Image Quality and Stability Criteria

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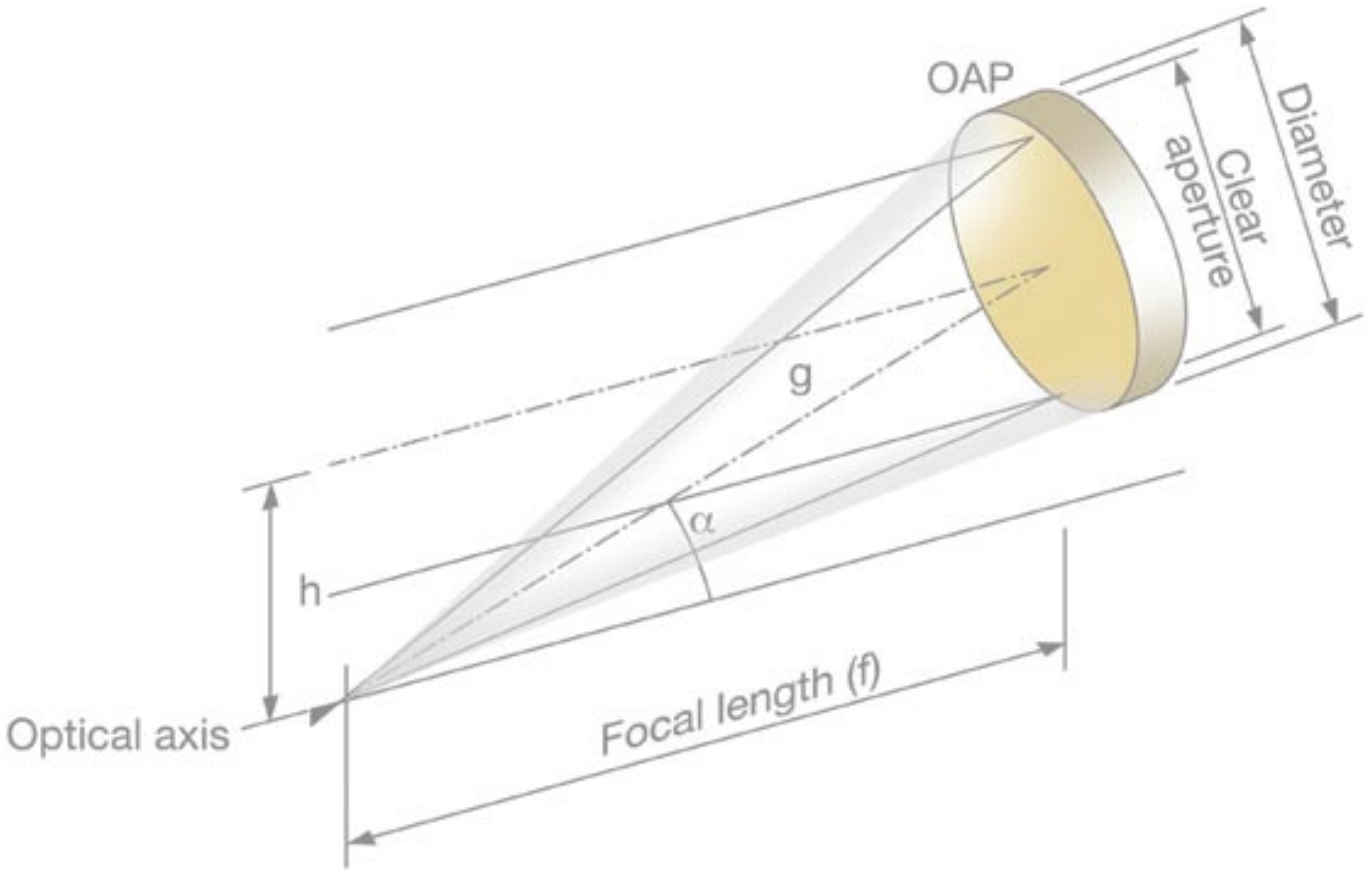
Off-Axis Angle



h = off axis distance (OAD) $h = 2f(\tan\alpha/2)$
g = apparent focal length
α = off axis angle (OAA)

Provisional Layout

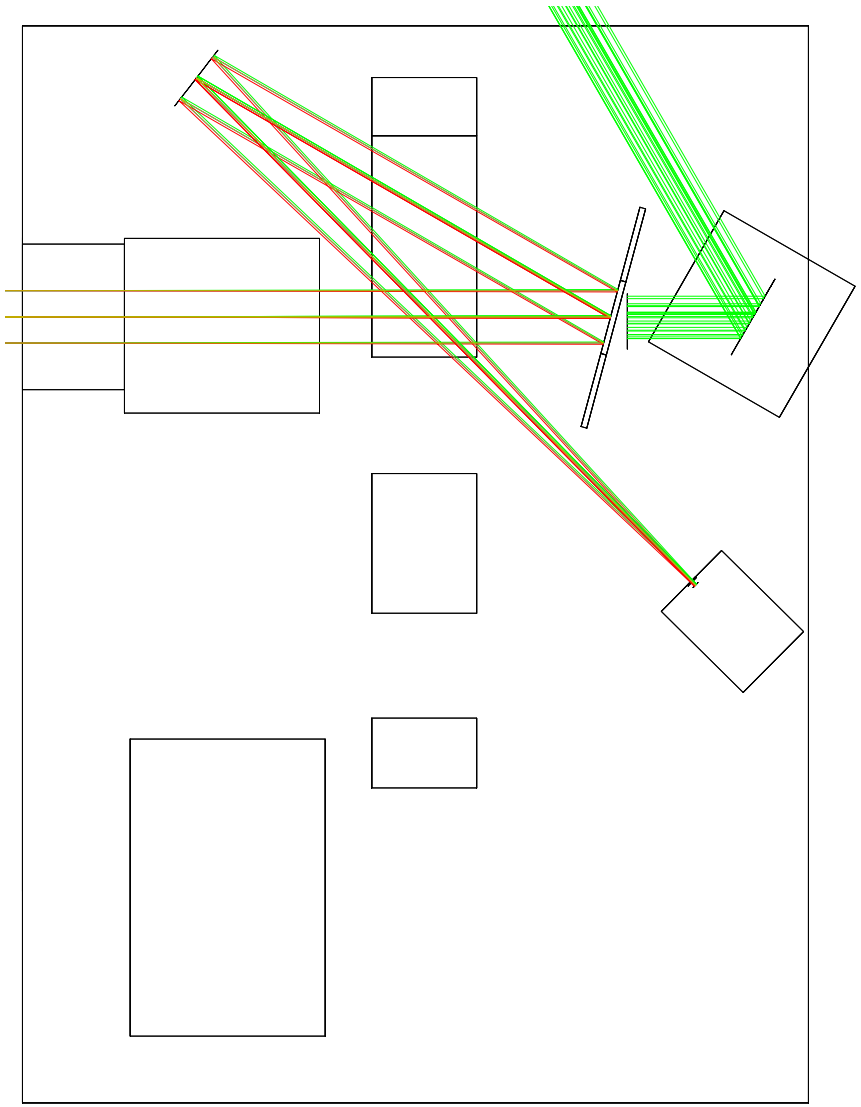


Image Quality

Criterion was that spread of the image should be no more than two Airy disks across a field of view of $\pm$ 10 arcseconds. Elements were set up correctly, and then perturbed.

Element	Degree of Freedom	Allowed movement
Dichroic	Δx, Δy, Δz	Insensitive
	$\Delta\theta_{\mathrm{x}}$, $\Delta\theta_{\mathrm{y}}$	6 arcmin
	$\Delta\theta_{\mathrm{z}}$	Unconstrained
OAP	Δx, Δy	Unconstrained
	Δz	600μm
	$\Delta\theta_{\mathrm{x}}$, $\Delta\theta_{\mathrm{y}}$	12 arcmin
	$\Delta\theta_{\mathrm{z}}$	Unconstrained
CCD	Δx, Δy	Unconstrained
	Δz	600μm
	$\Delta\theta_{\mathrm{x}}$, $\Delta\theta_{\mathrm{y}}$	Insensitive

Image Quality - Summary

- From a quality perspective, the defocus constraint is easy to meet.
- The angular requirements require the light reflected from the dichroic and the axis of the parent parabola of the OAP to be parallel; it is only the relative angle between the OAP and the dichroic that concerns us for the image quality.
- This fact can therefore perhaps be used to our advantage in the design of the mount?
  There are still a couple of sources of potential error not included here...

Image Quality - Implementation

Manufacturing uncertainties of the parabola can be corrected for, but we need to know what those are. Unfortunately, no indication of the expected uncetainty on the direction of axis. In communication with SORL.

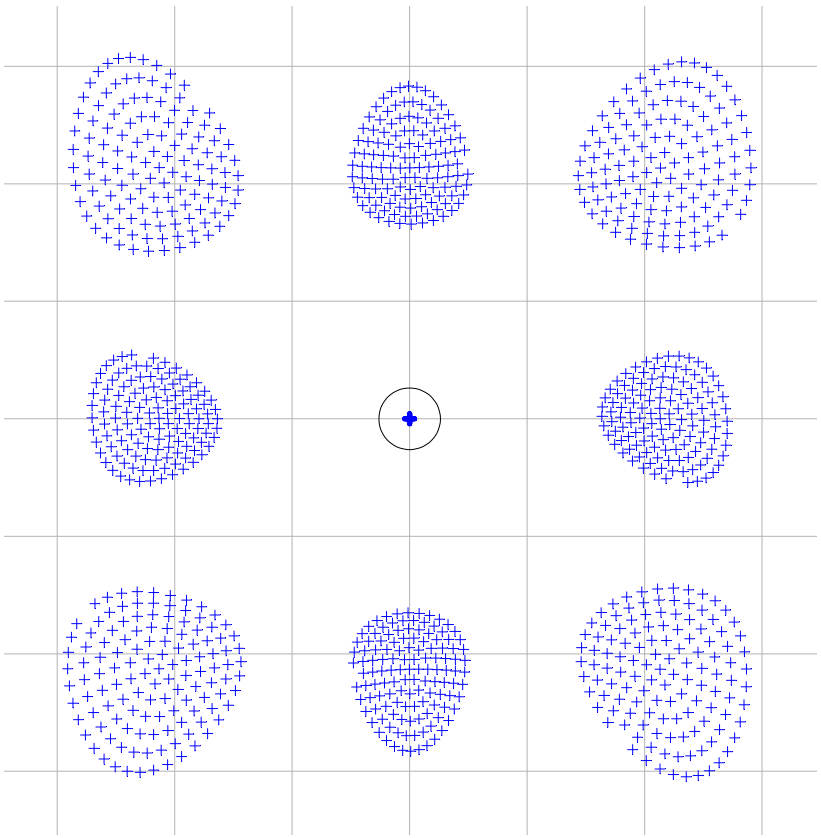


Image Stability - Absolute

Absolute stability requirements are hard - but we already knew this. Criterion was image should not move by more than 0.015 arcseconds, or $\Delta = 1.2\mu$m for the focal length being considered here.

Element	Degree of Freedom	Allowed movement
Dichroic	Δx, Δy, Δz	Insensitive
	$\Delta\theta_{\mathrm{x}}$, $\Delta\theta_{\mathrm{y}}$	0.36 arcsec
OAP	Δx, Δy	1.2μm
	Δz	Unconstrained
	$\Delta\theta_{\mathrm{x}}$, $\Delta\theta_{\mathrm{y}}$,	$\arctan\frac{\Delta}{f'} = 0.21$ arcsec
	$\Delta\theta_{\mathrm{z}}$	$\arctan\frac{\Delta}{OAD} = 0.76$ arcsec
CCD	Δx, Δy	1.2μm
	Δz	Unconstrained
	$\Delta\theta_{\mathrm{x}}$, $\Delta\theta_{\mathrm{y}}$	Insensitive

Image Stability - Expansion

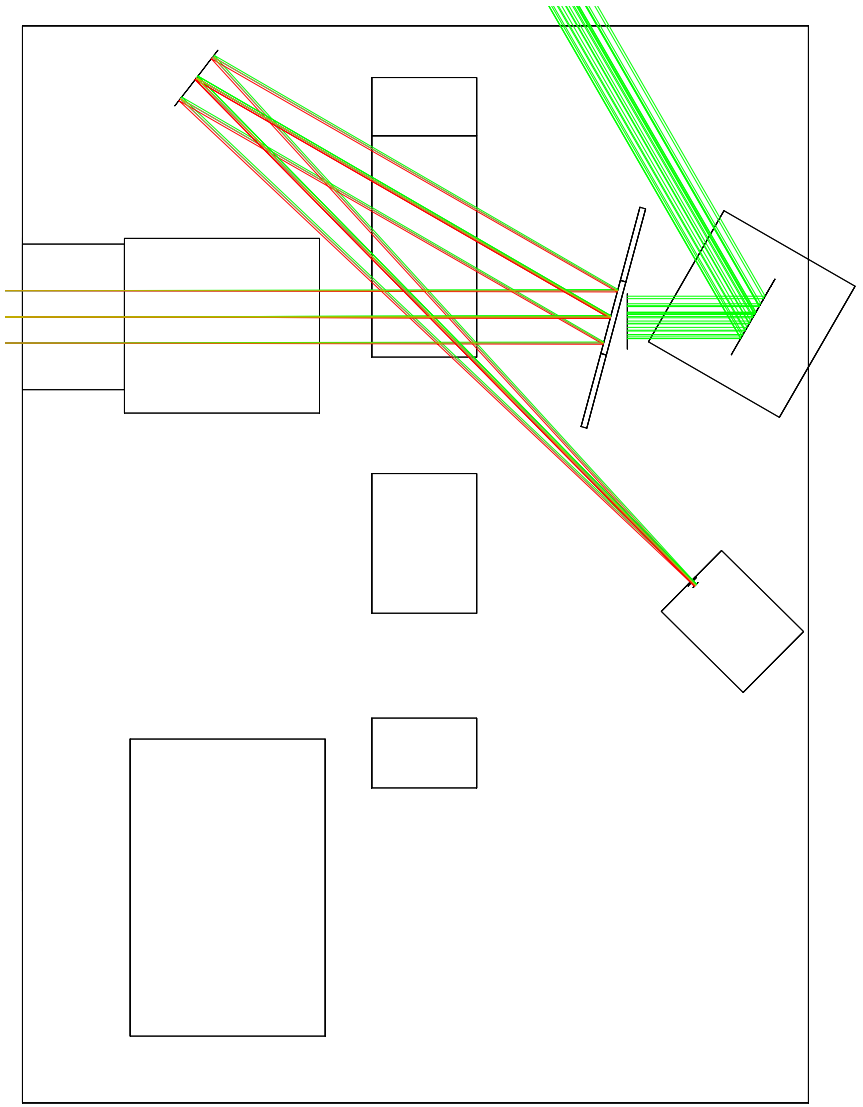


Image Stability - Expansion - $< 1.2\mu$m

ΔT	Δy_D	Δz_D	Δy_P	Δz_P	Δy_C	Δz_C	Movement
0.5	2.13	1.68	4.14	0.19	-0.1775	2.40	1.53
1	4.25	3.35	8.28	-0.38	-0.355	4.81	3.08
2	8.50	6.70	16.56	-0.76	-0.71	9.62	6.14
5	21.25	16.75	41.4	-1.88	-1.78	24.05	15.4
0.5	0	3.56	2.05	0	-0.23	0.43	1.4
1	0	7.12	4.10	0	-0.46	0.85	2.81
2	0	14.24	8.20	0	-0.92	1.70	5.58
5	0	35.6	20.5	0	-2.3	4.25	14.07

Lengths in μm, temperature in $^\circ$C

(Uniform) expansion of the table does not affect angles. Top data have the expansion about the centre of the table, bottom data have the expansion under the light ray.

Defocus is not shown, but is under 50μm in all cases.