

An Alignment and Visualisation Package for Multi-Instrument Observations

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Concept

- Modern telescopes provide a multitude of high resolution data from numerous instruments, each with their own separate spatial, temporal, spectral, and polarimetric coverage.
- For a researcher not used to this, downloading the individual data from different instruments may create a labyrinth.
- Similarly, trying to co-align and visualise this high-resolution ground-based data with space-based data may not prove trivial.
- Solution: To provide researchers with a platform to co-align and visualise multi-instrument data.

How can AVOCADO help?

Solution: To provide researchers with a platform to co-align and visualise multi-instrument data.

- Alignment and
- Visual
- Optimisation
- Code for
- Analysing
- DKIST
- Observations



Proposed Feature List

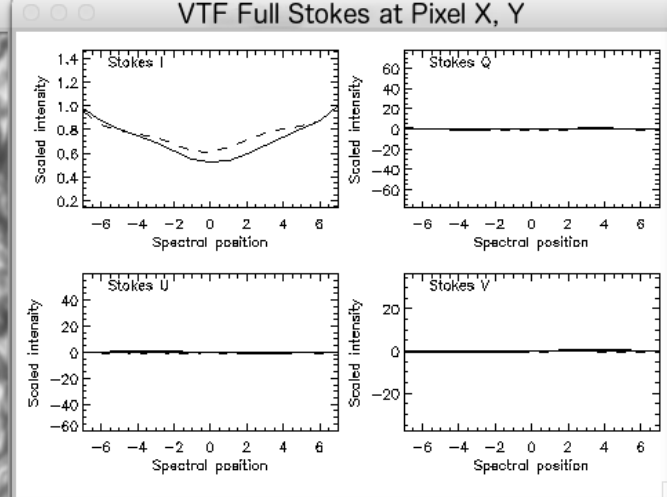
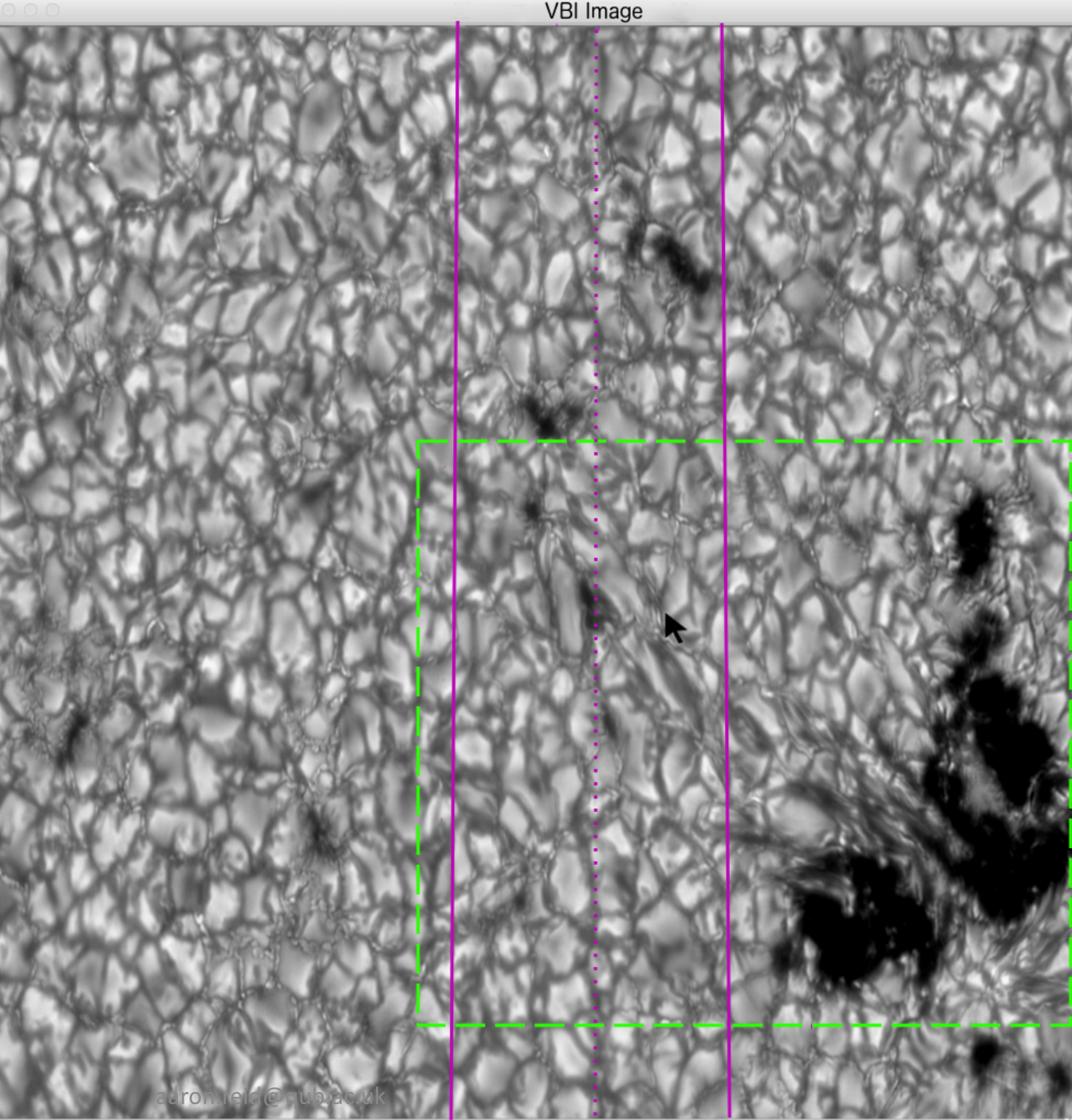
- Plot observed fields of view/coverage (of selected instruments) over (widest FOV) context image(s)
- Plot temporal coverage of different instruments
- Over-plot data from DKIST instruments on VBI context images (or mosaic)
- Automatic adjustment co-alignment of data from the DKIST instruments
- Recover the VTF line profiles for selected regions on the VBI/VTF context image
- Recover the ViSP spectra for selected regions on the VBI/VTF context images
- Display time-series of spectra (λ -t stacks)
- Retrieve and co-align space-based instruments with the DKIST instruments
- Over-plot space-based time series with DKIST data
- Identify spectral lines in VISP, DL-NIRSP, and Cryo-NIRSP
- Output snapshots and movies from tool
- Plot metadata timeseries (e.g. seeing, light level, x-ray flux, etc.)
- Display running-difference or average-subtracted image sequences
- Flag features of interest

Graphic window number 0

Start Date: 2/11/17 09:00:00

End Date: 2/11/17 10:00:00

<i>DKIST Data Found</i>	<i>Space Data Found</i>
<input checked="" type="checkbox"/> VBI Red	<input checked="" type="checkbox"/> SDO AIA <input type="button" value="v"/>
<input checked="" type="checkbox"/> VBI Blue	<input type="checkbox"/> SDO HMI <input type="button" value="v"/>
<input checked="" type="checkbox"/> VTF	<input type="checkbox"/> IRIS <input type="button" value="v"/>
<input type="checkbox"/> ViSP	



Control Panel

File Control shortcuts

Displays | Scaling | Slits | Miscellaneous

Temporal | Spectral | Spatial | Stokes

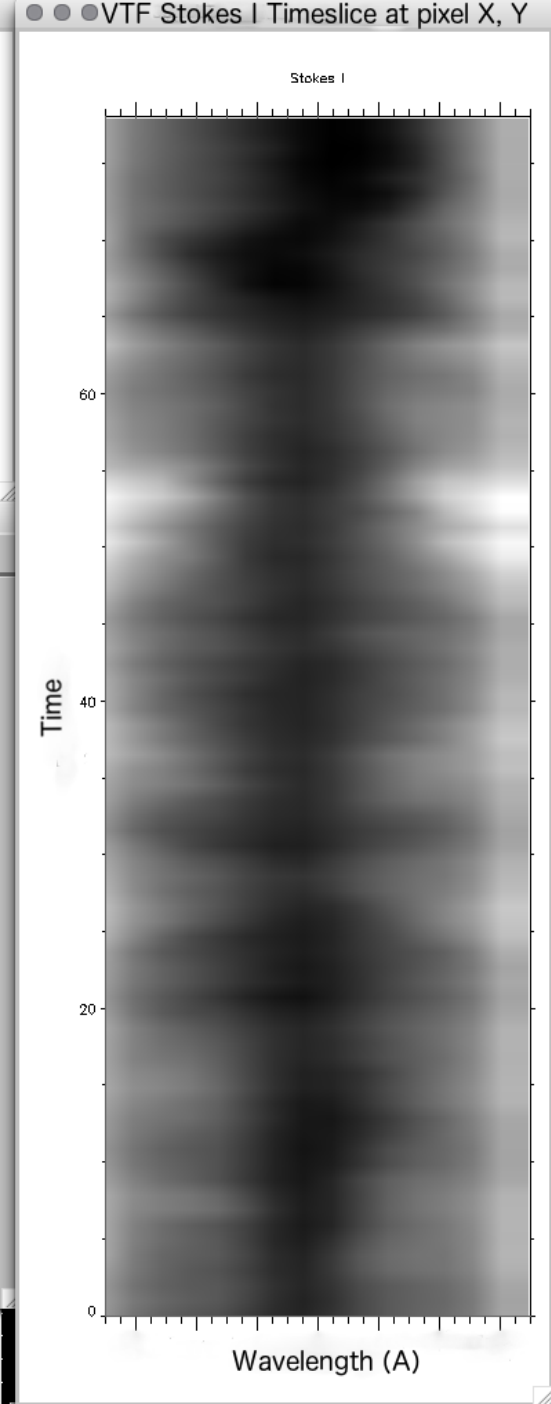
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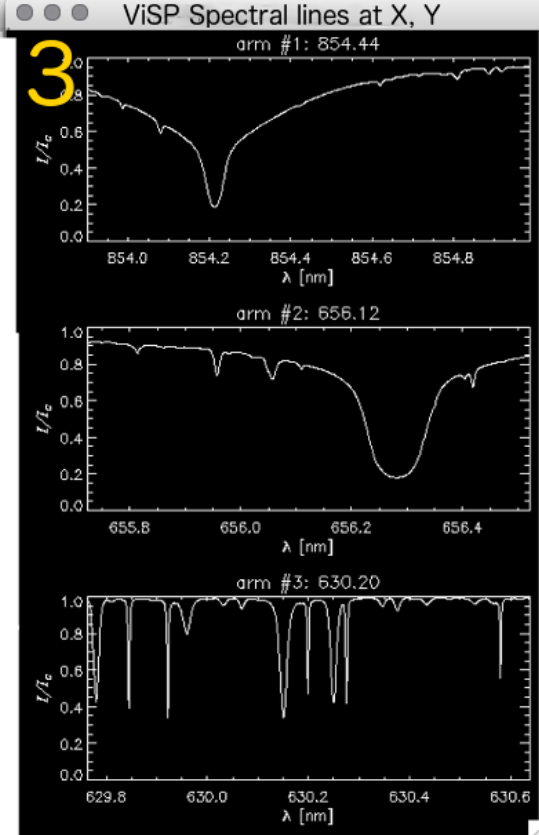
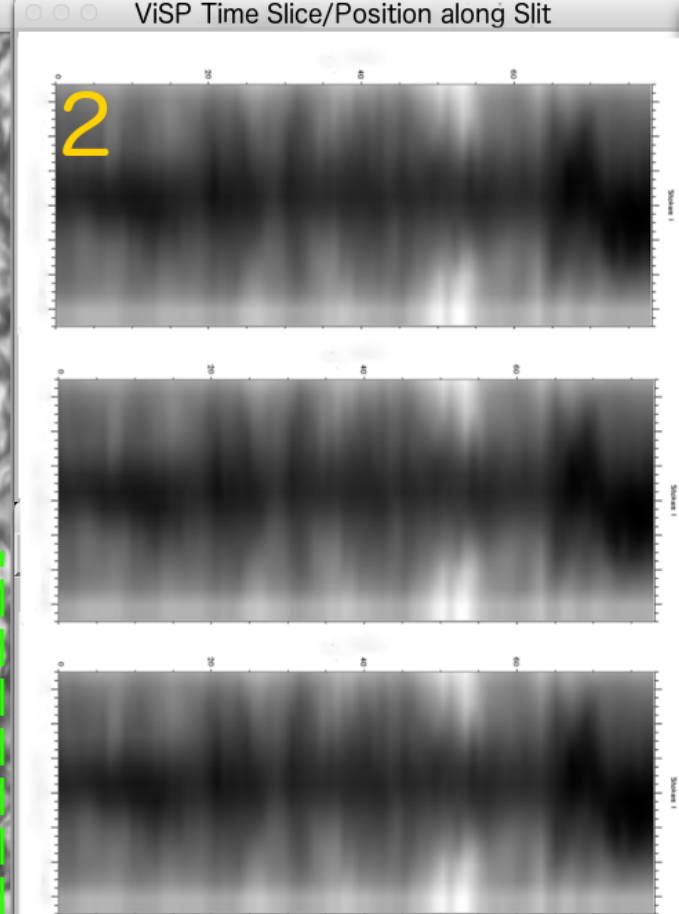
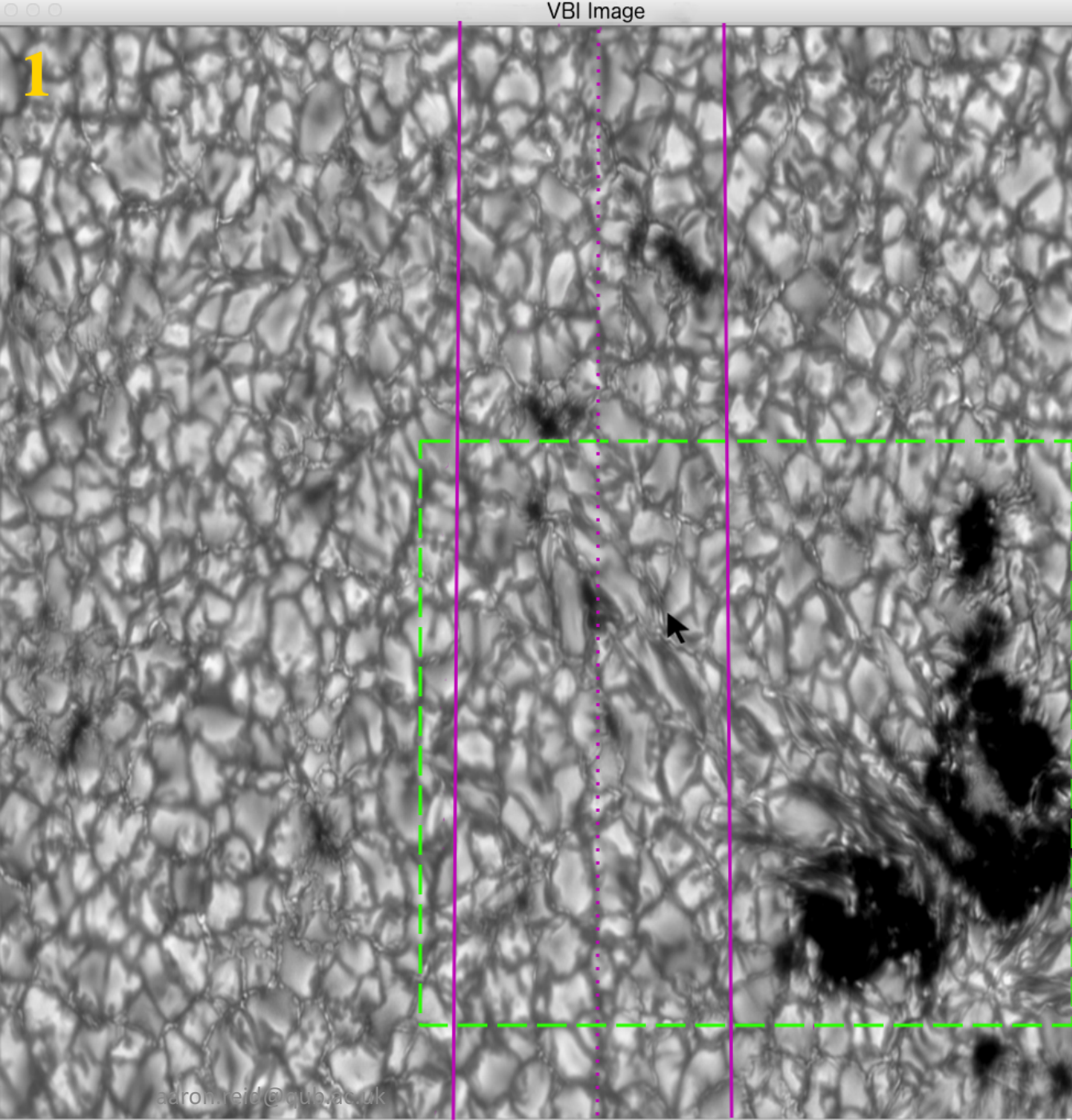
Frame number

VBI Blue VBI Red

VTF VISP DL-NIRSP

Lock to position Unlock from position





Control Panel

File Control shortcuts

Displays Scaling Slits Miscellaneous

Temporal Spectral Spatial Stokes

0

Frame number

◆ VBI Blue ◆ VBI Red

◆ MTF ◆ ViSP ◆ DL-NIRSP

◆ Lock to position ◆ Unlock from position

4

What about other visualisation tools?

- Current codes for data visualisation (e.g. CRISPex) are designed to load single, low resolution (1k x 1k) instrument data in real-time.
- Loading the DKIST data in real-time requires trade-offs and optimisation to be made.
- Co-aligning and overlaying data from multiple instruments in this manner is currently not implemented in any data visualisation package.
- Keeping the alignment, visualisation, and analysis of DKIST data with other internal and space-borne instruments in a concise package will provide users with a coherent environment for their work.
- I strongly feel that keeping a succinct, complete package for users would provide a user-friendly environment, which would encourage other researchers to fully utilize the potential of DKIST and multi-instrument observations.

What about GUAC?

- Preliminary tests show that real-time loading of multi-instrument DKIST FITS files is not viable.
- As such, an Pre AVOCADO routine will also be supplied. This will create lossy DKIST data for real-time visualisation purposes, and condense the necessary co-alignment information from the header files of the DKIST outputs into a quickly read-able file.
- The analysis set-up saved from AVOCADO can be loaded into the Graphical Utility for Analytical Computations (GUAC) for this purpose.

GUAC Feature List

- Create time-series for selected regions in the VBI/VTF/ViSP FOV including co-aligned space-based datasets
- Create Doppler images for selected regions in the spectral FOV (using Center of gravity method (Uitenbroek 2003))
- Create magnetograms from spectro-polarimetric data (Using COG Method where applicable)
- Extract curvilinear traces

Summary

- The Pre-AVOCADO package will create co-aligned data suitable for real-time visualisation. This package will also have the ability to search for space-based co-observations and will provide the option to create co-aligned data for this also.
- The AVOCADO project aims to deliver a user-friendly interface for co-aligning and displaying high resolution data from multiple instruments in real-time.
- The GUAC package will allow for a variety of analysis to be done, and can be given commands from AVOCADO, to provide science ready results.
- All packages are being written in Python 3.6, and make use of Tkinter (part of Anaconda3).