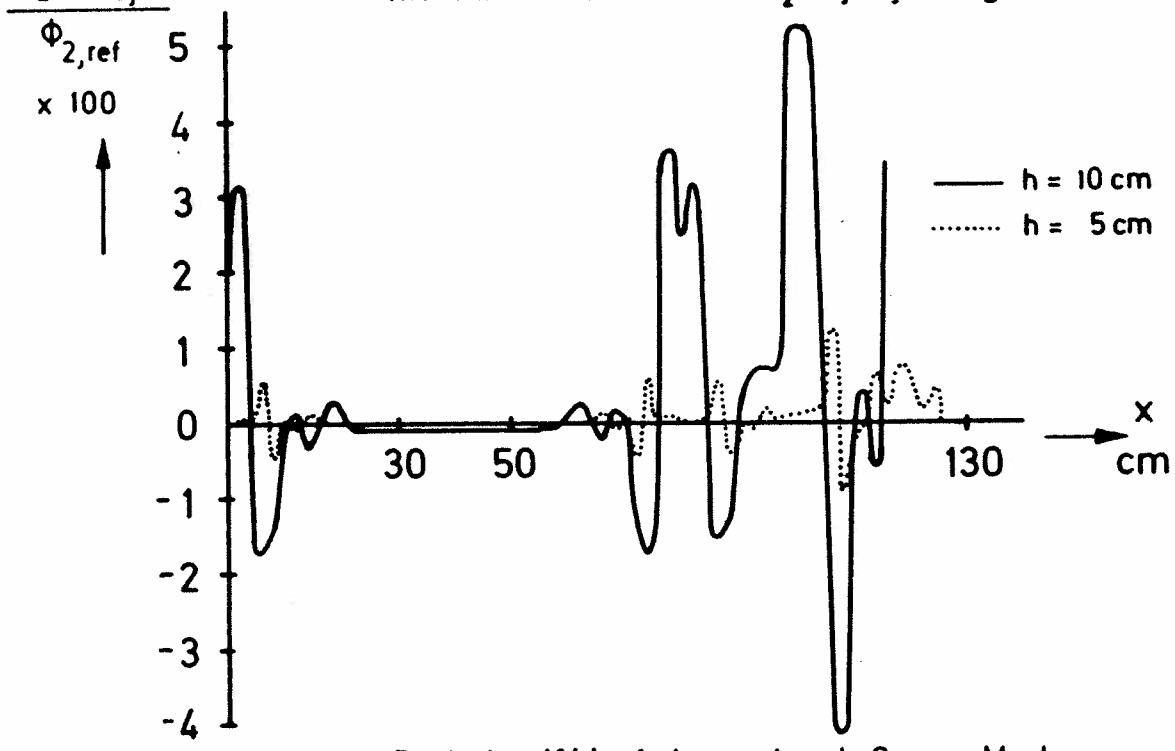


Exhibit A2 Relative Deviation (%) of Interpolated Coarse Mesh Solutions from Reference Solution

x(cm)	$\phi_1(x,x)$	$\phi_2(x,x)$	x(cm)	$\phi_1(x,x)$	$\phi_2(x,x)$
0	29.419	4.631	70	28.145	6.024
2	29.789	4.700	72	25.498	4.568
4	30.889	4.925	74	23.077	3.801
6	32.673	5.372	76	21.073	3.363
8	35.025	6.257	78	19.543	3.085
10	37.649	8.040	80	18.486	2.910
12	40.019	9.242	82	17.874	2.821
14	41.945	9.814	84	17.659	2.818
16	43.487	10.201	86	17.772	2.933
18	44.715	10.494	88	18.100	3.276
20	45.682	10.722	90	18.430	4.081
22	46.428	10.898	92	18.440	4.476
24	46.984	11.028	94	18.021	4.451
26	47.374	11.120	96	17.222	4.276
28	47.617	11.177	98	16.101	4.022
30	47.729	11.203	100	14.709	3.726
32	47.724	11.202	102	13.087	3.439
34	47.612	11.175	104	11.258	3.255
36	47.402	11.126	106	9.216	3.363
38	47.102	11.056	108	6.889	4.150
40	46.716	10.965	110	4.254	6.257
42	46.247	10.855	112	2.669	7.066
44	45.698	10.726	114	1.711	6.074
46	45.068	10.578	116	1.106	4.723
48	44.354	10.411	118	.715	3.444
50	43.552	10.223	120	.459	2.372
52	42.657	10.013	122	.289	1.525
54	41.662	9.779	124	.176	.889
56	40.556	9.519	126	.102	.437
58	39.328	9.231	128	.055	.149
60	37.964	8.911	130	.033	.030
62	36.443	8.553			
64	34.740	8.149			
66	32.818	7.680			
68	30.632	7.080			

Table 2: Radial Flux Traverse $\phi_g(x,x)$ Along Diagonal

J/I	1	2	3	4	5	6	7	8
	.746	1.310	1.454	1.211	.610	.935	.934	.755
1	1.085	1.464	1.479	1.407	.951	.998	.993	1.077
	11 11	11 11	4 11	1 11	1 11	9 11	1 11	11 6
		1.435	1.480	1.315	1.070	1.036	.950	.736
2		1.513	1.513	1.446	1.265	1.123	1.059	1.068
		11 11	1 11	1 11	1 11	1 11	1 11	11 1
			1.469	1.345	1.179	1.070	.975	.692
3			1.513	1.446	1.275	1.132	1.130	1.446
			1 1	1 1	1 4	1 4	11 11	3 11
				1.193	.967	.906	.846	
4				1.380	1.207	1.062	1.525	
				1 1	1 1	1 1	11 4	
		h = 3 1/3 cm						
					.471	.686	.597	
5					.813	.811	1.077	
					1 1	6 1	11 1	
		Average Subassembly Power —				.585		
6		Maximum Power ———				1.044		
		Location of Maximum ——				11 3		
		(2 cm Grid)						

J/I	1	2	3	4	5	6	7	8
	.744	1.308	1.452	1.210	.609	.935	.934	.755
1	1.085	1.462	1.478	1.406	.951	.998	.993	1.079
	11 11	11 11	4 11	1 11	1 11	9 11	1 11	11 6
		1.434	1.479	1.314	1.069	1.036	.951	.736
2		1.511	1.511	1.446	1.265	1.122	1.059	1.070
		11 11	1 11	1 11	1 11	1 11	1 11	11 1
			1.468	1.344	1.179	1.071	.976	.693
3			1.511	1.446	1.274	1.132	1.125	1.439
			1 1	1 1	1 4	1 4	11 11	3 11
				1.192	.967	.907	.847	
4				1.379	1.206	1.062	1.530	
				1 1	1 1	1 1	11 4	
		h = 10 cm						
					.471	.686	.599	
5					.814	.810	1.079	
					1 1	6 1	11 1	
						.587		
6						1.043		
						11 3		

Table 3 Average and Maximum Power Density per Subassembly

Table 4 2D IAEA Benchmark Problem

Table of average fast group fluxes ϕ_1
for a square mesh grid of 20 x 20 cm

						.642 .652		
					14.015 14.040	3.993 4.001	.573 .579	
				20.391 20.392	20.766 20.801	14.439 14.464	2.421 2.431	
			37.677 37.661	30.896 30.898	28.498 28.511	22.587 22.612	5.952 5.959	.712 .718
h = 3 1/3 cm ———		46.372 46.332	42.448 42.423	37.215 37.204	33.697 33.700	29.089 29.111	16.662 16.683	2.438 2.439
h = 10 cm ———								
	45.334 45.288	46.702 46.660	41.535 41.503	34.215 34.205	32.726 32.723	29.842 29.849	19.854 19.867	3.220 3.218
32.467 32.422	41.890 41.855	45.877 45.835	38.695 38.669	26.564 26.542	29.938 29.941	29.411 29.416	20.327 20.334	3.370 3.369

Table 5 2D IAEA Benchmark Problem

Table of average thermal group fluxes ϕ_2

for a square mesh grid of 20 x 20 cm

					2.564 2.608		
				4.332 4.345	8.334 8.355	2.238 2.270	
			3.486 3.486	5.078 5.084	4.424 4.435	6.038 6.061	
		8.836 8.833	7.163 7.163	6.714 6.718	6.268 6.276	12.441 12.483	2.812 2.853
h = 3 1/3 cm ———		10.885	9.964	8.735	7.929	7.223	5.127	5.839
h = 10 cm ———		10.875	9.958	8.732	7.930	7.226	5.137	5.833
	10.630 10.621	10.962 10.952	9.740 9.734	7.924 7.920	7.675 7.675	7.040 7.041	5.450 5.453	7.579 7.580
5.523 5.514	9.701 9.692	10.768 10.758	8.968 8.961	4.519 4.514	6.926 6.926	6.921 6.922	5.592 5.593	7.968 7.969

BENCHMARK PROBLEM SOLUTION

Identification: 11-A2-4 Benchmark Problem ID.11-A2

Date Submitted: June 1976 By: D. A. Meneley (Ontario Hydro)

Date Accepted: June 1977 By: H. L. Dodds, Jr. (U. of Tenn.)
M. V. Gregory (SRL)

Descriptive Title: Two-dimensional PWR Problem

Mathematical Model: Five-point central difference formula with fluxes calculated at the center of the mesh cell. Two-term Taylor series expansion to cell boundary in each direction to satisfy flux and current continuity at cell boundaries.

Special Acceleration Techniques: Line inversion with successive overrelaxation, with optimum overrelaxation factor calculated from dominance ratio estimates. Inner iteration on all points in one group is continued until the error norm is 10 percent of that found on the first iteration (arbitrary choice). Outer iterations are accelerated using a second optimum overrelaxation factor.

Initialization: Group one fluxes set to 1.0 and group two fluxes set to 0.25. Eigenvalue set to 1.0. Overrelaxation factor for plane fluxes set to 1.2 and outer iteration factor set to 1.4.

Convergence: Maximum value of flux change over two iterations relative to root mean square flux in the reactor less than 5×10^{-5}.

Primary Results:

1. Maximum eigenvalue

Uniform Mesh	Eigenvalue
34 x 34	1.02924
68 x 68	1.02942
Non-Uniform Mesh	
88 x 88	1.02968

Mesh description-non-uniform mesh problem.

No. of Intervals In Each Direction	Mesh Spacing
16	2.5
4	2.0
4	1.0
4	2.0
8	2.5
4	2.0
4	1.0
8	2.0
4	1.0
8	2.0
4	1.0
8	2.0
4	1.0
4	2.0
4	2.5

Note: This mesh places two intervals of 1.0 cm width on each side of core-reflector boundary.

2. Fundamental flux distributions- values for 88 x 88 mesh

2.1 Radial Flux Traverses $\phi_g(x,o)$ and $\phi_g(x,x)$

x(cm)	$\phi_1(x,1.25)$	$\phi_2(x,1.25)$	$\phi_1(x,x)$	$\phi_2(x,x)$
1.25	29.83	4.704	29.83	4.704
3.75	30.42	4.822	30.99	4.936
6.25	31.62	5.116	33.22	5.493
8.75	33.48	5.817	36.32	6.726
11.25	35.89	7.776	39.62	9.085
13.75	38.18	8.756	42.16	9.862
16.25	40.16	9.362	44.07	10.34
18.75	41.82	9.797	45.50	10.68
21.25	43.19	10.13	46.55	10.93
23.75	44.30	10.40	47.29	11.10
26.25	45.18	10.60	47.76	11.21
28.75	45.84	10.76	48.01	11.27
31.25	46.31	10.87	48.06	11.28
33.75	46.59	10.94	47.93	11.25
36.25	46.70	10.96	47.66	11.19
38.75	46.64	10.95	47.24	11.09
41.00	46.43	10.90	46.74	10.97
43.00	46.15	10.83	46.22	10.85
45.00	45.76	10.74	45.62	10.71

2.1 Radial Flux Traverses $\phi_g(x,o)$ and $\phi_g(x,x)$ (Continued)

x(cm)	$\phi_1(x,1.25)$	$\phi_2(x,1.25)$	$\phi_1(x,x)$	$\phi_2(x,x)$
47.00	45.26	10.62	44.93	10.55
48.50	44.80	10.52	44.36	10.41
49.50	44.47	10.44	43.95	10.32
50.50	44.12	10.36	43.52	10.22
51.50	43.73	10.26	43.06	10.11
53.00	43.11	10.12	42.35	9.939
55.00	42.16	9.894	41.29	9.691
57.00	41.08	9.640	40.11	9.415
59.00	39.87	9.351	38.81	9.109
61.25	38.34	8.981	37.17	8.725
63.75	36.38	8.484	35.10	8.235
66.25	34.16	7.840	32.70	7.650
68.75	31.68	6.875	29.87	6.855
71.25	29.10	5.066	26.52	4.926
73.75	27.02	4.376	23.37	3.872
76.25	25.50	4.044	20.85	3.324
78.75	24.52	3.866	19.06	3.007
81.00	24.07	3.794	18.11	2.855
83.00	23.97	3.788	17.68	2.803
85.00	24.17	3.855	17.62	2.847
87.00	24.69	4.042	17.84	3.037
88.50	25.32	4.381	18.13	3.410
89.50	25.80	4.753	18.29	3.790
90.50	26.33	5.368	18.40	4.259
91.50	26.86	5.795	18.39	4.422
93.00	27.64	6.252	18.19	4.471
95.00	28.54	6.608	17.56	4.351
97.00	29.29	6.838	16.57	4.128
99.00	29.88	6.998	15.30	3.846
101.00	30.32	7.112	13.78	3.547
103.00	30.64	7.190	12.05	3.292
105.00	30.84	7.239	10.13	3.202
107.00	30.94	7.262	7.995	3.517
108.50	30.94	7.262	6.139	4.446
109.50	30.92	7.257	4.836	5.414
110.50	30.87	7.247	3.695	6.774
111.50	30.81	7.231	2.927	7.032
113.00	30.68	7.201	2.072	6.570
115.00	30.43	7.143	1.337	5.303
117.00	30.11	7.067	0.8669	3.977
119.00	29.72	6.976	0.5602	2.818
121.00	29.26	6.871	0.3578	1.882
123.00	28.75	6.754	0.2232	1.163
125.00	28.17	6.628	0.1339	0.6348
127.00	27.54	6.502	0.07498	0.2724
128.50	27.02	6.423	0.04537	0.09840
129.50	26.65	6.385	0.03048	0.02939

2.1 Radial Flux Traverses $\phi_g(x,o)$ and $\phi_g(x,x)$ (Continued)

x(cm)	$\phi_1(x,1.25)$	$\phi_2(x,1.25)$	$\phi_1(x,x)$	$\phi_2(x,x)$
130.50	26.26	6.371		
131.50	25.85	6.319		
133.00	25.17	6.200		
135.00	24.13	5.970		
137.00	22.94	5.693		
139.00	21.61	5.387		
141.00	20.14	5.073		
143.00	18.52	4.794		
145.00	16.72	4.649		
147.00	14.65	4.883		
148.50	12.71	5.794		
149.50	11.16	6.926		
150.50	9.479	6.214		
151.50	8.227	10.87		
153.00	6.599	12.27		
155.00	4.963	12.25		
157.00	3.728	11.23		
159.00	2.796	9.740		
161.25	2.002	7.854		
163.75	1.374	5.741		
166.25	0.9195	3.690		
168.75	0.5818	1.648		

2.2 Value and Location of Maximum Power Density

Mesh	Max/Avg Power Density in Core	Location	Refl. Boundary Location*	
34 x 34	1.598	27.5,32.5	1.435	130,52.5
68 x 68	1.545	31.25,31.25	1.508	130,56.25
88 x 88	1.523	31.25,31.25	1.521	130,55

* Interpolated between adjacent points.

3. Average subassembly powers (88 x 88 mesh)

Subassembly Number	Average Power
1	0.7421
2	1.325
3	1.464
4	1.222
5	0.6054
6	0.9357
7	0.9303
8	0.7464
10	1.448
11	1.4905
12	1.323
13	1.077

3. Average subassembly powers (88 x 88 mesh) (Continued)

Subassembly Number	Average Power
14	1.036
15	0.9457
16	0.7272
18	1.478
19	1.351
20	1.182
21	1.069
22	0.9702
23	0.6810
25	1.198
26	0.9714
27	0.9041
28	0.8370
31	0.4656
32	0.6831
33	0.5876
35	0.5762

4. Convergence data

	34x34	68x68	88x88
Number of unknowns	1,928	7,712	11,328
Outer iterations	42	57	73
Avg. No. of inner iteration per outer iteration	5	4	5

5. Computer data (CDC6600 machine)

	34x34	68x68	88x88
Field length (words)	33,664	68,544	100,352
Iteration time (CP)	19	160	340
Total time (CP)	26	182	378
(PP)	70	309	606

6. Type and numerical values of convergence criteria.

Type and value noted above.

7. Average group fluxes on subassembly mesh grid (20x20 cm, 88 x 88 mesh)

Subassembly Number	$\overline{\phi}_1$	$\overline{\phi}_2$
1	32.71	5.497
2	42.29	9.817
3	46.21	10.85
4	38.98	9.054
5	26.63	4.484
6	29.94	6.931
7	29.29	6.891
8	20.17	5.529
9	3.295	7.898
10	45.72	10.72
11	47.02	11.04
12	41.79	9.802
13	34.37	7.979
14	32.73	7.677
15	29.71	7.005
16	19.69	5.387
17	3.147	7.510
18	46.63	10.95
19	42.64	10.01
20	37.30	8.756
21	33.66	7.919
22	28.94	7.187
23	16.49	5.044
24	2.381	5.777
25	37.82	8.871
26	30.97	7.196
27	28.43	6.697
28	22.42	6.200
29	5.812	12.32
30	0.6944	2.768
31	20.79	3.449
32	20.67	5.060
33	14.30	4.353
34	2.364	5.964
35	13.90	4.293
36	3.899	8.251
37	0.5584	2.197
38	0.6269	2.517