SAMP ImageJ Plugin

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Introduction

New plugins were developed to integrate ImageJ in workflows using the Virtual Observatory (VO) environment.
In the frame of the Europlanet/VESPA (Virtual European Solar and Planetary Access) project, a specific plug-in has been developed to provide SAMP connection and receive images from other VO tools. This development also improves the support of fits files and compressed formats in ImageJ.
The new SAMP connection to ImageJ provides new functions to the VO environment, including: extended visualization capabilities (e.g., TIFF format, especially useful from search clients), conversion between image formats, and high-level image processing functions.

ImageJ

https://imagej.net/ij/index.html

ImageJ is a public domain Java image processing application available on multiple platforms. Beyond usual visualization and analysis capacities, it provides standard image processing functions such as filtering, sharpening/smoothing, edge detection, Fourier analysis, segmentation, etc.
ImageJ is open source and its functionalities can be expanded through the use of plugins written in Java. Plugins can, e.g., add support of new file formats or filtering and analysis functions.

AstroImageJ

https://www.astro.louisville.edu/software/astroimagej/

The AstroImageJ software package (Collins et al 2017) extends ImageJ and existing plugins to better support astronomy data, with a focus on image calibration and data reduction. The package implements visualization similar to SAOImage DS9, better support of the FITS format, including edition of headers, object annotations, and World Coordinate System (WCS); standard image calibration procedures; aperture photometry; support for time series (ligh curves), and more. It is interfaced with web services such as SIMBAD to identify objects or astrometry.net for plate solving.

The SAMP protocol

https://www.ivoa.net/documents/SAMP/

SAMP (Simple Application Messaging Protocol) is a protocol of the IVOA (International Virtual Observatory Alliance), which maintains the VO infrastructure. SAMP enables communication between VO tools and clients opened on your machine through a common hub. In particular, it allows exchanging data files between tools— although SAMP provides a generic framework for more general messaging requirements.
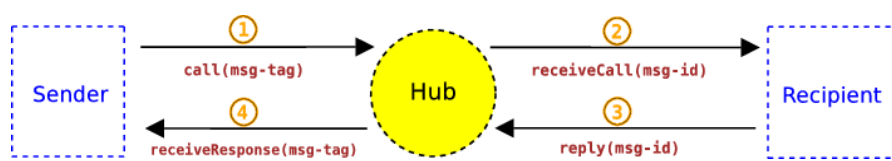
JSAMP (https://github.com/mbtaylor/jsamp) is a java library and toolkit for using SAMP. It comprises a client library, a command-line toolkit, and a hub implementation with a graphical view of the SAMP status.
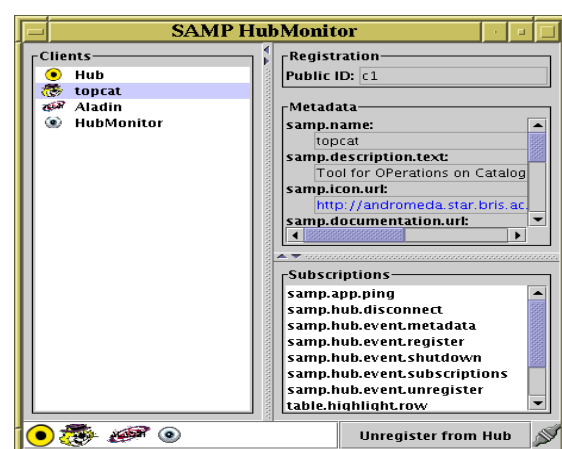
References:

Collins et al 2017, AJ 153, 77. doi:10.3847/1538-3881/153/2/77
Le Sidaner et al 2023: this conference
Erard et al 2022, https://ivoa.net/documents/EPNTAP/

The VESPA discovery portal

https://vespa.obspm.fr

The VESPA (Virtual European Solar & Planetary Access) portal is a VO client optimized for Solar System (including heliophysics) and exoplanet data (Le Sidaner et al 2023). The VESPA portal queries VO services responding to the IVOA EPN-TAP protocol (Erard et al 2022). It queries all EPN-TAP services simultaneously, proving data discovery functions to the user. It relies on VO standards and tools, and interacts through SAMP in particular with visualization tools: Aladin (for images), TOPCAT (tabular data) and CASSIS (spectra).
The VESPA portal was used as a testbed for ImageJ SAMP connectivity, although this functionality is of general interest to the VO.
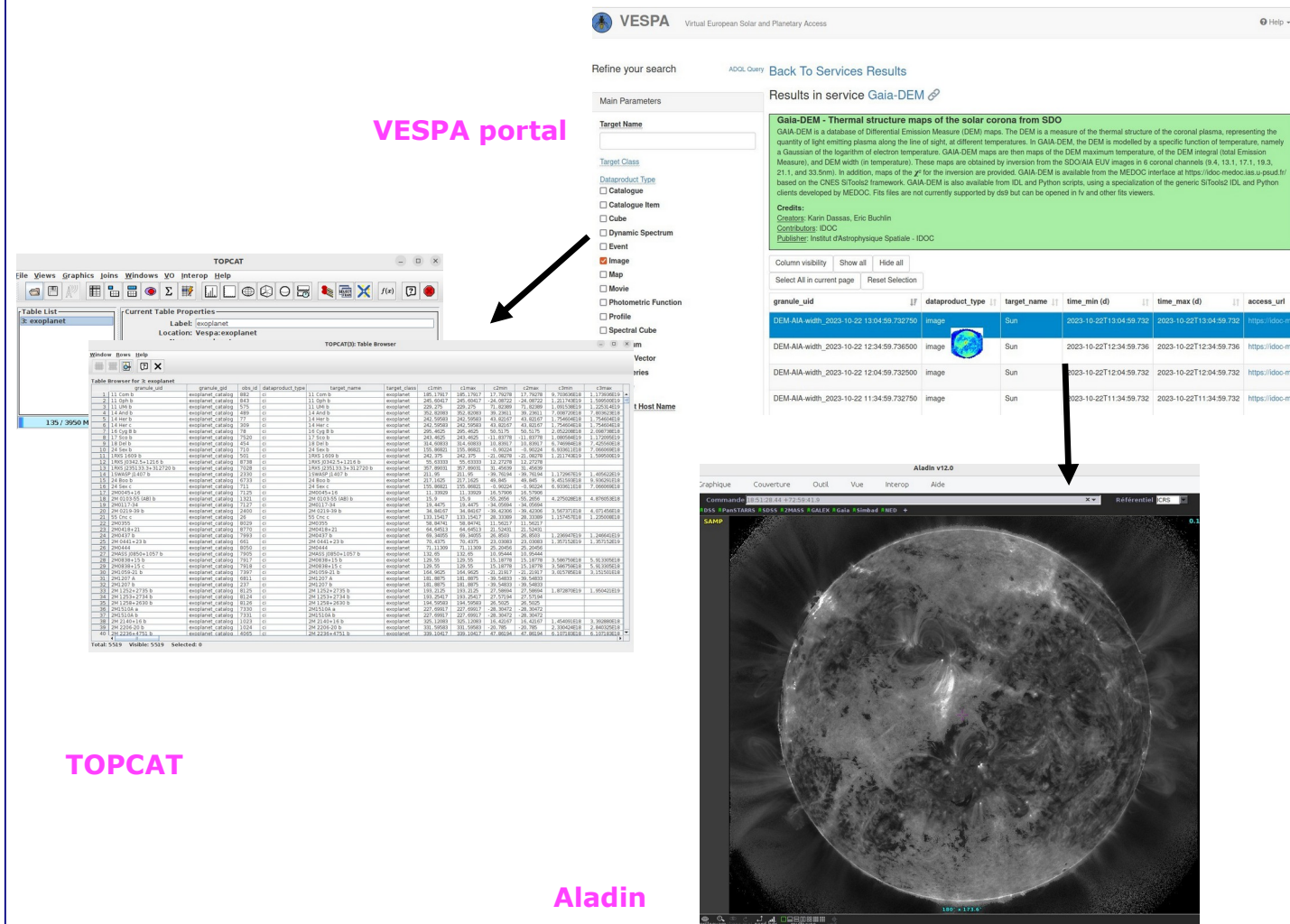
The ImageJ Samp Plugin

Our new plugin is available here:
https://github.com/epn-vespa/samp-imagej-plugin

The plugin provides ImageJ with connection via the SAMP protocol and improved FITS support. It is currently used to receive images from other VO tools, in particular search clients.
Plugin use cases include:
- Visualization of formats unusual in the VO, such as TIFF (e.g., from scanners)
- Format conversion, including to FITS for BW images
- Additional type conversions (e.g. 16 to 8 bits, stacking/unstacking, etc)
- Most of all, ImageJ and AstroImageJ now provide VO workflows with easy access to image processing functions

The plugins were tested with recent versions of ImageJ (v1.53t) and AstroImageJ (v5.1.3), which both required significant modifications with respect to previous versions. Since ImageJ analysis results can be of various types (image, tables, vectors, spectra…), no SAMP feedback connection has been installed at this point.
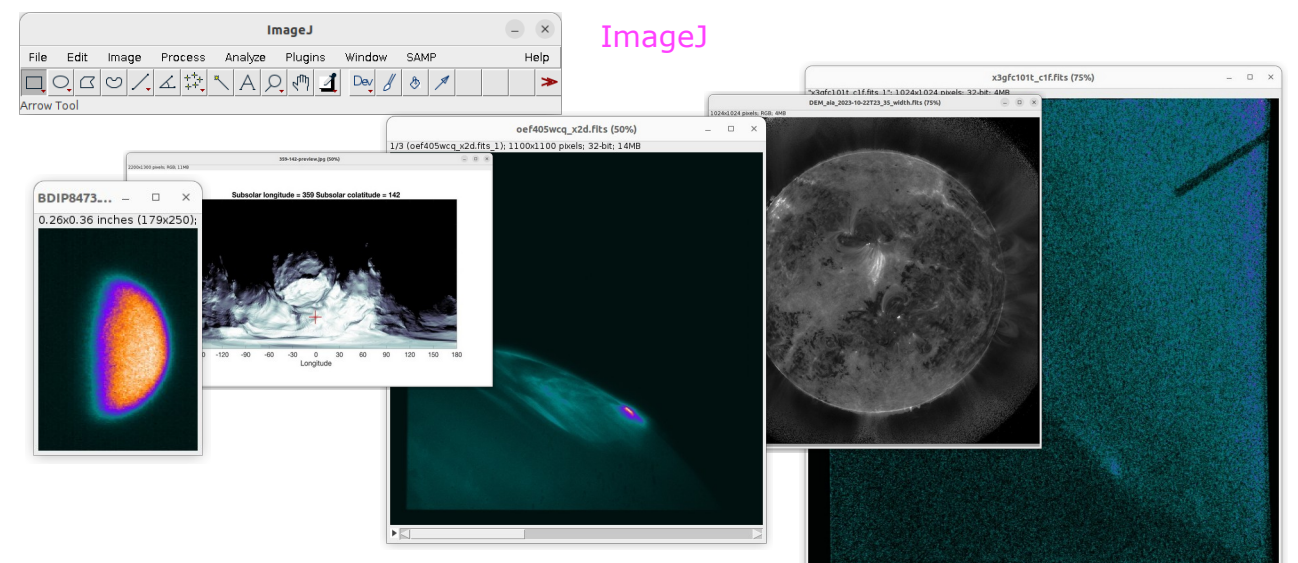
Future Developments

Main prospects include:
- Send back processing outcome to other VO tools via SAMP, in particular processed images and tables
- Support VOTables in I/O to exchange analysis results
- Support of compressed images such as *.fts.bz2 (supported in Aladin)
- Support sending time series from VO services to AstroImageJ
- Grab the cursor position and send it to / from Aladin via SAMP
- Assess the python interface to the new version ImageJ2