raw data, editing the appropriate header keywords to reflect the new calibration files and running the appropriate software. The STScI maintains a database that contains the recommended calibration reference files for each observation. However, this is not the most convenient approach for users, and this led us to develop an automatic recalibration process for HST data that essentially duplicates what a user would do manually. The on-the-fly re-calibration of the first generation of HST instruments was developed and introduced in the CADC and ST-ECF archive at the end of 1995 [1].

Implementation

In 1997, two new instruments were put on board of HST. During the last year, CADC and ST-ECF worked together on the extension of the OTF calibration pipeline to support NICMOS and STIS. The long developing period is due to the fact that the initial life of a new instrument is always somewhat difficult due to teething problems: instrument description keywords are found to be missing, or wrongly populated, the calibration software must be revised to consider changes in the instrument responses compared to the ground tests, calibration reference files are not immediately available, etc. All those stabilisation problems led us to actually offer the OTF pipeline only about 1 year after the Servicing Mission.

A decision was taken to not rely on the header of the files, but instead to retrieve the calibration keywords form the HST database. While the keywords in the files cannot change anymore, the HST database can be kept up-to-date and keywords values corrected. Therefore the OTF pipeline for NICMOS and STIS is completely database driven.

The OTF calibration pipeline steps for a science observation are the following:

1. getting raw data from CDs (stored in a compressed form)
2. getting latest database information on relevant keywords (new/updates)
3. getting latest database information on relevant calibration files (new/updates)
4. setting the proper calibration switches relevant to the observation mode for a specific instrument
5. update the header of the science file
6. apply calibration software (STSDAS)

As already mentioned some pre-requisites are necessary:

1. Database updates
2. Calibration file updates
3. Software updates

A SYBASE replication server keeps the CADC and ST-ECF HST database copies identical to the STScI one in real time; the calibration reference files are kept up to date via a retrieval that takes place on a daily basis by CADC, via a Starview request, and are then “pushed” to ST-ECF.

Particularities

While building the OTF pipeline, we had to deal with some aspects which are particular to the new instruments and which originate from some choices made by the IDTs (Instrument Dedicated Team) in the designing phase of the instruments data products. Multiple extension FITS files were introduced, and we had to wait for a stabilised release of a new version of IRAF (v 2.11) to be able to manipulate the new file types. The STSDAS calibration software (calnica, calnicb and calstis) evolved rapidly and is still changing. Some STIS observing modes are not yet completely covered by the calibration software. STIS and NICMOS association concepts differ, introducing therefore asymmetry in the development of the pipelines.

Conclusions

The OTF system contributed (and still contributes) to the reliability of the calibration software: we found and reported problems to the STScI/STSDAS group, which quickly fixed them. As soon as a new version of the calibration software is released, we install it in our pipeline. Our archive users, with their archival requests, also contribute to extensively test the software. The OTF pipeline is used at CADC to produce NICMOS and STIS preview images/spectra of all the available datasets (15 minutes after release date), further contributing in testing the pipeline.

In other words, the OTF pipeline, being in a never-ending development phase and continuously receiving new reference files, is a lively system. An observation calibrated two months ago is different from the one calibrated today. Only at the end of the life of an instrument, when the “final archive” is produced (i.e. no further development is foreseen), will this process stop and the best (?) calibration pipeline be available to the community.

At the time of writing, the HST archive is composed of 269 CDs for the RAW data (as of July 1st, 1998), and has 18 GBytes of calibration files.

The HST OTF service is available at:

http://archive.eso.org/archive/hst/ at ST-ECF (catalog@eso.org)

http://cadcwww.hia.nrc.ca/hst/ at CADC (cadc@hia.nrc.ca)

The ESO OTF service is foreseen; sometime in the future, also NTT and VLT archive users will benefit by this indispensable archive tool.

Acknowledgements

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References

[1] Dennis R. Crabtree, Daniel Durand, Siverin Gaudet, Norman Hill: “The CADC/ST- ECF Archives of HST Data: Less is More”; Astronomical Data Analysis Software and Systems V, ASP Conference Series, Vol. 101, 1996, George H. Jacoby and Jeannette Barnes, eds.

[2] The HST Data Handbook, STScI.

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HST Archive News: WFPC2 Associations

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Astronomers having browsed/visited the HST archive in the last six months have encountered a new type of WFPC2 dataset: the Association. This is the materialisation of a new service offered to ST-ECF archive researchers, meant to reconstruct the otherwise missing knowledge of the observing strategy (expected CR-SPLIT, expected dithering) adopted by a WFPC2 PI. Unlike NICMOS and STIS, where a dataset might be constituted of a set of exposures, the WFPC2 dataset’s structure was thought to be a repository of all the files belonging to a single exposure. Building associations of WFPC2 exposures is therefore to be considered an important step towards a comprehensive description of the HST archive contents. The association concept alleviates the need to discover:

- which observations can be grouped together in order to run a cosmic-ray cleaning algorithm;
- how a set of WFPC2 images map the region around an astronomical source of interest.

To achieve this goal of re-constructing the observing strategy of the PI, it is necessary to find out the exact displacement between any two exposures. There are two methods to compute the displacements among the images: by using the World Co-ordinate System (WCS) keywords normally stored in the header of the dataset, or via a cross-correlation technique. For WFPC2 exposures (more than 35,000 when writing this article), a number of problems arose while considering those two approaches:

• Before April 1996 the WCS keywords in the dataset fits header were not reflecting dithering strategy; even after that date, the WCS keywords are computed using phase two proposal information, that is, WCS values do not take into consideration what happened during the observation.

• Cross correlation of exposures would be difficult due to the presence of cosmic rays and depends on the signal-to-noise ratio of the features in the images.

These problems led to the impossibility to use any of those two methods in an automatic pipeline. Instead, to compute the offsets among all the exposures in the association, we decided to use the pointing information stored in the HST observation log files [2], informally called “jitter files”.

The jitter files have proven to be by far more reliable than any other available source of pointing information [1]. Some keywords (GUIDEACT, LOCKLOSS, SLEWING, etc.) in the jitter files along with the standard deviations of the measurements (right ascension, declination, roll angle) are used to evaluate the pointing stability during the observation and the accuracy of the measurements [3].

Once the offsets (in right ascension and declination) are computed, it is easy to derive the shifts expressed in pixels via the knowledge of the spacecraft orientation (roll angle) and of the focal plane geometry through the Science Instrument Aperture File (siaf).

A WFPC2 association containing all the WFPC2 exposures of the requested region of the sky, belonging to the same proposal, taken in the same filter, having the same position angle, can hence be seen as the ultimate repository of the observing strategy (real CR-SPLIT, real POS-TARG) as attained by the telescope.

Via the web (http://archive.eso.org/wdb/wdb/hst/science/form) users browse through the associations, have a closer look at a specific association, and immediately see what are the shifts among the exposures belonging to it.

Furthermore, an astronomer interested in that association can issue a request and ask our archive system to not only re-calibrate each exposure in the association, but also to combine them (if the offsets do not exceed the imposed limit of 5 mas beyond which the PSF of the combined images is degraded) to get cosmic-ray-free products. All the steps of the association pipeline are documented in log files that can be retrieved along with all the other products.

References

[1] A. Micol, P. Bristow, B. Pirenne: “Association of WFPC2 Exposures”; 1997 HST Calibration Workshop, Space Telescope Science Institute, 1997, S. Casertano, et. al., eds.

[2] M. Lallo: “Observation Logs”; http://www.stsci.edu/ftp/instrument_news/Observatory/obslog/OL_l.html, Data Systems Operations Branch, Space Telescope Science Institute, July 1998.

[3] M. Dolensky et. al.: “How the analysis of HST engineering telemetry supports the WFPC2 association project and enhances FOS calibration accuracy”, in this issue.

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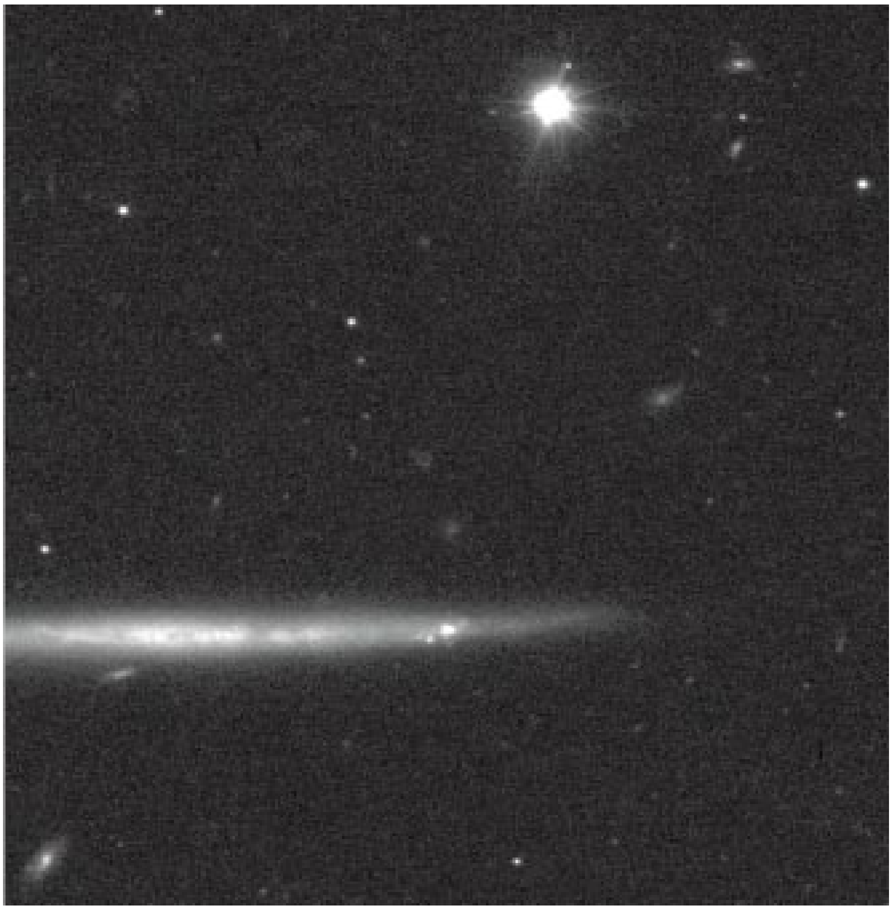
Image from the VLT Science Verification Programme



The galaxy ESO342-G017 was observed on August 19, 1998 during a spell of excellent observing conditions. Two exposures, each lasting 120 seconds, were taken through a red filter to produce this photo. The quality of the original images is excellent, with FWHM of only 0.26 arcsec measured on the stars in the frame. The frames were flat-fielded and cleaned for cosmics before combination.
ESO342-G017 is an Sc-type spiral galaxy seen edge-on, and the Test Camera was rotated so that the disk of the galaxy appears horizontal in the figure. Thanks to the image quality, the photo shows much detail in the rather flat disk, including a very thin, obscuring dust band and some brighter knots, most probably star-forming regions. This galaxy is located well outside the Milky Way band in the southern constellation of Sagittarius. Its distance is about 400 million light-years (recession velocity about 7,700 km/sec). A number of more distant galaxies are seen in the background on this short exposure.
The field shown measures ~ 1.5×1.5 arcmin. North is inclined 38° clockwise from the top, east is to the left.

(Figure and caption are from the ESO web pages at http://www.eso.org/outreach/press-rel/pr-1998/pr-12-98.html *prepared by the ESO Education and Public Relations Department.)*