

BLANCO TELESCOPE UPGRADES

ALISTAIR WALKER
NOAO/CTIO



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Blanco Telescope Upgrades

- **Background –**
 - Upgrading a long-lived facility is essential to keep it close to state-of-the-art.
 - Some upgrades were grouped as “*CTIO Facilities Improvement Project*” (*CFIP*), and formally became part of the DES Project.
 - Various other Facility Improvements have also been completed, or are underway:
 - Clean Room build inside the Blanco Coudé Room
 - Upgrades to the building glycol system
 - Relocated and enlarged Control Room & Computer Room
 - Installation of utility & cryogen lines for DECam and NEWFIRM
 - Enhanced bandwidth from La Serena to the USA
 - Data Transport System for reliable data transfer





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Today's Topics

- Repairing the Primary Mirror Radial Supports
- New Telescope Control System and Encoders
- Blanco Telescope Environmental Control System

All the above have a direct impact on the scientific performance of the Blanco telescope





Radial Supports Repair

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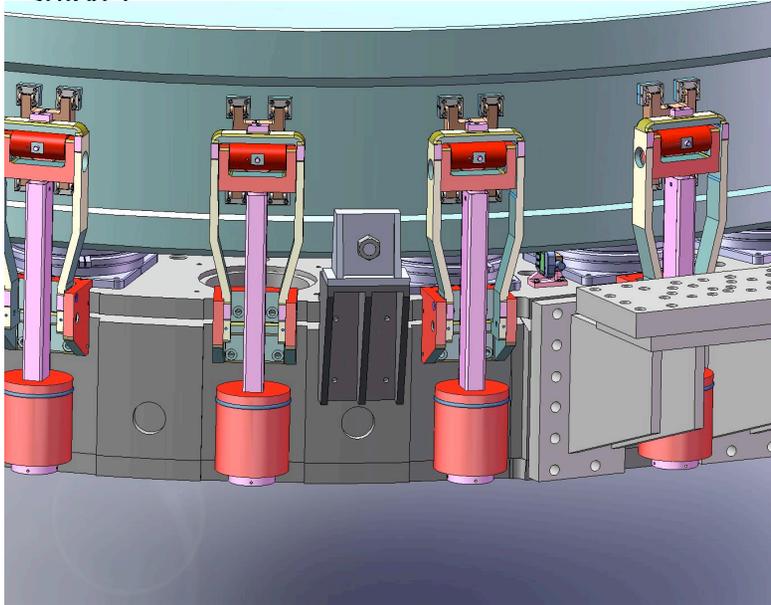
Modify the primary mirror radial (edge) support system to prevent separation of the supports from the mirror.

STATUS: Successful engineering shutdown April-May 2009, no failures since then, no uncontrolled mirror movements.





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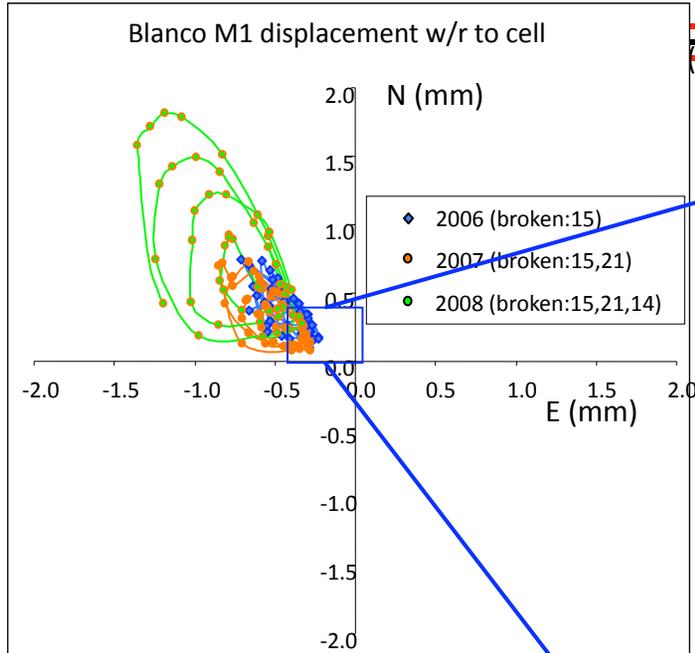


New radial support brackets (“H-bars”) have rotational freedom to reduce peeling stresses from marginal to factor 3 safety.



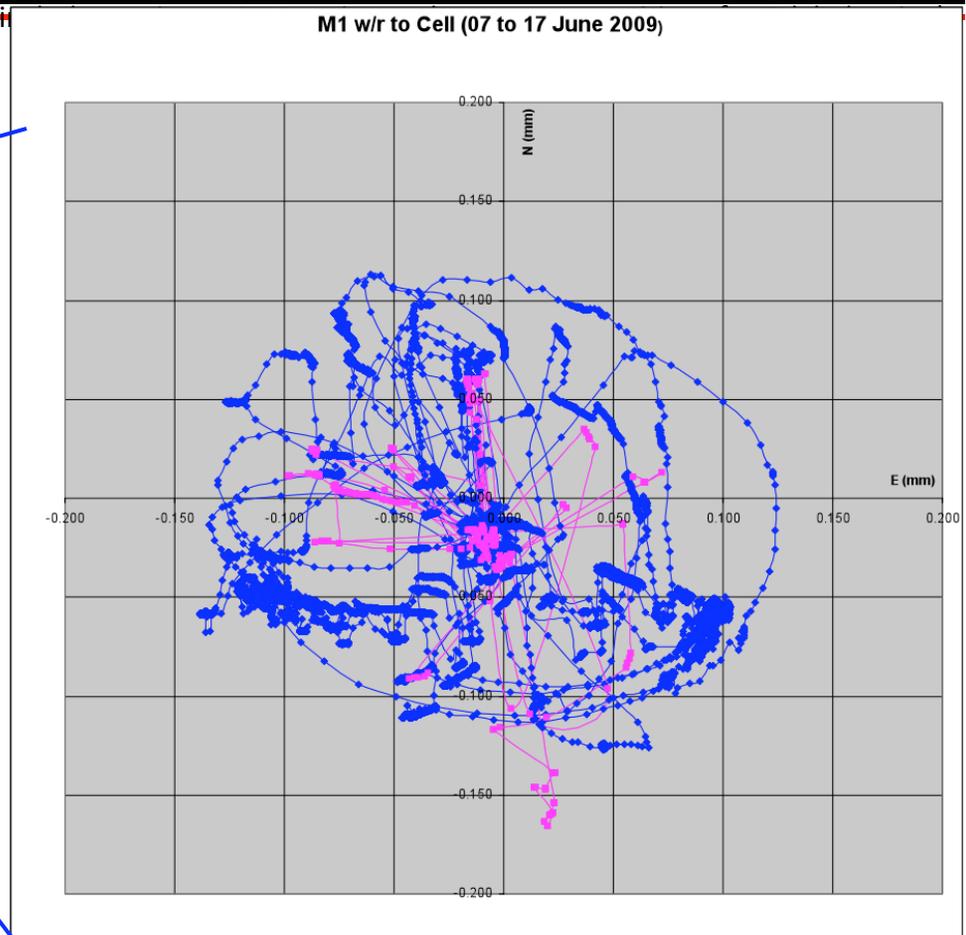


Primary Mirror displacement w/r to its cell



Results: The M1 walk w/r to cell is within a circle of maximum radius $\sim 100\mu\text{m}$ centered in the center of the mirror cell to within $\sim 50\mu\text{m}$.

Traces i



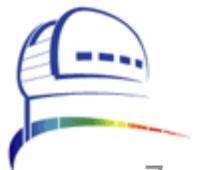


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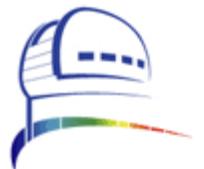




New TCS - Project Motivation

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- **Improve slew times, offset accuracies, pointing and tracking**
 - Tape encoders replace complex system of low resolution absolute plus high resolution incremental encoders
 - The mode-switching control model significantly constrains performance
- **Retire & replace obsolete components**
 - There are many of these.
 - Some components are home built, with off-the-shelf options now available.
 - The power amplifiers are originals.
- **Modernize software**
 - Modern servo technology, both at sense and drive ends, has advanced significantly since the last upgrade (20 years ago!).
 - Builds on the LabView-based system developed for the SOAR 4.2m telescope, and now being further developed for LSST and probably others. Same team.
 - Uses the industry-standard TPOINT kernel (Pat Wallace)





Specifications

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- Slew requirement: 2 degrees in 17 sec
 - To match DECam readout time
- Slew, project goal: 3 degrees in 20 seconds, track-to-track
- *Results – much better!! We achieve $a = 0.8 \text{ deg/s}^2$ and $v_{max} = 0.8 \text{ deg/s}$*
- Tracking: <0.5" drift in 60 sec everywhere within the DES area
- Jitter: 100 mas r.m.s.
- Guide error signal delivery rate: 1 Hz
- *Results – to be tested in January*





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Blanco ECS – Why?

- During operation, the optics of the telescope should be at or close to thermal equilibrium with the external ambient
- René Racine showed in the 1980's that having the primary mirror surface only slightly hotter (0.5C is significant) than ambient causes the formation of a thin, highly turbulent layer of air just above the primary
- This led to improvements and modifications to many of the existing ~4m telescopes, the CTIO Blanco modifications were done in the 1990's by a team led by Jack Baldwin
- The need has not gone away, indeed, with potentially a better performing imager (DECam) at prime focus, it has become even more important





Blanco ECS – Recommendations

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- Modify/Rebuild the primary mirror air extractor/air cooler plenum. The original plenum was removed due to interference with the radial supports
- Upgrade control PC, port software and provide an improved display interface. Better connections to the TCS and weather display system
- Increase the capacity and modernize the glycol cooling hardware

In the longer term:

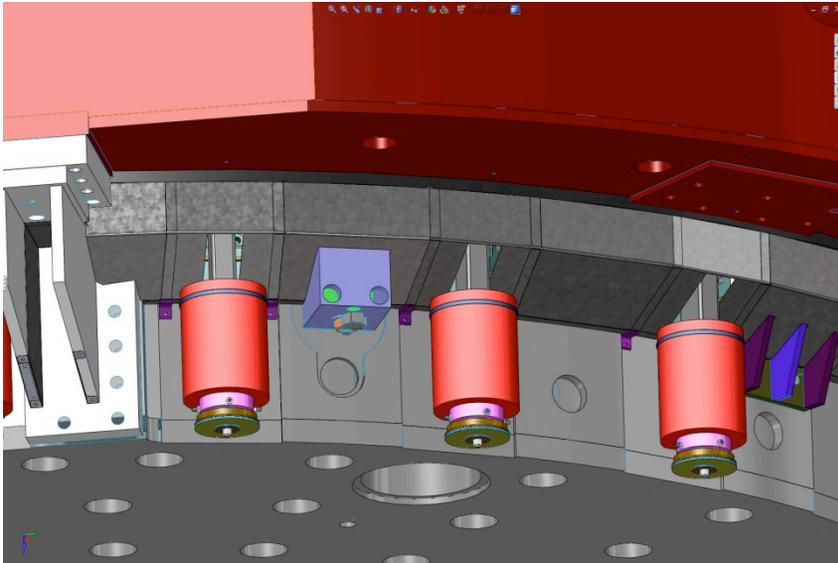
- Consider opening up more vent area
- Better control of the inside dome temperature during the daytime.





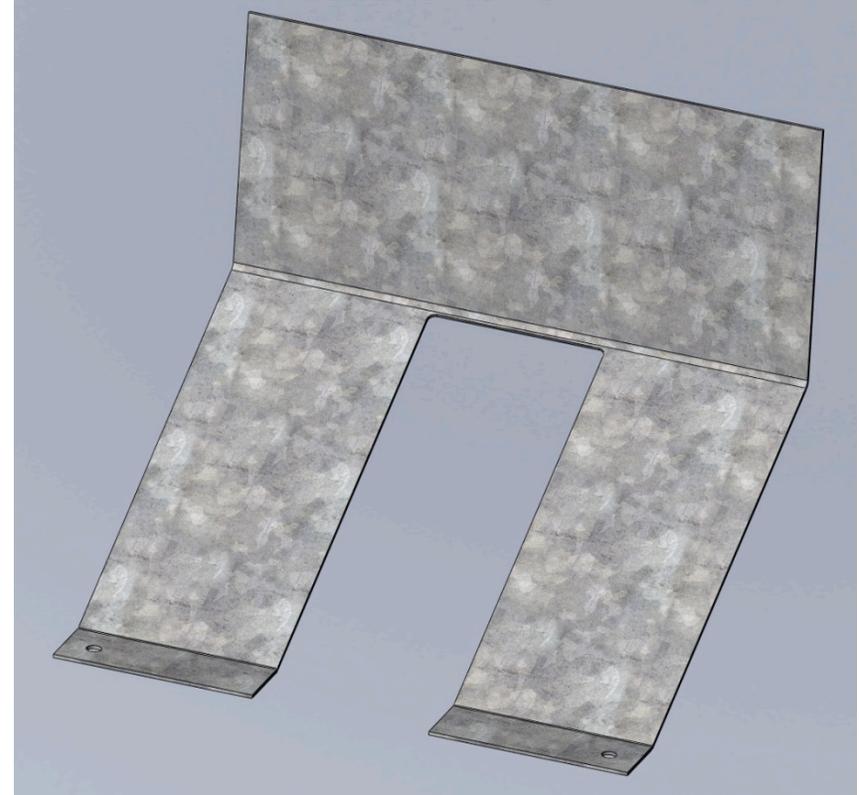
Plenum design

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Old design: monolithic, 3 thicknesses of metal, had to be removed for realuminization

New design: built in small sections, cut & folded sheet metal, remains with the cell. Will be installed in March 2011





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The end

