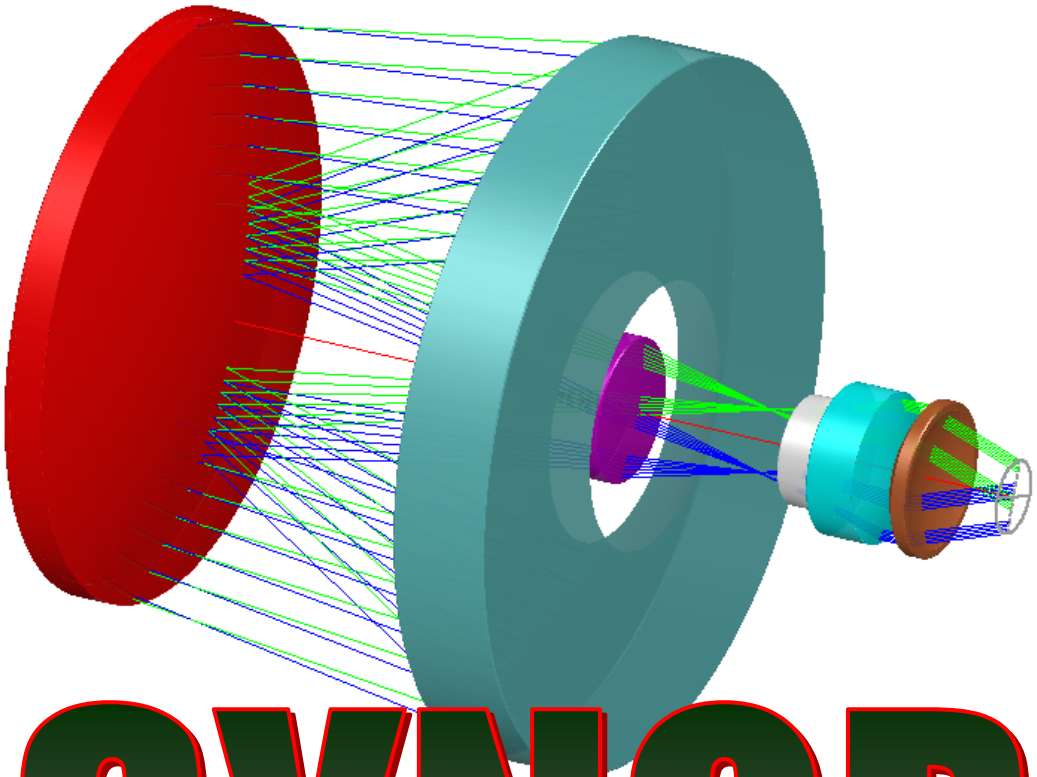


SYNOPSYS™

Syntax Summary

Optical Systems Design, Inc.

SYNOPSYS™ Input General Formats

The following pages contain a summary of the input syntax for SYNOPSYS, for reference by experienced users. For the sake of brevity, this summary does not contain explanations of the input other than the mnemonics describing input quantities.

All of the principal mnemonics may be found in the list below.

Syntax name	**Physical quantity**	**Legend**	**Example**
SN	A surface number	Capital letters: input the first three characters	DWG
NB	A number defined by a previous mnemonic	Underlined capitals: replace with numbers	TSCF
HBAR	Fractional Y-object height	Underlined lower-case: replace with letters	filename
GBAR	Fractional X-object height	Square brackets: optional input	[JSSS]
XEN	Fractional X-pupil coordinate		
YEN	Fractional Y-pupil coordinate	Curly brackets: pick one	{ NEAR / FAR }
NRYS	Number of rays in pupil		
ICOL	Color number		
JSSS	Starting surface number		
JSPS	Stopping surface number	Slash mark (/): indicates separate lines	GTB S / BK7
SCF	Scale factor: one inch on plots will be this number		
TSCF	Times scale factor, as in 5X scale		

Example general format: DWG [TSCF [JSSS JSPS [HBAR NB NB NB] [OFFSET XOS YOS]]]

Typical user input:

```
DWG             ; comment here
DWG .5
DWG .5 1 7
DWG .5 1 7 HBAR 0 –1 1
DWG 0 1 99 OFFSET .5 -2
```

Mode-Control Switches

Changing settings:
ON NB NB NB …
OFF NB NB NB …

Default settings:
1 2 4 5 7 8 10 27 28 29 32 35 41 42 45 54 62 67 are ON

Commands:
SSW
MSS

Switch Number	Function when turned ON	Switch Number	Function when turned ON
1	Bounded variables dropped for remainder of run	46	No color fill on PAD drawings
2	PSD III optimization algorithm used (with ON 8)	47	Surface trace from PGHOST
3	Iterate damping each pass (with OFF 2 8)	48	PAD layout applies to all ACONs
4	Suppress listing of aberrations each pass (with OFF 29)	49	GHOST, BGI add estimated diffraction blur radius to ghost size
5	Suppress listing of change vector each pass (with OFF 29)	50	IMAGE features print OPD array, spot diagram data, pupil mask
6	Prints evaluation of aberration array (with OFF 29)	51	DIFF prints table of image samples
7	Recalculates derivative increment each pass	52	Suppress circled surface numbers on PAD drawings
8	PSD algorithm used	53	AI parsing dump
9	Prints derivative matrix, L matrix each pass (with OFF 29)	54	Display all error messages in the Command Window
10	PAD / D draw from 3 HBARs	55	DMODEL, PSPRD use RAD/4 samples spacing instead of RAD/2
11	Output summary of indices from glass table glasses	56	Menu mode is on
12	Nonsequential ray loop is 1000 times instead of 200	57	Birefringent image analysys cycles through all modes
13	Misc. listings: DEF input, fit error; HOE errors with HP1, etc.	58	SAVE will prompt for text line to save with lens; printed with FETCH
14	MC correlates wedge orientation of adjacent elements	59	Scale FANS plot axes with pupil size
15	List model samples for DETECTOR	60	SOLID uses continuous greyscale, rather than stippled
16	List vignetted rays in TRACE, IMAGE	61	Test auto-store into location 10 for better merit function first
17	List image samples in DMODEL, PSPRD	62	Move bounded variables into valid region before first pass
18	Rims not drawn on lens elements in PER	63	Default DWG shows image regardless of size of BACK
19	Zero coefficient 5 in DIFF	64	BTOL derivative dump
20	Dummy surfaces w/o CAOs not shown by DWG, PER, RPER, SOLID	65	DWG, ZDWG, PAD/D show nominal pupil; otherwise reduce it for no vignetting
21	Surface numbers of vignetted rays shown on footprint, PAD	66	OPDs taken at next-to-last surface, not projected to infinity
22	Lists PARTC object spectrum	67	Double-sided derivatives used in optimization
23	Echoes change lines from PAD | Worksheet, Wizards	68	Aspherics output with Atn format for greater precision
24	Default UNIT is MM instead of INCHES	69	PAD rayfans have 20 rays instead of 10
25	OPDs are set to zero for image analysis of perfect system	70	ADD PLOT shows solid lines instead of dashed
26	GFIT results printed; also CONTOUR plots numbers, not lines	71	BTOL gives shorter printout
27	Spots drawn as dots without symbols	72	QUIET mode (printout discarded until LOUD command)
28	Use PCAO option if real rays cannot trace to determine apertures	73	SOLID uses finer samples.
29	Suppresses most optimization printout	74	SPEC and PRT do not show surface flags, such as “P” and “S”
30	Optimize with variable-metric option (with OFF 2 8)	75	Graphics windows use vector fonts instead of raster fonts
31	Print current metric each pass (with OFF 29)	76	Compensate for faulty printer drivers that draw text upside-down
32	Force first pass to complete, even if no improvement	77	QUIET mode affects monitor only; PON file sees all output
33	Suppress vignetting message from FANS, RPT, RFT, etc.	78	GTB glasses shown on the GlassMap with current N, V, not CDF
34	Strip annotation from plots before displaying	79	Do not display urgent error messages box
35	Color plots from RPT, RPO, RFT, RFO, TFS, SPT, PSPRD, PARTC	80	Do not draw Airy disk circle on geometric spot diagrams
36	DIFF gives local energy instead of knife-edge trace	81	Draw bitmaps in Graphics Window rotated by 90 degrees
37	Force sequential raytracing, even for nonsequential systems	82	Use calculated d2f/dx2 on first iteration
38	PAD shows circled surface numbers on all surfaces (see 52)	83	Adjust automatic raygrid aberrations according to color weights in lens
39	EFILE will be shown on PER, DWG, ELD, PAD, RPER, SOLID	84	Use linear interpolation for wavefront for MTF calculations
40	TOSP ray listing	85	Geometric image analysis approximates visual colors
41	No knife-edge printout from DIFF	86	Automatically run the annealing program if the first pass fails
42	Automatically store changed lenses in library location 10	87	Draw light grid lines on the MTF family of plots
43	Print testplate list when TPM is called	88	Draw entering rays on perspective family drawings starting at surface 1
44	XSYS diagnostic dump	89	Show starting and ending values of all aberrations
45	AI substitutes symbols in all columns	90	

Input file structure: { **RLE** / **CHG** } **/ … data … / END**

Lens data editors: **LE, SPS, SYS, WS, MPW, MEW, MSW**

Required system data:

[ID/ID1/…/ID5] [up to 33 characters of identification]

OBA TH0 YP0 YMP1 [YP1 XP0 XP1 XMP1]
OBF TH0 YP0 YMP1 [YP1 XP0 XP1 XMP1]
OBB UMP0 UPP0 YMP1 [YP1 UXP0 XP1 XMP1]
OBC TH0 YANG YMP1 [YP1 XANG XP1 XMP1]
OBD TH0 UPP0 YMP1 [0 UXP0 0 XMP1]
OBG WAIST [RBS [WAISTx [RBSx] [M2]]]
OBL TH0 YP0 ANGLE
OBI TH0 YP0 ANGLE XS YS NX NY
OBJECT FINITE TH0 YP0 [XP0]
OBJECT INFINITE UPP0 [VPP0]
REFERENCE HEIGHT YMP1 [YP1 XMP1 XP1]
REFERENCE ANGLE UMP0 [YP1 VMP0 XP1]
[OSNA NA]

Special surface options:

INTERSECTION { NEAR / FAR / AUTO }

[TAG / RVT]
[SIN / SOUT]
MXSF
NAS
SPH
NDEF
ADD NB
NORAY

REAL
DUMMY
DRAW
NODRAW
EDGE
NOEDGE
RAYS
SID 'label'

SURFACE { NEAR / FAR }

[NO]LOOSE
[NO]CAPTURE
ILOOSE
INLOOSE
[N]RECTIFY
[NO]MBOUNCE

DPROP [D/G/A]

VFIELD NHBAR
HBAR VYP VYN VIGX
…
(up to nine field points)

Optional system data:

APS SN

WAP { 1 / 2 / 3 }
VIG
NOVIG
FOCAL
AFOCAL
ACCOM DIOPT
FFIELD
NFFIELD
BTH NB
ADD NB
CFOV
RFOV
LRAYS
RRAYS

NCAP
CAP
PCAO
RCAO

FIX
SEQUENTIAL
NOSEQUENTIAL
ICR XEN YEN
GAUSSIAN RBS
CORDER P L S …
CSTOP [REAL X Y]
UNITS { INCH / MM / CM / M }

MODE XMODE YMODE

LHAND
RHAND
FNAME 'name'
NCOP
NTOP
NIOP
NSOLVE

XPXT	VACUUM
YPXT	AIR
NPXT	PRESSURE P
PXT	GLOBAL
	RELATIVE
FILLSTOP	GTS
NOFILL	GTZ
NOP	SYMM
CFIX	CPUPIL
CFREE	EPUPIL
	RPUPIL

PRESSURE P
TEMPERATURE T
APERFECT EFL
ALPHA { **name** / COEFFICIENT }
(see page 21 for name)
PRRULES / CRRULES

Prism options:

SN PRISM { AMICI / RANGLE / PORRO / PENTA / SCHMIDT / PECHAN / DOVE / PROOF / MROOF / ABBE / DPORRO } WIDTH

SN NPRISM

WAVL L1 L2 L3
WAVL L1 L2 L3 L4 L5
WA1 L1 [L2 L3 L4 L5]
WA2 L6 [L7 L8 L9 L10]
WT1 W1 [W2 W3 W4 W5]
WT2 W6 [W7 W8 W9 W10]
WAVL { CDF / GHI }

Surface Data Input: Curvatures

Curvature options:
Format: **SN option**
Where **option** is one of the following:

NULL
SPH
RD NB
RAD NB
CV NB

NCOP
PCV NB [M [B]]

UMC NB
UPC NB
YMC NB
YPC NB
VMC NB
VPC NB
XMC NB
XPC NB

AMY
APY
CCY
IMY NB
IPY NB
AMX
APX
CCX
IMX NB
IPX NB

NDEF
DC1 G1 G3 G6 G10 G16
DC2 G2 G4 G5 G7 G8 G9
DC3 G11 G12 G13 G14 G15 G17

AT1 G1 G2 G3 G4
AT2 G5 G6 G7 G8
AT3 G9 G10 G11 G12
AT4 G13 G14 G15 G16 G17

GRATING {X / Y} L/MM ORDER

CC NB
B NB
A NB

TORIC RX
ASTORIC RX
BICONIC KX KY
NCZONE COSPHI
BRD B A C
FRESNEL
USSHAPE TYPE

Curvature input files:

SN HOE
HIN INDEX MODULATION
HTH THICK
CWAV WAVELENGTH
P1 X1 Y1 Z1 PHASE1 [INDEX1]
P2 X2 Y2 Z2 PHASE2 [INDEX2]

A11 G1 G3 G6 G10 G16
A12 G2 G4 G5 G7 G8 G9
A13 G11 G12 G13 G14 G15

A21 G1 G3 G6 G10 G16
A22 G2 G4 G5 G7 G8 G9
A23 G11 G12 G13 G14 G15

Z11 Z1 Z2 Z3 Z4 Z5 Z6
Z12 Z7 Z8 Z9 Z10 Z11 Z12
Z13 Z13 Z14 Z15 Z16 Z17
Z14 Z18 Z19 Z20 Z21 Z22 Z23
Z15 Z24 Z25 Z26 Z27 Z28 Z29
Z16 Z30 Z31 Z32 Z33 Z34
Z17 Z35 Z36

Z21 …
Z22 …
…
Z27 …

[GA1]
[GA2]

ORDER N

SN SPLINE NPTS [LINEAR]
Y Z
Y Z
…
YN ZN

SN ZERNIKE [AP [XOS YOS]]
ZERNIKE NB COEFF
ZERNIKE …
…

SN DOE CWAVE HIN
[A11 …]
[Z11 …]
[WOPD / WLENS]
[RNORM RNORM]

[S0
S1 value
S2 value
S3 value
…
S21 value]

[XDD 1 XD1 XD2 … XD5
…
XDD 7 XD29 XD30 … XD33]

Surface Data Input: Thickness, Index, Apertures

Thickness options:

SN TH NB
SN PTH NB [M B]

SN YMT NB
SN YPT NB
SN XMT NB
SN XPT NB

SN NTOP

Index options:

SN { N1 . . . N10 } NB

SN INDEX N2
SN GLM Nd Vd
SN GID / type
SN MELT Nd Vd

SN GTB { S O H C F U G R } / type

SN **{** AIR / VACUUM **}**
SN NIOP
SN PIN NB

SN BIREF PHI CHI PSI [SPECIAL]
name

[N1 N2 N3 [N4 N5]] (ordinary)
[N1 N2 N3 [N4 N5]] (extraordinary)

SN { ORDINARY / EXTRAORDINARY }

SN GRIN { RADIAL AXIAL URN SPHERICAL SELFOC LUNEBERG MAXWELL USR } DT { N2 / N1 N2 N3 }

GC1 ICOL C1 C2 C3 C4
GC2 ICOL C5 C6 C7 C8

SN GRIN LP DT LPI LPF LPT

SN WPLATE TH RETARD

{CRQUARTZ / CALCITE }

SN GFIT NWAVL [D]
WAV1 INDEX1
WAV2 INDEX2
WAV3 INDEX3
…
WAVn INDEXn

SN GDF
A1 A2 A3
A4 A5 A6

SN GLASS / (6E13.7)
SN N13 N1 N2 N3 (mantissas only)
SN N15 N1 N2 N3 N4 N5
SN N610 N6 N7 N8 N9 N10

SN DNDT D1 D2 D3 [W1 W2 W3]

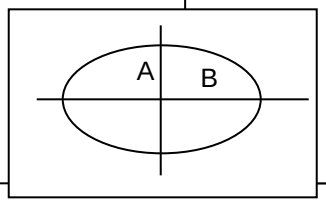
Aperture input:

SN NAP

SN CAO RADIUS XOS YOS
SN CAI RADIUS XOS YOS

SN RAO XS YS XOS YOS
SN RAI XS YS XOS YOS

SN EAO B A XOS YOS
SN EAI B A XOS YOS



SN UAP { 1 RAD XOS YOS / 2 XS YS / 3 NPTS / X Y / X Y / .. / 4 NPTS / X Y / X Y / .. / 5 TYPE A B C / 6 R1 R2 XOS YOS }

Examples of index input:

2 AIR
5 N13 836505 846663 872041
12 GTB S
K5
14 GTB S “SF16”
33 GLM 1.517 64.5

Relative options:

SN NAS

SN { AT / BT / GT } ANGLE AXIS NSURF

SN { RAT / RBT / RGT } ANGLE XR YR ZR NSURF

SNA PAS SNB NSURF
SN RELATIVE

SN DECENTER XDC YDC ZDC NSURF
SN GROUP NB

Local options:

SN NAS

SN LOCAL
SN LOCAL POSITION XL YL ZL
SN LOCAL **euler** AL BL GL

Global options:

SN NAS

SN GLOBAL
SN GLOBAL POSITION XG YG ZG
SN GLOBAL **euler** AG BG GG

SNA COINCIDENT SNB

ZFILE zoom input:

ZFILE NGROUPS
FIRST LAST
FIRST LAST
…

ZOOM NB
{ OBA / OBB / OBC / OBSAME } data
ZDATA ZD1 ZD2 …
END

External options:

EXTERNAL POSITION XE YE ZE
EXTERNAL **euler** AE BE GE

euler:

{ ABG AGB BAG BGA GAB GBA
ANGLE }

Examples of tilt and decenter input:

4 AT 45 0 100
6 DEC 0 -.223 0 5
25 GLOBAL ANGLE 0 45 0
13 LOCAL
6 LOCAL GAB 45 0 22.5

Basic output:

SPEC [{ -1 / SYS }]
[{ -2 / SURF }]
[SN / JSSS JSPS / RTG [JSSS JSPS] / LOCAL / GLOBAL [SN] / FULL / EXTERNAL]

PRT [{ -1 / SYS }]
[{ -2 / SURF }]
[SN / JSSS JSPS / GLOBAL SN / LOCAL / EXTERNAL]

DSPEC [TSCF [JSSS JSPS [F/0][YOS]
CAP [JSSS JSPS / SN]

SPC [JSSS JSPS]

LEO
OUT
POP
ZOUT [FULL]
TDC {GLO / LOC / EXT }
SPACERS [JSSS JSPS]

SSD { SN / JSSS JSPS }

RIN { SN / JSSS JSPS }

ASY { SN / GLOBAL [SN] / LOCAL / JSSS JSPS / EXTERNAL }

Utility features:

LOG [SET NB]
NLENS; SLENS
STORE [NB]
GET NB
DLL NB
PLB

VNUM [WAV1 WAV2 WAV3]
{ S / O / U / H / C /G } glassname
…
END

MSG message
! message
$ message

TIME

AGLASS SN
DGLASS / GID
PCGLASS

[O/F]CALC XOUT YOUT

SAVE [/] [filename / LOG]
FETCH [/] filename

ADEF SN { PRINT / PLOT } [Yo Ym ΔY [YINCR REF]]]
COMBINE [SN] / filename

REVERSE
FLIP { JSSS [JSPS] / ELEMENT NB [NB] }
MSET MAG [A]
IRG SN { S/O/H/U/C } [AUTO] / glassname
PGA { SN / ALL }
FVF [HBAR HBAR …]
FN HBAR GBAR
TN HBAR GBAR [ICOL / P]

CAM { INDEX [SET] / RANK NUMBER / MACRO }
CAM { DAMPING / EXPONENT } DATA
CAM SEARCH [ELOW EHIGH]
CAM SCALE SCF ORIGIN

```
SCALE { NB
        FOCL NB [ JSSS JSPS ] [PART]
        INCH
        MM
        CM
        M
        GIHT NB
        TOTL NB
        BACK NB
        SECTION JSSS JSPS NB }
```

```
AIM [ HBAR GBAR [ ICOL / P ]
TILT SN SN …
DECENTER SN SN …
GO
```

```
WGT SN [ SPG ]
GWGT [ JSSS JSPS ] [ P ]
END
```

```
GWGT [ INCLUDE / EXCLUDE ] [ P ]
SN [ SPG ] ]
…
END
```

```
GCOST [ JSSS JSPS ]
```

```
{ INSERT } { SN }
{ DELETE } { JSSS JSPS }

DELETE { ELEMENT NB [ NB ] }
       { SURFACE SN }
```

```
ZMCONVERT [ ZOOM ]
```

```
{ DEF    } [ L [ D [ APS APD ] ] ]
{ ZERNIKE }
{ ZE4    }

SN
X Y Z
…
END
```

```
TEXT
lines of text
…
END
```

```
GLASS
SN
A1 A2 A3
A4 A5 A6
[ ALSO SN SN … ]
…
END
```

```
DMASK ISN { LEVEL/GRAY/B0/B1/B2/B3/ZONES/PROFILE } GRID [ CAO [ SIGN ] ]
```

```
GSEARCH LLIB [ QUIET ] [ LOG ]

SURF
SN SN SN SN …
[ SN SN ]…
END

NAMES
{ S/O/H/U/C/F/G/R } glassname
{ S/O/H/U/C/F/G/R } glassname
{ S/O/H/U/C/F/G/R } glassname
…
END
GO
```

```
UCLOCK [ QUIET / LOUD / TEST [ MONO ] ]
[ WEIGHT WBORE WDISP ]

SN WEDGE
SN WEDGE
SN WEDGE
…
GO

[ UCLOCK [ LIST \ PLOT ] ]
```

First, third, fifth-order analysis:

PXT [P | JSSS JSPS]

FIRST [JSSS JSPS]

{ THIRD | NTHIRD } [ELEMENT | PLOT SCF] [CHROM [ICOL1 ICOL2]]

{ THIRD | NTHIRD } [SN | SURFACE] [FULL] [CHROM [ICOL1 ICOL2]]

{ THIRD | NTHIRD } [JSSS JSPS | P] [ELEMENT | FULL] [CHROM [ICOL1 ICOL2]]

{ FIFTH | NFIFTH } ELEMENT [CHROM [ICOL1 ICOL2]]

{ FIFTH | NFIFTH } [SN | SURFACE] [FULL] [CHROM [ICOL1 ICOL2]]

{ FIFTH | NFIFTH } [JSSS JSPS | P] [ELEMENT | FULL] [CHROM [ICOL1 ICOL2]]

Real raytrace:

RAY **{** ICOL / P **}** HBAR XEN YEN [SURF / 0] GBAR
PRAY **{** ICOL / P **}** HBAR XEN YEN [SURF / 0] GBAR
GRAY **{** ICOL / P **}** HBAR XEN YEN [SURF / 0] GBAR JCOORD
ERAY **{** ICOL / P **}** HBAR XEN YEN [SURF / 0] GBAR

{ OPD | TAP }

TARGET **{** ICOL / P **}** HBAR { X | CAO } { Y | CAO } SN GBAR [SURF]

{ SFAN | XFAN } NRYS **{** ICOL / P **}** HBAR GBAR

{ TFAN | YFAN } NRYS **{** ICOL / P **}** HBAR GBAR

FANS NRYS **{** ICOL / P **}** GBAR

Lens analysis utilities:

EDGE { SN | JSSS JSPS }

FEATHER SN [HAAP]
SAG SN HAAP NSTEPS
DSAG SN HAAP NSTEPS

FLUX NB **{** ICOL / P **}** SN

NARCISSUS [SN [AP]]
[X]BEAM
BGI [RADIUS]
RGI JREFL JHOT XEN YEN [SURF]
FGI JREFL JHOT RADIUS [POWER]

RGHOST JREFH JREFL XEN YEN [SURF]
STRAIN

GRS SN

{ RAY **{** ICOL / P **}** HBAR XEN YEN 0 GBAR
XFAN NRYS **{** ICOL / P **}** HBAR GBAR
YFAN NRYS **{** ICOL / P **}** HBAR GBAR
GNR 0 0 DEL **{** ICOL / P **}** HBAR GBAR }

GO

GHPLOT NRYS {ICOL/P} TSCF HBAR GBAR MODE {R/L/C}
[SINGLE JREFH JREFL]
[BURIED JREFH JREF]
[DRAD DRAD]
R REFL { ALL / SN SN SN … }
[SIMAGE { XS / BEST }]
[PER EL AZ [TSCF [JSSS JSPS [V/XOS YOS]]]
PLOT

GHOST [R DTS] [P]
[R REFL [ALL]
SN SN SN …
R REFL
SN SN SN …
…
]
END

Basic graphics: lens drawing, rayfans, field curves

```
[ USE BTOL ]
{DWG  } [ TSCF [ JSSS JSPS [ HBAR NB NB NB ] ] ]
{ZDWG }
DSPEC [ TSCF [ JSSS JSPS [ F/0 ] [ YOS ]
{RPT } { SCF } NRYS { ICOL / P / M } [ ICOL … ]
{RPO } {  0  }
{RFT }
{RFO }
FCV SCF [ { P / 0 } [ GBAR [ ICOL / M / P ] ] ]
DIS SCF [{P/0} {GBAR/0} { ICOL/P } [ REAL [REFHBAR]]]
LSA SCF [ P ]
```

Rayfans: long-form of input:

```
{RPT } SCF NRYS
{RPO }
{RFT }
{RPT }
ICOL { ICOL / P / M } [ ICOL … ]
[ FOV HBAR GBAR ]
[ FOV HBAR GBAR ]
[ FOV HBAR GBAR ]
[ FOV HBAR GBAR ]
PLOT
```

```
CDWG { 5 / 10 }

CDWG …
CDWG …
…
CDWG PLOT
```

```
Q1
(make a picture)
Q2
…
Q4
QPLOT
```

3-Parameter plots:

```
[ CONTOUR ]
PA3 { TEST / LOOP / AGAIN / QUIT } [ HT [ L/R ] ]/[COLOR]
RZ1 START END
RZ2 START END
RZ3 LOW HIGH
XLABEL "textstring"
YLABEL "textstring"
ZLABEL "textstring"
[[NO]SMOOTH]
LOOP
…
Z3 = something
PA3
```

Examples of graphical input:

```
DWG 0 1 99 HBAR 0 –1 1
RPT .005 10 2 1 3
PER 20 30 0 1 99
PLOT
PUP 2 1 20
RED
TRA 2 1 0 20
END
```

Perspective drawing, solid model

```
[ SSEP separation ]
[ HPLOT [ SN ] / APLOT [ SN ] ]

{PER    } EL AZ [ TSCF [ JSSS JSPS { [ XOS YOS ] ] ] }
{[R/D]SOLID }                      { V               }
{RPER   }

[ SPT ]
[ LINE ]
[ RAY { ICOL / P } HBAR XEN YEN GBAR ]
[ TONE A B C D E ]
[ GREYSCALE ]
[ PUP … ]
[ TRACE { ICOL / P } HBAR GBAR NRYS ]
[ GLINT SN X Y ]
[ COLOR R B G / SN SN … ]
[ HRAYS ]

PLOT

[ RED ]
[ BLUE ]
[ MAGENTA ]
[ CYAN ]
[ LIME ]
[ YELLOW ]
[ WHITE ]
[ BEAM ]
[ RAY { ICOL / P } HBAR XEN YEN GBAR ]
[ PUP … ]
[ TRACE { ICOL / P } HBAR GBAR NRYS ]

[ GET NB ]
[ BII ]
[ BIC ]

END
```

```
GDIS [ NGRID [ G ]]
```

```
GSS {ICOL} NRYS [ Q ]
    {P   }
    {M   }

[ HBAR HBAR HBAR HBAR ]
[ GBAR GBAR ]
[ DWG TSCF JSSS JSPS ]
[ PER EL AZ TSCF JSSS JSPS [V]]
[ PSCF PSCF [ R / L / 0 [ C ] ] ]
[ SSCF SSCF ]
[ PUSCF PUSCF [ WX WY ] ]
[ FSCF FSCF ]
[ DSCF DSCF ]
END
```

```
COLOR {DEFAULT }
      {RED     }
      {BLUE    }
      {GREEN   }
      {LIME    }
      {MAGENTA }
      {CYAN    }
      {BLACK   }
```

```
CPLOT
(make a picture
(make a picture
…
QPLOT
```

Surface profile plot:

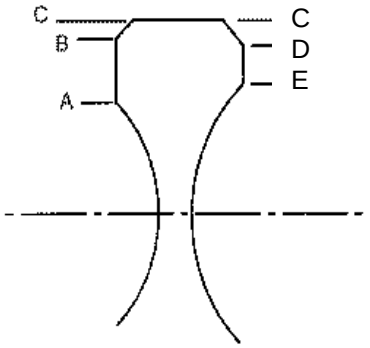
```
[ CONTOUR [ SCF ] ]
[ FRINGES [ WAVL ] ]
SPROFILE ISN {0/F} SCF [ {AP/0} [ PRINT ] ]
```

Edge-definition features:

(In RLE file:)

[MARGIN]
[BEVEL]

SN EFILE { OFF | UP | DOWN | MIXED }



SN EFILE { DIA 2*C | ERAD C | BEVEL BC | FACE AB | ANGLE ANG }

SN EFILE EX1 A B C ANG1
SN EFILE EX2 E D ANG2

SN EFILE MIRROR MTH

SN PEFILE {+/- } JSN

(Commands:)

EFILE CREATE [SNA SNB]
EFILE ERASE
ELIST

(Menu Edge Wizard:)

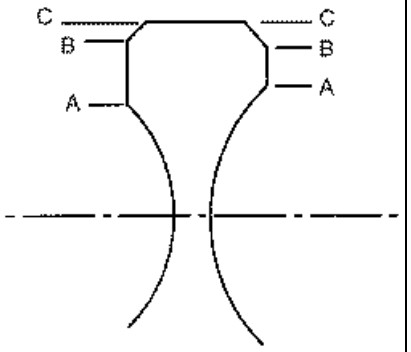
MEW

Element drawing:

[USE BTOL]
ELD **[-]**SN [TSCF]

[MTH TH]
[DIA DIA]
[RAD RAD]
[BEVEL BC]

[{1 | 2} { A A | SAG SAG | BC BC | ABC AB BC | AAB A AB | ANG ANGLE }]



[ID up to 20 characters of title]
[ID second line]
[ID third line]

PLOT

Example ELD input:

```
ELD 1 .2
MTH 3.0
BEVEL 0.1
2 ANG 30
2 ABC 3.5 .5
ID ELD EXAMPLE
ID BEVELED MIRROR
ID OSD, Inc
PLOT
```

Optimization Input: Aberration Definition, Ray Aberrations

Aberration definition file format:

[GTA]
AANT [P]
definitions
END
[STA]

AFILE MACro definition:

AFILE
NAME name1
aberration definition 1
NAME name2
definition 2
…
END

Automatic ray generation:

GNR RT WT DEL **{** ICOL / P **}** HBAR GBAR [SN [F [XWT]]]
GXR RT WT DEL **{** ICOL / P **}** HBAR GBAR [SN [F]]
GYR RT WT DEL **{** ICOL / P **}** HBAR GBAR [SN [F]]
GSR RT WT DEL **{** ICOL / P **}** HBAR GBAR [SN [F]]
GTR RT WT DEL **{** ICOL / P **}** HBAR GBAR [SN [F]]
GPR RT WT DEL **{** ICOL / P **}** HBAR GBAR [SN [F [XWT]]]
GO2 RT WT DEL **{** ICOL / P **}** HBAR GBAR [0 F]
GNO RT WT DEL **{** ICOL / P **}** HBAR GBAR [0 F]
GSO RT WT DEL **{** ICOL / P **}** HBAR GBAR [0 F]
GTO RT WT DEL **{** ICOL / P **}** HBAR GBAR [0 F]
GPO RT WT DEL **{** ICOL / P **}** HBAR GBAR [0 F]
GNN 0 WT DEL **{** ICOL / P **}** HBAR GBAR [SN]
GNV 0 WT DEL **{** ICOL / P **}** HBAR GBAR [0 F]
GPV 0 WT DEL **{** ICOL / P **}** HBAR GBAR [0 F]
GTP RT WT DEL **{** ICOL / P **}** 0 0 SN

[VSET FRAC POS]
[OBS { R1 / P1 R1 }]

Edge, center thickness control;, slope control:

{ ECP / ECN / ETP / ETN / CTT / CTC } TAR WT SN SN SN …

AEC TAR WT
ACC TAR WT
ASC ANG WT

Naming aberrations:

AANT [P]
NAME name
aberration …
…
AFILE name1 [WT]
…

***User-defined aberration format*: target [/] definition [/] definition**

Target format:

{ M / L / LIM / MF } TAR WT [SCR / SR]
LL A1 F1 A2 F2
C TAR WT
[LUL / LLL] TAR WT WIND

Definition format:

{ A / S / MUL / DIV } aberration

***Ray aberration format:* ICOL name HBAR XEN YEN GBAR [SN]**
Where **name** is one of the following:

YA	ZA	RA	XG	XL	XE	
YC	OPD	RC	YG	YL	YE	
YP	OPP	HFREQ	ZG	ZL	ZE	
XA	ZZ	HBRAGG	ZZG	ZZL	ZZE	ERROR
XC	HH	HEFFIC	HHG	HHL	HHE	
XP	UNI	HSFREQ	FLUX	PL	OPL …JSSS JSPS	
DSLOPE						

Example user-defined rays:

M 0 1 A 2 YA 0 0 1

M 0 10 A 1 YA 1 0 0
S 3 YA 1 0 0

M 22 1
A P OPL 0 0 1 0 5 13

Example generated rays:

GNR 0 1 3 2 1
GSR .5 5 5 2 0
GNR 0 2 3 1 .5
GNR 0 2 3 3 .5

Optimization Input: Other Aberrations

First-order aberrations:

FOCL	YP0
BACK	TH0
TOTL	YP1
GIHT	XP1
EPP	YMP1
DELF	XMP1
FNUM	
	GWR
BTH	GWL
ACCOM	GBR
	GBD

Third-order aberrations:

SA3	SAT
CO3	COT
TI3	ACD
SI3	ACT
PETZ	ECD
DI3	ECT
PAC	ESA
PLC	ECM
SAC	
SLC	

Fifth-order aberrations:

SA5	SAPU
CO5	TIPU
TI5	COPU
SI5	SIPU
ECOM	ASPU
PZ5	PZPU
DI5	DIPU
TOBSA	
SOBSA	

Other AANT input:

ZOOM NB
ACON NB
[VSET FRAC POS]
[OBSET { P1 R1 / R1 }]

DIOPTERS D
BIREF SN { ORD / EXTR }
POLAR (X / Y / CR / CL }

Section aberration format: **SECTION name JSSS JSPS [ICOL]**
where **name** is one of the following:

FFOCL	NP1	SA3	SA5	SAPU
FRONT	NP2	CO3	CO5	COPU
BACK	PP1	TI3	TI5	ASPU
FOCL	PP2	SI3	SI5	TIPU
ENP	PPSEP	PETZ	ECOM	SIPU
EPP	PIA	DI3	PZ5	PZP
		PAC	DI5	DIPU
		PLC	TOBSA	
		SAC	SOBSA	
		SLC		

MTF aberration format: { **ICOL** / **M** / **P** } **name HBAR C/MM GBAR**
where **name** is one of the following:

MTF	XMTF	YMTF	AMTF	MTX	MTY

Composite aberrations format:

M TAR WT COMPOSITE

CD1 aberration
CD2 aberration
…
CD9 aberration

= equation

Operators:

( ) + - * / **
SQRT SIN
ASIN EXP
COS ACOS
ALOG TAN
ATAN ALOG10
ABS

CLINK aberration format:

M TAR WT CLINK
-- valid command string --
CD1 aberration
…
= equation

Operators:

(same as Composite, above)

Examples of other aberrations:

```
M 2.3 .55 A SECTION FOCL 3 8
DIV SECTION PPSEP 3 8

M 1 10 A M AMTF .7 50

M 2 1 COMPOSITE
CD1 2 YA 0 0 1
CD2 2 YA 0 0 .5
= CD1 / CD2
```

Optimization Input: Construction Parameter Aberrations

Format:* name SN *where* name *is one of the following:

RD	XDC	XG	XL	AG	AL	NAR	PYA	PXA
RAD	YDC	YG	YL	BG	BL	RGR	PYB	PXB
INDEX	ZDC	ZG	ZL	GG	GL	SCAO	PUA	PVA
PDISP	WGT	TILT	LPI	LPF	LPT		PUB	PVB
TH	CAO	XE	YE	ZE			PIA	PJA
CV	CC	AE	BE	GE			PIB	PJB

Format:* name *where* name *is one of the following

XLOC	SAG SN X Y	GC NB SN
YLOC	CONST NB	ABR NB
ZDATA NGR ZOOM	G NB SN	OAL JSSS JSPS
PGHOST SN SN	BGI JREFL JHOT	PGH JREFH JREFL
BGI JREF JHOT		

Examples of construction parameter aberrations:

M 0 1 A RAD 6
S TH 6

M 1.5 1 A PGHOST 7 15

M 45 1 A 2 AG 6

M .009 1 A PDISP 4

Wavefront coefficients:

{ICOL / P} {COE / ZCOE} HBAR GBAR NB

HOE construction system:

HCOE NB
HPX
HPY
HPZ

{P1X, P1Y, P1Z, P2X, P2Y, P2Z} SN

DSEARCH:

DSEARCH LLIB [QUIET]

SYSTEM
(lens ID)
(object description)
(wavelengths)
(other system data, such as AFOCAL, etc.)
END

GOALS
ELEMENTS NB
FNUM FN
BACK BK WT
TOTL TT WT
STOP { FIRST / MIDDLE / LAST }
STOP { FIX / FREE }
RSTART RD
THSTART TH
NPASS NP
MONO
FOV HBAR HBAR HBAR HBAR HBAR
FWT WT WT WT WT WT
SNAP NPASSES
ANNEAL TEMP COOL
SAMPLE
GLASS {POSITIVE/NEGATIVE}
S/O/H/F/U/C/G/R glassname
END

File format: **PANT [P] / variables / … / END**

Data format: **VY SN name [UPPERL LOWER [INCRE]]**
VLIST name SN SN SN …
where **name** *is one of the following:*

RD	AT NB	G NB	GBC	ZOOM NB	XL
RAD	BT NB	XMP1	GBF	XG	YL
TH	GT NB	YMP1	GLASS, GLM	YG	ZL
INDEX	XDC NB	TH0	AP1 NB	ZG	AL
ASPHERIC	YDC NB	YP1	AP2 NB	AG	BL
CC	ZDC NB	YP0	LHG NB	BG	GL
CAO	GC NB	XP1	RHG NB	GG	ACCOM
BTH	LPI	LPF	LPT	GOUT	
XE	YE	ZE	AE	BE	GE

Other* PANT *input:

ACON JCONF
RDR FRACTION
VY NGROUP ZDATA NZOOM
VY SN VD [0 0 [INCRE]]
VY n VZN
CBOUNDS N1 V1 N2 V2
FBOUNDS N1 V1 N2 V2

Optimization options:

[NO]SNAPSHOT NPASS
METRIC RD TH IND V TDC G OBJ
[DAMPING D DLIM]

{ SYNOPSYS NPASS [MULTICONFIG] | DERIVATIVES [0 MULTI] | EVALUATE [0 MULTI] }

SUMMARY
FINAL NB
ALIST
MESSAGES
CHANGES

KICK TEMPERATURE
ANNEAL TEMPERATURE COOLING [QUIET]

Multiconfiguration optimization:

ACON [CLEAR / ENFORCE]
ACON NB
ACON NB NULL

ACON NB PICKUPS
SNA { PCV | PTH | PIN | PAS | PCAO } SNM [ACONF]

1 PZDATA 1 [ACONF]
1 PACCOM 1 [ACONF]
1 POB 1 [ACONF]
[-]SNM { HP1 / HP2 / HZ1 / HZ2 }

[[B/C]ZOOM [JSSS JSPS JFROMSURF]]
END

Testplate matching:

TPMATCH [0 MULTI]

MATCH { VARS / ALL / SN SN … }

MATCH …
EXCEPT …
[DFRAC FRACTION]
[PASSES NPASS]

{ DEGRADE FRACTION | MERIT MERIT }

[TEST { POWER FRACTION | WAVES WAVES }]

LISTNAME / listname

LIBRARY LLOC

[SELECT { NEAR | FAR }]

[PREOPT { FREE | FIX | NONE }]

GO

TPMATCH PRINT
listname

Input file structure:

[BTOL [CRITERION [MULTI]]]
[BTOL { SAVE / FETCH / LIST }]
[BTOL CRITERION 0 RECALC]
[DAMPING D]
[FOV NFOV]
[MONO ICOL]
[FWT WT WT WT]
[FWAV WAVELENGTH]
[OBSET { CAI / P1 R1 }]
[IMAX FRACTION]
[GRID NB]
[{ POWER / ZERNIKE }]
[ZOOM { ALL / NB NB … }]
[UCF NFOV / HBAR GBAR / HBAR GBAR …]
[PREPARE [MC / ELD]]
[ACON NB]
[NODMESS]
[SEGMENT]
[DEFAULTS]

ZAW { UNIFORM / FNUM / NB WT }

(variable attributes)
(adjustment requests)
(quality descriptors)
{ EVALUATE / GO }

RANGE **param** RANGE

FIX **param** TOLERANCE

param = RFR, TH, INDEX, VNUM, TILT, WEDGE, DECENTER, REDGE

Variable attributes:

[INCLUDE JSSS THRU JSPS]

[EXCLUDE SN THRU SN]
[EXCLUDE …]

[EXACT { ALL / { ***list*** } SN SN SN }…]
[EXACT SN { ***list*** }]
[RANGE SN { ***list*** } DMAX]
[FIX SN { ***list*** } TOL]
[TPR { SN SN SN … / ALL }]
[GROUP { LEFT / RIGHT } SN SN]
[THC SN SN]
[CEMENT SN SN …]

***list**: select one of the following:*

RAD	TH	TILT	XDC	RFR
RD	THI	DECENT	YDC	SSD NB
CV	INDEX	IRREG	WTR	VNUM
CONIC	VNO	WEDGE	TTR	REDGE
RL1	RL2	PEP	PAX	PAY

Inverse-sensitivity program:

PANT
…
END
AANT
…
END
TOL TOL [ADJUST SN TH TARGET ABN [DELQ]]
[TOL SUMMARY]

Quality descriptors:

TOL WAVE VARIANCE
TOL WAF VAR VAR VAR …
DEGRADE WAVE FRACTION
DEGRADE WAF VAR VAR …

TOL [X/Y]SPOT VARIANCE
TOL SPF VAR VAR VAR …
DEGRADE [X/Y]SPOT FRACTION
DEGRADE SPF VAR VAR …

TOL STREHL VALUE
TOL STF VALUE VALUE …
DEGRADE STREHL FRACTION
DEGRADE STF NB NB …

TOL { MTF / YMTF / TMTF / SMTF / XMTF } FREQ MTF
TOL { MFF / YMFF / TMFF / SMFF / XMFF } FREQ MTF MTF …
TOL { MSF / YMSF / TMSF / SMSF / XMSF } MTF FREQ FREQ …
DEGRADE { MTF / YMTF / TMTF / SMTF / XMTF } FREQ FRACTION
DEGRADE { MFF / YMFF / TMFF / SMFF / XMFF } FREQ FRACTION …
DEGRADE { MSF / YMSF / TMSF / SMSF / XMSF } FRACTION FREQ FREQ …

[TOL MAGNIFICATION MTOL]
[TOL DISTORTION DTOL]
[TOL BORESIGHT BTOL]

Adjustment requests:

[ADJUST SN ***name*** [AJMAX [{ ALL / EACH } ZOOM]]
[APPLY JSSS JSPS]
[FOCUS { REAL HBAR GBAR / ALL / EACH }]
[REOPTIMIZE NPASSES [QUIET]]
[ATABLE]
where ***name*** is one of:

RD	TH NSURF	TILT NSURF
RAD	THI NSURF	DEC NSURF
CV	XDC NSURF	YDC NSURF
TH0	ACCOM	

Image Evaluation: Geometric. Footprints

Through-focus geometric MTF:

[FCO FREQ]

TFG **{** ICOL / M / P **}** HBAR NRYS 0 GBAR [P]

DF { 1 / 3 / 5 } DELTAF

Monte-Carlo verification:

MC NSAMPLES { LIBLOC / MULTI } [QUIET] –>
–>[QTOL { QNUM / ALL } QLIB [**tstat**]]

MC IZn "label"
MC STATISTICS
MC PLOT [DIST]
(**tstat** = { U / E / T / H / L }

Through-focus spot diagram:

TFS NRYS [SCF]
[DF { 1 / 3 / 5 } DELTAF]
[HBAR HBAR1 HBAR2 HBAR3]
[GBAR GBAR]
[ICOL **{** ICOL / M / P **}** [ICOL ICOL …]
PLOT

Geometric image analysis:

SSIZE NB
MFB (field blur)

[FCO NB]
GMTF **{** ICOL / M / P **}** HBAR NRYS 0 GBAR [P]
SPT **{** ICOL / M / P **}** HBAR NRYS [SCF GBAR [YSCF]]
KNI **{** ICOL / M / P **}** HBAR NRYS SCF GBAR { X / Y } [P]
{ FOCUS / XFOCUS / YFOCUS } { **{** ICOL / P / M **}** / DF } HBAR NRYS 0 GBAR
{ RMS / XRMS / YRMS } **{** ICOL / M / P **}** HBAR NRYS 0 GBAR [XIP YIP]
FRMS **{** ICOL / P / M **}** **{** 0 / P **}** NRYS 0 GBAR
GMODEL **{** ICOL / M / P **}** HBAR NRYS WT GBAR [ADD [AXIS]]
ILLUM NRYS { HBAR / P } [GBAR]

MGMTF NRYS
[HBAR HBAR HBAR HBAR HBAR]
[GBAR GBAR]
ICOL { ICOL / P / M }
{PLOT / GO }

IPATTERN
[OBI INDEX JX JY]
TRACE [ICOL / P } HBAR GBAR NRYS
…
PLOT

Fabrication Adjust Monte-Carlo

FAMC NSAMPLES LIBLOC [QUIET] [QTOL { QNUM / ALL } QLIB [**tstat**]]
PASSES NPASS
FAORDER SN SN SN …
FAORDER SN SN SN …

PHASE 1	PHASE 2	PHASE 3
PANT … END	PANT … END	
AANT … END	AANT … END	
SNAP	SNAP	
EVAL	SYNO PASSES	

Footprint plots:

PUP { 1 (default round pupil) / 2 NXR NYR (X-Y grid specified) / 3 NRYS [LINE] (rim-rays only, expanding to max.) / 4 NRYS [LINE] (rim-rays only, contracting if vignetted) / 5 NRYS [LINE] (as 3, centered at ICR) }

PLOT SN TSCF { XOS YOS / CR }
[RED / BLUE / LIME / GREEN / MAGENTA / CYAN / YELLOW]
{ TRACE / PTRACE } **{** ICOL / P **}** HBAR GBAR NRYS [XEN YEN]
END

Diffraction image analysis:

[FCO NB]
OFPSPRD (see menu **MPF**)
[W]DMTF **{** ICOL / M / P **}** HBAR NRYS 0 GBAR [P]
M2F …
[FORCE FNUM FN]
[CONTOUR SCF | FRINGES]
{ PUPIL | IFR | IFP } **{** ICOL / P **}** HBAR 0 SCF GBAR [WX WY]

[ZOPD / ROPD | CONTOUR | PSVISUAL [MAGN [GAIN]]]
[W/L]PSPRD **{**ICOL/M/P**}** HBAR NRYS 0 GBAR [HT { R | L } C FD]

{D/W**}**MODEL **{** ICOL / M / P **}** HBAR NRYS WT GBAR

DPF **{** ICOL / P **}** HBAR NRYS 0 GBAR

[Q]VAR **{** ICOL / M / P **}** HBAR NRYS 0 GBAR [XIP YIP]
VFOCUS **{** ICOL / M / P **}** HBAR NRYS 0 GBAR [0 0 TVAR]

{ COE | ZCOE | ZC4 } **{** ICOL / P **}** HBAR 0 0 GBAR [FULL]

Convolution MTF options:

[Z]MTF **{** ICOL / M / P **}** HBAR FREQ [GRID / 0] GBAR

[Z]MTF **{** ICOL / M / P **}** HBAR 0 [GRID / 0] GBAR [P]

[Z]MOF **{** ICOL /M / P **}** 0 FRE [[GRID / 0] GBAR Q FRE FRE FRE]

request:

[X]SLICE
SURFACE
GEOM
FRINGES
MODEL
MTF
VISUAL

Diffractive propagation:

DPROP **{** ICOL / P **}** HBAR GBAR ISTOP **request** [HT [L / R] [RESAMPLE] [SMOOTH]]

Multifield MTF:

{ MFF | MZMTF [GRID] }

[HBAR HBAR HBAR HBAR HBAR]
[GBAR GBAR]

ICOL **{** ICOL / M / P **}**

{ PLOT | GO }

Through-focus Convolution MTF:

TFMTF FREQ
[HBAR HBAR HBAR HBAR HBAR]
[GBAR GBAR]
ICOL **{** ICOL / M / P **}**
INCREMENT DF
{ PLOT | GO }

VMR SFREQ
HBAR HBAR HBAR HBAR
[GBAR GBAR]
ICOL {M/P/ICOL}

Partial-coherence analysis

PARTC **{** ICOL / M / P **}** HBAR GBAR REL [DOUBLE]
[ANNULUS RHO NRHO]
[XREL XREL]
[KNIFE]
JTAR SWAV CONTRAST [X / Y [PHASE]]

{ PLOT | END }

Targets (JTAR):

1 sine	4 1-bar
2 square	5 edge
3 3-bar	6 user-spec.

Through-focus PSPRD

[PSVISUAL MAG GAIN]
TFP NRYS [HEIGHT [R / L]]
[DF { 1 / 3 / 5 }DELTAF]

[HBAR HBAR1 HBAR2 HBAR3]
[GBAR GBAR]
ICOL { ICOL / M / P } [ICOL ICOL …]
PLOT

Special diffraction analysis:

[OBS [P1] R1]
{ COE … | DPF … }
DIFF REGION SLICES SAMP HT { NPUP | -1 } [LOG]

[KEEP]
[COMBINE]
END

Special image dissection:

FOR { KNIFE | SLIT | CIRCLE | RECTANGLE }

[RAD RADIUS]

[SIZE { DIAMETER | XS YS }]

[ORIGIN X Y]
[SCALE XS YS]

CENTER [AT] XOS YOS

VARY { X | Y } { POSITION | SIZE } { FROM START TO END [BY INCREMENT] | ABOUT CENTER IN NB INCREM OF SIZE }

{ PLOT | GO }

Detector program:

IFOV { RECT XSIZE YSIZE | ROUND RADIUS | DATA NPTS / X Y WT / … }

[IOBJ { RECT GBAR HBAR | ROUND HBAR }]

DETECTOR { RECT XDS YDS XOS YOS | ROUND RADIUS XOS YOS }

FDS PERCENT XOS YOS

[FOR …]

Mapping program: MAP over field of view:

MAP { ZZ | HH | UNI } OVER FOV ON SURFACE SN

MAP { FOOT | XA | YA | ZA | SAG | HFREQ | HSFREQ | GFREQ } OVER FOV [ON SURFACE SN]

MAP { SPT | [R][H]DIST | OPD | PUPIL | TRANS | POLAR } OVER FOV

Mapping program: general input:

FGRID { RECT NHBAR NGBAR | CREC NHBAR NGBAR | CIRCLE NB | POINT HBAR GBAR | CUSTOM/HBAR GBAR/… }

RGRID { CREC NX NY | MCIRCLE NB | CIRCLE NB | POINT XEN YEN | RECT NX NY | ICRCIRC NB }

[COLOR ICOL / P / M]
[GIHT GIHT]
[SCALE TSCF]
[ACTUAL]
[EXPLODED]
[DIGITAL]
[ANALOG ASCF]
[KEEP]
[DIFFERENCES]
[SLANT NB]
[REFHBAR HBAR]

{ PRINT [FULL] | PLOT | GO }

Mapping program: MAP over pupil:

MAP { ZZ | HH | UNI } OVER PUPIL ON SURFACE SN

MAP { XA | YA | ZA | SAG | HFREQ | GFREQ | OPD | TRANS | POLAR } OVER PUPIL [ON SURFACE SN]

Also:

MAP SAG OVER SURFACE ON SURF SN

Analysis mode:

[RFILM]
[PHASE]
[TRANS]

{ LAM LLOW LHI NSTEPS ANGLE
{ PHI PLOW PHI NSTEPS WAVL

[PLOT]

[PLOT [SCF [ORIGIN]]]

[RETURN]
[DESIGN]

Command:

FILM

Design mode:

[WAVL LAMBDA0]
[ANGLE ANGLE]
[DI THETA]
[KSD { 1 / 2 }]
[TNET T1 T2 T3 T4]
[NNET N1 N2 N3 N4]
[TLIM LO HI]
[NLIM LO HI]
[BUILD ±SN No Nf [K]
[ID identification]
[ADD ±SN]
[FIX]

PANT
SN (1 / 0) (1 / 0)
SN (1 / 0) (1 / 0)
…
END

AANT

RAVE WAVL ANG TAR WT
RSP WAVL ANG TARS TARP WTS WTP
TAVE WAVL ANG TAR WT
TSP WAVL ANG TARS TARP WTS WTP
RP WAVL ANG TARS TARP WTS WTP
PDR WAVL ANG TAR WT
TP WAVL ANG TARS TARP WTS WTP
PDT WAVL ANG TAR WT
END

SYNOPSYS NPASSES

Film stack data:

RFILM
ID identificaion
[WAVL LAMBDA0]
[ANGLE ANGLE]
[MICRONS]

TH IND
TH IND
…
END

Common-mode input:

RFILM
DESIGN
ANALYSIS

PON …
POF …

SAVE [name]
FETCH [name]

SPEC

RETURN

Polarization input (in RLE or CHG file):

POLAR
- UNPOLARIZED
- LINEAR { X | Y | ANG }
- CIRCULAR { RIGHT | LEFT }
- ELLIPTICAL { RIGHT | LEFT } (A/B) ANGLE
- OFF

Coatings (in RLE or CHG file):

SN COATING { NONE | QMD | QMH | HEA | AL | ALSIO | AU | AGSIO | LOSSY | PERF }

SN POLARIZER

Thermal soak analysis:

THERM [TEST]
COE CNB **name**
…
RCHANGE CNB
SN SN SN …

TCHANGE CNB
SN SN SN …

DECENTER CNB
SN SN …

{ TEMP T / ATS T JCONF … / TEST }

name:

A5056	GRANITE
A6061	INVAR
BECU	SAPPHIRE
BER	S304
IRON	S316
FCBRASS	S440
BRASS	ZERODUR
COPPER	PYREX
FUSILICA	
COEFFICIENT	

Polarization evaluation:

PCOAT [SN / ALL]

PRAY **{** ICOL / P **}** HBAR XEN YEN [{ SURF | PSURF | 0 | E } GBAR [ISTOP]]

PTRACE **{** ICOL / P **}** HBAR GBAR NRYS [XEN YEN]

Environmental effects:

TPF **{** ICOL / P **}** HBAR NRYS GBAR TOSP DATA ISN JZN NPS CAP A1 A2 A3 A4 A5 A6 A7 A8 A9 ISN … END	TPF **{** ICOL / P **}** HBAR NRYS GBAR TOSP DATA ISN JZN NPS CAP EXACT DZ1 DZ2 DZ3 … DZ10 DZ11 DZ12 … DZ20 … ISN … END

GO
GPP…

Shortcut commands for dialog functions: Control sequences:

Ctrl + S	save the current MACro, plot, or lens
Ctrl + P	print the active window
Ctrl + N	open a new Command Window
Ctrl + C	copy selected text to the clipboard
Ctrl + V	paste the clipboard text into this window
Ctrl + Z	undo text editing change
Ctrl + U	undo changes to the lens
Ctrl + Y	redo changes to the lens

Interactive commands:

DIR { MAC / RLE / PLT / FILM / EFILE / TPL / SSP / BTO }
DIR

{ AI
INTERACTIVE }

HELP topic
PROJECT name
BELL

<F1> *for help file*
<F2> for help on TrayPrompt text

Print capture commands:

PON [filename [NEW]]
…
POFF [C / D / CLOSE]

MACro commands:

EE
LM filename
LTM filename
EM filename
EAM filename
PMA filename

GDS
GADS

Shortcut commands for dialog functions: Commands:

NCW	open a new Command Window
CCW	clear (erase) Command Window
PCW	print Command Window
KAG	kill all graphics windows
GAW	graphics add new window for each picture
GRW	graphics reuse existing window for each picture
BLANK	makes an empty graphics window
VERSION	shows revision number dialog
CHD [path]	to change directory
GDS	re-run the last MACro
PAD	
WS	to Worksheet
MSW	Spectrum Wizard
MPW	Pupil Wizard
MEW	Edge wizard
MGT	Glass-table display
LLB	Load Line Buffer
LMM	Load Menu MACro
SAE	Show All Errors
SSU	Save SetUp
RSU	Restore SetUp
DWL	Default window location
RTM	Return to last menu

Graphics converting:

HARD { HPG… / DXF… / POST…}

SYNOPSYS menus:

MMM	main menu mode	**MLI**	list all menus	**MSS**	mode switches
MLB	lens library functions	**MIM**	image analysis tree	**MOP**	MTF analysis features
MOS	open, save a lens file	**MMC**	multicolors, weights	**MFM**	Fourier-transform MTF
MWL	fetch a saved lens file	**MMO**	image model	**MMA**	MAP feature
SYS	dialog to edit lens system data	**MDI**	diffraction image analysis	**MPA**	partial-coherence analysis
SPS	dialog to edit lens surface data	**MMF**	multi-field MTF analysis	**MIT**	image tools
MUT	utilities	**MTM**	through-focus MTF	**MIF**	image tools 3D MTF
MLL	display the lens data	**MGI**	geometrical image analysis	**MTG**	through-focus geometric MTF
MFT	first, third, fifth-order analysis	**MTS**	through-focus spot diagram	**MDF**	special diffraction analysis
MRR	real raytrace	**MTP**	through-focus diffraction pattern	**MGS**	graphical system summary
MPL	plotted lens analysis	**MWM**	open a saved MACro	**MTB**	toolbar dialog
MFP	footprint plots	**MWP**	open a saved plot file	**MOM**	optimization dialog
MPE	perspective, solid drawings	**MIT**	Image Tools	**MIF**	Image tools MTF display
MSW	spectrum Wizard	**MPW**	pupil Wizard	**MEW**	edge Wizard
MFB	field blur analysis	**MPF**	PSPRD over field	**MTR**	transmission options
MDS	global design search	**MMT**	testplate fitting	**MGH**	ghost image analysis
MMG	multifield GMTF	**MFK**	Foucault test emulation	**MSB**	simple BTOL analysis
MGT	opens the Glass Map display				

Basic operations:

QUESTIONS:

What is …
Find …
Where is …

CHANGES:

Change __ to __
Increase __ by __
Decrease __ to __
Set __ equal to __
__ = __

LOOPS:

Plot __ for __ = __ to __
Print __ versus __ as __ varies from __ to __

Multi plot …
Add plot …
END

Example questions:

4 TH?
What is the thickness of surface 4?
Find the largest CAO
What is full field?
UPP0?
UNITS?
If 2 th = 2.3, find YA on 6 at hbar = 1
GLOBAL Y COORD OF SURF 5?
FIND 5 YG
If the wavelength is .66, find SA3

Example changes:

Increase 5 RAD by .1
Make surface 6 flat
6 = NULL
4 TH = 2.345
DECRE THE FIELD ANGLE BY 0.1
2 nd = 1.517
set YMP1 equal to 34.2
ID = “triplet”

Example loops:

Plot the sag of 4 for Y = 0 to 25
PRINT BACK VS SA3 AS WAVL VARIES FROM .3 TO .8
Plot yc for yen = .9 to 1
Do macro for 5 th = 5 to 8
PLOT TRANSM FOR YEN = -1 TO 1
Plot YA on 16 at full field for wavelength = .4 to .8
DO MACRO FOR AIP = 0 TO 10

MULTI PLOT SA3 FOR 1 RD = 200 TO 300
ADD PLOT CO3 FOR 1 RD = 200 TO 300
END

SCALE?
SCALE = .001 BY 1
SCALE = LAST
STEPS?
STEPS = 20
ALAB?
ABSCISSA LABEL?
ALAB = “this text is for X”
Label of ordinate?
OLAB = “and this is Y”

ORIGIN?
ORIGIN = 2, 15

ORDINATE = 4 TH
ABS = WAVELENGTH
Abscissa = cc of surface 3

SHOW BUFFER
ORD = FILE 1
ABSC IS FILE 6

4 TH = AIP
AIPSET 4 TH

AGAIN

Command, symbol definition:

VV: VARIANCE 2 0 200
%: find YA for YEN = 1 on surf 6
II: increase the field angle by 0.1

DD: DWG 2 1 99 HBAR 0 –1 1

gg: GRAY 2 0 0 1 SURF

GG 6
GG 9

BB: thick of elem 5
CC: 1.2435

Print BB
BB = CC

ON 45
HBA: 0.5
PP: PSPRD 2 HBA 300 0 0 3.5 R

PP

AA: CHANGE G 3 ON 6 TO

AA .0012

Other AI features: Equation Solving, Expert Systems, Vendor Stock Lenses

AI equation solving: the Zn array:

Z1 = 2 TH
Z2 EQUALS 3 RAD
3 TH = Z1

= Z1 / Z2
Z3 = FILE 1
5 TH = Z3

Composite in AI:

COMPOSITE
CD1 TH 6
CD2 OAL 2 5
= CD1 / CD2

Vendor stock lens elements:

MATCH ELEM 3 TO ***name***
MATCH ***type*** WITH ***conditions*** and ***conditions*** to ***name***

SHOW CHOICES
SHOW ***name***

INSERT CHOICE NB {BEFORE/AFTER} {SURF/ELEM} NB
INSERT EDMU '33892' BEFORE SURF 6

REPLACE ELEM 2 WITH CHOICE 4

type: SINGLET
DOUBLET
TRIPLET
TORIC

name: EDMU
MELL
SPIN
NEWP
CVI
JML
OFR
ALL

conditions: FOCL = NB
BENDING = NB
CAO = NB
WAVL = NB

XSYS: expert-systems program

(Switch 42 should be ON)

Main XSYS prompt:

START
ALTER
REENTER
LIST
USE
INITIALIZE
ADD
END

ALTER input:

MAXSN NB
MINSN NB
FNUM TAR WT
AFMAG TAR WT
BACK TAR WT
TOTL TAR WT
WFOV WT
CWT WT
FWT WT WT WT WT
WYB WT
WUB WT
ROOM WT

SNAP NPASS
PLOT [AUTO]
PASS NPASS

GO