engineering activities in the definition phase, or modifications and upgrades to existing systems. One example is a possible implementation of a nutating subreflector for the SEST. Development of such a facility is presently contracted to a subcontractor.

Conclusion

VLT Systems Engineering has now been fully set up and is in operation. It is expected that VLT Systems Engineering will play an important role during commissioning. Finally, Systems Engineering is seen as the nucleus for possible new large projects of ESO.

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KODAK Technical Pan 4415 Film at the ESO Schmidt Telescope

BO REIPURTH, ESO

For the past 25 years the ESO Schmidt telescope has operated with photographic plates, first using the IIa emulsions, and later the finer-grained IIIaJ and IIIaF emulsions. For a number of reasons, we have now discontinued the use of emulsions on glass plates and have changed to a new film-based emulsion. Firstly, prices for our large 30 cm × 30 cm plates have been increasing in recent years, and are now close to 100 US dollars per plate. Secondly, Kodak has for extended periods had difficulties delivering plates, and the continued production of large glass plates has been in doubt. Finally, and most importantly, reports from the United Kingdom Schmidt Telescope Unit on the astronomical use of Kodak's Tech-Pan 4415 film have been very positive. Consequently, one of our plateholders has been redesigned at La Silla for the use of film, and we are now in the final stages of an extended period of testing this new system.

Kodak Tech-Pan 4415 film is a black-and-white panchromatic negative film with extended red sensitivity. It has a fairly uniform spectral sensitivity at all visible wavelengths, and extends out to 690 nm, which makes it particularly useful for work at Hα. In fact, solar astronomers doing Hα photographs of the surface of the Sun were the first to exploit this emulsion for astronomical purposes. Night time astronomical use of the 4415 emulsion was pioneered by amateur astronomers, and it remained exclusively in amateur use until the UKSTU undertook a major study of its astronomical applications a few years ago (e.g. Parker et al., 1994). The film is extremely fine grained, with grains of about half the size of the IIIa emulsions, allowing much higher resolution. The sensitivity is very high for a photographic emulsion, and a DQE of 4–5% has been estimated for hypered emulsions.

As for most photographic emulsions, the best results for astronomical purposes with the 4415 emulsion are achieved when it is hypered. Tests at La Silla have shown that optimum results are achieved when the film is baked at 70°C and soaked in a flow of Nitrogen for 30 minutes followed by Hydrogen for 6 hours. After exposure the film is developed in D19 at 20°C for 8 minutes.

Glass plates have the advantage that they are stiff, and our plateholders have employed a simple mechanical pressure along the edges of the plates to bend them to the shape of the precisely machined mandrel. A similar method will not work for a film, so Wolfgang Eckert designed at La Silla a set of fine interconnected grooves in the mandrel, which, when connected to a vacuum

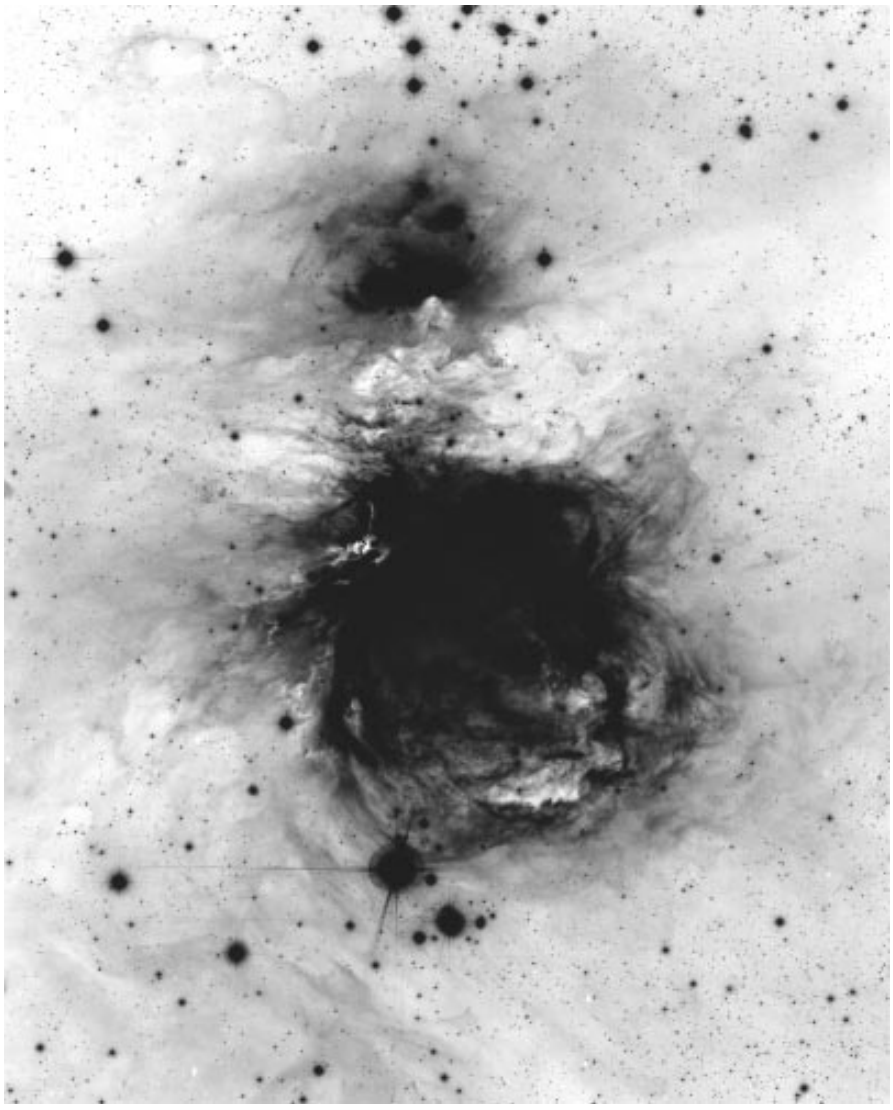

Figure 1: Part of an ESO Schmidt exposure of 150 minutes duration using the new Kodak Tech-Pan 4415 film-based emulsion and an RG 630 filter, showing the Orion Nebula.

pump, will hold the film firmly against the surface of the mandrel. The contact between film and mandrel is so tight that even a small dust grain will show up as a tiny deformation in the smooth film surface. The image quality is uniformly excellent across the film, with the exception of a small region in one corner, and we are currently looking into how to correct this.

In addition to its sensitivity and resolution, the Tech-Pan 4415 film has a number of practical advantages. One is cost, since the price of a 30 cm $\times$ 30 cm film currently is about 10 US dollars, almost a factor of ten lower than for the glass plates used up to now. Other advantages are the ability of storing hypered emulsions for longer periods without degradation, and the ease of transport. In the future, films will be mailed directly from La Silla to the users, without the delay of sending them via Garching, as was done for the glass plates.

The arrival of film at the ESO Schmidt telescope and the end to the use of emulsions on glass plates has, however, two disadvantages. The principal one is that we, at least for now, cannot take blue exposures that can be photometrically calibrated. To create a band-pass similar to B or V we would in the past select an appropriate filter that defines the blue limit and an appropriate emulsion that defines the red limit. However, the 4415 emulsion always has a red limit of 690 nm. We have looked into the possibility of purchasing a special B-band and V-band filter set, but for the very large size that we require, prices are exorbitant. Another problem with our blue filters is that they have red leaks. These red leaks were not of any consequence for our old glass-based emulsions with their more limited wavelength range, but they overlap with the extended red sensitivity of the 4415 emulsion. A possible exception to the above comments is our UG1 filter (300 nm–400 nm), where the contamination of red light appears to be small. The red leak of UG1 starts at 670 nm, and the tail of the 4415 emulsion sensitivity reaches out to 690 nm. We have tried to qualitatively estimate the effect of this impurity by exposing a 4415 emulsion through the UG1 filter and our objective prism. It turns out that for only the very brightest stars do the resulting spectra show a small and very weak red spectral component. This suggests that the red contamination is small, and that the UG1 filter can be used to make ultraviolet/blue exposures for projects where high photometric accuracy is not critical.

The second disadvantage is that it is not clear that films have the same structural stability as glass, and consequently high-precision astrometry is not recommended with film. The thick (178 μm) estar base that supports the emulsion has nonetheless great strength, and with a sufficiently fine grid of astrometric reference stars, it is likely that good results can be achieved, although a specific study is required to establish this.

Figure 1 shows part of an exposure on 4415 film centred on the Orion Nebula. The exposure was 150 minutes through a RG 630 filter, which transmits in particular the Hα emission of the region. The delicate large-scale structure of the HII region is remarkably well detected, and provides an example of data which can only be produced with a wide-field instrument like a Schmidt camera. Other recent studies that are now being carried out with the new 4415 emulsion include surveys for microlensing events towards the Galactic Bulge, light curves of RR Lyrae stars in a nearby galaxy, studies of large tidal tails of globular clusters, variability of young X-ray sources around molecular clouds, searches for new Trojan asteroids, and large-scale structure of the bright comets Hyakutake and Hale-Bopp. Also, using the objective prism, a major systematic survey is in progress, which identifies new young Hα emission stars in all the star forming dark clouds along the southern galactic plane; more than 1000 new pre-main sequence stars have already been discovered this way.

The ESO Schmidt telescope, with its large 5° by 5° field, continues to be a unique facility for the ESO community, and with the introduction of a modern, fine-grained and highly sensitive emulsion like the 4415 Tech-Pan emulsion, users are now able to conduct large-scale surveys that are deeper and have better resolution than in the past.

Acknowledgements

I am grateful to Quentin A. Parker of the United Kingdom Schmidt Telescope Unit for supplying very useful information on the progress of 4415 film use at the UKSTU in the early phases of this work. I also thank Lucky Achmad and night assistants Guido and Oscar Pizarro, who carried out the extensive hypering and development tests.

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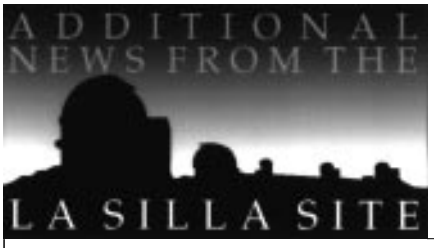

The La Silla News Page

The editors of the La Silla News Page would like to welcome readers of the fifth edition of a page devoted to reporting on technical updates and observational achievements at La Silla. We would like this page to inform the astronomical community of changes made to telescopes, instruments, operations, and of instrumental performances that cannot be reported conveniently elsewhere. Contributions and inquiries to this page from the community are most welcome. (P. Bouchet, R. Gredel, C. Lidman)

News from the 3.6-m Upgrade Project

L. PASQUINI, U. WEILENMANN; ESO La Silla

1. Introduction

The objective of the 3.6-m Upgrade Project is to improve performance and operations of the 3.6-m telescope, and to put this telescope into the front line for the first decade of the next century. In order to reach this goal, several points have to be investigated to firmly establish the real telescope capabilities, namely:

(i) Image quality and seeing,
(ii) M1 degradation and
(iii) Telescope pointing and mechanical behaviour.