SCIENTIFIC VALIDATION OF ASKAP CONTINUUM DATA

Jordan Collier | CASS & WSU 19th July 2017 | SPARCS VII

CSIRO ASTRONOMY & SPACE SCIENCE www.csiro.au

| Josh Marvil | Ray Norris | Denis Leahy | | ACES team | EMU team | ASKAP collaboration |



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Motivation

ASKAP

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- New instrument
- New technology
- Extended commissioning period expected
 - Debug telescope and software
 - Figure out how telescope generally works
- EMU will produce a deep (~10 uJy rms) continuum map of southern sky
- We need to validate the continuum data for science, ensuring instrument and software are producing adequate data





Motivation

• Precursors

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- New instrument
- New technology
- Extended commissioning period expected
 - Debug telescope and software
 - Figure out how telescope generally works
- ?? will produce a deep (?? rms) continuum map of sky
- We need to validate the continuum data for science, ensuring instrument and software are producing adequate data



The Goal

- End-to-end analysis of ASKAP continuum image / catalogue
 - Keep other radio data in mind
- Present a validation report
 - Options were
 - PDF

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- HTML (☺)
- Interactive plots in jupyter notebook
 - plotly or matplotlib / aplpy or bokeh
- Could host on EMU wiki or CASS webserver, etc



The Goal

- We chose to produce a HTML report, with option for plot on screen
 - Write html of matplotlib figures using mpld3
 - Produce several tables summarising data and validation metrics
 - Clickable thumbnails with interactive plots

Survey	Frequency (MHz)	Cross-matches	Median offset (arcsec)	Median flux ratio	Median spectral index
NVSS	1400.0	720	-6.45 ± 2.09 (RA) 0.41 ± 2.27 (Dec)	0.86 ± 0.16 (extrapolated)	
SUMSS	843.0	283	-6.15 ± 1.82 (RA) -0.07 ± 3.33 (Dec)	0.88 ± 0.17 (extrapolated)	-0.53 ± 0.42
		Α	SKAP continuum validat	ion metrics	

Cross-matches

Positional Offset Positional Offset Deviation Posolved Front

Flux Ratio (ASKAP / NVSS extrapolation)	Flux Ratio Deviation (ASKAP / NVSS extrapolation)	Positional Offset (arcsec) (ASKAP — NVSS)	Positional Offset Deviation (arcsec) (ASKAP — NVSS)	Resolved Fraction from int/peak Flux (ASKAP)	Spectral Index (ASKAP in- band)	Source Counts _{Xred} ² (ASKAP)
0.86	0.16	6.46	3.08	0.91	0.00	7.30
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ASKAP image

- Read in the ASKAP image in fits format
 - SBID, project ID, date, duration, frequency and synthesised beam from header
 - Also derive an appropriate search radius
 - FWHM/5, assuming S/N >= 5 (Condon 97)
 - Field centre from the central pixel
 - ASKAPsoft and pipeline versions from header

Observations

SBID	Project	Date	Duration Field Centre (hours)		Central Frequency (MHz)	
2827	<u>AS032</u>	2016-12-03T04:51:31.6	5.22	22:59:45.5907 -32:30:40.871		1368.49
			Image			
		File: 'image.i.į	gama.2827.cont.GAMA23_T0-0A.	linmos.restored.fits'		
ASKAPsoft version	Pipeline version	Synthesised Beam (arcsec)	Median r.m.s. (uJy)	Image peak (Jy)	Dynamic Range	Sky Area (deg ²)
0.18.0	0.18.3	16.9 x 12.0	340	1.11	7E+02	35.78
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Source Finding

- Pass in Selavy noise map and catalogue
- As output from ASKAPsoft pipeline, OR
- Run BANE and Aegean to produce noise map and catalogue
 - Optionally produce a model and residual map
- Based on catalogue, report number of sources, multi-component islands, sum of image and catalogue flux, median spectral index, and source counts

			Catalo	gue					
	File: 'selavy-image.i.gama.2827.cont.GAMA23_T0-0A.linmos.restored.components.xml'								
Source Finder	Flux Type	Number of sources (≥5.0σ)	Multi-component islands	Sum of image flux vs. sum of catalogue flux	Median spectral index	Source Counts χ_{red}^2			
selavy	integrated	2160	170	32.3 Jy vs. 34.7 Jy	0.00	7.30			

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- Read Selavy or Aegean catalogue into pandas
- Same process as reading in any other catalogue (e.g. NVSS)
 - Currently reads fits, xml, csv or other delimited file
 - Set source finder to Aegean or Selavy to use default column names & units
 - OR pass in catalogue, column names and units via a configuration file
 - Also pass in unique short-hand name, which also acts as dictionary key
- Create numpy / pandas lists of data in standardised units
 - Peak and integrated flux, uncertainties (10% or otherwise) and rms in Jy
 - RA and Dec in degrees
- Create other standardised values
 - Search radius in arcsec
 - Frequency in MHz

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Validation step 1 – Source Counts

- Reject sources with S/N < 5
- Shift counts to 1.4 GHz using spectral index of -0.8
- Use bins with equal number of sources (default 50 bins)
- Reject highest bin dominated by a few bright sources
- Derive bin centre (S) as mean value of all fluxes in bin
- Derive solid angle from noise map (S/5) or use fixed value from user
- Plot differential Euclidean counts
- Compare to fit to Norris+11

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- Filter sources before cross-matching
- Reject ASKAP sources based on parameters in configuration file
- OR
- Reject ASKAP sources using default criteria
 - < 1 mJy

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- int / peak flux > 1.4
- Multi-component sources
- Sources flagged as bad
- Fitted major axis > 1.5 times PSF major axis
- Std of residual flux in island boundaries > 3 times island rms



• Example output of filtering process

Filtering sources in 'image.i.gama2827.cont.GAMA23_T0-0A.linmos.taylor.0.restored_aegean_filtered.csv'... Initial number of sources: 2420. Rejected (faint) sources below 0.001 Jy. Number remaining: 2420. Rejected (resolved) sources with total flux > 1.4 times the peak flux. Number remaining: 1612. Rejected (resolved) sources belonging to a multi-component island. Number remaining: 1547. Rejected (resolved) sources with fitted major axis > 1.5 times the psf major axis. Number remaining: 1547. Rejected (poorly fit) sources with standard deviation in residual > 3 times the rms. Number remaining: 1472. Rejecting (problematic) sources with flags. Number remaining: 1463.



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- Individually process each catalogue configuration file passed in as a comma-separated list
 - Cut out catalogue sources in a box based on bounding box of fits image
 - Perform a nearest neighbour cross-match
 - Default is to use largest of the two search radii
 - Default is to keep all sources from ASKAP
 - Keep a running list of names of all cross-matched catalogues
 - Use this as dictionary key, appending lists of number of sources, frequency, radius, ra, dec, flux and uncertainty and rms to dictionary
 - Derive several properties between ASKAP and this catalogue
 - Spectral indices (if > 10% different in frequency)
 - Flux ratios (if < 1% different in frequency)
 - Positional offsets

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- Optionally use all cross-matched catalogues except ASKAP to derive radio SEDs
- Optionally write figures of these SEDs

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- Otherwise just use assume spectral index of -0.8 and extrapolate from each cross-matched catalogue
- Derive the flux at the ASKAP frequency
- Derive a fitted / measured flux density ratios from these
- Validation step 2

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• Test validation of the data using each cross-matched catalogue



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NVSS — ASKAP positional offsets by sky position



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- Produce row in report table for each cross-matched catalogue
- Write median positional offset, flux ratio and spectral index





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Validation step 3 – validation metrics

- Write the values of our seven validation tests and whether they were a pass / fail based on several tolerance values agreed on
 - Really depends on what science you're doing
 - A few failed tests will not result in image being rejected from archive
- Values used from catalogue with largest number of cross-matches



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Validation step 3 – validation metrics

- Seven tests (good; uncertain; bad):
 - Distance of median flux density ratio from 1.0 (< 0.05; < 0.1; > 0.1)
 - Deviation of median flux density ratios (< 0.1; < 0.2; > 0.2)
 - Median positional offset (< 1 arcsec; < 5 arcsec; > 5 arcsec)
 - Deviation of median position offsets (< 5 arcsec; < 10 arcsec; > 10 arcsec)
 - Fraction of resolved sources (considered resolved when difference between int and peak flux > 3 uncertainties – 0.05 < frac < 0.2; N/A; < 0.05 or > 0.2)
 - Distance of median spectral index away from -0.8 (< 0.2; N/A; > 0.2)
 - Reduced chi squared of source counts (< 3; < 50; > 50)

Flux Ratio (ASKAP / NVSS extrapolation)	Flux Ratio Deviation (ASKAP / NVSS extrapolation)	Positional Offset (arcsec) (ASKAP — NVSS)	Positional Offset Deviation (arcsec) (ASKAP — NVSS)	Resolved Fraction from int/peak Flux (ASKAP)	Spectral Index (ASKAP in- band)	Source Counts X _{red} ² (ASKAP)
0.86	0.16	6.46	3.08	0.91	0.00	7.30

ASKAP continuum validation metrics

Generated by Jordan Collier at 2017-06-29 07:21:15.826110





- Pass result into the CSIRO ASKAP
 Science Data
 Archive (CASDA)
- Use validation metrics to determine quality of data
- Query data based on metrics or flags
- Clickable link to CSIRO page with validation report

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e > Domain Search > CASDA Observation Search > Search Results



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- Pass result into the CSIRO ASKAP
 Science Data
 Archive (CASDA)
- Use validation metrics to determine quality of data
- Query data based on metrics or flags
- Clickable link to CSIRO page with validation report

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Validation Notes			
Description This page allows you to record the qu with your team.	ality of your project's data	products after conducting any necessa	ry validation exercise
Project: A Project Name: A W	S035 SKAP Early Science fidefield HI Survey	To download the evaluation files as a click <u>here</u>	tar file please
Scheduling Block ID: 2	338		
Observation Start Date: 1	8 October 2016		
Principal Investigator: Li	sa Harvey-Smith		
Action			
The following data quality indicators were encountered:	Interleaved mosaic	Strong RFI	
	External position reference	ence Strong sources	
	Baselines flagged	Extended sources	
	Beams flagged	No spectral indices	
	Observation truncated	No quality indicators	required
I want to:	Set a single data qua	ity level for ALL my data products from th	is observation
	Record the data quali	ty level for each data product	
Validation Metrics			
Positional Offset Uncertainty	2.72	Flux Ratio Uncertainty	0.2
Flux]Ratio	0.98	Resolved Fraction	0.64
Sou Median flux density ratio [ASK	AP / SUMSS extrapolation]	Positional Offset	0.13



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Gama G23 field

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			ASKAP Continuum Data Va	lidation Report		
			Observations			
SBID	Project	Date	Duration (hours)	Field Centre		Central Frequency (MHz)
2827	<u>AS032</u>	2016-12-03T04:51:31.6	5.22	22:59:45.5907 -32:30:40.871		1368.49
			Image			
			File: 'image.i.gama.2827.cont.GAMA23_T0-0/	A.linmos.restored.fits'		
ASKAPsoft version	Pipeline version	Synthesised Beam (arcsec)	Median r.m.s. (uJy)	Image peak (Jy)	Dynamic Range	Sky Area (deg ²)
0.18.0	0.18.3	16.9 x 12.0	340	1.11	7E+02	35.78
			Catalogue			
			File: 'selavy-image.i.gama.2827.cont.GAMA23_T0-0A.li	nmos.restored.components.xml'		
Source Finder	Flux Type	Number of sources (≥5.0σ)	Multi-component islands	Sum of image flux vs. sum of catalogue flux	Median spectral index	Source Counts Xred ²
selavy	integrated	2160	170	32.3 Jy vs. 34.7 Jy	0.00	7.30
			Cross-matches			
Survey	Frequency (MHz)	Cross-matches	Median offset (arcsec)	Median flux ratio	Mec	ian spectral index
NVSS	1400.0	720	-6.45 ± 2.09 (RA) 0.41 ± 2.27 (Dec)	0.86 ± 0.16 (extrapolated)		
SUMSS	843.0	283	-6.15 ± 1.82 (RA) -0.07 ± 3.33 (Dec)	0.88 ± 0.17 (extrapolated)		-0.53 ± 0.42
			ASKAP continuum validatio	on metrics		
Flux Ratio (ASKAP / NVSS extrapolation)	Flux Ratio (ASKAP / NVS	o Deviation Position S extrapolation) (ASE	al Offset (arcsec) Positional Offset Dev (AP - NVSS) (ASKAP - N	iation (arcsec) Resolved Fraction from NVSS) (ASKAP)	int/peak Flux Spectral Index (ASKAP in-band)	Source Counts _{Zred} ² (ASKAP)
	0	16	646 3.08	0.91	0.00	7.30





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NGC 7232 field

ASKAP Valida	ation Report ×					
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		A	SKAP Continuum Data	a Validation Report		
			Observatio	ons		
SBID F	Project	Date	Duration (hours)	Field Centre	e	Central Frequency (MHz)
2347	AS035	2016-10-19T06:30:59.4	12.00	22:10:08.8896 -44:50):07.2262	1400.49
			Image			
			File: 'image.i.SB2347.cont.NGC7232_B	_T0-0A.linmos.restored.fits'		
ASKAPsoft version	Pipeline version	Synthesised Beam (arcsec)	Median r.m. (uJy)	s. Image peak (Jy)	Dynamic Range	Sky Area (deg ²)
0.19.0	0.19.0	18.7 x 14.1	252	nan	7E+02	35.33
			Catalogu	e		
		Fi	le: 'selavy-image.i.SB2347.cont.NGC7232_B_T0	0-0A.linmos.restored.components.xml		
Source Finder	Flux Type	Number of sources (≥5.0σ)	Multi-component islands	Sum of image flux vs. sum of catalogue flux	Median spectral index	Source Counts χ_{red}^2
selavy	integrated	2366	179	33.9 Jy vs. 33.6 Jy	-99.00	1.63
			Cross-matc	hes		
Survey	Frequency (MHz)	Cross-matches	Median offset (arcsec)	Median flux r	atio	Median spectral index
SUMSS	843.0	419	0.01 ± 1.70 (RA) -0.13 ± 2.46 (Dec)	0.98 ± 0.19 (extra	polated)	-0.76 ± 0.39
			ASKAP continuum val	idation metrics		
Flux Ratio (ASKAP / SUMSS extrapolati	Flux ion) (ASKAP/)	Ratio Deviation Positio SUMSS extrapolation) (ASE	nal Offset (arcsec) Positional C (AP - SUMSS) (AS	Offset Deviation (arcsec) Resolve KAP – SUMSS)	ed Fraction from int/peak Flux Spe (ASKAP)	extral IndexSource Counts0(ASKAP)
0.08		0.19	0.13	2.00	0.62	.99.00 1.63



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Astrometry problems

- Consistent offset of ~5 arcsec in RA, and occasionally in Dec
- Different nights affected by different offsets
 - Causes smearing of synthesised beam when mosaicked together
- Solution implemented to correct bulk offset in measurement set





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Flux problems





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The good news!

• Peak fluxes largely ok





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The good news!







The Script

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1. bash

MC02RTBRAG8WP:~ jordan\$ ASKAP_continuum_validation.py -h Input an ASKAP continuum image and produce an external validation report (in html) of positions, fluxes, source counts, etc in the current directory.

Last updated: 28/06/2017

Usage:

ASKAP_continuum_validation.py -h | --help ASKAP_continuum_validation.py [-S --Selavy=<cat>] [-N --noise=<map>] [-C --catalogues=<list>] [-F --filter=<config>] [-R --snr=<ratio>] [-v --verbose] [-f --refind] [-r --redo] [-p --peak-flux] [-w --write] [-x --no-write] [-m --SEDs=<models>] [-e --SEDfig=<extn>] [-d --main-dir=<path>] [-n --ncores=<num>] [-b --nbins=<num>] [-s --source=<src>] [-a --aegean-params] <fits-file>

Arguments:

<fits-file> A fits continuum image from ASKAP.

Options:

-hhelp	Show this help message.
-SSelavy= <cat></cat>	Use this Selavy catalogue of the input ASKAP image. Default is to run Aegean [default: None].
-Nnoise= <map></map>	Use this fits image of the local rms. Default is to run BANE [default: None].
-Ccatalogues= <list></list>	A comma-separated list of filepaths to catalogue config files corresponding to catalogues to use
	(will look inmain-dir for each file not found in given path) [default: NVSS_config.txt,SUMSS_config.txt].
-Ffilter= <config></config>	A config file for filtering the sources in the input fits file [default: None].
-Rsnr= <ratio></ratio>	The signal-to-noise ratio cut to apply to the ASKAP catalogue and the source counts (doesn't affect source finding) [default: 5.0].
-vverbose	Verbose output [default: False].
-frefind	Force source finding step when catalogue already exists (sets redo to True) [default: False].
-rredo	Force every step again (except source finding), even when catalogues already exist [default: False].
-ppeak-flux	Use the peak flux rather than the integrated flux of the input ASKAP image (not used when -A used) [default: False].
-wwrite	Write intermediate files generated during processing (e.g. cross-matched and pre-filtered catalogues, etc).
	This will save having to reprocess the cross-matches, etc when executing the script again. [default: False].
-xno-write	Don't write any files except the html report and any files output from BANE and Aegean. [default: False].
-mSEDs= <models></models>	A comma-separated list of SED models to fit to the radio spectra ('pow','SSA','FFA','curve',etc) [default: pow,powCIbreak,SSA].
-eSEDfig= <extn></extn>	Write figures for each SED model with this file extension (may significantly slow down script) [default: None].
-dmain-dir= <path></path>	The absolute path to the main directory where this script and other required files are located [default: \$ACES/UserScripts/col52r].
-nncores= <num></num>	The number of cores (per node) to use when running BANE and Aegean (using >=20 cores may result in memory error) [default: 8].
-bnbins= <num></num>	The number of bins to use when performing source counts [default: 50].
-ssource= <src></src>	The format for writing plots (e.g. screen, html, eps, pdf, png, etc) [default: html].
-aaegean= <params></params>	A single string with any extra paramters to pass into Aegean (except cores, noise, background, and table) [default:floodclip=3].
MC02RTBRAG8WP:~ jordan\$	



The Script – documentation

- CSIRO confluence page
 - https://confluence.csiro.au/display/askapsst/Continuum+validation+pipeline





The Script – configuration files

• Pass required values into catalogue configuration files

S NVSS_config.txt Open with TextEdit	SUMSS_config.txt Open with TextEdit
<pre>filename=NVSS.fits name=NVSS frequency=1400 finder=None search_rad=10 ra_col=RAJ2000 dec_col=DEJ2000 ra_fmt=deg dec_fmt=deg flux_col=S1_4 flux_err_col=e_S1_4 peak_col=None use_peak=False rms_val=0.45 flux_unit=mJy island_col=None maj_col=MajAxis autoload=True</pre>	<pre>filename=SUMSS.fits name=SUMSS frequency=843 finder=None search_rad=10 ra_col=RAJ2000 dec_col=DEJ2000 ra_fmt=deg dec_fmt=deg flux_col=St flux_err_col=e_St peak_col=Sp peak_err_col=e_Sp use_peak=False rms_val=1.25 flux_unit=mJy island_col=None flag_col=None maj_col=MajAxis autoload=True</pre>



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The Script – configuration files

- Can use finder=Aegean or finder=Selavy
- Can pass criteria for filtering ASKAP sources into configuration file



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The Script – installing

- Get access to ACES svn
 - Email <u>Tony Maher</u>
 - https://svn.atnf.csiro.au/askap/ACES
 - Also includes large fits files (e.g. NVSS catalogue)
- See relevant documentation about svn here
 - <u>https://confluence.csiro.au/pages/viewpage.action?spaceKey=ACES&title=</u> <u>Getting+started+with+ACES+tools+on+Galaxy</u>



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The Script – running it on your machine

- Checkout script and associated files using ACES svn
- Install required modules from python



svn co https://svn.atnf.csiro.au/askap/ACES/UserScripts/col52r/

pip install -r requirements.txt

./ASKAP_continuum_validation.py -h





The Script – running it on Galaxy

- Add following to your ~/.bashrc file: export ACES=\$HOME/ACES export PATH=\$ACES/tools:\$PATHexport PYTHONPATH=\$ACES/pythonlib:\$PYTHONPATH
- Checkout whole ACES svn:

cd \$HOME svn co <u>https://svn.atnf.csiro.au/askap/ACES</u>

• Load module with required python modules and run script:

module use /group/askap/continuum_validation module load continuum_validation_env aprun -n 1 -N 1 \$ACES/UserScripts/col52r/ASKAP_continuum_validation.py -h



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The Script – running it on Galaxy

example.job — ~/ACES/col52r					
example.job					
1	#!/bin/bash -l				
2	#SBATCHntasks=1				
3	#SBATCHntasks-per-node=1				
4	#SBATCHtime=01:00:00				
5	#SBATCHjob-name=continuum_validation				
6	#SBATCHcluster=galaxy				
7	#SBATCHexport=NONE				
8					
9	<pre>module use /group/askap/continuum_validation</pre>				
10	module load continuum_validation_env				
11					
12	aprun -n 1 -N 1 \$ACES/UserScripts/col52r/ASKAP_continuum_validation.py -v gama_l	inmos.fits			
+	× example.job 1:1 LF UTF-8 Shell Scr	ipt 🦻 master	î 1 update		





The Script – running it on Galaxy

😑 😑 💼 validate_aegean.py — ~/ACES/col52r	• • •	💩 validate_selavy.py — ~/ACES/col52r
validate_aegean.py	validate_selavy.	•
1 #!/usr/bin/env python 2 from glob import glob 3 import os 4 import sys 5	1 #!/usr/ 2 from gl 3 import 4 import 5	bin/env python ob import glob os sys
<pre>6 submit_jobs = True 7 8 this_name = 'validate_aegean' 9</pre>	6 submit_ 7 8 this_na 9	jobs = True me = 'validate_aegean'
<pre>10 slurm_header = """#!/bin/bash -l 11 #SBATCHntasks=1 12 #SBATCHntasks-per-node=1 13 #SBATCHtime=01:00:00 14 #SBATCHjob-name={1} 15 #SBATCHcluster=galaxy 16 #SBATCHexport=NONE 17 #SBATCHaccount=askaprt 18 19 module use /group/askap/continuum_validation 20 module load continuum_validation_env 21 22 aprun -n 1 -N 1 \$ACES/UserScripts/col52r/ASKAP_continuum_validation.py {0} 23 </pre>	10 slurm_h 11 #SBATCH 12 #SBATCH 13 #SBATCH 14 #SBATCH 14 #SBATCH 15 #SBATCH 16 #SBATCH 17 #SBATCH 18 19 module 20 module 21 22 aprun - 23 -S sela	<pre>eader = """#!/bin/bash -lntasks=1ntasks-per-node=1time=01:00:00job-name={1}cluster=galaxyexport=NONEaccount=askaprt use /group/askap/continuum_validation load continuum_validation load continuum_validation_env n 1 -N 1 \$ACES/UserScripts/col52r/ASKAP_continuum_validation.py {0}.fits vy_{0}/selavy-{0}.components.xml -N selavy_{0}/noiseMap.{0}.fits</pre>
<pre>24 """ 25 26 27 out1 = open(this_name+'.sbatch', 'w') 28 out1.writelines(slurm_header.format(sys.argv[1], this_name)) 29 out1.close() 30 31 if submit_jobs: os.system('sbatch '+this_name+'.sbatch') 32 </pre>	24 25 UU 26 27 imagena 28 29 out1 = 30 out1.wr 31 out1.cl 32 33 if subm 34	<pre>me = sys.argv[1].replace('.fits','') open(this_name+'.sbatch', 'w') itelines(slurm_header.format(imagename, this_name)) ose() it_jobs: os.system('sbatch '+this_name+'.sbatch')</pre>
+ X validate_aegean.py 32:1 LF UTF-8 Python & master 🗊	1 update + × validat	e_selavy.py* 26:1 LF UTF-8 Python \hat{b}^2 master 🗇 1 update

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Future Work

- Test more widely with other radio images
- Put it on GitHub, publish it and tell people about it

	1. bash					
MC02RTBRAG8WP:~ jordan\$ Radio_continuum_validation.py -h Input a radio continuum image and produce an external validation report (in html) of positions, fluxes, source counts, etc in the current directory.						
Last updated: 26/06/2017						
Usage: Radio_continuum_validation.py -h help Radio_continuum_validation.py [-Ifits=] [-AASKAP= <main-cat>] [-Nnoise=<map>] [-Ccatalogues=<list>] [-Ffilter=<configs] [-rsnr="<ratio">] [-vverbose] [-frefind] [-rredo] [-ppeak-flux] [-wwrite] [-xno-write] [-mSEDs=<models>] [-eSEDfig=<extn>] [-ttelescope=<name>] [-dmain-dir=<path>] [-nncores=<num>] [-bnbins=<num>] [-ssource=<src>] [-aaegean-params] [-ccorrect=<level>]</level></src></num></num></path></name></extn></models></configs]></list></map></main-cat>						
Required: -Ifits= 	A fits continuum image from ASKAP [default: None].					
AND/OR -AASKAP= <main-cat></main-cat>	Use this catalogue config file of the input ASKAP image (overwrites options -p and -t). Default is to run Aegean [default: None].					
Options: -hhelp -Ccatalogues= <list> -Nnoise=<map> -Ffilter=<config> -Rsnr=<ratio> -vverbose -frefind -rredo -ppeak-flux -wwrite -xno-write -xno-write -xno-write -xsDfig=<coxtra -ttelescope=<name> -ttelescope=<name> -ttelescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope=<name> -tneilescope</name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></name></coxtra </ratio></config></map></list>	Show this help message. A comma-separated list of filepaths to catalogue config files corresponding to catalogues to use (will look inmain-dir for each file not found in given path) [default: NVSS_config.txt,SUMSS_config.txt,GLEAM_config.txt,TGSS_config.txt]. Use this fits image of the local rms. Default is to run BANE [default: None]. A config file for filtering the sources in the input fits file [default: None]. The signal-to-noise ratio cut to apply to the ASKAP catalogue and the source counts (doesn't affect source finding) [default: 5.0]. Verbose output [default: False]. Force source finding step when catalogue already exists (sets redo to True) [default: False]. Force every step again (except source finding), even when catalogues already exist [default: False]. Use the peak flux rather than the integrated flux of the input ASKAP image (not used when -A used) [default: False]. Write intermediate files generated during processing (e.g. cross-matched and pre-filtered catalogues, etc). This will save having to reprocess the cross-matches, etc when executing the script again. [default: False]. A comma-separated list of SED models to fit to the radio spectra ('pow', 'SSA', 'FA', 'curve', etc) [default: None]. Unique name of the telescope or survey to give to the main catalogue (not used when -A used). [default: None]. Unique name of the telescope or survey to give to the main catalogue (not used when -A used). [default: None]. Unique name of the telescope or survey to give to the main catalogue (not used when -A used). [default: None]. The absolute path to the main directory where this script and other required files are located [default: \$ACES/UserScripts/col52r]. The number of cores (per node) to use when running BANE and Aegean (using >=20 cores may result in memory error) [default: 8]. The number of bins to use when performing source counts [default: 50]. The number of bins to use when performing source counts [default: 50]. The format for writing plots (e.g. screen, html, eps, pdf, p					
MC02RTBRAG8WP:~ jordan\$	Fits image is corrected according to input level (0: none, 1: positions, 2: positions + fluxes) [default: 0].					



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Thank you

CASS / WSU Jordan Collier

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