Paul Baker Design   Schroeder, Table 6.17 Used

Design Procedure

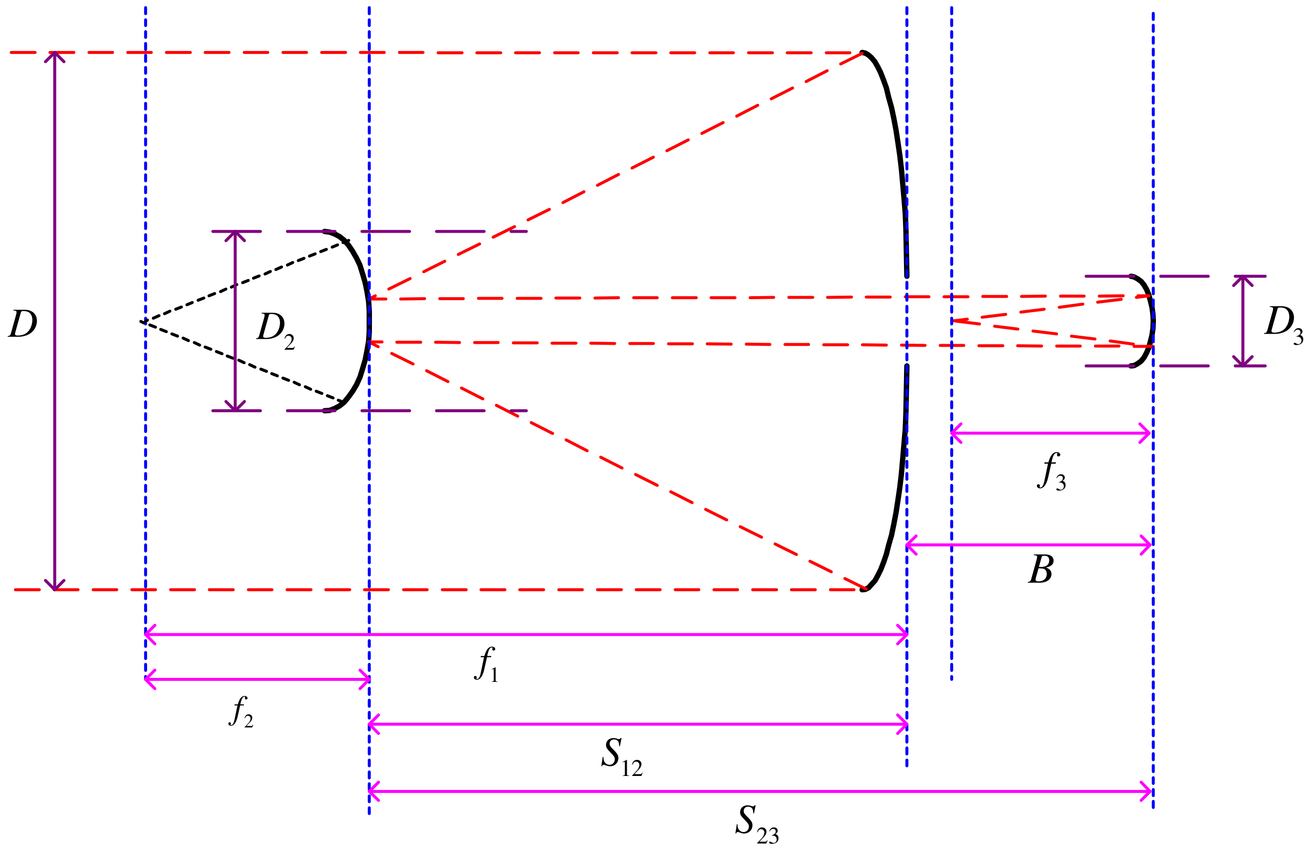


Figure 1 Paul Baker telescope layout

Assuming that I already have a known CCD size that I'm targeting, start with the desired focal length for the system f_{eff} and the F-number for the system F_{sys}. Then

$$D = \frac{f_{eff}}{F_{sys}} \tag{1}$$

The key parameter that is used to parameterize much of the design is the simple ratio between f_2 and f_1 given by

$$k = \frac{f_2}{f_1} \tag{2}$$

and the diameter of the secondary D_2 is given by

$$D_2 = kD \tag{3}$$

In the results that follow, f_1 will be swept from about 0.05 f_{eff} up to 0.95 f_{eff}. It is convenient to compute f_2 from (2) simply as

$$f_2 = kf_1 \tag{4}$$

The distance between the back of the primary mirror and the back of the third mirror extends the length of the overall scope. This distance will be referred to as the quantity B here and a little algebra shows that it is given by

$$B = \frac{2k}{1-k} f_1 - f_1 + f_2 \tag{5}$$

where k is the key ratio between the primary's focal length f_1 and that of the secondary f_2 given by

In this formula, f_2 is taken to be positive even though it is a convex mirror. It is also helpful to see that

$$k = 1 - \frac{f_1}{f_{eff}} \tag{6}$$

It strictly true that 0 < k < 1. Given f_{eff}, it is a simple matter to sweep f_1 from a small positive value to just less than f_{eff} and compute k from (6), then f_2 from (7), and finally B from a variant of (5) given by

$$B = \frac{2 f_1 f_2}{f_1 - f_2} - f_1 + f_2 \tag{8}$$

The focal length for the third mirror is given by

$$f_3 = \frac{1}{1-k} f_2 \tag{9}$$

The power loss ratio due to obstruction by the secondary is simply given by

$$P_{Loss} = k^2 \tag{10}$$

The F-numbers for all three mirrors are given by

$$\begin{aligned} F_1 &= \frac{f_1}{D} \\ F_2 &= \frac{f_2}{D_2} \\ F_3 &= \frac{1}{1-k}\frac{f_2}{D_3} = \frac{f_3}{D_3} \end{aligned} \tag{11}$$

in which $D_3 = D_2$. Neither D_2 nor D_3 includes the effects of the angular field of view and in general, these diameters must be increased. These diameters are further increased by the fact that the primary and secondary mirrors are conic sections (parabolic and elliptical).

The two mirror spacings shown in Figure 1 are given by

$$\begin{aligned} S_{12} &= f_1 - f_2 \\ S_{23} &= S_{12} \frac{f_3}{f_2}\left(\frac{2k}{1-k}\right) \end{aligned} \tag{12}$$

Parameterized results are shown graphically now for two 1200 mm systems with (i) F_{sys} = 2 and (ii) F_{sys} = 4 using U15228 for the computations.

Other needed design quantities are:

$$\frac{f_3}{f_2} = \frac{1}{1-k}$$
$$MSR = \frac{f_3}{f_2}\left(\frac{2k}{1-k}\right)$$
$$K_1 = -1$$
$$K_2 = -1 + \left(\frac{R_2}{R_3}\right)^3 \tag{13}$$

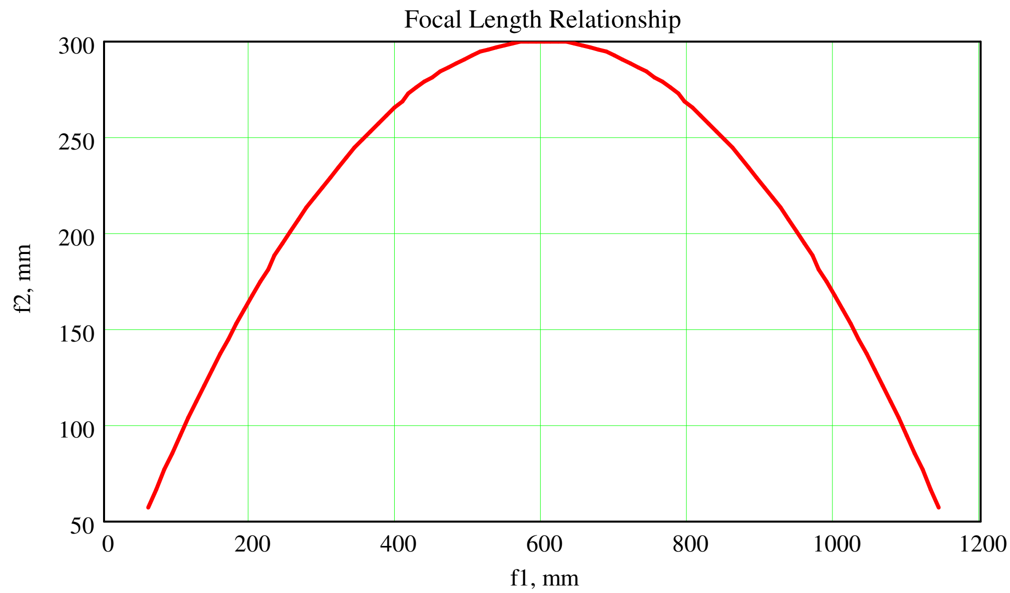


Figure 2 Relationship between f_2 and f_1 is independent of the system's F-number

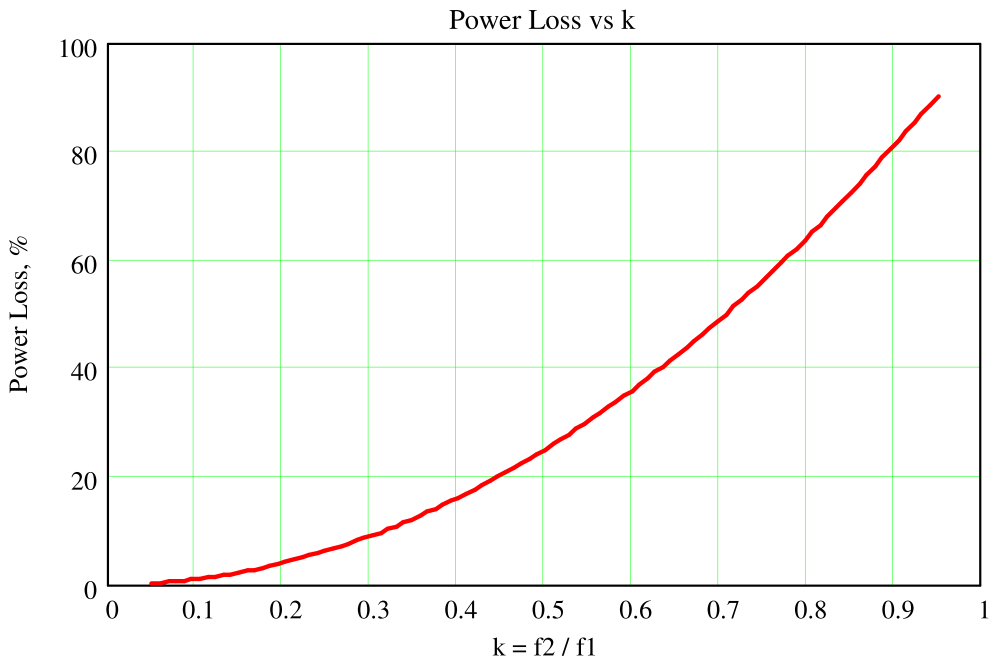


Figure 3 The percentage of optical power lost is dependent only parameter k

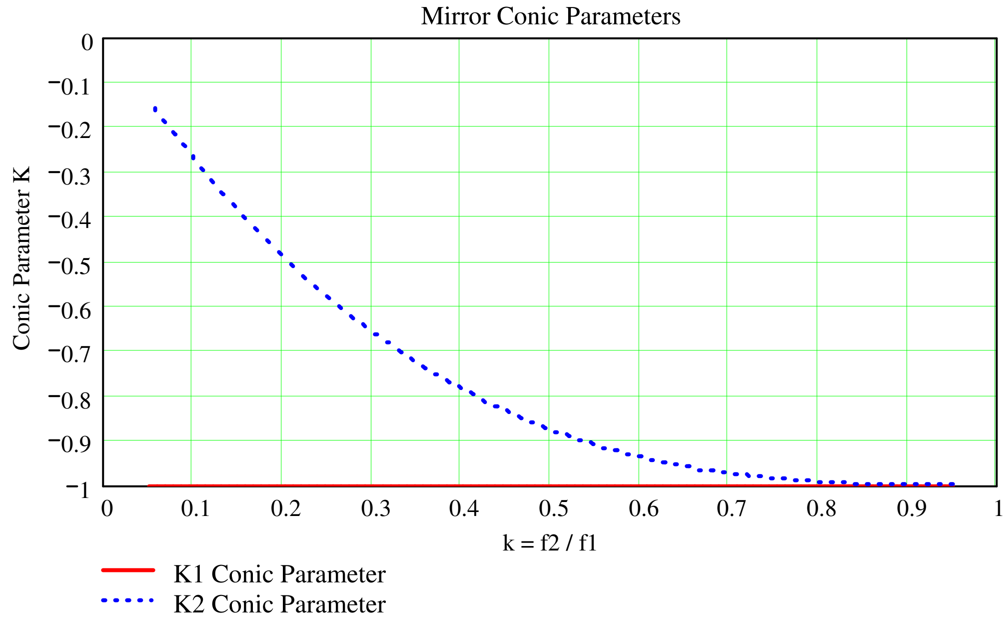


Figure 4 Primary and secondary mirror conical parameters are independent of system F-number, only dependent upon parameter k.

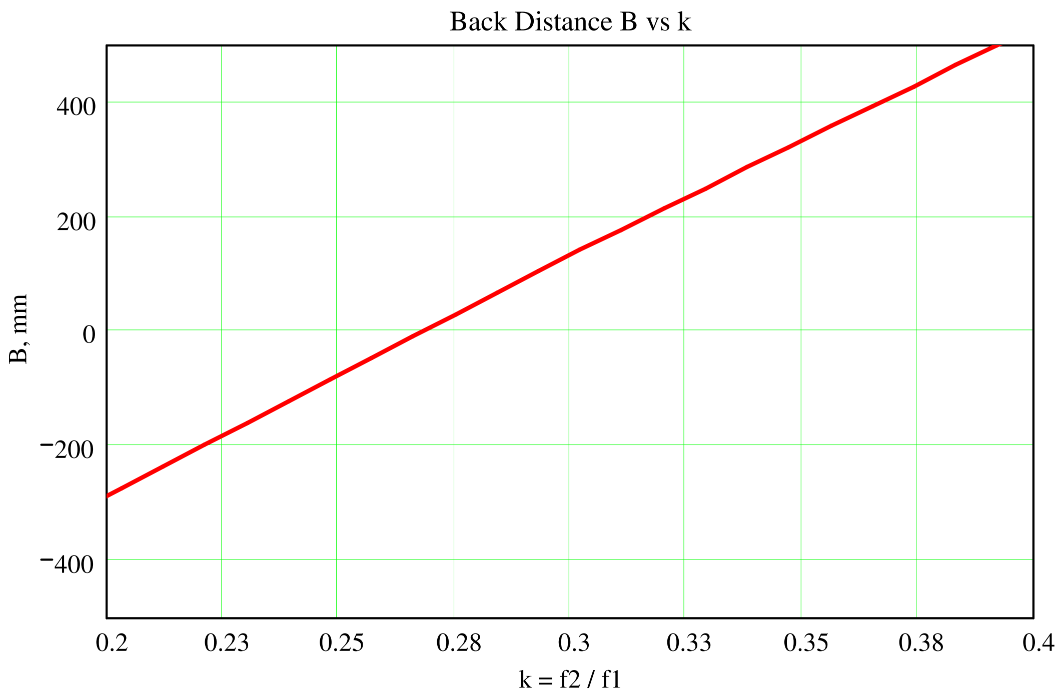


Figure 5 Back-distance B for F_{sys} = 2

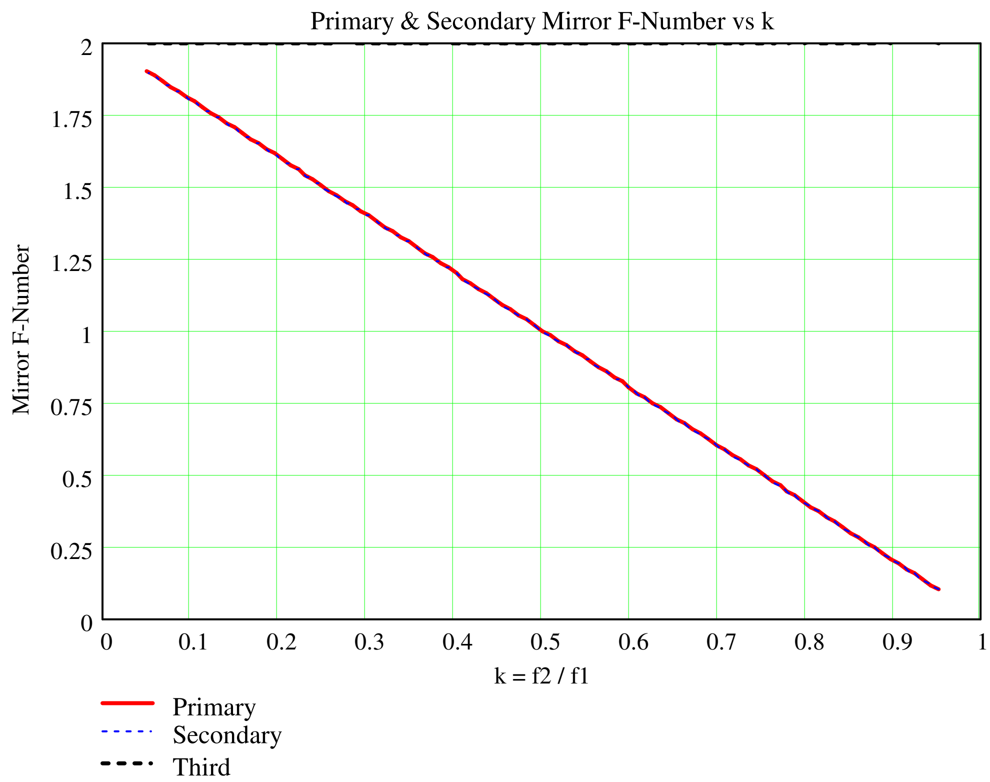


Figure 6 Mirror F-numbers versus k for F_{sys} = 2

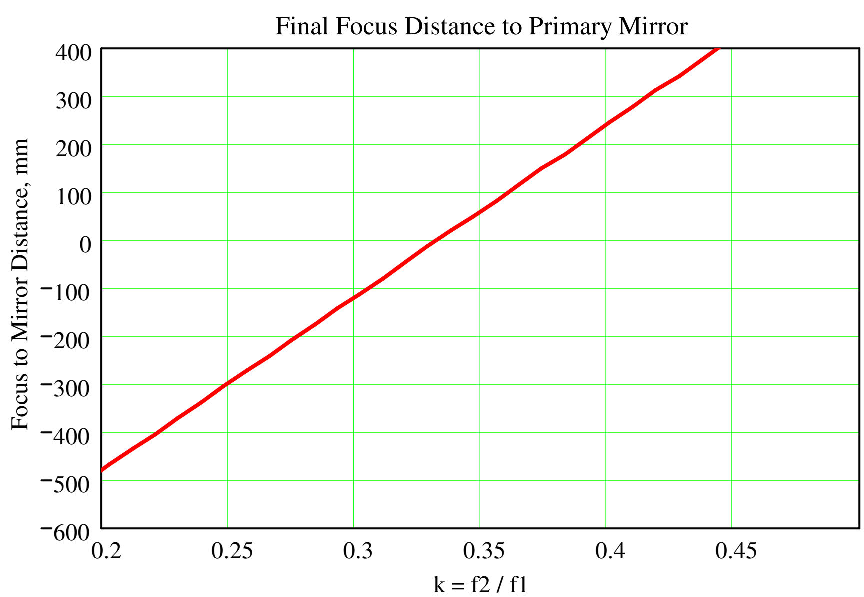


Figure 7 Distance from final focus to the back of the primary mirror. A negative value means that the focus is inside the main body of the telescope (between primary and secondary). F_{sys}= 2 here.

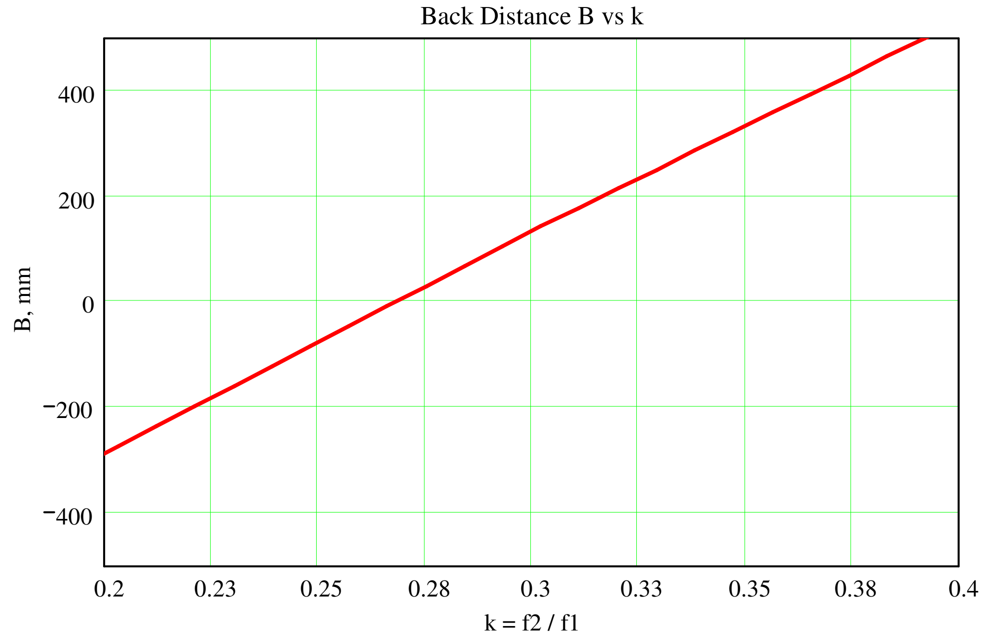


Figure 8 For F_{sys} = 4 system

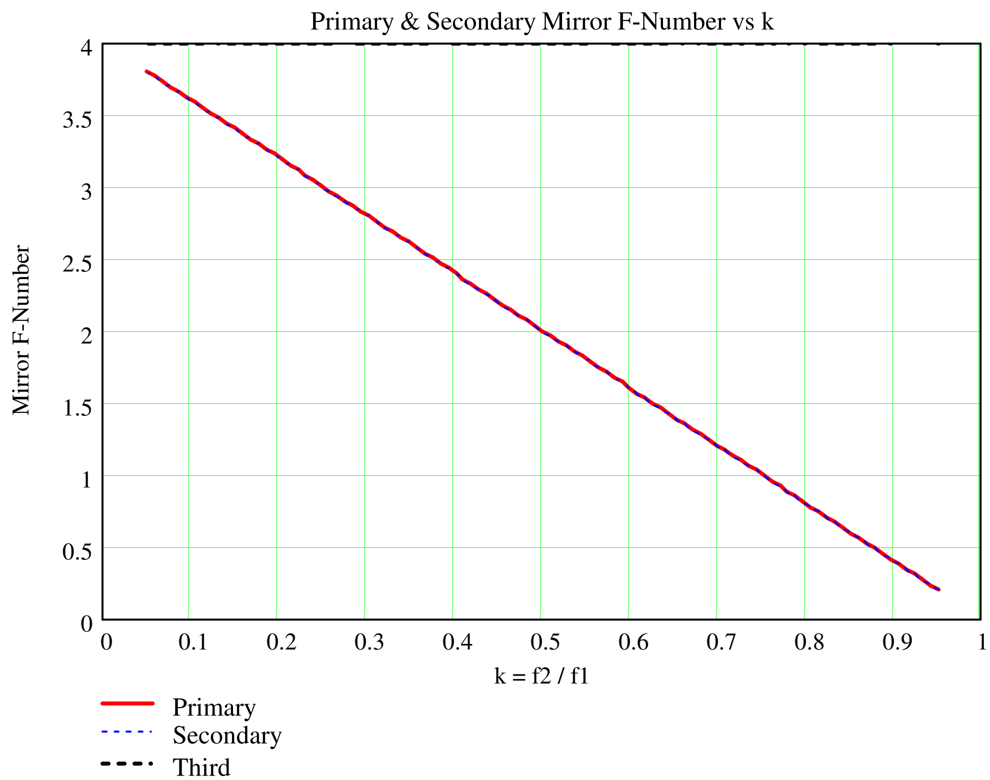


Figure 9 For F_{sys} = 4 system

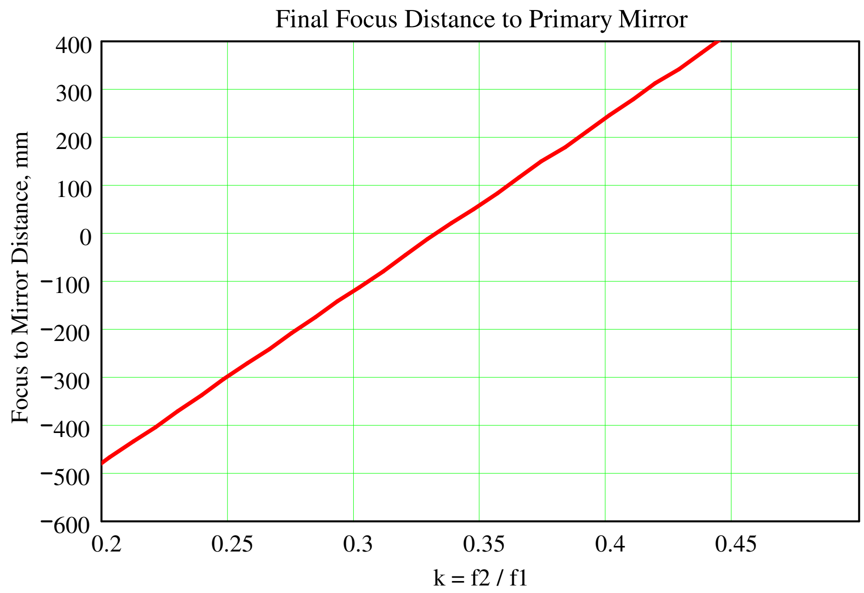
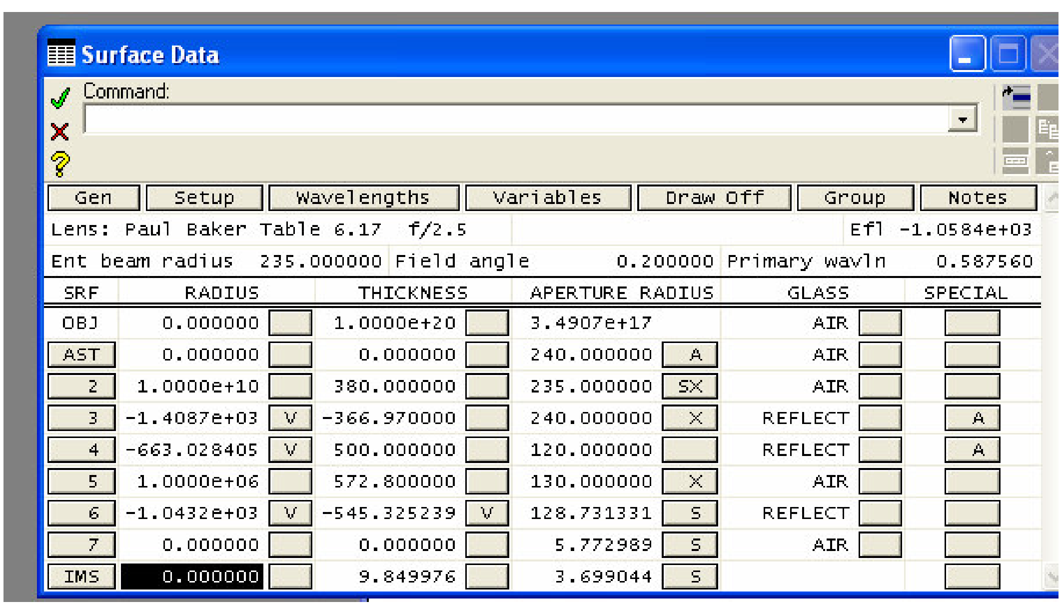


Figure 10 For F_{sys} = 4 system

Paul Baker 1 Telescope: F_{sys} = 2.5, f_{eff} = 1058 mm, D = 16.67"

This design was developed and put into OSLO before the convenient graphical results for key telescope dimensions had been put together. Consequently, the back distance and other parameters are less than ideal.

Originally, I put the optical details within OSLO but I could not get anything reasonable for performance. I quickly discovered that the fundamental problem was that serious baffling was required in order to prevent direct light from coming around the secondary mirror and the third mirror and corrupting the system performance. The designs shown here do not show these details, but they are crucial for good telescope performance.



Lens: Paul Baker Table 6.17 f/2.5 Efl -1.0584e+03

Ent beam radius 235.000000 Field angle 0.200000 Primary wavln 0.587560

SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		3.4907e+17		AIR		
AST	0.000000		0.000000		240.000000	A	AIR		
2	1.0000e+10		380.000000		235.000000	SX	AIR		
3	-1.4087e+03	V	-366.970000		240.000000	X	REFLECT		A
4	-663.028405	V	500.000000		120.000000		REFLECT		A
5	1.0000e+06		572.800000		130.000000	X	AIR		
6	-1.0432e+03	V	-545.325239	V	128.731331	S	REFLECT		
7	0.000000		0.000000		5.772989	S	AIR		
IMS	0.000000		9.849976		3.699044	S			

Figure 11 OSLO main table entries

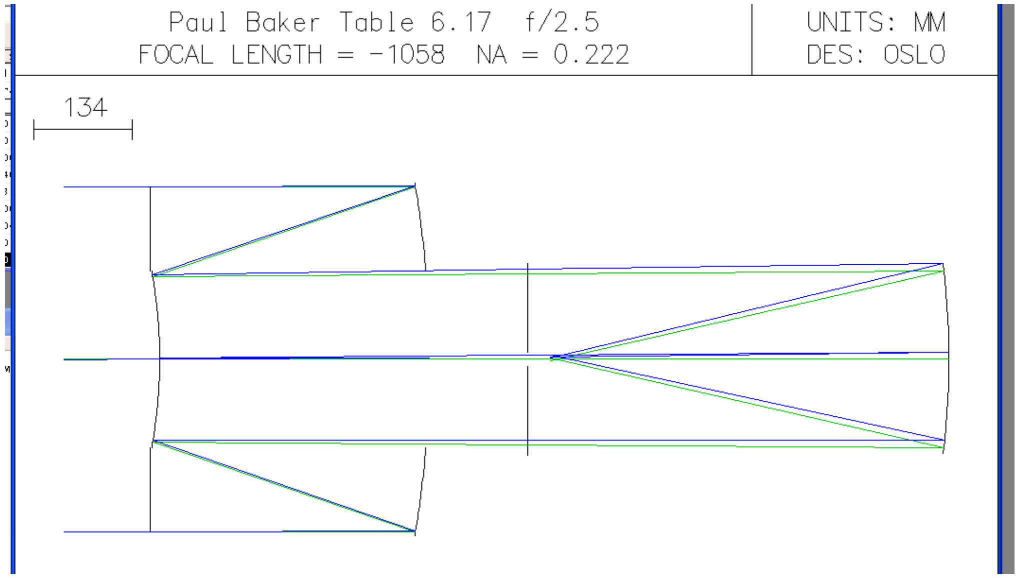


Figure 12 Paul Baker 1 design layout showing excessive back-distance B

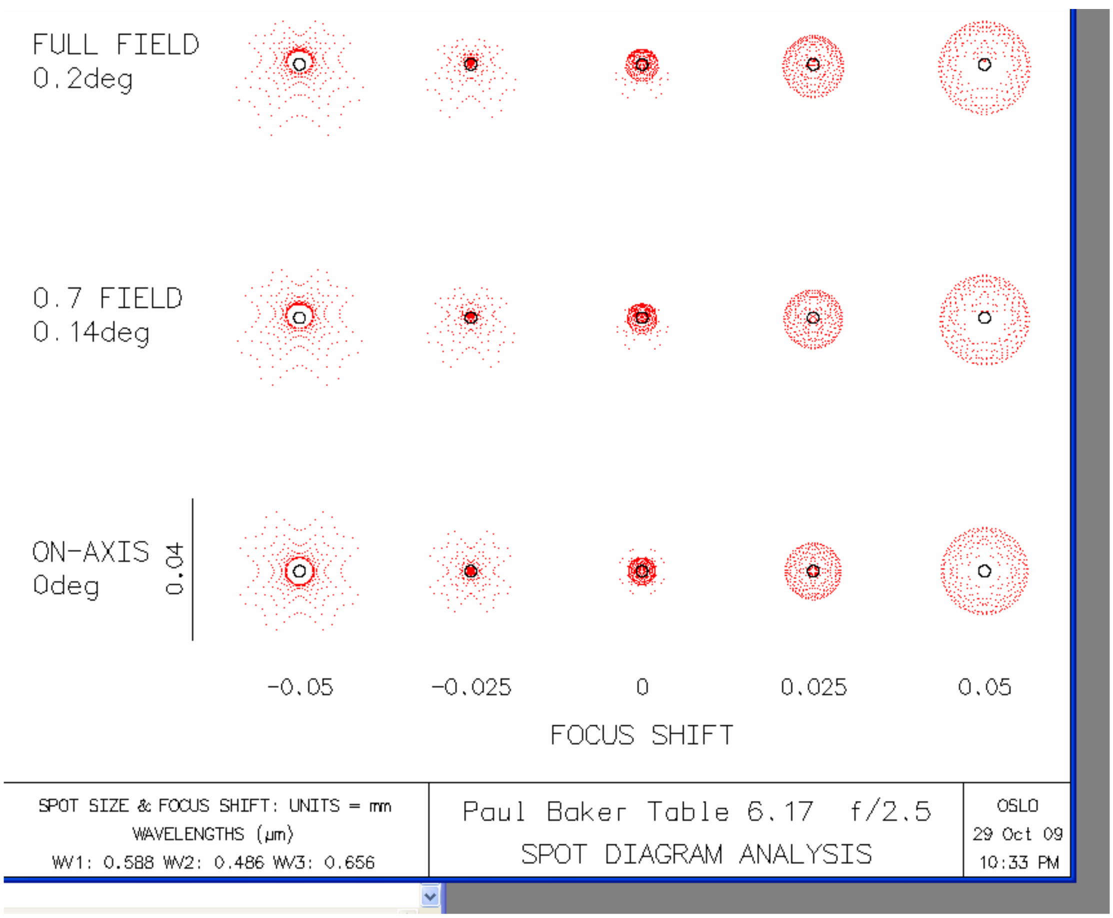


Figure 13 Spot diagram performance for Paul Baker 1 is nearly diffraction limited at proper focus. At this diameter, however, atmospherics will determine the resultant resolution rather than diffraction theory, so this performance would be quite acceptable.

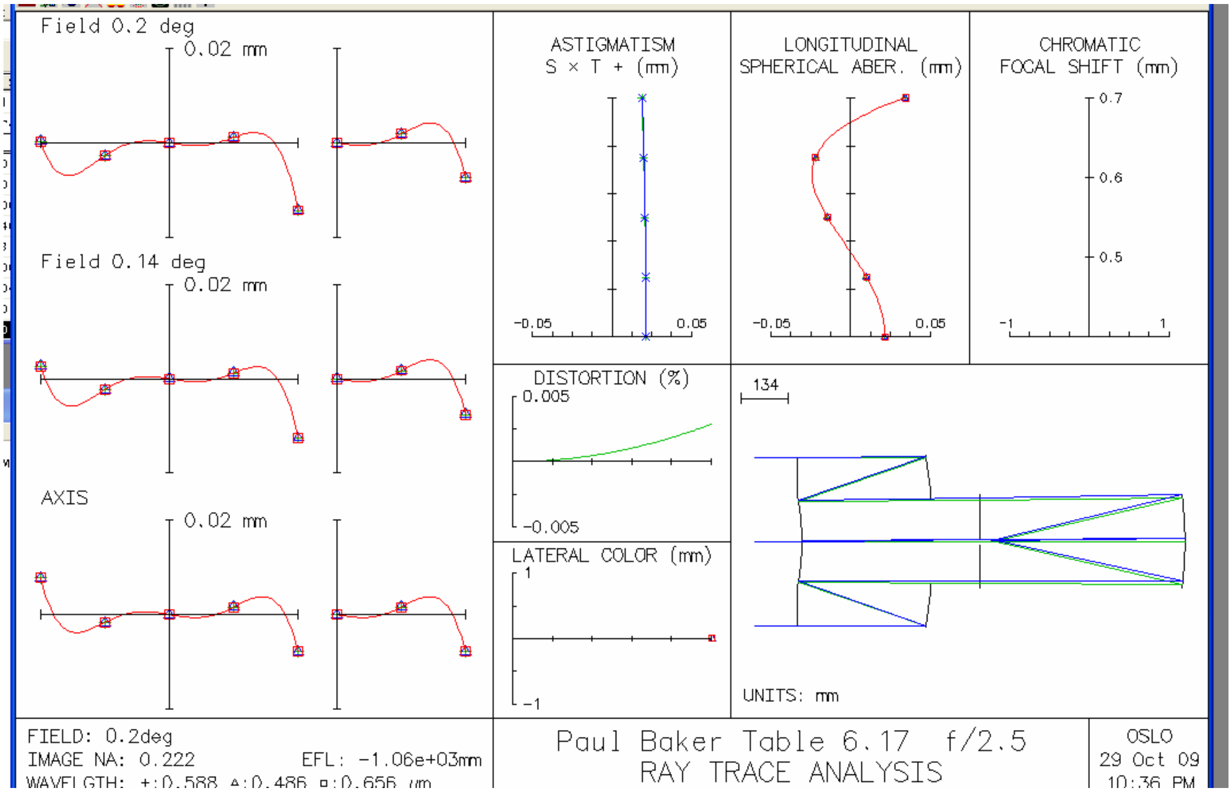


Figure 14 Ray trace analysis for Paul Baker 1 design

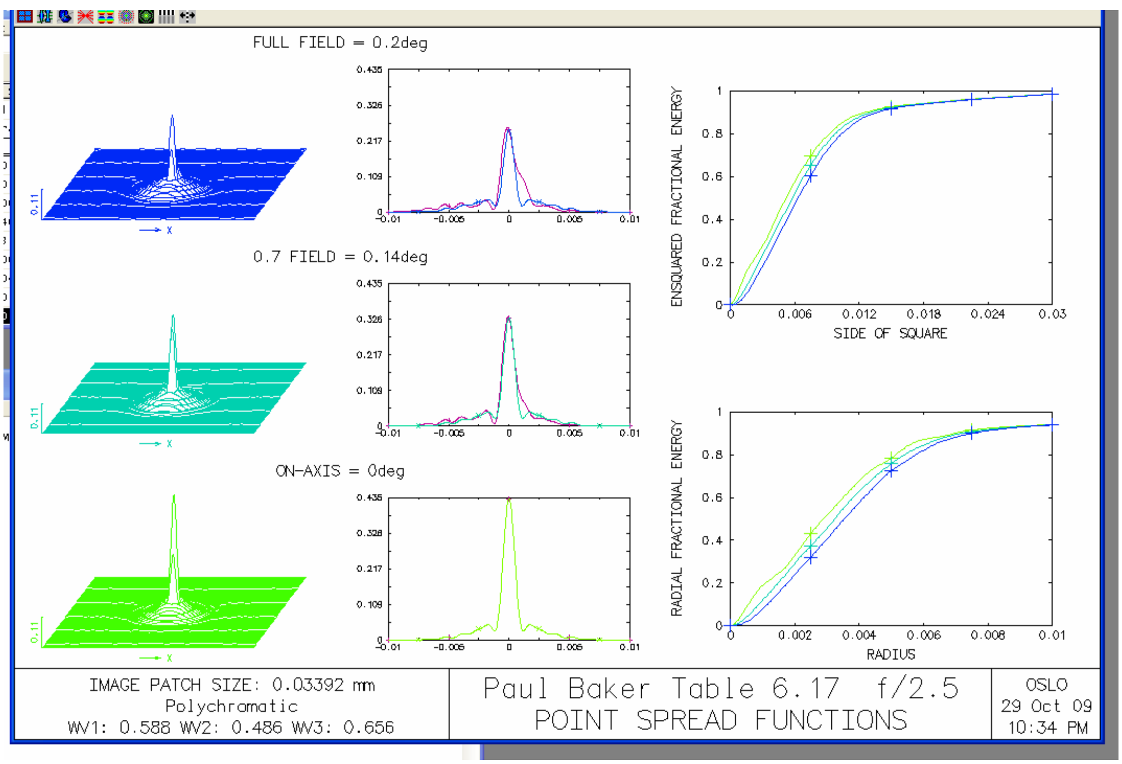


Figure 15 Point spread function for Paul Baker 1 design

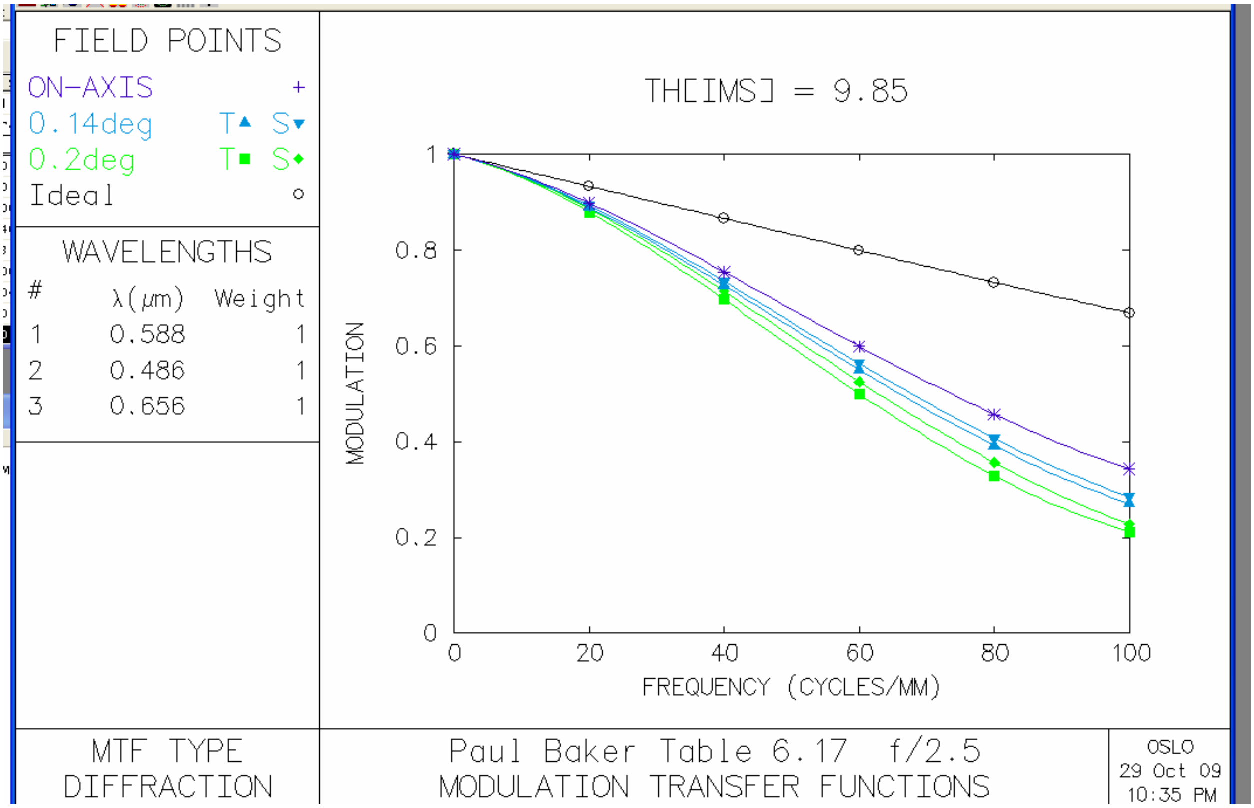


Figure 16 Modulation transfer function for Paul Baker 1 design

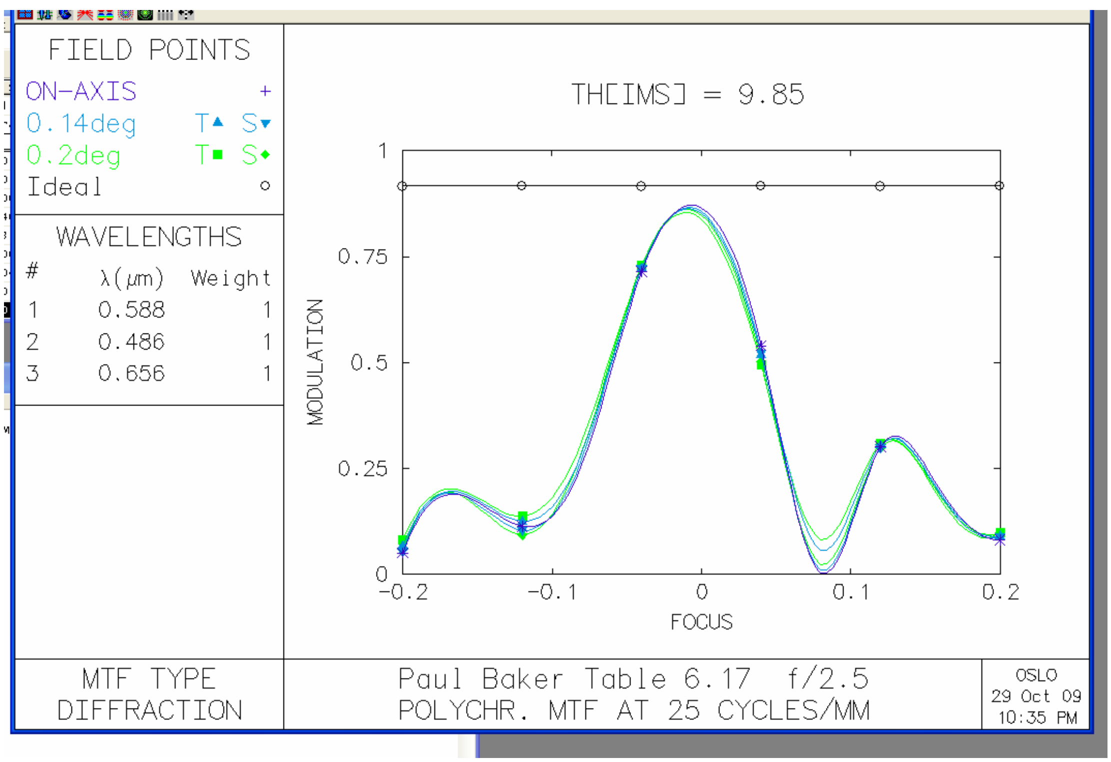


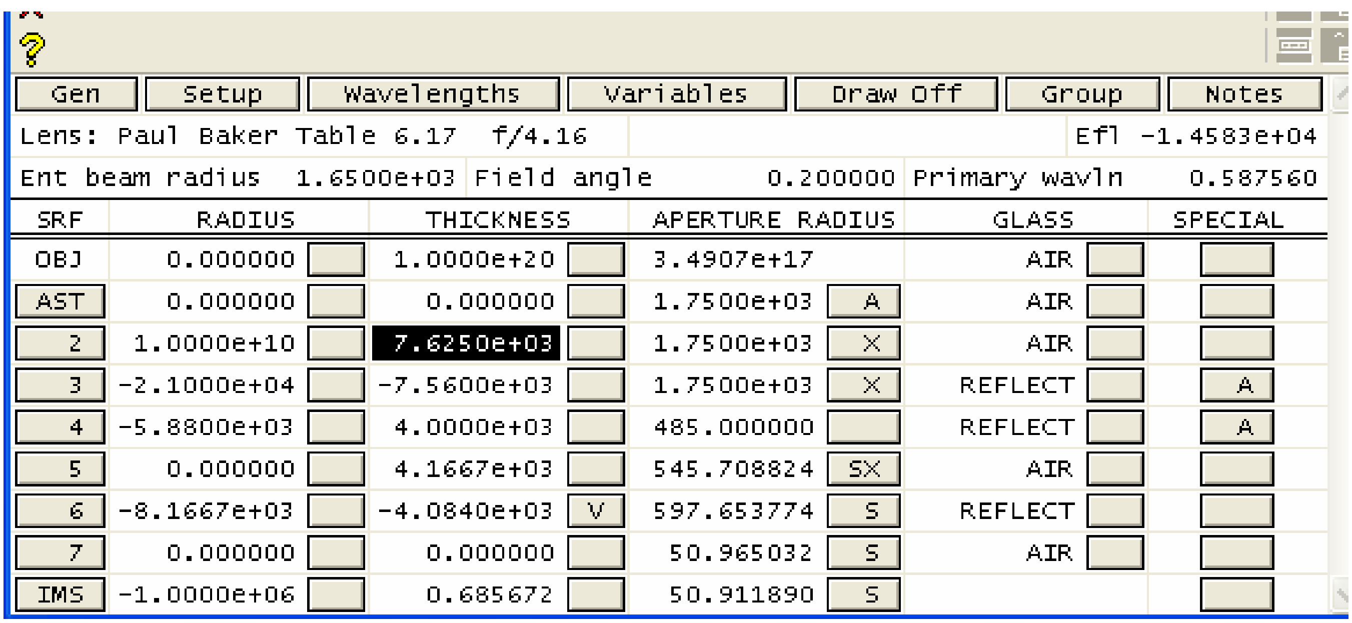
Figure 17 MTF diffraction for Paul Baker 1 design

Paul Baker 2 Design: f_{eff} = 14,583 mm, F_{sys} = 4.166, D = 137.8”

I originally had trouble duplicating very fast design given in Table 6.18 of Schroeder. At the time, I thought that the problem might be the very small F-number, but now I know that most of the problem was lack of any suitable baffling and the consequent pollution of the third-mirror by direct rays coming straight through the system.

Table 1 Paul Baker 2 Design Parameters

Parameter	Value	Comment
D	3500 mm	Diameter of primary mirror
F_1	3	F-number of primary mirror
f_1	10500 mm	Focal length of primary mirror. Concave surface
R_1	21000 mm	Radius of curvature for primary mirror
k	0.28	f_2 / f_1 ratio
f_2	2940 mm	Focal length for secondary mirror. Convex surface
R_2	5880 mm	Radius of curvature for secondary mirror
R_3 / R_2	1/(1-k) = 1.388888	For flat-field
R_3	8166.67 mm	Radius of curvature for third mirror, concave surface.
MSR	1.08025	Mirror separation ratio: M1 to M2 distance divided by M2 to M3 distance
S_{12}	3969 mm	Distance from primary to secondary
S_{23}	8166.7 mm	Distance from secondary to third mirror
K_1	–1	Conical parameter for primary (parabolic)
K_2	–0.62675	Conical parameter for secondary (elliptical) = $-1+\left(\frac{R_2}{R_3}\right)^2$
F_{sys}	4.16	F-number for the system



SRF	RADIUS	THICKNESS		APERTURE RADIUS		GLASS	SPECIAL
OBJ	0.000000	1.0000e+20		3.4907e+17		AIR	
AST	0.000000	0.000000		1.7500e+03	A	AIR	
2	1.0000e+10	7.6250e+03		1.7500e+03	X	AIR	
3	-2.1000e+04	-7.5600e+03		1.7500e+03	X	REFLECT	A
4	-5.8800e+03	4.0000e+03		485.000000		REFLECT	A
5	0.000000	4.1667e+03		545.708824	SX	AIR	
6	-8.1667e+03	-4.0840e+03	V	597.653774	S	REFLECT	
7	0.000000	0.000000		50.965032	S	AIR	
IMS	-1.0000e+06	0.685672		50.911890	S		

Figure 18 OSLO design parameters corresponding to Table 1

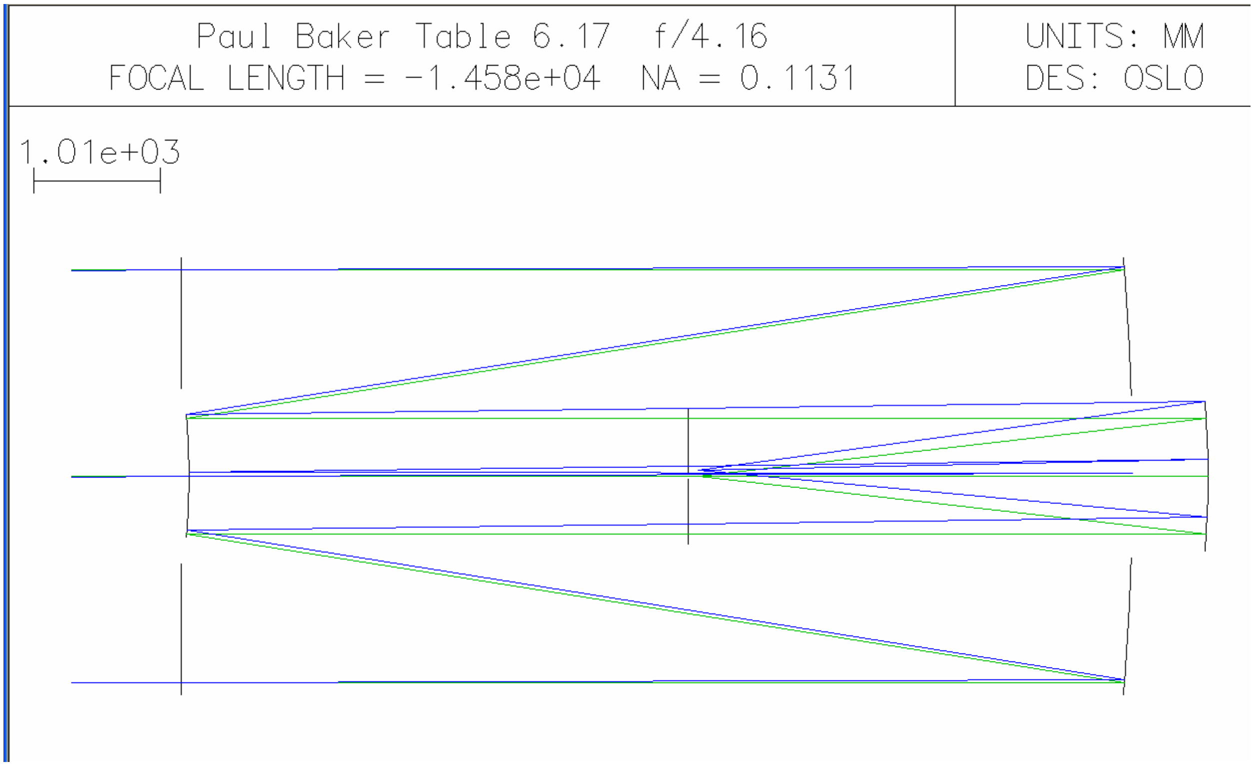


Figure 19 OSLO file paul baker 2.len for Paul Baker telescope f/4.16.

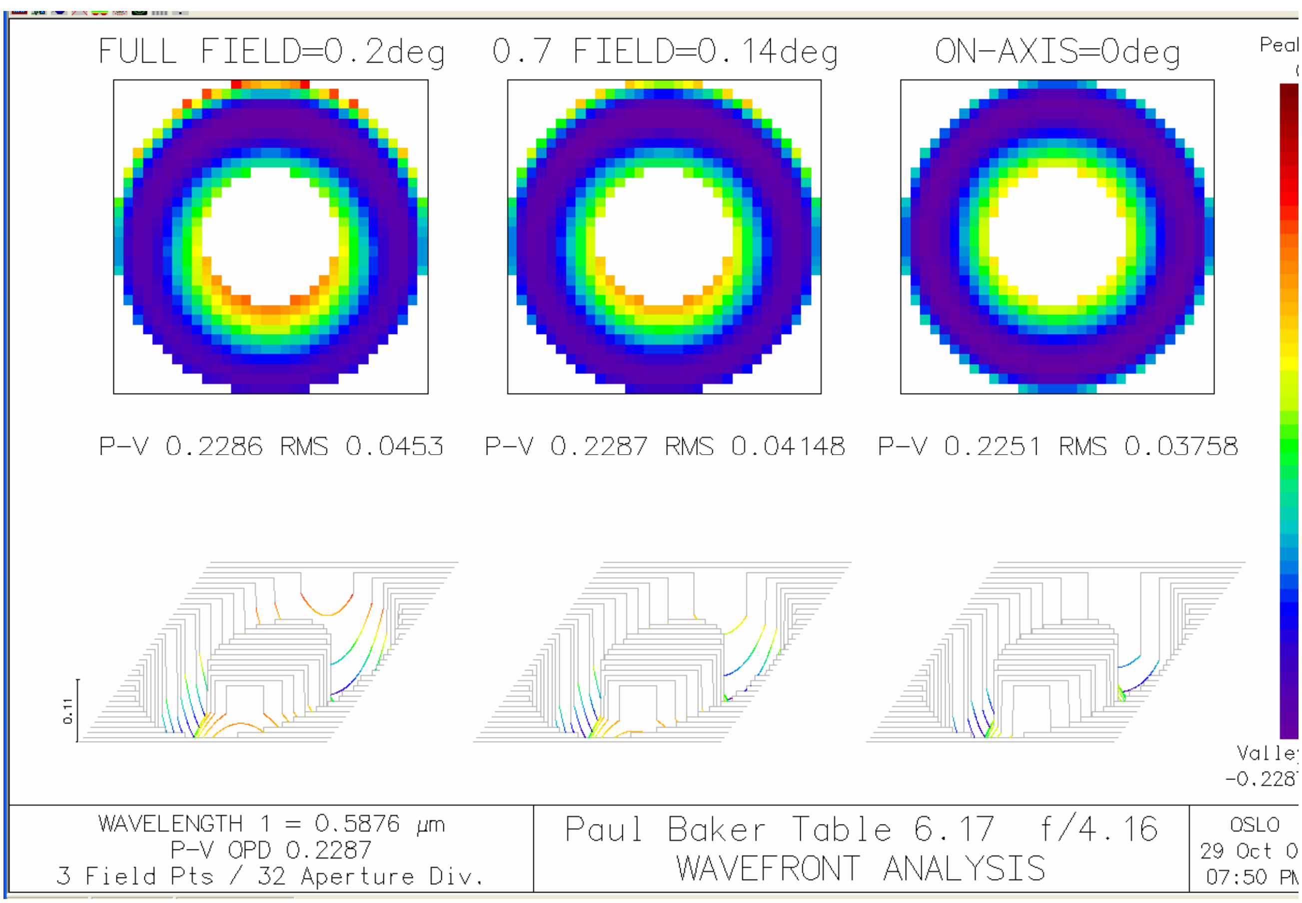


Figure 20 Wavefront analysis for Figure 19

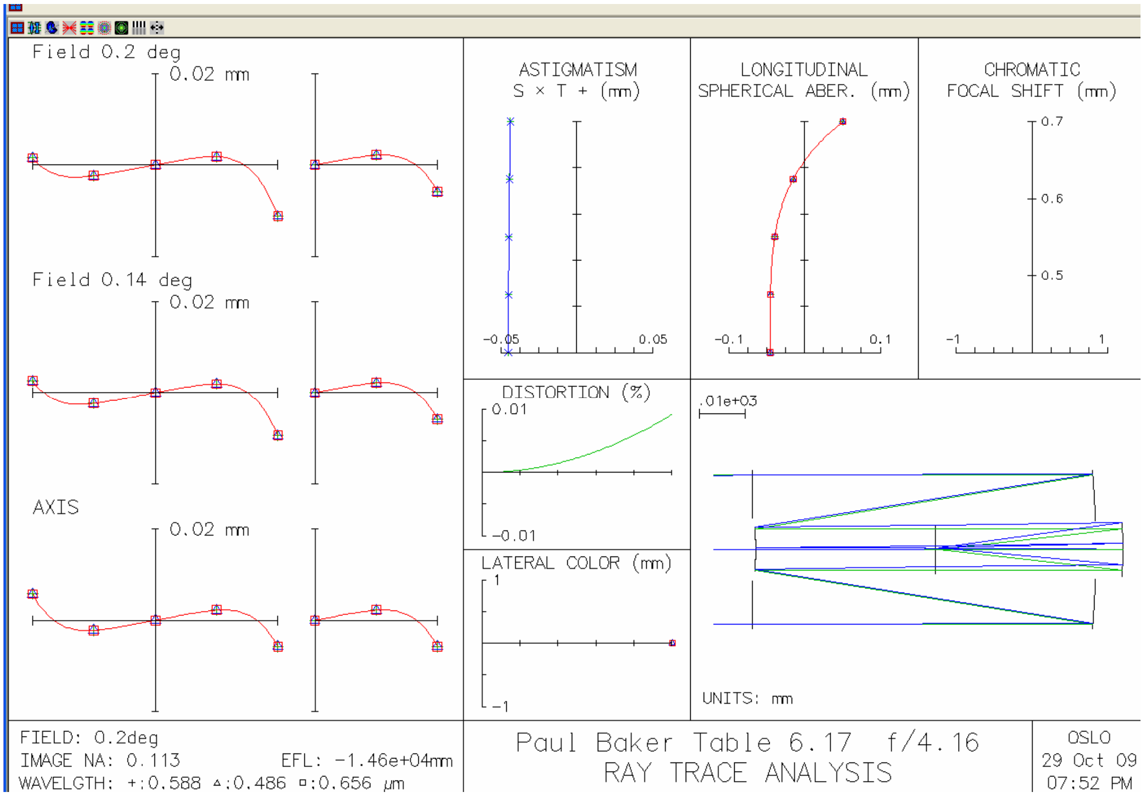


Figure 21 Ray trace analysis for Figure 19

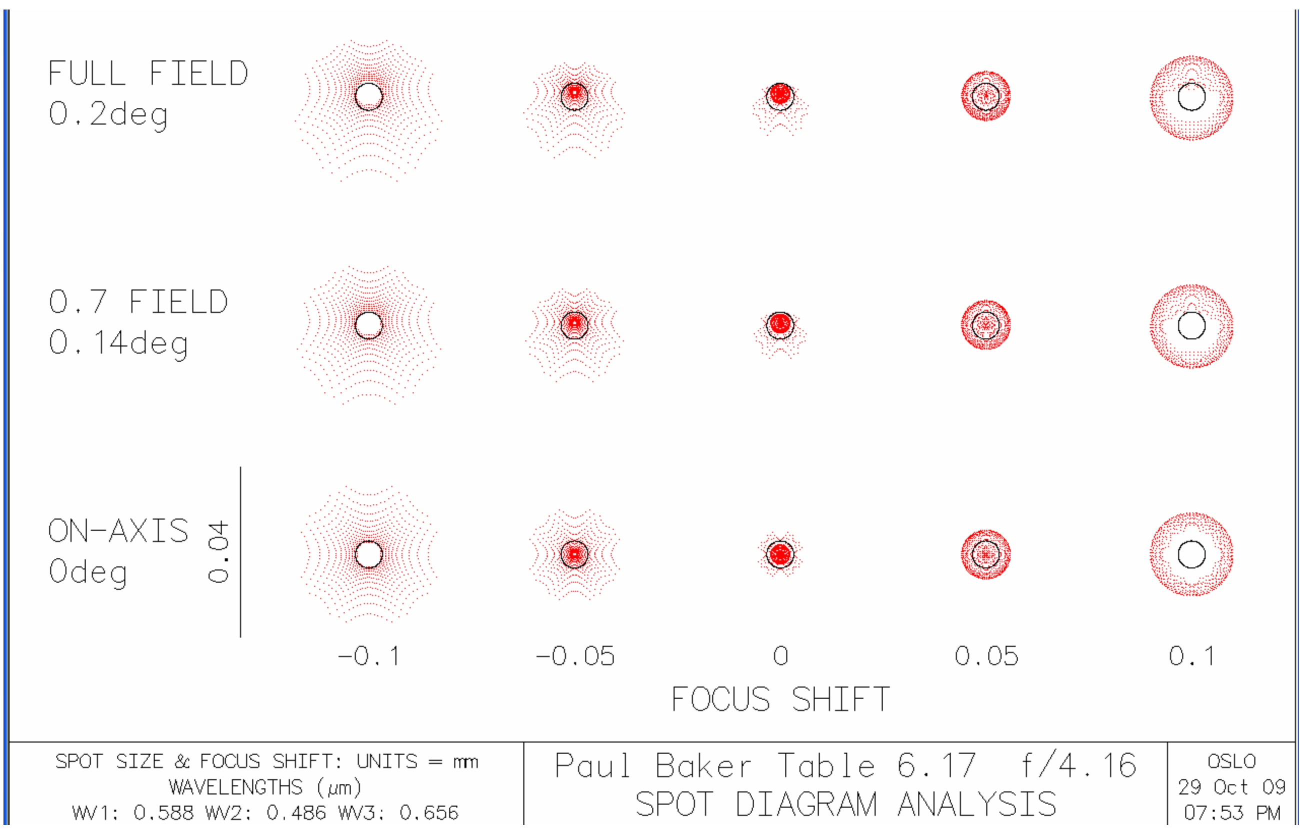


Figure 22 Spot analysis for Figure 19

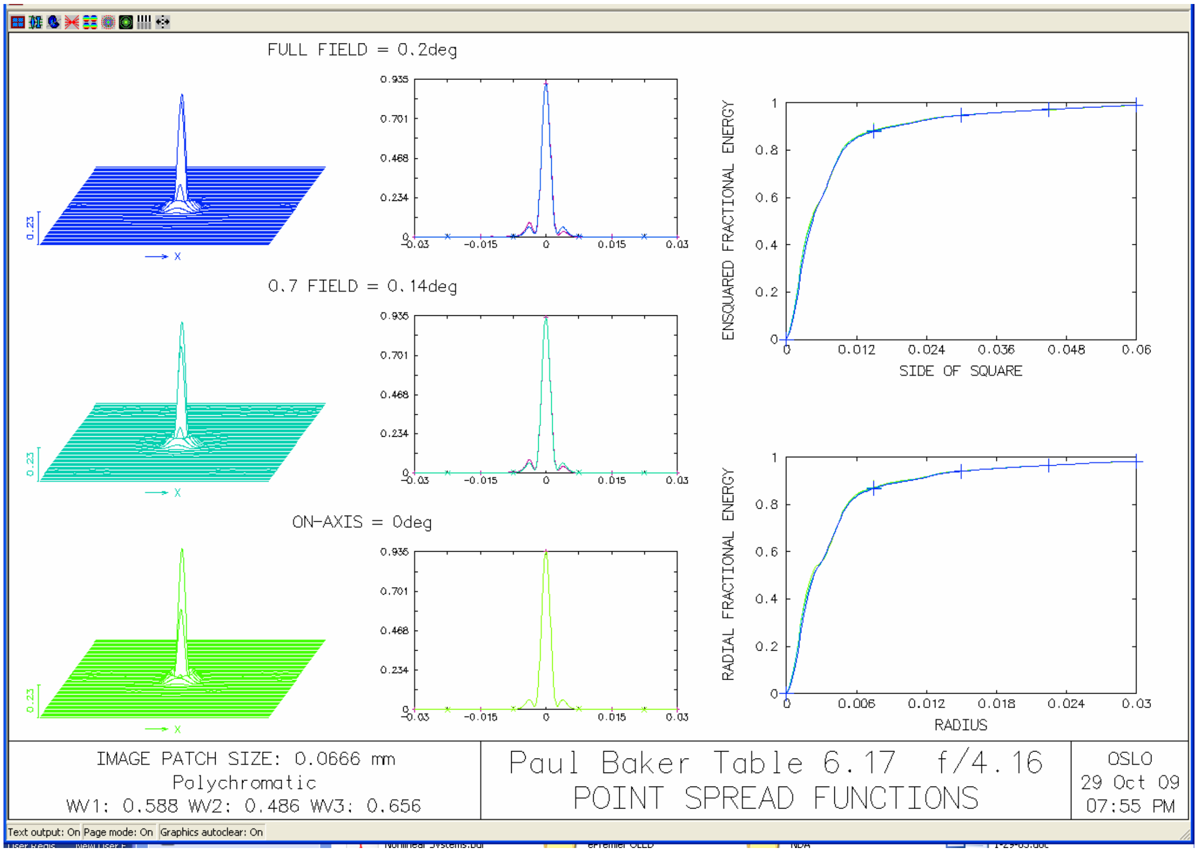


Figure 23 Point spread functions for Figure 19

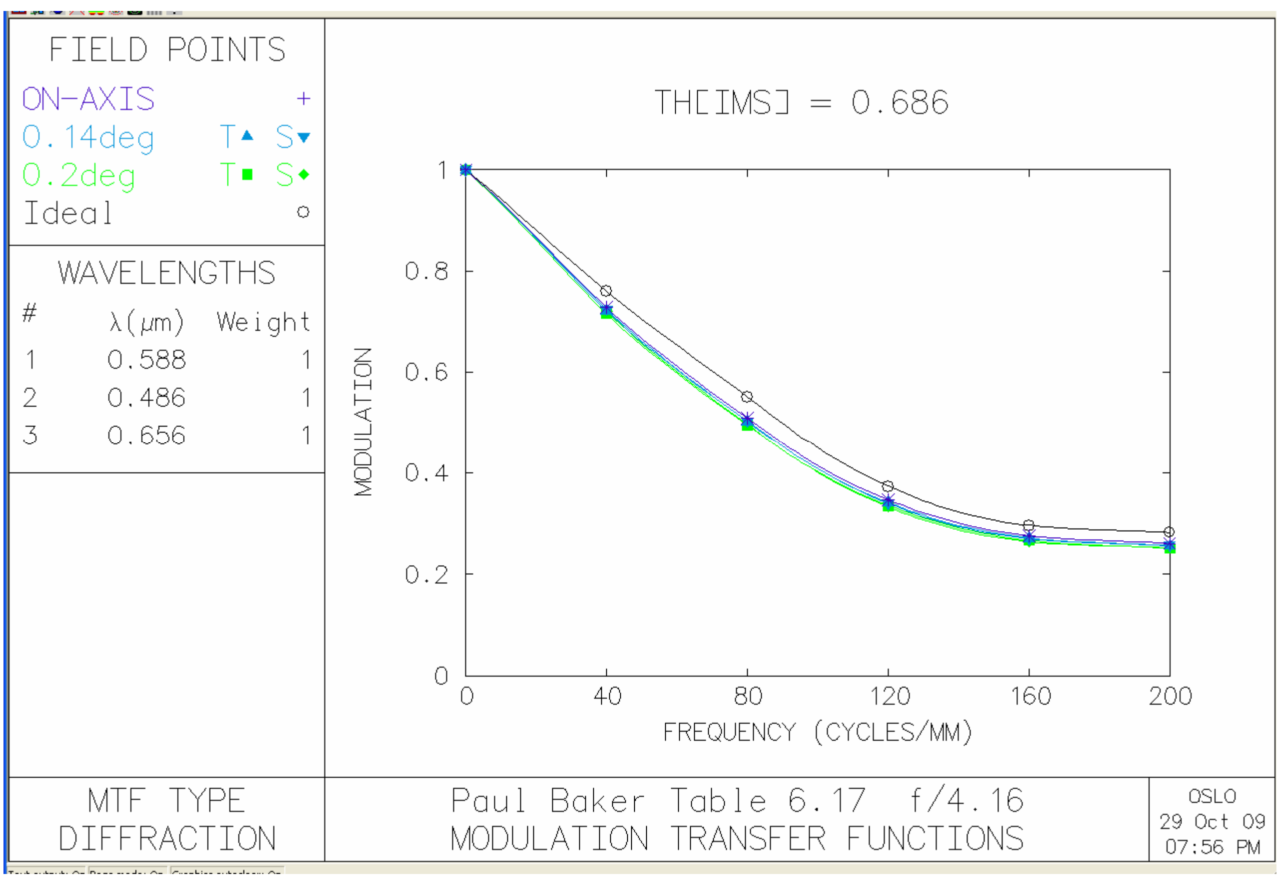


Figure 24 Modulation transfer functions for Figure 19

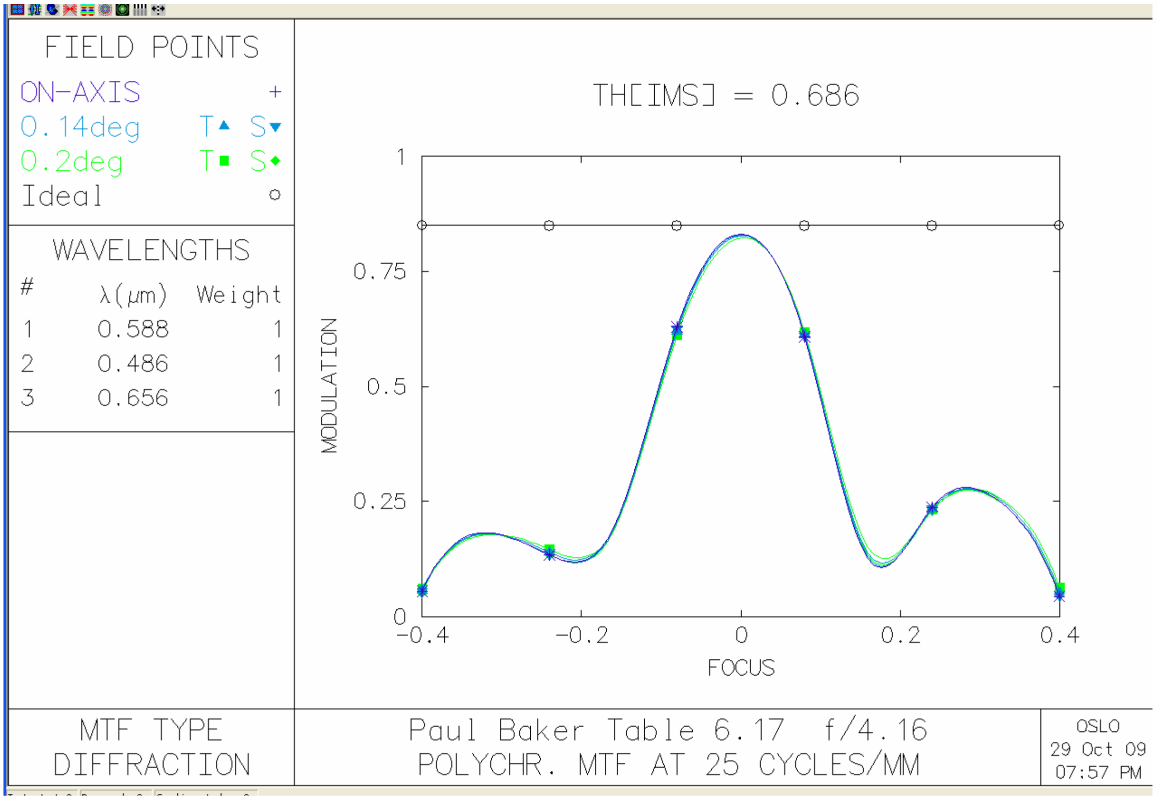


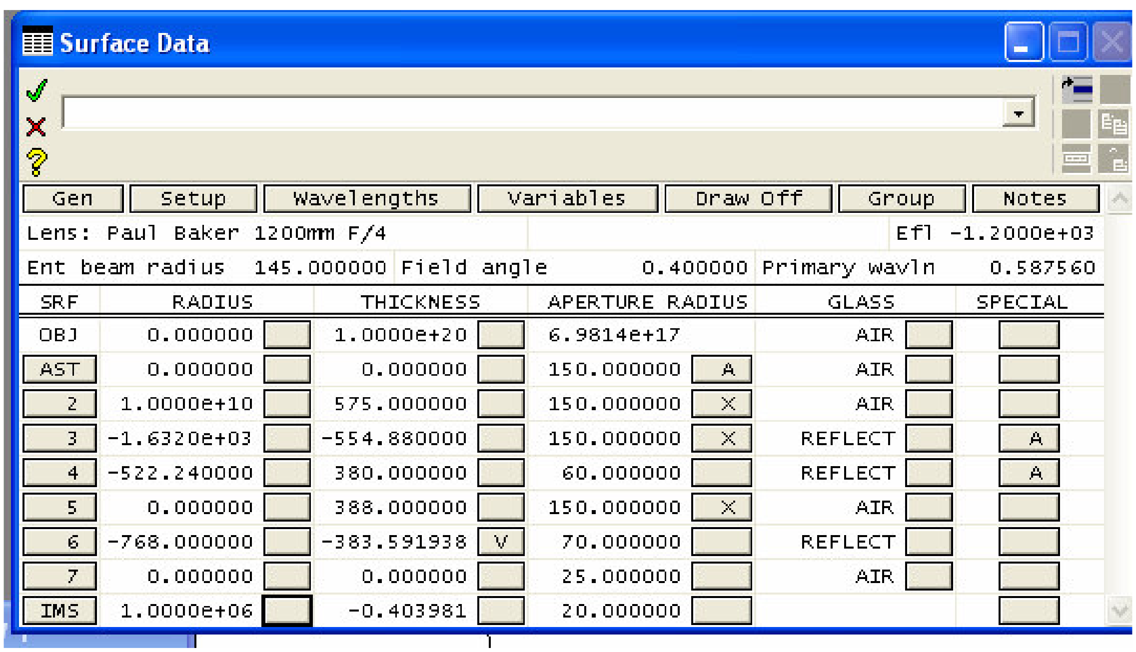
Figure 25 Polychromatic MTF for Figure 19

Paul Baker 3 Design (After Lessons Learned): f_{eff} = 1200 mm, D = 300 mm (12”), F_{sys} = 4

Truly remarkable performance. Access to image is very difficult, and baffling is very demanding and would need more work, but image clarity is really something.

Table 2 Paul Baker 3 Design Parameters

Parameter	Value	Comment
D	300 mm	Diameter of primary mirror
F_1	2.72	F-number of primary mirror
f_1	816 mm	Focal length of primary mirror. Concave surface
R_1	1632 mm	Radius of curvature for primary mirror
k	0.32	f_2 / f_1 ratio
f_2	261.12 mm	Focal length for secondary mirror. Convex surface
R_2	522.24 mm	Radius of curvature for secondary mirror
R_3 / R_2	1/(1-k) = 1.4706	For flat-field
R_3	768 mm	Radius of curvature for third mirror, concave surface.
f_3	384	Focal length of third mirror
MSR	1.38408	Mirror separation ratio: M1 to M2 distance divided by M2 to M3 distance
S_{12}	554.88 mm	Distance from primary to secondary
S_{23}	768 mm	Distance from secondary to third mirror
K_1	–1	Conical parameter for primary (parabolic)
K_2	–0.6856	Conical parameter for secondary (elliptical) = $-1+\left(\frac{R_2}{R_3}\right)^3$
F_{sys}	4	F-number for the system



Surface Data

Lens: Paul Baker 1200mm F/4 — Efl -1.2000e+03

Ent beam radius 145.000000 — Field angle 0.400000 — Primary wavln 0.587560

SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		6.9814e+17		AIR		
AST	0.000000		0.000000		150.000000	A	AIR		
2	1.0000e+10		575.000000		150.000000	X	AIR		
3	-1.6320e+03		-554.880000		150.000000	X	REFLECT		A
4	-522.240000		380.000000		60.000000		REFLECT		A
5	0.000000		388.000000		150.000000	X	AIR		
6	-768.000000		-383.591938	V	70.000000		REFLECT		
7	0.000000		0.000000		25.000000		AIR		
IMS	1.0000e+06		-0.403981		20.000000				

Figure 26 Paul Baker 3 design

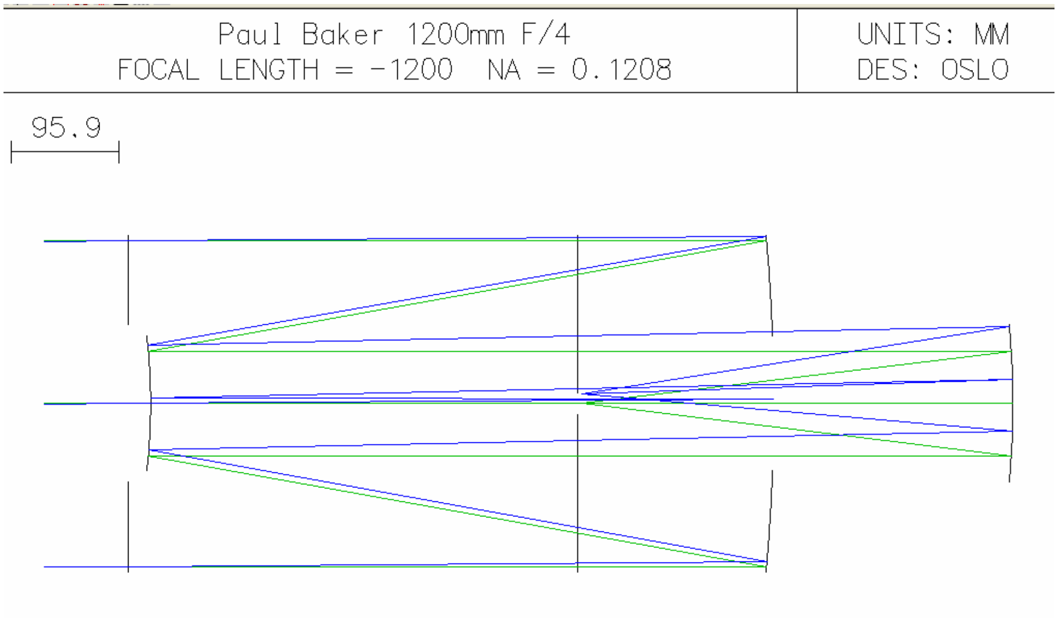


Figure 27 Paul Baker 3 design

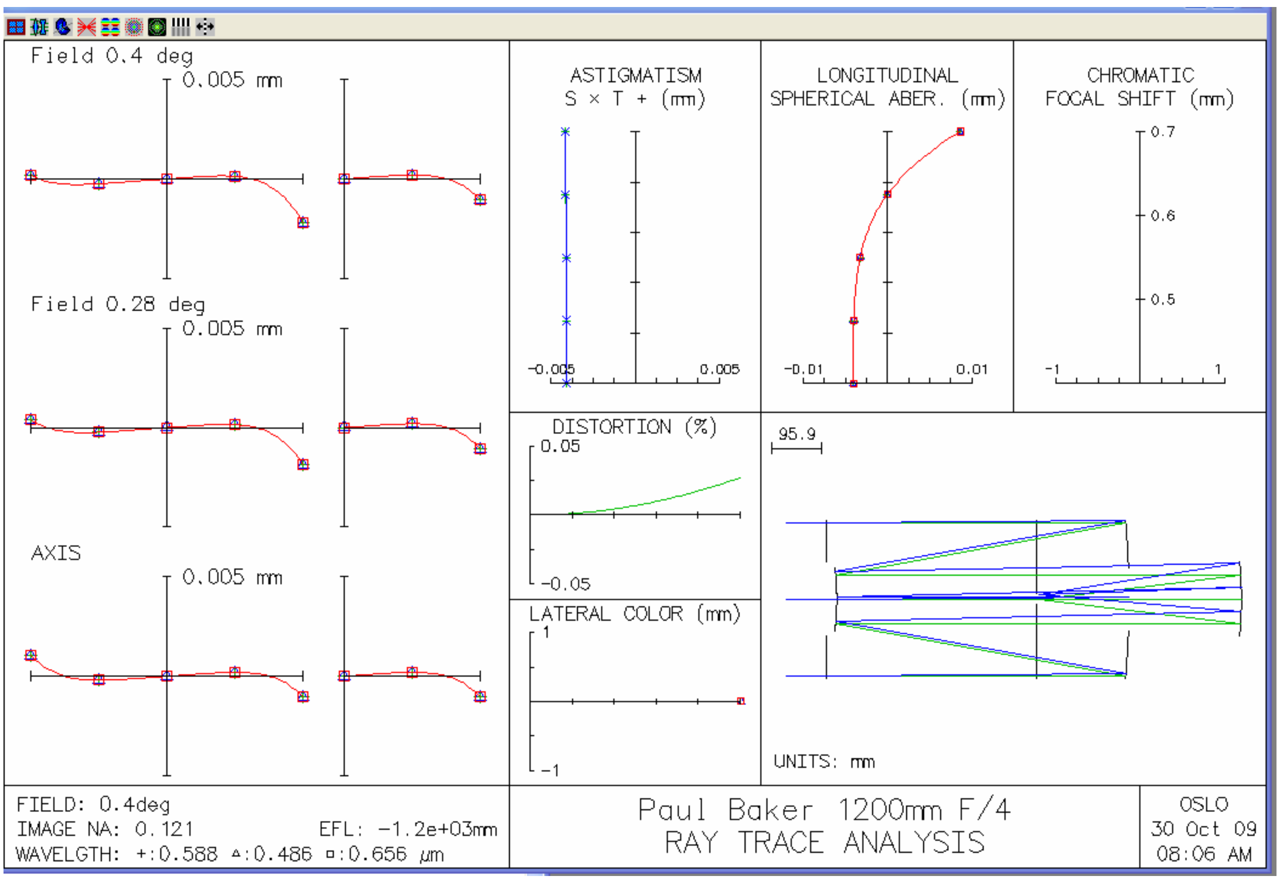


Figure 28 Paul Baker 3 design

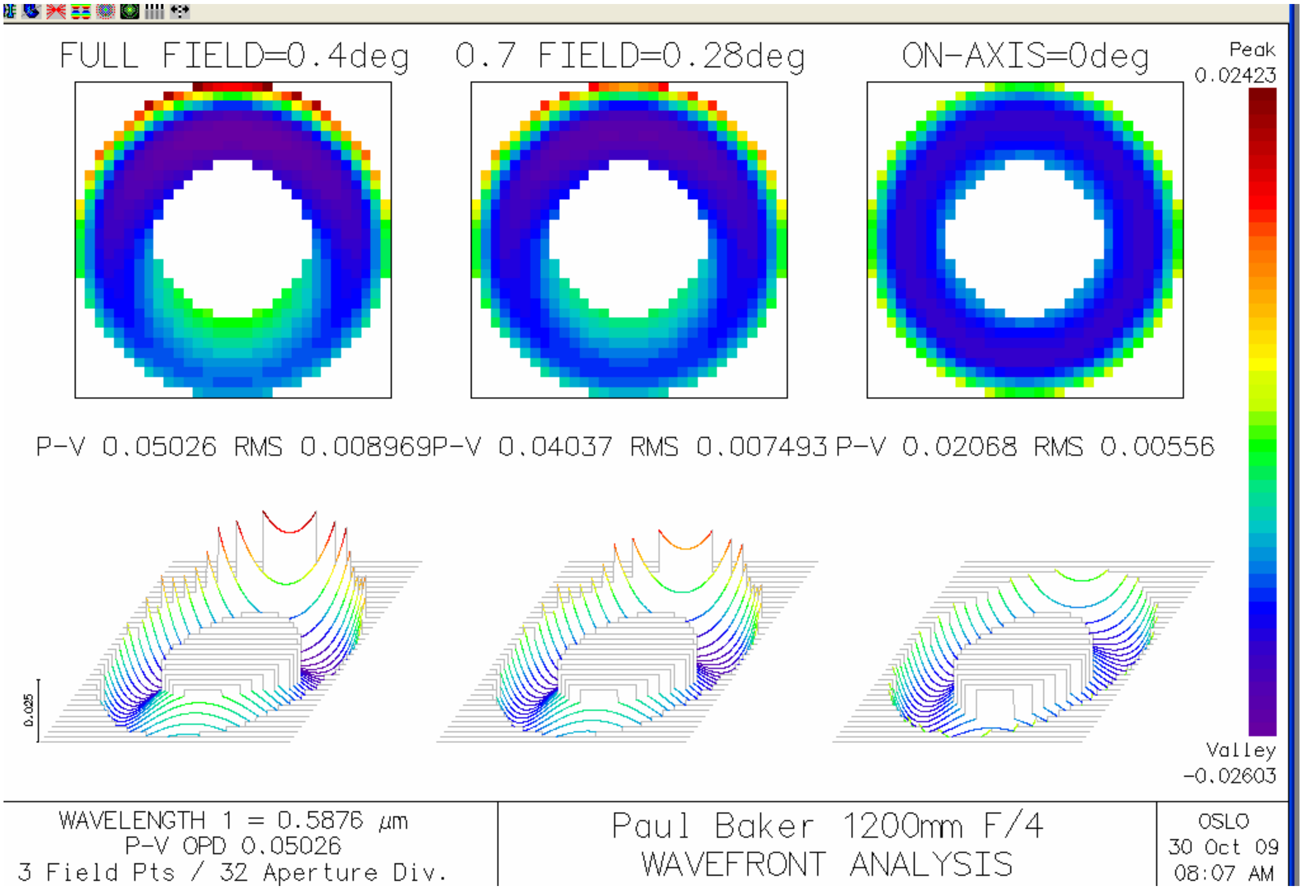


Figure 29 Paul Baker 3 design

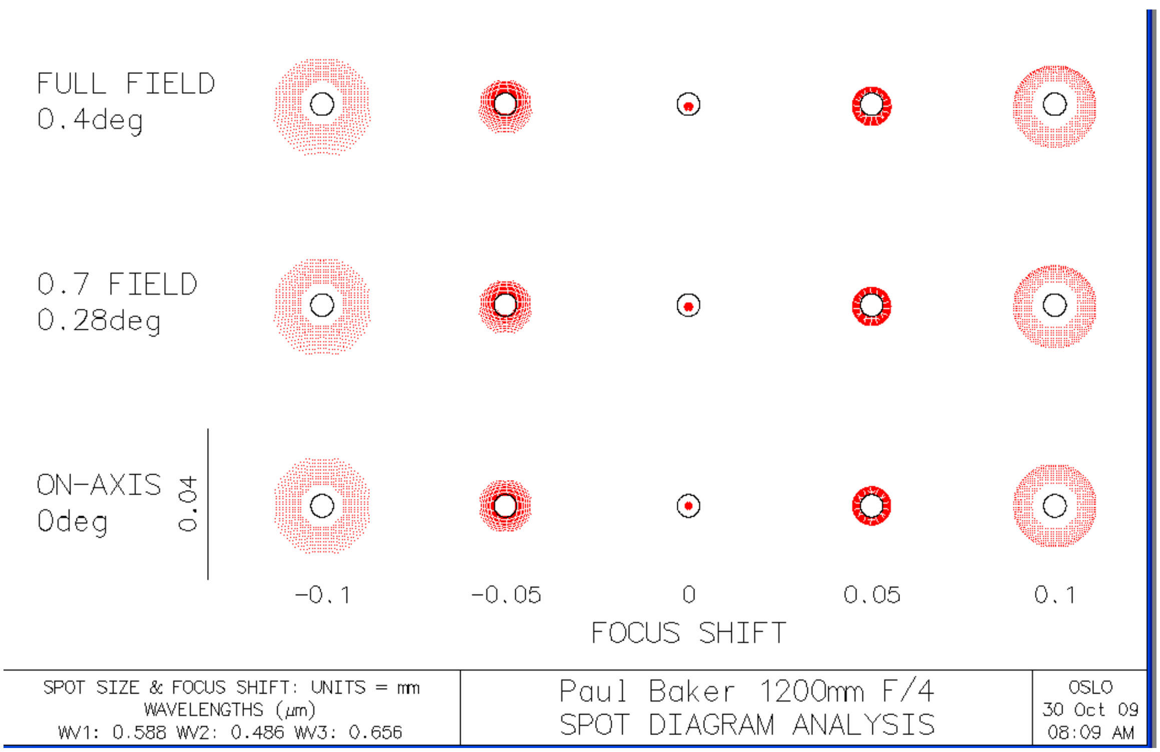


Figure 30 Paul Baker 3 design

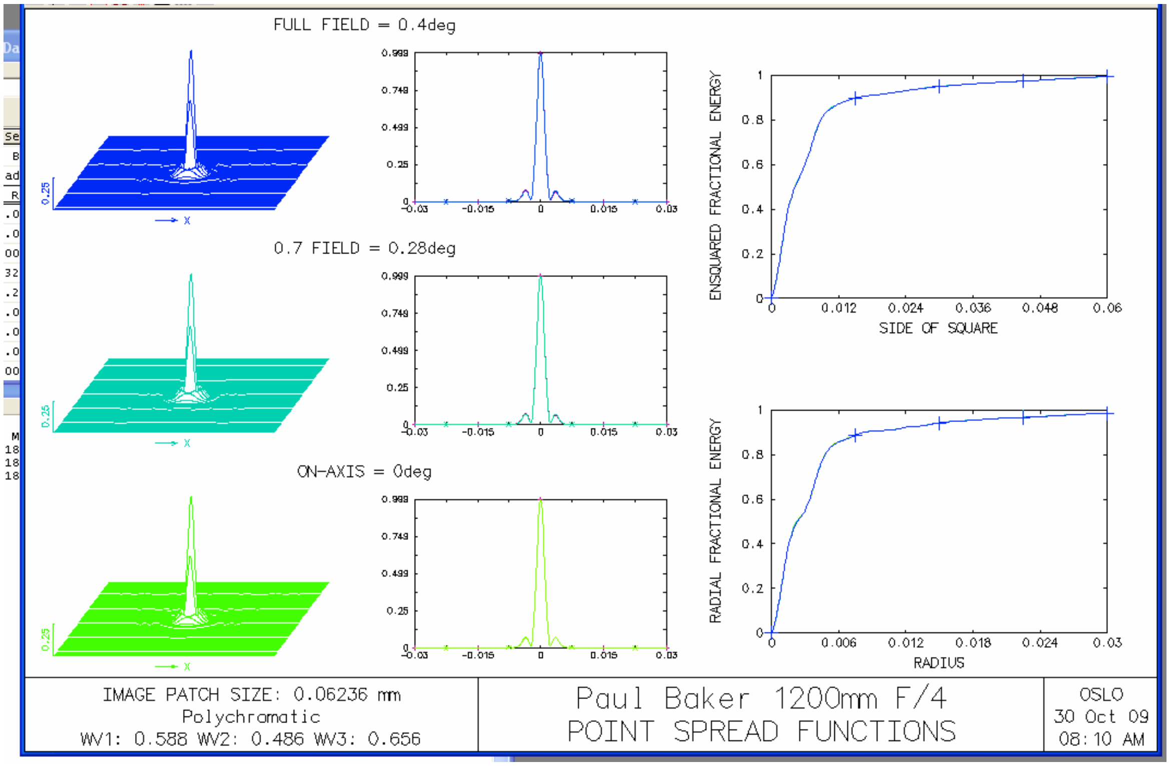


Figure 31 Paul Baker 3 design

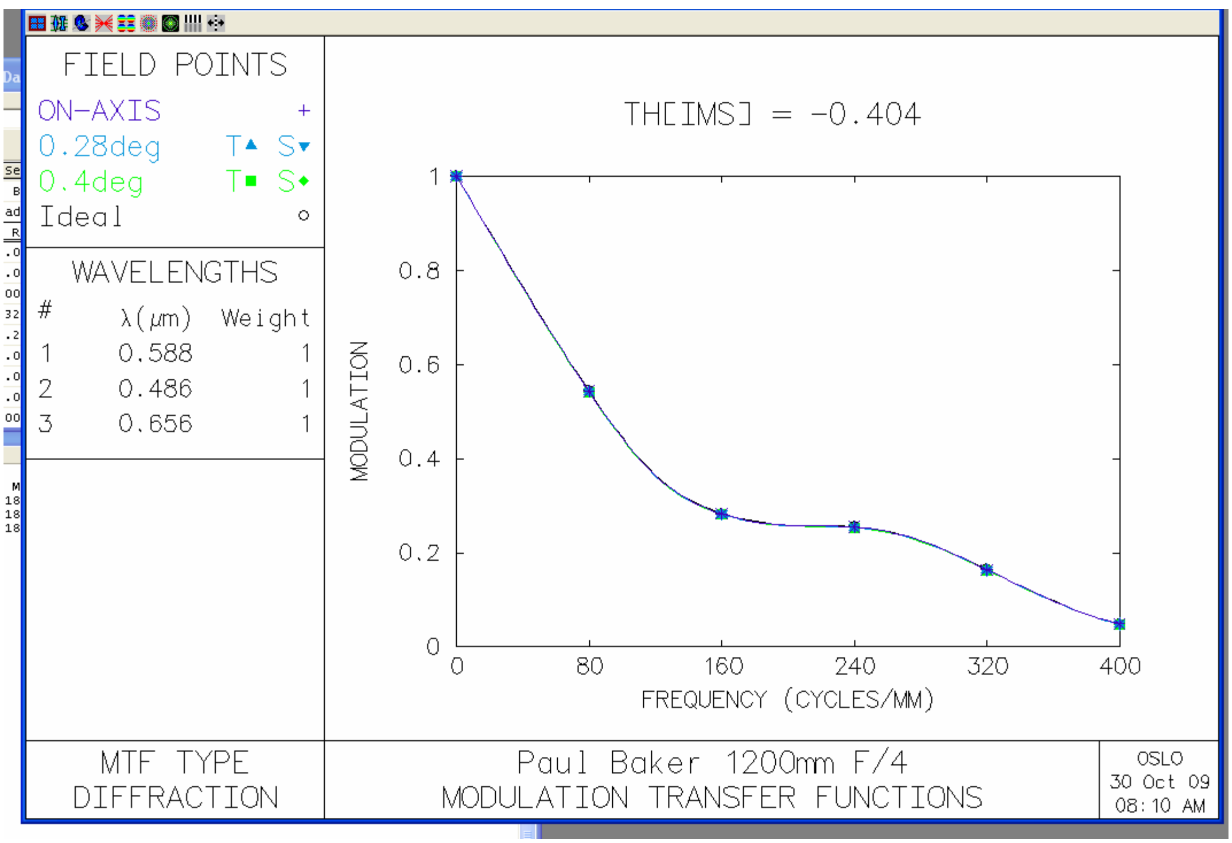


Figure 32 Paul Baker 3 design

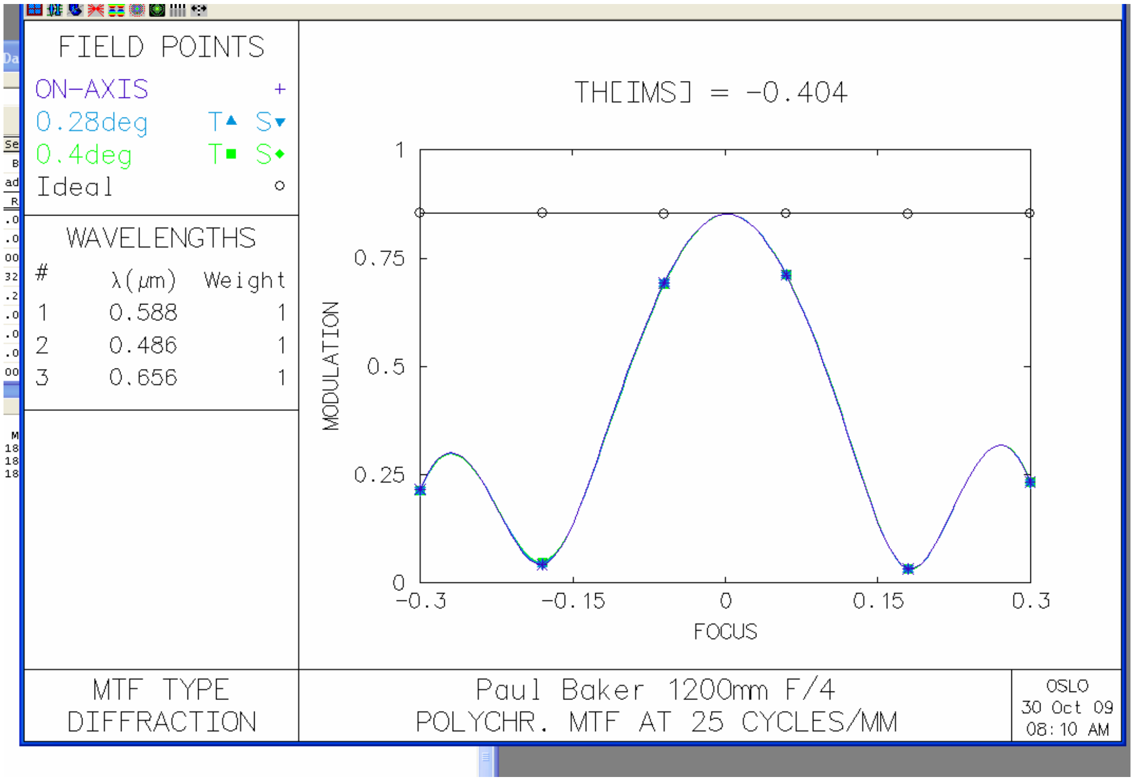


Figure 33 Paul Baker 3 design

Paul Baker 4 Design: 1200 mm F/4 with Key Optics Internal

Again, truly outstanding performance!

Surface Data

0.0038662035902

Gen | Setup | Wavelengths | Variables | Draw Off | Group | Notes

Lens: Paul Baker 1200mm F/4 Efl -1.2000e+03

Ent beam radius 145.000000 Field angle 1.000000 Primary wavln 0.587560

SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		1.7455e+18		AIR		
AST	0.000000		0.000000		150.000000	A	AIR		
2	1.0000e+10		715.000000		150.000000	X	AIR		
3	-1.8480e+03		-711.480000		160.000000	X	REFLECT		A
4	-425.040000		262.000000		55.000000		REFLECT		A
5	0.000000		290.000000		150.000000	X	AIR		
6	-552.000000		-276.000000	V	85.000000		REFLECT		
7	0.000000		0.000000		25.000000		AIR		
IMS	1.0000e+06				20.000000				

Figure 34 Paul Baker 4 design

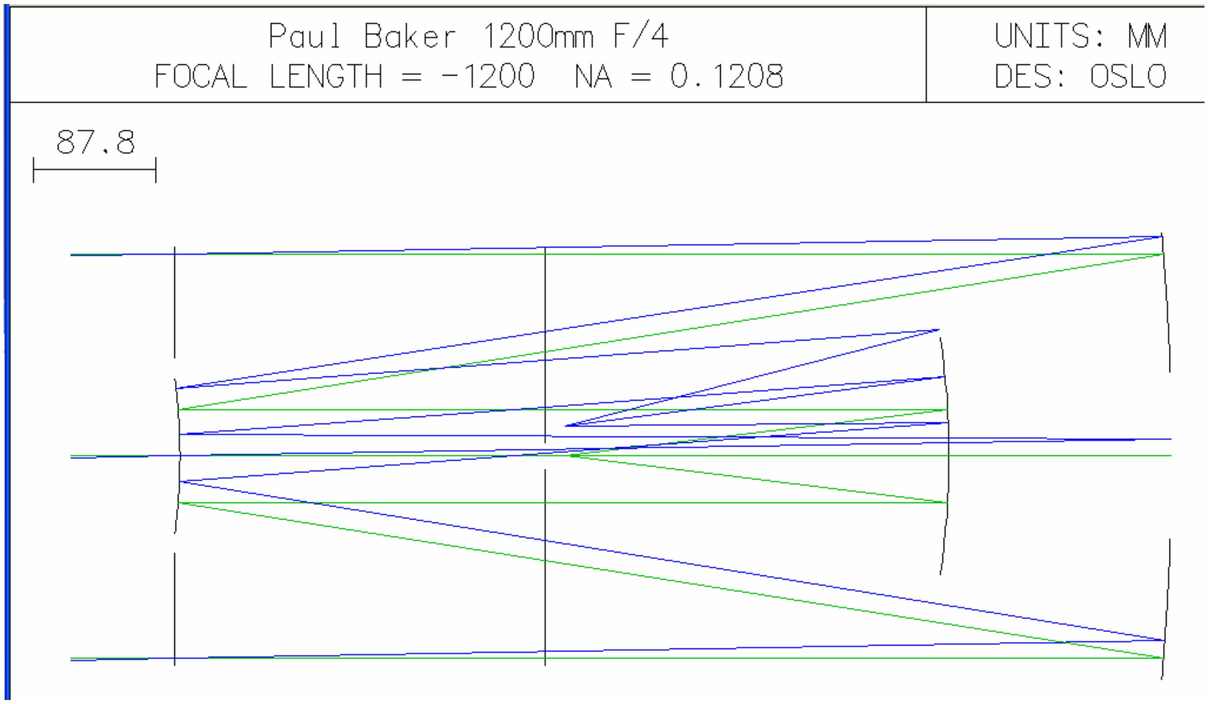


Figure 35 Paul Baker 4 design

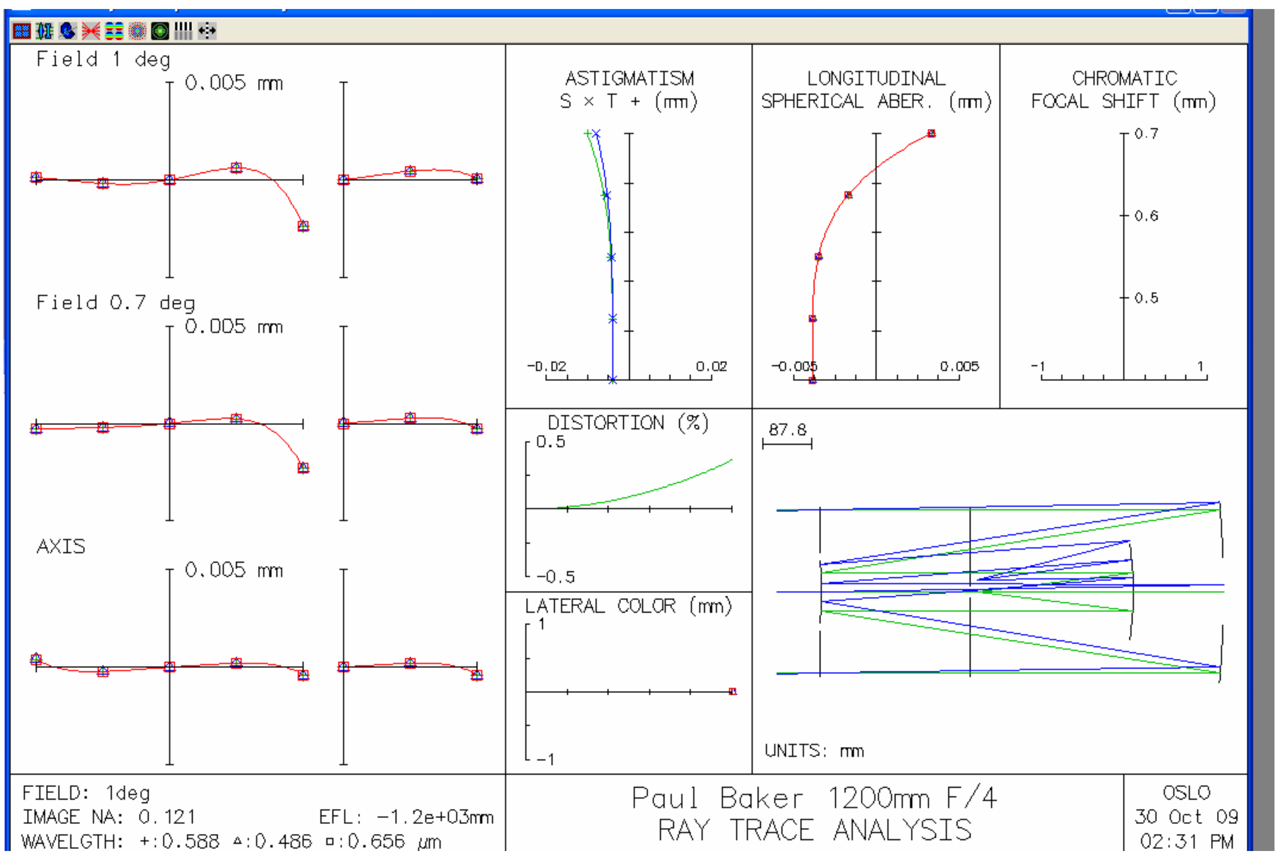


Figure 36 Paul Baker 4 design

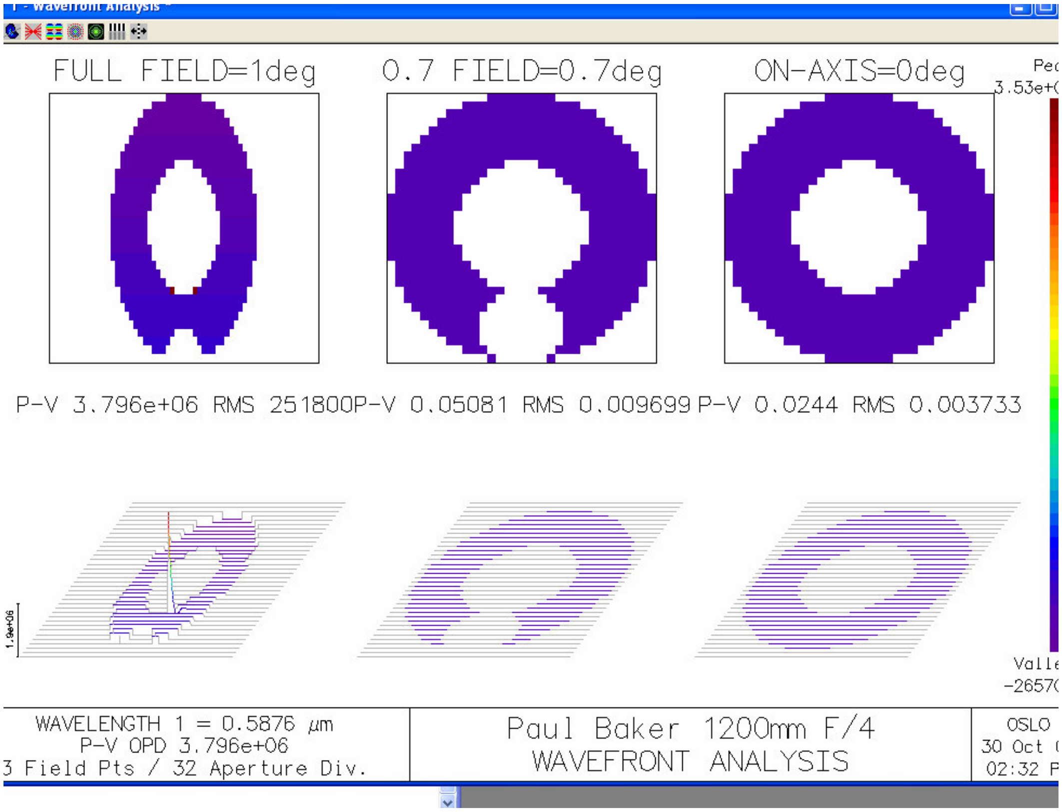


Figure 37 Paul Baker 4 design

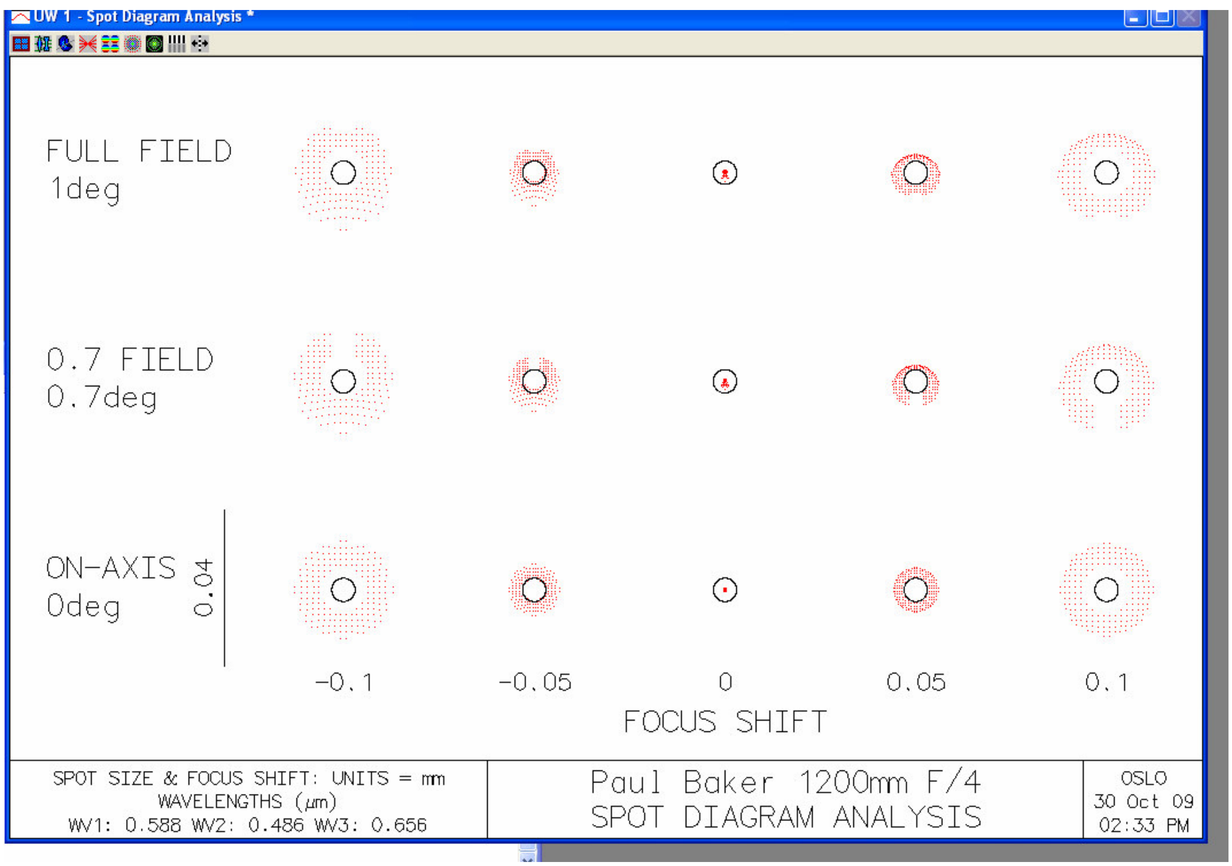


Figure 38 Paul Baker 4 design. Clearly diffraction-limited performance.

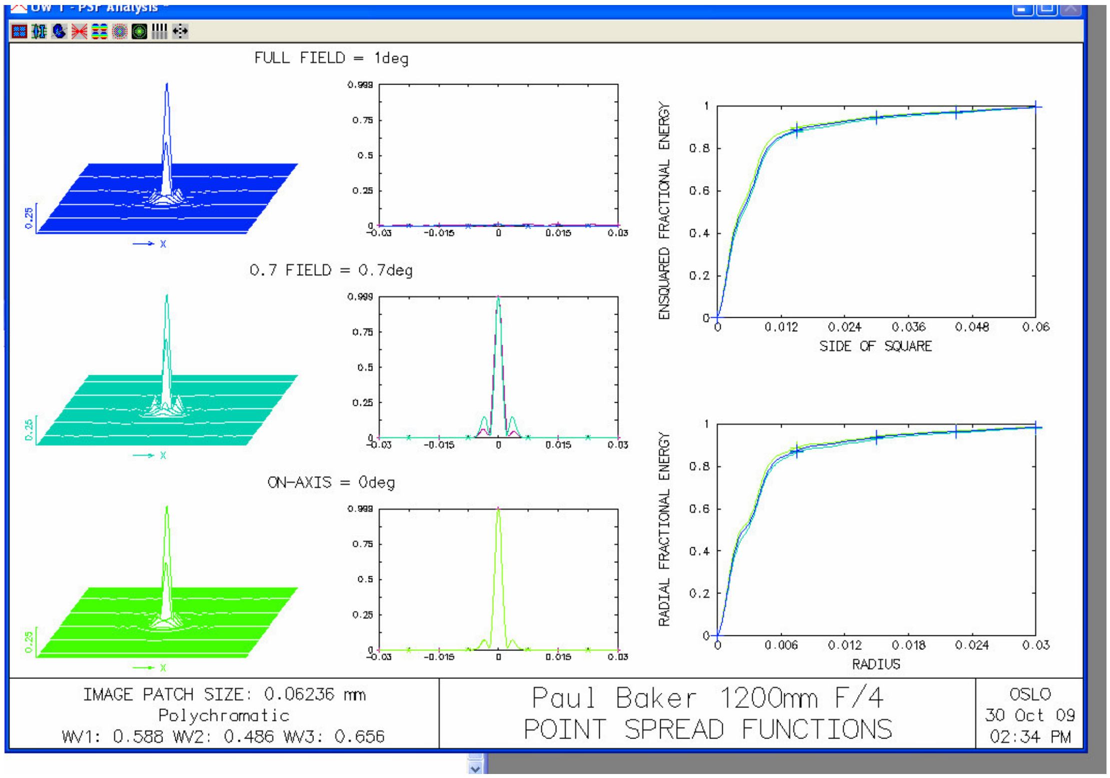


Figure 39 Paul Baker 4 design

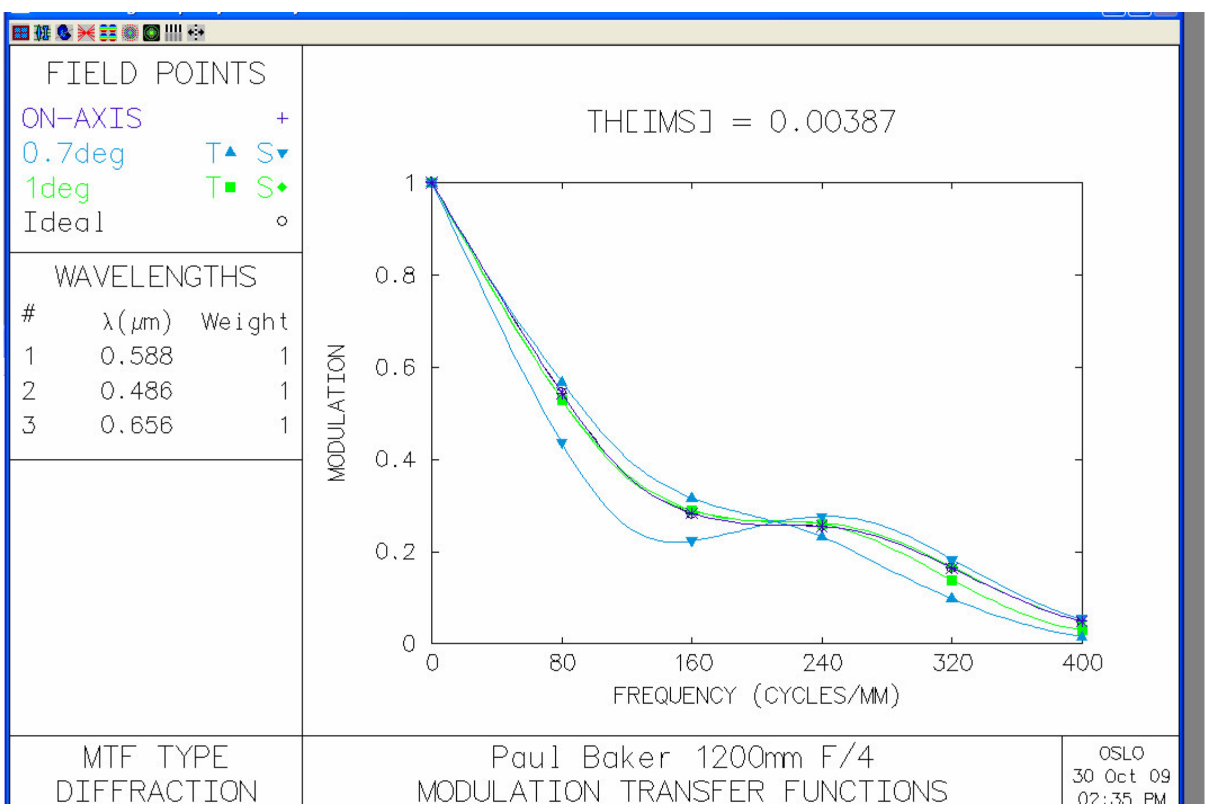


Figure 40 Paul Baker 4 design

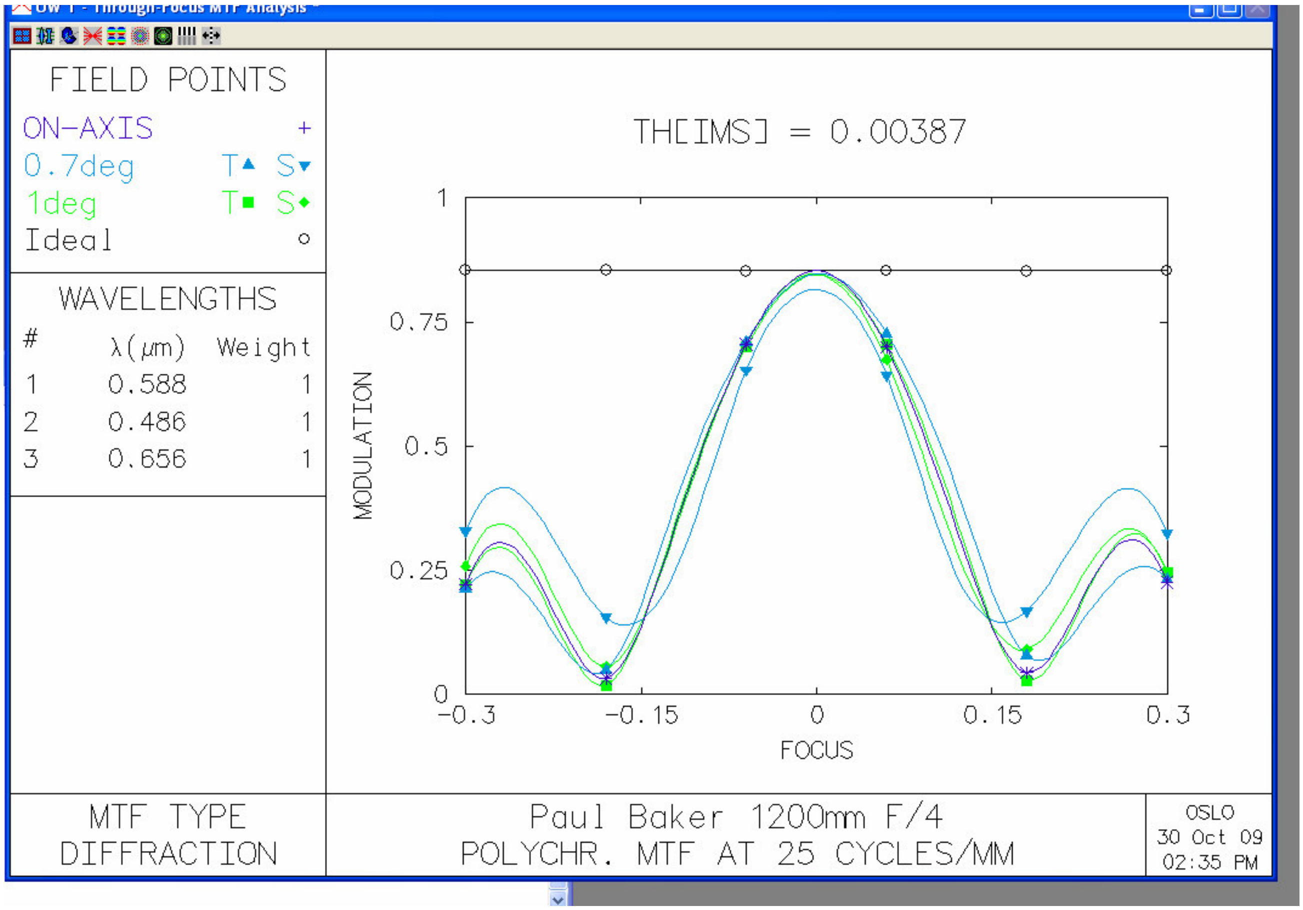
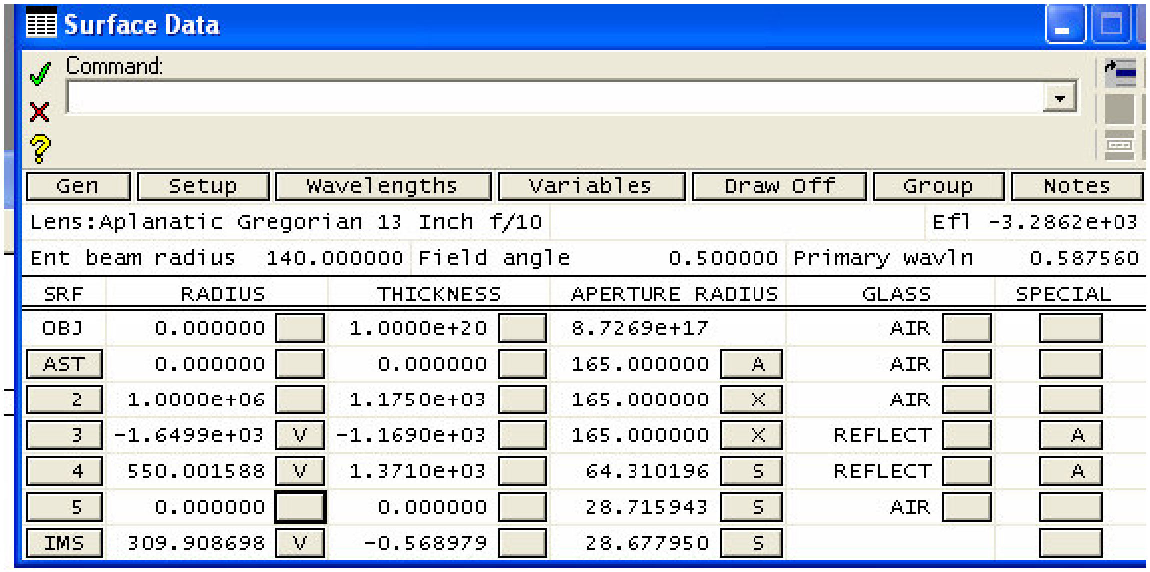


Figure 41 Paul Baker 4 design

Aplanatic Gregorian 13-Inch F/10



Surface Data

Command:

Gen | Setup | Wavelengths | Variables | Draw Off | Group | Notes

Lens:Aplanatic Gregorian 13 Inch f/10 Efl -3.2862e+03

Ent beam radius 140.000000 Field angle 0.500000 Primary wavln 0.587560

SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		8.7269e+17		AIR		
AST	0.000000		0.000000		165.000000	A	AIR		
2	1.0000e+06		1.1750e+03		165.000000	X	AIR		
3	-1.6499e+03	V	-1.1690e+03		165.000000	X	REFLECT		A
4	550.001588	V	1.3710e+03		64.310196	S	REFLECT		A
5	0.000000		0.000000		28.715943	S	AIR		
IMS	309.908698	V	-0.568979		28.677950	S			

Figure 42 Aplanatic Gregorian 1 design

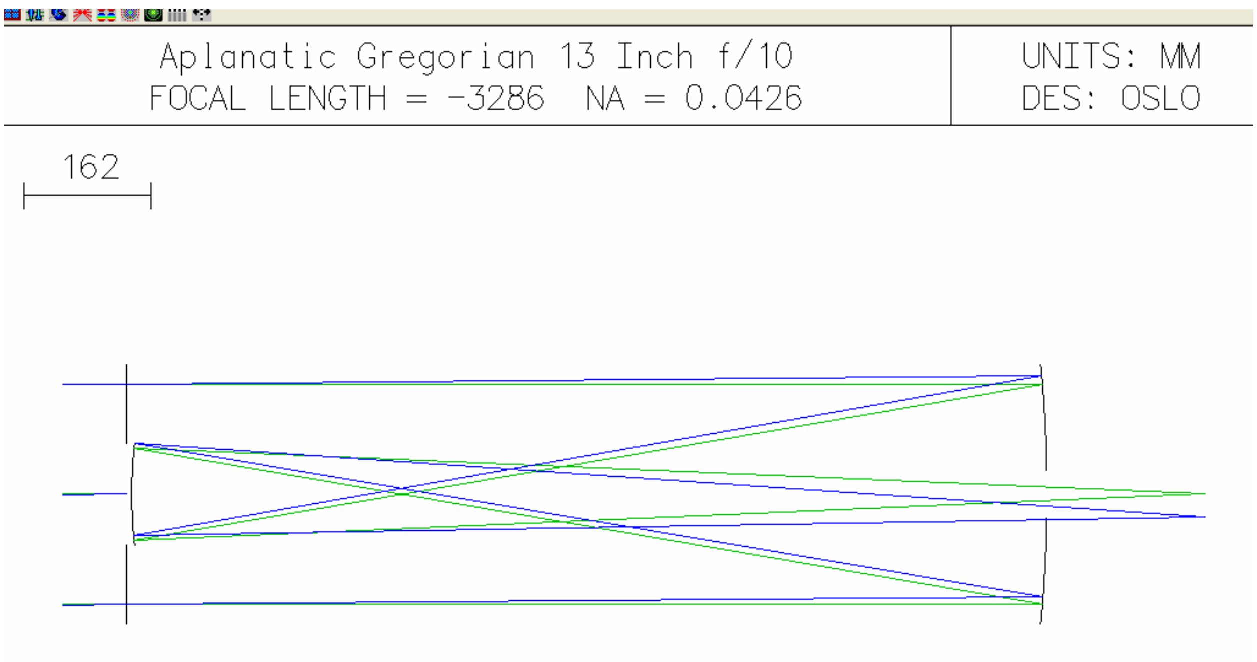


Figure 43 Aplanatic Gregorian 1 design

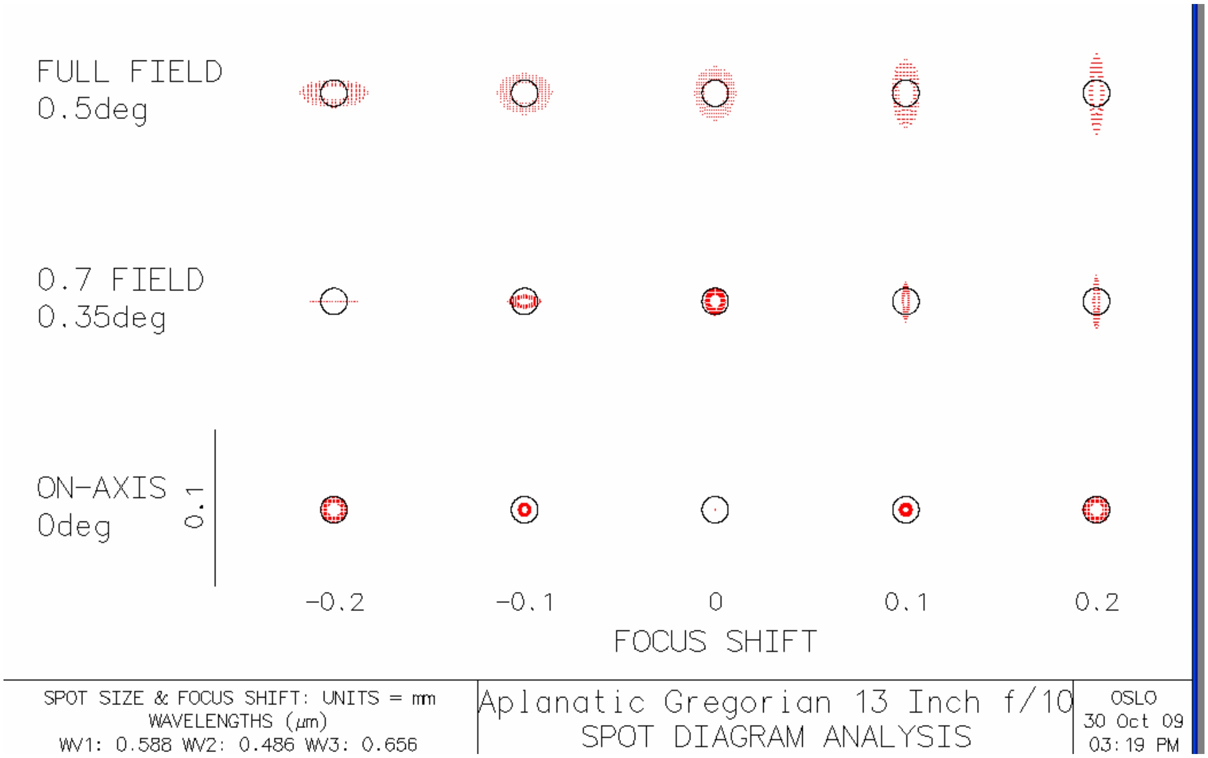


Figure 44 Aplanatic Gregorian 1 design

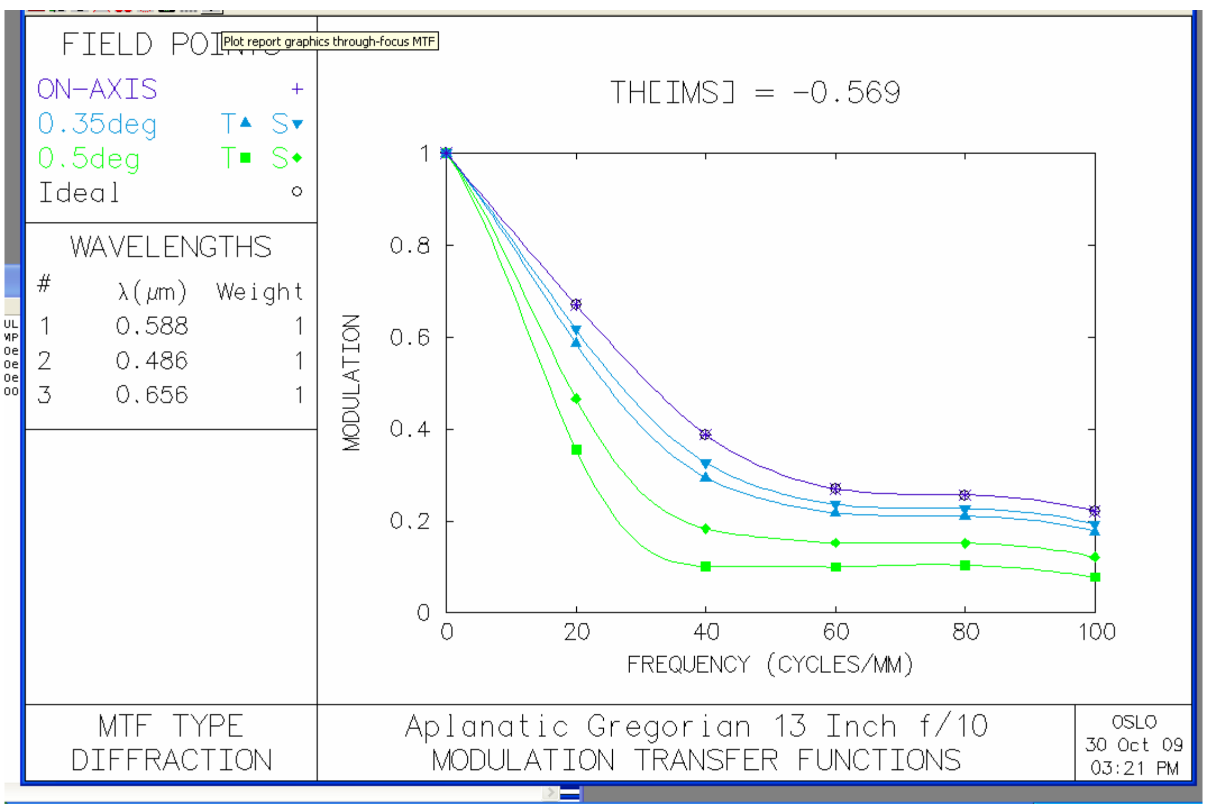
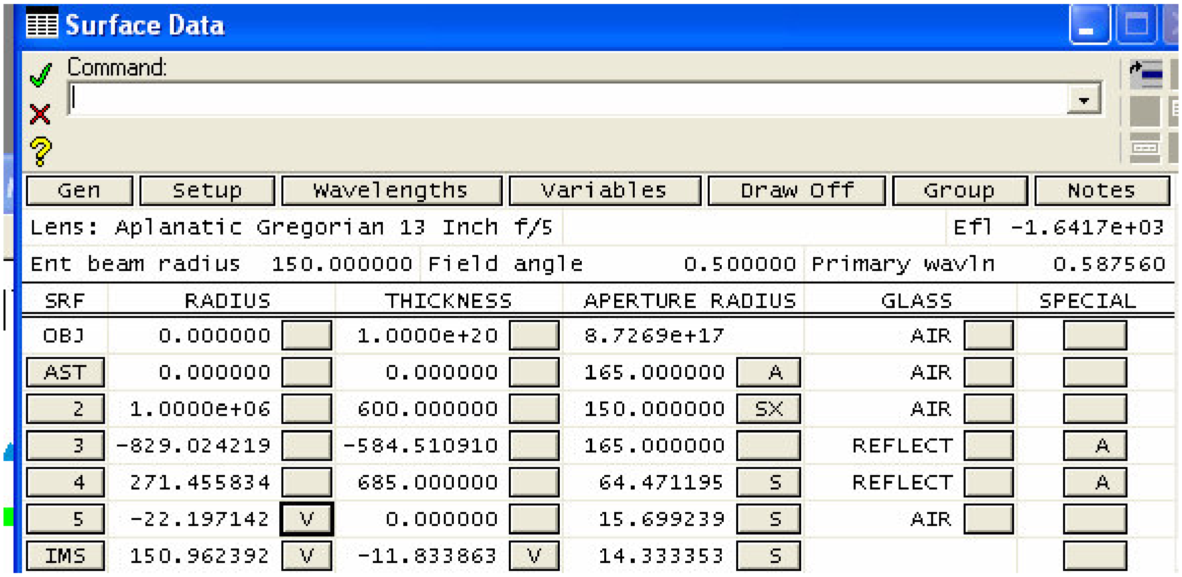


Figure 45 Aplanatic Gregorian 1 design

Aplanatic Gregorian 13-Inch F/5



Surface Data

Command:

Gen | Setup | Wavelengths | Variables | Draw Off | Group | Notes

Lens: Aplanatic Gregorian 13 Inch f/5 Efl -1.6417e+03

Ent beam radius 150.000000 Field angle 0.500000 Primary wavln 0.587560

SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		8.7269e+17		AIR		
AST	0.000000		0.000000		165.000000	A	AIR		
2	1.0000e+06		600.000000		150.000000	SX	AIR		
3	-829.024219		-584.510910		165.000000		REFLECT		A
4	271.455834		685.000000		64.471195	S	REFLECT		A
5	-22.197142	V	0.000000		15.699239	S	AIR		
IMS	150.962392	V	-11.833863	V	14.333353	S			

Figure 46 Aplanatic Gregorian 2 design

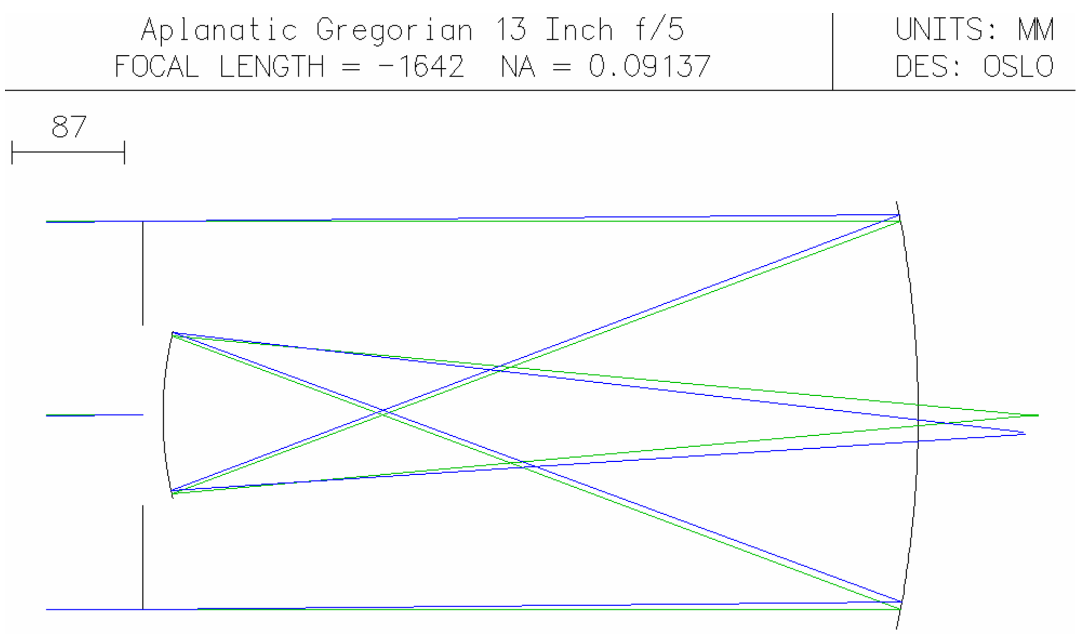


Figure 47 Aplanatic Gregorian 2 design

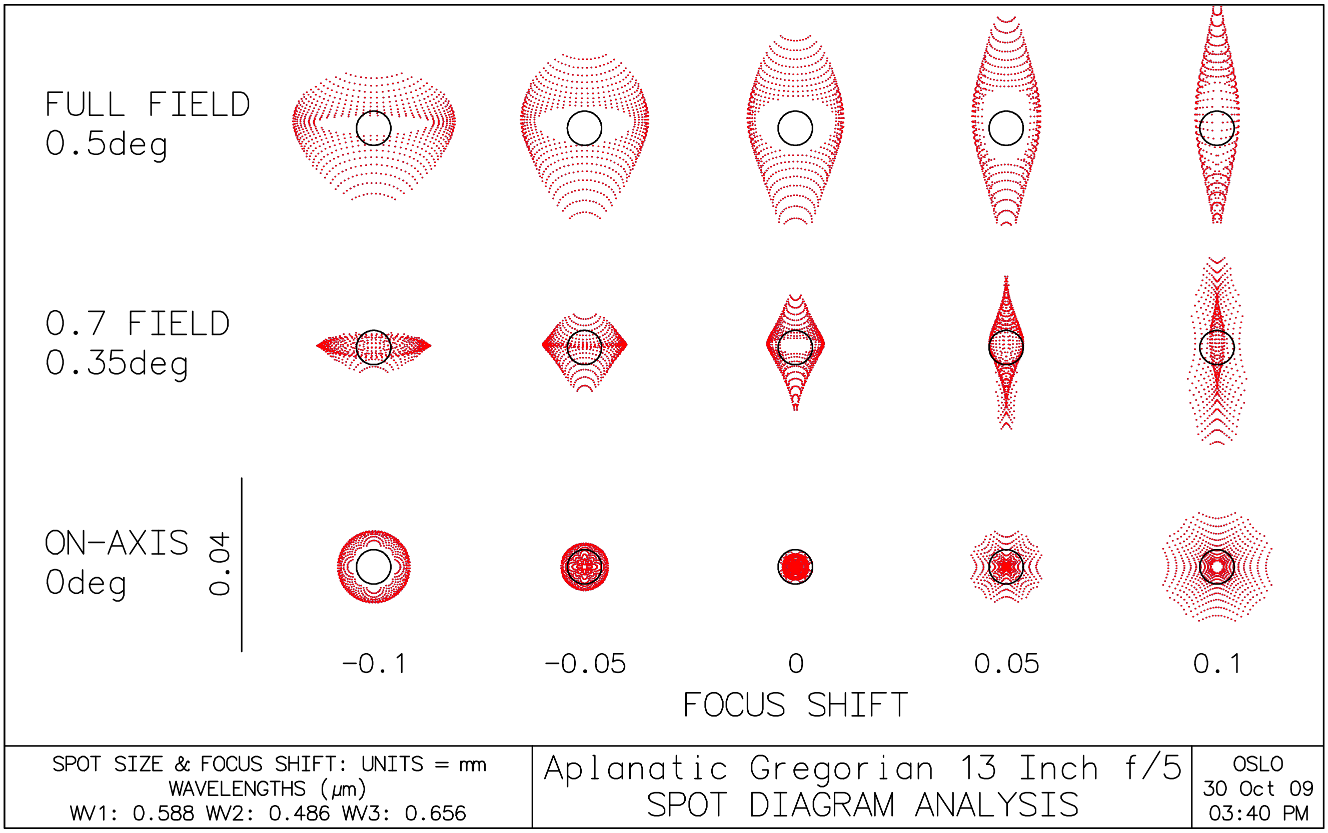


Figure 48 Aplanatic Gregorian 2 design

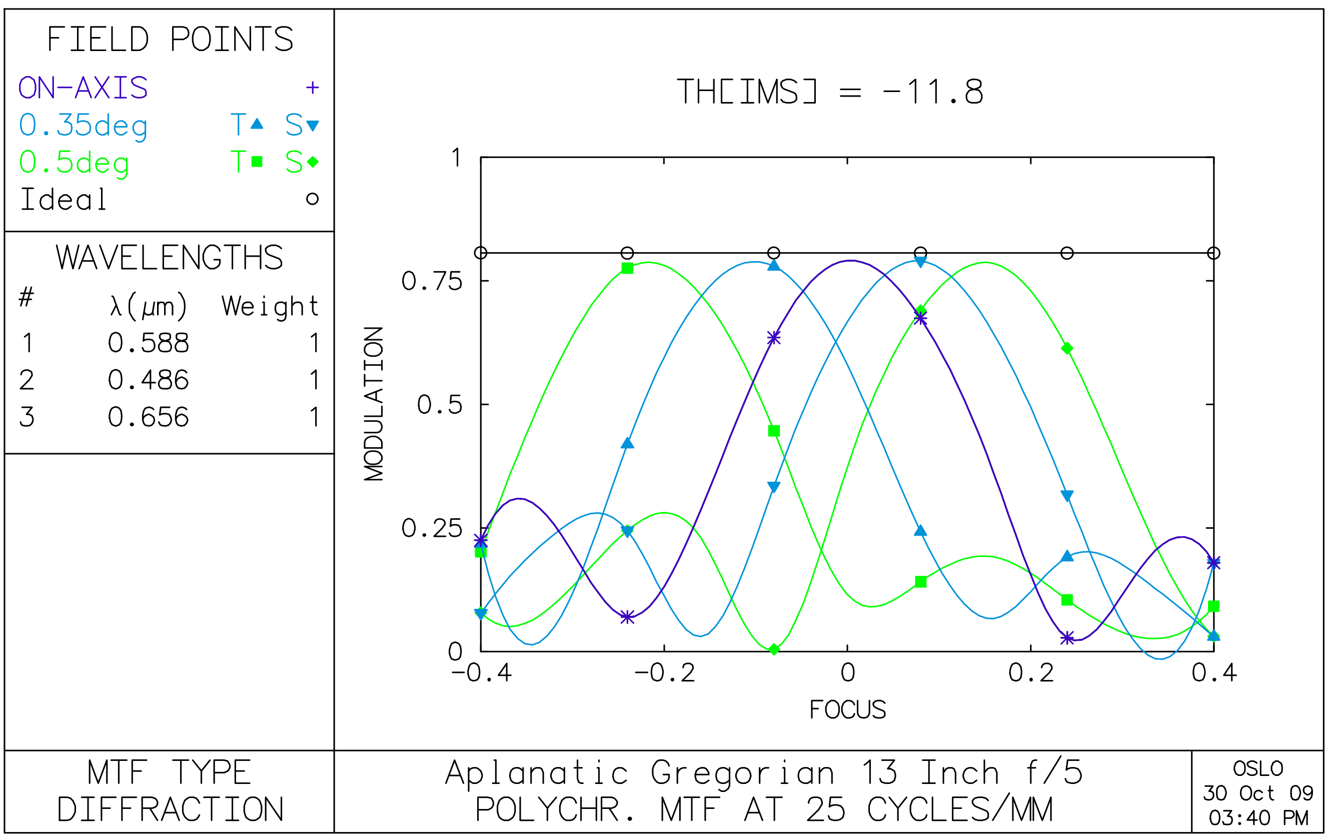


Figure 49 Aplanatic Gregorian 2 design

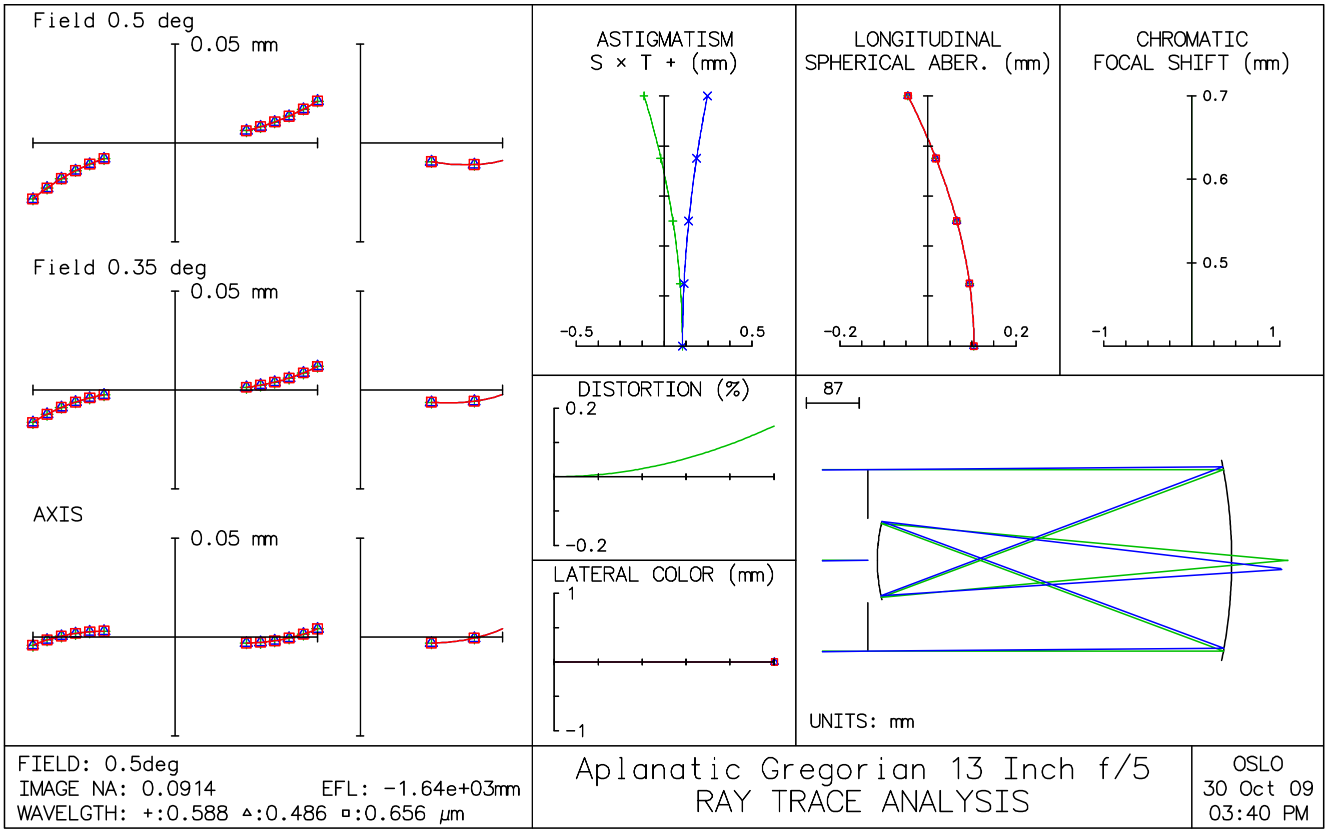
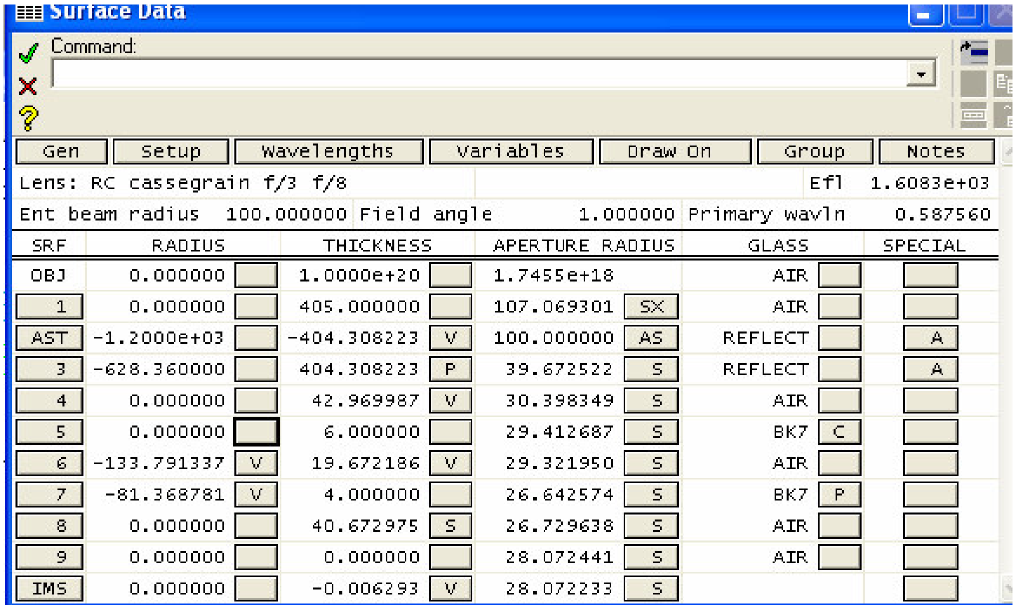


Figure 50 Aplanatic Gregorian 2 design

Ritchey-Chretien F/3 F/5 from OSLO Sample Files



Surface Data

Command:

Gen | Setup | Wavelengths | Variables | Draw On | Group | Notes

Lens: RC cassegrain f/3 f/8 Efl 1.6083e+03

Ent beam radius 100.000000 Field angle 1.000000 Primary wavln 0.587560

SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		1.7455e+18		AIR		
1	0.000000		405.000000		107.069301	SX	AIR		
AST	-1.2000e+03		-404.308223	V	100.000000	AS	REFLECT		A
3	-628.360000		404.308223	P	39.672522	S	REFLECT		A
4	0.000000		42.969987	V	30.398349	S	AIR		
5	0.000000		6.000000		29.412687	S	BK7	C	
6	-133.791337	V	19.672186	V	29.321950	S	AIR		
7	-81.368781	V	4.000000		26.642574	S	BK7	P	
8	0.000000		40.672975	S	26.729638	S	AIR		
9	0.000000		0.000000		28.072441	S	AIR		
IMS	0.000000		-0.006293	V	28.072233	S			

Figure 51 RC design

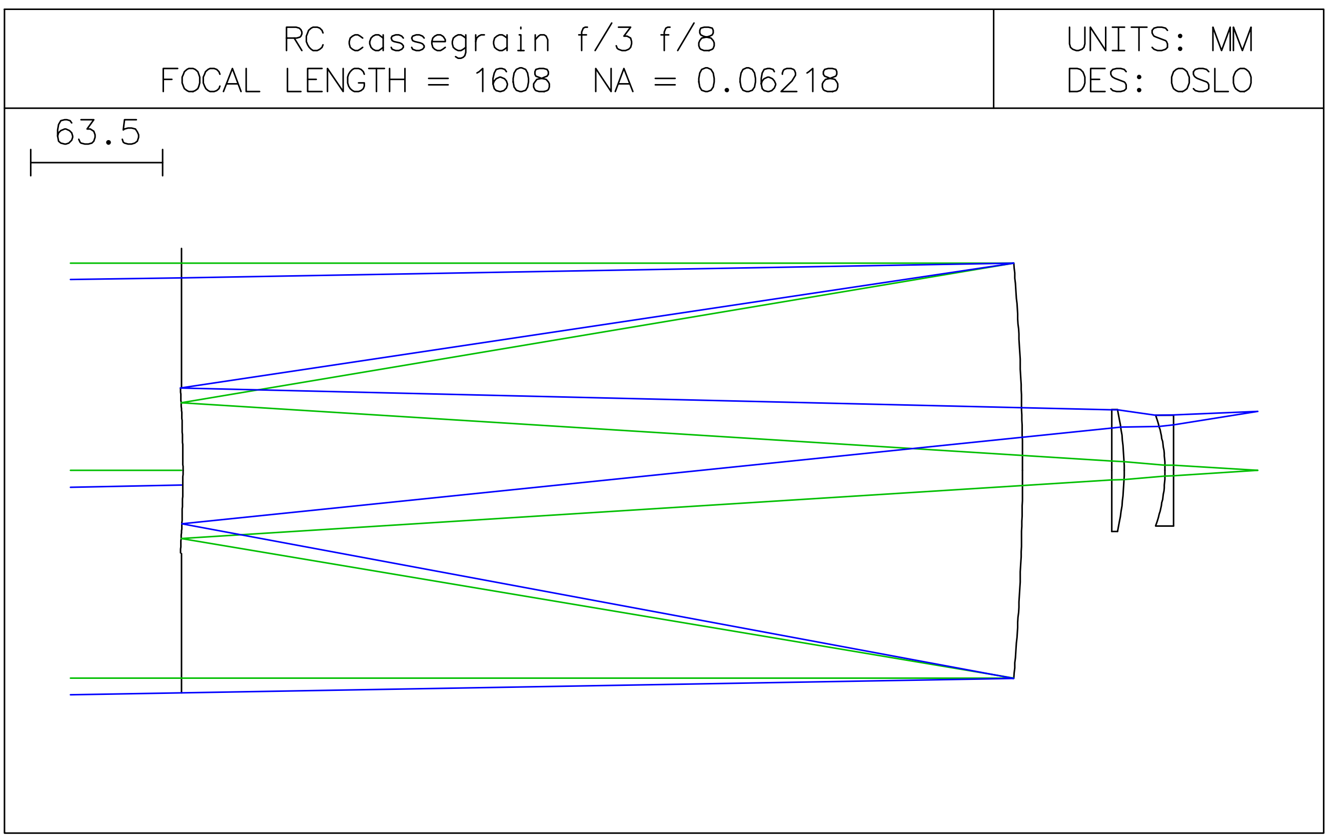


Figure 52 RC design

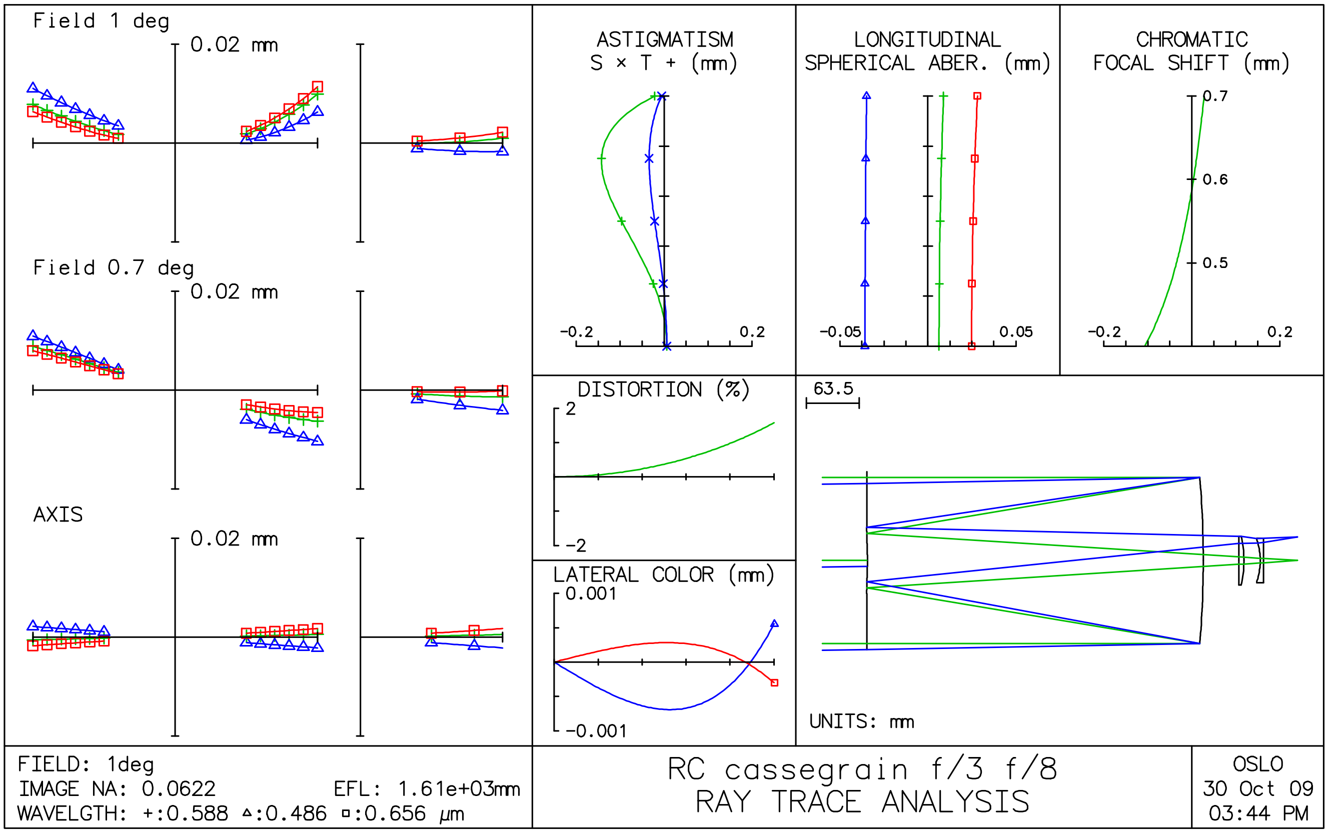


Figure 53 RC design

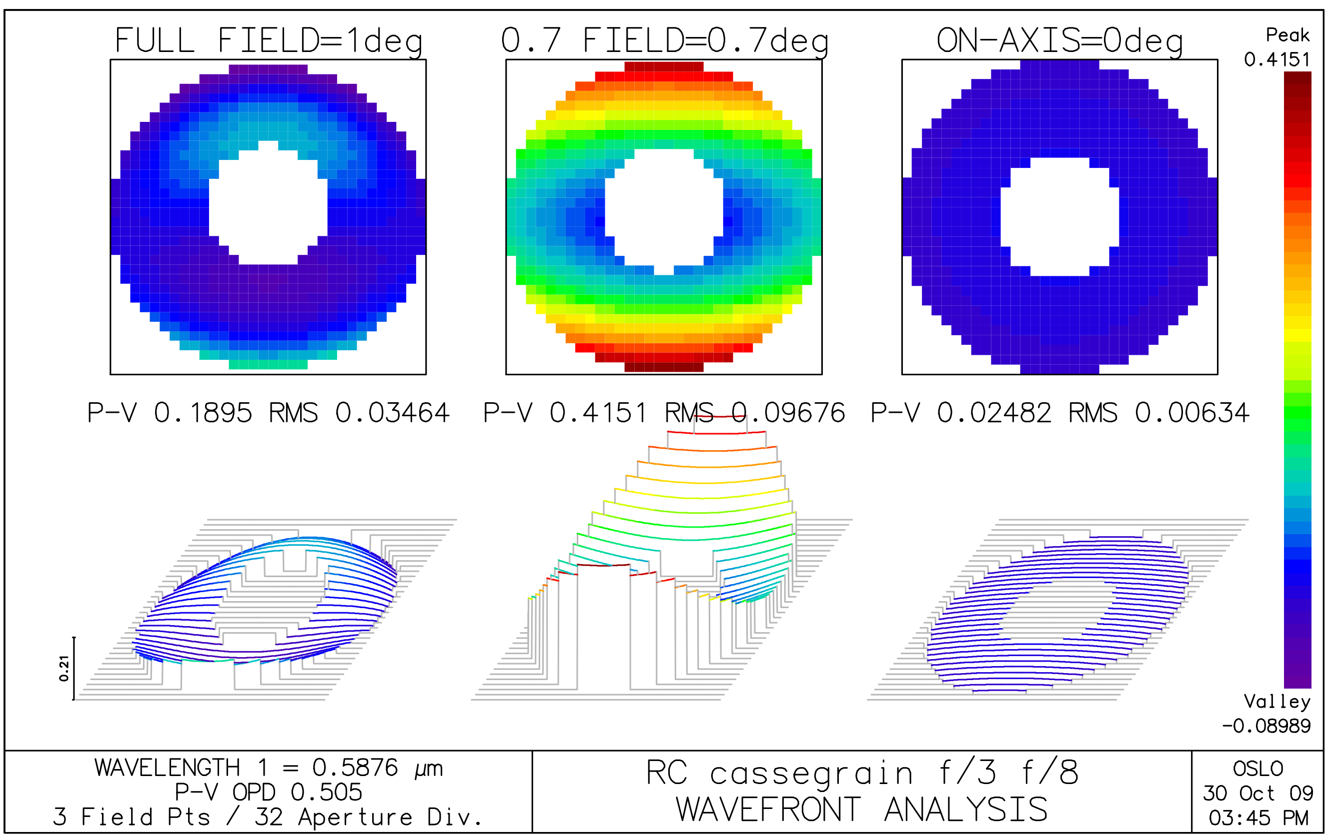


Figure 54 RC design

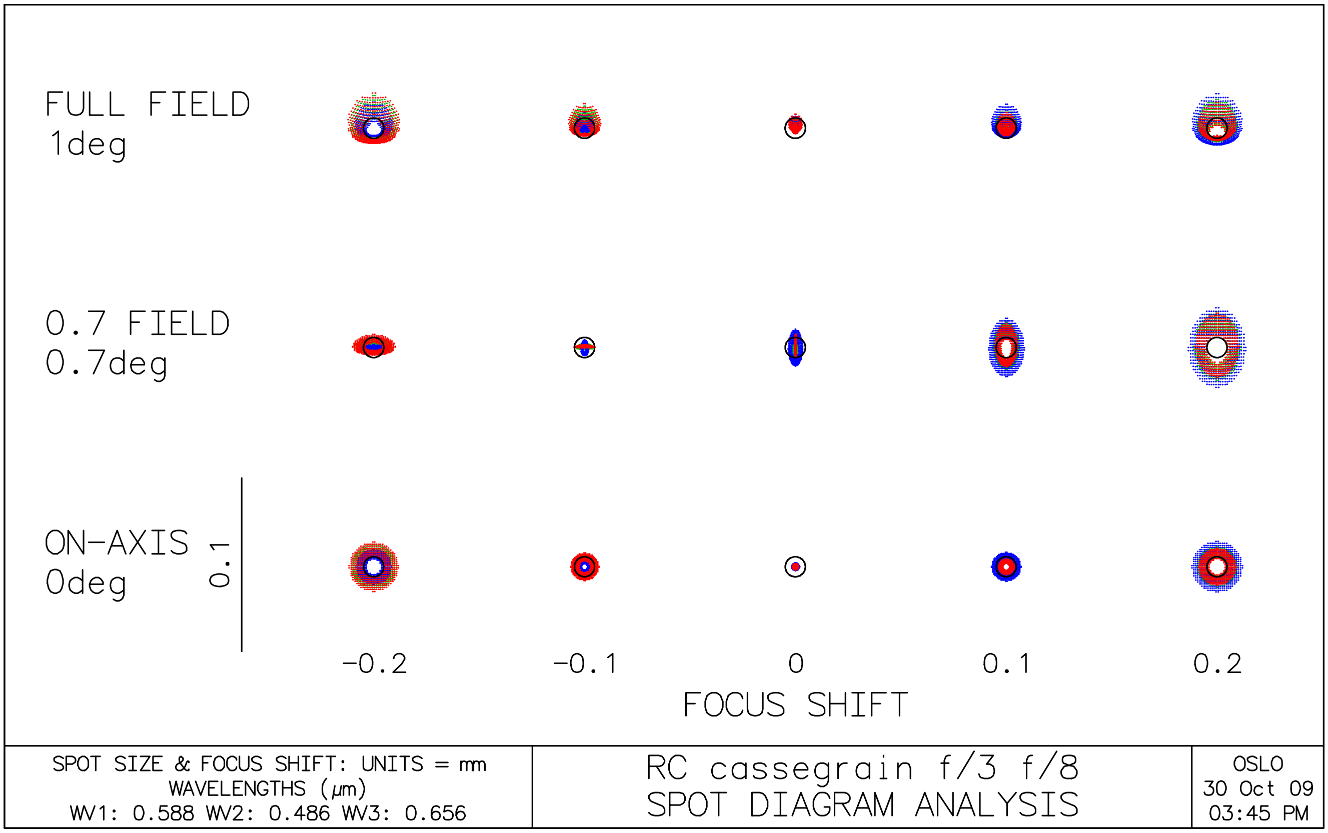


Figure 55 RC design

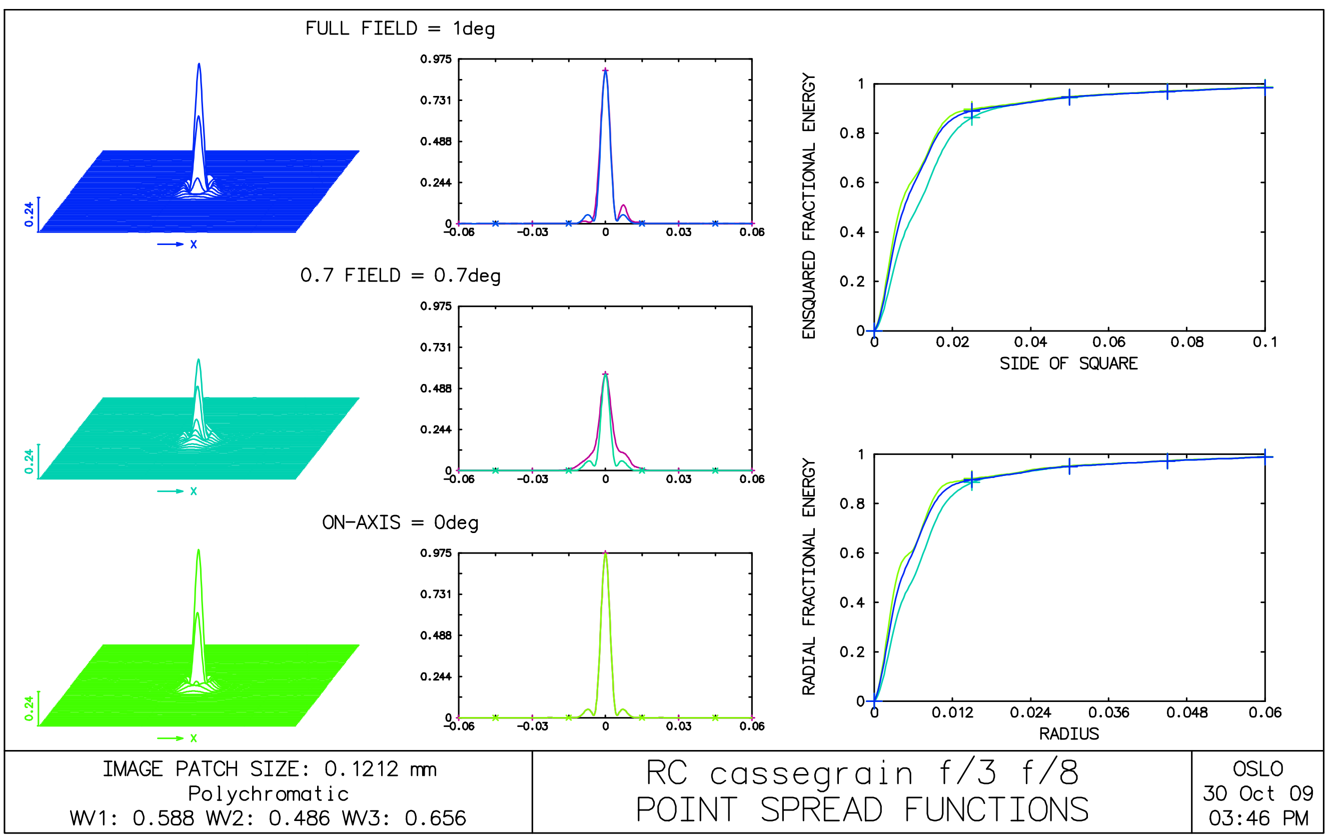


Figure 56 RC design

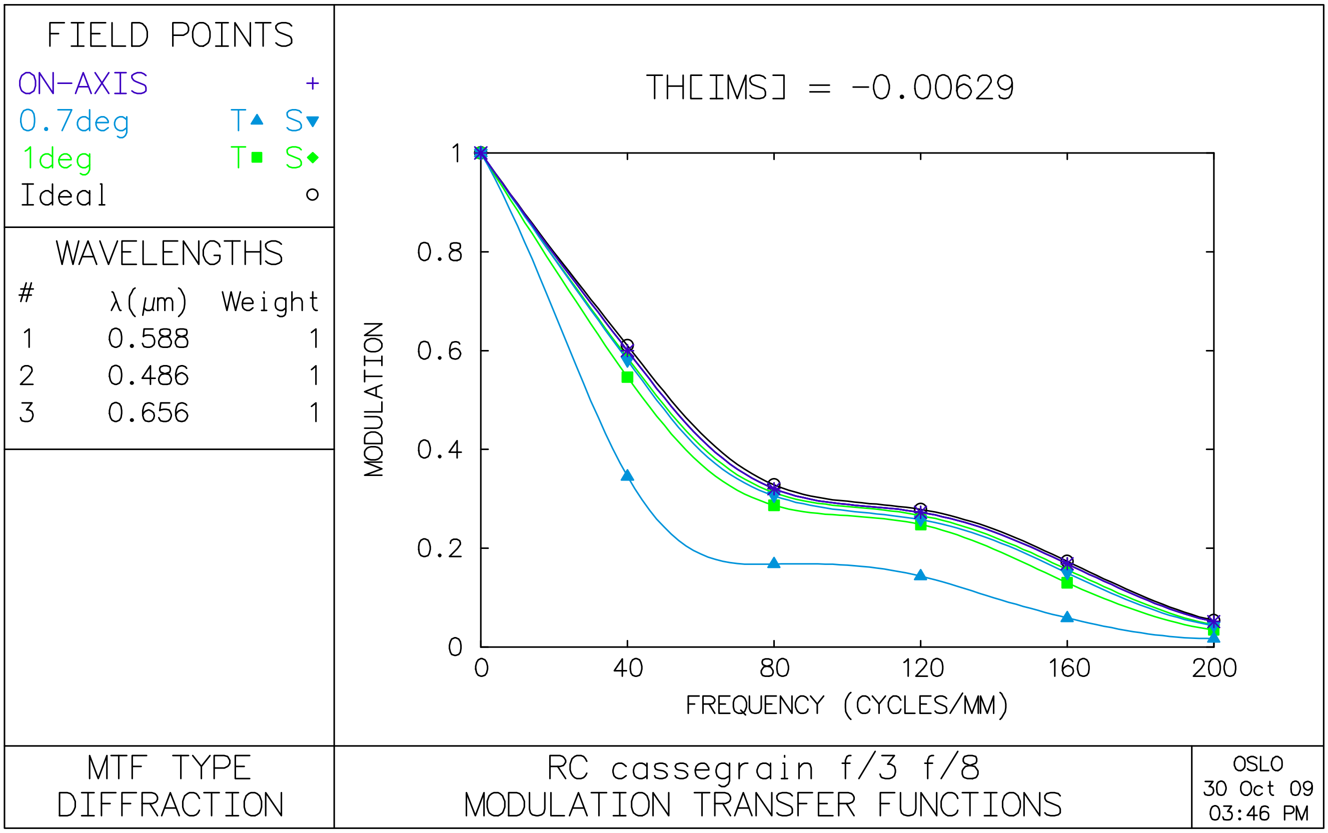


Figure 57 RC design

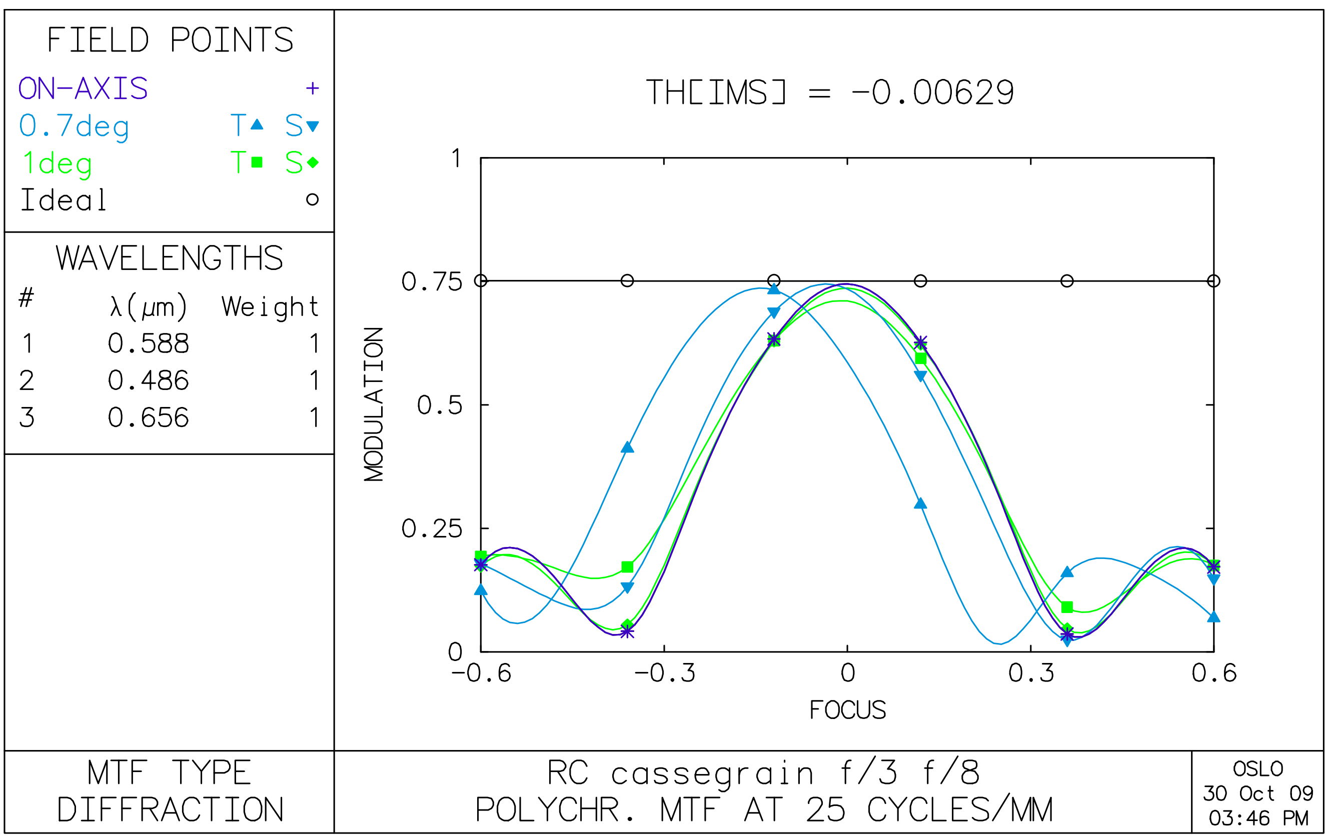
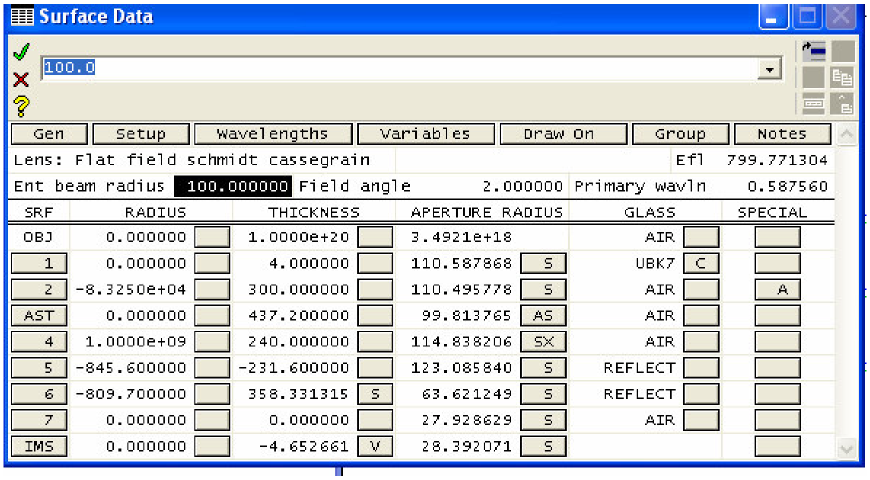


Figure 58 RC design

Flat-Field Schmidt Cassegrain



Surface Data

100.0

Gen | Setup | Wavelengths | Variables | Draw On | Group | Notes

Lens: Flat field schmidt cassegrain — Efl 799.771304

Ent beam radius 100.000000 — Field angle 2.000000 — Primary wavln 0.587560

SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		3.4921e+18		AIR		
1	0.000000		4.000000		110.587868	S	UBK7	C	
2	-8.3250e+04		300.000000		110.495778	S	AIR		A
AST	0.000000		437.200000		99.813765	AS	AIR		
4	1.0000e+09		240.000000		114.838206	SX	AIR		
5	-845.600000		-231.600000		123.085840	S	REFLECT		
6	-809.700000		358.331315	S	63.621249	S	REFLECT		
7	0.000000		0.000000		27.928629	S	AIR		
IMS	0.000000		-4.652661	V	28.392071	S			

Figure 59 Flat-field Schmidt Cassegrain

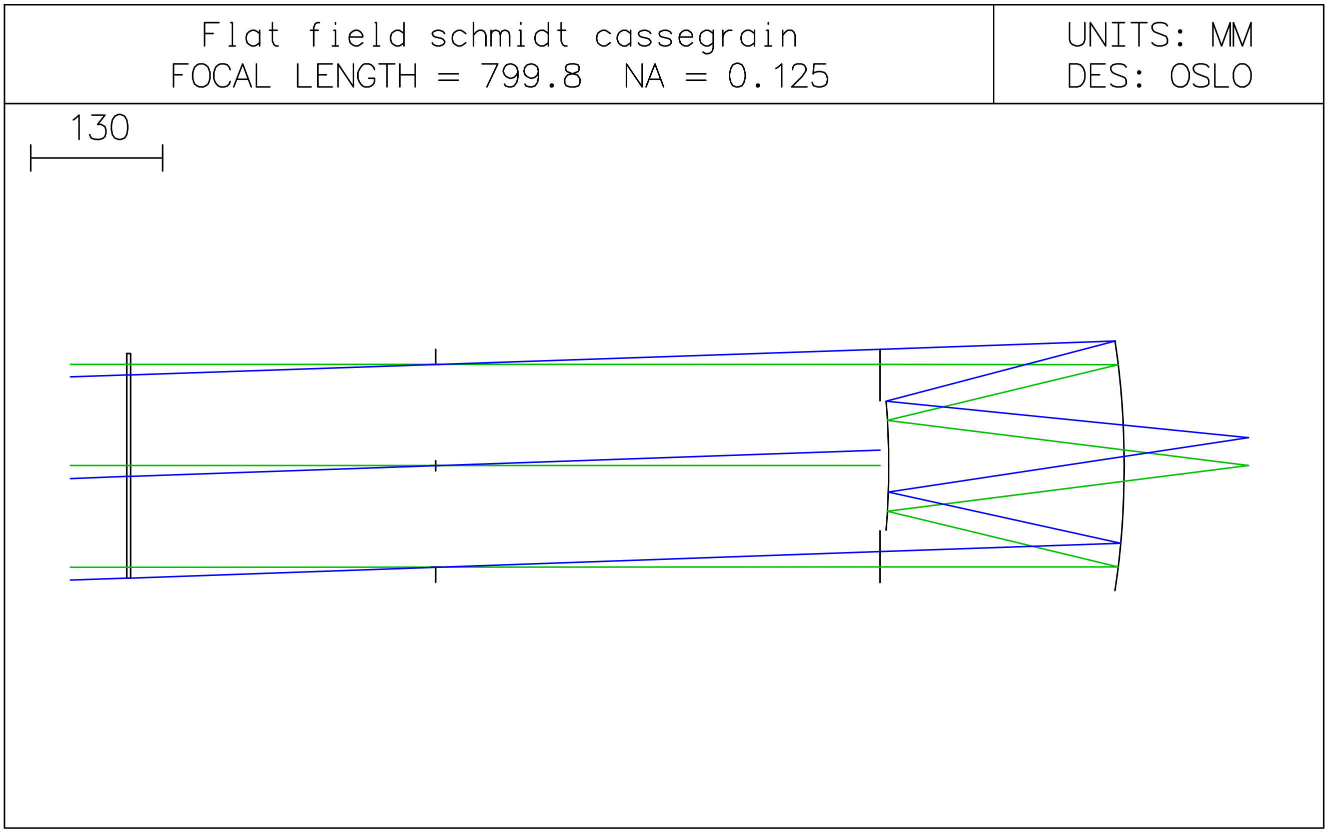


Figure 60 Flat-field Schmidt of Figure 59

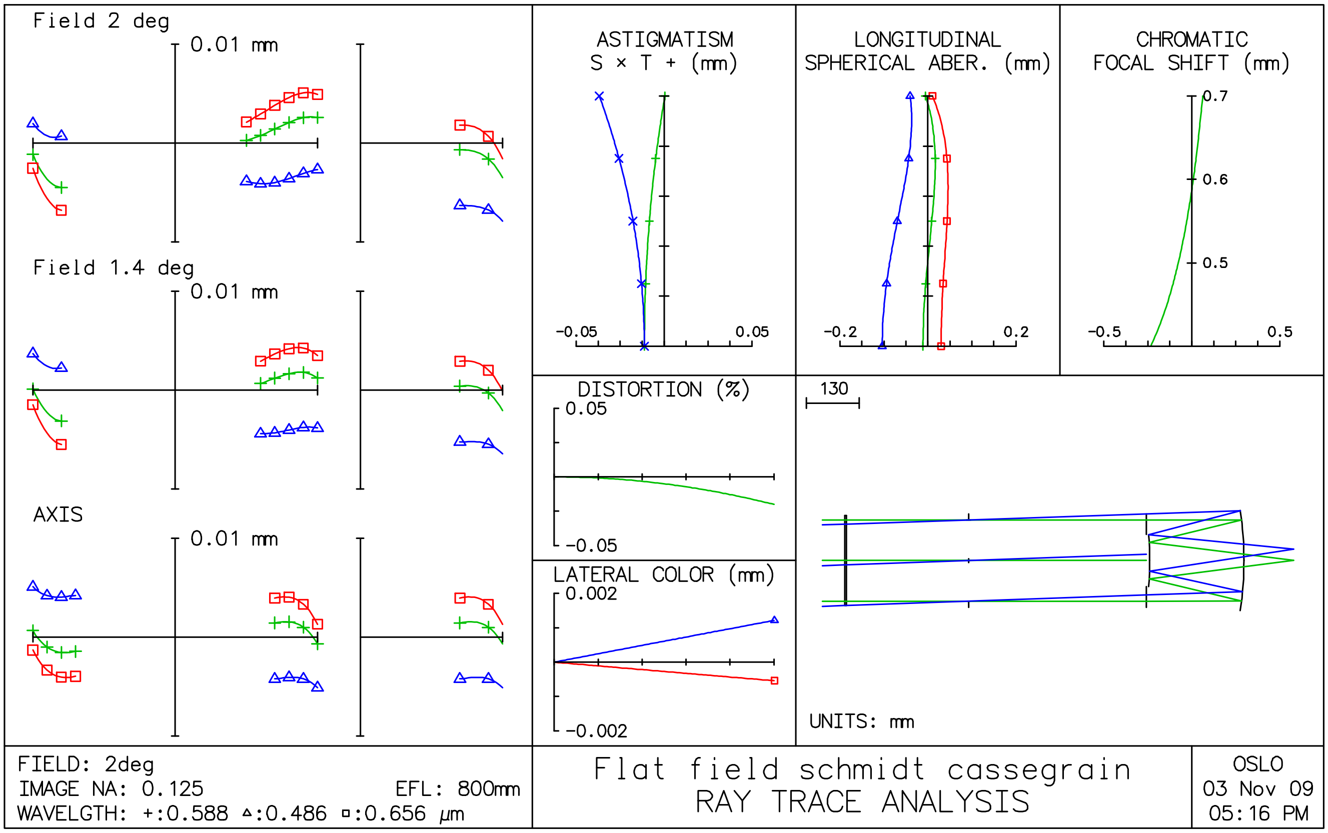


Figure 61 Flat-field Schmidt of Figure 59

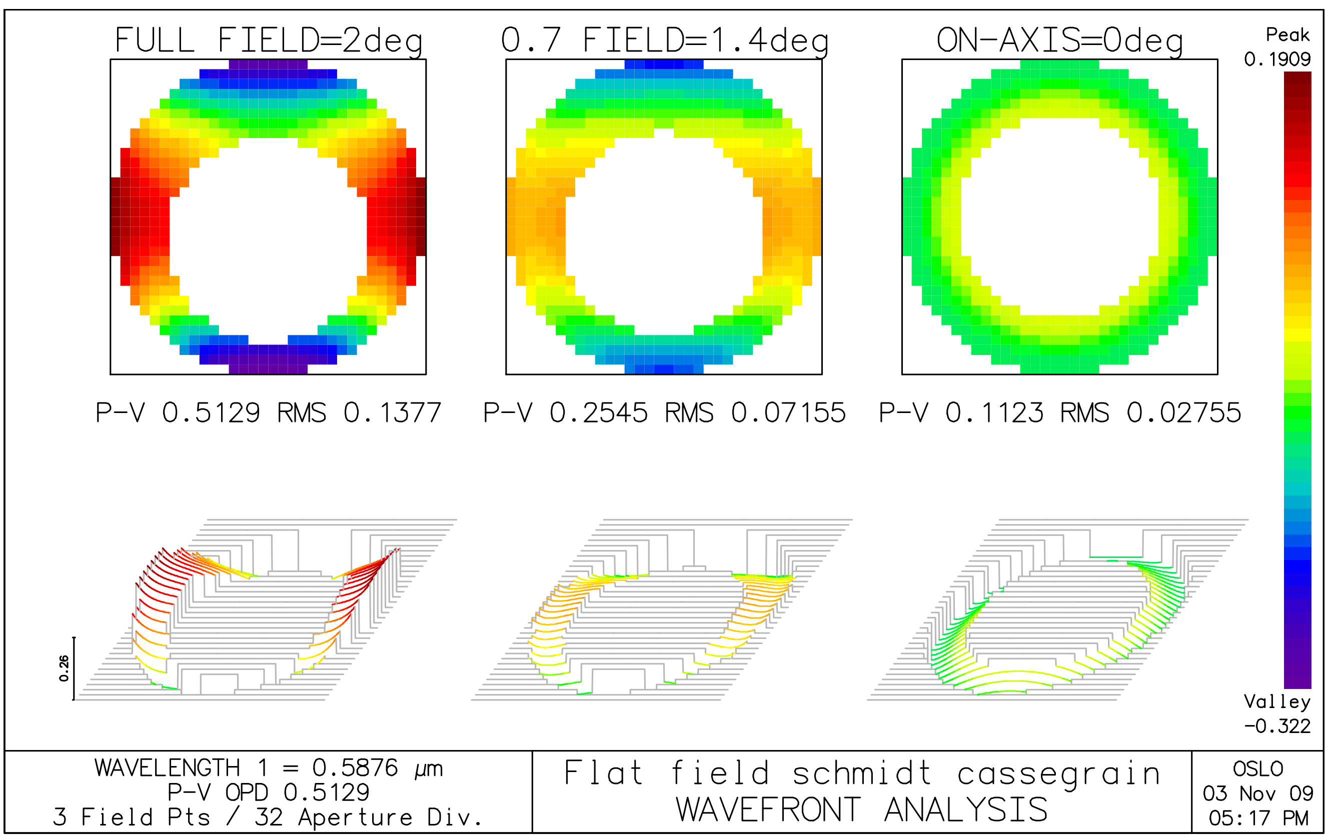


Figure 62 Flat-field Schmidt of Figure 59

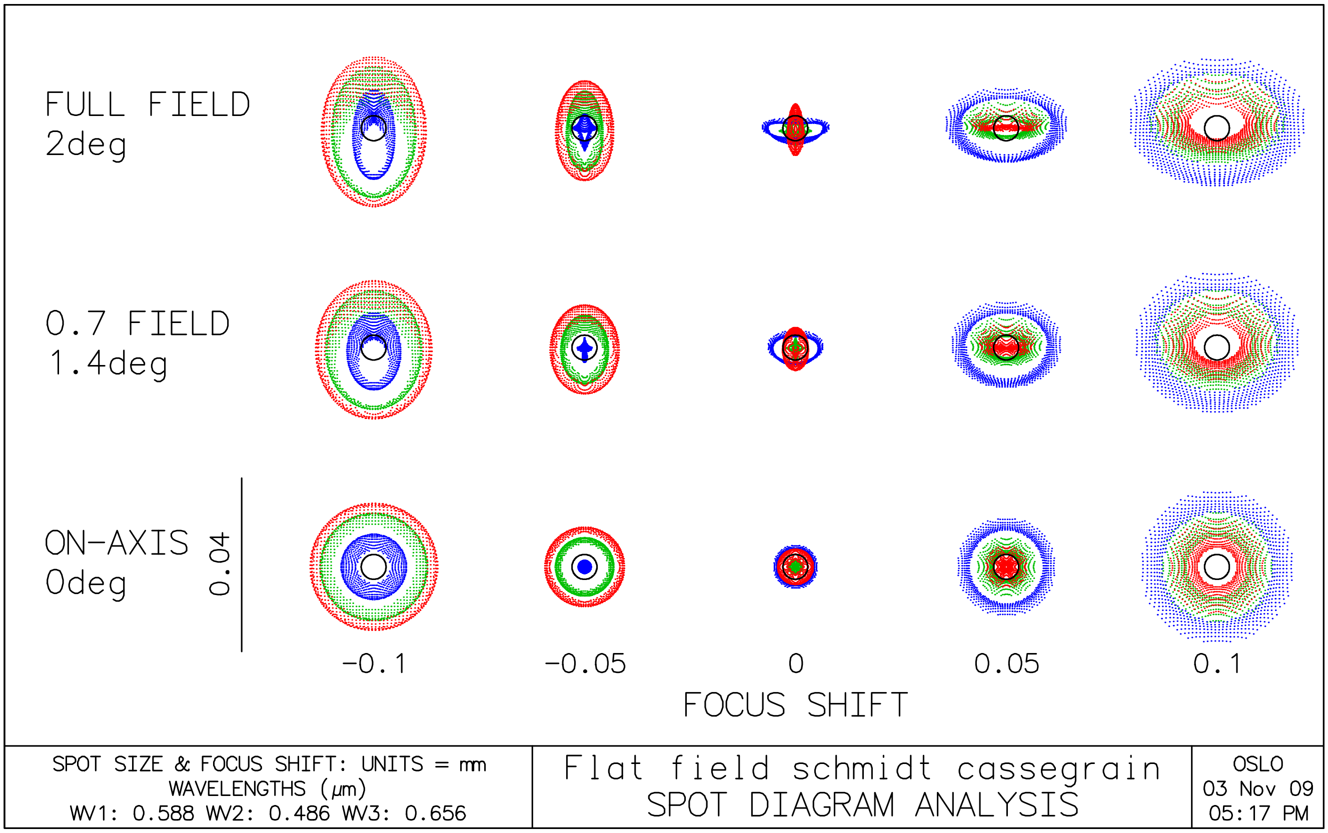


Figure 63 Flat-field Schmidt of Figure 59

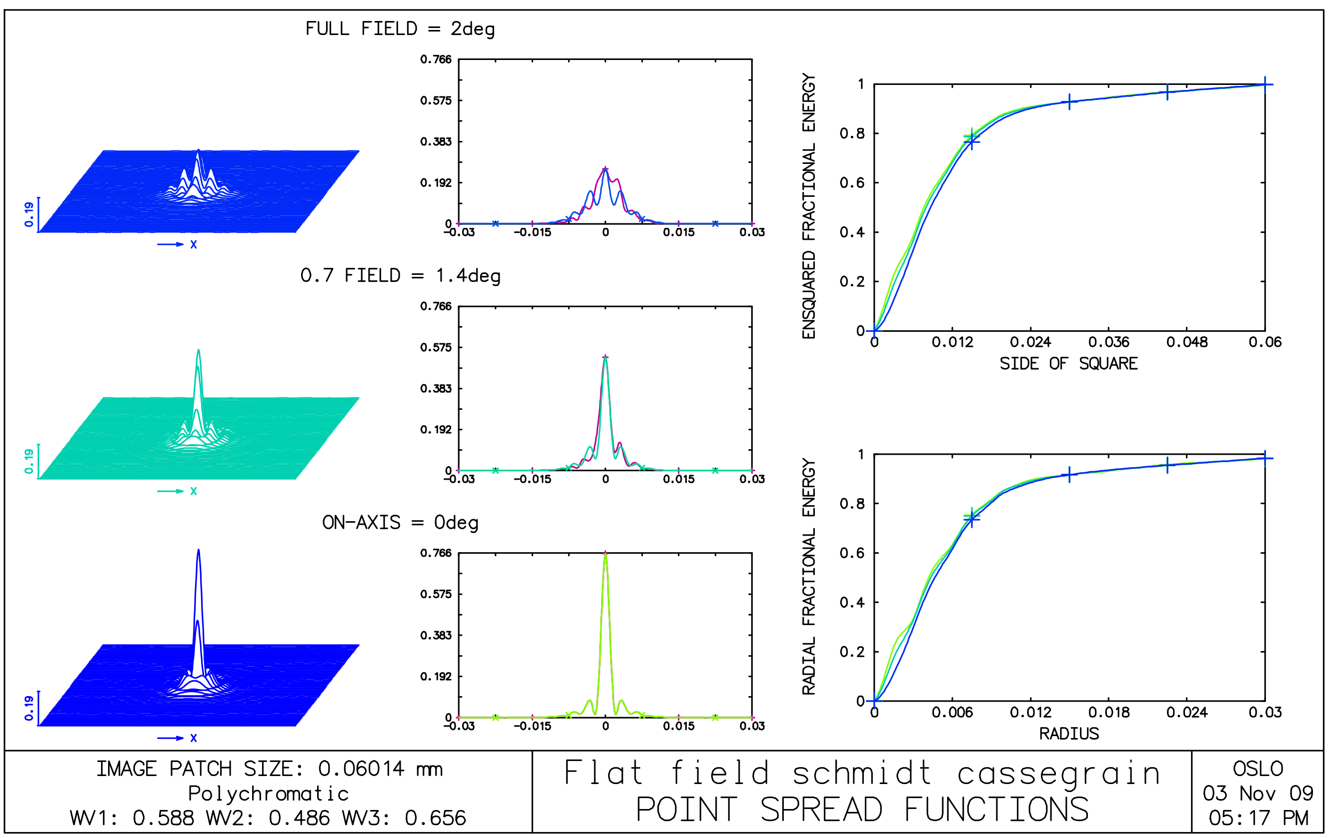


Figure 64 Flat-field Schmidt of Figure 59

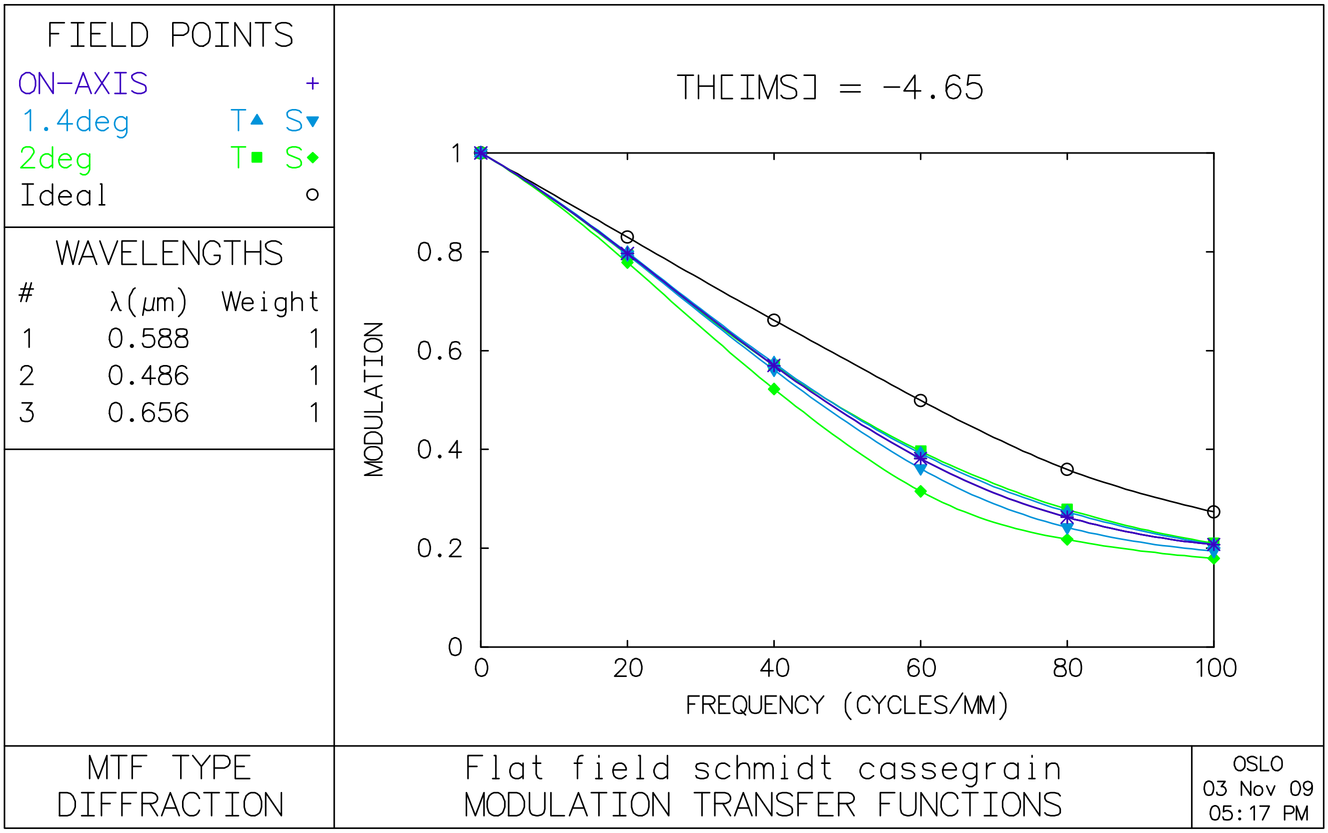


Figure 65 Flat-field Schmidt of Figure 59

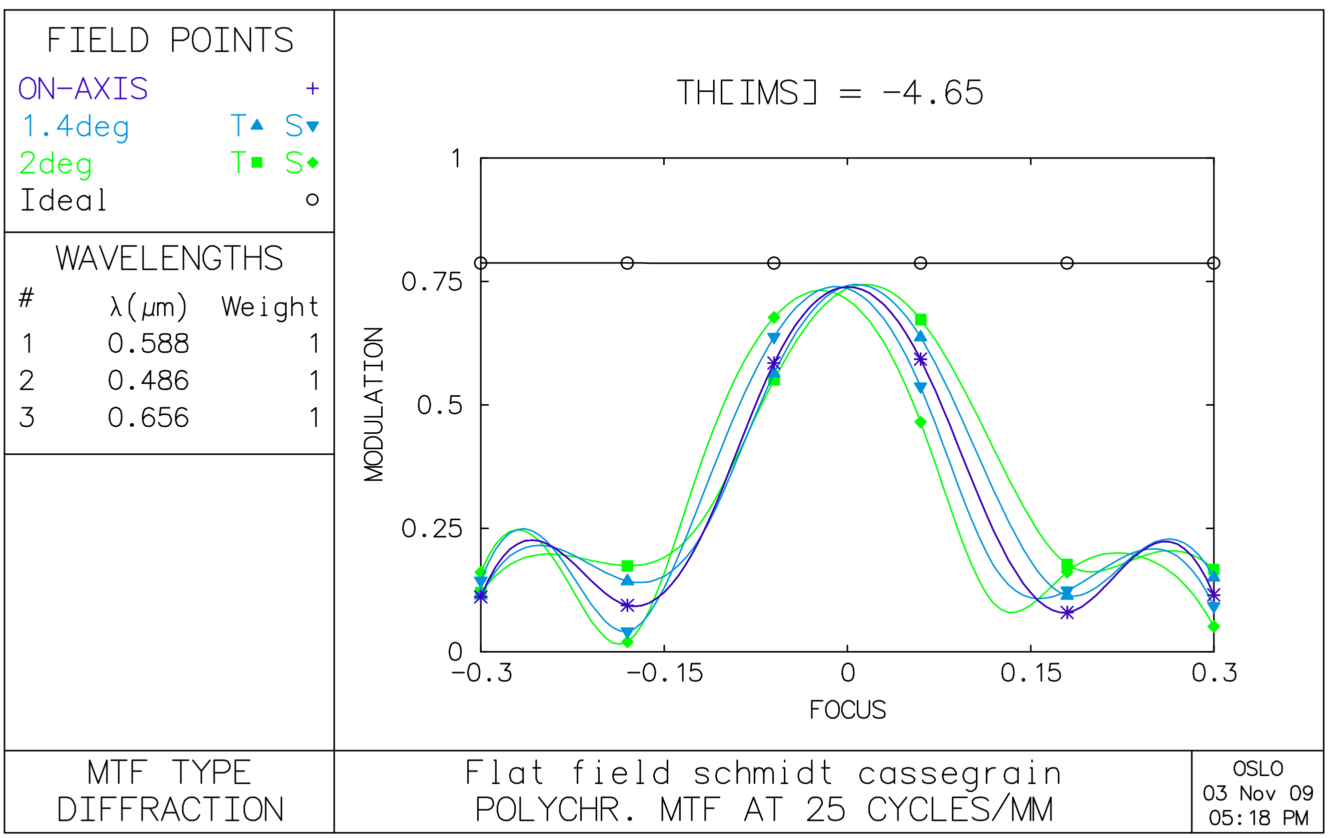
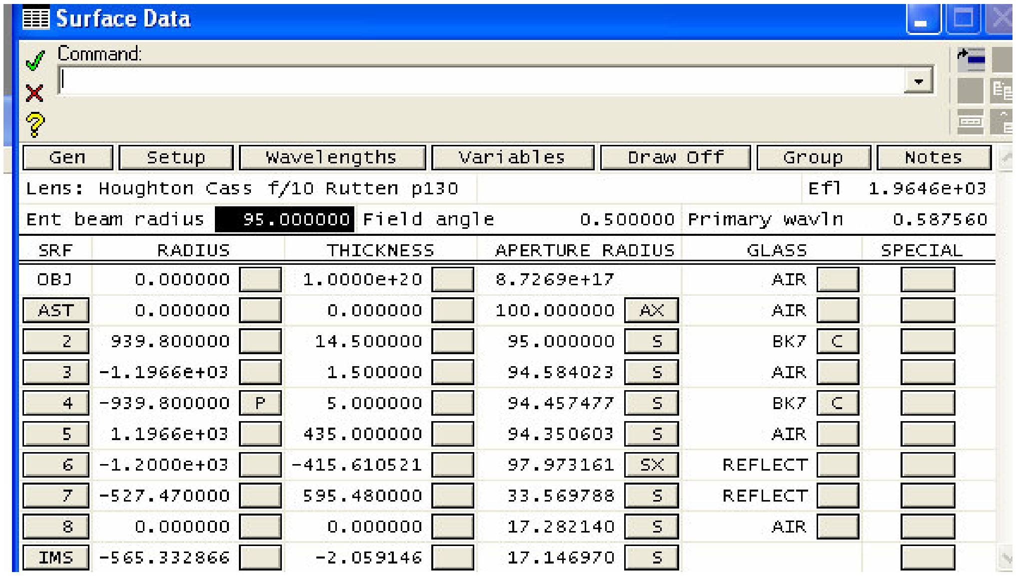


Figure 66 Flat-field Schmidt of Figure 59

Houghton Cassegrain 1



Surface Data

Command:

Gen | Setup | Wavelengths | Variables | Draw Off | Group | Notes

Lens: Houghton Cass f/10 Rutten p130 Efl 1.9646e+03

Ent beam radius 95.000000 Field angle 0.500000 Primary wavln 0.587560

SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		8.7269e+17		AIR		
AST	0.000000		0.000000		100.000000	AX	AIR		
2	939.800000		14.500000		95.000000	S	BK7	C	
3	-1.1966e+03		1.500000		94.584023	S	AIR		
4	-939.800000	P	5.000000		94.457477	S	BK7	C	
5	1.1966e+03		435.000000		94.350603	S	AIR		
6	-1.2000e+03		-415.610521		97.973161	SX	REFLECT		
7	-527.470000		595.480000		33.569788	S	REFLECT		
8	0.000000		0.000000		17.282140	S	AIR		
IMS	-565.332866		-2.059146		17.146970	S			

Figure 67 Houghton-Cassegrain 1 design

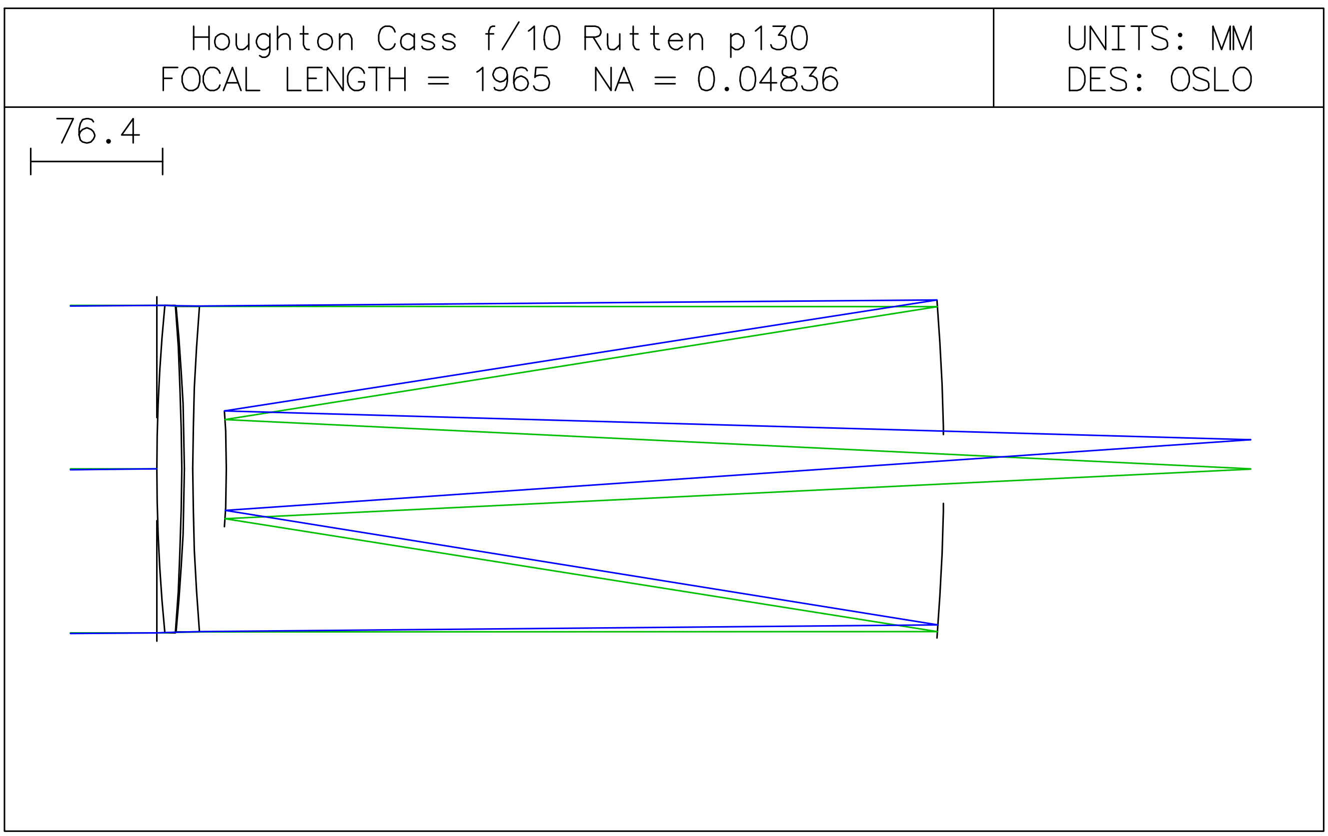


Figure 68 Houghton-Cassegrain 1 design

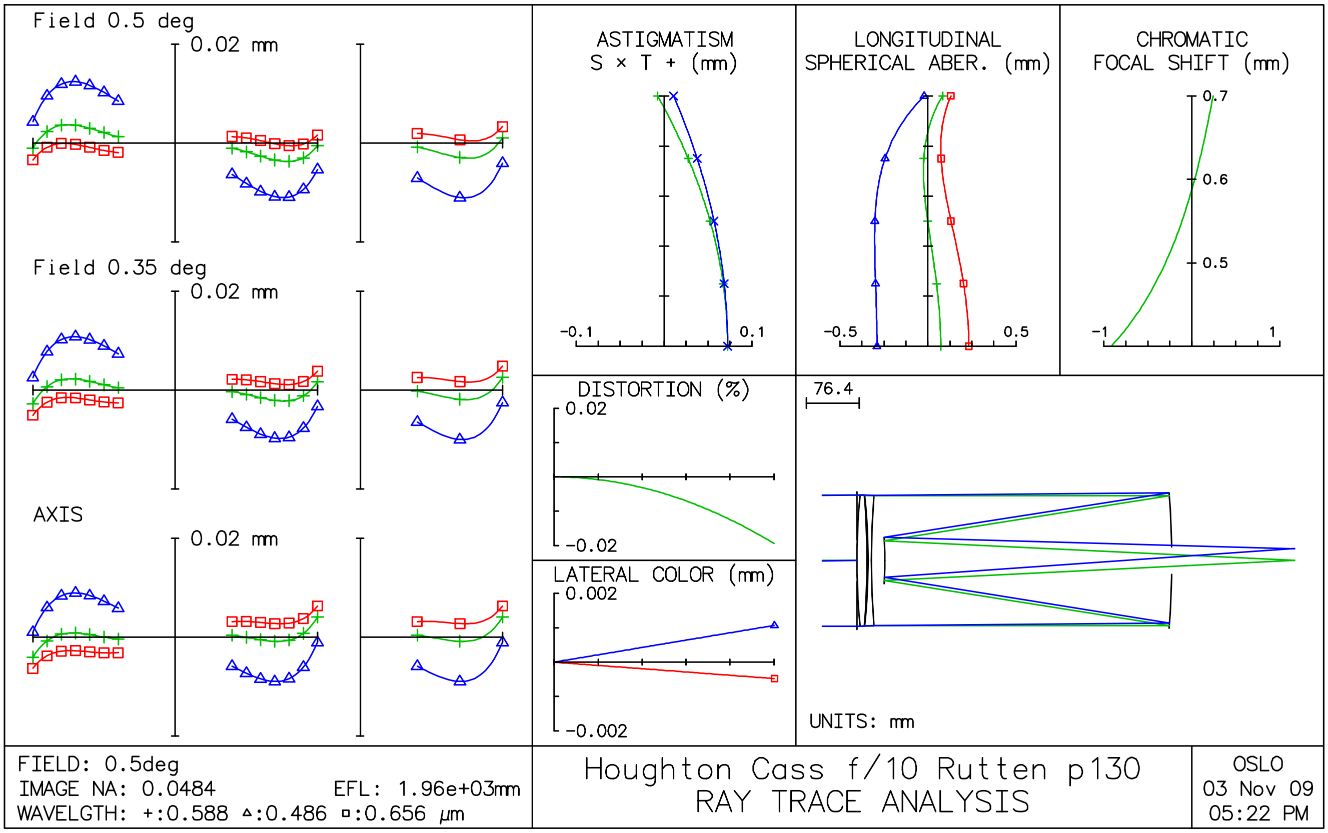


Figure 69 Houghton-Cassegrain 1 design

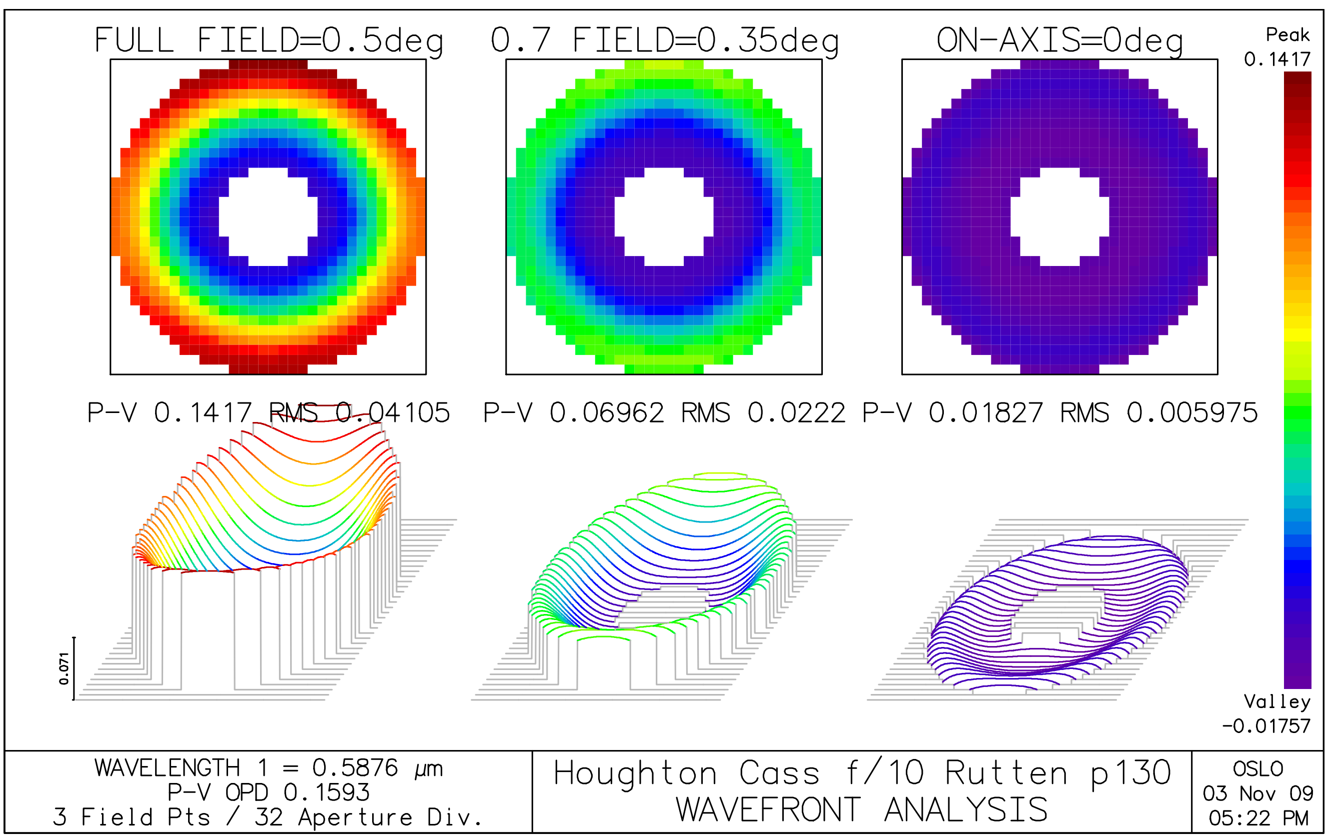


Figure 70 Houghton-Cassegrain 1 design

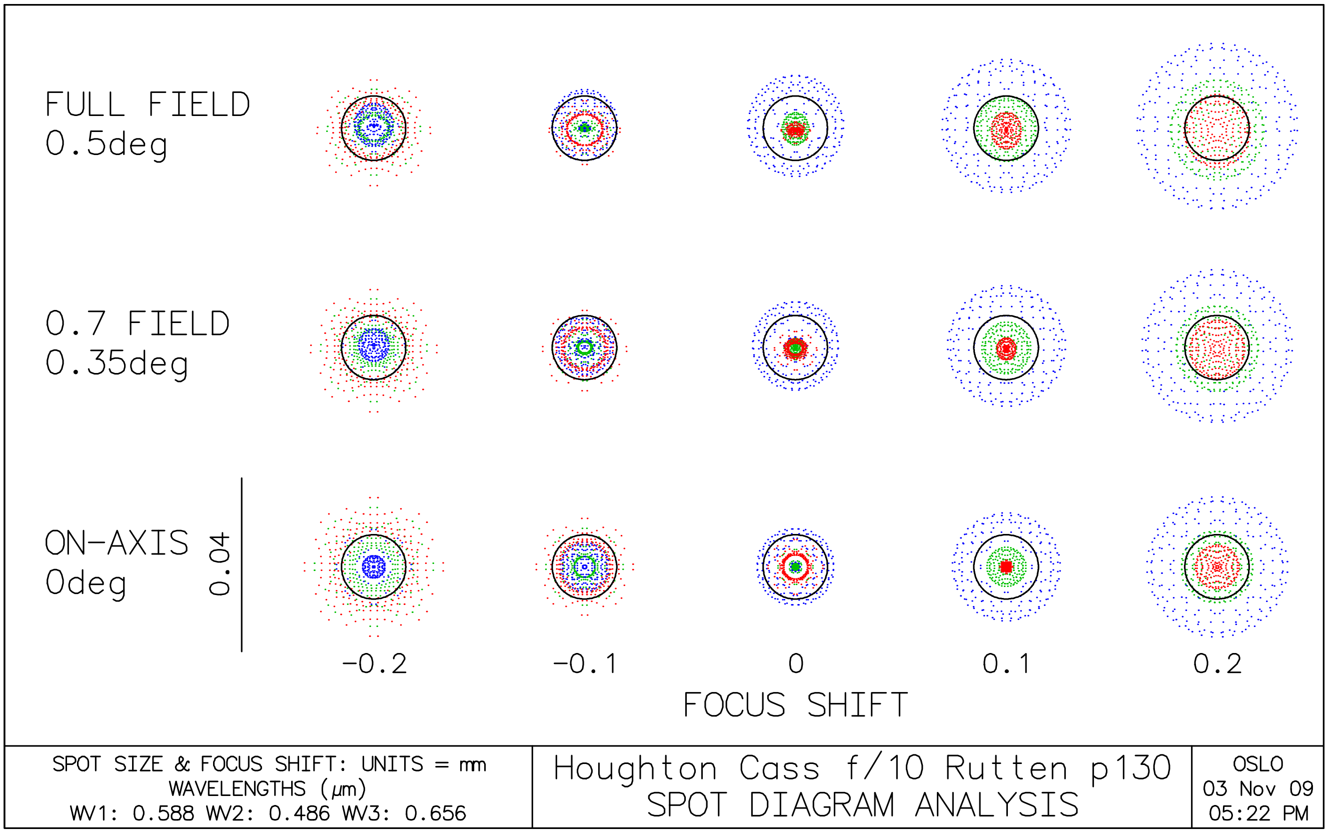


Figure 71 Houghton-Cassegrain 1 design

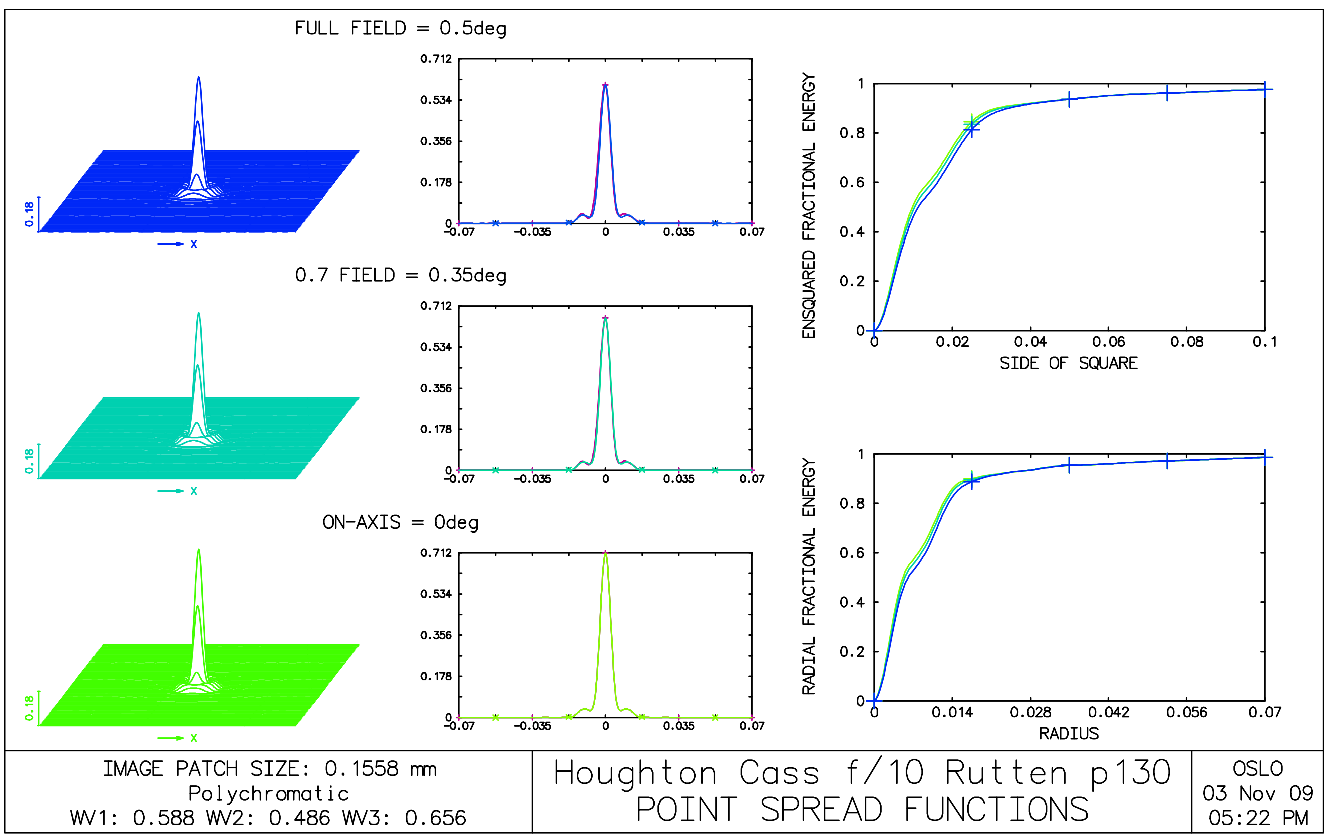


Figure 72 Houghton-Cassegrain 1 design

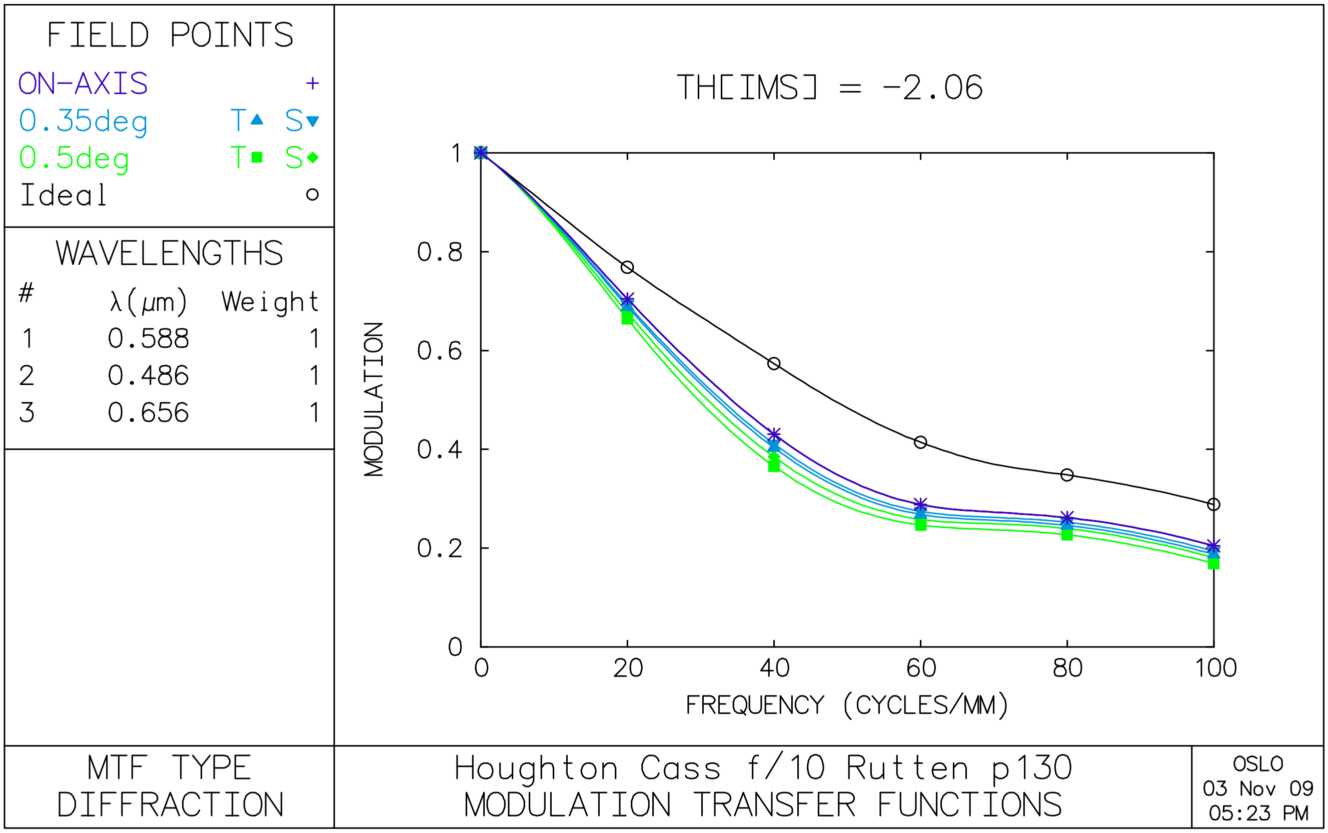


Figure 73 Houghton-Cassegrain 1 design

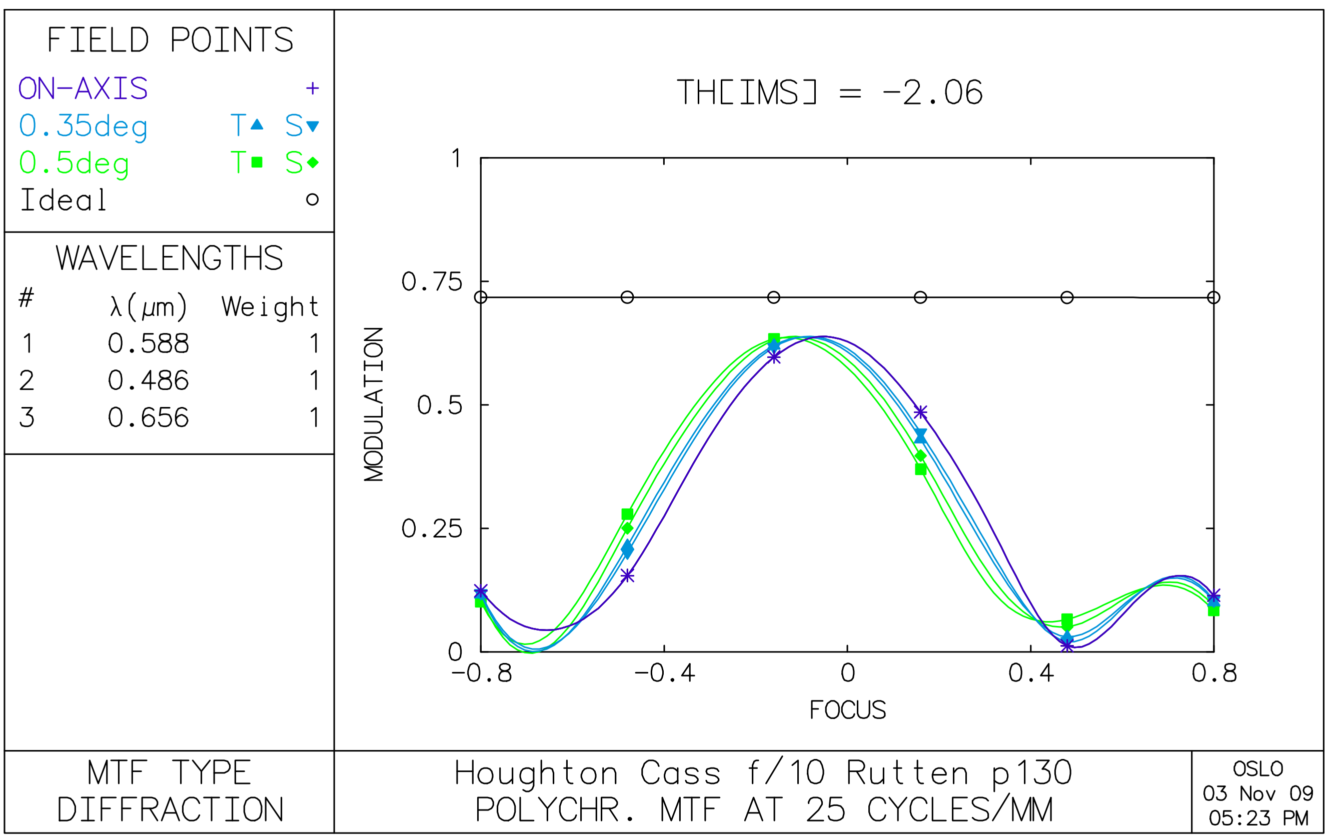
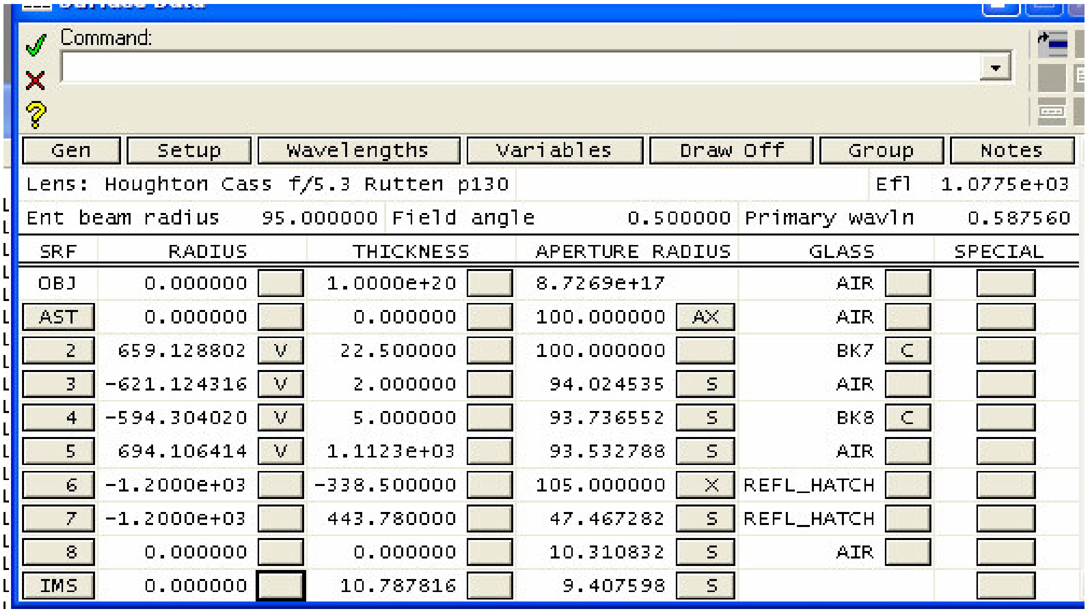


Figure 74 Houghton-Cassegrain 1 design

Houghton Cassegrain 2



SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		8.7269e+17		AIR		
AST	0.000000		0.000000		100.000000	AX	AIR		
2	659.128802	V	22.500000		100.000000		BK7	C	
3	-621.124316	V	2.000000		94.024535	S	AIR		
4	-594.304020	V	5.000000		93.736552	S	BK8	C	
5	694.106414	V	1.1123e+03		93.532788	S	AIR		
6	-1.2000e+03		-338.500000		105.000000	X	REFL_HATCH		
7	-1.2000e+03		443.780000		47.467282	S	REFL_HATCH		
8	0.000000		0.000000		10.310832	S	AIR		
IMS	0.000000		10.787816		9.407598	S			

Figure 75 Houghton Cassegrain 2 design, but with modifications compared to text. Different glass used in the two corrector lenses.

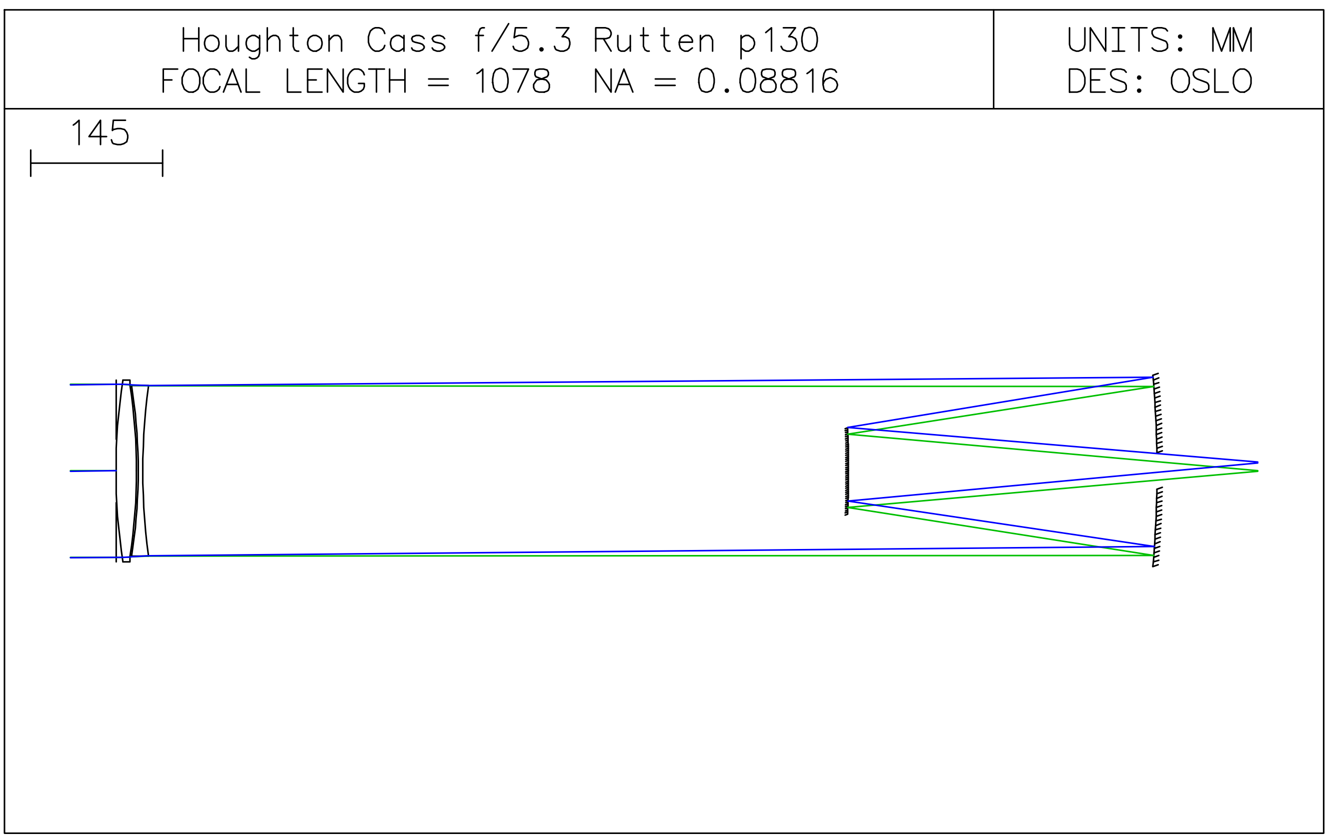


Figure 76 Houghton Cassegrain 2 design

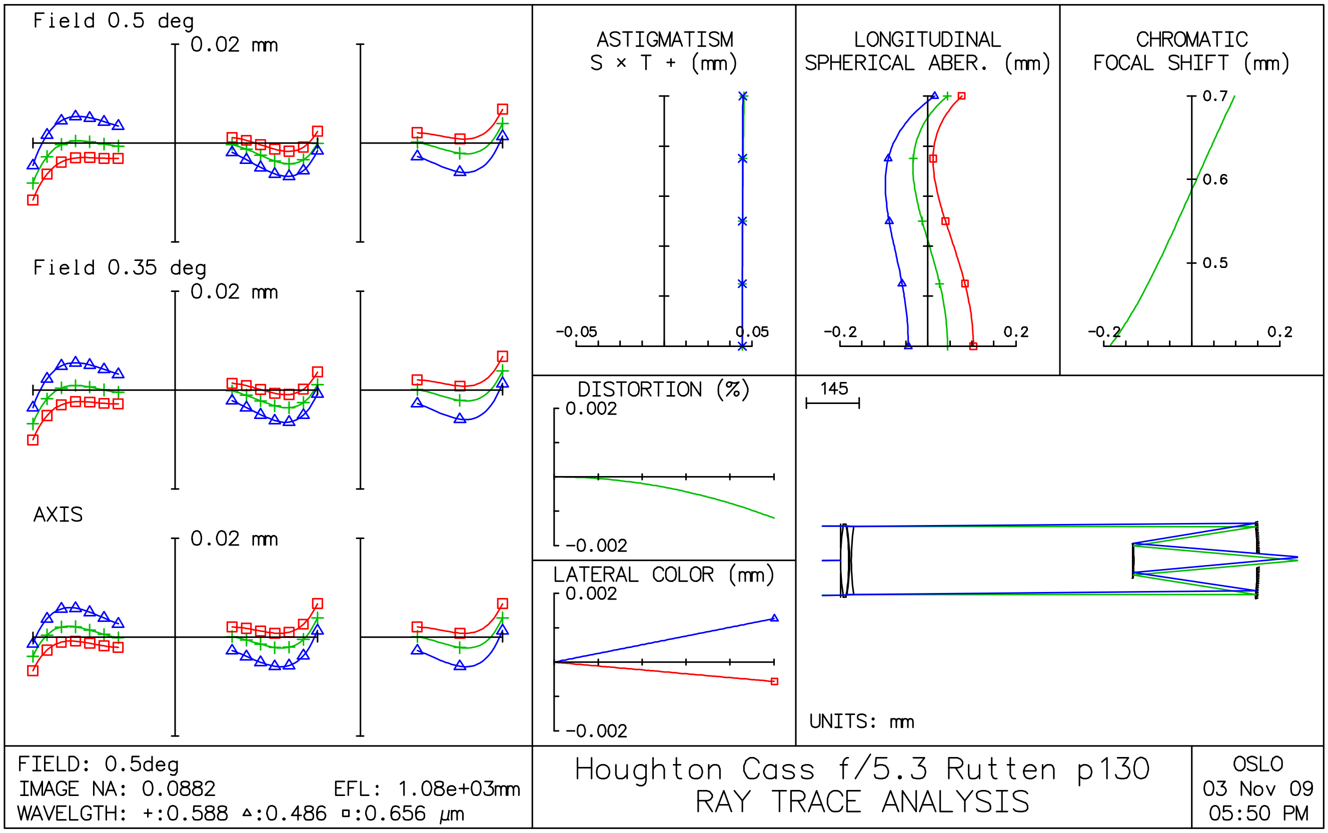


Figure 77 Houghton Cassegrain 2 design

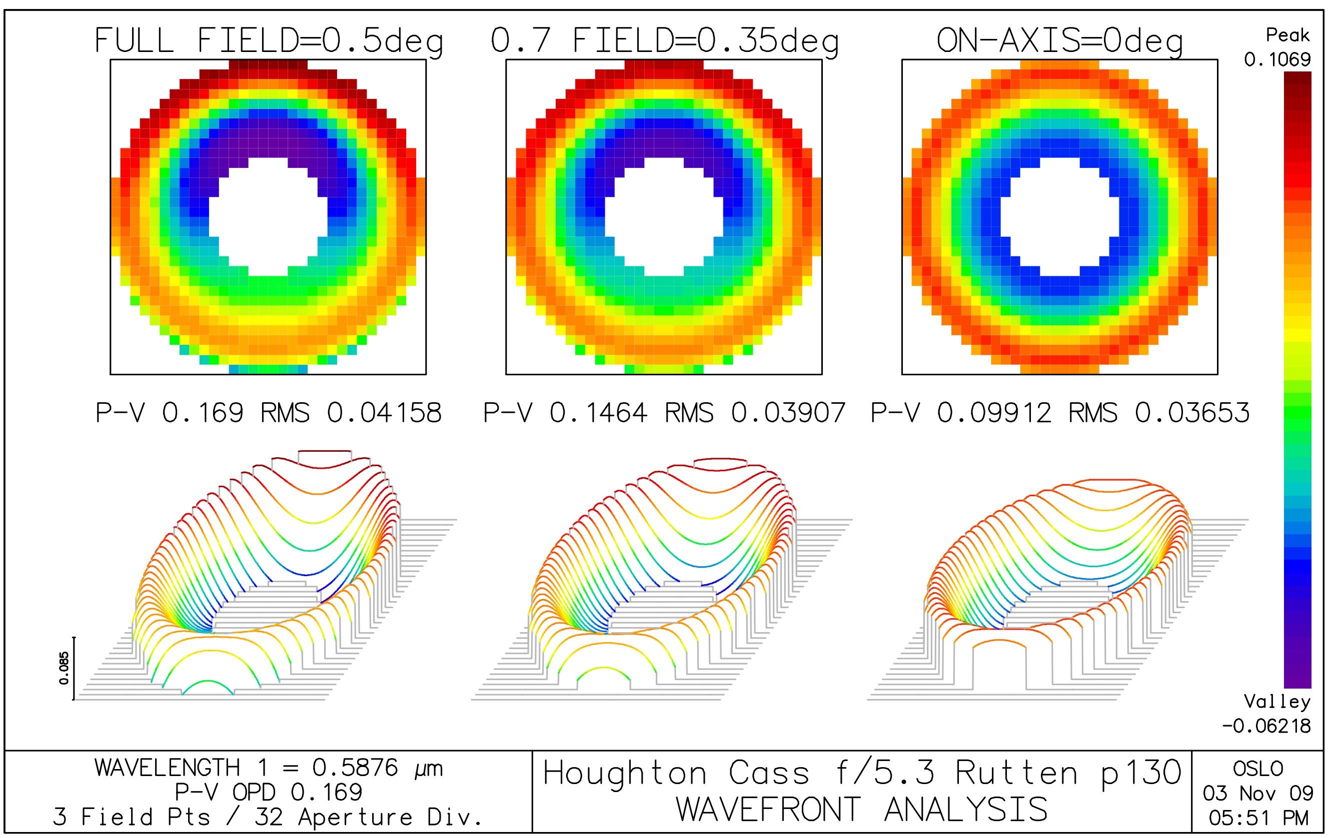


Figure 78 Houghton Cassegrain 2 design

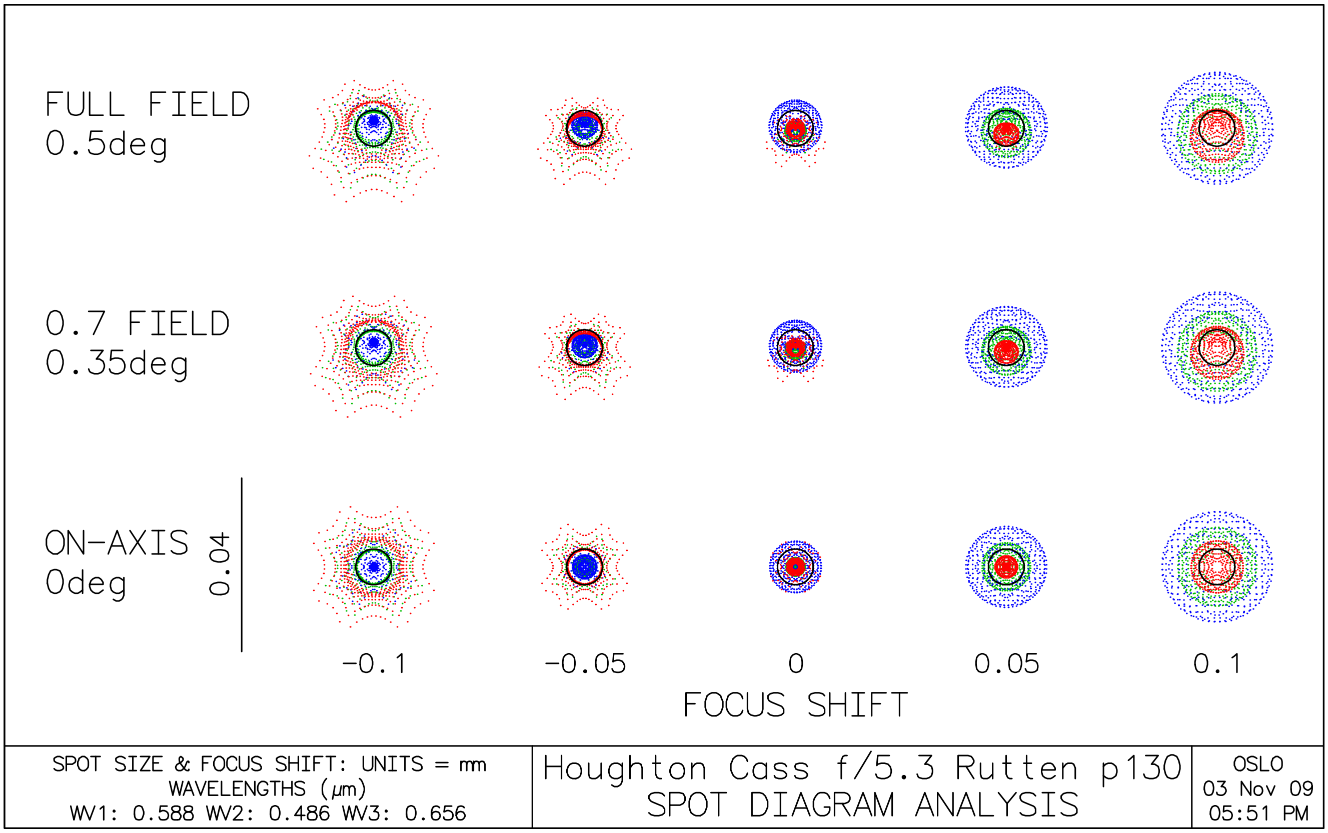


Figure 79 Houghton Cassegrain 2 design

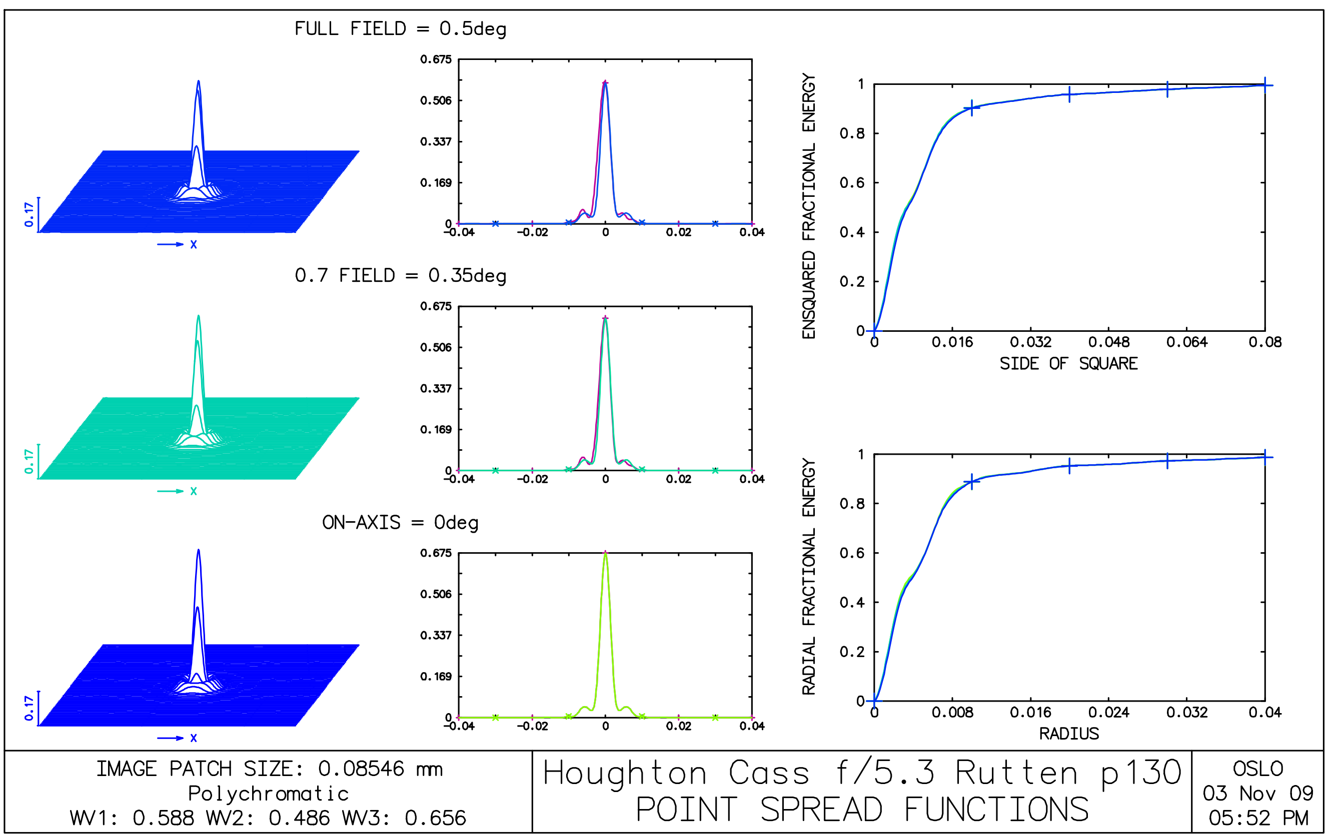


Figure 80 Houghton Cassegrain 2 design

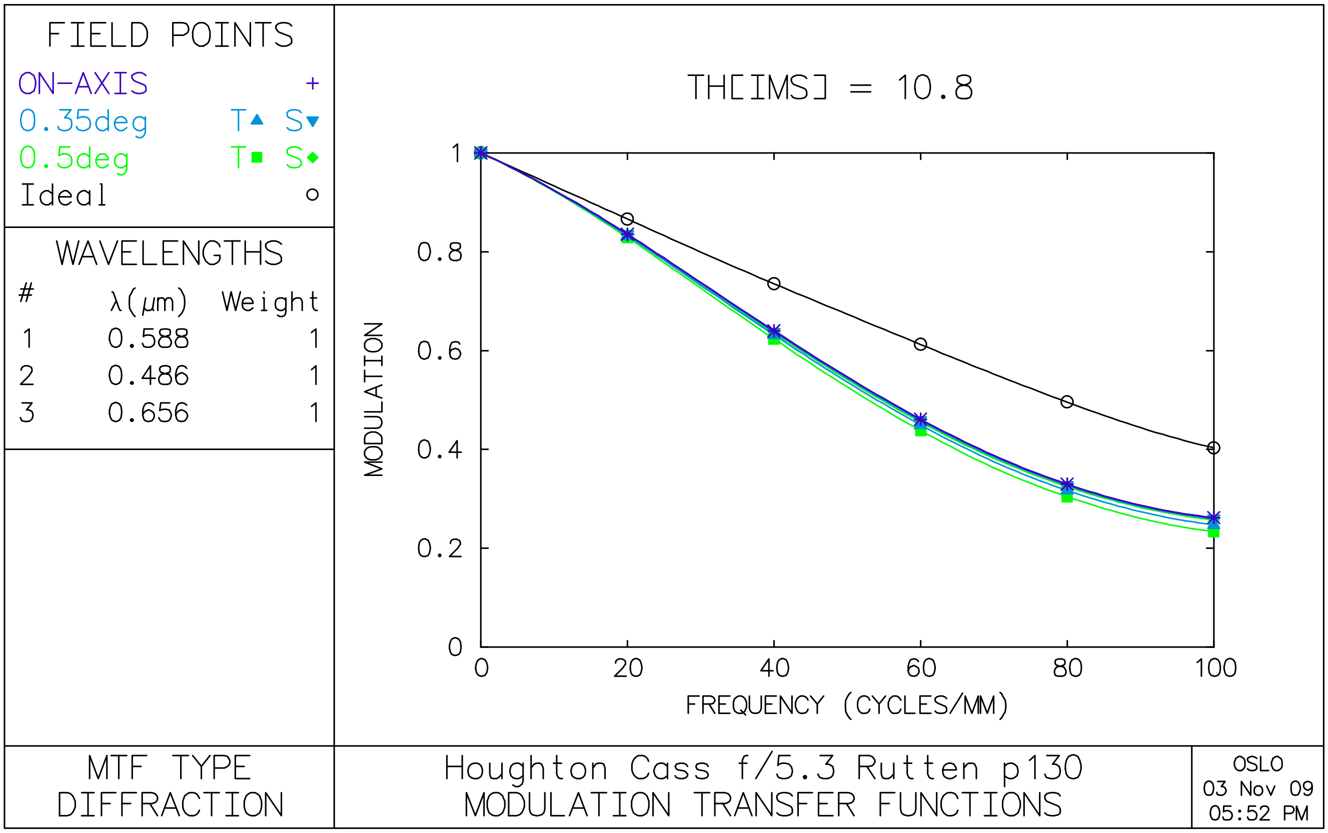


Figure 81 Houghton Cassegrain 2 design

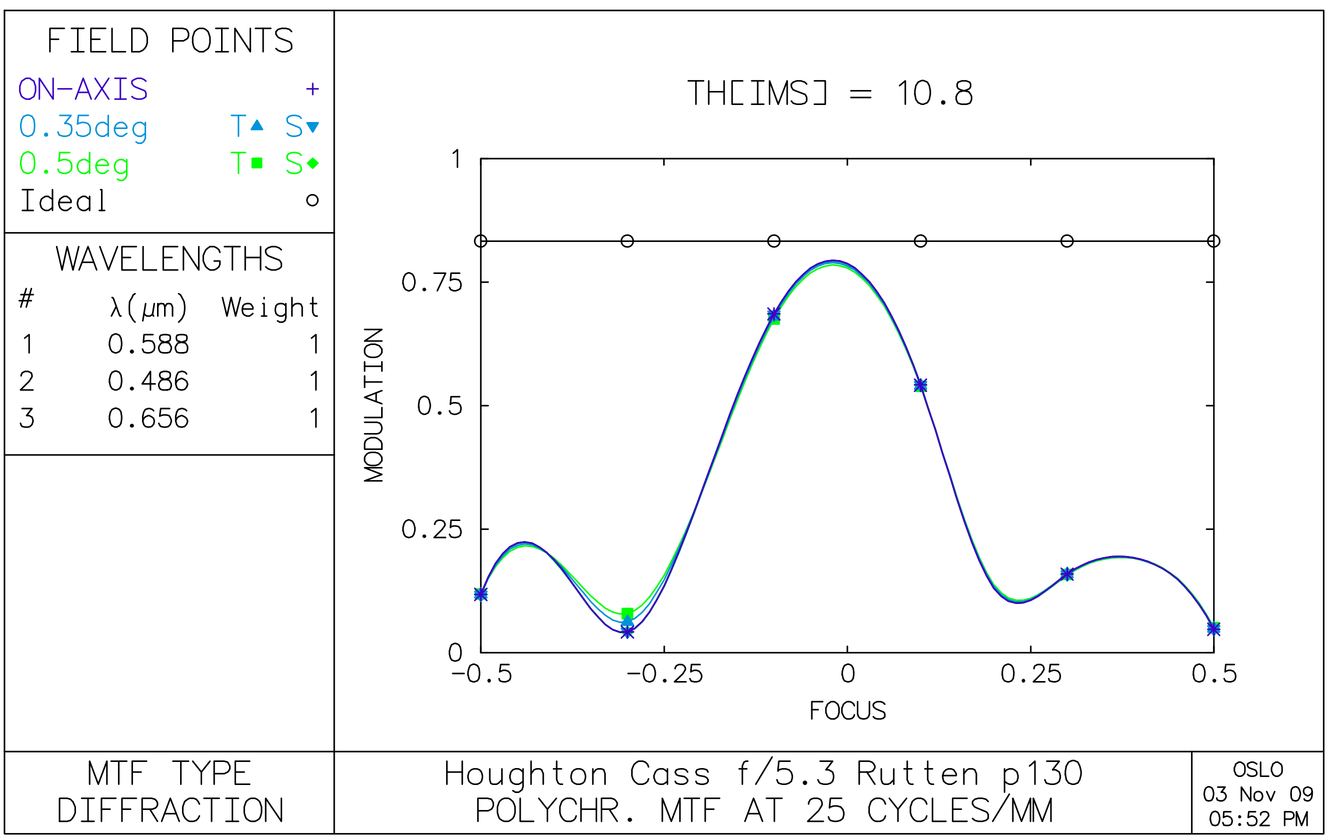
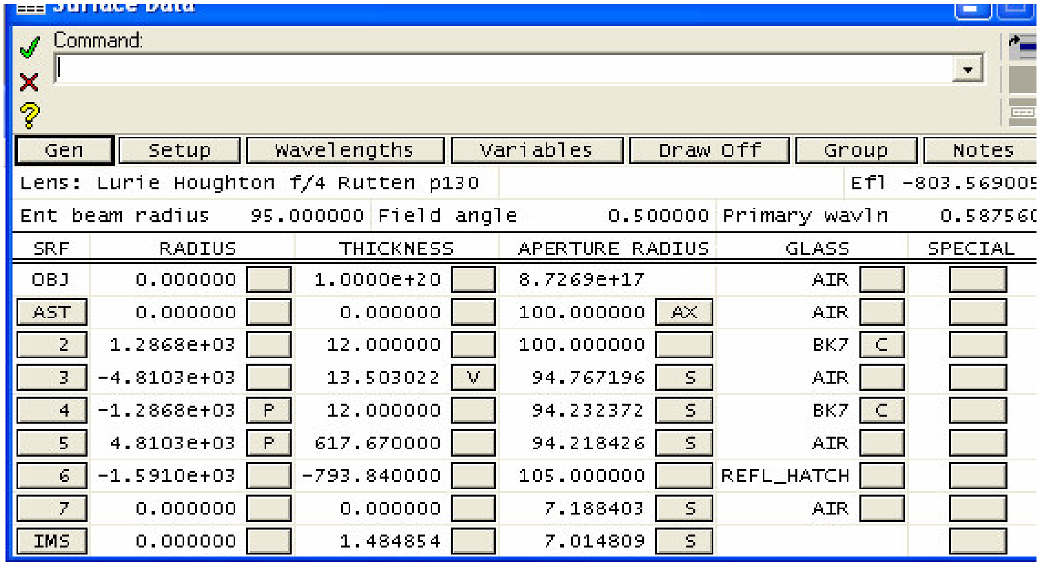


Figure 82 Houghton Cassegrain 2 design

Lurie Houghton 2 Design



Surface Data

Command:

Gen | Setup | Wavelengths | Variables | Draw Off | Group | Notes

Lens: Lurie Houghton f/4 Rutten p130 — Efl -803.569005

Ent beam radius 95.000000 — Field angle 0.500000 — Primary wavln 0.58756

SRF	RADIUS		THICKNESS		APERTURE RADIUS		GLASS		SPECIAL
OBJ	0.000000		1.0000e+20		8.7269e+17		AIR		
AST	0.000000		0.000000		100.000000	AX	AIR		
2	1.2868e+03		12.000000		100.000000		BK7	C	
3	-4.8103e+03		13.503022	V	94.767196	S	AIR		
4	-1.2868e+03	P	12.000000		94.232372	S	BK7	C	
5	4.8103e+03	P	617.670000		94.218426	S	AIR		
6	-1.5910e+03		-793.840000		105.000000		REFL_HATCH		
7	0.000000		0.000000		7.188403	S	AIR		
IMS	0.000000		1.484854		7.014809	S			

Figure 83 Lurie Houghton 2 design

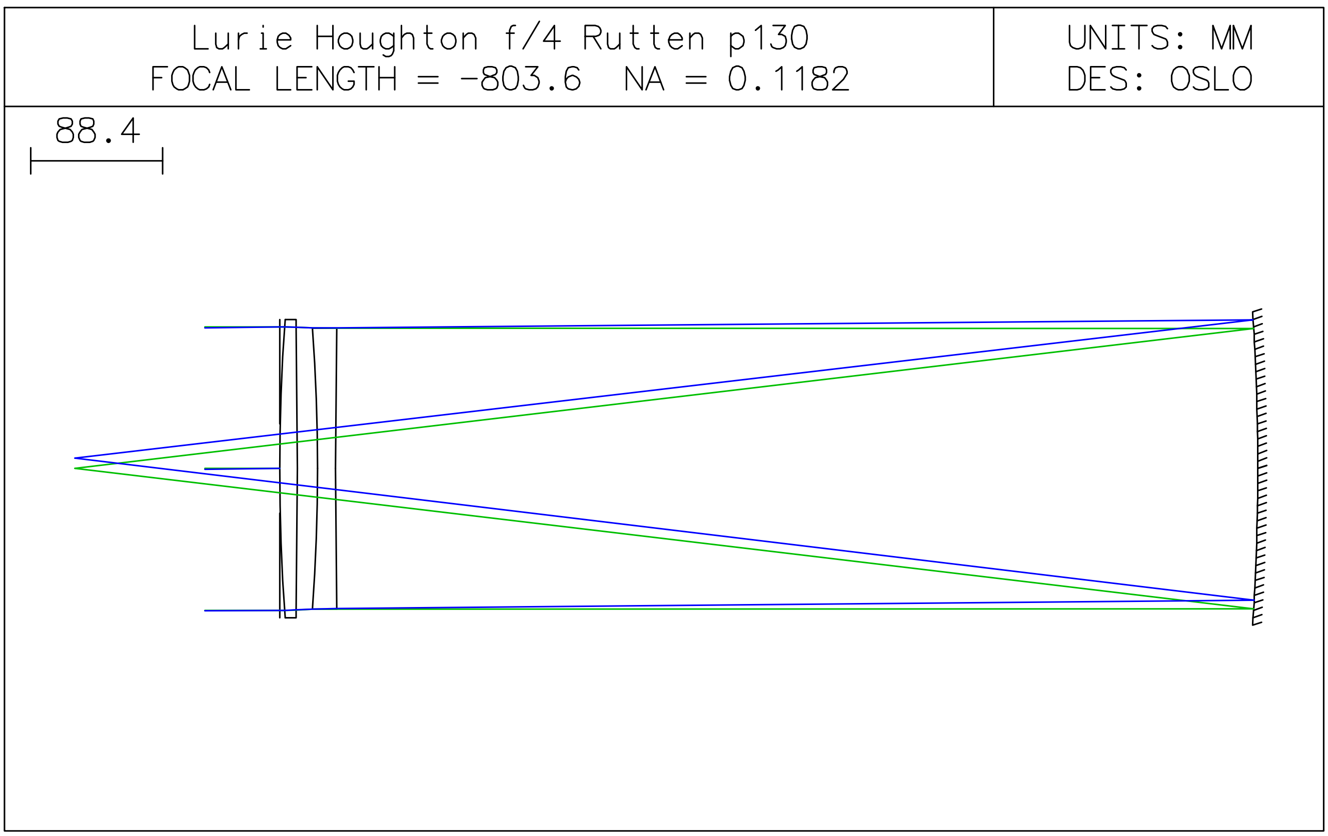


Figure 84 Lurie Houghton 2 design

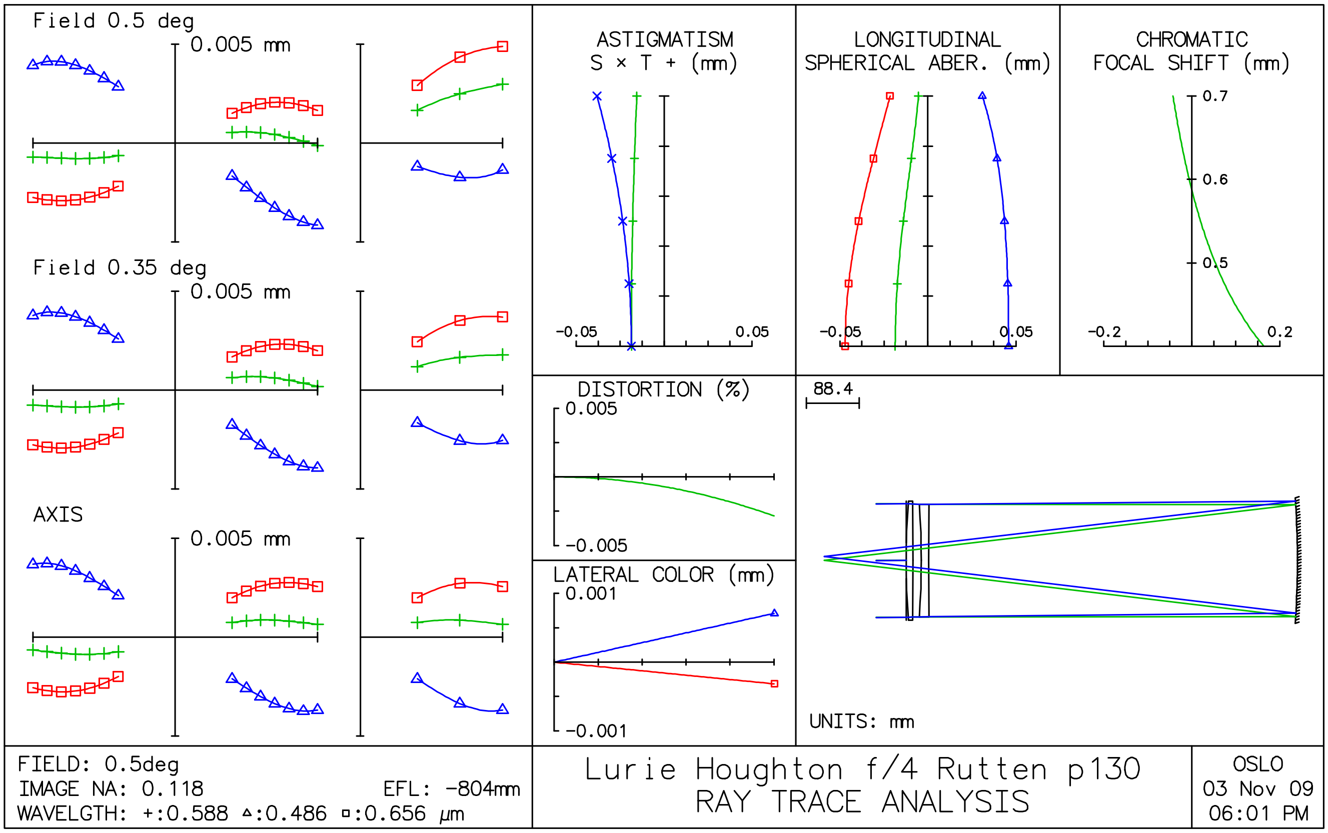


Figure 85 Lurie Houghton 2 design

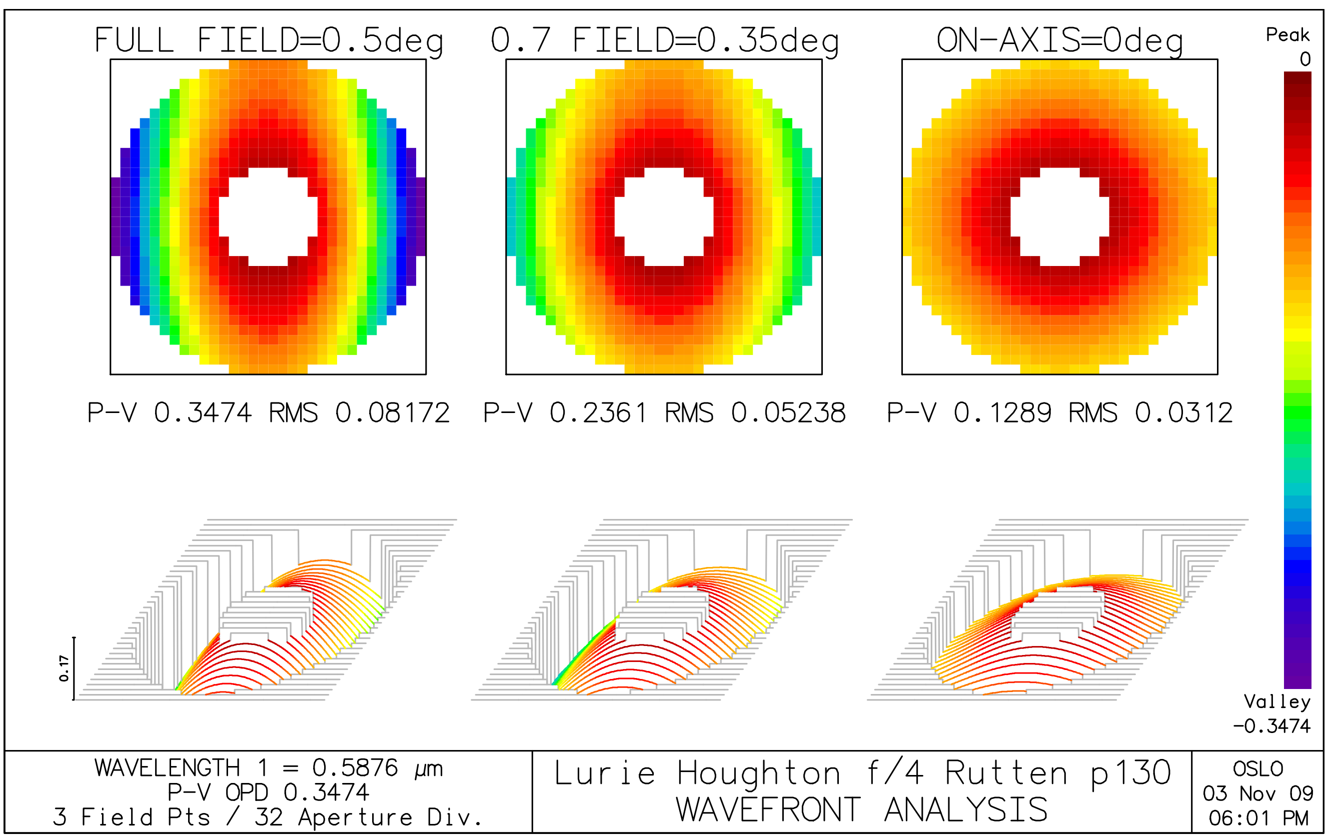


Figure 86 Lurie Houghton 2 design

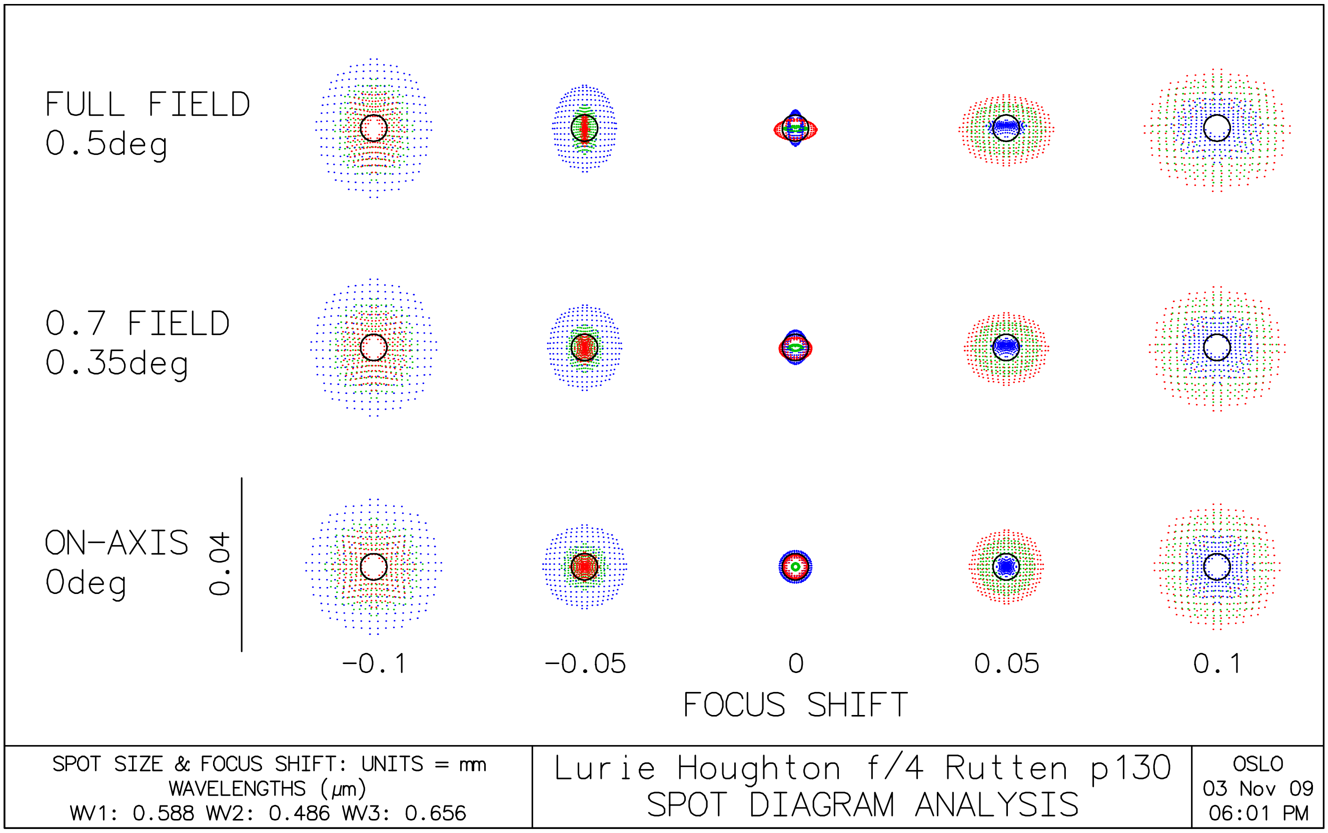


Figure 87 Lurie Houghton 2 design

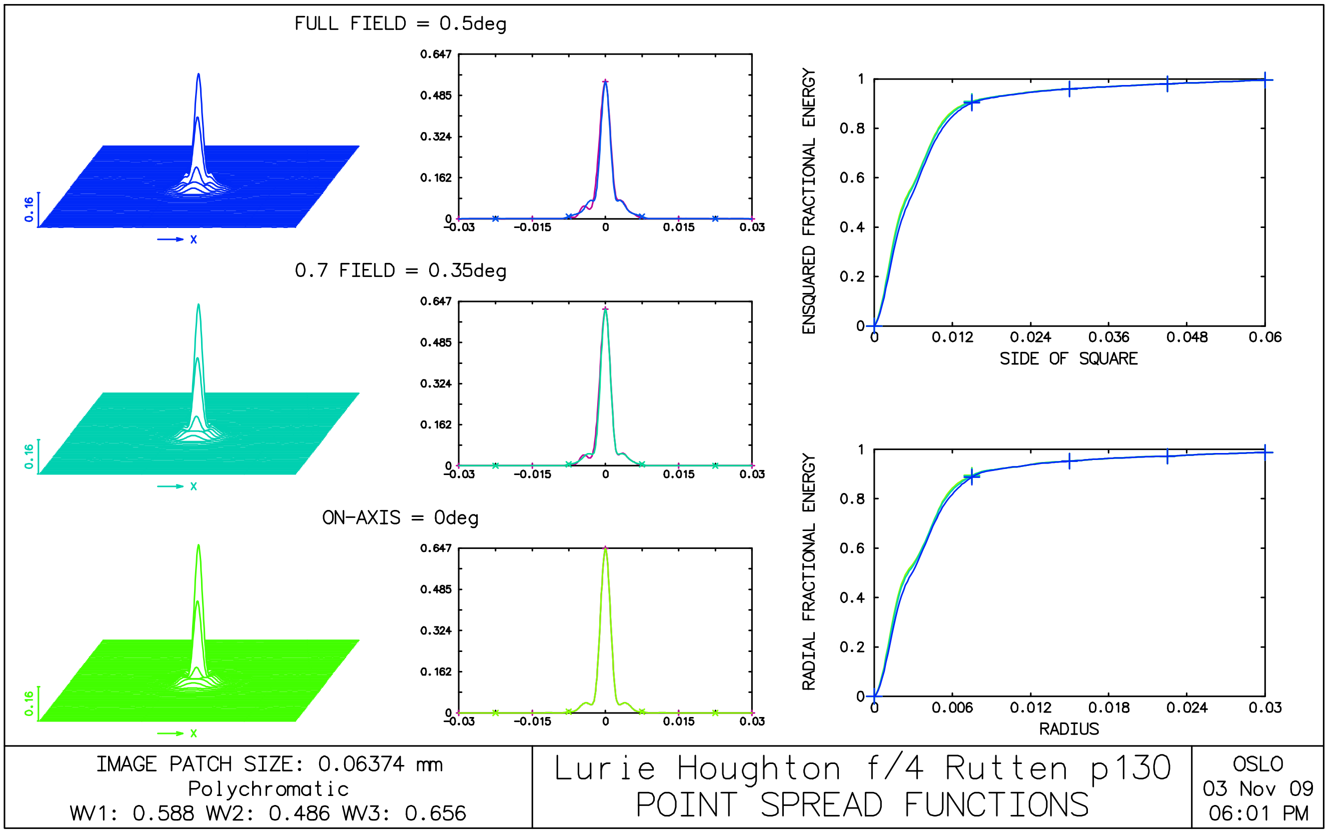


Figure 88 Lurie Houghton 2 design

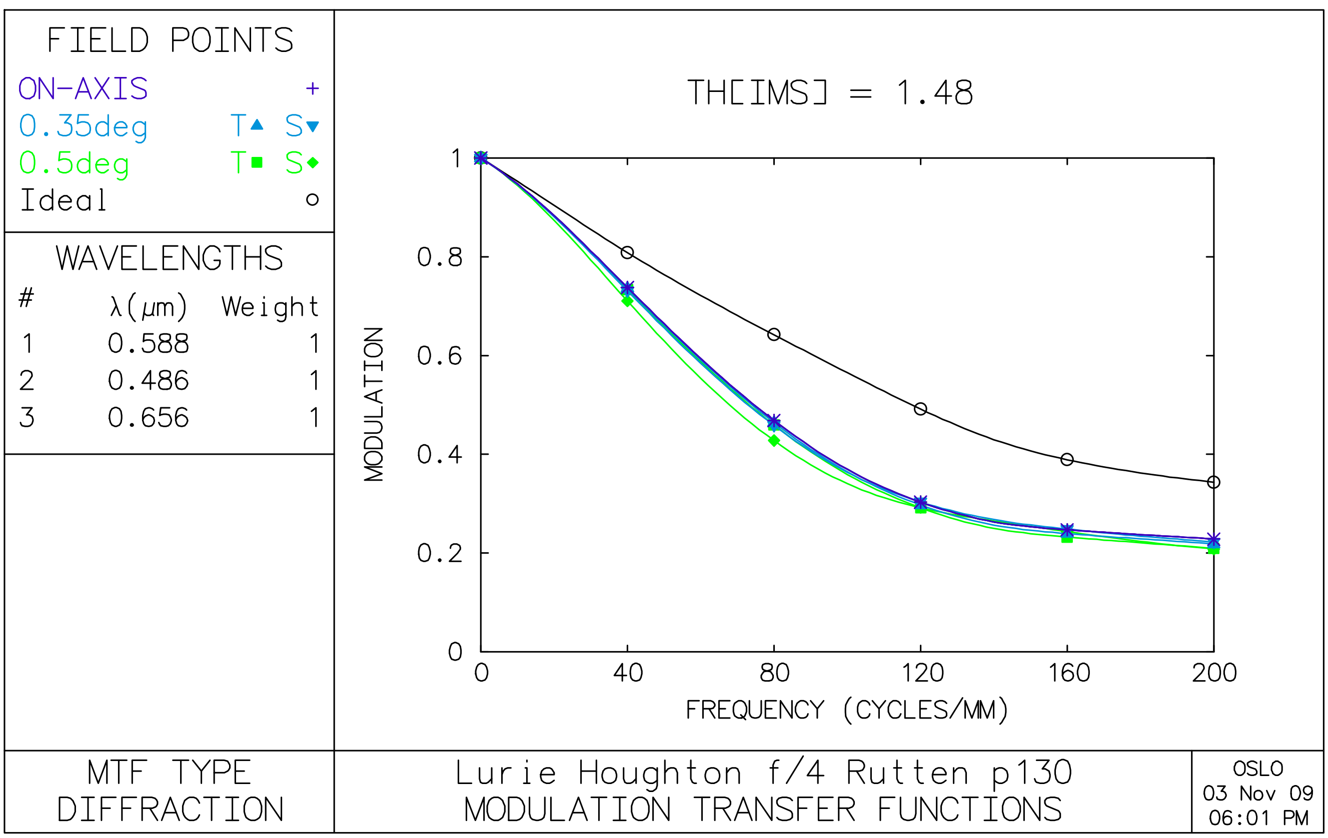


Figure 89 Lurie Houghton 2 design

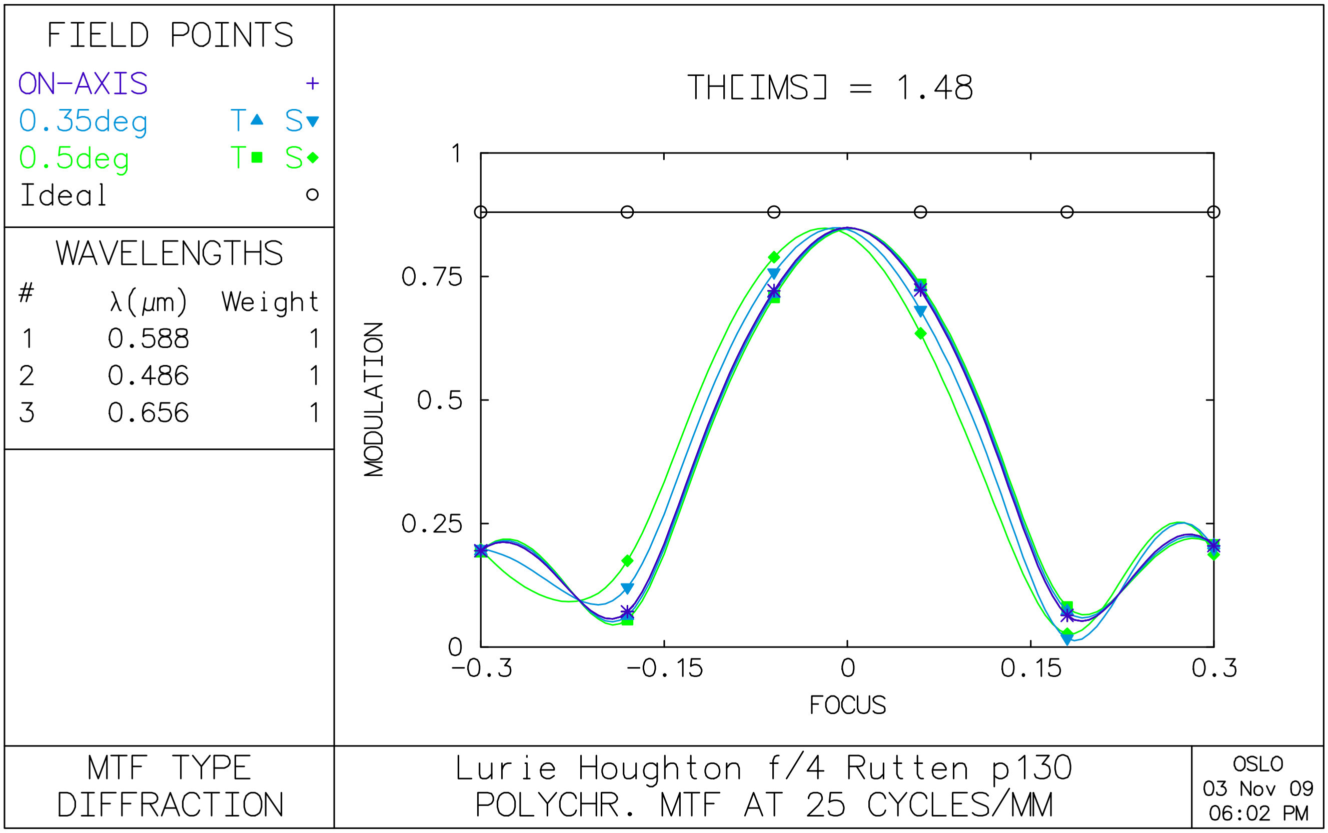


Figure 90 Lurie Houghton 2 design

Summary

0 = Poor 10 = Excellent

Design	Construction Difficulty	Focal Plane Access	Speed (F-#)	Size	Vignetting	Color	Spot	Near Term Interest	Longer Term Interest
Paul Baker 1	5	2	8	2	1	6	3	3	2
Paul Baker 2	5	2	8	6	2	9	8	3	2
Paul Baker 3	5	2	8	6	2	10	10	3	2
Paul Baker 4	5	1	8	6	1	9	10	2	1
Aplanatic Gregorian 1	7	10	4	4	4	8	9	3	2
Aplanatic Gregorian 2	7	10	7	7	6	3	2	2	1
RC Corrected	9	10	7	9	5	8	9	5	9
Flat Field Schmidt	9	10	10	7	3	3	9	2	2
Houghton Cass 1	6	10	4	8	7	5	8	3	7
Houghton Cass 2	6	10	6	4	7	4	4	3	7
Lurie Houghton 1	9	9	7	7	9	8	9	8	5

At F/4, the Lurie-Houghton is a very attractive candidate for a first telescope. Not only is the F-number acceptably small for astrophotography, but the optical surfaces are all spherical and image quality is outstanding. Staying at 12” or less for the primary makes the corrector lenses manageable. Higher-order aberrations begin setting in for F-numbers around 3.5 and lower; they can be compensated for by allowing different lens radii to be used along with different kinds of glass for the two lenses. However, these additional complexities do not seem worth the effort to go from F/4 to say F/3.

Longer term, I see doing a larger focal length scope and larger aperture. The larger aperture knocks out using a corrector plate in my opinion. This leaves me pretty much going toward the Ritchey-Chretien plus field flattener direction.