SIS News

Status of current guiding efficiency

During the SIS commissioning in July 1992, we demonstrated that the SIS active guiding loop was working similarly to HRCam, indeed improving the image quality, with an amount comparable to the HRCam image improvements. However, we also demonstrated that the SIS active guiding, as delivered to CFHT, was only possible for stars brighter than V=14.4, a 3 magnitude difference from what was expected. In December 1992, we encountered severe problems with the SIS guiding system which prevented from using the active guiding loop in December 1992 and again in February 1993 (not enough time for extensive SIS testing in between these two runs).

Extensive testing of the SIS active guiding occurred in May 1993. The inability for the active guiding loop to work in December and February was traced to two faulty components: (i) one of the piezo-actuators on the SIS mirror, was not responding to the deformation signals, (ii) a bad connection within one of the 4 photomultiplier units. In addition, we found that the fiber feeding the 4 quadrant PMTs with the star image, had slipped in its holder sending defocussed images to the PMTs, and reducing the S/N of the system. These three combined prevented us from reaching a real time diagnostic earlier in the semester.

The 3 above problems have been fixed by (i) replacing the faulty piezo-actuator by a spare, (ii) exchanging the PMT unit with one of the MOS units and (iii) refocusing of the fiber feed. The SIS was then successfully put back in operation August 19, 1993, during one engineering night. Proper calibration of SIS vs. TCS guide signals was achieved. A new Pegasus UI tool was implemented to allow for easy set-up of the active guiding. The active guiding demonstrably improved the image quality, although variable seeing this night did not facilitate the analysis. Finally, the efficiency of the guiding system has been measured to have improved to allow active guiding on stars with V=15.8, a result of the extensive lab tune up. Together with revised projections from the OPM team, the measured and predicted efficiencies of the current SIS guiding agree to within 0.5 mag.

SIS was then successfully used August 20 to 25 by visiting observers. Exceptional image quality as good as FWHM=0.38 arcsec under active guiding mode was reported by observers and later confirmed by measurements on images.

Plan for guiding system upgrade

The current limiting magnitude of V=15.8 of the guiding system falls short of V=19 currently achieved with HRCam. G. Barrick and G. Monnet have designed a new optical system, with a feed to avalanche photo-diodes (APDs), with the goal to improve the efficiency to allow guiding on stars V=18.5 or brighter. The new optics are based on a set of 4 micro-lenses feeding directly the APDs fibers. While the APDs alone will allow a gain of ~2 magnitudes compared to the PMTs, the new optics should allow a ~0.5 magnitude gain, largely due to the elimination of a 1m long fiber in the present system.

The current plan to upgrade the SIS guiding is as follows:

1. Design new optical system .... *done*
2. Design new mechanical assembly .... *done*
3. Order new set of optics from OPTEC .... *done*
   delivery date = December 1st
4. Assemble the optics and mechanics including fiber coupling onto micro lenses.................. *at DAO, December 10, 1993 to January 7, 1994*
5. Delivery and installation at CFHT with DAO's help .... *January 7, 1994*
6. Testing on sky January 11–12, 1994

This schedule is very tight, and provision has been made in 94II for additional engineering nights if the January 11–12 deadline is not met (late delivery of optics, problems with assembly, etc.).

SIS, with this new guiding system will then meet most of the requirements of HRCam, with the added benefits of a wider field of 3'x3', much better flat fielding, and a long slit and multi-slit spectroscopic capability under active guiding.

O. Le Fèvre

Status of the High Resolution Coudé F/4 Spectrograph (GECKO)

Brief History: Recently renamed, GECKO (**G**rating **E**chelle **C**oudé spe**K**tr**O**graph!) was conceived in the early years of the CFHT as a single order, high resolution (R=120,000) spectrograph using a mosaic of four 316 g/mm echelles used at low order. The steady scientific success of the f/8.2 spectrograph was a strong reason to pursue the implementation of the higher resolution spectrograph.

First light was attained on the night of September 18, 1992, when the first spectra, including some of stars, were recorded. Additional tests on the sky were made during November and December, 1992, and a variety of stellar objects were observed in early December. The early tests revealed a serious flaw, however: one of the echelles had a significant surface curvature, instead of being perfectly flat, leading to badly out-of-focus images from that echelle when the instrument was focussed for the other three. Subsequently, a second echelle began to demonstrate defocus, so it and the other bad echelle were sent to Milton Roy laboratories for detailed testing. Interferometric tests confirmed the curvature of the echelle surface. While these tests verified the previously diagnosed problems, both echelles were damaged in shipment. We arranged for replacement echelles from Milton Roy, which have since been received and installed in the spectrograph.

Over the summer the grating cell support system was modified extensively to ensure reliable positioning of the echelles with uniform pressure and with backup mechanical readouts of the alignment adjustments. A special mechanical jig was designed and fabricated to permit accurate installation of each echelle in the cell.

A variety of tests will be made prior to the observing run scheduled at the end of December, 1993, which will be used to improve the software control system for instrument setup and focussing control for the observers. One of the more complicated parameters to characterize is the correct position of the third element of the corrector lenses, which is wavelength sensitive, but the precise position of which determines the flatness of the spectrograph focal surface, which must be very flat to match the large flat CCDS to be used as detectors.

J. Glaspey