has an independent focus, optical aberrations and several other 'features', and so gives only an approximate (and certainly pessimistic) estimate of the true WHT seeing.

In the absence of dome seeing, the remaining tasks for the HAP at the WHT are to optimise the tracking and focus of the telescope. The power spectrum of image motion measured by the JOSE sensor reveals a spike due to the known oscillation of the WHT support structure at 2.7Hz. Whilst this resonance contributes little power on average, the oscillation can have a significant effect on image width if it is strongly excited, for example by wind buffeting of the telescope structure. In future it may be possible to monitor the telescope drive encoders automatically, and to alert the observer to excess tracking errors at high frequencies. A significant contribution to the image FWHM at the WHT (as for all telescopes) may result from imperfect focus. Current methods for estimation of the optimum focus are limited by the inherent variability of the site seeing. Improved methods to focus and to track the focus of the WHT are under investigation.

In the next issue of the ING newsletter we will discuss the HAP at the INT and the future of the HAP.

HAP Publications:

1. Wilson, R. W., O'Mahony, N., Packham, C., Azzaro, M., 1999, "The seeing at the William Herschel Telescope", *MNRAS*, **309**, 379.

2. Packham, C., O'Mahony, N., Wilson, R. W., 1998, "Recent developments in the Half Arcsecond Programme", *New AR*, **42**, 431.

3. Azzaro, M., Breare, M., 1998, "Some meteorological parameters affecting the image quality of the WHT on La Palma", *New AR*, **42**, 471.

4. O'Mahony, N., Packham, C., Wilson, R. W., Rutten, R., 1997, "Characterisation and Optimisation of Seeing at ING Telescopes", 23rd IAU General Assembly, Kyoto. ¤

Chris Packham (cp@ing.iac.es)

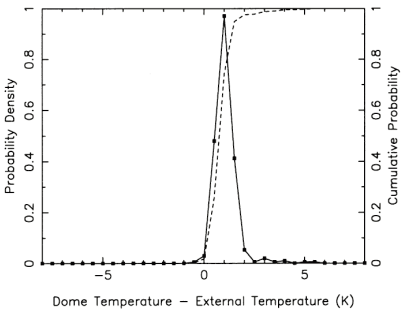

Figure 6. Dome-External Air Temperature Difference.

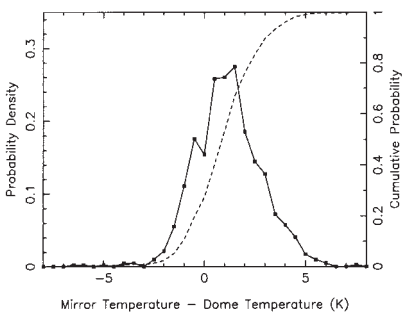

Figure 7. Mirror-External Air Temperature.

WHT Millenium Upgrade

Gordon Talbot (Head of Engineering, ING)

The Isaac Newton Group have embarked on a comprehensive upgrade of the William Herschel Telescope (WHT), involving replacing and enhancing many systems. The programme embraces a number of projects, and all ING engineering groups are contributing. The upgrade directly supports the NAOMI adaptive optics system and INGRID IR imager but also brings performance and reliability improvements to the WHT in support of other instruments. Previous, recent improvements include an Alpha computer based Telescope Control System (TCS), the introduction of 4k×2k EEV–42 detectors and improved dome seeing through oil cooling.

The programme includes:

– New Observatory Control System to replace the existing Instrument Control System for improved performance, ease of maintenance and development, further increased commonality between subsystems and reduced maintenance costs. Initially the system will support ING's new data acquisition system, ULTRADAS, for faster CCD readout, and the implementation of the 4k×4k two chip EEV–42 mosaic for use at prime focus and on UES. Instrument control will then be implemented sub-system by sub-system using DRAMA and EPICS (channel access) with appropriate mimic displays until all focal stations and instruments are converted. This project will build on basic control to provide more complex modes of observing —such as automatic guide star acquisition. Finally it will provide an efficient queue-observing tool to automate service observing.

– New autoguider. This will be a DRAMA based system similar to the INT system, replacing the existing FORTH based system that runs on unreliable, obsolete and irreplaceable hardware.

– New acquisition TV system will replace the existing, obsolete system with a modern supportable system that offers improved performance. Initially implemented as a stand-alone system the ultimate aim is to integrate with other telescope systems.

– Faster CCD readout through the ULTRADAS system. This embraces the production of a new data acquisition system (DAS), and its implementation for all science detectors at ING using the San Diego State University SDSU-2 CCD controller. Principle gains from the project are faster readout speed, and improved reliability —from both the DAS system and CCD controller— together with reduced maintenance requirements. The system will ultimately use a

PCI interface between the CCD controller and DAS computer, however due to delivery delays it is initially being implemented using an S-BUS card. With the S-BUS interface the system produces typically a threefold decrease in un-windowed readout cycle time over previous ING systems, with the PCI interface this will improve to sixfold, potentially offering an overall 5% increase in telescope observing time. The project is currently being expanded to include infra-red detectors, first in support of INGRID, and eventually the LIRIS spectrograph being developed by the IAC. ULTRADAS has been commissioned on the INT Wide Field Camera and WHT Prime Focus 4k×4k 2 chip mosaic.

– A new UNIX based Guide Star Server will be implemented. This work has been placed at the UKATC (to begin in FY 2000/2001) and it is expected it will be based on the porting of an existing system.

– The above improvements will remove several obsolete, failing and unsupportable systems, including the Network Interface Units (NIUs) and Data Management System (DMS) both dependent on bespoke hardware and software and both the causes of much lost time while requiring a large support effort.

– Improvements to GHRIL (Ground based High Resolution Imaging Laboratory) for NAOMI which include:

  – Reducing telescope vibration by tuning and modifying the oil damping system with extra dampers near to the bearing surfaces.

  – A new cooling system with glycol lines routed through the telescope to an external heat exchanger. This system was installed and operated for the last ELECTRA adaptive optics run. Extension is planned to the UES cooler — thus removing a further source of vibration in the telescope structure and heat within the dome.

  – A new optical bench for NAOMI. The previous two ELECTRA runs identified that the original, although adequate for other instruments was insufficiently damped for NAOMI and so will be replaced.

  – Improved access for instruments, including NAOMI through a roof hatch.

  – Improvements to GHRIL seeing by re-coating and adding CaF_2 windows to the infrared de-rotator. The windows will prevent airflow through the unit, eliminating turbulence in the light path and stopping the deposition of dust on the reflecting surfaces. Additionally, once the sealed unit is fitted, airflow within the optical bench room will be studied in an effort to understand and improve local seeing.

  – Improvement in telescope tracking/positioning ready for NAOMI, by the elimination of glitches seen by ELECTRA

After only 11 years of operation the WHT is still a young telescope. These measures ready it for common user adaptive optics, will offer better performance for observers together with improved reliability/reduced maintenance operation. In short they take it into the new millennium, and as they are being implemented over the next two years, fit in with either 2000 or 2001 as defining the start of the next millennium. ¤

Gordon Talbot (rgt@ing.iac.es)

New Instrumentation for the WHT

René Rutten (Director ING)

In order for the William Herschel Telescope to keep offering the best possible instrumentation in the future, it is important that new ideas and instruments are developed. For that reason, in June 1999 an announcement was sent out inviting novel ideas for new instrumentation for the WHT to be brought forward. The following four proposals for new instruments were received:

– Bacon (Lyon): *OASIS — an Adaptive Optics (AO) optimised integral field spectrograph.*

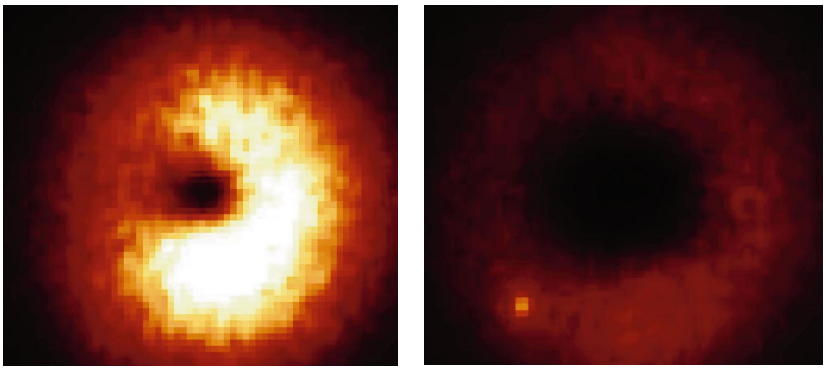

Figure 1. Simulated H-band coronagraphic PSFs with a secondary star 1.0 arcsec away from the central object (Δm= 7m) without (left) and with adaptive optics correction (right). The diameter of the focal plane stop was 1.0 arcsec and the uncorrected seeing was ~0.7 arcsec.