Basic in Data Analysis workshop

2024.7.25-26.

Aims & ....

- You can make your own image from the proposed/archive data.
  - You already found adequate ALMA data
    - Band (Frequencies)/ Beam sizes (configurations)
  - When No image product in archive
  - When you want to (slightly) modify the image
- Generally, there are NO Calibraton issues because the issues are already checked by ARC (QA0-2 pass)
- Download ALMA data

  → Run the scriptForPI.py file &

  Restore the calibrated data

  → Ready to imaging (tclean)

NRAO Synthesis Image Summer school/workshops.

https://web.cvent.com/event/90ae72df-7675-41b5-b056-48af11e1aa7f/summary

10:00 - 10:20 ***Coffee Break***
10:20 - 11:10 Antennas and receiver systems: Slides, Video (*Jay Blanchard*)
11:15 - 12:00 Fundamentals of radio interferometry I: Slides, Video (*Rick Perley*)

12:00 - 14:00 *Lunch break (self-catered)*

14:00 - 14:45 Fundamentals of radio interferometry II: Slides, Video (*Rick Perley*)
14:45 - 15:30 Basic radio interferometry - Geometry: Slides, Video (*Rick Perley*)
15:30 - 16:00 ***Coffee Break***
16:00 - 17:10 Cross Correlators: Slides, Video (*Adam Deller*)
17:15 - 18:15 Discussion groups

18:30 - 20:00 *Welcome Reception*

Thursday, 16 May

08:00 - 09:00 *Registration*

09:00 - 10:00 Calibration: Slides, Video (*Ian Heywood*)
10:00 - 10:20 ***Coffee Break***
10:20 - 11:20 Introduction to imaging and deconvolution: Slides, Video (*Joshua Marvil*)
11:20 - 12:30 Advanced calibration: Slides, Video (*Ian Heywood*)

Previous Workshops

19th Synthesis Imaging Workshop (2023)

Virtual 18th Synthesis Imaging Workshop (2022)

Virtual 17th Synthesis Imaging Workshop (2020)

16th Synthesis Imaging Workshop (2018)

15th Synthesis Imaging Workshop (2016)

14th Synthesis Imaging Workshop (2014)

13th Synthesis Imaging Workshop (2012)

12th Synthesis Imaging Workshop (2010)

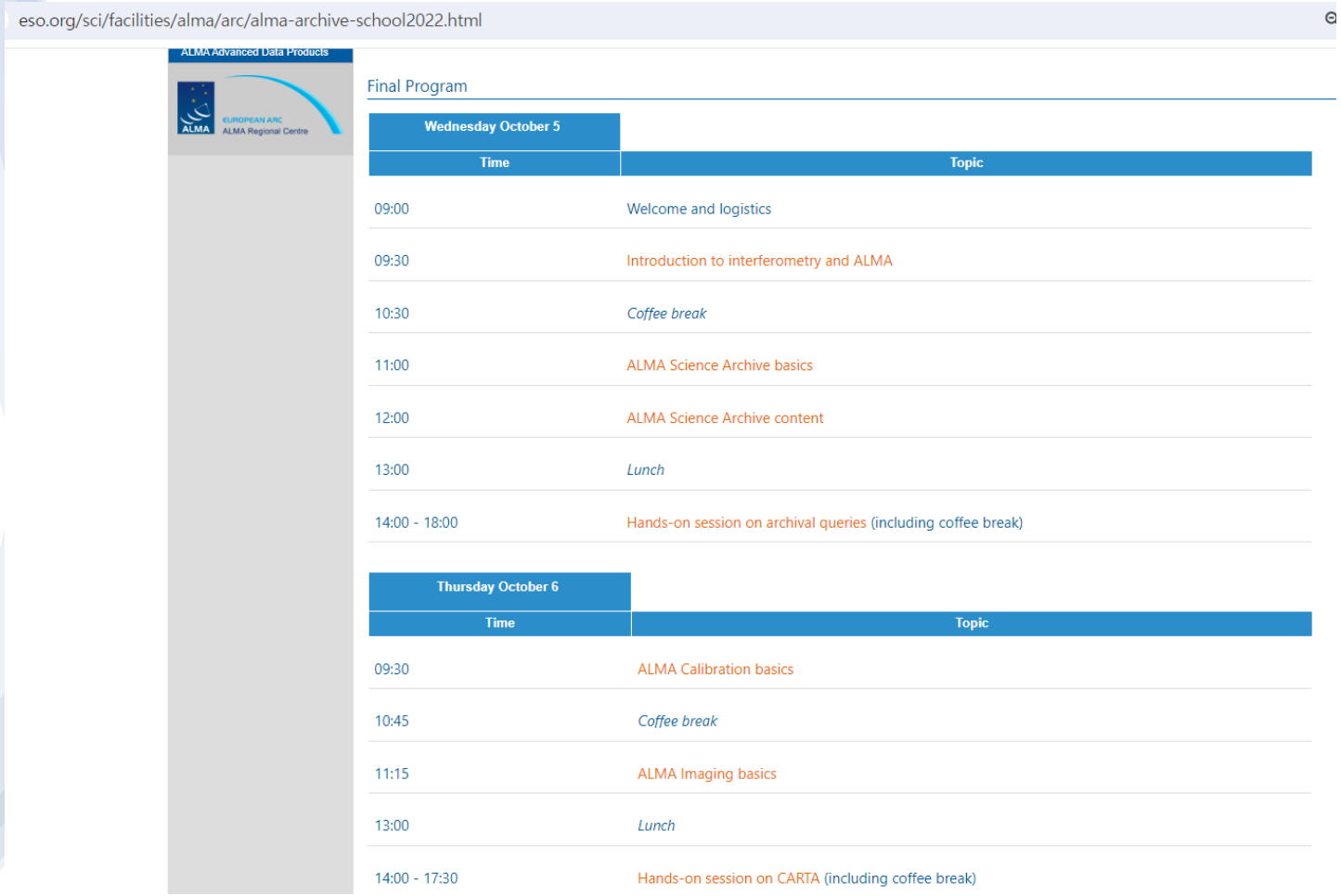
11th Synthesis Imaging Workshop (2008)

10th Synthesis Imaging Workshop (2006)

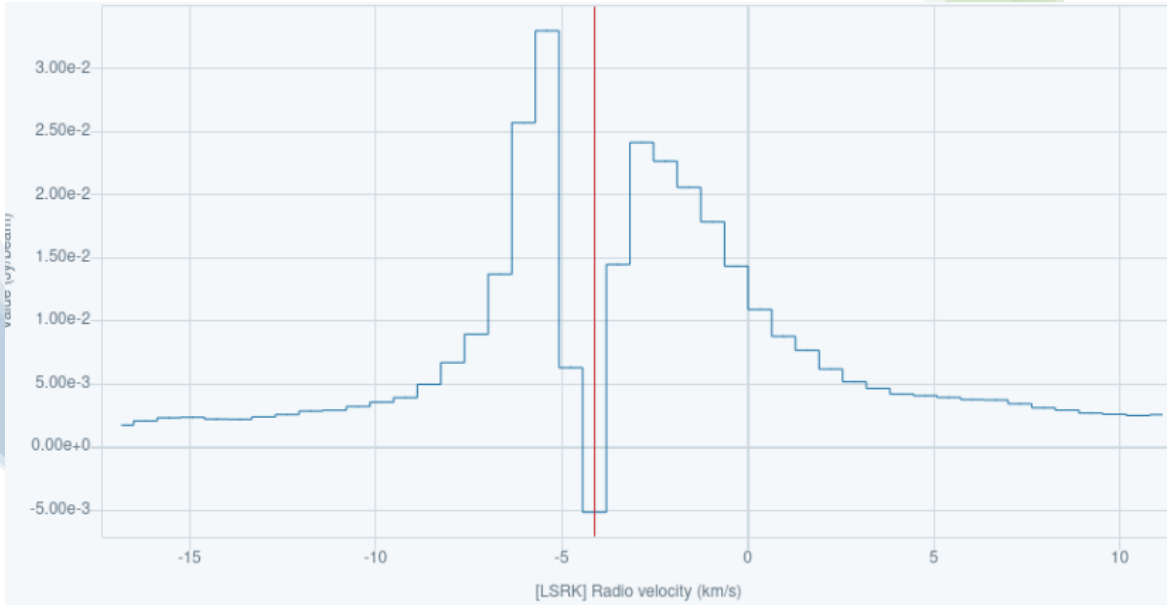
9th Synthesis Imaging Summer School (2004)

https://www.eso.org/sci/facilities/alma/arc/alma-archive-school2022.html

References



Scales

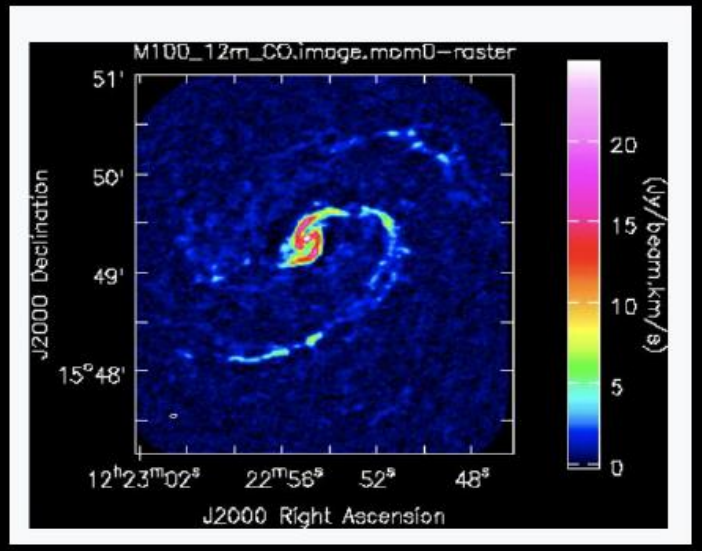


- **Angular Resolution (beam size)** ~ depend on the longest baseline

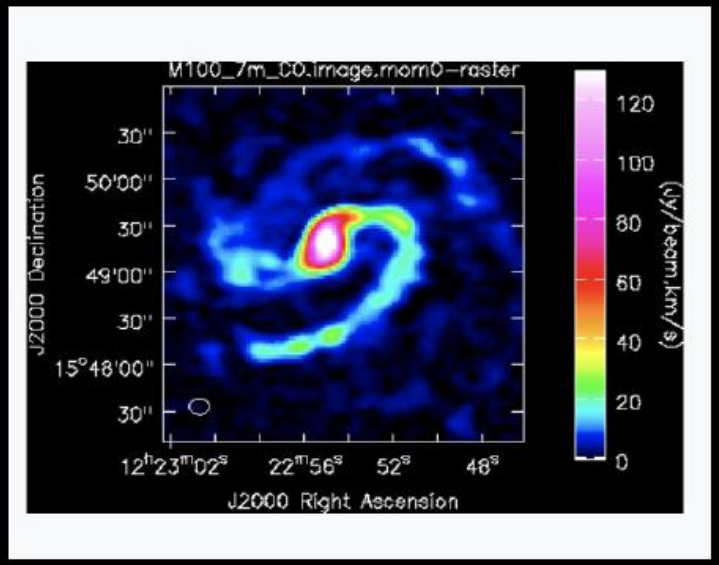
  0.2" x (300 GHz/Freq) x (1 km/longest baseline)
- **Maximum Recoverable Scale (MRS)**
  - 1.4" x (300 GHz/Freq) x (150m/shortest baseline)
  - depends on the shortest baseline (~ 10 x beam size)
  - When the emission is more extended than MRS, the emission is resolve out → multiple configuration or ACA and TP are added.
- **Field of View (FOV)**
  - FWHM of the 12m telescope primary beam
    - ~19 arcsec (33 arcsec) @ 300 GHz for 12m (7m)
  - Area of target is larger than 1/3 FOV, mosaic observation.

ALMA could map different angular scales

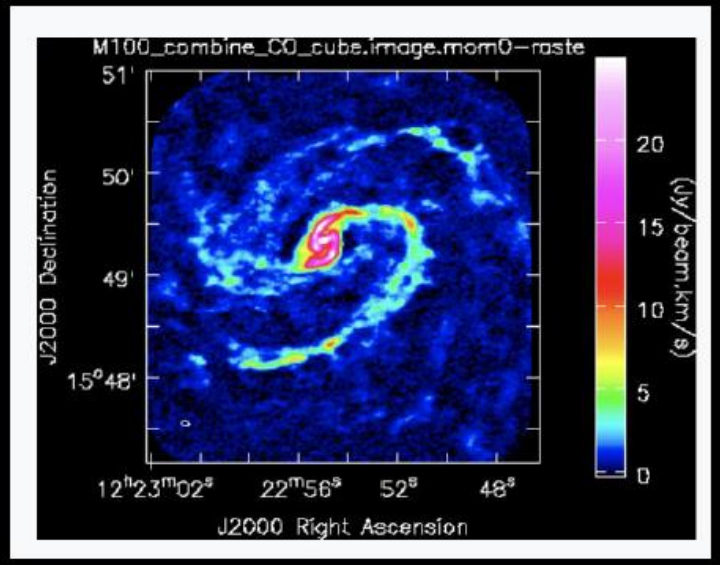
12 m



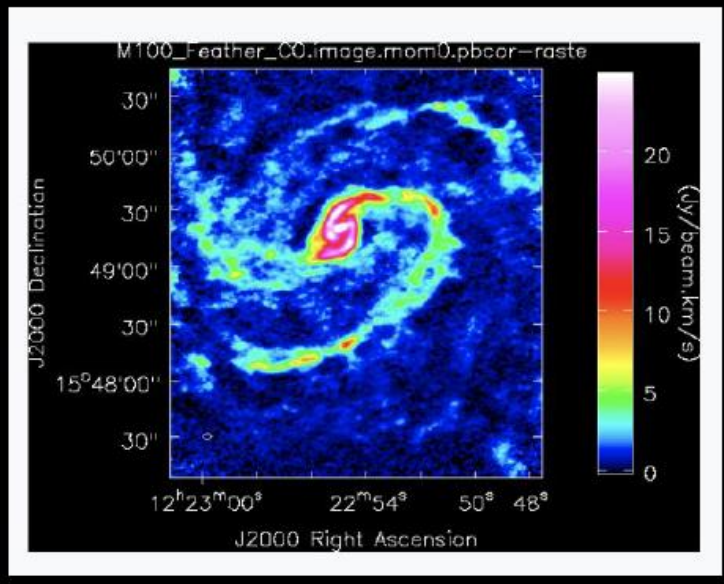
7 m



12m + 7m



12m + 7m + TP

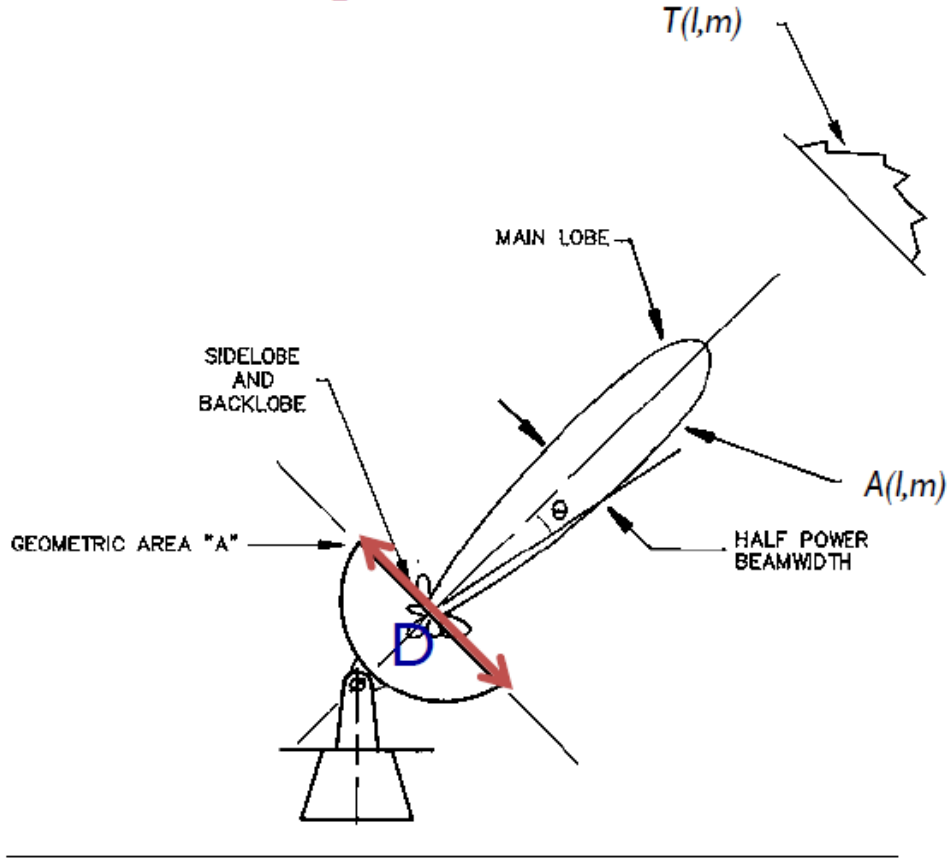


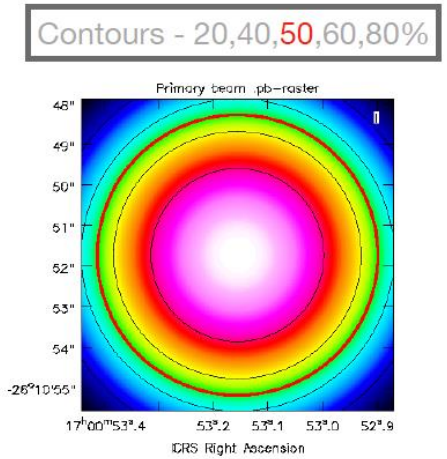
@Liuzzo's slide (2022)

Antenna Primary Beam Response

- antenna response *A(l,m)* is not uniform across the entire sky
  - main lobe = "primary beam" fwhm ~ λ/D
  - response beyond primary beam can be important ("sidelobes")

- antenna beam modifies the sky brightness distribution
  - $T(l,m) \rightarrow T(l,m)A(l,m)$
  - can correct with division by *A(l,m)* in the image plane
  - large source extents require multiple pointings of antennas = mosaicking





Default pblimit in tclean is 0.2.

T(l,m) → ##.pbcor

T(l,m)A(lm) = ##.image / ##.pb

@Wilner's slide (2016)

Imaging/tclean

Slides are copied from the references in p. 3-5.

Visibility and Sky Brightness

- *V(u,v), the complex visibility function, is the 2D Fourier transform of T(l,m), the sky brightness distribution (for incoherent source, small field of view, far field, etc.)*
  [for derivation from van Cittert-Zernike theorem, see TMS Ch. 14]

- mathematically

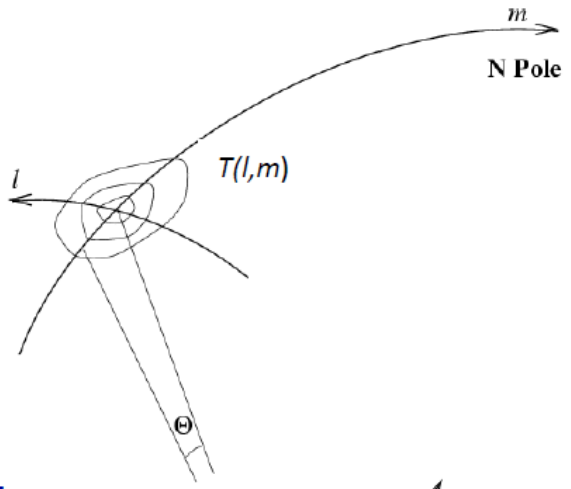
$$V(u,v) = \int\int T(l,m) e^{-i2\pi(ul+vm)} dl dm$$

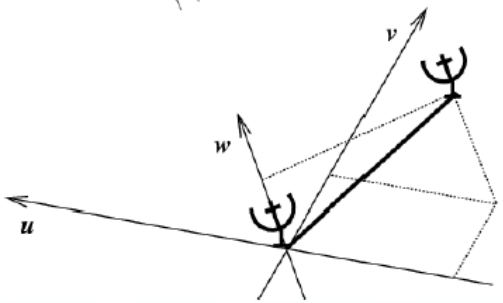
$$T(l,m) = \int\int V(u,v) e^{i2\pi(ul+vm)} du dv$$

u,v are E-W, N-S spatial frequencies [wavelengths]

l,m are E-W, N-S angles in the tangent plane [radians]

(recall $e^{ix} = \cos x + i \sin x$)





$$V(u,v) \xrightarrow{\mathcal{F}} T(l,m)$$

(R.A., Dec.)

@Wilner's slide (2016)

Basics of imaging synthesis

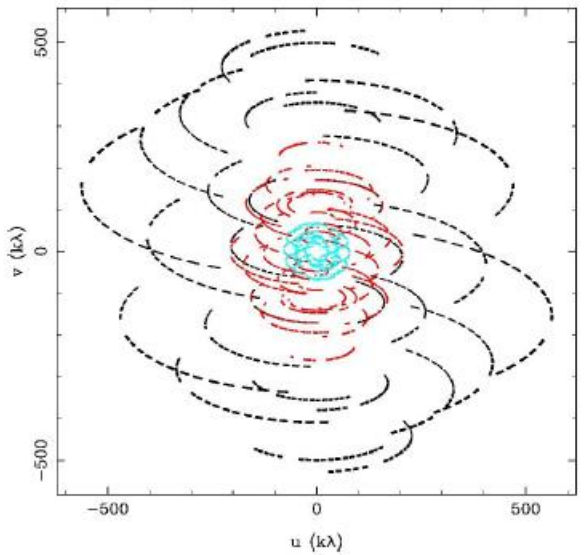
https://casaguides.nrao.edu/index.php/First_Look_at_Imaging

- Interferometers sample the sky in the Fourier Domain (the 'Visibilities') which are complex quantities (amplitude and phase) -> *think "flux and position"*
- Imaging is an inverse Fourier transform
  - We have sampled particular U, V coordinates with given baselines at given times. These must be 'converted' into physical parameter space onto an ***l, m*** grid
  - Mathematical transforms change U,V into image plane
    - $\boldsymbol{V}(U,V) = 2D\ FT\ \{\boldsymbol{B}_{primary}.\boldsymbol{I}_{source}\}$ (Visibilities)
    - $\boldsymbol{S}(U,V)$ = 1 where U,V are sampled, = 0 if not (Sampling function)
    - $\boldsymbol{B}_{dirty}(l,m) = 2D\ FT^{-1}\{S\}$ (Dirty Beam)
    - $\boldsymbol{I}_{meas}(l,m) = 2D\ FT^{-1}\{S.V\}$ (Measured image)

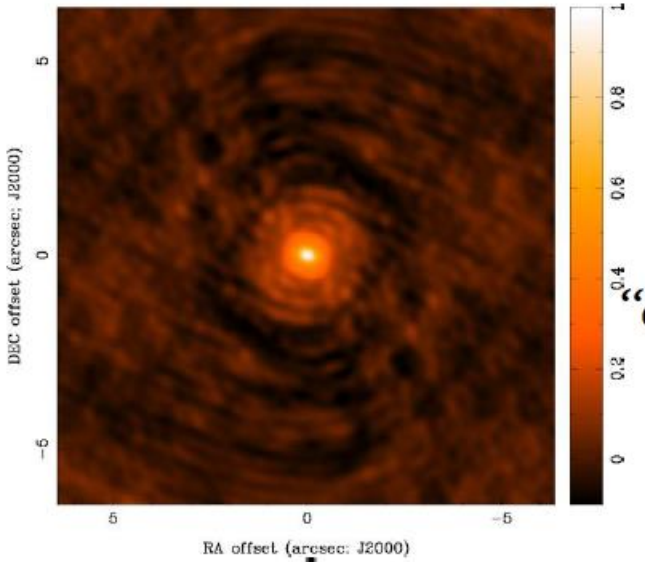
@Maud's slide (2022)

Dirty Beam and Dirty Image

$S(u,v)$



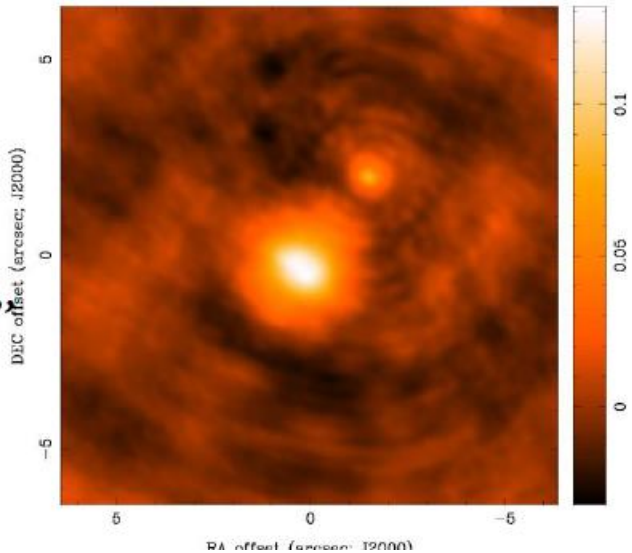
$\mathcal{F}$ →



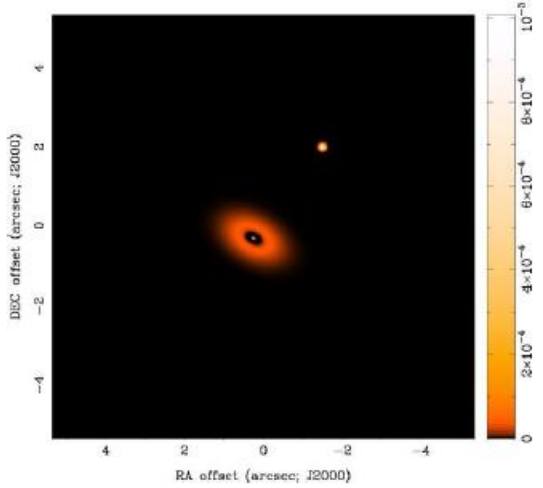
$s(l,m)$
"dirty beam"

*

$T^D(l,m)$
'dirty image"



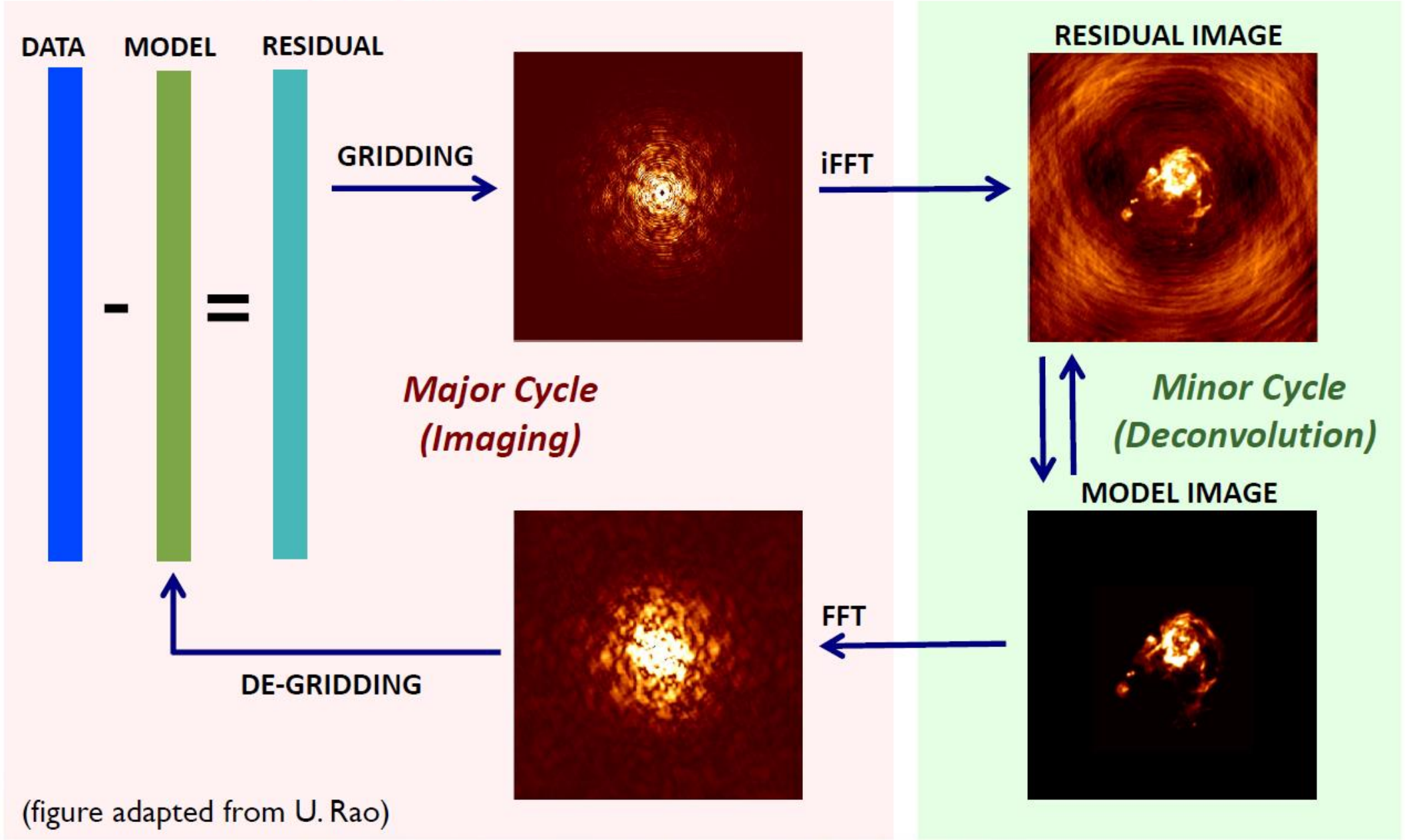
←



$T(l,m)$

@Wilner's slide (2016)

Deconvolution

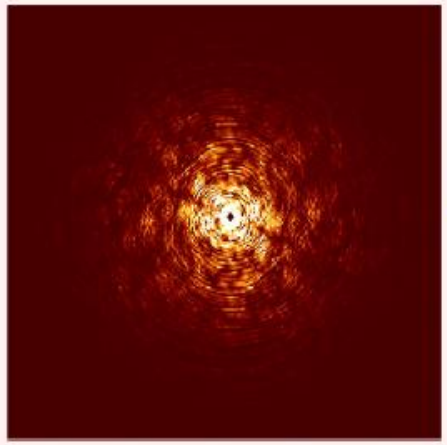


@ Marvil's slide (2024)

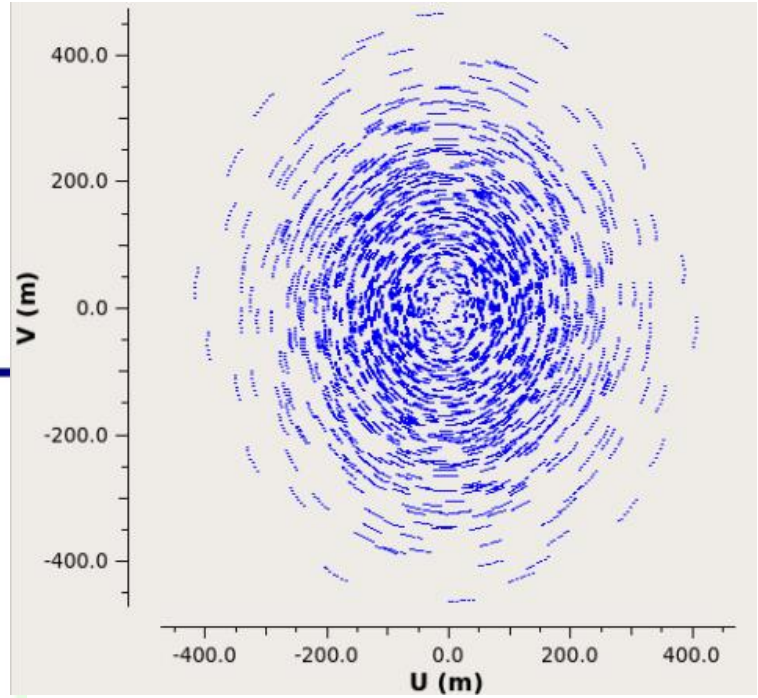
Deconvolution

DATA MODEL RESIDUAL

GRIDDING

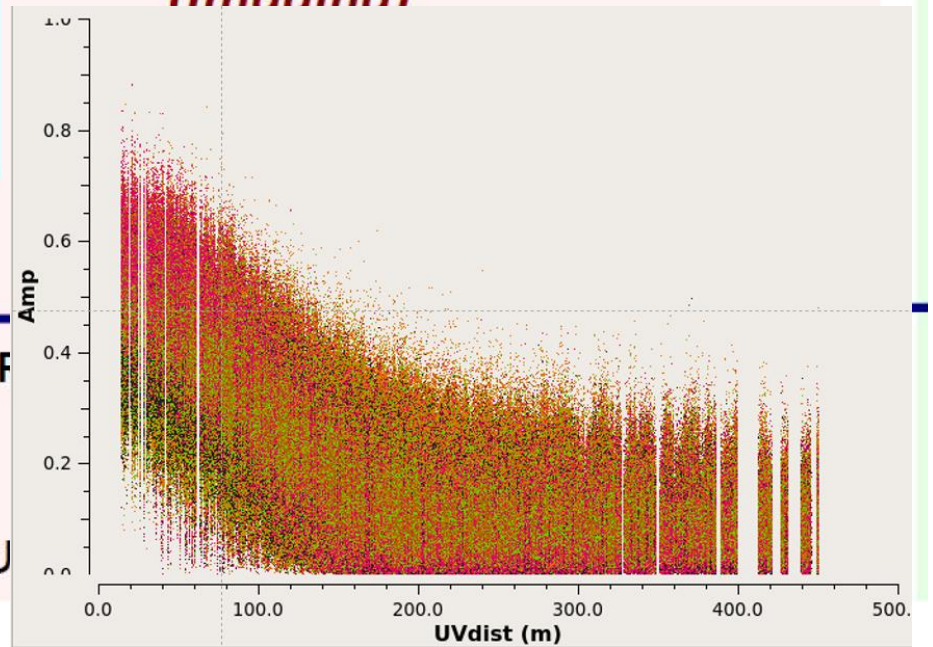


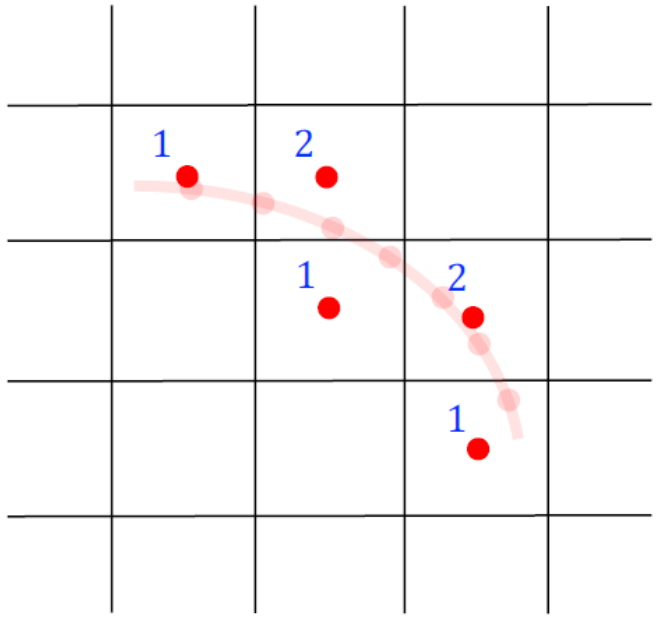
iFFT



Major Cycle
(Imaging)

DE-GR

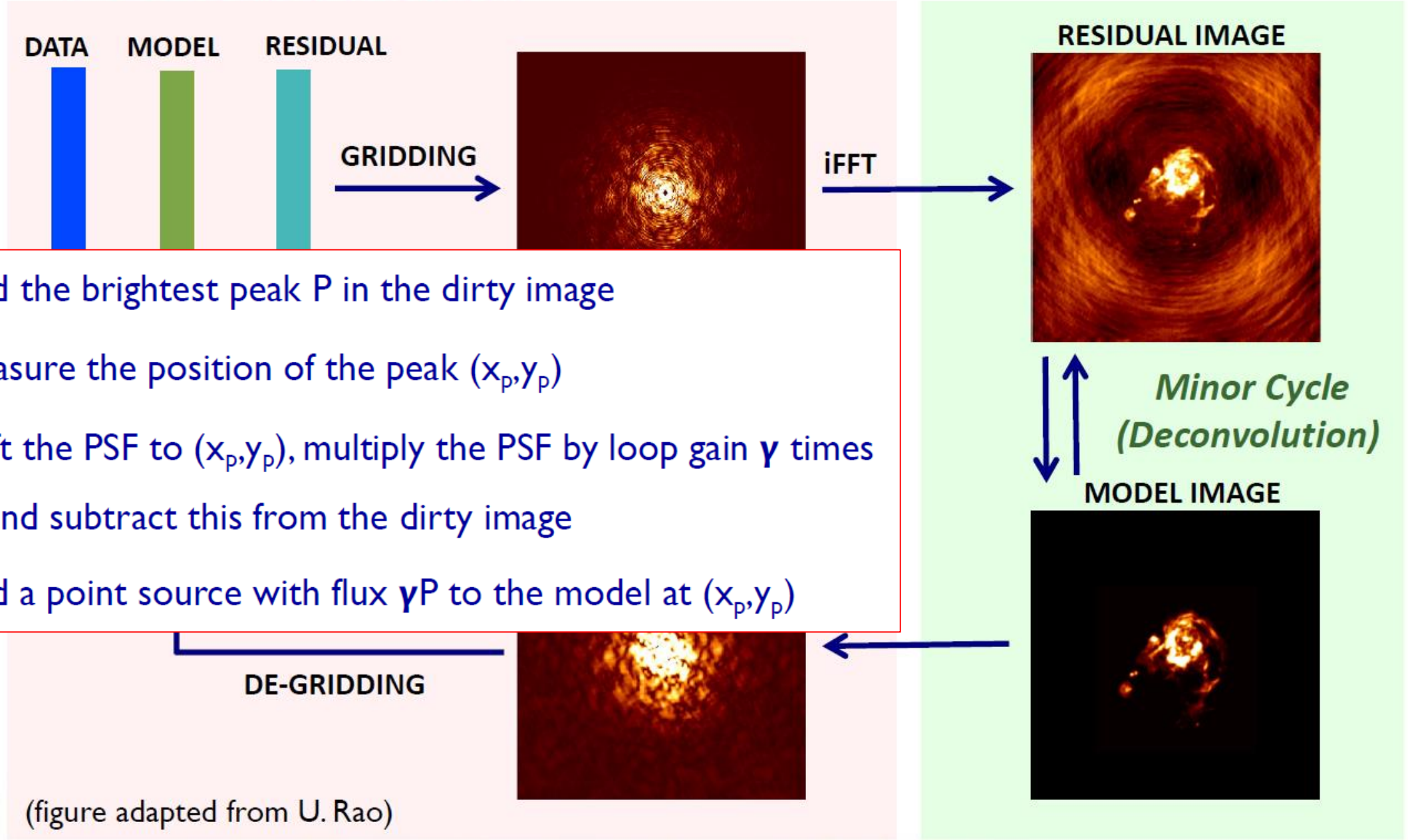




(figure adapted from U

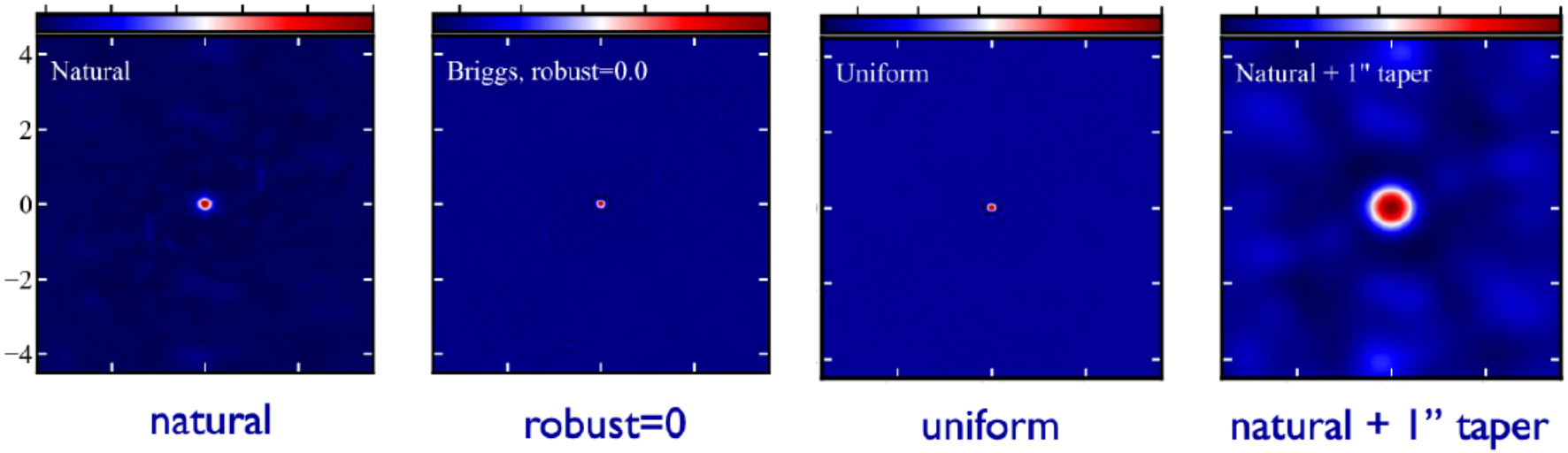
@ Marvil's slide (2024)

Deconvolution



@ Marvil's slide (2024)

Imaging parameter selection



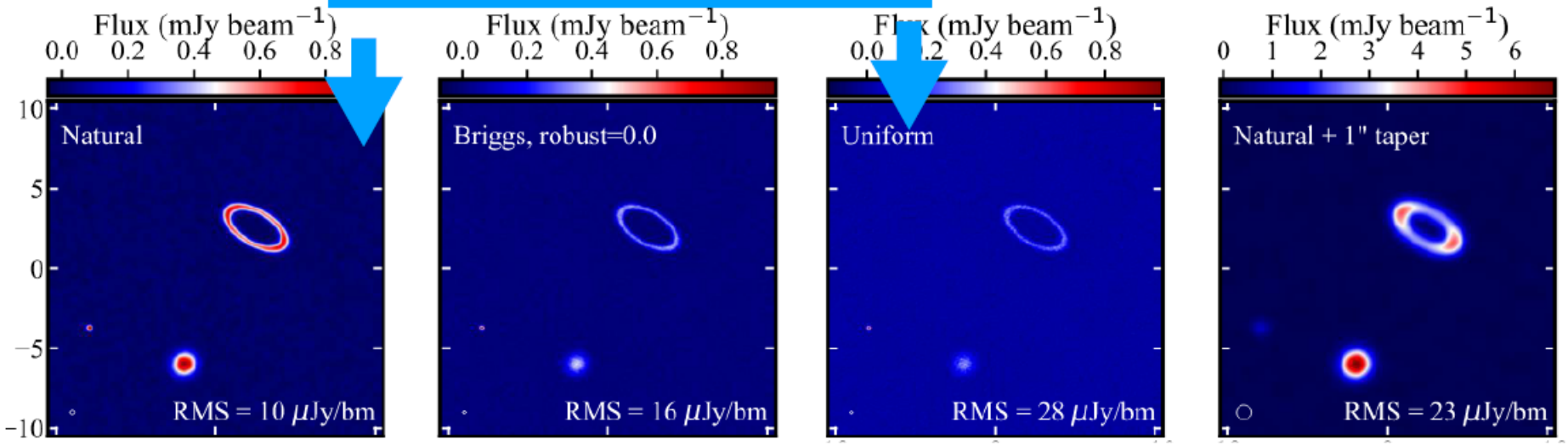
	Robust/Uniform	Natural	Taper
resolution	higher	medium	lower
sidelobes	lower	higher	depends
point source sensitivity	lower	maximum	lower
extended source sensitivity	lower	medium	higher

@Maud’s slide (2022)

Credits: Wilner - SMA

Imaging parameter selection

factor ~2.5 change in beam 'area'



natural
0.29x0.25 p.a. -81

robust=0
0.19x0.17 p.a. -78

uniform
0.17x0.15 p.a. -87

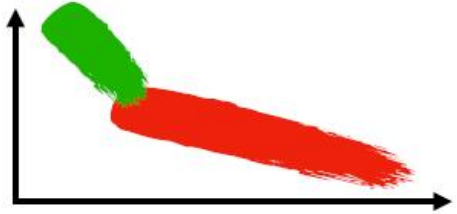
natural + 1" taper
0.93x0.88 p.a. -86

	Robust/Uniform	Natural	Taper
resolution	higher	medium	lower
sidelobes	lower	higher	depends
point source sensitivity	lower	maximum	lower
extended source sensitivity	lower	medium	higher

@Maud's slide (2022)

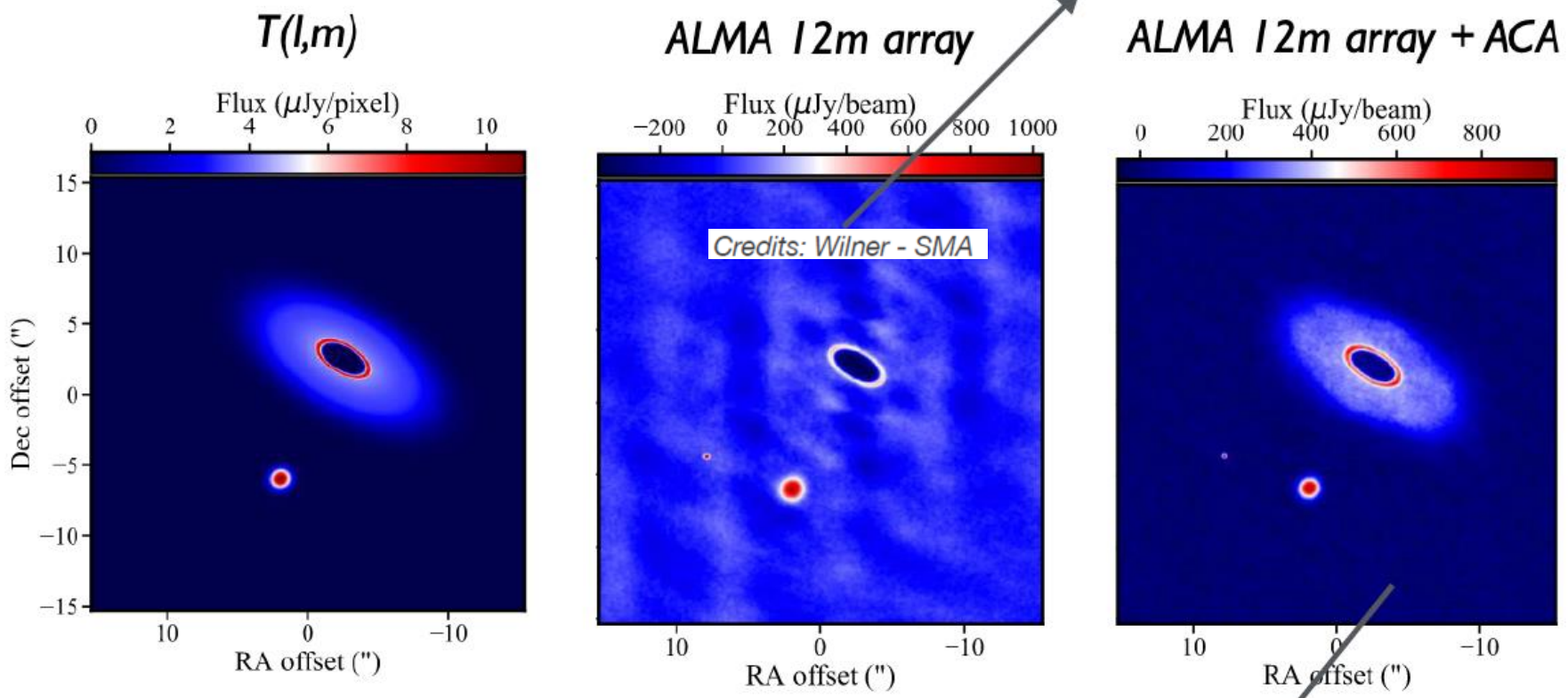
Credits: Wilner - SMA

Imaging parameter selection



Merging ACA and 12m to recover extended scales

Misses all extended structure, no U,V to sample this - so cannot image it



Recovers much of the extended structure

@Maud's slide (2022)

Credits: Wilner - SMA

EUROPEAN ARC

Imaging parameter selection

- When imaging a number of parameters need to be used:
  - **Cell (pixel) size**: clean beam / 5 - i.e. at least 5 cells (pixels) per clean beam *(you know AR)*
    - Required to grid correctly, ascribe flux to 'correct' locations within a 'clean beam'
    - Pixels too large - blocky image flux build up in 'wrong' places, poor clean beam 'fit'
    - Pixels too small - hard for the Fourier transform, cells 'empty', could affect weightings
  - **Image Size**: Cover the Primary Beam
    - If emission is not large scale, image to HPBW or smaller *(long baselines which can be huge images)*, for mosaics *always* extend past the edges
  - **Specmode**: 'mfs' (multi-frequency synthesis) or 'cube' spectral line cube
    - ALMA/CASA Pipeline specific 'cont' - merges all SPWs
  - **Cleaning type**: `CLEAN`ing - **Hogbom**, Clark, Multi-Scale; (but also Max Entropy MEM)
    - **niter** / **threshold** - how much to clean by before stopping

@Maud's slide (2022)

Imaging parameter selection

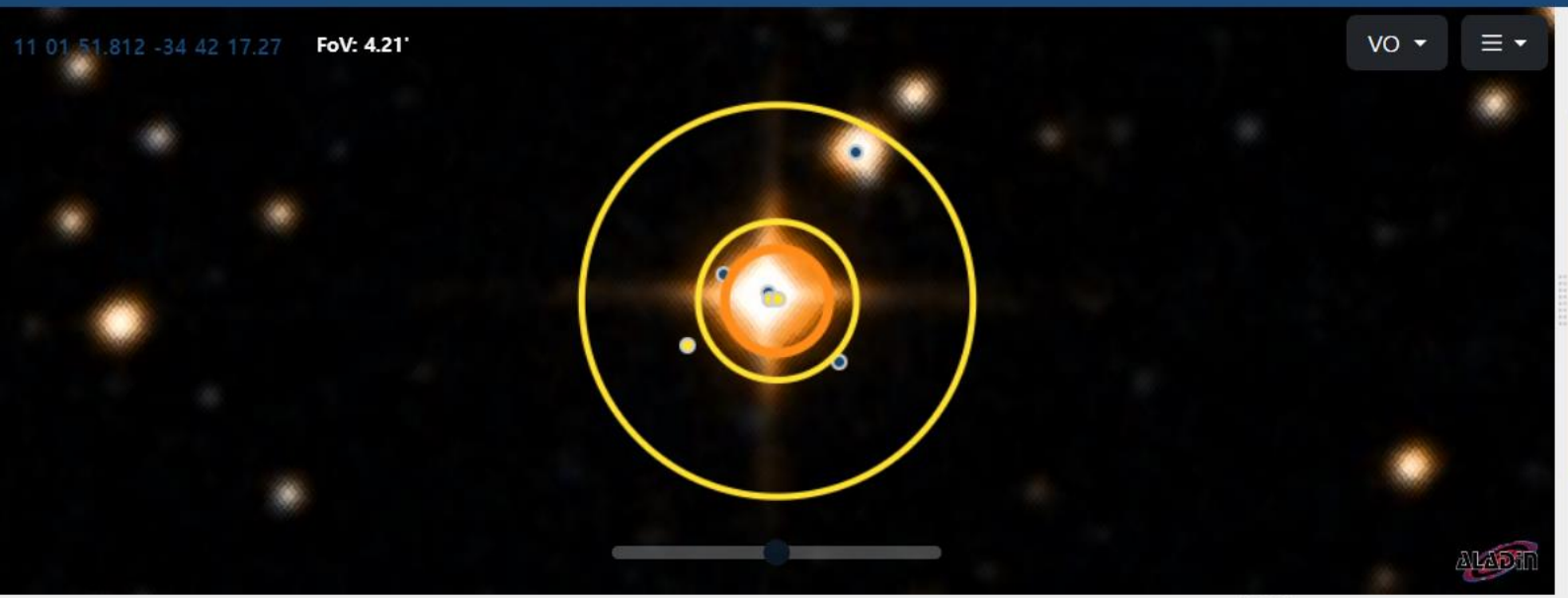
- When imaging a number of parameters need to be used:
  - **Robust**: Numerical Value from +2 *Natural* to -2 *Uniform (between is 'Briggs Robust')*
    - **+ve**, weights towards shorter baselines (each baselines is equally weighted and more shorter ones are always sampled - lower AR, but maximised sensitivity)
    - **-ve**, weights towards longer baselines (gives more power to least sampled visibilities - inversely proportioned, increasing noise but best AR)
    - Default = 0.5, 'middle-ground' between resolution and sensitivity
  - **Taper**: Make the beam larger (worse AR) by Apodizing the U,V by a Gaussian
    - Like smoothing the image with a Gaussian but not 'exactly' the same
  - **uvrange**: optional method to limit the range of visibilities in the image, e.g. if a few shorter baseline are causing a striping, you can exclude them from the time (uvrange = '800~16000' - default meters, or specify klambda - obeys list rule for multiple MS)

@Maud's slide (2022)

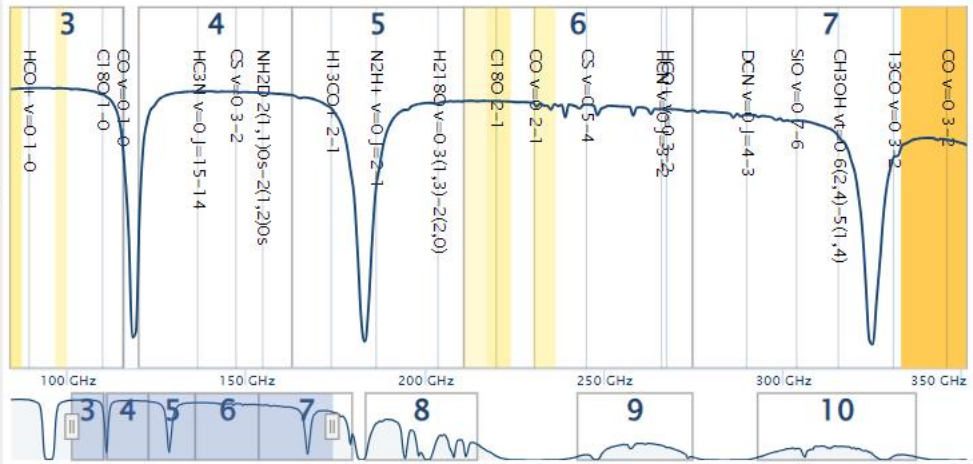
Download Data

almascience.nao.ac.jp/aq/?observationsProjectCode=2016.1.00229.S

Search | 1 column filter active | Explore and download



Molecules | Lines | Redshift 0.000044700 estimated



Observations (3) | Projects (4698) | Publications (3803)

Project code: 2016.1.00229.S | Remove tab filters

Project code	ALMA source name	RA h:m:s	Dec d:m:s	Band	Cont.sens. mJy/beam	Frequency support	↑ Release date	Publications	Ang.res. arcsec	Min.vel.res.
2016.1.(										
2016.1.00229.S	tw_hya	11:01:51.817	-34:42:17.270	7	0.0329	336.325..351.281 GHz	2018-03-03	4	0.293	0.209
2016.1.00229.S	TW_Hya	11:01:51.813	-34:42:17.276	6	0.0224	217.108..235.289 GHz	2018-05-07	4	0.660	0.158
2016.1.00229.S	TW_Hya	11:01:51.812	-34:42:17.263	3	0.0182	84.08..98.847 GHz	2018-09-06	4	0.318	0.186

Search

Explore and download

Position

Source name

ALMA source name

RA Dec

Galactic

Target List

Angular Resolution

Max. Recoverable Scale

Energy

Frequency

Band

Project

Project code

Project Title

Publication

BibCode

Publication Title

Abstract

First Author

Authors

Observation

Observation Date

Polarisation Type

Member ous id

Object type

Public data only

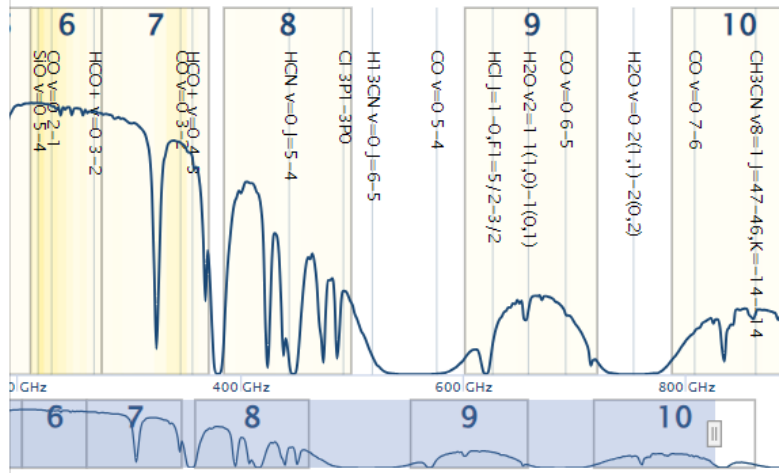
Calibration observations

Lines

Redshift

0

estimated



RA Dec

Info: Right Ascension and Declination

Description: Coordinate search with default radius of 10 arcmin or coordinate-range search. RA and Dec may be expressed in sexagesimal or in decimal degrees. An alternative search **radius** in arcmin can be added to the end separated by a comma. All observations that have footprints overlapping with the search region will be returned.

Units: Sexagesimal

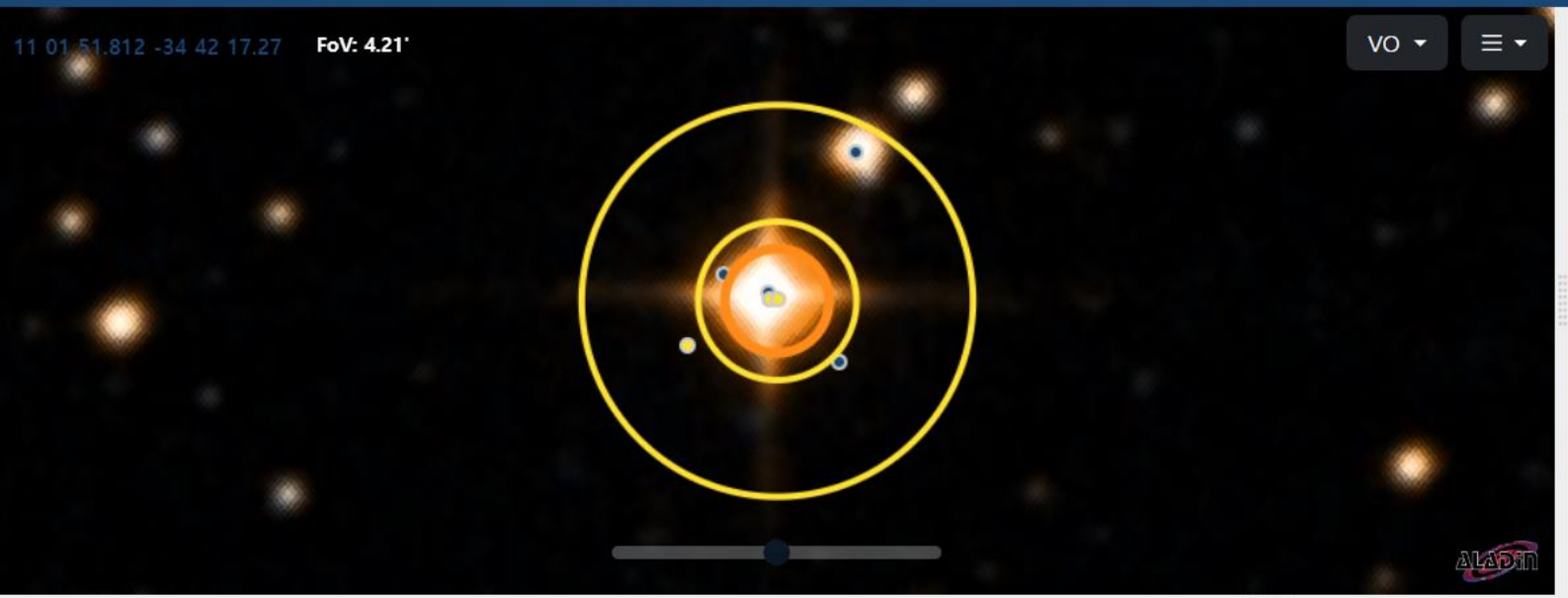
Examples:

- 13:37:00.89 -29:51:59.8
- 83.633075 22.014494
- 04:31:38.425 18:13:57.242, 5
- 181..185 >-0.1928

Project c		Dec d:m:s	Band	Cont.sens. mJy/beam	Frequency support	↑ Release date	Publications	Ang.res. arcsec	Min.vel.
2011.0.00191.S	Fomalhaut b	22:57:38.685	-29:37:12.616	7	0.1181	343.077..358.839 GHz	2012-12-06	2	1.047	0.816
2011.0.00101.S	GRB021004	00:26:54.680	+18:55:41.600	7	0.1136	337.009..353.001 GHz	2012-12-06	2	1.107	26.541
2011.0.00131.S	R Scl	01:26:58.079	-32:32:36.424	7	0.9115	330.246..346.109 GHz	2012-12-06	5	1.043	0.846
2011.0.00397.S	J035448.24-330827.2	03:54:48.240	-33:08:27.200	7	0.4848	337.026..353.011 GHz	2012-12-20	3	1.128	26.541
2011.0.00397.S	J041754.10-281655.9	04:17:54.100	-28:16:55.900	7	0.4848	337.023..353.008 GHz	2012-12-20	3	1.118	26.541
2011.0.00397.S	J063027.81-212058.6	06:30:27.810	-21:20:58.600	7	0.5346	337.007..352.992 GHz	2012-12-20	3	1.183	26.541

almascience.nao.ac.jp/aq/?observationsProjectCode=2016.1.00229.S

Search | 1 column filter active | Explore and download



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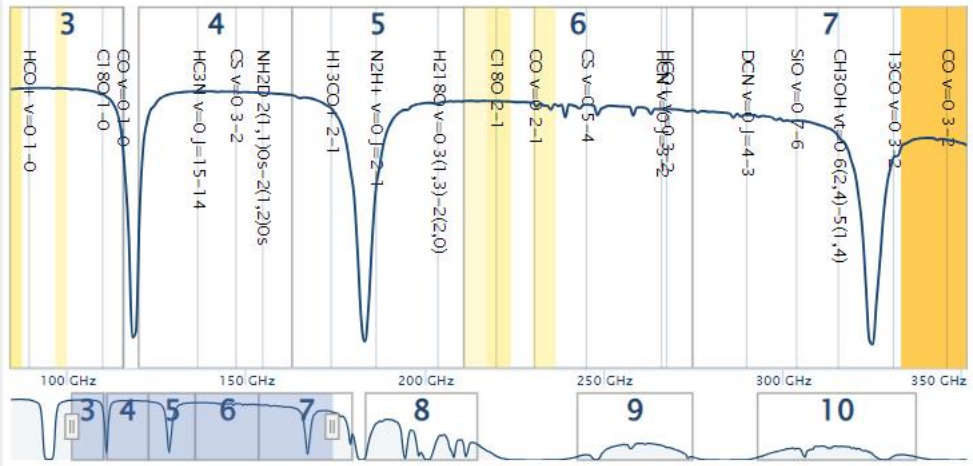


Observations (3) | Projects (4698) | Publications (3803)

Project code: 2016.1.00229.S | Remove tab filters

Project code	ALMA source name	RA h:m:s	Dec d:m:s	Band	Cont.sens. mJy/beam	Frequency support	↑ Release date	Publications	Ang.res. arcsec	Min.vel.res.
2016.1.(										
2016.1.00229.S	tw_hya	11:01:51.817	-34:42:17.270	7	0.0329	336.325..351.281 GHz	2018-03-03	4	0.293	0.209
2016.1.00229.S	TW_Hya	11:01:51.813	-34:42:17.276	6	0.0224	217.108..235.289 GHz	2018-05-07	4	0.660	0.158
2016.1.00229.S	TW_Hya	11:01:51.812	-34:42:17.263	3	0.0182	84.08..98.847 GHz	2018-09-06	4	0.318	0.186

Download 34 GB | Open legacy Request Handler | Login

Project (1)

Group ObsUniSet (1)

Member ObsUniSet (1)

Source (1)

Collection (1)

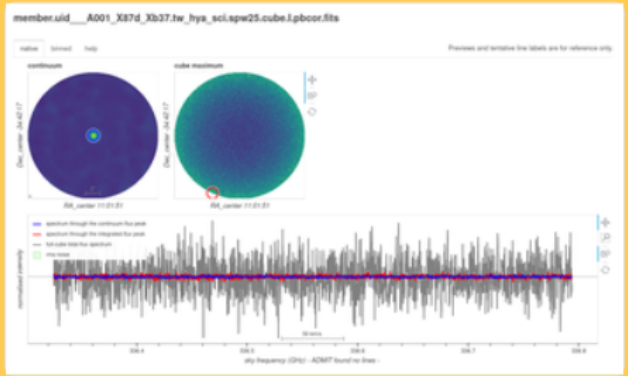
Array (1)

File type (5)

File class (3)

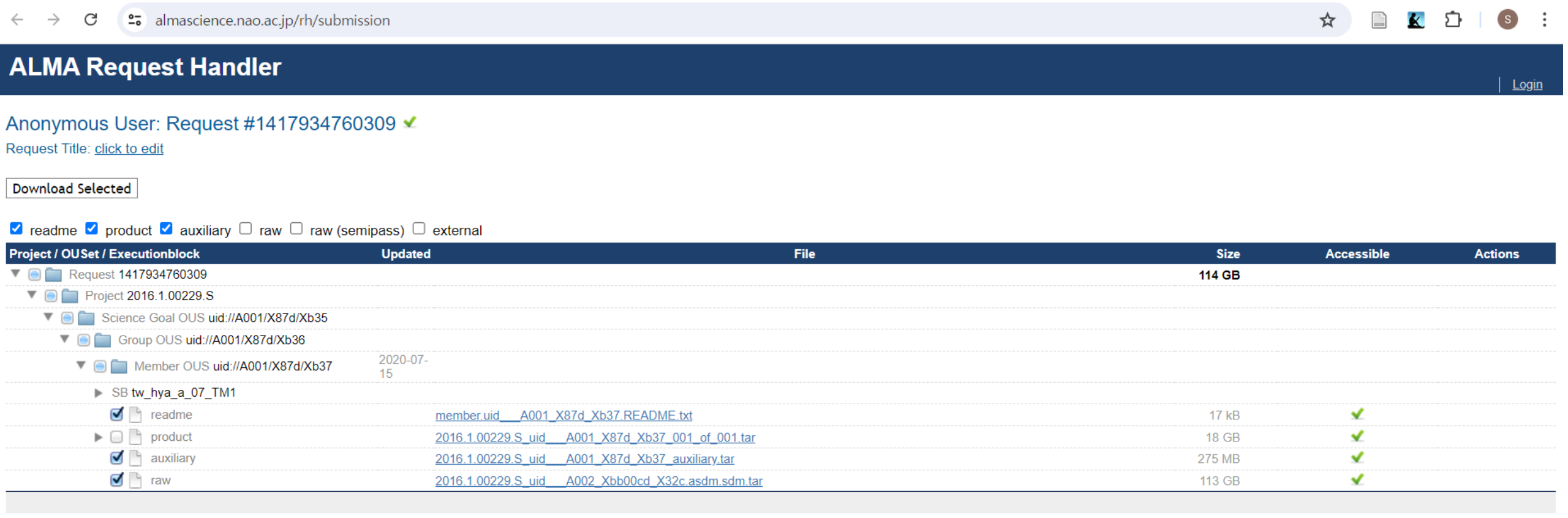
Readme | Product | Auxiliary | Raw | Raw (semipass) | External

Name		Size	Project	GOUS
member.uid___A001_X87d_Xb37.tw_hya_sci.spw27.cube.I.pb.fits.gz	(product)	1 GB	2016.1.00229.S	uid://A001/X87d/
member.uid___A001_X87d_Xb37.tw_hya_sci.spw25.cube.I.pbcor.fits	(product)	4 GB	2016.1.00229.S	uid://A001/X87d/
member.uid___A001_X87d_Xb37.tw_hya_sci.spw19_25_27_29.cont.I.pb.fits.gz	(product)	374 kB	2016.1.00229.S	uid://A001/X87d/
member.uid___A001_X87d_Xb37.tw_hya_sci.spw29.mfs.I.pbcor.fits	(product)	1 MB	2016.1.00229.S	uid://A001/X87d/



Band: 7
Frequency range: 336.325..336.794
Frequency resolution: 244.141 kHz
Line sens. (10km/s): 0.599mJy/beam
Line sens. (native): 0.093uJy/beam
Polaritazions: XX YY
Array: 12m

Band: 7
Frequency range: 349.099..349.568
Frequency resolution: 244.141 kHz
Line sens. (10km/s): 0.593mJy/beam
Line sens. (native): 0.094uJy/beam
Polaritazions: XX YY
Array: 12m



Each Member OUS (or SB) may have the following files available for download:
readme A text file with very basic information
product Final images and image cubes
auxiliary A file containing logs, quality assurance information, scripts, and calibration data
raw Raw visibility data
external Enhanced data products (including enhanced images or visibility data) created after the data delivery

In download_XXX.sh, check the server!!

```
LIST=("
https://almascience.nao.ac.jp/dataPortal/2016.1.00229.S_uid___A001_X87d_Xb3d_auxiliary.tar
https://almascience.nao.ac.jp/dataPortal/2016.1.00229.S_uid___A002_Xbfcd9b_X70c.asdm.sdm.tar
https://almascience.nao.ac.jp/dataPortal/member.uid___A001_X87d_Xb3d.README.txt
")
```

```
[shlee@pluto TW_Hya]$ ls
2016.1.00229.S
2016.1.00229.S_uid___A001_X87d_Xb3d_auxiliary.tar
2016.1.00229.S_uid___A002_Xbfcd9b_X70c.asdm.sdm.tar
download-files_twhya.sh
member.uid___A001_X87d_Xb3d.README.txt
[shlee@pluto TW_Hya]$ cd 2016.1.00229.S/science_goal.uid___A001_X87d_Xb3b/group.
uid___A001_X87d_Xb3c/member.uid___A001_X87d_Xb3d/
[shlee@pluto member.uid___A001_X87d_Xb3d]$ ls
calibrated  calibration  log  product  qa  raw  script
[shlee@pluto member.uid___A001_X87d_Xb3d]$ ls script/
casa-20240703-150200.log    ipython-20240703-150206.log    scriptForImaging.py
casa_piperestorescript.py   PPR_uid___A001_X87d_Xb3e.xml   scriptForPI.py
casa_pipescript.py          scriptForImagingPrep.py
```

```
|-- project_id/
|   |-- science_goal.ouss_id/
|   |   |-- group.ouss_id/
|   |   |   |-- member.ouss_id/
```

Project - All observations associated with a specific proposal.

Science Goal OUS - All observations associated with a specific science goal in that proposal.

Group OUS – Associated observations within a Science Goal (e.g., observations of the same fields with the same spectral tunings but with **different arrays** or **array configurations**.

Member OUS – A specific set of observations of the same fields using the same tunings and array or array configuration.

Execution block – An individual “unit” of the observations needed for a Member OUS.

```
Atacama Large Millimeter/submillimeter Array (ALMA)

#####

Cycle: 4
Project code: 2016.1.00229.S
SB name: TW_Hya_a_06_TM1
PI name: Edwin Bergin
Project title: Unveiling the Gas Phase Kinetic Chemistry in Protoplanetary Disks
Configuration: Longest Baseline = 460.0 m
Proposed rms: 5.0 mJy / 0.122070 MHz (0.166 km/s)
Proposed beam size: 1.0 arcsec
CASA version used for reduction: 4.7.2
QA2 Result: PASS
Total Number of Member SBs in this OUS Group: 1
Comments from Reducer:

This scheduling block was calibrated and imaged using the pipeline
version 38366 (C4-R2B) in CASA 4.7.2 (r39732).

The calibration appears reasonable, no additional flagging was required in stage 2 (hifa_flagdata).
The imaging
The continu                                    ied by the pipeline. The PI may choose to do a more carefu
l identific
The continu                                    ctral line cubes.
Self-calibr                                    tinuum.
All pipelin                                    an and a broad mask, the PI may want to do a deeper clean
with careful masking to improve the images.

member.uid__A001_X87d_Xb3d.README.txt                                  1,0-1         Top
```

In script directory,

- casa(4.7.2) –pipeline
- Execfile('scriptForPI.py')

```
[shlee@pluto member.uid___A001_X87d_
[shlee@pluto qa]$ ls
uid___A001_X87d_Xb3d.weblog.tgz
[shlee@pluto qa]$ tar -xzf uid___A00
[shlee@pluto qa]$ cd pipeline-201705
[shlee@pluto html]$ ls
casa-20170503-212520.log    stage10
casa-20170504-123945.log    stage11
casa_commands.log           stage12
casa_piperestorescript.py   stage13
casa_pipescript.py          stage14
index.html                  stage15
resources                   stage16
sessionsession_1            stage17
stage1                      stage18
```

```
|-- project_id/
|   |-- science_goal.ouss_id/
|   |   |-- group.ouss_id/
|   |   |   |-- member.ouss_id/
|   |   |   |   |-- README          (1)
|   |   |   |   |-- product/        (2)
|   |   |   |   |-- calibration/    (3)
|   |   |   |   |-- qa/             (4)
|   |   |   |   |-- script/         (5)
|   |   |   |   |-- log/            (6)   (only present in manually calibrated data)
|   |   |   |   |-- raw/            (7)   (only present when part b is unpacked)
```

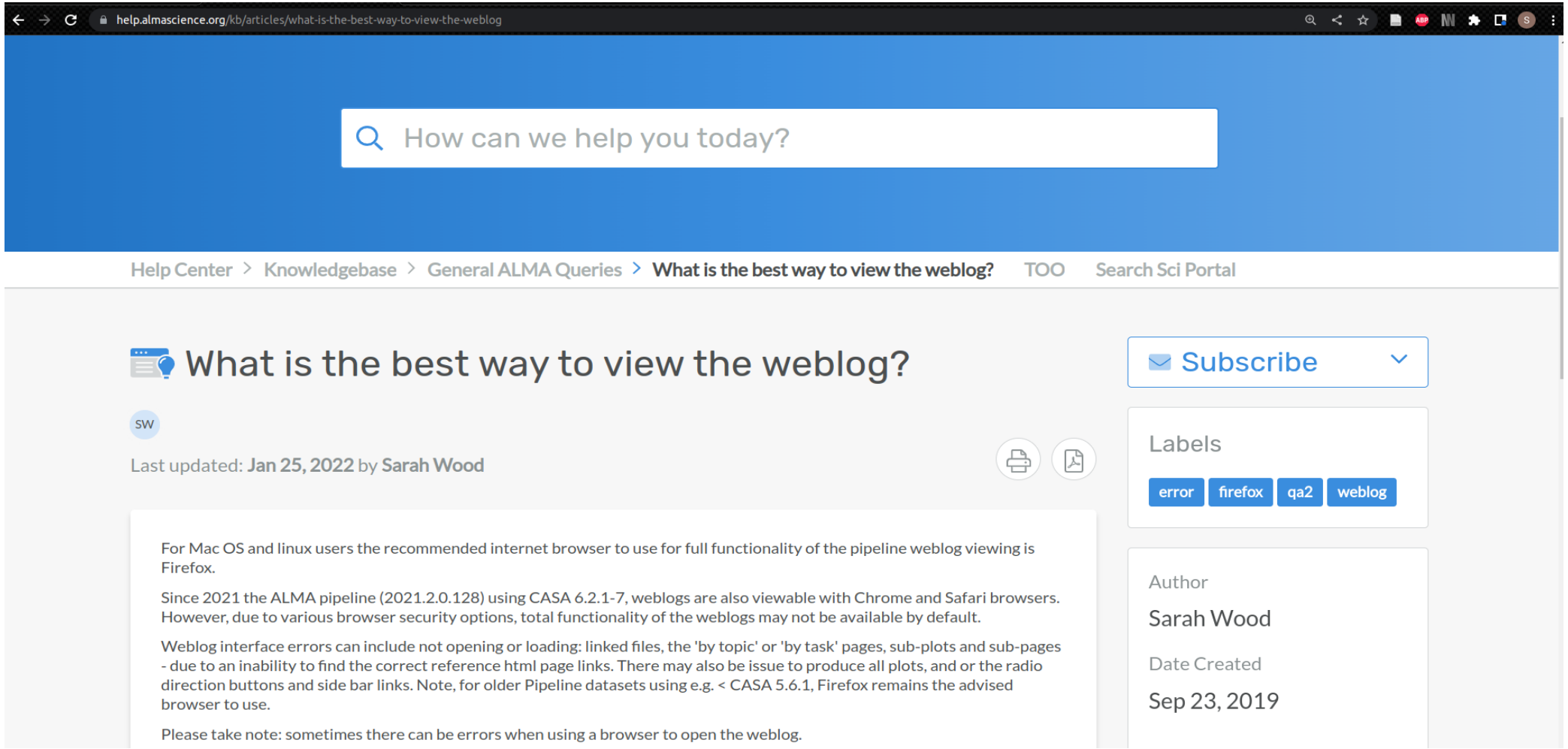
uid____XXXXX.weblog.tgz
pipeline-XXXXX/html (directory)

```
[shlee@pluto html]$ casa --pipeline

CASA <1>: h_weblog()
2024-07-03 20:06:57 INFO: Found weblogs at:
        t1-1.html
2024-07-03 20:07:02 INFO: Serving web log on 127.0.0.1 port 30000 (http://127.0.0.1:30000/) ...
2024-07-03 20:07:02 INFO: Opening http://127.0.0.1:30000/t1-1.html
```

Open Weblog

https://help.almascience.org/kb/articles/what-is-the-best-way-to-view-the-weblog



Open weblog

ii) Use a python3 call, external to a CASA session:

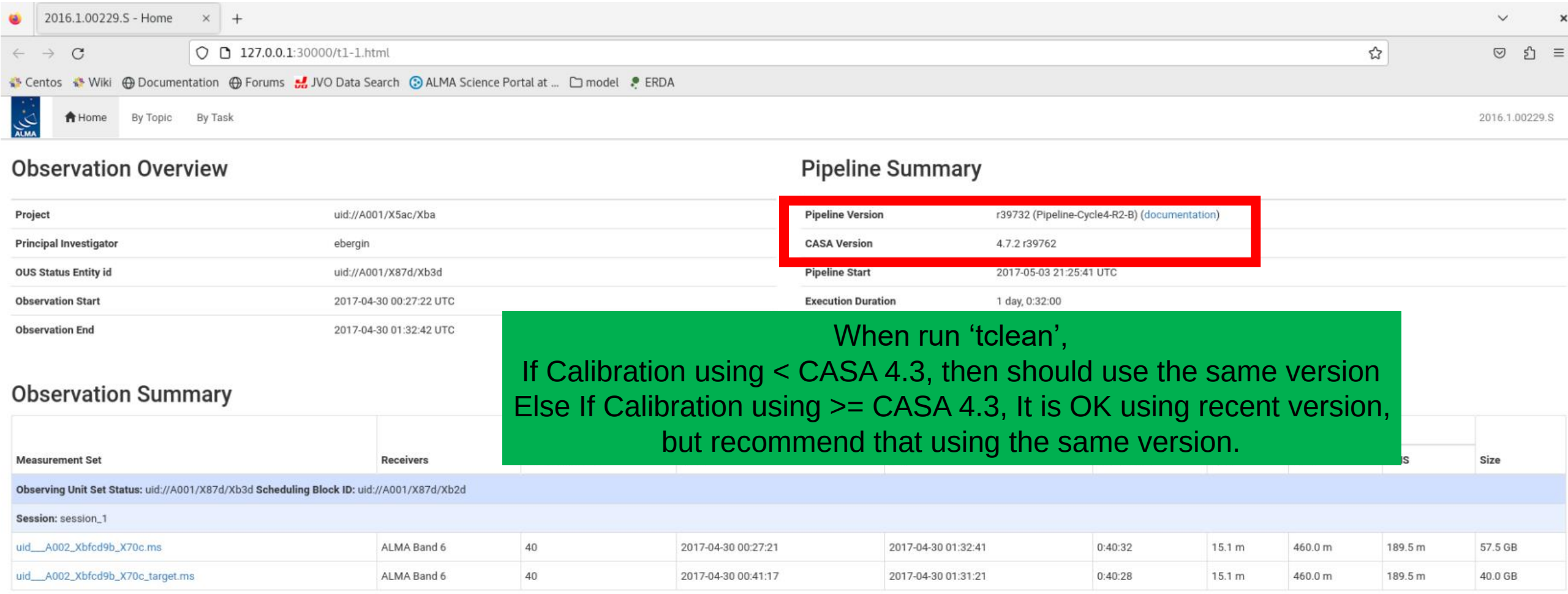
Outside of CASA one can also create the http server in which to view a local weblog. From the command line simply type:

```
python3 -m http.server 8080 --bind 127.0.0.1
```

The weblog can then be accessed in a web browser via the URL:

```
http://127.0.0.1:8080/"location_of_PL_weblog"/html/index.html
```

Note, this method requires python3, for which the version delivered with CASA can be used by setting it as an alias or by calling the full path. On MacOS this is found in "/Applications/CASA.app/Contents/MacOS/python3", or on Linux systems "'install_path'/casa-6.2.1-7-pipeline-2021.2.0.128/bin/python3"


2016.1.00229.S - Home
127.0.0.1:30000/t1-1.html
Centos
Wiki
Documentation
Forums
JVO Data Search
ALMA Science Portal at ...
model
ERDA
Home
By Topic
By Task
2016.1.00229.S
Observation Overview
Project
uid://A001/X5ac/Xba
Principal Investigator
ebergin
OUS Status Entity id
uid://A001/X87d/Xb3d
Observation Start
2017-04-30 00:27:22 UTC
Observation End
2017-04-30 01:32:42 UTC
Pipeline Summary
Pipeline Version
r39732 (Pipeline-Cycle4-R2-B) (documentation)
CASA Version
4.7.2 r39762
Pipeline Start
2017-05-03 21:25:41 UTC
Execution Duration
1 day, 0:32:00
When run ‘tclean’,
If Calibration using < CASA 4.3, then should use the same version
Else If Calibration using >= CASA 4.3, It is OK using recent version,
but recommend that using the same version.
Observation Summary
Measurement Set
Receivers
Size
Observing Unit Set Status: uid://A001/X87d/Xb3d Scheduling Block ID: uid://A001/X87d/Xb2d
Session: session_1
uid___A002_Xbfcd9b_X70c.ms
ALMA Band 6
40
2017-04-30 00:27:21
2017-04-30 01:32:41
0:40:32
15.1 m
460.0 m
189.5 m
57.5 GB
uid___A002_Xbfcd9b_X70c_target.ms
ALMA Band 6
40
2017-04-30 00:41:17
2017-04-30 01:31:21
0:40:28
15.1 m
460.0 m
189.5 m
40.0 GB

Observation Overview

Project	uid://A001/X5ac/Xba
Principal Investigator	ebergin
OUS Status Entity id	uid://A001/X87d/Xb3d
Observation Start	2017-04-30 00:27:22 UTC
Observation End	2017-04-30 01:32:42 UTC

Pipeline Summary

Pipeline Version	r39732 (Pipeline-Cycle4-R2-B) (documentation)
CASA Version	4.7.2 r39762
Pipeline Start	2017-05-03 21:25:41 UTC
Execution Duration	1 day, 0:32:00

Observation Summary

Measurement Set	Receivers	Num Antennas	Time (UTC)			Baseline Length			Size
			Start	End	On Source	Min	Max	RMS	
Observing Unit Set St A001/X87d/Xb3d **Scheduling Block ID:** uid://A001/X87d/Xb2d									
Session: session_1									
uid___A002_Xbfcd9b_X70c.ms	ALMA Band 6	40	2017-04-30 00:27:21	2017-04-30 01:32:41	0:40:32	15.1 m	460.0 m	189.5 m	57.5 GB
uid___A002_Xbfcd9b_X70c_target.ms	ALMA Band 6	40	2017-04-30 00:41:17	2017-04-30 01:31:21	0:40:28	15.1 m	460.0 m	189.5 m	40.0 GB

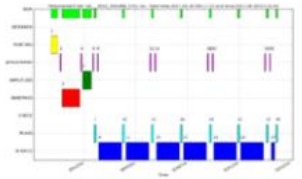
Session: session_1
uid___A002_Xbfcd9b_X70c.ms
uid___A002_Xbfcd9b_X70c_target.ms

Overview of 'uid___A002_Xbfcd9b_X70c.ms'

Observation Execution Time

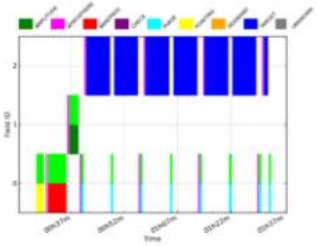
Start Time	2017-04-30 00:27:21
End Time	2017-04-30 01:32:41
Total Time on Source	0:56:56
Total Time on Science Target	0:40:32

LISTOBS OUTPUT



Intent vs Time

Track scan intent vs time



Field vs Time

Track observed field vs time

Spatial Setup

Science Targets	'TW_Hya'
Calibrators	'J1037-2934' and 'J1107-4449'

Spectral Setup

All Bands	'ALMA Band 6' and 'WVR'
Science Bands	'ALMA Band 6'

Antenna Setup

Min Baseline	15.1 m
Max Baseline	460.0 m
Number of Baselines	780
Number of Antennas	40

Sky Setup

Min Elevation	67.28 degrees
Max Elevation	83.36 degrees

```
##########################################
##### Begin Task: listobs                #####
listobs( vis='calibrated_final.ms', selectdata=True, spw='', field='', antenna='', uvrange='', timerange='', correlation='', scan='', intent='', feed='', arr
================================================================================
           MeasurementSet Name:  /scratch/alma/shlee/alma_summer/TW_Hya/2016.1.00229.S/science_goal.uid___A001_X87d_Xb3b/group.uid___A001_X87d_Xb3c/member.
================================================================================
   Observer: ebergin     Project: uid://A001/X5ac/Xba
Observation: ALMA
Computing scan and subscan properties...
Data records: 1640000       Total elapsed time = 3065.14 seconds
   Observed from   30-Apr-2017/00:41:17.1   to   30-Apr-2017/01:32:22.3 (UTC)

   ObservationID = 0         ArrayID = 0
  Date        Timerange (UTC)          Scan  FldId FieldName             nRows     SpwIds   Average Interval(s)     ScanIntent
  30-Apr-2017/00:41:17.1 - 00:47:51.8     9      2 TW_Hya                266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
               00:49:09.4 - 00:55:44.0    11      2 TW_Hya                266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
               00:58:02.6 - 01:04:37.3    15      2 TW_Hya                266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
               01:05:53.4 - 01:12:28.1    17      2 TW_Hya                266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
               01:14:41.0 - 01:21:15.6    21      2 TW_Hya                266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
               01:22:31.5 - 01:29:06.2    23      2 TW_Hya                266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
               01:31:21.8 - 01:32:22.3    27      2 TW_Hya                 41000  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
           (nRows = Total number of rows per scan)
Fields: 1
  ID   Code Name                RA               Decl           Epoch   SrcId      nRows
  2    none TW_Hya              11:01:51.812563 -34.42.17.27561 ICRS    2         1640000
Spectral Windows:  (5 unique spectral windows and 1 unique polarization setups)
  SpwID  Name                                           #Chans   Frame   Ch0(MHz)  ChanWid(kHz)  TotBW(kHz) CtrFreq(MHz) BBC Num  Corrs
  0      X2074619945#ALMA_RB_06#BB_2#SW-01#FULL_RES      128   TOPO  219075.479    -15625.000   2000000.0 218083.2912        2  XX  YY
  1      X2074619945#ALMA_RB_06#BB_4#SW-01#FULL_RES      128   TOPO  233286.533     15625.000   2000000.0 234278.7202        4  XX  YY
  2      X2074619945#ALMA_RB_06#BB_1#SW-01#FULL_RES     1920   TOPO  220437.264       -61.035    117187.5 220378.7008        1  XX  YY
  3      X2074619945#ALMA_RB_06#BB_1#SW-02#FULL_RES     1920   TOPO  219598.946       -61.035    117187.5 219540.3830        1  XX  YY
  4      X2074619945#ALMA_RB_06#BB_3#SW-01#FULL_RES     3840   TOPO  231082.493        61.035    234375.0 231199.6500        3  XX  YY
Sources: 15
  ID   Name                SpwId RestFreq(MHz)  SysVel(km/s)
  0    J1037-2934          0     218103.1       0
  0    J1037-2934          1     234300         0
  0    J1037-2934          2     220398.6842    0
  0    J1037-2934          3     219560.358     0
  0    J1037-2934          4     231220.686     0
  1    J1107-4449          2     220398.6842    0
  1    J1107-4449          3     219560.358     0
  1    J1107-4449          0     218103.1       0
  1    J1107-4449          4     231220.686     0
  1    J1107-4449          1     234300         0
  2    TW_Hya              2     220398.6842    13.4
  2    TW_Hya              3     219560.358     13.4
  2    TW_Hya              0     218103.1       13.4
  2    TW_Hya              4     231220.686     13.4
  2    TW_Hya              1     234300         13.4
Antennas: 40:
  ID   Name  Station   Diam.    Long.         Lat.                Offset from array center (m)                ITRF Geocentric coordinates (m)
```

Listobs in casalogger

Check the field ID and Spw ID

```
================================================================================
          MeasurementSet Name:  /scratch/alma/shlee/alma_summer/TW_Hya/2016.1.00229.S/science_goal.uid___A001_X87d_Xb3b/group.uid___A001_X87d_Xb3c/member.uid___A001_X87d_Xb3d/calibrated/calibrated.ms      MS Version 2
================================================================================
   Observer: ebergin     Project: uid://A001/X5ac/Xba
Observation: ALMA
Data records: 2455900       Total elapsed time = 3791.95 seconds
   Observed from   30-Apr-2017/00:30:00.9   to   30-Apr-2017/01:33:12.8 (UTC)

   ObservationID = 0         ArrayID = 0
  Date        Timerange (UTC)          Scan  FldId FieldName             nRows     SpwIds   Average Interval(s)    ScanIntent
  30-Apr-2017/00:30:00.9 - 00:30:17.0     2      0 J1037-2934              34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              00:30:37.3 - 00:35:39.7     3      0 J1037-2934             205000  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_BANDPASS#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
              00:36:04.2 - 00:36:20.3     4      1 J1107-4449              34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              00:36:36.3 - 00:39:07.5     5      1 J1107-4449             102500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_FLUX#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
              00:39:30.9 - 00:39:47.0     6      0 J1037-2934              34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              00:39:57.4 - 00:40:27.6     7      0 J1037-2934              20500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
              00:40:49.7 - 00:41:05.8     8      2 TW_Hya                  34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              00:41:17.1 - 00:47:51.8     9      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              00:48:13.7 - 00:48:43.9    10      0 J1037-2934              20500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
              00:49:09.4 - 00:55:44.0    11      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              00:56:06.1 - 00:56:22.3    12      0 J1037-2934              34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              00:56:37.1 - 00:57:07.3    13      0 J1037-2934              20500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
              00:57:32.3 - 00:57:48.4    14      2 TW_Hya                  34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              00:58:02.6 - 01:04:37.3    15      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              01:04:59.6 - 01:05:29.8    16      0 J1037-2934              20500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
              01:05:53.4 - 01:12:28.1    17      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              01:12:50.1 - 01:13:06.2    18      0 J1037-2934              34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              01:13:21.1 - 01:13:51.3    19      0 J1037-2934              20500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
              01:14:14.7 - 01:14:30.8    20      2 TW_Hya                  34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              01:14:41.0 - 01:21:15.6    21      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              01:21:37.1 - 01:22:07.3    22      0 J1037-2934              20500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
              01:22:31.5 - 01:29:06.2    23      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              01:29:27.3 - 01:29:43.4    24      0 J1037-2934              34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              01:29:57.7 - 01:30:27.9    25      0 J1037-2934              20500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
              01:30:51.2 - 01:31:07.3    26      2 TW_Hya                  34440  [0,1]  [0.576, 0.576] [CALIBRATE_ATMOSPHERE#AMBIENT,CALIBRATE_ATMOSPHERE#HOT,CALIBRATE_ATMOSPHERE#OFF_SOURCE,CALIBRATE_WVR#AMBIENT,CALIBRATE_WVR#HOT,CALIBRATE_WVR#OFF_SOURCE]
              01:31:21.8 - 01:32:22.3    27      2 TW_Hya                  41000  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              01:32:42.6 - 01:33:12.8    28      0 J1037-2934              20500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [CALIBRATE_PHASE#ON_SOURCE,CALIBRATE_WVR#ON_SOURCE]
          (nRows = Total number of rows per scan)
Fields: 3
  ID   Code Name                RA               Decl           Epoch   SrcId      nRows
  0    none J1037-2934          10:37:16.080000 -29.34.02.81300 ICRS    0         541200
  1    none J1107-4449          11:07:08.694000 -44.49.07.61800 ICRS    1         136940
  2    none TW_Hya              11:01:51.812563 -34.42.17.27561 ICRS    2        1777760
Spectral Windows:  (5 unique spectral windows and 1 unique polarization setups)
  SpwID  Name                                  #Chans   Frame   Ch0(MHz)  ChanWid(kHz)  TotBW(kHz) CtrFreq(MHz) BBC Num  Corrs
  0      X2074619945#ALMA_RB_06#BB_2#SW-01#FULL_RES    128   TOPO  219075.479    -15625.000   2000000.0 218083.2912        2  XX  YY
  1      X2074619945#ALMA_RB_06#BB_4#SW-01#FULL_RES    128   TOPO  233286.533     15625.000   2000000.0 234278.7202        4  XX  YY
  2      X2074619945#ALMA_RB_06#BB_1#SW-01#FULL_RES   1920   TOPO  220437.264       -61.035    117187.5 220378.7008        1  XX  YY
  3      X2074619945#ALMA_RB_06#BB_1#SW-02#FULL_RES   1920   TOPO  219598.946       -61.035    117187.5 219540.3830        1  XX  YY
  4      X2074619945#ALMA_RB_06#BB_3#SW-01#FULL_RES   3840   TOPO  231082.493        61.035    234375.0 231199.6500        3  XX  YY
Sources: 15
  ID   Name               SpwId RestFreq(MHz)  SysVel(km/s)
  0    J1037-2934         0     218103.1       0
  0    J1037-2934         1     234300         0
  0    J1037-2934         2     220398.6842    0
  0    J1037-2934         3     219560.358     0
  0    J1037-2934         4     231220.686     0
  1    J1107-4449         2     220398.6842    0
  1    J1107-4449         3     219560.358     0
  1    J1107-4449         0     218103.1       0
  1    J1107-4449         4     231220.686     0
  1    J1107-4449         1     234300         0
  2    TW_Hya             2     220398.6842    13.4
  2    TW_Hya             3     219560.358     13.4
  2    TW_Hya             0     218103.1       13.4
  2    TW_Hya             4     231220.686     13.4
  2    TW_Hya             1     234300         13.4
Antennas: 40:
```

```
================================================================================
           MeasurementSet Name:  /scratch/alma/shlee/alma_summer/TW_Hya/2016.1.00229.S/science_goal.uid___A001_X87d_Xb3b/group.uid___A001_X87d_Xb3c/member.uid___A001_X87d_Xb3d/calibrated/calibrated_final.ms      MS Version 2
================================================================================
   Observer: ebergin     Project: uid://A001/X5ac/Xba
Observation: ALMA
Data records: 1640000       Total elapsed time = 3065.14 seconds
   Observed from   30-Apr-2017/00:41:17.1   to   30-Apr-2017/01:32:22.3 (UTC)

   ObservationID = 0         ArrayID = 0
  Date        Timerange (UTC)          Scan  FldId FieldName             nRows     SpwIds   Average Interval(s)    ScanIntent
  30-Apr-2017/00:41:17.1 - 00:47:51.8     9      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              00:49:09.4 - 00:55:44.0    11      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              00:58:02.6 - 01:04:37.3    15      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              01:05:53.4 - 01:12:28.1    17      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              01:14:41.0 - 01:21:15.6    21      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              01:22:31.5 - 01:29:06.2    23      2 TW_Hya                 266500  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
              01:31:21.8 - 01:32:22.3    27      2 TW_Hya                  41000  [0,1,2,3,4]  [6.05, 6.05, 6.05, 6.05, 6.05] [OBSERVE_TARGET#ON_SOURCE]
          (nRows = Total number of rows per scan)
Fields: 1
  ID   Code Name                RA               Decl           Epoch   SrcId      nRows
  2    none TW_Hya              11:01:51.812563 -34.42.17.27561 ICRS    2        1640000
Spectral Windows:  (5 unique spectral windows and 1 unique polarization setups)
  SpwID  Name                                  #Chans   Frame   Ch0(MHz)  ChanWid(kHz)  TotBW(kHz) CtrFreq(MHz) BBC Num  Corrs
  0      X2074619945#ALMA_RB_06#BB_2#SW-01#FULL_RES    128   TOPO  219075.479    -15625.000   2000000.0 218083.2912        2  XX  YY
  1      X2074619945#ALMA_RB_06#BB_4#SW-01#FULL_RES    128   TOPO  233286.533     15625.000   2000000.0 234278.7202        4  XX  YY
  2      X2074619945#ALMA_RB_06#BB_1#SW-01#FULL_RES   1920   TOPO  220437.264       -61.035    117187.5 220378.7008        1  XX  YY
  3      X2074619945#ALMA_RB_06#BB_1#SW-02#FULL_RES   1920   TOPO  219598.946       -61.035    117187.5 219540.3830        1  XX  YY
  4      X2074619945#ALMA_RB_06#BB_3#SW-01#FULL_RES   3840   TOPO  231082.493        61.035    234375.0 231199.6500        3  XX  YY
Sources: 15
  ID   Name                SpwId RestFreq(MHz)  SysVel(km/s)
  0    J1037-2934          0     218103.1       0
  0    J1037-2934          1     234300         0
  0    J1037-2934          2     220398.6842    0
  0    J1037-2934          3     219560.358     0
  0    J1037-2934          4     231220.686     0
  1    J1107-4449          2     220398.6842    0
  1    J1107-4449          3     219560.358     0
  1    J1107-4449          0     218103.1       0
  1    J1107-4449          4     231220.686     0
  1    J1107-4449          1     234300         0
  2    TW_Hya              2     220398.6842    13.4
  2    TW_Hya              3     219560.358     13.4
  2    TW_Hya              0     218103.1       13.4
  2    TW_Hya              4     231220.686     13.4
  2    TW_Hya              1     234300         13.4
Antennas: 40:
  ID   Name  Station   Diam.    Long.         Lat.               Offset from array center (m)              ITRF Geocentric coordinates (m)
                                                                    East         North     Elevation               x              y              z
  0    DA41  A004      12.0 m   -067.45.15.9  -22.53.28.0        52.6608     -704.4170      21.7721  2225094.796411 -5440052.421403 -2481687.277071
  1    DA42  A064      12.0 m   -067.45.14.7  -22.53.31.4        85.6572     -808.0277      21.5201  2225109.989466 -5440002.411752 -2481782.629929
  2    DA43  A005      12.0 m   -067.45.14.8  -22.53.28.7        83.3310     -725.0764      21.7245  2225120.123607 -5440033.332230 -2481706.291028
  3    DA46  A034      12.0 m   -067.45.18.4  -22.53.27.8       -18.8313     -698.8163      22.1778  2225029.594375 -5440081.847514 -2481682.275280
```

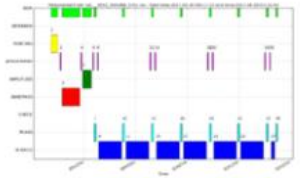
Session: session_1
uid___A002_Xbfcd9b_X70c.ms
uid___A002_Xbfcd9b_X70c_target.ms

Overview of 'uid___A002_Xbfcd9b_X70c.ms'

Observation Execution Time

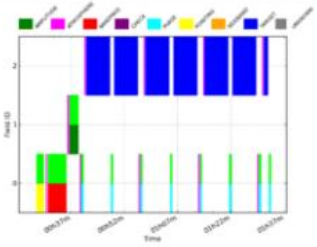
Start Time	2017-04-30 00:27:21
End Time	2017-04-30 01:32:41
Total Time on Source	0:56:56
Total Time on Science Target	0:40:32

LISTOBS OUTPUT



Intent vs Time

Track scan intent vs time



Field vs Time

Track observed field vs time

Spatial Setup

Science Targets	'TW_Hya'
Calibrators	'J1037-2934' and 'J1107-4449'

Spectral Setup

All Bands	'ALMA Band 6' and 'WVR'
Science Bands	'ALMA Band 6'

Antenna Setup

Min Baseline	15.1 m
Max Baseline	460.0 m
Number of Baselines	780
Number of Antennas	40

Sky Setup

Min Elevation	67.28 degrees
Max Elevation	83.36 degrees

All Windows

	Frequency (TOPO)				Channels (TOPO)					
ID	Start	Centre	End	Bandwidth (TOPO)	Number	Frequency Width	Velocity Width	Correlator Axis	Band	Intents
0	220.538 GHz	221.538 GHz	222.538 GHz	2.000 GHz	1	2.000 GHz	2706.465 km/s	XX, YY	ALMA Band 6	POINTING, WVR
1	222.538 GHz	223.538 GHz	224.538 GHz	2.000 GHz	1	2.000 GHz	2682.251 km/s	XX, YY	ALMA Band 6	POINTING, WVR
2	236.538 GHz	237.538 GHz	238.538 GHz	2.000 GHz	1	2.000 GHz	2524.164 km/s	XX, YY	ALMA Band 6	POINTING, WVR
3	238.538 GHz	239.538 GHz	240.538 GHz	2.000 GHz	1	2.000 GHz	2503.089 km/s	XX, YY	ALMA Band 6	POINTING
4	183.800 GHz	187.550 GHz	191.300 GHz	7.500 GHz	4	1.500 GHz	2397.700 km/s	XX	WVR	ASE, POINTING, TARGET, WVR
5	220.538 GHz	221.538 GHz	222.538 GHz	2.000 GHz	128	15.625 MHz	21.144 km/s	XX, YY		
6	220.624 GHz	221.515 GHz	222.405 GHz	1.781 GHz	1	1.781 GHz	2410.701 km/s	XX, YY		NG, WVR
7	222.538 GHz	223.538 GHz	224.538 GHz	2.000 GHz	128	15.625 MHz	20.955 km/s			POINTING, WVR
8	222.624 GHz	223.515 GHz	224.405 GHz	1.781 GHz	1	1.781 GHz			ALMA Band 6	POINTING, WVR
9	236.538 GHz	237.538 GHz	238.538 GHz	2.000 GHz	128	15.625 MHz			ALMA Band 6	POINTING, WVR
10	236.624 GHz	237.515 GHz	238.405 GHz	1.781 GHz	1			XX, YY	ALMA Band 6	POINTING, WVR
11	238.538 GHz	239.538 GHz	240.538 GHz	2.000 GHz			19.555 km/s	XX, YY	ALMA Band 6	POINTING, WVR
12	238.624 GHz	239.515 GHz	240.405 GHz	1.781 GHz			2229.532 km/s	XX, YY	ALMA Band 6	POINTING, WVR
13	218.960 GHz	219.960 GHz	220.960 GHz	2.000 GHz		2.000 GHz	2725.887 km/s	XX, YY	ALMA Band 6	AMPLITUDE, ATMOSPHERE, BANDPASS, PHASE, TARGET, WVR
14	217.083 GHz	218.083 GHz	219.083 GHz	2.000 GHz	1	2.000 GHz	2749.339 km/s	XX, YY	ALMA Band 6	AMPLITUDE, ATMOSPHERE, BANDPASS, PHASE, TARGET, WVR
15	230.959 GHz	231.959 GHz	232.959 GHz	2.000 GHz	1	2.000 GHz	2584.875 km/s	XX, YY	ALMA Band 6	AMPLITUDE, ATMOSPHERE, BANDPASS, PHASE, TARGET, WVR
16	233.279 GHz	234.279 GHz	235.279 GHz	2.000 GHz	1	2.000 GHz	2559.280 km/s	XX, YY	ALMA Band 6	AMPLITUDE, ATMOSPHERE, BANDPASS, PHASE, TARGET, WVR
17	218.960 GHz	219.960 GHz	220.960 GHz	2.000 GHz	128	15.625 MHz	21.296 km/s	XX, YY	ALMA Band 6	ATMOSPHERE
18	219.014 GHz	219.952 GHz	220.889 GHz	1.875 GHz	1	1.875 GHz	2555.610 km/s	XX, YY	ALMA Band 6	ATMOSPHERE
19	217.083 GHz	218.083 GHz	219.083 GHz	2.000 GHz	128	15.625 MHz	21.479 km/s	XX, YY	ALMA Band 6	AMPLITUDE, ATMOSPHERE, BANDPASS, PHASE, TARGET, WVR
20	217.169 GHz	218.068 GHz	218.966 GHz	1.797 GHz	1	1.797 GHz	2470.286 km/s	XX, YY	ALMA Band 6	AMPLITUDE, ATMOSPHERE, BANDPASS, PHASE, TARGET, WVR
21	230.959 GHz	231.959 GHz	232.959 GHz	2.000 GHz	128	15.625 MHz	20.194 km/s	XX, YY	ALMA Band 6	ATMOSPHERE
22	231.014 GHz	231.951 GHz	232.889 GHz	1.875 GHz	1	1.875 GHz	2423.402 km/s	XX, YY	ALMA Band 6	ATMOSPHERE
23	233.279 GHz	234.279 GHz	235.279 GHz	2.000 GHz	128	15.625 MHz	19.994 km/s	XX, YY	ALMA Band 6	AMPLITUDE, ATMOSPHERE, BANDPASS, PHASE, TARGET, WVR
24	233.365 GHz	234.263 GHz	235.162 GHz	1.797 GHz	1	1.797 GHz	2299.507 km/s	XX, YY	ALMA Band 6	AMPLITUDE, ATMOSPHERE, BANDPASS, PHASE, TARGET, WVR
25	220.320 GHz	220.379 GHz	220.437 GHz	117.188 MHz	1920	61.035 kHz	83.029 m/s	XX, YY	ALMA Band 6	AMPLITUDE, BANDPASS, PHASE, TARGET, WVR
26	220.320 GHz	220.379 GHz	220.437 GHz	117.188 MHz	1	117.188 MHz	159.416 km/s	XX, YY	ALMA Band 6	AMPLITUDE, BANDPASS, PHASE, TARGET, WVR
27	219.482 GHz	219.540 GHz	219.599 GHz	117.188 MHz	1920	61.035 kHz	83.346 m/s	XX, YY	ALMA Band 6	AMPLITUDE, BANDPASS, PHASE, TARGET, WVR
28	219.482 GHz	219.540 GHz	219.599 GHz	117.188 MHz	1	117.188 MHz	160.025 km/s	XX, YY	ALMA Band 6	AMPLITUDE, BANDPASS, PHASE, TARGET, WVR
29	231.082 GHz	231.200 GHz	231.317 GHz	234.375 MHz	3840	61.035 kHz	79.143 m/s	XX, YY	ALMA Band 6	AMPLITUDE, BANDPASS, PHASE, TARGET, WVR
30	231.082 GHz	231.200 GHz	231.317 GHz	234.375 MHz	1	234.375 MHz	303.910 km/s	XX, YY	ALMA Band 6	AMPLITUDE, BANDPASS, PHASE, TARGET, WVR

All Spectral Windows in uid___A002_Xbfcd9b_X70c.ms

Spectral Setup Details

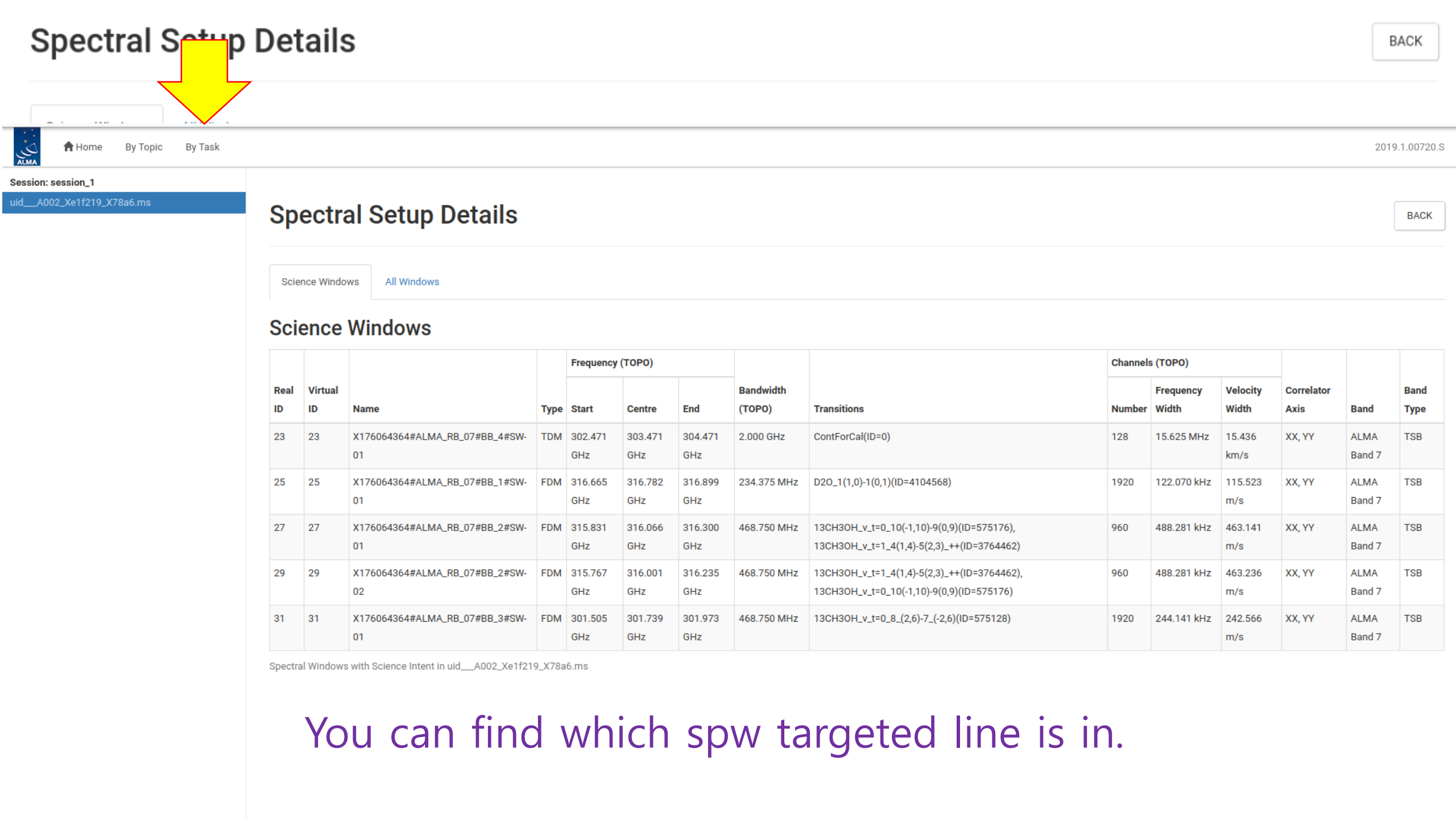
BACK

Science Windows | All Windows

Science Windows

ID	Frequency (TOPO)			Bandwidth (TOPO)	Channels (TOPO)			Correlator Axis	Band
	Start	Centre	End		Number	Frequency Width	Velocity Width		
19	217.083 GHz	218.083 GHz	219.083 GHz	2.000 GHz	128	15.625 MHz	21.479 km/s	XX, YY	ALMA Band 6
23	233.279 GHz	234.279 GHz	235.279 GHz	2.000 GHz	128	15.625 MHz	19.994 km/s	XX, YY	ALMA Band 6
25	220.320 GHz	220.379 GHz	220.437 GHz	117.188 MHz	1920	61.035 kHz	83.029 m/s	XX, YY	ALMA Band 6
27	219.482 GHz	219.540 GHz	219.599 GHz	117.188 MHz	1920	61.035 kHz	83.346 m/s	XX, YY	ALMA Band 6
29	231.082 GHz	231.200 GHz	231.317 GHz	234.375 MHz	3840	61.035 kHz	79.143 m/s	XX, YY	ALMA Band 6

Spectral Windows with Science Intent in uid___A002_Xbfcd9b_X70c.ms


Spectral Setup Details
BACK
Home
By Topic
By Task
2019.1.00720.S
Session: session_1
uid___A002_Xe1f219_X78a6.ms
Spectral Setup Details
BACK
Science Windows
All Windows
Science Windows
Real ID
Virtual ID
Name
Type
Frequency (TOPO)
Start
Centre
End
Bandwidth (TOPO)
Transitions
Channels (TOPO)
Number
Frequency Width
Velocity Width
Correlator Axis
Band
Band Type
23 23 X176064364#ALMA_RB_07#BB_4#SW-01 TDM 302.471 GHz 303.471 GHz 304.471 GHz 2.000 GHz ContForCal(ID=0) 128 15.625 MHz 15.436 km/s XX, YY ALMA Band 7 TSB
25 25 X176064364#ALMA_RB_07#BB_1#SW-01 FDM 316.665 GHz 316.782 GHz 316.899 GHz 234.375 MHz D2O_1(1,0)-1(0,1)(ID=4104568) 1920 122.070 kHz 115.523 m/s XX, YY ALMA Band 7 TSB
27 27 X176064364#ALMA_RB_07#BB_2#SW-01 FDM 315.831 GHz 316.066 GHz 316.300 GHz 468.750 MHz 13CH3OH_v_t=0_10(-1,10)-9(0,9)(ID=575176), 13CH3OH_v_t=1_4(1,4)-5(2,3)_++(ID=3764462) 960 488.281 kHz 463.141 m/s XX, YY ALMA Band 7 TSB
29 29 X176064364#ALMA_RB_07#BB_2#SW-02 FDM 315.767 GHz 316.001 GHz 316.235 GHz 468.750 MHz 13CH3OH_v_t=1_4(1,4)-5(2,3)_++(ID=3764462), 13CH3OH_v_t=0_10(-1,10)-9(0,9)(ID=575176) 960 488.281 kHz 463.236 m/s XX, YY ALMA Band 7 TSB
31 31 X176064364#ALMA_RB_07#BB_3#SW-01 FDM 301.505 GHz 301.739 GHz 301.973 GHz 468.750 MHz 13CH3OH_v_t=0_8_(2,6)-7_(-2,6)(ID=575128) 1920 244.141 kHz 242.566 m/s XX, YY ALMA Band 7 TSB
Spectral Windows with Science Intent in uid___A002_Xe1f219_X78a6.ms
You can find which spw targeted line is in.

Task Summaries

Task	QA Score
1. **hifa_importdata**: Register measurement sets with the pipeline	1.00
2. **hifa_flagdata**: ALMA deterministic flagging	1.00
3. **hifa_fluxcalflag**: Flag spectral features in solar system flux calibrators	1.00
4. **hif_rawflagchans**: Flag channels in raw data	1.00
5. **hif_refant**: Select reference antennas	1.00
6. **hifa_tsyscal**: Calculate Tsys calibration	1.00
7. **hifa_tsysflag**: Flag Tsys calibration	0.99
8. **hifa_antpos**: Correct for antenna position offsets	0.90
9. **hifa_wvrgcalflag**: Calculate and flag WVR calibration	1.00
10. **hif_lowgainflag**: Flag antennas with low gain	1.00
11. **hif_gaincalflag**: Flag antennas with gain outliers	1.00
12. **hif_setjy**: Set calibrator model visibilities	1.00
13. **hifa_bandpass**: Phase-up bandpass calibration	1.00
14. **hifa_spwphaseup**: Spw phase offsets calibration	1.00
15. **hifa_gfluxscale**: Transfer fluxscale from amplitude calibrator	1.00
16. **hifa_timegaincal**: Gain calibration	1.00
17. **hif_applycal**: Apply calibrations from context	1.00
18. **hif_makeimlist**: Set-up image parameters for calibrator imaging	1.00
19. **hif_makeimages**: Make calibrator images	1.00
20. **hif_checkproductsize**: Check product size	1.00
21. **hif_exportdata**: Prepare pipeline data products for export	1.00
22. **hif_mstransform**: Create science target MS	1.00
23. **hifa_flagtargets**: ALMA Target flagging	1.00
24. **hif_makeimlist**: Set-up image parameters for target per-spw continuum imaging	1.00
25. **hif_findcont**: Detect continuum frequency ranges	1.00
26. **hif_uvcontfit**: UV continuum fitting	1.00
27. **hif_uvcontsub**: UV continuum subtraction	1.00
28. **hif_makeimages**: Make target per-spw continuum images	1.00
29. **hif_makeimlist**: Set-up image parameters for target aggregate continuum imaging	1.00
30. **hif_makeimages**: Make target aggregate continuum images	1.00
31. **hif_makeimlist**: Set-up image parameters for target cube imaging	1.00
32. **hif_makeimages**: Make target cubes	1.00

Calibration process

Imagig process

CASA logs and scripts

- View, view in new tab or download casa-20170503-212520.log (8.5 MB)
- View, view in new tab or download casa-20170504-123945.log (5.4 MB)
- View, view in new tab or download casa_commands.log (93.9 KB)
- View, view in new tab or download casa_pipescript.py (1.5 KB)
- View, view in new tab or download casa_piperestorescript.py (163 bytes)

Tasks in execution order

1. hifa_importdata
2. hifa_flagdata
3. hifa_fluxcalflag
4. hif_rawflagchans
5. hif_refant
6. hifa_tsyscal
7. hifa_tsysflag
8. hifa_antpos
9. hifa_wvrgcalflag
10. hif_lowgainflag
11. hif_gainflag
12. hif_setjy
13. hifa_bandpass
14. hifa_spwphaseup
15. hifa_gfluxscale
16. hifa_timegaincal
17. hif_applycal
18. hif_makeimlist
19. hif_makeimages
20. hif_checkproductsize
21. hif_exportdata
22. hif_mstransform
23. hifa_flagtargets
24. hif_makeimlist
25. hif_findcont
26. hif_uvcontfit
27. hif_uvcontsub
28. hif_makeimages
29. hif_makeimlist
30. hif_makeimages
31. hif_makeimlist
32. hif_makeimages

24. Make image list

Set-up image parameters for target per-spw continuum imaging

BACK

Cell and Image sizes used in tclean

List of Clean Targets

field	intent	spw	phasecenter	cell	imsize	imagename	specmode	start	width	nbin	nchan	uvrange
TW_Hya	TARGET	19	ICRS 11:01:51.8126 -034.42.17.276	['0.12arcsec']	[378, 378]	id___A001_X87d_Xb3d.sSTAGENUMBER.TW_Hya_sci.spw19.mfs	mfs			-1	-1	
TW_Hya	TARGET	23	ICRS 11:01:51.8126 -034.42.17.276	['0.12arcsec']	[378, 378]	id___A001_X87d_Xb3d.sSTAGENUMBER.TW_Hya_sci.spw23.mfs	mfs			-1	-1	
TW_Hya	TARGET	25	ICRS 11:01:51.8126 -034.42.17.276	['0.12arcsec']	[378, 378]	id___A001_X87d_Xb3d.sSTAGENUMBER.TW_Hya_sci.spw25.mfs	mfs			-1	-1	
TW_Hya	TARGET	27	ICRS 11:01:51.8126 -034.42.17.276	['0.12arcsec']	[378, 378]	id___A001_X87d_Xb3d.sSTAGENUMBER.TW_Hya_sci.spw27.mfs	mfs			-1	-1	
TW_Hya	TARGET	29	ICRS 11:01:51.8126 -034.42.17.276	['0.12arcsec']	[378, 378]	id___A001_X87d_Xb3d.sSTAGENUMBER.TW_Hya_sci.spw29.mfs	mfs			-1	-1	

Clean Targets Summary

Pipeline QA

Input Parameters

Tasks Execution Statistics

CASA logs for stage 24

- View or download stage24/casapy.log (10.5 KB)

Representative Target: B335

Representative Frequency: 316.7910 GHz (SPW 25)

Bandwidth for Sensitivity: 1.057 MHz (rounded to nearest integer #channels (9), repBW = 1.099 MHz)

Min / Max Acceptable Resolution: 0.300 arcsec / 0.500 arcsec

Maximum expected beam axial ratio (from OT): 1.5

Goal PI sensitivity: 2.50 mJy

Single Continuum: False

Beam sized and theorical rms level according to robust parameter.

Estimated Synthesized Beam and Sensitivities for the Representative Target/Frequency

Estimates are given for four possible values of the tclean robust weighting parameter: robust = 0.0, +0.5 (default), +1.0, and +2.0. **If the "Min / Max Acceptable Resolution" is available (>=Cycle 5 12-m Array data)**, the robust value closest to the default (+0.5) that predicts a beam area (defined as simply major x minor) that is in the range of the PI requested beam areas according to the table row for repBW (Bandwidth for Sensitivity) is chosen. If none of these robust values predict a beam area that is in range, robust=+2.0 is chosen if the predicted beam area is too small, and robust=0.0 is chosen if the predicted beam area is too large. The chosen robust value is highlighted in green and used for all science target imaging. In addition to an estimate for the repBW, an estimate for the aggregate continuum bandwidth (aggBW) is also given assuming NO line contamination but accounting for spw frequency overlap. If the Bandwidth for Sensitivity (repBW) is > the bandwidth of the spw containing the representative frequency (repSPW), then the beam is predicted using all spws, otherwise the beam is predicted for the repSPW alone. A message appears on the "By Task" view if a non-default value of robust (i.e., not +0.5) is chosen. Additionally, if the predicted beam is not within the PI requested range using one of the four robust values, Warning messages appear on this page.

These estimates should always be considered as the BEST CASE SCENARIO. These estimates account for Tsys, the observed uv-coverage, and prior flagging. The estimates DO NOT account for (1) subsequent science target flagging; (2) loss of continuum bandwidth due to the hif_findcont process (i.e. removal of lines and other spectral features from the data used to image the continuum); (3) Issues that affect the image quality like (a) poor match of uv-coverage to image complexity; (b) dynamic range effects; (c) calibration deficiencies (poor phase transfer, residual baseline based effects, residual antenna position errors, etc.). *It is also important to note that both the repBW and aggBW beam calculations are intrinsically multi-frequency synthesis continuum calculations, using the relevant spws as described above. The synthesized beam for a single channel in a cube will typically be larger and can be significantly larger depending on the details of uv-coverage and channel width.*

robust	uvtaper	Synthesized Beam	Cell	Beam Ratio	Bandwidth	BW Mode	Effective Sensitivity
0.0	[]	0.356 x 0.312 arcsec @ -49.8 deg	0.062 x 0.062 arcsec	1.14	1.099 MHz	repBW	0.0021 Jy/beam
0.0	[]	0.346 x 0.312 arcsec @ -58.2 deg	0.062 x 0.062 arcsec	1.14	3237 MHz	aggBW	3.67e-05 Jy/beam
0.5	[]	0.372 x 0.343 arcsec @ -51.3 deg	0.069 x 0.069 arcsec	1.08	1.099 MHz	repBW	0.00173 Jy/beam
0.5	[]	0.374 x 0.353 arcsec @ -53.7 deg	0.071 x 0.071 arcsec	1.08	3237 MHz	aggBW	2.93e-05 Jy/beam
1.0	[]	0.407 x 0.393 arcsec @ -8.71 deg	0.079 x 0.079 arcsec	1.04	1.099 MHz	repBW	0.00159 Jy/beam
1.0	[]	0.419 x 0.405 arcsec @ -3.74 deg	0.081 x 0.081 arcsec	1.04	3237 MHz	aggBW	2.68e-05 Jy/beam
2.0	[]	0.432 x 0.408 arcsec @ 4.19 deg	0.082 x 0.082 arcsec	1.06	1.099 MHz	repBW	0.00158 Jy/beam
2.0	[]	0.447 x 0.425 arcsec @ 12.2 deg	0.085 x 0.085 arcsec	1.06	3237 MHz	aggBW	2.65e-05 Jy/beam

Tasks in execution order

1. hifa_importdata
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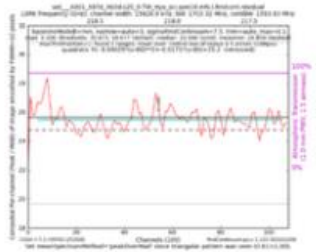
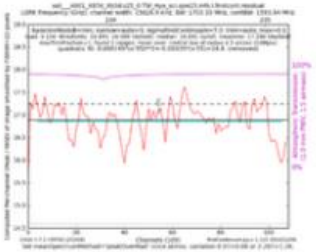
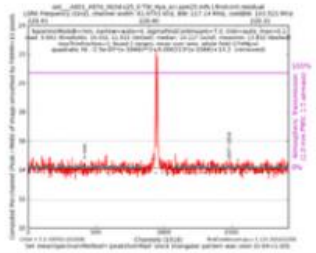
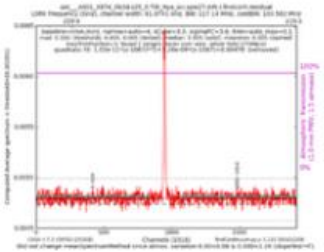
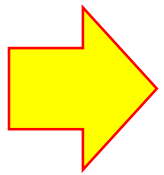
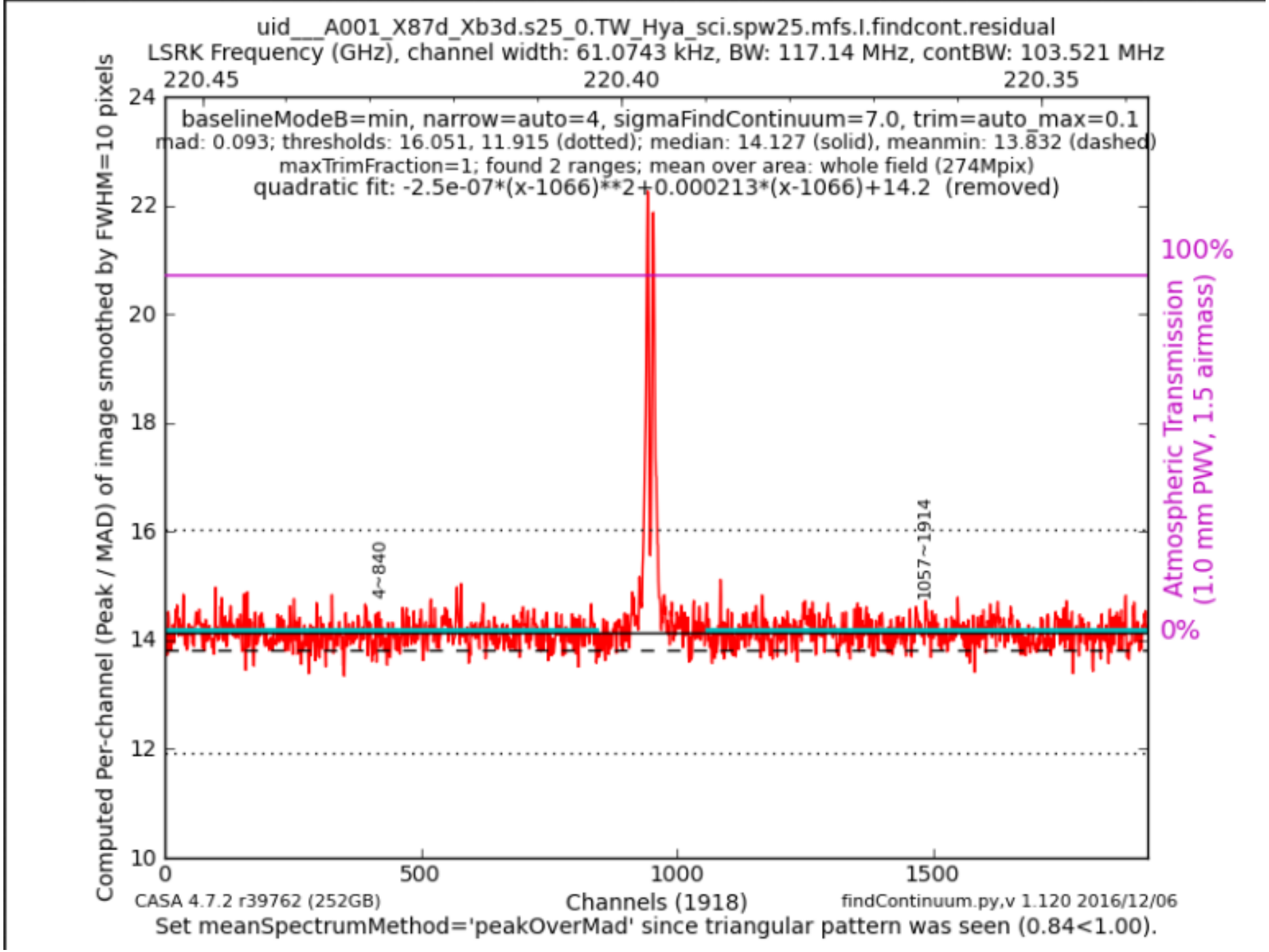
7. hifa_tsysflag
8. hifa_antpos
9. hifa_wvrgcalflag
10. hif_lowgainflag
11. hif_gainflag
12. hif_setjy
13. hifa_bandpass
14. hifa_spwphaseup
15. hifa_gfluxscale
16. hifa_timegaincal
17. hif_applycal
18. hif_makeimlist
19. hif_makeimages
20. hif_checkproductsize
21. hif_exportdata
22. hif_mstransform
23. hifa_flagtargets
24. hif_makeimlist
25. hif_findcont
26. hif_uvcontfit
27. hif_uvcontsub
28. hif_makeimages
29. hif_makeimlist
30. hif_makeimages
31. hif_makeimlist

		Continuum Frequency Range				
Field	Spw	Start	End	Frame	Status	Average spectrum
TW_Hya	19	217.28772 GHz	218.88165 GHz	LSRK	NEW	
	23	233.51566 GHz	235.10960 GHz			
	25	220.33751 GHz	220.38992 GHz			
		220.40311 GHz	220.45423 GHz			
	27	219.49913 GHz	219.55166 GHz			
		219.56479 GHz	219.61584 GHz			

Line channel
For uvcontsub

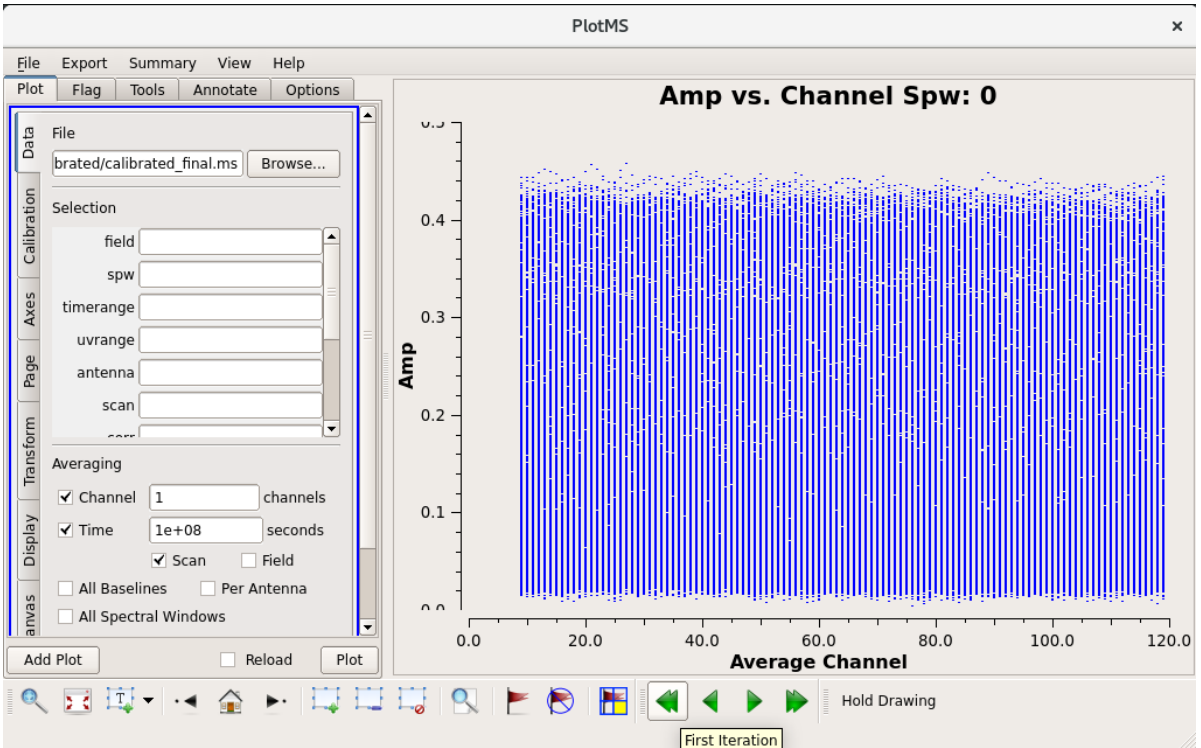


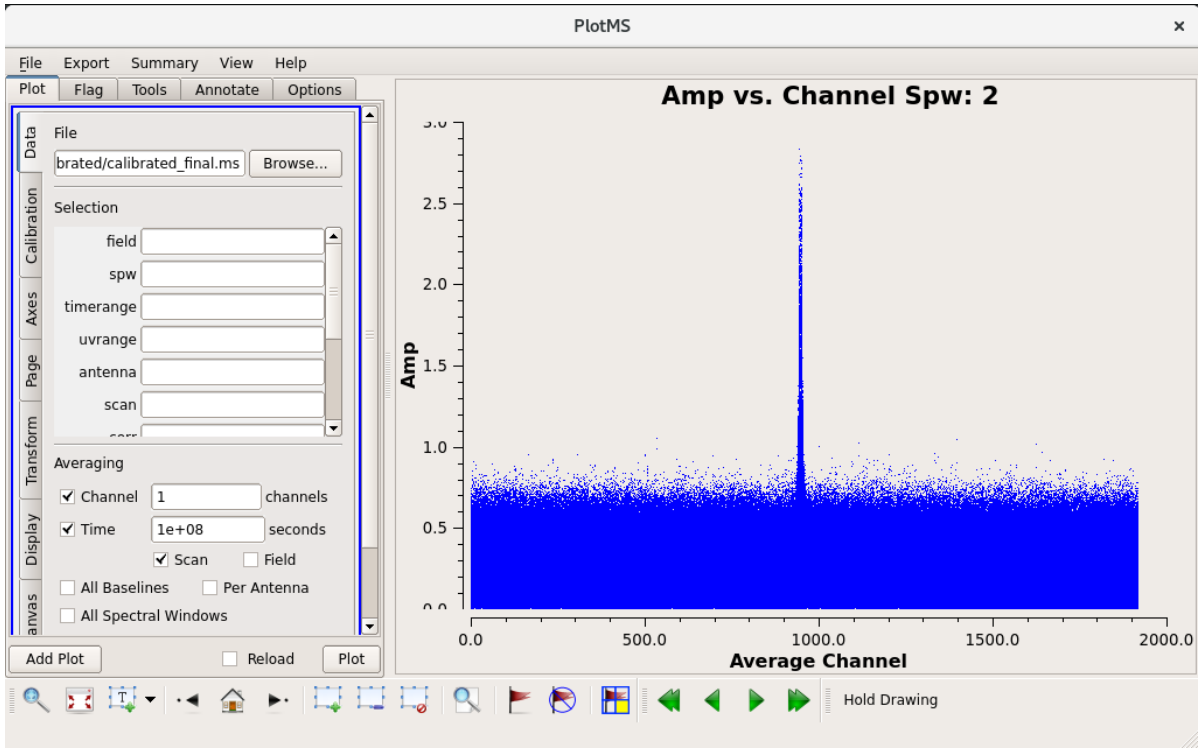
Line channels
for uvcontsub

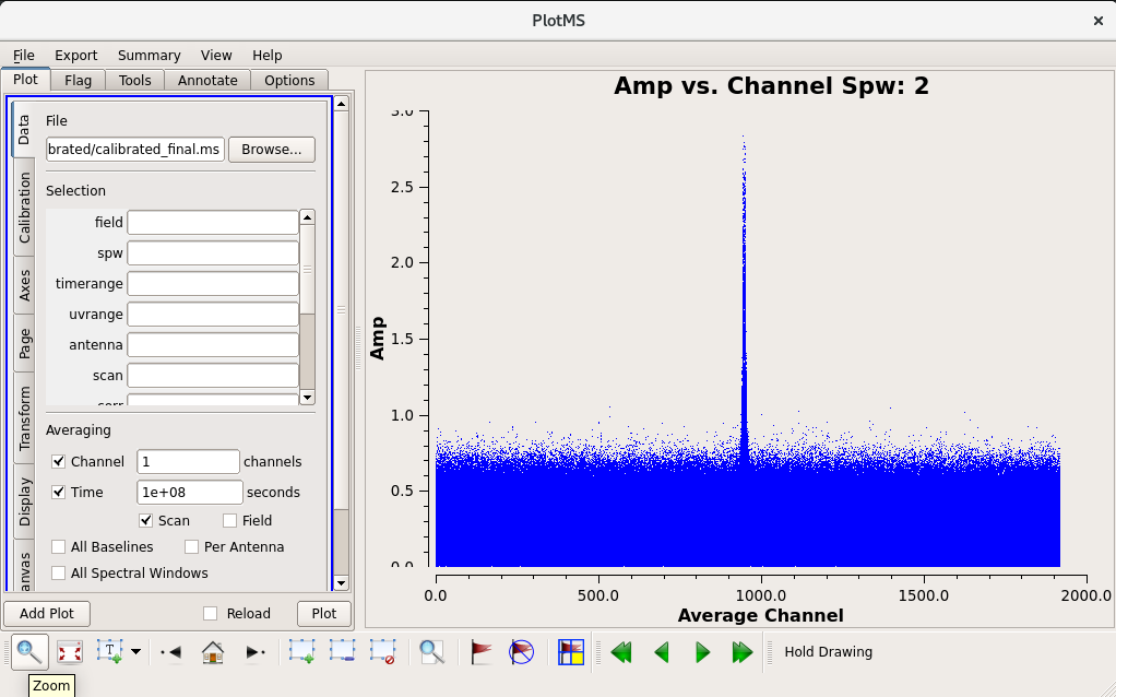


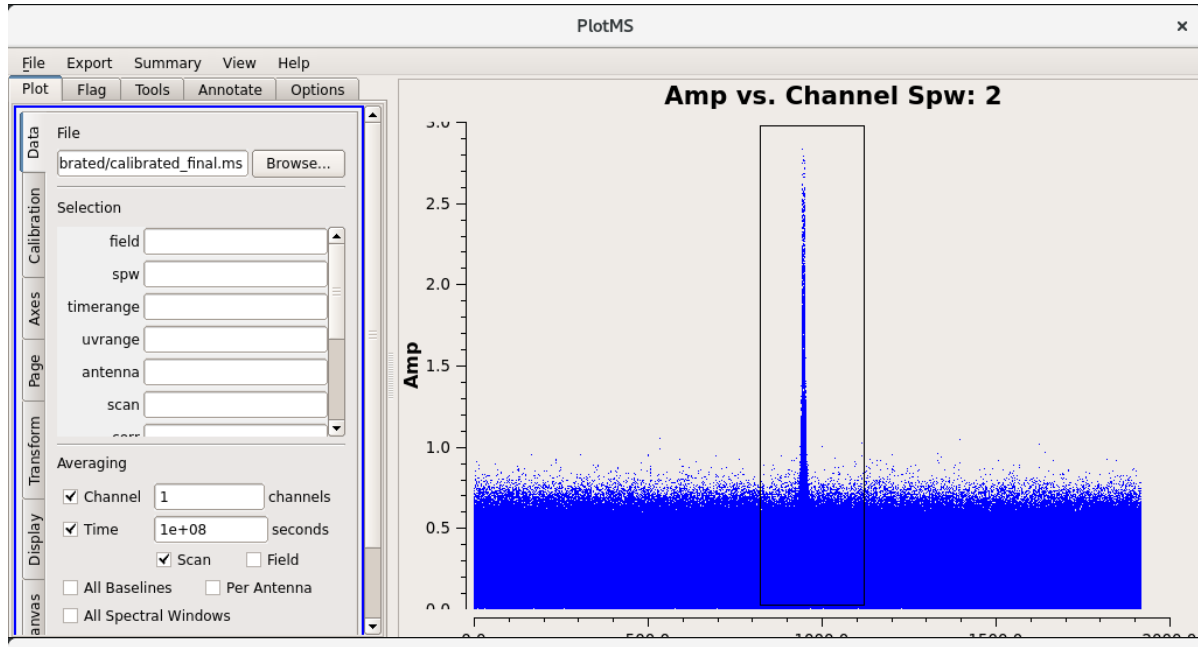
```
plotms(vis=finalvis, xaxis='channel', yaxis='amplitude',
       ydatacolumn='data',
       avgtime='1e8', avgscan=True, avgchannel='1',
       iteraxis='spw' )
```

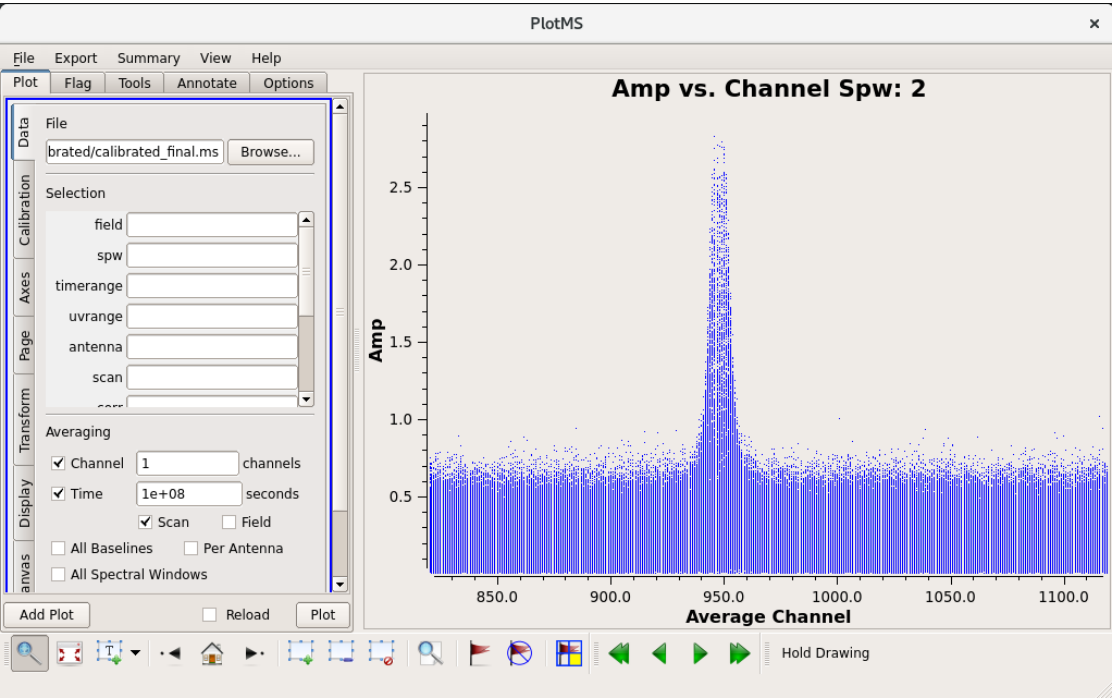
SPWs of 19,23,25,27 are renamed with 0,1,2,3

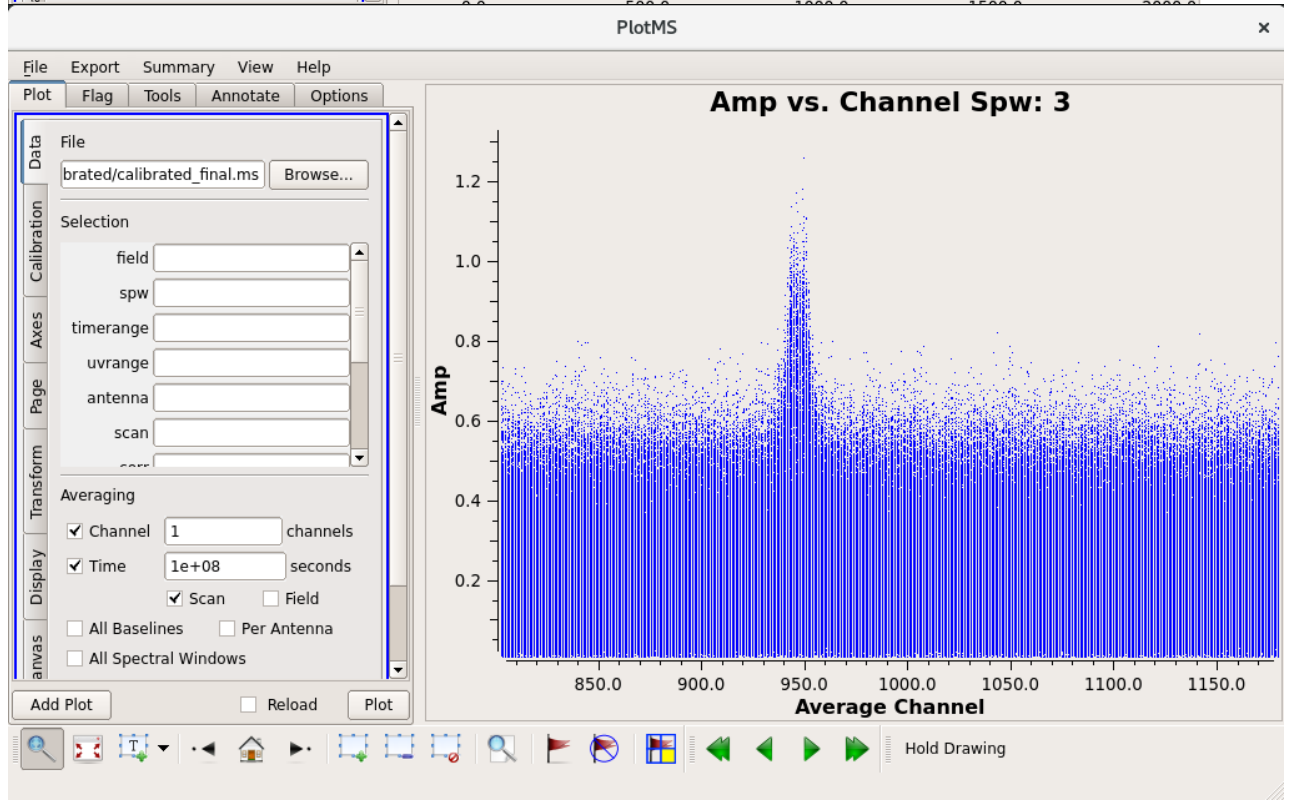




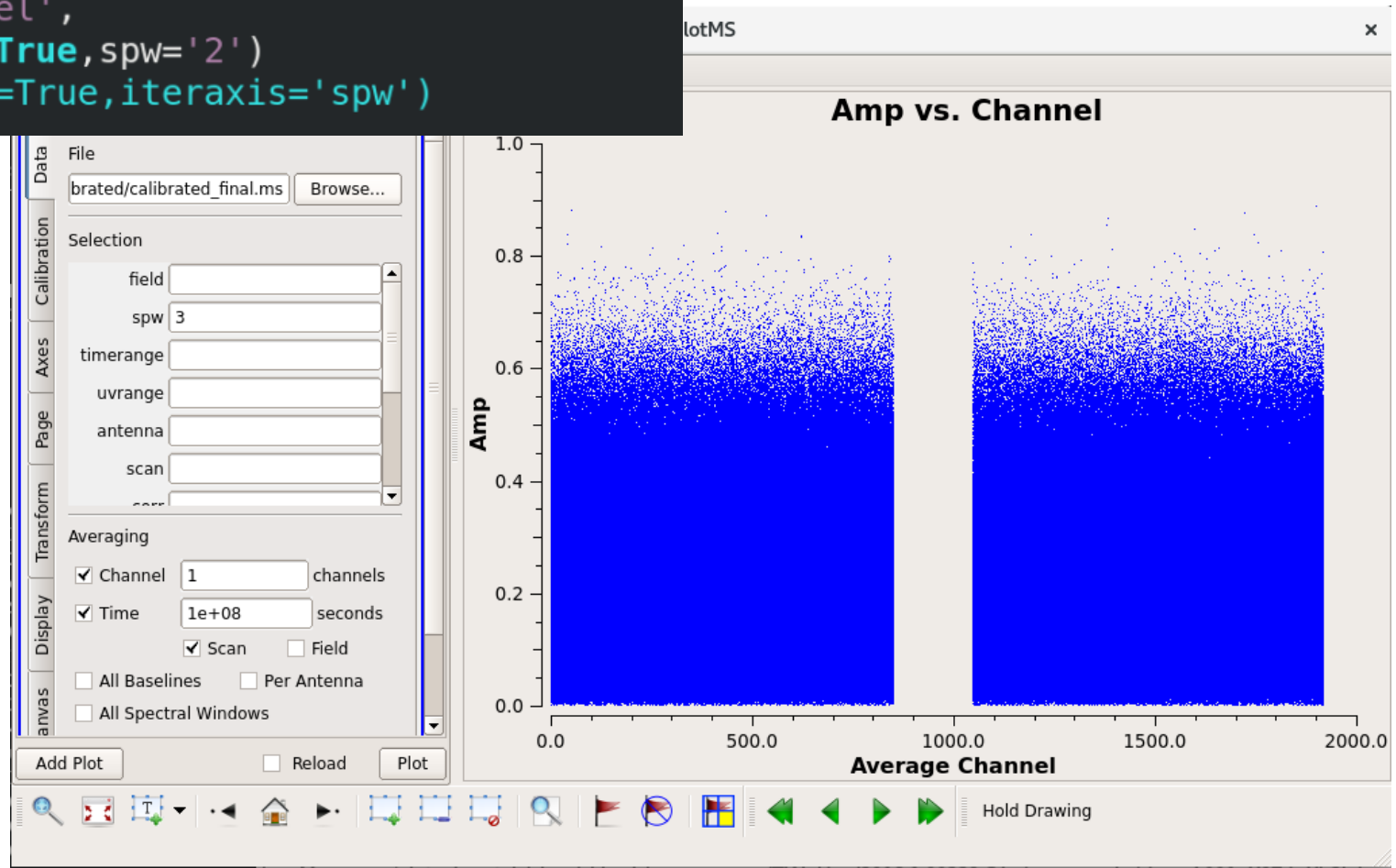

PlotMS
File Export Summary View Help
Plot Flag Tools Annotate Options
Data Calibration Axes Page Transform Display Canvas
File
brated/calibrated_final.ms
Browse...
Selection
field
spw
timerange
uvrange
antenna
scan
Averaging
Channel 1 channels
Time 1e+08 seconds
Scan Field
All Baselines Per Antenna
All Spectral Windows
Add Plot Reload Plot
Amp vs. Channel Spw: 2
Amp
Average Channel
Hold Drawing
Zoom


PlotMS
File Export Summary View Help
Plot Flag Tools Annotate Options
Data Calibration Axes Page Transform Display Canvas
File
brated/calibrated_final.ms
Browse...
Selection
field
spw
timerange
uvrange
antenna
scan
Averaging
Channel 1 channels
Time 1e+08 seconds
Scan Field
All Baselines Per Antenna
All Spectral Windows
Amp vs. Channel Spw: 2
Amp


PlotMS
File Export Summary View Help
Plot Flag Tools Annotate Options
Data Calibration Axes Page Transform Display Canvas
File
brated/calibrated_final.ms
Browse...
Selection
field
spw
timerange
uvrange
antenna
scan
Averaging
Channel 1 channels
Time 1e+08 seconds
Scan Field
All Baselines Per Antenna
All Spectral Windows
Add Plot Reload Plot
Amp vs. Channel Spw: 2
Amp
Average Channel
Hold Drawing

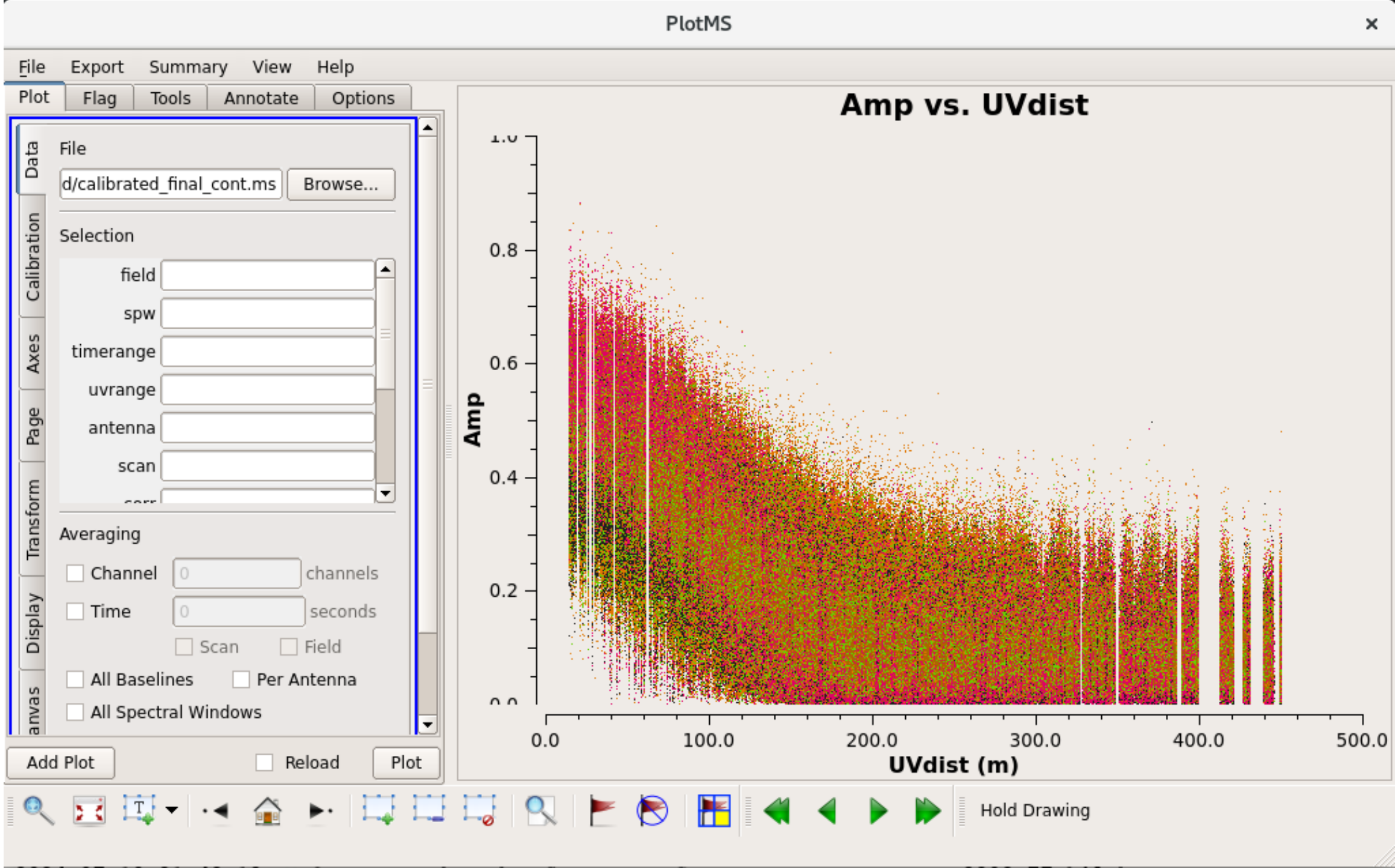

PlotMS
File Export Summary View Help
Plot Flag Tools Annotate Options
Data Calibration Axes Page Transform Display Canvas
File
brated/calibrated_final.ms
Browse...
Selection
field
spw
timerange
uvrange
antenna
scan
Averaging
Channel 1 channels
Time 1e+08 seconds
Scan Field
All Baselines Per Antenna
All Spectral Windows
Add Plot Reload Plot
Amp vs. Channel Spw: 3
Amp
Average Channel
Hold Drawing

```
# Flag the "line channels"
flagchannels='2:851~1049,3:851~1049' # In this example , spws 2&3 have a line
d 2199 and spectral windows 0 and 1 are line-free.


flagdata(vis=finalvis,mode='manual',
         spw=flagchannels,flagbackup=False)

# check that flags are as expected, NOTE must check reload on plotms
# gui if its still open.
plotms(vis=finalvis,yaxis='amp',xaxis='channel',
       avgchannel='1',avgtime='1e8',avgscan=True,spw='2')
#       avgchannel='1',avgtime='1e8',avgscan=True,iteraxis='spw')
```



Preparing the continuum ms file.

```
#>>> Note that to mitigate bandwidth smearing, please keep the width
#>>> of averaged channels less than 125MHz in Band 3, 4, and 6, and 250MHz
#>>> in Band 7 for both TDM and FDM modes. For example, for a 2GHz TDM window
#>>> with 15.625 MHz channels, this means that the maximum width parameter
#>>> should be 8 channels for Bands 3, 4, and 6 and 16 channels for Band 7.
#>>> This is especially important for any long baseline data. These limits
#>>> have been designed to have minimize the reduction of the peak flux to
#>>> 95%. See the "for continuum" header for more information on the imaging
#>>> wiki for more infomration.

#>>> Note that in CASA 5.1, split2 is now split. Previously split2 was
#>>> needed to deal correctly with channelized weights.
split(vis=finalvis,
     spw=contspws,
     outputvis=contvis,
      width=[16,16,1920,1920,3840], # number of channels to average together. The final
channel width should be less than 125MHz in Bands 3, 4, and 6 and 250MHz in Band 7.
     datacolumn='data')
```


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
anvas
File
d/calibrated_final_cont.ms
Browse...
Selection
field
spw
timerange
uvrange
antenna
scan
Averaging
Channel
0
channels
Time
0
seconds
Scan
Field
All Baselines
Per Antenna
All Spectral Windows
Add Plot
Reload
Plot
Amp vs. UVdist
Amp
0.8
0.6
0.4
0.2
0.0
100.0
200.0
300.0
400.0
500.0
UVdist (m)
Hold Drawing

29. Make image list

Set-up image parameters for target aggregate continuum imaging

BACK

List of Clean Targets

field	intent	spw	phasecenter	cell	imsize	imagename	specmode	start	width	nbin	nchan	uvrange
TW_Hya	TARGET	19,23,25,27,29	ICRS 11:01:51.8126 -034.42.17.276	['0.12arcsec']	[378, 378]	uid___A001_X87d_Xb3d.sSTAGENUMBER.TW_Hya_sci.spw19_23_25_27_29.cont	cont			-1	-1	

Clean Targets Summary

Pipeline QA

Input Parameters

Tasks Execution Statistics

CASA logs for stage 29

- View or download stage29/casapy.log (13.2 KB)

For line imaging, set threshold = 3 rms level

Tasks in execution order

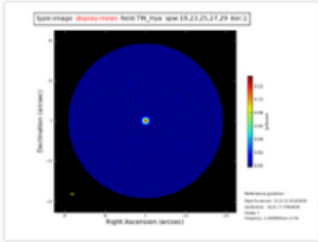
1. hifa_importdata
2. hifa_flagdata
3. hifa_fluxcalflag
4. hif_rawflagchans
5. hif_refant
6. hifa_tsyscal
7. hifa_tsysflag
8. hifa_antpos
9. hifa_wvrgcalflag
10. hif_lowgainflag
11. hif_gainflag
12. hif_setjy
13. hifa_bandpass
14. hifa_spwphaseup
15. hifa_gfluxscale
16. hifa_timegaincal
17. hif_applycal
18. hif_makeimlist
19. hif_makeimages
20. hif_checkproductsize
21. hif_exportdata
22. hif_mstransform
23. hifa_flagtargets
24. hif_makeimlist
25. hif_findcont
26. hif_uvcontfit
27. hif_uvcontsub
28. hif_makeimages
29. hif_makeimlist
30. hif_makeimages
31. hif_makeimlist
32. hif_makeimages

30. Tclean/MakeImages

Make target aggregate continuum images

BACK

Image Details

Field	Spw	Pol	Image details		Image result
TW_Hya (TARGET)	19,23,25,27,29	I	center frequency of image	226.1987GHz (LSRK)	
			beam	0.73 x 0.59 arcsec	
			beam p.a.	82.2deg	
			final theoretical sensitivity	1.8e-05 Jy/beam	
			cleaning threshold	0.0033 Jy/beam Dirty DR: 6.8e+03 DR correction: 45	
			non-pbcor image rms	0.00032 Jy/beam	
			pbcor image max / min	0.136 / -0.00310 Jy/beam	
			fractional bandwidth / nterms	7.9% / 1	
			aggregate bandwidth	3.63 GHz (LSRK)	
			score	1.00	
			image file	uid___A001_X87d_Xb3d.s30_0.TW_Hya_sci.spw19_23_25_27_29.cont.I.iter1.image	

View other QA images...

Real rms level could be higher than this value.

Pipeline QA

Input Parameters

Tasks Execution Statistics

CASA logs for stage 30

```
# source parameters
# -----------------

field='2' # science field(s). For a mosaic, select all mosaic fields. DO NOT LEAVE BLANK
 ('') OR YOU WILL POTENTIALLY TRIGGER A BUG IN CLEAN THAT WILL PUT THE WRONG COORDINATE
SYSTEM ON YOUR FINAL IMAGE.
gridder='standard' # uncomment if single field
# gridder='mosaic' # uncomment if mosaic or if combining one 7m and one 12m pointing.
cell='0.12arcsec' # cell size for imaging.
imsize = [378,378] # size of image in pixels.

# velocity parameters
# -------------------

outframe='lsrk' # velocity reference frame.
veltype='radio' # velocity type.


# imaging control
# ---------------

# The cleaning below is done interactively, so niter and threshold can
# be controlled within clean.

weighting = 'briggs'
robust=0.5
niter=1000
threshold = '0.0mJy'
```

```
contvis = 'calibrated_final_cont.ms'
contimagename = 'cont'

tclean(vis=contvis,
       imagename=contimagename,
       field=field,
       #  phasecenter=phasecenter, #
       specmode='mfs',
       deconvolver='hogbom',
       #deconvolver='mtmfs',
       #nterms=2,
       imsize = imsize,
       cell= cell,
       weighting = weighting,
       robust = robust,
       niter = niter,
       threshold = threshold,
       interactive = True,
       gridder = gridder,
       pbcor = True,
       usepointing=False)
```

Deconvolver

hogbom : default
clark/clarkstokes : for polarization
multiscale : Extented sources
  scales =[0,5,15] (in unit of pixel)
  [point, beam size, 3~5 x beamsize]
mtmfs : Multiterm(multiscale) + multifrequency
  too broad frequency is covered in the continuum imaging and emission varies with frequency.

CASA

Search docs

tclean

tclean(*vis, selectdata=True, field='', spw='', timerange='', uvrange='', antenna='', scan='', observation='', intent='', datacolumn='corrected', imagename='', imsize=[100], cell='"1arcsec"', phasecenter='', stokes='I', projection='SIN', startmodel='', specmode='mfs', reffreq='', nchan=-1, start='', width='', outframe='LSRK', veltype='radio', restfreq='', interpolation='linear', perchanweightdensity=True, gridder='standard', facets=1, psfphasecenter='', wprojplanes=1, vptable='', mosweight=True, aterm=True, psterm=False, wbawp=True, conjbeams=False, cfcache='', usepointing=False, computepastep=360.0, rotatepastep=360.0, pointingoffsetsigdev='', pblimit=0.2, normtype='flatnoise', deconvolver='hogbom', scales='', nterms=2, smallscalebias=0.0, fusedthreshold=0.0, largestscale=-1, restoration=True, restoringbeam='', pbcor=False, outlierfile='', weighting='natural', robust=0.5, noise='1.0Jy', npixels=0, uvtaper=[''], niter=0, gain=0.1, threshold=0.0, nsigma=0.0, cycleniter=-1, cyclefactor=1.0, minpsffraction=0.05, maxpsffraction=0.8, interactive=False, nmajor=-1, fullsummary=False, usemask='user', mask='', pbmask=0.0, sidelobethreshold=3.0, noisethreshold=5.0, lownoisethreshold=1.5, negativethreshold=0.0, smoothfactor=1.0, minbeamfrac=0.3, cutthreshold=0.01, growiterations=75, dogrowprune=True, minpercentchange=-1.0, verbose=False, fastnoise=True, restart=True, savemodel='none', calcres=True, calcpsf=True, psfcutoff=0.35, parallel=False*) [source]

```
RuntimeError: Error in selectData() : Data selection ended with 0 rows
##########################################
##### Begin Task: tclean                 #####
tclean( vis='calibrated_final_cont.ms', selectdata=True, field='2', spw='', timerange='', uvrange='', antenna='', scan='', obs
Verifying Input Parameters
MS : calibrated_final_cont.ms | Selecting on fields : 2 | [Opened in readonly mode]
  NRows selected : 1640000
Leap second table TAI_UTC seems out-of-date.
Until the table is updated (see the CASA documentation or your system admin),
times and coordinates derived from UTC could be wrong by 1s or more.
imsize with 378 pixels is not an efficient imagesize. Try 384 instead.
Define image coordinates for [cont] :
Impars : start
Shape : [378, 378, 1, 1]Spectral : [2.26199e+11] at [0] with increment [1.81969e+10]
Set Gridding options for [cont] with ftmachine : gridft
Required memory: 0.007725 GB. Available mem.: 189.6 GB (rc, mem. fraction: 80%, memory: -) => Subcubes: 1. Processes on node
Set imaging weights : Briggs weighting: sidelobes will be suppressed over full image
Normal robustness, robust = 0.5
Set Deconvolution Options for [cont] : hogbom
------------------------------------------------------------ Make PSF ------------------------------------------
[cont] Theoretical sensitivity (Jy/bm):1.58883e-05
Time to fit Gaussian to PSF 0.007957
Beam : 0.730786 arcsec, 0.585738 arcsec, 82.91 deg
vi2 : Evaluating Primary Beam model onto image grid(s)
------------------------------------------------------------ Run Major Cycle 1 ---------------------------------
 Absolute Peak residual within mask : 0.123077, over full image : 0.123077
[cont] Initializing new mask to 0.0 for interactive drawing
[cont] Number of pixels in the clean mask : 0 out of a total of 142884 pixels. [ 0 % ]
```

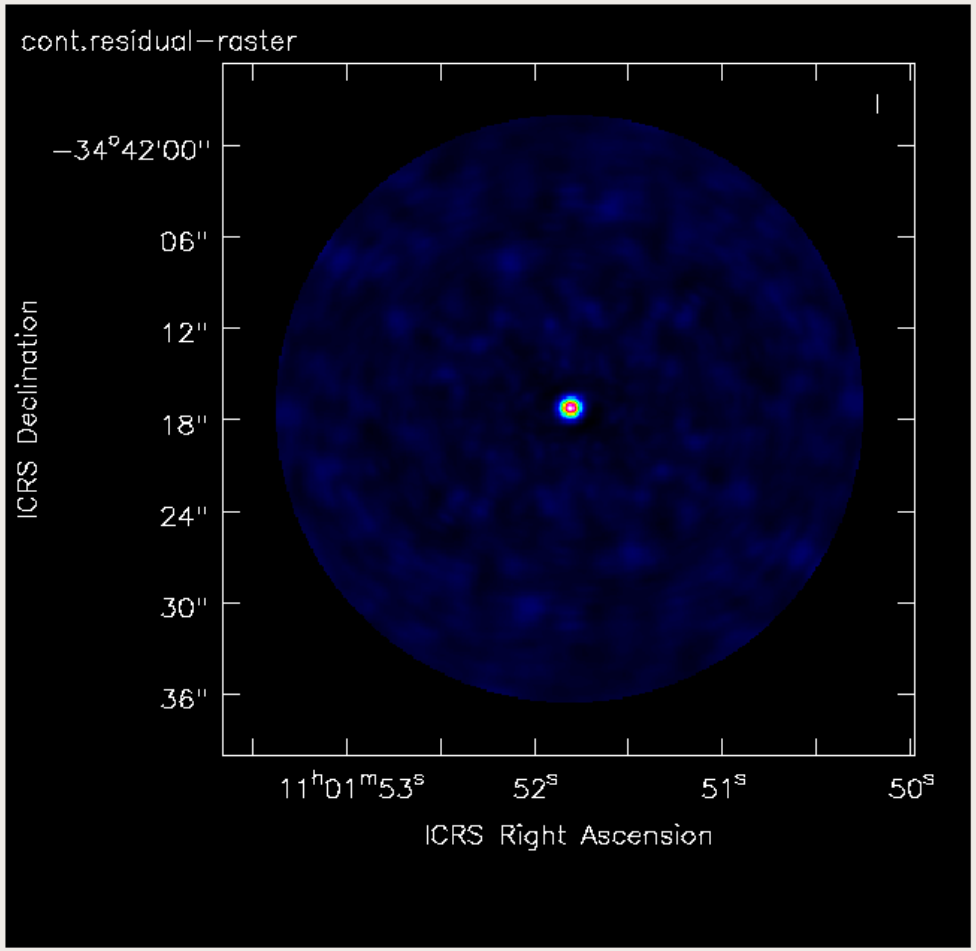
Viewer Display Panel (3n)

Data Display Panel Tools View Help

Add Erase | This Channel All Channels | This Polarization All Polarizations | Next Action:

max cycleniter	iterations left	threshold	cyclethreshold
100	1000	0.000000Jy	0.006624Jy

Display



Animators

Stokes

Images

Rate: 10 Jump 0 2

0 1

Cursors

cont.residual-raster

cont.mask

Viewer Display Panel (3n)

Data Display Panel Tools View Help

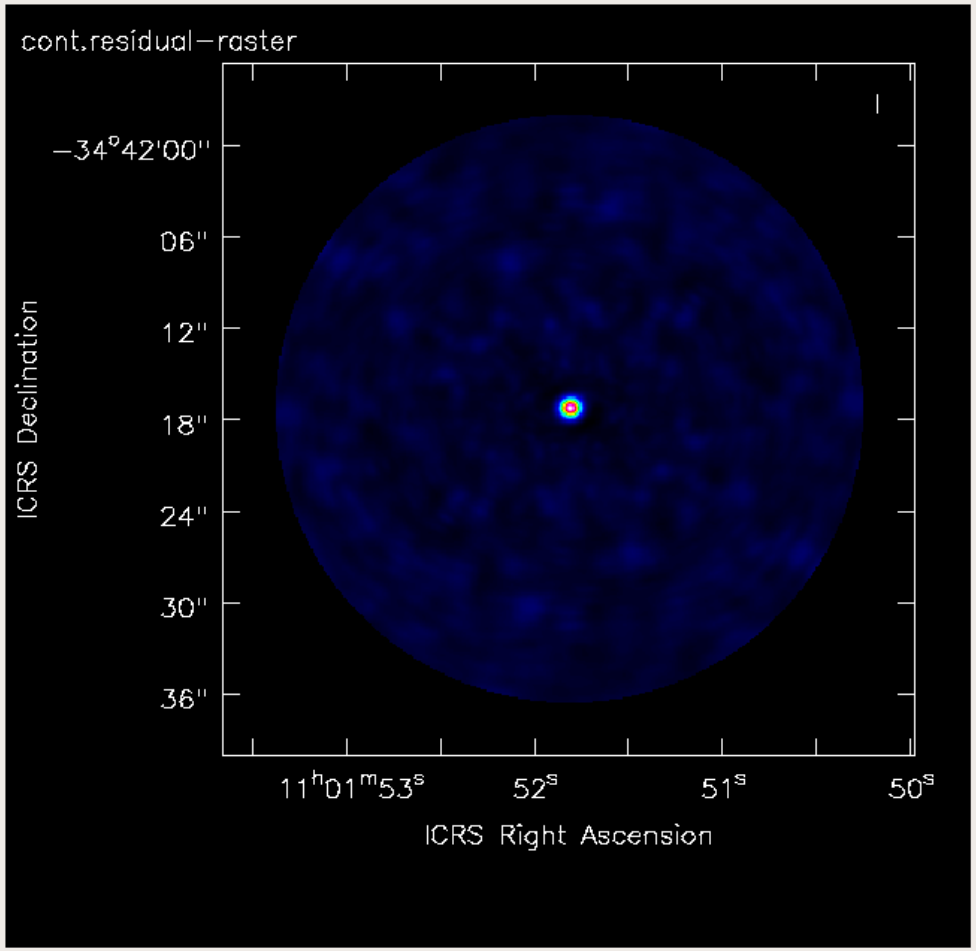
Click here with the desired mouse button to assign that button to 'Zooming'
Use the assigned mouse button to drag out a rectangle.
Use handles to resize.
Double click inside rectangle-> zoom in
Double click outside rectangle -> zoom out
<Esc> to cancel

Next Action:

cyclethreshold

100 1000 0.000000Jy 0.006624Jy

Display



Animators

Stokes

Images

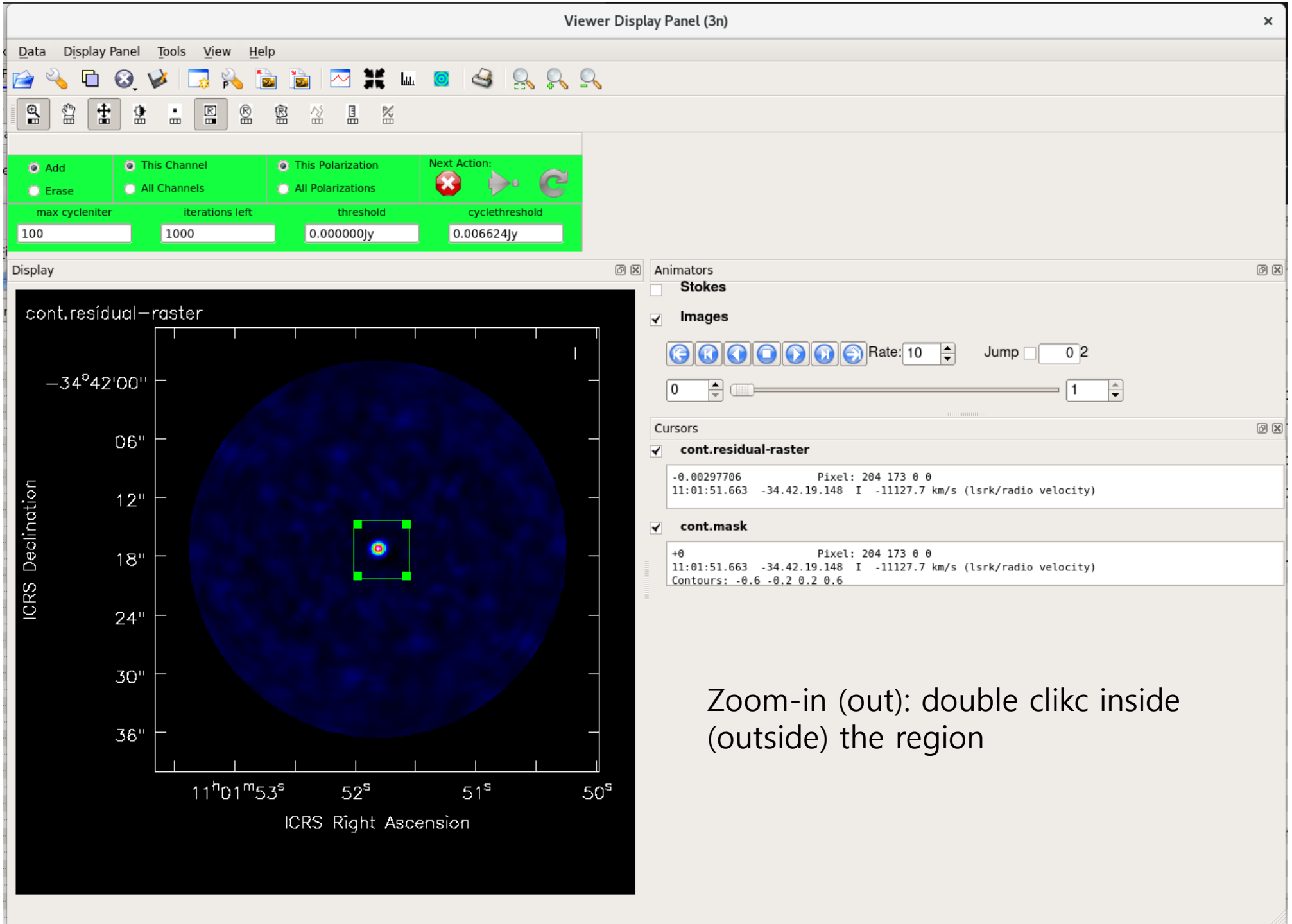
Rate: 10 Jump 0 2

0 1

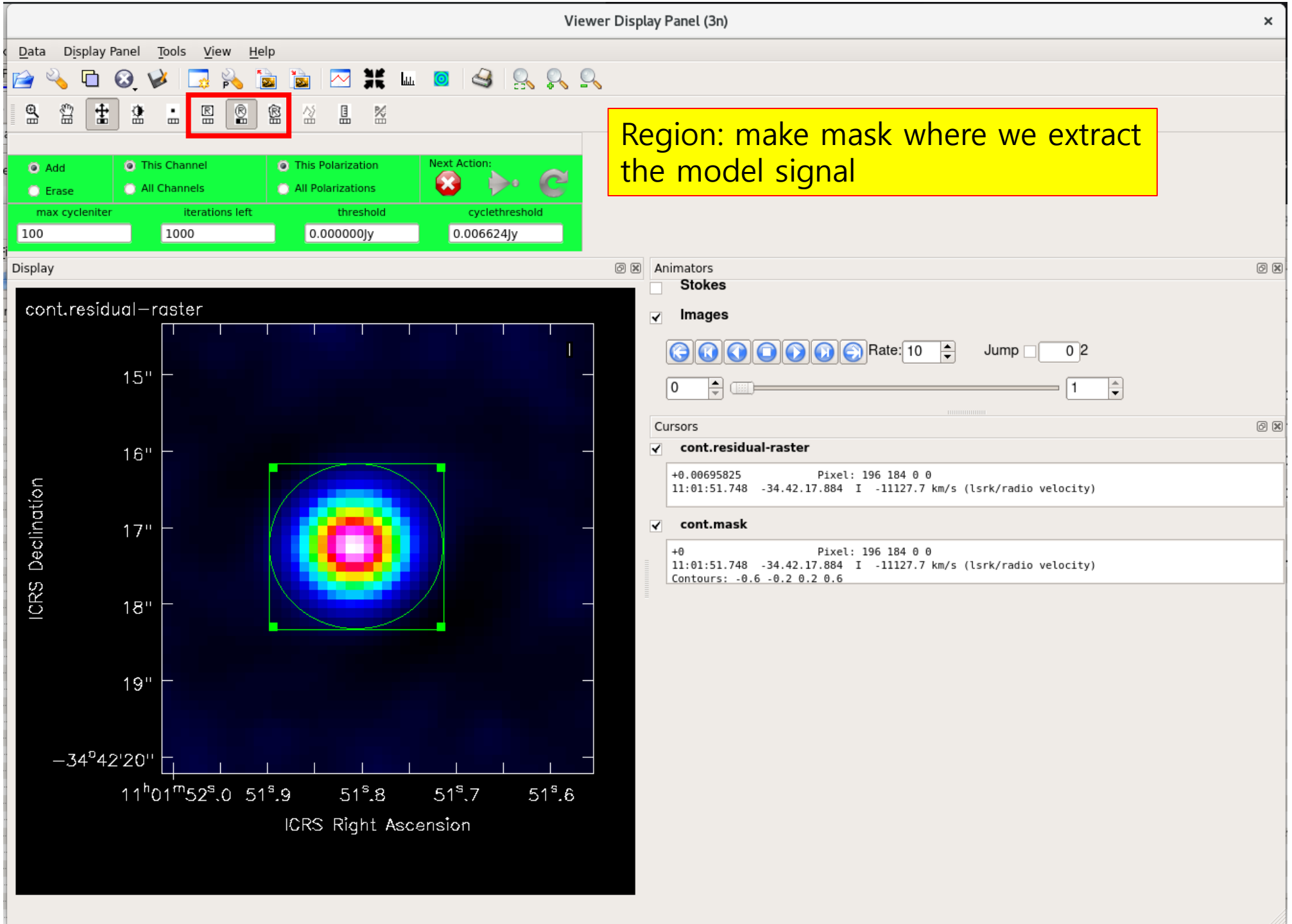
Cursors

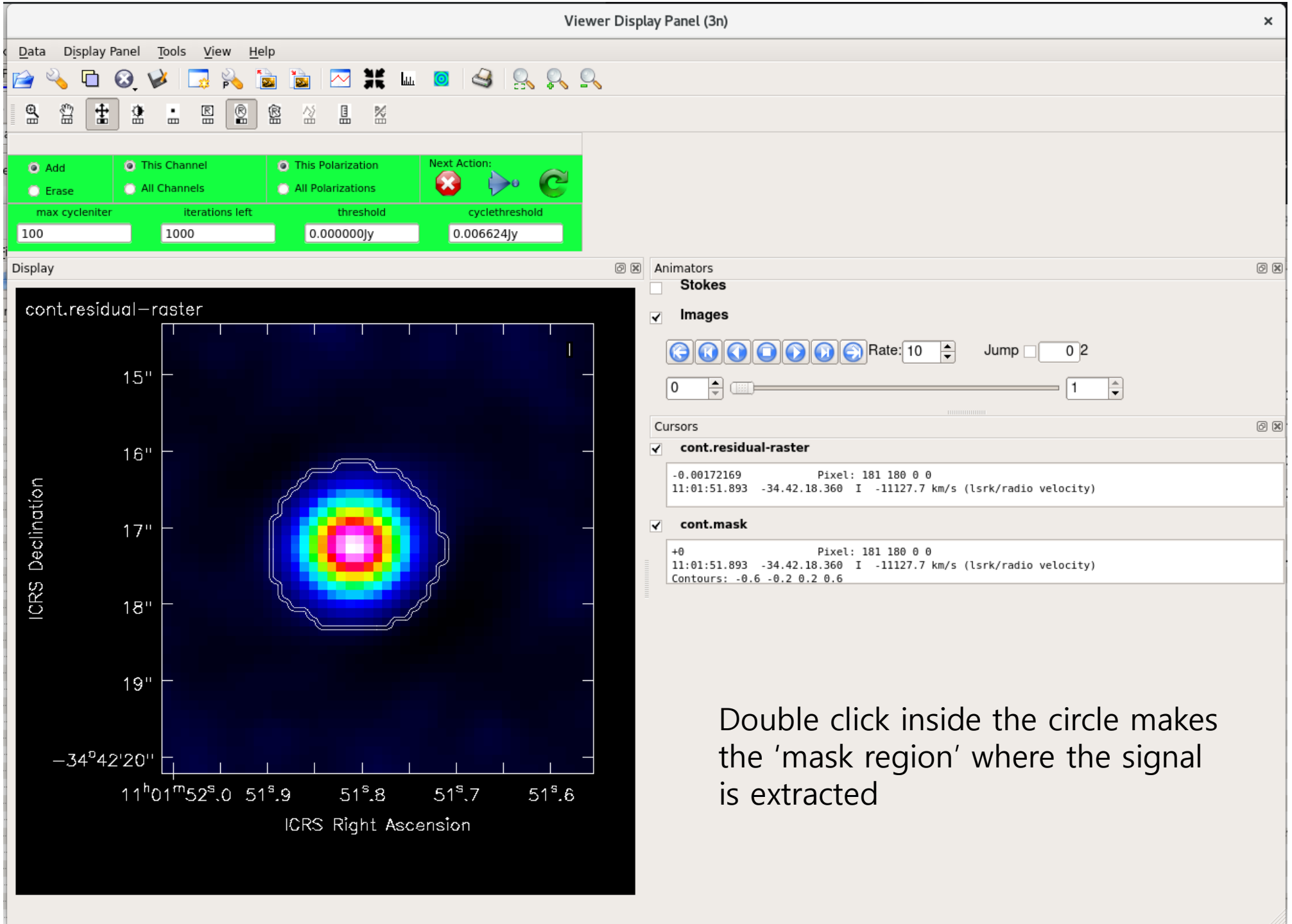
cont.residual-raster

cont.mask



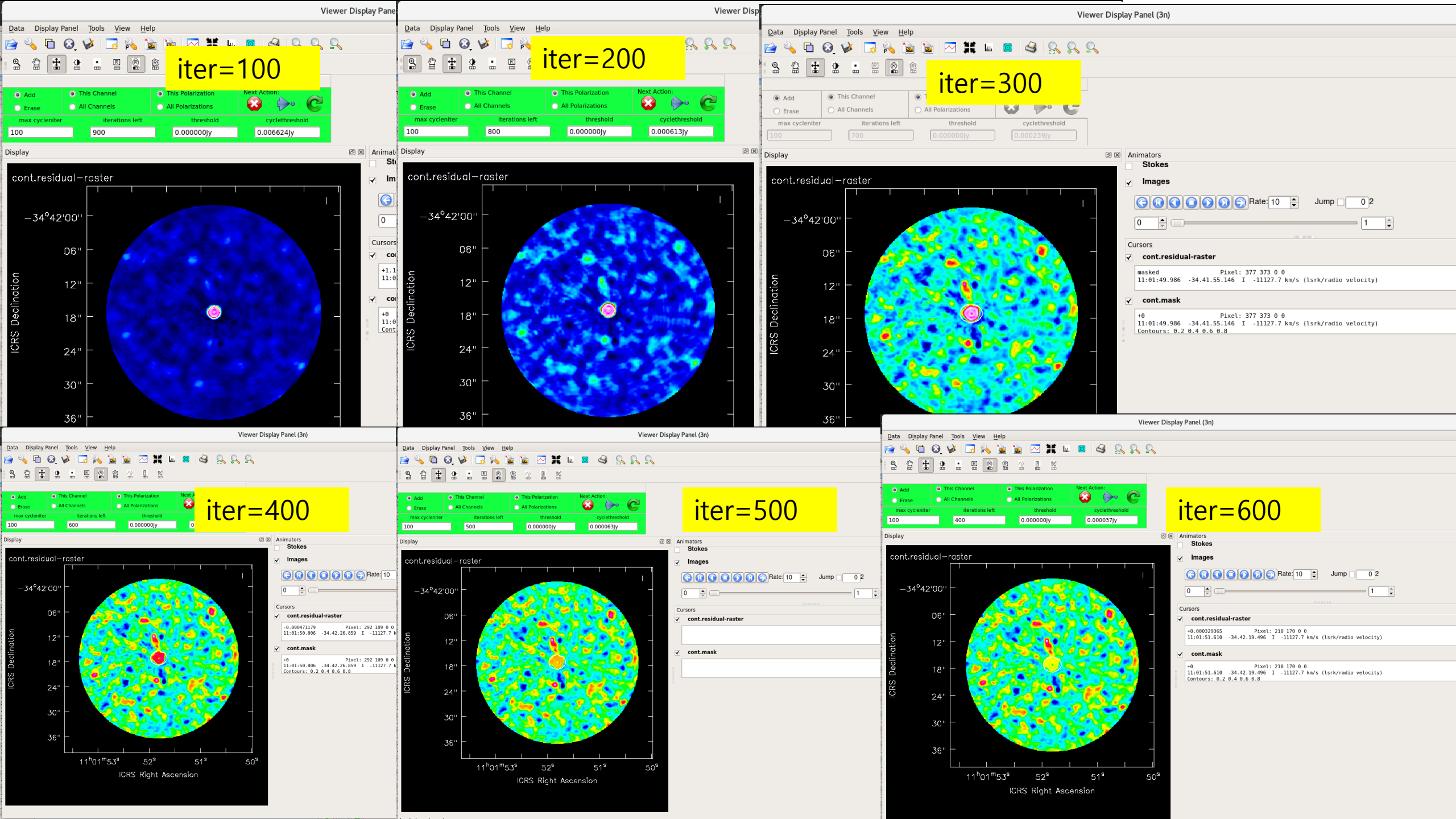
Zoom-in (out): double clikc inside (outside) the region

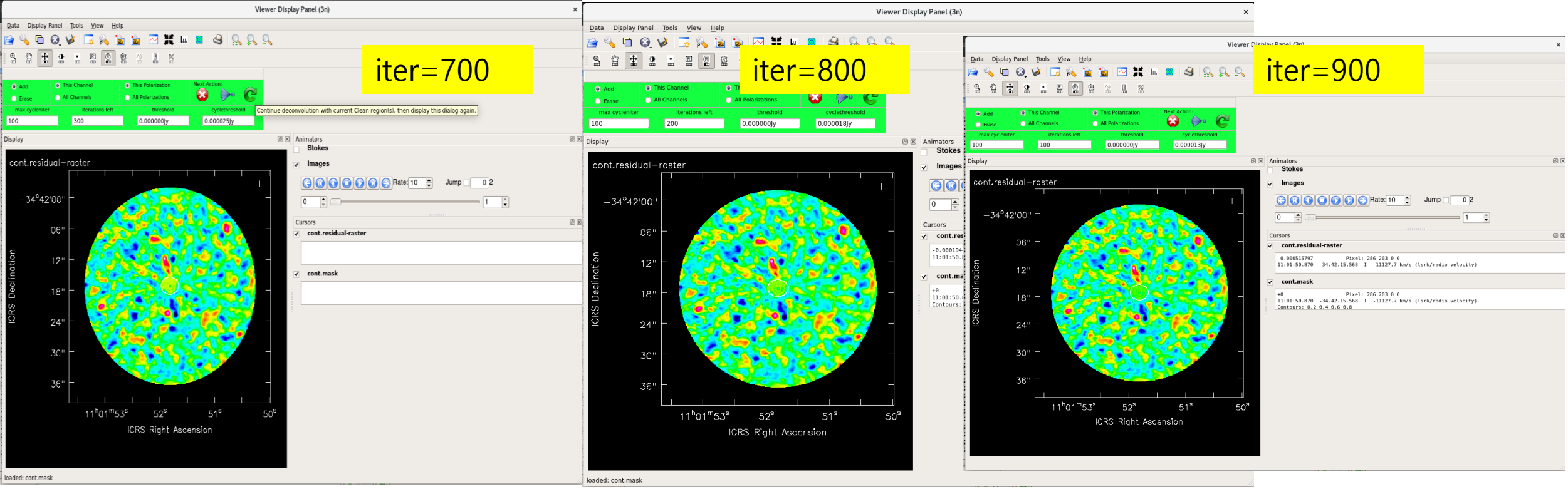

Viewer Display Panel (3n)
Data
Display Panel
Tools
View
Help
Add
Erase
This Channel
All Channels
This Polarization
All Polarizations
Next Action:
max cycleniter
iterations left
threshold
cyclethreshold
100
1000
0.000000Jy
0.006624Jy
Region: make mask where we extract the model signal
Display
cont.residual−raster
15"
16"
17"
18"
19"
−34°42'20"
11h01m52s.0
51s.9
51s.8
51s.7
51s.6
ICRS Declination
ICRS Right Ascension
Animators
Stokes
Images
Rate:
10
Jump
0
2
0
1
Cursors
cont.residual-raster
+0.00695825 Pixel: 196 184 0 0
11:01:51.748 -34.42.17.884 I -11127.7 km/s (lsrk/radio velocity)
cont.mask
+0 Pixel: 196 184 0 0
11:01:51.748 -34.42.17.884 I -11127.7 km/s (lsrk/radio velocity)
Contours: -0.6 -0.2 0.2 0.6



Double click inside the circle makes the 'mask region' where the signal is extracted

```
------------------------------------------------------------ Run Major Cycle 1 ------------------------------------
 Absolute Peak residual within mask : 0.123077, over full image : 0.123077
[cont] Initializing new mask to 0.0 for interactive drawing
[cont] Number of pixels in the clean mask : 0 out of a total of 142884 pixels. [ 0 % ]
[cont.mask] Mask modified from 0 pixels to 267 pixels
[cont] Mask changed interactively.
 Absolute Peak residual within mask : 0.123077, over full image : 0.123077
 Minor Cycle controls : {'cycleniter': 100, 'cyclethreshold': 0.006623855326324701, 'loopgain': 0.10000000149011612, 'nsigma': 0
     itsNsigma=0
[cont] Run Hogbom minor-cycle | CycleThreshold=0.00662386, CycleNiter=100, Gain=0.1
[cont] iters=0->100 [100], model=0->0.306273, peakres=0.123077->0.0113892, Reached cycleniter.
Completed 100 iterations.
------------------------------------------------------------ Run Major Cycle 2 ------------------------------------
```


iter=100
iter=200
iter=300
iter=400
iter=500
iter=600
Viewer Display Panel (3n)
Data
Display Panel
Tools
View
Help
Add
Erase
This Channel
All Channels
This Polarization
All Polarizations
Next Action:
max cycleniter
iterations left
threshold
cyclethreshold
Display
cont.residual−raster
ICRS Declination
ICRS Right Ascension
Animators
Stokes
Images
Rate:
Jump
Cursors
cont.residual−raster
cont.mask



When you make 'mask' where you trust there are 'Real' signal, then rms = 0 is OK.
However, other case, do not clean down to 3 sigma rms level.

Products of ‘tclean’

try.psf	Point Spread Function
try.pb	Primary Beam
try.residual	Residual Image (or initial Dirty Image)
try.model	Model Image after deconvolution
try.image	Restored output image
try.image.pbcor	Primary Beam corrected image
try.mask	Deconvolution mask

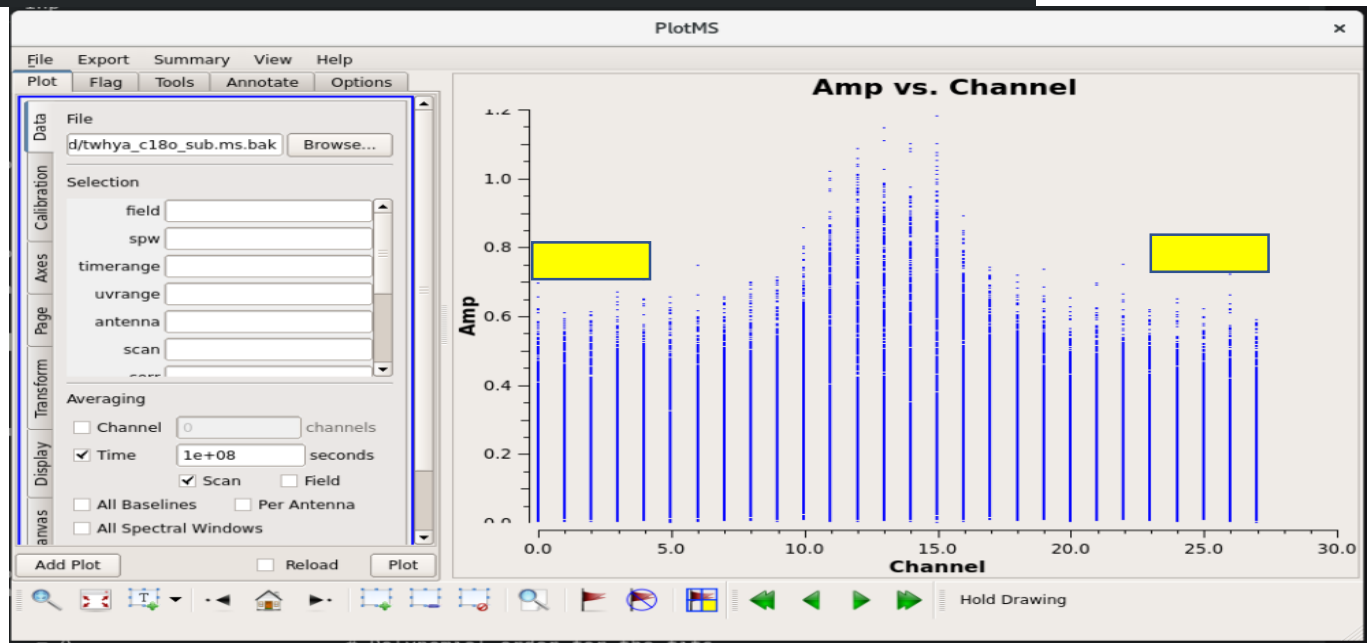
try.psf.tt0, try.psf.tt1, try.psf.tt2, try.model.tt0, try.model.tt1, try.residual.tt0, try.residual.tt1, try.image.tt0, try.image.tt1, etc…	Multi-term images representing Taylor coefficients (of polynomials that model the sky spectrum)
try.alpha	Spectral index, for multi-term wideband imagging
try.alpha.error	Estimate of error on spectral index
try.beta	Spectral curvature for multi-term wideband images (if nterms > 2)

LINE IMAGING

```
vis_c18o='twhya_c18o_sub.ms'
plotms(vis=vis_c18o,xaxis='channel',yaxis='amplitude',avgtime='1e8',avgscan=True, avgchanne
l='1')

fitspw = '0:0~4;23~27' # *line-free* channels for fitting continuum
linespw = '0' # line spectral windows. You can subtract the continuum from multiple spectra
l line windows at once.

linevis='twhya_c18o_sub_line.ms'

uvcontsub(vis=vis_c18o,
          spw=linespw, # spw to do continuum subtraction on
          fitspw=fitspw, # regions without lines.
          excludechans=False, # fit the regions in fitspw
          solint='int',
          fitorder=0,
          want_cont=False) # This value should not be changed.
```

Input parameters are changed.

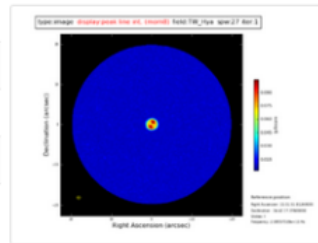
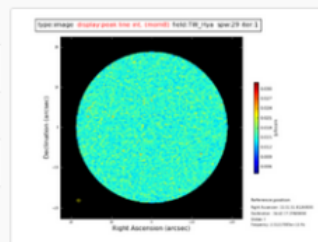
uvcontsub(vis=vis_c180,
outputvis=linevis,
fitspec =fitspw,
fitorder=0)



```
gridder='standard' # uncomment if single field
cell='0.12arcsec' # cell size for imaging.
#imsize = [378,378] # size of image in pixels.
imsize = [384,384] # size of image in pixels.
outframe='lsrk' # velocity reference frame.
veltype='radio' # velocity type.

spw = '0'
field='2'
weighting = 'briggs'
robust=0.5
niter=1000
threshold = '0.0mJy'

start='0' # start velocity. See science goals for appropriate value.
width='1' # velocity width. See science goals.
nchan = 27  # number of channels. See science goals for appropriate value.
restfreq='219.5603541GHz' # Typically the rest frequency of the line: C18O

linevis='twhya_c18o_sub_line.ms'
lineimagename =  'c18o.ch'
```

Tasks in execution order

1. hifa_importdata
2. hifa_flagdata
3. hifa_fluxcalflag
4. hif_rawflagchans
5. hif_refant
6. hifa_tsyscal
7. hifa_tsysflag
8. hifa_antpos
9. hifa_wvrgcalflag
10. hif_lowgainflag
11. hif_gainflag
12. hif_setjy
13. hifa_bandpass
14. hifa_spwphaseup
15. hifa_gfluxscale
16. hifa_timegaincal
17. hif_applycal
18. hif_makeimlist
19. hif_makeimages
20. hif_checkproductsize
21. hif_exportdata
22. hif_mstransform
23. hifa_flagtargets
24. hif_makeimlist
25. hif_findcont
26. hif_uvcontfit
27. hif_uvcontsub
28. hif_makeimages
29. hif_makeimlist
30. hif_makeimages
31. hif_makeimlist
32. hif_makeimages

			Dirty DR: 79 DR correction: 2	 View other QA images...
			non-pbcor image rms: 0.0033 Jy/beam	
			pbcor image max / min: 0.263 / -0.0530 Jy/beam	
			channels: 1918 x -0.0611MHz (LSRK)	
			score: 1.00	
			image file: uid___A001_X87d_Xb3d.s32_0.TW_Hya_sci.spw25.cube.I.iter1.image	
TW_Hya (TARGET)	27	I	center frequency of cube: 219.5575GHz (LSRK)	 View other QA images...
			beam: 0.78 x 0.62 arcsec	
			beam p.a.: 83.1deg	
			final theoretical sensitivity: 0.0025 Jy/beam	
			cleaning threshold: 0.015 Jy/beam Dirty DR: 38 DR correction: 1.5	
			non-pbcor image rms: 0.0027 Jy/beam	
			pbcor image max / min: 0.105 / -0.0434 Jy/beam	
			channels: 1918 x -0.0611MHz (LSRK)	
			score: 1.00	
			image file: uid___A001_X87d_Xb3d.s32_0.TW_Hya_sci.spw27.cube.I.iter1.image	
TW_Hya (TARGET)	29	I	center frequency of cube: 231.2177GHz (LSRK)	
			beam: 0.74 x 0.59 arcsec	
			beam p.a.: 82.3deg	
			final theoretical sensitivity: 0.0037 Jy/beam	
			cleaning threshold: 0.015 Jy/beam Dirty DR: 7.6	

```
tclean(vis=linevis,
       imagename=lineimagename,
           field=field,
           spw=spw,
       # phasecenter=phasecenter,
       # mosweight = True, # unco
       specmode='cube', # comment
       # specmode='cubesource', #
       perchanweightdensity=True,
       start=start,
       width=width,
       nchan=nchan,
       outframe=outframe,
       veltype=veltype,
       restfreq=restfreq,
       niter=niter,
       threshold=threshold,
       interactive=True,
       cell=cell,
       imsize=imsize,
       weighting=weighting,
       robust=robust,
       gridder=gridder,
       pbcor=False,
       restoringbeam='common',
       usepointing=False)
```

```
start='0' #
width='1' #
nchan = 27
```

```
start='1km/s'
width='0.2km/s'
nchan = 21
```

Tips.

- Save the niter and threshold to run the script automatically.
- Rename the ‘imge.mask’ to ‘image_mask.mask’
- When you run the automatic script, add/change the script

  mask = ‘image_mask.mask’

  Interactive = False

When you rerun the ‘tclean’, add following paramters,

calcpsf=False

calcres=False

Because we already have ‘##.psf’ and ‘##.residual’ and we do not need to make these again.