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

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	IMPOSSIBLE TO ADEQUATELY TEST THAT	RECENT
	THE CODING FOR THIS FORMALISM IS	RECENT
	CORRECT).	RECENT
	*INCREASED MAXIMUM NUMBER OF 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-6	RECENT
	CONVENTION TO ALLOW UNRESOLVED	RECENT
	RESONANCE CONTRIBUTION TO ALREADY	RECENT
	BE INCLUDED IN THE FILE 3 CROSS	RECENT
	SECTIONS (INFINITELY DIULUTE	RECENT
	CONTRIBUTION).	RECENT
VERSION 90-1 (JUNE 1990)	*UPDATED BASED ON USER COMMENTS	RECENT
	*ADDED FORTRAN SAVE OPTION	RECENT
	*NEW MORE CONSISTENT ENERGY OUTPUT	RECENT
	ROUTINE	RECENT
VERSION 91-1 (JULY 1991)	*NEW UNIFORM TREATMENT OF ALL 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-6 FORMATS AND	RECENT
	PROCEDURES MANUAL, PAGE 2.6)	RECENT
	*INCREASED PAGE SIZE FROM 4008 TO	RECENT
	20040 DATA POINTS.	RECENT
	*INCREASED MAXIMUM NUMBER OF 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 ADDL FOR ENERGY DEPENDENT	RECENT

	(TABULATED) SCATTERING RADIUS CASE.	RECENT
VERSION 96-1 (JANUARY 1996)	*COMPLETE RE-WRITE	RECENT
	*IMPROVED COMPUTER INDEPENDENCE	RECENT
	*ALL DOUBLE PRECISION	RECENT
	*ON SCREEN OUTPUT	RECENT
	*UNIFORM TREATMENT OF ENDF/B I/O	RECENT
	*IMPROVED OUTPUT PRECISION	RECENT
	*ALWAYS INCLUDE THERMAL VALUE	RECENT
	*DEFINED SCRATCH FILE NAMES	RECENT
VERSION 97-1 (APRIL 1997)	*OPTIONAL MAKE NEGATIVE CROSS	RECENT
	SECTION = 0 FOR OUTPUT	RECENT
	*INCREASED PAGE SIZE FROM 20040 TO	RECENT
	120000 DATA POINTS.	RECENT
	*INCREASED MAXIMUM NUMBER OF 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)	<ul style="list-style-type: none"> <li>*CORRECTED NRO/NAPS=1/1 - MUST RECENT</li> <li>DEFINE RHOX2 AT EACH RESONANCE USING RECENT</li> <li>SETRH01 BEFORE ENERGY DEPENDENT RECENT</li> <li>CALCULATION. RECENT</li> <li>*ADDED PRECISION TO RESONANCE PROFILE RECENT</li> <li>IN SUBROUTINE SUBINT RECENT</li> </ul>
VERS. 2009-1 (JULY 2009)	<ul style="list-style-type: none"> <li>*NEW REICH-MOORE COMPETITIVE WIDTHS - RECENT</li> <li>IF CHARGED PARTICLE REACTION (MT=103 RECENT</li> <li>THROUGH 107) WILL ADD RESONANCE RECENT</li> <li>CONTRIBUTION TO COMPETITIVE MT AND IFRECENT</li> <li>PRESENT, THE GROUND LEVEL, MT = 600 RECENT</li> <li>THROUGH 800. IF COMPETITIVE CHANNEL RECENT</li> <li>IS mt=4 (TOTAL N.N') IT WILL ALSO ADDRECENT</li> <li>COMPETITIVE RESONANCE CONTRIBUTION TORECENT</li> <li>MT=50 (N,N' GROUND). RECENT</li> <li>*NEW REICH-MOORE - SUM COMPETITIVE RECENT</li> <li>WIDTHS IF ALL FOR THE SAME STATE (MT)RECENT</li> </ul>
VERS. 2009-2 (AUG. 2009)	<ul style="list-style-type: none"> <li>*RE-WRITE TO USE 12, RATHER THAN 6, RECENT</li> <li>PARAMETERS PER RESONANCE. RECENT</li> <li>*MAJOR RE-WRITE TO ACCOMODATE GENERAL RECENT</li> <li>REICH-MOORE (LRF=7). RECENT</li> <li>*COMPLETE RE-WRITE FOR ADLER-ADLER RECENT</li> <li>AND HRF (N O LONGER USED IN ENDF/B) RECENT</li> <li>TO USE 12 PARAMETERS PER RESNANCE. RECENT</li> </ul>
VERS. 2010-1 (April 2010)	<ul style="list-style-type: none"> <li>*ADDED SAMRML LOGIC TO HANDLE ALL RECENT</li> <li>LRF=7 CASES. RECENT</li> <li>*EXTENDED SAMRML LOGIC TO PROCESS ALL RECENT</li> <li>EVALUATIONS = RESOLVED + UNRESOLVED +RECENT</li> <li>TABULATED - SAMRML ONLY DOES ONE RECENT</li> <li>SECTION OF RESOLVED LRF=7 DATA RECENT</li> <li>WITHOUT TABULATED BACKGROUND. RECENT</li> <li>*UPDATED ELASTIC POTENTIAL CALCULATIONRECENT</li> <li>FOR TOTAL (SLBW) AND CORRECTION FOR RECENT</li> <li>MISSING SEQUENCES (MLBW, RM, HRF). RECENT</li> <li>*ADDED HIDDEN (OPTIONAL) UNRESOLVED RECENT</li> <li>COMPETITION LISTING (NOT ENDF/B). RECENT</li> <li>*ADDED BOB MACFARLANE'S PROPOSAL - USERCENT</li> <li>LRX TO DEFINE COMPETITIVE L VALUE - RECENT</li> <li>COMPETITIVE L = LRX - 1, IF LRX &gt; 0. RECENT</li> <li>*CHECKED FOR NEGATIVE WIDTHS. RECENT</li> </ul>
VERS. 2012-1 (Nov. 2012)	<ul style="list-style-type: none"> <li>*ADDED ENERGY DEPENDENT STEP SIZE RECENT</li> <li>FOR STARTING GRID AROUND RESONANCES. RECENT</li> <li>*Added CODENAME RECENT</li> <li>*32 and 64 bit Compatible RECENT</li> <li>*Added ERROR stops RECENT</li> <li>*Check for no capture for Reich-Moore. RECENT</li> </ul>
VERS. 2012-2 (Nov. 2012)	<ul style="list-style-type: none"> <li>*Eliminated ERROR in NHIGH(0) index. RECENT</li> </ul>
VERS. 2013-1 (Nov. 2013)	<ul style="list-style-type: none"> <li>*Extended OUT9. RECENT</li> </ul>
VERS. 2015-1 (Jan. 2015)	<ul style="list-style-type: none"> <li>*Multiple LRF=7, General Reich-Moore RECENT</li> <li>Resonance Regions. RECENT</li> <li>*Added OUT10. RECENT</li> <li>*Replaced ALL 3 way IF Statements. RECENT</li> <li>*Replaced ALL LOGICAL by INTEGER. RECENT</li> </ul>
VERS. 2016-1 (Jan. 2016)	<ul style="list-style-type: none"> <li>*Do not Change LSSF during the RECENT</li> <li>reconstrction - for compatibility RECENT</li> <li>with later URR treatment. RECENT</li> <li>*Insured that all ERROR stops print RECENT</li> <li>a message explaining why the code RECENT</li> <li>stopped. RECENT</li> <li>*Partial Energy Range Processing RECENT</li> <li>no longer allowed - today's computersRECENT</li> <li>are so fast that this option is now RECENT</li> <li>out-of-date and no longer allowed. RECENT</li> <li>*L-Value dependent fission = Earlier RECENT</li> <li>was done only by entire isotope. RECENT</li> <li>*Denser Starting Energy Grid. RECENT</li> </ul>
VERS. 2017-1 (May 2017)	<ul style="list-style-type: none"> <li>*Corrected ERROR in LRF=3 treatment. RECENT</li> <li>This ERROR only existed in version RECENT</li> <li>2016-1, which was never released to RECENT</li> <li>the general public, so it will not RECENT</li> <li>effect any results calculated by codeRECENT</li> </ul>

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



DISK OR ANY OTHER MEDIUM. RECENT

PROCESSING DATA IN THE ENDF/B-6 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 SEQUENCERECENT  
TO THE POTENTIAL SCATTERING CROSS SECTION. RECENT

THIS IS THE PROCEDURE WHICH WAS FOLLOWED BY ALL VERSIONS OF RECENTRECENT  
SINCE 86-3 AND WILL CONTINUE TO BE THE PROCEDURE. 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-1, 2, 3, 4, 5, 6 FORMAT). 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 COPIESRECENT  
ALL OTHER SECTION OF DATA AS HOLLERITH AND AS SUCH IS INSENSITIVE RECENT  
TO THE CORRECTNESS OR INCORRECTNESS OF ALL OTHER SECTIONS. 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-4, 5 AND RECENT  
6 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-6 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

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

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

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 (VERSION 2021-1) \*\*\*\*\* RECENT  
RESONANCE CONTRIBUTION RECONSTRUCTED TO WITHIN 0.100 PER-CENT RECENT  
COMBINED DATA NOT THINNED (ALL RESONANCE + BACKGROUND DATA KEPT) 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-5 DIFFERS FROM THE THAT OF RECENT  
EARLIER VERSIONS OF ENDF/B. BY READING AN EXISTING MF=1, MT=451 RECENT  
IT IS POSSIBLE FOR THIS PROGRAM TO DETERMINE WHICH VERSION OF RECENT  
THE ENDF/B FORMAT THE DATA IS IN. WITHOUT HAVING A SECTION OF RECENT  
MF=1, MT=451 PRESENT IT IS IMPOSSIBLE FOR THIS PROGRAM TO RECENT  
DETERMINE WHICH VERSION OF THE ENDF/B FORMAT THE DATA IS IN, AND RECENT  
AS SUCH IT IS IMPOSSIBLE FOR THE PROGRAM TO DETERMINE WHAT FORMAT RECENT  
SHOULD BE USED TO CREATE A HOLLERITH SECTION. RECENT

#### REACTION INDEX

-----  
THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN RECENT  
SECTION MF=1, MT=451 OF EACH EVALUATION. 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

#### OUTPUT FORMAT OF ENERGIES

-----  
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

#### ACCURACY OF ENERGY

-----  
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

#### OUTPUT OF RESONANCE PARAMETERS

-----  
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

(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

(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

#### UNIFORM TREATMENT OF RESONANCE FORMALISMS



```

=====RECENT
NORMALIZATION RECENT
===== RECENT
ALL OF THE RESONANCE FORMALISMS INCLUDE A FACTOR OF, RECENT
PI*(FRACTIONAL ABUNDANCE)/(K**2) 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
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
SIMILARITIES RECENT
===== RECENT
FOR THE RESOLVED RESONANCE REGION, EXCEPT FOR SINGLE LEVEL BREIT RECENT
WIGNER, PARAMETERS ALL OF THE FORMALISMS DEFINE THE CROSS SECTIONSRECENT
IN AN EQUIVALENT FORM, RECENT
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
SINCE THE FIRST TERM IS THE TOTAL, THE SECOND TERM MUST BE RECENT
ABSORPTION. SO WE FIND, RECENT
ABSORPTION = GJ*(1 - (REAL(U)**2 + IM(U)**2)) RECENT
IN ALL CASES U IS DEFINED IN THE FORM, RECENT
U = EXP(-I*2*PS)*((1-X) - I*Y) RECENT
WHERE (X) AND (Y) ARE RELATED TO THE SYMMETRIC AND ANTI-SYMMETRIC RECENT
CONTRIBUTIONS OF THE RESONANCES, RESPECTIVELY. ONLY THE DEFINITIONRECENT
OF (X) AND (Y) WILL BE DIFFERENT FOR EACH RESONANCE FORMALISM. RECENT
BELOW WE WILL SHOW THAT WHAT MIGHT APPEAR TO BE A STRANGE CHOICE RECENT
OF DEFINITION OF THE SIGN OF (X) AND(Y) HAS BEEN SELECTED SO THAT RECENT
FOR BREIT-WIGNER PARAMETERS (X) AND (Y) CORRESPOND EXACTLY TO THE RECENT
SYMMETRIC AND ANTI-SYMMETRIC CONTRIBUTION OF THE RESONANCES. RECENT
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
REAL(U) = ((1-X)*COS(2*PS) - Y*SIN(2*PS)) RECENT
IM(U) = -((1-X)*SIN(2*PS) + Y*COS(2*PS)) 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
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
SUM = (1-X)**2 + (Y)**2 RECENT
WE NOW HAVE ALL THE QUANTITIES THAT WE NEED TO DEFINE THE CROSS RECENT
SECTIONS, 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
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



$$Y^{**2} = (GAM(N))^{**2} * ((E-ER))^{**2} / (DEN)^{**2} + (L-L)$$

$$X^{**2} + Y^{**2} = GAM(N)^{**2} * DEN / (DEN)^{**2} = GAM(N)^{**2} / DEN + (L-L)$$

TO SEE THE EFFECT OF INCLUDING MULTI-LEVEL INTERFERENCE WE CAN CONSIDER OUR GENERAL EXPRESSION FOR ABSORPTION,

$$ABSORPTION = GJ * (2 * X - ((X)^{**2} + (Y)^{**2}))$$

AND NOTE THAT FOR BOTH SINGLE AND MULTI-LEVEL BREIT WIGNER THE ENDF-102 SAYS TO TREAT ABSORPTION IN A SINGLE LEVEL APPROXIMATION I.E., IGNORE LEVEL-LEVEL INTERFERENCE. IF ALL INTERFERENCE IS IGNORED THIS IS EQUIVALENT TO COMPLETELY IGNORING  $X^{**2} + Y^{**2}$  AND DEFINING,

$$ABSORPTION = GJ * 2 * X$$

$$= 2 * GJ * GAM(N) * GAM(T) / DEN$$

WHICH IS INCORRECT - SINCE THIS SEEMS TO INDICATE EVERYTHING IS ABSORBED. IN ORDER TO OBTAIN THE CORRECT EXPRESSION WE CANNOT COMPLETELY IGNORE INTERFERENCE - WE CAN IGNORE LEVEL-LEVEL INTERFERENCE, BUT WE MUST INCLUDE LEVEL-SELF INTERFERENCE,

$$X^{**2} + Y^{**2} = GAM(N)^{**2} / DEN$$

$$ABSORPTION = GJ * (2 * X - ((X)^{**2} + (Y)^{**2}))$$

$$= GJ * GAM(N) * (GAM(T) - GAM(N)) / DEN$$

$$= GJ * GAM(N) * GAM(A) / DEN$$

**SUMMARY**  
 =====

AN IMPORTANT POINT TO NOTE IS THE DEFINITION OF (X) AND (Y) WHICH IN ALL CASES WILL CORRESPOND TO THE SYMMETRIC AND ANTI-SYMMETRIC CONTRIBUTION OF THE RESONANCES. IN PARTICULAR DEFINING (U) IN TERMS OF (1-X) INSTEAD OF (X) IS EXTREMELY IMPORTANT. NOTE, THAT THE DEFINITION OF THE ELASTIC AND ABSORPTION ONLY INVOLVE (X), NOT (1-X). FAR FROM RESONANCES (X) CAN BE EXTREMELY SMALL, THEREFORE (1-X) WILL BE VERY CLOSE TO (1). IF THE CALCULATION PROCEEDS BY FIRST CALCULATING (1-X) AND THEN DEFINING (X) BY SUBTRACTING (1), EXTREME ROUND-OFF PROBLEMS CAN RESULT. THESE PROBLEMS CAN BE AVOIDED BY IN ALL CASES DEFINING (X) DIRECTLY, WITHOUT ANY DIFFERENCES.

IN EACH FORMALISM THE DEFINITION OF (X) AND (Y) MAY BE DIFFERENT BUT ONCE WE HAVE DEFINED (X) AND (Y) WE CAN IMMEDIATELY WRITE THE CROSS SECTIONS USING A UNIFORM DEFINITION,

$$ELASTIC = GJ * (2 * SIN(PS)^{**2} - X)^{**2} + (SIN(2 * PS) + Y)^{**2}$$

$$ABSORPTION = -GJ * (2 * X + (X)^{**2} + (Y)^{**2})$$

AND DEFINE THE TOTAL AS THE SUM OF THESE 2 PARTS.

**RELATIONSHIP TO SINGLE LEVEL**  
 =====

HOW DO THE SINGLE AND MULTI-LEVEL FORMALISMS COMPARE. TO SEE, STARTING FROM OUR GENERAL DEFINITION OF THE ELASTIC IN THE FORM,

$$ELASTIC = GJ * (2 * SIN(PS)^{**2} + X)^{**2} + (SIN(2 * PS) + Y)^{**2}$$

$$= GJ * (4 * SIN(PS)^{**4} - 4 * X * SIN(PS)^{**2} + X^{**2} + SIN(2 * PS)^{**2} + 2 * Y * SIN(2 * PS) + Y^{**2})$$

$$= 4 * GJ * SIN(PS)^{**2} + GJ * (X^{**2} + Y^{**2} - 4 * X * SIN(PS)^{**2} + 2 * Y * SIN(2 * PS))$$

AND OUR SPECIFIC DEFINITIONS OF (X) AND (Y) FOR MULTI-LEVEL BREIT-WIGNER PARAMETERS,

$$X = GAM(N) * GAM(T) / 2 / DEN$$

$Y = \text{GAM}(N) * (E-ER) / \text{DEN}$  RECENT  
 $\text{DEN} = ((E-ER)**2 + (\text{GAM}(T)/2)**2)$  RECENT  
 $X**2+Y**2 = \text{GAM}(N)**2/\text{DEN} + (L-L)$  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  
 $\text{ELASTIC} = 4 * \text{GJ} * \text{SIN}(PS)**2 +$  RECENT  
 $\text{GJ} * \text{GAM}(N) * (\text{GAM}(N)$  RECENT  
 $\quad - 2 * \text{GAM}(T) * \text{SIN}(PS)**2$  RECENT  
 $\quad + 2 * (E-ER) * \text{SIN}(2*PS)) / \text{DEN}$  RECENT  
RECENT  
WHICH IS THE FORM THAT IT APPEARS IN ENDF-102, EXCEPT FOR TWO RECENT  
TYPOGRAPHICAL ERRORS IN THE SECOND TERM, RECENT  
RECENT  
 $-2 * \text{GAM}(T) * \text{SIN}(PS)**2$  RECENT  
RECENT  
WHICH IN ENDF-102 IS WRITTEN, RECENT  
RECENT  
 $-2 * (\text{GAM}(T) - \text{GAM}(N)) * \text{SIN}(2*PS)**2$  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

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-----
IN THE RESOLVED REGION THE RESOLVED PARAMETERS ARE USED TO          RECENT
CALCULATE COLD (0 KELVIN), LINEARLY INTERPOLABLE, ENERGY DEPENDENT RECENT
CROSS SECTIONS.                                                    RECENT
SCATTERING RADIUS                                                  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
FOR ANY ONE MATERIAL (I.E. MAT) IF ENERGY DEPENDENT SCATTERING RECENT
RADIII 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
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
RESOLVED REICH-MOORE AND MULTI-LEVEL BREIT-WIGNER PARAMETERS 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
(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
EXAMPLE
=====
AN EXAMPLE OF WHERE THIS OCCURS AND IS IMPORTANT TO CONSIDER RECENT
IS U-238 IN ENDF/B-4 AND 5 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.
(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

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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

EXAMPLE

===== 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

- (3) EACH RESONANCE MUST HAVE AN ASSIGNED, PHYSICALLY POSSIBLE RECENT  
J VALUE. PHYSICALLY IMPOSSIBLE OR AVERAGE J VALUES CANNOT BE RECENT  
UNIQUELY INTERPRETED USING THE EQUATIONS IN ENDF-102 AND RECENT  
THEIR USE WILL USUALLY RESULT IN PHYSICALLY UNRELIABLE CROSS RECENT  
SECTIONS. THIS PROGRAM WILL CHECK ALL J VALUES AND IF ANY ARE RECENT  
ARE FOUND TO BE PHYSICALLY IMPOSSIBLE (BASED ON TARGET SPIN RECENT  
AND L VALUE) AN ERROR MESSAGE WILL BE PRINTED TO INDICATE THATRECENT  
THE RECONSTRUCTED CROSS SECTIONS WILL BE UNRELIABLE AND THE RECENT  
PROGRAM WILL CONTINUE. IN AN ATTEMPT TO CALCULATE THE CORRECT RECENT  
POTENTIAL SCATTERING CROSS SECTION THIS PROGRAM WILL SUBTRACT RECENT  
THE POTENTIAL SCATTERING CONTRIBUTION DUE TO ALL FICTICIOUS J RECENT  
SEQUENCES AND ADD THE CONTRIBUTION OF ALL PHYSICALLY POSSIBLE RECENT  
J SEQUENCES (AS DESCRIBED ABOVE). RECENT

WARNING (LET THE USER BEWARE)

- ===== RECENT  
(A) IT CANNOT BE STRESSED ENOUGH THAT CROSS SECTIONS OBTAINED RECENT  
USING PHYSICALLY IMPOSSIBLE J VALUES FOR REICH-MOORE AND RECENT  
MULTI-LEVEL BREIT-WIGNER RESONANCE PARAMETERS WILL RESULT RECENT  
IN UNRELIABLE CROSS SECTIONS. THE DECISION TO HAVE THIS RECENT  
PROGRAM CONTINUE TO PROCESS WHEN THIS CONDITION IS FOUND RECENT  
IS BASED ON AN ATTEMPT TO ALLOW THE USER TO AT LEAST HAVE RECENT  
SOME RESULTS (HOWEVER BAD THEY MAY BE) IF THERE IS NO RECENT  
OTHER EVALUATED DATA AVAILABLE. RECENT  
(B) EVEN THOUGH THE REICH-MOORE AND MULTI-LEVEL EQUATIONS ARE RECENT  
DEFINED AS ABSOLUTE OR SQUARED CONTRIBUTIONS WHICH MUST RECENT  
ALL BE PHYSICALLY POSSIBLE, ATTEMPTING TO CORRECT THE RECENT  
POTENTIAL CROSS SECTION (AS DESCRIBED ABOVE) CAN LEAD TO RECENT  
NEGATIVE ELASTIC CROSS SECTIONS. THIS IS BECAUSE BASED ON RECENT  
THE INFORMATION AVAILABLE IN THE EVALUATION IT IS NOT RECENT  
NOT POSSIBLE TO CORRECTLY ACCOUNT FOR THE INTERFERENCE RECENT  
BETWEEN THE RESONANCE AND POTENTIAL CONTRIBUTIONS FOR EACHRECENT  
J SEQUENCE. RECENT

UNRESOLVED RESONANCE REGION

----- 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

## UNRESOLVED INTERPOLATION

-----  
IN THE UNRESOLVED RESONANCE REGION CROSS SECTIONS AT EACH ENERGY ARE CALCULATED BY INTERPOLATING PARAMETERS. THIS IS THE CONVENTION USED IN ENDF/B-4 AND EARLIER VERSIONS OF ENDF/B. THE ENDF/B-5 CONVENTION OF INTERPOLATING CROSS SECTIONS, NOT PARAMETERS, HAS BEEN ABANDONED AS IMPRACTICAL SINCE IT CAN LEAD TO THE SITUATION WHERE EXACTLY THE SAME PHYSICAL DATA CAN LEAD TO DIFFERENT RESULTS DEPENDING ON WHICH OF THE THREE ENDF/B UNRESOLVED PARAMETER FORMATS IS USED. FOR EXAMPLE, GIVEN A SET OF ENERGY INDEPENDENT PARAMETERS IT IS POSSIBLE TO CODE THESE PARAMETERS IN EACH OF THE THREE ENDF/B UNRESOLVED PARAMETER FORMATS. SINCE PHYSICALLY WE ONLY HAVE ONE SET OF PARAMETERS WE WOULD EXPECT THE RESULTS TO BE INDEPENDENT OF HOW THEY ARE REPRESENTED IN ENDF/B. UNFORTUNATELY USING THE ENDF/B-5 CONVENTION TO INTERPOLATE CROSS SECTIONS CAN LEAD TO THREE COMPLETELY DIFFERENT RESULTS. IN CONTRAST USING THE ENDF/B-4 AND EARLIER CONVENTION OF INTERPOLATING PARAMETERS LEADS TO COMPLETELY CONSISTENT RESULTS.

## INTERNAL REPRESENTATION OF UNRESOLVED PARAMETERS

-----  
ANY OF THE THREE POSSIBLE REPRESENTATIONS OF UNRESOLVED PARAMETERS CAN BE UNIQUELY REPRESENTED IN THE ALL PARAMETERS ENERGY DEPENDENT REPRESENTATIONS WITH THE APPROPRIATE (ENDF/B VERSION DEPENDENT) INTERPOLATION LAW. THIS IS DONE BY THE PROGRAM WHILE READING THE UNRESOLVED PARAMETERS AND ALL SUBSEQUENT CALCULATIONS NEED ONLY CONSIDER THE ALL PARAMETERS ENERGY DEPENDENT REPRESENTATION.

## RESONANCE RECONSTRUCTION STARTING ENERGY GRID

-----  
AS IN ANY ITERATIVE METHOD THE WAY TO SPEED CONVERGENCE IS TO TRY TO START CLOSE TO THE ANSWER. THIS PROGRAM ATTEMPTS TO DO THIS BY STARTING FROM AN ENERGY GRID WHICH IS A GOOD APPROXIMATION TO A SIMPLE BREIT-WIGNER LINE SHAPE,

$$\text{SIGMA}(X)=1.0/(1.0+X*X)$$

WHERE X IS THE DISTANCE FROM THE PEAK IN HALF-WIDTHS

SUBROUTINE SUBINT HAS A BUILT-IN TABLE OF NODES WHICH ARE THE HALF-WIDTH MULTIPLES TO APPROXIMATE THE SIMPLE BREIT-LINE SHAPE TO WITHIN 1 PER-CENT OVER THE ENTIRE INTERVAL 0 TO 500 HALF-WIDTHS

BETWEEN ANY TWO RESOLVED RESONANCES THE STARTING GRID IS BASED ON THE HALF-WIDTHS OF THE TWO RESONANCES. FROM THE LOWER ENERGY RESONANCE UP TO THE MID-POINT BETWEEN THE RESONANCES (MID-POINT IS DEFINED HERE AS AN EQUAL NUMBER OF HALF-WIDTHS FROM EACH RESONANCE) THE HALF-WIDTH OF THE LOWER ENERGY RESONANCE IS USED. FROM THE MID-POINT UP TO THE HIGHER ENERGY RESONANCE THE HALF-WIDTH OF THE UPPER ENERGY RESONANCE IS USED.

WITH THIS ALGORITHM CLOSELY SPACED RESONANCES WILL HAVE ONLY A FEW STARTING NODES PER RESONANCE (E.G. U-235). WIDELY SPACED RESONANCES WILL HAVE MORE NODES PER RESONANCE (E.G. U-238). FOR A MIX OF S, P, D ETC. RESONANCES THIS ALGORITHM GUARANTEES AN ADEQUATE DESCRIPTION OF THE PROFILE OF EVEN EXTREMELY NARROW RESONANCES (WHICH MAY IMMEDIATELY CONVERGENCE TO THE ACCURACY REQUESTED, THUS MINIMIZING ITERATION).

## BACKGROUND CROSS SECTIONS

-----  
THE PROGRAM WILL SEARCH FOR BACKGROUND CROSS SECTIONS FOR TOTAL (MT=1), ELASTIC (MT=2), FISSION (MT=18), FIRST CHANCE FISSION (MT=19) AND CAPTURE (MT=102).

- (1) THE BACKGROUND CROSS SECTIONS (FILE 3) CAN BE PRESENT OR NOT PRESENT FOR EACH REACTION.
- (2) IF FOR A GIVEN REACTION THE BACKGROUND CROSS SECTION IS PRESENT, IT WILL BE ADDED TO THE RESONANCE CONTRIBUTION AND THE RESULT WILL BE OUTPUT.
- (3) IF FOR A GIVEN REACTION THE BACKGROUND IS NOT PRESENT THE



PROGRAM WILL, RECENT

(A) IF THE INPUT TO THE PROGRAM SPECIFIES NO OUTPUT FOR REACTIONS WITH NO BACKGROUND THERE WILL BE NO OUTPUT. RECENT

(B) IF THE INPUT TO THE PROGRAM SPECIFIES OUTPUT FOR REACTIONS WITH NO BACKGROUND, RECENT

(I) THE RESONANCE CONTRIBUTION TO TOTAL, ELASTIC OR CAPTURE WILL BE OUTPUT. RECENT

(II) IF ALL FISSION RESONANCE PARAMETERS ARE ZERO THE FISSION CROSS SECTION (MT=18) WILL NOT BE OUTPUT. OTHERWISE THE RESONANCE CONTRIBUTION OF THE FISSION (MT=18) WILL BE OUTPUT. RECENT

(III) THERE WILL BE NO OUTPUT FOR FIRST CHANCE FISSION (MT=19). RECENT

COMBINING RESONANCES AND BACKGROUND CROSS SECTIONS RECENT

----- RECENT

IN ORDER TO BE COMBINED WITH THE RESONANCE CONTRIBUTION THE BACKGROUND CROSS SECTIONS MUST BE GIVEN AT 0 KELVIN TEMPERATURE AND MUST BE LINEARLY INTERPOLABLE. IF THESE CONDITIONS ARE MET THE RESONANCE AND BACKGROUND CONTRIBUTIONS WILL BE ADDED TOGETHER AND OUTPUT. IF THESE CONDITIONS ARE NOT MET THE BACKGROUND CROSS SECTION WILL BE IGNORED AND ONLY THE RESONANCE CONTRIBUTION WILL BE OUTPUT. IF THE BACKGROUND HAS NOT BEEN ADDED TO THE RESONANCE CONTRIBUTION AFTER THIS PROGRAM FINISHES THE USER CAN MAKE THE RESONANCE AND BACKGROUND CONTRIBUTIONS COMPATIBLE BY, RECENT

(1) IF THE BACKGROUND IS NOT LINEARLY INTERPOLABLE, LINEARIZE THE BACKGROUND (E.G., USE PROGRAM LINEAR). RECENT

(2) IF THE BACKGROUND IS NOT GIVEN AT 0 KELVIN, DOPPLER BROADEN THE RESONANCE (NOT BACKGROUND) CONTRIBUTION TO THE SAME TEMPERATURE AS THE BACKGROUND (E.G., USE PROGRAM SIGMA1). RECENT

ONCE THE RESONANCE AND BACKGROUND CONTRIBUTIONS HAVE BEEN MADE COMPATIBLE THEY CAN BE ADDED TOGETHER (E.G., USE PROGRAM MIXER). RECENT

THE RECONSTRUCTION OF THE RESONANCE CONTRIBUTION TO THE CROSS SECTION CAN BE QUITE EXPENSIVE (IN TERMS OF COMPUTER TIME). SINCE THE RECONSTRUCTION IS PERFORMED BEFORE THE BACKGROUND CROSS SECTIONS ARE READ, THE ABOVE CONVENTIONS HAVE BEEN ADOPTED IN ORDER TO AVOID LOSE OF COMPUTER TIME INVOLVED IN RECONSTRUCTING THE RESONANCE CONTRIBUTION. RECENT

COMMON ENERGY GRID RECENT

----- RECENT

THIS PROGRAM WILL RECONSTRUCT THE RESONANCE CONTRIBUTION TO THE TOTAL, ELASTIC, FISSION AND CAPTURE CROSS SECTIONS ALL ON THE SAME ENERGY GRID. EACH REACTION WILL THEN BE COMBINED WITH ITS BACKGROUND CROSS SECTION (IF ANY) AND OUTPUT WITHOUT ANY FURTHER THINNING. IF THERE ARE NO BACKGROUND CROSS SECTIONS, OR IF THE BACKGROUND CROSS SECTION FOR ALL FOUR REACTIONS ARE GIVEN ON A COMMON ENERGY GRID, THE OUTPUT FROM THIS PROGRAM WILL BE ON A COMMON ENERGY GRID FOR ALL FOUR REACTIONS. RECENT

THERMAL ENERGY RECENT

----- RECENT

IF THE RESONANCE REGION SPANS THERMAL ENERGY (0.0253 EV) THIS POINT IS ALWAYS INCLUDED IN THE COMMON ENERGY GRID USED FOR ALL REACTIONS AND WILL ALWAYS APPEAR IN THE OUTPUT DATA. RECENT

SECTION SIZE RECENT

----- RECENT

SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT TO THE NUMBER OF POINTS IN ANY SECTION, E.G., THE TOTAL CROSS SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS. RECENT

SELECTION OF DATA RECENT

----- RECENT

THE PROGRAM SELECTS MATERIALS TO BE PROCESSED BASED EITHER ON MAT (ENDF/B MAT NO.) OR ZA. THE PROGRAM ALLOWS UP TO 100 MAT OR ZA RANGES TO BE SPECIFIED. THE PROGRAM WILL ASSUME THAT THE 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 IS FOUND THAT IS ABOVE THE RANGE OF ALL REQUESTS.

ALLOWABLE ERROR

THE RECONSTRUCTION OF LINEARLY INTERPOLABLE CROSS SECTIONS FROM RESONANCE PARAMETERS CANNOT BE PERFORMED EXACTLY. HOWEVER IT CAN BE PERFORMED TO VIRTUALLY ANY REQUIRED ACCURACY AND MOST IMPORTANTLY CAN BE PERFORMED TO A TOLERANCE THAT IS SMALL COMPARED TO THE UNCERTAINTY IN THE CROSS SECTIONS THEMSELVES. AS SUCH THE CONVERSION OF CROSS SECTIONS TO LINEARLY INTERPOLABLE FORM CAN BE PERFORMED WITH ESSENTIALLY NO LOSS OF INFORMATION.

THE ALLOWABLE ERROR MAY BE ENERGY INDEPENDENT (CONSTANT) OR ENERGY DEPENDENT. THE ALLOWABLE ERROR IS DESCRIBED BY A TABULATED FUNCTION OF UP TO 20 (ENERGY,ERROR) PAIRS AND LINEAR INTERPOLATION BETWEEN TABULATED POINTS. IF ONLY ONE TABULATED POINT IS GIVEN THE ERROR WILL BE CONSIDERED CONSTANT OVER THE ENTIRE ENERGY RANGE. WITH THIS ENERGY DEPENDENT ERROR ONE MAY OPTIMIZE THE OUTPUT FOR ANY GIVEN APPLICATION BY USING A SMALL ERROR IN THE ENERGY RANGE OF INTEREST AND A LESS STRINGENT ERROR IN OTHER ENERGY RANGES, E.G., 0.1 PER-CENT FROM 0 UP TO THE LOW EV RANGE AND A LESS STRINGENT TOLERANCE AT HIGHER ENERGIES.

DEFAULT ALLOWABLE ERROR

IN ORDER TO INSURE CONVERGENCE OF THE RESONANCE RECONSTRUCTION THE ALLOWABLE ERROR MUST BE POSITIVE. IF THE USER INPUTS AN ERROR FOR RESONANCE RECONSTRUCTION THAT IS NOT POSITIVE IT WILL BE SET TO THE DEFAULT VALUE (CURRENTLY 0.1 PER-CENT) AND INDICATED AS SUCH IN THE OUTPUT LISTING.

INTERVAL HALVING ALGORITHM

THIS PROGRAM WILL START BY CALCULATING THE CROSS SECTIONS AT THE ENERGIES CORRESPONDING TO THE PEAK OF EACH RESONANCE, AS WELL AS A FIXED NUMBER OF HALF-WIDTHS ON EACH SIDE OF EACH RESONANCE. STARTING FROM THIS BASIC GRID OF POINTS THE PROGRAM WILL CONTINUE TO HALF EACH INTERVAL UNTIL THE CROSS SECTIONS FOR ALL REACTIONS AT THE CENTER OF THE INTERVAL CAN BE DEFINED BY LINEAR INTERPOLATION FROM THE ENDS OF THE INTERVAL TO WITHIN THE USER SPECIFIED ACCURACY CRITERIA.

DISTANT RESONANCE TREATMENT

THE OPTION TO TREAT DISTANT RESONANCES, WHICH WAS AVAILABLE IN EARLIER VERSIONS OF THIS PROGRAM, IS NO LONGER AVAILABLE, BECAUSE IT WAS FOUND TO PRODUCE UNRELIABLE RESULTS. IN THIS VERSION OF THE PROGRAM ALL RESONANCES ARE TREATED EXACTLY.

PROGRAM OPERATION

EDIT MODE

IT IS SUGGESTED THAT BEFORE RUNNING THIS PROGRAM TO RECONSTRUCT CROSS SECTIONS FROM RESONANCE PARAMETERS (WHICH CAN BE QUITE EXPENSIVE) THE USER FIRST RUN THE PROGRAM IN THE EDIT MODE (SEE, DESCRIPTION OF INPUT PARAMETERS BELOW). IN THE EDIT MODE THE PROGRAM WILL READ, LIST AND EXTENSIVELY CHECK THE CONSISTENCY OF ALL RESONANCE PARAMETERS AND ENDF/B DEFINED RESONANCE FLAGS. THIS IS A VERY INEXPENSIVE MEANS OF CHECKING ALL DATA BEFORE INVESTING A LARGE AMOUNT OF MONEY IN RECONSTRUCTING CROSS SECTIONS. ANY AND ALL DIGNOSTICS RECEIVED FROM THE EDIT WILL SUGGEST HOW TO CORRECT THE EVALUATED DATA TO MAKE IT CONSISTENT BEFORE RECONSTRUCTING CROSS SECTIONS. IN ORDER TO OBTAIN MEANINGFUL RESULTS FROM THE RECONSTRUCTION ALL SUGGESTED CHANGES TO THE EVALUATION SHOULD BE PERFORMED BEFORE TRYING RECONSTRUCTION (OTHERWISE THE RESULT OF RECONSTRUCTION WILL NOT BE RELIABLE).

RECONSTRUCTION MODE

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
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
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
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
THE CYCLE OF RECONSTRUCTING THE RESONANCE CONTRIBUTION AND ADDING	RECENT
THE BACKGROUND WILL BE REPEATED FOR EACH MATERIAL REQUESTED.	RECENT
-----2016/3/10 - This option is no longer allowed - today's computers	RECENT
are so much 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
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
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
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
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
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
IF YOU ARE ONLY INTERESTED IN THE CROSS SECTION OVER A NARROW	RECENT
ENERGY INTERVAL AND DO NOT INTEND 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



3	RECENT.LST		RECENT
10	ENDFB.IN		RECENT
11	ENDFB.OUT		RECENT
12	(SCRATCH)		RECENT
14	(SCRATCH)		RECENT
INPUT CARDS			RECENT
=====			
LINE	COLS.	FORMAT	DESCRIPTION
-----			
1	1-11	I11	RETRIEVAL CRITERIA (0=MAT, 1=ZA)
			THIS OPTION DEFINED WHETHER COLUMNS 1-22 OF
			SUBSEQUENT INPUT CARDS SHOULD BE INTERPRETED
			TO BE MAT OR ZA RANGES.
	12-22	E11.4	FILE 2 MINIMUM ABSOLUTE CROSS SECTION
			(IF 1.0E-10 OR LESS IS INPUT THE PROGRAM
			WILL USE 1.0E-10)
	23-33	I11	TREATMENT OF REACTIONS FOR WHICH BACKGROUND
			CROSS SECTION IS NOT GIVEN.
			= 0 - IGNOR (I.E. NO OUTPUT)
			= 1 - OUTPUT RESONANCE CONTRIBUTION.
			THIS OPTION IS USEFUL WITH PARTIAL EVALUATION
			(E.G. ENDF/B-5 DOSIMETRY LIBRARY) WHERE ONLY
			ONE OR MORE OF THE REACTIONS ARE OF ACTUAL
			INTEREST.
			WARNING...THE USE OF THIS FIELD HAS BEEN
			CHANGED. THIS FIELD WAS PREVIOUSLY USED TO
			DEFINE THE PRECISION OF THE CALCULATION AND
			OUTPUT. THE FORMER DEFINITION OF THIS FIELD
			WAS...
			MINIMUM ENERGY SPACING FLAG
			= 0 - 6 DIGIT MINIMUM ENERGY SPACING.
			STANDARD 6 DIGIT E11.4 OUTPUT.
			= 1 - 9 DIGIT MINIMUM ENERGY SPACING.
			STANDARD 6 DIGIT E11.4 OUTPUT.
			= 2 - 9 DIGIT MINIMUM ENERGY SPACING.
			VARIABLE 9 DIGIT F FORMAT OUTPUT.
			FROM EXPERIENCE IT HAS BEEN FOUND THAT
			FAILURE TO SET THIS OPTION TO 2 CAN RESULT
			IN LARGE ERRORS IN THE FINAL DATA. THEREFORE
			INTERNALLY THIS OPTION IS SET TO 2.
	34-44	I11	OPERATING MODE
			= 0 - CALCULATE. MINIMUM OUTPUT LISTING
			= 1 - CALCULATE. LIST ALL RESONANCE PARAMETERS
			= 2 - EDIT MODE. NO CALCULATION. LIST ALL
			RESONANCE PARAMETERS.
			NOTE, THE EDIT MODE (=2) IS THE SUGGESTED
			MODE TO FIRST TEST THE CONSISTENCY OF THE
			EVALUATED DATA, BEFORE RECONSTRUCTING CROSS
			SECTIONS (SEE, COMMENTS ABOVE).
	45-55	I11	NEGATIVE CROSS SECTION TREATMENT
			= 0 - O.K. - NO CHANGE
			= 1 - SET = 0
	56-66	I11	MONITOR MODE SELECTOR
			= 0 - NORMAL OPERATION
			= 1 - MONITOR PROGRESS OF RECONSTRUCTION OF
			FILE 2 DATA AND COMBINING FILE 2 AND
			FILE 3 DATA. EACH TIME A PAGE OF DATA
			POINTS IS WRITTEN TO A SCRATCH FILE
			PRINT OUT THE TOTAL NUMBER OF POINTS
			ON SCRATCH AND THE LOWER AND UPPER
			ENERGY LIMITS OF THE PAGE (THIS OPTION
			MAY BE USED IN ORDER TO MONITOR THE
			EXECUTION SPEED OF LONG RUNNING JOBS).
2	1-72	A72	ENDF/B INPUT DATA FILENAME
			(STANDARD OPTION = ENDFB.IN)
3	1-72	A72	ENDF/B OUTPUT DATA FILENAME
			(STANDARD OPTION = ENDFB.OUT)
4-N	1-11	I11	MINIMUM MAT OR ZA (SEE COLS. 1-11, LINE 1)
	12-22	I11	MAXIMUM MAT OR ZA (SEE COLS. 1-11, LINE 1)
			UP TO 100 MAT OR ZA RANGES MAY BE SPECIFIED,

ONE RANGE PER LINE. THE LIST IS TERMINATED RECENT  
 BY A BLANK LINE. IF THE THE UPPER LIMIT OF RECENT  
 ANY REQUEST IS LESS THAN THE LOWER LIMIT THE RECENT  
 UPPER LIMIT WILL BE SET EQUAL TO THE LOWER RECENT  
 LIMIT. IF THE FIRST REQUEST LINE IS BLANK IT RECENT  
 WILL TERMINATE THE REQUEST LIST AND CAUSE ALLRECENT  
 DATA TO BE RETRIEVED (SEE EXAMPLE INPUT). RECENT  
 ----- 2016/3/10 - Partial Processing no longer allowed. RECENT  
 If these fields are not blank the code will STOP RECENT  
 with a WARNING that this is no longer allowed. RECENT  
 23-33 E11.4 LOWER ENERGY LIMIT FOR PROCESSING. RECENT  
 34-44 E11.4 UPPER ENERGY LIMIT FOR PROCESSING. RECENT  
 \*THE LOWER AND UPPER ENERGY LIMITS MUST BE RECENT  
 ZERO, OR BLANK, UNLESS YOU WISH TO ONLY RECENT  
 PROCESS A PORTION OF RESONANCE REGIONS. RECENT  
 \*THESE ENERGY LIMITS ARE ONLY READ FROM THE RECENT  
 FIRST MAT/ZA REQUEST LINE RECENT  
 \*IF BOTH ARE ZERO (OR BLANK) THE ENTIRE RECENT  
 RESONANCE REGION FOR EACH MATERIAL WILL BE RECENT  
 PROCESSED RECENT  
 \*IF LIMITS ARE INPUT ONLY THAT PORTION OF THE RECENT  
 RESONANCE REGION FOR EACH MATERIAL WHICH RECENT  
 LIES BETWEEN THESE LIMITS WILL BE PROCESSED RECENT  
 \*SEE INSTRUCTIONS ABOVE BEFORE USING THIS RECENT  
 OPTION. RECENT  
 ----- 2016/3/10 - Partial Processing no longer allowed. RECENT  
 VARY 1-11 E11.4 ENERGY FOR FILE 2 ERROR LAW ( SEE ) RECENT  
 12-22 E11.4 ERROR FOR FILE 2 ERROR LAW (COMMENTS) RECENT  
 ( BELOW ) RECENT

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

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

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, CORRESPONDING 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

EXAMPLE INPUT NO. 1  
 -----

CONSIDER ALL URANIUM ISOTOPES AND TH-232. CONSIDER CROSS SECTIONS RECENT  
 WHICH ARE LARGER THAN 1.0E-8 BARNS IN ABSOLUTE VALUE. ONLY OUTPUT RECENT  
 REACTIONS FOR WHICH A BACKGROUND IS GIVEN. LIST ALL PARAMETERS ANDRECENT  
 CALCULATE CROSS SECTIONS. MONITOR THE EXECUTION PROGRESS OF THE RECENT  
 PROGRAM. BETWEEN 0 AND 100 EV USE 0.1 PER-CENT ACCURACY. BETWEEN RECENT  
 100 EV AND 1 KEV VARY THE ACCURACY FROM 0.1 TO 1 PER-CENT. ABOVE RECENT  
 1 KEV USE 1 PER-CENT ACCURACY. RECENT

EXPLICITLY SPECIFY THE STANDARD FILENAMES. RECENT

THE FOLLOWING 11 INPUT CARDS ARE REQUIRED. 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

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

LEAVE THE DEFINITION OF THE FILENAMES BLANK - THE PROGRAM WILL RECENT
THEN USE THE STANDARD FILENAMES. RECENT

THE FOLLOWING 7 INPUT CARDS ARE REQUIRED. RECENT

  1 1.00000-08 0 0 0 0 RECENT
          92000 92999 RECENT
          90232 (UPPER LIMIT AUTOMATICALLY SET TO 90232) RECENT
          (END REQUEST LIST) RECENT
          (USE STANDARD OPTION FOR ERROR LAW) 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

THE FOLLOWING 7 INPUT CARDS ARE REQUIRED. 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

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

THE FOLLOWING 6 INPUT CARDS ARE REQUIRED. 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

```

