System/Prescription Data

File : C:\tbida\zemax\dct\RC_D11\WFS_bench_paraxial.ZMX
Title:
Date : WED APR 28 2010

GENERAL LENS DATA:

```
Surfaces               :              34
Stop                   :               1
System Aperture        : Entrance Pupil Diameter = 19.4
Glass Catalogs         : SCHOTT
Ray Aiming             : Off
Apodization            : Uniform, factor =   0.00000E+000
Temperature (C)        :    2.00000E+001
Pressure (ATM)         :    1.00000E+000
 Adjust Index Data To Environment  : Off
Effective Focal Length  :        65.57146 (in air at system temperature and pressure)
Effective Focal Length  :        65.57146 (in image space)
Back Focal Length       :        4.613617
Total Track             :             480
Image Space F/#         :        3.379972
Paraxial Working F/#    :        3.379972
Working F/#             :        18.95081
Image Space NA          :       0.1463377
Object Space NA         :        9.7e-010
Stop Radius             :             9.7
Paraxial Image Height   :       0.3433345
Paraxial Magnification  :               0
Entrance Pupil Diameter :            19.4
Entrance Pupil Position :               0
Exit Pupil Diameter     :        4.948698
Exit Pupil Position     :        19.34008
Field Type              : Angle in degrees
Maximum Radial Field    :             0.3
Primary Wavelength      :            0.55 µm
Lens Units              :   Millimeters
Angular Magnification   :       -3.920224

Fields          : 3
Field Type: Angle in degrees
#        X-Value        Y-Value         Weight
 1       0.000000       0.000000       1.000000
 2       0.000000       0.100000       1.000000
 3       0.000000       0.300000       1.000000

Vignetting Factors
#       VDX       VDY       VCX       VCY       VAN
1  0.000000  0.000000  0.000000  0.000000  0.000000
2  0.000000  0.000000  0.000000  0.000000  0.000000
3  0.000000  0.000000  0.000000  0.000000  0.000000

Wavelengths     : 1
Units: µm
#          Value         Weight
 1       0.550000       1.000000
```

SURFACE DATA SUMMARY:

| Surf | Type | Radius | Thickness | Glass | Diameter | Conic | Comment |
|---|---|---|---|---|---|---|---|
| OBJ | STANDARD | Infinity | Infinity | | 0 | 0 | |
| STO | PARAXIAL | - | 240 | | 19.4 | - | |
| 2 | PARAXIAL | - | 0 | | 21.9133 | - | |
| 3 | COORDBRK | - | 240 | | - | - | |
| 4 | SZERNPHA | Infinity | 0 | MIRROR | 19.4 | 0 | DM |
| 5 | COORDBRK | - | -45 | | - | - | |
| 6 | COORDBRK | - | 0 | | - | - | |
| 7 | STANDARD | Infinity | 0 | MIRROR | 28.2501 | 0 | |
| 8 | COORDBRK | - | 45 | | - | - | |
| 9 | COORDBRK | - | 0 | | - | - | |
| 10 | STANDARD | Infinity | 0 | MIRROR | 28.92005 | 0 | |
| 11 | COORDBRK | - | -39.6971 | | - | - | |
| 12 | PARAXIAL | - | 0 | | 20.7582 | - | 011-1390 |
| 13 | COORDBRK | - | -120 | | - | - | |
| 14 | STANDARD | Infinity | -7 | | 1.256649 | 0 | TEL FOCUS |
| 15 | STANDARD | Infinity | -20 | N-BK7 | 20 | 0 | Beamsplitter |
| 16 | STANDARD | Infinity | -3.4 | N-BK7 | 20 | 0 | FL 011-1365 |
| 17 | STANDARD | 36.33 | -24.35517 | | 20 | 0 | |
| 18 | STANDARD | Infinity | -30 | | 7.076107 | 0 | |
| 19 | STANDARD | -32.13957 | -2 | N-KZFS11 | 20 | 0 | Coll 1 |
| 20 | STANDARD | -12 | -8 | N-FK51A | 20 | 0 | Coll 2 |
| 21 | STANDARD | 92.28585 | -4.401554 | | 20 | 0 | |
| 22 | STANDARD | Infinity | 0 | | 9.684744 | 0 | Pupil |
| 23 | USERSURF | -39.6 | -2 | N-BK7 | 9.684755 | 0 | 0768-86 S MLM |
| 24 | STANDARD | -46.71 | -12.517 | | 20 | 0 | OS 015-0147 |
| 25 | STANDARD | -19.04589 | -6.1 | N-FK51A | 19 | 0 | Cam 1 |
| 26 | STANDARD | 25.91594 | -5.419989 | | 19 | 0 | |
| 27 | STANDARD | 13.95997 | -2 | N-KZFS11 | 19 | 0 | Cam 2 |
| 28 | STANDARD | 19.93321 | -14.67273 | | 19 | 0 | |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 29 | STANDARD | 10.38 | -2 | N-BK7 | 12.7 | 0 | FF 015-0066 |
| 30 | STANDARD | Infinity | -2.5 | N-BK7 | 12.7 | 0 | Window |
| 31 | STANDARD | Infinity | -2 | | 30 | 0 | |
| 32 | COORDBRK | - | 0 | | - | - | |
| 33 | STANDARD | Infinity | 0 | | 6.656 | 0 | CCD67 |
| IMA | STANDARD | Infinity | | | 4.677429 | 0 | |

SURFACE DATA DETAIL:

```
Surface OBJ     : STANDARD
Surface STO     : PARAXIAL
 Focal length   :               120
 OPD Mode       :                 1
 Aperture       : Circular Obscuration
 Minimum Radius :                 0
 Maximum Radius :               3.3
Surface   2     : PARAXIAL
 Focal length   :               120
 OPD Mode       :                 1
Surface   3     : COORDBRK
 Decenter X     :                 0
 Decenter Y     :                 0
 Tilt About X   :                 0
 Tilt About Y   :                 0
 Tilt About Z   :                 0
 Order          : Decenter then tilt
Surface   4     : SZERNPHA DM
 Mirror Substrate : Curved, Thickness = 3.88000E-001
 Coating        : BEAMSPLIT
 Extrapolate?   : 0
 Number of terms:                11
 Maximum rad ap :                10
 Zernike Term  1:                 0
 Zernike Term  2:                 0
 Zernike Term  3:                 0
 Zernike Term  4:                 0
 Zernike Term  5:                 0
 Zernike Term  6:                 0
 Zernike Term  7:                 0
 Zernike Term  8:                 0
 Zernike Term  9:                 0
 Zernike Term 10:                 0
 Zernike Term 11:                 0
Surface   5     : COORDBRK
 Decenter X     :                 0
 Decenter Y     :                 0
 Tilt About X   :                 0
 Tilt About Y   :                 0
 Tilt About Z   :                 0
 Order          : Decenter then tilt
Surface   6     : COORDBRK
 Decenter X     :                 0
 Decenter Y     :                 0
 Tilt About X   :                45
 Tilt About Y   :                 0
 Tilt About Z   :                 0
 Order          : Decenter then tilt
Surface   7     : STANDARD
 Mirror Substrate : Curved, Thickness = 5.65002E-001
 Coating        : BEAMSPLIT
Surface   8     : COORDBRK
 Decenter X     :                 0
 Decenter Y     :                 0
 Tilt About X   :                45
 Tilt About Y   :                 0
 Tilt About Z   :                 0
 Order          : Decenter then tilt
Surface   9     : COORDBRK
 Decenter X     :                 0
 Decenter Y     :                 0
 Tilt About X   :               -45
 Tilt About Y   :                 0
 Tilt About Z   :                 0
 Order          : Decenter then tilt
Surface  10     : STANDARD
 Mirror Substrate : Curved, Thickness = 5.78401E-001
 Coating        : BEAMSPLIT
Surface  11     : COORDBRK
 Decenter X     :                 0
 Decenter Y     :                 0
 Tilt About X   :               -45
 Tilt About Y   :                 0
 Tilt About Z   :                 0
 Order          : Decenter then tilt
Surface  12     : PARAXIAL 011-1390
 Focal length   :               120
 OPD Mode       :                 1
Surface  13     : COORDBRK
 Decenter X     :                 0
 Decenter Y     :                 0
```

```
 Tilt About X   :               0
 Tilt About Y   :               0
 Tilt About Z   :               0
 Order          : Decenter then tilt
Surface  14     : STANDARD TEL FOCUS
Surface  15     : STANDARD Beamsplitter
 Aperture       : Rectangular Aperture
 X Half Width   :            10
 Y Half Width   :            10
Surface  16     : STANDARD FL 011-1365
Surface  17     : STANDARD
 Aperture       : Floating Aperture
 Maximum Radius :            10
Surface  18     : STANDARD
Surface  19     : STANDARD Coll 1
 Aperture       : Floating Aperture
 Maximum Radius :            10
Surface  20     : STANDARD Coll 2
 Aperture       : Floating Aperture
 Maximum Radius :            10
Surface  21     : STANDARD
 Aperture       : Floating Aperture
 Maximum Radius :            10
Surface  22     : STANDARD Pupil
Surface  23     : USERSURF (US_ARRAY.DLL) 0768-86 S MLM
        Number X:               32
        Number Y:               32
         Width X:            0.768
        Height Y:            0.768
Surface  24     : STANDARD OS 015-0147
 Aperture       : Floating Aperture
 Maximum Radius :            10
Surface  25     : STANDARD Cam 1
 Aperture       : Floating Aperture
 Maximum Radius :           9.5
Surface  26     : STANDARD
 Aperture       : Floating Aperture
 Maximum Radius :           9.5
Surface  27     : STANDARD Cam 2
 Aperture       : Floating Aperture
 Maximum Radius :           9.5
Surface  28     : STANDARD
 Aperture       : Floating Aperture
 Maximum Radius :           9.5
Surface  29     : STANDARD FF 015-0066
 Aperture       : Floating Aperture
 Maximum Radius :          6.35
Surface  30     : STANDARD Window
 Aperture       : Floating Aperture
 Maximum Radius :          6.35
Surface  31     : STANDARD
 Aperture       : Floating Aperture
 Maximum Radius :            15
Surface  32     : COORDBRK
 Decenter X     :               0
 Decenter Y     :               0
 Tilt About X   :               0
 Tilt About Y   :               0
 Tilt About Z   :               0
 Order          : Decenter then tilt
Surface  33     : STANDARD CCD67
 Aperture       : Rectangular Aperture
 X Half Width   :         3.328
 Y Half Width   :         3.328
Surface IMA     : STANDARD

COATING DEFINITIONS:

Coating Name: BEAMSPLIT (TABLE)


EDGE THICKNESS DATA:

Surf          X-Edge          Y-Edge
 STO     240.000000      240.000000
   2       0.000000        0.000000
   3     240.000000      240.000000
   4       0.000000        0.000000
   5     -45.000000      -45.000000
   6       0.000000        0.000000
   7       0.000000        0.000000
   8      45.000000       45.000000
   9       0.000000        0.000000
  10       0.000000        0.000000
  11     -39.697098      -39.697098
  12       0.000000        0.000000
  13    -120.000000     -120.000000
  14      -7.000000       -7.000000
  15     -20.000000      -20.000000
  16      -1.996622       -1.996622
```

| | | |
|---|---|---|
| 17 | -25.758545 | -25.758545 |
| 18 | -31.595308 | -31.595308 |
| 19 | -5.771443 | -5.771443 |
| 20 | -2.089855 | -2.089855 |
| 21 | -4.944949 | -4.944949 |
| 22 | -0.000694 | -0.000694 |
| 23 | -3.082296 | -3.082296 |
| 24 | -13.972451 | -13.972451 |
| 25 | -1.757566 | -1.757566 |
| 26 | -3.492929 | -3.492929 |
| 27 | -3.321624 | -3.321624 |
| 28 | -14.913240 | -14.913240 |
| 29 | -4.168916 | -4.168916 |
| 30 | -2.500000 | -2.500000 |
| 31 | -2.000000 | -2.000000 |
| 32 | 0.000000 | 0.000000 |
| 33 | 0.000000 | 0.000000 |
| IMA | 0.000000 | 0.000000 |

SOLVE AND VARIABLE DATA:

Parameter 3 Surf 5 : Solve, Pickup from surface 3 scaled by 1, offset by 0
Parameter 3 Surf 8 : Solve, Pickup from surface 6 scaled by 1, offset by 0
Thickness of 11 : Variable
Parameter 3 Surf 11 : Solve, Pickup from surface 9 scaled by 1, offset by 0
Semi Diameter 15 : Fixed
Semi Diameter 16 : Fixed
Semi Diameter 17 : Fixed
Semi Diameter 19 : Fixed
Semi Diameter 20 : Fixed
Semi Diameter 21 : Fixed
Semi Diameter 24 : Fixed
Semi Diameter 25 : Fixed
Semi Diameter 26 : Fixed
Semi Diameter 27 : Fixed
Semi Diameter 28 : Fixed
Semi Diameter 29 : Fixed
Semi Diameter 30 : Fixed
Semi Diameter 31 : Fixed
Semi Diameter 33 : Fixed

INDEX OF REFRACTION DATA:

System Temperature: 20.0000 Celsius
System Pressure : 1.0000 Atmospheres
Absolute air index: 1.000273 at wavelength 0.550000 µm
Index data is relative to air at the system temperature and pressure.
Wavelengths are measured in air at the system temperature and pressure.

| Surf | Glass | Temp | Pres | 0.550000 |
|---|---|---|---|---|
| 0 | | 20.00 | 1.00 | 1.00000000 |
| 1 | | 20.00 | 1.00 | 1.00000000 |
| 2 | | 20.00 | 1.00 | 1.00000000 |
| 3 | <CRD BRK> | | | 1.00000000 |
| 4 | MIRROR | 20.00 | 1.00 | 1.00000000 |
| 5 | <CRD BRK> | | | 1.00000000 |
| 6 | <CRD BRK> | | | 1.00000000 |
| 7 | MIRROR | 20.00 | 1.00 | 1.00000000 |
| 8 | <CRD BRK> | | | 1.00000000 |
| 9 | <CRD BRK> | | | 1.00000000 |
| 10 | MIRROR | 20.00 | 1.00 | 1.00000000 |
| 11 | <CRD BRK> | | | 1.00000000 |
| 12 | | 20.00 | 1.00 | 1.00000000 |
| 13 | <CRD BRK> | | | 1.00000000 |
| 14 | | 20.00 | 1.00 | 1.00000000 |
| 15 | N-BK7 | 20.00 | 1.00 | 1.51852239 |
| 16 | N-BK7 | 20.00 | 1.00 | 1.51852239 |
| 17 | | 20.00 | 1.00 | 1.00000000 |
| 18 | | 20.00 | 1.00 | 1.00000000 |
| 19 | N-KZFS11 | 20.00 | 1.00 | 1.64095082 |
| 20 | N-FK51A | 20.00 | 1.00 | 1.48779356 |
| 21 | | 20.00 | 1.00 | 1.00000000 |
| 22 | | 20.00 | 1.00 | 1.00000000 |
| 23 | N-BK7 | 20.00 | 1.00 | 1.51852239 |
| 24 | | 20.00 | 1.00 | 1.00000000 |
| 25 | N-FK51A | 20.00 | 1.00 | 1.48779356 |
| 26 | | 20.00 | 1.00 | 1.00000000 |
| 27 | N-KZFS11 | 20.00 | 1.00 | 1.64095082 |
| 28 | | 20.00 | 1.00 | 1.00000000 |
| 29 | N-BK7 | 20.00 | 1.00 | 1.51852239 |
| 30 | N-BK7 | 20.00 | 1.00 | 1.51852239 |
| 31 | | 20.00 | 1.00 | 1.00000000 |
| 32 | <CRD BRK> | | | 1.00000000 |
| 33 | | 20.00 | 1.00 | 1.00000000 |
| 34 | | 20.00 | 1.00 | 1.00000000 |

THERMAL COEFFICIENT OF EXPANSION DATA:

| Surf | Glass | TCE *10E-6 |
|---|---|---|
| 0 | | 0.00000000 |

| | | |
|---|---|---|
| 1 | | 0.00000000 |
| 2 | | 0.00000000 |
| 3 | <CRD BRK> | 0.00000000 |
| 4 | MIRROR | 0.00000000 |
| 5 | <CRD BRK> | 0.00000000 |
| 6 | <CRD BRK> | 0.00000000 |
| 7 | MIRROR | 0.00000000 |
| 8 | <CRD BRK> | 0.00000000 |
| 9 | <CRD BRK> | 0.00000000 |
| 10 | MIRROR | 0.00000000 |
| 11 | <CRD BRK> | 0.00000000 |
| 12 | | 0.00000000 |
| 13 | <CRD BRK> | 0.00000000 |
| 14 | | 0.00000000 |
| 15 | N-BK7 | 7.10000000 |
| 16 | N-BK7 | 7.10000000 |
| 17 | | 0.00000000 |
| 18 | | 0.00000000 |
| 19 | N-KZFS11 | 6.56000000 |
| 20 | N-FK51A | 12.74000000 |
| 21 | | 0.00000000 |
| 22 | | 0.00000000 |
| 23 | N-BK7 | 7.10000000 |
| 24 | | 0.00000000 |
| 25 | N-FK51A | 12.74000000 |
| 26 | | 0.00000000 |
| 27 | N-KZFS11 | 6.56000000 |
| 28 | | 0.00000000 |
| 29 | N-BK7 | 7.10000000 |
| 30 | N-BK7 | 7.10000000 |
| 31 | | 0.00000000 |
| 32 | <CRD BRK> | 0.00000000 |
| 33 | | 0.00000000 |
| 34 | | 0.00000000 |

GLOBAL VERTEX COORDINATES, ORIENTATIONS, AND ROTATION/OFFSET MATRICES:

Reference Surface: 1

| Surf | R11 | R12 | R13 | X | |
|---|---|---|---|---|---|
| | R21 | R22 | R23 | Y | |
| | R31 | R32 | R33 | Z | |
| 1 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 1.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.0000000000 | 1.0000000000 | 0.000000000E+000 | |
| 2 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 1.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.0000000000 | 1.0000000000 | 2.400000000E+002 | |
| 3 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 1.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.0000000000 | 1.0000000000 | 2.400000000E+002 | |
| 4 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | DM |
| | 0.0000000000 | 1.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.0000000000 | 1.0000000000 | 4.800000000E+002 | |
| 5 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 1.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.0000000000 | 1.0000000000 | 4.800000000E+002 | |
| 6 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.7071067812 | -0.7071067812 | 0.000000000E+000 | |
| | 0.0000000000 | 0.7071067812 | 0.7071067812 | 4.350000000E+002 | |
| 7 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.7071067812 | -0.7071067812 | 0.000000000E+000 | |
| | 0.0000000000 | 0.7071067812 | 0.7071067812 | 4.350000000E+002 | |
| 8 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.0000000000 | -1.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 1.0000000000 | 0.0000000000 | 4.350000000E+002 | |
| 9 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.7071067812 | -0.7071067812 | -4.500000000E+001 | |
| | 0.0000000000 | 0.7071067812 | 0.7071067812 | 4.350000000E+002 | |
| 10 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 0.7071067812 | -0.7071067812 | -4.500000000E+001 | |
| | 0.0000000000 | 0.7071067812 | 0.7071067812 | 4.350000000E+002 | |
| 11 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | |
| | 0.0000000000 | 1.0000000000 | 0.0000000000 | -4.500000000E+001 | |
| | 0.0000000000 | 0.0000000000 | 1.0000000000 | 4.350000000E+002 | |
| 12 | 1.0000000000 | 0.0000000000 | 0.0000000000 | 0.000000000E+000 | 011-1390 |
| | 0.0000000000 | 1.0000000000 | 0.0000000000 | -4.500000000E+001 | |
| | 0.0000000000 | 0.0000000000 | 1.0000000000 | 3.953029022E+002 | |

```
13   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  3.953029022E+002

14   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 TEL FOCUS
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  2.753029022E+002

15   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 Beamsplitter
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  2.683029022E+002

16   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 FL 011-1365
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  2.483029022E+002

17   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  2.449029022E+002

18   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  2.205477355E+002

19   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 Coll 1
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.905477355E+002

20   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 Coll 2
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.885477355E+002

21   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.805477355E+002

22   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 Pupil
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.761461815E+002

23   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 0768-86 S MLM
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.761461815E+002

24   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 OS 015-0147
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.741461815E+002

25   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 Cam 1
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.616291815E+002

26   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.555291815E+002

27   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 Cam 2
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.501091921E+002

28   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.481091921E+002

29   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 FF 015-0066
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.334364658E+002

30   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 Window
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.314364658E+002

31   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.289364658E+002

32   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.269364658E+002

33   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000 CCD67
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.269364658E+002

34   1.0000000000   0.0000000000   0.0000000000  0.000000000E+000
     0.0000000000   1.0000000000   0.0000000000 -4.500000000E+001
     0.0000000000   0.0000000000   1.0000000000  1.269364658E+002
```

GLOBAL SURFACE CENTER OF CURVATURE POINTS:

Reference Surface: 1

| Surf | X | Y | Z | |
|---|---|---|---|---|
| 1 | - | - | - | |
| 2 | - | - | - | |
| 3 | - | - | - | |
| 4 | - | - | - | DM |
| 5 | - | - | - | |
| 6 | - | - | - | |
| 7 | - | - | - | |
| 8 | - | - | - | |
| 9 | - | - | - | |
| 10 | - | - | - | |
| 11 | - | - | - | |
| 12 | - | - | - | 011-1390 |
| 13 | - | - | - | |
| 14 | - | - | - | TEL FOCUS |
| 15 | - | - | - | Beamsplitter |
| 16 | - | - | - | FL 011-1365 |
| 17 | 0.0000000000 | -45.0000000000 | 281.2329022018 | |
| 18 | - | - | - | |
| 19 | 0.0000000000 | -45.0000000000 | 158.4081676357 | Coll 1 |
| 20 | 0.0000000000 | -45.0000000000 | 176.5477355308 | Coll 2 |
| 21 | 0.0000000000 | -45.0000000000 | 272.8335886484 | |
| 22 | - | - | - | Pupil |
| 23 | 0.0000000000 | -45.0000000000 | 136.5461814643 | 0768-86 S MLM |
| 24 | 0.0000000000 | -45.0000000000 | 127.4361814643 | OS 015-0147 |
| 25 | 0.0000000000 | -45.0000000000 | 142.5832949100 | Cam 1 |
| 26 | 0.0000000000 | -45.0000000000 | 181.4451249694 | |
| 27 | 0.0000000000 | -45.0000000000 | 164.0691574048 | Cam 2 |
| 28 | 0.0000000000 | -45.0000000000 | 168.0424064440 | |
| 29 | 0.0000000000 | -45.0000000000 | 143.8164657570 | FF 015-0066 |
| 30 | - | - | - | Window |
| 31 | - | - | - | |
| 32 | - | - | - | |
| 33 | - | - | - | CCD67 |
| 34 | - | - | - | |

ELEMENT VOLUME DATA:

For centered elements with plane or spherical circular faces, exact volumes are computed by assuming edges are squared up to the larger of the front and back radial aperture.

For all other elements, approximate volumes are numerically integrated to 0.1% accuracy. Zero volume means the volume cannot be accurately computed.

Single elements that are duplicated in the Lens Data Editor for ray tracing purposes may be listed more than once yielding incorrect total mass estimates.

| | Volume cc | Density g/cc | Mass g |
|---|---|---|---|
| Element surf 15 to 16 | 0.000000 | 2.510000 | 0.000000 |
| Element surf 16 to 17 | 0.849147 | 2.510000 | 2.131358 |
| Element surf 19 to 20 | 1.141927 | 3.196000 | 3.649598 |
| Element surf 20 to 21 | 1.665929 | 3.675000 | 6.122289 |
| Element surf 23 to 24 | 0.439193 | 2.510000 | 1.102375 |
| Element surf 25 to 26 | 1.125561 | 3.675000 | 4.136438 |
| Element surf 27 to 28 | 0.734545 | 3.196000 | 2.347607 |
| Element surf 29 to 30 | 0.385387 | 2.510000 | 0.967322 |
| Element surf 30 to 31 | 1.767146 | 2.510000 | 4.435536 |
| Total Mass: | | | 24.892523 |

F/# DATA:

F/# calculations consider vignetting factors and ignore surface apertures.

Wavelength: 0.550000

| # | Field | Tan | Sag |
|---|---|---|---|
| 1 | 0.0000, 0.0000 deg: | 18.9508 | 18.9508 |
| 2 | 0.0000, 0.1000 deg: | 18.9558 | 18.9523 |
| 3 | 0.0000, 0.3000 deg: | 18.9959 | 18.9642 |

CARDINAL POINTS:

Object space positions are measured with respect to surface 1.
Image space positions are measured with respect to the image surface.
The index in both the object space and image space is considered.

| | Object Space | Image Space |
|---|---|---|
| W = 0.550000 (Primary) | | |
| Focal Length : | -65.571457 | -65.571457 |
| Focal Planes : | -257.054770 | 2.613617 |
| Principal Planes : | -191.483313 | 68.185074 |
| Anti-Principal Planes : | -322.626228 | -62.957841 |
| Nodal Planes : | -322.626228 | -62.957841 |
| Anti-Nodal Planes : | -191.483313 | 68.185074 |

PHYSICAL OPTICS PROPAGATION SETTINGS SUMMARY:

OBJ STANDARD
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

STO PARAXIAL
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

2 PARAXIAL
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

3 COORDBRK
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

4 SZERNPHA DM
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

5 COORDBRK
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

6 COORDBRK
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

7 STANDARD
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

8 COORDBRK
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

9 COORDBRK
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

10 STANDARD
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

11 COORDBRK
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

12 PARAXIAL 011-1390
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

13 COORDBRK
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off
Use Angular Spectrum Propagator : Off
Output Pilot Radius : Best Fit

14 STANDARD TEL FOCUS
Use Rays To Propagate To Next Surface : Off
Recompute Pilot Beam : Off
Do Not Rescale Beam Size Using Ray Data: Off

```
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
15 STANDARD         Beamsplitter
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
16 STANDARD          FL 011-1365
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
17 STANDARD
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
18 STANDARD
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
19 STANDARD              Coll 1
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
20 STANDARD              Coll 2
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
21 STANDARD
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
22 STANDARD               Pupil
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
23 USERSURF        0768-86 S MLM
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
24 STANDARD          OS 015-0147
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
25 STANDARD               Cam 1
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
26 STANDARD
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
27 STANDARD               Cam 2
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
28 STANDARD
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
  Use Angular Spectrum Propagator        : Off
  Output Pilot Radius                    : Best Fit
29 STANDARD          FF 015-0066
  Use Rays To Propagate To Next Surface  : Off
  Recompute Pilot Beam                   : Off
  Do Not Rescale Beam Size Using Ray Data: Off
```

```
    Use Angular Spectrum Propagator        : Off
    Output Pilot Radius                    : Best Fit
  30 STANDARD               Window
    Use Rays To Propagate To Next Surface  : Off
    Recompute Pilot Beam                   : Off
    Do Not Rescale Beam Size Using Ray Data: Off
    Use Angular Spectrum Propagator        : Off
    Output Pilot Radius                    : Best Fit
  31 STANDARD
    Use Rays To Propagate To Next Surface  : Off
    Recompute Pilot Beam                   : Off
    Do Not Rescale Beam Size Using Ray Data: Off
    Use Angular Spectrum Propagator        : Off
    Output Pilot Radius                    : Best Fit
  32 COORDBRK
    Use Rays To Propagate To Next Surface  : Off
    Recompute Pilot Beam                   : Off
    Do Not Rescale Beam Size Using Ray Data: Off
    Use Angular Spectrum Propagator        : Off
    Output Pilot Radius                    : Best Fit
  33 STANDARD               CCD67
    Use Rays To Propagate To Next Surface  : Off
    Recompute Pilot Beam                   : Off
    Do Not Rescale Beam Size Using Ray Data: Off
    Use Angular Spectrum Propagator        : Off
    Output Pilot Radius                    : Best Fit
 IMA STANDARD
    Use Rays To Propagate To Next Surface  : Off
    Recompute Pilot Beam                   : Off
    Do Not Rescale Beam Size Using Ray Data: Off
    Use Angular Spectrum Propagator        : Off
    Output Pilot Radius                    : Best Fit

FILES USED:

ZEMAX File
  C:\TBIDA\ZEMAX\DCT\RC_D11\WFS_BENCH_PARAXIAL.ZMX
Session File
  C:\TBIDA\ZEMAX\DCT\RC_D11\WFS_BENCH_PARAXIAL.SES
Glass Catalogs
  C:\PROGRAM FILES\ZEMAX\GLASSCAT\SCHOTT.AGF
Coating Data
  C:\PROGRAM FILES\ZEMAX\COATINGS\COATING.DAT
Surface DLL's
  C:\PROGRAM FILES\ZEMAX\DLL\US_ARRAY.DLL
```