**======================================================================= 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 OPTION Recent**

**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 RECONSTRUCTED Recent**

**AND BACKGROUND ENERGY POINTS. Recent**

**\*ADDED STANDARD ALLOWABLE ERROR OPTIONS Recent**

**(CURRENTLY 0.1 PER-CENT RECONSTRUCTION Recent**

**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-VI 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 FOR Recent**

**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-VI FORMAT Recent**

**TO BE THE SAME AS REICH-MOORE FORMAT Recent**

**IN EARLIER VERSIONS OF ENDF/B FORMAT. Recent**

**\*CHECK FOR PRELIMINARY ENDF/B-VI 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 THE Recent**

**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**

**IMPOSSIBLE TO ADEQUATELY TEST THAT Recent**

**THE CODING FOR THIS FORMALISM IS Recent**

**CORRECT). Recent**

**\*INCREASED MAXIMUM NUMBER OF RESONANCES Recent**

**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 SECTIONS Recent**

**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-VI 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 RESONANCE Recent**

**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 ROUNDING Recent**

**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-VI FORMATS AND Recent**

**PROCEDURES MANUAL, PAGE 2.6) Recent**

**\*INCREASED PAGE SIZE FROM 4008 TO Recent**

**20040 DATA POINTS. Recent**

**\*INCREASED MAXIMUM NUMBER OF RESONANCES Recent**

**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 ADDJ 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 RESONANCES Recent**

**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 CHANGE Recent**

**\*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 FORMALISM Recent**

**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 FOR Recent**

**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 ITERATION Recent**

**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 FOR Recent**

**ALL TYPES OF PARAMETERS - EARLIER Recent**

**ONLY DEFINED FOR B-W PARAMETERS. Recent**

**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 IF Recent**

**PRESENT, THE GROUND LEVEL, MT = 600 Recent**

**THROUGH 800. IF COMPETITIVE CHANNEL Recent**

**IS mt=4 (TOTAL N.N') IT WILL ALSO ADD Recent**

**COMPETITIVE RESONANCE CONTRIBUTION TO Recent**

**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 CALCULATION Recent**

**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 - USE Recent**

**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 computers Recent**

**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 code Recent**

**users. Recent**

**\*All floating input parameters changed Recent**

**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**

**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**

**Recent**

**ORIGINALLY WRITTEN BY Recent**

**------------------------------------ Recent**

**Dermott E. Cullen Recent**

**Recent**

**PRESENT CONTACT INFORMATION Recent**

**--------------------------- Recent**

**Dermott E. Cullen Recent**

**1466 Hudson Way Recent**

**Livermore, CA 94550 Recent**

**U.S.A. Recent**

**Telephone 925-443-1911 Recent**

**E. Mail RedCullen1@Comcast.net Recent**

**Website RedCullen1.net/HOMEPAGE.NEW 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 CONSIDERED Recent**

**THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASE Recent**

**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 COMPUTER Recent**

**INDEPENDENT PROGRAMS THAT CAN EASILY BE IMPLEMENTED ON ANY ONE Recent**

**OF A WIDE VARIETY OF COMPUTERS. IN ORDER TO ASSIST IN THIS PROJECT Recent**

**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 CONTRIBUTION Recent**

**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 RANGE Recent**

**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 RESONANCE Recent**

**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 Recent**

**TAPE--WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE TAPE, CARDS, Recent**

**DISK OR ANY OTHER MEDIUM. Recent**

**Recent**

**PROCESSING DATA IN THE ENDF/B-VI FORMAT Recent**

**================================================================== Recent**

**IT HAS NOW BEEN CONFIRMED (PRIVATE COMMUNICATION, CHARLES DUNFORD, Recent**

**APRIL, 1991) THAT THE PROPER PROCEDURE TO FOLLOW WHEN THERE ARE Recent**

**MISSING OR DUPLICATE J VALUES IS TO IN ALL CASES ADD A SEQUENCE Recent**

**WITH NO RESONANCES TO ACCOUNT FOR THE CONTRIBUTION OF THE SEQUENCE Recent**

**TO THE POTENTIAL SCATTERING CROSS SECTION. Recent**

**Recent**

**THIS IS THE PROCEDURE WHICH WAS FOLLOWED BY ALL VERSIONS OF RECENT Recent**

**SINCE 86-3 AND WILL CONTINUE TO BE THE PROCEDURE. Recent**

**Recent**

**INPUT ENDF/B FORMAT AND CONVENTIONS Recent**

**================================================================== Recent**

**ENDF/B FORMAT Recent**

**------------- Recent**

**THIS PROGRAM ONLY USES THE ENDF/B BCD OR LINE IMAGE FORMAT (AS Recent**

**OPPOSED TO THE BINARY FORMAT) AND CAN HANDLE DATA IN ANY VERSION Recent**

**OF THE ENDF/B FORMAT (I.E., ENDF/B-I, II,III, IV, V OR VI FORMAT). Recent**

**Recent**

**IT IS ASSUMED THAT THE DATA IS CORRECTLY CODED IN THE ENDF/B Recent**

**FORMAT AND NO ERROR CHECKING IS PERFORMED. IN PARTICULAR IT IS Recent**

**ASSUMED THAT THE MAT, MF AND MT ON EACH LINE IS CORRECT. SEQUENCE Recent**

**NUMBERS (COLUMNS 76-80) ARE IGNORED ON INPUT, BUT WILL BE Recent**

**CORRECTLY OUTPUT ON ALL CARDS. THE FORMAT OF SECTION MF=1, MT=451 Recent**

**AND ALL SECTIONS OF MF=2 AND 3 MUST BE CORRECT. THE PROGRAM COPIES Recent**

**ALL OTHER SECTION OF DATA AS HOLLERITH AND AS SUCH IS INSENSITIVE Recent**

**TO THE CORRECTNESS OR INCORRECTNESS OF ALL OTHER SECTIONS. Recent**

**Recent**

**ENDF/B FORMAT VERSION Recent**

**--------------------- Recent**

**THE FORMATS AND CONVENTIONS FOR READING AND INTERPRETING THE DATA Recent**

**VARIES FROM ONE VERSION OF ENDF/B TO THE NEXT. HOWEVER, IF THE Recent**

**HOLLERITH SECTION (MF=1, MT=451) IS PRESENT IT IS POSSIBLE FOR Recent**

**THIS PROGRAM TO DISTINGUISH BETWEEN DATA IN THE ENDF/B-IV, V AND Recent**

**VI FORMATS AND TO USE THE APPROPRIATE CONVENTIONS FOR EACH Recent**

**ENDF/B VERSION (SEE, SUBROUTINE FILE1 FOR A DESCRIPTION OF HOW Recent**

**THIS IS DONE). IF THE HOLLERITH SECTION IS NOT PRESENT THE Recent**

**PROGRAM WILL ASSUME THE DATA IS IN THE ENDF/B-VI FORMAT AND USE Recent**

**ALL CONVENTIONS APPROPRIATE TO ENDF/B-V. USERS ARE ENCOURAGED TO Recent**

**INSURE THAT THE HOLLERITH SECTION (MF=1, MT=451) IS PRESENT IN Recent**

**ALL EVALUATIONS. Recent**

**Recent**

**INPUT OF ENERGIES Recent**

**----------------- Recent**

**ALL ENERGIES ARE READ IN DOUBLE PRECISION (BY SPECIAL FORTRAN I/O Recent**

**ROUTINES) AND ARE TREATED IN DOUBLE PRECISION IN ALL CALCULATIONS. Recent**

**Recent**

**OUTPUT ENDF/B FORMAT AND CONVENTIONS Recent**

**================================================================== Recent**

**CONTENTS OF OUTPUT Recent**

**------------------ Recent**

**ENTIRE EVALUATIONS ARE OUTPUT, NOT JUST THE RECONSTRUCTED FILE Recent**

**3 CROSS SECTIONS, E.G. ANGULAR AND ENERGY DISTRIBUTIONS ARE Recent**

**ALSO INCLUDED. Recent**

**Recent**

**DOCUMENTATION Recent**

**------------- Recent**

**THE FACT THAT THIS PROGRAM HAS OPERATED ON THE DATA IS DOCUMENTED Recent**

**BY THE ADDITION OF COMMENT CARDS AT THE END OF EACH HOLLERITH Recent**

**SECTION IN THE FORM Recent**

**Recent**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* RECENT (VERSION 2017-1) \*\*\*\*\*\*\*\*\*\*\*\*\*\*\* Recent**

**RESONANCE CONTRIBUTION RECONSTRUCTED TO WITHIN 0.100 PER-CENT Recent**

**COMBINED DATA NOT THINNED (ALL RESONANCE + BACKGROUND DATA KEPT) Recent**

**Recent**

**THE ORDER OF ALL SIMILAR COMMENTS (FROM LINEAR, SIGMA1 AND GROUPY) Recent**

**REPRESENTS A COMPLETE HISTORY OF ALL OPERATIONS PERFORMED ON Recent**

**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 FORMAT Recent**

**OF THE HOLLERITH SECTION IN ENDF/B-V 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 WAS Recent**

**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 PROGRAM Recent**

**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 RESONANCE Recent**

**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 SECTIONS Recent**

**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 DEFINITION Recent**

**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 EXPLICITLY Recent**

**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 WILL Recent**

**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 EVALUATIONS Recent**

**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**

**Recent**

**RESOLVED REGION Recent**

**--------------- Recent**

**IN THE RESOLVED REGION THE RESOLVED PARAMETERS ARE USED TO Recent**

**CALCULATE COLD (0 KELVIN), LINEARLY INTERPOLABLE, ENERGY DEPENDENT Recent**

**CROSS SECTIONS. Recent**

**Recent**

**SCATTERING RADIUS Recent**

**----------------- Recent**

**FOR SINGLE OR MULTI LEVEL BREIT-WIGNER PARAMETERS THE SCATTERING Recent**

**RADIUS MAY BE SPECIFIED IN EITHER ENERGY INDEPENDENT (CONSTANT) Recent**

**OR ENERGY DEPENDENT FORM (A TABLE OF ENERGY VS. RADIUS AND AN Recent**

**ASSOCIATED INTERPOLATION LAW). IN ALL OTHER CASE ONLY AN ENERGY Recent**

**INDEPENDENT SCATTERING RADIUS IS ALLOWED. Recent**

**Recent**

**FOR ANY ONE MATERIAL (I.E. MAT) IF ENERGY DEPENDENT SCATTERING Recent**

**RADII ARE GIVEN THE TOTAL NUMBER OF INTERPOLATION REGIONS AND Recent**

**TABULATED VALUES FOR THE ENTIRE MATERIAL CANNOT EXCEED, Recent**

**200 - INTERPOLATION REGIONS Recent**

**500 - TABULATED VALUES Recent**

**IF THESE LIMITS ARE EXCEEDED THE PROGRAM WILL PRINT AN ERROR Recent**

**MESSAGE AND TERMINATE. Recent**

**Recent**

**IF YOU REQUIRE A LARGER NUMBER OF INTERPOLATION REGION AND/OR Recent**

**TABULATED VALUES, Recent**

**(1) INTERPOLATION REGIONS - INCREASE THE DIMENSION OF NBTRHO AND Recent**

**INTRHO IN COMMON/TABRHO/ THROUGHOUT THE PROGRAM AND CHANGE MAXSEC Recent**

**IN SUBROUTINE RDAP (MAXSEC = MAXIMUM NUMBER OF INTERPOLATION Recent**

**REGIONS). Recent**

**(2) TABULATED VALUES - INCREASE THE DIMENSION OF ERHOTB, RHOTAB Recent**

**AND APTAB IN COMMON/TABRHO/ THROUGHOUT THE PROGRAM AND CHANGE Recent**

**MAXRHO IN SUBROUTINE RDAP (MAXRHO = MAXIMUM NUMBER OF TABULATED Recent**

**VALUES). Recent**

**Recent**

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

**------------------------------------------------------------ Recent**

**CROSS SECTIONS FOR REICH-MOORE PARAMETERS ARE CALCULATED ACCORDING Recent**

**TO THE EQUATION (1) - (8) OF SECTION D.1.3 OF ENDF-102. IN ORDER Recent**

**TO CALCULATE CROSS SECTIONS FROM MULTI-LEVEL PARAMETERS IN A Recent**

**REASONABLE AMOUNT OF TIME THIS PROGRAM EXPRESSES THE CROSS SECTION Recent**

**IN TERMS OF A SINGLE SUM OVER RESONANCES (SEE, ENDF-102, SECTION Recent**

**D.1.2, EQUATIONS 6-7), RATHER THAN AS A DOUBLE SUM (SEE, ENDF-102 Recent**

**SECTION D.1.2, EQUATION 1-2). IN ORDER FOR THE ENDF-102 EQUATIONS Recent**

**TO BE CORRECT THE PARAMETERS MUST MEET THE FOLLOWING CONDITIONS, Recent**

**Recent**

**(1) FOR EACH L STATE ALL PHYSICALLY POSSIBLE J SEQUENCES MUST BE Recent**

**PRESENT. ONLY IN THIS CASE WILL THE CONTRIBUTIONS OF THE Recent**

**INDIVIDUAL J SEQUENCES ADD UP TO PRODUCE THE CORRECT POTENTIAL Recent**

**SCATTERING CONTRIBUTION FOR THE L STATE (SEE, ENDF-102, Recent**

**SECTION D.1.2, EQUATIONS 6-7). IF ANY J SEQUENCE IS MISSING Recent**

**THE PROGRAM WILL PRINT A WARNING AND ADD THE J SEQUENCE WITH Recent**

**NO RESONANCE PARAMETERS IN ORDER TO ALLOW THE POTENTIAL Recent**

**SCATTERING TO BE CALCULATED CORRECTLY (THIS IS EQUIVALENT TO Recent**

**ASSUMING THAT THE EVALUATOR REALIZES THAT ALL J SEQUENCES MUST Recent**

**BE AND ARE PRESENT AND THAT THE EVALUATION STATES THAT THERE Recent**

**ARE NO RESONANCES WITH CERTAIN PHYSICALLY POSSIBLE J VALUES... Recent**

**IN THIS CASE POTENTIAL CONTRIBUTION MUST STILL BE CONSIDERED). Recent**

**Recent**

**EXAMPLE Recent**

**======= Recent**

**AN EXAMPLE OF WHERE THIS OCCURS AND IS IMPORTANT TO CONSIDER Recent**

**IS U-238 IN ENDF/B-IV AND V LIBRARIES WHERE FOR L=1 THERE IS Recent**

**ONLY A J=1/2 SEQUENCE. NOT INCLUDING THE J=3/2 SEQUENCE LEADS Recent**

**TO UNDERESTIMATING THE POTENTIAL SCATTERING AND PRODUCES Recent**

**MINIMA IN THE ELASTIC CROSS SECTION WHICH ARE AN ORDER OF Recent**

**MAGNITUDE LOWER THAN THE CROSS SECTIONS OBTAINED BE INCLUDING Recent**

**THE J=3/2 SEQUENCE. Recent**

**Recent**

**(2) FOR A GIVEN TARGET SPIN AND L VALUE THERE MAY BE 2 POSSIBLE Recent**

**MEANS OF OBTAINING THE SAME J VALUE. WHEN THIS OCCURS IN Recent**

**ORDER TO CALCULATE THE CORRECT POTENTIAL SCATTERING CROSS Recent**

**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 THAT Recent**

**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 EACH Recent**

**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 CALCULATE Recent**

**ENERGY DEPENDENT CROSS SECTIONS. ONLY AVERAGES OR DISTRIBUTIONS Recent**

**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 CONVENTION Recent**

**USED IN ENDF/B-IV AND EARLIER VERSIONS OF ENDF/B. THE ENDF/B-V 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 RESULTS Recent**

**DEPENDING ON WHICH OF THE THREE ENDF/B UNRESOLVED PARAMTER FORMATS Recent**

**IS USED. FOR EXAMPLE, GIVEN A SET OF ENERGY INDEPENDENT UNRESOLVED Recent**

**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-V CONVENTION TO INTERPOLATE CROSS SECTIONS CAN Recent**

**LEAD TO THREE COMPLETELY DIFFERENT RESULTS. IN CONTRAST USING THE Recent**

**ENDF/B-IV 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 PARAMETERS Recent**

**CAN BE UNIQUELY REPRESENTED IN THE ALL PARAMETERS ENERGY DEPENDENT Recent**

**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-WIDTHS Recent**

**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**

**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 REACTIONS Recent**

**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 SEPARATELY Recent**

**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**

**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 2017-1) \*\*\*\*\*\*\*\*\*\*\*\*\* Recent**

**ONLY PROCESS 0.00000+ 0 TO 3.00000+ 3 EV Recent**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROGRAM RECENT (VERSION 2017-1) \*\*\*\*\*\*\*\*\*\*\*\*\* Recent**

**ONLY PROCESS 3.00000+ 3 TO 1.00000+ 4 EV Recent**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROGRAM RECENT (VERSION 2017-1) \*\*\*\*\*\*\*\*\*\*\*\*\* Recent**

**ONLY PROCESS 1.00000+ 4 TO 8.00000+ 4 EV Recent**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROGRAM RECENT (VERSION 2017-1) \*\*\*\*\*\*\*\*\*\*\*\*\* 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**

**---- ---------- 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 EVALUATION Recent**

**(E.G. ENDF/B-V 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 PARAMETERS Recent**

**= 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 ALL Recent**

**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 AND Recent**

**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 THE Recent**

**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 BACKGROUND Recent**

**CROSS SECTION IS GIVEN. DO NOT MONITOR THE PROGRESS OF THE PROGRAM Recent**

**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**