

Introduction to the INES Distribution System

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A clarification of the efforts invested in the preparation and construction of the IUE Newly Extracted Spectra (**INES**) data set and its associated distribution system as an important enhancement of the IUE Final Archive (**IUEFA**), is given. As most of the motivation and implementation for the IUEFA is described elsewhere (e.g. Proceedings of the last IUE conference: ESA SP 413; NEWSIPS User Manual), there is no need to expand here on the reasons and implementation details of the decision by the International Ultraviolet Explorer (**IUE**) Project to reprocess, after 18.5 years of orbital operations of the IUE Spacecraft (ESA SP 1215), the complete IUE archive with an improved version of the software.

1 History

A fundamental difference in the project structure and task distribution between NASA and ESA in the IUE Observatories motivated the design and implementation of INES. In the ESA context both archive and operations were combined into a single unit with the full responsibility for all needs of *multi-national* community. In the NASA scheme the operations and archival tasks were logically separated into two management units: the Observatory for the data acquisition and processing, and NSSDC (NASA main Archival Center) for the data distribution to a *national* community. This has made that the ESA Project management has always considered the archival activities as an integral part of operations. In the NASA context, conflicting requirements were present due to the fact that an *Operational Archive* has considerably different requirements than a *Historical Reference Archive* (Wamsteker, W., Griffin, R.E.M., 1995 ; WG95). In an operational environment the three archival stages identified by WG95 will flow naturally into each other, while conditions are quite different when the data distribution requirements are treated independently from the data acquisition needs. It is clear that when the natural conditions for such activities make the demands of operations and archive coherent, procedures can be made quite cost effective. Archives can then be released into the community of users since archival costs are minimized and data can be used directly as the community requires. This is the main purpose of an archive. Within ESA this has led to the development of the ULDA/USSP system (Wamsteker et al., 1989) where the data were transferred from Operational Archive into a Historical Reference Archive status every 2-3 years. The associated system of National Hosts has worked very well and allowed very heavy use of the

IUE Archive by a world wide community. The natural follow up of this process and the subsequent necessary transfer of the IUE Archive from the project into the astronomical community, has led to the development of the **INES** system, a modern data distribution system, easy to maintain, with high quality data and direct access for the end user community.

The dichotomy in management philosophy has also affected the way in which IUEFA was produced by NASA and ESA. While at the same time schedules and priorities were different between ESA and NASA, also operational conditions started to diverge as a consequence of the "hybrid" operations phase in the 19th Episode of IUE Observing (Wamsteker et al., 1996). Full compatibility was required between NASA and ESA IUEFA processing, and various developments for the processing had to be shared and synchronized between ESA and NASA, generating a fairly complex software development interface which required strict control. As the overall processing was designed to be a process without human interference, coordination of each task was an essential investment in time. Under these conditions serious problems could be foreseen for the quality of the archival data if no revision was done before distribution.

One of the main drivers has been to produce an archive where the effects of historical anomalies are to be kept to a minimum, while remaining within the resources available to the project. The structural arrangements were, at this stage, often driven by internal Agency requirements, rather than detailed Project requirements, and ESA placed strong emphasis on the overall processing system (pipeline) structure, before actual processing was started. Among these I like to mention CDI verification, ID homogenization and a full database-driven processing system with database-driven control procedures from software implementation all the way through final production. This approach has allowed that a science verification effort on large -reprocessed- data sets could be performed before the final processing was completed and that in the final data product (**INES**) nearly all data can be treated by the user without having to concern him/herself with the specific details of the actual processing, resulting in a homogenous archive.

2 INES data contents and Distribution system

The major efforts in INES have been directed towards improvements in the extraction procedures, since the SWET extraction was found to be a weak point in NEWSIPS. The limitations in SWET led to a situation where erroneous results were present with sufficient frequency to make a user, without in depth knowledge of the IUE observing system (Cameras, Spectrographs, Orbital environment, Radiation Conditions and many others), distrustful of the full data set. This would of course have significantly decreased the applicability of the data for the community, since no scientific method will be able to evaluate the usefulness of any data set under these conditions.

The choice of the improvements in INES has been decided as a consequence of the science verification effort, and has mainly been driven by the requirement that most data should be directly applicable to modern scientific analysis tools, without reprocessing. Of course, the limited number of the archival data which intrinsically can not be treated with a standard procedure, such as extended spectral sources and multiple spectra in the aperture, will

still require some further processing from the spectral image file to extract all possible information from the data. These are directly identifiable and this is anyhow always true for non-standard data acquisition methods. For the future users it is expected that the *Principal Center* for **INES** will maintain the INES extraction procedures available for those who do prefer to apply an individual extraction to each spectrum. Although it is certain that still important investigations will be made through the detailed analysis of individual IUE spectra, the main importance of the IUE Archive and the **INES** data system is that it will for the first time bring up some 110,000 ultraviolet spectra directly in the hands of the whole astronomical community and thus allows all astronomers to benefit from the wealth of data acquired with a space project, independent of his/her geographical location or other constraints.

The actual distribution system is driven by a number of requirements of which I would like to indicate a few here:

1. The cost associated with maintenance of the Archive should be minimal.
2. The system should be possible to be supported in a full stand-alone way with totally unrestricted access from the outside world at the National Hosts.
3. The system should be easy to restore in case of system corruption.
4. It should be able to be supported by the currently most advanced technology, but not only that.
5. The data transfers should be kept as small as practicable, so that the end user's communications bandwidth will not be a limiting factor in its usefulness to the end-user.
6. The system should not impose, neither on the National Host, nor on the end user, any specific commercial software which is required to support the distribution, retrieval or analysis of the data.

As a consequence of the above and many other requirements the final **INES** system was constructed under heavy time pressure as a consequence of the termination of the IUE Project support. I hope that those benefiting from the use of the data and the support supplied in the **INES** system (National Hosts and Principal Center) will recognize the efforts of the many people involved in the overall construction. The following will give a summary overview of the main aspects of the **INES** system and the improved data treatment applied. I hope and expect that the INES system will represent a proper Archival heritage of the successful IUE project and would like to thank all who have over the past nearly 30 years in their different ways contributed to the IUE Project.

References

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