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INTERNATIONAL ATOMIC ENERGY AGENCY

NUCLEAR DATA SERVICES

DOCUMENTATION SERIES OF THE IAEA NUCLEAR DATA SECTION

PNESD

Proton Nucleus Elastic Scattering Data

Contents and Documentation

Abstract

The data file PNESD contains numerical data and the related bibliography for the differential elastic cross sections, polarization and integral nonelastic cross sections for protons of 3 MeV to 1000 MeV incident on natural elements and their isotopes.

The file can be obtained on magnetic tape free of charge from the IAEA Nuclear Data Section.

N. DayDay

December 1979

IAEA NUCLEAR DATA SECTION, P.O. BOX 100, A-1400 VIENNA

PNESD

Proton Nucleus Elastic Scattering Data

CONTENTS

The Proton Nucleus Elastic Scattering Data File PNESD contains a compilation of the differential elastic cross sections, the polarizations and the integral non-elastic cross sections for elastic proton-nucleus scattering. Only data in tabular form are included which are found in the familiar literature of nuclear physics. In general data published in internal reports of institutes were not taken into consideration.

The data for 80 nuclides ranging from 1-H-2 through 92-U-Nat are presented. The energy range of the incident proton is from 3 MeV to 1000 MeV. In addition to the data, an index to the data, a list of references and FORTRAN programs for output listings of the index (LISTAD, references (LISTRE) and data (LISTDA) are also given.

For the list of nuclides, symbols and their meanings, and examples of data index, data, list of references and FORTRAN programmes refer to Tables 1 and 2 and to the Appendix.

FILE ORGANIZATION

The PNESD Library consists of 4 files:

- File 1 contains an index to the data
- File 2 contains the references
- File 3 contains the data
- File 4 contains the FORTRAN programs for the output listings:

  record 1 contains LISTDA, program for listing the data
  record 2 contains LISTRE, program for listing the references
  record 3 contains LISTDA, program for listing the index to the data

The meaning of various symbols used in the output listings are given in Table 2.

DOCUMENTATION

H. Leeb; Data File PNESD, Proton Nucleus Elastic Scattering Data,
AIAU 78201 (January 1978)

TABLE 1

LIST OF NUCLIDES

1-H-2	24-Cr-52	40-Zr-90
2-He-3	24-Cr-53	40-Zr-91
2-He-4	25-Mn-Nat	40-Zr-92
3-Li-Nat	26-Fe-Nat	40-Zr-94
4-Be-Nat	26-Fe-54	40-Zr-96
4-Be-9	26-Fe-56	41-Nb-Nat
5-B-11	26-Fe-57	42-Mo-Nat
6-C-Nat	26-Fe-58	45-Rh-Nat
6-C-12	27-Co-Nat	46-Pd-Nat
13-Al-Nat	27-Co-59	47-Ag-Nat
13-Al-27	28-Ni-Nat	48-Cd-Nat
14-Si-Nat	28-Ni-58	49-In-Nat
14-Si-28	28-Ni-60	50-Sn-Nat
16-S-Nat	28-Ni-62	50-Sn-116
18-Ar-Nat	28-Ni-64	50-Sn-117
20-Ca-Nat	29-Cu-Nat	50-Sn-118
20-Ca-40	29-Cu-63	50-Sn-119
20-Ca-42	29-Cu-65	50-Sn-120
20-Ca-44	30-Zn-Nat	62-Sm-148
20-Ca-48	30-Zn-64	73-Ta-Nat
22-Ti-Nat	30-Zn-66	73-Ta-181
22-Ti-48	30-Zn-68	79-Au-Nat
22-Ti-49	30-Zn-70	82-Pb-208
22-Ti-50	30-Zn-Nat	83-Bi-209
23-V-Nat	32-Kr-Nat	90-Th-Nat
23-V-51	39-Y-89	92-U-Nat
24-Cr-Nat	40-Zr-Nat	

TABLE 2

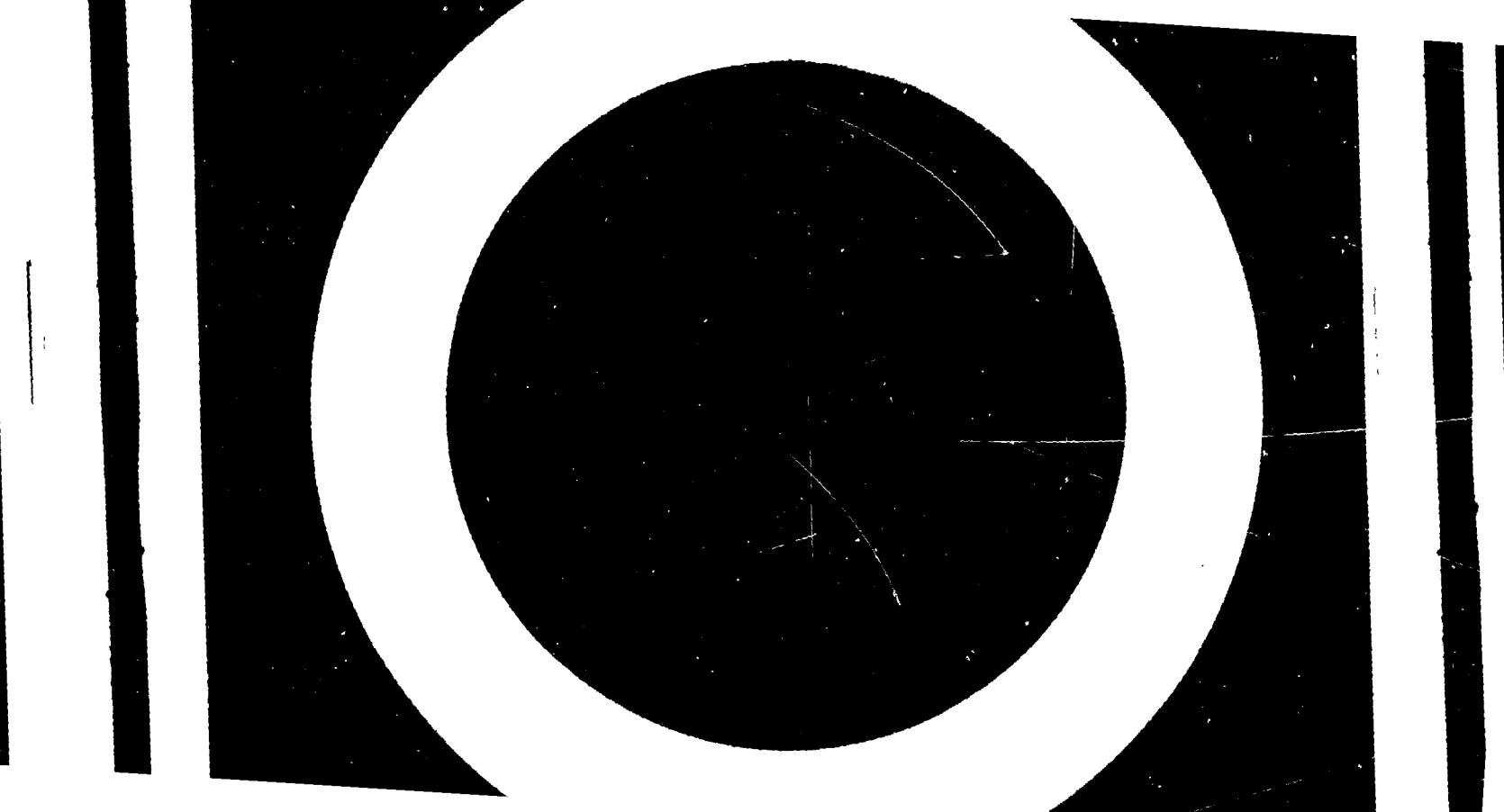
SYMBOL AND THEIR MEANINGS

SYMBOL	MEANING
KERN	Target Nucleus
Z	Atomic number
A	Mass number
NAT.GEM.	Natural Isotopic composition
ELAB(MEV)	Energy of the incident proton in the lab. frame
LAUF. NR.	Data order number
REF.NR.	Number of the reference
REL.M.	Relative atomic mass of the nucleus in AMU (AMU=1.660571 x 10^{-27} kg)
BINDEN	Binding energy of the nucleus in MeV
S(N)	Neutron separation energy from the target nucleus (in MeV)
S(P)	Proton separation energy from the target nucleus (in MeV)
LFD.NR.	Data order number

SYMBOL	MEANING
ART	Kind of data: S: diff. el. cross section P: polarization N: integral non el. cross section
R.NR.	Reference number
REF.	Reference
THETA	Scattering angle in degrees.
ELSIG	Diff. el. cross section
POL	Polarization
DPOL	Error in POL (Statistical)
NICHTEL-SIG	Integral nonelastic cross section
DNICHTEL-SIG	Error in NICHTEL-SIG (Statistical)
NTHETA	Number of angle measured
NSIG	Number of differential cross section values
NPOL	Number of polarization values

APPENDICES

- Example of the data index listing
- Example of the reference listing
- Example of the data listing
- FORTRAN programs



ADDRESSEN FUER DIE DATEI PNESD
==========

STAND VOM: 78/01/31
ZEIT: 13.53.45.

ANZAHL DER GESPREICHERTEN DATENPUNKTE: 670

ADDRESSEN SEIT 1

****

KERN: H Z= 1

A= 2 REL.M= 2.0141 BINDEN= 2.2246(MEV)
S(N)= 2.22460(MEV) S(P)= 2.22460(MEV)

ELAB(MEV)	LAUF NR.	REF.NR.	ART
10.0000	303	50	P
31.0000	46	8	S

****

KERN: HE Z= 2

NAT.GEM. REL.M= 4.0026

ELAB(MEV)	LAUF NR.	REF.NR.	ART
10.0000	304	50	P
312.0000	262	48	SP
725.0000	579	71	SP

A= 3 REL.M= 3.0160 BINDEN= 7.7184(MEV)
S(N)= 0.00000(MEV) S(P)= 5.49380(MEV)

ELAB(MEV)	LAUF NR.	REF.NR.	ART
31.0000	47	8	S
85.0000	243	43	S

A= 4 REL.M= 4.0026 BINDEN= 28.2969(MEV)
S(N)= 20.57850(MEV) S(P)= 19.81470(MEV)

ELAB(MEV)	LAUF NR.	REF.NR.	ART
8.5000	6	2	P
31.0000	39	6	S
85.0000	242	43	S
1004.0000	545	69	N

****

KERN: LI Z= 3

NAT.GEM. REL.M= 6.9410

ELAB(MEV)	LAUF.NR.	REF.NR.	ART
11.4000	305	50	P
160.0000	246	44	SP
180.0000	254	47	S

****

LITERATURSTELLEN ZUR DATEI PNESD

STAND VOM: 78/01/31
ZEIT: 10.06.01.

REFERENZEN

R.NR. REF BESCHREIBUNG DER LITERATURSTELLE

1 JOH61 A.JOHANNSON,U.SVANBERG, AND O.SUNDBERG, ARKIV FYSIK19(1961)572

2 ROS61 L.ROSEN, J.E.BROLLEY,JR., M.L.GURSKY, AND L.STEWART PHYS.REV. 124(1961)199 ELASTIC SCATTERING OF 8 MEV POLARIZED PROTONS

3 ROS62 L.ROSEN, P.DARRIULAT, H.FARAGGI AND A.GARIN NUCL.PHYS. 33(1962)458 ELASTIC SCATTERING OF POLARIZED PROTONS BY C12

4 DIC63 J.KIRK DICKENS, DAVID A. HAUER, AND CHARLES N. WADDELL PHYS.REV.129(1963)743 ELASTIC AND INELASTIC SCATTERING OF 31.1 MEV PROTONS BY CARBON-12

5 WAD63 C.N.WADDELL, M.Q. MAKINO AND R. M. EISBERG, BULL.AM.PHYS.SOC. 8(1963)485

6 BUN64 S.M.BUNCH, H.H.FORSTER AND C.C.KIM NUCL.PHYS.53(1964)241-251 INTERACTIONS OF 31 MEV PROTONS WITH HE4

7 CRA64 R.M.CRAIG, J.C.DORE, G.W.GREENLEES, J.S.LILLEY, J.LOWE AND P.C.ROWE NUCL.PHYS.58(1964)515-521 OPTICAL MODEL STUDIES OF PROTON SCATTERING AT 30 MEV III. POLARIZATION IN ELASTIC SCATTERING BY CA, CO59, NI58, NI60, SN120 AND PB208

8 KIM64 C.C.KIM, S.M.BUNCH, D.W.DEVINS AND H.H.FORSTER NUCL.PHYS. 58((1964)32-48 ELASTIC SCATTERING OF 31 MEV PROTONS FROM H2, HE3, N14 AND O16

9 MAK64 M.Q.MAKINO, C.N.WADDELL, R.M.EISBERG AND J.HESTENES, PHYS.LETT.9(1964)178. STUDY OF SHELL CLOSURE EFFECTS ON PROTON TOTAL REACTION CROSS SECTION

10 RID64 B.W.RIDLEY AND J.F.TURNER NUCL.PHYS.58(1964)497-508. OPTICAL MODEL STUDIES OF PROTON SCATTERING AT 30 MEV (I) DIFFERENTIAL CROSS SECTIONS FOR ELASTIC SCATTERING OF PROTONS AT 30.3 MEV

11 THO71 G.L.THOMAS, E.J.BURGE AND D.A.SMITH, NUCL.PHYS.A171(1971)165-176 PROTON ELASTIC SCATTERING FROM CU63 AND CU66 AT 30 AND 50MEV I) DIFFERENTIAL CROSS SECTION AND POLARIZATION MEASUREMENTS

12 TUR64 J.F.TURNER, B.W.RIDLEY,P.E.CAVANAGH, G.A.GARD AND A.G.HARDCARE NUCL.PHYS 58(1964)509 OPTICAL MODEL STUDIES OF PROTON SCATTERING AT 30 MEV II) PROTON TOTAL REACTION CROSS SECTIONS AT 28.5 +-1.5 MEV

13 BAU65 O.J.BAUGH, G.W. GREENLEES, J.S. LILLEY AND S.ROMAN NUCL.PHYS. 65(1965)33-42 POLARIZATION OF 17.8 MEV PROTONS SCATTERED BY NUCLEI

14 BAU66 O.J.BAUGH, J.A.R.GRIFFITH AND S.ROMAN NUCL.PHYS.83(1966)481-492 POLARIZATION OF 17.8 MEV PROTONS ELASTICALLY SCATTERED BY NUCLEI

DATEN LFD.NR. 1 SEITE 1

LFD.NR.	KERN	ELAB	R.NR.	REF	NTHETA	NSIG	NPOL
1	9BE	160.0000	1	JOH61	0	0	0

NICHTEL-SIG= 186.0000(MBARN) DNICHTEL-SIG= 5.0000(MBARN)

LFD.NR.	KERN	ELAB	R.NR.	REF	NTHETA	NSIG	NPOL
2	40CA	160.0000	1	JOH61	0	0	0

NICHTEL-SIG= 524.0000(MBARN) DNICHTEL-SIG= 14.0000(MBARN)

LFD.NR.	KERN	ELAB	R.NR.	REF	NTHETA	NSIG	NPOL
3	58NI	160.0000	1	JOH61	0	0	0

NICHTEL-SIG= 662.0000(MBARN) DNICHTEL-SIG= 19.0000(MBARN)

LFD.NR.	KERN	ELAB	R.NR.	REF	NTHETA	NSIG	NPOL
4	120SN	160.0000	1	JOH61	0	0	0

NICHTEL-SIG= 1165.0000(MBARN) DNICHTEL-SIG= 34.0000(MBARN)

LFD.NR.	KERN	ELAB	R.NR.	REF	NTHETA	NSIG	NPOL
5	208PB	160.0000	1	JOH61	0	0	0

NICHTEL-SIG= 1790.0000(MBARN) DNICHTEL-SIG= 50.0000(MBARN)

DATEN LFD.NR. 6 SEITE 2

LFD.NR.	KERN	ELAB	R.NR.	REF	NTHETA	NSIG	NPOL
6	4HE	8.5000	2	ROS61	13	0	13

SCHWERPUNKTSYSTEM

THETA (GRAD)	ELSIG (MB/SR)	DELSIG (MB/SR)	POL	DPOL
40.0000			-.2900	.070
51.5000			-.4100	.050
62.0000			-.5700	.050
75.5000			-.7400	.040
87.0000			-.7400	.050
97.0000			-.6500	.040
107.5000			-.1200	.070
118.0000			.6900	.060
127.0000			.9200	.060
129.5000			1.0000	.040
133.0000			.9600	.050
143.0000			.7000	.090
150.5000			.5200	.120

LFD.NR.	KERN	ELAB	R.NR.	REF	NTHETA	NSIG	NPOL
7	BE	8.5000	2	ROS61	11	0	11

SCHWERPUNKTSYSTEM

THETA (GRAD)	ELSIG (MB/SR)	DELSIG (MB/SR)	POL	DPOL
33.0000			-.1600	.050
44.0000			-.1800	.050
57.0000			-.2900	.050
65.5000			-.3200	.060
76.0000			-.0800	.080
88.5000			.4200	.070
96.5000			.2500	.100
101.5000			.2100	.090
106.5000			.0600	.090
116.0000			-.0400	.070
135.0000			.1000	.080

PROGRAM LISTAD 74/74 OPT=1 FTN 4.6+460

```
      PROGRAM LISTAD(AD,OUTPUT,TAPE5=AD,TAPE6=OUTPUT)
      DIMENSION E(4),LN(4),LR(4),NDA(4)
      N1=0
      READ(5,1000) N
      A1=DATE(DUMMY)
      A2=TIME(DUMMY
      WRITE(6,3000) A1,A2,N
      NZEIL=5
      NSE=1
      WRITE(6,3010) NSE
      NZEIL=NZEIL+3
   10 READ(5,1010) NU,NZ,NISO,SY
      IF(NZEIL.GT.50) 15,20
   15 NSE=NSE+1
      WRITE(6,3015) NSE
      NZEIL=4
   20 CONTINUE
      WRITE(6,3020) SY,NZ
      NZEIL=NZEIL+2
      DO 100 J=1,NISO
      READ(5,1020)NUE,NA,NE,RM,EB,SN,SP
      IF(NE.GT.4) GOTO 30
      NEC=NE
      IF(NE.GT.4) NEC=2
      IF((NZEIL+NEC+4).GT.60) 25,30
   25 NSE=NSE+1
      WRITE(6,3030) NSE
      WRITE(6,3020) SY,NZ
      NZEIL=5
   30 CONTINUE
      IF(NA.EQ.0) 35,40
   35 WRITE(6,3040) RM
      NZEIL=NZEIL+2
      GOTO 45
   40 CONTINUE
      WRITE (6,3050) NA,RM,EB,SN,SP
      NZEIL=NZEIL+3
   45 CONTINUE
      N1=N1+NE
      WRITE(6,3060)
      NZEIL=NZEIL+1
      K2=0
      DO 70 I=1,NUE
      L=4
      K2=K2+4
      IF(K2.GT.NE) L=NE-K2+4
      READ (5,1030) (E(II),LN(II),LR(II),II=1,4),(NDA(III),III=1,L)
      DO 65 II=1,L
      GOTO(50,51,52,53,54,55),NDA(II)
   50 DTA=3HS
      GOTO 60
   51 DTA=3HSP
      GOTO 60
```

PROGRAM LISTAD 74/74 OPT=1 FTN 4.6+460

```
   52 DTA=3HS N
      GOTO 60
   53 DTA=3H PN
      GOTO 60
   54 DTA=3H  N
      GOTO 60
   55 DTA=3H P
   60 CONTINUE
      WRITE(6,3070) E(II),LN(II),LR(II),DTA
      NZEIL=NZEIL+1
      IF(NZEIL.LE.60) GOTO 65
      IF((K2+II-4).EQ.NE) GOTO 65
      NSE=NSE+1
      WRITE(6,3030) NSE
      IF(NA.EQ.0) GOTO 61
      WRITE(6,3090) SY,NZ,NA
      GOTO 62
   61 WRITE(6,3080) SY,NZ
   62 CONTINUE
      WRITE(6,3060)
      NZEIL=5
   65 CONTINUE
   70 CONTINUE
  100 CONTINUE
      WRITE (6,3100)
      NZEIL=NZEIL+2
      IF(N.GT.N1) GOTO 10
      STOP
 1000 FORMAT(I4)
 1010 FORMAT(2X,3I3,A2)
 1020 FORMAT(2X,3I3,F8.4,3E12.4)
 1030 FORMAT (2X,4(F8.4,2I5),4I1)
 3000 FORMAT(1H1/1H0/1H0/,10X,30HADDRESSEN EUER DIE DATEI PNESD/1H,10X,
     130(1H=),20X,10HSTAND VOM:,A10,1H /1H ,65X,5HZEIT:,A10/1H ,10X,
     237HANZAHL DER GESPEICHERTEN DATENPUNKTE:,1X,I5)
 3010 FORMAT(1H0,10X,9HADDRESSEN,52X,5HSEITE,I4/1H ,10X,70(1H*))
 3015 FORMAT(1H1/1H0/1H0,10X,9HADDRESSEN,52X,5HSEITE,I4/1H ,10X,70(1H*))
 3020 FORMAT(1H0,10X,6HKERN: ,A2,7X,2HZ=,I3)
 3030 FORMAT(1H1/1H0,10X,9HADDRESSEN,52X,5Hseite,I4/1H ,1X)
 3040 FORMAT(1H0,14X,8HNAT.GEM.,8X,6HREL.M=,F8.4)
 3050 FORMAT(1H015X,2HA=,I3,10X,6HREL.M=,F8.4,11X,7HBINDEN=,F10.4,
     15H(MEV)/1H ,30X,5HS(N)=,F10.5,5H(MEV),5X,5HS(P)=,F10,5,5H(MEV))
 3060 FORMAT(1H ,30X,9HELAB(MEV),6X,8HLAUF NR.,4X,7HREF.NR.,4X,3HART)
 3070 FORMAT(1H ,30X,F9.4,7X,I5,7X,I5,5X,A3)
 3080 FORMAT(1H ,10X,5HKERN:,A2,5X,2HZ=,I3,5X,8HNAT.GEM.,29X,
     111HFORTSETZUNG)
 3090 FORMAT(1H ,10X,5HKERN:,A2,5X,2HZ=,I3,5X,2HA=,I3,32X,
     111HFORTSETZUNG)
 3100 FORMAT(1H0,10X,70(1H*))
      END
```

PROGRAM LISTRE 74/74 OPT=1 FTN 4.6+460

```
      PROGRAM LISTRE(TC,OUTPUT,TAPE5=TC,TAPE6=OUTPUT)
      DIMENSION GAMMA(13)
      NSE=1
      A1=DATE(DUMMY)
      A2=TIME(DUMMY)
      WRITE(6,2000) A1,A2
      WRITE(6,2010) NSE
      NZEIL=9
   10 READ(5,1000) NR,ALPHA,NU,GAMMA
      IF(EOF(5).NE.0) STOP
      IF(NZEIL+NU+2).LE.62) GOTO 20
      NSE=NSE+1
      WRITE(6,2040)
      WRITE(6,2010) NSE
      NZEIL=5
   20 CONTINUE
      WRITE(6,2020) NR,ALPHA,GAMMA
      NZEIL=NZEIL+2
      NU1=NU-1
      IF(NU1.EQ.0) GOTO 10
      DO 30 I=1,NU1
      READ(5,1010) GAMMA
      WRITE(6,2030) GAMMA
   30 CONTINUE
      NZEIL=NZEIL+NU1
      GOTO 10
 1000 FORMAT(I5,A5,I2,3X,13A5)
 1010 FORMAT(15X,13A5)
 2000 FORMAT(1H1/1H0/1H0,10X,32HLITERATURSTELLEN ZUR DATEI PNESD/1H ,
     110X,32(1H=),18X,10HSTAND VOM:,A10/1H ,65X,5HZEIT:,A10
 2010 FORMAT(1H ,10X,10HREFERENZEN,51X,5HSEITE,I4/1H ,10X,70(1H+)/1H0,
     110X,5HR.NR.,2X,3HREF,2X,32HBESCHREIBUNG DER LITERATURSTELLE)
 2020 FORMAT(1H0,10X,I5,1X,A5,1X,13A5)
 2030 FORMAT(1H ,22X,13A5)
 2040 FORMAT(1H1/1H0/1H )
      END
```

PROGRAM LISTDA 74/74 OPT=1 FTN 4.6+460

```
      PROGRAM LISTDA(TA,OUTPUT,TAPE5=TA,TAPE6=OUTPUT)
      DIMENSION GAMMA(15)
      NZEIL=60
      NSE=0
    5 READ(5,1000)E,LN,ALPHA,REF,NR,LS,LF,NTHETA,NNE,NOP,NB,NSIG,NPOL
      IF(EOF(5).NE.0) STOP
      IF((NTHETA+NOP).EQ.0) GOTO 7
      IF(NZEIL.LE.45) GOTO 8
    6 NSE=NSE+1
      WRITE(6,4070) LN,NSE
      NZEIL=2
      GOTO 8
    7 IF(NZEIL.GT.50) GOTO 6
    8 WRITE(6,4000)
      NZEIL=NZEIL+7
      WRITE(6,4010) LN,ALPHA,E,NR,REF,NTHETA,NSIG,NPOL
      IF(NTHETA.EQ.0) GOTO 200
      NTH=0
      NS=NP=0
   10 IF(LS.EQ.2) GOTO 20
      WRITE(6,4020)
      GOTO 30
   20 CONTINUE
      WRITE(6,4030)
   30 CONTINUE
      IF(LS.NE.4) GOTO 31
      WRITE(6,4120)
      NZEIL=NZEIL+1
   31 CONTINUE
      IF (LS.EQ.3) GOTO 32
      WRITE(6,4040)
      GOTO 33
   32 CONTINUE
      WRITE(6,4130)
   33 CONTINUE
      NZEIL=NZEIL+4
      A1=7H(MB/SR)
      A2=7H  (%)
      A3=7H
      IF(LS.NE.3) GOTO 45
      A1=7H
   45 CONTINUE
      IF(LF.NE.1) GOTO 35
      A2=A1
      GOTO 40
   35 CONTINUE
      A3=A2
   40 CONTINUE
      WRITE(6,4050) A1,A2,A3
   50 CONTINUE
      IF(NZEIL.LE.58) GOTO 55
      IF(NTHETA-NTH).LE.1) GOTO 55
```

PROGRAM LISTDA 74/74 OPT=1 FTN 4.6+460

```
      NSE=NSE+1
      WRITE(6,4070) LN,NSE
      NZEIL=2
      GOTO 10
   55 CONTINUE
      READ(5,1010) THETA,ELSIG,DELSIG,POL,DPOL
      B=POL*POL+DPOL*DPOL
      A=ELSIG*ELSIG+DELSIG*DELSIG
      IF(A.LE.1.E-40) GOTO 65
      IF(B.LE.1.E-40) GOTO 60
      NP=NP+1
      NS=NS+1
      WRITE(6,4060) THETA,ELSIG,DELSIG,POL,DPOL
      GOTO 70
   60 CONTINUE
      NS=NS+1
      WRITE(6,4061) THETA,ELSIG,DELSIG
      GOTO 70
   65 IF(B.LE.1.E-40) GOTO 66
      NP=NP+1
      WRITE(6,4062) THETA,POL,DPOL
      GOTO 70
   66 CONTINUE
      WRITE(6,4140)
   70 CONTINUE
      NZEIL=NZEIL+1
      NTH=NTH+1
      IF(NTH.NE.NTHETA) GOTO 50
      IF(((NSIG-NS)*(NSIG-NS)+(NPOL-NP)*(NPOL-NP)).NE.0) WRITE(6,4150)
     1NS,NP
  200 CONTINUE
      IF(NNE.EQ.0) GOTO 300
      READ(5,1020) ELSIG,DELSIG
      IF(NZEIL.LE.61) GOTO 210
      NSE=NSE+1
      WRITE(6,4070) LN,NSE
      NZEIL=1
  210 CONTINUE
      IF(LF.EQ.2) GOTO 220
      WRITE(6,4080) ELSIG,DELSIG
      GOTO 230
  220 WRITE(6,4090) ELSIG,DELSIG
  230 CONTINUE
      NZEIL=NZEIL+2
  300 CONTINUE
      IF(NB.EQ.0) GOTO 900
      IF((NZEIL+NB).LE.62) GOTO 820
      NSE=NSE+1
      WRITE(6,4070)
      NZEIL=1
  820 CONTINUE
      WRITE(6,4100)
```

PROGRAM LISTDA 74/74 OPT=1 FTN 4.6+460

```
      NZEIL=NZEIL+NB+1
      DO 830 I=1,NB
      READ(5,1030) GAMMA
      WRITE(6,4110) GAMMA
  830 CONTINUE
  900 CONTINUE
      GOTO 5
 1000 FORMAT(F10.5,I5,2A5,I5,2I1,I3,I1,I2,I1,2I3)
 1010 FORMAT(F8.4,4E12.4)
 1020 FORMAT(2E12.4)
 1030 FORMAT(5X,15A5)
 3800 FORMAT(1H0/1H0/1H0)
 4000 FORMAT(1H0/1H0/1H0,10X,7HLFD.NR.,3X,4HKERN,6X,4HELAB,8X,5HR.NR.,
     14X,3HREF,6X,6HNTHETA,3X,4HNSIG,4X,4HNPOL)
 4010 FORMAT(1H ,11X,I5,3X,A5,4X,F8.4,6X,I5,3X,A5,7X,I3,5X,I3,5X,I3)
 4020 FORMAT(1H0,20X,17HSCHWERPUNKTSYSTEM)
 4030 FORMAT(1H0,20X,3X,11HLABORSYSTEM)
 4040 FORMAT(1H ,17X,5HTHETA,12X,5HELSIG,9X,6HDELSIG,13X,3HPOL,7X,
     14HDPOL)
 4050 FORMAT(1H ,16X,6H(GRAD),11X,A7,7X,A7,21X,A7)
 4060 FORMAT(1H ,15X,F8.4,7X,E12.4,3X,E12.4,7X,F8.4,3X,F8.4)
 4061 FORMAT(1H ,15X,F8.4,7X,E12.4,3X,E12.4)
 4062 FORMAT(1H ,15X,F8.4,41X,F8.4,3X,F8.4)
 4070 FORMAT(1H1/1H ,10X,5HDATEN,32X,8HLFD.NR. ,I5,10X,5HSEITE,I5)
 4080 FORMAT(1H0,15X,12HNICHTEL-SIG=,F11.4,7H(MBARN),5X,13HDNICHTEL-SIG
     1,F11.4,7H(MBARN))
 4090 FORMAT(1H0,15X,12HNICHTEL-SIG=,F11.4,7H(MBARN),5X,13HDNICHTEL-SIG
     1,F11.4,4H (%))
 4100 FORMAT(1H0,10X,15A5)
 4110 FORMAT(1H0,10X,15A5)
 4120 FORMAT(1H ,20X,*WINKEL IM LABORSYSTEM*)
 4130 FORMAT(1H ,17X,5HTHETA,10X,9HSIG/SIGRE,7X,6HDELSIG,13X,3HPOL,7X,
     14HDPOL)
 4140 FORMAT(1H ,10(1H*),*FALSCHE DATENKARTE*,10(1H*))
 4150 FORMAT(1H ,10(1H*),*FEHLER*,10X,*NSIG=*,I4,10X,*NPOL=*,I4,1A
     110(1H*))
      END
```