Monthly Status Report
Prime Focus Imaging Spectrograph
September 2002

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Optics

• The Opto-Mechanical Consulting subcontract has been awarded to J. Alan Schier (Pilot Group), and a kick-off meeting is scheduled for Oct 18. The subcontract will cover opto-mechanical tolerancing, help on release of the collimator and camera optics RFPs, design of the lens cells, fabrication of lens cells, and assembly of the lens groups.

• Improved the VPH RCW code user interface to support VPH grating planning

- Modified the code to print out the T_M - T_E phase delay in VPH gratings to see whether this might result in depolarization of the E and O beams in polarimetry (suggestion of Jaap Tinbergen at SPIE conference). In the Kogelnik approximation, the phase delay in first order appears to be identically zero. In RCW, the gratings so far run have a nonzero phase difference, but it is <~0.01 wave in regions of interest, which would give < 0.1% depolarization for an E-O axis 45 deg to the grating axis (the current baseline). We are in the process of verifying this calculation.
- Verified that all but the lowest density VPH grating in the proposed PFIS complement are well represented by the Kogelnik approximation. We are devising a tool to allow easy optimization of the grating complement using Kogelnik, to prepare for grating blank procurement and the grating RFP.

• Received quotes for the folding flat and ordered it from NuTek. Expect delivery in 4-5 weeks.

• Developed Phase 4 event list and timeline for integration and testing.

• Further progress has been made on assessing the birefringence of the elements between the waveplate and beam-splitter. A depolarization budget has been established to quantify the relative importance of the elements. The goal maximum mean-square phase delay in U (at 45 degrees to the E/O beam axis) is 20 nm. This would cause a depolarization of 1, 2, and 4% at 586, 430, and 320 nm. Remaining concerns (other than the VPH gratings mentioned above) are:

- The NaCl element. No manufacturer actually has data on stress birefringence in their NaCl blanks. Hilger (the most inexpensive vendor) believes that theirs is on the order of 10 nm/cm, which would in worst case contribute about half of the acceptable budget. We have found a crystal firm in the US which has equipment to measure stress birefringence to good accuracy and is willing to measure blanks from other manufacturers, and Hilger has agreed to send them some samples, including some that have been "annealed", which should improve stress. We should have results by mid-October.
- The etalons. The specification for the etalon fused silica is < 5 nm/cm. In worst case, this would give a similar depolarization as the NaCl element. This effect is probably unavoidable, but applies only to the Fabry-Perot polarimetry mode, which goes down to only 430 nm.
- The folding flat coatings. Using the current LLNL coating model, the depolarization for the E-O axis 45 deg to the fold axis rises to 2% at 320 nm.

Mechanical

• We are currently going through the final process of hiring the services of the design consulting company, Design Concepts. They will assist us with the final drafting and consulting on best practices for having components machined.

• The design of the Articulation Mechanism is progressing well and should be tied up in the next week. All major components have been chosen to meet the system specifications and are being implemented into the solid model. We have settled on a rack and pinion drive with a powerful detent for precision alignment at about 200 discrete positions. The system is designed to facilitate 90 degrees of motion in under 20 seconds.

• The truss layout has been updated to the latest optical geometry.

• Started development of the detailed Phase 4 fabrication timeline.

Control

• The "generic mechanism" (a laboratory setup to aid in testing control software for the PFIS mechanisms) hardware has been finished.

• The Labview software for the generic mechanism has been coded, including a client/server prototype, and scripting concepts. Testing awaits delivery of the PFIS Instrument Computer, expected Oct 7.

• Worked with the Electrical Engineer in refining the specification for the interlock system

• Worked with the Electrical Engineer in defining the architecture of the control box. The current concept is to divide this box into PXI/ power supply, collimator control, and VIS camera control boxes, allowing the NIR camera control to be added in a modular manner.

• Worked with the Electrical Engineer on the wiring diagrams.

• Developed Phase 4 control system coding, integration, and testing timeline.

Management

• Finished budget restructuring of Capital Items and Subcontracts. Moved Swales detailed PDR mechanical and control system procurement and fabrication estimates into this format and updated to the latest mechanism configuration.

• Started integration of the detailed phase 4 schedule.

Detectors (Darragh O'Donoghue; James O'Connor)

• Planned preparation for PFIS CDR:

- Latest interface specification: mid Nov. - (Wisconsin to provide)
- Final design of Cryostat: Dec to mid Feb.
- FDR Documentation - complete by mid Feb
- Manufacturing drawings - mid Feb to end March.

• The current concept is
- The design is to be a clone of Salticam Cryostat (even some common components).
- The housing will be modified from the PDR round design to have similar flats as Salticam.
- Most probably a similar type plugbox as Salticam.

Etalons

(Ted Williams and Chuck Joseph)
• The Rutgers Effort to acquire and test the Fabry-Perot Etalons is proceeding on schedule and within budget. The etalons were ordered in the first quarter of 2002 and Rutgers expects delivery in late December or early January. A status report on the Etalon Fabrication is given below.

• Rutgers has developed a test apparatus for evaluating etalons. A 0.5 m focal length spectrograph was purchased for $9630. Two additional granite slabs with supporting tables and optical rails were acquired. In addition, two 90 mm aperture, 1000 mm focal length telescopes were bought. The entire setup was purchased using external funds (i.e. that will not be charged to the SALT budget). These telescopes are used without their eyepieces, one to collimate the beam from the light source and the second to re-image the light onto the slit of the spectrograph. (For the SALT/PFIS etalons, these 90 mm telescopes will need to be replaced with 150 mm ones.) The etalons are slid in and out of the beam for testing. The entire 3.5-meter-long apparatus is optically shielded from stray light by the telescopes and the slide mechanism. Also, the entire optical bench has been leveled, is vibration isolated, and has very minimal flexure. Extra lamps, both continuum and line sources, were supplied by external funds as well.

• Rutgers has secured the services of an outstanding mechanical engineer (ME), Sam Goldfarb. We have initiated a meeting with Mr. Goldfarb and generated a list of requirements. The ME design for the insertion and retraction of two etalons is straight forward. The only outstanding concern is the grappling system that will be used to remove (or install) the etalon assemblies from/into PFIS during telescope operations. We can accommodate a number of different grappling systems, but this will need to be defined. Once the etalons arrive and are evaluated the final selection of the filter set will be made.

• Etalon Fabrication: (as Reported by IC Optical Systems)
The fused silica blanks have been polished to the stage where the centre optical elements have just today been optically contacted to the end plates. At this stage the matching of the etalon surfaces will be started prior to the coating. We have all the materials to construct the piezo electric actuator stacks and we will shortly be ordering the printed circuit cards and metalwork for the cells. Please note that there are 3 ET150s in work at present. The two CS100s have completed testing and will be ready to ship at any time in the near future. We need confirmation as to the final length of the cables.

Activities for the next month

- Mechanism designs:
  - UW work with Rutgers ME on etalon mechanism interface
  - start on filter mechanism design
- Optics
  - optomechanical subcontract kickoff meeting
  - work on camera/ collimator blank RFP's
  - write grating blank RFP
- Control
  - test generic mechanism software
  - continue wiring diagram design
- Detectors
  - ICD and Statement of Work update
- Management
  - Finish Phase 4 detailed schedule