HIRES Dewar Upgrade

Project Monthly Report – Dec 20/3

Progress

Detectors

We have a serious contamination problem in the dewar that either started after we installed the science mosaic or only became apparent at that time. With the RGA that detects molecules up to a mass count of 64 we see water, CO2 and N2. Several attempts to dry out the dewar have failed. It appears that water is created when the ion pump is running.

Richard Stover and Kirk Gilmore are leading a drive to solve this problem.

Mechanical

Z-gauge plate has been fitted with an alignment mirror.

The overflow shield has been remade to allow clear access of the electronic connectors to the footlockers interface panel.

An installation and alignment plan has been developed.

A second optical baffle has been fabricated from Delrin.

We have identified one potential optical black coating material that is suitable for vacuum applications. Should it be necessary to re-coat the optical baffle and mask components, this may be used. The product is Pyromark 800 and is made by Tempil. It was mentioned in discussions groups on CCD-World, so it has been used with success and comes recommended. We have since found a local distributor from whom we can obtain the product in gallon amounts, and possibly quart sizes if still available from the manufacturer.

Testing of the CCDs, S/W, and electronics continues in parallel as we continue to work with the issue of water contamination. The optical baffle and mask were removed and the problem became worse. Once at room temperature, a lamp with a 100W bulb directed at the array thru the window boils off the film, which returns once the light is removed and the dewar is cooled again. Experiments to dry out the dewar are currently underway. In addition to the lamp, the dewar, and coldfinger pipe are being warmed with heating coils while pumping on the system continues. This process may boil off the water and remove it from the system. Results of this experiment are pending.

One possible source of the contamination may be coming from the o-ring seal at the field flattener interface. Leak rate calculations show that this might be a

problem. If this is the case, a solution would be to purge the interface joint with a dry gas to keep air (and the accompanying water vapor) out. To this end, an N2 purge assembly has been designed which consists of a 1/4" tube is directed at the window-dewar interface. The interface joint is "sealed" from the environment by a 1/2" Viton band. N2 can be pumped (by small positive pressure) thru the tube to fill the volume made by the rear chamfer on the window. Gas will simply leak (escape) from underneath the elastic band. All the mechanical parts for this assembly have been made and the Viton bands are now on order.

Electronics

We have completed testing of the daughter boards for the CCD controller utilities support board. These new boards control the LN2 fill and the shutter.

Software

CCD Controller, VME crate, and host software

The major effort for this period was mating the HIRES upgrade CCD controller to the CCD interface electronics chassis that provides the electrical interface to the Ilex shutter and the LN2 level sensors for both the 3.8-liter dewar and the 50-liter reservoir. The keywords for reading the shutter open/close status (SHUTTER) and the LN2 levels in the dewar and reservoir (keywords DWRN2LV and RESN2LV) have been successfully tested using a Melles-Griot shutter (borrowed from the CCD lab) and the LN2-level-sensing capacitor for the 3.8-liter dewar.

The dewar auto-fill software that runs in the VME crate has been ported from the Sparcengine-1E architecture (as used in the existing HIRES CCD subsystem in Hawaii) to the PowerPC architecture (used in the HIRES upgrade VME crate). The ported auto-fill software is now running in new VME crate and appears to be functioning correctly, to the extent that it can be tested without the actual auto-fill hardware. Final test and integration of the auto-fill software will occur once the system is in Hawaii and mated with the 50-liter external tank and compressed air solenoids used to operate the auto-fill mechanism.

The source code for the Echelle simulator package and underlying graphics libraries has been updated sufficiently to enable it to be recompiled under modern Fortran compilers, as are installed on Lick SPG machines. (We do not have a Fortran compiler on the new HIRES instrument computer, lehoula). The Echelle simulator package now can be successfully rebuilt on SPG computers, and the resulting executable runs correctly on lehoula. The ability to once again be able to rebuild the Echelle simulator executable enabled us to fix a bug in that package which had prevented it from working correctly in the orientation where the primary dispersion runs vertically on the display screen. As a result of this bug fix, the Echelle simulator now works correctly in either orientation.

Similarly, we have demonstrated that the ds9 image display operates correctly (both for realtime display of the CCD readout and also for displaying images read back in from disk) in a mode in which the image is rotated 90 degrees and flipped in X so as to match the orientation of the Echelle format to which HIRES astronomers have been accustomed for the last decade (i.e., primary dispersion runs horizontally, and the Echelle orders stack vertically). The orientations of the displayed images on ds9 and the Echelle simulator can thus be made consistent, as can the X,Y coordinate systems and CCD pixel numbering.

The new HIRES CCD exposure control GUI has been updated so that it fits better on the screen alongside the ds9 image display. It has also been updated to utilize the SHUTTER keyword so as to graphically display the shutter open/close status (and hence the light-path status) on the GUI, similar to what is done on the ESI and DEIMOS GUIs.

Most of the HIRES CCD upgrade software effort is now complete. The items that remain prior to shipment are:

1. Complete and test the modifications needed to support readout windowing in the column axis of the CCDs.

2. Verify that the revised PAL chip for the clock generation boards will support the future implementation of separate exposure times for each CCD of the mosaic.

CCD Controller hardware/software integration and imaging tests
---
We have previously reported a problem with anomalously low gain on the CCD 1A amplifier. Our initial diagnosis was that this problem was within the dewar, but that proved to be incorrect. The low gain problem was ultimately traced to a broken (cracked) resistor on the CCD 1A video processing board inside the CCD controller. Now that that resistor has been replaced, the low gain problem has been resolved. However, as a result of this hardware repair, we will need to double-check the linearity and gain measurements for that amplifier.

Although we had planned to test the replacement PAL chips from ARC (the ones designed to permit the future implementation of a capability for providing separate exposure times on each CCD of the mosaic) during this period, those tests have been deferred into the next period because the CCD controller has been in nearly constant use conducting various imaging tests to assess the impact of the material that has been condensing onto the surfaces of the CCDs in the mosaic. An extensive number of UV flat field images have been taken in support of that effort to understand this condensation problem.

A series of extremely well focused images of a resolution target have been obtained along with images of a metal plate containing narrow slots. We have analyzed these images to measure the gaps between the CCDs in the mosaic and

the (small) rotations of the CCDs to each other. The measurements have been translated into the appropriate configuration files for the Echelle simulator so that it correctly displays the actual orientation of each of the CCDs in the mosaic.

Issues and Concerns

We have material that may be water condensing out on the science mosaic. Resolution of this problem has been determined to be vital to be solved before shipping. As a result the Pre-Ship Review has been delayed as well as the ship and installation/commissioning schedules.

Schedule

The Pre-Ship review, shipping, installation and commissioning schedules are delayed pending resolution of the contamination problem in the dewar. There are possible installation times in February and April.

Budget and Spending Profile

To the end of Nov the project has spent $ 761,366 or 93% of the project cost estimate, not including contingency. A summary of the budget is attached, as is a chart of the spending profile. We expect to overspend the budget, including contingency, but have no plans to bill beyond the total for the project, including contingency.