IUE DATA REDUCTION

VIII. Planned Changes to High Dispersion Extraction Slit Height

In the planned new high dispersion data reduction system described in memo VI. of this series, the height of the extraction slit will be allowed to vary with order number in such a way that the order overlap phenomenon is minimized and that the extracted fluxes are stable against small registration (order-tracking) errors. At the short wavelength end of the spectral format, where the echelle order separation is least, a suitable slit length is defined by the order separation itself. A slit with length equal to the (increasing) order separation continues to be suitable through the mid-range of wavelengths, until the order separation attains a value of ~12 pixels, which is approximately the effective slit length in the current low dispersion point-source reduction algorithm. Beyond this point, increasing the slit length is probably detrimental in terms of the added background and decreased signal-to-noise ratio associated with a longer slit. Accordingly, the proposed point-source high dispersion slit height will equal the order separation until a maximum effective length equal to 12 pixels is obtained.

Figure 1 illustrates the echelle order separations for the SWP and LWR cameras as a function of order number; calculated as follows. For any echelle order m, the central wavelength λ_c is defined through the grating equation

$$\lambda_c = K/m \qquad (1)$$

where K is the echelle grating constant (K = 137,725 for SWP; K = 231,150 for LWR). Since the echelle orders are separated by a cross-disperser grating with linear dispersion d (d = 1.67 Å/px in SWP, d = 2.65 Å/px in LWR), the difference in the central wavelengths of adjacent orders thus corresponds to a calculable pixel spacing in the cross-dispersion direction.

If we define the wavelength spacing between adjacent orders (at order m) to be $\Delta\lambda(m)$ where

$$2\Delta\lambda(m) \equiv \frac{K}{m-1} - \frac{K}{m+1} \qquad (2)$$

then the corresponding pixel separation $\Delta px(m)$ is given by

$$\Delta px(m) = \Delta\lambda(m)/d \qquad (3)$$

The quantity $\Delta px(m)$ is plotted in Figure 1 for both cameras. Shown at the left hand pixel scale are the effective lengths of the current high dispersion point-source ("HT = 5") and extended-source ("HT = 7") extraction slits, as well as the current low dispersion point-source slit ("HT = 9"). The latter value ($\sim$12 pixels) is the proposed maximum high dispersion slit height for all cases. For point-source reductions, the slit height will equal the $\Delta px(m)$ separation values given in Figure 1 or by equations (1) and (2) as long as $\Delta px(m) < 12$. For extended-source reduction, the $\Delta px(m)$ values are followed until a minimum value of 10 pixels is reached (slightly larger than the effective slit length for the current high dispersion extended-source reduction, where the large aperture is $\sim$ 7 pixels wide perpendicular to the dispersion) to ensure extraction of the total large-aperture flux. The Guest Observer is to be reminded that the use of a long slit such as this at short wavelengths can lead to serious order overlap problems if a continuum signal is present in adjacent orders.

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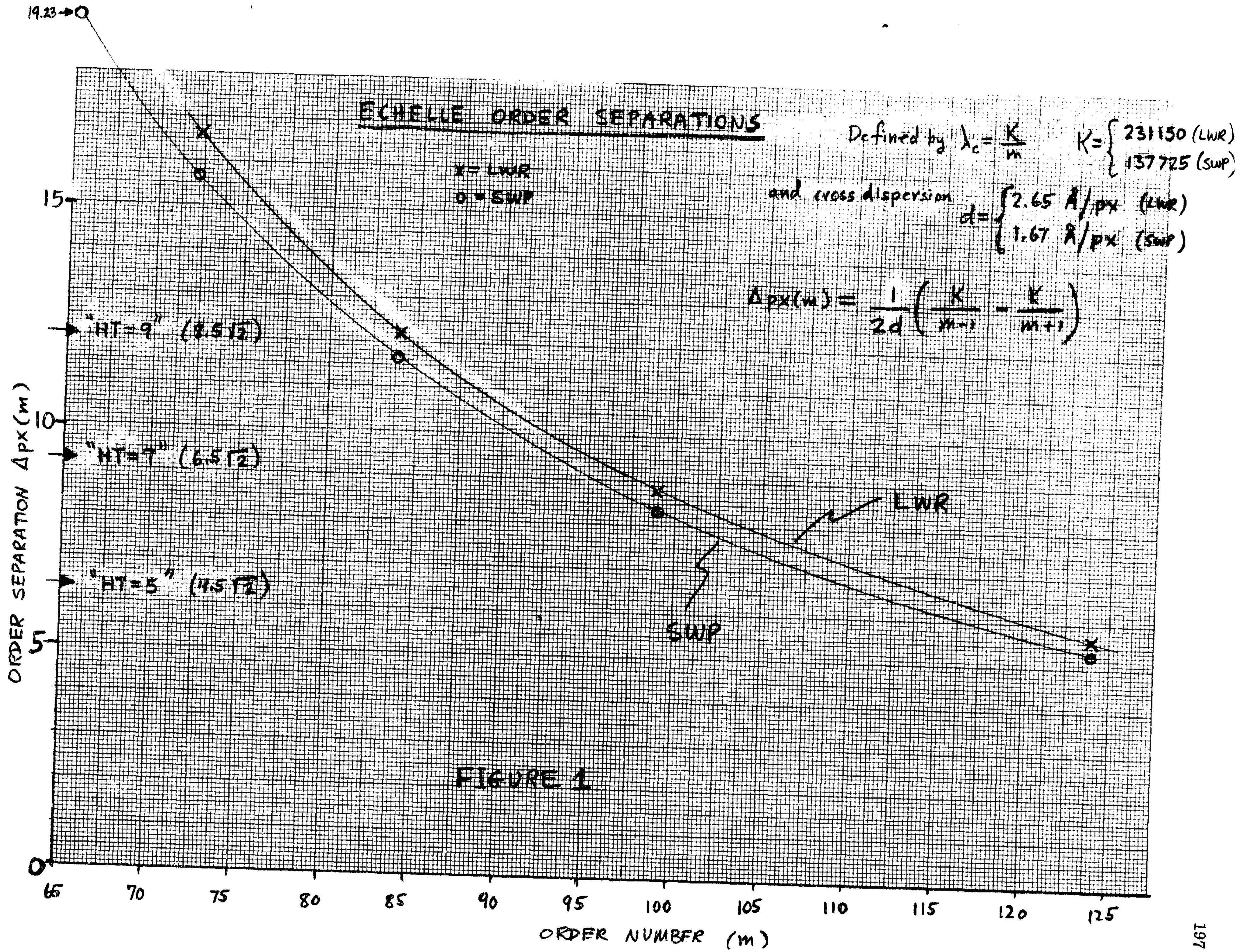
ECHELLE ORDER SEPARATIONS
Defined by $\lambda_c = \frac{K}{m}$
$K = \begin{cases} 231150 \text{ (LWR)} \\ 137725 \text{ (SWP)} \end{cases}$
and cross dispersion
$d = \begin{cases} 2.65 \text{ Å/px (LWR)} \\ 1.67 \text{ Å/px (SWP)} \end{cases}$
$\Delta px(m) = \frac{1}{2d}\left(\frac{K}{m-1} - \frac{K}{m+1}\right)$
x = LWR
o = SWP
19.23
"HT=9" (8.5√2)
"HT=7" (6.5√2)
"HT=5" (4.5√2)
LWR
SWP
ORDER SEPARATION Δpx (m)
ORDER NUMBER (m)
0
5
10
15
65
70
75
80
85
90
95
100
105
110
115
120
125

FIGURE 1