

FIRST - SPIRE
Optical design configuration control file
SPECTROMETER

LAM.PJT.SPI.???.200100x Ind. 01

Date: 14 march 2001

SPIRE-LAM-PRJ-000641

Calculations based on identification numbers:

VertexCalc!IDup	(BOLSP501G)
VertexCalc!IDlo	(BOLSP501F_LO)
GutCalc!IDup	(BOLSP501E)
GutCalc!IDlo	(BOLSP501F_LO)
M3Cent	(BOLPHT154C)
M5Cent	(BOLPHT154C)

The configuration control file takes data generated by the SYNOPSIS raytracing program and calculates data concerning:

- Gut ray impacts on the optical surfaces
- Interface points for each mirror in the instrument coordinate system
- Interface points in the local surface coordinates

It also transforms the left handed system used by SYNOPSIS into a right handed one and transforms the labels of the axis to be compatible with the instrument standard:

<i>SPIRE</i>	<i>SYNO</i>	<i>LOCAL</i>	<i>Directions</i>
X	-Zsyno	Norm	Tow. tel
Y	Xsyno	Sag	Tow. Spectro
Z	Ysyno	Tang	Tow. PAX

Contents:

The file contains the following spreadsheets:

Introduction: This sheet.

History: Evolution history of the file

Theory:

Variables: List of variables

Final results:

GutRayImpacts: Coordinates of gut ray impacts on each surface

Interfaces: Coordinates defining mirror interfaces in global coordinates

SurfDef: Coordinates defining mirror interfaces in local coordinates

Intermediate calculations:

GutCalc: Calculating surface normal vectors at gut ray impacts

M3CentCalc: Calculating surface normal vectors at centre of M3

M5CentCalc: Calculating surface normal vectors at centre of M5

VertexCalc: Transform vertex data into instrument coordinates

VerticesSyno: Read vertex data from SYNO output and calculate local axes

RayImpacts: Transform ray impact data into instrument coordinates

RayImpactsSyno: Read ray impact data from SYNO output

SYNOPSIS outputs:

SpecGlobUp: System listing with surface data in global coordinates and Euler angles, upper arm (BOLSPECGLOB01.MAC)

SpecGlobLo: System listing with surface data in global coordinates and Euler angles, lower arm (BOLSPECGLOB01.MAC)

GutRayUp: Ray impacts for gut ray in global coordinates, upper arm (BOLGUTGLOB01.MAC)

GutRayLo: Ray impacts for gut ray in global coordinates, lower arm (BOLGUTGLOB01.MAC)

M3CentRay: Ray impacts for ray centred on M3 in global coordinates (BOLGUTGLOB02.MAC)

M5CentRay: Ray impacts for ray centred on M5 in global coordinates (BOLGUTGLOB02.MAC)

Filename	Date	Comments
SPIREconfig01	210700	
SPIREconfig02	240800	Corrected error in jumping from detector back to dichroic. Added dummy for normal on primary. Corrected sign of normals (norm = ray out - ray in).
SPIREconfig03	240800	Reviewed 'comments' sheet.
SPIREconfigPhot03	10900	Separate file for Phot and Spec
SPIREconfigPhot10	171000	Spigot axes calculated. Transformation to IID-B ("MSSL") coordinates.
SPIREconfigPhot11		
SPIREconfigPhot12	141100	Corrected Euler calculations, dowls added
SPIREconfigPhot13		
SPIREconfigPhot20	160101	Entirely renovated. Error in dowl calculation eliminated.
SPIREconfigSpec20	140301	Spectrometer data
SPIREconfigSpec21	200301	CM5 interface erroneously calculated. Calculated in photometer file so not needed in spectrometer file. Increased accuracy in interface output.
SPIREconfigSpec22	210301	SM6 and SM7 rotated 90 degrees
SPIREconfigSpec23	210301	SM8B added by simple reflection through Y-Z plane containing SBS 1 and 2
SPIREconfigSpec24	230301	Correct spigot direction (modify automatic sign calculation) and dowl direction (add flag).
SPIREconfigSpec25	20401	Corrected computation of SM8B interfaces

Theory

Contents

1. Surface orientation from Euler angles
2. Surface normal vectors from ray impact data
3. Surface sagittal vectors
4. Interface data in global coordinates
5. Interface data in local coordinates

1. Surface orientation from Euler angles

The listing of surface data in global coordinates give coordinates for each surface vertex and the Euler angles (in degrees with 5 significant decimals, ie a precision of 1e-5 deg) defining the orientation of the surface in space. These are used to calculate interface data for all mirrors except CM3 and CM5, see sec. 2 and 3.

The global coordinate system used by SYNOPSIS is left-handed and has its origin at the telescope focal point, ie 202mm above the SPIRE origin. The Z-axis is along the telescope axis, pointing away from the telescope, the Y-axis is in the plane of the photometer, pointing towards PAX, the X-axis is perpendicular to the plane of the photometer, pointing towards the spectrometer, see table.

X	-Zsyno	Norm	Tow. tel
Y	Xsyno	Sag	Tow. Spectro
Z	Ysyno	Tang	Tow. PAX

Euler angles aEuler, bEuler, cEuler represent consecutive rotations about the X, Y, and Z axes, respectively, in a counter-clockwise direction. The resulting coordinate system representing local surface coordinates are named Sag, Tang, and Norm, respectively. Norm is along the surface axis, Tan is in general in the plane of the system and Sag is in general pointing towards the optical bench. For centred surfaces, Norm defines the spigot axis and Sag defines the dowl location.

The local axes are produced by the following:

$$\begin{aligned}
 & \begin{bmatrix} ySag & yTan & yNorm \\ zSag & zTan & zNorm \\ -xSag & -xTan & -xNorm \end{bmatrix}_{SPIRE} \\
 &= \begin{bmatrix} xSag & xTan & xNorm \\ ySag & yTan & yNorm \\ zSag & zTan & zNorm \end{bmatrix}_{SYNOPSIS} \\
 &= \begin{bmatrix} 1 & 0 & 0 \\ 0 & \cos a & \sin a \\ 0 & -\sin a & \cos a \end{bmatrix} \begin{bmatrix} \cos b & 0 & -\sin b \\ 0 & 1 & 0 \\ \sin b & 0 & \cos b \end{bmatrix} \begin{bmatrix} \cos c & \sin c & 0 \\ -\sin c & \cos c & 0 \\ 0 & 0 & 1 \end{bmatrix} \\
 &= \begin{bmatrix} \cos b \cos c & \cos b \sin c & -\sin b \\ \sin a \cos b \cos c - \cos a \sin b \cos c + \sin a \sin b \sin c & \sin a \cos b \sin c + \cos a \sin b \sin c - \sin a \cos c & \sin a \cos b \\ \cos a \sin b \cos c + \sin a \cos b \cos c & \cos a \sin b \sin c - \sin a \cos c & \cos a \cos b \end{bmatrix}
 \end{aligned}$$

2. Surface normal vectors from ray impact data

For each component (i) the direction cosines of the exiting ray vector is calculated by normalizing the difference between ray impact coordinates on surfaces i and i+1:

$$\mathbf{r}_i = \frac{\mathbf{P}_{i+1} - \mathbf{P}_i}{|\mathbf{P}_{i+1} - \mathbf{P}_i|}$$

For reflecting surfaces, the local normal is obtained as the normalized difference between incident and reflected rays:

$$\mathbf{n}_i = \frac{\mathbf{r}_i - \mathbf{r}_{i-1}}{|\mathbf{r}_i - \mathbf{r}_{i-1}|}$$

3. Surface sagittal vectors

For centred surfaces, the spigot axis intercepts the optical surface at the surface vertex point, which is also coincident with the gut ray impact point. Two surfaces are not of this type:

CM3: This mirror is an off-axis asphere, ie its surface vertex does not coincide with the gut ray impact point. Also, since the mirror is common for photometer and spectrometer, its aperture is not symmetrical about the photometer gut ray impact point, and so the spigot, which is located near the centre of gravity of the mirror, does not intercept the surface in the gut ray impact point.

CM5: This mirror is common for photometer and spectrometer, its aperture is therefore not symmetrical about the photometer gut ray impact point, and so the spigot, which is located near the centre of gravity of the mirror, does not intercept the surface in the gut ray impact point.

For each of these surfaces a separate ray is traced for which the sky coordinates are chosen so as to impact the mirror surface at the spigot axis interception point. Local normal vectors are calculated as above and used to define the spigot vectors for these mirrors.

The local Sag vector (required to define the dowl position) is calculated by rotating the Sag vector at the vertex through an angle Theta in the X-Y plane:

$$\begin{aligned} X_{sag} &= \text{VertexCalc!Xsag} \cdot \text{COS}(\text{Theta}) - \text{VertexCalc!Ysag} \cdot \text{SIN}(\text{Theta}) \\ Y_{sag} &= \text{VertexCalc!Xsag} \cdot \text{SIN}(\text{Theta}) + \text{VertexCalc!Ysag} \cdot \text{COS}(\text{Theta}) \\ Z_{sag} &= \text{VertexCalc!Zsag} \end{aligned}$$

Theta is the angle between the projections onto the X-Y plane of the spigot vector and the vertex normal vector:

$$\begin{aligned} \text{Theta} &= \text{ACOS}((X_{\text{norm}} * \text{VertexCalc!Xnorm} + Y_{\text{norm}} * \text{VertexCalc!Ynorm}) \\ &\quad / ((\text{RACINE}(X_{\text{norm}}^2 + Y_{\text{norm}}^2) * \text{RACINE}(\text{VertexCalc!Xnorm}^2 + \text{VertexCalc!Ynorm}^2))) \\ &\quad * \text{SIGNE}(X_{\text{norm}} * Y_{\text{norm}})) \end{aligned}$$

where the SIGNE function provides the correct sign of Theta.

4 Interface data in global coordinates

For each mirror, the following are given in the global instrument coordinate system:

(Xmirr, Ymirr, Zmirr): coordinates of the intersection point between the spigot axis and the optical surface

(Xnorm, Ynorm, Znorm): direction cosines of the spigot axis

(Xspig, Yspig, Zspig): coordinates of a second point along the spigot axis

(Xsag, Ysag, Zsag): direction cosines of the sag vector, pointing towards the dowl

(Xdowl, Ydowl, Zdowl): coordinates of a point along the sag vector

5. Interface data in local coordinates

For each mirror, the interface vectors listed above are also given in terms of local coordinates for each optical surface, whose origin is at the surface vertex and whose axes are aligned with the vertex normal. For the spigot interception points, this requires a transformation involving translation and rotation, expressed as:

$$\begin{aligned} X_{\text{mirr}} &= \text{VertexCalc!Xnorm} * (\text{Interfaces!Xmirr} - \text{VertexCalc!Xmirr}) \\ &\quad + \text{VertexCalc!Ynorm} * (\text{Interfaces!Ymirr} - \text{VertexCalc!Ymirr}) \\ &\quad + \text{VertexCalc!Znorm} * (\text{Interfaces!Zmirr} - \text{VertexCalc!Zmirr}) \\ Y_{\text{mirr}} &= \text{VertexCalc!Xsag} * (\text{Interfaces!Xmirr} - \text{VertexCalc!Xmirr}) \\ &\quad + \text{VertexCalc!Ysag} * (\text{Interfaces!Ymirr} - \text{VertexCalc!Ymirr}) \\ &\quad + \text{VertexCalc!Zsag} * (\text{Interfaces!Zmirr} - \text{VertexCalc!Zmirr}) \\ Z_{\text{mirr}} &= \text{VertexCalc!Xtang} * (\text{Interfaces!Xmirr} - \text{VertexCalc!Xmirr}) \\ &\quad + \text{VertexCalc!Ytang} * (\text{Interfaces!Ymirr} - \text{VertexCalc!Ymirr}) \\ &\quad + \text{VertexCalc!Ztang} * (\text{Interfaces!Zmirr} - \text{VertexCalc!Zmirr}) \end{aligned}$$

For the direction cosines for the Norm (spigot) and Sag (dowl) vectors, the transformation only involves rotation:

$$\begin{aligned} X_{\text{norm}} &= \text{VertexCalc!Xnorm} * \text{Interfaces!Xnorm} + \text{VertexCalc!Ynorm} * \text{Interfaces!Ynorm} \\ &\quad + \text{VertexCalc!Znorm} * \text{Interfaces!Znorm} \\ Y_{\text{norm}} &= \text{VertexCalc!Xsag} * \text{Interfaces!Xnorm} + \text{VertexCalc!Ysag} * \text{Interfaces!Ynorm} \\ &\quad + \text{VertexCalc!Zsag} * \text{Interfaces!Znorm} \\ Z_{\text{norm}} &= \text{VertexCalc!Xtang} * \text{Interfaces!Xnorm} + \text{VertexCalc!Ytang} * \text{Interfaces!Ynorm} \\ &\quad + \text{VertexCalc!Ztang} * \text{Interfaces!Znorm} \end{aligned}$$

Name	Description
ID	System identification number
IDup	
IDlo	
SystemPart	
CompName	
Flag	
SurfNum	
Line	
Ray	
SpigLength	Distance to spigot point
DowlSep	Distance to dowl point
Theta	Angle between surface vertex normal and spigot axis
UpFlag	Direction of exiting ray, 1 for +X
LeftHandCorr	Factor applied to Zspire to transform LHS to RHS
NormDirCorr	Factor applied to VertexNormal to point it up (+X)
NormDir	Automatically determined normal direction factor
DowlDir	Manually entered factor (+/-1) to determine dowl direction (gen tow bench)
Xgut	Gut ray impact coordinates
Ygut	
Zgut	
XM3cent	Ray centred on M3, impact coordinates
YM3cent	
ZM3cent	
XM5cent	Ray centred on M5, impact coordinates
YM5cent	
ZM5cent	
aEuler	Surface orientation Euler angles
bEuler	
cEuler	
Xaxis	Surface vertex axis direction vector
Yaxis	
Zaxis	
Xtang	Surface vertex tangential vector
Ytang	
Ztang	
Xsag	Surface vertex sagittal vector
Ysag	
Zsag	
Xmirr	Mirror surface coordinate
Ymirr	
Zmirr	
Xnorm	Mirror normal vector (spigot vector)
Ynorm	
Znorm	
Xspig	Point along spigot vector
Yspig	
Zspig	
XsagM	Mirror sagittal vector (pointing towards dowl)
YsagM	
ZsagM	
Xdowl	Point in direction of dowl
Ydowl	
Zdowl	
Line0	Line of first surface in listing
Line0Up	
Line0Lo	
Xcol	Column of each coordinate in listing
Ycol	
Zcol	
X0	Offset of SPIRE origin with respect to Synopsys origin
Y0	
Z0	
Xdiff	Difference between ray impact coordinates
Ydiff	
Zdiff	
DiffMod	Modulo of difference vector
Xray	Unit ray vector
Yray	
Zray	
dXray	Difference between unit ray vectors
dYray	
dZray	
dRayMod	Modulo of difference vector
SBS1	Components in upper arm
SM9A	
SCCA1	
SCCA2	
SCCA3	
SM10A	
SBS2	
SM11A	
SM12A	
SSW	
Arm	Designates upper or lower spectrometer arm raytrace data

SystemPart	CompName	Flag	Xgut	Ygut	Zgut
	Dummy	Ignore			
Telescope	M1		1252.785	36.849	54.804
	M2		2840.131	0.000	0.000
Common optics	CFP	Hole	241.660	-60.321	-89.713
	CM3		136.531	-62.761	-93.343
	CM4		316.038	0.230	-200.363
	CM5		125.121	58.002	-183.379
Spectrometer optics	SM6		306.147	33.819	-263.978
	SCS	Hole	314.984	141.696	-233.044
	SM7		317.372	170.859	-224.681
	SM8A		373.504	170.860	-234.579
Upper arm	SBS1		223.128	170.857	-321.398
	SM9A		373.124	170.854	-407.997
	SCCA1		248.124	170.855	-407.998
	SCCA2		248.127	170.859	-457.999
	SCCA3		248.124	170.855	-457.996
	SM10A		373.123	170.859	-457.998
	SBS2		223.128	170.856	-544.598
	SM11A		354.746	170.854	-620.587
	SM12A		263.584	170.855	-636.663
	SSW	Det	263.583	250.857	-636.664
	SM8A	Ignore			
Lower arm	SBS1	Hole	223.128	170.857	-321.398
	SM9B		73.132	170.854	-407.997
	SCCB1		198.132	170.855	-407.998
	SCCB2		198.129	170.859	-457.999
	SCCB3		198.132	170.855	-457.996
	SM10B		73.132	170.859	-457.998
	SBS2		223.128	170.856	-544.598
	SM11B		91.509	170.854	-620.587
	SM12B		182.672	170.855	-636.663
	SLW	Det	182.673	250.857	-636.664

Axis directions:

X	-Zsyno	Tow. tel
Y	Xsyno	Tow. Spectro
Z	Ysyno	Tow. PAX

SystemPart	CompName	Arm	DowlDir	Flag	Xmirr	Ymirr	Zmirr	Xnorm	Ynorm	Znorm	Xspig	Yspig	Zspig	Xsug	Ysug	Zsug	Xdowl	Ydowl	Zdowl	Check
Telescope	Dummy	Up		Ignore																
	M1	Up		Ignore																
	M2	Up		Ignore																
	CTP	Up		Ignore																
	CM3	Up	1	Ignore																
Common optics	CM4	Up	1	Ignore																
	CM5	Up	1	Ignore																
	SM5	Up	1	Vertex	306.150668	33.820000	-263.975222	-0.544804	0.709952	0.446270	306.695472	33.110048	-264.421492	0.377416	0.682830	-0.625539	306.528084	34.502830	-264.600761	90
	SCS	Up		Hole																
	SM7	Up	-1	Vertex	317.370319	170.856678	-224.680587	0.650560	-0.687862	-0.321895	316.719759	171.544540	-224.358692	0.314669	0.629897	-0.710080	317.056650	170.226781	-223.970507	90
	SM8A	Up	-1	Vertex	373.504361	170.856678	-234.578533	-0.984808	0.000000	-0.173648	374.489169	170.856678	-234.404885	0.018814	0.994113	-0.106700	373.485547	169.862565	-234.471833	90
	SRS1	Up		Ignore																
	SM9A	Up	-1	Vertex	373.123310	170.856678	-407.998533	-0.965926	0.000000	0.258819	374.089236	170.856678	-408.257352	0.000000	1.000000	0.000000	373.123310	169.856678	-407.998533	90
	SCCA1	Up		Ignore																
	Upper arm	SCCA2	Up		Ignore															
SCCA3		Up		Ignore																
SM10A		Up	-1	Vertex	373.123310	170.856678	-457.998533	-0.965926	0.000000	-0.258819	374.089236	170.856678	-457.739714	0.000000	1.000000	0.000000	373.123310	169.856678	-457.998533	90
SBS2		Up		Ignore																
SM11A		Up	-1	Vertex	354.746250	170.856678	-620.588533	-0.984808	0.000000	0.173648	355.731058	170.856678	-620.762181	0.005424	0.999512	0.030762	354.740826	169.857166	-620.619295	90
SM12A		Up	-1	Vertex	263.582597	170.856678	-636.663145	0.696364	0.707107	0.122788	263.886233	170.149571	-636.785933	-0.696364	0.707107	-0.122788	264.278961	170.149571	-636.540357	90
SSW		Up		Det																
SLW		Up		Det																
SM8A		Lo		Ignore																
Lower arm		SRS1	Lo		Hole															
	SM9B	Lo	-1	Vertex	73.132110	170.856678	-407.998533	0.965926	0.000000	0.258819	72.166184	170.856678	-408.257352	0.000000	1.000000	0.000000	73.132110	169.856678	-407.998533	90
	SCCB1	Lo		Ignore																
	SCCB2	Lo		Ignore																
	SCCB3	Lo		Ignore																
	SM10B	Lo	-1	Vertex	73.132110	170.856678	-457.998533	0.965926	0.000000	-0.258819	72.166184	170.856678	-457.739714	0.000000	1.000000	0.000000	73.132110	169.856678	-457.998533	90
	SBS2	Lo		Ignore																
	SM11B	Lo	-1	Vertex	91.509169	170.856678	-620.588533	0.984808	0.000000	0.173648	90.524361	170.856678	-620.762181	-0.005424	0.999512	0.030762	91.514593	169.857166	-620.619295	90
	SM12B	Lo	-1	Vertex	182.672823	170.856678	-636.663145	-0.696364	0.707107	0.122788	183.369187	170.149571	-636.785933	0.696364	0.707107	-0.122788	181.976459	170.149571	-636.540357	90
	SLW	Lo		Det																
Ref Arm	SM8B	Lo		Ignore	72.751059	170.856678	-234.578533	0.984808	0.000000	-0.173648	71.766251	170.856678	-234.404885	-0.018814	0.994113	-0.106700	72.769873	169.862565	-234.471833	90

Axis directions:

X -Zsyno Tow, tel
 Y Xsyno Tow, Spectro
 Z Ysyno Tow, PAX

SHIRE

X SYNO LOCAL
 Y -Zsyno Tow, tel
 Z Xsyno Sug Tow, Spectro
 Ysyno Tang Tow, PAX

LeftHandCorr -1
 NormDirCorr -1

SpigLength
DowlSep

SystemPart	CompName	Arm	Flag	Xmirr	Ymirr	Zmirr	Xnorm	Ynorm	Znorm	Xspig	Yspig	Zspig	Xsag	Ysag	Zsag	Xdowl	Ydowl	Zdowl	Check
Telescope	M1	Up	Ignore																
	M2	Up	Ignore																
Common optics	CFP	Up	Ignore																
	CM3	Up	Ignore																
	CM4	Up	Ignore																
Spectrometer optics	CM5	Up	Ignore																
	SM6	Up		0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
	SCS	Up	Hole																
	SM7	Up		0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
Upper arm	SM8A	Up		0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
	SBS1	Up	Hole																
	SM9A	Up		0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
	SCCA1	Up	Ignore																
	SCCA2	Up	Ignore																
	SCCA3	Up	Ignore																
	SM10A	Up		0.000	0.000	0.000	-1.000	0.000	0.000	-1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
	SBS2	Up	Hole																
	SM11A	Up		0.000	0.000	0.000	-1.000	0.000	0.000	-1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
	SM12A	Up		0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
SSW	Up	Det																	
SM8A	Lo	Ignore																	
Lower arm	SBS1	Lo	Hole																
	SM9B	Lo		0.000	0.000	0.000	-1.000	0.000	0.000	-1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
	SCCB1	Lo	Ignore																
	SCCB2	Lo	Ignore																
	SCCB3	Lo	Ignore																
	SM10B	Lo		0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
	SBS2	Lo	Hole																
	SM11B	Lo		0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
	SM12B	Lo		0.000	0.000	0.000	-1.000	0.000	0.000	-1.000	0.000	0.000	0.000	1.000	0.000	0.000	1.000	0.000	90
	SLW	Lo	Det																

Axis directions:

X -Zsyno Tow. tel
 Y Xsyno Tow. Spectro
 Z Ysyno Tow. PAX

SPIRE

SYNO LOCAL Directions
 X -Zsyno Norm Tow. tel
 Y Xsyno Sag Tow. Spectro
 Z Ysyno Tang Tow. PAX

LeftHandCorr -1
 NormDirCorr -1

IDup	(BOLSP501E)	SystemPart	CompName	Arm	Flag	Xgut	Ygut	Zgut	Xdiff	Ydiff	Zdiff	DiffMod	Xray	Yray	Zray	dXray	dYray	dZray	drayMod	Xnorm	Ynorm	Znorm	UpFlag
IDlo	(BOLSP501F_LG	Telescope	M1	Up	Ignore	1252.785	36.849	54.804	-1999.377	-4.292	-6.384	1999.392	-1.000	-0.002	-0.003	1.999	-0.021	-0.031	1.999	1.000	-0.011	-0.016	1.000
			M2	Up		2840.131	0.000	0.000	1587.346	-36.849	-54.804	1588.719	0.999	-0.023	-0.034	-1.998	0.000	0.000	1.998	-1.000	0.000	0.000	-1.000
Ray	gut	Common optics	CFP	Up	Hole	241.660	-60.321	-89.713	-2598.471	-60.321	-89.713	2600.719	-0.999	-0.023	-0.034	-0.999	0.312	-0.456	1.903	0.957	0.164	-0.239	1.000
			CM3	Up		136.531	-62.761	-93.343	-105.129	-2.440	-3.630	105.220	-0.999	-0.023	-0.034	-1.776	0.000	0.575	1.867	-0.951	0.000	0.308	-1.000
			CM4	Up		316.038	0.230	-200.363	179.507	62.991	-107.020	218.275	0.822	0.289	-0.490	1.861	-0.410	-0.489	1.967	0.946	-0.208	-0.248	1.000
			CM5	Up		125.121	58.002	-183.379	-190.917	57.772	16.984	200.188	-0.954	0.289	0.085	-0.828	1.079	0.679	1.520	-0.545	0.710	0.446	-1.000
		Spectrometer optics	SM6	Up		306.147	33.819	-263.978	181.027	-24.183	-80.599	199.629	0.907	-0.121	-0.404	0.078	0.958	0.275	1.393	0.651	-0.688	-0.322	1.000
			SCS	Up	Hole	314.984	141.696	-233.044	8.836	107.877	30.934	112.572	0.078	0.958	0.275	0.906	-0.958	-0.448	1.879	-0.985	0.000	-0.174	-1.000
			SM7	Up		317.372	170.859	-224.681	2.389	29.163	8.363	30.432	0.078	0.958	0.275	-1.851	0.000	-0.326	1.879	-0.985	0.000	-0.174	-1.000
			SM8A	Up		373.504	170.860	-234.579	56.132	0.001	-9.898	56.998	0.985	0.000	-0.174	0.000	1.000	0.000					1.000
		Upper arm	SBS1	Up		223.128	170.857	-321.398	-150.377	-0.003	-86.819	173.640	-0.866	0.000	-0.500	1.732	0.000	0.000	1.732	1.000	0.000	0.000	1.000
			SM9A	Up		373.124	170.854	-407.997	149.996	-0.003	-86.599	173.200	0.866	0.000	-0.500	-1.866	0.000	0.500	1.932	-0.966	0.000	0.259	-1.000
			SCCA1	Up		248.124	170.855	-407.998	-125.000	0.000	-0.001	125.000	-1.000	0.000	0.000	1.000	0.000	-1.000	1.414	0.707	0.000	-0.707	1.000
			SCCA2	Up		248.127	170.859	-457.999	0.003	0.004	-50.001	50.001	0.000	0.000	-1.000	-0.500	-0.707	1.500	1.732	-0.289	-0.408	0.866	-1.000
			SCCA3	Up		248.124	170.855	-457.996	-0.003	-0.004	0.003	0.006	-0.500	-0.707	0.500	1.500	0.707	-0.500	1.732	0.866	0.408	-0.289	1.000
			SM10A	Up		373.123	170.859	-457.998	125.000	0.004	-0.002	125.000	1.000	0.000	0.000	-1.866	0.000	-0.500	1.932	-0.966	0.000	-0.259	-1.000
			SBS2	Up		223.128	170.856	-544.598	-149.996	-0.003	-86.599	173.200	-0.866	0.000	-0.500	1.732	0.000	0.000	1.732	1.000	0.000	0.000	1.000
			SM11A	Up		354.746	170.854	-620.587	131.619	-0.002	-75.990	151.980	0.866	0.000	-0.500	-1.851	0.000	0.326	1.879	-0.985	0.000	0.174	-1.000
			SM12A	Up		263.584	170.855	-636.663	-91.163	0.002	-16.075	92.569	-0.985	0.000	-0.174	0.985	1.000	0.174	1.414	0.696	0.707	0.123	1.000
			SSW	Up	Det	263.583	250.857	-636.664	-0.001	80.001	-0.001	80.001	0.000	1.000	0.000								
			SM8A	Lo	Ignore	373.504	170.860	-234.579															
Axis directions:																							
X	-Zsyno																						
Y	Xsyno																						
Z	Ysyno																						
		Lower arm	SBS1	Lo	Hole	223.128	170.857	-321.398	-150.377	-0.003	-86.819	173.640	-0.866	0.000	-0.500								
			SM9B	Lo		73.132	170.854	-407.997	-149.996	-0.003	-86.599	173.200	-0.866	0.000	-0.500	1.866	0.000	0.500	1.932	0.966	0.000	0.259	1.000
			SCCB1	Lo		198.132	170.855	-407.998	125.000	0.000	-0.001	125.000	1.000	0.000	0.000	-1.000	0.000	-1.000	1.414	-0.707	0.000	-0.707	-1.000
			SCCB2	Lo		198.129	170.859	-457.999	-0.003	0.004	-50.001	50.001	0.000	0.000	-1.000	0.500	-0.707	1.500	1.732	0.289	-0.408	0.866	1.000
			SCCB3	Lo		198.132	170.855	-457.996	0.003	-0.004	0.003	0.006	0.500	-0.707	0.500	-1.500	0.707	-0.500	1.732	-0.866	0.408	-0.289	-1.000
			SM10B	Lo		73.132	170.859	-457.998	-125.000	0.004	-0.002	125.000	-1.000	0.000	0.000	1.866	0.000	-0.500	1.932	0.966	0.000	-0.259	1.000
			SBS2	Lo		223.128	170.856	-544.598	149.996	-0.003	-86.599	173.200	0.866	0.000	-0.500	-1.732	0.000	0.000	1.732	-1.000	0.000	0.000	-1.000
			SM11B	Lo		91.509	170.854	-620.587	-131.619	-0.002	-75.990	151.980	-0.866	0.000	-0.500	1.851	0.000	0.326	1.879	0.985	0.000	0.174	1.000
			SM12B	Lo		182.672	170.855	-636.663	91.163	0.002	-16.075	92.569	0.985	0.000	-0.174	-0.985	1.000	0.174	1.414	-0.696	0.707	0.123	-1.000
			SLW	Lo	Det	182.673	250.857	-636.664	0.001	80.001	-0.001	80.001	0.000	1.000	0.000								

Axis directions:

X -Zsyno Tow. tel
 Y Xsyno Tow. Spectro
 Z Ysyno Tow. PAX

SPIRE

SYNO LOCAL Directions
 X -Zsyno Norm Tow. tel
 Y Xsyno Sag Tow. Spectro
 Z Ysyno Tang Tow. PAX

LeftHandCorr -1
 NormDirCorr -1

ID	Ray	SystemPart			CompName	Arm	Flag	ZAMS/VMSCent/VMSCent/VMSCent/XMASCent/XMASCent/DIRMMod/Xray/Yray/Zray/dXray/dYray/dZray/dBaryMod/Xnorm/Ynorm/Znorm/Thetu/Lowthetha/Xang/Yang/Zang/normdOTMag																	
		Telescope	Common optics	Optics				VMSCent	VMSCent	VMSCent	VMSCent	DIRMMod	Xray	Yray	Zray	dXray	dYray	dZray	dBaryMod	Xnorm	Ynorm	Znorm	Thetu	Lowthetha	Xang
3521.020		16.6096		60.2982	Up		16.6096	60.2982																	89.665
3840.130		10.0000		0.0000	Up		10.0000	0.0000																	90.000
229.0220		0.0000		0.0000	Up		0.0000	0.0000																	96.349
132.0690		0.0000		0.0000	Up		0.0000	0.0000																	90.000
316.1157		0.0000		0.0000	Up		0.0000	0.0000																	90.000
120.0547		16.6096		60.2982	Up		16.6096	60.2982																	79.011
421.8711		11.0248		5.8154	Up	Hole	11.0248	5.8154																	77.279
131.3549		11.0248		5.8154	Up		11.0248	5.8154																	100.443
131.0713		-34.1400		-626.9683	Up		-34.1400	-626.9683																	22.280
139.3896		-10.8296		-619.2132	Up		-10.8296	-619.2132																	109.633
342.3318		-10.8497		-513.6240	Up		-10.8497	-513.6240																	26.797
300.6062		-62.1064		-518.7968	Up		-62.1064	-518.7968																	90.000
337.5438		-10.2729		-514.2300	Up		-10.2729	-514.2300																	90.000
382.1457		-11.4818		-477.5053	Up		-11.4818	-477.5053																	90.674
382.1546		-11.6248		-468.5153	Up		-11.6248	-468.5153																	102.809
202.0000		0.0000		0.0000	Up		0.0000	0.0000																	101.197
131.3549		11.0248		-626.7329	Up	Det	11.0248	-626.7329																	#DIV/0!
131.0713		-34.1400		-626.9683	Up	Hole	-34.1400	-626.9683																	#DIV/0!
139.3896		-10.8296		-619.2132	Up		-10.8296	-619.2132																	26.797
342.3318		-10.8497		-513.6240	Up		-10.8497	-513.6240																	90.000
292.1583		-72.8890		-519.8378	Up		-72.8890	-519.8378																	77.173
337.5438		-10.2729		-514.2300	Up		-10.2729	-514.2300																	90.000
382.1457		-11.4818		-477.5053	Up		-11.4818	-477.5053																	90.674
382.1546		-11.6248		-468.5153	Up		-11.6248	-468.5153																	102.809
202.0000		0.0000		0.0000	Up		0.0000	0.0000																	#DIV/0!
131.3549		11.0248		-626.7329	Up	Det	11.0248	-626.7329																	#DIV/0!
131.0713		-34.1400		-626.9683	Up	Hole	-34.1400	-626.9683																	#DIV/0!
139.3896		-10.8296		-619.2132	Up		-10.8296	-619.2132																	26.797
342.3318		-10.8497		-513.6240	Up		-10.8497	-513.6240																	90.000
292.1583		-72.8890		-519.8378	Up		-72.8890	-519.8378																	77.173
337.5438		-10.2729		-514.2300	Up		-10.2729	-514.2300																	90.000
382.1457		-11.4818		-477.5053	Up		-11.4818	-477.5053																	90.674
382.1546		-11.6248		-468.5153	Up		-11.6248	-468.5153																	102.809
202.0000		0.0000		0.0000	Up		0.0000	0.0000																	#DIV/0!
131.3549		11.0248		-626.7329	Up	Det	11.0248	-626.7329																	#DIV/0!
131.0713		-34.1400		-626.9683	Up	Hole	-34.1400	-626.9683																	#DIV/0!
139.3896		-10.8296		-619.2132	Up		-10.8296	-619.2132																	26.797
342.3318		-10.8497		-513.6240	Up		-10.8497	-513.6240																	90.000
292.1583		-72.8890		-519.8378	Up		-72.8890	-519.8378																	77.173
337.5438		-10.2729		-514.2300	Up		-10.2729	-514.2300																	90.000
382.1457		-11.4818		-477.5053	Up		-11.4818	-477.5053																	90.674
382.1546		-11.6248		-468.5153	Up		-11.6248	-468.5153																	102.809
202.0000		0.0000		0.0000	Up		0.0000	0.0000																	#DIV/0!
131.3549		11.0248		-626.7329	Up	Det	11.0248	-626.7329																	#DIV/0!
131.0713		-34.1400		-626.9683	Up	Hole	-34.1400	-626.9683																	#DIV/0!
139.3896		-10.8296		-619.2132	Up		-10.8296	-619.2132																	26.797
342.3318		-10.8497		-513.6240	Up		-10.8497	-513.6240																	90.000
292.1583		-72.8890		-519.8378	Up		-72.8890	-519.8378																	77.173
337.5438		-10.2729		-514.2300	Up		-10.2729	-514.2300																	90.000
382.1457		-11.4818		-477.5053	Up		-11.4818	-477.5053																	90.674
382.1546		-11.6248		-468.5153	Up		-11.6248	-468.5153																	102.809
202.0000		0.0000		0.0000	Up		0.0000	0.0000																	#DIV/0!
131.3549		11.0248		-626.7329	Up	Det	11.0248	-626.7329																	#DIV/0!
131.0713		-34.1400		-626.9683	Up	Hole	-34.1400	-626.9683																	#DIV/0!
139.3896		-10.8296		-619.2132	Up		-10.8296	-619.2132																	26.797
342.3318		-10.8497		-513.6240	Up		-10.8497	-513.6240																	90.000
292.1583		-72.8890		-519.8378	Up		-72.8890	-519.8378																	77.173
337.5438		-10.2729		-514.2300	Up		-10.2729	-514.2300																	90.000
382.1457		-11.4818		-477.5053	Up		-11.4818	-477.5053																	90.674
382.1546		-11.6248		-468.5153	Up		-11.6248	-468.5153																	102.809
202.0000		0.0000		0.0000	Up		0.0000	0.0000																	#DIV/0!
131.3549		11.0248		-626.7329	Up	Det	11.0248	-626.7329																	#DIV/0!
131.0713		-34.1400		-626.9683	Up	Hole	-34.1400	-626.9683																	#DIV/0!
139.3896		-10.8296		-619.2132	Up		-10.82																		

IDup	IDlo	SystemPart	CompName	Arm	Flag	Xnmr	Ynmr	Znmr	Xnorm	Ynorm	Znorm	NormDir	Xsug	Ysug	Zsug	Xtang	Ytang	Ztang	TangDotNorm	SagDotNorm	SagDotFtan		
<p>SPiRE coordinates X=X0-Zsyno Y=Y0-Xsyno Z=Z0+Ysyno where: X0 Y0 Z0</p>																							
		Telescope	M1	Up	Ignore	3252.1620	0.0000	0.0000	-1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
		Common optics	M2	Up	Hole	2840.1310	0.0000	0.0000	-1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		
			CM3	Up		123.6207	0.0000	-245.0659	-0.9885	0.0000	0.0000	-0.1510	-0.9999	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			CM4	Up		316.1254	0.0000	-200.0950	-0.9514	0.0000	0.0000	0.2613	-0.9780	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
			CM5	Up		119.7829	0.0000	-179.6873	-0.9653	0.0000	0.0000	0.4463	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Spectrometer optics	SM6	Up		306.1507	33.8200	-263.9752	-0.5448	0.7100	0.4463	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SCS	Up	Hole	314.9828	141.6957	-233.0424	0.4964	0.7528	0.4322	1.0000	0.0000	-0.8678	0.4418	0.2273	0.0198	-0.1724	-0.6400	0.0000	0.0000	0.0000	0.0000
			SM7	Up		317.3703	170.8567	-224.6806	0.6506	-0.6879	0.0000	0.3147	1.0000	0.0000	0.0000	0.0000	0.0000	-0.3607	-0.6262	0.0000	0.0000	0.0000	0.0000
			SM8A	Up		373.5044	170.8567	-234.5785	-0.9848	0.0000	0.0000	-0.1736	1.0000	0.0000	0.0188	0.9941	-0.1067	0.1726	-0.1083	-0.9790	0.0000	0.0000	0.0000
		Upper arm	SM8A	Up		223.1277	170.8567	-321.3985	-1.0000	0.0000	0.2588	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SM9A	Up		373.1233	170.8567	-407.9985	-0.9659	0.0000	0.0000	0.7071	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SCCA1	Up		248.1233	170.8567	-407.9985	-0.7071	0.0000	0.7071	0.5000	0.3773	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
			SCCA2	Up		248.1233	170.8567	-457.9985	0.5000	-0.7071	0.5000	0.3773	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
		Lower arm	SCCA3	Up		373.1233	170.8567	-457.9985	0.5000	0.0000	0.2588	1.0000	0.0000	0.0000	0.0000	0.0000	-0.2588	0.0000	0.0000	0.0000	0.0000	0.0000	
			SM10A	Up		223.1277	170.8567	-544.5985	1.0000	0.0000	0.0000	0.0000	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SB82	Up		354.7463	170.8567	-620.5985	0.9848	0.0000	-0.1736	1.0000	0.0000	0.0054	0.9995	0.0308	0.1736	-0.0312	0.9843	0.0000	0.0000	0.0000	0.0000
			SM11A	Up		263.5826	170.8567	-636.6631	0.6964	0.7071	0.1228	1.0000	0.0000	-0.6964	0.7071	-0.1228	0.0000	0.0000	-0.9848	0.0000	0.0000	0.0000	0.0000
		Upper arm	SM12A	Up	Det	263.5826	250.8567	-636.6631	0.0000	1.0000	0.0000	0.0000	1.0000	0.0188	0.9941	-0.1067	-0.1726	0.1083	0.9790	0.0000	0.0000	0.0000	
			SSW	Up	Ignore	373.5044	170.8567	-234.5785	-1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SM8A	Lo		223.1277	170.8567	-321.3985	-1.0000	0.0000	0.2588	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SM9B	Lo	Hole	73.1321	170.8567	-407.9985	-0.9659	0.0000	0.0000	-0.2588	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
		Lower arm	SCCB1	Lo		198.1321	170.8567	-407.9985	-0.7071	0.0000	-0.7071	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SCCB2	Lo		198.1321	170.8567	-457.9985	0.5000	0.0000	-0.7071	0.5000	0.3774	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SCCB3	Lo		198.1321	170.8567	-457.9985	0.5000	-0.7071	0.5000	0.3774	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SM10B	Lo		73.1321	170.8567	-457.9985	0.9659	0.0000	-0.2588	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
		Spiral	SB82	Lo		223.1277	170.8567	-544.5985	1.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	
			SM11B	Lo		91.5092	170.8567	-620.5985	0.9848	0.0000	0.1736	1.0000	0.0000	-0.0054	0.9995	0.0308	0.1736	-0.0312	0.9843	0.0000	0.0000	0.0000	
			SM12B	Lo		182.6728	170.8567	-636.6631	0.6964	-0.7071	-0.1228	1.0000	0.0000	0.6964	0.7071	-0.1228	0.1736	0.0000	0.9848	0.0000	0.0000	0.0000	
			SLW	Lo	Det	182.6728	250.8567	-636.6631	0.0000	-1.0000	0.0000	0.0000	0.0000	-0.8992	0.0000	-0.4375	-0.4375	0.0000	0.8992	0.0000	0.0000	0.0000	

Axis directions:

- X Tow. tel
- Y Tow. Spectro
- Z Tow. PAX

SPiRE

- X SYNO LOCAL
- Y -Zsyno Norm
- Z Xsyno Sug
- Y Ysyno Tung

LeftHandCarr
 NormDirCarr

-1
 -1

SystemPart	CompName	Arm	Flag	SurfNum	Line	Xvert	Yvert	Zvert	aEuler	bEuler	cEuler	xNorm	yNorm	zNorm	xTang	yTang	zTang	xSag	ySag	zSag	angDoiNorm	SagDoiNorm	SagDoiTan	
Telescope	M1	Up	Ignore	5	248	0.000	0.000	-8050.162	0.000000	0.000000	0.000000	0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	M2	Up		6	249	0.000	0.000	-1050.161	0.000000	0.000000	0.000000	0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	M2	Up		7	250	0.000	0.000	-2638.131	0.000000	0.000000	0.000000	0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Common optics	CP1	Up	Hole	9	252	0.000	0.000	0.000	0.000000	0.000000	0.000000	0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	CM3	Up		11	254	0.000	-243.066	78.379	-8.683230	0.000000	0.000000	0.000	-0.151	0.989	0.000	0.989	0.151	0.000	0.000	0.000	0.000	0.000	0.000	
	CM4	Up		14	257	0.000	-200.093	-114.125	17.943400	0.000000	0.000000	0.000	0.308	0.951	0.000	0.951	-0.308	0.000	0.000	0.000	0.000	0.000	0.000	
Spectrometer optics	SM6	Up		17	260	0.000	-179.687	82.217	15.145400	0.000000	0.000000	0.000	0.261	0.965	0.000	0.965	-0.261	0.000	0.000	0.000	0.000	0.000	0.000	
	SCS	Up		22	265	33.820	-263.975	-104.151	39.322330	-45.231040	-14.167190	0.710	0.446	0.545	0.172	0.640	-0.749	0.683	0.000	0.000	-0.377	0.000	0.000	
	SM7	Up	Hole	26	269	141.696	-233.042	-112.983	138.959950	-48.837300	-47.836300	0.753	0.432	-0.496	0.488	-0.873	0.020	0.442	0.000	0.000	0.868	0.000	0.000	
	aCol	Up		30	273	170.857	-224.681	-115.370	153.673930	43.461140	29.794080	-0.688	-0.322	-0.651	-0.361	-0.626	0.691	-0.315	0.630	0.000	0.000	-0.315	0.000	0.000
	bCol	Up		36	279	170.857	-234.579	-171.504	-10.000000	0.000000	-6.220000	0.000	-0.174	0.985	0.108	0.979	0.173	0.994	0.000	0.000	-0.107	0.000	0.000	
	cCol	Up		39	282	170.857	-321.399	-21.128	15.000000	0.000000	0.000000	0.000	0.000	0.259	0.966	0.000	0.966	-0.259	0.000	0.000	0.000	0.000	0.000	
Upper arm	SM9A	Up		43	286	170.857	-407.999	-171.123	45.000000	0.000000	0.000000	0.000	0.707	0.707	0.000	0.707	-0.707	0.000	0.000	0.000	0.000	0.000	0.000	
	SCCA1	Up		46	289	170.857	-407.999	-46.123	45.000000	0.000000	0.000000	0.000	0.707	0.707	0.000	0.707	-0.707	0.000	0.000	0.000	0.000	0.000	0.000	
	SCCA2	Up		51	294	170.857	-457.999	-46.123	135.000000	45.000000	0.000000	-0.707	0.500	-0.500	0.000	-0.707	0.000	0.000	0.000	0.500	0.000	0.000	0.000	
	SCCA3	Up		53	296	170.857	-457.999	-46.123	135.000000	-45.000000	0.000000	0.707	0.500	-0.500	0.000	-0.707	0.000	0.000	0.000	0.500	0.000	0.000	0.000	
	SM10A	Up		56	299	170.857	-457.999	-171.123	165.000000	0.000000	0.000000	0.000	0.259	-0.966	0.000	-0.966	-0.259	0.000	0.000	0.000	0.000	0.000	0.000	
	SBS2	Up		60	303	170.857	-544.599	-21.128	180.000000	0.000000	-0.000001	0.000	0.000	-1.000	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
Lower arm	SM11A	Up		63	306	170.857	-620.589	-152.746	-170.000000	0.000000	0.000000	0.000	-0.174	-0.985	0.031	-0.984	0.174	1.000	0.031	-0.005	0.000	0.000	0.000	
	SM12A	Up		67	310	170.857	-636.663	-61.583	170.000000	-45.000000	0.000000	0.707	0.123	-0.696	0.000	0.000	0.000	0.000	0.000	0.696	0.000	0.000	0.000	
	SSW	Up	Det	70	313	250.857	-636.663	-61.583	-139.797030	-90.000000	-49.797030	1.000	0.000	0.000	0.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000		
	SM8A	Lo	Ignore	36	274	170.857	-234.579	-171.504	-10.000000	0.000000	-6.220000	0.000	-0.174	0.985	0.108	0.979	0.173	0.994	0.000	0.000	-0.107	0.000	0.000	
	SBS1	Lo	Hole	39	277	170.857	-321.399	-21.128	0.000000	0.000000	0.000000	0.000	0.000	1.000	0.000	1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	SM9B	Lo		43	281	170.857	-407.999	128.868	-15.000000	0.000000	0.000000	0.000	-0.259	0.966	0.000	0.966	0.259	0.000	1.000	0.000	0.000	0.000	0.000	
Axis directions:	SCCB1	Lo		46	284	170.857	-407.999	3.868	-45.000000	0.000000	0.000000	0.000	-0.707	0.707	0.000	0.707	0.000	0.000	0.000	0.000	0.000	0.000		
	SCCB2	Lo		51	289	170.857	-457.999	3.868	-135.000000	-45.000000	0.000000	0.707	-0.500	-0.500	0.000	-0.707	0.000	0.000	0.000	0.500	0.000	0.000		
	SCCB3	Lo		53	291	170.857	-457.999	3.868	-135.000000	45.000000	0.000000	-0.707	-0.500	-0.500	0.000	-0.707	0.000	0.000	0.000	-0.500	0.000	0.000		
	SM10B	Lo		56	294	170.857	-457.999	128.868	-165.000000	0.000000	0.000000	0.000	-0.259	-0.966	0.000	-0.966	0.259	0.000	0.000	0.000	0.000	0.000	0.000	
	SBS2	Lo		60	298	170.857	-544.599	-21.128	180.000000	0.000000	0.000000	0.000	0.000	-1.000	0.000	-1.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	
	SM11B	Lo		63	301	170.857	-620.589	110.491	170.000000	0.000000	-1.790000	0.000	0.174	-0.985	0.031	-0.984	-0.174	1.000	0.000	0.000	0.000	0.000	0.000	
Z	SM12B	Lo		67	305	170.857	-636.663	19.327	-170.000000	45.000000	0.000000	-0.707	-0.123	-0.696	0.000	-0.985	0.174	0.707	0.000	-0.123	-0.696	0.000	0.000	
	SLW	Lo	Det	70	308	250.857	-636.663	19.327	82.431220	90.000000	#####	-1.000	0.000	0.000	0.000	0.899	0.438	0.000	0.000	0.899	0.000	0.000	0.000	

Axis directions:
X Z-syno
Y X-syno
Z Y-syno

Tow.ted
Tow.Spectro
Tow.PAX

SystemPart	CompName	Arm	Flag	Xgut	Ygut	Zgut	XM3cent	YM3cent	ZM3cent	XM5cent	YM5cent	ZM5cent
Telescope	M1	Up	Ignore	3252.1620	41.1407	61.1872	3252.1620	12.7595	62.3054	3252.1620	13.8175	60.2982
	M2	Up		2840.1310	0.0000	0.0000	2840.1310	0.0000	55.8034	2840.1310	0.0000	54.0055
	CM3	Up	Hole	316.5309	-62.7612	89.7131	316.5309	-18.7846	-91.7265	299.0220	-20.3548	-88.8262
	CM4	Up		156.0379	0.2303	-200.3831	131.2298	-19.5005	95.2223	316.1157	0.0070	-200.1227
	CM5	Up		125.1208	58.0022	-183.3787	120.7179	18.0297	-178.4826	120.0547	19.4999	-181.3148
Spectrometer optics	SN6	Up		306.1474	33.8193	-263.9780	306.1474	15.5219	-277.5065	94.2458	16.6906	-280.9240
	SCS	Up	Hole	314.9837	141.6961	-233.0441	192.8564	0.0878	-448.9510	192.8529	0.0808	-448.9477
	SN7	Up		317.3724	170.8591	-224.6815	422.0852	-10.7557	-505.2610	421.8711	-11.6248	-503.5564
	SN8A	Up		373.5045	170.8599	-234.5790	133.0902	-10.1690	-627.3619	131.3549	-11.0046	-626.7329
	SRS1	Up		223.1277	170.8571	-321.3982	132.8469	-34.1400	-627.6186	131.0713	-34.1400	-626.9683
Upper arm	SN9A	Up		373.1236	170.8544	-407.9974	140.5021	-10.0191	-620.3997	139.3896	-10.8296	-619.2132
	SCCA1	Up		248.1239	170.8545	-407.9980	342.1664	9.5693	-515.2279	342.3318	-10.3497	-513.6240
	SCCA2	Up		248.1266	170.8588	-457.9960	300.1692	-61.5580	-520.5613	300.6067	-62.1064	-518.7998
	SCCA3	Up		248.1237	170.8546	-457.9960	300.1692	-61.5580	-520.5613	300.6067	-62.1064	-518.7998
	SM10A	Up		373.1233	170.8586	-457.9984	337.7385	-9.5035	-515.7801	337.5438	-10.2729	-514.2300
Lower arm	SM11A	Up		223.1277	170.8559	-544.5978	380.4442	-10.6233	-477.5052	382.1457	-11.4818	-477.5053
	SBS2	Up		354.7465	170.8535	-620.5874	380.4366	-10.7557	-468.5152	382.1546	-11.6248	-468.5153
	SM12A	Up	Det	263.5839	170.8553	-636.6627	202.0000	0.0000	0.0000	202.0000	0.0000	0.0000
	SSW	Up		263.5825	250.8567	-636.6637	202.0000	0.0000	0.0000	202.0000	0.0000	0.0000
	SN8A	Lo	Ignore	373.5045	170.8599	-234.5790	133.0902	-10.1690	-627.3619	131.3549	-11.0046	-626.7329
Lower arm	SRS1	Lo	Hole	223.1277	170.8571	-321.3982	132.8469	-34.1400	-627.6186	131.0713	-34.1400	-626.9683
	SN9B	Lo		73.1318	170.8544	-407.9974	140.5021	-10.0191	-620.3997	139.3896	-10.8296	-619.2132
	SCCB1	Lo		198.1315	170.8545	-407.9980	342.1664	9.5693	-515.2279	342.3318	-10.3497	-513.6240
	SCCB2	Lo		198.1288	170.8588	-457.9989	291.7118	-72.0274	-521.6353	292.1383	-72.3860	-519.8478
	SCCB3	Lo		198.1317	170.8546	-457.9960	300.1692	-61.5580	-520.5613	300.6067	-62.1064	-518.7998
Axis directions:	SBS2	Lo		73.1322	170.8586	-457.9984	337.7385	-9.5035	-515.7801	337.5438	-10.2729	-514.2300
	SM11B	Lo		223.1277	170.8559	-544.5978	380.4442	-10.6233	-477.5052	382.1457	-11.4818	-477.5053
	SM12B	Lo		91.5090	170.8535	-620.5874	380.4366	-10.7557	-468.5152	382.1546	-11.6248	-468.5153
	SN12B	Lo	Det	182.6715	170.8553	-636.6627	202.0000	0.0000	0.0000	202.0000	0.0000	0.0000
	SLW	Lo	Det	182.6729	250.8567	-636.6637	202.0000	0.0000	0.0000	202.0000	0.0000	0.0000

Axis directions:

- X Z-syno
- Y X-syno
- Z Y-syno
- Tow. tel
- Tow. Spectro
- Tow. PAX

SPiRE coordinates
 X=X0-Zsyno
 Y=Y0-Xsyno
 Z=Z0-Ysyno
 where:
 X0 202
 Y0 0
 Z0 0

Line#	SurfNum	Line	Xpart	Ypart	Zpart	XMcent	YMcent	ZMcent	XMScnt	YMScnt	ZMScnt	SystemPart	CompName	Arm	Flag
	5	27	41.1407	61.1872	-3050.1620	12.7595	62.3054	-3050.1620	13.8175	60.2982	-3050.1620	Telescope	M1	Up	Ignore
	6	28	36.8486	54.8036	-1050.7850	11.4279	55.8034	-1050.7850	12.3755	54.0005	-1050.6005		M2	Up	
	7	29	0.0000	0.0000	-2638.1310	0.0000	0.0000	-2638.1310	0.0000	0.0000	-2638.1310		CM3	Up	
	9	31	-60.3208	89.7131	39.6598	-18.7846	91.7265	-38.6808	-20.3548	88.8262	-27.0220	Common optics	CTP	Up	Hole
	11	33	-62.7612	93.3427	65.4691	-19.5005	-95.2223	70.7702	-21.1104	-92.1237	69.9110		CM4	Up	
	14	36	0.2303	-200.3631	-114.0379	-0.0026	-200.1183	-114.1172	0.0070	-200.1227	-114.1157		CM5	Up	
	17	39	58.0022	-183.3787	76.8792	18.0297	-178.4826	81.2821	19.4999	-181.3148	81.9453		CM6	Up	
	22	44	33.8193	-265.9780	-104.1474	15.5219	-277.5065	106.7873	16.6906	-280.9240	107.7542	Spectrometer optics	SCS	Up	Hole
c	26	48	141.6961	-233.0441	-112.9837	0.0878	-448.9510	9.1436	0.0808	-448.9477	9.1472		SM7	Up	
d	30	52	170.8591	-224.6815	-115.3724	-10.7557	-505.2610	-220.0852	-11.6248	-503.5564	-219.8711		SM8A	Up	
e	36	58	170.8599	-234.5790	-171.5045	-10.1690	-627.3619	68.9098	-11.0046	-626.7329	70.6451		SM9A	Up	
	39	61	170.8571	-321.3982	-211.1277	-34.1400	-627.6186	69.1531	-34.1400	-626.9683	70.9287	Upper arm	SM8A	Lo	
	43	65	170.8544	-407.9974	-171.1236	-10.0191	-620.8997	61.4979	-10.8296	-619.2132	62.6104		SM9B	Up	
	46	68	170.8545	-407.9980	-461.1239	-9.5693	-515.2279	140.1664	-10.3497	-513.6240	-140.3318		SCCA1	Up	
	51	73	170.8588	-457.9989	-461.1266	-7.20274	-521.6533	-89.7118	-72.8660	-519.8478	-90.1583		SCCA2	Up	
	53	75	170.8546	-457.9960	-461.1237	-61.5880	-520.5613	-98.1692	-62.1064	-518.7998	-98.6067		SM10A	Up	
	56	78	170.8586	-457.9984	-171.1233	-9.5033	-515.7801	-135.7385	-10.2729	-514.2300	-135.5438		SBS2	Up	
	60	82	170.8559	-544.5978	-211.1277	-10.6233	-477.5052	-178.4442	-11.4818	-477.5053	-180.1457		SM11A	Up	
	63	85	170.8535	-620.5874	-152.7465	-10.7557	-468.5152	-178.4566	0.0000	0.0000	0.0000		SM12A	Up	
	67	89	170.8553	-636.6627	-61.5839	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		SSW	Up	Det
	70	92	250.8567	-636.6637	-61.5825	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		SM8A	Lo	Ignore
	36	58	170.8599	-234.5790	-171.5045	-10.1690	-627.3619	68.9098	-11.0046	-626.7329	70.6451	Lower arm	SBS1	Lo	Hole
	39	61	170.8571	-321.3982	-211.1277	-34.1400	-627.6186	69.1531	-34.1400	-626.9683	70.9287		SM9B	Lo	
	43	65	170.8544	-407.9974	128.8682	-10.0191	-620.8997	61.4979	-10.8296	-619.2132	62.6104		SCCB1	Lo	
	46	68	170.8545	-407.9980	3.8685	-9.5693	-515.2279	-140.1664	-10.3497	-513.6240	-140.3318		SCCB2	Lo	
	51	73	170.8588	-457.9989	3.8712	-7.20274	-521.6533	-89.7118	-72.8660	-519.8478	-90.1583		SCCB3	Lo	
	53	75	170.8546	-457.9960	3.8683	-61.5880	-520.5613	-98.1692	-62.1064	-518.7998	-98.6067		SM10B	Lo	
	56	78	170.8586	-457.9984	128.8678	-9.5033	-515.7801	-135.7385	-10.2729	-514.2300	-135.5438		SBS2	Lo	
	60	82	170.8559	-544.5978	-211.1277	-10.6233	-477.5052	-178.4442	-11.4818	-477.5053	-180.1457		SM11B	Lo	
	63	85	170.8535	-620.5874	110.4910	-10.7557	-468.5152	-178.4566	0.0000	0.0000	0.0000		SM12B	Lo	
	67	89	170.8553	-636.6627	19.3285	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000		SLW	Lo	Det
	70	92	250.8567	-636.6637	19.3271	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000				

Axis directions:

- X Tow. tel
- Y Tow. Spectro
- Z Tow. PAX


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--- ID?
The current lens ID is: ID SPIRE SPECTRO (BOLSP501G)
---
--- TIME
21-mars-01 12:18:54
---
!GRAY !GRAY 2 0 0 0 SURF 0 Z1
!GRAY 2 0 0 0 SURF 0 Z1
---
SPEC GLOB Z1

ID SPIRE SPECTRO (BOLSP501G) 243 21-mars-01 12:18:54
LENS SPECIFICATIONS:

SYSTEM SPECIFICATIONS
-----
OBJECT DISTANCE (TH0) INFINITE FOCAL LENGTH (FOCL) 45846.389
OBJECT HEIGHT (YPP0) INFINITE BACK FOCAL LENGTH 133.6632
MARG RAY HEIGHT (YMP1) 1641.705 IMAGE DISTANCE (BACK) 0
MARG RAY ANGLE (UMP0) 0 CELL LENGTH (TOTL) 1154.012
CHIEF RAY HEIGHT (YPP1) -4.989 F/NUMBER (FNUM) 13.963
CHIEF RAY ANGLE (UPP0) 0.0167 GAUSSIAN IMAGE HT(GIHT) 5.6669
ENTR PUPIL SEMI-APERTU 1641.705 EXIT PUPIL SEMI-APERTU 8.3211
ENTR PUPIL LOCATION 17150.7042 EXIT PUPIL LOCATION -98.741

X-OBJECT HEIGHT (XPP0) INFINITE
X-MARG RAY HEIGHT (XMP1) 1641.705 X-CHIEF RAY HT (XPP1) -4.989
X-MARG RAY ANGLE (VMP0) 0 X-CHIEF RAY ANGLE(VPP0) 0.0167

WAVL (uM) 200 400 600 250 0.6328
WEIGHTS 1 1 1 1 1
COLOR ORDER 2 1 3 4 5
UNITS MM
APERTURE STOP SURFACE (APS) 7 SEMI-APERTU 155.17235
REAL PUPIL OPTION ON
NONSEQUENRAYTRACE ON
FOCAL MODE ON
MAGNIFICAT -1.95E-08
GLOBAL OPTION ON
VIGNETTINGOPTION (VIG) OFF
POLARIZATIOND COATINGS ARE IGNORED.

SURFACE DATA
-----
SURF RADIUS THICKNESS MEDIUM INDEX V-NUMBER
-----
0 INFINITE INFINITE AIR
1 INFINITE 17771.1 AIR
2A INFINITE 0 AIR
3A INFINITE -17771.1 AIR
4 INFINITE -2000 AIR
5 INFINITE 2000.00000P AIR
6 -3500 O -1587.969 #NOM?
APS -345.264 O 1587.96900P AIR
8 INFINITE 1050.162 AIR
9 -167.171 0 AIR
10A INFINITE 70.9 AIR
11A -365.963 O 0 #NOM?
12A INFINITE -213.5 #NOM?
13A INFINITE 0 #NOM?
14 INFINITE 0.00000P AIR
15 INFINITE 0 AIR
16A INFINITE 197.4 AIR
17A -294.638 O 0 #NOM?
18A INFINITE -193.6 #NOM?
19A INFINITE -10 #NOM?
20A INFINITE 0 #NOM?
21A INFINITE 0 #NOM?
22 L 269.92 O 1.97E-13 AIR
23 INFINITE 0 AIR
24A INFINITE 112.57 AIR
25 INFINITE 0 AIR
26 L INFINITE 7.11E-15 AIR
27 INFINITE 30.43 AIR
28A INFINITE 0 AIR
29 INFINITE 0 AIR
30 L INFINITE -1.27E-13 #NOM?
31 INFINITE 0 #NOM?
32A INFINITE 0 #NOM?
33A INFINITE 0 #NOM?
34A INFINITE -57 #NOM?
35A INFINITE 0 #NOM?
36A 230.34 O 0 AIR
37 INFINITE 0 AIR
38A INFINITE 173.64 AIR
39A INFINITE 0 #NOM?
40A INFINITE -40 #NOM?
41 INFINITE 0 #NOM?
42 INFINITE -133.2 #NOM?
43A 259.5 0 AIR
44A INFINITE 150 AIR
45 INFINITE -25 AIR
46A INFINITE 0 #NOM?
47A INFINITE -25.00000P #NOM?
48 INFINITE 0 #NOM?
49 INFINITE -25.00000P #NOM?
50A INFINITE 0 #NOM?
51A INFINITE 0 AIR
52 INFINITE 0 #NOM?
53A INFINITE 0 AIR
54A INFINITE -25.00000P AIR
55 INFINITE 150.00000P AIR
56A -260 0 #NOM?
57A INFINITE -133.20000P #NOM?
58 INFINITE 0 #NOM?
59 INFINITE -40.00000P #NOM?
60A INFINITEP 0 AIR

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61A INFINITE 151.98 AIR
 62A INFINITE 0 AIR
 63A -196.99 O 0 #NOM?
 64 INFINITE 0 #NOM?
 65A INFINITE -60 #NOM?
 66 INFINITE -32.57 #NOM?
 67A INFINITE 0 AIR
 68A INFINITE 80 AIR
 69 INFINITE 0 AIR
 IMG INFINITE

KEY TO SYMBOLS

A SURFACE HAS TILTS AND DECENTERS B TAG ON SURFACE IN LOCAL COORDINATES
 G SURFACE IS IN GLOBAL COORDINATES
 O SPECIAL SURFACE TYPE P ITEM IS SUBJECT TO PICKUP
 S ITEM IS SUBJECT TO SOLVE

SPECIAL SURFACE DATA

SURFACE NO. 6 -- CONIC SURFACE
 CONIC CONSTANT (CC) -1.00129
 SEMI-MAJORAXIS (b) 2.71E+06 SEMI-MINORAXIS (a) -97448.0619

SURFACE NO. 7 -- CONIC SURFACE
 CONIC CONSTANT (CC) -1.296
 SEMI-MAJORAXIS (b) 1166.432433 SEMI-MINORAXIS (a) -634.607853

SURFACE NO. 11 -- CONIC SURFACE
 CONIC CONSTANT (CC) -0.5095
 SEMI-MAJORAXIS (b) -746.101937 SEMI-MINORAXIS (a) 522.537753

SURFACE NO. 17 -- TORIC SURFACE
 RX -278.418

SURFACE NO. 22 -- TORIC SURFACE
 RX 523.79

SURFACE NO. 36 -- TORIC SURFACE
 RX 202

SURFACE NO. 63 -- TORIC SURFACE
 RX -169.84

TILT AND DECENTER DATA LEFT-HANDECOORDINATES

SURF	TYPE	X	Y	Z	ALPHA	BETA	GAMMA
2	REL	0	0	0	0.1829	0	0
3	REL	0	0	0	0	-0.123	0
10	REL	0	-91.048	0	-1.9766	0	0
11	REL	0	-149.224	12.676	-6.7066	0	0
12	REL	0	0	0	31.93	0	0
13	REL	0	0	0	-12.01	0	0
16	REL	0	0	0	-24.02	0	0
17	REL	0	0	0	9.212	0	0
18	REL	0	0	0	18.424	0	0
19	REL	0	0	0	-24.3574	0	0
20	REL	33.82	-4.442	0	0	0	74
21	REL	0	0	0	45	0	0
22	LOC	ABG	0	0	0	10.926	13.491
24	REL	0	0	0	49.5	0	0
26	LOC	ABG	0	0	0	26	12
28	REL	0	0	0	-45	0	0
30	LOC	ABG	0	0	0	179.559	-6.882
32	REL	0	0	0	-49.5	0	0
33	REL	0	0	0	0	0	-74
34	REL	0	0	0	10	0	0
35	REL	0	0	0	-20	0	0
36	REL	0	0	0	0	0	-6.22
38	REL	0	0	0	-40	0	0
39	REL	0	0	0	30	0	0
40	REL	0	0	0	60	0	0
43	REL	0	0	0	-15	0	0
44	REL	0	0	0	-30	0	0
46	REL	0	0	0	45	0	0
47	REL	0	0	0	90	0	0
50	REL	0	0	0	45	0	0
51	REL	0	0	0	0	45	0
53	REL	0	0	0	0	-45	0
54	REL	0	0	0	45	0	0
56	REL	0	0	0	-15	0	0
57	REL	0	0	0	-30	0	0
60	REL	0	0	0	30	0	0
61	REL	0	0	0	60	0	0
62	REL	0	0	0	-20	0	0
63	REL	0	0	0	0	0	-1.79
65	REL	0	0	0	-40	0	0
67	REL	0	0	0	0	-45	0
68	REL	0	0	0	0	-90	0

KEY TO SURFACE TYPES

GLB GLOBAL COORDINATE LOCAL COORDINATE
 REL RELATIVE COORDINATE REMOTE TILTS IN RELATIVE COORD.

SURF MESSAGES

12 UNDO TILTS/DECENOF SURFACE NO. 11
 16 UNDO TILTS/DECENOF SURFACE NO. 13

18	UNDO	TILTS/DECENOF	SURFACE	NO.	17
23	COINCIDENTWITH	SURFACE	NO.	21	
27	COINCIDENTWITH	SURFACE	NO.	25	
31	COINCIDENTWITH	SURFACE	NO.	29	
37	UNDO	TILTS/DECENOF	SURFACE	NO.	36
38	UNDO	TILTS/DECENOF	SURFACE	NO.	35
40	UNDO	TILTS/DECENOF	SURFACE	NO.	39
44	UNDO	TILTS/DECENOF	SURFACE	NO.	43
47	UNDO	TILTS/DECENOF	SURFACE	NO.	46
52	UNDO	TILTS/DECENOF	SURFACE	NO.	51
54	UNDO	TILTS/DECENOF	SURFACE	NO.	53
56	TILTS/DECENPICKUP	FROM	SURFACE	NO.	43
57	UNDO	TILTS/DECENOF	SURFACE	NO.	56
57	TILTS/DECENPICKUP	FROM	SURFACE	NO.	44
60	TILTS/DECENPICKUP	FROM	SURFACE	NO.	39
61	UNDO	TILTS/DECENOF	SURFACE	NO.	60
61	TILTS/DECENPICKUP	FROM	SURFACE	NO.	40
64	UNDO	TILTS/DECENOF	SURFACE	NO.	63
65	UNDO	TILTS/DECENOF	SURFACE	NO.	62
68	UNDO	TILTS/DECENOF	SURFACE	NO.	67

GLOBAL COORDINATIDATA

GLOBAL COORDINATISURFACE LOCATION IN COORDINATSYSTEM OF SURFACE 9

SURF	X	Y	Z	NOTES	ALPHA	BETA	GAMMA
1	38.149974	56.739172	-1050.03047	-0.18293	0.123	-0.00039	
2	0	0	1.67E+04	0	0.123	0	
3	0	0	1.67E+04	0	0	0	
4	0	0	-1050.162	0	0	0	
5	0	0	-3050.162	0	0	0	
6	0	0	-1050.162	0	0	0	
7	0	0	-2638.131	0	0	0	
8	0	0	-1050.162	0	0	0	
9	0	0	0	0	0	0	
10	0	-91.048	0	-1.9766	0	0	
11	0	-243.065859	78.379337	-8.6832	0	0	
12	0	-93.493436	70.857814	29.9534	0	0	
13	0	-200.09302	-114.125371	17.9434	0	0	
14	0	-200.09302	-114.125371	17.9434	0	0	
15	0	-200.09302	-114.125371	17.9434	0	0	
16	0	-200.09302	-114.125371	5.9334	0	0	
17	0	-179.687314	82.217104	15.1454	0	0	
18	0	-179.687314	82.217104	24.3574	0	0	
19	0	-259.533222	-94.150668	0	0	0	
20	33.82	-263.975222	-104.150668	0	0	74	
21	33.82	-263.975222	-104.150668	15.4102	-42.82135	67.9265	
22	33.82	-263.975222	-104.150668	39.32223	-45.23104	-14.16719	
23	33.82	-263.975222	-104.150668	15.4102	-42.82135	67.9265	
24	33.82	-263.975222	-104.150668	105.93544	-73.39516	-15.30268	
25	141.695656	-233.042376	-112.982809	105.93544	-73.39516	-15.30268	
26	141.695656	-233.042376	-112.982809	138.95995	-48.8373	-47.8363	
27	141.695656	-233.042376	-112.982809	105.93544	-73.39516	-15.30268	
28	170.856678	-224.680587	-115.370319	17.88644	-46.96602	66.1775	
29	170.856678	-224.680587	-115.370319	17.88644	-46.96602	66.1775	
30	170.856678	-224.680587	-115.370319	-153.67393	43.46114	29.79408	
31	170.856678	-224.680587	-115.370319	17.88644	-46.96602	66.1775	
32	170.856678	-224.680587	-115.370319	0	0	74	
33	170.856678	-224.680587	-115.370319	0.00E+00	0	0.00E+00	
34	170.856678	-224.680587	-115.370319	10	0	0	
35	170.856678	-234.578533	-171.504361	-10	0	0	
36	170.856678	-234.578533	-171.504361	-10	0	-6.22	
37	170.856678	-234.578533	-171.504361	-10	0	0	
38	170.856678	-234.578533	-171.504361	-30	0	0	
39	170.856678	-321.398533	-21.12771	0.00E+00	0	0.00E+00	
40	170.856678	-321.398533	-21.12771	30	0	0	
41	170.856678	-341.398533	-55.768726	30	0	0	
42	170.856678	-341.398533	-55.768726	30	0	0	
43	170.856678	-407.998533	-171.12331	15	0	0	
44	170.856678	-407.998533	-171.12331	0.00E+00	0	0.00E+00	
45	170.856678	-407.998533	-21.12331	0.00E+00	0	0.00E+00	
46	170.856678	-407.998533	-46.12331	45	0	0	
47	170.856678	-407.998533	-46.12331	90	0	0	
48	170.856678	-432.998533	-46.12331	90	0	0	
49	170.856678	-432.998533	-46.12331	90	0	0	
50	170.856678	-457.998533	-46.12331	135	0	0	
51	170.856678	-457.998533	-46.12331	135	45	0	
52	170.856678	-457.998533	-46.12331	135	0	0	
53	170.856678	-457.998533	-46.12331	135	-45	0	
54	170.856678	-457.998533	-46.12331	180	0	-7.39E-07	
55	170.856678	-457.998533	-21.12331	180	0	-7.39E-07	
56	170.856678	-457.998533	-171.12331	165	0	0	
57	170.856678	-457.998533	-171.12331	150	0	0	
58	170.856678	-524.598533	-55.768726	150	0	0	
59	170.856678	-524.598533	-55.768726	150	0	0	
60	170.856678	-544.598533	-21.12771	180	0	-8.54E-07	
61	170.856678	-544.598533	-21.12771	-150	0	0	
62	170.856678	-620.588533	-152.74625	-170	0	0	
63	170.856678	-620.588533	-152.74625	-170	0	-1.79	
64	170.856678	-620.588533	-152.74625	-170	0	0	
65	170.856678	-620.588533	-152.74625	170	0	0	
66	170.856678	-631.007424	-93.657785	170	0	0	
67	170.856678	-636.663145	-61.582597	170	-45	0	
68	170.856678	-636.663145	-61.582597	-139.79703	-90	-49.79703	
69	250.856678	-636.663145	-61.582597	-139.79703	-90	-49.79703	
70	250.856678	-636.663145	-61.582597	-139.79703	-90	-49.79703	

Unless noted, Euler angles are taken in the order alpha, beta, gamma

 --- POF C

 --- ID?
 The current lens ID is: ID SPIRE SPECTRO (BOLSP501F_LO)

--- TIME
 15-mars-01 12:00:55

 !GRAY !GRAY 2 0 0 0 SURF 0 SURF 0 Z1
 --- SPEC GLOB Z1

ID SPIRE SPECTRO (BOLSP501F_ 242 15-mars-01 12:00:55
 LENS SPECIFICATIONS:

SYSTEM SPECIFICATIONS

OBJECT	DISTANCE	(TH0)	INFINITE	FOCAL	LENGTH	(FOCL)	46037.9196
OBJECT	HEIGHT	(YPP0)	INFINITE	BACK	FOCAL	LENGTH	-133.6632
MARG	RAY	HEIGHT	(YMP1)	1641.705	IMAGE	DISTANCE (BACK)	0
MARG	RAY	ANGLE	(UMP0)	0	CELL	LENGTH (TOTL)	1167.992
CHIEF	RAY	HEIGHT	(YPP1)	-4.989	F/NUMBER	(FNUM)	-14.0214
CHIEF	RAY	ANGLE	(UPP0)	0.0167	GAUSSIAN	IMAGE	HT(GIHT) 4.689
ENTR	PUPIL	SEMI-APERT	1641.705	EXIT	PUPIL	SEMI-APERT	7.3344
ENTR	PUPIL	LOCATION	17150.7042	EXIT	PUPIL	LOCATION	72.0137
X-OBJECT	HEIGHT	(XPP0)	INFINITE				
X-MARG	RAY	HEIGHT	(XMP1)	1641.705	X-CHIEF	RAY	HT (XPP1) -4.989
X-MARG	RAY	ANGLE	(VMP0)	0	X-CHIEF	RAY	ANGLE(VPP0) 0.0167

WAVL (uM) 200 400 600 250 0.6328
 WEIGHTS 1 1 1 1 1
 COLOR ORDER 2 1 3 4 5
 UNITS MM
 APERTURE STOP SURFACE (APS) 7 SEMI-APERT 155.17235
 REAL PUPIL OPTION ON
 NONSEQUENRAYTRACE ON
 FOCAL MODE ON
 MAGNIFICAT -1.61E-08
 GLOBAL OPTION ON
 VIGNETTINGOPTION (VIG) OFF
 POLARIZATIAND COATINGS ARE IGNORED.

SURFACE DATA

SURF	RADIUS	THICKNESS	MEDIUM	INDEX	V-NUMBER
	0	INFINITE	INFINITE	AIR	
	1	INFINITE	17771.1	AIR	
2A		INFINITE	0	AIR	
3A		INFINITE	-17771.1	AIR	
	4	INFINITE	-2000	AIR	
	5	INFINITE	2000.00000P	AIR	
APS	6	-3500 O	-1587.969	#NOM?	
		-345.264 O	1587.96900P	AIR	
	8	INFINITE	1050.162	AIR	
	9	-167.171	0	AIR	
10A		INFINITE	70.9	AIR	
11A		-365.963 O	0	#NOM?	
12A		INFINITE	-213.5	#NOM?	
13A		INFINITE	0	#NOM?	
	14	INFINITE	0.00000P	AIR	
	15	INFINITE	0	AIR	
16A		INFINITE	197.4	AIR	
17A		-294.638 O	0	#NOM?	
18A		INFINITE	-193.6	#NOM?	
19A		INFINITE	-10	#NOM?	
20A		INFINITE	0	#NOM?	
21A		INFINITE	0	#NOM?	
	22	L	523.79	O	-1.61E-13 AIR
	23	INFINITE	0	AIR	
24A		INFINITE	112.57	AIR	
	25	INFINITE	0	AIR	
	26	L	INFINITE	-5.73E-14	AIR
	27	INFINITE	30.43	AIR	
28A		INFINITE	0	AIR	
	29	INFINITE	0	AIR	
	30	L	INFINITE	1.27E-13	#NOM?
	31	INFINITE	0	#NOM?	
32A		INFINITE	0	#NOM?	
33A		INFINITE	0	#NOM?	
34A		INFINITE	-57	#NOM?	
35A		INFINITE	0	#NOM?	
36A		230.34 O	0	AIR	
	37	INFINITE	0	AIR	
38A		INFINITE	173.64	AIR	
39A		INFINITE	0	AIR	
40A		INFINITE	40	AIR	
	41	INFINITE	0	AIR	
	42	INFINITE	133.2	AIR	
43A		-259.5	0	#NOM?	
44A		INFINITE	-150	#NOM?	

	45	INFINITE		25	#NOM?
46A		INFINITE		0	AIR
47A		INFINITE	25.00000P		AIR
	48	INFINITE		0	AIR
	49	INFINITE	25.00000P		AIR
50A		INFINITE		0	AIR
51A		INFINITE		0	#NOM?
	52	INFINITE		0	AIR
53A		INFINITE		0	#NOM?
54A		INFINITE	25.00000P		#NOM?
	55	INFINITE	-150.00000P		#NOM?
56A		260		0	AIR
57A		INFINITE	133.20000P		AIR
	58	INFINITE		0	AIR
	59	INFINITE	40.00000P		AIR
60A		INFINITEP		0	#NOM?
61A		INFINITE	-151.98		#NOM?
62A		INFINITE		0	#NOM?
63A		196.99 O			0 AIR
	64	INFINITE		0	AIR
65A		INFINITE		60	AIR
	66	INFINITE		32.57	AIR
67A		INFINITE		0	#NOM?
68A		INFINITE	-80		#NOM?
	69	INFINITE		0	#NOM?
IMG		INFINITE			

KEY TO SYMBOLS

A	SURFACE	HAS	TILTS	AND	DECENTERS B	TAG	ON	SURFACE		
G	SURFACE	IS	IN	GLOBAL	COORDINATL	SURFACE	IS	IN	LOCAL	COORDINATES
O	SPECIAL	SURFACE	TYPE	P	ITEM	SUBJECT	TO	PICKUP		
S	ITEM	IS	SUBJECT	TO	SOLVE					

SPECIAL SURFACE DATA

SURFACE	NO.		6 --	CONIC	SURFACE		
CONIC	CONSTANT (CC)			-1.00129			
SEMI-MAJORAXIS	(b)			2.71E+06	SEMI-MINORAXIS	(a)	-97448.0619

SURFACE	NO.		7 --	CONIC	SURFACE		
CONIC	CONSTANT (CC)			-1.296			
SEMI-MAJORAXIS	(b)			1166.432433	SEMI-MINORAXIS	(a)	-634.607853

SURFACE	NO.		11 --	CONIC	SURFACE		
CONIC	CONSTANT (CC)			-0.5095			
SEMI-MAJORAXIS	(b)			-746.101937	SEMI-MINORAXIS	(a)	522.537753

SURFACE	NO.		17 --	TORIC	SURFACE		
RX	-278.418						

SURFACE	NO.		22 --	TORIC	SURFACE		
RX	269.92						

SURFACE	NO.		36 --	TORIC	SURFACE		
RX	202						

SURFACE	NO.		63 --	TORIC	SURFACE		
RX	169.84						

TILT AND DECENTER DATA
LEFT-HANDECOORDINATES

SURF	TYPE	X	Y	Z	ALPHA	BETA	GAMMA			
2	REL		0	0	0	0.1829	0	0		
3	REL		0	0	0	0	-0.123	0		
10	REL		0	-91.048	0	-1.9766	0	0		
11	REL		0	-149.224	12.676	-6.7066	0	0		
12	REL		0	0	0	31.93	0	0		
13	REL		0	0	0	-12.01	0	0		
16	REL		0	0	0	-24.02	0	0		
17	REL		0	0	0	9.212	0	0		
18	REL		0	0	0	18.424	0	0		
19	REL		0	0	0	-24.3574	0	0		
20	REL		33.82	-4.442	0	0	0	74		
21	REL		0	0	0	45	0	0		
22	LOC	ABG		0	0	0	10.926	13.491	25.95	
24	REL		0	0	0	49.5	0	0		
26	LOC	ABG		0	0	0	26	12	0	
28	REL		0	0	0	-45	0	0		
30	LOC	ABG		0	0	0	-0.441	-173.118	0	
32	REL		0	0	0	-49.5	0	0		
33	REL		0	0	0	0	0	-74		
34	REL		0	0	0	10	0	0		

35 REL	0	0	0	-20	0	0
36 REL	0	0	0	0	0	-6.22
38 REL	0	0	0	-40	0	0
39 REL	0	0	0	30	0	0
40 REL	0	0	0	90	0	0
43 REL	0	0	0	15	0	0
44 REL	0	0	0	30	0	0
46 REL	0	0	0	-45	0	0
47 REL	0	0	0	-90	0	0
50 REL	0	0	0	-45	0	0
51 REL	0	0	0	0	-45	0
53 REL	0	0	0	0	45	0
54 REL	0	0	0	-45	0	0
56 REL	0	0	0	15	0	0
57 REL	0	0	0	30	0	0
60 REL	0	0	0	-30	0	0
61 REL	0	0	0	-30	0	0
62 REL	0	0	0	20	0	0
63 REL	0	0	0	0	0	-1.79
65 REL	0	0	0	20	0	0
67 REL	0	0	0	0	45	0
68 REL	0	0	0	0	90	0

KEY	TO	SURFACE	TYPES				
GLB	GLOBAL	COORDINATLOC	LOCAL	COORDINATES			
REL	RELATIVE	COORDINATREM	REMOTE	TILTS	IN	RELATIVE	COORD.

SURF MESSAGES

12 UNDO	TILTS/DECENOF	SURFACE	NO.		11
16 UNDO	TILTS/DECENOF	SURFACE	NO.		13
18 UNDO	TILTS/DECENOF	SURFACE	NO.		17
23 COINCIDENTWITH	SURFACE	NO.		21	
27 COINCIDENTWITH	SURFACE	NO.		25	
31 COINCIDENTWITH	SURFACE	NO.		29	
37 UNDO	TILTS/DECENOF	SURFACE	NO.		36
38 UNDO	TILTS/DECENOF	SURFACE	NO.		35
40 UNDO	TILTS/DECENOF	SURFACE	NO.		39
41 UNDO	TILTS/DECENOF	SURFACE	NO.		40
44 UNDO	TILTS/DECENOF	SURFACE	NO.		43
47 UNDO	TILTS/DECENOF	SURFACE	NO.		46
52 UNDO	TILTS/DECENOF	SURFACE	NO.		51
54 UNDO	TILTS/DECENOF	SURFACE	NO.		53
57 UNDO	TILTS/DECENOF	SURFACE	NO.		56
64 UNDO	TILTS/DECENOF	SURFACE	NO.		63
68 UNDO	TILTS/DECENOF	SURFACE	NO.		67

GLOBAL COORDINATDATA

GLOBAL	COORDINAT	SURFACE	LOCATION	IN	COORDINAT	SYSTEM	OF	SURFACE	
SURF	X	Y	Z	NOTES	ALPHA	BETA	GAMMA		
	1	38.149974	56.739172	-1.05E+03	-0.18293	0.123	-0.00039		
	2	0	0	1.67E+04	0	0.123	0		
	3	0	0	1.67E+04	0	0	0		
	4	0	0	-1050.162	0	0	0		
	5	0	0	-3050.162	0	0	0		
	6	0	0	-1050.162	0	0	0		
APS		0	0	-2638.131	0	0	0		
	8	0	0	-1050.162	0	0	0		
	9	0	0	0	0	0	0		
	10	0	-91.048	0	-1.9766	0	0		
	11	0	-243.065859	78.379337	-8.6832	0	0		
	12	0	-93.493436	70.857814	29.9534	0	0		
	13	0	-200.09302	-114.125371	17.9434	0	0		
	14	0	-200.09302	-114.125371	17.9434	0	0		
	15	0	-200.09302	-114.125371	17.9434	0	0		
	16	0	-200.09302	-114.125371	5.9334	0	0		
	17	0	-179.687314	82.217104	15.1454	0	0		
	18	0	-179.687314	82.217104	24.3574	0	0		
	19	0	-259.533222	-94.150668	0	0	0		
	20	33.82	-263.975222	-104.150668	0	0	74		
	21	33.82	-263.975222	-104.150668	15.4102	-42.82135	67.9265		
	22	33.82	-263.975222	-104.150668	39.32223	-45.23104	75.83281		
	23	33.82	-263.975222	-104.150668	15.4102	-42.82135	67.9265		
	24	33.82	-263.975222	-104.150668	105.93544	-73.39516	-15.30268		
	25	141.695656	-233.042376	-112.982809	105.93544	-73.39516	-15.30268		
	26	141.695656	-233.042376	-112.982809	138.95995	-48.8373	-47.8363		
	27	141.695656	-233.042376	-112.982809	105.93544	-73.39516	-15.30268		
	28	170.856678	-224.680587	-115.370319	17.88644	-46.96602	66.1775		
	29	170.856678	-224.680587	-115.370319	17.88644	-46.96602	66.1775		
	30	170.856678	-224.680587	-115.370319	26.32607	136.53886	-60.20592		
	31	170.856678	-224.680587	-115.370319	17.88644	-46.96602	66.1775		
	32	170.856678	-224.680587	-115.370319	0	0	74		
	33	170.856678	-224.680587	-115.370319	0	0	0		
	34	170.856678	-224.680587	-115.370319	10	0	0		
	35	170.856678	-234.578533	-171.504361	-10	0	0		
	36	170.856678	-234.578533	-171.504361	-10	0	-6.22		
	37	170.856678	-234.578533	-171.504361	-10	0	0		
	38	170.856678	-234.578533	-171.504361	-30	0	0		

39	170.856678	-321.398533	-21.12771	0	0	0
40	170.856678	-321.398533	-21.12771	60	0	0
41	170.856678	-341.398533	13.513306	-30	0	0
42	170.856678	-341.398533	13.513306	-30	0	0
43	170.856678	-407.998533	128.86789	-15	0	0
44	170.856678	-407.998533	128.86789	0	0	0
45	170.856678	-407.998533	-21.13211	0	0	0
46	170.856678	-407.998533	3.86789	-45	0	0
47	170.856678	-407.998533	3.86789	-90	0	0
48	170.856678	-432.998533	3.86789	-90	0	0
49	170.856678	-432.998533	3.86789	-90	0	0
50	170.856678	-457.998533	3.86789	-135	0	0
51	170.856678	-457.998533	3.86789	-135	-45	0
52	170.856678	-457.998533	3.86789	-135	0	0.00E+00
53	170.856678	-457.998533	3.86789	-135	45	0.00E+00
54	170.856678	-457.998533	3.86789	180	0	-8.54E-07
55	170.856678	-457.998533	-21.13211	180	0	-7.39E-07
56	170.856678	-457.998533	128.86789	-165	0	0
57	170.856678	-457.998533	128.86789	-150	0	0
58	170.856678	-524.598533	13.513306	-150	0	0.00E+00
59	170.856678	-524.598533	13.513306	-150	0	0
60	170.856678	-544.598533	-21.12771	180	0	-8.54E-07
61	170.856678	-544.598533	-21.12771	150	0	0
62	170.856678	-620.588533	110.490831	170	0	0
63	170.856678	-620.588533	110.490831	170	0	-1.79
64	170.856678	-620.588533	110.490831	170	0	0
65	170.856678	-620.588533	110.490831	-170	0	0
66	170.856678	-631.007424	51.402366	-170	0	0
67	170.856678	-636.663145	19.327177	-170	45	0
68	170.856678	-636.663145	19.327177	82.43122	90	-108.3757
69	250.856678	-636.663145	19.327177	82.43122	90	-108.3757
70	250.856678	-636.663145	19.327177	82.43122	90	-108.3757

Unless noted, Euler angles are taken in the order alpha, beta, gamma

 --- POF C

```

---
--- ID?
The current lens ID is: ID SPIRE SPECTRO (BOLSP501E)
---
--- TIME
06-sept-00 09:58:01
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--- GRAY 2 0 0 0 SURF 0 ZI
ID SPIRE SPECTRO (BOLSP501E) 216 06-sept-00 09:58:01

GLOBAL RAYTRACE ANALYSIS

RAY DATA IN COORDINAT SYSTEM OF SURFACE NO. 9

FRACT. OBJECT HEIGHT HBAR 0 GBAR 0
FRACT. ENTRANCE PUPIL COORD. YEN 0 XEN 0
COLOR NUMBER 2

RAY VECTORS (X DIR TAN) (Y DIR TAN)
SURF X Y Z ZZ HH

1 36.846967 54.801254 -1050.03946 -0.002147 -0.003193
2 -1.30302 -1.937938 16720.9352 -0.002147 -0.003193
3 -1.303026 -1.937947 16720.938 -0.002147 -0.003193
4 36.84723 54.801645 -1050.162 -0.002147 -0.003193
5 41.140746 61.187248 -3050.162 -0.002147 -0.003193
6 36.848567 54.803634 -1050.78504 0.023214 0.034525
7 3.77E-13 -3.62E-13 -2638.131 -0.023214 -0.034525
8 -36.86303 -54.825145 -1050.162 -0.023214 -0.034525
9 -60.320777 -89.713062 -39.659771 -0.023214 -0.034525
10 -61.241409 -91.082288 -1.18E-03 -0.023214 -0.034525
11 -62.761232 -93.342669 65.469052 -0.350914 0.596191
12 -64.145984 -90.990021 69.415181 -0.350914 0.596191
13 0.23026 -200.363128 -114.037902 -0.350914 0.596191
14 0.23026 -200.363128 -114.037902 0.302602 0.088962
15 0.23026 -200.363128 -114.037902 0.302602 0.088962
16 0.212451 -200.368364 -114.096754 0.302602 0.088962
17 58.002151 -183.378714 76.879249 0.133588 0.445235
18 58.7814 -180.781552 82.712492 0.133588 0.445235
19 35.15469 -259.52714 -94.150668 0.133588 0.445235
20 33.818815 -263.979485 -104.150668 0.133588 0.445235
21 33.819062 -263.978662 -104.148819 0.133588 0.445235
22 33.819252 -263.978028 -104.147395 -12.208409 -3.500795
23 33.817394 -263.978561 -104.147243 -12.208409 -3.500795
24 33.820924 -263.977549 -104.147532 -12.208409 -3.500795
25 141.696068 -233.044057 -112.983667 -12.208409 -3.500795
26 141.696058 -233.04406 -112.983666 -12.208409 -3.500795
27 141.696068 -233.044057 -112.983667 -12.208409 -3.500795
28 170.858814 -224.68156 -115.372409 -12.208409 -3.500795
29 170.858814 -224.68156 -115.372409 -12.208409 -3.500795
30 170.859094 -224.68148 -115.372432 -1.40E-05 0.176326
31 170.859094 -224.681533 -115.372733 -1.40E-05 0.176326
32 170.859094 -224.681107 -115.370319 -1.40E-05 0.176326
33 170.859094 -224.681107 -115.370319 -1.40E-05 0.176326
34 170.859094 -224.681091 -115.37023 -1.40E-05 0.176326
35 170.859883 -234.57904 -171.50445 -1.40E-05 0.176326
36 1.71E+02 -234.57904 -171.50445 -1.83E-05 -0.577344
37 1.71E+02 -234.57904 -171.50445 -1.83E-05 -0.577344
38 170.859883 -234.578952 -171.504602 -1.83E-05 -0.577344
39 170.857126 -321.398179 -21.12771 1.83E-05 0.577344
40 170.857126 -321.398267 -21.127863 1.83E-05 0.577344
41 170.856491 -341.398109 -55.768971 1.83E-05 0.577344
42 1.71E+02 -341.398109 -55.768971 1.83E-05 0.577344
43 1.71E+02 -407.997437 -171.123603 1.26E-06 -4.19E-06
44 1.71E+02 -407.997437 -171.12331 1.26E-06 -4.19E-06
45 1.69E+02 1.00E+06 -21.12331 8.06E-04 -0.000746
46 1.71E+02 -407.997961 -46.123882 0.30052 -2.39E+05
47 170.854534 -407.998533 -4.61E+01 0.30052 -2.39E+05
48 170.854565 -432.998533 -46.123777 0.30052 -2.39E+05
49 1.71E+02 -432.998533 -46.123777 0.30052 -2.39E+05
50 1.69E+02 -7.08E+05 -7.07E+05 1.080066 -1340.34181
51 170.858759 -457.998896 -46.126616 1.26E-06 -4.19E-06
52 -1857.54682 -7.08E+05 -7.07E+05 1.417942 1.002283
53 170.854597 -457.995952 -46.123672 -1.41E+00 1.00E+00
54 168.554662 -1.00E+06 -46.122592 -0.000806 -0.000746
55 1.69E+02 -1.00E+06 -21.122592 -8.06E-04 -0.000746
56 1.71E+02 -457.998372 -171.123266 -1.80E-05 -0.577346
57 1.71E+02 -457.998394 -171.123229 -1.80E-05 -0.577346
58 1.71E+02 -524.598058 -55.768452 -1.80E-05 -0.577346
59 1.71E+02 -524.598058 -55.768452 -1.80E-05 -0.577346
60 1.71E+02 -544.597766 -21.12771 1.80E-05 0.577346
61 1.71E+02 -544.597958 -21.128042 1.80E-05 0.577346
62 1.71E+02 -620.587374 -152.746455 1.80E-05 0.577346
63 1.71E+02 -620.587374 -152.746455 1.95E-05 -0.176336
64 170.853544 -620.587374 -152.746455 1.95E-05 -0.176336
65 170.853544 -620.587444 -152.746058 1.95E-05 -0.176336
66 170.854694 -631.006879 -93.657689 1.95E-05 -0.176336
67 170.855319 -636.662659 -61.583891 5.78E+04 -0.717173
68 170.856678 -636.662659 -61.583891 5.78E+04 -0.717173
69 250.856678 -636.663651 -61.582508 5.78E+04 -0.717173
70 250.856678 -636.663651 -61.582508

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--- POF C

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---
--- ID?
The current lens ID is: ID SPIRE SPECTRO (BOLSP501F_LO)
---
TIME
15-mars-01 11:35:03
---
--- GRAY 2 0 0 0 SURF 0 ZI
ID SPIRE SPECTRO (BOLSP501F_ 242 15-mars-01 11:35:03
GLOBAL RAYTRACE ANALYSIS
RAY DATA IN COORDINAT SYSTEM OF SURFACE NO. 9
FRACT. OBJECT HEIGHT HBAR 0 GBAR 0
FRACT. ENTRANCE PUPIL COORD. YEN 0 XEN 0
COLOR NUMBER 2
RAY VECTORS (X DIR TAN) (Y DIR TAN)
SURF X Y Z ZZ HH
1 36.846967 54.801254 -1050.03946 -0.002147 -0.003193
2 -1.30302 -1.937938 16720.9352 -0.002147 -0.003193
3 -1.303026 -1.937947 16720.938 -0.002147 -0.003193
4 36.84723 54.801645 -1050.162 -0.002147 -0.003193
5 41.140746 61.187248 -3050.162 -0.002147 -0.003193
6 36.848567 54.803634 -1050.78504 0.023214 0.034525
7 3.77E-13 -3.62E-13 -2638.131 -0.023214 -0.034525
8 -36.86303 -54.825145 -1050.162 -0.023214 -0.034525
9 -60.320777 -89.713062 -39.659771 -0.023214 -0.034525
10 -61.241409 -91.082288 -0.001183 -0.023214 -0.034525
11 -62.761232 -93.342669 65.469052 -0.350914 0.596191
12 -64.145984 -90.990021 69.415181 -0.350914 0.596191
13 0.23026 -200.363128 -114.037902 -0.350914 0.596191
14 0.23026 -200.363128 -114.037902 0.302602 0.088962
15 0.23026 -200.363128 -114.037902 0.302602 0.088962
16 0.212451 -200.368364 -114.096754 0.302602 0.088962
17 58.002151 -183.378714 76.879249 0.133588 0.445235
18 58.7814 -180.781552 82.712492 0.133588 0.445235
19 35.15469 -259.52714 -94.150668 0.133588 0.445235
20 33.818815 -263.979485 -104.150668 0.133588 0.445235
21 33.819062 -263.978662 -104.148819 0.133588 0.445235
22 33.819252 -263.978028 -104.147395 -12.208409 -3.500795
23 33.817394 -263.978561 -104.147243 -12.208409 -3.500795
24 33.820924 -263.977549 -104.147532 -12.208409 -3.500795
25 141.696068 -233.044057 -112.983667 -12.208409 -3.500795
26 141.696058 -233.04406 -112.983666 -12.208409 -3.500795
27 141.696068 -233.044057 -112.983667 -12.208409 -3.500795
28 170.858814 -224.68156 -115.372409 -12.208409 -3.500795
29 170.858814 -224.68156 -115.372409 -12.208409 -3.500795
30 170.859094 -224.68148 -115.372432 -1.40E-05 0.176326
31 170.859094 -224.681533 -115.372733 -1.40E-05 0.176326
32 170.859094 -224.681107 -115.370319 -1.40E-05 0.176326
33 170.859094 -224.681107 -115.370319 -1.40E-05 0.176326
34 170.859094 -224.681091 -115.37023 -1.40E-05 0.176326
35 170.859883 -234.57904 -171.50445 -1.40E-05 0.176326
36 170.859883 -234.57904 -171.50445 -1.83E-05 -0.577344
37 170.859883 -234.57904 -171.50445 -1.83E-05 -0.577344
38 170.859883 -234.578952 -171.504602 -1.83E-05 -0.577344
39 170.857126 -321.398179 -21.12771 -1.83E-05 -0.577344
40 170.857126 -321.398267 -21.127556 -1.83E-05 -0.577344
41 170.856491 -341.398109 13.513551 -1.83E-05 -0.577344
42 170.856491 -341.398109 13.513551 -1.83E-05 -0.577344
43 170.854376 -407.997437 128.868184 -1.26E-06 4.19E-06
44 170.854376 -407.997437 128.86789 -1.26E-06 4.19E-06
45 168.534517 1.00E+06 -21.13211 -0.000806 0.000746
46 170.854534 -407.997961 3.868462 -0.30052 2.39E+05
47 170.854534 -407.998533 3.868462 -0.30052 2.39E+05
48 170.854565 -432.998533 3.868358 -0.30052 2.39E+05
49 170.854565 -432.998533 3.868358 -0.30052 2.39E+05
50 168.546847 -7.08E+05 7.07E+05 -1.080066 1340.341805
51 170.858759 -457.998896 3.871196 -1.26E-06 4.19E-06
52 -1857.54682 -7.08E+05 7.07E+05 -1.417942 -1.002283
53 170.854597 -457.995952 3.868253 1.414228 -1.000004
54 168.554662 -1.00E+06 3.867173 0.000806 0.000746
55 168.534517 -1.00E+06 -21.132827 0.000806 0.000746
56 170.858602 -457.998372 128.867847 1.80E-05 0.577346
57 170.858602 -457.998394 128.86781 1.80E-05 0.577346
58 170.85653 -524.598058 13.513032 1.80E-05 0.577346
59 170.85653 -524.598058 13.513032 1.80E-05 0.577346
60 170.855908 -544.597766 -21.12771 -1.80E-05 -0.577346
61 170.855908 -544.597958 -21.127377 -1.80E-05 -0.577346
62 170.853544 -620.587374 110.491036 -1.80E-05 -0.577346
63 170.853544 -620.587374 110.491035 -1.95E-05 0.176336
64 170.853544 -620.587374 110.491036 -1.95E-05 0.176336
65 170.853544 -620.587444 110.490639 -1.95E-05 0.176336
66 170.854694 -631.006879 51.40227 -1.95E-05 0.176336
67 170.855319 -636.662659 19.328471 -57841.5508 0.717173
68 170.856678 -636.662659 19.328471 -57841.5508 0.717173
69 250.856678 -636.663651 19.327088 -57841.5508 0.717173
70 250.856678 -636.663651 19.327088
---
--- POF C

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---
--- ID?
The current lens ID is: ID SPIRE PHOT (BOLPHT154C)
---
--- TIME
16-janv-01 18:16:55
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--- GRAY 2 ZZ 0 0 SURF Z3 Z1
ID SPIRE PHOT (BOLPHT154C) 238 16-janv-01 18:16:55

GLOBAL RAYTRACE ANALYSIS

RAY DATA IN COORDINATE SYSTEM OF SURFACE NO. 9
FRACT. OBJECT HEIGHT HBAR -0.2026 GBAR -2.2892
FRACT. ENTRANCE PUPIL COORD. YEN 0 XEN 0
COLOR NUMBER 2

RAY VECTORS (X DIR TAN) (Y DIR TAN)
SURF X Y Z ZZ HH
1 11.427556 55.801639 -1050.07442 -0.000666 -0.003252
2 -0.406484 -1.984891 16720.938 -0.000666 -0.003252
3 -0.406484 -1.984891 16720.938 -0.000666 -0.003252
4 11.427614 55.801923 -1050.162 -0.000666 -0.003252
5 12.75945 62.305383 -3050.162 -0.000666 -0.003252
6 11.427923 55.803431 -1050.62552 0.007199 0.035152
7 3.55E-15 1.42E-14 -2638.131 -0.007199 -0.035152
8 -11.431259 -55.819724 -1050.162 -0.007199 -0.035152
9 -18.784562 -91.72647 -28.68079 -0.007199 -0.035152
10 -18.990607 -92.732603 -0.058139 -0.007199 -0.035152
11 -19.500476 -95.222336 70.770194 -0.105458 0.56735
12 -19.586621 -94.75889 71.587053 -0.105458 0.56735
13 -0.002619 -200.11827 -114.117194 -0.105458 0.56735
14 -0.002619 -200.11827 -114.117194 0.092284 0.110726
15 -0.002619 -200.11827 -114.117194 0.092284 0.110726
16 -0.003126 -200.118878 -114.122683 0.092284 0.110726
17 18.0297 -178.482563 81.282101 0.040144 0.455486
18 18.042666 -178.335449 81.605082 0.040144 0.455486
19 10.994499 -258.30578 -93.966358 0.040144 0.455486
20 10.973657 -258.542261 -94.485541 0.022597 -0.094222
21 10.983347 -258.582662 -94.056751 0.022597 -0.094222
22 15.521875 -277.506548 106.787347 0.08344 0.82359
23 15.490912 -277.812169 106.416262 0.08344 0.82359
24 3.403216 -397.122812 -38.450296 -0.069661 -1.088966
25 3.386021 -397.391603 -38.203465 -0.069661 -1.088966
26 0.087781 -448.950976 9.143638 -0.069661 -1.088966
27 -6.04551 -544.828974 97.188646 0.014846 -0.124712
28 -6.041554 -544.862206 97.455115 0.014846 -0.124712
29 -10.755735 -505.261042 -220.085158 0.014846 -0.124712
30 -10.755735 -505.261042 -220.085158 0.014846 -0.124712
31 -8.033705 -528.127272 -36.733246 -0.020212 -0.939339
32 -7.956233 -524.526814 -40.566217 -0.020212 -0.939339
33 -8.111177 -531.727731 -32.900276 -0.020212 -0.939339
34 -8.033705 -528.127272 -36.733246 -0.020212 -0.939339
35 -8.030349 -527.971302 -36.89929 -0.020212 -0.939339
36 -10.168951 -627.36187 68.909762 -98.506828 -1.055117
37 3.59E-09 -627.252949 68.806531 -98.506828 -1.055117
38 -50 -627.788504 69.31411 -98.506828 -1.055117
39 -34.14 -627.618626 69.153106 -98.506828 -1.055117
40 -29.14 -627.565071 69.102348 -98.506828 -1.055117
41 -34.14 -627.618626 69.153106 -98.506828 -1.055117
42 -10.168951 -627.36187 68.909762 -0.020212 -0.939339
43 -10.019144 -620.399652 61.497935 -0.020212 -0.939339
44 -8.033705 -528.127272 -36.733246 0.014846 -0.124712
45 -8.030349 -528.155465 -36.507188 0.014846 -0.124712
46 -9.569267 -515.227885 -140.166446 -1.237908 -0.126994
47 -5.261249 -514.785935 -143.646527 -1.237908 -0.126994
48 -13.877286 -515.669835 -136.686366 -1.237908 -0.126994
49 -9.569267 -515.227885 -140.166446 -1.237908 -0.126994
50 -6.108752 -514.872878 -142.961902 -1.237908 -0.126994
51 -72.027431 -521.635326 -89.711826 -1.237908 -0.126994
52 -65.435563 -520.959081 -95.036834 -1.237908 -0.126994
53 -61.557994 -520.56129 -98.169191 -1.237908 -0.126994
54 -65.435563 -520.959081 -95.036834 -1.237908 -0.126994
55 -9.569267 -515.227885 -140.166446 0.014846 -0.124712
56 -9.503531 -515.780101 -135.738523 0.014846 -0.124712
57 -10.137949 -510.45071 -178.47202 -17.433341 1183.380263
58 -10.151731 -509.515229 -178.471229 -17.433341 1183.380263
59 -10.755735 -468.515228 -178.436583 -17.433341 1183.380263
60 -10.623296 -477.505228 -178.44418 -17.433341 1183.380263
61 -10.549637 -482.505228 -178.448405 -17.433341 1183.380263
62 -10.623296 -477.505228 -178.44418 -17.433341 1183.380263
63 -10.755735 -468.515228 -178.436583
---
---
--- POF C

```

```

---
--- ID?
The current lens ID is: ID SPIRE PHOT (BOLPHT154C)

```

```

--- TIME
16-janv-01 18:41:53

```

```

--- GRAY 2 Z2 0 0 SURF Z3 Z1
ID SPIRE PHOT (BOLPHT154C) 238 16-janv-01 18:41:53

```

GLOBAL RAYTRACE ANALYSIS

```

RAY DATA IN COORDINATSYSTEM OF SURFACE NO. 9

```

```

FRACT. OBJECT HEIGHT HBAR 0.1572 GBAR -2.4791
FRACT. ENTRANCE PUPIL COORD. YEN 0 XEN 0
COLOR NUMBER 2

```

```

RAY VECTORS (X DIR TAN) (Y DIR TAN)
SURF X Y Z ZZ HH

```

1	12.375137	54.003853	-1050.08016	-0.000721	-0.003147
2	-0.440591	-1.922697	16720.938	-0.000721	-0.003147
3	-0.440591	-1.922697	16720.938	-0.000721	-0.003147
4	12.375196	54.00411	-1050.162	-0.000721	-0.003147
5	13.817514	60.298241	-3050.162	-0.000721	-0.003147
6	12.375513	54.005491	-1050.60054	0.007795	0.034019
7	1.78E-15	-7.11E-15	-2638.131	-0.007795	-0.034019
8	-12.378931	-54.020409	-1050.162	-0.007795	-0.034019
9	-20.354767	-88.826152	-27.022003	-0.007795	-0.034019
10	-20.565766	-89.746929	0.044902	-0.007795	-0.034019
11	-21.110403	-92.123671	69.910954	-0.114752	0.586866
12	-21.12391	-92.054594	70.028658	-0.114752	0.586866
13	0.00704	-200.122747	-114.115744	-0.114752	0.586866
14	0.00704	-200.122747	-114.115744	0.099422	0.095929
15	0.00704	-200.122747	-114.115744	0.099422	0.095929
16	0.006397	-200.123368	-114.122216	0.099422	0.095929
17	19.499867	-181.314796	81.945342	0.043529	0.449163
18	19.53635	-180.938338	82.783472	0.043529	0.449163
19	11.828507	-260.474142	-94.291954	0.043529	0.449163
20	11.832463	-260.433321	-94.20107	0.024055	-0.101461
21	11.831546	-260.42945	-94.239217	0.024055	-0.101461
22	16.690589	-280.923961	107.75419	0.089229	0.800018
23	16.754343	-280.352359	108.468676	0.089229	0.800018
24	3.639387	-397.939241	-38.511584	-0.074667	-1.070286
25	3.649176	-397.79892	-38.64269	-0.074667	-1.070286
26	0.080828	-448.947719	9.14715	-0.074667	-1.070286
27	-6.533386	-543.756057	97.729392	0.016031	-0.126573
28	-6.535522	-543.739193	97.59616	0.016031	-0.126573
29	-11.624777	-503.556441	-219.871068	0.016031	-0.126573
30	-11.624777	-503.556441	-219.871068	0.016031	-0.126573
31	-8.679048	-526.814757	-36.116781	-0.021783	-0.935897
32	-8.595462	-523.223463	-39.954056	-0.021783	-0.935897
33	-8.762634	-530.40605	-32.279506	-0.021783	-0.935897
34	-8.679048	-526.814757	-36.116781	-0.021783	-0.935897
35	-8.682551	-526.965284	-35.955943	-0.021783	-0.935897
36	-11.004597	-626.732892	70.64512	-81.56915	-0.830102
37	3.88E-09	-626.620901	70.510209	-81.56915	-0.830102
38	-50	-627.129735	71.123186	-81.56915	-0.830102
39	-34.14	-626.968333	70.928749	-81.56915	-0.830102
40	-29.14	-626.917449	70.867452	-81.56915	-0.830102
41	-34.14	-626.968333	70.928749	-81.56915	-0.830102
42	-11.004597	-626.732892	70.64512	-0.021783	-0.935897
43	-10.829581	-619.213249	62.610429	-0.021783	-0.935897
44	-8.679048	-526.814757	-36.116781	0.016031	-0.126573
45	-8.682551	-526.787095	-36.335327	0.016031	-0.126573
46	-10.349698	-513.62396	-140.331781	-1.240422	-0.124046
47	-6.03512	-513.192491	-143.810095	-1.240422	-0.124046
48	-14.664277	-514.05543	-136.853467	-1.240422	-0.124046
49	-10.349698	-513.62396	-140.331781	-1.240422	-0.124046
50	-6.603321	-513.249312	-143.352024	-1.240422	-0.124046
51	-72.58604	-519.847765	-90.158272	-1.240422	-0.124046
52	-65.987769	-519.18792	-95.477647	-1.240422	-0.124046
53	-62.106432	-518.799775	-98.606691	-1.240422	-0.124046
54	-65.987769	-519.18792	-95.477647	-1.240422	-0.124046
55	-10.349698	-513.62396	-140.331781	0.016031	-0.126573
56	-10.272944	-514.229985	-135.543836	0.016031	-0.126573
57	-10.987456	-508.588478	-180.115035	16.118236	-1013.47537
58	-10.972716	-509.515269	-180.114121	16.118236	-1013.47537
59	-11.624777	-468.51527	-180.154575	16.118236	-1013.47537
60	-11.481801	-477.50527	-180.145705	16.118236	-1013.47537
61	-11.402281	-482.505269	-180.140771	16.118236	-1013.47537
62	-11.481801	-477.50527	-180.145705	16.118236	-1013.47537
63	-11.624777	-468.51527	-180.154575		

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--- POF C

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