PNGS
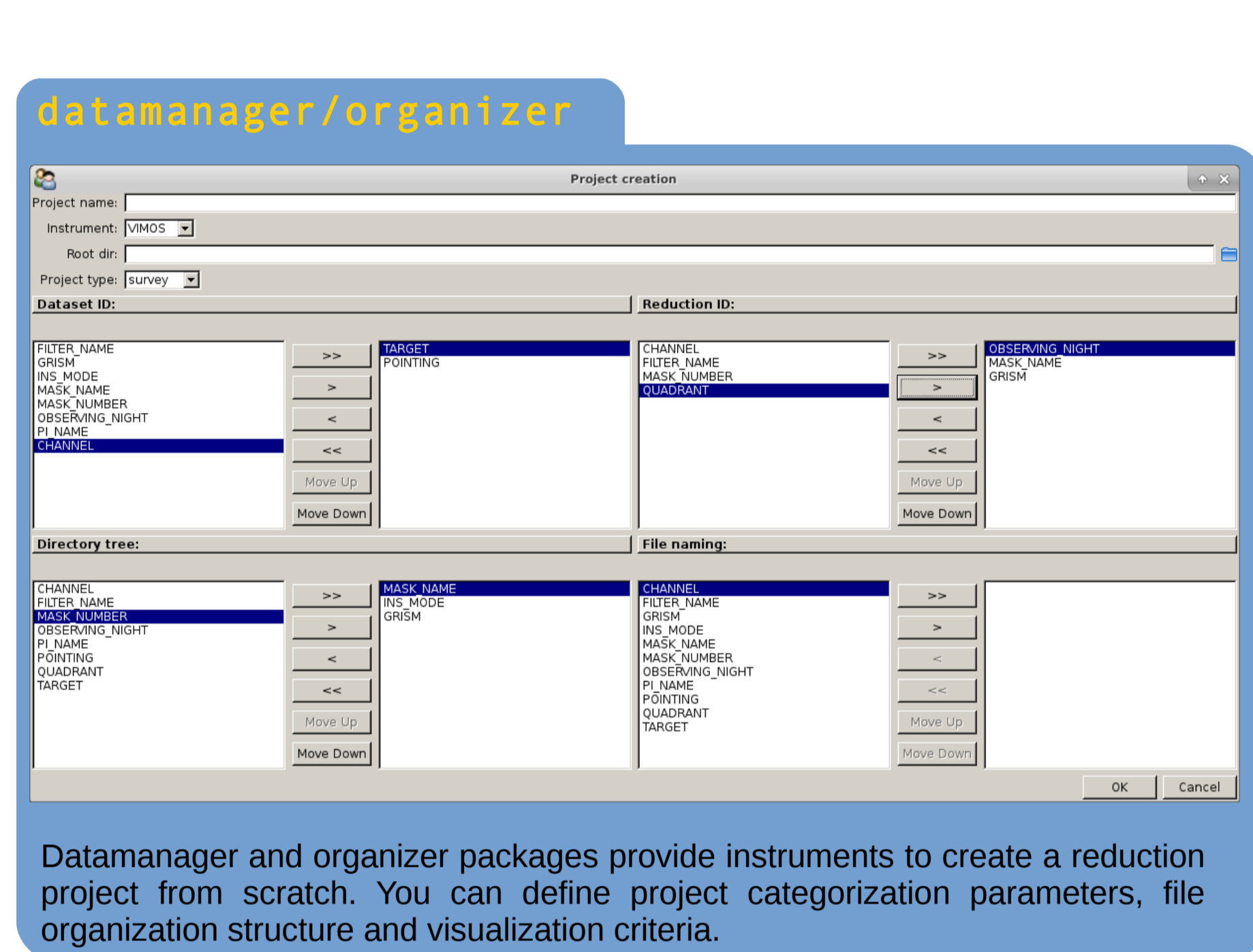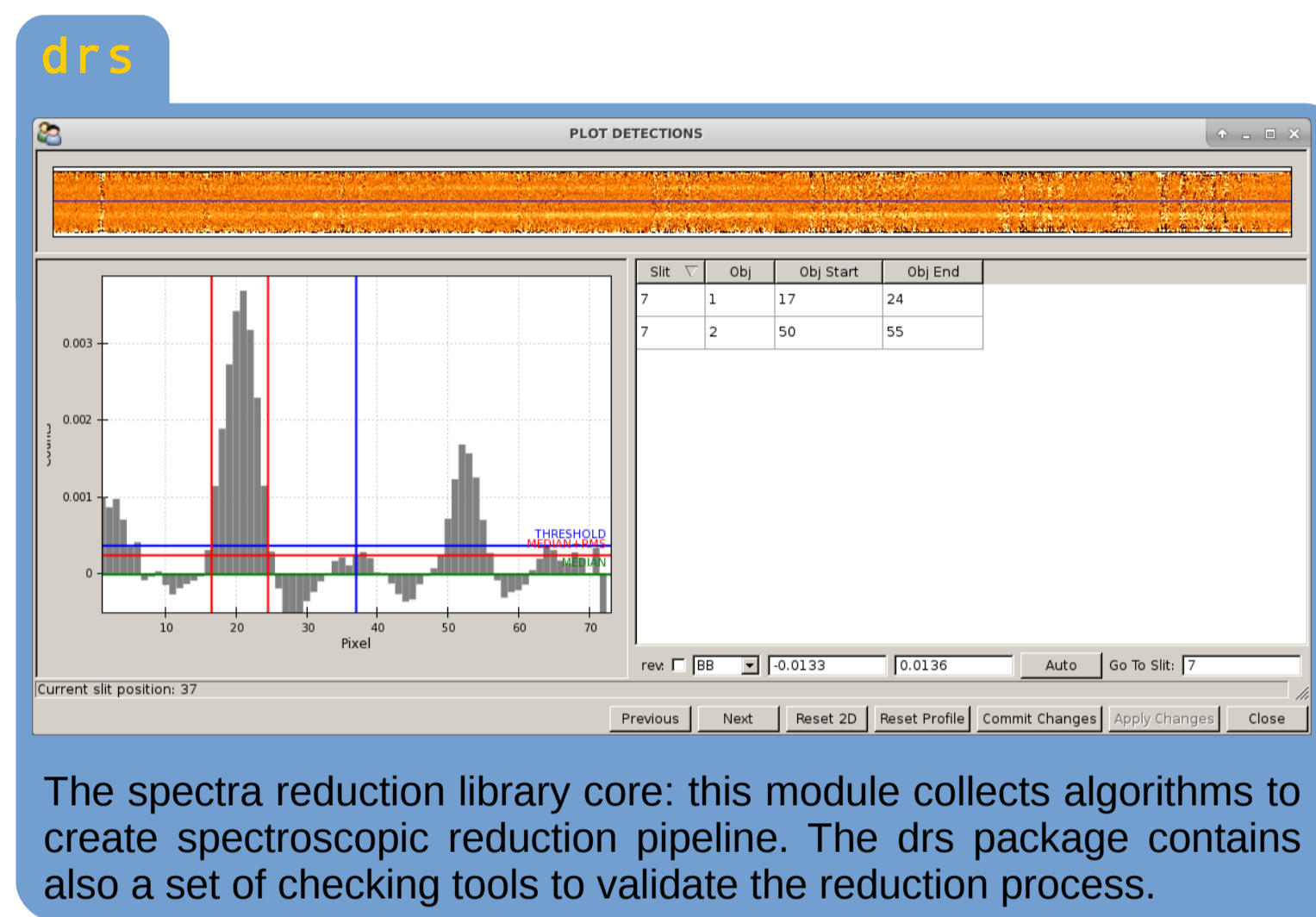## an API ecosystem for Astronomical Applications Development

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PNGS is a collection of object oriented Application Programming Interfaces (APIs) implementing a broad set of functionalities and routines aimed at the manipulation of spectroscopic astronomical data. In particular a subset of GUI-oriented APIs are available. The idea of the PNGS APIs collection as an ecosystem has led us to conceive and design them as a modular and independent set of objects, taking into consideration SoC (Separation of Concerns) and encapsulation principles; at the same time, the way PNGS is designed makes it simple to expand this ecosystem in terms of new functionalities and data containers. PNGS relies on the astronomical software framework FASE[1].
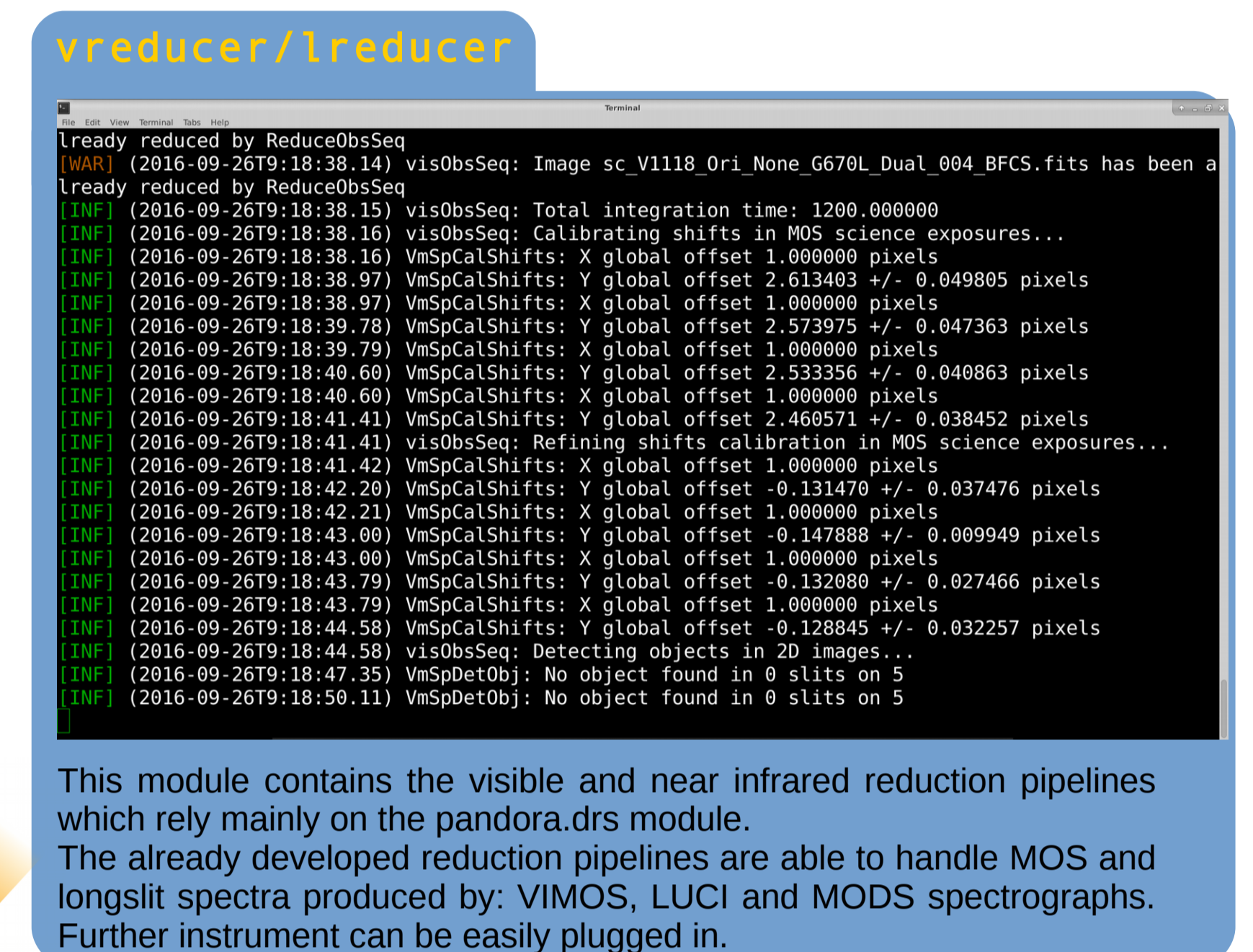
datamanager/organizer
Datamanager and organizer packages provide instruments to create a reduction project from scratch. You can define project categorization parameters, file organization structure and visualization criteria.
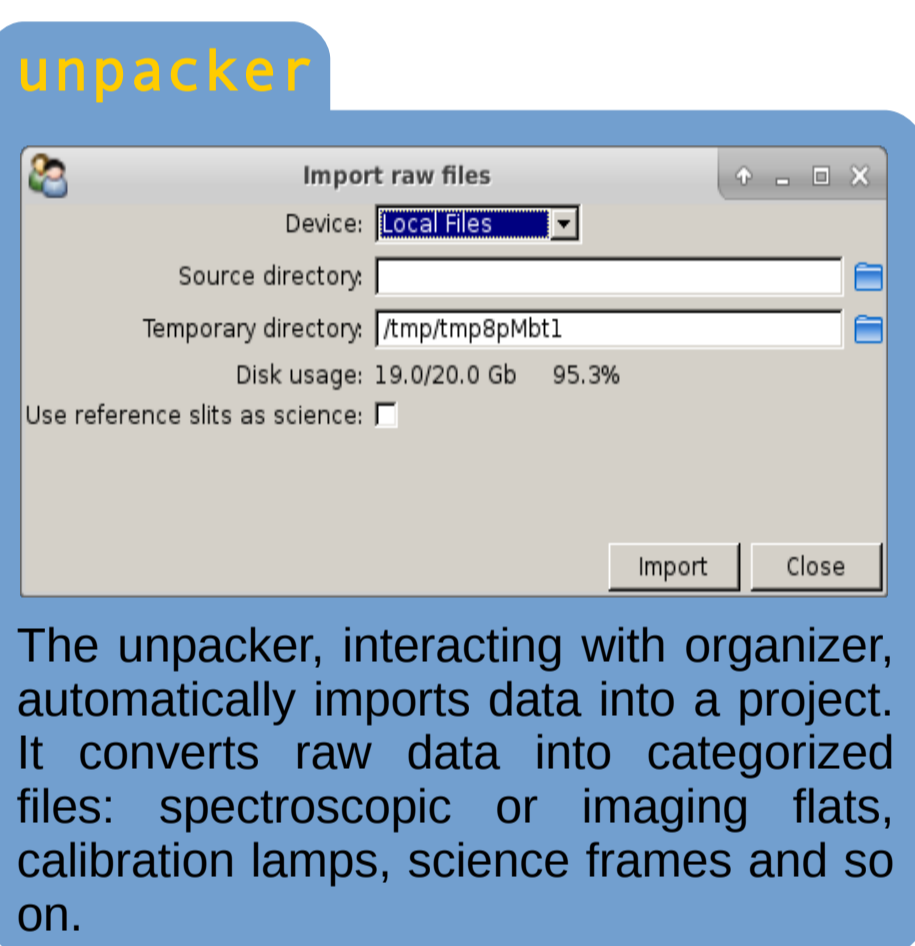
drs
The spectra reduction library core: this module collects algorithms to create spectroscopic reduction pipeline. The drs package contains also a set of checking tools to validate the reduction process.
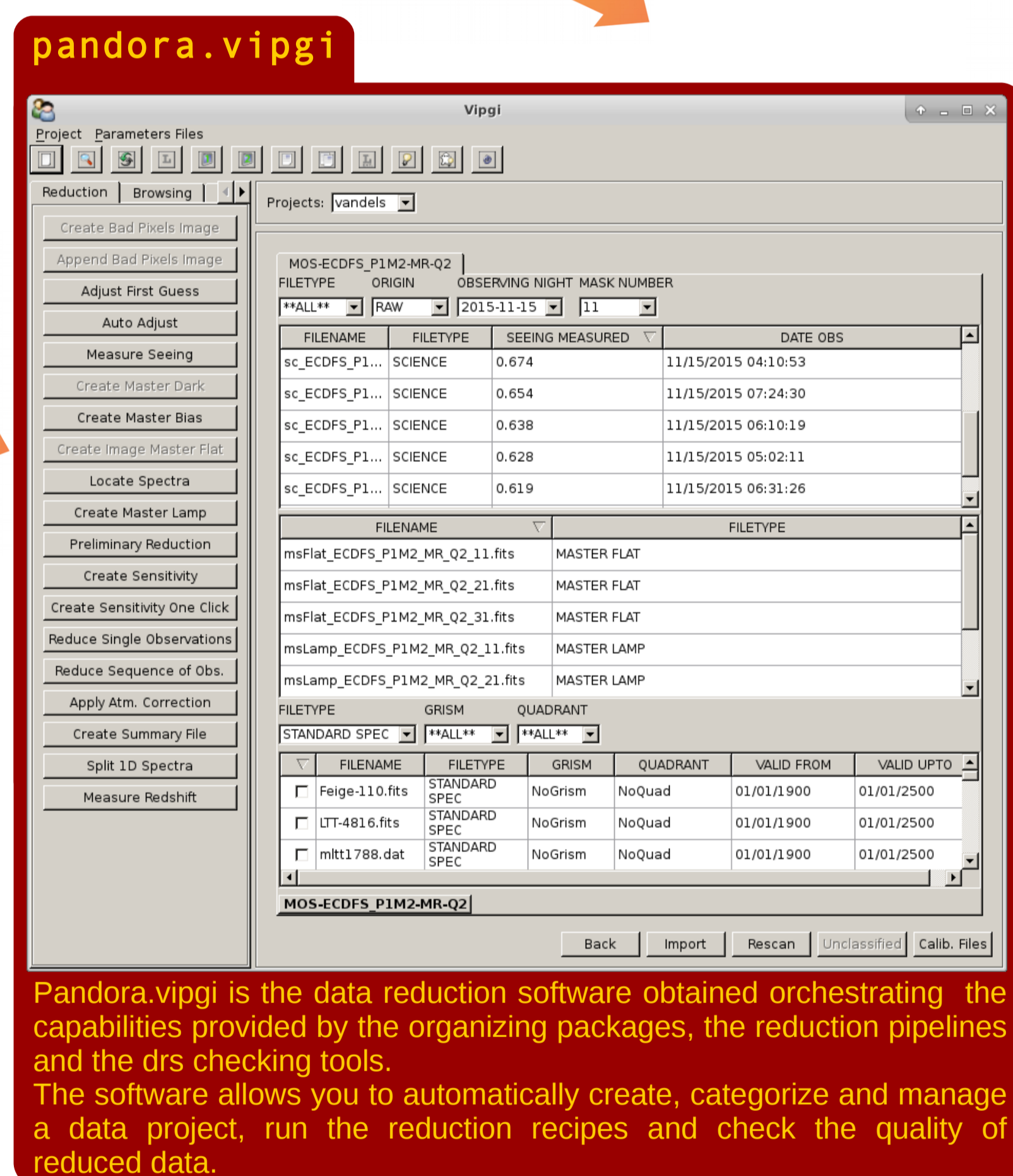
vreducer/ireducer
This module contains the visible and near infrared reduction pipelines which rely mainly on the pandora.drs module.
The already developed reduction pipelines are able to handle MOS and longslit spectra produced by: VIMOS, LUCI and MODS spectrographs. Further instrument can be easily plugged in.
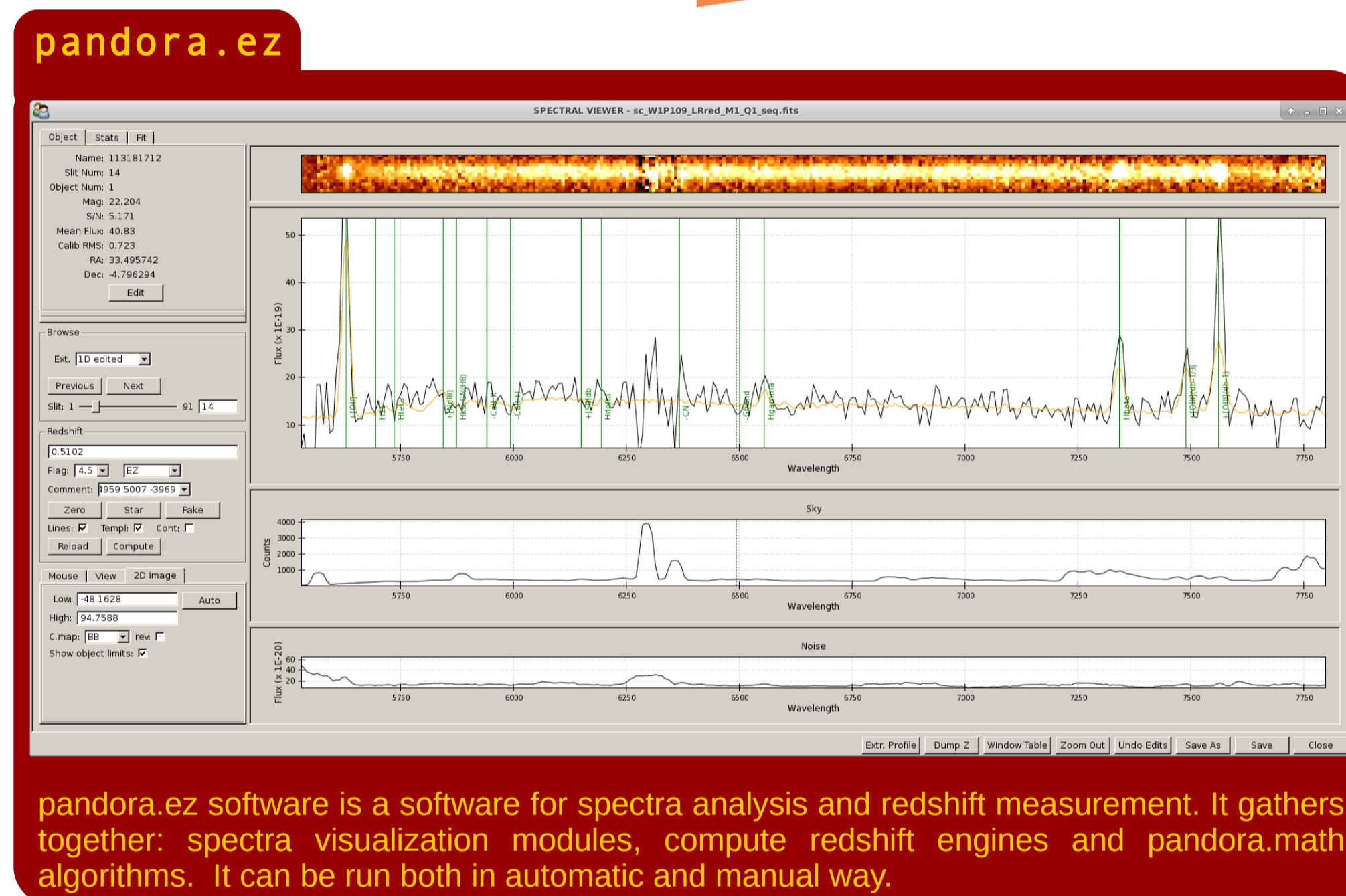
unpacker
The unpacker, interacting with organizer, automatically imports data into a project. It converts raw data into categorized files: spectroscopic or imaging flats, calibration lamps, science frames and so on.
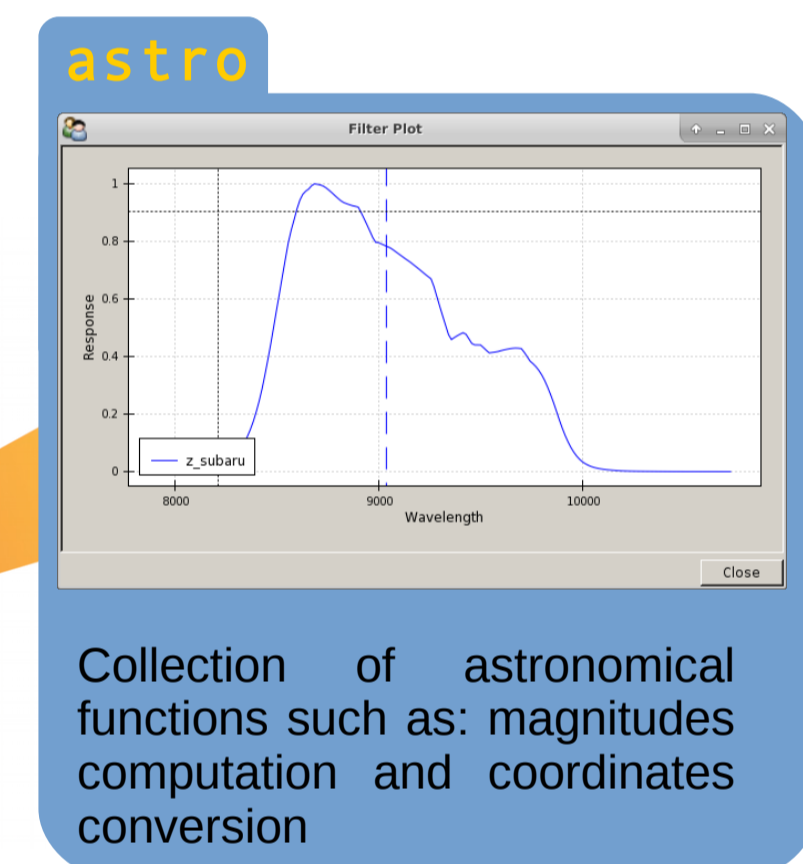
pandora.vipgi
Pandora.vipgi is the data reduction software obtained orchestrating the capabilities provided by the organizing packages, the reduction pipelines and the drs checking tools.
The software allows you to automatically create, categorize and manage a data project, run the reduction recipes and check the quality of reduced data.
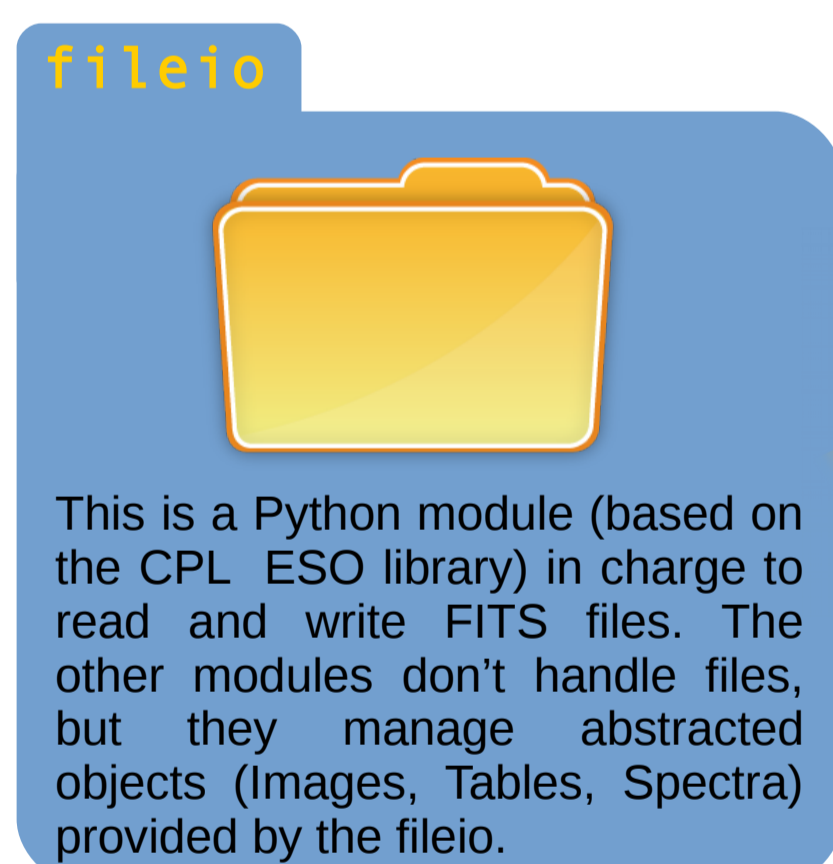
pandora.ez
pandora.ez software is a software for spectra analysis and redshift measurement. It gathers together: spectra visualization modules, compute redshift engines and pandora.math algorithms. It can be run both in automatic and manual way.
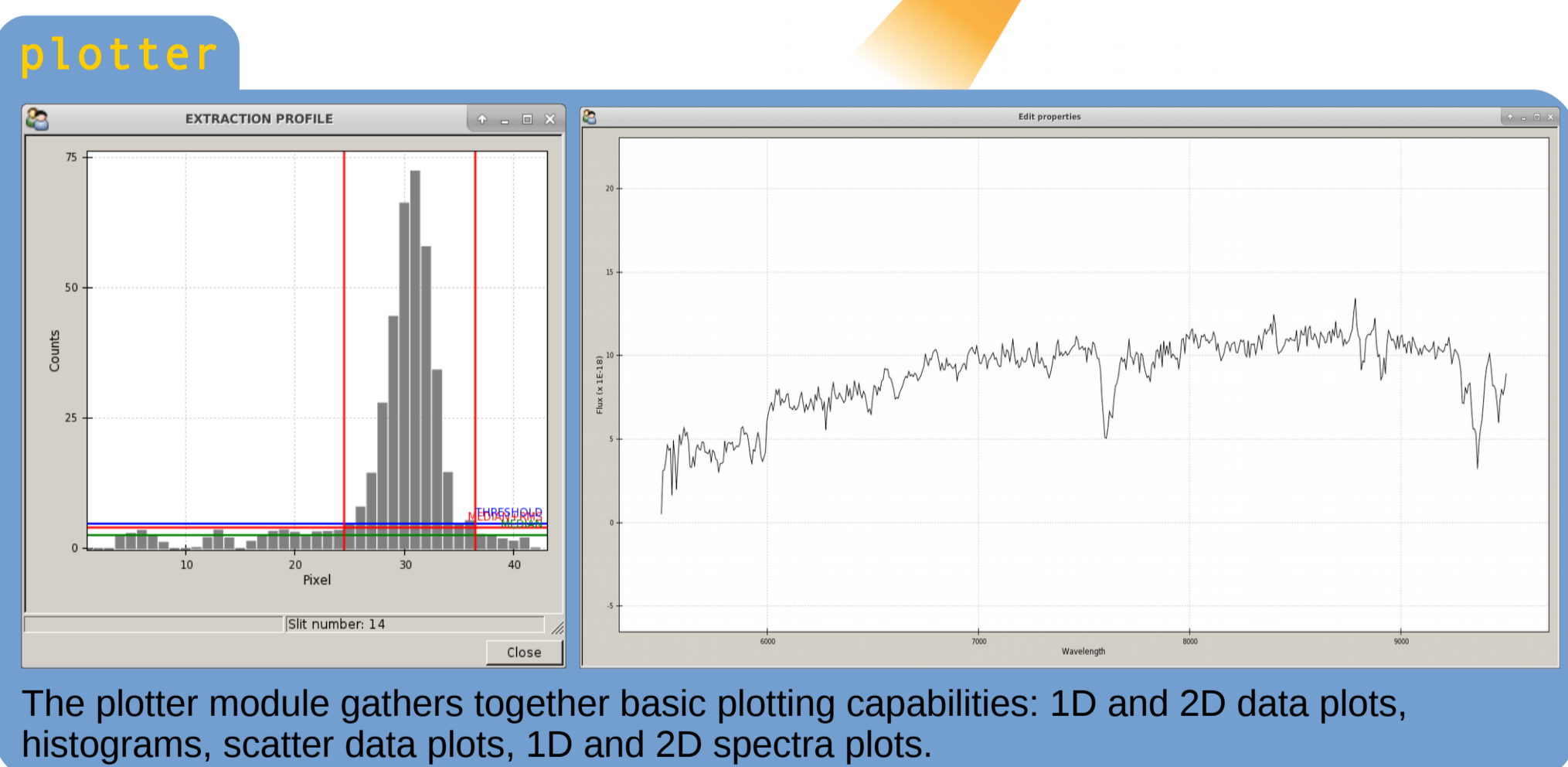
astro
Collection of astronomical functions such as: magnitudes computation and coordinates conversion
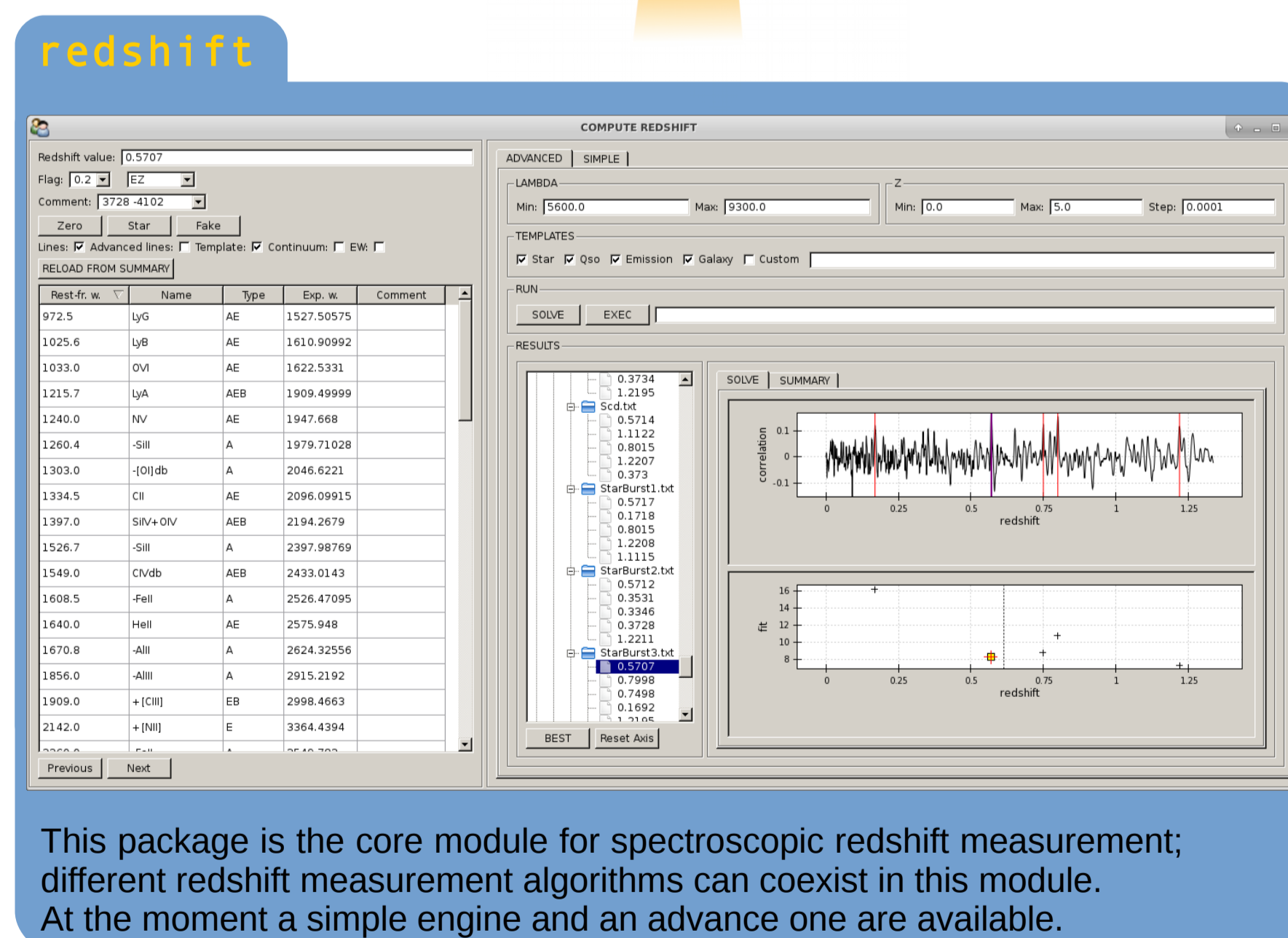
fileio
This is a Python module (based on the CPL ESO library) in charge to read and write FITS files. The other modules don't handle files, but they manage abstracted objects (Images, Tables, Spectra) provided by the fileio.

math
This module collects generic mathematical functions such as: fitting methods, interpolation routines, bspline utilities and so on. Mathematical functions rely on the GSL C library and the scipy Python package.

redshift
This package is the core module for spectroscopic redshift measurement; different redshift measurement algorithms can coexist in this module. At the moment a simple engine and an advance one are available.
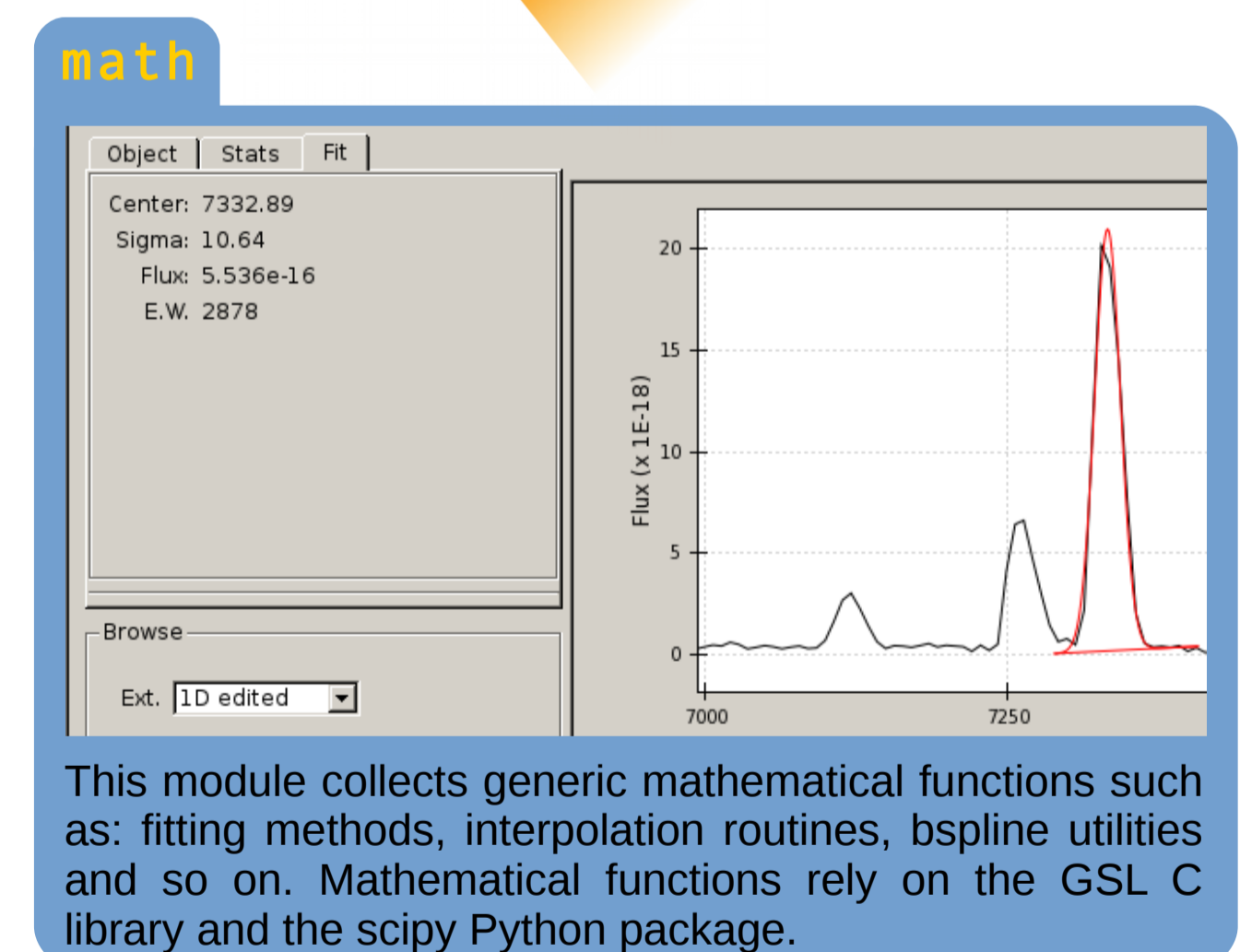
plotter
The plotter module gathers together basic plotting capabilities: 1D and 2D data plots, histograms, scatter data plots, 1D and 2D spectra plots.

PNGS APIs have been used to implement the improved versions of:
- VIPGI[2]: a graphical application for data reduction/organization;
- EZ[3]: an integrated environment for spectra analysis and visualization.
These softwares are currently used by the LBT[4] Italian reduction center in Milan, to reduce data acquired by LUCI and MODS spectrograph for the Italian community.
The new releases of VIPGI and EZ are also used to reduce data and analyze spectra of the ESO public spectroscopic survey VANDELS[5].

1 Grosböl, P. 2012ASPC..461..619G
2 Scodeggio et al. 2005 2005PASP..117.1284S
3 Garilli et al. 2010   2010PASP..122..827G
4 http://www.lbto.org/
5 McLure R., Pentericci L. in preparation (http://vandels.inaf.it/)