

## HIRES Dewar Upgrade

Project Monthly Report – Jan 20 2004

Progress

### Detectors

HIRES science grade CCD 17-7-6 (CCD #2 in the HIRES mosaic) was returned to the CCD lab test dewar #7 for evaluation. It was given an O<sub>2</sub> soak and cooled to approximately -120C. QE measurements confirmed our earlier deductions that the battleship grey was not present during the initial testing of this device. Repeated QE measurements showed that over the course of 68 hours the QE slowly dropped at wavelengths of 5000A and shorter by as much as 12% while going up a few percent at longer wavelengths.

After 68 hours of cold operation the CCD had a noticeable grey appearance but it was still not as bad as 24 hours in the HIRES dewar. A graph of the QE is attached. Whatever is depositing on the CCD appears to be acting to modify the effective AR coating thickness, shifting the optimize wavelength to the red.

As in the HIRES dewar the material deposited on the CCD could be removed by heating the CCD to a temperature between -90C and -80C.

After heating the CCD to -80 and driving off any visible effect the QE returned to its initial value, showing that the QE enhancement of the O<sub>2</sub> soak is not significantly degraded by the contamination.

The month of January was spent trying to isolate the cause of the CCD #2 (17-7-6) surface becoming contaminated. This feature causes the surface to become very battleship grey (hereafter BG). The lab test dewar was cleaned according to the recently established protocol, i.e., acetone bath, isopropyl bath and oven bake. The test dewar was then cooled with nothing in it. Residual Gas Analyzer (RGA) tests showed nothing unusual in the species selected by the RGA. Lab dewar parts were also cleaned as per above but included an ultrasonic clean and DI water rinse before acetone. After the installation of these dewar parts, spider, backplane, thermal circuitry and associated screws, the dewar was pumped and cooled again. RGA tests were again performed with no changes to the relative partial pressure species selected by the RGA. As previously reported, two dead Lot 17 CCDs were obtained from MIT-LL for test purposes. These CCDs were cleaned and put in the test dewar. After pump and cooling, the dewar was allowed to sit for 48 hours before any RGA tests were performed. After 48 hours, an examination of the CCDs revealed no BG effects of any kind. RGA tests again showed no changes of any species in the dewar. Hires dewar parts were then put in the test dewar. These parts included black delrin, a circuit board, mylar shim, copper blocks, hermetic connectors and zeolite cans. These parts have not been

"cleaned" as discussed above but have been wiped with isopropyl to get rid of the worst contamination. After pumping and cooling and being cold for twelve hours, serious BG effects were seen on both CCDs. RGA tests indicated a factor of 10 rise in H<sub>2</sub>O. All other species remained where they were when previous tests were done. Work continues to further isolate the offending Hires part.

### **Mechanical**

All parts of the N<sub>2</sub> purge assembly have been made. The Viton elastic bands have also been obtained.

A procedure for the disassembly of the dewar electronics has been documented. The procedure outlines the removal of the CCD electronics assembly and the electronic box assembly as an integral unit attached to the dewar lid. This sub-assembly can be fixed to a test stand so that it can be bench tested and inspected.

A materials list of all components located within the dewar vacuum housing has been made. A list of the ingredients in the paint used to coat the optical baffle and mask components has also been obtained from the manufacturer.

Investigations are underway to redesign the dewar flex circuit. The objective is to make the flex circuit and its connection to the hermetic connector more durable and robust. Once the new design is complete it will be made available to the manufacturer for a quote.

### **Electronics**

The two Leach 2 video boards that were giving problems were fixed and tested and one can now replace the lab board that was installed in the controller. The remaining spare boards are being tested.

### **Software**

CCD Controller, VME crate, and host software

The major effort for this period was implementation and test of the new mosaic format structures for the image transmission protocol that is used between the VME crate and the host software. This involved a significant rework of the CCD readout code on the VME crate and in the lickserv2 software that runs on the host. These changes were needed to support readout windowing in the column axis of the mosaic, which was the last major software item outstanding at the end of the previous review period.

The new mosaic format structures are now in place and functioning as intended. We are now conducting tests of readout windowing in the column axis of the mosaic. This testing is being done without the dewar attached, so we are

adjusting the video offsets of each video processing board in order to simulate distinct data for each of the 6 readout amplifiers.

We are also continuing to make minor refinements in the new HIRES CCD exposure control GUI in order to support readout windowing in the column axis.

We are also working up the estimate for the software effort that would be required to fully implement the capability for supporting separate exposure times for each CCD of the mosaic.

#### CCD Controller hardware/software integration and imaging tests

Since the mosaic has been removed from the dewar and the dewar disconnected from the controller for nearly all of this period, no imaging tests have occurred during

#### Issues and Concerns

The contamination issue and its resolution remain the most significant problem for this project. Until a resolution is determined, and meaningful schedule is not possible.

#### Schedule

The Pre-Ship review, shipping, installation and commissioning schedules are delayed pending resolution of the contamination problem in the dewar. The earliest installation date is now in August.

#### Budget and Spending Profile

To the end of Dec the project has spent \$779,850 or 96% of the project cost estimate, not including contingency. A summary of the budget is attached. We expect to over spend the budget, including contingency, but have no plans to bill beyond the total agreed to price, which includes contingency.