STOA

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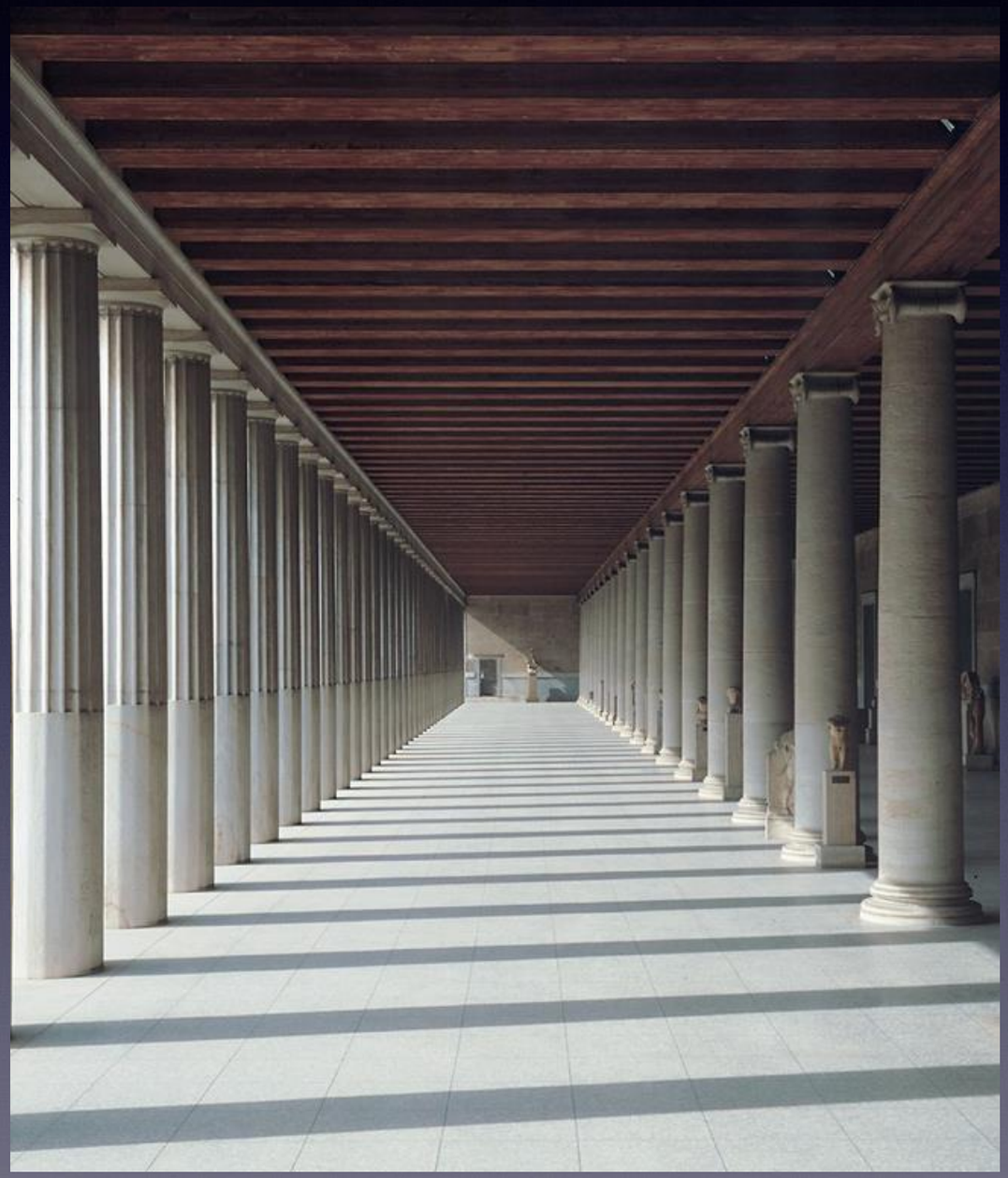
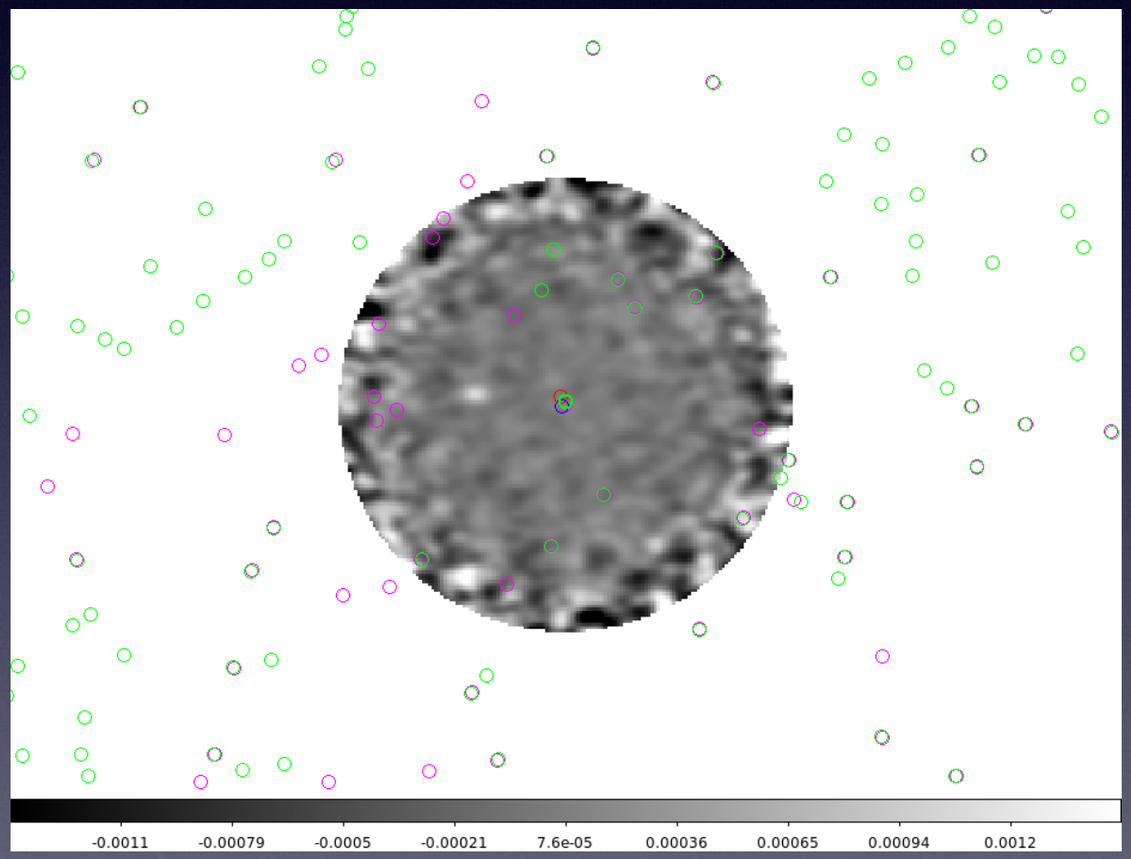
STOA - Script Tracking for Observational Astronomy

- Process management system
- Runs scripts on multiple sets of data, each time with different parameters and a different environment (containerisation)
- Collaboration features - can flag and annotate data and products
- Interfaces with existing astronomy software (e.g. TOPCAT)



Motivation

- Source matching between an existing quasar catalogues (e.g. Veron 2010) and the ALMA archive observation log



- Want to find match known sources with detections in ALMA images using standard source finders (SExtractor and Aegean* initially)

- Several batch scripts coalesced into a single application

*https://github.com/PaulHancock/Aegean

Motivation

- Find additional value in already processed data
- Do surveys across multiple archived projects
- Compare with observations at other wavelengths not considered in initial project

ALMACAL I: FIRST DUAL-BAND NUMBER COUNTS FROM A DEEP AND WIDE ALMA SUBMM SURVEY, FREE FROM COSMIC VARIANCE

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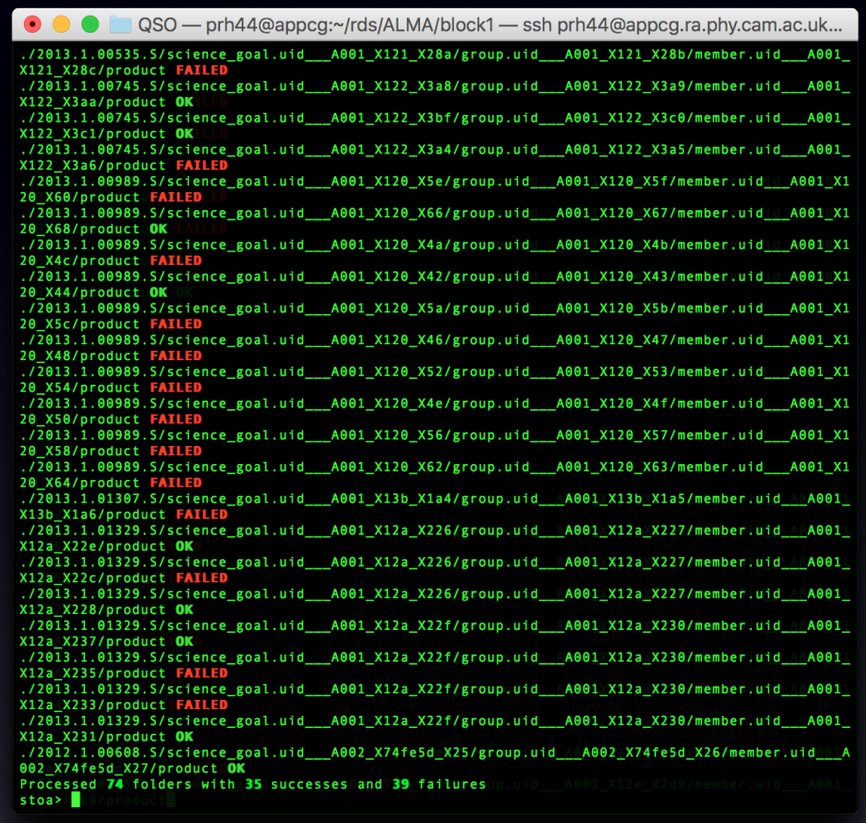
ABSTRACT

We have exploited ALMA calibration observations to carry out a novel, wide and deep submm survey, ALMACAL. These calibration data comprise a large number of observations of calibrator fields in a variety of frequency bands and array configurations. Gathering together data acquired during multiple visits to many ALMA calibrators, it is possible to reach noise levels which allow the detection of faint dusty, star-forming galaxies (DSFGs) over a significant area. In this paper we outline our survey strategy and report the first results. We have analysed data for 69 calibrators, reaching depths of $\sim 25\,\mu$Jy beam^{-1} at sub-arcsec resolution. Adopting a conservative approach based on $\geq 5\sigma$ detections, we have found eight and 11 DSFGs in ALMA bands 6 and 7, respectively, with flux densities $S_{1.2\mathrm{mm}} \geq 0.2$ mJy. The faintest galaxies would have been missed by even the deepest *Herschel* surveys. Our cumulative number counts have been determined independently at 870 μm and 1.2 mm, from a sparse sampling of the astronomical sky, and are thus relatively free of cosmic variance. The counts are lower than reported previously by a factor of at least 2×. Future analyses will yield large, secure samples of DSFGs, with redshifts determined via detection of submm spectral lines. Uniquely, our strategy then allows morphological studies of very faint DSFGs – representative of more normal star-forming galaxies than conventional submm galaxies (SMGs) – in fields where self-calibration is feasible, yielding milliarcsecond spatial resolution.

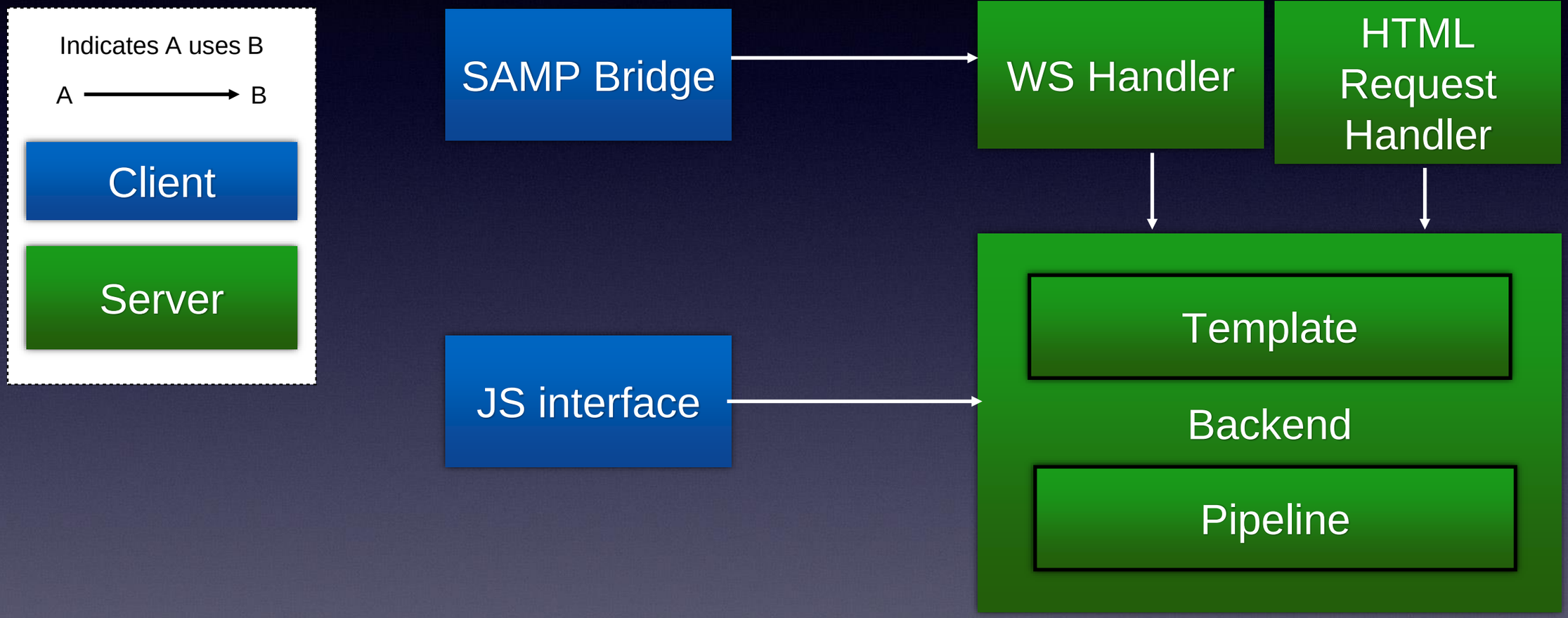
Subject headings: galaxy evolution; submm galaxies; dust emission; number counts

Design

- Command line written in Python, with web interface using Tornado
- Run a process on multiple targets, review targets (e.g. products folder) that have failed and flag targets after manual inspection of data
- Modify process and/or parameter. Rerun process on failed and flagged targets

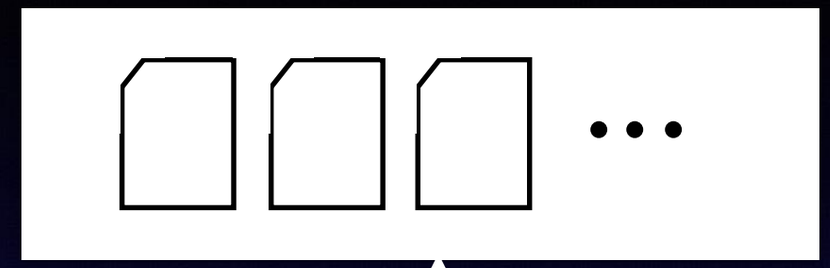


Design

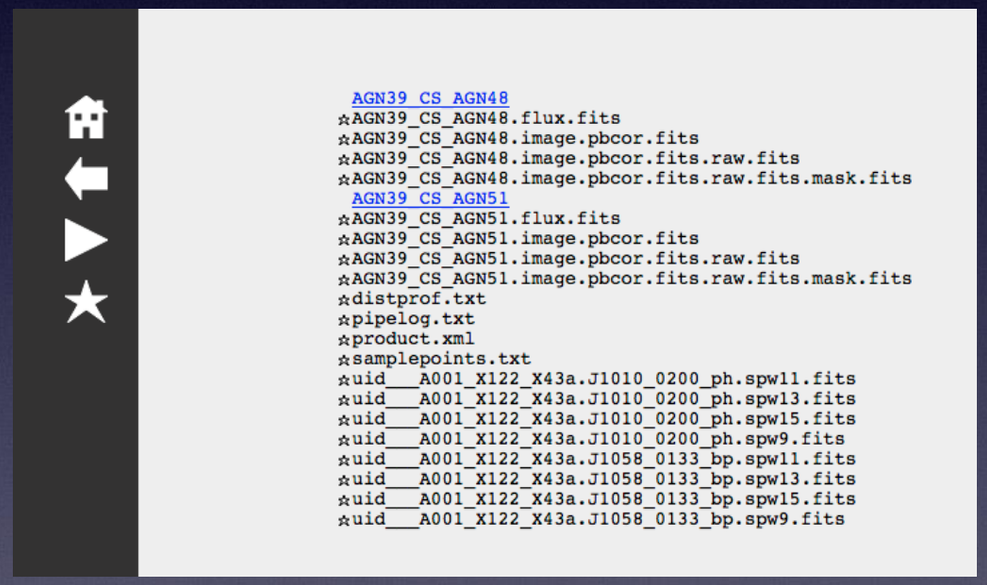

Indicates A uses B
A
B
Client
Server
SAMP Bridge
WS Handler
HTML Request Handler
JS interface
Template
Backend
Pipeline

Design

- Multiple users can work on the same data set
- Can flag data for others inspection, and add comments (pending)
- Allows sharing of data tables with local apps via SAMP bridge

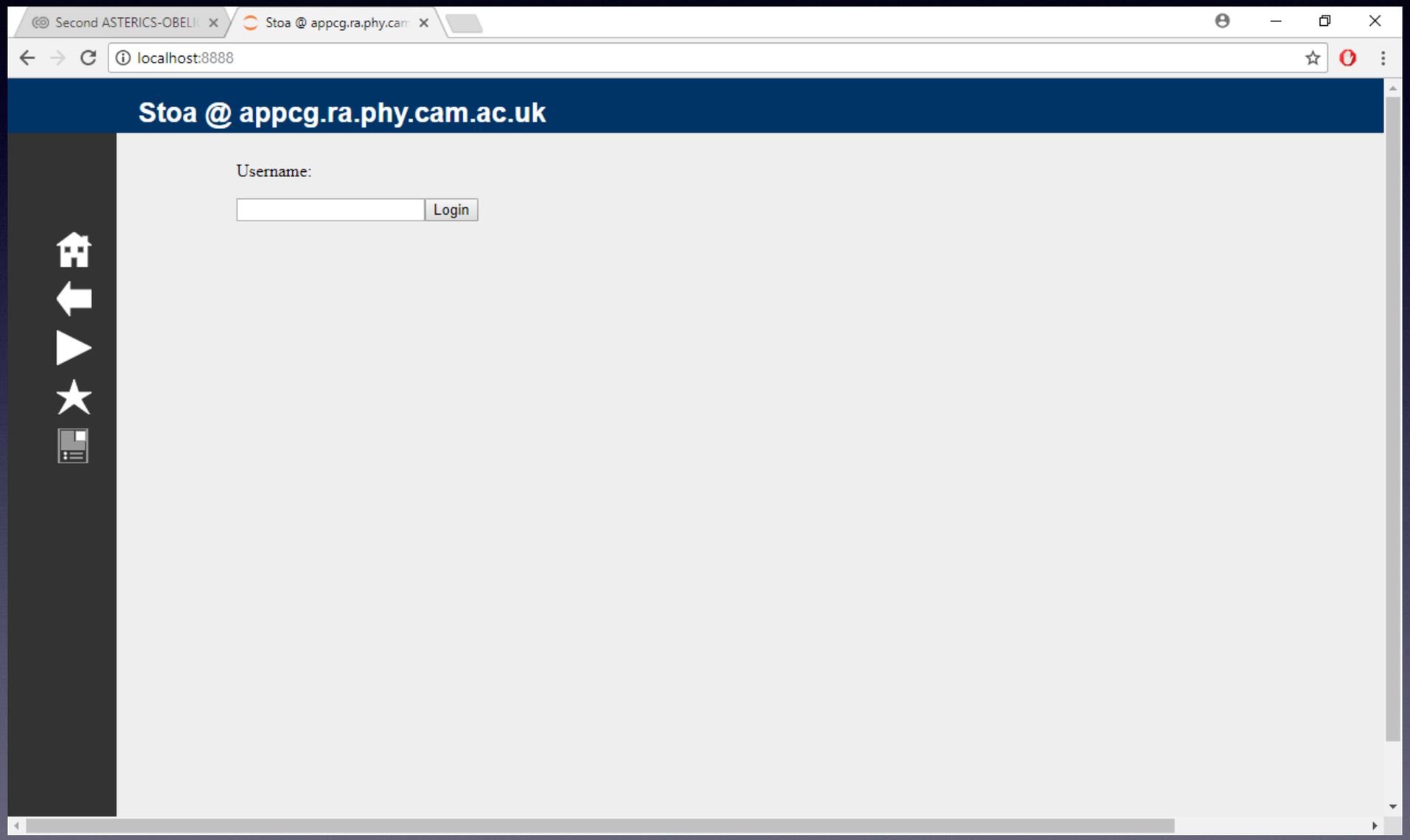


WebSockets



SAMP + WS

Design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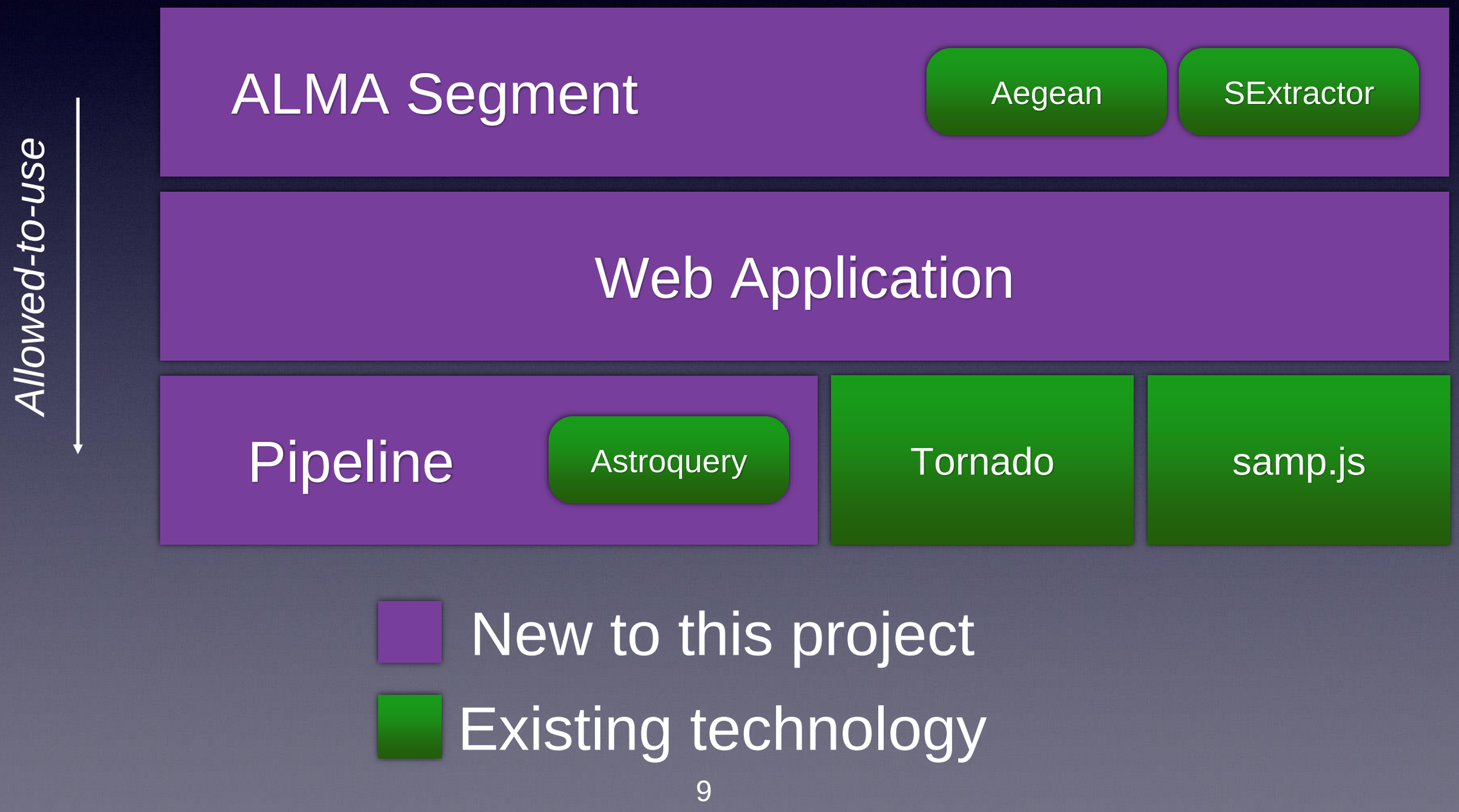
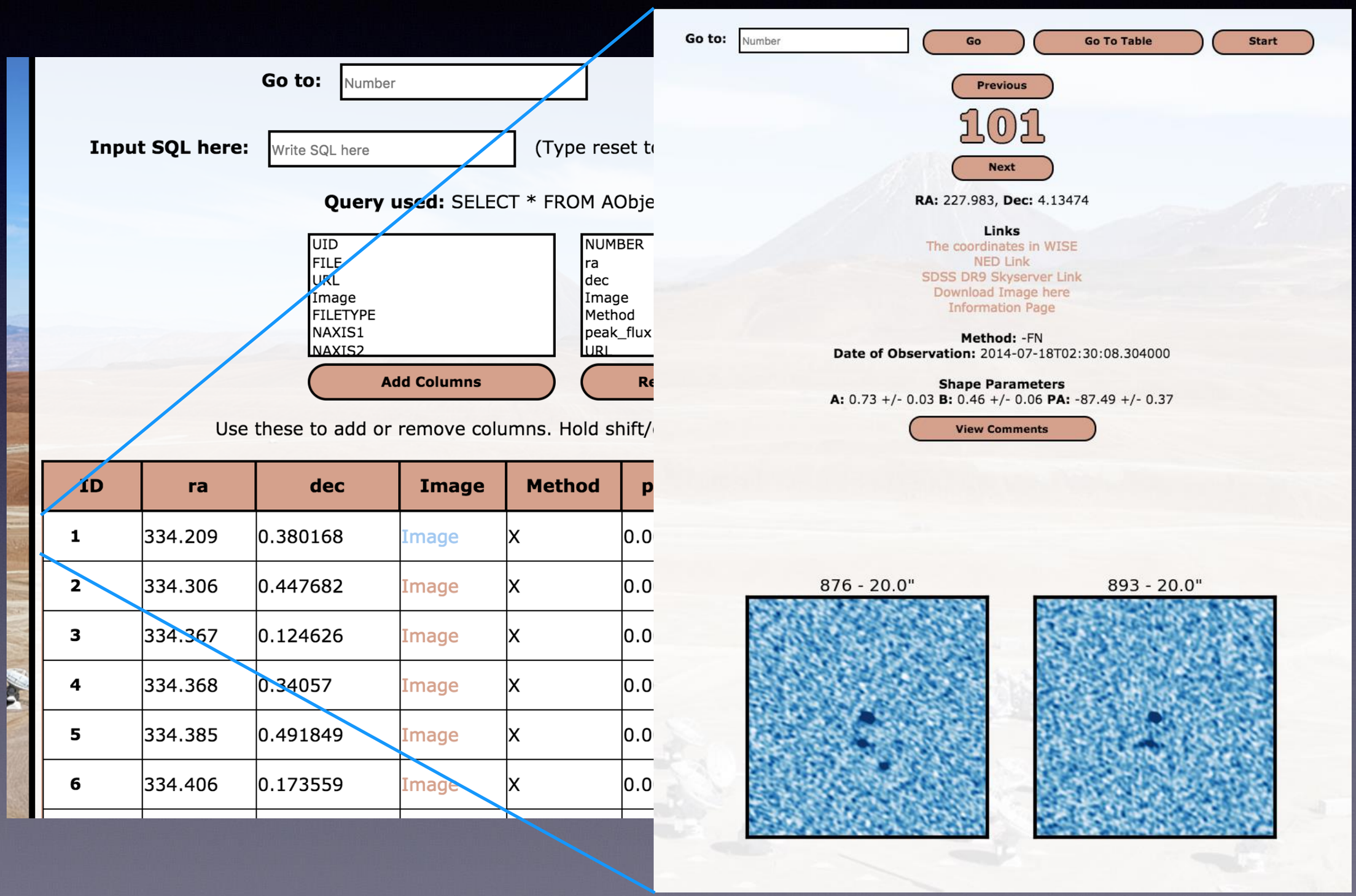
Stoa @ appcg.ra.phy.cam.ac.uk
Username:
Login

Design


ALMA Segment
Aegean
SExtractor
Web Application
Pipeline
Astroquery
Tornado
samp.js
Allowed-to-use
New to this project
Existing technology

Design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UID
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NUMBER
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Image
Method
peak_flux
URL
Add Columns
Use these to add or remove columns. Hold shift/
ID
ra
dec
Image
Method
1 334.209 0.380168 Image X
2 334.306 0.447682 Image X
3 334.367 0.124626 Image X
4 334.368 0.34057 Image X
5 334.385 0.491849 Image X
6 334.406 0.173559 Image X
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101
Next
RA: 227.983, Dec: 4.13474
Links
The coordinates in WISE
NED Link
SDSS DR9 Skyserver Link
Download Image here
Information Page
Method: -FN
Date of Observation: 2014-07-18T02:30:08.304000
Shape Parameters
A: 0.73 +/- 0.03 B: 0.46 +/- 0.06 PA: -87.49 +/- 0.37
View Comments
876 - 20.0"
893 - 20.0"

Metadata Construction

- Important metadata about observations is not carried forward into ALMA image products
- In order to do batch work across heterogenous archive, need a uniform metadata format
- Products are always contained in a single folder. Use XML file to direct later stages of the pipeline
- Groups FITS files into ones that pertain to a single image and includes identifying information

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  BTYPE="Intensity" OBJECT="CS_AGN51" CTYPE1="RA---SIN"
  CRVAL1="149.955829167" CDELT1="-5.55555555556e-05" CRPIX1="151.0"
  CUNIT1="deg" CTYPE2="DEC--SIN" CRVAL2="2.02806388889"
  CDELT2="5.55555555556e-05" CRPIX2="151.0" CUNIT2="deg" CTYPE3="FREQ"
  CRVAL3="3.43494693736e+11" CDELT3="16015783495.4" CRPIX3="1.0" CUNIT3="Hz"
  DATE-OBS="2014-12-31T09:42:21.840000">AGN39_CS_AGN51.image.pbcor.fits</file>
  <file FILETYPE="primaryBeam"  NAXIS1="300" NAXIS2="300" NAXIS3="1" BMAJ=""
  BMIN="" BPA="" BTYPE="Intensity" OBJECT="CS_AGN51" CTYPE1="RA---SIN"
  CRVAL1="149.955829167" CDELT1="-5.55555555556e-05" CRPIX1="151.0"
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  CDELT2="5.55555555556e-05" CRPIX2="151.0" CUNIT2="deg" CTYPE3="FREQ"
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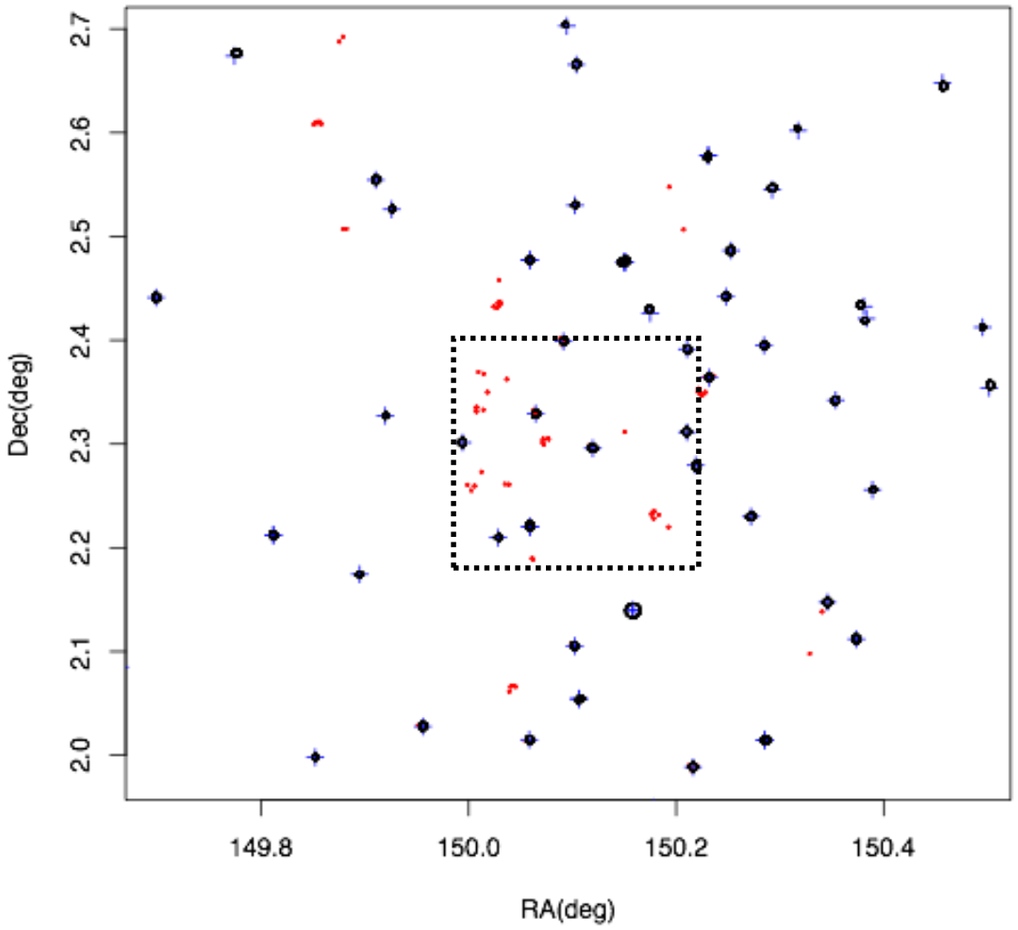
  DATE-OBS="2014-12-31T09:42:21.840000">AGN39_CS_AGN51.flux.fits</file>
</group>
```

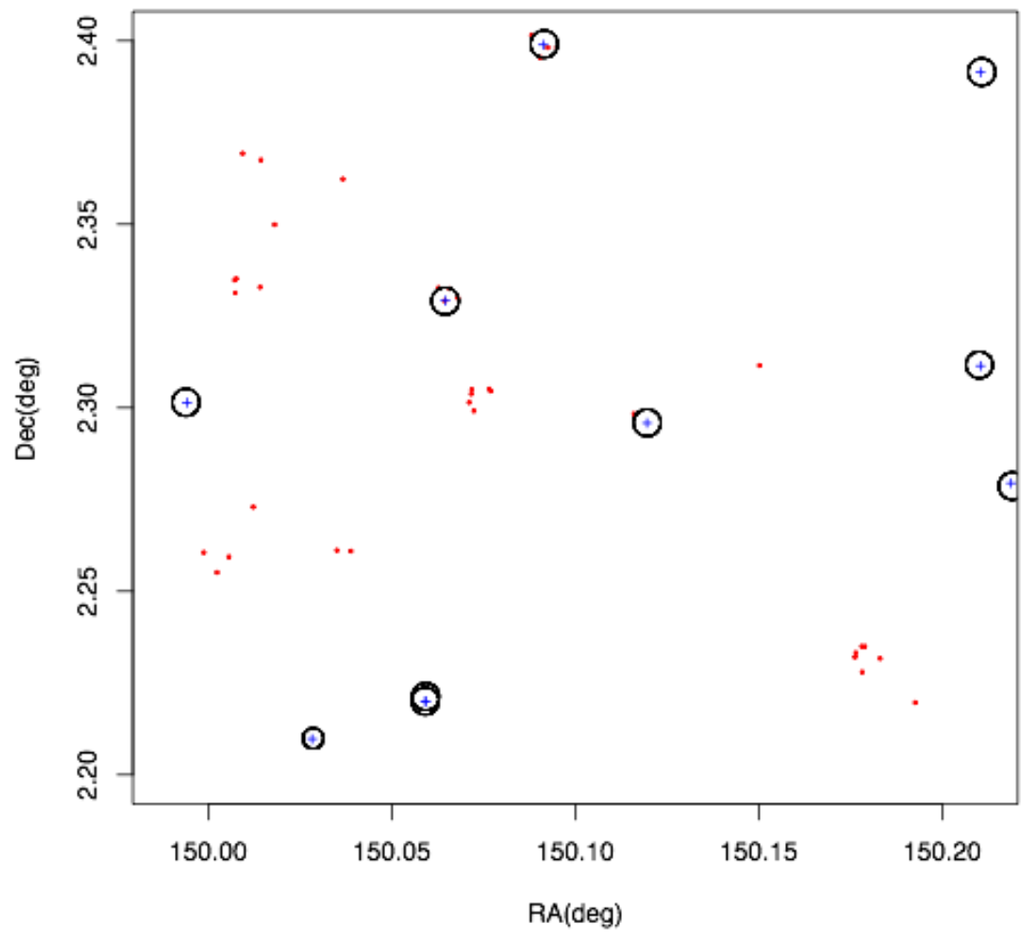
This observation consists of a primary beam corrected image and the flux profile used to correct it. Some FITS header information is also reproduced

Results

- 138 Images processed
- 351 sources passed through quality control
- 27 matched with Veron sources within 5”
- Pipeline failures are due to difficulties reverse engineering metadata

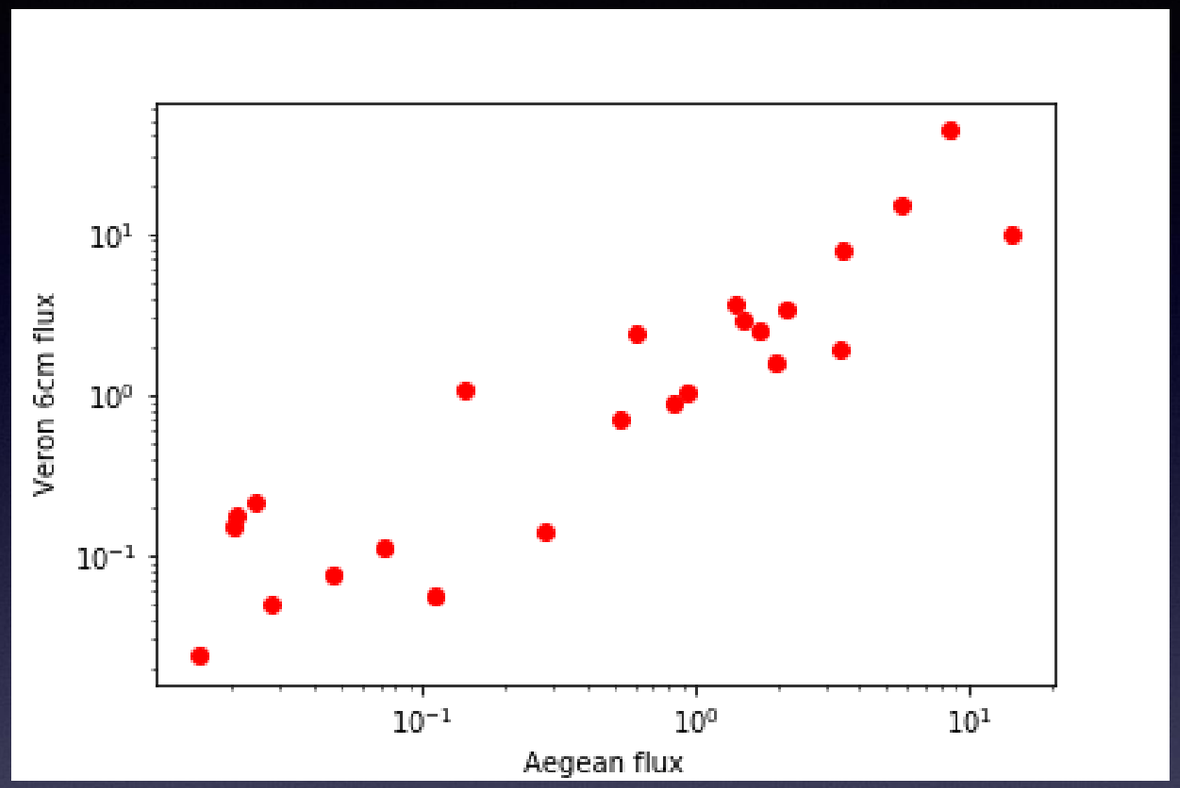
Results





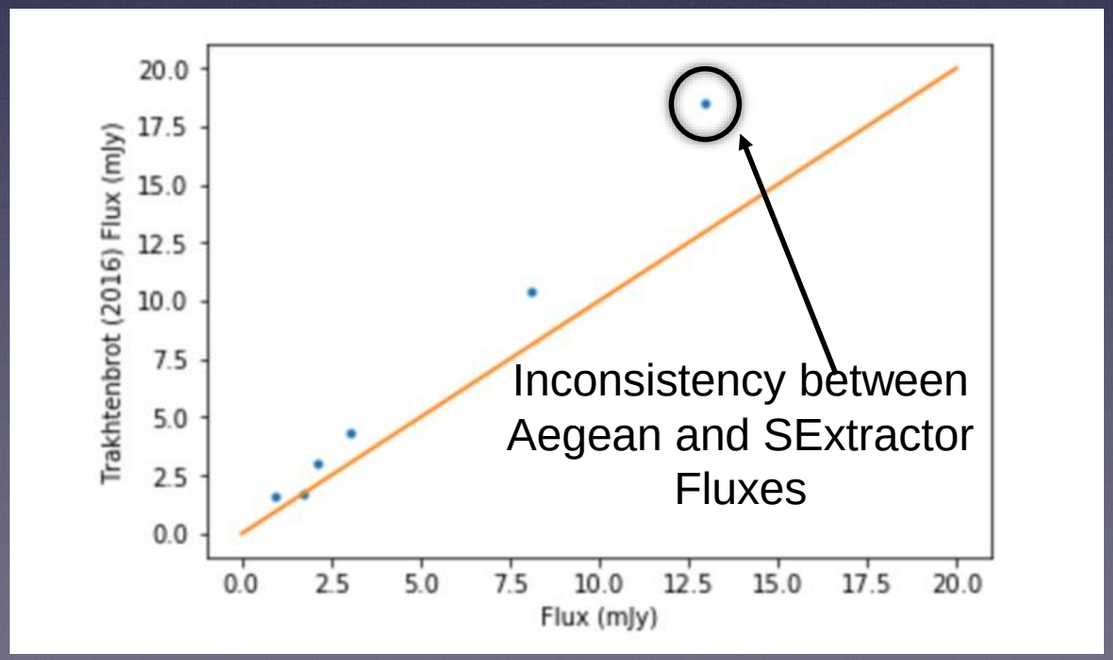
Red dots - ALMA sources, Blue crosses - Veron (2010) quasars
Circles - HWHM of observational hits

Results

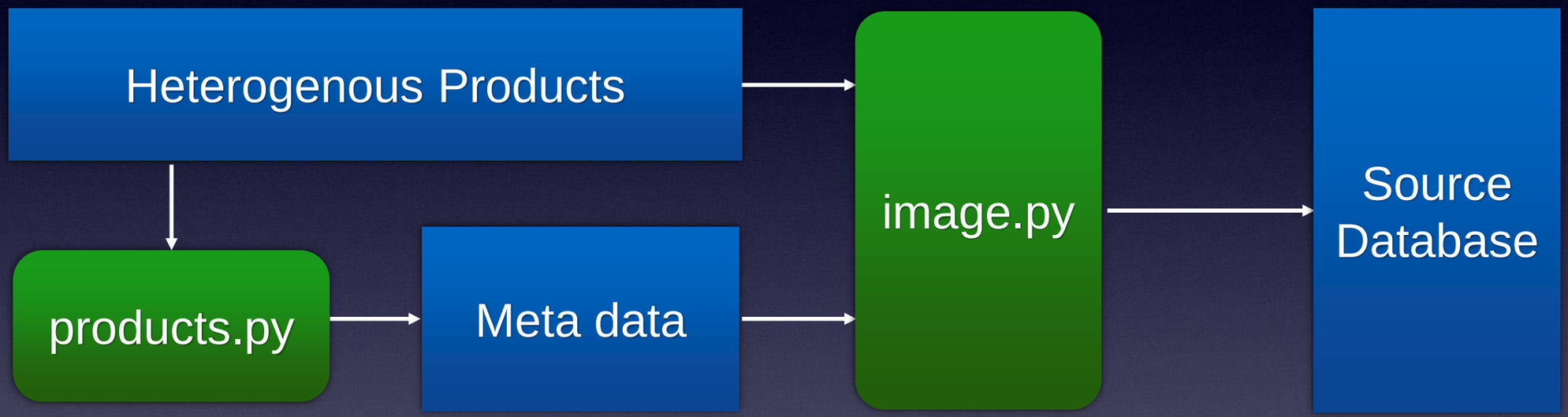


Continuum fluxes correlate to published 6cm fluxes in Veron catalogue

Mostly agree with published fluxes (from Trakhtenbrot et al. 2016)



Reprocessing



Replace with a standardised product set

Reprocessing

- ALMA image products are heterogenous and have incomplete metadata

- Product folders often don’t include dirty images (needed for more advanced analysis)

- Often only have the primary beam corrected image (and not enough information to remove the correction)

The Future…

- Integration with Jupyter Notebook
- Direct access to VO services
- Controlable interface for CASA

Its all about integration

Thanks for Listening

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