======================================================================= 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

 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 http://home.comcast.net/~redcullen1 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 2015-1) \*\*\*\*\*\*\*\*\*\*\*\*\*\*\* 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

 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 2015-1) \*\*\*\*\*\*\*\*\*\*\*\*\* Recent

 ONLY PROCESS 0.00000+ 0 TO 3.00000+ 3 EV Recent

 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROGRAM RECENT (VERSION 2015-1) \*\*\*\*\*\*\*\*\*\*\*\*\* Recent

 ONLY PROCESS 3.00000+ 3 TO 1.00000+ 4 EV Recent

 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROGRAM RECENT (VERSION 2015-1) \*\*\*\*\*\*\*\*\*\*\*\*\* Recent

 ONLY PROCESS 1.00000+ 4 TO 8.00000+ 4 EV Recent

 \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROGRAM RECENT (VERSION 2015-1) \*\*\*\*\*\*\*\*\*\*\*\*\* 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

 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

 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

 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

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