

HIRES Dewar Upgrade

Project Monthly Report – Sept 20/3

Progress

Detectors

The Science grade CCD mosaic is being assembled.

One of the chips (17-7-6) has several features related to the re-work done at MIT/LL and the Coating done by Mike Lesser. These included apparent cracking of the coating and three bond pads that are gone. Only one of the bond pads was wire bonded to the chip, for a parallel clock. This clock is also attached to another pad. This chip was re-tested in the CCD lab and shown to be working despite the missing pad, and is being installed on the mosaic. We do not have a backup for the science chips we are using on the mosaic.

Mechanical

Footlocker construction is virtually complete. An interconnect panel was designed by Barry Alcott, fabricated, then integrated into the lower dewar panel of the footlocker.

Hanging hardware has been obtained and has been implemented in recent system fit tests and the latest cold test.

All coolant fittings and hoses have been obtained. The far side panel (footlocker) will be modified to accommodate a coolant hose connection panel designed by the shop.

Insulation has been cut, fitted, and implemented. All that remains are the main sheets that connect directly onto the panels. The Poron gasket material has been ordered and is due in any day now.

A cold test was conducted on the entire system in its present configuration. The system was cooled to 0C in the Lick Observatory cold chamber. (See pictures) This test included the engineering grade mosaic cooled to -120C along with all electronics including the components that reside in the footlocker. Adequate cooling of the footlocker has been confirmed at .6 gpm.

During the test, intermittent thermal shorts (coldfinger to pipe) appeared. As a result, the lowest mosaic temperature that could be reached was around -130 C. The coldfinger shall be modified to accommodate Teflon buttons to eliminate possible shorting in the future.

Two major tasks are left to do. The dark slide may need modification to conform to the size and position of the new window. Crate and shipping packages need to be identified for shipment of all equipment.

CCD Controller, VME crate, and host software

Up until late August, we had been using existing DEIMOS software (including the DEIMOS keyword library) for test and debug of the HIRES CCD controller hardware. We have now completed the transition to the new HIRES CCD mosaic keyword library, and are using it for all testing of the HIRES dewar and controller.

Similarly, most of the host application software (e.g., exposure control GUI, ds9 image display) is now running on the new HIRES instrument computer, lehoula. (We have not yet started porting the HIRES instrument GUI, "xhires", or the exposure meter dashboard GUI, but neither of those is needed for our tests of the mosaic.) Also, the HIRES CCD VME crate is now booting from lehoula. At this point, we are no longer dependent on any local UCO/Lick computers when operating the HIRES CCD VME crate, CCD controller, and CCD mosaic.

A preliminary version of the new mosaic exposure control GUI (to replace the existing "xpose" GUI) has been released and is being used to conduct imaging tests.

We are about to begin porting the existing HIRES keyword keyword library (which is used to operate the motorized stages inside HIRES) and the exposure meter keyword library onto lehoula. We will use our Santa Cruz remote operations facility as a conduit for testing these ported libraries by attempting to control the HIRES spectrograph and exposure meter using the newly-ported libraries on lehoula.

CCD Controller hardware/software integration and imaging tests

In late August, hardware fixtures were completed that enabled attachment of a temporary shutter and lens assembly to the front of the HIRES mosaic dewar. The first non-dark (i.e., test pattern) images from the HIRES engineering mosaic were obtained on August 29, and these showed that all 3 CCDs of that mosaic were imaging correctly at moderate light levels and exposure times. These first images were made available to the Keck Observatory Archive team at the end of August.

Unfortunately, further imaging tests in early September revealed a puzzling problem with charge smearing and/or reduced full well capacity when acquiring

images with higher light levels or longer exposure times. Two separate hardware problems were found.

The first (and most baffling) problem turned out to be the result of a subtle design error in the custom PAL chips that Astronomical Research Cameras (ARC) installed on the two clock generation boards that they delivered as part of the CCD controller electronics. The custom PAL chips incorporated a minor change that we had requested to enable us to provide the hardware capability to clock charge from each of the 3 CCDs either separately or simultaneously (so as to be able to provide separate exposures times for each CCD) without any penalty in per pixel readout time.

When these custom PAL chips were delivered in May, they were tested to confirm that they provided the required new functionality; they did. Unfortunately, there was a subtle timing defect in the design of these PALs, which did not become apparent until they were used to take long exposures with a real mosaic. This defect resulted in unstable parallel clocks during exposures of 30 seconds duration or longer, and this resulted in the charge smearing and reduced full well that was observed only on such long exposures.

After reporting this problem to Bob Leach at ARC, they sent us a set of non-custom PAL chips; those have been installed temporarily, and this has corrected the parallel clock instability problem on long exposures so that we can continue our imaging tests. (However, with these non-custom PALs in place, we can not currently clock charge out of each CCD separately.) ARC will re-work the design of the custom PALs and send replacements within the next few weeks (at no charge).

The second hardware problem we found was an intermittent short circuit in the parallel phase 3 clock for CCD #3. This short appears to be either in the hermetic connectors that pass the clocks and bias voltages into the vacuum, or somewhere else inside the dewar.

Finally, in mid-September, fixtures were completed to hold a movable Fe55 Xray source inside the HIRES mosaic dewar. This fixture has been tested with the dewar cold, and a series of Xray images have been obtained that will enable calculation of CTE and gain for each CCD of the engineering mosaic. Those Xray images are now being reduced. The Xray fixture appears to work as intended, except that additional shielding is needed when the Xray source is in its park position. That modification will be made before this Xray fixture is used with the science mosaic.

Issues and Concerns

We will need to repeat the cold chamber test once the changes have been made to the cold finger. This reduces the float in the schedule to about 10 days and does not leave much time for anything else to go wrong.

Schedule

The updated schedule is attached. We currently expect to be ready for a Pre-ship review on November 26th, 2003 which is a move of about 10 days.

Budget and Spending Profile

To the end of August the project has spent \$630,539 or 77% of the project cost estimate, not including contingency. A summary of the budget is attached as is a chart and the spending profile.