```
=========================================================================RECENT
                                                                        RECENT
     PROGRAM RECENT                                                     RECENT
     ==============                                                     RECENT
     VERSION 79-1 (OCTOBER 1979)  CDC-7600                              RECENT
     VERSION 80-1 (MAY 1980)      IBM, CDC AND CRAY VERSION             RECENT
     VERSION 80-2 (DECEMBER 1980) IMPROVED TREATMENT OF UNRESOLVED      RECENT
                                  REGION TO COMPUTE ALL REACTIONS AT    RECENT
                                  THE SAME TIME.                        RECENT
     VERSION 81-1 (MARCH 1981)  IMPROVED BASED ON USER COMMENTS.        RECENT
     VERSION 81-2 (AUGUST 1981) ADDED MONITOR MODE. ADDED SPEED OPTION  RECENT
                                TO BYPASS BACKWARDS THINNING IF FILE 3  RECENT
                                ALLOWABLE ERROR = 0.0 (NOTE THIS OPTIONRECENT
                                WILL RESULT IN ALL TABULATED POINTS     RECENT
                                FROM THE EVALUATION BEING KEPT IN THE   RECENT
                                OUTPUT FROM THIS PROGRAM).              RECENT
     VERSION 82-1 (JANUARY 1982) IMPROVED COMPUTER COMPATIBILITY.       RECENT
     VERSION 83-1 (JANUARY 1983)*MAJOR RE-DESIGN.                       RECENT
                                *PAGE SIZES INCREASED.                  RECENT
                                *ELIMINATED COMPUTER DEPENDENT CODING.  RECENT
                                *NEW, MORE COMPATIBLE I/O UNIT NUMBERS.RECENT
                                *ADDED OPTION TO KEEP ALL RECONSTRUCTEDRECENT
                                 AND BACKGROUND ENERGY POINTS.          RECENT
                                *ADDED STANDARD ALLOWABLE ERROR OPTIONSRECENT
                                 (CURRENTLY 0.1 PER-CENT RECONSTRUCTIONRECENT
                                 AND 0.0 PER-CENT THINNING).            RECENT
     VERSION 83-2 (OCTOBER 1983) IMPROVED BASED ON USER COMMENTS.       RECENT
     VERSION 84-1 (JANUARY 1984) IMPROVED INTERVAL HALFING CONVERGENCE.RECENT
     VERSION 85-1 (APRIL 1985)  *A BRAND NEW PROGRAM WHICH COMPLETELY   RECENT
                                 SUPERCEDES ALL PREVIOUS VERSIONS OF    RECENT
                                 THIS PROGRAM.                          RECENT
                                *UPDATED FOR ENDF/B-6 FORMATS.          RECENT
                                *ADDED GENERAL REICH-MOORE FORMALISM    RECENT
                                 (WITH TWO FISSION CHANNELS).           RECENT
                                *DECREASED RUNNING TIME.                RECENT
                                *SPECIAL I/O ROUTINES TO GUARANTEE      RECENT
                                 ACCURACY OF ENERGY.                    RECENT
                                *DOUBLE PRECISION TREATMENT OF ENERGY   RECENT
                                 (REQUIRED FOR NARROW RESONANCES).      RECENT
     VERSION 85-2 (AUGUST 1985) *FORTRAN-77/H VERSION                   RECENT
     VERSION 86-1 (JANUARY 1986)*ENERGY DEPENDENT SCATTERING RADIUS     RECENT
     VERSION 86-2 (JUNE 1986)   *IF FIRST CHANCE FISSION (MT=19)        RECENT
                                 BACKGROUND IS PRESENT ADD RESONANCE    RECENT
                                 CONTRIBUTION OF FISSION TO IT.         RECENT
     VERSION 86-3 (OCTOBER 1986)*MULTI-LEVEL OR REICH-MOORE..CORRECT    RECENT
                                 POTENTIAL SCATTERING CROSS SECTION FORRECENT
                                 MISSING AND/OR FICTICIOUS (L,J)        RECENT
                                 SEQUENCES.                             RECENT
     VERSION 87-1 (JANUARY 1987)*IMPROVED COMBINING FILE 2+3            RECENT
     VERSION 87-2 (MARCH 1987)  *CORRECTED ADLER-ADLER CALCULATIONS.    RECENT
     VERSION 88-1 (JULY 1988)   *UPDATED REICH-MOORE ENDF/B-6 FORMAT    RECENT
                                 TO BE THE SAME AS REICH-MOORE FORMAT   RECENT
                                 IN EARLIER VERSIONS OF ENDF/B FORMAT.  RECENT
                                *CHECK FOR PRELIMINARY ENDF/B-6         RECENT
                                 REICH-MOORE FORMAT (NOW ABANDONED)     RECENT
                                 AND TERMINATE EXECUTION IF DATA IS     RECENT
                                 IN THIS FORMAT.                        RECENT
                                *CALCULATE CHANNEL RADIUS OR SET IT     RECENT
                                 EQUAL TO THE SCATTERING RADIUS.        RECENT
                                *IMPLEMENTED HYBRID R-FUNCTION WITH THERECENT
                                 FOLLOWING RESTRICTIONS                 RECENT
                                 - ONLY INELASTIC COMPETITION (NO       RECENT
                                   CHARGED PARTICLES)                   RECENT
                                 - NO TABULATED FILE 2 BACKGROUND       RECENT
                                 - NO TABULATED OPTICAL MODEL PHASE     RECENT
                                   SHIFT                                RECENT
                                *PROGRAM EXIT IF GENERAL R-MATRIX IN    RECENT
                                 THE EVALUATION (THIS FORMALISM WILL    RECENT
                                 BE IMPLEMENTED ONLY AFTER THE AUTHOR   RECENT
                                 RECEIVES REAL EVALUATIONS WHICH USE    RECENT
                                 THIS FORMALISM...UNTIL THEN IT IS      RECENT
```

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                          IMPOSSIBLE TO ADEQUATELY TEST THAT    RECENT
                          THE CODING FOR THIS FORMALISM IS      RECENT
                          CORRECT).                             RECENT
                         *INCREASED MAXIMUM NUMBER OF RESONANCESRECENT
                          FROM 1002 TO 4008.                    RECENT
                         *DOUBLE PRECISION RESONANCE REGION     RECENT
                          LIMITS.                               RECENT
                         *FILE 2 AND FILE 3 ENERGIES WHICH ARE  RECENT
                          NEARLY EQUAL ARE TREATED AS EQUAL     RECENT
                          (I.E., SAME TO ABOUT 9 DIGITS).       RECENT
                         *CHECK FILE 3 BACKGROUND CROSS SECTIONSRECENT
                          IN EDIT MODE.                         RECENT
                         *OPTION...INTERNALLY DEFINE FILENAMES  RECENT
                          (SEE SUBROUTINE FILEIO FOR DETAILS).  RECENT
VERSION 89-1 (JANUARY 1989)*PSYCHOANALYZED BY PROGRAM FREUD TO  RECENT
                          INSURE PROGRAM WILL NOT DO ANYTHING   RECENT
                          CRAZY.                                RECENT
                         *UPDATED TO USE NEW PROGRAM CONVERT    RECENT
                          KEYWORDS.                             RECENT
                         *CORRECTED MULTILEVEL, REICH-MOORE AND RECENT
                          HYBRID R-FUNCTION POTENTIAL SCATTER   RECENT
                          TO ACCOUNT FOR REPEATED J-VALUES FOR  RECENT
                          THE SAME TARGET SPIN AND L-VALUE.     RECENT
                         *ADDED LIVERMORE CIVIC COMPILER        RECENT
                          CONVENTIONS.                          RECENT
                         *UPDATED TO USE NEW ENDF/B-6           RECENT
                          CONVENTION TO ALLOW UNRESOLVED        RECENT
                          RESONANCE CONTRIBUTION TO ALREADY     RECENT
                          BE INCLUDED IN THE FILE 3 CROSS       RECENT
                          SECTIONS (INFINITELY DIULUTE          RECENT
                          CONTRIBUTION).                        RECENT
VERSION 90-1 (JUNE 1990)  *UPDATED BASED ON USER COMMENTS       RECENT
                         *ADDED FORTRAN SAVE OPTION             RECENT
                         *NEW MORE CONSISTENT ENERGY OUTPUT     RECENT
                          ROUTINE                               RECENT
VERSION 91-1 (JULY 1991)  *NEW UNIFORM TREATMENT OF ALL RESONANCERECENT
                          FORMALISMS (SEE, COMMENTS BELOW)      RECENT
                         *NEW REICH-MOORE ALGORITHM             RECENT
                         *MORE EXTENSIVE ERROR CHECKING AND     RECENT
                          ERROR MESSAGE EXPLANATIONS            RECENT
VERSION 92-1 (JANUARY 1992)*MAJOR RESTRUCTING TO IMPROVE ACCURACY RECENT
                          AND COMPUTER INDEPENDENCE.            RECENT
                         *INCREASED ENERGY POINT PAGE SIZE FROM RECENT
                          1002 TO 4008.                         RECENT
                         *NO MORE THAN 2 ENERGY POINTS WHERE    RECENT
                          CROSS SECTION IS ZERO AT BEGINNING    RECENT
                          OF A SECTION FOR EACH REACTION,E.G.,  RECENT
                          THRESHOLD FISSION.                    RECENT
                         *PROCESS ONLY A PORTION OF RESONANCE   RECENT
                          REGION - SEE EXPLANATION BELOW        RECENT
                         *ALL ENERGIES INTERNALLY ROUNDED PRIOR RECENT
                          TO CALCULATIONS.                      RECENT
                         *COMPLETELY CONSISTENT I/O AND ROUNDINGRECENT
                          ROUTINES - TO MINIMIZE COMPUTER       RECENT
                          DEPENDENCE.                           RECENT
VERSION 93-1 (MARCH 1993)  *UPDATED REICH-MOORE TREATMENT TO USE RECENT
                          L DEPENDENT SCATTERING RADIUS (APL)   RECENT
                          RATHER THAN SCATTERING RADIUS (AP)    RECENT
                          (SEE, ENDF/B-6 FORMATS AND            RECENT
                           PROCEDURES MANUAL, PAGE 2.6)         RECENT
                         *INCREASED PAGE SIZE FROM 4008 TO      RECENT
                          20040 DATA POINTS.                    RECENT
                         *INCREASED MAXIMUM NUMBER OF RESONANCESRECENT
                          FROM 4008 TO 20040.                   RECENT
VERSION 94-1 (JANUARY 1994)*VARIABLE ENDF/B DATA FILENAMES      RECENT
                          TO ALLOW ACCESS TO FILE STRUCTURES    RECENT
                          (WARNING - INPUT PARAMETER FORMAT     RECENT
                          HAS BEEN CHANGED).                    RECENT
                         *CLOSE ALL FILES BEFORE TERMINATING    RECENT
                          (SEE, SUBROUTINE ENDIT)               RECENT
VERSION 94-2 (AUGUST 1994) *CORRECTED ADDL FOR ENERGY DEPENDENT RECENT
```

```
                          (TABULATED) SCATTERING RADIUS CASE.   RECENT
VERSION 96-1 (JANUARY 1996) *COMPLETE RE-WRITE                  RECENT
                          *IMPROVED COMPUTER INDEPENDENCE       RECENT
                          *ALL DOUBLE PRECISION                 RECENT
                          *ON SCREEN OUTPUT                     RECENT
                          *UNIFORM TREATMENT OF ENDF/B I/O      RECENT
                          *IMPROVED OUTPUT PRECISION            RECENT
                          *ALWAYS INCLUDE THERMAL VALUE         RECENT
                          *DEFINED SCRATCH FILE NAMES           RECENT
VERSION 97-1 (APRIL 1997)   *OPTIONAL MAKE NEGATIVE CROSS       RECENT
                            SECTION = 0 FOR OUTPUT              RECENT
                          *INCREASED PAGE SIZE FROM 20040 TO    RECENT
                          120000 DATA POINTS.                   RECENT
                          *INCREASED MAXIMUM NUMBER OF RESONANCESRECENT
                          FROM 20040 TO 120000.                 RECENT
VERSION 99-1 (MARCH 1999)   *CORRECTED CHARACTER TO FLOATING    RECENT
                            POINT READ FOR MORE DIGITS          RECENT
                          *UPDATED TEST FOR ENDF/B FORMAT       RECENT
                           VERSION BASED ON RECENT FORMAT CHANGERECENT
                          *UPDATED CONSTANTS BASED ON CSEWG     RECENT
                           SUBCOMMITTEE RECOMMENDATIONS         RECENT
                          *GENERAL IMPROVEMENTS BASED ON        RECENT
                           USER FEEDBACK                        RECENT
VERSION 99-2 (JUNE 1999)    *IMPLEMENTED NEW REICH-MOORE FORMALISMRECENT
                            TO ALLOW DEFINITION OF (L,J,S) FOR  RECENT
                            EACH SEQUENCE.                      RECENT
                          *ASSUME ENDF/B-VI, NOT V, IF MISSING  RECENT
                           MF=1, MT-451.                        RECENT
VERS. 2000-1 (FEBRUARY 2000)*GENERAL IMPROVEMENTS BASED ON      RECENT
                           USER FEEDBACK                        RECENT
VERS. 2002-1 (MAY 2002)     *OPTIONAL INPUT PARAMETERS          RECENT
             (SEPT. 2002)   *OUTPUT RESONANCE WITH 9 DIGITS     RECENT
                          *TO BE C AND C++ COMPATIBLE OUTPUT    RECENT
VERS. 2004-1 (JAN. 2004)    *ADDED INCLUDE 'recent.h'           RECENT
                          *MADE ENDF/B-VII READY                RECENT
                          *UPDATED FOR NEW REICH-MOORE LRF=7    RECENT
                           PARAMETERS WITH COMPETITION          RECENT
                          *ADDED COULOMB PENETRATION FACTORS FORRECENT
                           LRF=7 COMPETITIVE CHANNELS.          RECENT
                          *EXTENDED DEFINITIONS OF PENETRATION  RECENT
                           FACTOR, LEVEL SHIFT FACTOR, AND      RECENT
                           POTENTIAL SCATTERING PHASE SHIFT     RECENT
                           ABOVE L = 5 TO INFINITY.             RECENT
                          *ADDED QUICK CALCULATION - IF THE     RECENT
                           INPUT ALLOWABLE ERROR IS 1.0 OR MORE RECENT
                           (100 % OR MORE) THERE IS NO ITERATIONRECENT
                           TO CONVERGENCE - CROSS SECTION ARE   RECENT
                           QUICKLY CALCULATED ONLY AT A FIXED   RECENT
                           SET OF ENERGY POINTS, BASED ON THE   RECENT
                           ENERGY AND WIDTH OF ALL RESONANCES.  RECENT
                           THIS CAN BE USED TO QUICKLY "SEE"    RECENT
                           NEW EVALUATIONS THAT MAY CONTAIN     RECENT
                           ERRORS, THAT WOULD OTHERWISE CAUSE   RECENT
                           THIS CODE TO RUN FOR AN EXCESSIVELY  RECENT
                           LONG TIME.                           RECENT
VERS. 2005-1 (JUNE 2005)    *ADDED ENERGY DEPENDENT SCATTERING  RECENT
                            RADIUS FOR ALL RESONANCE TYPES      RECENT
                            (EARLIER ONLY BREIT-WIGNER ALLOWED). RECENT
VERS. 2007-1 (JAN. 2007)    *CHECKED AGAINST ALL ENDF/B-VII.    RECENT
                          *DECOUPLED PAGE SIZE FROM MAX. # OF   RECENT
                           RESONANCES.                          RECENT
                          *INCREASED PAGE SIZE FROM 120,000 TO  RECENT
                           750,000 DATA POINTS.                 RECENT
                          *KEPT MAX. # OF RESONANCE AT 120,000. RECENT
                          *CORRECTED ALL BACKGROUND = 0 CASE    RECENT
VERS. 2007-2 (OCT. 2007)    *NO MT=19 OUTPUT IF NO BACKGROUND,  RECENT
                            REGARDLESS OF INPUT OPTION.         RECENT
                          *72 CHARACTER FILE NAMES.             RECENT
VERS. 2008-1 (FEB. 2008)    *CORRECTED NAPS ERROR - NOW DEFINE FORRECENT
                            ALL TYPES OF PARAMETERS - EARLIER   RECENT
                            ONLY DEFINED FOR B-W PARAMETERS.    RECENT
```

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VERS. 2008-2 (APRIL 2008)   *CORRECTED NRO/NAPS=1/1 - MUST        RECENT
                             DEFINE RHOX2 AT EACH RESONANCE USING RECENT
                             SETRHO1 BEFORE ENERGY DEPENDENT      RECENT
                             CALCULATION.                         RECENT
                            *ADDED PRECISION TO RESONANCE PROFILE RECENT
                             IN SUBROUTINE SUBINT                 RECENT
VERS. 2009-1 (JULY 2009)    *NEW REICH-MOORE COMPETITIVE WIDTHS - RECENT
                             IF CHARGED PARTICLE REACTION (MT=103 RECENT
                             THROUGH 107) WILL ADD RESONANCE      RECENT
                             CONTRIBUTION TO COMPETITIVE MT AND IFRECENT
                             PRESENT, THE GROUND LEVEL, MT = 600  RECENT
                             THROUGH 800. IF COMPETITIVE CHANNEL  RECENT
                             IS mt=4 (TOTAL N.N') IT WILL ALSO ADDRECENT
                             COMPETITIVE RESONANCE CONTRIBUTION TORECENT
                             MT=50 (N,N' GROUND).                 RECENT
                            *NEW REICH-MOORE - SUM COMPETITIVE    RECENT
                             WIDTHS IF ALL FOR THE SAME STATE (MT)RECENT
VERS. 2009-2 (AUG. 2009)    *RE-WRITE TO USE 12, RATHER THAN 6,   RECENT
                             PAAMETERS PER RESONANCE.             RECENT
                            *MAJOR RE-WRITE TO ACCOMODATE GENERAL RECENT
                             REICH-MOORE (LRF=7).                 RECENT
                            *COMPLETE RE-WRITE FOR ADLER-ADLER    RECENT
                             AND HRF (N O LONGER USED IN ENDF/B)  RECENT
                             TO USE 12 PARAMETERS PER RESNANCE.   RECENT
VERS. 2010-1 (April 2010)   *ADDED SAMRML LOGIC TO HANDLE ALL     RECENT
                             LRF=7 CASES.                         RECENT
                            *EXTENDED SAMRML LOGIC TO PROCESS ALL RECENT
                             EVALUATIONS = RESOLVED + UNRESOLVED +RECENT
                             TABULATED - SAMRML ONLY DOES ONE     RECENT
                             SECTION OF RESOLVED LRF=7 DATA       RECENT
                             WITHOUT TABULATED BACKGROUND.        RECENT
                            *UPDATED ELASTIC POTENTIAL CALCULATIONRECENT
                             FOR TOTAL (SLBW) AND CORRECTION FOR  RECENT
                             MISSING SEQUENCES (MLBW, RM, HRF).   RECENT
                            *ADDED HIDDEN (OPTIONAL) UNRESOLVED   RECENT
                             COMPETITION LISTING (NOT ENDF/B).    RECENT
                            *ADDED BOB MACFARLANE'S PROPOSAL - USERECENT
                             LRX TO DEFINE COMPETITIVE L VALUE -  RECENT
                             COMPETITIVE L = LRX - 1, IF LRX > 0. RECENT
                            *CHECKED FOR NEGATIVE WIDTHS.         RECENT
VERS. 2012-1 (Nov.  2012)   *ADDED ENERGY DEPENDENT STEP SIZE     RECENT
                             FOR STARTING GRID AROUND RESONANCES. RECENT
                            *Added CODENAME                       RECENT
                            *32 and 64 bit Compatible             RECENT
                            *Added ERROR stops                    RECENT
                            *Check for no capture for Reich-Moore.RECENT
VERS. 2012-2 (Nov.  2012)   *Eliminated ERROR in NHIGH(0) index.  RECENT
VERS. 2013-1 (Nov.  2013)   *Extended OUT9.                        RECENT
VERS. 2015-1 (Jan.  2015)   *Multiple LRF=7, General Reich-Moore  RECENT
                             Resonance Regions.                   RECENT
                            *Added OUT10.                         RECENT
                            *Replaced ALL 3 way IF Statements.    RECENT
                            *Replaced ALL LOGICAL by INTEGER.     RECENT
VERS. 2016-1 (Jan.  2016)   *Do not Change LSSF during the        RECENT
                             reconstrcution - for compatibility   RECENT
                             with later URR treatment.            RECENT
                            *Insured that all ERROR stops print   RECENT
                             a message explaining why the code    RECENT
                             stopped.                             RECENT
                            *Partial Energy Range Processing      RECENT
                             no longer allowed - today's computersRECENT
                             are so fast that this option is now  RECENT
                             out-of-date and no longer allowed.   RECENT
                            *L-Value dependent fission = Earlier  RECENT
                             was done only by entire isotope.     RECENT
                            *Denser Starting Energy Grid.         RECENT
VERS. 2017-1 (May   2017)   *Corrected ERROR in LRF=3 treatment.  RECENT
                             This ERROR only existed in version   RECENT
                             2016-1, which was never released to  RECENT
                             the general public, so it will not   RECENT
                             effect any results calculated by codeRECENT
```

```
                          users.                                  RECENT
                         *All floating input parameters changedRECENT
                          to character input + IN9 conversion. RECENT
                         *Added points to starting energy grid RECENT
                          to approximate the shape of each     RECENT
                          resonance = based on comparisons of  RECENT
                          0.01% to 0.1% results.               RECENT
                         *Increased max. points to 1,200,000.  RECENT
                         *LRF=7 Shift option no longer allowed RECENT
                          Set = 0, print WARNING and continue. RECENT
                         *Corrected COMMON/NAPRHO/NRO,NAPS     RECENT
                          /NAPRHO/ mispelled - Freud found.    RECENT
VERS. 2017-2 (Sept. 2017) *Corrected Write statemnt at 5731.    RECENT
VERS. 2018-1 (Nov.  2018) *Added output for ALL ENDERROR        RECENT
VERS. 2019-1 (June  2019) *Terminate if MF/MT=1/451 Temperature RECENT
                          is NOT = 0 = Incompaible with the    RECENT
                          0 Kelvin data output to MF=3 by this RECENT
                          code.                                RECENT
                         *Terminate if MF=3 Point Count and    RECENT
                          Interpolation Law do not agree.      RECENT
                         *Terminate if MF=3 Background         RECENT
                          Interpolation is NOT Linear.         RECENT
                         *Ignor background if zero at all      RECENT
                          energies - previously merged.        RECENT
                         *Output competitive data even if no   RECENT
                          MF=3 background = previously skipped.RECENT
                         *Additional Interpolation Law Tests.  RECENT
                         *Check Maximum Tabulated Energy to    RECENT
                          insure it is the same for all MTs -  RECENT
                          if not,print WARNING messages.       RECENT
                         *Reduced Max. # of Resonance to       RECENT
                          100,000 from 300,000, e.g., for      RECENT
                          ENDF/B-VIII U235 and U238 have about RECENT
                          3,000 resonances each.               RECENT
VERS. 2020-1 (Dec.  2020) *Major re-write.                      RECENT
                         *Much more detailed starting grid     RECENT
                         *Updated minimum/maximum convergence  RECENT
                          procedures.                          RECENT
                         *Added Target Isomer State            RECENT
                         *WARNING - print if resolved resonanceRECENT
                          enegies do not extend to top of      RECENT
                          resolved energy range.               RECENT
                         *Stricter convergence for all except  RECENT
                          total and elastic,e.g., narrower     RECENT
                          capture resonances                   RECENT
                         *Increased minimum cross sections to  RECENT
                          handle RML Charged Particles         RECENT
VERS. 2021-1 (Mar.  2021) *Valentin Sinitsa (GRUCON) supplied   RECENT
                          Solution for LRF=7, SHIFT=1 problems.RECENT
                          Search for Valentin to find changes. RECENT
                         *Updated for FORTRAN 2018             RECENT
                         *Changed FUNCTION   Xdot to           RECENT
                                  SUBROUTINE XdotQ with        RECENT
                          arguments returned through COMMON.   RECENT
                         *Mimimum Cross Section is no longer   RECENT
                          an input option - set to 1.0d-30.    RECENT
                         *Insure ALL nodes are INCORE10 to     RECENT
                          prevent repeated energies in ENDF    RECENT
                          format output.                       RECENT
                         *Corrected dummy arguments ,1) to ,*) RECENT
                          Thank Arjan                          RECENT
VERS. 2023-1 (Feb.  2023) *Decreased page size from 1,200,000   RECENT
                          to 120,000.                          RECENT
                                                               RECENT
OWNED, MAINTAINED AND DISTRIBUTED BY                           RECENT
-----------------------------------                            RECENT
THE NUCLEAR DATA SECTION                                       RECENT
INTERNATIONAL ATOMIC ENERGY AGENCY                             RECENT
P.O. BOX 100                                                   RECENT
A-1400, VIENNA, AUSTRIA                                        RECENT
EUROPE                                                         RECENT
```

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                                                                      RECENT
ORIGINALLY WRITTEN BY                                                 RECENT
-------------------------------------                                 RECENT
Dermott E. Cullen                                                     RECENT
                                                                      RECENT
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---------------------------                                           RECENT
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                                                                      RECENT
Acknowledgement (Version 2021-1)                                      RECENT
======================================================================RECENT
The author thanks Valentin Sinitsa (Kurchatov Institute) for          RECENT
providing the FORTRAN coding to handle the Reich-Moore Limited        RECENT
(RML) LRF=7, SHIFT=1, case. Valentin, I could not have completed      RECENT
the RECENT 2021-1 release without your invaluable contribution -      RECENT
I and all RECENT code users are indebted to you = SPASIBO.            RECENT
                                                                      RECENT
Acknowledgement (Version 2004-1)                                      RECENT
======================================================================RECENT
The author thanks Nancy Larson, ORNL, for providing her SAMRML        RECENT
code for comparison to RECENT output for Reich-Moore evaluations,     RECENT
in particular to verify results for the new LFR=7 evaluations. I      RECENT
also thank her for providing guidance to help me understand and       RECENT
implement this new teatment for Reich-Moore parameters.               RECENT
                                                                      RECENT
ACKNOWLEDGEMENT (VERSION 92-1)                                        RECENT
======================================================================RECENT
THE AUTHOR THANKS SOL PEARLSTEIN (BROOKHAVEN NATIONAL LAB) FOR        RECENT
SIGNIFICANTLY CONTRIBUTING TOWARD IMPROVING THE ACCURACY AND          RECENT
COMPUTER INDEPENDENCE OF THIS CODE - THANKS, SOL                      RECENT
======================================================================RECENT
                                                                      RECENT
AUTHORS MESSAGE                                                       RECENT
======================================================================RECENT
THE REPORT DESCRIBED ABOVE IS THE LATEST PUBLISHED DOCUMENTATION      RECENT
FOR THIS PROGRAM. HOWEVER, THE COMMENTS BELOW SHOULD BE CONSIDEREDRECENT
THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASERECENT
READ ALL OF THESE COMMENTS BEFORE IMPLEMENTATION, PARTICULARLY        RECENT
THE COMMENTS CONCERNING MACHINE DEPENDENT CODING.                     RECENT
                                                                      RECENT
AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTERRECENT
INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE        RECENT
OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECTRECENT
IT WOULD BE APPECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY          RECENT
COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO RECENT
IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF       RECENT
THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR            RECENT
COMPUTER.                                                             RECENT
                                                                      RECENT
PURPOSE                                                               RECENT
======================================================================RECENT
THIS PROGRAM IS DESIGNED TO RECONSTRUCT THE RESONANCE CONTRIBUTIONRECENT
TO THE CROSS SECTION IN LINEARLY INTERPOLABLE FORM, ADD IN ANY        RECENT
LINEARLY INTERPOLABLE BACKGROUND CROSS SECTION AND OUTPUT THE         RECENT
RESULT IN THE ENDF/B FORMAT. THE CROSS SECTIONS OUTPUT BY THIS        RECENT
PROGRAM WILL BE LINEARLY INTERPOLABLE OVER THE ENTIRE ENERGY RANGERECENT
                                                                      RECENT
THE RESONANCE CONTRIBUTION IS CALCULATED FOR TOTAL (MT=1),            RECENT
ELASTIC (MT=2), CAPTURE (MT=102) AND FISSION (MT=18), ADDED           RECENT
TO THE BACKGROUND (IF ANY) AND OUTPUT. IN ADDITION, IF THERE          RECENT
IS A FIRST CHANCE FISSION (MT=19) BACKGROUND PRESENT THE RESONANCERECENT
CONTRIBUTION OF FISSION WILL BE ADDED TO THE BACKGROUND AND           RECENT
OUTPUT. IF THERE IS NO FIRST CHANCE FISSION (MT=19) BACKGROUND        RECENT
PRESENT THE PROGRAM WILL NOT OUTPUT MT=19.                            RECENT
                                                                      RECENT
```

IN THE FOLLOWING FOR SIMPLICITY THE ENDF/B TERMINOLOGY--ENDF/B TAPE--WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE TAPE, CARDS, DISK OR ANY OTHER MEDIUM.

PROCESSING DATA IN THE ENDF/B-6 FORMAT

IT HAS NOW BEEN CONFIRMED (PRIVATE COMMUNICATION, CHARLES DUNFORD, APRIL, 1991) THAT THE PROPER PROCEDURE TO FOLLOW WHEN THERE ARE MISSING OR DUPLICATE J VALUES IS TO IN ALL CASES ADD A SEQUENCE WITH NO RESONANCES TO ACCOUNT FOR THE CONTRIBUTION OF THE SEQUENCE TO THE POTENTIAL SCATTERING CROSS SECTION.

THIS IS THE PROCEDURE WHICH WAS FOLLOWED BY ALL VERSIONS OF RECENT SINCE 86-3 AND WILL CONTINUE TO BE THE PROCEDURE.

INPUT ENDF/B FORMAT AND CONVENTIONS

ENDF/B FORMAT

THIS PROGRAM ONLY USES THE ENDF/B BCD OR LINE IMAGE FORMAT (AS OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION OF THE ENDF/B FORMAT (I.E., ENDF/B-1, 2, 3, 4, 5, 6 FORMAT).

IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS ASSUMED THAT THE MAT, MF AND MT ON EACH LINE IS CORRECT. SEQUENCE NUMBERS (COLUMNS 76-80) ARE IGNORED ON INPUT, BUT WILL BE CORRECTLY OUTPUT ON ALL CARDS. THE FORMAT OF SECTION MF=1, MT=451 AND ALL SECTIONS OF MF=2 AND 3 MUST BE CORRECT. THE PROGRAM COPIES ALL OTHER SECTION OF DATA AS HOLLERITH AND AS SUCH IS INSENSITIVE TO THE CORRECTNESS OR INCORRECTNESS OF ALL OTHER SECTIONS.

ENDF/B FORMAT VERSION

THE FORMATS AND CONVENTIONS FOR READING AND INTERPRETING THE DATA VARIES FROM ONE VERSION OF ENDF/B TO THE NEXT. HOWEVER, IF THE HOLLERITH SECTION (MF=1, MT=451) IS PRESENT IT IS POSSIBLE FOR THIS PROGRAM TO DISTINGUISH BETWEEN DATA IN THE ENDF/B-4, 5 AND 6 FORMATS AND TO USE THE APPROPRIATE CONVENTIONS FOR EACH ENDF/B VERSION (SEE, SUBROUTINE FILE1 FOR A DESCRIPTION OF HOW THIS IS DONE). IF THE HOLLERITH SECTION IS NOT PRESENT THE PROGRAM WILL ASSUME THE DATA IS IN THE ENDF/B-6 FORMAT AND USE ALL CONVENTIONS APPROPRIATE TO ENDF/B-V. USERS ARE ENCOURAGED TO INSURE THAT THE HOLLERITH SECTION (MF=1, MT=451) IS PRESENT IN ALL EVALUATIONS.

INPUT OF ENERGIES

ALL ENERGIES ARE READ IN DOUBLE PRECISION (BY SPECIAL FORTRAN I/O ROUTINES) AND ARE TREATED IN DOUBLE PRECISION IN ALL CALCULATIONS.

OUTPUT ENDF/B FORMAT AND CONVENTIONS

CONTENTS OF OUTPUT

ENTIRE EVALUATIONS ARE OUTPUT, NOT JUST THE RECONSTRUCTED FILE 3 CROSS SECTIONS, E.G. ANGULAR AND ENERGY DISTRIBUTIONS ARE ALSO INCLUDED.

DOCUMENTATION

THE FACT THAT THIS PROGRAM HAS OPERATED ON THE DATA IS DOCUMENTED BY THE ADDITION OF COMMENT CARDS AT THE END OF EACH HOLLERITH SECTION IN THE FORM

********** RECENT (VERSION 2023-1) **********
RESONANCE CONTRIBUTION RECONSTRUCTED TO WITHIN 0.100 PER-CENT
COMBINED DATA NOT THINNED (ALL RESONANCE + BACKGROUND DATA KEPT)

THE ORDER OF ALL SIMILAR COMMENTS (FROM LINEAR, SIGMA1 AND GROUPY) REPRESENTS A COMPLETE HISTORY OF ALL OPERATIONS PERFORMED ON

THE DATA, INCLUDING WHICH VERSION OF EACH PROGRAM WAS USED. RECENT
RECENT
THESE COMMENT CARDS ARE ONLY ADDED TO EXISTING HOLLERITH SECTIONS,RECENT
I.E., THIS PROGRAM WILL NOT CREATE A HOLLERITH SECTION. THE FORMATRECENT
OF THE HOLLERITH SECTION IN ENDF/B-5 DIFFERS FROM THE THAT OF RECENT
EARLIER VERSIONS OF ENDF/B. BY READING AN EXISTING MF=1, MT=451 RECENT
IT IS POSSIBLE FOR THIS PROGRAM TO DETERMINE WHICH VERSION OF RECENT
THE ENDF/B FORMAT THE DATA IS IN. WITHOUT HAVING A SECTION OF RECENT
MF=1, MT=451 PRESENT IT IS IMPOSSIBLE FOR THIS PROGRAM TO RECENT
DETERMINE WHICH VERSION OF THE ENDF/B FORMAT THE DATA IS IN, AND RECENT
AS SUCH IT IS IMPOSSIBLE FOR THE PROGRAM TO DETERMINE WHAT FORMAT RECENT
SHOULD BE USED TO CREATE A HOLLERITH SECTION. RECENT
RECENT
REACTION INDEX RECENT
-------------- RECENT
THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN RECENT
SECTION MF=1, MT=451 OF EACH EVALUATION. RECENT
RECENT
THIS PROGRAM DOES NOT UPDATE THE REACTION INDEX IN MF=1, MT=451. RECENT
THIS CONVENTION HAS BEEN ADOPTED BECAUSE MOST USERS DO NOT RECENT
REQUIRE A CORRECT REACTION INDEX FOR THEIR APPLICATIONS AND IT WASRECENT
NOT CONSIDERED WORTHWHILE TO INCLUDE THE OVERHEAD OF CONSTRUCTING RECENT
A CORRECT REACTION INDEX IN THIS PROGRAM. HOWEVER, IF YOU REQUIRE RECENT
A REACTION INDEX FOR YOUR APPLICATIONS, AFTER RUNNING THIS PROGRAMRECENT
YOU MAY USE PROGRAM DICTIN TO CREATE A CORRECT REACTION INDEX. RECENT
RECENT
OUTPUT FORMAT OF ENERGIES RECENT
------------------------- RECENT
IN THIS VERSION OF RECENT ALL FILE 3 ENERGIES WILL BE OUTPUT IN RECENT
F (INSTEAD OF E) FORMAT IN ORDER TO ALLOW ENERGIES TO BE WRITTEN RECENT
WITH UP TO 9 DIGITS OF ACCURACY. IN PREVIOUS VERSIONS THIS WAS AN RECENT
OUTPUT OPTION. HOWEVER USE OF THIS OPTION TO COMPARE THE RESULTS RECENT
OF ENERGIES WRITTEN IN THE NORMAL ENDF/B CONVENTION OF 6 DIGITS RECENT
TO THE 9 DIGIT OUTPUT FROM THIS PROGRAM DEMONSTRATED THAT FAILURE RECENT
TO USE THE 9 DIGIT OUTPUT CAN LEAD TO LARGE ERRORS IN THE DATA RECENT
JUST DUE TO TRANSLATION OF ENERGIES FROM THEIR INTERNAL (BINARY) RECENT
REPRESENTATION TO THE ENDF/B FORMAT. RECENT
RECENT
ACCURACY OF ENERGY RECENT
------------------ RECENT
IN ORDER TO ALLOW ENERGIES TO BE ACCURATELY OUTPUT TO 9 DIGITS RECENT
ON SHORT WORD LENGTH COMPUTERS (E.G. IBM) ALL ENERGIES AND RECENT
ENERGY DEPENDENT TERMS ARE READ AND TREATED IN DOUBLE PRECISION. RECENT
RECENT
OUTPUT OF RESONANCE PARAMETERS RECENT
------------------------------ RECENT
A SPECIAL CONVENTION HAS BEEN INTRODUCED REGARDING RESONANCE RECENT
PARAMETERS. IN ORDER TO ALLOW THE USER TO DOPPLER BROADEN AND/OR RECENT
SELF-SHIELD CROSS SECTIONS THE RESONANCE PARAMETERS ARE ALSO RECENT
INCLUDED IN THE OUTPUT WITH THE EVALUATION. IN ORDER TO AVOID THE RECENT
POSSIBILITY OF ADDING THE RESONANCE CONTRIBUTION A SECOND TIME RECENT
TWO CONVENTIONS HAVE BEEN ADOPTED TO INDICATE THAT THE RESONANCE RECENT
CONTRIBUTION HAS ALREADY BEEN ADDED TO THE FILE 3 CROSS SECTIONS, RECENT
RECENT
(1) WHEN THE DATA IS PROCESSED BY THIS PROGRAM LRP (IN MF=1, RECENT
MT=451) IS SET EQUAL TO 2. THIS IS A CONVENTION WHICH HAS BEEN RECENT
ADOPTED AS A STANDARD CONVENTION IN ENDF/B-VI, BUT IS ONLY TO BE RECENT
USED FOR PROCESSED DATA, AS OPPOSED TO THE ORIGINAL EVALUATIONS. RECENT
IN EVALUATIONS WHICH CONTAIN MF=1, MT=451 LRP CAN BE USED TO RECENT
DETERMINE IF THE MATERIAL HAS BEEN PROCESSED. RECENT
RECENT
(2) THE LRU FLAG IN EACH SECTION OF FILE 2 DATA IS CHANGED TO RECENT
LRU=LRU+3. FOR EXAMPLE WHEN READING AN ENDF/B EVALUATION LRU=0 RECENT
(NO RESONANCES), =1 (RESOLVED) OR =2 (UNRESOLVED) INDICATES THAT RECENT
THE DATA IS IN THE ORIGINAL ENDF/B FORM. LRU=3 (NO RESONANCES), RECENT
=4 (RESOLVED) OR =5 (UNRESOLVED) INDICATES THAT THE RESONANCE RECENT
CONTRIBUTION HAS ALREADY BEEN ADDED TO THE FILE 3 DATA. THIS RECENT
SECOND CONVENTION HAS BEEN ADOPTED AS INSURANCE THAT THE RESONANCERECENT
CONTRIBUTION WILL NOT BE ADDED TWICE, EVEN FOR EVALUATIONS WHICH RECENT
DO NOT CONTAIN MF=1, MT=451 (EVALUATIONS WHICH CONTAIN MF=1, RECENT
MT=451 ARE COVERED BY CONVENTION (1), DESCRIBED ABOVE). RECENT

```
                                                                      RECENT
UNIFORM TREATMENT OF RESONANCE FORMALISMS                             RECENT
======================================================================RECENT
NORMALIZATION                                                         RECENT
=============                                                         RECENT
ALL OF THE RESONANCE FORMALISMS INCLUDE A FACTOR OF,                  RECENT
                                                                      RECENT
PI*(FRACTIONAL ABUNDANCE)/(K**2)                                      RECENT
                                                                      RECENT
THIS FACTOR HAS BEEN REMOVED FROM THE CALCULATION OF EACH TYPE        RECENT
OF RESONANCE FORMALISM AND IS APPLIED AS A FINAL NORMALIZATION        RECENT
AFTER THE CALCULATION, ONLY ONE PLACE IN THIS PROGRAM.                RECENT
                                                                      RECENT
FOR SIMPLICITY THIS TERM IS NOT INCLUDED IN THE FOLLOWING             RECENT
DERIVATIONS - IN ALL CASES THE ACTUAL CROSS SECTION IS A PRODUCT      RECENT
OF THE ABOVE FACTOR TIMES THE RESULTS PRESENTED BELOW.                RECENT
                                                                      RECENT
SIMILARITIES                                                          RECENT
============                                                          RECENT
FOR THE RESOLVED RESONANCE REGION, EXCEPT FOR SINGLE LEVEL BREIT      RECENT
WIGNER, PARAMETERS ALL OF THE FORMALISMS DEFINE THE CROSS SECTIONSRECENT
IN AN EQUIVALENT FORM,                                                RECENT
                                                                      RECENT
TOTAL    = 2*GJ*REAL(1 - U)                                           RECENT
         = 2*GJ*(1 - REAL(U))                                         RECENT
ELASTIC  =   GJ*(1 - U)**2                                            RECENT
         =   GJ*((1 - 2*REAL(U)) + (REAL(U)**2 + IM(U)**2))           RECENT
         = 2*GJ*(1 - REAL(U)) - GJ*(1 - (REAL(U)**2 + IM(U)**2))      RECENT
                                                                      RECENT
SINCE THE FIRST TERM IS THE TOTAL, THE SECOND TERM MUST BE            RECENT
ABSORPTION. SO WE FIND,                                               RECENT
                                                                      RECENT
ABSORPTION = GJ*(1 - (REAL(U)**2 + IM(U)**2))                         RECENT
                                                                      RECENT
IN ALL CASES U IS DEFINED IN THE FORM,                                RECENT
                                                                      RECENT
U        = EXP(-I*2*PS)*((1-X) - I*Y)                                 RECENT
                                                                      RECENT
WHERE (X) AND (Y) ARE RELATED TO THE SYMMETRIC AND ANTI-SYMMETRIC     RECENT
CONTRIBUTIONS OF THE RESONANCES, RESPECTIVELY. ONLY THE DEFINITIONRECENT
OF (X) AND (Y) WILL BE DIFFERENT FOR EACH RESONANCE FORMALISM.        RECENT
BELOW WE WILL SHOW THAT WHAT MIGHT APPEAR TO BE A STRANGE CHOICE      RECENT
OF DEFINITION OF THE SIGN OF (X) AND(Y) HAS BEEN SELECTED SO THAT     RECENT
FOR BREIT-WIGNER PARAMETERS (X) AND (Y) CORRESPOND EXACTLY TO THE     RECENT
SYMMETRIC AND ANTI-SYMMETRIC CONTRIBUTION OF THE RESONANCES.          RECENT
                                                                      RECENT
U        = (COS(2*PS) - I*SIN(2*PS))*((1-X) - I*Y)                    RECENT
         =   ((1-X)*COS(2*PS) - Y*SIN(2*PS))                          RECENT
         =-I*((1-X)*SIN(2*PS) + Y*COS(2*PS))                          RECENT
                                                                      RECENT
REAL(U)  = ((1-X)*COS(2*PS) - Y*SIN(2*PS))                            RECENT
IM(U)    =-((1-X)*SIN(2*PS) + Y*COS(2*PS))                            RECENT
                                                                      RECENT
R(U)**2  =((1-X)*COS(2*PS))**2 + (Y*SIN(2*PS))**2                     RECENT
          -2*(1-X)*Y*COS(2*PS)*SIN(2*PS)                              RECENT
I(U)**2  =((1-X)*SIN(2*PS))**2 + (Y*COS(2*PS))**2                     RECENT
          +2*(1-X)*Y*COS(2*PS)*SIN(2*PS)                              RECENT
                                                                      RECENT
THE TERMS 2*(1-X)*Y*COS(2*PS)*SIN(2*PS) CANCEL AND UPON USING         RECENT
THE IDENTITY COS(2*PS)**2 + SIN(2*PS)**2 = 1,                         RECENT
                                                                      RECENT
SUM      = (1-X)**2 + (Y)**2                                          RECENT
                                                                      RECENT
WE NOW HAVE ALL THE QUANTITIES THAT WE NEED TO DEFINE THE CROSS       RECENT
SECTIONS,                                                             RECENT
                                                                      RECENT
ELASTIC                                                               RECENT
=======                                                               RECENT
ELASTIC  =GJ*(1 - 2*REAL(U) + (REAL(U)**2 + IM(U)**2))                RECENT
         =GJ*(1 - 2*((1-X)*COS(2*PS)-Y*SIN(2*PS))+(1-X)**2+(Y)**2)RECENT
                                                                      RECENT
```

```
THIS CAN BE WRITTEN AS A SUM OF 2 SQUARES,                              RECENT
                                                                        RECENT
ELASTIC  =GJ*(COS(2*PS) - (1-X))**2 + (SIN(2*PS) + Y)**2)               RECENT
                                                                        RECENT
         =GJ*((COS(2*PS))**2 - 2*(1-X)*COS(2*PS) + (1-X)**2) +          RECENT
              (SIN(2*PS))**2 + 2*Y*SIN(2*PS)    + (Y)**2)               RECENT
                                                                        RECENT
AGAIN USING THE IDENTITY COS(2*PS)**2 + SIN(2*PS)**2 = 1, WE CAN        RECENT
SEE THAT THE DEFINITION AS THE SUM OF 2 SQUARES IS IDENTICAL TO         RECENT
THE PRECEDING DEFINITION OF THE ELASTIC.                                RECENT
                                                                        RECENT
ELASTIC  =GJ*(COS(2*PS) - (1-X))**2 + (SIN(2*PS) + Y)**2)               RECENT
         =GJ*((COS(2*PS)-1) + X)**2 + (SIN(2*PS) + Y)**2)               RECENT
                                                                        RECENT
USING THE IDENTITY (1 - COS(2*PS))) = 2*SIN(PS)**2, WE OBTAIN           RECENT
THE FINAL FORM FOR THE ELASTIC,                                         RECENT
                                                                        RECENT
ELASTIC =GJ*(2*SIN(PS)**2 - X)**2 + (SIN(2*PS) + Y)**2)                 RECENT
                                                                        RECENT
ABSORPTION                                                              RECENT
==========                                                              RECENT
ABSORPTION = GJ*(1 - (REAL(U)**2 + IM(U)**2))                           RECENT
           = GJ*(1 - ((1-X)**2   + (Y)**2)                              RECENT
           = GJ*(1 - (1 - 2*X + (X)**2 + (Y)**2)                        RECENT
           = GJ*(2*X - (X)**2 + (Y)**2)                                 RECENT
                                                                        RECENT
SINCE PHYSICALLY THE ABSORPTION CANNOT BE NEGATIVE WE CAN SEE           RECENT
THAT (X) MUST BE POSITIVE AND 2*X MUST BE GREATER THAN                  RECENT
(X)**2 + (Y)**2, FOR ALL OF THE FORMALISMS.                             RECENT
                                                                        RECENT
TOTAL                                                                   RECENT
=====                                                                   RECENT
IN THIS PROGRAM THE TOTAL CROSS SECTION IS ALWAYS DEFINED TO BE         RECENT
THE SUM OF ITS PARTS - SO THE ABOVE DEFINITION IS NEVER EXPLICITLYRECENT
USED. HOWEVER, WE CAN LEARN SOMETHING BY EXAMINING THE DEFINITION,RECENT
                                                                        RECENT
TOTAL    = 2*GJ*REAL(1 - U)                                             RECENT
         = 2*GJ*(1 - (((1-X)*COS(2*PS) - Y*SIN(2*PS)))                  RECENT
         = 2*GJ*((1 - COS(2*PS))*(1-X) - (1-X) + Y*SIN(2*PS))           RECENT
         = 2*GJ*(2*SIN(PS)**2*(1-X)    - (1-X) + Y*SIN(2*PS))           RECENT
                                                                        RECENT
         = 4*GJ*SIN(PS)**2 +                                            RECENT
           2*GJ*((X-1) - 2*X*SIN(PS)**2 +  Y*SIN(2*PS))                 RECENT
                                                                        RECENT
THE IMPORTANT POINT TO NOTE IS THAT THE DEFINITION OF THE TOTAL         RECENT
DOES NOT EXPLICITLY CONTAIN ANY DEPENDENCE ON X**2 AND Y**2 -           RECENT
THE LEVEL-LEVEL INTERFERENCE TERMS.                                     RECENT
                                                                        RECENT
THIS IMPLIES THAT IF A GIVEN SET OF RESONANCE PARAMETERS ARE USED RECENT
WITH THIS DEFINITION THEY WILL PRODUCE EXACTLY THE SAME TOTAL           RECENT
CROSS SECTION - WHETHER WE CLAIM THE PARAMETERS HAVE BEEN               RECENT
PRODUCED USING A SINGLE OR MULTI-LEVEL FIT. THIS RESULT COULD           RECENT
BE VERY MISLEADING, IF THIS RESULT FOR THE TOTAL IS IMPLIED TO          RECENT
MEAN THAT ONE INTERPRETATION OR THE OTHER WILL NOT HAVE ANY             RECENT
EFFECT ON THE INDIVIDUAL CROSS SECTIONS.                                RECENT
                                                                        RECENT
STARTING FROM EXACTLY THE SAME RESONANCE PARAMETERS, RELATIVE TO        RECENT
THE RESULTS OBTAINED USING THE SINGLE LEVEL FORMULA, MULTI-LEVEL        RECENT
RESULTS WILL TEND TO ALWAYS DECREASE THE ABSORPTION AND INCREASE        RECENT
THE ELASTIC. THIS CAN BE IMMEDIATELY SEEN FROM OUR GENERAL              RECENT
MULTI-LEVEL DEFINITION OF ABSORPTION,                                   RECENT
                                                                        RECENT
ABSORPTION =GJ*(2*X - ((X)**2 + (Y)**2))                                RECENT
                                                                        RECENT
THE SINGLE LEVEL ABSORPTION IS,                                         RECENT
                                                                        RECENT
ABSORPTION =GJ*(2*X)                                                    RECENT
                                                                        RECENT
THE DIFFERENCE BETWEEN THE TWO IS -2*GJ*(X**2 + Y**2), SO THAT          RECENT
REGARDLESS OF HOW WE DEFINE (X) AND (Y) THE INCLUSION OF THIS           RECENT
TERM WILL ALWAYS DECREASE ABSORPTION. SINCE THE TOTAL CROSS             RECENT
```

SECTION IS THE SAME IN BOTH CASE, THIS MEANS THAT THE ELASTIC RECENT
HAS BEEN INCREASED BY THIS AMOUNT. RECENT
RECENT
AGAIN, THESE RESULTS ARE BASED ON STARTING FROM EXACTLY THE SAME RECENT
PARAMETERS - IN ANY ACTUAL CASE THE PARAMETERS BASED ON A SINGLE RECENT
OR MULTI-LEVEL FIT WILL BE QUITE DIFFERENT - THE POINT THAT WE RECENT
WANT TO STRESS HERE IS THAT YOU SHOULD NEVER USE PARAMETERS RECENT
WHICH HAVE BEEN DEFINED BY A FIT USING ONE FORMALISM - IN THE RECENT
EQUATIONS FOR A DIFFERENT FORMALISM - AND ASSUME THAT THE RESULTS RECENT
WILL BE CONSISTENT - AND NEVER USE THE TOTAL CROSS SECTION TO RECENT
SEE WHETHER OR NOT A SET OF SINGLE LEVEL PARAMETERS CAN BE USED RECENT
WITH A MULTI-LEVEL FORMALISM. RECENT
RECENT
POTENTIAL CROSS SECTION RECENT
====================== RECENT
FAR FROM RESONANCES (X) AND (Y) WILL BE SMALL AND THE ELASTIC RECENT
CROSS SECTION REDUCES TO, RECENT
RECENT
ELASTIC =GJ*(2*SIN(PS)**2)**2 + (SIN(2*PS))**2 RECENT
=GJ*4*(SIN(PS)**4 + SIN(2*PS)**2 RECENT
RECENT
USING THE IDENTITY SIN(2*PS) = 2*SIN(PS)*COS(PS) RECENT
RECENT
=4*GJ*(SIN(PS)**4 + (SIN(PS)*COS(PS))**2) RECENT
=4*GJ*SIN(PS)**2*(SIN(PS)**2 + COS(PS)**2) RECENT
=4*GJ*SIN(PS)**2 RECENT
RECENT
WHICH IS THE POTENTIAL CROSS SECTION. NOTE THAT THIS RESULT IS RECENT
INDEPENDENT OF THE FORMALISM USED, AS IT MUST PHYSICALLY BE, RECENT
AND AS SUCH ALTHOUGH AS YET WE HAVE NOT DEFINED IT, WE CAN RECENT
NOW SEE THAT IN ALL CASES (PS) MUST BE THE PHASE SHIFT AND FOR RECENT
CONSISTENCY IT MUST BE DEFINED USING EXACTLY THE SAME DEFINITION RECENT
IN ALL CASES. RECENT
RECENT
IN ADDITION SINCE PHYSICALLY FOR EACH L VALUE WE EXPECT TO OBTAIN RECENT
A POTENTIAL CROSS SECTION, RECENT
RECENT
4*(2*L+1)*SIN(PS)**2 RECENT
RECENT
OBVIOUSLY FOR CONSISTENCY WE MUST HAVE, RECENT
RECENT
(2*L+1) = (SUM OVER J) GJ RECENT
RECENT
ONLY IN THIS CASE WILL THE RESULTS BE CONSISTENT - THIS POINT WILLRECENT
BE DISCUSSED IN DETAIL BELOW. RECENT
RECENT
WHAT ARE THIS TERMS (X) AND (Y) RECENT
============================== RECENT
(X) AND (Y) CAN BE EASILY IDENTIFIED BY CONSIDERING THE SINGLE RECENT
AND MULTI-LEVEL BREIT WIGNER FORMALISMS. IN THESE CASES WE WILL RECENT
FIND THAT, RECENT
RECENT
X = GAM(N)*GAM(T)/2/DEN RECENT
Y = GAM(N)*(E-ER)/DEN RECENT
DEN = ((E-ER)**2 + (GAM(T)/2)**2) RECENT
RECENT
EXTREME CARE HAS TO BE USED TO PROPERLY DEFINE (Y) SUCH THAT IT RECENT
IS NEGATIVE FOR E LESS THAN ER AND POSITIVE FOR E GREATER THAN RECENT
ER. I WILL MERELY MENTION THAT THE EQUATIONS FOR ALL FORMALISMS RECENT
IN ENDF-102 DO NOT CONSISTENTLY USE (E - ER) - IN SOME CASES RECENT
THIS IS WRITTEN AS (ER - E), WHICH CAN LEAD TO AN INCORRECT RECENT
SIGN IN THE DEFINITION OF THE (Y) THAT WE REQUIRE. RECENT
RECENT
THE INTERFERENCE TERMS CAN BE WRITTEN IN TERMS OF, RECENT
1) LEVEL-SELF INTERFERENCE = THE CONTRIBUTION OF EACH LEVEL RECENT
INTERFERRING WITH ITSELF RECENT
2) LEVEL-LEVEL INTERFERENCE = THE CONTRIBUTION OF EACH LEVEL RECENT
INTERFERRRING WITH ALL OTHER LEVELS RECENT
RECENT
WE WILL REFER TO THESE TWO AS (L-S) AND (L-L), RECENT
RECENT

```
X**2     = (GAM(N)*(GAM(T)/2)**2/(DEN)**2      + (L-L)            RECENT
         = (GAM(N)**2*((GAM(T)/2)**2)/(DEN)**2 + (L-L)            RECENT
Y**2     = (GAM(N))**2*((E-ER))**2/(DEN)**2    + (L-L)            RECENT
                                                                  RECENT
X**2+Y**2= GAM(N)**2*DEN/(DEN)**2 = GAM(N)**2/DEN + (L-L)         RECENT
                                                                  RECENT
TO SEE THE EFFECT OF INCLUDING MULTI-LEVEL INTERFERENCE WE CAN    RECENT
CONSIDER OUR GENERAL EXPRESSION FOR ABSORPTION,                   RECENT
                                                                  RECENT
ABSORPTION =GJ*(2*X - ((X)**2 + (Y)**2))                          RECENT
                                                                  RECENT
AND NOTE THAT FOR BOTH SINGLE AND MULTI-LEVEL BREIT WIGNER THE    RECENT
ENDF-102 SAYS TO TREAT ABSORPTION IN A SINGLE LEVEL APPROXIMATION RECENT
I.E., IGNORE LEVEL-LEVEL INTERFERENCE. IF ALL INTERFERENCE IS     RECENT
IGNORED THIS IS EQUIVALENT TO COMPLETELY IGNORING X**2 + Y**2 AND RECENT
DEFINING,                                                         RECENT
                                                                  RECENT
ABSORPTION =GJ*2*X                                                RECENT
           =2*GJ*GAM(N)*GAM(T)/DEN                                RECENT
                                                                  RECENT
WHICH IS INCORRECT - SINCE THIS SEEMS TO INDICATE EVERYTHING IS   RECENT
ABSORBED. IN ORDER TO OBTAIN THE CORRECT EXPRESSION WE CANNOT     RECENT
COMPLETELY IGNORE INTERFERENCE - WE CAN IGNORE LEVEL-LEVEL        RECENT
INTERFERENCE, BUT WE MUST INCLUDE LEVEL-SELF INTERFERENCE,        RECENT
                                                                  RECENT
X**2+Y**2= GAM(N)**2/DEN                                          RECENT
                                                                  RECENT
ABSORPTION =GJ*(2*X - ((X)**2 + (Y)**2))                          RECENT
           =GJ*GAM(N)*(GAM(T)-GAM(N))/DEN                         RECENT
           =GJ*GAM(N)*GAM(A)/DEN                                  RECENT
                                                                  RECENT
SUMMARY                                                           RECENT
=======                                                           RECENT
AN IMPORTANT POINT TO NOTE IS THE DEFINITION OF (X) AND (Y)       RECENT
WHICH IN ALL CASES WILL CORRESPOND TO THE SYMMETRIC AND           RECENT
ANTI-SYMMETRIC CONTRIBUTION OF THE RESONANCES. IN PARTICULAR      RECENT
DEFINING (U) IN TERMS OF (1-X) INSTEAD OF (X) IS EXTREMELY        RECENT
IMPORTANT. NOTE, THAT THE DEFINITION OF THE ELASTIC AND           RECENT
ABSORPTION ONLY INVOLVE (X), NOT (1-X). FAR FROM RESONANCES       RECENT
(X) CAN BE EXTREMELY SMALL, THEREFORE (1-X) WILL BE VERY CLOSE    RECENT
TO (1). IF THE CALCULATION PROCEEDS BY FIRST CALCULATING (1-X)    RECENT
AND THEN DEFINING (X) BY SUBTRACTING (1), EXTREME ROUND-OFF       RECENT
PROBLEMS CAN RESULT. THESE PROBLEMS CAN BE AVOIDED BY IN ALL      RECENT
CASES DEFINING (X) DIRECTLY, WITHOUT ANY DIFFERENCES.             RECENT
                                                                  RECENT
IN EACH FORMALISM THE DEFINITION OF (X) AND (Y) MAY BE DIFFERENT  RECENT
BUT ONCE WE HAVE DEFINED (X) AND (Y) WE CAN IMMEDIATELY WRITE     RECENT
THE CROSS SECTIONS USING A UNIFORM DEFINITION,                    RECENT
                                                                  RECENT
ELASTIC =GJ*(2*SIN(PS)**2 - X)**2 + (SIN(2*PS) + Y)**2)           RECENT
                                                                  RECENT
ABSORPTION =-GJ*(2*X + (X)**2 + (Y)**2)                           RECENT
                                                                  RECENT
AND DEFINE THE TOTAL AS THE SUM OF THESE 2 PARTS.                 RECENT
                                                                  RECENT
RELATIONSHIP TO SINGLE LEVEL                                      RECENT
============================                                      RECENT
HOW DO THE SINGLE AND MULTI-LEVEL FORMALISMS COMPARE. TO SEE,     RECENT
STARTING FROM OUR GENERAL DEFINITION OF THE ELASTIC IN THE FORM,  RECENT
                                                                  RECENT
ELASTIC =GJ*(2*SIN(PS)**2 + X)**2 + (SIN(2*PS) + Y)**2)           RECENT
        =GJ*(4*SIN(PS)**4 - 4*X*SIN(PS)**2 + X**2                 RECENT
           + SIN(2*PS)**2 + 2*Y*SIN(2*PS)  + Y**2)                RECENT
                                                                  RECENT
        =4*GJ*SIN(PS)**2 +                                        RECENT
           GJ*(X**2 + Y**2                                        RECENT
              -4*X*SIN(PS)**2                                     RECENT
              +2*Y*SIN(2*PS))                                     RECENT
                                                                  RECENT
AND OUR SPECIFIC DEFINITIONS OF (X) AND (Y) FOR MULTI-LEVEL BREIT-RECENT
WIGNER PARAMETERS,                                                RECENT
```

```
                                                                      RECENT
X        = GAM(N)*GAM(T)/2/DEN                                        RECENT
Y        = GAM(N)*(E-ER)/DEN                                          RECENT
DEN      = ((E-ER)**2 + (GAM(T)/2)**2)                                RECENT
                                                                      RECENT
X**2+Y**2= GAM(N)**2/DEN + (L-L)                                      RECENT
                                                                      RECENT
WE CAN RECOGNIZE X**2 AND Y**2 AS THE INTERFERENCE - (L-S) + (L-L)RECENT
TERMS IN THE MULTI-LEVEL FORMALISM. IN ORDER TO OBTAIN THE SINGLE RECENT
LEVEL EQUATION WE CAN ASSUME THAT EACH LEVEL DOES NOT INTERFERE   RECENT
WITH ANY OTHER LEVEL - THEREFORE THE (L-L) CONTRIBUTION IS ZERO.  RECENT
                                                                      RECENT
ELASTIC =4*GJ*SIN(PS)**2 +                                            RECENT
           GJ*GAM(N)*(GAM(N)                                          RECENT
                      -2*GAM(T)*SIN(PS)**2                            RECENT
                      +2*(E-ER)*SIN(2*PS))/DEN                        RECENT
                                                                      RECENT
WHICH IS THE FORM THAT IT APPEARS IN ENDF-102, EXCEPT FOR TWO     RECENT
TYPOGRAPHICAL ERRORS IN THE SECOND TERM,                          RECENT
                                                                      RECENT
-2*GAM(T)*SIN(PS)**2                                              RECENT
                                                                      RECENT
WHICH IN ENDF-102 IS WRITTEN,                                     RECENT
                                                                      RECENT
-2*(GAM(T)-GAM(N))*SIN(2*PS)**2                                   RECENT
                                                                      RECENT
PROGRAM CONVENTIONS                                               RECENT
======================================================================RECENT
MINIMUM INPUT DATA                                                RECENT
------------------                                                RECENT
FOR EACH MATERIAL TO BE PROCESSED THE MINIMUM INPUT DATA ARE THE  RECENT
RESONANCE PARAMETERS IN FILE 2. IF THERE ARE NO FILE 2 PARAMETERS RECENT
IN A GIVEN MATERIAL THE ENTIRE MATERIAL WILL SIMPLY BE COPIED.    RECENT
NEITHER THE HOLLERITH SECTION (MF=1, MT=451) NOR THE BACKGROUND   RECENT
CROSS SECTION (SECTIONS OF MF=3) NEED BE PRESENT FOR THIS PROGRAM RECENT
TO EXECUTE PROPERLY. HOWEVER, SINCE THE CONVENTIONS USED IN       RECENT
INTERPRETING THE RESONANCE PARAMETERS DEPENDS ON ENDF/B VERSION   RECENT
USERS ARE STRONGLY RECOMMENDED TO INSURE THAT MF=1, MT=451 IS     RECENT
PRESENT IN EACH MATERIAL TO ALLOW THE PROGRAM TO DETERMINE THE    RECENT
ENDF/B FORMAT VERSION.                                            RECENT
                                                                  RECENT
RESONANCE PARAMETERS                                              RECENT
--------------------                                              RECENT
RESONANCE PARAMETERS MAY BE REPRESENTED USING ANY COMBINATION     RECENT
OF THE REPRESENTATIONS ALLOWED IN ENDF/B,                         RECENT
(1) RESOLVED DATA                                                 RECENT
    (A) SINGLE LEVEL BREIT-WIGNER                                 RECENT
    (B) MULTI-LEVEL BREIT-WIGNER                                  RECENT
    (C) ADLER-ADLER                                               RECENT
    (D) REICH-MOORE                                               RECENT
    (E) HYBRID R-FUNCTION                                         RECENT
(2) UNRESOLVED DATA                                               RECENT
    (A) ALL PARAMETERS ENERGY INDEPENDENT                         RECENT
    (B) FISSION PARAMETERS ENERGY DEPENDENT                       RECENT
    (C) ALL PARAMETERS ENERGY DEPENDENT                           RECENT
                                                                  RECENT
THE FOLLOWING RESOLVED DATA FORMALISMS ARE NOT TREATED BY THIS    RECENT
VERSION OF THE CODE AND WILL ONLY BE IMPLEMENTED AFTER EVALUATIONSRECENT
USING THESE FORMALISMS ARE AVAILABLE TO THE AUTHOR OF THIS CODE   RECENT
FOR TESTING IN ORDER TO INSURE THAT THEY CAN BE HANDLED PROPERLY  RECENT
    (A) GENERAL R-MATRIX                                          RECENT
                                                                  RECENT
CALCULATED CROSS SECTIONS                                         RECENT
-------------------------                                         RECENT
THIS PROGRAM WILL USE THE RESONANCE PARAMETERS TO CALCULATE THE   RECENT
TOTAL, ELASTIC, CAPTURE AND POSSIBLY FISSION CROSS SECTIONS. THE  RECENT
COMPETITIVE WIDTH WILL BE USED IN THESE CALCULATIONS, BUT THE     RECENT
COMPETITIVE CROSS SECTION ITSELF WILL NOT BE CALCULATED. THE      RECENT
ENDF/B CONVENTION IS THAT ALTHOUGH A COMPETITIVE WIDTH MAY BE     RECENT
GIVEN, THE COMPETITIVE CROSS SECTION MUST BE SEPARATELY TABULATED RECENT
AS A SECTION OF FILE 3 DATA.                                      RECENT
```

RESOLVED REGION

IN THE RESOLVED REGION THE RESOLVED PARAMETERS ARE USED TO CALCULATE COLD (0 KELVIN), LINEARLY INTERPOLABLE, ENERGY DEPENDENT CROSS SECTIONS.

SCATTERING RADIUS

FOR SINGLE OR MULTI LEVEL BREIT-WIGNER PARAMETERS THE SCATTERING RADIUS MAY BE SPECIFIED IN EITHER ENERGY INDEPENDENT (CONSTANT) OR ENERGY DEPENDENT FORM (A TABLE OF ENERGY VS. RADIUS AND AN ASSOCIATED INTERPOLATION LAW). IN ALL OTHER CASE ONLY AN ENERGY INDEPENDENT SCATTERING RADIUS IS ALLOWED.

FOR ANY ONE MATERIAL (I.E. MAT) IF ENERGY DEPENDENT SCATTERING RADII ARE GIVEN THE TOTAL NUMBER OF INTERPOLATION REGIONS AND TABULATED VALUES FOR THE ENTIRE MATERIAL CANNOT EXCEED,
200 - INTERPOLATION REGIONS
500 - TABULATED VALUES
IF THESE LIMITS ARE EXCEEDED THE PROGRAM WILL PRINT AN ERROR MESSAGE AND TERMINATE.

IF YOU REQUIRE A LARGER NUMBER OF INTERPOLATION REGION AND/OR TABULATED VALUES,
(1) INTERPOLATION REGIONS - INCREASE THE DIMENSION OF NBTRHO AND INTRHO IN COMMON/TABRHO/ THROUGHOUT THE PROGRAM AND CHANGE MAXSEC IN SUBROUTINE RDAP (MAXSEC = MAXIMUM NUMBER OF INTERPOLATION REGIONS).
(2) TABULATED VALUES - INCREASE THE DIMENSION OF ERHOTB, RHOTAB AND APTAB IN COMMON/TABRHO/ THROUGHOUT THE PROGRAM AND CHANGE MAXRHO IN SUBROUTINE RDAP (MAXRHO = MAXIMUM NUMBER OF TABULATED VALUES).

RESOLVED REICH-MOORE AND MULTI-LEVEL BREIT-WIGNER PARAMETERS

CROSS SECTIONS FOR REICH-MOORE PARAMETERS ARE CALCULATED ACCORDING TO THE EQUATION (1) - (8) OF SECTION D.1.3 OF ENDF-102. IN ORDER TO CALCULATE CROSS SECTIONS FROM MULTI-LEVEL PARAMETERS IN A REASONABLE AMOUNT OF TIME THIS PROGRAM EXPRESSES THE CROSS SECTION IN TERMS OF A SINGLE SUM OVER RESONANCES (SEE, ENDF-102, SECTION D.1.2, EQUATIONS 6-7), RATHER THAN AS A DOUBLE SUM (SEE, ENDF-102 SECTION D.1.2, EQUATION 1-2). IN ORDER FOR THE ENDF-102 EQUATIONS TO BE CORRECT THE PARAMETERS MUST MEET THE FOLLOWING CONDITIONS,

(1) FOR EACH L STATE ALL PHYSICALLY POSSIBLE J SEQUENCES MUST BE PRESENT. ONLY IN THIS CASE WILL THE CONTRIBUTIONS OF THE INDIVIDUAL J SEQUENCES ADD UP TO PRODUCE THE CORRECT POTENTIAL SCATTERING CONTRIBUTION FOR THE L STATE (SEE, ENDF-102, SECTION D.1.2, EQUATIONS 6-7). IF ANY J SEQUENCE IS MISSING THE PROGRAM WILL PRINT A WARNING AND ADD THE J SEQUENCE WITH NO RESONANCE PARAMETERS IN ORDER TO ALLOW THE POTENTIAL SCATTERING TO BE CALCULATED CORRECTLY (THIS IS EQUIVALENT TO ASSUMING THAT THE EVALUATOR REALIZES THAT ALL J SEQUENCES MUST BE AND ARE PRESENT AND THAT THE EVALUATION STATES THAT THERE ARE NO RESONANCES WITH CERTAIN PHYSICALLY POSSIBLE J VALUES...IN THIS CASE POTENTIAL CONTRIBUTION MUST STILL BE CONSIDERED).

    EXAMPLE

    =======

    AN EXAMPLE OF WHERE THIS OCCURS AND IS IMPORTANT TO CONSIDER IS U-238 IN ENDF/B-4 AND 5 LIBRARIES WHERE FOR L=1 THERE IS ONLY A J=1/2 SEQUENCE. NOT INCLUDING THE J=3/2 SEQUENCE LEADS TO UNDERESTIMATING THE POTENTIAL SCATTERING AND PRODUCES MINIMA IN THE ELASTIC CROSS SECTION WHICH ARE AN ORDER OF MAGNITUDE LOWER THAN THE CROSS SECTIONS OBTAINED BE INCLUDING THE J=3/2 SEQUENCE.

(2) FOR A GIVEN TARGET SPIN AND L VALUE THERE MAY BE 2 POSSIBLE MEANS OF OBTAINING THE SAME J VALUE. WHEN THIS OCCURS IN ORDER TO CALCULATE THE CORRECT POTENTIAL SCATTERING CROSS

SECTION IT IS IMPORTANT TO INCLUDE THE EFFECT OF BOTH RECENT
POSSIBLE J SEQUENCES, EVEN THOUGH FROM THE ENDF/B DATA IT IS RECENT
NOT POSSIBLE TO DETERMINE WHICH OF THE 2 POSSIBLE SEQUENCES RECENT
ANY GIVEN RESONANCE BELONGS TO. IN THIS CASE THIS PROGRAM RECENT
TREAT ALL RESONANCES WITH THE SAME J VALUE AS BELONGING TO RECENT
THE SAME J SEQUENCE (TO ALLOW INTERFERENCE) AND WILL ADD AN RECENT
ADDITIONAL J SEQUENCE WITH NO RESONANCES IN ORDER TO ALLOW RECENT
THE POTENTIAL CROSS SECTION TO BE CALCULATED CORRECTLY. WHEN RECENT
THIS OCCURS A WARNING MESSAGE IS PRINTED, BUT BASED ON THE RECENT
ENDF/B DATA THERE IS NOTHING WRONG WITH THE DATA AND THERE IS RECENT
NOTHING THAT THE USER CAN DO TO CORRECT OR IN ANY WAY MODIFY RECENT
THE DATA TO ELIMINATE THE PROBLEM. RECENT
RECENT
EXAMPLE RECENT
======= RECENT
FOR A TARGET SPIN =1 AND L=1 THE 2 RANGES OF PHYSICALLY RECENT
POSSIBLE J ARE 1/2, 3/2, 5/2 AND 1/2, 3/2. BY CHECKING THE RECENT
ENDF/B DATA IT IS POSSIBLE TO INSURE THAT THE 3 POSSIBLE RECENT
J VALUES (1/2, 3/2, 5/2) ARE PRESENT AND TO INCLUDE ALL 3 RECENT
J SEQUENCES IN THE CALCULATIONS. HOWEVER, UNLESS ALL 5 RECENT
POSSIBLE J SEQUENCES ARE INCLUDED THE STATISTICAL WEIGHTS RECENT
OF THE J SEQUENCES WILL NOT SUM UP TO 2*L+1 AND THE RECENT
POTENTIAL CROSS SECTION WILL BE UNDERESTIMATED. IN THIS RECENT
EXAMPLE THE SUM OF THE 3 J SEQUENCES 1/2, 3/2, 5/2 IS 2, RECENT
RATHER THAN 3 AS IT SHOULD BE FOR L=1, AND THE CONTRIBUTION RECENT
OF THE L=1 RESONANCES TO THE POTENTIAL SCATTERING CROSS RECENT
SECTION WILL ONLY BE 2/3 OF WHAT IT SHOULD BE, UNLESS THE RECENT
OTHER 2 J SEQUENCES (WITH DUPLICATE J VALUES) ARE INCLUDED RECENT
IN THE CALCULATION. RECENT
RECENT
(3) EACH RESONANCE MUST HAVE AN ASSIGNED, PHYSICALLY POSSIBLE RECENT
J VALUE. PHYSICALLY IMPOSSIBLE OR AVERAGE J VALUES CANNOT BE RECENT
UNIQUELY INTERPRETED USING THE EQUATIONS IN ENDF-102 AND RECENT
THEIR USE WILL USUALLY RESULT IN PHYSICALLY UNRELIABLE CROSS RECENT
SECTIONS. THIS PROGRAM WILL CHECK ALL J VALUES AND IF ANY ARE RECENT
ARE FOUND TO BE PHYSICALLY IMPOSSIBLE (BASED ON TARGET SPIN RECENT
AND L VALUE) AN ERROR MESSAGE WILL BE PRINTED TO INDICATE THATRECENT
THE RECONSTRUCTED CROSS SECTIONS WILL BE UNRELIABLE AND THE RECENT
PROGRAM WILL CONTINUE. IN AN ATTEMPT TO CALCULATE THE CORRECT RECENT
POTENTIAL SCATTERING CROSS SECTION THIS PROGRAM WILL SUBTRACT RECENT
THE POTENTIAL SCATTERING CONTRIBUTION DUE TO ALL FICTICIOUS J RECENT
SEQUENCES AND ADD THE CONTRIBUTION OF ALL PHYSICALLY POSSIBLE RECENT
J SEQUENCES (AS DESCRIBED ABOVE). RECENT
RECENT
WARNING (LET THE USER BEWARE) RECENT
============================== RECENT
(A) IT CANNOT BE STRESSED ENOUGH THAT CROSS SECTIONS OBTAINED RECENT
USING PHYSICALLY IMPOSSIBLE J VALUES FOR REICH-MOORE AND RECENT
MULTI-LEVEL BREIT-WIGNER RESONANCE PARAMETERS WILL RESULT RECENT
IN UNRELIABLE CROSS SECTIONS. THE DECISION TO HAVE THIS RECENT
PROGRAM CONTINUE TO PROCESS WHEN THIS CONDITION IS FOUND RECENT
IS BASED ON AN ATTEMPT TO ALLOW THE USER TO AT LEAST HAVE RECENT
SOME RESULTS (HOWEVER BAD THEY MAY BE) IF THERE IS NO RECENT
OTHER EVALUATED DATA AVAILABLE. RECENT
(B) EVEN THOUGH THE REICH-MOORE AND MULTI-LEVEL EQUATIONS ARE RECENT
DEFINED AS ABSOLUTE OR SQUARED CONTRIBUTIONS WHICH MUST RECENT
ALL BE PHYSICALLY POSSIBLE, ATTEMPTING TO CORRECT THE RECENT
POTENTIAL CROSS SECTION (AS DESCRIBED ABOVE) CAN LEAD TO RECENT
NEGATIVE ELASTIC CROSS SECTIONS. THIS IS BECAUSE BASED ON RECENT
THE INFORMATION AVAILABLE IN THE EVALUATION IT IS NOT RECENT
NOT POSSIBLE TO CORRECTLY ACCOUNT FOR THE INTERFERENCE RECENT
BETWEEN THE RESONANCE AND POTENTIAL CONTRIBUTIONS FOR EACHRECENT
J SEQUENCE. RECENT
RECENT
UNRESOLVED RESONANCE REGION RECENT
---------------------------- RECENT
IN THE UNRESOLVED RESONANCE REGION THE UNRESOLVED PARAMETERS RECENT
ARE USED TO CALCULATE INFINITELY DILUTE AVERAGE CROSS SECTIONS. RECENT
NOTE, IT IS IMPORTANT TO UNDERSTAND THAT FROM THE DEFINITION OF RECENT
THE UNRESOLVED PARAMETERS IT IS NOT POSSIBLE TO UNIQUELY CALCULATERECENT
ENERGY DEPENDENT CROSS SECTIONS. ONLY AVERAGES OR DISTRIBUTIONS RECENT

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MAY BE CALCULATED.                                                      RECENT
                                                                        RECENT
UNRESOLVED INTERPOLATION                                                RECENT
------------------------                                                RECENT
IN THE UNRESOLVED RESONANCE REGION CROSS SECTIONS AT EACH ENERGY  RECENT
ARE CALCULATED BY INTERPOLATING PARAMETERS. THIS IS THE CONVENTIONRECENT
USED IN ENDF/B-4 AND EARLIER VERSIONS OF ENDF/B. THE ENDF/B-5     RECENT
CONVENTION OF INTERPOLATING CROSS SECTIONS, NOT PARAMETERS, HAS   RECENT
BEEN ABANDONED AS IMPRACTICAL SINCE IT CAN LEAD TO THE SITUATION  RECENT
WHERE EXACTLY THE SAME PHYSICAL DATA CAN LEAD TO DIFFERENT RESULTSRECENT
DEPENDING ON WHICH OF THE THREE ENDF/B UNRESOLVED PARAMTER FORMATSRECENT
IS USED. FOR EXAMPLE, GIVEN A SET OF ENERGY INDEPENDENT UNRESOLVEDRECENT
PARAMETERS IT IS POSSIBLE TO CODE THESE PARAMETERS IN EACH OF THE RECENT
THREE ENDF/B UNRESOLVED PARAMETER FORMATS. SINCE PHYSICALLY WE    RECENT
ONLY HAVE ONE SET OF PARAMETERS WE WOULD EXPECT THE RESULTS TO BE RECENT
INDEPENDENT OF HOW THEY ARE REPRESENTED IN ENDF/B. UNFORTUNATELY  RECENT
USING THE ENDF/B-5 CONVENTION TO INTERPOLATE CROSS SECTIONS CAN   RECENT
LEAD TO THREE COMPLETELY DIFFERENT RESULTS. IN CONTRAST USING THE RECENT
ENDF/B-4 AND EARLIER CONVENTION OF INTERPOLATING PARAMETERS LEADS RECENT
TO COMPLETELY CONSISTENT RESULTS.                                  RECENT
                                                                        RECENT
INTERNAL REPRESENTATION OF UNRESOLVED PARAMETERS                  RECENT
------------------------------------------------                  RECENT
ANY OF THE THREE POSSIBLE REPRESENTATIONS OF UNRESOLVED PARAMETERSRECENT
CAN BE UNIQUELY REPRESENTED IN THE ALL PARAMETERS ENERGY DEPENDENTRECENT
REPRESENTATIONS WITH THE APPROPRIATE (ENDF/B VERSION DEPENDENT)   RECENT
INTERPOLATION LAW. THIS IS DONE BY THE PROGRAM WHILE READING THE  RECENT
UNRESOLVED PARAMETERS AND ALL SUBSEQUENT CALCULATIONS NEED ONLY   RECENT
CONSIDER THE ALL PARAMETERS ENERGY DEPENDENT REPRESENTATION.      RECENT
                                                                  RECENT
RESONANCE RECONSTRUCTION STARTING ENERGY GRID                     RECENT
---------------------------------------------                     RECENT
AS IN ANY ITERATIVE METHOD THE WAY TO SPEED CONVERGENCE IS TO TRY RECENT
TO START CLOSE TO THE ANSWER. THIS PROGRAM ATTEMPTS TO DO THIS BY RECENT
STARTING FROM AN ENERGY GRID WHICH IS A GOOD APPROXIMATION TO A   RECENT
SIMPLE BREIT-WIGNER LINE SHAPE,                                   RECENT
                                                                  RECENT
SIGMA(X)=1.0/(1.0+X*X)                                            RECENT
                                                                  RECENT
WHERE X IS THE DISTANCE FROM THE PEAK IN HALF-WIDTHS              RECENT
                                                                  RECENT
SUBROUTINE SUBINT HAS A BUILT-IN TABLE OF NODES WHICH ARE THE     RECENT
HALF-WIDTH MULTIPLES TO APPROXIMATE THE SIMPLE BREIT-LINE SHAPE   RECENT
TO WITHIN 1 PER-CENT OVER THE ENTIRE INTERVAL 0 TO 500 HALF-WIDTHSRECENT
                                                                  RECENT
BETWEEN ANY TWO RESOLVED RESONANCES THE STARTING GRID IS BASED ON RECENT
THE HALF-WIDTHS OF THE TWO RESONANCES. FROM THE LOWER ENERGY      RECENT
RESONANCE UP TO THE MID-POINT BETWEEN THE RESONANCES (MID-POINT   RECENT
IS DEFINED HERE AS AN EQUAL NUMBER OF HALF-WIDTHS FROM EACH       RECENT
RESONANCE) THE HALF-WIDTH OF THE LOWER ENERGY RESONANCE IS USED.  RECENT
FROM THE MID-POINT UP TO THE HIGHER ENERGY RESONANCE THE HALF-    RECENT
WIDTH OF THE UPPER ENERGY RESONANCE IS USED.                       RECENT
                                                                  RECENT
WITH THIS ALOGORITHM CLOSELY SPACED RESONANCES WILL HAVE ONLY     RECENT
A FEW STARTING NODES PER RESONANCE (E.G. U-235). WIDELY SPACED    RECENT
RESONANCES WILL HAVE MORE NODES PER RESONANCE (E.G. U-238). FOR   RECENT
A MIX OF S, P, D ETC. RESONANCES THIS ALOGORITHM GUARANTEES AN    RECENT
ADEQUTE DESCRIPTION OF THE PROFILE OF EVEN EXTREMELY NARROW       RECENT
RESONANCES (WHICH MAY IMMEDIATELY CONVERGENCE TO THE ACCURACY     RECENT
REQUESTED, THUS MINIMIZING ITERATION).                            RECENT
                                                                  RECENT
BACKGROUND CROSS SECTIONS                                         RECENT
-------------------------                                         RECENT
THE PROGRAM WILL SEARCH FOR BACKGROUND CROSS SECTIONS FOR TOTAL   RECENT
(MT=1), ELASTIC (MT=2), FISSION (MT=18), FIRST CHANCE FISSION     RECENT
(MT=19) AND CAPTURE (MT=102).                                     RECENT
                                                                  RECENT
(1) THE BACKGROUND CROSS SECTIONS (FILE 3) CAN BE PRESENT OR NOT  RECENT
    PRESENT FOR EACH REACTION.                                    RECENT
(2) IF FOR A GIVEN REACTION THE BACKGROUND CROSS SECTION IS       RECENT
    PRESENT, IT WILL BE ADDED TO THE RESONANCE CONTRIBUTION AND   RECENT
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    THE RESULT WILL BE OUTPUT.                                          RECENT
(3) IF FOR A GIVEN REACTION THE BACKGROUND IS NOT PRESENT THE           RECENT
    PROGRAM WILL,                                                       RECENT
    (A) IF THE INPUT TO THE PROGRAM SPECIFIES NO OUTPUT FOR             RECENT
        REACTIONS WITH NO BACKGROUND THERE WILL BE NO OUTPUT.           RECENT
    (B) IF THE INPUT TO THE PROGRAM SPECIFIES OUTPUT FOR REACTIONSRECENT
        WITH NO BACKGROUND,                                             RECENT
        (I) THE RESONANCE CONTRIBUTION TO TOTAL, ELASTIC OR             RECENT
            CAPTURE WILL BE OUTPUT.                                     RECENT
        (II) IF ALL FISSION RESONANCE PARAMETERS ARE ZERO THE           RECENT
             FISSION CROSS SECTION (MT=18) WILL NOT BE OUTPUT.          RECENT
             OTHERWISE THE RESONANCE CONTRIBUTION OF THE FISSION        RECENT
             (MT=18) WILL BE OUTPUT.                                    RECENT
        (III) THERE WILL BE NO OUTPUT FOR FIRST CHANCE FISSION          RECENT
              (MT=19).                                                  RECENT
                                                                        RECENT
COMBINING RESONANCES AND BACKGROUND CROSS SECTIONS                      RECENT
-------------------------------------------------                       RECENT
IN ORDER TO BE COMBINED WITH THE RESONANCE CONTRIBUTION THE             RECENT
BACKGROUND CROSS SECTIONS MUST BE GIVEN AT 0 KELVIN TEMPERATURE         RECENT
AND MUST BE LINEARLY INTERPOLABLE. IF THESE CONDITIONS ARE MET          RECENT
THE RESONANCE AND BACKGROUND CONTRIBUTIONS WILL BE ADDED TOGETHER RECENT
AND OUTPUT. IF THESE CONDITIONS ARE NOT MET THE BACKGROUND CROSS        RECENT
SECTION WILL BE IGNORED AND ONLY THE RESONANCE CONTRIBUTION WILL        RECENT
BE OUTPUT. IF THE BACKGROUND HAS NOT BEEN ADDED TO THE RESONANCE        RECENT
CONTRIBUTION AFTER THIS PROGRAM FINISHES THE USER CAN MAKE THE          RECENT
RESONANCE AND BACKGROUND CONTRIBUTIONS COMPATIBLE BY,                   RECENT
                                                                        RECENT
(1) IF THE BACKGROUND IS NOT LINEARLY INTERPOABLE, LINEARIZE THE        RECENT
    BACKGROUND (E.G., USE PROGRAM LINEAR).                              RECENT
(2) IF THE BACKGROUND IS NOT GIVEN AT 0 KELVIN, DOPPLER BROADEN         RECENT
    THE RESONANCE (NOT BACKGROUND) CONTRIBUTION TO THE SAME             RECENT
    TEMPERATURE AS THE BACKGROUND (E.G., USE PROGRAM SIGMA1).           RECENT
                                                                        RECENT
ONCE THE RESONANCE AND BACKGROUND CONTRIBUTIONS HAVE BEEN MADE          RECENT
COMPATIBLE THEY CAN BE ADDED TOGETHER (E.G., USE PROGRAM MIXER).        RECENT
                                                                        RECENT
THE RECONSTRUCTION OF THE RESONANCE CONTRIBUTION TO THE CROSS           RECENT
SECTION CAN BE QUITE EXPENSIVE (IN TERMS OF COMPUTER TIME). SINCE RECENT
THE RECONSTRUCTION IS PERFORMED BEFORE THE BACKGROUND CROSS             RECENT
SECTIONS ARE READ, THE ABOVE CONVENTIONS HAVE BEEN ADOPTED IN           RECENT
ORDER TO AVOID LOSE OF COMPUTER TIME INVOLVED IN RECONSTRUCTING         RECENT
THE RESONANCE CONTRIBUTION.                                             RECENT
                                                                        RECENT
COMMON ENERGY GRID                                                      RECENT
------------------                                                      RECENT
THIS PROGRAM WILL RECONSTRUCT THE RESONANCE CONTRIBUTION TO THE         RECENT
TOTAL, ELASTIC, FISSION AND CAPTURE CROSS SECTIONS ALL ON THE           RECENT
SAME ENERGY GRID. EACH REACTION WILL THEN BE COMBINED WITH ITS          RECENT
BACKGROUND CROSS SECTION (IF ANY) AND OUTPUT WITHOUT ANY FURTHER RECENT
THINNING. IF THERE ARE NO BACKGROUND CROSS SECTIONS, OR IF THE          RECENT
BACKGROUND CROSS SECTION FOR ALL FOUR REACTIONS ARE GIVEN ON A          RECENT
COMMON ENERGY GRID, THE OUTPUT FROM THIS PROGRAM WILL BE ON A           RECENT
COMMON ENERGY GRID FOR ALL FOUR REACTIONS.                              RECENT
                                                                        RECENT
THERMAL ENERGY                                                          RECENT
--------------                                                          RECENT
IF THE RESONANCE REGION SPANS THERMAL ENERGY (0.0253 EV) THIS           RECENT
POINT IS ALWAYS INCLUDED IN THE COMMON ENERGY GRID USED FOR ALL         RECENT
REACTIONS AND WILL ALWAYS APPEAR IN THE OUTPUT DATA.                    RECENT
                                                                        RECENT
SECTION SIZE                                                            RECENT
------------                                                            RECENT
SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT RECENT
TO THE NUMBER OF POINTS IN ANY SECTION, E.G., THE TOTAL CROSS           RECENT
SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS.                      RECENT
                                                                        RECENT
SELECTION OF DATA                                                       RECENT
-----------------                                                       RECENT
THE PROGRAM SELECTS MATERIALS TO BE PROCESSED BASED EITHER ON           RECENT
MAT (ENDF/B MAT NO.) OR ZA. THE PROGRAM ALLOWS UP TO 100 MAT OR         RECENT
```

ZA RANGES TO BE SPECIFIED. THE PROGRAM WILL ASSUME THAT THE RECENT
ENDF/B TAPE IS IN EITHER MAT OR ZA ORDER, WHICHEVER CRITERIA IS RECENT
USED TO SELECT MATERIALS, AND WILL TERMINATE WHEN A MAT OR ZA RECENT
IS FOUND THAT IS ABOVE THE RANGE OF ALL REQUESTS. RECENT
RECENT
ALLOWABLE ERROR RECENT
--- RECENT
THE RECONSTRUCTION OF LINEARLY INTERPOLABLE CROSS SECTIONS FROM RECENT
RESONANCE PARAMETERS CANNOT BE PERFORMED EXACTLY. HOWEVER IT CAN RECENT
BE PERFORMED TO VIRTUALLY ANY REQUIRED ACCURACY AND MOST RECENT
IMPORTANTLY CAN BE PERFORMED TO A TOLERANCE THAT IS SMALL COMPARED RECENT
TO THE UNCERTAINTY IN THE CROSS SECTIONS THEMSELVES. AS SUCH THE RECENT
CONVERSION OF CROSS SECTIONS TO LINEARLY INTERPOLABLE FORM CAN BE RECENT
PERFORMED WITH ESSENTIALLY NO LOSS OF INFORMATION. RECENT
RECENT
THE ALLOWABLE ERROR MAY BE ENERGY INDEPENDENT (CONSTANT) OR ENERGY RECENT
DEPENDENT. THE ALLOWABLE ERROR IS DESCRIBED BY A TABULATED RECENT
FUNCTION OF UP TO 20 (ENERGY,ERROR) PAIRS AND LINEAR INTERPOLATION RECENT
BETWEEN TABULATED POINTS. IF ONLY ONE TABULATED POINT IS GIVEN THE RECENT
ERROR WILL BE CONSIDERED CONSTANT OVER THE ENTIRE ENERGY RANGE. RECENT
WITH THIS ENERGY DEPENDENT ERROR ONE MAY OPTIMIZE THE OUTPUT FOR RECENT
ANY GIVEN APPLICATION BY USING A SMALL ERROR IN THE ENERGY RANGE RECENT
OF INTEREST AND A LESS STRINGENT ERROR IN OTHER ENERGY RANGES, RECENT
E.G., 0.1 PER-CENT FROM 0 UP TO THE LOW EV RANGE AND A LESS RECENT
STRINGENT TOLERANCE AT HIGHER ENERGIES. RECENT
RECENT
DEFAULT ALLOWABLE ERROR RECENT
--- RECENT
IN ORDER TO INSURE CONVERENCE OF THE RESONANCE RECONSTRUCTION THE RECENT
ALLOWABLE ERROR MUST BE POSITIVE. IF THE USER INPUTS AN ERROR FOR RECENT
RESONANCE RECONSTRUCTION THAT IS NOT POSITIVE IT WILL BE SET TO RECENT
THE DEFAULT VALUE (CURRENTLY 0.1 PER-CENT) AND INDICATED AS SUCH RECENT
IN THE OUTPUT LISTING. RECENT
RECENT
INTERVAL HALVING ALGORITHM RECENT
--- RECENT
THIS PROGRAM WILL START BY CALCULATING THE CROSS SECTIONS AT THE RECENT
ENERGIES CORRESPONDING TO THE PEAK OF EACH RESONANCE, AS WELL AS RECENT
A FIXED NUMBER OF HALF-WIDTHS ON EACH SIDE OF EACH RESONANCE. RECENT
STARTING FROM THIS BASIC GRID OF POINTS THE PROGRAM WILL CONTINUE RECENT
TO HALF EACH INTERVAL UNTIL THE CROSS SECTIONS FOR ALL REACTIONS RECENT
AT THE CENTER OF THE INTERVAL CAN BE DEFINED BY LINEAR RECENT
INTERPOLATION FROM THE ENDS OF THE INTERVAL TO WITHIN THE USER RECENT
SPECIFIED ACCURACY CRITERIA. RECENT
RECENT
DISTANT RESONANCE TREATMENT RECENT
--- RECENT
THE OPTION TO TREAT DISTANT RESONANCES, WHICH WAS AVAILABLE IN RECENT
EARLIER VERSIONS OF THIS PROGRAM, IS NO LONGER AVAILABLE, BECAUSE RECENT
IT WAS FOUND TO PRODUCE UNRELIABLE RESULTS. IN THIS VERSION OF RECENT
THE PROGRAM ALL RESONANCES ARE TREATED EXACTLY. RECENT
RECENT
PROGRAM OPERATION RECENT
==========RECENT
EDIT MODE RECENT
--- RECENT
IT IS SUGGESTED THAT BEFORE RUNNING THIS PROGRAM TO RECONSTRUCT RECENT
CROSS SECTIONS FROM RESONANCE PARAMETERS (WHICH CAN BE QUITE RECENT
EXPENSIVE) THE USER FIRST RUN THE PROGRAM IN THE EDIT MODE (SEE, RECENT
DESCRIPTION OF INPUT PARAMETERS BELOW). IN THE EDIT MODE THE RECENT
PROGRAM WILL READ, LIST AND EXTENSIVELY CHECK THE CONSISTENCY OF RECENT
ALL RESONANCE PARAMETERS AND ENDF/B DEFINED RESONANCE FLAGS. THIS RECENT
IS A VERY INEXPENSIVE MEANS OF CHECKING ALL DATA BEFORE INVESTING RECENT
A LARGE AMOUNT OF MONEY IN RECONSTRUCTING CROSS SECTIONS. ANY AND RECENT
ALL DIGNOSTICS RECEIVED FROM THE EDIT WILL SUGGEST HOW TO CORRECT RECENT
THE EVALUATED DATA TO MAKE IT CONSISTENT BEFORE RECONSTRUCTING RECENT
CROSS SECTIONS. IN ORDER TO OBTAIN MEANINGFUL RESULTS FROM THE RECENT
RECONSTRUCTION ALL SUGGESTED CHANGES TO THE EVALUATION SHOULD BE RECENT
PERFORMED BEFORE TRYING RECONSTRUCTION (OTHERWISE THE RESULT OF RECENT
RECONSTRUCTION WILL NOT BE RELIABLE). RECENT
RECENT

```
     RECONSTRUCTION MODE                                                  RECENT
     -------------------                                                  RECENT
     FOR EACH REQUESTED MATERIAL                                          RECENT
     ---------------------------                                          RECENT
     IF SECTION MF=1, MT=451 IS PRESENT COMMENTS WILL BE ADD TO           RECENT
     DOCUMENT THAT THE MATERIAL HAS BEEN PROCESSED. MF=1, MT=451 WILL     RECENT
     ALSO BE USED TO DETERMINE THE VERSION OF THE ENDF/B FORMAT WHICH     RECENT
     WILL ALLOW THE PROGRAM TO USE THE APPROPRIATE CONVENTIONS.           RECENT
                                                                          RECENT
     ALL OF THE FILE 2 RESONANCE PARAMETERS ARE FIRST READ AND THE        RECENT
     LINEARLY INTERPOLABLE CONTRIBUTION OF THE RESONANCE PARAMETERS       RECENT
     TO THE TOTAL, ELASTIC, CAPTURE AND FISSION CROSS SECTIONS IS         RECENT
     CALCULATED SIMULTANEOUSLY USING A COMMON ENERGY GRID FOR ALL         RECENT
     FOUR REACTIONS.                                                      RECENT
                                                                          RECENT
     AFTER THE RESONANCE CONTRIBUTION HAS BEEN RECONSTRUCTED EACH OF      RECENT
     THE FIVE REACTIONS (MT=1, 2, 18, 19, 102) IS CONSIDERED SEPARATELYRECENT
     FOR COMBINATION WILL THE BACKGROUND CROSS SECTION, IF ANY, AS        RECENT
     DESCRIBED ABOVE.                                                     RECENT
                                                                          RECENT
     OUTPUT WILL INCLUDE THE ENTIRE EVALUATION, INCLUDING RESONANCES      RECENT
     PARAMETERS WITH LRU MODIFIED (AS DESCRIBED ABOVE) TO INDICATE        RECENT
     THAT THE RESONANCE CONTRIBUTION HAS ALREADY BEEN ADDED TO THE        RECENT
     FILE 3 CROSS SECTIONS.                                               RECENT
                                                                          RECENT
     THE CYCLE OF RECONSTRUCTING THE RESONANCE CONTRIBUTION AND ADDING RECENT
     THE BACKGROUND WILL BE REPEATED FOR EACH MATERIAL REQUESTED.         RECENT
                                                                          RECENT
-----2016/3/10 - This option is no longer allowed - today's computers     RECENT
                 are so mjuch faster that this option is no longer        RECENT
                 needed.                                                  RECENT
     PROCESS ONLY A PORTION OF RESONANCE REGION                           RECENT
     ======================================================================RECENT
     MODERN EVALUATIONS MAY BE EXTREMELY LARGE AND IT MAY NOT BE          RECENT
     POSSIBLE TO PROCESS AN ENTIRE EVALUATION (I.E., ADD THE RESONANCE RECENT
     CONTRIBUTION) DURING A SINGLE COMPUTER RUN.                          RECENT
                                                                          RECENT
     ALSO IN THE CASE WHERE YOU ARE ONLY INTERESTED IN THE CROSS          RECENT
     SECTIONS OVER A SMALL ENERGY RANGE, YOU MAY NOT WANT TO PROCESS      RECENT
     AN ENTIRE EVALUATION, E.G., IF YOU ONLY WANT TO KNOW WHAT THE        RECENT
     CROSS SECTIONS ARE NEAR THERMAL ENERGY, 0.0253 EV.                   RECENT
                                                                          RECENT
     IN ORDER TO ALLOW AN EVALUATION TO BE PROCESSED USING A NUMBER OF RECENT
     SHORTER COMPUTER RUNS AN OPTION HAS BEEN ADDED TO THIS PROGRAM TO RECENT
     ALLOW THE USER TO SPECIFY THE ENERGY RANGE TO BE PROCESSED.          RECENT
                                                                          RECENT
     USING THIS OPTION YOU MAY START AT THE LOWEST ENERGY (ZERO UP TO     RECENT
     SOME ENERGY) AND USE THE RESULTS OF THIS RUN AS INPUT TO THE         RECENT
     NEXT RUN, WHERE YOU CAN SPECIFY THE NEXT ENERGY RANGE. THIS          RECENT
     CYCLE CAN BE REPEATED UNTIL YOU HAVE PROCESSED THE ENTIRE            RECENT
     EVALUATION.                                                          RECENT
                                                                          RECENT
     WARNING - THIS OPTION SHOULD BE USED WITH EXTREME CARE - THIS        RECENT
     OPTION HAS BEEN RELUCTANTLY ADDED - RELUCTANTLY BECAUSE IT CAN       RECENT
     BE EXTREMELY DANGEROUS TO USE THIS OPTION UNLESS YOU CAREFULLY       RECENT
     CHECKED WHAT YOU ARE DOING.                                          RECENT
                                                                          RECENT
     THE OPTION SHOULD ONLY BE USED AS FOLLOWS,                           RECENT
     1) YOU MUST PROCESS USING ENERGY RANGES STARTING AT LOW ENERGY       RECENT
        AND WORKING YOUR WAY TOWARD HIGH ENERGY, E.G.,                    RECENT
         0.0   TO  3.0+3                                                  RECENT
         3.0+3 TO 10.0+3                                                  RECENT
        10.0+3 TO 80.0+3, ETC.                                            RECENT
     2) FOR THE LAST ENERGY RANGE THE LOWER ENERGY LIMIT MUST BE          RECENT
        NON-ZERO (WHERE TO START) AND THE UPPER ENERGY LIMIT MUST         RECENT
        BE ZERO (NO LIMIT)                                                RECENT
        80.0+3 TO  0.0                                                    RECENT
                                                                          RECENT
     IF YOU ARE ONLY INTERESTED IN THE CROSS SECTION OVER A NARROW        RECENT
     ENERGY INTERVAL AND DO NOT INTENT TO MAKE ANY OTHER USE OF THE       RECENT
     RESULTS, YOU CAN IGNORE THESE WARNINGS AND MERELY SPECIFY ANY        RECENT
```

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     ENERGY INTERVAL OVER WHICH YOU WISH CALCULATIONS TO BE            RECENT
     PERFORMED.                                                        RECENT
                                                                       RECENT
     NORMALLY WHEN THIS PROGRAM PROCESSES AN EVALUATION IT WILL SET    RECENT
     FLAGS IN THE EVALUATION TO PREVENT THE SAME RESONANCE             RECENT
     CONTRIBUTION FROM BEING ADDED TO THE CROSS SECTION MORE THAN      RECENT
     ONCE, SHOULD YOU USE THE OUTPUT FROM THIS PROGRAM AS INPUT TO     RECENT
     THE PROGRAM.                                                      RECENT
                                                                       RECENT
     WHEN PROCESSING ONLY PORTIONS OF THE RESONANCE REGION THIS        RECENT
     PROGRAM CANNOT SET THESE FLAGS TO PROTECT AGAINST ADDING THE      RECENT
     RESONANCE CONTRIBUTION MORE THAN ONCE - WHICH MAKES USE OF        RECENT
     THIS OPTION EXTREMELY DANGEROUS.                                  RECENT
                                                                       RECENT
     ONLY YOU CAN CHECK TO MAKE SURE THAT YOU HAVE CORRECTLY           RECENT
     INCLUDED EACH ENERGY RANGE ONLY ONCE - SEE THE COMMENT LINES      RECENT
     AT THE END OF SECTION, MF=1, MT=451, FOR A COMPLETE RECORD        RECENT
     OF EACH RUN USING THIS PROGRAM. THIS SECTION WILL CONTAIN         RECENT
     LINES OF THE FORM                                                 RECENT
                                                                       RECENT
     ***************** PROGRAM RECENT (VERSION 2023-1) *************   RECENT
     ONLY PROCESS  0.00000+ 0 TO  3.00000+ 3 EV                        RECENT
     ***************** PROGRAM RECENT (VERSION 2023-1) *************   RECENT
     ONLY PROCESS  3.00000+ 3 TO  1.00000+ 4 EV                        RECENT
     ***************** PROGRAM RECENT (VERSION 2023-1) *************   RECENT
     ONLY PROCESS  1.00000+ 4 TO  8.00000+ 4 EV                        RECENT
     ***************** PROGRAM RECENT (VERSION 2023-1) *************   RECENT
     ONLY PROCESS  8.00000+ 4 TO  2.00000+ 7 EV                        RECENT
                                                                       RECENT
     YOU SHOULD CHECK TO INSURE THAT THERE ARE NO OVERLAPPING ENERGY    RECENT
     RANGES OR MISSING ENERGY RANGES.                                  RECENT
                                                                       RECENT
     WHEN YOU INDICATE BY INPUT THAT YOU ARE ABOUT TO PROCESS THE      RECENT
     LAST ENERGY RANGE (SEE ABOVE, LOWER ENERGY LIMIT = NON-ZERO,      RECENT
     UPPER ENERGY LIMIT = ZERO), THIS PROGRAM WILL ASSUME THAT         RECENT
     YOU HAVE NOW COMPLETED ALL PROCESSING - AND ONLY THEN WILL        RECENT
     IT SET FLAGS IN THE EVALUATION TO PREVENT THE RESONANCE           RECENT
     CONTRIBUTION FROM BEING ADDED MORE THAN ONCE. FOR THIS REASON     RECENT
     YOU CANNOT PROCESS STARTING WITH ENERGY INTERVALS AT HIGH         RECENT
     ENERGY AND WORKING TOWARD LOW ENERGY - YOU MUST START AT LOW      RECENT
     ENERGY AND WORK TOWARD HIGH ENERGY.                               RECENT
-----2016/3/10 - This option is no longer allowed - today's computers  RECENT
                                                                       RECENT
     I/O FILES                                                         RECENT
     ==================================================================RECENT
     INPUT FILES                                                       RECENT
     -----------                                                       RECENT
     UNIT  DESCRIPTION                                                 RECENT
     ----  -----------                                                 RECENT
       2   INPUT LINE (BCD - 80 CHARACTERS/RECORD)                     RECENT
      10   ORIGINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)           RECENT
                                                                       RECENT
     OUTPUT FILES                                                      RECENT
     ------------                                                      RECENT
     UNIT  DESCRIPTION                                                 RECENT
     ----  -----------                                                 RECENT
       3   OUTPUT REPORT (BCD - 120 CHARACTERS/RECORD)                 RECENT
      11   FINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD)              RECENT
                                                                       RECENT
     SCRATCH FILES                                                     RECENT
     -------------                                                     RECENT
     UNIT  DESCRIPTION                                                 RECENT
     ----  -----------                                                 RECENT
      12   SCRATCH FILE FOR DATA RECONSTRUCTED FROM RESONANCE          RECENT
           PARAMETERS (BINARY - 100200 WORDS/RECORD)                   RECENT
      14   SCRATCH FILE FOR COMBINED FILE 2 AND 3 DATA                 RECENT
           (BINARY - 40080 WORDS/RECORD)                               RECENT
                                                                       RECENT
     OPTIONAL STANDARD FILE NAMES (SEE SUBROUTINE FILEIO)              RECENT
     ==================================================================RECENT
     UNIT  FILE NAME                                                   RECENT
```

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----  ----------                                                          RECENT
  2   RECENT.INP                                                          RECENT
  3   RECENT.LST                                                          RECENT
 10   ENDFB.IN                                                            RECENT
 11   ENDFB.OUT                                                           RECENT
 12   (SCRATCH)                                                           RECENT
 14   (SCRATCH)                                                           RECENT
                                                                          RECENT
INPUT CARDS                                                              RECENT
==========================================================================RECENT
LINE  COLS.  FORMAT  DESCRIPTION                                         RECENT
----  -----  ------  -----------                                         RECENT
  1    1-11    I11   RETRIEVAL CRITERIA (0=MAT, 1=ZA)                   RECENT
                     THIS OPTION DEFINED WHETHER COLUMNS 1-22 OF        RECENT
                     SUBSEQUENT INPUT CARDS SHOULD BE INTERPRETED       RECENT
                     TO BE MAT OR ZA RANGES.                            RECENT
      12-22   E11.4  FILE 2 MINIMUM ABSOLUTE CROSS SECTION              RECENT
                     (IF 1.0E-10 OR LESS IS INPUT THE PROGRAM           RECENT
                     WILL USE 1.0E-10)                                  RECENT
      23-33    I11   TREATMENT OF REACTIONS FOR WHICH BACKGROUND        RECENT
                     CROSS SECTION IS NOT GIVEN.                        RECENT
                     = 0 - IGNOR (I.E. NO OUTPUT)                       RECENT
                     = 1 - OUTPUT RESONANCE CONTRIBUTION.               RECENT
                     THIS OPTION IS USEFUL WITH PARTIAL EVALUATIONRECENT
                     (E.G. ENDF/B-5 DOSIMETRY LIBRARY) WHERE ONLY       RECENT
                     ONE OR MORE OF THE REACTIONS ARE OF ACTUAL         RECENT
                     INTEREST.                                          RECENT
                     WARNING...THE USE OF THIS FIELD HAS BEEN           RECENT
                     CHANGED. THIS FIELD WAS PREVIOUSLY USED TO         RECENT
                     DEFINE THE PRECISION OF THE CALCULATION AND        RECENT
                     OUTPUT. THE FORMER DEFINITION OF THIS FIELD        RECENT
                     WAS...                                             RECENT
                     MINIMUM ENERGY SPACING FLAG                        RECENT
                     = 0 - 6 DIGIT MINIMUM ENERGY SPACING.              RECENT
                           STANDARD 6 DIGIT E11.4 OUTPUT.               RECENT
                     = 1 - 9 DIGIT MINIMUM ENERGY SPACING.              RECENT
                           STANDARD 6 DIGIT E11.4 OUTPUT.               RECENT
                     = 2 - 9 DIGIT MINIMUM ENERGY SPACING.              RECENT
                           VARIABLE 9 DIGIT F FORMAT OUTPUT.            RECENT
                     FROM EXPERIENCE IT HAS BEEN FOUND THAT             RECENT
                     FAILURE TO SET THIS OPTION TO 2 CAN RESULT         RECENT
                     IN LARGE ERRORS IN THE FINAL DATA. THEREFORE       RECENT
                     INTERNALLY THIS OPTION IS SET TO 2.                RECENT
      34-44    I11   OPERATING MODE                                     RECENT
                     = 0 - CACULATE. MINIMUM OUTPUT LISTING             RECENT
                     = 1 - CACULATE. LIST ALL RESONANCE PARAMETERSRECENT
                     = 2 - EDIT MODE. NO CALCULATION. LIST ALL          RECENT
                           RESONANCE PARAMETERS.                        RECENT
                     NOTE, THE EDIT MODE (=2) IS THE SUGGESTED          RECENT
                     MODE TO FIRST TEST THE CONSISTENCY OF THE          RECENT
                     EVALUATED DATA, BEFORE RECONSTRUCTING CROSS        RECENT
                     SECTIONS (SEE, COMMENTS ABOVE).                    RECENT
      45-55    I11   NEGATIVE CROSS SECTIOIN TREATMENT                  RECENT
                     = 0 - O.K. - NO CHANGE                             RECENT
                     = 1 - SET = 0                                      RECENT
      56-66    I11   MONITOR MODE SELECTOR                              RECENT
                     = 0 - NORMAL OPERATION                             RECENT
                     = 1 - MONITOR PROGRESS OF RECONSTRUCTION OF        RECENT
                           FILE 2 DATA AND COMBINING FILE 2 AND         RECENT
                           FILE 3 DATA. EACH TIME A PAGE OF DATA        RECENT
                           POINTS IS WRITTEN TO A SCRATCH FILE          RECENT
                           PRINT OUT THE TOTAL NUMBER OF POINTS         RECENT
                           ON SCRATCH AND THE LOWER AND UPPER           RECENT
                           ENERGY LIMITS OF THE PAGE (THIS OPTION       RECENT
                           MAY BE USED IN ORDER TO MONITOR THE          RECENT
                           EXECUTION SPEED OF LONG RUNNING JOBS).       RECENT
  2    1-72    A72   ENDF/B INPUT DATA FILENAME                         RECENT
                     (STANDARD OPTION = ENDFB.IN)                       RECENT
  3    1-72    A72   ENDF/B OUTPUT DATA FILENAME                        RECENT
                     (STANDARD OPTION = ENDFB.OUT)                      RECENT
4-N    1-11    I11   MINIMUM MAT OR ZA (SEE COLS. 1-11, LINE 1)         RECENT
```

```
          12-22    I11   MAXIMUM MAT OR ZA (SEE COLS. 1-11, LINE 1)   RECENT
                         UP TO 100 MAT OR ZA RANGES MAY BE SPECIFIED, RECENT
                         ONE RANGE PER LINE. THE LIST IS TERMINATED   RECENT
                         BY A BLANK LINE. IF THE THE UPPER LIMIT OF   RECENT
                         ANY REQUEST IS LESS THAN THE LOWER LIMIT THE RECENT
                         UPPER LIMIT WILL BE SET EQUAL TO THE LOWER   RECENT
                         LIMIT. IF THE FIRST REQUEST LINE IS BLANK IT RECENT
                         WILL TERMINATE THE REQUEST LIST AND CAUSE ALLRECENT
                         DATA TO BE RETRIEVED (SEE EXAMPLE INPUT).    RECENT
----- 2016/3/10 - Partial Processing no longer allowed.               RECENT
                  If these fields are not blank the code will STOP     RECENT
                  with a WARNING that this is no longer allowed.       RECENT
          23-33   E11.4  LOWER ENERGY LIMIT FOR PROCESSING.            RECENT
          34-44   E11.4  UPPER ENERGY LIMIT FOR PROCESSING.            RECENT
                        *THE LOWER AND UPPER ENERGY LIMITS MUST BE     RECENT
                         ZERO, OR BLANK, UNLESS YOU WISH TO ONLY      RECENT
                         PROCESS A PORTION OF RESONANCE REGIONS.      RECENT
                        *THESE ENERGY LIMITS ARE ONLY READ FROM THE   RECENT
                         FIRST MAT/ZA REQUEST LINE                    RECENT
                        *IF BOTH ARE ZERO (OR BLANK) THE ENTIRE       RECENT
                         RESONANCE REGION FOR EACH MATERIAL WILL BE   RECENT
                         PROCESSED                                    RECENT
                        *IF LIMITS ARE INPUT ONLY THAT PORTION OF THE RECENT
                         RESONANCE REGION FOR EACH MATERIAL WHICH     RECENT
                         LIES BETWEEN THESE LIMITS WILL BE PROCESSED  RECENT
                        *SEE INSTRUCTIONS ABOVE BEFORE USING THIS     RECENT
                         OPTION.                                      RECENT
----- 2016/3/10 - Partial Processing no longer allowed.               RECENT
     VARY   1-11   E11.4  ENERGY FOR FILE 2 ERROR LAW     (  SEE   )   RECENT
          12-22   E11.4  ERROR FOR FILE 2 ERROR LAW      (COMMENTS)   RECENT
                                                         ( BELOW  )   RECENT
                                                                      RECENT
     NOTE, THIS VERSION OF THE PROGRAM DOES NOT THIN THE COMBINED FILE RECENT
     FILE 2 + 3 DATA. AS SUCH THE ERROR LAW FOR COMBINING FILE 2 + 3   RECENT
     WHICH WAS REQUIRED IN EARLIER VERSIONS OF THIS CODE ARE NO LONGER RECENT
     REQUIRED.                                                        RECENT
                                                                      RECENT
     THE FILE 2 ERROR LAW MAY BE ENERGY INDEPENDENT (DEFINED BY A      RECENT
     SINGLE ERROR) OR ENERGY DEPENDENT (DEFINED BY UP TO 20 ENERGY,    RECENT
     ERROR PAIRS). FOR THE ENERGY DEPENDENT CASE LINEAR INTERPOLATION  RECENT
     WILL BE USED TO DEFINE THE ERROR AT ENERGIES BETWEEN THOSE AT     RECENT
     WHICH THE ERROR IS TABULATED. THE ERROR LAW IS TERMINATED BY A    RECENT
     BLANK LINE. IF ONLY ONE ENERGY, ERROR PAIR IS GIVEN THE LAW WILL  RECENT
     BE CONSIDERED TO BE ENERGY INDEPENDENT. IF MORE THAN ONE PAIR     RECENT
     IS GIVEN IT BE CONSIDERED TO BE ENERGY DEPENDENT (NOTE, THAT      RECENT
     FOR A CONSTANT ERROR THE ENERGY INDEPENDENT FORM WILL RUN FASTER. RECENT
     HOWEVER, FOR SPECIFIC APPLICATIONS AN ENERGY DEPENDENT ERROR MAY  RECENT
     BY USED TO MAKE THE PROGRAM RUN CONSIDERABLE FASTER).            RECENT
                                                                      RECENT
     ALL ENERGIES MUST BE IN ASCENDING ENERGY ORDER. FOR CONVERGENCE   RECENT
     OF THE FILE 2 RECONSTRUCTION ALGORITHM ALL THE ERRORS MUST BE     RECENT
     POSITIVE. IF ERROR IS NOT POSITIVE IT WILL BE SET EQUAL TO THE    RECENT
     STANDARD OPTION (CURRENTLY 0.001, CORRRESPONDING TO 0.1 PER-CENT).RECENT
     IF THE FIRST LINE OF THE ERROR LAW IS BLANK IT WILL TERMINATE THE RECENT
     ERROR LAW AND THE ERROR WILL BE TREATED AS ENERGY INDEPENDENT,    RECENT
     EQUAL TO THE STANDARD OPTION (CURRENTLY, 0.1 PER-CENT). SEE,      RECENT
     EXAMPLE INPUT 4.                                                 RECENT
                                                                      RECENT
     EXAMPLE INPUT NO. 1                                              RECENT
     -------------------                                              RECENT
     CONSIDER ALL URANIUM ISOTOPES AND TH-232. CONSIDER CROSS SECTIONS RECENT
     WHICH ARE LARGER THAN 1.0E-8 BARNS IN ABSOLUTE VALUE. ONLY OUTPUT RECENT
     REACTIONS FOR WHICH A BACKGROUND IS GIVEN. LIST ALL PARAMETERS ANDRECENT
     CALCULATE CROSS SECTIONS. MONITOR THE EXECUTION PROGRESS OF THE   RECENT
     PROGRAM. BETWEEN 0 AND 100 EV USE 0.1 PER-CENT ACCURACY. BETWEEN  RECENT
     100 EV AND 1 KEV VARY THE ACCURACY FROM 0.1 TO 1 PER-CENT. ABOVE  RECENT
     1 KEV USE 1 PER-CENT ACCURACY.                                   RECENT
                                                                      RECENT
     EXPLICITLY SPECIFY THE STANDARD FILENAMES.                       RECENT
                                                                      RECENT
     THE FOLLOWING 11 INPUT CARDS ARE REQUIRED.                       RECENT
```

```
                                                                      RECENT
         1 1.00000-08          0          1          0         1     RECENT
ENDFB.IN                                                              RECENT
ENDFB.OUT                                                             RECENT
     92000      92999                                                 RECENT
     90232                  (UPPER LIMIT AUTOMATICALLY SET TO 90232)  RECENT
                            (END REQUEST LIST)                        RECENT
0.00000+ 0 1.00000-03                                                 RECENT
1.00000+02 1.00000-03                                                 RECENT
1.00000+03 1.00000-02                                                 RECENT
1.00000+09 1.00000-02                                                 RECENT
                            (END FILE 2 ERROR LAW)                    RECENT
                                                                      RECENT
    EXAMPLE INPUT NO. 2                                               RECENT
    -------------------                                               RECENT
    CONSIDER ALL URANIUM ISOTOPES AND TH-232. CONSIDER CROSS SECTIONS RECENT
    WHICH ARE LARGER THAN 1.0E-8 BARNS IN ABSOLUTE VALUE. ONLY OUTPUT RECENT
    REACTIONS FOR WHICH A BACKGROUND IS GIVEN. CROSS SECTIONS WILL BE RECENT
    CALCULATED, BUT PARAMETERS WILL NOT BE LISTED. THE PROGRESS OF THERECENT
    PROGRAM WILL NOT BE MONITORED. USE 0.1 PER-CENT ACCURACY FOR ALL  RECENT
    ENERGIES. SINCE 0.1 PER-CENT IS THE STANDARD OPTION FOR THE ERROR RECENT
    LAW THE FIRST ERROR LAW LINE MAY BE LEFT BLANK.                   RECENT
                                                                      RECENT
    LEAVE THE DEFINITION OF THE FILENAMES BLANK - THE PROGRAM WILL    RECENT
    THEN USE THE STANDARD FILENAMES.                                  RECENT
                                                                      RECENT
    THE FOLLOWING 7 INPUT CARDS ARE REQUIRED.                         RECENT
                                                                      RECENT
         1 1.00000-08          0          0          0         0     RECENT
                                                                      RECENT
                                                                      RECENT
     92000      92999                                                 RECENT
     90232                  (UPPER LIMIT AUTOMATICALLY SET TO 90232)  RECENT
                            (END REQUEST LIST)                        RECENT
                            (USE STANDARD OPTION FOR ERROR LAW)       RECENT
                                                                      RECENT
    EXAMPLE INPUT NO. 3                                               RECENT
    -------------------                                               RECENT
    THE SAME AS EXAMPLE INPUT NO. 2, ONLY IN THIS CASE ONLY CALCULATE RECENT
    CROSS SECTIONS OVER THE ENERGY RANGE 0.01 TO 0.1 EV - ACROSS THE  RECENT
    THERMAL ENERGY RANGE. NOTE, THE ONLY DIFFERENCE BETWEEN THE INPUT RECENT
    PARAMETERS IN THIS CASE AND IN EXAMPLE NO. 2, IS THAT ON THE      RECENT
    SECOND INPUT LINE WE HAVE ADDED THE ENERGY RANGE 0.01 TO 0.1 EV.  RECENT
    USE \PREPRO94\LINEAR\ENDFB.OUT AS INPUT AND ENDFB.OUT AS OUTPUT - RECENT
    SINCE ENDFB.OUT IS THE STANDARD OUTPUT FILENAME THE NAME CAN BE   RECENT
    EITHER INCLUDED IN THE INPUT OR LEFT BLANK.                       RECENT
                                                                      RECENT
    THE FOLLOWING 7 INPUT CARDS ARE REQUIRED.                         RECENT
                                                                      RECENT
         1 1.00000-08          0          0          0         0     RECENT
\PREPRO94\LINEAR\ENDFB.OUT                                            RECENT
ENDFB.OUT                                                             RECENT
     92000      92999 1.00000- 2 1.00000- 1                           RECENT
     90232                  (UPPER LIMIT AUTOMATICALLY SET TO 90232)  RECENT
                            (END REQUEST LIST)                        RECENT
                            (USE STANDARD OPTION FOR ERROR LAW)       RECENT
                                                                      RECENT
    EXAMPLE INPUT NO. 4                                               RECENT
    -------------------                                               RECENT
    RECONSTRUCT ALL DATA. OUTPUT ALL REACTIONS, REGARDING OF WHETHER  RECENT
    OR NOT THERE IS A BACKGROUND CROSS SECTION. DO NOT MONITOR THE    RECENT
    PROGRESS OF THE PROGRAM. RECONSTRUCT CROSS SECTIONS TO 1 PER-CENT RECENT
    ACCURACY. USE \ENDFB6\LINEAR\ZA092238 AS INPUT AND                RECENT
    \ENDFB6\RECENT\ZA092238 AS OUTPUT.                                RECENT
                                                                      RECENT
    THE FOLLOWING 6 INPUT CARDS ARE REQUIRED.                         RECENT
                                                                      RECENT
         0 0.0                 1          0          0         0     RECENT
\ENDFB6\ZA092238                                                      RECENT
\ENDFB6\RECENT\ZA092238                                               RECENT
                     (RETRIEVE ALL DATA, END REQUEST LIST)            RECENT
```

```
       1.00000- 2                                                    RECENT
                 (END FILE 2 ERROR LAW)                              RECENT
                                                                     RECENT
EXAMPLE INPUT NO. 5                                                  RECENT
------------------                                                   RECENT
RECONSTRUCT ALL DATA. ONLY OUTPUT REACTIONS FOR WHICH A BACKGROUNDRECENT
CROSS SECTION IS GIVEN. DO NOT MONITOR THE PROGRESS OF THE PROGRAMRECENT
RECONSTRUCT CROSS SECTIONS TO 0.1 PER-CENT ACCURACY. USE ENDFB.IN RECENT
AS INPUT AND ENDFB.OUT AS OUTPUT.                                    RECENT
                                                                     RECENT
THIS CORRESPONDS TO USING ALL OF THE STANDARD OPTONS BUILT-IN TO     RECENT
THE PROGRAM AND ALL INPUT CARDS MAY BE BLANK.                        RECENT
                                                                     RECENT
IN THIS CASE THE FOLLOWING 5 INPUT CARDS ARE REQUIRED.               RECENT
(ZEROES ARE INDICATED ON THE FIRST LINE, BELOW, ONLY TO INDICATE     RECENT
WHERE THE LINE IS. THE ACTUAL INPUT LINE CAN BE COMPLETELY BLANK).RECENT
                                                                     RECENT
     0 0.0               0          0          0         0          RECENT
                 (USE STANDARD INPUT FILENAME = ENDFB.IN)            RECENT
                 (USE STANDARD OUTPUT FILENAME = ENDFB.OUT)          RECENT
                 (RETRIEVE ALL DATA, END REQUEST LIST)               RECENT
                 (0.1 ERROR, END FILE 2 ERROR LAW)                   RECENT
                                                                     RECENT
=====================================================================RECENT
```