

New STScI Data Analysis Applications

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Abstract. Tools exist within the STSDAS package for visualizing and analyzing spectra and for removing cosmic rays and distortion from sets of images. However, using these tools can sometimes be a complex experience. PyDrizzle and Specview have been developed at STScI to simplify the tasks of working with images and spectra, respectively. The Python task PyDrizzle automates the use of the *drizzle* and *blot* tasks from the dither package in STSDAS. The demonstration illustrated some of the most recently added capabilities to PyDrizzle that allow it to be used as a basis for removing cosmic rays and distortion from ACS data. Specview, on the other hand, provides easy simultaneous display and analysis of multiple 1-D spectrograms of the same astronomical source taken with different instruments. Its visualization and powerful spectral model fitting capabilities were demonstrated. Both tasks can be obtained online from STScI.

1. PyDrizzle

This package of tasks makes it easy for a user to dither-combine and/or remove geometric distortion from either dithered or single images. The tasks use the IRAF tasks *drizzle* and *blot* from the STSDAS **dither** package which implements the Drizzle algorithm (Fruchter & Hook 2002) to remove distortion and combine images. It consists of the tasks:

- **pydrizzle**
Automates the use of both *drizzle* and *blot* by calculating all the necessary parameters, creating the appropriate distortion coefficients tables, and keeping track of all the inputs and outputs.
- **buildasn**
Generates association tables for user-specified sets of images to be processed by PyDrizzle.
- **xytosky**
Computes the distortion corrected RA/Dec based on the X/Y pixel position from a distorted image.

All these tasks have both a Python command line interface as well as an IRAF parameter-driven interface suitable for use with PyRAF's graphical EPAR. Pipeline use only requires the name of the input association table or exposure as input while all other parameters can be determined automatically or use conservative default values. This allows the task to be run, in most cases,

with only one simple command and almost no parameters compared to the many required parameters for the *drizzle* or *blot* tasks themselves.

The task *pydrizzle* provides the user with the ability to:

- process ACS, WFPC2, and eventually STIS and NICMOS, images,
- modify computed parameters with values updated using external programs,
- keep track and modify intermediate file products, such as the static mask image,
- keep track of offsets from nominal shifts and rotations,
- compute distortion-corrected RA/Dec positions for any object from any input image,
- *drizzle* each input observation to a separate output, and
- *blot* separate outputs to separate inputs.

These capabilities allow PyDrizzle to maintain all the bookkeeping necessary for performing more advanced processing such as cosmic-ray rejection using the techniques from the Dither Handbook. PyDrizzle can also serve as the basis for a library of functions usable by any Python task for astronomical reductions. The *xytosky* task demonstrates how the methods from PyDrizzle can be developed into a separate task for use on data from any supported instrument.

A lot of work still needs to be done to expand the range of additional tasks derived from the PyDrizzle methods and classes, such as a *skytoxy* task, with an emphasis on making them generally applicable to any astronomical dataset. However, the current software still represents a dramatic step forward in the ease of use of advanced image processing, specifically processing provided by the tasks in the STSDAS *dither* package.

1.1. Status

PyDrizzle Version 3.0 was released with STSDAS Version 3.0. The latest version, starting with *Version 3.3e (7-Nov-2002)*, can be downloaded from the PyDrizzle WWW pages.¹

A serious effort to provide documentation for PyDrizzle has been undertaken, starting with built-in help, IRAF-style help files in STSDAS and a user's guide for PyDrizzle. As a starting place, a preliminary draft of the first chapter of a user's guide can be downloaded from the WWW site, with the full version being posted as soon as it gets completed.

2. Specview

Specview is a spectral visualization tool that has been designed to provide easy simultaneous display and analysis of multiple 1-D spectrograms of the same astronomical source taken with different instruments.

Currently, Specview fully supports a variety of FITS file formats:

- HST STIS 1-D extracted spectra,
- HST STIS 2-D rectified spectra,
- HST GHRS,

¹<http://stsdas.stsci.edu/pydrizzle/>

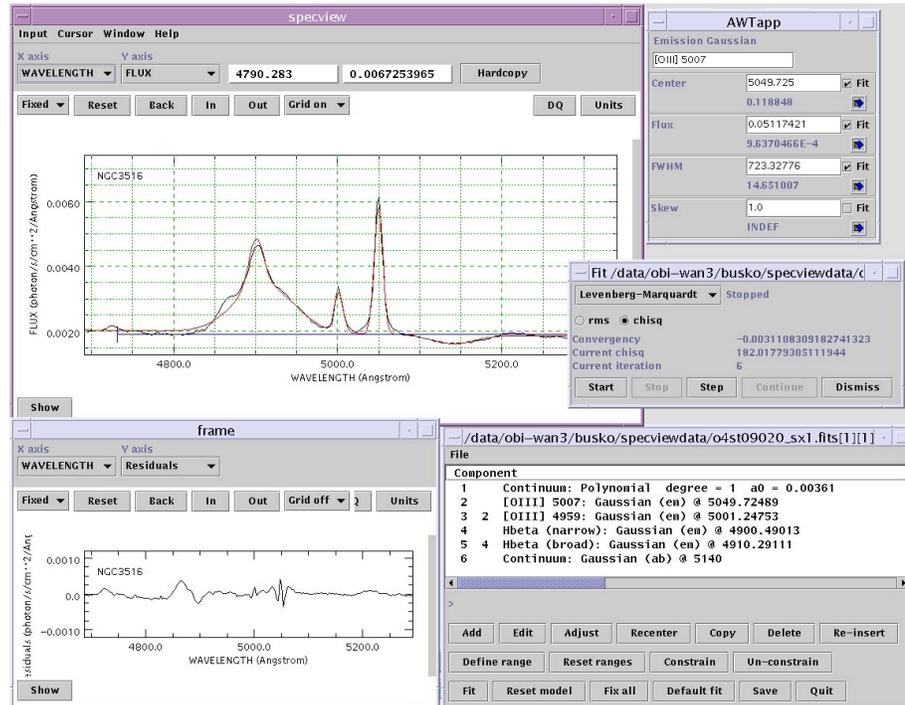


Figure 1. Specview in action.

- HST FOS,
- ACS grism 1-D spectra extracted by aXe,
- IUE MXHI echelle,
- IUE MXLO first order,
- SDSS 1-D extracted spectra,
- FUSE,
- STScI Archive preview FITS files,
- generic FITS binary table reader, and
- generic text-based format that can be used to input almost anything, including SED data.

Specview provides a number of interactive tools to enable the user to explore the internal structure of complex spectroscopic files, such as STIS and IUE echelle data. It provides interactive tools for zooming and panning into the data, and for selecting particular data arrays within a file. There are also interactive tools for browsing the FITS headers, and for customizing the plots, such as a physical units selector, log scaling, a color and plot style editor, and plot annotation. Plots can be sent to a hardcopy device or a file. Most of these features can be accessed from buttons or menus shown in Figure 1.

Specview features a powerful spectral model fitting engine which allows the user to: build spectral models, maintain spectral models using interactive tools, and fit data using non-linear chi-square minimization. Models are built from spectral components selectable from a library. Choices include functions such as blackbody, power laws, recombination continuum, bremsstrahlung, accretion

disk, a variety of Gaussian types, Lorentz, Voigt, etc. Components can be edited in a variety of ways, and also be constrained to each other using physical criteria. Users with minimal proficiency in Java coding can add their own functions to the library as well. Models can be saved to disk at any time and brought back later for further use.

A “quick measurement tool” is in the works to provide point-and-click functionality to measure spectral line properties without the need to invoke the full power of the model fitting engine. Also in the works is a data processing engine that will provide spectrum arithmetic, splicing, rebinning, and Fourier filtering capabilities.

2.1. Status

Specview is a standalone application written in Java. It can be downloaded and installed as independent software, or it can be bundled with other Java applications. Specview is currently bundled with the StarView archive data browser as its main spectral preview tool.

Specview has been tested under a variety of systems: Solaris, Linux, Windows 98/NT/XP. A MacOS X port will occur in the near future.

The software can be downloaded from the Specview WWW pages.²

References

Fruchter, A. S. & Hook R. N. 2002, PASP, 114, 144

²<http://specview.stsci.edu>