

# QUALITY CONTROL OF THE IUE FINAL ARCHIVE

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## Abstract

All spectra ever taken with IUE are being reduced with the NEWSIPS software package and are made available to the astronomical community worldwide in such way that they can be used with confidence by scientists without the need to know every detail of the reduction of the data and the possible observational and/or software anomalies. For this purpose a quality control is performed at VILSPA at every stage of the data reduction. In the present contribution we describe the verification of the data and of the observational parameters with the consequent definition of quality flags. We also describe the procedures performed to control the different versions of the software library and of the actual recording of the data on optical disks.

Key words: IUE Final Archive; quality control.

## 1 QUALITY CONTROL OF IMAGE HEADERS

- Pre-processing: CDI Verification,

To fully and accurately characterize the IUE data set and facilitate future analysis, a group of "core data items" descriptive of each image was identified. These core data items (CDIs) are defined as all parameters related to the acquired images which were either necessary for image processing with the NEWSIPS software or for scientific analysis of the data. The CDIs are divided into two groups: input and output CDIs. All input CDIs are verified before NEWSIPS processing of the image at the acquiring observing station, whereas the output CDIs are generated by the NEWSIPS processing. There are three primary sources for the input CDIs: the VICAR image label, the Observing Log and the Merged log.

- Post-processing: Catalog Verification

The Master Catalog for the IUE Final Archive (IUEFA) database is constructed with the verified data. At this stage a few errors may still be discovered, and a Change ReQuest (CRQ) is then generated to correct these errors.

## 2 SOFTWARE QUALITY CONTROL

Quality controls have been performed to test the different versions of each software reduction package:

- Compatibility tests with GSFC processing version: tests are done to check if images reduced at Goddard and at VILSPA give the same result. The list of images used is listed in **Table 1**.
- Compatibility tests for upgraded versions: the same images are reduced with different software versions to test these versions upward and downward.
- Stability tests: a set of images is reduced periodically to check (byte-by-byte comparison) for possible problems or undetected changes in the software.

Table 1: List of images used for the compatibility tests.

Low dispersion					
LWP01455	LWP10494	LWP24364	LWR12644	SWP18898	SWP33897
LWP01552	LWP11435	LWP27293	LWR12970	SWP19413	SWP37575
LWP01606	LWP12163	LWP29269	LWR15163	SWP19861	SWP37850
LWP01695	LWP12242	LWP29924	LWR18132	SWP20102	SWP37851
LWP01998	LWP12273	LWP30081	LWR18150	SWP20499	SWP37924
LWP02359	LWP13798	LWR01648	SWP07206	SWP22381	SWP37932
LWP04074	LWP13821	LWR03473	SWP07444	SWP22939	SWP37949
LWP05053	LWP14249	LWR05727	SWP07661	SWP23010	SWP38316
LWP05359	LWP15058	LWR08066	SWP10965	SWP23489	SWP43557
LWP05372	LWP17048	LWR08201	SWP17157	SWP24917	SWP43611
LWP05555	LWP17058	LWR09981	SWP17426	SWP27088	SWP47914
LWP07722	LWP17252	LWR10972	SWP17433	SWP29928	SWP50495
LWP10005	LWP17968	LWR11207	SWP17450	SWP32310	SWP53259
LWP10490	LWP24169	LWR12221	SWP18852	SWP32525	

High dispersion					
LWP01379	LWR06257	LWR14514	SWP02860	SWP20243	SWP32649
LWP06316	LWR07106	LWR16181	SWP05136	SWP20931	SWP34718
LWP30581	LWR09343	LWR17203	SWP15569	SWP22105	SWP39900
LWR01920	LWR10040	LWR18149	SWP18696	SWP22876	SWP40192
LWR04154	LWR10676	LWR18381	SWP19736	SWP32212	SWP46134
LWR04191	LWR13138	LWR18487	SWP20166	SWP32597	SWP54862

### 3 DATA REDUCTION QUALITY CONTROL

There is a science quality control to test different reduction software versions and their possible problems with particular types of spectra:

- Pre-processing control: before starting with the processing of a new camera or dispersion mode, a sample of images covering a wide range of types are selected (continuum sources, emission-line sources, point/extended sources, overexposed/underexposed sources, etc.) This sample of images is reduced and if no error is detected the software version is accepted and the processing of the data set is started.
- Processing control: During the NEWSIPS image processing different errors or problems of the data generate quality flags, defined pixel by pixel. The flags can indicate from fairly minor problems to very serious ones, like dropouts in the spectral region, the worst problems being indicated with more negative values (see the list of flag values in **Table 2** and an example of a spectrum with a reseau mark and its associated quality in **Fig. 1**)

Table 2: List of Quality Flag values.

Condition	$\nu$ flag value	Bit
Pixels not photometrically corrected	-16384	15
Telemetry dropout (Missing Minor Frame)	-8192	14
Reseau (in the ITF)	-4096	13
Permanent ITF artifact	-2048	12
Saturated pixel	-1024	11
Warning track (near edge of PHOTOM region)	-512	10
Positively extrapolated ITF	-256	9
Negatively extrapolated ITF (far below ITF level 1)	-128	8
<i>RAW-SCREEN</i> cosmic ray/ bright spot	-64	7
<i>SWET</i> cosmic ray (low disp. only)	-32	6
Microphonics (LWR only)	-16	5
Potential DMU corrupted pixel	-8	4
Missing minor frame in extracted background	-4	3
Uncalibrated data point	-2	2
No known problem condition	0	1

- Post-processing control: The images that have processing problems are analyzed individually by the IUE Observatory staff. If necessary an explanatory comment is appended in the image header, in the COMMENT BY THE RA line. For homogeneity these comments are standardized.

## 4 QUALITY CONTROL OF OPTICAL DISKS

IUEFA data are recorded on optical disks and another QUALITY CONTROL is performed to check for possible problems occurring during this procedure. No scientific validation is performed at this stage. Two images per side of each optical disk are randomly selected for quality control. The tests performed by the responsible astronomer are the following:

- Cross control of the output files (RILO/HI, LILO/HI, SILO/HI and MXLO/HI), the MXLO file is also compared with the MELO file of the same spectrum in ULDA (when available).
- Fits Image Header:
  - The basic FITS keywords and the CDIs are compared with templates for every output file to confirm that no information is missing and that both the FITS keywords and the CDIs are located in the correct positions.
  - The IUE VICAR Headers of the different output files of an image are checked to be identical.
  - The Processing Logs of the different output files of an image are also checked to be identical.
  - The Processing Log is inspected to look for anomalies occurred during the processing that may not have been flagged in the header.
- Auxiliary Files: each side of the optical disks has a file README (with information on the IUE Master Archive) and a file INDEX (with information on the disk content, both in FITS and in HTML). These two files are also inspected.
- Optical disks directories: optical disks are catalogued and automatic procedures read the disks directories to check for missing files, anomalous file sizes and FITS conformance.

## 5 SCIENCE QUALITY CONTROL

As part of the IUEFA production the most important aspects of the output products were carefully revised. The issues addressed were: extraction procedure, noise model, sensitivity, linearity, background degradation, calibrations and flags propagation. It was found that the noise model and the flag carry-through applied by NEWSIPS, as well as the extraction procedure itself, introduced in many cases severe errors in the final spectra (see the documents by P. Rodríguez and N. Schartel). This led to the decision of re-extracting all VILSPA and Goddard low resolution spectra from the SILO images, producing INES (IUE Newly Extracted Spectra). This has assured that users can make direct use of INES data, eluding an otherwise needed further processing. In **Fig. 2** the same spectrum as in **Fig. 1** is plotted as extracted with INES.

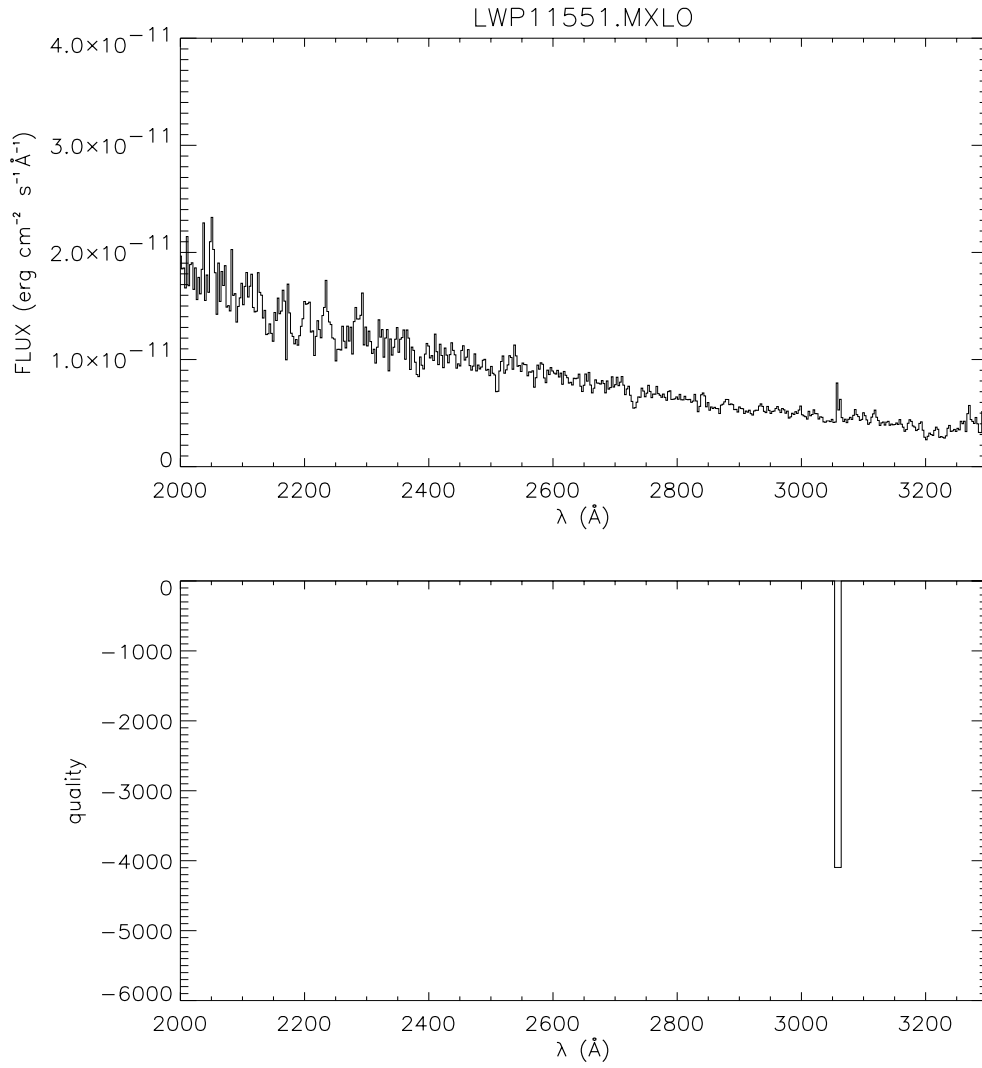


Figure 1: IUEFA spectrum with a flag marking a problem (reseau mark)

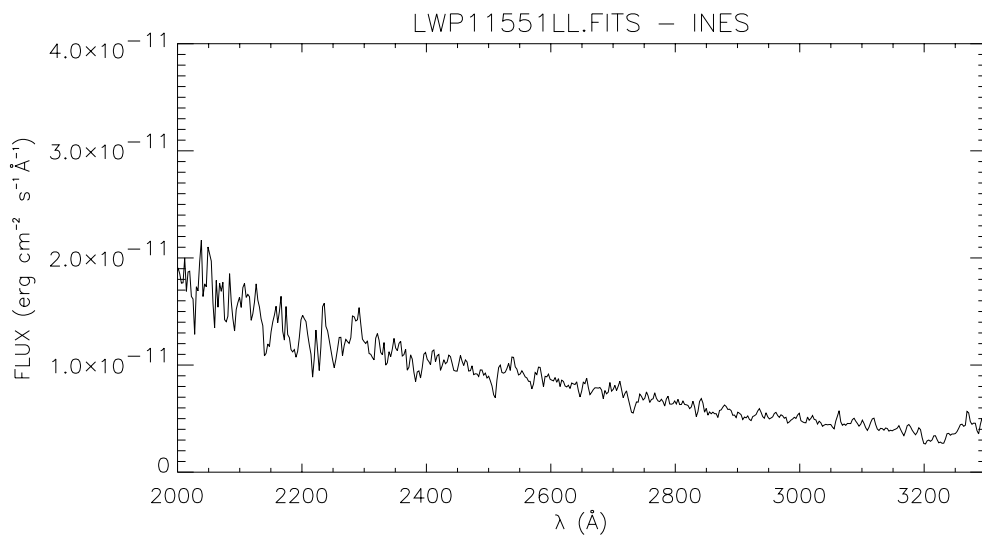


Figure 2: The same spectrum as in Fig.1, extracted with INES