IUE DATA REDUCTION

IX. Planned changes to the Order-Locating Software: DCSHIFT

Because of thermal displacements, it is necessary to register each IUE spectral image with the current dispersion relations before the spectral data are extracted. Currently, this registration operation is performed by the IUESIPS applications program DSPCON*, which samples portions of the geometrically-corrected image to locate the spectral orders automatically. DSPCON then alters the zero-point terms of the dispersion relations (see memo V of the IUE DATA REDUCTION series in Newsletter No. 6), to transplant the relations (in the direction perpendicular to the dispersion direction) by the amount required to effect registration with the spectral orders.

In the future reduction era outlined in memo VI of this series (also in IUE NEWSLETTER No. 6), the geometric correction will only be performed implicitly. This implies that the registration operation will have to be performed on a raw image; the program DCSHIFT will be used to do this and thus will replace DSPCON.

In the new reduction system the dispersion relations will continue to be defined with reference to a geometrically corrected coordinate system, in which a lower order polynomial fit is possible because the orders are less curved. DCSHIFT will utilize the array of geometric displacements DISP (used to perform the conversion from raw to geometrically-corrected image under the current reduction system) and a pixel-mapping subroutine UNGEOM to establish the necessary correspondence between the geometrically-corrected and raw coordinate systems. The displacements DISP specify the difference between the pixel coordinates of reseau marks in the raw and the geometrically-corrected images. Through bilinear interpolation, the subroutine UNGEOM calculates this coordinate difference for any image point and thus maps any pixel location in the geometrically-corrected image into the corresponding

* DSPCON can be used successfully on approximately 75 percent of all IUE images. Those images unsuitable for automatic registration (e.g., pure emission-line spectra, or very weak spectra) are registered manually via operator intervention.

pixel location in the raw image. Hence, the locations of the sampling regions used in the registration algorithm (originally specified in a geometrically-corrected image) are transformed by UNGEOM so that the sampling is done in the appropriate portions of the raw image. Then, by a cross-correlation search technique within each sampling region, the perpendicular shift required to register the order with the dispersion relation is calculated.

As is now being done in DSPCON, the final perpendicular shift calculated for a given image by DCSHIFT will be the arithmetic mean of the shifts measured in each sampling region (sampling regions with saturated signals or low signal-to-noise ratios are thrown out). This is possible even in the raw-image coordinate system because the relative geometric distortion within the confines of any given sampling region (15 x 15 pixels) is very small, so the shifts measured in the raw image in the manner described above are nearly the same as the shifts measured by DSPCON. Tests in both dispersion modes in both cameras indicate that the final mean shifts returned by DCSHIFT for a raw image exhibit a maximum deviation of about 0.3 pixels from the values returned for the same image (geometrically corrected) by DSPCON, with the average agreement being considerably better (0.1-0.2 pixels). It is therefore concluded that the DCSHIFT algorithm is adequate for determining a mean pixel shift to be applied to the current fiducial dispersion relations in order to define a set of dispersion relations registered with the particular spectral image being reduced.

It should be noted that the pixel-mapping algorithm used in UNGEOM will also be used in the new reduction era in the programs which:

a. mark the locations of the spectral orders in a raw image with a wavelength-scale overlay (new program TRACE to replace OSCRIBE which works on a geometrically-corrected image)
b. perform the photometric correction of a raw image (new program PHOTOM to replace FICOR5 which works on a geometrically-corrected image)
c. extract the spectral fluxes (new programs SPECLO and SPECHI to replace EXTLOW and DATEXTH which each work on a geometrically-corrected image).

The implementation of these new reduction methods, some of which are still under development, will be announced through the IUE NEWSLETTER at the appropriate time.

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