**=======================================================================SPECTRA**

**SPECTRA**

**PROGRAM SPECTRA SPECTRA**

**=============== SPECTRA**

**An extension of LINEAR to linearize ALl MF=5 spectra. SPECTRA**

**2012/05/28 - Added MF=15 neutron induced, photon spectra. SPECTRA**

**2021/01/26 - MF=6 Still NOT Implemented SPECTRA**

**SPECTRA**

**First released in 2010 - Earlier below dates refer to LINEAR. SPECTRA**

**SPECTRA**

**VERSION 74-1 (MAY 1974) SPECTRA**

**VERSION 75-1 (APRIL 1975) SPECTRA**

**VERSION 76-2 (OCTOBER 1976) SPECTRA**

**VERSION 77-1 (JANUARY 1977) SPECTRA**

**VERSION 78-1 (JULY 1978) SPECTRA**

**VERSION 79-1 (JULY 1979) CDC-7600 AND CRAY-1 VERSION. SPECTRA**

**VERSION 80-1 (MAY 1980) IBM, CDC AND CRAY VERSION. SPECTRA**

**VERSION 80-2 (DECEMBER 1980) SPECTRA**

**VERSION 81-1 (MARCH 1981) SPECTRA**

**VERSION 82-1 (JANUARY 1982) IMPROVED COMPUTER COMPATIBILITY. SPECTRA**

**VERSION 83-1 (JANUARY 1983) \*MAJOR RE-DESIGN. SPECTRA**

**\*PAGE SIZE INCREASED - 1002 TO 3006. SPECTRA**

**\*ELIMINATED COMPUTER DEPENDENT CODING.SPECTRA**

**\*NEW, MORE COMPATIBLE I/O UNIT NUMBER.SPECTRA**

**\*ADDED OPTION TO KEEP ALL ORIGINAL SPECTRA**

**ENERGY POINTS FROM EVALUATION. SPECTRA**

**\*ADDED STANDARD ALLOWABLE ERROR OPTIONSPECTRA**

**(CURRENTLY 0.1 PER-CENT). SPECTRA**

**VERSION 83-2 (OCTOBER 1983) IMPROVED BASED ON USER COMMENTS. SPECTRA**

**VERSION 84-1 (APRIL 1984) IMPROVED BASED ON USER COMMENTS. SPECTRA**

**VERSION 84-2 (JUNE 1984) \*UPDATED FOR ENDF/B-VI FORMATS. SPECTRA**

**\*SPECIAL I/O ROUTINES TO GUARANTEE SPECTRA**

**ACCURACY OF ENERGY. SPECTRA**

**\*DOUBLE PRECISION TREATMENT OF ENERGY SPECTRA**

**(REQUIRED FOR NARROW RESONANCES). SPECTRA**

**VERSION 85-1 (AUGUST 1985) \*FORTRAN-77/H VERSION SPECTRA**

**VERSION 86-1 (JANUARY 1986)\*ENDF/B-VI FORMAT SPECTRA**

**VERSION 87-1 (JANUARY 1987)\*DOUBLE PRECISION TREATMENT OF CROSS SPECTRA**

**SECTION SPECTRA**

**VERSION 88-1 (JULY 1988) \*OPTION...INTERNALLY DEFINE ALL I/O SPECTRA**

**FILE NAMES (SEE, SUBROUTINE FILEIO SPECTRA**

**FOR DETAILS). SPECTRA**

**\*IMPROVED BASED ON USER COMMENTS. SPECTRA**

**VERSION 89-1 (JANUARY 1989)\*PSYCHOANALYZED BY PROGRAM FREUD TO SPECTRA**

**INSURE PROGRAM WILL NOT DO ANYTHING SPECTRA**

**CRAZY. SPECTRA**

**\*UPDATED TO USE NEW PROGRAM CONVERT SPECTRA**

**KEYWORDS. SPECTRA**

**\*ADDED LIVERMORE CIVIC COMPILER SPECTRA**

**CONVENTIONS. SPECTRA**

**VERSION 90-1 (JUNE 1990) \*EXTENDED TO LINEARIZE PHOTON SPECTRA**

**INTERACTION DATA, MF=23 AND 27 SPECTRA**

**\*ADDED FORTRAN SAVE OPTION SPECTRA**

**\*UPDATED BASED ON USER COMMENTS. SPECTRA**

**\*NEW MORE CONSISTENT ENERGY OUTPUT SPECTRA**

**ROUTINE. SPECTRA**

**\*WARNING...INPUT PARAMETER FORMAT SPECTRA**

**HAS BEEN CHANGED...SEE DESCRIPTION SPECTRA**

**BELOW. SPECTRA**

**VERSION 91-1 (JULY 1991) \*ADDED INTERPOLATION LAW 6 - ONLY USED SPECTRA**

**FOR CHARGED PARTICLE CROSS SECTIONS SPECTRA**

**FOR COULOMB PENETRABILITIES. SPECTRA**

**VERSION 92-1 (JANUARY 1992)\*ADDED NU-BAR (TOTAL, DELAYED, PROMPT) SPECTRA**

**POLYNOMIAL OR TABULATED ALL CONVERTED SPECTRA**

**TO LINEARLY INTERPOLABLE SPECTRA**

**\*INCREASED PAGE SIZE FROM 3006 TO 5010 SPECTRA**

**POINTS. SPECTRA**

**\*ALL ENERGIES INTERNALLY ROUNDED PRIOR SPECTRA**

**TO CALCULATIONS. SPECTRA**

**\*COMPLETELY CONSISTENT I/O AND ROUNDINGSPECTRA**

**ROUTINES - TO MINIMIZE COMPUTER SPECTRA**

**DEPENDENCE. SPECTRA**

**VERSION 92-2 (JULY 1992) \*CORRECTED CONVERSION OF NU-BAR FROM SPECTRA**

**POLYNOMIAL TO TABULATED - COPY SPECTRA**

**SPONTANEOUS NU-BAR (BY DEFINITION SPECTRA**

**THE SPONTANEOUS NU-BAR IS NOT AN SPECTRA**

**ENERGY DEPENDENT QUANTITY). SPECTRA**

**VERSION 93-1 (MARCH 1993) \*UPDATED FOR USE WITH LAHEY COMPILER SPECTRA**

**ON IBM-PCS. SPECTRA**

**\*INCREASED PAGE SIZE FROM 5010 TO SPECTRA**

**30000 POINTS SPECTRA**

**VERSION 94-1 (JANUARY 1994)\*VARIABLE ENDF/B DATA FILENAMES SPECTRA**

**TO ALLOW ACCESS TO FILE STRUCTURES SPECTRA**

**(WARNING - INPUT PARAMETER FORMAT SPECTRA**

**HAS BEEN CHANGED) SPECTRA**

**\*CLOSE ALL FILES BEFORE TERMINATING SPECTRA**

**(SEE, SUBROUTINE ENDIT) SPECTRA**

**VERSION 96-1 (JANUARY 1996) \*COMPLETE RE-WRITE SPECTRA**

**\*IMPROVED COMPUTER INDEPENDENCE SPECTRA**

**\*ALL DOUBLE PRECISION SPECTRA**

**\*ON SCREEN OUTPUT SPECTRA**

**\*UNIFORM TREATMENT OF ENDF/B I/O SPECTRA**

**\*IMPROVED OUTPUT PRECISION SPECTRA**

**\*DEFINED SCRATCH FILE NAMES SPECTRA**

**\*ALWAYS INCLUDE THERMAL VALUE SPECTRA**

**\*INCREASED PAGE SIZE FROM 30000 TO SPECTRA**

**60000 POINTS SPECTRA**

**VERSION 99-1 (MARCH 1999) \*CORRECTED CHARACTER TO FLOATING SPECTRA**

**POINT READ FOR MORE DIGITS SPECTRA**

**\*UPDATED TEST FOR ENDF/B FORMAT SPECTRA**

**VERSION BASED ON RECENT FORMAT CHANGESPECTRA**

**\*GENERAL IMPROVEMENTS BASED ON SPECTRA**

**USER FEEDBACK SPECTRA**

**VERSION 99-2 (JUNE 1999) \*ASSUME ENDF/B-VI, NOT V, IF MISSING SPECTRA**

**MF=1, MT-451. SPECTRA**

**VERS. 2000-1 (FEBRUARY 2000)\*ADDED MF = 9 AND 10 LINEARIZATION SPECTRA**

**\*GENERAL IMPROVEMENTS BASED ON SPECTRA**

**USER FEEDBACK SPECTRA**

**VERS. 2002-1 (MAY 2002) \*OPTIONAL INPUT PARAMETERS SPECTRA**

**VERS. 2004-1 (JAN. 2004) \*GENERAL UPDATE BASED ON USER FEEDBACKSPECTRA**

**VERS. 2005-1 (JAN. 2005) \*ALWAYS KEEP ORIGINAL TABULATED SPECTRA**

**NU-BAR POINTS. SPECTRA**

**VERS. 2006-1 (FEB. 2006) \*CORRECTED INT=6 NEAR THRESHOLD SPECTRA**

**\*NO SUBDIVIDE BELOW MINIMUM XCMIN SPECTRA**

**VERS. 2007-1 (JAN. 2007) \*CHECKED AGAINST ALL ENDF/B-VII. SPECTRA**

**\*INCREASED PAGE SIZE FROM 60,000 TO SPECTRA**

**600,000 POINTS SPECTRA**

**VERS. 2010-1 (JUNE 2010) \*ADDED MF = 5 - MF = 6 STILL PLANNED. SPECTRA**

**\*72 CHARACTER FILE NAMES. SPECTRA**

**\*ONLY PROCESS MF=5 - SKIP ALL OTHERS SPECTRA**

**TO PREVENT CONFLICT WITH LINEAR SPECTRA**

**THINNING. SPECTRA**

**VERS. 2012-1 (Aug. 2012) \*Added MF=15, neutron induced photon SPECTRA**

**spectra. SPECTRA**

**\*Added CODENAME SPECTRA**

**\*32 and 64 bit Compatible SPECTRA**

**\*Added ERROR stop SPECTRA**

**VERS. 2015-1 (Jan. 2015) \*Extended OUT9. SPECTRA**

**\*Replaced ALL 3 way IF Statements. SPECTRA**

**\*Corrected MF=15 Data - it was adding SPECTRA**

**SEND between sub-sections. SPECTRA**

**\*Deleted unused parts, e.g., NUBAR. SPECTRA**

**VERS. 2017-1 (May 2017) \*Increased page size to 3,000,000 SPECTRA**

**\*Updated based on user feedback SPECTRA**

**\*Changed DGAMMA to REDGAMMA to avoid SPECTRA**

**conflict with possble RESERVED NAME SPECTRA**

**\*All floating input parameters changedSPECTRA**

**to character input + IN9 conversion. SPECTRA**

**VERS. 2018-1 (Jan. 2018) \*On-line output for ALL ENDERROR SPECTRA**

**VERS. 2019-1 (June 2019) \*Additional Interpolation Law Tests SPECTRA**

**\*Check Maximum Tabulated Energy to SPECTRA**

**insure it is the same for all MTs - SPECTRA**

**if not, print WARNING messages. SPECTRA**

**\*Corrected END Histogram linearized - SPECTRA**

**Previously deleted last point - ERRORSPECTRA**

**to assume this has Y=0 - now keep SPECTRA**

**point, but insure Y = 0. SPECTRA**

**VERS. 2020-1 (Mar. 2020) \*Added Target Isomer State SPECTRA**

**VERS. 2021-1 (Jan. 2021) \*Updated for FORTRAN 2018 SPECTRA**

**VERS. 2023-1 (Feb. 2023) \*Decreased page size from 3,000,000 SPECTRA**

**to 120,000 SPECTRA**

**SPECTRA**

**OWNED, MAINTAINED AND DISTRIBUTED BY SPECTRA**

**------------------------------------ SPECTRA**

**THE NUCLEAR DATA SECTION SPECTRA**

**INTERNATIONAL ATOMIC ENERGY AGENCY SPECTRA**

**P.O. BOX 100 SPECTRA**

**A-1400, VIENNA, AUSTRIA SPECTRA**

**EUROPE SPECTRA**

**SPECTRA**

**ORIGINALLY WRITTEN BY SPECTRA**

**------------------------------------ SPECTRA**

**Dermott E. Cullen SPECTRA**

**SPECTRA**

**PRESENT CONTACT INFORMATION SPECTRA**

**--------------------------- SPECTRA**

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**SPECTRA**

**AUTHORS MESSAGE SPECTRA**

**--------------- SPECTRA**

**THE REPORT DESCRIBED ABOVE IS THE LATEST PUBLISHED DOCUMENTATION SPECTRA**

**FOR THIS PROGRAM. HOWEVER, THE COMMENTS BELOW SHOULD BE CONSIDEREDSPECTRA**

**THE LATEST DOCUMENTATION INCLUDING ALL RECENT IMPROVEMENTS. PLEASESPECTRA**

**READ ALL OF THESE COMMENTS BEFORE IMPLEMENTATION. SPECTRA**

**SPECTRA**

**AT THE PRESENT TIME WE ARE ATTEMPTING TO DEVELOP A SET OF COMPUTERSPECTRA**

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

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

**IT WOULD BE APPECIATED IF YOU WOULD NOTIFY THE AUTHOR OF ANY SPECTRA**

**COMPILER DIAGNOSTICS, OPERATING PROBLEMS OR SUGGESTIONS ON HOW TO SPECTRA**

**IMPROVE THIS PROGRAM. HOPEFULLY, IN THIS WAY FUTURE VERSIONS OF SPECTRA**

**THIS PROGRAM WILL BE COMPLETELY COMPATIBLE FOR USE ON YOUR SPECTRA**

**COMPUTER. SPECTRA**

**SPECTRA**

**PURPOSE SPECTRA**

**------- SPECTRA**

**THIS PROGRAM IS DESIGNED TO CONVERT ENDF/B FILE 3, 23 AND 27 DATA SPECTRA**

**TO LINEAR-LINEAR INTERPOLABLE FORM. ANY SECTION THAT IS ALREADY SPECTRA**

**LINEAR-LINEAR INTERPOLABLE WILL BE THINNED. SPECTRA**

**SPECTRA**

**IN THE FOLLOWING DISCUSSION FOR SIMPLICITY THE ENDF/B TERMINOLOGY SPECTRA**

**---ENDF/B TAPE---WILL BE USED. IN FACT THE ACTUAL MEDIUM MAY BE SPECTRA**

**TAPE, CARDS, DISK OR ANY OTHER MEDIUM. SPECTRA**

**SPECTRA**

**ENDF/B FORMAT SPECTRA**

**------------- SPECTRA**

**THIS PROGRAM ONLY USES THE ENDF/B BCD OR CARD IMAGE FORMAT (AS SPECTRA**

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

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

**SPECTRA**

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

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

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

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

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

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

**OTHER SECTION OF DATA AS HOLLERITH AND AS SUCH IS INSENSITIVE TO SPECTRA**

**THE CORRECTNESS OR INCORRECTNESS OF ALL OTHER SECTIONS. SPECTRA**

**SPECTRA**

**OUTPUT FORMAT SPECTRA**

**------------- SPECTRA**

**IN THIS VERSION OF LINEAR ALL ENERGIES WILL BE OUTPUT IN SPECTRA**

**F (INSTEAD OF E) FORMAT IN ORDER TO ALLOW ENERGIES TO BE WRITTEN SPECTRA**

**WITH UP TO 9 DIGITS OF ACCURACY. IN PREVIOUS VERSIONS THIS WAS AN SPECTRA**

**OUTPUT OPTION. HOWEVER USE OF THIS OPTION TO COMPARE THE RESULTS SPECTRA**

**OF ENERGIES WRITTEN IN THE NORMAL ENDF/B CONVENTION OF 6 DIGITS SPECTRA**

**TO THE 9 DIGIT OUTPUT FROM THIS PROGRAM DEMONSTRATED THAT FAILURE SPECTRA**

**TO USE THE 9 DIGIT OUTPUT CAN LEAD TO LARGE ERRORS IN THE DATA SPECTRA**

**DUE TO TRUNCATION OF ENERGIES TO 6 DIGITS DURING OUTPUT. SPECTRA**

**SPECTRA**

**CONTENTS OF OUTPUT SPECTRA**

**------------------ SPECTRA**

**ENTIRE EVALUATIONS ARE OUTPUT, NOT JUST THE LINEARIZED DATA SPECTRA**

**CROSS SECTIONS, E.G. ANGULAR AND ENERGY DISTRIBUTIONS ARE ALSO SPECTRA**

**INCLUDED. SPECTRA**

**SPECTRA**

**DOCUMENTATION SPECTRA**

**------------- SPECTRA**

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

**BY THE ADDITION OF 3 COMMENT LINES AT THE END OF EACH HOLLERITH SPECTRA**

**SECTION IN THE FORM SPECTRA**

**SPECTRA**

**\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* PROGRAM SPECTRA (2023-1) \*\*\*\*\*\*\*\*\*\*\*\*\*\*\*\* SPECTRA**

**FOR ALL DATA GREATER THAN 1.00000-10 IN ABSOLUTE VALUE SPECTRA**

**DATA LINEARIZED TO WITHIN AN ACCURACY OF 0.1 PER-CENT SPECTRA**

**SPECTRA**

**THE ORDER OF SIMILAR COMMENTS (FROM RECENT, SIGMA1 AND GROUPIE) SPECTRA**

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

**THE DATA BY THESE PROGRAMS. SPECTRA**

**SPECTRA**

**THESE COMMENT LINES ARE ONLY ADDED TO EXISTING HOLLERITH SECTIONS,SPECTRA**

**I.E., THIS PROGRAM WILL NOT CREATE A HOLLERITH SECTION. THE FORMATSPECTRA**

**OF THE HOLLERITH SECTION IN ENDF/B-V DIFFERS FROM THE THAT OF SPECTRA**

**EARLIER VERSIONS OF ENDF/B. BY READING AN EXISTING MF=1, MT=451 SPECTRA**

**IT IS POSSIBLE FOR THIS PROGRAM TO DETERMINE WHICH VERSION OF SPECTRA**

**THE ENDF/B FORMAT THE DATA IS IN. WITHOUT HAVING A SECTION OF SPECTRA**

**MF=1, MT=451 PRESENT IT IS IMPOSSIBLE FOR THIS PROGRAM TO SPECTRA**

**DETERMINE WHICH VERSION OF THE ENDF/B FORMAT THE DATA IS IN, AND SPECTRA**

**AS SUCH IT IS IMPOSSIBLE FOR THE PROGRAM TO DETERMINE WHAT FORMAT SPECTRA**

**SHOULD BE USED TO CREATE A HOLLERITH SECTION. SPECTRA**

**SPECTRA**

**REACTION INDEX SPECTRA**

**-------------- SPECTRA**

**THIS PROGRAM DOES NOT USE THE REACTION INDEX WHICH IS GIVEN IN SPECTRA**

**SECTION MF=1, MT=451 OF EACH EVALUATION. SPECTRA**

**SPECTRA**

**THIS PROGRAM DOES NOT UPDATE THE REACTION INDEX IN MF=1, MT=451. SPECTRA**

**THIS CONVENTION HAS BEEN ADOPTED BECAUSE MOST USERS DO NOT SPECTRA**

**REQUIRE A CORRECT REACTION INDEX FOR THEIR APPLICATIONS AND IT WASSPECTRA**

**NOT CONSIDERED WORTHWHILE TO INCLUDE THE OVERHEAD OF CONSTRUCTING SPECTRA**

**A CORRECT REACTION INDEX IN THIS PROGRAM. HOWEVER, IF YOU REQUIRE SPECTRA**

**A REACTION INDEX FOR YOUR APPLICATIONS, AFTER RUNNING THIS PROGRAMSPECTRA**

**YOU MAY USE PROGRAM DICTIN TO CREATE A CORRECT REACTION INDEX. SPECTRA**

**SPECTRA**

**SECTION SIZE SPECTRA**

**------------ SPECTRA**

**SINCE THIS PROGRAM USES A LOGICAL PAGING SYSTEM THERE IS NO LIMIT SPECTRA**

**TO THE NUMBER OF POINTS IN ANY SECTION, E.G., THE TOTAL CROSS SPECTRA**

**SECTION MAY BE REPRESENTED BY 200,000 DATA POINTS. SPECTRA**

**SPECTRA**

**FOR ANY LINEARIZED SECTION THAT CONTAINS 60000 OR FEWER POINTS SPECTRA**

**THE ENTIRE OPERATION WILL BE PERFORMED IN CORE AND THE LINEARIZED SPECTRA**

**DATA WILL BE OUTPUT DIRECTLY TO THE ENDF/B FORMAT. FOR ANY SECTIONSPECTRA**

**THAT CONTAINS MORE POINTS THE DATA WILL BE LINEARIZED A PAGE AT A SPECTRA**

**TIME (1 PAGE = 60000 POINTS) AND OUTPUT TO SCRATCH. AFTER THE SPECTRA**

**ENTIRE SECTION HAS BEEN LINEARIZED THE DATA WILL BE READ BACK FROMSPECTRA**

**SCRATCH AND OUTPUT TO THE ENDF/B FORMAT. SPECTRA**

**SPECTRA**

**SELECTION OF DATA SPECTRA**

**----------------- SPECTRA**

**THE PROGRAM SELECTS DATA TO BE LINEARIZED BASED EITHER ON EITHER SPECTRA**

**MAT (ENDF/B MAT NO.) OR ZA AS WELL AS MF AND MT NUMBERS. THIS SPECTRA**

**PROGRAM ALLOWS UP TO 100 MAT/MF/MT OR ZA/MF/MT RANGES TO BE SPECTRA**

**SPECIFIED BY INPUT PARAMETERS. THE PROGRAM WILL ASSUME THAT THE SPECTRA**

**ENDF/B TAPE IS IN MAT ORDER, REGARDLESS OF THE CRITERIA USED SPECTRA**

**TO RETRIEVE MATERIALS. IF RETRIEVAL IS BY MAT RANGE THE PROGRAM SPECTRA**

**WILL TERMINATE WHEN A MAT IS FOUND THAT IS ABOVE ALL REQUESTED SPECTRA**

**MAT RANGES. IF RETRIEVAL IS BY ZA RANGE THE PROGRAM WILL SEARCH SPECTRA**

**THE ENTIRE ENDF/B TAPE. SPECTRA**

**SPECTRA**

**PROGRAM OPERATION SPECTRA**

**----------------- SPECTRA**

**EACH SECTION OF DATA IS CONSIDERED SEPARATELY. EACH SECTION OF SPECTRA**

**ENDF/B DATA TO LINEARIZE IS REPRESENTED BY A TABLE OF ENERGY SPECTRA**

**VS. CROSS SECTION AND ANY ONE OF FIVE ALLOWABLE INTERPOLATION LAWSSPECTRA**

**BETWEEN ANY TWO TABULATED POINTS. THIS PROGRAM WILL REPLACE EACH SPECTRA**

**SECTION OF DATA CROSS SECTIONS BY A NEW TABLE OF ENERGY VS. SPECTRA**

**CROSS SECTION IN WHICH THE INTERPOLATION LAW IS ALWAYS LINEAR IN SPECTRA**

**ENERGY AND CROSS SECTION BETWEEN ANY TWO TABULATED POINTS. SPECTRA**

**SPECTRA**

**DATA IS READ AND LINEARIZED A PAGE AT A TIME (ONE PAGE CONTAINS SPECTRA**

**60000 DATA POINTS). IF THE FINAL LINEARIZED SECTION CONTAINS TWO SPECTRA**

**PAGES OR LESS, DATA POINTS IT WILL BE ENTIRELY CORE RESIDENT SPECTRA**

**AFTER IT HAS BEEN LINEARIZED AND WILL BE WRITTEN DIRECTLY FROM SPECTRA**

**CORE TO THE OUTPUT TAPE. IF THE LINEARIZED SECTION IS LARGER THAN SPECTRA**

**TWO PAGES, AFTER EACH PAGE IS LINEARIZED IT WILL BE WRITTEN TO SPECTRA**

**SCRATCH. AFTER THE ENTIRE SECTION HAS BEEN LINEARIZED IT WILL SPECTRA**

**BE READ BACK FROM SCRATCH, TWO PAGES AT A TIME, AND WRITTEN TO SPECTRA**

**THE OUTPUT TAPE. SPECTRA**

**SPECTRA**

**KEEP EVALUATED DATA POINTS SPECTRA**

**-------------------------- SPECTRA**

**SOMETIMES IT IS CONVENIENT TO KEEP ALL ENERGY POINTS WHICH WERE SPECTRA**

**PRESENT IN THE ORIGINAL EVALUATION AND TO MERELY SUPPLEMENT THESE SPECTRA**

**POINTS WITH ADDITIONAL ENERGY POINTS IN ORDER TO LINEARIZE THE SPECTRA**

**CROSS SECTIONS. FOR EXAMPLE, IT IS OFTEN CONVENIENT TO KEEP THE SPECTRA**

**THERMAL VALUE (AT 0.0253 EV) OR THE VALUE AT 14.1 MEV. SPECTRA**

**SPECTRA**

**THE CURRENT VERSION OF THIS PROGRAM WILL ALLOW THE USER TO KEEP SPECTRA**

**ALL ORIGINAL EVALUATED DATA POINTS BY SPECIFYING 1 IN COLUMNS SPECTRA**

**34-44 OF THE FIRST INPUT LINE. THIS WILL TURN OFF THE BACKWARD SPECTRA**

**THINNING (SEE UCRL-50400, VOL. 17, PART A FOR EXPLANATION) AND SPECTRA**

**RESULT IN ALL ORIGINAL ENERGY POINTS BEING KEPT. CAUTION SHOULD SPECTRA**

**BE EXERCISED IN USING THIS OPTION SINCE IT CAN RESULT IN A SPECTRA**

**CONSIDERABLE INCREASE IN THE NUMBER OF DATA POINTS OUTPUT BY SPECTRA**

**THIS CODE. SPECTRA**

**SPECTRA**

**FOR ALL USERS WHO ARE NOT INTERESTED IN THIS OPTIONS NO CHANGES SPECTRA**

**ARE REQUIRED IN THE INPUT TO THIS PROGRAM, I. E. IF COLUMNS SPECTRA**

**34-44 ARE BLANK (AS FOR ALL PREVIOUS VERSIONS OF THIS CODE) THE SPECTRA**

**PROGRAM WILL OPERATE EXACTLY AS IT DID BEFORE. SPECTRA**

**SPECTRA**

**ALLOWABLE ERROR SPECTRA**

**--------------- SPECTRA**

**ALLOWABLE ERROR MUST ALWAYS BE SPECIFIED IN THE INPUT TO THIS SPECTRA**

**PROGRAM AS A FRACTION, NOT A PER-CENT. FOR EXAMPLE, INPUT THE SPECTRA**

**ALLOWABLE FRACTIONAL ERROR 0.001 IN ORDER TO OBTAIN DATA THAT IS SPECTRA**

**ACCURATE TO WITHIN 0.1 PER-CENT. SPECTRA**

**SPECTRA**

**THE CONVERSION OF THE DATA FROM THE GENERAL INTERPOLATION FORM TO SPECTRA**

**LINARLY INTERPOLABLE FORM CANNOT BE PERFORMED EXACTLY. HOWEVER, ITSPECTRA**

**CAN BE PERFORMED TO VIRTUALLY ANY REQUIRED ACCURACY AND MOST SPECTRA**

**IMPORTANTLY CAN BE PERFORMED TO A TOLERANCE THAT IS SMALL COMPAREDSPECTRA**

**TO THE UNCERTAINTY IN THE CROSS SECTIONS THEMSELVES. AS SUCH THE SPECTRA**

**CONVERSION OF CROSS SECTIONS TO LINEARLY INTERPOLABLE FORM CAN BE SPECTRA**

**PERFORMED WITH ESSENTIALLY NO LOSE OF INFORMATION. SPECTRA**

**SPECTRA**

**THE ALLOWABLE ERROR MAY BE ENERGY INDEPENDENT (CONSTANT) OR ENERGYSPECTRA**

**DEPENDENT. THE ALLOWABLE ERROR IS DESCRIBED BY A TABULATED SPECTRA**

**FUNCTION OF UP TO 20 (ENERGY,ERROR) PAIRS AND LINEAR INTERPOLATIONSPECTRA**

**BETWEEN TABULATED POINTS. IF ONLY ONE TABULATED POINT IS GIVEN THESPECTRA**

**ERROR WILL BE CONSIDERED CONSTANT OVER THE ENTIRE ENERGY RANGE. SPECTRA**

**WITH THIS ENERGY DEPENDENT ERROR ONE MAY OPTIMIZE THE OUTPUT FOR SPECTRA**

**ANY GIVEN APPLICATION BY USING A SMALL ERROR IN THE ENERGY RANGE SPECTRA**

**OF INTEREST AND A LESS STRINGENT ERROR IN OTHER ENERGY RANGES. SPECTRA**

**SPECTRA**

**DEFAULT ALLOWABLE ERROR SPECTRA**

**----------------------- SPECTRA**

**IN ORDER TO INSURE CONVERGENCE OF THE LINEARIZING ALGORITHM THE SPECTRA**

**ALLOWABLE ERROR MUST BE POSITIVE. IF THE USER INPUTS AN ERROR SPECTRA**

**THAT IS NOT POSITIVE IT WILL AUTOMATICALLY BE SET TO THE DEFAULT SPECTRA**

**VALUE (CURRENTLY 0.001, CORRESPONDING TO 0.1 PER-CENT) AND SPECTRA**

**INDICATED AS SUCH IN THE OUTPUT LISTING. SPECTRA**

**SPECTRA**

**COULOMB PENETRABILITY (INTERPOLATION LAW = 6) SPECTRA**

**-------------------------------------------- SPECTRA**

**INTRODUCED FOR ENDF/B-VI. THIS IS DEFINED AS, SPECTRA**

**SPECTRA**

**SIG(E) = C1\*EXP(-C2/SQRT(E - T)) SPECTRA**

**SPECTRA**

**THIS PROGRAM ONLY CONSIDERS EXOTHERMIC REACTIONS - T = 0 SPECTRA**

**SPECTRA**

**SIG(E) = C1\*EXP(-C2/SQRT(E)) SPECTRA**

**SPECTRA**

**WARNING...THIS INTERPOLATION LAW SHOULD ONLY BE USED FOR REACTIONSSPECTRA**

**WHICH HAVE A POSITIVE Q-VALUE (EXOTHERMIC REACTIONS), SPECTRA**

**SINCE HERE WE ONLY CONSIDER T = 0.0 IN THE FORMALISM. SPECTRA**

**IN ALL OTHER CASES A WARNING MESSAGE WILL BE PRINTED. SPECTRA**

**SPECTRA**

**INPUT FILES SPECTRA**

**----------- SPECTRA**

**UNIT DESCRIPTION SPECTRA**

**---- ----------- SPECTRA**

**2 INPUT LINES (BCD - 80 CHARACTERS/RECORD) SPECTRA**

**10 ORIGINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD) SPECTRA**

**SPECTRA**

**OUTPUT FILES SPECTRA**

**------------ SPECTRA**

**UNIT DESCRIPTION SPECTRA**

**---- ----------- SPECTRA**

**3 OUTPUT REPORT (BCD - 120 CHARACTERS/RECORD) SPECTRA**

**11 FINAL ENDF/B DATA (BCD - 80 CHARACTERS/RECORD) SPECTRA**

**SPECTRA**

**SCRATCH FILES SPECTRA**

**------------- SPECTRA**

**UNIT DESCRIPTION SPECTRA**

**---- ----------- SPECTRA**

**12 SCRATCH FILE (BINARY - 180000 WORDS/RECORD SPECTRA**

**SPECTRA**

**OPTIONAL STANDARD FILE NAMES (SEE SUBROUTINE FILEIO) SPECTRA**

**---------------------------------------------------- SPECTRA**

**UNIT FILE NAME SPECTRA**

**---- ---------- SPECTRA**

**2 SPECTRA.INP SPECTRA**

**3 SPECTRA.LST SPECTRA**

**10 ENDFB.IN SPECTRA**

**11 ENDFB.OUT SPECTRA**

**12 (SCRATCH) SPECTRA**

**SPECTRA**

**SPECTRA**

**INPUT PARAMETERS SPECTRA**

**---------------- SPECTRA**

**FOR VERSIONS EARLIER THAN 90-1 THIS PROGRAM ONLY ALLOWED THE USER SPECTRA**

**TO SPECIFY BY INPUT PARAMETERS WHICH MATERIALS (MAT) TO PROCESS. SPECTRA**

**FOR EACH REQUESTED MATERIAL NEUTRON INTERACTION CROSS SECTIONS SPECTRA**

**(MF=3) WOULD BE LINEARIZED AND THE REMAINDER OF THE MATERIAL SPECTRA**

**WOULD BE COPIED. SPECTRA**

**SPECTRA**

**FOR VERSIONS 90-1 AND LATER THIS PROGRAM WILL ALLOW THE USER TO SPECTRA**

**TO SPECIFY BY INPUT PARAMETERS EXACTLY WHAT SECTIONS OF DATA SPECTRA**

**TO PROCESS. FOR EACH SECTION OF DATA, SPECIFIED BY MAT, MF, MT SPECTRA**

**RANGES, SECTIONS OF MF=3, 23 AND 27 WILL BE LINEARIZED AND ALL SPECTRA**

**OTHER REQUESTED SECTIONS WILL BE COPIED. ALL SECTIONS WHICH ARE SPECTRA**

**NOT EXPLICITLY REQUESTED WILL BE SKIPPED AND WILL NOT APPEAR ON SPECTRA**

**ENDF/B FILE OUTPUT BY THIS PROGRAM. SPECTRA**

**SPECTRA**

**WITH THIS NEW PROCEDURE YOU CAN MINIMIZE THE SIZE OF THE ENDF/B SPECTRA**

**FILE OUTPUT BY THIS PROGRAM, E.G., IF YOU ONLY WANT NEUTRON SPECTRA**

**CROSS SECTIONS FOR SUBSEQUENT PROCESSING YOU NEED ONLY REQUEST SPECTRA**

**ONLY MF=3 DATA. SPECTRA**

**SPECTRA**

**HOWEVER, YOU MUST UNDERSTAND THAT ONLY THOSE SECTIONS WHICH YOU SPECTRA**

**EXPLICITLY REQUEST WILL APPEAR ON THE ENDF/B FILE OUTPUT BY SPECTRA**

**THIS PROGRAM. FOR EXAMPLE, IF YOU WISH TO DOCUMENT EXACTLY SPECTRA**

**HOW YOU LINEARIZED THE DATA BY INCLUDING COMMENTS IN MF=1, MT=451 SPECTRA**

**THEN YOU MUST EXPLICITLY REQUEST THAT MF=1, MT=451 BE PROCESSED SPECTRA**

**FOR EACH MATERIAL THAT YOU REQUEST. SIMILAR IF YOU WANT THE SPECTRA**

**ENTIRE EVALUATION YOU MUST REQUEST ALL MF AND MT TO BE OUTPUT. SPECTRA**

**SPECTRA**

**LINE COLS. DESCRIPTION SPECTRA**

**---- ----- ----------- SPECTRA**

**1 1-11 SELECTION CRITERIA (0=MAT, 1=ZA) SPECTRA**

**12-22 MONITOR MODE SELECTOR SPECTRA**

**= 0 - NORMAL OPERATION SPECTRA**

**= 1 - MONITOR PROGRESS OF LINEARIZING OF THE DATA. SPECTRA**

**EACH TIME A PAGE OF DATA POINTS IS WRITTEN TO SPECTRA**

**THE SCRATCH FILE PRINT OUT THE TOTAL NUMBER OF SPECTRA**

**POINTS ON SCRATCH AND THE LOWER AND UPPER SPECTRA**

**ENERGY LIMITS OF THE PAGE (THIS OPTION MAY BE SPECTRA**

**USED IN ORDER TO MONITOR THE EXECUTION SPEED SPECTRA**

**OF LONG RUNNING JOBS). SPECTRA**

**23-33 MINIMUM CROSS SECTION OF INTEREST (BARNS). SPECTRA**

**(IF 0.0 OR LESS IS INPUT THE PROGRAM WILL SPECTRA**

**USE 1.0E-10). ENERGY INTERVALS WILL NOT BE SPECTRA**

**SUB-DIVIDED IF THE ABSOLUTE VALUE OF THE CROSS SPECTRA**

**SECTION WITHIN THE INTERVAL IS LESS THAN THIS VALUE. SPECTRA**

**AN EXCEPTION TO THIS RULE IS NEAR THRESHOLDS ENERGY SPECTRA**

**INTERVALS WILL BE SUB-DIVIDED UNTIL CONVERGENCE SPECTRA**

**REGARDLESS OF THE MAGNITUDE OF THE CROSS SECTION. SPECTRA**

**34-44 KEEP ORIGINAL EVALUATED DATA POINTS. SPECTRA**

**= 0 - NO. SPECTRA**

**= 1 - YES - ADDITIONAL POINTS MAY BE ADDED IN ORDER SPECTRA**

**TO LINEARIZE DATA, BUT ALL ORIGINAL SPECTRA**

**DATA POINTS WILL BE INCLUDED IN THE SPECTRA**

**RESULTS. SPECTRA**

**2 1-72 ENDF/B INPUT DATA FILENAME SPECTRA**

**(STANDARD OPTION = ENDFB.IN) SPECTRA**

**3 1-72 ENDF/B OUTPUT DATA FILENAME SPECTRA**

**(STANDARD OPTION = ENDFB.OUT) SPECTRA**

**4-N 1- 6 LOWER MAT OR ZA LIMIT SPECTRA**

**7- 8 LOWER MF LIMIT SPECTRA**

**9-11 LOWER MT LIMIT SPECTRA**

**12-17 UPPER MAT OR ZA LIMIT SPECTRA**

**18-19 UPPER MF LIMIT SPECTRA**

**20-22 UPPER MT LIMIT SPECTRA**

**UP TO 100 RANGES MAY BE SPECIFIED, ONLY ONE RANGE SPECTRA**

**PER LINE. THE LIST OF RANGES IS TERMINATED BY A SPECTRA**

**BLANK LINE. IF THE UPPER MAT LIMIT OF ANY REQUEST SPECTRA**

**IS LESS THAN THE LOW LIMIT IT WILL BE SET EQUAL TO SPECTRA**

**THE LOWER LIMIT. IF THE UPPER LIMIT IS STILL ZERO SPECTRA**

**IT WILL BE SET EQUAL TO 999999. IF THE UPPER MF OR SPECTRA**

**MT LIMIT IS ZERO IT WILL BE SET TO 99 OR 999 SPECTRA**

**RESPECTIVELY. SPECTRA**

**VARY 1-11 ENERGY FOR ERROR LAW SPECTRA**

**12-22 ALLOWABLE FRACTIONAL ERROR FOR ERROR LAW. SPECTRA**

**THE ACCEPTABLE LINEARIZING ERROR MAY BE SPECIFIED TO SPECTRA**

**BE EITHER ENERGY INDEPENDENT (DEFINED BY A SINGLE SPECTRA**

**ERROR), OR ENERGY DEPENDENT (DEFINED BY UP TO 20 SPECTRA**

**ENERGY, ERROR PAIRS). FOR THE ENERGY DEPENDENT CASE SPECTRA**

**LINEAR INTERPOLATION WILL BE USED TO DEFINE THE ERRORSPECTRA**

**AT ENERGIES BETWEEN THOSE AT WHICH IT IS TABULATED. SPECTRA**

**IN ALL CASES THE ERROR LAW IS TERMINATED BY A BLANK SPECTRA**

**LINE. IF ONLY ONE ENERGY, ERROR PAIR IS GIVEN THE SPECTRA**

**THE LAW WILL BE CONSIDERED TO BE ENERGY INDEPENDENT. SPECTRA**

**IF MORE THAN ONE PAIR IS GIVEN IT WILL BE CONSIDERED SPECTRA**

**TO BE ENERGY DEPENDENT (NOTE, ENERGY INDEPENDENT SPECTRA**

**FORM WILL RUN FASTER THAN THE EQUIVALENT ENERGY SPECTRA**

**DEPENDENT FORM). FOR AN ENERGY DEPENDENT ERROR LAW SPECTRA**

**ALL ENERGIES MUST BE ASCENDING ENERGY ORDER. FOR SPECTRA**

**CONVERGENCE OF THE LINEARIZING ALGORITHM ALL ERRORS SPECTRA**

**MUST BE POSITIVE. IF AN ALLOWABLE ERROR IS NOT SPECTRA**

**POSITIVE IT WILL BE SET EQUAL TO THE STANDARD OPTION SPECTRA**

**(CURRENTLY 0.001, CORRESPONDING TO 0.1 PER-CENT). SPECTRA**

**IF THE FIRST ERROR LINE IS BLANK IT WILL TERMINATE SPECTRA**

**THE ERROR LAW AND THE ERROR WILL BE TREATED AS SPECTRA**

**ENERGY INDEPENDENT, EQUAL TO THE STANDARD OPTION SPECTRA**

**(CURRENTLY 0.1 PER-CENT). (SEE EXAMPLE INPUT 4). SPECTRA**

**SPECTRA**

**EXAMPLE INPUT NO. 1 SPECTRA**

**------------------- SPECTRA**

**RETRIEVE DATA BY ZA IN ORDER TO FIND ALL URANIUM ISOTOPES AND SPECTRA**

**THORIUM 232. RETRIEVE ALL NEUTRON INTERACTION CROSS SECTIONS SPECTRA**

**(MF=3). ALL ENERGY INTERVALS IN WHICH THE CROSS SECTION IS SPECTRA**

**AT LEAST 1 MICRO-BARN (1.0E-06 BARNS) WILL BE SUBDIVIDED. SPECTRA**

**BACKWARD THINNING WILL BE PERFORMED. FROM 0 TO 100 EV LINEARIZE SPECTRA**

**TO WITHIN 0.1 PER-CENT ACCURACY. FROM 100 EV TO 1 KEV VARY SPECTRA**

**ACCURACY BETWEEN 0.1 AND 1.0 PER-CENT. ABOVE 1 KEV USE 1 SPECTRA**

**PER-CENT ACCURACY. SPECTRA**

**SPECTRA**

**EXPLICITLY SPECIFY THE STANDARD FILENAMES. SPECTRA**

**SPECTRA**

**IN THIS CASE THE FOLLOWING 11 INPUT LINES ARE REQUIRED SPECTRA**

**SPECTRA**

**1 0 1.00000- 6 0 SPECTRA**

**ENDFB.IN SPECTRA**

**ENDFB.OUT SPECTRA**

**92000 3 0 92999 3999 SPECTRA**

**90232 3 0 0 3 0 (UPPER LIMIT AUTOMATICALLY SET TO 90232 3999)SPECTRA**

**(END OF REQUEST LIST) SPECTRA**

**0.00000+ 0 1.00000-03 SPECTRA**

**1.00000+ 2 1.00000-03 SPECTRA**

**1.00000+ 3 1.00000-02 SPECTRA**

**1.00000+ 9 1.00000-02 SPECTRA**

**(END OF ERROR LAW) SPECTRA**

**SPECTRA**

**EXAMPLE INPUT NO. 2 SPECTRA**

**------------------- SPECTRA**

**SAME AS THE ABOVE CASE, EXCEPT LINEARIZE ALL DATA TO WITHIN THE SPECTRA**

**STANDARD ACCURACY (CURRENTLY 0.1 PER-CENT). IN ORDER TO USE THE SPECTRA**

**STANDARD ACCURACY YOU NEED NOT SPECIFY ANY ERROR LAW AT ALL. IN SPECTRA**

**THIS CASE INCLUDE THE HOLLERITH SECTION, MF=1, MT=451, FOR EACH SPECTRA**

**MATERIAL. SPECTRA**

**SPECTRA**

**LEAVE THE DEFINITION OF THE FILENAMES BLANK - THE PROGRAM WILL SPECTRA**

**THEN USE STANDARD FILENAMES. SPECTRA**

**SPECTRA**

**IN THIS CASE THE FOLLOWING 9 INPUT LINES ARE REQUIRED SPECTRA**

**SPECTRA**

**1 0 1.00000- 6 0 SPECTRA**

**(USE DEFAULT FILENAME = ENDFB.IN) SPECTRA**

**(USE DEFAULT FILENAME = ENDFB.OUT) SPECTRA**

**92000 1451 92999 1451 SPECTRA**

**92000 3 0 92999 3999 SPECTRA**

**90232 1451 0 1451 SPECTRA**

**90232 3 0 0 3 0 (UPPER LIMIT AUTOMATICALLY SET TO 90232 3999)SPECTRA**

**(END OF REQUEST LIST) SPECTRA**

**(0.1 PER-CENT ERROR, END OF ERROR LAW) SPECTRA**

**SPECTRA**

**EXAMPLE INPUT NO. 3 SPECTRA**

**------------------- SPECTRA**

**LINEARIZE ALL MATERIALS ON AN ENDF/B TAPE TO WITHIN AN ACCURACY SPECTRA**

**OF 0.5 PER-CENT (0.005 AS A FRACTION). IN THIS CASE YOU NEED NOT SPECTRA**

**SPECIFY THE MAT, MF, MT RANGES. SPECTRA**

**SPECTRA**

**READ THE ENDF/B DATA FROM \ENDFB6\ZA092238 AND WRITE THE ENDF/B SPECTRA**

**DATA TO \ENDFB6\LINEAR\ZA092238. SPECTRA**

**SPECTRA**

**IN THIS CASE THE FOLLOWING 6 INPUT LINES ARE REQUIRED SPECTRA**

**SPECTRA**

**(MAT, 1.0E-10 BARNS, THIN)SPECTRA**

**\ENDFB6\ZA092238 SPECTRA**

**\ENDFB6\LINEAR\ZA092238 SPECTRA**

**(RETRIEVE ALL DATA, END REQUEST LIST) SPECTRA**

**5.00000-03 SPECTRA**

**(END OF ERROR LAW) SPECTRA**

**SPECTRA**

**NOTE THAT IN THIS CASE IF THE INPUT HAD SPECIFIED AN EQUIVALENT SPECTRA**

**ENERGY DEPENDENT ERROR LAW BY GIVING A NUMBER OF ENERGY POINTS SPECTRA**

**AT EACH OF WHICH THE ERROR IS 0.5 PER-CENT THE PROGRAM WOULD TAKE SPECTRA**

**LONGER TO RUN (I.E., ONLY USE AN ENERGY DEPENDENT ERROR LAW WHEN SPECTRA**

**IT IS NECESSARY). SPECTRA**

**SPECTRA**

**EXAMPLE INPUT NO. 4 SPECTRA**

**------------------- SPECTRA**

**IN ORDER TO LINEARIZE ALL MATERIALS ON AN ENDF/B TAPE TO THE SPECTRA**

**STANDARD OPTION OF 0.1 PER-CENT IT IS ADEQUATE TO INPUT A SET SPECTRA**

**OF COMPLETELY BLANK LINES WHICH WILL AUTOMATICALLY INVOKE ALL SPECTRA**

**OF THE STANDARD OPTIONS. SPECTRA**

**SPECTRA**

**LEAVE THE DEFINITION OF THE FILENAMES BLANK - THE PROGRAM WILL SPECTRA**

**THEN USE STANDARD FILENAMES. SPECTRA**

**SPECTRA**

**IN THIS CASE THE FOLLOWING THREE INPUT LINES ARE REQUIRED SPECTRA**

**SPECTRA**

**(MAT, 1.0E-10 BARNS, THIN)SPECTRA**

**(USE DEFAULT FILENAME = ENDFB.IN) SPECTRA**

**(USE DEFAULT FILENAME = ENDFB.OUT) SPECTRA**

**(RETRIEVE ALL DATA, END REQUEST LIST) SPECTRA**

**(0.1 PER-CENT ERROR, END OF ERROR LAW) SPECTRA**

**SPECTRA**

**=======================================================================SPECTRA**