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(Rev. 2)

PROGRAM WEIGHT: A FORTRAN IV PROGRAM FOR EVALUATION OF WEIGHTING
FUNCTIONS USED IN SMALL-ANGLE X-RAY SCATTERING

Robert W. Hendricks

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MARCH 1972

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PROGRAM WEIGHT: A FORTRAN IV PROGRAM FOR EVALUATION OF WEIGHTING
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ABSTRACT

A new FORTRAN IV program is presented which evaluates the weighting functions needed to correct observed small-angle x-ray scattering data for the smearing effects of the collimation system. Moments of the weighting functions about both the origin and the mean may also be computed. In the case of slit-lengths the effective weighting function is computed. CALCOMP plotting routines are included.

INTRODUCTION

A general equation for evaluating the slit-length and slit-width weighting functions which are necessary for correcting small-angle x-ray scattering data for the smearing effects of the collimation system was derived by Hendricks and Schmidt.¹ PROGRAM WEIGHT, a FORTRAN IV code for evaluating their result, was presented in its original form in September 1967 as ORNL-TM-1950, and in an improved version in November 1970 as ORNL-TM-1950 (Revision 1). Recently, Hendricks and Schmidt² have discussed some previously unrecognized limitations of the original weighting function equation and have presented a revised formulation.³ The new result, for slit widths, is

¹R. W. Hendricks and P. W. Schmidt, "Calculation of Weighting Functions for Collimation Corrections in Small-Angle X-Ray Scattering," Acta Phys. Austriaca 26, 97-122 (1967).

²R. W. Hendricks and P. W. Schmidt, "Comments on Calculation of Weighting Functions for Collimation Corrections in Small-Angle X-Ray Scattering," submitted to Acta Phys. Austriaca.

³Comparison of the original and revised formulations show the results to be identical if there is only one pair of slit edges between the sample plane and the detector plane ($n = 1$; see page 4). For this special case the previous versions of PROGRAM WEIGHT give the correct results. For those cases in which $n > 1$ the previous programs give erroneous results, the magnitude of the error being unpredictable but significant. Apart from the corrections introduced by the revised formulation, because of the improved efficiency of the present code it is recommended that current users interested only in the case $n = 1$ also convert to the new program.

$$W_w(u) = L_o L [A_w(L_o + L)]^{-1} \int_{x_a(u)}^{x_b(u)} dx e_w(x) \int_{z_a(x,u)}^{z_b(x,u)} dz f_w(z) . \quad (1)$$

The limits of integration are given by

$$\begin{aligned} z_b(x,u) &= \text{Min}(z_{2i-1}; z_{2j-1}) \\ z_a(x,u) &= \text{Max}(z_{2i}; z_{2j}) \end{aligned} \quad (2a)$$

in which

$$\begin{aligned} z_i &= \frac{-(L_o - d_i)(Lu + x) + (-1)^{i+1}(L + L_o)h_i}{L + d_i} \\ z_j &= -L_o u - \frac{(L_o + d_j)x + (-1)^j(L + L_o)h_j}{L - d_j} , \end{aligned} \quad (2b)$$

and

$$\begin{aligned} x_b(u) &= \text{Min}(x_{2i,2i'-1}; x_{2i,2j-1}; x_{2j',2j-1}; w_c) \\ x_a(u) &= \text{Max}(x_{2i-1,2i'}; x_{2i-1,2j}; x_{2j'-1,2j}; -w_c) \end{aligned} \quad (3a)$$

with

$$\begin{aligned} x_{ii'} &= \frac{-(d_i - d_{i'})u + (-1)^i h_i(L + d_{i'}) + (-1)^{i'+1} h_{i'}(L + d_i)}{d_i - d_{i'}} \\ x_{ij} &= \frac{-(L - d_j)d_i u + (-1)^i h_i(L - d_j) + (-1)^{j+1} h_j(L + d_i)}{d_i + d_j} \\ x_{j'j} &= \frac{(-1)^{j'} h_{j'}(L - d_j) + (-1)^{j+1} h_j(L - d_{j'})}{d_j - d_{j'}} . \end{aligned} \quad (3b)$$

The weighting function is nonzero only in the range

$$u_{aaa} \leq u \leq u_{bbb} \quad (4)$$

where

$$u_{bbb} = \text{Min}[u_{2i,2i'-1}(x_a); u_{2i,2j-1}(x_a); u_{2i,2i'-1,2k-1,2j}; \\ u_{2i,2j-1,2k-1,2\ell}] , \quad (5a)$$

$$u_{aaa} = \text{Max}[u_{2i-1,2i'}(x_b); u_{2i-1,2j}(x_b); u_{2i-1,2i',2k,2j-1}; \\ u_{2i-1,2j,2k,2\ell-1}] ,$$

$$u_{ii'} = -\frac{x}{L} + \frac{(-1)^i h_i(L + d_i) + (-1)^{i'+1} h_{i'}(L + d_i)}{L(d_i - d_{i'})} , \quad (5b)$$

$$u_{ij} = \frac{-x(d_i + d_j) + (-1)^i h_i(L - d_j) + (-1)^{j+1} h_j(L + d_i)}{d_i(L - d_j)} ,$$

$$u_{ii'kj} = \frac{d_k + d_j}{d_j(L + d_k)} \left\{ \frac{(-1)^i h_i(L + d_{i'}) + (-1)^{i'+1} h_{i'}(L + d_i)}{d_i - d_{i'}} \right. \\ \left. + \frac{(-1)^{k+1} h_k(L - d_j) + (-1)^j h_j(L + d_k)}{d_k + d_j} \right\} , \quad (5c)$$

$$u_{ijkl} = \frac{d_k + d_\ell}{A_{ijkl}} \{ (-1)^i h_i(L - d_j) + (-1)^{j+1} h_j(L + d_i) \} \\ + \frac{d_i + d_j}{A_{ijkl}} \{ (-1)^{k+1} h_k(L - d_\ell) + (-1)^\ell h_\ell(L + d_k) \} ,$$

$$A_{ijkl} = d_i(L - d_j)(d_k + d_\ell) - d_k(L - d_\ell)(d_i + d_j) > 0 , \quad (5d)$$

and

$$x_b = \text{Min}(x_{2j',2j-1}; w_c) \quad (5e)$$

$$x_a = \text{Max}(x_{2j'-1,2j}; w_c) .$$

In this derivation, the variables have the following meanings: L is the distance from the sample plane to the detector plane, L_0 is the distance from the sample plane to the tube plane, d_i is the distance from the sample plane to the i^{th} collimation edge between the sample plane and the tube plane, h_i is the distance from the i^{th} collimation edge to the camera axis, and d_j and h_j are similarly defined for edges between the sample plane and the detector plane (not including the slit at the detector). The width of the detector slit is $2w_c$, $e_w(x)$ describes the sensitivity of the detector in a direction parallel to the slit width, $f_w(z)$ describes the intensity of the focal spot in the direction of the slit-width, and A_w is a normalization constant which ensures that the area under the weighting function is unity. The weighting function for slit-lengths has the same form and can be evaluated from Eqs. (1) through (5) by making the appropriate changes in notation.¹ PROGRAM WEIGHT may be used to evaluate either type of weighting function without modification.

In the derivation, the subscripts i, j, k and ℓ took on all values in the ranges $1 \leq i \leq m$, $1 \leq j \leq n$, $1 \leq k \leq m$, and $1 \leq \ell \leq n$, respectively, subject to the conditions $i' \leq i$ and $j' < j$. Here m is the number of pairs of edges between the sample plane and the tube plane, while n is the number of pairs of edges between the sample plane and the detector plane. In that derivation it is not necessary that each member of a pair of edges be equidistant from the sample plane. This leads to the possibility that the denominator in the equations for $x_{ii'}$, $u_{ii'}$, and $u_{ii'kj}$ could be zero for some values of i and i' in their allowable range. For hand calculations, division by zero produces an infinity which is easily handled. However, for computer evaluation, such division must be avoided. Careful examination of the original derivation reveals that if the edges occur in pairs in which each member of the pair is equidistant from the sample plane⁴ the restriction on i and i' becomes $i' < i$. It is easily verified that under these conditions, the denominators in $x_{ii'}$, $u_{ii'}$ and $u_{ii'kj}$ can never be zero.

⁴This condition in no way implies that the computation applies only to camera geometries which have real edges which occur in pairs equidistant from the sample. If, as in the Kratky camera, a real edge exists only on one side of the reference line, a dummy edge which is a large distance from the reference line is inserted on the other side of the reference line at the same distance from the sample plane. Such a dummy edge in no way alters the physical situation, but it does meet the mathematical requirements of the equations, and simplifies the computational procedure.

The slit-width collimation correction procedures outlined by Kratky, Porod, and Skala,⁵ and Sauder,⁶ require only knowledge of the k^{th} moment of the weighting function about either the origin or the mean. These moments are readily computed from the relationships

$$M_k = \int_{u_{aaa}}^{u_{bbb}} u^k W_w(u) du$$

and

(6)

$$M_k(\bar{u}) = \int_{u_{aaa}}^{u_{bbb}} (u - \bar{u})^k W_w(u) du$$

In the case of the slit-length weighting function, the integral equation relating the weighting function $W_\ell(u)$, the observed intensity $I(\epsilon)$, and the slit-smeared intensity $F(\epsilon)$ is¹

$$F(\epsilon) = \int_{-\infty}^{\infty} W_\ell(u) I(\sqrt{\epsilon^2 + u^2}) du \quad (7)$$

However, most collimation correction procedures have zero as the lower limit of integration. If $W_\ell(u)$ is not an even function, Eq. (7) may still be cast into the more familiar form by defining an effective slit-length weighting function $W_\ell^{\text{eff}}(u)$. Then

$$F(\epsilon) = 2 \int_0^{\infty} W_\ell^{\text{eff}}(u) I(\sqrt{\epsilon^2 + u^2}) du \quad (8)$$

where

$$W_\ell^{\text{eff}}(u) = [W_\ell(u) + W_\ell(-u)]/2 \quad (9)$$

In the case of a slit-width weighting function the minimum angle to which data can be taken may be shown to be u_{bbb} .⁷ The effects of parasitic

⁵O. Kratky, G. Porod, and Z. Skala, Acta Phys. Austriaca 13, 96 (1960).

⁶W. C. Sauder, J. Appl. Phys. 37, 1495 (1966).

⁷L. B. Shaffer and R. W. Hendricks, "Optimization of Small-Angle Collimation Systems: I. The Kratky Camera," submitted to J. Appl. Cryst.

scattering may or may not be included in this value depending on the particular geometry under consideration. In the case of a slit-length weighting function the maximum angle to which the "infinite beam" approximation is valid is the angle at which the weighting function ceases to be a constant.⁷

The practical evaluation of Eqs. (1) and (6) is tedious except for geometries having a high degree of symmetry. However, they are ideally suited to computer evaluation. This report describes a new FORTRAN IV program which may be used to calculate the weighting function, its moments, and the minimum or maximum angle for small-angle x-ray cameras having a variety of geometries. If the computations are for a slit-length weighting function, the effective slit-length weighting function [Eq. (9)] may also be computed. The reader is referred to the original derivation¹ for a complete discussion of the approximations which limits the validity of the application of Eq. (1) and hence the usefulness of this program.

PROGRAM DESCRIPTION

The object of the program, for which a listing is given in Appendix A, is to evaluate the double integral described by Eq. (1). The integrations are performed by using Simpson's rule for evenly spaced intervals. However, the major portion of the program deals with the calculation of the limits of the integration from Eqs. (2) through (5). Appendix B is a flow chart which explains the operation of the program. Selected program variables are defined in Appendix C, while a complete listing of all variable names used in each subroutine as prepared by FORTDOC⁸ is given in Appendix A. In addition, Appendix A contains a complete input-output table for each subroutine which performs an input-output operation.

Before starting the main portion of the program, a short data format check is performed in loops 1 and 2 to ensure that the input data corresponds to pairs of edges, each member of which is equidistant from the sample plane. If this criterion is not met, an error message is presented in the output, and the computations are terminated.

⁸R. C. Durfee, private communication, July 1968.

The first computations are those of x_a and x_b [Eqs. (5e)]. The values of $x_{j,j}$ [Eqs. (3b)] are computed in loops 3 and 4, and are compared with $\pm w_c$ in SUBMIN and SUBMAX. The results, x_a and x_b , are stored in WM and WC, respectively.

Using Eqs. (4) and (5), the limits of integration u_{aaa} and u_{bbb} are computed. The values of u_{ii} and u_{ij} [Eqs. (5b)] are evaluated at x_a and x_b [Eqs. (5e)] in loops 5 and 6 or loops 7 and 8 respectively, while the values of $u_{ii'kj}$ and $u_{ijk\ell}$ [Eqs. (5c)] are evaluated in loops 9 through 12 or loops 13 through 16, respectively. The results are compared in two sequential calls to SUBMIN and SUBMAX. Then the u increment is calculated as $(u_{bbb} - u_{aaa}) / (NU - 1)$. The initial value of u is set equal to the lower limit, and each successive u up to the upper limit is calculated from the relationship $u_\ell = u_{aaa} + (\ell - 1) \cdot u_{incr}$, where $1 \leq \ell \leq NU$.

In essence, the remainder of the program consists of a series of nested loops. The outside loop (loop 17) calculates the u value. For each value of u , a pair of x limits is calculated in two pairs of inner loops. Loops 18 and 19 find $x_{ii}(u_\ell)$ while loops 20 and 21 find $x_{ij}(u_\ell)$. Values of $x_a(u_\ell)$ and $x_b(u_\ell)$ are found in SUBMAX and SUBMIN and the x values are incremented between these limits in the same manner as for u . In order to provide the same degree of accuracy in all of the integrations, the number of x increments (and z increments, to be described below) is the same as the number of u increments (NU). In turn, for each value of u and x a pair of z limits is calculated in loops 23 and 24. The value of z is incremented as before in loop 22, and the function $f_w(z)$ is integrated between these limits. If $f_w(z)$ is not a constant, the appropriate value is found from tabulated input data. It is readily seen that if a value of $f_w(z)$ is to be found for each value of z used in the program, $(NU)^3$ interpolations must be made, while $(NU)^2$ interpolations would be made to find the necessary values of $e_w(x)$. Since NU is of the order of 10^2 , this leads to an unreasonable number of interpolations and excessive machine time. In order to reduce this problem, an alternative procedure has been followed. Immediately upon reading in the $f_w(z)$ data,

an N point Lagrangian interpolation procedure^{9,10} generates a table consisting of $10*(NU - 1)$ equispaced values of $f_w(z)$ and z . (The number of points N used in the interpolation is chosen by the user.) Then a table called ZINT(I) is generated which contains a Simpson's Rule integration of $f_w(z)$ from $I = 1$ to $I = I$. With reference to Fig. 1, we find the integral

$$ZANS(MM) = \int_{z_a(x,u)}^{z_b(x,u)} f_w(z) dz \quad (10)$$

may be approximated by

$$ZANS(MM) = ZINT(INTT - 1) - ZINT(INTB) + AREAB + AREAT. \quad (11)$$

The areas AREAB and AREAT are found assuming $f_w(z)$ may be approximated by a straight line from $FWZ(I)$ to $FWZ(I + 1)$.

⁹F. B. Hildebrande, Introduction to Numerical Analysis, p. 60, McGraw-Hill, New York, 1956.

¹⁰W. E. Milne, Numerical Calculus, Princeton University Press, Princeton, New Jersey, 1949.

Fig. 1. Schematic Drawing Showing Method for Performing the z -Integrations.

Experience with the calculation of weighting functions which have a nonfully illuminated entrance slit has shown that if the number of points in the nonzero range of $f_w(z)$ falls below about 100, errors of a few percent will occur in the z -integrations.

After the integrations have been performed, the corresponding x integral is evaluated. Here, it is not practical to attempt to reduce the number of interpolations in the $e_w(x)$ table in the same manner as for $f_w(z)$. Hence, for each value of ZANS(MM), a value of EWX(MM) is interpolated, and their product XINT(MM) = EWX(MM)*ZANS(MM) becomes the integrand. [As with the $f_w(z)$ interpolation, the number of points used in the $e_w(x)$ interpolation is chosen by the user.] The values from the x integrations are the unnormalized values of $W_w(u)$. An integration of these values in loop 25 gives the normalization constant. The final values of $W_w(u)$ are obtained by dividing the unnormalized values by this constant. The computation of the various moments is a straightforward integration of the weighting function multiplied by the appropriate factor as indicated by Eq. (6). The final results may be plotted on the CALCOMP plotters using the plotting package EZPLOT.¹¹

It is important to point out that the manner in which the quantities x_{ii} , x_{ij} , z_i and z_j are computed (as well as the variables used to evaluate u_{aaa} and u_{bbb}) has been significantly improved in the present version of PROGRAM WEIGHT, with an attendant decrease in the computation time for each weighting function (see next section).

DETAILED OPERATING INSTRUCTIONS

The program requires up to 49 input constants and, if $e_w(x)$ and $f_w(z)$ are not constant, two input tables. Each input variable is defined in Appendix D and its format is described in Table D.1. Although the appendix is self-explanatory, a few general remarks are in order.

Experience has shown that for greatest accuracy in the integration, the number of points for which the integration is performed (NU) should

¹¹EZPLOT is a general purpose plotting package written for the most part in FORTRAN IV. However, one subroutine is written in Assembly Language. A punched deck and instructions are available from the author.

exceed 100. Comparison of computed results in which $NU = 101$ with an analytic evaluation of Eq. (1) for a very simple geometry shows that integration errors are less than 0.001%.

The program computation time is critically dependent on (i) the value of NU , and (ii) whether $e_w(x)$ and $f_w(z)$ are constant or are interpolated. It is readily seen that, including the computations necessary for normalization, the running time is roughly proportional to $(NU)^3$. Hence, increasing NU by a factor of 2, increases the running time eightfold. Typical running times on the IBM 360 computers are shown in Table 1. A comparison of the running times of the present version (Version IV) and the previous release (Version II) shows that, even though more variables must be evaluated, the machine time has been decreased by about a factor of three. This improvement is due solely to the more efficient coding, especially that inside loops 18 and 19, 20 and 21, 23, and 24. Note also that if the extended error analysis output is requested, an additional 10 CPU seconds is required. It is interesting to note the improvement in running time by a factor of about 800 from the 7090 days to the present, and the improvement by a factor of about 160 over the 360/50. These improvements reflect not only the increased machine speeds, but also improvements in the code optimization produced by the FORTRAN IV compilers, and the revised coding.

The printed output consists of the input data, including the values of z , $f_w(z)$, x , and $e_w(x)$ if they were given: the normalization factor; the u values and corresponding $W_w(u)$ values; and the moments of the function, if they were calculated. Punched output, if requested, contains NU , A_w , u and $W_w(u)$ values. Three examples are listed in Appendix E, along with the CALCOMP plotted results.

ACKNOWLEDGEMENTS

The present program, although almost totally revised from the previous versions, is based on the concepts developed by Miss Mary G. Buchanan in those early versions.

Table 1. Running Times of Program Weight for NU = 101

Version	Date	Machine	Input		Output		Time per Weighting Function
			$f_w(z)$	$e_w(x)$	Min	Max	
I	1967	IBM/7090	No	No	✓		≈ 20 min
I	1967	IBM 360/50	No	No	✓		4 min
I	1967	IBM 360/50	Yes	No	✓		17 min
I	1967	IBM 360/50	Yes	Yes	✓		22 min
II	1970	IBM 360/75	No	No	✓		20 sec
II	1970	IBM 360/75	Yes	No	✓		150 sec
II	1970	IBM 360/75	Yes	Yes	✓		250 sec
II	1970	IBM 360/91	No	No	✓		4 sec
II	1970	IBM 360/91	Yes	No	✓		30 sec
II	1970	IBM 360/91	Yes	Yes	✓		50 sec
III	1971	Program not released					
IV	1972	IBM 360/91	No	No	✓		1.4 sec
IV	1972	IBM 360/91	No	No		✓	12 sec
IV	1972	IBM 360/91	Yes	No	✓		33 sec
IV	1972	IBM 360/91	Yes	Yes	✓		48 sec

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APPENDIX A
PROGRAM WEIGHT FORTRAN IV LISTING

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DIPENSION AANS(202), APLMTZ(5000), EWX(1001), FWZ(1001),	1500
1G(8), H(8), SD(8), SIMPX(1001), SIMPY(1001), TD(8), UDTF(202), UA(96),	151
2UAC(256), UB(96), UBB(256), UEE(6), UIE(16), UIO(16), UL(202), ULL(2),	152
3UOC(6), USTORE(202), UUL(2), UVAL(202), WC(1), WCE(8), WCO(8), WM(1),	153
4WL(202), WHU(202), WHUP(202), XANS(202), XAU(202), XBU(202), XTE(16),	154
5XINT(1001), XIO(16), XMAXD(1), XMIND(1), XRAY(1001), XVAL(50), XWX(50),	155
6XXE(6), XXG(6), ZANS(202), ZAU(202), ZBU(202), ZIE(4), ZINT(1001),	156
7ZIC(4), ZJF(4), ZJO(4), ZVAL(50), ZWZ(50)	157
REAL*8 BCD(4)	160
DATA BCD/ZE62FE62FE4DE45D40,ZE62F032E4DE45D40,Z40C5C6C6C5C3E3C9,	170
1 ZE5C5404040404040/	171
LOGICAL*1 TITLE(80)	180
DATA BLANK/ZFFFFFFFFFF/	190
DATA BLNK/Z40/	200
WRITE(6,8000)	210
8000 FORMAT(1H1,//////////)	220
120X,'*****'	221
220X,'*	222
320X,'* VERSION FOUR OF	223
420X,'* PROGRAM WEIGHT	224
520X,'* *	225
620X,'* NOW STANDARD	226
720X,'* ON THE	227
820X,'* ORNL COMPUTERS	228
920X,'* *	229
920X,'* SEE CRNL-TM-1950	229
920X,'* (REVISION 2)	229
920X,'*****'	229
5 FIRSTM=0.	230
SECND=BLANK	240
THIRD=BLANK	250
FRSTM=BLANK	260
SCNDMM=BLANK	270
THRDM=BLANK	280
IUAAA=0	290
CALL TIMER(0)	300
DO 10 J=1,80	310
10 TITLE(I)=BLNK	320
READ(5,8005,CND=600) TITLE	330
8005 FORMAT(1H1)	340
READ(5,8010) M,N,NU,KK,JJ,IOUT,IFZ,TEX,NUMZ,NUMX,KOUT,IPLDT,ILNGTH	350
8010 FORMAT(13I5)	360
ITWGNU=10*(NU-1)	370
TWCNU=ITWGNU	380
ITCHV=ITWGNU*1	390
DO 15 K=1,8	400
SD(K)=BLANK	410
TD(K)=BLANK	420
H(K)=BLANK	430
G(K)=BLANK	440
15 CONTINUE	450
M2=2*M	460
N2=2*N	470
READ(5,8015)EL,ELO,WCE(1)	480
WCE(1)=WCE(1)	490
8015 FORMAT(7F10.4)	500
READ(5,8020) (SD(I),I=1,M2)	510
READ(5,8020) (H(I),I=1,M)	520
READ(5,8020) (TD(I),I=1,N2)	530
READ(5,8020) (G(I),I=1,N2)	540
8020 FORMAT(8F10.3)	550
C	560
C... TEST H AND N	570
C	580
IF(M.LE.4) GO TO 20	590
WRITE(6,8025)	600
8025 FORMAT(1H1,20X,'TOO MANY EDGES BETWEEN FOCAL SPOT AND SAMPLE'//)	610
M=4	620
M2=8	630
20 IF(N.LE.4) GO TO 25	640
WRITE(6,8030)	650
8030 FORMAT(1H1,20X,'TOO MANY EDGES BETWEEN SAMPLE AND DETECTOR'//)	660
N=4	670
N2=8	680
C	690
C... SET UP FWZ ARRAY	700
C	710
25 IF(IFZ)30,60,30	720
30 READ(5,8035) (ZVAL(I),ZWZ(I),I=1,NUMZ)	730
8035 FORMAT(8F10.3)	740
ZINCR=(ZVAL(NUMZ)-ZVAL(1))/TWONU	750
SIMPZ(1)=ZVAL(1)	760
DO 35 LA=2,ITONU	770
35 SIMPZ(LA)=SIMPZ(LA-1)+ZINCR	780
DO 55 LA=1,ITONU	790
DO 45 LO=1,NUMZ	800

```

L L      1 IF(SIMPZ(LA)-ZVAL(LO))50,40,45      810
L L      40 FWZ(LA)=ZWZ(LO)                    820
L L      GO TO 55                              830
L L----- 45 CONTINUE                        840
L L      50 FWZ(LA)=YLAG(SIMPZ(LA),ZVAL,ZWZ,0,IFZ,NUMZ,IEC) 850
L L----- 55 CONTINUE                        860
L L      CALL SIMP(SIMPZ,FWZ,ZINT,ITONU)        870
C      880
C....SET UP EWX ARRAY                        890
C      900
L L      60 IF(IEIX)65,95,65                  910
L L      65 READ(5,8035)(XVAL(I),XWX(I),I=1,NUMX) 920
L L      XINCR=(XVAL(NUMX)-XVAL(1))/TWNUN      930
L L      SIMPX(1)=XVAL(1)                     940
L L----- DO 70 LB=2,ITONU                    950
L L----- 70 SIMPX(LB)=SIMPX(LB-1)+XINCR      960
L L----- DO 90 LB=1,ITONU                    970
L L      980
L L----- DO 80 LP=1,NUMX                      990
L L      IF(SIMPX(LB)-XVAL(LP))85,75,80       1000
L L      75 EWX(LB)=XWX(LP)                   1010
L L      GO TO 90                             1020
L L----- 80 CONTINUE                         1030
L L      85 EWX(LB)=YLAG(SIMPX(LB),XVAL,XWX,0,IEIX,NUMX,IEC) 1040
L L----- 90 CONTINUE                         1050
C.... LOOP ONE                             1060
C.... 1070
C.... 95 IFLAG=0                             1080
L L----- DO 100 I=1,M                       1090
L L      NDX=2*I                             1100
L L      MDX=NDX-1                           1110
L L----- C                                  1120
L L      C.... CHECK TO SEE THAT THE SD ARRAY CONTAINS PAIRS OF EDGES EQUIDISTANT 1130
L L      C.... FROM THE SAMPLE PLANE TO THE I-TH EDGE, I=1,2,...,2*M 1140
L L      C                                  1150
L L      IF(SD(NDX).EQ.SD(NDX-1))GO TO 100    1160
L L      IFLAG=1                             1170
L L      WRITE(6,8040)                       1180
L L      8040 FORMAT(1H1,3X,8HSD ARRAY//)     1190
L L      WRITE(6,8045)MDX,SD(MDX),NDX,SD(NDX) 1200
L L      8045 FORMAT(1H ,3HSD(,I3,3H)= ,F10.5,10H*****ERROR/ 1210
L L      13HSD(,I3,3H)= ,F10.5,10H*****ERROR) 1211
L L----- 100 CONTINUE                       1220
L L      C                                  1230
L L      C.... END LOOP ONE                   1240
L L      C                                  1250
L L      C.... START LOOP TWO                 1260
L L      C                                  1270
L L----- DO 105 I=1,N                       1280
L L      NDX=2*I                             1290
L L      MDX=NDX-1                           1300
L L----- C                                  1310
L L      C.... CHECK TO SEE THAT THE TD ARRAY CONTAINS PAIRS OF EDGES EQUIDISTANT 1320
L L      C.... THE SAMPLE PLANE TO THE J-TH EDGE, J=1,2,...,2*N 1330
L L      C                                  1340
L L      IF(TD(NDX).EQ.TD(MDX))GO TO 105      1350
L L      IFLAG=1                             1360
L L      WRITE(6,8050)                       1370
L L      8050 FORMAT(1H1,3X,8HTD ARRAY//)     1380
L L      WRITE(6,8055)MDX,TD(MDX),NDX,TD(NDX) 1390
L L      8055 FORMAT(1H ,3HTD(,I3,3H)= ,F10.5,10H*****ERROR/1H , 1400
L L      13HTD(,I3,3H)= ,F10.5,10H*****ERROR) 1410
L L----- 105 CONTINUE                       1411
L L      C                                  1420
L L      C.... END LOOP TWO                   1430
L L      C                                  1440
L L      C.... WERE ERRORS DISCOVERED IN THE SD AND/OR TD ARRAYS 1450
L L      C.... IF YES, PROCESS THE NEXT CASE 1460
L L      C.... IF(IFLAG.EQ.1) GO TO 5         1470
L L      C                                  1480
L L      C.... CALCULATE ALLOWABLE RANGE OF X VALUES 1490
L L      C.... START LOOP THREE              1500
L L      C                                  1510
L L      C                                  1520
L L      JO=1                                1530
L L----- DO 115 L=1,N                       1540
L L      LEVN=2*L                            1550
L L      LODD=LEVN-1                         1560
L L      DO 110 J=1,N                        1570
L L      IF(J .GE. L) GO TO 115              1580
L L      JO=JO+1                             1590
L L      JEVN=2*J                            1600
L L      JODD=JEVN-1                         1610
L L      WCO(JO)=-(G(LEVN)*(EL-TD(JODD))+G(JODD)*(EL-TD(LEVN)))/ 1620
L L      1 (TD(LEVN)-TD(JODD))               1621
L L      WCE(JC)=-(G(LODD)*(EL-TD(JEVN))+G(JEVN)*(EL-TD(LODD)))/ 1630
L L      1 (TD(LODD)-TD(JEVN))               1631
L L----- 110 CONTINUE                       1640
L L----- 115 CONTINUE                       1650
L L      C.... END LOOP THREE                1660
L L      C                                  1670
L L      CALL SUBMAX(WCC,WCO,XMIN,JO,0)       1680
L L      CALL SUBMIN(WCE,WCE,XMAX,JO,0)       1690
L L      WM(1)=XMIN                          1700
L L      WC(1)=XMAX                          1710
L L      C                                  1720
L L      C.... CALCULATE U(I,IPRIME) AND U(I,J) 1730
L L      C.... START LOOP FIVE              1740
L L      C                                  1750
L L      NUMI=0                              1760

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I----- DO 120 I=1,M 1770
I
I----- DO 120 IP=1,M 1780
I I IF(I.LE.IP) GO TO 120 1790
I I NUMI=NUMI+1 1800
I I LIE=2*I 1810
I I LIO=LIE-1 1820
I I LPE=2*IP 1830
I I LPO=LPE-1 1840
I I UEE(NUMI)=-WM(1)/EL+((EL+SD(LPO))*H(LIE)+(EL+SD(LIE))*H(LPO))/ 1850
I I 1 (EL*(SD(LIE)-SD(LPO))) 1851
I I UOO(NUMI)=-WC(1)/EL-((EL+SD(LPE))*H(LIO)+(EL+SD(LIN))*H(LPE))/ 1860
I I 1 (EL*(SD(LIO)-SD(LPE))) 1861
I I----- 120 CONTINUE 1870
I C 1880
I C... END LOOP FIVE 1890
I C... START LOOP SEVEN 1900
I C 1910
I NUMA=0 1920
I DO 125 I=1,M 1930
I
I----- DO 125 J=1,N 1940
I J NUMA=NUMA+1 1950
I J ICVN=2*I 1960
I J IODD=IEVN-1 1970
I J JEVN=2*J 1980
I J JODD=JEVN-1 1990
I J C1=SD(IODD)*(EL-TD(JEVN)) 2000
I J C2=SD(IEVN)*(EL-TD(JODD)) 2010
I J UOQ(NUMA)=-WC(1)*(SD(IODD)+TD(JEVN))/C1 - H(IODD)/SD(IODD) - 2020
I J 1 (EL*SD(IODD))*C(JEVN)/C1 2021
I J UIE(NUMA)=-WM(1)*(SD(IEVN)+TD(JODD))/C2 + H(IEVN)/SD(IEVN) + 2030
I J----- 125 1 (EL+SD(IEVN))*G(JODD)/C2 2031
I C 2040
I C... END LOOP SEVEN 2050
I C 2060
I C... CALCULATE U(I,IPRIME,K,J) AND U(I,J,K,L) 2070
I C... START LOOP NINE 2080
I C 2090
I NUMIJK=0 2100
I DO 135 I=1,M 2110
I I EVN=2*I 2120
I I IODD=IEVN-1 2130
I I DO 130 IP=1,M 2140
I I I IF(I.LE.IP) GO TO 135 2150
I I I IPEVN=2*IP 2160
I I I IPODD=IPEVN-1 2170
I I I CA=- (H(IODD)*(EL+SD(IPEVN))+H(IPEVN)*(EL+SD(IODD)))/ 2180
I I I 1 (SD(IODD)-SD(IPEVN)) 2190
I I I CB= (H(IEVN)*(EL+SD(IPODD))+H(IPODD)*(EL+SD(IEVN)))/ 2191
I I I 1 (SD(IEVN)-SD(IPODD)) 2200
I I I DO 130 K=1,M 2210
I I I KEVN=2*K 2220
I I I KODD=KEVN-1 2230
I I I K J----- DO 130 J=1,N 2240
I I I K J JEVN=2*J 2250
I I I K J JODD=JEVN-1 2260
I I I K J NUMIJK=NUMIJK+1 2270
I I I K J CAA=- (H(KEVN)*(EL-TD(JODD))+G(JODD)*(EL+SD(KEVN))) 2280
I I I K J CBB= (H(KODD)*(EL-TD(JEVN))+G(JEVN)*(EL+SD(KODD))) 2290
I I I K J C1=SD(KEVN)+TD(JODD) 2300
I I I K J C2=1./ (TD(JODD)*(EL+SD(KEVN))) 2310
I I I K J C3=SD(KODD)+TD(JEVN) 2320
I I I K J C4=1./ (TD(JEVN)*(EL+SD(KODD))) 2330
I I I K J UA(NUMIJK)=C1*C2*CA+C2*CAA 2340
I I I K J UB(NUMIJK)=C3*C4*CB+C4*CBB 2350
I I I----- 130 CONTINUE 2360
I I----- 135 CONTINUE 2370
I C 2380
I C... END LOOP NINE 2390
I C... START LOOP THIRTEEN 2400
I C 2410
I NUMIKL=0 2420
I DO 155 I=1,M 2430
I I EVN=2*I 2440
I I IODD=IEVN-1 2450
I I DO 155 J=1,N 2460
I I JEVN=2*J 2470
I I JODD=JEVN-1 2480
I I CA=- (H(IODD)*(EL-TD(JEVN))+G(JEVN)*(EL+SD(IODD))) 2490
I I CB= (H(IEVN)*(EL-TD(JODD))+G(JODD)*(EL+SD(IEVN))) 2500
I I C1=SD(IODD)+TD(JEVN) 2510
I I C2=SD(IEVN)+TD(JODD) 2520
I I J K----- DO 155 K=1,M 2530
I I J K KEVN=2*K 2540
I I J K KODD=KEVN-1 2550
I I J K L----- DO 155 L=1,N 2560
I I J K L LEVN=2*L 2570
I I J K L LPODD=LEVN-1 2580
I I J K L NUMJKL=NUMJKL+1 2590
I I J K L C3=SD(KEVN)+TD(LPODD) 2600
I I J K L C4=SD(KODD)+TD(LEVN) 2610
I I J K L AIJKLB=SD(IEVN)*(EL-TD(JODD))*C4-SD(KODD)*(EL-TD(LEVN))*C2 2620
I I J K L IF(AIJKLB.LE.0.) GO TO 140 2630
I I J K L CBB= (H(KODD)*(EL-TD(LEVN))+G(LEVN)*(EL+SD(KODD))) 2640
I I J K L UBB(NUMJKL)=(C4*CB+C2*CBB)/AIJKLB 2650
I I J K L GO TO 145 2660
I I J K L 140 UBB(NUMJKL)= 999. 2670
I I J K L 145 AIJKLA=SD(IODD)*(EL-TD(JEVN))*C3-SD(KEVN)*(EL-TD(LPODD))*C1 2680
I I J K L IF(AIJKLA.LE.0.) GO TO 150 2690
I I J K L CAA=- (H(KEVN)*(EL-TD(LPODD))+G(LPODD)*(EL+SD(KEVN))) 2700

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L      C
L      CALL SUBMIN(XIF,XXF,XMIN,10,100)
L      CALL SUBMAX(XIO,XXO,XMAX,10,100)
L      XMIND(1)=XMIN
L      XMAXD(1)=XMAX
L      CALL SUBMAX(XMAXD,WM,XAU1,1,1)
L      CALL SUBMIN(XMIND,WC,XBU1,1,1)
L      XBU(L)=XBU1
L      XAU(L)=XAU1
L      XINC=(XBU(L)-XAU(L))/FLOAT(NU-1)
L      C
L      C... START X LOOP - (LOOP TWENTY TWO)
L      C
L      M----- DO 270 MM=1,NU
L      M          XRAY(MM)=XAU(L)+FLOAT(MM-1)*XINC
L      M          IE=0
L      M          C1=-EL*UVAL(L)-XRAY(MM)
L      M          C
L      M          C... CALCULATE Z(I)
L      M          C... START LOOP TWENTY THREE
L      M          C
L      M          DO 180 I=1,M
L      M          IE=IE+1
L      M          IEVN=2*I
L      M          IODD=IEVN-1
L      M          ZIO(IE)=((ELC-SD(IODD))*C1+C2*(IODD))/(EL+SD(IODD))
L      M          ZIE(IE)=((ELC-SD(IEVN))*C1-C2*(IEVN))/(EL+SD(IEVN))
L      M          C
L      M          C... CALCULATE Z(J)
L      M          C... START LOOP TWENTY FOUR
L      M          C
L      M          IF=0
L      M          C1=-ELO*UVAL(L)
L      M          DO 185 J=1,N
L      M          JE=JE+1
L      M          JEVN=2*J
L      M          JOOD=JEVN-1
L      M          ZJO(JE)=C1-((ELO+TD(JOOD))*XRAY(MM)-C2*(JOOD))/(EL+TD(JOOD))
L      M          ZJE(JE)=C1-((ELO+TD(JEVN))*XRAY(MM)+C2*(JEVN))/(EL+TD(JEVN))
L      M          C
L      M          C... CALCULATE ZB(X,U) AND ZA(X,U)
L      M          C
L      M          CALL SUBMIN(ZIO,ZJO,ZBU1,IE,JE)
L      M          CALL SUBMAX(ZIE,ZJE,ZAU1,IE,JE)
L      M          ZBU(MM)=ZBU1
L      M          ZAU(MM)=ZAU1
L      M          C
L      M          C... DO Z INTEGRATION
L      M          C
L      M          IF(I+Z) 190,265,190
L      M          IF(ZAU(MM).GE. SIMPZ(1)) .AND.
L      M          1 ZAU(MM).LE. SIMPZ(1TONU)) GO TO 195
L      M          WRITE(6,8110)
L      M          8110 FORMAT(1H0,20X,'ZAU OUT OF RANGE OF ZVAL INPUT'/
L      M          1 20X,'TERMINATE PROCESSING'//)
L      M          GO TO 5
L      M          195 IF(ZBU(MM).GE. SIMPZ(1)) .AND.
L      M          1 ZBU(MM).LE. SIMPZ(1TONU)) GO TO 200
L      M          WRITE(6,8115)
L      M          8115 FORMAT(1H0,20X,'ZBU OUT OF RANGE OF ZVAL INPUT'/
L      M          1 20X,'TERMINATE PROCESSING'//)
L      M          GO TO 5
L      M          200 AREAB=0.
L      M          AREAT=0.
L      M          IF(ZAU(MM)-SIMPZ(1))205,205,210
L      M          IF(ZBU(MM)-SIMPZ(1TONU))230,260,260
L      M          DO 220 INTB=2,1TONU
L      M          IF(ZAU(MM)-SIMPZ(INTB))215,225,220
L      M          215 FWZINB=FWZ(INTB-1)+(ZAU(MM)-SIMPZ(INTB-1))*(FWZ(INTB)-FWZ(INTB-1))
L      M          1/2 INCR
L      M          AREAB=0.5*(SIMPZ(INTB)-ZAU(MM))*(FWZ(INTB)+FWZINB)
L      M          GO TO 225
L      M          220 CONTINUE
L      M          225 INTB=INTB
L      M          GO TO 235
L      M          230 INTD=1
L      M          DO 245 INTT=1INTB,1TONU
L      M          IF(ZAU(MM)-SIMPZ(INTT))240,250,245
L      M          240 FWZINT=FWZ(INTT-1)+(ZBU(MM)-SIMPZ(INTT-1))*(FWZ(INTT)-FWZ(INTT-1))
L      M          1/2 INCR
L      M          AREAT=0.5*(ZBU(MM)-SIMPZ(INTT-1))*(FWZ(INTT)+FWZINT)
L      M          GO TO 255
L      M          245 CONTINUE
L      M          250 AREAT=ZINT(INTT)-ZINT(INTT-1)
L      M          255 ZANS(MM)=ZINT(INTT-1)-ZINT(INTB)+AREAB+AREAT
L      M          GO TO 270
L      M          260 ZANS(MM)=ZINT(1TONU)
L      M          GO TO 270
L      M          265 ZANS(MM)=ZBU(MM)-ZAU(MM)
L      M          270 CONTINUE
L      M          C
L      M          C... END X LOOP - (LOOP TWENTY TWO)
L      M          C
L      M          C... DO X INTEGRATION
L      M          C
L      M          IF(IE)275,305,275
L      M          DO 300 MM=1,NU
L      M          IF(XRAY(MM).GE. SIMPX(1)) .AND.
L      M          1 XRAY(MM).LE. SIMPX(1TONU)) GO TO 280
L      M          WRITE(6,8120)
L      M          8120 FORMAT(1H0,20X,'XRAY OUT OF RANGE OF XVAL INPUT'/

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L M      1      20X,'TERMINATE PROCESSING'//) 4611
L M      GO TO 5 4620
L M      280 IF(XRAY(MM)-SIMPX(1))285,290,290 4630
L M      285 XINT(MM)=0. 4640
L M      GO TO 300 4650
L M      290 IF(XRAY(MM)-SIMPX(1TONU))295,295,285 4660
L M      295 XINT(MM)=ZANS(MM)*YLAG(XRAY(MM),SIMPX,EWX,0,2,1TONU,IEC) 4670
L M----- 300 CONTINUE 4680
L      GO TO 315 4690
L I----- 305 DO 310 I=1,NU 4700
L I----- 310 XINT(I)=ZANS(I) 4710
L      C 4720
L      C... WRITE INTERMEDIATE COMPUTATIONS 4730
L      C 4740
L      315 IF(KOUT)320,325,320 4750
L      320 WRITE(6,8125)UVAL(L),XAU(L),XBU(L),(ZAU(ML),ZBU(ML),ZANS(ML),XINT( 4760
L      IML),ML=1,NU) 4761
L      8125 FORMAT(1H1,3H1U=F9.5,5X,4HXAU=E14.6,5X,4HXBUE14.6/3X,2(3HZAU, 4770
L      11X,3HZBU,11X,4HZANS,10X,4HXINT,10X)/(1X,8E14.6)) 4771
L      C 4780
L      C... CALCULATE UNNORMALIZED WW(U) 4790
L      C 4800
L      325 CALL SIMP(XRAY,XINT,XANS,NU) 4810
L      WWUP(L)=XANS(NU)*EL*ELO/(EL+ELO) 4820
L      C 4830
L----- 330 CONTINUE 4840
L      C 4850
L      C... END U LOOP - (LOOP SEVENTEEN) 4860
L      C 4870
L      C... CALCULATE AW (NORMALIZATION FACTOR) 4880
L      C 4890
L      CALL SIMP(UVAL,WWUP,AANS,NU) 4900
L      IF(AANS(NU).NE.0.) GO TO 335 4910
L      WRITE(6,8130) 4920
L      8130 FORMAT(1H0,20X,'AANS(NU) = 0.'//) 4930
L      GO TO 5 4940
L      C 4950
L      C... CALCULATE NORMALIZED WW(U) AND CONVERT TO MILLIRADIANS 4960
L      C 4970
L----- 335 AW=AANS(NU) 4980
L      DO 340 L=1,NU 4990
L      WWU(L)=WWUP(L)*0.001/AW 5000
L      IF(WWU(L).LT.0.) WWU(L)=0. 5010
L      UVAL(L)=1000.*UVAL(L) 5020
L----- 340 CONTINUE 5030
L      C 5040
L      C... START PRINT-OUT 5050
L      C 5060
L      345 WRITE(6,8135) 5070
L      8135 FORMAT(1H1,20X,'INPUT DATA'//) 5080
L      IF(ILNGTH.EQ.0) GO TO 350 5090
L      WRITE(6,8140) 5100
L      8140 FORMAT(1H0,8X,'THIS IS A LENGTH WEIGHTING FUNCTION'//) 5110
L      GO TO 355 5120
L      350 WRITE(6,8145) 5130
L      8145 FORMAT(1H0,8X,'THIS IS A WIDTH WEIGHTING FUNCTION'//) 5140
L      355 WRITE(6,8150)M,N,NU,KK,JJ,IFZ,NUMZ,IEX,NUMX,ELO,EL,WCE(1),WM,WCE 5150
L      8150 FORMAT(1H0,5X,'THERE ARE',12,' PAIRS OF EDGES BETWEEN THE FOCAL SP 5160
L      10T AND THE SAMPLE'// 5161
L      2 6X,'THERE ARE',12,' PAIRS OF EDGES BETWEEN THE SAMPLE A 5162
L      3ND THE DETECTOR'// 5163
L      4 6X,'13,' DATA POINTS WILL BE COMPUTED'// 5164
L      5 6X,'COMPUTE THE',12,' MOMENT ABOUT THE ORIGIN'// 5165
L      6 6X,'COMPUTE THE',12,' MOMENT ABOUT THE MEAN'// 5166
L      7 6X,'INTERPOLATION IN THE F(Z) ARRAY WILL BE BY A',12,' 5167
L      8POINT LAGRANGIAN'// 5168
L      9 6X,'THERE ARE',13,' POINTS IN THE F(Z) ARRAY'// 5169
L      9 6X,'INTERPOLATION IN THE E(X) ARRAY WILL BE BY A',12,' 5169
L      9POINT LAGRANGIAN'// 5169
L      9 6X,'THERE ARE',13,' POINTS IN THE E(X) ARRAY'// 5169
L      9 6X,'THE FOCAL SPOT TO SAMPLE DISTANCE IS',F6.1,' MM'// 5169
L      9 6X,'THE SAMPLE TO DETECTOR DISTANCE IS',F6.1,' MM'// 5169
L      9 6X,'THE RECEIVING SLIT WIDTH IS 2X',F6.3,' MM'// 5169
L      9 6X,'THE LOWER LIMIT OF X VALUES IS',F6.3,' MM'// 5169
L      9 6X,'THE UPPER LIMIT OF X VALUES IS',F6.3,' MM'//) 5169
L      WRITE(6,8155) 5170
L      8155 FORMAT(1H0,2X,12H SUBSCRIPT I,1CX,12H SUBSCRIPT J) 5180
L      WRITE(6,8160)(SD(I),TD(I),I=1,8),(F(I),G(I),I=1,8) 5190
L      8160 FORMAT(1H0, 2(5HD(1)=F7.3,11X)/2(6H D(2)=F7.3,1CX)/2(6H D(3)= 5200
L      1,F7.3,10X)/2(6H D(4)=F7.3,10X)/ 2(6H D(5)=F7.3,10X)/2(6H D(6)=F 5201
L      27.3,10X)/2(6H D(7)=F7.3,10X)/2(6H D(8)=F7.3,10X)/2(6H H(1)=F7.3 5202
L      3,10X)/2(6H H(2)=F7.3,10X)/2(6H H(3)=F7.3,10X)/2(6H H(4)=F7.3,10 5203
L      4X)/2(6H H(5)=F7.3,10X)/2(6H H(6)=F7.3,10X)/2(6H H(7)=F7.3,10X)/ 5204
L      52(6H H(8)=F7.3,10X)) 5205
L      IF(IEX)36C,365,360 5210
L      360 CALL WOUT1(NUMX,XVAL,XWX) 5220
L      365 IF(IPZ)370,375,370 5230
L      370 CALL WOUT2(NUMZ,ZVAL,ZWZ) 5240
L      375 WRITE(6,8165) TITLE 5250
L      8165 FORMAT(1H1,2CX,80A1,///) 5260
L      IF(111AAA.EQ.0) GO TO 380 5270
L      WRITE(6,8170) 5280
L      8170 FORMAT(1H1,20X,'UAAA GREATER THAN UBBB') 5290
L      GO TO 5 5300
L      380 IF(ILNGTH.NE.0) GO TO 385 5310
L      WRITE(6,8175) 5320
L      8175 FORMAT(1H 10X,'WEIGHTING FUNCTION BEFORE SHIFT ABOUT FIRST MOMENT 5330
L      1'//) 5331
L      385 WRITE(6,8205) 5340
L      NNU=NU/2 5350
L      WRITE(6,8210)(UVAL(I),WWU(I),UVAL(I+NNU),WWU(I+NNU),I=1,NNU) 5360
L      IF(MOD(NU,2))390,395,390 5370

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390 WRITE(6,8180) UVAL(NU),WWU(NU) 5380
8180 FORMAT(1H,52X,F11.6,E13.5) 5390
395 WRITE(6,8185) AW 5400
8185 FORMAT(1H0,24HNORMALIZATION FACTOR AW=,E13.5///) 5410
C 5420
C... CALCULATE MOMENTS ABOUT THE ORIGIN 5430
C 5440
IF(KK) 430,430,400 5450
DO 425 MAP=1,KK 5460
M----- 400
M L----- DO 405 LAP=1,NU 5470
M L----- 405 USTORE(LAP)=(UVAL(LAP)**MAP)*WWU(LAP) 5480
M CALL SIMP(UVAL,USTORE,AMOMNT,NU) 5490
M IF(MAP-2) 410,415,420 5500
M 410 FIRSTM=AMOMNT(NU) 5510
M GO TO 425 5520
M 415 SCNDM=AMOMNT(NU) 5530
M GO TO 425 5540
M 420 THIRDM=AMOMNT(NU) 5550
M 425 CONTINUE 5560
M----- C 5570
C... CALCULATE MOMENTS ABOUT THE MEAN 5580
C 5590
430 IF(JJ) 465,465,435 5600
435 DO 460 MAP=1,JJ 5610
M-----
M L----- DO 440 LAP=1,NU 5620
M L----- 440 UDIF(LAP)=(UVAL(LAP)-FIRSTM)**MAP)*WWU(LAP) 5630
M CALL SIMP(UVAL,UDIF,AMOMNT,NU) 5640
M IF(MAP-2) 445,445,455 5650
M 445 FRSTM=AMOMNT(NU) 5660
M GO TO 460 5670
M 450 SCNDM=AMOMNT(NU) 5680
M GO TO 460 5690
M 455 THKUMP=AMLMNI(NU) 5700
M 460 CONTINUE 5710
I----- 465 DO 470 I=1,NU 5720
I----- 470 UVAL(I)=UVAL(I)-FIRSTM 5730
IF(IOUT) 475,480,475 5740
475 WRITE(7,8190) NU, AW 5750
8190 FORMAT(15,E20.8) 5760
WRITE(7,8195) (UVAL(I),WWU(I),I=1,NU) 5770
8195 FORMAT(2E20.8,40X) 5780
480 IF(KK.EQ.0) GO TO 495 5790
WRITE(6,8165) TITLE 5800
WRITE(6,8200) 5810
8200 FORMAT(1H,10X,'WEIGHTING FUNCTION AFTER SHIFT ABOUT FIRST MOMENT' 5820
1'///) 5821
WRITE(6,8205) 5830
8205 FORMAT(1H0,4X,2H U,7X,6H WW(U),37X,2H U,7X,6H WW(U)///) 5840
WRITE(6,8210) (UVAL(I),WWU(I),UVAL(I+1),WWU(I+1),I=1,1,NU) 5850
8210 FORMAT(1H,52X,F11.6,E13.5,28X,F11.6,E13.5) 5860
IF(MNC(NU),2) 485,490,485 5870
485 WRITE(6,8180) UVAL(NU),WWU(NU) 5880
490 WRITE(6,8185) AW 5890
495 IF(LENGTH.NE.0) GO TO 520 5900
IF(KK) 500,590,500 5910
500 WKIE(8,8215)IFKSI,SELNDM,IMIRUM 5920
8215 FORMAT(1H0,40H MOMENTS OF THE FUNCTION ABOUT THE ORIGIN///1X,5HIST 5930
1E15.5,10X,5H2ND =,E15.5,10X,5H3RD =,E15.5) 5940
DO 505 I=1,NU 5950
II=NU+1-I 5960
IF(WWU(II).NE.0.) GO TO 510 5970
505 CONTINUE 5980
510 WRITE(6,8220) UVAL(II) 5990
8220 FORMAT(1H0,'MINIMUM ANGLE TO WHICH DATA CAN BE TAKEN = ',F6.2,' MR 5991
1'///) 6000
IF(II) 515,590,515 6010
515 WRITE(6,8225)FRSTM,SCNDM,THRDM 6020
8225 FORMAT(1H0,38H MOMENTS OF THE FUNCTION ABOUT THE MEAN///1X,5HIST =, 6021
1E15.5,10X,5H2ND =,E15.5,10X,5H3RD =,E15.5) 6030
GO TO 590 6040
C 6050
C... COMPUTE EFFECTIVE SLIT-LENGTH WEIGHTING FUNCTION 6060
C 6070
520 IF(LENGTH.NE.1) GO TO 590 6080
IF(UAAA.GT.UBBB) GO TO 525 6090
DELU=UBBB/FLOAT(NU-1) 6100
GO TO 530 6110
525 DELU=UAAA/FLOAT(NU-1) 6120
530 DO 555 L=1,NU 6130
L L(L)=FLOAT(L-1)*DELU 6140
L IF(L.LT.UBBB) GO TO 535 6150
L TEMP1=YLAG(L,L),UVAL,WWU,0,3,NU,IEC) 6160
L GO TO 540 6170
L 535 TEMP1=0. 6180
L 540 IF(L.LT.UAAA) GO TO 545 6190
L TEMP2=YLAG(L,L),UVAL,WWU,0,3,NU,IEC) 6200
L GO TO 550 6210
L 545 TEMP2=0. 6220
L 550 WLU(L)=(TEMP1+TEMP2)/2. 6230
L IF(WLU(L).LT.0.) WLU(L)=0. 6240
L 555 CONTINUE 6250
IF(IOUT) 560,565,560 6260
560 WRITE(7,8190) NU,AW 6270
WRITE(7,8195) (L(I),WLU(I),I=1,NU) 6280
565 WRITE(6,8230) 6290
8230 FORMAT(1H1,20X,'EFFECTIVE SLIT-LENGTH WEIGHTING FUNCTION'///) 6300
WRITE(6,8205) 6310
WRITE(6,8210) (L(I),WLU(I),L(I+1),WLU(I+1),I=1,NU) 6320

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      IF (MOD (NU, 2)) .570, 575, 570
570  WRITE (6, 8180) UL (NU), WLU (NU)
575  C1 = WLU (1) * 0.99
      DO 580 L = 1, NU
      L1 = L
      IF (WLU (L) .LT. C1) GO TO 585
      CONTINUE
580  CONTINUE
585  WRITE (6, 8235) UL (L1)
8235  FORMAT (1H0, 'MAXIMUM ANGLE TO WHICH THE INFINITE BEAM APPROXIMATION
      1 IS VALID = ', F6.2, ' MR')
590  CALL TIMER (1)
      C
      C... START PLOTTING PROCEDURES
      C
      IF (IPLOT .EQ. 0) GO TO 5
      IF (IPLOT .LT. 0) GO TO 595
      CALL PLOTS (APLTZ, 5000)
      IPLOT = -IPLOT
595  CALL LNPLT (-NU, 1, UVAL, 1, .07, WWU)
      CALL SYMBOL (1.0, 10.6, 0.14, TITLE (1), 0.0, 80)
      CALL SYMBOL (5.0, 0.1, 0.14, 16HU (MILLIRADIANS), 0.0, 16)
      N = 1
      IF (ILNGTH .NE. 0) N = 2
      CALL SYMBOL (0.0, 4.0, 0.14, BCD (N), 90.0, 8)
      CALL PLOT (13.0, 0.0, -3)
      IF (ILNGTH .NE. 1) GO TO 5
      CALL LNPLT (-NU, 1, UL, 1, .07, WLU)
      CALL SYMBOL (1.0, 10.6, 0.14, TITLE (1), 0.0, 80)
      CALL SYMBOL (5.0, 0.1, 0.14, 16HU (MILLIRADIANS), 0.0, 16)
      CALL SYMBOL (0.0, 4.0, 0.14, BCD (2), 90.0, 24)
      CALL PLOT (13.0, 0.0, -3)
      GO TO 5
600  STOP
      END

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TABLE OF VARIABLE NAMES

VARIABLE NAME	ARRAY DIMENSIONS	TOTAL NO ELEMENTS	ELEMENT TYPE	DECLARATION	CROSS REFERENCE TABLE (BY SEQUENCE NUMBERS)
AANS	(202)	202	REAL*4	LOCAL	150, 4900, 4910, 4980
AIJKLA			REAL*4	LOCAL	2680*, 2690, 2710
AIJKLB			REAL*4	LOCAL	2620*, 2630, 2650
AMCMT	(202)	202	REAL*4	LOCAL	150, 5490, 5510, 5530, 5550, 5640, 5660, 5680, 5700
APLTZ	(5000)	5000	REAL*4	LOCAL	150, 6480
AREAB			REAL*4	LOCAL	4250*, 4320*, 4450
AREAT			REAL*4	LOCAL	4260*, 4410*, 4440*, 4450
AW			REAL*4	LOCAL	4980*, 5000, 5400, 5750, 5890, 6260
BCD	(4)	4	REAL*8	LOCAL (DATA)	160, 170, 6550, 6610
BLANK			REAL*4	LOCAL (DATA)	190, 240, 350, 360, 270, 200, 410, 420, 430, 440
BLNK			REAL*4	LOCAL (DATA)	200, 320
CA			REAL*4	LOCAL	2190*, 2340, 2490*, 2710
CAA			REAL*4	LOCAL	2280*, 2340, 2700*, 2710
CB			REAL*4	LOCAL	2200*, 2350, 2500*, 2650
CBB			REAL*4	LOCAL	2290*, 2350, 2640*, 2650
C1			REAL*4	LOCAL	2000*, 2020*, 2300*, 2340, 2510*, 2680, 2710, 3830*, 3920, 3930, 3990*, 4040, 4050, 6350*, 6380
C2			REAL*4	LOCAL	2010*, 2030, 2310*, 2340, 2520*, 2620, 2650, 3260*, 3920, 3930, 4040, 4050
C3			REAL*4	LOCAL	2320*, 2350, 2600*, 2680, 2710
C4			REAL*4	LOCAL	2330*, 2350, 2610*, 2620, 2650
DELU			REAL*4	LOCAL	6090*, 6110*, 6130
EL			REAL*4	LOCAL	480, 1620, 1630, 1850, 1860, 2000, 2010, 2020, 2030, 2190, 2200, 2280, 2290, 2310, 2330, 2490, 2500, 2620, 2640, 2680, 2700, 3260, 3420, 3430, 3600, 3610, 3870, 3920, 3930, 4040, 4050, 4820, 5150
EL0			REAL*4	LOCAL	480, 3260, 3920, 3930, 3990, 4040, 4050, 4820, 5150

EWX	(1001)	1001	REAL*4	LOCAL	150,	1000*	1030*	4670				
FIRSTM			REAL*4	LOCAL	230*	5510*	5630,	5730,	5920			
FLCAT			REAL*4	FUNCTION	3220,	3280,	3760,	3810,	6090,	6110,	6130	
FRSTMM			REAL*4	LOCAL	260*	5660*	6010					
FWZ	(1001)	1001	REAL*4	LOCAL	150,	820*	850*	870,	4310,	4320,	4400,	
					4410							
FWZINB			REAL*4	LOCAL	4310*	4320						
FWZINT			REAL*4	LOCAL	4400*	4410						
G	(8)	8	REAL*4	LOCAL	150,	440*	540,	1620,	1630,	2020,	2030,	
					2280,	2290,	2490,	2500,	2640,	2700,	3600,	
					3610,	4040,	4050,	5190				
H	(8)	8	REAL*4	LOCAL	150,	430*	520,	1850,	1860,	2020,	2030,	
					2190,	2200,	2280,	2290,	2490,	2500,	2640,	
					2700,	3420,	3430,	3600,	3610,	3920,	3930,	
					5190							
I			INTEGER*4	LOCAL	310*	320,	510*	520*	730*	920*	1090*	
					1100,	1290*	1300,	1770*	1790,	1810,	1940*	
					1960,	2120*	2130,	2160,	2430*	2440,	2870*	
					2910*	2940*	2970*	3000*	3030*	3060*	3090*	
					3340*	3360,	3380,	3530*	3560,	3880*	3900,	
					4700*	4710,	5190*	5360*	5720*	5730,	5770*	
					5850*	5940*	5950,	6270*	6320*			
IE			INTEGER*4	LOCAL	3820*	3890*	3920,	3930,	4090,	4100		
IEC			INTEGER*4	LOCAL	850,	1030,	4670,	6150,	6190			
IEVN			INTEGER*4	LOCAL	1960*	1970*	2010,	2030,	2130*	2140,	2200,	
					2440*	2450,	2500,	2520,	2620,	3900*	3910,	
					3930							
ISX			INTEGER*4	LOCAL	350,	910,	1030,	4570,	5150,	5210		
IFLAG			INTEGER*4	LOCAL	1080*	1170*	1370*	1480				
IFZ			INTEGER*4	LOCAL	350,	720,	850,	4160,	5150,	5230		
II			INTEGER*4	LOCAL	5950*	5960,	5980,	6370*	6400			
IINB			INTEGER*4	LOCAL	4350*	4370*	4380					
IINLTH			INTEGER*4	LOCAL	350,	5090,	5310,	5900,	6070,	6540,	6570	
INTB			INTEGER*4	LOCAL	4290*	4300,	4310,	4320,	4350,	4450		
INTT			INTEGER*4	LOCAL	4380*	4390,	4400,	4410,	4440,	4450		
IQ			INTEGER*4	LOCAL	3520*	3550*	3600,	3610,	3680,	3690		
IQCD			INTEGER*4	LOCAL	1970*	2000,	2020,	2140*	2190,	2450*	2490,	
					2510,	2680,	3910*	3920				
IOC			INTEGER*4	LOCAL	3330*	3370*	3420,	3430,	3680,	3690		
IOUT			INTEGER*4	LOCAL	330,	5740,	6250					
IP			INTEGER*4	LOCAL	1780*	1790,	1830,	2150*	2160,	2170,	3350*	
					3360,	3400						
IPEVN			INTEGER*4	LOCAL	2170*	2180,	2190					
IPIOT			INTEGER*4	LOCAL	350,	6460,	6470,	6470*				
IPCON			INTEGER*4	LOCAL	2180*	2200						
ITCNU			INTEGER*4	LOCAL	390*	770,	790,	870,	950,	970,	4170,	
					4210,	4280,	4290,	4300,	4470,	4590,	4660,	
					4670							
ITWONU			INTEGER*4	LOCAL	370*	380,	390					
IUAAA			INTEGER*4	LOCAL	290*	3200*	3270					
IXE			INTEGER*4	LOCAL	3560*	3570,	3600					
IXC			INTEGER*4	LOCAL	3570*	3610						
J			INTEGER*4	LOCAL	530*	540*	1570*	1580,	1600,	1940*	1980,	
					2240*	2250,	2460*	2470,	3540*	3580,	4000*	
					4020							
JE			INTEGER*4	LOCAL	3980*	4010*	4040,	4050,	4090,	4100		
JEVN			INTEGER*4	LOCAL	1600*	1610,	1630,	1980*	1990,	2000,	2020,	
					2250*	2260,	2290,	2320,	2330,	2470*	2480,	
					2490,	2510,	2680,	4020*	4030,	4050		
JJ			INTEGER*4	LOCAL	350,	5150,	5600,	5610,	6000			
JO			INTEGER*4	LOCAL	1530*	1590*	1620,	1630,	1680,	1690		
JODD			INTEGER*4	LOCAL	1610*	1620,	1990*	2010,	2030,	2260*	2280,	
					2300,	2310,	2480*	2500,	2520,	2620,	4030*	
					4040							

JXE	INTEGER*4	LOCAL	3580*	3590,	3610						
JXC	INTEGER*4	LOCAL	3590*	3600							
K	INTEGER*4	LOCAL	400*, 2530*	410, 2540	420,	430,	440,	2210*	2220,		
KEVN	INTEGER*4	LOCAL	2220*, 2600,	2230, 2680,	2280, 2700	2300,	2310,	2540*	2550,		
KK	INTEGER*4	LOCAL	350,	5150,	5450,	5460,	5700,	5910			
KODD	INTEGER*4	LOCAL	2230*, 2640	2290,	2320,	2330,	2550*	2610,	2620,		
KOUT	INTEGER*4	LOCAL	350,	2810,	4750						
L	INTEGER*4	LOCAL	1540*, 3420, 3810, 5010, 6190,	1550, 3430, 3830, 5020, 6220,	1580, 3600, 3990, 6120*, 6230,	2560*, 3610, 4760, 6130, 6360*	2570, 3740, 4820, 6140, 6370,	3270*, 3750, 4990*, 6150, 6380	3280, 3760, 5000, 6180,		
LA	INTEGER*4	LOCAL	770*	780,	790*	810,	820,	850			
LAP	INTEGER*4	LOCAL	5470*	5480,	5620*	5630					
LB	INTEGER*4	LOCAL	950*	960,	970*	990,	1000,	1030			
LEVN	INTEGER*4	LOCAL	1550*, 2640	1560,	1620,	2570*	2580,	2610,	2620,		
LIE	INTEGER*4	LOCAL	1810*	1820,	1850,	3380*	3390,	3430			
LIC	INTEGER*4	LOCAL	1820*	1860,	3390*	3420					
LNPLDT		SUBROUTINE	6500,	6580							
LO	INTEGER*4	LOCAL	800*	810,	820						
LODD	INTEGER*4	LOCAL	1560*	1630,	2580*	2600,	2680,	2700			
LP	INTEGER*4	LOCAL	980*	990,	1000						
LPE	INTEGER*4	LOCAL	1830*	1840,	1860,	3400*	3410,	3420			
LPC	INTEGER*4	LOCAL	1840*	1850,	3410*	3430					
M	INTEGER*4	LOCAL	350, 1930, 3350,	460, 2120, 3530,	590, 2150, 3880,	620*, 2210, 5150	1090, 2430,	1770, 2530,	1780, 3340,		
MAP	INTEGER*4	LOCAL	5460*	5480,	5500,	5610*	5630,	5650			
MDX	INTEGER*4	LOCAL	1110*	1200,	1310*	1360,	1400				
ML	INTEGER*4	LOCAL	4760*								
MM	INTEGER*4	LOCAL	3800*, 4170, 4390, 4590,	3810, 4210, 4400, 4630,	3830, 4270, 4410, 4640,	4040*, 4280, 4450, 4660,	4050, 4300, 4470, 4670	4110, 4310, 4490,	4120, 4320, 4580*		
MOD	INTEGER*4	FUNCTION	5370,	5870,	6330						
MZ	INTEGER*4	LOCAL	460*	510,	520,	630*					
N	INTEGER*4	LOCAL	350, 1940, 6530*	470, 2240, 6540*	640, 2460, 6550	670*, 2560,	1290, 3540,	1540, 4000,	1570, 5150,		
NDX	INTEGER*4	LOCAL	1100*, 1400	1110,	1160,	1200,	1300*	1310,	1360,		
NNU	INTEGER*4	LOCAL	5350*	5360,	5850,	6320					
NU	INTEGER*4	LOCAL	350, 4700, 4990, 5510, 5700, 5950, 6270,	370, 4760, 5150, 5530, 5720, 6090, 6330,	3220, 4810, 5350, 5550, 5750, 6110, 6340,	3270, 4820, 5370, 5620, 5770, 6120, 6360,	3760, 4900, 5380, 5640, 5870, 6150, 6500,	3800, 4910, 5470, 5660, 5880, 6190, 6580	4580, 4980, 5490, 5680, 5940, 6260,		
NUMA	INTEGER*4	LOCAL	1920*, 3150,	1950*, 3160	2020,	2030,	2890,	2910,	3030,		
NUMI	INTEGER*4	LOCAL	1760*, 3150,	1800*, 3160	1850,	1860,	2850,	2870,	3000,		
NUMJK	INTEGER*4	LOCAL	2110*, 3130,	2270*, 3140	2340,	2350,	2920,	2940,	3060,		
NUMJKL	INTEGER*4	LOCAL	2420*, 2970,	2590*, 3090,	2650*, 3130,	2670, 3140	2710,	2730,	2950,		
NUMX	INTEGER*4	LOCAL	350,	920,	930,	980,	1030,	5150,	5220		
NUMZ	INTEGER*4	LOCAL	350,	730,	750,	800,	8				

PLCT			SUBROUTINE	6560, 6620						
PLCTS			SUBROUTINE	6480						
SCNDMM		REAL*4	LOCAL	270*	5680*	6010				
SD	(8)	8 REAL*4	LOCAL	150, 2000, 2290, 2510, 2700, 5190	410*, 2010, 2300, 2520, 3420,	510, 2020, 2310, 2600, 3430,	1160, 2030, 2320, 2610, 3600,	1200, 2120, 2330, 2620, 3610,	1850, 2200, 2400, 2640, 3920,	1860, 2280, 2500, 2680, 3930,
SECNDM		REAL*4	LOCAL	240*	5530*	5920				
SIMP			SUBROUTINE	870, 4810,	4900,	5490,	5640			
SIMPX	(1001)	1001 REAL*4	LOCAL	150, 4660,	940*, 4670	960*	990, 1030,	4590,	4630,	
SIMPZ	(1001)	1001 REAL*4	LOCAL	150, 4210, 4400,	760*, 4270, 4410	780*, 4280,	810, 4300,	850, 4310,	870, 4320,	4170, 4390,
SUBMAX			SUBROUTINE	1680,	3130,	3150,	3170,	3690,	3720,	4100
SUBMIN			SUBROUTINE	1690,	3140,	3160,	3180,	3680,	3730,	4090
SYMBOL			SUBROUTINE	6510,	6520,	6550,	6590,	6600,	6610	
TD	(8)	8 REAL*4	LOCAL	150, 2000, 2310, 2600, 3610,	420*, 2010, 2320, 2610, 4040,	530, 2020, 2330, 2620, 4050,	1360, 2030, 2490, 5190	1400, 2280, 2500,	1620, 2290, 2510,	1630, 2300, 2520, 3600,
TEMP1		REAL*4	LOCAL	6150*	6170*	6220				
TEMP2		REAL*4	LOCAL	6190*	6210*	6220				
THIRDM		REAL*4	LOCAL	250*	5550*	5920				
THRDMM		REAL*4	LOCAL	280*	5700*	6010				
TIMER			SUBROUTINE	300,	6420					
TITLE	(80)	80 LOGICAL*1	LOCAL	180, 6590	320*	330,	2820,	5250,	5800,	6510,
TWCNU		REAL*4	LOCAL	380*	750,	930				
UA	(256)	256 REAL*4	LOCAL	150,	2710*	2730*	2970,	3130		
UA4A		REAL*4	LOCAL	3170,	3190,	3220,	3280,	6080,	6110,	6180
UB	(256)	256 REAL*4	LOCAL	150,	2650*	2670*	3090,	3140		
UBB		REAL*4	LOCAL	3180,	3190,	3220,	6080,	6090,	6140	
UDIF	(202)	202 REAL*4	LOCAL	150,	5630*	5640				
UEE	(6)	6 REAL*4	LOCAL	150,	1850*	3000,	3160			
UTE	(16)	16 REAL*4	LOCAL	150,	2030*	3030,	3160			
UINC		REAL*4	LOCAL	3220*	3280					
UID	(16)	16 REAL*4	LOCAL	150,	2020*	2910,	3150			
UL	(202)	202 REAL*4	LOCAL	150, 6320,	6130*, 6340,	6140, 6400,	6150, 6580	6180,	6190,	6270,
ULL	(2)	2 REAL*4	LOCAL	150,	3130,	3150,	3170			
UOC	(6)	6 REAL*4	LOCAL	150,	1860*	2870,	3150			
USTORE	(202)	202 REAL*4	LOCAL	150,	5480*	5490				
UUL	(2)	2 REAL*4	LOCAL	150,	3140,	3160,	3180			
UVAL	(202)	202 REAL*4	LOCAL	150, 3990, 5490, 5980,	3280*, 4760, 5630, 6150,	3420, 4900, 5640,	3430, 5020*, 5730*, 6500	3600, 5360, 5770,	3610, 5380, 5850,	3830, 5480, 5880,
WC	(1)	1 REAL*4	LOCAL	150,	1710*	1860,	2020,	2730,	5150	
WCE	(8)	8 REAL*4	LOCAL	150,	480,	490,	1630*	1690,	5150	
WCG	(8)	8 REAL*4	LOCAL	150,	490*	1620*	1680			
WLU	(202)	202 REAL*4	LOCAL	150, 6380,	6220*, 6580	6230*, 6270*,	6320,	6340,	6350,	
WM	(1)	1 REAL*4	LOCAL	150,	1700*	1850,	2030,	3720,	5150	
WOUTI			SUBROUTINE	5220						

WOUT2				SUBROUTINE	5240							
WWU	(202)	202	REAL*4	LOCAL	150, 5770,	5000* 5850,	5010* 5880,	5360, 5960,	5380, 6150,	5480, 6190,	5630, 6500	
WYUP	(202)	202	REAL*4	LOCAL	150,	4820*	4900,	5000				
XANS	(202)	202	REAL*4	LOCAL	150,	4810,	4820					
XAU	(202)	202	REAL*4	LOCAL	150,	3750*	3760,	3810,	4760			
XAU1			REAL*4	LOCAL	3720,	3750						
XBU	(202)	202	REAL*4	LOCAL	150,	3740*	3760,	4760				
XBU1			REAL*4	LOCAL	3730,	3740						
XIE	(16)	16	REAL*4	LOCAL	150,	3600*	3680					
XINC			REAL*4	LOCAL	3760*	3810						
XINCR			REAL*4	LOCAL	930*	960						
XINT	(1001)	1001	REAL*4	LOCAL	150,	4640*	4670*	4710*	4760,	4810		
XIC	(16)	16	REAL*4	LOCAL	150,	3610*	3690					
XMAX			REAL*4	LOCAL	1690,	1710,	3690,	3710				
XMAXD	(1)	1	REAL*4	LOCAL	150,	3710*	3720					
XMIN			REAL*4	LOCAL	1680,	1700,	3680,	3700				
XMIND	(1)	1	REAL*4	LOCAL	150,	3700*	3730					
XRAY	(1001)	1001	REAL*4	LOCAL	150, 4660,	3810* 4670,	3830, 4810	4040,	4050,	4590,	4630,	
XVAL	(50)	50	REAL*4	LOCAL	150,	920,	930,	940,	990,	1030,	5220	
XWX	(50)	50	REAL*4	LOCAL	150,	920,	1000,	1030,	5220			
XXE	(6)	6	REAL*4	LOCAL	150,	3430*	3680					
XXD	(6)	6	REAL*4	LOCAL	150,	3420*	3690					
YLAG			REAL*4	FUNCTION	850,	1030,	4670,	6150,	6190			
ZANS	(202)	202	REAL*4	LOCAL	150,	4450*	4470*	4490*	4670,	4710,	4760	
ZAU	(202)	202	REAL*4	LOCAL	150, 4490,	4120* 4760	4170,	4270,	4300,	4310,	4720,	
ZAU1			REAL*4	LOCAL	4100,	4120						
ZBU	(202)	202	REAL*4	LOCAL	150, 4490,	4110* 4760	4210,	4280,	4390,	4400,	4410,	
ZBU1			REAL*4	LOCAL	4090,	4110						
ZIE	(4)	4	REAL*4	LOCAL	150,	3930*	4100					
ZINCR			REAL*4	LOCAL	750*	780,	4310,	4400				
ZINT	(1001)	1001	REAL*4	LOCAL	150,	870,	4440,	4450,	4470			
ZIC	(4)	4	REAL*4	LOCAL	150,	3920*	4090					
ZJE	(4)	4	REAL*4	LOCAL	150,	4050*	4100					
ZJC	(4)	4	REAL*4	LOCAL	150,	4040*	4090					
ZVAL	(50)	50	REAL*4	LOCAL	150,	730,	750,	760,	810,	850,	5240	
ZWZ	(50)	50	REAL*4	LOCAL	150,	730,	820,	850,	5240			

* = VARIABLES USED ON LEFT HAND SIDE OF EQUAL SIGN

STATEMENT NUMBER TABLE

CROSS REFERENCE TABLE

NO	DEFINING SEQUENCE NO	STATEMENT NUMBER	REFERENCING SEQUENCE NUMBERS
1	220	8000	210
2	230	5	1480, 4200, 4240, 4620, 4940, 5300, 6460, 6570, 6630
3	320	10	310
4	340	8005	330
5	360	8010	350
6	450	15	400
7	500	8015	480
8	550	8020	510, 520, 530, 540
9	610	8025	600
10	640	20	590
11	660	8030	650
12	720	25	640
13	730	30	720, 720
14	740	8035	730, 920
15	780	35	770
16	820	40	810
17	840	45	800, 810
18	850	50	810
19	860	55	790, 830
20	910	60	720
21	920	65	910, 910
22	960	70	950
23	1000	75	900
24	1020	80	980, 990
25	1030	85	990
26	1040	90	970, 1010
27	1080	95	910
28	1190	8040	1180
29	1210	8045	1200
30	1220	100	1090, 1160
31	1390	8050	1380
32	1410	8055	1400
33	1420	105	1290, 1360
34	1430	110	1570
35	1440	115	1540, 1580
36	1870	120	1770, 1780, 1790
37	2030	125	1930, 1940
38	2360	130	2150, 2210, 2240
39	2370	135	2120, 2160
40	2670	140	2630
41	2680	145	2660
42	2720	150	2690
43	2740	155	2430, 2460, 2530, 2560, 2720
44	2840	8060	2830
45	2860	8065	2850
46	2880	8070	2870, 2910, 2940, 2970, 3000, 3030, 3060, 3090
47	2900	8075	2890

48	2930	8080	2920
49	2960	8085	2950
50	2990	8090	2980
51	3020	8095	3010
52	3050	8100	3040
53	3080	8105	3070
54	3130	160	2810
55	3220	165	3190
56	3440	170	3340, 3350, 3360
57	3610	175	3530, 3540
58	3930	180	3880
59	4050	185	4000
60	4170	190	4160, 4160
61	4190	8110	4180
62	4210	195	4170
63	4230	8115	4220
64	4250	200	4210
65	4280	205	4270, 4270
66	4290	210	4270
67	4310	215	4300
68	4340	220	4290, 4300
69	4350	225	4300, 4330
70	4370	230	4280
71	4380	235	4360
72	4400	240	4390
73	4430	245	4380, 4390
74	4440	250	4390
75	4450	255	4420
76	4470	260	4280, 4280
77	4490	265	4160
78	4500	270	3800, 4460, 4480
79	4580	275	4570, 4570
80	4610	8120	4600
81	4630	280	4590
82	4640	285	4630, 4660
83	4660	290	4630, 4630
84	4670	295	4660, 4660
85	4680	300	4580, 4650
86	4700	305	4570
87	4710	310	4700
88	4750	315	4690
89	4760	320	4750, 4750
90	4770	8125	4760
91	4810	325	4750
92	4840	330	3270
93	4930	8130	4920
94	4980	335	4910
95	5030	340	4990
96	5070	345	3210
97	5080	8135	5070
98	5110	8140	5100

99	5130	350	5090
100	5140	8145	5130
101	5150	355	5120
102	5160	8150	5150
103	5180	0155	5170
104	5200	8160	5190
105	5220	360	5210, 5210
106	5230	365	5210
107	5240	370	5230, 5230
108	5250	375	5230
109	5260	8165	2820, 5250, 5800
110	5290	8170	5280
111	5310	380	5270
112	5330	8175	5320
113	5340	385	5310
114	5380	390	5370, 5370
115	5390	8180	5380, 5880, 6340
116	5400	395	5370
117	5410	8185	5400, 5890
118	5460	400	5450
119	5480	405	5470
120	5510	410	5500
121	5530	415	5500
122	5550	420	5500
123	5560	425	5460, 5520, 5540
124	5600	430	5450, 5450
125	5610	435	5600
126	5630	440	5620
127	5660	445	5650
128	5680	450	5650
129	5700	455	5650
130	5710	460	5610, 5670, 5690
131	5720	465	5600, 5600
132	5730	470	5720
133	5750	475	5740, 5740
134	5760	8190	5750, 6260
135	5780	8195	5770, 6270
136	5790	480	5740
137	5820	8200	5810
138	5840	8205	5340, 5830, 6310
139	5860	8210	5360, 5850, 6320
140	5880	485	5870, 5870
141	5890	490	5870
142	5900	495	5790
143	5920	500	5910, 5910
144	5930	8215	5920
145	5970	505	5940
146	5980	510	5960
147	5990	8220	5980
148	6010	515	6000, 6000
149	6020	8225	6010

150	6070	520	5900
151	6110	525	6080
152	6120	530	6100
153	6170	535	6140
154	6180	540	6160
155	6210	545	6180
156	6220	550	6200
157	6240	555	6120
158	6260	560	6250, 6250
159	6290	565	6250
160	6300	8230	6290
161	6340	570	6330, 6330
162	6350	575	6330
163	6390	580	6360
164	6400	585	6380
165	6410	8235	6400
166	6420	590	5910, 6000, 6030, 6070
167	6500	595	6470
168	6640	600	330

INPUT / OUTPUT TABLE.

DEFINING SEQ. NO.	I/O OPERATION	LOGICAL UNIT	I/O TYPE	FORMAT USED	I/O LIST
330	READ	5	BCD	8005	TITLE
350	READ	5	BCD	8010	M,N,NU,KK,JJ, IOUT, IFZ, IEX, NUMZ, NUMX, KOUT, IPLOT, ILENGTH
480	READ	5	BCD	8015	EL, ELO, WCE(1)
510	READ	5	BCD	8020	(SD(I), I=1, M2)
520	READ	5	BCD	8020	(H(I), I=1, M2)
530	READ	5	BCD	8020	(TD(J), J=1, N2)
540	READ	5	BCD	8020	(G(J), J=1, N2)
730	READ	5	BCD	8035	(ZVAL(I), ZWZ(I), I=1, NUMZ)
920	READ	5	BCD	8035	(XVAL(I), XWX(I), I=1, NUMX)
210	WRITE	6	BCD	8000	
600	WRITE	6	BCD	8025	
650	WRITE	6	BCD	8030	
1180	WRITE	6	BCD	8040	
1200	WRITE	6	BCD	8045	MDX, SD(MDX), NDY, SD(NDY)
1380	WRITE	6	BCD	8050	
1400	WRITE	6	BCD	8055	MDX, TD(MDX), NDY, TD(NDY)
2820	WRITE	6	BCD	8165	TITLE
2830	WRITE	6	BCD	8060	
2850	WRITE	6	BCD	8065	NUM1
2870	WRITE	6	BCD	8070	(UOD(I), I=1, NUM1)
2890	WRITE	6	BCD	8075	NUMA
2910	WRITE	6	BCD	8070	(UID(I), I=1, NUMA)
2920	WRITE	6	BCD	8080	NUMJK
2940	WRITE	6	BCD	8070	(UA(I), I=1, NUMJK)
2950	WRITE	6	BCD	8085	NUMJKL
2970	WRITE	6	BCD	8070	(UAA(I), I=1, NUMJKL)
2980	WRITE	6	BCD	8090	
3000	WRITE	6	BCD	8070	(UEE(I), I=1, NUM1)

3010	WRITE	6	BCD	8095	
3030	WRITE	6	BCD	8070	(UTE(I),I=1,NUMA)
3040	WRITE	6	BCD	8100	
3060	WRITE	6	BCD	8070	(UB(I),I=1,NUM1JK)
3070	WRITE	6	BCD	8105	
3090	WRITE	6	BCD	8070	(UBB(I),I=1,NUMJKL)
4180	WRITE	6	BCD	8110	
4220	WRITE	6	BCD	8115	
4600	WRITE	6	BCD	8120	
4760	WRITE	6	BCD	8125	UVAL(L),XAU(L),XBU(L),(ZAU(ML),ZBU(ML),ZANS(ML),XTNT(ML),...
4920	WRITE	6	BCD	8130	
5070	WRITE	6	BCD	8135	
5100	WRITE	6	BCD	8140	
5130	WRITE	6	BCD	8145	
5150	WRITE	6	BCD	8150	M,N,NU,KK,JJ,IFZ,NUMZ,LEX,NUMX,ELO,EL,WCE(1),WM,WC
5170	WRITE	6	BCD	8155	
5190	WRITE	6	BCD	8160	(SD(I),TD(I),I=1,8),(H(I),G(I),I=1,8)
5250	WRITE	6	BCD	8165	TITLE
5280	WRITE	6	BCD	8170	
5320	WRITE	6	BCD	8175	
5340	WRITE	6	BCD	8205	
5360	WRITE	6	BCD	8210	(UVAL(I),WWU(I),UVAL(I+NNU),WWU(I+NNU),I=1,NNU)
5380	WRITE	6	BCD	8180	UVAL(NU),WWU(NU)
5400	WRITE	6	BCD	8185	AW
5800	WRITE	6	BCD	8165	TITLE
5810	WRITE	6	BCD	8200	
5830	WRITE	6	BCD	8205	
5850	WRITE	6	BCD	8210	(UVAL(I),WWU(I),UVAL(I+NNU),WWU(I+NNU),I=1,NNU)
5880	WRITE	6	BCD	8180	UVAL(NU),WWU(NU)
5890	WRITE	6	BCD	8185	AW
5920	WRITE	6	BCD	8215	FIRSTM,SECDMM,THRDMM
5980	WRITE	6	BCD	8220	UVAL(II)
6010	WRITE	6	BCD	8225	FRSTMM,SCNDMM,THRDMM
6290	WRITE	6	BCD	8230	
6310	WRITE	6	BCD	8205	
6320	WRITE	6	BCD	8210	(UL(I),WLU(I),UL(I+NNU),WLU(I+NNU),I=1,NNU)
6340	WRITE	6	BCD	8180	UL(NU),WLU(NU)
6400	WRITE	6	BCD	8235	UL(II)
5750	WRITE	7	BCD	8190	NU,AW
5770	WRITE	7	BCD	8195	(UVAL(I),WWU(I),I=1,NU)
6260	WRITE	7	BCD	8190	NU,AW
6270	WRITE	7	BCD	8195	(UL(I),WLU(I),I=1,NU)

		SUBROUTINE SUBMIN(A,B,C,M,N)		
		DIMENSION A(1),B(1)		SUBMT 10
		AMIN=A(1)		SUBMT 20
		BMIN=B(1)		SUBMT 30
I-----		DO 10 I=1,M		SUBMT 40
I-----		IF(AMIN-A(I)) 10,5,5		SUBMT 50
I-----	5	AMIN=A(I)		SUBMT 60
I-----	10	CONTINUE		SUBMT 70
		IF(N.EQ. 0) GO TO 25		SUBMT 80
J-----		DO 20 J=1,N		SUBMT 90
J-----		IF(BMIN-B(J)) 20,15,15		SUBM 100
J-----	15	BMIN=B(J)		SUBM 110
J-----	20	CONTINUE		SUBM 120
		IF(AMIN-BMIN)25,25,30.		SUBM 130
	25	C=AMIN		SUBM 140
		GO TO 35		SUBM 150
	30	C=BMIN		SUBM 160
	35	RETURN		SUBM 170
		END		SUBM 180
				SUBM 190

TABLE OF VARIABLE NAMES.

VARIABLE NAME	ARRAY DIMENSIONS	TOTAL NO ELEMENTS	ELEMENT TYPE	DECLARATION	CROSS REFERENCE TABLE (BY SEQUENCE NUMBERS)				
A	(1)	1	REAL*4	PARAMETER	10,	20,	30,	60,	70
AMIN			REAL*4	LOCAL	30*	6C,	70*	140,	150
B	(1)	1	REAL*4	PARAMETER	10,	20,	40,	110,	120
BMIN			REAL*4	LOCAL	40*	11C,	120*	140,	170
C			REAL*4	PARAMETER	10,	150*	170*		
I			INTEGER*4	LOCAL	50*	6C,	70		
J			INTEGER*4	LOCAL	100*	11C,	120		
M			INTEGER*4	PARAMETER	10,	50			
N			INTEGER*4	PARAMETER	10,	9C,	100		
SUBMIN			REAL*4	ENTRY POINT	10				

* = VARIABLES USED ON LEFT HAND SIDE OF EQUAL SIGN

STATEMENT NUMBER TABLE

CROSS REFERENCE TABLE

NO	DEFINING SEQUENCE NO.	STATEMENT NUMBER	REFERENCING SEQUENCE NUMBERS	
1	70	5	60,	60
2	80	10	50,	60
3	120	15	110,	110
4	130	20	100,	110
5	150	25	90,	140, 140
6	170	30	140	
7	180	35	160	

```

SUBROUTINE SIMP(XX,FX,AX,NX)
DIMENSION XX(2),FX(2),AX(2)
DELX=XX(2)-XX(1)
AX(1)=0.0
DO 10 IX=2,NX,2
IF(NX-IX)5,15,5
AX(IX)=DELX*(5.0*FX(IX-1)+8.0*FX(IX)-FX(IX+1))/12.0*AX(IX-1)
AX(IX+1)=DELX*(FX(IX-1)+4.0*FX(IX)+FX(IX+1))/3.0*AX(IX-1)
GO TO20
AX(NX)=DELX*(-FX(NX-2)+8.0*FX(NX-1)+5.0*FX(NX))/12.0*AX(NX-1)
RETURN
END
SIMP 10
SIMP 20
SIMP 30
SIMP 40
SIMP 50
SIMP 60
SIMP 70
SIMP 80
SIMP 90
SIMP 100
SIMP 110
SIMP 120

```

TABLE OF VARIABLE NAMES

VARIABLE NAME	ARRAY DIMENSIONS	TOTAL NO. ELEMENTS	ELEMENT TYPE	DECLARATION	CROSS REFERENCE TABLE (BY SEQUENCE NUMBERS)					
AX	(2)	2	REAL*4	PARAMETER	10,	20,	40*	70*	80*	100*
DELX			REAL*4	LOCAL	30*	70,	80,	100		
FX	(2)	2	REAL*4	PARAMETER	10,	20,	70,	80,	100	
IX			INTEGER*4	LOCAL	50*	60,	70,	80		
NX			INTEGER*4	PARAMETER	10,	50,	60,	100		
SIMP			REAL*4	ENTRY POINT	10					
XX	(2)	2	REAL*4	PARAMETER	10,	20,	30			

* = VARIABLES USED ON LEFT HAND SIDE OF EQUAL SIGN

STATEMENT NUMBER TABLE

CROSS REFERENCE TABLE

NO	DEFINING SEQUENCE NO	STATEMENT NUMBER	REFERENCING SEQUENCE NUMBERS	
1	70	5	60,	60
2	80	10	50	
3	100	15	60	
4	110	20	90	

```

SUBROUTINE SUBMAX(A,B,C,M,N)
DIMENSION A(1),B(1)
AMAX=A(1)
BMAX=B(1)
I-----
DO 10 I=1,M
IF(AMAX-A(I)) 5,10,10
I----- 5
AMAX=A(I)
I----- 10
CONTINUE
IF(N .EQ. 0) GO TO 30
DO 20 J=1,N
IF(BMAX-B(J)) 15,20,20
J----- 15
BMAX=B(J)
J----- 20
CONTINUE
IF(AMAX-BMAX)25,30,30
I----- 25
C=BMAX
GO TO 35
I----- 30
C=AMAX
I----- 35
RETURN
END

```

```

SUBMA 10
SUBMA 20
SUBMA 30
SUBMA 40
SUBMA 50
SUBMA 60
SUBMA 70
SUBMA 80
SUBMA 90
SUBM 100
SUBM 110
SUBM 120
SUBM 130
SUBM 140
SUBM 150
SUBM 160
SUBM 170
SUBM 180
SUBM 190

```

TABLE OF VARIABLE NAMES

VARIABLE NAME	ARRAY DIMENSIONS	TOTAL NO ELEMENTS	ELEMENT TYPE	DECLARATION	CROSS REFERENCE TABLE (BY SEQUENCE NUMBERS)
A	(1)	1	REAL*4	PARAMETER	10, 20, 30, 60, 70
AMAX			REAL*4	LOCAL	30*, 60, 70*, 140, 170
B	(1)	1	REAL*4	PARAMETER	10, 20, 40, 110, 120
BMAX			REAL*4	LOCAL	40*, 110, 120*, 140, 150
C			REAL*4	PARAMETER	10, 150*, 170*
I			INTEGER*4	LOCAL	50*, 60, 70
J			INTEGER*4	LOCAL	100*, 110, 120
M			INTEGER*4	PARAMETER	10, 50
N			INTEGER*4	PARAMETER	10, 90, 100
SUBMAX			REAL*4	ENTRY POINT	10

* = VARIABLES USED ON LEFT HAND SIDE OF EQUAL SIGN

STATEMENT NUMBER TABLE

CROSS REFERENCE TABLE

NO	DEFINING SEQUENCE NO	STATEMENT NUMBER	REFERENCING SEQUENCE NUMBERS
1	70	5	60
2	80	10	50, 60, 60
3	120	15	110
4	130	20	100, 110, 110
5	150	25	140
6	170	30	90, 140, 140
7	180	35	180


```

      FUNCTION YLAG(XI,X,Y,IND1,N1,IMAX,IEX)
      C LAGRANGIAN INTERPOLATION
      C XI IS INTERPOLATED ENTRY INTO X-ARRAY
      C N IS THE ORDER OF LAGRANGIAN INTERPOLATION
      C Y IS ARRAY FROM WHICH YLAG IS OBTAINED BY INTERPOLATION
      C IND IS THE MIN-I FOR X(I).GT.XI
      C IF IND=0,X-ARRAY WILL BE SEARCHED
      C IMAX IS MAX INDEX OF X-AND Y-ARRAYS
      C EXTRAPOLATION CAN OCCUR,IEX=-1 OR +1
      C DIMENSION X(1),Y(1)
      IND=IND1
      N=N1
      IEX=0
      IF(N-IMAX) 10,10,5
      5 N=IMAX
      IEX=N
      10 IF(IND)15,15,30
      15 DO 20 J=1,IMAX
      J IF (XI-X(J)) 25,90,20
      J CONTINUE
      20 IEX=1
      GO TO 55
      25 IND=J
      30 IF (IND-1) 35,45,40
      35 IEX=-1
      40 INL=IND-(N+1)/2
      IF (INL)45,45,50
      45 INL=1
      50 INU=INL+N-1
      IF (INU-IMAX) 60, 60, 55
      55 INL=IMAX-N+1
      INU=IMAX
      60 S=0.
      P=1.
      DO 80 J=INL,INU
      J P=P*(XI-X(J))
      J D=1.
      J I=INL,INU
      J I IF(I-J)70,65,70
      J I 65 XD=XI
      J I GU IU /S
      J I 70 XD=X(J)
      J I D=D*(XD-X(I))
      J I 75 S=S*(J)/D
      J 80 YLAG=S*P
      85 RETURN
      90 YLAG=Y(J)
      GO TO 85
      END

```

```

      YLAG 10
      YLAG 20
      YLAG 30
      YLAG 40
      YLAG 50
      YLAG 60
      YLAG 70
      YLAG 80
      YLAG 90
      YLAG 100
      YLAG 110
      YLAG 120
      YLAG 130
      YLAG 140
      YLAG 150
      YLAG 160
      YLAG 170
      YLAG 180
      YLAG 190
      YLAG 200
      YLAG 210
      YLAG 220
      YLAG 230
      YLAG 240
      YLAG 250
      YLAG 260
      YLAG 270
      YLAG 280
      YLAG 290
      YLAG 300
      YLAG 310
      YLAG 320
      YLAG 330
      YLAG 340
      YLAG 350
      YLAG 360
      YLAG 370
      YLAG 380
      YLAG 390
      YLAG 400
      YLAG 410
      YLAG 420
      YLAG 430
      YLAG 440
      YLAG 450
      YLAG 460
      YLAG 470
      YLAG 480
      YLAG 490

```

TABLE OF VARIABLE NAMES

VARIABLE NAME	ARRAY DIMENSIONS	TOTAL NO ELEMENTS	ELEMENT TYPE	DECLARATION	CROSS REFERENCE TABLE (BY SEQUENCE NUMBERS)								
D			REAL*4	LOCAL	370*	430*	440						
I			INTEGER*4	LOCAL	380*	390,	430						
IEX			INTEGER*4	PARAMETER	10,	130*	160*	210*	250*				
IMAX			INTEGER*4	PARAMETER	10,	140,	150,	180,	300,	310,	320		
IND			INTEGER*4	LOCAL	110*	170,	210*	240,	260				
IND1			INTEGER*4	PARAMETER	10,	110							
INL			INTEGER*4	LOCAL	260*	270,	280*	290,	310*	350,	380		
INU			INTEGER*4	LOCAL	240*	300,	320*	350,	380				
J			INTEGER*4	LOCAL	180*	190,	230,	350*	360,	390,	420,		
N			INTEGER*4	LOCAL	120*	140,	150*	160,	260,	290,	310		
N1			INTEGER*4	PARAMETER	10,	120							
P			REAL*4	LOCAL	340*	360*	450						
S			REAL*4	LOCAL	330*	440*	450						
X	(1)	1	REAL*4	PARAMETER	10,	100,	190,	360,	420,	430			
XD			REAL*4	LOCAL	400*	420*	430						
XI			REAL*4	PARAMETER	10,	190,	360,	400					
Y	(1)	1	REAL*4	PARAMETER	10,	100,	440,	470					
YLAG			REAL*4	ENTRY POINT	10,	450*	470*						

* = VARIABLES USED ON LEFT HAND SIDE OF EQUAL SIGN

STATEMENT NUMBER TABLE

NO	DEFINING SEQUENCE NO	STATEMENT NUMBER
1	150	5
2	170	10
3	180	15
4	200	20
5	230	25
6	240	30
7	250	35
8	260	40
9	280	45
10	290	50
11	310	55
12	330	60
13	400	65
14	420	70
15	430	75
16	440	80
17	460	85
18	470	90

CROSS REFERENCE TABLE

REFERENCING SEQUENCE NUMBERS	
140	
140,	140
170,	170
180,	190
190	
170	
240,	240
240	
270,	270
270	
220,	300
300,	300
390	
390,	390
380,	410
350	
480	
190	

```

SUBROUTINE WOUT1(NUMX,XVAL,XWX)
DIMENSION XVAL(50),XWX(50)
J1=NUMX/2
WRITE(6,8000)
8000 FORMAT(1H0,20X,'DETECTOR SENSITIVITY*')
WRITE(6,8005)(XVAL(ML),XWX(ML),XVAL(ML+J1),XWX(ML+J1),ML=1,J1)
8005 FORMAT(1H0,8X,4HXVAL,11X,3HXWX,12X,4HXVAL,11X,4HXWX /12(1XF14.6,1XWOUT1
1F14.6))
IF(MOD(NUMX,2)) 5,10,5
5 WRITE(6,8010) XVAL(NUMX), XWX(NUMX)
8010 FORMAT(30XF14.6,1XF14.6)
10 RETURN
END
WOUT1 10
WOUT1 20
WOUT1 30
WOUT1 40
WOUT1 50
WOUT1 60
WOUT1 70
WOUT1 71
WOUT1 80
WOUT1 90
WOUT 100
WOUT 110
WOUT 120

```

TABLE OF VARIABLE NAMES

VARIABLE NAME	ARRAY DIMENSIONS	TOTAL NO ELEMENTS	ELEMENT TYPE	DECLARATION	CROSS REFERENCE TABLE (BY SEQUENCE NUMBERS)			
J1			INTEGER*4	LOCAL	30*	60		
ML			INTEGER*4	LOCAL	60*			
MOD			INTEGER*4	FUNCTION	80			
NUMX			INTEGER*4	PARAMETER	10,	30,	80,	90
WOUT1			REAL*4	ENTRY POINT	10			
XVAL	(50)	50	REAL*4	PARAMETER	10,	20,	60,	90
XWX	(50)	50	REAL*4	PARAMETER	10,	20,	60,	90

* = VARIABLES USED ON LEFT HAND SIDE OF EQUAL SIGN

STATEMENT NUMBER TABLE

CROSS REFERENCE TABLE

NO	DEFINING SEQUENCE NO	STATEMENT NUMBER	REFERENCING SEQUENCE NUMBERS
1	50	8000	40
2	70	8005	60
3	90	5	80, 80
4	100	8010	90
5	110	10	80

INPUT / OUTPUT TABLE

DEFINING SEQ. NO.	I/O OPERATION	LOGICAL UNIT	I/O TYPE	FORMAT USED	I/O LIST
40	WRITE	6	BCD	8000	
60	WRITE	6	BCD	8005	(XVAL(ML),XWX(ML),XVAL(ML+J1),XWX(ML+J1),ML=1,J1)
90	WRITE	6	BCD	8010	XVAL(NUMX),XWX(NUMX)

```

SUBROUTINE WOUT2(NUMZ,ZVAL,ZWZ)
  DIMENSION ZVAL(50),ZWZ(50)
  J1=NUMZ/2
  WRITE(6,8000)
8000 FORMAT(1H0,20X,'FOCAL SPOT INTENSITY'/)
  WRITE(6,8005) (ZVAL(ML),ZWZ(ML),ZVAL(ML+J1),ZWZ(ML+J1),ML=1,J1)
8005 FORMAT(1H0,8X,4HZVAL,11X,3HZWZ,12X,4HZVAL,11X,3HZWZ/(2(1XF14.6,1XF
114.6)))
  IF (MOD(NUMZ,2)) 5,10,5
5  WRITE(6,8010) ZVAL(NUMZ), ZWZ(NUMZ)
8010 FORMAT(30XF14.6,1XF14.6)
10  RETURN
END

```

```

WOUT2 10
WOUT2 20
WOUT2 30
WOUT2 40
WOUT2 50
WOUT2 60
WOUT2 70
WOUT2 71
WOUT2 80
WOUT2 90
WOUT 100
WOUT 110
WOUT 120

```

TABLE OF VARIABLE NAMES

VARIABLE NAME	ARRAY DIMENSIONS	TOTAL NO ELEMENTS	ELEMENT TYPE	DECLARATION	CROSS REFERENCE TABLE (BY SEQUENCE NUMBERS)
J1			INTEGER*4	LOCAL	30* 60
ML			INTEGER*4	LOCAL	60*
MDC			INTEGER*4	FUNCTION	80
NUMZ			INTEGER*4	PARAMETER	10, 30, 80, 90
WOUT2			REAL*4	ENTRY POINT	10
ZVAL	(50)	50	REAL*4	PARAMETER	10, 20, 60, 90
ZWZ	(50)	50	REAL*4	PARAMETER	10, 20, 60, 90

* = VARIABLES USED ON LEFT HAND SIDE OF EQUAL SIGN

STATEMENT NUMBER TABLE

CROSS REFERENCE TABLE

NO.	DEFINING SEQUENCE NO	STATEMENT NUMBER	DEFINING SEQUENCE NUMBERS
1	50	8000	40
2	70	8005	60
3	90	5	80, 80
4	100	8010	90
5	110	10	80

INPUT / OUTPUT TABLE

DEFINING SEQ. NO.	I/O OPERATION	LOGICAL UNIT	I/O TYPE	FORMAT USED	I/O LIST
40	WRITE	6	BCD	8000	
60	WRITE	6	BCD	8005	(ZVAL(ML),ZWZ(ML),ZVAL(ML+J1),ZWZ(ML+J1),ML=1,J1)
90	WRITE	6	BCD	8010	ZVAL(NUMZ),ZWZ(NUMZ)

```

SUBROUTINE TIMER(INIT)
  IF(INIT .EQ. 0) GO TO 5
  TIME=(FLOAT(ICLOCK(0))-TMP)/100.
  WRITE(6,8000) TIME
8000 FORMAT(1H0//10X,'TIME = ',F6.2,' CPU SECONDS'////)
  IF(INIT .LT. 0) GO TO 10
  5  TMP=FLOAT(ICLOCK(0))
  10 RETURN
  END

```

```

TIMER 10
TIMER 20
TIMER 30
TIMER 40
TIMER 50
TIMER 60
TIMER 70
TIMER 80
TIMER 90

```

TABLE OF VARIABLE NAMES

VARIABLE NAME	ARRAY DIMENSIONS	TOTAL NO ELEMENTS	ELEMENT TYPE	DECLARATION	CROSS REFERENCE TABLE (BY SEQUENCE NUMBERS)	
FLCAT			REAL*4	FUNCTION	30,	70
IGLOCK			INTEGER*4	FUNCTION	30,	70
INIT			INTEGER*4	PARAMETER	10,	20, 60
TIME			REAL*4	LOCAL	30*	40
TIMER			REAL*4	ENTRY POINT	10	
TMP			REAL*4	LOCAL	30,	70*

* = VARIABLES USED ON LEFT HAND SIDE OF EQUAL SIGN

STATEMENT NUMBER TABLE

CROSS REFERENCE TABLE

NO	DEFINING SEQUENCE NO	STATEMENT NUMBER	REFERENCING SEQUENCE NUMBERS
1	50	0000	50
2	70	5	20
3	80	10	60

INPUT / OUTPUT TABLE

DEFINING SEQ. NO.	I/O OPERATION	LOGICAL UNIT	I/O TYPE	FORMAT USED	I/O LIST
40	WRITE	6	REEL	8000	TIME

APPENDIX B
FLOW CHART OF PROGRAM WEIGHT

ORNL-DWG 67-7176R

APPENDIX C
DEFINITION OF SELECTED PROGRAM VARIABLES

<u>Variable</u>	<u>Description</u>
AANS(202)	Array containing values of the normalization factor.
AMOMNT(202)	Array used in calculating moments of the function.
APLTZ(5000)	Work area for plotting routines.
AREAB	Area under $f_w(z)$ between $z_a(u,x)$ and next highest value of SIMPZ.
AREAT	Area under $f_w(z)$ between $z_b(x,u)$ and next lowest value of ZIMPZ.
BCD(4)	Array containing y-axis label for weighting function plots.
EWX(1001)	Array containing calculated values of $e_w(x)$.
FIRSTM	First moment about the origin.
FRSTMM	First moment about the mean.
FWZ(1001)	Array containing calculated values of $f_w(z)$.
FWZINB	Interpolated value of $f_w(z)$ corresponding to $z_a(x,u)$.
FWZINT	Interpolated value of $f_w(z)$ corresponding to $z_b(x,u)$.
G(8)	Array containing h_j .
H(8)	Array containing h_i .
IEX	Flag indicating whether or not x and $e_w(x)$ values are given as data.
IFLAG	Computed flag indicating whether the input data corresponds to pairs of edges with each member of the pair equidistant from the sample plane.
IFZ	Flag indicating whether or not z and $f_w(z)$ values are given as data.
IPILOT	Flag indicating whether or not plots will be made (IPILOT $\neq$ 0; plots).
IOUT	Flag indicating form of output.
JJ	Flag indicating whether or not moments about the mean are to be calculated.
KK	Flag indicating whether or not moments about the origin are to be calculated.
M	Number of pairs of slits between sample plane and tube plane.
N	Number of pairs of slits between sample plane and detector plane.
NU	Number values of u .

<u>Variable</u>	<u>Description</u>
NUMX	Number of pairs of x and $e_w(x)$ values given as data.
NUMZ	Number of pairs of z and $f_w(z)$ values given as data.
SCNDMM	Second moment about the mean.
SD(8)	Array containing d_i .
SECNDM	Second moment about the origin.
SIMPX(1001)	Array containing x values that corresponds to $e_w(x)$.
SIMPZ(1001)	Array containing z values that corresponds to $f_w(z)$.
TD(8)	Array containing d_j .
TITLE(80)	Array containing user's title of computations.
UA(96)	$u_{2i-1,2i',2k,2j-1}$.
UAA(256)	$u_{2i-1,2j,2k,2l-1}$.
UB(96)	$u_{2i,2i'-1,2k-1,2j}$.
UBB(256)	$u_{2i,2j-1,2k-1,2l}$.
UDIF(202)	Array containing values of $(u_i - \bar{u})^k * W_w(u)$ for each value of u .
UEE(6)	$u_{2i,2i'-1}$.
UIE(16)	$u_{2i,2j-1}$.
UINC	u increment.
UIO(16)	$u_{2i-1,2j}$.
UL(202)	Array containing u -values for the effective slit-length weighting functions.
ULL(2)	Array containing $\text{Max}(UA, UAA)$.
UOO(6)	$u_{2i-1,2i'}$.
USTORE(202)	Array containing values of $u^k * W_w(u)$ for each value of u .
UUL(2)	Array containing $\text{Min}(UB, UBB)$.
UVAL(202)	u array.
WC(1)	Array containing $\text{Min}(x_{2j',2j-1}, w_c)$.
WCE(8)	$x_{2j'-1,2j}$.
WCO(8)	$x_{2j',2j-1}$.
WLU(202)	u values for $W_l^{\text{eff}}(u)$.
WM(1)	Array containing $\text{Max}(x_{2j'-1,2j}, w_c)$.
WWU(202)	Array containing normalized $W_w(u)$ for all u values.
WWUP(202)	Array containing unnormalized $W_w(u)$ values for all u values.

<u>Variable</u>	<u>Description</u>
XANS(202)	Array containing results of x integration; last element of the array contains most accurate answer.
XAU(202)	$x_a(u)$.
XBU(202)	$x_b(u)$.
XIE(16)	$x_{2i,2j-1}$.
XINC	x increment.
XINT(1001)	Array containing the integrand for x integration; $XTNT(I) = EWX(I)*ZANS(I)$.
XIO(16)	$x_{2i-1,2j}$.
XMAXD(1)	Variable containing maximum x.
XMIND(1)	Variable containing minimum x.
XRAY(1001)	Array containing x values for the integration from XAU to XBU.
XVAL(50)	x values for $e_w(x)$ given as data.
XWX(50)	$e_w(x)$ values given as data.
XXE(6)	$x_{2i,2i'-1}$.
XXO(6)	$x_{2i-1,2i'}$.
ZANS(202)	Array containing results of z integration; last element contains most accurate answer.
ZAU(202)	$z_a(x,u)$.
ZBU(202)	$z_b(x,u)$.
ZIE(4)	z_{2i} : z values calculated using d_i and h_i .
ZINT(1001)	Array containing the integral of FWZ from SIMPZ(1) to SIMPZ(I).
ZINCR	Increment of z integration.
ZIO(4)	z_{2i-1} .
ZJE(4)	z_{2j} : z values calculated using d_j and h_j .
ZJO(4)	z_{2j-1} .
ZVAL(50)	z values for $f_w(z)$ given as data.
ZWZ(50)	$f_w(z)$ values given as data.

APPENDIX D
INPUT VARIABLES

<u>Variable</u>	<u>Description</u>
EL	The distance from the sample plane to the detector plane; equivalent to L .
ELO	The distance from the sample plane to the tube plane; equivalent to L_0 .
G(J)	The distance from the j^{th} slit to the camera axis; equivalent to h_j .
H(I)	The distance from the i^{th} slit to the camera axis; equivalent to h_i .
IEX	Flag indicating whether or not x and $e_w(x)$ supplied as data; for $IEX = 0$, set $e_w(x) = 1$ for all values of x . When $IEX \neq 0$, values of x and $e_w(x)$ will be read in as data. The value of IEX is the order of the Lagrangian interpolation in the $e_w(x)$ table and should usually be 2 to 4.
IFZ	Flag indicating whether or not z and $f_w(z)$ supplied as data; for $IFZ = 0$, set $f_w(z) = 1$ for all values of z . When $IFZ \neq 0$, values of z and $f_w(z)$ will be read in as data. The value of IFZ is the order of the Lagrangian interpolation in the $f_w(z)$ table.
ILNGTH	Flag indicating whether the calculation is a width or length weighting function. $I = 0$, width weighting function. $I = 1$, length weighting function; also calculate effective weighting function. $I = 2$, length weighting function; do not calculate effective weighting function.
IOUT	Flag indicating whether or not a punched deck of the final u and $W_w(u)$ values is to be punched.
JJ	Flag indicating whether or not moments about the mean are to be calculated. $JJ = 0$, do not calculate moments; $JJ = 1$, calculate 1st moment; $JJ = 2$, calculate 1st and 2nd moments; $JJ = 3$, calculate 1st, 2nd, and 3rd moments. 3 is the maximum value of JJ .
KK	Flag indicating whether or not moments about origin are to be calculated. If $KK = 0$, JJ must also be 0. $KK = 0$, do not calculate moments; $KK = 1$, calculate 1st moment; $KK = 2$, calculate 1st and 2nd moments; $KK = 3$, calculate 1st, 2nd, and 3rd moments. 3 is the maximum value of KK .
KOUT	Flag indicating whether or not the values of u , u_{aaa} , u_{bbb} , $x_a(u)$, $x_b(u)$ versus $z_a(x,u)$ and $z_b(x,u)$ are printed out. This information is helpful in error analysis. $KOUT = 0$, no printout; $KOUT \neq 0$, printout.
M	Number of pairs of slits between sample plane and tube plane; $1 \leq M \leq 4$.

<u>Variable</u>	<u>Description</u>
N	Number of pairs of slits between sample plane and detector plane; $1 \leq N \leq 4$.
NU	Number of u values to be calculated; NU - 1 is the number of intervals to be used in evaluating the integrals. NU $\leq$ 200.
NUMX	Number of pairs of x and $e_w(x)$ supplied as data.
NUMZ	Number of pairs of z and $f_w(z)$ supplied as data.
SD(I)	Array of distances from sample plane to the i^{th} slit between the sample plane and the tube plane; $1 \leq i \leq 2*M$.
TD(J)	Array of distances from sample plane to the j^{th} slit between sample plane and detector plane; $1 \leq J \leq 2*N$.
WC	One-half width of receiving slit.
X(NUMX)	Array of x values.
XWX(NUMX)	Array of $e_w(x)$ values.
Z(NUMZ)	Array of z values.
ZWZ(NUMZ)	Array of $f_w(z)$ values.

Table D.1. Format of Information Shown on Data Cards

Card Number ^a	Format	Variables
1	80A1	TITLE
2	13I5	M, N, NU, KK, JJ, IOUT, IFZ, IEX, NUMZ, NUMX, KOUT, IPLOT, ILENGTH
3	3F10.4	EL, ELO, WC
4	8F10.3	SD(I), where $I = 1, 2, \dots, 2 \cdot M$
5	8F10.3	H(I)
6	8F10.3	TD(J), where $J = 1, 2, \dots, 2 \cdot N$
7	8F10.3	G(J)
8-20	8F10.3	Z(K), ZWZ(K) alternately; K = 1, 2, ..., NUMZ
21-32	8F10.3	X(K), XWX(K) alternately; K = 1, 2, ..., NUMX

^aCards 8-32 are not necessary if IFZ and IEX are both 0. Provision has been made for 50 values each of X, XWX, Z, and ZWZ. If the user requires fewer than this number, the number of data cards required for the values can be reduced. For example, if NUMZ = 25, there would be 25 Z values and 25 ZWZ values. Therefore, the Z and ZWZ values would only occupy cards 8-14 and the X and XWX values would be started in data card number 14. If Z and ZWZ values are not read in as data, the X and XWX values start in data card number 8. Reading Z, ZWZ, X, and XWX values in as data is optional. The only restriction is that if Z values are fed in, ZWZ values must be furnished; the same applies for X and XWX.

APPENDIX E
SAMPLE CALCULATIONS

- Example 1: Slit-width computations for a typical Kratky camera geometry. Note the use of dummy edges at $H(I)$ for $I = 2$ and $I = 3$, and at $H(J)$ for $J = 1$ and $J = 2$. There were no $e_w(x)$ or $f_w(z)$ input data.
- Example 2: Same as example 1 except with $e_w(x)$ and $f_w(z)$ values read in as input data.
- Example 3: Slit-length computations for one component of a Rigaku-Denki collimation system with a Soller slit at the detector. This computation was not possible with versions 1 and 2 of Program WEIGHT.

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INPUT DATA

THIS IS A LENGTH WEIGHTING FUNCTION

THERE ARE 4 PAIRS OF EDGES BETWEEN THE FOCAL SPOT AND THE SAMPLE
 THERE ARE 3 PAIRS OF EDGES BETWEEN THE SAMPLE AND THE DETECTOR
 101 DATA POINTS WILL BE COMPUTED
 COMPUTE THE 0 MOMENT ABOUT THE ORIGIN
 COMPUTE THE 0 MOMENT ABOUT THE MEAN
 INTERPOLATION IN THE F(Z) ARRAY WILL BE BY A 0 POINT LAGRANGIAN
 THERE ARE 0 POINTS IN THE F(Z) ARRAY
 INTERPOLATION IN THE E(X) ARRAY WILL BE BY A 0 POINT LAGRANGIAN
 THERE ARE 0 POINTS IN THE E(X) ARRAY
 THE FOCAL SPOT TO SAMPLE DISTANCE IS 354.0 MM
 THE SAMPLE TO DETECTOR DISTANCE IS 76.5 MM
 THE RECEIVING SLIT WIDTH IS 2X 7.500 MM
 THE LOWER LIMIT OF X VALUES IS -3.252 MM
 THE UPPER LIMIT OF X VALUES IS 1.668 MM

SUBSCRIPT I

D(1)= 39.500
 D(2)= 39.500
 D(3)= 98.500
 D(4)= 98.500
 D(5)=273.000
 D(6)=273.000
 D(7)=353.999
 D(8)=353.999
 H(1)= 5.000
 H(2)= 5.000
 H(3)= 5.000
 H(4)= 5.000
 H(5)= 5.000
 H(6)= 5.000
 H(7)= 6.000
 H(8)= 6.000

SUBSCRIPT J

D(1)= 37.500
 D(2)= 37.500
 D(3)= 43.500
 D(4)= 43.500
 D(5)= 71.500
 D(6)= 71.500
 D(7)=*****
 D(8)=*****
 H(1)= 7.500
 H(2)= 7.500
 H(3)= -1.876
 H(4)= 3.044
 H(5)= -1.876
 H(6)= 3.044
 H(7)=*****
 H(8)=*****

RIGAKU-DENKI CAMERA SOLLER SLIT NUMBER 3

U	WW(U)	U	WW(U)
-72.367661	0.0	-6.949365	0.16856E-01
-71.059280	0.11039E-04	-5.640984	0.16836E-01
-69.750900	0.44104E-04	-4.332602	0.16771E-01
-68.442520	0.99194E-04	-3.024280	0.16666E-01
-67.134201	0.17631E-03	-1.715899	0.16514E-01
-65.825806	0.27545E-03	-0.407517	0.16321E-01
-64.517426	0.39678E-03	0.900865	0.16090E-01
-63.209045	0.54000E-03	2.209187	0.15815E-01
-61.900726	0.70524E-03	3.517568	0.15496E-01
-60.592361	0.89251E-03	4.825950	0.15132E-01
-59.283997	0.11018E-02	6.134331	0.14729E-01
-57.975632	0.13334E-02	7.442653	0.14285E-01
-56.667267	0.15868E-02	8.751035	0.13810E-01
-55.358887	0.18622E-02	10.059416	0.13313E-01
-54.050522	0.21596E-02	11.367798	0.12796E-01
-52.742157	0.24791E-02	12.676120	0.12267E-01
-51.433792	0.28205E-02	13.984501	0.11736E-01
-50.125427	0.31845E-02	15.292883	0.11201E-01
-48.817062	0.35700E-02	16.601257	0.10663E-01
-47.508698	0.39776E-02	17.909576	0.10126E-01
-46.200333	0.44072E-02	19.217957	0.95860E-02
-44.891568	0.48588E-02	20.526337	0.90439E-02
-43.583588	0.53331E-02	21.834717	0.84993E-02
-42.275223	0.58288E-02	23.143051	0.79482E-02
-40.966858	0.63462E-02	24.451431	0.73967E-02
-39.658493	0.68724E-02	25.759811	0.68511E-02
-38.350128	0.74024E-02	27.068192	0.63244E-02
-37.041763	0.79320E-02	28.376511	0.58167E-02
-35.733398	0.84625E-02	29.684891	0.53280E-02
-34.425034	0.89967E-02	30.993271	0.48577E-02
-33.116653	0.95302E-02	32.301651	0.44072E-02
-31.808289	0.10068E-01	33.609985	0.39776E-02
-30.499924	0.10608E-01	34.918365	0.35700E-02
-29.191559	0.11148E-01	36.226746	0.31845E-02
-27.883194	0.11680E-01	37.535126	0.28205E-02
-26.574829	0.12231E-01	38.843445	0.24791E-02
-25.266464	0.12776E-01	40.151825	0.21596E-02
-23.958099	0.13307E-01	41.460205	0.18622E-02
-22.649734	0.13820E-01	42.768585	0.15868E-02
-21.341354	0.14304E-01	44.076920	0.13334E-02
-20.032990	0.14747E-01	45.385300	0.11018E-02
-18.724625	0.15152E-01	46.693680	0.89252E-03
-17.416260	0.15508E-01	48.002060	0.70524E-03
-16.107895	0.15828E-01	49.310379	0.54000E-03
-14.799535	0.16100E-01	50.618759	0.39678E-03
-13.491168	0.16331E-01	51.927139	0.27545E-03
-12.182801	0.16523E-01	53.235519	0.17631E-03
-10.874434	0.16670E-01	54.543000	0.99106E-04
-9.566069	0.16776E-01	55.852234	0.44106E-04
-8.257747	0.16837E-01	57.160614	0.11040E-04
		58.468994	0.0

NORMALIZATION FACTOR AW= 0.43641E 02

TIME = 1.56 CPU SECONDS

INPUT DATA

THIS IS A WIDTH WEIGHTING FUNCTION

THERE ARE 4 PAIRS OF EDGES BETWEEN THE FOCAL SPOT AND THE SAMPLE
 THERE ARE 1 PAIRS OF EDGES BETWEEN THE SAMPLE AND THE DETECTOR
 101 DATA POINTS WILL BE COMPUTED
 COMPUTE THE 3 MOMENT ABOUT THE ORIGIN
 COMPUTE THE 3 MOMENT ABOUT THE MEAN
 INTERPOLATION IN THE F(Z) ARRAY WILL BE BY A 0 POINT LAGRANGIAN
 THERE ARE 0 POINTS IN THE F(Z) ARRAY
 INTERPOLATION IN THE E(X) ARRAY WILL BE BY A 0 POINT LAGRANGIAN
 THERE ARE 0 POINTS IN THE E(X) ARRAY
 THE FOCAL SPOT TO SAMPLE DISTANCE IS 281.0 MM
 THE SAMPLE TO DETECTOR DISTANCE IS 262.0 MM
 THE RECEIVING SLIT WIDTH IS 2X 0.350 MM
 THE LOWER LIMIT OF X VALUES IS -0.350 MM
 THE UPPER LIMIT OF X VALUES IS 0.350 MM

SUBSCRIPT I

D(1)= 63.000
 D(2)= 63.000
 D(3)= 78.000
 D(4)= 78.000
 D(5)=138.000
 D(6)=138.000
 D(7)=198.000
 D(8)=198.000
 H(1)= 0.0
 H(2)=999.000
 H(3)= 0.0
 H(4)=999.000
 H(5)=999.000
 H(6)= 0.0
 H(7)= 0.300
 H(8)= 0.0

SUBSCRIPT J

D(1)= 10.000
 D(2)= 10.000
 D(3)=*****
 D(4)=*****
 D(5)=*****
 D(6)=*****
 D(7)=*****
 D(8)=*****
 H(1)=999.000
 H(2)=999.000
 H(3)=*****
 H(4)=*****
 H(5)=*****
 H(6)=*****
 H(7)=*****
 H(8)=*****

KRATKY CAMERA FULLY ILLUMINATED ENTRANCE SLIT

WEIGHTING FUNCTION BEFORE SHIFT ABOUT FIRST MOMENT

U	WW(U)	U	WW(U)
-8.969460	0.0	-3.816794	0.21250E 00
-8.866403	0.11865E-03	-3.713741	0.21424E 00
-8.763350	0.47456E-03	-3.610689	0.21542E 00
-8.660297	0.10677E-02	-3.507636	0.21604E 00
-8.557244	0.18981E-02	-3.404579	0.21610E 00
-8.454192	0.29658E-02	-3.301527	0.21560E 00
-8.351139	0.42707E-02	-3.198474	0.21455E 00
-8.248083	0.58130E-02	-3.095422	0.21294E 00
-8.145030	0.75924E-02	-2.992369	0.21077E 00
-8.041978	0.96090E-02	-2.889316	0.20804E 00
-7.938925	0.11863E-01	-2.786260	0.20475E 00
-7.835872	0.14354E-01	-2.683207	0.20091E 00
-7.732820	0.17083E-01	-2.580154	0.19650E 00
-7.629763	0.20049E-01	-2.477101	0.19154E 00
-7.526711	0.23252E-01	-2.374049	0.18602E 00
-7.423657	0.26652E-01	-2.270996	0.17994E 00
-7.320604	0.30369E-01	-2.167940	0.17330E 00
-7.217552	0.34284E-01	-2.064887	0.16611E 00
-7.114499	0.38436E-01	-1.961834	0.15835E 00
-7.011443	0.42826E-01	-1.858782	0.15011E 00
-6.908390	0.47452E-01	-1.755729	0.14178E 00
-6.805338	0.52316E-01	-1.652677	0.13346E 00
-6.702285	0.57417E-01	-1.549620	0.12514E 00
-6.599232	0.62755E-01	-1.446567	0.11682E 00
-6.496180	0.68331E-01	-1.343514	0.10850E 00
-6.393123	0.74144E-01	-1.240461	0.10031E 00
-6.290071	0.80193E-01	-1.137409	0.92448E-01
-6.187017	0.86344E-01	-1.034356	0.84904E-01
-6.083965	0.92496E-01	-0.931300	0.77682E-01
-5.980912	0.98647E-01	-0.828247	0.70780E-01
-5.877859	0.10480E 00	-0.725195	0.64200E-01
-5.774803	0.11095E 00	-0.622142	0.57941E-01
-5.671750	0.11710E 00	-0.519089	0.52002E-01
-5.568698	0.12325E 00	-0.416037	0.46385E-01
-5.465645	0.12940E 00	-0.312980	0.41088E-01
-5.362592	0.13555E 00	-0.209928	0.36112E-01
-5.259540	0.14170E 00	-0.106875	0.31458E-01
-5.156483	0.14786E 00	-0.003822	0.27125E-01
-5.053434	0.15401E 00	0.099231	0.23112E-01
-4.950381	0.16016E 00	0.202283	0.19421E-01
-4.847328	0.16631E 00	0.305340	0.16050E-01
-4.744276	0.17246E 00	0.408392	0.13000E-01
-4.641219	0.17861E 00	0.511445	0.10272E-01
-4.538167	0.18471E 00	0.614498	0.78647E-02
-4.435114	0.19036E 00	0.717551	0.57782E-02
-4.332062	0.19545E 00	0.820603	0.40126E-02
-4.229009	0.19998E 00	0.923660	0.25681E-02
-4.125956	0.20395E 00	1.026711	0.14446E-02
-4.022900	0.20736E 00	1.129765	0.64203E-03
-3.919847	0.21021E 00	1.232818	0.16055E-03
		1.335870	0.22667E-11

NORMALIZATION FACTOR AW= 0.73764E-01

KRATKY CAMERA FULLY ILLUMINATED ENTRANCE SLIT

WEIGHTING FUNCTION AFTER SHIFT ABOUT FIRST MOMENT

U	WW(U)	U	WW(U)
-5.343479	0.0	-0.190814	0.21250E 00
-5.240422	0.11865E-03	-0.087761	0.21424E 00
-5.137370	0.47456E-03	0.015291	0.21542E 00
-5.034317	0.10677E-02	0.118344	0.21604E 00
-4.931264	0.18981E-02	0.221401	0.21610E 00
-4.828212	0.29658E-02	0.324453	0.21560E 00
-4.725159	0.42707E-02	0.427506	0.21455E 00
-4.622103	0.58130E-02	0.530559	0.21294E 00
-4.519050	0.75924E-02	0.633612	0.21077E 00
-4.415998	0.96090E-02	0.736665	0.20804E 00
-4.312944	0.11863E-01	0.839721	0.20475E 00
-4.209891	0.14354E-01	0.942774	0.20091E 00
-4.106839	0.17083E-01	1.045826	0.19650E 00
-4.003782	0.20049E-01	1.148079	0.19154E 00
-3.900730	0.23252E-01	1.251931	0.18602E 00
-3.797677	0.26692E-01	1.354984	0.17994E 00
-3.694624	0.30369E-01	1.458040	0.17330E 00
-3.591572	0.34284E-01	1.561093	0.16611E 00
-3.488519	0.38436E-01	1.664146	0.15835E 00
-3.385463	0.42826E-01	1.767199	0.15011E 00
-3.282410	0.47452E-01	1.870252	0.14178E 00
-3.179358	0.52216E-01	1.979304	0.13348E 00
-3.076304	0.57417E-01	2.076361	0.12514E 00
-2.973251	0.62755E-01	2.179414	0.11682E 00
-2.870199	0.68331E-01	2.282466	0.10850E 00
-2.767142	0.74144E-01	2.385519	0.10031E 00
-2.664090	0.80193E-01	2.488571	0.92448E-01
-2.561037	0.86344E-01	2.591624	0.84904E-01
-2.457985	0.92496E-01	2.694679	0.77682E-01
-2.354932	0.98647E-01	2.797732	0.70780E-01
-2.251879	0.10480E 00	2.900705	0.64200E-01
-2.148823	0.11095E 00	3.003838	0.57941E-01
-2.045770	0.11710E 00	3.106891	0.52002E-01
-1.942718	0.12325E 00	3.209943	0.46385E-01
-1.839664	0.12940E 00	3.313000	0.41088E-01
-1.736611	0.13555E 00	3.416053	0.36112E-01
-1.633559	0.14170E 00	3.519105	0.31458E-01
-1.530502	0.14786E 00	3.622158	0.27125E-01
-1.427454	0.15401E 00	3.725210	0.23112E-01
-1.324401	0.16016E 00	3.828263	0.19421E-01
-1.221348	0.16631E 00	3.931319	0.16050E-01
-1.118296	0.17246E 00	4.034372	0.13000E-01
-1.015239	0.17861E 00	4.137425	0.10272E-01
-0.912187	0.18471E 00	4.240478	0.78647E-02
-0.809134	0.19036E 00	4.343531	0.57782E-02
-0.706081	0.19545E 00	4.446583	0.40126E-02
-0.603028	0.19998E 00	4.549640	0.25681E-02
-0.499975	0.20395E 00	4.652692	0.14446E-02
-0.396919	0.20736E 00	4.755745	0.64203E-03
-0.293866	0.21021E 00	4.858798	0.16055E-03
		4.961850	0.22667E-11

NORMALIZATION FACTOR AW= 0.73764E-01

MOMENTS OF THE FUNCTION ABOUT THE ORIGIN

1ST = -0.36260E 01 2ND = 0.16189E 02 3RD = -0.81308E 02

MINIMUM ANGLE TO WHICH DATA CAN BE TAKEN = 4.96 MR

MOMENTS OF THE FUNCTION ABOUT THE MEAN

1ST = 0.22461E-04 2ND = 0.30411E 01 3RD = -0.55438E 00

TIME = 1.43 CPU SECONDS

INPUT DATA

THIS IS A WIDTH WEIGHTING FUNCTION

THERE ARE 4 PAIRS OF EDGES BETWEEN THE FOCAL SPOT AND THE SAMPLE
 THERE ARE 1 PAIRS OF EDGES BETWEEN THE SAMPLE AND THE DETECTOR
 101 DATA POINTS WILL BE COMPUTED
 COMPUTE THE 3 MOMENT ABOUT THE ORIGIN
 COMPUTE THE 3 MOMENT ABOUT THE MEAN
 INTERPOLATION IN THE F(Z) ARRAY WILL BE BY A 2 POINT LAGRANGIAN
 THERE ARE 10 POINTS IN THE F(Z) ARRAY
 INTERPOLATION IN THE E(X) ARRAY WILL BE BY A 0 POINT LAGRANGIAN
 THERE ARE 0 POINTS IN THE E(X) ARRAY
 THE FOCAL SPOT TO SAMPLE DISTANCE IS 281.0 MM
 THE SAMPLE TO DETECTOR DISTANCE IS 262.0 MM
 THE RECEIVING SLIT WIDTH IS 2×0.350 MM
 THE LOWER LIMIT OF X VALUES IS -0.350 MM
 THE UPPER LIMIT OF X VALUES IS 0.350 MM

SUBSCRIPT I

D(1)= 63.000
 D(2)= 63.000
 D(3)= 78.000
 D(4)= 78.000
 D(5)=138.000
 D(6)=138.000
 D(7)=158.000
 D(8)=198.000
 H(1)= 0.0
 H(2)=999.000
 H(3)= 0.0
 H(4)=999.000
 H(5)=999.000
 H(6)= 0.0
 H(7)= 0.300
 H(8)= 0.0

SUBSCRIPT J

D(1)= 10.000
 D(2)= 10.000
 D(3)=*****
 D(4)=*****
 D(5)=*****
 D(6)=*****
 D(7)=*****
 D(8)=*****
 H(1)=999.000
 H(2)=999.000
 H(3)=*****
 H(4)=*****
 H(5)=*****
 H(6)=*****
 H(7)=*****
 H(8)=*****

FOCAL SPOT INTENSITY

ZVAL	ZWZ	ZVAL	ZWZ
-0.100000	0.0	0.514000	0.400000
0.304000	0.0	0.515000	1.000000
0.305000	1.000000	0.585000	1.000000
0.375000	1.000000	0.586000	0.0
0.376000	0.400000	0.800000	0.0

KRATKY CAMERA NON-FULLY ILLUMINATED ENTRANCE SLIT

WEIGHTING FUNCTION BEFORE SHIFT ABOUT FIRST MOMENT

U	WW(U)	U	WW(U)
-8.969460	0.0	-3.816794	0.28932E 00
-8.866403	0.0	-3.713741	0.28776E 00
-8.763350	0.0	-3.610689	0.28423E 00
-8.660297	0.0	-3.507636	0.27845E 00
-8.557244	0.0	-3.404579	0.27086E 00
-8.454192	0.0	-3.301527	0.26151E 00
-8.351139	0.0	-3.198474	0.25103E 00
-8.248083	0.0	-3.095422	0.24063E 00
-8.145030	0.0	-2.992369	0.23036E 00
-8.041978	0.0	-2.889316	0.22022E 00
-7.938925	0.0	-2.786260	0.21019E 00
-7.835872	0.0	-2.683207	0.20028E 00
-7.732820	0.0	-2.580154	0.19022E 00
-7.629763	0.0	-2.477101	0.17960E 00
-7.526711	0.19921E-03	-2.374049	0.16842E 00
-7.423657	0.14278E-02	-2.270996	0.15669E 00
-7.320604	0.37788E-02	-2.167940	0.14439E 00
-7.217552	0.72470E-02	-2.064887	0.13155E 00
-7.114499	0.11843E-01	-1.961834	0.11800E 00
-7.011443	0.17558E-01	-1.858782	0.10380E 00
-6.908390	0.24391E-01	-1.755729	0.90169E-01
-6.805338	0.32338E-01	-1.652677	0.77281E-01
-6.702285	0.40920E-01	-1.549620	0.65151E-01
-6.599232	0.45967E-01	-1.446567	0.53776E-01
-6.496180	0.55458E-01	-1.343514	0.43148E-01
-6.393123	0.65399E-01	-1.240461	0.33276E-01
-6.290071	0.79780E-01	-1.137409	0.24135E-01
-6.187017	0.90560E-01	-1.034356	0.15793E-01
-6.083965	0.10131E 00	-0.931300	0.90372E-02
-5.980912	0.11195E 00	-0.828247	0.41558E-02
-5.877859	0.12246E 00	-0.725195	0.11488E-02
-5.774803	0.13286E 00	-0.622142	0.12555E-04
-5.671750	0.14314E 00	-0.519089	0.0
-5.568698	0.15331E 00	-0.416037	0.0
-5.465645	0.16335E 00	-0.312980	0.0
-5.362592	0.17328E 00	-0.209928	0.0
-5.259540	0.18330E 00	-0.106875	0.0
-5.156483	0.19388E 00	-0.003822	0.0
-5.053434	0.20501E 00	0.099231	0.0
-4.950381	0.21670E 00	0.202283	0.0
-4.847328	0.22870E 00	0.305340	0.0
-4.744276	0.24019E 00	0.408392	0.0
-4.641219	0.25124E 00	0.511445	0.0
-4.538167	0.26187E 00	0.614498	0.0
-4.435114	0.27088E 00	0.717551	0.0
-4.332062	0.27802E 00	0.820603	0.0
-4.229009	0.28330E 00	0.923660	0.0
-4.125956	0.28673E 00	1.026711	0.0
-4.022900	0.28879E 00	1.129765	0.0
-3.919847	0.28966E 00	1.232818	0.0
		1.335870	0.0

NORMALIZATION FACTOR AW= 0.31508E-01

KRATKY CAMERA NON-FULLY ILLUMINATED ENTRANCE SLIT

WEIGHTING FUNCTION AFTER SHIFT ABOUT FIRST MOMENT

U	WW(U)	U	WW(U)
-5.003510	0.0	0.149156	0.28932E 00
-4.900453	0.0	0.252209	0.28776E 00
-4.757400	0.0	0.355261	0.28423E 00
-4.694347	0.0	0.458314	0.27845E 00
-4.591294	0.0	0.561371	0.27086E 00
-4.488242	0.0	0.664423	0.26151E 00
-4.385189	0.0	0.767476	0.25103E 00
-4.282133	0.0	0.870528	0.24063E 00
-4.179080	0.0	0.973581	0.23036E 00
-4.076028	0.0	1.076634	0.22022E 00
-3.972975	0.0	1.179690	0.21019E 00
-3.869922	0.0	1.282743	0.20028E 00
-3.766870	0.0	1.385796	0.19022E 00
-3.663813	0.0	1.488849	0.17960E 00
-3.560760	0.19921E-03	1.591901	0.16842E 00
-3.457707	0.14278E-02	1.694954	0.15669E 00
-3.354654	0.37788E-02	1.798010	0.14439E 00
-3.251602	0.72470E-02	1.901063	0.13155E 00
-3.148549	0.11843E-01	2.004116	0.11800E 00
-3.045493	0.17558E-01	2.107168	0.10380E 00
-2.942440	0.24391E-01	2.210221	0.90169E-01
-2.839388	0.32338E-01	2.313273	0.77281E-01
-2.736335	0.40920E-01	2.416330	0.65151E-01
-2.633282	0.49967E-01	2.519383	0.53776E-01
-2.530230	0.55458E-01	2.622436	0.43148E-01
-2.427173	0.69399E-01	2.725489	0.33276E-01
-2.324121	0.79780E-01	2.828541	0.24135E-01
-2.221067	0.90560E-01	2.931594	0.15793E-01
-2.118015	0.10131E 00	3.034649	0.90372E-02
-2.014962	0.11155E 00	3.137702	0.41558E-02
-1.911909	0.12246E 00	3.240755	0.11488E-02
-1.808853	0.13286E 00	3.343807	0.12555E-02
-1.705800	0.14314E 00	3.446860	0.0
-1.602748	0.15331E 00	3.549912	0.0
-1.499695	0.16335E 00	3.652969	0.0
-1.396642	0.17328E 00	3.756022	0.0
-1.293590	0.18330E 00	3.859075	0.0
-1.190533	0.19380E 00	3.962128	0.0
-1.087484	0.20501E 00	4.065100	0.0
-0.984431	0.21670E 00	4.168233	0.0
-0.881378	0.22870E 00	4.271289	0.0
-0.778326	0.24019E 00	4.374342	0.0
-0.675269	0.25124E 00	4.477395	0.0
-0.572217	0.26187E 00	4.580447	0.0
-0.469164	0.27088E 00	4.683500	0.0
-0.366112	0.27002E 00	4.786552	0.0
-0.263059	0.28330E 00	4.889609	0.0
-0.160006	0.28673E 00	4.992661	0.0
-0.056950	0.28879E 00	5.095715	0.0
0.046103	0.28966E 00	5.198768	0.0
		5.301820	0.0

NORMALIZATION FACTOR AW= 0.31508E-01

MOMENTS OF THE FUNCTION ABOUT THE ORIGIN

1ST = -0.39660E 01 2ND = 0.17383E 02 3RD = -0.82211E 02

MINIMUM ANGLE TO WHICH DATA CAN BE TAKEN = 3.34 MR

MOMENTS OF THE FUNCTION ABOUT THE MEAN

1ST = 0.12336E-04 2ND = 0.16539E 01 3RD = -0.15307E 00

TIME = 33.03 CPU SECONDS

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