
STDPipe

Simple Transient Detection Pipeline

— Status and future development —

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STDPipe on the Web

GitHub repository for development - <https://github.com/karpov-sv/stdpipe>

GitLab (“official”) repository - <https://gitlab.in2p3.fr/icare/stdpipe>

Documentation - <https://stdpipe.readthedocs.io/>

Tutorial - https://github.com/karpov-sv/stdpipe/blob/master/notebooks/stdpipe_tutorial.ipynb

STDPipe - Simple Transient Detection Pipeline

STDPipe is a set of Python routines for astrometry, photometry and transient detection related tasks, intended for quick and easy implementation of custom pipelines, as well as for interactive data analysis.

Design principles:

- implemented as a library of routines covering most common tasks
- operates on standard Python objects: NumPy arrays for images, Astropy Tables for catalogs and object lists, ...
- does not try to re-implement the things already implemented in other Python packages
- conveniently wraps external codes that do not have their own Python interfaces (SExtractor, SCAMP, PSFEx, HOTPANTS, Astrometry.Net, ...)

Aimed for the scientists who want to create simple pipelines for their telescopes or data

STDPipe - features

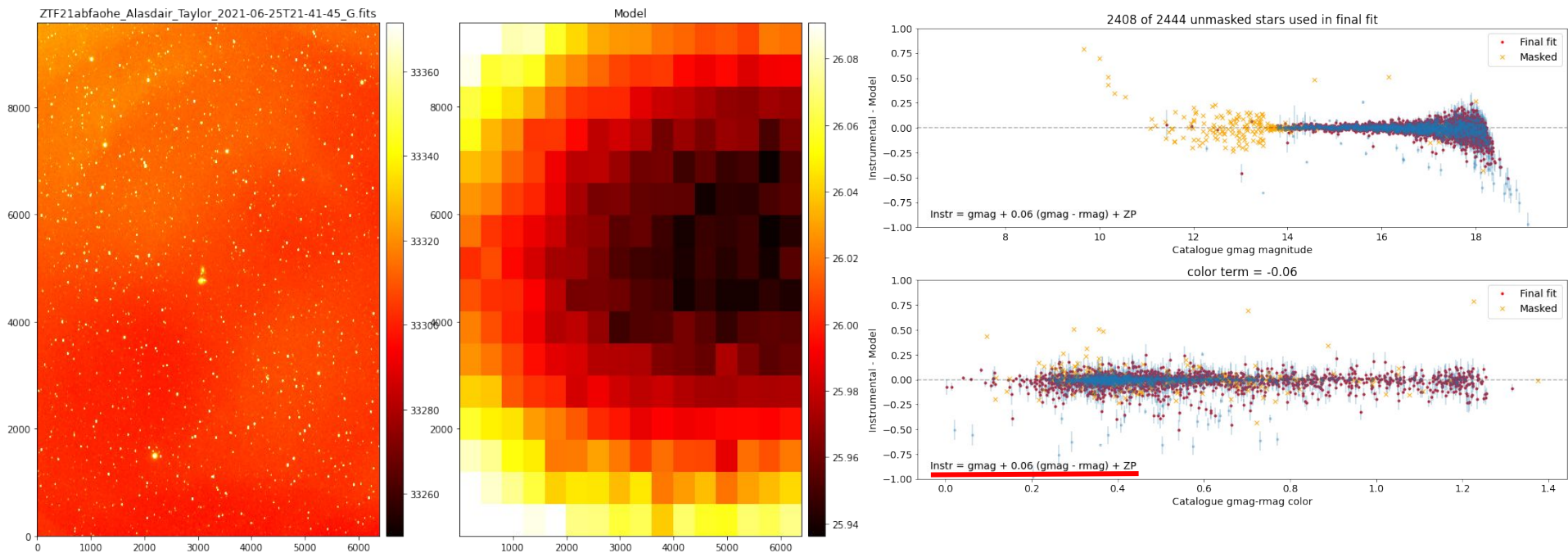
- ~~pre-processing~~ - should be handled before in an instrument-specific way
 - bias/dark subtraction, flatfielding, masking
- object detection and photometry
 - **SExtractor** or **SEP** for detection, photutils for photometry
- astrometric calibration
 - **Astrometry.Net** for blind WCS solving, both local and online
 - **SCAMP** or Astropy-based code for refinement
- photometric calibration
 - **Vizier** catalogues, passband conversion (PS1 to Johnson, Gaia to Johnson, ...)
 - spatial polynomial + color term + additive term + intrinsic scatter
- image subtraction
 - HiPS templates or Pan-STARRS images
 - **hotpants** + custom noise model
- transient detection and photometry
 - noise-weighted detection, cutout adjustment, ...
- auxiliary functions
 - PSF estimation, simulated stars, FITS header utilities, plotting, ...
- light curve creation (in progress)
 - spatial clustering, color regression, variability analysis, ...

STDPipe in detail – photometry

Instrumental = ***Catalogue*** + ZP(x, y) + color_term****color*** + additive(x, y) + scatter + error

- catalogue magnitude
 - (optionally spatially varying) zero point
 - (optionally) catalogue color
 - (very optionally) additive flux term, corresponding e.g. to biased background estimation
 - (very very optionally) intrinsic scatter on top of measurement errors
- ❖ iterative rejection of outliers, robust fitting, noise rescaling, ...

STDPipe in detail – photometry



Both spatial and color terms are usually important!

STDPipe in detail - subtraction

- Template images!
 - you are lucky if you have your own templates :-)
 - HiPS surveys through CDS **hips2fits** service (Pan-STARRS, SkyMapper, DES, ...)
 - has its own shortcomings
 - Direct downloads for Pan-STARRS images and masks
- Image subtraction
 - depends on external **hoptants** code
 - strongly depends on image noise model!
 - we have an option to derive it from the image itself
 - for background it is robust enough, for stars - requires correct **gain** value
 - often requires manual adjustments of subtraction parameters!
 - we try our best to select optimal defaults, but be careful anyway

STDPipe - development

- Documentation is being written right now
- Tutorials - what is interesting for you?
 - “main” tutorial
 - image stacking - new!
 - injection of artificial stars
 - ???
- Pan-STARRS images are being re-uploaded to HiPS
 - expect all sorts of strange problems!..
 - g band is broken

- Feedback is welcome!