Johns

WIYN Project

Wisconsin **Indiana** **Yale** **NOAO**

MEMORANDUM

TO: Sam Barden
FROM: Dan Blanco
SUBJECT: WIYN Wide Field Corrector Installation Tolerances
DATE: April 26, 1994

At the WF Corrector CDR there were some questions raised as to the effect on performance due to mislocation of the corrector along the optical axis. The attached graphs and tables give some idea of the effect over the wide field. The first graph plots RMS image diameter at 11 points in the field as a function of the corrector position along the optical axis. The data was generated using a "quick look" feature in the Zemax ray tracing code. For each case five rays were traced through the system and used to determine RMS image diameter. Because of this limited sampling the absolute values of RMS image diameters are not very accurate, however they are sufficient to show trends.

Two things become clear; first that the location is not terribly important within a few millimeters, and second, effects are most pronounced at the edge of the one degree field. I did not include spot diagrams, however examination shows that there is no chromatic separation as the corrector is moved along the axis.

The second graph shows values of Zernike wavefront expansion terms for an image at the edge of the field while the corrector is moved along the optical axis. The only significant variation in the wavefront terms are astigmatism and focus.

It may be possible to take several photographic plates while moving the corrector cell along the axis, and by examining the images, determine the optimum cell location. It is probably more effective to do the measurement with a wavefront sensor which can be moved across the field.

It seems to me that in order to optimize the corrector position we would need to move the corrector a fairly long way - about 10 to 20 mm to trial positions along the axis. On the other hand, since the position tolerance is fairly loose, we should be able to place the corrector by dead reckoning with sufficient accuracy. This is the approach I recommend.

cc:
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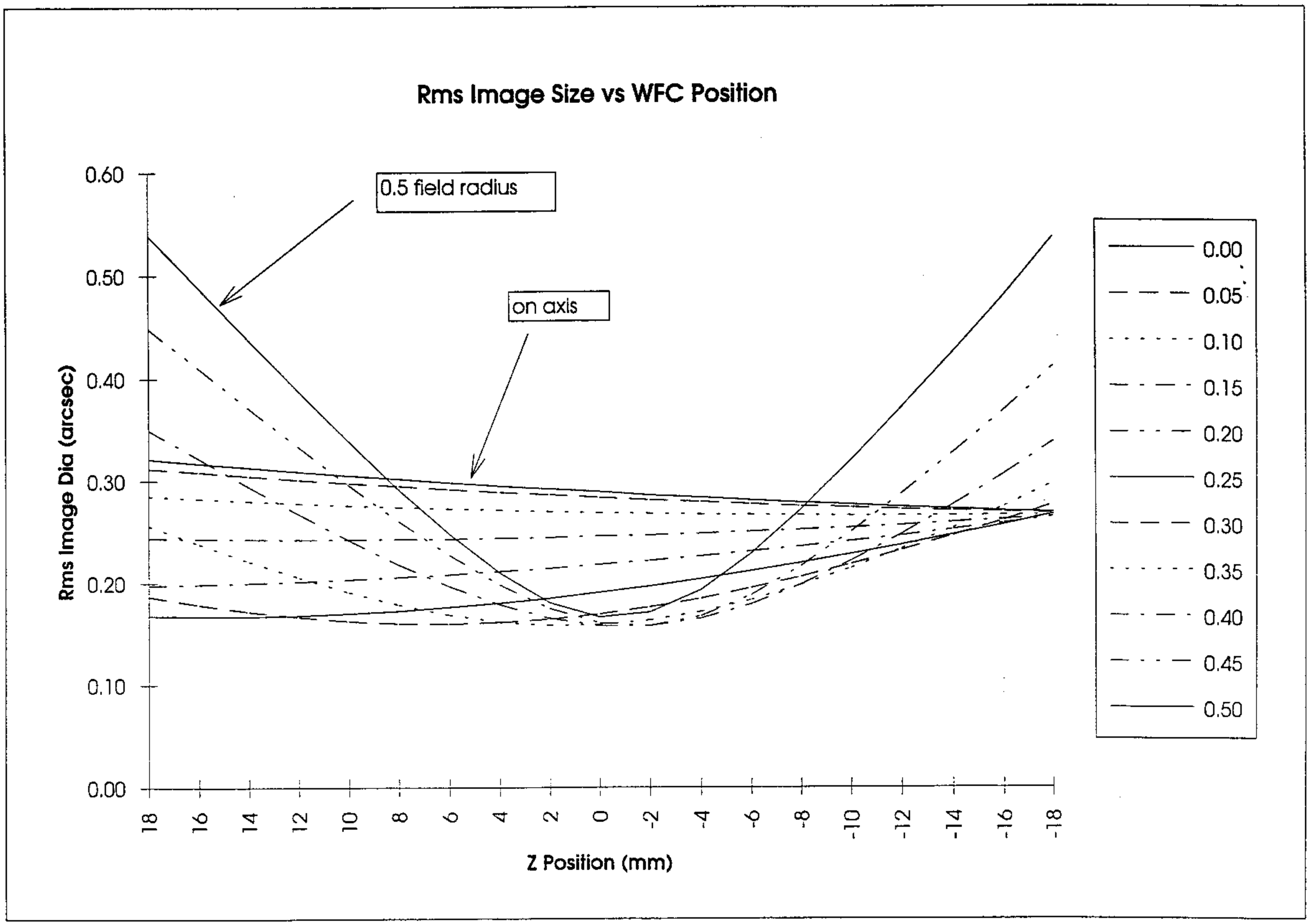
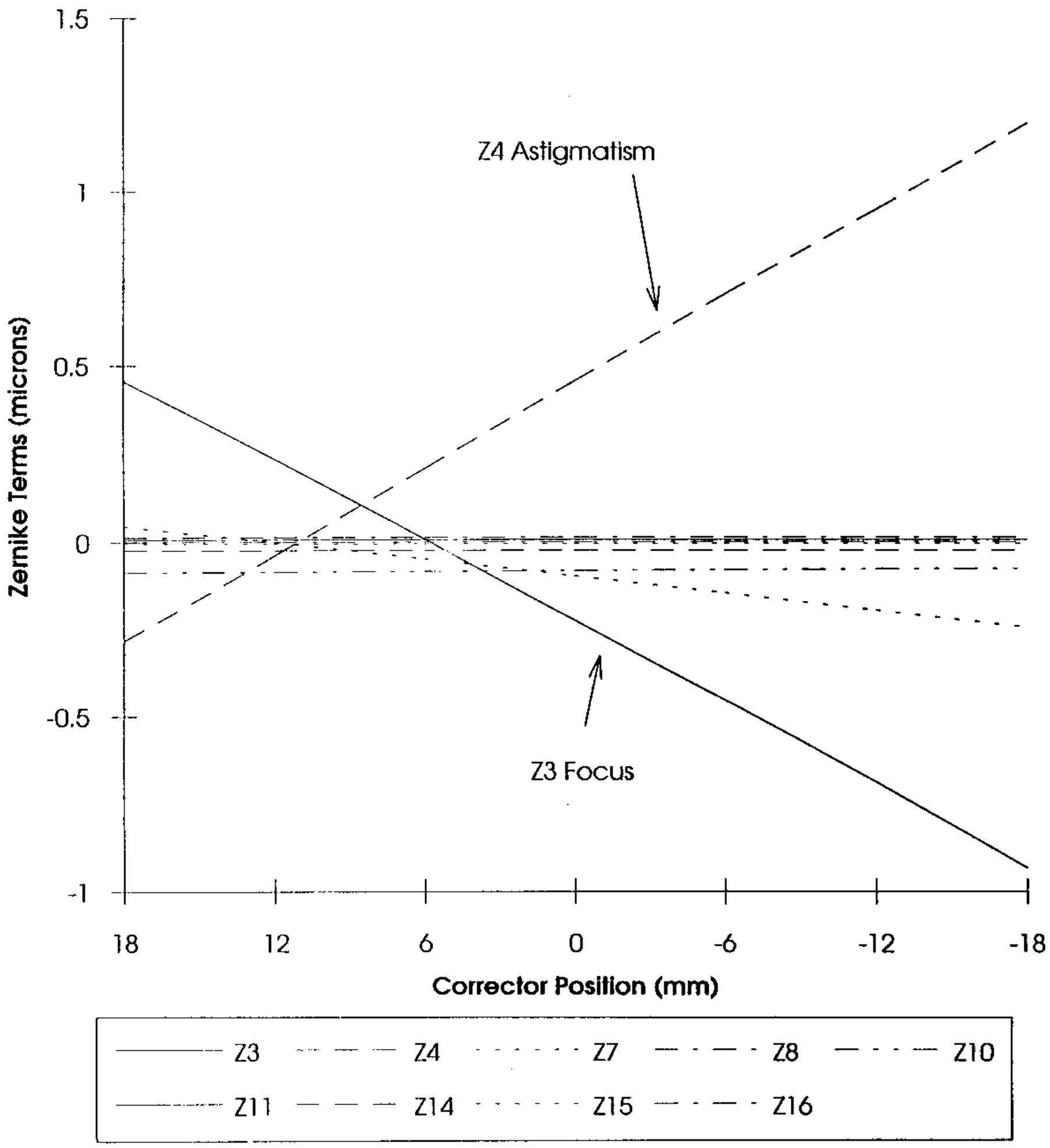

Rms Image Size vs WFC Position
0.5 field radius
on axis
Rms Image Dia (arcsec)
0.60
0.50
0.40
0.30
0.20
0.10
0.00
18
16
14
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
Z Position (mm)
0.00
0.05
0.10
0.15
0.20
0.25
0.30
0.35
0.40
0.45
0.50

Wavefront (0.5 deg off axis) vs Corrector Position



Wavelength averaged RMS spot radius (microns):

	Corrector position (mm, negative = towards secondary)																		
Field	18	16	14	12	10	8	6	4	2	0	-2	-4	-6	-8	-10	-12	-14	-16	-18
0.00	17.7	17.5	17.3	17.1	16.9	16.7	16.5	16.3	16.1	15.9	15.8	15.6	15.5	15.4	15.2	15.1	15.0	14.9	14.8
0.05	17.2	17.0	16.8	16.6	16.4	16.3	16.1	15.9	15.8	15.7	15.5	15.4	15.3	15.2	15.1	15.0	14.9	14.9	14.8
0.10	15.7	15.6	15.5	15.3	15.2	15.1	15.0	15.0	14.9	14.8	14.8	14.7	14.7	14.7	14.7	14.7	14.7	14.7	14.7
0.15	13.5	13.4	13.4	13.4	13.4	13.4	13.4	13.4	13.5	13.5	13.6	13.7	13.8	13.9	14.0	14.1	14.3	14.4	14.6
0.20	10.9	10.9	11.0	11.1	11.2	11.3	11.5	11.6	11.8	12.0	12.2	12.5	12.7	13.0	13.3	13.6	13.9	14.2	14.6
0.25	9.2	9.2	9.2	9.3	9.4	9.5	9.7	9.9	10.2	10.5	10.8	11.2	11.6	12.1	12.6	13.1	13.6	14.2	14.7
0.30	10.3	9.9	9.5	9.2	9.0	8.8	8.8	8.9	9.1	9.3	9.7	10.2	10.7	11.3	12.0	12.8	13.6	14.4	15.3
0.35	14.1	13.1	12.2	11.3	10.5	9.9	9.3	8.9	8.7	8.8	9.0	9.5	10.1	10.9	11.8	12.8	14.0	15.2	16.4
0.40	19.3	17.7	16.2	14.8	13.3	12.0	10.8	9.8	9.1	8.7	8.7	9.1	9.9	10.9	12.2	13.6	15.2	16.9	18.6
0.45	24.8	22.6	20.5	18.4	16.3	14.4	12.5	10.9	9.6	8.9	8.7	9.2	10.4	11.9	13.8	15.8	18.0	20.3	22.7
0.50	29.8	26.9	24.1	21.4	18.7	16.1	13.7	11.6	10.0	9.2	9.4	10.6	12.6	15.0	17.6	20.5	23.4	26.5	29.6

Wavelength averaged RMS image diameter (arcseconds):

	Corrector position (mm, negative = towards secondary)																		
Field	18	16	14	12	10	8	6	4	2	0	-2	-4	-6	-8	-10	-12	-14	-16	-18
0.00	0.32	0.32	0.31	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27
0.05	0.31	0.31	0.30	0.30	0.30	0.29	0.29	0.29	0.29	0.28	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27
0.10	0.29	0.28	0.28	0.28	0.28	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27	0.27
0.15	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.24	0.25	0.25	0.25	0.25	0.25	0.25	0.26	0.26	0.26	0.26
0.20	0.20	0.20	0.20	0.20	0.20	0.21	0.21	0.21	0.21	0.22	0.22	0.23	0.23	0.24	0.24	0.25	0.25	0.26	0.26
0.25	0.17	0.17	0.17	0.17	0.17	0.17	0.18	0.18	0.18	0.19	0.20	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27
0.30	0.19	0.18	0.17	0.17	0.16	0.16	0.16	0.16	0.16	0.17	0.18	0.18	0.19	0.21	0.22	0.23	0.25	0.26	0.28
0.35	0.26	0.24	0.22	0.21	0.19	0.18	0.17	0.16	0.16	0.16	0.16	0.17	0.18	0.20	0.21	0.23	0.25	0.27	0.30
0.40	0.35	0.32	0.29	0.27	0.24	0.22	0.20	0.18	0.17	0.16	0.16	0.17	0.18	0.20	0.22	0.25	0.28	0.31	0.34
0.45	0.45	0.41	0.37	0.33	0.30	0.26	0.23	0.20	0.17	0.16	0.16	0.17	0.19	0.22	0.25	0.29	0.33	0.37	0.41
0.50	0.54	0.49	0.44	0.39	0.34	0.29	0.25	0.21	0.18	0.17	0.17	0.19	0.23	0.27	0.32	0.37	0.43	0.48	0.54

Zernike Terms (in microns) vs WF Corrector Position (mm)
For image at edge of field

	18	12	6	0	-6	-12	-18
Z0	0.525483	0.303516	0.077416	-0.152806	-0.387136	-0.625562	-0.868071
Z1	0	0	0	0	0	0	0
Z2	0.881767	0.832928	0.781305	0.726878	0.669627	0.609532	0.546573
Z3	0.456189	0.234747	0.009106	-0.220725	-0.454734	-0.692912	-0.935248
Z4	-0.279408	-0.03703	0.207401	0.45387	0.70236	0.952857	1.205343
Z5	0	0	0	0	0	0	0
Z6	0	0	0	0	0	0	0
Z7	0.044654	-0.000022	-0.046023	-0.093358	-0.142038	-0.192073	-0.243474
Z8	0.013576	0.013977	0.014312	0.014579	0.014775	0.014899	0.014949
Z9	0	0	0	0	0	0	0
Z10	-0.084392	-0.082737	-0.081005	-0.079196	-0.077312	-0.075351	-0.073314
Z11	0.007986	0.007939	0.007908	0.007895	0.007899	0.007921	0.007962
Z12	0	0	0	0	0	0	0
Z13	0	0	0	0	0	0	0
Z14	-0.022137	-0.022125	-0.022114	-0.022104	-0.022096	-0.022089	-0.022084
Z15	-0.003353	-0.003351	-0.00335	-0.003348	-0.003346	-0.003344	-0.003342
Z16	0.000806	0.000818	0.000829	0.00084	0.00085	0.000859	0.000868
Z17	0	0	0	0	0	0	0
Z18	0	0	0	0	0	0	0