ENDF-103
(BAW-316)
May 1967

U-238 NEUTRON CROSS-SECTION DATA FOR THE ENDF/B

Babcock & Wilcox

ENDF-103
(BAW-316)
May 1967

U-238 NEUTRON CROSS-SECTION DATA FOR THE ENDF/B

by

W. A. Wittkopf
D. H. Roy
A. Z. Livolsi

THE BABCOCK & WILCOX COMPANY
Lynchburg, Virginia

Babcock & Wilcox

The Babcock & Wilcox Company
Report BAW-316 (ENDF-103)
May 1967

ABSTRACT

As part of the cooperative effort of the Cross Section Evaluation Working Group organized at Brookhaven National Laboratory in June 1966, the nuclear data on U-238 for use in the Evaluated Nuclear Data File B (ENDF/B) are presented. The data cover the energy range from 0.001 eV to 15 MeV. Data sources are referenced and the theoretical methods used in evaluating certain data are described. A complete listing of the data in the ENDF/B format is provided.

CONTENTS

List of Tables

Tables (Cont'd)

List of Figures

1. INTRODUCTION

1.1. Purpose

The Cross Section Evaluation Working Group (CSEWG) was established as the result of a request by the Director of the USAEC Division of Reactor Development and Technology (DRDT) for laboratories to participate in a cooperative effort on the evaluation and processing of nuclear data for immediate use in reactor calculations.[1] As part of this cooperative effort, the nuclear data on U-238 for use in the Evaluated Nuclear Data File B (ENDF/B) are presented. Honeck gives an excellent summary of the purposes and objectives of the evaluation program,[2] and BNL-8381 includes a detailed description of the ENDF/B structure.[3]

1.2. Ground Rules

At a CSEWG meeting in June 1966, the assignment of specific isotopes to evaluators was completed and ground rules for the evaluations were established. In view of the limited time available to complete the required work, the evaluators were instructed to utilize the best evaluations (bases on their experience) currently available and to put them in the standard ENDF/B format. Data could be re-evaluated if it could be done within the time schedule. Fortunately, U-238 is an element for which more than the average amount of experimental cross-section data are available in the energy range from 0.001 eV to 15 MeV, so that we do not have to rely greatly on theoretical calculations.

In keeping with these ground rules, the present compilation reflects to a large extent the results of other evaluators—the evaluations of Parker[4] and Schmidt,[5] in particular, have been used extensively. Furthermore, where we have used the results of others, we did not list the references to the basic data used by them, nor did we describe the methods used in their evaluations; this information is available in their own reports. However, for data that are the result of our evaluation, the methods are described and the basic source data are referenced.

1.3. Thermal Scattering Law Data

Data for the thermal scattering law are given in the form of a free-gas model. The constant free-scattering cross section is given as 10.6 barns, and the thermal energy cutoff is 2.5 eV. The data are tabulated in File 7 of the ENDF/B listing (Appendix A).

1.4. Possible Neutron Reactions With U-238

Table 1-1 lists thresholds for various reactions of neutrons with U-238. Except for the (n, F) reaction these thresholds are taken from the results of Howerton.[6]

Table 1-1. Thresholds for Reactions of Neutrons With U-238

Reaction	Threshold, MeV
(n, γ)	Exothermic
(n, F)	1.47
(n, n')	0.05
(n, 2n)	6.07
(n, 3n)	11.51
(n, p)	2.03
(n, np)	7.59
(n, d)	5.35
(n, nd)	10.45
(n, t)	4.16
(n, nt)	10.03
(n, He^3)	5.01
(n, nHe^3)	10.74
(n, α)	Exothermic

The threshold for the (n, F) reaction was obtained by selecting the energy at which the fission cross section equals half the value at the first plateau. As mentioned in section 3.8, the last nine reactions in Table 1-1 are assumed to be small and have been neglected in this compilation.

1.5. Outline of the Data

In compiling the U-238 nuclear data the energy range has been separated into two main divisions. The data for neutron energies below 50 KeV are given in section 2, and those for energies between 50 KeV and 15 MeV are given in section 3. The data in section 2 are further subdivided into a low-energy range (from 0.001 to 5 eV), a resolved-resonance energy range (from 5 to 3920 eV), and an unresolved-resonance range (from 3920 eV to 50 KeV). This separation was convenient because of the somewhat different methods used in each range. In section 3 (energy range from 50 KeV to 15 MeV) the subdivisions are based on cross-section type for convenience. Section 4 is a list of references, and Appendix A is a listing of all data in the ENDF/B format. Table 3-1 gives the interpolation scheme for interpolation between energy points in the various tables of cross sections and parameters.

2. U-238 CROSS SECTIONS BELOW 50 KeV

(A. Z. Livolsi, D. H. Roy)

Below 1 eV, the capture cross section of U-238 is almost 1/v, since all resonance levels (including those below the neutron separation threshold) lie considerably above or below this range. From 1 to approximately 5 eV, the capture cross section profile is dominated by the 6.67 eV resonance level. This profile is essentially unaffected by Doppler broadening even at normal reactor fuel temperature. Thus 5.0 eV has been chosen as the cutoff between the thermal and the resonance energy regions.

2.1. Thermal Energy Region ($10^{-3} \leq E \leq 5$ eV)

For any energy point the capture cross section can be computed by summing the contributions from the various positive and negative energy resonance levels. In this study, these contributions have been obtained from the single-level, Breit-Wigner formula corrected for Doppler broadening:

$$\sigma_{n,\gamma}(E) = \sum_i \sigma_o^i \sqrt{\frac{E_i}{E}}\, \psi(X, \theta) \qquad (2\text{-}1)$$

where

$$\sigma_o^i = \frac{2.6038 \times 10^6}{\sqrt{E_i}} \left(\frac{A+1}{A}\right)^2 g_i \; \frac{\Gamma_n^{o,i}\Gamma_\gamma^i}{\left(\sqrt{E_i}\,\Gamma_n^{o,i} + \Gamma_\gamma^i\right)^2} \qquad (2\text{-}2)$$

At E = 0.0253 eV, the first 22 positive levels in U-238 contribute 2.38 barns; parameters for these levels were taken from reference 7 (recommended values) and are tabulated in Table 2-1. Taking

$$\sigma_{n,\gamma}(0.0253\ eV) = 2.73 \pm 0.04 \text{ barns}$$

as the preferred experimental value,[8] then 0.35 barns must be attributed to the negative energy levels and to the remaining positive energy resonances. In this evaluation, the remaining contributions were attributed to a single negative energy level at −15 eV (as noted by Sumner,[9] the first two negative levels would be expected at approximately −11 and −29 eV). By assigning $\Gamma_n^o = 0.7884 \times 10^{-3}\ (eV)^{1/2}$ and $\Gamma_\gamma = 24.6$ meV, this fiducial level contributes the 0.35 barns necessary to produce the experimental value of the capture cross section at 2200 M/S.

The entire analysis is performed by the DOPS code, a FORTRAN IV program for cross-section calculations using the single-level, Breit-Wigner formula corrected for Doppler broadening.

Total cross-section data were taken from Parker's compilation[4] and appear on the Aldermaston/Winfrith data file of ENDF-A. This tabulation is derived from the graphical representation of the slow-chopper data from BNL, Columbia, and ANL given in BNL-325 (2nd Ed.).[8] Sumner also gives a description of the data.[9] The scattering cross section varies sharply at the Bragg limit (about 0.003 eV). Scattering below this cutoff is due to coherent thermal inelastic effects with a small incoherent contribution due to isotopic impurity of the samples used in the cross-section measurements (there being no spin incoherence for nuclei with I = 0). It is accurate enough, however, to assume that between 1 and 3 meV, the scattering cross section is nul. From 3 meV to 5 eV, values of the capture cross section were calculated at the energy points for which the total cross section was tabulated, and the scattering cross section was obtained as the difference:

$$\sigma_s(E) = \sigma_{TOT}(E) - \sigma_{n,\gamma}(E) \qquad (2\text{-}3)$$

The total, capture, and elastic scattering cross sections of U-238 for the energy range 1 meV to 5 eV are listed in Table 3-2 and are presented graphically in Figure 2-1.

Table 2-1. U-238 Resolved Resonances

Γ_γ = 24.6 meV

g = 1.0

E	Γ_n	E	Γ_n	E	Γ_n
-1.5000+01	3.0534-03	1.2670+03	2.7000-02	2.7168+03	7.0887-02
6.6700+00	1.5200-03	1.2732+03	2.9000-02	2.7300+03	2.6125-03
1.0200+01	1.4000-06	1.2985+03	3.6000-03	2.7501+03	3.9331-02
2.1000+01	8.5000-03	1.3172+03	4.7000-03	2.7619+03	1.5766-02
3.6700+01	3.1000-02	1.3357+03	1.5000-03	2.7879+03	1.0560-02
6.6200+01	2.5000-02	1.3930+03	1.7000-01	2.7980+03	2.6448-03
8.1100+01	2.0000-03	1.4051+03	8.2000-02	2.8062+03	6.8866-03
8.9500+01	8.5000-05	1.4197+03	1.1000-02	2.8286+03	9.0414-03
1.0270+02	6.8000-02	1.4278+03	3.4000-02	2.8452+03	2.6670-03
1.1690+02	2.6000-02	1.4441+03	2.3000-02	2.8661+03	7.9233-02
1.4570+02	7.0000-04	1.4738+03	8.0500-02	2.8829+03	5.2619-01
1.6540+02	3.0000-03	1.5231+03	2.1000-01	2.8978+03	2.6916-02
1.8960+02	1.4500-01	1.5460+03	2.0000-03	2.9085+03	2.6965-03
2.0860+02	5.6000-02	1.5500+03	2.0000-03	2.9236+03	4.3256-03
2.3740+02	2.9000-02	1.5650+03	2.4000-03	2.9323+03	2.4909-02
2.6390+02	2.3000-04	1.6229+03	9.0000-02	2.9563+03	1.5224-02
2.7370+02	2.5000-02	1.6382+03	4.0400-02	2.9674+03	8.1711-03
2.9110+02	1.6000-02	1.6621+03	1.6000-01	2.9740+03	2.7267-03
3.1110+02	9.9000-04	1.6883+03	7.0000-02	2.9874+03	5.4657-03
3.4790+02	7.5000-02	1.7094+03	5.0000-02	3.0031+03	9.3161-02
3.7690+02	1.1500-03	1.7230+03	1.4000-02	3.0150+03	7.1382-03
3.9760+02	7.0000-03	1.7558+03	7.0000-02	3.0290+03	1.3759-01
4.1030+02	1.8000-02	1.7823+03	5.0000-01	3.0410+03	2.7573-03
4.3420+02	9.0000-03	1.7977+03	2.1200-03	3.0602+03	2.7660-02
4.5420+02	5.0000-04	1.8083+03	1.7009-02	3.0811+03	4.4405-03
4.6330+02	5.2000-03	1.8456+03	1.3318-02	3.1094+03	1.0037-01
4.7870+02	3.1000-03	1.9023+03	2.0935-02	3.1332+03	5.5975-03
4.8890+02	4.4000-04	1.9171+03	2.1692-02	3.1490+03	6.1728-02
5.1860+02	4.3000-02	1.9687+03	5.7680-01	3.1690+03	1.0133-02
5.3550+02	4.0000-02	1.9746+03	4.6659-01	3.1794+03	6.2025-02
5.5610+02	7.0000-04	2.0236+03	2.0243-01	3.1890+03	4.3483-02
5.8020+02	3.1000-02	2.0311+03	4.9574-02	3.2060+03	5.6522-02
5.9520+02	8.0000-02	2.0886+03	1.3710-02	3.2260+03	2.2719-02
6.2000+02	3.0000-02	2.0965+03	1.0073-02	3.2492+03	1.1400-02
6.2870+02	4.0000-03	2.1243+03	4.6091-03	3.2800+03	1.0309-01
6.6120+02	1.2100-01	2.1460+03	3.4743-02	3.2950+03	8.6103-03
6.7700+02	9.0000-04	2.1528+03	1.7631-01	3.3109+03	9.4942-02
6.9330+02	3.7000-02	2.1720+03	2.3302-03	3.3213+03	8.1836-02
7.0850+02	2.1000-02	2.1850+03	3.6469-01	3.3340+03	5.7741-02
7.2180+02	1.2000-03	2.1940+03	2.3420-03	3.3557+03	7.5307-02
7.3010+02	1.6000-03	2.2014+03	1.1261-01	3.3710+03	2.9030-03
7.6510+02	6.6000-03	2.2300+03	4.7222-03	3.3878+03	8.1437-03
7.7920+02	1.7000-03	2.2357+03	4.7284-03	3.4090+03	1.0510-01
7.9090+02	5.1000-03	2.2415+03	1.4203-03	3.4190+03	2.9236-03
8.2160+02	5.9000-02	2.2591+03	6.5591-02	3.4369+03	1.9053-01
8.5100+02	5.8000-02	2.2664+03	1.4520-01	3.4591+03	3.8229-01
8.5620+02	8.2000-02	2.2813+03	1.0985-01	3.4700+03	1.1781-03
8.6650+02	3.5000-03	2.2887+03	2.3920-03	3.4843+03	1.1806-01
8.9130+02	1.2000-03	2.3020+03	9.5958-04	3.4920+03	1.1228-02
9.0510+02	5.1000-02	2.3159+03	1.4437-02	3.5120+03	2.9631-03
9.2520+02	1.0000-02	2.3374+03	4.8347-03	3.5260+03	1.0688-02
9.3690+02	1.5000-01	2.3520+03	6.3047-02	3.5615+03	1.4323-01
9.5840+02	1.5500-01	2.3560+03	6.3100-02	3.5740+03	2.3913-01
9.9180+02	3.5000-01	2.3925+03	1.1250-02	3.5930+03	1.5585-02
1.0113+03	1.3000-03	2.4102+03	4.4184-03	3.6000+03	3.0000-03
1.0230+03	1.3000-02	2.4265+03	8.1278-02	3.6110+03	3.0046-03
1.0332+03	7.0000-04	2.4462+03	1.1128-01	3.6250+03	3.0104-03
1.0539+03	6.5000-02	2.4540+03	2.4769-03	3.6300+03	2.1690-01
1.0705+03	3.2700-04	2.4898+03	5.4888-02	3.6470+03	3.0195-03
1.0811+03	7.0000-04	2.5207+03	1.0041-02	3.6740+03	3.0675-03
1.0984+03	1.2000-02	2.5457+03	3.4330-01	3.6930+03	2.4308-01
1.1089+03	2.3000-02	2.5593+03	2.1753-01	3.7177+03	6.0973-02
1.1315+03	2.3000-03	2.5807+03	2.4384-01	3.7333+03	1.5275-01
1.1404+03	2.3000-01	2.5987+03	5.6075-01	3.7647+03	3.4360-02
1.1675+03	7.0000-02	2.6040+03	2.5515-03	3.7837+03	2.7680-01
1.1776+03	5.8000-02	2.6206+03	4.0953-02	3.7997+03	3.0821-03
1.1950+03	8.3000-02	2.6316+03	1.0260-03	3.8320+03	6.1903-03
1.2109+03	9.0000-03	2.6728+03	1.7578-01	3.8581+03	3.4162-01
1.2451+03	2.3000-01	2.6956+03	2.3364-02	3.8713+03	2.4888-01
				3.8950+03	4.9928-03
				3.9044+03	2.2495-01

2.2. Resonance Energy Region (5.0 eV ≤ E ≤ 50 KeV)

2.2.1. Resolved Resonances

The resolved energy region for U-238 extends from 5 eV to 3.92 KeV. The peak parameters for the resonances between 5 eV and 1.782 KeV are the recommended values given in reference 7. For the remaining energy interval the peak parameters (last resolved resonance appears at 3.904 KeV) were obtained from the measurements reported by Garg, et al.[10] The capture width was taken as constant, $\Gamma_\gamma = 24.6$ meV in accordance with theoretical predictions. All levels were taken as s-wave ($\ell = 0$) levels even though a few of the measurements reported in reference 10 were denoted p-wave or doubtful; this should introduce little error in the cross-section calculation. These parameters are to be used in the single-level, Breit-Wigner formula designed as Type 1 (LRF = 1) in ENDF/B.

A smooth contribution to the capture cross section has been added in the upper portion of the resolved region between 0.748 and 3.92 KeV. As shown in Figure 2-2, the p-wave used in the unresolved region does not have a negligible value at the high energy cutoff for the resolved region. Therefore, an attempt was made to compare the contribution obtained from a statistical treatment with that derived by the calculation of the resolved peaks (cross sections averaged over 1/4-unit lethargy groups, GAM scheme with $E_{max} = 10$ MeV); Figure 2-2 shows that if the unresolved region started at 0.748 KeV, it would contribute 1.02 barns more to the total resonance integral (0.54 barns is the contribution of the p-wave). The 0.75 KeV cutoff was chosen because below it, the p-wave contributions account for less than 5% of the capture cross section. Since the ENDF/B does not have provisions for different energy ranges for the various waves, a smooth p-wave component, as from infinite dilution, is entered in File 3 and is also shown in Figure 2-2; therefore it is unshielded. Although the effect of shielding is slight in this energy range, in regard to the capture it might affect the Doppler coefficient. However, no investigations were conducted in that direction for this evaluation.

The potential scattering cross section for U-238 has been analyzed by Seth, et al,[11] Lynn,[12] and Uttley.[13] The value recommended by both Lynn and Uttley, 10.6 barns, was selected. It corresponds to a spin-independent scattering length (AM) of 0.0184×10^{-12} cm.

The resolved resonance parameters are shown in Table 2-1, and a graphical representation of the total, absorption, and scattering cross section for each resolved peak is provided in Appendix B.

2.2.2. Unresolved Resonances

The unresolved energy region for U-238 extends from 3.92 to 50 KeV and the capture cross section throughout this region may be calculated by using appropriate parameters for only the s- and p-wave neutrons.

The s-wave parameters were taken from MC^2 library prepared at ANL. The strength function is in good agreement with the value ($0.90 \pm 0.10 \times 10^{-4}$) determined by Garg, et al,[10] and the average level spacing, $\overline{D}$, corresponds to an arithmetic average of the minimum (pure s-wave) and maximum (s-wave + doubtful and p-wave) values reported by these same workers.*

The p-wave strength function was obtained by comparing effective, infinitely-dilute capture cross sections computed by the ERIC 2 Code[14] with experimental values presented in reference 7.

The capture cross-section values for the combined s- and p-waves were compared over an energy range extending from 10 to 200 KeV, although the unresolved region is limited to E = 50 KeV. For these calculations, the strength function was taken as constant for all J and the average level spacing assumed proportional to $(2J + 1)^{-1}$; the mean reduced neutron width can then be computed from

$$\overline{\Gamma}_n^o(E) = S_\ell \times \overline{D}_{\ell, J} \sqrt{E} \times \nu_\ell$$

-----

*For $2.0 \leq E \leq 3.9$ KeV.

where S_ℓ = strength function

υ_ℓ = penetration factor

$\upsilon_\ell = 1$ for $\ell = 0$

$$\upsilon_\ell = \frac{X^2}{1 + X^2} \text{ for } \ell = 1;\ X = 0.00191\sqrt{E}$$

The neutron level widths were assumed to be distributed in a χ^2-distribution with one degree of freedom ($\upsilon = 1$). For $S_1 = 1.58 \times 10^{-4}$, the calculated and experimental capture cross sections are in good agreement, as indicated in Figure 2-3. The solid curve in Figure 2-3 corresponds to the curve appearing in reference 7. The ERIC 2 unresolved resonance calculations employed 100 "narrow" groups, and the potential scattering cross section was taken as 10.6 barns.

The scattering cross sections for the unresolved region were obtained by subtracting the calculated capture cross section (infinitely dilute) from the total cross section taken from Parker's compilation.[4] The resulting infinitely dilute set of cross sections is shown in Figure 2-4. This procedure, of course, implies that in reactor calculations the scattering cross section of U-238 is to remain independent of composition and temperature; this assumption is normally made in practice but is not necessary. If this procedure is not compatible with the cross-section generation methods employed in ETOE and ETOM, then the appropriate effective scattering cross sections can be computed with the unresolved parameters, and the entries for MT = 2 on File 3 deleted. It was not determined if the capture and scattering cross sections generated in this way would yield reasonable agreement with the measured total cross section. In this presentation, the capture cross section is to be computed using the unresolved parameters, and the scattering cross section taken from File 3.

Table 2-2. Unresolved Resonance Parameters for U-238

	$\ell = 0$ $J = 1/2$	$\ell = 1$ $J = 1/2$	$\ell = 1$ $J = 3/2$
$\bar{D}$, eV	18.5	18.5	9.25
$S \times 10^4$, $(eV)^{-3/2}$	0.94	1.58	1.58
Γ_γ, meV	24.6	24.6	24.6

2.2.3 Evaluation of Resonance Integrals

The ENDF/B resolved and unresolved resonances of U-238 were input to the STRIP* and ERIC 2 codes to compare the total resonance integrals obtained through experimental fits and calculation methods in the case of infinite dilution, oxide and metal rods.

As stated previously, the ENDF/B contains the recommended resolved peak parameters obtained from BNL-325[7] up to approximately 1.8 KeV, and for the rest of the energy interval the peak parameters are from Garg, et al.[10] For the sake of comparison, in Table 2-3 are also shown the results obtained by Joanou and Stevens[15] in the resolved region by using only Grag's parameters. The calculated values of the resonance integrals compare fairly well with the ones obtained through Hellstrand's experimental fits (although for the large rods they start to diverge) and with the ones calculated by Joanou and Stevens.

Although the total resonance integral calculated with ENDF/B parameters for the case of infinite dilution falls within the experimental uncertainty, it has a somewhat lower value than the one calculated with Garg's parameters. The difference appears mainly in the resolved region and is due to the somewhat larger neutron width used in the low-energy resonances (the 6.7 eV level contributes about half of the total integral). At this point it would be proper to suggest

-----

* STRIP is a B&W computer code that solves the slowing down in the resolved region with overlapping resonances by using a generalized Nordheim treatment.

a modification of the ENDF/B parameters for a few low-energy peaks; however, the authors feel that appropriate actions may be taken after discussion of the problem with the Data Testing Subcommittee.

Table 2-3. Comparison of U-238 Resonance Integrals

			Resolved res.		Unresolved res.		Total resonance integral[c]		
	$\bar{l}$	S/M	B&W	GA	s-wave	p-wave	B&W	GA	EXP
Infinite dilution			268.70	273.20	0.834	1.019	270.72	275.30	280 ± 10
Oxide rods									
$\rho(UO_2)$ = 10.2 g/cc	0.50	0.8855	25.11	25.82	0.714	1.005	26.92	27.89	27.70[a]
	1.0	0.6261	18.66	19.03	0.661	0.995	20.41	21.09	20.80[a]
	4.0	0.3131	11.42	11.48	0.567	0.970	13.05	13.40	12.48[a]
Metal rods									
$\rho(U)$ = 18.7 g/cc	0.50	0.6542	16.78	--	0.638	0.970	18.52	--	19.83[b]
	1.0	0.4626	12.50	--	0.576	0.953	14.12	--	14.89[b]
	4.0	0.2313	7.35	--	0.480	0.913	8.84	--	8.92[b]

High-energy (>50 KeV) contribution: 0.652 barns

Smooth resolved contribution: 0.54 barns

1/v contribution: 1.1 barn

(a) Hellstrand's: 4.15 + 26.6 S/M.

(b) Hellstrand's: 2.95 + 25.8 S/M.

(c) 1/v contribution excluded.

Figure 2-1. U-238 Thermal Energy Range

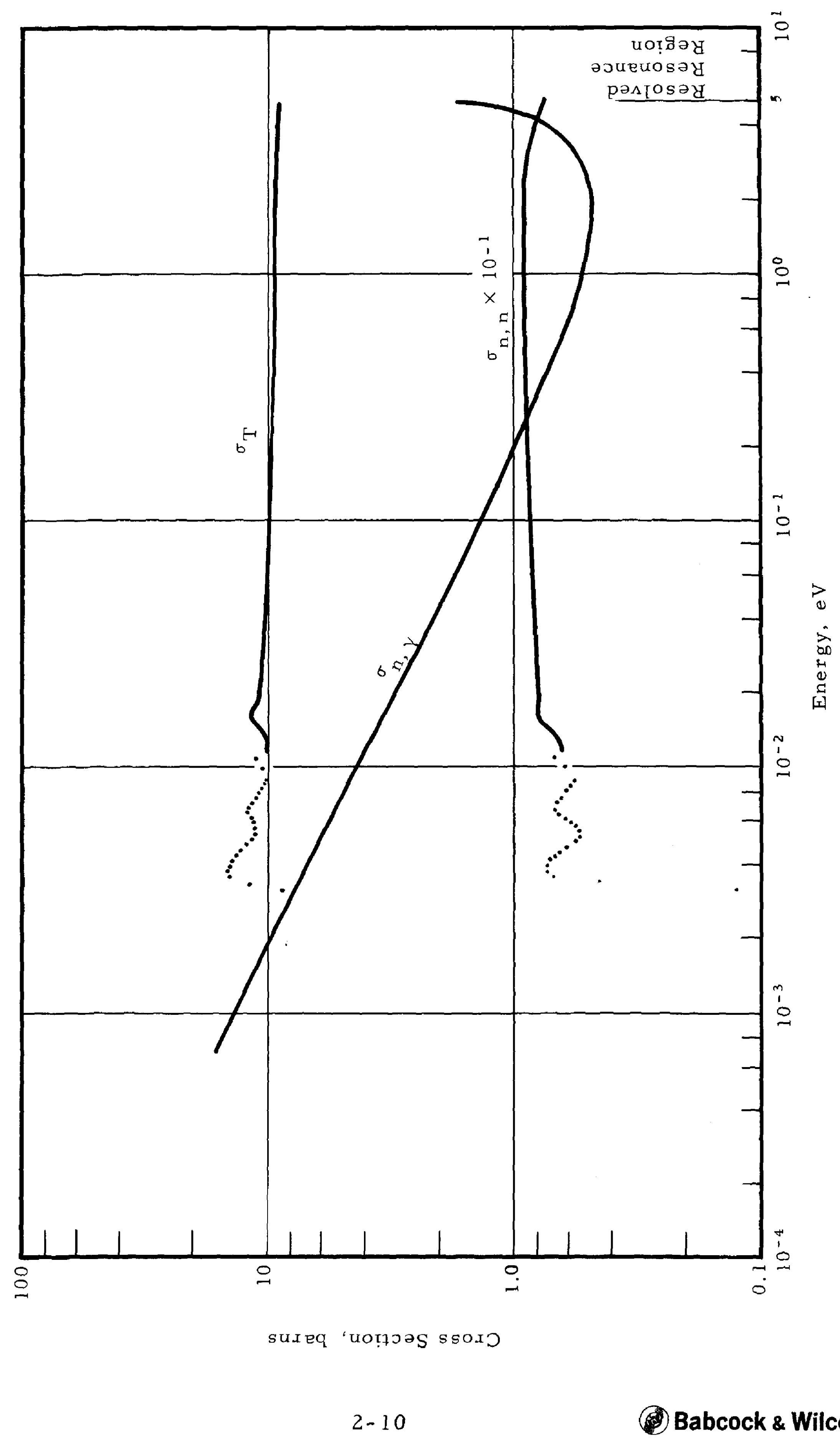


Figure 2-2. U-238 p-Wave in Upper Resolved Region

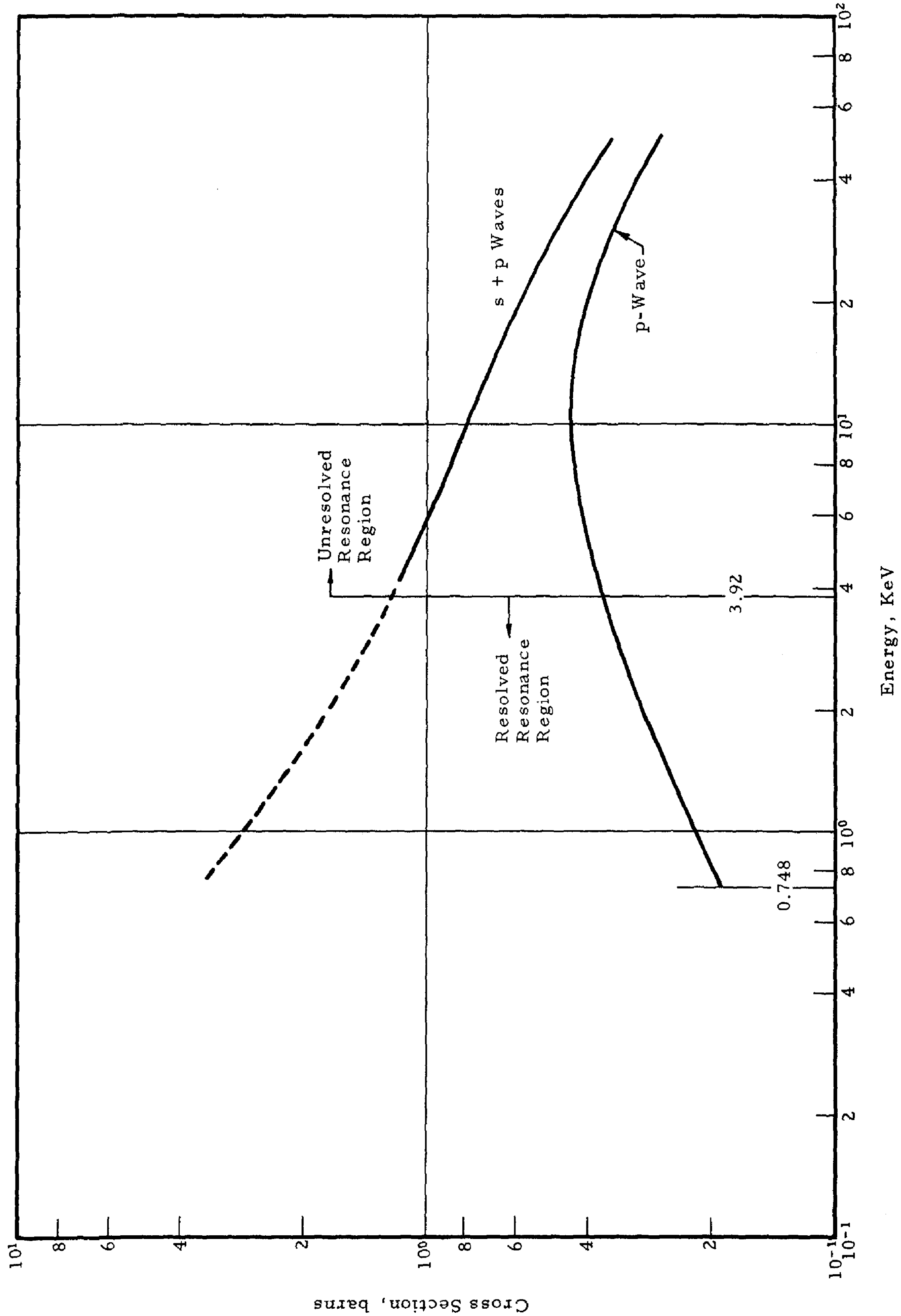


Figure 2-3. U-238 Unresolved Resonance Energy Range, Calculations Vs Experiments

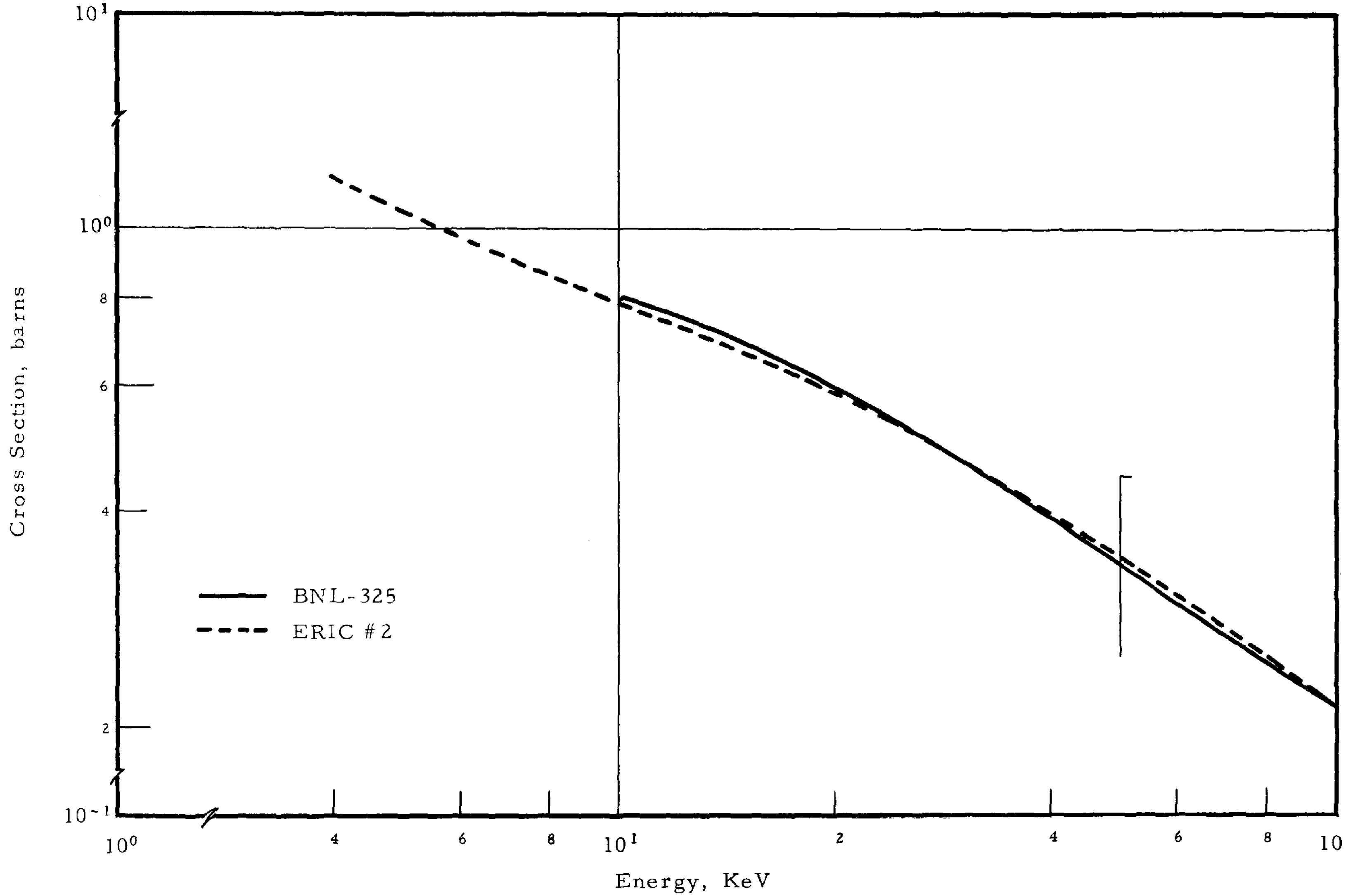
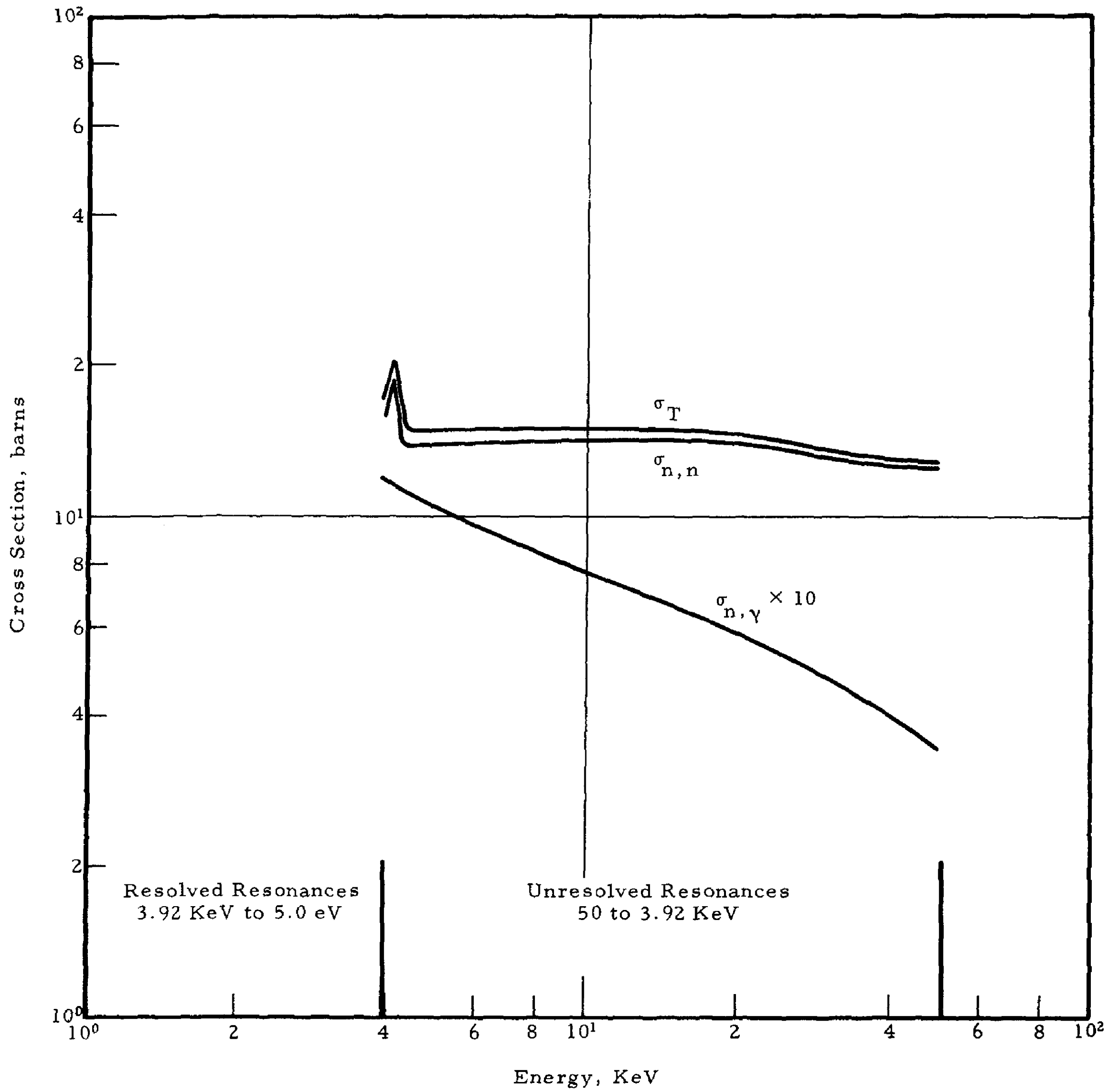


Figure 2-4. U-238 Unresolved Resonance Energy Range



3. U-238 CROSS SECTIONS BETWEEN 50 KeV AND 15 MeV

(W. A. Wittkopf)

In compiling the neutron cross-section data for the energy range between 50 KeV and 15 MeV, the primary sources of data were references 4, 5, 7, and 8. Both Parker[4] and Schmidt[5] give evaluated neutron cross-section data in this energy range. Parker has considered references known to him up to December 31, 1962, and Schmidt has considered references known to him through about July 23, 1965. Both of these are quite complete and are well documented. The main differences between the two evaluations are caused by recent measurements of neutron inelastic scattering and neutron capture.

3.1. The Total Cross Section

The total cross section used for ENDF/B is that recommended by Parker[4] and shown (along with experimental data) in his Figures 2 and 3, pages 94 and 95. Schmidt[5] shows the additional experimental points of recent measurements and recommends a total cross section that is (relative to Parker's curve) slightly lower between 0.2 and 1.0 MeV, slightly higher between 1.2 and 7 MeV, and slightly lower between 7 and 10 MeV. Schmidt's total cross-section values extend only to 10 MeV. However, the differences between these two recommended curves is less than about 3% over most of the energy range of interest. Schmidt estimates the accuracy of his total cross-section values to be in the range of plus or minus 4 to 10% in this energy range. Since we had already based our analysis on Parker's data when we learned of Schmidt's evaluation, and because the differences were relatively small in size and somewhat random in nature, we felt justified in accepting Parker's data for the total cross section. The total cross section is shown in Figure 3-1 and tabulated in Table 3-2.

3.2. The Elastic Scattering Cross Section

The elastic scattering cross section was taken as the difference between the total cross section and the non-elastic cross section (σ_x).

$$\sigma_{x} = \sigma_{n,\gamma} + \sigma_{n,F} + \sigma_{n,n'} + \sigma_{n,2n} + \sigma_{n,3n} \tag{3-1}$$

$$\sigma_{n,n} = \sigma_{T} - \sigma_{x} \tag{3-2}$$

The resulting cross section is shown in Figure 3-1 and is tabulated in Table 3-2. This cross section agrees within about 3% of the values recommended by Schmidt[5] over the range from 0.05 to 10 MeV.

The differential elastic scattering cross section is represented by a Legendre polynomial expansion with the center-of-mass (CM) scattering angle (μ) as variable.

$$\sigma(E,\mu) = \frac{\sigma_s(E)}{4\pi} \sum_{\ell=0}^{18} (2\ell + 1) f_\ell^c(E) P_\ell(\mu) \tag{3-3}$$

Thus, if the $f_\ell^c(E)$ are available, the differential cross section is given by equation 3-3. In addition, the average cosine of the laboratory scattering angle ($\bar{\mu}_o$), the average logarithmic energy decrement (ξ), and the slowing-down parameter (γ) are given by equations 3-4 through 3-6.

$$\bar{\mu}_0 = \sum_{\ell=0}^{18} T_{1\ell} f_\ell^c \tag{3-4}$$

$$\xi = -\sum_{\ell=0}^{18} T_{0\ell}^1 f_\ell^c \tag{3-5}$$

$$\gamma = \xi^{-1} \sum_{\ell=0}^{18} T_{0\ell}^2 f_\ell^c \tag{3-6}$$

where

$$T^n_{Li} = \frac{2i + 1}{2n!} \int_{-1}^{1} P_L(\mu_o)(-U)^n P_i(\mu)d\mu \qquad (3\text{-}7)$$

$$-U = \ell n \left[1 - \frac{2A(1 - \mu)}{(A + 1)^2}\right] \qquad (3\text{-}8)$$

$$\mu_o = \frac{A\mu + 1}{\sqrt{A^2 + 2A\mu + 1}} \qquad (3\text{-}9)$$

In choosing the $f^c_\ell(E)$ for the ENDF/B, the f_ℓ data of Wittkopf,[16] Alter,[17] and Joanou[15] were considered. All of these f_ℓ data were obtained by fitting equation 3-3 to the basic experimental data listing of Goldberg[18] and Howerton.[19] Figure 3-2 compares the basic parameter $\overline{\mu}_o$ calculated using equation 3-4 and the various f_ℓ data. Except at the three highest energy points, the data of Wittkopf and Alter agree quite well; the data of Joanou do not agree. On this basis the f_ℓ data were obtained by drawing smooth "eyeball" curves through the data of Wittkopf and Alter to give the data shown in Figure 3-3 and tabulated in Table 3-3. Using these f_ℓ data and equation 3-4, the smooth solid $\overline{\mu}_o$ curve of Figure 3-2 is obtained and used for the ENDF/B. This latter curve may be compared with the recent recommended curve of Schmidt,[5] which is the dotted curve in Figure 3-2. Except for sharp oscillatory-type peaks in Schmidt's data near 1.7 and 2.2 MeV, the two curves agree to within about 5%. The fact that we smoothed the basic f_ℓ data would eliminate any sharp variations in our curve. Perhaps optical model calculations (which we did not have time to perform) would help to resolve the differences in the region from 1 to 3 MeV.

The energy-dependent values of ξ and γ were calculated from equations 3-5 and 3-6 respectively by using the f_ℓ data of Figure 3-3. These calculated values are shown in Figure 3-4. Finally, the calculated values of $\overline{\mu}_o$, ξ, and γ are tabulated in Table 3-4.

The center-of-mass-to-laboratory-system transfer matrix ($U_{\ell m}$) for elastic scattering was calculated using the work of Lane.[29] The relation between the Legendre expansion coefficients in the laboratory system (f_ℓ^L) and the center of mass system (f_ℓ^C) is given by

$$f_\ell^L = \sum_{m=0}^{18} U_{\ell m} f_m^C \tag{3-10}$$

The matrix elements ($U_{\ell m}$) are tabulated in Table 3-5.

3.3. The Radiative Capture Cross Section

From 0.05 to 0.1 MeV the smooth (n, γ) curve of Stehn[7] was used. From 0.1 to 7.6 MeV the curve is drawn to agree closely with the results of Barry,[20] who used the well known (n, p) cross section as standard. From 7.6 to 15 MeV the curve was extended through the 14 MeV measurement of Perkin.[21] The resulting curve is shown in Figure 3-5 and the values are tabulated in Table 3-2. The resulting curve agrees to within about 3% of that recommended by Schmidt.[5]

3.4. The Fission Cross Section

The fission cross section up to 10 MeV was taken from the work of Davey,[22] in which the author makes a detailed study of the reference cross section used, in relation to the experimental measurements, to arrive at the best cross sections for fast reactor analysis. From 10 to 15 MeV the cross section was taken from Stehn.[7] The resulting curve is shown in Figures 3-6a and 3-6b, and the values are tabulated in Table 3-2.

The neutrons per fission are based on the curve recommended by Schmidt[5] and may be expressed in the form

$$\nu = 2.358 + 0.156E, \quad (E \text{ in MeV}) \tag{3-11}$$

Over the range from 1 to 15 MeV, this expression agrees to within 1.5% of the values given by the solid line of Stehn.[7]

The secondary energy distribution is taken from the work of Barnard, et al.,[23] who fitted the measured spectra to a simple fission spectrum. Barnard obtained Maxwellian temperature values of T = 1.29 and 1.42 MeV at incident neutron energies of 2.09 and 4.91 MeV, respectively. The 1966 ENDF/B format restrictions require that the fission spectra be independent of incident neutron energy, so we have chosen a Maxwellian temperature of T = 1.35 MeV. The fission spectrum is then of the form

$$p(E \rightarrow E') = \sqrt{\frac{4E'}{\pi T^3}} \exp - \frac{E'}{T}, \quad (T = 1.35 \text{ MeV}) \tag{3-12}$$

By plotting the results of his and other experimenters against the average number of neutrons per fission ($\bar{\nu}$) Barnard[23] found that the energy dependence of neutron temperature could be represented approximately by a formula derived by Terrell.[24]

$$T \cong 0.52 + 0.42 \sqrt{\bar{\nu} + 1} \tag{3-13}$$

Using the value of $\bar{\nu}$ from equation 3-11 gives

$$T \cong 0.52 + 0.42 \sqrt{3.358 + 0.156E} \tag{3-14}$$

When the restriction of energy independence on T is removed from the ENDF/B format, equation 3-14 should be used to give a more sophisticated representation of the secondary fission energy distribution. The ENDF/B format does allow for a distribution of the form

$$p(E \rightarrow E') = p_1 \sqrt{\frac{4E'}{\pi \theta_1^3}} \exp - \frac{E'}{\theta_1} + p_2 \frac{E'}{\theta_1^2} \exp - \frac{E'}{\theta_2} \tag{3-15}$$

where p_2 is the fraction of evaporation neutrons from second and third chance fission, and $p_1 = 1 - p_2$. However, θ_1 is energy-dependent (given by equation 3-14) and θ_2 is also energy-dependent.

3.5. The (n, 2n) Cross Section

The (n, 2n) cross section is taken from the recommended curve of Schmidt.[5] In addition, data in the form of IBM cards and computer printout were obtained from Pearlstein.[25] The data of Pearlstein agree well with those of Schmidt from threshold to about 8 MeV and then rise above Schmidt's curve from 8 to 15 MeV. The data are plotted in Figure 3-7 and a comparison is shown. The tabulated data are found in Table 3-6.

We know of no direct measurements of the (n, 2n) secondary neutrons; consequently, we have used the estimations of Parker[4] for the energy distributions of the secondary neutrons. Parker estimates the following distributions for the secondary neutrons:

$$E' = 0.2(E - 6.00), \quad (6.07 \leq E < 7 \text{ MeV})$$

$$p(E \rightarrow E') = \frac{E'}{T^2} \exp - \frac{E'}{T}, \quad (7 \leq E \leq 15 \text{ MeV})$$

$$T = 0.0378 \sqrt{E}, \quad (7 \leq E < 9 \text{ MeV})$$

$$= 0.125 \sqrt{E}, \quad (9 \leq E < 12 \text{ MeV})$$

$$= 0.200 \sqrt{E}, \quad (12 \leq E \leq 15 \text{ MeV})$$

As Parker[4] states, this gives a roughly linear variation of T from 0.1 at 7 MeV to 0.75 at 14 MeV. For the ENDF/B file, we have chosen this linear variation of T from 6.09 to 15 MeV and have arbitrarily set T = 0.01 at threshold. The resulting curve is illustrated and tabulated in Figure 3-9.

3.6. The (n, 3n) Cross Section

The (n, 3n) cross section is taken from the recommended curve of Schmidt.[5] Data in the form of IBM cards and computer printout were also obtained from Pearlstein.[25] The (n, 3n) cross section is relatively small except in the vicinity of 15 MeV. We used Schmidt's data because they were more consistent with the non-elastic cross section in this range and agreed with the few experimental measurements. The resulting curve is shown in Figure 3-8 and the data points are tabulated in Table 3-6.

We know of no direct measurements of (n, 3n) secondary neutron spectra, so we used a modification of Parker's estimates to obtain the Maxwellian temperature variation. Parker estimates the following distribution for the (n, 3n) secondary neutrons:

$$E' = 0.2\,(E - 11.5), \quad (\text{Threshold} \leq E < 13.5 \text{ MeV})$$

$$p(E \rightarrow E') = \frac{E'}{T^2} \exp - \frac{E'}{T}, \quad T = 0.0802\sqrt{E}, \quad (13.5 \leq E \leq 15 \text{ MeV})$$

We have approximated this variation of T with two straight lines on a plot of T versus E. The resulting curve is shown in Figure 3-9, and the values are also tabulated there.

3.7. The Inelastic (n, n') Cross Section

Schmidt[5] has recently completed an extensive evaluation of the (n, n') total and partial cross sections for U-238. His evaluation includes the recent measurements of Barnard, et al.,[26] who obtained data on 21 levels up to 1.47 MeV. We believe the evaluation of Schmidt to be the most complete and extensive available at this time and have selected his recommended curves for the ENDF/B for 1966. From threshold to 2 MeV the total inelastic cross section was obtained by summing the contributions of individual levels. From 2 to 15 MeV the inelastic cross section is obtained primarily by subtracting the (n, γ), (n, F), (n, 2n), and (n, 3n) cross sections from the measured non-elastic cross section. The total inelastic cross section obtained in this manner is shown in Figure 3-1, and the tabulated values are given in Table 3-7.

The cross sections for the excitation of specific levels are shown in Figures 3-10a, 3-10b, and 3-10c, and the fractional contribution of each level to the total inelastic cross section is tabulated in Table 3-8.

The secondary energy distribution for individual levels is given by a δ-function, and the energy of the level as provided by the ENDF/B format. The secondary energy distribution for the remaining part of the inelastic cross section (not due to specific levels) is given by a Maxwellian distribution with the Maxwellian temperature a function of the incident neutron energy. By choosing two fictitious levels (one each at 1.5 and 1.75 MeV) Schmidt[5] was able to represent the region from threshold to 2.0 MeV by individual level data. From 2.0 to 15 MeV the Maxwellian temperature for evaporation neutrons was obtained by passing a smooth curve through the data points of Batchelor, et al.,[27] as given in their Figure 8, page 249. The resulting curve is shown in Figure 3-11 and the data are tabulated in Table 3-9. For comparison, the widely used relation,

$$T_c = 3.22\sqrt{E/A} \ \text{MeV} \tag{3-16}$$

is shown as the dotted line in Figure 3-11.[28] In this manner the secondary energy distribution for inelastic scattering is given by

$$p(E \rightarrow E') = \sum_{k=1}^{K} p_k \delta(E' + \theta_k - E) + p_c \frac{E'}{T_c^2} \exp - \frac{E'}{T_c} \tag{3-17}$$

where

k = level index

p_k = fractional contribution of level k

θ_k = energy of level k

p_c = fractional contribution of continuum

T_c = Maxwellian temperature for continuum

also

$$\sum_{k=1}^{K} p_k + p_c = 1 \tag{3-18}$$

It should be noted that this inelastic secondary energy distribution (and also the distribution for the (n, 2n), (n, 3n), etc., reactions) are normalized in the range $(0, \infty)$ and the processing code should properly renormalize these when generating transfer matrices.

It is also mentioned that the (n, n'), (n, 2n), (n, 3n), and (n, F) secondary neutrons are assumed to be isotropic in the laboratory system.

3.8. Other Cross Sections

It is seen from Table 1-1 that certain charged-particle reactions are possible in the range from 0.05 to 15 MeV. However, because of Coulomb barrier effects, these cross sections should be negligible below 15 MeV. In a more elaborate compilation perhaps some of these reactions should be considered. In particular, the exothermic (n, α) reaction should be investigated. For the 1966 ENDF/B compilation, we have neglected the (n, p), (n, d), (n, t), (n, He^3), and (n, α) reactions.

Table 3-1. Interpolation Scheme for Smooth Cross Sections

Cross section type	Energy Region I		Energy Region II		Energy Region III	
	Energy range, eV	Interpolation scheme	Energy range, eV	Interpolation scheme	Energy range, eV	Interpolation scheme
Total	$0.001 - 5$	$\log \sigma$ vs $\log E$	$5 - 5 \times 10^4$	σ = constant	$5 \times 10^4 - 15 \times 10^6$	σ vs E
(n, n)	$0.001 - 5$	$\log \sigma$ vs $\log E$	$5 - 3920$	σ = constant	$3920 - 15 \times 10^6$	σ vs E
(n, F)	$0.001 - 4.5 \times 10^5$	σ = constant	$4.5 \times 10^5 - 3.5 \times 10^6$	$\log \sigma$ vs E	$3.5 \times 10^6 - 15 \times 10^6$	σ vs E
(n, γ)	$0.001 - 15 \times 10^6$	$\log \sigma$ vs $\log E$	--	--	--	--
(n, n')	$0.001 - 4.5 \times 10^4$	σ = constant	$4.5 \times 10^4 - 15 \times 10^6$	σ vs E	--	--
(n, 2n)	$0.001 - 6.07 \times 10^6$	σ = constant	$6.07 \times 10^6 - 15 \times 10^6$	σ vs E	--	--
(n, 3n)	$0.001 - 11.51 \times 10^6$	σ = constant	$11.51 \times 10^6 - 15 \times 10^6$	σ vs E	--	--
$\bar{\mu}_o$	$0.001 - 1.0 \times 10^4$	$\bar{\mu}_o$ = constant	$1.0 \times 10^4 - 15 \times 10^6$	$\bar{\mu}_o$ vs log E	--	--
ξ	$0.001 - 1.0 \times 10^4$	ξ = constant	$1.0 \times 10^4 - 15 \times 10^6$	ξ vs log E	--	--
γ	$0.001 - 1.0 \times 10^4$	γ = constant	$1.0 \times 10^4 - 15 \times 10^6$	γ vs log E	--	--
T_c	$2.0 \times 10^6 - 15 \times 10^6$	T_c vs E	--	--	--	--

Table 3-2. Energy-Dependent Smooth Neutron Cross Sections for U-238

Energy, eV	Neutron cross section, barns			
	Total	(n, n)	(n, F)	(n, γ)
1.000 – 3	13.68	0	0	13.68
3.0	7.90	0		--
3.2	--	0		--
3.2	8.90	1.25		--
3.6	14.20	6.99		--
4.0	14.11	7.27		--
4.4	13.30	6.77		--
4.8	12.30	6.05		--
5.2	11.38	5.38		--
5.6	11.21	5.43		--
6.2	11.70	6.20		--
6.8	11.94	6.69		--
7.4	11.29	6.26		--
8.0	10.75	5.91		--
8.6	10.30	5.63		--
9.0	10.10	5.53		--
1.000 – 2	10.66	6.33		--
1.1	11.09	6.96		--
1.2	9.99	6.03		--
1.3	9.89	6.09		--
1.5	10.88	7.34		--
1.7	11.40	8.07		--
2.0	11.01	7.94		--
3.0	10.55	8.04		--
5.0	10.18	8.23		--
1.000 – 1	9.87	8.48		1.390
2.0	--	--		1.000
3.0	9.54	8.71		0.829
4.0	--	--		0.731
5.0	--	--		0.665
6.0	--	--		0.619
7.0	--	--		0.584
8.0	--	--		0.557
9.0	--	--		0.536
1.000 + 0	9.43	8.91		0.519
1.5	--	--		0.475
1.8	--	--		0.469
2.0	--	8.86		0.471
2.5	--	--		0.494
3.0	--	8.59		0.546
3.500 + 0	--	--		0.637
4.0	9.00	8.21		0.793
4.5	--	--		1.07
4.7	--	--		1.25
5.0	9.10	7.46		1.64
5.0 + 0	0	0	0	0

Table 3-2. (Cont'd)

Energy eV	Neutron cross section, barns			
	Total	(n, n)	(n, F)	(n, γ)
7.480 + 2	0	0	0	0
7.48				0.192
8.50				0.204
9.00				0.207
9.61				0.213
1.10 + 3				0.226
1.23				0.239
1.35				0.250
1.59				0.268
1.80				0.283
2.04				0.300
2.30				0.312
2.61				0.328
3.00				0.344
3.36				0.358
3.60				0.370
3.92		0		0.382
3.92		16.4		0
4.10		19.2		
4.25		14.5		
4.37		13.9		
5.00		14.0		
1.000 + 4		14.2		
1.5		14.3		
2.0		14.0		
3.0		13.1		
4.0		12.8		
5.0	0	12.5		0
5.0	12.9	12.5		0.345
5.5	12.8	--		--
6.0	12.7	12.25		0.305
7.0	12.5	11.98		0.274
8.0	12.3	11.71		0.248
9.000 + 4	12.1	11.44		0.228
1.000 + 5	12.0	11.26		0.211
1.4	--	--		0.182
1.5	11.2	10.13		--
2.0	10.7	9.46		0.159
2.5	10.3	8.98		--
3.0	9.86	8.48		0.140
3.4	--	--		0.137
3.5	9.49	8.03		--
3.8	--	--		0.134
4.0	9.15	7.56		0.133
4.4	--	--		0.132
4.5	8.84	7.06		--
4.8 + 5	--	--	0	--

Table 3-2. (Cont'd)

Energy eV	Neutron cross section, barns			
	Total	(n, n)	(n, F)	(n, γ)
5.0 + 5	8.56	6.65	0.00025	0.133
5.5	8.30	6.35	--	--
5.8	--	--	0.00100	--
6.0	8.07	6.10	0.00110	0.138
6.5	7.86	5.79	0.00120	--
7.0	7.76	5.78	--	0.142
7.2	--	--	0.00125	--
7.5	7.51	5.42	0.0020	--
8.0	7.37	5.14	0.0038	0.149
8.4	--	--	--	0.150
8.5	7.24	4.90	0.0064	--
9.0	7.14	4.73	0.0110	0.151
9.2	--	--	0.0140	--
9.5	7.05	4.65	0.0160	0.151
1.000 + 6	6.98	4.55	0.0169	0.150
1.05	--	--	0.0180	--
1.10	6.89	4.22	0.024	0.149
1.15	--	--	0.034	--
1.20	6.84	4.02	0.040	0.142
1.25	--	--	0.042	--
1.30	6.85	3.85	0.056	0.130
1.35	--	--	0.092	--
1.40	6.89	3.53	0.150	0.114
1.45	--	--	0.225	--
1.50	6.96	3.45	0.295	0.096
1.550 + 6	--	--	0.343	--
1.60	7.05	3.32	0.381	0.082
1.65	--	--	0.419	--
1.70	7.15	3.42	0.443	--
1.75	--	--	0.468	--
1.80	7.25	3.65	0.483	0.064
1.85	--	--	0.505	--
1.90	7.35	3.92	0.521	--
1.95	--	--	0.539	--
2.00	7.44	4.17	0.550	0.0525
2.25	7.55	4.32	0.590	--
2.50	7.62	4.42	0.565	--
2.75	7.72	4.53	0.543	--
3.00	7.80	4.61	0.540	0.0268
3.25	7.88	4.70	0.540	--
3.50	7.90	4.70	0.560	--
3.75	7.87	4.66	0.568	--
4.00	7.84	4.65	0.566	0.0158
4.25	--	--	0.563	--
4.50	7.80	4.64	0.563	--
4.75	--	--	0.565	--
5.00 + 6	7.70	4.58	0.569	0.0109

Table 3-2. (Cont'd)[a]

Energy eV	Neutron cross section, barns			
	Total	(n, n)	(n, F)	(n, γ)
5.25 + 6	--	--	0.571	--
5.50	7.50	4.40	0.575	--
5.75	--	--	0.585	--
6.00	7.18	4.11	0.620	0.0085
6.25	--	--	0.700	--
6.50	7.00	3.97	0.822	--
6.75	--	--	0.911	--
7.00	6.80	3.76	0.968	0.0072
7.25	--	--	1.001	--
7.50	6.58	3.58	1.010	--
7.75	--	--	1.002	--
8.00	6.35	3.39	0.991	--
8.25	--	--	1.009	--
8.50	6.22	3.26	1.040	--
8.75	--	--	1.054	--
9.00	6.10	3.15	1.050	0.0053
9.25	--	--	1.035	--
9.500 + 6	6.05	3.13	1.021	--
9.75	--	--	1.011	--
10.00	6.00	3.12	1.004	0.0047
10.50	5.93	3.06	--	--
11.00	5.85	3.00	--	--
11.50	5.82	2.99	1.005	--
12.00	5.80	2.96	1.010	0.0039
12.50	5.75	2.90	--	--
13.00	5.70	2.85	1.020	--
13.50	5.60	2.75	--	--
14.00	5.70	2.86	1.150	--
14.50	5.80	2.95	--	--
15.00 + 6	5.70	2.86	1.300	0.0032

(a) Table 3-2 contains only the smooth contribution to the various cross sections. The contributions of the resonances are given by the Breit-Wigner formula as described in section 2. For this reason, some of the smooth cross sections of Table 3-2 are double-valued at certain energies. When this occurs, the first value applies below and the second value applies above that energy.

Table 3-3. Legendre Expansion Coefficients for Elastic Scattering in CM System (f_0 = 1.0 for all energies)

Energy, eV	f_1	f_2	f_3	f_4	f_5	f_6	f_7	f_8	f_9
1.0 + 4	0	0	0	0	0	0	0	0	0
1.5	4.00 − 3	0	↓	↓	↓	↓	↓	↓	↓
2.0	9.00 − 3	0	↓	↓	↓	↓	↓	↓	↓
3.0	1.80 − 2	0	↓	↓	↓	↓	↓	↓	↓
5.0	3.40 − 2	3.00 − 3	↓	↓	↓	↓	↓	↓	↓
7.0	5.20 − 2	9.00 − 3	↓	↓	↓	↓	↓	↓	↓
1.0 + 5	8.30 − 2	1.70 − 2	↓	↓	↓	↓	↓	↓	↓
1.5	1.32 − 1	2.70 − 2	0	↓	↓	↓	↓	↓	↓
2.0	1.71	4.00 − 2	2.00 − 3	↓	↓	↓	↓	↓	↓
3.0	2.31	6.50 − 2	1.10 − 2	0	0	0	0	0	0
5.0	3.18	1.33 − 1	4.18 − 2	1.28 − 2	4.17 − 3	2.80 − 3	2.63 − 3	1.87 − 3	4.60 − 4
7.2	3.86	1.99	7.74 − 2	2.27 − 2	6.14 − 3	4.66 − 3	6.02	4.44	1.65 − 3
1.1 + 6	4.77	3.14	1.85 − 1	7.31 − 2	2.35 − 2	1.05 − 2	3.59	−2.38	−3.99 − 3
1.7	5.75	4.11	2.74	1.72 − 1	8.29 − 2	2.78 − 2	3.27	−4.13	−4.47 − 3
2.5	6.61	4.97	3.52	2.60	1.36 − 1	4.32 − 2	2.98 − 3	−5.68 − 3	−4.90 − 3
4.1	7.51	6.00	4.69	3.72	2.41	1.29 − 1	6.51 − 2	3.10 − 2	1.27 − 2
7.0	8.21	6.89	5.74	4.61	3.49	2.42	1.53 − 1	8.91 − 2	4.37 − 2
1.0 + 7	8.58	7.41	6.27	5.12	4.00	2.95	2.05 − 1	1.34 − 1	7.66 − 2
1.5 + 7	9.01 − 1	8.00 − 1	6.87 − 1	5.69 − 1	4.57 − 1	3.56 − 1	2.65 − 1	1.85 − 1	1.14 − 1

Energy, eV	f_{10}	f_{11}	f_{12}	f_{13}	f_{14}	f_{15}	f_{16}	f_{17}	f_{18}
1.0 + 4	0	0	0	0	0	0	0	0	0
1.5	↓	↓	↓	↓	↓	↓	↓	↓	↓
2.0	↓	↓	↓	↓	↓	↓	↓	↓	↓
3.0	↓	↓	↓	↓	↓	↓	↓	↓	↓
5.0	↓	↓	↓	↓	↓	↓	↓	↓	↓
7.0	↓	↓	↓	↓	↓	↓	↓	↓	↓
1.0 + 5	↓	↓	↓	↓	↓	↓	↓	↓	↓
1.5	↓	↓	↓	↓	↓	↓	↓	↓	↓
2.0	↓	↓	↓	↓	↓	↓	↓	↓	↓
3.0	0	0	↓	↓	↓	↓	↓	↓	↓
5.0	−6.49 − 4	−5.27 − 4	↓	↓	↓	↓	↓	↓	↓
7.2	6.24 − 4	1.28 − 4	0	0	↓	↓	↓	↓	↓
1.1 + 6	−1.83 − 3	5.81 − 4	8.77 − 4	4.85 − 4	↓	↓	↓	↓	↓
1.7	−3.79	−3.08 − 3	−1.66 − 3	1.66 − 4	↓	↓	↓	↓	↓
2.5	−5.52	−6.32 − 3	−3.91 − 3	−1.17 − 4	0	0	↓	↓	↓
4.1	4.43	1.11 − 3	6.03 − 4	1.11 − 3	3.16 − 4	−1.03 − 3	0	0	0
7.0	9.27 − 3	−1.38 − 2	−2.31 − 2	−2.21 − 2	−1.80 − 2	−1.47 − 2	−1.13 − 2	−6.67 − 3	−2.06 − 3
1.0 + 7	2.99 − 2	−5.31 − 3	−2.63 − 2	−3.43 − 2	−3.36 − 2	−2.84 − 2	−2.02 − 2	−1.05 − 2	−1.67 − 3
1.5 + 7	5.34 − 2	4.34 − 3	−2.99 − 2	−4.80 − 2	−5.14 − 2	−4.39 − 2	−3.02 − 2	−1.48 − 2	−1.22 − 3

Table 3-4. $\bar{\mu}$ (equation 3-4), ξ (equation 3-5), and γ (equation 3-6) Vs Neutron Energy

Energy, eV	$\bar{\mu}_o$	ξ	γ
1.0 – 3	2.825 – 3	8.450 – 3	5.642 – 3
1.0 + 4	2.825 – 3	8.450	5.642
1.5	6.825 – 3	8.417	5.630
2.0	1.183 – 2	8.374	5.616
3.0	2.083	8.298	5.590
5.0	3.682	8.162	5.551
7.0	5.480	8.010	5.514
1.0 + 5	8.578	7.748	5.438
1.5	1.348 – 1	7.333	5.300
2.0	1.737	7.002	5.195
3.0	2.336	6.494	5.032
5.0	3.205	5.759	4.876
7.2	3.883	5.184	4.783
1.1 + 6	4.789	4.416	4.764
1.7	5.767	3.588	4.554
2.5	6.624	2.861	4.279
4.1	7.521	2.101	3.932
7.0	8.219	1.509	3.562
1.0 + 7	8.587	1.197	3.319
1.5 + 7	9.016	8.342 – 4	2.766

Table 3-5. Center of Mass to Laboratory System Transfer Matrix ($U_{\ell m}$) for Elastic Scattering of Neutrons on U-238

ℓ \ m	0	1	2	3	4	5	6	7	8	9
0	1.00000	0	0	0	0	0	0	0	0	0
1	2.825-3	0.99999	-2.825-3	1.077-5	0	↓	↓	↓	↓	↓
2	3.591-6	5.085-3	0.99997	-5.085-3	2.462-5	0	↓	↓	↓	↓
3	0	1.231-5	7.264-3	0.99994	-7.264-3	4.275-5	0	↓	↓	↓
4	↓	0	2.565-5	9.416-3	0.99991	-9.416-3	6.529-5	0	↓	↓
5	↓	↓	0	4.353-5	1.156-2	0.99986	-1.156-2	9.228-5	0	↓
6	↓	↓	↓	0	6.592-5	1.369-2	0.99981	-1.369-2	1.237-4	0
7	↓	↓	↓	↓	0	9.281-5	1.582-2	0.99975	-1.582-2	1.597-4
8	↓	↓	↓	↓	↓	0	1.242-4	1.795-2	0.99968	-1.795-2
9	↓	↓	↓	↓	↓	↓	0	1.601-4	2.007-2	0.99959
10	↓	↓	↓	↓	↓	↓	↓	0	2.005-4	2.220-2
11	0	0	0	0	0	0	0	0	0	2.453-4

ℓ \ m	10	11	12	13	14	15	16	17	18
8	2.001-4	0	0	0	0	0	0	0	0
9	-2.007-2	2.450-4	0	↓	↓	↓	↓	↓	↓
10	0.99951	-2.220-2	2.944-4	0	↓	↓	↓	↓	↓
11	2.432-2	0.99941	-2.432-2	3.483-4	0	↓	↓	↓	↓
12	2.947-4	2.644-2	0.99930	-2.644-2	4.066-4	0	↓	↓	↓
13	0	3.486-4	2.856-2	0.99918	-2.856-2	4.695-4	0	↓	↓
14	↓	0	4.069-4	3.068-2	0.99906	-3.068-2	5.368-4	0	↓
15	↓	↓	0	4.697-4	3.280-2	0.99892	-3.280-2	6.086-4	0
16	↓	↓	↓	0	5.370-4	3.493-2	0.99878	-3.493-2	6.850-4
17	↓	↓	↓	↓	0	6.089-4	3.705-2	0.99863	-3.705-2
18	0	0	0	0	0	0	6.852-4	3.917-2	0.99846

$$f_\ell^L = \sum_{m=0}^{18} U_{\ell m} f_m^c$$

Table 3-6. Neutron Cross Sections for (n, 2n) and (n, 3n) Reactions Vs Neutron Energy

Energy, eV	Neutron cross section, barns	
	(n, 2n)	(n, 3n)
1.00 - 3	0	0
6.07 + 6	0	
6.25	0.03	
6.50	0.10	
6.75	0.22	
7.00	0.46	
7.25	0.75	
7.50	0.93	
7.75	1.05	
8.00	1.13	
8.25	1.20	
8.50	1.25	
8.75	1.28	
9.00	1.31	
9.25	1.33	
9.50	1.34	
10.00	1.35	
10.50	1.34	
10.75	1.33	
11.00	1.32	
11.25	1.31	
11.50	1.30	0
11.75	1.29	0.14
12.00	1.27	0.28
12.25	1.24	0.39
12.50	1.21	0.47
12.75	1.18	0.51
13.00	1.13	0.55
13.25	1.07	0.57
13.50	1.01	0.60
13.75	0.93	0.65
14.00	0.85	0.69
14.25	0.77	0.73
14.50	0.71	0.76
14.75	0.65	0.80
15.00 + 6	0.58	0.84

Table 3-7. U-238 Inelastic Cross Section

Energy, MeV	$\sigma_{n,n''}$ barns	Energy, MeV	$\sigma_{n,n''}$ barns	Energy, MeV	$\sigma_{n,n''}$ barns	Energy, MeV	$\sigma_{n,n''}$ barns
1.000 − 9	0	0.55	1.818	1.50	3.117	8.25	0.73
0.045	0	0.56	1.825	1.55	3.180	8.50	0.66
0.050	0.050	0.58	1.833	1.60	3.263	8.75	0.62
0.055	0.098	0.60	1.831	1.65	3.274	9.00	0.58
0.060	0.143	0.61	1.834	1.70	3.220	9.25	0.56
0.065	0.193	0.62	1.833	1.75	3.140	9.50	0.55
0.070	0.242	0.64	1.824	1.80	3.043	10.00	0.52
0.075	0.289	0.66	1.818	1.85	2.945	11.50	0.52
0.080	0.337	0.68	1.807	1.90	2.850	11.75	0.40
0.085	0.385	0.69	1.820	1.95	2.733	12.00	0.28
0.090	0.433	0.70	1.832	2.00	2.667	12.25	0.20
0.095	0.480	0.72	1.858	2.25	2.60	12.50	0.15
0.10	0.530	0.74	1.908	2.50	2.60	14.50	0.15
0.12	0.728	0.76	1.978	2.75	2.61	14.75	0.14
0.14	0.850	0.78	2.032	3.00	2.62	15.00	0.12
0.16	0.938	0.80	2.080	3.25	2.62		
0.18	1.024	0.82	2.126	3.50	2.62		
0.20	1.085	0.84	2.165	3.75	2.62		
0.22	1.125	0.86	2.209	4.00	2.61		
0.24	1.161	0.88	2.242	4.25	2.60		
0.26	1.189	0.90	2.252	4.50	2.58		
0.28	1.215	0.92	2.248	4.75	2.56		
0.30	1.240	0.94	2.234	5.00	2.54		
0.32	1.265	0.96	2.231	5.25	2.53		
0.34	1.296	0.98	2.238	5.50	2.51		
0.36	1.346	1.00	2.259	5.75	2.47		
0.38	1.383	1.05	2.301	6.00	2.44		
0.40	1.454	1.10	2.492	6.25	2.32		
0.42	1.532	1.15	2.644	6.50	2.11		
0.44	1.611	1.20	2.642	6.75	1.87		
0.46	1.690	1.25	2.673	7.00	1.60		
0.48	1.738	1.30	2.818	7.25	1.32		
0.50	1.772	1.35	3.011	7.50	1.05		
0.52	1.794	1.40	3.091	7.75	0.90		
0.54	1.812	1.45	3.111	8.00	0.83		

Table 3-8. Fractional Contribution of Each Level to the Total Inelastic Cross Section of U-238

Neutron energy, MeV	Inelastic energy level, MeV									
	0.0447	0.148	0.310	0.680	0.732	0.838	0.939	0.968	1.006	1.047
0.045	0	0	0	0	0	0	0	0	0	0
.05	1.000	↓	↓	↓	↓	↓	↓	↓	↓	↓
.055	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.06	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.065	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.07	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.075	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.08	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.085	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.09	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.095	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.10	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.12	↓	↓	↓	↓	↓	↓	↓	↓	↓	↓
.14	1.000	0	↓	↓	↓	↓	↓	↓	↓	↓
.16	0.986	0.014	↓	↓	↓	↓	↓	↓	↓	↓
.18	.964	.036	↓	↓	↓	↓	↓	↓	↓	↓
.20	.947	.053	↓	↓	↓	↓	↓	↓	↓	↓
.22	.931	.069	↓	↓	↓	↓	↓	↓	↓	↓
.24	.916	.084	↓	↓	↓	↓	↓	↓	↓	↓
.26	.906	.094	↓	↓	↓	↓	↓	↓	↓	↓
.28	.895	.105	↓	↓	↓	↓	↓	↓	↓	↓
.30	.885	.115	0	↓	↓	↓	↓	↓	↓	↓
.32	.874	.124	0.002	↓	↓	↓	↓	↓	↓	↓
.34	.860	.132	.008	↓	↓	↓	↓	↓	↓	↓
.36	.850	.137	.013	↓	↓	↓	↓	↓	↓	↓
.38	.841	.142	.017	↓	↓	↓	↓	↓	↓	↓
.40	.836	.143	.021	↓	↓	↓	↓	↓	↓	↓
.42	.831	.144	.025	↓	↓	↓	↓	↓	↓	↓
0.44	0.828	0.144	0.028	0	0	0	0	0	0	0

Table 3-8. (Cont'd)

Neutron energy, MeV	Inelastic energy level, MeV									
	0.0447	0.148	0.310	0.680	0.732	0.838	0.939	0.968	1.006	1.047
0.46	0.825	0.144	0.031	0	0	0	0	0	0	0
.48	.820	.146	.034	↓	↓	↓	↓	↓	↓	↓
.50	.813	.150	.037	↓	↓	↓	↓	↓	↓	↓
.52	.805	.154	.041	↓	↓	↓	↓	↓	↓	↓
.54	.799	.157	.044	↓	↓	↓	↓	↓	↓	↓
.55	.795	.159	.046	↓	↓	↓	↓	↓	↓	↓
.56	.792	.161	.047	↓	↓	↓	↓	↓	↓	↓
.58	.782	.167	.051	↓	↓	↓	↓	↓	↓	↓
.60	.772	.173	.055	↓	↓	↓	↓	↓	↓	↓
.61	.767	.177	.056	↓	↓	↓	↓	↓	↓	↓
.62	.762	.180	.058	↓	↓	↓	↓	↓	↓	↓
.64	.751	.186	.063	↓	↓	↓	↓	↓	↓	↓
.66	.741	.193	.066	↓	↓	↓	↓	↓	↓	↓
.68	.729	.201	.070	0	↓	↓	↓	↓	↓	↓
.69	.717	.202	.072	0.009	↓	↓	↓	↓	↓	↓
.70	.705	.204	.073	.018	↓	↓	↓	↓	↓	↓
.72	.681	.207	.076	.036	0	↓	↓	↓	↓	↓
.74	.652	.209	.076	.051	0.012	↓	↓	↓	↓	↓
.76	.616	.209	.075	.066	.034	↓	↓	↓	↓	↓
.78	.589	.211	.073	.080	.047	↓	↓	↓	↓	↓
.80	.565	.213	.072	.093	.057	↓	↓	↓	↓	↓
.82	.542	.216	.071	.105	.066	↓	↓	↓	↓	↓
.84	.521	.221	.069	.117	.072	0	↓	↓	↓	↓
.86	.503	.225	.067	.128	.076	0.001	↓	↓	↓	↓
.88	.484	.232	.065	.136	.080	.003	↓	↓	↓	↓
.90	.472	.234	.064	.142	.084	.004	↓	↓	↓	↓
.92	.461	.236	.064	.146	.088	.005	↓	↓	↓	↓
.94	.453	.235	.064	.149	.093	.006	0	↓	↓	↓
.96	.439	.232	.063	.150	.096	.008	0.012	0	↓	↓
0.98	0.423	0.223	0.062	0.151	0.099	0.009	0.025	0.008	0	0

Table 3-8. (Cont'd)

Neutron energy, Mev	Inelastic energy level, MeV									
	0.0447	0.148	0.310	0.680	0.732	0.838	0.939	0.968	1.006	1.047
1.00	0.404	0.210	0.060	0.150	0.101	0.011	0.039	0.025	0	0
1.05	.359	.185	.056	.146	.106	.015	.071	.052	0.010	0
1.10	.297	.161	.050	.132	.102	.020	.095	.065	.031	0.032
1.15	.247	.144	.044	.117	.100	.027	.102	.075	.054	.048
1.20	.214	.139	.042	.099	.100	.031	.092	.086	.064	.061
1.25	.178	.131	.039	.091	.095	.033	.081	.094	.068	.070
1.30	.137	.118	.035	.083	.087	.032	.085	.095	.068	.073
1.35	.099	.102	.031	.078	.078	.030	.094	.092	.067	.071
1.40	.069	.091	.028	.076	.073	.029	.091	.092	.067	.071
1.45	.041	.083	.026	.072	.069	.029	.083	.091	.067	.073
1.50	0.014	.073	.024	.067	.065	.029	.075	.090	.068	.074
1.55	0	.063	.021	.061	.059	.029	.067	.086	.067	.074
1.60		.051	.019	.051	.053	.028	.058	.081	.065	.072
1.65		.041	.017	.043	.050	.027	.050	.077	.065	.072
1.70		.031	.015	.037	.046	.027	.044	.074	.065	.071
1.75		.020	.014	.030	.042	.027	.037	.072	.065	.070
1.80		0.007	.012	.023	.038	.027	.031	.069	.065	.069
1.85		0	.011	.015	.034	.028	.024	.066	.065	.067
1.90			.009	0.007	.030	.028	.016	.062	.065	.066
1.95			.007	0	.024	.028	0.008	.058	.064	.064
2.00			0.005		0.018	0.028	0	0.052	0.061	0.061
2.00001			0		0	0	0	0	0	0
15.00	0	0	0	0	0	0	0	0	0	0

Neutron energy, Mev	Inelastic energy level, MeV									
	1.076	1.123	1.150	1.190	1.210	1.246	1.272	1.313	1.361	1.401
1.10	0.015	0	0	0	0	0	0	0	0	0
1.15	0.040	0.002	0	0	0	0	0	0	0	0

Table 3-8. (Cont'd)

Neutron energy, MeV	Inelastic energy level, MeV									
	1.076	1.123	1.150	1.190	1.210	1.246	1.272	1.313	1.361	1.401
1.20	0.057	0.007	0.007	0.001	0	0	0	0	0	0
1.25	.074	.018	.017	.008	0.003	0	0	0	↓	↓
1.30	.088	.033	.030	.017	.008	0.007	0.004	0	↓	↓
1.35	.101	.045	.045	.027	.013	.014	.011	0.002	0	↓
1.40	.108	.053	.054	.035	.018	.019	.017	.006	0.003	0
1.45	.109	.058	.058	.040	.024	.025	.022	.016	.008	0.004
1.50	.108	.061	.059	.042	.029	.030	.028	.029	.016	.009
1.55	.103	.062	.058	.042	.031	.033	.032	.041	.023	.014
1.60	.097	.062	.056	.042	.032	.034	.035	.048	.030	.019
1.65	.091	.062	.054	.042	.032	.034	.036	.049	.031	.022
1.70	.087	.061	.053	.042	.032	.033	.035	.047	.029	.023
1.75	.083	.061	.052	.042	.032	.030	.033	.040	.024	.020
1.80	.079	.060	.052	.042	.031	.026	.029	.031	.019	.015
1.85	.073	.059	.051	.041	.030	.020	.023	.022	.014	.011
1.90	.067	.056	.050	.041	.028	.014	.018	.013	.008	.006
1.95	.062	.053	.050	.040	.027	.008	.012	0.006	0.003	0.002
2.00	0.054	0.047	0.049	0.039	0.025	0.002	0.005	0	0	0
2.00001	0	0	0	0	0	0	0	0	0	0
15.00	0	0	0	0	0	0	0	0	0	0

Neutron energy, MeV	Inelastic energy level, MeV				
	1.437	1.470	1.500	1.750	Continuum
1.45	0.002	0	0	0	0
1.50	.008	0.002	0	↓	↓
1.55	.017	.008	0.009	↓	↓
1.60	.025	.014	0.028	↓	↓
1.65	0.029	0.019	0.057	0	0

Table 3-8. (Cont'd)

Neutron energy, MeV	Inelastic energy level, MeV: 1.437	1.470	1.500	1.750	Continuum
1.70	0.027	0.018	0.103	0	0
1.75	.020	.012	.174	0	↓
1.80	.013	.007	.243	0.012	↓
1.85	.007	0.002	.308	.029	↓
1.90	0.002	0	.360	.054	↓
1.95	0	↓	.393	.091	↓
2.00	↓	↓	0.410	0.145	0
2.00001	↓	↓	0	0	1.000
15.00	0	0	0	0	1.000

Table 3-9. Maxwellian Temperature (T_c) for Evaporation Neutrons for U-238

Neutron energy, MeV	Maxwellian temperature, MeV
2.0	0.270
2.5	.311
3.0	.353
3.5	.396
4.0	.438
4.5	.464
5.0	.483
5.5	.497
6.0	.509
6.5	.519
7.0	.527
7.5	.534
8.0	.539
8.5	.543
9.0	.547
9.5	.549
10.0	.550
15.0	0.550

Figure 3-1. U-238 Neutron Cross Sections

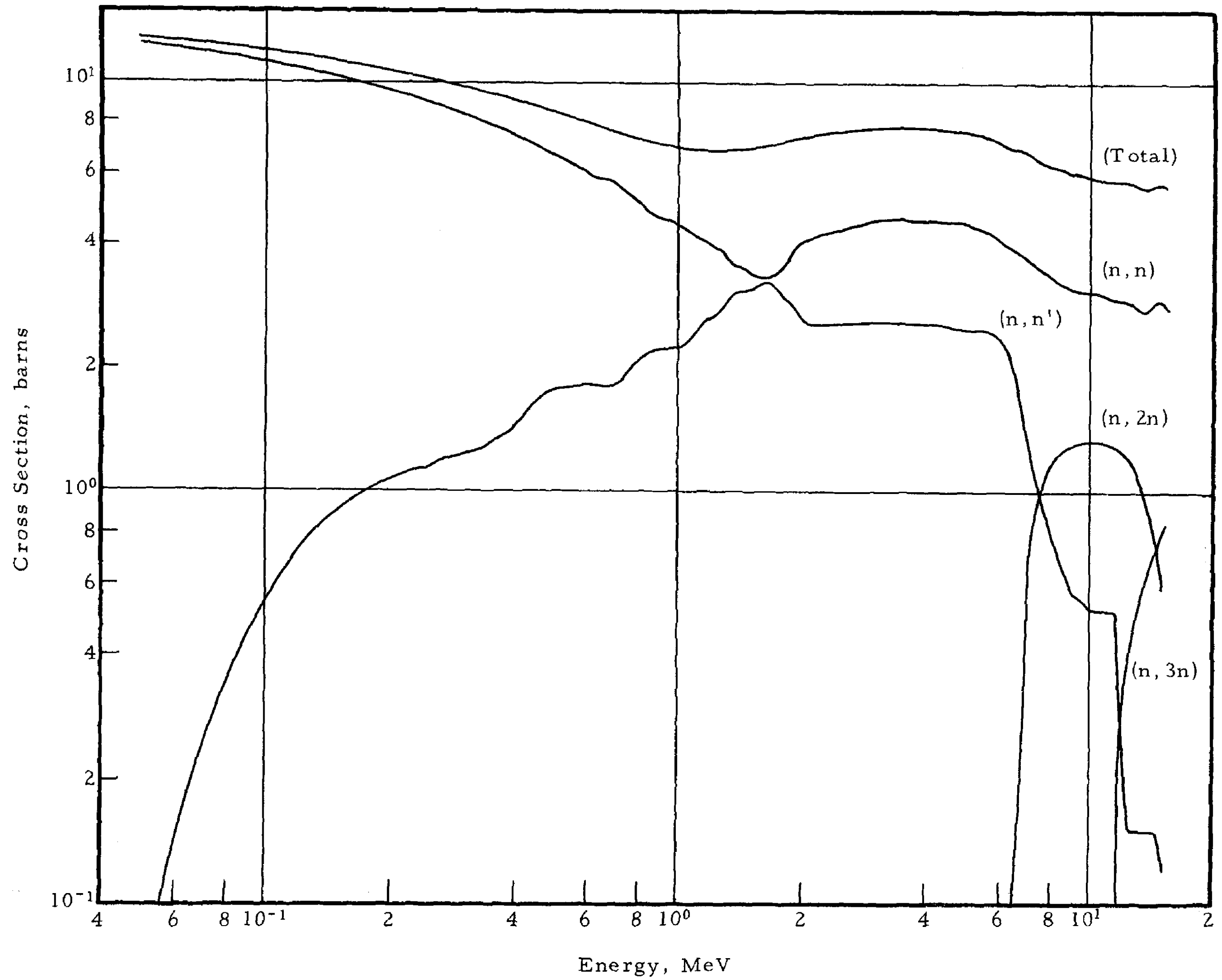


Figure 3-2. Average Cosine of Scattering Angle ($\bar{\mu}_o$) Vs Neutron Energy

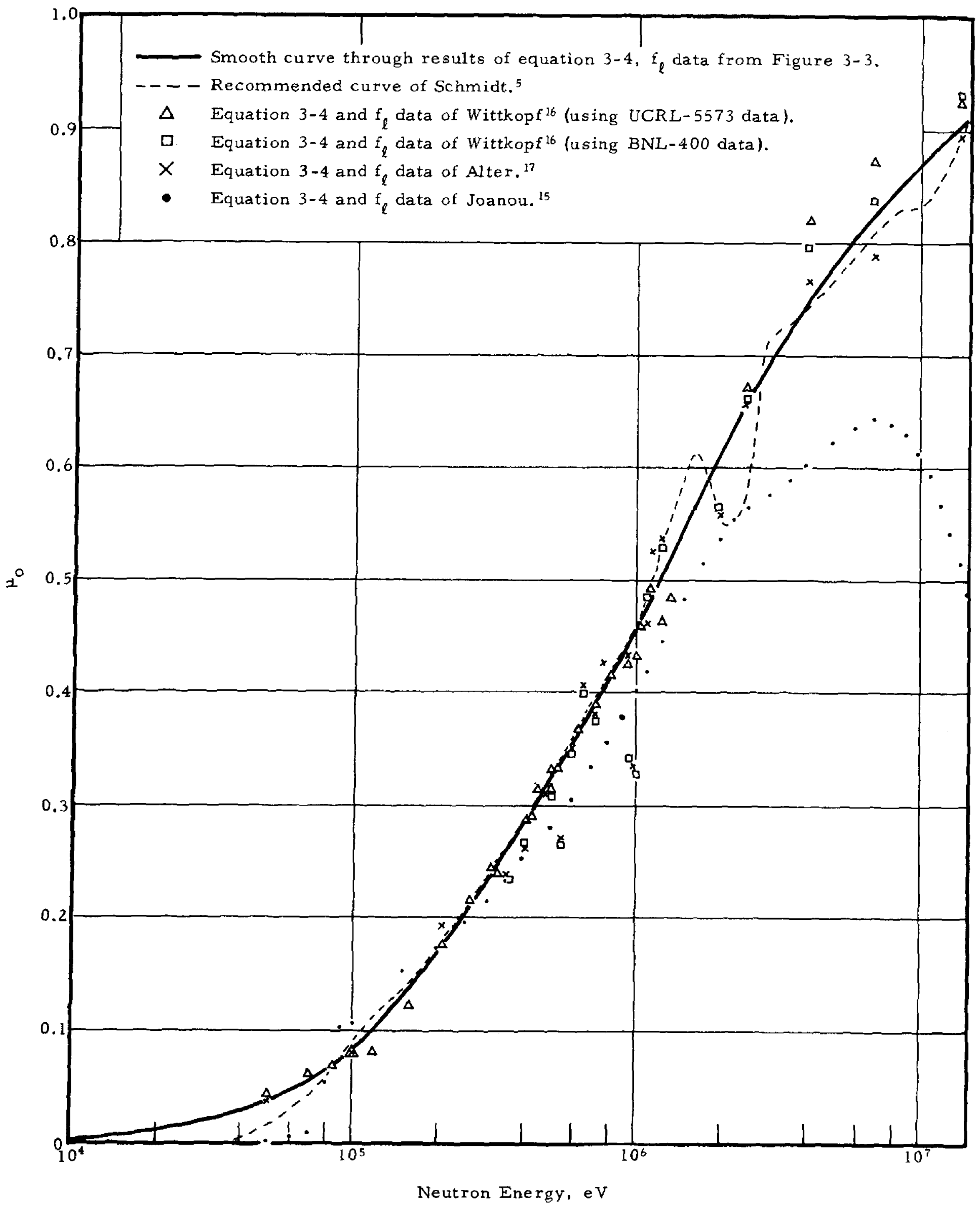


Figure 3-3. Legendre Expansion Coefficients (f_ℓ) for Elastic Scattering in CM System ($f_0 = 1.0$, all energies)

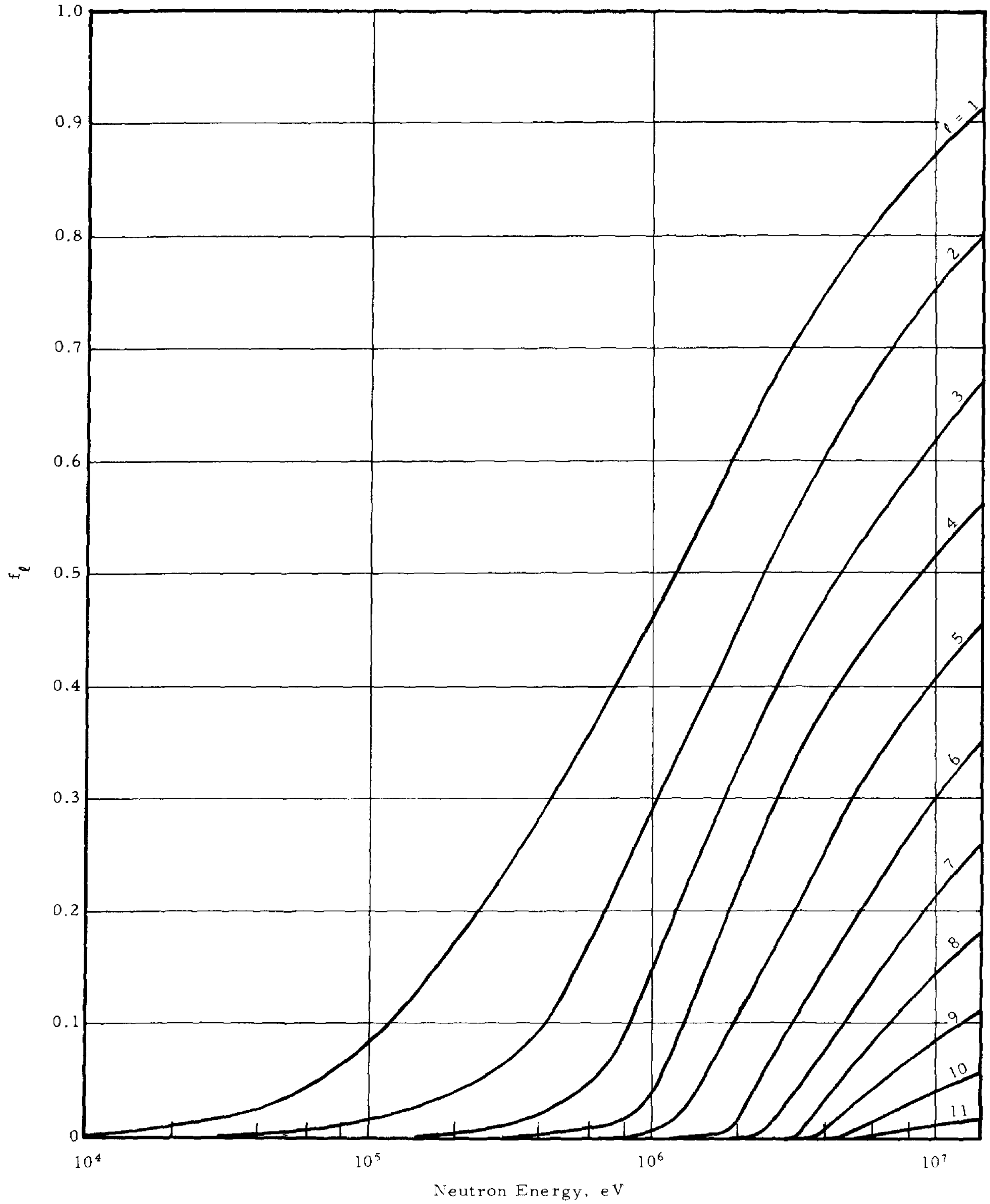


Figure 3-7. U-238 (n, 2n) Cross Section

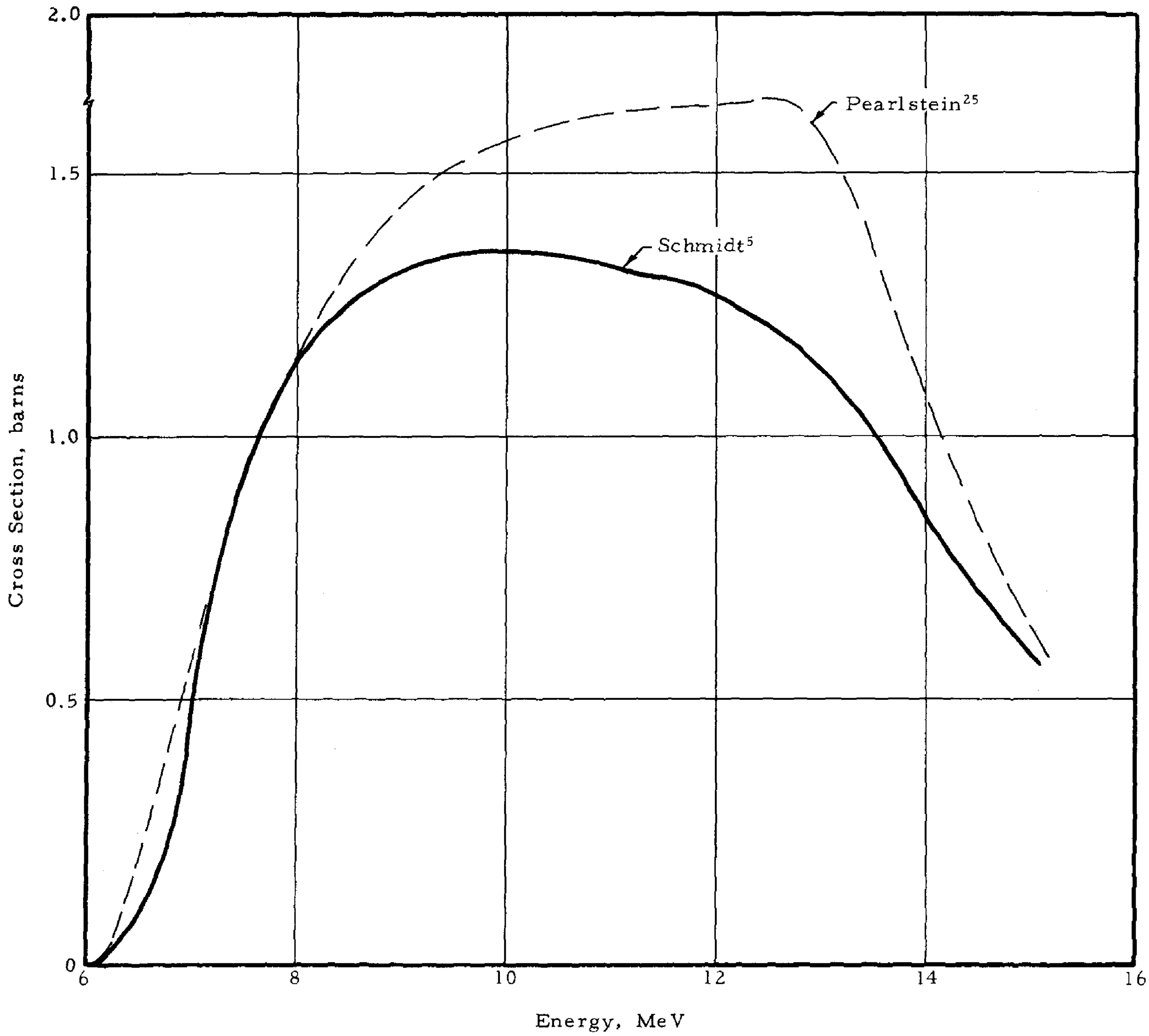


Figure 3-8. U-238 (n, 3n) Cross Section

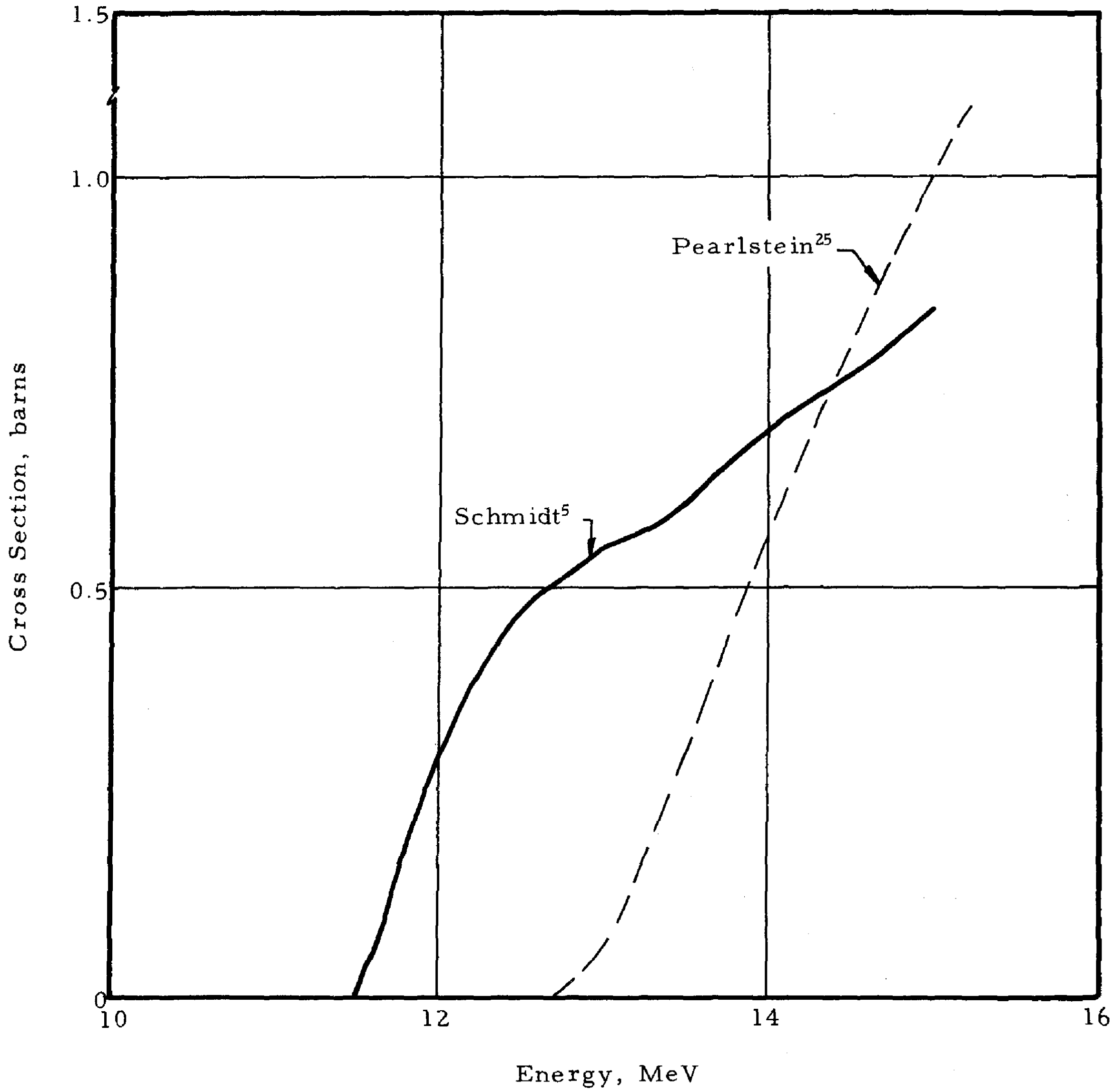
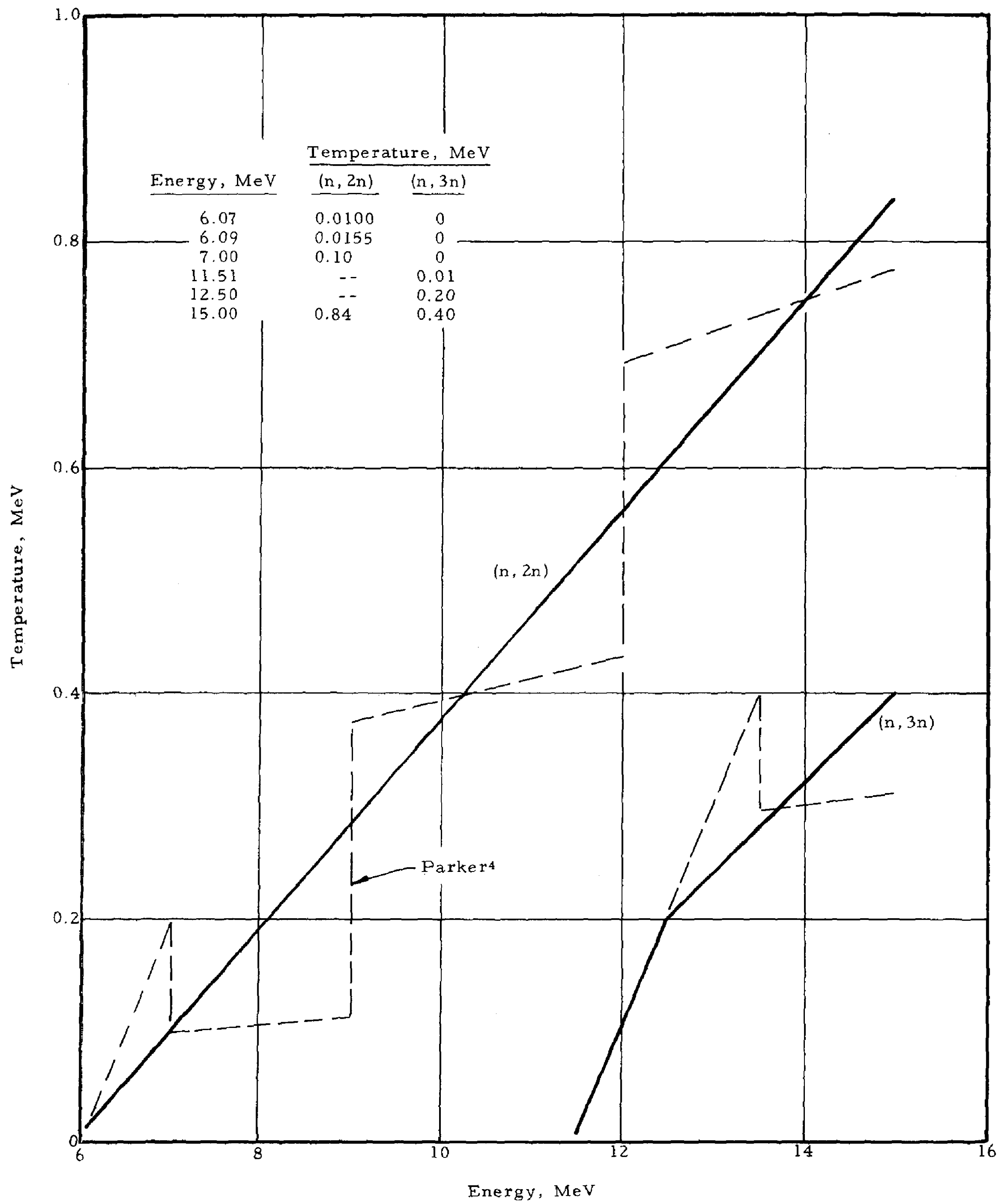


Figure 3-9. U-238 Evaporation "Temperature" for (n, 2n) and (n, 3n) Secondary Neutrons



Energy, MeV	Temperature, MeV (n, 2n)	Temperature, MeV (n, 3n)
6.07	0.0100	0
6.09	0.0155	0
7.00	0.10	0
11.51	--	0.01
12.50	--	0.20
15.00	0.84	0.40

Figure 3-10a. U-238 (n, n') Level Data

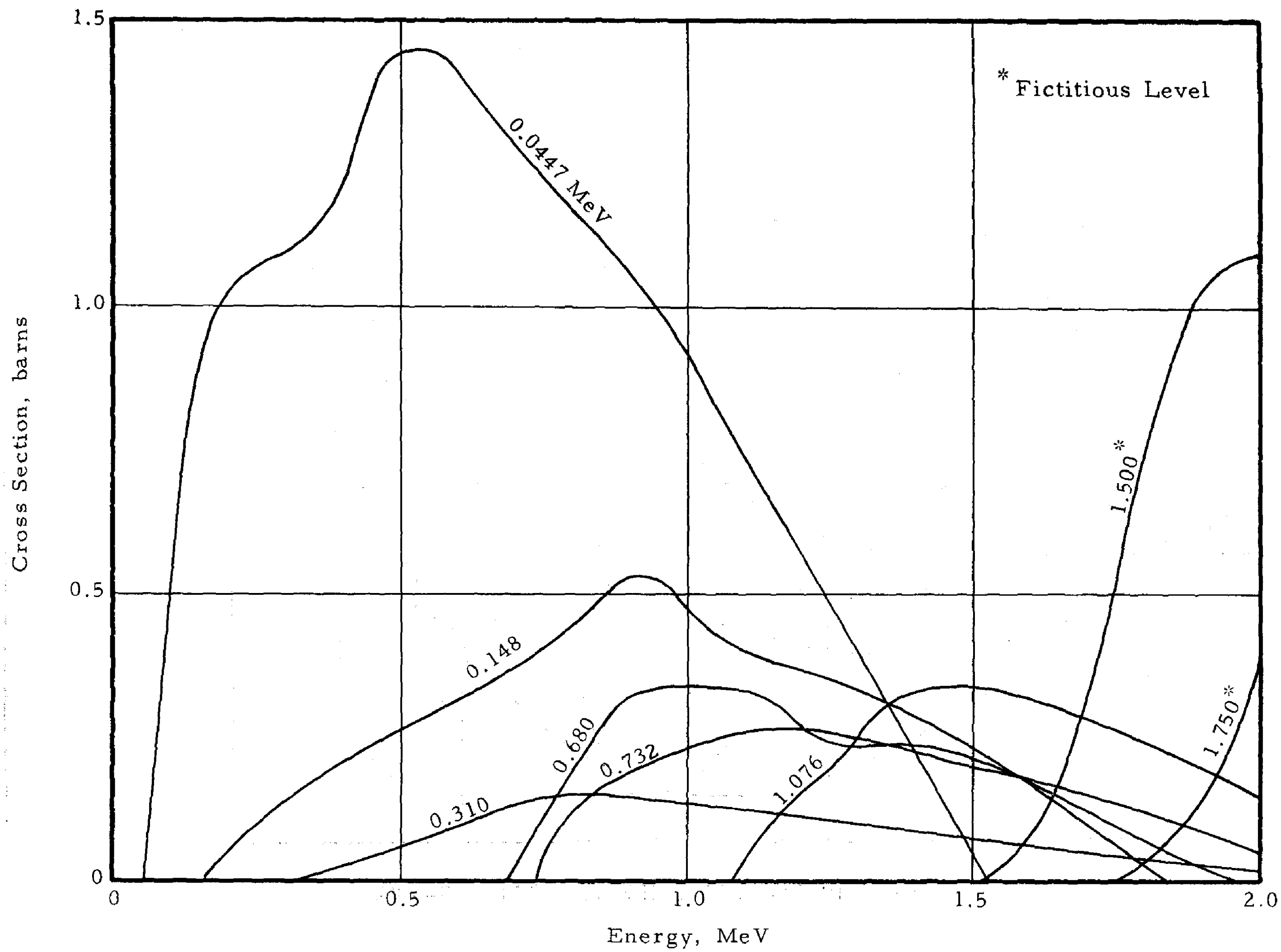
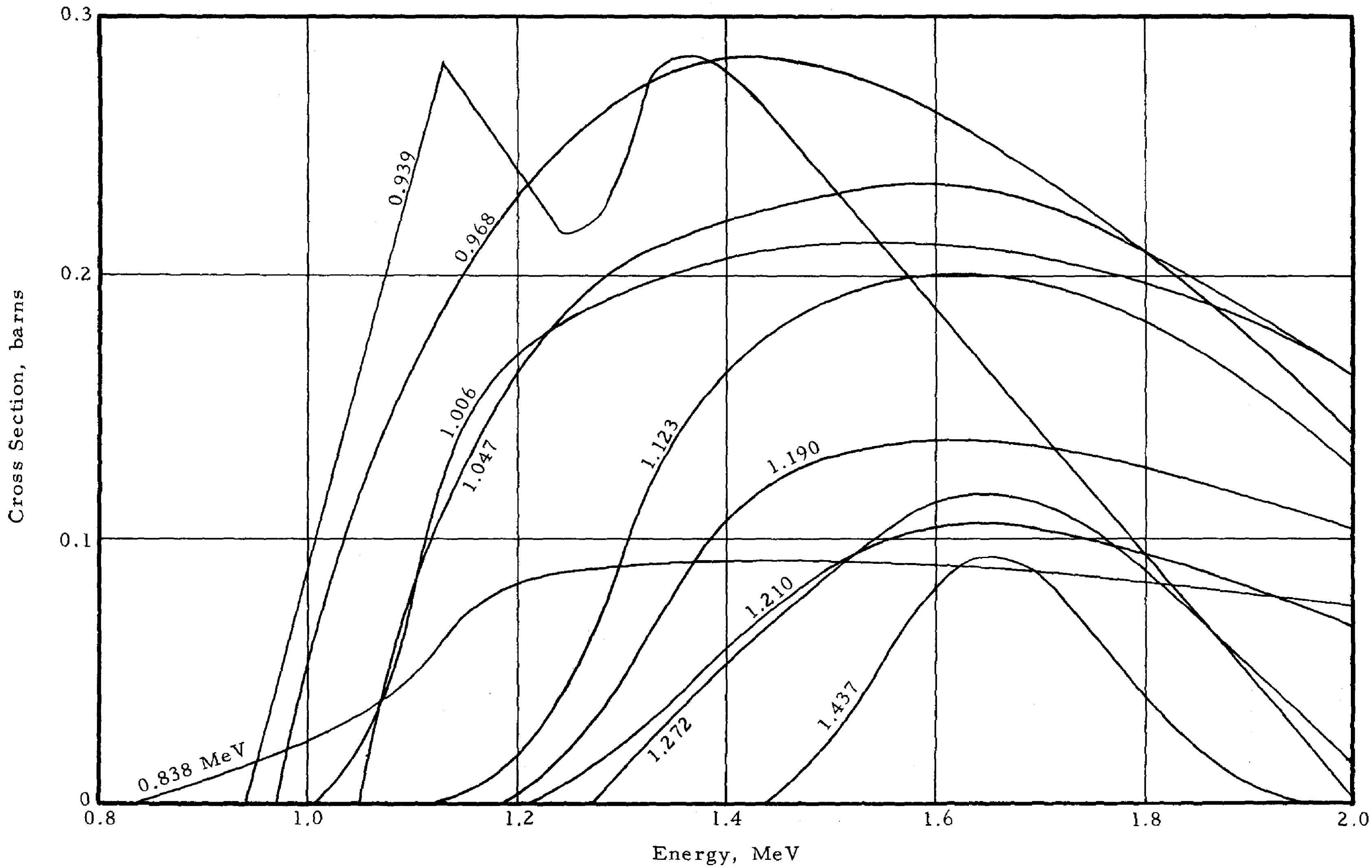


Figure 3-10b. U-238 (n,n') Level Data



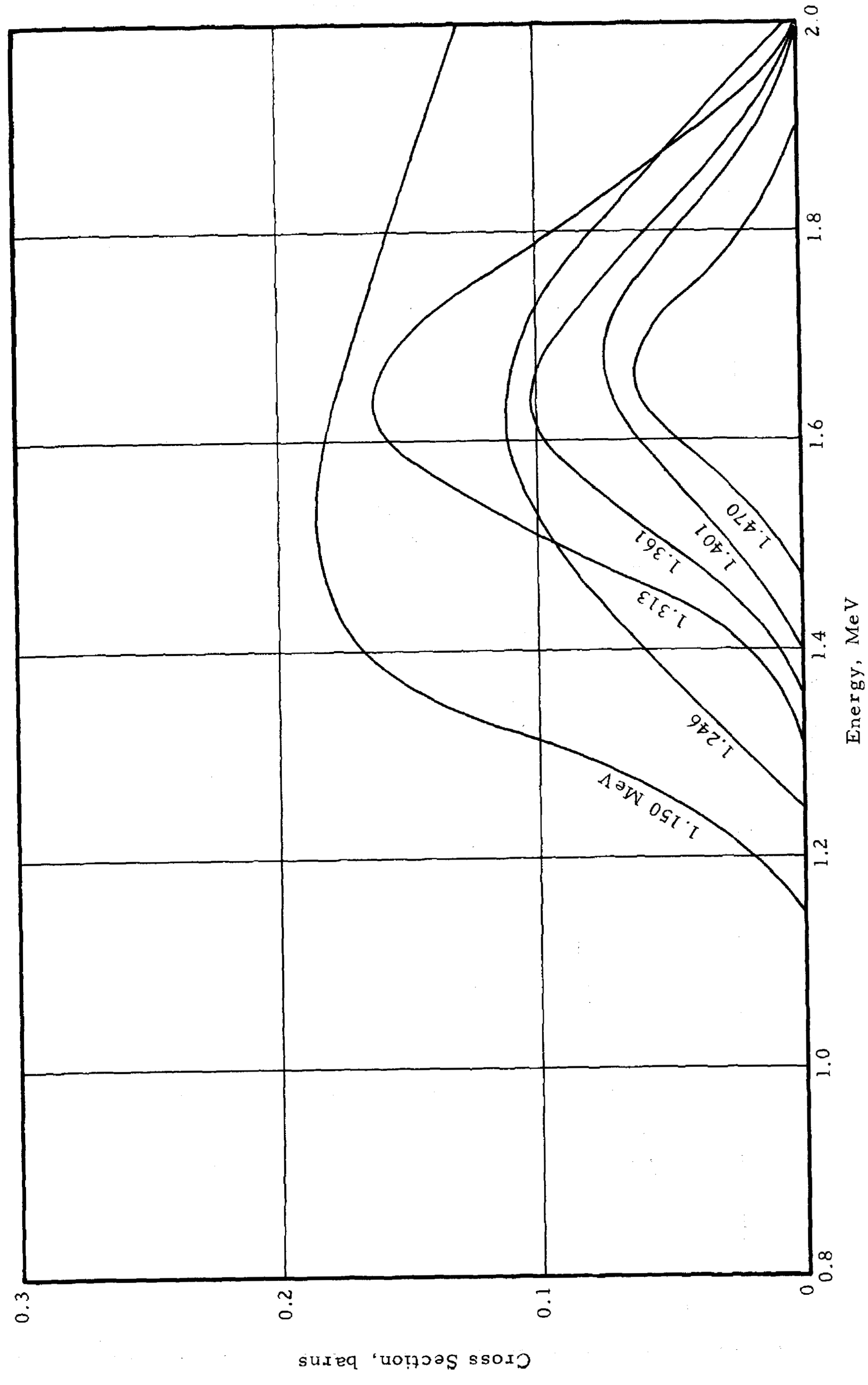
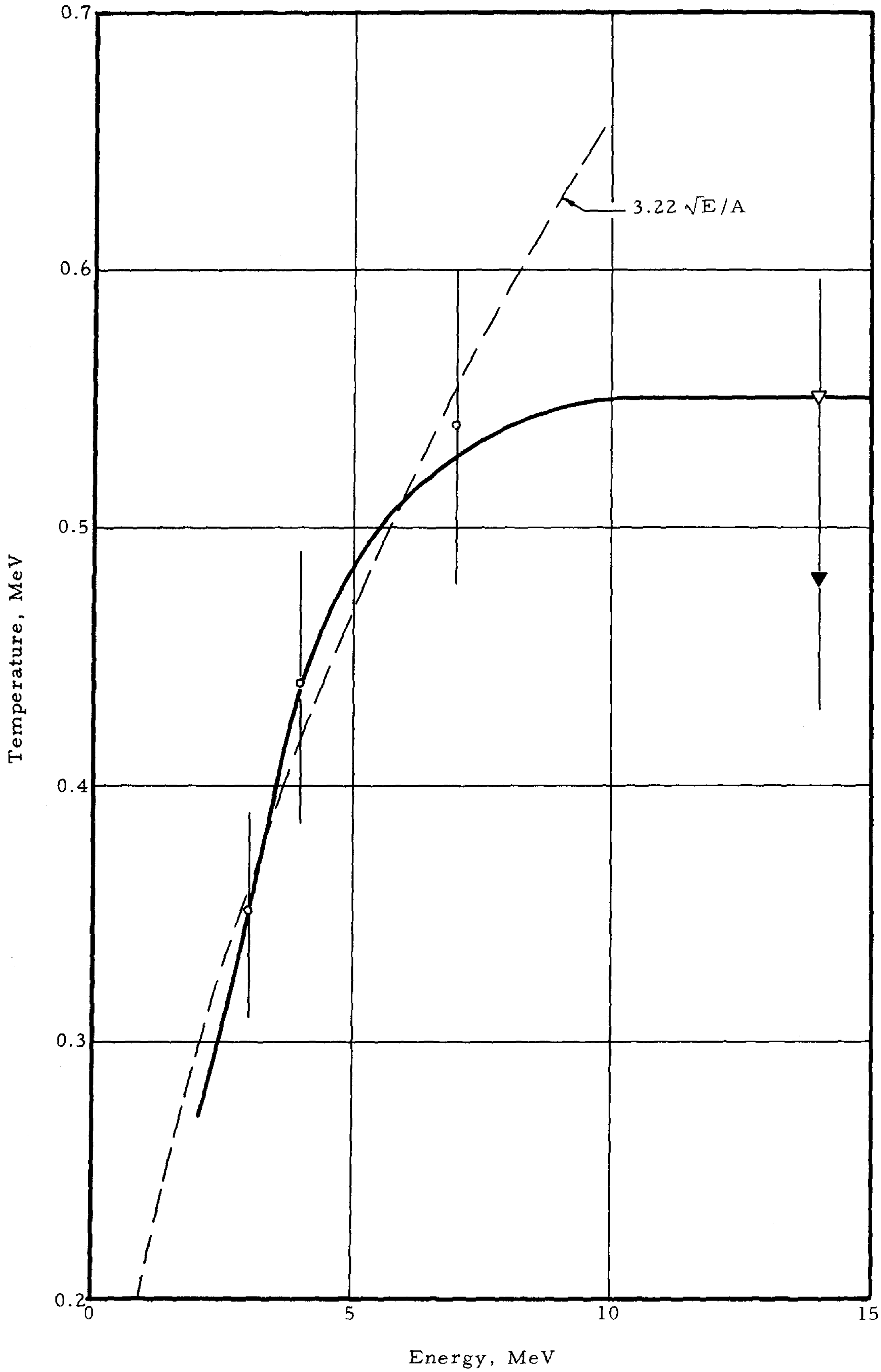


Figure 3-10c. U-238 (n, n') Level Data

Figure 3-11. U-238 Evaporation Temperature for (n, n') Secondary Neutrons



4. REFERENCES

[1] Pearlstein, S., letter to CSEWG participants, June 1, 1966.

[2] Honeck, H., "The Evaluation and Processing of Nuclear Data for Use in Reactor Calculations," Trans. Amer. Nuc. Soc., 9, No. 2, 469 (1966).

[3] BNL-8381 and supplements, Sigma Center, June 1964.

[4] Parker, K., AWRE 0-79/63, 1964.

[5] Schmidt, J. J., private communication to W. A. Wittkopf, October 1966 (to be published in KFK 120, Part I).

[6] Howerton, R. J., et al., UCRL-14000, 1964.

[7] Stehn, J. R., et al., BNL-325, 2nd Ed., Sup. 2, Vol III, 1965.

[8] Hughes, D. J. and Schwartz, R. B., BNL-325, 2nd Ed., 1958.

[9] Sumner, H. M., AEEW-M-414, 1963.

[10] Garg, J. B., et al., Phys. Rev., 134, B895 (1964).

[11] Seth, K. K., et al., Phys. Rev., 110, 692 (1962).

[12] Lynn, J. E., Proc. Phys. Soc., 82, 903 (1963).

[13] Uttley, C. A., Proc. Int. Cong. Nuc. Phys., Paris, France, 700 (1964).

[14] Sumner, H. W., AEEW-R-323, April 1964.

[15] Joanou, G. D., GA-6087, January 1965.

[16] Wittkopf, W. A., unpublished B&W work from analyses of data in BNL-400 and UCRL-5573.

[17] Alter, H., private communication to W. A. Wittkopf, August 1966 (author stated data sources would be in NAA-SR-11231 and NAA-SR-11980, Vol II).

[18] Goldberg, M., et al., BNL-400, 2nd Ed., Vol II, October 1962.

[19] Howerton, R. S., UCRL-5573, January 1961.

[20] Barry, J. F., Bunce, J., and White, P. H., J. Nuc. Energy, 18, 481 (1964).

[21] Perkin, J. L., O'Connor, L. P., and Coleman, R. F., Proc. Phys. Soc. Lond., 2, 505 (1958).

[22] Davey, W. G., Nuc. Sci. Engr., 26, 149 (1966).

[23] Barnard, E., et al., Nuclear Physics, 71, 228 (1965).

[24] Terrell, J., Phys. Rev., 113, 527 (1959).

[25] Pearlstein, S., personal communication to W. A. Wittkopf, 1966.

[26] Barnard, E., et al., Nuclear Physics, 80, 46 (1965).

[27] Batchelor, R., Gilboy, W. B., and Towle, J. H., Nuclear Physics, 65, 236 (1964).

[28] Blatt, J. M. and Weisskopf, V. F., Theoretical Nuclear Physics, Wiley, New York, N. Y. (1952).

[29] Lane, R. O., et al., ANL-6039 (p 6), August 1959.

APPENDIX A

Listing of ENDF/B Data

92238.0	236.0058	1	1	0		01047 1451	1
0.0	0.0	0	0	2		01047 1451	2
URANIUM-238 COMPILED NOV. 15,1966 AT BABCOCK AND WILCOX CO.						01047 1451	3
COMPILATION PROCESS AND DATA SOURCES ARE DESCRIBED IN ENDF-103						01047 1451	4
0.0	0.0	0	0	0		01047 1 0	5
92238.0	236.0058	0	1	0		01047 1452	6
0.0	0.0	0	0	2		01047 1452	7
2.358	0.156-6					01047 1452	8
0.0	0.0	0	0	0		01047 1 0	9
0.0	0.0	0	0	0		01047 0 0	10
92238.0	236.0058	0	0	1		01047 2151	11
92238.0	1.0	0	0	2		01047 2151	12
5.0	3.92+3	1	1	0		01047 2151	13
0.0	0.9184	0	0	1		01047 2151	14
0.191-2	0.0	0	0	1254		2091047 2151	15
-1.5000+01	5.0000-01	2.7653-02	3.0534-03	2.4600-02	0.	1047 2151	16
6.6700+00	5.0000-01	2.6120-02	1.5200-03	2.4600-02	0.	1047 2151	17
1.0200+01	5.0000-01	2.4601-02	1.4000-06	2.4600-02	0.	1047 2151	18
2.1000+01	5.0000-01	3.3100-02	8.5000-03	2.4600-02	0.	1047 2151	19
3.6700+01	5.0000-01	5.5600-02	3.1000-02	2.4600-02	0.	1047 2151	20
6.6200+01	5.0000-01	4.9600-02	2.5000-02	2.4600-02	0.	1047 2151	21
8.1100+01	5.0000-01	2.6600-02	2.0000-03	2.4600-02	0.	1047 2151	22
8.9500+01	5.0000-01	2.4685-02	8.5000-05	2.4600-02	0.	1047 2151	23
1.0270+02	5.0000-01	9.2600-02	6.8000-02	2.4600-02	0.	1047 2151	24
1.1690+02	5.0000-01	5.0600-02	2.6000-02	2.4600-02	0.	1047 2151	25
1.4570+02	5.0000-01	2.5300-02	7.0000-04	2.4600-02	0.	1047 2151	26
1.6540+02	5.0000-01	2.7600-02	3.0000-03	2.4600-02	0.	1047 2151	27
1.8960+02	5.0000-01	1.6960-01	1.4500-01	2.4600-02	0.	1047 2151	28
2.0860+02	5.0000-01	8.0600-02	5.6000-02	2.4600-02	0.	1047 2151	29
2.3740+02	5.0000-01	5.3600-02	2.9000-02	2.4600-02	0.	1047 2151	30
2.6390+02	5.0000-01	2.4830-02	2.3000-04	2.4600-02	0.	1047 2151	31
2.7370+02	5.0000-01	4.9600-02	2.5000-02	2.4600-02	0.	1047 2151	32
2.9110+02	5.0000-01	4.0600-02	1.6000-02	2.4600-02	0.	1047 2151	33
3.1110+02	5.0000-01	2.5590-02	9.9000-04	2.4600-02	0.	1047 2151	34
3.4790+02	5.0000-01	9.9600-02	7.5000-02	2.4600-02	0.	1047 2151	35
3.7690+02	5.0000-01	2.5750-02	1.1500-03	2.4600-02	0.	1047 2151	36
3.9760+02	5.0000-01	3.1600-02	7.0000-03	2.4600-02	0.	1047 2151	37
4.1030+02	5.0000-01	4.2600-02	1.8000-02	2.4600-02	0.	1047 2151	38
4.3420+02	5.0000-01	3.3600-02	9.0000-03	2.4600-02	0.	1047 2151	39
4.5420+02	5.0000-01	2.5100-02	5.0000-04	2.4600-02	0.	1047 2151	40
4.6330+02	5.0000-01	2.9800-02	5.2000-03	2.4600-02	0.	1047 2151	41
4.7870+02	5.0000-01	2.7700-02	3.1000-03	2.4600-02	0.	1047 2151	42
4.8890+02	5.0000-01	2.5040-02	4.4000-04	2.4600-02	0.	1047 2151	43
5.1860+02	5.0000-01	6.7600-02	4.3000-02	2.4600-02	0.	1047 2151	44
5.3550+02	5.0000-01	6.4600-02	4.0000-02	2.4600-02	0.	1047 2151	45
5.5610+02	5.0000-01	2.5300-02	7.0000-04	2.4600-02	0.	1047 2151	46
5.8020+02	5.0000-01	5.5600-02	3.1000-02	2.4600-02	0.	1047 2151	47
5.9520+02	5.0000-01	1.0460-01	8.0000-02	2.4600-02	0.	1047 2151	48
6.2000+02	5.0000-01	5.4600-02	3.0000-02	2.4600-02	0.	1047 2151	49
6.2870+02	5.0000-01	2.8600-02	4.0000-03	2.4600-02	0.	1047 2151	50
6.6120+02	5.0000-01	1.4560-01	1.2100-01	2.4600-02	0.	1047 2151	51
6.7700+02	5.0000-01	2.5500-02	9.0000-04	2.4600-02	0.	1047 2151	52
6.9330+02	5.0000-01	6.1600-02	3.7000-02	2.4600-02	0.	1047 2151	53
7.0850+02	5.0000-01	4.5600-02	2.1000-02	2.4600-02	0.	1047 2151	54

7.2180+02	5.0000-01	2.5800-02	1.2000-03	2.4600-02	0.	1047	2151	55
7.3010+02	5.0000-01	2.6200-02	1.6000-03	2.4600-02	0.	1047	2151	56
7.6510+02	5.0000-01	3.1200-02	6.6000-03	2.4600-02	0.	1047	2151	57
7.7920+02	5.0000-01	2.6500-02	1.7000-03	2.4600-02	0.	1047	2151	58
7.9090+02	5.0000-01	2.9700-02	5.1000-03	2.4600-02	0.	1047	2151	59
8.2160+02	5.0000-01	8.3600-02	5.9000-02	2.4600-02	0.	1047	2151	60
8.5100+02	5.0000-01	8.2600-02	5.8000-02	2.4600-02	0.	1047	2151	61
8.5620+02	5.0000-01	1.0660-01	8.2000-02	2.4600-02	0.	1047	2151	62
8.6650+02	5.0000-01	2.8100-02	3.5000-03	2.4600-02	0.	1047	2151	63
8.9130+02	5.0000-01	2.5800-02	1.2000-03	2.4600-02	0.	1047	2151	64
9.0510+02	5.0000-01	7.5600-02	5.1000-02	2.4600-02	0.	1047	2151	65
9.2520+02	5.0000-01	3.4600-02	1.0000-02	2.4600-02	0.	1047	2151	66
9.3690+02	5.0000-01	1.7460-01	1.5000-01	2.4600-02	0.	1047	2151	67
9.5840+02	5.0000-01	1.7960-01	1.5500-01	2.4600-02	0.	1047	2151	68
9.9180+02	5.0000-01	3.7460-01	3.5000-01	2.4600-02	0.	1047	2151	69
1.0113+03	5.0000-01	2.5900-02	1.3000-03	2.4600-02	0.	1047	2151	70
1.0230+03	5.0000-01	3.7600-02	1.3000-02	2.4600-02	0.	1047	2151	71
1.0332+03	5.0000-01	2.5300-02	7.0000-04	2.4600-02	0.	1047	2151	72
1.0539+03	5.0000-01	8.9600-02	6.5000-02	2.4600-02	0.	1047	2151	73
1.0705+03	5.0000-01	2.4927-02	3.2700-04	2.4600-02	0.	1047	2151	74
1.0811+03	5.0000-01	2.5300-02	7.0000-04	2.4600-02	0.	1047	2151	75
1.0984+03	5.0000-01	3.6600-02	1.2000-02	2.4600-02	0.	1047	2151	76
1.1089+03	5.0000-01	4.7600-02	2.3000-02	2.4600-02	0.	1047	2151	77
1.1315+03	5.0000-01	2.6900-02	2.3000-03	2.4600-02	0.	1047	2151	78
1.1404+03	5.0000-01	2.5460-01	2.3000-01	2.4600-02	0.	1047	2151	79
1.1675+03	5.0000-01	9.4600-02	7.0000-02	2.4600-02	0.	1047	2151	80
1.1776+03	5.0000-01	8.2600-02	5.8000-02	2.4600-02	0.	1047	2151	81
1.1950+03	5.0000-01	1.0760-01	8.3000-02	2.4600-02	0.	1047	2151	82
1.2109+03	5.0000-01	3.3600-02	9.0000-03	2.4600-02	0.	1047	2151	83
1.2451+03	5.0000-01	2.5460-01	2.3000-01	2.4600-02	0.	1047	2151	84
1.2670+03	5.0000-01	5.1600-02	2.7000-02	2.4600-02	0.	1047	2151	85
1.2732+03	5.0000-01	5.3600-02	2.9000-02	2.4600-02	0.	1047	2151	86
1.2985+03	5.0000-01	2.8200-02	3.6000-03	2.4600-02	0.	1047	2151	87
1.3172+03	5.0000-01	2.9300-02	4.7000-03	2.4600-02	0.	1047	2151	88
1.3357+03	5.0000-01	2.6100-02	1.5000-03	2.4600-02	0.	1047	2151	89
1.3930+03	5.0000-01	1.9460-01	1.7000-01	2.4600-02	0.	1047	2151	90
1.4051+03	5.0000-01	1.0660-01	8.2000-02	2.4600-02	0.	1047	2151	91
1.4197+03	5.0000-01	3.5600-02	1.1000-02	2.4600-02	0.	1047	2151	92
1.4278+03	5.0000-01	5.8600-02	3.4000-02	2.4600-02	0.	1047	2151	93
1.4441+03	5.0000-01	4.7600-02	2.3000-02	2.4600-02	0.	1047	2151	94
1.4738+03	5.0000-01	1.0510-01	8.0500-02	2.4600-02	0.	1047	2151	95
1.5231+03	5.0000-01	2.3460-01	2.1000-01	2.4600-02	0.	1047	2151	96
1.5460+03	5.0000-01	2.6600-02	2.0000-03	2.4600-02	0.	1047	2151	97
1.5500+03	5.0000-01	2.6600-02	2.0000-03	2.4600-02	0.	1047	2151	98
1.5650+03	5.0000-01	2.7000-02	2.4000-03	2.4600-02	0.	1047	2151	99
1.6229+03	5.0000-01	1.1460-01	9.0000-02	2.4600-02	0.	1047	2151	100
1.6382+03	5.0000-01	6.5000-02	4.0400-02	2.4600-02	0.	1047	2151	101
1.6621+03	5.0000-01	1.8460-01	1.6000-01	2.4600-02	0.	1047	2151	102
1.6883+03	5.0000-01	9.4600-02	7.0000-02	2.4600-02	0.	1047	2151	103
1.7094+03	5.0000-01	7.4600-02	5.0000-02	2.4600-02	0.	1047	2151	104
1.7230+03	5.0000-01	3.8600-02	1.4000-02	2.4600-02	0.	1047	2151	105
1.7558+03	5.0000-01	9.4600-02	7.0000-02	2.4600-02	0.	1047	2151	106
1.7823+03	5.0000-01	5.2460-01	5.0000-01	2.4600-02	0.	1047	2151	107
1.7977+03	5.0000-01	2.6720-02	2.1200-03	2.4600-02	0.	1047	2151	108
1.8083+03	5.0000-01	4.1609-02	1.7009-02	2.4600-02	0.	1047	2151	109

1.8456+03	5.0000-01	3.7918-02	1.3318-02	2.4600-02	0.	1047	2151	110
1.9023+03	5.0000-01	4.5535-02	2.0935-02	2.4600-02	0.	1047	2151	111
1.9171+03	5.0000-01	4.6492-02	2.1892-02	2.4600-02	0.	1047	2151	112
1.9687+03	5.0000-01	6.0140-01	5.7680-01	2.4600-02	0.	1047	2151	113
1.9746+03	5.0000-01	4.9119-01	4.6659-01	2.4600-02	0.	1047	2151	114
2.0236+03	5.0000-01	2.2703-01	2.0243-01	2.4600-02	0.	1047	2151	115
2.0311+03	5.0000-01	7.4174-02	4.9574-02	2.4600-02	0.	1047	2151	116
2.0886+03	5.0000-01	3.8310-02	1.3710-02	2.4600-02	0.	1047	2151	117
2.0965+03	5.0000-01	3.4673-02	1.0073-02	2.4600-02	0.	1047	2151	118
2.1243+03	5.0000-01	2.9209-02	4.6091-03	2.4600-02	0.	1047	2151	119
2.1460+03	5.0000-01	5.9343-02	3.4743-02	2.4600-02	0.	1047	2151	120
2.1528+03	5.0000-01	2.0091-01	1.7631-01	2.4600-02	0.	1047	2151	121
2.1720+03	5.0000-01	2.6930-02	2.3302-03	2.4600-02	0.	1047	2151	122
2.1860+03	5.0000-01	3.8929-01	3.6469-01	2.4600-02	0.	1047	2151	123
2.1940+03	5.0000-01	2.6942-02	2.3420-03	2.4600-02	0.	1047	2151	124
2.2014+03	5.0000-01	1.3721-01	1.1261-01	2.4600-02	0.	1047	2151	125
2.2300+03	5.0000-01	2.9322-02	4.7222-03	2.4600-02	0.	1047	2151	126
2.2357+03	5.0000-01	2.9328-02	4.7284-03	2.4600-02	0.	1047	2151	127
2.2415+03	5.0000-01	2.6020-02	1.4203-03	2.4600-02	0.	1047	2151	128
2.2591+03	5.0000-01	9.0191-02	6.5591-02	2.4600-02	0.	1047	2151	129
2.2664+03	5.0000-01	1.6980-01	1.4520-01	2.4600-02	0.	1047	2151	130
2.2813+03	5.0000-01	1.3445-01	1.0985-01	2.4600-02	0.	1047	2151	131
2.2887+03	5.0000-01	2.6992-02	2.3920-03	2.4600-02	0.	1047	2151	132
2.3020+03	5.0000-01	2.5560-02	9.5958-04	2.4600-02	0.	1047	2151	133
2.3159+03	5.0000-01	3.9037-02	1.4437-02	2.4600-02	0.	1047	2151	134
2.3374+03	5.0000-01	2.9435-02	4.8347-03	2.4600-02	0.	1047	2151	135
2.3520+03	5.0000-01	8.7647-02	6.3047-02	2.4600-02	0.	1047	2151	136
2.3560+03	5.0000-01	8.7700-02	6.3100-02	2.4600-02	0.	1047	2151	137
2.3925+03	5.0000-01	3.5850-02	1.1250-02	2.4600-02	0.	1047	2151	138
2.4102+03	5.0000-01	2.9018-02	4.4184-03	2.4600-02	0.	1047	2151	139
2.4265+03	5.0000-01	1.0588-01	8.1278-02	2.4600-02	0.	1047	2151	140
2.4462+03	5.0000-01	1.3588-01	1.1128-01	2.4600-02	0.	1047	2151	141
2.4540+03	5.0000-01	2.7077-02	2.4769-03	2.4600-02	0.	1047	2151	142
2.4898+03	5.0000-01	7.9488-02	5.4888-02	2.4600-02	0.	1047	2151	143
2.5207+03	5.0000-01	3.4641-02	1.0041-02	2.4600-02	0.	1047	2151	144
2.5487+03	5.0000-01	3.6790-01	3.4330-01	2.4600-02	0.	1047	2151	145
2.5593+03	5.0000-01	2.4213-01	2.1753-01	2.4600-02	0.	1047	2151	146
2.5807+03	5.0000-01	2.6844-01	2.4384-01	2.4600-02	0.	1047	2151	147
2.5987+03	5.0000-01	5.8535-01	5.6075-01	2.4600-02	0.	1047	2151	148
2.6040+03	5.0000-01	2.7151-02	2.5515-03	2.4600-02	0.	1047	2151	149
2.6206+03	5.0000-01	6.5553-02	4.0953-02	2.4600-02	0.	1047	2151	150
2.6316+03	5.0000-01	2.5626-02	1.0260-03	2.4600-02	0.	1047	2151	151
2.6728+03	5.0000-01	2.0038-01	1.7578-01	2.4600-02	0.	1047	2151	152
2.6956+03	5.0000-01	4.7964-02	2.3364-02	2.4600-02	0.	1047	2151	153
2.7168+03	5.0000-01	9.5487-02	7.0887-02	2.4600-02	0.	1047	2151	154
2.7300+03	5.0000-01	2.7212-02	2.6125-03	2.4600-02	0.	1047	2151	155
2.7501+03	5.0000-01	6.3931-02	3.9331-02	2.4600-02	0.	1047	2151	156
2.7619+03	5.0000-01	4.0366-02	1.5766-02	2.4600-02	0.	1047	2151	157
2.7879+03	5.0000-01	3.5160-02	1.0560-02	2.4600-02	0.	1047	2151	158
2.7980+03	5.0000-01	2.7245-02	2.6448-03	2.4600-02	0.	1047	2151	159
2.8062+03	5.0000-01	3.1487-02	6.8866-03	2.4600-02	0.	1047	2151	160
2.8286+03	5.0000-01	3.3641-02	9.0414-03	2.4600-02	0.	1047	2151	161
2.8452+03	5.0000-01	2.7267-02	2.6670-03	2.4600-02	0.	1047	2151	162
2.8661+03	5.0000-01	1.0383-01	7.9233-02	2.4600-02	0.	1047	2151	163
2.8829+03	5.0000-01	5.5079-01	5.2619-01	2.4600-02	0.	1047	2151	164
2.8978+03	5.0000-01	5.1516-02	2.6916-02	2.4600-02	0.	1047	2151	165

2,9085+03	5.0000-01	2.7297-02	2.6965-03	2.4600-02	0.	1047	2151	166
2,9236+03	5.0000-01	2.8926-02	4.3256-03	2.4600-02	0.	1047	2151	167
2,9323+03	5.0000-01	4.9509-02	2.4909-02	2.4600-02	0.	1047	2151	168
2,9563+03	5.0000-01	3.9824-02	1.5224-02	2.4600-02	0.	1047	2151	169
2,9674+03	5.0000-01	3.2771-02	8.1711-03	2.4600-02	0.	1047	2151	170
2,9740+03	5.0000-01	2.7327-02	2.7267-03	2.4600-02	0.	1047	2151	171
2,9874+03	5.0000-01	3.0066-02	5.4657-03	2.4600-02	0.	1047	2151	172
3,0031+03	5.0000-01	1.1776-01	9.3161-02	2.4600-02	0.	1047	2151	173
3,0150+03	5.0000-01	3.1738-02	7.1382-03	2.4600-02	0.	1047	2151	174
3,0290+03	5.0000-01	1.6219-01	1.3759-01	2.4600-02	0.	1047	2151	175
3,0410+03	5.0000-01	2.7357-02	2.7573-03	2.4600-02	0.	1047	2151	176
3,0602+03	5.0000-01	5.2260-02	2.7660-02	2.4600-02	0.	1047	2151	177
3,0811+03	5.0000-01	2.9041-02	4.4406-03	2.4600-02	0.	1047	2151	178
3,1094+03	5.0000-01	1.2497-01	1.0037-01	2.4600-02	0.	1047	2151	179
3,1332+03	5.0000-01	3.0197-02	5.5975-03	2.4600-02	0.	1047	2151	180
3,1490+03	5.0000-01	8.6328-02	6.1728-02	2.4600-02	0.	1047	2151	181
3,1690+03	5.0000-01	3.4733-02	1.0133-02	2.4600-02	0.	1047	2151	182
3,1794+03	5.0000-01	8.6625-02	6.2025-02	2.4600-02	0.	1047	2151	183
3,1890+03	5.0000-01	6.8083-02	4.3483-02	2.4600-02	0.	1047	2151	184
3,2060+03	5.0000-01	8.1222-02	5.6622-02	2.4600-02	0.	1047	2151	185
3,2260+03	5.0000-01	4.7319-02	2.2719-02	2.4600-02	0.	1047	2151	186
3,2492+03	5.0000-01	3.6000-02	1.1400-02	2.4600-02	0.	1047	2151	187
3,2800+03	5.0000-01	1.2769-01	1.0309-01	2.4600-02	0.	1047	2151	188
3,2950+03	5.0000-01	3.3210-02	8.6103-03	2.4600-02	0.	1047	2151	189
3,3109+03	5.0000-01	1.1954-01	9.4942-02	2.4600-02	0.	1047	2151	190
3,3213+03	5.0000-01	1.0644-01	8.1836-02	2.4600-02	0.	1047	2151	191
3,3340+03	5.0000-01	8.2341-02	5.7741-02	2.4600-02	0.	1047	2151	192
3,3557+03	5.0000-01	9.9907-02	7.5307-02	2.4600-02	0.	1047	2151	193
3,3710+03	5.0000-01	2.7503-02	2.9030-03	2.4600-02	0.	1047	2151	194
3,3878+03	5.0000-01	3.2749-02	8.1487-03	2.4600-02	0.	1047	2151	195
3,4090+03	5.0000-01	1.2970-01	1.0510-01	2.4600-02	0.	1047	2151	196
3,4190+03	5.0000-01	2.7524-02	2.9236-03	2.4600-02	0.	1047	2151	197
3,4369+03	5.0000-01	2.1513-01	1.9053-01	2.4600-02	0.	1047	2151	198
3,4591+03	5.0000-01	4.0689-01	3.8229-01	2.4600-02	0.	1047	2151	199
3,4700+03	5.0000-01	2.5778-02	1.1781-03	2.4600-02	0.	1047	2151	200
3,4843+03	5.0000-01	1.4266-01	1.1806-01	2.4600-02	0.	1047	2151	201
3,4920+03	5.0000-01	3.5828-02	1.1228-02	2.4600-02	0.	1047	2151	202
3,5120+03	5.0000-01	2.7563-02	2.9631-03	2.4600-02	0.	1047	2151	203
3,5260+03	5.0000-01	3.5288-02	1.0688-02	2.4600-02	0.	1047	2151	204
3,5615+03	5.0000-01	1.6783-01	1.4323-01	2.4600-02	0.	1047	2151	205
3,5740+03	5.0000-01	2.6373-01	2.3913-01	2.4600-02	0.	1047	2151	206
3,5930+03	5.0000-01	4.0185-02	1.5585-02	2.4600-02	0.	1047	2151	207
3,6000+03	5.0000-01	2.7600-02	3.0000-03	2.4600-02	0.	1047	2151	208
3,6110+03	5.0000-01	2.7605-02	3.0046-03	2.4600-02	0.	1047	2151	209
3,6250+03	5.0000-01	2.7610-02	3.0104-03	2.4600-02	0.	1047	2151	210
3,6300+03	5.0000-01	2.4150-01	2.1690-01	2.4600-02	0.	1047	2151	211
3,6470+03	5.0000-01	2.7620-02	3.0195-03	2.4600-02	0.	1047	2151	212
3,6740+03	5.0000-01	2.7668-02	3.0676-03	2.4600-02	0.	1047	2151	213
3,6930+03	5.0000-01	2.6768-01	2.4308-01	2.4600-02	0.	1047	2151	214
3,7177+03	5.0000-01	8.5573-02	6.0973-02	2.4600-02	0.	1047	2151	215
3,7333+03	5.0000-01	1.7735-01	1.5275-01	2.4600-02	0.	1047	2151	216
3,7647+03	5.0000-01	5.8960-02	3.4360-02	2.4600-02	0.	1047	2151	217
3,7837+03	5.0000-01	3.0140-01	2.7680-01	2.4600-02	0.	1047	2151	218
3,7997+03	5.0000-01	2.7682-02	3.0821-03	2.4600-02	0.	1047	2151	219
3,8320+03	5.0000-01	3.0790-02	6.1903-03	2.4600-02	0.	1047	2151	220

3.8581+03	5.0000-01	3.6622-01	3.4162-01	2.4600-02	0.	1047	2151	221
3.8713+03	5.0000-01	2.7348-01	2.4888-01	2.4600-02	0.	1047	2151	222
3.8950+03	5.0000-01	2.9593-02	4.9928-03	2.4600-02	0.	1047	2151	223
3.9044+03	5.0000-01	2.4955-01	2.2495-01	2.4600-02	0.	1047	2151	224
3.92+3	5.0+4	2	1	0		01047	2151	225
0.0	0.9184	1	0	2		01047	2151	226
0.191-2	0.0	0	0	6		11047	2151	227
18.5	0.5	1.0	1.739-3	24.6-3		0.01047	2151	228
0.191-2	0.0	1	0	12		21047	2151	229
18.5	0.5	1.0	2.923-3	24.6-3		0.01047	2151	230
9.25	1.5	1.0	1.4615-3	24.6-3		0.01047	2151	231
0.0	0.0	0	0	0		01047	2 0	232
0.0	0.0	0	0	0		01047	0 0	233
92238.	236.0058	0	0	0		01047	3 1	234
0.0	0.0	0	0	3		961047	3 1	235
29	5	32	1	96		21047	3 1	236
1.0-3	13.68	3.0-3	7.90	3.2-3		8.901047	3 1	237
3.6-3	14.20	4.0-3	14.11	4.4-3		13.301047	3 1	238
4.8-3	12.30	5.2-3	11.38	5.6-3		11.211047	3 1	239
6.2-3	11.70	6.8-3	11.94	7.4-3		11.291047	3 1	240
8.0-3	10.75	8.6-3	10.30	9.0-3		10.101047	3 1	241
1.0-2	10.66	1.1-2	11.09	1.2-2		9.991047	3 1	242
1.3-2	9.89	1.5-2	10.88	1.7-2		11.401047	3 1	243
2.0-2	11.01	3.0-2	10.55	5.0-2		10.181047	3 1	244
1.0-1	9.87	3.0-1	9.54	1.0+0		9.431047	3 1	245
4.0+0	9.00	5.0+0	9.10	5.0+0		1.-501047	3 1	246
5.0+4	1.-50	5.0+4	12.90	5.5+4		12.801047	3 1	247
6.0+4	12.70	7.0+4	12.50	8.0+4		12.301047	3 1	248
.09+6	12.10	0.1+6	12.00	.15+6		11.201047	3 1	249
.20+6	10.70	.25+6	10.30	.30+6		9.861047	3 1	250
.35+6	9.49	.40+6	9.15	.45+6		8.841047	3 1	251
.50+6	8.56	.55+6	8.30	.60+6		8.071047	3 1	252
.65+6	7.86	.70+6	7.76	.75+6		7.511047	3 1	253
.80+6	7.37	.85+6	7.24	.90+6		7.141047	3 1	254
.95+6	7.05	1.0+6	6.98	1.1+6		6.891047	3 1	255
1.2+6	6.84	1.3+6	6.85	1.4+6		6.891047	3 1	256
1.5+6	6.96	1.6+6	7.05	1.7+6		7.151047	3 1	257
1.8+6	7.25	1.9+6	7.35	2.0+6		7.441047	3 1	258
2.25+6	7.55	2.5+6	7.62	2.75+6		7.721047	3 1	259
3.0+6	7.80	3.25+6	7.88	3.5+6		7.901047	3 1	260
3.75+6	7.87	4.0+6	7.84	4.5+6		7.801047	3 1	261
5.0+6	7.70	5.5+6	7.50	6.0+6		7.181047	3 1	262
6.5+6	7.00	7.0+6	6.80	7.5+6		6.581047	3 1	263
8.0+6	6.35	8.5+6	6.22	9.0+6		6.101047	3 1	264
9.5+6	6.05	10.0+6	6.00	10.5+6		5.931047	3 1	265
11.0+6	5.85	11.5+6	5.82	12.0+6		5.801047	3 1	266
12.5+6	5.75	13.0+6	5.70	13.5+6		5.421047	3 1	267
14.0+6	5.70	14.5+6	5.80	15.0+6		5.701047	3 1	268
0.0	0.0	0	0	0		01047	3 0	269
92238.	236.0058	0	0	0		01047	3 2	270
0.0	0.0	0	0	3		1071047	3 2	271
31	5	34	1	107		21047	3 2	272
1.0-3	1.-6	3.2-3	1.-6	3.2-3		1.251047	3 2	273
3.6-3	6.99	4.0-3	7.27	4.4-3		6.771047	3 2	274
4.8-3	6.05	5.2-3	5.38	5.6-3		5.431047	3 2	275

6,2-3	6,20	6,8-3	6,69	7,4-3	6.261047	3	2	276
8,0-3	5,91	8,6-3	5,63	9,0-3	5.531047	3	2	277
1,0-2	6,33	1,1-2	6,96	1,2-2	6.031047	3	2	278
1,3-2	6,09	1,5-2	7,34	1,7-2	8,071047	3	2	279
2,0-2	7,94	3,0-2	8,04	5,0-2	8,231047	3	2	280
1,0-1	8,48	3,0-1	8,71	1,0+0	8,911047	3	2	281
2,0+0	8,86	3,0+0	8,59	4,0+0	8,211047	3	2	282
5,0+0	7,46	5,0+0	0.0	3.92+3	0.01047	3	2	283
3.92+3	16.40	4,1+3	19.2	4.25+3	14.51047	3	2	284
4.37+3	13.90	5,0+3	14.0	1,0+4	14.21047	3	2	285
1,5+4	14.30	2,0+4	14,0	3,0+4	13,11047	3	2	286
4,0+4	12.80	5,0+4	12.5	6,0+4	12.251047	3	2	287
7,0+4	11,98	8,0+4	11,71	9,0+4	11,441047	3	2	288
1,0+5	11,26	1,5+5	10,13	2,0+5	9,461047	3	2	289
2,5+5	8,98	3,0+5	8,48	3,5+5	8,031047	3	2	290
4,0+5	7,56	4,5+5	7,06	5,0+5	6,651047	3	2	291
5,5+5	6,35	6,0+5	6,10	6,5+5	5,901047	3	2	292
7,0+5	5,78	7,5+5	5,42	8,0+5	5,141047	3	2	293
8,5+5	4,90	9,0+5	4,73	9,5+5	4,651047	3	2	294
1,0+6	4,55	1,10+6	4,22	1.20+6	4,021047	3	2	295
1.30+6	3,85	1,40+6	3,53	1,50+6	3,451047	3	2	296
1.60+6	3.32	1.70+6	3,42	1,80+6	3,651047	3	2	297
1.90+6	3.92	2.00+6	4,17	2.25+6	4.321047	3	2	298
2.50+6	4,42	2.75+6	4,53	3.00+6	4.611047	3	2	299
3.25+6	4,70	3,50+6	4,70	3.75+6	4,661047	3	2	300
4.00+6	4.65	4,50+6	4,64	5.00+6	4,581047	3	2	301
5.50+6	4,40	6.00+6	4,11	6.50+6	3.971047	3	2	302
7.00+6	3.76	7.50+6	3,58	8.00+6	3.391047	3	2	303
8.50+6	3.26	9,00+6	3,15	9,50+6	3.131047	3	2	304
1,00+7	3.12	1,05+7	3,06	1,10+7	3.001047	3	2	305
1.15+7	2.99	1.20+7	2.96	1.25+7	2.901047	3	2	306
1,30+7	2,85	1,35+7	2,75	1.40+7	2.861047	3	2	307
1.45+7	2.95	1.50+7	2,86		1047	3	2	308
0.0	0.0	0	0	0	01047	3	0	309
92238.0	236.0058	0	0	0	01047	3	4	310
0.0	0.0	0	0	2	1201047	3	4	311
2	1	120	2		1047	3	4	312
1,0-3	0.0	0.045+6	0.0	0,050+6	0,0501047	3	4	313
0,055+6	0,098	0.060+6	0.143	0.065+6	0,1931047	3	4	314
0,070+6	0.242	0.075+6	0.289	0.080+6	0.3371047	3	4	315
0,085+6	0.385	0,090+6	0.433	0,095+6	0.4801047	3	4	316
0,100+6	0,530	0.120+6	0.728	0.140+6	0,8501047	3	4	317
0,160+6	0,938	0.180+6	1.024	0,200+6	1,0851047	3	4	318
0.220+6	1.125	0.240+6	1.161	0.260+6	1.1891047	3	4	319
0,280+6	1,215	0,300+6	1,240	0,320+6	1,2651047	3	4	320
0,340+6	1.296	0.360+6	1,346	0.380+6	1.3831047	3	4	321
0,400+6	1.454	0.420+6	1.532	0.440+6	1,6111047	3	4	322
0,460+6	1,690	0.480+6	1.738	0,500+6	1,7721047	3	4	323
0,520+6	1.794	0,540+6	1.812	0.550+6	1,8181047	3	4	324
0,560+6	1.825	0,580+6	1.833	0.600+6	1,8311047	3	4	325
0,610+6	1,834	0,620+6	1,833	0.640+6	1,8241047	3	4	326
0,660+6	1,818	0,680+6	1.807	0,690+6	1,8201047	3	4	327
0,700+6	1,832	0.720+6	1.858	0.740+6	1.9081047	3	4	328
0,760+6	1,978	0.780+6	2,032	0,800+6	2,0801047	3	4	329
0,820+6	2.126	0,840+6	2.165	0.860+6	2.2091047	3	4	330
0,880+6	2,242	0.900+6	2.252	0,920+6	2.2481047	3	4	331

0.940+6	2.234	0.960+6	2.231	0.980+6	2.2381047	3	4	332
1.00+6	2.259	1.05+6	2.301	1.10+6	2.4921047	3	4	333
1.15+6	2.644	1.20+6	2.642	1.25+6	2.6731047	3	4	334
1.30+6	2.818	1.35+6	3.011	1.40+6	3.0911047	3	4	335
1.45+6	3.111	1.50+6	3.117	1.55+6	3.1801047	3	4	336
1.60+6	3.263	1.65+6	3.274	1.70+6	3.2201047	3	4	337
1.75+6	3.140	1.80+6	3.043	1.85+6	2.9451047	3	4	338
1.90+6	2.850	1.95+6	2.733	2.00+6	2.6671047	3	4	339
2.25+6	2.60	2.50+6	2.60	2.75+6	2.611047	3	4	340
3.00+6	2.62	3.25+6	2.62	3.50+6	2.621047	3	4	341
3.75+6	2.62	4.00+6	2.61	4.25+6	2.601047	3	4	342
4.50+6	2.58	4.75+6	2.56	5.00+6	2.541047	3	4	343
5.25+6	2.53	5.50+6	2.51	5.75+6	2.471047	3	4	344
6.00+6	2.44	6.25+6	2.32	6.50+6	2.111047	3	4	345
6.75+6	1.87	7.00+6	1.60	7.25+6	1.321047	3	4	346
7.50+6	1.05	7.75+6	0.90	8.00+6	0.831047	3	4	347
8.25+6	0.73	8.50+6	0.66	8.75+6	0.621047	3	4	348
9.00+6	0.58	9.25+6	0.56	9.50+6	0.551047	3	4	349
10.00+6	0.52	11.50+6	0.52	11.75+6	0.401047	3	4	350
12.00+6	0.28	12.25+6	0.20	12.50+6	0.151047	3	4	351
14.50+6	0.15	14.75+6	0.14	15.00+6	0.121047	3	4	352
0.0	0.0	0	0	0	01047	3	0	353
92238.0	236.0058	0	0	0	01047	3	16	354
0.0	6.04+6	0	0	2	361047	3	16	355
2	1	36	2		1047	3	16	356
1.0-3	0.0	6.07+6	0.0	6.25+6	0.031047	3	16	357

6.50+6	0.10	6.75+6	0,22	7,00+6	0.461047	3 16	358
7.25+6	0.75	7.50+6	0,93	7,75+6	1.051047	3 16	359
8.00+6	1.13	8.25+6	1,20	8.50+6	1.251047	3 16	360
8,75+6	1,28	9.00+6	1,31	9,25+6	1,331047	3 16	361
9.50+6	1,34	10.00+6	1,35	10.50+6	1.341047	3 16	362
10.75+6	1.33	11.00+6	1,32	11.25+6	1.311047	3 16	363
11,50+6	1.30	11.75+6	1,29	12.00+6	1.271047	3 16	364
12.25+6	1.24	12.50+6	1,21	12,75+6	1.181047	3 16	365
13.00+6	1.13	13.25+6	1,07	13.50+6	1.011047	3 16	366
13.75+6	0.93	14.00+6	0,85	14.25+6	0.771047	3 16	367
14.50+6	0.71	14.75+6	0.65	15.00+6	0.581047	3 16	368
0.0	0.0	0	0	0	01047	3 0	369
92238.0	236.0058	0	0	0	01047	3 17	370
0,0	11.46+6	0	0	2	161047	3 17	371
2	1	16	2		1047	3 17	372
1,0-3	0.0	11.51+6	0,0	11,75+6	0,141047	3 17	373
12.00+6	0.28	12.25+6	0,39	12.50+6	0.471047	3 17	374
12.75+6	0.51	13.00+6	0,55	13.25+6	0.571047	3 17	375
13,50+06	0.60	13.75+6	0,65	14.00+6	0.691047	3 17	376
14.25+6	0,73	14.50+6	0,76	14,75+6	0,801047	3 1	377
15.00+6	0.84				1047	3 17	378
0.0	0.0	0	0	0	01047	3 0	379
92238.0	236.0058	0	0	0	01047	3 18	380
0,0		0	0	3	711047	3 18	381
2	1	40	4	71	21047	3 18	382
1,0-3	1,-50	0,45+6	1,-50	0,50+6	0,000251047	3 18	383
0.58+6	0,001	0.60+6	0,0011	0.65+6	0,00121047	3 18	384
0.72+6	0.00125	0.75+6	0,0020	0.80+6	0.00381047	3 18	385
0,85+6	0,0064	0.90+6	0.011	0,92+6	0.0141047	3 18	386
0.95+6	0.016	1.00+6	0,0169	1.05+6	0.0181047	3 18	387
1.10+6	0.024	1.15+6	0.034	1.20+6	0.0401047	3 18	388
1,25+6	0,042	1.30+6	0.056	1.35+6	0.0921047	3 18	389
1.40+6	0,150	1,45+6	0.225	1,50+6	0.2951047	3 18	390
1.55+6	0.343	1.60+6	0.381	1,65+6	0.4191047	3 18	391
1.70+6	0.443	1.75+6	0.468	1.80+6	0.4831047	3 18	392
1.85+6	0.505	1.90+6	0.521	1,95+6	0.5391047	3 18	393
2.00+6	0.550	2.25+6	0.590	2,50+6	0.5651047	3 18	394
2,75+6	0,543	3.00+6	0.540	3,25+6	0,5401047	3 18	395
3,50+6	0,560	3,75+6	0.568	4,00+6	0,5661047	3 18	396
4.25+6	0,563	4,50+6	0.563	4,75+6	0,5651047	3 18	397
5.00+6	0.569	5.25+6	0.571	5.50+6	0.5751047	3 18	398
5,75+6	0.585	6.00+6	0.620	6,25+6	0.7001047	3 18	399
6.50+6	0.822	6.75+6	0.911	7,00+6	0.9681047	3 18	400
7.25+6	1.001	7.50+6	1.010	7.75+6	1.0021047	3 18	401
8.00+6	0.991	8.25+6	1.009	8.50+6	1.0401047	3 18	402
8.75+6	1.054	9.00+6	1.050	9.25+6	1.0351047	3 18	403
9.50+6	1.021	9.75+6	1.011	1.00+7	1.0041047	3 18	404
1,15+7	1.005	1,20+7	1.010	1,30+7	1,0201047	3 18	405
1.40+7	1.150	1.50+7	1.300		1047	3 18	406
0.0	0.0	0	0	0	01047	3 0	407
92238.0	236.0058	0	0	0	01047	3102	408
0,0	0.0	0	0	1	791047	3102	409
79	5				1047	3102	410
1,0-3	13,68	0.10	1,39	0.20	1,001047	3102	411

0.30	0.829	0.40	0.731	0.50	0.6651047	3102	412
0.60	0.619	0.70	0.584	0.80	0.5571047	3102	413
0.90	0.536	1.00	0.519	1.50	0.4751047	3102	414
1.80	0.469	2.00	0.471	2.50	0.4941047	3102	415
3.00	0.546	3.50	0.637	4.00	0.7931047	3102	416
4.50	1.07	4.70	1.25	5.00	1.641047	3102	417
5,0+0	1.0-50	7.48+2	1,0-50	7,48+2	0.1921047	3102	418
8.50+2	0.204	9.00+2	0.207	9.61+2	0.2131047	3102	419
1.10+3	0.226	1.23+3	0.239	1.35+3	0.2501047	3102	420
1.59+3	0.268	1.80+3	0.283	2.04+3	0.3001047	3102	421
2.30+3	0.312	2.61+3	0.328	3.00+3	0.3441047	3102	422
3.36+3	0.358	3.60+3	0.370	3.92+3	0.3821047	3102	423
3.92+3	1.-50	5.00+4	1.-50	5.00+4	.3451047	3102	424
6,0+4	0.305	7,0+4	0.274	8,0+4	0.2481047	3102	425
.09+6	.228	.10+6	.211	.14+6	.1821047	3102	426
.20+6	.159	.30+6	.140	.34+6	.1371047	3102	427
.38+6	.134	.40+6	.133	.44+6	.1321047	3102	428
.50+6	.133	.60+6	.138	.70+6	.1421047	3102	429
.80+6	.149	.84+6	.150	.90+6	.1511047	3102	430
.94+6	.151	1.0+6	.150	1.1+6	.1491047	3102	431
1.2+6	.142	1.3+6	.130	1.4+6	.1141047	3102	432
1.5+6	.096	1.6+6	.082	1.8+6	.0641047	3102	433
2.0+6	.0525	3.0+6	.0268	4.0+6	.01581047	3102	434
5.0+6	.0109	6.0+6	.0085	7.0+6	.00721047	3102	435
9.0+6	.0053	10.+6	.0047	12.+6	.00391047	3102	436
15.+6	.0032				1047	3102	437
0.0	0.0	0	0	0	01047	3 0	438
92238.0	236.0058	0	0	0	01047	3251	439
0.0	0.0	0	0	1	201047	3251	440
20	3				1047	3251	441
1.0-3	2.825-3	1.0+4	2.825-3	1.5+4	6.825-31047	3251	442
2.0+4	1.183-2	3.0+4	2.083-2	5.0+4	3.682-21047	3251	443
7.0+4	5.480-2	1.0+5	8.578-2	1.5+5	1.348-11047	3251	444
2.0+5	1.737-1	3.0+5	2.336-1	5.0+5	3.205-11047	3251	445
7.2+5	3.883-1	1.1+6	4.789-1	1.7+6	5.767-11047	3251	446
2.5+6	6.624-1	4.1+6	7.521-1	7.0+6	8.219-11047	3251	447
1.0+7	8.587-1	1.5+7	9.016-1		1047	3251	448
0.0	0.0	0	0	0	01047	3 0	449
92238.0	236.0058	0	0	0	01047	3252	450
0.0	0.0	0	0	1	201047	3252	451
20	3				1047	3252	452
1.0-3	8.450-3	1.0+4	8.450-3	1.5+4	8.417-31047	3252	453
2.0+4	8.374-3	3.0+4	8.298-3	5.0+4	8.162-31047	3252	454
7.0+4	8.010-3	1.0+5	7.748-3	1.5+5	7.333-31047	3252	455
2.0+5	7.002-3	3.0+5	6.494-3	5.0+5	5.759-31047	3252	456
7.2+5	5.184-3	1.1+6	4.416-3	1.7+6	3.588-31047	3252	457
2.5+6	2.861-3	4.1+6	2.101-3	7.0+6	1.509-31047	3252	458
1.0+7	1.197-3	1.5+7	8.342-4		1047	3252	459
0.0	0.0	0	0	0	01047	3 0	460
92238.0	236.0058	0	0	0	01047	3253	461

0.0	0.0	0	0	1	201047	3253		462
20	3				1047	3253		463
1.0-3	5.642-3	1.0+4	5.642-3	1.5+4	5.630-31047	3253		464
2.0+4	5.616-3	3.0+4	5.590-3	5.0+4	5.551-31047	3253		465
7.0+4	5.514-3	1.0+5	5.438-3	1.5+5	5.300-31047	3253		466
2.0+5	5.195-3	3.0+5	5.032-3	5.0+5	4.876-31047	3253		467
7.2+5	4.783-3	1.1+6	4.764-3	1.7+6	4.554-31047	3253		468
2.5+6	4.279-3	4.1+6	3.932-3	7.0+6	3.562-31047	3253		469
1.0+7	3.319-3	1.5+7	2.766-3		1047	3253		470
0.0	0.0	0	0	0	01047	3	0	471
0.0	0.0	0	0	0	01047	0	0	472
92238.0	236.0058	1	1	0	01047	4	2	473
0.0	236.0058	0	2	361	181047	4	2	474
1.0000+0	2.8250-3	3.5910-6	.0	.0	.01047	4	2	475
.0	.0	.0	.0	.0	.01047	4	2	476
.0	.0	.0	.0	.0	.01047	4	2	477
.0	.0	9.9999-1	5.0850-3	1.2310-5	.01047	4	2	478
.0	.0	.0	.0	.0	.01047	4	2	479
.0	.0	.0	.0	.0	.01047	4	2	480
.0	.0	.0	-2.8250-3	9.9997-1	7.2640-31047	4	2	481
2.5650-5	.0	.0	.0	.0	.01047	4	2	482
.0	.0	.0	.0	.0	.01047	4	2	483
.0	.0	.0	.0	1.0770-5	-5.0850-31047	4	2	484
9.9994-1	9.4160-3	4.3530-5	.0	.0	.01047	4	2	485
.0	.0	.0	.0	.0	.01047	4	2	486
.0	.0	.0	.0	.0	.01047	4	2	487
2.4620-5	-7.2640-3	9.9991-1	1.1560-2	6.5920-5	.01047	4	2	488
.0	.0	.0	.0	.0	.01047	4	2	489
.0	.0	.0	.0	.0	.01047	4	2	490
.0	.0	4.2750-5	-9.4160-3	9.9986-1	1.3690-21047	4	2	491
9.2810-5	.0	.0	.0	.0	.01047	4	2	492
.0	.0	.0	.0	.0	.01047	4	2	493
.0	.0	.0	.0	6.5290-5	-1.1560-21047	4	2	494
9.9981-1	1.5820-2	1.2420-4	.0	.0	.01047	4	2	495
.0	.0	.0	.0	.0	.01047	4	2	496
.0	.0	.0	.0	.0	.01047	4	2	497
9.2280-5	-1.3690-2	9.9975-1	1.7950-2	1.6010-4	.01047	4	2	498
.0	.0	.0	.0	.0	.01047	4	2	499
.0	.0	.0	.0	.0	.01047	4	2	500
.0	.0	1.2370-4	-1.5820-2	9.9968-1	2.0070-21047	4	2	501
2.0050-4	.0	.0	.0	.0	.01047	4	2	502
.0	.0	.0	.0	.0	.01047	4	2	503
.0	.0	.0	.0	1.5970-4	-1.7950-21047	4	2	504
9.9959-1	2.2200-2	2.4530-4	.0	.0	.01047	4	2	505
.0	.0	.0	.0	.0	.01047	4	2	506
.0	.0	.0	.0	.0	.01047	4	2	507
2.001- 4	-2.0070-2	9.9951-1	2.4320-2	2.9470-4	.01047	4	2	508
.0	.0	.0	.0	.0	.01047	4	2	509
.0	.0	.0	.0	.0	.01047	4	2	510
.0	.0	2.4500-4	-2.2200-2	9.9941-1	2.6440-21047	4	2	511
3.4860-4	.0	.0	.0	.0	.01047	4	2	512
.0	.0	.0	.0	.0	.01047	4	2	513
.0	.0	.0	.0	2.9440-4	-2.4320-21047	4	2	514
9.9930-1	2.8560-2	4.0690-4	.0	.0	.01047	4	2	515

.0	.0	.0	.0	.0	.01047	4	2	516
.0	.0	.0	.0	.0	.01047	4	2	517
3.4830-4	-2.6440-2	9.9918-1	3.0680-2	4.6970-4	.01047	4	2	518
.0	.0	.0	.0	.0	.01047	4	2	519
.0	.0	.0	.0	.0	.01047	4	2	520
.0	.0	4.0660-4	-2.8560-2	9.9906-1	3.2800-21047	4	2	521
5.3700-4	.0	.0	.0	.0	.01047	4	2	522
.0	.0	.0	.0	.0	.01047	4	2	523
.0	.0	.0	.0	4.6950-4	-3.0680-21047	4	2	524
9.9892-1	3.4930-2	6.0890-4	.0	.0	.01047	4	2	525
.0	.0	.0	.0	.0	.01047	4	2	526
.0	.0	.0	.0	.0	.01047	4	2	527
5.3680-4	-3.2800-2	9.9878-1	3.7050-2	6.8520-4	.01047	4	2	528
.0	.0	.0	.0	.0	.01047	4	2	529
.0	.0	.0	.0	.0	.01047	4	2	530
.0	.0	6.0860-4	-3.4930-2	9.9863-1	3.9170-21047	4	2	531
.0	.0	.0	.0	.0	.01047	4	2	532
.0	.0	.0	.0	.0	.01047	4	2	533
.0	.0	.0	.0	6.8500-4	-3.7050-21047	4	2	534
9.9846-1					1047	4	2	535
0.0	0.0	0	0	2	201047	4	2	536
2	2	20	3		1047	4	2	537
0.0	0.0	0	0	1	01047	4	2	538
0.0					1047	4	2	539
0.0	1.0+4	0	0	1	01047	4	2	540
0.0					1047	4	2	541
0.0	1.5+4	0	0	1	01047	4	2	542
0.004					1047	4	2	543
0.0	2.0+4	0	0	1	01047	4	2	544
0.009					1047	4	2	545
0.0	3.0+4	0	0	1	01047	4	2	546
0.018					1047	4	2	547
0.0	5.0+4	0	0	2	01047	4	2	548
0.034	0.003				1047	4	2	549
0.0	7.0+4	0	0	2	01047	4	2	550
0.052	0.009				1047	4	2	551
0.0	1.0+5	0	0	2	01047	4	2	552
0.083	0.017				1047	4	2	553
0.0	1.5+5	0	0	2	01047	4	2	554
0.132	0.027				1047	4	2	555
0.0	2.0+5	0	0	3	01047	4	2	556
0.171	0.040	0.002			1047	4	2	557
0.0	3.0+5	0	0	3	01047	4	2	558
0.231	0.065	0.011			1047	4	2	559
0.0	5.00+5	0	0	11	01047	4	2	560
3.18-1	1.33-1	4.18-2	1.28-2	4.17-3	2.80-31047	4	2	561
2.63-3	1.87-3	4.60-4	-6.49-4	-5.27-4	1047	4	2	562
0.0	7.20+5	0	0	11	01047	4	2	563
3.86-1	1.99-1	7.74-2	2.27-2	6.14-3	4.66-31047	4	2	564
6.02-3	4.44-3	1.65-3	6.24-4	1.28-4	1047	4	2	565
0.0	1.10+6	0	0	13	01047	4	2	566
4.47-1	3.14-1	1.85-1	7.31-2	2.35-2	1.05-21047	4	2	567
3.59-3	-2.38-3	-3.99-3	-1.83-3	5.81-4	8.77-41047	4	2	568
4.85-4					1047	4	2	569
0.0	1.70+6	0	0	13	01047	4	2	570

5.75-1	4.11-1	2.74-1	1.72-1	8.29-2	2.78-21047	4	2	571
3.27-3	-4.13-3	-4.47-3	-3.79-3	-3.08-3	-1.66-31047	4	2	572
1.66-4					1047	4	2	573
0.0	2.50+6	0	0	13	01047	4	2	574
6.61-1	4.97-1	3.52-1	2.60-1	1.36-1	4.32-21047	4	2	575
2.98-3	-5.68-3	-4.90-3	-5.52-3	-6.32-3	-3.91-31047	4	2	576
-1.17-4					1047	4	2	577
0.0	4.10+6	0	0	15	01047	4	2	578
7.51-1	6.00-1	4.69-1	3.72-1	2.41-1	1.29-11047	4	2	579
6.51-2	3.10-2	1.27-2	4.43-3	1.11-3	6.03-41047	4	2	580
1.11-3	3.16-4	-1.03-3			1047	4	2	581
0.0	7.00+6	0	0	18	01047	4	2	582
8.21-1	6.89-1	5.74-1	4.61-1	3.49-1	2.42-11047	4	2	583
1.53-1	8.91-2	4.37-2	9.27-3	-1.38-2	-2.31-21047	4	2	584
-2.21-2	-1.80-2	-1.47-2	-1.13-2	-6.67-3	-2.06-31047	4	2	585
0.0	1.00+7	0	0	18	01047	4	2	586
8.58-1	7.41-1	6.27-1	5.12-1	4.00-1	2.95-11047	4	2	587
2.05-1	1.34-1	7.66-2	2.99-2	-5.31-3	-2.63-21047	4	2	588
-3.43-2	-3.36-2	-2.84-2	-2.02-2	-1.05-2	-1.67-31047	4	2	589
0.0	1.50+7	0	0	18	01047	4	2	590
9.01-1	8.00-1	6.87-1	5.69-1	4.57-1	3.56-11047	4	2	591
2.65-1	1.85-1	1.14-1	5.34-2	4.34-3	-2.99-21047	4	2	592
-4.80-2	-5.14-2	-4.39-2	-3.02-2	-1.48-2	-1.22-31047	4	2	593
0.	0.	0	0	0	01047	4	0	594
0.0	0.0	0	0	0	01047	0	0	595
92238.0	236.0058	0	0	25	01047	5	4	596
0.0	0.0447+6	0	3	2	591047	5	4	597
2	1	59	2		1047	5	4	598
0.0447+6	1.000	0.14+6	1.000	0.16+6	0.9861047	5	4	599
0.18+6	0.964	0.20+6	0.947	0.22+6	0.9311047	5	4	600
0.24+6	0.916	0.26+6	0.906	0.28+6	0.8951047	5	4	601
0.30+6	0.885	0.32+6	0.874	0.34+6	0.8601047	5	4	602
0.36+6	0.850	0.38+6	0.841	0.40+6	0.8361047	5	4	603
0.42+6	0.831	0.44+6	0.828	0.46+6	0.8251047	5	4	604
0.48+6	0.820	0.50+6	0.813	0.52+6	0.8051047	5	4	605
0.54+6	0.799	0.55+6	0.795	0.56+6	0.7921047	5	4	606
0.58+6	0.782	0.60+6	0.772	0.61+6	0.7671047	5	4	607
0.62+6	0.762	0.64+6	0.751	0.66+6	0.7411047	5	4	608
0.68+6	0.729	0.69+6	0.717	0.70+6	0.7051047	5	4	609
0.72+6	0.681	0.74+6	0.652	0.76+6	0.6161047	5	4	610
0.78+6	0.589	0.80+6	0.565	0.82+6	0.5421047	5	4	611
0.84+6	0.521	0.86+6	0.503	0.88+6	0.4841047	5	4	612
0.90+6	0.472	0.92+6	0.461	0.94+6	0.4531047	5	4	613
0.96+6	0.439	0.98+6	0.423	1.00+6	0.4041047	5	4	614
1.05+6	0.359	1.10+6	0.297	1.15+6	0.2471047	5	4	615
1.20+6	0.214	1.25+6	0.178	1.30+6	0.1371047	5	4	616
1.35+6	0.099	1.40+6	0.069	1.45+6	0.0411047	5	4	617
1.50+6	0.014	1.55+6	0.0		1047	5	4	618
0.0	0.148+6	0	3	1	641047	5	4	619
64	2				1047	5	4	620
0.148+6	0.0	0.16+6	0.014	0.18+6	0.0361047	5	4	621
0.20+6	0.053	0.22+6	0.069	0.24+6	0.0841047	5	4	622
0.26+6	0.094	0.28+6	0.105	0.30+6	0.1151047	5	4	623
0.32+6	0.124	0.34+6	0.132	0.36+6	0.1371047	5	4	624
0.38+6	0.142	0.40+6	0.143	0.42+6	0.1441047	5	4	625
0.44+6	0.144	0.46+6	0.144	0.48+6	0.1461047	5	4	626

0.50+6	0.150	0.52+6	0.154	0.54+6	0.1571047	5	4	627
0.55+6	0.159	0.56+6	0.161	0.58+6	0.1671047	5	4	628
0.60+6	0.173	0.61+6	0.177	0.62+6	0.1801047	5	4	629
0.64+6	0.186	0.66+6	0.193	0.68+6	0.2011047	5	4	630
0.69+6	0.202	0.70+6	0.204	0.72+6	0.2071047	5	4	631
0.74+6	0.209	0.76+6	0.209	0.78+6	0.2111047	5	4	632
0.80+6	0.213	0.82+6	0.216	0.84+6	0.2211047	5	4	633
0.86+6	0.225	0.88+6	0.232	0.90+6	0.2341047	5	4	634
0.92+6	0.236	0.94+6	0.235	0.96+6	0.2321047	5	4	635
0.98+6	0.223	1.00+6	0.210	1.05+6	0.1851047	5	4	636
1.10+6	0.161	1.15+6	0.144	1.20+6	0.1391047	5	4	637
1.25+6	0.131	1.30+6	0.118	1.35+6	0.1021047	5	4	638
1.40+6	0.091	1.45+6	0.083	1.50+6	0.0731047	5	4	639
1.55+6	0.063	1.60+6	0.051	1.65+6	0.0411047	5	4	640
1.70+6	0.031	1.75+6	0.020	1.80+6	0.0071047	5	4	641
1.85+6	0+0				1047	5	4	642
0.0	0.310+6	0	3	1	601047	5	4	643
60	2				1047	5	4	644
0.310+6	0.0	0.32+6	0.002	0.34+6	0.0081047	5	4	645
0.36+6	0.013	0.38+6	0.017	0.40+6	0.0211047	5	4	646
0.42+6	0.025	0.44+6	0.028	0.46+6	0.0311047	5	4	647
0.48+6	0.034	0.50+6	0.037	0.52+6	0.0411047	5	4	648
0.54+6	0.044	0.55+6	0.046	0.56+6	0.0471047	5	4	649
0.58+6	0.051	0.60+6	0.055	0.61+6	0.0561047	5	4	650
0.62+6	0.058	0.64+6	0.063	0.66+6	0.0661047	5	4	651
0.68+6	0.070	0.69+6	0.072	0.70+6	0.0731047	5	4	652
0.72+6	0.076	0.74+6	0.076	0.76+6	0.0751047	5	4	653
0.78+6	0.073	0.80+6	0.072	0.82+6	0.0711047	5	4	654
0.84+6	0.069	0.86+6	0.067	0.88+6	0.0651047	5	4	655
0.90+6	0.064	0.92+6	0.064	0.94+6	0.0641047	5	4	656
0.96+6	0.063	0.98+6	0.062	1.00+6	0.0601047	5	4	657
1.05+6	0.056	1.10+6	0.050	1.15+6	0.0441047	5	4	658
1.20+6	0.042	1.25+6	0.039	1.30+6	0.0351047	5	4	659
1.35+6	0.031	1.40+6	0.028	1.45+6	0.0261047	5	4	660
1.50+6	0.024	1.55+6	0.021	1.60+6	0.0191047	5	4	661
1.65+6	0.017	1.70+6	0.015	1.75+6	0.0141047	5	4	662
1.80+6	0.012	1.85+6	0.011	1.90+6	0.0091047	5	4	663
1.95+6	0.007	2.00+6	0.005	2.00001+6	0.01047	5	4	664
0.0	0.680+6	0	3	1	371047	5	4	665
37	2				1047	5	4	666
0.680+6	0.0	0.69+6	0.009	0.70+6	0.0181047	5	4	667
0.72+6	0.036	0.74+6	0.051	0.76+6	0.0661047	5	4	668
0.78+6	0.080	0.80+6	0.093	0.82+6	0.1051047	5	4	669
0.84+6	0.117	0.86+6	0.128	0.88+6	0.1361047	5	4	670
0.90+6	0.142	0.92+6	0.146	0.94+6	0.1491047	5	4	671
0.96+6	0.150	0.98+6	0.151	1.00+6	0.1501047	5	4	672
1.05+6	0.146	1.10+6	0.132	1.15+6	0.1171047	5	4	673
1.20+6	0.099	1.25+6	0.091	1.30+6	0.0831047	5	4	674
1.35+6	0.078	1.40+6	0.076	1.45+6	0.0721047	5	4	675
1.50+6	0.067	1.55+6	0.061	1.60+6	0.0511047	5	4	676
1.65+6	0.043	1.70+6	0.037	1.75+6	0.0301047	5	4	677
1.80+6	0.023	1.85+6	0.015	1.90+6	0.0071047	5	4	678
1.95+6	0.0				1047	5	4	679
0.0	0.732+6	0	3	1	361047	5	4	680
36	2				1047	5	4	681

0.732+6	0.0	0.74+6	0.012	0.76+6	0.0341047	5	4	682
0.78+6	0.047	0.80+6	0.057	0.82+6	0.0661047	5	4	683
0.84+6	0.072	0.86+6	0.076	0.88+6	0.0801047	5	4	684
0.90+6	0.084	0.92+6	0.088	0.94+6	0.0931047	5	4	685
0.96+6	0.096	0.98+6	0.099	1.00+6	0.1011047	5	4	686
1.05+6	0.106	1.10+6	0.102	1.15+6	0.1001047	5	4	687
1.20+6	0.100	1.25+6	0.095	1.30+6	0.0871047	5	4	688
1.35+6	0.078	1.40+6	0.073	1.45+6	0.0691047	5	4	689
1.50+6	0.065	1.55+6	0.059	1.60+6	0.0531047	5	4	690
1.65+6	0.050	1.70+6	0.046	1.75+6	0.0421047	5	4	691
1.80+6	0.038	1.85+6	0.034	1.90+6	0.0301047	5	4	692
1.95+6	0.024	2.00+6	0.018	2.00001+6	0.01047	5	4	693
0.0	0.838+6	0	3	1	301047	5	4	694
30	2				1047	5	4	695
0.838+6	0.0	0.86+6	0.001	0.88+6	0.0031047	5	4	696
0.90+6	0.004	0.92+6	0.005	0.94+6	0.0061047	5	4	697
0.96+6	0.008	0.98+6	0.009	1.00+6	0.0111047	5	4	698
1.05+6	0.015	1.10+6	0.020	1.15+6	0.0271047	5	4	699
1.20+6	0.031	1.25+6	0.033	1.30+6	0.0321047	5	4	700
1.35+6	0.030	1.40+6	0.029	1.45+6	0.0291047	5	4	701
1.50+6	0.029	1.55+6	0.029	1.60+6	0.0281047	5	4	702
1.65+6	0.027	1.70+6	0.027	1.75+6	0.0271047	5	4	703
1.80+6	0.027	1.85+6	0.028	1.90+6	0.0281047	5	4	704
1.95+6	0.028	2.00+6	0.028	2.00001+6	0.01047	5	4	705
0.0	0.939+6	0	3	1	241047	5	4	706
24	2				1047	5	4	707
0.939+6	0.0	0.96+6	0.012	0.98+6	0.0251047	5	4	708
1.00+6	0.039	1.05+6	0.071	1.10+6	0.0951047	5	4	709
1.15+6	0.102	1.20+6	0.092	1.25+6	0.0811047	5	4	710
1.30+6	0.085	1.35+6	0.094	1.40+6	0.0911047	5	4	711
1.45+6	0.083	1.50+6	0.075	1.55+6	0.0671047	5	4	712
1.60+6	0.058	1.65+6	0.050	1.70+6	0.0441047	5	4	713
1.75+6	0.037	1.80+6	0.031	1.85+6	0.0241047	5	4	714
1.90+6	0.016	1.95+6	0.008	2.00+6	0.01047	5	4	715
0.0	0.968+6	0	3	1	241047	5	4	716
24	2				1047	5	4	717
0.968+6	0.0	0.98+6	0.008	1.00+6	0.0251047	5	4	718
1.05+6	0.052	1.10+6	0.065	1.15+6	0.0751047	5	4	719
1.20+6	0.086	1.25+6	0.094	1.30+6	0.0951047	5	4	720
1.35+6	0.092	1.40+6	0.092	1.45+6	0.0911047	5	4	721
1.50+6	0.090	1.55+6	0.086	1.60+6	0.0811047	5	4	722
1.65+6	0.077	1.70+6	0.074	1.75+6	0.0721047	5	4	723
1.80+6	0.069	1.85+6	0.066	1.90+6	0.0621047	5	4	724
1.95+6	0.058	2.00+6	0.052	2.00001+6	0.01047	5	4	725
0.0	1.006+6	0	3	1	221047	5	4	726
22	2				1047	5	4	727
1.006+6	0.0	1.05+6	0.010	1.10+6	0.0311047	5	4	728
1.15+6	0.054	1.20+6	0.064	1.25+6	0.0681047	5	4	729
1.30+6	0.068	1.35+6	0.067	1.40+6	0.0671047	5	4	730
1.45+6	0.067	1.50+6	0.068	1.55+6	0.0671047	5	4	731
1.60+6	0.065	1.65+6	0.065	1.70+6	0.0651047	5	4	732
1.75+6	0.065	1.80+6	0.065	1.85+6	0.0651047	5	4	733
1.90+6	0.065	1.95+6	0.064	2.00+6	0.0611047	5	4	734
2.00001+6	0.0				1047	5	4	735
0.0	1.047+6	0	3	1	211047	5	4	736

21	2				1047	5	4	737
1,047+6	0.0	1.10+6	0.032	1.15+6	0.0481047	5	4	738
1.20+6	0.061	1.25+6	0.070	1.30+6	0.0731047	5	4	739
1.35+6	0.071	1.40+6	0.071	1.45+6	0.0731047	5	4	740
1.50+6	0.074	1.55+6	0.074	1.60+6	0.0721047	5	4	741
1.65+6	0.072	1.70+6	0.071	1.75+6	0.0701047	5	4	742
1.80+6	0.069	1.85+6	0.067	1.90+6	0.0661047	5	4	743
1.95+6	0.064	2.00+6	0.061	2.00001+6	0.01047	5	4	744
0.0	1,076+6	0	3	1	211047	5	4	745
21	2				1047	5	4	746
1,076+6	0.0	1.10+6	0.015	1.15+6	0.0401047	5	4	747
1.20+6	0.057	1.25+6	0.074	1.30+6	0.0881047	5	4	748
1.35+6	0.101	1.40+6	0.108	1.45+6	0.1091047	5	4	749
1.50+6	0.108	1.55+6	0.103	1.60+6	0.0971047	5	4	750
1.65+6	0.091	1.70+6	0.087	1.75+6	0.0831047	5	4	751
1.80+6	0.079	1.85+6	0.073	1.90+6	0.0671047	5	4	752
1.95+6	0.062	2.00+6	0.054	2.00001+6	0.01047	5	4	753
0.0	1.123+6	0	3	1	201047	5	4	754
20	2				1047	5	4	755
1,123+6	0.0	1.15+6	0.002	1.20+6	0.0071047	5	4	756
1.25+6	0.018	1.30+6	0.033	1.35+6	0.0451047	5	4	757
1.40+6	0.053	1.45+6	0.058	1.50+6	0.0611047	5	4	758
1.55+6	0.062	1.60+6	0.062	1.65+6	0.0621047	5	4	759
1.70+6	0.061	1.75+6	0.061	1.80+6	0.0601047	5	4	760
1.85+6	0.059	1.90+6	0.056	1.95+6	0.0531047	5	4	761
2.00+6	0.047	2.00001+6	0.0		1047	5	4	762
0.0	1.150+6	0	3	1	201047	5	4	763
20	2				1047	5	4	764
1,150+6	0.0	1.15+6	0.002	1.20+6	0.0071047	5	4	765
1.25+6	0.017	1.30+6	0.030	1.35+6	0.0451047	5	4	766
1.40+6	0.054	1.45+6	0.058	1.50+6	0.0591047	5	4	767
1.55+6	0.058	1.60+6	0.056	1.65+6	0.0541047	5	4	768
1.70+6	0.053	1.75+6	0.052	1.80+6	0.0521047	5	4	769
1.85+6	0.051	1.90+6	0.050	1.95+6	0.0501047	5	4	770
2.00+6	0.049	2.00001+6	0.0		1047	5	4	771
0.0	1.19+6	0	3	1	141047	5	4	772
14	2				1047	5	4	773
1.19+6	0.000	1.20+6	0.001	1.25+6	0.0081047	5	4	774
1.30+6	0.017	1.35+6	0.027	1.40+6	0.0351047	5	4	775
1.45+6	0.040	1.50+6	0.042	1.80+6	0.0421047	5	4	776
1.85+6	0.041	1.90+6	0.041	1.95+6	0.0401047	5	4	777
2.00+6	0.039	2.00001+6	0.000		1047	5	4	778
0.0	1.21+6	0	3	1	161047	5	4	779
16	2				1047	5	4	780
1.21+6	0.000	1.25+6	0.003	1.30+6	0.0081047	5	4	781
1.35+6	0.013	1.40+6	0.018	1.45+6	0.0241047	5	4	782
1.50+6	0.029	1.55+6	0.031	1.60+6	0.0321047	5	4	783
1.75+6	0.032	1.80+6	0.031	1.85+6	0.0301047	5	4	784
1.90+6	0.028	1.95+6	0.027	2.00+6	0.0251047	5	4	785
2.00001+6	0.000				1047	5	4	786
0.0	1,246+6	0	3	1	171047	5	4	787
17	2				1047	5	4	788
1,246+6	0.000	1.30+6	0.007	1.35+6	0.0141047	5	4	789
1.40+6	0.019	1.45+6	0.025	1.50+6	0.0301047	5	4	790
1.55+6	0.033	1.60+6	0.034	1.65+6	0.0341047	5	4	791
1.70+6	0.033	1.75+6	0.030	1.80+6	0.0261047	5	4	792

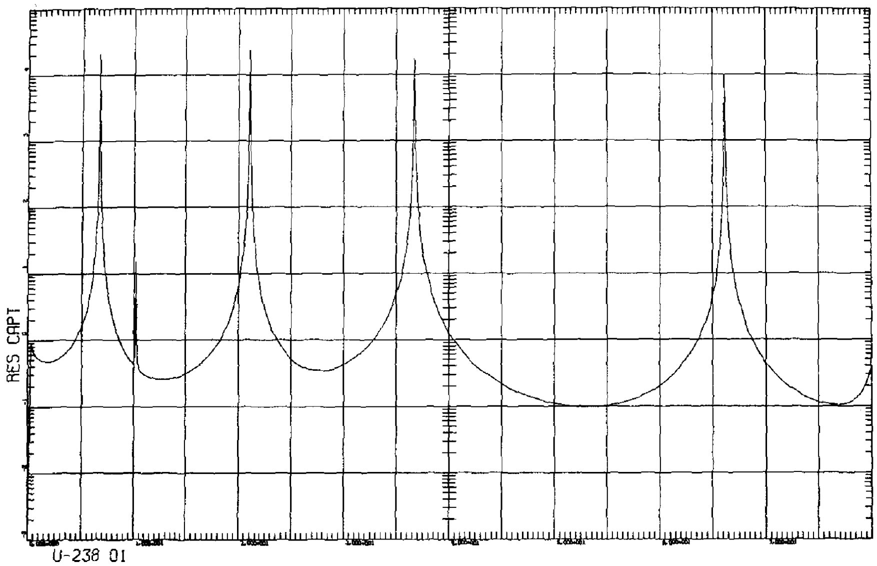
1.85+6	0.020	1.90+6	0.014	1.95+6	0.0081047	5	4	793
2.00+6	0.002	2.00001+6	0.000		1047	5	4	794
0.0	1.272+6	0	3	1	171047	5	4	795
17	2				1047	5	4	796
1.272+6	0.000	1.30+6	0.004	1.35+6	0.0111047	5	4	797
1.40+6	0.017	1.45+6	0.022	1.50+6	0.0281047	5	4	798
1.55+6	0.032	1.60+6	0.035	1.65+6	0.0361047	5	4	799
1.70+6	0.035	1.75+6	0.033	1.80+6	0.0291047	5	4	800
1.85+6	0.023	1.90+6	0.018	1.95+6	0.0121047	5	4	801
2.00+6	0.005	2.00001+6	0.0		1047	5	4	802
0.0	1.313+6	0	3	1	151047	5	4	803
15	2				1047	5	4	804
1.313+6	.000	1.35+6	.002	1.40+6	.0061047	5	4	805
1.45+6	0.016	1.50+6	0.029	1.55+6	0.0411047	5	4	806
1.60+6	0.048	1.65+6	0.049	1.70+6	0.0471047	5	4	807
1.75+6	0.040	1.80+6	0.031	1.85+6	0.0221047	5	4	808
1.90+6	0.013	1.95+6	0.006	2.00+6	0.0001047	5	4	809
0.0	1.361+6	0	3	1	141047	5	4	810
14	2				1047	5	4	811
1.361+6	0.000	1.40+6	0.003	1.45+6	0.0081047	5	4	812
1.50+6	0.016	1.55+6	0.023	1.60+6	0.0301047	5	4	813
1.65+6	0.031	1.70+6	0.029	1.75+6	0.0241047	5	4	814
1.80+6	0.019	1.85+6	0.014	1.90+6	0.0081047	5	4	815
1.95+6	0.003	2.00+6	0.000		1047	5	4	816
0.0	1.401+6	0	3	1	131047	5	4	817
13	2				1047	5	4	818
1.401+6	0.000	1.45+6	0.004	1.50+6	0.0091047	5	4	819
1.550+6	0.014	1.60+6	0.019	1.65+6	0.0221047	5	4	820
1.700+6	0.023	1.75+6	0.020	1.80+6	0.0151047	5	4	821
1.850+6	0.011	1.90+6	0.006	1.95+6	0.0021047	5	4	822
2.000+6	0.000				1047	5	4	823
0.0	1.437+6	0	3	1	121047	5	4	824
12	2				1047	5	4	825
1.437+6	0.000	1.45+6	0.002	1.50+6	0.0081047	5	4	826
1.550+6	0.017	1.60+6	0.025	1.65+6	0.0291047	5	4	827
1.700+6	0.027	1.75+6	0.020	1.80+6	0.0131047	5	4	828
1.850+6	0.007	1.90+6	0.002	1.95+6	0.0001047	5	4	829
0.0	1.47+6	0	3	1	101047	5	4	830
10	2				1047	5	4	831
1.47+6	0.000	1.50+6	0.002	1.55+6	0.0081047	5	4	832
1.60+6	0.014	1.65+6	0.019	1.70+6	0.0181047	5	4	833
1.75+6	0.012	1.80+6	0.007	1.85+6	0.0021047	5	4	834
1.90+6	0.000				1047	5	4	835
0.0	1.50+6	0	3	1	121047	5	4	836
12	2				1047	5	4	837
1.50+6	0.000	1.55+6	0.009	1.60+6	0.0281047	5	4	838
1.65+6	0.057	1.70+6	0.103	1.75+6	0.1741047	5	4	839
1.80+6	0.243	1.85+6	0.308	1.90+6	0.3601047	5	4	840
1.95+6	0.393	2.00+6	0.410	2.00001+6	0.0001047	5	4	841
0.0	1.75+6	0	3	1	71047	5	4	842
7	2				1047	5	4	843
1.75+6	0.000	1.80+6	0.012	1.85+6	0.0291047	5	4	844
1.90+6	0.054	1.95+6	0.091	2.00+6	0.1451047	5	4	845
2.00001+6	0.000				1047	5	4	846
0.0	0.0	0	9	1	31047	5	4	847

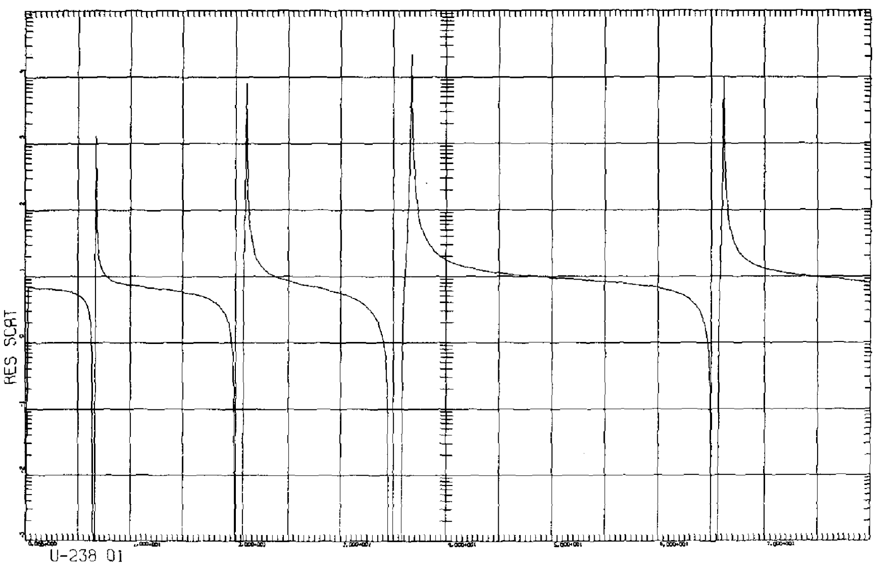
3	2				1047	5	4	848
2.00+6	0.0	2.00001+6	1.0	15.0+6	1.01047	5	4	849
0.0	0.0	0	0	1	181047	5	4	850
18	2				1047	5	4	851
2.0+6	.270+6	2.5+6	.311+6	3.0+6	.353+61047	5	4	852
3.5+6	.396+6	4.0+6	.438+6	4.5+6	.464+61047	5	4	853
5.0+6	.483+6	5.5+6	.497+6	6.0+6	.509+61047	5	4	854
6.5+6	.519+6	7.0+6	.527+6	7.5+6	.534+61047	5	4	855
8.0+6	.539+6	8.5+6	.543+6	9.0+6	.547+61047	5	4	856
9.5+6	.549+6	10.0+6	.550+6	15.0+6	.550+61047	5	4	857
0.0	0.0	0	0	0	01047	5	0	858
92238.	236.0058	0	0	1	01047	5	16	859
0.	0.	0	9	1	21047	5	16	860
2	1				1047	5	16	861
6.07+6	1.	15.0+6	1.		1047	5	16	862
0.	0.	0	0	1	41047	5	16	863
4	2				1047	5	16	864
6.07+6	1.0+4	6.09+06	0.0155+06	7.0+6	0.10+61047	5	16	865
15.0+6	0.84+6				1047	5	16	866
0.	0.	0	0	0	01047	5	0	867
92238.	236.0058	0	0	1	01047	5	17	868
0.	0.	0	9	1	21047	5	17	869
2	1				1047	5	17	870
11.51+6	1.	15.0+6	1.		1047	5	17	871
0.	0.	0	0	1	31047	5	17	872
3	2				1047	5	17	873
11.51+6	1.0+4	12.5+6	0.20+6	15.0+6	0.40+61047	5	17	874
0.	0.	0	0	0	01047	5	0	875
92238.	236.0058	0	0	1	01047	5	18	876
0.	1.35+6	0	6	1	21047	5	18	877
2	1				1047	5	18	878
0.48+6	1.	15.0+6	1.		1047	5	18	879
0.	0.	0	0	0	01047	5	0	880
0.	0.	0	0	0	01047	0	0	881
92238.0	236.0058	0	0	0	01047	7	4	882
0.0	0.0	0	0	12	11047	7	4	883
0.0	100.0	236.0058	2.5	0.0	0.01047	7	4	884
1.0	10.6	236.0058	0.0	0.0	0.01047	7	4	885
0.0	0.0	0	0	0	01047	7	0	886
0.0	0.0	0	0	0	01047	0	0	887
0.0	0.0	0	0	0	0 0	0	0	888
0.0	0.0	0	0	0	0 -1	0	0	889

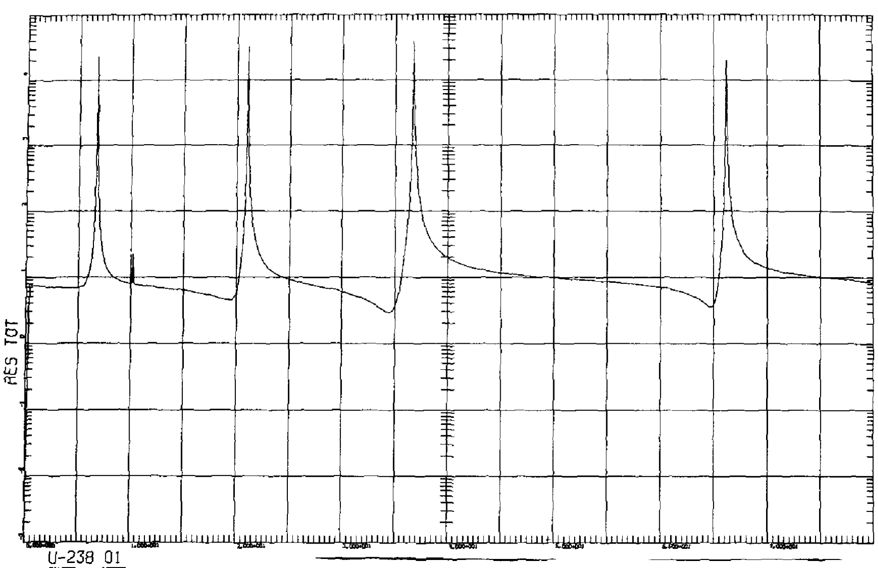
APPENDIX B

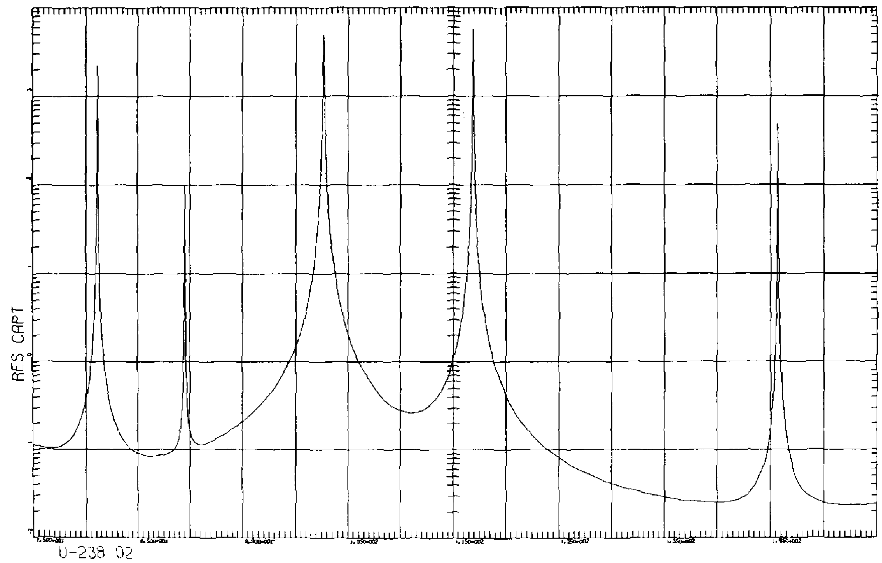
Graphical Representation of Resolved Resonance Levels

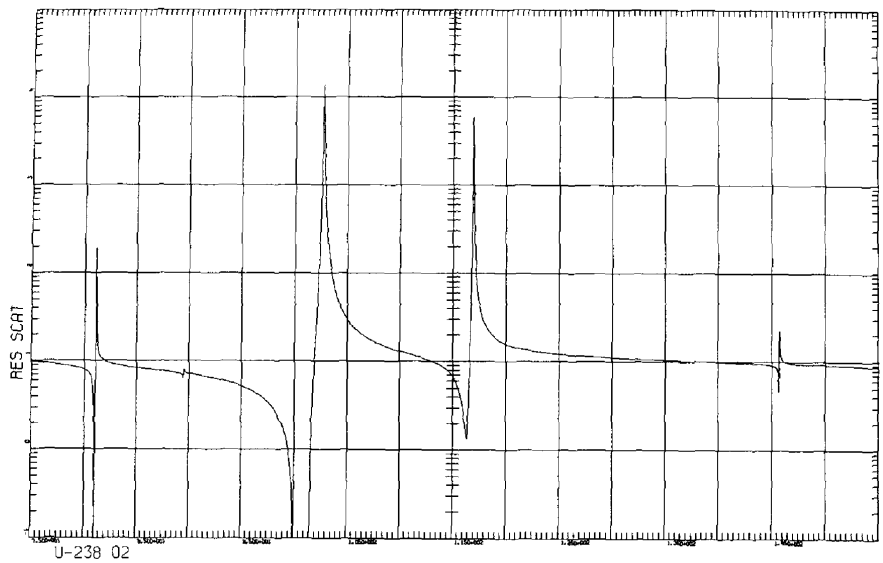
By courtesy of Dr. E. M. Pennington of Argonne National Laboratory, Calcomp plots of the capture, scattering, and total cross sections were obtained using the single-level, Breit-Wigner model and the ENDF/B resonance parameters.

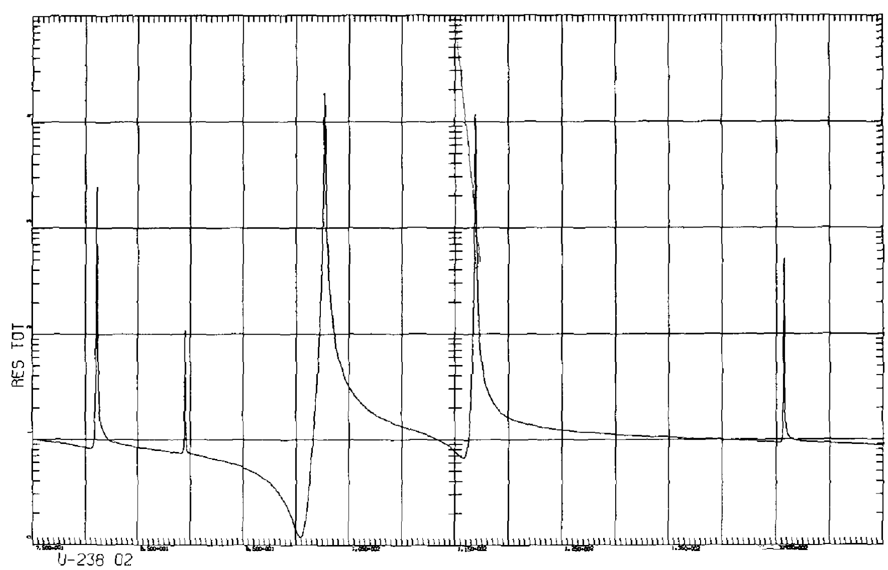

RES CAPT
U-238 01

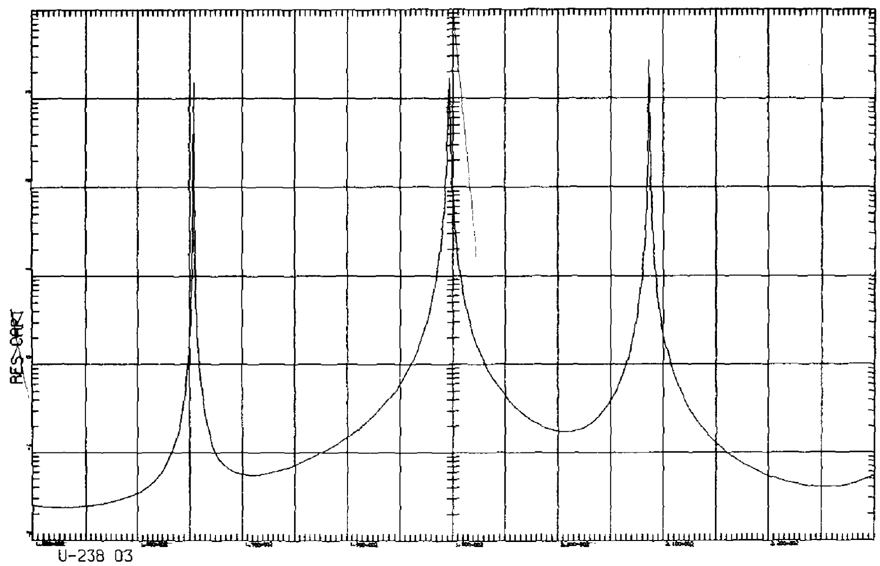

RES SCAT
U-238 01

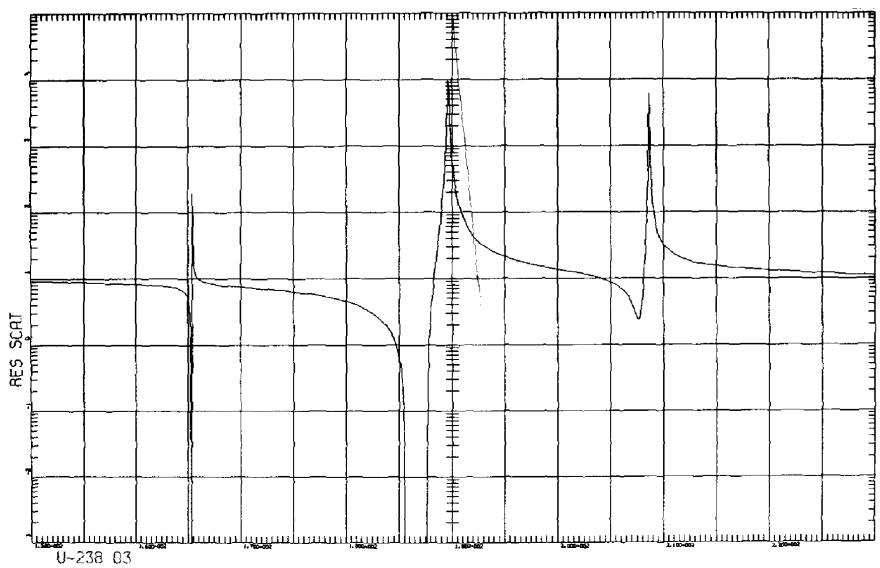

RES TOT
U-238 01

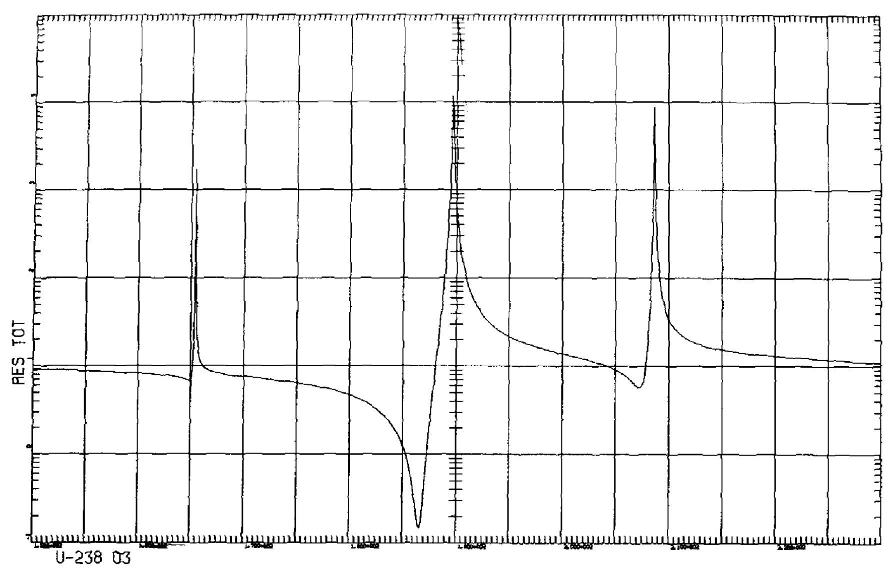

RES CAPT
U-238 02

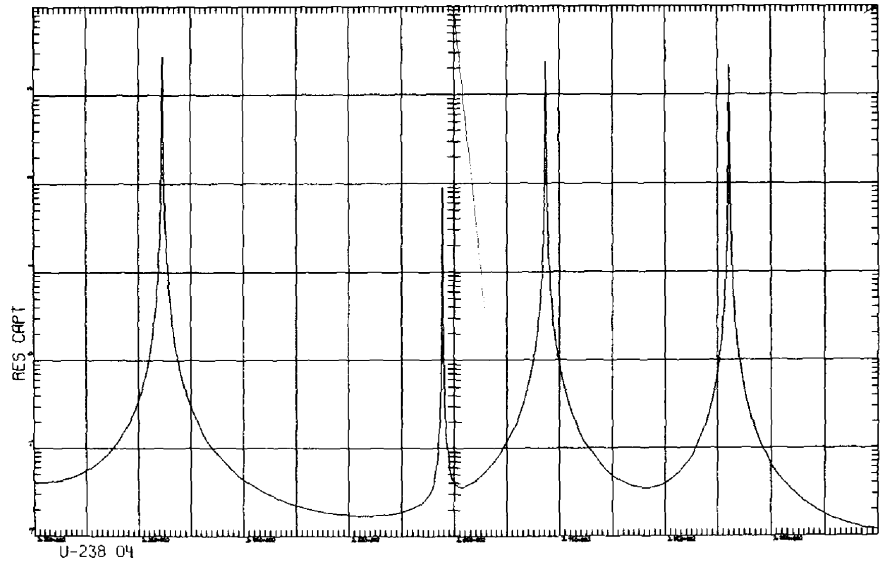

RES SCAT
U-238 02

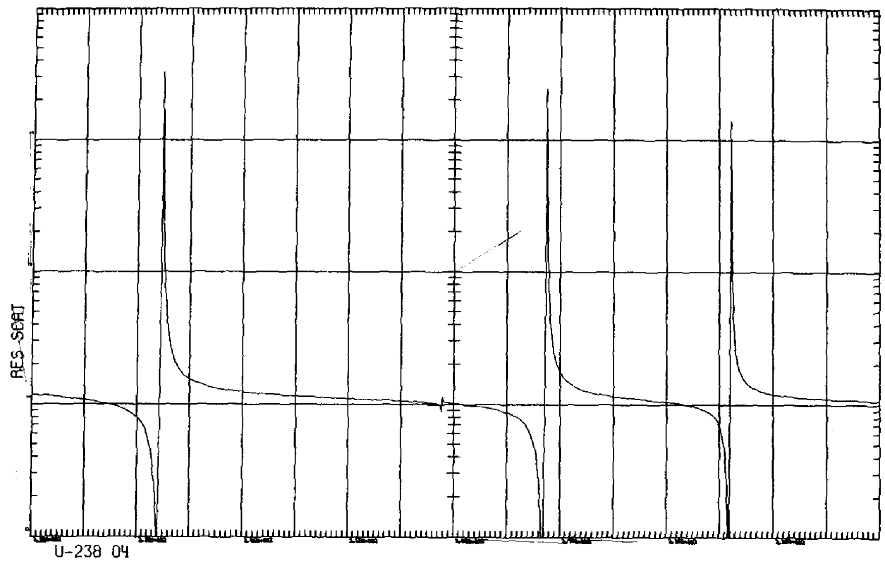

RES TOT
U-238 02

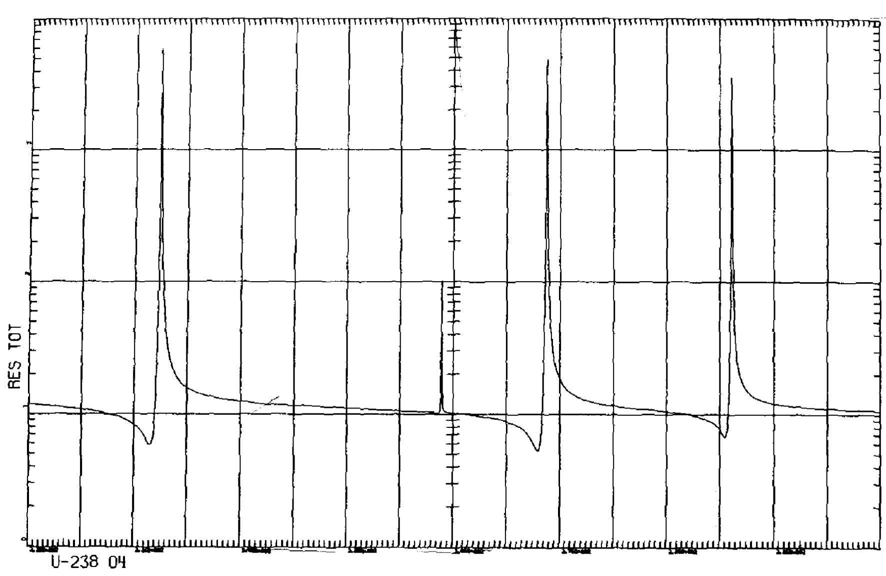

RES CAPT
U-238 03

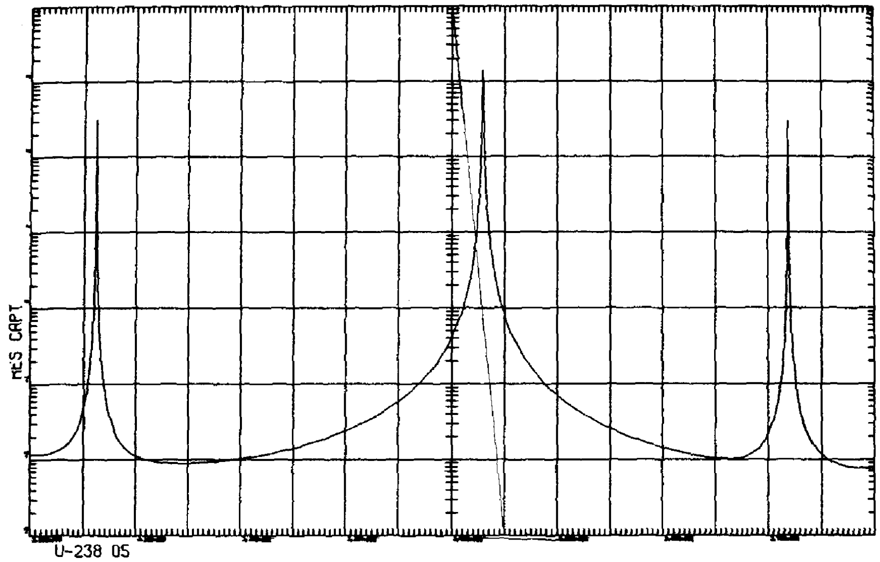

RES SCAT
U-238 03

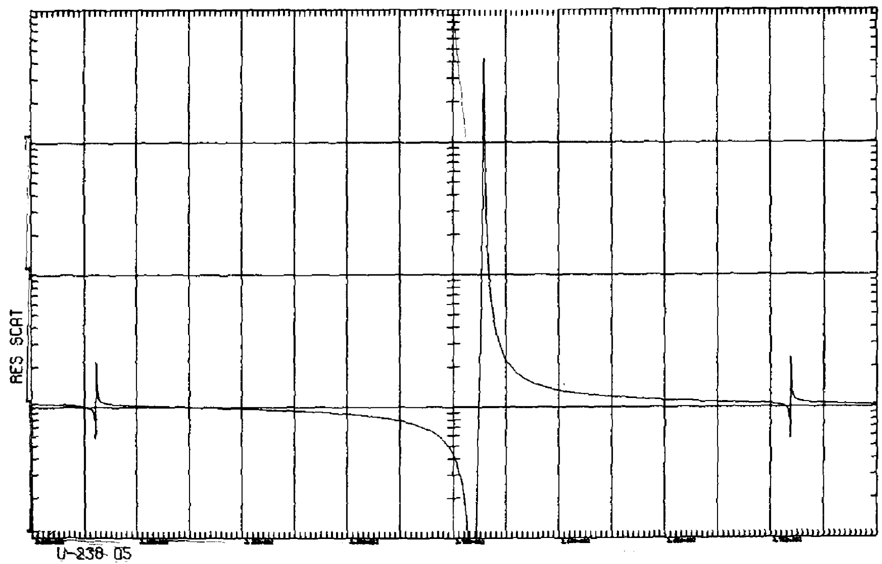

RES TOT
U-238 03

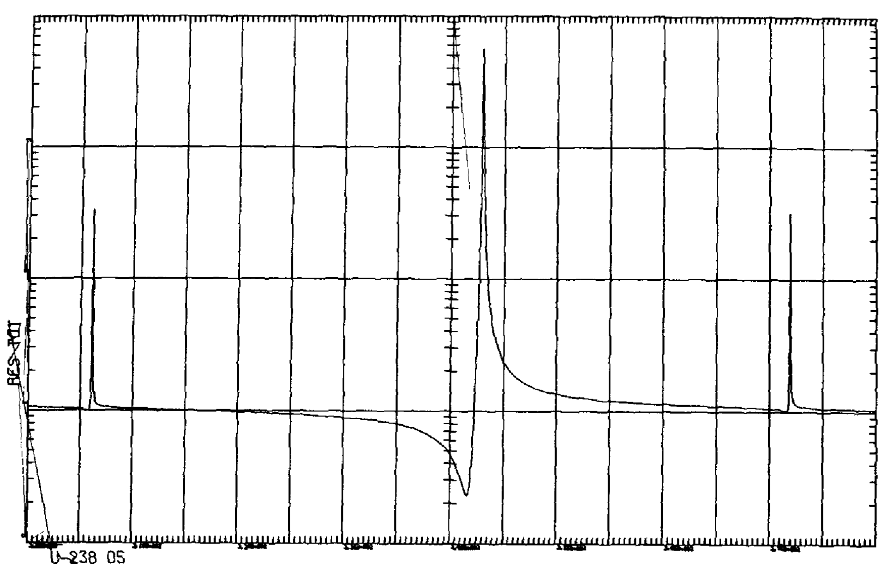

RES CAPT
U-238 04

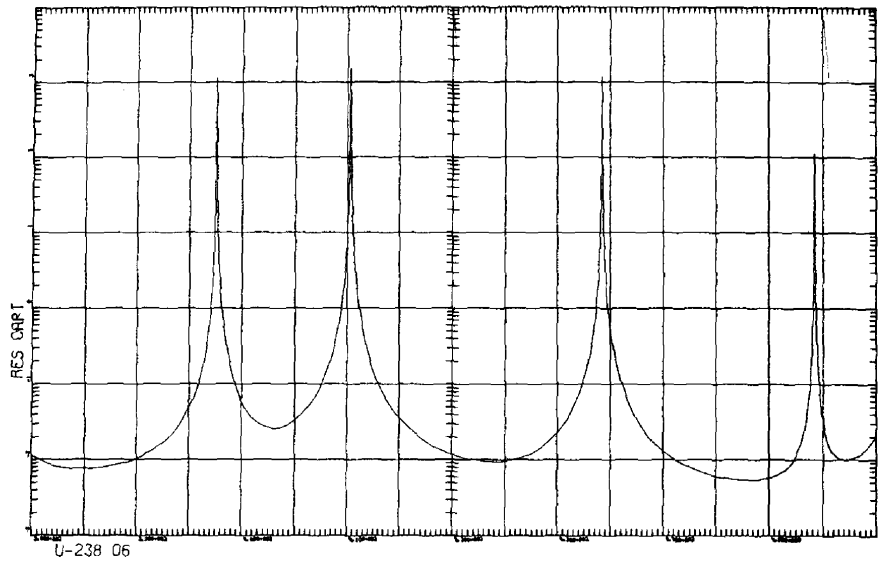

RES SCAT
U-238 04

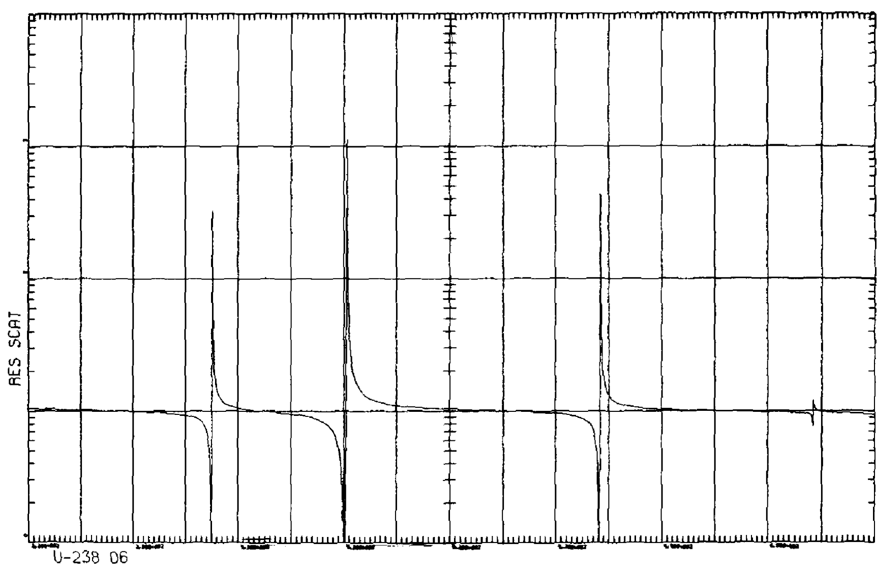

RES TOT
U-238 04

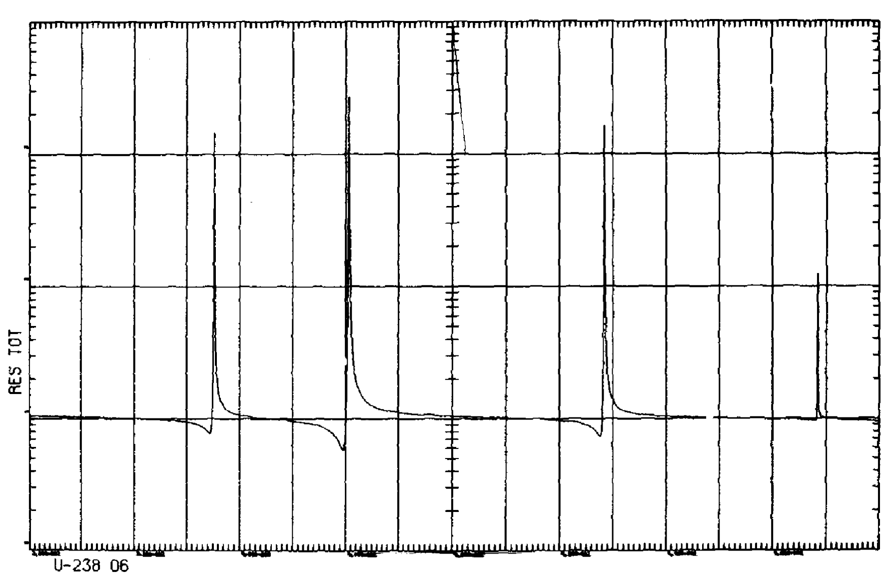

RES CAPT
U-238 05

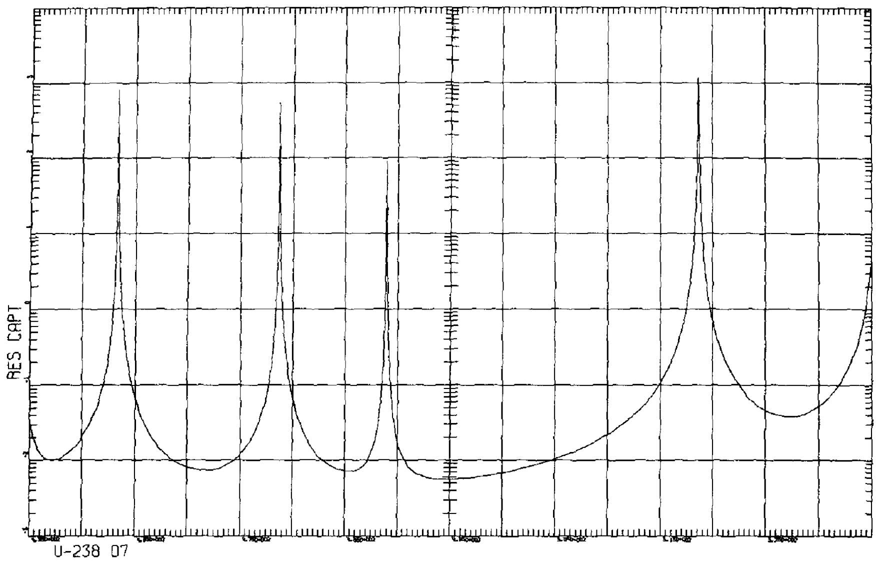

RES SCAT
U-238 05

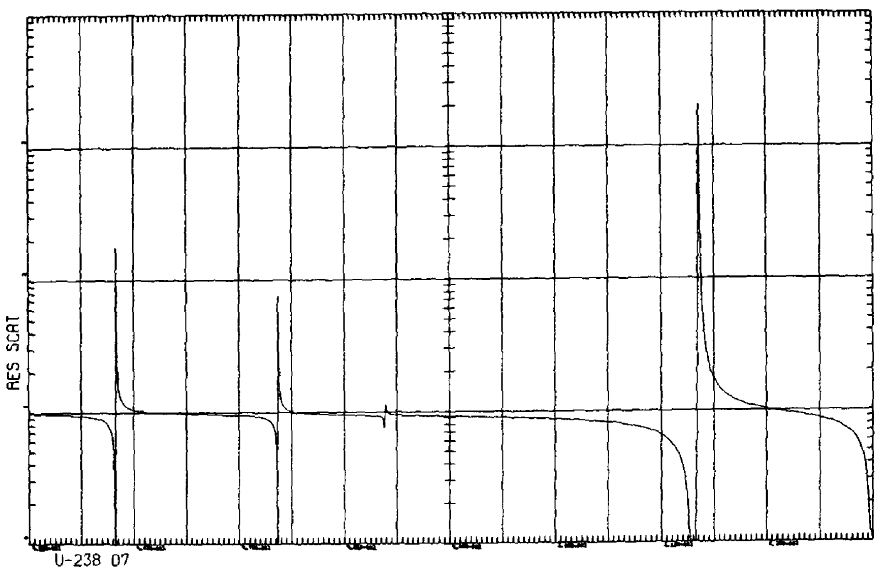

U-238 05

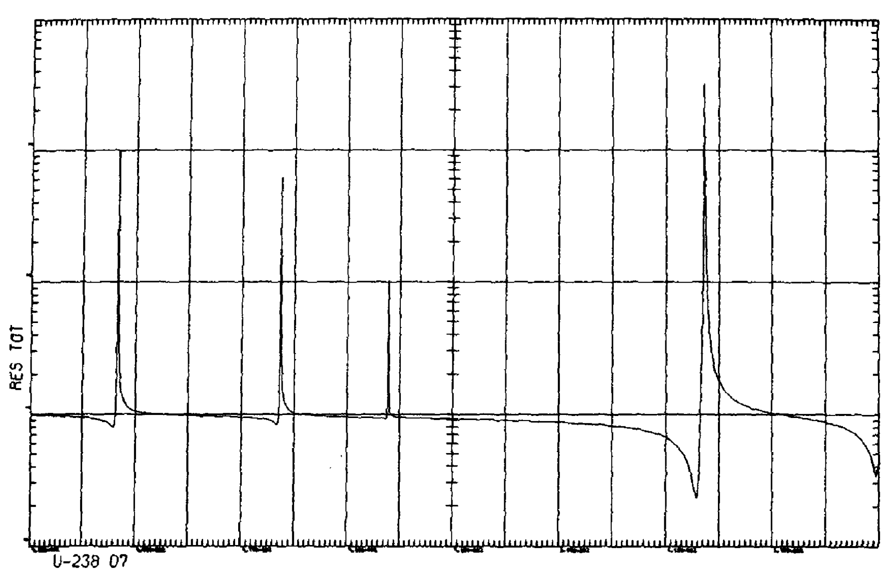

RES CAPT
U-238 06

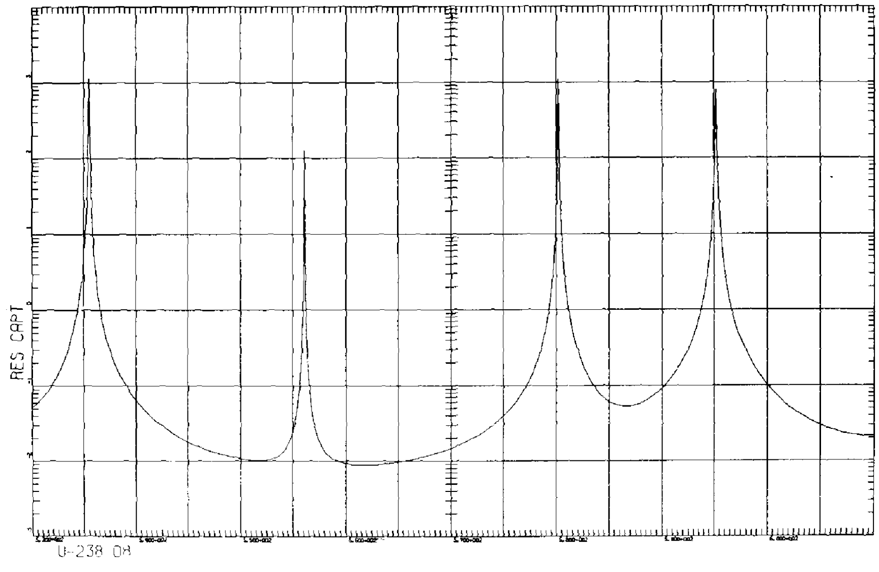

RES SCAT
U-238 06

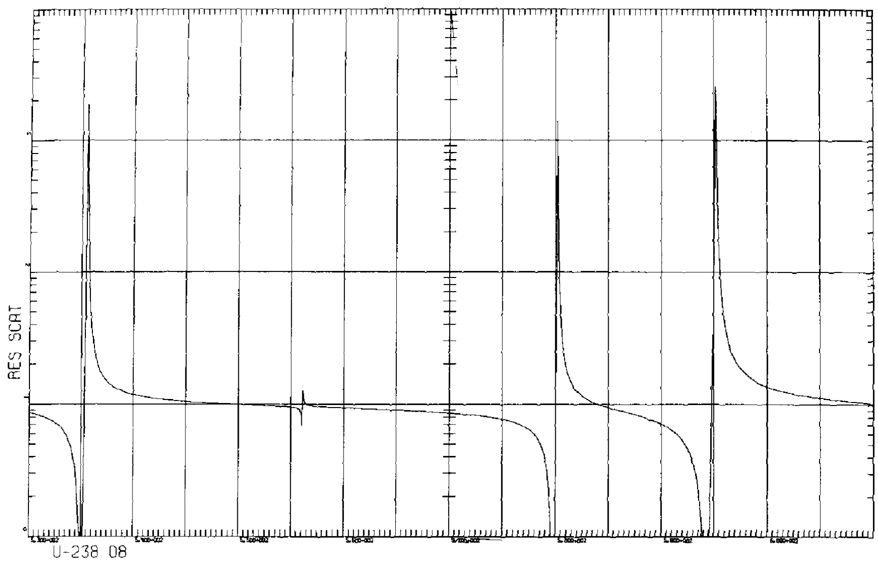

RES TOT
U-238 06

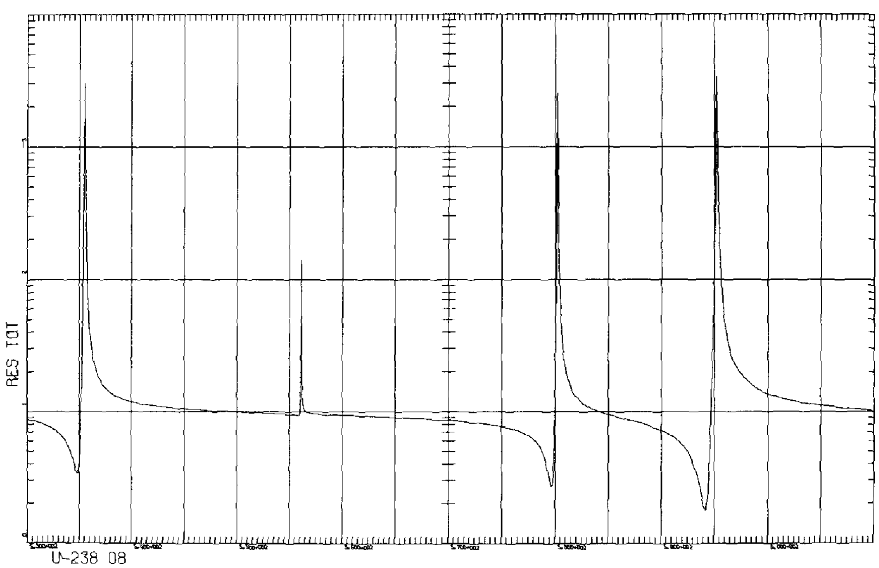

RES CAPT
U-238 07

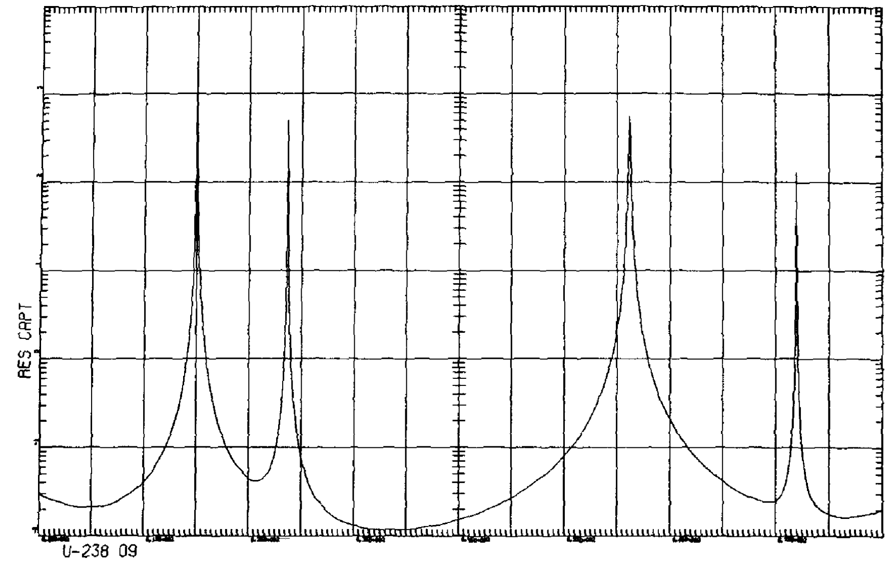

RES SCAT
U-238 07

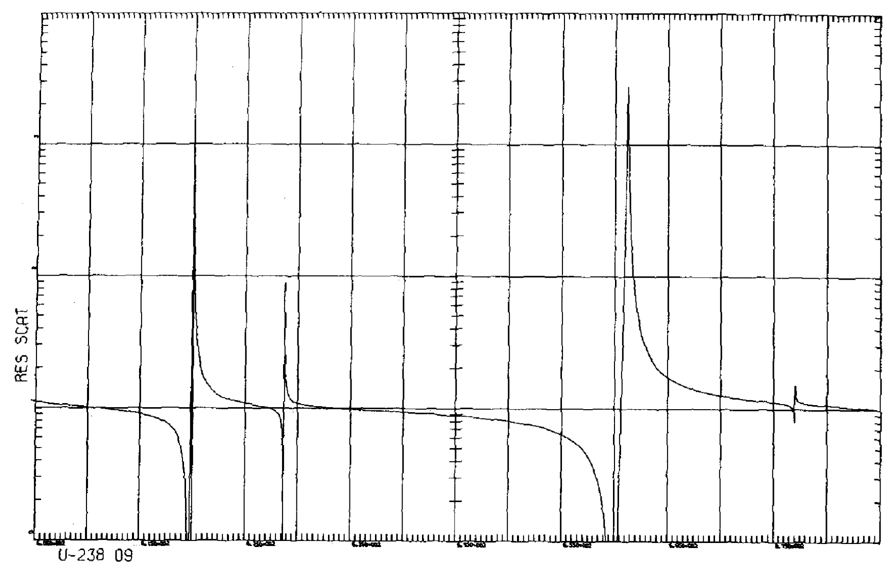

RES TOT
U-238 07

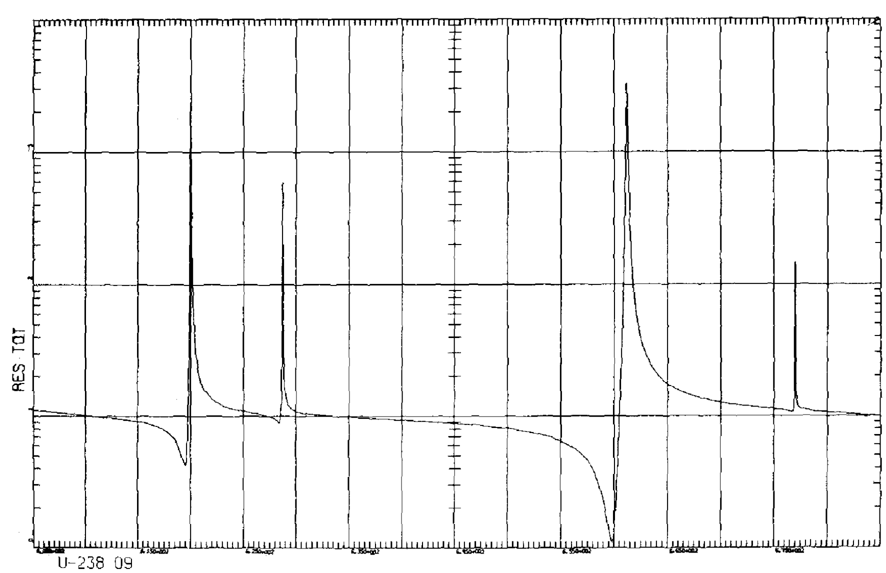

RES CAPT
U-238 08

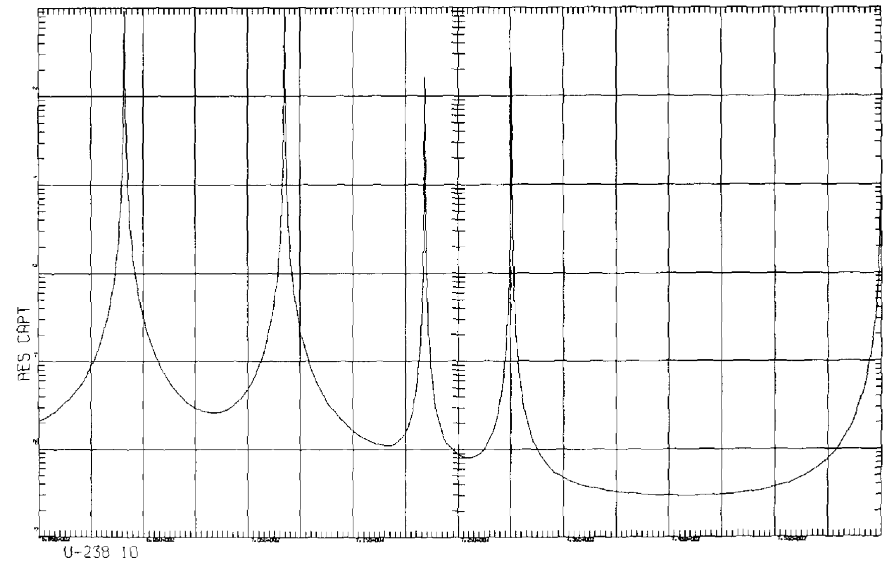

RES SCAT
U-238 08

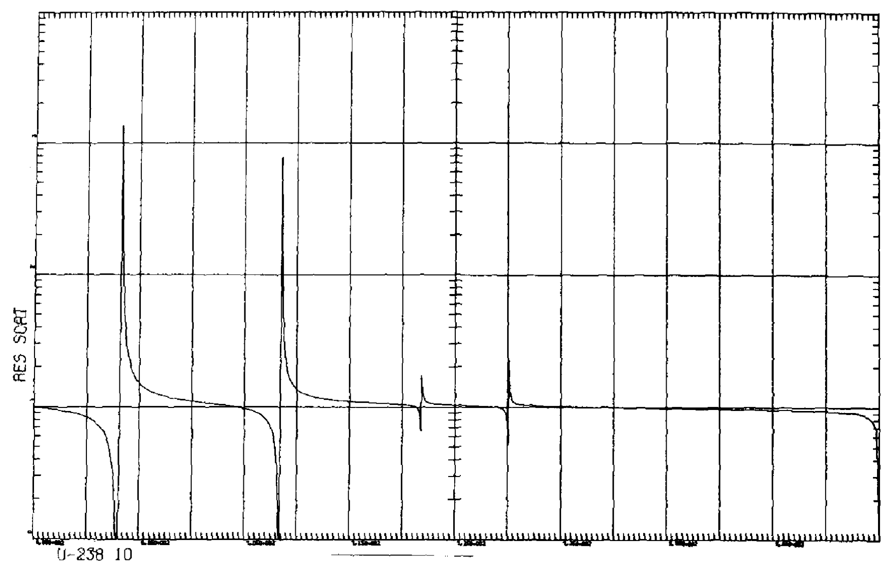

RES TOT
U-238 08

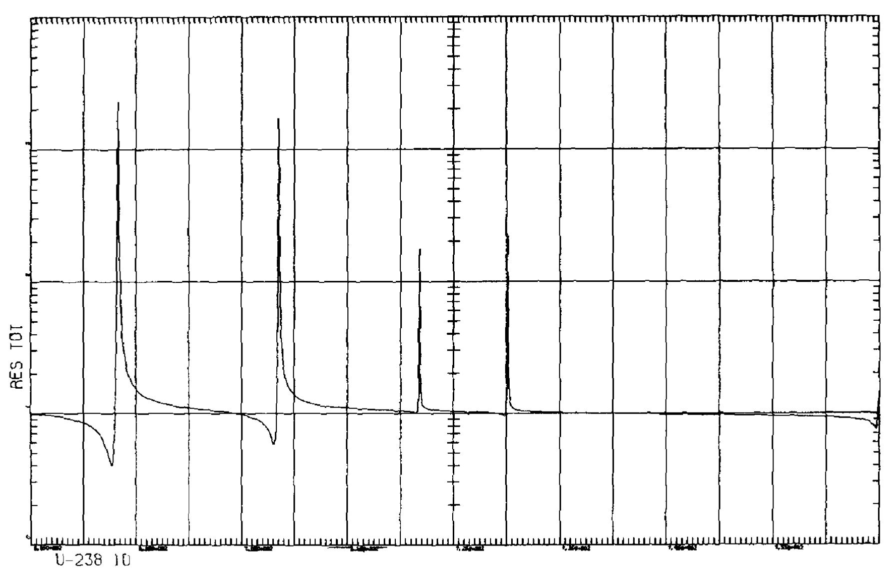

RES CAPT
U-238 09

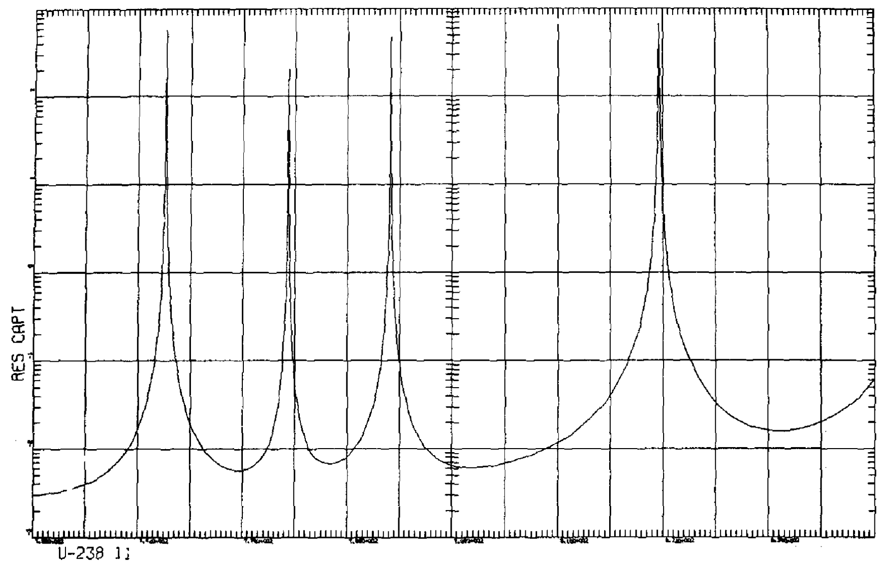

RES SCAT
U-238 09

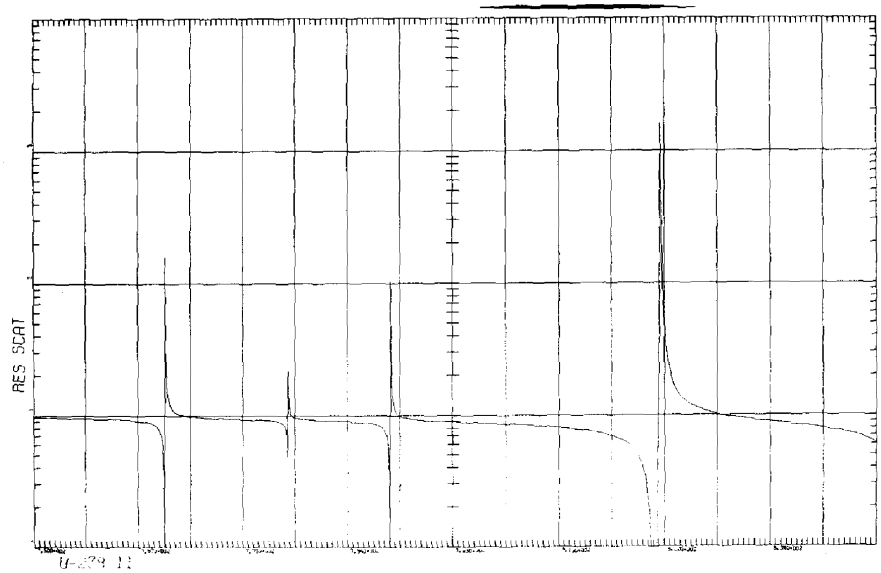

RES TOT
U-238 09

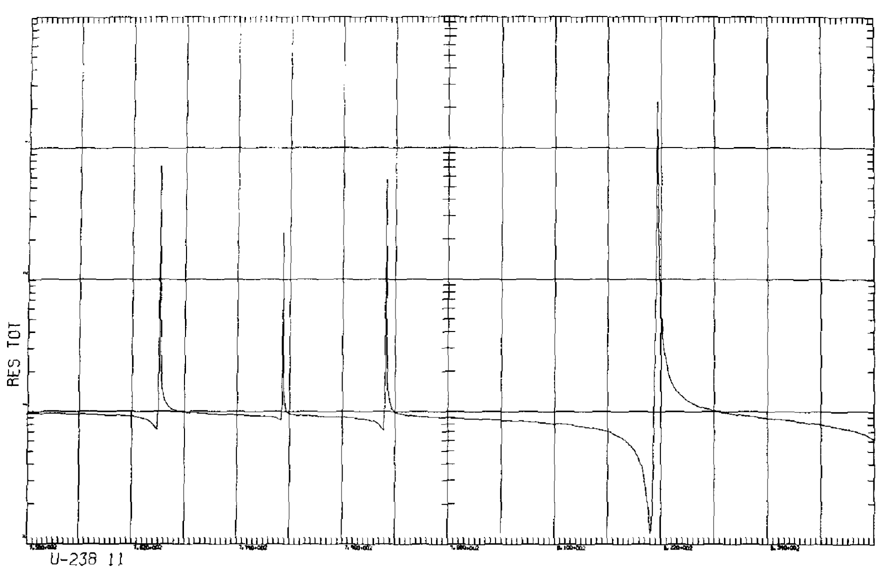

RES CAPT
U-238 10

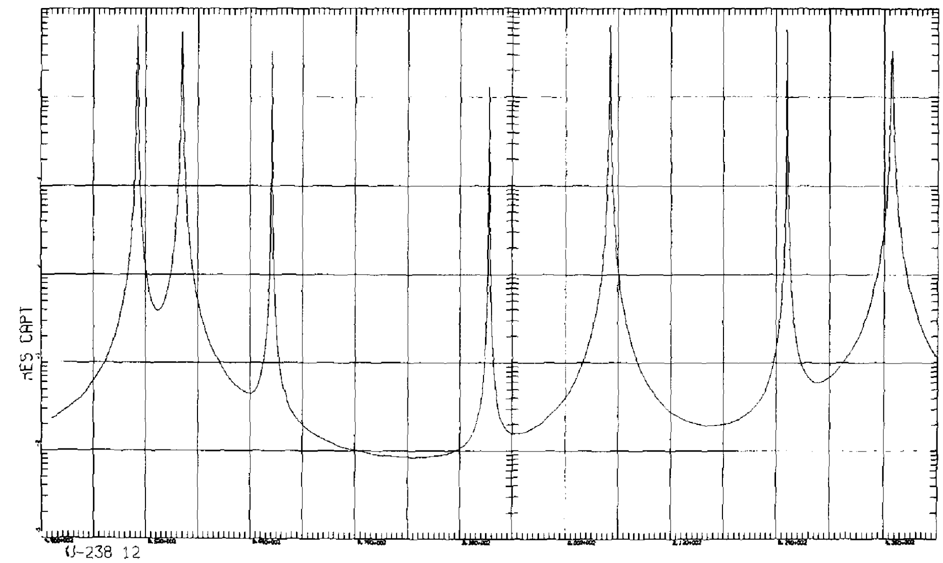

RES SCAT
U-238 10

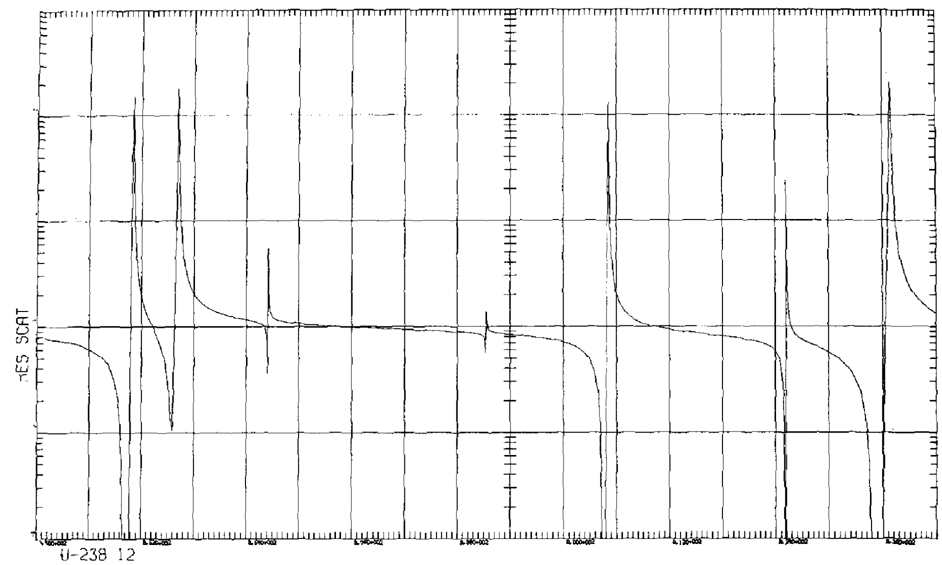

RES TOT
U-238 10

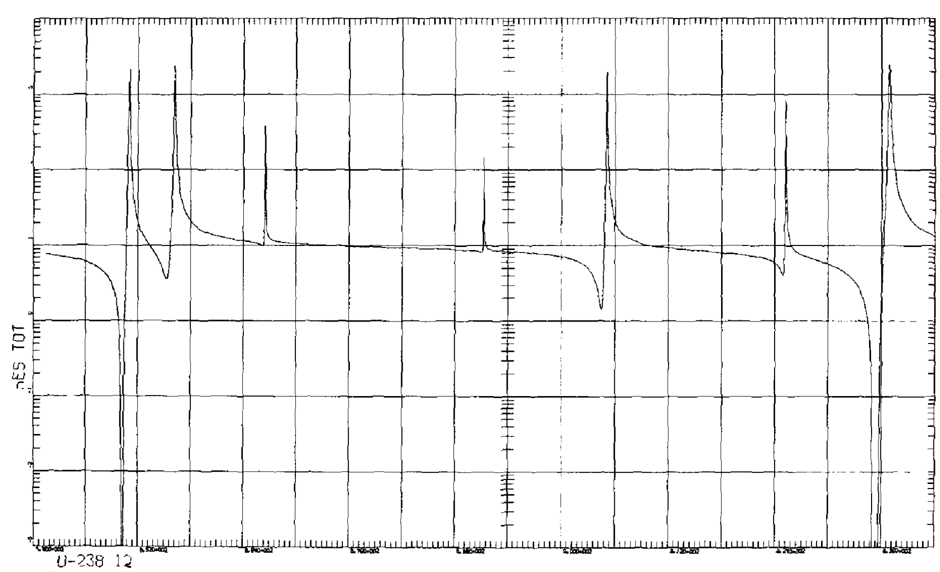

RES CAPT
U-238 11

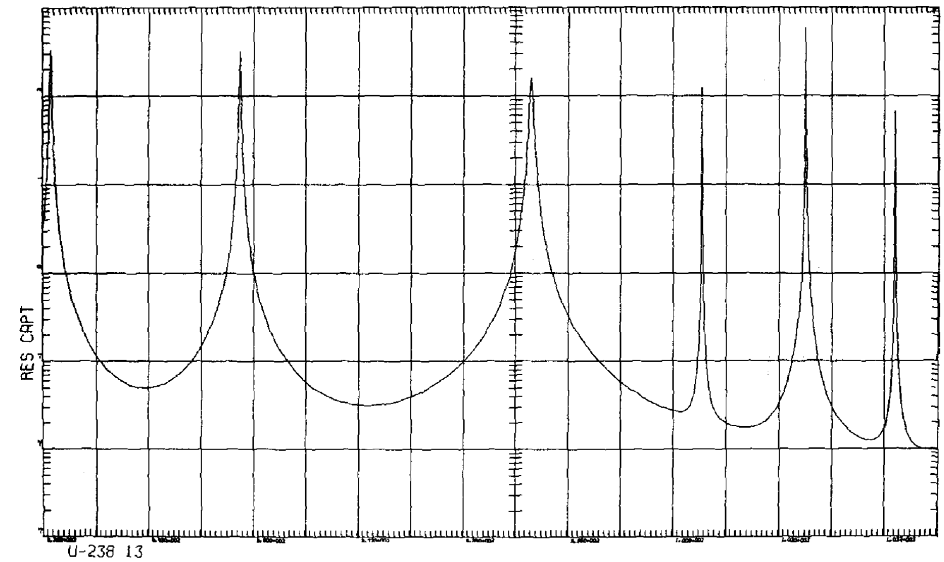

RES SCAT

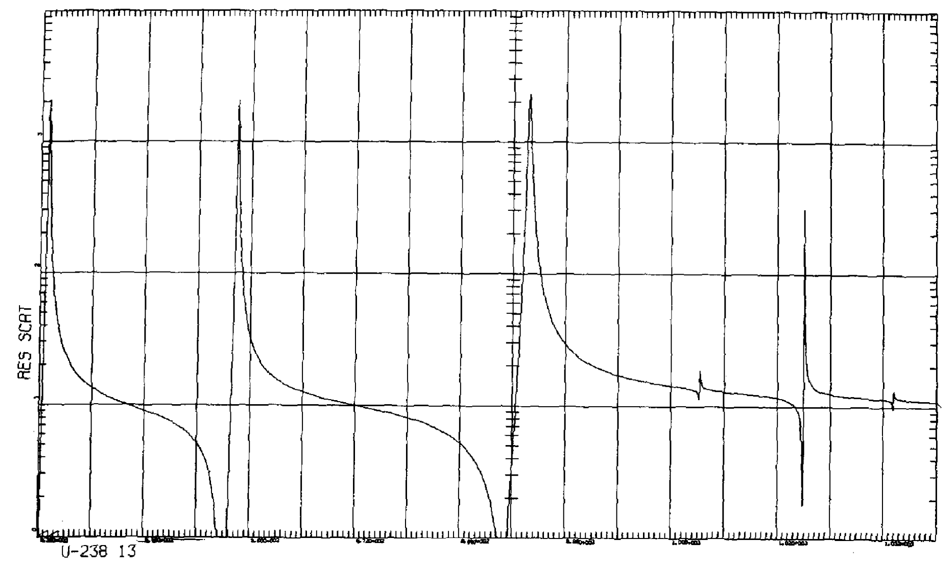

RES TOT
U-238 11

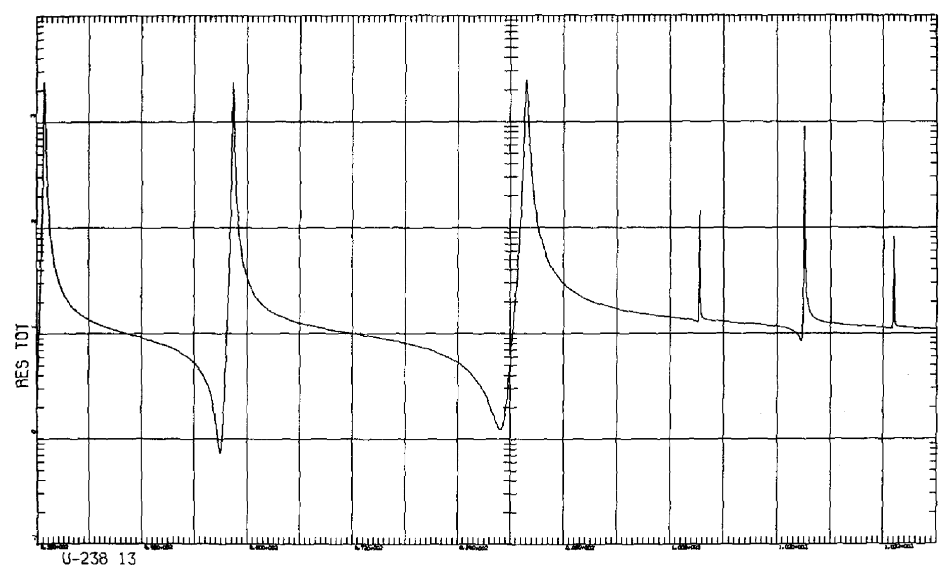

RES CAPT
U-238 12

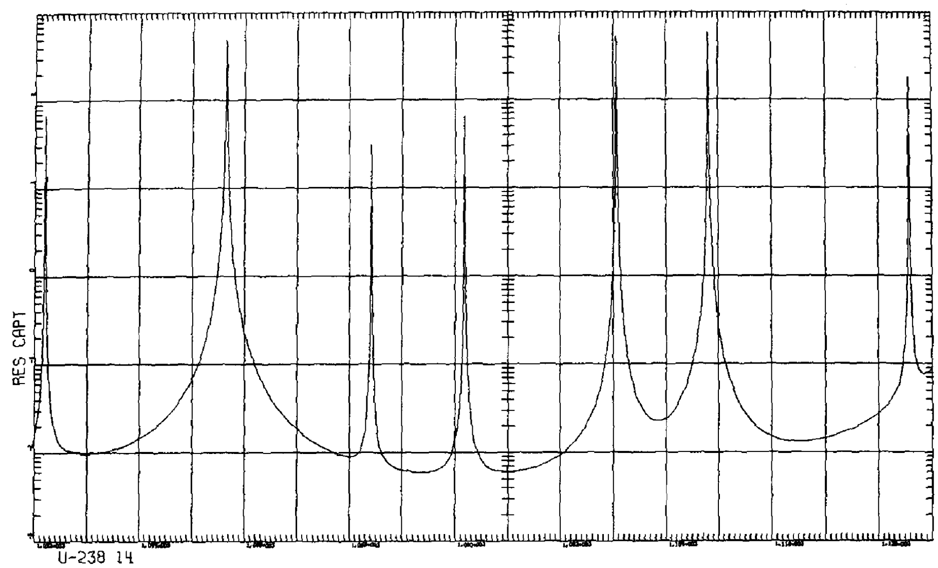

RES SCAT
U-238 12

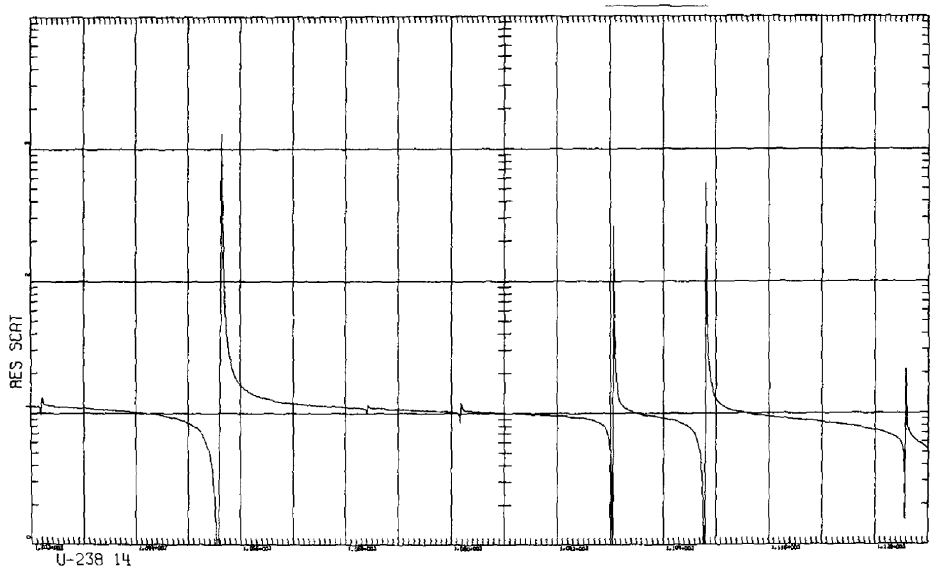

RES TOT
U-238 12

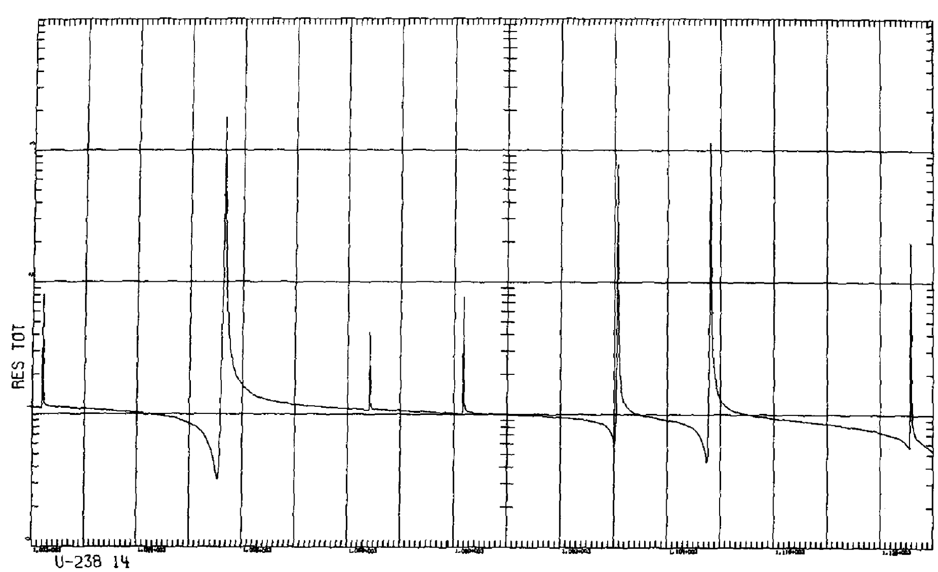

RES CAPT
U-238 13

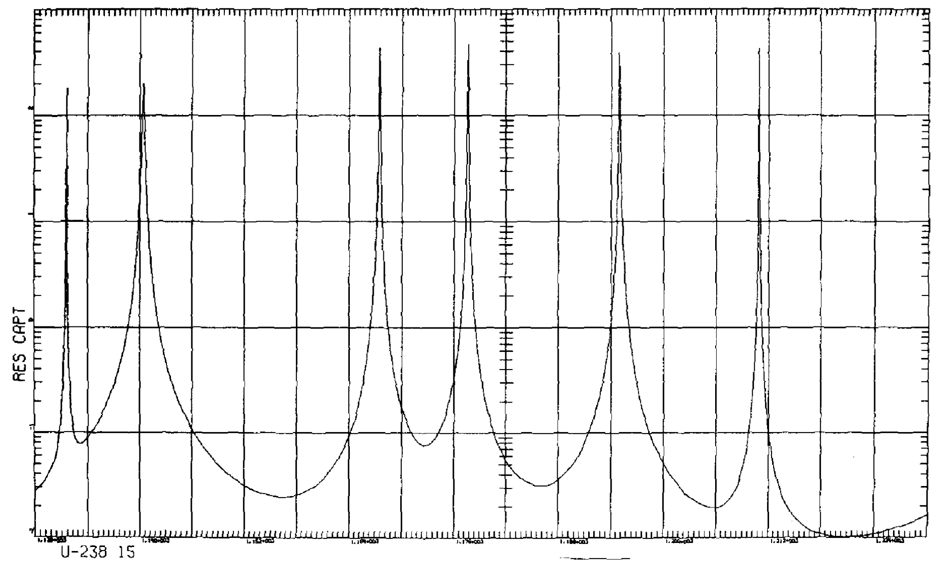

RES SCAT
U-238 13

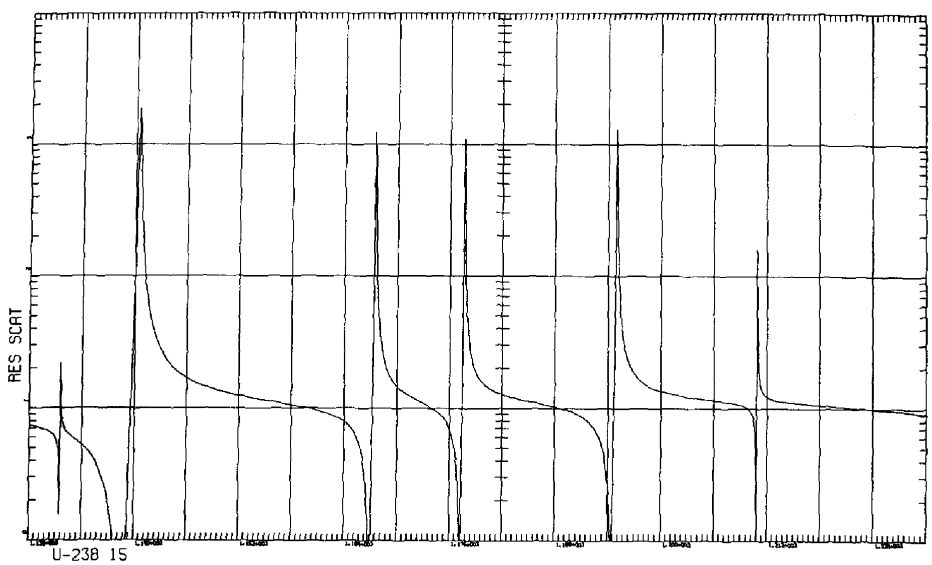

RES TOT
U-238 13

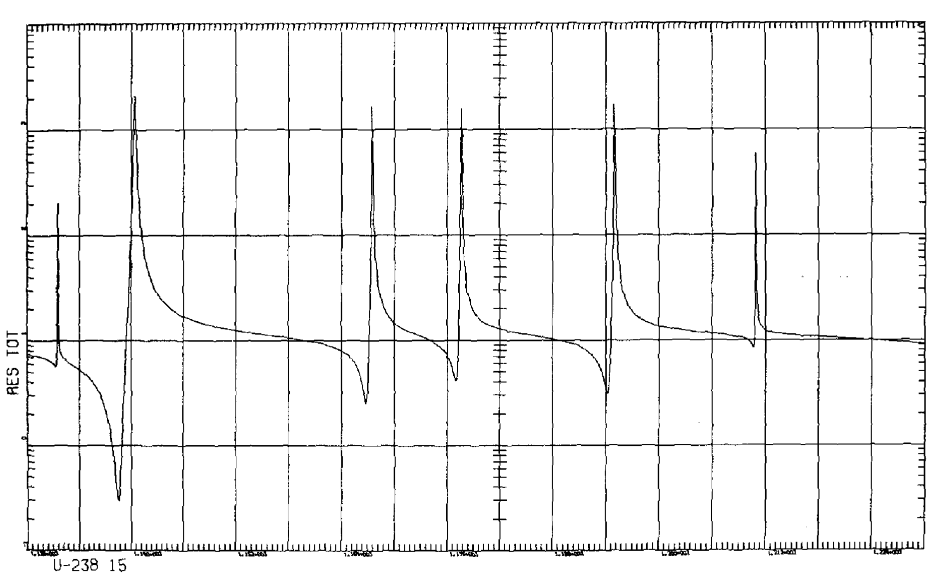

RES CAPT
U-238 14

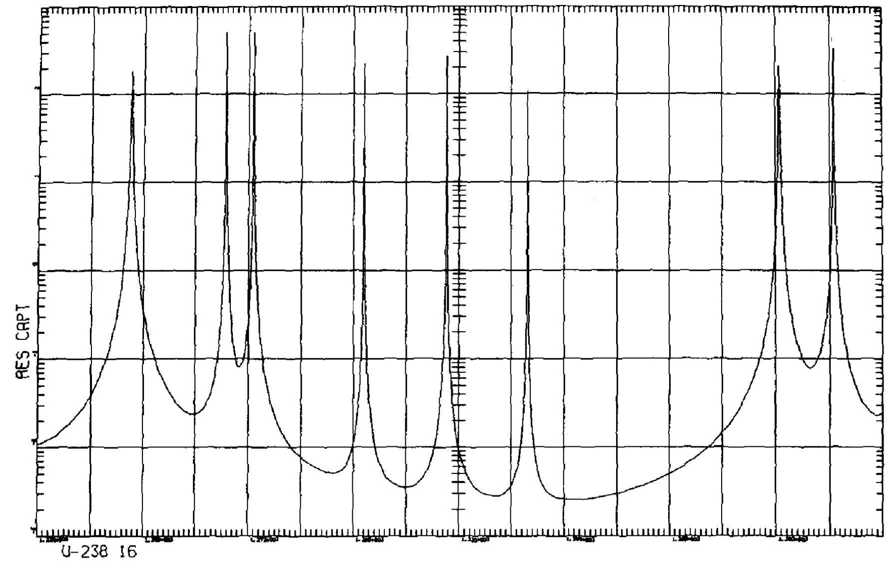

RES SCAT
U-238 14


RES TOT
U-238 14

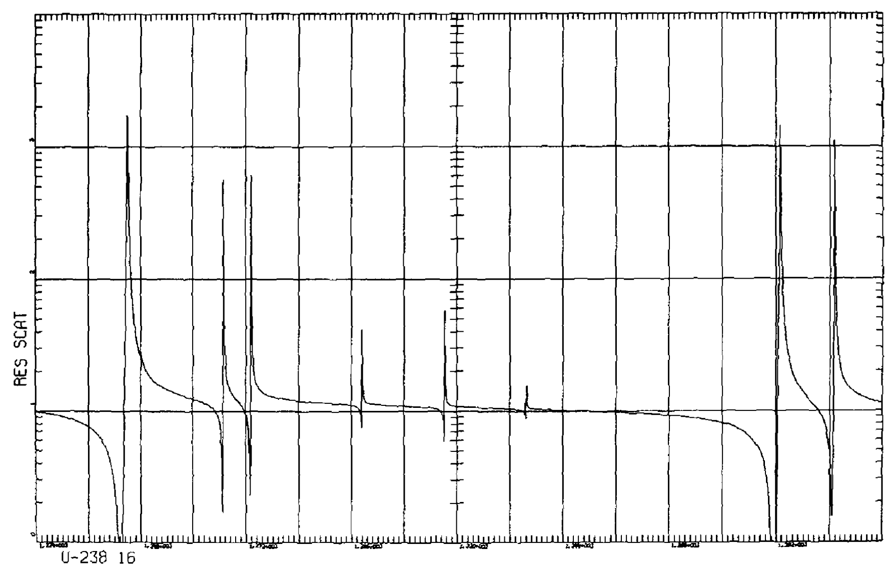

RES CAPT
U-238 15


RES SCAT
U-238 15

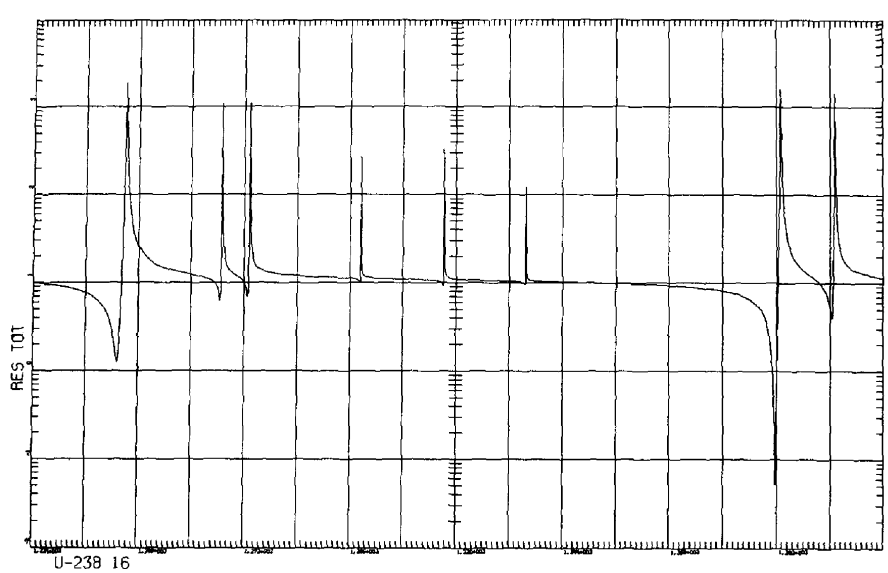

RES TOT
U-238 15



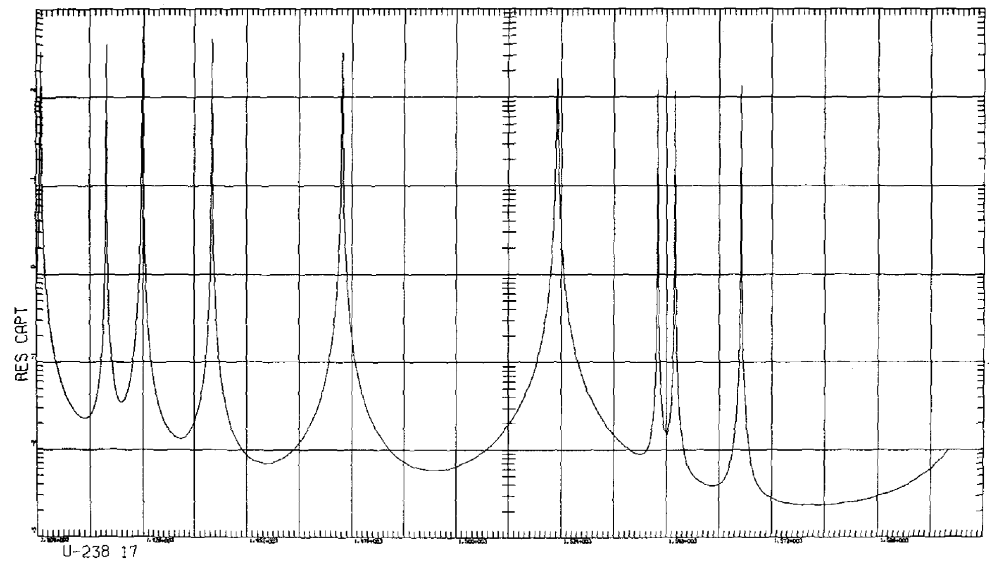
RES CAPT
U-238 16

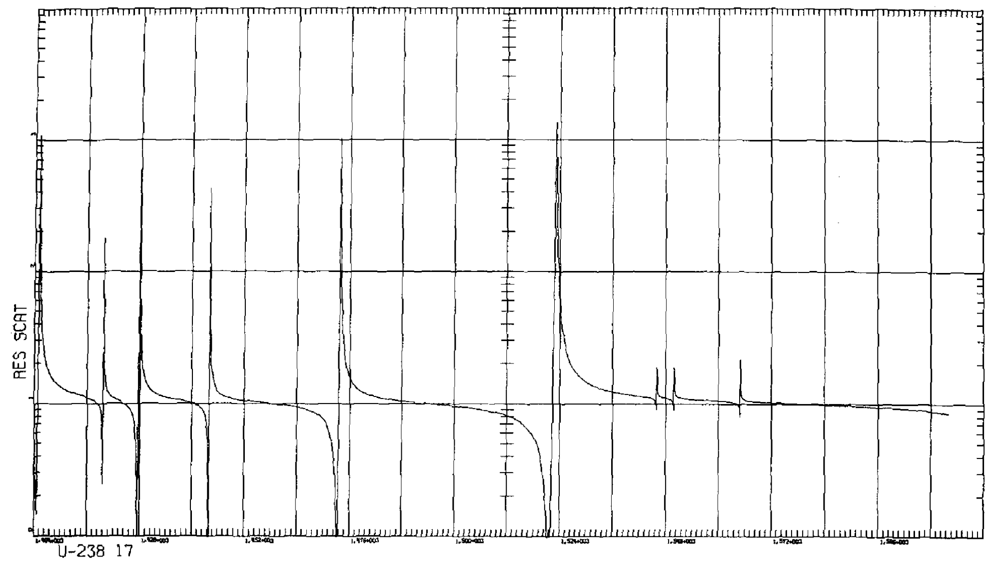


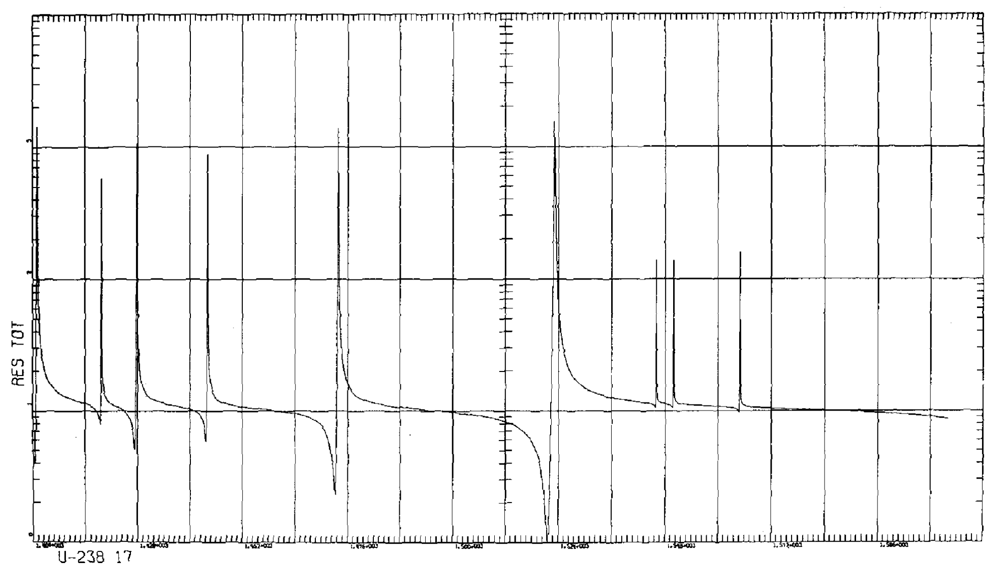
RES SCAT
U-238 16

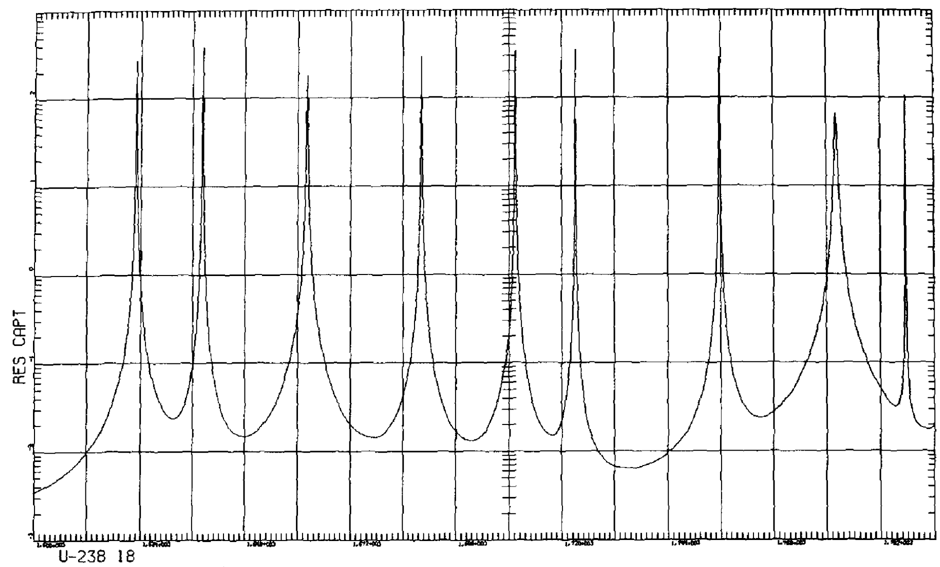


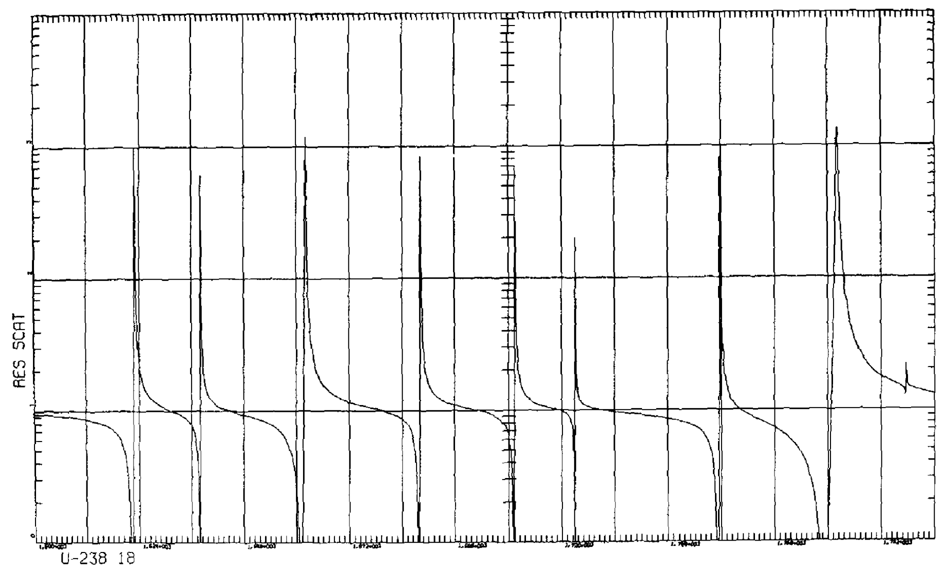
RES TOT
U-238 16

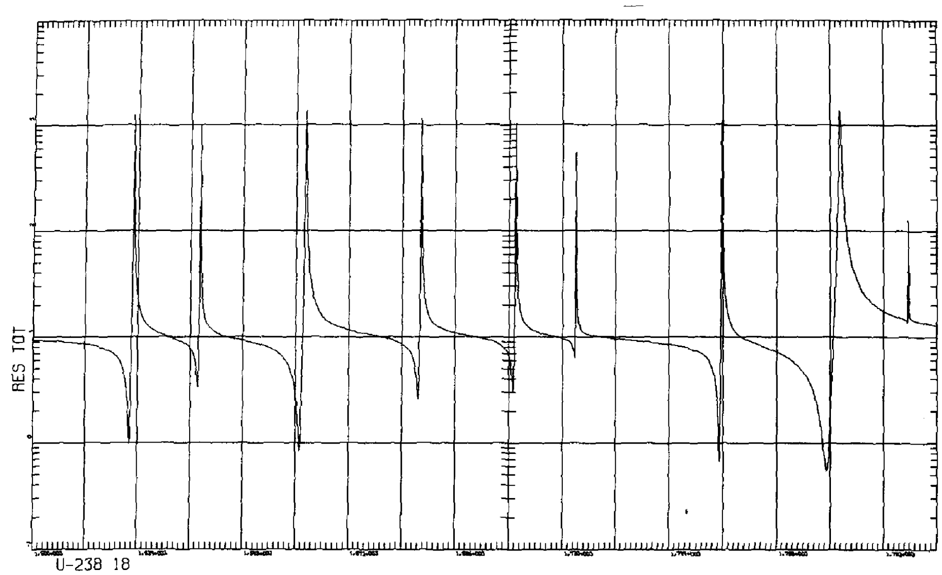

RES CAPT
U-238 17

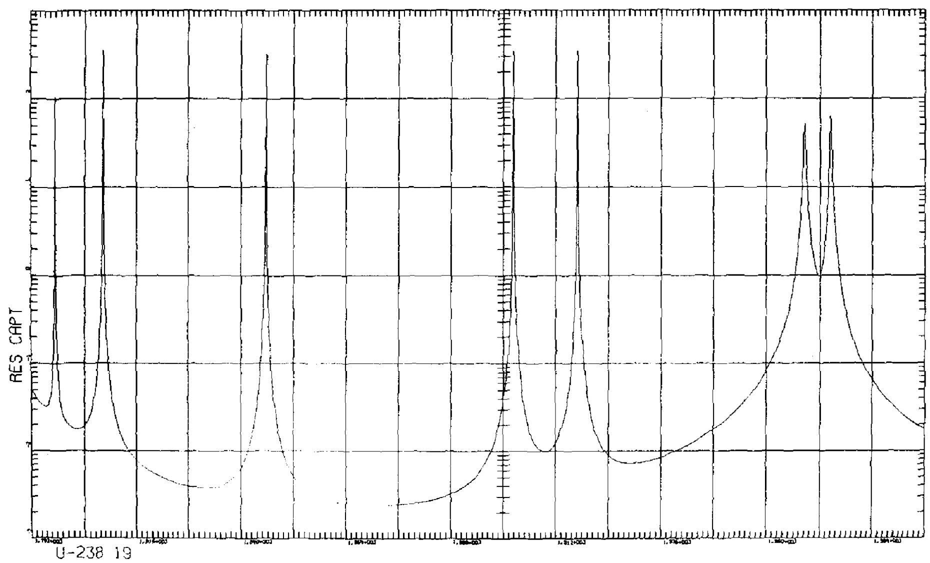

RES SCAT
U-238 17

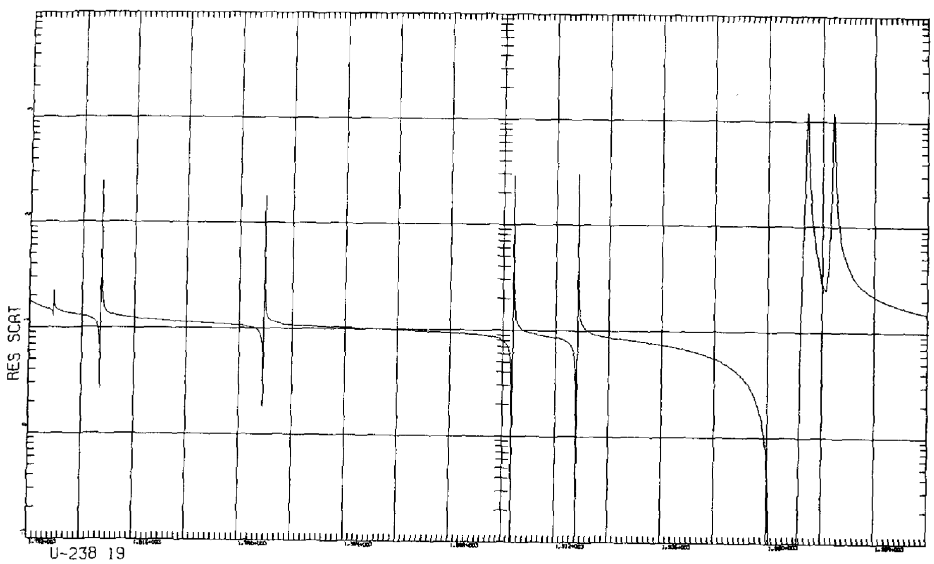

RES TOT
U-238 17

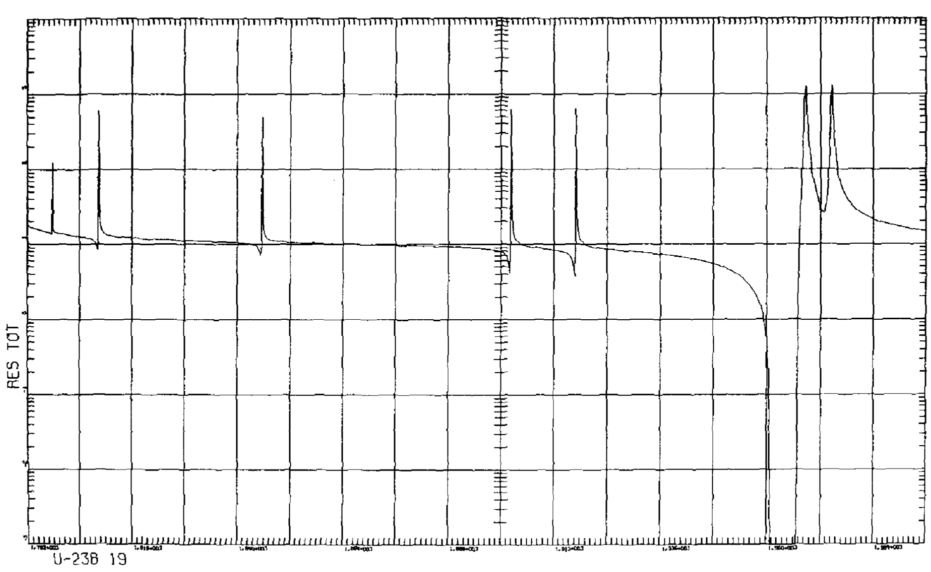

RES CAPT
U-238 18

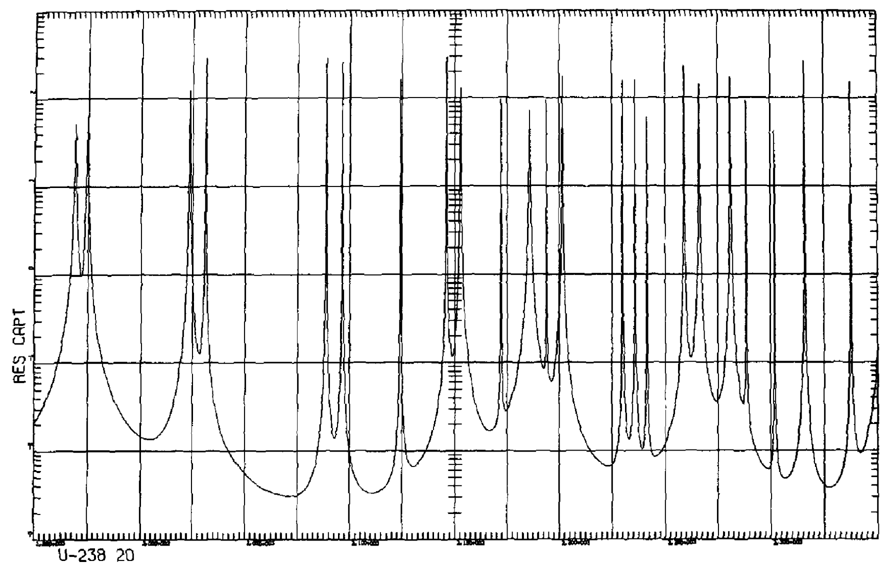

RES SCAT
U-238 18

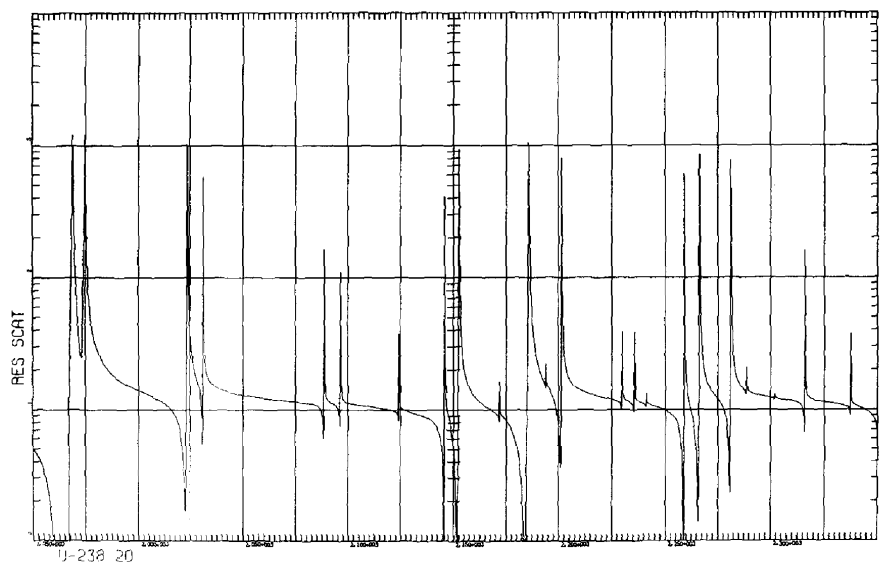

RES TOT
U-238 18

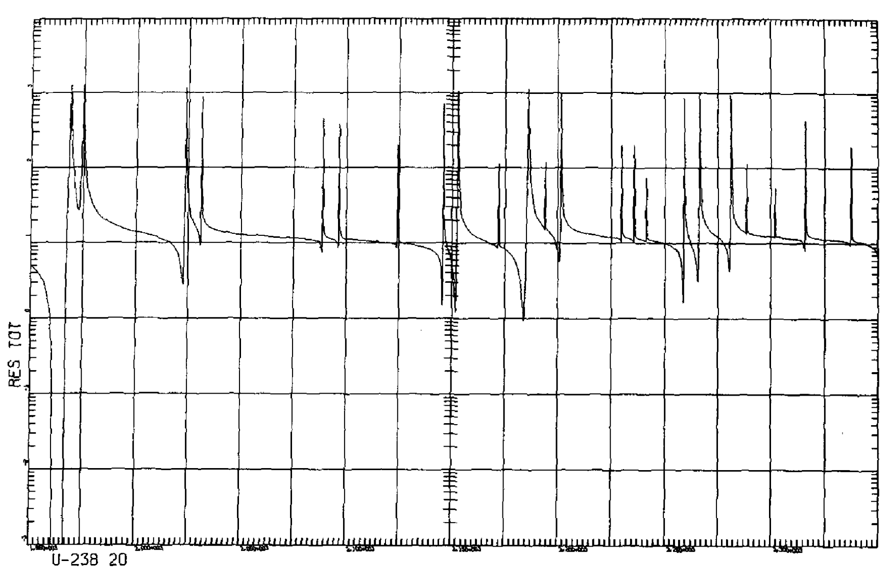

RES CAPT
U-238 19

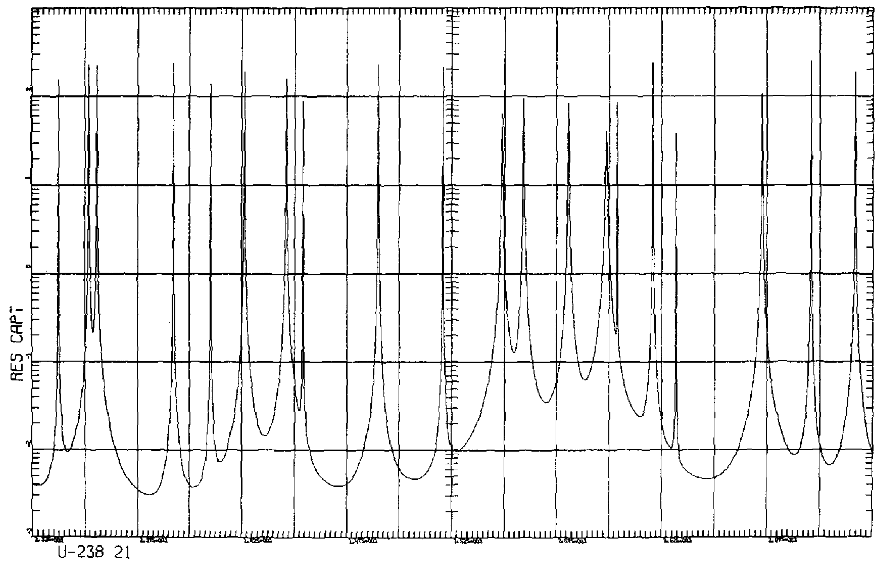

RES SCAT
U-238 19

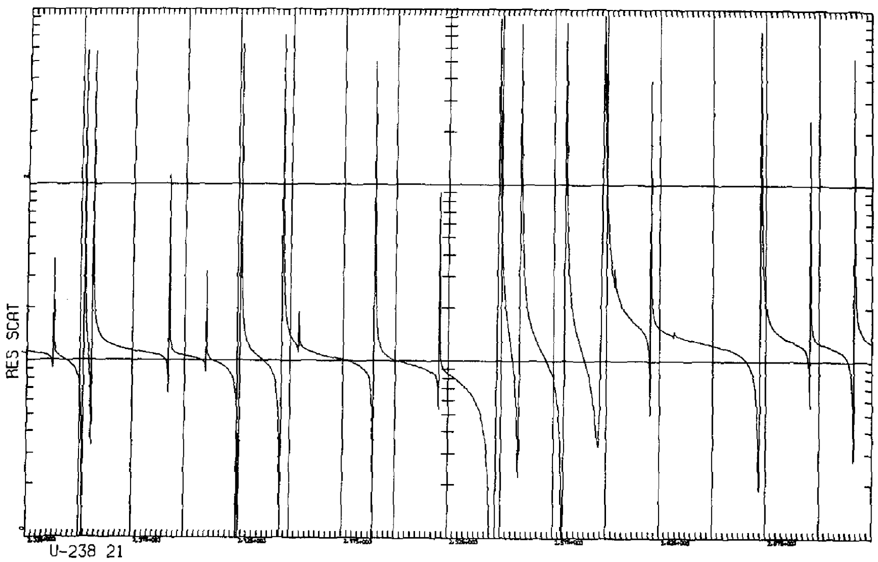

RES TOT
U-238 19

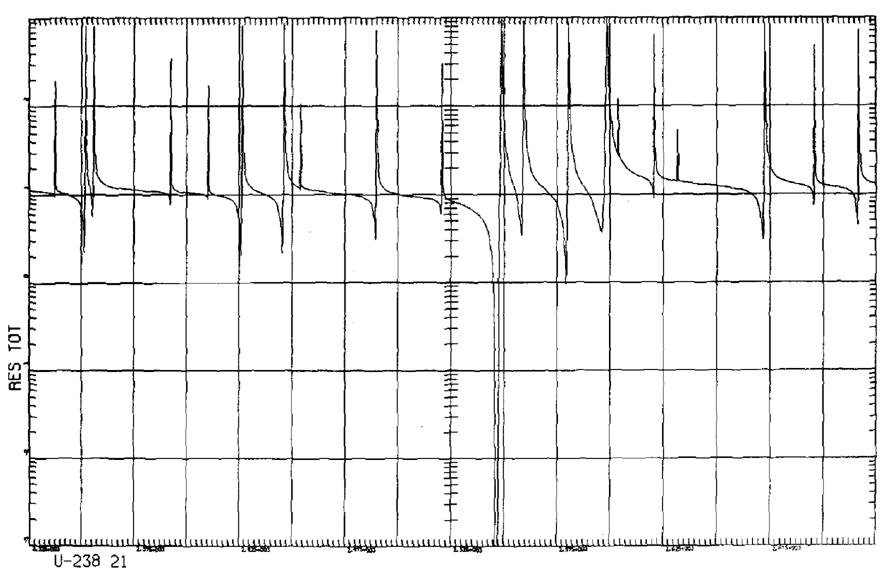

RES CAPT
U-238 20

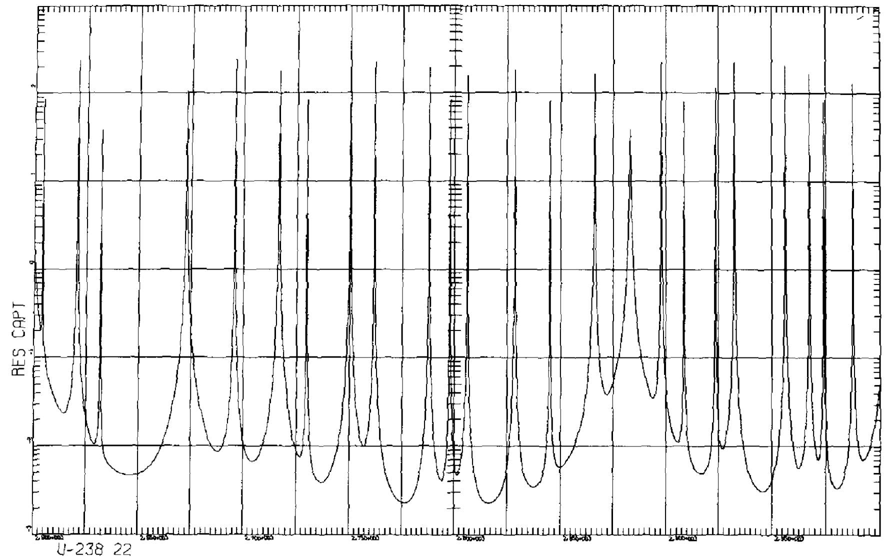

RES SCAT
U-238 20

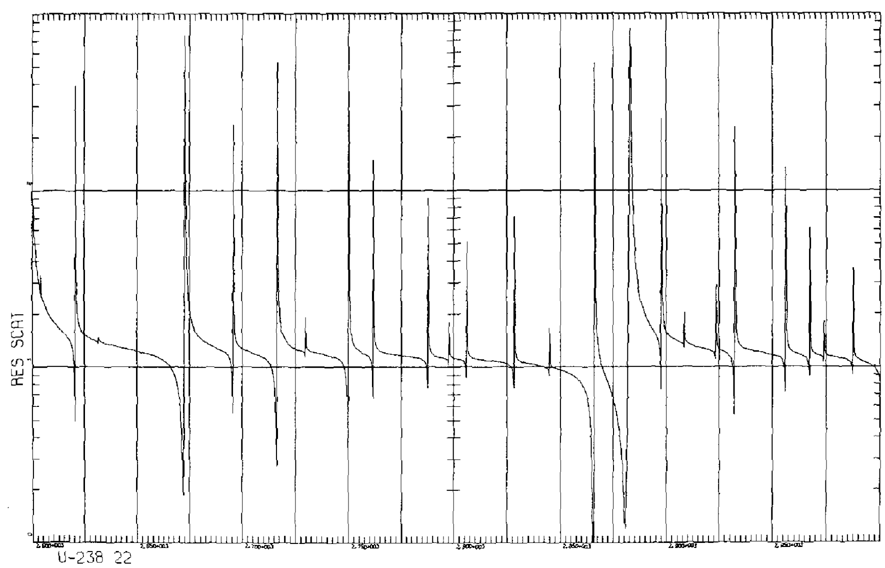

RES TOT
U-238 20

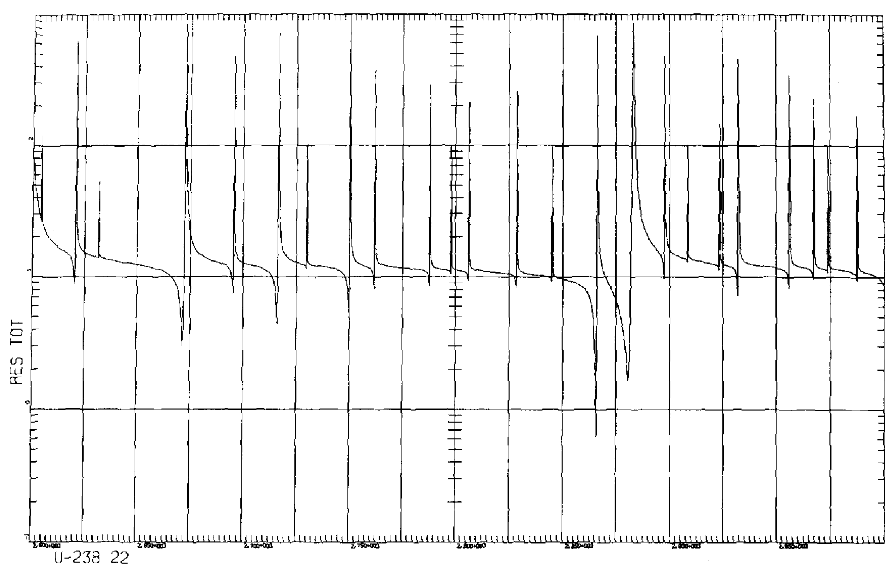

RES CAPT
U-238 21

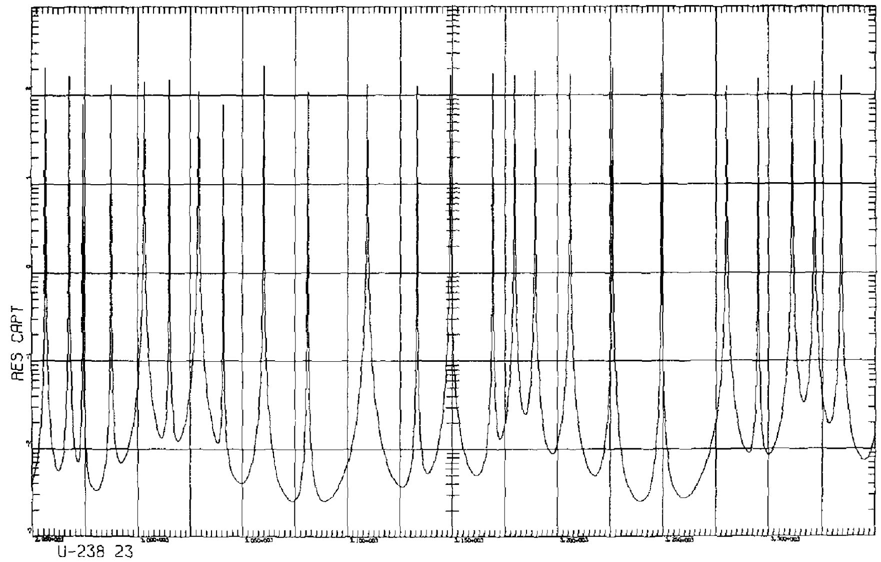

RES SCAT
U-238 21

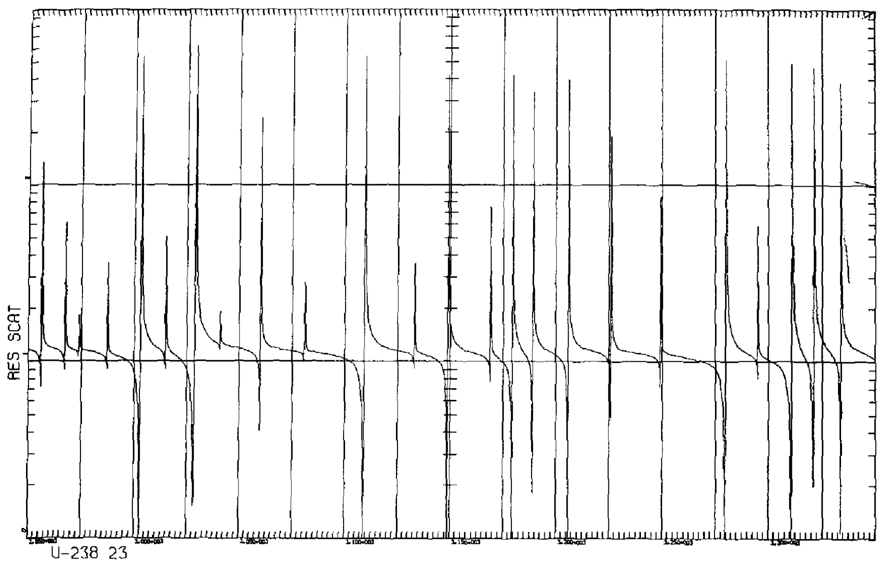

RES TOT
U-238 21

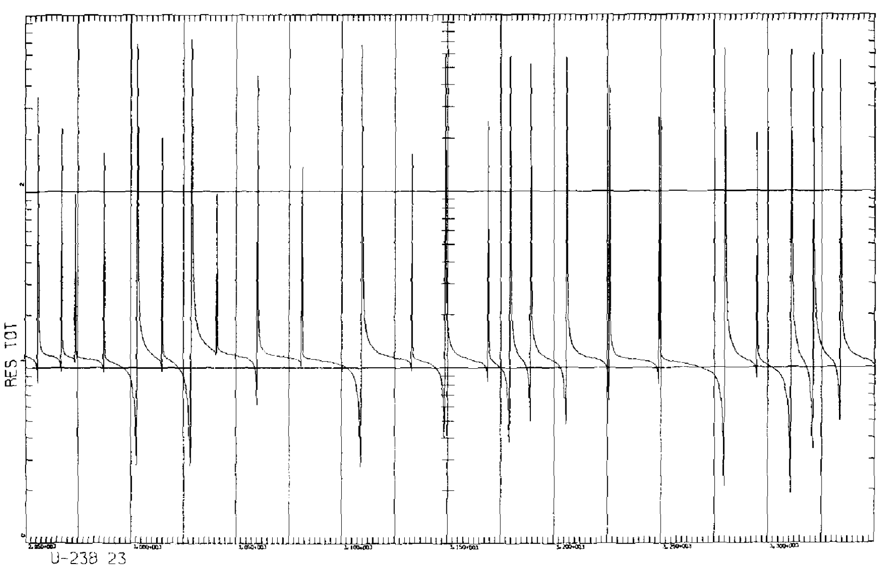

RES CAPT
U-238 22

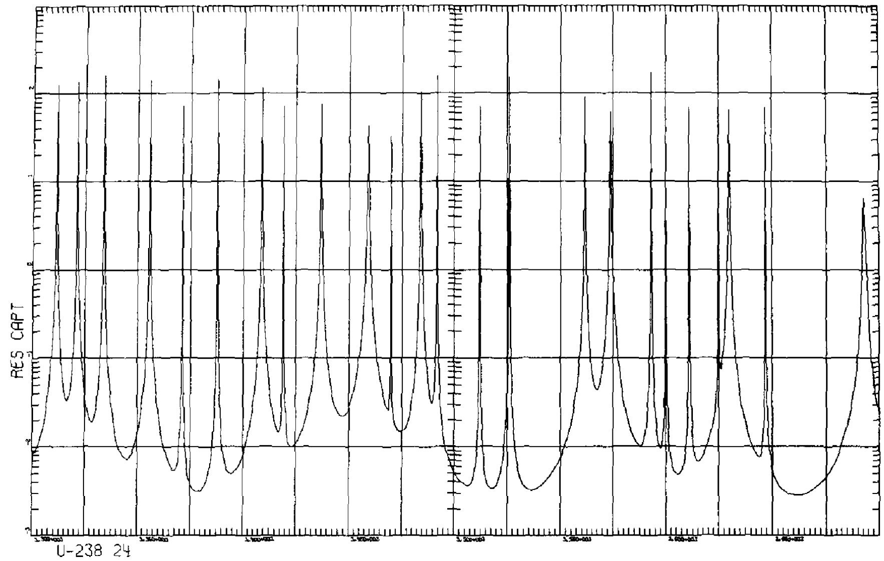

RES SCAT
U-238 22

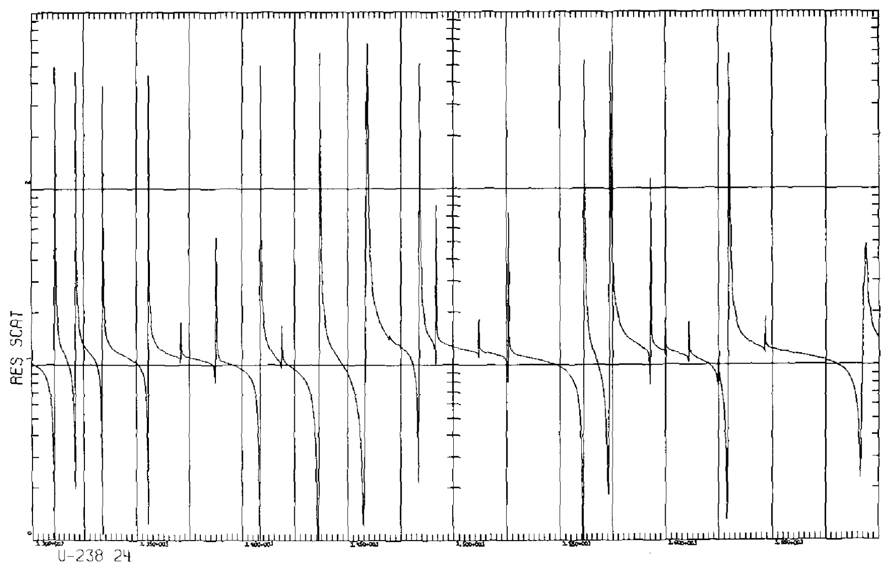

RES TOT
U-238 22

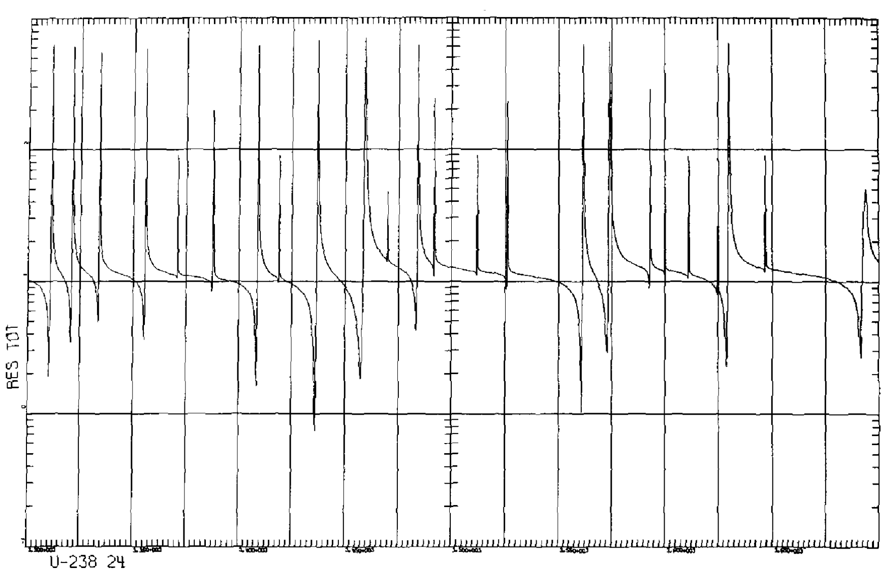

RES CAPT
U-238 23

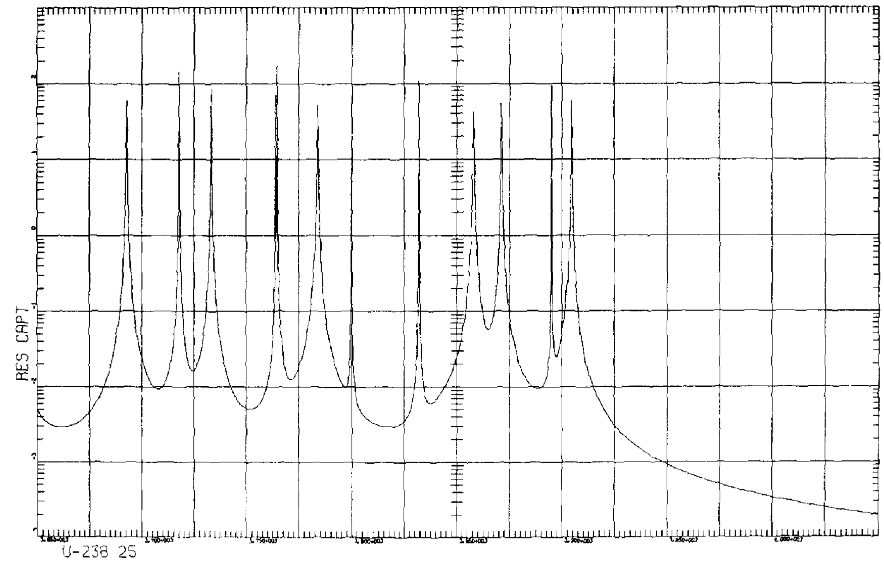

RES SCAT
U-238 23

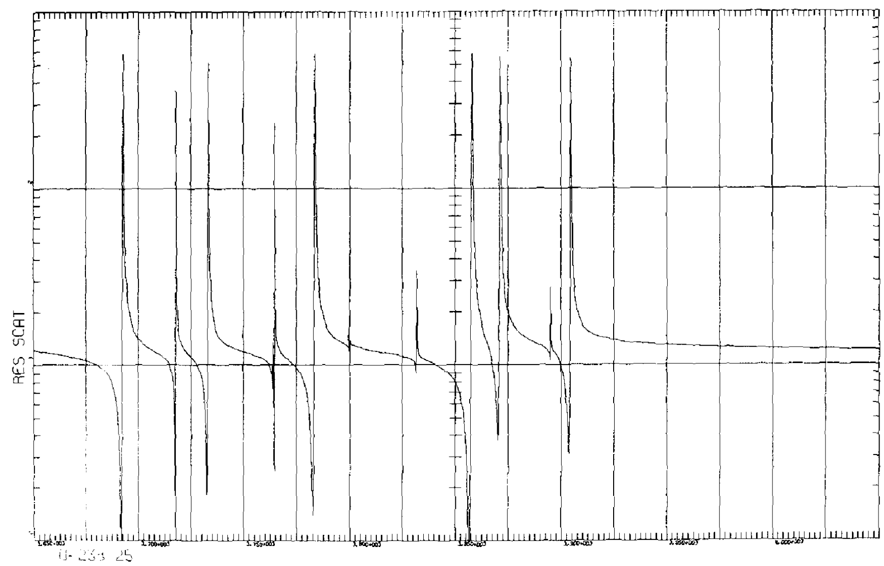

RES TOT
U-238 23

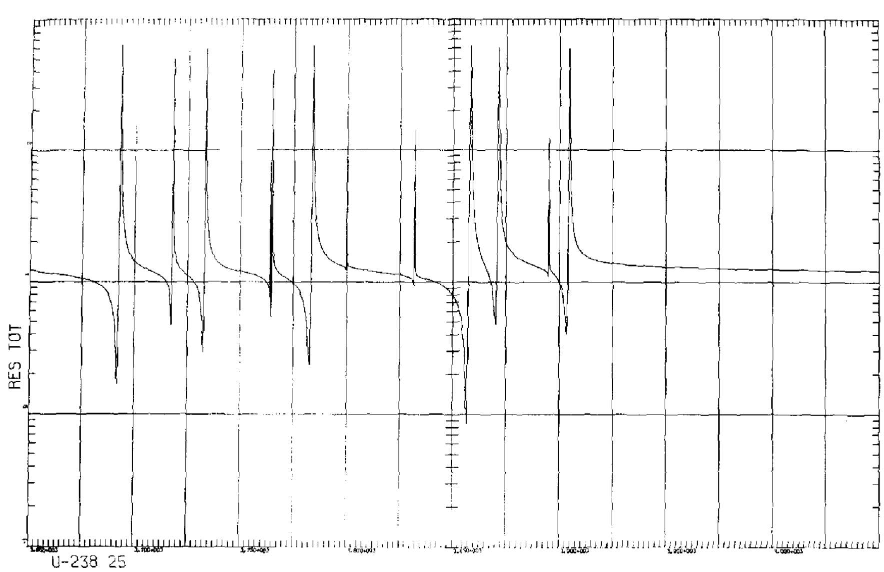

RES CAPT
U-238 24


RES SCAT
U-238 24


RES TOT
U-238 24


RES CAPT
U-238 25


RES SCAT


RES TOT
U-238 25

DISTRIBUTION

1. Brookhaven National Laboratory (500)
   Upton, L. I., New York 11973

   Attn: Dr. Sol Pearlstein

2. The Babcock & Wilcox Company (62)

   Barringer, HS
   Bingham, BE
   Central Files (20)
   Croft, MW
   Deuster, RW
   Engelder, TC
   Helholtz, J
   Holt, CD
   Hostetler, DR
   Howard, JO
   Jones, HM
   Judd, DF
   Library (2)
   Littrell, LW (2)
   Livolsi, AZ (5)
   Minner, DA
   Mumm, JF
   Neuhold, RJ
   Paulson, AE
   Pettus, WG
   Poor, HH/Alliance
   Probert, PB/Barberton
   Roy, DH (5)
   Schuler, TM
   Snidow, NL
   Travis, CC/TRG
   Webb, RA
   Wittkopf, WA (5)
   Wolfe, GE