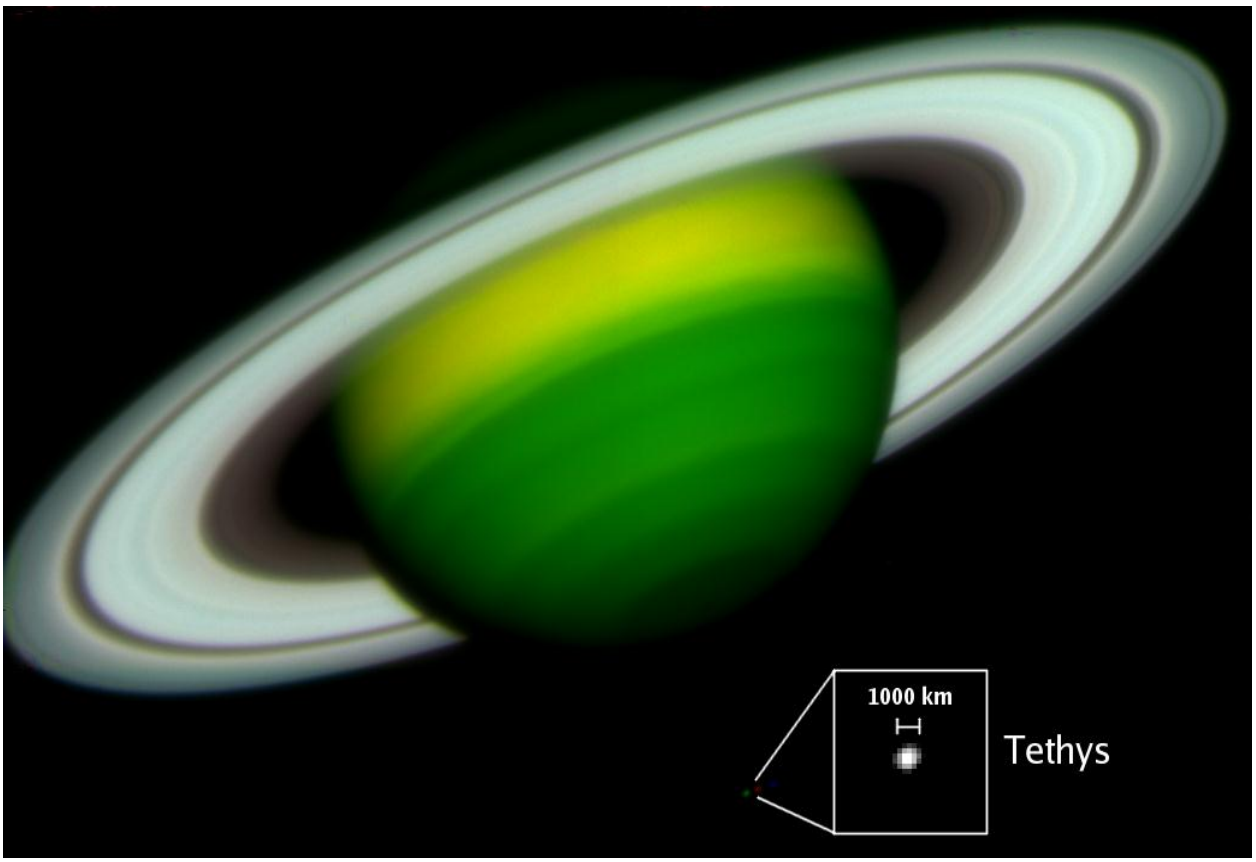
BIMONTHLY SUMMARY

November – December 2005



This false color image of Saturn was taken with the Arizona Infrared Imager and Echelle Spectrograph (ARIES) on December 8, 2005 at the focus of the f/15 adaptive secondary by Craig Kulesa and Donald McCarthy. Three narrow-band images comprise this RGB composite: an image taken at 1.64 µm is referenced to green, 2.09 µm is set to red, and 2.29 µm to blue. The Saturnian moon Tethys (V=10.3), seen at the bottom of the image, was used to provide a wavefront signal for the adaptive secondary. On a night of median seeing, the adaptive correction yields 0.08" on-axis imaging, essentially the diffraction limit at K-band. The 0.18" image of Tethys is dominated by the angular size of the moon itself.

Saturn's visual appearance is controlled by the distribution and optical properties of clouds and haze. The three infrared bands provide dramatically different views of Saturn. The 1.64 µm filter provides an image of the infrared continuum. From thermochemical equilibrium theory it is believed that we are seeing the top of an ammonia ice cloud which lies above deeper ammonium hydrosulfide and water/ammonia clouds. At 2.09 µm, we witness partial absorption by neutral molecular hydrogen and methane. High altitude haze produces additional reflectivity in the equatorial bands. Finally, strong atmospheric methane absorption produces an image at 2.29 µm in which the entire disk is absent!

Personnel

Creighton Chute returned to work on November 2 after having five screws placed in his heel. His recovery is going well.

Staff Technician Bill Stangret transferred from LBTO to MMTO November 21. Bill comes with a wealth of experience in telescope assembly, mechanics, metal fabrication, and large equipment operations.

New MMT Director Faith Vilas arrived December 5. MMTO and parent institutions enthusiastically welcomed Faith to her new job, but none more than J.T. Williams, Interim Director since May 2004.

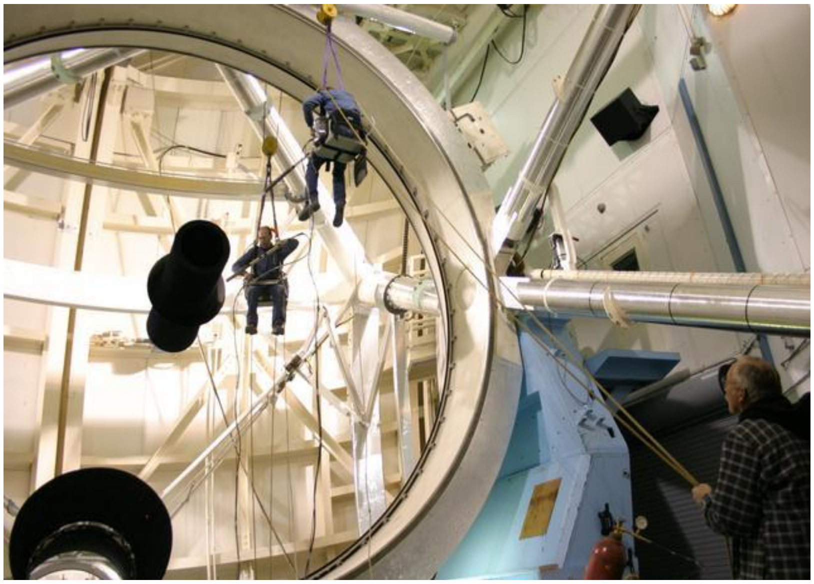
In late December Brian Love transferred from the MMTO to the Steward Observatory Mirror Lab (SOML) mirror casting team.

Thomas Stalcup attended the Laser Clearinghouse Working Group meeting in Colorado Springs, Colorado, November 9-10, and participated in discussions about predictive avoidance of satellites to prevent damage through inadvertent illumination. The main topic of discussion was methods to reduce the impact that predictive avoidance has on science programs.

Primary Mirror Systems

Optics

We discovered how meticulous we must be when CO_2 cleaning the primary mirror. After re-installing the mirror cell flocking, the color contrast of the black flocking revealed residual dust bands from the first CO_2 cleaning. This new effort will double the passes, time, and gas required to perform a mirror cleaning. CO_2 cleaning will be scheduled before and after each *f*/5 block.



Bill Stangret assists Dennis Smith with CO_2 cleaning of the primary mirror.

Thermal System

When reconnecting the T-series thermocouple system after shutdown, it was noticed that many wiring and documentation errors were extant in the system. Brian Comisso spent several days gathering existing documentation, comparing it to the as-built hardware, and generating corrected drawings for the system. In addition, Dusty Clark began a serious design effort to correct the flaws in getting temperature measurements from the system. A preliminary design has been identified, and should be ready for deployment in the spring of 2006.

Optics Support Structure

Secondary Hub

Steps are being taken to install bracing wires to the pre-stressed spider straps. The wires are to be attached to the midpoint of the spiders, creating a node. This will effectively stiffen the spiders by twice their fundamental frequency. Brackets for these bracing wires have been installed on the optics support structure (OSS) by Bill Stangret and Court Wainwright. Testing is still being done to determine the natural frequencies of the spiders using a triaxial PCB Piezotronics accelerometer analyzed by a dynamic signal analyzer unit. Creighton Chute and Court Wainwright will finish this testing in early February. Adjustments to the laser guide star (LGS) pupil box may be necessary to ensure the laser beam safely clears the bracing wires.

The position of the fixed hub was measured in late November. Although a complete set of data was not attained due to the large number of tasks occurring that day, the location of the hub proved to be adequately centered. The *f*/15 was able to collimate and there were no reports of collisions during the entire adaptive optics run. Planning is underway to measure and document this location for future reference.

Telescope Tracking and Pointing

Servos and Encoders

The new mount servo bridge interface card arrived during the reporting period and was assembled for use on the mountain by Dusty Clark, with assistance from Brian Love on the 19" mounting panel. We await further software development to begin use in the mount control system.

Cory Knop and Brian Comisso continued layout and construction of the new absolute encoder electronics. An additional board, a test tool for qualifying encoder to digital conversion ICs, was designed as an aid in troubleshooting absolute encoder problems and developing the new system. This was prompted by a serious failure in December of the azimuth encoder that led to a few days of red-herring problem (non)resolution. It turned out in the end to be a bad digital line connection that froze an encoder bit. Replacement of the electronic chips had no effect on the problem, and in fact, led to a second error in fixing the system: the azimuth encoder "coarse offset," a number used in meshing the coarse and fine encoder values in the mount computer software, needed to be changed for the first time in the 10-year history of the system's operation. The digital line connection and the coarse offset were both corrected, and we have not experienced any more of the problematic 42-arcminute glitches that were the original issue.

Telescope Collimation and Optical Performance

M2 (Secondary Mirror/Hexapod) Open Loop Corrections

We were able to make dedicated observations to calibrate our M2 open loop (a.k.a. ElColl) corrections on the nights of November 10 and 22. The data from the two November nights agree fairly well with some offset in the zeropoint of each term (see Figure 1). There are, however, significant differences in behavior between the May and November data. There is a transverse component seen in the Tilt Y and Trans X terms that was not there before, and the shapes of the best-fit curves for Trans Y and Focus have changed somewhat. It's not entirely clear what is the root cause of the observed changes. By the end of December, a primary mirror (M1) hardpoint was identified as a possible source of collimation changes.

We had hoped to take more ElColl data on the night of December 20, but were unable to do so due to poor observing conditions. It became clear over the following week that the sag term (M2 Y translation vs. elevation) had changed significantly since we had last measured it in mid-November. Analyzing the hexapod positions logged by the WFS after corrections have been applied found that the sag term has indeed changed, and that there is also a significant temperature dependence that we were not correcting for previously. Figure 2 shows the WFS data and ElColl fits projected to show the temperature dependence. Figure 3 shows the same information projected to show the elevation dependence. The slope of the temperature dependence is 115 microns per degree C. The elevation dependence is much closer to linear versus the more purely cos(el) seen before. Given the fairly large amount of scatter in the data, it's not clear how significant this result is. The Z (focus) component of ElColl has not changed significantly, and the model determined in November did a reasonably good job of predicting the focus position in December. There is even larger scatter in the focus data due largely to primary thermal state. The results from the WFS data are also too noisy to compare the transverse Tilt Y/Trans X components to previous ElColl runs.

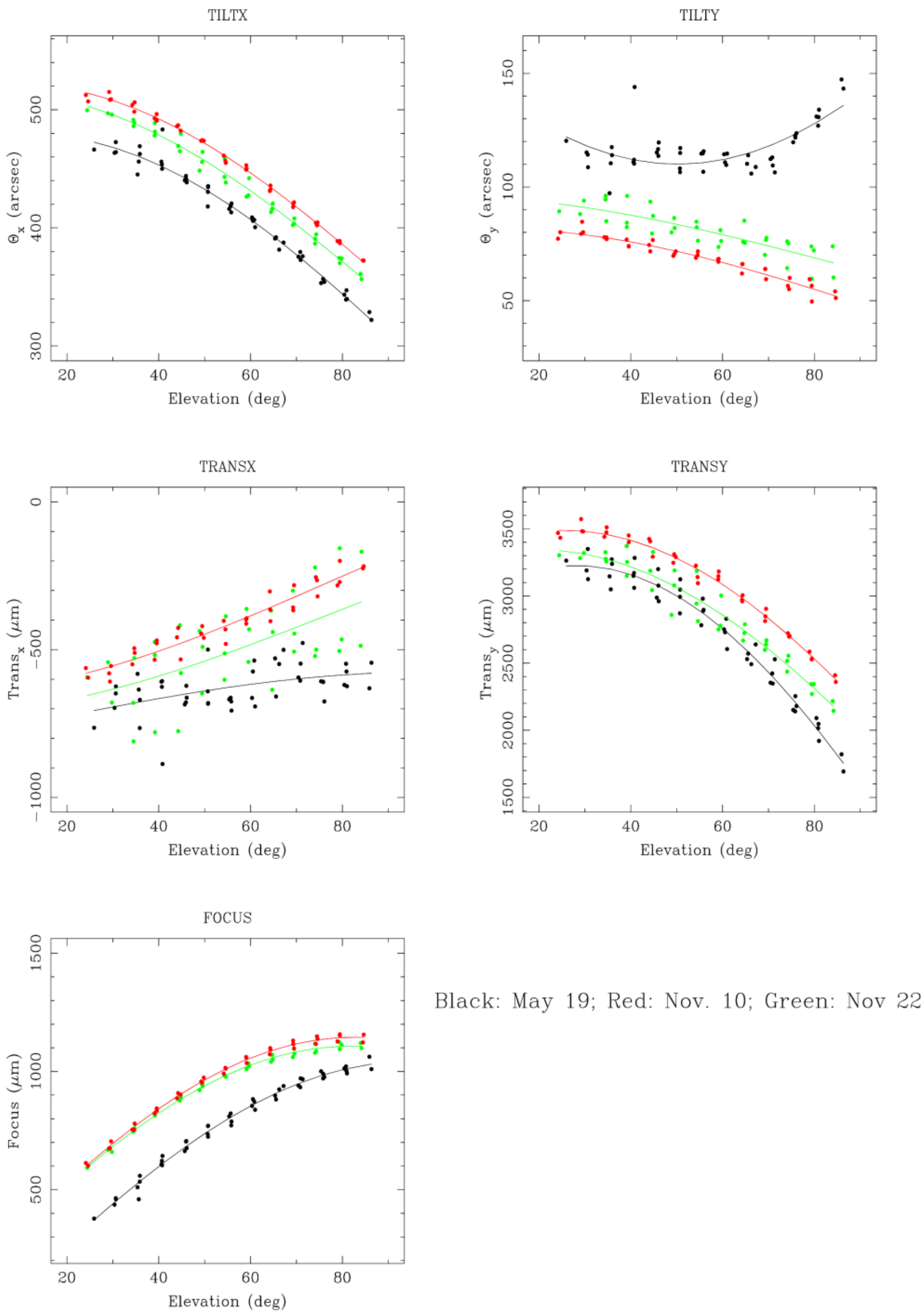


Figure 1: Results from the WFS data taken to calibrate M2 open loop corrections. The data in black were taken before summer shutdown on May 19. The red and green data are post-shutdown from the nights of November 10 (red) and November 22.

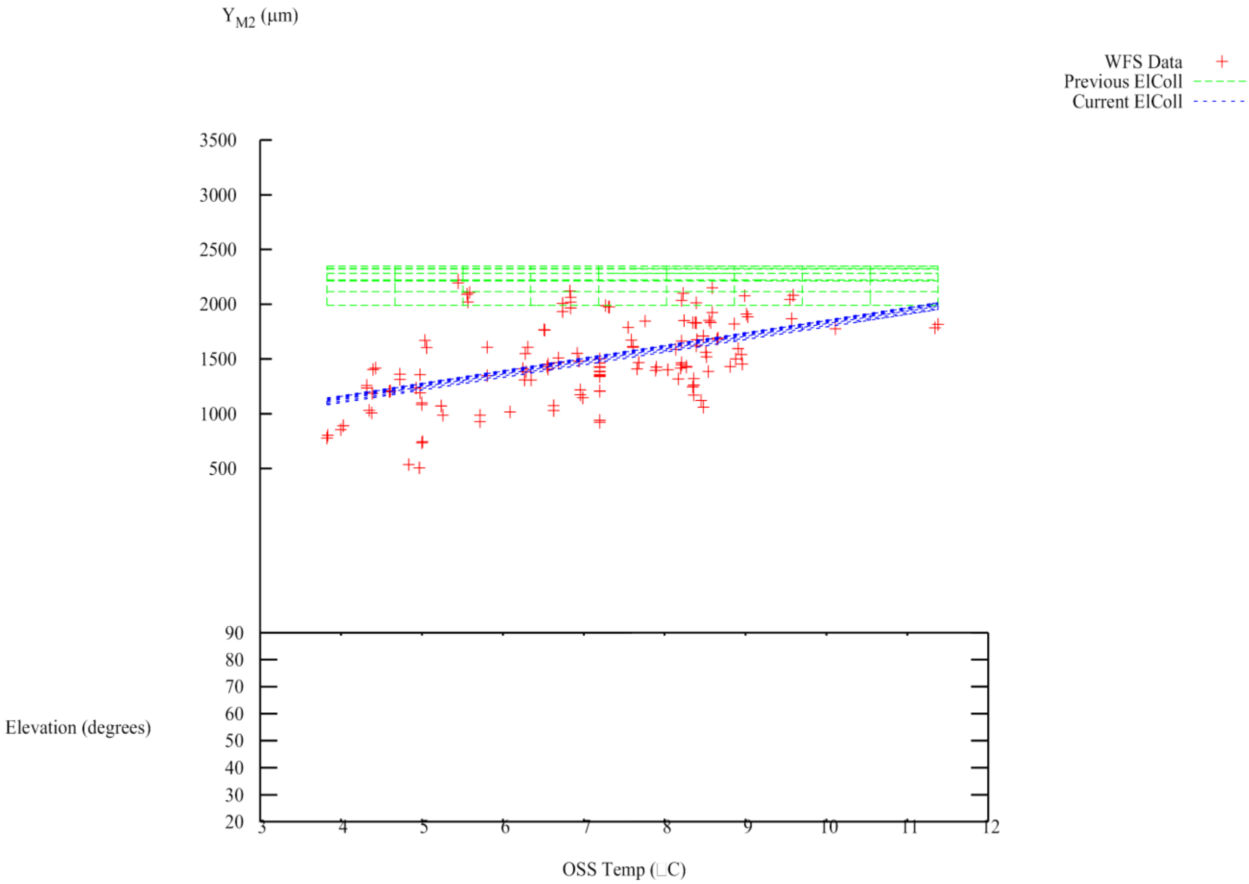


Figure 2: Known good M2 Y positions as logged by the WFS (red crosses) during the last two weeks of December 2005 plotted with ElColl fits determined from dedicated observations during November 2005 engineering time (green dashes) and by fitting a model to the WFS data (blue dashes). The data are projected to most clearly show the temperature dependence seen in the December WFS data.

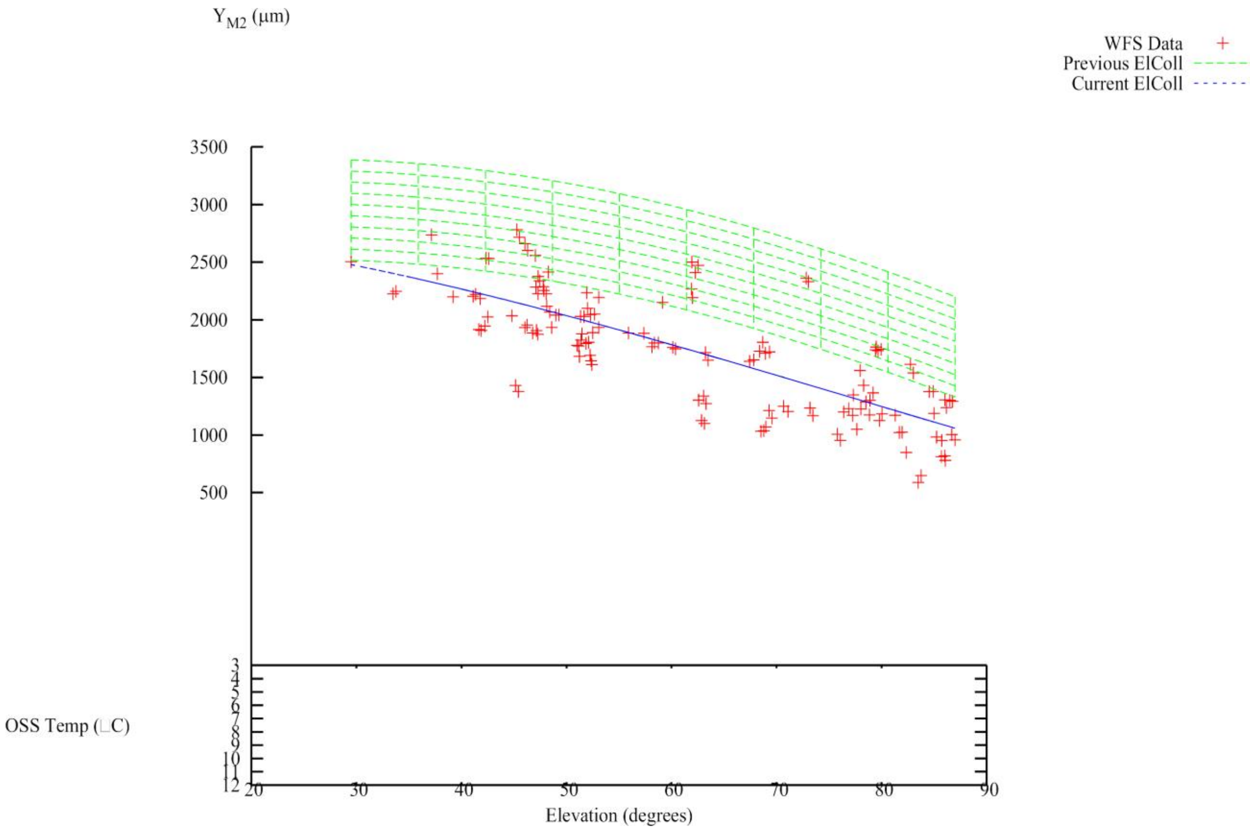


Figure 3: Same as Figure 1, but projected to show the elevation dependence.

Wavefront Aberrations Due to Primary Mirror Temperature Variations

In the past we have performed experiments to see how focus (as measured by a WFS) would change as the temperature of the OSS changed. In the course of doing so we saw large variations (~100 µm) in focus on short timescales (0.5 to 1 hour) that did not correlate with any observed ambient or OSS temperature change. Upon further analysis it was found that the focus changes did correlate with changes in the thermal structure within the primary mirror. In hindsight it was obvious that this would be the case. The softest circularly-symmetric bending mode of the primary mirror (the so-called "cone mode") does not correspond to any single Zernike mode that we measure. Instead, it projects into all circularly-symmetric Zernike modes and most strongly into focus and spherical aberration. So whenever we'd see spherical aberration change as temperature gradients in the mirror change, the focal length of the primary would be changing at the same time.

On the night of November 21 we performed another experiment where we pointed at a star near the celestial pole to remove any elevation dependence and continuously took WFS data over a span of about 6 hours. For the first hour or so we just ran the thermal system normally. Then we cranked up the setpoint to warm the mirror. After about 3 hours we lowered it to start cooling the primary again. Figure 4 shows the results of modeling the primary's thermal structure. The structure in each plate is modeled by a surface described by a nine mode Zernike polynomial. This should, in principle, simplify relating temperature structure variations to variations in figure at the mirror surface. Figure 5 shows the corresponding modes of wavefront aberrations measured by the WFS. Note how the focus changes by over 100 μm within an hour of changing the thermal system's setpoint. The variations in measured focus correlate most closely with the focus term in the mid-plate fits. The spherical term in the mid-plate also correlates with the measured spherical, though there is a phase shift in the peak that is not completely understood. Engineering time in mid-January 2006 will be used to further explore these issues with the goal of building an open loop tool that measures the primary's thermal state, and applies corrections based on the predicted wavefront errors.

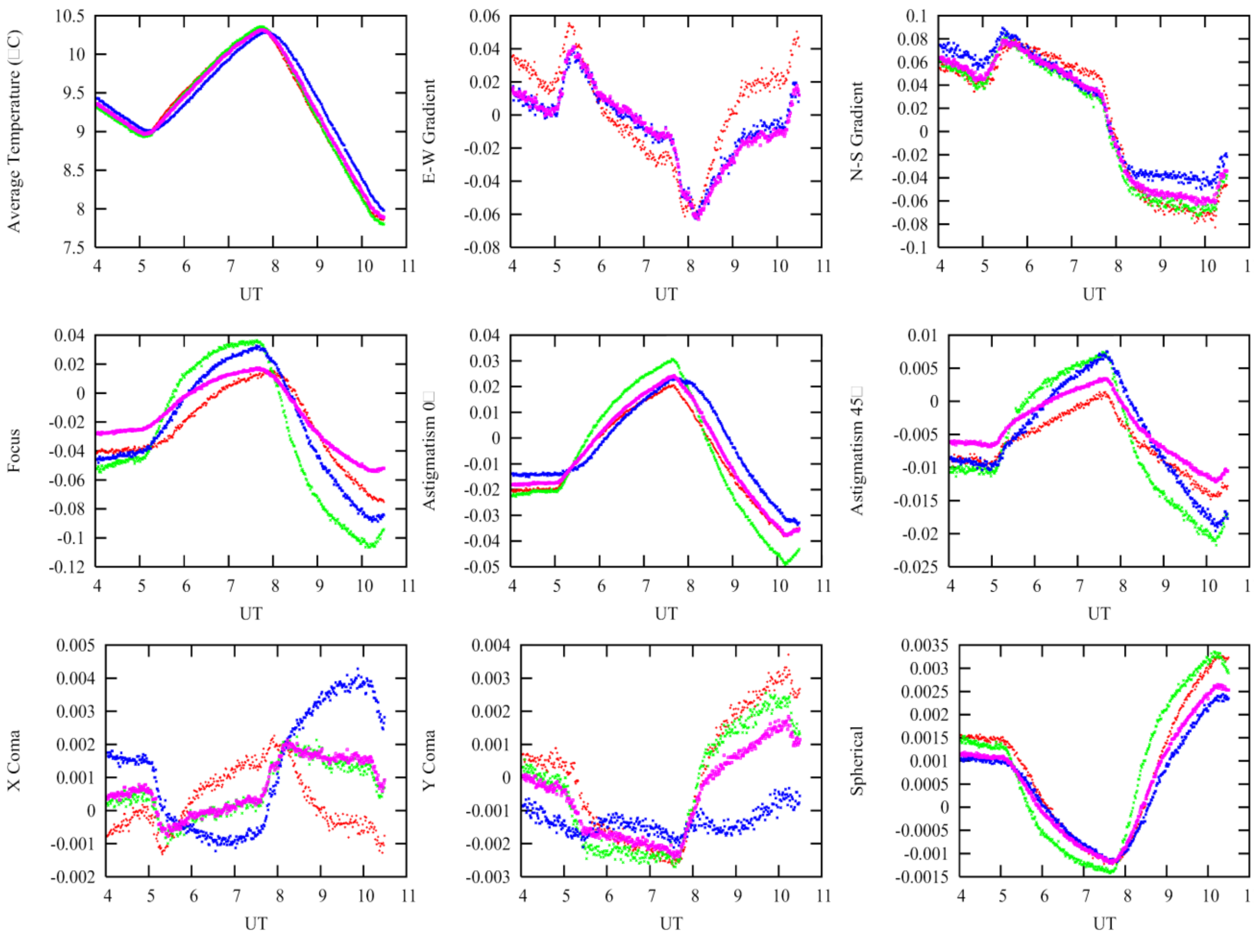


Figure 4: Results of Zernike polynomial fits to the temperature structure of the primary mirror over the course of the night of November 21, 2005. In all plots the red data corresponds to the front plate, green to the mid plate, blue to the back plate, and magenta to the average temperature. The temperatures all come from the cell's E-series thermocouples.

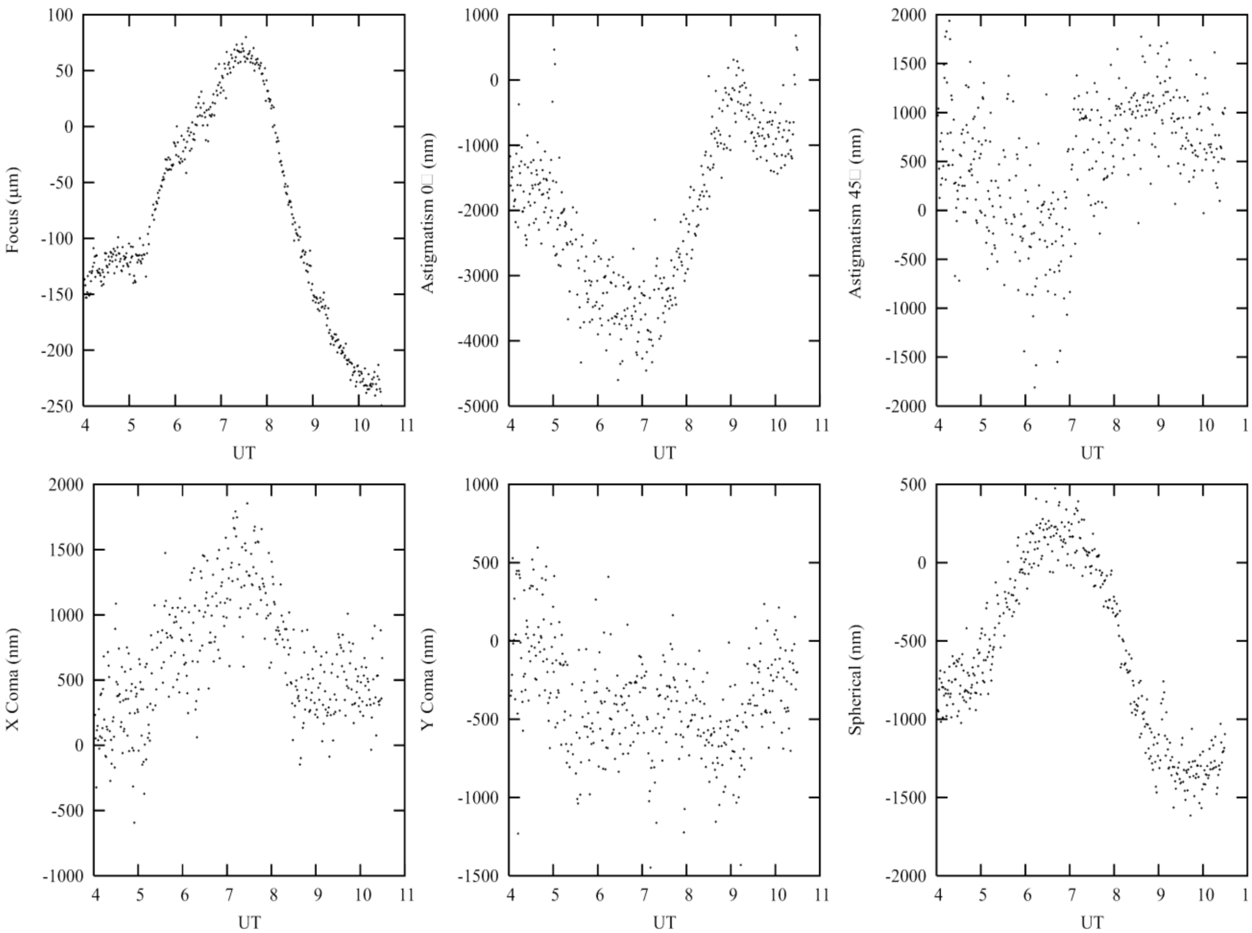


Figure 5: Results of wavefront measurements over the same period of time shown in Figure 3. The large scatter in the data is due to the fairly poor seeing conditions (~1.5") during the time the data were taken. In spite of this, the variations in focus, spherical aberration, and 0-degree astigmatism are clearly seen.

Computers and Software

f/5 Wavefront Sensor Computer and Hardware

A problem in the IEEE1394 host controller interface in the *f*/5 wavefront sensor (WFS) computer resulted in loss of control of the PixeLINK acquisition camera. The problem was intermittent but appeared to be getting worse. The computer reports errors loading the IEEE1394 driver but the camera works fine when connected to other computers. Because of its very low sensitivity, we began investigating alternatives to the PixeLINK rather than replacing the computer's motherboard just to support it. One option was an Astrovid StellaCam II low light video camera, the same type of camera that is currently used in the MMTO All-Sky Camera. The StellaCam was estimated to be more than an order of magnitude more sensitive. Also, it is more versatile as it also allows for on-board frame integration, providing the capability to integrate up to 8 seconds if necessary.

During the engineering night of November 21 a StellaCam was installed, using temporary cable drapes, in place of the PixeLINK in order to test its operation and performance. The camera worked flawlessly. Even it its default mode of median gain and no integration it was much more sensitive than the PixeLINK. Stars down to 10th magnitude were easily visible in the TV monitor even when defocused by up to 400 microns. Adjusting gain and integration time via the StellaCam's RS232 interface allowed us to easily reach 13th or 14th magnitude stars. The pixel scale was measured to be 0.06 arcsec/pixel, which results in a field-of-view of 40 x 30 arcsec.

Following the successful engineering tests with the StellaCam, the decision was made to replace the PixeLINK with the StellaCam. Cory Knop routed an RS232 cable and a video cable through the *f*/5 WFS energy chain, and then routed an additional RS232 cable and video cable through the mirror cell into the instrument cone. During operation the video cable is connected to Video 1 input on the PI patch panel, and the RS232 cable is connected to the *f*/9 wavefront sensor computer. There was an existing 12V DC power cable that was previously used by the science camera's filter wheel and that was already switched through the internal LabJack interface. That power provided sufficient current, but after several nights' observations it was determined that it made the *f*/5 WFS computer unstable. The WFS computer has not crashed since the StellaCam was powered off. We will revisit the power issue in early February when the *f*/5 WFS is off the telescope.

Mount Catalogs

A number of enhancements have been made to the catalog format that observers use to present objects to the mount control software at the MMT. The changes are documented on the observer guidelines/catalog section of the MMTO website (*http://www.mmto.org/obscats/*), and now allow preparation of a nearly free form catalog. The restrictions are that fields are presented in the order ID, RA, DEC, RA and DEC proper motion, magnitude, spectral type, epoch, and PA. The addition of PA is new, and allows preparation of catalogs that include position angle, which makes observing more efficient for programs that specify position angle information. The scope GUI (written in the Perl language) was enhanced to parse these files, maintaining backward compatibility with previously prepared catalogs, and retaining position angle information in the slew and scratch catalogs it maintains.

New Mount Computer

Work has continued on the new mount computer (which in its present incarnation is a 3 GHz Pentium IV with 1 gigabyte of memory). The stock distribution of VxWorks was flustered by 1 gigabyte of RAM and needed to be modified to detect that much memory (rather than defaulting to an absurdly small amount on the order of 3M or so). This and other niggling problems have been solved. The new system boots diskless using etherboot in a pleasantly generic way, and supports a 100 Mbit ethernet using the Intel Etherpro 100 PCI network card. Some driver portability issues have been sorted out (the initial system will access encoders and servos using the same set of IP-module hardware, albeit in a PCI-bus IP-carrier card). By using IP-modules and simply moving them to a carrier board for the new bus architecture, we have been able to use our existing base of IP module drivers. We expect to be using the new system for full time observing during the last part of January 2006.

Service Tracking System

To keep track of service and trouble reports, a new MMT Service Tracking System was implemented at *http://hacksaw.mmto.arizona.edu/service/*. This system uses the PHP scripting language and a MySQL database to provide a web-based interface to issues, problems, and corrective actions that arise during the operation of the telescope. System documentation, also written during this reporting period, can be found at *http://www.mmto.org/dokuwiki/doku.php?id=service_documentation:service_main*.

The software for the system was obtained from David Gasson of NOAO. Minor software modifications were required to enable it to run at the MMT.

The "service" tracking system is the first MMTO application on hacksaw that uses MySQL. Work included getting MySQL configured and running on hacksaw as well as installing phpMyAdmin to administer the MySQL database server. A "service" MySQL database was created with the same schema as is being used by NOAO. This database was populated with 15 categories and 92 subjects (so far) that are specific to MMTO needs.

A variety of other "bug" tracking software packages were installed and evaluated prior to final selection of the NOAO software. These other software packages included "bugzilla," see *http://www.bugzilla.org/*, and "phpBB," see *http://www.phpbb.com/*, as well as others. In general, it was felt that the NOAO software most closely matched the requirements of the MMTO to track operational issues at this time.

MMT DokuWiki

A new MMT DokuWiki was started and can be found at *http://www.mmto.org/dokuwiki/doku.php*. A general description of DokuWiki can be found at *http://www.splitbrain.org/projects/dokuwiki*.

As with other wikis, the content of the MMT DokuWiki is constantly evolving. Initial input to the MMT DokuWiki included an overall structuring of documentation, including the sections below:

- MMT Operations
- MMT Systems
- MMT Instruments
- Observer Information
- Other Documentation
- To-Do Lists

This overall structure is expected to change with time and needs of the MMTO.

An Operator's Manual, with text provided by Ale Milone and photographs taken by Duane Gibson, was one of the first documents on the Wiki. This manual is currently under review by the operators and MMT staff.

Similarly, various checklists and a lightning shutdown procedure were also added to the Wiki; they are undergoing revisions and review. Tim Pickering has begun work on providing information for observers who use the MMT. Portions of the MMT staff, such as the Electronics Group, are using the Wiki for to-do lists of planned and ongoing work.

Non-Sidereal Tracking

Work continued on various aspects of non-sidereal tracking. Additional programming and documentation were done on the Perl script edb_gui, which is used to load coordinates into the mount crate from XEphem-format (i.e., *.edb) files as well as two-line element (i.e., *.tle) files, commonly used for earth-orbiting satellites. Minor programming changes were made to the Perl utility scripts, astorb2.edb.pl and mpcorb2edb.pl, part of the XEphem distribution and used to convert publicly available catalogs to edb format, to correct formatting errors in date fields.

Changes were made to the libastro based code used in the mount crate to handle orbital calculations. The mount required an RA/Dec coordinate for any object being tracked on every tick (every 0.01 second). Performing the full calculation to generate RA and Dec from the orbital elements at 100 Hz cannot be done in real time on the VME mount crate (but will be entirely feasible on the x86 mount crate), so we calculate RA and Dec at 1 Hz, keeping ahead of ourselves so that we can perform an interpolation at 100 Hz. This scheme seems to work nicely, although it may not suffice for satellites in near earth orbit.

Miscellaneous Software

Work continued on the next generation of the "hexgui" graphical user interface (GUI). Much of this work was in understanding, improving, and simplifying the use of Gtk2 within Ruby applications and making Gtk2/Ruby applications more similar to existing MMTO GUIs.

Some additional analysis of pressure and deposition rate data from last shutdown's aluminization was performed. Results will be presented at the SPIE conference in late May.

Instruments

Adaptive Optics

During the December adaptive optics (AO) run, the MMT staff began taking over responsibility for mounting the *f*/15 secondary and topbox. Under the supervision of the AO group, Creighton Chute, Thomas Stalcup, and Court Wainwright did most of the work to mount the secondary while using and revising the written procedures. Everything went reasonably smoothly.

Much progress has been made on the clean room in the common building basement, and it will now be the permanent storage area for the *f*/15 secondary between AO runs. The clean room tent in the old control room is now gone permanently. During the upcoming February run the new handling fixture for the *f*/15 secondary, the DM jockey, will be tested and put into operation. It should make handling and transporting the secondary both easier and safer.

The AO group's fabled weather problems continued, but the time lost due to the AO system/instruments was minimal. For the December run, 13 nights were scheduled, of which a total of 7 nights were lost to weather. There was only about one hour lost to the AO instrumentation system during the entire run.

New safety procedures for the laser guide star (LGS) system are nearly ready for circulation. This will include more structured warning announcements and a system of warning lights.

The LGS time in December experienced some bad weather, but useful data was still collected. Beam quality was examined in greater detail than ever before, and the preliminary results show that the return was seeing-limited in the approximately 1 arcsec seeing during the test. A fast steering mirror to stabilize pointing errors due to ~20 Hz secondary vibrations was also tested, and while the results look promising, the test data have not yet been reduced.

Megacam

The new SAO computers, lewis, clark, and hudson, have been experiencing problems whereby they become unresponsive because of a runaway "mount" process on lewis. The only solution has been to reboot all three machines. The origin of this problem is unknown, but it is believed that it is related to the kernel, which will be updated soon.

The Megacam observer's manual was updated December 21. The new version includes information regarding operation with the new computers, lewis, clark, and hudson. The updates also include instructions for backing up Megacam data on an external USB disk. Modifications to the "mice" GUI required some changes to the manual.

Hectochelle

Plans to support Hectochelle calibration lamps are now in progress. A cluster of lamps will be mounted on the *f*/5 upper baffle. Mounting these lamps in this location will significantly reduce the time required for calibration while increasing the accuracy of the wavelength solution.

***f*/5 Wavefront Sensor**

The *f*/5 WFS failed to check out properly during the instrument change from Hectochelle to SWIRC on November 15. Initially there were intermittent problems loading the PMAC driver, which resulted in the waveserv server hanging. On occasions when the server started properly (approximately 2 in 15), the waveserv motion control GUI indicated that an ESTOP was depressed.

Tom Gauron (SAO) provided a detailed procedure for troubleshooting the system; the WFS was removed from the telescope on November 16 to do so. An inspection of the internal electronics by Ken Van Horn and Brian Comisso revealed that a daughter card mounted on the PMAC card was partially unseated. An attempt was made to reseat the card, but the gap could only be closed by about half because of over-sized nylon standoffs provided by the manufacturer. The card was removed and the standoffs were sanded down by 0.040". The card was reinstalled and seated properly, and there were no longer problems with the waveserv server starting. However, the motion control GUI still indicated that an ESTOP was depressed, and the PMAC "ticker" in that GUI was not updating.

John Roll and Grant Williams realized that the firmware on the PMAC board may have been lost. New firmware was downloaded to the board, after which the system checked out and worked properly.

We would like to arrange for some formal training and to obtain the up-to-date drawings on the equipment we are inheriting from SAO.

General Facility

Building Drive

It was recently discovered that some of the 10-year-old building drive drawings had not been updated. Ken Van Horn has now updated those drawings into the latest ORCAD format for the "dumper circuit" and the "hand paddle." The latest version of the power control drawings also show the new soft-start installed external to the building drive rack. This soft-start was installed after the original circuit failed and destroyed the current limiting resistors in the external box. The actual cause of this failure has not been positively identified, but was initially thought to be related to part of the 26 volt interlock system that was temporarily modified for the removal of the loading dock lift. A portion of the safety chain was bypassed while the new soft-start was being developed, but it has now been reinstalled and no new incidents have been observed.

Other Facility Improvements and Repairs

Work continued in December on the roof heater. Good progress has been made, and it should be up and running by late February.

Bill Stangret and Court Wainwright reinstalled the magnetic flocking on the primary cell wall. The three panels that cover a bearing access panel on the east and west sides have been mechanically secured to the cell.

On December 13, Creighton Chute, Brian Love, and Court Wainwright cleaned the oil and dust film off the elevation drive arcs.

Light Pollution

On November 1 the Cochise County Board of Supervisors voted unanimously to approve the proposed Cochise County Light Pollution Code. The code, results of a Southern Arizona dark skies initiative, took effect on December 2, 2005. A copy of the code is available at the Cochise County web site: *http://www.co.cochise.az.us/P&Z/PollutionCode.htm*.

The Benson City Council unanimously approved a similar code, the Benson Outdoor Lighting Code, on November 28.

Visitors

November 3: Dan Brocious and Emilio Falco (FLWO) escorted a group from the Southern Arizona section of the Illuminating Engineering Society of North America (IESNA) on a tour of the MMT.

November 15: The CfA Public Affairs Department visited the MMT to shoot video. They are producing a video about CfA astronomy to be used in the SI Visitors Center in both Cambridge and Arizona, serve the news media, and be available for general use.

November 22: Frank Perez and Alan Uomoto (Magellan) visited the MMT to witness the secondary mirror change from *f*/5 to *f*/9.

December 8: Peter Strittmatter and Gary Schmidt (SO) visited the MMT during the December AO run.

December 15: Michael Lloyd-Hart (CAAO) accompanied Dr. Joe Janni, former Director of the Air Force Office of Scientific Research, Lt. Ben Karlow and Maj. Scott Schroer of the AF Research Lab, Dr. Brent Ellerbroek of the Thirty Meter Telescope Project, Dr. Keith Knox of Boeing LTS (Maui), and Mark Hoffman of the Maui Community College. There were also other representatives from Boeing, Maui Community College, Trex Inc. (Maui), and Oceanit Inc. (Honolulu).

Publications

MMTO Internal Technical Memoranda

None

MMTO Technical Memoranda

None

MMTO Technical Reports

None

Scientific Publications

05-32 Variation in the Scattering Shroud Surrounding Markarian 231
Gallagher, S. C., Schmidt, G. D., Smith, P. S., Brandt, W. N., Chartas, G., Hylton, S., Hines, D. C., Brotherton, M. S.
ApJ, **633**, 71

05-33 Detection of Long-Period Variations in the Subdwarf B Star PG 0101+039 on the Basis of Photometry from the *MOST* Satellite
Randall, S. K., Matthews, J. M., Fontaine, G., Rowe, J., Kuschnig, R., Green, E. M., Brassard, P., Chayer, P., Guenther, D. B., Moffat, A. F. J., Rucinski, S., Sasselov, D., Walker, G. A. H., Weiss, W. W.
ApJ, **633**, 460

05-34 Structural Parameters of the Hot Pulsating B Subdwarf Feige 48 from Asteroseismology
Charpinet, S., Fontaine, G., Brassard, P., Billères, M., Green, E. M., Chayer, P.
A&A, **443**, 251

05-35 SHELS: The Hectospec Lensing Survey
Geller, M. J., Dell'Antonio, I. P., Kurtz, M. J., Ramella, M., Fabricant, D. G., Caldwell, N., Tyson, J. A., Wittman, D.
ApJ, **635**, L125

05-36 The Hypervelocity Star SDSS J090745.0+024507 is Variable
Fuentes, C. I., Stanek, K. Z., Gaudi, B. S., McLeod, B. A., Bogdanov, S., Hartman, J. D., Hickox, R. C., Holman, M. J.
ApJ, **636**, L37

05-37 XBootes: An X-Ray Survey of the NDWFS Bootes Field. I. Overview and Initial Results
Murray, S. S., Kenter, A., Forman, W. R., Jones, C., Green, P. J., Kochanek, C. S., Vikhlinin, A., Fabricant, D. Fazio, G., Brand, K., Brown, M. J. I., Dey, A., Jannuzi, B. T., Najita, J., McNamara, B., Shields, J., Rieke, M.
ApJ Supp, **161**, 1

05-38 High-Ionization Emission in Metal-Deficient Blue Compact Dwarf Galaxies
Thuan, T. X., Izotov, Y. I.
ApJ Supp, **161**, 240

05-39 The First-Optical-VLA Survey for Lensed Radio Lobes
Haarsma, D. B., Winn, J. N., Falco, E. E., Kochanek, C. S., Ammar, P., Boersma, C., Fogwell, S., Muxlow, T. W. B., McLeod, B. A., Lehár, J.
AJ, **130**, 1977

05-40 Pushing the Limits of Ground-Based Photometric Precision: Submillimagnitude Time-Series Photometry of the Open Cluster NGC 6791
Hartman, J. D., Stanek, K. Z., Gaudi, B. S., Holman, M. J., McLeod, B. A.
AJ, **130**, 2241

05-41 Absolute Properties of the Eclipsing Binary Star RW Lacertae
Lacy, C. H. S., Torres, G., Claret, A., Ribeiro Vaz, L P.
AJ, **130**, 2838

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 University of Arizona and the Smithsonian Institution."

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:

- General information about the MMT and Mt. Hopkins.
- Telescope schedule.
- User documentation, including instrument manuals, detector specifications, and observer's almanac.
- A photo gallery of the Conversion Project as well as specifications related to the Conversion.
- Information for visiting astronomers, including maps to the site.
- 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.

NOTE: Beginning January 2005, the formula for accounting lost time on the telescope has been changed. Previously, time lost to weather was deducted from the total observing time before calculating time lost to instrument, telescope, and facility from the remaining balance. From now on, the time lost to each source is computed as a fraction of the total scheduled time.

And beginning June 2005, a new category, environment, was added to account for time lost to natural, uncontrollable, non-weather events such as flying insects melting in laser beams and forest fires.

Use of MMT Scientific Observing Time

November 2005

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	* Lost to Telescope	Lost to Gen'l Facility	Lost to Environment	Total Lost
MMT SG	6.50	76.90	31.30	0.00	13.40	0.00	0.00	44.70
PI Instr	20.00	230.70	17.00	14.60	21.10	0.00	0.00	52.70
Engr	2.50	29.35	7.00	0.00	0.00	0.00	0.00	7.00
Sec Change	1.00	11.65	0.00	0.00	0.00	0.00	0.00	0.00
Total	**30.00**	**348.60**	**55.30**	**14.60**	**34.50**	**0.00**	**0.00**	**104.40**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	88.2
Percentage of time scheduled for engineering	8.4
Percentage of time scheduled for sec/instr change	3.3
Percentage of time lost to weather	15.9
Percentage of time lost to instrument	4.2
Percentage of time lost to telescope	9.9
Percentage of time lost to general facility	0.0
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	29.9

* Breakdown of hours lost to telescope

az drives 21.65
building drives, el encoder 9.1
mount software 2
wavefront sensor 1.75

December 2005

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	* Lost to Telescope	Lost to Gen'l Facility	Lost to Environment	Total Lost
MMT SG	6.00	71.40	3.00	0.25	0.80	0.00	0.00	4.05
PI Instr	22.00	264.00	74.50	9.75	3.50	0.00	0.00	87.75
Engr	0.50	6.00	0.00	0.00	0.00	0.00	0.00	0.00
Sec Change	1.50	17.90	0.00	0.00	0.00	0.00	0.00	0.00
Total	**30.00**	**359.30**	**77.50**	**10.00**	**4.30**	**0.00**	**0.00**	**91.80**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	93.3
Percentage of time scheduled for engineering	1.7
Percentage of time scheduled for sec/instr change	5.0
Percentage of time lost to weather	21.6
Percentage of time lost to instrument	2.8
Percentage of time lost to telescope	1.2
Percentage of time lost to general facility	0.0
Percentage of time lost to environment (non-weather)	0.0
Percentage of time lost	25.5

* Breakdown of hours lost to telescope

az oscillation, erratic tracking 0.3
hexapod 0.5
primary panics 1.75
telescope/bldg collision 0.25
UMAC power supply 1
VME crate 0.5

Year to Date December 2005

Instrument	Nights Scheduled	Hours Scheduled	Lost to Weather	Lost to Instrument	Lost to Telescope	Lost to Gen'l Facility	Lost to Environment	Total Lost
MMT SG	46.00	482.00	221.00	0.25	18.95	2.50	47.80	290.50
PI Instr	210.25	2110.40	632.40	145.70	50.80	0.00	9.60	838.50
Engr	9.75	95.50	10.00	0.00	0.00	0.00	8.00	18.00
Sec Change	9.00	93.60	11.50	6.00	0.00	0.00	0.00	17.50
Total	**275.00**	**2781.50**	**874.90**	**151.95**	**69.75**	**2.50**	**65.40**	**1164.50**

Time Summary Exclusive of Shutdown

Percentage of time scheduled for observing	93.2
Percentage of time scheduled for engineering	3.4
Percentage of time scheduled for sec/instr change	3.4
Percentage of time lost to weather	31.5
Percentage of time lost to instrument	5.5
Percentage of time lost to telescope	2.5
Percentage of time lost to general facility	0.1
Percentage of time lost to environment (non-weather)	2.4
Percentage of time lost	41.9