

CASS - Telescope Design Program, SPP Version of 19-APR-99
 Executed on: Mon 22:47:45 07-Feb-2000
 Parameters based on third order aberration calculations.

LBT F/15 BENT GREGORIAN FOCUS (infrared, case D, new BFD)

telescope input parameters

3.	number of mirrors in optical train
3.	gregorian configuration
8.408	primary mirror diameter (m)
1.14177	primary focal ratio
-14.7204	system focal ratio
5.3	axis -- focus distance (m)
INDEF	secondary focal length (m)
4.	field diameter (arcmin)
0.898	primary obstruction (m)
40.	maximum infrared wavelength (microns)
3.7	tolerable diffraction radius
7.000000E-4	infrared centration allowance (m)
2.25	height of tertiary above vertex (m)
1.00029	refractive index of air

other telescope parameters

9.600002	primary focal length (m)
solving based on fs and eve	
3.05	effective vertex distance (m)
-12.89261	magnification of secondary
-123.7691	system focal length (m)
0.002445788	throughput (ubar1*y1)
-0.03396647	telescope numerical aperture
-0.03396315	half angle of telescope light cone (in air, rad)
0.7853982	tertiary tilt angle from optical axis (rad)
5.3	pathlength from tertiary to focus (m)
10.66369	separation of m1 and m2 (m)
13.71369	pathlength from secondary to focus (m)
0.7775945	l = separation / back focal distance
0.3177083	beta = vertex distance / focal length of m1
0.3627498	eta = normalized vertex back focus
0.01140689	specified central obstruction (fractional area)
0.9871208	focal length of secondary (m)
96.24219	entrance pupil position relative to primary (m)
-9.025225	entrance pupil magnification, paraxial
0.9442862	vertex diameter of secondary (m)
0.0126131	obscuration by secondary (fractional area)
0.9318784	vertex diameter of beam at secondary (m)
0.1749726	?exit pupil throughput (ubar*y) for secondary
-1.	primary asphere fixed
-0.7328021	secondary asphere for cass
1.	primary eccentricity
0.8560386	secondary eccentricity
normalized structural aberration coefficients	
0.	sigmai
-1.	sigmaii
-9.80282	sigmaiii
138.2766	sigmaiv
-22.57252	sigmav

primary mirror parameters

0.4602503	sagitta of primary mirror (m)
-5652.75	primary aspheric amplitude (microns)

0.4311129	half angle of primary light cone (rad)
0.4180033	primary numerical aperture
1.196163	??primary focal ratio apparently
secondary mirror parameters	
0.9404014	edge diameter of secondary mirror (m)
1.04968	secondary focal ratio
0.05620711	sagitta of secondary mirror (m)
0.9145526	*infrared vertex diameter of secondary mirror (m)
8.254044	*entrance pupil diameter, paraxial (m)
	(using chief rays through secondary vertex)
-0.01240776	field correction to m2 diameter (m)
-0.0014	centration correction to m2 diameter (m)
1.624639E-4	infrared diffraction angle (radians)
-0.003515957	diffraction correction to m2 diameter (m)
0.9109714	infrared edge diameter of secondary mirror (m)
1.083591	infrared secondary focal ratio
0.0527317	sagitta of secondary mirror (m)
8.251091	effective primary aperture (m)
15.00001	effective system focal ratio
8.362538	effective primary envelope (m)
100.7615	??entrance pupil position relative to primary (m)
-9.495984	??entrance pupil magnification
8.65057	??entrance pupil diameter, from edge (m)
-530.295	secondary aspheric amplitude (microns)
0.1182378	infrared unused hole in secondary (m)
-12.89261	??magnification by focal length
-12.89261	??magnification by image distance
-12.69355	??magnification by angle U
-13.53796	??magnification by tangent U
-12.30635	??magnification by numerical aperture
tertiary mirror parameters	
0.3601479	diameter of beam at tertiary (m)
0.08835412	field correction to tertiary diameter (m)
0.448502	minor axis diameter of tertiary (m)
0.4578008	upper tertiary minor axis diameter (m)
0.4395734	lower tertiary minor axis diameter (m)
0.006444376	offset of the tertiary ellipse (m)
0.4486871	corrected minor axis diameter of tertiary (m)
0.6345394	major axis diameter of tertiary (m)
0.001366921	diffraction correction to m3 diameter (m)
0.0014	centration correction to m3 diameter (m)
0.451454	infrared minor axis diameter of tertiary (m)
0.6384524	infrared major axis diameter of tertiary (m)
0.6789233	hole in converging light above tertiary (m)
0.0126131	fractional area of telescope obscuration
52.76998	net telescope collecting area (m**2)
wavefront aberration coefficients	
0.	w040 (microns) spherical aberration
-0.7054392	w131 (microns) coma
0.2368898	w222 (microns) astigmatism
-1.67076	w220p (microns) field curvature
-0.01868577	w311 (microns) distortion
focal plane parameters	
0.6000496	platescale (mm/arcsec)
5.817764E-4	field radius angle (ubar1), (rad)
0.1440119	linear diameter of focal plane (m)
0.047	rms angular image radius tolerance (arcsec)

28.20233	rms physical image radius tolerance (microns)
1.520967	fractional curved field radius
6.083869	maximum curved field diameter (arcmin)
-0.8950837	?petzval radius of curvature (m)
-1.042961	focal plane radius of curvature (m)
0.8939903	fractional flat field radius
3.575961	maximum flat field diameter (arcmin)
1.17422	height of largest flat field (mm)
-0.550124	full field distortion (microns)

field focus curve for aligned system

radius	focal plane height	image size	wave aberration
(mm)	(arcmin)	(mm) (+/-mm)	(micron rms)
0.00	0.00	0. 1.17	0. 0.
3.60	0.10	0.006214 1.17	0.848 0.00141
7.20	0.20	0.02486 1.17	1.7 0.00283
10.80	0.30	0.05593 1.17	2.55 0.00424
14.40	0.40	0.09943 1.17	3.4 0.00566
18.00	0.50	0.1554 1.16	4.25 0.00708
21.60	0.60	0.2237 1.15	5.11 0.00851
25.20	0.70	0.3045 1.15	5.97 0.00994
28.80	0.80	0.3977 1.14	6.83 0.0114
32.40	0.90	0.5033 1.13	7.7 0.0128
36.00	1.00	0.6214 1.12	8.57 0.0143
39.60	1.10	0.7519 1.11	9.45 0.0157
43.20	1.20	0.8948 1.09	10.3 0.0172
46.80	1.30	1.05 1.08	11.2 0.0187
50.40	1.40	1.218 1.06	12.1 0.0202
54.00	1.50	1.398 1.04	13. 0.0217
57.60	1.60	1.591 1.02	13.9 0.0232
61.21	1.70	1.796 0.998	14.8 0.0247
64.81	1.80	2.013 0.973	15.8 0.0263
68.41	1.90	2.243 0.946	16.7 0.0279
72.01	2.00	2.486 0.916	17.7 0.0294

secondary alignment tolerances based on rms image radius

0.09588546	wavefront focus -- axial motion (micron/micron)
7.064276	m2 focus tolerance (on-axis) -- axial motion (micron)
5.507792	m2 focus tolerance (field) -- axial motion (micron)
1.833691E-7	scale change without refocus (fraction/micron)
2.532618E-7	scale change with refocus (fraction/micron)
0.004568509	wavefront spherical ab'n -- axial motion
(micron/micron)	
0.08966701	induced image radius (micron/micron)
1.494327E-4	induced image radius (arcsec/micron)
314.5229	tolerable secondary motion (micron)
27.48479	wavefront spherical ab'n -- focal motion (micron/meter)
-0.05227985	tolerable focal plane motion (m)
0.01103283	wavefront spherical ab'n -- primary asphere
(micron/ppm)	
0.2165435	induced image radius (micron/ppm)
3.608759E-4	induced image radius (arcsec/ppm)
1.302387E-4	tolerable primary asphere error
0.001529529	wavefront spherical ab'n -- secondary asphere
(micron/ppm)	
0.03002037	induced image radius (micron/ppm)
5.002981E-5	induced image radius (arcsec/ppm)
9.394400E-4	tolerable secondary asphere error
1.063686	distance from m2 to zero-coma pivot (m)

0.	distance from prime focus to zero-coma pivot (m)
-0.1022064	image motion from zero-coma rotation (arcsec/arcsec)
-0.2216011	image motion from m2 vertex rotation (arcsec/arcsec)
13.89261	image motion from lateral displacement (micron/micron)
0.02315244	image motion from lateral displacement (arcsec/micron)
0.02098232	wavefront coma -- lateral motion (micron/micron)
0.5043794	induced image radius (micron/micron)
8.405629E-4	induced image radius (arcsec/micron)
55.91491	tolerable motion (micron)
0.1082036	wavefront coma -- vertex rotation (micron/arcsec)
2.601031	induced image radius (micron/arcsec)
0.004334693	induced image radius (arcsec/arcsec)
10.84275	tolerable rotation (arcsec)
-0.4882808	wavefront coma -- vertex chop angle (micron/arcsec)
-11.73745	induced image radius (micron/arcsec)
-0.01956079	induced image radius (arcsec/arcsec)
-2.402766	tolerable vertex chop throw (arcsec)
74.90606	tolerable zero coma chop throw (arcsec), astig only
0.9765616	wavefront coma -- primary rotation (micron/arcsec)
23.47489	induced image radius (micron/arcsec)
0.03912158	induced image radius (arcsec/arcsec)
1.201383	tolerable rotation (arcsec)

tertiary alignment tolerances

0.08564333	image motion from tertiary rotation (arcsec/arcsec)
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Writing OSLO format input file: ybg15.len
Deleting existing output file.