THE PROCEDURE IN USE AT THE TRIESTE ASTRONOMICAL OBSERVATORY TO EXTRACT THE MAXIMUM INFORMATION FROM IUE HIGH RESOLUTION IMAGES

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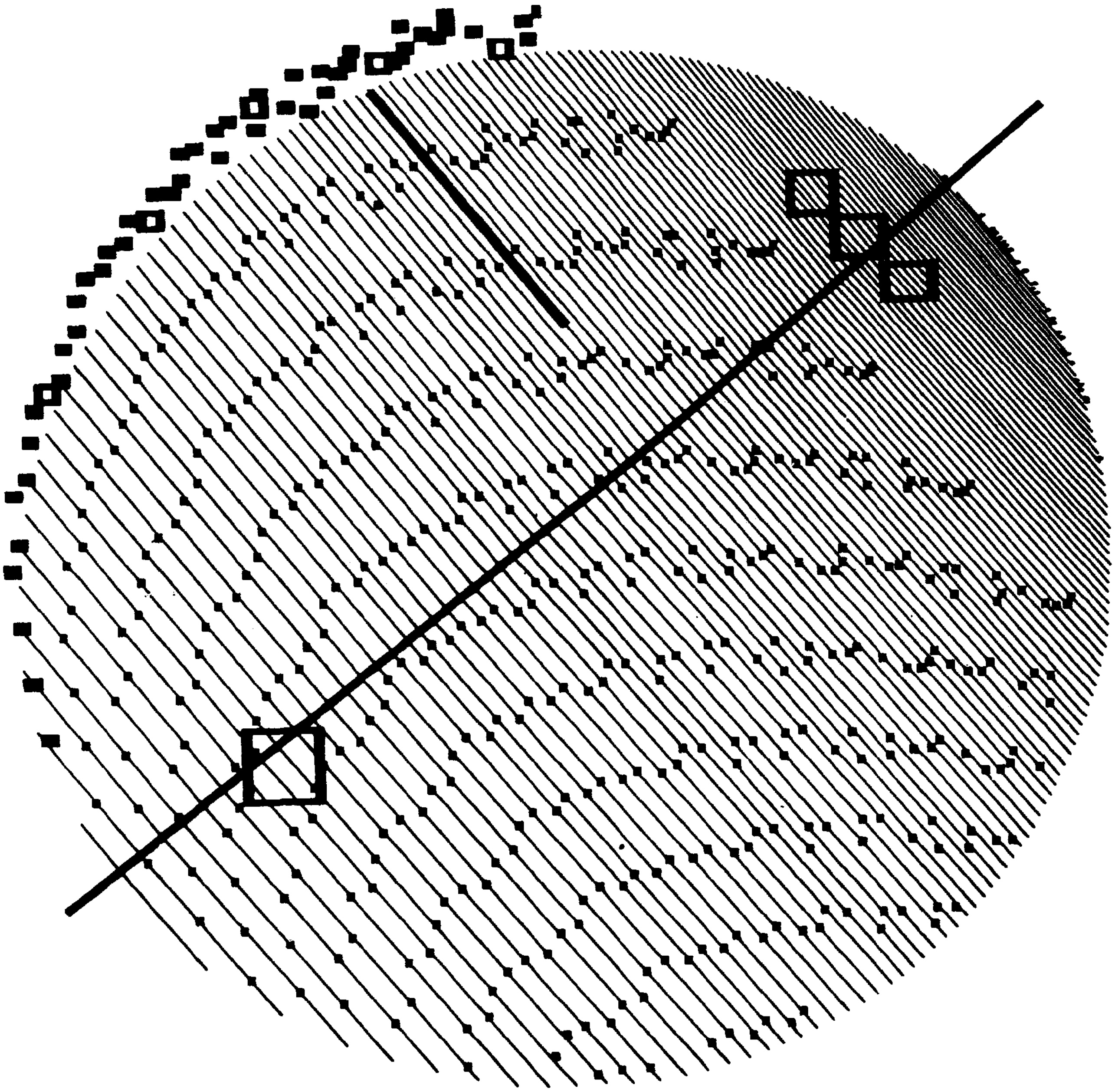
The standard extraction procedure, IUESIPS, for High Resolution IUE spectra is unable to compensate adequately for certain inherent defects in the output image of the echelle spectrograph. Light scattered by the cross-disperser and the imaging system enlarges the width of the spectral orders. In those parts of the image where the orders lie close together, these "wings" overlap. As a consequence the determination of the background, BKG, to be subtracted is incorrect, and even the resulting "NET" spectrum not only has incorrect intensities but also contains spurious contributions from nearby orders. We have developed an entirely new extraction procedure, IUEARM, which is more effective and reliable.

The procedure begins with the first program which copies the 2nd file of the IUE tape on to a disc file in an appropriate standard format. The colour display management program (Pucillo M. 1981, Publ. Oss. Astron. Trieste, No.733) is given control in order to allow the user to select interactively areas and cross-sections on the image shown. We show as an example (Fig.1), the selection of BKG zones, of a zone where the signal is present, and of two cross-sections, one perpendicular and one parallel to the direction of the dispersion.

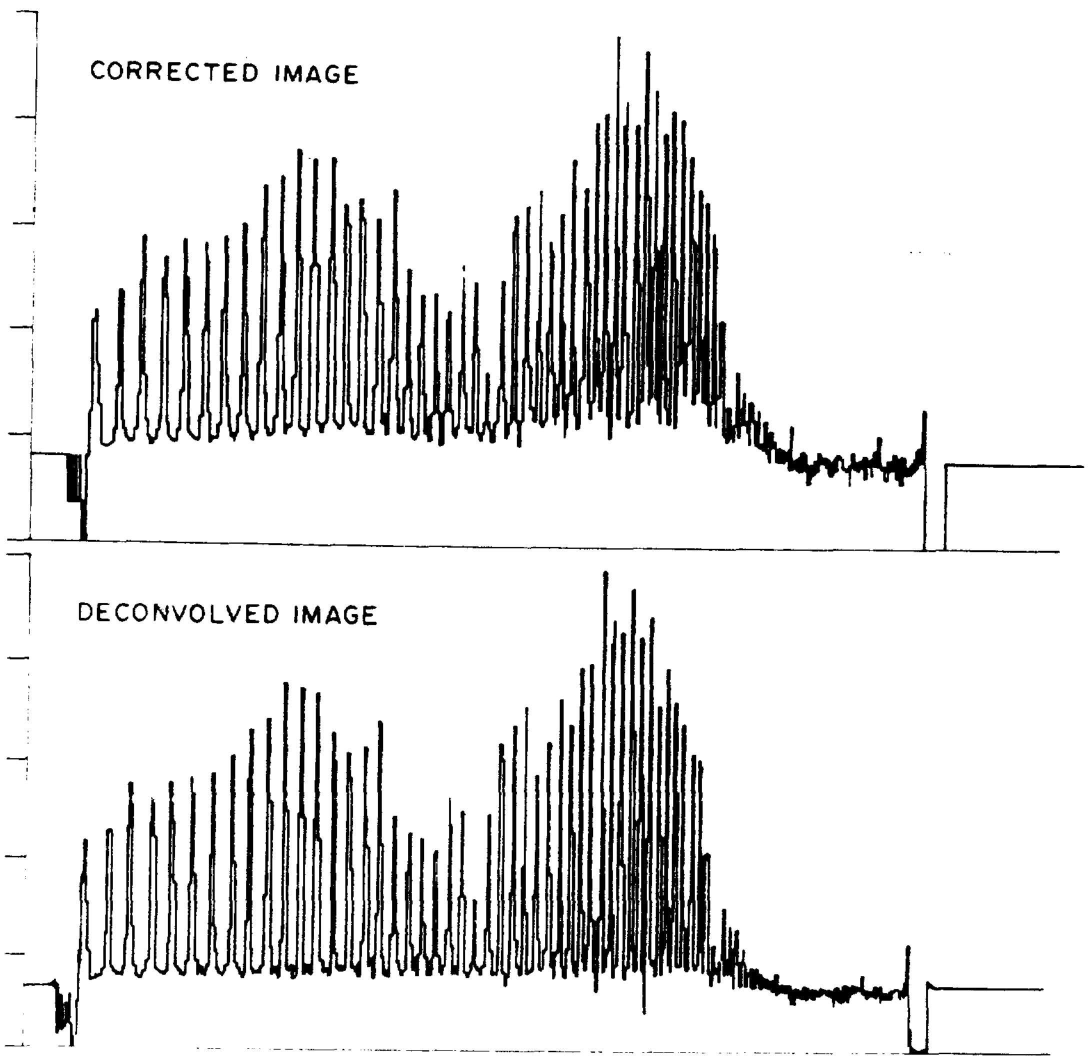
We perform a two-dimensional Fourier transform of the whole image and a gaussian filter is used to remove the high frequency noise. It is possible at this point to deconvolve the image using the IUE instrumental profile. After an inverse FT of the filtered and deconvolved signal, we obtain an image with well-separated orders. The value of the BKG level is estimated and then subtracted from the whole image.

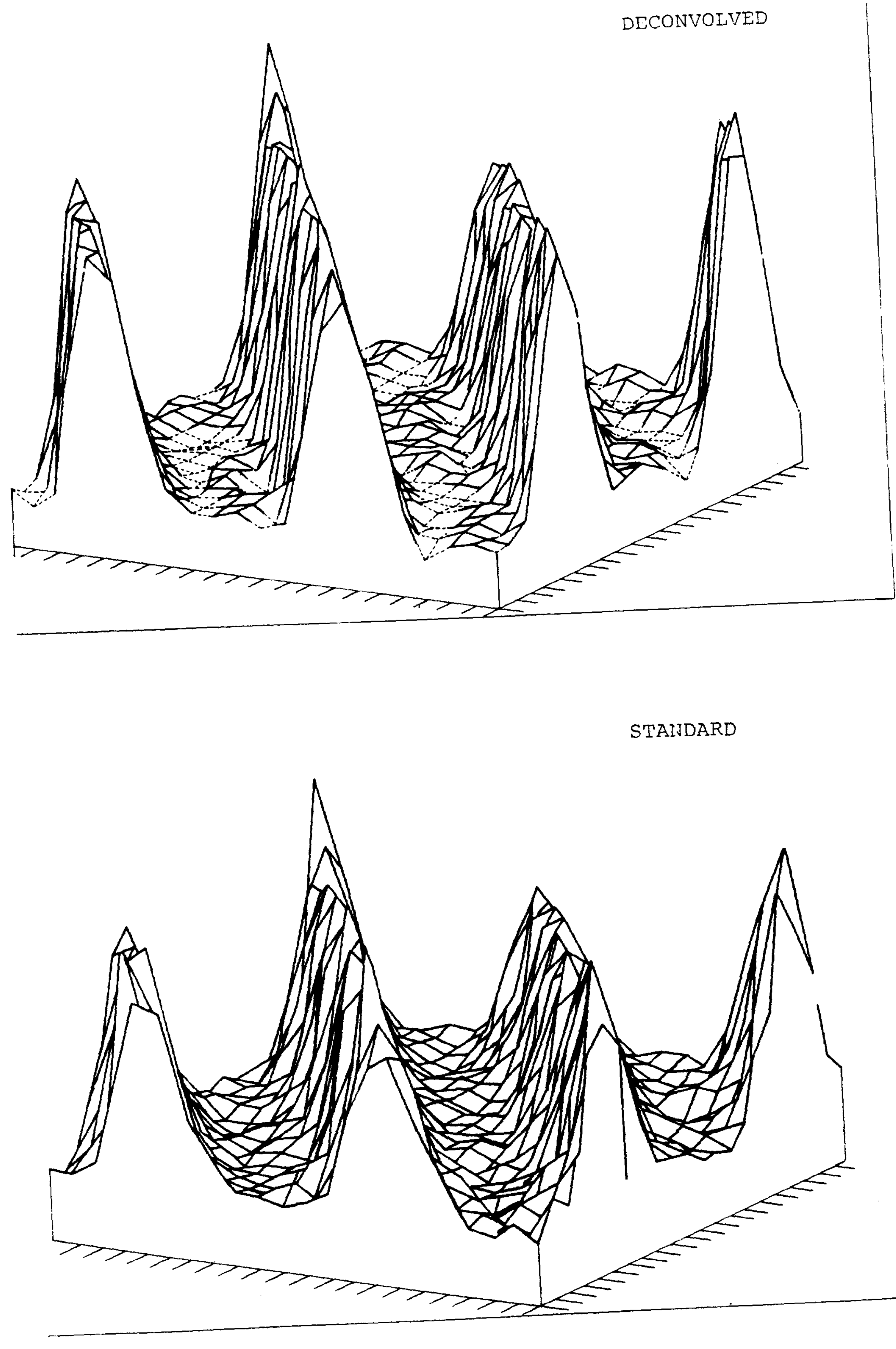


- FIGURE 1 -

The way deconvolution reduces overlapping of the orders is clear from the comparison between the two corresponding cross-sections (Fig.2) and between the two three-dimensional representations of the same area, taken on the standard and on the deconvolved image respectively, (Fig.3). In particular, the true BKG level (dashed lines) can be seen between the orders in the reprocessed area, while it is covered by the "wings" of the orders in the other one.

FIGURE 2





- FIGURE 3 -

After deconvolution and BKG subtraction, the spectrum is extracted from an order by passing a narrow mathematical pseudo-slit, two pixels high, along the orders. As a chief consequence of this use of a very small pseudo-slit the number of spectral regions badly affected by detected anomalies (for example the "bright spots" which appear on the cathode) is significantly reduced. It is also useful to note that the same extraction method can be used to obtain Low Resolution spectra directly from a photometrically corrected LR image. The extracted spectrum is calibrated at each wavelength point using an interpolation from the table of Bohlin et al, (1980 A.&A. 85, 1) obtained by means of a 5th degree lagrangian spline. Using our procedure, the interpolation function turns out to be reasonably smooth, and problems in the regions of order overlap disappear. The calibration functions that we have derived for each order do indeed coincide in the overlap regions of the adjacent orders, and this gives a "prima facie" confirmation of the validity of our method.

MEAN POLYNOMIAL USED IN IUEARM
IUESIPS BLAZE FUNCTION

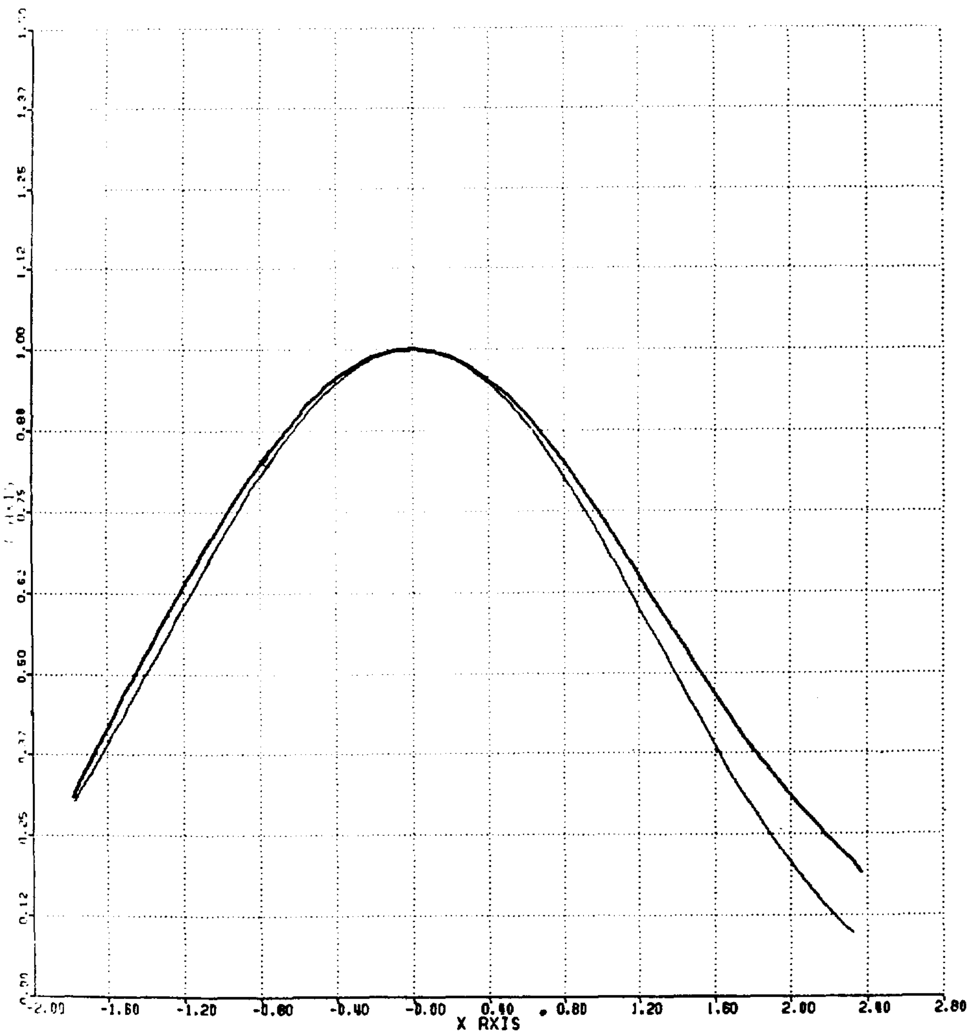


FIGURE 4

A 6th degree polynomial (Figure 4, thick line) is used as a blaze efficiency correction function. It has been derived by comparing the IUE spectra with those obtained with the Copernicus satellite for the same stars (Allocchio et al, 1983, A.&A., in press). It has been proven that the derived polynomial works more effectively than the standard blaze correction function used in IUESIPS (thin line).

As an example (Figure 5) of the output of our procedure, we show three orders image SWP 13589 of the star ζ Oph. The goodness of the fit of the orders in the overlapping regions is clearly seen.

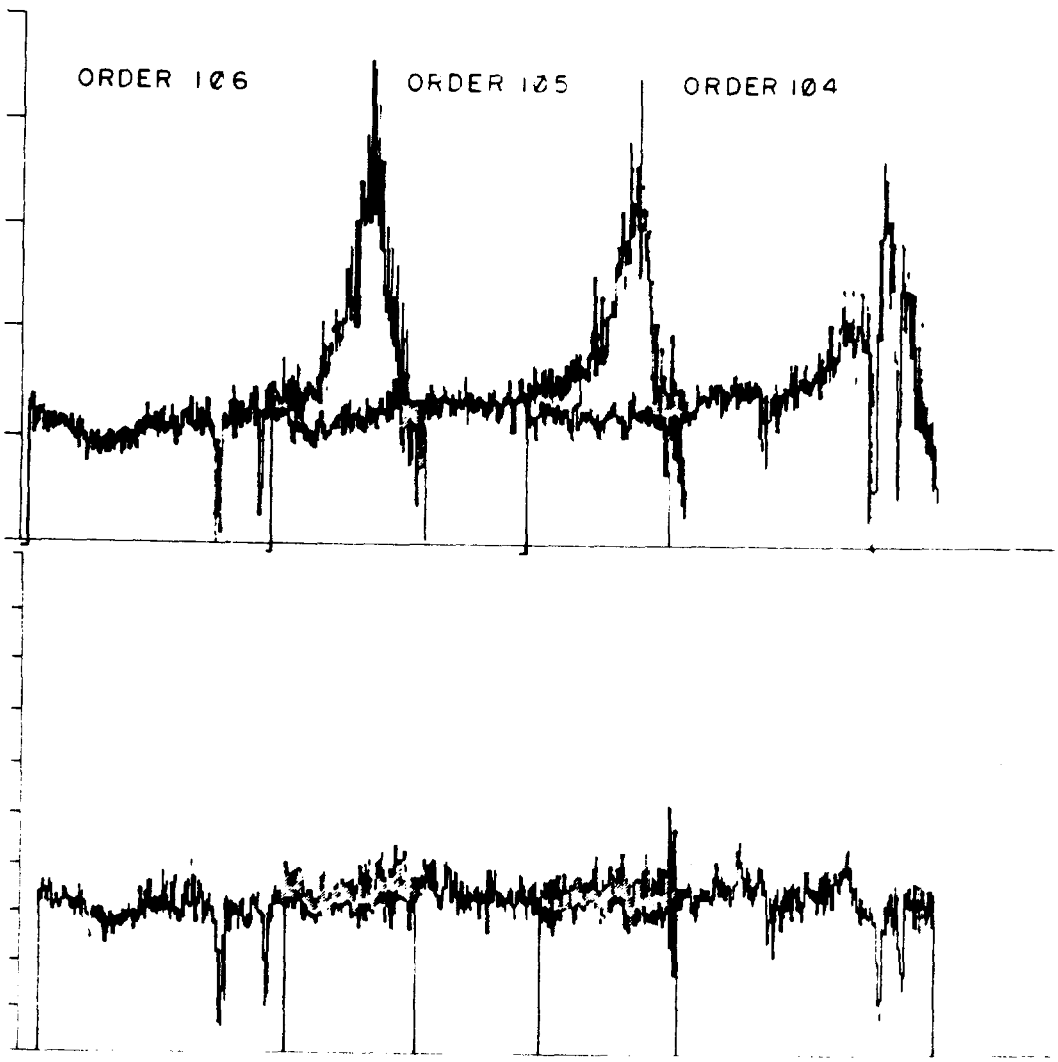
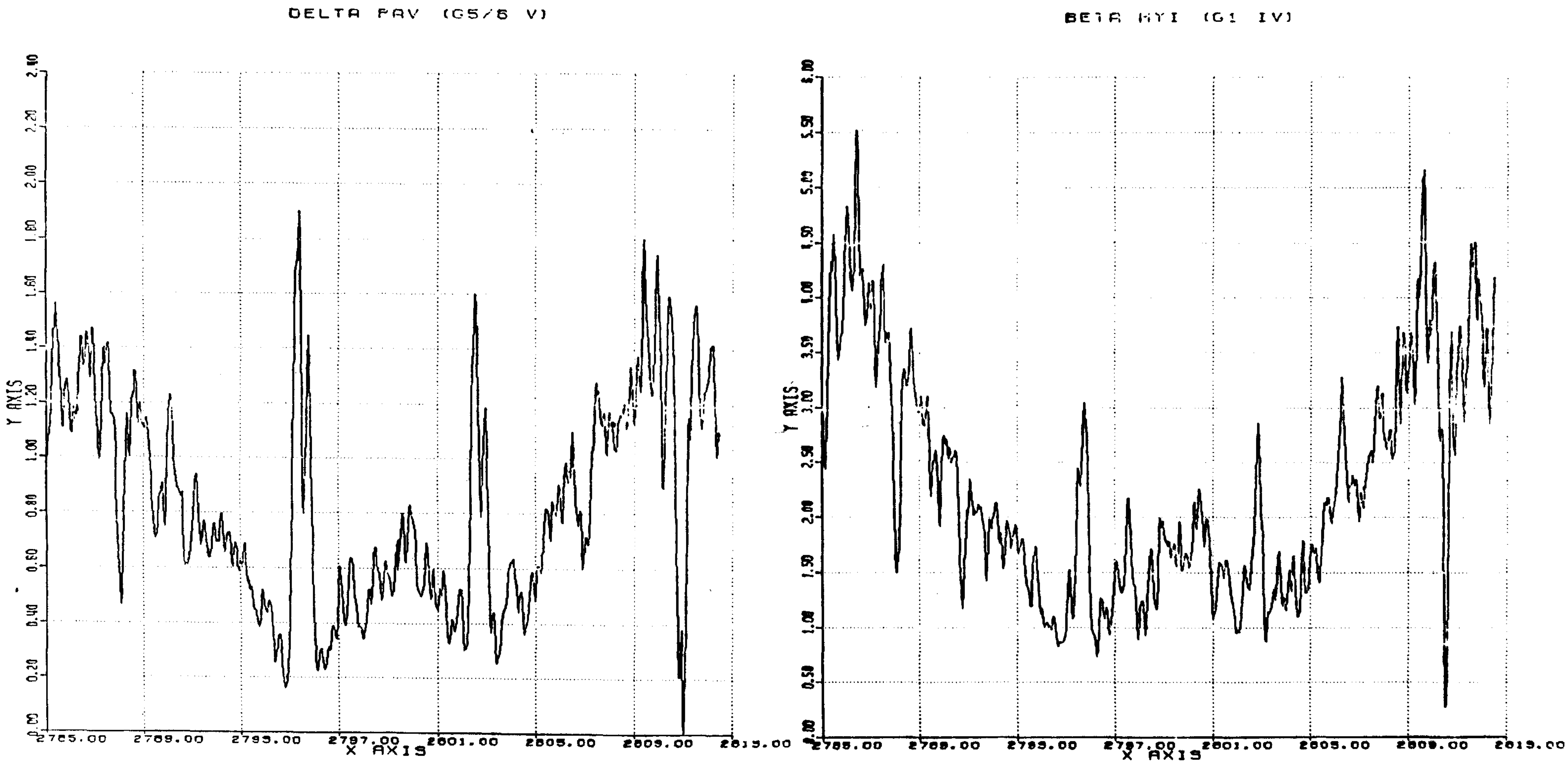


FIGURE 5

The limiting case of MgII line profiles. - The improved subtraction of the BKG and better correction for blaze allow us to achieve undistorted line profiles. The resolution in the spectra is also improved. In a forthcoming paper, we will present a set of high quality MgII h and k profiles for a selected group of sample stars, β TrA, α Hyi, ζ Tuc, β Hyi, δ Pav and τ Cet, from F0 V to G8 V. The quality of the newly reduced data, supplemented with a more recent set of spectra, has enabled us to improve on our previous search for variability, reported in Crivellari et al (1983, A.&A. Suppl. Ser. 52, 135), and the enhanced resolution has revealed a new absorption feature in the chromospheric Mg II lines of β Hyi (Figure 6). We believe these profiles represent the practical limit of the quality of High Resolution spectra obtained with IUE.


DELTA PAV (G5/6 V)
BETA HYI (G1 IV)
Y AXIS
X AXIS
2785.00
2789.00
2793.00
2797.00
2801.00
2805.00
2809.00
2813.00

- FIGURE 6 -