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A FILE OF REFERENCE DATA FOR MULTIPLE-ELEMENT NEUTRON ACTIVATION ANALYSIS

(Software Data)

L.P. Kabina, I.A. Kondurov and I.M. Shesterneva

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ABSTRACT

Data needed for planning neutron activation analysis experiments and processing their results are given. The decay schemes of radioactive nuclei formed in irradiation with thermal neutrons during the (n,γ) reaction taken from the international ENSDF file are used for calculating the activities of nuclei and for drawing up an optimum table for identifying gamma lines in the spectra measured.

A FILE OF REFERENCE DATA FOR MULTIPLE-ELEMENT NEUTRON ACTIVATION ANALYSIS (Software Data)

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The need for calculation of the activation of different isotopes by thermal neutrons frequently arises in applied research, especially where activation analysis is concerned.

The neutron activation analysis (NAA) method with standard samples, which has an advantage over the theoretical method in that it automatically takes the actual irradiation, cooling and measurement conditions into account, can be successfully used for solving individual NAA problems. However, difficulties associated with the preparation of "ideal" samples, especially in multiple-element analysis, make it necessary to calculate the concentrations of elements in the sample with allowance for the conditions of irradiation, cooling and measurement of the decay spectra of activated isotopes. In many cases it also becomes necessary to take into account the radioactive transformations of disintegrating nuclei.

When identifying elements from the gamma quanta relating to them, detailed information is also needed on the decay schemes of the radioactive nuclei obtained with activation by thermal neutrons. Together with neutron cross-sections, these data are necessary when selecting the optimum time of irradiation and cooling of samples used for analysis of the content of any particular element. An important role in the automatic unfolding of spectra and in the identification of elements with computer programs is played by a priori information, which can be used to limit considerably the group of gamma transitions forming the gamma spectrum measured.

The decay schemes of radioactive nuclei are most fully represented in the Evaluated Nuclear Structure Data File (ENSDF) [1], which is maintained as an international network of co-operating centres for data on the structure of the nucleus and on nuclear reactions. The Data Centre of the B.P. Konstantinov Institute of Nuclear Physics, Leningrad (LIYaF) is part of this network and receives the ENSDF file, which is

updated twice each year. The availability of nuclear data on magnetic tape makes it possible to use a computer program to select from the file the necessary information on radioactive decay schemes of nuclei and to calculate the intensities of the gamma quanta from disintegration of the nuclei obtained in the irradiation of a given chemical element, with the neutron flux and activation cross-section being taken into account.

The basis of all the calculations is the data presented in the new NAADF file, which contains a selection of data from the basic ENSDF file on the decay schemes of all nuclei obtained in the (n,γ) reaction, either directly or as a result of subsequent decay of the products of this reaction. The NAADF file contains for each chemical element the half-lives of these nuclei, the gamma quantum yields from disintegrations and a matrix of the coefficients of the system of differential equations describing the build-up of radioactive nuclei in the (n,γ) reaction (with burn-up and their subsequent disintegration chains taken into account). In calculation of the coefficients, use was made of the data on the isotopic composition of elements and the neutron cross-sections taken from Ref. [2] for elements with $z = 1$-10 and of those from Ref. [3] for the remaining chemical elements.

On the basis of the NAADF file a computer program can be used to calculate the intensities of all disintegration gamma quanta formed with the irradiation of nuclei in a given neutron flux with irradiation and cooling time taken into account. The results of these calculations are used to compile a realistic table intended for identification of the gamma lines in activation analysis spectra.

It is important to note that not all the gamma quanta obtained in the disintegration of nuclei activated in the (n,γ) reaction need appear in these spectra, but rather some of them, which may well be a very small part. It became possible to shorten the list of gamma quanta for identification purposes by taking into account the relationship between irradiation and cooling times and the half-lives of the nuclei and also the theoretical intensity of gamma quanta required for a reasonable detection efficiency on the part of the spectrometer. The program can also render the list even shorter by taking into account the maximum possible concentration of each element in the sample. Finally, the list of gamma transitions can be reduced yet further for

automatic processing of gamma spectra if allowance is made for the actual dependence of the detection limit of a gamma line on the gamma quantum energy, which, with a given measurement time, is determined in every individual spectrum - in addition to the effectiveness of the spectrometer - by the statistical spread of the continuous background from tails of Compton distributions from more powerful gamma quanta. Here the detection level is taken to mean the lowest intensity of a gamma quantum which can be detected by the spectrometer at the 3σ level. In this case the length of the list is reduced from a total number of transitions in the decay of nuclei formed in the (n,γ) reaction of 7300 to a few hundred transitions for a typical irradiation procedure with a given neutron flux and measurement with standard apparatus.

Tables 1 and 2 show the actual gamma quanta which can be detected in a spectrometer with a sensitivity of 10 quanta/s with activation of a sample weighing 0.1 g in a thermal neutron flux of 10^{13} over three days with subsequent cooling for three days. The total number of gamma transitions in the list is 378. Table 1 shows the data by elements and Table 2 can be used for ascribing a gamma transition to the corresponding element.

Table 3 shows curves for the variation in intensity of those radioactive decay gamma quanta which are most characteristic of each element as a function of irradiation time (t_{irr}) and of an equal cooling time (t_{coo}). These two times were taken to be equal in view of the fact that the maximum ratio of a particular activity to all others is obtained where $t_{irr} = t_{coo} = \tau$, where τ is the average life-time of the radioactive nucleus. These figures are convenient for selecting the optimum irradiation conditions and for estimating the sensitivity of activation analysis. Above the figures the isotopic compositions and neutron cross-sections used when performing calculations are shown.

Some of these data, namely the intensity of the strongest gamma transition (in quanta/s) for each element in the same irradiation and cooling conditions as in Table 3 and with a sample weight of 100 mg, are shown in Table 4. The latter table can be useful for selection of the optimum irradiation conditions for determining a given set of elements.

This publication serves chiefly to indicate that the LIYaF Data Centre can upon request send specific information on neutron activation analysis to any interested organization.

REFERENCES

1. W.B.Ewbank, M.R.Schmorak, "Evaluated Nuclear Structure Data File" A Manual for Preparation of Data Sets, ORNL - 5054/R1, Oak Ridge, 1977.
2. S.F.Mughabghab, M.Divadeenam, N.E.Holden, Neutron Cross Section, Academic Press, 1981.
3. S.F.Mughabghab and D.I.Garber, Neutron Cross Section, v.1-Brookhaven National Laboratory, BNL-325, 1973.

Table 1

THERMAL NEUTRON FLUX 10^{13} N/CM^2 SEC
SAMPLE WEIGHT 100. MG
ACTIVATION TIME 3.0 D
COOLING TIME 3.0 D
ENERGY RANGE FROM 50. KEV TO 5000. KEV
INTENSITY RANGE (MAX/MIN) 50.
GAMMA-LINE OBSERVATION LIMIT 10. QUANT/SEC

Z	KEV	QUANT/SEC	T 1/2	Z	KEV	QUANT/SEC	T 1/2
NA	1368.55	4.821E8	24NA 15.0 H	GE	634.39	1.176E4	77GE 11.3 H
NA	2754.05	4.819E8	24NA 15.0 H	GE	194.76	1.002E4	77GE 11.3 H
K	1524.66	4.474E6	42K 12.4 H	AS	559.10	2.060E9	76AS 1.10 D
CA	1297.09	5.903E4	47CA 4.5 D	AS	657.03	2.802E8	76AS 1.10 D
CA	159.38	4.311E4	47SC 3.4 D	AS	1216.02	1.772E8	76AS 1.10 D
CA	807.86	5.430E3	47CA 4.5 D	AS	1212.72	7.499E7	76AS 1.10 D
CA	489.23	5.312E3	47CA 4.5 D	AS	1228.52	6.387E7	76AS 1.10 D
SC	1120.51	8.695E9	46SC 84 D	AS	563.23	5.398E7	76AS 1.10 D
SC	889.25	8.695E9	46SC 84 D	SE	264.66	3.791E7	75SE 120 D
CR	320.08	5.491E7	51CR 28 D	SE	136.00	3.784E7	75SE 120 D
MN	846.75	5.655E2	56MN 2.6 H	SE	279.54	1.615E7	75SE 120 D
MN	1810.72	1.555E2	56MN 2.6 H	SE	121.12	1.111E7	75SE 120 D
MN	2113.05	8.199E1	56MN 2.6 H	SE	400.66	7.416E6	75SE 120 D
FE	1099.22	9.087E5	59FE 45 D	SE	96.73	2.233E6	75SE 120 D
FE	1291.56	7.062E5	59FE 45 D	SE	198.60	9.440E5	75SE 120 D
FE	192.34	4.859E4	59FE 45 D	SE	303.92	8.606E5	75SE 120 D
CO	1332.50	4.084E8	60CO 5.3 y	BR	776.49	1.487E9	82BR 1.47 D
CO	1173.24	4.081E8	60CO 5.3 y	BR	554.32	1.260E9	82BR 1.47 D
CU	1345.77	2.776E6	64CU 12.7 H	BR	619.07	7.734E8	82BR 1.47 D
ZN	1115.52	1.484E7	65ZN 244 D	BR	698.33	5.071E8	82BR 1.47 D
ZN	438.63	2.944E6	69ZN 13.8 H	BR	1043.97	4.841E8	82BR 1.47 D
GA	834.03	4.295E8	72GA 14.1 H	BR	1317.47	4.720E8	82BR 1.47 D
GA	2201.66	1.164E8	72GA 14.1 H	BR	827.81	4.279E8	82BR 1.47 D
GA	629.96	1.112E8	72GA 14.1 H	BR	1474.82	2.905E8	82BR 1.47 D
GA	2507.79	5.738E7	72GA 14.1 H	BR	221.45	4.030E7	82BR 1.47 D
GA	894.25	4.437E7	72GA 14.1 H	KR	261.26	3.887E6	79KR 1.46 D
GA	2490.98	3.449E7	72GA 14.1 H	KR	397.56	2.908E6	79KR 1.46 D
GA	1050.69	3.105E7	72GA 14.1 H	KR	606.07	2.479E6	79KR 1.46 D
GA	600.95	2.487E7	72GA 14.1 H	KR	306.31	7.958E5	79KR 1.46 D
GA	1861.09	2.358E7	72GA 14.1 H	KR	217.02	7.346E5	79KR 1.46 D
GA	1596.68	1.903E7	72GA 14.1 H	KR	299.51	4.805E5	79KR 1.46 D
GA	1464.00	1.593E7	72GA 14.1 H	KR	389.00	4.652E5	79KR 1.46 D
GA	786.44	1.439E7	72GA 14.1 H	KR	832.04	3.857E5	79KR 1.46 D
GA	810.20	9.019E6	72GA 14.1 H	KR	135.99	3.061E5	79KR 1.46 D
GE	239.10	3.770E5	77AS 1.62 D	KR	208.45	2.387E5	79KR 1.46 D
GE	264.44	3.047E5	77GE 11.3 H	KR	1332.13	1.347E5	79KR 1.46 D
GE	211.03	1.743E5	77GE 11.3 H	KR	525.32	1.316E5	79KR 1.46 D
GE	215.50	1.618E5	77GE 11.3 H	KR	1115.14	1.132E5	79KR 1.46 D
GE	416.33	1.233E5	77GE 11.3 H	RB	1076.60	2.031E7	86RB 18.7 D
GE	520.78	1.006E5	77AS 1.62 D	SR	513.99	1.054E6	85SR 65 D
GE	250.00	9.613E4	77AS 1.62 D	y	1760.70	3.439E5	90y 2.7 D
GE	558.02	9.078E4	77GE 11.3 H	ZR	756.74	9.402E5	95ZR 64 D
GE	367.40	7.926E4	77GE 11.3 H	ZR	724.23	7.616E5	95ZR 64 D
GE	88.00	6.484E4	77AS 1.62 D	ZR	657.92	2.076E5	97NB 1.20 H
GE	714.34	4.041E4	77GE 11.3 H	ZR	743.36	1.819E5	97NB 1.0 H
GE	162.00	3.979E4	77SE 17.4 S	ZR	765.83	1.480E5	95NB 35 D
GE	631.82	3.937E4	77GE 11.3 H	NB	765.83	7.860E3	95NB 35 D
GE	1085.19	3.419E4	77GE 11.3 H	NB	702.63	2.088E3	94NB 203E2y
GE	1368.40	1.901E4	77GE 11.3 H	NB	871.10	2.088E3	94NB 203E2y
GE	1193.26	1.452E4	77GE 11.3 H	MO	140.47	4.112E7	99TC 6.0 H
GE	810.35	1.283E4	77GE 11.3 H	MO	739.50	5.852E6	99MO 2.8 D
GE	281.60	1.282E4	77AS 1.62 D	MO	181.06	2.909E6	99MO 2.8 D

Z	KEV	QUANT/SEC		T 1/2		Z	KEV	QUANT/SEC		T 1/2	
MO	777.92	2.072E6	99MO	2.8	D	CS	1365.15	1.097E7	134CS	2.06	Y
RU	497.08	9.864E7	103RU	39	D	BA	496.28	3.290E6	131BA	11.8	D
RU	215.68	2.157E7	97RU	2.9	D	BA	123.80	2.183E6	131BA	11.8	D
RU	318.90	1.396E7	105RH	1.47	D	BA	216.09	1.496E6	131BA	11.8	D
RU	610.33	6.214E6	103RU	39	D	BA	373.25	1.002E6	131BA	11.8	D
RU	306.10	3.727E6	105RH	1.47	D	BA	268.24	3.976E5	133BA	1.20	D
RU	324.55	2.558E6	97RU	2.9	D	BA	249.44	2.109E5	131BA	11.8	D
RH	318.90	6.114E3	105RH	1.47	D	BA	239.63	1.810E5	131BA	11.8	D
RH	306.10	1.632E3	105RH	1.47	D	BA	133.61	1.665E5	131BA	11.8	D
PD	88.04	1.072E7	109AG	40	S	BA	486.48	1.421E5	131BA	11.8	D
PD	342.12	1.794E6	111AG	7.4	D	BA	620.05	1.181E5	131BA	11.8	D
PD	245.42	3.318E5	111AG	7.4	D	BA	404.04	9.721E4	131BA	11.8	D
AG	657.75	9.733E7	110AG	250	D	BA	585.02	9.272E4	131BA	11.8	D
AG	884.67	7.485E7	110AG	250	D	BA	1047.56	8.973E4	131BA	11.8	D
AG	937.48	3.525E7	110AG	250	D	BA	276.09	8.305E4	133BA	1.62	D
AG	1384.27	2.501E7	110AG	250	D	LA	1596.49	7.584E9	140LA	1.68	D
AG	763.93	2.297E7	110AG	250	D	LA	487.03	3.652E9	140LA	1.68	D
AG	706.67	1.720E7	110AG	250	D	LA	815.80	1.879E9	140LA	1.68	D
AG	1505.00	1.347E7	110AG	250	D	LA	328.77	1.649E9	140LA	1.68	D
AG	677.61	1.101E7	110AG	250	D	LA	925.24	5.604E8	140LA	1.68	D
AG	818.02	7.524E6	110AG	250	D	LA	867.82	4.444E8	140LA	1.68	D
AG	686.99	6.667E6	110AG	250	D	LA	751.83	3.504E8	140LA	1.68	D
AG	744.26	4.789E6	110AG	250	D	LA	2521.70	2.730E8	140LA	1.68	D
AG	1475.76	4.098E6	110AG	250	D	LA	432.53	2.374E8	140LA	1.68	D
AG	446.80	3.757E6	110AG	250	D	LA	919.63	2.131E8	140LA	1.68	D
AG	620.35	2.852E6	110AG	250	D	CE	145.44	6.107E7	141CE	32	D
CD	336.24	5.618E7	115IN	4.5	H	CE	293.26	3.220E7	143CE	1.38	D
CD	336.24	5.511E7	115IN	4.5	H	CE	57.36	9.017E6	143CE	1.38	D
CD	527.90	3.018E7	115CD	2.23	D	CE	664.55	4.025E6	143CE	1.38	D
CD	492.35	8.830E6	115CD	2.23	D	CE	721.96	3.929E6	143CE	1.38	D
CD	260.90	2.133E6	115CD	2.23	D	CE	350.59	2.576E6	143CE	1.38	D
IN	190.27	1.128E7	114IN	50	D	CE	231.56	1.546E6	143CE	1.38	D
IN	558.43	3.214E6	114IN	50	D	CE	490.36	1.514E6	143CE	1.38	D
IN	725.24	3.169E6	114IN	50	D	PR	1575.60	1.244E8	142PR	19.1	H
SN	391.69	5.968E5	113IN	1.66	H	ND	91.11	3.950E7	147ND	11.0	D
SN	158.56	4.809E5	117SN	13.6	D	ND	531.02	1.853E7	147ND	11.0	D
SN	427.89	2.181E4	125SB	2.7	Y	ND	340.08	8.749E6	151PM	1.18	D
SN	255.06	1.695E4	113SN	115	D	ND	285.90	4.106E6	149PM	2.21	D
SN	1067.10	1.537E4	125SN	9.6	D	ND	167.73	3.062E6	151PM	1.18	D
SN	600.56	1.317E4	125SB	2.7	Y	ND	319.41	2.765E6	147ND	11.0	D
SB	564.24	2.929E9	122SB	2.7	D	ND	275.20	2.581E6	151PM	1.18	D
SB	602.72	2.782E8	124SB	60	D	ND	439.89	1.699E6	147ND	11.0	D
SB	692.65	1.596E8	122SB	2.7	D	ND	465.65	1.566E6	151PM	1.18	D
SB	1691.02	1.385E8	124SB	60	D	ND	717.60	1.557E6	151PM	1.18	D
TE	364.48	6.519E7	131I	8.0	D	ND	260.08	1.409E6	151PM	1.18	D
TE	636.97	5.831E6	131I	8.0	D	ND	177.15	1.400E6	151PM	1.18	D
TE	284.30	4.861E6	131I	8.0	D	ND	104.82	1.374E6	151PM	1.18	D
TE	80.18	2.103E6	131I	8.0	D	ND	398.15	1.233E6	147ND	11.0	D
TE	159.00	2.007E6	123TE	120	D	ND	685.90	1.150E6	147ND	11.0	D
TE	773.67	1.833E6	131TE	1.25	D	ND	275.37	1.134E6	147ND	11.0	D
TE	722.89	1.448E6	131I	8.0	D	ND	100.00	9.887E5	151PM	1.18	D
XE	81.00	4.481E7	133XE	5.2	D	ND	344.89	8.224E5	151PM	1.18	D
XE	188.43	2.202E7	125XE	17.0	H	SM	103.18	1.390E10	153SM	1.95	D
XE	243.40	1.156E7	125XE	17.0	H	SM	69.67	2.578E9	153SM	1.95	D
XE	54.96	2.378E6	125XE	17.0	H	SM	97.43	3.585E8	153SM	1.95	D
XE	453.83	1.695E6	125XE	17.0	H	EU	841.63	4.231E9	152EU	9.3	H
XE	233.18	1.499E6	133XE	2.19	D	EU	963.37	3.482E9	152EU	9.3	H
CS	604.70	3.522E8	134CS	2.06	Y	EU	121.78	2.090E9	152EU	9.3	H
CS	795.84	3.082E8	134CS	2.06	Y	EU	121.78	1.323E9	152EU	13.3	Y
CS	569.31	5.568E7	134CS	2.06	Y	EU	344.28	1.240E9	152EU	13.3	Y
CS	801.93	3.150E7	134CS	2.06	Y	EU	1408.01	9.723E8	152EU	13.3	Y
CS	563.23	3.024E7	134CS	2.06	Y	EU	344.28	7.080E8	152EU	9.3	H

Z	KEV	QUANT/SEC		T 1/2		Z	KEV	QUANT/SEC		T 1/2	
EU	964.13	6.756E8	152EU	13.3	Y	YB	144.86	5.646E7	175YB	4.2	D
EU	1112.12	6.324E8	152EU	13.3	Y	YB	93.61	2.603E7	169YB	32	D
EU	778.91	6.043E8	152EU	13.3	Y	YB	208.36	2.268E7	177LU	6.7	D
EU	1085.91	4.624E8	152EU	13.3	Y	LU	208.36	3.391E9	177LU	6.7	D
EU	244.70	3.500E8	152EU	13.3	Y	LU	112.95	1.973E9	177LU	6.7	D
EU	1314.67	2.773E8	152EU	9.3	H	HF	482.00	5.796E8	181HF	42	D
EU	1389.00	2.236E8	152EU	9.3	H	HF	133.02	2.898E8	181HF	42	D
EU	123.07	2.090E8	154EU	8.8	Y	HF	345.85	9.436E7	181HF	42	D
EU	867.39	1.964E8	152EU	13.3	Y	HF	343.40	5.658E7	175HF	70	D
EU	1274.45	1.833E8	154EU	8.8	Y	HF	136.25	4.111E7	181HF	42	D
EU	970.38	1.751E8	152EU	9.3	H	HF	136.86	1.213E7	181HF	42	D
EU	443.98	1.306E8	152EU	13.3	Y	TA	67.75	5.010E8	182TA	115	D
EU	411.11	1.041E8	152EU	13.3	Y	TA	1121.28	4.246E8	182TA	115	D
EU	723.30	1.017E8	154EU	8.8	Y	TA	1221.42	3.325E8	182TA	115	D
EU	1004.76	9.239E7	154EU	8.8	Y	TA	1189.06	1.996E8	182TA	115	D
GD	97.43	2.177E7	153GD	242	D	TA	100.11	1.707E8	182TA	115	D
GD	363.56	1.981E7	159GD	18.6	H	TA	1230.97	1.405E8	182TA	115	D
GD	103.18	1.559E7	153GD	242	D	TA	222.10	9.172E7	182TA	115	D
GD	74.58	1.185E7	161TB	6.9	D	TA	152.43	8.704E7	182TA	115	D
GD	58.00	4.160E6	159GD	18.6	H	TA	246.06	4.646E7	183TA	5.1	D
GD	57.20	1.935E6	161TB	6.9	D	TA	229.32	4.416E7	182TA	115	D
GD	69.67	1.785E6	153GD	242	D	TA	264.07	4.416E7	182TA	115	D
TB	879.36	7.830E8	160TB	72	D	TA	179.39	3.821E7	182TA	115	D
TB	298.57	7.151E8	160TB	72	D	TA	65.72	3.397E7	182TA	115	D
TB	966.15	6.655E8	160TB	72	D	TA	156.38	3.312E7	182TA	115	D
TB	1177.94	4.045E8	160TB	72	D	TA	84.68	3.227E7	182TA	115	D
TB	86.79	3.497E8	160TB	72	D	TA	1001.68	2.539E7	182TA	115	D
TB	962.30	2.610E8	160TB	72	D	TA	113.67	2.335E7	182TA	115	D
TB	1271.86	1.984E8	160TB	72	D	TA	353.99	1.979E7	183TA	5.1	D
TB	197.03	1.368E8	160TB	72	D	TA	198.35	1.868E7	182TA	115	D
TB	215.65	1.049E8	160TB	72	D	TA	1257.47	1.839E7	182TA	115	D
TB	1312.14	7.751E7	160TB	72	D	TA	1289.17	1.715E7	182TA	115	D
TB	1199.89	6.159E7	160TB	72	D	TA	107.93	1.699E7	183TA	5.1	D
TB	765.28	5.324E7	160TB	72	D	TA	161.34	1.552E7	183TA	5.1	D
TB	1115.12	4.071E7	160TB	72	D	TA	244.26	1.496E7	183TA	5.1	D
TB	392.50	3.549E7	160TB	72	D	TA	99.08	1.091E7	183TA	5.1	D
TB	1002.88	2.714E7	160TB	72	D	W	685.81	1.111E9	187W	23.9	H
TB	309.56	2.271E7	160TB	72	D	W	479.53	8.898E8	187W	23.9	H
DY	82.47	3.977E7	166DY	3.4	D	W	72.06	4.537E8	187W	23.9	H
DY	80.57	2.362E7	166HO	1.12	D	W	134.22	3.587E8	187W	23.9	H
DY	1379.43	3.543E6	166HO	1.12	D	W	618.37	2.557E8	187W	23.9	H
DY	54.24	2.088E6	166DY	3.4	D	W	551.55	2.072E8	187W	23.9	H
DY	425.99	1.671E6	166DY	3.4	D	W	772.88	1.678E8	187W	23.9	H
DY	371.75	1.432E6	166DY	3.4	D	W	625.52	4.431E7	187W	23.9	H
HO	80.57	1.870E9	166HO	1.12	D	W	511.76	2.627E7	187W	23.9	H
HO	1379.43	2.806E8	166HO	1.12	D	RE	137.16	2.877E9	186RE	3.8	D
HO	1581.89	5.458E7	166HO	1.12	D	RE	155.04	1.141E9	188RE	17.0	H
ER	308.29	2.610E6	171ER	7.5	H	RE	122.70	5.989E8	186RE	3.8	D
ER	295.90	1.171E6	171ER	7.5	H	RE	633.00	9.556E7	188RE	17.0	H
ER	111.62	8.308E5	171ER	7.5	H	RE	477.96	7.964E7	188RE	17.0	H
ER	124.02	3.688E5	171ER	7.5	H	OS	129.43	3.148E8	191IR	4.9	S
ER	116.66	9.321E4	171ER	7.5	H	OS	646.12	3.063E7	185OS	94	D
TU	84.26	1.738E8	170TU	129	D	OS	138.89	1.717E7	193OS	1.27	D
YB	396.32	1.107E9	175YB	4.2	D	OS	460.49	1.590E7	193OS	1.27	D
YB	282.52	5.203E8	175YB	4.2	D	OS	73.01	1.304E7	193OS	1.27	D
YB	63.12	4.253E8	169YB	32	D	IR	316.50	2.424E10	192IR	74	D
YB	197.95	3.667E8	169YB	32	D	IR	468.06	1.399E10	192IR	74	D
YB	113.80	3.255E8	175YB	4.2	D	IR	308.45	8.682E9	192IR	74	D
YB	177.21	2.281E8	169YB	32	D	IR	295.95	8.474E9	192IR	74	D
YB	109.78	1.778E8	169YB	32	D	IR	604.40	2.395E9	192IR	74	D
YB	130.52	1.173E8	169YB	32	D	IR	328.45	1.909E9	194IR	19.1	H
YB	307.73	1.008E8	169YB	32	D	IR	612.45	1.561E9	192IR	74	D

Z	KEV	QUANT/SEC	T 1/2		Z	KEV	QUANT/SEC	T 1/2	
IR	588.57	1.323E9	192IR	74 D	TH	311.98	4.747E8	233PA	27 D
IR	205.79	9.623E8	192IR	74 D	TH	300.12	8.164E7	233PA	27 D
IR	484.56	9.235E8	192IR	74 D	TH	340.50	5.554E7	233PA	27 D
PT	158.37	7.516E7	199AU	3.1 D	TH	86.99	2.326E7	233PA	27 D
PT	208.20	1.706E7	199AU	3.1 D	TH	415.76	1.994E7	233PA	27 D
PT	77.35	5.999E6	197PT	18.3 H	TH	398.62	1.566E7	233PA	27 D
PT	98.90	2.522E6	195PT	4.0 D	TH	75.28	1.547E7	233PA	27 D
AU	411.79	6.962E10	198AU	2.7 D	U	59.54	8.391E2	237U	6.7 D
HG	77.35	6.618E8	197HG	2.7 D	U	208.00	5.431E2	237U	6.7 D
HG	279.19	1.475E8	203HG	47 D	U	164.61	4.592E1	237U	6.7 D
HG	279.01	4.266E7	197AU	7.8 S	U	332.36	3.007E1	237U	6.7 D
HG	133.88	2.022E7	197HG	23.8 H	U	64.83	2.914E1	237U	6.7 D
HG	191.36	1.780E7	197HG	2.7 D	U	267.54	1.783E1	237U	6.7 D

Table 2

Z	EG(IG)	EG(IG)	EG(IG)	Z	EG(IG)	EG(IG)	EG(IG)
DY	54.2(5)	82.5(100)	80.6(59)	SE	136.0(100)	264.7(100)	279.5(43)
XE	55.0(5)	81.0(100)	188.4(49)	HF	136.2(7)	482.0(100)	133.0(50)
GD	57.2(9)	97.4(100)	363.6(91)	HF	136.9(2)	482.0(100)	133.0(50)
CE	57.4(15)	145.4(100)	293.3(53)	RE	137.2(100)	155.0(40)	122.7(21)
GD	58.0(19)	97.4(100)	363.6(91)	OS	138.9(5)	129.4(100)	646.1(10)
U	59.5(100)	208.0(65)	164.6(5)	MO	140.5(100)	739.5(14)	181.1(7)
YB	63.1(38)	396.3(100)	282.5(47)	YB	144.9(5)	396.3(100)	282.5(47)
U	64.8(3)	59.5(100)	208.0(65)	CE	145.4(100)	293.3(53)	57.4(15)
TA	65.7(7)	67.7(100)	1121.3(85)	TA	152.4(17)	67.7(100)	1121.3(85)
TA	67.7(100)	1121.3(85)	1221.4(66)	RE	155.0(40)	137.2(100)	122.7(21)
SM	69.7(19)	103.2(100)	97.4(3)	TA	156.4(7)	67.7(100)	1121.3(85)
GD	69.7(8)	97.4(100)	363.6(91)	PT	158.4(100)	208.2(23)	77.3(8)
W	72.1(41)	685.8(100)	479.5(80)	SN	158.6(81)	391.7(100)	427.9(4)
OS	73.0(4)	129.4(100)	646.1(10)	TE	159.0(3)	364.5(100)	637.0(9)
GD	74.6(54)	97.4(100)	363.6(91)	CA	159.4(73)	1297.1(100)	807.9(9)
TH	75.3(3)	312.0(100)	300.1(17)	TA	161.3(3)	67.7(100)	1121.3(85)
PT	77.3(8)	158.4(100)	208.2(23)	GE	162.0(11)	239.1(100)	264.4(81)
HG	77.4(100)	279.2(22)	279.0(6)	U	164.6(5)	59.5(100)	208.0(65)
TE	80.2(3)	364.5(100)	637.0(9)	ND	167.7(8)	91.1(100)	531.0(47)
DY	80.6(59)	82.5(100)	1379.4(9)	ND	177.1(4)	91.1(100)	531.0(47)
HO	80.6(100)	1379.4(15)	1581.9(3)	YB	177.2(21)	396.3(100)	282.5(47)
XE	81.0(100)	188.4(49)	243.4(26)	TA	179.4(8)	67.7(100)	1121.3(85)
DY	82.5(100)	80.6(59)	1379.4(9)	MO	181.1(7)	140.5(100)	739.5(14)
TU	84.3(100)			XE	188.4(49)	81.0(100)	243.4(26)
TA	84.7(6)	67.7(100)	1121.3(85)	IN	190.3(100)	558.4(29)	725.2(28)
TH	86.6(5)	312.0(100)	300.1(17)	HG	191.4(3)	77.4(100)	279.2(22)
TB	86.8(45)	879.4(100)	298.6(91)	FE	192.3(5)	1099.2(100)	1291.6(78)
GE	88.0(17)	239.1(100)	264.4(81)	GE	194.8(3)	239.1(100)	264.4(81)
PD	88.0(100)	342.1(17)	245.4(3)	TB	197.0(17)	879.4(100)	298.6(91)
ND	91.1(100)	531.0(47)	340.1(22)	YB	198.0(33)	396.3(100)	282.5(47)
YB	93.6(2)	396.3(100)	282.5(47)	TA	198.3(4)	67.7(100)	1121.3(85)
SE	96.7(6)	264.7(100)	136.0(100)	SE	198.6(2)	264.7(100)	136.0(100)
SM	97.4(3)	103.2(100)	69.7(19)	IR	205.8(4)	316.5(100)	468.1(58)
GD	97.4(100)	363.6(91)	103.2(72)	U	208.0(65)	59.5(100)	164.6(5)
PT	98.9(3)	158.4(100)	208.2(23)	PT	208.2(23)	158.4(100)	77.3(8)
TA	99.1(2)	67.7(100)	1121.3(85)	YB	208.4(2)	396.3(100)	282.5(47)
ND	100.0(3)	91.1(100)	531.0(47)	LU	208.4(100)	113.0(58)	
TA	100.1(34)	67.7(100)	1121.3(85)	KR	208.4(6)	261.3(100)	397.6(75)
SM	103.2(100)	69.7(19)	97.4(3)	GE	211.0(46)	239.1(100)	264.4(81)
GD	103.2(72)	97.4(100)	363.6(91)	GE	213.5(43)	239.1(100)	264.4(81)
ND	104.8(3)	91.1(100)	531.0(47)	TB	213.6(13)	879.4(100)	298.6(91)
TA	107.9(3)	67.7(100)	1121.3(85)	RU	213.7(22)	497.1(100)	318.9(14)
YB	109.8(16)	396.3(100)	282.5(47)	BA	216.1(45)	496.3(100)	123.8(66)
ER	111.6(32)	308.3(100)	295.9(45)	KR	217.0(19)	261.3(100)	397.6(75)
LU	113.0(58)	208.4(100)		BR	221.4(3)	776.5(100)	554.3(85)
TA	113.7(5)	67.7(100)	1121.3(85)	TA	222.1(18)	67.7(100)	1121.3(85)
YB	113.8(29)	396.3(100)	282.5(47)	TA	229.3(9)	67.7(100)	1121.3(85)
ER	116.7(4)	308.3(100)	295.9(45)	CE	231.6(3)	145.4(100)	293.3(53)
SE	121.1(29)	264.7(100)	136.0(100)	XE	233.2(3)	81.0(100)	188.4(49)
EU	121.8(31)	841.6(100)	963.4(82)	GE	239.1(100)	264.4(81)	211.0(46)
EU	121.8(49)	841.6(100)	963.4(82)	BA	239.6(5)	496.3(100)	123.8(66)
RE	122.7(21)	137.2(100)	155.0(40)	ND	240.1(4)	91.1(100)	531.0(47)
EU	123.1(5)	841.6(100)	963.4(82)	XE	243.4(26)	81.0(100)	188.4(49)
BA	123.8(66)	496.3(100)	216.1(45)	TA	244.3(3)	67.7(100)	1121.3(85)
ER	124.0(14)	308.3(100)	295.9(45)	EU	244.7(8)	841.6(100)	963.4(82)
OS	129.4(100)	646.1(10)	138.9(5)	PD	245.4(3)	88.0(100)	342.1(17)
YB	130.5(11)	396.3(100)	282.5(47)	TA	246.1(9)	67.7(100)	1121.3(85)
HF	133.0(50)	482.0(100)	345.8(16)	BA	249.4(6)	496.3(100)	123.8(66)
BA	133.6(5)	496.3(100)	123.8(66)	GE	250.0(25)	239.1(100)	264.4(81)
HG	133.9(3)	77.4(100)	279.2(22)	SN	253.1(3)	391.7(100)	158.6(81)
W	134.2(32)	685.8(100)	479.5(80)	CD	260.9(4)	336.2(100)	336.2(98)
KR	136.0(8)	261.3(100)	397.6(75)	KR	261.3(100)	397.6(75)	606.1(64)

Z	EG(IG)	EG(IG)	EG(IG)	Z	EG(IG)	EG(IG)	EG(IG)
TA	264.1(9)	67.7(100)	1121.3(85)	TH	398.6(3)	312.0(100)	300.1(17)
GE	264.4(81)	239.1(100)	211.0(46)	SE	400.7(20)	264.7(100)	136.0(100)
SE	264.7(100)	136.0(100)	279.5(43)	BA	404.0(3)	496.3(100)	123.8(66)
U	267.5(2)	59.5(100)	208.0(65)	EU	411.1(2)	841.6(100)	963.4(82)
BA	268.2(12)	496.3(100)	123.8(66)	AU	411.8(100)		
ND	275.2(7)	91.1(100)	531.0(47)	TH	415.8(4)	312.0(100)	300.1(17)
ND	275.4(3)	91.1(100)	531.0(47)	GE	416.3(33)	239.1(100)	264.4(81)
BA	276.1(3)	496.3(100)	123.8(66)	DY	426.0(4)	82.5(100)	80.6(59)
HG	279.0(6)	77.4(100)	279.2(22)	SN	427.9(4)	391.7(100)	158.6(81)
HG	279.2(22)	77.4(100)	279.0(6)	LA	432.5(3)	1596.5(100)	487.0(48)
SE	279.5(43)	264.7(100)	136.0(100)	ZN	438.6(20)	1115.5(100)	
GE	281.6(3)	239.1(100)	264.4(81)	ND	439.9(4)	91.1(100)	531.0(47)
YB	282.5(47)	396.3(100)	63.1(38)	EU	444.0(3)	841.6(100)	963.4(82)
TE	284.3(7)	364.5(100)	637.0(9)	ND	445.6(4)	91.1(100)	531.0(47)
ND	285.9(10)	91.1(100)	531.0(47)	AG	446.8(4)	657.7(100)	884.7(77)
CE	293.3(53)	145.4(100)	57.4(15)	XE	453.8(4)	81.0(100)	188.4(49)
ER	295.9(45)	308.3(100)	111.6(32)	OS	460.5(5)	129.4(100)	646.1(10)
IR	296.0(35)	316.5(100)	468.1(58)	IR	468.1(58)	316.5(100)	308.4(36)
TB	298.6(91)	879.4(100)	966.2(85)	RE	478.0(3)	137.2(100)	155.0(40)
KR	299.5(12)	261.3(100)	397.6(75)	W	479.5(80)	685.8(100)	72.1(41)
TH	300.1(17)	312.0(100)	340.5(12)	HF	482.0(100)	133.0(50)	345.8(16)
SE	303.9(2)	264.7(100)	136.0(100)	IR	484.6(4)	316.5(100)	468.1(58)
RU	306.1(4)	497.1(100)	215.7(22)	BA	486.5(4)	496.3(100)	123.8(66)
RH	306.1(27)	318.9(100)		LA	487.0(48)	1596.5(100)	815.8(25)
KR	306.3(20)	261.3(100)	397.6(75)	CA	489.2(9)	1297.1(100)	159.4(73)
YB	307.7(9)	396.3(100)	282.5(47)	CE	490.4(2)	145.4(100)	293.3(53)
ER	308.3(100)	295.9(45)	111.6(32)	CD	492.4(16)	336.2(100)	336.2(98)
IR	308.4(36)	316.5(100)	468.1(58)	BA	496.3(100)	123.8(66)	216.1(45)
TB	309.6(3)	879.4(100)	298.6(91)	RU	497.1(100)	215.7(22)	318.9(14)
TH	312.0(100)	300.1(17)	340.5(12)	W	511.8(2)	685.8(100)	479.5(80)
IR	316.5(100)	468.1(58)	308.4(36)	SR	514.0(100)		
RU	318.9(14)	497.1(100)	215.7(22)	GE	520.8(27)	239.1(100)	264.4(81)
RH	318.9(100)	306.1(27)		KR	525.3(3)	261.3(100)	397.6(75)
ND	319.4(7)	91.1(100)	531.0(47)	CD	527.9(54)	336.2(100)	336.2(98)
CR	320.1(100)			ND	531.0(47)	91.1(100)	340.1(22)
RU	324.5(3)	497.1(100)	215.7(22)	W	551.5(19)	685.8(100)	479.5(80)
IR	328.4(8)	316.5(100)	468.1(58)	BR	554.3(85)	776.5(100)	619.1(52)
LA	328.8(22)	1596.5(100)	487.0(48)	GE	558.0(24)	239.1(100)	264.4(81)
U	332.4(4)	59.5(100)	208.0(65)	IN	558.4(29)	190.3(100)	725.2(28)
CD	336.2(100)	336.2(98)	527.9(54)	AS	559.1(100)	657.0(14)	1216.0(9)
CD	336.2(98)	336.2(100)	527.9(54)	CS	563.2(9)	604.7(100)	795.8(88)
ND	340.1(22)	91.1(100)	531.0(47)	AS	563.2(3)	559.1(100)	657.0(14)
TH	340.5(12)	312.0(100)	300.1(17)	SB	564.2(100)	602.7(9)	692.6(5)
PD	342.1(17)	88.0(100)	245.4(3)	CS	569.3(16)	604.7(100)	795.8(88)
HF	343.4(10)	482.0(100)	133.0(50)	BA	585.0(3)	496.3(100)	123.8(66)
EU	344.3(29)	841.6(100)	963.4(82)	IR	588.6(5)	316.5(100)	468.1(58)
EU	344.3(17)	841.6(100)	963.4(82)	SN	600.6(2)	391.7(100)	158.6(81)
ND	344.9(2)	91.1(100)	531.0(47)	GA	600.9(6)	834.0(100)	2201.7(27)
HF	345.8(16)	482.0(100)	133.0(50)	SB	602.7(9)	564.2(100)	692.6(5)
CE	350.6(4)	145.4(100)	293.3(53)	IR	604.4(10)	316.5(100)	468.1(58)
TA	354.0(4)	67.7(100)	1121.3(85)	CS	604.7(100)	795.8(88)	569.3(16)
GD	363.6(91)	97.4(100)	103.2(72)	KR	606.1(64)	261.3(100)	397.6(75)
TE	364.5(100)	637.0(9)	284.3(7)	RU	610.3(6)	497.1(100)	215.7(22)
GE	367.4(21)	239.1(100)	264.4(81)	IR	612.5(6)	316.5(100)	468.1(58)
DY	371.7(4)	82.5(100)	80.6(59)	W	618.4(23)	685.8(100)	479.5(80)
BA	373.2(30)	496.3(100)	123.8(66)	BR	619.1(52)	776.5(100)	554.3(85)
KR	389.0(12)	261.3(100)	397.6(75)	BA	620.0(4)	496.3(100)	123.8(66)
SN	391.7(100)	158.6(81)	427.9(4)	AG	620.3(3)	657.7(100)	884.7(77)
TB	392.5(5)	879.4(100)	298.6(91)	W	625.5(4)	685.8(100)	479.5(80)
YB	396.3(100)	282.5(47)	63.1(38)	GA	630.0(26)	834.0(100)	2201.7(27)
KR	397.6(75)	261.3(100)	606.1(64)	GE	631.8(10)	239.1(100)	264.4(81)
ND	398.2(3)	91.1(100)	531.0(47)	RE	633.0(3)	137.2(100)	155.0(40)

Z	EG(IG)	EG(IG)	EG(IG)	Z	EG(IG)	EG(IG)	EG(IG)
GE	634.4(3)	239.1(100)	264.4(81)	TB	966.2(85)	879.4(100)	298.6(91)
TE	637.0(9)	364.5(100)	284.3(7)	EU	970.4(4)	841.6(100)	963.4(82)
OS	646.1(10)	129.4(100)	138.9(5)	TA	1001.7(5)	67.7(100)	1121.3(85)
AS	657.0(14)	559.1(100)	1216.0(9)	TB	1002.9(3)	879.4(100)	298.6(91)
AG	657.7(100)	884.7(77)	937.5(36)	EU	1004.8(2)	841.6(100)	963.4(82)
ZR	657.9(22)	756.7(100)	724.2(81)	BR	1044.0(33)	776.5(100)	554.3(85)
CE	664.5(7)	145.4(100)	293.3(53)	BA	1047.6(3)	496.3(100)	123.8(66)
AG	677.6(11)	657.7(100)	884.7(77)	GA	1050.7(7)	834.0(100)	2201.7(27)
W	685.8(100)	479.5(80)	72.1(41)	SN	1067.1(3)	391.7(100)	158.6(81)
ND	685.9(3)	91.1(100)	531.0(47)	RB	1076.6(100)		
AG	687.0(7)	657.7(100)	884.7(77)	GE	1085.2(9)	239.1(100)	264.4(81)
SB	692.6(5)	564.2(100)	602.7(9)	EU	1085.9(11)	841.6(100)	963.4(82)
BR	698.3(34)	776.5(100)	554.3(85)	FE	1099.2(100)	1291.6(78)	192.3(5)
NB	702.6(27)	765.8(100)	871.1(27)	EU	1112.1(15)	841.6(100)	963.4(82)
AG	706.7(18)	657.7(100)	884.7(77)	TB	1115.1(5)	879.4(100)	298.6(91)
GE	714.3(11)	239.1(100)	264.4(81)	KR	1115.1(3)	261.3(100)	397.6(75)
ND	717.6(4)	91.1(100)	531.0(47)	ZN	1115.5(100)	438.6(20)	
CE	722.0(6)	145.4(100)	293.3(53)	SC	1120.5(100)	889.2(100)	
TE	722.9(2)	364.5(100)	637.0(9)	TA	1121.3(85)	67.7(100)	1221.4(66)
EU	723.3(2)	841.6(100)	963.4(82)	CO	1173.2(100)	1332.5(100)	
ZR	724.2(81)	756.7(100)	657.9(22)	TB	1177.9(52)	879.4(100)	298.6(91)
IN	725.2(28)	190.3(100)	558.4(29)	TA	1189.0(40)	67.7(100)	1121.3(85)
MO	739.5(14)	140.5(100)	181.1(7)	GE	1193.3(4)	239.1(100)	264.4(81)
ZR	743.4(19)	756.7(100)	724.2(81)	TB	1199.9(8)	879.4(100)	298.6(91)
AG	744.3(5)	657.7(100)	884.7(77)	AS	1212.7(4)	559.1(100)	657.0(14)
LA	751.8(5)	1596.5(100)	487.0(48)	AS	1216.0(9)	559.1(100)	657.0(14)
ZR	756.7(100)	724.2(81)	657.9(22)	TA	1221.4(66)	67.7(100)	1121.3(85)
AG	763.9(24)	657.7(100)	884.7(77)	AS	1228.5(3)	559.1(100)	657.0(14)
TB	765.3(7)	879.4(100)	298.6(91)	TA	1231.0(28)	67.7(100)	1121.3(85)
ZR	765.8(16)	756.7(100)	724.2(81)	TA	1257.5(4)	67.7(100)	1121.3(85)
NB	765.8(100)	702.6(27)	871.1(27)	TB	1271.9(25)	879.4(100)	298.6(91)
W	772.9(15)	685.8(100)	479.5(80)	EU	1274.4(4)	841.6(100)	963.4(82)
TE	773.7(3)	364.5(100)	637.0(9)	TA	1289.2(3)	67.7(100)	1121.3(85)
BR	776.5(100)	554.3(85)	619.1(52)	FE	1291.6(78)	1099.2(100)	192.3(5)
MO	777.9(5)	140.5(100)	739.5(14)	CA	1297.1(100)	159.4(73)	807.9(9)
EU	778.9(14)	841.6(100)	963.4(82)	TB	1312.1(10)	879.4(100)	298.6(91)
GA	786.4(3)	834.0(100)	2201.7(27)	EU	1314.7(7)	841.6(100)	963.4(82)
CS	795.8(88)	604.7(100)	569.3(16)	BR	1317.5(32)	776.5(100)	554.3(85)
CS	801.9(9)	604.7(100)	795.8(88)	KR	1332.1(3)	261.3(100)	397.6(75)
CA	807.9(9)	1297.1(100)	159.4(73)	CO	1332.5(100)	1173.2(100)	
GA	810.2(2)	834.0(100)	2201.7(27)	CU	1345.8(100)		
GE	810.4(3)	239.1(100)	264.4(81)	CS	1365.1(3)	604.7(100)	795.8(88)
LA	815.8(25)	1596.5(100)	487.0(48)	GE	1368.4(5)	239.1(100)	264.4(81)
AG	818.0(8)	657.7(100)	884.7(77)	NA	1368.5(100)	2754.0(100)	
BR	827.8(29)	776.5(100)	554.3(85)	DY	1379.4(9)	82.5(100)	80.6(59)
KR	832.0(10)	261.3(100)	397.6(75)	HO	1379.4(15)	80.6(100)	1581.9(3)
GA	834.0(100)	2201.7(27)	630.0(26)	AG	1384.3(26)	657.7(100)	884.7(77)
EU	841.6(100)	963.4(82)	121.8(49)	EU	1389.0(5)	841.6(100)	963.4(82)
MN	846.8(100)	1810.7(27)	2113.0(14)	EU	1408.0(23)	841.6(100)	963.4(82)
EU	867.4(5)	841.6(100)	963.4(82)	GA	1464.0(4)	834.0(100)	2201.7(27)
LA	867.8(6)	1596.5(100)	487.0(48)	BR	1474.8(20)	776.5(100)	554.3(85)
NB	871.1(27)	765.8(100)	702.6(27)	AG	1475.8(4)	657.7(100)	884.7(77)
TB	879.4(100)	298.6(91)	966.2(85)	AG	1505.0(14)	657.7(100)	884.7(77)
AG	884.7(77)	657.7(100)	937.5(36)	K	1524.7(100)		
SC	889.2(100)	1120.5(100)		PR	1575.6(100)		
GA	894.2(10)	834.0(100)	2201.7(27)	HO	1581.9(3)	80.6(100)	1379.4(15)
LA	919.6(3)	1596.5(100)	487.0(48)	LA	1596.5(100)	487.0(48)	815.8(25)
LA	925.2(7)	1596.5(100)	487.0(48)	GA	1596.7(4)	834.0(100)	2201.7(27)
AG	937.5(36)	657.7(100)	884.7(77)	SB	1691.0(5)	564.2(100)	602.7(9)
TB	962.3(33)	879.4(100)	298.6(91)	Y	1760.7(100)		
EU	963.4(82)	841.6(100)	121.8(49)	MN	1810.7(27)	846.8(100)	2113.0(14)
EU	964.1(16)	841.6(100)	963.4(82)	GA	1861.1(5)	834.0(100)	2201.7(27)

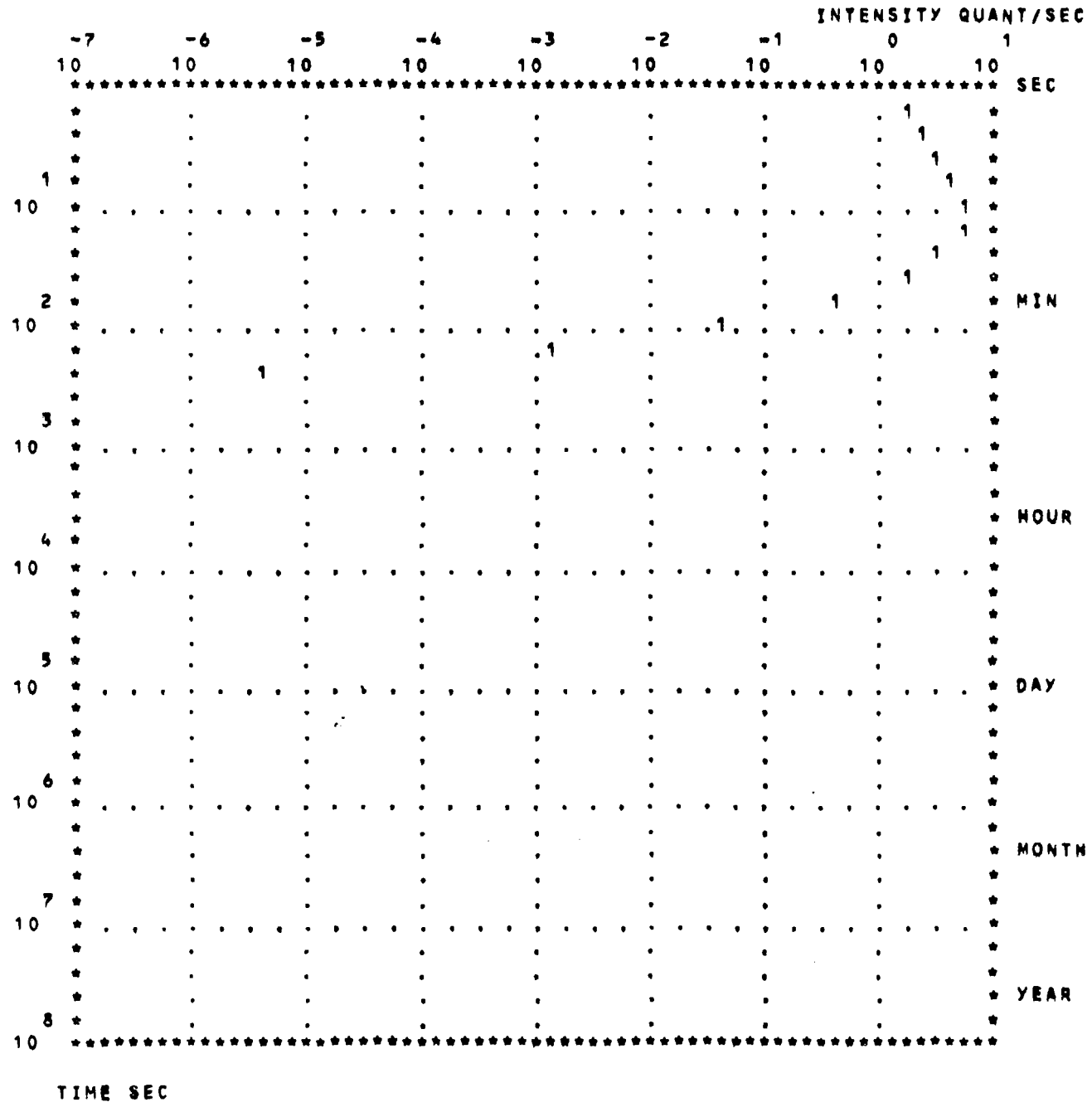
Z	EG(IG)	EG(IG)	EG(IG)	Z	EG(IG)	EG(IG)	EG(IG)
MN	2113.0(14)	846.8(100)	1810.7(27)	GA	2507.8(13)	834.0(100)	2201.7(27)
GA	2201.7(27)	834.0(100)	630.0(26)	LA	2521.7(4)	1596.5(100)	487.0(48)
GA	2491.0(8)	834.0(100)	2201.7(27)	NA	2754.0(100)	1368.5(100)	

Table 3

NITROGEN 10^{13} N/SM^2 SEC* 1.0 MG

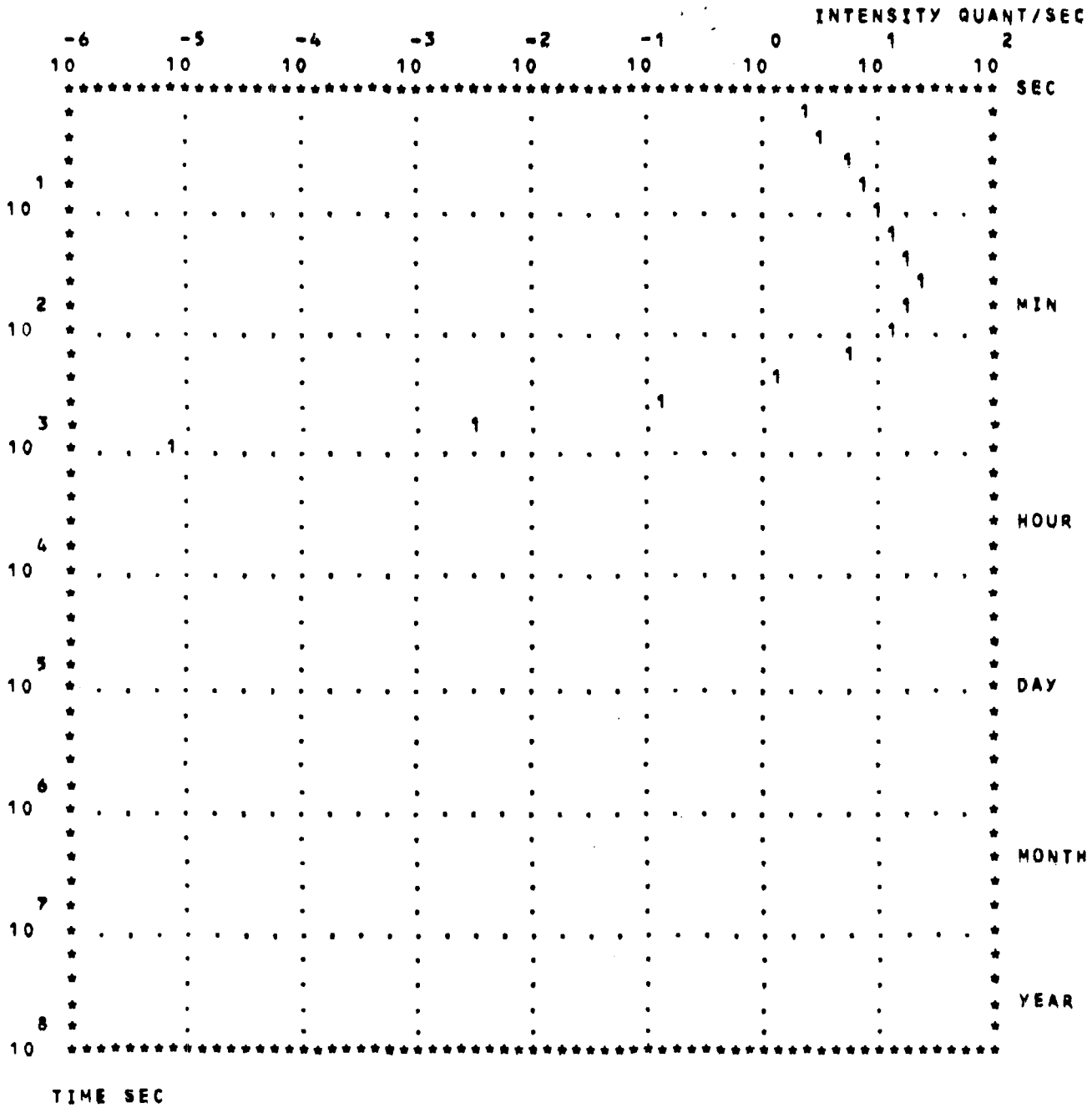
1 - 15N 0.37 % 2.4E-9(8) B 16N (7.1 S) 160 6129.4 KEV 69

* pages 14-88: read N/CM^2 SEC



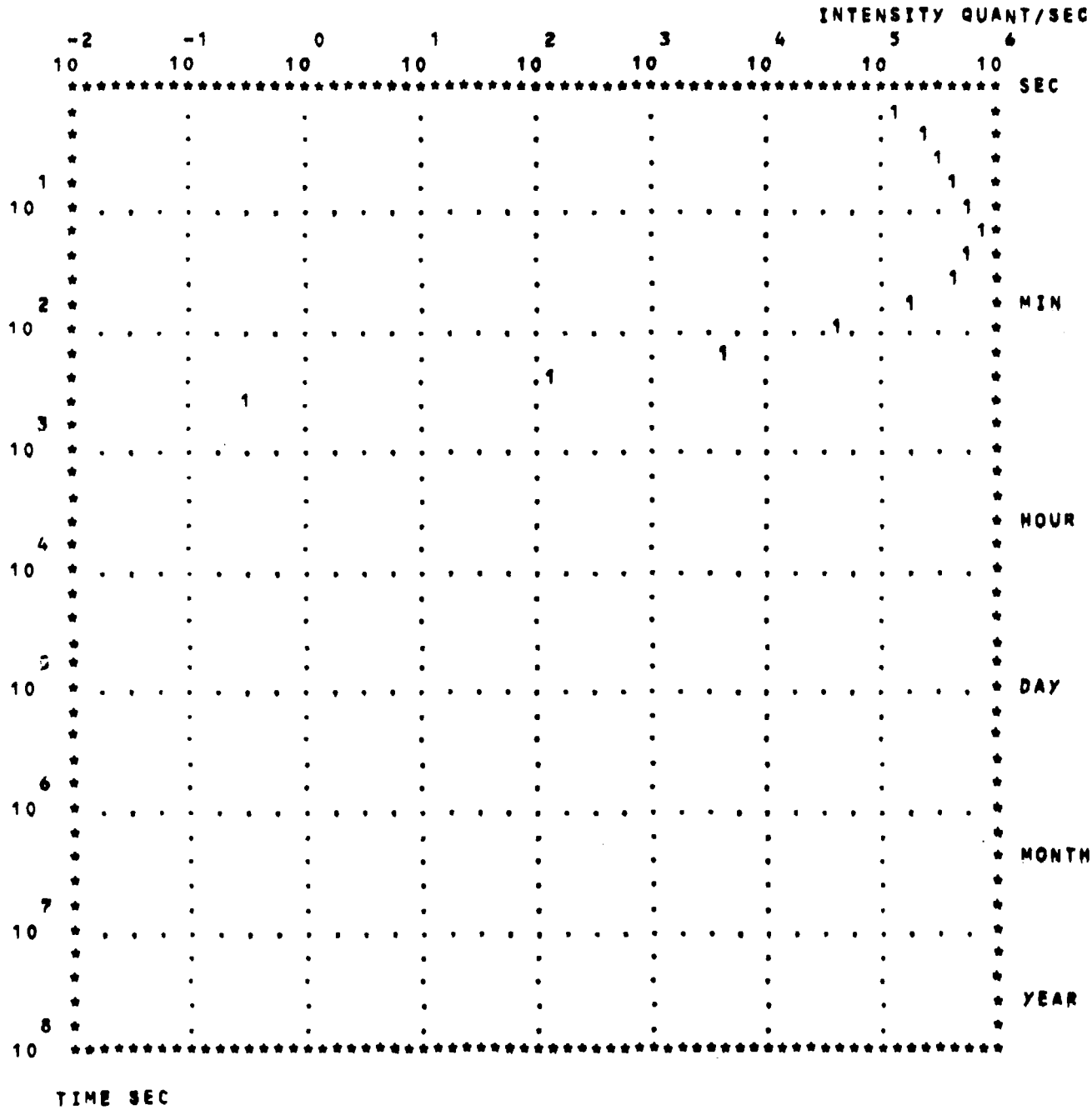
OXYGEN 10^{13} N/SM SEC 1.0 MG

1 = 180 0.2 % 1.6E-4(1) B 190 (27 S) 19F 197.00 KEV 90.34



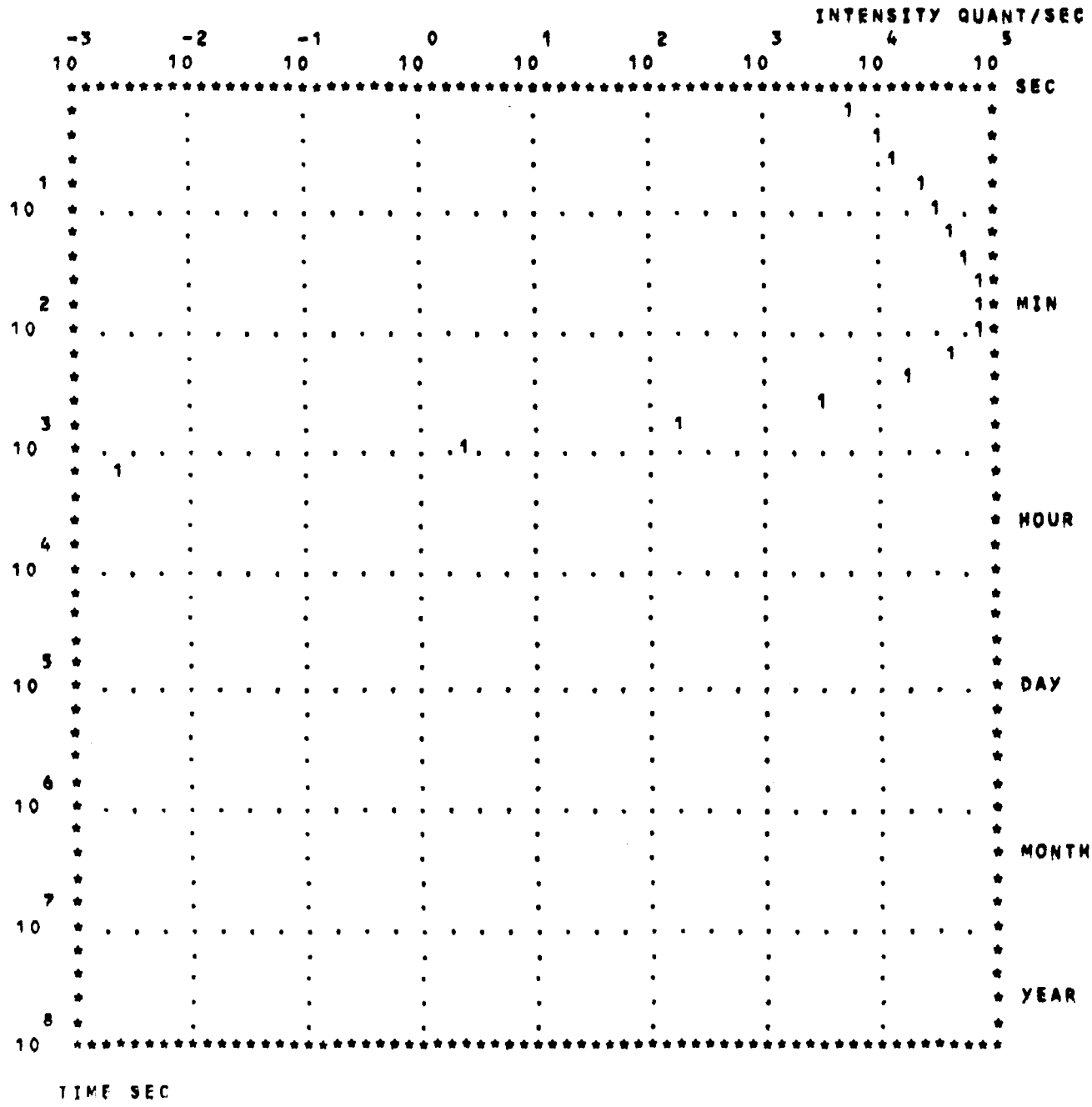
FLUORINE 10^{13} N/SM^2 SEC 1.0 MG

1 - 19F 100. % 0.0096(5) B 20F (11.0 S) 20NE 1633.6 KEV 100



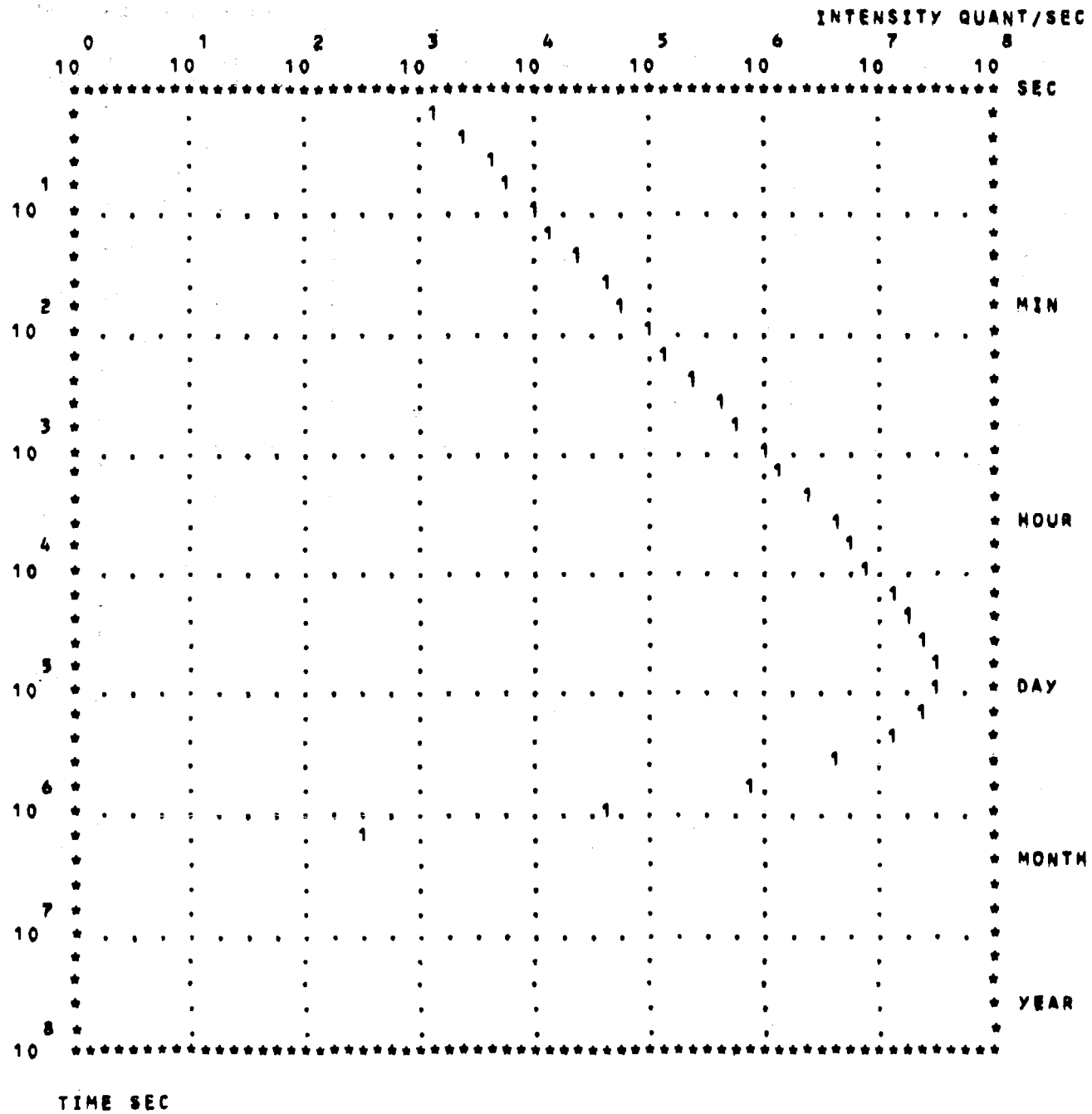
NEON 10^{13} N/SM^{2} SEC 1.0 MG

1 - 22NE 9.22 % 0.045(6) B 23NE(37 S) 23NA 439.80 KEV 33.0



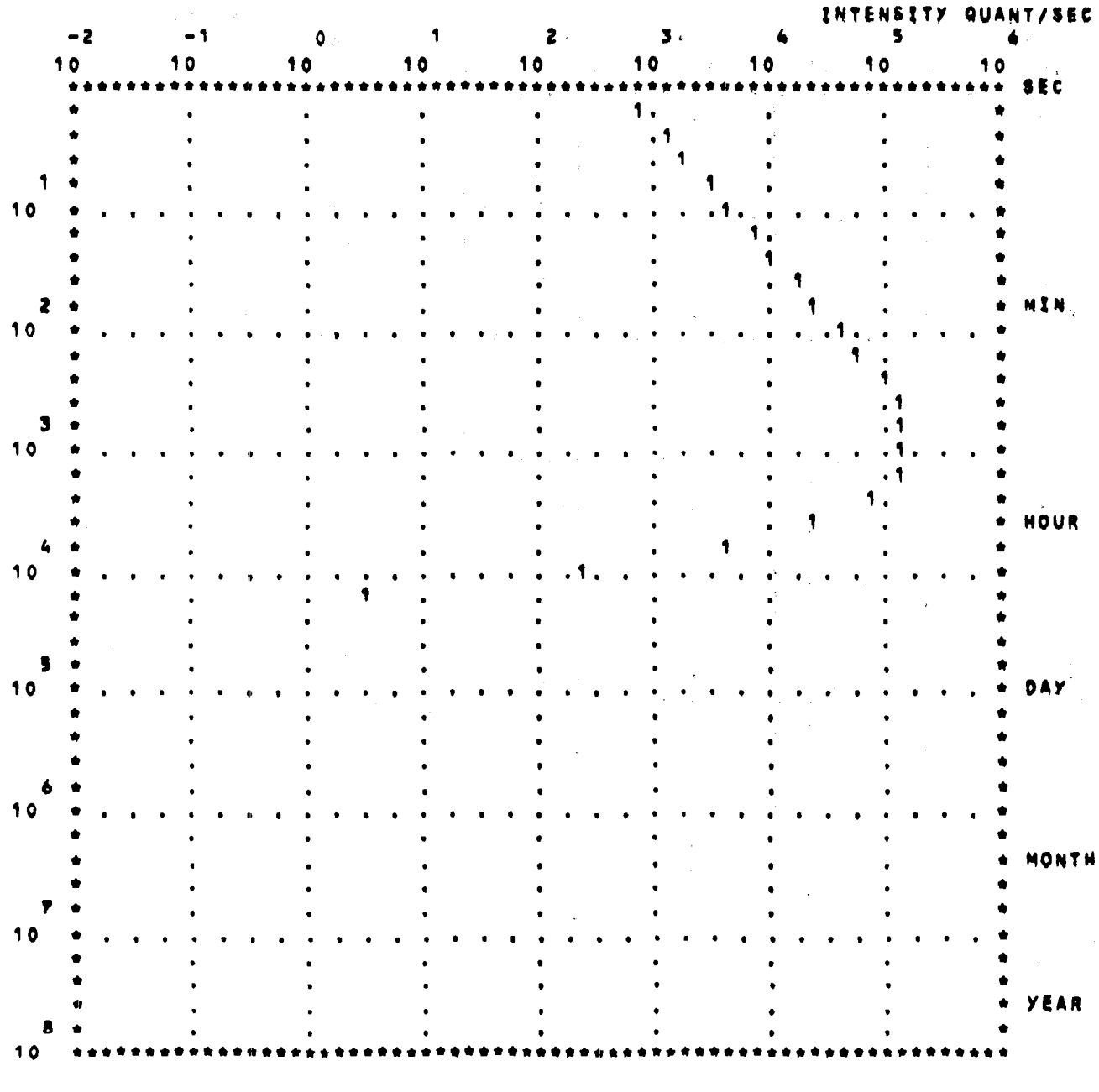
SODIUM 10^{13} 10^{2} N/SM SEC 1,0 MG

1 - 23NA 100, % 0.530(5) B 24NA(15.0 H) 24MG 1368.5 KEV 100



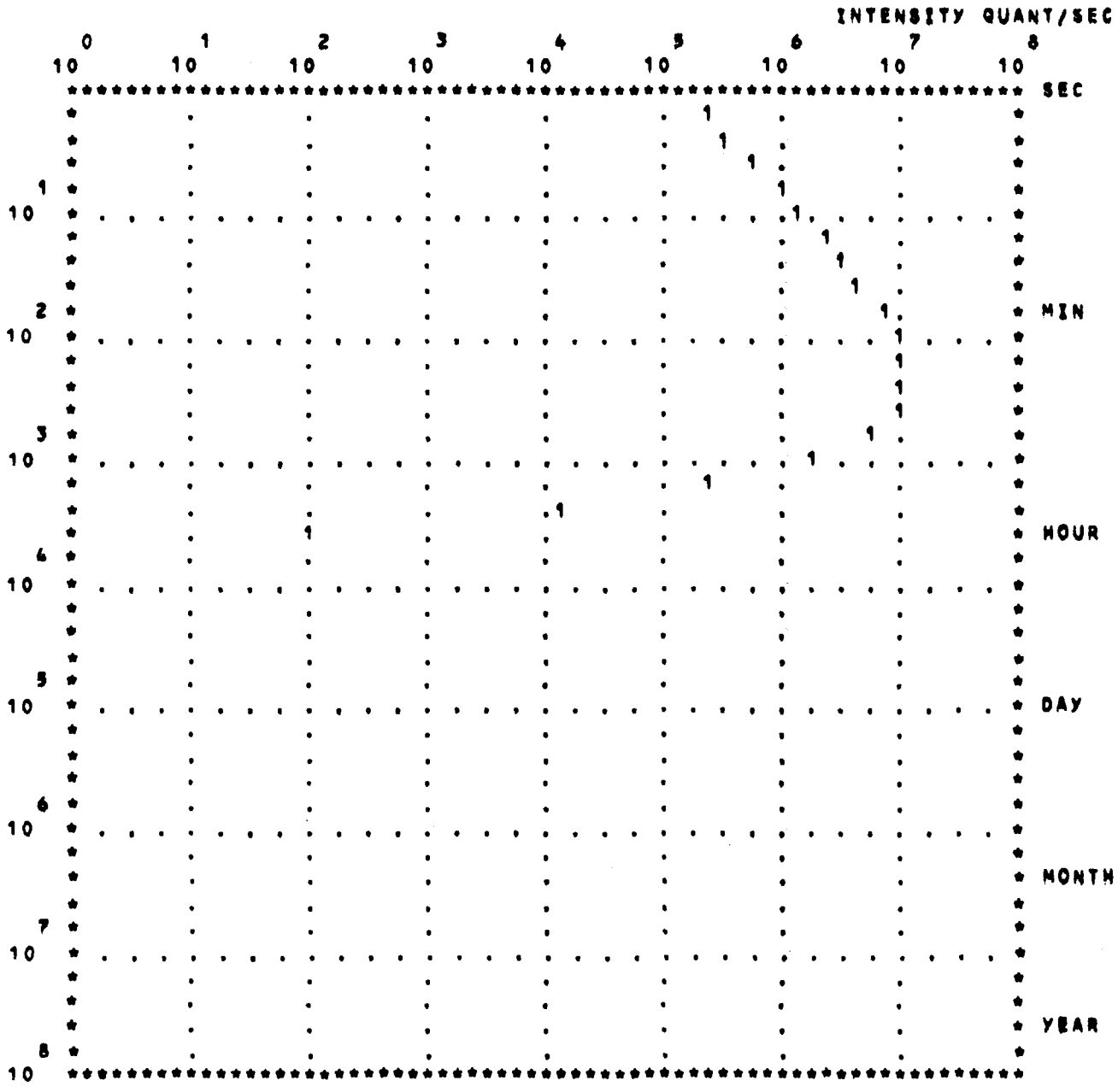
MAGNESIUM 10^{13} N/SM^2 SEC 1.0 MG

1 -	26MG	11.01 %	0.0382(8) B	27MG(9.5 M)	27AL	843.76 KEV	72
2 -	27MG		0.07(2) B	28MG(20.9 H)	28AL	30.66 KEV	66
3 -				28AL(2.24 M)	28SI	1778.8 KEV	100



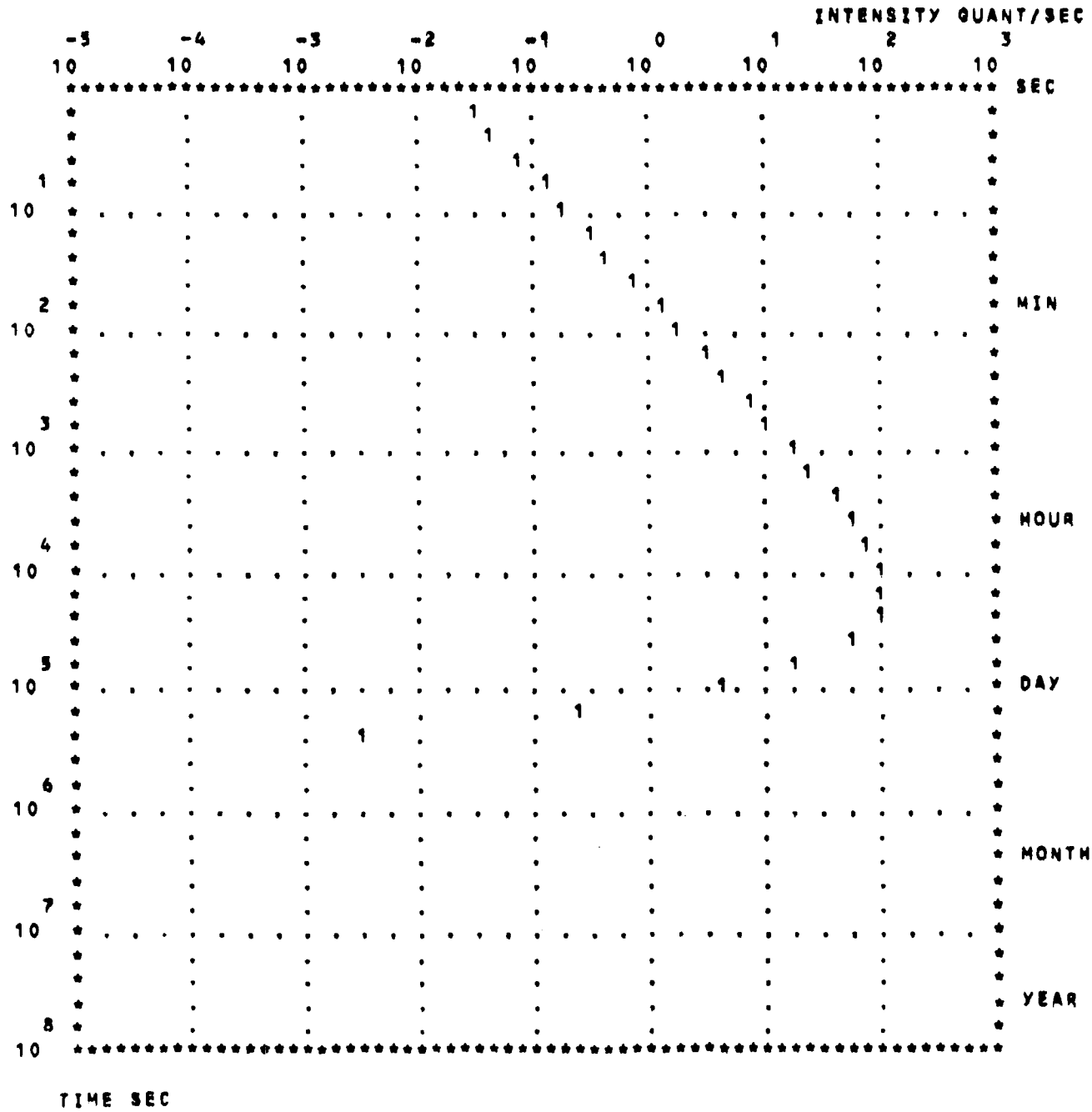
ALUMINIUM 10^{13} N/SM^{2} SEC 1.0 MG

1 - 27AL 100. % 0.231(3) B 28AL(2.24 M) 2891 1778.8 KEV 100



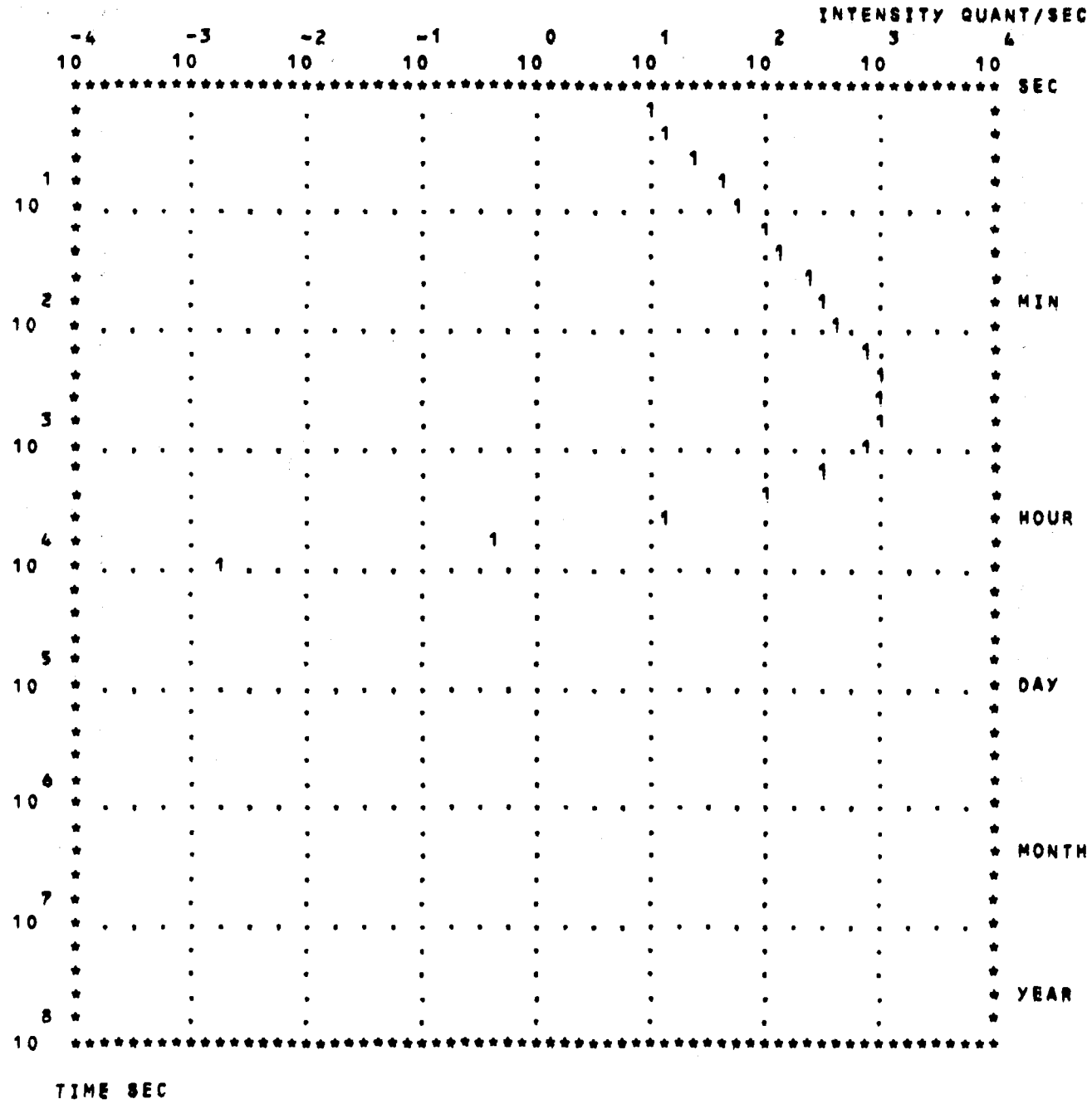
SILICON 10^{13} N/SM 10^{2} SEC 1.0 MG

1 - 30SI 3.1 % 0.107(2) B 31SI(2.6 H) 31P 1266.1 KEV 0.070
32P (14.3 D) NO GAMMAS



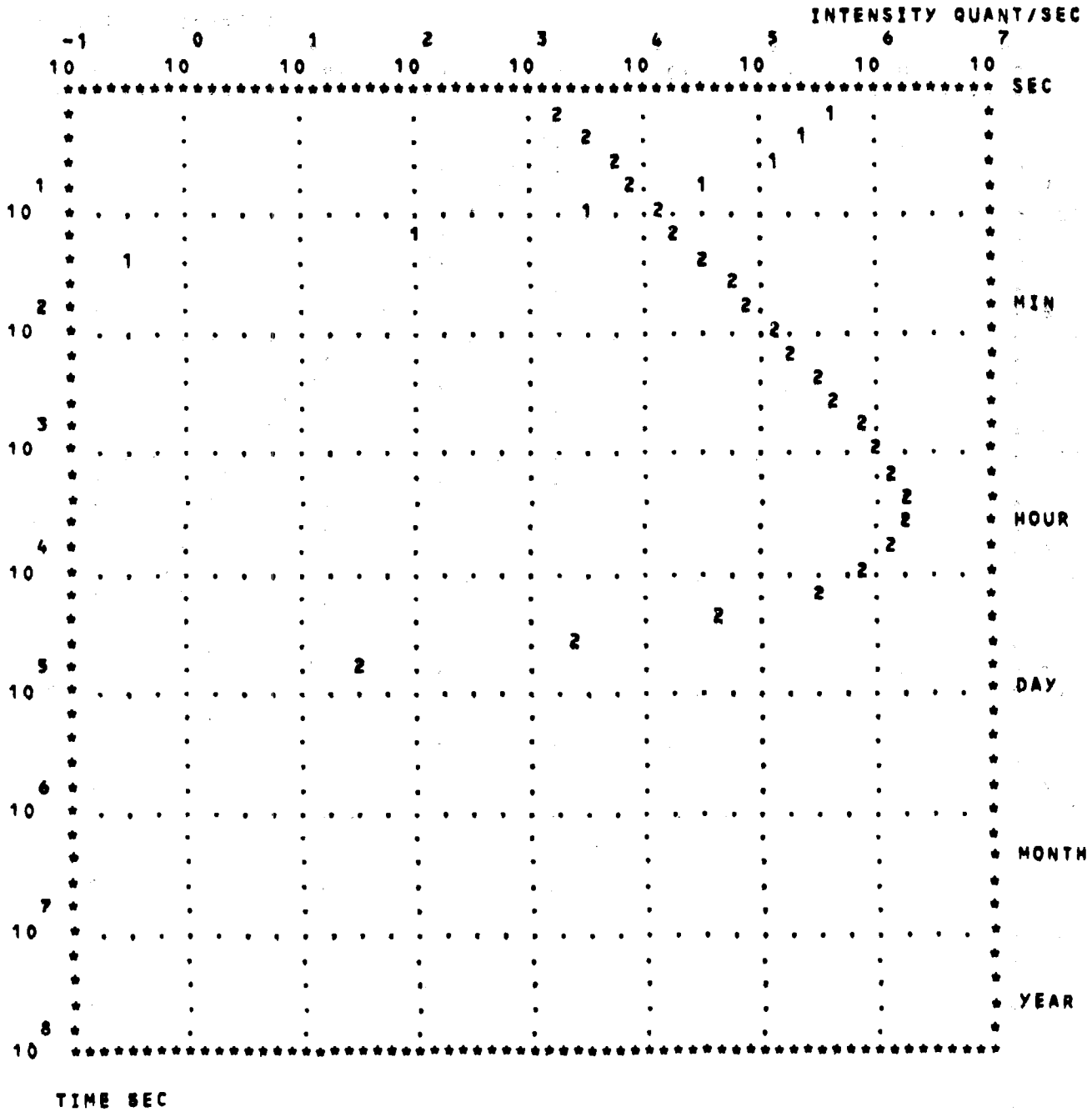
SULPHUR 10^{13} N/SM^{2} SEC 1.0 MG

	34S	4.21 %	0.227(5) B	35S (87 D)		NO GAMMAS		
1 -	36S	0.02 %	0.15(3) B	37S (5.0 M)	37CL	3103.3 KEV	94	



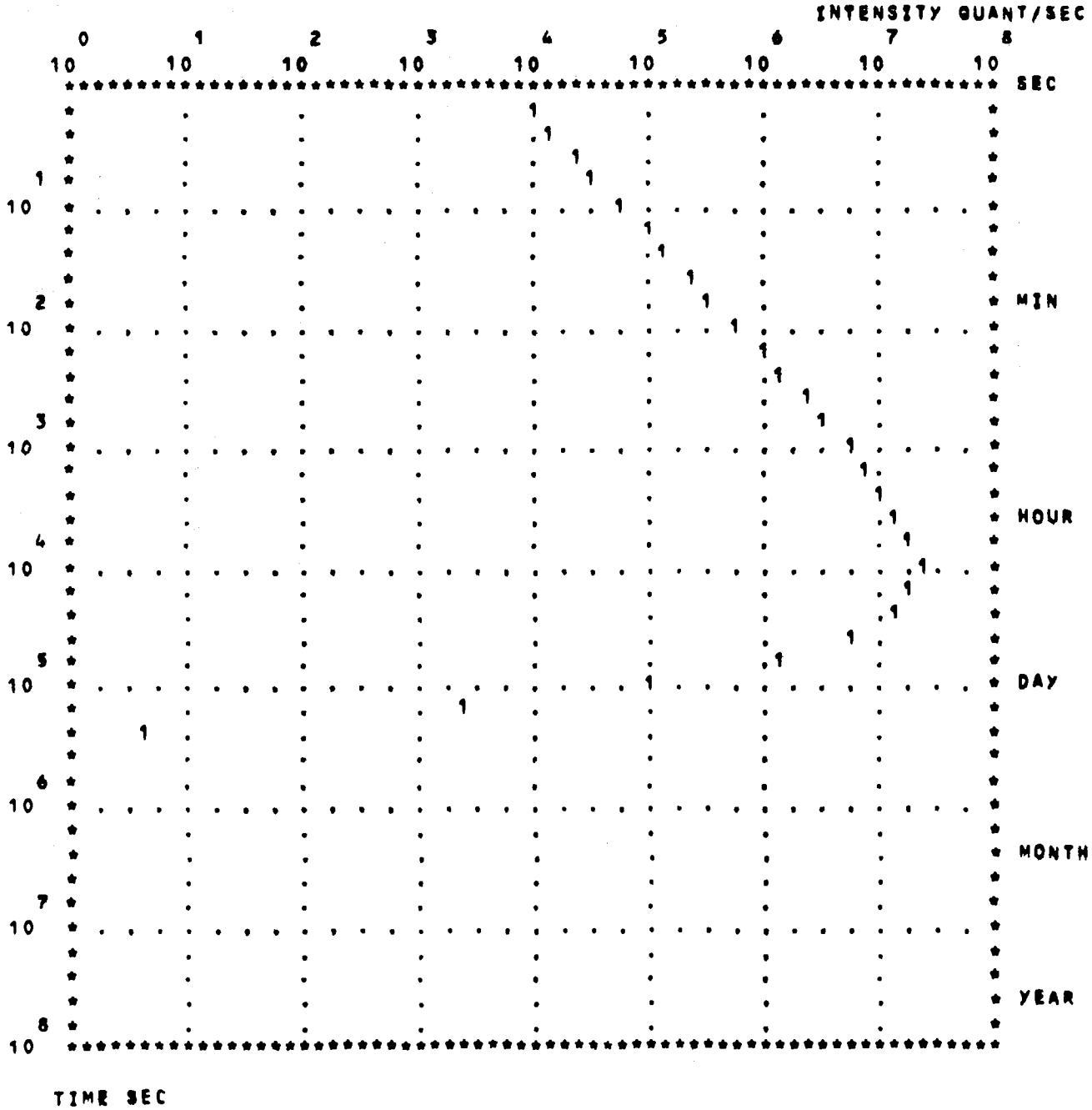
CHLORINE 10^{13} N/SM^2 SEC 1.0 MG

1 -	37CL 24.23 %	0.047(10) B	38CL(0.72 S)	38CL	671.27 KEV	100
2 -		0.386(12) B	38CL(37 M)	38AR	2167.5 KEV	44.0



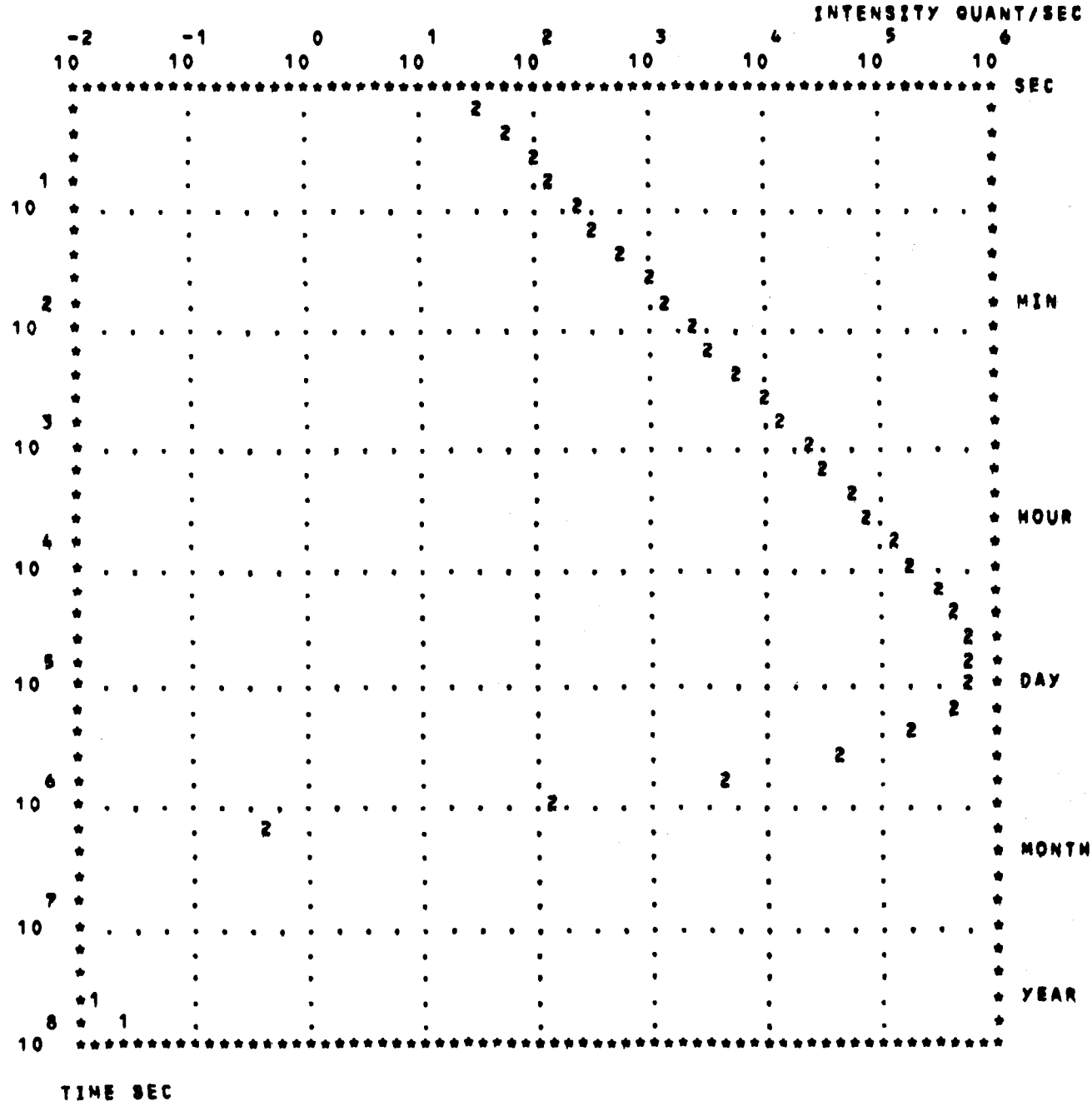
ARGON 10^{13} N/SM^2 SEC 1.0 MG

	36AR 0.337 %	5.2(5) B	37AR(35 D)	NO GAMMAS	
1 -	40AR 99.6 %	0.66(1) B	41AR(1.83 H)	41K 1293.6 KEV	99



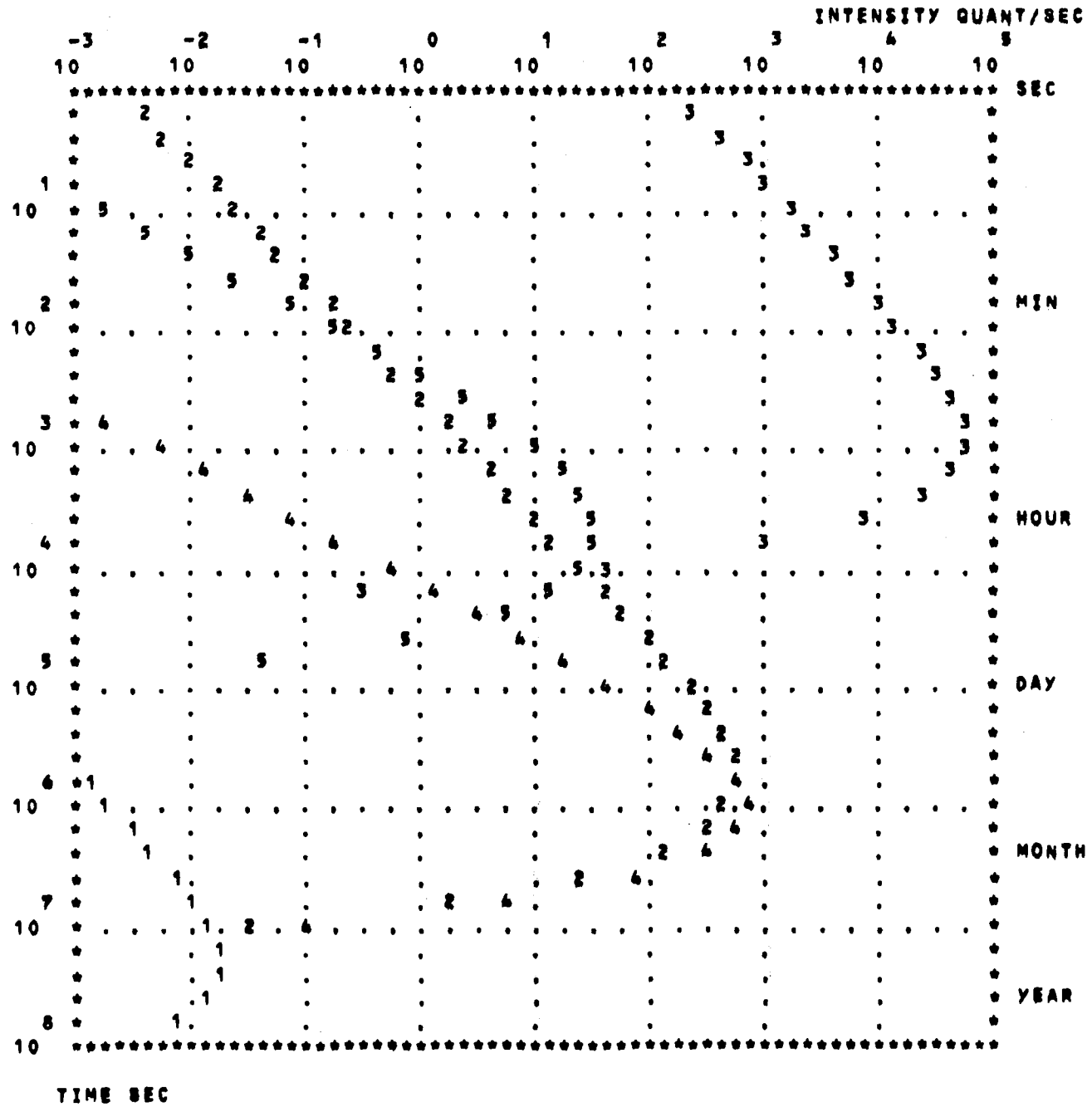
POTASSIUM 10^{13} N/SM^2 SEC 1.0 MG

1 -	39K	93.258 %	2.1(2) B	40K (128E7 y)	40AR	1460.7 KEV	10.7
2 -	41K	6.73 %	1.46(3) B	42K (12.4 H)	42CA	1524.7 KEV	17.9



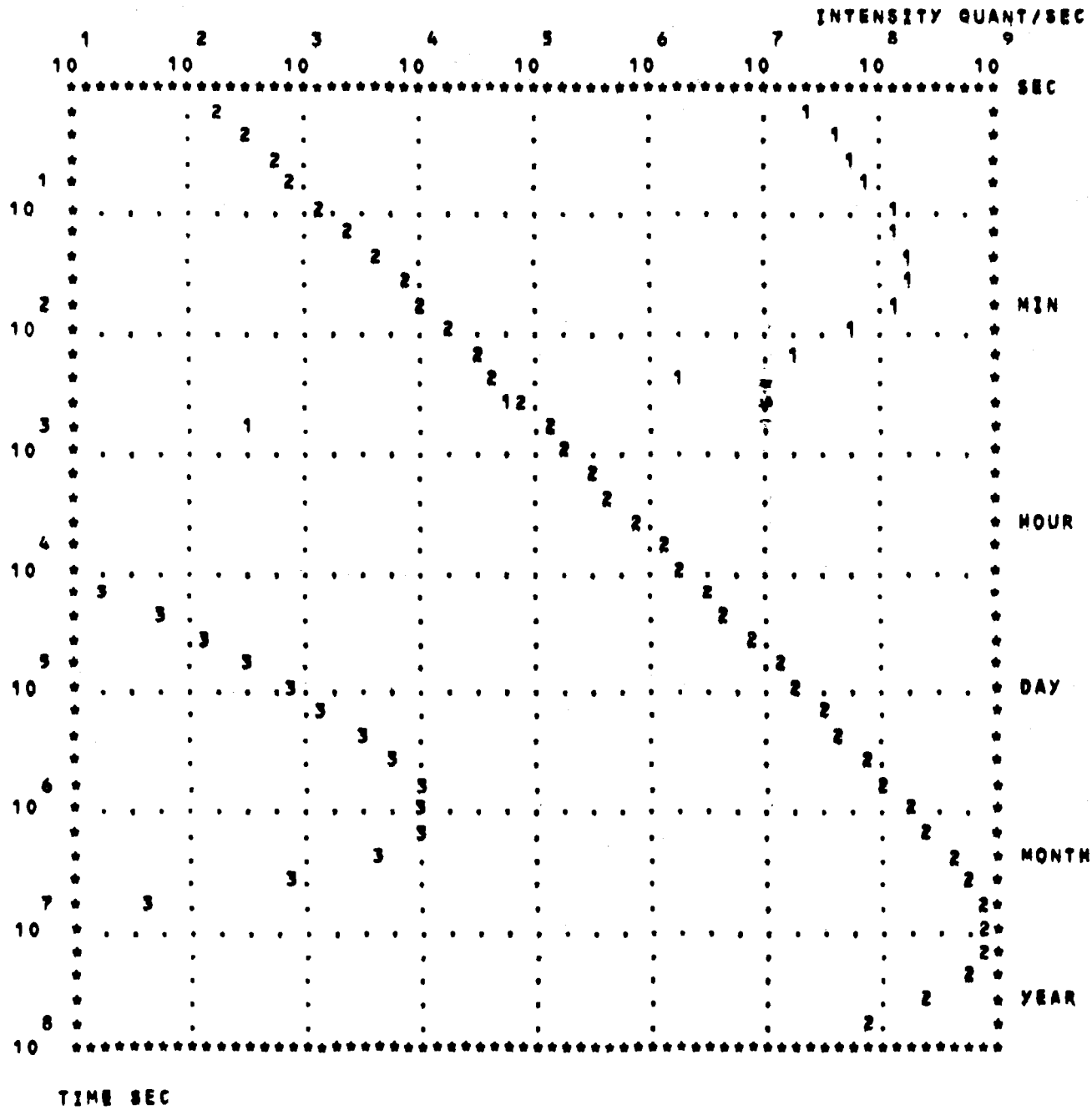
CALCIUM 10^{13} N/SM^2 SEC 1.0 MG

1 -	44CA 2.09 %	0.88(5) B	45CA(163 D)	45SC	12.5 KEV	3.E-6		
2 -	46CA0.0035 %	0.74(7) B	47CA(4.5 D)	47SC	1297.1 KEV	75		
3 -	48CA 0.187 %	1.09(14) B	49CA(8.7 M)	49SC	3084.4 KEV	92		
			45SC(6.0 S)		NO GAMMAS			
4 -			47SC(3.4 D)	47TI	159.38 KEV	68		
5 -			49SC(57 M)	49TI	1761.9 KEV	0.05		



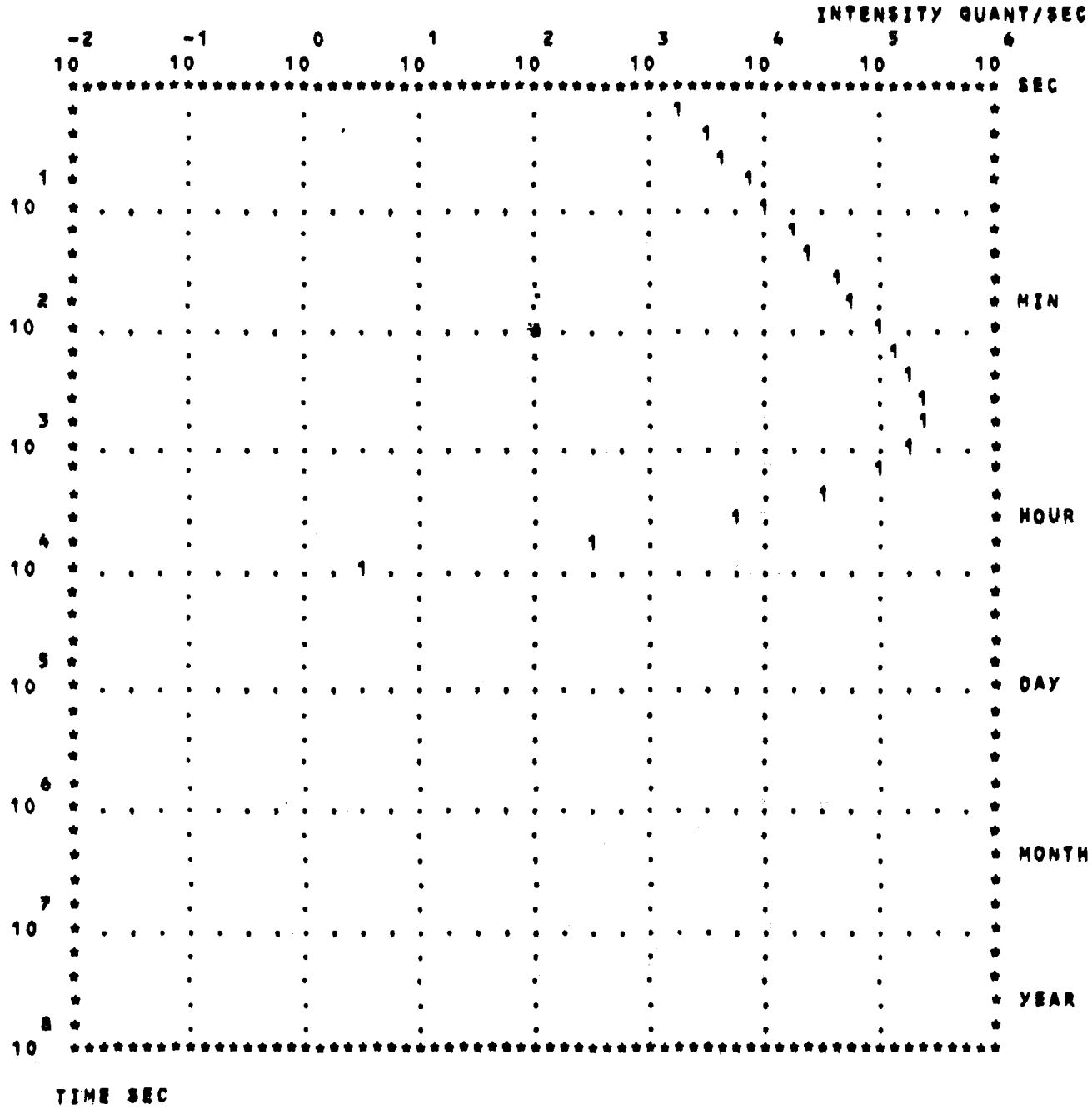
SCANDIUM 10^{13} N/SM 10^{2} SEC 1.0 MG

1 -	45SC	100. %	9.8(11) B	46SC(18.7 S)	46SC	142.53 KEV	62
2 -			17.4(11) B	46SC(84 D)	46TI	1120.5 KEV	100
3 -	46SC		8(1) B	47SC(3.4 D)	47TI	159.38 KEV	68



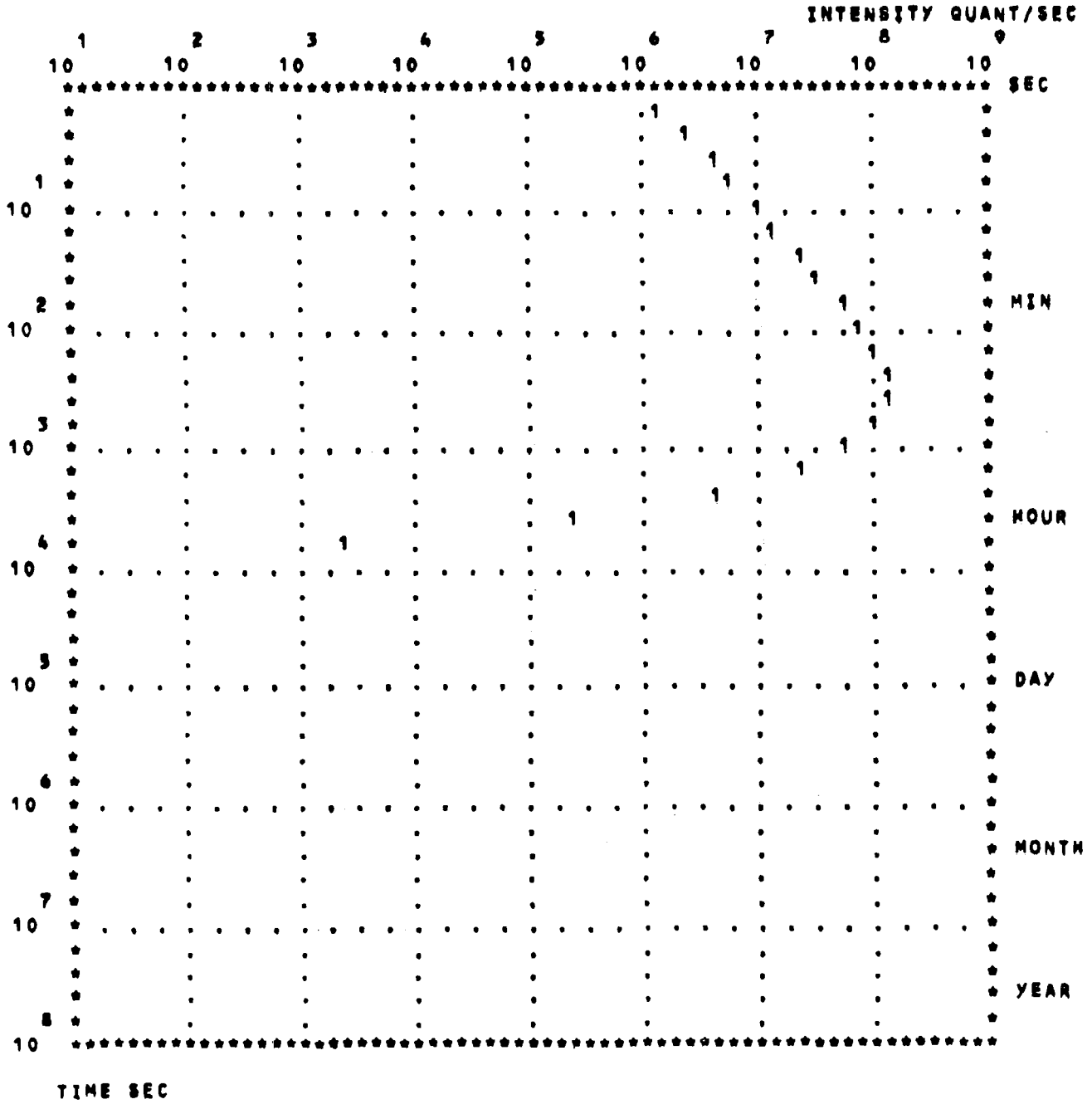
TITANIUM 10^{13} N/SM^2 SEC 1,0 MG

1 - 50TI 5.2 % 0,179(3) B 51TI(5.8 M) 51V 320.08 KEV 93



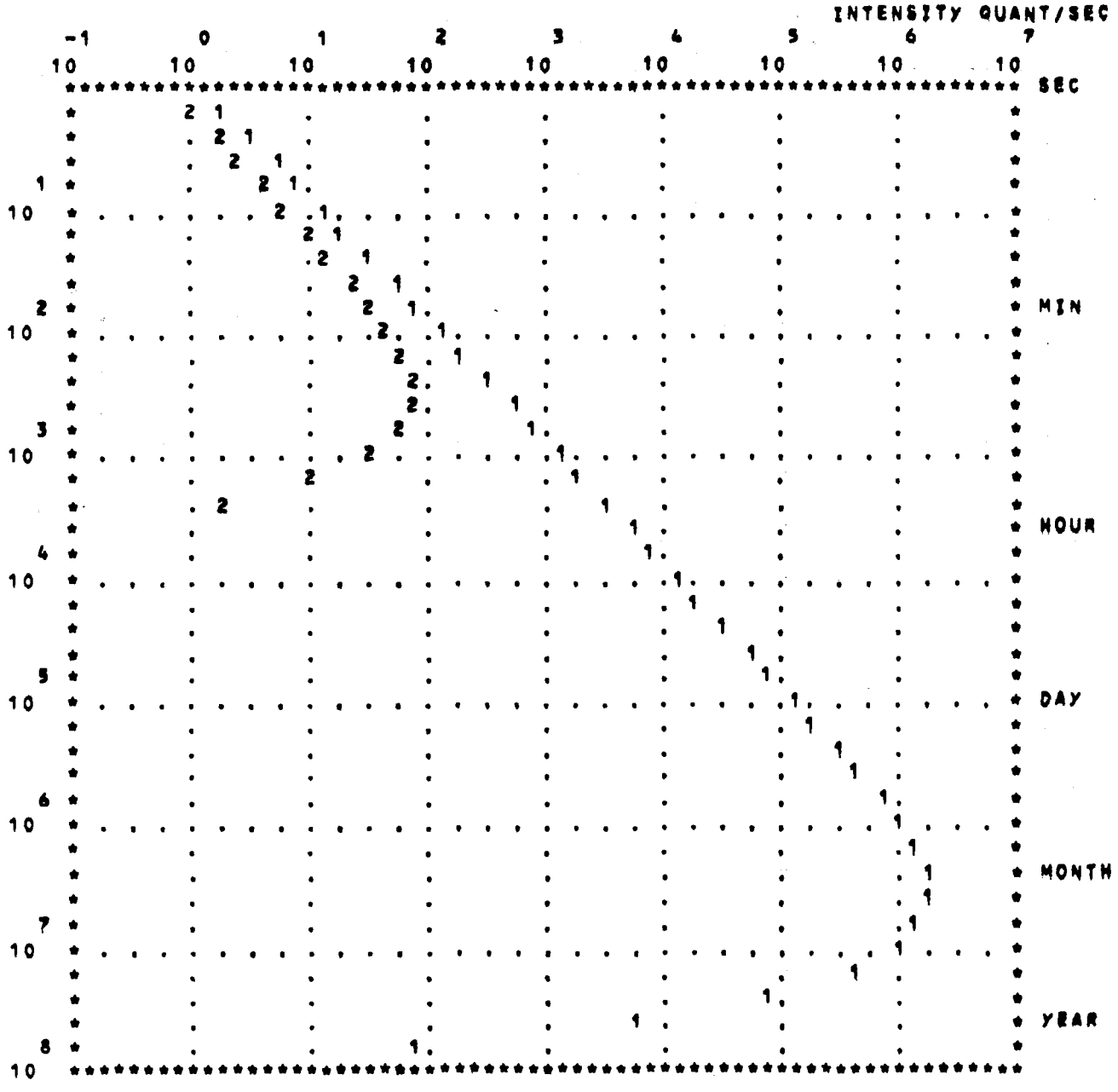
VANADIUM 10^{13} N/cm^2 SEC 1.0 MG

1 - 51V 99.75 % 4.9(1) B 52V (3.7 M) 52CR 1434.1 KEV 100



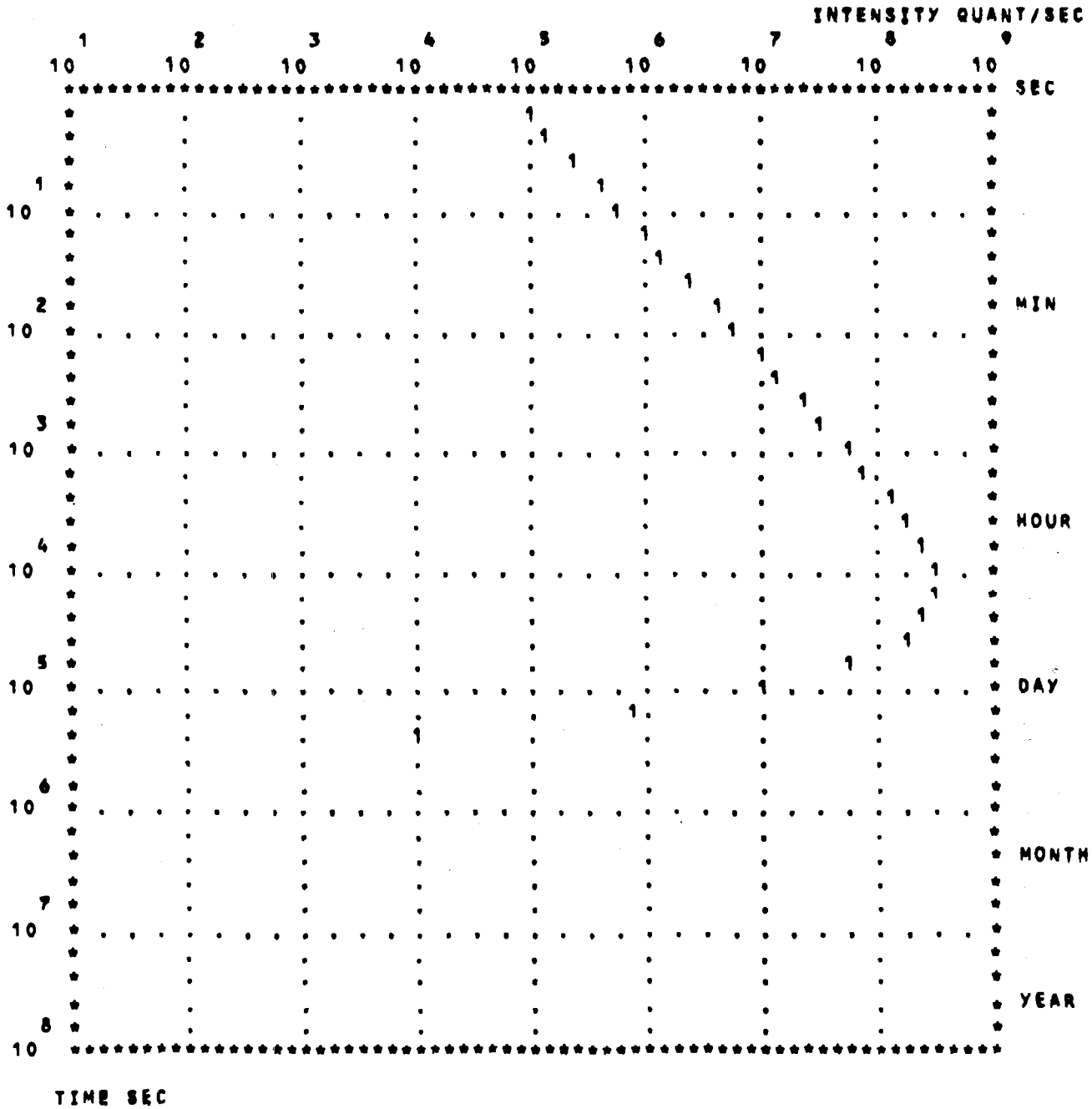
CHROMIUM 10^{13} N/SM^2 SEC 1.0 MG

1 -	50CR	4.35 %	15.9(2) B	51CR(	28 D)	51V	320.08 KEV	9.8
2 -	54CR	2.36 %	0.36(4) B	55CR(	3.5 M)	55MN	1528.0 KEV	0.037



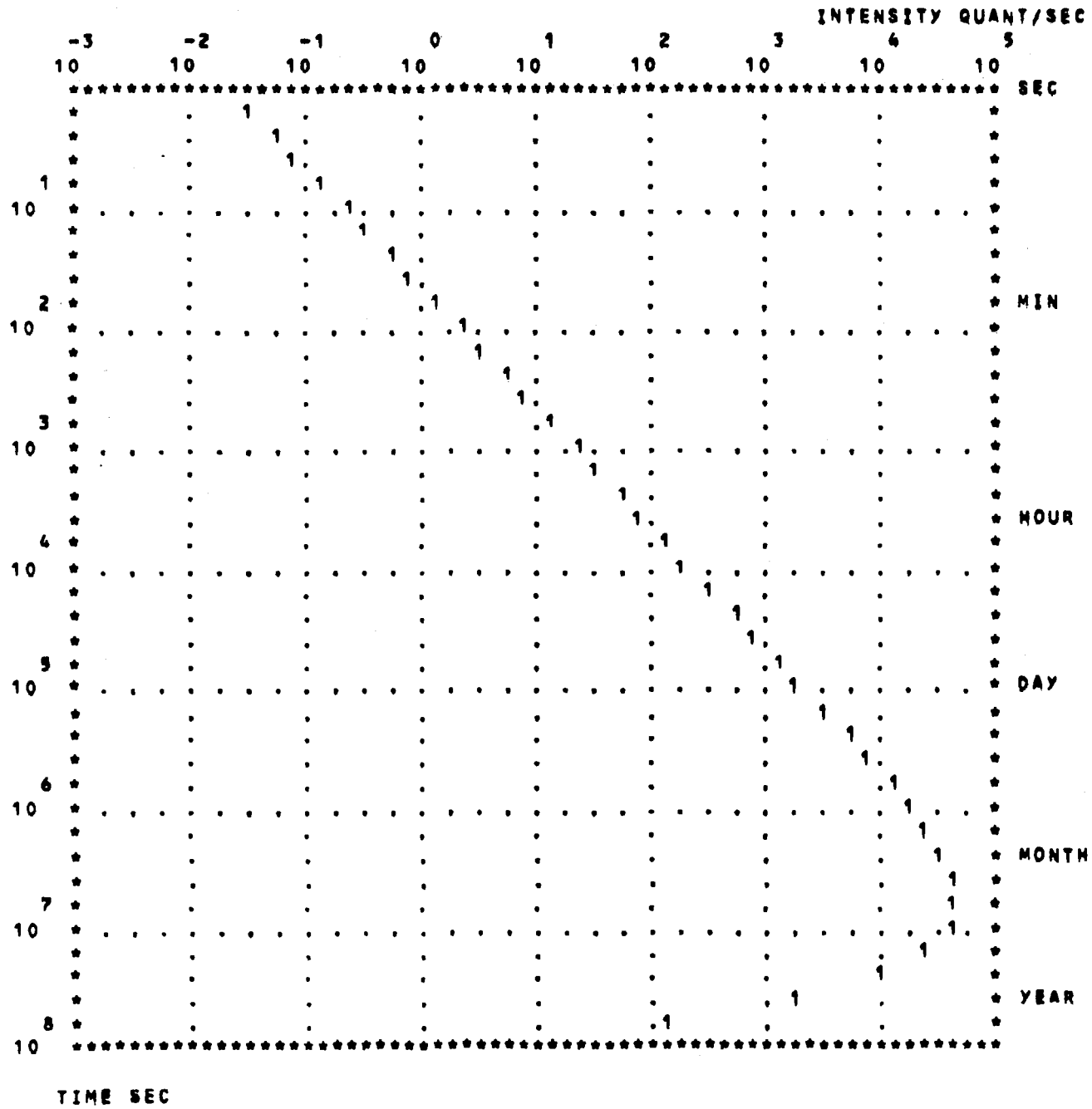
MANGANESE 10^{13} N/SM^{2} SEC 1.0 MG

1 - 55MN 100. % 13.3(2) B 56MN(2.6 H) 56FE 846.75 KEV 99



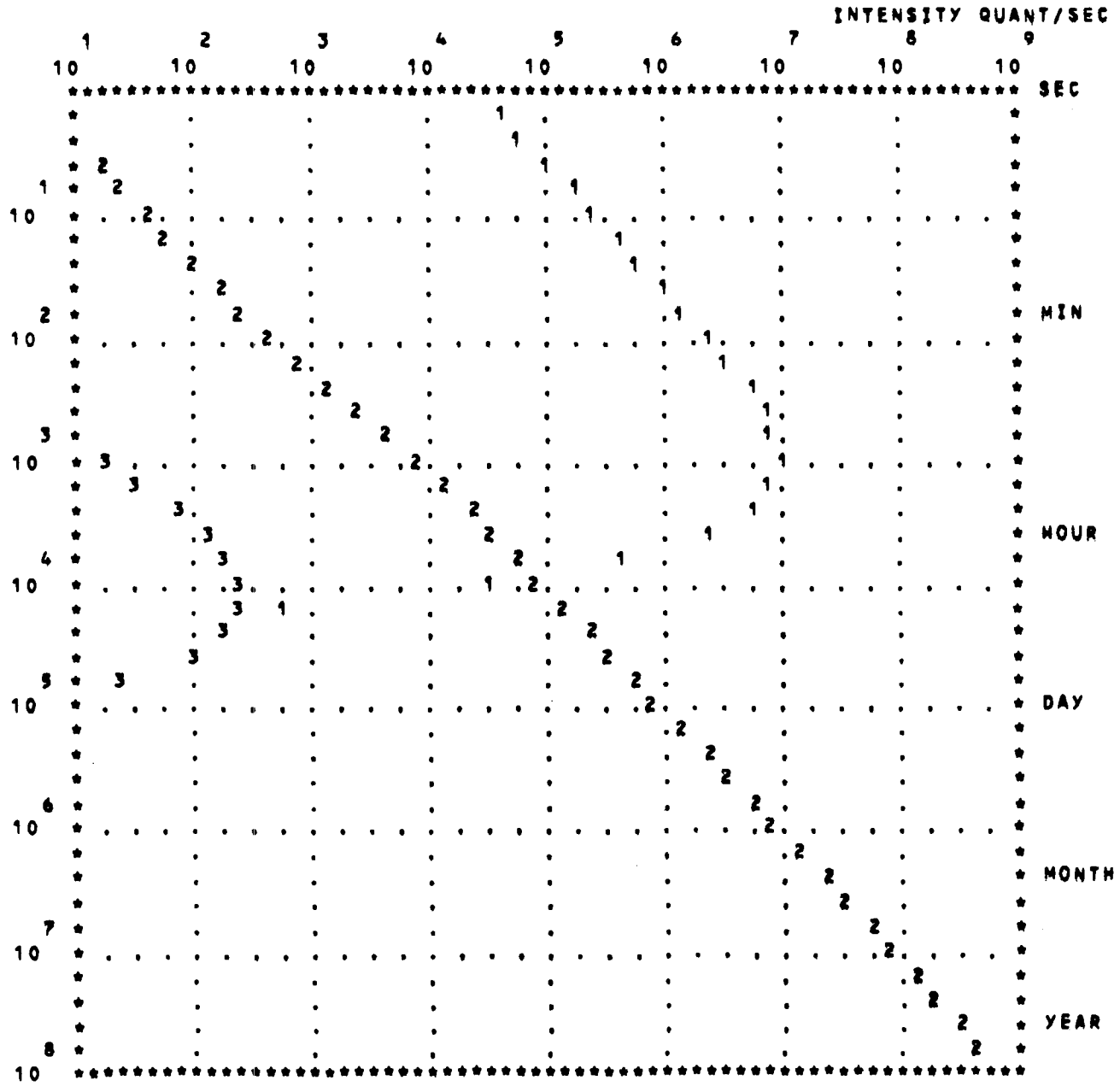
IRON 10^{13} N/SM^2 SEC 1.0 MG

	54FE	5.8 %	2.25(18) B	55FE(2.7 Y)		NO GAMMAS	
1 -	58FE	0.28 %	1.28(5) B	59FE(45 D)	59CO	1099.2 KEV	56



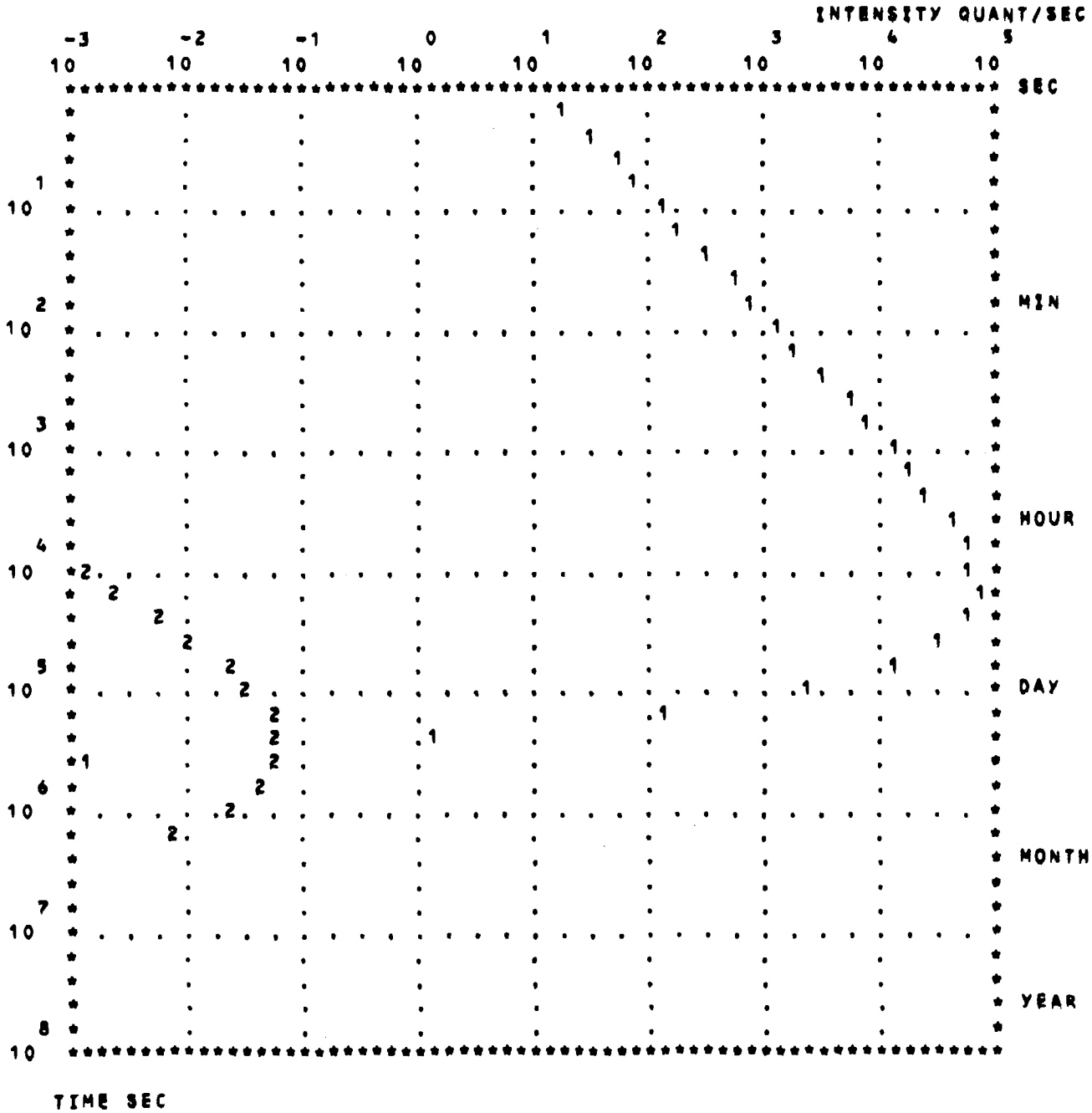
COBALT 10^{13} N/SM^{2} SEC 1.0 MG

1 -	59CO	100. %	20.6(8) B	60CO(10.5 M)	60CO	58.603 KEV	2.02
2 -			16.8(8) B	60CO(5.3 Y)	60NI	1332.5 KEV	100
3 -	60CO		2.0(2) B	61CO(1.65 H)	61NI	67.415 KEV	86



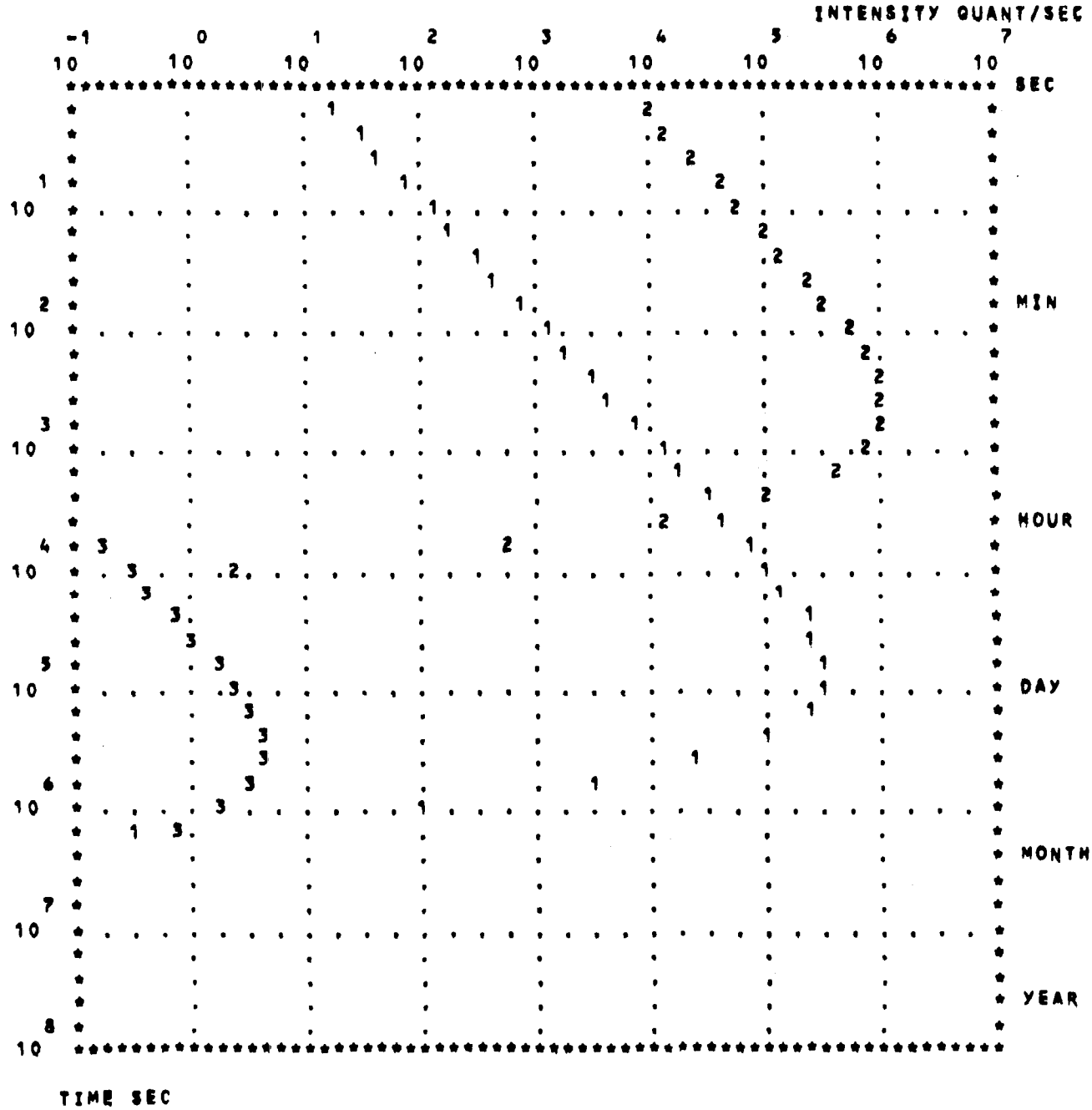
NICKEL 10^{13} N/SM 10^{2} SEC 1.0 MG

1 -	64NI	0.91 %	1.52(3) B	65NI(2.5 M)	65CU	1481.8 KEV	23.5
	65NI		22.4(20) B	66NI(2.27 D)		NO GAMMAS	
2 -				66CU(5.1 M)	66ZN	1039.2 KEV	8



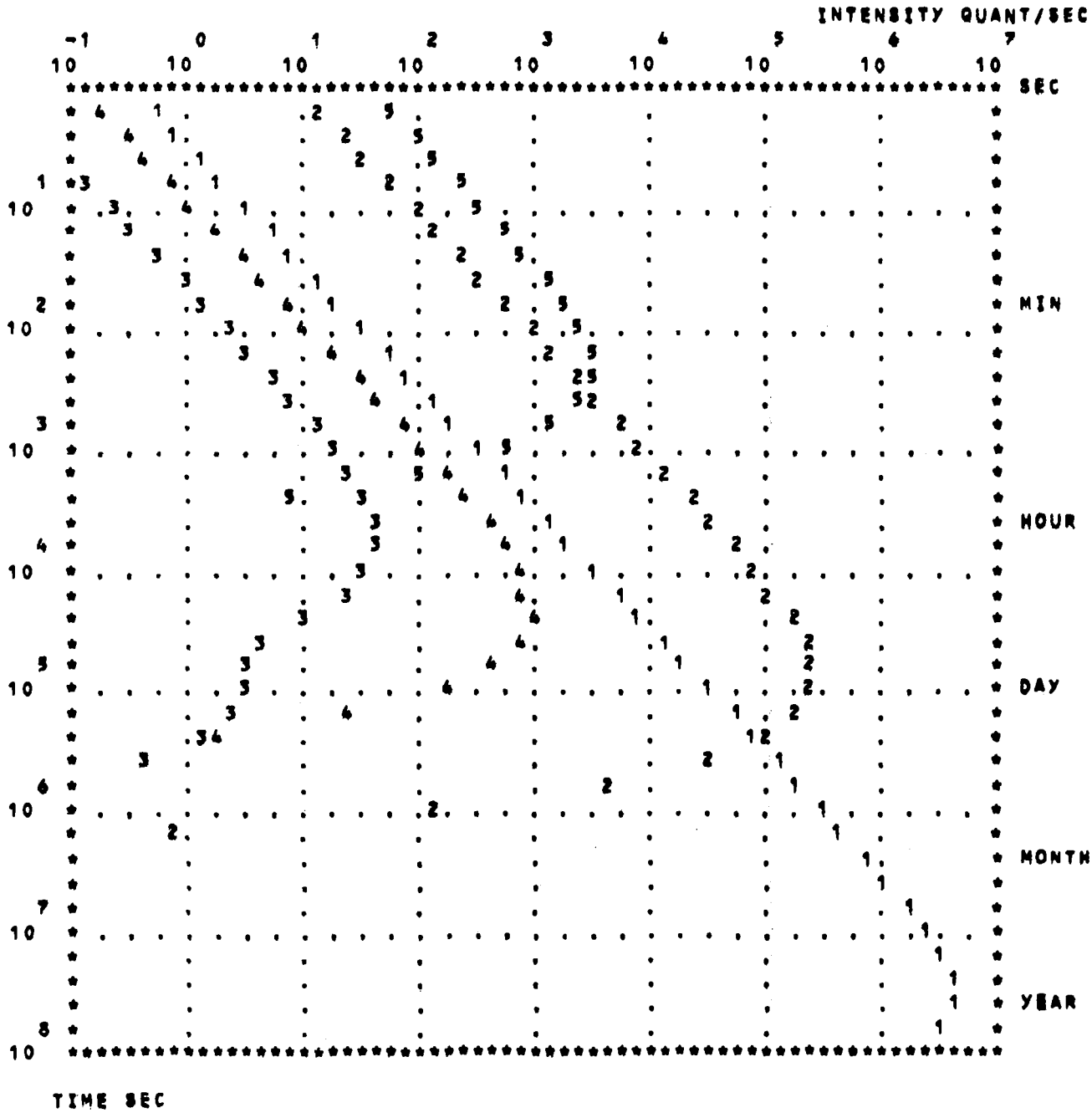
COPPER 10^{13} N/SM^2 SEC 1.0 MG

1 -	63CU 69.17 %	4.50(2) B	64CU(12.7 M)	64NI	1345.8 KEV	0.48
2 -	65CU 30.83 %	2.17(3) B	66CU(5.1 M)	66ZN	1039.2 KEV	8
3 -	66CU	135(10) B	67CU(2.6 D)	67ZN	184.58 KEV	48.7



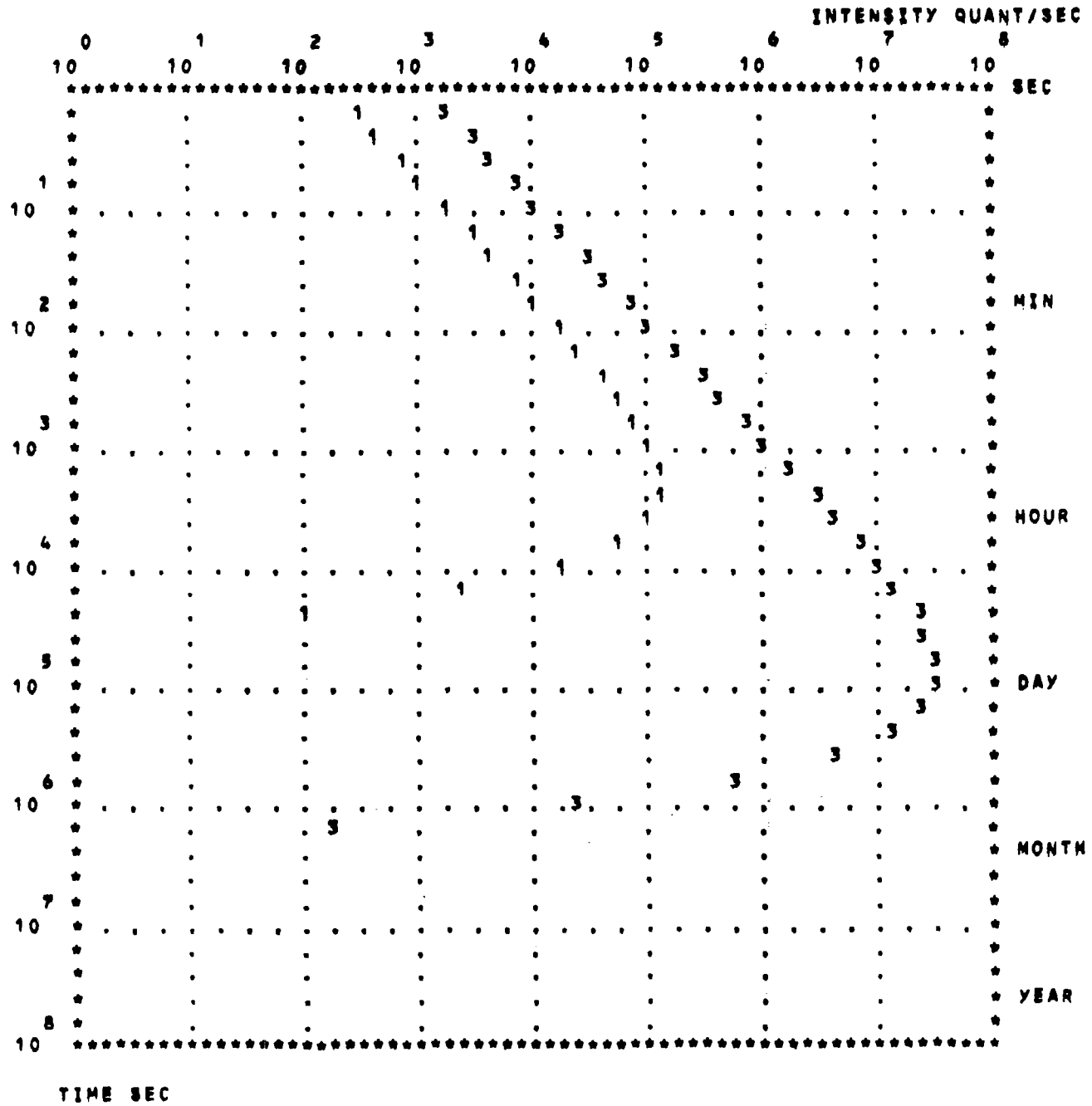
ZINC 10^{13} N/SM^2 SEC 1.0 MG

1 -	64ZN	48.6 %	0.76(2) B	65ZN(244 D)	65CU	1115.5 KEV	51
2 -	68ZN	18.8 %	0.072(4) B	69ZN(13.8 H)	69ZN	438.63 KEV	95
3 -			1.0(1) B	69ZN(57 M)	69GA	318.4 KEV	0.0012
4 -	70ZN	0.6 %	0.0087(5) B	71ZN(3.9 H)	71GA	386.28 KEV	93
5 -			0.083(5) B	71ZN(2.45 M)	71GA	511.6 KEV	32.0



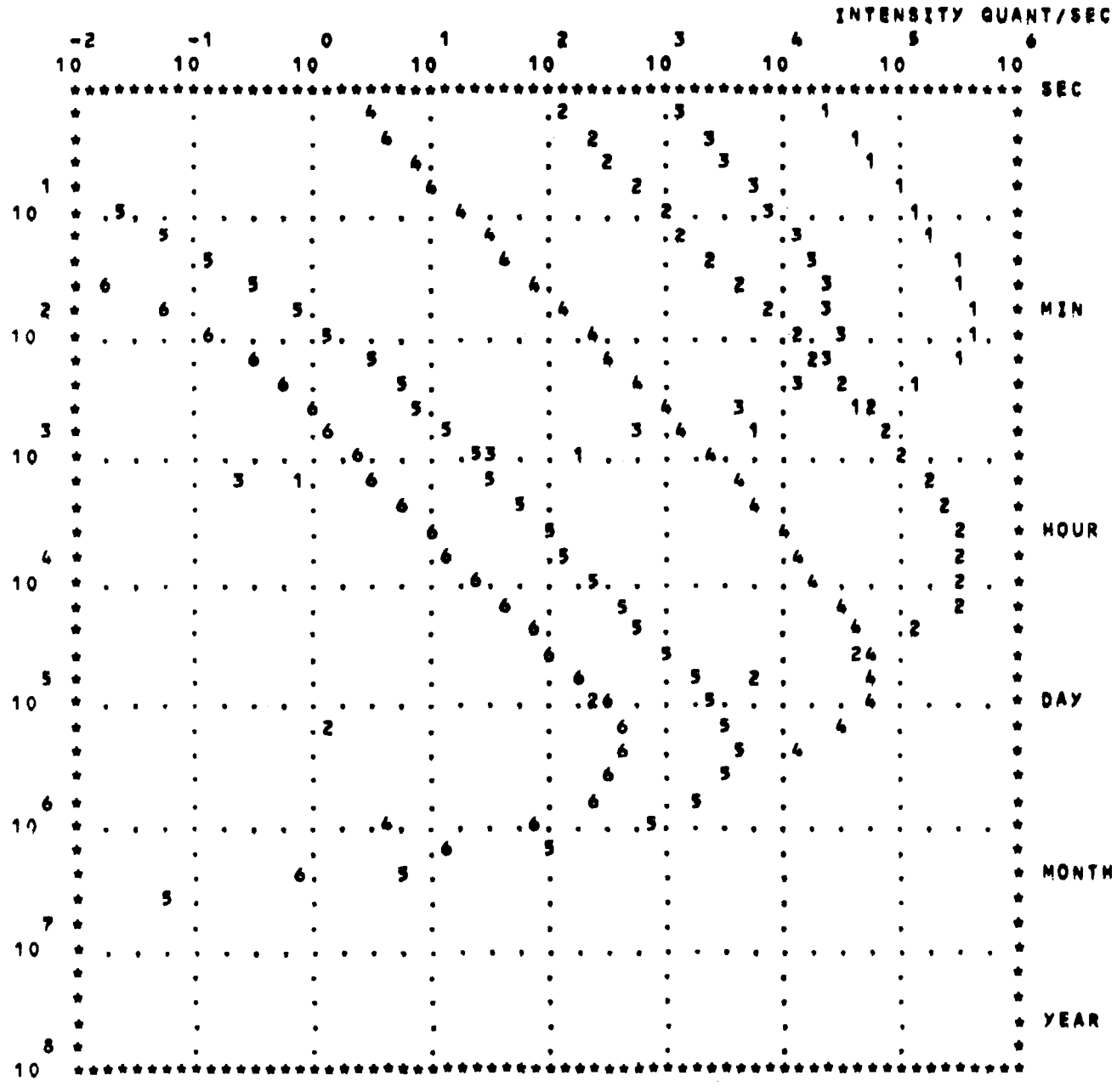
GALLIUM 10^{13} N/SM² SEC 1.0 MG

1 -	69GA	60.1 %	1.68(7) B	70GA(21.1 M)	70GE	1039.2 KEV	0.68
2 -	71GA	39.9 %	0.15(5) B	72GA(0.040 S)	72GA	103.23 KEV	50
3 -			4.56(24) B	72GA(14.1 H)	72GE	834.03 KEV	96



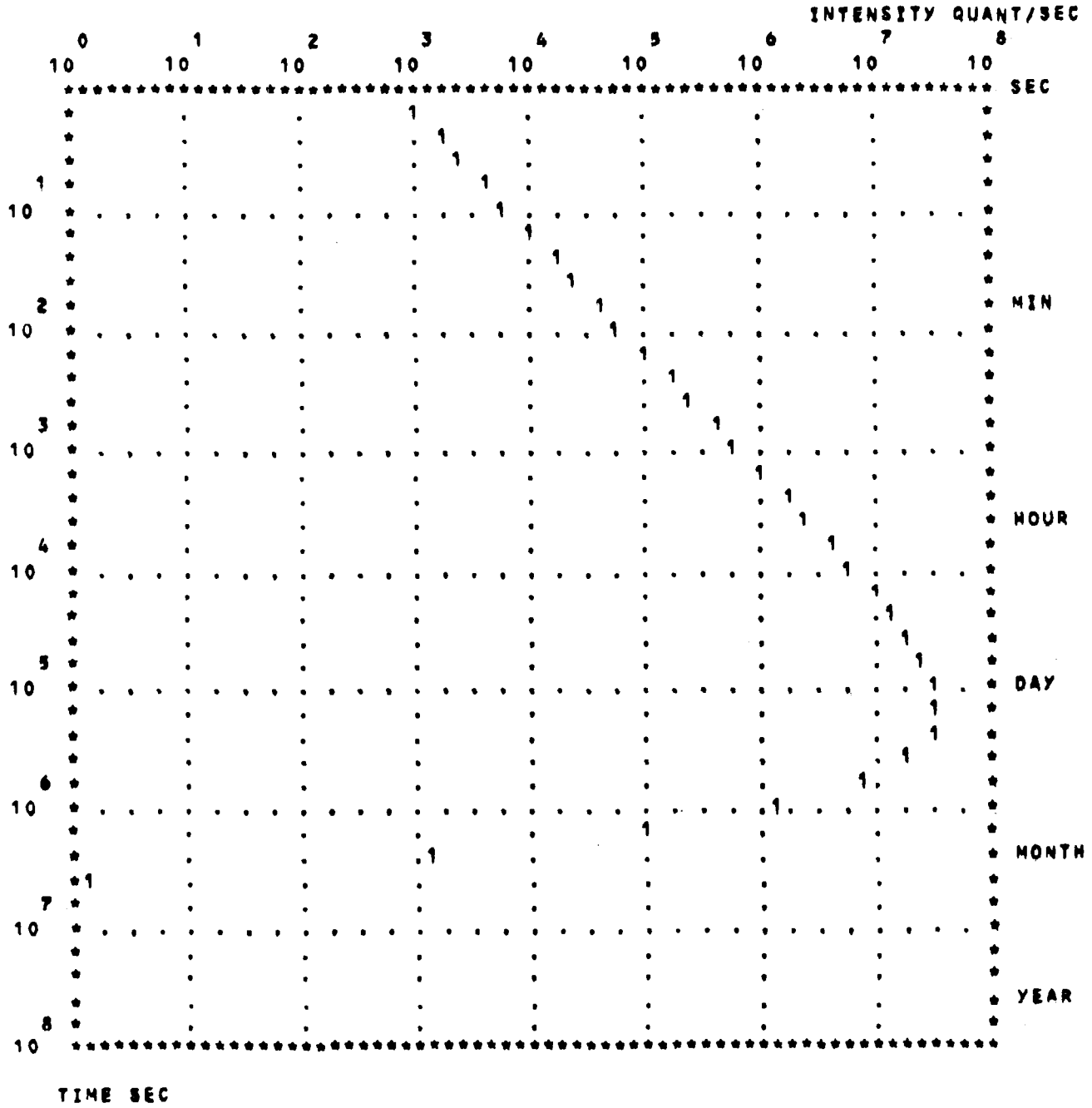
GERMANIUM 10^{13} N/SM^{2} SEC 1.0 MG

	70GE	20.5 %	3.43(20) B	71GE(11.8 D)		NO GAMMAS		
1 -	74GE	36.5 %	0.17(3) B	75GE(48 S)	75GE	139.68 KEV		38.8
2 -			0.36(8) B	75GE(1.38 H)	75AS	264.6 KEV		11.3
3 -	76GE	7.8 %	0.10(1) B	77GE(53 S)	77AS	215.5 KEV		20.9
4 -			0.06(1) B	77GE(11.3 H)	77AS	264.44 KEV		51
5 -				77AS(1.62 D)	77SE	239.1 KEV		1.59
6 -				77SE(17.4 S)	77SE	162.0 KEV		52



ARSENIC 10^{13} N/SM^2 SEC 1.0 MG

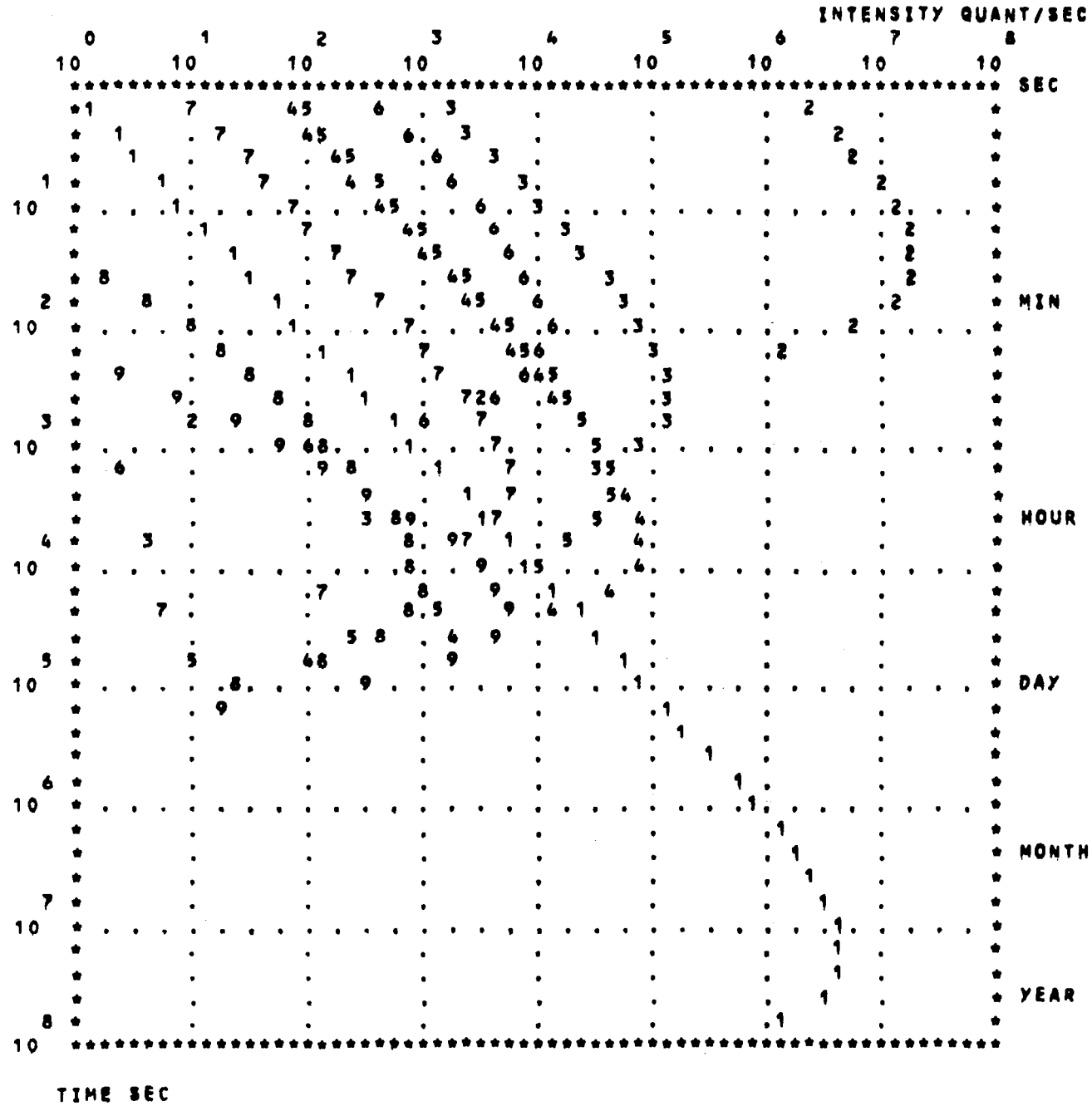
1 - 75AS 100. % 4.5(1) B 76AS(1.10 D) 76SE 559.10 KEV 44.7



SELENIUM

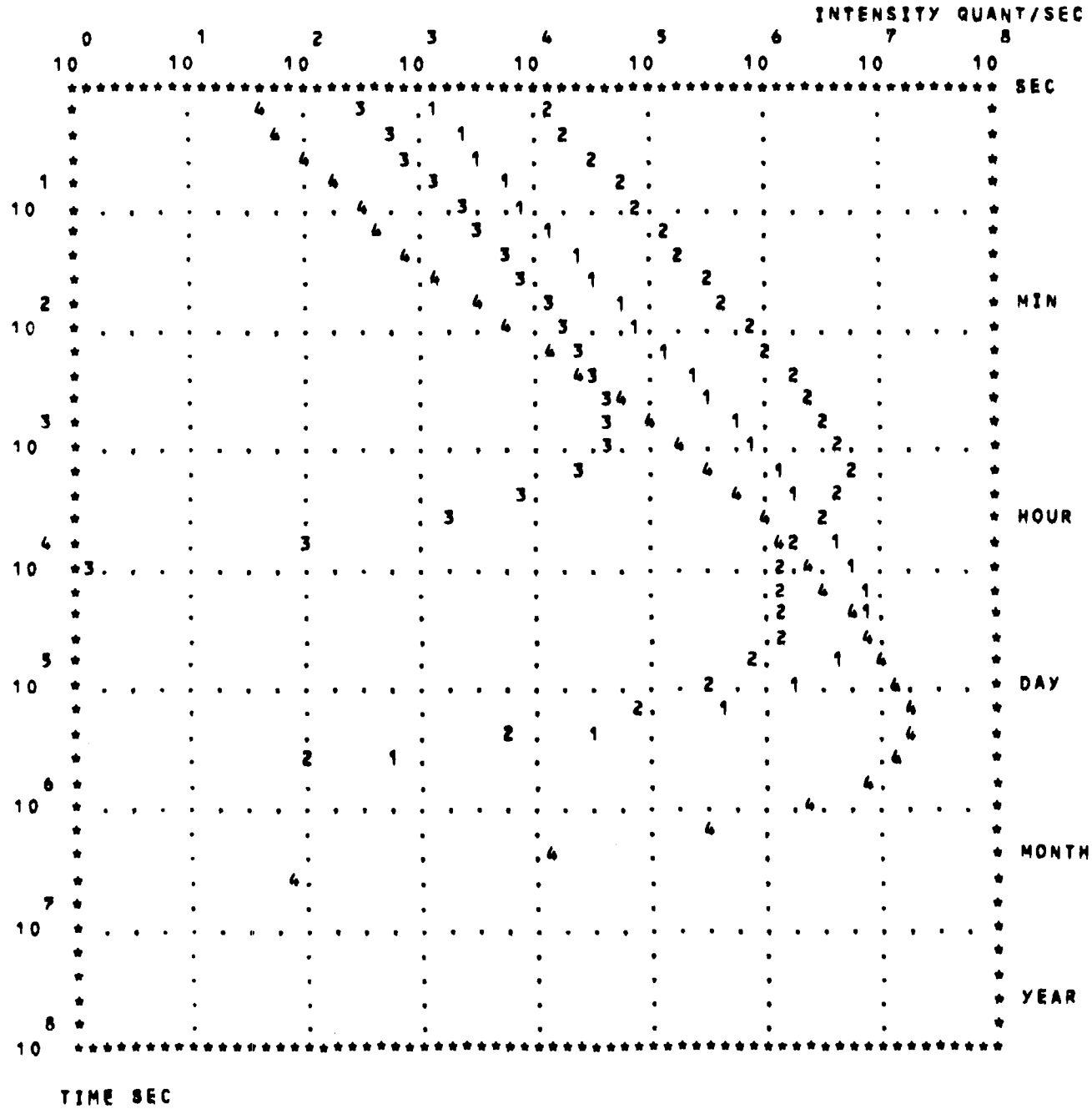
10^{13} N/SM ^{2} SEC 1.0 MG

1 -	74SE	0.9 %	51.8(12) B	75SE(120 D)	75AS	264.66	KEV	59
2 -	76SE	9. %	22(1) B	77SE(17.4 S)	77SE	162.0	KEV	52
3 -	78SE	23.5 %	0.38(2) B	79SE(3.9 M)	79SE	95.75	KEV	9.5
4 -	80SE	49.6 %	0.08(1) B	81SE(57 M)	81SE	103.00	KEV	12.6
5 -			0.53(4) B	81SE(18.5 M)	81BR	275.90	KEV	0.87
6 -	82SE	9.4 %	0.039(3) B	83SE(1.17 M)	83BR	1030.5	KEV	20.9
7 -			0.0052(4) B	83SE(22.5 M)	83BR	356.66	KEV	69
8 -				83BR(2.39 H)	83KR	529.5	KEV	1.30
9 -				83KR(1.85 H)	83KR	9.40	KEV	5.4



BROMINE 10^{13} N/SM ^{2} SEC 1.0 MG

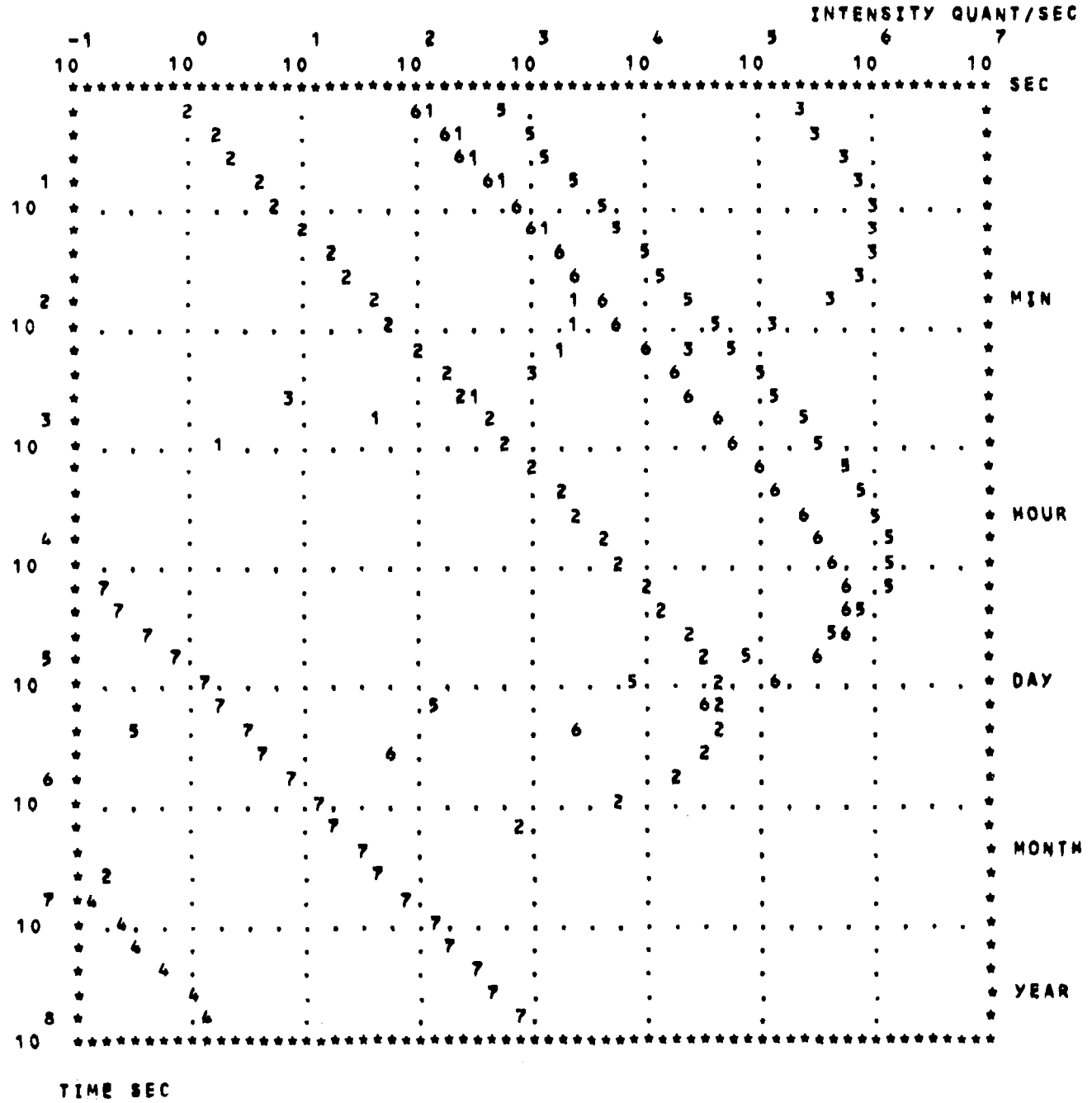
1 -	79BR 50.69 %	2.4(6) B	80BR(4.4 M)	80BR	37.052 KEV	39
2 -		8.6(4) B	80BR(17.4 M)	80KR	616.20 KEV	6.6
3 -	81BR 49.31 %	2.4(4) B	82BR(6.1 M)	82BR	46 KEV	0.238
4 -		0.26( ) B	82BR(1.47 D)	82KR	776.49 KEV	84



KRYPTON

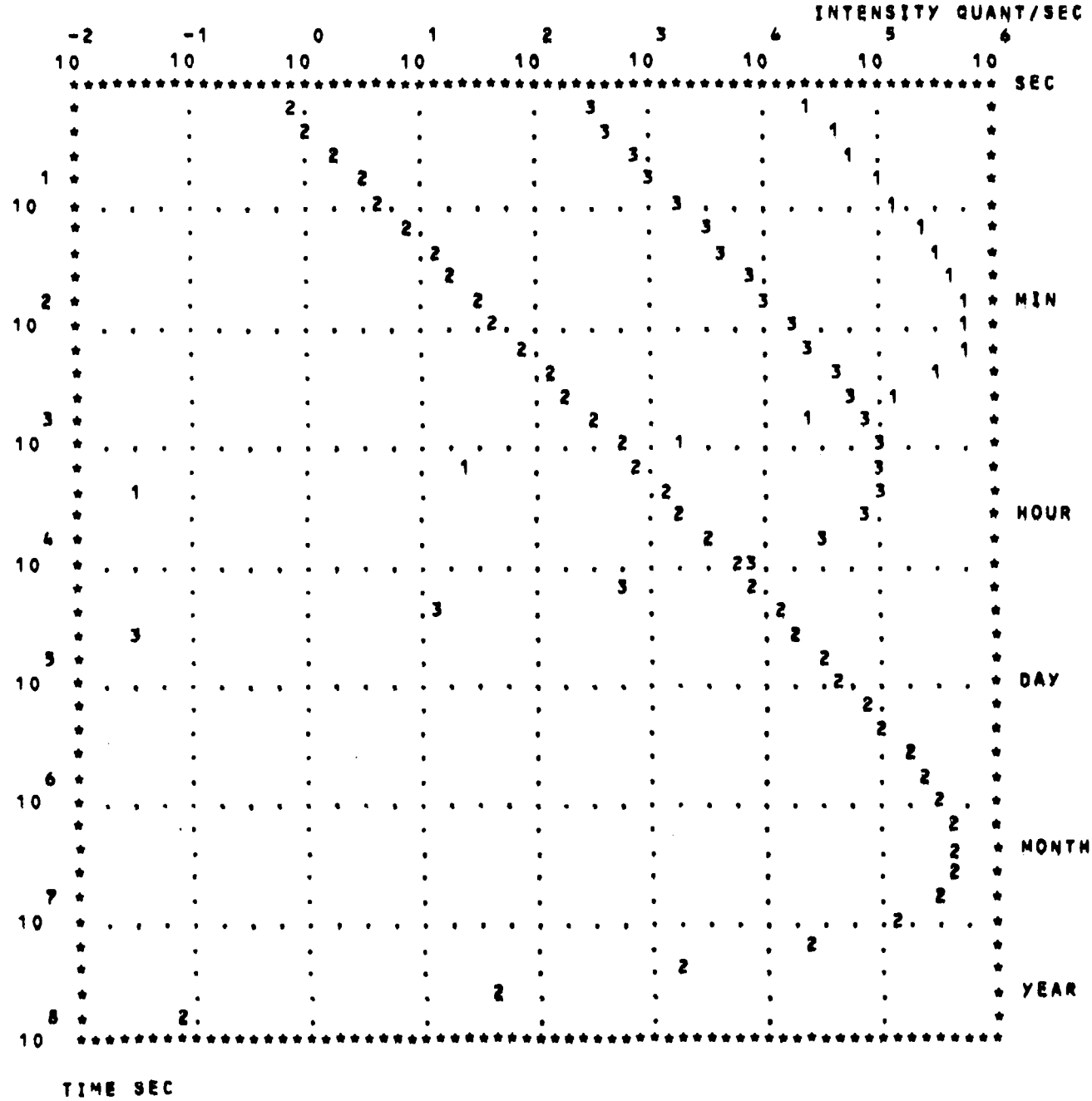
10^{13} N/SM SEC 1.0 MG

1 -	78KR	0.35 %	0.17(2) B	79KR(50 S)	79KR	130.01 KEV	27.0
2 -			6.0(9) B	79KR(1.46 D)	79BR	261.26 KEV	12.7
3 -	80KR	2.25 %	4.5(6) B	81KR(13.0 S)	81KR	190.00 KEV	67
4 -			6.9(8) B	81KR(210E3 Y)	81BR	275.99 KEV	2.
5 -	82KR	11.6 %	14.0(25) B	83KR(1.83 H)	83KR	9.40 KEV	5.4
6 -	84KR	57. %	0.090(13) B	85KR(4.5 H)	85RB	151.17 KEV	75
7 -			0.042(4) B	85KR(10.7 Y)	85RB	517 KEV	0.434



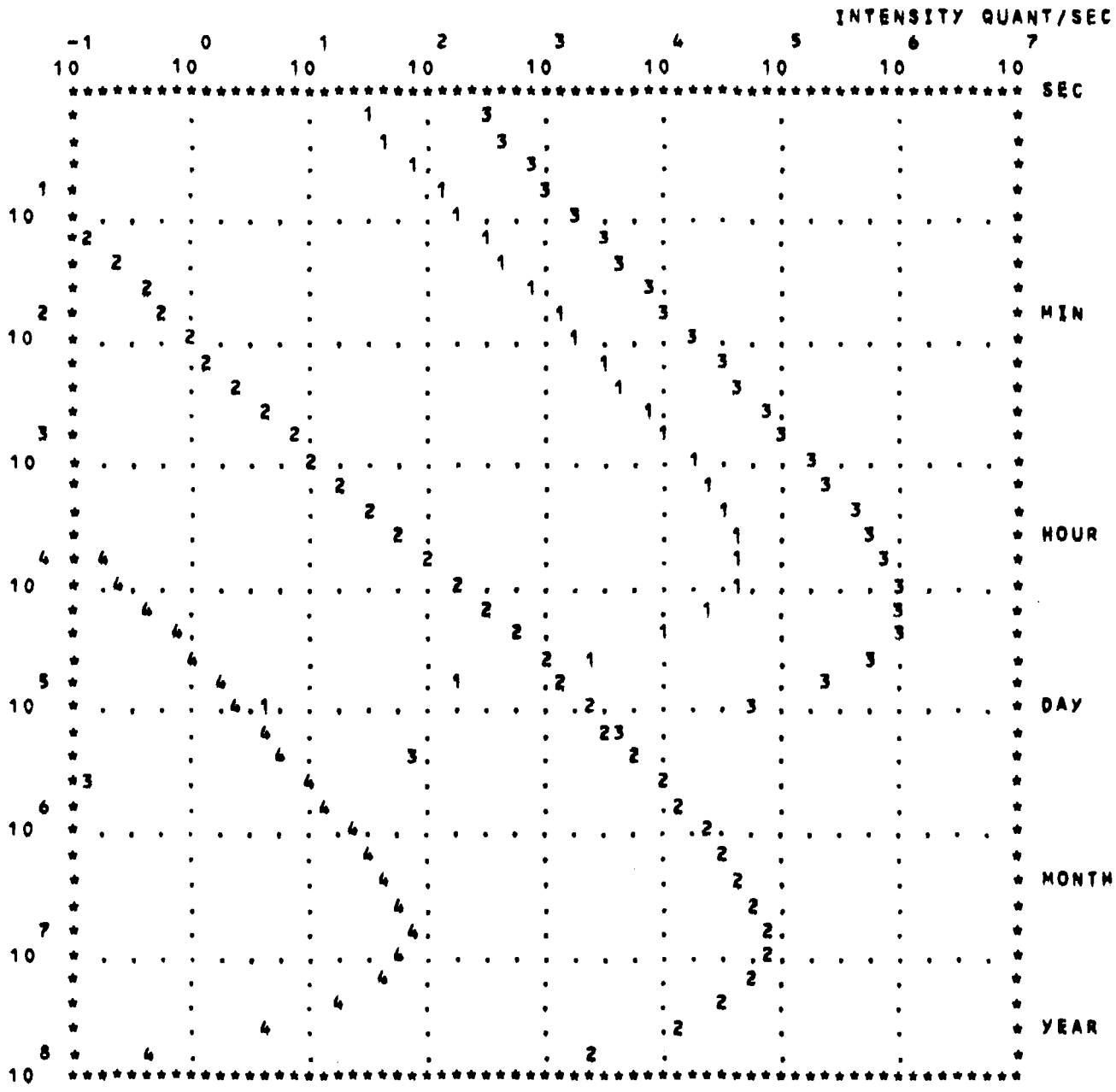
RUBIDIUM 10^{13} N/SM^2 SEC 1.0 MG

1 -	85RB 72.17 %	0.053(8) B	86RB(1.02 M)	86RB	556.07	KEV	98
2 -		0.427(11) B	86RB(18.7 D)	86SR	1076.6	KEV	8.8
3 -	87RB 27.83 %	0.12(3) B	88RB(17.8 M)	88SR	1836.0	KEV	21.4
4 -	88RB	1.0(3) B	89RB(15.2 M)	89SR	1031.9	KEV	58
5 -			89SR(50 D)	89Y	909.1	KEV	0.0093



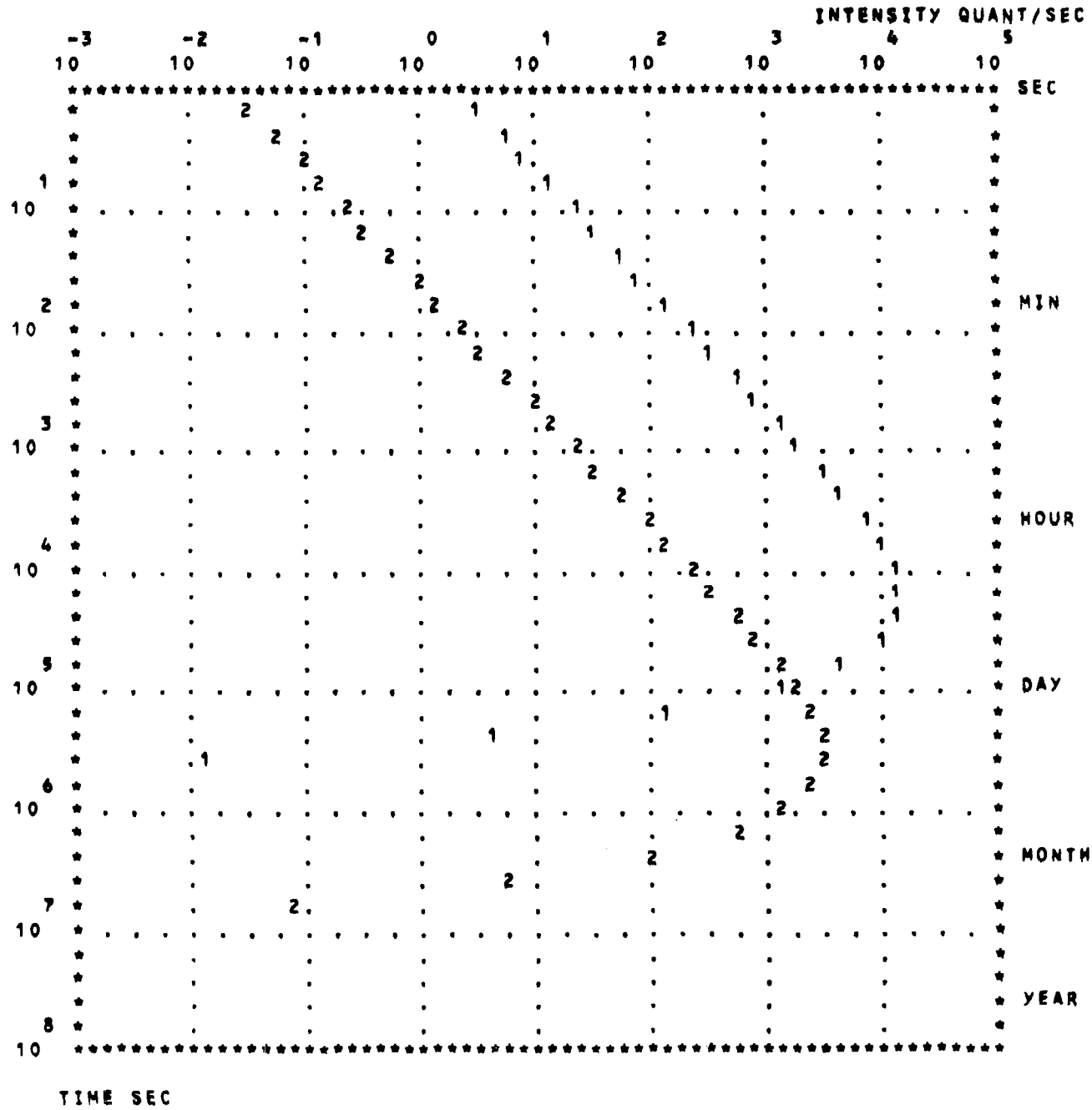
STRONTIUM 10^{13} N/SM^2 SEC 1.0 MG

1 -	84SR	0.56 %	0.60(6) B	85SR(1.13 H)	85SR	231.67 KEV	84	
2 -			0.35(7) B	85SR(65 D)	85RB	513.99 KEV	98	
3 -	86SR	9.86 %	0.84(6) B	87SR(2.8 H)	87SR	388.40 KEV	82	
4 -	88SR	82.58 %	0.0580(4) B	89SR(50 D)	89Y	909.1 KEV	0.0093	
5 -				90Y (2.7 D)	90ZR	1760.7 KEV	0.016	



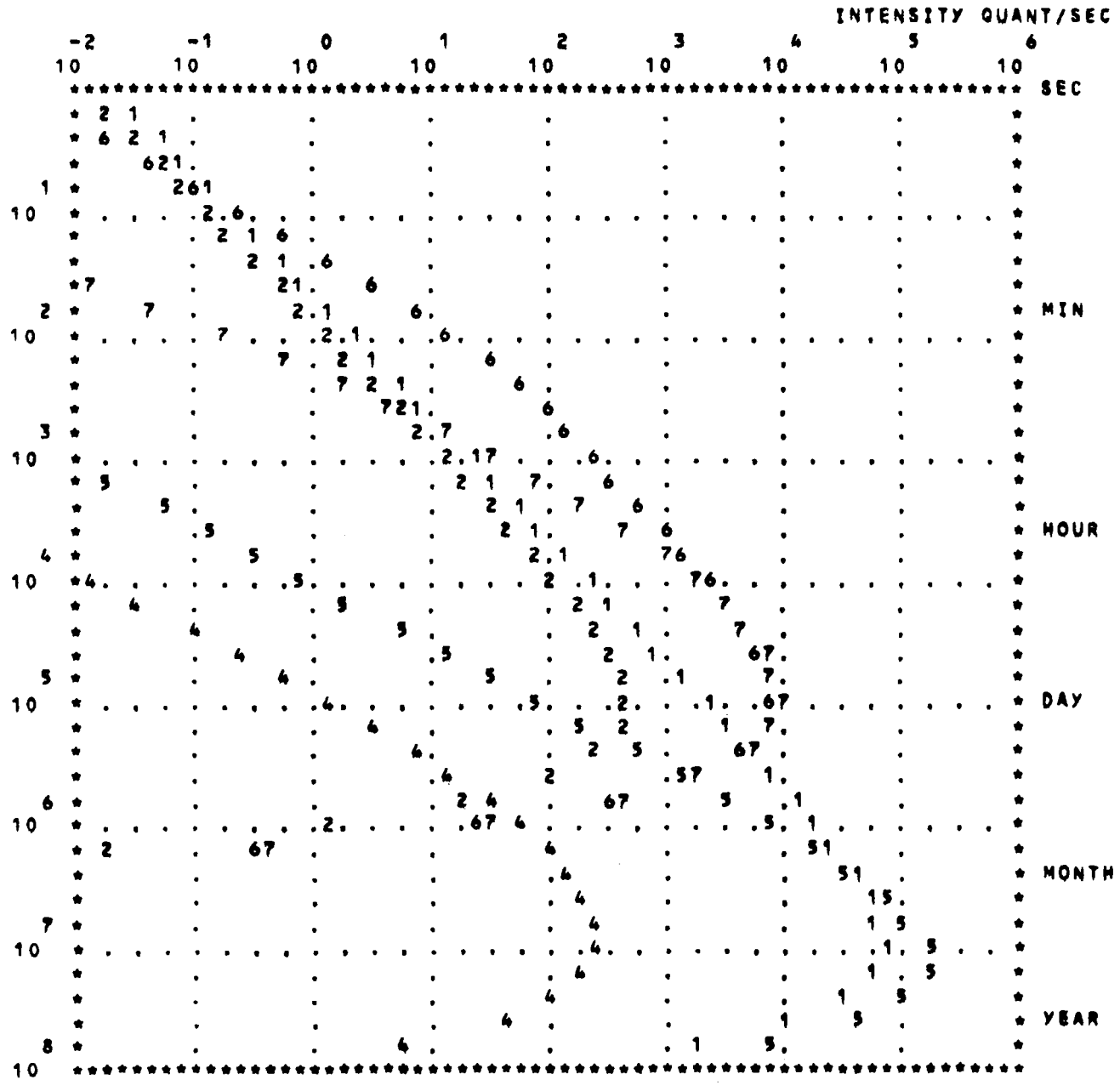
YTTRIUM 10^{13} N/SM 10^{2} SEC 1.0 MG

1 -	89Y	100. %	0.0010(2)	B	90Y (3.2 H)	90Y	202.51	KEV	97
2 -			1.279(20)	B	90Y (2.7 D)	90ZR	1760.7	KEV	0.016



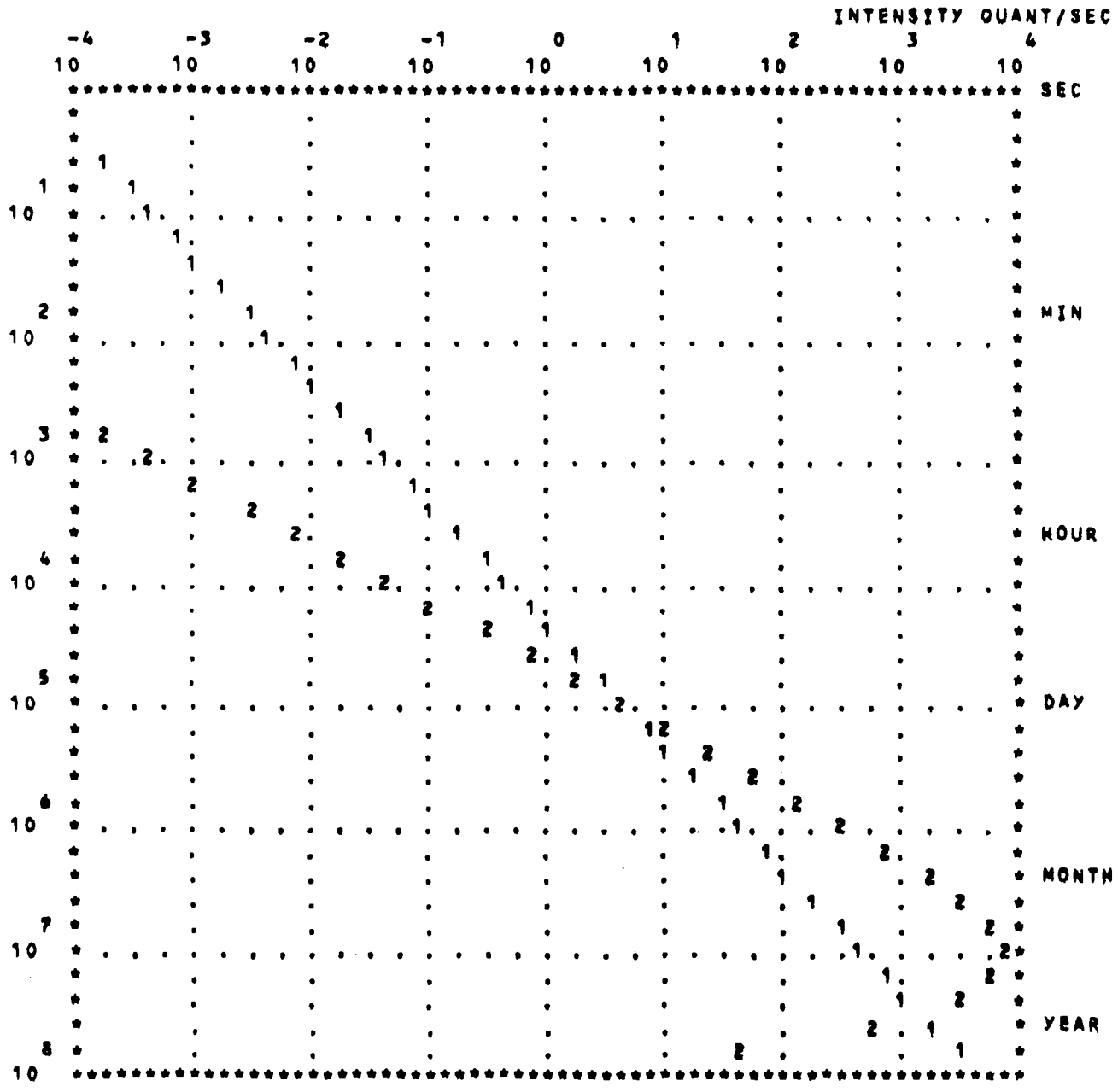
ZIRCONIUM 10^{13} N/SM ^{2} SEC 1.0 MG

1 -	94ZR	17.28 %	0.0499(24) B	95ZR(64 D)	95NB	756.74 KEV	55
2 -	96ZR	2.76 %	0.0229(10) B	97ZR(16.9 H)	97NB	507.63 KEV	5.1
3 -				93NB(13.6 Y)	93NB	30.4 KEV	5.3E-6
4 -				95NB(3.6 D)	95NB	234.70 KEV	26.1
5 -				95NB(35 D)	95MO	765.83 KEV	100
6 -				97NB(1.0 M)	97NB	743.36 KEV	98
7 -				97NB(1.20 M)	97MO	657.92 KEV	98



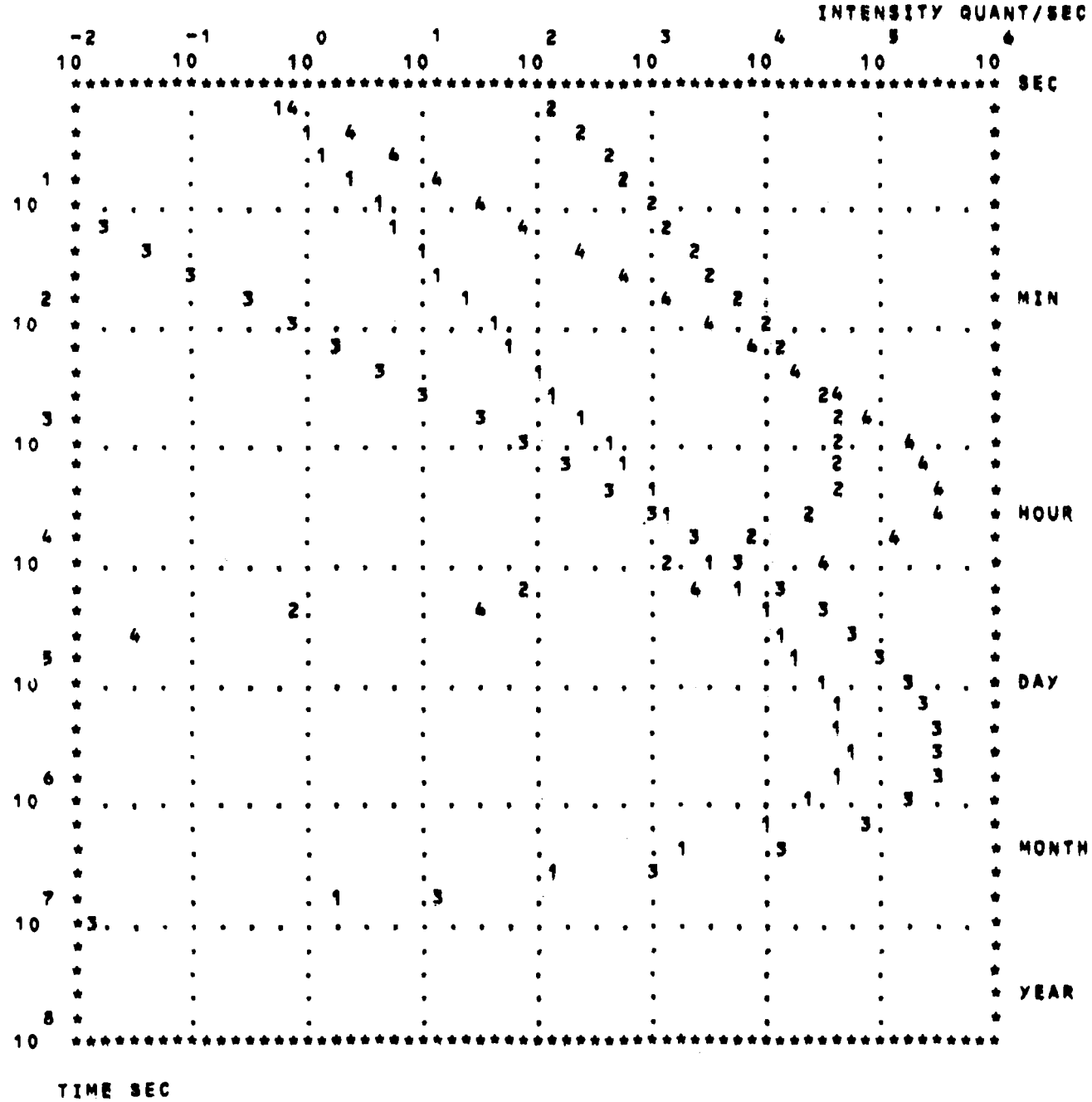
NIOBIUM 10^{13} N/SM^2 SEC 1.0 MG

1 -	93NB	100. %	1.15(5) B	94NB(203E2 Y)	94MO	871.10 KEV	100
2 -	94NB		14.9(10) B	93NB(35 D)	93MO	765.83 KEV	100



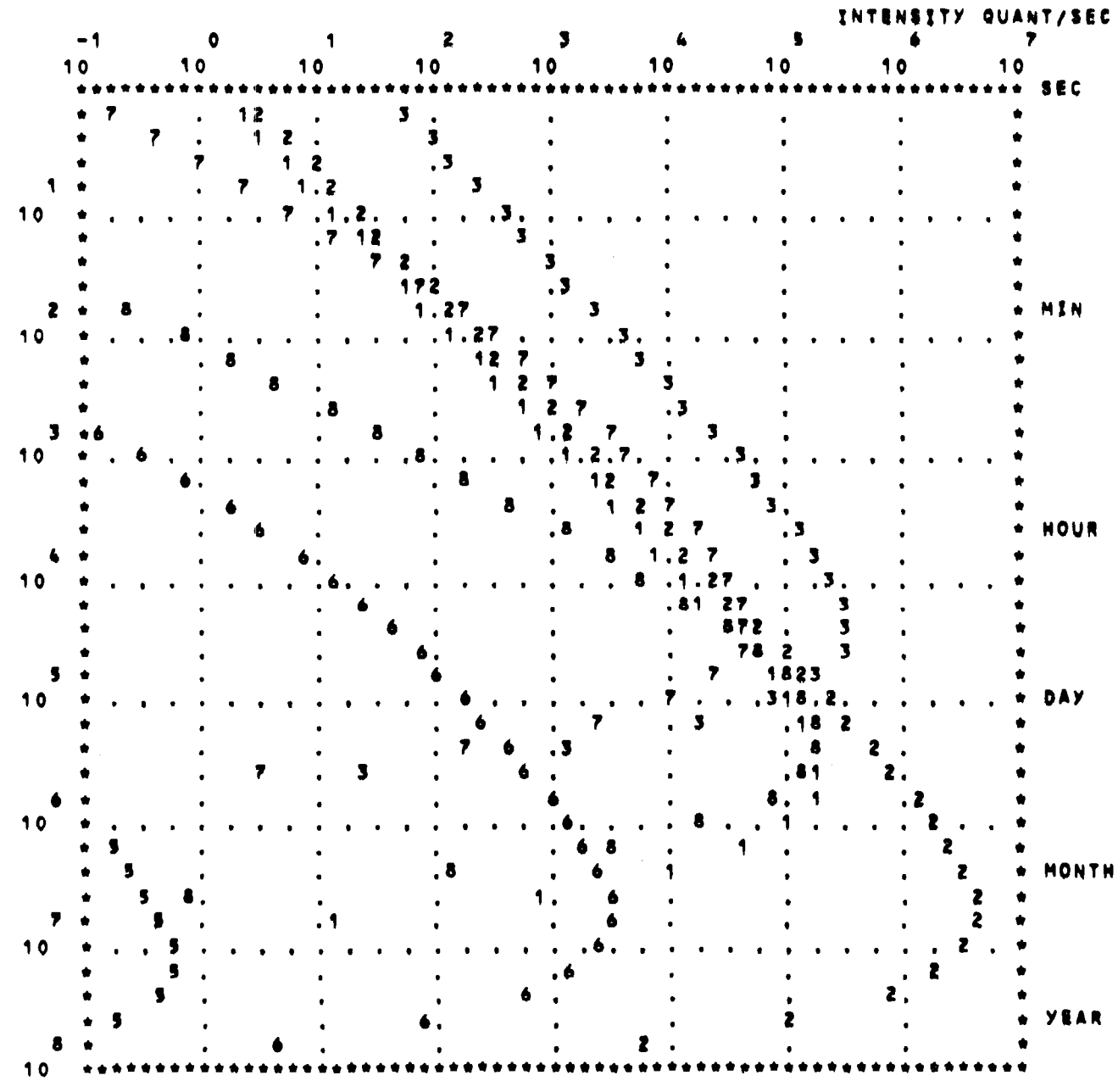
MOLYBDENUM 10^{13} N/SM^{2} SEC 1.0 MG

1 -	98MO	24.13 %	0.130(6) B	99MO(	2.8 D)	99TC	739.50 KEV	12.2
2 -	100MO	9.63 %	0.199(3) B	101MO(	14.6 M)	101TC	191.92 KEV	18.8
3 -				99TC(	6.0 H)	99TC	140.47 KEV	89
4 -				101TC(	14.2 M)	101RU	306.83 KEV	88



RUTHENIUM 10^{13} N/SM 10^{2} SEC 1.0 MG

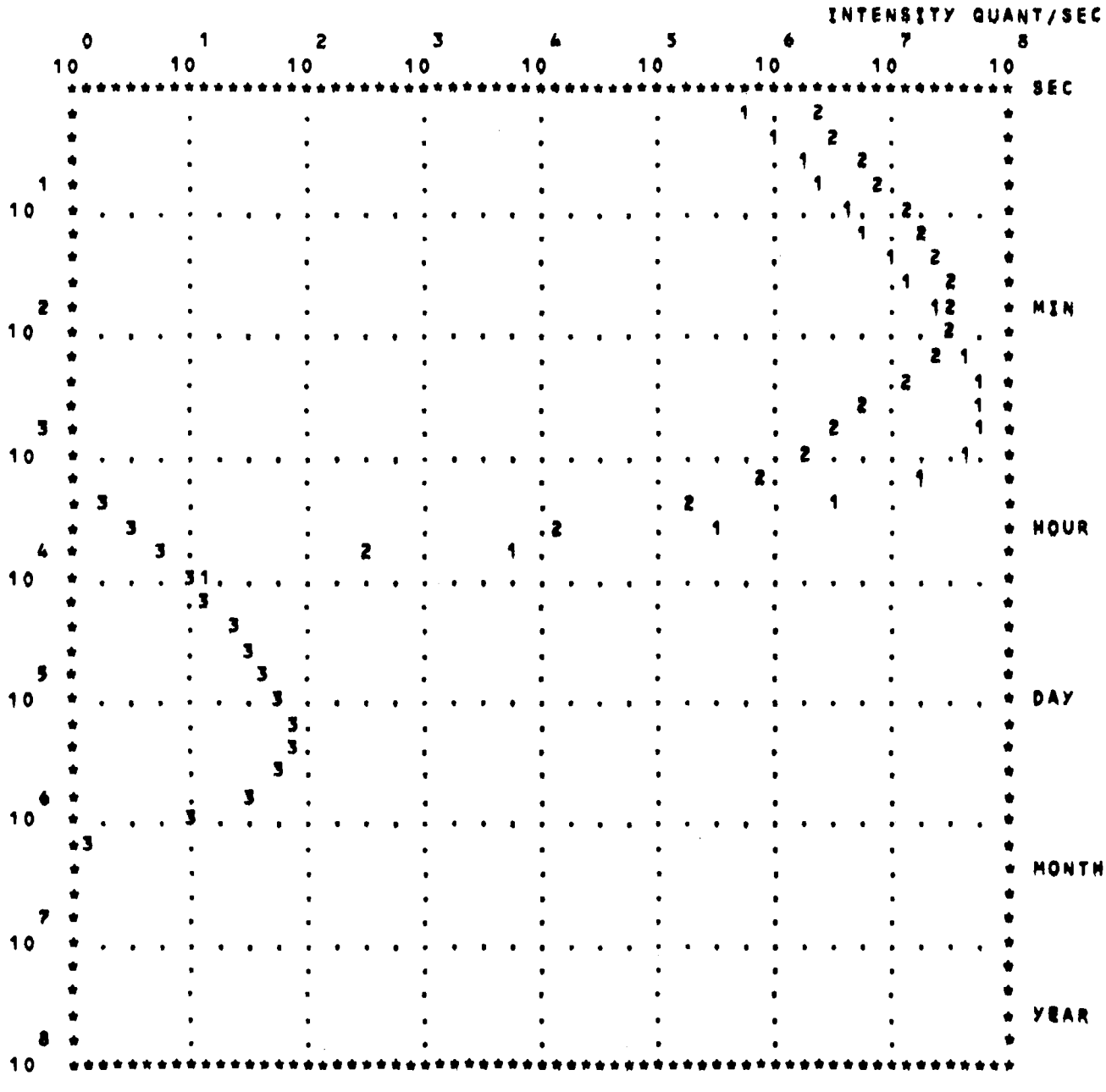
1 -	96RU	5.52 %	0.29(2) B	97RU(	2.9 D)	97TC	215.68 KEV	86
2 -	102RU	31.61 %	1.21(7) B	103RU(	39 D)	103RH	497.08 KEV	89
3 -	104RU	18.6 %	0.32(2) B	105RU(	4.4 H)	105RH	724.21 KEV	46.7
	105RU		0.39(6) B	106RU(	1.02 Y)		NO GAMMAS	
4 -	106RU		0.15(4) B	107RU(	4.2 M)	107RH	194.50 KEV	14.3
5 -				97TC(	89 D)	97TC	96.5 KEV	0.324
6 -				103RH(	56 M)	103RH	39.755 KEV	0.068
7 -				105RH(	45 S)	105RH	129.57 KEV	20
8 -				105RH(	1.47 D)	105PD	318.9 KEV	19.2
9 -				106RH(	30 S)	106PD	511.86 KEV	20.7
A -				107RH(	21.7 M)	107PD	302.8 KEV	73
B -				107PD(	0.85 S)	107PD	115.7 KEV	52



RHODIUM

10^{13} N/BM SEC 1.0 MG

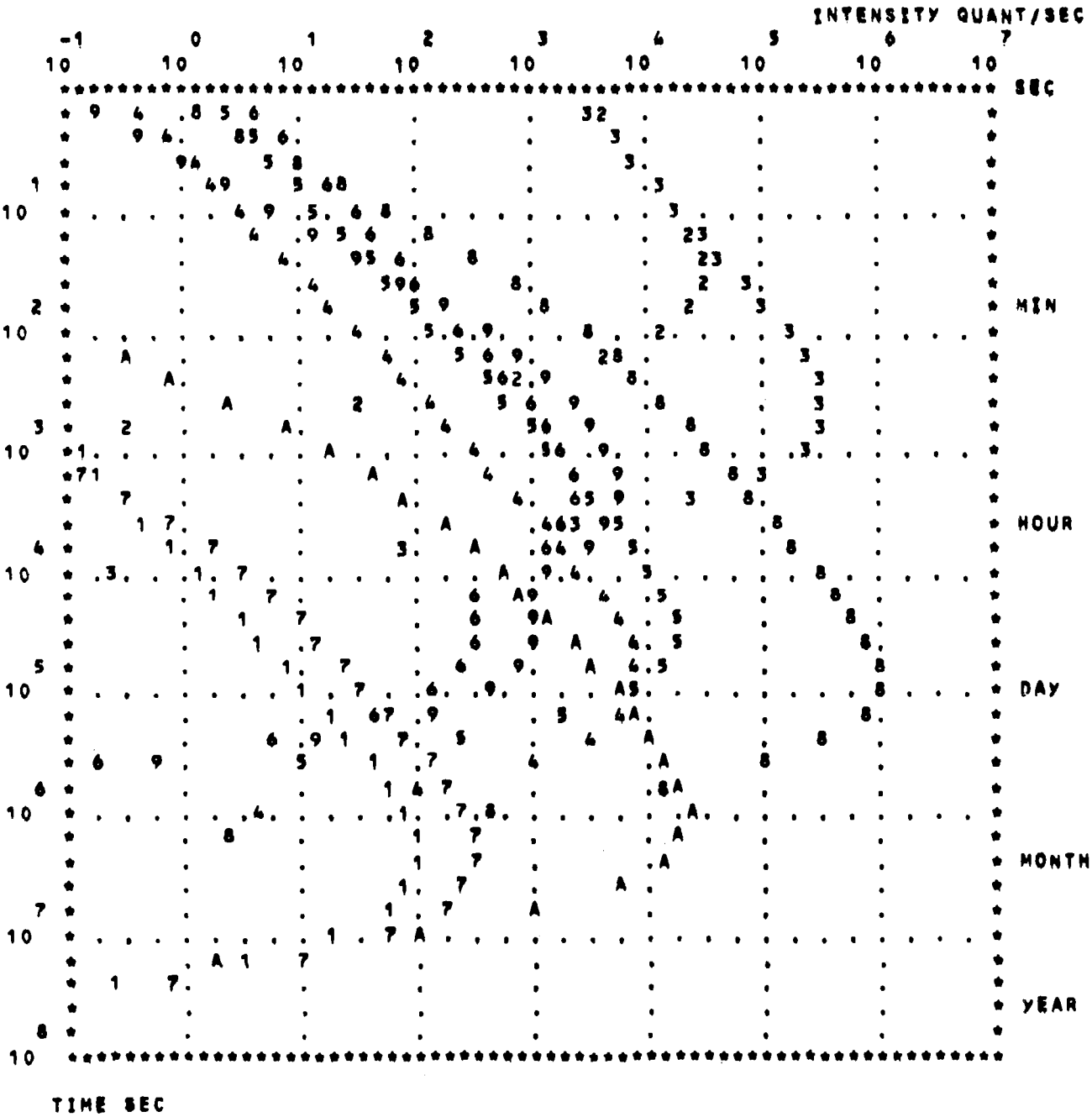
1 - 103RH	100. %		10(1) B	104RH(	4.3 M)104RH		51.422 KEV	48.2
2 -			135.0(22) B	104RH(	42 S)104PD		555.81 KEV	1.99
3 - 104RH			8E2(1) B	105RH(	1.67 D)105PD		318.9 KEV	19.2
4 - 105RH			5E3(1) B	106RH(	2.17 H)106PD		511.7 KEV	87
5 -			11E3(3) B	106RH(	30 S)106PD		511.86 KEV	20.7



PALLADIUM

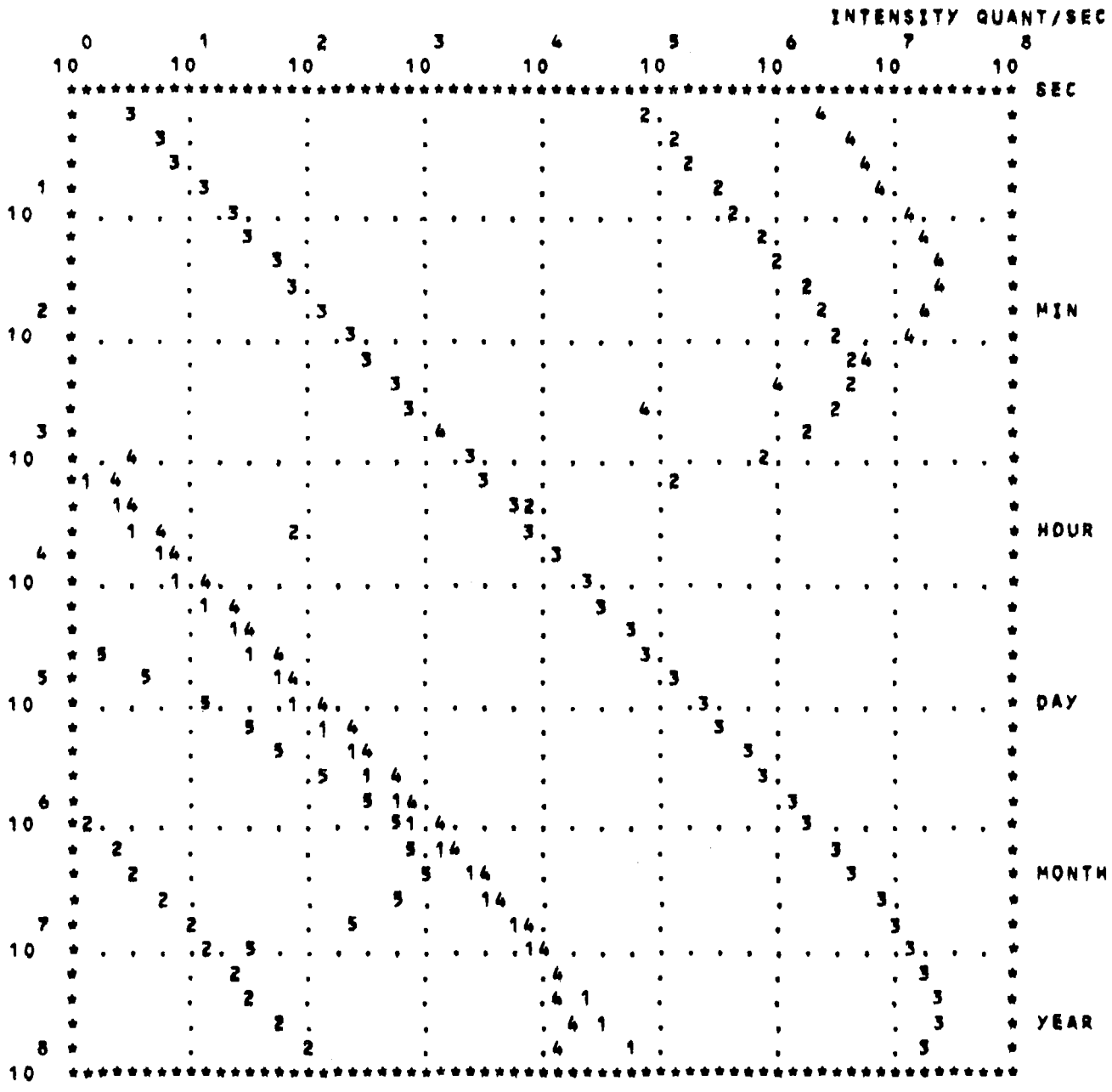
10^{13} N/SM ^{2} SEC 1.0 MG

1 =	102PD	1.02 %	3.4(3) B	103PD(	17.0 D)	103RH	357.65 KEV	0.0221
2 =	106PD	27.33 %	0.013(2) B	107PD(	21.3 S)	107PD	214 KEV	68
3 =	108PD	26.46 %	0.18(3) B	109PD(	4.7 M)	109PD	188.9 KEV	56
4 =			8.3(5) B	109PD(	13.4 H)	109AG	311.4 KEV	0.0319
5 =	110PD	11.72 %	0.037(6) B	111PD(	5.5 H)	111PD	172.18 KEV	34
6 =			0.19(3) B	111PD(	23.4 M)	111AG	580.00 KEV	0.84
7 =				103RH(	56 M)	103RH	39.755 KEV	0.068
8 =				109AG(	40 S)	109AG	88.04 KEV	3.61
9 =				111AG(	1.08 M)	111AG	59.77 KEV	1.96
A =				111AG(	7.4 D)	111CD	342.12 KEV	6.7



SILVER 10^{13} N/SM^2 SEC 1.0 MG

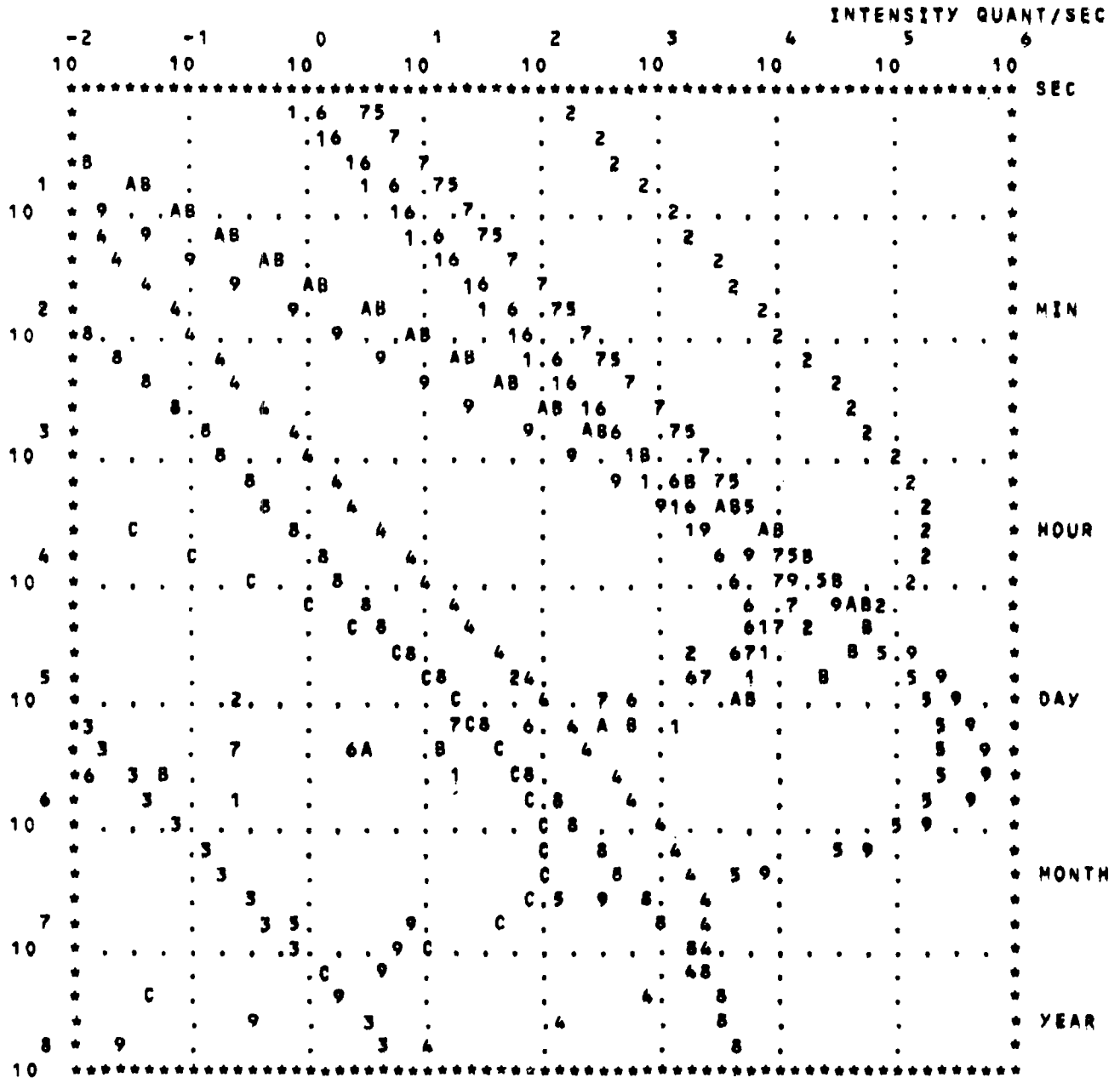
1 - 107AG 51.83 %	0.33(8) B	108AG(127 Y)108PD	722.95 KEV	91
2 -	37.3(12) B	108AG(2.37 M)108CD	632.98 KEV	1.75
3 - 109AG 48.17 %	4.7(2) B	110AG(250 D)110CD	657.75 KEV	95
4 -	86(3) B	110AG(24.6 S)110CD	657.75 KEV	4.50
5 - 110AG	82(11) B	111AG(7.4 D)111CD	342.12 KEV	6.7



TIME SEC

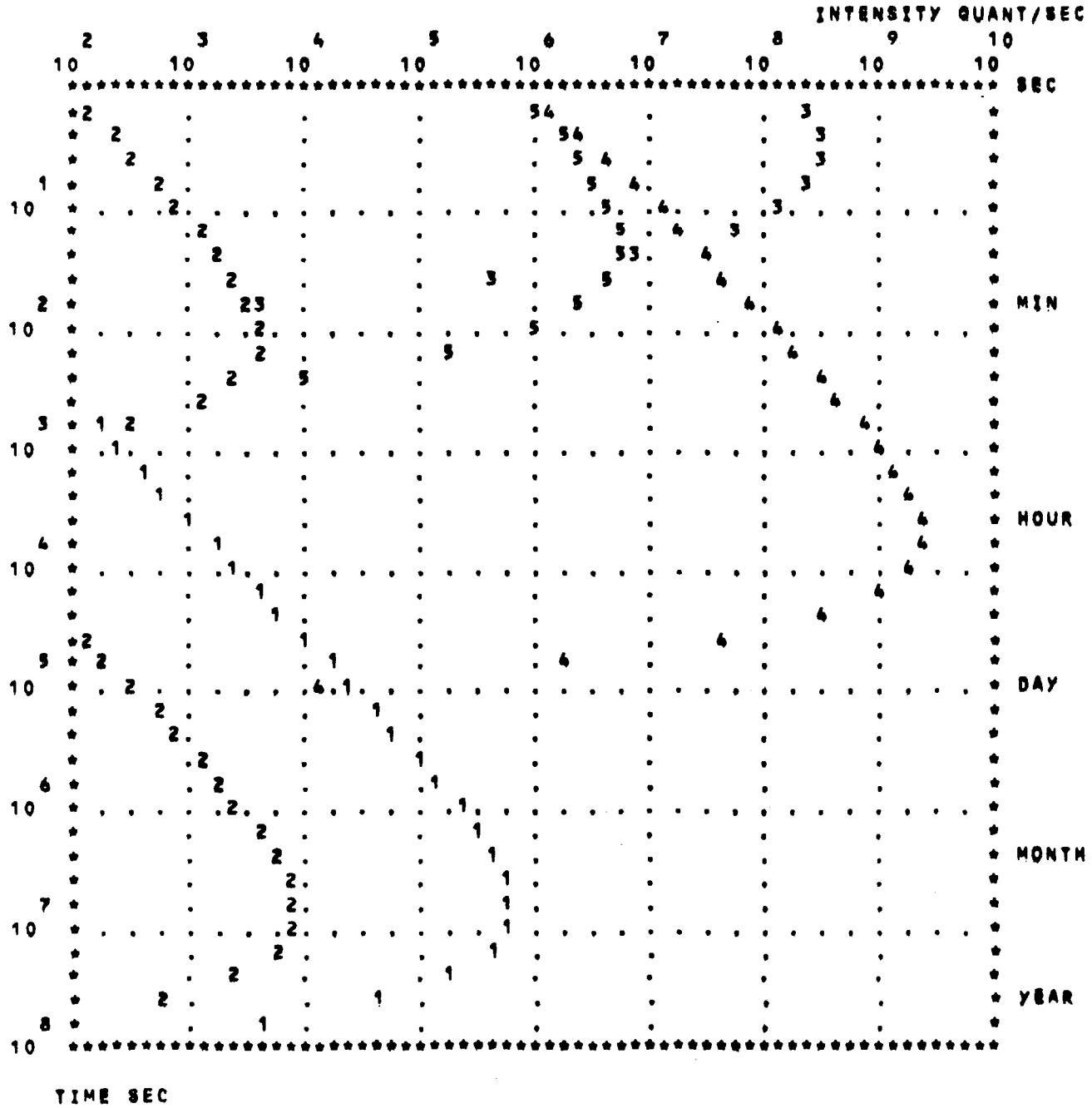
CADMIUM 10^{13} N/cm^2 SEC 1.0 MG

1 -	106CD	1.25 %	1.(*) B	107CD(	6.5	H)107AG	93.10	KEV	4.6
	108CD	0.89 %	1.1(3) B	109CD(	1.27	Y)	NO GAMMAS		
2 -	110CD	12.51 %	0.14(5) B	111CD(	49	M)111CD	245.39	KEV	94
3 -	112CD	24.13 %	0.030(15) B	113CD(	14.1	Y)113CD	263.7	KEV	0.0230
4 -	114CD	28.72 %	0.036(7) B	115CD(	45	D)115IN	933.86	KEV	2.0
5 -			0.30(2) B	115CD(	2.23	D)115IN	527.90	KEV	27.4
6 -	116CD	7.47 %	0.025(10) B	117CD(	3.4	H)117IN	1997.3	KEV	26.2
7 -			0.050(8) B	117CD(	2.49	H)117IN	273.35	KEV	27.9
8 -				109AG(	40	S)109AG	88.032	KEV	3.61
9 -				115IN(	4.5	H)115IN	336.24	KEV	46.7
A -				117IN(	1.94	H)117IN	315.30	KEV	100
B -				117IN(	44	M)117SN	552.9	KEV	100
C -			0.025(10) B	117SN(	13.6	D)117SN	158.56	KEV	86



INDIUM 10^{13} N/SM^2 SEC 1.0 MG

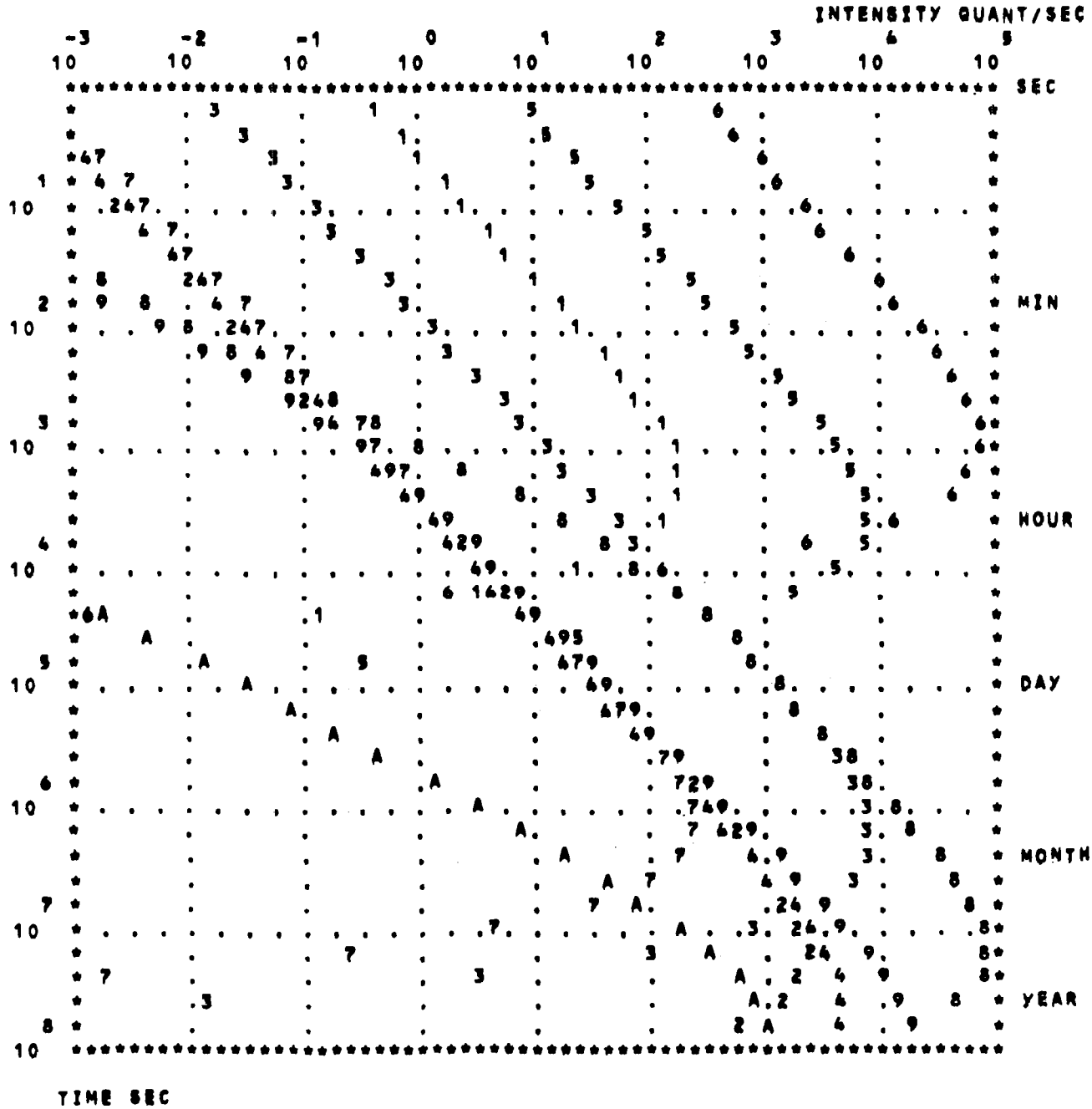
1 -	113IN	4.3 %	8.1(8) B	114IN(	50 D)	114IN	190.27 KEV	15.4
2 -			3.9(4) B	114IN(	1.20 M)	114SN	1299.8 KEV	0.201
3 -	115IN	95.7 %	81(8) B	116IN(	2.18 S)	116IN	162.39 KEV	36.6
4 -			162.3(7) B	116IN(	54 M)	116SN	1293.5 KEV	84
5 -			40(2) B	116IN(	14.1 S)	116SN	1293.5 KEV	1.3



TIN

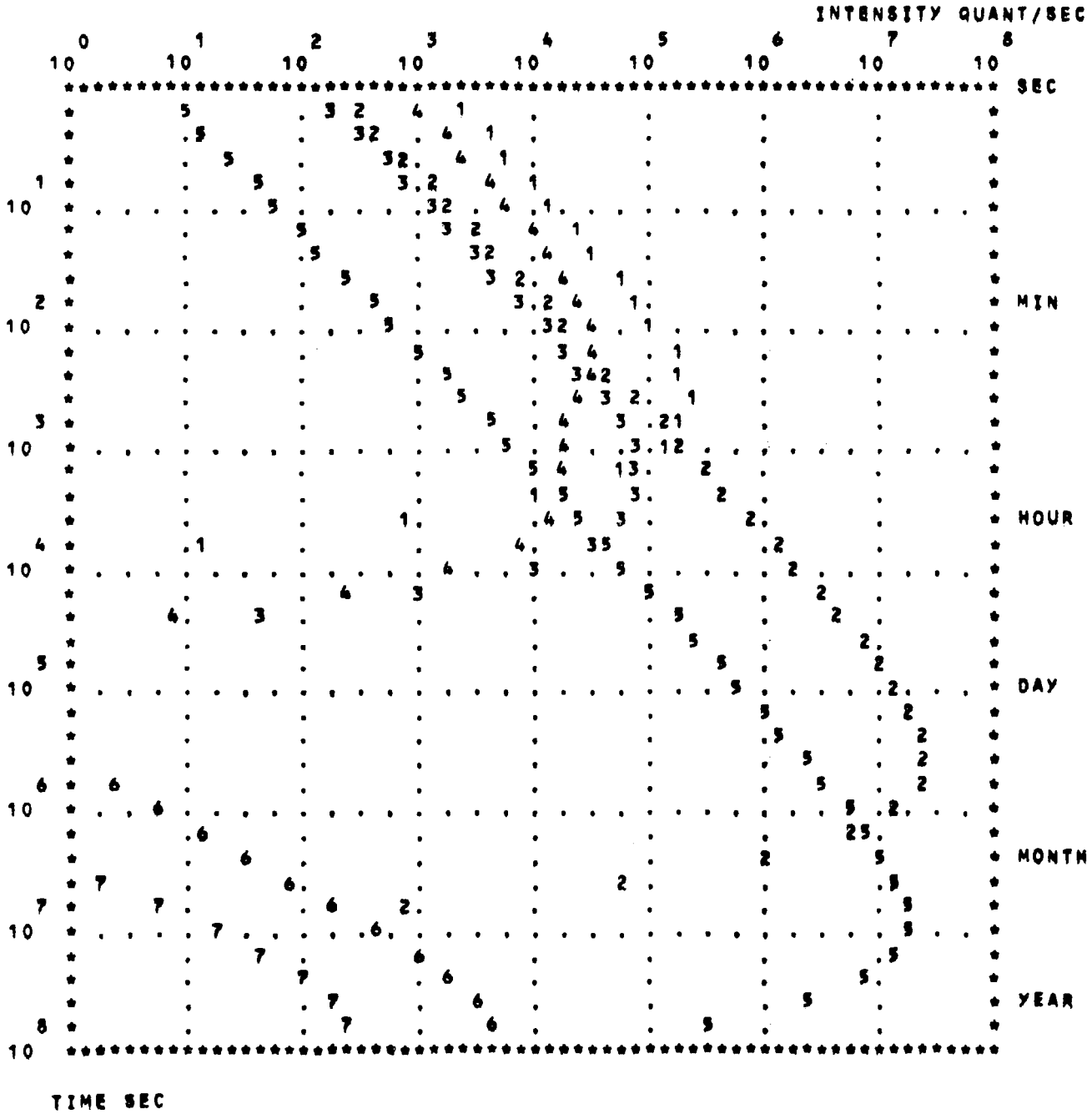
10^{13} N/SM 10^{2} SEC 1.0 MG

1 -	112SN	1. %	0.30(4) B	113SN(21.4 M)	113SN	77.000 KEV	0.55
2 -			0.71(10) B	113SN(115 D)	113IN	255.06 KEV	1.82
3 -	116SN	14.7 %	0.006(2) B	117SN(13.6 D)	117SN	158.56 KEV	86
4 -	118SN	24.3 %	0.010(6) B	119SN(29E1 D)	119SN	23.870 KEV	16.1
	120SN	32.4 %	0.16(3) B	121SN(1.13 D)		NO GAMMAS	
5 -	122SN	4.6 %	0.018(2) B	123SN(40 M)	123SB	160.33 KEV	86
6 -	124SN	5.6 %	0.130(5) B	125SN(9.5 M)	125SB	331.9 KEV	100
7 -			0.004(2) B	125SN(9.6 D)	125SB	1067.1 KEV	9.0
8 -				113IN(1.66 H)	113IN	391.69 KEV	64
9 -				125SB(2.7 y)	125TE	427.89 KEV	29.4
A -				125TE(58 D)	125TE	35.46 KEV	6.7



ANTIMONY 10^{13} N/SM 10^{2} SEC 1.0 MG

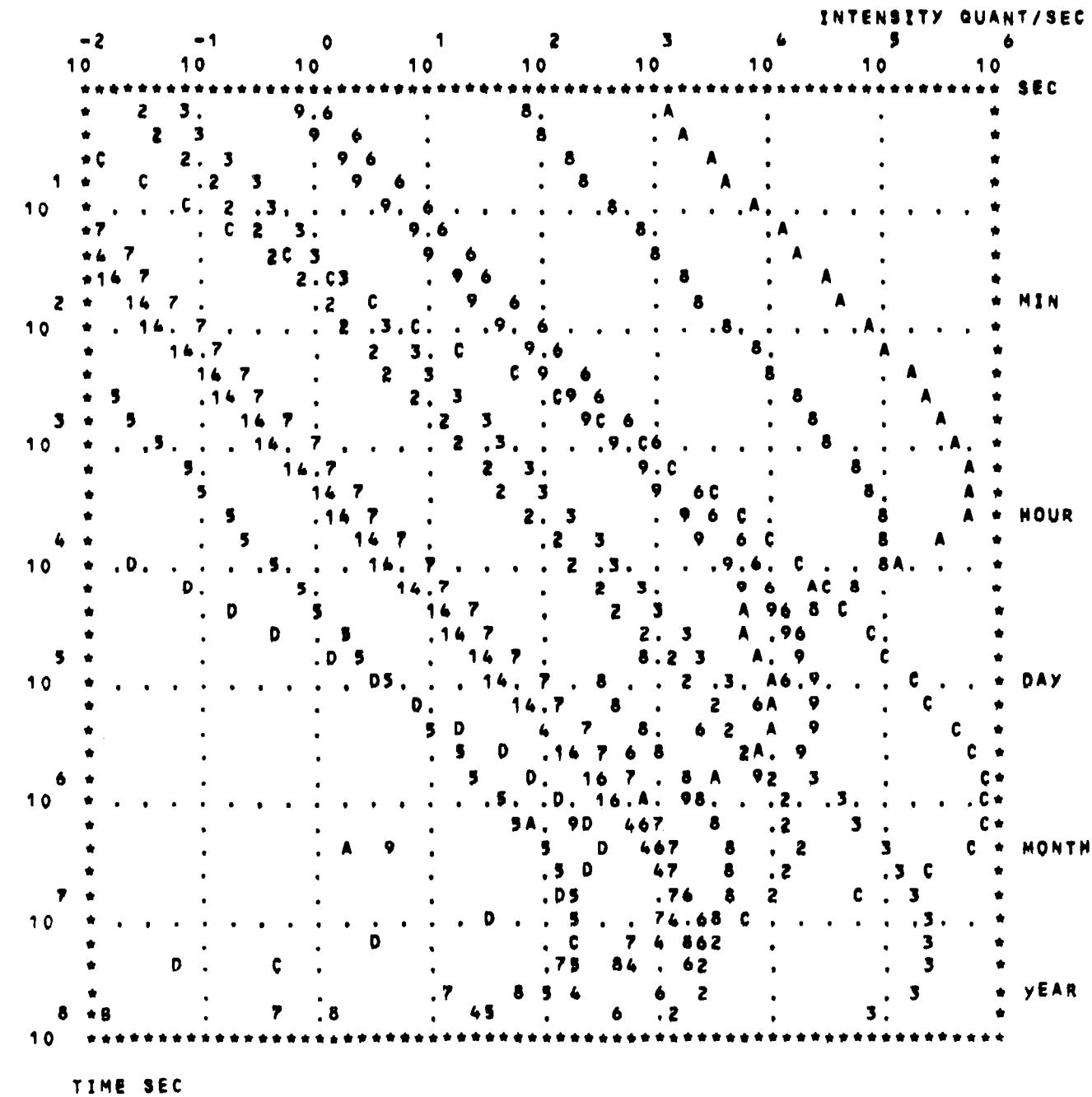
1 -	121SB	57.3 %	0.06(1) B	122SB(	4.2 M)	122SB	61.413	KEV	57
2 -			5.84(20) B	122SB(	2.7 D)	122TE	564.24	KEV	70
3 -	123SB	42.7 %	0.019(10) B	124SB(	20.2 M)	124SB	25.00	KEV	100
4 -			0.037(10) B	124SB(	1.55 M)	124TE	645.80	KEV	20
5 -			4.1(1) B	124SB(	60 D)	124TE	602.72	KEV	98
6 -	124SB		17(3) B	125SB(	2.7 Y)	125TE	427.89	KEV	29.4
7 -				125TE(	58 D)	125TE	35.46	KEV	6.7



TIME SEC

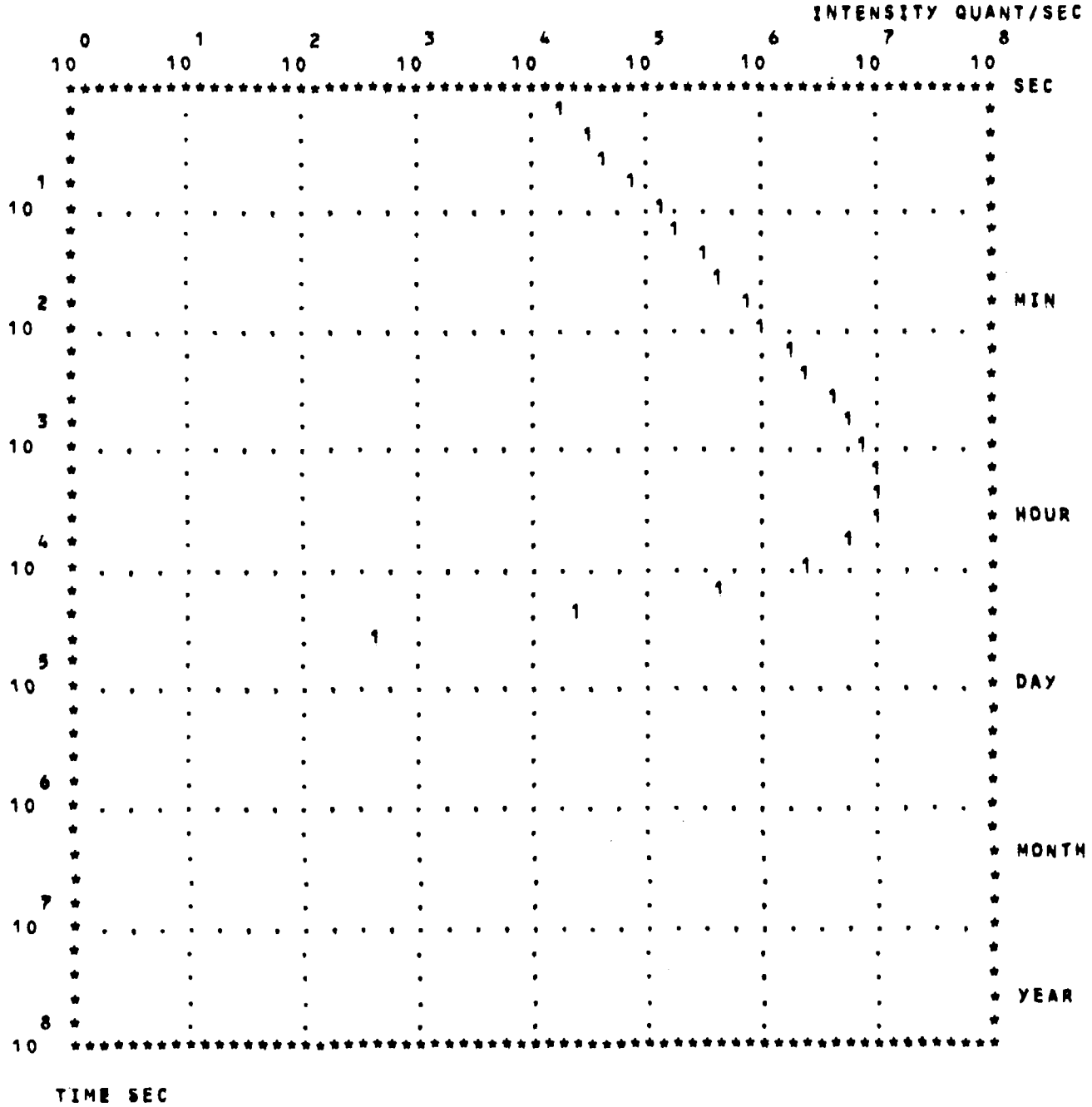
TELLURIUM 10^{13} N/SM SEC 1.0 MG

1 - 120TE 0.091 %	0.34(6) B	121TE(154 D)121TE	212.19 KEV	81
2 -	2.0(3) B	121TE(16.8 D)121SB	573.14 KEV	80
3 - 122TE 2.6 %	1.1(5) B	123TE(120 D)123TE	159.00 KEV	84
4 - 124TE 4.816 %	0.060(25) B	125TE(58 D)125TE	35.46 KEV	6.7
5 - 126TE 18.95 %	0.135(23) B	127TE(109 D)127TE	88.26 KEV	0.086
6 -	0.90(15) B	127TE(9.3 H)127I	417.9 KEV	0.99
7 - 128TE 31.69 %	0.015(1) B	129TE(36 D)129I	693.88 KEV	3.06
8 -	0.200(8) B	129TE(1.16 H)129I	27.81 KEV	15.6
9 - 130TE 33.8 %	0.02(1) B	131TE(1.25 D)131I	773.67 KEV	38.1
A -	0.27(6) B	131TE(25.0 M)131I	149.72 KEV	69
B -		129I (157E5 Y)129XE	39.58 KEV	7.5
C -		131I (8.0 D)131XE	364.48 KEV	81
D -		131XE(11.9 D)131XE	163.93 KEV	1.96



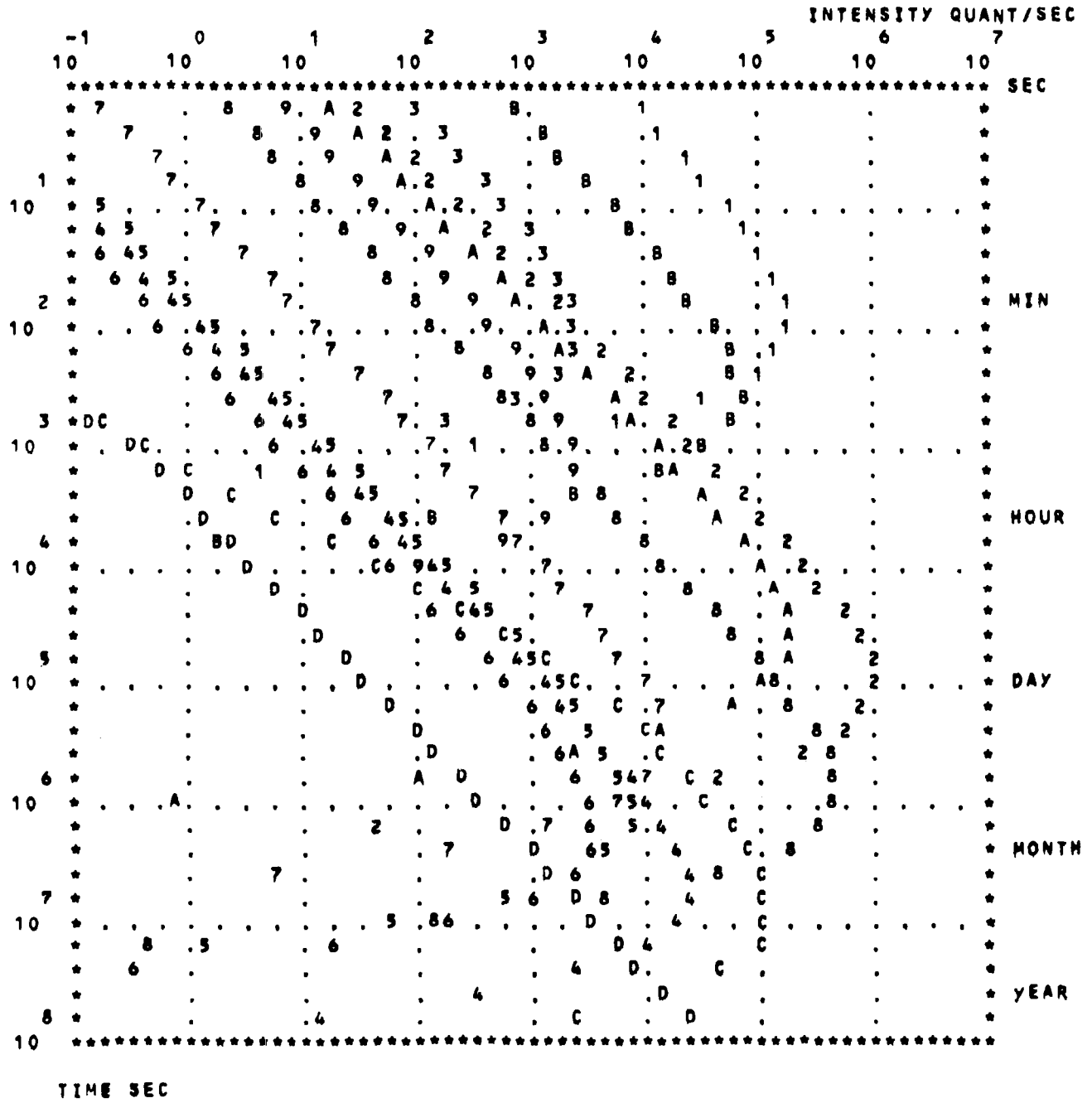
IODINE 10^{13} N/SM^{2} SEC 1,0 MG

1 - 127I 100, % 6.2(2) B 128I (25.0 M)128XE 442.91 KEV 16.0



XENON 10^{13} N/SM^2 SEC 1.0 MG

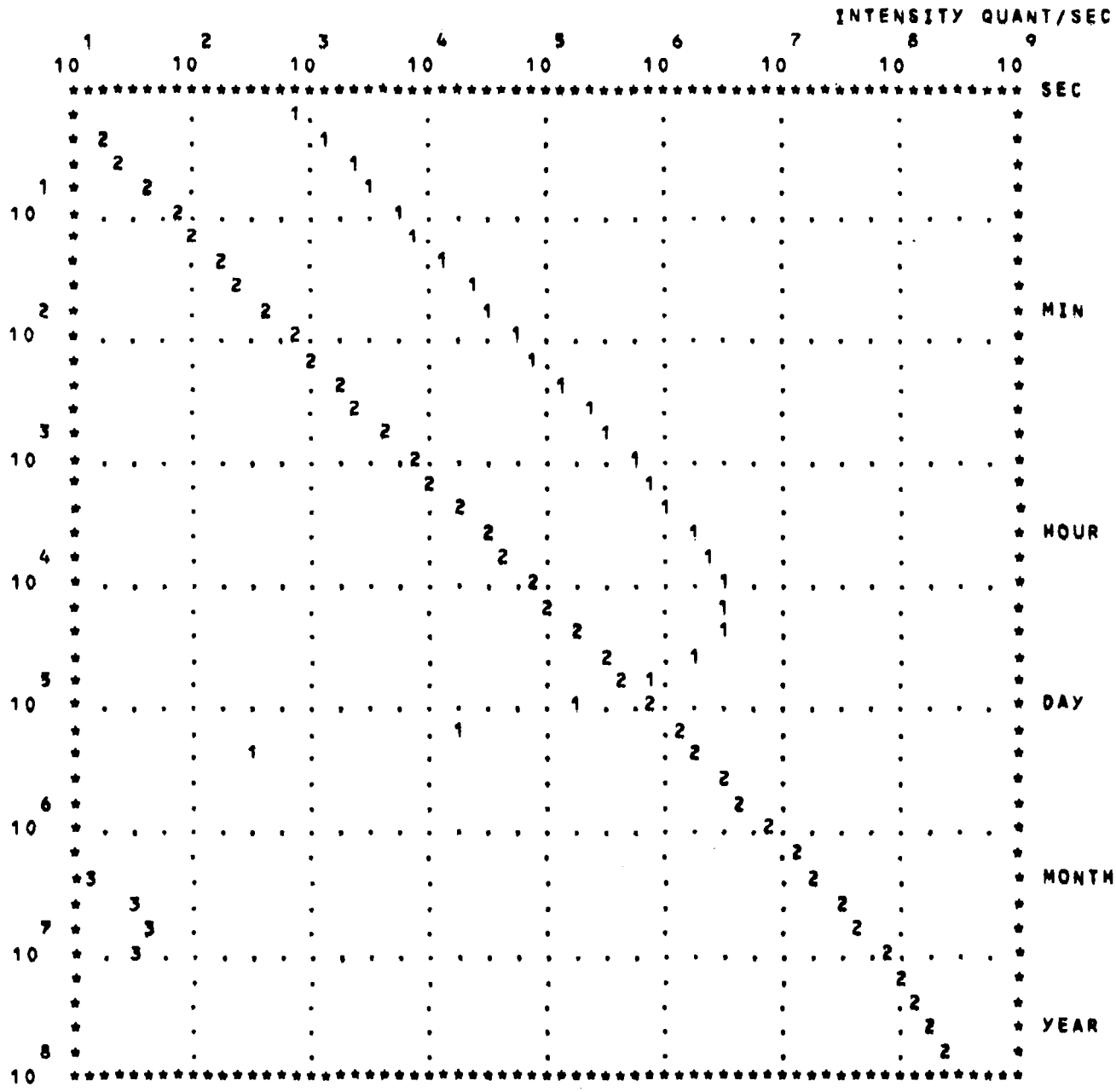
1 -	124XE	0.1 %	28(5) B	129XE(57 S)	125XE	111.00 KEV	62
2 -			137(21) B	125XE(17.0 M)	125I	188.43 KEV	55
3 -	126XE	0.09 %	0.45(13) B	127XE(1.17 M)	127XE	124.70 KEV	61
4 -			3.0(8) B	127XE(36 D)	127I	202.84 KEV	68
5 -	128XE	1.91 %	0.48(10) B	129XE(8.0 D)	129XE	39.58 KEV	7.5
6 -	130XE	4.1 %	0.45(10) B	131XE(11.9 D)	131XE	163.93 KEV	1.96
7 -	132XE	26.9 %	0.05(1) B	133XE(2.19 D)	133XE	233.18 KEV	10.3
8 -			0.40(6) B	133XE(5.2 D)	133CS	80.997 KEV	37.1
9 -	134XE	10.4 %	0.0030(3) B	135XE(15.3 M)	135XE	526.57 KEV	81
A -			0.262(20) B	135XE(9.1 H)	135CS	249.79 KEV	90
B -	136XE	8.9 %	0.26(2) B	137XE(3.8 M)	137CS	455.51 KEV	30.0
C -				125I (60 D)	125TE	35.492 KEV	6.7
D -				137BA(2.6 M)	137BA	661.64 KEV	90



CESIUM

10^{13} N/SM ^{2} SEC 1.0 MG

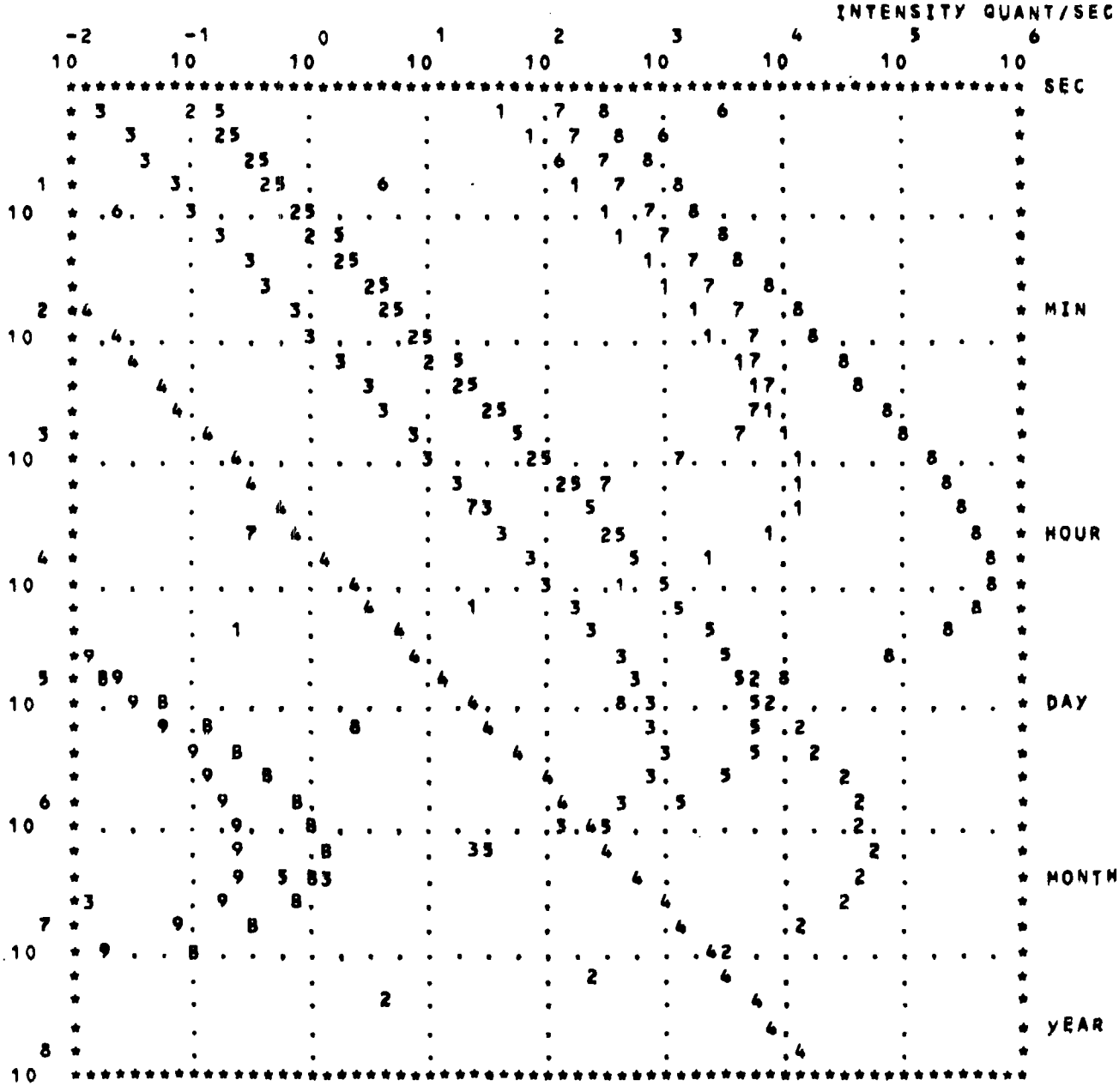
1 - 133CS	100. %	2.5(2)	B	134CS(2.9 H)134CS	127.42	KEV	12.9
2 -		26.5(15)	B	134CS(2.06 Y)134BA	604.70	KEV	98
3 - 135CS		8.7(5)	B	136CS(13.2 D)136BA	818.50	KEV	85
4 - 137CS		0.11(3)	B	138CS(32 M)138BA	1435.9	KEV	76
5 -				136BA(0.31 S)136BA	1047.7	KEV	100
6 -				137BA(2.6 M)137BA	661.64	KEV	90



BARIUM

10^{13} N/SM SEC 1.0 MG

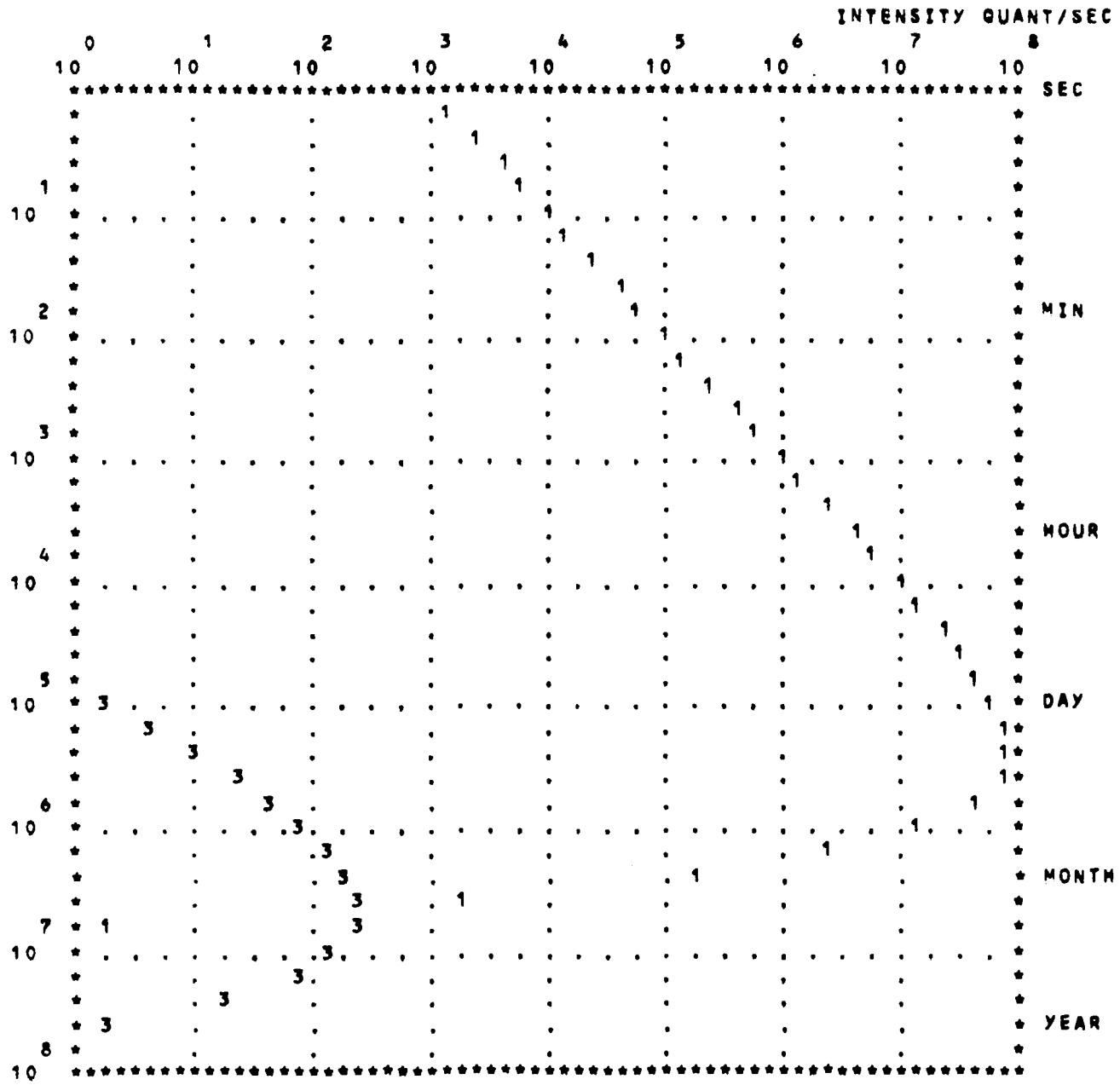
1	-	130BA	0.106 %	2.5(3)	B	131BA(14.6 M)	131BA	108.45 KEV	55
2	-			8.8(9)	B	131BA(11.8 D)	131CS	496.28 KEV	44
3	-	132BA	0.101 %	0.5(*)	B	133BA(1.62 D)	133BA	276.09 KEV	18.0
4	-			6.5(8)	B	133BA(10.7 Y)	133CS	356.00 KEV	62
5	-	134BA	2.417 %	0.158(24)	B	135BA(1.20 D)	135BA	268.24 KEV	16.0
6	-	135BA	6.592 %	0.0139(7)	B	136BA(0.31 S)	136BA	1047.7 KEV	100
7	-	136BA	7.854 %	0.010(1)	B	137BA(2.6 M)	137BA	661.64 KEV	90
8	-	138BA	71.7 %	0.36(4)	B	139BA(1.41 H)	139LA	165.85 KEV	22.0
9	-	139BA		6.2(16)	B	140BA(12.7 D)	140LA	537.32 KEV	24.4
A	-	140BA		1.6(3)	B	141BA(18.3 M)	141LA	190.33 KEV	46
						131CS(9.7 D)		NO GAMMAS	
B	-					140LA(1.68 D)	140CE	1596.5 KEV	95
C	-					141LA(3.9 H)	141CE	1354.5 KEV	2.63
D	-					141CE(32 D)	141PR	145.44 KEV	48.4



TIME SEC

LANTHANUM 10^{13} N/SM SEC 1.0 MG

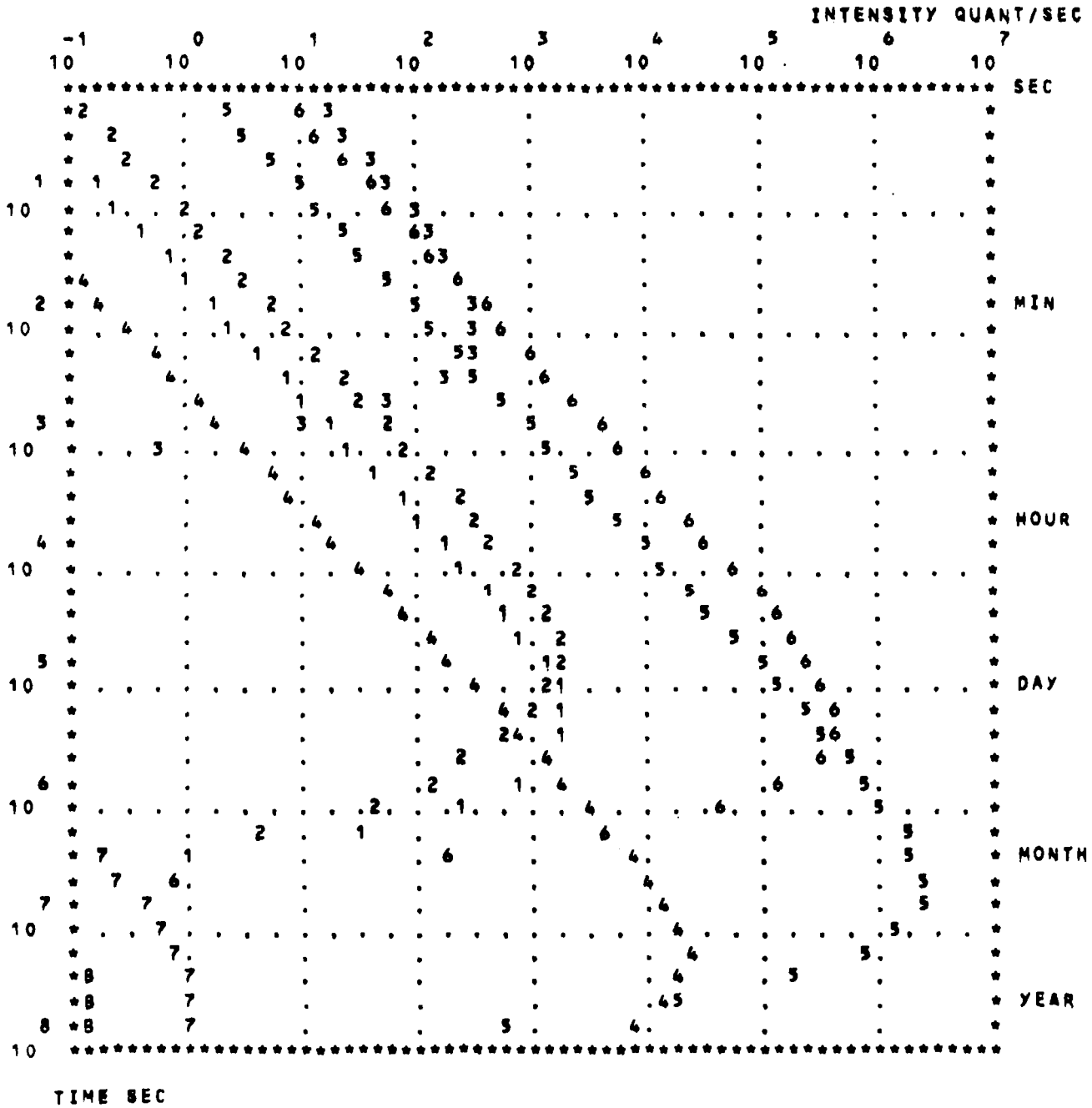
1 - 139LA 99.91 %	8.93(4) B	140LA(1.68 D)140CE	1596.5 KEV	95
2 - 140LA	2.7(3) B	141LA(3.9 H)141CE	1354.5 KEV	2.63
3 -		141CE(32 D)141PR	145.44 KEV	48.4



CERIUM

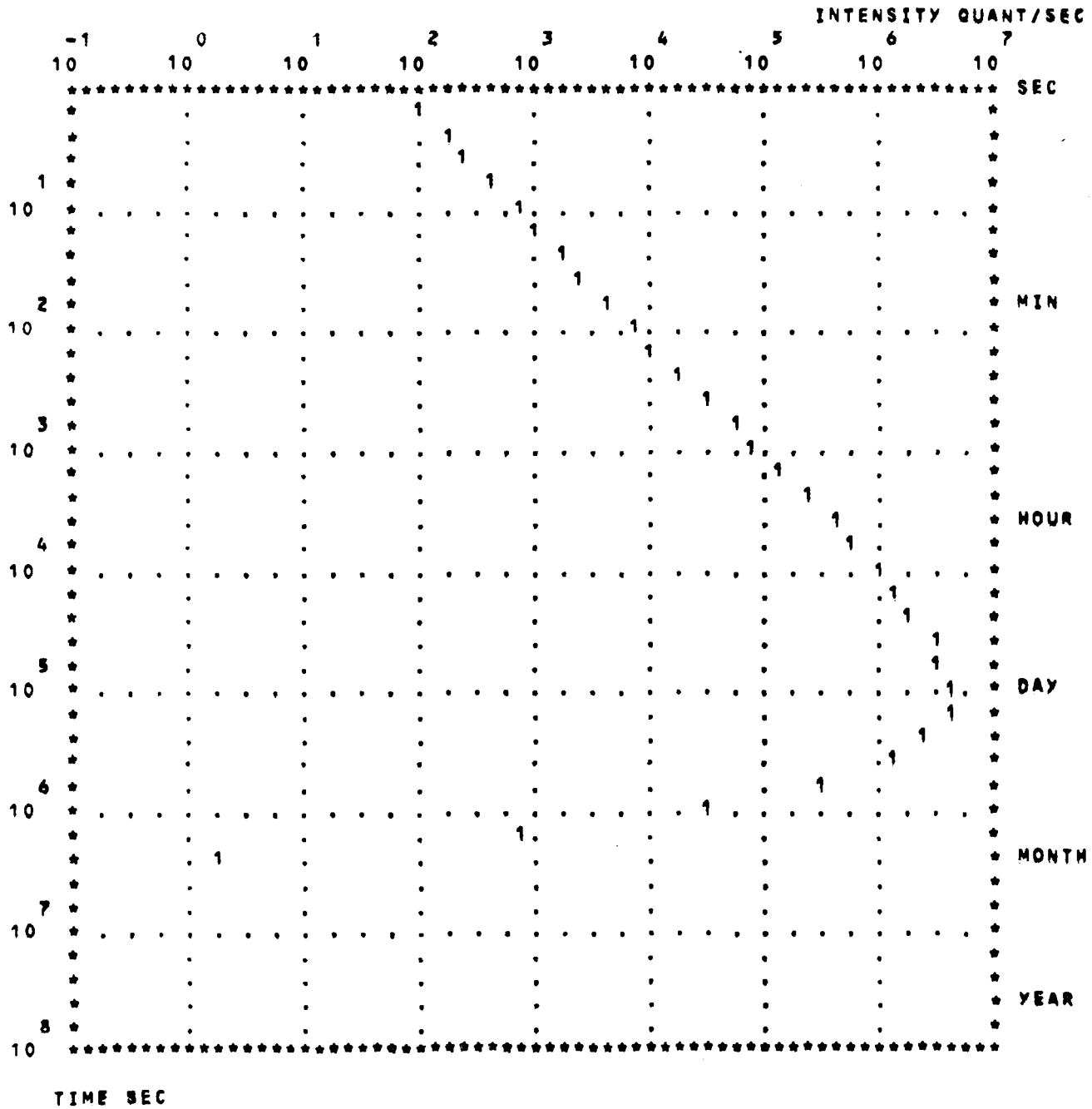
10^{13} N/SM^{2} SEC 1.0 MG

1 -	136CE	0.19 %	0.95(25) B	137CE(	1.43	D)137CE	254.3	KEV	10.8
2 -			6.3(15) B	137CE(	9.0	M)137LA	447.1	KEV	1.4
3 -	138CE	0.254 %	0.015(5) B	139CE(	56	S)139CE	754.24	KEV	92
4 -			1.1(3) B	139CE(	138	D)139LA	165.85	KEV	80
5 -	140CE	88.48 %	0.57(4) B	141CE(	32	D)141PR	145.44	KEV	48.4
6 -	142CE	11.08 %	0.95(5) B	143CE(	1.38	D)143PR	293.26	KEV	42
7 -	143CE		6.0(7) B	144CE(	28E1	D)144PR	133.54	KEV	11.1
8 -	144CE		1.0(1) B	145CE(	3.0	M)145PR	723.6	KEV	59
9 -				143PR(	13.6	D)143ND	742.00	KEV	1.2E-6
A -				144PR(	7.2	M)144PR	59.03	KEV	0.079
B -				144PR(	17.3	M)144ND	696.49	KEV	1.34
C -				145PR(	6.0	M)145ND	748.28	KEV	0.43



PRASEODYMIUM 10^{13} N/SM SEC 1.0 MG

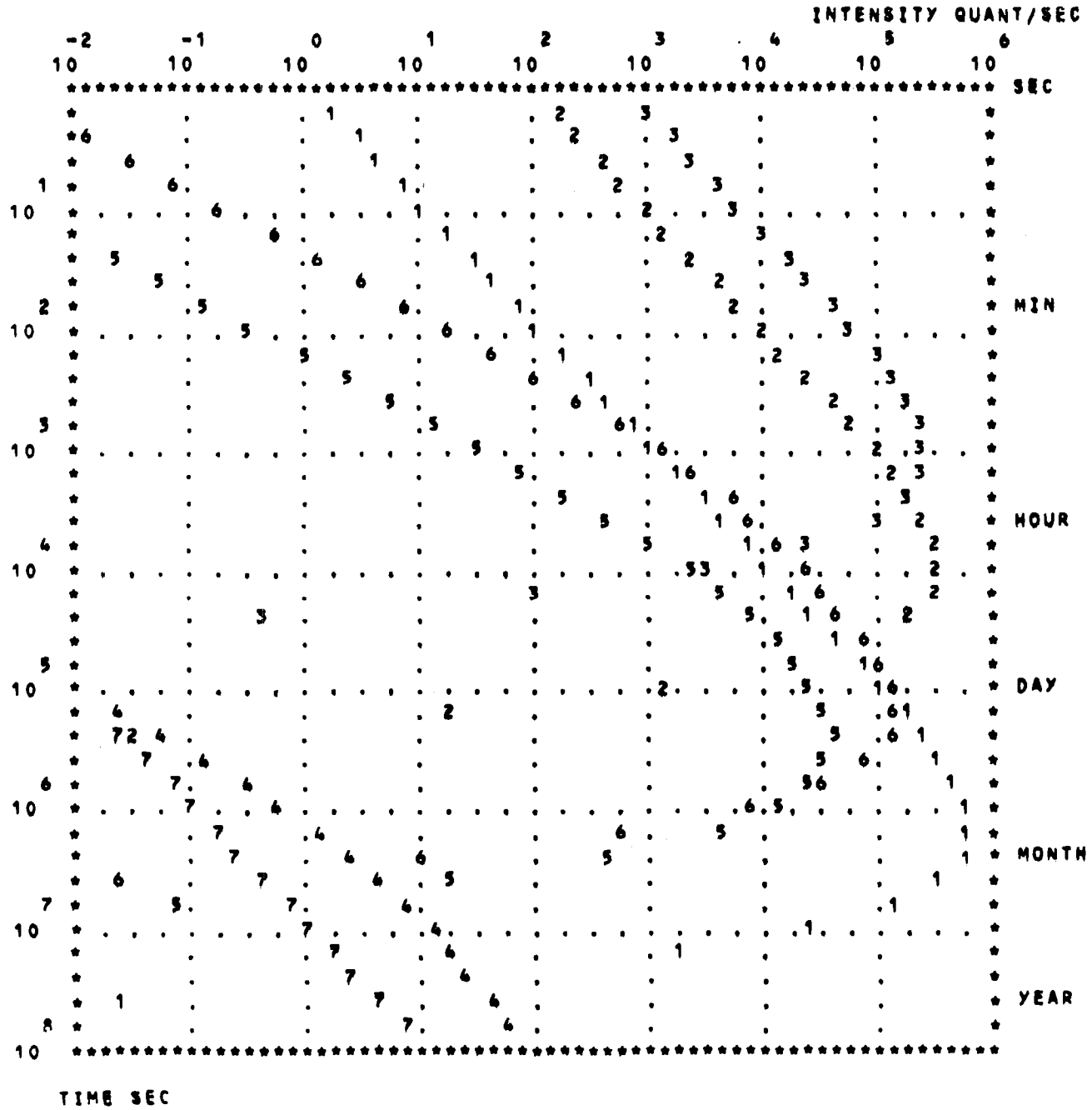
	141PR 100. %	3.9(3) B	142PR(14.6 M)		NO GAMMAS			
1 -		7.6(4) B	142PR(19.1 H)	142ND	1575.6 KEV	3.7		
2 -	142PR	20(3) B	143PR(13.6 D)	143ND	742.00 KEV	1.2E-6		
3 -	143PR	90(10) B	144PR(17.3 M)	144ND	696.49 KEV	1.34		



NEODYMIUM

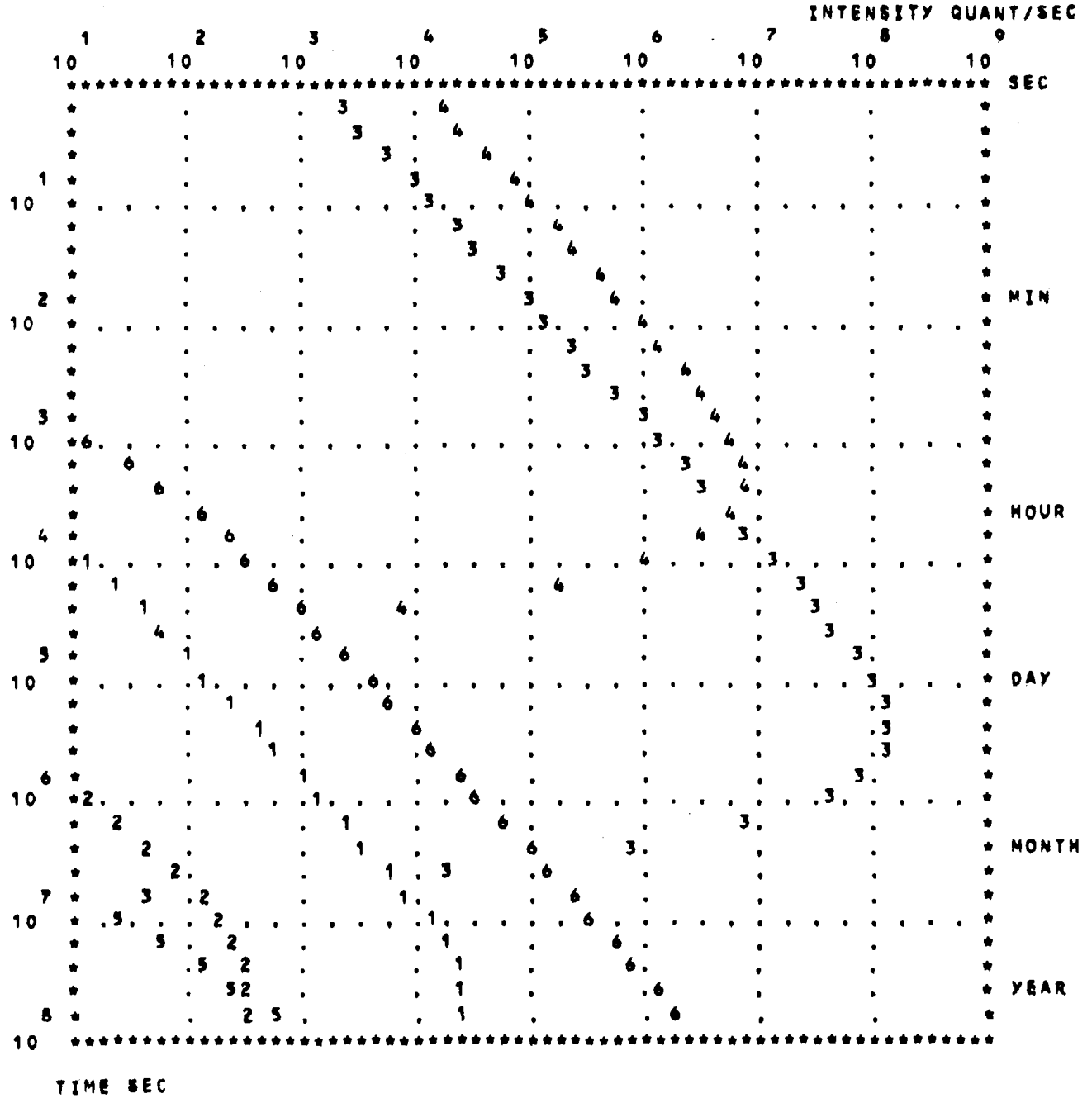
10^{13} N/SM SEC 1.0 MG

1 - 146ND 17.19 %	1.4(1) B	147ND(11.0 D)147PM	91.106 KEV	27.9
2 - 148ND 5.76 %	2.5(2) B	149ND(1.73 H)149PM	211.31 KEV	27.3
3 - 150ND 5.64 %	1.2(2) B	151ND(12.4 M)151PM	116.7 KEV	47
4 -		147PM(2.6 Y)147SM	121.25 KEV	0.00285
5 -		149PM(2.21 D)149SM	285.90 KEV	2.8
6 -		151PM(1.18 D)151SM	340.08 KEV	22
7 -		151SM(90 Y)151EU	21.540 KEV	0.0300



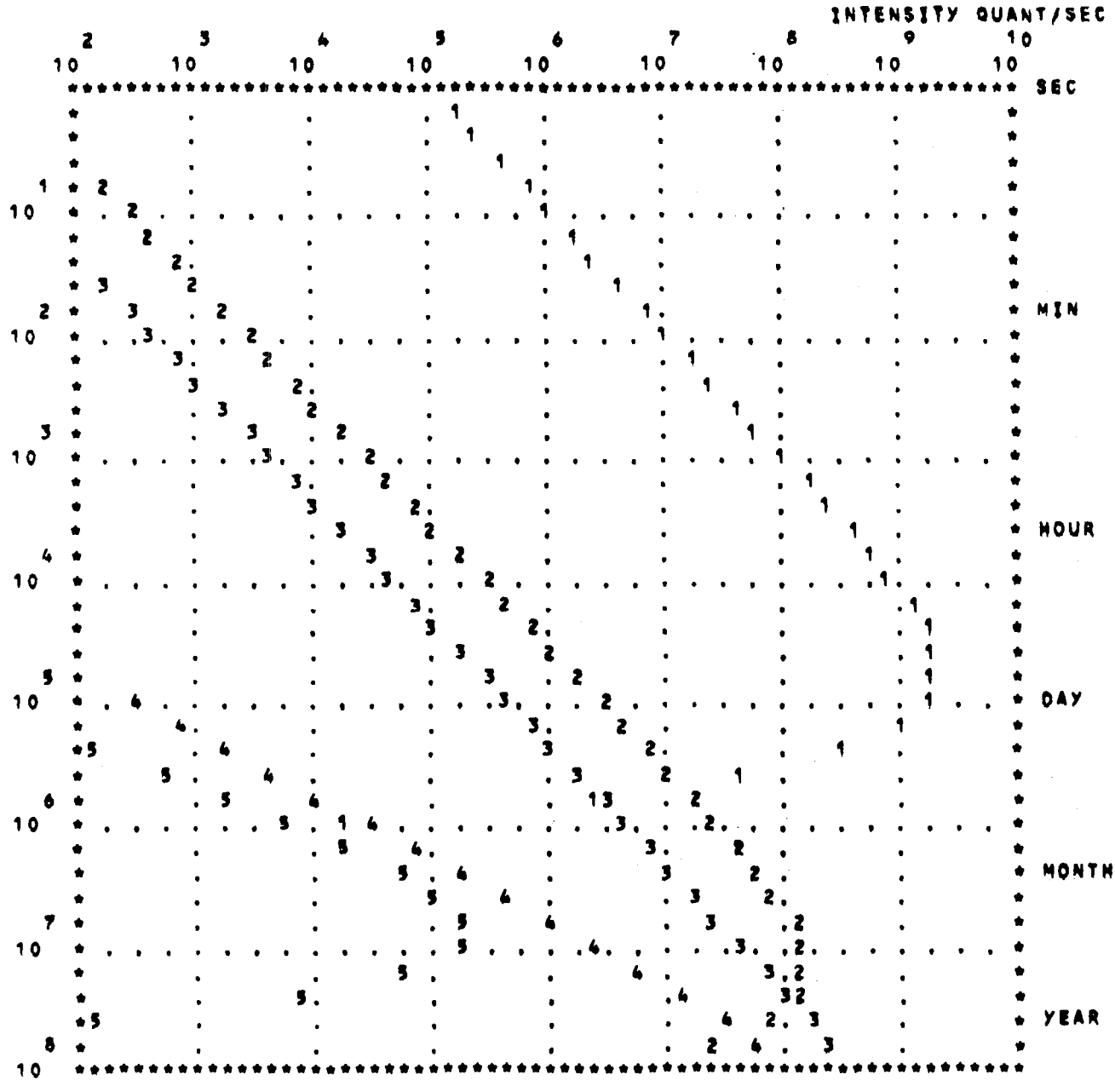
SAMARIUM 10^{13} N/SM ^{2} SEC 1.0 MG

1 - 144SM	3.16 %	0.7(*) B	145SM(34E1 D)145PM	61.25 KEV	12.4
2 - 150SM	7.4 %	102(5) B	151SM(90 Y)151EU	21.540 KEV	0.0300
3 - 152SM	26.7 %	206(6) B	153SM(1.95 D)153EU	103.18 KEV	28.3
4 - 154SM	22.8 %	5.5(11) B	155SM(22.1 M)155EU	104.32 KEV	75
5 -			145PM(17.7 Y)145ND	72.6 KEV	1.85
6 -			155EU(5.0 Y)155GD	86.543 KEV	30.9



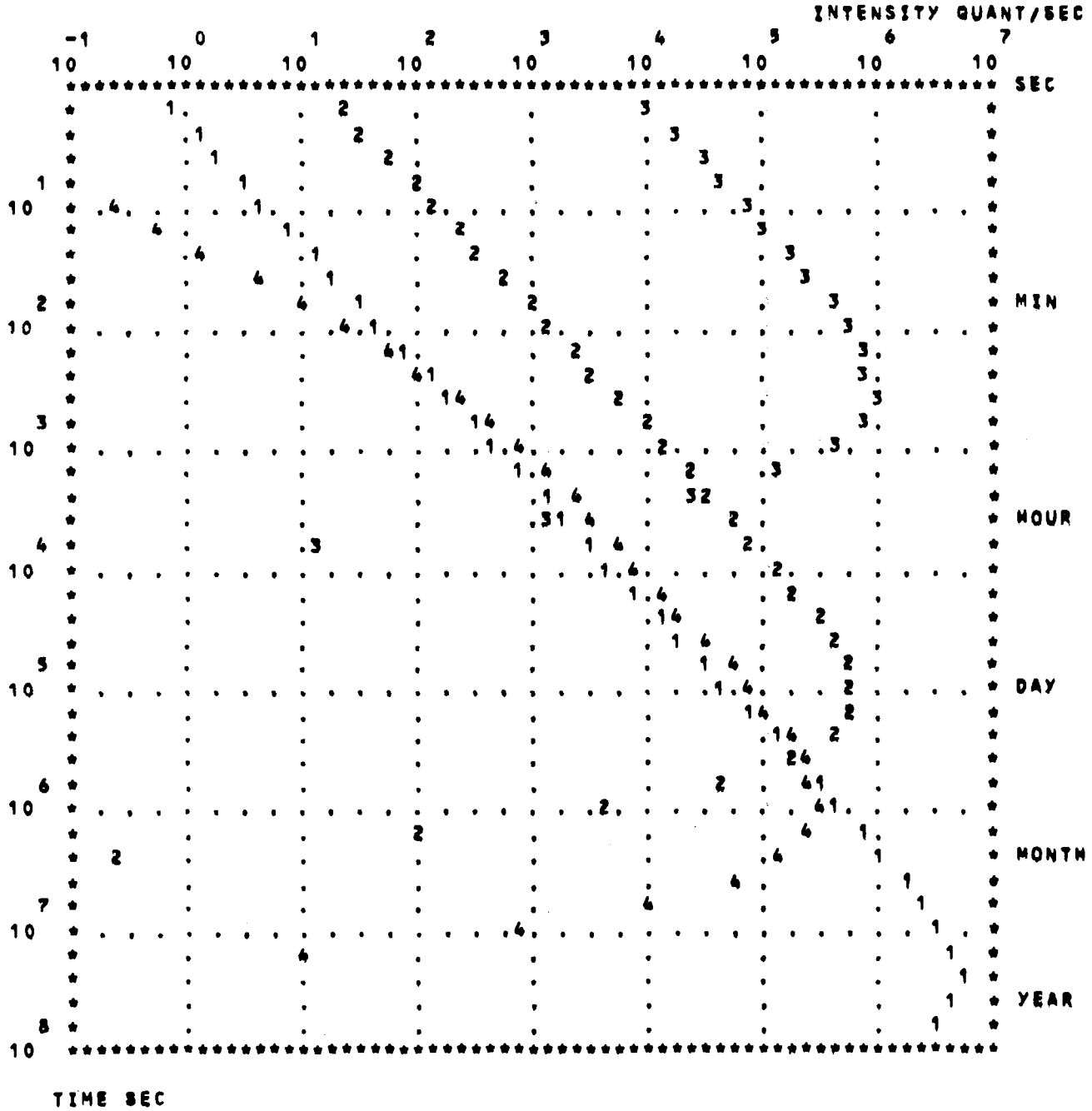
EUROPIUM 10^{13} N/SM 10^{2} SEC 1.0 MG

1 - 151EU	47.8 %	33E2(2) B	152EU(9.3 H)152SM	841.63 KEV	14.6
2 -		59E2(2) B	152EU(13.3 Y)152SM	121.78 KEV	28.4
3 - 153EU	52.2 %	39E1(3) B	154EU(8.8 Y)154GD	123.07 KEV	40.5
4 - 154EU		15E2(4) B	155EU(5.0 Y)155GD	86.543 KEV	30.9
5 - 155EU		404E1(13) B	156EU(15.2 D)156GD	811.77 KEV	10.2



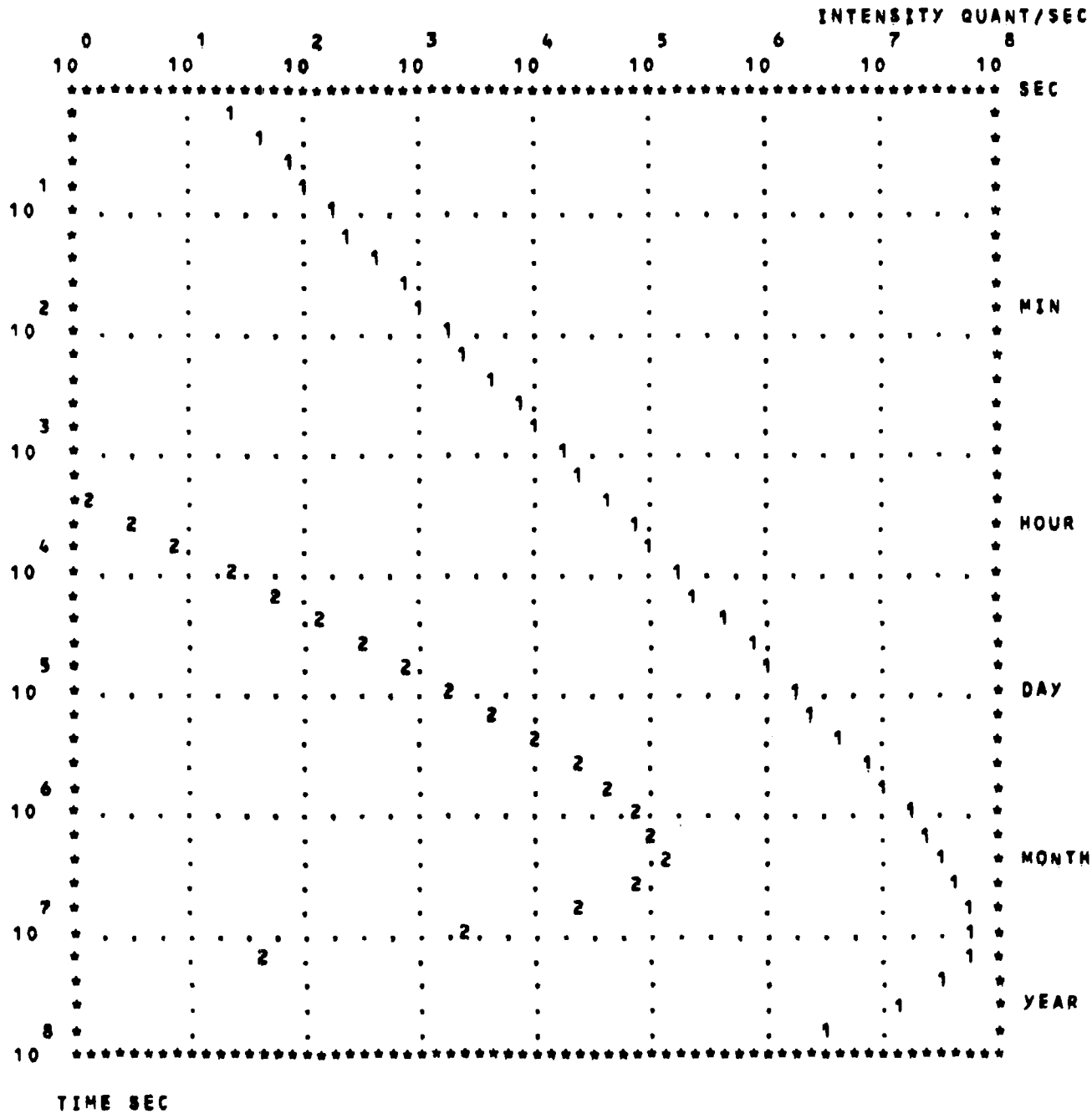
GADOLINIUM 10^{13} N/SM 10^{2} SEC 1.0 MG

1 - 152GD	0.2 %	1182(1) B	153GD(242 D)	153EU	97.430 KEV	29.5
2 - 158GD	24.7 %	2.5(5) B	159GD(18.6 H)	159TB	363.56 KEV	11
3 - 160GD	21.7 %	0.77(2) B	161GD(3.7 M)	161TB	360.70 KEV	65
4 -			161TB(6.9 D)	161DY	25.655 KEV	21



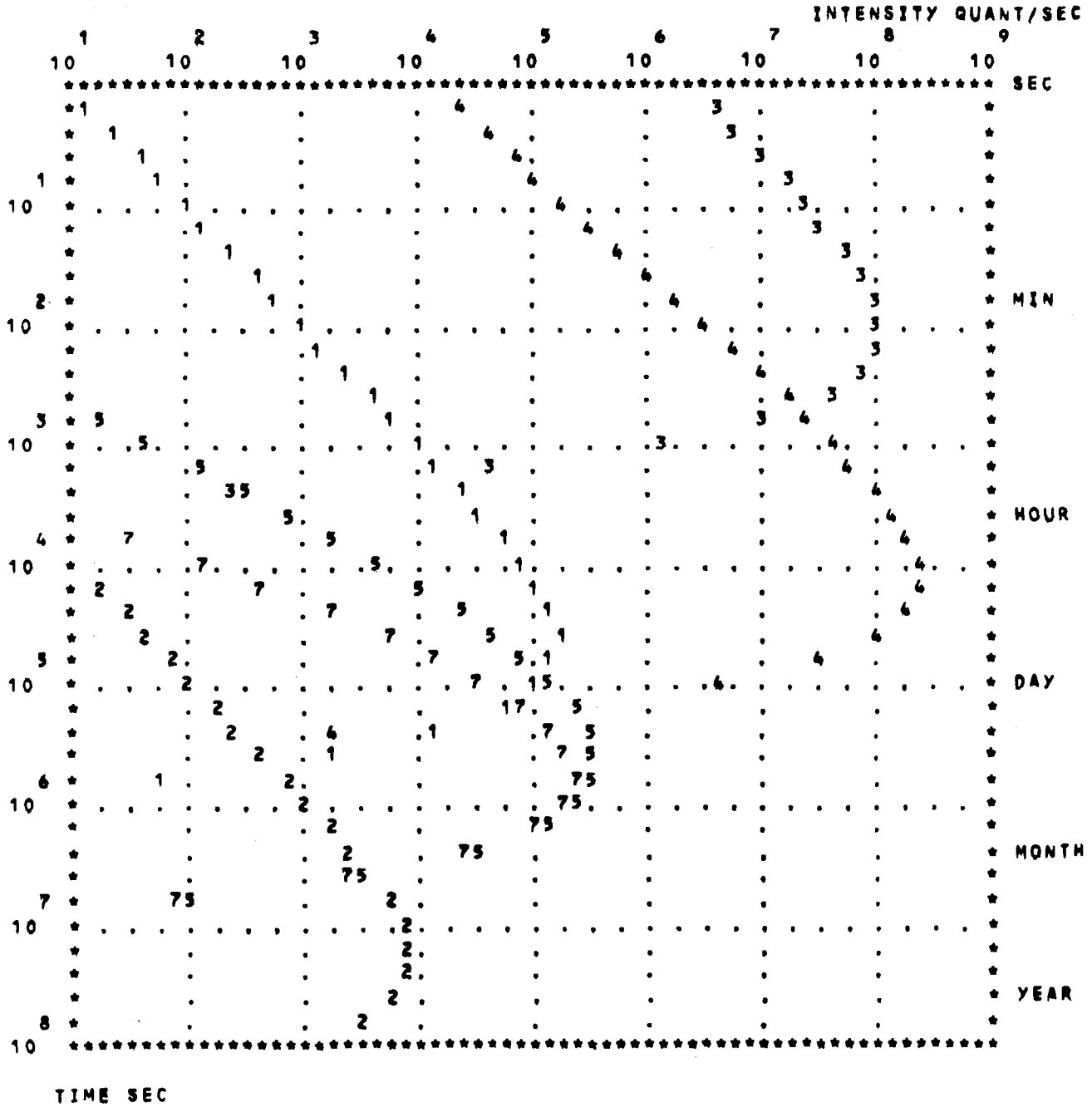
TERBIUM 10^{13} N/SM SEC 1.0 MG

1 = 159TB	100. %	25.5(11) B	160TB(	72 D)160DY	879.36 KEV	29.5
2 = 160TB		53E1(10) B	161TB(	6.9 D)161DY	25.655 KEV	21



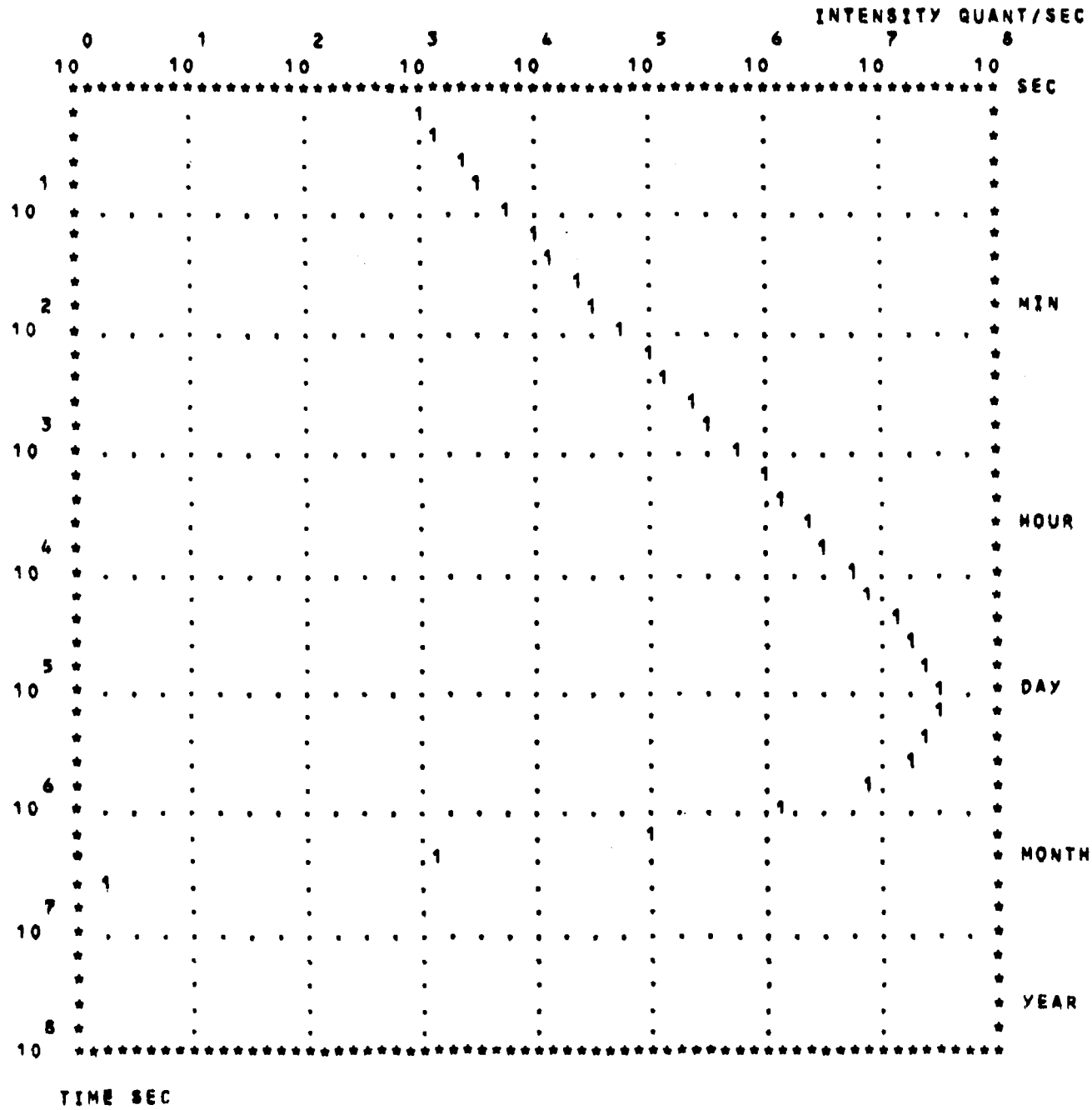
DYSPROSIUM 10^{13} N/SM^{2} SEC 1.0 MG

1 - 156DY	0.06 %	33(3) B	157Dy(8.1 M)157TB	326.16 KEV	95
2 - 158DY	0.1 %	43(6) B	159Dy(144 D)159TB	58.00 KEV	2.22
3 - 164DY	28.2 %	170E1(25) B	165Dy(1.26 M)165DY	108.16 KEV	2.94
4 -		100E1(15) B	165Dy(2.33 M)165HO	94.700 KEV	3.6
5 - 165DY		39E2(3) B	166Dy(3.4 D)166HO	82.470 KEV	13
6 -			157TB(150 Y)157GD	54.35 KEV	0.008
7 -			166HO(1.12 D)166ER	80.574 KEV	6.2



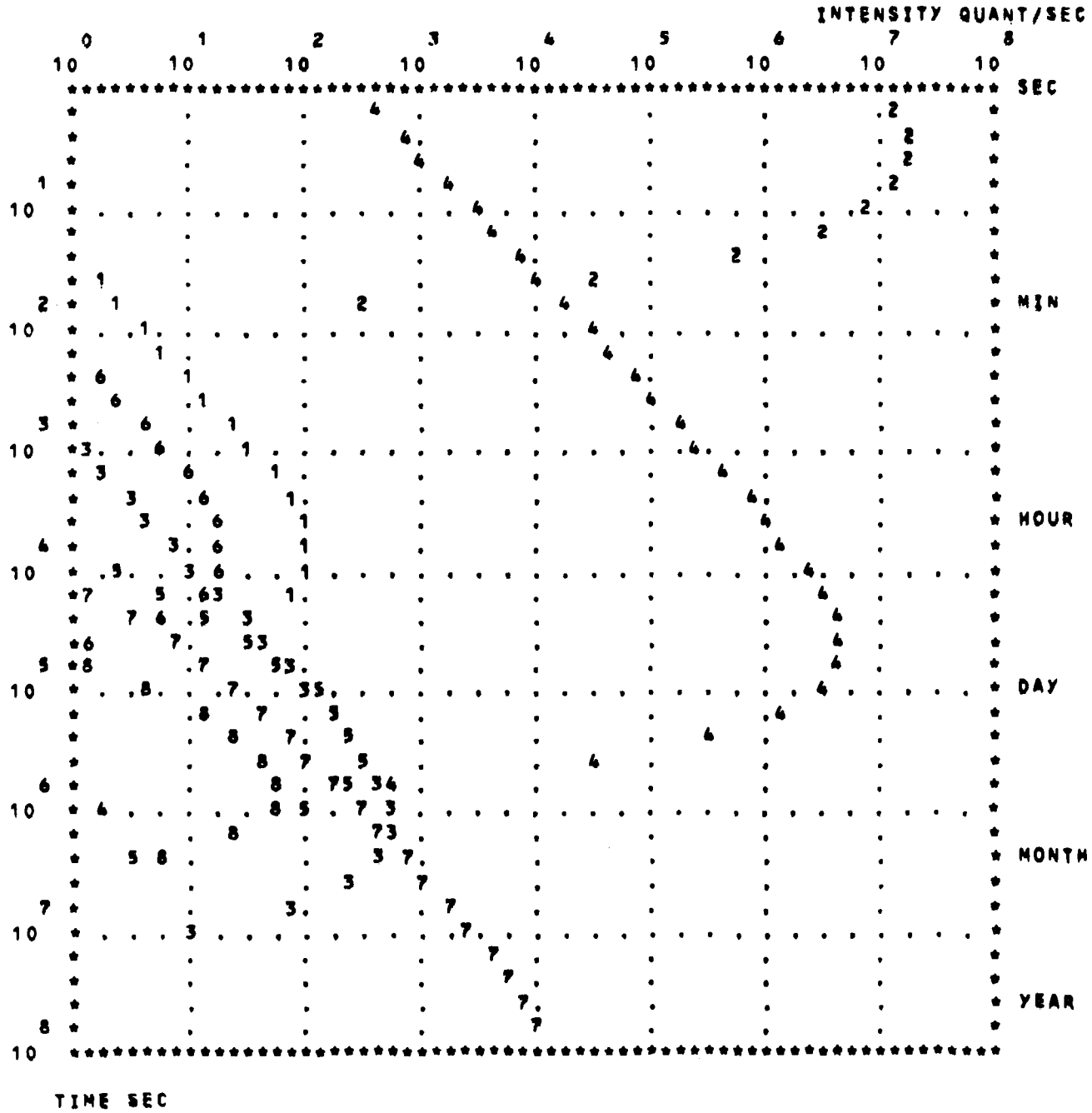
HOLMIUM 10^{13} N/SM^{2} SEC 1.0 MG

1 - 165HO 100. % 63(3) B 166HO(1.12 D)166ER 80.574 KEV 6.2



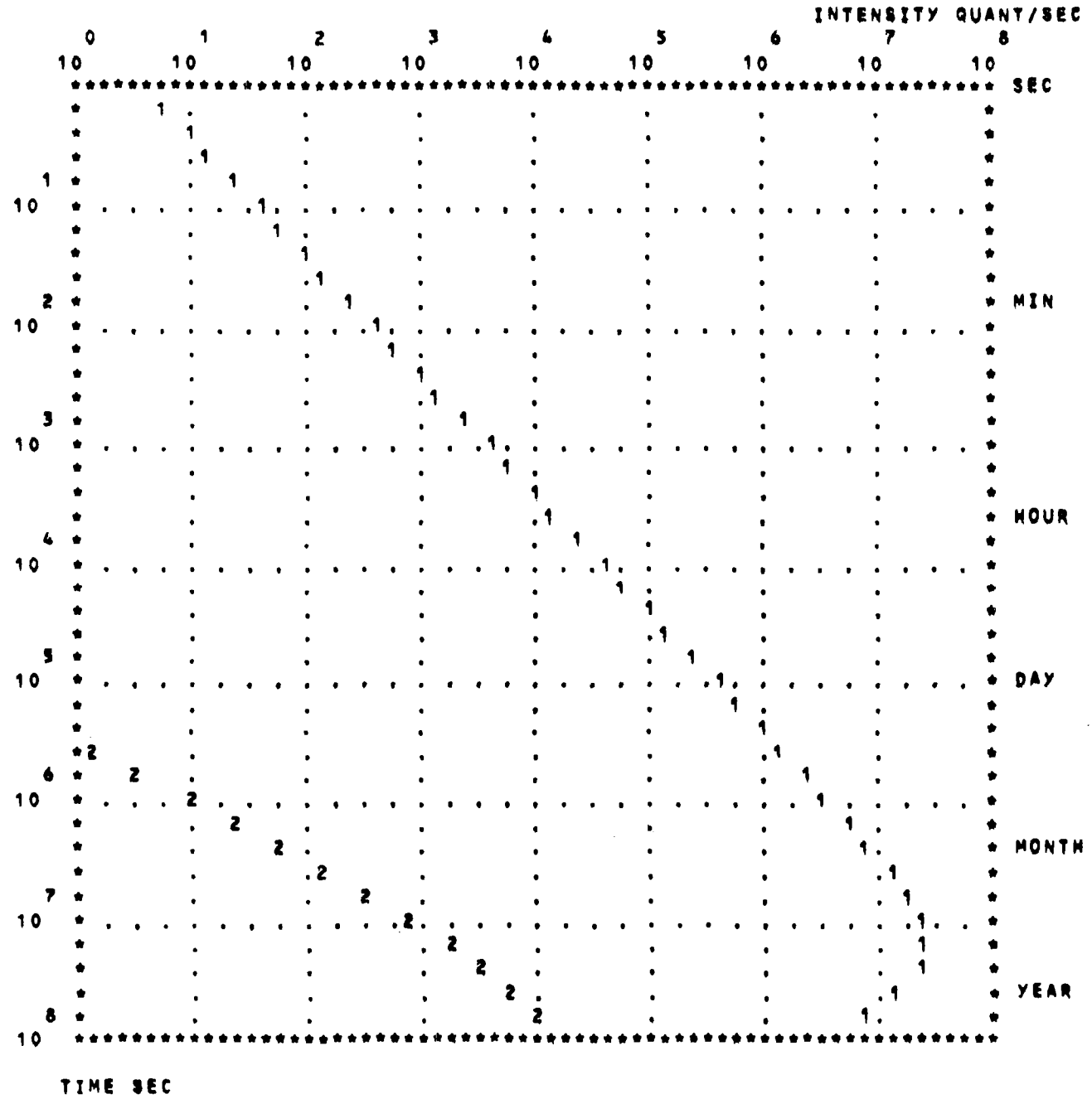
ERBIUM 10^{13} N/SM^2 SEC 1.0 MG

1 -	162ER	0.14 %	19(2) B	163ER(1.25 H)163HO	1113.5 KEV	0.0490
	164ER	1.6 %	13(2) B	165ER(10.4 M)	NO GAMMAS	
2 -	166ER	33.4 %	15(2) B	167ER(2.28 S)167ER	207.80 KEV	41.7
3 -	168ER	27. %	1.95(5) B	169ER(9.3 D)169TU	109.74 KEV	0.013
4 -	170ER	15. %	5.7(2) B	171ER(7.5 H)171TU	308.29 KEV	66
5 -	171ER		28E1(3) B	172ER(2.05 D)172TU	610.06 KEV	47.3
6 -				163HO(1.09 S)163HO	299 KEV	77
7 -				171TU(1.92 Y)171YB	66.718 KEV	0.15
8 -				172TU(2.6 D)172YB	78.750 KEV	6.6



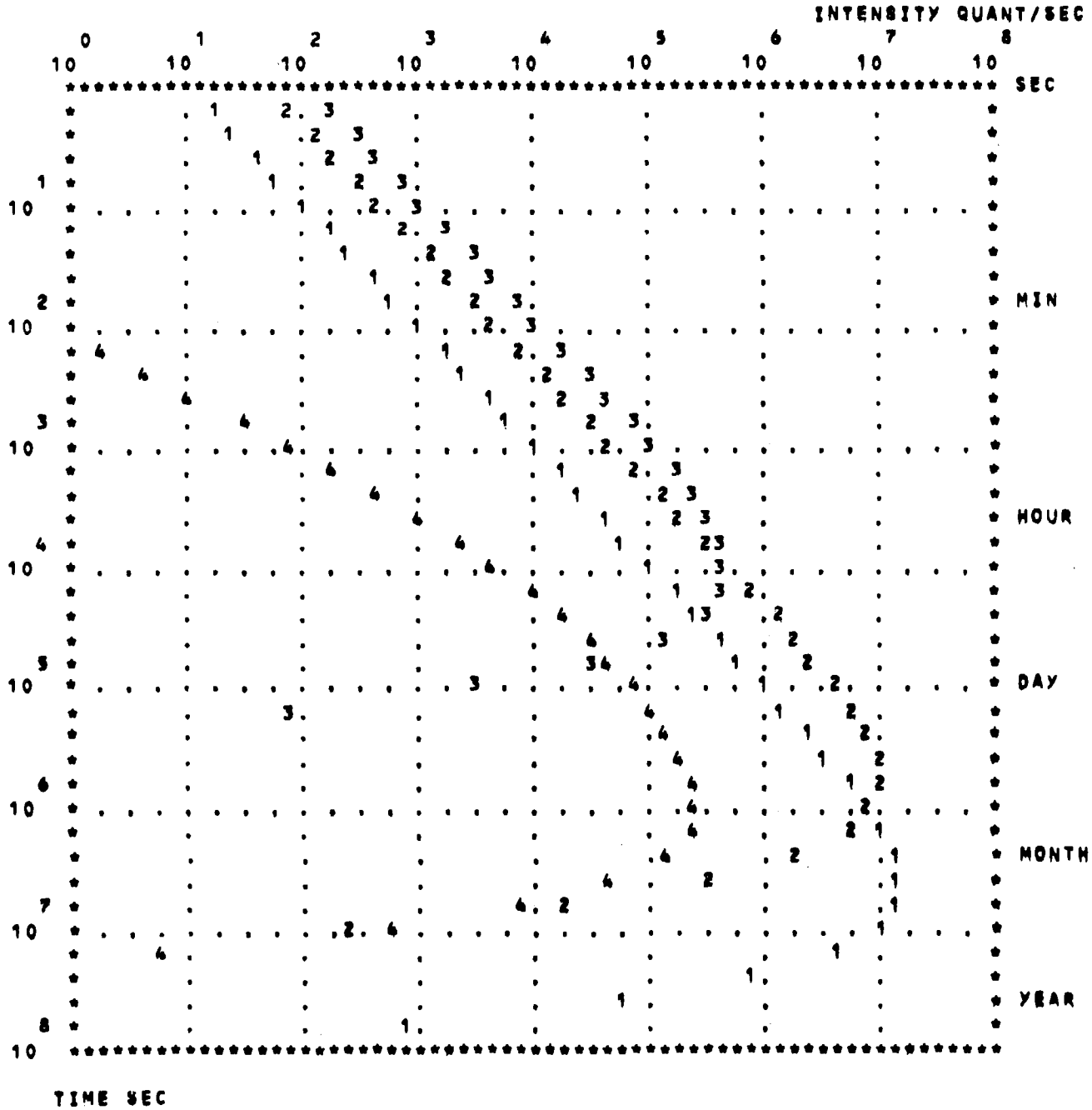
THULIUM 10^{13} N/SM 2 SEC 1,0 MG

1 - 169TU	100. %	95(2) B	170TU(129 D)170YB	84.257 KEV	3.26
2 - 170TU		92(4) B	171TU(1.92 Y)171YB	66.718 KEV	0.15
3 - 171TU		4.5(2) B	172TU(2.6 D)172YB	78.750 KEV	6.6



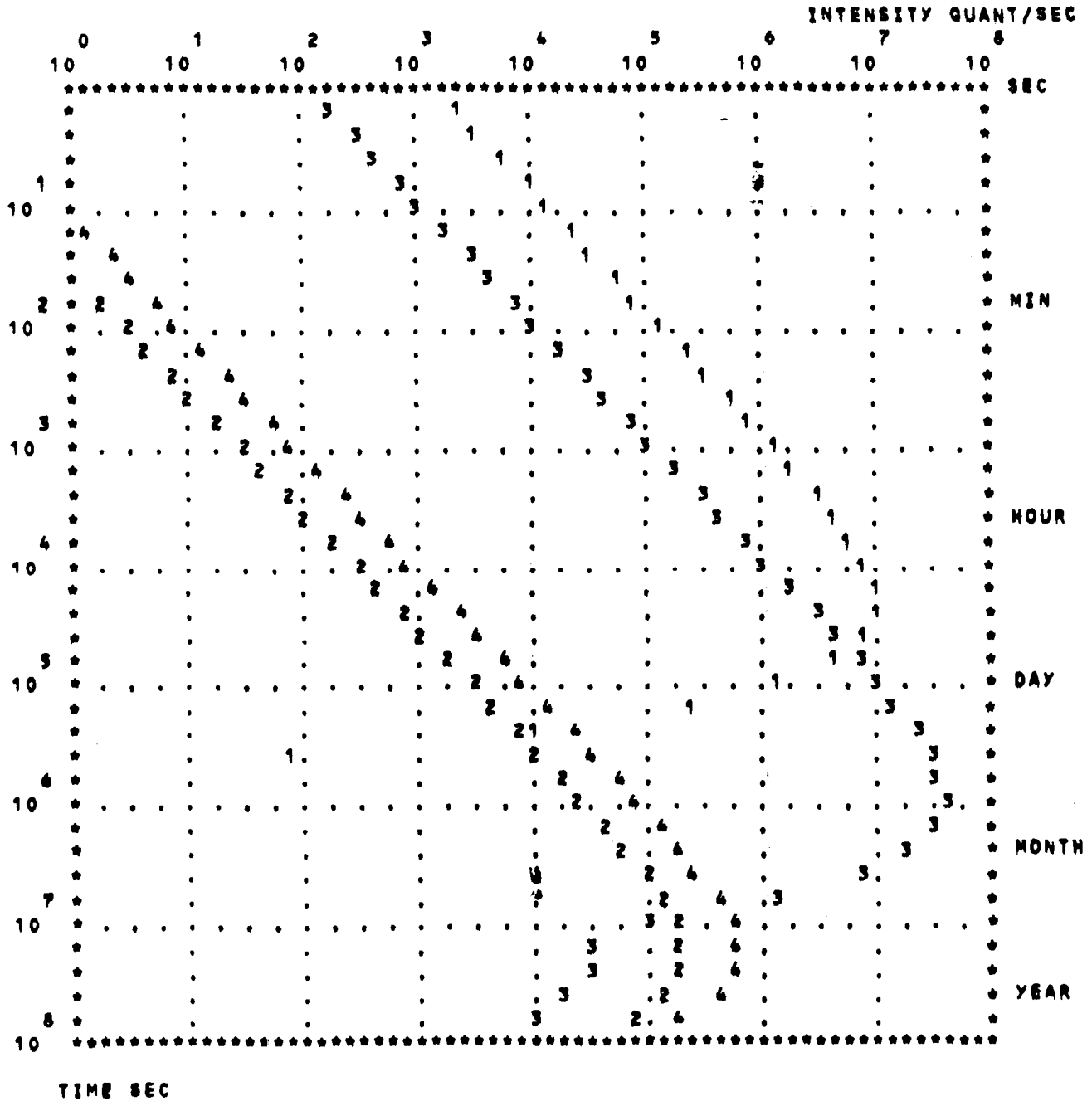
YTTERBIUM 10^{13} N/SM^{2} SEC 1.0 MG

1 - 168YB	0.14 %	347E1(10) B	169YB(32 D)169TU	63.119 KEV	41.6
2 - 174YB	31.8 %	65(5) B	175YB(4.2 D)175LU	396.32 KEV	6.5
3 - 176YB	12.7 %	2.4(2) B	177YB(1.90 H)177LU	150.39 KEV	20
4 -			177LU(6.7 D)177HF	208.36 KEV	11.0



LUTETIUM 10^{13} N/SM^{2} SEC 1.0 MG

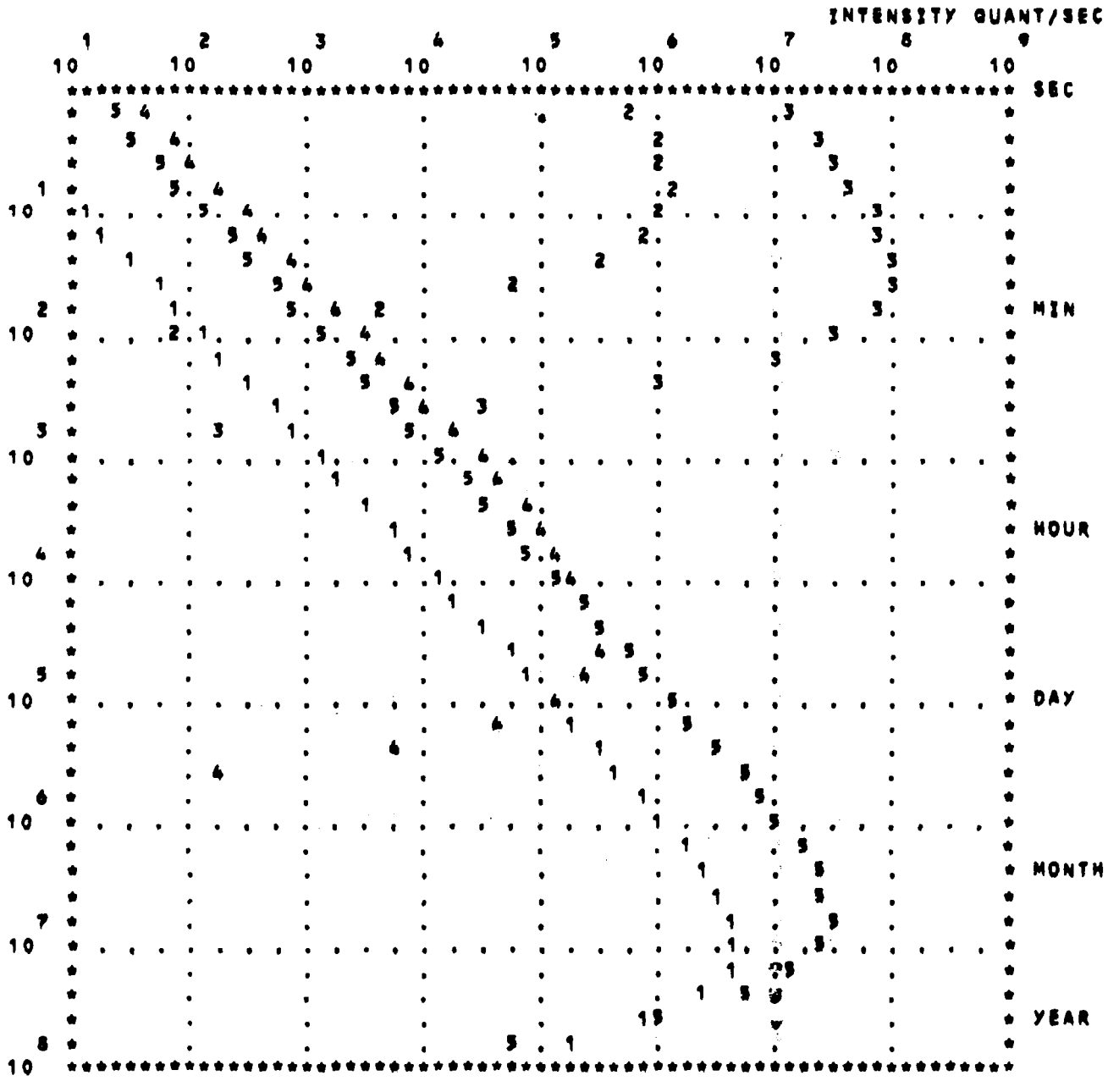
1 - 175LU	97.4 %	16.4(9) B	176LU(3.7 H)176HF	88.361 KEV	8.8
2 - 176LU	2.6 %	7(2) B	177LU(161 D)177LU	413.70 KEV	17
3 -		178E1(7) B	177LU(6.7 D)177HF	208.36 KEV	11.0
4 -			177HF(1.08 S)177HF	208.36 KEV	80



13 2

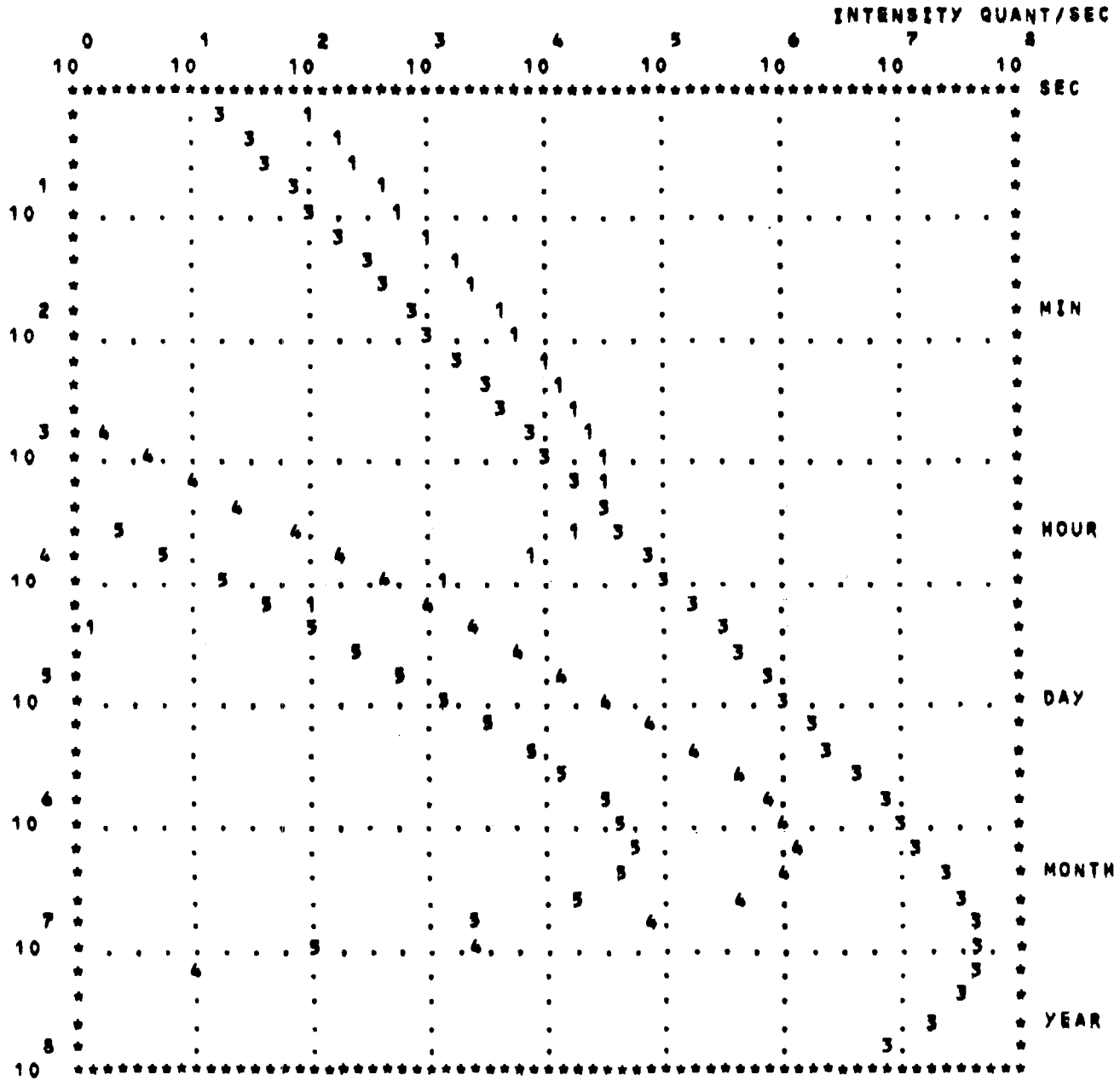
HAFNIUM 10 N/BM SEC 1.0 MG

1 - 174HF	0.17 %	39E1(5) B	175HF(	70	D)175LU	343.40 KEV	87
2 - 177HF	18.5 %	1.1(1) B	178HF(	4.3	S)178HF	426.37 KEV	86
3 - 178HF	27.2 %	93(6) B	179HF(	18.7	S)179HF	216.10 KEV	95
4 - 179HF	13.8 %	0.34(3) B	180HF(	5.5	H)180HF	332.31 KEV	94
5 - 180HF	35.1 %	12.6(7) B	181HF(	42	D)181TA	482.0 KEV	86
6 - 181HF		4E1(3) B	182HF(	90E5	Y)182TA	270.40 KEV	80
7 -			182TA(	115	D)182W	67.749 KEV	41.2



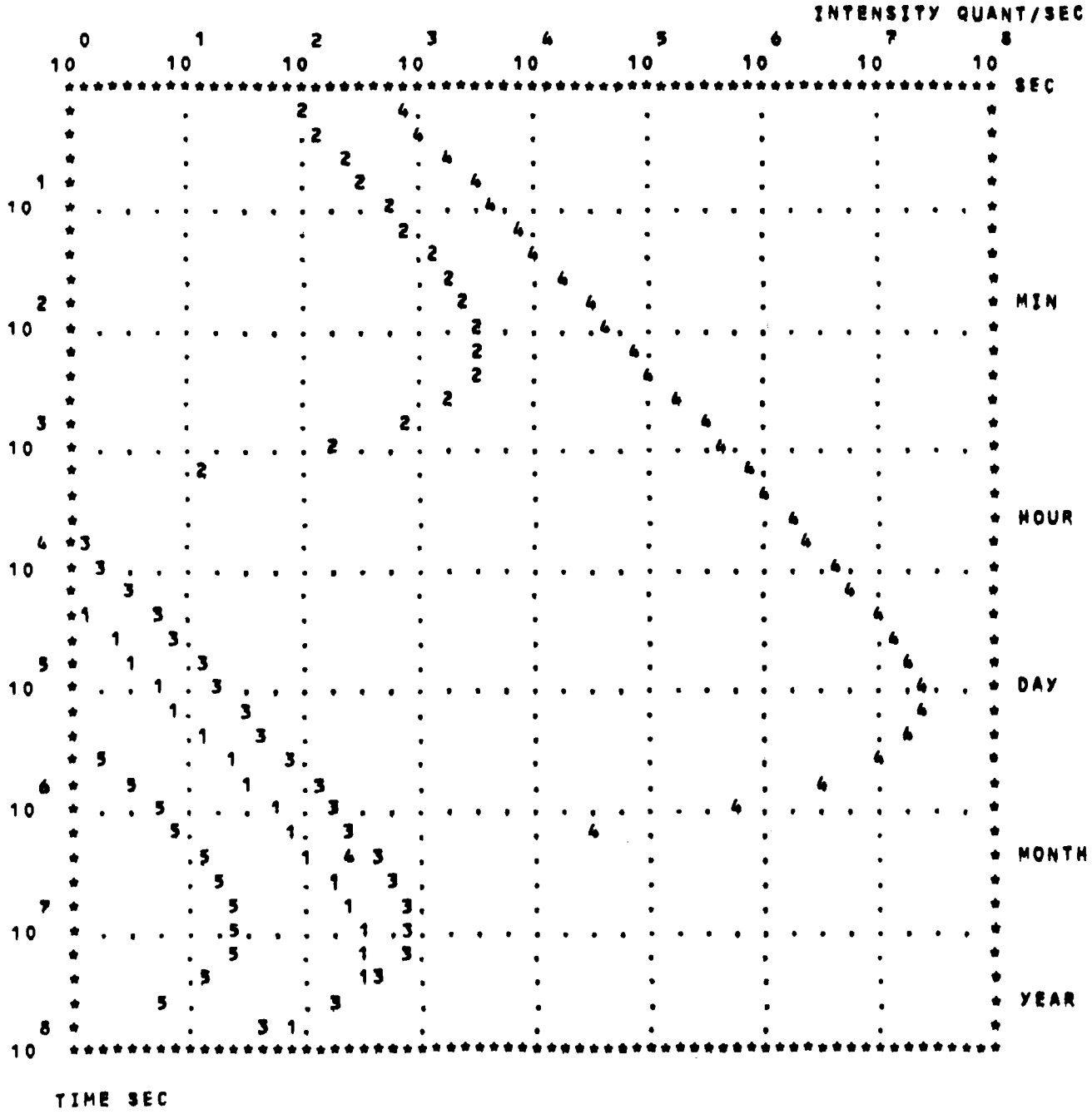
TANTALUM 10^{13} N/SM^2 SEC 1.0 MG

1 -	181TA99.988 %	0.0103(25) B	182TA(15.8 M)182TA	171.59 KEV	48.7
2 -			182TA(0.28 S)182TA	15.00 KEV	0.00153
3 -		21.0(7) B	182TA(115 D)182W	67.749 KEV	41.2
4 -	182TA	8282(6) B	183TA(5.1 D)183W	246.06 KEV	26.7
5 -			183W (5.1 S)183W	107.93 KEV	24.1



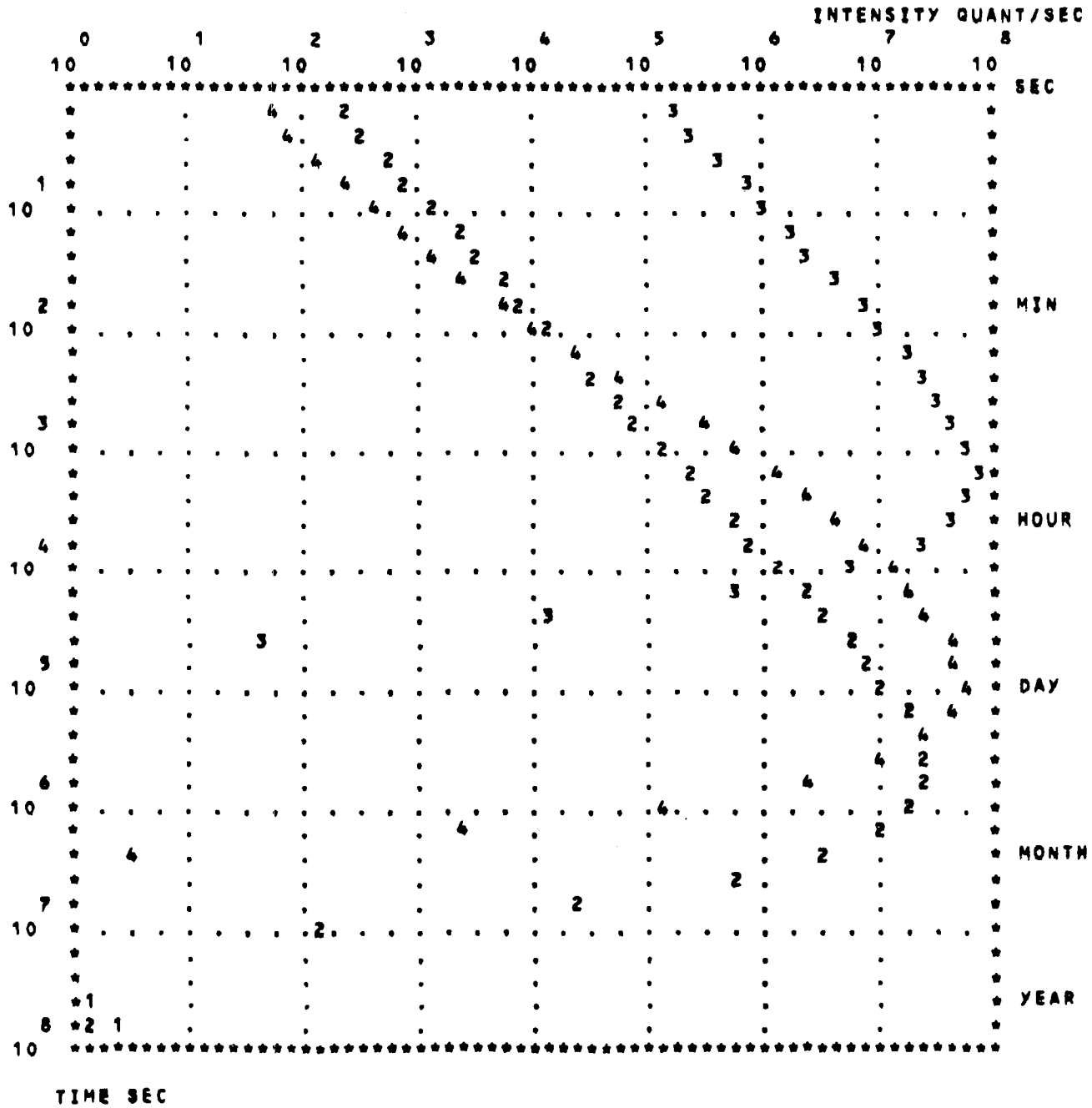
TUNGSTEN 10^{13} N/SM ^{2} SEC 1.0 MG

1 - 180W	0.13 %	3.5(10) B	181W	(121	D)181TA	6.21 KEV	0.98
2 - 184W	30.7 %	0.002(1) B	185W	(1.67	M)185W	9.53 KEV	74
3 -		1.8(2) B	185W	(75	D)185RE	125.36 KEV	0.019
4 - 186W	28.6 %	37.8(15) B	187W	(23.9	M)187RE	685.81 KEV	29.3
5 - 187W		64(10) B	188W	(69	D)188RE	290.67 KEV	0.402



RHENIUM 10^{13} N/SM 10^{2} SEC 1.0 MG

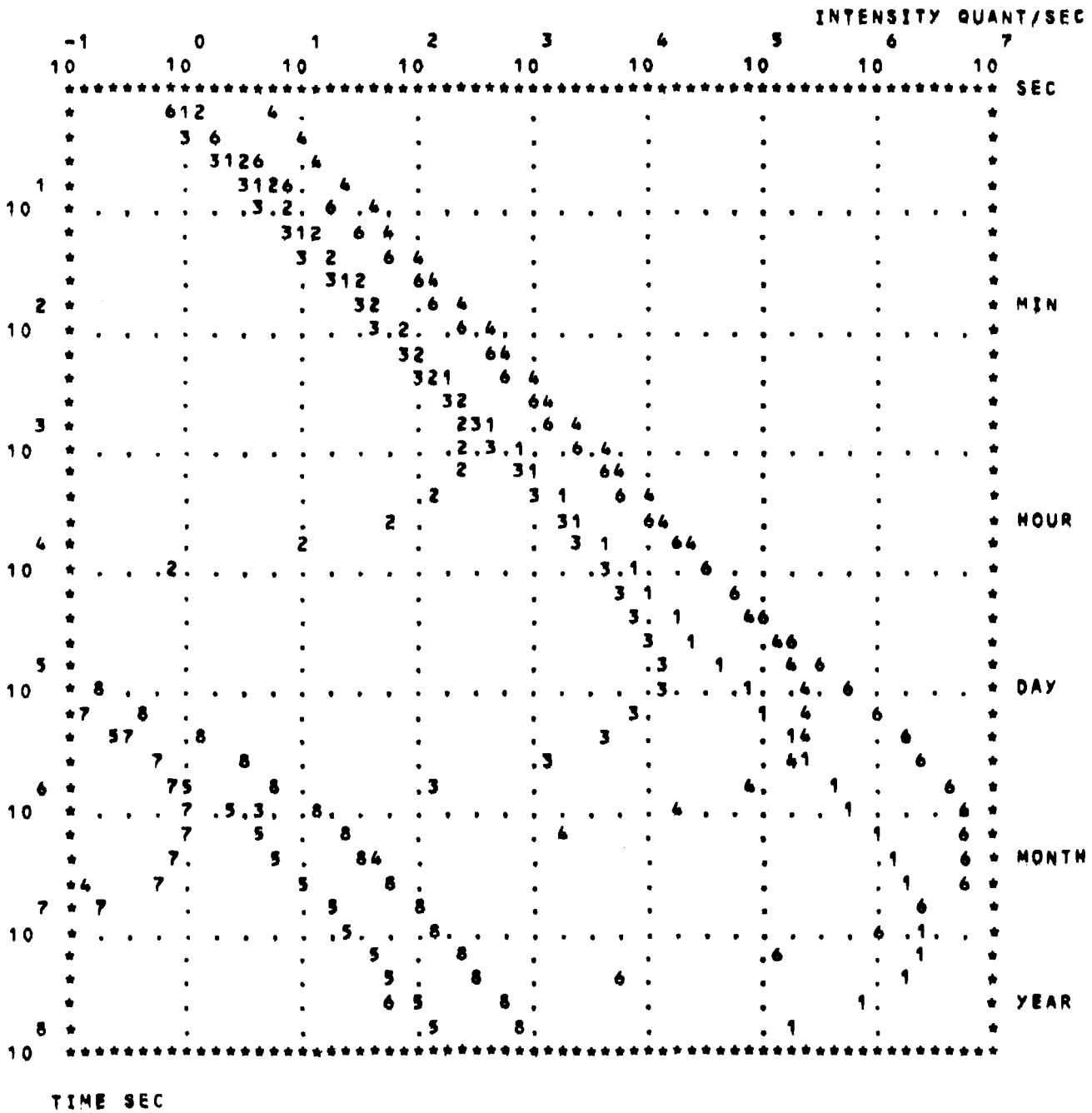
1 - 185RE	37.5 %	0.3(1) B	186RE(20E4 Y)186RE	58.980 KEV	17.8
2 -		112(3) B	186RE(3.8 D)186OS	137.16 KEV	8.6
3 - 187RE	62.5 %	73(4) B	188RE(18.6 M)188RE	63.580 KEV	21.6
4 -		1.6(3) B	188RE(17.0 H)188OS	155.04 KEV	14.9



OSMIUM

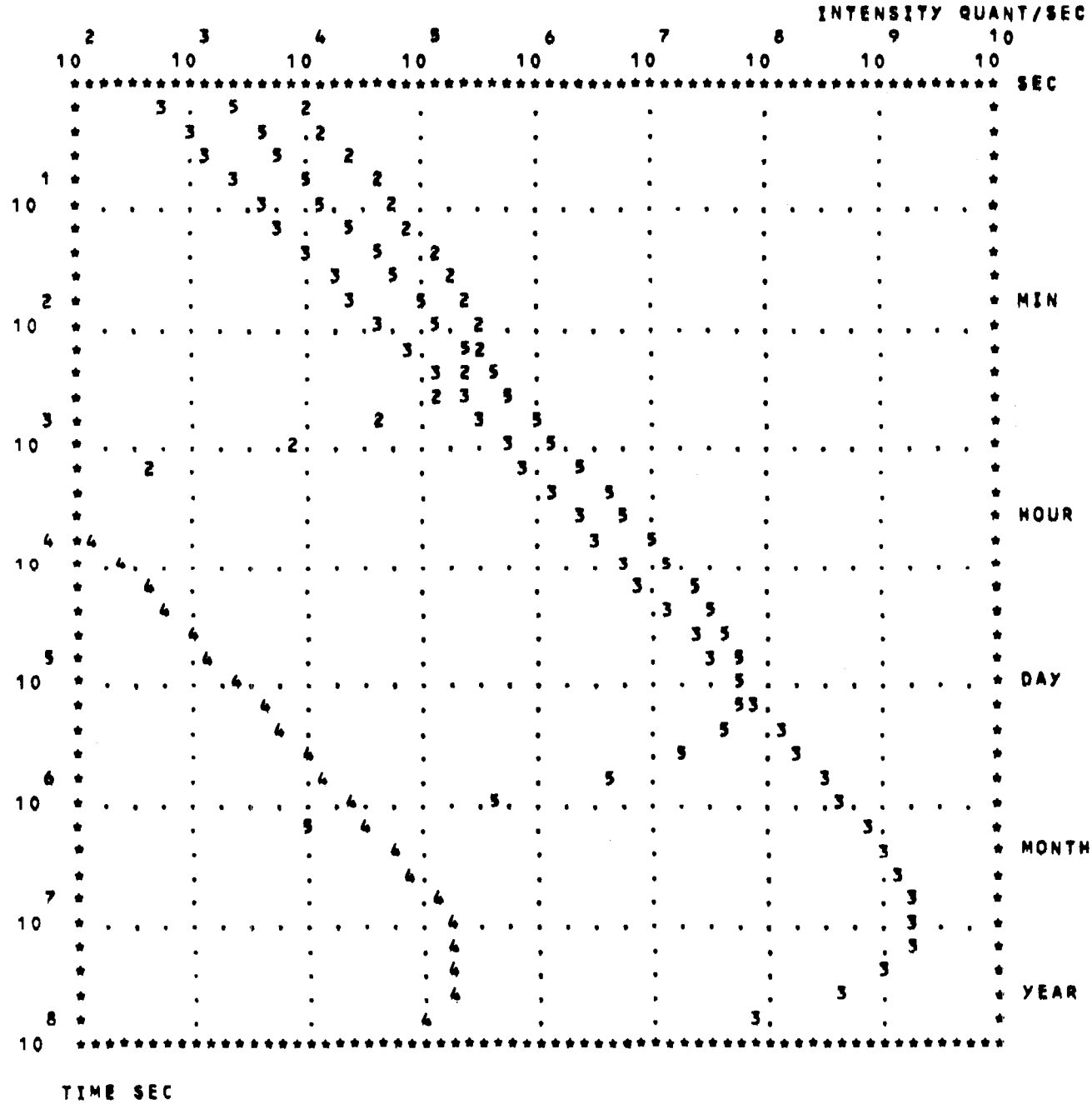
10^{13} N/SM SEC 1.0 MG

1 -	184OS	0.018 %	300E1(15) B	185OS(	94	D)185RE	666.12 KEV	81
2 -	189OS	16.1 %	2.6E-4(3) B	190OS(	9.9	M)190OS	616.40 KEV	94
3 -	190OS	26.4 %	9.1(5) B	191OS(	13.1	H)191OS	74.38 KEV	0.074
			3.9(8) B	191OS(	15.4	D)	NO GAMMAS	
4 -	192OS	41. %	2.0(1) B	193OS(	1.27	D)193IR	138.89 KEV	4.27
5 -	193OS		15E2(5) B	194OS(	6.0	Y)194IR	43.1 KEV	2.3
6 -				191IR(	4.9	S)191IR	129.43 KEV	29.7
7 -				193IR(	10.6	D)193IR	80.27 KEV	0.00457
8 -				194IR(	19.1	H)194PT	328.45 KEV	13



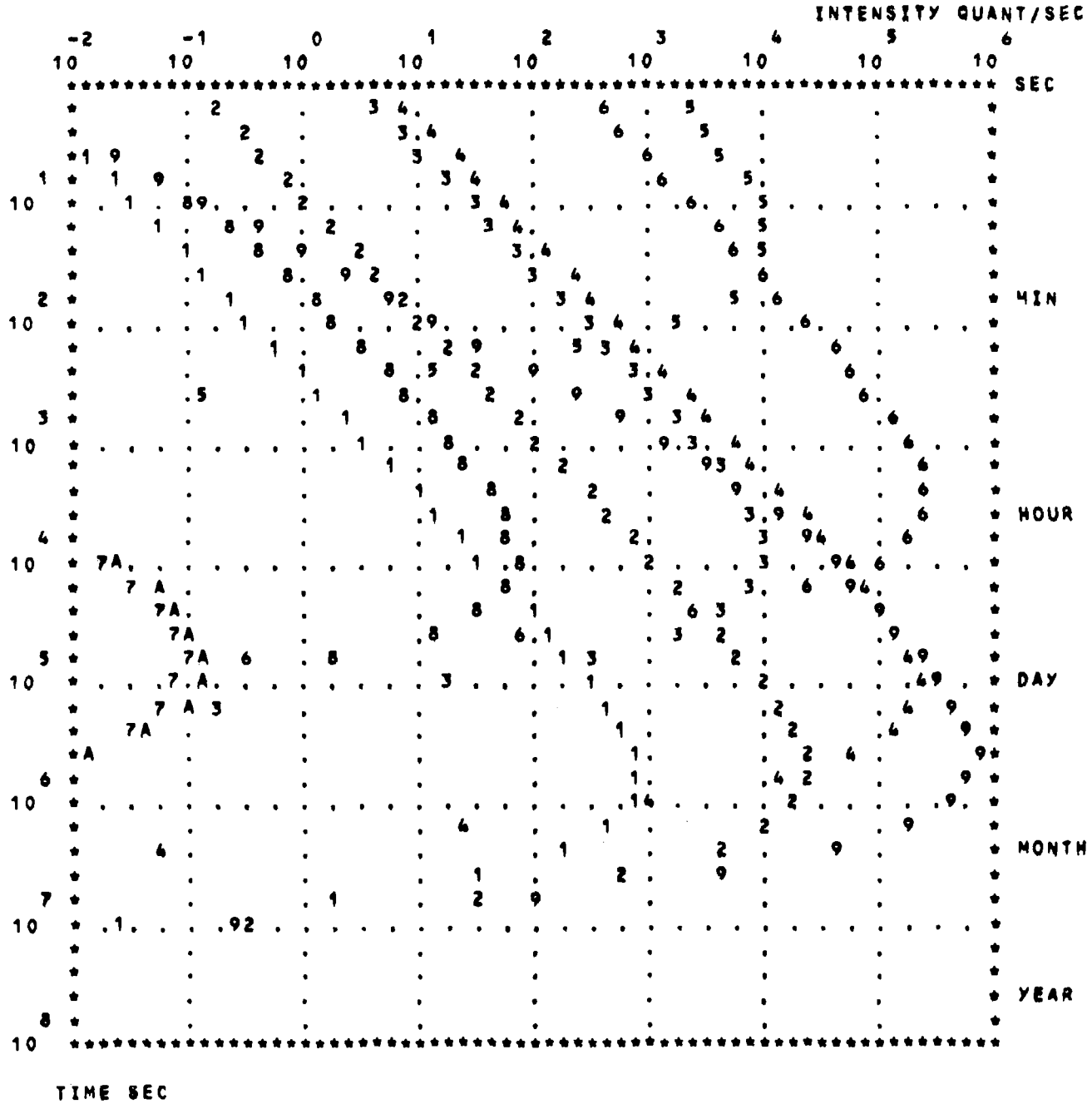
IRIDIUM 10^{13} N/SM ^{2} SEC 1.0 MG

1	- 191IR	37.4 %	0.38(17)	B	192IR(	241	Y)192IR	161	KEV	0.126
2	-		30E1(3)	B	192IR(	1.44	M)192IR	58	KEV	0.0392
3	-		62E1(6)	B	192IR(	74	D)192PT	316.50	KEV	83
4	- 193IR	62.6 %	0.05(2)	B	194IR(	171	D)194PT	482.60	KEV	97
5	-		110(15)	B	194IR(	19.1	H)194PT	328.45	KEV	13



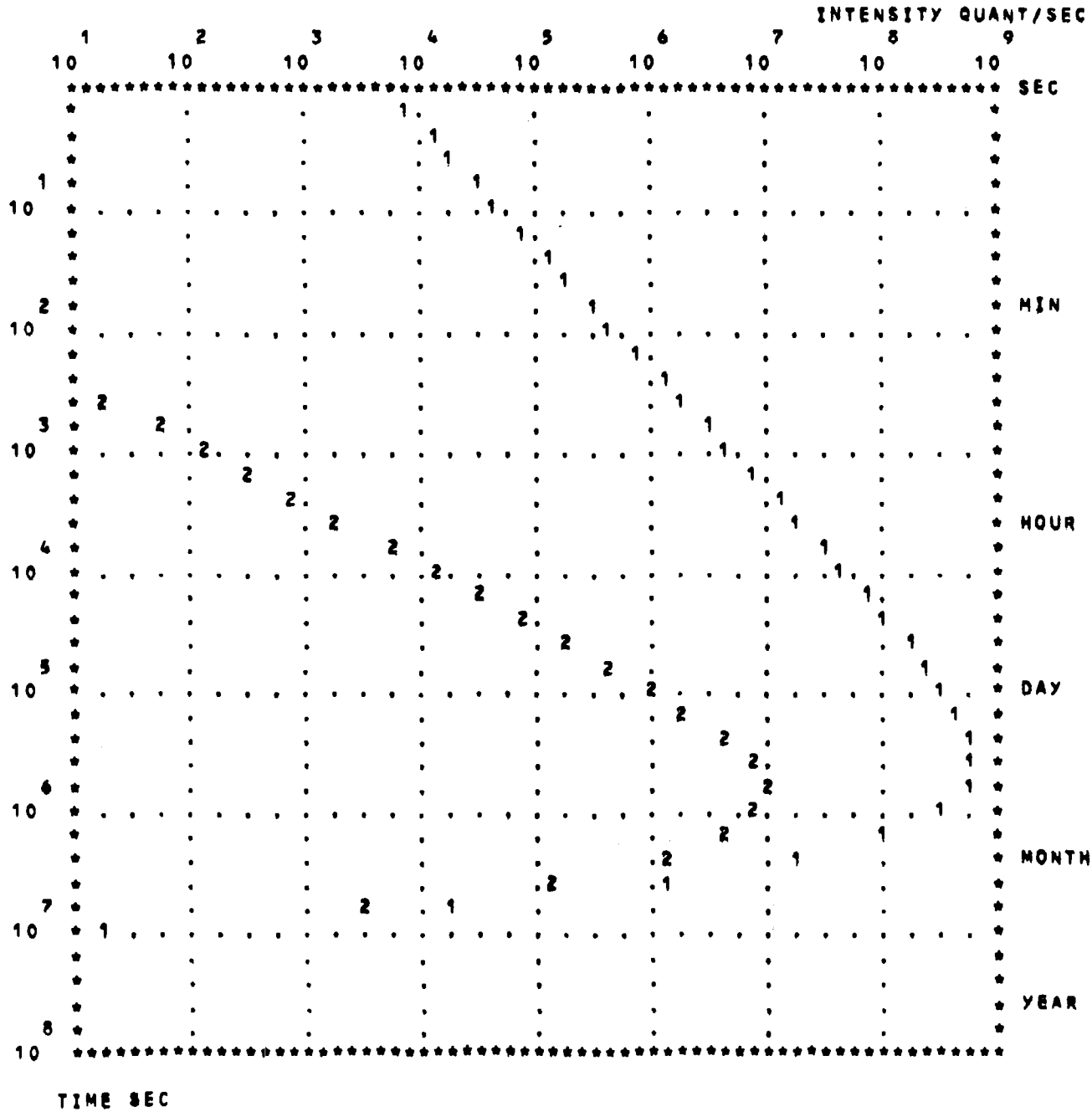
PLATINUM 10^{13} N/SM^2 SEC 1.0 MG

1 - 192PT	0.78 %	2.2(8) B	193PT(4.3 D)193PT	12.634 KEV	0.6644
2 - 194PT	32.9 %	0.090(13) B	195PT(4.0 D)195PT	98.90 KEV	11.4
3 - 196PT	25.3 %	0.05(1) B	197PT(1.57 H)197PT	346.5 KEV	11.1
4 -		0.69(8) B	197PT(18.3 H)197AU	77.35 KEV	17
5 - 198PT	7.2 %	0.027(3) B	199PT(13.6 S)199PT	391.93 KEV	85
6 -		3.67(20) B	199PT(31 M)199AU	542.98 KEV	14.8
7 - 199PT		15(10) B	200PT(12.5 H)200AU	76.20 KEV	13.4
8 -			197AU(7.8 S)197AU	279.01 KEV	72
9 -			199AU(3.1 D)199HG	158.37 KEV	36.9
A -			200AU(48 M)200HG	367.90 KEV	19



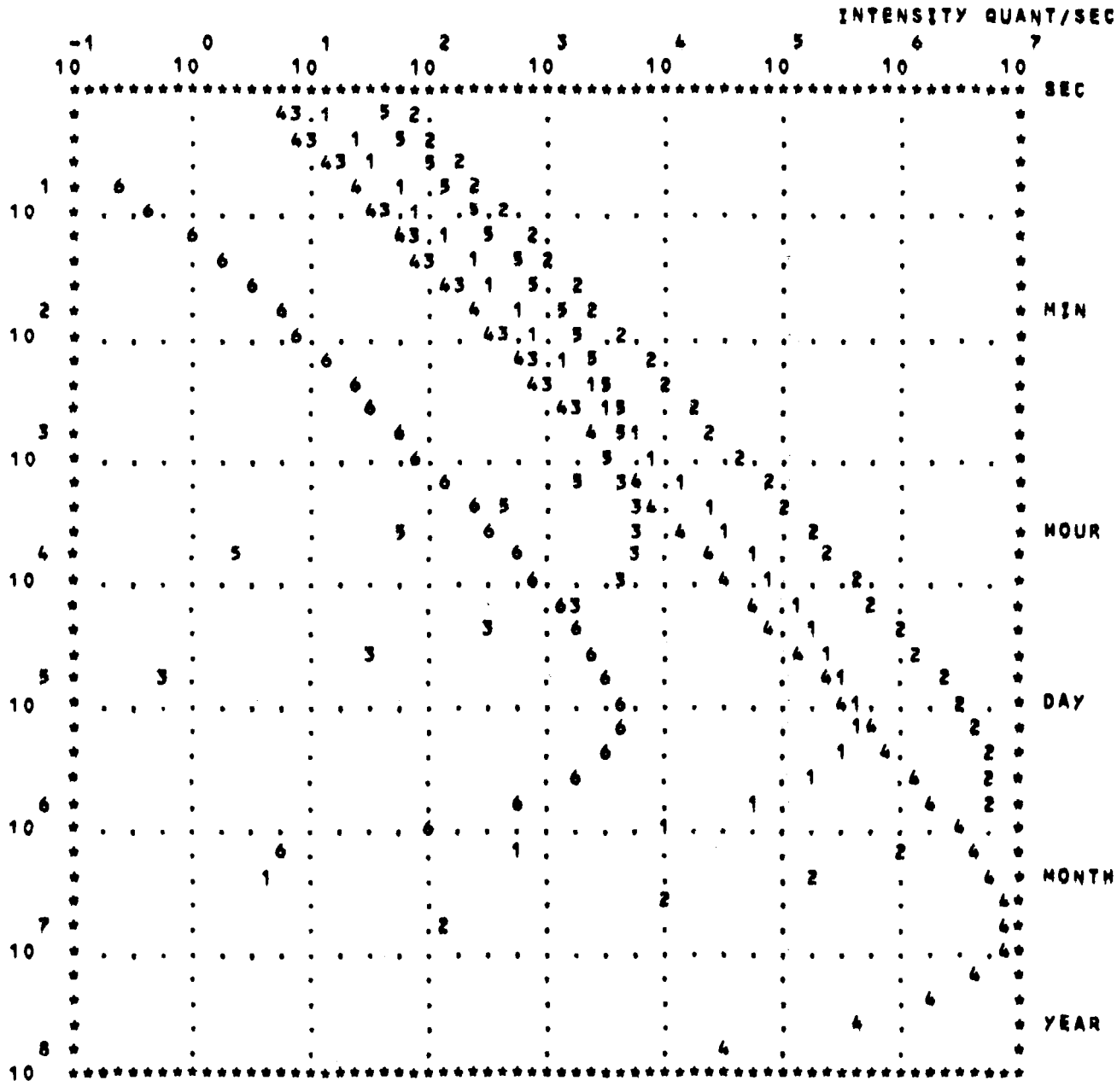
GOLD 10^{13} N/SM^2 SEC 1.0 MG

1 - 197AU	100. %	98.8(3) B	198AU(	2.7 D)	198HG	411.79 KEV	95
2 - 198AU		258E2(12) B	199AU(	3.1 D)	199HG	158.37 KEV	36.9
3 - 199AU		30(15) B	200AU(	48 M)	200HG	367.90 KEV	19



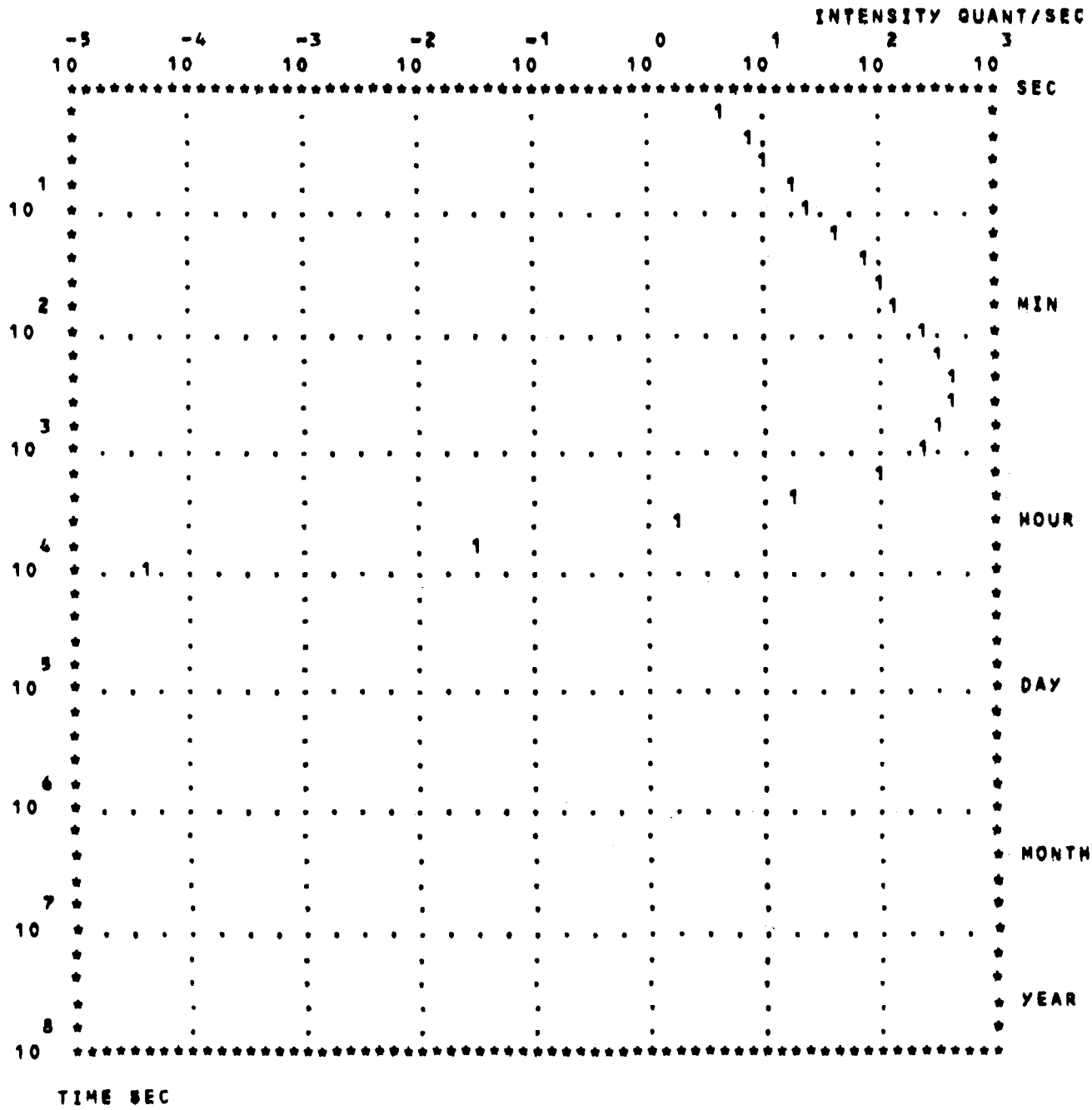
MERCURY 10^{13} N/SM^2 SEC 1.0 MG

1 -	196HG	0.15 %	120(13) B	197HG(	23.8	H)197HG	133.88	KEV	34
2 -			308E1(20) B	197HG(	2.7	D)197AU	77.352	KEV	18
3 -	198HG	10.1 %	0.018(4) B	199HG(	43	M)199HG	158.37	KEV	53
4 -	202HG	29.7 %	4.9(1) B	203HG(	47	D)203TL	279.19	KEV	81
5 -	204HG	6.9 %	0.43(10) B	205HG(	5.2	M)205TL	203.74	KEV	2.2
6 -				197AU(	7.8	S)197AU	279.01	KEV	72



THALLIUM 10^{13} N/SM^2 SEC 1.0 MG

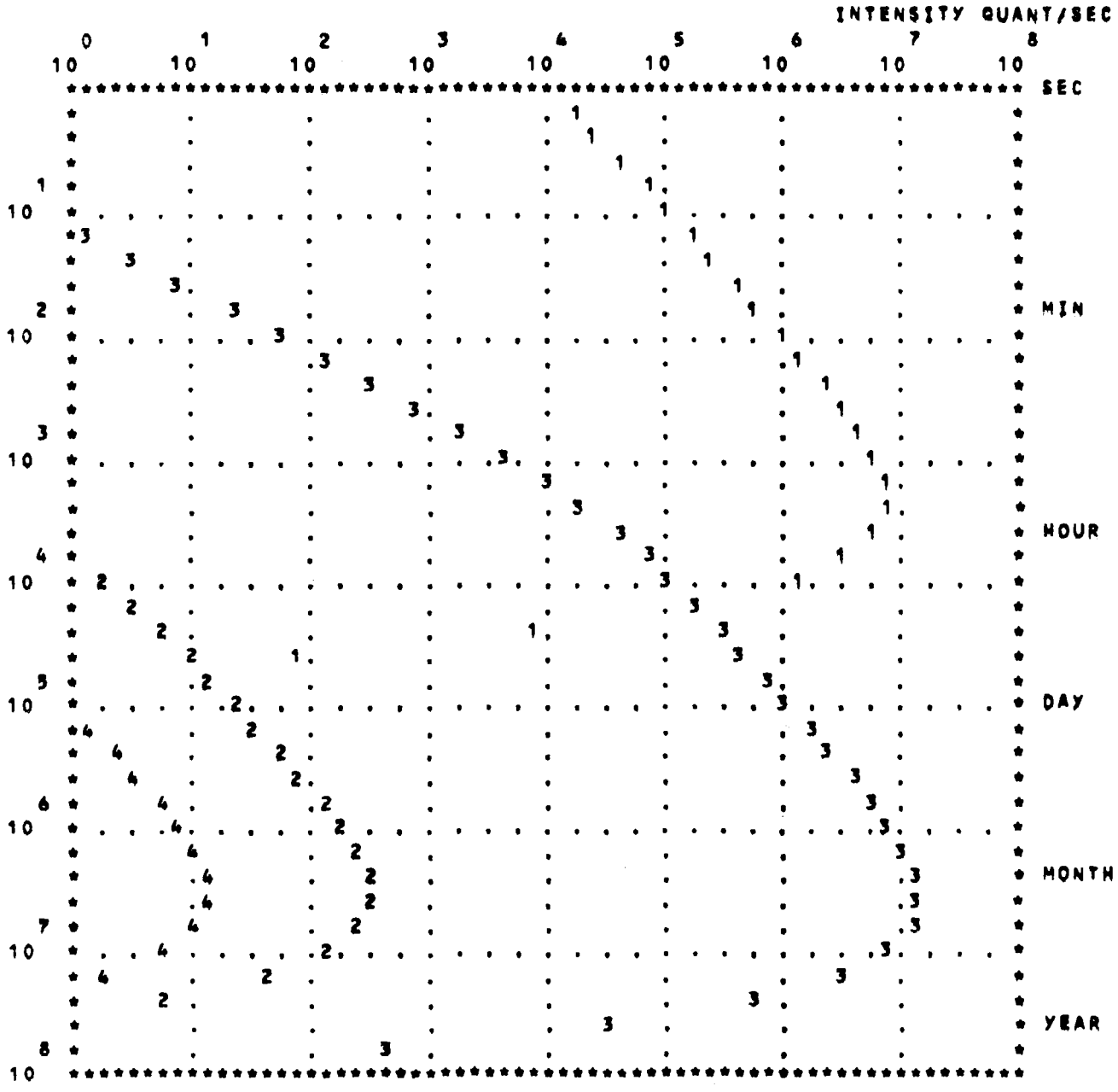
1 - 205TL 70.5 % 0.10(3) B 206TL(4.2 M)206PB 1165.0 KEV 0.09



THORIUM

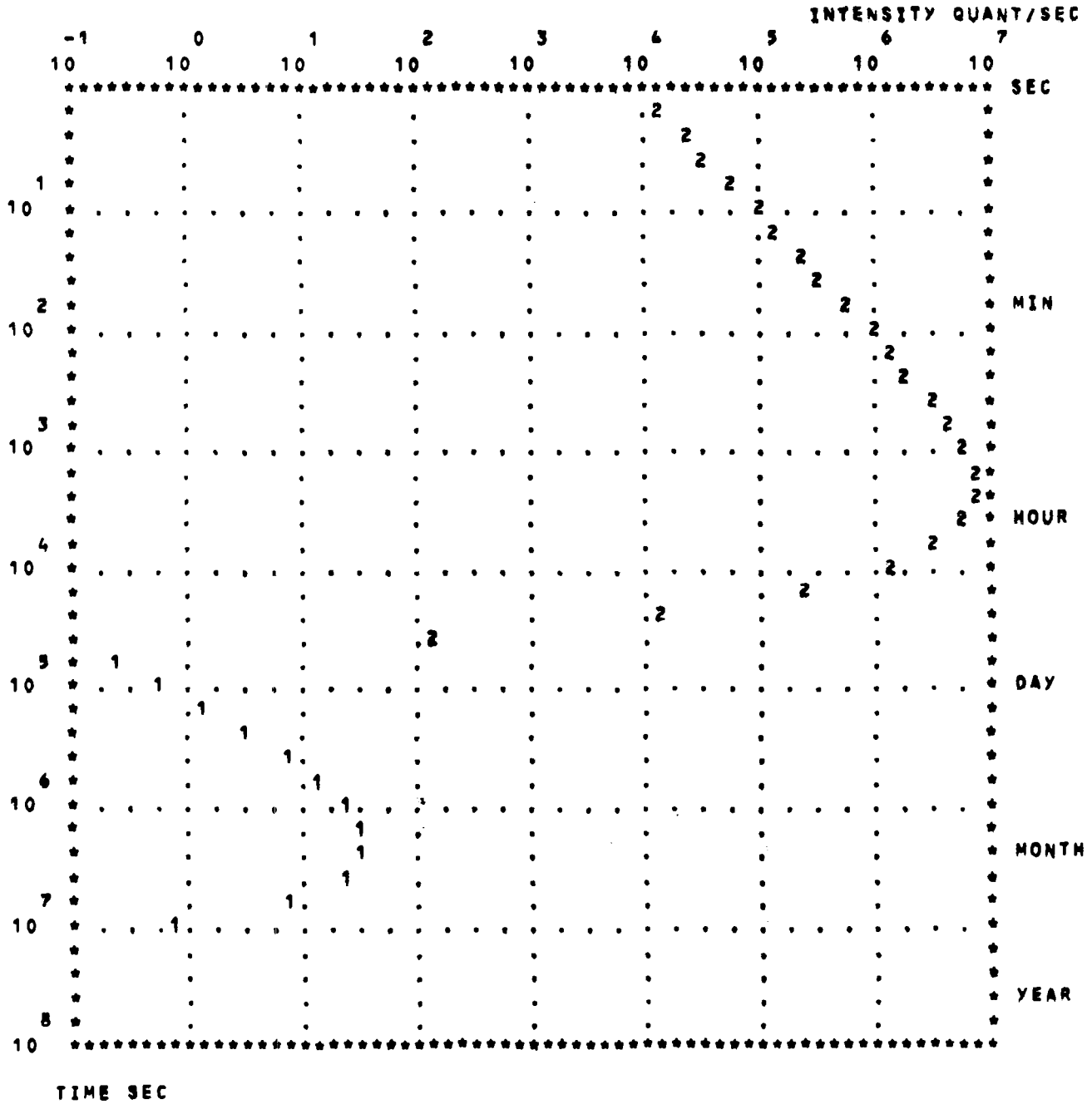
10^{13} N/SM SEC 1.0 MG

1 - 232TH 100. %	7.40(8) B	233TH(22.3 M)233PA	8.22 KEV	19.
2 - 233TH	15E2(1) B	234TH(24.1 D)234PA	73.92 KEV	23.9
3 -		233PA(27 D)233U	311.98 KEV	36
4 -		234PA(1.17 M)234U	43,500 KEV	0.65
5 -		234PA(6.7 H)234U	131.2 KEV	20



URANIUM 10^{13} N/SM^2 SEC 1.0 MG

1 - 236U		5.2(3) B	237U (6.7 D)	237NP	59.543 KEV	33	
2 - 238U	99.27 %	2.70(2) B	239U (23.5 M)	239NP	74.670 KEV	50	



THERMAL NEUTRON FLUX 10^{13} N/SM^2 SEC
SAMPLE WEIGHT 100. MG
ACTIVATION TIME IS EQUAL TO COOLING TIME(SEC)

Z	1	10	10^2	10^3	10^4	10^5	10^6	10^7
H								
HE								
LI								
BE								
B								
C								
N	2.07E2	5.78E2	0.14					
O	2.40E2	1.70E3	6.80E2					
F	1.74E7	7.57E7	5.57E5					
NE	6.86E5	5.34E6	4.97E6	0.31				
NA	1.78E5	1.78E6	1.77E7	1.74E8	1.47E9	2.78E9	3.76E4	
MG	8.52E4	8.38E5	7.11E6	1.45E7	3.48E2			
AL	2.64E7	2.46E8	1.24E9	2.95E7				
SI	3.42	3.42E1	3.38E2	3.07E3	1.16E4	3.01E1		
P								
S	1.09E3	1.06E4	7.75E4	4.21E4				
CL	4.36E7	2.32E6	2.23E7	1.47E8	3.22E7			
AR	1.03E6	1.03E7	1.02E8	8.83E8	2.23E9	2.60E5		
K	4.02E3	4.02E4	4.01E5	3.93E6	3.10E7	4.29E7	4.43E1	0.89
CA	3.11E4	3.06E5	2.56E6	4.59E6	4.37E3	3.45E4	7.08E4	1.79
SC	2.85E9	1.74E10	1.95E9	3.48E7	3.48E8	3.43E9	3.02E10	8.59E10
TI	2.08E5	2.03E6	1.55E7	1.21E7	0.20			
V	1.77E8	1.70E9	1.12E10	2.93E9				
CR	2.37E2	2.37E3	2.37E4	2.37E5	2.36E6	2.27E7	1.54E8	4.27E7
MN	1.07E7	1.07E8	1.06E9	9.61E9	3.59E10	8.22E7		
FE	3.76	3.76E1	3.76E2	3.76E3	3.75E4	3.66E5	2.87E6	2.88E6
CO	4.64E6	4.57E7	3.94E8	9.34E8	1.58E7	1.58E8	1.57E9	1.48E10
NI	2.34E3	2.33E4	2.31E5	2.08E6	7.61E6	1.47E4	0.87	
CU	1.12E6	1.08E7	8.01E7	4.61E7	1.74E7	2.47E7	7.64E1	
ZN	6.42E3	6.02E4	3.21E5	1.56E6	1.29E7	2.11E7	5.52E7	3.56E8
GA	2.08E5	2.08E6	2.08E7	2.04E8	1.70E9	2.90E9	1.79E4	
GE	2.78E6	2.29E7	3.51E7	1.94E7	3.20E7	3.80E6	1.33E4	
AS	1.18E5	1.18E6	1.18E7	1.17E8	1.06E9	4.03E9	1.07E7	
SE	3.08E8	1.81E9	1.52E8	5.62E6	4.34E6	1.49E7	1.36E8	5.58E8
BR	1.46E6	1.45E7	1.33E8	5.66E8	8.26E8	1.97E9	3.44E7	
KR	2.54E7	1.25E8	6.69E6	5.81E7	1.47E8	5.19E6	8.70E4	2.13E4
RB	2.96E6	2.54E7	5.78E7	1.23E7	9.20E5	8.68E6	4.89E7	2.88E6
SR	3.27E4	3.26E5	3.23E6	2.95E7	1.19E8	5.04E5	3.55E6	7.10E6
Y	3.94E2	3.94E3	3.91E4	3.60E5	1.62E6	2.66E5	6.50E4	
ZR	3.81	6.64E1	3.40E3	4.12E4	3.55E5	9.14E5	3.16E6	1.89E7
NB	0.01	0.08	0.80	8.05	8.05E1	1.23E3	9.35E4	6.86E5
MO	1.71E4	1.70E5	1.52E6	2.89E7	1.62E6	3.06E7	8.45E6	
TC								
RU	6.98E3	6.97E4	6.93E5	6.54E6	3.67E7	3.99E7	3.04E8	2.29E8
RH	2.51E8	2.02E9	5.05E9	1.83E9	1.63E3	8.13E3	1.41E2	
PD	4.25E5	3.58E6	2.57E7	1.17E7	5.23E7	8.20E7	2.19E6	1.23E3
AG	2.79E8	1.91E9	5.80E8	1.44E7	3.80E6	3.78E7	3.62E8	2.34E9
CD	2.14E4	2.13E5	2.07E6	1.50E7	7.59E6	4.90E7	6.55E6	2.56E5
IN	2.95E10	5.93E9	2.13E10	1.60E11	1.07E11	4.52E6	3.64E7	4.33E7
SN	4.26E4	4.19E5	3.56E6	7.35E6	1.85E5	2.34E5	2.13E6	8.48E6
SB	2.67E5	2.57E6	1.78E7	3.48E7	3.35E8	2.23E9	9.26E8	1.65E9
TE	1.34E5	1.34E6	1.26E7	6.79E7	7.16E6	3.10E7	8.74E7	2.96E7
I	2.17E6	2.16E7	2.03E8	1.09E9	4.57E7			
XE	1.00E6	8.52E6	1.75E7	4.90E6	4.20E7	9.58E7	3.71E7	1.03E7
CS	9.69E4	9.68E5	9.60E6	8.77E7	3.65E8	1.36E8	1.34E9	1.15E10
BA	3.86E5	3.38E5	3.32E6	2.76E7	4.72E7	1.49E6	6.07E6	3.97E5
LA	1.76E5	1.76E6	1.76E7	1.75E8	1.64E9	8.68E9	3.07E8	8.19E3

Z	1	10	10^2	10^3	10^4	10^5	10^6	10^7
CE	1.85E3	1.57E4	1.09E5	1.08E6	1.00E7	4.62E7	1.79E8	8.14E7
PR	1.21E4	1.21E5	1.27E6	1.61E7	1.58E8	4.23E8	7.76E4	
ND	1.18E5	1.16E6	1.03E7	3.04E7	3.53E7	1.81E7	6.90E7	1.85E5
PM								
SM	1.92E6	1.91E7	1.78E8	8.87E8	2.39E9	1.38E10	9.81E8	6.27E7
EU	1.89E7	1.89E8	1.89E9	1.84E10	1.39E11	1.01E11	4.69E9	1.70E10
GD	1.27E6	1.22E7	8.02E7	1.72E7	2.28E7	6.32E7	8.06E7	4.91E8
TB	3.16E3	3.16E4	3.16E5	3.16E6	3.13E7	3.10E8	2.67E9	6.14E9
DY	4.69E8	4.14E9	1.24E10	7.23E9	2.44E10	2.58E7	1.40E7	8.87E5
HO	1.02E5	1.02E6	1.02E7	1.01E8	9.19E8	3.56E9	1.08E7	
ER	1.47E9	3.45E8	5.08E6	4.91E7	3.48E8	1.42E8	6.00E4	4.38E5
TU	6.87E2	6.87E3	6.87E4	6.87E5	6.87E6	6.81E7	6.25E8	2.71E9
YB	2.11E4	2.11E5	2.08E6	1.82E7	8.65E7	6.69E8	1.23E9	4.29E8
LU	2.52E5	2.52E6	2.50E7	2.33E8	1.16E9	1.74E9	3.63E9	6.72E7
HF	1.63E9	9.93E9	1.11E9	4.95E6	3.10E7	2.34E8	1.81E9	1.63E9
TA	1.14E4	1.13E5	1.02E6	3.91E6	2.00E7	1.98E8	1.74E9	5.13E9
W	8.25E4	8.25E5	8.24E6	8.15E7	7.31E8	2.53E9	3.24E6	7.59E4
RE	1.97E7	1.95E8	1.80E9	7.90E9	218E9	4.97E9	1.24E9	7.11E1
OS	6.92E2	6.92E3	6.92E4	6.86E5	6.33E6	1.25E8	6.91E8	2.96E8
IR	1.10E6	9.86E6	3.43E7	2.76E8	2.41E9	9.61E9	8.23E10	1.83E11
PT	2.37E5	1.20E6	4.25E6	2.58E7	8.70E6	5.26E7	2.15E7	0.02
AU	8.58E5	8.58E6	8.58E7	8.54E8	8.19E9	5.44E10	1.30E10	0.07
HG	7.67E3	7.67E4	7.67E5	7.64E6	7.36E7	5.05E8	4.71E8	5.20E8
TL	5.10E2	4.92E3	3.40E4	1.11E4				
PB								
BI								
TH	1.89E6	1.87E7	1.75E8	8.79E8	2.04E7	1.97E8	1.32E9	3.36E8
U	1.66E6	1.65E7	1.55E8	8.05E8	2.49E7	1.60E2	3.98E3	1.92