

Monthly Status Report  
Robert Stobie Prime Focus Imaging Spectrograph  
April 2007

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This RSS monthly report summarizes the RSS status as of April 30, 2007.

## Optics and Testing

- Monochromator transmission results for lens coupling fluid from the SOAR Goodman spectrograph confirm that LL5610 lens coupling fluid exposed to viton causes a roll-off in transmission below about 360 nm. Chris Clemens supplied several samples of new fluid and fluid exposed for one month and for three years from the spectrograph. The fluid exposed for three years showed a transmission of 60-80% at 340 nm and 30-70% at 320 nm. We will now need to decide whether the risk of this UV loss, which is more modest than the polyurethane effect, justifies a possibly more involved replacement of the RSS viton O-rings, which would require a full disassembly of the multiplets.
- Progress toward a repair of the UV loss problem:
  - An SPIE article was found describing the Keck LRIS-B UV camera optical design (McCarthy et al 1998 SPIE 3355, 81). It specifies yet another coupling fluid, Cargille FS50350, a hydrocarbon-based liquid. It was to be used with neoprene rubber O-rings and an unspecified expansion bladder material. We are trying to get comments from the LRIS-B article authors on their experience with this, with no response yet.
  - Samples have been obtained of possible replacement materials for the RSS O-rings, the expansion bladders, and/or the coupling fluid. A new fluid, Cargille LL3421, which is a perfluorocarbon, a completely different formulation from LL5610 and 1074 (“siloxane”), is a promising possibility, since it could potentially allow for a fix of both the polyurethane and viton compatibility problems with a simple exchange of fluid. However, because the maximum index of refraction of the LL3421 fluid is 1.40, and the optimal index for RSS is 1.46 - 1.49, there is a small performance penalty: reflections at the fluid-glass boundaries are increased by 3-4×, resulting in a transmission loss for the spectrograph of about 1%, and for the polarizing beamsplitter of about 0.5%. No fluid-surface reflectivity exceeds 1%, so the increase in ghosting should not be an issue.
  - We will proceed with flushing the fluid first from the non-NaCl multiplets and the beam-splitter, since that needs to be done regardless of the ultimate bladder/ fluid choice. Consultation with NaCl lens manufacturers indicates that anhydrous ethanol is a likely safe solvent for the flushing process, but several more compatibility tests will have to be run first.
- The camera triplet has been disassembled far enough to identify the grey loss in this multiplet. Apparently a large amount of fluid was lost, completely collapsing the expansion bladders. This brought the curved NaCl/ silica surfaces into contact. After slowly backing off the pressure and refilling the fluid, the surfaces resumed their normal positions, and the bright

contact disk vanished. There is no evidence of damage to the optical elements, and there is no sign of further liquid loss in the last few weeks. However, the source of the liquid loss is still unknown. The remaining multiplet bladders will be inspected for similar effects to see if this is a generic problem.

- Spectrum Thin Films has evaluated the failed field flattener coating that is implicated in the "yellow ghost" problem. Contrary to indications from last month, while they admit that there is a serious problem with the coating, they do not know what caused it. The part has been sent to Janos to have the coating polished off in preparation for recoating. SPT has proposed that after recoating they apply a new water resistant overcoating which is much more impervious to moisture than the previous coating. They will have to first verify that this does not affect the UV performance.
- A draft of a publication on the Littrow ghost (Burgh, Bershady, Westfall & Nordsieck) has been circulated.

## **Mechanical**

- Slitmask mechanism. The slitmask mechanism is being redesigned to eliminate the jamming which plagued its early operations. The reworked mechanism has been assembled, and bench testing is in progress.
- Grating mechanism. We have been attempting to alleviate excessive bearing play in the grating rotation stage, which has been implicated in the cross-dispersion spectral mode image motion observed during commissioning. A new grating rotation stage has been received. The mechanical interface is being reworked to be compatible, since this is an "improved" stage with a slightly different bolt pattern. The old stage has been disassembled and excessive bearing play has been identified. The manufacturer has agreed to a fix for this. When complete, the bearing play of both units will be measured and the better one re-integrated with the instrument.
- Filter mechanism. A modification of the filter holders has been devised that will prevent wear on the bar codes that makes them unreadable after several months of use. All the existing filter holders have now been so modified, and are awaiting a black finish.
- Etalon mechanism. A modification to the etalon seating fixture has been designed to improve the etalon flexure during an observation. Machining is underway.
- Baffling. New baffling material has been procured to repair the moving baffle and make it more robust. An improvement to the filter insertion seal is also being investigated.
- Installation/ removal improvements. It has been decided that a structure modification is unnecessary to allow routing of payload cabling beneath the instrument, allowing its removal and installation without decabling the payload.

- Humidity sensors for the instrument air supply are being procured.

## **Control**

- Electronics box fixes: New, more robust electronics box brackets have been designed for the PSC1 and PSC2 boxes; design of the PDS and SCB box brackets is in progress.
- Detector work continues:
  - Amplifier crosstalk. This problem is definitely within the cryostat, and will require major surgery to fix. The investigation will continue, but a repair will be postponed for now.
  - Anomalous CCD full well. This is now known to be associated with the CCD output node. Apparently, in the "high sensitivity" mode that is currently being used, the signal saturates the output amplifier at 150 ke. It would be possible with the current interface to switch to a "low sensitivity" mode, which would have a maximum signal of 600 ke, accommodating the full capability of the chip summing wells. Testing shows that in this mode, readout noise is approximately double that in high sensitivity mode, at the same gain. A proposed change to the current four gain/ speed choices has been proposed, in which the BRIGHT/ FAST mode uses low sensitivity, and FAINT/FAST uses high sensitivity but a lower gain.
  - An improved binning scheme proposed by Ted Williams, which eliminates fractional pixels between amplifiers, has been implemented and is being tested.
- Coding of the high level PCON control software is in progress.

## **Management**

- The RSS schedule has been updated, and is attached to this report. The delivery of the optics to South Africa is unchanged, except that the flattener would be shipped later, to allow more time for recoating.
- The 2006 Quarter 3 Quarterly Management Report was finished. Work proceeds on the 2006 Quarter 4 Quarterly Management Report.

## Activities for next month

- Analysis
  - Work on analysis of polarimetric commissioning data.
- Optics
  - Test compatibility of possible fluid/ bladder materials at Pilot Group. Complete flushing of multiplets.
  - Polish bad coating off field flattener (Janos).
- Mechanical
  - Finish testing the reworked slitmask mechanism.
  - Finish grating rotator interface modification; repair old rotation stage.
  - Finish machining improved etalon seat.
  - Finalize redesign of articulation fall arrester.
  - Finish design of improved electronics box brackets.
  - Design improved instrument installation and removal fixtures.
  - Review optics and instrument installation/ removal procedures.
  - Work on baffling improvements for the moving baffle and filter insertion seal.
- Control
  - Continue coding of PCON high-level control software.
- Detector
  - Complete full well and crosstalk investigations.
- Management
  - Finish Quarter 4, 2006 Quarterly Report.



