IUE DATA REDUCTION

VI. An Outline for Basic Studies of IUE Data and Planned Improvements of the Processed Results

Now that IUE is a mature operational satellite, a large amount of flight data is available for assessing the in-orbit performance of the scientific instrument. Since the chances for a long lifetime appear good, it seems appropriate to optimize the data reduction system in order to realize the full capabilities of the system. Contracts are in effect with Computer Sciences Corp. and Andrulis Research Corp. to address and solve the following major problems during the next few months.

1. Wavelength Inaccuracies

A. Establish the accuracy of the current low dispersion wavelength scale and of corrections to the older incorrect scales. Provide written summary of results and table of new dispersion constants to correct old data (see Memo III of this series in IUE Newsletter #5).

B. Update the current set of Pt-Ne lamp lines in high dispersion. Quantify the improvement and define the errors in old dispersion constants. Compute the radial velocity correction due to the earth's and satellite's orbital velocity. Apply correction to wavelengths, where a completely automated procedure with no operator intervention is preferred.

2. Unknown Thermal Time Constants

Plots of typical reseaux movements at the center and edge of the tube and of calibration spectral features are required to provide the guest investigator with the expected thermal stability of the system. These motions should be correlated with camera and optical bench temperatures and translated to typical wavelength errors in high and low dispersion.

3. Loss of Photometric Precision Due to Resampling in GEOM

The photometric correction will be done first in the data reduction, thus avoiding the resampling of the non-linear raw image. As a by-product of this change, all saturated pixels in the raw image can be flagged in the final products.

4. Loss of Spectral Resolution in Extracted Spectra

The spectral extractions will be optimized in order to obtain the full instrumental resolution. This will be accomplished by 1) doing an implicit GEOM, thus avoiding the resampling in the GEOM step of the data reduction and 2) selecting an optimum width for the pseudo slit in the data extraction. In low dispersion, the pseudo slit must be tilted with respect to the dispersion line.

5. Order Overlap in High Dispersion

The background removal will be improved by allowing the slit height to be set to any (including non-integer) value. In high dispersion, the effective slit height will be a function of order number. The extraction of the inter-order signal will be optimized with the reseaux removed as the data are extracted. Currently, high dispersion extractions have $\lesssim$ 5% too much background subtracted at Lα and $\sim$10% too much at 1175Å. Percentage values are with respect to the continuum level. A background that is apparently worse than this amount can be caused by dispersion constants that lie off the orders. This is why the time constants discussed in Section 2 are of great importance in regard to optimally extracting the net spectra in high echelle orders. Thus, three potential improvements in the current effort should affect the order overlap problem: 1) Better dispersion constants from an improved operational monitoring of thermal distortion. 2) Better order separation by avoiding the resampling in GEOM. 3) Better extracted GROSS and BKG data by optimizing the slit placements and heights.

If the above improvements still do not reduce order overlap to an acceptable value, the scheme envisaged to correct for the effect using the profile and strength of neighboring orders can be implemented.

6. Quantification of Some Basic Properties of the Data

Spectra will be extracted from flat fields and from actual spectral images to answer and document the following questions.

A. How much is the flat field noise enhanced for errors of reseaux alignment of 1 pixel?

B. How much is the noise level changed when a flat field is reduced using the new photometric correction technique?

C. What is the improvement in photometric repeatability of a standard star spectrum when reduced using the new extraction techniques?

D. Compare the old and new spectral resolutions. What is the difference in the FWHM? Produce a new set of resolution values to replace those in the IUE Nature paper.

E. What is the effect on the ripple correction of the new techniques?

As a follow on effort, the results of Section 2 and Section 6 may demonstrate the need to identify reseau positions on every spectral image obtained. Because of the confusion of reseaux with the data, this requirement could significantly increase processing time.

In conclusion, guest observers should be aware of two format changes proposed for the output data package:

a) No geometrically corrected image will be provided in high dispersion. Photometrically corrected images will appear on tape and on photowrites with an OSCRIBE of the location of the extracted spectrum.

b) The size of the extracted spectral arrays will increase from the present 602 words (1204 bytes) to 1024 words (2048 bytes), in order to extract spectra with the resolution actually achieved in flight.

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