

EX01

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PROGRAM XBJECT
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLLEL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLE 1
THE PROGRAM XBJECT BACK-PROJECTS A POINT SOURCE PROJECTION
FUNCTION FOR PARALLEL BEAM, FAN BEAM CURVED DETECTOR, FAN BEAM
FLAT DETECTOR GEOMETRIES AND COMPARES THE RESULT WITH A 1/R
RESPONSE.
DIMENSION B(4096),BX(4096),P(100),AG(180)
COMMON/BLANK/WORK(2600)
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0 EACH LINE WILL BE WITHIN 80 CHARACTERS
(OTHERWISE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
5 (CATN ,PAR( 4))
EXTERNAL BRP,PRF,BRPF2,PRFF
DATA BX/3055*0.,1.,1040*0./
LUNOUT=2
I80132=0
THE INPUT PARAMETERS ARE
NDIMU=64
ICIR=1
IGEOM=0
NANG=180
MODANG=5
KDIMU=100
IMIT=1
NWORK=2600
NFLOAT=2
ISTORE=0
IPRINT=7
LUNATN=0
PWID=1.
AXISU=50.5
RFAN=0.
CATN=0.
OPEN OUTPUT FILE
OPEN (LUNOUT,FILE='E01.OUT',FORM='FORMATTED')
PARALLEL BEAM GEOMETRY
CALL SETUP (IPAR,PAR,AG)
DO 10 M=1,NANG
CALL PJECT (BX,P,M,PRF)
CALL BJECT (B,P,M,BRF)
WRITE (LUNOUT,22)
CALL ARRAY (B,NDIMU)
DO 12 I=1,64
DO 12 J=1,64
K=(J-1)*64+I
B(K)=B(K)*SQRT((I-48.)**2+(J-48.)**2)
WRITE (LUNOUT,22)
CALL ARRAY (B,NDIMU)
FAN BEAM GEOMETRY - CURVED DETECTOR
IGEOM=1
RFAN=80.
CALL SETUP (IPAR,PAR,AG)
DO 14 M=1,NANG
CALL PJECT (BX,P,M,PRFF)
CALL BJECT (B,P,M,BRPF2)
WRITE (LUNOUT,24)
CALL ARRAY (B,NDIMU)
DO 16 I=1,64
DO 16 J=1,64
K=(J-1)*64+I
B(K)=B(K)*SQRT((I-48.)**2+(J-48.)**2)
WRITE (LUNOUT,24)
CALL ARRAY (B,NDIMU)
FAN BEAM GEOMETRY - FLAT DETECTOR
IGEOM=2
RFAN=80.
CALL SETUP (IPAR,PAR,AG)
DO 18 M=1,NANG
CALL PJECT (BX,P,M,PRFF)
CALL BJECT (B,P,M,BRPF2)
WRITE (LUNOUT,26)
CALL ARRAY (B,NDIMU)
DO 20 I=1,64
DO 20 J=1,64

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K=(J-1)*64+I
B(K)=B(K)*SQRT((I-48.)**2+(J-48.)**2)
WRITE (LUNOUT,26)
CALL ARRAY (B,NDIMU)
CLOSE (LUNOUT)
22 FORMAT(1X/' PARALLEL BEAM GEOMETRY')
24 FORMAT(1X/' FAN BEAM GEOMETRY - CURVED DETECTOR')
26 FORMAT(1X/' FAN BEAM GEOMETRY - FLAT DETECTOR')
END

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I	IPAR(I)	DESCRIPTION
1	64	LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2	1	RECONSTRUCT IN A SQUARE ARRAY
3	0	GEOMETRY FLAG
4	180	PARALLEL BEAM GEOMETRY
5	5	NUMBER OF PROJECTION ANGLES
		MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
		ANGLES GENERATED BETWEEN ZERO AND 2*PI
		STARTING AT ZERO
6	100	NUMBER OF RAYS FOR EACH PROJECTION
7	1	TRANSMISSION DATA
8	2600	DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9	2	NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10	0	EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11	7	PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
		PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
		PRINT PROJECTION DATA AND UNCERTAINTIES
		PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12	0	LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE

I	PAR(I)	DESCRIPTION
1	1.000	PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2	50.500	LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3	0.000 NA	NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4	0.000 NA	CONSTANT ATTENUATION COEFFICIENT IN UNITS OF INVERSE PROJECTION BIN WIDTHS

BLANK COMMON REQUIRED	180	(264)
BLANK COMMON REQUIRED	360	(550)
BLANK COMMON REQUIRED	540	(1034)
BLANK COMMON REQUIRED	740	(1344)
BLANK COMMON REQUIRED	804	(1444)

A TOTAL OF 92 (5 THRU 96) OF THE 100 USER PROJECTION BINS WILL BE USED

92 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 804 FLOATING POINT WORDS.

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SSS EEEEE TTTT U U PPPP
S E T U U P P
SSS EEE T U U PPPP
S E T U U P
SSS EEEEE T UUU P

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BLANK COMMON REQUIRED	896	(1600)
BLANK COMMON REQUIRED	986	(1732)
BLANK COMMON REQUIRED	2389	(4525)

BLANK COMMON REQUIRED	2297	(4371)
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MAXIMUM SIZE OF BLANK COMMON THUS FAR= 2389 FLOATING POINT WORDS.

EX02

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PROGRAM XCONVO
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 2
C
C THE PROGRAM XCONVO USES THE CONVOLUTION ALGORITHM TO
C RECONSTRUCT EMISSION AND TRANSMISSION PROJECTION DATA FOR
C PARALLEL BEAM, FAN BEAM CURVED DETECTOR, AND FAN BEAM FLAT
C DETECTOR.
C
C DIMENSION X(4096),XE(4096)
C COMMON/BLANK/WORK(2000)
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C 1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C 2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C 3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C 4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
C 5 (CATN ,PAR( 4))
C
C EXTERNAL BIN,BINF,SHLO,LAKS,RALA
C
C LUNOUT=2
C I80132=0
C
C THE INPUT PARAMETERS ARE
C
C NDIMU=64
C ICIR=0
C NANG=72
C MODANG=5
C KDIMU=100
C NWORK=2000
C NFLOAT=2
C ISTORE=0
C IPRINT=12
C LUNATN=0
C AXISU=50.5
C
C OPEN OUTPUT FILE
C
C OPEN (LUNOUT,FILE='E02.OUT',FORM='FORMATTED')
C
C IMIT=-1
C DO 10 I=1,2
C IMIT=IMIT+1
C
C IGEOM=0
C PWID=1.
C RFAN=0.
C CATN=0.
C
C CALL SETUP (IPAR,PAR,DUM)
C
C RECONSTRUCTION OF PARALLEL BEAM GEOMETRY USING SHLO CONVOLVER
C
C CALL CONVO (X,XE,SHLO,BIN,1)
C
C DISPLAY OF THE RECONSTRUCTED IMAGE X AND THE ERRORS XE
C
C WRITE (LUNOUT,12)
C IF (IMIT.EQ.0) WRITE (LUNOUT,22)
C IF (IMIT.EQ.1) WRITE (LUNOUT,24)
C CALL ARRAY (X,NDIMU)
C WRITE (LUNOUT,14)
C CALL ARRAY (XE,NDIMU)
C
C RECONSTRUCTION OF PARALLEL BEAM GEOMETRY USING RALA CONVOLVER
C
C CALL CONVO (X,XE,RALA,BIN,1)
C
C DISPLAY OF THE RECONSTRUCTED IMAGE X AND THE ERRORS XE
C
C WRITE (LUNOUT,16)
C IF (IMIT.EQ.0) WRITE (LUNOUT,22)
C IF (IMIT.EQ.1) WRITE (LUNOUT,24)
C CALL ARRAY (X,NDIMU)
C WRITE (LUNOUT,14)
C CALL ARRAY (XE,NDIMU)
C
C IGEOM=1
C PWID=1.33
C RFAN=125.
C
C CALL SETUP (IPAR,PAR,DUM)
C
C RECONSTRUCTION OF FAN BEAM GEOMETRY - CURVED DETECTOR USING
C LAKS CONVOLVER
C
C CALL CONVO (X,XE,LAKS,BINF,1)
C
C DISPLAY OF THE RECONSTRUCTED IMAGE X AND THE ERRORS XE
C
C WRITE (LUNOUT,18)
C IF (IMIT.EQ.0) WRITE (LUNOUT,22)
C IF (IMIT.EQ.1) WRITE (LUNOUT,24)
C CALL ARRAY (X,NDIMU)
C WRITE (LUNOUT,14)
C CALL ARRAY (XE,NDIMU)
C
C IGEOM=2
C
C CALL SETUP (IPAR,PAR,DUM)
C
C RECONSTRUCTION OF FAN BEAM GEOMETRY - FLAT DETECTOR USING
C LAKS CONVOLVER

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CALL CONVO (X,XE,LAKS,BINF,1)
C
C DISPLAY OF THE RECONSTRUCTED IMAGE X AND THE ERRORS XE
C
C WRITE (LUNOUT,20)
C IF (IMIT.EQ.0) WRITE (LUNOUT,22)
C IF (IMIT.EQ.1) WRITE (LUNOUT,24)
C CALL ARRAY (X,NDIMU)
C WRITE (LUNOUT,14)
C CALL ARRAY (XE,NDIMU)
C
C 10 CONTINUE
C
C CALL BCOM (MAXFW)
C
C CLOSE (LUNOUT)
C
C
C 12 FORMAT(LX/' RECONSTRUCTION FOR PARALLEL BEAM GEOMETRY USING SHL',
C 1 'O CONVOLVER')
C 14 FORMAT(LX/' ERRORS IN THE RECONSTRUCTED IMAGE')
C 16 FORMAT(LX/' RECONSTRUCTION FOR PARALLEL BEAM GEOMETRY USING RAL',
C 1 'A CONVOLVER')
C 18 FORMAT(LX/' RECONSTRUCTION FOR FAN BEAM GEOMETRY - CURVED DETEC',
C 1 'TOR USING LAKS CONVOLVER')
C 20 FORMAT(LX/' RECONSTRUCTION FOR FAN BEAM GEOMETRY - FLAT DETECTO',
C 1 'R USING LAKS CONVOLVER')
C 22 FORMAT(' EMISSION DATA')
C 24 FORMAT(' TRANSMISSION DATA')
C
C END
C
C SUBROUTINE GETUM (M,DATA,ERR)
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 2
C
C THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
C A CHEST PHANTOM. ERRORS IN PROJECTION DATA ARE GIVEN IF
C IMIT = 0, IE. IF IT IS EMISSION DATA.
C
C DIMENSION DATA(*),ERR(*)
C DIMENSION B(4096)
C DIMENSION A1(4),B1(4),X1(4),Y1(4),PHI(4),Z(4),ITYPE(4)
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C 1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C 2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C 3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C 4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
C 5 (CATN ,PAR( 4))
C
C DATA ITYPE/1,1,1,1/
C DATA A1/40.,10.,14.,14./
C DATA B1/40.,10.,10.,10./
C DATA X1/0.,0.,10.,-10./
C DATA Y1/0.,-10.,0.,0./
C DATA PHI/0.,0.,1.57079633,1.57079633/
C DATA Z/5.,27.,-4.,-4./
C
C IF (M.EQ.1) THEN
C IF (IMIT.EQ.0) THEN
C PWIDTH=-PWID
C ELSE
C PWIDTH=PWID
C ENDIF
C CALL PHAN (4,10,ITYPE,Z,X1,Y1,A1,B1,PHI,B,NDIMU,PWIDTH)
C CALL ARRAY (B,NDIMU)
C ENDIF
C
C CALL PHANL (4,ITYPE,Z,X1,Y1,A1,B1,PHI,DATA,M)
C
C IF (IMIT.EQ.0) THEN
C DO 12 K=1,KDIMU
C DK=1.
C DK=MAX(DATA(K),DK)
C 12 ERR(K)=SQRT(DK)
C ELSE
C DO 16 K=1,KDIMU
C 16 ERR(K)=1.
C ENDIF
C
C RETURN
C END

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INTEGER PARAMETER ARRAY (IPAR)

I	IPAR(I)	DESCRIPTION
1	64	LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2	0	RECONSTRUCT IN A CIRCULAR ARRAY
3	0	GEOMETRY FLAG
		PARALLEL BEAM GEOMETRY
4	72	NUMBER OF PROJECTION ANGLES
5	5	MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
		ANGLES GENERATED BETWEEN ZERO AND 2*PI
		STARTING AT ZERO
6	100	NUMBER OF RAYS FOR EACH PROJECTION
7	0	EMISSION DATA
8	2000	DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9	2	NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10	0	EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)

5 5 MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND 2*PI
STARTING AT ZERO
6 100 NUMBER OF RAYS FOR EACH PROJECTION
7 1 TRANSMISSION DATA
8 2000 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 12 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
PRINT FILTER FUNCTION FOR CONVOLUTION AND FILTER ROUTINES
12 0 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE

FLOATING POINT PARAMETER ARRAY (PAR)

I PAR(I) DESCRIPTION
1 1.330 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH AT CENTER OF ROTATION
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 125.000 DISTANCE FROM SOURCE TO CENTER OF ROTATION FOR FAN BEAM IN UNITS OF PROJECTION BIN WIDTH AT CENTER OF ROTATION
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS OF INVERSE PROJECTION BIN WIDTHS

A TOTAL OF 94 (4 THRU 97) OF THE 100 USER PROJECTION BINS WILL BE USED
94 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 1541 FLOATING POINT WORDS.

EEEE N N DDDD SSS EEEE TTTT U U PPPP
E NN ND D S E T U U P P P
EEE N NN D D SSS EEE T U U PPPP
E N NN D D S E T U U P P
EEEE N N DDDD SSS EEEE T UUU P

CCC OOOO N N V V OOOO
C C O O NN N V V O O
C O O N N N V V O O
C C O O NN NN V V O O
CCC OOOO N N V OOOO

PARAMETERS FOR SUBROUTINE CONVO

DESCRIPTION
IERR - 1 CALCULATE ERRORS

BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES
PERFORM THE FOLLOWING FUNCTIONS

ARG FUNCTION RAY WEIGHTING ATTENUATION FAN BEAM
BCK BACKPROJECTION INTERPOLATION NO YES
CNV CONVOLUTION N/A NO YES

THE VALUES FOR THE FILTER IN REAL SPACE (CONVOLI,I=0..93)
0.785E+00 -0.118E+00 0.000E+00 -0.354E-01 0.000E+00
-0.127E-01 0.000E+00 -0.650E-02 0.000E+00 -0.393E-02
0.000E+00 -0.263E-02 0.000E+00 -0.188E-02 0.000E+00
-0.141E-02 0.000E+00 -0.110E-02 0.000E+00 -0.882E-03
0.000E+00 -0.722E-03 0.000E+00 -0.602E-03 0.000E+00
-0.509E-03 0.000E+00 -0.437E-03 0.000E+00 -0.378E-03
0.000E+00 -0.331E-03 0.000E+00 -0.292E-03 0.000E+00
-0.260E-03 0.000E+00 -0.233E-03 0.000E+00 -0.209E-03
0.000E+00 -0.189E-03 0.000E+00 -0.172E-03 0.000E+00
-0.157E-03 0.000E+00 -0.144E-03 0.000E+00 -0.133E-03
0.000E+00 -0.122E-03 0.000E+00 -0.113E-03 0.000E+00
-0.105E-03 0.000E+00 -0.980E-04 0.000E+00 -0.914E-04
0.000E+00 -0.855E-04 0.000E+00 -0.802E-04 0.000E+00
-0.753E-04 0.000E+00 -0.709E-04 0.000E+00 -0.669E-04
0.000E+00 -0.631E-04 0.000E+00 -0.597E-04 0.000E+00
-0.565E-04 0.000E+00 -0.537E-04 0.000E+00 -0.510E-04
0.000E+00 -0.485E-04 0.000E+00 -0.462E-04 0.000E+00
-0.441E-04 0.000E+00 -0.421E-04 0.000E+00 -0.402E-04
0.000E+00 -0.384E-04 0.000E+00 -0.368E-04

THE WEIGHTS USED FOR THE FAN BEAM CONVOLUTION (WEIGHT(I),I=1..94)

0.937E+00 0.940E+00 0.942E+00 0.944E+00 0.947E+00
0.949E+00 0.951E+00 0.954E+00 0.956E+00 0.958E+00
0.960E+00 0.962E+00 0.964E+00 0.966E+00 0.968E+00
0.970E+00 0.971E+00 0.973E+00 0.975E+00 0.977E+00
0.978E+00 0.980E+00 0.981E+00 0.983E+00 0.984E+00
0.986E+00 0.987E+00 0.988E+00 0.989E+00 0.990E+00
0.991E+00 0.992E+00 0.993E+00 0.994E+00 0.995E+00
0.996E+00 0.996E+00 0.997E+00 0.998E+00 0.998E+00
0.999E+00 0.999E+00 0.999E+00 1.000E+01 1.000E+01
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.100E+01
0.100E+01 0.999E+00 0.999E+00 0.999E+00 0.998E+00
0.998E+00 0.997E+00 0.996E+00 0.996E+00 0.995E+00
0.994E+00 0.993E+00 0.992E+00 0.991E+00 0.990E+00
0.989E+00 0.988E+00 0.987E+00 0.986E+00 0.984E+00
0.983E+00 0.981E+00 0.980E+00 0.978E+00 0.977E+00
0.975E+00 0.973E+00 0.971E+00 0.970E+00 0.968E+00
0.966E+00 0.964E+00 0.962E+00 0.960E+00 0.958E+00
0.956E+00 0.954E+00 0.951E+00 0.949E+00 0.947E+00
0.944E+00 0.942E+00 0.940E+00 0.937E+00

PPPP H H AAA N N
P P H H A A NN N
PPPP HHHH A A NN N
P H H AAAAA NN
P H H A A N N

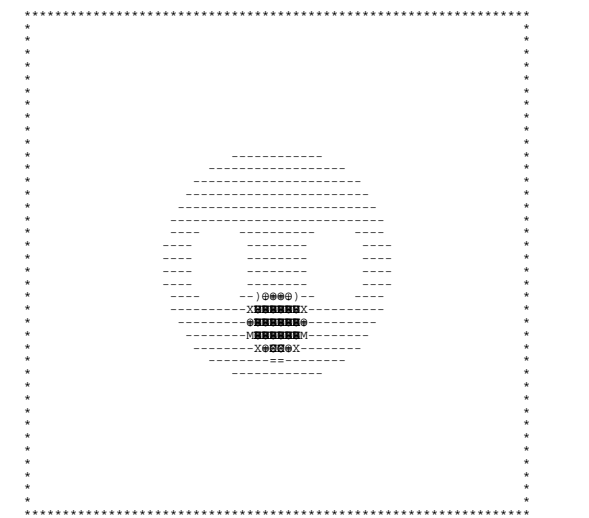
PHANTOM GENERATED
ARRAY SIZE 64 X 64 INTEGRATION FACTOR = 10 SCALING FACTOR = 0.752
NUMBER OF ELLIPSES AND/OR RECTANGLES = 4

THE PARAMETERS FOR THE ELLIPSES AND/OR RECTANGLES ARE
X,Y - CENTER
A,B - LENGTH OF AXIS OR SIDE A AND B
PHI - ANGLE OF AXIS OR SIDE A
DENS - INTENSITY
THE PARENTHESES INDICATES THE SCALED VALUE

ITYPE X Y A B PHI DENS
1 - EL@D@D 0.00 5.00
(0.00),(0.00)(30.08),(30.08) (6.65)
1 - EL \$@S@S 0.00 27.00
(0.00),(-7.52)(7.52)(7.52) (35.91)
1 - EL@S@,S@ 1.57 -4.00
(7.52),(0.00)(10.53),(7.52) (-5.32)
1 - EL \$@,S@ 1.57 -4.00
(-7.52),(0.00)(10.53),(7.52) (-5.32)

EEEE N N DDDD PPPP H H AAA N N
E NN ND D P P H H A A NN N
EEE N NN D D PPPP HHHH A A NN N
E N NN D D P H H AAAAA NN
EEEE N N DDDD P H H A A N N

XMIN = 0.00E+00 XMAX = 0.43E+02 XSUM = 0.5656E+04



0.0000E+00 0.3192E+01 0.7874E+01 0.1000E+02 0.1149E+02 0.1319E+02 0.1490E+02

Z 0.1639E+02 0.1745E+02 0.1851E+02 0.2085E+02 0.2320E+02 0.2468E+02 0.2639E+02

@ 0.2788E+02 0.3107E+02 0.3490E+02 0.3703E+02 0.3873E+02 0.4043E+02 0.4192E+02

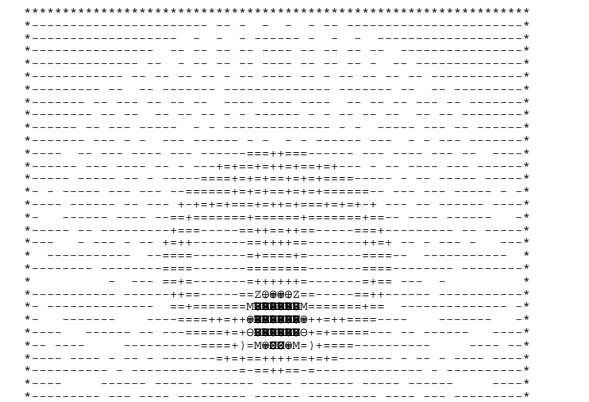
0.4256E+02

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 1541 FLOATING POINT WORDS.

EEEE N N DDDD CCC OOOO N N V V OOOO
E NN ND D C C O ON N V V O O
EEE N NN D D C C O ON NN V V O O
E N NN D D C C O O N NN V V O O
EEEE N N DDDD CCC OOOO N N V OOOO

RECONSTRUCTION FOR FAN BEAM GEOMETRY - FLAT DETECTOR USING LAKS CONVOLVER
TRANSMISSION DATA

XMIN = -0.40E+01 XMAX = 0.43E+02 XSUM = 0.5623E+04



EX03

```

PROGRAM XBKFIL
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLE 3
THE PROGRAM XBKFIL USES THE BACK-PROJECTION OF THE
FILTERED PROJECTION ALGORITHM TO RECONSTRUCT PARALLEL BEAM
PROJECTION DATA FOR VARIOUS TYPES OF FILTERS
DIMENSION B(4096),AG(180)
COMMON/TYPE/LTYPE
COMMON/BLANK/WORK(2000)
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0 EACH LINE WILL BE WITHIN 80 CHARACTERS
(OBJECTIVE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
5 (CATN , PAR( 4))
EXTERNAL BRP, HAN, HAM, PARZN, BUTER, RAMP
LUNOUT=2
I80132=0
THE INPUT PARAMETERS ARE
NDIMU=64
ICIR=1
IGEOM=0
NANG=72
MODANG=5
KDIMU=100
IMIT=1
NWORK=2000
NFLOAT=2
ISTORE=0
IPRINT=13
LUNATN=0
PWID=1
AXISU=50.5
RFAN=0.
CATN=0.
OPEN OUTPUT FILE
OPEN (LUNOUT,FILE='E03.OUT',FORM='FORMATTED')
CALL SETUP (IPAR,PAR,AG)
DO 20 LTYPE=1,5
GO TO (10,12,14,16,18),LTYPE
10 ORDERX=0.
FREQX=.5
CALL BKFIL (B,RAMP,BRF,ORDERX,FREQX)
WRITE (LUNOUT,22)
GO TO 20
12 ORDERX=0.
FREQX=.5
CALL BKFIL (B,HAN,BRF,ORDERX,FREQX)
WRITE (LUNOUT,24)
GO TO 20
14 ORDERX=0.
FREQX=.5
CALL BKFIL (B,HAM,BRF,ORDERX,FREQX)
WRITE (LUNOUT,26)
GO TO 20
16 ORDERX=0.
FREQX=.5
CALL BKFIL (B,PARZN,BRF,ORDERX,FREQX)
WRITE (LUNOUT,28)
GO TO 20
18 ORDERX=388.
FREQX=.52
CALL BKFIL (B,BUTER,BRF,ORDERX,FREQX)
WRITE (LUNOUT,30)
20 CALL ARRAY (B,NDIMU)
CLOSE (LUNOUT)
22 FORMAT(1X// ' RECONSTRUCTION USING THE RAMP FILTER')
24 FORMAT(1X// ' RECONSTRUCTION USING THE HAN FILTER')
26 FORMAT(1X// ' RECONSTRUCTION USING THE HAM FILTER')
28 FORMAT(1X// ' RECONSTRUCTION USING THE PARZN FILTER')
30 FORMAT(1X// ' RECONSTRUCTION USING THE BUTER FILTER (ORDERX=388, ',
1 ' FREQX=.52)')
END
SUBROUTINE GETUM (M,DATA,ERR)
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLE 3

```

```

THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
A CHEST PHANTOM CONSISTING OF A HEART, LUNGS AND SURROUNDING
TISSUE.
DIMENSION DATA(*),ERR(*)
DIMENSION B(4096)
DIMENSION AMAJ(5),AMIN(5),X1(5),Y1(5),PHI(5),Z(5),ITYPE(5)
COMMON/TYPE/LTYPE
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0 EACH LINE WILL BE WITHIN 80 CHARACTERS
(OBJECTIVE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
5 (CATN , PAR( 4))
DATA ITYPE/1,1,1,1,2/
DATA AMAJ/40.,10.,14.,14.,6./
DATA AMIN/40.,10.,10.,10.,6./
DATA X1/0.,0.,10.,-10.,26./
DATA Y1/0.,-10.,0.,0.,26./
DATA PHI/0.,0.,1.57079633,1.57079633,0./
DATA Z/5.,27.,-4.,-4.,32./
IF (M.EQ.1.AND.LTYPE.EQ.1) THEN
IF (IMIT.EQ.0) THEN
PWID=PWID
ELSE
PWID=PWID
ENDIF
CALL PHAN (5,10,ITYPE,Z,X1,Y1,AMAJ,AMIN,PHI,B,NDIMU,PWID)
CALL ARRAY (B,NDIMU)
ENDIF
CALL PHANL (5,ITYPE,Z,X1,Y1,AMAJ,AMIN,PHI,DATA,M)
RETURN
END
SSS EEEEE TTTT U U PPPP
S E T U U P P
SSS EEE T U U PPPP
S E T U U P
SSS EEEEE T UUU P
INTEGER PARAMETER ARRAY (IPAR)
I IPAR(I) DESCRIPTION
1 64 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 1 RECONSTRUCT IN A SQUARE ARRAY
3 0 GEOMETRY FLAG
PARALLEL BEAM GEOMETRY
4 72 NUMBER OF PROJECTION ANGLES
5 5 MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND 2*PI
STARTING AT ZERO
6 100 NUMBER OF RAYS FOR EACH PROJECTION
7 1 TRANSMISSION DATA
8 2000 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 13 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12 0 PRINT FILTER FUNCTION FOR CONVOLUTION AND FILTER ROUTINES
LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE
FLOATING POINT PARAMETER ARRAY (PAR)
I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS
BLANK COMMON REQUIRED 72 ( 110)
BLANK COMMON REQUIRED 144 ( 220)
BLANK COMMON REQUIRED 216 ( 330)
BLANK COMMON REQUIRED 416 ( 640)
BLANK COMMON REQUIRED 480 ( 740)
A TOTAL OF 92 ( 5 THRU 96) OF THE 100 USER PROJECTION BINS WILL BE USED
92 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 480 FLOATING POINT WORDS.
EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN N D D S E T U U P P
EEE N N N D D SSS EEE T U U PPPP
E N NN D D S E T U U P
EEEE N N DDDD SSS EEEEE T UUU P

```

```

BBBB K K FFFF III L
B B K K F I L
BBBB KKK FFF I L
B B K K F I L
BBBB K K F III LLLLL

```

PARAMETERS FOR SUBROUTINE BKFIL

```

DESCRIPTION
ORDERX - 0.0 FILTER PARAMETER USED ONLY BY THE FILTER BUTER
FREQX - 0.500 FREQUENCY PARAMETER FOR THE FILTER

```

```

BLANK COMMON REQUIRED 516 ( 1004)
BLANK COMMON REQUIRED 1126 ( 2146)

```

BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES PERFORM THE FOLLOWING FUNCTIONS

ARG	FUNCTION	RAY WEIGHTING	ATTENUATION	FAN BEAM
BCK	BACKPROJECTION	UNIFORM SQUARE	NO	NO
FIL	FILTER	N/A	NO	N/A

```

BLANK COMMON REQUIRED 1382 ( 2546)
BLANK COMMON REQUIRED 1510 ( 2746)

```

THE VALUES FOR THE FREQUENCY SPACE FILTER (FILF(I,I=0,128) WITH A FREQUENCY SPACING OF 1/256 = 0.391E-02 CYCLES PER PROJECTION BIN ARE

0.000E+00	0.391E-02	0.781E-02	0.117E-01	0.156E-01
0.195E-01	0.234E-01	0.273E-01	0.312E-01	0.352E-01
0.391E-01	0.430E-01	0.469E-01	0.508E-01	0.547E-01
0.586E-01	0.625E-01	0.664E-01	0.703E-01	0.742E-01
0.781E-01	0.820E-01	0.859E-01	0.898E-01	0.938E-01
0.977E-01	0.102E+00	0.105E+00	0.109E+00	0.113E+00
0.117E+00	0.121E+00	0.125E+00	0.129E+00	0.133E+00
0.137E+00	0.141E+00	0.145E+00	0.148E+00	0.152E+00
0.156E+00	0.160E+00	0.164E+00	0.168E+00	0.172E+00
0.176E+00	0.180E+00	0.184E+00	0.188E+00	0.191E+00
0.195E+00	0.199E+00	0.203E+00	0.207E+00	0.211E+00
0.215E+00	0.219E+00	0.223E+00	0.227E+00	0.230E+00
0.234E+00	0.238E+00	0.242E+00	0.246E+00	0.250E+00
0.254E+00	0.258E+00	0.262E+00	0.266E+00	0.270E+00
0.273E+00	0.277E+00	0.281E+00	0.285E+00	0.289E+00
0.293E+00	0.297E+00	0.301E+00	0.305E+00	0.309E+00
0.312E+00	0.316E+00	0.320E+00	0.324E+00	0.328E+00
0.332E+00	0.336E+00	0.340E+00	0.344E+00	0.348E+00
0.352E+00	0.356E+00	0.359E+00	0.363E+00	0.367E+00
0.371E+00	0.375E+00	0.379E+00	0.383E+00	0.387E+00
0.391E+00	0.395E+00	0.398E+00	0.402E+00	0.406E+00
0.410E+00	0.414E+00	0.418E+00	0.422E+00	0.426E+00
0.430E+00	0.434E+00	0.438E+00	0.441E+00	0.445E+00
0.449E+00	0.453E+00	0.457E+00	0.461E+00	0.465E+00
0.469E+00	0.473E+00	0.477E+00	0.480E+00	0.484E+00
0.488E+00	0.492E+00	0.496E+00	0.500E+00	

```

PPPP H H AAA N N
P P H H A A NN N
PPPP HHHH A A NN N
P H H AAAAA N NN
P H H A A N N

```

PHANTOM GENERATED

```

ARRAY SIZE 64 X 64 INTEGRATION FACTOR = 10 SCALING FACTOR = 1.000
NUMBER OF ELLIPSES AND/OR RECTANGLES = 5
THE PARAMETERS FOR THE ELLIPSES AND/OR RECTANGLES ARE
X,Y - CENTER
A,B - LENGTH OF AXIS OR SIDE A AND B
PHI - ANGLE OF AXIS OR SIDE A
DENS - INTENSITY
THE PARENTHESIS INDICATES THE SCALED VALUE
ITYPE X Y A B PHI DENS
1 - ELLIPSE ( 0.00, ( 0.00)( 40.00,( 40.00 0.00 5.00
( 0.00, ( -10.00 10.00, ( 10.00 0.00 ( 5.00)
1 - ELLIPSE ( 0.00, ( -10.00)( 10.00),( 10.00)
( 10.00, ( 0.00 14.00, ( 10.00 1.57 (-4.00)
1 - ELLIPSE ( -10.00,( 0.00)( 14.00),( 10.00)
( -10.00,( 0.00) 14.00, ( 10.00) 1.57 (-4.00)
2 - RECTANGLE ( 26.00, ( 26.00)( 6.00,( 6.00) 0.00 ( 32.00)
( 26.00,( 26.00)( 6.00),( 6.00) ( 32.00)

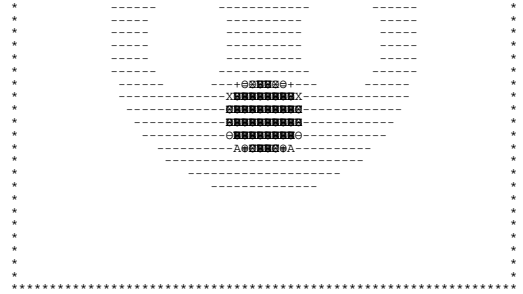
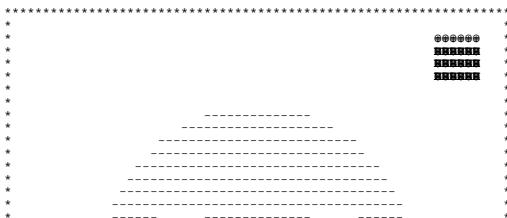
```

```

EEEE N N DDDD PPPP H H AAA N N
E NN ND D P P H H A A NN N
EEE N NN D D PPPP HHHH A A NN N
E N NN D D P H H AAAAA N NN
EEEE N N DDDD P H H A A N N

```

XMIN = 0.00E+00 XMAX = 0.32E+02 XSUM = 0.8678E+04



```

0.000E+00 0.2400E+01 0.5920E+01 0.7520E+01 0.8640E+01 0.9920E+01 0.1120E+02
Z X A M @ @ @
0.1232E+02 0.1312E+02 0.1392E+02 0.1568E+02 0.1744E+02 0.1856E+02 0.1984E+02
@ @ @ @ @ @ @
0.2096E+02 0.2336E+02 0.2624E+02 0.2784E+02 0.2912E+02 0.3040E+02 0.3152E+02

```

```

0.3200E+02
BLANK COMMON REQUIRED 1550 ( 3016)
BLANK COMMON REQUIRED 1510 ( 2746)
BLANK COMMON REQUIRED 1254 ( 2346)
BLANK COMMON REQUIRED 1126 ( 2146)

```

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 1550 FLOATING POINT WORDS.

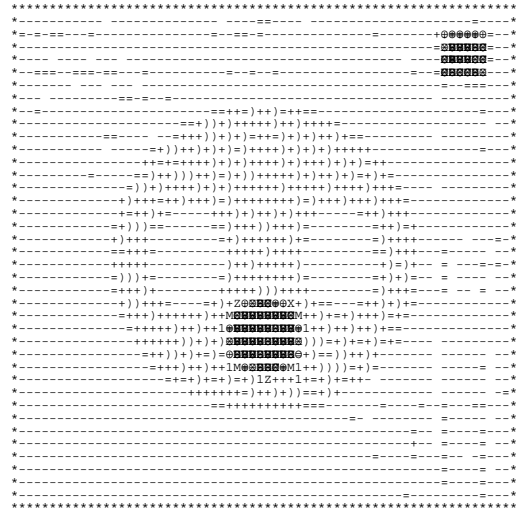
```

EEEE N N DDDD BBBB K K FFFF III L
E NN ND D B B K K F I L
EEE N NN D D BBBB KKK FFF I L
E N NN D D B B K K F I L
EEEE N N DDDD BBBB K K F III LLLLL

```

RECONSTRUCTION USING THE RAMP FILTER

XMIN = -0.51E+01 XMAX = 0.33E+02 XSUM = 0.8401E+04



```

-0.5146E+01 -0.2262E+01 0.1967E+01 0.3890E+01 0.5235E+01 0.6773E+01 0.8311E+01
Z X A M @ @ @
0.9657E+01 0.1062E+02 0.1158E+02 0.1369E+02 0.1581E+02 0.1715E+02 0.1869E+02
@ @ @ @ @ @ @
0.2004E+02 0.2292E+02 0.2638E+02 0.2830E+02 0.2984E+02 0.3138E+02 0.3273E+02

```

```

0.3330E+02
BBBB K K FFFF III L
B B K K F I L
BBBB KKK FFF I L

```


EX04

```

PROGRAM XFILBK
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
*       RECLBL   --   DP VERSION 2.0   --   JULY91       *
*****
EXAMPLE 4
THE PROGRAM XFILBK USES THE FILTER OF THE BACK-PROJECTION
ALGORITHM TO RECONSTRUCT PROJECTION DATA FOR PARALLEL BEAM,
FAN BEAM - CURVED DETECTOR, AND FAN BEAM - FLAT DETECTOR
GEOMETRIES.
DIMENSION B(4096),AG(180)
COMMON/BLANK/WORK(18500)
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0   EACH LINE WILL BE WITHIN 80 CHARACTERS
      (OTHERWISE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1      (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
2      (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
3      (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4      (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
5      (CATN ,PAR( 4))
EXTERNAL BRP,BRFF2,HAN
LUNOUT=2
I80132=0
THE INPUT PARAMETERS ARE
NDIMU=64
ICIR=1
IGEOM=0
NFLOAT=2
ISTORE=0
IPRINT=13
LUNATN=0
PWID=1
AXISU=50.5
RFAN=0.
CATN=0.
OPEN OUTPUT FILE
OPEN (LUNOUT,FILE='E04.OUT',FORM='FORMATTED')
CALL SETUP (IPAR,PAR,AG)
RECONSTRUCTION OF THE TRANSVERSE SECTION FOR PARALLEL BEAM
GEOMETRY
ORDERX=0.
FREQX=.5
CALL FILBK (B,HAN,BRF,ORDERX,FREQX)
WRITE (LUNOUT,26)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
NMAT=NDIMU**2
KK1=1
KU=NDIMU/15+1
DO 12 K=1,KU
WRITE (LUNOUT,22)
KK2=MIN(15*K,NDIMU)
DO 10 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
10 WRITE (LUNOUT,24) (B(I),I=ISUB1,ISUB2)
12 KK1=KK2+1
IGEOM=1
IPRINT=5
PWID=1.33
RFAN=125.
CALL SETUP (IPAR,PAR,AG)
RECONSTRUCTION OF THE TRANSVERSE SECTION FOR FAN BEAM GEOMETRY
WITH CURVED DETECTOR
ORDERX=0.
FREQX=.5
CALL FILBK (B,HAN,BRFF2,ORDERX,FREQX)
WRITE (LUNOUT,28)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
KK1=1
KU=NDIMU/15+1
DO 16 K=1,KU
WRITE (LUNOUT,22)
KK2=MIN(15*K,NDIMU)
DO 14 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
14 WRITE (LUNOUT,24) (B(I),I=ISUB1,ISUB2)
16 KK1=KK2+1
IGEOM=2

```

```

CALL SETUP (IPAR,PAR,AG)
RECONSTRUCTION OF THE TRANSVERSE SECTION FOR FAN BEAM GEOMETRY
WITH FLAT DETECTOR
ORDERX=0.
FREQX=.5
CALL FILBK (B,HAN,BRFF2,ORDERX,FREQX)
WRITE (LUNOUT,30)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
KK1=1
KU=NDIMU/15+1
DO 20 K=1,KU
WRITE (LUNOUT,22)
KK2=MIN(15*K,NDIMU)
DO 18 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
18 WRITE (LUNOUT,24) (B(I),I=ISUB1,ISUB2)
20 KK1=KK2+1
CLOSE (LUNOUT)
22 FORMAT(1X,//////)
24 FORMAT(1X,15F5.1)
26 FORMAT(1X,/' RECONSTRUCTION FOR PARALLEL BEAM GEOMETRY')
28 FORMAT(1X,/' RECONSTRUCTION FOR FAN BEAM GEOMETRY WITH CURVED DE',
1 'TECTOR')
30 FORMAT(1X,/' RECONSTRUCTION FOR FAN BEAM GEOMETRY WITH FLAT DETE',
1 'CTOR')
END
SUBROUTINE GETUM (M,DATA,ERR)
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
*       RECLBL   --   DP VERSION 2.0   --   JULY91       *
*****
EXAMPLE 4
THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
A CHEST PHANTOM CONSISTING OF A HEART, LUNGS AND SURROUNDING
TISSUE.
DIMENSION DATA(*),ERR(*)
DIMENSION B(4096)
DIMENSION AMAJ(4),AMIN(4),X1(4),Y1(4),PHI(4),Z(4),ITYPE(4)
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0   EACH LINE WILL BE WITHIN 80 CHARACTERS
      (OTHERWISE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1      (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
2      (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
3      (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4      (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
5      (CATN ,PAR( 4))
DATA ITYPE/1,1,1,1/
DATA AMAJ/40.,10.,14.,14./
DATA AMIN/40.,10.,10.,10./
DATA X1/0.,0.,10.,-10./
DATA Y1/0.,-10.,0.,0./
DATA PHI/0.,0.,1.57079633,1.57079633/
DATA Z/5.,27.,-4.,-4./
IF (M.EQ.1) THEN
IF (IMIT.EQ.0) THEN
PWIDH=PWID
ELSE
PWIDH=PWID
ENDIF
CALL PHAN (4,10,ITYPE,Z,X1,Y1,AMAJ,AMIN,PHI,B,NDIMU,PWIDH)
CALL ARRAY (B,NDIMU)
PRINTOUT OF THE VALUES FOR THE PHANTOM
NMAT=NDIMU**2
KK1=1
KU=NDIMU/15+1
DO 12 K=1,KU
WRITE (LUNOUT,16)
KK2=MIN(15*K,NDIMU)
DO 10 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
10 WRITE (LUNOUT,18) (B(I),I=ISUB1,ISUB2)
12 KK1=KK2+1
ENDIF
CALL PHANL (4,ITYPE,Z,X1,Y1,AMAJ,AMIN,PHI,DATA,M)
RETURN
16 FORMAT(1X,//////)
18 FORMAT(1X,15F5.1)
END
SSS EEEEE TTTT U U PPPP
S E E T U U P P P
SSS EEE T U U PPPP
S E E T U U P
SSS EEEEE T UUU P

```

```

INTEGER PARAMETER ARRAY (IPAR)
I  IPAR(I)  DESCRIPTION
1  64      LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2  1       RECONSTRUCT IN A SQUARE ARRAY
3  0       GEOMETRY FLAG
4  72      PARALLEL BEAM GEOMETRY
5  5       NUMBER OF PROJECTION ANGLES
        MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
        ANGLES GENERATED BETWEEN ZERO AND 2*PI
        STARTING AT ZERO
6  129     NUMBER OF RAYS FOR EACH PROJECTION
7  1       TRANSMISSION DATA
8  18500   DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9  2       NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0       EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 13      PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
        PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
        PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
        PRINT FILTER FUNCTION FOR CONVOLUTION AND FILTER ROUTINES
12 0       LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE

```

```

FLOATING POINT PARAMETER ARRAY (PAR)
I  PAR(I)  DESCRIPTION
1  1.000   PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2  50.500  LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3  0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4  0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
        OF INVERSE PROJECTION BIN WIDTHS

```

```

BLANK COMMON REQUIRED 72 ( 110)
BLANK COMMON REQUIRED 144 ( 220)
BLANK COMMON REQUIRED 216 ( 330)
BLANK COMMON REQUIRED 474 ( 732)
BLANK COMMON REQUIRED 538 ( 1032)
A TOTAL OF 92 ( 5 THRU 96) OF THE 129 USER PROJECTION BINS WILL BE USED
92 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 538 FLOATING POINT WORDS.

```

```

EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN ND D S E T U U P P P
EEE N N N D D SSS EEE T U U P P P P
E N NN D D S E T U U P P
EEEE N N DDDD SSS EEEEE T UUU P
        FFFFF III L BBBB K K
        FFF I L BBBB K K
        F I L B B K K
        F III LLLLL BBBB K K

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PARAMETERS FOR SUBROUTINE FILBK
DESCRIPTION
ORDERX - 0.0 FILTER PARAMETER USED ONLY BY THE FILTER BUTER
FRQX - 0.500 FREQUENCY PARAMETER FOR THE FILTER

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BLANK COMMON REQUIRED 574 ( 1076)
BLANK COMMON REQUIRED 1184 ( 2240)
BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES
PERFORM THE FOLLOWING FUNCTIONS
ARG FUNCTION RAY WEIGHTING ATTENUATION FAN BEAM
BCK BACKPROJECTION UNIFORM SQUARE NO NO
FIL FILTER N/A NO N/A
        FILTERED BACK-PROJECTION RECONSTRUCTIONS MUST BE EXECUTED IN AN
        ARRAY WITH DIMENSIONS AT LEAST TWICE AS LARGE AS THE FINAL IMAGE.
        THUS, THE EFFECTIVE SIZE OF THE RECONSTRUCTION ARRAY WILL NOW
        BE INCREASED.
BLANK COMMON REQUIRED 1248 ( 2340)
A TOTAL OF 129 ( 1 THRU 129) OF THE 129 USER PROJECTION BINS WILL BE USED
182 PROJECTION BINS WILL BE USED OF WHICH 53 HAVE BEEN ZEROED BY THE PROGRAM
BLANK COMMON REQUIRED 17632 ( 42340)
BLANK COMMON REQUIRED 17814 ( 42626)
THE VALUES FOR THE FREQUENCY SPACE FILTER (FILT(I,J), I=0,J , J=0, 64) WITH A
FREQUENCY SPACING OF 1/128 = 0.781E-02 CYCLES PER PIXEL ARE

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J= 0 0.000E+00
J= 1 0.781E-02 0.110E-01
J= 2 0.156E-01 0.174E-01 0.220E-01
J= 3 0.233E-01 0.246E-01 0.279E-01 0.328E-01
J= 4 0.309E-01 0.319E-01 0.345E-01 0.385E-01 0.433E-01
J= 5 0.385E-01 0.392E-01 0.413E-01 0.446E-01 0.488E-01
    0.536E-01
J= 6 0.459E-01 0.465E-01 0.482E-01 0.510E-01 0.546E-01

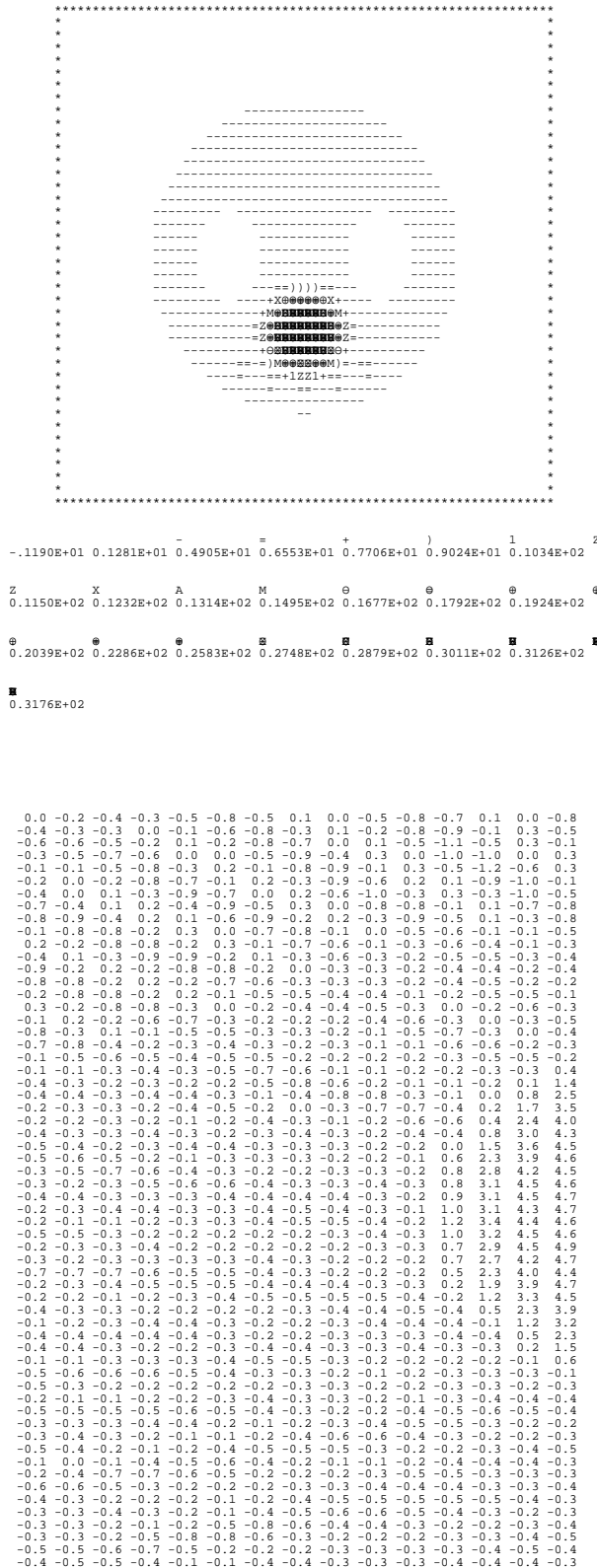
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J= 7	0.588E-01	0.635E-01	0.551E-01	0.574E-01	0.606E-01
J= 8	0.643E-01	0.684E-01	0.729E-01	0.619E-01	0.666E-01
J= 9	0.698E-01	0.735E-01	0.775E-01	0.817E-01	0.861E-01
J= 10	0.669E-01	0.673E-01	0.684E-01	0.702E-01	0.725E-01
J= 11	0.754E-01	0.787E-01	0.823E-01	0.861E-01	0.900E-01
J= 12	0.735E-01	0.738E-01	0.748E-01	0.763E-01	0.784E-01
J= 13	0.809E-01	0.838E-01	0.871E-01	0.905E-01	0.941E-01
J= 14	0.798E-01	0.801E-01	0.809E-01	0.823E-01	0.841E-01
J= 15	0.863E-01	0.889E-01	0.918E-01	0.949E-01	0.981E-01
J= 16	0.101E+00	0.105E+00	0.108E+00	0.112E+00	0.116E+00
J= 17	0.916E-01	0.939E-01	0.964E-01	0.991E-01	0.102E+00
J= 18	0.105E+00	0.108E+00	0.111E+00	0.114E+00	0.116E+00
J= 19	0.916E-01	0.918E-01	0.924E-01	0.934E-01	0.949E-01
J= 20	0.966E-01	0.986E-01	0.101E+00	0.103E+00	0.106E+00
J= 21	0.970E-01	0.971E-01	0.977E-01	0.986E-01	0.998E-01
J= 22	0.101E+00	0.103E+00	0.105E+00	0.107E+00	0.110E+00
J= 23	0.112E+00	0.114E+00	0.117E+00	0.119E+00	0.121E+00
J= 24	0.102E+00	0.102E+00	0.103E+00	0.103E+00	0.105E+00
J= 25	0.106E+00	0.107E+00	0.109E+00	0.111E+00	0.113E+00
J= 26	0.115E+00	0.117E+00	0.119E+00	0.121E+00	0.123E+00
J= 27	0.125E+00	0.127E+00	0.130E+00	0.132E+00	0.134E+00
J= 28	0.110E+00	0.111E+00	0.111E+00	0.112E+00	0.113E+00
J= 29	0.114E+00	0.115E+00	0.116E+00	0.118E+00	0.119E+00
J= 30	0.121E+00	0.122E+00	0.124E+00	0.125E+00	0.126E+00
J= 31	0.115E+00	0.115E+00	0.115E+00	0.116E+00	0.117E+00
J= 32	0.117E+00	0.118E+00	0.119E+00	0.121E+00	0.122E+00
J= 33	0.123E+00	0.124E+00	0.126E+00	0.127E+00	0.128E+00
J= 34	0.129E+00	0.130E+00	0.132E+00	0.133E+00	0.134E+00
J= 35	0.130E+00	0.130E+00	0.131E+00	0.131E+00	0.131E+00
J= 36	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 37	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 38	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 39	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 40	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 41	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 42	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 43	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 44	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 45	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 46	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 47	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 48	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 49	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 50	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 51	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 52	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 53	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 54	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 55	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 56	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 57	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 58	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 59	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 60	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 61	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 62	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 63	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00
J= 64	0.130E+00	0.130E+00	0.130E+00	0.130E+00	0.130E+00

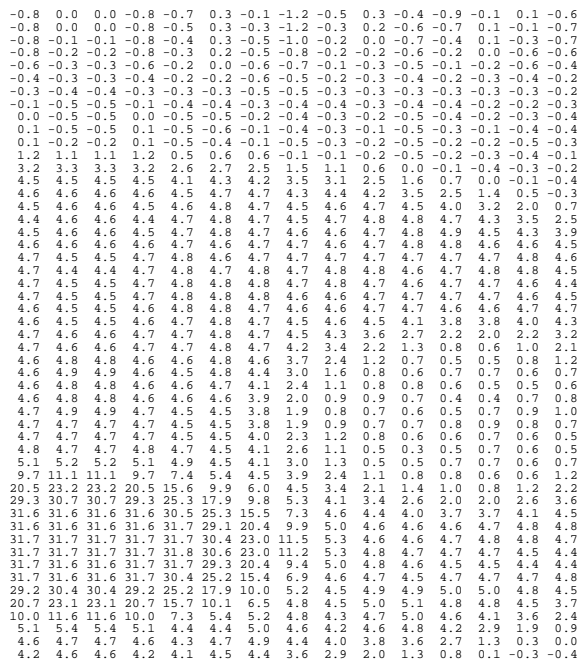
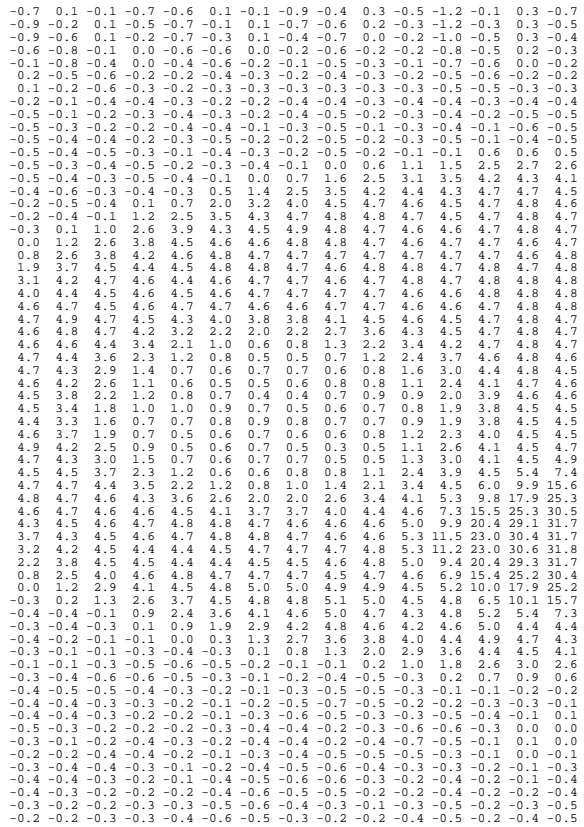
	0.105E+00	0.103E+00	0.101E+00	0.994E-01	0.973E-01	0.333E-01	0.318E-01	0.303E-01	0.288E-01	0.272E-01
	0.950E-01	0.926E-01	0.900E-01	0.873E-01	0.845E-01	0.256E-01	0.239E-01	0.222E-01	0.205E-01	0.188E-01
	0.816E-01	0.785E-01	0.753E-01	0.720E-01	0.686E-01	0.170E-01	0.153E-01	0.136E-01	0.120E-01	0.104E-01
	0.652E-01	0.616E-01	0.580E-01	0.544E-01	0.507E-01	0.883E-02	0.756E-02	0.670E-02	0.470E-02	0.355E-02
	0.470E-01					0.252E-02	0.165E-02	0.946E-03	0.425E-03	0.103E-03
J= 36	0.113E+00	0.113E+00	0.113E+00	0.113E+00	0.112E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.112E+00	0.111E+00	0.110E+00	0.109E+00	0.108E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.108E+00	0.107E+00	0.106E+00	0.104E+00	0.103E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.101E+00	0.992E-01	0.973E-01	0.953E-01	0.933E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.908E-01	0.883E-01	0.858E-01	0.831E-01	0.802E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.773E-01	0.742E-01	0.711E-01	0.678E-01	0.645E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.610E-01	0.576E-01	0.540E-01	0.505E-01	0.469E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.432E-01	0.397E-01				0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
J= 37	0.109E+00	0.109E+00	0.109E+00	0.109E+00	0.109E+00	0.302E-01	0.392E-01	0.390E-01	0.388E-01	0.384E-01
	0.108E+00	0.107E+00	0.107E+00	0.106E+00	0.105E+00	0.178E-01	0.163E-01	0.149E-01	0.135E-01	0.121E-01
	0.104E+00	0.103E+00	0.101E+00	0.100E+00	0.985E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.968E-01	0.950E-01	0.930E-01	0.910E-01	0.888E-01	0.134E-02	0.728E-03	0.292E-03	0.478E-04	0.000E+00
	0.864E-01	0.840E-01	0.814E-01	0.787E-01	0.758E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.729E-01	0.699E-01	0.668E-01	0.635E-01	0.602E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.569E-01	0.535E-01	0.500E-01	0.465E-01	0.430E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.396E-01	0.361E-01	0.327E-01			0.331E-01	0.326E-01	0.320E-01	0.313E-01	0.305E-01
J= 38	0.105E+00	0.105E+00	0.105E+00	0.105E+00	0.104E+00	0.297E-01	0.288E-01	0.278E-01	0.267E-01	0.256E-01
	0.104E+00	0.103E+00	0.103E+00	0.102E+00	0.101E+00	0.244E-01	0.231E-01	0.218E-01	0.205E-01	0.191E-01
	0.997E-01	0.985E-01	0.972E-01	0.957E-01	0.941E-01	0.178E-01	0.163E-01	0.149E-01	0.135E-01	0.121E-01
	0.924E-01	0.906E-01	0.886E-01	0.865E-01	0.843E-01	0.107E-01	0.934E-02	0.802E-02	0.675E-02	0.555E-02
	0.819E-01	0.794E-01	0.769E-01	0.742E-01	0.714E-01	0.443E-02	0.340E-02	0.248E-02	0.169E-02	0.102E-02
	0.685E-01	0.655E-01	0.624E-01	0.592E-01	0.560E-01	0.512E-02	0.169E-03	0.972E-05	0.000E+00	0.000E+00
	0.527E-01	0.494E-01	0.460E-01	0.426E-01	0.393E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.359E-01	0.412E-01	0.261E-01			0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
J= 39	0.101E+00	0.101E+00	0.101E+00	0.101E+00	0.100E+00	0.295E-01	0.294E-01	0.293E-01	0.291E-01	0.288E-01
	0.996E-01	0.990E-01	0.982E-01	0.973E-01	0.963E-01	0.284E-01	0.279E-01	0.273E-01	0.267E-01	0.260E-01
	0.952E-01	0.940E-01	0.926E-01	0.911E-01	0.895E-01	0.252E-01	0.243E-01	0.234E-01	0.224E-01	0.214E-01
	0.878E-01	0.859E-01	0.840E-01	0.819E-01	0.796E-01	0.202E-01	0.203E-01	0.193E-01	0.184E-01	0.175E-01
	0.773E-01	0.748E-01	0.723E-01	0.696E-01	0.669E-01	0.143E-01	0.130E-01	0.117E-01	0.105E-01	0.921E-02
	0.639E-01	0.610E-01	0.580E-01	0.549E-01	0.517E-01	0.799E-02	0.682E-02	0.569E-02	0.463E-02	0.364E-02
	0.485E-01	0.453E-01	0.420E-01	0.388E-01	0.355E-01	0.275E-02	0.195E-02	0.127E-02	0.720E-03	0.315E-03
J= 40	0.323E-01	0.291E-01	0.260E-01	0.229E-01	0.200E-01	0.707E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.965E-01	0.964E-01	0.962E-01	0.959E-01	0.955E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.950E-01	0.925E-01	0.898E-01	0.872E-01	0.846E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.906E-01	0.893E-01	0.879E-01	0.864E-01	0.848E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.831E-01	0.812E-01	0.792E-01	0.771E-01	0.749E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.726E-01	0.701E-01	0.676E-01	0.649E-01	0.622E-01	0.249E-01	0.249E-01	0.247E-01	0.245E-01	0.243E-01
	0.594E-01	0.565E-01	0.535E-01	0.505E-01	0.474E-01	0.239E-01	0.235E-01	0.229E-01	0.224E-01	0.217E-01
	0.443E-01	0.418E-01	0.393E-01	0.366E-01	0.339E-01	0.210E-01	0.210E-01	0.202E-01	0.194E-01	0.187E-01
	0.288E-01	0.257E-01	0.228E-01	0.199E-01	0.172E-01	0.165E-01	0.154E-01	0.144E-01	0.133E-01	0.122E-01
	0.145E-01					0.111E-01	0.994E-02	0.883E-02	0.773E-02	0.666E-02
J= 41	0.917E-01	0.916E-01	0.914E-01	0.911E-01	0.907E-01	0.563E-02	0.465E-02	0.373E-02	0.288E-02	0.211E-02
	0.902E-01	0.895E-01	0.888E-01	0.879E-01	0.868E-01	0.144E-02	0.881E-03	0.447E-03	0.152E-03	0.106E-04
	0.857E-01	0.844E-01	0.831E-01	0.816E-01	0.799E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.782E-01	0.763E-01	0.743E-01	0.723E-01	0.701E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.678E-01	0.653E-01	0.628E-01	0.602E-01	0.576E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.548E-01	0.520E-01	0.491E-01	0.462E-01	0.432E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.402E-01	0.372E-01	0.342E-01	0.312E-01	0.282E-01	0.206E-01	0.206E-01	0.205E-01	0.203E-01	0.200E-01
	0.253E-01	0.225E-01	0.197E-01	0.170E-01	0.145E-01	0.197E-01	0.197E-01	0.195E-01	0.193E-01	0.191E-01
	0.121E-01	0.981E-02				0.170E-01	0.163E-01	0.155E-01	0.147E-01	0.139E-01
J= 42	0.867E-01	0.867E-01	0.865E-01	0.862E-01	0.858E-01	0.130E-01	0.121E-01	0.111E-01	0.102E-01	0.918E-02
	0.852E-01	0.846E-01	0.838E-01	0.829E-01	0.819E-01	0.821E-02	0.725E-02	0.630E-02	0.537E-02	0.449E-02
	0.807E-01	0.794E-01	0.781E-01	0.766E-01	0.749E-01	0.364E-02	0.286E-02	0.215E-02	0.151E-02	0.972E-03
	0.732E-01	0.713E-01	0.693E-01	0.673E-01	0.653E-01	0.537E-03	0.459E-03	0.381E-03	0.303E-03	0.225E-03
	0.629E-01	0.605E-01	0.581E-01	0.555E-01	0.529E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.502E-01	0.475E-01	0.447E-01	0.419E-01	0.390E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.361E-01	0.333E-01	0.304E-01	0.275E-01	0.247E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.220E-01	0.193E-01	0.168E-01	0.143E-01	0.119E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.076E-02	0.577E-02				0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
J= 43	0.816E-01	0.816E-01	0.814E-01	0.811E-01	0.807E-01	0.167E-01	0.166E-01	0.165E-01	0.163E-01	0.161E-01
	0.801E-01	0.794E-01	0.787E-01	0.778E-01	0.767E-01	0.158E-01	0.154E-01	0.150E-01	0.145E-01	0.140E-01
	0.756E-01	0.743E-01	0.730E-01	0.715E-01	0.699E-01	0.134E-01	0.128E-01	0.121E-01	0.114E-01	0.106E-01
	0.682E-01	0.663E-01	0.644E-01	0.624E-01	0.602E-01	0.983E-02	0.903E-02	0.821E-02	0.738E-02	0.655E-02
	0.580E-01	0.560E-01	0.538E-01	0.513E-01	0.488E-01	0.573E-02	0.482E-02	0.391E-02	0.300E-02	0.210E-02
	0.457E-01	0.430E-01	0.404E-01	0.376E-01	0.349E-01	0.206E-02	0.148E-02	0.980E-03	0.569E-03	0.260E-03
	0.321E-01	0.294E-01	0.267E-01	0.240E-01	0.214E-01	0.662E-04	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.188E-01	0.163E-01	0.140E-01	0.117E-01	0.960E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.764E-02	0.586E-02	0.427E-02	0.290E-02	0.174E-02	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
J= 44	0.749E-01	0.742E-01	0.735E-01	0.726E-01	0.715E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.704E-01	0.692E-01	0.678E-01	0.663E-01	0.648E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.631E-01	0.613E-01	0.594E-01	0.574E-01	0.553E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.531E-01	0.509E-01	0.486E-01	0.462E-01	0.437E-01	0.123E-01	0.119E-01	0.116E-01	0.111E-01	0.107E-01
	0.412E-01	0.387E-01	0.361E-01	0.335E-01	0.309E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.283E-01	0.257E-01	0.231E-01	0.206E-01	0.182E-01	0.706E-02	0.638E-02	0.569E-02	0.500E-02	0.432E-02
	0.158E-01	0.135E-01	0.114E-01	0.934E-02	0.745E-02	0.366E-02	0.302E-02	0.242E-02	0.186E-02	0.135E-02
J= 45	0.573E-02	0.420E-02	0.288E-02	0.178E-02	0.922E-03	0.905E-03	0.537E-03	0.256E-03	0.730E-04	0.662E-06
	0.711E-01	0.710E-01	0.708E-01	0.705E-01	0.701E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.596E-01	0.589E-01	0.582E-01	0.573E-01	0.563E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.652E-01	0.639E-01	0.626E-01	0.612E-01	0.596E-01	0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00
	0.580E-01	0.562E-01	0.544E-01	0.524E-01	0.504E-01					

RECONSTRUCTION FOR PARALLEL BEAM GEOMETRY

XMIN = -0.12E+01 XMAX = 0.32E+02 XSUM = 0.6181E+04



-0.3 -0.4 -0.3 -0.3 -0.4 -0.5 -0.4 -0.2 -0.2 -0.3 -0.3 -0.4 -0.4 -0.4 -0.4 -0.4
-0.7 -0.5 -0.4 -0.4 -0.4 -0.3 -0.1 -0.2 -0.4 -0.4 -0.4 -0.4 -0.4 -0.6 -0.4 -0.3 -0.3
-0.6 -0.2 -0.3 -0.3 -0.1 -0.2 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.6 -0.4 -0.3 -0.3
0.1 0.0 -0.4 -0.3 -0.3 -0.3 -0.6 -0.5 -0.1 -0.2 -0.4 -0.4 -0.6 -0.5 -0.3 -0.2 -0.3



2.7 3.5 3.5 2.7 2.6 3.0 2.6 1.8 1.0 0.2 -0.1 -0.1 -0.2 -0.5 -0.6
0.7 1.3 1.3 0.7 0.6 0.9 0.7 0.2 -0.3 -0.5 -0.4 -0.2 -0.1 -0.3 -0.5
-0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.1 -0.1 -0.3 -0.5 -0.5 -0.3 -0.1 -0.2 -0.3
-0.2 -0.6 -0.2 -0.2 -0.1 -0.1 -0.3 -0.3 -0.2 -0.5 -0.7 -0.5 -0.3 -0.2 -0.3
-0.2 -0.7 -0.7 -0.2 0.1 -0.1 -0.4 -0.5 -0.3 -0.3 -0.5 -0.6 -0.3 -0.1 -0.2
-0.3 -0.7 -0.7 -0.3 0.0 0.0 -0.3 -0.6 -0.6 -0.3 -0.2 -0.4 -0.4 -0.3 -0.2
-0.4 -0.8 -0.8 -0.4 0.0 0.1 -0.1 -0.3 -0.5 -0.7 -0.4 -0.2 -0.4 -0.4 -0.2 -0.3
-0.4 -0.7 -0.7 -0.4 -0.1 0.0 -0.1 -0.3 -0.5 -0.5 -0.5 -0.4 -0.3 -0.1 -0.2
-0.5 -0.5 -0.4 -0.5 -0.3 -0.1 -0.2 -0.4 -0.2 -0.3 -0.2 -0.3 -0.6 -0.5 -0.4 -0.1
-0.6 -0.3 -0.3 -0.6 -0.4 -0.1 -0.1 -0.2 -0.4 -0.2 -0.3 -0.6 -0.6 -0.5 -0.4 -0.1
-0.4 -0.2 -0.2 -0.4 -0.4 -0.2 -0.2 -0.4 -0.2 -0.2 -0.5 -0.5 -0.6 -0.4 -0.2
-0.3 -0.3 -0.3 -0.3 -0.3 -0.2 -0.5 -0.3 -0.1 -0.3 -0.4 -0.6 -0.5 -0.3
-0.2 -0.3 -0.3 -0.2 -0.5 -0.4 -0.2 -0.5 -0.4 -0.2 -0.2 -0.3 -0.5 -0.6 -0.4

-0.7 -0.1 0.1 -0.7 -0.8 0.0 0.1 -0.7 -0.8 -0.5 0.0 0.1 -0.5 -0.8 -0.5
-0.5 0.1 -0.2 -0.9 -0.5 0.3 -0.1 -0.9 -0.8 -0.2 0.1 -0.3 -0.8 -0.6 -0.1
-0.2 0.1 -0.6 -0.9 -0.1 0.3 -0.5 -1.1 -0.5 0.1 0.0 -0.7 -0.8 -0.2 0.1
0.0 -0.1 -0.8 -0.6 0.3 0.0 -1.0 -1.0 0.0 0.3 -0.4 -0.9 -0.5 0.0 0.0
0.0 -0.4 -0.8 -0.1 0.3 -0.6 -1.2 -0.5 0.3 -0.1 -0.9 -0.8 -0.1 0.2 0.3
-0.2 -0.6 -0.5 0.2 -0.1 -1.0 -0.9 0.1 0.2 -0.6 -0.9 -0.3 0.2 -0.1 -0.7
-0.3 -0.6 -0.2 0.1 -0.5 -1.0 -0.3 0.3 -0.3 -1.0 -0.6 0.2 0.0 -0.7 -0.9
-0.4 -0.4 -0.2 -0.2 -0.8 -0.7 0.1 -0.1 -0.8 -0.8 0.0 0.3 -0.5 -0.9 -0.4
-0.3 -0.2 -0.1 -0.5 -0.8 -0.3 0.1 -0.5 -0.9 -0.3 0.2 -0.2 -0.9 -0.6 0.1
-0.2 -0.2 -0.3 -0.5 -0.5 -0.1 -0.1 -0.6 -0.5 0.0 -0.1 -0.8 -0.7 0.0 0.3
-0.2 -0.4 -0.4 -0.5 -0.3 -0.1 -0.4 -0.6 -0.3 -0.1 -0.6 -0.7 -0.1 0.3 -0.2
-0.3 -0.5 -0.4 -0.5 -0.4 -0.3 -0.5 -0.5 -0.2 -0.3 -0.6 -0.3 0.1 -0.2 -0.9
-0.5 -0.4 -0.2 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.8 -0.8
-0.5 -0.3 -0.4 -0.5 -0.2 -0.2 -0.5 -0.4 -0.2 -0.3 -0.3 -0.3 -0.6 -0.7 -0.2
-0.4 -0.3 -0.6 -0.4 -0.1 -0.5 -0.5 -0.2 -0.1 -0.4 -0.4 -0.5 -0.5 -0.1 0.2
0.1 -0.4 -0.5 -0.2 -0.3 -0.6 -0.2 0.0 -0.3 -0.5 -0.4 -0.4 -0.2 0.0 -0.3
1.2 -0.1 -0.4 -0.2 -0.5 -0.3 0.0 -0.3 -0.6 -0.4 -0.2 -0.2 -0.2 -0.3 -0.7
2.6 1.0 0.1 0.3 -0.4 0.0 0.3 -0.7 -0.5 -0.1 -0.2 -0.3 -0.3 -0.5 -0.5
3.8 2.6 1.2 0.0 -0.3 -0.2 -0.6 -0.6 -0.1 -0.1 -0.3 -0.2 -0.3 -0.4 -0.3
4.2 3.8 2.6 0.8 -0.2 -0.5 -0.5 -0.3 -0.2 -0.2 -0.2 -0.2 -0.5 -0.5 -0.4
4.4 4.5 3.7 1.9 0.4 -0.3 -0.3 -0.2 -0.2 -0.1 -0.1 -0.6 -0.7 -0.5 -0.3
4.6 4.7 4.2 3.1 1.4 0.1 -0.2 -0.1 -0.1 -0.2 -0.6 -0.8 -0.5 -0.2 -0.2
4.6 4.5 4.4 4.0 2.5 0.8 0.0 -0.1 -0.3 -0.8 -0.8 -0.4 -0.1 -0.3 -0.4
4.6 4.5 4.7 4.6 3.5 1.7 0.2 -0.4 -0.7 -0.7 -0.3 0.0 -0.2 -0.5 -0.4
4.5 4.7 4.9 4.7 4.0 2.4 0.4 -0.6 -0.6 -0.2 -0.1 -0.3 -0.4 -0.2 -0.1
4.2 4.7 4.8 4.6 4.3 3.0 0.8 -0.4 -0.4 -0.2 -0.3 -0.4 -0.3 -0.2 -0.3
3.4 4.4 4.6 4.6 4.5 3.6 1.5 0.0 -0.2 -0.2 -0.3 -0.3 -0.3 -0.4 -0.4
2.3 3.6 4.4 4.7 4.6 3.9 2.3 0.6 -0.1 -0.2 -0.2 -0.3 -0.3 -0.3 -0.1
1.4 2.9 4.3 4.7 4.5 4.2 2.8 0.8 -0.2 -0.3 -0.3 -0.2 -0.2 -0.3 -0.4
1.1 2.6 4.2 4.6 4.6 4.5 3.1 0.8 -0.3 -0.4 -0.3 -0.3 -0.4 -0.6 -0.6
1.2 2.2 3.8 4.5 4.7 4.5 3.1 0.9 -0.2 -0.3 -0.4 -0.4 -0.4 -0.4 -0.3
1.0 1.8 3.4 4.5 4.7 4.3 3.1 1.0 -0.1 -0.3 -0.4 -0.5 -0.4 -0.3 -0.2
0.9 1.4 -0.1 -0.2 -0.8 -0.7 0.1 -0.1 -0.8 -0.8 0.0 0.3 -0.5 -0.9 -0.4
0.7 1.9 3.7 4.6 4.6 4.6 4.5 3.2 1.0 -0.3 -0.4 -0.3 -0.2 -0.2 -0.2
0.9 2.5 4.2 4.9 4.9 4.5 2.9 0.7 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2
1.5 3.0 4.3 4.7 4.7 4.2 2.7 0.7 -0.2 -0.2 -0.2 -0.3 -0.4 -0.3 -0.3
2.3 3.7 4.5 4.5 4.4 4.0 2.3 0.5 -0.2 -0.2 -0.2 -0.3 -0.4 -0.5 -0.5
3.5 4.4 4.2 4.7 4.7 3.9 1.9 0.2 -0.3 -0.3 -0.4 -0.4 -0.4 -0.5 -0.5
4.3 4.6 4.7 4.8 4.5 3.3 1.2 -0.2 -0.2 -0.4 -0.5 -0.5 -0.5 -0.4 -0.3
4.6 4.6 4.7 4.6 3.9 2.3 0.5 -0.4 -0.5 -0.4 -0.4 -0.3 -0.2 -0.2 -0.2
4.7 4.6 4.5 4.3 3.2 1.2 -0.1 -0.4 -0.4 -0.4 -0.3 -0.2 -0.2 -0.3 -0.4
4.6 4.5 4.3 3.7 2.3 0.5 -0.4 -0.4 -0.3 -0.3 -0.3 -0.2 -0.2 -0.3 -0.4
4.4 4.5 4.2 4.1 4.6 4.4 3.4 1.2 -0.2 -0.4 -0.5 -0.5 -0.4 -0.3 -0.3
4.5 4.5 3.8 2.2 0.6 -0.1 -0.2 -0.2 -0.2 -0.2 -0.3 -0.5 -0.5 -0.4 -0.3
4.6 4.0 2.5 0.8 -0.1 -0.3 -0.3 -0.3 -0.2 -0.1 -0.2 -0.3 -0.3 -0.4 -0.5
4.1 2.9 1.2 0.0 -0.3 -0.2 -0.3 -0.3 -0.2 -0.2 -0.3 -0.3 -0.2 -0.2 -0.2
2.6 1.3 0.2 -0.3 -0.4 -0.4 -0.4 -0.3 -0.1 -0.2 -0.3 -0.3 -0.4 -0.3 -0.2
0.3 -0.1 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.4 -0.5 -0.6
0.1 -0.3 -0.4 -0.3 -0.2 -0.2 -0.3 -0.5 -0.5 -0.4 -0.3 -0.2 -0.1 -0.2 -0.4
-0.1 -0.1 -0.2 -0.4 -0.3 -0.2 -0.2 -0.3 -0.4 -0.6 -0.6 -0.4 -0.2 -0.1 -0.1
-0.3 -0.1 -0.1 -0.3 -0.5 -0.4 -0.3 -0.2 -0.2 -0.3 -0.5 -0.5 -0.5 -0.4 -0.2
-0.5 -0.3 -0.1 -0.1 -0.3 -0.4 -0.4 -0.4 -0.2 -0.1 -0.1 -0.2 -0.4 -0.6 -0.5
-0.6 -0.6 -0.4 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3
-0.4 -0.5 -0.5 -0.4 -0.4 -0.4 -0.3 -0.3 -0.4 -0.4 -0.4 -0.3 -0.2 -0.2 -0.2
-0.3 -0.3 -0.4 -0.4 -0.3 -0.4 -0.5 -0.5 -0.5 -0.5 -0.5 -0.4 -0.2 -0.1 -0.2
-0.2 -0.3 -0.4 -0.4 -0.3 -0.2 -0.3 -0.4 -0.5 -0.6 -0.6 -0.5 -0.4 -0.1 -0.2
-0.2 -0.2 -0.3 -0.5 -0.4 -0.3 -0.2 -0.2 -0.3 -0.4 -0.4 -0.6 -0.8 -0.5 -0.2
-0.4 -0.2 -0.1 -0.3 -0.5 -0.4 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3
-0.4 -0.4 -0.2 -0.2 -0.4 -0.5 -0.4 -0.3 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.5
-0.3 -0.4 -0.4 -0.3 -0.3 -0.4 -0.4 -0.4 -0.3 -0.3 -0.3 -0.4 -0.4 -0.1 -0.1
-0.2 -0.3 -0.4 -0.4 -0.3 -0.4 -0.4 -0.4 -0.3 -0.3 -0.2 -0.2 -0.4 -0.5 -0.4
-0.2 -0.2 -0.3 -0.4 -0.4 -0.3 -0.5 -0.5 -0.3 -0.4 -0.4 -0.2 -0.1 -0.3 -0.4
-0.3 -0.2 -0.3 -0.3 -0.3 -0.3 -0.4 -0.6 -0.4 -0.2 -0.4 -0.4 -0.4 -0.2 -0.1
-0.3 -0.3 -0.2 -0.2 -0.3 -0.2 -0.3 -0.5 -0.6 -0.4 -0.2 -0.1 -0.5 -0.6 -0.3

-0.2 -0.3 -0.4 -0.4
-0.3 -0.3 -0.1 -0.1
-0.6 -0.6 -0.6 -0.5
-0.2 -0.2 -0.3 -0.5
-0.2 -0.1 -0.1 -0.2
-0.5 -0.5 -0.5 -0.5
-0.4 -0.3 -0.3 -0.3
-0.2 -0.3 -0.4 -0.3
-0.1 -0.2 -0.4 -0.5
-0.4 -0.1 0.0 -0.1
-0.7 -0.7 -0.4 -0.2
-0.3 -0.5 -0.6 -0.6
-0.2 -0.2 -0.3 -0.4
-0.3 -0.4 -0.3 -0.3
-0.1 -0.2 -0.3 -0.3
-0.5 -0.2 -0.3 -0.3
-0.7 -0.6 -0.5 -0.5
-0.4 -0.5 -0.5 -0.4
-0.3 -0.3 -0.4 -0.3
-0.4 -0.4 -0.5 -0.7
-0.3 -0.3 -0.2 -0.6
-0.3 -0.4 0.0 0.1

SSS EEEEE TTTT U U PPPP
S E T U U P P P
SSS EEE T U U PPPP
S E T U U P
SSS EEEEE T UUU P

INTEGER PARAMETER ARRAY (IPAR)

I	IPAR(I)	DESCRIPTION
1	64	LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2	1	RECONSTRUCT IN A SQUARE ARRAY
3	1	GEOMETRY FLAG
4	72	NUMBER OF PROJECTION ANGLES
5		MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
		ANGLES GENERATED BETWEEN ZERO AND 2*PI
6	129	STARTING AT ZERO
7	1	NUMBER OF RAYS FOR EACH PROJECTION
8	18500	TRANSMISSION DATA
9	2	DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
10	2	NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
11	5	EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
		PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
		PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
		PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12	0	LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE

FLOATING POINT PARAMETER ARRAY (PAR)

I	PAR(I)	DESCRIPTION
1	1.330	PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH AT CENTER OF ROTATION
2	50.500	LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3	125.000	DISTANCE FROM SOURCE TO CENTER OF ROTATION FOR FAN BEAM IN UNITS OF PROJECTION BIN WIDTH AT CENTER OF ROTATION
4	0.000 NA	CONSTANT ATTENUATION COEFFICIENT IN UNITS OF INVERSE PROJECTION BIN WIDTHS
		BLANK COMMON REQUIRED 72 (110)
		BLANK COMMON REQUIRED 144 (220)
		BLANK COMMON REQUIRED 216 (330)
		BLANK COMMON REQUIRED 474 (732)
		BLANK COMMON REQUIRED 538 (1032)

A TOTAL OF 114 (1 THRU 114) OF THE 129 USER PROJECTION BINS WILL BE USED
128 PROJECTION BINS WILL BE USED OF WHICH 14 HAVE BEEN ZEROED BY THE PROGRAM
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 17846 FLOATING POINT WORDS.

EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN N D D S E T U U P P P
EEE N N N D D SSS EEE T U U PPPP
E N NN D D S E T U U P P
EEEE N N DDDD SSS EEEEE T UUU P

FFFF III L BBBB K K
F I L B B K K
FFF I L BBBB KKK
F I L B B K K
F III LLLLL BBBB K K

PARAMETERS FOR SUBROUTINE FILBK

ORDERX - 0.0 FILTER PARAMETER USED ONLY BY THE FILTER BUTER
FREQUX - 0.500 FREQUENCY PARAMETER FOR THE FILTER

BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES PERFORM THE FOLLOWING FUNCTIONS

ARG	FUNCTION	RAY WEIGHTING	ATTENUATION	FAN BEAM
BCK	BACKPROJECTION	UNIFORM SQUARE	NO	YES
FIL	FILTER	N/A	NO	N/A

FILTERED BACK-PROJECTION RECONSTRUCTIONS MUST BE EXECUTED IN AN ARRAY WITH DIMENSIONS AT LEAST TWICE AS LARGE AS THE FINAL IMAGE.

-0.3 -0.4 -0.2 0.0
0.0 -0.3 -0.3 -0.4
-0.2 -0.5 -0.6 -0.6
-0.6 -0.7 -0.5 -0.3
-0.8 -0.5 -0.1 -0.1
-0.8 -0.2 0.0 -0.2
-0.3 0.1 0.0 -0.4
0.2 0.1 -0.4 -0.7
0.2 -0.4 -0.9 -0.8
-0.2 -0.8 -0.8 -0.1
-0.8 -0.8 -0.2 0.2
-0.9 -0.3 0.1 -0.4
-0.2 0.2 -0.2 -0.9
0.2 -0.2 -0.8 -0.8
-0.2 -0.8 -0.8 -0.2
-0.8 -0.2 0.3
-0.6 -0.2 0.2 -0.1
-0.1 0.1 -0.3 -0.8
-0.2 -0.4 -0.8 -0.7
-0.5 -0.6 -0.5 -0.1
-0.4 -0.3 -0.1 -0.3
-0.3 -0.2 -0.3 -0.4
-0.4 -0.3 -0.4 -0.4
-0.2 -0.3 -0.3 -0.2
-0.2 -0.3 -0.2 -0.2
-0.4 -0.3 -0.2 -0.4
-0.3 -0.2 -0.4 -0.5
-0.2 -0.5 -0.6 -0.5
-0.6 -0.7 -0.5 -0.3
-0.5 -0.3 -0.2 -0.3
-0.9 -0.1 -0.2 -0.3
-0.4 -0.4 -0.3 -0.2
-0.2 -0.1 -0.1 -0.2
-0.2 -0.3 -0.5 -0.5
-0.4 -0.3 -0.3 -0.2
-0.3 -0.3 -0.2 -0.3
-0.6 -0.7 -0.7 -0.7
-0.5 -0.4 -0.3 -0.2
-0.2 -0.1 -0.2 -0.2
-0.2 -0.3 -0.3 -0.4
-0.4 -0.3 -0.2 -0.1
-0.4 -0.4 -0.4 -0.4

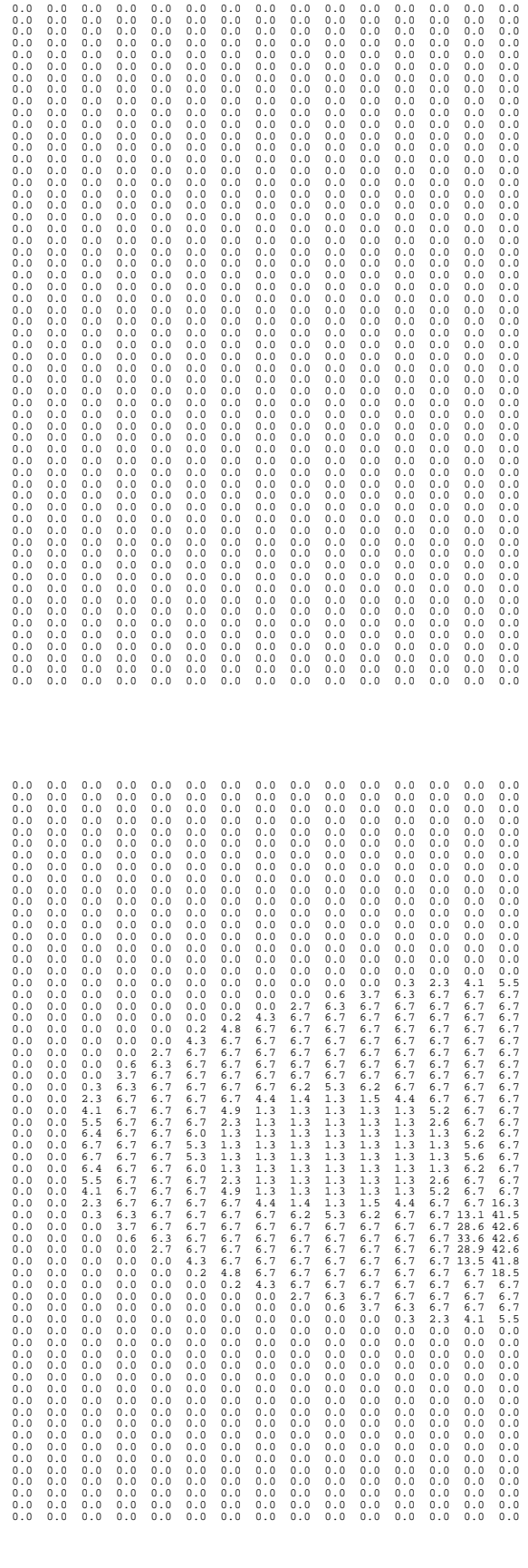
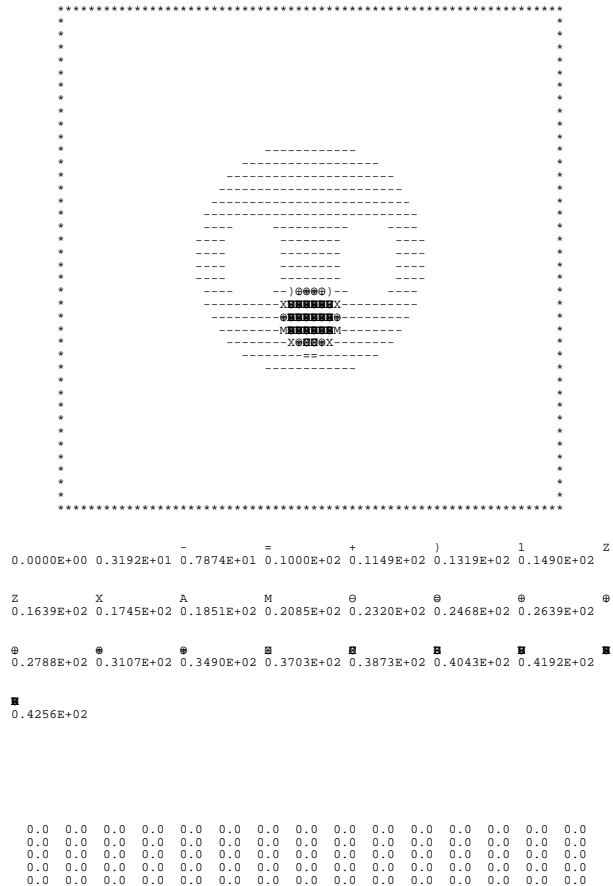
THUS, THE EFFECTIVE SIZE OF THE RECONSTRUCTION ARRAY WILL NOW BE INCREASED.
FOR FAN BEAM RECONSTRUCTIONS THE FAN SOURCE MUST BE OUTSIDE THIS LARGE ARRAY.
BLANK COMMON REQUIRED 602 (1132)
A TOTAL OF 129 (1 THRU 129) OF THE 129 USER PROJECTION BINS WILL BE USED
328 PROJECTION BINS WILL BE USED OF WHICH 199 HAVE BEEN ZEROED BY THE PROGRAM
BLANK COMMON REQUIRED 16986 (41132)
BLANK COMMON REQUIRED 17314 (41642)

PPPP H H AAA N N
P P H H A A NN N
PPPP HHHH A A NN N
P H H AAAAA N NN
P H H A A N N

PHANTOM GENERATED
ARRAY SIZE 64 X 64 INTEGRATION FACTOR = 10 SCALING FACTOR = 0.752
NUMBER OF ELLIPSES AND/OR RECTANGLES = 4
THE PARAMETERS FOR THE ELLIPSES AND/OR RECTANGLES ARE
X,Y - CENTER
A,B - LENGTH OF AXIS OR SIDE A AND B
PHI - ANGLE OF AXIS OR SIDE A
DENS - INTENSITY
THE PARENTHESIS INDICATES THE SCALED VALUE
ITYPE X Y A B PHI DENS
1 - ELLIPSE (0.00, (0.00)(30.08),(30.08) (6.65) 5.00
1 - ELLIPSE (0.00, -10.00 10.00, (10.00 0.00 27.00
1 - ELLIPSE (0.00),(-7.52)(7.52),(7.52) (35.91)
1 - ELLIPSE (10.00, (0.00 14.00, (10.00 1.57 -4.00
1 - ELLIPSE (-7.52,(0.00)(10.53),(7.52) (-5.32)
1 - ELLIPSE (-10.00, (0.00) 14.00 (10.00 -4.00
1 - ELLIPSE (-7.52),(0.00)(10.53),(7.52) (-5.32)

EEEE N N DDDD PPPP H H AAA N N
E NN ND D P P H H A A NN N
EEE NN ND D PPPP HHHH A A NN N
E N NN D D P H H AAAAA N NN
EEEE N N DDDD P H H A A N N

XMIN = 0.00E+00 XMAX = 0.43E+02 XSUM = 0.5656E+04




```

-0.2 0.1 -0.3 -0.6 -0.2 0.0 -0.1 -0.6 -0.6 -0.2 0.1 0.0 -0.5 -0.8 -0.3
0.0 0.0 -0.5 -0.4 -0.1 -0.1 -0.4 -0.6 -0.3 0.0 0.0 -0.4 -0.7 -0.5 0.2
0.1 -0.3 -0.5 -0.1 0.0 -0.3 -0.4 -0.4 -0.2 0.0 -0.2 -0.5 -0.5 -0.1 0.2
0.0 -0.5 -0.3 0.9 -0.2 -0.5 -0.4 -0.2 -0.1 -0.1 -0.4 -0.5 -0.3 0.2 -0.1
-0.2 -0.4 -0.1 -0.1 -0.5 -0.4 -0.2 -0.2 -0.2 -0.3 -0.5 -0.4 0.0 0.0 -0.4
-0.4 -0.2 0.0 -0.4 -0.4 -0.1 -0.2 -0.4 -0.3 -0.4 -0.4 -0.1 0.0 -0.2 -0.5
-0.3 -0.1 -0.2 -0.5 -0.2 -0.1 -0.4 -0.4 -0.2 -0.3 -0.3 -0.1 -0.2 -0.4 -0.4
-0.1 -0.1 -0.5 -0.3 0.0 -0.3 -0.5 -0.1 -0.2 -0.4 -0.2 -0.1 -0.3 -0.3 -0.1
-0.1 -0.4 -0.5 -0.1 -0.2 -0.5 -0.3 -0.1 -0.4 -0.4 0.0 -0.1 -0.3 -0.2 -0.1
-0.3 -0.5 -0.2 0.0 -0.4 -0.4 -0.1 -0.3 -0.4 -0.1 0.0 -0.3 -0.4 -0.2 -0.3
-0.5 -0.4 0.0 -0.3 -0.5 -0.2 -0.1 -0.4 -0.2 0.1 -0.3 -0.4 -0.2 -0.2 -0.5
-0.4 -0.1 -0.1 -0.5 -0.3 -0.1 -0.4 -0.3 0.0 -0.2 -0.5 -0.2 -0.1 -0.5 -0.6
-0.2 -0.1 -0.4 -0.4 -0.1 -0.2 -0.4 -0.1 -0.1 -0.4 -0.3 -0.1 -0.4 -0.6 -0.2
-0.2 -0.2 -0.3 -0.3 -0.2 -0.1 -0.1 -0.3 -0.4 -0.2 -0.2 -0.3 -0.3 -0.3 -0.3
-0.2 -0.4 -0.4 -0.2 -0.2 -0.2 -0.1 -0.3 -0.4 -0.2 -0.3 -0.5 -0.3 0.1 -0.1
-0.2 -0.4 -0.3 -0.1 -0.2 -0.2 -0.3 -0.3 -0.2 -0.2 -0.4 -0.3 0.0 -0.1 -0.4
-0.3 -0.3 -0.1 -0.2 -0.3 -0.3 -0.3 -0.2 -0.2 -0.4 -0.3 -0.1 -0.2 -0.4 -0.4
-0.3 -0.2 -0.2 -0.3 -0.3 -0.2 -0.1 -0.1 -0.3 -0.4 -0.2 -0.2 -0.4 -0.3 -0.2
-0.2 -0.3 -0.3 -0.2 -0.1 -0.1 -0.3 -0.4 -0.3 -0.2 -0.3 -0.4 -0.3 -0.3 -0.3
-0.1 -0.3 -0.2 -0.1 -0.1 -0.3 -0.4 -0.3 -0.2 -0.3 -0.4 -0.3 -0.2 -0.2 -0.1
0.6 -0.2 -0.1 -0.1 -0.3 -0.5 -0.4 -0.2 -0.2 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2
1.9 0.3 -0.1 -0.3 -0.5 -0.4 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2
3.4 0.9 -0.3 -0.5 -0.4 -0.2 -0.2 -0.2 -0.2 -0.1 -0.1 -0.1 -0.1 -0.2 -0.3
4.5 1.6 -0.2 -0.4 -0.2 -0.1 -0.1 -0.2 -0.1 -0.1 -0.1 -0.1 -0.2 -0.4 -0.5 -0.5
5.2 2.5 0.3 -0.2 -0.1 -0.1 -0.1 -0.1 -0.2 -0.3 -0.4 -0.5 -0.5 -0.4 -0.2
5.7 3.5 0.9 -0.1 -0.1 -0.2 -0.2 -0.2 -0.4 -0.5 -0.4 -0.4 -0.3 -0.2 -0.2
6.1 4.1 1.2 -0.2 -0.3 -0.3 -0.4 -0.4 -0.4 -0.4 -0.3 -0.2 -0.2 -0.3 -0.3
6.1 4.4 1.3 -0.3 -0.3 -0.3 -0.3 -0.4 -0.3 -0.2 -0.2 -0.2 -0.1 -0.1 -0.2
6.1 4.6 1.6 -0.1 -0.3 -0.4 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.3
6.2 4.7 1.7 0.0 -0.2 -0.3 -0.2 -0.2 -0.1 -0.2 -0.2 -0.2 -0.3 -0.3 -0.3
6.3 4.4 1.4 -0.2 -0.2 -0.2 -0.1 -0.1 -0.1 -0.2 -0.2 -0.3 -0.3 -0.3 -0.2
6.1 4.1 1.2 -0.1 -0.2 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3
5.8 3.6 1.0 0.1 -0.2 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3
5.4 2.8 0.5 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2
4.5 1.6 -0.1 -0.4 -0.4 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2
3.0 0.6 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.1 -0.1 -0.2 -0.2 -0.2 -0.2 -0.2
1.7 0.1 -0.2 -0.2 -0.2 -0.2 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2
0.8 -0.2 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3
0.1 -0.2 -0.2 -0.3 -0.3 -0.4 -0.4 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.3 -0.3
-0.2 -0.1 -0.1 -0.1 -0.2 -0.2 -0.3 -0.4 -0.4 -0.4 -0.3 -0.3 -0.3 -0.2 -0.2
-0.2 -0.2 -0.2 -0.2 -0.1 -0.1 -0.2 -0.2 -0.3 -0.3 -0.4 -0.4 -0.4 -0.4 -0.3
-0.2 -0.3 -0.4 -0.4 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.4 -0.4 -0.5
-0.2 -0.2 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.2
-0.2 -0.2 -0.1 -0.2 -0.2 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.1 -0.1 -0.1
-0.2 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2
-0.3 -0.3 -0.4 -0.3 -0.2 -0.2 -0.2 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2
-0.2 -0.2 -0.3 -0.3 -0.3 -0.3 -0.2 -0.2 -0.3 -0.3 -0.3 -0.3 -0.2 -0.2 -0.3
-0.3 -0.2 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3
-0.3 -0.2 -0.1 -0.2 -0.3 -0.3 -0.4 -0.4 -0.2 -0.2 -0.2 -0.3 -0.4 -0.4 -0.2
-0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.1 -0.2 -0.4 -0.4 -0.3 -0.1 -0.2 -0.5 -0.6
-0.2 -0.3 -0.3 -0.3 -0.3 -0.3 -0.2 -0.1 -0.2 -0.3 -0.3 -0.5 -0.4 -0.2 0.0
-0.2 -0.3 -0.3 -0.3 -0.3 -0.3 -0.2 -0.1 -0.2 -0.3 -0.3 -0.5 -0.4 -0.2 0.0
-0.1 -0.2 -0.3 -0.4 -0.3 -0.2 -0.2 -0.3 -0.2 -0.3 -0.3 -0.2 -0.1 -0.2 -0.4
-0.1 -0.2 -0.2 -0.3 -0.4 -0.3 -0.2 -0.2 -0.2 -0.2 -0.3 -0.4 -0.3 -0.2 -0.1
-0.1 -0.1 -0.2 -0.2 -0.3 -0.4 -0.3 -0.2 -0.3 -0.2 -0.1 -0.2 -0.4 -0.4 -0.2
-0.2 -0.1 -0.2 -0.2 -0.2 -0.4 -0.3 -0.2 -0.3 -0.4 -0.3 0.0 -0.2 -0.4 -0.4
-0.3 -0.2 -0.1 -0.2 -0.2 -0.4 -0.4 -0.3 -0.2 -0.2 -0.3 -0.4 -0.3 -0.2 -0.1
-0.4 -0.3 -0.1 -0.2 -0.3 -0.1 -0.3 -0.6 -0.3 0.0 -0.3 -0.5 -0.2 -0.2 -0.3
-0.3 -0.4 -0.3 -0.1 -0.3 -0.2 0.0 -0.4 -0.6 -0.2 -0.1 -0.3 -0.3 -0.2 -0.3
-0.2 -0.4 -0.5 -0.1 -0.2 -0.5 -0.1 0.0 -0.5 -0.5 -0.2 -0.2 -0.3 -0.2 -0.2

```

```

SSS EEEEE TTTTT U U PPPP
S E T U U P P
SSS EEE T U U PPPP
S E T U U P
SSS EEEEE T UUU P

```

INTEGER PARAMETER ARRAY (IPAR)

I	IPAR(I)	DESCRIPTION
1	64	LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2	1	RECONSTRUCT IN A SQUARE ARRAY
3	2	GEOMETRY FLAG FAN BEAM GEOMETRY (FLAT DETECTOR)
4	72	NUMBER OF PROJECTION ANGLES
5	5	MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES) ANGLES GENERATED BETWEEN ZERO AND 2*PI STARTING AT ZERO
6	129	NUMBER OF RAYS FOR EACH PROJECTION
7	1	TRANSMISSION DATA
8	18500	DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9	2	NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10	0	EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11	5	PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES) PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12	0	LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE

FLOATING POINT PARAMETER ARRAY (PAR)

I	PAR(I)	DESCRIPTION
1	1.330	PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH AT CENTER OF ROTATION
2	50.500	LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3	125.000	DISTANCE FROM SOURCE TO CENTER OF ROTATION FOR FAN BEAM IN UNITS OF PROJECTION BIN WIDTH AT CENTER OF ROTATION
4	0.000 NA	CONSTANT ATTENUATION COEFFICIENT IN UNITS OF INVERSE PROJECTION BIN WIDTHS
		BLANK COMMON REQUIRED 72 (110)
		BLANK COMMON REQUIRED 144 (220)
		BLANK COMMON REQUIRED 216 (330)
		BLANK COMMON REQUIRED 474 (732)
		BLANK COMMON REQUIRED 538 (1032)

A TOTAL OF 120 (1 THRU 120) OF THE 129 USER PROJECTION BINS WILL BE USED
140 PROJECTION BINS WILL BE USED OF WHICH 20 HAVE BEEN ZEROED BY THE PROGRAM

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 17846 FLOATING POINT WORDS.

```

EEEE N N DDDD SSS EEEEE TTTTT U U PPPP
E MN N D D S E T U U P P
EEE N N N D D SSS EEE T U U PPPP
E N N N D D S E T U U P
EEEE N N DDDD SSS EEEEE T UUU P

```

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FFFF III L BBBB K K
F I L B B K K
FFF I L BBBB KKK
F I L B B K K
F III LLLL BBBB K K

```

PARAMETERS FOR SUBROUTINE FILBK

DESCRIPTION
ORDERX - 0.0 FILTER PARAMETER USED ONLY BY THE FILTER BUTER
FREQX - 0.500 FREQUENCY PARAMETER FOR THE FILTER

BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES

PERFORM THE FOLLOWING FUNCTIONS

ARG	FUNCTION	RAY WEIGHTING	ATTENUATION	FAN BEAM
BCK	BACKPROJECTION	UNIFORM SQUARE	NO	YES
FIL	FILTER	N/A	NO	N/A

FILTERED BACK-PROJECTION RECONSTRUCTIONS MUST BE EXECUTED IN AN ARRAY WITH DIMENSIONS AT LEAST TWICE AS LARGE AS THE FINAL IMAGE. THUS, THE EFFECTIVE SIZE OF THE RECONSTRUCTION ARRAY WILL NOW BE INCREASED.

FOR FAN BEAM RECONSTRUCTIONS THE FAN SOURCE MUST BE OUTSIDE THIS LARGE ARRAY.

BLANK COMMON REQUIRED 602 (1132)

A TOTAL OF 129 (1 THRU 129) OF THE 129 USER PROJECTION BINS WILL BE USED

896 PROJECTION BINS WILL BE USED OF WHICH 767 HAVE BEEN ZEROED BY THE PROGRAM

BLANK COMMON REQUIRED 16986 (41132)

BLANK COMMON REQUIRED 17882 (42732)

```

-0.6 0.2 0.3 -0.5
-0.1 0.3 -0.2 -0.9
0.3 0.1 -0.7 -0.8
0.2 -0.4 -0.3 0.2
-0.3 -0.8 -0.5 0.2
-0.6 -0.5 0.1 0.3
-0.5 -0.1 0.2 -0.2
-0.3 0.1 -0.1 -0.7
-0.1 0.0 -0.5 -0.8
0.0 -0.3 -0.8 -0.5
-0.3 -0.8 -0.7 -0.2
-0.7 -0.7 -0.1 0.3
-0.6 -0.1 0.3 0.1
-0.2 -0.2 -0.9 -0.6
0.1 -0.1 -0.5 -0.6
-0.1 -0.5 -0.5 -0.2
-0.5 -0.5 -0.2 0.0
-0.4 -0.1 0.0 -0.3
-0.2 -0.2 -0.4 -0.6
-0.2 -0.4 -0.5 -0.2
-0.4 -0.3 0.0 0.1
-0.2 0.0 -0.1 -0.4
-0.1 -0.2 -0.4 -0.4
-0.3 -0.3 -0.2 0.0
-0.2 -0.2 -0.2 -0.3
-0.3 -0.4 -0.5 -0.5
-0.5 -0.4 -0.3 -0.1
-0.1 -0.1 -0.1 -0.2
-0.2 -0.3 -0.2 -0.1
-0.3 -0.2 -0.2 -0.1
-0.2 -0.2 -0.2 -0.3
-0.4 -0.5 -0.5 -0.5
-0.3 -0.2 -0.1 -0.1
-0.2 -0.2 -0.3 -0.3
-0.3 -0.3 -0.4 -0.3
-0.2 -0.2 -0.1 -0.1
-0.3 -0.2 -0.2 -0.2
-0.3 -0.4 -0.4 -0.6
-0.2 -0.1 0.0 0.1
-0.5 -0.5 -0.4 -0.3
-0.3 -0.4 -0.5 -0.7
-0.1 -0.1 0.0 -0.1
-0.3 -0.4 -0.3 -0.2
-0.1 -0.1 -0.2 -0.3
-0.3 -0.2 -0.1 0.0
-0.3 -0.4 -0.4 -0.4
-0.1 0.0 -0.1 -0.4
-0.5 -0.2 0.0 0.1
-0.5 -0.7 -0.6 -0.2
0.0 -0.3 -0.6 -0.6
-0.2 0.0 -0.2 -0.4
-0.4 -0.3 -0.1 -0.2
-0.3 -0.3 -0.2 -0.2
-0.2 -0.3 -0.2 -0.1
-0.3 -0.4 -0.3 -0.2
-0.2 -0.3 -0.5 -0.4
-0.2 -0.2 -0.4 -0.4
-0.3 -0.2 -0.3 -0.4
-0.3 -0.3 -0.3 -0.3

```


1.8 0.2 -0.1 -0.3 -0.5 -0.4 -0.3 -0.3 -0.3 -0.2 -0.1 -0.2 -0.2 -0.2 -0.2
3.3 0.8 -0.3 -0.4 -0.4 -0.2 -0.2 -0.2 -0.1 -0.1 -0.1 -0.1 -0.1 -0.2 -0.3
4.5 1.5 -0.2 -0.3 -0.2 -0.2 -0.2 -0.1 -0.1 -0.1 -0.2 -0.4 -0.5 -0.5 -0.5
5.3 2.4 0.2 -0.2 -0.1 -0.1 -0.1 -0.1 -0.2 -0.3 -0.4 -0.5 -0.5 -0.4 -0.2
5.8 3.4 0.8 -0.1 -0.2 -0.2 -0.2 -0.3 -0.4 -0.5 -0.4 -0.4 -0.3 -0.2 -0.2
6.2 4.1 1.1 -0.2 -0.2 -0.3 -0.4 -0.4 -0.5 -0.4 -0.3 -0.2 -0.2 -0.3 -0.3
6.3 4.4 1.2 -0.3 -0.3 -0.3 -0.4 -0.4 -0.3 -0.2 -0.2 -0.2 -0.1 -0.1 -0.2
6.2 4.6 1.5 -0.2 -0.4 -0.4 -0.3 -0.3 -0.2 -0.1 -0.2 -0.2 -0.2 -0.2 -0.3
6.3 4.7 1.6 -0.1 -0.2 -0.2 -0.2 -0.2 -0.1 -0.2 -0.2 -0.3 -0.3 -0.3 -0.3
6.4 4.4 1.2 -0.2 -0.2 -0.1 -0.1 -0.1 -0.2 -0.3 -0.3 -0.3 -0.3 -0.2 -0.2
6.2 4.0 1.1 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3 -0.2 -0.2
5.9 3.6 0.9 -0.1 -0.1 -0.2 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2
5.5 2.7 0.3 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.3
4.5 1.5 -0.2 -0.4 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2
2.9 0.6 -0.2 -0.1 -0.1 -0.2 -0.2 -0.2 -0.1 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2
1.6 0.0 -0.2 -0.1 -0.2 -0.2 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2
0.7 -0.2 -0.4 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.3 -0.3 -0.3 -0.3
0.0 -0.2 -0.2 -0.3 -0.3 -0.4 -0.4 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.3 -0.4
-0.3 -0.2 -0.1 -0.1 -0.2 -0.3 -0.3 -0.4 -0.4 -0.4 -0.3 -0.3 -0.3 -0.2 -0.2
-0.3 -0.2 -0.2 -0.2 -0.1 -0.1 -0.1 -0.2 -0.3 -0.3 -0.3 -0.4 -0.4 -0.4 -0.2
-0.2 -0.3 -0.4 -0.4 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.4 -0.5
-0.2 -0.2 -0.3 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.1 -0.1 -0.2 -0.2
-0.2 -0.1 -0.1 -0.2 -0.2 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.1 -0.1
-0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.2 -0.2 -0.2 -0.3 -0.2 -0.2
-0.3 -0.3 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2
-0.3 -0.2 -0.3 -0.3 -0.3 -0.3 -0.2 -0.1 -0.2 -0.3 -0.3 -0.3 -0.2 -0.2 -0.3
-0.3 -0.2 -0.2 -0.3 -0.4 -0.4 -0.3 -0.2 -0.1 -0.1 -0.3 -0.4 -0.3 -0.2 -0.1
-0.3 -0.2 -0.2 -0.2 -0.3 -0.4 -0.4 -0.4 -0.3 -0.1 -0.2 -0.3 -0.4 -0.4 -0.2
-0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.2 -0.2 -0.2 -0.4 -0.4 -0.4 -0.3 -0.1 -0.1
-0.3 -0.3 -0.3 -0.3 -0.2 -0.2 -0.2 -0.1 -0.2 -0.3 -0.3 -0.5 -0.4 -0.2 -0.1
-0.2 -0.3 -0.4 -0.3 -0.2 -0.2 -0.3 -0.2 -0.2 -0.2 -0.1 -0.2 -0.4 -0.5 -0.4
-0.1 -0.2 -0.3 -0.4 -0.3 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.2 -0.1 -0.2 -0.4
-0.3 -0.2 -0.3 -0.4 -0.3 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.2 -0.1 -0.2 -0.4
-0.2 -0.2 -0.2 -0.2 -0.2 -0.3 -0.4 -0.3 -0.3 -0.3 -0.2 -0.1 -0.2 -0.4 -0.4
-0.2 -0.2 -0.2 -0.2 -0.2 -0.3 -0.3 -0.2 -0.3 -0.4 -0.3 0.0 -0.1 -0.4 -0.3
-0.3 -0.2 -0.1 -0.2 -0.2 -0.2 -0.4 -0.3 0.0 -0.3 -0.5 -0.3 0.0 -0.2 -0.3
-0.4 -0.3 -0.1 -0.2 -0.3 -0.1 -0.2 -0.6 -0.3 0.0 -0.3 -0.5 -0.2 -0.2 -0.3
-0.3 -0.4 -0.4 -0.4 -0.2 0.0 -0.4 -0.6 -0.2 -0.1 -0.3 -0.3 -0.2 -0.3
-0.2 -0.4 -0.4 -0.1 -0.2 -0.5 -0.1 0.0 -0.4 -0.4 -0.2 -0.2 -0.3 -0.2 -0.2

-0.5 0.2 0.2 -0.6
-0.1 0.3 -0.2 -0.9
0.3 0.1 -0.7 -0.8
0.2 -0.4 -0.8 -0.3
-0.3 -0.8 -0.5 0.2
-0.6 -0.6 0.1 0.3
-0.5 -0.1 0.2 -0.2
-0.3 0.1 -0.1 -0.7
-0.1 0.0 -0.5 -0.8
0.0 -0.3 -0.7 -0.5
-0.3 -0.7 -0.7 -0.2
-0.7 -0.6 -0.1 0.2
-0.5 -0.1 0.3 0.0
-0.2 0.1 -0.1 -0.6
0.1 -0.1 -0.5 -0.6
-0.1 -0.5 -0.5 -0.1
-0.5 -0.5 -0.2 0.0
-0.4 -0.1 0.0 -0.3
-0.2 -0.1 -0.4 -0.6
-0.2 -0.4 -0.5 -0.2
-0.3 -0.3 0.0 0.1
-0.2 0.0 -0.1 -0.4
-0.1 -0.2 -0.4 -0.5
-0.3 -0.4 -0.2 0.0
-0.2 -0.2 -0.2 -0.3
-0.3 -0.4 -0.5 -0.5
-0.5 -0.4 -0.3 -0.1
-0.1 -0.1 -0.1 -0.2
-0.2 -0.3 -0.4 -0.4
-0.3 -0.2 -0.2 -0.1
-0.2 -0.2 -0.2 -0.3
-0.4 -0.5 -0.5 -0.5
-0.3 -0.2 -0.1 -0.1
-0.2 -0.2 -0.2 -0.3
-0.2 -0.3 -0.4 -0.3
-0.2 -0.1 -0.1 0.0
-0.3 -0.3 -0.4 -0.4
-0.2 -0.2 -0.2 -0.2
-0.2 -0.1 -0.1 -0.1
-0.3 -0.4 -0.5 -0.5
-0.2 -0.2 -0.1 -0.1
-0.3 -0.2 -0.2 -0.2
-0.2 -0.3 -0.4 -0.6
-0.2 -0.1 0.0 0.1
-0.5 -0.5 -0.4 -0.3
-0.3 -0.4 -0.5 -0.7
-0.1 -0.1 0.0 -0.1
-0.3 -0.4 -0.3 -0.2
-0.1 -0.1 -0.2 -0.3
-0.3 -0.2 -0.1 0.0
-0.3 -0.4 -0.5 -0.4
-0.1 0.0 -0.1 -0.4
-0.4 -0.2 0.0 0.1
-0.5 -0.6 -0.5 -0.2
-0.1 -0.3 -0.6 -0.6
-0.2 0.0 -0.2 -0.5
-0.4 -0.3 -0.2 -0.3
-0.3 -0.3 -0.2 -0.2
-0.2 -0.3 -0.2 -0.1
-0.3 -0.4 -0.4 -0.2
-0.2 -0.3 -0.4 -0.3
-0.2 -0.2 -0.3 -0.4
-0.3 -0.2 -0.3 -0.3
-0.3 -0.3 -0.3 -0.3

EX05

```

PROGRAM XCONGR
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 5
C
C THE PROGRAM XCONGR USES THE ITERATIVE CONJUGATE GRADIENT
C ALGORITHM TO RECONSTRUCT PARALLEL BEAM PROJECTION DATA.
C
C DIMENSION B(4096),AG(180)
C COMMON/BLANK/WORK(15000)
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
C (CATN , PAR( 4))
C
C EXTERNAL BRP,PRF
C
C LUNOUT=2
C I80132=0
C
C THE INPUT PARAMETERS ARE
C
C NDIMU=64
C ICIR=0
C IGEOM=0
C NANG=72
C MODANG=4
C KDIMU=100
C IMIT=1
C NWORK=15000
C NFLOAT=2
C ISTORE=0
C IPRINT=7
C LUNATN=0
C PWID=1.
C AXISU=50.5
C RFAN=0.
C CATN=0.
C
C OPEN OUTPUT FILE
C
C OPEN (LUNOUT,FILE='E05.OUT',FORM='FORMATTED')
C
C CALL SETUP (IPAR,PAR,AG)
C
C ISTEP=15
C IRLX=1
C IERR=0
C IZER=0
C
C CALL CONGR (B,PRF,BRF,ISTP,IRLX,IERR,IZER)
C
C CALL ARRAY (B,NDIMU)
C
C PRINTOUT THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
C
C NMAT=NDIMU**2
C KK1=1
C KU=NDIMU/15+1
C DO 12 K=1,KU
C WRITE (LUNOUT,14)
C KK2=MIN(15*K,NDIMU)
C DO 10 J=1,NDIMU
C ISUB1=NMAT-J*NDIMU+KK1
C ISUB2=NMAT-J*NDIMU+KK2
C WRITE (LUNOUT,16) (B(I),I=ISUB1,ISUB2)
C 10 KK1=KK2+1
C 12
C
C CLOSE (LUNOUT)
C
C 14 FORMAT(1X,////)
C 16 FORMAT(1X,15F5.1)
C END
C
C SUBROUTINE GETUM (M,DATA,ERR)
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 5
C
C THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
C A PIE PHANTOM.
C
C DIMENSION B(4096),DATA(*),ERR(*)
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),

```

```

3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
5 (CATN , PAR( 4))
C
C EXTERNAL PLL
C
C DATA R,X1,Y1,Z,INTFR,NSLIPI,ISTART/30.,0.,0.,1.,10,10,1/
C
C IF (M.EQ.1) THEN
C CALL PIE (B,NDIMU,R,X1,Y1,Z,INTFR,NSLIPI,ISTART)
C CALL ARRAY (B,NDIMU)
C ENDIF
C
C CALL PJECT (B,DATA,M,PLL)
C
C RETURN
C END

```

```

SSS EEEEE TTTT U U PPPP
S E T U U P P P
SSS EEE T U U PPPP
S E T U U P P
SSS EEEEE T UUU P

```

```

INTEGER PARAMETER ARRAY (IPAR)
I IPAR(I) DESCRIPTION
1 64 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 0 RECONSTRUCT IN A CIRCULAR ARRAY
3 0 GEOMETRY FLAG
4 72 PARALLEL BEAM GEOMETRY
5 4 NUMBER OF PROJECTION ANGLES
MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND PI
STARTING AT ZERO
6 100 NUMBER OF RAYS FOR EACH PROJECTION
7 1 TRANSMISSION DATA
8 15000 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 7 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT PROJECTION DATA AND UNCERTAINTIES
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12 0 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE

```

```

FLOATING POINT PARAMETER ARRAY (PAR)
I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS

```

```

BLANK COMMON REQUIRED 72 ( 110)
BLANK COMMON REQUIRED 144 ( 220)
BLANK COMMON REQUIRED 216 ( 330)
BLANK COMMON REQUIRED 416 ( 640)
BLANK COMMON REQUIRED 480 ( 740)
A TOTAL OF 68 ( 17 THRU 84) OF THE 100 USER PROJECTION BINS WILL BE USED
68 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 480 FLOATING POINT WORDS.

```

```

EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN N D D S E T U U P P P
EEE N N N D D SSS EEE T U U PPPP
E N NN D D S E T U U P P
EEEE N N DDDD SSS EEEEE T UUU P

```

```

CCC OOOO N N GGG RRRR
C C O O NN N G G R R R
C C O O NN N G RRRR
C C O O N NN G GG R R R
CCC OOOO N N GGG R R R

```

```

PARAMETERS FOR SUBROUTINE CONGR
DESCRIPTION
ISTP - 15 NUMBER OF ITERATION STEPS
IRLX - 1 ITERATIVE RELAXATION METHOD
IERR - 0 DO NOT USE ERROR ARRAY
IZER - 0 INITIAL SOLUTION IS ZERO
BLANK COMMON REQUIRED 516 ( 1004)
BLANK COMMON REQUIRED 1675 ( 3213)
BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES
PERFORM THE FOLLOWING FUNCTIONS

```


0.208E+02	0.240E+02	0.256E+02	0.265E+02	0.253E+02
0.242E+02	0.230E+02	0.217E+02	0.199E+02	0.195E+02
0.203E+02	0.215E+02	0.250E+02	0.277E+02	0.318E+02
0.347E+02	0.383E+02	0.430E+02	0.408E+02	0.408E+02
0.361E+02	0.281E+02	0.161E+02	0.582E+01	0.574E+01
0.163E+02	0.266E+02	0.358E+02	0.408E+02	0.430E+02
0.412E+02	0.383E+02	0.352E+02	0.321E+02	0.279E+02
0.253E+02	0.215E+02	0.204E+02	0.193E+02	0.199E+02
0.212E+02	0.229E+02	0.243E+02	0.251E+02	0.254E+02
0.257E+02	0.239E+02	0.208E+02	0.176E+02	0.186E+02
0.103E+02	0.852E+01	0.895E+01	0.756E+01	0.759E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 28 1.178 RADIAN 67.500 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.562E+00	0.663E+01
0.883E+01	0.925E+01	0.116E+02	0.140E+02	0.172E+02
0.206E+02	0.228E+02	0.242E+02	0.248E+02	0.256E+02
0.247E+02	0.234E+02	0.213E+02	0.213E+02	0.215E+02
0.229E+02	0.234E+02	0.242E+02	0.269E+02	0.309E+02
0.343E+02	0.373E+02	0.383E+02	0.373E+02	0.358E+02
0.342E+02	0.337E+02	0.211E+02	0.789E+01	0.762E+01
0.212E+02	0.322E+02	0.344E+02	0.359E+02	0.373E+02
0.385E+02	0.373E+02	0.347E+02	0.312E+02	0.275E+02
0.241E+02	0.234E+02	0.227E+02	0.216E+02	0.212E+02
0.213E+02	0.231E+02	0.245E+02	0.255E+02	0.247E+02
0.242E+02	0.228E+02	0.205E+02	0.172E+02	0.142E+02
0.117E+02	0.914E+01	0.890E+01	0.689E+01	0.737E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 29 1.222 RADIAN 70.000 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.444E+00	0.572E+01
0.872E+01	0.109E+02	0.132E+02	0.144E+02	0.169E+02
0.199E+02	0.213E+02	0.221E+02	0.235E+02	0.244E+02
0.245E+02	0.245E+02	0.231E+02	0.216E+02	0.222E+02
0.253E+02	0.260E+02	0.254E+02	0.267E+02	0.293E+02
0.330E+02	0.329E+02	0.335E+02	0.325E+02	0.322E+02
0.313E+02	0.328E+02	0.298E+02	0.158E+02	0.150E+02
0.305E+02	0.315E+02	0.317E+02	0.323E+02	0.326E+02
0.306E+02	0.297E+02	0.294E+02	0.297E+02	0.294E+02
0.253E+02	0.257E+02	0.252E+02	0.246E+02	0.231E+02
0.233E+02	0.229E+02	0.244E+02	0.243E+02	0.236E+02
0.221E+02	0.212E+02	0.200E+02	0.168E+02	0.145E+02
0.133E+02	0.110E+02	0.875E+01	0.601E+01	0.610E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 30 1.265 RADIAN 72.500 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.356E+00	0.461E+01
0.894E+01	0.124E+02	0.141E+02	0.157E+02	0.172E+02
0.182E+02	0.195E+02	0.209E+02	0.216E+02	0.222E+02
0.232E+02	0.252E+02	0.249E+02	0.265E+02	0.270E+02
0.281E+02	0.269E+02	0.279E+02	0.285E+02	0.288E+02
0.274E+02	0.275E+02	0.288E+02	0.281E+02	0.287E+02
0.289E+02	0.310E+02	0.290E+02	0.335E+02	0.344E+02
0.301E+02	0.297E+02	0.294E+02	0.297E+02	0.294E+02
0.288E+02	0.280E+02	0.273E+02	0.288E+02	0.284E+02
0.281E+02	0.265E+02	0.279E+02	0.270E+02	0.265E+02
0.249E+02	0.251E+02	0.233E+02	0.221E+02	0.214E+02
0.209E+02	0.196E+02	0.181E+02	0.173E+02	0.155E+02
0.142E+02	0.000E+00	0.000E+00	0.491E+01	0.501E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 31 1.309 RADIAN 75.000 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.209E+00	0.349E+01
0.939E+01	0.172E+02	0.184E+02	0.196E+02	0.176E+02
0.231E+02	0.248E+02	0.278E+02	0.291E+02	0.303E+02
0.290E+02	0.298E+02	0.303E+02	0.297E+02	0.268E+02
0.235E+02	0.230E+02	0.226E+02	0.240E+02	0.252E+02
0.262E+02	0.202E+02	0.170E+02	0.485E+02	0.499E+02
0.332E+02	0.275E+02	0.269E+02	0.255E+02	0.244E+02
0.228E+02	0.231E+02	0.234E+02	0.262E+02	0.296E+02
0.302E+02	0.298E+02	0.287E+02	0.301E+02	0.291E+02
0.279E+02	0.250E+02	0.230E+02	0.212E+02	0.197E+02
0.184E+02	0.175E+02	0.171E+02	0.175E+02	0.177E+02
0.152E+02	0.137E+02	0.942E+01	0.379E+01	0.309E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 32 1.353 RADIAN 77.500 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.271E+00	0.274E+01
0.966E+01	0.142E+02	0.176E+02	0.178E+02	0.172E+02
0.164E+02	0.160E+02	0.173E+02	0.180E+02	0.201E+02
0.230E+02	0.261E+02	0.287E+02	0.311E+02	0.316E+02
0.326E+02	0.318E+02	0.308E+02	0.289E+02	0.253E+02
0.235E+02	0.202E+02	0.192E+02	0.192E+02	0.194E+02
0.238E+02	0.302E+02	0.408E+02	0.532E+02	0.540E+02
0.426E+02	0.296E+02	0.246E+02	0.211E+02	0.197E+02
0.173E+02	0.196E+02	0.233E+02	0.249E+02	0.284E+02
0.306E+02	0.316E+02	0.325E+02	0.317E+02	0.310E+02
0.247E+02	0.232E+02	0.232E+02	0.202E+02	0.180E+02
0.173E+02	0.160E+02	0.163E+02	0.171E+02	0.177E+02
0.174E+02	0.146E+02	0.101E+02	0.264E+01	0.128E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 33 1.396 RADIAN 80.000 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.159E+01
0.969E+01	0.144E+02	0.179E+02	0.179E+02	0.174E+02
0.169E+02	0.162E+02	0.159E+02	0.179E+02	0.200E+02
0.223E+02	0.254E+02	0.284E+02	0.314E+02	0.347E+02
0.346E+02	0.331E+02	0.302E+02	0.275E+02	0.257E+02
0.228E+02	0.192E+02	0.172E+02	0.141E+02	0.156E+02
0.243E+02	0.345E+02	0.438E+02	0.549E+02	0.553E+02
0.454E+02	0.339E+02	0.255E+02	0.166E+02	0.142E+02
0.169E+02	0.190E+02	0.222E+02	0.254E+02	0.273E+02
0.298E+02	0.328E+02	0.343E+02	0.317E+02	0.317E+02
0.285E+02	0.255E+02	0.224E+02	0.201E+02	0.180E+02
0.159E+02	0.160E+02	0.168E+02	0.173E+02	0.178E+02
0.179E+02	0.145E+02	0.104E+02	0.177E+01	0.000E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 34 1.440 RADIAN 82.500 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.218E+01
0.870E+01	0.160E+02	0.181E+02	0.180E+02	0.172E+02
0.165E+02	0.158E+02	0.156E+02	0.168E+02	0.201E+02
0.235E+02	0.235E+02	0.235E+02	0.199E+02	0.192E+02
0.341E+02	0.334E+02	0.322E+02	0.279E+02	0.236E+02
0.223E+02	0.201E+02	0.164E+02	0.144E+02	0.185E+02
0.237E+02	0.330E+02	0.435E+02	0.548E+02	0.552E+02
0.453E+02	0.330E+02	0.246E+02	0.189E+02	0.146E+02
0.161E+02	0.161E+02	0.161E+02	0.161E+02	0.161E+02
0.318E+02	0.332E+02	0.339E+02	0.332E+02	0.310E+02
0.285E+02	0.266E+02	0.238E+02	0.204E+02	0.170E+02
0.155E+02	0.157E+02	0.163E+02	0.170E+02	0.178E+02
0.181E+02	0.162E+02	0.951E+01	0.233E+01	0.000E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 35 1.484 RADIAN 85.000 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.413E+01
0.848E+01	0.142E+02	0.165E+02	0.180E+02	0.179E+02
0.171E+02	0.171E+02	0.171E+02	0.186E+02	0.204E+02
0.232E+02	0.260E+02	0.288E+02	0.311E+02	0.310E+02
0.306E+02	0.309E+02	0.312E+02	0.283E+02	0.248E+02
0.221E+02	0.201E+02	0.214E+02	0.225E+02	0.221E+02
0.235E+02	0.266E+02	0.394E+02	0.535E+02	0.541E+02
0.417E+02	0.265E+02	0.235E+02	0.235E+02	0.223E+02
0.214E+02	0.200E+02	0.218E+02	0.244E+02	0.279E+02

0.310E+02	0.309E+02	0.305E+02	0.308E+02	0.311E+02
0.290E+02	0.262E+02	0.233E+02	0.205E+02	0.186E+02
0.171E+02	0.163E+02	0.170E+02	0.177E+02	0.180E+02
0.165E+02	0.165E+02	0.165E+02	0.165E+02	0.165E+02
0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.000E+00

PROJECTION DATA FOR ANGLE NO. 36 1.527 RADIAN 87.500 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.475E+01
0.945E+01	0.136E+02	0.158E+02	0.172E+02	0.172E+02
0.165E+02	0.172E+02	0.184E+02	0.195E+02	0.205E+02
0.217E+02	0.245E+02	0.274E+02	0.283E+02	0.294E+02
0.301E+02	0.305E+02	0.309E+02	0.312E+02	0.290E+02
0.250E+02	0.232E+02	0.230E+02	0.232E+02	0.242E+02
0.272E+02	0.304E+02	0.300E+02	0.472E+02	0.484E+02
0.317E+02	0.289E+02	0.273E+02	0.244E+02	0.231E+02
0.229E+02	0.231E+02	0.246E+02	0.284E+02	0.310E+02
0.308E+02	0.305E+02	0.300E+02	0.293E+02	0.283E+02
0.275E+02	0.247E+02	0.219E+02	0.205E+02	0.195E+02
0.184E+02	0.172E+02	0.164E+02	0.170E+02	0.172E+02
0.158E+02	0.138E+02	0.972E+01	0.542E+01	0.000E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 37 1.571 RADIAN 90.000 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.475E+01
0.922E+01	0.119E+02	0.140E+02	0.158E+02	0.173E+02
0.186E+02	0.198E+02	0.209E+02	0.219E+02	0.228E+02
0.236E+02	0.244E+02	0.251E+02	0.257E+02	0.263E+02
0.268E+02	0.273E+02	0.277E+02	0.281E+02	0.285E+02
0.289E+02	0.291E+02	0.291E+02	0.295E+02	0.297E+02
0.298E+02	0.307E+02	0.300E+02	0.305E+02	0.300E+02
0.299E+02	0.291E+02	0.298E+02	0.296E+02	0.295E+02
0.292E+02	0.290E+02	0.287E+02	0.284E+02	0.281E+02
0.277E+02	0.272E+02	0.268E+02	0.262E+02	0.257E+02
0.245E+02	0.245E+02	0.235E+02	0.231E+02	0.230E+02
0.210E+02	0.198E+02	0.187E+02	0.173E+02	0.158E+02
0.141E+02	0.120E+02	0.943E+01	0.541E+01	0.000E+00
0.000E+00	0.000E+00	0.000E+00		

PROJECTION DATA FOR ANGLE NO. 38 1.614 RADIAN 92.500 DEGREES

0.000E+00	0.000E+00	0.000E+00	0.000E+00	0.475E+01
0.921E+01	0.109E+02	0.119E+02	0.141E+02	0.173E+02
0.206E+02	0.224E+02	0.234E+02	0.243E+02	0.251E+02
0.255E+02	0.242E+02	0.227E+02	0.231E+02	0.233E+02
0.235E+02	0.245E+02	0.246E+02	0.251E+02	0.251E+02
0.262E+02	0.349E+02	0.357E+02	0.359E+02	0.352E+02
0.326E+02	0.311E+02	0.300E+02	0.139E+02	0.114E+02
0.281E+02	0.293E+02			

0.000E+00 0.000E+00 0.000E+00 0.227E+00 0.461E+01 0.293E+02 0.297E+02 0.317E+02 0.316E+02 0.319E+02
0.929E+01 0.117E+02 0.138E+02 0.157E+02 0.174E+02 0.316E+02 0.326E+02 0.320E+02 0.293E+02 0.270E+02
0.192E+02 0.199E+02 0.211E+02 0.221E+02 0.235E+02 0.262E+02 0.260E+02 0.252E+02 0.247E+02 0.241E+02
0.243E+02 0.235E+02 0.248E+02 0.249E+02 0.248E+02 0.230E+02 0.234E+02 0.244E+02 0.235E+02 0.230E+02
0.258E+02 0.277E+02 0.273E+02 0.277E+02 0.282E+02 0.218E+02 0.208E+02 0.200E+02 0.173E+02 0.148E+02
0.304E+02 0.307E+02 0.300E+02 0.308E+02 0.307E+02 0.134E+02 0.110E+02 0.903E+01 0.627E+01 0.550E+00
0.306E+02 0.304E+02 0.310E+02 0.279E+02 0.253E+02 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.298E+02 0.284E+02 0.301E+02 0.303E+02 0.304E+02
0.296E+02 0.302E+02 0.302E+02 0.313E+02 0.277E+02
0.272E+02 0.276E+02 0.257E+02 0.258E+02 0.248E+02
0.249E+02 0.234E+02 0.243E+02 0.235E+02 0.221E+02
0.212E+02 0.199E+02 0.192E+02 0.176E+02 0.158E+02
0.140E+02 0.118E+02 0.966E+01 0.523E+01 0.442E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 45 1.920 RADIAN 110.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.117E+00 0.364E+01 0.000E+00 0.000E+00 0.000E+00 0.265E+00 0.634E+01
0.924E+01 0.130E+02 0.150E+02 0.168E+02 0.178E+02 0.914E+01 0.952E+01 0.118E+02 0.137E+02 0.168E+02
0.225E+02 0.258E+02 0.267E+02 0.281E+02 0.281E+02 0.205E+02 0.225E+02 0.237E+02 0.247E+02 0.251E+02
0.286E+02 0.286E+02 0.299E+02 0.295E+02 0.278E+02 0.247E+02 0.233E+02 0.220E+02 0.215E+02 0.222E+02
0.248E+02 0.253E+02 0.250E+02 0.266E+02 0.271E+02 0.342E+02 0.372E+02 0.375E+02 0.369E+02 0.355E+02
0.262E+02 0.287E+02 0.303E+02 0.448E+02 0.456E+02 0.342E+02 0.327E+02 0.255E+02 0.981E+01 0.750E+01
0.297E+02 0.269E+02 0.279E+02 0.269E+02 0.252E+02 0.213E+02 0.309E+02 0.338E+02 0.350E+02 0.362E+02
0.247E+02 0.251E+02 0.242E+02 0.271E+02 0.292E+02 0.370E+02 0.372E+02 0.344E+02 0.308E+02 0.274E+02
0.299E+02 0.285E+02 0.286E+02 0.280E+02 0.281E+02 0.245E+02 0.228E+02 0.242E+02 0.249E+02 0.247E+02
0.268E+02 0.261E+02 0.227E+02 0.210E+02 0.207E+02 0.237E+02 0.226E+02 0.209E+02 0.173E+02 0.140E+02
0.195E+02 0.185E+02 0.174E+02 0.177E+02 0.169E+02 0.121E+02 0.977E+01 0.913E+01 0.727E+01 0.656E+00
0.151E+02 0.139E+02 0.425E+01 0.271E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 46 1.963 RADIAN 112.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.393E-01 0.276E+01 0.000E+00 0.000E+00 0.000E+00 0.311E+02 0.670E+01
0.918E+01 0.166E+02 0.179E+02 0.188E+02 0.201E+02 0.899E+01 0.889E+01 0.102E+02 0.135E+02 0.170E+02
0.223E+02 0.254E+02 0.290E+02 0.299E+02 0.309E+02 0.203E+02 0.236E+02 0.254E+02 0.263E+02 0.257E+02
0.310E+02 0.312E+02 0.312E+02 0.293E+02 0.264E+02 0.207E+02 0.218E+02 0.244E+02 0.288E+02 0.311E+02
0.235E+02 0.210E+02 0.201E+02 0.216E+02 0.235E+02 0.351E+02 0.380E+02 0.408E+02 0.423E+02 0.402E+02
0.255E+02 0.255E+02 0.254E+02 0.529E+02 0.572E+02 0.373E+02 0.289E+02 0.192E+02 0.738E+01 0.547E+01
0.390E+02 0.265E+02 0.254E+02 0.233E+02 0.215E+02 0.154E+02 0.260E+02 0.362E+02 0.395E+02 0.416E+02
0.198E+02 0.205E+02 0.228E+02 0.257E+02 0.286E+02 0.409E+02 0.382E+02 0.352E+02 0.430E+02 0.290E+02
0.309E+02 0.310E+02 0.309E+02 0.308E+02 0.300E+02 0.245E+02 0.219E+02 0.206E+02 0.194E+02 0.201E+02
0.292E+02 0.257E+02 0.225E+02 0.203E+02 0.189E+02 0.213E+02 0.225E+02 0.238E+02 0.252E+02 0.262E+02
0.179E+02 0.170E+02 0.170E+02 0.167E+02 0.167E+02 0.254E+02 0.239E+02 0.207E+02 0.175E+02 0.140E+02
0.167E+02 0.149E+02 0.996E+01 0.341E+01 0.126E+00 0.106E+02 0.894E+01 0.895E+01 0.771E+01 0.629E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 47 2.007 RADIAN 115.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.533E-01 0.223E+01 0.000E+00 0.000E+00 0.000E+00 0.205E+00 0.670E+01
0.911E+01 0.150E+02 0.177E+02 0.183E+02 0.172E+02 0.899E+01 0.233E+02 0.340E+02 0.430E+02 0.290E+02
0.164E+02 0.161E+02 0.159E+02 0.175E+02 0.199E+02 0.409E+02 0.386E+02 0.354E+02 0.319E+02 0.289E+02
0.232E+02 0.255E+02 0.285E+02 0.315E+02 0.328E+02 0.253E+02 0.215E+02 0.189E+02 0.185E+02 0.201E+02
0.333E+02 0.334E+02 0.303E+02 0.287E+02 0.254E+02 0.212E+02 0.224E+02 0.237E+02 0.252E+02 0.265E+02
0.231E+02 0.193E+02 0.179E+02 0.160E+02 0.156E+02 0.265E+02 0.243E+02 0.206E+02 0.175E+02 0.146E+02
0.234E+02 0.326E+02 0.436E+02 0.548E+02 0.543E+02 0.000E+00 0.000E+00 0.000E+00 0.779E+01 0.600E+00
0.437E+02 0.324E+02 0.242E+02 0.185E+02 0.159E+02
0.170E+02 0.193E+02 0.223E+02 0.247E+02 0.280E+02
0.297E+02 0.330E+02 0.331E+02 0.329E+02 0.316E+02
0.299E+02 0.257E+02 0.345E+02 0.316E+02 0.275E+02
0.160E+02 0.159E+02 0.162E+02 0.170E+02 0.181E+02
0.178E+02 0.156E+02 0.987E+01 0.299E+01 0.265E-01
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 48 2.051 RADIAN 117.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.567E-03 0.208E+01 0.000E+00 0.000E+00 0.000E+00 0.205E+00 0.670E+01
0.903E+01 0.147E+02 0.184E+02 0.180E+02 0.173E+02 0.242E+02 0.231E+02 0.218E+02 0.206E+02 0.196E+02
0.166E+02 0.156E+02 0.155E+02 0.171E+02 0.200E+02 0.207E+02 0.218E+02 0.244E+02 0.288E+02 0.311E+02
0.229E+02 0.260E+02 0.279E+02 0.319E+02 0.335E+02 0.351E+02 0.380E+02 0.423E+02 0.402E+02
0.349E+02 0.254E+02 0.285E+02 0.308E+02 0.330E+02 0.372E+02 0.375E+02 0.375E+02 0.369E+02 0.357E+01
0.228E+02 0.197E+02 0.177E+02 0.147E+02 0.156E+02 0.154E+02 0.260E+02 0.362E+02 0.395E+02 0.416E+02
0.247E+02 0.341E+02 0.449E+02 0.552E+02 0.546E+02 0.409E+02 0.382E+02 0.352E+02 0.314E+02 0.290E+02
0.448E+02 0.340E+02 0.258E+02 0.161E+02 0.141E+02 0.245E+02 0.219E+02 0.206E+02 0.194E+02 0.201E+02
0.170E+02 0.190E+02 0.222E+02 0.248E+02 0.271E+02 0.213E+02 0.225E+02 0.238E+02 0.252E+02 0.262E+02
0.281E+02 0.263E+02 0.232E+02 0.204E+02 0.174E+02 0.254E+02 0.239E+02 0.202E+02 0.175E+02 0.140E+02
0.154E+02 0.153E+02 0.164E+02 0.171E+02 0.178E+02 0.106E+02 0.895E+01 0.895E+01 0.771E+01 0.629E+00
0.186E+02 0.154E+02 0.983E+01 0.144E-01
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 49 2.094 RADIAN 120.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.240E-01 0.237E+01 0.000E+00 0.000E+00 0.000E+00 0.244E+00 0.547E+01
0.892E+01 0.143E+02 0.172E+02 0.181E+02 0.173E+02 0.882E+01 0.107E+02 0.132E+02 0.146E+02 0.170E+02
0.166E+02 0.159E+02 0.166E+02 0.182E+02 0.197E+02 0.198E+02 0.207E+02 0.218E+02 0.230E+02 0.236E+02
0.324E+02 0.325E+02 0.313E+02 0.281E+02 0.260E+02 0.246E+02 0.239E+02 0.232E+02 0.244E+02 0.248E+02
0.233E+02 0.202E+02 0.182E+02 0.182E+02 0.208E+02 0.321E+02 0.329E+02 0.321E+02 0.322E+02 0.318E+02
0.234E+02 0.305E+02 0.425E+02 0.542E+02 0.540E+02 0.319E+02 0.313E+02 0.317E+02 0.306E+02 0.169E+02
0.424E+02 0.307E+02 0.235E+02 0.209E+02 0.181E+02 0.293E+02 0.297E+02 0.317E+02 0.316E+02 0.319E+02
0.279E+02 0.252E+02 0.252E+02 0.275E+02
0.306E+02 0.321E+02 0.322E+02 0.328E+02 0.309E+02 0.316E+02 0.326E+02 0.320E+02 0.293E+02 0.270E+02
0.286E+02 0.257E+02 0.233E+02 0.199E+02 0.183E+02 0.230E+02 0.234E+02 0.244E+02 0.236E+02 0.230E+02
0.167E+02 0.157E+02 0.165E+02 0.171E+02 0.180E+02 0.218E+02 0.208E+02 0.200E+02 0.173E+02 0.148E+02
0.174E+02 0.148E+02 0.975E+01 0.315E+01 0.858E-01 0.134E+02 0.110E+02 0.903E+01 0.627E+01 0.550E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 50 2.138 RADIAN 122.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.510E-01 0.318E+01 0.000E+00 0.000E+00 0.000E+00 0.244E+00 0.547E+01
0.886E+01 0.139E+02 0.156E+02 0.176E+02 0.178E+02 0.882E+01 0.107E+02 0.132E+02 0.146E+02 0.170E+02
0.222E+02 0.255E+02 0.279E+02 0.294E+02 0.302E+02 0.316E+02 0.326E+02 0.320E+02 0.293E+02 0.270E+02
0.302E+02 0.301E+02 0.308E+02 0.291E+02 0.271E+02 0.230E+02 0.234E+02 0.244E+02 0.236E+02 0.230E+02
0.240E+02 0.216E+02 0.223E+02 0.233E+02 0.250E+02 0.218E+02 0.208E+02 0.200E+02 0.173E+02 0.148E+02
0.261E+02 0.274E+02 0.345E+02 0.506E+02 0.513E+02 0.134E+02 0.110E+02 0.903E+01 0.627E+01 0.550E+00
0.346E+02 0.265E+02 0.258E+02 0.249E+02 0.232E+02 0.000E+00 0.000E+00 0.000E+00
0.221E+02 0.213E+02 0.233E+02 0.264E+02 0.285E+02 0.000E+00 0.000E+00 0.000E+00
0.305E+02 0.298E+02 0.299E+02 0.300E+02 0.291E+02 0.000E+00 0.000E+00 0.000E+00
0.281E+02 0.257E+02 0.225E+02 0.210E+02 0.195E+02 0.000E+00 0.000E+00 0.000E+00
0.186E+02 0.174E+02 0.165E+02 0.176E+02 0.177E+02
0.159E+02 0.141E+02 0.972E+01 0.391E+01 0.173E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 51 2.182 RADIAN 125.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.151E+00 0.430E+01 0.000E+00 0.000E+00 0.000E+00 0.244E+00 0.547E+01
0.873E+01 0.125E+02 0.144E+02 0.161E+02 0.179E+02 0.886E+01 0.139E+02 0.156E+02 0.176E+02 0.178E+02
0.229E+02 0.247E+02 0.263E+02 0.268E+02 0.276E+02 0.271E+02 0.275E+02 0.279E+02 0.287E+02 0.292E+02
0.278E+02 0.284E+02 0.286E+02 0.291E+02 0.284E+02 0.222E+02 0.255E+02 0.279E+02 0.294E+02 0.302E+02
0.269E+02 0.268E+02 0.272E+02 0.280E+02 0.285E+02 0.302E+02 0.301E+02 0.308E+02 0.291E+02 0.271E+02
0.296E+02 0.282E+02 0.271E+02 0.385E+02 0.395E+02 0.240E+02 0.216E+02 0.223E+02 0.233E+02 0.250E+02
0.286E+02 0.282E+02 0.285E+02 0.281E+02 0.279E+02 0.261E+02 0.249E+02 0.229E+02 0.224E+02 0.212E+02
0.271E+02 0.265E+02 0.266E+02 0.279E+02 0.287E+02 0.262E+02 0.260E+02 0.252E+02 0.247E+02 0.241E+02
0.284E+02 0.281E+02 0.285E+02 0.286E+02 0.284E+02 0.261E+02 0.249E+02 0.229E+02 0.224E+02 0.212E+02
0.284E+02 0.281E+02 0.285E+02 0.286E+02 0.284E+02 0.202E+02 0.193E+02 0.178E+02 0.179E+02 0.163E+02
0.202E+02 0.202E+02 0.218E+02 0.202E+02 0.218E+02 0.146E+02 0.128E+02 0.940E+01 0.502E+01 0.360E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 52 2.225 RADIAN 127.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.244E+00 0.547E+01 0.000E+00 0.000E+00 0.000E+00 0.244E+00 0.547E+01
0.882E+01 0.107E+02 0.132E+02 0.146E+02 0.170E+02 0.886E+01 0.139E+02 0.156E+02 0.176E+02 0.178E+02
0.198E+02 0.207E+02 0.218E+02 0.230E+02 0.236E+02 0.262E+02 0.260E+02 0.252E+02 0.247E+02 0.241E+02
0.198E+02 0.207E+02 0.218E+02 0.230E+02 0.236E+02 0.221E+02 0.213E+02 0.233E+02 0.264E+02 0.285E+02
0.246E+02 0.239E+02 0.229E+02 0.244E+02 0.248E+02 0.305E+02 0.298E+02 0.299E+02 0.300E+02 0.291E+02
0.255E+02 0.261E+02 0.265E+02 0.272E+02 0.291E+02 0.281E+02 0.285E+02 0.286E+02 0.284E+02 0.281E+02
0.321E+02 0.321E+02 0.322E+02 0.318E+02 0.318E+02 0.240E+02 0.216E+02 0.223E+02 0.233E+02 0.250E+02
0.246E+02 0.239E+02 0.229E+02 0.244E+02 0.248E+02 0.261E+02 0.249E+02 0.229E+02 0.224E+02 0.212E+02
0.255E+02 0.261E+02 0.265E+02 0.272E+02 0.291E+02 0.262E+02 0.260E+02 0.252E+02 0.247E+02 0.241E+02
0.319E+02 0.313E+02 0.317E+02 0.306E+02 0.302E+02 0.302E+02 0.301E+02 0.308E+02 0.291E+02 0.271E+02
0.240E+02 0.216E+02 0.223E+02 0.233E+02 0.250E+02 0.261E+02 0.274E+02 0.345E+02 0.506E+02 0.513E+02
0.000E+00 0.000E+00 0.000E+00 0.547E+01
0.882E+01 0.107E+02 0.132E+02 0.146E+02 0.170E+02 0.221E+02 0.213E+02 0.233E+02 0.264E+02 0.285E+02
0.198E+02 0.207E+02 0.218E+02 0.230E+02 0.236E+02 0.262E+02 0.260E+02 0.252E+02 0.247E+02 0.241E+02
0.246E+02 0.239E+02 0.229E+02 0.244E+02 0.248E+02 0.305E+02 0.298E+02 0.299E+02 0.300E+02 0.291E+02
0.255E+02 0.261E+02 0.265E+02 0.272E+02 0.291E+02 0.281E+02 0.285E+02 0.286E+02 0.284E+02 0.281E+02
0.321E+02 0.321E+02 0.322E+02 0.318E+02 0.318E+02 0.240E+02 0.216E+02 0.223E+02 0.233E+02 0.250E+02
0.246E+02 0.239E+02 0.229E+02 0.244E+02 0.248E+02 0.261E+02 0.249E+02 0.229E+02 0.224E+02 0.212E+02
0.255E+02 0.261E+02 0.265E+02 0.272E+02 0.291E+02 0.262E+02 0.260E+02 0.252E+02 0.247E+02 0.241E+02
0.319E+02 0.313E+02 0.317E+02 0.306E+02 0.302E+02 0.302E+02 0.301E+02 0.308E+02 0.291E+02 0.271E+02
0.240E+02 0.216E+02 0.223E+02 0.233E+02 0.250E+02 0.261E+02 0.274E+02 0.345E+02 0.506E+02 0.513E+02
0.000E+00 0.000E+00 0.000E+00 0.547E+01

PROJECTION DATA FOR ANGLE NO. 61 2.618 RADIAN 150.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.240E-01 0.237E+01
0.892E+01 0.143E+02 0.181E+02 0.173E+02 0.173E+02
0.166E+02 0.159E+02 0.166E+02 0.182E+02 0.197E+02
0.231E+02 0.254E+02 0.285E+02 0.308E+02 0.330E+02
0.324E+02 0.325E+02 0.313E+02 0.281E+02 0.260E+02
0.233E+02 0.202E+02 0.182E+02 0.182E+02 0.208E+02
0.234E+02 0.205E+02 0.165E+02 0.171E+02 0.190E+02
0.424E+02 0.307E+02 0.235E+02 0.209E+02 0.181E+02
0.179E+02 0.194E+02 0.228E+02 0.252E+02 0.275E+02
0.306E+02 0.321E+02 0.322E+02 0.328E+02 0.309E+02
0.286E+02 0.257E+02 0.233E+02 0.199E+02 0.183E+02
0.167E+02 0.157E+02 0.165E+02 0.171E+02 0.190E+02
0.174E+02 0.148E+02 0.975E+01 0.315E+01 0.858E-01
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 62 2.662 RADIAN 152.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.557E-03 0.208E+01
0.903E+01 0.147E+02 0.184E+02 0.180E+02 0.173E+02
0.166E+02 0.156E+02 0.155E+02 0.171E+02 0.200E+02
0.229E+02 0.260E+02 0.279E+02 0.319E+02 0.335E+02
0.349E+02 0.332E+02 0.306E+02 0.278E+02 0.255E+02
0.228E+02 0.197E+02 0.177E+02 0.147E+02 0.156E+02
0.247E+02 0.341E+02 0.449E+02 0.552E+02 0.546E+02
0.448E+02 0.340E+02 0.258E+02 0.161E+02 0.141E+02
0.170E+02 0.190E+02 0.222E+02 0.248E+02 0.271E+02
0.299E+02 0.324E+02 0.345E+02 0.336E+02 0.321E+02
0.281E+02 0.257E+02 0.232E+02 0.204E+02 0.174E+02
0.154E+02 0.153E+02 0.164E+02 0.171E+02 0.178E+02
0.186E+02 0.154E+02 0.983E+01 0.291E+01 0.144E-01
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 63 2.705 RADIAN 155.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.533E-02 0.223E+01
0.911E+01 0.150E+02 0.177E+02 0.183E+02 0.172E+02
0.164E+02 0.161E+02 0.159E+02 0.175E+02 0.199E+02
0.232E+02 0.255E+02 0.285E+02 0.315E+02 0.328E+02
0.338E+02 0.319E+02 0.290E+02 0.299E+02 0.254E+02
0.231E+02 0.199E+02 0.179E+02 0.160E+02 0.168E+02
0.234E+02 0.326E+02 0.436E+02 0.548E+02 0.543E+02
0.437E+02 0.324E+02 0.242E+02 0.185E+02 0.159E+02
0.170E+02 0.193E+02 0.223E+02 0.247E+02 0.280E+02
0.297E+02 0.265E+02 0.232E+02 0.257E+02 0.316E+02
0.288E+02 0.257E+02 0.235E+02 0.203E+02 0.176E+02
0.160E+02 0.159E+02 0.162E+02 0.170E+02 0.181E+02
0.178E+02 0.156E+02 0.987E+01 0.299E+01 0.265E-01
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 64 2.749 RADIAN 157.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.393E-01 0.276E+01
0.918E+01 0.145E+02 0.166E+02 0.177E+02 0.172E+02
0.170E+02 0.166E+02 0.179E+02 0.188E+02 0.201E+02
0.233E+02 0.257E+02 0.299E+02 0.329E+02 0.341E+02
0.310E+02 0.312E+02 0.312E+02 0.293E+02 0.264E+02
0.235E+02 0.210E+02 0.201E+02 0.216E+02 0.235E+02
0.255E+02 0.274E+02 0.384E+02 0.529E+02 0.527E+02
0.390E+02 0.265E+02 0.254E+02 0.233E+02 0.215E+02
0.198E+02 0.205E+02 0.228E+02 0.257E+02 0.286E+02
0.309E+02 0.310E+02 0.309E+02 0.308E+02 0.300E+02
0.292E+02 0.257E+02 0.225E+02 0.203E+02 0.189E+02
0.179E+02 0.167E+02 0.169E+02 0.170E+02 0.175E+02
0.167E+02 0.149E+02 0.996E+01 0.341E+01 0.126E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 65 2.793 RADIAN 160.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.117E+00 0.364E+01
0.924E+01 0.130E+02 0.150E+02 0.168E+02 0.178E+02
0.174E+02 0.157E+02 0.189E+02 0.196E+02 0.214E+02
0.225E+02 0.258E+02 0.267E+02 0.281E+02 0.281E+02
0.286E+02 0.286E+02 0.299E+02 0.295E+02 0.278E+02
0.248E+02 0.253E+02 0.250E+02 0.266E+02 0.271E+02
0.282E+02 0.287E+02 0.303E+02 0.448E+02 0.456E+02
0.297E+02 0.265E+02 0.232E+02 0.279E+02 0.252E+02
0.247E+02 0.251E+02 0.242E+02 0.271E+02 0.292E+02
0.299E+02 0.285E+02 0.286E+02 0.280E+02 0.281E+02
0.268E+02 0.261E+02 0.227E+02 0.210E+02 0.207E+02
0.195E+02 0.185E+02 0.174E+02 0.177E+02 0.169E+02
0.151E+02 0.156E+02 0.425E+01 0.271E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 66 2.836 RADIAN 162.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.227E+00 0.461E+01
0.929E+01 0.117E+02 0.138E+02 0.157E+02 0.174E+02
0.192E+02 0.199E+02 0.211E+02 0.221E+02 0.235E+02
0.243E+02 0.235E+02 0.248E+02 0.249E+02 0.258E+02
0.258E+02 0.277E+02 0.273E+02 0.277E+02 0.282E+02
0.304E+02 0.307E+02 0.300E+02 0.308E+02 0.307E+02
0.306E+02 0.210E+02 0.279E+02 0.298E+02 0.293E+02
0.298E+02 0.284E+02 0.301E+02 0.303E+02 0.304E+02
0.296E+02 0.302E+02 0.302E+02 0.281E+02 0.277E+02
0.272E+02 0.276E+02 0.257E+02 0.258E+02 0.248E+02
0.249E+02 0.234E+02 0.243E+02 0.235E+02 0.221E+02
0.212E+02 0.237E+02 0.242E+02 0.176E+02 0.161E+02
0.140E+02 0.118E+02 0.966E+01 0.523E+01 0.442E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 67 2.880 RADIAN 165.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.329E+00 0.563E+01
0.918E+01 0.105E+02 0.124E+02 0.143E+02 0.165E+02
0.201E+02 0.224E+02 0.230E+02 0.239E+02 0.248E+02
0.244E+02 0.237E+02 0.222E+02 0.224E+02 0.225E+02
0.247E+02 0.246E+02 0.250E+02 0.263E+02 0.303E+02
0.333E+02 0.325E+02 0.289E+02 0.129E+02 0.950E+01
0.262E+02 0.304E+02 0.327E+02 0.336E+02 0.344E+02
0.357E+02 0.350E+02 0.342E+02 0.306E+02 0.266E+02
0.250E+02 0.244E+02 0.247E+02 0.225E+02 0.223E+02
0.230E+02 0.234E+02 0.242E+02 0.248E+02 0.239E+02
0.230E+02 0.224E+02 0.204E+02 0.167E+02 0.145E+02
0.126E+02 0.106E+02 0.929E+01 0.630E+01 0.579E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 68 2.923 RADIAN 167.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.424E+00 0.672E+01
0.914E+01 0.906E+01 0.109E+02 0.132E+02 0.174E+02
0.210E+02 0.234E+02 0.245E+02 0.260E+02 0.254E+02
0.241E+02 0.226E+02 0.217E+02 0.207E+02 0.211E+02
0.210E+02 0.234E+02 0.242E+02 0.273E+02 0.316E+02
0.340E+02 0.379E+02 0.417E+02 0.398E+02 0.391E+02
0.359E+02 0.317E+02 0.195E+02 0.802E+01 0.562E+01
0.170E+02 0.284E+02 0.350E+02 0.383E+02 0.393E+02
0.412E+02 0.384E+02 0.342E+02 0.319E+02 0.275E+02
0.245E+02 0.222E+02 0.202E+02 0.210E+02 0.204E+02
0.215E+02 0.224E+02 0.238E+02 0.252E+02 0.260E+02
0.246E+02 0.235E+02 0.212E+02 0.178E+02 0.135E+02
0.111E+02 0.907E+01 0.909E+01 0.748E+01 0.678E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 69 2.967 RADIAN 170.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.460E+00 0.762E+01
0.915E+01 0.886E+01 0.103E+02 0.140E+02 0.163E+02
0.202E+02 0.238E+02 0.264E+02 0.259E+02 0.251E+02
0.246E+02 0.245E+02 0.220E+02 0.203E+02 0.192E+02
0.192E+02 0.214E+02 0.251E+02 0.285E+02 0.312E+02

0.348E+02 0.388E+02 0.414E+02 0.449E+02 0.437E+02
0.357E+02 0.274E+02 0.240E+02 0.164E+02 0.454E+01
0.145E+02 0.240E+02 0.338E+02 0.427E+02 0.448E+02
0.416E+02 0.391E+02 0.351E+02 0.313E+02 0.288E+02
0.254E+02 0.216E+02 0.193E+02 0.181E+02 0.200E+02
0.218E+02 0.232E+02 0.243E+02 0.249E+02 0.257E+02
0.264E+02 0.240E+02 0.206E+02 0.166E+02 0.142E+02
0.106E+02 0.879E+01 0.902E+01 0.834E+01 0.724E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 70 3.011 RADIAN 172.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.330E+00 0.747E+01
0.909E+01 0.893E+01 0.933E+01 0.128E+02 0.172E+02
0.214E+02 0.245E+02 0.261E+02 0.266E+02 0.251E+02
0.234E+02 0.221E+02 0.217E+02 0.207E+02 0.196E+02
0.200E+02 0.215E+02 0.233E+02 0.281E+02 0.332E+02
0.350E+02 0.380E+02 0.420E+02 0.445E+02 0.409E+02
0.362E+02 0.285E+02 0.165E+02 0.634E+01 0.478E+01
0.145E+02 0.251E+02 0.345E+02 0.402E+02 0.443E+02
0.425E+02 0.383E+02 0.353E+02 0.334E+02 0.286E+02
0.237E+02 0.215E+02 0.199E+02 0.195E+02 0.204E+02
0.214E+02 0.219E+02 0.232E+02 0.249E+02 0.264E+02
0.261E+02 0.246E+02 0.217E+02 0.176E+02 0.132E+02
0.947E+01 0.887E+01 0.896E+01 0.814E+01 0.556E+00
0.000E+00 0.000E+00 0.000E+00

PROJECTION DATA FOR ANGLE NO. 71 3.054 RADIAN 175.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.191E-01 0.649E+01
0.904E+01 0.909E+01 0.113E+02 0.138E+02 0.177E+02
0.201E+02 0.229E+02 0.245E+02 0.251E+02 0.251E+02
0.240E+02 0.227E+02 0.213E+02 0.203E+02 0.216E+02
0.230E+02 0.237E+02 0.243E+02 0.279E+02 0.324E+02
0.356E+02 0.380E+02 0.373E+02 0.366E+02 0.374E+02
0.360E+02 0.348E+02 0.297E+02 0.757E+01 0.575E+01
0.179E+02 0.316E+02 0.358E+02 0.371E+02 0.366E+02
0.370E+02 0.381E+02 0.359E+02 0.328E+02 0.284E+02
0.244E+02 0.236E+02 0.230E+02 0.217E+02 0.202E+02
0.210E+02 0.224E+02 0.238E+02 0.250E+02 0.249E+02
0.244E+02 0.230E+02 0.204E+02 0.179E+02 0.141E+02
0.114E+02 0.913E+01 0.891E+01 0.732E+01 0.957E-01
0.000E+00 0.000E+00 0.000E+00

BLANK COMMON REQUIRED 14723 (34603)
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 14791 FLOATING POINT WORDS.

EEEE N N DDD PPPP J EEEEE CCC TTTT
E NN N D D P P J E E C C T
EEE N N D D PPPP J E E C C T
EEEE N N DDD P J J J EEEEE CCC T

PROJECTION DATA FOR ANGLE NO. 72 3.098 RADIAN 177.500 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.475E+01
0.921E+01 0.109E+02 0.119E+02 0.141E+02 0.173E+02
0.206E+02 0.224E+02 0.234E+02 0.243E+02 0.251E+02
0.255E+02 0.242E+02 0.227E+02 0.231E+02 0.233E+02
0.235E+02 0.241E+02 0.246E+02 0.251E+02 0.281E+02
0.246E+02 0.230E+02 0.204E+02 0.192E+02 0.141E+02
0.326E+02 0.311E+02 0.300E+02 0.139E+02 0.114E+02
0.281E+02 0.293E+02 0.322E+02 0.350E+02 0.358E+02
0.356E+02 0.350E+02 0.329E+02 0.284E+02 0.251E+02
0.245E+02 0.240E+02 0.235E+02 0.231E+02 0.230E+02
0.228E+02 0.240E+02 0.253E+02 0.251E+02 0.243E+02
0.234E+02 0.224E+02 0.208E+02 0.175E+02 0.142E+02
0.120E+02 0.109E+02 0.942E+01 0.542E+01 0.000E+00
0.000E+00 0.000E+00 0.000E+00

FOR CONGR AND GRADY FCN IS THE VALUE OF THE CHI-SQUARE
FOR ENTPY FCN IS EVALUATED BY THE SUBROUTINE DULFC
ITER 0 FCN 0.274E+07
ITER 1 FCN 0.139E+06
ITER 2 FCN 0.148E+05
ITER 3 FCN 0.829E+04
ITER 4 FCN 0.335E+04
ITER 5 FCN 0.232E+04
ITER 6 FCN 0.155E+04
ITER 7 FCN 0.935E+03
ITER 8 FCN 0.761E+03
ITER 9 FCN 0.622E+03
ITER 10 FCN 0.556E+03
ITER 11 FCN 0.518E+03
ITER 12 FCN 0.479E+03
ITER 13 FCN 0.465E+03
ITER 14 FCN 0.463E+03
ITER 15 FCN 0.443E+03

BLANK COMMON REQUIRED 14587 (34373)
BLANK COMMON REQUIRED 11359 (26137)
BLANK COMMON REQUIRED 8131 (17703)
BLANK COMMON REQUIRED 4903 (11447)
BLANK COMMON REQUIRED 1675 (3213)
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 14791 FLOATING POINT WORDS.

EEEE N N DDD CCC OOOO N N GGG RRRR
E NN N D D C C O NN N G G R R
EEE N N D D C C O NN N G RRRR
E N NN D D C C O N N N G G R R
EEEE N N DDD CCC OOOO N N GGG R R

XMIN = -0.37E+00 XMAX = 0.14E+01 XSUM = 0.1414E+04

*****+*****
*****-1*****
*****1*****
*****-2*****
*****A*****
*****-1*****
*****-*****
*****MX*****

EX06

```

PROGRAM XGRADY
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLEBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 6
C
C THE PROGRAM XGRADY USES THE ITERATIVE GRADIENT ALGORITHM
C TO RECONSTRUCT PARALLEL BEAM PROJECTION DATA.
C
C DIMENSION B(4096),AG(180)
C COMMON/BLANK/WORK(12000)
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
C (CATN , PAR( 4))
C
C EXTERNAL BRP,PRF
C
C LUNOUT=2
C I80132=0
C
C THE INPUT PARAMETERS ARE
C
C NDIMU=64
C ICIR=0
C IGEOM=0
C NANG=72
C MODANG=4
C KDIMU=100
C IMIT=1
C NWORK=12000
C NFLOAT=2
C ISTORE=0
C IPRINT=5
C LUNATN=0
C PWID=1.
C AXISU=50.5
C RFAN=0.
C CATN=0.
C
C OPEN OUTPUT FILE
C
C OPEN (LUNOUT,FILE='E06.OUT',FORM='FORMATTED')
C
C CALL SETUP (IPAR,PAR,AG)
C
C ISTEP=15
C IRLX=1
C IERR=0
C IZER=0
C
C CALL GRADY (B,PRF,BRF,ISTP,IRLX,IERR,IZER)
C
C CALL ARRAY (B,NDIMU)
C
C PRINTOUT THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
C
C NMAT=NDIMU**2
C KK1=1
C KU=NDIMU/15+1
C DO 12 K=1,KU
C WRITE (LUNOUT,14)
C KK2=MIN(15*K,NDIMU)
C DO 10 J=1,NDIMU
C ISUB1=NMAT-J*NDIMU+KK1
C ISUB2=NMAT-J*NDIMU+KK2
C WRITE (LUNOUT,16) (B(I),I=ISUB1,ISUB2)
C 10
C 12 KK1=KK2+1
C
C CLOSE (LUNOUT)
C
C 14 FORMAT(1X,////)
C 16 FORMAT(1X,15F5.1)
C END
C
C SUBROUTINE GETUM (M,DATA,ERR)
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLEBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 6
C
C THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
C A PIE PHANTOM.
C
C DIMENSION B(4096),DATA(*),ERR(*)
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),

```

```

3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
5 (CATN , PAR( 4))
C
C EXTERNAL PLL
C
C DATA R,X1,Y1,Z,INTFR,NSLIPI,ISTART/30.,0.,0.,1.,10,10,1/
C
C IF (M.EQ.1) THEN
C CALL PIE (B,NDIMU,R,X1,Y1,Z,INTFR,NSLIPI,ISTART)
C CALL ARRAY (B,NDIMU)
C ENDF
C
C CALL PJECT (B,DATA,M,PLL)
C
C RETURN
C END

```



```

SSS EEEEE TTTT U U PPPP
S E T U U P P
SSS EEE T U U PPPP
S E T U U P
SSS EEEEE T UUU P

```



```

INTEGER PARAMETER ARRAY (IPAR)
I IPAR(I) DESCRIPTION
1 64 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 0 RECONSTRUCT IN A CIRCULAR ARRAY
3 0 GEOMETRY FLAG
4 72 PARALLEL BEAM GEOMETRY
5 4 NUMBER OF PROJECTION ANGLES
MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND PI
STARTING AT ZERO
6 100 NUMBER OF RAYS FOR EACH PROJECTION
7 1 TRANSMISSION DATA
8 12000 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 5 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12 0 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE

```



```

FLOATING POINT PARAMETER ARRAY (PAR)
I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS

```



```

BLANK COMMON REQUIRED 72 ( 110)
BLANK COMMON REQUIRED 144 ( 220)
BLANK COMMON REQUIRED 216 ( 330)
BLANK COMMON REQUIRED 416 ( 640)
BLANK COMMON REQUIRED 480 ( 740)

```



```

A TOTAL OF 68 ( 17 THRU 84) OF THE 100 USER PROJECTION BINS WILL BE USED
68 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 480 FLOATING POINT WORDS.

```



```

EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN N D D S E T U U P P
EEE N N D D SSS EEE T U U PPPP
E N NN D D S E T U U P
EEEE N N DDDD SSS EEEEE T UUU P

```



```

GGG RRRR AAA DDDD Y Y
G G R R A A D D Y Y
G RRRR A A D D Y
G G R R AAAAA D D Y
GGG R R A A DDDD Y

```



```

PARAMETERS FOR SUBROUTINE GRADY
DESCRIPTION
ISTP - 15 NUMBER OF ITERATION STEPS
IRLX - 1 ITERATIVE RELAXATION METHOD
IERR - 0 DO NOT USE ERROR ARRAY
IZER - 0 INITIAL SOLUTION IS ZERO
BLANK COMMON REQUIRED 516 ( 1004)
BLANK COMMON REQUIRED 1675 ( 3213)
BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES
PERFORM THE FOLLOWING FUNCTIONS

```


EX07

```
PROGRAM XITRFN
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 7
C
C THE PROGRAM XITRFN USES THE ITERATIVE CONJUGATE GRADIENT
C ALGORITHM TO RECONSTRUCT FAN BEAM PROJECTION DATA COLLECTED
C USING BOTH A CURVED DETECTOR AND A FLAT DETECTOR.
C
C DIMENSION B(1024),AG(36)
C COMMON/BLANK/WORK(5000)
C
C COMMON/OUTCOM/LUNOUT,180132
C
C LUNOUT - OUTPUT FILE
C 180132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C 1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C 2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C 3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C 4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
C 5 (CATN ,PAR( 4))
C
C EXTERNAL BCFD,PCDF
C
C LUNOUT=2
C 180132=0
C
C THE INPUT PARAMETERS ARE
C
C NDIMU=32
C ICIR=0
C IGEOM=1
C NANG=36
C MODANG=5
C KDIMU=67
C IMIT=1
C NWORK=5000
C NFLOAT=2
C ISTORE=0
C IPRINT=5
C LUNATN=0
C PWID=1.33
C AXISU=33.
C RFAN=65.
C CATN=0.
C
C OPEN OUTPUT FILE
C
C OPEN (LUNOUT,FILE='E07.OUT',FORM='FORMATTED')
C
C CALL SETUP (IPAR,PAR,AG)
C
C RECONSTRUCTION OF THE TRANSVERSE SECTION FOR FAN BEAM GEOMETRY
C WITH CURVED DETECTOR
C
C ISTEP=5
C IRLX=1
C IERR=0
C IZER=0
C
C CALL CONGR (B,PCDF,BCDF,ISTEP,IRLX,IERR,IZER)
C
C WRITE (LUNOUT,22)
C CALL ARRAY (B,NDIMU)
C
C PRINTOUT THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
C
C NMAT=NDIMU**2
C KK1=1
C KU=NDIMU/15+1
C DO 12 K=1,KU
C WRITE (LUNOUT,18)
C KK2=MIN(15*K,NDIMU)
C DO 10 J=1,NDIMU
C ISUB1=NMAT-J*NDIMU+KK1
C ISUB2=NMAT-J*NDIMU+KK2
C 10 WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
C 12 KK1=KK2+1
C
C IGEOM=2
C
C CALL SETUP (IPAR,PAR,AG)
C
C RECONSTRUCTION OF THE TRANSVERSE SECTION FOR FAN BEAM GEOMETRY
C WITH FLAT DETECTOR
C
C ISTEP=5
C IRLX=1
C IERR=0
C IZER=0
C
C CALL CONGR (B,PCDF,BCDF,ISTEP,IRLX,IERR,IZER)
C
C WRITE (LUNOUT,24)
C CALL ARRAY (B,NDIMU)
C
C PRINTOUT THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
C
C KK1=1
C KU=NDIMU/15+1
C DO 16 K=1,KU
C WRITE (LUNOUT,18)
C KK2=MIN(15*K,NDIMU)
C DO 14 J=1,NDIMU
C ISUB1=NMAT-J*NDIMU+KK1
C ISUB2=NMAT-J*NDIMU+KK2
C 14 WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
C 16 KK1=KK2+1
C
C CLOSE (LUNOUT)
```

```
C
C 18 FORMAT(1X,////)
C 20 FORMAT(1X,15F5.1)
C 22 FORMAT(1X/' RECONSTRUCTION FOR FAN BEAM GEOMETRY WITH CURVED DE',
C 1 'TECTOR')
C 24 FORMAT(1X/' RECONSTRUCTION FOR FAN BEAM GEOMETRY WITH FLAT DETE',
C 1 'CTOR')
C
C END
C SUBROUTINE GETUM (M,DATA,ERR)
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 7
C
C THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
C A CHEST PHANTOM CONSISTING OF A HEART, LUNGS AND SURROUNDING
C TISSUE.
C
C COMMON/OUTCOM/LUNOUT,180132
C
C LUNOUT - OUTPUT FILE
C 180132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C 1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C 2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C 3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C 4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
C 5 (CATN ,PAR( 4))
C
C DIMENSION DATA(*),ERR(*),B(1024)
C DIMENSION ITYPE(4),X1(4),Y1(4),A1(4),B1(4),Z(4),PHI(4)
C DATA ITYPE/1,1,1,1/
C DATA A1/26.6,6.65,9.31,9.31/
C DATA B1/26.6,6.65,6.65,6.65/
C DATA X1/0.,0.,6.65,-6.65/
C DATA Y1/0.,-6.65,0.,0./
C DATA PHI/0.,0.,1.57079633,1.57079633/
C DATA Z/5.,27.,-4.,-4./
C
C IF (M.EQ.1) THEN
C
C CALL PHAN (4,10,ITYPE,Z,X1,Y1,A1,B1,PHI,B,NDIMU,PWID)
C
C WRITE (LUNOUT,16)
C CALL ARRAY (B,NDIMU)
C
C PRINTOUT THE VALUES FOR THE PHANTOM
C
C NMAT=NDIMU**2
C KK1=1
C KU=NDIMU/15+1
C DO 12 K=1,KU
C WRITE (LUNOUT,18)
C KK2=MIN(15*K,NDIMU)
C DO 10 J=1,NDIMU
C ISUB1=NMAT-J*NDIMU+KK1
C ISUB2=NMAT-J*NDIMU+KK2
C 10 WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
C 12 KK1=KK2+1
C
C ENDIF
C
C CALL PHANL (4,ITYPE,Z,X1,Y1,A1,B1,PHI,DATA,M)
C
C RETURN
C
C 16 FORMAT('1')
C 18 FORMAT('1')
C 20 FORMAT(1X,15F5.1)
C
C END
C SUBROUTINE USER (ITER,X,CHISQ)
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 7
C
C THE SUBROUTINE USER PRINTS OUT THE CHI-SQUARE FOR EACH
C ITERATION ALONG WITH A GRAY LEVEL PLOT OF THE IMAGE AND A CROSS
C SECTIONAL PLOT THROUGH THE IMAGE.
C
C COMMON/OUTCOM/LUNOUT,180132
C
C LUNOUT - OUTPUT FILE
C 180132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C 1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C 2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C 3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C 4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
C 5 (CATN ,PAR( 4))
C
C DIMENSION X(*)
C
C IF (ITER.EQ.0) WRITE (LUNOUT,10)
C WRITE (LUNOUT,12) ITER,CHISQ
C
C IF (ITER.EQ.0) RETURN
C
C CALL ARRAY (X,NDIMU)
C
C CROSS SECTIONAL PLOT PARALLEL TO THE X AXIS AT J = 15
C
C NI=1
C BMAX=999999.
C BMIN=999999.
C IXY=0
C ICOR=15
C IL=
C IU=32
```


6.7 6.7 6.7 6.7 6.7 6.7 6.7 6.7 6.7 6.0 0.2 0.0 0.0 0.0 0.0
6.7 6.7 6.7 6.7 6.5 4.5 4.5 6.5 6.7 6.7 2.4 0.0 0.0 0.0 0.0
6.7 6.7 6.7 6.7 2.8 1.3 1.3 2.8 6.7 6.7 4.5 0.0 0.0 0.0 0.0
6.7 6.7 6.7 5.3 1.3 1.3 1.3 1.3 5.3 6.7 5.8 0.0 0.0 0.0 0.0
6.7 6.7 6.7 4.1 1.3 1.3 1.3 1.3 4.1 6.7 6.6 0.0 0.0 0.0 0.0
6.7 6.7 6.7 4.1 1.3 1.3 1.3 1.3 4.1 6.7 6.6 0.0 0.0 0.0 0.0
6.7 6.7 6.7 5.3 1.3 1.3 1.3 1.3 5.3 6.7 5.8 0.0 0.0 0.0 0.0
22.5 22.5 9.5 6.7 2.8 1.3 1.3 2.8 6.7 6.7 4.5 0.0 0.0 0.0 0.0
42.6 42.6 39.0 9.5 6.5 4.5 4.5 6.5 6.7 6.7 2.4 0.0 0.0 0.0 0.0
42.6 42.6 42.6 22.5 6.7 6.7 6.7 6.7 6.7 6.0 0.2 0.0 0.0 0.0
42.6 42.6 42.6 22.5 6.7 6.7 6.7 6.7 2.3 0.0 0.0 0.0 0.0 0.0
42.6 42.6 39.0 9.5 6.7 6.7 6.7 6.7 4.0 0.0 0.0 0.0 0.0 0.0
22.5 22.5 9.5 6.7 6.7 6.7 4.0 0.1 0.0 0.0 0.0 0.0 0.0 0.0
6.7 6.7 6.7 6.7 6.0 2.3 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
6.6 6.6 5.8 4.5 2.4 0.2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
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0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
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0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

BLANK COMMON REQUIRED 3648 (7100)
BLANK COMMON REQUIRED 3616 (7040)

ITER 0 CHISQ 0.208E+08
ITER 1 CHISQ 0.449E+07
XMIN = 0.00E+00 XMAX = 0.11E+02 XSUM = 0.2966E+04

XYGRF PRINTOUT
SYMBOL MINIMUM MAXIMUM INTERCEPT
X -0.773E+00 0.130E+02 THE Y-INTERCEPT = 15.
PLOT RANGE -0.773E+00 0.130E+02
1 IX I
2 IXXX I
3 IXXXX I
4 IXXXXXXX I
5 IXXXXXXXXXX I
6 IXXXXXXXXXXXXXXXXXX I
7 IXXXXXXXXXXXXXXXXXXXXXXXXXX I
8 IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX I
9 IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX I
10 IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX I
11 IXX I
12 IXX I
13 IXX I
14 IXX I

XYGRF PRINTOUT
SYMBOL MINIMUM MAXIMUM INTERCEPT
X 0.201E+01 0.702E+01 THE Y-INTERCEPT = 15.
PLOT RANGE 0.201E+01 0.702E+01
1 IX I
2 IXXX I
3 IXXXX I
4 IXXXXXXX I
5 IXXXXXXXXXX I
6 IXXXXXXXXXXXXXX I
7 IXXXXXXXXXXXXXXXXXX I
8 IXXXXXXXXXXXXXXXXXXXXXX I
9 IXXXXXXXXXXXXXXXXXXXXXXXXXX I
10 IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX I
11 IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX I
12 IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX I
13 IXX I
14 IXX I

15 IXXX I
16 IXXX I
17 IXXX I
18 IXXX I
19 IXXX I
20 IXXX I
21 IXXX I
22 IXXX I
23 IXXX I
24 IXXX I
25 IXXX I
26 IXXX I
27 IXXX I
28 IXXX I
29 IXXXXXXXXXX I
30 IXXXXX I
31 IXXX I
32 IX I

ITER 2 CHISQ 0.893E+06
XMIN = -0.15E+01 XMAX = 0.32E+02 XSUM = 0.2449E+04

XYGRF PRINTOUT
SYMBOL MINIMUM MAXIMUM INTERCEPT
X -0.1489E+01 0.1032E+01 0.4730E+01 0.6410E+01 0.7587E+01 0.8931E+01 1 0.1028E+02 Z
PLOT RANGE -0.1489E+01 0.1032E+01 0.4730E+01 0.6410E+01 0.7587E+01 0.8931E+01 1 0.1028E+02
Z 0.1145E+02 0.1229E+02 0.1313E+02 0.1498E+02 0.1683E+02 0.1801E+02 0.1935E+02
0.2053E+02 0.2305E+02 0.2607E+02 0.2775E+02 0.2910E+02 0.3044E+02 0.3162E+02
0.3212E+02

XYGRF PRINTOUT
SYMBOL MINIMUM MAXIMUM INTERCEPT
X -0.773E+00 0.130E+02 THE Y-INTERCEPT = 15.
PLOT RANGE -0.773E+00 0.130E+02
1 IX I
2 IXXX I
3 IXXX I
4 IX I
5 IXXXX I
6 IXXXXXXXX I
7 IXXX I
8 IXXX I
9 IXXX I
10 IXXX I
11 IXXX I
12 IXXX I
13 IXXX I
14 IXXX I
15 IXXX I
16 IXXX I
17 IXXX I
18 IXXX I
19 IXXX I
20 IXXX I
21 IXXX I
22 IXXX I
23 IXXX I
24 IXXX I
25 IXXX I
26 IXXX I
27 IXXXXXXXXXX I
28 IXXXXX I
29 IX I
30 IX I
31 IX I
32 IXX I

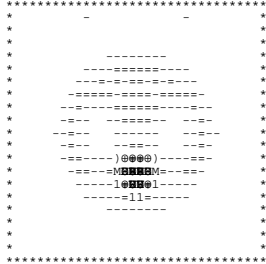
ITER 3 CHISQ 0.323E+06
XMIN = -0.19E+01 XMAX = 0.41E+02 XSUM = 0.2469E+04

XYGRF PRINTOUT
SYMBOL MINIMUM MAXIMUM INTERCEPT
X -0.19E+01 0.41E+02 THE Y-INTERCEPT = 15.
PLOT RANGE -0.19E+01 0.41E+02
1 IX I
2 IXXX I
3 IXXXX I
4 IXXXXXXX I
5 IXXXXXXXXXX I
6 IXXXXXXXXXXXXXX I
7 IXXXXXXXXXXXXXXXXXX I
8 IXXXXXXXXXXXXXXXXXXXXXX I
9 IXXXXXXXXXXXXXXXXXXXXXXXXXX I
10 IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX I
11 IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX I
12 IXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXXX I
13 IXX I
14 IXX I

EEEE N N DDDD CCC OOOO N N GGG RRRR
E NN ND D C C O ONN NG GR R R
EEE N N N D D C O ONN NG RRRR
E N ND D C C O N NN G GR R R
EEEE N N DDDD CCC OOOO N N GGG R R R

RECONSTRUCTION FOR FAN BEAM GEOMETRY WITH CURVED DETECTOR

XMIN = -0.26E+01 XMAX = 0.47E+02 XSUM = 0.2502E+04



- .2615E+01 0.1107E+01 0.6568E+01 0.9050E+01 0.1079E+02 0.1277E+02 0.1476E+02 Z
Z X A M @ @ @ @
0.1650E+02 0.1774E+02 0.1898E+02 0.2171E+02 0.2444E+02 0.2618E+02 0.2816E+02 @
@ @ @ @ @ @ @ @ @ @ @ @
0.2990E+02 0.3362E+02 0.3809E+02 0.4057E+02 0.4256E+02 0.4454E+02 0.4628E+02 ■
■ 0.4702E+02

0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
-0.5 0.0
0.2 0.0
0.1 0.0
0.2 0.1
-0.4 -0.6
-0.9 -0.4
0.2 0.1
-0.4 -0.2
0.0 0.3
0.2 -0.3
-0.3 0.5
0.3 0.0
-1.0 0.0
0.2 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0

SSS EEEEE TTTT U U PPPP
S E T U U P P
SSS EEE T U U P P P P
S E T U U P
SSS EEEEE T U U P P

INTEGER PARAMETER ARRAY (IPAR)

I	IPAR(I)	DESCRIPTION
1	32	LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2	0	RECONSTRUCT IN A CIRCULAR ARRAY
3	2	FAN BEAM GEOMETRY (FLAT DETECTOR)
4	36	NUMBER OF PROJECTION ANGLES
5	5	MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES) ANGLES GENERATED BETWEEN ZERO AND 2*PI
6	67	NUMBER OF RAYS FOR EACH PROJECTION
7	1	TRANSMISSION DATA
8	5000	DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9	2	NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10	0	EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11	5	PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES) PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12	0	LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE

FLOATING POINT PARAMETER ARRAY (PAR)

I	PAR(I)	DESCRIPTION
1	1.330	PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH AT CENTER OF ROTATION
2	33.000	LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3	65.000	DISTANCE FROM SOURCE TO CENTER OF ROTATION FOR FAN BEAM IN UNITS OF PROJECTION BIN WIDTH AT CENTER OF ROTATION
4	0.000 NA	CONSTANT ATTENUATION COEFFICIENT IN UNITS OF INVERSE PROJECTION BIN WIDTHS

BLANK COMMON REQUIRED 36 (44)
BLANK COMMON REQUIRED 72 (110)
BLANK COMMON REQUIRED 108 (154)
BLANK COMMON REQUIRED 242 (362)
BLANK COMMON REQUIRED 274 (422)

A TOTAL OF 49 (9 THRU 57) OF THE 67 USER PROJECTION BINS WILL BE USED
49 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 3648 FLOATING POINT WORDS.

EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN ND D S E T U U P P
EEE N N N D D SSS EEE T U U P P P
E N ND D S E T U U P
EEEE N N DDDD SSS EEEEE T U U P P

CCC OOOO N N GGG RRRR
C C O ONN NG GR R R
C O ONN NG RRRR
C O N NN G GR R R
CCC OOOO N N GGG R R R

PARAMETERS FOR SUBROUTINE CONGR

0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.2 1.0 -1.1
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.3 0.8 -1.5 0.0 0.9 -1.0
0.0 0.0 0.0 0.0 0.0 0.0 -0.1 -2.6 0.7 1.9 -1.0 0.0 0.3 -0.4
0.0 0.0 0.0 0.0 0.0 0.0 1.0 0.9 -1.7 -0.3 0.9 -0.3 -0.4 -0.1 -0.1
0.0 0.0 0.0 0.0 0.0 -1.1 0.4 0.6 -0.1 -1.7 0.5 0.1 -0.8 -0.2 0.0
0.0 0.0 0.0 0.0 0.8 -0.7 -0.2 0.2 0.3 -1.3 -0.4 0.1 -0.3 0.1 1.3
0.0 0.0 0.0 -0.8 0.7 -0.2 -0.9 -0.1 -0.4 0.1 -1.0 1.0 3.9 3.7 5.5
0.0 0.0 0.3 -0.3 -0.6 0.3 -0.8 0.2 1.2 3.1 7.1 6.1 6.3 7.7 6.6
0.0 -0.5 -0.1 0.0 -0.7 -0.3 0.0 -0.1 5.1 5.8 6.4 8.2 5.4 8.2 6.3
0.0 0.2 -0.6 0.1 -0.5 -0.7 0.3 3.0 6.2 8.3 5.9 7.9 6.4 7.2 6.9
0.0 0.1 0.1 -0.7 0.3 -0.8 0.4 6.1 7.0 7.8 6.9 7.0 7.4 6.2 7.5
0.1 0.2 -0.1 -0.2 -0.8 0.6 3.1 6.2 7.0 6.7 4.8 4.7 6.0 7.2 7.2
-0.6 -0.4 0.1 0.4 -0.2 0.0 5.1 7.5 6.7 3.1 1.9 1.4 3.6 7.4 6.3
-0.4 -0.9 -0.7 -0.8 0.2 1.2 5.3 7.6 6.0 1.8 0.8 0.6 2.3 5.0 6.9
0.1 0.2 -0.4 -0.7 -1.0 1.1 5.6 6.6 5.5 1.6 1.6 0.6 0.3 4.6 6.4
-0.2 -0.4 -0.2 -0.1 0.1 1.3 6.1 6.9 4.1 1.4 0.6 0.6 0.7 3.5 6.3
0.3 0.0 -0.3 -0.7 -0.8 0.3 4.9 7.1 6.0 1.0 0.5 0.1 -0.5 3.5 6.0
-0.3 0.2 0.8 0.7 0.7 1.0 4.8 6.9 7.0 3.6 0.8 0.5 2.4 5.6 11.0
0.5 -0.3 -1.0 -0.9 -0.9 0.3 3.5 6.9 6.9 5.6 3.7 3.1 5.4 13.3 34.2
0.0 0.3 0.7 0.6 0.6 -0.1 1.1 5.4 6.8 7.2 5.8 5.7 8.2 20.3 44.3
0.0 -1.0 -0.9 -0.9 -1.0 -1.0 -0.2 3.6 6.6 7.3 7.1 6.4 6.2 21.2 44.1
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.1 -0.2 -0.6 -0.3 -0.1 0.1 0.8 4.3 5.7 4.7 4.3 5.8 11.5
0.0 0.0 0.2 0.2 0.7 1.0 0.6 0.0 0.3 0.1 2.1 4.1 5.1 5.7 6.3
0.0 0.0 0.0 0.1 0.4 -0.9 -0.6 0.0 -0.4 0.5 -0.5 1.1 2.4 3.3 4.1
0.0 0.0 0.0 0.0 -0.3 0.8 1.6 0.1 0.5 -0.7 0.1 -0.1 -0.6 -0.2 0.1
0.0 0.0 0.0 0.0 0.0 0.9 -0.4 0.2 0.9 -0.4 0.2 0.2 -0.1 -0.8 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.3 1.6 -1.1 0.4 0.4 0.4 0.4 -0.6 0.7
0.0 0.0 0.0 0.0 0.0 0.0 0.0 -0.8 -0.1 1.2 0.6 -0.3 1.1 -0.5 1.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.6 0.1 0.6 0.3 0.6
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.2 -0.1 1.0

0.4 0.4 -1.1 1.0 0.2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.3 0.3 -1.0 0.9 0.0 -1.5 0.8 1.3 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.1 0.1 -0.4 0.3 0.0 -1.0 1.0 0.7 -2.6 -0.1 0.0 0.0 0.0 0.0 0.0
-0.3 0.3 -0.1 -0.1 -0.4 -0.3 0.9 -0.3 -1.7 0.9 1.0 0.0 0.0 0.0 0.0
-0.6 -0.6 0.0 -0.2 -0.8 0.1 0.5 -1.7 -0.1 0.6 0.4 -1.1 0.0 0.0 0.0
0.9 0.9 1.3 0.1 -0.3 0.1 -0.4 -1.3 0.3 0.2 -0.2 -0.7 0.8 0.0 0.0
5.6 5.6 5.5 3.7 3.9 1.0 -1.0 0.1 -0.4 -0.1 -0.9 -0.2 0.7 -0.8 0.0
7.0 7.0 7.1 6.6 6.8 4.3 3.6 0.2 -0.5 -0.3 -0.1 0.1 0.0 -0.4 0.3
7.2 7.2 6.6 7.7 6.3 6.1 7.1 3.1 1.2 0.2 -0.8 0.3 -0.6 -0.3 0.3
7.4 7.4 6.3 8.2 5.4 8.2 6.4 5.8 5.1 -0.1 0.0 -0.3 -0.7 0.0 -0.1
7.0 7.0 6.9 7.2 6.4 7.9 5.9 8.3 6.2 3.0 0.3 -0.7 -0.5 0.1 -0.6
6.6 6.6 7.5 6.2 7.4 7.0 6.9 7.8 7.0 6.1 0.4 -0.8 0.3 -0.7 0.1
6.7 6.7 7.2 7.2 6.0 4.7 4.1 6.2 7.0 6.2 3.1 4.2 -0.1 2.2 1.1
7.3 7.3 6.3 7.4 3.6 1.4 1.9 3.1 6.7 7.5 5.1 0.0 -0.2 0.4 0.1
6.6 6.6 6.9 5.0 2.3 0.6 0.8 1.8 6.0 7.6 5.3 1.2 0.2 -0.8 -0.7
6.3 6.3 6.4 4.6 0.3 0.6 1.6 1.6 5.5 6.6 5.6 1.1 -1.0 -0.7 -0.4
5.4 5.4 6.3 3.5 0.7 0.6 0.6 1.4 4.1 6.9 6.1 1.3 0.1 -0.1 -0.2
6.9 6.9 6.0 3.5 -0.5 0.1 0.5 1.0 6.0 7.1 4.9 0.3 -0.8 -0.7 -0.3
21.8 21.8 11.0 5.6 2.4 0.5 0.8 3.6 7.0 6.9 4.8 1.0 0.7 0.7 0.8
44.6 44.6 34.2 13.3 5.4 3.1 3.7 5.6 6.9 6.9 3.5 0.3 -0.9 -0.9 -1.0
47.0 47.0 44.3 20.3 8.2 5.7 5.8 7.2 6.8 5.4 1.1 -0.1 0.6 0.6 0.7
47.0 47.0 44.1 21.2 6.2 6.4 7.1 7.3 6.6 3.6 -0.2 -1.0 -1.0 -0.9 -0.9
45.3 45.3 35.5 12.9 4.7 5.1 6.1 5.8 4.0 0.3 -0.3 0.5 0.3 0.3 0.0
20.9 20.9 11.5 5.8 4.3 4.7 5.7 4.3 0.8 0.1 -0.1 -0.3 -0.6 -0.2 0.1
6.5 6.5 6.3 5.7 5.1 4.1 2.1 0.1 0.3 0.0 0.6 1.0 0.7 0.2 0.2
4.7 4.7 4.1 3.3 2.4 1.1 -0.5 0.5 -0.4 0.0 -0.6 -0.9 0.4 0.1 0.0
1.0 1.0 0.1 -0.2 -0.6 -0.1 0.1 -0.7 0.5 0.1 1.6 0.8 -0.3 0.0 0.0
-0.2 -0.2 0.0 -0.8 -0.1 0.2 0.2 -0.4 0.9 -0.2 -0.5 1.0 0.0 0.0 0.0
-0.1 -0.1 0.7 -0.6 0.4 0.4 0.4 0.4 -1.1 1.6 0.3 0.0 0.0 0.0 0.0
0.2 0.2 1.0 -0.5 1.1 -0.3 0.6 1.2 -0.1 -0.8 0.0 0.0 0.0 0.0 0.0
0.3 0.3 0.6 0.3 0.6 0.1 0.6 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.1 0.1 1.0 -0.1 1.2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

DESCRIPTION
IISTP - 5 NUMBER OF ITERATION STEPS
IRLX - 1 ITERATIVE RELAXATION METHOD
IERR - 0 DO NOT USE ERROR ARRAY
IZER - 0 INITIAL SOLUTION IS ZERO

BACKPROJECTION AND PROJECTION/CONVOLUSION/FILTER ROUTINES
PERFORM THE FOLLOWING FUNCTIONS

ARG FUNCTION RAY WEIGHTING ATTENUATION FAN BEAM
ECK BACKPROJECTION CONCAVE DISK NO YES
PRJ PROJECTION CONCAVE DISK NO YES

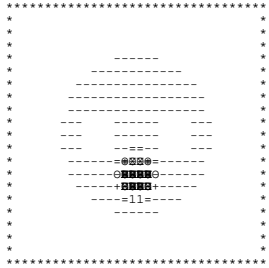
BLANK COMMON REQUIRED 372 (564)
BLANK COMMON REQUIRED 1184 (2240)
BLANK COMMON REQUIRED 1996 (3714)
BLANK COMMON REQUIRED 2808 (5370)
BLANK COMMON REQUIRED 3620 (7044)
PPPP H H AAA N N
P P H H A A NN N
PPPP HHHHH A A NN N
P H H AAAAA N NN
P H H A A N N

PHANTOM GENERATED
ARRAY SIZE 32 X 32 INTEGRATION FACTOR = 10 SCALING FACTOR = 0.752
NUMBER OF ELLIPSES AND/OR RECTANGLES = 4
THE PARAMETERS FOR THE ELLIPSES AND/OR RECTANGLES ARE
X, Y - CENTER
A, B - LENGTH OF AXIS OR SIDE A AND B
PHI - ANGLE OF AXIS OR SIDE A
DENS - INTENSITY
THE PARENTHESIS INDICATES THE SCALED VALUE

Table with 7 columns: ITYPE, X, Y, A, B, PHI, DENS. It lists parameters for four elliptical regions.

EEEE N N DDDD PPPP H H AAA N N
E NN ND D P P H H A A NN N
EEE NN ND D PPPP HHHHH A A NN N
E N NN D D P H H AAAAA N NN
EEEE N N DDDD P H H A A N N

XMIN = 0.00E+00 XMAX = 0.43E+02 XSUM = 0.2507E+04



0.0000E+00 0.3192E+01 0.7874E+01 0.1000E+02 0.1149E+02 0.1319E+02 0.1490E+02 Z
Z X A M @ @ @ @
0.1639E+02 0.1745E+02 0.1851E+02 0.2085E+02 0.2320E+02 0.2468E+02 0.2639E+02 @
@ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @
0.2788E+02 0.3107E+02 0.3490E+02 0.3703E+02 0.3873E+02 0.4043E+02 0.4192E+02 @
@ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @
0.4256E+02

Table with 16 columns of numerical data values, likely representing the intensity distribution of the phantom.

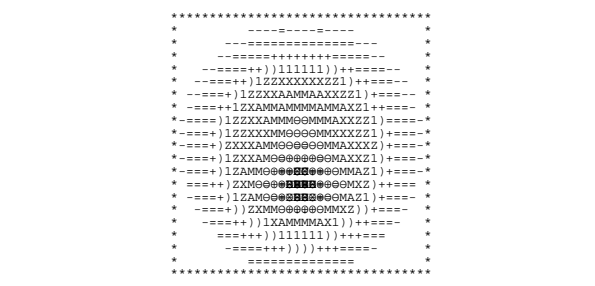
Table with 16 columns of numerical data values, likely representing the intensity distribution of the phantom.

0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0

BLANK COMMON REQUIRED 3652 (7104)
BLANK COMMON REQUIRED 3620 (7044)

ITER 0 CHISQ 0.210E+08
ITER 1 CHISQ 0.450E+07

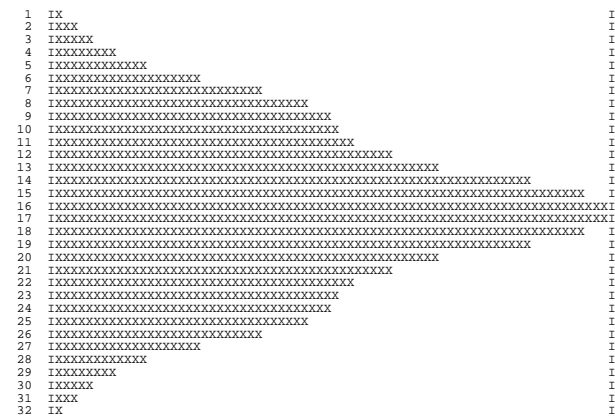
XMIN = 0.00E+00 XMAX = 0.11E+02 XSUM = 0.2976E+04



0.0000E+00 0.8473E+00 0.2090E+01 0.2655E+01 0.3050E+01 0.3502E+01 0.3954E+01 Z
Z X A M @ @ @ @ @
0.4349E+01 0.4632E+01 0.4914E+01 0.5536E+01 0.6157E+01 0.6552E+01 0.7004E+01 @
@ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @
0.7400E+01 0.8247E+01 0.9264E+01 0.9828E+01 0.1028E+02 0.1073E+02 0.1113E+02 @
@ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @ @
0.1130E+02

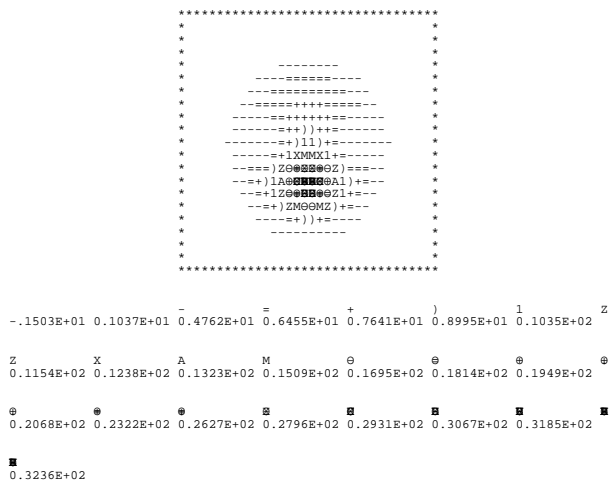
XYGRF PRINTOUT

SYMBOL X MINIMUM MAXIMUM INTERCEPT
PLOT RANGE 0.203E+01 0.203E+01 0.707E+01 0.707E+01
THE Y-INTERCEPT = 15.



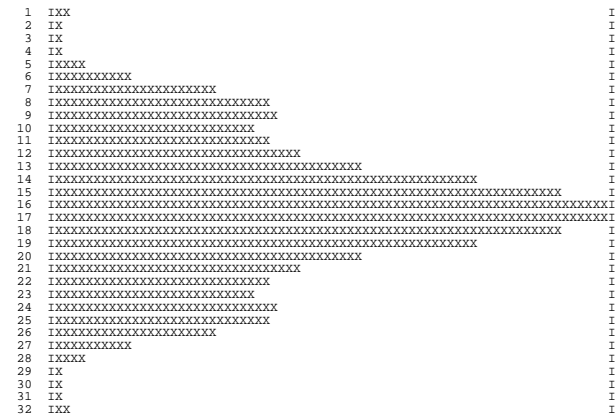
ITER 2 CHISQ 0.895E+06

XMIN = -0.15E+01 XMAX = 0.32E+02 XSUM = 0.2458E+04



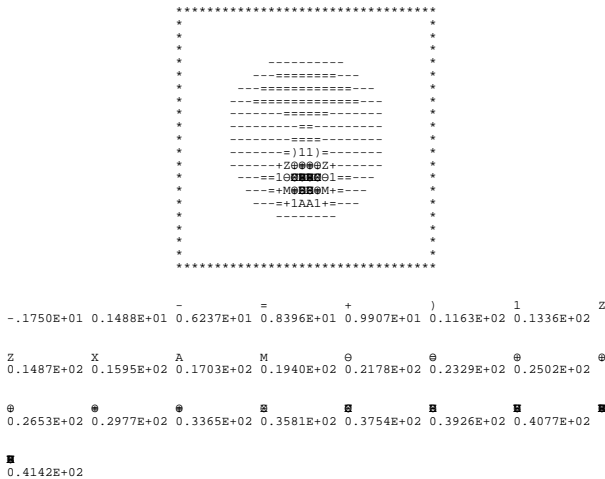
XYGRF PRINTOUT

SYMBOL X MINIMUM MAXIMUM INTERCEPT
PLOT RANGE -0.777E+00 -0.777E+00 0.130E+02 0.130E+02
THE Y-INTERCEPT = 15.



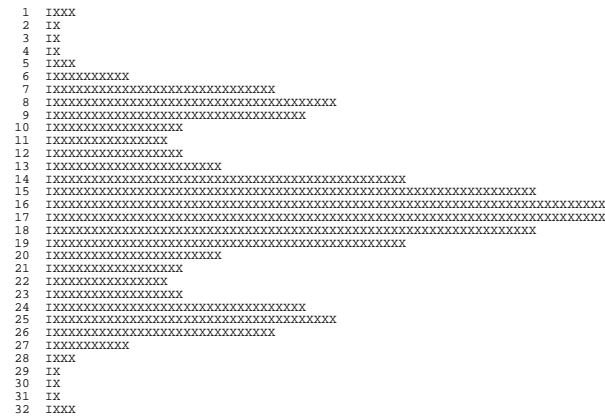
ITER 3 CHISQ 0.322E+06

XMIN = -0.17E+01 XMAX = 0.41E+02 XSUM = 0.2477E+04



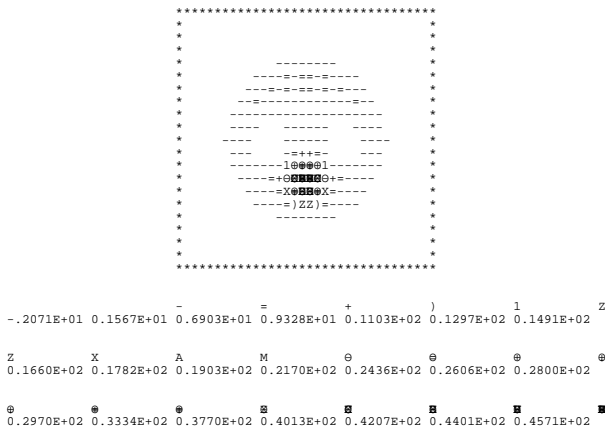
XYGRF PRINTOUT

SYMBOL X MINIMUM MAXIMUM INTERCEPT
PLOT RANGE -0.547E+00 -0.547E+00 0.109E+02 0.109E+02
THE Y-INTERCEPT = 15.



ITER 4 CHISQ 0.137E+06

XMIN = -0.21E+01 XMAX = 0.46E+02 XSUM = 0.2519E+04



0.4644E+02

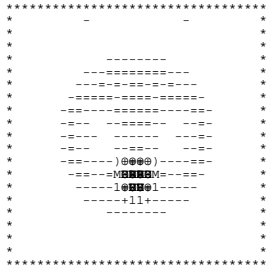
XYGRF PRINTOUT

SYMBOL MINIMUM MAXIMUM INTERCEPT THE Y-INTERCEPT = 15.
X -0.166E+00 0.844E+01
PLOT RANGE -0.166E+00 0.844E+01

1 IXXXXXX I
2 IXXXX I
3 IXX I
4 IX I
5 IXX I
6 IXXXXXXXXXX I
7 IXXX I
8 IXXX I
9 IXXX I
10 IXXX I
11 IXXXX I
12 IXX I
13 IXXX I
14 IXXX I
15 IXXX I
16 IXXX I
17 IXXX I
18 IXXX I
19 IXXX I
20 IXX I
21 IXX I
22 IXXXX I
23 IXXXXXXXXXXXX I
24 IXXX I
25 IXXX I
26 IXXX I
27 IXXXXXXXXXXXX I
28 IXX I
29 IX I
30 IXX I
31 IXXXX I
32 IXXXXXX I

ITER 5 CHISQ 0.773E+05

XMIN = -0.27E+01 XMAX = 0.47E+02 XSUM = 0.2511E+04



- .2687E+01 0.1056E+01 0.6547E+01 0.9043E+01 0.1079E+02 0.1279E+02 0.1478E+02
Z
0.1653E+02 0.1778E+02 0.1903E+02 0.2177E+02 0.2452E+02 0.2626E+02 0.2826E+02
@
0.3001E+02 0.3375E+02 0.3824E+02 0.4074E+02 0.4274E+02 0.4473E+02 0.4648E+02
#
0.4723E+02

XYGRF PRINTOUT

SYMBOL MINIMUM MAXIMUM INTERCEPT THE Y-INTERCEPT = 15.
X -0.802E+00 0.725E+01
PLOT RANGE -0.802E+00 0.725E+01

1 IXXXXXXXXXX I
2 IXXXXXX I
3 IXXXXXX I
4 IX I
5 IX I
6 IXXXXXXXXXX I
7 IXXX I
8 IXXX I
9 IXXX I
10 IXXX I
11 IXXXXXXXXXXXX I
12 IXXXXXX I
13 IXXX I
14 IXXX I
15 IXXX I
16 IXXX I
17 IXXX I
18 IXXX I
19 IXXX I
20 IXX I
21 IXXXXXX I
22 IXXXXXXXXXXXX I
23 IXXXXXXXXXXXXXXXXXXXX I
24 IXXX I
25 IXXX I
26 IXXX I
27 IXXXXXXXXXXXX I
28 IX I
29 IX I
30 IXXXXXX I

31 IXXXXXX I
32 IXXXXXXXXXX I

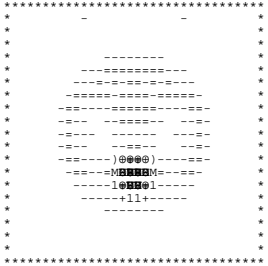
BLANK COMMON REQUIRED 3522 (6702)
BLANK COMMON REQUIRED 2710 (5226)
BLANK COMMON REQUIRED 1898 (3552)
BLANK COMMON REQUIRED 1086 (2076)
BLANK COMMON REQUIRED 274 (422)

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 3652 FLOATING POINT WORDS.

EEEE N N DDDD CCC OOOO N N GGG RRRR
E NN NN D D C O O NN NG G R R R
EEE N N D D C O O N N G RRR
E N NN D D C C O O N N G G R R
EEEE N N DDDD CCC OOOO N N GGGG R R

RECONSTRUCTION FOR FAN BEAM GEOMETRY WITH FLAT DETECTOR

XMIN = -0.27E+01 XMAX = 0.47E+02 XSUM = 0.2511E+04



- .2687E+01 0.1056E+01 0.6547E+01 0.9043E+01 0.1079E+02 0.1279E+02 0.1478E+02
Z
0.1653E+02 0.1778E+02 0.1903E+02 0.2177E+02 0.2452E+02 0.2626E+02 0.2826E+02
@
0.3001E+02 0.3375E+02 0.3824E+02 0.4074E+02 0.4274E+02 0.4473E+02 0.4648E+02
#
0.4723E+02

0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.1 1.0 -1.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.4 0.7 -1.5 0.0 1.0 -1.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.9 0.9 -1.7 -0.3 0.8 -0.3 -0.4 -0.1 -0.1
0.0 0.0 0.0 0.0 0.0 -1.0 0.4 0.6 -0.1 -1.8 0.4 0.1 -0.7 -0.2 0.0
0.0 0.0 0.0 0.0 0.8 -0.6 -0.2 0.2 0.2 -1.2 -0.5 0.2 -0.3 -0.1 1.1
0.0 0.0 0.0 -0.7 0.7 -0.1 -0.8 0.0 -0.4 0.1 -1.1 0.7 3.6 3.8 5.8
0.0 0.0 0.2 -0.4 0.0 0.1 -0.2 0.3 -0.7 0.1 3.4 4.5 7.1 6.7 7.2
0.0 0.0 0.3 -0.3 -0.5 0.4 -0.8 0.2 0.9 3.1 7.4 6.3 6.5 7.8 6.7
0.0 -0.5 -0.2 0.0 -0.8 -0.2 -0.1 -0.4 5.1 6.1 6.6 8.2 5.4 8.3 6.3
0.0 0.3 -0.5 0.1 -0.5 -0.6 0.3 2.7 6.5 8.4 6.1 8.0 6.4 7.1 6.9
0.0 0.1 0.2 -0.8 0.4 -0.9 0.2 6.3 7.1 7.9 7.0 7.0 7.5 6.2 7.5
0.0 0.2 -0.1 -0.1 -0.8 0.5 2.9 6.5 7.0 6.8 4.8 4.7 6.0 7.1 7.2
-0.6 -0.5 0.0 0.4 -0.1 -0.3 5.1 7.6 6.6 3.3 1.9 1.3 3.5 7.4 6.2
0.1 -0.7 -0.7 -0.9 0.1 1.0 5.5 7.8 5.9 1.9 0.8 0.6 2.2 5.0 6.8
0.0 0.4 -0.1 -0.6 -1.1 0.7 6.1 6.8 5.3 1.7 1.6 0.5 0.2 4.5 6.4
-0.3 -0.5 -0.3 0.1 0.3 0.9 6.4 7.2 3.9 1.5 0.6 0.6 0.7 3.5 6.2
0.4 -0.1 -0.3 -0.8 -0.8 0.4 5.4 7.3 5.9 1.0 0.5 0.1 -0.5 3.5 5.9
-0.4 0.2 0.7 0.8 0.7 0.7 5.0 7.3 6.8 3.7 0.7 0.6 2.3 5.5 11.0
0.4 -0.3 -1.0 -0.9 -1.0 0.1 3.2 7.2 7.3 5.8 3.5 3.1 5.4 13.1 34.1
0.0 0.2 0.5 0.4 0.6 -0.2 0.7 5.4 6.7 7.5 6.3 5.6 8.2 20.4 44.3
0.0 -0.9 -0.6 -0.8 -0.9 -1.1 -0.4 3.1 6.6 6.9 7.0 6.6 6.5 21.3 44.1
0.0 0.0 0.0 0.0 0.0 0.9 -0.6 -0.3 0.9 -0.3 0.4 0.3 -0.1 -1.0 0.0
0.0 0.0 0.6 0.3 -0.1 0.2 0.4 0.6 1.0 4.8 6.5 5.5 5.1 6.4 12.4
0.0 0.0 0.0 0.0 0.5 0.8 0.5 -0.2 0.0 -0.3 1.9 4.2 5.1 5.4 6.4
0.0 0.0 0.0 0.2 0.5 -0.8 -0.6 0.1 -0.4 0.4 -0.9 0.5 2.1 3.7 4.2
0.0 0.0 0.0 0.0 -0.3 0.7 1.5 -0.1 0.2 -0.8 0.0 0.3 -0.4 -0.6 -0.3
0.0 0.0 0.0 0.0 0.0 0.9 -0.6 -0.3 0.9 -0.3 0.4 0.3 -0.1 -1.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.3 1.6 -0.9 0.6 0.3 0.3 0.3 -0.5 0.7
0.0 0.0 0.0 0.0 0.0 0.0 0.0 -0.6 -0.3 1.0 0.6 -0.4 1.1 -0.5 1.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.4 0.1 0.6 0.4 0.5
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 1.2 -0.1 1.1

7.3 7.3 6.3 8.3 5.4 8.2 6.6 6.1 5.1 -0.4 -0.1 -0.2 -0.8 0.0 -0.2
7.0 7.0 6.9 7.1 6.5 8.0 6.1 8.4 6.5 2.7 0.3 -0.6 -0.5 0.1 -0.5
6.5 6.5 7.5 6.2 7.5 7.0 7.0 7.9 7.1 6.3 0.2 -0.9 0.4 -0.8 0.2
6.7 6.7 7.2 7.1 6.0 4.7 4.8 6.8 7.0 6.5 2.9 0.5 -0.8 -0.1 -0.1
7.3 7.3 6.2 7.4 3.5 1.3 1.9 3.3 6.6 7.6 5.1 -0.3 -0.1 0.4 0.0
6.5 6.5 6.8 5.0 2.2 0.6 0.8 1.9 5.9 7.8 5.5 1.0 0.1 -0.9 -0.7
6.2 6.2 6.4 4.5 0.2 0.5 1.6 1.7 5.3 6.8 6.1 0.7 -1.1 -0.6 -0.1
5.3 5.3 6.2 3.5 0.7 0.6 0.6 1.5 3.9 7.2 6.4 0.9 0.3 0.1 -0.3
6.8 6.8 5.9 3.5 -0.5 0.1 0.5 1.0 5.9 7.3 5.4 0.4 -0.8 -0.8 -0.3
21.8 21.8 10.9 5.5 2.3 0.6 0.7 3.7 6.8 7.3 5.0 0.7 0.7 0.8 0.7
44.5 44.5 34.1 13.1 5.4 3.1 3.5 5.8 7.3 7.2 3.2 0.1 -1.0 -0.9 -1.0
46.9 46.9 44.3 20.4 8.2 5.6 6.3 7.5 6.7 5.4 0.7 -0.2 0.6 0.4 0.5
47.2 47.2 44.1 21.3 6.5 6.6 7.0 6.9 6.6 3.1 -0.4 -1.1 -0.9 -0.8 -0.6
45.1 45.1 35.4 13.1 4.3 4.8 6.1 6.1 4.0 0.1 -0.3 0.6 0.2 0.2 -0.1
21.8 21.8 12.4 6.4 5.1 5.5 6.5 4.8 1.0 0.6 0.4 0.2 -0.1 0.3 0.6
6.7 6.7 6.4 5.4 5.1 4.2 1.9 -0.3 0.0 -0.2 0.5 0.8 0.5 0.0 0.0
5.0 5.0 4.2 3.7 2.1 0.5 -0.9 0.4 -0.4 0.1 -0.6 -0.8 0.5 0.2 0.0
0.7 0.7 -0.3 -0.6 -0.4 0.3 0.0 -0.8 0.2 -0.1 1.5 0.7 -0.3 0.0 0.0
-0.4 -0.4 0.0 -1.0 -0.1 0.3 0.4 -0.3 0.9 -0.3 -0.6 0.9 0.0 0.0 0.0
-0.1 -0.1 0.7 -0.5 0.3 0.3 0.3 0.6 -0.9 1.6 0.3 0.0 0.0 0.0 0.0
0.1 0.1 1.0 -0.5 1.1 -0.4 0.6 1.0 -0.3 -0.6 0.0 0.0 0.0 0.0 0.0
0.3 0.3 0.5 0.4 0.6 0.1 0.4 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 1.1 -0.1 1.2 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

0.0 0.0
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0.0 0.0
0.0 0.0
0.0 0.0
-0.5 0.0
0.3 0.0
0.1 0.0
0.2 0.0
-0.5 -0.6
-0.7 0.1
0.4 0.0
-0.5 -0.3
-0.1 0.4
0.2 -0.4
-0.3 0.4
0.2 0.0
-0.9 0.0
0.3 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0
0.0 0.0

EX08

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PROGRAM XATEN
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLES 8, 9, AND 10
THE PROGRAM XATEN RECONSTRUCTS ATTENUATED DATA USING
ATTENUATION FACTORS WHICH ARE EVALUATED FROM THE RECONSTRUCTION
OF THE ATTENUATION COEFFICIENTS FROM PROJECTIONS OBTAINED FROM
A TRANSMISSION SCAN.
DIMENSION B(4096),AG(72)
COMMON/TYPE/LTYPE
COMMON/BLANK/WORK(18000)
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0 EACH LINE WILL BE WITHIN 80 CHARACTERS
(OTHERWISE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
5 (CATN ,PAR( 4))
EXTERNAL BRF,PRF,BRFA,PRFA
LUNOUT=2
I80132=0
THE INPUT PARAMETERS ARE
NDIMU=64
ICIR=1
IGEOM=0
NANG=72
MODANG=4
KDIMU=100
NWORK=18000
NFLOAT=2
ISTORE=0
IPRINT=5
LUNATN=3
PWID=1
AXISU=50.5
RFAN=0.
CATN=0.
OPEN OUTPUT FILE AND SCRATCH FILE FOR ATTENUATION FACTORS
OPEN (LUNOUT,FILE='E08.OUT',FORM='FORMATTED')
OPEN (LUNATN,FILE='E08.TMP',FORM='UNFORMATTED',STATUS='SCRATCH')
IMIT=1
LTYPE=1
CALL SETUP (IPAR,PAR,AG)
RECONSTRUCTION OF THE TRANSVERSE SECTION FOR A
TRANSMISSION SCAN
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRF,BRF,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,24)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE ATTENUATION COEFFICIENTS
NMAT=NDIMU**2
KK1=1
KU=NDIMU/15+1
DO 12 K=1,KU
WRITE (LUNOUT,18)
KK2=MIN(15*K,NDIMU)
DO 10 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
10 WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
12 KK1=KK2+1
MODANG=5
IMIT=0
LTYPE=2
CALL SETUP (IPAR,PAR,AG)
EVALUATE THE ATTENUATION FACTORS
CALL EVATN (B)
RECONSTRUCTION OF THE TRANSVERSE SECTION FOR AN EMISSION SCAN
WHICH IS CORRECTED FOR ATTENUATION
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRFA,BRFA,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,26)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE TRANSVERSE SECTION FOR THE
EMISSION SCAN
KK1=1
KU=NDIMU/15+1
DO 16 K=1,KU
WRITE (LUNOUT,18)

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KK2=MIN(15*K,NDIMU)
DO 14 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
14 WRITE (LUNOUT,22) (B(I),I=ISUB1,ISUB2)
16 KK1=KK2+1
CLOSE (LUNOUT)
CLOSE (LUNATN)
*****
18 FORMAT(1X,//////)
20 FORMAT(1X,15F5.3)
22 FORMAT(1X,15F5.1)
24 FORMAT(1X,/' RECONSTRUCTION FOR THE TRANSMISSION SCAN')
26 FORMAT(1X,/' RECONSTRUCTION FOR THE EMISSION SCAN CORRECTED FOR ',
1 'ATTENUATION')
END
SUBROUTINE GETUM (M,DATA,ERR)
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLE 8
THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
AN ELIPICAL SOURCE PHANTOM AND ELIPICAL ATTENUATOR OF THE SAME
SIZE.
IF
LTYPE = 1 GETUM RETURNS TRANSMISSION DATA OF THE
ATTENUATOR
LTYPE = 2 GETUM RETURNS ATTENUATED PROJECTION DATA
OF THE SOURCE
DIMENSION DATA(*),ERR(*)
COMMON/TYPE/LTYPE
DIMENSION ITYPE(2),Z(2),X1(2),Y1(2),A1(2),B1(2),PHI(2)
DATA Z/.075,30./
DATA X1/0.,0./
DATA Y1/0.,0./
DATA A1/40.,40./
DATA B1/60.,60./
DATA PHI/0.,0./
IF (LTYPE.EQ.1) THEN
ITYPE(1)=1
CALL PHANL (1,ITYPE,Z,X1,Y1,A1,B1,PHI,DATA,M)
ELSE
ITYPE(1)=-1
ITYPE(2)=1
CALL PHANL (2,ITYPE,Z,X1,Y1,A1,B1,PHI,DATA,M)
ENDIF
RETURN
END
SSS EEEEE TTTT U U PPPP
S E T U U P P
SSS EEE T U U PPPP
S E T U U P
SSS EEEEE T UUU P
INTEGER PARAMETER ARRAY (IPAR)
I IPAR(I) DESCRIPTION
1 64 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 1 RECONSTRUCT IN A SQUARE ARRAY
3 0 GEOMETRY FLAG
4 72 PARALLEL BEAM GEOMETRY
5 4 MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND PI
STARTING AT ZERO
6 100 NUMBER OF RAYS FOR EACH PROJECTION
7 1 TRANSMISSION DATA
8 18000 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 5 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12 3 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE
FLOATING POINT PARAMETER ARRAY (PAR)
I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS
BLANK COMMON REQUIRED 72 ( 110)
BLANK COMMON REQUIRED 144 ( 220)
BLANK COMMON REQUIRED 216 ( 330)
BLANK COMMON REQUIRED 416 ( 640)
BLANK COMMON REQUIRED 480 ( 740)

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0.3	-0.2	1.0	0.8	0.0	-1.2	1.1	0.6	-0.7	1.2	0.9	-0.3	1.0	0.1	-0.3	
-0.1	-1.3	0.0	0.1	-0.5	-1.5	0.2	0.1	-1.2	0.4	0.1	-0.9	0.8	-0.5	-0.4	
1.1	-0.1	0.6	1.0	0.4	-0.6	0.5	1.1	-0.5	0.8	0.8	-0.6	1.2	0.1	0.1	
0.7	-0.3	-0.4	0.4	0.0	-1.2	-0.7	0.5	-1.0	-0.1	0.4	-0.8	0.8	-0.2	0.8	
0.6	0.1	-0.8	0.7	0.5	-0.2	-0.6	1.4	0.0	0.5	0.7	-0.7	0.7	-0.5	0.9	
1.1	1.0	0.0	0.7	0.4	1.4	0.5	1.1	0.9	0.2	0.2	1.0	-0.8	0.0	0.7	
-0.4	0.4	-0.4	0.3	0.8	0.3	-1.1	0.9	0.2	0.2	1.0	-0.8	0.0	-0.7	0.0	
-0.6	1.2	0.4	0.2	1.2	0.5	-1.2	-0.1	-0.6	-1.4	0.4	-0.6	0.7	-0.8	1.4	
-1.2	1.0	0.3	-1.1	0.1	-0.4	-1.6	-0.6	0.2	-0.5	0.9	0.0	1.6	-0.6	-0.2	
-1.9	-1.0	-0.3	-1.1	0.6	1.2	-0.3	-0.8	0.6	-0.4	1.8	-0.4	0.0	-1.4	0.4	
0.2	0.2	0.4	-1.3	-0.2	0.8	0.6	-0.3	1.3	-1.2	0.6	-1.2	0.6	0.8	1.1	
0.3	-1.7	0.3	0.4	0.4	1.4	0.5	-1.8	-0.1	-1.3	0.9	0.2	1.0	-0.2	-0.5	
0.3	-0.1	0.7	0.9	-0.5	0.1	-0.6	-1.6	0.7	0.0	1.5	-0.6	0.5	-0.2	-2.6	
1.1	0.0	-1.2	0.2	-1.6	0.5	0.7	-0.8	0.8	0.2	0.4	0.2	0.1	-0.5	-2.6	
0.4	-1.0	-2.5	0.7	0.5	0.1	1.3	-0.1	-0.6	-0.2	1.3	-0.7	0.0	-1.3	0.3	
-0.1	0.6	-0.3	-0.8	1.1	0.5	-1.1	-0.8	-0.9	0.6	-0.7	0.1	-1.3	0.1	3.5	
0.6	0.5	-0.2	-0.9	1.2	-0.4	0.7	0.8	-1.4	0.3	0.5	-1.5	0.4	0.7	7.6	
-0.8	1.4	0.8	-1.1	-0.6	0.0	1.4	0.2	-1.7	0.5	-1.2	0.3	0.1	2.1	14.8	
0.2	0.8	0.4	-1.2	-0.4	1.0	-0.3	0.6	-0.5	-1.4	0.2	-0.1	0.7	4.0	21.4	
0.1	-1.1	0.9	0.8	-1.4	-0.1	-1.1	1.0	-1.7	0.0	-0.1	0.3	0.7	8.4	24.0	
0.2	0.8	-0.4	0.9	-0.9	0.3	-0.7	0.8	0.9	1.3	0.2	5.3	27.7	4.0	21.4	
1.3	0.3	-1.1	0.4	0.5	-1.1	0.7	0.5	0.8	-1.0	0.1	1.0	2.9	18.3	27.7	
0.9	-0.2	-1.6	1.3	0.5	-2.6	0.5	-0.7	0.5	-0.6	-0.3	0.4	5.4	21.8	28.3	
-1.0	0.4	0.6	-0.9	-0.3	0.3	0.3	-0.1	1.5	-1.0	-0.2	0.5	9.1	24.8	29.0	
-0.6	1.3	0.2	-2.2	0.9	0.5	-0.8	0.5	1.5	-0.5	-1.1	0.8	11.9	26.6	30.4	
0.8	-0.5	-0.6	0.1	-0.4	1.1	-1.1	0.7	0.7	0.4	-1.6	0.2	15.3	27.3	29.4	
0.1	-0.9	1.1	0.5	-0.7	1.1	0.0	-1.1	0.7	1.1	0.0	-1.4	2.4	18.3	28.1	
-0.9	0.5	-0.4	1.1	0.1	0.0	0.9	-1.7	0.7	0.7	-2.2	4.1	20.6	28.2	28.9	
0.9	0.4	-0.3	0.8	0.3	-0.3	0.5	-0.5	-0.6	1.3	-3.0	5.3	22.4	27.4	29.1	
-0.3	0.7	0.8	-0.9	1.3	0.1	-0.4	0.6	-1.6	1.1	-1.1	4.2	22.3	27.4	29.4	
1.0	0.2	0.8	-0.3	0.5	0.4	-0.2	0.5	-0.9	-0.8	1.0	2.9	25.0	29.2	28.2	
1.0	0.1	-0.3	0.8	-0.7	0.4	0.5	-0.4	0.2	-2.0	1.9	2.9	24.4	28.4	29.5	
0.0	0.2	0.8	-0.3	0.5	0.4	-0.2	0.5	-0.9	-0.8	1.0	2.9	25.0	29.2	28.2	
-0.3	0.7	0.8	-0.9	1.3	0.1	-0.4	0.6	-1.6	1.1	-1.1	4.2	22.3	27.4	29.4	
0.2	0.8	-0.4	0.9	-0.9	0.3	-0.7	0.8	0.9	1.3	0.2	5.3	27.7	4.0	21.4	
-0.9	0.5	-0.4	1.1	0.1	0.0	0.9	-1.7	0.7	0.7	-2.2	4.1	20.6	28.2	28.9	
0.1	-1.9	1.1	0.5	-0.7	1.1	-0.1	-0.7	1.1	0.0	-1.4	2.4	18.3	28.1	28.0	
0.8	-0.5	-0.6	0.1	-0.4	1.1	-1.1	0.7	0.7	0.4	-1.6	0.2	15.3	27.3	29.4	
-0.6	1.3	0.2	-2.2	0.9	0.5	-0.8	0.5	1.5	-0.5	-1.1	0.8	11.9	26.6	30.4	
-1.5	0.1	-0.4	-1.3	-0.5	0.4	-0.3	0.6	-0.5	-1.4	0.2	-0.1	0.7	4.0	21.4	
0.9	-0.2	-1.6	1.3	0.5	-2.6	0.5	-0.7	0.5	-0.6	-0.3	0.4	5.4	21.8	28.3	
1.3	0.3	-1.1	0.4	0.5	-1.1	-0.7	0.5	0.8	-1.0	0.1	1.0	2.9	18.3	27.7	
-0.4	-0.4	1.1	0.7	-1.8	0.5	-0.1	-0.6	0.1	0.1	0.2	0.4	1.4	13.8	26.4	
0.1	-1.1	0.9	0.8	-1.4	-0.1	-1.1	1.0	-1.7	0.0	-0.1	0.3	0.7	8.4	24.0	
0.2	0.8	-0.4	0.9	-0.9	0.3	-0.7	0.8	0.9	1.3	0.2	5.3	27.7	4.0	21.4	
-0.8	1.4	0.8	-1.1	-0.6	0.0	1.4	0.2	-1.7	0.5	-1.2	0.3	0.1	2.1	14.8	
0.6	0.5	-0.2	-0.9	1.2	-0.4	0.7	0.8	-1.4	0.3	0.5	-1.5	0.4	0.7	7.6	
0.1	0.6	-0.3	-0.8	1.1	0.5	-1.1	-0.8	-0.9	0.6	-0.7	0.1	-1.3	0.1	3.5	
0.4	-1.0	-2.5	0.7	0.5	0.1	1.3	-0.1	-0.6	-0.2	1.3	-0.7	0.0	-1.3	0.3	
0.8	0.5	-0.6	0.1	-0.4	1.1	-1.1	0.7	0.7	0.4	-1.6	0.2	15.3	27.3	29.4	
0.3	-0.1	0.7	0.9	-0.5	0.1	-0.6	-1.6	0.7	0.0	1.5	-0.6	0.5	-0.2	-2.6	
0.3	-1.7	0.3	0.4	0.4	1.4	0.5	-1.8	-0.1	-1.3	0.9	0.2	1.0	-0.2	-0.5	
-0.4	-0.6	1.5	-0.3	-0.2	0.8	0.6	-0.3	1.3	-1.2	0.0	-1.2	0.6	0.8	0.1	
-1.9	-1.0	-0.3	-1.1	0.6	1.2	-0.3	-0.8	0.6	-0.4	1.8	-0.4	0.0	-1.4	0.4	
-0.1	0.6	-0.3	-0.8	1.1	0.5	-1.1	-0.8	-0.9	0.6	-0.7	0.1	-1.3	0.1	3.5	
-0.6	1.2	0.4	0.2	1.2	0.5	-1.2	-0.1	-0.6	-1.4	0.4	-0.6	0.7	-0.8	1.4	
-0.4	0.4	-0.4	0.3	0.8	0.3	-1.1	0.9	0.2	0.2	1.0	-0.8	0.0	-1.7	0.0	
1.0	1.0	-0.4	0.7	0.5	-0.4	-1.7	0.8	0.0	0.4	1.1	-0.3	1.2	-0.3	0.4	
0.6	0.1	-0.8	0.7	0.5	-0.2	-0.6	1.4	0.0	0.5	0.7	-0.7	0.7	-0.5	0.9	
0.2	0.8	-0.4	0.9	-0.9	0.3	-0.7	0.8	0.9	1.3	0.2	5.3	27.7	4.0	21.4	
1.1	-0.1	0.6	1.0	0.4	-0.6	0.5	1.1	-0.5	0.8	-0.8	-0.6	1.2	0.1	0.1	
-0.1	-1.3	0.0	0.1	-0.5	-1.5	0.2	0.1	-1.2	0.4	0.1	-0.9	1.0	-0.8	-0.5	-0.4
0.3	-0.2	1.0	0.8	0.0	-1.2	1.1	0.6	-0.7	1.2	0.9	-0.3	1.0	0.1	-0.3	

0.1	-0.4	0.2	0.9	-0.9	0.4	0.9	1.0	0.9	0.2	10.8	20.8	26.0	27.5	28.7
0.3	-1.2	0.0	0.5	-0.6	-0.5	-0.1	0.3	0.7	1.3	-0.4	3.8	10.1	14.4	20.3
0.2	-1.7	0.2	0.6	0.3	-1.0	-0.5	0.0	0.3	0.5	0.3	-1.6	-0.6	2.6	3.0
0.5	-1.1	0.7	0.5	0.4	-1.3	-0.4	0.1	0.4	0.9	1.0	-0.1	-2.1	-2.0	-0.3

0.5	-1.3	-1.3	0.5	-0.3	-2.0	-2.1	-0.1	1.0	0.9	0.4	0.1	-0.4	-1.3	0.4
3.4	4.9	4.9	3.4	3.0	2.6	-0.6	2.6	2.6	2.9	3.5	3.0	0.0	-0.5	0.9
23.6	23.6	23.6	23.6	20.3	14.4	10.1	3.8	-0.4	1.3	0.7	0.3	-0.1	-0.5	-0.6
29.3	29.1	29.1	29.3	28.7	27.5	26.0	20.8	10.8	0.2	0.9	1.0	0.9	0.4	-0.9
29.9	31.1	31.1	29.9	30.9	29.6	30.2	27.9	26.7	19.2	5.3	2.5	-0.5	-1.5	-1.7
30.8	30.1	30.1	30.8	32.0	29.9	30.5	31.5	31.0	28.5	24.3	10.6	3.9	0.4	-1.2
31.2	32.6	32.6	31.2	31.1	30.6	31.2	32.9	30.9	29.2	30.2	25.3	12.9	5.3	-1.3
30.8	31.8	31.8	30.8	31.3	31.1	30.3	30.7	30.8	30.4	30.6	28.6	25.3	14.1	4.8
29.6	29.4	29.4	29.6	29.4	29.9	30.5	32.4	32.2	30.4	29.5	29.8	29.1	25.2	14.1
30.8	30.5	30.5	30.8	30.5	30.2	30.3	29.9	29.1	30.0	31.3	30.7	28.7	29.2	24.1
30.2	30.5	30.5	30.2	30.8	31.6	31.3	32.2	30.8	30.7	30.6	28.7	29.9	30.1	26.8
29.0	31.2	31.2	29.0	29.9	31.0	28.9	28.5	31.3	32.2	31.2	30.5	29.9	30.5	30.5
31.4	29.8	29.8	31.4	29.0	31.1	31.1	30.7	30.3	31.2	32.0	30.0	29.6	29.7	31.7
30.9	30.1	30.1	30.9	29.2	29.6	30.7	30.8	30.9	31.7	31.0	30.1	30.6	30.6	29.9
30.8	30.6	30.6	28.8	30.1	30.0	30.6	29.2	31.5	32.8	31.0	30.9	30.5	30.8	29.6
29.3	30.8	30.8	29.3	29.8	29.5	31.5	30.1	30.8	31.5	30.4	30.5	30.0	30.9	30.1
29.5	29.1	29.1	29.5	28.7	31.7	31.8	29.5	30.6	31.8	30.6	30.6	30.1	31.9	30.7
28.8	30.4	30.4	28.8	30.2	32.5	30.4	30.1	30.0	31.3	31.5	30.2	31.9	30.8	30.1
30.9	28.8	28.8	30.9	30.9	29.5	30.2	31.0	29.4	30.8	32.1	30.2	30.4	31.2	31.1
28.8	29.3	29.3	28.8	27.6	29.5	30.4	30.5	30.8	31.7	32.3	30.5	30.3	31.2	31.1
28.1	28.6	28.6	28.1	30.3	32.2	30.0	30.4	30.0	30.1	30.3	30.9	31.4	31.2	30.3
28.1	28.6	28.6	28.1	32.0	31.6	30.2	29.4	30.3	30.2	30.0	33.5	30.9	31.3	29.7
29.3	27.8	27.8	29.3	31.1	28.4	30.8	30.1	30.1	31.1	31.9	33.9	28.7	31.0	31.1
29.3	28.2	28.2	29.3	30.7	27.9	30.0	31.1	30.8	31.0	30.8	31.5	29.6	30.9	30.1
28.3	30.7	30.7	28.3	30.2	29.7	28.6	29.3	32.0	32.9	31.6	31.6	31.2	29.3	30.2
31.0	28.7	28.7	31.0	27.9	30.3	30.4	30.6	31.6	31.4	31.3	31.5	31.9	28.0	32.1
28.3	30.7	30.7	28.3	30.2	29.7	28.6	29.3	32.0	32.9	31.6	31.6	31.2	29.3	30.2
30.9	21.7	21.7	30.9	31.3	28.5	31.3	30.7	30.9	31.3	30.9	30.8			

29.1 24.8 10.4 0.5 -2.6 -0.2 0.5 -0.6 1.5 0.0 0.7 -1.6 -0.6 0.1 -0.5
26.6 18.1 0.4 -0.3 -0.5 -0.2 1.0 0.2 0.9 -1.3 -0.1 -1.8 0.5 1.4 0.4
21.4 5.4 -0.2 -0.9 0.1 0.8 0.6 -1.2 0.0 -1.2 1.3 -0.3 0.6 0.8 -0.2
11.9 -1.6 0.4 0.4 -1.4 0.0 -0.4 1.8 -0.4 0.6 -0.8 -0.3 1.2 0.6
1.9 -0.9 1.1 -2.5 -0.2 -0.6 1.6 0.0 0.9 -0.5 0.2 -0.6 -1.6 -0.4 0.1
-1.1 -0.9 0.0 -0.8 1.4 -0.8 0.7 -0.6 0.4 -1.4 -0.6 -0.1 -1.2 0.5 1.2
-1.7 1.5 0.1 -1.6 0.0 -1.7 0.0 -0.8 1.0 0.2 0.2 0.9 -1.1 0.3 0.8
-1.8 -0.5 -1.0 -0.9 0.4 -0.3 1.2 -0.3 1.1 0.4 0.0 0.8 -1.7 -0.4 0.5
0.1 0.9 0.1 0.3 0.9 -0.5 0.7 -0.7 0.7 0.5 0.0 1.4 -0.6 -0.2 0.5
0.9 0.2 -0.4 0.1 0.8 -0.2 0.8 -0.8 0.4 -0.1 -1.0 0.5 -0.7 -1.2 0.0
0.5 0.0 -1.2 0.3 0.1 0.1 1.2 -0.6 0.8 0.8 -0.5 1.1 0.5 -0.6 0.4
0.6 0.2 -1.7 0.2 -0.4 -0.5 0.8 -0.9 0.1 0.4 -1.2 0.1 0.2 -1.5 -0.5
0.5 0.7 -1.1 0.5 -0.3 0.1 1.0 -0.3 0.9 1.2 -0.7 0.6 1.1 -1.2 0.0

0.8 1.0 -0.2 0.3
0.1 0.0 -1.3 -0.1
1.0 0.6 -0.1 1.1
0.4 -0.4 -0.3 0.7
0.7 -0.8 0.1 0.6
0.7 -0.4 1.0 1.0
0.3 -0.4 0.4 -0.4
0.2 0.4 1.2 0.6
-1.1 0.3 1.0 -1.2
-1.1 -0.3 -1.0 -1.9
-0.3 1.5 -0.6 -0.4
0.4 0.3 -1.7 0.3
0.9 0.7 -0.1 0.3
0.2 -1.2 0.0 1.1
0.7 -2.5 -1.0 0.4
-0.8 -0.3 0.6 -0.1
-0.9 -0.2 0.5 0.6
-1.1 0.8 1.4 0.8
-1.2 0.4 0.8 0.2
0.8 0.9 -1.1 0.1
0.7 1.1 -0.4 -0.4
0.4 -1.1 0.3 1.3
1.3 -1.6 -0.2 0.9
-0.9 0.6 0.4 -1.0
-2.2 0.2 1.3 -0.6
0.1 -0.6 -0.5 0.8
0.5 1.1 -1.9 0.1
1.1 -0.4 0.5 -0.9
0.8 -0.3 0.4 0.9
-0.9 0.8 0.7 -0.3
-0.3 0.8 0.2 0.0
0.8 -0.3 0.1 1.0
0.8 -0.3 0.1 1.0
-0.3 0.8 0.2 0.0
-0.9 0.8 0.7 -0.3
0.8 -0.3 0.4 0.9
1.1 -0.4 0.5 -0.9
0.5 1.1 -1.9 0.1
0.1 -0.6 -0.5 0.8
-2.2 0.2 1.3 -0.6
-0.9 0.6 0.4 -1.0
1.3 -1.6 -0.2 0.9
0.4 -1.1 0.3 1.3
0.7 1.1 -0.4 -0.4
0.8 0.9 -1.1 0.1
-1.2 0.4 0.8 0.2
-1.1 0.8 1.4 -0.8
-0.9 -0.2 0.5 0.6
-0.8 -0.3 0.6 -0.1
0.7 -2.5 -1.0 0.4
0.2 -1.2 0.0 1.1
0.9 0.7 -0.1 0.3
0.4 0.3 -1.7 0.3
-0.3 1.5 -0.6 -0.4
-1.1 -0.3 -1.0 -1.9
-1.1 0.3 1.0 -1.2
0.2 0.4 1.2 -0.6
0.3 -0.4 0.4 0.4
0.7 -0.4 1.0 1.0
0.7 -0.8 0.1 0.6
0.4 -0.4 -0.3 0.7
1.0 0.6 -0.1 1.1
0.1 0.0 -1.3 -0.1
0.8 1.0 -0.2 0.3

EX09

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PROGRAM XATEN
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLES 8, 9, AND 10
THE PROGRAM XATEN RECONSTRUCTS ATTENUATED DATA USING
ATTENUATION FACTORS WHICH ARE EVALUATED FROM THE RECONSTRUCTION
OF THE ATTENUATION COEFFICIENTS FROM PROJECTIONS OBTAINED FROM
A TRANSMISSION SCAN.
DIMENSION B(4096),AG(72)
COMMON/TYPE/LTYPE
COMMON/BLANK/WORK(18000)
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0 EACH LINE WILL BE WITHIN 80 CHARACTERS
(OTHERWISE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
5 (CATN ,PAR( 4))
EXTERNAL BRP, PRF, BRFA, PRFA
LUNOUT=2
I80132=0
THE INPUT PARAMETERS ARE
NDIMU=64
ICIR=1
IGEOM=0
NANG=72
MODANG=4
KDIMU=100
NWORK=18000
NFLOAT=2
ISTORE=0
IPRINT=5
LUNATN=3
PWID=1
AXISU=50.5
RFAN=0.
CATN=0.
OPEN OUTPUT FILE AND SCRATCH FILE FOR ATTENUATION FACTORS
OPEN (LUNOUT,FILE='E09.OUT',FORM='FORMATTED')
OPEN (LUNATN,FILE='E09.TMP',FORM='UNFORMATTED',STATUS='SCRATCH')
IMIT=1
LTYPE=1
CALL SETUP (IPAR,PAR,AG)
RECONSTRUCTION OF THE TRANSVERSE SECTION FOR A
TRANSMISSION SCAN
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRF,BRF,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,24)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE ATTENUATION COEFFICIENTS
NMAT=NDIMU**2
KK1=1
KU=NDIMU/15+1
DO 12 K=1,KU
WRITE (LUNOUT,18)
KK2=MIN(15*K,NDIMU)
DO 10 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
10 WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
12 KK1=KK2+1
MODANG=5
IMIT=0
LTYPE=2
CALL SETUP (IPAR,PAR,AG)
EVALUATE THE ATTENUATION FACTORS
CALL EVATN (B)
RECONSTRUCTION OF THE TRANSVERSE SECTION FOR AN EMISSION SCAN
WHICH IS CORRECTED FOR ATTENUATION
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRFA,BRFA,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,26)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE TRANSVERSE SECTION FOR THE
EMISSION SCAN
KK1=1
KU=NDIMU/15+1
DO 16 K=1,KU
WRITE (LUNOUT,18)

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```

KK2=MIN(15*K,NDIMU)
DO 14 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
14 WRITE (LUNOUT,22) (B(I),I=ISUB1,ISUB2)
16 KK1=KK2+1
CLOSE (LUNOUT)
CLOSE (LUNATN)
18 FORMAT(1X,//////)
20 FORMAT(1X,15F5.3)
22 FORMAT(1X,15F5.1)
24 FORMAT(1X,/' RECONSTRUCTION FOR THE TRANSMISSION SCAN')
26 FORMAT(1X,/' RECONSTRUCTION FOR THE EMISSION SCAN CORRECTED FOR ',
1 'ATTENUATION')
END
SUBROUTINE GETUM (M,DATA,ERR)
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLE 9
THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
A HEART PHANTOM WHICH IS ATTENUATED BY AN ATTENUATOR CONSISTING
OF CHEST TISSUE AND LUNGS.
IF
LTYPE = 1 GETUM RETURNS TRANSMISSION DATA OF THE
ATTENUATOR
LTYPE = 2 GETUM RETURNS ATTENUATED PROJECTION DATA
OF THE SOURCE
DIMENSION DATA(*),ERR(*)
COMMON/TYPE/LTYPE
DIMENSION A1(4),B1(4),XMU(4),X1(4),Y1(4),PHI(4),ITYPE(4)
DATA A1/40.,10.,10.,10./
DATA B1/40.,14.,14.,10./
DATA XMU/.10,-.07,-.07,30./
DATA X1/0.,10.,-10.,0./
DATA Y1/0.,0.,0.,-10./
DATA PHI/0.,0.,0.,0./
IF (LTYPE.EQ.1) THEN
ITYPE(1)=1
ITYPE(2)=1
ITYPE(3)=1
CALL PHANL (3,ITYPE,XMU,X1,Y1,A1,B1,PHI,DATA,M)
ELSE
ITYPE(1)=-1
ITYPE(2)=-1
ITYPE(3)=-1
ITYPE(4)=1
CALL PHANL (4,ITYPE,XMU,X1,Y1,A1,B1,PHI,DATA,M)
ENDIF
RETURN
END
SSS EEEEE TTTT U U PPPP
S E T U U P P
SSS EEE T U U PPPP
S E T U U P
SSS EEEEE T UUU P
INTEGER PARAMETER ARRAY (IPAR)
I IPAR(I) DESCRIPTION
1 64 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 1 RECONSTRUCT IN A SQUARE ARRAY
3 0 GEOMETRY FLAG
4 72 PARALLEL BEAM GEOMETRY
5 4 NUMBER OF PROJECTION ANGLES
MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND PI
STARTING AT ZERO
6 100 NUMBER OF RAYS FOR EACH PROJECTION
7 1 TRANSMISSION DATA
8 18000 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 5 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12 3 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE
FLOATING POINT PARAMETER ARRAY (PAR)
I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS
BLANK COMMON REQUIRED 72 ( 110)
BLANK COMMON REQUIRED 144 ( 220)
BLANK COMMON REQUIRED 216 ( 330)
BLANK COMMON REQUIRED 416 ( 640)

```


-.001-.0010.0010.000
0.002-.0010.002-.001

SSS EEEEE TTTT U U PPPP
S E T U U P P P
SSS EEE T U U PPPP
S E T U U P
SSS EEEEE T U U P

INTEGER PARAMETER ARRAY (IPAR)

I IPAR(I) DESCRIPTION
1 64 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 1 RECONSTRUCT IN A SQUARE ARRAY
3 0 GEOMETRY FLAG
4 72 PARALLEL BEAM GEOMETRY
5 5 NUMBER OF PROJECTION ANGLES
MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND 2*PI
STARTING AT ZERO
6 100 NUMBER OF RAYS FOR EACH PROJECTION
7 0 EMISSION DATA
8 18000 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 5 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12 3 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE

FLOATING POINT PARAMETER ARRAY (PAR)

I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS

BLANK COMMON REQUIRED 72 (110)

BLANK COMMON REQUIRED 144 (220)

BLANK COMMON REQUIRED 216 (330)

BLANK COMMON REQUIRED 416 (640)

BLANK COMMON REQUIRED 480 (740)

A TOTAL OF 92 (5 THRU 96) OF THE 100 USER PROJECTION BINS WILL BE USED

92 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 14171 FLOATING POINT WORDS.

EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN N D D S E T U U P P
EEE N N D D SSS EEE T U U PPPP
E N NN D D S E T U U P
EEEE N N DDDD SSS EEEEE T U U P

EEEE V V AAA TTTT N N
E V V A A T NN N
EEE V V A A T NN N
E V V AAAAA T N NN
EEEE V A A T N N

BLANK COMMON REQUIRED 4576 (10740)

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 14171 FLOATING POINT WORDS.

EEEE N N DDDD EEEEE V V AAA TTTT N N
E NN N D D E V V A A T NN N
EEE N N D D EEE V V A A T NN N
E N NN D D E V V AAAAA T N NN
EEEE N N DDDD EEEEE V A A T N N

GGG RRRR AAA DDDD Y Y
G G R R A A D D Y Y
G RRRR A A D D Y
G G R R AAAAA D D Y
GGGG R R A A DDDD Y

PARAMETERS FOR SUBROUTINE GRADY

DESCRIPTION
ISTP - 15 NUMBER OF ITERATION STEPS
IRLX - 1 ITERATIVE RELAXATION METHOD
IERR - 0 DO NOT USE ERROR ARRAY
IZER - 0 INITIAL SOLUTION IS ZERO

BLANK COMMON REQUIRED 4612 (11004)

BLANK COMMON REQUIRED 5222 (12146)

BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES
PERFORM THE FOLLOWING FUNCTIONS

ARG FUNCTION RAY WEIGHTING ATTENUATION FAN BEAM
BCK BACKPROJECTION UNIFORM SQUARE YES YES NO
PRJ PROJECTION UNIFORM SQUARE YES NO

BLANK COMMON REQUIRED 5406 (12436)

BLANK COMMON REQUIRED 9502 (22436)

BLANK COMMON REQUIRED 13598 (32436)

BLANK COMMON REQUIRED 17694 (42436)

BLANK COMMON REQUIRED 17726 (42476)

BLANK COMMON REQUIRED 17694 (42436)

FOR CONGR AND GRADY FCN IS THE VALUE OF THE CHI-SQUARE
FOR ENTPY FCN IS EVALUATED BY THE SUBROUTINE DULFC

ITER 0 FCN 0.270E+07
ITER 1 FCN 0.107E+07
ITER 2 FCN 0.570E+06
ITER 3 FCN 0.347E+06
ITER 4 FCN 0.230E+06
ITER 5 FCN 0.161E+06
ITER 6 FCN 0.118E+06
ITER 7 FCN 0.900E+05
ITER 8 FCN 0.708E+05
ITER 9 FCN 0.573E+05
ITER 10 FCN 0.474E+05
ITER 11 FCN 0.400E+05
ITER 12 FCN 0.343E+05
ITER 13 FCN 0.299E+05
ITER 14 FCN 0.263E+05
ITER 15 FCN 0.234E+05

BLANK COMMON REQUIRED 17510 (42146)

BLANK COMMON REQUIRED 13414 (32146)

BLANK COMMON REQUIRED 9318 (22146)

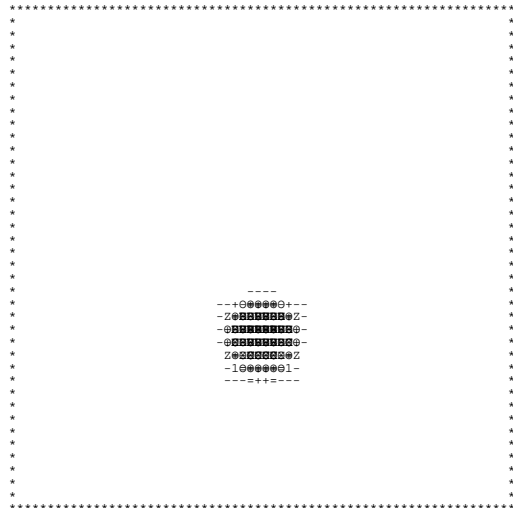
BLANK COMMON REQUIRED 5222 (12146)

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 17726 FLOATING POINT WORDS.

EEEE N N DDDD GGG RRRR AAA DDDD Y Y
E NN N D D G G R R A A D D Y Y
EEE N N D D G RRRR A A D D Y
E N NN D D G GG R R AAAAA D D Y
EEEE N N DDDD GGGG R R A A DDDD Y

RECONSTRUCTION FOR THE EMISSION SCAN CORRECTED FOR ATTENUATION

XMIN = -0.12E+01 XMAX = 0.32E+02 XSUM = 0.2416E+04



- .1183E+01 0.1323E+01 0.4998E+01 0.6668E+01 0.7838E+01 0.9174E+01 1.0151E+02

Z X A M @ @ @ @
0.1168E+02 0.1252E+02 0.1335E+02 0.1519E+02 0.1703E+02 0.1819E+02 0.1953E+02

@ @ @ @ @ @ @ @ @ @
0.2070E+02 0.2321E+02 0.2621E+02 0.2788E+02 0.2922E+02 0.3056E+02 0.3173E+02

0.3223E+02

0.0 -0.1 0.0 0.0 0.0 0.0 -0.1 -0.1 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.1 0.0 0.0 0.0 0.0 0.1 0.1 0.1 0.1 0.0 0.0 0.1 0.1 0.1 0.0 0.0
0.1 0.1 0.1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 -0.1 -0.1 0.0 0.0 0.0 0.0
0.0 0.0 0.1 0.0 0.0 0.0 0.1 0.1 0.1 0.1 0.1 0.1 0.0 0.0 0.0 0.0
0.0 0.1 0.1 0.1 0.1 0.0 0.0 -0.1 0.0 0.0 0.0 0.0 0.1 0.0 0.0 0.0
-0.2 -0.1 0.0 0.1 0.1 0.0 0.0 -0.1 0.0 0.1 0.1 0.0 0.0 0.0 0.0 -0.1
0.0 0.0 0.0 -0.1 -0.1 0.0 0.0 0.1 -0.1 0.0 0.1 0.0 0.0 0.0 0.0 0.1
0.0 0.0 0.0 -0.1 0.0 0.0 -0.1 -0.1 -0.1 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.1 0.0 -0.1 -0.1 0.0 0.1 0.1 0.1 0.1 0.1 0.1 0.0 0.1 0.1 0.0 0.0
0.1 0.0 0.0 -0.1 0.0 -0.1 0.1 0.1 0.1 0.1 0.0 0.0 -0.1 -0.2 0.0 0.1
0.0 0.1 0.0 0.0 -0.1 0.1 0.0 -0.1 0.1 0.1 0.0 0.1 0.0 -0.2 -0.2
0.0 -0.1 0.1 0.1 -0.1 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.1 0.1 -0.1
0.0 0.0 0.0 0.0 0.2 -0.1 0.0 0.0 0.0 0.1 0.0 -0.1 -0.1 0.1 0.1
0.0 0.0 0.1 0.0 -0.1 0.1 0.1 0.0 0.0 0.0 0.1 0.1 0.0 0.1 0.1 0.0
0.1 0.0 0.0 0.1 0.0 0.0 0.0 0.0 0.1 -0.1 0.0 0.0 0.1 0.1 -0.1
0.0 0.1 0.0 0.0 0.0 0.0 0.0 -0.2 0.0 0.1 -0.1 -0.1 0.0 0.1 0.1
0.0 0.0 0.1 0.0 0.1 0.0 0.1 0.1 0.1 -0.2 0.0 0.1 0.0 -0.1 0.0 0.0

0.0 0.0 0.0 0.0
0.1 0.0 0.0 0.0
0.0 0.0 0.0 0.0
-0.1 0.0 0.1 0.1
0.0 0.0 0.0 0.1
0.0 0.0 0.1 0.0
0.0 0.1 0.0 0.0
0.1 0.1 0.0 0.0
0.1 0.0 0.0 0.0
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0.0 -0.1 0.0 0.1
-0.1 0.0 0.1 0.0
0.0 0.1 0.0 -0.1
0.1 0.1 -0.1 0.0
0.1 -0.1 0.0 0.0
-0.1 0.0 0.0 0.1
0.0 0.0 0.1 0.1
0.0 0.0 0.0 -0.1
0.0 0.0 -0.1 0.0
0.0 0.0 0.0 0.1
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0
0.1 0.0 0.0 0.0
-0.1 -0.1 -0.1 0.0
0.0 0.1 0.1 0.0
0.1 0.0 0.0 0.0
-0.1 -0.1 0.0 0.0
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-0.1 -0.1 -0.1 -0.1
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-0.1 0.1 0.1 0.1
0.1 0.1 0.1 0.1
-0.1 -0.1 -0.1 -0.1
0.1 0.1 0.1 0.0
0.0 0.0 0.0 0.1
0.0 0.0 0.0 -0.1
-0.1 0.1 0.1 0.1
-0.1 0.0 0.0 0.1
0.1 0.0 -0.1 -0.1
0.0 0.1 0.1 0.0
0.0 0.0 0.0 0.1
-0.1 0.1 0.0 0.0
-0.1 0.1 0.1 0.1
-0.1 -0.1 -0.1 0.0
0.0 0.0 0.0 0.0
0.1 0.0 0.0 0.1
-0.1 0.0 0.0 0.0
0.0 0.0 0.0 -0.1
0.0 0.0 0.1 0.0

EX10

```

PROGRAM XATEN
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLES 8, 9, AND 10
THE PROGRAM XATEN RECONSTRUCTS ATTENUATED DATA USING
ATTENUATION FACTORS WHICH ARE EVALUATED FROM THE RECONSTRUCTION
OF THE ATTENUATION COEFFICIENTS FROM PROJECTIONS OBTAINED FROM
A TRANSMISSION SCAN.
DIMENSION B(4096),AG(72)
COMMON/TYPE/LTYPE
COMMON/BLANK/WORK(18000)
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0 EACH LINE WILL BE WITHIN 80 CHARACTERS
(OBJECTIVE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU,IPAR(1)),(ICIR,IPAR(2)),(IGEOM,IPAR(3)),
1 (NANG,IPAR(4)),(MODANG,IPAR(5)),(KDIMU,IPAR(6)),
2 (IMIT,IPAR(7)),(NWORK,IPAR(8)),(NFPLOT,IPAR(9)),
3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID,PAR(1)),(AXISU,PAR(2)),(RFAN,PAR(3)),
5 (CATN,PAR(4))
EXTERNAL BRP,PRF,BRF,PRFA
LUNOUT=2
I80132=0
THE INPUT PARAMETERS ARE
NDIMU=64
ICIR=1
IGEOM=0
NANG=72
MODANG=4
KDIMU=100
NWORK=18000
NFPLOT=2
ISTORE=0
IPRINT=5
LUNATN=3
PWID=1
AXISU=50.5
RFAN=0.
CATN=0.
OPEN OUTPUT FILE AND SCRATCH FILE FOR ATTENUATION FACTORS
OPEN (LUNOUT,FILE='E10.OUT',FORM='FORMATTED',STATUS='SCRATCH')
OPEN (LUNATN,FILE='E10.TMP',FORM='UNFORMATTED',STATUS='SCRATCH')
IMIT=1
LTYPE=1
CALL SETUP (IPAR,PAR,AG)
RECONSTRUCTION OF THE TRANSVERSE SECTION FOR A
TRANSMISSION SCAN
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRF,BRF,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,24)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE ATTENUATION COEFFICIENTS
NMAT=NDIMU**2
KK1=1
KU=NDIMU/15+1
DO 12 K=1,KU
WRITE (LUNOUT,18)
KK2=MIN(15*K,NDIMU)
DO 10 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
10 WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
12 KK1=KK2+1
MODANG=5
IMIT=0
LTYPE=2
CALL SETUP (IPAR,PAR,AG)
EVALUATE THE ATTENUATION FACTORS
CALL EVATN (B)
RECONSTRUCTION OF THE TRANSVERSE SECTION FOR AN EMISSION SCAN
WHICH IS CORRECTED FOR ATTENUATION
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRFA,BRFA,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,26)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE TRANSVERSE SECTION FOR THE
EMISSION SCAN
KK1=1
KU=NDIMU/15+1
DO 16 K=1,KU
WRITE (LUNOUT,18)

```

```

KK2=MIN(15*K,NDIMU)
DO 14 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
14 WRITE (LUNOUT,22) (B(I),I=ISUB1,ISUB2)
16 KK1=KK2+1
CLOSE (LUNOUT)
CLOSE (LUNATN)
18 FORMAT(1X,//////)
20 FORMAT(1X,15F5.3)
22 FORMAT(1X,15F5.1)
24 FORMAT(1X/' RECONSTRUCTION FOR THE TRANSMISSION SCAN')
26 FORMAT(1X/' RECONSTRUCTION FOR THE EMISSION SCAN CORRECTED FOR ',
1 'ATTENUATION')
END
SUBROUTINE GETUM (M,DATA,ERR)
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLE 10
THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
A PHANTOM WITH A CIRCULAR ANNULUS AND A CENTRAL CIRCULAR SOURCE
WHICH IS ATTENUATED BY A CIRCULAR ATTENUATOR.
IF
LTYPE = 1 GETUM RETURNS TRANSMISSION DATA OF THE
ATTENUATOR
LTYPE = 2 GETUM RETURNS ATTENUATED PROJECTION DATA
OF THE SOURCE
DIMENSION DATA(*),ERR(*)
COMMON/TYPE/LTYPE
DIMENSION ITYPE(4),Z(4),X1(4),Y1(4),A1(4),B1(4),PHI(4)
DATA ITYPE/-1,1,1,1/
DATA Z/.075,30,-30,30./
DATA X1/0.,0.,0.,0./
DATA Y1/0.,0.,0.,0./
DATA A1/60.,60.,40.,20./
DATA B1/60.,60.,40.,20./
DATA PHI/0.,0.,0.,0./
DATA ITYPEX,ZX,XX,YY,AX,BX,PHIX/1,.,075,0.,0.,60.,60.,0./
IF (LTYPE.EQ.1) THEN
CALL PHANL (1,ITYPEX,ZX,XX,YY,AX,BX,PHIX,DATA,M)
ELSE
CALL PHANL (4,ITYPE,Z,X1,Y1,A1,B1,PHI,DATA,M)
ENDIF
RETURN
END
SSS EEEEE TTTT U U PPPP
S E T U U P P
SSS EEE T U U PPPP
S E T U U P
SSS EEEEE T UUU P
INTEGER PARAMETER ARRAY (IPAR)
I IPAR(I) DESCRIPTION
1 64 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 1 RECONSTRUCT IN A SQUARE ARRAY
3 0 GEOMETRY FLAG
4 72 PARALLEL BEAM GEOMETRY
5 4 NUMBER OF PROJECTION ANGLES
MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND PI
STARTING AT ZERO
6 100 NUMBER OF RAYS FOR EACH PROJECTION
7 1 TRANSMISSION DATA
8 18000 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 5 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12 3 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE
FLOATING POINT PARAMETER ARRAY (PAR)
I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS
BLANK COMMON REQUIRED 72 ( 110)
BLANK COMMON REQUIRED 144 ( 220)
BLANK COMMON REQUIRED 216 ( 330)
BLANK COMMON REQUIRED 416 ( 640)
BLANK COMMON REQUIRED 480 ( 740)
A TOTAL OF 92 ( 5 THRU 96) OF THE 100 USER PROJECTION BINS WILL BE USED

```


0.4 -0.7 1.2 0.2 0.1 1.1 -0.5 1.2 0.1 0.6 0.5 0.9 0.4 0.5 0.4
-0.1 -0.8 -0.3 -1.1 0.3 0.9 -1.1 0.4 -0.2 -1.0 0.4 0.8 0.2 -0.1 -0.8
1.2 -0.3 0.2 0.1 0.5 0.9 0.1 0.9 -0.2 1.1 -0.2 0.8 0.1 -0.3 0.2
0.2 -1.3 0.1 -1.1 -0.6 -0.7 -0.5 -0.8 -0.9 -0.9 -0.3 -0.6 0.5 0.0 0.0
0.1 -0.9 0.5 -0.6 0.3 -0.1 1.1 0.3 1.4 -0.3 0.2 -0.6 -1.0 -0.3 -0.2
1.1 0.0 0.9 -0.7 -0.1 -1.5 -0.2 -1.7 0.4 0.2 -0.2 0.4 -0.5 -0.9 -1.0
-0.6 -1.5 -0.2 0.1 0.5 -0.5 0.4 0.4 0.3 0.6 0.1 0.7 -0.3 0.3
1.2 0.3 0.9 -0.8 0.3 -1.7 -0.1 0.5 -0.4 0.2 -0.3 -0.2 -0.9 2.5 15.7
0.1 -1.1 -0.2 -0.9 1.4 0.4 -0.6 -0.3 -0.1 -0.5 -0.7 -0.3 4.7 20.1 27.0
0.6 0.2 1.1 -0.9 -0.3 0.2 -0.2 -0.2 -0.5 -0.5 -0.5 7.5 22.2 27.8 29.0
0.5 -1.4 -0.2 -0.3 0.2 -0.2 -0.3 -0.3 -0.7 -0.5 7.4 22.6 26.9 29.1 30.5
0.9 0.4 0.8 -0.6 -0.6 0.4 -0.5 -0.2 -0.3 7.5 22.6 27.7 28.8 29.3 30.8
0.4 -1.1 0.1 0.5 -1.0 -0.5 -1.0 -0.9 4.7 22.2 26.9 28.8 29.9 30.9 31.4
0.5 0.2 -0.3 0.0 -0.3 -0.9 -0.6 2.5 20.1 27.8 29.1 29.3 30.9 31.6 31.3
0.4 -0.8 0.2 0.0 -0.2 -1.0 -0.3 15.7 27.0 29.0 30.5 30.8 31.4 31.3 28.9
0.0 0.1 -0.7 -0.1 -0.5 -0.8 8.8 24.0 28.2 29.0 29.5 29.8 30.1 30.9 29.8
-0.4 0.3 0.2 -0.8 -0.8 2.1 20.8 26.6 29.5 29.9 30.7 30.5 32.5 32.8 28.2
0.8 -0.2 -0.4 -1.1 -0.5 13.5 26.2 29.6 30.1 30.3 30.6 29.7 30.3 31.0 31.3
-0.1 0.3 -0.9 -0.6 3.1 22.6 27.2 29.6 29.6 30.3 30.2 30.9 32.0 29.1 30.3
0.5 -0.1 -1.0 -0.7 12.9 26.6 28.3 28.4 30.1 30.2 31.4 29.5 29.4 32.4 29.6 27.4
-0.7 0.2 -1.0 1.9 22.2 28.5 29.9 29.8 30.1 31.3 31.6 31.5 29.8 29.0 26.2
-0.1 -0.3 -1.1 8.6 25.3 28.6 29.0 29.9 31.0 29.6 30.6 32.4 29.4 27.0 20.9
-0.5 -0.6 -0.2 16.9 28.3 30.4 29.9 30.9 31.5 29.1 31.0 28.5 24.4 14.0
0.2 -0.2 1.9 21.9 26.6 30.0 31.4 30.3 30.1 30.9 29.9 30.4 28.6 20.3 9.9
0.3 -0.5 6.7 25.3 28.5 30.0 29.8 31.1 30.7 29.5 29.8 29.4 26.1 15.4 7.5
-0.2 -0.4 13.1 26.9 28.6 31.5 31.2 30.3 31.5 28.3 29.6 28.6 22.6 11.2 4.6
-0.5 -0.1 17.9 28.5 28.0 31.1 32.8 28.9 31.8 28.8 29.5 31.1 27.8 19.2 8.7 2.9
-0.1 0.3 -1.1 8.6 25.3 28.6 29.0 29.9 31.0 29.6 30.6 32.4 29.4 27.0 20.9
-0.7 0.2 -1.0 1.9 22.2 28.5 29.9 29.8 30.1 31.3 31.6 31.5 29.8 29.0 26.2
0.5 -0.1 -1.0 -0.7 12.9 26.6 28.3 28.4 30.1 30.2 31.4 29.5 29.4 32.4 29.6 27.4
-0.1 0.3 -0.9 -0.6 3.1 22.6 27.2 29.6 29.6 30.3 30.2 30.9 32.0 29.1 30.3
1.5 0.5 -0.4 3.1 12.9 26.6 28.3 28.4 30.1 30.2 31.4 29.5 29.4 32.4 29.6 27.4
0.0 0.3 0.2 -0.8 -0.8 2.1 20.8 26.6 29.5 29.9 30.7 30.5 32.5 32.8 28.2
0.0 0.1 -0.7 -0.3 -0.5 -0.8 8.8 24.0 28.2 29.0 29.5 29.8 30.1 30.9 29.8
0.4 -0.8 0.2 0.0 -0.2 -1.0 -0.3 15.7 27.0 29.0 30.5 30.8 31.4 31.3 28.9
0.5 0.2 -0.3 0.0 -0.3 -0.9 -0.6 2.5 20.1 27.8 29.1 29.3 30.9 31.6 31.3
0.9 0.4 0.8 -0.6 -0.6 0.4 -0.5 -0.2 -0.3 7.5 22.6 27.7 28.8 29.3 30.8
0.5 -1.4 -0.2 -0.3 0.2 -0.2 -0.3 -0.3 -0.7 -0.5 7.4 22.6 26.9 29.1 30.5
0.6 0.2 1.1 -0.9 -0.3 0.2 -0.2 -0.2 -0.5 -0.5 -0.5 7.5 22.2 27.8 29.0
0.1 -1.1 -0.2 -0.9 1.4 0.4 -0.6 -0.3 -0.1 -0.5 -0.7 -0.3 4.7 20.1 27.0
-0.4 -0.3 -0.1 -0.1 0.2 -0.5 -0.9 1.1 0.8 -0.2 -0.1 -0.1 0.8 -0.2 -0.4
-0.5 -1.5 0.1 -0.5 1.1 -0.2 1.6 -0.1 -0.6 -0.2 -0.3 -0.5 -1.0 -0.6 -0.3
1.1 0.0 0.9 -0.7 -0.1 -1.5 -0.2 -1.7 0.4 0.2 -0.2 0.4 -0.5 -0.9 -1.0
0.1 -0.9 0.5 -0.6 0.3 -0.1 1.1 0.3 1.4 -0.3 0.2 -0.6 -1.0 -0.3 -0.2
0.2 -1.3 0.1 -1.1 -0.6 -0.7 -0.5 -0.8 -0.9 -0.9 -0.3 -0.6 0.5 0.0 0.0
-0.7 -1.8 -0.3 -1.3 -0.9 0.0 -1.5 0.3 -1.1 0.2 -1.4 0.4 -1.1 0.2 -0.8
0.4 -0.7 1.2 0.2 0.1 1.1 -0.5 1.2 0.1 0.6 0.5 0.9 0.4 0.5 0.4

-0.7 0.2 -0.4 -0.9 -1.0 -1.0 -1.1 0.2 1.9 6.7 13.1 17.9 20.3 22.4 24.9
0.1 -0.3 -0.2 0.3 -0.1 0.4 -0.1 -0.6 -0.2 -0.5 0.4 -0.1 1.5 3.0 4.2
0.0 0.0 0.8 -0.1 0.5 -0.7 0.1 -0.5 0.2 0.3 -0.2 -0.4 -0.8 -0.5 -0.8

-0.7 -0.4 -0.4 -0.7 -0.8 -0.5 -0.8 -0.4 -0.2 0.3 0.2 -0.5 0.1 -0.7 0.5
5.6 6.5 6.5 5.6 4.2 3.0 1.5 -0.1 -0.4 -0.5 -0.2 -0.6 -0.3 0.2 -0.1
25.7 24.4 24.4 25.7 24.9 22.4 20.3 17.9 13.1 6.7 1.9 0.2 -1.1 -1.0 -1.0
28.8 28.7 28.8 28.8 28.9 28.2 29.2 28.5 26.9 25.3 21.9 16.9 8.6 1.9 -0.7
29.3 30.5 30.5 29.3 30.2 29.5 29.9 28.0 28.6 28.5 26.6 28.0 25.3 22.2 12.9
30.0 29.3 29.3 30.0 31.7 29.2 30.7 31.1 31.5 30.0 30.0 30.4 28.6 28.5 26.3
31.2 32.3 32.3 31.2 30.4 30.9 30.8 32.8 31.2 29.8 31.4 29.7 29.0 29.8 28.4
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
28.1 28.3 28.3 28.1 29.0 29.9 29.9 31.1 29.6 29.8 29.9 29.9 31.0 30.6 31.6 29.5
22.9 22.5 22.5 22.9 24.7 26.2 26.9 27.8 28.6 29.4 30.4 31.0 32.4 31.5 29.4
11.6 10.0 10.0 11.6 10.9 13.6 16.1 19.2 22.6 26.1 28.6 28.5 29.4 29.8 32.4
4.0 3.8 3.8 4.0 4.3 4.9 6.6 8.7 11.2 15.4 20.3 24.4 27.0 29.0 29.6
1.2 1.6 1.6 1.2 1.3 1.7 2.0 2.9 4.6 7.5 9.9 14.0 20.9 26.2 27.4
0.7 0.0 0.0 0.7 -0.4 0.0 0.3 1.1 1.9 2.5 4.5 6.1 10.2 16.9 24.5
0.1 -1.7 -1.7 0.1 -0.7 -0.9 0.3 0.2 -0.4 0.6 1.5 3.3 4.2 8.8 14.7
-1.4 -1.7 -1.7 -1.4 -1.8 0.3 -0.8 -1.3 -1.1 -0.9 0.4 1.4 4.4 7.4
-1.9 -1.2 -1.2 -1.9 -0.1 -0.1 -0.9 -1.3 -1.5 -1.5 0.5 1.3 2.3 3.2
0.6 -0.9 -0.9 0.6 -0.4 -2.2 0.0 -0.6 -1.5 -1.9 -0.8 0.2 -1.5 0.2 2.5
0.3 0.8 0.9 0.3 -0.7 -0.1 -1.3 -1.1 -0.3 -0.8 -0.5 -1.4 -1.1 -0.7 2.5
4.7 7.9 7.9 4.7 3.2 1.8 0.2 -0.7 0.3 0.6 -1.3 -1.5 -1.1 -1.1 -1.5
21.6 21.8 21.8 21.6 17.7 13.2 6.4 3.2 0.5 -0.4 -0.8 -1.4 -1.5 -1.4 0.2
28.8 28.3 28.8 28.8 26.9 25.0 20.6 13.3 3.6 -0.1 -0.4 -0.8 -1.3 -0.5 -0.8
29.2 29.6 29.6 29.2 30.8 32.0 28.0 23.5 16.8 4.6 -0.1 -0.4 0.6 -0.8 -1.9
30.1 30.7 30.7 30.1 32.9 31.9 30.7 27.9 24.1 16.8 3.6 0.5 0.3 -0.3 -1.5
31.4 29.8 29.8 31.4 32.5 29.4 31.9 30.1 27.9 23.5 13.3 3.2 -0.7 -1.1 -0.6
30.4 30.8 30.8 30.4 32.0 29.8 30.7 31.9 30.7 28.0 20.6 6.4 0.2 -1.3 0.0
30.0 33.9 33.9 30.0 31.5 31.5 29.8 29.4 31.9 32.0 20.5 13.2 1.8 -0.1 -2.2
31.7 30.8 30.8 31.7 28.3 31.5 32.0 32.5 32.9 30.8 26.9 17.7 3.2 -0.7 -0.4
31.1 28.5 28.5 33.1 31.7 30.0 30.4 31.4 30.1 29.2 28.6 21.6 4.7 0.3 0.6
28.5 29.8 29.8 28.5 30.8 33.9 30.8 29.8 30.7 29.6 28.3 21.8 7.9 0.8 -0.9
28.5 29.7 29.7 28.5 30.3 31.9 30.8 29.9 30.1 29.6 28.3 21.9 8.7 -0.8 -0.7
31.1 28.5 28.5 33.1 31.7 30.0 30.4 31.4 30.1 29.2 28.8 21.6 4.7 0.3 0.6
31.7 30.8 30.8 31.7 28.3 31.5 32.0 32.5 32.9 30.8 26.9 17.7 3.2 -0.7 -0.4
30.0 33.9 33.9 30.0 31.5 31.5 29.8 29.4 31.9 32.0 20.5 13.2 1.8 -0.1 -2.2
30.4 30.8 30.8 30.4 32.0 29.8 30.7 31.9 30.7 28.0 20.6 6.4 0.2 -1.3 0.0
30.4 29.9 29.9 31.4 32.5 29.4 31.9 30.1 27.9 23.5 13.3 3.2 -0.7 -1.1 -0.6
30.1 30.7 30.7 30.1 32.9 31.9 30.7 27.9 24.1 16.8 3.6 0.5 0.3 -0.3 -1.5
29.2 29.6 29.6 29.2 30.8 32.0 28.0 23.5 16.8 4.6 -0.1 -0.4 0.6 -0.8 -1.9
28.8 28.3 28.3 28.8 26.9 25.0 20.6 13.3 3.6 -0.1 -0.4 -0.8 -1.3 -0.5 -0.8
21.6 21.8 21.8 21.6 17.7 13.2 6.4 3.2 0.5 -0.4 -0.8 -1.4 -1.5 -1.4 0.2
4.7 7.9 7.9 4.7 3.2 1.8 0.2 -0.7 0.3 0.6 -1.3 -1.5 -1.1 -1.1 -1.5
0.3 0.9 0.8 0.3 -0.7 -0.1 -1.3 -1.1 -0.3 -0.8 -0.5 -1.4 -1.1 -0.7 0.2
0.6 -0.9 -0.9 0.6 -0.4 -2.2 0.0 -0.6 -1.5 -1.9 -0.8 0.2 -1.5 0.2 2.5
-1.9 -1.2 -1.2 -1.9 -0.1 -0.1 -0.9 -1.3 -1.5 -1.5 -0.5 0.5 1.3 2.3 3.2
-1.4 -1.7 -1.7 -1.4 -1.8 0.3 -0.8 -1.3 -1.1 -0.8 -0.4 0.4 3.0 4.4 7.4
-1.2 -1.9 -1.9 -1.2 -1.7 0.3 -0.8 -1.3 -1.1 -0.7 0.3 1.5 2.7 4.5 7.7
0.7 0.0 0.0 0.7 -0.4 0.0 0.3 1.1 1.9 2.5 4.5 6.1 10.2 16.9 24.5
1.2 1.6 1.6 1.2 1.3 1.7 2.0 2.9 4.6 7.5 9.9 14.0 20.9 26.2 27.4
4.0 3.8 3.8 4.0 4.3 4.9 6.6 8.7 11.2 15.4 20.3 24.4 27.0 29.0 29.6
11.6 10.0 10.0 11.6 10.9 13.6 16.1 19.2 22.6 26.1 28.6 28.5 29.4 29.8 32.4
22.9 22.5 22.5 22.9 24.7 26.2 26.9 27.8 28.6 29.4 30.4 31.0 32.4 31.5 29.4
28.1 28.3 28.3 28.1 29.0 29.9 29.9 31.1 29.6 29.8 29.9 29.9 31.0 30.6 31.6 29.5
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
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28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
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29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
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29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
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30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
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29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
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28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
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29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28.3 29.5 30.9 31.5 29.6 31.3 31.4
29.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
30.9 31.7 31.7 30.9 31.3 31.1 30.1 29.9 30.3 31.1 30.3 29.9 29.9 29.8 30.1
28.8 28.6 28.6 28.9 28.6 29.2 30.0 31.8 31.5 30.7 30.1 30.9 31.0 30.1 30.2
29.8 29.5 29.5 29.8 29.3 29.1 29.4 28.5 28

30.9 29.7 30.5 29.8 30.8 29.3 28.8 27.7 22.6 7.5 -0.3 -0.2 -0.5 0.4 -0.6
30.2 30.6 30.7 29.5 30.5 29.1 26.9 22.6 7.4 -0.5 -0.7 -0.3 -0.3 -0.2 0.2
30.3 30.3 29.9 29.0 29.0 27.8 22.2 7.5 -0.5 -0.5 -0.5 0.2 -0.2 0.2 -0.3
29.6 30.1 29.5 28.2 27.0 20.1 4.7 -0.3 -0.7 -0.5 -0.1 -0.3 -0.6 0.4 1.4
29.6 29.6 26.6 24.0 15.7 2.5 -0.9 -0.2 -0.3 0.2 -0.3 0.5 -0.1 -1.7 0.3
27.2 26.2 20.8 8.8 -0.3 -0.6 -1.0 -0.5 -0.3 -0.2 -0.6 -0.1 1.6 -0.2 1.1
22.6 13.5 2.1 -0.8 -1.0 -0.9 -0.5 0.4 -0.2 0.2 0.4 -1.7 -0.2 -1.5 -0.1
3.1 -0.5 -0.8 -0.5 -0.2 -0.3 -1.0 -0.6 0.2 -0.3 1.4 0.3 1.1 -0.1 0.3
-0.6 -1.1 -0.3 0.0 0.0 0.5 -0.6 -0.3 -0.9 -0.9 -0.8 -0.5 -0.7 -0.6
-0.9 -0.4 0.2 -0.7 0.2 -0.3 0.1 0.8 -0.2 1.1 -0.2 0.9 0.1 0.9 0.5
0.3 -0.2 -0.3 0.1 -0.8 0.2 -1.1 0.4 -1.4 0.2 -1.1 0.3 -1.5 0.0 -0.9
-0.1 0.8 0.0 0.0 0.4 0.5 0.4 0.9 0.5 0.6 0.1 1.2 -0.5 1.1 0.1

0.2 1.2 -0.7 0.4
-1.3 -0.3 -1.8 -0.7
0.1 1.2 -0.3 1.2
-1.1 0.1 -1.3 0.2
-0.6 0.5 -0.9 0.1
-0.7 0.9 0.0 1.1
-0.5 0.1 -1.5 -0.5
-0.8 0.9 0.3 1.2
-0.9 -0.2 -1.1 0.1
-0.9 1.1 0.2 0.6
-0.3 -0.2 -1.4 0.5
-0.6 0.8 0.4 0.9
0.5 0.1 -1.1 0.4
0.0 -0.3 0.2 0.5
0.0 0.2 -0.8 0.4
-0.3 -0.7 0.1 0.0
-0.8 0.2 -0.3 0.0
-1.1 -0.4 -0.2 0.8
-0.6 -0.9 0.3 -0.1
-0.7 -1.0 -0.1 0.5
1.9 -1.0 0.2 -0.7
8.6 -1.1 -0.3 0.1
16.9 0.2 -0.6 -0.5
21.9 1.9 -0.2 0.2
25.3 6.7 -0.5 0.3
26.9 13.1 -0.4 -0.2
28.5 17.9 -0.1 -0.4
29.2 20.3 1.5 -0.8
28.2 22.4 3.0 -0.5
28.9 24.9 4.2 -0.8
28.8 25.7 5.6 -0.7
28.7 24.4 6.5 -0.4
28.7 24.4 6.5 -0.4
28.8 25.7 5.6 -0.7
28.9 24.9 4.2 -0.8
28.2 22.4 3.0 -0.5
29.2 20.3 1.5 -0.8
28.5 17.9 -0.1 -0.4
26.9 13.1 -0.4 -0.2
25.3 6.7 -0.5 0.3
21.9 1.9 -0.2 0.2
16.9 0.2 -0.6 -0.5
8.6 -1.1 -0.3 0.1
1.9 -1.0 0.2 -0.7
-0.7 -1.0 -0.1 0.5
-0.6 -0.9 0.3 -0.1
-1.1 -0.4 -0.2 0.8
-0.8 0.2 -0.3 0.0
-0.3 -0.7 0.1 0.0
0.0 0.2 -0.8 0.4
0.0 -0.3 0.2 0.5
0.5 0.1 -1.1 0.4
-0.6 0.8 0.4 0.9
-0.3 -0.2 -1.4 0.5
-0.9 1.1 0.2 0.6
-0.9 -0.2 -1.1 0.1
-0.8 0.9 0.3 1.2
-0.5 0.1 -1.5 -0.5
-0.7 0.9 0.0 1.1
-0.6 0.5 -0.9 0.1
-1.1 0.1 -1.3 0.2
0.1 1.2 -0.3 1.2
-1.3 -0.3 -1.8 -0.7
0.2 1.2 -0.7 0.4

EX11

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PROGRAM XATENU
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
*   RECLBL   --   DP VERSION 2.0   --   JULY91   *
*****
EXAMPLES 11 AND 12
      THE PROGRAM XATENU RECONSTRUCTS ATTENUATED DATA ASSUMING
      A CONSTANT ATTENUATION COEFFICIENT AND USING ATTENUATION
      FACTORS WHICH ARE EVALUATED AFTER DETERMINING THE BOUNDARY OF
      THE OBJECT BY AN APPROXIMATED RECONSTRUCTION.
DIMENSION B(4096),AG(72)
COMMON/BLANK/WORK(18000)
COMMON/OUTCOM/LUNOUT,I80132
      LUNOUT - OUTPUT FILE
      I80132 - OUTPUT LINE LENGTH FLAG
      =0   EACH LINE WILL BE WITHIN 80 CHARACTERS
      (OTHERWISE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1 (NANG ,IPAR( 4)),(MODANG ,IPAR( 5)),(KDIMU ,IPAR( 6)),
2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT ,IPAR( 9)),
3 (ISTORE ,IPAR(10)),(IPRINT ,IPAR(11)),(LUNATN ,IPAR(12)),
4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
5 (CATN ,PAR( 4))
EXTERNAL BRP,PRF,BRFA,PRFA
LUNOUT=2
I80132=0
      THE INPUT PARAMETERS ARE
NDIMU=64
ICIR=1
IGEOM=0
NANG=72
MODANG=5
KDIMU=100
IMIT=0
NWORK=18000
NFLOAT=2
ISTORE=0
IPRINT=5
LUNATN=3
PWID=1
AXISU=50.5
RFAN=0.
CATN=0.
      OPEN OUTPUT FILE AND SCRATCH FILE FOR ATTENUATION FACTORS
OPEN (LUNOUT,FILE='E11.OUT',FORM='FORMATTED')
OPEN (LUNATN,FILE='E11.TMP',FORM='UNFORMATTED',STATUS='SCRATCH')
CALL SETUP (IPAR,PAR,AG)
      RECONSTRUCTION OF THE TRANSVERSE SECTION WITH NO CORRECTION
      FOR ATTENUATION
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRF,BRF,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,22)
CALL ARRAY (B,NDIMU)
      PRINTOUT THE VALUES FOR THE APPROXIMATED RECONSTRUCTION
NMAT=NDIMU**2
KK1=1
KU=NDIMU/15+1
DO 12 K=1,KU
      WRITE (LUNOUT,18)
      KK2=MIN(15*K,NDIMU)
      DO 10 J=1,NDIMU
          ISUB1=NMAT-J*NDIMU+KK1
          ISUB2=NMAT-J*NDIMU+KK2
10      WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
12      KK1=KK2+1
      EVALUATE THE ATTENUATION FACTORS ASSUMING A CONSTANT
      ATTENUATION COEFFICIENT
XLEV=3.5
ATENL=.075
CALL EVATU (B,XLEV,ATENL)
      RECONSTRUCTION OF THE TRANSVERSE SECTIONS FOR AN EMISSION SCAN
      WHICH IS CORRECTED FOR ATTENUATION
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRFA,BRFA,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,24)
CALL ARRAY (B,NDIMU)
      PRINTOUT THE VALUES FOR THE CORRECTED RECONSTRUCTION
KK1=1
KU=NDIMU/15+1
DO 16 K=1,KU
      WRITE (LUNOUT,18)
      KK2=MIN(15*K,NDIMU)
      DO 14 J=1,NDIMU
  
```

```

ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
14      KK1=KK2+1
CLOSE (LUNOUT)
CLOSE (LUNATN)
*****
18 FORMAT(LX,//////)
20 FORMAT(LX,15F5.1)
22 FORMAT(LX,/' THE APPROXIMATED RECONSTRUCTION FOR AN EMISSION SCA',
1 'B')
24 FORMAT(LX,/' RECONSTRUCTION FOR THE EMISSION SCAN CORRECTED FOR ',
1 'ATTENUATION')
END
SUBROUTINE GETUM (M,DATA,ERR)
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
*   RECLBL   --   DP VERSION 2.0   --   JULY91   *
*****
EXAMPLE 11
      THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
      AN ELLIPTICAL SOURCE PHANTOM AND ELLIPTICAL ATTENUATOR OF THE
      SAME SIZE.
DIMENSION DATA(*),ERR(*)
DIMENSION ITYPE(2),Z(2),X1(2),Y1(2),A1(2),B1(2),PHI(2)
DATA ITYPE/1,-1/
DATA Z/30.,.075/
DATA X1/0.,0./
DATA Y1/0.,0./
DATA A1/40.,40./
DATA B1/60.,60./
DATA PHI/0.,0./
CALL PHANL (2,ITYPE,Z,X1,Y1,A1,B1,PHI,DATA,M)
RETURN
END
SSS EEEEE TTTT U U PPPP
S E E T U U P P P
SSS EEE T U U PPPP
S E T U U P P
SSS EEEEE T UUU P
INTEGER PARAMETER ARRAY (IPAR)
I IPAR(I) DESCRIPTION
1 64 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 1 RECONSTRUCT IN A SQUARE ARRAY
3 0 GEOMETRY FLAG
4 72 PARALLEL BEAM GEOMETRY
5 5 NUMBER OF PROJECTION ANGLES
MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND 2*PI
STARTING AT ZERO
6 100 NUMBER OF RAYS FOR EACH PROJECTION
7 0 EMISSION DATA
8 18000 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 5 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12 3 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE
FLOATING POINT PARAMETER ARRAY (PAR)
I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS
BLANK COMMON REQUIRED 72 ( 110)
BLANK COMMON REQUIRED 144 ( 220)
BLANK COMMON REQUIRED 216 ( 330)
BLANK COMMON REQUIRED 416 ( 640)
BLANK COMMON REQUIRED 480 ( 740)
A TOTAL OF 92 ( 5 THRU 96) OF THE 100 USER PROJECTION BINS WILL BE USED
92 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 480 FLOATING POINT WORDS.
EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN ND D S E T U U P P P
EEE N N D D SSS EEE T U U PPPP
E N NN D D S E T U U P P
EEEE N N DDDD SSS EEEEE T UUU P
  
```


9.6 9.3 8.0 7.5 7.4 6.5 6.6 6.4 6.1 5.9 5.7 5.7 5.7 5.6 5.8
10.2 8.7 8.0 7.8 7.1 6.5 6.8 6.3 6.0 5.8 5.8 5.6 5.7 5.9 5.5
10.2 8.7 8.0 7.8 7.1 6.5 6.8 6.3 6.0 5.8 5.8 5.6 5.7 5.9 5.5
9.9 9.3 8.0 7.7 7.4 6.3 6.6 6.3 6.2 6.2 6.1 6.0 5.9 5.8 5.4
9.9 8.7 8.7 8.2 7.2 6.7 6.6 6.5 6.3 6.4 6.1 5.6 5.5 5.7 5.7
10.8 9.4 8.9 7.9 7.1 7.0 6.4 6.3 6.0 6.1 6.1 6.0 5.8 5.4 5.9
10.3 8.9 8.3 7.8 7.4 7.0 6.3 7.0 6.4 6.1 5.9 5.8 6.0 5.5 5.9
10.7 9.3 8.8 7.8 7.2 7.2 6.9 6.9 6.1 6.1 6.1 6.3 6.7 6.0 6.1
11.1 10.0 9.1 8.2 7.5 7.3 7.1 6.6 6.2 6.1 6.0 6.0 5.9 6.1 5.9
11.0 10.0 8.9 8.4 8.0 7.5 7.0 6.8 7.2 6.2 5.9 6.2 5.8 6.0 5.8
11.4 10.6 9.2 8.4 7.7 7.3 7.0 6.5 6.7 6.4 6.5 6.6 6.0 6.1 5.9
11.4 10.5 9.8 9.0 8.0 7.5 7.0 6.9 6.7 6.7 6.4 5.8 5.9 6.2 6.0
12.5 11.5 9.8 9.0 8.5 7.9 7.3 7.0 7.1 6.8 6.5 6.3 6.2 6.0 5.6
12.8 11.8 10.5 9.1 8.7 8.2 7.5 7.1 7.2 6.7 6.4 6.5 6.3 6.2 6.4
13.5 11.8 10.6 9.6 8.7 8.3 8.0 7.4 7.2 7.0 6.6 6.5 6.6 6.9 6.4
14.1 13.0 11.2 10.0 9.5 8.6 8.4 7.7 7.3 7.4 7.0 6.7 7.0 6.9 6.3
13.2 13.7 12.2 10.4 10.0 9.4 8.4 8.3 7.7 7.6 6.9 6.7 7.1 6.4 6.9
12.0 14.0 12.9 11.4 10.1 9.5 8.5 8.1 7.7 7.7 7.4 7.2 7.4 6.7 6.7
7.7 13.1 13.5 12.3 10.6 10.0 9.2 8.7 8.4 8.5 7.8 7.1 7.3 7.2 7.1
4.8 12.5 14.2 12.6 11.7 10.7 9.8 8.8 8.7 8.4 8.0 7.8 7.6 7.3 7.1
2.2 7.5 13.8 13.8 13.1 11.1 10.5 9.7 9.6 8.8 8.1 8.1 8.0 7.9 7.3
1.0 2.5 11.0 14.0 13.1 12.4 11.8 10.4 10.0 9.3 8.9 8.6 8.2 8.6 8.0
0.2 1.7 4.7 12.5 13.6 13.3 12.0 10.6 10.4 9.8 9.3 9.3 8.9 8.8 8.5
0.3 1.5 1.0 8.2 13.4 14.4 14.4 12.6 12.1 11.5 10.4 9.5 9.3 9.2 8.9 8.9
-1.4 1.1 0.7 2.7 9.2 13.6 14.3 13.1 11.8 11.3 11.4 10.7 9.8 9.5 9.1
-0.5 0.2 -0.2 0.4 4.3 9.0 13.6 14.1 13.3 12.4 11.9 11.2 10.5 10.5 10.3
-1.2 -0.2 0.9 -0.6 0.3 4.4 8.4 13.7 14.8 13.3 13.1 13.2 11.8 11.3 11.2
-0.4 -1.1 -0.1 -0.3 1.4 14.1 14.1 14.1 14.1 14.1 14.1 14.1 14.1 14.1 14.1
-0.2 -0.6 0.0 -0.4 -1.4 -1.0 0.1 2.4 4.0 10.9 14.1 14.0 14.4 13.4 13.8
-0.4 -1.0 -0.5 0.0 -1.3 -0.5 0.2 0.6 0.9 0.9 6.5 11.5 13.7 14.0 14.2
-0.3 -1.6 -0.7 -0.6 -1.3 -1.0 -0.6 -0.2 0.3 -0.2 2.3 6.0 8.2 11.1
-0.7 -2.2 -1.1 -1.0 -1.1 -2.2 -1.9 -1.4 -1.3 -1.2 -1.1 -2.0 -1.2 0.9 1.4
-0.6 -2.0 -1.1 -1.0 -1.5 -2.2 -2.4 -2.2 -2.1 -1.8 -1.7 -2.3 -3.6 -3.4 -2.2

-1.7 -2.6 -2.6 -1.7 -2.2 -3.4 -3.6 -2.3 -1.7 -1.8 -2.1 -2.2 -2.4 -2.8 -1.5
1.6 2.5 2.7 1.6 1.4 0.9 -1.2 -2.0 -1.1 1.4 2.2 -1.4 -1.9 2.2 7.1
12.6 12.5 12.5 12.6 11.1 8.2 6.0 2.3 -0.2 0.3 -0.2 -0.6 -1.0 -1.3 -1.3
14.2 13.9 13.9 14.2 14.2 14.0 13.7 11.5 6.5 0.9 0.9 0.6 0.2 -0.5 -1.3
12.9 13.3 13.3 12.9 13.8 13.4 14.4 14.0 14.1 10.9 4.0 2.4 0.1 -1.0 -1.4
11.9 11.6 11.6 11.9 12.7 12.1 12.9 14.1 14.7 14.6 13.3 7.0 3.6 1.1 -0.7
11.4 13.4 11.4 13.0 13.2 11.3 13.2 14.1 14.1 13.3 14.8 13.7 8.4 6.4 0.3
10.1 10.3 10.3 10.1 10.3 10.5 10.5 11.2 11.9 12.4 13.3 14.1 13.6 9.0 4.3
9.1 9.0 9.0 9.1 9.1 9.5 9.8 10.7 11.4 11.3 11.8 13.1 14.3 13.6 9.2
8.9 8.8 8.8 8.9 8.9 8.9 9.2 9.3 9.5 10.4 11.5 12.1 12.6 14.4 13.4
8.2 8.2 8.2 8.2 8.5 8.8 8.9 9.3 9.3 9.8 10.4 10.6 12.0 13.3 13.6
7.7 7.8 7.8 7.8 8.5 8.9 9.3 10.1 10.1 10.1 10.1 10.1 10.1 10.1 10.1
7.8 7.5 7.5 7.8 7.3 7.9 8.0 8.1 8.1 8.8 9.6 9.7 10.5 11.1 13.1
7.5 7.3 7.3 7.5 7.1 7.3 7.6 7.8 8.0 8.4 8.7 8.8 9.8 10.7 11.7
6.7 7.2 7.2 6.7 7.1 7.2 7.3 7.1 7.8 8.5 8.4 8.7 9.2 10.0 10.6
6.6 7.0 7.0 6.6 6.7 6.7 7.4 7.2 7.4 7.7 7.7 8.1 8.5 9.5 10.1
6.6 6.5 6.5 6.6 6.6 6.9 7.6 7.6 7.6 7.6 7.6 7.6 7.6 7.6 7.6
6.3 6.3 6.3 6.3 6.3 6.9 7.0 6.7 7.0 7.4 7.3 7.7 8.4 8.6 9.5
6.2 6.5 6.5 6.2 6.4 6.9 6.6 6.5 6.6 7.0 7.2 7.4 8.0 8.3 8.7
6.3 6.0 6.0 6.3 6.4 6.2 6.3 6.5 6.4 6.7 7.2 7.1 7.5 8.2 8.7
5.8 5.9 5.9 5.8 5.6 6.0 6.2 6.3 6.5 6.8 7.1 7.0 7.3 7.9 8.5
6.3 6.2 6.2 6.6 6.0 6.2 5.9 5.8 6.4 6.7 6.7 6.9 7.0 7.5 8.0
6.0 5.9 5.9 6.0 5.9 6.1 6.0 6.6 6.5 6.4 6.7 6.5 7.0 7.3 7.7
5.9 5.7 5.7 5.9 5.8 6.0 5.8 6.2 5.9 6.2 7.2 6.8 7.0 7.5 8.0
5.6 5.6 5.6 5.6 5.9 6.1 5.9 6.0 6.0 6.1 6.2 6.6 7.1 7.3 7.5
5.6 5.7 5.7 5.6 6.1 6.0 5.9 5.8 6.1 6.1 6.0 6.9 6.9 7.2 7.2
5.6 5.5 5.5 5.6 5.9 5.5 6.0 5.8 5.9 6.1 6.4 7.0 6.3 7.0 7.4
5.6 5.6 5.6 5.6 5.9 5.4 5.8 6.0 6.1 6.1 6.0 6.3 6.4 7.0 7.1
5.5 5.8 5.8 5.5 5.7 5.7 5.5 5.6 6.1 6.4 6.3 6.5 6.6 6.7 7.2
5.8 5.6 5.6 5.8 5.4 5.8 5.9 6.0 6.1 6.2 6.2 6.3 6.6 6.3 7.4
6.0 5.4 5.4 6.0 5.8 5.6 5.7 5.7 5.7 5.9 6.1 6.4 6.6 6.5 7.4
13.3 13.4 13.4 13.0 13.2 11.3 13.2 14.1 14.1 13.3 14.8 13.7 8.4 6.4 0.3
5.3 5.4 5.4 5.3 5.5 5.9 5.7 5.6 5.8 5.8 6.0 6.3 6.8 6.5 7.1
6.0 5.4 5.4 6.0 5.8 5.6 5.7 5.7 5.7 5.9 6.1 6.4 6.6 6.5 7.4
5.8 5.6 5.6 5.8 5.4 5.8 5.9 6.0 6.1 6.2 6.2 6.3 6.6 6.3 7.4
5.5 5.8 5.8 5.5 5.7 5.7 5.5 5.6 6.1 6.4 6.3 6.5 6.6 6.7 7.2
5.6 5.5 5.5 5.6 5.9 5.5 6.0 5.8 5.9 6.1 6.4 7.0 6.3 7.0 7.4
5.6 5.5 5.5 5.6 5.9 5.5 6.0 5.8 5.9 6.1 6.4 7.0 6.3 7.0 7.4
5.6 5.7 5.7 5.6 6.1 6.0 5.9 5.8 6.1 6.1 6.0 6.9 6.9 7.2 7.2
5.6 5.6 5.6 5.6 5.9 6.1 5.9 6.0 6.0 6.1 6.2 6.6 7.1 7.3 7.5
5.9 5.7 5.7 5.9 5.8 6.0 5.8 6.2 5.9 6.2 7.2 6.8 7.0 7.5 8.0
6.5 5.9 5.9 6.5 6.4 6.9 6.5 6.4 6.7 6.5 7.0 7.3 7.7 7.7
6.0 6.2 6.2 6.0 6.0 6.2 5.9 5.8 6.4 6.7 6.7 6.9 7.0 7.5 8.0
5.8 5.9 5.9 5.8 5.6 6.0 6.2 6.3 6.5 6.8 7.1 7.0 7.3 7.9 8.5
6.3 6.0 6.0 6.3 6.4 6.2 6.3 6.5 6.4 6.7 7.2 7.1 7.5 8.2 8.7
6.2 6.5 6.5 6.2 6.4 6.9 6.6 6.5 6.6 7.0 7.2 7.4 8.0 8.3 8.7
6.8 6.4 6.4 6.8 6.9 6.7 7.4 7.4 7.7 7.4 7.7 8.3 8.4 9.4 10.0
6.8 6.4 6.4 6.8 6.9 6.7 7.4 7.4 7.7 7.4 7.7 8.3 8.4 9.4 10.0
6.6 7.0 7.0 6.6 6.7 6.7 7.4 7.2 7.4 7.7 7.7 8.1 8.5 9.5 10.1
6.7 7.2 7.2 6.7 7.1 7.2 7.3 7.1 7.8 8.5 8.4 8.7 9.2 10.0 10.6
7.5 7.3 7.3 7.5 7.1 7.3 7.6 7.8 8.0 8.4 8.7 8.8 9.8 10.7 11.7
7.1 7.8 7.8 7.8 8.5 8.6 8.2 8.6 8.9 9.3 10.0 10.4 11.8 12.4 13.1
7.8 7.8 7.8 7.8 8.0 8.6 8.2 8.6 8.9 9.3 10.0 10.4 11.8 12.4 13.1
8.2 8.2 8.2 8.2 8.5 8.8 8.9 9.3 9.3 9.8 10.4 10.6 12.0 13.3 13.6
8.9 8.8 8.8 8.9 8.9 8.9 9.2 9.3 9.5 10.4 11.5 12.1 12.6 14.4 13.4
9.1 9.0 9.0 9.1 9.1 9.5 9.8 10.7 11.4 11.3 11.8 13.1 14.3 13.6 9.2
10.1 10.3 10.3 10.1 10.3 10.5 10.5 11.2 11.9 12.4 13.3 14.1 13.6 9.0 4.3
11.0 11.4 11.4 11.0 11.2 11.3 11.8 13.2 13.1 13.3 14.8 13.7 8.4 4.4 0.3
11.9 11.6 11.6 11.9 12.7 12.1 12.9 14.1 14.7 14.6 13.3 7.0 3.6 1.1 -0.7
12.9 13.3 13.3 12.9 13.8 13.4 14.4 14.0 14.1 10.9 4.0 2.4 0.1 -1.0 -1.4
14.2 13.9 13.9 14.2 14.2 14.0 13.7 11.5 6.5 0.9 0.9 0.6 0.2 -0.5 -1.3
12.6 12.5 12.5 12.6 11.1 8.2 6.0 2.3 -0.2 0.3 -0.2 -0.6 -1.0 -1.3 -1.3
1.6 2.5 2.5 1.6 1.4 0.9 -1.2 -2.0 -1.1 -1.2 -1.3 -1.4 -1.9 -2.2 -1.1
-1.7 -2.6 -2.6 -1.7 -2.2 -3.4 -3.6 -2.3 -1.7 -1.8 -2.1 -2.2 -2.4 -2.8 -1.5

9.0 9.8 10.5 11.4 13.4 11.0 4.3 2.7 1.5 0.3 1.5 1.1 0.4 0.0 1.1
8.4 9.2 10.6 11.4 13.3 12.1 5.5 2.5 1.3 0.9 1.3 1.3 1.1 -0.9 1.3
8.4 9.9 10.0 11.0 12.9 13.2 7.3 2.6 1.6 0.8 1.3 0.8 0.8 0.7 0.6
8.2 9.1 10.5 11.1 13.1 13.9 8.4 3.0 1.3 1.0 1.9 1.4 0.2 1.2 1.4
7.8 8.8 9.3 10.7 12.2 13.8 10.0 2.8 0.9 1.6 1.5 1.3 0.4 1.6 0.6
7.8 8.3 8.9 10.3 11.4 13.8 11.2 3.8 1.4 1.6 1.7 0.5 1.0 1.7 0.6
7.9 8.9 9.4 10.8 11.6 13.5 12.0 4.7 1.1 1.9 1.6 0.0 1.6 0.8 1.1
8.2 8.7 8.7 9.9 11.4 13.0 12.7 5.7 0.7 2.2 0.8 0.8 1.4 0.7 1.2
7.7 8.0 9.3 9.9 11.4 12.7 12.6 5.0 1.6 2.3 0.2 1.6 0.7 1.2 1.9
7.5 8.0 9.3 9.6 10.7 13.3 14.1 4.2 2.9 1.2 0.7 1.5 0.9 1.4 1.3
7.8 8.0 8.7 10.2 11.3 13.0 13.7 4.1 3.5 0.4 1.4 0.8 1.5 1.2 0.8
7.8 8.0 8.7 10.2 11.3 13.0 13.7 4.1 3.5 0.4 1.4 0.8 1.5 1.2 0.8
7.5 8.0 9.3 9.6 10.7 13.3 14.1 4.2 2.9 1.2 0.7 1.5 0.9 1.4 1.3
7.7 8.0 9.3 9.9 11.4 12.7 12.6 5.0 1.6 2.3 0.2 1.6 0.7 1.2 1.9
8.2 8.7 8.7 9.9 11.4 13.0 12.7 5.7 0.7 2.2 0.8 0.8 1.4 0.7 1.2
7.9 8.9 9.4 10.8 11.6 13.5 12.0 4.7 1.1 1.9 1.6 0.0 1.6 0.8 1.1
7.8 8.3 8.9 10.3 11.4 13.8 11.2 3.8 1.4 1.6 1.7 0.5 1.0 1.7 0.6
7.8 8.8 9.3 10.7 12.2 13.8 10.0 2.8 0.9 1.6 1.5 1.3 0.4 1.6 0.6
8.2 9.1 10.0 11.1 13.1 13.9 8.4 3.0 1.3 1.0 1.9 1.4 0.2 1.2 1.4
8.4 8.9 10.0 11.0 12.9 13.2 7.3 2.6 1.6 0.8 1.8 0.8 0.8 0.7 0.6
8.4 9.2 10.6 11.4 13.3 12.1 5.5 2.5 1.3 0.9 1.3 1.3 1.1 -0.9 1.3
9.0 9.8 10.5 11.4 13.4 11.0 4.3 2.7 1.5 0.3 1.5 1.1 0.4 0.0 1.1
9.0 9.8 11.5 12.5 13.8 9.2 3.4 2.1 1.3 0.9 0.9 0.4 0.8 0.9 -0.4
9.1 10.5 11.8 12.8 13.0 6.9 2.9 1.7 1.0 0.7 -0.2 1.5 0.6 0.7 0.0
9.6 10.6 11.8 13.5 12.3 4.7 2.6 1.3 0.9 0.0 0.5 1.0 0.4 1.6 0.4
10.0 11.2 13.0 14.1 9.6 3.7 1.8 1.2 -0.1 1.1 -0.5 0.9 1.4 0.7 0.4
10.4 12.2 13.7 13.2 6.2 2.7 1.8 0.0 0.9 0.5 0.3 1.1 1.0 0.4 1.5
11.4 12.9 14.0 12.0 4.2 1.8 0.5 0.6 0.1 1.1 -0.1 0.3 1.4 0.8 1.5
12.3 13.1 12.7 11.7 2.1 0.5 0.9 0.2 1.2 0.4 0.1 0.7 1.4 0.6 1.0
12.6 14.2 12.5 4.8 0.2 0.6 0.8 0.5 0.6 0.6 0.8 0.0 1.0 0.7 -0.5
13.8 13.8 7.5 2.2 -0.2 0.5 0.8 0.1 1.2 0.3 0.8 -0.7 0.1 0.6 0.1
14.0 11.0 2.5 1.0 0.6 0.2 1.1 0.5 0.8 -0.7 0.3 -0.8 0.8 1.4 0.7
12.5 4.7 1.7 0.2 0.6 0.7 0.6 -0.6 0.3 -0.6 1.2 0.0 0.8 0.9 0.2
12.7 1.6 1.3 2.6 0.5 -0.8 0.2 -0.2 1.4 -0.2 0.7 -0.3 0.2 1.2 0.7
2.7 0.7 1.1 -1.4 0.1 -0.3 1.1 0.0 0.8 -0.2 0.4 -0.3 -0.8 0.1 0.5
0.4 -0.2 0.2 -0.5 0.8 -0.5 0.5 -0.5 0.3 -1.0 -0.1 0.2 -0.4 0.7 1.2
-0.6 0.9 -0.2 -1.2 -0.2 -1.2 0.0 -0.6 0.7 0.0 0.2 0.8 -0.5 0.5 0.9
-1.2 -0.6 -1.1 -0.8 -0.1 -0.4 0.7 -0.3 0.6 0.1 0.0 0.7 -1.1 0.0 0.7
-1.2 -0.6 -1.1 -0.8 -0.1 -0.4 0.7 -0.3 0.6 0.1 0.0 0.7 -1.1 0.0 0.7
0.0 -0.5 -1.0 -0.4 0.0 -0.4 0.2 -0.8 0.1 -0.2 -0.8 0.4 -0.6 -0.6 0.3
-0.6 -0.7 -1.6 -0.3 -0.5 -0.4 0.5 -0.8 0.3 0.3 -0.5 0.6 0.1 -0.4 0.5
-1.0 -1.1 -2.2 -0.7 -1.3 -1.0 -0.1 -1.3 -0.4 -0.2 -1.1 -0.2 -0.2 -1.2 -0.4
-1.4 -1.1 -2.0 -0.6 -1.3 -0.7 0.0 -1.0 0.1 0.4 -0.8 0.2 0.6 -1.0 0.1

1.0 1.2 0.2 0.5
0.3 0.3 -0.8 0.0
1.1 0.1 0.2 1.0
0.7 0.1 0.2 1.0
0.9 -0.3 0.4 1.0
0.8 0.0 1.1 1.4
0.4 0.1 0.8 0.4
1.8 0.9 1.6 1.7
0.1 1.4 1.7 1.8
1.4 1.5 0.5 1.9
1.3 1.8 1.0 1.4
1.1 0.3 1.6 2.8
1.2 1.9 0.8 1.3
0.3 1.7 1.6 1.1
-0.5 1.3 2.2 1.4
1.2 0.7 1.2 2.6
1.4 1.8 0.3 2.2
1.8 0.9 1.8 1.3
1.4 1.0 1.7 2.4
0.6 1.8 1.9 1.7
1.0 1.8 1.6 2.0
1.6 1.0 1.7 2.6
1.6 1.0 1.7 2.6
1.0 1.8 1.6 2.0
0.6 1.8 1.9 1.7
1.4 1.0 1.7 2.4
1.8 0.8 1.8 1.3
1.2 1.9 0.8 1.3
1.2 0.7 1.2 2.6
-0.5 1.3 2.2 1.4
0.3 1.7 1.6 1.1
1.8 0.0 1.3 2.6
1.1 1.3 1.6 1.7
1.3 1.8 1.0 1.4
1.4 1.5 0.5 1.9
0.1 1.4 1.7 1.8
0.1 1.5 2.1 0.8
12.1 0.9 1.6 1.7
0.1 0.6 1.5 1.3
1.0 -0.8 0.6 1.8
0.9 -0.1 1.0 2.1
1.2 1.0 0.8 1.3
0.8 0.9 -0.2 1.3
0.4 1.8 0.3 0.7
-0.3 0.5 0.1 -0.3
-0.4 0.8 1.5 0.1
0.4 0.7 1.6 0.4
0.4 0.1 0.8 0.4
0.8 0.0 1.1 1.4
0.9 -0.3 0.4 1.0
0.7 0.1 0.2 1.0
1.1 0.7 0.3 1.2
0.3 3 0 0 0
1.0 1.2 0.2 0.5

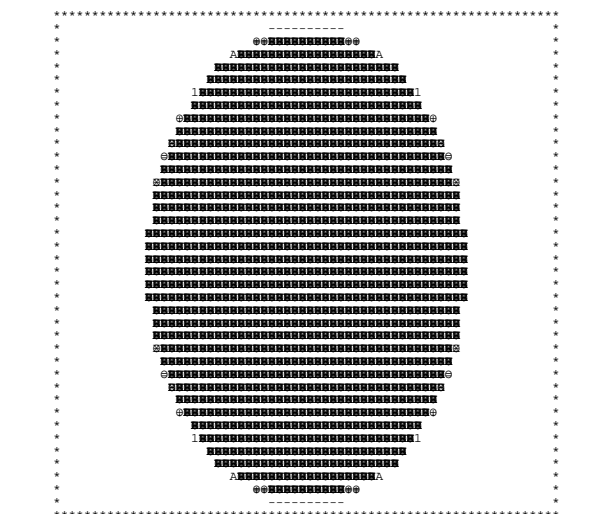
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EEEE V V AAA TTTT U U
E V VA A T U U
EEE V V A A T U U
E V V AAAAA T U U
EEEE V A A T UUU

```

PARAMETERS FOR SUBROUTINE EVATU
DESCRIPTION
XLEV - 3.500 THE TARGET-TO-NONTARGET RATIO
ATNL - 0.075 ATTENUATION COEFFICIENT

BLANK COMMON REQUIRED 5222 (12146)
 BLANK COMMON REQUIRED 9318 (22146)
 XMIN = 0.00E+00 XMAX = 0.75E-01 XSUM = 0.1494E+03



- = +) 1 Z
 0.0000E+00 0.5625E-02 0.1387E-01 0.1762E-01 0.2025E-01 0.2325E-01 0.2625E-01
 Z X A M @ @ @ @
 0.2887E-01 0.3075E-01 0.3263E-01 0.3675E-01 0.4088E-01 0.4350E-01 0.4650E-01
 @ @ @ @ @ @ @ @
 0.4913E-01 0.5475E-01 0.6150E-01 0.6525E-01 0.6825E-01 0.7125E-01 0.7387E-01
 @ @ @ @ @ @ @ @
 0.7500E-01

BLANK COMMON REQUIRED 5222 (12146)
 MAXIMUM SIZE OF BLANK COMMON THUS FAR= 13614 FLOATING POINT WORDS.

```

EEEE N N DDDD  EEEEE V V AAA TTTT U U
E NN N D D  E V V A A T U U U
EEE NN ND D  EEE V V A A T U U U
E N NN D D  E V V AAAAA T U U U
EEEE N N DDDD  EEEEE V A A T U U U

GGG RRRR AAA DDDD Y Y
G G R R R A A D D Y Y
G RRR R A A D D Y
G G R R AAAAA D D Y
GGGG R R A A DDDD Y

```

PARAMETERS FOR SUBROUTINE GRADY

DESCRIPTION
 ISTEP - 15 NUMBER OF ITERATION STEPS
 IRLX - 1 ITERATIVE RELAXATION METHOD
 IERR - 0 DO NOT USE ERROR ARRAY
 IZER - 0 INITIAL SOLUTION IS ZERO

BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES PERFORM THE FOLLOWING FUNCTIONS

ARG	FUNCTION	RAY WEIGHTING	ATTENUATION	FAN BEAM
BCK	BACKPROJECTION	UNIFORM SQUARE	YES	NO
PRJ	PROJECTION	UNIFORM SQUARE	YES	NO
BLANK COMMON REQUIRED	5406 (12436)			
BLANK COMMON REQUIRED	9502 (22436)			
BLANK COMMON REQUIRED	13598 (32436)			
BLANK COMMON REQUIRED	17694 (42436)			
BLANK COMMON REQUIRED	17710 (42456)			
BLANK COMMON REQUIRED	17694 (42436)			

FOR CONGR AND GRADY FCN IS THE VALUE OF THE CHI-SQUARE
 FOR ENTPY FCN IS EVALUATED BY THE SUBROUTINE DULFC
 ITER 0 FCN 0.494E+09
 ITER 1 FCN 0.596E+08

ITER 2 FCN 0.186E+08
 ITER 3 FCN 0.115E+08
 ITER 4 FCN 0.758E+07
 ITER 5 FCN 0.528E+07
 ITER 6 FCN 0.385E+07
 ITER 7 FCN 0.295E+07
 ITER 8 FCN 0.234E+07
 ITER 9 FCN 0.192E+07
 ITER 10 FCN 0.162E+07
 ITER 11 FCN 0.139E+07
 ITER 12 FCN 0.122E+07
 ITER 13 FCN 0.108E+07
 ITER 14 FCN 0.967E+06
 ITER 15 FCN 0.876E+06

BLANK COMMON REQUIRED 17510 (42146)
 BLANK COMMON REQUIRED 13414 (32146)
 BLANK COMMON REQUIRED 9318 (22146)
 BLANK COMMON REQUIRED 5222 (12146)

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 17710 FLOATING POINT WORDS.

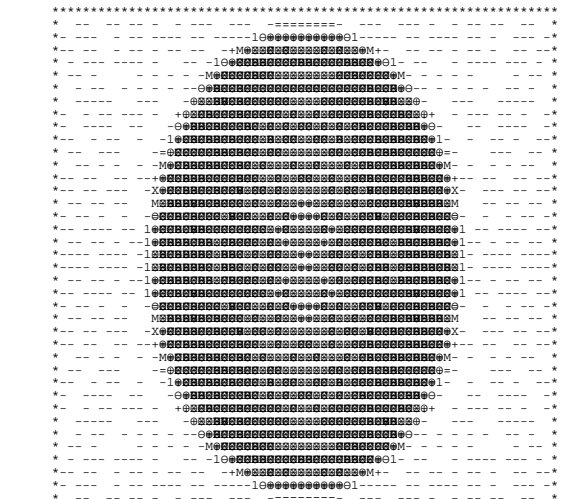
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EEEE N N DDDD  GGG RRRR AAA DDDD Y Y
E NN N D D  G G R R A A D D Y Y
EEE NN ND D  G RRRR A A D D Y
E N NN D D  G G R R AAAAA D D Y
EEEE N N DDDD  GGG R R A A DDDD Y

```

RECONSTRUCTION FOR THE EMISSION SCAN CORRECTED FOR ATTENUATION

XMIN = -0.30E+01 XMAX = 0.36E+02 XSUM = 0.5996E+05



- = +) 1 Z
 -0.2975E+01 -0.5850E-01 0.4219E+01 0.6164E+01 0.7525E+01 0.9080E+01 0.1064E+02
 Z X A M @ @ @ @
 0.1200E+02 0.1297E+02 0.1394E+02 0.1608E+02 0.1822E+02 0.1958E+02 0.2114E+02
 @ @ @ @ @ @ @ @
 0.2250E+02 0.2541E+02 0.2891E+02 0.3086E+02 0.3241E+02 0.3397E+02 0.3533E+02
 @ @ @ @ @ @ @ @
 0.3591E+02

0.3	-0.1	1.2	1.0	-0.2	-0.8	1.2	0.3	-0.3	1.0	0.7	-0.3	1.2	0.2	0.0	
-0.4	-1.2	0.0	-0.1	0.6	-1.3	0.1	-0.1	-1.0	0.4	-0.1	-0.9	0.8	-0.5	-0.3	
1.3	-0.1	0.9	1.2	0.5	-0.3	0.7	0.9	-0.2	0.9	0.7	-0.4	1.3	0.1	0.2	
0.6	-0.5	-0.3	0.5	-0.1	-1.1	-0.6	0.3	-1.1	0.0	0.1	-0.7	0.8	-0.1	0.7	
0.6	0.0	-0.6	0.8	0.7	-0.2	-0.2	1.3	-0.1	0.7	0.6	-0.6	0.8	-0.3	0.7	
1.1	0.8	-0.6	0.7	0.5	-0.6	-1.3	0.7	-0.3	0.4	0.8	-0.2	1.2	-0.1	-0.1	
-0.3	0.3	-0.6	0.3	0.2	0.4	-1.2	2.1	1.0	0.2	0.4	0.7	-0.8	0.0	-1.2	-0.3
-0.2	1.3	0.3	0.3	1.2	0.4	-0.8	-0.1	-0.6	-1.2	0.3	-0.6	0.6	-0.3	1.1	
-0.9	1.0	0.1	-1.1	0.0	-0.5	-1.3	-0.4	0.1	-0.4	0.7	-0.1	1.2	-0.3	-0.4	
-1.6	-0.8	-0.3	-1.0	0.7	1.0	-0.4	-0.6	0.5	-0.1	1.5	-0.4	-0.2	-1.3	0.1	
-0.4	-0.2	1.5	-0.3	-0.1	0.7	0.4	0.1	1.0	-0.9	-0.1	-1.1	0.3	0.7	0.0	
-0.1	-1.4	0.3	0.2	0.4	-1.2	2.1	1.4	-1.0	0.4	0.2	0.7	-0.4	-0.5	0.5	
0.2	-0.1	0.7	0.8	-0.7	0.2	-0.7	-1.2	0.4	0.1	1.1	-0.7	0.4	-0.5	-1.7	
1.0	-0.1	-0.9	0.3	-1.5	0.6	0.5	-0.5	0.8	0.1	0.2	-0.1	0.0	-0.8	-1.0	
0.4	-1.1	-2.0	0.7	0.3	0.2	1.1	0.1	-0.5	-0.2	1.0	-1.1	-0.4	-1.9	0.0	
0.0	0.5	-0.3	-0.8	0.8	0.3	0.9	-0.7	-0.8	0.5	-0.9	-0.3	-1.6	-0.8	2.9	
0.7	0.5	-0.2	-0.4	1.2	-0.4	0.8	0.6	-0.9	-0.3	0.3	-1.8	-0.1	0.4	10.4	
-0.8	1.3	0.6	-0.9	-0.4	-0.2	1.1	-0.1	-1.4	0.1	-1.1	0.0	0.5	2.8	17.7	
0.2	0.9	0.4	-1.1	-0.1	0.8	-0.2	0.3	-0.3	-1.2	0.2	-0.2	1.6	8.2	25.5	
0.0	-1.0	0.8	0.5	-1.0	-0.1	-0.2	0.9	-1.3	-0.1	0.1	-0.3	1.4	13.3	28.5	
-0.4	-0.4	1.0	0.4	-1.5	0.3	-0.3	-0.5	0.0	-0.2	0.4	0.5	2.7	17.4	30.8	
1.4	0.2	-0.9	0.4	0.4	-0.7	-0.7	0.5	0.8	-0.9	0.5	2.1	7.9	23.9	31.4	
0.9	-0.2	-1.4	1.2	0.1	-2.1	0.3	0.8	0.2	-0.4	-0.1	1.5	11.5	27.4	32.2	

-0.8 0.6 0.4 -0.7 -0.2 -0.3 0.3 -0.2 1.1 -1.0 -0.6 0.4 14.2 29.1 32.6
-0.7 1.2 0.1 -1.8 0.8 0.5 -0.7 0.2 1.3 -0.7 -2.1 -0.1 15.3 29.8 33.3
0.5 -0.3 -0.4 0.0 -0.1 0.9 -0.8 0.7 0.5 -0.1 -3.0 -1.2 17.2 30.5 32.3
-0.1 -1.7 1.0 0.3 -0.5 0.7 0.0 -0.9 0.9 -0.1 0.4 -1.5 2 8 9.1 30.3 32.8 32.8
-0.5 0.5 -0.3 1.0 0.0 0.3 0.8 -1.1 0.7 0.7 -0.5 8.3 25.1 32.0 31.8
0.9 0.3 -0.3 0.8 0.2 -0.1 0.3 -0.1 -0.4 1.4 -0.4 11.6 29.1 31.8 32.2
-0.4 0.7 0.7 -0.8 1.4 0.0 -0.2 0.6 -1.2 1.5 0.6 10.3 28.5 31.8 33.0
-0.2 0.4 0.7 -0.3 0.7 0.3 0.1 0.3 -0.4 -0.3 2.2 9.0 31.1 34.0 31.5
-1.0 0.0 -0.1 0.9 -0.6 0.5 0.4 -0.1 0.4 -1.5 2.8 9.1 30.3 32.8 32.8
1.0 0.0 -0.1 0.9 -0.6 0.5 0.4 -0.1 0.4 -1.5 2.8 9.1 30.3 32.8 32.8
-0.2 0.4 0.7 -0.3 0.7 0.3 0.1 0.3 -0.4 -0.3 2.2 9.0 31.1 34.0 31.5
-0.4 0.7 0.7 -0.8 1.4 0.0 -0.2 0.6 -1.2 1.5 0.6 10.3 28.5 31.8 33.0
0.9 0.3 -0.3 0.8 0.2 -0.1 0.3 -0.1 -0.4 1.4 -0.4 11.6 29.1 31.8 32.2
-0.5 0.5 -0.3 1.0 0.0 0.3 0.8 -1.1 0.7 0.7 -0.5 8.3 25.1 32.0 31.8
0.1 -1.7 1.0 0.3 -0.5 0.7 0.0 -0.9 0.9 -0.1 0.4 -1.5 2 8 9.1 30.3 32.8 32.8
0.5 -0.3 -0.4 0.0 -0.1 0.9 -0.8 0.7 0.5 -0.1 -3.0 -1.2 17.2 30.5 32.3
-0.7 1.2 0.1 -1.8 0.8 0.5 -0.7 0.2 1.3 -0.7 -2.1 -0.1 15.3 29.8 33.3
-0.8 0.6 0.4 -0.7 -0.2 -0.3 0.3 -0.2 1.1 -1.0 -0.6 0.4 14.2 29.1 32.6
-0.5 0.5 -0.3 1.0 0.0 0.3 0.8 -1.1 0.7 0.7 -0.5 8.3 25.1 32.0 31.8
1.4 0.2 -0.9 0.4 0.4 -0.7 -0.7 0.5 0.8 -0.9 0.5 2.1 7.9 23.9 31.4
-0.4 -0.4 1.0 0.4 -1.5 0.3 -0.3 -0.5 0.0 -0.2 0.4 0.5 2.7 17.4 30.8
0.0 -1.0 0.8 0.5 -1.0 -0.1 -0.2 0.9 -1.3 -0.1 0.1 -0.3 1.4 13.3 28.5
0.2 0.9 0.4 -1.1 -0.1 0.8 -0.2 0.3 -0.3 -1.2 0.2 -0.2 1.6 8.2 25.5
-0.8 1.3 0.6 -0.9 -0.4 -0.2 1.1 -0.1 -1.4 0.1 -1.1 0.0 0.5 2.8 17.7
0.7 0.5 -0.2 -0.4 1.2 -0.4 0.7 0.6 -0.9 -0.3 0.3 -1.8 -0.1 0.4 10.2
0.0 0.5 -0.3 -0.8 0.8 0.3 0.9 -0.7 -0.8 0.5 -0.9 -0.3 -1.6 -0.8 2.9
0.4 -1.1 -2.0 0.7 0.3 0.2 1.1 -0.1 -0.5 -0.2 1.0 -1.1 -0.4 -1.9 0.0
1.0 -0.1 -0.9 0.3 -1.5 0.6 0.5 -0.5 0.8 0.1 0.2 -0.1 0.0 -0.8 -1.0
0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7 0.4 0.7
-0.1 -1.4 0.3 0.2 0.4 1.2 0.2 -1.4 -0.4 -1.0 0.4 0.2 0.7 -0.4 -0.5
-0.4 -0.2 1.5 -0.3 -0.1 0.7 0.4 0.1 1.0 -0.9 -0.1 -1.1 0.3 0.7 0.0
-1.6 -0.8 -0.3 -1.0 0.7 1.0 -0.4 -0.6 0.5 -0.1 1.5 -0.4 -0.2 1.3 0.1
-0.9 1.0 0.1 -1.1 0.0 -0.5 -1.3 -0.4 0.1 -0.1 0.4 0.7 -0.1 1.2 -0.3 -0.4
-0.5 0.3 1.4 0.2 0.2 -0.3 -0.3 0.7 0.2 0.1 -1.1 0.2 0.5 0.4 0.9 1.7
-0.3 0.3 -0.6 0.3 0.9 0.2 -0.5 1.0 0.2 0.4 0.7 -0.8 0.0 -1.2 -0.3
1.1 0.8 -0.6 0.7 0.5 -0.6 -1.3 0.7 -0.3 0.4 0.8 -0.2 1.2 -0.1 0.1
0.6 0.0 -0.6 0.8 0.7 -0.2 -0.2 1.3 -0.1 0.7 0.6 -0.6 0.8 -0.3 0.7
0.6 -0.5 -0.3 0.5 -0.1 -1.1 -0.6 0.3 -1.1 0.0 0.1 -0.7 0.8 -0.1 0.7
-0.1 -0.1 -0.1 0.2 -0.2 -0.2 -0.2 -0.2 0.9 0.1 -0.2 -0.2 0.9 0.1 0.1
-0.4 -1.2 0.0 0.1 -0.6 -1.3 0.1 -0.1 -1.0 0.4 -0.1 -0.9 0.8 -0.5 -0.3
0.3 -0.1 1.2 1.0 -0.2 -0.8 1.2 0.3 -0.3 1.0 0.7 -0.3 1.2 0.2 0.0

0.7 -0.6 0.5 0.5 0.4 -1.0 -0.5 -0.2 0.2 0.6 0.6 0.6 -0.3 -1.8 -2.1 -1.2
0.2 -1.1 0.2 0.6 0.4 -0.8 -0.4 0.1 0.1 0.1 -0.1 -1.5 0.4 2.9 2.2
0.4 -0.7 0.3 0.6 -0.2 -0.4 -0.2 0.2 0.5 0.8 -0.5 3.8 12.6 17.0 21.3
0.4 -0.2 0.5 1.0 -0.3 0.6 0.7 0.9 0.9 0.2 12.3 21.9 28.2 29.8 29.8
0.1 -0.1 0.2 0.1 0.7 0.8 0.1 0.4 0.7 0.4 0.7 1.8 5.6 29.3 29.9 31.7
-0.5 -1.1 -0.1 -0.9 0.4 1.4 3.8 12.2 26.7 30.5 32.3 32.1 31.7 30.5 32.4
-0.9 0.1 1.7 -0.5 1.5 9.7 16.2 27.5 32.2 30.8 32.5 33.6 31.8 31.4 31.5
-0.4 -0.1 -0.9 -0.2 9.4 20.3 29.5 31.7 32.0 31.7 31.9 31.3 31.0 31.9 32.2
-2.3 0.5 -1.2 2.0 17.9 30.1 32.4 32.2 31.2 31.5 33.0 32.6 31.3 30.3 29.7
-0.7 33.3 34.3 32.3 32.1 32.2 31.8 31.9 31.9 31.7 30.8 31.0 30.8 31.9 29.4
-1.5 -0.3 8.8 25.1 30.3 33.4 31.8 31.0 32.1 31.4 32.5 33.0 31.9 32.2 32.1
-1.0 0.7 20.6 29.6 30.7 32.5 34.1 32.1 33.1 32.0 31.6 31.4 31.1 32.0 30.9
1.8 13.2 27.5 31.9 34.2 31.7 32.1 31.9 32.9 31.5 31.8 30.9 31.7 32.1 29.2
8.9 26.3 31.2 30.6 32.7 32.6 32.3 31.5 32.3 31.9 32.4 31.4 31.5 30.7 29.9
0.1 28.1 34.9 32.3 32.1 32.2 32.0 31.0 30.2 31.0 31.1 31.7 30.8 31.9 29.7
22.2 30.4 32.5 32.3 31.9 32.5 32.7 31.7 31.0 31.3 30.8 31.3 29.7 32.6 29.5 30.8
26.4 32.2 32.5 31.4 33.4 33.3 32.3 32.4 32.1 32.5 31.7 29.7 32.8 29.6 31.6
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31.6 31.7 32.3 32.4 31.9 33.0 33.1 31.4 33.2 31.6 31.0 30.9 31.4 33.4 30.8
31.4 33.3 34.3 32.7 32.1 32.2 32.0 31.0 30.2 31.0 31.1 31.7 30.8 31.9 29.9 30.4
32.2 33.4 32.4 32.4 32.4 32.3 31.3 31.3 32.8 31.7 30.8 30.9 30.5 28.6 28.5
31.4 32.7 33.6 33.2 32.4 32.4 31.2 31.7 32.7 32.5 32.2 29.3 30.1 31.9 30.9
31.7 33.6 33.1 32.3 32.2 32.2 31.0 31.1 33.0 31.1 32.7 31.8 29.7 30.9 30.1
31.7 32.9 33.0 32.3 32.6 32.8 31.5 31.8 35.9 30.2 30.7 30.5 29.3 31.1 30.0
32.7 33.3 34.3 32.7 32.1 32.2 32.0 31.0 30.2 31.0 31.1 31.7 30.8 31.9 29.4
32.9 32.4 33.6 31.8 31.4 32.8 31.3 31.3 34.6 30.9 30.7 31.4 29.5 31.3 31.0 33.0
32.8 33.3 33.1 32.5 32.7 32.0 29.7 34.3 32.4 31.6 30.2 29.2 30.9 29.3 30.1
34.5 33.1 35.0 32.9 31.6 32.4 30.9 32.3 31.7 31.7 31.8 32.1 31.2 27.9 32.0
32.6 31.2 34.2 34.7 31.5 30.1 31.5 32.4 33.0 32.2 32.7 29.4 28.8 29.7 30.4
32.7 33.8 32.2 33.4 33.2 29.6 31.8 32.8 32.0 31.3 31.6 29.7 31.9 29.6 28.2
31.9 34.2 32.9 32.6 31.6 29.7 32.6 32.6 31.5 31.4 30.7 30.5 29.2 29.8 29.8
34.0 31.9 32.5 34.0 31.7 29.9 33.6 32.5 32.1 30.0 31.8 28.8 31.9 32.2 29.4
34.0 31.9 32.5 34.0 31.7 29.9 33.6 32.5 32.1 30.0 31.8 28.8 31.9 32.2 29.4
31.9 34.2 32.9 32.6 33.6 29.7 32.6 32.9 31.5 31.4 30.7 30.5 29.2 29.8 29.6
32.7 33.9 32.3 33.4 33.2 29.6 31.8 32.8 32.0 31.3 31.6 29.7 31.9 29.6 28.2
32.6 31.2 34.2 34.7 31.5 30.1 31.2 32.4 33.0 32.2 32.7 29.4 28.8 29.7 30.4
34.5 33.1 35.0 32.9 31.6 32.4 30.9 32.3 31.7 31.7 31.8 32.1 31.2 27.9 32.0
32.9 32.4 33.6 31.8 31.4 32.3 31.3 34.6 30.9 30.7 31.4 29.5 31.3 31.0 33.3
31.2 33.3 34.3 31.2 31.0 31.1 31.0 31.8 35.9 30.2 30.7 30.5 29.9 30.9 31.7
31.7 32.9 33.0 32.8 32.6 32.8 31.5 31.8 35.9 30.2 30.7 30.5 29.9 30.9 31.7
31.7 33.6 33.1 32.3 32.2 32.2 31.0 31.1 33.0 31.1 32.7 31.8 29.7 30.9 30.1
31.4 32.7 33.6 33.2 32.4 32.4 31.2 31.7 32.7 32.5 32.2 29.3 30.1 31.9 30.9
32.2 33.4 32.4 32.4 32.5 32.3 31.3 31.3 32.8 31.7 30.8 30.9 30.5 28.6 28.5
31.4 33.3 34.3 31.9 32.7 31.7 31.0 31.3 31.0 31.3 30.2 30.7 29.9 30.9 31.7
31.6 31.7 32.3 32.4 31.9 33.0 33.1 31.4 33.2 31.6 31.0 30.9 31.4 33.4 30.8
30.6 32.1 32.2 31.5 33.0 32.3 32.2 31.4 31.7 31.9 31.2 29.7 31.9 31.1 29.0
26.4 32.2 32.5 31.4 33.4 33.4 31.3 33.4 32.1 32.5 31.7 29.7 32.8 29.6 31.6
22.2 30.4 32.5 32.3 31.9 32.1 31.2 31.5 30.8 31.8 31.3 29.7 32.6 29.5 30.6
15.0 28.1 32.4 33.0 31.3 32.8 31.9 31.9 32.4 33.5 32.4 29.6 31.4 30.3 31.2
8.9 26.3 31.2 30.6 32.7 32.6 32.3 31.5 32.3 31.9 32.4 31.4 31.5 30.7 29.9
1.8 13.2 27.5 31.9 34.2 31.7 32.1 31.9 32.9 31.5 31.8 30.9 31.7 32.1 29.2
-1.0 0.7 20.6 29.6 30.7 32.5 34.1 32.1 33.1 32.0 31.6 31.4 31.1 32.0 30.9
-1.5 -0.3 8.8 25.1 30.3 33.4 31.8 31.0 32.1 31.4 32.5 33.0 31.9 32.2 32.1
-2.3 0.5 -1.2 2.0 17.9 30.1 32.4 32.2 31.2 31.5 33.0 32.6 31.3 30.3 29.7
-0.4 -0.1 -0.9 -0.2 9.4 20.3 29.5 31.7 32.0 31.7 31.9 31.3 31.0 31.9 32.2
-0.9 0.1 1.7 -0.5 1.5 9.7 16.2 27.5 32.2 30.8 32.5 33.6 31.8 31.4 31.5
-0.5 -1.1 -0.1 -0.9 0.4 1.4 3.8 12.2 26.7 30.5 32.3 32.1 31.7 30.5 32.4
0.4 -0.2 0.5 1.0 -0.3 0.6 0.7 0.9 0.9 0.2 12.3 21.9 28.2 29.8 29.8
0.4 -0.2 0.5 1.0 -0.3 0.6 0.7 0.9 0.9 0.2 12.3 21.9 28.2 29.8 29.8
0.2 -1.1 0.2 0.6 0.4 -0.8 -0.4 0.2 0.1 0.5 0.8 -0.1 -1.5 0.4 2.9 2.2
0.7 -0.6 0.5 0.5 0.4 -1.0 -0.5 -0.2 0.2 0.6 0.6 0.6 -0.3 -1.8 -2.1 -1.2

-1.0 -2.8 -2.8 -1.0 -1.2 -2.1 -1.8 -0.3 0.6 0.6 0.2 -0.2 -0.5 -1.0 0.4
2.0 2.9 2.9 2.0 2.2 2.9 0.4 -1.5 -0.1 0.1 0.1 0.1 -0.4 -0.8 0.4
23 22 7 22 21 2 8 17 2 8 18 5 5 4 2 2
29.5 29.0 29.0 29.5 29.8 28.8 21.9 12.3 0.2 0.9 0.9 0.7 0.6 -0.3
30.3 31.1 31.1 30.3 31.8 30.9 31.8 29.8 28.3 20.6 7.8 2.7 -1.1 -1.3 -1.0
30.9 30.2 30.2 30.9 32.4 30.5 31.7 32.1 32.3 30.5 26.7 12.2 3.8 1.4 0.4
31.7 33.0 33.0 31.7 31.5 31.4 31.8 33.6 32.5 30.8 32.2 27.5 16.2 9.7 1.5
31.2 32.2 32.2 31.2 32.2 32.1 31.7 32.1 31.7 32.1 31.7 29.9 24.1 9.4
30.2 29.7 29.7 30.2 29.7 30.3 31.3 32.6 33.0 31.5 31.2 32.2 32.4 30.1 17.9
31.6 31.1 31.1 31.6 31.2 31.2 30.8 30.2 30.2 31.5 33.0 32.5 31.5 32.7 27.1
30.6 31.5 31.5 30.6 32.1 32.1 31.9 33.0 32.5 31.4 32.1 31.0 31.8 33.4 30.4
30.6 30.4 30.4 30.6 30.9 32.0 31.1 31.4 31.6 32.0 33.1 32.1 34.1 32.5 30.7
32 32 7 30 32 8 2 8 32 8 31 9 7 30 9 5 8 11 2 2 8 11 7 34 2
32.0 30.9 30.9 32.0 29.9 30.1 31.7 31.5 31.4 32.4 31.9 32.3 31.5 32.3 32.6 32.7

29.3 31.1 31.1 29.3 31.2 30.3 31.4 29.6 32.4 33.5 32.4 31.9 31.9 32.8 31.3
29.3 31.3 31.3 29.3 30.6 29.5 32.6 29.7 31.7 33.5 30.4 31.9 31.3 31.2 31.9
31.9 29.6 29.6 31.9 31.6 29.6 32.8 29.7 31.7 32.5 32.1 33.4 31.3 33.4 33.4
29.5 29.1 29.1 29.9 29.9 31.1 31.9 29.7 31.9 31.9 31.7 31.4 32.9 32.3 33.0
31.1 31.1 31.1 29.6 30.8 33.4 31.4 30.9 31.0 31.6 33.2 31.4 33.1 33.0 31.9
31.5 29.4 29.4 31.5 30.7 29.9 30.7 31.5 30.0 31.7 33.1 31.0 31.7 32.7 32.5
29.1 29.1 29.1 29.1 28.5 28.6 30.5 30.9 30.8 31.7 32.8 31.0 31.3 31.3 32.5 32.5
30.2 31.8 31.8 30.2 30.3 31.9 30.1 29.3 32.2 32.5 32.7 31.7 31.2 32.4 32.4
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30.0 29.2 29.2 30.0 30.0 31.1 29.3 30.7 30.2 30.2 35.9 31.8 31.5 32.8 32.6
29.3 28.4 28.4 29.3 29.4 31.9 30.8 31.0 31.0 30.2 31.0 32.0 32.1 32.6 32.1
28.3 29.3 29.3 28.3 33.3 31.0 31.3 29.5 31.4 30.7 30.9 34.6 31.3 32.3 31.4
28.0 28.5 28.5 28.0 30.1 29.3 30.9 29.2 30.2 31.6 32.4 34.3 29.7 32.0 32.7
30.2 28.8 28.8 30.2 32.0 27.9 31.2 32.1 31.8 31.7 31.7 32.3 30.9 32.4 31.6
28.4 30.3 30.3 28.4 30.4 29.7 28.8 29.4 32.7 32.2 33.0 32.4 31.5 30.1 31.5
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32.1 26.3 26.3 32.1 29.6 29.8 29.2 30.5 30.7 31.4 31.5 32.5 32.9 32.6 29.7 33.6
30.6 27.8 27.8 30.0 29.4 32.2 31.9 28.8 31.8 30.0 32.1 32.5 33.6 29.9 31.7
31.2 26.3 26.3 32.1 29.6 29.8 29.2 30.6 30.7 31.4 31.5 32.5 32.6 29.7 33.6
30.7 29.7 29.7 30.7 28.2 29.6 31.9 29.7 31.6 31.3 32.0 32.8 31.8 29.6 33.2
28.4 30.3 30.3 28.4 30.4 29.7 28.8 29.4 32.7 32.2 33.0 32.4 31.5 30.1 31.5
30.2 28.8 28.8 30.2 32.0 27.9 31.2 32.1 31.8 31.7 31.7 32.3 30.9 32.4 31.6
28.3 29.3 29.3 28.3 33.3 31.0 31.3 29.5 31.4 30.7 30.9 34.6 31.3 32.3 31.4
29.3 28.4 28.4 29.3 29.4 31.9 30.8 31.0 31.0 30.2 31.0 32.0 32.1 32.6 32.1
30.0 29.2 29.2 30.0 30.0 31.1 29.3 30.7 30.2 30.2 35.9 31.8 31.5 32.8 32.6
29.5 30.1 30.1 29.5 30.1 30.9 29.7 31.8 32.7 31.1 33.0 31.1 31.0 32.2 32.2
31.2 29.9 31.2 29.9 31.1 31.9 29.7 31.7 32.5 31.7 31.2 32.7 31.6 32.5 32.9
29.1 29.1 29.1 29.1 28.5 28.6 30.5 30.9 30.8 31.7 32.8 31.0 31.3 31.3 32.5 32.5
31.5 29.4 29.4 31.5 30.7 29.9 30.7 31.5 30.0 31.7 33.1 31.0 31.7 32.7 32.5
29.6 31.1 31.1 29.6 30.8 33.4 31.4 30.9 31.0 31.6 33.2 31.4 31.3 33.0 31.9
29.9 29.1 29.1 29.9 29.0 31.1 31.9 29.7 31.2 31.9 31.7 31.4 32.2 32.3 33.0
31.7 31.0 31.0 31.6 31.6 31.6 31.6 31.6 31.6 31.6 31.6 31.6 31.6 31.6 31.6 31.6
29.3 31.3 31.3 29.3 30.6 29.5 32.6 29.7 31.3 31.8 30.8 31.5 31.2 32.1 31.9
29.3 31.1 31.1 29.3 31.2 30.3 31.4 29.6 32.4 33.5 32.4 31.9 31.9 32.8 31.3
32.0 30.9 30.9 32.0 29.9 30.7 31.5 31.4 32.4 31.9 32.3 31.5 32.3 32.6 32.7
32.0 30.7 30.7 32.0 29.2 32.1 31.7 30.9 31.8 31.5 32.9 31.9 32.1 31.7 34.2
30.6 31.5 31.5 30.6 32.0 32.1 32.2 31.9 33.0 33.0 32.5 31.1 32.1 31.8 33.4 30.3
31.6 31.1 31.1 31.6 31.2 31.2 30.8 30.2 30.2 31.5 33.0 32.5 31.5 32.7 27.1
2.0 2.9 2.9 2.0 2.2 2.9 0.4 -1.5 -0.1 0.1 0.1 0.1 -0.4 -0.8 0.4
23 22 7 22 21 2 8 17 2 8 18 5 5 4 2 2
29.5 29.0 29.0 29.5 29.8 28.8 21.9 12.3 0.2 0.9 0.9 0.7 0.6 -0.3
30.3 31.1 31.1 30.3 31.8 30.9 31.8 29.8 28.3 20.6 7.8 2.7 -1.1 -1.3 -1.0
30.9 30.2 30.2 30.9 32.4 30.5 31.7 32.1 32.3 30.5 26.7 12.2 3.8 1.4 0.4
31.7 33.0 33.0 31.7 31.5 31.4 31.8 33.6 32.5 30.8 32.2 27.5 16.2 9.7 1.5
31.2 32.2 32.2 31.2 32.2 32.1 31.7 32.1 31.7 32.1 31.7 29.9 24.1 9.4
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31.6 31.1 31.1 31.6 31.2 31.2 30.8 30.2 30.2 31.5 33.0 32.5 31.5 32.7 27.1
30.6 31.5 31.5 30.6 32.1 32.1 31.9 33.0 32.5 31.4 32.1 31.0 31.8 33.4 30.4
30.6 30.4 30.4 30.6 30.9 32.0 31.1 31.4 31.6 32.0 33.1 32.1 34.1 32.5 30.7
32 32 7 30 32 8 2 8 32 8 31 9 7 30 9 5 8 11 2 2 8 11 7 34 2
32.0 30.9 30.9 32.0 29.9 30.1 31.7 31.5 31.4 32.4 31.9 32.3 31.5 32.3 32.6 32.7

0.5 0.5 -0.6 0.7 0.0 0.2 1.2 -0.3 0.7 1.0 -0.3 0.3 1.2 1.0 -0.8 0.6
0.6 0.2 -1.1 0.2 -0.3 -0.5 0.8 -0.9 -0.1 0.4 -1.0 -0.1 0.1 -1.3 -0.2
0.6 0.3 -0.7 0.4 0.2 0.1 1.3 -0.4 0.7 0.9 -0.2 0.9 0.7 -0.3 0.5
1.0 0.5 -0.2 0.4 0.7 -0.1 0.8 -0.7 0.1 0.0 -1.1 0.3 -0.6 -1.1 -0.1
0.6 1.4 0.2 0.6 0.7 -0.3 0.8 -0.6 0.6 0.7 0.1 1.3 -0.2 -0.2 0.7
31.9 -0.1 -1.1 0.5

0.7 -0.6 0.8 1.1
0.3 -0.6 0.3 -0.3
0.3 0.3 1.3 -0.2
-1.1 0.1 1.0 -0.9
-1.0 -0.3 -0.8 -1.6
-0.3 1.5 -0.2 -0.4
0.2 0.3 -1.4 -0.1
0.8 0.7 -0.1 0.2
0.3 -0.9 -0.1 1.0
0.7 -2.0 -1.1 0.4
-0.8 -0.3 0.5 0.0
-0.4 -0.2 0.5 0.7
-0.9 0.6 1.3 -0.8
-1.1 0.4 0.9 0.2
0.5 0.8 -1.0 0.0
0.4 1.0 -0.4 -0.4
0.4 -0.9 0.2 1.4
1.2 -1.4 -0.2 0.9
-0.7 0.4 0.6 -0.8
-1.8 0.1 1.2 -0.7
0.0 -0.4 -0.3 0.5
0.3 1.0 -1.7 0.1
1.0 -0.3 0.5 -0.5
0.8 -0.3 0.3 0.9
-0.8 0.7 0.7 -0.4
-0.3 0.7 0.4 -0.2
0.9 -0.1 0.0 1.0
0.9 -0.1 0.0 1.0
-0.3 0.7 0.4 -0.2
-0.8 0.7 0.7 -0.4
0.8 -0.3 0.3 0.9
1.0 -0.3 0.5 -0.5
0.3 1.0 -1.7 0.1
0.0 -0.4 -0.3 0.5
-1.8 0.1 1.2 -0.7
-0.7 0.4 0.6 -0.8
1.2 -1.4 -0.2 0.9
0.4 -0.9 0.2 1.4
0.4 1.0 -0.4 -0.4
0.5 0.8 -1.0 0.0
-1.1 0.4 0.9 0.2
-0.9 0.6 1.3 -0.8
-0.4 -0.2 0.5 0.7
-0.8 -0.3 0.5 0.0
0.7 -2.0 -1.1 0.4
0.3 -0.9 -0.1 1.0
0.8 0.7 -0.1 0.2
0.2 0.3 -1.4 -0.1
-0.3 1.5 -0.2 -0.4
-1.0 -0.3 -0.8 -1.6
-1.1 0.1 1.0 -0.9
0.3 0.3 1.3 -0.2
0.3 -0.6 0.3 -0.3
0.7 -0.6 0.8 1.1
0.8 -0.6 0.0 0.6
0.5 -0.3 -0.5 0.6
1.2 0.9 -0.1 1.3
0.1 0.0 -1.2 -0.4
1.0 1.2 -0.1 0.3

EX12

```

PROGRAM XATENU
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
*   RECLBL   --   DP VERSION 2.0   --   JULY91   *
*****
EXAMPLES 11 AND 12
      THE PROGRAM XATENU RECONSTRUCTS ATTENUATED DATA ASSUMING
      A CONSTANT ATTENUATION COEFFICIENT AND USING ATTENUATION
      FACTORS WHICH ARE EVALUATED AFTER DETERMINING THE BOUNDARY OF
      THE OBJECT BY AN APPROXIMATED RECONSTRUCTION.
DIMENSION B(4096),AG(72)
COMMON/BLANK/WORK(18000)
COMMON/OUTCOM/LUNOUT,I80132
      LUNOUT - OUTPUT FILE
      I80132 - OUTPUT LINE LENGTH FLAG
      =0   EACH LINE WILL BE WITHIN 80 CHARACTERS
      (OTHERWISE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1 (NANG ,IPAR( 4)),(MODANG ,IPAR( 5)),(KDIMU ,IPAR( 6)),
2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT ,IPAR( 9)),
3 (ISTORE ,IPAR(10)),(IPRINT ,IPAR(11)),(LUNATN ,IPAR(12)),
4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
5 (CATN ,PAR( 4))
EXTERNAL BRP,PRF,BRFA,PRFA
LUNOUT=2
I80132=0
      THE INPUT PARAMETERS ARE
NDIMU=64
ICIR=1
IGEOM=0
NANG=72
MODANG=5
KDIMU=100
IMIT=0
NWORK=18000
NFLOAT=2
ISTORE=0
IPRINT=5
LUNATN=3
PWID=1
AXISU=50.5
RFAN=0.
CATN=0.
      OPEN OUTPUT FILE AND SCRATCH FILE FOR ATTENUATION FACTORS
OPEN (LUNOUT,FILE='E12.OUT',FORM='FORMATTED')
OPEN (LUNATN,FILE='E12.TMP',FORM='UNFORMATTED',STATUS='SCRATCH')
CALL SETUP (IPAR,PAR,AG)
      RECONSTRUCTION OF THE TRANSVERSE SECTION WITH NO CORRECTION
      FOR ATTENUATION
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRF,BRP,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,22)
CALL ARRAY (B,NDIMU)
      PRINTOUT THE VALUES FOR THE APPROXIMATED RECONSTRUCTION
NMAT=NDIMU**2
KK1=1
KU=NDIMU/15+1
DO 12 K=1,KU
      WRITE (LUNOUT,18)
      KK2=MIN(15*K,NDIMU)
      DO 10 J=1,NDIMU
          ISUB1=NMAT-J*NDIMU+KK1
          ISUB2=NMAT-J*NDIMU+KK2
10      WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
12      KK1=KK2+1
      EVALUATE THE ATTENUATION FACTORS ASSUMING A CONSTANT
      ATTENUATION COEFFICIENT
XLEV=3.5
ATENL=.075
CALL EVATU (B,XLEV,ATENL)
      RECONSTRUCTION OF THE TRANSVERSE SECTIONS FOR AN EMISSION SCAN
      WHICH IS CORRECTED FOR ATTENUATION
ISTP=15
IRLX=1
IERR=0
IZER=0
CALL GRADY (B,PRFA,BRFA,ISTP,IRLX,IERR,IZER)
WRITE (LUNOUT,24)
CALL ARRAY (B,NDIMU)
      PRINTOUT THE VALUES FOR THE CORRECTED RECONSTRUCTION
KK1=1
KU=NDIMU/15+1
DO 16 K=1,KU
      WRITE (LUNOUT,18)
      KK2=MIN(15*K,NDIMU)
      DO 14 J=1,NDIMU
  
```

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ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
WRITE (LUNOUT,20) (B(I),I=ISUB1,ISUB2)
16      KK1=KK2+1
      CLOSE (LUNOUT)
      CLOSE (LUNATN)
*****
18 FORMAT(LX,//////)
20 FORMAT(LX,15F5.1)
22 FORMAT(LX,/' THE APPROXIMATED RECONSTRUCTION FOR AN EMISSION SCA',
1 'B')
24 FORMAT(LX,/' RECONSTRUCTION FOR THE EMISSION SCAN CORRECTED FOR ',
1 'ATTENUATION')
      END
      SUBROUTINE GETUM (M,DATA,ERR)
      IMPLICIT DOUBLE PRECISION (A-H,O-Z)
      SAVE
      *****
      *   RECLBL   --   DP VERSION 2.0   --   JULY91   *
      *****
      EXAMPLE 12
      THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
      A PHANTOM WITH A CIRCULAR ANNULUS AND A CENTRAL CIRCULAR SOURCE
      WHICH IS ATTENUATED BY A CIRCULAR ATTENUATOR.
      DIMENSION DATA(*),ERR(*)
      DIMENSION ITYPE(4),Z(4),X1(4),Y1(4),A1(4),B1(4),PHI(4)
      DATA ITYPE/-1,1,1,1/
      DATA Z/.075,30.,-30.,30./
      DATA X1/0.,0.,0.,0./
      DATA Y1/0.,0.,0.,0./
      DATA A1/60.,60.,40.,20./
      DATA B1/60.,60.,40.,20./
      DATA PHI/0.,0.,0.,0./
      CALL PHANL (4,ITYPE,Z,X1,Y1,A1,B1,PHI,DATA,M)
      RETURN
      END
      SSS EEEEE TTTT U U PPPP
      S E T U U P P
      SSS EEE T U U PPPP
      S E T U U P
      SSS EEEEE T UUU P
      INTEGER PARAMETER ARRAY (IPAR)
      I IPAR(I) DESCRIPTION
1 64 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 1 RECONSTRUCT IN A SQUARE ARRAY
3 0 GEOMETRY FLAG
4 72 PARALLEL BEAM GEOMETRY
5 5 NUMBER OF PROJECTION ANGLES
MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND 2*PI
6 100 STARTING AT ZERO
7 0 NUMBER OF RAYS FOR EACH PROJECTION
8 18000 EMISSION DATA
9 2 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
10 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
11 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
12 5 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12 3 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE
      FLOATING POINT PARAMETER ARRAY (PAR)
      I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 50.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS
BLANK COMMON REQUIRED 72 ( 110)
BLANK COMMON REQUIRED 144 ( 220)
BLANK COMMON REQUIRED 216 ( 330)
BLANK COMMON REQUIRED 416 ( 640)
BLANK COMMON REQUIRED 480 ( 740)
A TOTAL OF 92 ( 5 THRU 96) OF THE 100 USER PROJECTION BINS WILL BE USED
92 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM
      MAXIMUM SIZE OF BLANK COMMON THUS FAR= 480 FLOATING POINT WORDS.
      EEEEE N N DDDD SSS EEEEE TTTT U U PPPP
      E NN ND D S E T U U P P
      EEE N N D D SSS EEE T U U PPPP
      E N NN D D S E T U U P
      EEEEE N N DDDD SSS EEEEE T UUU P
  
```


0.5 0.5 0.3 0.4 0.6 0.6 1.3 3.0 3.8 3.9 3.9 4.0 3.9 3.9 4.0
0.6 0.3 0.3 0.4 0.5 0.7 1.6 3.1 3.7 3.8 3.9 3.9 3.9 4.2 3.9
0.6 0.3 0.3 0.4 0.5 0.7 1.6 3.1 3.7 3.8 3.9 3.9 3.9 4.2 3.9
0.4 0.5 0.3 0.5 0.5 0.5 1.0 2.6 3.6 4.0 4.2 4.1 4.1 4.0 3.8
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0.1 -0.4 -0.1 -0.3
0.2 0.2 -0.6 0.2
-0.1 -0.1 0.0 0.1
0.1 -0.1 -0.9 0.2
-0.4 0.6 11.2 13.4
-0.5 -0.1 -0.9 0.2
-0.6 0.6 0.0 0.2
-0.7 -0.2 -0.6 0.1
-0.5 0.5 0.1 0.7
-0.4 0.0 -1.0 -0.5
-0.3 0.6 -0.1 0.6
-0.3 0.3 -0.8 -0.1
-0.5 0.3 -0.7 0.2
0.3 1.1 0.0 0.5
0.6 7.1 -1.3 5.5
0.2 0.9 -0.5 0.1

EEEE V V AAA TTTT U U
E V V A A T U U
EE V V A A T U U
E V V AAAAA T U U
EEEE V A A T UUU

PARAMETERS FOR SUBROUTINE EVATU

DESCRIPTION

XLEV - 3.500 THE TARGET-TO-NONTARGET RATIO
ATENL - 0.075 ATTENUATION COEFFICIENT

-0.1 0.0 7.0 28.2 31.7 34.3 34.9 32.6 32.7 32.9 31.4 31.8 29.1 20.4 9.0
-0.4 -1.9 10.6 31.1 33.8 33.9 33.3 34.0 32.5 31.8 30.9 30.9 26.6 15.0 6.4
-0.7 -0.9 15.9 32.0 33.6 35.2 33.8 32.8 33.4 30.0 31.2 28.9 23.1 10.1 2.9
...

-0.6 0.2 0.2 -0.6 0.2 0.1 1.0 1.3 2.9 6.4 9.0 14.0 21.0 27.6 28.4
-1.0 -2.2 -2.2 -1.0 -2.5 -2.4 -2.1 -1.2 0.3 0.4 3.1 5.2 9.5 16.9 24.8
-1.0 -3.1 -3.1 -1.0 -2.6 -2.1 -1.7 -0.3 -2.6 -0.5 0.1 2.3 2.3 8.2 14.2
...

-0.5 0.8 -0.2 0.8
-0.2 0.2 -1.2 -0.4
-0.7 0.7 0.3 0.9
-0.7 -0.2 -0.8 0.1
-0.7 0.8 0.1 0.4
-0.4 -0.1 -1.3 0.3
-0.6 0.7 0.3 0.6
0.3 0.0 -1.1 0.2
-0.1 -0.2 0.1 0.2
0.0 0.4 -0.6 0.3
-0.3 -0.4 0.0 0.0
-1.2 0.3 -0.3 0.1
-1.5 -0.6 -0.4 0.7
-1.1 -1.0 -0.2 -0.2
-0.7 -1.4 -0.3 0.0
4.9 -0.7 -0.3 -0.6
12.6 0.4 -0.4 0.0
22.6 4.5 0.1 -0.5
28.2 7.0 0.0 -0.1
31.1 10.6 -1.9 -0.4
32.0 15.9 -0.9 -0.7
33.8 23.5 3.1 0.6
34.6 26.6 6.2 0.6
33.5 28.4 7.5 0.1
34.0 30.8 7.9 -0.8
33.7 31.2 9.4 -1.4
33.5 29.7 10.2 -1.3
33.5 29.7 10.2 -1.3
33.7 31.2 9.4 -1.4
34.0 30.8 7.9 -0.8
33.5 28.4 7.5 0.1
34.6 26.6 6.2 0.6
33.8 23.5 3.1 0.6
32.0 15.9 -0.9 -0.7
31.1 10.6 -1.9 -0.4
28.2 7.0 0.0 -0.1
22.6 4.5 0.1 -0.5
12.6 0.4 -0.4 0.0
4.9 -0.7 -0.3 -0.6
-0.7 -1.4 -0.3 0.0
-1.1 -1.0 -0.2 -0.2
-1.5 -0.6 -0.4 0.7
-1.2 0.3 -0.3 0.1
-0.3 -0.4 0.0 0.0
0.0 0.4 -0.6 0.3
-0.1 -0.2 0.1 0.2
0.3 0.0 -1.1 0.2
-0.6 0.7 0.3 0.6
-0.4 -0.1 -1.3 0.3
-0.7 0.8 0.1 0.4
-0.7 -0.2 -0.8 0.1
-0.7 0.7 0.1 0.9
-0.2 0.2 -1.2 -0.4
-0.5 0.8 -0.2 0.8
-0.4 0.6 -0.8 0.1
-1.0 0.2 -1.2 0.0
0.2 1.5 0.0 1.3
-1.2 0.0 -1.6 -0.7
0.0 1.3 -0.7 0.3

EX13

```

PROGRAM XMARR
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 13
C
C THE PROGRAM XMARR RECONSTRUCTS PROJECTION DATA FOR A RING
C DETECTOR USING THE ALGORITHM DEVELOPED BY MARR FOR REPRESENTING
C THE RECONSTRUCTED IMAGE AS AN EXPANSION OF ORTHOGONAL
C POLYNOMIALS.
C
C DIMENSION B(4096)
C COMMON/BLANK/WORK(3000)
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C 1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C 2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C 3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C 4 (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
C 5 (CATN , PAR( 4))
C
C LUNOUT=2
C I80132=0
C
C THE INPUT PARAMETERS ARE
C
C NDIMU=64
C ICIR=0
C IGEOM=3
C NANG=64
C MODANG=5
C KDIMU=100
C IMIT=1
C NWORK=3000
C NFLOAT=2
C ISTORE=0
C IPRINT=7
C LUNATN=0
C PI=4.*ATAN(1.)
C PWID=NANG/PI*NDIMU
C AKISU=50.5
C RFAN=0.
C CATN=0.
C
C OPEN OUTPUT FILE
C
C OPEN (LUNOUT,FILE='E13.OUT',FORM='FORMATTED')
C
C CALL SETUP (IPAR,PAR,AG)
C
C NDEG=62
C CALL MARR (B,NDEG)
C
C CALL ARRAY (B,NDIMU)
C
C PRINTOUT OF THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
C
C NMAT=NDIMU*2
C KK1=1
C KU=NDIMU/15+1
C DO 12 K=1,KU
C WRITE (LUNOUT,14)
C KK2=MIN(15*K,NDIMU)
C DO 10 J=1,NDIMU
C ISUB1=NMAT-J*NDIMU+KK1
C ISUB2=NMAT-J*NDIMU+KK2
C 10 WRITE (LUNOUT,16) (B(I),I=ISUB1,ISUB2)
C 12 KK1=KK2+1
C
C CLOSE (LUNOUT)
C
C 14 FORMAT(1X////////)
C 16 FORMAT(1X,15F5.1)
C END
C SUBROUTINE GETUM (M,D,E)
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 13
C
C THIS GETUM SUBROUTINE GENERATES PROJECTION DATA FOR A RING
C DETECTOR OF A CHEST PHANTOM CONSISTING OF A HEART, LUNGS AND
C SURROUNDING TISSUE.
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C 1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C 2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C 3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C 4 (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
C 5 (CATN , PAR( 4))

```

```

DIMENSION D(*),E(*),B2(4096)
DIMENSION A(4),B(4),X(4),Y(4),Z(4),PHI(4),ITYPE(4)
DATA NPHAN/4/
DATA R/40.,10.,14.,14./
DATA B/40.,10.,10.,10./
DATA X/0.,0.,10.,-10./
DATA Y/0.,-10.,0.,0./
DATA Z/5.,27.,-4.,-4./
DATA PHI/0.,0.,0.,0./
DATA ITYPE/1,1,1,1/
C
C DATA IFLG/0/
C
C IF (IFLG.EQ.0) THEN
C IFLG=1
C PI=4.*ATAN(1.)
C PHI(3)=PI/2.
C PHI(4)=PI/2.
C
C SCALE PHANTOM PARAMETERS TO SIZE OF RING
C
C FAC=NDIMU/64.*PWID
C DO 10 I=1,NPHAN
C A(I)=A(I)*FAC
C B(I)=B(I)*FAC
C X(I)=X(I)*FAC
C Y(I)=Y(I)*FAC
C 10
C
C IF (IMIT.EQ.0) THEN
C PWIDTH=-PWID
C ELSE
C PWIDTH=PWID
C ENDF
C CALL PHAN (NPHAN,10,ITYPE,Z,X,Y,A,B,PHI,B2,NDIMU,PWIDTH)
C CALL ARRAY (B2,NDIMU)
C
C ENDF
C
C CALL PHANL (NPHAN,ITYPE,Z,X,Y,A,B,PHI,D,M)
C
C RETURN
C END

```

I	IPAR(I)	DESCRIPTION
1	64	LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2	0 NA	NOT APPLICABLE (RING GEOMETRY)
3	3	GEOMETRY FLAG
		RING DETECTOR GEOMETRY
4	64	NUMBER OF PROJECTION ANGLES (EQUAL TO NUMBER OF CRYSTALS)
5	5 NA	NOT APPLICABLE (RING GEOMETRY)
6	100 NA	NOT APPLICABLE (RING GEOMETRY)
7		TRANSMISSION DATA
8	3000	DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9	2	NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10	0	EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11	7	PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
		PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
		PRINT PROJECTION DATA AND UNCERTAINTIES
		PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
12	0 NA	NOT APPLICABLE (RING GEOMETRY)

```

C
C SSS EEEEE TTTT U U PPPP
C S E T U U P P
C SSS EEE T U U PPPP
C S E T U U P
C SSS EEEEE T UUU P

```

I	PAR(I)	DESCRIPTION
1	0.318	PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2	50.500 NA	NOT APPLICABLE (RING GEOMETRY)
3	0.000 NA	NOT APPLICABLE (RING GEOMETRY)

```

BLANK COMMON REQUIRED 128 ( 200)
BLANK COMMON REQUIRED 256 ( 400)
BLANK COMMON REQUIRED 384 ( 600)
BLANK COMMON REQUIRED 512 ( 1000)

```

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 512 FLOATING POINT WORDS.

```

C
C EEEEE N N DDDD SSS EEEEE TTTT U U PPPP
C E NN N D D S E T U U P P
C EEE N N D D SSS EEE T U U PPPP
C E N NN D D S E T U U P
C EEEEE N N DDDD SSS EEEEE T UUU P

```

```

C
C M M AAA RRRR RRRR
C MM MM A A R R R R
C M M A A RRRR RRRR
C M M AAAA R R R R
C M M A A R R R R

```

PARAMETERS FOR SUBROUTINE MARR

DESCRIPTION
NXTAL - 64 NUMBER OF CRYSTALS

2.0	1.8	1.4	1.1	1.1	1.2	1.1	0.8	0.4	0.4	1.0	2.3	4.1	6.0	7.6
1.8	1.8	1.5	1.1	1.5	1.6	1.5	1.1	0.7	0.8	1.7	3.3	5.4	7.5	9.1
1.7	1.7	1.6	1.6	1.7	1.9	1.7	1.3	1.0	1.2	2.2	4.1	6.4	8.5	10.1
1.5	1.6	1.6	1.7	1.9	2.0	1.8	1.4	1.1	1.4	2.6	4.6	6.9	9.0	10.5
1.3	1.5	1.6	1.7	1.9	2.0	1.8	1.4	1.1	1.4	2.6	4.7	7.0	9.1	10.6
1.0	1.3	1.4	1.6	1.9	2.0	1.8	1.4	1.0	1.1	2.2	4.2	6.6	8.7	10.3
0.6	0.9	1.2	1.4	1.8	2.0	1.9	1.4	0.9	0.8	1.6	3.3	5.5	7.7	9.4
0.2	0.5	0.7	1.1	1.5	1.9	2.0	1.6	1.0	0.7	1.0	2.1	3.9	5.9	7.6
-0.1	0.1	0.3	0.6	1.1	1.7	2.0	1.9	1.4	0.8	0.7	1.2	2.3	3.8	5.2
-0.1	-0.1	-0.1	0.1	0.5	1.2	1.8	2.0	1.8	1.3	0.9	0.8	1.2	2.0	2.9
-0.1	-0.1	-0.1	-0.2	0.0	0.5	1.2	1.8	2.0	1.8	1.4	1.1	0.9	1.1	1.4
0.0	0.1	0.0	-0.1	-0.2	-0.1	0.4	1.0	1.6	1.8	1.8	1.5	1.3	1.1	1.1
0.0	0.1	0.2	0.1	-0.1	-0.3	-0.2	0.2	0.7	1.2	1.5	1.6	1.5	1.4	1.3
-0.1	0.0	0.2	0.3	0.2	0.0	-0.3	-0.3	-0.1	0.2	0.6	0.9	1.1	1.3	1.3
-0.1	-0.2	-0.1	0.1	0.3	0.3	0.1	-0.2	-0.4	-0.4	-0.3	-0.1	0.2	0.5	0.7
0.2	-0.1	-0.2	-0.2	0.1	0.3	0.3	0.2	-0.1	-0.4	-0.5	-0.5	-0.4	-0.3	-0.1
0.2	0.2	0.0	-0.2	-0.2	0.0	0.2	0.3	0.3	0.1	-0.1	-0.3	-0.4	-0.4	-0.4
-0.2	0.1	0.3	0.2	-0.1	-0.2	-0.2	0.0	0.1	0.2	0.3	0.2	0.1	0.1	0.0
-0.1	-0.3	0.0	0.2	0.3	0.1	-0.2	-0.3	-0.3	-0.1	0.0	0.2	0.3	0.3	0.3
0.3	0.1	-0.2	-0.1	0.1	0.2	0.2	0.0	-0.2	-0.3	-0.3	-0.2	-0.1	0.0	0.0
-0.3	0.1	0.3	0.0	-0.2	-0.1	0.0	0.2	0.2	0.1	0.0	-0.1	-0.1	-0.2	-0.2
0.0	0.1	-0.3	0.2	0.2	-0.1	-0.2	-0.2	0.0	0.1	0.2	0.2	0.2	0.1	0.1
0.0	0.0	-0.5	0.0	-0.2	0.1	0.2	0.0	-0.1	-0.2	-0.1	0.0	0.0	0.0	0.1
0.0	0.2	0.0	0.0	0.0	0.2	-0.2	-0.1	0.1	0.2	0.1	0.1	-0.1	-0.1	-0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.1	-0.1	-0.1	0.0	0.1	0.1	0.1
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.2	0.1	0.1	0.1	0.0

0.0	0.1	0.1	0.0	0.1	0.2	0.2	-0.6	0.0	0.0	0.0	0.0	0.0	0.0	0.0	
0.2	0.3	0.3	0.2	0.1	0.0	-0.1	-0.1	-0.2	0.0	0.2	-0.3	0.0	0.0	0.0	
-0.2	-0.1	-0.1	-0.2	-0.2	-0.2	0.0	0.0	0.2	0.3	0.3	0.1	-0.2	-0.3	0.2	0.0
0.0	0.1	0.1	0.0	-0.1	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.0	0.1	0.1	0.0	0.0
0.2	0.2	0.2	0.2	0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.1	0.1	0.1	0.1	0.2	0.1	0.0	-0.1	-0.1
0.2	0.2	0.2	0.2	0.2	0.1	0.1	0.0	-0.1	-0.1	-0.2	-0.2	-0.1	0.0	0.1	0.1
0.3	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.1	0.0	-0.1	-0.1	-0.1	-0.1
-0.3	-0.2	-0.2	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.2	-0.1	0.0	0.1	0.1	0.1	0.1
0.4	0.4	0.4	0.4	0.3	0.2	0.1	0.0	-0.1	-0.2	-0.2	-0.2	-0.1	0.0	0.0	0.1
1.2	1.2	1.2	1.2	1.2	1.1	0.9	0.7	0.4	0.2	0.0	-0.2	-0.2	-0.2	-0.1	0.1
1.7	1.7	1.7	1.7	1.7	1.7	1.6	1.4	1.1	0.8	0.5	0.2	0.0	-0.1	-0.2	-0.2
1.1	1.6	1.6	1.6	1.6	1.7	1.7	1.7	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6
1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.6	1.7	1.7	1.6	1.4	1.2	0.8	0.5	0.5
1.4	1.4	1.4	1.4	1.4	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.5	1.3	0.9	0.9
1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
1.8	1.7	1.7	1.8	1.8	1.8	1.7	1.6	1.6	1.6	1.6	1.7	1.7	1.6	1.5	1.5
1.7	1.6	1.6	1.7	1.8	1.8	1.7	1.7	1.6	1.6	1.6	1.6	1.6	1.6	1.6	1.6
1.5	1.4	1.4	1.5	1.6	1.6	1.6	1.6	1.5	1.5	1.6	1.6	1.7	1.7	1.7	1.7
1.3	1.2	1.2	1.3	1.4	1.5	1.5	1.5	1.5	1.5	1.6	1.6	1.6	1.7	1.7	1.7
1.4	1.3	1.3	1.4	1.5	1.6	1.6	1.5	1.5	1.5	1.6	1.6	1.6	1.6	1.7	1.7
1.6	1.5	1.5	1.6	1.7	1.8	1.8	1.7	1.6	1.5	1.5	1.5	1.4	1.4	1.5	1.5
1.1	1.7	1.7	1.8	1.9	2.0	1.9	1.8	1.7	1.4	1.3	1.1	1.0	0.9	0.8	0.9
1.8	1.7	1.7	1.8	1.9	1.9	1.8	1.7	1.4	1.3	1.1	1.0	0.9	0.8	0.9	0.9
1.5	1.4	1.4	1.5	1.6	1.7	1.6	1.4	1.1	0.9	0.8	0.7	0.6	0.6	0.6	0.6
1.3	1.2	1.2	1.3	1.4	1.4	1.3	1.0	0.7	0.5	0.4	0.3	0.3	0.4	0.5	0.5
1.4	1.3	1.3	1.4	1.5	1.4	1.2	0.8	0.4	0.1	0.0	0.1	0.2	0.3	0.4	0.4
1.7	1.7	1.7	1.7	1.7	1.6	1.3	0.8	0.4	0.0	-0.1	0.0	0.1	0.3	0.5	0.5
2.0	2.0	2.0	2.0	2.0	1.8	1.5	1.0	0.5	0.2	0.0	0.1	0.2	0.3	0.5	0.5
2.0	2.0	2.0	2.0	2.0	1.9	1.6	1.2	0.8	0.4	0.3	0.2	0.3	0.3	0.4	0.4
1.6	1.6	1.6	1.6	1.6	1.5	1.4	1.1	0.8	0.6	0.5	0.4	0.3	0.3	0.3	0.3
1.1	1.1	1.1	1.1	1.1	1.0	0.9	0.8	0.7	0.6	0.6	0.5	0.4	0.2	0.1	0.1
1.1	1.1	1.1	1.1	1.1	1.0	0.9	0.8	0.7	0.6	0.6	0.5	0.4	0.2	0.1	0.1
2.0	2.1	2.1	2.0	1.6	1.2	0.7	0.3	0.1	0.2	0.3	0.4	0.4	0.2	0.0	0.0
3.9	4.2	4.2	3.9	3.3	2.4	1.4	0.6	0.1	0.0	0.2	0.4	0.5	0.4	0.3	0.3
6.4	6.8	6.8	6.4	5.4	4.1	2.7	1.3	0.4	0.1	0.2	0.6	0.8	0.7	0.6	0.6
8.6	9.2	9.2	8.6	7.6	6.0	4.1	2.3	1.0	0.4	0.4	0.8	1.1	1.2	1.1	1.1
10.1	10.7	10.7	10.2	9.1	7.5	5.4	3.3	1.7	0.8	0.7	1.1	1.5	1.6	1.5	1.5
10.0	11.4	11.4	11.0	10.1	8.5	6.4	4.1	2.2	1.2	1.0	1.3	1.7	1.9	1.7	1.7
11.2	11.5	11.5	11.2	10.5	9.0	6.9	4.6	2.6	1.4	1.1	1.4	1.8	2.0	1.9	1.9
11.3	11.6	11.6	11.3	10.6	9.1	7.0	4.7	2.6	1.4	1.1	1.4	1.8	2.0	1.9	1.9
11.2	11.5	11.5	11.2	10.3	8.7	6.6	4.2	2.2	1.1	1.0	1.4	1.8	2.0	1.9	1.9
10.5	11.0	11.0	10.5	9.4	7.1	5.0	3.0	1.6	0.8	0.7	1.1	1.5	1.8	1.8	1.8
8.8	9.4	9.4	8.8	7.6	5.9	3.9	2.1	1.0	0.7	1.0	1.6	2.0	1.9	1.5	1.5
6.3	6.9	6.9	6.3	5.2	3.8	2.3	1.2	0.7	0.8	1.4	1.9	2.0	1.7	1.1	1.1
3.7	4.1	4.1	3.7	2.9	2.0	1.2	0.8	0.9	1.3	1.8	2.0	1.8	1.2	0.5	0.5
1.8	2.0	2.0	1.8	1.4	1.1	0.9	1.1	1.4	1.8	2.0	1.8	1.2	0.5	0.0	0.0
1.1	1.2	1.2	1.1	1.4	1.3	1.2	1.5	1.8	2.0	1.6	1.1	1.2	0.5	0.0	0.0
1.3	1.3	1.3	1.3	1.3	1.4	1.5	1.6	1.5	1.2	0.7	0.2	-0.2	-0.3	-0.1	-0.1
1.4	1.4	1.4	1.4	1.3	1.3	1.1	0.9	0.6	0.2	-0.1	-0.3	-0.3	0.0	0.2	0.2
0.8	0.9	0.9	0.8	0.7	0.5	0.2	-0.1	-0.3	-0.4	-0.4	-0.2	0.1	0.3	0.3	0.3
0.0	0.1	0.1	0.0	-0.1	-0.3	-0.4	-0.5	-0.5	-0.4	-0.1	0.2	0.3	0.3	0.1	0.1
-0.1	0.3	0.3	0.3	0.4	0.4	0.4	0.4	0.4	0.3	0.3	0.3	0.3	0.2	0.2	0.2
0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.2	0.3	0.2	0.1	0.0	-0.2	-0.2	-0.1
0.3	0.3	0.3	0.3	0.3	0.3	0.3	0.2	0.0	-0.1	-0.3	-0.3	-0.2	0.1	0.1	0.3
0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.2	-0.3	-0.3	-0.2	0.0	0.2	0.2	0.1	0.1
-0.2	-0.2	-0.2	-0.2	-0.2	-0.2	-0.1	-0.1	0.0	0.1	0.2	0.2	0.0	-0.1	-0.2	-0.2
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.1	0.2	0.2	0.2	0.2
0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0	-0.2	-0.1	0.0	0.2	0.1	-0.2	-0.2
-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	-0.1	0.0	0.1	0.2	0.1	-0.1	-0.2	0.2	0.0	0.0
0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.0	-0.1	-0.1	0.1	-0.2	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.1	0.1	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.1	-0.2	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.2	-0.1	-0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.1	0.0	-0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	-0.1	-0.1	0.0	0.0	0.1	0.0	0.0	0.0							

EX14

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PROGRAM XENTPY
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLE 14
THE PROGRAM XENTPY RECONSTRUCTS PARALLEL BEAM PROJECTION
DATA BY MAXIMIZING THE ENTROPY OF THE RECONSTRUCTED IMAGE.
DIMENSION B(441),AG(4)
COMMON/BLANK/WORK(1500)
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0 EACH LINE WILL BE WITHIN 80 CHARACTERS
(OBJECTIVE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
5 (CATN , PAR( 4))
EXTERNAL BRP,PRF
LUNOUT=2
I80132=0
THE INPUT PARAMETERS ARE
NDIMU=21
ICIR=0
IGEOM=0
NANG=4
MODANG=4
KDIMU=25
IMIT=1
NWORK=1500
NFLOAT=2
ISTORE=0
IPRINT=23
LUNATN=0
PWID=1.
AXISU=13.
RFAN=0.
CATN=0.
OPEN OUTPUT FILE
OPEN (LUNOUT,FILE='E14.OUT',FORM='FORMATTED')
CALL SETUP (IPAR,PAR,AG)
LIMITX=1000
ERENTX=.000001
CALL ENTPTY (B,BRF,BRF,LIMITX,ERENTX)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
NMAT=NDIMU**2
KK1=1
KU=NDIMU/15+1
DO 12 K=1,KU
WRITE (LUNOUT,14)
KK2=MIN(15*K,NDIMU)
DO 10 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
10 WRITE (LUNOUT,16) (B(I),I=ISUB1,ISUB2)
12 KK1=KK2+1
CLOSE (LUNOUT)
14 FORMAT(1X,//////)
16 FORMAT(1X,15F5.1)
END
SUBROUTINE GETUM (M,DATA,ERR)
IMPLICIT DOUBLE PRECISION (A-H,O-Z)
SAVE
*****
* RECLBL -- DP VERSION 2.0 -- JULY91 *
*****
EXAMPLE 14
THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
A CIRCULAR PHANTOM WITH TWO RECTANGULAR HOLES.
DIMENSION DATA(*),ERR(*)
DIMENSION B(441)
DIMENSION ITYPE(3),X1(3),Y1(3),A1(3),B1(3),PHI(3),Z(3)
COMMON/OUTCOM/LUNOUT,I80132
LUNOUT - OUTPUT FILE
I80132 - OUTPUT LINE LENGTH FLAG
=0 EACH LINE WILL BE WITHIN 80 CHARACTERS
(OBJECTIVE 132 CHARACTERS)
COMMON/PARM/IPAR(12),PAR(4)
EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),

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3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
4 (PWID , PAR( 1)),(AXISU , PAR( 2)),(RFAN , PAR( 3)),
5 (CATN , PAR( 4))
EXTERNAL PRF
DATA ITYPE/1,2,2/
DATA X1/0.,-3.,2./
DATA Y1/0.,0.,-2./
DATA A1/20.,3.,5./
DATA B1/20.,7.,3./
DATA PHI/0.,0.,0./
DATA Z/20.,-15.,-15./
DATA NPHAN,INTG/3,10/
IF (M.EQ.1) THEN
IF (IMIT.EQ.0) THEN
PWID=PWID
ELSE
PWID=PWID
ENDIF
CALL PHAN (NPHAN,INTG,ITYPE,Z,X1,Y1,A1,B1,PHI,B,NDIMU,PWID)
CALL ARRAY (B,NDIMU)
PRINTOUT THE VALUES FOR THE PHANTOM
NMAT=NDIMU**2
KK1=1
KU=NDIMU/15+1
DO 12 K=1,KU
WRITE (LUNOUT,16)
KK2=MIN(15*K,NDIMU)
DO 10 J=1,NDIMU
ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
10 WRITE (LUNOUT,18) (B(I),I=ISUB1,ISUB2)
12 KK1=KK2+1
ENDIF
CALL PJECT (B,DATA,M,PRF)
RETURN
16 FORMAT(1X,//////)
18 FORMAT(1X,15F5.1)
END
SSS EEEEE TTTT U U PPPP
S E T U U P P P
SSS EEE T U U PPPP
S E T U U P P
SSS EEEEE T UUU P
INTEGER PARAMETER ARRAY (IPAR)
I IPAR(I) DESCRIPTION
1 21 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
2 0 RECONSTRUCT IN A CIRCULAR ARRAY
3 0 GEOMETRY FLAG
4 4 PARALLEL BEAM GEOMETRY
5 4 NUMBER OF PROJECTION ANGLES
MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
ANGLES GENERATED BETWEEN ZERO AND PI
STARTING AT ZERO
6 25 NUMBER OF RAYS FOR EACH PROJECTION
7 1 TRANSMISSION DATA
8 1500 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
9 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
10 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
11 23 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
PRINT PROJECTION DATA AND UNCERTAINTIES
PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
PRINT VALUES FOR THE LAGRANGE MULTIPLIERS AND THE GRADIENT
FOR THE FUNCTION OF LAGRANGE MULTIPLIERS FOR THE ENTROPY
RECONSTRUCTION
12 0 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE
FLOATING POINT PARAMETER ARRAY (PAR)
I PAR(I) DESCRIPTION
1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
2 13.000 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
OF INVERSE PROJECTION BIN WIDTHS
BLANK COMMON REQUIRED 4 ( 4)
BLANK COMMON REQUIRED 8 ( 10)
BLANK COMMON REQUIRED 12 ( 14)
BLANK COMMON REQUIRED 62 ( 76)
BLANK COMMON REQUIRED 83 ( 123)
A TOTAL OF 25 ( 1 THRU 25) OF THE 25 USER PROJECTION BINS WILL BE USED
25 PROJECTION BINS WILL BE USED OF WHICH 0 HAVE BEEN ZEROED BY THE PROGRAM
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 83 FLOATING POINT WORDS.
EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN N D D S E T U U P P

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THE ESTIMATE OF THE MINIMUM IS EST = 5.8551 .

FOR CONGR AND GRADY FCN IS THE VALUE OF THE CHI-SQUARE
FOR ENTYPY FCN IS EVALUATED BY THE SUBROUTINE DULFC

ITER 0 FCN 0.585E+01
ITER 1 FCN 0.581E+01
ITER 2 FCN 0.580E+01
ITER 3 FCN 0.580E+01
ITER 4 FCN 0.579E+01
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ITER164 FCN 0.579E+01
ITER165 FCN 0.579E+01
ITER166 FCN 0.579E+01

THE OPTIMUM SOLUTION FOR THE LAGRANGE MULTIPLIERS
WAS DETERMINED IN 167 ITERATIONS.

FINAL SOLUTION FOR THE LAGRANGE MULTIPLIERS

THE FINAL SOLUTION FOR XLAGR(I), I=1, 100
0.174E-03 0.174E-03 -0.177E+00 0.775E+00 0.761E+00
0.627E+00 0.448E+00 0.259E+00 0.120E+00 -0.372E+00
-0.417E+00 -0.440E+00 -0.221E+00 -0.232E+00 -0.238E+00
-0.230E+00 -0.527E-01 0.990E-02 0.119E+00 0.233E+00
0.329E+00 0.340E+00 -0.594E+00 0.174E-03 -0.174E-03
-0.174E-03 -0.276E-01 -0.256E+01 -0.124E+01 -0.852E+00
-0.644E+00 -0.480E+00 -0.424E+00 -0.322E+00 -0.263E+00
-0.810E-01 0.640E-01 0.132E+00 0.748E-01 0.155E+00
0.900E-01 0.185E+00 0.199E+00 0.250E+00 0.193E+00
0.128E+00 -0.917E-01 -0.136E+01 0.514E+01 0.174E-03
0.174E-03 0.174E-03 0.338E+00 0.113E+01 0.102E+01
0.820E+00 0.627E+00 0.438E+00 0.159E+00 0.251E-01
-0.716E-01 -0.152E+00 -0.224E+00 -0.171E+00 -0.541E+00
-0.587E+00 -0.584E+00 -0.195E+00 -0.829E-01 0.197E-01
0.665E-01 0.446E-02 -0.980E+00 0.174E-03 0.174E-03
-0.174E-03 -0.131E-01 -0.176E+01 -0.546E+00 -0.241E+00
-0.801E-01 0.620E-01 0.198E+00 0.393E+00 0.460E+00
0.523E+00 0.415E+00 0.326E+00 0.242E+00 0.400E+00
0.363E+00 0.407E+00 0.423E+00 0.486E+00 0.412E+00
0.292E+00 -0.357E-01 -0.132E+01 0.953E+00 0.174E-03

THE VALUE OF THE MINIMUM IS 5.7919 .

THE GRADIENT GRAD(I), I=1, 100
0.000E+00 0.000E+00 -0.897E-10 -0.682E-10 0.111E-08
-0.302E-09 -0.112E-08 0.872E-09 -0.162E-08 0.999E-09
-0.126E-08 -0.416E-09 0.424E-09 0.162E-09 -0.826E-09
-0.910E-09 0.121E-08 -0.643E-09 0.570E-09 0.699E-10
-0.744E-09 0.102E-08 -0.705E-09 0.000E+00 -0.241E+00
0.000E+00 0.905E-10 0.136E-08 0.198E-08 0.135E-08
0.108E-08 -0.695E-10 0.878E-09 -0.155E-09 0.393E-09
-0.128E-08 0.269E-09 -0.104E-08 0.512E-09 -0.122E-09
0.215E-09 0.488E-09 0.806E-10 0.726E-09 -0.129E-08
-0.267E-08 -0.181E-08 -0.132E-08 -0.228E-09 0.000E+00
0.000E+00 0.000E+00 -0.173E-08 -0.149E-08 -0.179E-09
-0.164E-09 0.167E-09 -0.727E-09 -0.294E-09 -0.905E-09
-0.718E-09 0.233E-09 -0.648E-09 0.614E-10 0.118E-08
-0.807E-09 0.129E-08 0.749E-09 0.420E-09 0.969E-09
0.167E-08 -0.911E-08 0.466E-09 0.000E+00 0.000E+00
0.000E+00 0.121E-09 0.662E-09 0.985E-09 0.239E-09
-0.931E-09 0.108E-08 -0.253E-09 0.406E-09 -0.128E-08
0.136E-08 0.297E-09 -0.123E-08 0.498E-09 -0.695E-09
0.258E-10 0.918E-09 -0.101E-08 -0.263E-09 -0.115E-08
0.229E-09 0.616E-10 -0.365E-09 -0.266E-09 0.000E+00

THE ENTROPY OF THE RECONSTRUCTION IS 5.7919 .

BLANK COMMON REQUIRED 1056 (2040)
BLANK COMMON REQUIRED 707 (1303)
BLANK COMMON REQUIRED 607 (1137)
BLANK COMMON REQUIRED 507 (773)
BLANK COMMON REQUIRED 407 (627)
BLANK COMMON REQUIRED 207 (317)

MAXIMUM SIZE OF BLANK COMMON THUS FAR= 1206 FLOATING POINT WORDS.

EEEE N N DDDD EEEEE N N TTTT PPPP Y Y Y
E NN N D D E NN N T P P P Y Y
EEE N N N D D EEE N N N T P P P Y Y
E N NN D D E N NN T P Y
EEEE N N DDDD EEEEE N N T P Y

XMIN = 0.00E+00 XMAX = 0.27E+02 XSUM = 0.5744E+04

* ZM@#####M *
* =#####+ *
* -X#####A- *
* ##### *
* =##### *
*)##### *
* =##### *
* -##### *
* ##### *
* -A#####- *
* +#####- *
*)##### *
* ##### *

0.0000E+00 0.2060E+01 0.5081E+01 = 0.6454E+01 + 0.7415E+01) 0.8514E+01 1 0.9612E+01 Z
Z X A M @ @ @ @
0.1057E+02 0.1126E+02 0.1195E+02 0.1346E+02 0.1497E+02 0.1593E+02 0.1703E+02
@ @ @ @ @ @ @ @
0.1799E+02 0.2005E+02 0.2252E+02 0.2389E+02 0.2499E+02 0.2609E+02 0.2705E+02
■
0.2746E+02

0.0 0.0 0.0 0.0 0.0 0.0 0.0 4.0 5.2 7.8 7.0 6.9 6.3 4.7 0.0
0.0 0.0 0.0 0.0 0.0 8.3 12.7 16.3 16.6 22.8 20.7 20.1 19.5 16.8 12.9
0.0 0.0 0.0 0.0 9.0 20.3 18.1 19.5 20.0 26.1 22.4 21.3 20.6 19.1 17.4
0.0 0.0 0.0 8.0 18.3 23.9 19.4 19.4 20.3 27.5 21.8 20.8 19.8 18.8 19.9
0.0 0.0 7.3 15.9 21.0 22.6 17.2 19.0 19.0 25.4 22.2 19.8 18.5 19.6 19.3
0.0 6.6 17.0 20.3 20.0 20.0 15.1 16.1 17.3 23.5 20.4 19.6 19.3 18.3 18.9
0.0 14.9 21.4 23.7 20.5 18.4 13.3 13.7 15.1 22.2 19.2 20.7 20.0 18.8 20.1
4.8 17.6 20.7 20.3 19.7 16.0 10.1 10.6 11.4 16.7 17.7 17.4 17.7 18.9 17.9
6.9 20.0 22.0 21.5 19.0 16.9 10.3 9.5 10.1 16.4 15.8 17.8 19.1 19.2 19.1
7.8 22.0 23.4 22.1 18.9 16.3 10.9 9.4 10.0 14.8 14.7 17.5 19.3 18.8 18.5
7.8 23.2 24.8 21.9 19.3 16.1 10.2 11.0 10.1 13.8 14.5 15.9 17.1 18.0 16.9
6.0 17.6 19.2 18.2 15.0 12.7 8.8 8.3 8.7 11.9 10.4 11.1 11.6 11.8 13.5
5.1 15.9 18.3 17.7 15.3 13.8 8.8 8.5 9.0 12.8 10.3 9.6 9.6 10.7 12.4
3.5 13.6 16.7 16.7 16.8 14.4 9.2 9.4 9.2 12.2 10.7 9.0 8.9 10.0 11.3
0.0 14.6 21.7 26.2 24.8 23.2 16.3 14.9 14.4 18.3 14.7 15.3 14.4 14.2 16.6
0.0 6.4 18.0 23.9 25.6 26.1 17.9 16.7 15.0 18.6 16.3 16.4 16.9 16.2 16.7
0.0 0.0 8.2 19.5 26.7 27.4 19.0 18.0 16.4 21.5 19.2 18.7 19.0 20.1 18.5
0.0 0.0 0.0 9.6 20.9 25.4 18.6 17.6 18.5 25.6 21.6 21.9 21.7 20.7 20.6
0.0 0.0 0.0 0.0 8.8 17.9 15.3 17.3 19.0 27.1 24.6 23.7 22.4 20.5 18.3
0.0 0.0 0.0 0.0 0.0 6.2 10.1 14.0 16.3 24.8 23.3 22.2 19.6 16.9 12.5
0.0 0.0 0.0 0.0 0.0 0.0 3.4 5.0 8.1 7.5 7.2 6.3 4.4 0.0

0.0 0.0 0.0 0.0 0.0 0.0
5.7 0.0 0.0 0.0 0.0 0.0
17.0 8.0 0.0 0.0 0.0 0.0
21.0 17.6 9.0 0.0 0.0 0.0
22.1 23.2 18.9 8.7 0.0 0.0
23.4 23.8 22.5 17.2 6.8 0.0
23.3 23.6 22.7 20.0 14.8 0.0
19.8 19.7 18.7 18.9 16.9 5.0
19.6 18.5 19.5 20.3 18.5 6.7
19.8 19.5 20.4 21.0 20.3 7.6
20.2 21.8 21.2 22.2 21.3 7.7
16.2 17.4 18.8 18.5 16.5 5.8
16.2 17.8 19.3 19.3 15.9 5.2
15.2 18.2 18.7 18.4 15.3 4.0
21.9 24.8 27.2 25.1 17.7 0.0
20.8 22.8 23.4 20.0 8.5 0.0
20.0 20.5 17.6 9.1 0.0 0.0
19.8 15.2 7.9 0.0 0.0 0.0
16.5 7.2 0.0 0.0 0.0 0.0
6.5 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0

EX15

```

PROGRAM XGVERS
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 15
C
C THE PROGRAM XGVERS USES THE GENERALIZED INVERSE TO
C RECONSTRUCT PARALLEL BEAM PROJECTION DATA AND COMPARES
C THE RESULT WITH THE CONJUGATE GRADIENT METHOD OF RECONS-
C TRUCTION.
C
C DIMENSION B(144),BE(144),AG(18)
C COMMON/BLANK/WORK(46000)
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C 1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C 2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C 3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C 4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
C 5 (CATN ,PAR( 4))
C
C EXTERNAL BLL,PLL
C
C LUNOUT=2
C I80132=0
C
C THE INPUT PARAMETERS ARE
C
C NDIMU=12
C ICIR=0
C IGEOM=0
C NANG=18
C MODANG=2
C KDIMU=12
C IMIT=0
C NWORK=46000
C NFLOAT=2
C ISTORE=0
C IPRINT=7
C LUNATN=0
C PWID=1
C AXISU=6.5
C RFAN=0
C CATN=0.
C
C OPEN OUTPUT FILE
C
C OPEN (LUNOUT,FILE='E15.OUT',FORM='FORMATTED')
C
C CALL SETUP (IPAR,PAR,AG)
C
C IERR=2
C
C CALL GVERS (B,BE,PLL,BLL,CHISQ,IERR)
C
C WRITE (LUNOUT,24) CHISQ
C
C CALL ARRAY (B,NDIMU)
C
C PRINTOUT OF THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
C
C NMAT=NDIMU**2
C KK1=1
C KU=NDIMU/15+1
C DO 12 K=1,KU
C WRITE (LUNOUT,22)
C KK2=MIN(15,K,NDIMU)
C DO 10 J=1,NDIMU
C ISUB1=NMAT-J*NDIMU+KK1
C ISUB2=NMAT-J*NDIMU+KK2
C WRITE (LUNOUT,26) (B(I),I=ISUB1,ISUB2)
C 10 KK1=KK2+1
C
C CALL ARRAY (BE,NDIMU)
C
C PRINTOUT THE VALUES FOR THE RECONSTRUCTION ERRORS
C
C KK1=1
C KU=NDIMU/15+1
C DO 16 K=1,KU
C WRITE (LUNOUT,22)
C KK2=MIN(15,K,NDIMU)
C DO 14 J=1,NDIMU
C ISUB1=NMAT-J*NDIMU+KK1
C ISUB2=NMAT-J*NDIMU+KK2
C WRITE (LUNOUT,26) (BE(I),I=ISUB1,ISUB2)
C 14 KK1=KK2+1
C
C COMPARE THE GENERALIZED INVERSE METHOD WITH THE CONJUGATE
C GRADIENT METHOD
C
C ISTEP=15
C IRLX=1
C IERR=1
C IZER=0
C
C CALL CONGR (B,PLL,BLL,ISTP,IRLX,IERR,IZER)
C
C CALL ARRAY (B,NDIMU)
C
C PRINTOUT OF THE VALUES FOR THE RECONSTRUCTED TRANSVERSE SECTION
C
C KK1=1
C KU=NDIMU/15+1
C DO 20 K=1,KU
C WRITE (LUNOUT,22)
C KK2=MIN(15,K,NDIMU)
C DO 18 J=1,NDIMU

```

```

ISUB1=NMAT-J*NDIMU+KK1
ISUB2=NMAT-J*NDIMU+KK2
WRITE (LUNOUT,26) (B(I),I=ISUB1,ISUB2)
20 KK1=KK2+1
C
C CLOSE (LUNOUT)
C
C 22 FORMAT(LX////////)
24 FORMAT(LX/' CHISQ = ',E15.7)
26 FORMAT(LX,15P5.1)
END
SUBROUTINE GETUM (M,DATA,ERR)
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 15
C
C THE SUBROUTINE GETUM GIVES SIMULATED PROJECTION DATA FOR
C TWO RECTANGLES.
C
C DIMENSION DATA(*),ERR(*)
C DIMENSION B(144)
C DIMENSION A1(2),B1(2),X1(2),Y1(2),PHI(2),Z(2),ITYPE(2)
C
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT - OUTPUT FILE
C I80132 - OUTPUT LINE LENGTH FLAG
C =0 EACH LINE WILL BE WITHIN 80 CHARACTERS
C (OTHERWISE 132 CHARACTERS)
C
C COMMON/PARM/IPAR(12),PAR(4)
C
C EQUIVALENCE (NDIMU ,IPAR( 1)),(ICIR ,IPAR( 2)),(IGEOM ,IPAR( 3)),
C 1 (NANG ,IPAR( 4)),(MODANG,IPAR( 5)),(KDIMU ,IPAR( 6)),
C 2 (IMIT ,IPAR( 7)),(NWORK ,IPAR( 8)),(NFLOAT,IPAR( 9)),
C 3 (ISTORE,IPAR(10)),(IPRINT,IPAR(11)),(LUNATN,IPAR(12)),
C 4 (PWID ,PAR( 1)),(AXISU ,PAR( 2)),(RFAN ,PAR( 3)),
C 5 (CATN ,PAR( 4))
C
C DATA ITYPE/2,2/
C DATA A1/3.5,7/
C DATA B1/8.,4./
C DATA X1/-3.5,2.5/
C DATA Y1/0.,0./
C DATA PHI/0.,0./
C DATA Z/1.,1./
C
C IF (M.EQ.1) THEN
C IF (IMIT.NE.0) PWIDTH=PWID
C IF (IMIT.EQ.0) PWIDTH=PWID
C CALL PHAN (2,10,ITYPE,Z,X1,Y1,A1,B1,PHI,B,NDIMU,PWIDTH)
C ENDF
C
C CALL PHANL (2,ITYPE,Z,X1,Y1,A1,B1,PHI,DATA,M)
C
C DO 12 I=1,12
C IF (DATA(I).GT.0.) THEN
C ERR(I)=SQRT(DATA(I))
C ELSE
C ERR(I)=1.
C ENDF
C 12 CONTINUE
C
C RETURN
C END
C
C *****
C SSS EEEEE TTTT U U PPPP
C S E T U U P P P
C SSS EEE T U U PPPP
C S E T U U P
C SSS EEEEE T UUU P
C
C INTEGER PARAMETER ARRAY (IPAR)
C
C I IPAR(I) DESCRIPTION
C 1 12 LINEAR DIMENSION OF THE RECONSTRUCTION ARRAY
C 2 0 RECONSTRUCT IN A CIRCULAR ARRAY
C 3 0 GEOMETRY FLAG
C 4 18 PARALLEL BEAM GEOMETRY
C 5 2 NUMBER OF PROJECTION ANGLES
C 6 18 MODE FOR PROJECTION ANGLE INPUT (SEE FOLLOWING LINES)
C 7 0 ANGLES GENERATED BETWEEN ZERO AND PI
C 8 12 STARTING AT THE HALF ANGLE
C 9 0 NUMBER OF RAYS FOR EACH PROJECTION
C 10 46000 EMISSION DATA
C 11 2 DIMENSION OF THE FLOATING POINT USERS BLANK COMMON BLOCK
C 12 2 NUMBER OF WORDS FOR A FLOATING POINT VARIABLE
C 13 0 EXECUTE THE RECONSTRUCTION (NOT JUST STORAGE SIZE TEST)
C 14 7 PRINT FLAGS (OPTIONS SELECTED ARE ON THE FOLLOWING LINES)
C 15 0 PRINT REQUIRED FLOATING POINT BLANK COMMON WHENEVER CHANGED
C 16 0 PRINT PROJECTION DATA AND UNCERTAINTIES
C 17 0 PRINT SETUP VALUES FROM IPAR AND PAR ARRAYS
C 18 0 LOGICAL UNIT NO. FOR ATTENUATION FACTOR STORAGE
C
C *****
C FLOATING POINT PARAMETER ARRAY (PAR)
C
C I PAR(I) DESCRIPTION
C 1 1.000 PIXEL WIDTH IN UNITS OF PROJECTION BIN WIDTH
C 2 6.500 LOCATION OF THE ROTATION AXIS IN THE PROJECTION ARRAY
C 3 0.000 NA NOT APPLICABLE (NOT FAN BEAM GEOMETRY)
C 4 0.000 NA CONSTANT ATTENUATION COEFFICIENT IN UNITS
C OF INVERSE PROJECTION BIN WIDTHS
C
C BLANK COMMON REQUIRED 18 ( 22)
C
C BLANK COMMON REQUIRED 36 ( 44)

```

BLANK COMMON REQUIRED 54 (66)
 BLANK COMMON REQUIRED 78 (116)
 BLANK COMMON REQUIRED 90 (132)
 A TOTAL OF 12 (1 THRU 12) OF THE 12 USER PROJECTION BINS WILL BE USED
 16 PROJECTION BINS WILL BE USED OF WHICH 4 HAVE BEEN ZEROED BY THE PROGRAM
 MAXIMUM SIZE OF BLANK COMMON THUS FAR= 90 FLOATING POINT WORDS.

```

EEEE N N DDDD SSS EEEEE TTTT U U PPPP
E NN ND D S E T U UP P
EEE N N D D SSS EEE T U U PPPP
E N NN D D S E T U UP
EEEE N N DDDD SSS EEEEE T UUU P
  
```

```

GGG V V EEEEE RRRR SSS
G G V V E R R S
G V V EEE RRRR SSS
G G V V E R R S
GGGG V EEEEE R R SSS
  
```

PARAMETERS FOR SUBROUTINE GVERS

DESCRIPTION
 IERR - 2 USE UNCERTAINTIES AND CALCULATE ERRORS

BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES
 PERFORM THE FOLLOWING FUNCTIONS

```

ARG FUNCTION RAY WEIGHTING ATTENUATION FAN BEAM
BCK BACKPROJECTION LINE LENGTH NO NO
PRJ PROJECTION LINE LENGTH NO NO
  
```

BLANK COMMON REQUIRED 32346 (77132)
 BLANK COMMON REQUIRED 44890 (127532)
 BLANK COMMON REQUIRED 44946 (127622)
 BLANK COMMON REQUIRED 45058 (130002)
 BLANK COMMON REQUIRED 45634 (131102)
 BLANK COMMON REQUIRED 45666 (131142)

```

PPPP H H AAA N N
P PH HA A NN N
PPPP HHHH A A N N
P H H AAAAA NN
P H H A A N N
  
```

PHANTOM GENERATED

ARRAY SIZE 12 X 12 INTEGRATION FACTOR = 10 SCALING FACTOR = 1.000
 NUMBER OF ELLIPSES AND/OR RECTANGLES = 2
 THE PARAMETERS FOR THE ELLIPSES AND/OR RECTANGLES ARE
 X,Y - CENTER
 A,B - LENGTH OF AXIS OR SIDE A AND B
 PHI - ANGLE OF AXIS OR SIDE A
 DENS - INTENSITY
 THE PARENTHESIS INDICATES THE SCALED VALUE

```

ITYPE X Y A B PHI DENS
2 - RE @ @ ( 0.00, 1.00 ) ( 3.00, 8.00 ) ( 1.00 )
2 - RE @ @ ( 0.00, 1.00 ) ( 2.50, 5.00 ) ( 4.00 ) ( 1.00 )
  
```

```

EEEE N N DDDD PPPP H H AAA N N
E NN ND D P PH HA A NN N
EEE N N N D D PPPP HHHH A A N N
E N NN D D P H H AAAAA NN
EEEE N N DDDD P H H A A N N
  
```

BLANK COMMON REQUIRED 45682 (131162)
 PROJECTION DATA FOR ANGLE NO. 1 0.087 RADIAN 5.000 DEGREES
 0.000E+00 0.000E+00 0.000E+00 0.167E+00
 0.167E+00 0.446E+00 0.446E+00 0.446E+00
 0.167E+00 0.167E+00 0.000E+00 0.000E+00
 PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 1
 0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.409E+00
 0.409E+00 0.668E+00 0.668E+00 0.668E+00 0.668E+00
 0.409E+00 0.409E+00 0.100E+01 0.100E+01 0.100E+01
 PROJECTION DATA FOR ANGLE NO. 2 0.262 RADIAN 15.000 DEGREES
 0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
 0.334E+00 0.460E+00 0.460E+00 0.259E+00
 0.173E+00 0.173E+00 0.146E+00 0.000E+00 0.000E+00
 PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 2
 0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.100E+01
 0.578E+00 0.578E+00 0.678E+00 0.518E+00
 0.415E+00 0.415E+00 0.382E+00 0.100E+01 0.100E+01
 PROJECTION DATA FOR ANGLE NO. 3 0.436 RADIAN 25.000 DEGREES
 0.000E+00 0.000E+00 0.000E+00 0.617E-01
 0.247E+00 0.490E+00 0.490E+00 0.374E+00 0.229E+00

```

0.184E+00 0.184E+00 0.180E+00 0.346E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 3
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.248E+00
0.497E+00 0.700E+00 0.700E+00 0.612E+00 0.479E+00
0.429E+00 0.429E+00 0.424E+00 0.186E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 4 0.611 RADIAN 35.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.731E-03 0.119E+00
0.237E+00 0.414E+00 0.446E+00 0.338E+00 0.220E+00
0.203E+00 0.203E+00 0.194E+00 0.762E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 4
0.100E+01 0.100E+01 0.100E+01 0.270E-01 0.345E+00
0.487E+00 0.643E+00 0.667E+00 0.581E+00 0.469E+00
0.451E+00 0.451E+00 0.441E+00 0.276E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 5 0.785 RADIAN 45.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.500E-01 0.161E+00
0.272E+00 0.314E+00 0.314E+00 0.314E+00 0.236E+00
0.236E+00 0.236E+00 0.207E+00 0.960E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 5
0.100E+01 0.100E+01 0.100E+01 0.224E+00 0.401E+00
0.522E+00 0.561E+00 0.561E+00 0.561E+00 0.485E+00
0.485E+00 0.485E+00 0.455E+00 0.310E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 6 0.960 RADIAN 55.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.878E-01 0.206E+00
0.271E+00 0.271E+00 0.213E+00 0.213E+00 0.255E+00
0.291E+00 0.291E+00 0.223E+00 0.105E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 6
0.100E+01 0.100E+01 0.100E+01 0.296E+00 0.454E+00
0.521E+00 0.521E+00 0.462E+00 0.462E+00 0.505E+00
0.539E+00 0.539E+00 0.473E+00 0.324E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 7 1.134 RADIAN 65.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.127E+00 0.245E+00
0.245E+00 0.245E+00 0.195E+00 0.105E+00 0.200E+00
0.345E+00 0.394E+00 0.250E+00 0.105E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 7
0.100E+01 0.100E+01 0.100E+01 0.357E+00 0.495E+00
0.495E+00 0.495E+00 0.442E+00 0.324E+00 0.447E+00
0.587E+00 0.628E+00 0.500E+00 0.324E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 8 1.309 RADIAN 75.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.188E+00 0.230E+00
0.230E+00 0.230E+00 0.226E+00 0.392E-02 0.134E+00
0.356E+00 0.460E+00 0.303E+00 0.811E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 8
0.100E+01 0.100E+01 0.100E+01 0.434E+00 0.480E+00
0.480E+00 0.480E+00 0.476E+00 0.626E-01 0.366E+00
0.597E+00 0.678E+00 0.551E+00 0.285E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 9 1.484 RADIAN 85.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.223E+00 0.223E+00
0.223E+00 0.223E+00 0.223E+00 0.000E+00 0.000E+00
0.446E+00 0.446E+00 0.446E+00 0.000E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 9
0.100E+01 0.100E+01 0.100E+01 0.472E+00 0.472E+00
0.472E+00 0.472E+00 0.472E+00 0.100E+01 0.100E+01
0.668E+00 0.668E+00 0.668E+00 0.100E+01 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 10 1.658 RADIAN 95.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.223E+00 0.223E+00
0.223E+00 0.223E+00 0.223E+00 0.000E+00 0.000E+00
0.446E+00 0.446E+00 0.446E+00 0.000E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 10
0.100E+01 0.100E+01 0.100E+01 0.472E+00 0.472E+00
0.472E+00 0.472E+00 0.472E+00 0.100E+01 0.100E+01
0.668E+00 0.668E+00 0.668E+00 0.100E+01 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 11 1.833 RADIAN 105.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.188E+00 0.230E+00
0.230E+00 0.230E+00 0.226E+00 0.392E-02 0.134E+00
0.356E+00 0.460E+00 0.303E+00 0.811E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 11
0.100E+01 0.100E+01 0.100E+01 0.434E+00 0.480E+00
0.480E+00 0.480E+00 0.476E+00 0.626E-01 0.366E+00
0.597E+00 0.678E+00 0.551E+00 0.285E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 12 2.007 RADIAN 115.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.127E+00 0.245E+00
0.245E+00 0.245E+00 0.195E+00 0.105E+00 0.200E+00
0.345E+00 0.394E+00 0.250E+00 0.105E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 12
0.100E+01 0.100E+01 0.100E+01 0.357E+00 0.495E+00
0.495E+00 0.495E+00 0.442E+00 0.324E+00 0.447E+00
0.587E+00 0.628E+00 0.500E+00 0.324E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 13 2.182 RADIAN 125.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.878E-01 0.206E+00
0.271E+00 0.271E+00 0.213E+00 0.213E+00 0.255E+00
0.291E+00 0.291E+00 0.223E+00 0.105E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 13
0.100E+01 0.100E+01 0.100E+01 0.296E+00 0.454E+00
0.521E+00 0.521E+00 0.462E+00 0.462E+00 0.505E+00
0.539E+00 0.539E+00 0.473E+00 0.324E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 14 2.356 RADIAN 135.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.500E-01 0.161E+00
0.272E+00 0.314E+00 0.314E+00 0.314E+00 0.236E+00
0.236E+00 0.236E+00 0.207E+00 0.960E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 14
0.100E+01 0.100E+01 0.100E+01 0.224E+00 0.401E+00
0.522E+00 0.561E+00 0.561E+00 0.561E+00 0.485E+00
0.485E+00 0.485E+00 0.455E+00 0.310E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 15 2.531 RADIAN 145.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.731E-03 0.119E+00
0.237E+00 0.414E+00 0.446E+00 0.338E+00 0.220E+00
0.203E+00 0.203E+00 0.194E+00 0.762E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 15
  
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0.100E+01 0.100E+01 0.100E+01 0.270E-01 0.345E+00
0.487E+00 0.643E+00 0.667E+00 0.581E+00 0.469E+00
0.451E+00 0.451E+00 0.441E+00 0.276E+00 0.100E+01
0.100E+01

PROJECTION DATA FOR ANGLE NO. 16 2.705 RADIAN 155.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.617E-01
0.247E+00 0.490E+00 0.490E+00 0.374E+00 0.229E+00
0.184E+00 0.184E+00 0.180E+00 0.346E-01 0.000E+00
0.000E+00

PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 16
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.248E+00
0.497E+00 0.700E+00 0.700E+00 0.612E+00 0.479E+00
0.429E+00 0.429E+00 0.424E+00 0.186E+00 0.100E+01
0.100E+01

PROJECTION DATA FOR ANGLE NO. 17 2.880 RADIAN 165.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.334E+00 0.460E+00 0.460E+00 0.460E+00 0.259E+00
0.173E+00 0.173E+00 0.146E+00 0.000E+00 0.000E+00
0.000E+00

PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 17
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.100E+01
0.578E+00 0.678E+00 0.678E+00 0.678E+00 0.518E+00
0.415E+00 0.415E+00 0.382E+00 0.100E+01 0.100E+01
0.100E+01

BLANK COMMON REQUIRED 45666 (131142)

PROJECTION DATA FOR ANGLE NO. 18 3.054 RADIAN 175.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.167E+00
0.167E+00 0.446E+00 0.446E+00 0.446E+00 0.446E+00
0.167E+00 0.167E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00

PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 18
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.409E+00
0.409E+00 0.668E+00 0.668E+00 0.668E+00 0.668E+00
0.409E+00 0.409E+00 0.100E+01 0.100E+01 0.100E+01
0.100E+01

BLANK COMMON REQUIRED 13410 (32142)

BLANK COMMON REQUIRED 866 (1542)

BLANK COMMON REQUIRED 810 (1452)

BLANK COMMON REQUIRED 698 (1272)

BLANK COMMON REQUIRED 666 (1232)

BLANK COMMON REQUIRED 90 (132)

MAXIMUM SIZE OF BLANK COMMON THUS FAR = 45682 FLOATING POINT WORDS.

EEEE N N DDDD GGG V V EEEEE RRRR SSS
E NN N D D G G V V E R R S
EEE N N D D G G V V EEE RRRR SSS
E N NN D D G GG V V E R R S
EEEE N N DDDD GGGG V EEEEE R R SSS

CHISQ = 0.1014746E-11

XMIN = -0.37E-05 XMAX = 0.10E+01 XSUM = 0.4400E+02

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-.3688E-05 0.7500E-01 0.1850E+00 0.2350E+00 0.2700E+00 0.3100E+00 0.3500E+00

Z 0.3850E+00 0.4100E+00 0.4350E+00 0.4900E+00 0.5450E+00 0.5800E+00 0.6200E+00

0.6550E+00 0.7300E+00 0.8200E+00 0.8700E+00 0.9100E+00 0.9500E+00 0.9850E+00

0.1000E+01

0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 1.0 1.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 1.0 1.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 1.0 1.0 1.0 0.0 0.0 1.0 1.0 1.0 1.0 1.0 0.0 0.0 0.0
0.0 1.0 1.0 1.0 0.0 0.0 1.0 1.0 1.0 1.0 1.0 1.0 0.0 0.0
0.0 1.0 1.0 1.0 0.0 0.0 1.0 1.0 1.0 1.0 1.0 1.0 0.0 0.0
0.0 1.0 1.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 1.0 1.0 1.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0
0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0 0.0

XMIN = 0.00E+00 XMAX = 0.29E+02 XSUM = 0.8535E+03

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*
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*
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-))11))Z)--
-))11))Z)--
-))11))Z)--
--))1111)--
--))1111)--

0.0000E+00 0.2154E+01 0.5314E+01 0.6750E+01 0.7756E+01 0.8905E+01 0.1005E+02

Z 0.1106E+02 0.1178E+02 0.1250E+02 0.1408E+02 0.1566E+02 0.1666E+02 0.1781E+02

0.1882E+02 0.2097E+02 0.2355E+02 0.2499E+02 0.2614E+02 0.2729E+02 0.2829E+02

0.2873E+02

0.0 0.0 0.0 0.0 4.0 3.9 4.3 4.1 0.0 0.0 0.0 0.0
0.0 0.0 3.9 6.0 5.2 5.2 5.3 5.0 5.6 4.2 0.0 0.0
0.0 3.7 6.8 7.6 8.6 8.6 8.6 8.2 7.7 6.5 4.3 0.0
0.0 6.0 8.1 8.1 10.7 10.1 9.8 10.2 8.1 7.9 5.8 0.0
4.1 5.4 8.2 9.9 9.2 8.4 8.4 8.9 10.7 8.1 5.0 3.8
3.8 5.3 8.6 8.7 6.8 28.7 28.7 7.0 9.8 8.2 4.9 4.1
3.8 5.3 8.6 8.7 6.8 28.7 28.7 7.0 9.8 8.2 4.9 4.1
4.1 5.4 8.2 9.9 9.2 8.4 8.4 8.9 10.7 8.1 5.0 3.8
0.0 6.0 8.1 8.1 10.7 10.1 9.8 10.2 8.1 7.9 5.8 0.0
0.0 3.7 6.8 7.6 8.6 8.6 8.6 8.2 7.7 6.5 4.3 0.0
0.0 0.0 3.9 6.0 5.2 5.2 5.3 5.0 5.6 4.2 0.0 0.0
0.0 0.0 0.0 0.0 4.0 3.9 4.3 4.1 0.0 0.0 0.0 0.0

CCC OOOO N N GGG RRRR
C C O O N N N G G R R R
C C O O N N N G G R R R
C C O O N N N G G R R R
CCC OOOO N N GGGG R R R

PARAMETERS FOR SUBROUTINE CONGR

DESCRIPTION
ISTP - 15 NUMBER OF ITERATION STEPS
IRLX - 1 ITERATIVE RELAXATION METHOD
IERR - 1 USE ERROR ARRAY
IZER - 0 INITIAL SOLUTION IS ZERO

BACKPROJECTION AND PROJECTION/CONVOLUTION/FILTER ROUTINES
PERFORM THE FOLLOWING FUNCTIONS

ARG FUNCTION RAY WEIGHTING ATTENUATION FAN BEAM
BCK BACKPROJECTION LINE LENGTH NO NO
PRJ PROJECTION LINE LENGTH NO NO

BLANK COMMON REQUIRED 122 (172)

BLANK COMMON REQUIRED 234 (352)

BLANK COMMON REQUIRED 522 (1012)

BLANK COMMON REQUIRED 634 (1172)

BLANK COMMON REQUIRED 746 (1352)

BLANK COMMON REQUIRED 858 (1532)

PPPP H H AAA N N
P P H H A A N N N
PPPP HHHHH A A N N N
P H H AAAAA N N N
P H H A A N N

PHANTOM GENERATED
ARRAY SIZE 12 X 12 INTEGRATION FACTOR = 10 SCALING FACTOR = 1.000
NUMBER OF ELLIPSES AND/OR RECTANGLES = 2
THE PARAMETERS FOR THE ELLIPSES AND/OR RECTANGLES ARE
X,Y - CENTER
A,B - LENGTH OF AXIS OR SIDE A AND B
PHI - ANGLE OF AXIS OR SIDE A
DENS - INTENSITY

THE PARENTHESIS INDICATES THE SCALED VALUE
ITYPE X Y A B PHI DENS
2 - RE @@@ (0.00 , 1.00) (3.00) (8.00) (1.00)
2 - RE @@@ (-3.50) (0.00) (3.00) (8.00) (1.00)
2 - RE @@@ (0.00 , 1.00) (5.00) (4.00) (1.00)
2 - RE @@@ (2.50) (0.00) (5.00) (4.00) (1.00)

EEEE N N DDDD PPPP H H AAA N N
E NN N D D P P H H A A N N N
EEE N N D D PPPP HHHHH A A N N N
E N NN D D P H H AAAAA N N N
EEEE N N DDDD P H H A A N N

BLANK COMMON REQUIRED 874 (1552)

PROJECTION DATA FOR ANGLE NO. 1 0.087 RADIAN 5.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.167E+00
0.167E+00 0.446E+00 0.446E+00 0.446E+00 0.446E+00
0.167E+00 0.167E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00

PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 1

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0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.409E+00
0.409E+00 0.668E+00 0.668E+00 0.668E+00 0.668E+00
0.409E+00 0.409E+00 0.100E+01 0.100E+01 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 2 0.262 RADIANS 15.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.334E+00 0.460E+00 0.460E+00 0.460E+00 0.269E+00
0.173E+00 0.173E+00 0.146E+00 0.000E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 2
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.100E+01
0.578E+00 0.678E+00 0.678E+00 0.678E+00 0.518E+00
0.415E+00 0.415E+00 0.382E+00 0.100E+01 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 3 0.436 RADIANS 25.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.617E-01
0.247E+00 0.490E+00 0.490E+00 0.374E+00 0.229E+00
0.184E+00 0.184E+00 0.180E+00 0.346E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 3
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.248E+00
0.497E+00 0.700E+00 0.700E+00 0.612E+00 0.479E+00
0.429E+00 0.429E+00 0.424E+00 0.186E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 4 0.611 RADIANS 35.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.731E-03 0.119E+00
0.237E+00 0.414E+00 0.446E+00 0.338E+00 0.220E+00
0.203E+00 0.203E+00 0.194E+00 0.762E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 4
0.100E+01 0.100E+01 0.100E+01 0.270E-01 0.345E+00
0.487E+00 0.643E+00 0.667E+00 0.581E+00 0.469E+00
0.451E+00 0.451E+00 0.441E+00 0.276E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 5 0.785 RADIANS 45.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.500E-01 0.161E+00
0.272E+00 0.314E+00 0.314E+00 0.314E+00 0.236E+00
0.236E+00 0.236E+00 0.207E+00 0.960E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 5
0.100E+01 0.100E+01 0.100E+01 0.224E+00 0.401E+00
0.522E+00 0.561E+00 0.561E+00 0.561E+00 0.485E+00
0.485E+00 0.485E+00 0.455E+00 0.310E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 6 0.960 RADIANS 55.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.878E-01 0.206E+00
0.271E+00 0.271E+00 0.213E+00 0.213E+00 0.255E+00
0.291E+00 0.291E+00 0.223E+00 0.105E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 6
0.100E+01 0.100E+01 0.100E+01 0.296E+00 0.454E+00
0.521E+00 0.521E+00 0.462E+00 0.462E+00 0.505E+00
0.539E+00 0.539E+00 0.473E+00 0.324E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 7 1.134 RADIANS 65.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.127E+00 0.245E+00
0.245E+00 0.245E+00 0.195E+00 0.105E+00 0.200E+00
0.345E+00 0.394E+00 0.250E+00 0.105E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 7
0.100E+01 0.100E+01 0.100E+01 0.357E+00 0.495E+00
0.495E+00 0.495E+00 0.442E+00 0.324E+00 0.447E+00
0.597E+00 0.628E+00 0.500E+00 0.324E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 8 1.309 RADIANS 75.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.188E+00 0.230E+00
0.230E+00 0.230E+00 0.226E+00 0.392E-02 0.134E+00
0.356E+00 0.460E+00 0.303E+00 0.811E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 8
0.100E+01 0.100E+01 0.100E+01 0.434E+00 0.480E+00
0.480E+00 0.480E+00 0.476E+00 0.626E-01 0.366E+00
0.597E+00 0.678E+00 0.551E+00 0.285E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 9 1.484 RADIANS 85.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.223E+00 0.223E+00
0.223E+00 0.223E+00 0.223E+00 0.000E+00 0.000E+00
0.446E+00 0.446E+00 0.446E+00 0.000E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 9
0.100E+01 0.100E+01 0.100E+01 0.472E+00 0.472E+00
0.472E+00 0.472E+00 0.472E+00 0.100E+01 0.100E+01
0.668E+00 0.668E+00 0.668E+00 0.100E+01 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 10 1.658 RADIANS 95.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.223E+00 0.223E+00
0.223E+00 0.223E+00 0.223E+00 0.000E+00 0.000E+00
0.446E+00 0.446E+00 0.446E+00 0.000E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 10
0.100E+01 0.100E+01 0.100E+01 0.472E+00 0.472E+00
0.472E+00 0.472E+00 0.472E+00 0.100E+01 0.100E+01
0.668E+00 0.668E+00 0.668E+00 0.100E+01 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 11 1.833 RADIANS 105.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.188E+00 0.230E+00
0.230E+00 0.230E+00 0.226E+00 0.392E-02 0.134E+00
0.356E+00 0.460E+00 0.303E+00 0.811E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 11
0.100E+01 0.100E+01 0.100E+01 0.434E+00 0.480E+00
0.480E+00 0.480E+00 0.476E+00 0.626E-01 0.366E+00
0.597E+00 0.678E+00 0.551E+00 0.285E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 12 2.007 RADIANS 115.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.127E+00 0.245E+00
0.245E+00 0.245E+00 0.195E+00 0.105E+00 0.200E+00
0.345E+00 0.394E+00 0.250E+00 0.105E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 12
0.100E+01 0.100E+01 0.100E+01 0.357E+00 0.495E+00
0.495E+00 0.495E+00 0.442E+00 0.324E+00 0.447E+00
0.597E+00 0.628E+00 0.500E+00 0.324E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 13 2.182 RADIANS 125.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.878E-01 0.206E+00
0.271E+00 0.271E+00 0.213E+00 0.213E+00 0.255E+00
0.291E+00 0.291E+00 0.223E+00 0.105E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 13
0.100E+01 0.100E+01 0.100E+01 0.296E+00 0.454E+00
0.521E+00 0.521E+00 0.462E+00 0.462E+00 0.505E+00
0.539E+00 0.539E+00 0.473E+00 0.324E+00 0.100E+01
0.100E+01

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0.100E+01
PROJECTION DATA FOR ANGLE NO. 14 2.356 RADIANS 135.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.500E-01 0.161E+00
0.272E+00 0.314E+00 0.314E+00 0.314E+00 0.236E+00
0.236E+00 0.236E+00 0.207E+00 0.960E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 14
0.100E+01 0.100E+01 0.100E+01 0.224E+00 0.401E+00
0.522E+00 0.561E+00 0.561E+00 0.561E+00 0.485E+00
0.485E+00 0.485E+00 0.455E+00 0.310E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 15 2.531 RADIANS 145.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.731E-03 0.119E+00
0.237E+00 0.414E+00 0.446E+00 0.338E+00 0.220E+00
0.203E+00 0.203E+00 0.194E+00 0.762E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 15
0.100E+01 0.100E+01 0.100E+01 0.270E-01 0.345E+00
0.487E+00 0.643E+00 0.667E+00 0.581E+00 0.469E+00
0.451E+00 0.451E+00 0.441E+00 0.276E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 16 2.705 RADIANS 155.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.617E-01
0.247E+00 0.490E+00 0.490E+00 0.374E+00 0.229E+00
0.184E+00 0.184E+00 0.180E+00 0.346E-01 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 16
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.248E+00
0.497E+00 0.700E+00 0.700E+00 0.612E+00 0.479E+00
0.429E+00 0.429E+00 0.424E+00 0.186E+00 0.100E+01
0.100E+01
PROJECTION DATA FOR ANGLE NO. 17 2.880 RADIANS 165.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.000E+00
0.334E+00 0.460E+00 0.460E+00 0.460E+00 0.269E+00
0.173E+00 0.173E+00 0.146E+00 0.000E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 17
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.100E+01
0.578E+00 0.678E+00 0.678E+00 0.678E+00 0.518E+00
0.415E+00 0.415E+00 0.382E+00 0.100E+01 0.100E+01
0.100E+01
BLANK COMMON REQUIRED 858 ( 1532 )
PROJECTION DATA FOR ANGLE NO. 18 3.054 RADIANS 175.000 DEGREES
0.000E+00 0.000E+00 0.000E+00 0.000E+00 0.167E+00
0.167E+00 0.446E+00 0.446E+00 0.446E+00 0.446E+00
0.167E+00 0.167E+00 0.000E+00 0.000E+00 0.000E+00
0.000E+00
PROJECTION DATA UNCERTAINTY FOR ANGLE NO. 18
0.100E+01 0.100E+01 0.100E+01 0.100E+01 0.409E+00
0.409E+00 0.668E+00 0.668E+00 0.668E+00 0.668E+00
0.409E+00 0.409E+00 0.100E+01 0.100E+01 0.100E+01
0.100E+01
FOR CONGR AND GRADY FCN IS THE VALUE OF THE CHI-SQUARE
FOR ENTWPY FCN IS EVALUATED BY THE SUBROUTINE DULFC
ITER 0 FCN 0.441E+02
ITER 1 FCN 0.540E+01
ITER 2 FCN 0.193E+01
ITER 3 FCN 0.378E+00
ITER 4 FCN 0.135E+00
ITER 5 FCN 0.845E-01
ITER 6 FCN 0.387E-01
ITER 7 FCN 0.150E-01
ITER 8 FCN 0.613E-02
ITER 9 FCN 0.318E-02
ITER 10 FCN 0.216E-02
ITER 11 FCN 0.194E-02
ITER 12 FCN 0.130E-02
ITER 13 FCN 0.896E-03
ITER 14 FCN 0.730E-03
ITER 15 FCN 0.536E-03
BLANK COMMON REQUIRED 826 ( 1472 )
BLANK COMMON REQUIRED 714 ( 1312 )
BLANK COMMON REQUIRED 426 ( 652 )
BLANK COMMON REQUIRED 314 ( 472 )
BLANK COMMON REQUIRED 202 ( 312 )
BLANK COMMON REQUIRED 90 ( 132 )
MAXIMUM SIZE OF BLANK COMMON THUS FAR= 45682 FLOATING POINT WORDS.
EEEE N N DDDD CCC OOOO N N GGG RRRR
E NN N D D C C O O NN N G G R R
EEE N N N D D C C O O NN N G RRRR
E N NN D D C C O O N NN G GG R R
EEEE N N DDDD CCC OOOO N N GGG R R
XMIN = -0.31E-01 XMAX = 0.10E+01 XSUM = 0.4402E+02
*****
* *
* *****
* *****
* *****
* *****
* *****
* *****
* *****
* *****
* *****
* *****
- .3104E-01 0.4853E-01 0.1652E+00 = 0.2183E+00 + 0.2554E+00 0.2979E+00 0.3403E+00 Z
Z 0.3774E+00 X 0.4040E+00 A 0.4305E+00 M 0.4889E+00 @ 0.5472E+00 @ 0.5843E+00 @ 0.6268E+00 @
@ @ @ @ @ @ @ @ @

```


EX16

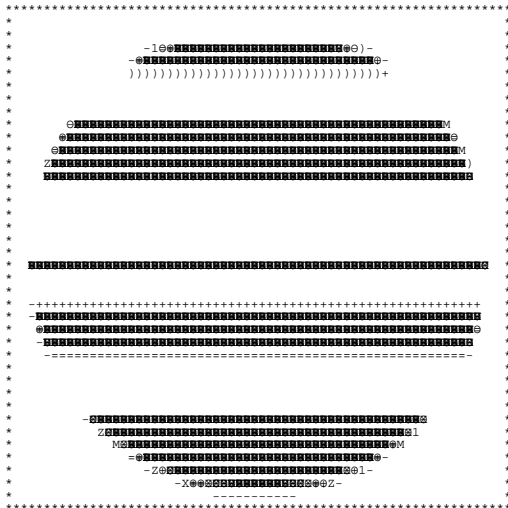
```
C PROGRAM XCBARP
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C SAVE
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C EXAMPLE 16
C THE PROGRAM XCBARP GENERATES A CIRCULAR BAR PHANTOM.
C COMMON/OUTCOM/LUNOUT,I80132
C DIMENSION B(4096)
C LUNOUT=2
C I80132=0
C
C NDIMU=64
C R=30.
C X1=0.
C Y1=0.
C Z=1.
C INTFAC=10
C NBAR=5
C NREPS=2
C IDIREC=1
C
C OPEN OUTPUT FILE
C OPEN (LUNOUT,FILE='E16.OUT',FORM='FORMATTED')
C CALL CBARP (B,NDIMU,R,X1,Y1,Z,INTFAC,NBAR,NREPS,IDIREC)
C CALL ARRAY (B,NDIMU)
C CLOSE (LUNOUT)
C END
```

```
CCC BBBB AAA RRRR PPPP
C C B B A A R R P P
C BBBB A A RRRR PPPP
C C B B AAAAA R R P
CCC BBBB A A R R P
```

BAR PATTERN PHANTOM GENERATED
ARRAY SIZE 64X 64
CIRCLE RADIUS 30.00 AT (0., 0.)
INT FACTOR 10
NO. OF BARS 5

```
EEEE N N DDDD CCC BBBB AAA RRRR PPPP
E NN N D D C C B B A A R R P P
EEE N N D D C BBBB A A RRRR PPPP
E N NN D D C C B B AAAAA R R P
EEEE N N DDDD CCC BBBB A A R R P
```

XMIN = 0.00E+00 XMAX = 0.10E+01 XSUM = 0.1313E+04



```
0.0000E+00 0.7500E-01 - 0.1850E+00 = 0.2350E+00 + 0.2700E+00 ) 0.3100E+00 1 0.3500E+00 Z
Z X A M @ @ @ @
0.3850E+00 0.4100E+00 0.4350E+00 0.4900E+00 0.5450E+00 0.5800E+00 0.6200E+00 @
@ @ @ @ @ @ @ @
0.6550E+00 0.7300E+00 0.8200E+00 0.8700E+00 0.9100E+00 0.9500E+00 0.9850E+00 #
#
0.1000E+01
```

EX17

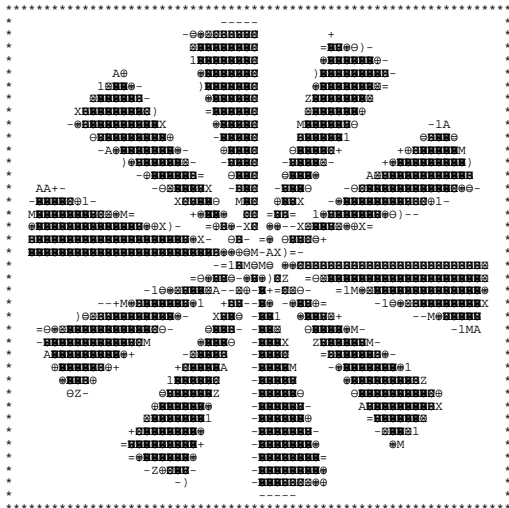
```
PROGRAM XPIE
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 17
C
C THE PROGRAM XPIE SHOWS HOW TO GENERATE A PIE PHANTOM.
C
C DIMENSION B(4096)
C COMMON/OUTCOM/LUNOUT,I80132
C
C LUNOUT=2
C I80132=0
C
C NDIMU=64
C R=30
C X1=0.
C Y1=0.
C Z=1.
C INTFAC=10
C NSLPI=10
C ISTART=0
C
C OPEN OUTPUT FILE
C
C OPEN (LUNOUT,FILE='E17.OUT',FORM='FORMATTED')
C
C CALL PIE (B,NDIMU,R,X1,Y1,Z,INTFAC,NSLPI,ISTART)
C
C CALL ARRAY (B,NDIMU)
C
C CLOSE (LUNOUT)
C
C END
```

```
PPPP III EEEEE
P P I E
PPPP I EEE
P I E
P III EEEEE
```

```
PIE PHANTOM GENERATED
ARRAY SIZE 64X 64
CIRCLE RADIUS 30.00 AT ( 0., 0.)
INT FACTOR 10
SECTOR WIDTH 0.314
```

```
EEEE N N DDDD P P P P III EEEEE
E NN N D D P P I E
EEE N N D D P P P P I EEE
E N NN D D P I E
EEEE N N DDDD P III EEEEE
```

```
XMIN = 0.00E+00 XMAX = 0.10E+01 XSUM = 0.1413E+04
```



```
0.0000E+00 0.7500E-01 0.1850E+00 0.2350E+00 0.2700E+00 0.3100E+00 0.3500E+00 Z
```

```
Z 0.3850E+00 X 0.4100E+00 A 0.4350E+00 M 0.4900E+00 @ 0.5450E+00 @ 0.5800E+00 @ 0.6200E+00 @
@ 0.6550E+00 @ 0.7300E+00 @ 0.8200E+00 @ 0.8700E+00 @ 0.9100E+00 @ 0.9500E+00 @ 0.9850E+00 @
@ 0.1000E+01
```

EX18

```

PROGRAM XRECT
C
C IMPLICIT DOUBLE PRECISION (A-H,O-Z)
C
C SAVE
C
C *****
C * RECLBL -- DP VERSION 2.0 -- JULY91 *
C *****
C
C EXAMPLE 18
C
C THE PROGRAM XRECT SHOWS HOW TO GENERATE RECTANGULAR AND
C ELLIPTICAL PHANTOMS.
C
C DIMENSION B(4096)
C DIMENSION ITYPE(4),A1(4),B1(4),X1(4),Y1(4),PHI(4),Z(4)
C COMMON/OUTCOM/LUNOUT,I80132
C
C DATA ITYPE/1,1,2,2/
C DATA A1/20.,15.,15.,20./
C DATA B1/10.,7.,7.,10./
C DATA X1/-16.,16.,16.,-16./
C DATA Y1/16.,-16.,16.,-16./
C DATA PHI/.785398,2.356194,2.356194,.785398/
C DATA Z/1.,2.,3.,4./
C
C LUNOUT=2
C I80132=0
C
C OPEN OUTPUT FILE
C
C OPEN (LUNOUT,FILE='E18.OUT',FORM='FORMATTED')
C
C NPHAN=4
C INTG=10
C NDIMU=64
C PWID=1.
C CALL PHAN (NPHAN,INTG,ITYPE,Z,X1,Y1,A1,B1,PHI,B,NDIMU,PWID)
C
C CALL ARRAY (B,NDIMU)
C
C CLOSE (LUNOUT)
C
C END

```

```

PPPP H H AAA N N
P P H H A A NN N
PPPP HHHH A A N N N
P H H AAAAA N NN
P H H A A N N

```

```

PHANTOM GENERATED
ARRAY SIZE 64 X 64 INTEGRATION FACTOR = 10 SCALING FACTOR = 1.000
NUMBER OF ELLIPSES AND/OR RECTANGLES = 4
THE PARAMETERS FOR THE ELLIPSES AND/OR RECTANGLES ARE
X,Y - CENTER
A,B - LENGTH OF AXIS OR SIDE A AND B
PHI - ANGLE OF AXIS OR SIDE A
DENS - INTENSITY
THE PARENTHESIS INDICATES THE SCALED VALUE
ITYPE X Y A B PHI DENS
1 - EL 0@0@4@S 0.79 , 1.00 (-16.00),( 16.00)( 20.00),( 10.00) ( 1.00)
1 - EL@0 0@.@ 2.36 , 2.00 ( 16.00),( -16.00)( 15.00),( 7.00) ( 2.00)
2 - RE@00@.@ 2.36 , 3.00 ( 16.00),( 16.00)( 15.00),( 7.00) ( 3.00)
2 - RE 0 0@4@S 0.79 , 4.00 (-16.00),( -16.00)( 20.00),( 10.00) ( 4.00)

```

```

EEEE N N DDDD PPPP H H AAA N N
E NN N D D P P H H A A NN N
EEE N N N D D PPPP HHHH A A N N N
E N NN D D P H H AAAAA N NN
EEEE N N DDDD P H H A A N N

```

XMIN = 0.00E+00 XMAX = 0.40E+01 XSUM = 0.1436E+04

