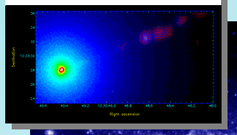
ORAC-DR

the flexible data-reduction tool—continues to develop

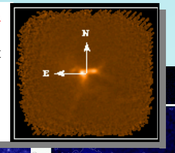
Starlink is extending ORAC-DR—created at the Joint Astronomy Centre to offer real-time automatic reductions during observation, using Starlink applications—to reduce data from other instruments. The emphasis is on those ESO instruments where no adequate science pipeline already exists, prioritised according to community requests. ORAC-DR recipes already span a wide wavelength range from the optical to millimetre, and a variety of techniques, as illustrated below. The latest release (v4.0-1) on the summer 2003 CD features ISAAC and INGRID imaging. It also has recipes for the multi-mode UIST instrument at UKIRT, including integral-field spectroscopy. There are many improvements to the existing recipes and infrastructure. Meanwhile the development system includes ISAAC spectroscopy and polarimetry; NAOS-CONICA, WFCAM, and Magellan ClassicCam imaging.

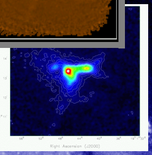
We welcome your suggestions for which ESO instruments and modes should be tackled next.

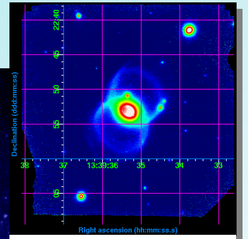
UFTI K-band polarimetry of M87 and its jet.



SCUBA data for W48, at 850 microns





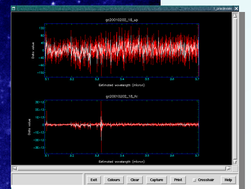


NACO data of MyCn18

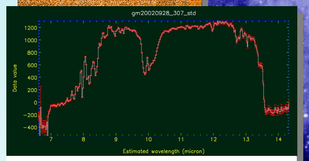
Michelle mid-IR chopped and nodded data of a quasar. Upper inset shows the combined positive and negatives, lower inset shows quality indicating "reality"

Some examples of data processed by ORAC-DR. It is relatively easy to add new instruments and we are adding recipes all the time.

GMOS optical CCD image of M79

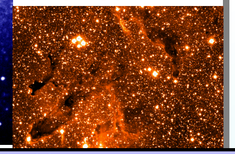


CGS4 spectra showing data errors

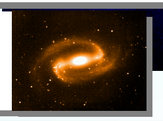


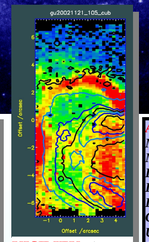
Michelle mid-IR spectrum of a standard, showing 2-sigma error bars

"Pillars of Creation" data from **ISAAC** on VLT

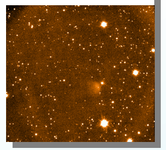


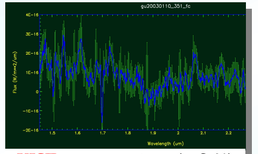
IRIS2 image of NGC1300 in Ks band





First **INGRID** mosaic produced by ORAC-DR





UIST quasar spectrum (**z=6.41**)

UIST IFU views of NGC 7027 showing S(1) as an image with BrG as a contour overlay

Acknowledgments:
Michelle spectrum - Tom Kerr (JAC/Gemini)
Michelle image - Olga Kuhn (JAC)
IRIS2 --- S Ryder (AAO) and B Cavanagh (JAC)
IFU --- Stephen Todd (IfA)
INGRID - Andy Longmore (ATC)
GMOS & CGS4 --- Paul Hirst (JAC)
UFTI --- Lerotodi Leeuw (Univ. of Toledo)
SCUBA --- Tim Jenness (JAC)
ISAAC --- ESO archive
UIST quasar spectrum---Willott C.J., McLure R. J., Jarvis M.J., 2003, ApJ, 587, L1.
NACO MyCn18 image---Myfanwy Bryce to be presented at "Asymmetric Planetary Nebulae III"

News and Contact Info

Starlink and the Virtual Observatory (VO)

Starlink programmers have been contributing ideas to the International Virtual Observatory Alliance, which authorises standards used by the VO. These ideas are derived from our years of real-life experience with applications based on a sophisticated hierarchical Data Model (HDX/NDX) which tracks data quality and error estimates. These kinds of features will be ever more important in the VO era as astronomers combine data from many sources. Capabilities such as those of the new version of AST are also vital. If you have two datasets with different coordinate systems and want to compare them, AST will automatically find a way, if one exists, to match the coordinate systems and units. These new capabilities are available in all Starlink applications using AST. This is well illustrated in SPLAT shown overleaf—you can drag and drop spectra onto one another and AST will automatically match coordinate systems. Spectra ranging from X-ray (originally keV units) to near-IR were dropped onto a UV plot (Ångstroms) and all the spectra were automatically plotted as Ångstroms. In addition Starlink applications can use Web Services, for VO compatibility, and can handle many data formats.

VOTable support

The Table Java package, on which TOPCAT is built, includes a VOTable class which provides full support for the VOTable standard.

New Features on the Summer 2003 CD

There are many new features throughout the whole software collection—this Bulletin highlights just a few. Look on the Web site, or Starlink News, or at *README_FIRST.html* or *docs/sun212.tex* or *docs/sun212.htx/sun212.html* on the CD, for details of all the new features on the new CD and the Software Store (URL given below).

Note the new quick and easy installation command.

GPL Licence

Starlink software is now being released under the GPL open-source licence and will be available via CVS to make it easier for all to contribute.

Site Visits

We have been visiting sites to demonstrate Starlink software and to find out what users need next. If you would like us to visit your site please email *d.giaretta@rl.ac.uk*.

MS Windows

You can run the full set of Java applications under Windows—including access to FITS and HDS files. See the Windows directory on the CD or *http://www.starlink.ac.uk/treeview*

Contact information

World Wide Web : *http://www.starlink.ac.uk*
E-mail: *ussc@star.rl.ac.uk*
Anonymous ftp : *ftp.starlink.ac.uk*
News service: *http://www.starlink.ac.uk/news.html*
Newsgroup: *uk.org.starlink.announce*
Software Store: *http://www.starlink.ac.uk/cgi-store/storetop*
Telephone: *David Giaretta 01235 446235*

Quick

Did you know you could have a Starlink programmer work on **your** reduction, analysis, or programming problem for up to a day at short notice?

Typical problems include adding astrometry to an image; conversion between data formats; providing scripts for automating tedious reductions for many files, often involving tools from more than one package; adding options to existing applications, and software building.

While it cannot guarantee to solve your problem, the Quick team has a wealth of experience in a variety of techniques, software packages, and programming languages. Even if your job would take too long for the Quick service, your submissions help us identify omissions in the Starlink collection and formulate longer-term projects.

Problems should be addressed to *quick@star.rl.ac.uk*. See the Quick home page *http://www.starlink.ac.uk/Software/quick_service.htm* for more details and a selection of previous solutions.

Note that Quick is not intended for bug reports, which should be still be sent to *bugs@star.rl.ac.uk*.

Don't forget the full range of Starlink software is available on CD, with the new easy installation procedure. Updates for applications and support for new instruments in ORAC-DR are made available on the Web site

http://www.starlink.ac.uk

CLRC

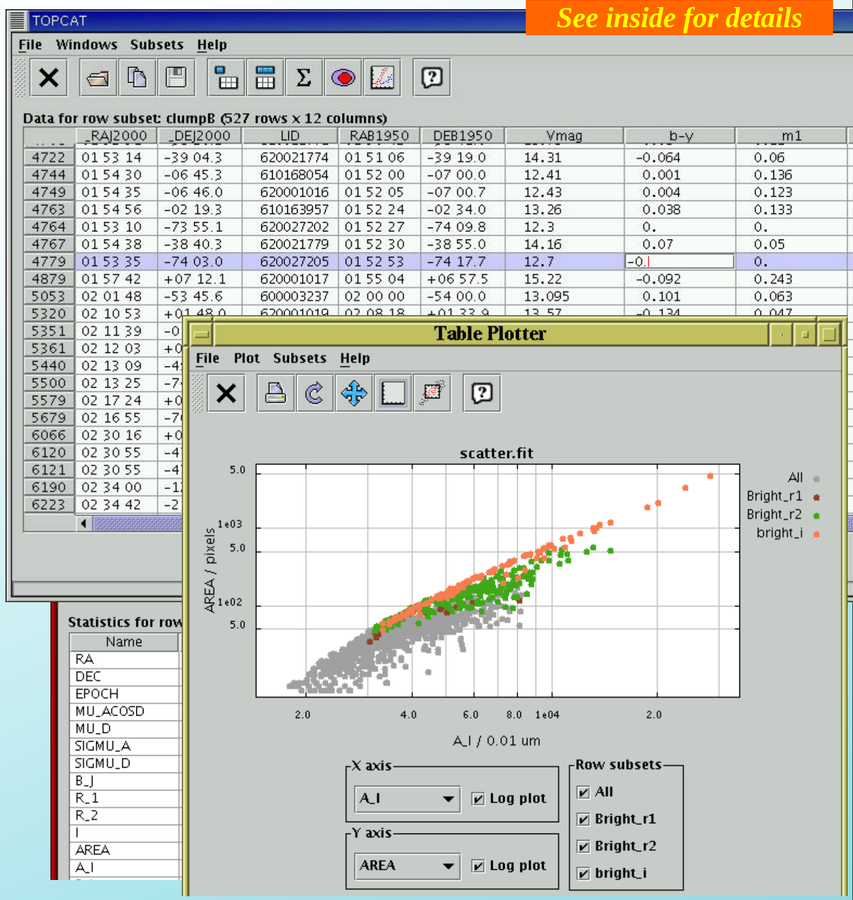
Starlink bulletin

RUTHERFORD APPLETON LABORATORY August 2003 Issue No. 23

TOPCAT is a new application for reading, writing, editing and plotting tables of all kinds.

TOPCAT is TOPS

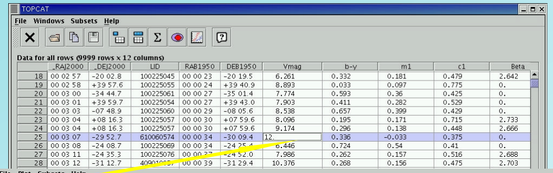
See inside for details

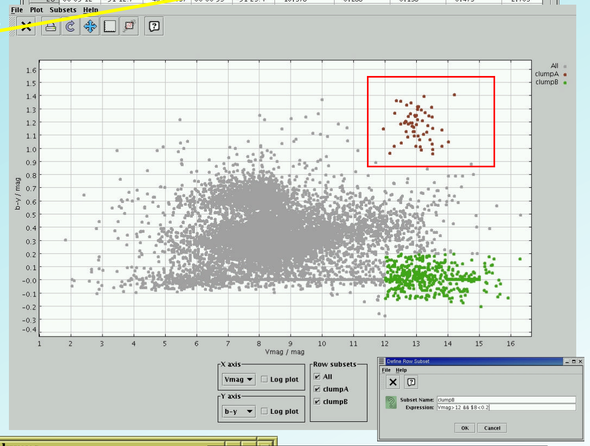


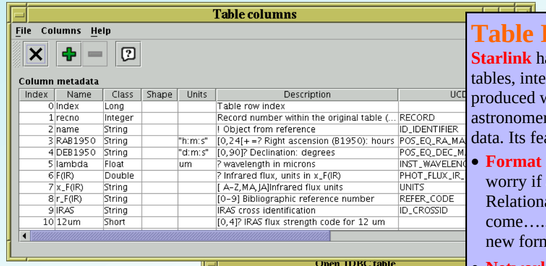
TOPCAT

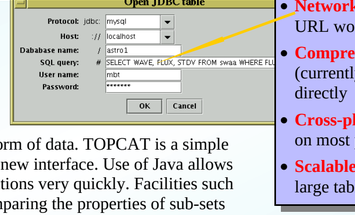
Capabilities

- Read/write tables in many formats
- View the table data in a scrollable window (even for very large tables)
- Create subsets from a plot or by writing general algebraic expressions
- Plot table columns against each other—all rows or selected subsets in different colours
- **Edit table cells**
- **Edit table and column metadata**
- **Edit large tables in place**
- **Write out any selection as a new table in a choice of formats**
- Sort on a selected column
- Make new columns by combining existing ones using a powerful expression syntax
- Rearrange columns by drag and drop
- Launch table analysis applications such as Mirage
- Display column statistics
- View table and column metadata - parameters, column units, UCDs etc
- Full VOTable support









Rationale

Large catalogues and tables are increasingly important in astronomy—especially in the VO era. The Table Interface is aimed at supporting this form of data. TOPCAT is a simple example of the use of this new interface. Use of Java allows us to develop such applications very quickly. Facilities such as statistical analyses, comparing the properties of sub-sets and fitting functions are planned.

Table Interface

Starlink has developed a new interface for tables, intended to allow applications to be produced which make life easier for astronomers who need to work with tabular data. Its features are:

- **Format independent**—you don't need to worry if a given table is in a FITS file, Relational Database, VOTable with more to come…..and it's designed to be easy to add new formats
- **Network transparent**—tables named by URL work just the same as local files
- **Compression aware**—compressed data (currently gzip/bzip2) can be handled directly
- **Cross-platform**—Java implementation runs on most platforms without rebuilding
- **Scalable**—designed for use with extremely large tables

See *http://www.starlink.ac.uk/topcat*

TREEVIEW

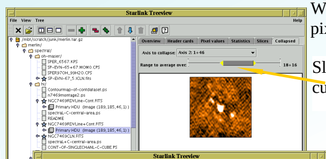
Treeview is an extensible tool for viewing hierarchical data structures.

It shows which of a number of data models a particular piece of data conforms to, and allows you to invoke an application which understands a specific model in order to perform more specialised operations. For example, a VOTable may be viewed as an XML file or as tabular data. The latter will show a button to start TOPCAT which allows you, for example, to edit and plot the data. The applications communicate using Web Services, as do GRID/Virtual Observatory applications.

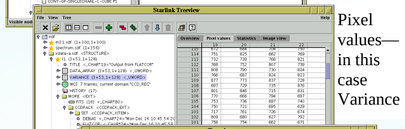
New Features

- Full display of items within tar/zip/jar archives
- Full display of items in a compressed file (gzip,bzip2) or from a URL
- Launching of specialist viewer applications (SoG for images, SPLAT for spectra, TOPCAT for tables)
- Full VOTable support
- HDX/NDX support
- 1-d array plotting & grid drawing improvements
- More options for display of datacubes
- Table data and metadata display improvements (FITS tables, VOTables)
- More navigation options
- Calculation of array statistics
- Hex dumps for file data
- Demo data supplied

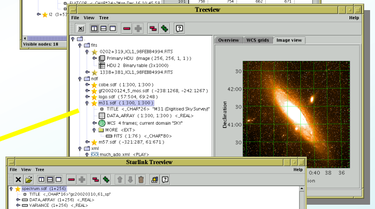
In a 2-d FITS image extension you can see the list of header cards, a table of pixel values, the image itself, WCS information and pixel statistics.



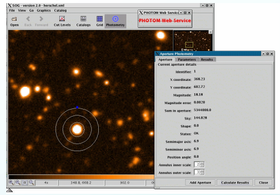
Slice from cube



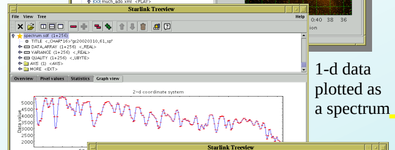
Pixel values—in this case Variance



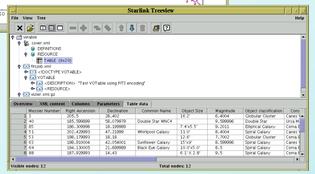
SoG—for detailed image inspection



SoG uses Web Services to run other applications (in this case PHOTOM) to allow you to use spare CPU capacity on remote machines.



1-d data plotted as a spectrum



Tabular data and metadata is displayed appropriately.

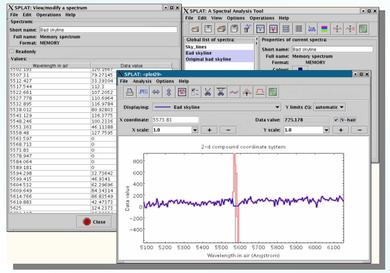
Web Services

Web Services

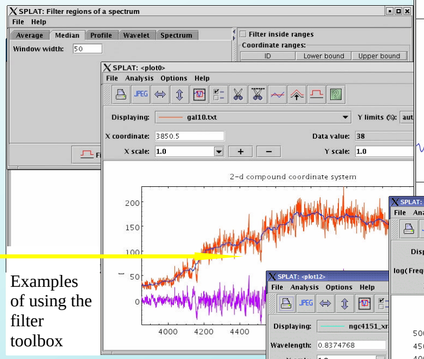
For more information please see
http://www.starlink.ac.uk/treeview
Suggestions for additional capabilities are welcomed.

SPLAT

SPectraL Analysis Tool



- **Directly edit individual values**
- **Use an algebraic expression to transform all the values of a column**
- **Add noise**
- **Generate an error column**
- **Add model lines**
- **Red or blue shift coordinates**
- **Insert and delete rows.**
- **UNDO and REDO for all changes**
- **Changes immediately displayed on plots**



Examples of using the filter toolbox

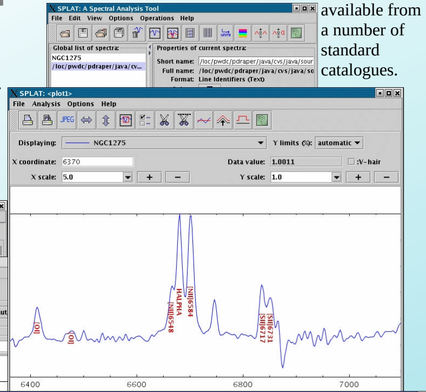
Coming Soon

- better support for fitting absorption
- new print options
- addition of a cross-correlation toolbox
- support for additional input formats

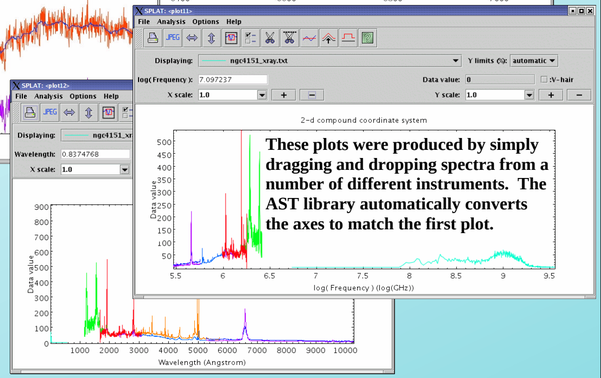
Major changes to SPLAT in this release are:

- **Facilities to view and edit spectra in a table, with undo support**
- **The incorporation of a set of standard line identification catalogues for optical, IR and sub-millimetre**
- **Full support for spectral coordinate systems**
- **A new toolbox for filtering and smoothing spectra**

Other changes include the ability to delete as well as extract parts of spectra, to specify the types of spectra when the file extension is not one of the standard types, and to drag-and-drop spectra from the global list to plots.



Lines are available from a number of standard catalogues.



These plots were produced by simply dragging and dropping spectra from a number of different instruments. The AST library automatically converts the axes to match the first plot.

See *http://www.starlink.ac.uk/splat*