

Monthly Status Report
Robert Stobie Prime Focus Imaging Spectrograph
February 2007

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This RSS monthly report summarizes the RSS status as of February 28, 2007.

Optics and Testing

- Monochromator transmission results have now been obtained for all nine multiplets in the RSS optics. We can separate the results into three spectral signatures:
 - 1) yellow-green reflection. In just the field flattener, there is a ~20% reflectivity and transmission effect near 500 nm.
 - 2) UV loss. A sharp drop at 375 nm (~ 20 nm wide) to a plateau, seen in four multiplets.
 - 3) grey loss. In the three singlets, there may be ~5-10% grey loss, while in three of the four UV-loss multiplets there is a substantial (15 - 25%) grey loss.

Our deductions, in order of increasing confusion (schedule implications of this are described below in "Management"):

- 1) The yellow reflection problem in the field flattener is nicely consistent with being the origin of the "ring ghost" that confounds the Fabry-Perot calibration. The monochromator transmission curve shows in addition a ~10% absorption effect below 500 nm, but no UV drop. Given that the surface that can reproduce the ring ghost looks yellow, and we have a notation that this was noticed on receipt from the coating manufacturer (Spectrum Thin Films), this really looks like a one-time production problem that was missed by STF. We are sending it to STF for evaluation. They will attempt to clean it using more aggressive cleaning techniques than we would attempt, but most likely it will have to be polished off and recoated.
- 2) The four groups with UV loss are the collimator triplet and doublet and the camera quartet and triplet. One of those, the camera triplet, does not have CaF₂, so that ruins the coating-induced CaF₂ color center theory, and the hopes of fixing the problem with a UV flood. (Since one bad UV group has only CaF₂ surfaces and one has only Silica surfaces, one would require a color center problem that is identical in the two materials, extremely unlikely. The consistent appearance of the UV loss signature means there has to be something in common). As a result the whole UV flood effort has been dropped. So what is in common? Looking at the two surfaces involved in each of the bad UV groups:

Coll Trip:	CC solgel/ CaF ₂	STF MgF ₂ / CaF ₂
Coll Doub:	STF ML/ CaF ₂	STF ML/ Silica
Cam Quart:	STF ML/ Silica	CC solgel/ CaF ₂
Cam Trip:	CC solgel/ Silica	STF ML/ Silica

Substrate: as above, there is no one substrate in common

Coating: there is also no one coating in common (no solgel in Doublet; no ML in Coll

Triplet)

So it's got to be something else, and the fact that these are all multiplets is the only thing we can see. The coupling fluid is a logical suspect, and we are moving onto that track as our next effort. First, we will be measuring the transmission of the fluid still on hand. If it is the problem, it is conceivable that the fluid can be exchanged without demating the multiplets (easiest for the two which don't have NaCl). We also need to check the beamsplitter, which also uses the same coupling fluid. It is interesting that there is one multiplet, the field lens, that shows little UV absorption. We don't know what to make of that.

- 3) Grey loss. The worst grey loss is in three of the four multiplets having UV loss. Hopefully, if the UV loss is caused by lens fluid this will also explain and fix the grey loss, though why one of the UV loss multiplets does not show grey loss, we don't know. There are also the three singlets that appear to show a marginal grey loss. We don't know whether our monochromator setup is capable of reliable measurements at this level: one of the most difficult things is to avoid geometric beam effects that would mimic a grey absorption. If one compares the total camera and collimator throughputs as deduced from the monochromator and from our laser tests, the monochromator is 10 - 20% low, so a grey loss in the monochromator is a concern. We are shipping our laser equipment out to Pilot Group to try and get a second opinion on that. If this effect is real, it is disturbing, since one thing in common here is that they all have Cleveland Crystals (CC) solgel coatings. Degradation of solgel coatings would very likely be grey.
- Our inspection of the camera in October revealed a bright disk-shaped reflection that was not there when it was installed. Alan Schier has confirmed that this is in the camera triplet, and looks like there are two elements in contact. This would cause a grey loss of ~8% if there is air in the gap. This multiplet, unfortunately a NaCl one, will certainly need to be disassembled to fix this.

Mechanical

- Slit Mask mechanism. The slitmask mechanism is being redesigned to eliminate the jamming which plagued its early operations. The reworked mechanism is being reassembled after anodizing, and the test apparatus is ready for testing, likely to begin with the next two weeks.
- Grating mechanism. A new grating rotation stage has been ordered. This has a redesigned interface which it is hoped will better meet bearing-play specifications which are implicated in the spectral mode image motion.
- Filter mechanism. A modification of the filter holders has been designed that will prevent wear on the bar codes that makes them unreadable after several months of use. One filter holder has been modified in this way, and will soon be tested.

- Etalon mechanism. A modification to the etalon seating fixture is being designed to improve the etalon flexure during an observation.
- Articulation fall arrester. This mechanism is being revisited to see if there is a solution which is less maintenance-intensive. The margin requirements of the arrester need to be re-evaluated first.
- Baffling. New baffling material has been procured to repair the moving baffle and make it more robust.
- Storage boxes are being designed for slitmasks and filters when they are not in the magazines. The slitmask storage box has been finished, and the filter storage box should be done in the next month.
- A bracket is being designed to mount the UW Startracker on top of RSS to provide a wide-field (7°) digital image of the telescope field of view. This is to be used for evaluation of cloud cover and for outreach.
- Humidity sensors for the instrument air supply are being procured.

Control

- Electronics box fixes:
 - The 24 Volt motor power supply which fried after removal of RSS has been repaired, and a spare ordered.
 - An additional heat exchanger has been installed in the main power supply box, in an attempt to reduce marginal temperatures in the box. This will be tested in the next few weeks.
- The guide probe interface to RSS, damaged during removal of the instrument, has been fixed. The guide probe interference which prevented reliable access to parts of the field of view has also been fixed.
- Detector work continues on the anomalous CCD full well and the amplifier crosstalk.
- The new RSS Software Design Document, documenting high level operation of RSS, has been finished, and is under review.

Management

- The RSS schedule has been updated, and is attached to this report. In particular, the optics repair section has been completely reworked to reflect our new understanding of the repair

process. Our current best estimate of the ship date to South Africa is May 30, 2007, about one month later than the previous schedule. With more conservative shipping and re-assembly assumptions, this would place lift of RSS onto the telescope on 4 July, 2007, with recommissioning extending into late July. This schedule is based on two conservative assumptions about the optics repair process, 1) the field flattener coating will not be successfully cleaned, and its coating will need to be polished off and replaced, and 2) the four multipllets with UV and grey loss will have to be disassembled, cleaned, and reassembled to fix the presumed lens coupling fluid problem. If the multipllets can be simply drained and refilled, a savings of one month would result, returning to the original ship date (even assuming the conservative flattener repair scenario). On the other hand, the lens fluid scenario has not been absolutely established (it will be in the next month), and there is still the possibility of an additional coating-related problem hidden beneath it which might, for instance, cause grey loss. But for now, we assume that there are just two independent problems, the yellow field flattener coating and UV/ grey loss in the lens fluid.

- Work proceeds on 2006 Quarter 3 Quarterly Management Report

Activities for next month

- Analysis
 - Work on analysis of polarimetric commissioning data.
- Optics
 - Test transmission of lens fluid samples at Pilot Group. Start repair of UV-loss multiplets.
 - Spectrum Thin Films inspection of and attempt to clean field flattener
- Mechanical
 - Finish assembly and start testing of the reworked slitmask mechanism.
 - Test filter holder bar code modification.
 - Finish design of etalon anti-flexure seat.
 - Ship spare invar tubing to South Africa for use in modification of the RSS mechanical interface to simplify instrument installation and removal.
 - Review optics and instrument installation/ removal procedures.
 - Finalize redesign of articulation fall arrester.
 - Work on baffling improvements for the moving baffle and filter insertion seal.
- Control
 - Review Software Design Document.
- Detector
 - Complete full well and crosstalk investigations.
- Management
 - Finish Quarter 3, 2006 Quarterly Report.

ID	Task Name	Start	Finish
1	MS	Thu 11/16/06	Mon 11/20/06
2	MS	Tue 11/21/06	Tue 11/28/06
3	Remove Deaver window	Wed 11/29/06	Tue 12/5/06
4	RSS Fixes	Mon 12/11/06	Fri 4/27/07
5	Slit Mask mechanism Rework	Mon 12/18/06	Fri 4/27/07
6	Integrate Mechanical	Mon 12/18/06	Fri 3/16/07
7	Electronic Testing	Mon 3/5/07	Fri 4/6/07
8	Integrate with Instrument	Mon 4/9/07	Fri 4/27/07
9	Grating Fork Flexure Correct	Mon 12/11/06	Mon 4/23/07
10	Grating preload plate: mod and remake	Mon 12/11/06	Fri 1/19/07
11	Order spare rotation stage	Mon 1/8/07	Fri 3/30/07
12	Measure play on new stage and compare with	Mon 4/2/07	Mon 4/2/07
13	Disassemble to check/correct existing stage fr	Tue 4/3/07	Mon 4/23/07
14	Filter Mag bar code reading	Mon 1/8/07	Wed 4/4/07
15	Design Fix	Mon 1/8/07	Tue 1/30/07
16	Machine 1 Holder/ Test	Wed 1/31/07	Tue 2/13/07
17	Machine Filter Holders	Thu 3/8/07	Wed 4/4/07
18	Fix slow wave plate slide	Mon 1/8/07	Fri 1/26/07
19	Beam Splitter / Air wrap interface	Mon 1/8/07	Fri 1/19/07
20	Improve Etalon flexure	Mon 1/8/07	Fri 4/27/07
21	Design	Mon 1/8/07	Fri 1/26/07
22	Machine	Mon 3/19/07	Fri 4/27/07
23	Electronics Fixes	Mon 1/8/07	Fri 3/16/07
24	Fix YoYo Power Supply	Mon 1/22/07	Mon 1/22/07
25	Fix mains connector on POS box (strain relief)	Mon 1/8/07	Mon 1/8/07
26	Replace 24V PSU (UZ)	Mon 1/29/07	Fri 3/16/07
27	Mount PDS box heat exchanger	Thu 1/18/07	Wed 3/7/07
28	Instrument Interface	Mon 1/8/07	Fri 3/30/07
29	Instrument Air Dryness	Mon 1/8/07	Fri 3/30/07
30	Repair guide probe elect interface	Fri 1/26/07	Tue 2/6/07
31	Fix guide probe interference with front of RSS	Mon 1/29/07	Fri 3/2/07
32	RSS Improvements	Mon 1/8/07	Fri 4/27/07
33	Rework Articulation Fail Arrestor	Mon 1/8/07	Fri 4/13/07
34	Design	Mon 1/8/07	Fri 3/16/07
35	Implement	Mon 3/19/07	Fri 4/13/07
36	Electronic box mounting brackets	Mon 2/12/07	Fri 4/6/07
37	Replace optics thermocouples with AD590's - cablr	Mon 3/5/07	Fri 3/23/07
38	Buffer Purge Improvements	Mon 1/8/07	Fri 4/27/07
39	RSS: payload baffling	Mon 1/8/07	Fri 3/30/07
40	Improve window purge/ seal	Mon 3/12/07	Fri 3/30/07
41	Moving baffle	Mon 3/5/07	Fri 4/27/07
42	Mount Star Tracker on RSS	Mon 1/22/07	Fri 3/16/07
43	RSS Detector Improvements	Mon 1/22/07	Wed 5/2/07
44	Crosstalk	Mon 1/29/07	Thu 3/22/07
45	investigation/test	Mon 1/29/07	Fri 2/9/07
46	apply fix	Mon 2/12/07	Thu 3/22/07
47	Full well investigation	Mon 1/22/07	Mon 3/12/07
48	phase 1	Mon 1/22/07	Fri 1/26/07
49	phase 2	Mon 2/12/07	Mon 3/12/07
50	temperature control	Fri 3/23/07	Wed 4/11/07
51	design mod	Fri 3/23/07	Wed 3/28/07
52	manufacture & clean	Thu 3/29/07	Thu 4/5/07
53	test	Fri 4/6/07	Wed 4/11/07
54	upgrade vacuum valve	Mon 2/19/07	Wed 3/14/07
55	design/manufacture parts	Mon 2/19/07	Fri 3/2/07
56	clean & test	Mon 3/5/07	Thu 3/8/07
57	install & test	Fri 3/9/07	Wed 3/14/07



