```
======================================================================= Sixpak
                                                                        Sixpak
     PROGRAM SIXPAK                                                     Sixpak
     ================================================================== Sixpak
     VERSION 92-1 (JANUARY 1992)                                        Sixpak
     VERSION 92-2 (FEBRUARY 1992)*INCREASED CORE ALLOCATION TO          Sixpak
                                  ACCOMMODATE JEF AND EFF EVALUATIONS.  Sixpak
     VERSION 92-3 (APRIL 1992)   *ADDED ADDITIONAL DATA TESTS.          Sixpak
     VERSION 92-4 (SEPT. 1992)   *CORRECTED KALBACH-MANN CALCULATIONS.  Sixpak
                                 *FOR PHOTON PRODUCTION OUTPUT MF=12    Sixpak
                                  (MULTIPLICITY), MF=14 (ISOTROPIC      Sixpak
                                  ANGULAR DISTRIBUTIONS) AND MF=15      Sixpak
                                  (SPECTRA) - PREVIOUSLY ONLY MF=15.    Sixpak
                                 *FIRST ORDER CORRECTIONS TRANSFORMING  Sixpak
                                  CENTER-OF-MASS SPECTRA TO LAB SYSTEM  Sixpak
                                  FOR OUTPUT IN MF=5                    Sixpak
                                 *CORRECTED ISOTROPIC ANGULAR           Sixpak
                                  DISTRIBUTION FLAG (LI)                Sixpak
     VERSION 94-1 (JANUARY 1994) *VARIABLE ENDF/B INPUT DATA FILENAME   Sixpak
                                  TO ALLOW ACCESS TO FILE STRUCTURES    Sixpak
                                  (WARNING - INPUT PARAMETER FORMAT     Sixpak
                                  HAS BEEN CHANGED)                     Sixpak
                                 *CLOSE ALL FILES BEFORE TERMINATING    Sixpak
                                  (SEE, SUBROUTINE ENDIT)               Sixpak
                                 *INCREASED MAXIMUM TABLE SIZE FROM     Sixpak
                                  2000 TO 6000.                         Sixpak
     VERSION 96-1 (JANUARY 1996) *COMPLETE RE-WRITE                     Sixpak
                                 *IMPROVED COMPUTER INDEPENDENCE        Sixpak
                                 *ALL DOUBLE PRECISION                  Sixpak
                                 *ON SCREEN OUTPUT                      Sixpak
                                 *UNIFORM TREATMENT OF ENDF/B I/O       Sixpak
                                 *IMPROVED OUTPUT PRECISION             Sixpak
     VERSION 99-1 (MARCH 1999)   *CORRECTED CHARACTER TO FLOATING       Sixpak
                                  POINT READ FOR MORE DIGITS            Sixpak
                                 *UPDATED TEST FOR ENDF/B FORMAT        Sixpak
                                  VERSION BASED ON RECENT FORMAT CHANGE Sixpak
                                 *GENERAL IMPROVEMENTS BASED ON         Sixpak
                                  USER FEEDBACK                         Sixpak
     VERSION 99-2 (JUNE 1999)    *ASSUME ENDF/B-VI, NOT V, IF MISSING   Sixpak
                                  MF=1, MT-451.                         Sixpak
     VERS. 2000-1 (FEBRUARY 2000)*GENERAL IMPROVEMENTS BASED ON         Sixpak
                                  USER FEEDBACK                         Sixpak
     VERS. 2002-1 (JANUARY 2002) *CORRECTED ANGULAR DISTRIBUTION (MF=4) Sixpak
                                  OUTPUT TO INSURE USED FIELDS ARE 0    Sixpak
                  (MAY 2002)     *OPTIONAL INPUT PARAMETERS             Sixpak
                  (NOV. 2002)    *EXTENDED TO ALLOW CHARGED PARTICLE    Sixpak
                                  ANGULAR DISTRIBUTION IN MF=4 -        Sixpak
                                  WARNING - STRICTLY SPEAKING THIS IS   Sixpak
                                  NOT LEGAL, SINCE MF=4 IS SUPPOSED TO  Sixpak
                                  BE USED ONLY FOR NEUTRON ANGULAR      Sixpak
                                  DISTRIBUTIONS - BUT WHERE MT MAKES    Sixpak
                                  IT OBVIOUS THAT THE OUTGOING PARTICLE Sixpak
                                  IS NOT A NEUTRON HOPEFULLY IT WILL    Sixpak
                                  NOT CAUSE A PROBLEM IF MF=4 IS USED   Sixpak
                                  FOR CHARGED PARTICLES.                Sixpak
     VERS. 2004-1 (MARCH 2004)   *ADDED INCLUDE FOR COMMON              Sixpak
                                 *INCREASED MAXIMUM TABLE SIZE FROM     Sixpak
                                  6,000 TO 12,000.                      Sixpak
                                  *ADDED DUMMY A FOR ELEMENTS           Sixpak
                                  *CORRECTED OUTPUT INTERPOLATON LAWS   Sixpak
                                                                        Sixpak
     OWNED, MAINTAINED AND DISTRIBUTED BY                               Sixpak
     ------------------------------------                               Sixpak
     THE NUCLEAR DATA SECTION                                           Sixpak
     INTERNATIONAL ATOMIC ENERGY AGENCY                                 Sixpak
     P.O. BOX 100                                                       Sixpak
     A-1400, VIENNA, AUSTRIA                                            Sixpak
     EUROPE                                                             Sixpak
                                                                        Sixpak
     ORIGINALLY WRITTEN BY                                              Sixpak
     ------------------------------------                               Sixpak
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DERMOTT E. CULLEN                                                  Sixpak
UNIVERSITY OF CALIFORNIA                                           Sixpak
LAWRENCE LIVERMORE NATIONAL LABORATORY                             Sixpak
L-159                                                              Sixpak
P.O. BOX 808                                                       Sixpak
LIVERMORE, CA 94550                                                Sixpak
U.S.A.                                                             Sixpak
TELEPHONE  925-423-7359                                            Sixpak
E. MAIL    CULLEN1@LLNL.GOV                                        Sixpak
WEBSITE    HTTP://WWW.LLNL.GOV/CULLEN1                             Sixpak
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                                                                   Sixpak
COLLABORATION                                                      Sixpak
================================================================== Sixpak
DEVELOPED IN COLLABORATION WITH,                                   Sixpak
                                                                   Sixpak
*THE NATIONAL NUCLEAR DATA CENTER, BROOKHAVEN NATIONAL LAB         Sixpak
                                                                   Sixpak
*THE NUCLEAR DATA SECTION, IAEA, VIENNA, AUSTRIA                   Sixpak
                                                                   Sixpak
*CENTRO TECNICO AEROSPACIAL, SAO JOSE DOS CAMPOS, BRAZIL           Sixpak
                                                                   Sixpak
AS A PART OF AN INTERNATIONAL PROJECT ON THE EXCHANGE OF           Sixpak
NUCLEAR DATA                                                       Sixpak
                                                                   Sixpak
ACKNOWLEDGEMENT (VERSION 92-1)                                     Sixpak
================================================================== Sixpak
THE AUTHOR THANKS SOL PEARLSTEIN (BROOKHAVEN NATIONAL LAB) FOR     Sixpak
SIGNIFICANTLY CONTRIBUTING TOWARD IMPROVING THE ACCURACY AND       Sixpak
COMPUTER INDEPENDENCE OF THIS CODE - THANKS, SOL                   Sixpak
                                                                   Sixpak
ACKNOWLEDGEMENT (VERSION 92-4)                                     Sixpak
================================================================== Sixpak
THE AUTHOR THANKS BOB MACFARLANE (LOS ALAMOS) FOR SUGGESTING HOW   Sixpak
TO PROPERLY OUTPUT THE PHOTON PRODUCTION DATA TO PUT IT INTO       Sixpak
EXACTLY THE FORM NEEDED FOR USE IN PROCESSING CODES.               Sixpak
                                                                   Sixpak
THE AUTHOR THANKS CHRIS DEAN (WINFRITH) FOR POINTING OUT ERRORS    Sixpak
IN THE EARLIER TREATMENT OF THE KALBACH-MANN FORMALISM AND IN      Sixpak
THE DEFINITION OF THE ISOTROPIC ANGULAR DISTRIBUTION FLAG (LI).    Sixpak
                                                                   Sixpak
AUTHORS MESSAGE                                                    Sixpak
================================================================== Sixpak
THE COMMENTS BELOW SHOULD BE CONSIDERED THE LATEST DOCUMENTATION   Sixpak
INCLUDING ALL RECENT IMPROVEMENTS. PLEASE READ ALL OF THESE        Sixpak
COMMENTS BEFORE IMPLEMENTING AND USING THESE CODES.                Sixpak
                                                                   Sixpak
AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTER Sixpak
INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE     Sixpak
OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT Sixpak
IT WOULD BE APPECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY       Sixpak
COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO  Sixpak
IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF    Sixpak
THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR         Sixpak
COMPUTER.                                                          Sixpak
                                                                   Sixpak
PURPOSE                                                            Sixpak
================================================================== Sixpak
1) CHECK ALL DOUBLE-DIFFERENTIAL DATA (MF=6)                       Sixpak
                                                                   Sixpak
2) OUTPUT EQUIVALENT MF = 4, 5, 12, 14 AND 15 DATA.                Sixpak
                                                                   Sixpak
DATA CHECKING                                                      Sixpak
================================================================== Sixpak
ALL OF THE ENDF/B-VI MF=6 DATA IS CHECKED - FOR DETAILS SEE BELOW. Sixpak
                                                                   Sixpak
THE MF=6 DATA IS NOT CORRECTED AND OUTPUT IN THE ENDF/B FORMAT.    Sixpak
IT IS MERELY CHECKED. IF ERRORS ARE FOUND IT IS UP TO THE USER     Sixpak
TO TAKE CORRECTIVE ACTION ON THE MF=6 DATA.                        Sixpak
                                                                   Sixpak
IN CONTRAST WHEN PROBLEMS ARE FOUND IN DATA WHICH WILL BE OUTPUT   Sixpak
IN THE ENDF/B FORMAT (MF=4, 5, 12, 14 AND 15), WHENEVER POSSIBLE   Sixpak
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CORRECTIVE ACTION WILL BE TAKEN.                                    Sixpak
                                                                    Sixpak
FURTHER CHECKS AND CORRECTIONS                                      Sixpak
=================================================================== Sixpak
ONCE THE DATA HAS BEEN OUTPUT IN MF = 4, 5, 12, 14 AND 15 FORMATS   Sixpak
FURTHER CORRECTIVE ACTION CAN BE TAKEN AS FOLLOWS,                  Sixpak
                                                                    Sixpak
PROGRAM LEGEND                                                      Sixpak
==============                                                      Sixpak
CAN BE USED TO CORRECT ANGULAR DISTRIBUTIONS WHICH ARE NEGATIVE,    Sixpak
TO CONVERT FROM LEGENDRE COEFFICIENTS TO TABULATED ANGULAR          Sixpak
DISTRIBUTIONS AND GENERALLY PERFORM MORE EXTENSIVE TESTS OF         Sixpak
ALL MF=4 DATA.                                                      Sixpak
                                                                    Sixpak
PROGRAM EVALPLOT                                                    Sixpak
================                                                    Sixpak
VERSION 92-1 AND LATER VERSIONS CAN PLOT ALL OF THE MF=4, 5 AND 15 Sixpak
DATA OUTPUT BY THIS CODE. EARLIER VERSIONS CAN PLOT MF=4 AND 5.     Sixpak
GRAPHICS IS AN EXCELLENT WAY TO CHECK THIS DATA.                    Sixpak
                                                                    Sixpak
PROGRAM PLOTTAB                                                     Sixpak
===============                                                     Sixpak
THIS IS A GENERAL PLOTTING PROGRAM AND THERE IS AN INTERFACE IN     Sixpak
THIS CODE TO PRODUCE OUTPUT FOR ANY MF=6 DATA IN THE PLOTTAB        Sixpak
INPUT FORMAT. THIS PROGRAM CAN BE USED TO CHECK ALL OF THE MF=6     Sixpak
DATA AS WELL AS THE EQUIVALENT MF=4, 5, 12, 14 AND 15 DATA - AS     Sixpak
WELL AS COMPARING THE ORIGINAL MF=6 AND EQUIVALENT DATA.            Sixpak
                                                                    Sixpak
DATA OUTPUT                                                         Sixpak
=================================================================== Sixpak
THE ENDF/B MF=4, 5, 12, 14 AND 15 FORMATS ONLY ALLOW FOR NEUTRONS   Sixpak
INCIDENTS                                                           Sixpak
                                                                    Sixpak
THE ENDF/B MF=4 AND 5 FORMATS ONLY ALLOW FOR NEUTRONS OUTGOING.     Sixpak
                                                                    Sixpak
THE ENDF/B MF=12, 14 AND 15 ONLY ALLOWS FOR PHOTONS OUTGOING.       Sixpak
                                                                    Sixpak
THESE ARE THE ONLY COMBINATIONS OF DATA OUTPUT BY THIS CODE.        Sixpak
                                                                    Sixpak
ALL OTHER COMBINATIONS OF INCIDENT AND OUTGOING PARTICLES ARE       Sixpak
CHECKED, BUT THE RESULTS CANNOT BE OUTPUT IN THE ENDF/B FORMAT.     Sixpak
HOWEVER, USING THE PLOTTAB INTERFACE BUILT INTO THIS CODE THIS      Sixpak
DATA CAN, AND HAS BEEN, OUTPUT AND CHECKED.                         Sixpak
                                                                    Sixpak
THE NEUTRON DATA IN MF=4 CAN BE IN THE FORM OF EITHER TABULATED     Sixpak
ANGULAR DISTRIBUTIONS OR LEGENDRE COEFFICIENTS.                     Sixpak
                                                                    Sixpak
THE NEUTRON (MF=5) OR PHOTON (MF=15) SPECTRA ARE BOTH IN EXACTLY    Sixpak
THE SAME FORMAT = ARBITRARY TABULATED FUNCTIONS - ENDF/B OPTION     Sixpak
LF=1.                                                               Sixpak
                                                                    Sixpak
ENDF/B DATA OUTPUT ORDER                                            Sixpak
=================================================================== Sixpak
ENDF/B DATA IS OUTPUT IN ASCENDING MAT, MF, MT ORDER. IN ORDER TO   Sixpak
ALLOW THIS PROGRAM TO PRODUCE ALL OUTPUT IN A SINGLE PASS THROUGH   Sixpak
THE MF=6 DATA, OUTPUT FOR EACH (MAT, MT) IS OUTPUT TO SEPERATE      Sixpak
FILES FOR MF=4, 5, 12, 14 AND 15.                                   Sixpak
                                                                    Sixpak
FOR SUBSEQUENT USE THE ENDF/B FORMATTED DATA OUTPUT BY THIS CODE    Sixpak
CAN BE MERGED TOGETHER USING PROGRAM MERGER (CONTAIN THE AUTHOR     Sixpak
OF THIS CODE FOR A COPY OF MERGER), E.G., MERGE MF=12, 14 AND 15    Sixpak
DATA IN ORDER TO THEN CALCULATE PHOTON PRODUCTION DATA OR MF=4      Sixpak
AND 5 CAN BE MERGED TOGETHER TO CALCULATE NEUTRON TRANSFER - OR     Sixpak
ALL OF THEM CAN BE MERGED TOGETHER TO PERFORM NEUTRON AND PHOTON    Sixpak
CALCULATIONS.                                                       Sixpak
                                                                    Sixpak
CORRELATED (MF=6) VS. UNCORRELATED (MF=4 AND 5) DATA                Sixpak
=================================================================== Sixpak
THE ENDF/B DOUBLE DIFFERENTAL = CORRELATED - DATA IN MF=6           Sixpak
REPRESENTS DATA IN THE FORM,                                        Sixpak
                                                                    Sixpak
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F(E,EP,COS) = SIG(E)*Y(E)*G0(E,EP)*F(E,EP,COS)                   Sixpak
                                                                  Sixpak
SIG(E)      = MF=3 CROSS SECTIONS                                 Sixpak
Y(E)        = YIELD (MULTIPLICITY)                                Sixpak
G0(E,EP)    = ENERGY SPECTRUM                                     Sixpak
F(E,EP,COS) = ANGULAR DISTRIBUTION                                Sixpak
                                                                  Sixpak
IN A SITUATION WHERE YOU HAVE MONOENERGETIC AND MONODIRECTIONAL   Sixpak
NEUTRONS INCIDENT YOU WILL BE ABLE TO OBSERVE CORRELATION EFFECTS Sixpak
IN THE NEUTRON SPECTRUM AND ANGULAR DISTRIBUTION.                 Sixpak
                                                                  Sixpak
EVEN IN SITUATIONS WHERE YOU HAVE A NARROW SPECTRUM OF NEUTRONS   Sixpak
THAT ARE HIGHLY DIRECTIONALLY ORIENTED YOU MAY BE ABLE TO OBSERVE Sixpak
THESE CORRELATION EFFECTS, E.G., A NARROW 14 MEV FUSION SOURCE    Sixpak
INCIDENT ON THE FIRST WALL OF A CTR DEVICE.                       Sixpak
                                                                  Sixpak
FOR SUCH SITUATIONS USE OF THE CORRELATED (MF=6) DATA IS REQUIRED Sixpak
IN CALCULATIONS.                                                  Sixpak
                                                                  Sixpak
HOWEVER, IN MANY APPLICATIONS WHERE THERE IS A BROAD SPECTRUM OF  Sixpak
NEUTRONS AND THE NEUTRON FLUX IS NOT HIGHLY DIRECTIONALLY         Sixpak
ORIENTED, THE NEUTRON MULTIPLICATION, SPECTRUM AND ORIENTATION    Sixpak
CAN BE FAIRLY ACCURATELY CALCULATED WITHOUT CONSIDERING           Sixpak
CORRELATION EFFECTS.                                              Sixpak
                                                                  Sixpak
THE UNCORRELATED DATA PRODUCED BY THIS CODE REPLACES THE          Sixpak
CORRELATED DATA,                                                  Sixpak
                                                                  Sixpak
F(E,EP,COS) = SIG(E)*Y(E)*G0(E,EP)*F(E,EP,COS)                    Sixpak
                                                                  Sixpak
BY THE UNCORRELATED DATA,                                         Sixpak
                                                                  Sixpak
F(E,EP,COS) = SIG(E)*Y(E)*G0(E,EP)*F0(E,COS)                      Sixpak
                                                                  Sixpak
BY INTEGRATING G0(E,EP)*F(E,EP,COS) OVER SECONDARY ENERGY (EP)    Sixpak
TO DEFINE AN AVERAGE ANGULAR DISTRIBUTION, F0(E,COS).             Sixpak
                                                                  Sixpak
WHAT IS LOST IN THIS PROCESS IS THE CORRELATION BETWEEN EP AND COS Sixpak
SO THAT IN A TRANSPORT CALCULATION ALL MOMENTS OF THE FLUX WILL   Sixpak
HAVE THE SAME SPECTRUM, G0(E,EP) AND EACH WILL BE EFFECTED BY THE Sixpak
AVERAGE ANGULAR DISTRIBUTION.                                     Sixpak
                                                                  Sixpak
FOR APPLICATIONS TO HIGH ENERGY FUSION APPLICATIONS CORRELATED    Sixpak
DATA SHOULD BE USED. HOWEVER, FOR LOWER ENERGY APPLICATIONS,      Sixpak
SUCH AS FISSION REACTORS, IT SHOULD BE ADEQUATE TO USE THE        Sixpak
UNCORRELATED DATA - IN THIS CASE THE MOST IMPORTANT EFFECT        Sixpak
WILL BE THE OVERALL NEUTRON MULTIPLICATION AND SPECTRUM.          Sixpak
                                                                  Sixpak
AN IMPORTANT CONSIDERATION IN DESIGNING THIS PROGRAM IS THAT      Sixpak
MANY COMPUTER CODES - DATA PROCESSING AND TRANSPORT CODES -       Sixpak
CANNOT USE THE CORRELATED (MF=6) DATA - NOR ARE THEY INTENDED     Sixpak
FOR HIGH ENERGY USE. FOR THESE CODES THE UNCORRELATED DATA        Sixpak
PRODUCED BY THIS CODE SHOULD BE ADEQUATE TO MEET THEIR NEEDS.     Sixpak
                                                                  Sixpak
WARNING - IT CANNOT BE STRESSED ENOUGH THAT THE OUTPUT OF THIS    Sixpak
CODE SHOULD ONLY BE USED FOR LOW ENERGY APPLICATIONS - FAILURE    Sixpak
TO HEED THIS WARNING CAN LEAD TO COMPLETELY UNRELIABLE RESULTS.   Sixpak
                                                                  Sixpak
ENDF/B FORMAT                                                     Sixpak
================================================================== Sixpak
THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS    Sixpak
OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION  Sixpak
OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II,III, IV, V OR VI FORMAT). Sixpak
                                                                  Sixpak
IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B      Sixpak
FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS    Sixpak
ASSUMED THAT THE MAT, MF AND MT ON EACH LINE IS CORRECT. SEQUENCE Sixpak
NUMBERS (COLUMNS 76-80) ARE IGNORED ON INPUT, BUT WILL BE         Sixpak
CORRECTLY OUTPUT ON ALL LINES. THE FORMAT OF SECTION MF=1, MT=451 Sixpak
AND ALL SECTIONS OF MF=6 MUST BE CORRECT. THE PROGRAM SKIPS ALL   Sixpak
OTHER SECTIONS OF DATA AND AS SUCH IS INSENSITIVE TO THE FORMAT   Sixpak
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OF ALL OTHER SECTIONS.                                            Sixpak
                                                                  Sixpak
CONTENTS OF OUTPUT                                                Sixpak
================================================================= Sixpak
5 ENDF/B FORMATTED OUTPUT FILES ARE PRODUCED FOR NEUTRON INCIDENT  Sixpak
DATA,                                                             Sixpak
                                                                  Sixpak
1) ENDFB.MF4 - ANGULAR DISTRIBUTIONS AND LEGENDRE COEFFICIENTS     Sixpak
               FOR NEUTRONS                                       Sixpak
2) ENDFB.MF5 - TABULATED NEUTRON ENERGY SPECTRA                   Sixpak
3) ENDFB.M12 - PHOTON EMISSION MULTIPLICITY                       Sixpak
4) ENDFB.M14 - PHOTON EMISSION ANGULAR DISTRIBUTIONS (ALWAYS       Sixpak
               ISOTROPIC)                                         Sixpak
5) ENDFB.M15 - TABULATED PHOTON EMISSION SPECTRA                  Sixpak
                                                                  Sixpak
EMITTED PARTICLE YIELD                                            Sixpak
================================================================= Sixpak
NEUTRONS                                                          Sixpak
========                                                          Sixpak
IN MF=6 THE YIELD FOR EACH REACTION IS THE ACTUAL MULTIPLICITY OF  Sixpak
THE REACTION, E.G., (N,2N) = 2. IN USING MF=4 AND 5 DATA THE       Sixpak
ENDF/B CONVENTION IS THAT THE MULTIPLICITY IS IMPLIED BY THE       Sixpak
MT NUMBER, E.G., MT=16 = (N,2N) = 2.                              Sixpak
                                                                  Sixpak
THE ONLY EXCEPT IN ENDF/B-VI IS MT=201 = TOTAL NEUTRON PRODUCTION  Sixpak
WHERE AN ACTUAL ENERGY DEPENDENT YIELD IS INCLUDED IN MF=6.        Sixpak
HOWEVER, IN THIS CASE THE MF=3 CROSS SECTION INCLUDES THE          Sixpak
MULTIPLICITY (S. PEARLSTEIN, PRIVATE COMMUNICATION, JAN. 1992),    Sixpak
SIG(MT=201) = 2*SIG(N,2N)+3*SIG(N,3N).....ETC.                    Sixpak
                                                                  Sixpak
SO THAT FOR ALL ENDF/B-VI DATA AS OF JANUARY 1992 THE MF=4 AND 5   Sixpak
DATA OUTPUT BY THIS CODE CAN BE USED IN CONJUNCTION WITH THE MF=3  Sixpak
CROSS SECTIONS - WITHOUT ANY REFERENCE TO THE MF=6 YIELD.          Sixpak
                                                                  Sixpak
PHOTONS                                                           Sixpak
=======                                                           Sixpak
UNLIKE THE NEUTRONS WHERE WITH ONLY ONE EXCEPTION (MT=201) THE     Sixpak
MF=6 YIELD IS ENERGY INDEPENDENT, IN THE CASE OF PHOTON EMISSION   Sixpak
ALMOST ALL OF THE PHOTONS HAVE AN ENERGY DEPENDENT YIELD.          Sixpak
                                                                  Sixpak
THIS PROGRAM WILL OUTPUT THE PHOTON MULTIPLICITY IN MF=12 AND      Sixpak
INDICATE THAT THERE IS A NORMALIZED DISTRIBUTION IN MF=15          Sixpak
(LF=1 IN MF=12).                                                  Sixpak
                                                                  Sixpak
THIS PROGRAM WILL OUTPUT THE NORMALIZED PHOTON SPECTRA IN MF=15.   Sixpak
CONTINUOUS ENERGY SPECTRA AND DISCRETE PHOTONS WILL ALL BE OUTPUT  Sixpak
AS NORMALIZED SPECTRA.                                            Sixpak
                                                                  Sixpak
THIS PROGRAM WILL ALSO OUTPUT MF=14 PHOTON ANGULAR DISTRIBUTION    Sixpak
DATA, ALWAYS USING THE ISOTROPIC FLAG TO MINIMIZE OUTPUT.          Sixpak
                                                                  Sixpak
WARNING OF ENERGY DEPENDENT YIELD                                 Sixpak
=================================                                 Sixpak
THIS PROGRAM WILL PRINT A WARNING MESSAGE IF A SECTION OF DATA     Sixpak
BEING OUTPUT IN THE ENDF/B FORMAT HAS AN ENERGY DEPENDENT MF=6     Sixpak
YIELD AND THE EMITTED PARTICLE IS A NEUTRON - SINCE THE ENDF/B     Sixpak
CONVENTION IS THAT FOR EACH MT NUMBER THE MULTIPLICITY IS IMPLIED  Sixpak
WE DO NOT EXPECT AN ENERGY DEPENDENT MULTIPLICITY FOR NEUTRON      Sixpak
EMISSION.                                                         Sixpak
                                                                  Sixpak
USING THE OUTPUT                                                  Sixpak
================================================================= Sixpak
NOTE, THAT IN USING THIS DATA, STARTING FROM THE RELATIONSHIP,     Sixpak
                                                                  Sixpak
F(E,EP,COS) = SIG(E)*Y(E)*G0(E,EP)*F0(E,COS)                      Sixpak
                                                                  Sixpak
USING THE ENDF/B CONVENTION THAT THE MULTIPLICITY IS EITHER        Sixpak
IMPLIED BY THE MT NUMBER (E.G., MT=16 = N,2N - MULTIPLICITY = 2)   Sixpak
OR INCLUDED IN THE CROSS SECTION (E.G., MT=201 = TOTAL NEUTRON     Sixpak
PRODUCTION) ALL THE INFORMATION REQUIRED FOR A CALCULATION IS      Sixpak
AVAILABLE IN,                                                     Sixpak
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                                                                  Sixpak
MF=3       - SIG(E)                                               Sixpak
MF=4       - F0(E,COS) - FOR OUTGOING NEUTRONS                    Sixpak
MF=5       - G0(E,EP)  - FOR OUTGOING NEUTRONS                    Sixpak
MF=12      - Y(E)      - FOR OUTGOING PHOTONS                     Sixpak
MF=14      - F0(E,COS) - FOR OUTGOING PHOTONS (ALWAYS ISOTROPIC)  Sixpak
MF=15      - G0(E,EP)  - FOR OUTGOING PHOTONS                     Sixpak
                                                                  Sixpak
DOCUMENTATION                                                     Sixpak
================================================================= Sixpak
ONLY SECTIONS OF MF=4, 5, 12, 14, 15 ARE OUTPUT ON A ENDF/B FILE. Sixpak
THE ONLY DOCUMENTATION IS THE ENDF/B TAPE LABEL (FIRST RECORD OF  Sixpak
EACH FILE) WHICH IDENTIFIES THE DATA AS SIXPAK OUTPUT.            Sixpak
                                                                  Sixpak
REACTION INDEX                                                    Sixpak
================================================================= Sixpak
THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN    Sixpak
SECTION MF=1, MT=451 OF EACH EVALUATION.                          Sixpak
                                                                  Sixpak
SECTION SIZE                                                      Sixpak
================================================================= Sixpak
ALL OF THE DATA IN ENDF/B-VI, MF=6 ARE QUITE SMALL TABLES. AS SUCH Sixpak
THIS PROGRAM ONLY ALLOWS TABLES OF UP TO 12000 POINTS (12,000 X,  Sixpak
Y VALUES). THIS SIZE IS MORE THAN ADEQUATE TO HANDLE ALL OF THE   Sixpak
CURRENT ENDF/B-VI DATA, AND IT CAN BE EASILY INCREASED TO HANDLE  Sixpak
ANY NEWER DATA AS IT BECOMES AVAILABLE.                           Sixpak
                                                                  Sixpak
PLEASE CONTACT THE AUTHOR IF YOU HAVE AN EVALUATION WHICH EXCEEDS Sixpak
THIS LIMIT.                                                       Sixpak
                                                                  Sixpak
SELECTION OF DATA                                                 Sixpak
================================================================= Sixpak
THE PROGRAM SELECTS DATA TO BE PROCESSED BASED ON MAT/MT RANGES   Sixpak
(MF=6 ASSUMED). THIS PROGRAM ALLOWS UP TO 100 MAT/MT RANGES TO BE Sixpak
SPECIFIED BY INPUT PARAMETERS. THE PROGRAM WILL ASSUME THAT THE   Sixpak
ENDF/B TAPE IS IN MAT ORDER. THE PROGRAM WILL TERMINATE EXECUTION Sixpak
WHEN A MAT IS FOUND THAT IS ABOVE ALL REQUESTED MAT RANGES.       Sixpak
                                                                  Sixpak
PROGRAM OPERATION                                                 Sixpak
================================================================= Sixpak
EACH SECTION (MT) OF MF=6 DATA IS SUBDIVIDED INTO SUBSECTIONS -   Sixpak
ONE SUBSECTION FOR EACH EMITTED PARTICLE.                         Sixpak
                                                                  Sixpak
EACH SUBSECTION OF DATA IS CONSIDERED SEPARATELY. EACH SUBSECTION Sixpak
OF ENDF/B MF=6 DATA TO PROCESS IS IN THE FORM,                    Sixpak
                                                                  Sixpak
F(E,EP,COS) = SIG(E)*Y(E)*G0(E,EP)*F(E,EP,COS)                    Sixpak
                                                                  Sixpak
SIG(E)      = MF=3 CROSS SECTIONS                                 Sixpak
Y(E)        = YIELD (MULTIPLICITY)                                Sixpak
G0(E,EP)    = ENERGY SPECTRUM                                     Sixpak
F(E,EP,COS) = ANGULAR DISTRIBUTION                                Sixpak
                                                                  Sixpak
G0(E,EP) = 1 WHEN INTEGRATED OVER EP (SECONDARY ENERGY)           Sixpak
G0(E,EP)*F(E,EP,COS) = 1 WHEN INTEGRATED OVER EP AND COS          Sixpak
                                                                  Sixpak
THIS PROGRAM WILL DEFINE THE ZEROTH ORDER MOMENTS OF THE           Sixpak
ENERGY AND ANGULAR DISTRIBUTIONS,                                 Sixpak
                                                                  Sixpak
G0(E,EP)  = G0(E,EP)*F(E,EP,COS) INTEGRATED OVER COS              Sixpak
F0(E,COS) = G0(E,EP)*F(E,EP,COS) INTEGRATED OVER EP               Sixpak
                                                                  Sixpak
FOR NEUTRON INDUCED REACTIONS THE ENDF/B FORMATTED OUTPUT WILL BE Sixpak
                                                                  Sixpak
F0(E,COS)- IN ENDFB.MF4 FOR NEUTRONS OUT OF A REACTION            Sixpak
G0(E,EP) - IN ENDFB.MF5 FOR NEUTRONS OUT OF A REACTION            Sixpak
         - IN ENDFB.M15 FOR PHOTONS OUT OF A REACTION             Sixpak
                                                                  Sixpak
FOR NEUTRONS INCIDENT AND NEUTRONS EMITTED THIS DATA WILL BE      Sixpak
OUTPUT IN MF=4 AND 5 FORMATS.                                     Sixpak
                                                                  Sixpak
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FOR NEUTRONS INCIDENT AND PHOTONS EMITTED THIS DATA WILL BE        Sixpak
OUTPUT IN MF=15 FORMAT - THE SPECTRA ARE OUTPUT AND THE            Sixpak
ANGULAR DISTRIBUTION IS IGNORED.                                   Sixpak
                                                                   Sixpak
ALL PHOTON EMISSION IN THE ENDF/B-VI LIBRARY AS OF JANUARY 1992    Sixpak
IS ISOTROPIC AND AS SUCH NO DISTRIBUTION OF PHOTON ANGULAR         Sixpak
DISTRIBUTIONS NEED BE OUTPUT - IT IS ALWAYS ISOTROPIC.             Sixpak
                                                                   Sixpak
FOR ALL OTHER COMBINATIONS INCIDENT AND EMITTED PARTICLES          Sixpak
THERE WILL BE NO ENDF/B FORMATTED OUTPUT.                          Sixpak
                                                                   Sixpak
VARIATIONS FROM ENDF/B MANUAL                                      Sixpak
================================================================== Sixpak
LAW=1, LANG=2 = KALBACH-MANN                                       Sixpak
============================                                       Sixpak
FOR THE DISTRIBUTIONS,                                             Sixpak
                                                                   Sixpak
F(MU,E,EP) = G0(E,EP)*A*(COSH(MU*A)+R(E,EP)*SINH(MU*A))            Sixpak
                                                                   Sixpak
G0(E,EP) = 1 - WHEN INTEGRATED OVER EP.                            Sixpak
                                                                   Sixpak
A*(COSH(MU*A)+R(E,EP)*SINH(MU*A)) = 2 - WHEN INTEGRATD OVER MU     Sixpak
                                                                   Sixpak
THIS MEANS AS DEFINED IN THE ENDF/B MANUAL THE DISTRIBUTIONS       Sixpak
ARE NORMALIZED TO 2, INSTEAD OF 1. IN ORDER TO OBTAIN CORRECTLY    Sixpak
NORMALIZED DISTRIBUTIONS THE DISTRIBUTION SHOULD BE DEFINED        Sixpak
TO INCLUDE A FACTOR OF 1/2 MULTIPLYING THE ANGULAR PART OF         Sixpak
THE DISTRIBUTION.                                                  Sixpak
                                                                   Sixpak
F(MU,E,EP) = G0(E,EP)*0.5*A*(COSH(MU*A)+R(E,EP)*SINH(MU*A))        Sixpak
                                                                   Sixpak
THIS IS THE FORM USED IN THIS CODE                                 Sixpak
                                                                   Sixpak
LAW=1, ND NOT 0 = DISCRETE SECONDARY ENERGY DISTRIBUTION           Sixpak
========================================================           Sixpak
THE ENDF/B MANUAL SAYS THESE ARE FLAGGED WITH NEGATIVE ENERGIES.   Sixpak
IN ENDF/B-VI ALL OF THESE HAVE POSITIVE ENERGY. THIS CODE DOES     Sixpak
NOT CONSIDER THE ENDF/B-VI DATA TO BE IN ERROR.                    Sixpak
                                                                   Sixpak
WITH THE CONVENTION ACTUALLY USED IN ENDF/B-VI ALL SECONDARY       Sixpak
ENERGIES SHOULD BE NON-NEGATIVE AND IN ASCENDING ENERGY ORDER      Sixpak
FOR EACH INCIDENT ENERGY.                                          Sixpak
                                                                   Sixpak
FROM THE ENDF/B MANUAL IT IS NOT OBVIOUS WHAT G0(E,EP) SHOULD BE   Sixpak
FOR DISCRETE PHOTONS - PHYSICALLY THIS IS A DELTA FUNCTION. IN     Sixpak
ENDF/B-VI IT IS ENTERED AS 1.0 = INTERPRETING IT AS INTEGRATED     Sixpak
OVER SECONDARY ENERGY - IN WHICH CASE THE DELTA FUNCTION = 1.0.    Sixpak
                                                                   Sixpak
LIMITATIONS                                                        Sixpak
================================================================== Sixpak
CHECKING DATA                                                      Sixpak
================================================================== Sixpak
THIS PROGRAM CHECKS ALL ENDF/B-VI MF=6 DATA. THE FOLLOWING CHECKS  Sixpak
ARE PERFORMED.                                                     Sixpak
                                                                   Sixpak
PARAMETERS                                                         Sixpak
==========                                                         Sixpak
ALL PARAMETERS ARE CHECKED FOR CONSISTENCY. IF PARAMETERS ARE      Sixpak
NOT CONSISTENT THE PROGRAM MAY NOT BE ABLE TO PERFORM THE          Sixpak
FOLLOWING TESTS AND WILL MERELY SKIP A SECTION OF DATA.            Sixpak
                                                                   Sixpak
INTERPOLATION LAWS                                                 Sixpak
==================                                                 Sixpak
ALL INTEGRATIONS ARE PERFORMED USING THE INTERPOLATION LAW GIVEN   Sixpak
FOR SECONDARY ENERGY AND/OR COSINE. INTEGRATIONS ARE NOT           Sixpak
PERFORMED OVER INCIDENT - ONLY INTEGRATION OVER SECONDARY ENERGY   Sixpak
AND/OR COSINE ARE PERFORMED AT EACH INCIDENT ENERGY. THEREFORE     Sixpak
THE INTERPOLATION LAW FOR INCIDENT ENERGY IS NOT USED BY THIS      Sixpak
CODE.                                                              Sixpak
                                                                   Sixpak
ALL INTERPOLATION LAWS ARE CHECKED. ALL DATA ASSOCIATED WITH       Sixpak
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INTERPOLATION LAWS ARE CHECKED, E.G., NO NON-NEGATIVE VALUES       Sixpak
REQUIRING LOG INTERPOLATION. IN ORDER TO PERFORM REQUIRED          Sixpak
INTEGRALS OVER COS AND EP IT IS IMPERATIVE THAT THE INTERPOLATION  Sixpak
LAWS BE COMPATIBLE WITH THE DATA.                                  Sixpak
                                                                   Sixpak
ENDF/B-VI ALLOWS NEW INTERPOLATION LAWS FOR CORRESPONDING POINT    Sixpak
AND UNIT BASE TRANSFORMATION INTERPOLATION. NONE OF THESE NEW      Sixpak
INTERPOLATION LAWS ARE USED IN THE ENDF/B-VI LIBRARY AS OF         Sixpak
JANUARY 1992 TO INTERPOLATE IN SECONDARY ENERGY OR COSINE.         Sixpak
THEREFORE THIS PROGRAM CAN PERFORM ALL OF THE REQUIRED INTEGRALS   Sixpak
OVER SECONDARY ENERGY AND/OR COSINE USING ONLY THE OLDER           Sixpak
INTERPOLATION CODES. THIS PROGRAM ONLY PERFORMS INTEGRALS FOR      Sixpak
EACH INCIDENT ENERGY, SO THAT INTERPOLATION IN INCIDENT ENERGY     Sixpak
IS NOT PERFORMED BY THIS PROGRAM.                                  Sixpak
                                                                   Sixpak
NEW INTERPOLATION SCHEMES ARE USED FOR INCIDENT ENERGY - FOR       Sixpak
EXAMPLE, CORRESPONDING POINT INTERPOLATION IS SPECIFIED TO ALLOW   Sixpak
INTERPOLATION IN G0(E,EP) TO SIMULATE CASES WHERE THE INPUT ENERGY Sixpak
LIMIT IS DEFINED BY E-EP = A DIAGONAL CURVE ACROSS (E,EP) SPACE.   Sixpak
THIS INTERPOLATION CODE CANNOT BE SPECIFIED IN THE MF=5 OUTPUT     Sixpak
OF THIS CODE - MF=5 ONLY ALLOWS THE OLDER INTERPOLATION LAWS       Sixpak
INT=1 THROUGH 5. THEREFORE THIS PROGRAM WILL USE THE CLOSEST       Sixpak
CORRESPONDING INTERPOLATION CODE FOR OUTPUT TO MF=5. FOR USE       Sixpak
WHERE THE OUTPUT OF THIS CODE = LOW ENERGY APPLICATIONS - THIS     Sixpak
SHOULD HAVE LITTLE EFFECT ON RESULTS.                              Sixpak
                                                                   Sixpak
FOR CONSISTENCY WITH EARLIER VERSIONS OF ENDF/B IN CREATING THE    Sixpak
ENDF/B OUTPUT, IF ANY INPUT INTERPOLATION LAW IS NOT IN THE        Sixpak
RANGE 1-5, IT WILL FIRST BE TESTED TO SEE IF MOD(10) IT IS         Sixpak
IN THIS RANGE, FINALLY IF EVEN THIS DOESN'T WORK IT IS SET         Sixpak
EQUAL TO 2 (LINEARLY INTERPOLATION). THIS METHOD WILL EFFECTIVELY  Sixpak
REPLACE CORRESPONDING POINT AND UNIT BASE TRANSFORMATION BY THE    Sixpak
CLOSEST RELATED INTERPOLATION LAW 1 THROUGH 5 - AGAIN NOTE, AS     Sixpak
OF JANUARY 1992 NONE OF THESE NEW LAWS ARE USED IN ENDF/B-VI. IF   Sixpak
THIS MUST BE DONE FOR INTERPOLATION IN SECONDARY ENERGY OR COSINE  Sixpak
AN ERROR MESSAGE WILL BE PRINTED - SINCE THIS WOULD EFFECT THE     Sixpak
ACCURACY OF THE INTEGRALS PERFORMED BY THIS PROGRAM. IF THIS MUST  Sixpak
BE DONE FOR INCIDENT ENERGY NO MESSAGE IS PRINTED - SINCE THIS     Sixpak
WILL NOT EFFECT THE ACCURACY OF THE INTEGRALS PERFORMED BY THIS    Sixpak
PROGRAM.                                                           Sixpak
                                                                   Sixpak
SPECTRA AND ANGULAR DISTRIBUTIONS                                  Sixpak
=================================                                  Sixpak
ALL SPECTRA AND ANGULAR DISTRIBUTIONS ARE CHECKED TO INSURE        Sixpak
THEY ARE NORMALIZED AND DO NOT INCLUDE ANY NEGATIVE VALUES.        Sixpak
                                                                   Sixpak
LEGENDRE COEFFICIENTS                                              Sixpak
=====================                                              Sixpak
THE NORMALIZATION, F0, CANNOT BE NEGATIVE.                         Sixpak
                                                                   Sixpak
LEGENDRE COEFFICIENTS IN NORMAL FORM ARE CHECKED TO INSURE         Sixpak
THEY ARE IN THE RANGE -1 TO +1 = THE LEGENDRE EXPANSION OF A       Sixpak
DELTA FUNCTION AT COS=+1 OR -1 - COEFFICIENTS SHOULD NOT           Sixpak
EXCEED WHAT YOU GET FROM A DELTA FUNCTION.                         Sixpak
                                                                   Sixpak
ANGULAR DISTRIBUTIONS ARE CHECKED AT COS = -1, 0 AND +1.           Sixpak
                                                                   Sixpak
CREATING ENDF/B OUTPUT                                             Sixpak
================================================================== Sixpak
THIS PROGRAM CAN CREATE EQUIVALENT MF =4, 5, 12, 14, 15 DATA FOR   Sixpak
ALL OF THE DATA INCLUDED IN ENDF/B-VI AS OF JANUARY 1992, EXCEPT   Sixpak
FOR 1 SECTION OF LAW=6 DATA (SEE DETAILS BELOW).                   Sixpak
                                                                   Sixpak
THIS PROGRAM HAS NOT BEEN TESTED ON OTHER DATA LIBRARIES, E.G.,    Sixpak
JEF, JENDL, ETC.                                                   Sixpak
                                                                   Sixpak
THE PROGRAM HAS THE FOLLOWING LIMITATION AS FAR AS CREATING        Sixpak
ENDF/B FORMATTED OUTPUT.                                           Sixpak
                                                                   Sixpak
ISOTROPIC PHOTON EMISSION                                          Sixpak
=========================                                          Sixpak
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FOR PHOTON EMISSION THE DISTRIBUTIONS ARE ASSUMED TO BE ISOTROPIC  Sixpak
AND ONLY THE MULTIPLICITY IS OUTPUT IN MF=12, ISOTROPIC ANGULAR    Sixpak
DISTRIBUTIONS IN MF=14 AND THE SPECTRA IN MF=15. ALL ENDF/B-VI     Sixpak
MF=6 DATA AS OF JANUARY 1992 INCLUDE ONLY ISOTROPIC PHOTON         Sixpak
EMISSION - SO THAT THIS IS NOT A LIMITATION ON TRANSLATING         Sixpak
ENDF/B-VI DATA.                                                    Sixpak
                                                                   Sixpak
EITHER TABULATED OR LEGENDRE COEFFICIENTS                          Sixpak
=========================================                          Sixpak
FOR LAW=2 THE REPRESENTATION, EITHER TABULATED OR LEGENDRE         Sixpak
COEFFICIENTS, CAN BE SPECIFIED FOR EACH INCIDENT ENERGY.           Sixpak
                                                                   Sixpak
IN ORDER TO OBTAIN CORRECT ENDF/B OUTPUT THE REPRESENTATION        Sixpak
MUST BE THE SAME FOR ALL INCIDENT ENERGIES = MF=4 DATA CAN ONLY    Sixpak
BE TABULATED OR LEGENDRE OVER THE ENTIRE ENERGY RANGE.             Sixpak
                                                                   Sixpak
YIELD AND OUTPUT NORMALIZATION                                     Sixpak
==============================                                     Sixpak
THE YIELD INCLUDED WITH EACH SECTION OF DATA IS NOT USED FOR       Sixpak
OUTPUT FOR NEUTRONS, BUT IS INCLUDED IN THE OUTPUT FOR PHOTONS.    Sixpak
IN ALL CASES THE ANGULAR DISTRIBUTIONS AND SPECTRA OUTPUT ARE      Sixpak
NORMALIZED TO UNITY.                                               Sixpak
                                                                   Sixpak
LAW=0                                                              Sixpak
=====                                                              Sixpak
NO OUTPUT - INCIDENT NEUTRON - EMITTED PHOTON OR NEUTRON           Sixpak
            REACTIONS ARE NOT EXPECTED.                            Sixpak
                                                                   Sixpak
LAW=1                                                              Sixpak
=====                                                              Sixpak
FOR EACH INCIDENT ENERGY DISCRETE AND CONTINUOUS EMISSION SPECTRA  Sixpak
CANNOT BE MIXED TOGETHER - THEY MUST BE ALL EITHER DISCRETE OR     Sixpak
CONTINUOUS. IF DISCRETE EMISSION IS GIVEN ONLY 1 SECONDARY         Sixpak
ENERGY (NEP=1) MAY BE GIVEN = A NORMALIZED DISTRIBUTION FOR A      Sixpak
SINGLE DISCRETE EMISSION ENERGY. ALL OF THE ENDF/B-VI DATA AS      Sixpak
OF JANUARY 1992 CONFORM TO THESE LIMITATIONS.                      Sixpak
                                                                   Sixpak
SINCE THE FLAG NA, TO INDICATE ISOTROPIC DISTRIBUTIONS, IS ONLY    Sixpak
GIVEN FOR EACH SECONDARY ENERGY (EP) THE PROGRAM CANNOT DECIDE     Sixpak
IN ADVANCE WHETHER OR NOT THE DISTRIBUTION WILL BE ISOTROPIC       Sixpak
AT ALL INCIDENT ENERGIES. THEREFORE ISOTROPIC DISTRIBUTIONS        Sixpak
WILL BE OUTPUT EITHER: LANG = 1 - AS 1 LEGENDRE COEFFICIENT = 0.0  Sixpak
OR LANG = NOT 1 - AS A 2 POINT ANGULAR DISTRIBUTION AT COS = -1.0  Sixpak
AND +1.0 WITH BOTH VALUES EQUAL TO 0.5 (A NORMALIZED ISOTROPIC     Sixpak
DISTRIBUTION).                                                     Sixpak
                                                                   Sixpak
DISCRETE PHOTONS ARE OUTPUT IN MF=15 AS 3 POINT DISTRIBUTIONS      Sixpak
WITH SECONDARY ENERGY POINTS AT EP-DEP, EP, EP+DEP, WHERE          Sixpak
DEP=0.001*EP. THE VALUES AT EP-DEP AND EP+DEP ARE 0.0, AND         Sixpak
AT EP THE VALUE IS 1000.0/EP TO NORMALIZE THE DISTRIBUTION.        Sixpak
                                                                   Sixpak
LAW=2                                                              Sixpak
=====                                                              Sixpak
NO LIMITATION ON REPRESENTATIONS.                                  Sixpak
                                                                   Sixpak
LAW=3                                                              Sixpak
=====                                                              Sixpak
NO LIMITATION ON REPRESENTATIONS.                                  Sixpak
                                                                   Sixpak
LAW=4                                                              Sixpak
=====                                                              Sixpak
NO OUTPUT - INCIDENT NEUTRON - EMITTED PHOTON OR NEUTRON           Sixpak
            REACTIONS ARE NOT EXPECTED.                            Sixpak
                                                                   Sixpak
LAW=5                                                              Sixpak
=====                                                              Sixpak
NO OUTPUT - INCIDENT NEUTRON - EMITTED PHOTON OR NEUTRON           Sixpak
            REACTIONS ARE NOT EXPECTED.                            Sixpak
                                                                   Sixpak
LAW=6                                                              Sixpak
=====                                                              Sixpak
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NO OUTPUT - ENDF/B-VI ONLY INCLUDES 1 SECTION OF THIS TYPE OF DATA Sixpak
            FOR (N,D) 2N,P.                                        Sixpak
                                                                   Sixpak
LAW=7                                                              Sixpak
=====                                                              Sixpak
FOR EACH INCIDENT ENERGY THE REPRESENTATION MUST BE EITHER,        Sixpak
                                                                   Sixpak
1) SQUARE = FOR EACH INCIDENT COSINE EXACTLY THE SAME SECONDARY    Sixpak
            ENERGIES.                                              Sixpak
                                                                   Sixpak
2) LINEAR = FOR EACH INCIDENT COSINE THE INTERPOLATION LAW         Sixpak
            BETWEEN SECONDARY ENERGIES MUST BE LINEAR.             Sixpak
                                                                   Sixpak
THESE 2 PRESENTATIONS ARE THE ONLY ONES PRESENTED IN ENDF/B-VI     Sixpak
AS OF JANUARY 1992 - SO THIS PROGRAM CAN TRANSLATED ALL LAW=7      Sixpak
DATA FOR ENDF/B-VI.                                                Sixpak
                                                                   Sixpak
LABORATORY VS. CENTER-OF-MASS SYSTEM                               Sixpak
================================================================== Sixpak
IN MANY CASES PEOPLE ASSUME THAT FOR HEAVY (HIGH ATOMIC WEIGHT)    Sixpak
MATERIALS THE CENTER-OF-MASS AND LAB SYSTEMS ARE ALMOST IDENTICAL, Sixpak
SINCE IN THIS CASE THE CENTER-OF-MASS ENERGY WILL BE MUCH SMALLER  Sixpak
THAN THE INCIDENT ENERGY. FOR A PROCESS SUCH AS ELASTIC SCATTERING Sixpak
WHERE FOR HEAVY MATERIALS THE SECONDARY ENERGY, EP, WILL ALWAYS    Sixpak
BE A LARGE FRACTION OF THE INCIDENT ENERGY, THIS ASSUMPTION IS     Sixpak
VALID. HOWEVER, FOR THE TYPICAL REACTIONS INCLUDED IN MF=6 THIS    Sixpak
IS NOT ALWAYS TRUE - IN MANY OF THESE CASES THE SECONDARY ENERGY   Sixpak
CAN EXTEND ALL THE WAY DOWN TO ZERO, AND IN PARTICULAR IT CAN      Sixpak
BE SMALL COMPARED TO THE CENTER-OF-MASS ENERGY - WHICH MAKES THE   Sixpak
TRANSFORMATION FROM CENTER-OF-MASS TO LAB IMPORTANT. THEREFORE     Sixpak
GENERALLY TO TREAT MF=6 DATA WE MUST CONSIDER THIS TRANSFORMATION. Sixpak
                                                                   Sixpak
THE FOLLOWING DISCUSSING ONLY APPLIES TO SPECTRA THAT MAY BE       Sixpak
OUTPUT IN MF=5 = ONLY DATA FOR NEUTRONS INCIDENT AND EMITTED -     Sixpak
IN PARTICULAR THE FOLLOWING DEFINITIONS ARE NOT GENERAL - THEY     Sixpak
ARE ONLY VALID FOR INCIDENT AND EMITTED NEUTRONS.                  Sixpak
                                                                   Sixpak
DOUBLE DIFFERENTIAL DATA IN MF=6 MAY BE GIVEN IN EITHER THE LAB    Sixpak
OR C.M. SYSTEM. SIMILARLY ANGULAR DISTRIBUTIONS IN MF=4 MAY BE     Sixpak
GIVEN IN EITHER THE LAB OR C.M. SYSTEM. IN CONTRAST ENERGY         Sixpak
SPECTRA IN MF=5 CAN ONLY BE GIVEN IN THE LABORATORY SYSTEM.        Sixpak
                                                                   Sixpak
THE ANGULAR DISTRIBUTIONS OUTPUT BY THIS CODE IN MF=4 ARE IN THE   Sixpak
SAME SYSTEM IN WHICH THEY ARE GIVEN IN MF=6 - EITHER LAB OR        Sixpak
CENTER-OF-MASS SYSTEM.                                             Sixpak
                                                                   Sixpak
THE ENERGY SPECTRA OUTPUT BY THIS CODE IN MF=5 MUST BE IN THE LAB  Sixpak
SYSTEM - THIS IS THE ONLY ALLOWED FORM FOR MF=5 DATA.              Sixpak
                                                                   Sixpak
FOR MF=6 SPECTRA GIVEN IN THE LAB SYSTEM THIS MERELY REQUIRES      Sixpak
COPYING THE GIVEN SPECTRA TO MF=5 OUTPUT.                          Sixpak
                                                                   Sixpak
FOR MF=6 SPECTRA GIVEN IN THE CENTER-OF-MASS SYSTEM ONLY FIRST     Sixpak
ORDER CORRECTIONS IN THE SPECTRA AND USED AND THEY ARE THEN        Sixpak
OUTPUT IN MF=5 AS IN THE LAB SYSTEM - THE FIRST ORDER CORRECTIONS  Sixpak
ARE DESCRIBED BELOW.                                               Sixpak
                                                                   Sixpak
DEFINING,                                                          Sixpak
MM      = CENTER OF MASS MOTION                                    Sixpak
CM      = OUTGOING (EMITTED) PARTICLE IN CENTER OF MASS            Sixpak
LAB     = OUTGOING (EMITTED) PARTICLE IN LAB                       Sixpak
THETA   = CM SCATTERING ANGLE RELATIVE TO INCIDENT DIRECTION       Sixpak
COS(CM) = COSINE OF THE CM SCATTERING ANGLE                        Sixpak
                                                                   Sixpak
FOR NEUTRONS INCIDENT WITH AN ENERGY, E, AND THEREFORE A SPEED,    Sixpak
                                                                   Sixpak
VN(E) = 2*SQRT(E)/MASS(IN)                                         Sixpak
                                                                   Sixpak
THE CENTER-OF-MASS SPEED IS GIVEN BY,                              Sixpak
                                                                   Sixpak
V(MM) = VN(E)/(1 + A)                                              Sixpak
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                                                                    Sixpak
AND THE CENTER OF MASS ENERGY BY,                                   Sixpak
                                                                    Sixpak
E(MM) = 1/2*MASS(IN)*V(MM)**2                                       Sixpak
      = 1/2*MASS(IN)*VN(E)**2/(1 + A)**2                            Sixpak
      = E/(1 + A)**2                                                Sixpak
                                                                    Sixpak
FOR DISTRIBUTIONS GIVEN IN MF=6 IN THE CM, THE SPEED, V(CM),        Sixpak
SHOULD BE VECTORIALLY ADDED TO THAT OF OUTGOING PARTICLES TO        Sixpak
DEFINE THE OUTGOING PARTICLES LAB VELOCITY, AND IN TURN IT'S        Sixpak
ENERGY,                                                             Sixpak
                                                                    Sixpak
V(LAB)*COS(LAB) = V(MM) + V(CM)*COS(CM)                             Sixpak
V(LAB)*SIN(LAB) =         V(CM)*SIN(CM)                             Sixpak
                                                                    Sixpak
V(LAB)**2 = V(MM)**2 + V(CM)**2 + 2*COS(CM)*V(MM)*V(CM)             Sixpak
                                                                    Sixpak
EP(LAB)   = 0.5*MASS(OUT)*V(LAB)**2                                 Sixpak
                                                                    Sixpak
          = E(MM) + EP(CM) + 2*COS(CM)*SQRT(E(MM)*EP(CM))           Sixpak
                                                                    Sixpak
WE CAN ALSO DEFINE THE REVERSE TRANSFORMATION USING,                Sixpak
                                                                    Sixpak
V(CM)*COS(CM) = V(LAB)*COS(LAB) - V(MM)                             Sixpak
V(CM)*SIN(CM) = V(LAB)*SIN(LAB)                                     Sixpak
                                                                    Sixpak
V(CM)**2 = V(MM)**2 + V(LAB)**2 - 2*COS(LAB)*V(MM)*V(LAB)           Sixpak
                                                                    Sixpak
EP(CM)   = 0.5*MASS(OUT)*V(CM)**2                                   Sixpak
                                                                    Sixpak
          = E(MM) + EP(LAB) - 2*COS(LAB)*SQRT(E(MM)*EP(LAB))        Sixpak
                                                                    Sixpak
WE CAN DEFINE COS(LAB) FROM THE RELATIONSHIP,                       Sixpak
                                                                    Sixpak
V(LAB)*COS(LAB) = V(MM) + V(CM)*COS(CM)                             Sixpak
                                                                    Sixpak
COS(LAB)        =[V(MM) + V(CM)*COS(CM)]/V(LAB)                     Sixpak
                                                                    Sixpak
                 [V(MM) + V(CM)*COS(CM)]                            Sixpak
COS(LAB)        =---------------------------------------------      Sixpak
                 SQRT[V(MM)**2+V(CM)**2+2*COS(CM)*V(MM)*V(CM)]      Sixpak
                                                                    Sixpak
OR COS(CM) FROM THE RELATIONSHIP,                                   Sixpak
                                                                    Sixpak
V(CM)*COS(CM)  = V(LAB)*COS(LAB) - V(MM)                            Sixpak
                                                                    Sixpak
COS(CM)         =[V(LAB)*COS(LAB) - V(MM)]/V(CM)                    Sixpak
                                                                    Sixpak
                 [V(LAB)*COS(LAB) - V(MM)]                          Sixpak
COS(CM)         =------------------------------------------------   Sixpak
                 SQRT[V(LAB)**2+V(CM)**2-2*COS(LAB)*V(LAB)*V(MM)]   Sixpak
                                                                    Sixpak
THE JACOBIAN CAN BE DEFINED FROM,                                   Sixpak
                                                                    Sixpak
V(LAB)*COS(LAB) = V(MM) + V(CM)*COS(CM)                             Sixpak
                                                                    Sixpak
J = D[COS(CM)]/D[COS(LAB)] = V(LAB)/V(CM)                           Sixpak
                           = SQRT[EP(LAB)/EP(CM)]                   Sixpak
                                                                    Sixpak
WITH THESE DEFINITIONS OF EP(LAB) AND COS(LAB) IN TERMS OF E(MM),   Sixpak
EP(CM) AND COS(CM) IT IS POSSIBLE TO PERFORM A POINT-BY-POINT       Sixpak
TRANSFORMATION OF DISTRIBUTIONS FROM THE CM TO LAB SYSTEM USING     Sixpak
THESE DEFINITIONS - OR IF WE WISHED WE COULD PERFORM THE REVERSE    Sixpak
TRANSFORMATION USING THE ABOVE RELATIONSHIPS AND THE IDENTITY,      Sixpak
                                                                    Sixpak
F(E,EP(LAB),COS(LAB))*D(COS(LAB))=F(E,EP(CM),COS(CM))*D(COS(CM))    Sixpak
                                                                    Sixpak
THIS IS NOT WHAT WILL BE DONE HERE, SINCE WE WILL ONLY BE           Sixpak
INTERESTED IN THE ZEROTH ORDER MOMENTS OF THESE DISTRIBUTIONS,      Sixpak
BUT WE WILL BE INTERESTED IN DEFINING THOSE MOMENTS IN THE          Sixpak
LAB SYSTEM IN TERMS OF MF=6 SPECTRA GIVEN IN THE CM SYSTEM USING,   Sixpak
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                                                                   Sixpak
F(E,EP(LAB),COS(LAB)) = F(E,EP(CM),COS(CM))*J                      Sixpak
                                                                   Sixpak
THE LIMITS OF EP(LAB) ARE DEFINED BY SETTING COS(CM) = +1 OR -1,   Sixpak
                                                                   Sixpak
EP(LAB)   = (SQRT(EP(CM)) + SQRT(E(MM)))**2  FOR COS(CM) = +1      Sixpak
          = (SQRT(EP(CM)) - SQRT(E(MM)))**2  FOR COS(CM) = -1      Sixpak
                                                                   Sixpak
IN THIS FORM WE CAN SEE THAT AS LONG AS THE SECONDARY ENERGY IN    Sixpak
THE CENTER-OF-MASS SYSTEM, EP(CM), IS MUCH LARGER THAN THE         Sixpak
ENERGY OF THE CENTER-OF-MASS, E(MM), THE CENTER-OF-MASS AND LAB    Sixpak
ENERGIES WILL BE ALMOST EQUAL - SIMILARLY FOR THE COSINE, IN       Sixpak
THIS CASE COS(LAB) AND COS(CM) WILL BE ALMOST EQUAL - HOWEVER,     Sixpak
FOR THE MF=6 DATA WE CANNOT ASSUME THAT THIS IS TRUE.              Sixpak
                                                                   Sixpak
TO FIRST ORDER THE ANGULAR DEPENDENCE CAN BE IGNORED,              Sixpak
                                                                   Sixpak
EP(LAB)   = E(MM) + EP(CM)                                         Sixpak
                                                                   Sixpak
ALL THIS SAYS IS THAT TO FIRST ORDER THE EFFECT OF TRANSFORMING    Sixpak
FROM THE CM TO LAB SYSTEM IS TO INCREASE THE ENERGY OF THE         Sixpak
EMITTED PARTICLE IN THE CENTER-OF-MASS SYSTEM BY THE ENERGY OF     Sixpak
THE CENTER-OF-MASS TO DEFINE THE LAB ENERGY.                       Sixpak
                                                                   Sixpak
NOT ONLY THE ENERGY, BUT ALSO THE SPECTRA MUST BE TRANSFORMED.     Sixpak
STARTING FROM THE DOUBLE DIFFERENTIAL DATA IN THE LAB SYSTEM,      Sixpak
F(E,EP,COS(LAB)), WE CAN DEFINE THE LAB SCALAR SPECTRUM AS,        Sixpak
                                                                   Sixpak
G0(E,EP) = INTEGRAL F(E,EP,COS(LAB))*D(COS(LAB))                   Sixpak
                                                                   Sixpak
THIS IS THE NORMAL CALCULATION DEFINED ABOVE AND USED FOR DATA     Sixpak
GIVEN IN THE LAB SYSTEM.                                           Sixpak
                                                                   Sixpak
STARTING FROM DATA IN THE CENTER OF MASS SYSTEM F(E,EP,COS(CM)),   Sixpak
WE CAN USE THE RELATIONSHIP,                                       Sixpak
                                                                   Sixpak
F(E,EP,COS(LAB))*D(COS(LAB)) = F(E,EP,COS(CM))*J*D(COS(LAB))       Sixpak
                                                                   Sixpak
J         = SQRT(EP(LAB)/EP(CM)) - THE JACOBIAN                    Sixpak
                                                                   Sixpak
          = E(MM)/EP(CM) + 1 + 2*COS(CM)*SQRT(E(MM)/EP(CM))        Sixpak
                                                                   Sixpak
AS IN THE CASE OF THE ENERGY, IN THIS FORM WE CAN SEE THAT AS      Sixpak
LONG AS THE SECONDARY ENERGY IN THE CENTER-OF-MASS SYSTEM,         Sixpak
EP(CM), IS LARGE COMPARED TO THE CENTER-OF-MASS ENERGY, E(MM),     Sixpak
THE JACOBIAN IS ESSENTIALLY UNITY AND THE CENTER-OF-MASS AND LAB   Sixpak
SPECTRA WILL BE VERY SIMILAR - AGAIN, GENERALLY WE CANNOT          Sixpak
ASSUME THAT THIS IS TRUE FOR THE MF=6 SPECTRA.                     Sixpak
                                                                   Sixpak
THEREFORE WE CAN ALSO DEFINE THE LAB SCALAR SPECTRUM IN TERMS OF   Sixpak
THE CM SPECTRUM IN THE FORM,                                       Sixpak
                                                                   Sixpak
G0(E,EP) = INTEGRAL F(E,EP,COS(CM))*J*D(COS(LAB))                  Sixpak
                                                                   Sixpak
CONSISTENT WITH THE ABOVE ASSUMPTION THAT THE ANGULAR DEPENDENCE   Sixpak
OF EP(LAB) CAN BE IGNORED THE JACOBIAN WILL NOT BE USED IN         Sixpak
PERFORMING THESE INTEGRALS - IN WHICH CASE THE INTEGRAL REDUCES    Sixpak
TO EXACTLY THE SAME FORM AS IF THE DATA WERE IN THE LAB SYSTEM.    Sixpak
                                                                   Sixpak
IT SHOULD BE NOTED THAT SINCE IN THIS CASE THE MF=4 ANGULAR        Sixpak
DISTRIBUTIONS ARE GIVEN IN THE CM SYSTEM AND WHEN USED IN ANY      Sixpak
APPLICATION THEY WILL BE TRANSFORMED TO THE LAB SYSTEM - WHEN      Sixpak
THIS IS DONE THE JACOBIAN WILL BE APPLIED.                         Sixpak
                                                                   Sixpak
IN THIS CODE WHERE WE ARE MOSTLY CONCERNED WITH CONSERVING THE     Sixpak
NUMBER OF EMITTED PARTICLES AND AVERAGE ENERGIES THE NEUTRON       Sixpak
SPECTRA OUTPUT IN MF=5 WILL NOT BE COMPLETELY CONVERTED TO THE     Sixpak
LAB SYSTEM - ONLY FIRST ORDER CORRECTIONS WILL BE INCLUDED BY      Sixpak
INCREASING THE EMITTED PARTICLE ENERGY BY THE CENTER OF MASS       Sixpak
ENERGY, I.E., FOR A CENTER OF MASS SPECTRUM TABULATED AT CENTER    Sixpak
OF MASS ENERGIES EP(CM) THESE WILL ALL BE UNIFORMLY INCREASED      Sixpak
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BY E(MM) TO ACCOUNT FOR THE CENTER OF MASS MOTION - THE SPECTRA    Sixpak
WILL NOT BE MODIFIED BY THE JACOBIAN FACTOR SQRT(EP(LAB)/EP(CM))   Sixpak
SINCE THIS WOULD REQUIRE A DETAILED TRANSFORMATION IN ENERGY AND   Sixpak
COS(THETA) SPACE - WHICH IS JUDGED NOT TO BE WORTH PERFORMING      Sixpak
WITHIN THE LIMITS OF WHERE THE OUTPUT FROM THIS CODE IS INTENDED   Sixpak
TO BE USED.                                                        Sixpak
                                                                   Sixpak
SINCE THE ANGULAR DISTRIBUTION IS ALWAYS OUTPUT IN THE SAME        Sixpak
SYSTEM AS WHICH IT IS GIVEN IN MF=6, NO TRANSFORMATION IS          Sixpak
REQUIRED FOR THE MF=4 OUTPUT.                                      Sixpak
                                                                   Sixpak
WHEN USED IN LOW ENERGY APPLICATIONS (E.G., FISSION REACTORS) THE  Sixpak
HIGH ENERGY SPECTRA PRESENTED IN MF=6 WILL BE MOSTLY IMPORTANT     Sixpak
SIMPLY IN CONSERVING PARTICLES, (E.G., AS IN (N,2N)) AND ENERGY    Sixpak
AND THE DETAILS OF THE CORRELATION AND GROSS ENERGY SPECTRA WILL   Sixpak
NOTE PLAY THAT IMPORTANT A ROLE. IN THIS CASE THE SPECTRA OUTPUT   Sixpak
BY THIS PROGRAM IN MF=5 SHOULD BE ADEQUATE.                        Sixpak
                                                                   Sixpak
PLOTTAB FORMATTED OUTPUT                                           Sixpak
================================================================== Sixpak
THIS PROGRAM CONTAINS ROUTINES TO PRODUCE OUTPUT THAT CAN BE USED  Sixpak
AS INPUT TO THE PLOTTAB CODE TO OBTAIN GRAPHIC RESULTS.            Sixpak
                                                                   Sixpak
THESE ROUTINES ARE DESIGNED ONLY FOR USE BY THE AUTHOR TO CHECK    Sixpak
THIS CODE. USERS ARE ASKED NOT TO ACTIVATE OR TRY TO USE THESE     Sixpak
ROUTINES. UNLESS YOU COMPLETELY UNDERSTAND THIS CODE THE RESULTS   Sixpak
CAN BE UNRELIABLE IF YOU ACTIVATE THESE ROUTINES.                  Sixpak
                                                                   Sixpak
INPUT FILES                                                        Sixpak
================================================================== Sixpak
UNIT  DESCRIPTION                                                  Sixpak
----  -----------                                                  Sixpak
   2  INPUT LINES (BCD - 80 CHARACTERS/RECORD)                     Sixpak
  10  ORIGINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)            Sixpak
                                                                   Sixpak
OUTPUT FILES                                                       Sixpak
================================================================== Sixpak
UNIT  DESCRIPTION                                                  Sixpak
----  -----------                                                  Sixpak
   3  OUTPUT REPORT (BCD - 120 CHARACTERS/RECORD)                  Sixpak
  11  ENDF/B DATA MF=4 (BCD - 80 CHARACTERS/RECORD)                Sixpak
  12  ENDF/B DATA MF=5 (BCD - 80 CHARACTERS/RECORD)                Sixpak
  14  ENDF/B DATA MF=15 (BCD - 80 CHARACTERS/RECORD)               Sixpak
  17  ENDF/B DATA MF=12 (BCD - 80 CHARACTERS/RECORD)               Sixpak
  18  ENDF/B DATA MF=14 (BCD - 80 CHARACTERS/RECORD)               Sixpak
  15  PLOTTAB INPUT PARAMETERS (BCD - 80 CHARACTERS/RECORD)        Sixpak
  16  PLOTTAB FORMATTED OUTPUT (BCD - 80 CHARACTERS/RECORD)        Sixpak
                                                                   Sixpak
SCRATCH FILES                                                      Sixpak
================================================================== Sixpak
NONE                                                               Sixpak
                                                                   Sixpak
OPTIONAL STANDARD FILE NAMES (SEE SUBROUTINE FILIO1 AND FILIO2)    Sixpak
================================================================== Sixpak
UNIT  FILE NAME                                                    Sixpak
----  ----------                                                   Sixpak
  2   SIXPAK.INP                                                   Sixpak
  3   SIXPAK.LST                                                   Sixpak
 10   ENDFB.IN                                                     Sixpak
 11   ENDFB.MF4                                                    Sixpak
 12   ENDFB.MF5                                                    Sixpak
 14   ENDFB.M15                                                    Sixpak
 17   ENDFB.M12                                                    Sixpak
 18   ENDFB.M14                                                    Sixpak
 15   PLOTTAB.INP                                                  Sixpak
 16   PLOTTAB.CUR                                                  Sixpak
                                                                   Sixpak
                                                                   Sixpak
INPUT PARAMETERS                                                   Sixpak
================================================================== Sixpak
LINE  COLS.  DESCRIPTION                                           Sixpak
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     ----  -----  -----------                                       Sixpak
        1   1-60  ENDF/B INPUT DATA FILENAME                        Sixpak
                  (STANDARD OPTION = ENDFB.IN)                      Sixpak
      2-N   1-6   MINIMUM MAT FOR REQUESTED RANGE                   Sixpak
            9-11  MINIMUM MT FOR REQUESTED RANGE                    Sixpak
           12-17  MAXIMUM MAT FOR REQUESTED RANGE                   Sixpak
           20-22  MAXIMUM MT FOR REQUESTED RANGE                    Sixpak
                                                                    Sixpak
     LEAVE THE DEFINITION OF THE FILENAME BLANK - THE PROGRAM WILL  Sixpak
     THEN USE THE STANDARD FILENAME (ENDFB.IN).                     Sixpak
                                                                    Sixpak
     UP TO 100 MAT/MT RANGES MAY BE SPECIFIED. THE LIST OF RANGES IS   Sixpak
     TERMINATED BY A BLANK LINE. IF THE FIRST INPUT LINE IS COMPLETELY  Sixpak
     BLANK ALL DATA WILL BE PROCESSED.                              Sixpak
                                                                    Sixpak
     EXAMPLE INPUT NO. 1                                            Sixpak
     -------------------                                            Sixpak
     PROCESS ALL MF=6 DATA ON AN ENDF/B TAPE. USE THE STANDARD INPUT   Sixpak
     DATA FILENAME ENDFB.IN IN THIS CASE THE USER CAN EITHER EXPLICITLY Sixpak
     SPECIFY THE FILENAME AND MAT/MT RANGE BY THE FOLLOWING  2 INPUT   Sixpak
     LINES,                                                         Sixpak
                                                                    Sixpak
     ENDFB.IN                                                       Sixpak
         1    1  9999  999                                          Sixpak
                           (BLANK LINE, TERMINATES REQUEST LIST)    Sixpak
                                                                    Sixpak
     OR BY INPUTTING 2 BLANK LINE = PROCESS EVERYTHING.             Sixpak
                                                                    Sixpak
     EXAMPLE INPUT NO. 2                                            Sixpak
     -------------------                                            Sixpak
     PROCESS BE-9, MAT=425, MT=16. READ THE DATA FROM ENDFB6\BE9.   Sixpak
     IN THIS CASE THE FOLLOWING 3 INPUT LINES ARE REQUIRED,         Sixpak
                                                                    Sixpak
     ENDFBB6\BE9                                                    Sixpak
        425   16   425   16                                         Sixpak
                           (BLANK LINE, TERMINATES REQUEST LIST)    Sixpak
                                                                    Sixpak
     EXAMPLE INPUT NO. 3                                            Sixpak
     -------------------                                            Sixpak
     PROCESS ALL MT=16 (N,2N) DATA. THIS CAN BE DONE BY SPECIFYING THE  Sixpak
     MAXIMUM MAT RANGE = 1 TO 9999, AND MT=16 FOR THE MINIMUM AND   Sixpak
     MAXIMUM MT RANGE. READ THE DATA FROM ENDFB6\K300. IN THIS CASE    Sixpak
     CASE THE FOLLOWING 3 INPUT LINES ARE REQUIRED,                 Sixpak
                                                                    Sixpak
     ENDFB6\K300                                                    Sixpak
         1   16  9999   16                                          Sixpak
                           (BLANK LINE, TERMINATES REQUEST LIST)    Sixpak
                                                                    Sixpak
==================================================================== Sixpak
```