

(52 actionneurs sur le miroir comparés à 19 détecteurs pour l'analyse de la surface d'onde) dans le but de faciliter les développements prévisibles du système. Dans une première phase d'utilisation, la surface éclairée du miroir déformable ne couvrira que quelques 20 actionneurs sur les 52 disponibles afin que le nombre de détecteurs utilisés pour l'analyse de la surface d'onde corresponde au nombre d'actionneurs commandés sur le miroir. Par la suite, les 19 photodiodes à avalanche seront remplacées par de nouveaux détecteurs bidimensionnels à comptage de photons, actuellement développés par plusieurs compagnies. Cette nouvelle génération de détecteurs permettra d'échantillonner la surface d'onde en 52 zones pour commander l'ensemble des actionneurs du miroir, produisant ainsi des images proches de la limite de diffraction du télescope.

Le schéma optique de la bonnette d'optique adaptative n'est pas encore figée. Il est clair néanmoins que les éléments suivants seront inclus dans le banc opto-mécanique: miroir déformable sur une image de la pupille du télescope, miroir de basculement, jeu de lames séparatrices pour diviser le faisceau, partie dans la voie imagerie/spectroscopie, partie dans la voie d'analyse de la surface d'onde. Dans un premier temps, l'analyse de la surface d'onde sera effectuée aux longueurs d'onde visibles alors que les observations seront réalisées dans un domaine de longueur d'onde choisi entre 0.4 et 2.5 μm . Il est prévu à terme de développer un analyseur de surface d'onde fonctionnant dans le domaine infrarouge non-thermique. Le jeu de lames séparatrices permettra de sélectionner un domaine particulier de longueurs d'onde pour les observations, ainsi que différents rapports de flux entre la voie imagerie/spectroscopie et la voie d'analyse de la surface d'onde.

Des schémas optiques préliminaires, dans lesquels la bonnette d'optique adaptative est fixée au foyer F/35 du télescope et délivre un faisceau ayant un rapport d'ouverture de F/45, ont été discutés lors de la réunion du groupe de travail. Sur la recommandation du SAC, de nouvelles études sont en cours pour définir le schéma optique d'une bonnette d'optique adaptative fonctionnant au foyer F/8 du télescope et fournissant un rapport d'ouverture de F/20 dans les voies image et analyse, sur un champ de 1.5 arcmin de diamètre. Par un jeu de miroirs rétractables, il sera également possible d'utiliser directement le faisceau F/8 délivré par le télescope, sans passer par la bonnette d'optique adaptative. Dans ce mode, la surface d'onde n'est pas corrigée, mais un plus large champ est disponible (5' de diamètre). Cette option "grand-champ" se révélera intéressante lorsque les mauvaises conditions de turbulence rendront les corrections de la surface d'onde illusoire.

Parallèlement à la définition de la bonnette d'optique adaptative, plusieurs programmes menés au TCFH ont pour but d'améliorer la qualité d'image "passive" obtenue au télescope. Des expériences de refroidissement local du miroir primaire du télescope auront lieu l'an prochain afin d'éliminer la turbulence induite par le miroir lorsqu'il est plus chaud que l'air ambiant (voir le Bulletin d'Information du CFH no. 25, Juillet 1991). D'autre part, une étude en cours de développement se propose d'agir en temps réel (optique active) sur les supports du miroir primaire afin d'améliorer l'alignement de l'optique du télescope et ainsi réduire les aberrations de coma. Finalement, l'analyse d'images extra-focales obtenues au télescope a été confiée à C. Roddier afin de déterminer les aberrations dominantes de l'optique du télescope. Les résultats de ces études seront publiés dans de prochains Bulletins d'Information du TCFH.

J. Bouvier

Progress Report on the MOS/SIS Spectrograph

Summary of Recent Activities

The past months have been a very active phase in the MOS/SIS integration. All of the mechanical assemblies have been completed and tested in Meudon and shipped to DAO as follows:

1. The Octagon arrived at DAO in January 1991
2. The storage cart arrived in February 1991
3. The MOS arrived in April
4. The SIS and the optical test bench arrived in August

The optics of both the MOS and SIS were apparently successfully completed and coated from a combination of Canadian and French optics companies (Arnold Optics, Applied Physics Specialty, MATRA). However, a major problem surfaced after the MOS optical train was integrated and installed: images were not better than 300 μm , as compared to the specification of 80% of the energy within 20 μm . The problem was traced down to the aspherical surfaces of the MOS camera, apparently surfaced to the wrong figure. To correct this problem, DAO agreed to issue a new contract to Applied Physics Specialties to manufacture the entire 2 triplets, including the aspheric lenses. Delivery of the new elements is expected in December 1991, and should not delay the project by any means.

Following the reception of each of the mechanical assemblies, integration of the electrical cabling, optics, control system, has been underway at DAO.

The high level user interface design for the MOS/SIS is almost complete, and actual work at the software level is scheduled to start shortly. Most of the basic tools have already been implemented in the MARLIN and TIGER user interface, and extensively tested.

Testing

The tests undertaken in Meudon indicate superb mechanical performances, for the overall assembly as well as for the individual devices, well into the specifications. In particular, instrumental flexures as observed in the MOS focal plane seems to be better than 15 μm over 60° motions.

A team from OPM went to DAO in April and then in August for two periods of two weeks testing, making sure that the instrument arrived at DAO as it left France. Time was also taken to transfer knowledge between the OPM team and DAO's on the parts fabricated at OPM.

Tests are being performed by the DAO staff along with their integration of the various components. Control tests of the mechanical, optical, electrical, and control systems were defined in a CFHT document and are underway at DAO by the CFHT staff. A first week of testing on the MOS was completed in September, while a second week of testing had to be postponed for several weeks due to recurrent strikes in the Canadian public service, preventing us to use a cold chamber facility in Victoria.

A two weeks testing period is scheduled in December for the SIS. Joint pre-shipment tests will be conducted at DAO by all parties involved, before the instrument is being shipped to Hawaii.

Shipment and Integration at CFHT

The instrument is scheduled to be shipped from Victoria by the end of January. We expect to have received the instrument at CFHT by the second week of February.

Approximately ten weeks will be needed for integration of the instrument within the CFHT environment: tests to check the performances of the instrument after the shipment, compared to the DAO performances; integration of the control/user interface system; handling at the summit; preliminary tests on the telescope (daytime).

Commissioning Phase

We expect to follow the following schedule for commissioning the instrument on the sky: (gray time, 2 quarter moon):

1. First light on the telescope end of April 1992: 5 nights of engineering tests of the MOS (and SIS).
2. Five nights of engineering tests for the SIS (and MOS), end of May 1992.
3. Four nights of engineering for the MOS/SIS, including the scanning Fabry-Pérot configuration, end of June 1992.

This will complete the series of engineering tests needed for a proper check-out of the behavior of the 2 spectrographs.

We are planning on performing the full scientific performance evaluation on eight nights early in the second semester 1992.

The final commissioning and release to the general observers will then take place in August/September 1992.

O. Le Fèvre

MONICA Performances

The University of Montreal's Infrared Camera, MONICA, will be opened to general use within the CFHT community during 1992. Anyone interested in using the camera should contact René Doyon, Daniel Nadeau, or Neil Rowlands, at the Université de Montréal. MONICA is intended to satisfy the immediate need for a near infrared camera while the facility cameras are completed, which is expected in late 1992. Briefly, MONICA employs a science grade NICMOS 3 256x256 pixel Hg:Cd:Te detector that is sensitive from 1-2.5 μm . Some of the basic performance characteristics of MONICA, as derived from a September 1991 run with this instrument mounted at the f/8 focus of CFHT, include:

1. plate scale: 0.22 arcsec/pixel yielding a 56" field of view
2. filters: J, H, and K available plus a CVF covering the 1.9 - 2.5 μm range with $\sim 1.5\%$ spectral resolution
3. detector read noise: 30 e- per read
4. dark current: ~ 2 e-/second
5. Throughput and Background Flux:

Filter	Throughput (%)	Sky (mag/arcsec ²)
J	7	14.9
H	14	13.0
K	16	12.1

These numbers translate to $K=17.9$ and $J=19.0$ per arcsec² for a $S/N=1$ in 1 second of integration, when background limited.

6. Cosmetics: Approximately 250 bad pixels with most either in the form of single "hot" or "cold" pixels and a few 3x3 clumps. No bad rows or columns exist.
7. Flat Field: Typical rms deviation from the mean is $\sim 5\%$. It

is straightforward to remove pixel-to-pixel variations to $<1\%$ for background limited frames, which will usually be the case given the low read noise of the detector. The flatfields obtained during the September run show a 30% drop in the signal towards the corners of the array. At this time it is not clear whether this is intrinsic to the detector or due to some vignetting caused by a misalignment inside the dewar. In the latter case it will be corrected.

8. Image Quality: During the September run stellar PSFs were generally between 0.6 and 0.7" FWHM, with values of 0.5" seen occasionally. A simple reimaging lens system was used, which was appropriate for the scientific programs allocated time (narrowband imaging near 2.15 μm and imaging of a source extending over 10"). Aberrations were expected and were seen at the edge of the field, mostly in the J band. At the moment, J images have significant chromatic aberration, creating stellar PSFs that appear somewhat elliptical for stars that are $>20''$ from the center of the field of view. J-band stellar PSFs near the corners of the field have long-axes $\sim 50\%$ greater than their short-axes. Also, chromatic aberration causes a non-linear change of plate scale with wavelength, yielding as much as a $\sim 3\%$ difference in plate scale between J and K. Therefore, programs involving accurate multi-color photometry of multiple point sources in the field (e.g., a globular cluster field) or precise astrometry are discouraged at this time.

Raw data are written in FITS format and transferred from MONICA to the CFHT computer network automatically, where they can be manipulated or stored on Exabyte tapes. A TCS link that will permit automatic beam-switching during data acquisition is expected to be available, which will help to reduce the overhead often associated with IR imaging.

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Coudé Detector Environment

In November of 1989, the initial specifications for a six motions detector environment to be used at the new F/4 spectrograph were defined. The six motions will be computer controlled, consisting of an X, Y, Z (focus), X & Y ± 2 degree Tilt, and a ± 15 degree Rotation. The tilt and rotation will allow precise alignment of the CCD chip during set up, and the X and Y stage will allow precise on demand positioning of the detector along the spectrum during observing.

The detector environment will be able to accommodate any dewar body up to 25 cm in diameter and 60 centimeters long. Initially, the dewar is clamped to an adapter plate in the CCD laboratory. The assembly is then inserted from below the detector environment up into the Rotation stage which supports a 30 cm diameter bayonet system conceptualized by T. Gregory. This will eliminate having to fumble around with fasteners and tools to mount the dewar. It also allows additional adapter plates to be custom fitted to any unusual dewar configurations we may encounter in the future.

The X & Y stage is a complete unit supplied by Daedal Corporation. All of the other motions as well as the structure were designed by W. Knight using his CAD system. This took