Results of the Tests

After some small modifications to its original housing, Grating #11 was successfully mounted for the first time in November 1993. The first astronomical tests were performed in December 1993.

The dispersion, as measured directly on Th-Ar spectra, is 0.64 nm/mm at 390 nm. Considering the pixel size (24 μm) of the Tektronix CCD mounted on the blue arm of EMMI and the non-cross-dispersed format, this translates into a spectral range of 15 nm. The slit resolving power product R_s is about 9000 at 400 nm (1" slit) but the maximum resolving power (considering two pixels FWHM) is almost 13,000 at 400 nm. This resolving power can only be realized with a 0.7" slit but it is not at all unreasonable to use such a narrow slit at the NTT. Tests with the internal Th-Ar lamp have shown that two pixels FWHM can also be obtained in practice with this grating, if the instrument focus is kept under very good control. These tests also showed that the resolution was uniform within $\pm$ 0.2 pixels over the covered spectral range without any obvious trends with wavelength.

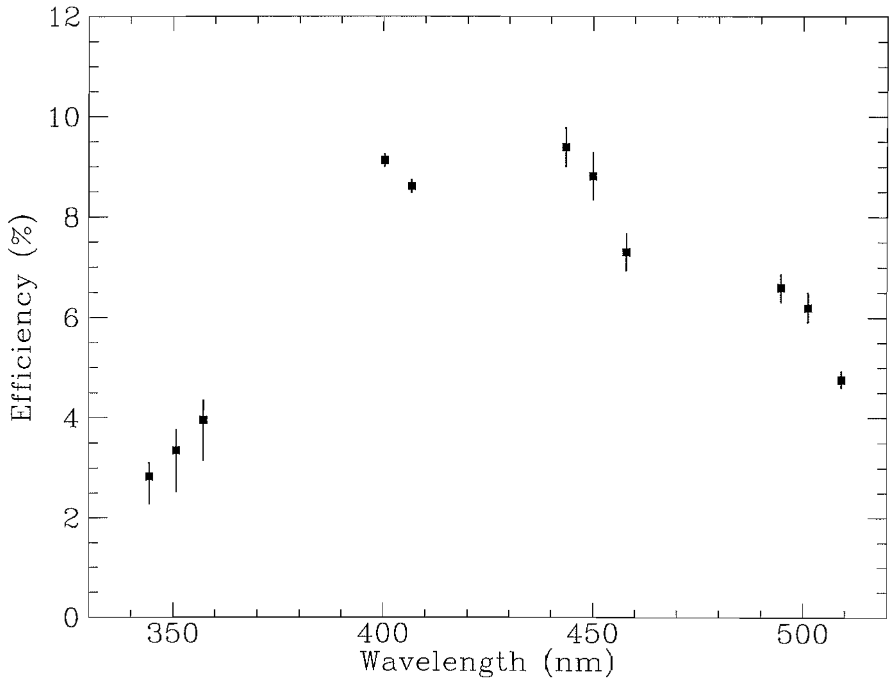

Figure 2: *The total efficiency of the NTT, EMMI blue with Grating #11 and CCD#31 as a function of wavelength. The error bars indicate the actually measured values for the two stars observed.*

No ghosts were found, even in very high S/N observations. Note here that ghosts are quite common with high-density groove conventional gratings.

The efficiency of the whole system (NTT + EMMI + Grating #11 + CCD #31) was measured with 4 different wavelength settings, observing two high-resolution spectrophotometric standard stars (Hamuy et al. 1992). One star was observed at low and one at high airmass. The results are summarized in Figure 2, where the measured efficiency is given as a function of wavelength. The error bars indicate the position of the individual measurements for the two stars. For the wavelengths shorter than 390 nm the high airmass measurements were only given half weight as mean extinction coefficients were used for the reduction.

The curve matches very well the efficiency expected from the grating efficiency curve of Figure 1, together with the CCD #31 response and the transmission of the EMMI blue optics (Giraud 1994).

The efficiency peaks at more than 9% in the B pass band, a value which compares very well with state-of-the-art high-resolution spectrographs in this spectral region.

An obvious use of the grating will be in the dichroic mode (DIMD) with one of the echelle gratings mounted in the red arm of EMMI. In this configuration the new grating will, simultaneously, provide a complementary blue spectrum at a comparable resolution to the one achieved in the red arm. The light loss due to the dichroic beamsplitter in the wavelength range 385 to 400 nm ranges from about 15 to 25% but this should be considered an upper limit as the dichroic prism and the wide-band mirror are performing better at bluer wavelengths.

Grating #11 is offered to the users starting the next period.

Acknowledgements

We thank the optical group at ESO Garching, the optical and operation groups at La Silla for providing and setting up the grating. The grating specifications and laboratory measurements were made by B. Buzzoni. We thank S. D'Odorico and D. Baade for useful comments and suggestions.

References

Dravins, D. 1978: *Applied Optics*, Vol. **17**, No. 3, 404.
Gilliotte, A., Mendes de Oliveira, C., Tighe, R. 1994: *The Messenger* No. 77, p. 6.
Giraud, E. (Ed.) 1994: EMMI and SUSI. *ESO Operating Manual* No. **5**, Vers. 2.0.
Hamuy, M. et al. 1992: *PASP* **104**, 533.
Hutley, 1976: *J. Phys.* E **9**, 513.

New Holographic Grating for the B&C on the ESO 1.52-m Telescope

C.M. DE OLIVEIRA, A. GILLIOTTE and R. TIGHE, ESO-La Silla

There are 31 ruled gratings currently available for the Boller and Chivens spectrograph (B&C) on the ESO 1.52-m telescope. These have dispersions ranging from 3.2 to 51 nm/mm. Recently, a new holographic blazed grating has become available from the Jobin-Yvon manufacturer and successfully tested at La Silla. This grating is designated #32. Its main characteristics are given in Table 1.

In first order, grating #32 gives the

TABLE 1.

Specifications of Grating #32 for the B&C	
Type	Holographic blazed grating
Grooves/mm	2400
Blaze wavelength	400 nm
Wavelength range	320-470 nm
Dispersion	3.2 nm/mm
Size	110 × 110 mm

same dispersion as the second order of the ruled gratings #11, 12, 20 and 22. A comparison of the efficiency of grating #32 with that of one of the ruled gratings (#20) of same dispersion is given in Figure 1. As can be seen from the curves given by the manufacturer, grating #32 is 1.9 and 1.6 times more efficient than grating #20 at 350 and 450 nm respectively.

In addition to greater efficiency, the holographic grating also produces significantly less stray-light contamination than any of the ruled gratings. This will be an important consideration for any programmes in which high-precision placement of the continuum is important, e.g. abundance measurements, and for spectrophotometry.

The superior performance of the holographic grating can be seen in the spectra shown in Figure 2. These spectra were taken with grating #32, in first order, and with grating #20, in second order (using CCD #24). Both grating set-ups give a dispersion of ~ 3.2 nm/pixel.

In Figure 2 we show a cut around the Ca II H and K lines in the spectrum of the star HR 3459. The effects of the lower stray-light contamination for the holographic grating are well exemplified here. For the spectrum taken with grating #32 the doublet Ca II lines are clearly more detailed. Also, the small absorption features on the wings of the Ca II lines are deeper. This figure also demonstrates the higher efficiency of grating #32, as compared to #20 with a significantly higher signal-to-noise ratio in the spectrum obtained with the former.

The new holographic grating for the B&C on the ESO 1.52-m, grating #32, is offered to the astronomical community starting October 1994.

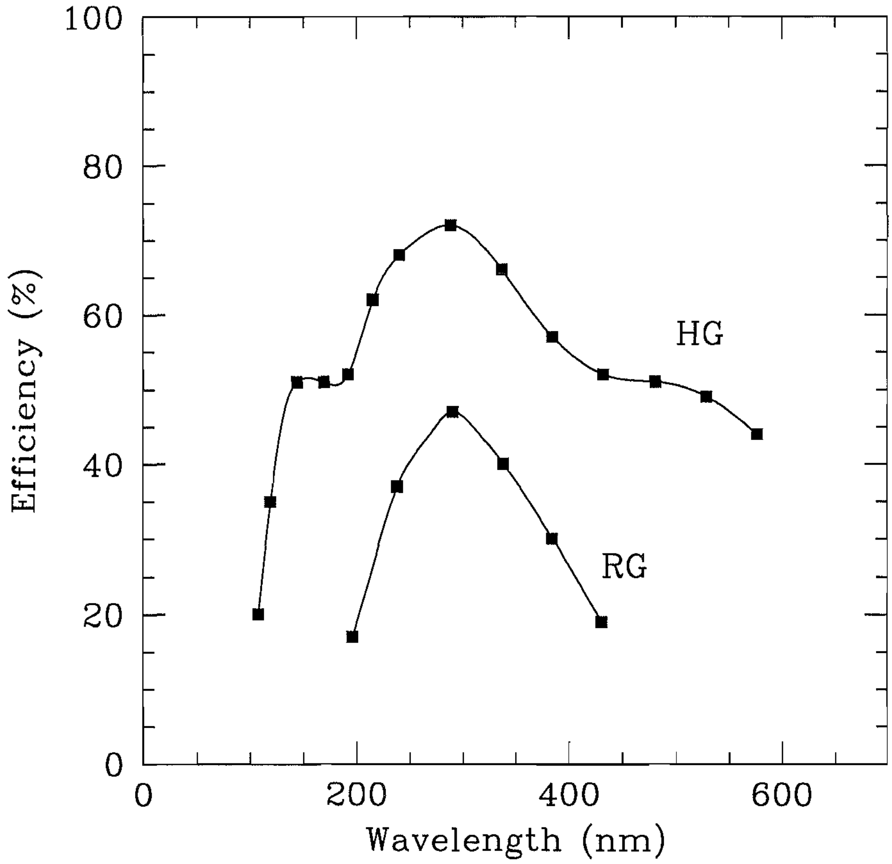

Figure 1: *The efficiency curves for the ruled grating #20 (RG), in second order and the new grating #32 (HG), in first order, as measured by the manufacturer, Jobin-Yvon.*

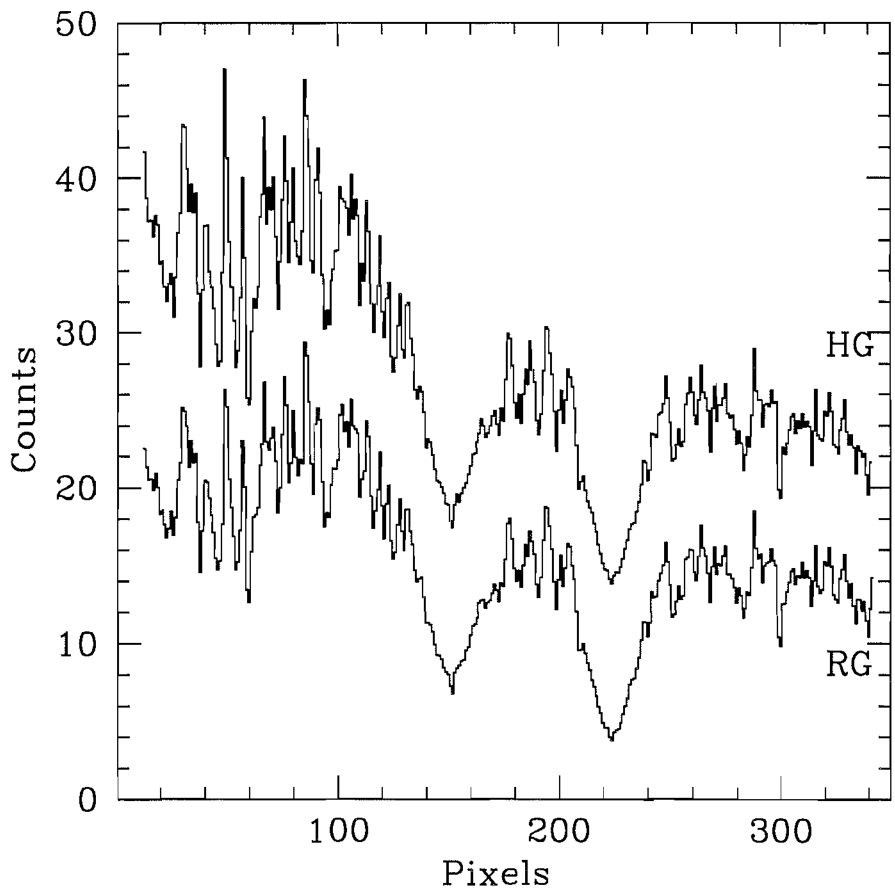

Figure 2: *A comparison between two spectra taken with equivalent set-ups using a classical ruled grating (grating #20, in second order) and the new holographic grating (grating #32 in first order). The top spectrum was arbitrarily shifted upwards by 10 units, to allow a comparison. The grating #32 spectrum has less stray light contamination and thus it shows a cleaner stellar line profile, in which more details of the lines can be detected.*