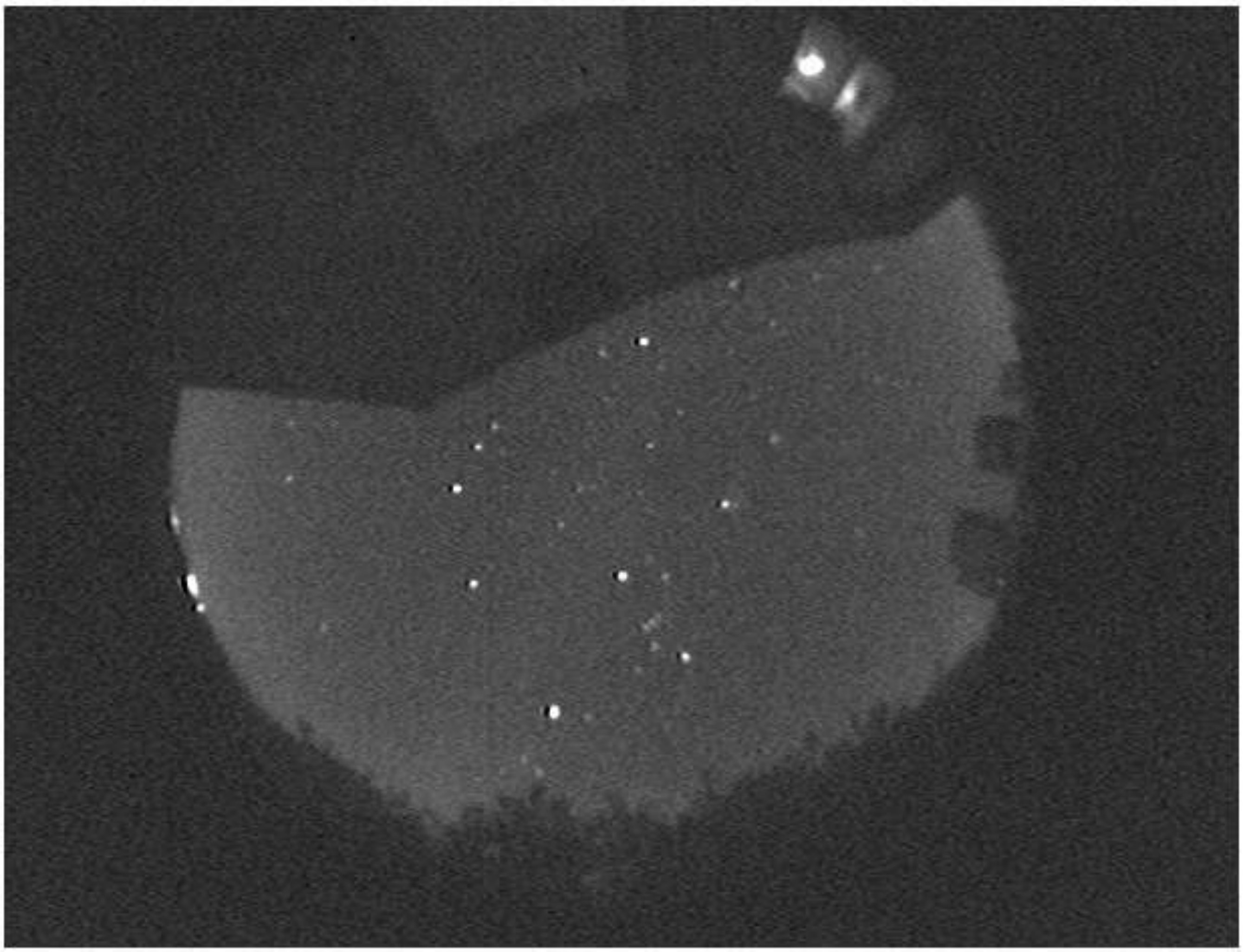
MMT Observatory
Smithsonian Institution &
The University of Arizona®

# BIMONTHLY SUMMARY

## September – October 2004



*A wide-angle view of the night sky taken in front of the summit support building. This image was obtained using one of our low-light surveillance cameras with a 180 degree fisheye lens attachment. The video signal was fed into our new FlashBus MV framegrabber and integrated for two minutes each on sky and with the camera covered to obtain a dark frame. The dark frame was then subtracted to create the final result shown here. Image by T. Pickering.*

## Personnel

In mid October Keith Powell of Steward's Engineering and Technical Services began working part-time for MMTO doing servo modeling and analysis with Dusty Clark.

For the week of September 20, the MMTO borrowed Steward student employee Sean Coles to scan MMT technical memoranda, which have since been linked on the MMT web site and are now available at URL *http://www.mmto.org/MMTpapers*/.

## Primary Mirror Systems

### Primary Mirror Status

During the instrument change on September 23, fractures in the primary mirror Cassegrain hole were re-inspected. During routine monitoring inspections we found a small live fracture that had been overlooked in earlier inspections. On this occasion the live fracture showed a new feature — evidence of crack growth. The Mirror Lab was notified and on September 30 Randy Lutz (SOML) drilled out and cemented this last known fracture.

### Optics

SAO has requested that $CO_2$ snow cleaning of the 6.5-m primary mirror be suspended while the wide field corrector is installed on the telescope. As a result, $CO_2$ cleanings are not being done as frequently as desired. The primary mirror was $CO_2$ cleaned on September 7 and October 27.

### Aluminizing

Negotiations with Dynex Semiconductor on a custom power switcher module appear to have broken down. They cannot guarantee the IGBTs will handle the power dissipation required due to the low bus voltage (they will be dissipating ~960 W each, plus the switching losses). When asked to produce a DC-link and chopper system based on 480 VAC 3-phase input, they declined to continue. J.T. Williams and D. Clark will instead continue to pursue the commercial welder supply approach with Miller Electric.

## Secondary Mirror Systems

### Hexapod Control

A major improvement to operations was realized on September 30 with the installation of a Delta Tau UMAC controller for the *f*/5 secondary. During the time allocated for installation and engineering, some problems with cabling, reversed direction of motion (sign conventions), and coordination of the pod legs were sorted out. Secondary mirror motions are now both faster and smoother than before. Typical pod motion is controlled to an accuracy of less than one micron, (an order of magnitude better than the old controller). Image motion during focus/collimation adjustments has been reduced to one arcsecond or less, down from 20 arcseconds.

We are retaining the old PIC controller as a spare in case of a failure of the UMAC hardware, and the system is designed so that a fall-back strategy is reasonably straightforward. We have a number of unexplored options from which we might gain additional performance from the UMAC controller. Additional servo tuning (which has not been done since running the hexapod while supporting the mass of the secondary) would be expected to yield immediate benefits, and software tools are being developed to aid this effort. The UMAC controller sports features that support coordinated multi-axis motion, and exploiting these will yield a greater reduction in image motion during hexapod moves. Current efforts are focused on software changes needed to run the *f*/9-*f*/15 secondary using the UMAC, which we intend to do during the *f*/9 run in December.

Deployment of the UMAC controller is a major step towards real-time focus and collimation of the telescope, overcoming a problem that has limited performance to date. This work was spearheaded by T. Trebisky, advised by John Roll and others at SAO, and with critical electronics support by B. Comisso and C. Knop.

## *f*/9 Hexapod

Encouraged by the success of the UMAC controller for the *f*/5 hexapod, the *f*/9 hexapod is now in the process of being upgraded to this system. In mid October the *f*/9 hexapod was disassembled and stiffness testing was performed on each actuator. The results varied from 20 N/micron to 32 N/micron, and can be seen in Figure 1. Actuator B, which was not used in the hexapod, had about 100 microns of backlash. C. Chute and N. Forghani are increasing the stiffness of actuators B, C, and Spare to at least 30 N/micron.

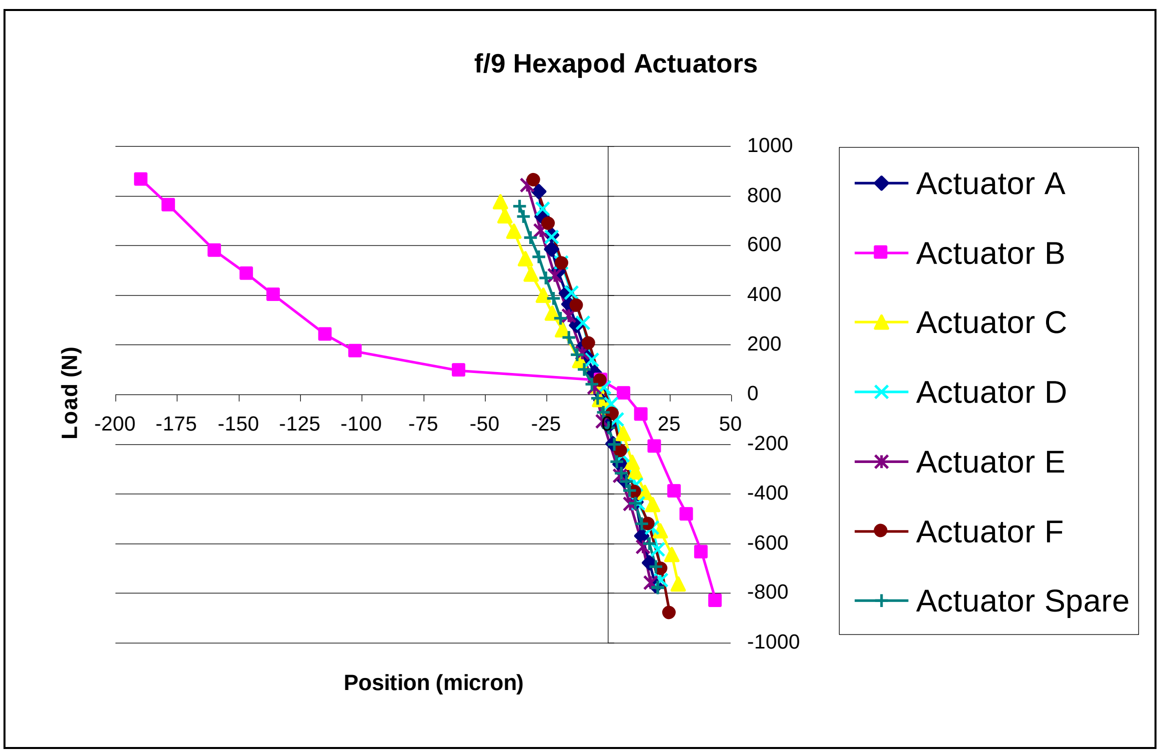



*Figure 1: Stiffness testing results of f/9 hexapod actuators.*

### *f*/5 Secondary Mirror Support

On October 11 we experienced erratic motions of the *f*/5 secondary mirror. On the 12th an inspection revealed that the mirror was loose in its cell; two of the three lateral defining flexures (tangent rods) had de-bonded their pucks from the mirror edge. Fortunately the mirror was adequately and safely retained by its seismic restraints. There was no damage to either the mirror or its support hardware other than torn glue bonds. Figure 2 shows the ruptured bond.

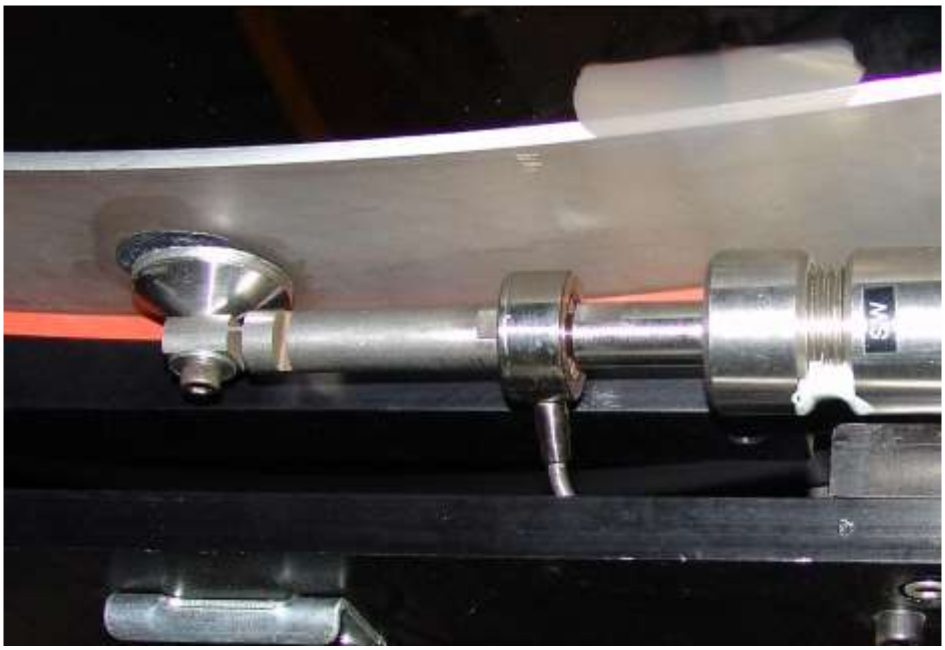


*Figure 2: One of two ruptured glue bonds (two-part RTV, Q3-6093).*

The day crew removed the *f*/5 secondary on October 12, and over the next three days and nights C. Chute, C. Wainwright, C. Knop, B. Comisso, B. Love, P. Ritz, D. Blanco, and J.T. Williams investigated the problem to determine the cause and develop a fix. The broken glue bonds developed after a two-tier failure. The first tier involved the secondary mirror lateral support actuators. These are equipped with spring stacks that support the glass even when the active support system is off. We have yet to determine the cause, but the spring-stacks failed to engage. When this distributed support system failed to engage, the mirror moved to a back-up restraint and was safely retained by its seismic supports.

The mirror centration is defined in its cell by six flexures; each is fitted with a breakaway device that allows the mirror to move to its seismic restraints in the event of a serious jolt. The second failure was in these breakaway devices — the lateral defining flexures did not have sufficient over-travel, so when the mirror moved onto its seismic restraints, the flexure-to-glass glue bonds were overloaded and ultimately failed. When the mirror support system is turned off at horizon, the mirror moves approximately one millimeter more than the travel of the tangent rod breakaway devices.

After examining the problem, we determined that a satisfactory repair could be done by adjusting both the flexures (to gain more breakaway travel) and the seismic restraints (to limit the amount of required travel). The flexures were re-bonded, the support system was re-calibrated, and the mirror was reinstalled. Though adequate, the repair is temporary, however, and further work is needed on the supports when the *f*/5 secondary is available. Thanks to the hard work of the MMT staff, the telescope was again operational in the time it took for the new bonds to fully cure. Further inspection and testing will be performed when the *f*/5 secondary is removed from the telescope in December.

## Telescope Tracking and Pointing

### MMT Servos

Development of prototype controllers continued during the reporting period. D. Clark implemented a "first cut" controller and verified that the I/O signs are correct and that the controller is stable in implementation. K. Powell joined D. Clark for follow-up visits with the controller, and together they checked the actual controller versus the model prediction, with *excellent* results. Although we experience a deviation at ~2.5 Hz, this is explained by the telescope having been in a different configuration than the design setup (*f*/5 versus *f*/9). Furthermore, the system models are strictly linear and do not compensate for friction, which is highly non-linear and difficult to accurately model.

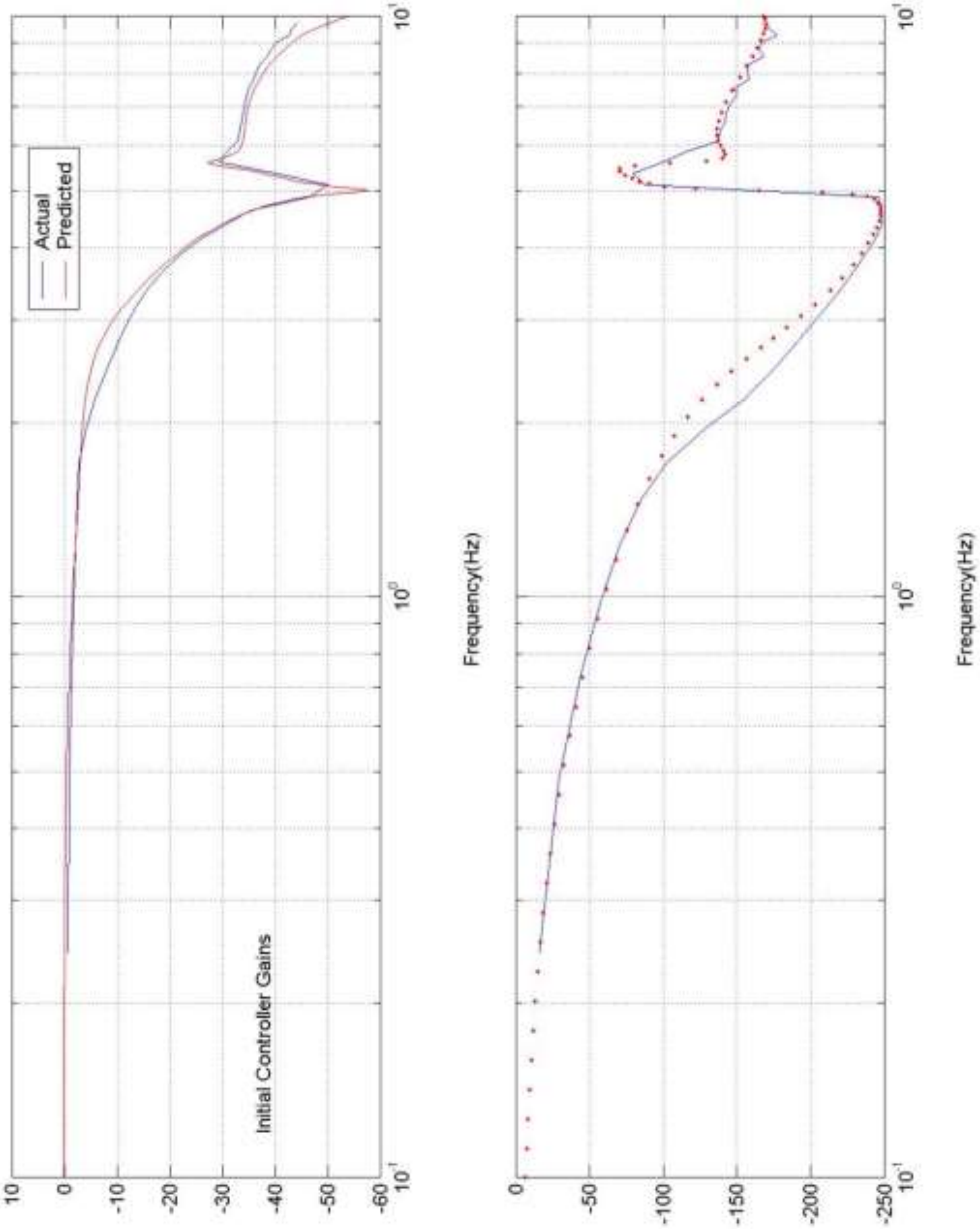



*Figure 3: Bode plot of controller closed-loop bandwidth measurement.*

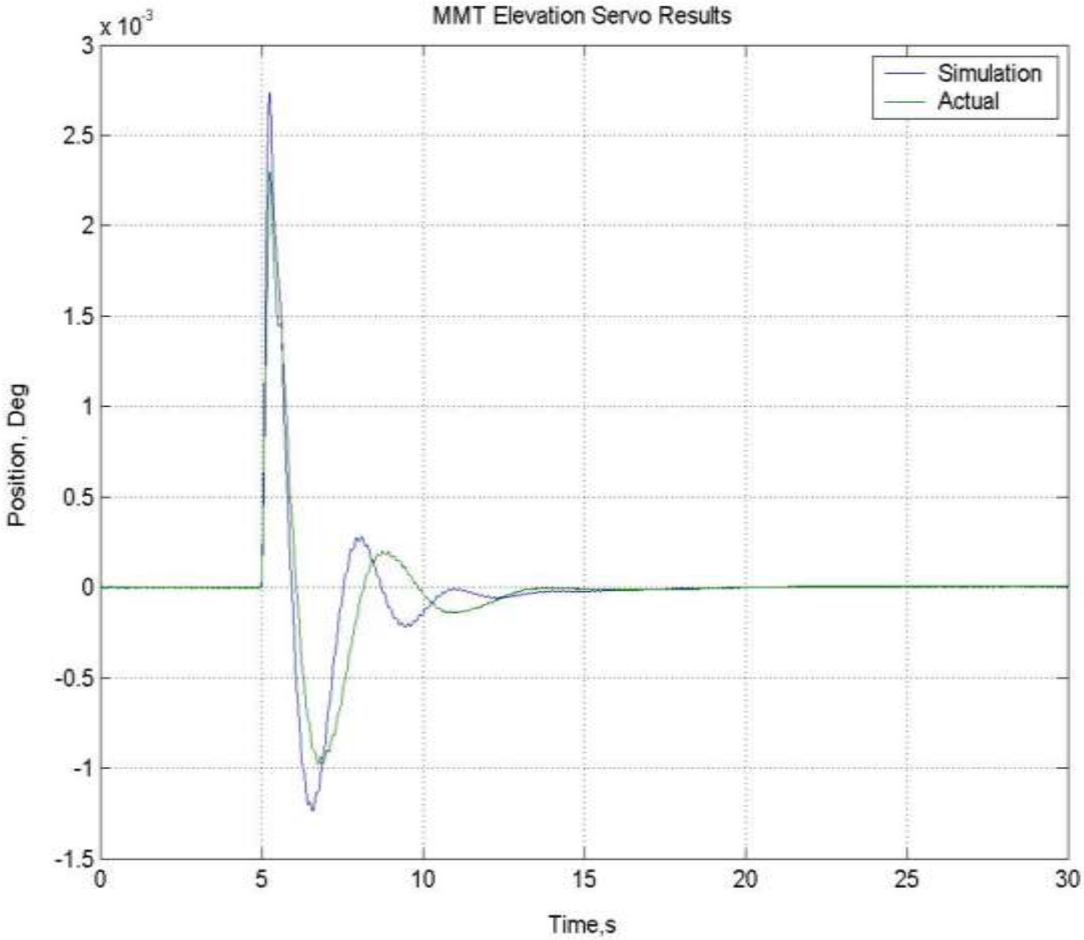



*Figure 4: Closed-loop step disturbance response.*

More work remains to further optimize the controller gains and forward-path filters to push the operating bandwidth out as far as is possible. However, this is a milestone achievement in that for the first time we know we can confidently predict the telescope's closed-loop operation, making on-line tuning of controller parameters forever unnecessary; all guesswork is eliminated from the process.

E. Bell's controller design continues; he encountered much difficulty in converting his physical-insight plant model to one that is implementable with fixed-step solvers (i.e., ODE4 or Runge-Kutta continuous-time equation solvers). His model and controller contained many continuous states that would not mathematically converge to a solution with fixed sample rates, making the controller unstable and unusable in terms of software implementation. He is converting all his modeling work to discrete-time methods, and we expect to have a version to test on the telescope during the next reporting period.

All hardware for a more permanent controller PC and interpolation electronics arrived during the reporting period. Since all servo design work has been done with MATLAB version 6.5.1, and The

Mathworks is busy updating their product lines to version 7.0, we decided to delay migration to the new controller (and software) until they release a patch for 7.0 (D. Clark very early on caught a bug in their xPC Target blockset, which was subsequently fixed in version 7.1). When version 7.1 arrives and is stable, D. Clark will then migrate all the controller hardware and I/O drivers to that version. K. Powell and E. Bell remain using 6.5.1, so we expect the process to go back and forth a bit between versions.

### Encoders

C. Chute and C. Wainwright have taken measurements of the drive arc encoder tape run-out. C. Chute is aligning the Heidenhain elevation encoder read-heads with an adjustable mount.

## Computers and Software

### On-Line Documentation

#### *MMT Documentation Web Pages*

Much work was done to make existing and new MMT documentation readily available on the web. A total of approximately 275 web links to MMT-related documentation were organized into six overall areas: 1) Cell/Cell Crate; 2) Instruments/Guiders/Wavefront Sensors; 3) Mount/Mount Crate; 4) Secondary/Hexapod Crate; 5) Thermal/Environmental; and 6) System/Other. This documentation contains materials written by MMT staff, scientists, and engineers that use MMT facilities, manufacturers' manuals, schematics, and diagrams. When documents were obtained from another web site, those documents were copied into the *http://www.mmto.org/documentation/* site. Links were added to both the MMT documentation site and to the off-site version of the document.

#### *MMT Software Web Pages*

Work continued on compiling a listing of software used at the MMT. This software is divided into the same six sections as the MMT documentation web page (see above). As of November 1, there are 686 web links to programs, scripts, and documentation included in this software compilation. This site is primarily for MMT software engineers.

#### *MMT Engineering Web Pages*

Approximately one dozen new engineering web pages were added to display the commanded and monitored actuator forces for the MMT primary mirror support. These web pages (*http://www.mmto.org/engineering/*) present a plan view of the primary mirror in a grid-like format similar to that used for thermal data. The pages display the absolute commanded and measured forces, the differences between commanded and measured forces, and the ratio of commanded forces to actuator limits. The web pages are also incorporated into a set of new Ruby/Gtk GUIs for use by the telescope operators.

Minor changes were also made on other engineering web pages and operator GUIs. Additional entry fields were added to the "balancer" web page to allow more equipment to be included in telescope balance calculations. Thermal GUIs and web pages were updated to present data in a more consistent manner. Web pages that display current values for the various mini-servers now have either a green background, indicating that data are being received successfully by the mini-server, or a red background, indicating that no data are being received. Additional web pages were added to display 24-hour data for hexapod axes for the secondary mirror. These scatter plots can be used to detect sudden changes in position, such as if the secondary were to move because of partial glue failure.

### *Elcoll and SO Guider*

The step-by-step procedure for performing elcoll (elevation dependent collimation) measurements was compiled and posted to the documentation web page:

*http://www.mmto.org/documentation/hexapod/elcoll.shtml*

This procedure will allow the operators to perform elcoll runs during engineering time without real time support from the science staff.

The basic start-up procedure and some software and hardware notes for the Steward Observatory guider were compiled and posted to the documentation web page:

*http://www.mmto.org/documentation/instruments/soguider/soguider.shtml*

This information can be used by the operators to troubleshoot the SO guider should the need arise.

### Miscellaneous

Changes were made to other programs and scripts. A script to remotely reset the Lantronix units was written. A "watchdog" script for monitoring the mini-servers was also created. Work began on a GUI to monitor status of the various MMT services and mini-servers. A draft of a new cell crate GUI was also created that uses a new ASCII protocol with the cell crate. Code was added to the cell error logging script to attempt to capture failure data. Changes were also made to the main hexapod GUI to display pod limit status.

## Seeing

### Hartmann-DIMM Seeing Monitor

After a successful proof of concept, we decided to acquire the components needed to assemble a Hartmann-DIMM seeing monitor system. The primary component is a 10" Meade LX200-GPS telescope. The mount of this telescope provides full remote control capability via its RS232 interface and well-documented serial protocol. Several Linux applications (e.g., xephem and kstars) support this protocol out of the box and were successfully tested using both a direct serial connection and over USB using Meade's USB-to-serial converter. The protocol is simple and straightforward, which makes it easy to add LX200 communication to custom applications.

At least initially, we will use a Supercircuits PC164 camera as the detector since it proved itself sensitive enough in our tests. However, the maximum of 30 frames/sec that the DT3155 framegrabber card could manage was somewhat disappointing, so we purchased an Integral Technologies FlashBus MV card for comparison. Despite costing half as much as a DT3155 and being color instead of pure monochrome, the FlashBus appears to be at least as sensitive as the DT3155 and doesn't have any of the pattern noise that the DT3155 cards sometimes exhibit. More important, the Linux driver for the FlashBus easily allows full 60 Hz framegrabbing with minimal system load. In fact, the FlashBus' DMA buffer can be read at up to 600 Hz if the reads are not synced to the video signal. The FlashBus card also supports progressive scan framegrabbing, which provides an upgrade path to a faster camera if the need arises.

The Linux software development kit that Integral Technologies provides has proven to work quite well. The kernel module did require some modification to work with Linux 2.6.x kernels, but the changes were minor and the ported driver has been stable. Many examples were included, which eased the development of custom code for grabbing and centroiding frames in real time. Work is ongoing to test out various centroiding algorithms, but the basic center-of-mass algorithm used in our autoguiders seems to be the most robust and is very fast. We hope to perform some on-sky tests on the summit in early November so that we can compare the seeing measurements from the DIMM and the *f*/5 wavefront sensor (WFS).

**MMT Seeing Statistics**

A measure of seeing can be estimated from Shack-Hartmann wavefront sensor images by relating the width of the spots to differential image motion. Such estimates have been measured and logged for every wavefront sensor image that was acquired and analyzed in the past year and a half. Figure 5 shows a histogram of the WFS seeing measurements obtained to date (top), a cumulative histogram (middle), and a scatter plot of seeing versus UT of observation (bottom). The seeing measurements are corrected for zenith distance, z, using the relation:

$$\text{seeing}(z = 0) = \text{seeing}(z)/\sec(z)^{**}0.6$$

The histogram is qualitatively very similar to that observed with the old system previous to 1998 and shows how good our site is most of the time. We are doing better than 0.5" about one fifth of the time and better than 1" almost three quarters of the time. Somewhat surprisingly, there is no significant correlation between the quality of seeing and time of night, i.e., no systematic indication of the expected effects of dome seeing at the beginning or of turbulence later in the night from temperature inversions.

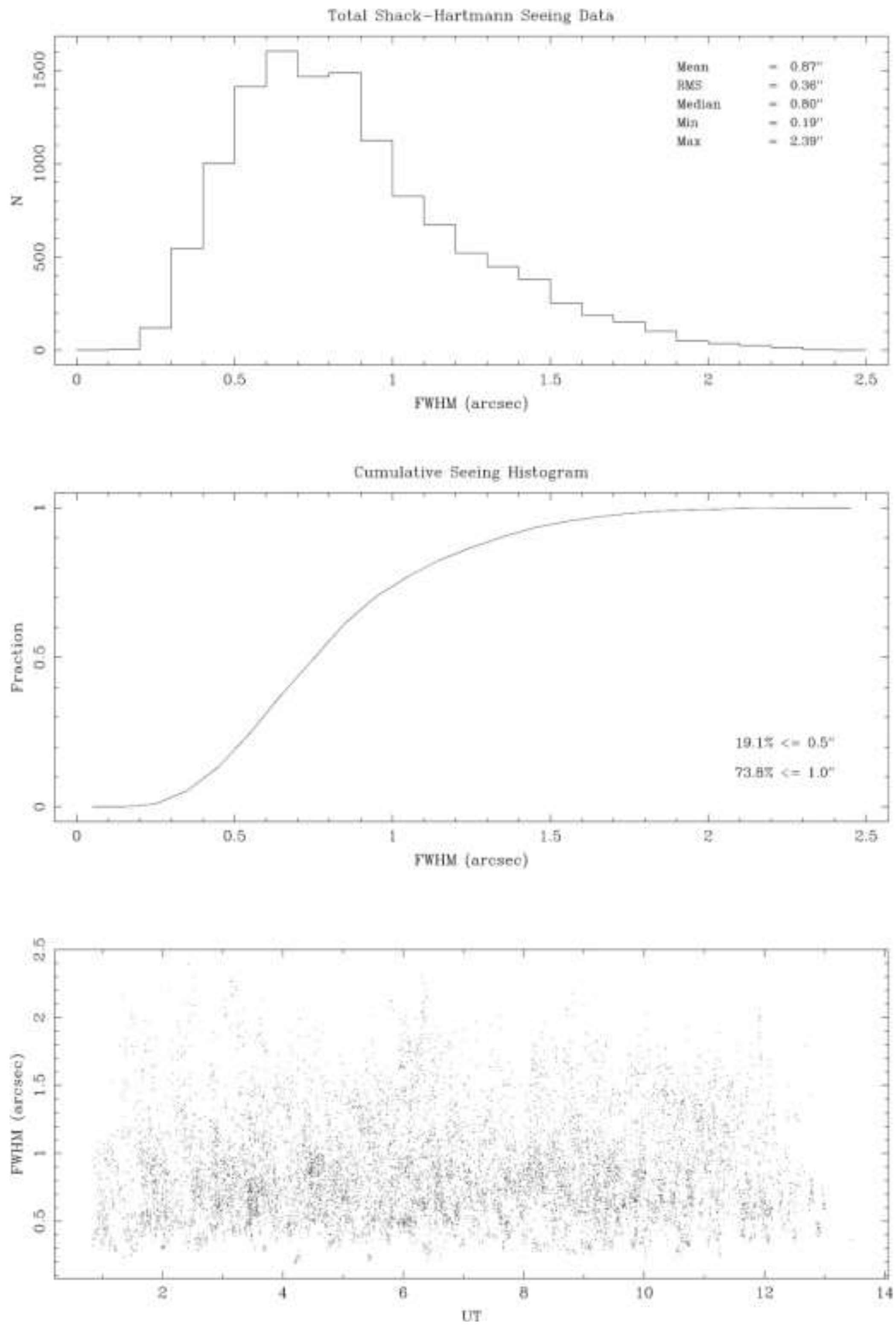



*Figure 5: Histogram of seeing measurements taken with the Shack-Hartmann wavefront sensors (top), cumulative histogram of the same data (middle), and seeing versus time of observation (bottom).*

## Instruments

### Red Channel Spectrograph

The engineering night of September 1 was used to obtain calibration data for the Red Channel spectrograph. The two goals were to measure the collimator position of the best focus in the spatial and dispersion axes and to determine the spectrograph throughput in echellete mode.

The focus measurements were performed to ensure that the proper shim thickness was installed between the dewar and the instrument. The required shim thickness may have changed when the new Red Channel CCD was installed. This was the case for the Blue Channel spectrograph. The dual pinhole aperture and 1200 l/mm grating were used to measure the FWHM in both the spatial and dispersion axes. We found that the collimator position that produced the best focus was nearly the same for both axes, and therefore conclude that the current shim thickness is correct.

Echellete data of two spectrophotometric standard stars, Feige 110 and BD +28 4211, were obtained through the 5 arcsecond aperture. The data, which have not yet been reduced or analyzed, will be used to determine the throughput of the spectrograph in echellete mode. This is part of an ongoing effort to measure the throughput for both spectrographs in all configurations.

### Megacam

#### *Megacam Modifications*

Several improvements were made to the Megacam instrument during September. Some of these tasks required opening the dewar.

- We had previously seen that the FWHM of the stellar images varied across the focal plane. We determined that this was because of four G-10 bars attached to the CCD mounting surface in an over-constrained manner. The bars were replaced with new ones, and image quality is now much more uniform.

- A black mask was added around the focal plane to reduce scattered light. We have obtained data to assess with results.

- We added a battery backup system for the window heater. During a lightning shutdown in July we found that moisture was condensing on the dewar window. To keep the window dry, the new battery pack can be connected when the instrument is unplugged.

- We attempted to electrically isolate the Megacam dewar from the topbox. However, as all the bolts were tightened, the short returned. We did not have time to continue to investigate the source, so the issue will need to be revisited.

#### *Megacam Observations and Performance*

During the Megacam run of October 2-20 more than 2600 engineering and science images were recorded. During the run several aspects of the Megacam performance were investigated:

- Non-linearity: We found that, by dividing two flats with different exposure times, the non-linearity varies from chip-to-chip. Fluorescent work lights were set up in the chamber to illuminate Megacam through the closed mirror covers. This provided a light source stable enough to measure any non-linearity greater than about two percent. As a result of these measurements, the default gain mode will be changed to reduce the non-linearity. A more stable source will be necessary for more accurate measurements.

- Rising pressure and temperature: It appears that the dewar pressure was slowly rising during the run. When powered on, the pressure gauge emits light through several LEDs. For this reason it is typically powered off during operation. We would like to implement remote power control of the pressure gauge so we can monitor pressure on a regular basis. The power supply for the Ion pump was hooked up and the pump was turned on for the second half of the run. This quickly lowered the pressure.

  The CCD chip temperature appeared to be rising slowly during the week. Initially there was some concern that the dewar was running out of $LN_2$ so the fill cycle was switched to 12 hours rather than 24. A subsequent analysis showed that this was due to two roughly equal effects: 1) The CCD temperature follows the average ambient temperature — this is expected based on heat transfer calculations; and 2) as the $LN_2$ level drops in the dewars, the temperature rises because the thermal conductivity to the $LN_2$ decreases. This is expected to be on the order of 2K in 12 hours. There is no evidence that the dewar ever ran out of $LN_2$ so a 24 hour fill cycle will be resumed in the future.

- Flat-field stability: We are assessing the flatness and stability of the twilight flats. There are significant gradients in the twilight flats that should not be present. An area of suspicion is that the area around the primary mirror is visible from the focal plane as reflected by the oversized secondary. This area may need to be blackened.

- Software: We used the new observing GUI, "mice," exclusively during this run, eliminating all use of ICE. This software allows observers to create preplanned sequences of exposures and to take twilight flats with automatically computed exposure times. The basic functionality of this software is in place. Over the next few months, we will make improvements to the GUI layout as well as correct various problems encountered during this run. Improvements in streamlining the startup of the several Megacam software systems were also implemented.

- Computers: The new rack computers, intended to replace *packrat* and *cfaguider*, continue to be problematic. There have been several apparent disk drive failures, though we are now suspicious of one slot in the disk controller. In addition, the device driver for the EDT data acquisition interface to the CCD controller is not stable. We are awaiting updates from the manufacturer.

- Performance of new hexapod system: The performance of the UMAC system is a vast improvement over the old system. We were able to make small focus changes during Megacam exposures without noticeable image motion. We attempted to implement a script that automatically performs an elcoll correction every 60 seconds. However, elcoll moves did cause the image to shift, perhaps because an elcoll move does not move all six pods the same amount. Because of this image motion we were only able to do elcoll between exposures, not during exposures. Image motion associated with elcoll and focus and temperature drifts are currently limiting Megacam image quality.

- Observers Manual: The Megacam user's manual was modified and updated; the current version will soon be posted to the Megacam web page.

### Hectochelle

On October 25 the newly coated Hectochelle collimator arrived on site. E. Hertz, R. Eng and W. Brymer of SAO were on hand to unpack and re-install the optics on the bench spectrograph. MMT day crew assisted with lifting the 1-m collimator into place.

## General Facility

### September-October Operations

Operations for this two-month period were hampered by poor weather. On many of the clear nights, high humidity forced closures and kept the operators on their toes as they tried to work through intermittent clouds, keeping the primary mirror temperature at ambient but above the dew point. September 2-4 and 13-20, and October 20-31 were completely clouded out.

On September 1 we lost three hours to a fuse that blew twice in succession in the 26V rack. Modifications made to the safety chain to accommodate a new rotator brake caused the failure; K. Van Horn fixed the problem the next day.

On September 5 the *f*/9 wavefront sensor computer died, emitting a smell of burnt insulation. T. Pickering traced this to the wavefront camera controller card. An improperly set dipswitch had caused a component meltdown on the board.

We experienced several dropouts of the azimuth drives on September 5, October 7-8, three times on October 10, and again on October 17 and 19. On each occurrence the problem cleared after restart. K. Van Horn, with help from T. Trebisky, developed an Excel tool to analyze the status of the control bits at the time of the dropout. Work continues on analyzing this intermittent and elusive problem.

Erratic motions of the *f*/5 secondary mirror were experienced on October 11 (see *f*/5 Secondary Mirror Support above).

### Instrument Rotator

In early October a new solenoid valve for the instrument rotator brake was installed. This automated brake was a needed safety improvement since we had seen occasional slips of the rotator axis with heavily imbalanced instruments. The brake is now fully operational, but testing still remains to measure the actual braking force.

**Methanol Chiller**

On September 27 D. Blanco, P. Ritz, and B. Love completed construction and installation of a new methanol chiller. The new unit consists of a pump and heat exchanger to circulate on-telescope methanol and extract heat by direct exchange to the facility glycol. This unit will replace the loft Neslab that has been dissipating several kilowatts of waste heat into the loft where it is difficult to extract, and where it has been degrading the local seeing when the chiller is in use. For now, both the loft Neslab and the new unit are available until the performance can be verified.

**Safety**

At D. Blanco's invitation, Carolyn Vieira from the UA Radiation Control Office conducted a class on laser safety at the FLWO basecamp on September 28. Several MMT and SAO staff attended. Safety goggles for the Nd:Yag laser, used with the MMT's Rayleigh beacon, and for use with HeNe lasers were ordered and are now on site.

**Ventilation**

Measurements last winter indicated that during the day the primary mirror ventilation system was subject to backflow driven by passive thermal heating of the exposed ducts behind the summit shop. On October 11 spring-loaded butterfly-style barometric dampers were installed in the ventilation air ducts to stop back-flow and help reduce thermal gradients in the primary.

**Miscellaneous**

K. Van Horn installed a separate UPS for the mountain network hardware so that it can be left on during lightning shutdown.

The calibration lamp boxes that were removed from the telescope in March were fitted with new bases and remounted on the chamber walls.

J. Labbe installed two video cameras in the chamber and a video switch and monitor in the control room. This gives the operators a view of the floor space in front of and behind the telescope.

J. Labbe installed fluorescent lighting on the fork just outside the drive arcs. This greatly improves the lighting around the Cassegrain instrument area.

The day crew reconnected a ground-strap to the east elevation structure (last year the west cable was connected). This completes restoration of the original scheme that had been removed during the conversion.

P. Ritz, assisted by B. Love, repaired a glycol leak between the pumps and the tower filter.

P. Ritz drove the air-ride truck van, purchased for temporary instrument storage and transport, from the FLWO basecamp to the MMT. This was the van's first trip up the mountain, transporting SWIRC.

## Visitors

October 8: D. Clark accompanied Lockheed-LOTIS engineers Pete Sorlie and Wes Green. Both are based in California; Wes Green is currently on assignment in Tucson.

October 10: Francois Wildi accompanied two students, Damien Ferrario (electrical engineering) and Benjamin Girardet (microtechnology), from West Switzerland University of Applied Sciences. Both are working at CAAO to finish their diploma theses. Francois is now professor of engineering at West Switzerland University, where he teaches signal processing and optical systems. He is also an adjunct senior staff scientist with Steward and is still active in adaptive optics systems and LBTI, and is starting activity in ophthalmic adaptive optics. In addition, he is also on one of the two teams competing for the European planet finder instrument.

## Publications

### MMTO Internal Technical Memoranda

None

### MMTO Technical Memoranda

None

### MMTO Technical Reports

None

### Scientific Publications

04-52 Developing Improved Servos for the Multiple Mirror Telescope
Clark, D.
Submitted to the IEEE 2005 American Control Conference

04-53 MMT Observations of the Black Hole Candidate XTE J1118+480 Near and In Quiescence
Torres, M. A. P., Callanan, P. J., Garcia, M. R., Zhao, P., Laycock, S., Kong, A. K. H.
*ApJ*, **612**, 1026

04-54 Cataclysmic Variables from the Sloan Digital Sky Survey. III. The Third Year
Szkody, P., Henden, A., Fraser, O., Silvestri, N., Bochanski, J., Wolfe, M. A., Agüeros, Warner, B., Woudt, P., Tramposch, J., Homer, L., Schmidt, G., Knapp, G. R., Anderson, S. F., Covey, K., Harris, H., Hawley, S., Schneider, D. P., Voges, W., Brinkmann, J.
*AJ*, **128**, 1882

04-55 Globular Cluster and Galaxy Formation: M31, the Milky Way, and Implications for Globular Cluster Systems of Spiral Galaxies
Burstein, D., Li, Y., Freeman, K. C., Norris, J. E., Bessell, M. S., Bland-Hawthorn, J., Gibson, B. K., Beasley, M. A., Lee, H.-C., Barbuy, B., Huchra, J. P., Brodie, J. P., Forbes, D. A.
*ApJ*, **614**, 158

04-56 Unravelling the Puzzle of the Eclipsing Polar SDSS J015543.40+002807.2 with *XMM* and Optical Photometry/Spectropolarimetry
Schmidt, G. D., Szkody, P., Homer, L., Smith, P. S., Chen, B., Henden, A., Solheim, J.-E., Wolfe, M. A., Greimel, R.
*ApJ*, in press

04-57 The Highs and Lows of It: Magnetic Accretion at all Rates
Schmidt, G. D.
*The Astrophysics of Cataclysmic Variables and Related Objects*, ASP Conf. Ser., eds. J. M. Hameury and J. P. Lasota, (San Francisco: ASP), in press

04-58 Candidate Type II Quasars from the SDSS: III. Spectropolarimetry Reveals Hidden Type I Nuclei
Zakamska, N., Schmidt, G. D., Smith, P. S., Strauss, M. A., Hall, P. B., Krolik, J. H., Richards, G. T., et al.
*AJ*, in press

04-59 AAS Annual Report
Williams, J. T.
*BAAS*, **37**

**Observing Reports**

Copies of these publications are available from the MMTO office. We remind MMT observers to submit observers' reports, as well as preprints of publications based on MMT research, to the MMTO office. Such publications should have the standard MMTO credit line: "Observations reported here were obtained at the MMT Observatory, a facility operated jointly by the Smithsonian Institution and the University of Arizona."

Submit publication preprints to *bruss@mmto.org* or to the following address:

MMT Observatory
P.O. Box 210065
University of Arizona
Tucson, AZ 85721-0065

**MMTO in the Media**

No activity to report.

## MMTO Home Page

The MMTO maintains a web site (*http://www.mmto.org*) that includes a diverse set of information about the MMT and its use. Documents that are linked to include:

1. General information about the MMT and Mt. Hopkins.

2. Telescope schedule.

3. User documentation, including instrument manuals, detector specifications, and observer's almanac.

4. A photo gallery of the Conversion Project as well as specifications related to the Conversion.

5. Information for visiting astronomers, including maps to the site.

6. The MMTO staff directory.

## Observing Database

The MMTO maintains a database containing relevant information pertaining to the operation of the telescope, facility instruments, and the weather. Details are given in the June 1985 monthly summary. The data attached to the back of this report are taken from that database.

# Use of MMT Scientific Observing Time

## September 2004

| Instrument | Nights Scheduled | Hours Scheduled | Lost to Weather | Lost to Instrument | * Lost to Telescope | ** Lost to Gen'l Facility | Total Lost |
|---|---|---|---|---|---|---|---|
| MMT SG | 20 | 196.30 | 86.45 | 0.00 | 0.25 | 0.75 | 87.45 |
| PI Instr | 7 | 71.90 | 1.00 | 0.00 | 0.00 | 0.00 | 1.00 |
| Engr | 2 | 18.90 | 14.00 | 0.00 | 3.00 | 0.00 | 17.00 |
| Sec Change | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total** | **29** | **287.10** | **101.45** | **0.00** | **3.25** | **0.75** | **105.45** |

Time Summary Exclusive of Shutdown

| | |
|---|---|
| Percentage of time scheduled for observing | 93.4 |
| Percentage of time scheduled for engineering | 6.6 |
| Percentage of time scheduled for secondary change | 0.0 |
| Percentage of time lost to weather | 35.3 |
| Percentage of time not lost to weather lost to instrument | 0.0 |
| Percentage of time not lost to weather lost to telescope | 1.8 |
| Percentage of time not lost to weather lost to general facility | 0.4 |
| Percentage of time lost | 36.7 |

* Breakdown of hours lost to telescope
26V rack 3
hexapod crate 0.25

** Breakdown of hours lost to facility
power outage 0.75

## October 2004

| Instrument | Nights Scheduled | Hours Scheduled | Lost to Weather | Lost to Instrument | * Lost to Telescope | Lost to Gen'l Facility | Total Lost |
|---|---|---|---|---|---|---|---|
| MMT SG | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| PI Instr | 26 | 282.50 | 128.90 | 2.05 | 37.65 | 0.00 | 168.60 |
| Engr | 5 | 53.90 | 42.10 | 0.00 | 0.00 | 0.00 | 42.10 |
| Sec Change | 0 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| **Total** | **31** | **336.40** | **171.00** | **2.05** | **37.65** | **0.00** | **210.70** |

Time Summary Exclusive of Shutdown

| | |
|---|---|
| Percentage of time scheduled for observing | 84.0 |
| Percentage of time scheduled for engineering | 16.0 |
| Percentage of time scheduled for secondary change | 0.0 |
| Percentage of time lost to weather | 50.8 |
| Percentage of time not lost to weather lost to instrument | 1.2 |
| Percentage of time not lost to weather lost to telescope | 22.8 |
| Percentage of time not lost to weather lost to general facility | 0.0 |
| Percentage of time lost | 62.6 |

* Breakdown of hours lost to telescope

f/5 secondary 33.9
cell crate 2
hexapod 1
wavefront sensor 0.75

## Year to Date October 2004

| Instrument | Nights Scheduled | Hours Scheduled | Lost to Weather | Lost to Instrument | Lost to Telescope | Lost to Gen'l Facility | Total Lost |
|---|---|---|---|---|---|---|---|
| MMT SG | 78 | 770.80 | 431.85 | 4.13 | 9.38 | 4.25 | 449.60 |
| PI Instr | 170 | 1619.90 | 543.90 | 54.00 | 85.20 | 1.75 | 684.85 |
| Engr | 20 | 203.30 | 75.20 | 0.00 | 3.00 | 0.00 | 78.20 |
| Sec Change | 6 | 57.60 | 11.00 | 0.00 | 0.00 | 0.00 | 11.00 |
| **Total** | **274** | **2651.60** | **1061.95** | **58.13** | **97.58** | **6.00** | **1223.65** |

Time Summary Exclusive of Shutdown

| | |
|---|---|
| Percentage of time scheduled for observing | 90.2 |
| Percentage of time scheduled for engineering | 7.7 |
| Percentage of time scheduled for secondary change | 2.2 |
| Percentage of time lost to weather | 40.0 |
| Percentage of time not lost to weather lost to instrument | 3.7 |
| Percentage of time not lost to weather lost to telescope | 6.1 |
| Percentage of time not lost to weather lost to general facility | 0.4 |
| Percentage of time lost | 46.1 |