NOT **Nordic Optical Telescope**

Report on NOT Tracking Test 21/10/97

Colin Aspin

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During the technical night on the 21st October 1997, Jacob Clasen obtained a set of 'tracking' data on NOT at my request. These images were solicited to attempt to quantify the current telescope tracking characteristics both *without* and *with* autoguiding at both near zenith and large hour angles locations. The dataset obtained consisted of the following eight images:

Close to Zenith (actual airmass=1.07 or zd=27^o) – focus field.

- 1 minute V band image tracking *without* autoguiding.
- 5 minute V band image tracking *without* autoguiding.
- 10 minute V band image tracking *without* autoguiding.
- 10 minute V band image tracking *with* autoguiding.

Hour Angle ∼4 hours (actual airmass=1.77 or zd=57^o) – focus field.

- 1 minute V band image tracking *without* autoguiding.
- 5 minute V band image tracking *without* autoguiding.
- 10 minute V band image tracking *without* autoguiding.
- 10 minute V band image tracking *with* autoguiding.

The data was obtained at the start of the night and from the raw images (gj210001–0008) the image quality was analysed using CA's ircamdr Starlink software package. The average stellar profile (or point spread function, psf) over 5 (unsaturated) stars was used to calculate the full-width half maximum (FWHM) 'seeing', the mean axis ratio R.A. to Dec (elongation of the stellar profile), the mean orientation of the major axis of any elongation and the γ (gamma) factor of the stellar images (the radial fall-off of the profile, a γ=2 is a pure gaussian psf). For this the Starlink kappa program **psf** was used. The results of the analysis are given in Table 1.

Image	Image Details	FWHM	Elongation	Orientation	γ
gj210001	1m T-No AG (1.07)	0.92″	1.59	-32	1.85
gj210002	5m T-No AG (1.07)	0.95″	1.44	0	1.92
gj210003	10m T-No AG (1.07)	0.96″	1.38	5	2.06
gj210004	10m T-AG (1.07)	0.73″	1.09	37	1.62
gj210005	1m T-No AG (1.77)	1.27″	1.19	12	1.74
gj210006	5m T-No AG (1.77)	1.65″	1.83	54	1.85
gj210007	10m T-No AG (1.77)	1.17″	2.80	-65	1.52
gj210008	10m T-AG (1.77)	1.17″	1.03	85	1.65

Table 1: Results of Tracking Data Analysis.

Clearly there is a significant change in FWHM of the stellar psf over the images. This change is better defined in contour maps of a typical stellar psf in each of the images. These are shown in Fig. 1.

The best psf FWHM are given, as expected, when autoguiding. This is true at both zenith and airmass=1.77 and will be true at any (intermediate or other) zenith distance. Near zenith, the psf FWHM deteriorates somewhat in the non-autoguided images but the difference between the 1min, 5min and 10min images is not significant in these test data. Autoguiding is clearly an advantage however, since the best FWHM (0.73″) is achieved.

At a zenith distance of 56° there is an extremely large advantage to autoguiding; the images in the 5min and 10min images are misshapen and distinctly non-stellar while in the 10min autoguided image a more optimum psf FHWM is achieved. It is obvious that the psf fitting has failed miserably in the distorted 5min and 10min non-autoguided images at large zenith distance so the values quoted in Table 1 should be treated with caution!

The conclusions of these tests are that :

- As expected, autoguiding should be used whenever possible.
- Observing for up to 10min without autoguiding when near the zenith is acceptable but some deterioration is image quality (but not obviously psf shape) will occur.
- The radial profile of the stellar images produced by ALFOSC are rarely exact gaussian but close to it.

I suggest that additional tracking tests at low, intermediate and large zenith distances should be acquired to better characterize the change in stellar psf shape and FWHM (in stable seeing conditions).

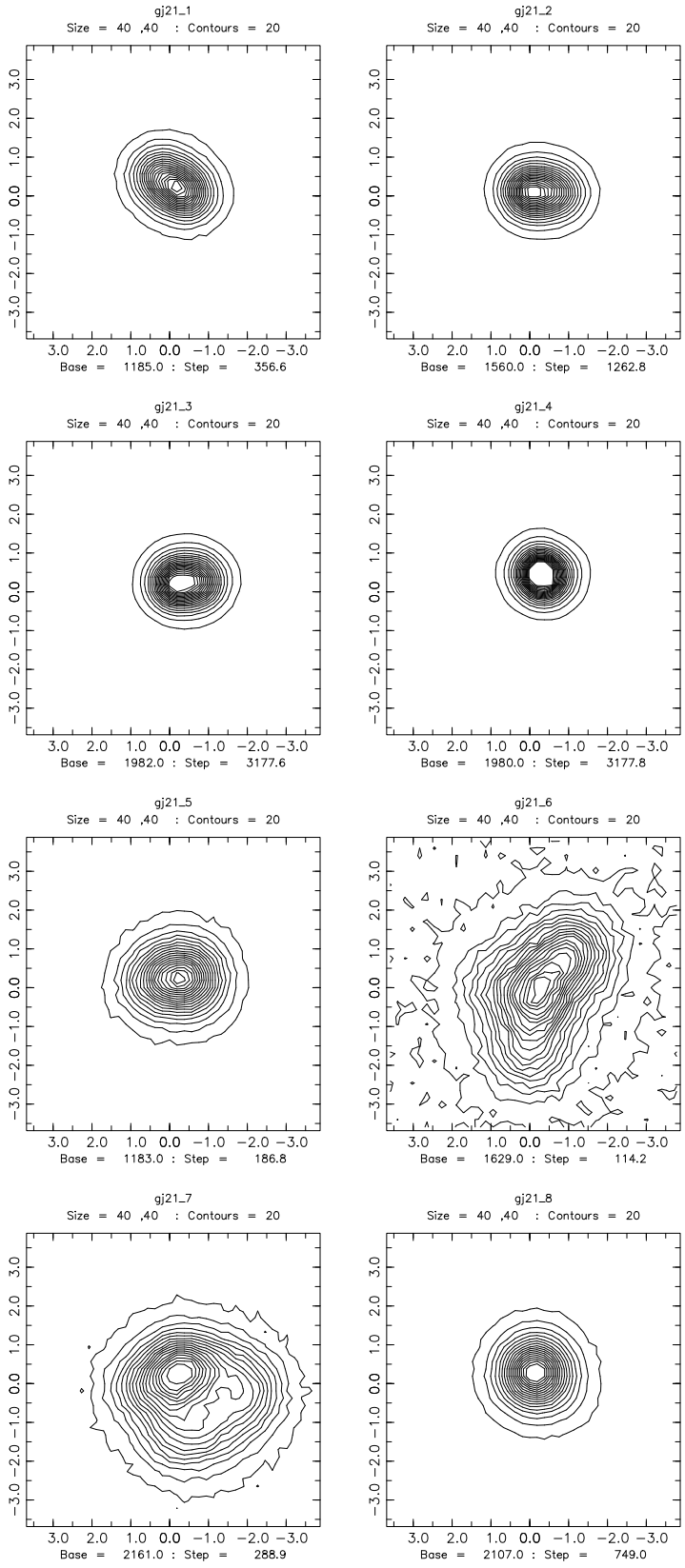

Figure 1: Contour plots of the stellar psf for the eight tracking images detailed above.