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THE NEUTRON METROLOGY FILE NMF-90

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Abstract: The Neutron Metrology File NMF-90 is an integrated database and software package for neutron spectrum adjustment and radiation damage (exposure) parameter calculations on PC. It contains 4 different neutron spectrum adjustment ("spectra unfolding") codes, the reactor dosimetry cross section library IRDF–90/NMF–G with covariance files, 6 input data sets for benchmark reactor neutron fields and a number of utility programs for processing and plotting the input and output data. The package – including manuals – is distributed on CD–ROM by the Nuclear Data Section of IAEA (free of charge). It is also available online (http://www-nds.iaea.or.at). About 30 MB of HDD space is needed to install the file and run a typical reactor dosimetry neutron spectrum adjustment problem.

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Introduction

The Nuclear Data Section of the International Atomic Energy Agency (IAEA NDS) organized a long term reactor dosimetry programme in order to improve the accuracy in the radiation damage characterization and hereby in the service life prediction of nuclear facilities. The emphasis was concentrated on radiation damage (exposure) parameters (derived from neutron spectrum information by an adjustment procedure) for reactor pressure vessels and related nuclear technology.

The programme was realized in frame of several interlaboratory exercises named REAL–80[*], REAL–84 and REAL–88, and covered a period longer than a decade [1–4]. The improvement of the radiation damage (exposure) parameters required the use of good quality input data and proper calculation methods. The combined effort of the participants and evaluators[**] of the exercises contributed to the solution of numerous basic mathematical and physics problems detected in the neutron spectrum adjustment procedure for radiation damage purposes.

The final outcome of the project resulted in the Neutron Metrology File NMF–90 [4,5] comprising the following information in the form of separate modules:

1. DEMO;
2. Reference data file for the benchmark neutron fields of the REAL–88 project;
3. Tested cross section library;
4. Software packages and utility programs for neutron spectrum adjustment ("spectra unfolding") and subsequent radiation damage (exposure) parameter calculations.

The file is distributed by the Nuclear Data Section of IAEA.

1. Module DEMO

The module DEMO contains a sample problem and performs neutron spectrum adjustment runs (including cross section processing as well) and related radiation damage calculations with all the programs involved in NMF–90. The spectrum set chosen for this purpose was derived for the reactor cavity of the Arcansas Power and Light Reactor (Arcansas Nuclear One–1), and is one of the reference spectrum sets in the neutron metrology file (see below). It is recommended to run the DEMO in order to see all the details of the calculations before using the programs of the neutron spectrum adjustment modules.

[*] REAL = Reaction Rate Estimates Evaluated by Adjustment Analysis in Leading Laboratories.

[**] The evaluators of the exercises were: Energy Research Foundation of the Netherlands (ECN) and Institute of Nuclear Techniques of the Technical University of Budapest (INT TUB).

2. Reference Data File

This module contains problem dependent input data sets for the six benchmark neutron fields of the REAL–88 exercise, furthermore, characteristic data calculated by some experienced laboratories for the spectrum sets in question. The benchmark neutron fields are:

1. ANO – Pressure vessel cavity (between the pressure vessel wall and the concrete shielding) of the Arkansas Power and Light Reactor (Arkansas Nuclear One-1).

2. PS1 – Oak Ridge Research Reactor, Poolside Facility; metallurgical irradiation experiment, simulated surveillance position.

3. PS2 – Oak Ridge Research Reactor, Poolside Facility; metallurgical irradiation experiment, simulated pressure vessel capsule position.

4. RTN – Fusion simulation spectrum measured at RTNS–11, a 14 MeV neutron source at the Lawrence Lovermore Laboratory. The spectrum is a simulation of the first wall spectrum in a fusion reactor.

5. Fission neutron spectrum of ^{235}U.

6. CFR – Neutron spectrum in the centre of the coupled fast reactivity measurement facility (CFRMF).

Each input data set contains the following information:

a) measured reaction rates and related uncertainty information (in the form of covariance matrices) in the neutron field of interest;

b) calculated neutron spectrum for the neutron field in question, accompanied with covariance information;

c) weighting neutron spectrum in a fine energy group structure (for cover and selfshielding calculations and cross section processing).

The file has been developed in order to create consistent data sets for neutron spectrum adjustment and related radiation damage (exposure) parameter calculations, which can be considered as benchmarks for interested scientists in testing their relevant calculation procedures. At the same time, certain data of the benchmark fields can be used for substituting missing data (eg input neutron spectrum covariance matrix) of the neutron spectrum adjustment calculations in similar environments. Nevertheless, this method can be applied only in case if it is justified by physics based information.

3. Tested cross section library (IRDF–90)

The cross section library (named IRDF–90/NMF–G [6]) involved in NMF–90 is based on the second version of IRDF–90 [7–9]. Some corrections have been introduced to the numerical values, furthermore, the files in ENDF–5 format of the second version have been converted into ENDF–6 format. The cross sections are available in 640 groups (extended SAND II) histogram format.

The library contains 53 dosimetry reactions together with uncertainty information in the form of covariance matrices.* Besides these data, cross sections for detector cover materials and radiation damage calculations (eg dpa) are also present. Some results on testing of the library data can be found in [6,8,9].

4. Software packages and utility programs

Three software packages (STAYNL, MIEKE and LSL [5,11–14]) developed by different laboratories and running on PC-s have been made available for the users. Each package can provide a complete neutron metrology calculation for radiation damage purposes. They start with cross section processing from ENDF–6 format data (except LSL, which contains a master library), perform neutron spectrum adjustment by the generalized LSQ method and terminate in radiation damage (exposure) parameter calculation.

The modules STAYNL and LSL have been written in standard FORTRAN77. The module MIEKE applies Microsoft Fortran77 compiler specific extensions, therefore, it can run only in case if Microsoft runtime libraries are available. A mathemetical processor is strongly recommended for older PCs.

4.1. Module STAYNL

The module STAYNL – developed by the Institute of Nuclear Techniques of the Technical University of Budapest and by the Energy Research Foundation of the Netherlands – comprises two computer codes: *X333* and *STAYNL* [11,12,15].

X333 – The code X333 is the cross section processing code of the module. It calculates group cross section values and their covariance matrices from the data given in MF=3 and MF=33 of preprocessed cross section libraries in ENDF–6 format like IRDF–90. The cross section data present in file MF=3 are given in histogram form, in the 640 group SAND II energy group structure. The code performs simple self- and cover-shielding calculations as well. The input requires the list of the reactions, the cross sections of which will have to be processed, the detector and cover geometry and material data (optional), the requested output energy group structure, and a weighting neutron spectrum for the neutron field of interest (based on reactor physics information) in a fine energy group structure. The output of the code is a problem dependent cross section and cross section covariance library.

* The content of the files MF=32 present in Ver. 2. of IRDF–90 has been converted into form MF=33 during the preparatory work of IRDF–90/NMF–G [10].

STAYNL – The code solves the neutron spectrum adjustment problem by the generalized least squares method (GLSQM). The spectrum normalization before adjustment is performed also by the GLSQM, and the cross covariance terms in the calculation of the covariance matrix of the reaction rates are also taken into consideration. The user's input consists of the measured reaction rates and their covariance matrix, and of the calculated neutron spectrum in the neutron field of interest, also accompanied by its covariance information. The problem dependent cross section library can be generated using the code X333. The output of the code is the adjusted neutron spectrum (together with its covariance information) that minimizes the χ^2 value for the problem.

XSSPPP – This utility program converts the I/O files of the codes X333 and STAYNL into a form similar to file MF=3 in ENDF–6. The output of the utility can be used as input for the plotting programs EVALPLOT and COMPLOT* of the ENDF pre-processing code package PREPRO96 [16].

COVPLOT – This utility program plots the covariance matrices obtained from the jobs of X333 and STAYNL both in 3D and color coded 2D forms.

XSL&OUT – This utility program calculates the radiation damage (exposure) parameters based on the outputs of the codes X333 and STAYNL.

XSLXTRCT – This utility program converts the (direct access, binary) cross section library generated by the code X333 into card–image ASCII form (eg for the purpose of further manual editing).

X333SCR – This utility program converts the content of the scratch files of the job X333 into character form to help the user in the debugging procedure of the cross section processing.

All the programs of the module have been written in a user friendly form, ie no manual editing is needed between the neutron spectrum adjustment, plotting and radiation damage parameter calculations. Furthermore, the same input is possible for the codes X333 and STAYNL.

4.2. Module MIEKE

The module MIEKE [13] – developed by the Physikalische Technische Bundesanstalt (PTB) Braunschweig (BRD), contains a cross section processing code (UNC33M) and three neutron spectrum adjustment codes (MSITER, MSANDB, MIEKEB), accompanied by several utility programs.

1) The cross section processing in this module is performed by the application of the code UNC33M and 3 utility programs.

UNC33M – Cross section covariance processing code converting ENDF–6 format covariance data in the file MF=33 to the user’s energy group structure.

MCROBI – This utility program converts the ENDF–6 formatted data into a formatted SAND II 640 energy group library.

* Also these programs are recorded on the NMF–90 CD–ROM.

UMSBIB – This utility program converts the formatted SAND II library into binary form needed as input for UNC33M.

MFITIB – This utility program converts cross section and neutron fluence rate data given in SAND II energy grid to coarse energy groups, and performs simple neutron self-shielding calculations for cross sections needed as input for MSITER.

XSC32M90 – The module MIEKE can process data from the cross section library IRDF–85 in case, if the covariance information on the resonance parameters (MF=32 files) of the target materials ^{23}Na, ^{237}Np, and ^{58}Fe has been pre-processed and attached to the library in a special format. Then the utility program XSC32M90 selects the one of the 3 materials requested by the user for further processing by the code UNC33M. (Neither the pre-processing code nor the pre-processed data are present in the module MIEKE.)

2) Neutron spectrum adjustment codes:

MSITER – This code solves the neutron spectrum adjustment problem also by the GLSQ method, but the neutron spectrum modification is performed in iterative way. The number of iterations to be performed by the program can be given either in the input, or it is determined by the convergency of the results obtained in the subsequent iteration steps. The normalization of the input neutron spectrum can be performed in three different ways:

a) the normalization factor can be a constant defined in the input;

b) the normalization can be performed by the GLSQM before the spectrum modification;

c) the normalization and the spectrum modification can be performed in one step by the GLSQM.

Selection of the procedure to be carried out is done by the user in the input.

MSANDB – The algorithm of this adjustment code is taken from the code SAND II [17], however, the uncertainties of the reaction rates (ie the elements along the main diagonal of the covariance matrix of the reaction rates) can be taken into account in the adjustment procedure.

MIEKEB– It is a neutron spectrum adjustment code for use in cases when there is a lack of *a priori* information on the neutron spectrum. The code is using Monte–Carlo algorithm for solving the problem. (It is not a GLSQM code.)

Running the codes of the module MIEKE requires some editing work. Several utility programs are given to prepare the input for the codes and to plot the results of the spectrum adjustment runs and radiation damage (exposure) parameter calculations.

MSPECT – This utility program creates neutron fluence rate values in the required energy group structure for: Watt fission spectrum, NBS-Uranium fission spectrum, NBS-Californium fission spectrum or for a neutron spectrum defined by the user, to be used as input for the code MSITER.

UMSDAT – This utility program converts the data of the reference data file to the format needed in this (MIEKE) module.

PLOT – This utility program prepares plots for a HP-plotter or LASER JET printer.

PLOF – This utility program plots cross section data from IRDF–90 or from a formatted or unformatted SAND II type cross section library.

4.3. Module LSL

The module – developed by the ORNL, Oak Ridge, USA – contains the neutron spectrum adjustment code LSL–M2 [14] and a MASTER cross section library (based on IRDF–85 data). For using data of ENDF–6 type in the neutron spectrum adjustment by this program one has to run the code X333 from the module STAYNL (and a small utility program for format conversion), thus producing the cross section data for the sample problem. The code LSL–M2 is based on the GLSQM and it is working in the logarythmic space. The spectrum normalization before adjustment is based on the ratio of measured and calculated reaction rates of the detector(s) selected by the user. The calculations require several editing steps.

The code LSL–M2 is not distributed in this package, it can be obtained from RSSIC, Oak Ridge, TN, USA.

5. Hardware and software requirements

The NMF–90 has been developed for running on PC. Depending on the HDD addressing system, about 23–29 MB of disk space is needed to install the file, and about 2–5 MB is needed for the solution of a typical reactor dosimetry neutron spectrum adjustment problem.

The codes available in executable form (.EXE files) run under MS–DOS operating system Ver. 3.2 or above, furthermore in full screen DOS window of Windows 3.1x or Windows 95. The programs of the module STAYNL can be compiled for other platforms than PC + MS–DOS as well, while the programs of the modules DEMO and MIEKE can run only on PC.

The file NMF–90 is distributed on CD–ROM.

The manuals on the CD–ROM are given in their original format (extended ASCII, Microsoft Word 2.0, Microsoft Word 6.0, and WordPerfect).

The installation procedure is described on the CD–ROM in the file \SUMMARY.TXT.

6. References

[1] W. L. Zijp, É. M. Zsolnay, H. J. Nolthenius, E. J. Szondi, G. C. H. M. Verhaag, D. E. Cullen, C. Ertek: “Final Report on the REAL–80 exercise.” Report ECN–128, INDC–(NED)–7, BME–TR–RES–6/82, (Petten) February 1983.

[2] W. L. Zijp, É. M. Zsolnay, H. J. Nolthenius, E. J. Szondi: “Final report on the REAL–84 exercise.” Report ECN–212, BME–TR–RES–18/88, IAEA–NDS–212, Petten, 1988. 99 p.

[3] H. J. Nolthenius: “Progress Report on the REAL–88 exercise.” Report. ECN–89–140. Petten, September 1989.

[4] É. M Zsolnay, H. J. Nolthenius, E. J. Szondi: “The role of the REAL–88 exercise in the radiation damage characterization of nuclear facilities.” In: Nuclear data for radiation damage assessment and related safety aspects, IAEA–TECDOC–572, Vienna, 1990. p.133–137.

[5] É. M. Zsolnay, H. J. Nolthenius, L. R. Greenwood, E. J. Szondi: “Reference data file for neutron spectrum adjustment and related radiation damage calculations.” In: Proc. of the 7th ASTM–EURATOM Symp. on Reactor Dosimetry, Strasbourg, France, 27–31 August, 1990. EUR 14356 EN, (G. Tsotridis, R. Dierickx, P. Hondt, editors). Kluwer Academic Publishers, 1992. (ISBN 0–7923–1792–0).

[6] E. J. Szondi, H. J. Nolthenius, É. M. Zsolnay: “The cross section library IRDF–90/NMF–G and its user-friendly processing for practical applications.” In: J. K. Dickens (ed.): Nuclear data for Science and technology. Proceedings of the International Conference, Gatlinburg, TN, May 9–13, 1994. American Nuclear Society, LaGrande Park. IL., ISBN 0–89448–194–0.

[7] N. P. Kocherov, P. K. McLaughlin: “The International Reactor Dosimetry File IRDF–90, Version 2.” Report IAEA–NDS–141, Rev.2. October 1993.

[8] É. M. Zsolnay, H. J. Nolthenius: “On the quality of the uncertainty information in the International Reactor Dosimetry File IRDF–90 (Version June 1992).” Report ECN–I–93–019. ECN Petten, June 1993.

[9] H. J. Nolthenius, É. M. Zsolnay, E. J. Szondi: “Testing of the IRDF–90 cross section library in benchmark neutron spectra.” In Proc. of the 8th ASTM–EURATOM Symposium on Reactor Dosimetry, Vail, 29 Aug. – 3 Sept., 1993. Reactor Dosimetry. (Eds.: H. Farrar IV, E. Lippincot, et al.) ASTM 1228, Philadelphia, 1994.

[10] Sz. Czifrus: “Evaluation of resonance region covariance information.” Report BME–TR–RES–21/93. Technical University of Budapest, Oct. 1993. ISBN 963 420 414 7.

[11] E: J. Szondi, H. J. Nolthenius: “User's guide to the cross section processing code X333 (Version 95–1).” Report, BME–NTI 222/95, Istitute of Nuclear Techniques, Technical University of Budapest, May 1995.

[12] E. J. Szondi, H. J. Nolthenius, É. M. Zsolnay: “User's guide to the neutron spectrum adjustment code STAYNL (Version 95–1).” Report, BME–NTI 223/95, Institute of Nuclear Techniques, Technical University of Budapest, May 1995.

[13] M. Matzke: “MIEKE – a package of programs for neutron spectrum adjustment based on “few channel” measurements.” Version March 1991, new comments added: 1994. File README.DOC on the distribution diskette of the module MIEKE (2–23–95).

[14] F. W. Stallmann: “LSL–M2: A computer program for least squares logarithmic adjustment of neutron spectra.” Report NUREG/CR–4349, ORNL/TM–9933 (Oak Ridge National Laboratory, Oak Ridge, TN, March 1986).

[15] É. M. Zsolnay, E. J. Szondi, H. J. Nolthenius. “Experiences with the module STAYNL of the Neutron metrology File NMF–90.” In: Reactor Dosimetry. Proc. of the 9th International Symposium on Reactor Dosimetry, September 2–6, 1996, Prague, Czech Republik, Eds. H. Aït Abderrahim, P. D'hondt, B. Osmera, World Sci. Publ., Singapore (1998), ISBN 981–02–3346–9.

[16] D. E. Cullen: “The 1996 ENDF pre-processing codes, PREPRO96.” Report IAEA–NDS–39, Rev. 9. International Atomic Energy Agency, Nov. 1996.

[17] W. N. McElroy et al: “SAND, neutron flux spectra determination by multiple foil activation.” Report CCC–112, ORNL RSIC, Oak Ridge National Laboratory, Oak Ridge, TN. May 1969.

List of files contained on the CD–ROM

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      BATCHBS.BAT   04-04-91      |      COMPLINK.BAT  03-14-91
      BATCHRD.BAT   02-23-95      |      INSTALL.BAT   07-29-98
      BSSETUP.BAT   02-23-95      |      PACKLIST.TXT  07-29-98
      CHANGES.!!!   02-02-95      |      RDSETUP.BAT   02-23-95

Directory of \NMF-90\MIEKE\BONNIN
      ACT           06-29-90      |      MSITER.INP    01-26-90
      MIEKEB.IN2    01-27-90      |      MSPECT.INP    03-06-91
      MIEKEB.INP    01-26-90      |      PACKLIST.TXT  07-29-98
      MRESBI.INP    03-08-91      |      RESPDAT       11-08-88
      MSANDB.INP    03-09-91      |

Directory of \NMF-90\MIEKE\BONNOUT
      FLUX48.MI1    04-04-91      |      MRESBI.48     04-04-91
      FLUX48.MI2    04-04-91      |      MRESBI.PR1    04-04-91
      FLUX48.MS     04-04-91      |      MSANDB.PR1    04-04-91
      FLUX48.SAN    04-04-91      |      MSITER.PR1    04-04-91
      FLUXC48.MI1   04-04-91      |      MSPECT.OUT    03-21-91
      FLUXC48.MI2   02-02-95      |      MSPECT.PR     02-02-95
      FLUXC48.MS    04-04-91      |      PACKLIST.TXT  07-29-98
      MIEKEB.PR1    04-04-91      |      RESP48.BIN    04-04-91
      MIEKEB.PR2    04-04-91      |      RESP48.FMT    04-04-91

Directory of \NMF-90\MIEKE\DOCU
      PACKLIST.TXT  07-29-98      |      README.DOC    02-23-95
      READ1.DOC     06-29-95      |

Directory of \NMF-90\MIEKE\FORTRAN
      ENDF.FOR      01-24-95      |      MSPECT.FOR    03-07-91
      MCROBI.FOR    03-29-91      |      PACKLIST.TXT  07-29-98
      MFITIB.FOR    04-03-91      |      UMSBIB.FOR    01-18-90
      MIEKEB.FOR    03-19-91      |      UMSDAT.FOR    03-29-91
      MRESBI.FOR    03-08-91      |      UNC33M.FOR    03-29-91
      MSANDB.FOR    03-07-91      |      XSC32M90.FOR  03-07-91
      MSITER.FOR    04-03-91      |

Directory of \NMF-90\MIEKE\INPUT
      MCROBI.DAT    03-22-91      |      MSPECT.INP    03-06-91
      MCROBI.INP    03-07-91      |      PACKLIST.TXT  07-29-98

Directory of \NMF-90\MIEKE\INPUTANO
      ACT.ANO       03-15-91      |      MSITERIN.ANO  03-19-91
      MFITIBIN.ANO  03-14-91      |      PACKLIST.TXT  07-29-98
      MIEKEBI2.ANO  03-24-91      |      UMSDATIN.ANO  03-14-91
      MIEKEBIN.ANO  03-24-91      |      UNC33MIN.ANO  03-14-91
      MSANDBIN.ANO  03-19-91      |
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Directory of \NMF-90\MIEKE\INPUTCFR
      ACT.CFR       03-15-91      |      MSITERIN.CFR  03-15-91
      MFITIBIN.CFR  03-14-91      |      PACKLIST.TXT  07-29-98
      MIEKEBI2.CFR  03-24-91      |      UMSDATIN.CFR  03-14-91
      MIEKEBIN.CFR  03-24-91      |      UNC33MIN.CFR  03-14-91
      MSANDBIN.CFR  03-14-91      |

Directory of \NMF-90\MIEKE\INPUTPS1
      ACT.PS1       03-21-91      |      MSITERIN.PS1  03-15-91
      MFITIBIN.PS1  03-07-91      |      PACKLIST.TXT  07-29-98
      MIEKEBI2.PS1  04-06-91      |      UMSDATIN.PS1  03-07-91
      MIEKEBIN.PS1  03-24-91      |      UNC33MIN.PS1  03-07-91
      MSANDBIN.PS1  01-23-90      |

Directory of \NMF-90\MIEKE\INPUTPS2
      ACT.PS2       03-14-91      |      MSITERIN.PS2  03-15-91
      MFITIBIN.PS2  03-14-91      |      PACKLIST.TXT  07-29-98
      MIEKEBI2.PS2  04-06-91      |      UMSDATIN.PS2  03-14-91
      MIEKEBIN.PS2  03-24-91      |      UNC33MIN.PS2  03-14-91
      MSANDBIN.PS2  03-14-91      |

Directory of \NMF-90\MIEKE\INPUTRTN
      ACT.RTN       03-21-91      |      MSITERIN.RTN  03-15-91
      MFITIBIN.RTN  03-14-91      |      PACKLIST.TXT  07-29-98
      MIEKEBI2.RTN  03-24-91      |      UMSDATIN.RTN  03-14-91
      MIEKEBIN.RTN  03-24-91      |      UNC33MIN.RTN  03-14-91
      MSANDBIN.RTN  03-14-91      |

Directory of \NMF-90\MIEKE\INPUTU35
      ACT.U35       03-14-91      |      MSITERIN.U35  03-15-91
      MFITIBIN.U35  03-14-91      |      PACKLIST.TXT  07-29-98
      MIEKEBI2.U35  04-06-91      |      UMSDATIN.U35  03-14-91
      MIEKEBIN.U35  03-24-91      |      UNC33MIN.U35  03-14-91
      MSANDBIN.U35  03-14-91      |

Directory of \NMF-90\MIEKE\IRDF1
      COMPNEPT.EXE  01-27-95      |      IRDFDAM       09-28-93
      COMPXSC1.EXE  01-27-95      |      PACKLIST.TXT  07-29-98

Directory of \NMF-90\MIEKE\IRDFLIB
      IRDF.BIN      03-22-91      |      PACKLIST.TXT  07-29-98
      IRDF.FMT      03-22-91      |

Directory of \NMF-90\MIEKE\PLOT
      ERZFON.EXE    04-05-91      |      PLOF.EXE      04-12-91
      PACKLIST.TXT  07-29-98      |      PLOT.EXE      04-12-91

Directory of \NMF-90\MIEKE\PROGRAMS
      MCROBI.EXE    03-21-91      |      MSPECT.EXE    03-21-91
      MFITIB.EXE    03-21-91      |      PACKLIST.TXT  07-29-98
      MIEKEB.EXE    04-04-91      |      UMSBIB.EXE    04-05-91
      MRESBI.EXE    04-04-91      |      UMSDAT.EXE    03-21-91
      MSANDB.EXE    03-21-91      |      UNC33M.EXE    03-29-91
      MSITER.EXE    03-21-91      |      XSC32M90.EXE  04-05-91
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Directory of \NMF-90\MIEKE\PS1OUT
      ACT.PS1       03-21-91      |      FMIEKE1.PS1   03-23-91
      ACT2.PS1      03-22-91      |      FMIEKE2.PS1   04-12-91
      CF.PS1        03-22-91      |      FSAND.PS1     03-22-91
      CFMIEKE1.PS1  03-23-91      |      FSITER.PS1    03-22-91
      CFMIEKE2.PS1  04-12-91      |      MFITIBPR.PS1  03-22-91
      CFSITER.PS1   03-22-91      |      MIEKEBP2.PS1  04-12-91
      COV.PS1       03-22-91      |      MIEKEBPR.PS1  03-23-91
      COVACT.PS1    03-22-91      |      MSANDBPR.PS1  03-22-91
      CROSS.PS1     03-22-91      |      MSITERPR.PS1  03-22-91
      CROSS1.PS1    03-22-91      |      PACKLIST.TXT  07-29-98
      CROSS1BI.PS1  03-22-91      |      UMSDATPR.PS1  03-22-91
      CROSSBI.PS1   03-22-91      |      UNC33MPR.PS1  03-22-91
      F1.PS1        03-22-91      |      W1.PS1        03-22-91
      FF1.PS1       03-22-91      |

Directory of \PREPRO96

      DOCU.TXT      07-29-98      |      PACKLIST.TXT  07-29-98
      ENDFIO.FOR    11-08-96      |      PLOT.CHR      11-19-96
      HARDSAVE.FOR  11-19-96      |      PLOT.SYM      11-19-96
      HARDSEND.FOR  11-19-96      |      SCRATCH1.FOR  10-10-96
      INSTALL.BAT   07-29-98      |      SCREEN.FOR    11-12-96
      MT.DAT        11-19-96      |      TIMER.FOR     10-10-96

Directory of \PREPRO96\COMPLOT
      AAREADME      12-05-96      |      COMPSAVE.EXE  12-05-96
      COMPLOT.EXE   11-19-96      |      COMPSEND.EXE  12-05-96
      COMPLOT.FOR   11-08-96      |      MAKEFILE      10-10-96
      COMPLOT.INP   10-01-96      |      PACKLIST.TXT  07-29-98
      COMPLOT.LST   12-05-96      |      SEND.BAT      11-25-96

Directory of \PREPRO96\EVALPLOT
      AAREADME      12-05-96      |      EVALSAVE.EXE  12-05-96
      EVALPLOT.EXE  11-19-96      |      EVALSEND.EXE  12-05-96
      EVALPLOT.FOR  11-08-96      |      MAKEFILE      10-10-96
      EVALPLOT.INP  11-19-96      |      PACKLIST.TXT  07-29-98
      EVALPLOT.LST  12-05-96      |      SEND.BAT      11-28-96
```