KfK 3904
EUR 7996e
März 1985

HADA
A FORTRAN-IV Program for the Thermohydraulic Design of an Advanced Pressurized Light Water Reactor with a Tight Fuel Rod Lattice

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H A D A

A FORTRAN-IV Program for the Thermohydraulic Design of an Advanced Pressurized Light Water Reactor with a Tight Fuel Rod Lattice

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ISSN 0303-4003

Abstract

For the user of the program the input data are described in detail. Two sample runs demonstrate the usage of the program and the output. In addition to the description of the physical background given in KfK 3453, the provided and used solution algorithms are explained. In the last chapters the utility programs are described and an installation guide for the program system is listed.

H A D A

Ein FORTRAN-IV-Programm zur thermohydraulischen Auslegung von fortgeschrittenen Druckwasserreaktoren mit enger Stabteilung

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Zusammenfassung

Es werden zunächst die Eingabedaten für die Anwendung des Programms ausführlich beschrieben. Zwei Beispiele, die mit der letzten Version gerechnet wurden, sollen die Anwendung des Programms demonstrieren und die Programmausgabe erläutern. Es folgt in Ergänzung zur Beschreibung der physikalischen Grundlagen in KfK 3453 eine kurze Erläuterung des mathematischen Lösungsverfahrens. Den Abschluß bilden eine Beschreibung der Hilfsprogramme und eine Anleitung zum Einrichten des Programmsystems.

Contents

1. Introduction

HADA is a FORTRAN-IV program which computes the thermohydraulic parameters for Advanced Pressurized Light Water Reactors with tight fuel rod lattices based on the data of a Pressurized Light Water Reactor. It was developed and run on the IBM 3081/Siemens 7890 computer configuration in the Kernforschungszentrum Karlsruhe. It was translated under MVS/SP 1.3.2 using the Siemens Fortran 77 compiler with language level 66 and standard optimization. The program is written in FORTRAN-IV to grant the usage of earlier compiler versions, but it can also be translated with a Fortran 77 compiler. It doesn't contain computer specific statements or subroutine calls except DATUM. This routine provides two REAL*8 arguments, first the current date, and second the actual time, both as text strings.

For the graphical representation of the results an independent program is available - written in FORTRAN-IV too and using Calcomp/Versatec plotter software. Probably some changes may be necessary to run this program with another plotter software.

In this report only the usage of the program is described, for a more detailed description of the physical background and the mathematical formulation of the problem the reader should refer to the three previous reports cited in literature list as number 1 to 3. The first report [1] describes the formulation and the results of an extended parametric study. In this report the reader will find also the explanation of all output parameters. In the second and third report [2],[3] the used modified correlations for the critical heat flux are described.

The program copy is delivered on a 9-track nolabel-tape with a blocksize of 3120 bytes. The records are of fixed length of 80 bytes each. All source programs (main programs, subroutines, functions) are each written in their own file.

2. Input Data

The input parameters are divided into five groups

- problem identification
  (unit 47)
- control parameters for the input flow and programmable options
  (unit 05)
- common physical parameters
  (unit INP)
- special physical parameters
  (unit JNP)
- physical parameters for the computation of the critical heat flux
  (unit 05).

All data except character strings are read without format control

READ(...,*,...) ...

This means, that, if there are required more then one input datum per line, successive data must be separated by at least one blank or a comma and may be entered in the same input line or, if necessary in continuation lines. It is not allowed to replace zeroes by blanks - as in formatted read - so, as many data must be present as required. The input data set should not be line numbered, to avoid misinterpreting in the case of continuation lines (the line numbers are treated as input data !).

2.1 Problem Identification (Unit 47)

A text of up to 55 characters can be entered as a problem identification. This text and the current date and time are used as header lines in all output data sets. If there are more characters then the allowed maximum, truncation occurs.

2.2 Control Parameters and Options (Unit 05)

The data of this group is read from the system input stream (unit 05) named SYSIN (IBM standards). The following values are required in particular:

1. line	INP	integer	unit number associated to the data set containing the common physical parameters.
2. line	IOP1	integer	option controlling the computation of the pumping power in the primary circuit. =1 constant pumping power, =2 pumping power is computed using a given pump characteristic. Other values are not allowed.
	IOP2	integer	option selecting the reactor type. =0 computation of the power fraction K for a given pressure drop Δp, =1 computing the design parameters of a reactor with a homogeneous core, =2 computing the design parameters of a reactor with a heterogeneous core. Other values are not allowed.
	IOP3	integer	option controlling the construction of the linear system. <0 the coefficient matrix is constructed in inverse order as the functional equations, ≥0 the coefficient matrix is constructed in the same order as the functional equations (use this method only).
	IOP4	integer	option selecting the solution method. =1 Gauß algorithm without improvements (use this method), =2 Gauß algorithm with pivot search (rows), =3 Gauß algorithm with pivot search (rows and columns), =4 Gauß algorithm for a symmetrisized coefficient matrix, =5 Gauß algorithm for a symmetrisized coefficient matrix with reordering of the original matrix.

3. line IDR2 integer parameter controlling the output of the results. This parameter is divided into two subparameters

IDR2 and IMOD = IDR2/10

The subparameter IMOD denotes the number of iteration steps between successive dumps of the actual results. IDR2 controls the type and the extent of this output in correspondence to the following table :

IDR2	IMOD = 0
≤0	only the mean results are printed,
=1	the initial estimate is printed and after each iteration step the actual accuracy,
=2	as 1, and at the beginning of the iteration the coefficient matrix is printed before entering the elimination step,
=3	as 1,2, and at the beginning of the iteration the coefficient matrix is printed after leaving the elimination step,

IDR2	IMOD = IDR2/10
=10	as 1,2,3, and after solving the linear
=20	system the actual solutions are printed
=30	out every IMOD iteration step.
...	

IDR3 integer parameter controlling the output of the heat flux calculations.

<1 Only the most important results are printed,

≥1 additionally local data as a function of the axial position is printed into a separate data set.

The following input line is only necessary for IOP2 > 0. If IOP2 = 0 a special physical parameter must be present instead (s. 2.4.1).

4. line	JNP	integer	unit number associated to the data set containing the special physical parameters
5. line	GENAU	real	parameter denoting the required accuracy. The iteration is terminated, if the condition of eq. (6) comes true (the boundary ε corresponds to GENAU).
	DMAX	real	upper boundary for the increment of the solution vector. After each iteration step the condition of eq. (6) is tested against DMAX. If any of the increments is greater then DMAX, the solution is divided by two, until Eq. (6) is met. In most cases a value of 0.5 will result in good convergence of the iteration. But in some cases a smaller value may be needed to omit problems of divergency.
	ITMX	integer	maximum number of iteration steps. Non-convergent iterations are stopped after ITMX steps. Depending on the results, the computation may be repeated with a greater value of ITMX or with updated parameters.

2.3 Common Physical Parameters (Unit INP)

The data of this group is read from unit INP, which must be assigned to the data set containing the input.

1. line	Q0	real	Q_0 [W] thermal power of the reference Pressurized Light Water Reactor.
2. line	OP	real	O_p [-] power plant overpower factor.
	FDH0	real	$F_{\Delta H}$ [-] hot channel factor for the enthalpy rise in the core.
	CDH	real	$c_{\Delta H}$ [-] parameter to force a DNB ratio of at least 1.3.
	AKS	real	K' [-] part of the total mass flow rate cooling the core.
3. line	ALC	real	L_c [m] total length of the axial reflectors.
4. line	DN	real	N [W] total pumping power for the primary circuit.
	ETA	real	η [-] efficiency of the water pumps in the primary circuit.
5. line	P20	real	p_{20} [bar] water pressure at the outlet of the reference PWR.
6. line	T20	real	T_{20} [°C] average water temperature at the outlet of the reference PWR.

7. line	POS	real	p_{0s} [bar] saturation pressure at the turbine of the reference PWR.
8. line	DMO	real	M_0 [kg/s] total mass flow rate in the primary circuit of the reference PWR.
9. line	DKO	real	KF [W/°C] heat transfer coefficient times the average total surface of the heat exchangers.
10.line	T10	real	T_{10} [°C] average water temperature at the inlet of the reference PWR.
11.line	P10	real	p_{10} [bar] water pressure at the inlet of the reference PWR.
12.line	HR	real	H [m] pressure head available for the rest of the primary circuit (besides the core) in the case of the reference PWR.
13.line	DNEL	real	N_{el} [W] total electrical power for internal use in the plant.
14.line	HTO	real	H_{T0} [m] total pressure head of the water pumps in the primary circuit of the reference PWR.
15.line	QELO	real	Q_{el0} [W] net electrical power of the reference PWR.

2.4 Special Physical Parameters (Unit 05, JNP)

For IOP2 > 0 the data of this group is read from unit JNP, which must be assigned to the data set containing the input. The number of the required parameters and their meaning depend on the value of IOP2. For IOP2 = 0 the data is read from unit 05 (system input stream).

2.4.1 Computation of the Power Ratio (IOP2=0, Unit 05)

In this case the power ratio K for an Advanced Pressurized Light Water Reactor is computed from the data of the reference Pressurized Water Reactor (common physical parameters) and a fixed value for the pressure drop over the core.

4. line	DPC	real	Δp_c [bar] required pressure drop over the core of the Advanced Pressurized Water Reactor.
5. line	GENAU	real	
	DMAX	real	
	ITMX	integer	as in chapter 2.2, 5. line.

2.4.2 Reactor with a Homogeneous Core (Unit JNP)

For an Advanced Pressurized Water Reactor with a homogeneous core the geometry and special factors are read from unit JNP, which must be assigned to the corresponding data set.

1. line	P	real	p [m] fuel rod pitch.
2. line	D	real	d [m] fuel rod diameter.
3. line	AKO	real	K_0 [-] aspect ratio for the spiral spacer ribs.
4. line	AK1	real	K_1 [-] ratio denoting the part of the total core cross section which is occupied by fuel rods and the subchannels between them.
	AKL$	real	K_{KL} [-] correction factor for the relationship between average fuel rod linear rating and p/d ratio.
5. line	AK2	real	K_2 [-] fraction of the "non-useful" cross section area (interface between fuel elements, control and structure rods) occupied by flowing water.
6. line	DEQ	real	D_{eq} [m] equivalent diameter, diameter of a circle with the same area as the cross section of the core.
7. line	HZUD	real	H/d [-] pitch to diameter ratio for the spiral rib spacers.
8. line	AKI	real	K_I [-] inlet pressure drop coefficient.

2.4.3 Reactor with a Heterogeneous Core (unit JNP)

For an Advanced Pressurized Water Reactor with a heterogeneous core the geometry and special factors are read from a data set assigned to unit JNP. In this case the reactor core is divided into two zones (seed and blanket).

1. line	RK1	real	K_1 [-] ratio of cross section area of seed to cross section area of blanket.
	AKLS$	real	K_{KLs} [-] correction factor for the relationship between seed fuel rod linear rating and p/d ratio.
	AKLB$	real	K_{KLb} [-] correction factor for the relationship between blanket fuel rod linear rating and p/d ratio.
2. line	RK2S	real	K_{2s} [-] ratio denoting the part of the seed cross section which is occupied by fuel rods and relative cooling water.
3. line	RK2B	real	K_{2b} [-] ratio denoting the part of the blanket cross section which is occupied by fuel rods and relative cooling water.
4. line	RK3	real	K_3 [-] power ratio seed over blanket.
5. line	QVS	real	q_{vs} [W/m³] average volume power density (seed).
6. line	DS	real	d_s [m] fuel rod diameter (seed).
7. line	DEQ	real	D_{eq} [m] equivalent diameter, diameter of a circle with the same area as the cross section of the core.

8. line	ALSC	real	L_{sC} [m] axial distance of spacer grids in the active core region (seed).
9. line	ALSR	real	L_{sR} [m] axial distance of spacer grids in the fission gas plenum region (seed).
10.line	DKI	real	K_I [-] inlet pressure drop coefficient.
11.line	CV	real	C_v [-] modified drag coefficient of the spacer grid.
12.line	RKO	real	K_0 [-] aspect ratio for the spiral spacer ribs (blanket).
13.line	HZUDB	real	$[H/d]_b$ [-] pitch to diameter ratio for the spiral rib spacers (blanket).

2.5 Physical Parameters for the CHF Computations (Unit 05)

This group of data is read again from unit 05 (system input stream). The input stream contains options and parameters for the critical heat flux correlations. Four different correlations are available according to [2]. In an earlier version of the program the Shippingport relation was used [2], but in the present version an improved modified relation according to [3] is used. The subprogram which does the Shippingport calculations is still available and the input parameters must be present as dummy entries. The computation of the critical heat flux is done for a singular rod.

6. line	FIAX	real	ϕ_{ax} [-] form factor accounting for the axial power distribution.
7. line	AK	real	K [W/m²] 2.37 10^6 constant used in the Shippingport relation. This parameter must be present as a dummy entry (its value has no importance), but it is not used in the latest version of the program.
8. line	HO	real	H_0 [J/kg] 1.588 10^6 enthalpy base (depending on pressure) for the Shippingport relation. As the previous parameter this datum must be present as a dummy entry.
9. line	FQ	real	F_q [-] hot channel factor for the heat flux at the fuel rod surface.
10.line	AK4	real	K_4 [-] ratio between the shortening of the core active length due to insertion of the control rods and core active length without control rod insertion.
11.line	NC	integer	n_c [-] number of axial nodes for the computation of the local heat fluxes.

12.line	OP	real	O_p [-] overpower factor for the fuel rod under consideration.
13.line	Q1A	real	Q_1 1.763
	Q2A	real	Q_2 9.157
	Q4A	real	Q_4 6.507 parameters used in the earlier version of our CHF correlation [2].
	Q1B	real	Q_1 1.748
	Q2B	real	Q_2 7.540
	Q4B	real	Q_4 8.783 parameters used in the latter version of our CHF correlation [3].
14.line	FQN	real	F_{qN} [-] factor for the maximal heat flux accounting for the axial and radial power distribution.

3. Output

The program uses four output data sets associated to units 06,08,09, and 10. The first one, assigned to the system output data set (named SYSPRINT on IBM-systems), is used for the printing of system error messages. The second data set (unit 08) must be assigned to an existing file (named PROJECT.APWRS.DATA in the examples) with the following (or corresponding) DCB attributes

- record format RECFM=VBS
- record length LRECL=2996
- block size BLKSIZE=3000.

This data set is used as a result pool and contains the main results of consecutive runs. Data may be retrieved from this file by using one of the existing utility programs (s. chapter 6).

The input data, the main results, and, if required, the matrix, vector, and solution dumps are printed out to unit 09.

The local results of the critical heat flux calculation are printed out to unit 10.

The output in 09 and 10 is self-explaining, the same variable names are used as in chapter 2.5 for the input parameters. The variable names of the output parameters are explained in [1], so that no more detailed description is necessary here. In chapter 5 the output data of two sample runs are listed.

4. Mathematical Background

The program HADA computes the solution of a nonlinear algebraic system by iteration. This system is given by a set of equations

(1) $$F_j(x_i) = 0.$$

The elements of the solution vector $x_i (i=1,\dots,n)$ are the zeroes of the (n) relations F_j. For solving this equations a simple Newton method is used as usually. In the first order Taylor approximation

(2) $$F_j(x_i+\delta x_i) \simeq F_j(x_i) + [\partial F_j(x_i)/\partial x_k]\delta x_k.$$

The condition $F_j(x_i+\delta x_i) \to 0$ is forced by setting the left hand side of the equations system equal to zero

(3) $$[\partial F_j(x_i)/\partial x_k]\delta x_k = -F_j(x_i).$$

Starting with an initial estimate x_i^o we obtain a series of approximations to the solution

(4) $$[\partial F_j(x_i^\nu)/\partial x_k]\delta x_k^{\nu+1} = -F_j(x_i^\nu)$$

and

(5) $$x_k^{\nu+1} = x_k^\nu + \delta x_k^{\nu+1},$$

which is considered as adequate if the related increment of all elements is less then a given positive number ε:

(6) $$\max_k|\delta x_k^\nu/x_k^\nu| < \varepsilon.$$

The linear algebraic system (linear relative to δx) is solved by using a Gauß algorithm (with or without pivot search). The matrix of coefficients is

(7.1) $$a_j^k = \partial F(x_i^\nu)/\partial x_k$$

and the right hand sides are

(7.2) $$b_j = -F_j(x_i^{\nu}).$$

Five different methods based on the Gauß algorithm are available in the program:

- straightforward algorithm without any computational improvements,
- pivot method (only rows are exchanged),
- pivot method (rows and columns are exchanged),
- Gauß algorithm for a system with symmetrical coefficient matrix,
- Gauß algorithm for a symmetrical system using a reordered coefficient matrix.

The two last methods don't solve the original equations (7), but a derived system which is obtained by multiplication from the left with the transposed coefficient matrix. From

(8) $$a_j^{\,k}\delta x_k = b_j$$

we get the derived system

(9) $$a_j^{\,l}a_l^{\,k}\delta x_k = a_j^{\,l}b_l.$$

The new matrix of coefficients is symmetrical:

(10.1) $$s_j = a_j^{\,l}a_l^{\,k}.$$

The new right hand sides are

(10.2) $$c_j = a_j^{\,l}b_l.$$

These two equations describe a new linear system replacing (8)

(11) $$s_j^{\,k}\delta x_k = c_j.$$

To compute the elements of the coefficient matrix we need the partial derivatives of the functions. They are approximated numerically by a first order Taylor expansion.

For $|x_k| \leq 10^{-6}$ we use:

$$f_1 = F_j(x_1, x_2, \ldots, x_k - 0.001, \ldots, x_n),$$

$$f_2 = F_j(x_1, x_2, \ldots, x_k + 0.001, \ldots, x_n),$$

$$\Delta x = 0.002,$$

and for $|x_k| > 10^{-6}$:

$$f_1 = F_j(x_1, x_2, \ldots, 0.999 * x_k, \ldots, x_n),$$

$$f_2 = F_j(x_1, x_2, \ldots, 1.001 * x_k, \ldots, x_n),$$

$$\Delta x = 0.002 * x_k.$$

The derivatives are then calculated from

(12) $$\partial F_j(x_i)/\partial x_k \simeq (f_2 - f_1)/\Delta x.$$

In the testphase the increment Δx and the accuracy of the calculation have been varied, but the presented values and double precision arithmetic proved to be optimal.

5. Examples

To demonstrate the use of the program two sample runs are presented. The first sample is for a homogeneous reactor with computation of the water pumping power from a given characteristic. The input data and the control statements are shown at first. The used load module must be generated at first as described in chapter 7. For this sample the entire output is shown (units 09 and 10 in this order).

The second sample is for a heterogeneous reactor with computation of the water pumping power from a given characteristic too. In this case only the main results (unit 09) are shown.

5.1 Sample 1, Homogeneous Core, Constant Pump Charakteristic

Control statements and input

```
Starting in column 1
↓
//PROJECT1 JOB (....,.......,.....),....,MSGCLASS=A
// EXEC PGM=HADA
//STEPLIB     DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//*****************************************************************
//**
//**          UNIT INP     COMMON PHYSICAL PARAMETERS
//**
//FT01F001    DD *
3.765E9                    Q0 IN W
1.00,1.6,1.0266,0.94       OP,FDH0,CDH,K'
0.0                        ALC FUER LR=1.1885*LC+0.02+ALC
1.7E7,0.774                N  IN W,       ETA (NEU 8.9.83)
158.26                     P20  IN BAR
326.12                     T20  IN GRD C
64.5                       POS  IN BAR
1.8800E4                   M0  IN KG/S
1.55927E8                  KF0  IN W/GRD C
291.14                     T10  IN GRD C
159.65                     P10  IN BAR
70.6                       HR  IN M
5.4D7                      NEL  IN W
89.6                       HT0  IN M
1.3E9                      NEL  IN W
```

```
//***************************************************************
//**
//**          UNIT JNP      SPECIAL PHYSICAL PARAMETERS
//**
//FT02F001    DD *
11.4000E-3                 P  IN M
9.5E-3                     D  IN M                         2 REAL 9.
.3333333333333333          K0
.9064,1.                   K1,KL
.5001                      K2
3.8594                     DEQ  IN M                       1 REAL 9.
20.                        H/D
1.2                        KI
//***************************************************************
//**
//**          UNIT 05       SYSIN
//**
//FT05F001    DD *
1                          INP
2,1,1,1                    IOP1,IOP2,IOP3,IOP4 .,1,.,. HOMOGEN   <==
1,2                        IDR1,IDR2
2                          JNP                2     HOMOGEN   <==
1.D-5,.5,20                EPS,DMAX,IMAX
1.48                       PHIAX                         4 REAL 9.9.
2.37D6                     K
1588.D3                    H0
2.1                        FQ                            7 REAL 9.9.
.1                         K4
40                         NC
1.12                       OP
1.763,9.157,6.507,1.748,7.540,8.783    (Q1,Q2,Q4)ALT,(Q1,Q2,Q4)NEU
1.776                      FQN                           5 REAL 12.9
//FT06F001    DD SYSOUT=*,
//            DCB=(LRECL=133,BLKSIZE=3857,RECFM=FBA)
//FT08F001    DD DSN=PROJECT.APWRS.DATA,DISP=(MOD,PASS)
//FT09F001    DD SYSOUT=*,
//            DCB=(LRECL=133,BLKSIZE=3857,RECFM=FBA)
//FT10F001    DD SYSOUT=*,
//            DCB=(LRECL=133,BLKSIZE=3857,RECFM=FBA)
//***************************************************************
//**
//**          UNIT 47       PROBLEM IDENTIFICATION
//**
//FT47F001 DD *
SAMPLE 1 HOMOGENEOUS CORE, CHARAKTERISTIC
//
```

Main results (unit 09)

TITEL :

SAMPLE 1 HOMOGENEOUS REACTOR, CHARAKTERISTIC 18.01.85 11.36.25

EINGABEPARAMETER

Q0	=	3.7650D+09	W
POS	=	64.500	BAR
P20	=	158.26	BAR
T20	=	326.12	GRD C
KF0	=	1.5593D+08	WATT/GRD
N	=	1.7000D+07	WATT
P10	=	159.65	BAR
M0	=	18800.	KG/S
FDH0	=	1.6000	
CDH	=	1.0266	
OPF	=	1.0000	
T10	=	291.14	GRD C
HR	=	70.600	M
NEL	=	5.4000D+07	W
ALC	=	0.0	M

CONSTANT PUMP CHARACTERISTICS

P	=	1.1400D-02	M	
D	=	9.5000D-03	M	
DH	=	3.6908D-03	M	
K0	=	0.33333		
K1	=	0.90640		
K2	=	0.50010		
DEQ	=	3.8594	M	
H/D	=	20.000		
KI	=	1.2000		
P/D	=	1.2000		
B	=	6.3333D-04	M	
KL	=	1.0000	-	12.09.1983
QL	=	18000.	W/M	
QV	=	1.5993D+08	W/CBM	
AT	=	10.604	QM	
NT	=	94212		
VM/VF	=	0.61890		
CELL	:	0.58783		

HOMOGENEOUS REACTOR

EPS	=	1.0000D-03	%
DELTA	=	50.000	%

LOESUNGSVEKTOR UND ERREICHTE GENAUIGKEIT

NAME	NR	EINHEIT	WERT	ZUWACHS
****	**	*******	***********	***********
K	1	-	1.0000	0.0
Q	2	W	2.9077D+09	0.0
T1	3	GRD C	291.14	0.0
RO1	4	KG/CBM	745.55	0.0
P1	5	BAR	159.65	0.0
H1	6	J/KG	1.2891D+06	0.0
T2	7	GRD C	326.12	0.0
RO2	8	KG/CBM	664.73	0.0
H2	9	J/KG	1.4900D+06	0.0
TS	10	GRD C	280.40	0.0
PS	11	BAR	64.500	0.0
TQ	12	GRD C	308.63	0.0
ROQ	13	KG/CBM	709.37	0.0
PQ	14	BAR	158.95	0.0
M	15	KG/S	18736.	0.0
KF	16	W/GRD	1.5583D+08	0.0
HT	17	M	91.473	0.0
HC	18	M	21.351	0.0
DP	19	BAR	1.3900	0.0
Y	20	-	1.4412	0.0
TSU	21	GRD C	332.91	0.0
RO2U	22	KG/CBM	643.72	0.0
H2U	23	J/KG	1.5355D+06	0.0
TQU	24	GRD C	308.63	0.0
ROQU	25	KG/CBM	709.37	0.0
NY	26	QM/S	1.2605D-07	0.0
U	27	M/S	6.0073	0.0
RE	28	-	2.1532D+05	0.0
LAM	29	-	2.4470D-02	0.0

```
ITER =   0 ABS :    8.1101D+08   2 *** REL :     0.50000      19
ITER =   1 ABS :    1.1757D+07   2 *** REL :     9.4562D-02   19
ITER =   2 ABS :    5.0986D+05   2 *** REL :     2.9138D-03   18
```

LOESUNGSVEKTOR UND ERREICHTE GENAUIGKEIT

NAME	NR	EINHEIT	WERT	ZUWACHS
****	**	*******	***********	***********
K	1	-	0.99068	-4.0402D-07
Q	2	W	3.7299D+09	-1521.1
T1	3	GRD C	290.33	-4.0844D-05
RO1	4	KG/CBM	747.22	7.4016D-05
P1	5	BAR	160.54	-2.6688D-06
H1	6	J/KG	1.2848D+06	-0.21171
T2	7	GRD C	326.09	-1.4125D-05
RO2	8	KG/CBM	664.80	4.0203D-05
H2	9	J/KG	1.4899D+06	-9.0553D-02
TS	10	GRD C	279.78	-2.7524D-05
PS	11	BAR	63.899	-2.6059D-05
TQ	12	GRD C	308.21	-2.7484D-05
ROQ	13	KG/CBM	710.41	5.9667D-05
PQ	14	BAR	159.40	-1.3344D-06
M	15	KG/S	18189.	-1.6975D-02
KF	16	W/GRD	1.5499D+08	-27.442
HT	17	M	96.968	1.5329D-04
HC	18	M	31.125	2.8047D-04
DP	19	BAR	2.2808	-2.6688D-06
Y	20	-	1.4790	1.5023D-06
TSU	21	GRD C	333.02	-9.9624D-06
RO2U	22	KG/CBM	643.35	3.2284D-05
H2U	23	J/KG	1.5363D+06	-6.8821D-02
TQU	24	GRD C	311.67	-2.5403D-05
ROQU	25	KG/CBM	702.48	5.9507D-05
NY	26	QM/S	1.2606D-07	-3.4434D-16
U	27	M/S	5.8890	-5.9456D-06
RE	28	-	2.1107D+05	-1.3620
LAM	29	-	2.4553D-02	2.7604D-08

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ERGEBNISSE

 Q       =      3.7299D+09  W
 K       =     0.99068
 PS      =      63.899      BAR
 TS      =      279.78      GRD C
 P1      =      160.54      BAR
 T1      =      290.33      GRD C
 T2      =      326.09      GRD C
 M       =      18189.      KG/S
 NP      =      1.7800D+07  W
 QNT     =      1.2854D+09  W
QNT/QELO =     0.98879

*********** ZUSATZ 08.09.1983 *********

KS      =      0.94000      -
ETA     =      0.77400      -
MS      =       17098.      KG/S
NPEL    =      2.2998D+07   W

HOMOGENEOUS REACTOR

LC      =       2.1995      M
LR      =       2.6341      M
T2U     =       333.02      GRD C
U       =       5.8890      M/S
RE      =       2.1107D+05
LAMBDA  =       2.4553D-02
DP      =       2.2808      BAR
DPTOT   =       2.4992      BAR

*********** ZUSATZ 08.09.1983 *********

DPP     =       7.1056      BAR

CHF-CALCULATIONS

LC      =       2.1995      M
T1      =       290.33      GRD C
RO1     =       747.22      KG/CBM
P1      =       160.54      BAR
H1      =       1.2848D+06  J/KG
T2      =       333.02      GRD
P2      =       158.26      BAR
ROQ     =       702.48      KG/CBM
U       =       5.8890      M/S
QL      =       18000.      W/M
D       =       9.5000D-03  M
DH      =       3.6908D-03  M
PZUD    =       1.2000

EINGABEDATEN

FIAX    =       1.4800
AK      =       2.3700D+06
HO      =       1.5880D+06  J/KG
FQ      =       2.1000
K4      =      0.10000
NC      =          40
OP      =       1.1200
Q10     =       1.7630
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Q20	=	9.1570
Q40	=	6.5070
Q1N	=	1.7480
Q2N	=	7.5400
Q4N	=	8.7830
FQN	=	1.7760

ERGEBNISSE

X	=	1.4729
PI/2X	=	1.0665
LC'	=	2.3456
RLCR	=	1.980
RLCR'	=	2.126
V1	=	0.70000D+00 WSC-2
V2	=	0.46105D+00 EIGENE,ALT
V2	=	0.27023D+00 EIGENE,NEU

OVERPOWER FACTOR : 1.0000

POS	X	T(X)	TW	EIGENE,ALT CHF	SM	SMLWR	EDLUND CHF	SM	SMLWR	WSC-2 CHF	SM	SMLWR	EIGENE,NEU CHF	SM	SMLWR
0	0.0	324.48	338.68	2.656D+06	2.10	2.04	1.831D+06	1.45	1.31	1.979D+06	1.56	1.48	2.964D+06	2.34	2.28
1	0.05	327.00	340.45	2.515D+06	1.99	1.93	1.756D+06	1.39	1.25	1.907D+06	1.51	1.43	2.798D+06	2.22	2.15
2	0.11	329.51	342.08	2.379D+06	1.90	1.83	1.683D+06	1.34	1.21	1.834D+06	1.46	1.38	2.639D+06	2.11	2.04
3	0.16	332.00	343.57	2.246D+06	1.82	1.75	1.613D+06	1.31	1.17	1.760D+06	1.42	1.35	2.484D+06	2.01	1.94
4	0.22	334.44	344.91	2.116D+06	1.75	1.68	1.545D+06	1.27	1.14	1.686D+06	1.39	1.32	2.334D+06	1.93	1.86
5	0.27	336.83	346.09	1.989D+06	1.68	1.62	1.478D+06	1.25	1.12	1.611D+06	1.36	1.29	2.188D+06	1.85	1.78
6	0.33	339.15	347.11	1.864D+06	1.63	1.56	1.412D+06	1.23	1.11	1.534D+06	1.34	1.27	2.046D+06	1.79	1.72
7	0.38	341.39	347.96	1.741D+06	1.58	1.52	1.347D+06	1.22	1.10	1.457D+06	1.32	1.26	1.906D+06	1.73	1.67
8	0.44	343.54	348.64	1.620D+06	1.54	1.48	1.283D+06	1.22	1.10	1.377D+06	1.31	1.25	1.769D+06	1.68	1.62
9	0.49	345.59	348.69	1.501D+06	1.50	1.45	1.218D+06	1.22	1.11	1.296D+06	1.30	1.25	1.634D+06	1.64	1.58
10	0.55	347.52	348.63	1.382D+06	1.47	1.42	1.153D+06	1.23	1.13	1.213D+06	1.29	1.25	1.501D+06	1.60	1.55
11	0.60	349.33	348.57	1.263D+06	1.45	1.40	1.088D+06	1.25	1.16	1.127D+06	1.29	1.25	1.369D+06	1.57	1.52
12	0.66	351.01	348.50	1.145D+06	1.43	1.39	1.022D+06	1.27	1.19	1.039D+06	1.29	1.26	1.239D+06	1.54	1.50
13	0.71	352.53	348.43	1.027D+06	1.41	1.38	9.537D+05	1.31	1.25	9.477D+05	1.30	1.28	1.108D+06	1.52	1.48
14	0.77	353.91	348.35	9.089D+05	1.40	1.37	8.835D+05	1.36	1.32	8.528D+05	1.31	1.30	9.783D+05	1.50	1.47
15	0.82	355.13	348.27	7.899D+05	1.39	1.37	8.103D+05	1.42	1.43	7.541D+05	1.32	1.32	8.482D+05	1.49	1.47
16	0.88	356.18	347.89	6.699D+05	1.38	1.37	7.331D+05	1.51	1.58	6.509D+05	1.34	1.36	7.177D+05	1.48	1.47
17	0.93	357.06	347.05	5.487D+05	1.38	1.38	6.503D+05	1.64	1.84	5.428D+05	1.37	1.40	5.864D+05	1.48	1.47
18	0.99	357.76	346.06	4.258D+05	1.39	1.39	5.597D+05	1.82	2.34	4.292D+05	1.40	1.44	4.540D+05	1.48	1.48
19	1.04	358.29	344.91	3.009D+05	1.39	0.0	4.571D+05	2.11	0.0	3.091D+05	1.43	0.0	3.201D+05	1.48	0.0
20	1.10	358.63	343.62	1.736D+05	1.40	0.0	3.333D+05	2.69	0.0	1.819D+05	1.47	0.0	1.842D+05	1.49	0.0

MINIMALWERTE

CORRELATION		SMMIN	X	POS			
EIGENE,ALT	:	1.3821	0.93477	17	1.3684	0.82480	15
EDLUND	:	1.2180	0.43989	8	1.1036	0.38491	7
WSC-2	:	1.2912	0.60485	11	1.2456	0.49488	9
EIGENE,NEU	:	1.4768	0.98976	18	1.4662	0.87979	16

OVERPOWER FACTOR : 1.1200

POS	X	T(X)	TW	EIGENE,ALT CHF	SM	SMLWR	EDLUND CHF	SM	SMLWR	WSC-2 CHF	SM	SMLWR	EIGENE,NEU CHF	SM	SMLWR
0	0.0	328.58	341.65	2.656D+06	1.87	1.82	1.831D+06	1.29	1.17	1.979D+06	1.40	1.32	2.964D+06	2.09	2.04
1	0.05	331.40	343.63	2.515D+06	1.78	1.72	1.756D+06	1.24	1.12	1.907D+06	1.35	1.27	2.798D+06	1.98	1.92
2	0.11	334.22	345.47	2.379D+06	1.70	1.63	1.683D+06	1.20	1.08	1.834D+06	1.31	1.23	2.639D+06	1.88	1.82
3	0.16	337.00	347.17	2.246D+06	1.62	1.56	1.613D+06	1.17	1.05	1.760D+06	1.27	1.20	2.484D+06	1.79	1.73
4	0.22	339.73	348.70	2.116D+06	1.56	1.50	1.545D+06	1.14	1.02	1.686D+06	1.24	1.17	2.334D+06	1.72	1.66
5	0.27	342.41	348.89	1.989D+06	1.50	1.44	1.478D+06	1.12	1.00	1.611D+06	1.22	1.15	2.188D+06	1.65	1.59
6	0.33	345.01	348.85	1.864D+06	1.45	1.40	1.412D+06	1.10	0.99	1.534D+06	1.20	1.14	2.046D+06	1.60	1.54
7	0.38	347.52	348.80	1.741D+06	1.41	1.36	1.347D+06	1.09	0.99	1.457D+06	1.18	1.12	1.906D+06	1.54	1.49
8	0.44	349.93	348.75	1.620D+06	1.37	1.32	1.283D+06	1.09	0.99	1.377D+06	1.17	1.12	1.769D+06	1.50	1.45
9	0.49	352.22	348.69	1.501D+06	1.34	1.29	1.218D+06	1.09	0.99	1.296D+06	1.16	1.11	1.634D+06	1.46	1.41
10	0.55	354.39	348.63	1.382D+06	1.31	1.27	1.153D+06	1.10	1.01	1.213D+06	1.15	1.11	1.501D+06	1.43	1.38
11	0.60	356.41	348.57	1.263D+06	1.29	1.25	1.088D+06	1.11	1.03	1.127D+06	1.15	1.12	1.369D+06	1.40	1.36
12	0.66	358.29	348.50	1.145D+06	1.27	1.24	1.022D+06	1.14	1.07	1.039D+06	1.15	1.13	1.239D+06	1.38	1.34
13	0.71	360.00	348.43	1.027D+06	1.26	1.23	9.537D+05	1.17	1.11	9.477D+05	1.16	1.14	1.108D+06	1.36	1.32
14	0.77	361.54	348.35	9.089D+05	1.25	1.22	8.835D+05	1.21	1.18	8.528D+05	1.17	1.16	9.783D+05	1.34	1.31
15	0.82	362.91	348.27	7.899D+05	1.24	1.22	8.103D+05	1.27	1.27	7.541D+05	1.18	1.18	8.482D+05	1.33	1.31
16	0.88	364.08	348.17	6.699D+05	1.23	1.22	7.331D+05	1.35	1.41	6.509D+05	1.20	1.21	7.177D+05	1.32	1.31
17	0.93	365.07	348.06	5.487D+05	1.23	1.23	6.503D+05	1.46	1.64	5.428D+05	1.22	1.25	5.864D+05	1.32	1.31
18	0.99	365.86	347.94	4.258D+05	1.24	1.24	5.597D+05	1.63	2.09	4.292D+05	1.25	1.29	4.540D+05	1.32	1.32
19	1.04	366.44	347.86	3.009D+05	1.24	0.0	4.571D+05	1.89	0.0	3.091D+05	1.28	0.0	3.201D+05	1.32	0.0
20	1.10	366.82	347.66	1.736D+05	1.25	0.0	3.333D+05	2.40	0.0	1.819D+05	1.31	0.0	1.842D+05	1.33	0.0

MINIMALWERTE

CORRELATION		SMMIN	X	POS			
EIGENE,ALT	:	1.2340	0.93477	17	1.2218	0.82480	15
EDLUND	:	1.0875	0.43989	8	0.98535	0.38491	7
WSC-2	:	1.1528	0.60485	11	1.1121	0.49488	9
EIGENE,NEU	:	1.3186	0.98976	18	1.3091	0.87979	16

Local results from CHF calculations (unit 10)

TITEL :

SAMPLE 1 HOMOGENEOUS REACTOR, CHARAKTERISTIC 18.01.85 11.36.25

OVERPOWER FACTOR : 1.0000

POS	X	T(X) / CORRELATION	P(X)	HCHF(X)	HG(X) / PHICHF(X)	HFG(X) / PHIHS(X)	PR(X) / PHIHSCR(X)	ALFA(X) / SM(X)	RE(X)	PHIN(X) / SMCR(X)	TW(X)	TW1	TW2
NKD =		82 FAKT =		1.000									
0	0.0	324.48	159.40	1.5D+06	2.6D+06	9.3D+05	9.8D-01	4.7D+04	1.7D+05	1.1D+06	338.68	338.68	349.08
		EIGENE,ALT :			2.6562D+06	1.2665D+06	1.3991D+06	2.10		2.04			
		EDLUND :			1.8310D+06			1.45		1.31			
		WSC-2 :			1.9790D+06			1.56		1.48			
		EIGENE,NEU :			2.9641D+06			2.34		2.28			
1	0.05	327.00	159.34	1.5D+06	2.6D+06	9.4D+05	1.0D+00	4.7D+04	1.8D+05	1.1D+06	340.45	340.45	349.05
		EIGENE,ALT :			2.5153D+06	1.2631D+06	1.3944D+06	1.99		1.93			
		EDLUND :			1.7557D+06			1.39		1.25			
		WSC-2 :			1.9065D+06			1.51		1.43			
		EIGENE,NEU :			2.7983D+06			2.22		2.15			
2	0.11	329.51	159.29	1.5D+06	2.6D+06	9.4D+05	1.0D+00	4.7D+04	1.8D+05	1.1D+06	342.08	342.08	349.01
		EIGENE,ALT :			2.3786D+06	1.2528D+06	1.3806D+06	1.90		1.83			
		EDLUND :			1.6832D+06			1.34		1.21			
		WSC-2 :			1.8337D+06			1.46		1.38			
		EIGENE,NEU :			2.6385D+06			2.11		2.04			
3	0.16	332.00	159.23	1.5D+06	2.6D+06	9.4D+05	1.0D+00	4.8D+04	1.8D+05	1.0D+06	343.57	343.57	348.98
		EIGENE,ALT :			2.2456D+06	1.2358D+06	1.3577D+06	1.82		1.75			
		EDLUND :			1.6129D+06			1.31		1.17			
		WSC-2 :			1.7602D+06			1.42		1.35			
		EIGENE,NEU :			2.4840D+06			2.01		1.94			
4	0.22	334.44	159.17	1.6D+06	2.6D+06	9.4D+05	1.1D+00	4.8D+04	1.8D+05	1.0D+06	344.91	344.91	348.94
		EIGENE,ALT :			2.1158D+06	1.2120D+06	1.3258D+06	1.75		1.68			
		EDLUND :			1.5446D+06			1.27		1.14			
		WSC-2 :			1.6860D+06			1.39		1.32			
		EIGENE,NEU :			2.3340D+06			1.93		1.86			
5	0.27	336.83	159.12	1.6D+06	2.6D+06	9.4D+05	1.1D+00	4.8D+04	1.8D+05	1.0D+06	346.09	346.09	348.89
		EIGENE,ALT :			1.9888D+06	1.1816D+06	1.2851D+06	1.68		1.62			
		EDLUND :			1.4777D+06			1.25		1.12			
		WSC-2 :			1.6108D+06			1.36		1.29			
		EIGENE,NEU :			2.1881D+06			1.85		1.78			
6	0.33	339.15	159.06	1.6D+06	2.6D+06	9.4D+05	1.1D+00	4.8D+04	1.8D+05	9.7D+05	347.11	347.11	348.85
		EIGENE,ALT :			1.8641D+06	1.1449D+06	1.2360D+06	1.63		1.56			
		EDLUND :			1.4120D+06			1.23		1.11			
		WSC-2 :			1.5344D+06			1.34		1.27			
		EIGENE,NEU :			2.0456D+06			1.79		1.72			
7	0.38	341.39	159.00	1.6D+06	2.6D+06	9.4D+05	1.1D+00	4.8D+04	1.8D+05	9.3D+05	347.96	347.96	348.80
		EIGENE,ALT :			1.7415D+06	1.1019D+06	1.1787D+06	1.58		1.52			
		EDLUND :			1.3471D+06			1.22		1.10			
		WSC-2 :			1.4567D+06			1.32		1.26			
		EIGENE,NEU :			1.9061D+06			1.73		1.67			
8	0.44	343.54	158.94	1.6D+06	2.6D+06	9.4D+05	1.1D+00	4.8D+04	1.8D+05	8.9D+05	348.64	348.64	348.75
		EIGENE,ALT :			1.6204D+06	1.0530D+06	1.1137D+06	1.54		1.48			
		EDLUND :			1.2826D+06			1.22		1.10			
		WSC-2 :			1.3774D+06			1.31		1.25			
		EIGENE,NEU :			1.7692D+06			1.68		1.62			
LOKALES SIEDEN : 0.495 M, TB = 348.69													
9	0.49	345.59	158.89	1.7D+06	2.6D+06	9.4D+05	1.2D+00	4.9D+04	1.8D+05	8.4D+05	348.69	349.15	348.69
		EIGENE,ALT :			1.5005D+06	9.9837D+05	1.0412D+06	1.50		1.45			
		EDLUND :			1.2181D+06			1.22		1.11			
		WSC-2 :			1.2963D+06			1.30		1.25			
		EIGENE,NEU :			1.6343D+06			1.64		1.58			
LOKALES SIEDEN : 0.550 M, TB = 348.63													
10	0.55	347.52	158.83	1.7D+06	2.6D+06	9.4D+05	1.2D+00	4.9D+04	1.8D+05	7.9D+05	348.63	349.48	348.63
		EIGENE,ALT :			1.3816D+06	9.3832D+05	9.6195D+05	1.47		1.42			
		EDLUND :			1.1535D+06			1.23		1.13			
		WSC-2 :			1.2131D+06			1.29		1.25			

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               EIGENE,NEU      :      1.5012D+06                                       1.60        1.55
LOKALES SIEDEN :          0.605 M,  TB =      348.57
   11    0.60 349.33 158.77      1.7D+06    2.6D+06    9.4D+05      1.2D+00   4.9D+04    1.9D+05   7.4D+05     348.57 349.64 348.57
               EIGENE,ALT      :      1.2633D+06  8.7319D+05       8.7631D+05    1.45        1.40
               EDLUND          :      1.0881D+06                                 1.25        1.16
               WSC-2           :      1.1274D+06                                 1.29        1.25
               EIGENE,NEU      :      1.3694D+06                                 1.57        1.52
LOKALES SIEDEN :          0.660 M,  TB =      348.50
   12    0.66 351.01 158.72      1.7D+06    2.6D+06    9.4D+05      1.2D+00   4.9D+04    1.9D+05   6.8D+05     348.50 349.63 348.50
               EIGENE,ALT      :      1.1453D+06  8.0332D+05       7.8489D+05    1.43        1.39
               EDLUND          :      1.0217D+06                                 1.27        1.19
               WSC-2           :      1.0391D+06                                 1.29        1.26
               EIGENE,NEU      :      1.2385D+06                                 1.54        1.50
LOKALES SIEDEN :          0.715 M,  TB =      348.43
   13    0.71 352.53 158.66      1.7D+06    2.6D+06    9.4D+05      1.3D+00   4.9D+04    1.9D+05   6.2D+05     348.43 349.44 348.43
               EIGENE,ALT      :      1.0273D+06  7.2909D+05       6.8828D+05    1.41        1.38
               EDLUND          :      9.5370D+05                                 1.31        1.25
               WSC-2           :      9.4769D+05                                 1.30        1.28
               EIGENE,NEU      :      1.1083D+06                                 1.52        1.48
LOKALES SIEDEN :          0.770 M,  TB =      348.35
   14    0.77 353.91 158.60      2.7D+06    2.6D+06    9.4D+05      1.3D+00   5.0D+04    1.9D+05   5.5D+05     348.35 349.09 348.35
               EIGENE,ALT      :      9.0891D+05  6.5091D+05       5.8713D+05    1.40        1.37
               EDLUND          :      8.8348D+05                                 1.36        1.32
               WSC-2           :      8.5283D+05                                 1.31        1.30
               EIGENE,NEU      :      9.7831D+05                                 1.50        1.47
LOKALES SIEDEN :          0.825 M,  TB =      348.27
   15    0.82 355.13 158.55      2.7D+06    2.6D+06    9.4D+05      1.3D+00   5.0D+04    1.9D+05   4.8D+05     348.27 348.57 348.27
               EIGENE,ALT      :      7.8991D+05  5.6920D+05       4.8211D+05    1.39        1.37
               EDLUND          :      8.1028D+05                                 1.42        1.43
               WSC-2           :      7.5407D+05                                 1.32        1.32
               EIGENE,NEU      :      8.4824D+05                                 1.49        1.47
   16    0.88 356.18 158.49      2.7D+06    2.6D+06    9.4D+05      1.3D+00   5.0D+04    1.9D+05   4.1D+05     347.89 347.89 348.17
               EIGENE,ALT      :      6.6994D+05  4.8441D+05       3.7390D+05    1.38        1.37
               EDLUND          :      7.3305D+05                                 1.51        1.58
               WSC-2           :      6.5093D+05                                 1.34        1.36
               EIGENE,NEU      :      7.1773D+05                                 1.48        1.47
   17    0.93 357.06 158.43      2.7D+06    2.6D+06    9.4D+05      1.4D+00   5.0D+04    1.9D+05   3.4D+05     347.05 347.05 348.06
               EIGENE,ALT      :      5.4868D+05  3.9699D+05       2.6323D+05    1.38        1.38
               EDLUND          :      6.5031D+05                                 1.64        1.84
               WSC-2           :      5.4284D+05                                 1.37        1.40
               EIGENE,NEU      :      5.8644D+05                                 1.48        1.47
   18    0.99 357.76 158.37      2.7D+06    2.6D+06    9.4D+05      1.4D+00   5.0D+04    1.9D+05   2.6D+05     346.06 346.06 347.94
               EIGENE,ALT      :      4.2578D+05  3.0742D+05       1.5082D+05    1.39        1.39
               EDLUND          :      5.5972D+05                                 1.82        2.34
               WSC-2           :      4.2915D+05                                 1.40        1.44
               EIGENE,NEU      :      4.5400D+05                                 1.48        1.48
   19    1.04 358.29 158.32      2.7D+06    2.6D+06    9.4D+05      1.4D+00   5.1D+04    1.9D+05   1.8D+05     344.91 344.91 347.86
               EIGENE,ALT      :      3.0088D+05  2.1618D+05       1.5082D+05    1.39        0.0
               EDLUND          :      4.5712D+05                                 2.11        0.0
               WSC-2           :      3.0913D+05                                 1.43        0.0
               EIGENE,NEU      :      3.2005D+05                                 1.48        0.0
   20    1.10 358.63 158.26      2.7D+06    2.6D+06    9.4D+05      1.4D+00   5.1D+04    1.9D+05   1.0D+05     343.62 343.62 347.66
               EIGENE,ALT      :      1.7359D+05  1.2377D+05       1.5082D+05    1.40        0.0
               EDLUND          :      3.3330D+05                                 2.69        0.0
               WSC-2           :      1.8193D+05                                 1.47        0.0
               EIGENE,NEU      :      1.8420D+05                                 1.49        0.0
         NKD =     107
```

```
  OVERPOWER FACTOR :      1.1200

 POS     X      T(X)    P(X)        HCHF(X)     HG(X)     HFG(X)          PR(X)     ALFA(X)     RE(X)     PHIN(X)     TW(X)    TW1      TW2
                CORRELATION                PHICHF(X)      PHIHS(X)        PHIHSCR(X)     SM(X)          SMCR(X)
*****************************************************************************************************************************************
NKD =          108 FAKT =         1.120
    0   0.0   328.58 159.40     1.5D+06    2.6D+06    9.3D+05        1.0D+00    4.7D+04     1.8D+05    1.1D+06     341.65 341.65 349.08
                EIGENE,ALT     :      2.6562D+06      1.4185D+06      1.5669D+06      1.87          1.82
                EDLUND         :      1.8310D+06                                      1.29          1.17
                WSC-2          :      1.9790D+06                                      1.40          1.32
                EIGENE,NEU     :      2.9641D+06                                      2.09          2.04
    1   0.05 331.40 159.34      1.5D+06    2.6D+06    9.4D+05        1.0D+00    4.7D+04     1.8D+05    1.1D+06     343.63 343.63 349.05
                EIGENE,ALT     :      2.5153D+06      1.4147D+06      1.5618D+06      1.78          1.72
                EDLUND         :      1.7557D+06                                      1.24          1.12
                WSC-2          :      1.9065D+06                                      1.35          1.27
                EIGENE,NEU     :      2.7983D+06                                      1.98          1.92
    2   0.11 334.22 159.29      1.5D+06    2.6D+06    9.4D+05        1.0D+00    4.8D+04     1.8D+05    1.1D+06     345.47 345.47 349.01
                EIGENE,ALT     :      2.3786D+06      1.4032D+06      1.5463D+06      1.70          1.63
                EDLUND         :      1.6832D+06                                      1.20          1.08
                WSC-2          :      1.8337D+06                                      1.31          1.23
                EIGENE,NEU     :      2.6385D+06                                      1.88          1.82
    3   0.16 337.00 159.23      1.6D+06    2.6D+06    9.4D+05        1.1D+00    4.8D+04     1.8D+05    1.0D+06     347.17 347.17 348.98
                EIGENE,ALT     :      2.2456D+06      1.3841D+06      1.5206D+06      1.62          1.56
                EDLUND         :      1.6129D+06                                      1.17          1.05
                WSC-2          :      1.7602D+06                                      1.27          1.20
                EIGENE,NEU     :      2.4840D+06                                      1.79          1.73
    4   0.22 339.73 159.17      1.6D+06    2.6D+06    9.4D+05        1.1D+00    4.8D+04     1.8D+05    1.0D+06     348.70 348.70 348.94
                EIGENE,ALT     :      2.1158D+06      1.3574D+06      1.4849D+06      1.56          1.50
                EDLUND         :      1.5446D+06                                      1.14          1.02
                WSC-2          :      1.6860D+06                                      1.24          1.17
                EIGENE,NEU     :      2.3340D+06                                      1.72          1.66
LOKALES SIEDEN :        0.275 M, TB =      348.89
    5   0.27 342.41 159.12      1.6D+06    2.6D+06    9.4D+05        1.1D+00    4.8D+04     1.8D+05    1.0D+06     348.89 350.08 348.89
                EIGENE,ALT     :      1.9888D+06      1.3234D+06      1.4394D+06      1.50          1.44
                EDLUND         :      1.4777D+06                                      1.12          1.00
                WSC-2          :      1.6108D+06                                      1.22          1.15
                EIGENE,NEU     :      2.1881D+06                                      1.65          1.59
LOKALES SIEDEN :        0.330 M, TB =      348.85
    6   0.33 345.01 159.06      1.6D+06    2.6D+06    9.4D+05        1.2D+00    4.9D+04     1.8D+05    9.7D+05     348.85 351.28 348.85
                EIGENE,ALT     :      1.8641D+06      1.2823D+06      1.3843D+06      1.45          1.40
                EDLUND         :      1.4120D+06                                      1.10          0.991
                WSC-2          :      1.5344D+06                                      1.20          1.14
                EIGENE,NEU     :      2.0456D+06                                      1.60          1.54
LOKALES SIEDEN :        0.385 M, TB =      348.80
    7   0.38 347.52 159.00      1.7D+06    2.6D+06    9.4D+05        1.2D+00    4.9D+04     1.8D+05    9.3D+05     348.80 352.31 348.80
                EIGENE,ALT     :      1.7415D+06      1.2342D+06      1.3202D+06      1.41          1.36
                EDLUND         :      1.3471D+06                                      1.09          0.985
                WSC-2          :      1.4567D+06                                      1.18          1.12
                EIGENE,NEU     :      1.9061D+06                                      1.54          1.49
LOKALES SIEDEN :        0.440 M, TB =      348.75
    8   0.44 349.93 158.94      1.7D+06    2.6D+06    9.4D+05        1.2D+00    4.9D+04     1.9D+05    8.9D+05     348.75 353.16 348.75
                EIGENE,ALT     :      1.6204D+06      1.1794D+06      1.2473D+06      1.37          1.32
                EDLUND         :      1.2826D+06                                      1.09          0.986
                WSC-2          :      1.3774D+06                                      1.17          1.12
                EIGENE,NEU     :      1.7692D+06                                      1.50          1.45
LOKALES SIEDEN :        0.495 M, TB =      348.69
    9   0.49 352.22 158.89      1.7D+06    2.6D+06    9.4D+05        1.3D+00    4.9D+04     1.9D+05    8.4D+05     348.69 353.83 348.69
                EIGENE,ALT     :      1.5005D+06      1.1182D+06      1.1662D+06      1.34          1.29
                EDLUND         :      1.2181D+06                                      1.09          0.993
                WSC-2          :      1.2963D+06                                      1.16          1.11
                EIGENE,NEU     :      1.6343D+06                                      1.46          1.41
LOKALES SIEDEN :        0.550 M, TB =      348.63
```

```
  10   0.55 354.39 158.83    2.7D+06   2.6D+06   9.4D+05     1.3D+00   5.0D+04    1.9D+05   7.9D+05    348.63 354.32 348.63
             EIGENE,ALT     :       1.3816D+06   1.0509D+06    1.0774D+06    1.31          1.27
             EDLUND         :       1.1535D+06                               1.10          1.01
             WSC-2          :       1.2131D+06                               1.15          1.11
             EIGENE,NEU     :       1.5012D+06                               1.43          1.38
LOKALES SIEDEN :       0.605 M,  TB =     348.57
  11   0.60 356.41 158.77    2.7D+06   2.6D+06   9.4D+05     1.4D+00   5.0D+04    1.9D+05   7.4D+05    348.57 354.62 348.57
             EIGENE,ALT     :       1.2633D+06   9.7797D+05    9.8147D+05    1.29          1.25
             EDLUND         :       1.0881D+06                               1.11          1.03
             WSC-2          :       1.1274D+06                               1.15          1.12
             EIGENE,NEU     :       1.3694D+06                               1.40          1.36
LOKALES SIEDEN :       0.660 M,  TB =     348.50
  12   0.66 358.29 158.72    2.7D+06   2.6D+06   9.4D+05     1.4D+00   5.1D+04    1.9D+05   6.8D+05    348.50 354.74 348.50
             EIGENE,ALT     :       1.1453D+06   8.9971D+05    8.7907D+05    1.27          1.24
             EDLUND         :       1.0217D+06                               1.14          1.07
             WSC-2          :       1.0391D+06                               1.15          1.13
             EIGENE,NEU     :       1.2385D+06                               1.38          1.34
LOKALES SIEDEN :       0.715 M,  TB =     348.43
  13   0.71 360.00 158.66    2.7D+06   2.6D+06   9.4D+05     1.4D+00   5.1D+04    1.9D+05   6.2D+05    348.43 354.68 348.43
             EIGENE,ALT     :       1.0273D+06   8.1658D+05    7.7087D+05    1.26          1.23
             EDLUND         :       9.5370D+05                               1.17          1.11
             WSC-2          :       9.4769D+05                               1.16          1.14
             EIGENE,NEU     :       1.1083D+06                               1.36          1.32
LOKALES SIEDEN :       0.770 M,  TB =     348.35
  14   0.77 361.54 158.60    2.8D+06   2.6D+06   9.4D+05     1.5D+00   5.1D+04    1.9D+05   5.5D+05    348.35 354.45 348.35
             EIGENE,ALT     :       9.0891D+05   7.2902D+05    6.5759D+05    1.25          1.22
             EDLUND         :       8.8348D+05                               1.21          1.18
             WSC-2          :       8.5283D+05                               1.17          1.16
             EIGENE,NEU     :       9.7831D+05                               1.34          1.31
LOKALES SIEDEN :       0.825 M,  TB =     348.27
  15   0.82 362.91 158.55    2.8D+06   2.6D+06   9.4D+05     1.5D+00   5.2D+04    1.9D+05   4.8D+05    348.27 354.05 348.27
             EIGENE,ALT     :       7.8991D+05   6.3751D+05    5.3996D+05    1.24          1.22
             EDLUND         :       8.1028D+05                               1.27          1.27
             WSC-2          :       7.5407D+05                               1.18          1.18
             EIGENE,NEU     :       8.4824D+05                               1.33          1.31
LOKALES SIEDEN :       0.880 M,  TB =     348.17
  16   0.88 364.08 158.49    2.8D+06   2.6D+06   9.4D+05     1.6D+00   5.2D+04    1.9D+05   4.1D+05    348.17 353.48 348.17
             EIGENE,ALT     :       6.6994D+05   5.4254D+05    4.1877D+05    1.23          1.22
             EDLUND         :       7.3305D+05                               1.35          1.41
             WSC-2          :       6.5093D+05                               1.20          1.21
             EIGENE,NEU     :       7.1773D+05                               1.32          1.31
LOKALES SIEDEN :       0.935 M,  TB =     348.06
  17   0.93 365.07 158.43    2.8D+06   2.6D+06   9.4D+05     1.6D+00   5.3D+04    1.9D+05   3.4D+05    348.06 352.76 348.06
             EIGENE,ALT     :       5.4868D+05   4.4463D+05    2.9481D+05    1.23          1.23
             EDLUND         :       6.5031D+05                               1.46          1.64
             WSC-2          :       5.4284D+05                               1.22          1.25
             EIGENE,NEU     :       5.8644D+05                               1.32          1.31
LOKALES SIEDEN :       0.990 M,  TB =     347.94
  18   0.99 365.86 158.37    2.8D+06   2.6D+06   9.4D+05     1.7D+00   5.3D+04    1.9D+05   2.6D+05    347.94 351.87 347.94
             EIGENE,ALT     :       4.2578D+05   3.4431D+05    1.6891D+05    1.24          1.24
             EDLUND         :       5.5972D+05                               1.63          2.09
             WSC-2          :       4.2915D+05                               1.25          1.29
             EIGENE,NEU     :       4.5400D+05                               1.32          1.32
LOKALES SIEDEN :       1.045 M,  TB =     347.86
  19   1.04 366.44 158.32    2.8D+06   2.6D+06   9.4D+05     1.7D+00   5.3D+04    1.9D+05   1.8D+05    347.86 350.84 347.86
             EIGENE,ALT     :       3.0088D+05   2.4212D+05    1.6891D+05    1.24          0.0
             EDLUND         :       4.5712D+05                               1.89          0.0
             WSC-2          :       3.0913D+05                               1.28          0.0
             EIGENE,NEU     :       3.2005D+05                               1.32          0.0
LOKALES SIEDEN :       1.100 M,  TB =     347.66
  20   1.10 366.82 158.26    2.8D+06   2.6D+06   9.4D+05     1.7D+00   5.4D+04    1.9D+05   1.0D+05    347.66 349.65 347.66
             EIGENE,ALT     :       1.7359D+05   1.3862D+05    1.6891D+05    1.25          0.0
```

```
            EDLUND        :    3.3330D+05                          2.40      0.0
            WSC-2         :    1.8193D+05                          1.31      0.0
            EIGENE,NEU    :    1.8420D+05                          1.33      0.0
      NKD =     133
RC001 1 DATENSATZ

      NA =      72 ZEICHEN TITELZEILE:
                SAMPLE 1 HOMOGENEOUS REACTOR, CHARAKTERISTIC       18.01.85  11.36.25
RC003 NR =     133 WOERTER REAL*4
RC004 NI =       4 WOERTER INTEGER*4
RC002 NEU GESCHRIEBEN
```

5.2 Sample 2, Heterogeneous Core, Constant Pump Characteristic

Control statements and input

Starting in column 1
↓
```
//PROJECT2 JOB (....,...,.....),....,MSGCLASS=A
// EXEC PGM=HADA
//STEPLIB  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//*******************************************************************
//**
//**          UNIT INP      COMMON PHYSICAL PARAMETERS
//**
//FT01F001 DD *
3.765E9                    Q0 IN W
1.00,1.6,1.0000,0.94       OP,FDH0,CDH,K'
0.0                        ALC
1.7E7,0.774                N  IN W
158.26                     P20  IN BAR
326.12                     T20  IN GRD C
64.5                       POS  IN BAR
18800.                     M0  IN KG/S
1.55927E8                  KF0  IN W/GRD C
291.14                     T10  IN GRD C
159.65                     P10  IN BAR
70.6                       HR  IN M
5.4D7                      NEL  IN W
89.6                       HT0  IN M
1.3E9                      NEL  IN W
//*******************************************************************
//**
//**          UNIT JNP      SPECIAL PHYSICAL PARAMETERS
//**
//FT03F001 DD *
.302605,1.,1.              K1,KLS,KLB
.884686                    K2S
.929184                    K2B
.50824D0                   K3
2.44652E8                  QVS IN W/M**3
7.4000E-3                  DS   IN M
3.8469                     DEQ  IN M
.15                        LSC  IN M
.2                         LSR  IN M
1.2                        KI
7.                         CV
.3333333333333333          K0
20.                        H/D
```

```
//******************************************************************
//**
//**         UNIT 05      SYSIN
//**
//FT05F001 DD *
1                         INP
2,2,1,1                   IOP1,IOP2,IOP3,IOP4 .,2,.,. HETEROGEN <==
1,2                       IDR1,IDR2
3                         JNP                 3     HETEROGEN <==
1.D-5,.5,20               EPS,DMAX,IMAX
1.54                      PHIAX
2.37D6                    K
1588.D3                   HO
2.1                       FQ
.1                        K4
40                        NC
1.12                      OP
1.763,9.157,6.507,1.748,7.540,8.783   (Q1,Q2,Q4)ALT,(Q1,Q2,Q4)NEU
1.848                     FQN
//FT06F001 DD SYSOUT=*,
//           DCB=(LRECL=133,BLKSIZE=3857,RECFM=FBA)
//FT08F001 DD DSN=PROJECT.APWRS.DATA,DISP=(MOD,PASS)
//FT09F001 DD SYSOUT=*,
//           DCB=(LRECL=133,BLKSIZE=3857,RECFM=FBA)
//FT10F001 DD SYSOUT=*,
//           DCB=(LRECL=133,BLKSIZE=3857,RECFM=FBA)
//******************************************************************
//**
//**         UNIT 47      PROBLEM IDENTIFICATION
//**
//FT47F001 DD *
SAMPLE 2 HETEROGENEOUS CORE, CHARACTERISTIC
//
```

Main results (unit 09)

TITEL :

SAMPLE 2 HETEROGENEOUS, CHARAKTERISTIC 18.01.85 16.28.10

EINGABEPARAMETER

Q0	=	3.7650D+09	W
POS	=	64.500	BAR
P20	=	158.26	BAR
T20	=	326.12	GRD C
KFO	=	1.5593D+08	WATT/GRD
N	=	1.7000D+07	WATT
P10	=	159.65	BAR
M0	=	18800.	KG/S
FDHO	=	1.6000	
CDH	=	1.0000	
OPF	=	1.0000	
T10	=	291.14	GRD C
HR	=	70.600	M
NEL	=	5.4000D+07	W
ALC	=	0.0	M

CONSTANT PUMP CHARACTERISTICS

K1	=	0.30260	
K2S	=	0.88469	
K2B	=	0.92918	
K3	=	0.50824	
QVS	=	2.4465D+08	W/CBM
QVB	=	1.2434D+08	W/CBM
DEQ	=	3.8469	M
LSC	=	0.15000	M
LSR	=	0.20000	M
KI	=	1.2000	
CV	=	7.0000	
KO	=	0.33333	
H/DB	=	20.000	
QLS	=	19465.	W/M
DHS	=	6.2897D-03	M
HETEROGENEOUS REACTOR			
EPS	=	1.0000D-03	%
DELTA	=	50.000	%

LOESUNGSVEKTOR UND ERREICHTE GENAUIGKEIT

NAME	NR	EINHEIT	WERT	ZUWACHS
****	**	*******	***********	***********
K	1	-	1.0000	0.0
Q	2	W	3.7650D+09	0.0
T1	3	GRD C	291.14	0.0
RO1	4	KG/CBM	745.55	0.0
P1	5	BAR	159.65	0.0
H1	6	J/KG	1.2891D+06	0.0
T2	7	GRD C	326.12	0.0
RO2	8	KG/CBM	664.73	0.0
H2	9	J/KG	1.4900D+06	0.0
TS	10	GRD C	280.40	0.0
PS	11	BAR	64.500	0.0
TQ	12	GRD C	308.63	0.0
ROQ	13	KG/CBM	709.37	0.0
PQ	14	BAR	158.95	0.0
M	15	KG/S	18736.	0.0
KF	16	W/GRD	1.5583D+08	0.0
HT	17	M	91.473	0.0
HC	18	M	21.351	0.0
DP	19	BAR	1.4325	0.0
Y	20	-	1.4412	0.0
LR	21	M	2.6557	0.0
T2US	22	GRD C	326.12	0.0
RO2US	23	KG/CBM	664.73	0.0
H2US	24	J/KG	1.5307D+06	0.0
TQS	25	GRD C	308.63	0.0
ROQS	26	KG/CBM	709.37	0.0
NYS	27	QM/S	1.2605D-07	0.0
US	28	M/S	6.8892	0.0
RES	29	-	3.4375D+05	0.0
LAMS	30	-	1.4640D-02	0.0
NG	31	-	18.000	0.0
PB	32	M	1.3486D-02	0.0
BB	33	M	5.6908D-04	0.0
DB	34	M	1.1779D-02	0.0
AB	35	QM	2.2542D-05	0.0
DHB	36	M	3.8169D-03	0.0
T2UB	37	GRD C	326.12	0.0
RO2UB	38	KG/CBM	664.73	0.0
H2UB	39	J/KG	1.5192D+06	0.0
TQB	40	GRD C	308.63	0.0
ROQB	41	KG/CBM	709.37	0.0
NYB	42	QM/S	1.2605D-07	0.0
UB	43	M/S	6.6184	0.0
FB	44	-	0.77268	0.0
REB	45	-	1.7616D+05	0.0
CB	46	-	1.0000	0.0
LAMB	47	-	1.3055D-02	0.0
QLB	48	W/M	16958.	0.0

ITER =	0 ABS :	5.5611D+07	2	*** REL :	0.50000	44
ITER =	1 ABS :	8.4338D+06	2	*** REL :	0.49161	19
ITER =	2 ABS :	4.5661D+06	2	*** REL :	5.0263D-02	35
ITER =	3 ABS :	1.0100D+05	2	*** REL :	1.2077D-03	33

LOESUNGSVEKTOR UND ERREICHTE GENAUIGKEIT

NAME	NR	EINHEIT	WERT	ZUWACHS
****	**	*******	***********	***********
K	1	-	0.98418	-1.0579D-08
Q	2	W	3.7054D+09	-39.831
T1	3	GRD C	289.58	-1.5078D-06
RO1	4	KG/CBM	748.79	-2.6675D-06
P1	5	BAR	161.48	-1.5542D-07
H1	6	J/KG	1.2808D+06	-6.0453D-03
T2	7	GRD C	326.68	-1.0092D-07
RO2	8	KG/CBM	663.09	2.8178D-06
H2	9	J/KG	1.4937D+06	-2.4937D-03
TS	10	GRD C	279.34	-7.3271D-07
PS	11	BAR	63.479	-6.8236D-07
TQ	12	GRD C	308.13	-8.0438D-07
ROQ	13	KG/CBM	710.70	2.0787D-06
PQ	14	BAR	159.87	-7.7708D-08
M	15	KG/S	17408.	-4.2005D-04
KF	16	W/GRD	1.5369D+08	-0.75269
HT	17	M	104.07	2.3310D-06
HC	18	M	43.914	4.8997D-06
DP	19	BAR	3.2246	-1.5542D-07
Y	20	-	1.5314	6.9107D-08
LR	21	M	2.6140	-2.7883D-08
T2US	22	GRD C	333.09	9.9135D-08
RO2US	23	KG/CBM	643.11	2.7610D-06
H2US	24	J/KG	1.5368D+06	-1.7745D-03
TQS	25	GRD C	311.33	-7.0435D-07
ROQS	26	KG/CBM	703.38	1.9329D-06
NYS	27	QM/S	1.2605D-07	-6.1046D-17
US	28	M/S	6.4552	-1.7280D-07
RES	29	-	3.2210D+05	-1.0604D-02
LAMS	30	-	1.5014D-02	1.0163D-10
NG	31	-	18.000	0.0
PB	32	M	1.2161D-02	1.4730D-10
BB	33	M	4.0000D-04	0.0
DB	34	M	1.1089D-02	-6.6198D-11
AB	35	QM	1.5101D-05	1.2931D-12
DHB	36	M	2.9276D-03	8.1619D-11
T2UB	37	GRD C	331.31	-3.8534D-07
RO2UB	38	KG/CBM	648.91	3.9597D-07
H2UB	39	J/KG	1.5245D+06	-1.9790D-03
TQB	40	GRD C	310.45	-9.4659D-07
ROQB	41	KG/CBM	705.44	2.5932D-07
NYB	42	QM/S	1.2605D-07	3.3804D-16
UB	43	M/S	6.6936	-8.8267D-08
FB	44	-	1.2721	6.4038D-08
REB	45	-	1.7534D+05	-1.8223D-02
CB	46	-	1.0000	0.0
LAMB	47	-	2.1509D-02	1.8287D-09
QLB	48	W/M	15924.	3.9807D-04

ERGEBNISSE

Q	=	3.7054D+09	W	
K	=	0.98418		
PS	=	63.479	BAR	
TS	=	279.34	GRD C	
P1	=	161.48	BAR	
T1	=	289.58	GRD C	
T2	=	326.68	GRD C	
M	=	17408.	KG/S	
NP	=	1.8284D+07	W	
QNT	=	1.2750D+09	W	
QNT/QELO	=	0.98073		

*********** ZUSATZ 08.09.1983 *********

KS	=	0.94000	-	
ETA	=	0.77400	-	
MS	=	16363.	KG/S	
NPEL	=	2.3622D+07	W	

HETEROGENEOUS REACTOR

LC	=	2.1825	M	
LR	=	2.6140	M	

SEED

KLS	=	1.0000	-	12.09.1983
QLS	=	19465.	W/M	
PS	=	9.5850D-03	M	
BS	=	7.2833D-04	M	
DS	=	7.4000D-03	M	
PS/DS	=	1.2953		
T2US	=	333.09	GRD C	
US	=	6.4552	M/S	
RES	=	3.2210D+05		
LAMS	=	1.5014D-02		

BLANKET

KLB	=	1.00000	-	12.09.1983
QLB	=	15924.3	W/M	
PB	=	1.21606D-02	M	
BB	=	4.00000D-04	M	
DB	=	1.10892D-02	M	
PB/DB	=	1.09662		
T2UB	=	331.314	GRD C	
UB	=	6.69356	M/S	
REB	=	175344.		
LAMB	=	2.15095D-02		

GESAMT

DP	=	3.2246	BAR	
DPTOT	=	3.4445	BAR	

*********** ZUSATZ 08.09.1983 *********

DPP	=	7.6421	BAR	
NG	=	18		
NS	=	39107		
NB	=	58809		
NT	=	97916		

VM/VF = 0.50771
CELL : 0.48458

SEED

CHF-CALCULATIONS

LC	=	2.1825	M
T1	=	289.58	GRD C
RO1	=	748.79	KG/CBM
P1	=	161.48	BAR
H1	=	1.2808D+06	J/KG
T2	=	333.09	GRD
P2	=	158.26	BAR
ROQ	=	703.38	KG/CBM
U	=	6.4552	M/S
QL	=	19465.	W/M
D	=	7.4000D-03	M
DH	=	6.2897D-03	M
PZUD	=	1.2953	

EINGABEDATEN

FIAX	=	1.5400	
AK	=	2.3700D+06	
HO	=	1.5880D+06	J/KG
FQ	=	2.1000	
K4	=	0.10000	
NC	=	40	
OP	=	1.1200	
Q10	=	1.7630	
Q20	=	9.1570	
Q40	=	6.5070	
Q1N	=	1.7480	
Q2N	=	7.5400	
Q4N	=	8.7830	
FQN	=	1.8480	

ERGEBNISSE

X	=	1.5392	
PI/2X	=	1.0205	
LC'	=	2.2273	
RLCR	=	1.964	
RLCR'	=	2.009	
V1	=	0.70000D+00	WSC-2
V2	=	0.49357D+00	EIGENE,ALT
V2	=	0.62284D+00	EIGENE,NEU

OVERPOWER FACTOR : 1.0000

POS	X	T(X)	TW	EIGENE,ALT CHF	SM	SMLWR	EDLUND CHF	SM	SMLWR	WSC-2 CHF	SM	SMLWR	EIGENE,NEU CHF	SM	SMLWR
0	0.0	324.39	349.49	4.553D+06	2.59	2.52	2.718D+06	1.55	1.39	3.858D+06	2.19	2.08	4.036D+06	2.30	2.20
1	0.05	327.06	349.45	4.295D+06	2.45	2.37	2.602D+06	1.48	1.33	3.700D+06	2.11	2.00	3.839D+06	2.19	2.10
2	0.11	329.73	349.40	4.045D+06	2.33	2.25	2.489D+06	1.43	1.28	3.541D+06	2.04	1.93	3.645D+06	2.10	2.00
3	0.16	332.36	349.35	3.804D+06	2.22	2.14	2.381D+06	1.39	1.24	3.382D+06	1.98	1.87	3.454D+06	2.02	1.93
4	0.22	334.94	349.29	3.569D+06	2.13	2.05	2.275D+06	1.36	1.21	3.223D+06	1.92	1.82	3.265D+06	1.95	1.86
5	0.27	337.46	349.24	3.339D+06	2.05	1.97	2.172D+06	1.33	1.19	3.062D+06	1.88	1.78	3.078D+06	1.89	1.80
6	0.33	339.90	349.18	3.115D+06	1.98	1.90	2.070D+06	1.31	1.18	2.900D+06	1.84	1.75	2.892D+06	1.84	1.76
7	0.38	342.25	349.11	2.894D+06	1.92	1.84	1.969D+06	1.30	1.17	2.736D+06	1.81	1.73	2.707D+06	1.79	1.72
8	0.44	344.50	349.04	2.677D+06	1.87	1.79	1.869D+06	1.30	1.18	2.569D+06	1.79	1.71	2.522D+06	1.76	1.69
9	0.49	346.62	348.97	2.463D+06	1.82	1.76	1.769D+06	1.31	1.19	2.398D+06	1.77	1.70	2.336D+06	1.73	1.66
10	0.55	348.62	348.89	2.250D+06	1.78	1.72	1.668D+06	1.32	1.21	2.225D+06	1.76	1.70	2.150D+06	1.70	1.65
11	0.60	350.47	348.81	2.039D+06	1.75	1.70	1.566D+06	1.34	1.25	2.046D+06	1.76	1.71	1.962D+06	1.68	1.64
12	0.65	352.17	348.72	1.828D+06	1.72	1.68	1.461D+06	1.38	1.30	1.863D+06	1.76	1.72	1.772D+06	1.67	1.63
13	0.71	353.70	348.63	1.618D+06	1.70	1.67	1.354D+06	1.43	1.38	1.674D+06	1.76	1.74	1.579D+06	1.66	1.63
14	0.76	355.06	348.52	1.407D+06	1.69	1.66	1.242D+06	1.49	1.48	1.479D+06	1.78	1.77	1.383D+06	1.66	1.64
15	0.82	356.24	348.41	1.195D+06	1.68	1.66	1.124D+06	1.58	1.63	1.276D+06	1.79	1.80	1.183D+06	1.66	1.66
16	0.87	357.22	348.29	9.811D+05	1.68	1.67	9.982D+05	1.71	1.88	1.065D+06	1.82	1.85	9.783D+05	1.67	1.68
17	0.93	358.02	348.14	7.649D+05	1.68	1.68	8.610D+05	1.89	2.36	8.444D+05	1.85	1.90	7.684D+05	1.68	1.71
18	0.98	358.61	347.17	5.456D+05	1.68	0.0	7.063D+05	2.18	0.0	6.127D+05	1.89	0.0	5.522D+05	1.70	0.0
19	1.04	359.01	345.06	3.225D+05	1.69	0.0	5.213D+05	2.74	0.0	3.686D+05	1.94	0.0	3.290D+05	1.73	0.0
20	1.09	359.19	342.78	9.486D+04	1.71	0.0	2.603D+05	4.69	0.0	1.104D+05	1.99	0.0	9.753D+04	1.76	0.0

MINIMALWERTE

CORRELATION		SMMIN	X	POS			
EIGENE,ALT	:	1.6759	0.87302	16	1.6622	0.76389	14
EDLUND	:	1.3021	0.43651	8	1.1744	0.38195	7
WSC-2	:	1.7566	0.60020	11	1.7029	0.54564	10
EIGENE,NEU	:	1.6608	0.76389	14	1.6316	0.65476	12

OVERPOWER FACTOR : 1.1200

POS	X	T(X)	TW	EIGENE,ALT CHF	SM	SMLWR	EDLUND CHF	SM	SMLWR	WSC-2 CHF	SM	SMLWR	EIGENE,NEU CHF	SM	SMLWR
******		******		********************			********************			********************			********************		
0	0.0	328.56	349.49	4.553D+06	2.31	2.25	2.718D+06	1.38	1.24	3.858D+06	1.96	1.86	4.036D+06	2.05	1.97
1	0.05	331.56	349.45	4.295D+06	2.19	2.12	2.602D+06	1.32	1.19	3.700D+06	1.88	1.79	3.839D+06	1.95	1.87
2	0.11	334.54	349.40	4.045D+06	2.08	2.01	2.489D+06	1.28	1.15	3.541D+06	1.82	1.72	3.645D+06	1.87	1.79
3	0.16	337.49	349.35	3.804D+06	1.98	1.91	2.381D+06	1.24	1.11	3.382D+06	1.76	1.67	3.454D+06	1.80	1.72
4	0.22	340.38	349.29	3.569D+06	1.90	1.83	2.275D+06	1.21	1.08	3.223D+06	1.72	1.63	3.265D+06	1.74	1.66
5	0.27	343.20	349.24	3.339D+06	1.83	1.76	2.172D+06	1.19	1.06	3.062D+06	1.68	1.59	3.078D+06	1.69	1.61
6	0.33	345.94	349.18	3.115D+06	1.77	1.70	2.070D+06	1.17	1.05	2.900D+06	1.64	1.56	2.892D+06	1.64	1.57
7	0.38	348.57	349.11	2.894D+06	1.71	1.65	1.969D+06	1.16	1.05	2.736D+06	1.62	1.54	2.707D+06	1.60	1.53
8	0.44	351.09	349.04	2.677D+06	1.67	1.60	1.869D+06	1.16	1.05	2.569D+06	1.60	1.53	2.522D+06	1.57	1.51
9	0.49	353.47	348.97	2.463D+06	1.63	1.57	1.769D+06	1.17	1.06	2.398D+06	1.58	1.52	2.336D+06	1.54	1.48
10	0.55	355.70	348.89	2.250D+06	1.59	1.54	1.668D+06	1.18	1.08	2.225D+06	1.57	1.52	2.150D+06	1.52	1.47
11	0.60	357.78	348.81	2.039D+06	1.56	1.52	1.566D+06	1.20	1.12	2.046D+06	1.57	1.53	1.962D+06	1.50	1.46
12	0.65	359.68	348.72	1.828D+06	1.54	1.50	1.461D+06	1.23	1.16	1.863D+06	1.57	1.54	1.772D+06	1.49	1.46
13	0.71	361.39	348.63	1.618D+06	1.52	1.49	1.354D+06	1.27	1.23	1.674D+06	1.57	1.55	1.579D+06	1.49	1.46
14	0.76	362.92	348.52	1.407D+06	1.51	1.48	1.242D+06	1.33	1.32	1.479D+06	1.59	1.58	1.383D+06	1.48	1.47
15	0.82	364.23	348.41	1.195D+06	1.50	1.48	1.124D+06	1.41	1.46	1.276D+06	1.60	1.61	1.183D+06	1.49	1.48
16	0.87	365.34	348.29	9.811D+05	1.50	1.49	9.982D+05	1.52	1.68	1.065D+06	1.62	1.65	9.783D+05	1.49	1.50
17	0.93	366.23	348.14	7.649D+05	1.50	1.50	8.610D+05	1.69	2.11	8.444D+05	1.65	1.70	7.684D+05	1.50	1.53
18	0.98	366.90	348.06	5.456D+05	1.50	0.0	7.063D+05	1.94	0.0	6.127D+05	1.69	0.0	5.522D+05	1.52	0.0
19	1.04	367.34	347.84	3.225D+05	1.51	0.0	5.213D+05	2.44	0.0	3.686D+05	1.73	0.0	3.290D+05	1.54	0.0
20	1.09	367.55	347.47	9.486D+04	1.53	0.0	2.603D+05	4.19	0.0	1.104D+05	1.78	0.0	9.753D+04	1.57	0.0

MINIMALWERTE

CORRELATION		SMMIN	X	POS			
*************		***********	*********	***			
EIGENE,ALT	:	1.4964	0.87302	16	1.4841	0.76389	14
EDLUND	:	1.1626	0.43651	8	1.0486	0.38195	7
WSC-2	:	1.5684	0.60020	11	1.5205	0.54564	10
EIGENE,NEU	:	1.4828	0.76389	14	1.4568	0.65476	12

BLANKET

CHF-CALCULATIONS

LC	=	2.1825	M
T1	=	289.58	GRD C
RO1	=	748.79	KG/CBM
P1	=	161.48	BAR
H1	=	1.2808D+06	J/KG
T2	=	331.31	GRD
P2	=	158.26	BAR
ROQ	=	705.44	KG/CBM
U	=	6.6936	M/S
QL	=	15924.	W/M
D	=	1.1089D-02	M
DH	=	2.9276D-03	M
PZUD	=	1.0966	

EINGABEDATEN

FIAX	=	1.5400	
AK	=	2.3700D+06	
HO	=	1.5880D+06	J/KG
FQ	=	2.1000	
K4	=	0.10000	
NC	=	40	
OP	=	1.1200	
Q10	=	1.7630	
Q20	=	9.1570	
Q40	=	6.5070	
Q1N	=	1.7480	
Q2N	=	7.5400	
Q4N	=	8.7830	
FQN	=	1.8480	

ERGEBNISSE

X	=	1.5392	
PI/2X	=	1.0205	
LC'	=	2.2273	
RLCR	=	1.964	
RLCR'	=	2.009	
V1	=	0.70000D+00	WSC-2
V2	=	0.47975D+00	EIGENE,ALT
V2	=	0.57310D+00	EIGENE,NEU

OVERPOWER FACTOR : 1.0000

POS	X	T(X)	TW	EIGENE,ALT CHF	SM	SMLWR	EDLUND CHF	SM	SMLWR	WSC-2 CHF	SM	SMLWR	EIGENE,NEU CHF	SM	SMLWR
0	0.0	322.97	330.21	2.401D+06	2.50	2.41	1.794D+06	1.87	1.69	1.683D+06	1.75	1.65	2.077D+06	2.16	2.06
1	0.05	325.54	332.05	2.278D+06	2.38	2.29	1.717D+06	1.79	1.61	1.626D+06	1.70	1.59	1.987D+06	2.08	1.97
2	0.11	328.09	333.78	2.158D+06	2.28	2.18	1.643D+06	1.73	1.55	1.568D+06	1.65	1.55	1.898D+06	2.00	1.90
3	0.16	330.61	335.40	2.040D+06	2.18	2.09	1.572D+06	1.68	1.50	1.509D+06	1.62	1.52	1.808D+06	1.94	1.84
4	0.22	333.09	336.89	1.925D+06	2.10	2.01	1.502D+06	1.64	1.47	1.449D+06	1.58	1.49	1.719D+06	1.88	1.78
5	0.27	335.51	338.25	1.810D+06	2.03	1.95	1.434D+06	1.61	1.44	1.387D+06	1.56	1.47	1.630D+06	1.83	1.74
6	0.33	337.85	339.48	1.697D+06	1.98	1.89	1.368D+06	1.59	1.43	1.324D+06	1.54	1.46	1.540D+06	1.79	1.71
7	0.38	340.11	340.56	1.585D+06	1.92	1.84	1.301D+06	1.58	1.42	1.259D+06	1.53	1.45	1.450D+06	1.76	1.68
8	0.44	342.26	341.49	1.474D+06	1.88	1.81	1.235D+06	1.58	1.43	1.192D+06	1.52	1.45	1.358D+06	1.73	1.66
9	0.49	344.30	342.26	1.362D+06	1.84	1.78	1.169D+06	1.58	1.44	1.122D+06	1.52	1.46	1.265D+06	1.71	1.65
10	0.55	346.21	342.87	1.251D+06	1.81	1.75	1.103D+06	1.60	1.47	1.049D+06	1.52	1.47	1.171D+06	1.70	1.64
11	0.60	347.99	343.33	1.139D+06	1.79	1.74	1.036D+06	1.63	1.52	9.737D+05	1.53	1.49	1.074D+06	1.69	1.64
12	0.65	349.62	343.62	1.027D+06	1.77	1.73	9.668D+05	1.67	1.58	8.946D+05	1.55	1.52	9.758D+05	1.69	1.65
13	0.71	351.09	343.75	9.129D+05	1.76	1.73	8.959D+05	1.73	1.67	8.114D+05	1.57	1.55	8.748D+05	1.69	1.66
14	0.76	352.39	343.71	7.978D+05	1.76	1.73	8.221D+05	1.81	1.80	7.237D+05	1.59	1.60	7.708D+05	1.70	1.69
15	0.82	353.52	343.51	6.810D+05	1.75	1.74	7.445D+05	1.92	1.98	6.308D+05	1.62	1.65	6.634D+05	1.71	1.71
16	0.87	354.47	343.15	5.619D+05	1.76	1.76	6.616D+05	2.07	2.29	5.320D+05	1.66	1.72	5.521D+05	1.73	1.75
17	0.93	355.23	342.63	4.403D+05	1.77	1.79	5.710D+05	2.29	2.87	4.265D+05	1.71	1.79	4.364D+05	1.75	1.80
18	0.98	355.80	341.95	3.157D+05	1.78	0.0	4.688D+05	2.65	0.0	3.131D+05	1.77	0.0	3.158D+05	1.78	0.0
19	1.04	356.18	341.11	1.876D+05	1.80	0.0	3.465D+05	3.33	0.0	1.908D+05	1.83	0.0	1.894D+05	1.82	0.0
20	1.09	356.36	340.12	5.549D+04	1.83	0.0	1.736D+05	5.73	0.0	5.792D+04	1.91	0.0	5.656D+04	1.87	0.0

MINIMALWERTE

CORRELATION		SMMIN	X	POS			
EIGENE,ALT	:	1.7541	0.81845	15	1.7290	0.70933	13
EDLUND	:	1.5764	0.43651	8	1.4217	0.38195	7
WSC-2	:	1.5187	0.49107	9	1.4511	0.38195	7
EIGENE,NEU	:	1.6859	0.65476	12	1.6419	0.54564	10

OVERPOWER FACTOR : 1.1200

POS	X	T(X)	TW	EIGENE,ALT CHF	SM	SMLWR	EDLUND CHF	SM	SMLWR	WSC-2 CHF	SM	SMLWR	EIGENE,NEU CHF	SM	SMLWR
0	0.0	326.97	333.15	2.401D+06	2.23	2.15	1.794D+06	1.67	1.50	1.683D+06	1.57	1.47	2.077D+06	1.93	1.84
1	0.05	329.85	335.21	2.278D+06	2.13	2.04	1.717D+06	1.60	1.44	1.626D+06	1.52	1.42	1.987D+06	1.85	1.76
2	0.11	332.71	337.16	2.158D+06	2.03	1.95	1.643D+06	1.55	1.39	1.568D+06	1.48	1.38	1.898D+06	1.79	1.70
3	0.16	335.54	338.99	2.040D+06	1.95	1.87	1.572D+06	1.50	1.34	1.509D+06	1.44	1.35	1.808D+06	1.73	1.64
4	0.22	338.31	340.70	1.925D+06	1.88	1.80	1.502D+06	1.47	1.31	1.449D+06	1.41	1.33	1.719D+06	1.68	1.59
5	0.27	341.02	342.26	1.810D+06	1.82	1.74	1.434D+06	1.44	1.29	1.387D+06	1.39	1.31	1.630D+06	1.64	1.55
6	0.33	343.64	343.69	1.697D+06	1.76	1.69	1.368D+06	1.42	1.27	1.324D+06	1.38	1.30	1.540D+06	1.60	1.52
7	0.38	346.17	344.96	1.585D+06	1.72	1.65	1.301D+06	1.41	1.27	1.259D+06	1.36	1.30	1.450D+06	1.57	1.50
8	0.44	348.58	346.06	1.474D+06	1.68	1.61	1.235D+06	1.41	1.27	1.192D+06	1.36	1.30	1.358D+06	1.55	1.48
9	0.49	350.87	347.01	1.362D+06	1.65	1.59	1.169D+06	1.41	1.29	1.122D+06	1.36	1.30	1.265D+06	1.53	1.47
10	0.55	353.01	347.78	1.251D+06	1.62	1.57	1.103D+06	1.43	1.31	1.049D+06	1.36	1.31	1.171D+06	1.52	1.47
11	0.60	355.00	348.39	1.139D+06	1.60	1.55	1.036D+06	1.45	1.35	9.737D+05	1.37	1.33	1.074D+06	1.51	1.47
12	0.65	356.82	348.46	1.027D+06	1.58	1.55	9.668D+05	1.49	1.41	8.946D+05	1.38	1.36	9.758D+05	1.51	1.47
13	0.71	358.47	348.37	9.129D+05	1.57	1.54	8.959D+05	1.54	1.49	8.114D+05	1.40	1.39	8.748D+05	1.51	1.49
14	0.76	359.93	348.27	7.978D+05	1.57	1.55	8.221D+05	1.61	1.60	7.237D+05	1.42	1.43	7.708D+05	1.51	1.50
15	0.82	361.19	348.17	6.810D+05	1.57	1.56	7.445D+05	1.71	1.77	6.308D+05	1.45	1.47	6.634D+05	1.53	1.53
16	0.87	362.25	348.06	5.619D+05	1.57	1.57	6.616D+05	1.85	2.04	5.320D+05	1.49	1.53	5.521D+05	1.54	1.56
17	0.93	363.11	347.93	4.403D+05	1.58	1.60	5.710D+05	2.05	2.57	4.265D+05	1.53	1.60	4.364D+05	1.56	1.60
18	0.98	363.75	347.80	3.157D+05	1.59	0.0	4.688D+05	2.36	0.0	3.131D+05	1.58	0.0	3.158D+05	1.59	0.0
19	1.04	364.17	347.04	1.876D+05	1.61	0.0	3.465D+05	2.98	0.0	1.908D+05	1.64	0.0	1.894D+05	1.63	0.0
20	1.09	364.37	346.11	5.549D+04	1.64	0.0	1.736D+05	5.12	0.0	5.792D+04	1.71	0.0	5.656D+04	1.67	0.0

MINIMALWERTE

CORRELATION		SMMIN	X	POS			
EIGENE,ALT	:	1.5661	0.81845	15	1.5437	0.70933	13
EDLUND	:	1.4075	0.43651	8	1.2694	0.38195	7
WSC-2	:	1.3560	0.49107	9	1.2956	0.38195	7
EIGENE,NEU	:	1.5053	0.65476	12	1.4659	0.54564	10

6. Utility Programs

All main results of a run are appended to an existing data set, so that the results of many runs can be accumulated in this data pool. To retrieve and present these results some utility programs are necessary.

6.1 Creating the Data Pool

To create and initiate the data pool, the program INIT must be used as demonstrated in the following example:

```
//PROJECTL JOB (...,...,.....),....,TIME=(,30),MSGCLASS=A
// EXEC PGM=IEFBR14
//DD1 DD DSN=PROJECT.APWRH.DATA,DISP=(OLD,DELETE)
// EXEC PGM=INIT
//STEPLIB  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//FT08F001 DD DSN=PROJECT.APWRH.DATA,UNIT=DISK,VOL=SER=BAT00D,
// DCB=(LRECL=2996,RECFM=VBS,BLKSIZE=3000),
// DISP=(NEW,CATLG),SPACE=(CYL,(10,10))
```

6.2 Listing the Results

With the program LIST accumulated results may be listed in a sorted manner as shown in [1]. This program requests as input first the unit number assigned to the data pool, and then one or more group indicators in successive lines as shown and described.

```
//PROJECTL JOB (...,...,.....),....,TIME=(,30),MSGCLASS=A
//LIST EXEC PGM=LIST
//STEPLIB  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//FT05F001 DD *
8         EINGABEEINHEIT PROJECT.APWRS.DATA
2
3           DP-ITER.(1), HOMOGEN(2), HETEROGEN(3)
//FT06F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT08F001 DD DISP=SHR,DSN=PROJECT.APWRS.DATA
//FT09F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
```

6.3 Deleting Entries

With the program DELT the results of certain runs may be deleted from the data pool. To do this the original data set is copied to a new one by excluding the specified entries. As first input line the unit numbers of the input and output data sets are required. Then in consecutive lines as many entry numbers as desired may be marked for exclusion. As the numbers of the entries (the record number in the data set) are changed during deletion, it is useful to start with the greatest number going down to the lowest one. In the following example deleting is demonstrated.

```
//PROJECTD JOB (....,....,.....),....,TIME=(,30),MSGCLASS=A
//DELT EXEC PGM=DELT
//STEPLIB DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//FT05F001 DD *
8,18     EINGABEEINHEIT PROJECT.APWRD.DATA,AUSGABEEINHEIT
88
87
32
//FT06F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT08F001 DD DISP=SHR,DSN=PROJECT.APWRS.DATA
//FT09F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT18F001 DD DISP=SHR,DSN=PROJECT.APWRH.DATA
```

6.4 Listing a Specified Entry

With the program OUT1 one or more entries may be listed as they are present in the data pool. The first input to this program is again the unit number. Then one or more entry numbers may be specified in consecutive lines. The following example demonstrates the usage of OUT1:

```
//PROJECTD JOB (....,....,.....),....,TIME=(,30),MSGCLASS=A
//OUT1 EXEC PGM=OUT1
//STEPLIB DD DISP=SHR,DSN=TSO090.HADA.LOAD
//FT05F001 DD *
8         EINGABEEINHEIT PROJECT.APWRD.DATA,AUSGABEEINHEIT
31
75
//FT06F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT08F001 DD DISP=SHR,DSN=PROJECT.APWRD.DATA
//FT09F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT18F001 DD DISP=SHR,DSN=PROJECT.APWRH.DATA
```

6.5 Compressing the Data Pool

The program COMP is used to omit entries with the same input data. As DELT this program uses two different data sets for input and output, so that the original data set remains unaffected. The program requires as input only the unit numbers assigned to the data pools.

```
//PROFECTC JOB (....,........,.....),....,TIME=(,30),MSGCLASS=A
//COMP EXEC PGM=COMP
//STEPLIB  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//FT05F001 DD *
8,18      EINGABEEINHEIT PROJECT.APWRD.DATA,AUSGABEEINHEIT
//FT06F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT08F001 DD DISP=SHR,DSN=PROJECT.APWRS.DATA
//FT09F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT18F001 DD DISP=SHR,DSN=PROJECT.APWRH.DATA
```

6.6 Plotting the Results

With the program PLOT specified entries or group of entries may be selected as input for the plot routines. This program needs Calcomp/ Versatec plotter software and it is therefore restricted in usage. The following example shows the different commands and their meaning. The presented input stream was used to plot the figures in [1].

```
//PROJECTP JOB (....,........,.....),....,TIME=(,30),MSGCLASS=A
//*MAIN LINES=50
//PLOT EXEC PGM=PLOT
//STEPLIB  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//PLOTWK01 DD UNIT=SYSSQ,SPACE=(CYL,(10,5))
//PLOTWK02 DD UNIT=SYSSQ,SPACE=(CYL,(10,5))
//VECTR1   DD UNIT=SYSSQ,SPACE=(CYL,(10,5)),DISP=(MOD,PASS),
//            DSN=&&VECTR1
//VECTR2   DD UNIT=SYSSQ,SPACE=(CYL,(10,5)),DISP=(MOD,PASS),
//            DSN=&&VECTR2
//PLOTLOG  DD SYSOUT=*
//COMM     DD SYSOUT=*
```

```
//FT01F001 DD *
KOM
KOM
KOM                BESCHREIBUNG DER EINGABEDATEN
KOM
KOM  INI PLOTTERNUMMER,XMAX,YMAX,PLOTFAKTOR
KOM      0,1,2,3,4,... 0 = DUMMY-PLOT
KOM                    1 = BILDSCHIRM GA
KOM                    2 = BILDSCHIRM T4015
KOM                    3 = SPEICHERBILDSCHIRM KSG
KOM                    4 = CALCOMP,STATOS,XYNETICS,VERSATEC
KOM                   >4 = PLOTAUSGABE ERFOLGT UEBER EINHEIT 9
KOM      XMAX              ZEICHNUNGSLAENGE IN CM (FUER FAKTOR 1)
KOM      YMAX              ZEICHNUNGSHOEHE  IN CM (FUER FAKTOR 1)
KOM      PLOTFAKTOR    1   PLOTTEREINHEIT = 1CM
KOM                   <1   VERKLEINERUNG
KOM                   >1   VERGROESSERUNG
KOM
KOM
KOM  NPL
KOM
KOM
KOM  GRP INDEX,TEXT1,TEXT2
KOM      INDEX             GRUPPENINDEX
KOM                      1 HOMOGENE REAKTOREN
KOM                      2 HETEROGENE REAKTOREN
KOM                      3 1 UND 2
KOM
KOM
KOM  FIG NUMMER,TEXT1,TEXT2
KOM      NUMMER            ABBILDUNGSNUMMER
KOM
KOM
KOM  PAR NPAR,NAME=,EINHEIT,UMRECHNUNGSFAKTOR DARSTELLUNG/INTERN
KOM      NPAR              INDEX DES PARAMETERWERTS
KOM
KOM
KOM  XAX TEXT ,EINHEIT,UMRECHNUNGSFAKTOR,STARTWERT,ENDWERT,ACHSENLAENGE
KOM      BEISPIEL      1.E2 CM/M  WERT IN M WIRD IN CM DARGESTELLT.
KOM                DIE ACHSE BEGINNT BEI 0.7 CM
KOM                                 UND ENDET BEI 1.2 CM.
KOM                       DIE GEZEICHNETE ACHSENLAENGE IST 10 CM.
KOM
KOM
KOM  YAX TEXT ,EINHEIT,UMRECHNUNGSFAKTOR,STARTWERT,ENDWERT,ACHSENLAENGE
KOM
KOM
KOM  TXT X-KOORD.,Y-KOORD.,HOEHE,TEXT,WINKEL
KOM
KOM
KOM  PLT TYP,OPTION,NX,NY
KOM      TYP :     DPI        DP-ITERATION
KOM                HOM        HOMOGENER KERN
KOM                HET        HETEROGENER KERN
KOM      OPTION :  POW        KONSTANTE PUMPLEISUNG
KOM                CHR        KONSTANTE PUMPENCHARAKTERISTIK
KOM                NX         INDEX DES ABSZISSENWERTES
KOM                NY         INDEX DES ORDINATENWERTES
KOM
```

```
KOM
KOM  SYM TYP,OPTION,NX,NY,NSYM
KOM
KOM
KOM  ADI NN,NN WERTEPAARE IN INTERNEN EINHEITEN
KOM
KOM
KOM  ADD NN,NN WERTEPAARE IN DARSTELLUNGSEINHEITEN
KOM
KOM
KOM  ADZ NN,NN WERTEPAARE IN PLOTTEREINHEITEN
KOM
KOM
KOM  MIT FIG WIRD EIN EINZELPLOT EROEFFNET, DIESES KOMMANDO
KOM  MUSS DESHALB STETS ALS ERSTES ERSCHEINEN.
KOM  DIE KOMMANDOS PAR,XAX,YAX KOENNEN IN BELIEBIGER REIHEN-
KOM  FOLGE ANGESCHLOSSEN WERDEN, FEHLT DAS KOMMANDO PAR, SO
KOM  WERDEN ALLE DATEN FUER DIE AUSGEWAEHLTE DATENGRUPPE DAR-
KOM  GESTELLT (ALS EINE KURVE).
KOM  DIE GRUPPE PLT,ADI,ADD,ADZ,SYM SCHLIESST IN BELIEBIGER
KOM  REIHENFOLGE DIE KOMMANDOSEQUENZ AB. DAMIT EIN SINNVOLLER
KOM  PLOT ERSTELLT WERDEN KANN, MUSS MINDESTENS EINES DAVON
KOM  VORHANDEN SEIN.
KOM
KOM  EIN NEUES EINZELBILD KANN DURCH FIG ODER DURCH INI
KOM  EROEFFNET WERDEN, WOBEI INI NUR DANN ANZUGEBEN IST, WENN
KOM  DIE GRUNDPARAMETER GEAENDERT WERDEN SOLLEN.
KOM
KOM     DARSTELLUNG DER ERGEBNISSE
KOM
KOM
KOM     1. BILD QELNET VS. D MIT P ALS PARAMETER
KOM
KOM
PRT
GRP 1,HOMOGENEOUS CORE,CONSTANT PUMP CHARACTERISTICS
PAR 15, P=,CM,1.E2
XAX ROD DIAMETER D,CM,1.E2,0.7,1.2,10.
YAX NET PLANT ELECTRICAL POWER QELNET,MW,1.E-6,800.,1300.,10.
PLT HOM,CHR,16,42
NPL
YAX DNB RATIO,-,1.,1.2,1.7,10.
PLT HOM,CHR,16,101
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1,0.
ADD 4,0.7,1.301,1.2,1.301,1.2,1.299,0.7,1.299
NPL
YAX DNB RATIO WITH CONTROL ROD,-,1.,1.2,1.7,10.
PLT HOM,CHR,16,104
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1,0.
ADD 4,0.7,1.301,1.2,1.301,1.2,1.299,0.7,1.299
NPL
YAX DNB RATIO,-,1.,1.1,1.6,10.
PLT HOM,CHR,16,127
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1.12,0.
ADD 4,0.7,1.301,1.2,1.301,1.2,1.299,0.7,1.299
```

```
NPL
YAX DNB RATIO WITH CONTROL ROD,-,1.,1.1,1.6,10.
PLT HOM,CHR,16,130
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1.12,0.
ADD 4,0.7,1.301,1.2,1.301,1.2,1.299,0.7,1.299
NPL
YAX INLET TEMPERATURE T1,GRD C,1.,260.,310.,10.
PLT HOM,CHR,16,38
NPL
YAX OUTLET TEMPERATURE T2,GRD C,1.,316.,326.,10.
PLT HOM,CHR,16,39
NPL
YAX MASS FLOW RATE M,KG/S,1.,10000.,20000.,10.
PLT HOM,CHR,16,40
NPL
YAX PUMPING POWER NP,MW,1.E-6,15.,20.,10.
PLT HOM,CHR,16,41
NPL
YAX WATER TO FUEL ROD VOLUME RATIO VM/VF,-,1.,0.,1.,10.
PLT HOM,CHR,16,29
NPL
YAX CORE FRICTION PRESSURE DROP DP,BAR,1.,0.,10.,10.
PLT HOM,CHR,16,50
NPL
YAX ROD LINEAR POWER QL,W/CM,1.E-2,100.,200.,10.
PLT HOM,CHR,16,26
NPL
YAX CORE POWER DENSITY QV,W/CM**3,1.E-6,100.,300.,10.
PLT HOM,CHR,16,27
NPL
YAX VELOCITY U,M/S,1.,5.,10.,10.
PLT HOM,CHR,16,47
NPL
YAX POSITION OF INCIPIENT LOCAL BOILING,CM,1.E2,0.,200.,10.
PLT HOM,CHR,16,107
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1,0.
NPL
YAX POSITION OF INCIPIENT LOCAL BOILING,CM,1.E2,0.,100.,10.
PLT HOM,CHR,16,133
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1.12,0.
NPL
YAX CORE HEIGHT LC,CM,1.E2,120.,320.,10.
PLT HOM,CHR,16,44
GRP 2,HETEROGENEOUS CORE,CONSTANT PUMP CHARACTERISTICS
PAR 48, DS=,CM,1.E2
XAX SEED POWER DENSITY QVS,W/CM**3,1.E-6,100.,300.,10.
YAX NET PLANT ELECTRICAL POWER QELNET,MW,1.E-6,800.,1300.,10.
PLT HET,CHR,19,41
NPL
YAX DNB RATIO SEED,-,1.,1.5,2.0,10.
PLT HET,CHR,19,116
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1,0.
NPL
YAX DNB RATIO SEED  WITH CONTROL ROD,-,1.,1.5,2.0,10.
PLT HET,CHR,19,119
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1,0.
```

```
NPL
YAX DNB RATIO SEED,-,1.,1.3,1.8,10.
PLT HET,CHR,19,142
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1.12,0.
NPL
YAX DNB RATIO SEED  WITH CONTROL ROD,-,1.,1.3,1.8,10.
PLT HET,CHR,19,145
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1.12,0.
NPL
YAX DNB RATIO BLANKET,-,1.,1.3,1.8,10.
PLT HET,CHR,19,198
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1,0.
NPL
YAX DNB RATIO BLANKET WITH CONTROL ROD,-,1.,1.3,1.8,10.
PLT HET,CHR,19,201
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1,0.
NPL
YAX DNB RATIO BLANKET,-,1.,1.1,1.6,10.
PLT HET,CHR,19,224
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1.12,0.
ADD 4,100.,1.301,300.,1.301,300.,1.299,100.,1.299
NPL
YAX DNB RATIO BLANKET WITH CONTROL ROD,-,1.,1.1,1.6,10.
PLT HET,CHR,19,227
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1.12,0.
ADD 4,100.,1.301,300.,1.301,300.,1.299,100.,1.299
NPL
YAX INLET TEMPERATURE T1,GRD C,1.,260.,310.,10.
PLT HET,CHR,19,37
NPL
YAX OUTLET TEMPERATURE T2,GRD C,1.,316.,326.,10.
PLT HET,CHR,19,38
NPL
YAX MASS FLOW RATE M,KG/S,1.,10000.,20000.,10.
PLT HET,CHR,19,39
NPL
YAX PUMPING POWER NP,MW,1.E-6,15.,20.,10.
PLT HET,CHR,19,40
NPL
YAX WATER TO FUEL ROD VOLUME RATIO VM/VF,-,1.,0.,1.5,10.
PLT HET,CHR,19,65
NPL
YAX CORE FRICTION PRESSURE DROP DP,BAR,1.,0.,10.,10.
PLT HET,CHR,19,63
NPL
YAX POSITION OF INCIPIENT LOCAL BOILING SEED,CM,1.E2,0.,200.,10.
PLT HET,CHR,19,122
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1,0.
NPL
YAX POSITION OF INCIPIENT LOCAL BOILING SEED,CM,1.E2,0.,100.,10.
PLT HET,CHR,19,148
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1.12,0.
NPL
YAX POSITION OF INCIPIENT LOCAL BOILING BLANKET,CM,1.E2,0.,200.,10.
PLT HET,CHR,19,204,10
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1,0.
```

```
NPL
YAX POSITION OF INCIPIENT LOCAL BOILING BLANKET,CM,1.E2,0.,100.,10.
PLT HET,CHR,19,230
TXT 8.,-2.5,.21,OVERPOWER FACTOR 1.12,0.
NPL
YAX CORE HEIGHT LC,CM,1.E2,100.,500.,10.
PLT HET,CHR,19,43
NPL
YAX PITCH BLANKET PB,CM,1.E2,.8,1.8,10.
PLT HET,CHR,19,55
NPL
YAX PITCH SEED PS,CM,1.E2,.6,1.6,10.
PLT HET,CHR,19,46
NPL
YAX ROD DIAMETER BALNKET DB,CM,1.E2,.8,1.8,10.
PLT HET,CHR,19,57
NPL
YAX PITCH TO DIAMETER RATIO SEED PS/DS,-,1.,1.,1.5,10.
PLT HET,CHR,19,49
NPL
YAX PITCH TO DIAMETER RATIO BLANKET PB/DB,-,1.,.9,1.4,10.
PLT HET,CHR,19,58
NPL
YAX ROD LINEAR POWER SEED QLS,W/CM,1.E-2,150.,250.,10.
PLT HET,CHR,19,28
NPL
YAX ROD LINEAR POWER BLANKET QLB,W/CM,1.E-2,100.,200.,10.
PLT HET,CHR,19,54
NPL
YAX VELOCITY BLANKET UB,M/S,1.,5.,10.,10.
PLT HET,CHR,19,60
NPL
YAX VELOCITY SEED US,M/S,1.,6.,8.5,10.
PLT HET,CHR,19,51
GRP 3
PAR
XAX NET PLANT ELECTRICAL POWER QELNET,MW,1.E-6,800.,1300.,10.
YAX WATER TO FUEL ROD VOLUME RATIO VM/VF,-,1.,0.,1.,10.
PLS HOM,CHR,42,29,2
PLS HET,CHR,41,65,10
SYM 8.,2.,.21,2,0.
TXT 8.5,1.9,.21,HOM.,0.
SYM 8.,1.5,.21,10,0.
TXT 8.5,1.4,.21,HET.,0.
//FT05F001 DD *
8,1,0
//FT06F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT08F001 DD DISP=SHR,DSN=PROJECT.APWRS.DATA
//FT09F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT20F001 DD DISP=(,DELETE),UNIT=SYSSQ,SPACE=(1,1),
//          DCB=(RECFM=FB,LRECL=80,BLKSIZE=3120)
//PLOTPARM DD *
 &PLOT XMAX=300. &END
//VERS EXEC SVPLOT
```

6.7 Listing the Contents

With the program SHOW selected Variables of a specified entry may be listed. The following example demonstrates the usage:

```
//PROJECTS JOB (....,....,.....),....,TIME=(,30),MSGCLASS=A
//SHOW EXEC PGM=SHOW
//STEPLIB DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//FT05F001 DD *
8        EINGABEEINHEIT PROJECT.APWRS.DATA
48       REAKTORNUMMER
XF 149,230
//FT06F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
//FT08F001 DD DISP=SHR,DSN=PROJECT.APWRS.DATA
//FT09F001 DD SYSOUT=*,DCB=(RECFM=FBA,LRECL=133,BLKSIZE=3857)
```

7. Installing the Programs

All programs, subroutines, and functions are copied to the tape each in a separate file. The following shows how the program library HADA.LOAD is to be generated.

```
//PROJECTG JOB (....,....,.....),....,TIME=1,MSGCLASS=N
//*MAIN LINES=20
//*****************************************************************
//INPUTO EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(INPUTO)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(INPUT1)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(INPUT2)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS INPUT1,INPUT2
 NAME INPUTO(R)
//*****************************************************************
//COMPRS EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(COMPRS)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 NAME COMPRS(R)
//*****************************************************************
//IVGL EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(IVGL)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 NAME IVGL(R)
//*****************************************************************
//OUTPUT EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(OUTPUT)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 NAME OUTPUT(R)
```

```
//******************************************************************
//DELETE EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(DELETE)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 NAME DELETE(R)
//******************************************************************
//OUTLST EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(OUTLST)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 NAME OUTLST(R)
//******************************************************************
//OUTHOM EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(OUTHOM)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(OUTHET)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS OUTHET
 NAME OUTHOM(R)
//******************************************************************
//OUTLIN EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(OUTLIN)
//L.SYSPRINT DD SYSOUT=H
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSIN    DD *
 NAME OUTLIN(R)
//******************************************************************
//OUTPLT EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(OUTPLT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(BILDER)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(KOMGET)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(EXINT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(EXTXT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(EXREL)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(EXTRC)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS BILDER,STORE,STORP,ZEICHN,KOMGET,EXINT,EXTXT,EXREL,EXTRC
 NAME OUTPLT(R)
```

```
//*****************************************************************
//XACHSE EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(XACHSE)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(ENCODE)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(IENT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(PLTEXT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(LAENGE)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(YACHSE)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS YACHSE,ENCODE,IENT,PLTEXT,LAENGE
 NAME XACHSE(R)
//*****************************************************************
//PLTIN EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(PLTIN)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS PLTOF,NULLP
 NAME PLTIN(R)
//*****************************************************************
//OUTSHW EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(OUTSHW)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(GETIND)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(IGET)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(GET2)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS GETIND,IGET,GET2
 NAME OUTSHW(R)
//CHFCLC EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(CHFCLC)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SHIP)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(EDLD)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(WSC2)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(DDCR)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(VKNEW)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(VKOLD)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS SHIP,EDLD,WSC2,DDCR,VKNEW,VKOLD
 NAME CHFCLC(R)
```

```
//GAUSS EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(GAUSS)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(ELIMS)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SOLVS)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(GAUS0)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(GAUS1)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(GAUS2)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(ELIMN)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SOLVN)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SETLIN)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SETIT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(DMPMAT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(XNEU)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SETMAT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SETVEK)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(MAT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(VEK)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SORT)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(TAUS)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(EXCH)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SMAX)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(IMAX)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS ELIMS,SOLVS,GAUS0,GAUS1,ELIMN,SOLVN,SETLIN,SETIT,DMPMAT,XNEU,   *
               SETMAT,SETVEK,MAT,VEK,SORT,TAUS,EXCH,SMAX,IMAX
 NAME GAUSS(R)
//*****************************************************************
//EFPW EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(EFPW)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(EFPD)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(EFS)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(PSI0)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(PSI)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(Q)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(B)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(FI)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(PR)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(HR)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(HS)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(PS)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(ARG1)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SUCHEN)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(PINV)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(RP)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(SUMME)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(FE)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(FL)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(FC)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS EFPD,EFS,PSI0,PSI,Q,B,FI,PR,HR,HS,PS,ARG1,SUCHEN,PINV,RP,SUMME, *
               FE,FL,FC
 NAME EFPW(R)
```

```
//*****************************************************************
//DRUCK EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(DRUCK)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(STOR8)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(OUTREC)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS OUTREC,STOR8
 NAME DRUCK(R)
//F EXEC F7CL,PARM.L='NCAL'
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(F)
//           DD DISP=SHR,DSN=PROJECT.HADA.DATA(DF)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ALIAS DF
 NAME F(R)
//*****************************************************************
//**
//**                                      COMP
//**                                       |
//**                      +---------------+--------+
//**                      |               |        |
//**                    INPUTO         COMPRS   OUTPUT
//**                      |               |
//**                  +--------+         IVGL
//**                  |        |
//**                INPUT1   INPUT2
//**
//COMP EXEC F7CL
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(COMP)
//L.SYSLIB   DD
//           DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ENTRY MAIN
 NAME COMP(R)
```

```
//*******************************************************************
//**
//**                                        DELT
//**                                         |
//**                      +--------------+--------+
//**                      |              |        |
//**                    INPUT0        DELETE   OUTPUT
//**                      |              |
//**                  +--------+        IVGL
//**                  |        |
//**               INPUT1   INPUT2
//**
//DELT EXEC F7CL
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(DELT)
//L.SYSLIB   DD
//           DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ENTRY MAIN
 NAME DELT(R)
//*******************************************************************
//**
//**                                        INIT
//**
//INIT EXEC F7CL
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(INIT)
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ENTRY MAIN
 NAME INIT(R)
//*******************************************************************
//**
//**                                        LIST
//**                                         |
//**                    +----------------+--------+
//**                    |                |        |
//**                  INPUT0          OUTLST   DATUM
//**                    |                |
//**                +--------+       +--------+
//**                |        |       |        |
//**             INPUT1   INPUT2   OUTHOM   OUTHET
//**
//LIST EXEC F7CL
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(LIST)
//L.SYSLIB   DD
//           DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ENTRY MAIN
 NAME LIST(R)
```

```
//*****************************************************************
//**
//**                                     OUT1
//**                                      |
//**                             +----------------+
//**                             |                |
//**                           INPUT0           OUTLIN
//**                             |
//**                         +--------+
//**                         |       |
//**                       INPUT1  INPUT2
//**
//OUT1 EXEC F7CL
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(OUT1)
//L.SYSLIB   DD
//           DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ENTRY MAIN
 NAME OUT1(R)
//*****************************************************************
//**
//**                                     PLOT
//**                                      |
//**           +----------------------+-------------------+--------+
//**           |                      |         |         |        |
//**         INPUT0                 OUTPLT    ZEICHN    BILDER   DATUM
//**           |                      |                   |
//**       +--------+       +------+------+-------+       |
//**       |        |       |      |      |       |       |
//**     INPUT1  INPUT2   STORP  STORE  OUTHOM  OUTHET    |
//**                                                      |
//**           +-------------+-------+------+-------+-----+-------+
//**           |             |       |      |       |     |       |
//**         XACHSE        YACHSE  PLTIN  KOMGET PLTEXT  NULLP  PLTOF
//**           |             |       |      |
//**       +-------+-------+ |     DATUM    |
//**       |       |       | |              |
//**  ENCODE  PLTEXT  LAENGE |           +------+------+
//**    |                    |           |      |      |
//**  IENT           +-------+-------+ EXINT  EXTXT  EXREL
//**                 |       |       |
//**               ENCODE  PLTEXT  LAENGE
//**                 |
//**               IENT
//**
//PLOT EXEC F7CL
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(PLOT)
//L.SYSLIB   DD
//           DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ENTRY MAIN
 NAME PLOT(R)
```

```
//*******************************************************************
//**
//**                                      SHOW
//**                                        |
//**           +----------------------+---------+
//**           |                      |         |
//**         INPUT0                 OUTSHW     DATUM
//**           |                      |
//**       +--------+              +--------+
//**       |        |              |        |
//**     INPUT1   INPUT2         GETIND   LAENGE
//**                               |
//**                            +------+
//**                            |      |
//**                          GET2   IGET
//**
//SHOW EXEC F7CL
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(SHOW)
//L.SYSLIB   DD
//           DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ENTRY MAIN
 NAME SHOW(R)
//*******************************************************************
//**
//HADA EXEC F7CL
//C.SYSPRINT DD SYSOUT=N
//C.SYSIN    DD DISP=SHR,DSN=PROJECT.HADA.DATA(HADA)
//L.SYSLIB   DD
//           DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSLMOD  DD DISP=SHR,DSN=PROJECT.HADA.LOAD
//L.SYSPRINT DD SYSOUT=H
//L.SYSIN    DD *
 ENTRY MAIN
 NAME HADA(R)
```

8. Literature

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