PROGRAM LEGEND

VERSION 80-1 (SEPTEMBER 1980)
*CORRECTED BASED ON USER COMMENTS
*FORTRAN-77/H VERSION

VERSION 84-1 (NOVEMBER 1984)

VERSION 86-1 (JANUARY 1986)
*FORTRAN-77/H VERSION
*CORRECTED BASED ON USER COMMENTS

VERSION 87-1 (JANUARY 1987)
*FORTRAN-77/H VERSION
*CORRECTED BASED ON USER COMMENTS

VERSION 88-1 (JULY 1988)
*OPTION...INTERNALLY DEFINE ALL I/O FILE NAMES (SEE, SUBROUTINE FILEIO FOR DETAILS).
*IMPROVED BASED ON USER COMMENTS.

VERSION 89-1 (JANUARY 1989)
*PSYCHOANALYZED BY PROGRAM FREUD TO INSURE PROGRAM WILL NOT DO ANYTHING CRAZY.
*UPDATED TO USE NEW PROGRAM CONVERT KEYWORDS.
*ADDED LIVERMORE CIVIC COMPILER CONVENTIONS.

VERSION 92-1 (JANUARY 1992)
*FOR ANGULAR DISTRIBUTIONS CALCULATED FROM LEGENDRE COEFFICIENTS, INTERVAL HALF TO CONVERGENCE.
*UPDATED BASED ON USER COMMENTS
*ADDED FORTRAN SAVE OPTION
*ADDED SELECTED OF DATA TO PROCESS BY MAT/MF/MT/ENERGY RANGES.
*WARNING...THE INPUT PARAMETER FORMAT HAS BEEN CHANGED - FOR DETAILS SEE BELOW.

VERSION 92-2 (SEPT. 1992)
*CORRECTED PROCESSING OF ISOTROPIC ANGULAR DISTRIBUTIONS

VERSION 94-1 (JANUARY 1994)
*VARIABLE ENDF/B DATA FILENAMES TO ALLOW ACCESS TO FILE STRUCTURES (WARNING - INPUT PARAMETER FORMAT HAS BEEN CHANGED)
*CLOSE ALL FILES BEFORE TERMINATING (SEE, SUBROUTINE ENDIT)

VERSION 96-1 (JANUARY 1996)
*COMPLETE RE-WRITE
*IMPROVED COMPUTER INDEPENDENCE
*ALL DOUBLE PRECISION
*UNIFORM TREATMENT OF ENDF/B I/O
*IMPROVED OUTPUT PRECISION
*INCREASED MAX. POINTS FROM 5,000 TO 20,000.

VERSION 99-1 (MARCH 1999)
*CORRECTED CHARACTER TO FLOATING POINT READ FOR MORE DIGITS
*UPDATED TEST FOR ENDF/B FORMAT VERSION BASED ON RECENT FORMAT CHANGE
*GENERAL IMPROVEMENTS BASED ON USER FEEDBACK

VERS. 2000-1 (FEBRUARY 2000)
*GENERAL IMPROVEMENTS BASED ON USER FEEDBACK

VERS. 2001-1 (MARCH 2001)
*UPDATED TO HANDLE COMBINATIONS OF LEGENDRE COEFFICIENTS AT LOW ENERGY AND TABULATED DATA AT HIGH ENERGY.

VERS. 2002-1 (MAY 2002)
*OPTIONAL INPUT PARAMETERS

VERS. 2004-1 (MARCH 2004)
*ADDED INCLUDE FOR COMMON
*ZERO ANGULAR DISTRIBUTIONS ARE O.K. (PREVIOUSLY ZERO OR NEGATIVE WAS TREATED AS AN ERROR - ZERO IS O.K.) FOR SOME REACTIONS OVER SOME COSINE RANGES)

VERS. 2006-1 (MARCH 2006)
*INCREASED MAXIMUM NUMBER OF LEGENDRE COEFFICIENTS FROM 50 TO 500. WARNING - THE RECURSION RELATIONSHIP FOR LEGENDRE POLYNOMIALS BECOMES UNSTABLE IN HIGHER ORDER POLYNOMIALS EVEN USING DOUBLE PRECISION.

VERS. 2007-1 (JAN. 2007)
*CHECKED AGAINST ALL ENDF/B=VII.
*INCREASED MAX. POINTS FROM 60,000 TO 240,000.

VERS. 2007-2 (MAY 2007)
*CORRECTED SIZE OF XMUBASE IN ANGLEN FOR INCREASED NUMBER OF COEFFICIENTS.

VERS. 2010-1 (Apr. 2010)
*General update based on user feedback

VERS. 2012-1 (Aug. 2012)
*added CODENAME
*32 and 64 bit Compatible
*Added ERROR stop
*Extended OUT9

VERS. 2015-1 (Jan. 2015)
*Replaced ALL 3 way IF Statements.
*OPEN optional LEGEND.INP after OPENING LEGEND.LST.
*Coefficient checks are turned OFF if LEGEND.INP is missing = this agrees with BEST INPUT.
*Switched from LISTO to LISTO9 (no 10 digit output)

VERS. 2015-2 (Oct. 2015)
*Added ERROR stop

VERS. 2016-1 (May 2016)
*Changed multiple IF statement to accommodate compiler optimizer
*Increased Maximum allowed points per angular distribution from 900 to MAXPOINT (currently 240,000)

VERS. 2017-1 (May 2017)
*More tests. Expanded to handle new R-M (LRF=7) detailed angular distributions.
*Max. points increased to 3,000,000.
*All floating input parameters changed to characte input + IN9 conversion.
*If near COS=0 - set = 0
*Default changed to negative fixes.
*At end print tallies for, 1-Number of negative distributions. 2-Number of duplicate or out-of-order Energies

VERS. 2018-1 (Jan. 2018)
*Added on-line output for ALL ENDERROR

VERS. 2019-1 (June 2019)
*Additional Interpolation Law Tests
*Checked Maximum Tabulated Energy to insure it is the same for all MTs - if not, print WARNING messages.
*Corrected END Histogram linearized - Previously assumed Y = 0 and deleted
Now output whatever the Y value.

VERS. 2020-1 (Feb. 2020)
*Identical to 2019-1.

VERS. 2021-1 (Jan. 2021)
*Updated for FORTRAN 2018

VERS. 2023-1 (Feb. 2023)
*Decreased page size from 3,000,000 to 120,000

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PURPOSE
CALCULATE LINEARLY INTERPOLABLE TABULATED ANGULAR DISTRIBUTIONS STARTING FROM DATA IN THE ENDF/B FORMAT. ANGULAR DISTRIBUTIONS MAY BE DESCRIBED IN THE ENDF/B FORMAT IN ONE OF THREE WAYS. FOR EACH OF THESE THREE FORMS THE USER MAY CHOOSE (SEE, INPUT OPTIONS) TO EITHER COPY EACH TYPE OF DATA OR TO PROCESS IT AT AS FOLLOWS,

(1) ANGULAR DISTRIBUTION IS ISOTROPIC AT ALL ENERGIES (LTT=0) IN THIS CASE THE INPUT DATA DOES NOT INCLUDE ANY ANGULAR DISTRIBUTIONS. A SECTION MERELY CONTAINS A FLAG TO INDICATE THE ANGULAR DISTRIBUTION IS ISOTROPIC AT ALL ENERGIES. IN THIS CASE THE SECTION IS OUTPUT IN EXACTLY THE SAME FORM IN WHICH IT WAS READ FROM THE INPUT.

(2) ANGULAR DISTRIBUTIONS GIVEN BY LEGENDRE COEFFICIENTS (LTT=1) LEGENDRE COEFFICIENTS ARE GIVEN AT A SERIES OF ENERGIES. AN INTERPOLATION LAW IS GIVEN BETWEEN ENERGIES. THE INTERPOLATION LAW BETWEEN ENERGIES IS COPIED AS INPUT (I.E., NO ATTEMPT IS MADE TO LINEARIZE THE VARIATION WITH ENERGY!) FOR EACH ENERGY AT WHICH LEGENDRE COEFFICIENTS ARE GIVEN A LINEARLY INTERPOLABLE ANGULAR DISTRIBUTION IS RECONSTRUCTED IN THE SYSTEM IN WHICH THE COEFFICIENTS ARE GIVEN (I.E., CM OR LAB - NO ATTEMPT IS MADE TO CONVERT FROM ONE SYSTEM TO THE OTHER). A MAXIMUM OF 50 LEGENDRE COEFFICIENTS IS ALLOWED. REGARDLESS OF THE NUMBER OF COEFFICIENTS INPUT THE PROGRAM WILL ONLY USE COEFFICIENTS UP TO THE LAST ORDER AT WHICH THE COEFFICIENTS ARE NON-ZERO (E.G. IF COEFFICIENTS P1 THROUGH P12 ARE READ, BUT P9=P10=P11=P12=0.0, THE PROGRAM WILL ONLY USE COEFFICIENTS UP TO P8). IF OVER 50 NON-ZERO COEFFICIENTS ARE READ ONLY THE FIRST 50 WILL BE USED.

(2) ANGULAR DISTRIBUTIONS IS TABULATED (LTT=2) ANGULAR DISTRIBUTIONS ARE GIVEN AT A SERIES OF ENERGIES. AN INTERPOLATION LAW IS GIVEN BETWEEN ENERGIES AND A SECOND INTERPOLATION LAW IS GIVEN AT EACH ENERGY TO INTERPOLATE BETWEEN THE POINTS IN EACH TABULATED DISTRIBUTION. AT EACH ENERGY THE ANGULAR DISTRIBUTION WILL BE CONVERTED TO LINEARLY INTERPOLABLE FORM. THE INTERPOLATION BETWEEN ENERGIES IS OUTPUT EXACTLY AS INPUT. THE INTERPOLATION LAW AT EACH ENERGY IS OUTPUT TO INDICATE THE NOW LINEARLY INTERPOLABLE ANGULAR DISTRIBUTION.

(3) LEGENDRE COEFFICIENTS AND TABULATED (LTT=3) ENDF-102 SAYS THIS SHOULD BE LTT=4, BUT ALL OF THE EVALUATIONS IN ENDF/B-VI, RELEASE 7, USE LTT=3? THIS CODE WILL TREAT THESE AS LTT=4 - SEE BELOW.

(4) LEGENDRE COEFFICIENTS AND TABULATED (LTT=4) THIS IS A COMBINATION OF (1) AND (2) DESCRIBED ABOVE. THE LEGENDRE DATA IS ALWAYS GIVEN FIRST, FOR LOWER ENERGIES, FOLLOWED BY TABULATED ANGULAR DISTRIBUTIONS, FOR HIGHER ENERGIES. THIS TYPE OF DATA CAN ONLY BE COPIED OR ALL CONVERTED TO TABULATED (LTT=2).

POINT VALUES - NORMALIZED VS. UNNORMALIZED THE VALUE OF AN ANGULAR DISTRIBUTION AT ANY COSINE WILL BE CORRECTLY CALCULATED BY THIS CODE, BASED EITHER DIRECTLY ON THE ANGULAR DISTRIBUTION, OR ON THE SUM OF THE CONTRIBUTING LEGENDRE MOMENTS.

ENDF/B ANGULAR DISTRIBUTIONS ARE BY DEFINITION NORMALIZED WHEN INTEGRATED OVER COSINE. THEREFORE THIS CODE WILL NORMALIZE EACH ANGULAR DISTRIBUTION BEFORE IT IS OUTPUT. THE OUTPUT REPORT FROM THIS CODE WILL INDICATE THE NORMALIZATION FACTOR USED.

THE REASON THAT AN ANGULAR DISTRIBUTION MAY NOT BE NORMALIZED IS
Due to the approximation of creating linearly interpolable tabulated angular distributions, the more accurately this is done, the closer the normalization factor will be to unity. As you decrease the allowable error, the normalized values will approach the correct point values calculated by the code. Since the data is normalized prior to output, the results in the ENDF/B format may differ slightly from values referred to be error messages, etc. printed by the code during execution. In all cases, the values printed by the code in error messages, etc. should be considered to be the correct values and the output tabulated angular distributions approximate due to the re-normalization. To re-iterate, the output tabulated values are approximate due to the approximations used in constructing linear interpolable angular distributions to within some allowable tolerance.

Elimination of Negative Values

The reconstructed angular distribution will be tested and if it is negative at one or more cosines an error message will be output and based on the input option selected one of the following corrective actions will be taken (see, input options):

1. No Correction
2. Change individual Legendre coefficients (each by less than 1.0 percent) until the reconstructed angular distribution is positive (minimum more than 1 milli-barn). The allowable percent change in coefficients and minimum cross section can be changed by input.
3. Change all Legendre coefficients to force the distribution to be positive (minimum more than 1 milli-barn). With this option there is no restriction on the amount that each coefficient is changed and as such this option should be used with caution and only as a last resort if no other approach can be used to make the distribution positive.

Output

The user may request output of either,

1. Tabulated values - possibly corrected to eliminate negative values. The tabulated distribution will be normalized before output.
2. Legendre coefficients - possibly corrected to eliminate negative values and without higher order zero coefficients. By definition distributions defined by Legendre coefficients are normalized to unity.
3. Angular distributions given by a tabulation (LTT=2)

Tabulated angular distributions are given at a series of energies. An interpolation law is given between energies. The interpolation law between energies is copied as input (i.e., no attempt is made to linearize the variation with energy). For each energy at which tabulated data are given a linearly interpolable angular distribution is constructed in the system in which the tabulated Legendre data are given (i.e., cm or lab - no attempt is made to convert from one system to the other). A maximum of 60000 points is allowable to represent the angular distribution at each energy.

Elimination of Negative Values

The reconstructed angular distribution will be tested and if it is negative at one or more cosines an error message will be output and based on the input option selected one of the following corrective actions will be taken (see, input options):

1. No Correction
2. Change all tabulated values to force distribution to be positive (minimum more than 1 milli-barn). The minimum value may be changed by input. With this option there is no restriction on the amount that each value is changed and as such this option should be used with caution and only as a last resort if no other approach can be used to make the distribution positive.

Legend

Legend
THE OUTPUT WILL BE THE LINEARIZED ANGULAR DISTRIBUTION. THE TABULATED DISTRIBUTION WILL BE NORMALIZED TO UNITY BEFORE OUTPUT.

CORRECTING NEGATIVE ANGULAR DISTRIBUTION

IF AN ANGULAR DISTRIBUTION IS NEGATIVE AN ERROR MESSAGE WILL BE PRINTED AND THE USER MAY DECIDE (BASED ON INPUT OPTION) TO:

(1) NOT PERFORM ANY CORRECTIVE ACTION.

(2) FOR TABULATED DISTRIBUTIONS - ADD THE SAME VALUE TO EACH POINT VALUE SUCH THAT WHEN THE DISTRIBUTION IS RE-NORMALIZED THE MINIMUM VALUE IS 0.001 (1 MILLI-BARN). THE MINIMUM VALUE CAN BE CHANGED BY INPUT. WARNING...EXCEPT FOR SELECTION OF THE MINIMUM VALUE (BY INPUT) THE USER HAS NO CONTROL OVER HOW MUCH THE DISTRIBUTION IS CHANGED. THEREFORE THIS OPTION SHOULD BE USED WITH CAUTION.

(3) FOR LEGENDRE COEFFICIENTS ONE OF TWO OPTIONS MAY BE SELECTED:

(A) CHANGE INDIVIDUAL COEFFICIENTS (NO ONE COEFFICIENT BY MORE THAN 1 PER-CENT) TO MAKE THE DISTRIBUTION POSITIVE WITH A MINIMUM VALUE OF 0.001 (1 MILLI-BARN). THE MAXIMUM PER-CENT CHANGE IN EACH COEFFICIENT AND MINIMUM VALUE MAY BE CHANGED BY INPUT. INPUT THE PROGRAM CANNOT MAKE THE DISTRIBUTION POSITIVE BY CHANGING EACH COEFFICIENT BY UP TO THE MAXIMUM ALLOWABLE AMOUNT, THE ORIGINAL ANGULAR DISTRIBUTION OR COEFFICIENTS WILL BE OUTPUT. ONLY IN THE LATTER CASE SHOULD THE USER TAKE THE FOLLOWING OPTIONS (B) DESCRIBED BELOW.

(B) LOGICALLY ADD THE SAME VALUE TO EACH POINT VALUE SUCH THAT WHEN THE DISTRIBUTION IS RE-NORMALIZED THE MINIMUM VALUE IS 0.001 (1 MILLI-BARN). THIS IS EQUIVALENT AT INCREASING $P_0$ BY A CERTAIN AMOUNT AND RE-NORMALIZATION IS EQUIVALENT TO THEN DIVIDING EACH COEFFICIENT BY A CERTAIN AMOUNT. THEREFORE, WHAT IS PHYSICALLY DONE BY THE PROGRAM IS TO DIVIDE EACH LEGENDRE COEFFICIENT BY THE SAME AMOUNT. WARNING...EXCEPT FOR SELECTION OF THE MINIMUM VALUE (BY INPUT) THE USER HAS NO CONTROL OVER HOW MUCH THE DISTRIBUTION IS CHANGED. THEREFORE THIS OPTION SHOULD BE USED WITH CAUTION.

WARNING MESSAGES FROM PROGRAM

THE WARNING MESSAGES PRINTED BY THIS PROGRAM SHOULD ONLY BE CONSIDERED TO BE EXACTLY THAT..WARNINGS..NOT AN ABSOLUTE JUDGEMENT BY THIS PROGRAM THAT THERE IS SOMETHING WRONG WITH THE DATA. WHEN WARNING MESSAGES ARE PRINTED EXAMINE THE DATA AND EITHER TAKE NO ACTION (IF YOU FEEL THAT THE DATA IS O.K.) OR CORRECT THE DATA (IF YOU FEEL THAT THE DATA IS INCORRECT AND YOU CAN CORRECT IT).

VALIDITY OF MODIFIED DATA

BEFORE BELIEVING AND USING DATA WHICH HAS BEEN MODIFIED (EITHER TABULATED ANGULAR DISTRIBUTIONS OR LEGENDRE COEFFICIENTS) THE USER SHOULD INSURE THAT THE MODIFIED DATA IS PHYSICALLY MORE ACCEPTABLE THAN THE ORIGINAL DATA. IN ORDER TO DO THIS ONE OR MORE OF THE FOLLOWING METHODS SHOULD BE USED:

(1) USE THE ENERGY VARIATION TESTS BUILT-IN TO THIS PROGRAM AND EVALPLOT TO PLOT THE ENERGY DEPENDENCE OF THE LEGENDRE COEFFICIENTS IN ORDER TO IDENTIFY AND CORRECT (BY HAND...NOT BY THIS PROGRAM) ANY COEFFICIENTS WHICH HAVE UNREALISTIC ENERGY AND $L$ ORDER VARIATIONS. THIS SHOULD ALWAYS BE DONE FIRST TO ELIMINATE MAJOR PROBLEMS BEFORE USING THIS PROGRAM TO AUTOMATICALLY MAKE MINOR CORRECTIONS.

(1) OUTPUT AND PLOT THE UNCORRECTED AND CORRECTED ANGULAR DISTRIBUTIONS. COMPARE THE PLOTS TO INSURE THAT THE CORRECTED DATA DOES NOT SERIOUSLY CHANGE THE ENERGY DEPENDENCE OF THE DISTRIBUTION.

(2) IF PLOTTING CAPABILITY IS NOT AVAILABLE, USE THE PRINTED OUT OF THIS PROGRAM TO DETERMINE HOW MUCH THE TABULATED ANGULAR DISTRIBUTION OR LEGENDRE COEFFICIENTS HAVE BEEN MODIFIED.
GENERALLY IF ONE COEFFICIENT HAS BEEN ONLY SLIGHTLY MODIFIED THE DISTRIBUTION WILL BE ACCEPTABLE. HOWEVER IF MANY COEFFICIENTS HAVE BEEN MODIFIED THE RESULT WILL NOT BE RELIABLE.

SEEING ANGULAR DISTRIBUTIONS AND LEGENDRE COEFFICIENTS

PROGRAM EVALPLOT CAN BE USED TO PLOT ANGULAR DISTRIBUTION AND LEGENDRE COEFFICIENTS - WHEN IT COMES TO CHECKING THIS TYPE OF DATA THERE IS NO SUBSTITUTE FOR PLOTS OF THE DATA TO MAKE THE JOB EASY AND STRAIGHTFORWARD.

FOR LEGENDRE COEFFICIENTS EVALPLOT CAN BE USED TO SEE THE ENERGY DEPENDENCE OF EACH COEFFICIENT - THIS IS AN EXTREMELY EASY AND USEFUL WAY TO CHECK FOR ERRORS IN THE BASIC DATA.

FOR ANGULAR DISTRIBUTION EVALPLOT CAN BE USED TO PLOT THEM AT EACH ENERGY THAT THEY ARE TABULATED - THIS IS ALSO AN EASY AND USEFUL WAY TO CHECK FOR ERRORS.

I/O UNIT DEFINITIONS

UNIT  DESCRIPTION
---  --------
2    INPUT CARDS
3    OUTPUT REPORT
10   ORIGINAL DATA IN ENDF/B FORMAT
11   FINAL DATA IN ENDF/B FORMAT

OPTIONAL STANDARD FILE NAMES (SEE SUBROUTINE FILIO1 AND FILIO2)

UNIT  FILE NAME
---  --------
2    LEGEND.INP
3    LEGEND.LST
10   ENDFB.IN
11   EENDFB.OUT

INPUT CARD

CARD COLS.  FORMAT  DESCRIPTION
----  ------  -------
1    1-11    E11.4 FRACTIONAL THINNING CRITERIA
12-22 I11   MAXIMUM NUMBER OF POINTS IN ANGULAR DISTRIBUTION RECONSTRUCTED FROM LEGENDRE COEFFICIENTS (PRESENT LIMITS ARE 11 TO 60000 POINTS)
*THIS OPTION CAN BE USED TO RUN QUICK, BUT NOT NECESSARILY SO ACCURATE CALCULATIONS - TO ROUGHLY SEE WHAT THE ANGULAR DISTRIBUTIONS LOOK LIKE. *IT IS RECOMMENDED THAT YOU USE 0 AS INPUT - IN WHICH CASE THE PROGRAM WILL USE THE MAXIMUM ALLOWABLE NUMBER OF POINTS = 60000.

23-33 I11   TABULATED ANGULAR DISTRIBUTION TREATMENT
= 0 - COPY TABLES
= 1 - LINEARIZE TABLES (OUTPUT TABLES)
= 2 - LINEARIZE AND THIN TABLES (OUTPUT TABLES)

34-44 I11   LEGENDRE COEFFICIENT TREATMENT
= 0 - COPY LEGENDRE COEFFICIENTS
= 1 - RECONSTRUCT TABULATED ANGULAR DISTRIBUTION. (OUTPUT TABLES).
= 2 - RECONSTRUCT TABULATED ANGULAR DISTRIBUTION. (OUTPUT LEGENDRE COEFFICIENTS).

45-55 I11   NEGATIVE ANGULAR DISTRIBUTION TREATMENT.
= 0 - NO CORRECTION
= 1 - TABULATE DATA - NO CORRECTION.
= 2 - TABULATE DATA - CHANGE COEFFICIENTS (NONE BY MORE THAN 1.0 PER-CENT - CAN BE CHANGED BY INPUT).
= 3 -FORCE DISTRIBUTIONS TO BE POSITIVE (TABULATED OR LEGENDRE DATA).

56-66 I11   LEGENDRE COEFFICIENT VARIATION TEST FLAG.
= 0 - TEST TESTS.  
= 1 - PERFORM TESTS.  

(A) LEGENDRE ORDER INCREASES WITH ENERGY.  
(C) MONOTONIC VARIATION OF COEFFICIENTS AS A FUNCTION OF ENERGY.  
(C) COEFFICIENTS DECREASE AS A FUNCTION OF LEGENDRE ORDER.  

2 1-60 60A1 ENDF/B INPUT DATA FILENAME  
(standard option = ENDFB.IN)  

3 1-60 60A1 ENDF/B OUTPUT DATA FILENAME  
(standard option = ENDFB.OUT)  

4-N 1-6 16 LOWER MAT LIMIT  
7-8 12 LOWER MF LIMIT  
9-11 13 LOWER MT LIMIT  
12-17 16 UPPER MAT LIMIT  
18-19 12 UPPER MF LIMIT  
20-22 13 UPPER MT LIMIT  
23-33 E11.4 LOWER ENERGY LIMIT  
34-44 E11.4 UPPER ENERGY LIMIT  
45-55 E11.4 MINIMUM ALLOWABLE VALUE OF ANGULAR DISTRIBUTION  
56-66 E11.4 ALLOWABLE FRACTION (NOT PER-CENT) CHANGE IN ANY ONE LEGENDRE COEFFICIENT TO MAKE THE ANGULAR DISTRIBUTION POSITIVE (AND AT LEAST EQUAL TO THE INPUT MINIMUM ALLOWABLE VALUE).  

*UP TO 100 MAT/MT/E RANGES MAY BE INPUT, EACH SPECIFYING AN ALLOWABLE MINIMUM SIGMA AND MAXIMUM CHANGE IN COEFFICIENTS.  
*INPUT IS TERMINATED BY A BLANK CARD.  
*ALL MAT/MT/E RANGES NOT SPECIFIED BY INPUT WILL BE TREATED BY ALLOWING A MINIMUM SIGMA OF 0.001 (1 MILLI-BARN) AND A CHANGE IN EACH COEFFICIENT BY UP TO 0.01 (1 PER-CENT).  
*THESE MAT/MT/E RANGES ARE NOT USED TO CORRECT ALL ANGULAR DISTRIBUTIONS WHERE SIGMA IS LESS THAN THE MINIMUM. THEY ARE ONLY USED TO CORRECT DISTRIBUTION THAT ARE NEGATIVE AND TO INSURE THAT THE CROSS SECTION AT THE COSINES WHERE THE ANGULAR DISTRIBUTION ARE INITIALLY NEGATIVE ARE CORRECTED TO BE POSITIVE AND AT LEAST AS LARGE AS THE MINIMUM ALLOWABLE SIGMA (SPECIFIED BY INPUT).  

EXAMPLE INPUT NO. 1  
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PROCESS BOTH LEGENDRE COEFFICIENTS AND TABULATED DATA TO OBTAIN ANGULAR DISTRIBUTION WHICH ARE ACCURATE TO WITHIN 0.1 PER-CENT AND OUTPUT UNCORRECTED TABULATED ANGULAR DISTRIBUTION USING A MAXIMUM OF 501 POINTS IN EACH TABULATED ANGULAR DISTRIBUTION.  
SINCE LEGENDRE COEFFICIENTS WILL NOT BE CORRECTED THE INPUT NEED NOT SPECIFY MAT/MT/E RANGES.  
READ /ENDFB6/K300/LEAD.IN AND WRITE /ENDFB6/K300/LEAD.OUT  
THE FOLLOWING 4 INPUT LINES ARE REQUIRED,  
1.00000 3 501 2 1 0  
(ENDLB CARD TERMINATED INPUT)  

EXAMPLE INPUT NO. 2  
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PROCESS BOTH LEGENDRE COEFFICIENTS AND TABULATED DATA TO OBTAIN ANGULAR DISTRIBUTION WHICH ARE ACCURATE TO WITHIN 0.1 PER-CENT AND OUTPUT CORRECTED TABULATED ANGULAR DISTRIBUTION (ONLY THOSE RE-CONSTRUCTED FROM LEGENDRE COEFFICIENTS WILL BE CORRECTED).  
FOR ALL MAT/MT/E CORRECT NEGATIVE ANGULAR DISTRIBUTION TO A VALUE OF 0.01 (10 MILLI-BARNS) AND ALLOW LEGENDRE COEFFICIENTS TO BE CHANGED BY UP TO 0.02 (2 PER-CENT).  
USE THE DEFAULT FILENAMES ENDFB.IN AND ENDFB.OUT (THIS CAN BE DONE BY LEAVING THE SECOND AND THIRD INPUT LINES BLANK).  
THE FOLLOWING 5 INPUT LINES ARE REQUIRED,  

PROCESS BOTH LEGENDRE COEFFICIENTS AND TABULATED DATA TO OBTAIN ANGULAR DISTRIBUTION WHICH ARE ACCURATE TO WITHIN 0.1 PER-CENT AND OUTPUT CORRECTED LEGENDRE COEFFICIENTS AND UNCORRECTED TABULATED ANGULAR DISTRIBUTIONS. FOR MAT=1800, MT=2 CORRECT NEGATIVE ANGULAR DISTRIBUTIONS TO INSURE THE MINIMUM IS 0.01 (10 MILLI-BARNS) ALLOWING EACH LEGENDRE COEFFICIENT TO CHANGE BY UP TO 0.02 (2 PER-CENT). ALL OTHER MAT/MT/E WILL BE CORRECTED TO A MINIMUM OF 0.001 (1 MILLI-BARN) ALLOWING A 0.01 (1 PER-CENT) CHANGE (BUILT-IN OPTION).

READ /ENDFB6/K300/LEAD.IN AND WRITE /ENDFB6/K300/LEAD.OUT

THE FOLLOWING 5 INPUT LINES ARE REQUIRED:

1.00000- 3 501 2 1 1
1 1 199999999 0.00000+ 0 3.00000+ 7 1.00000- 2 2.00000- 2
(BLANK CARD TERMINATED INPUT)

EXAMPLE INPUT NO. 3

TO COPY TABULATED ANGULAR DISTRIBUTION AND CONVERT LEGENDRE COEFFICIENTS TO UNCORRECTED TABULAR DISTRIBUTIONS.

USE THE DEFAULT FILENAMES ENDFB.IN AND ENDFB.OUT (THIS CAN BE DONE BY LEAVING THE SECOND AND THIRD INPUT LINES BLANK).

THE FOLLOWING 4 INPUT LINES ARE REQUIRED:

1.00000- 3 501 0 1 0

(BLANK CARD TERMINATED INPUT)

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