

CASA Pipelines



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Overview



- ALMA and VLA have CASA Pipelines
- Currently calibration only
 - Diagnostic calibrator images
 - ALMA science target imaging being commissioned
- The Pipelines use dedicated Pipeline tasks in CASA
- Execute using python scripts provided by the telescopes. Or self-build
- ALMA and VLA Pipelines common output: Pipeline WebLog

CASA Pipeline Versions



- CASA 4.2.2 and CASA 4.3.1 have special versions including the Pipeline
 - Obtain from http://casa.nrao.edu/casa_obtaining.shtml
- CASA 4.4 has no pipeline version
- Starting with CASA 4.5 (this month), one version
- Earliest CASA versions to be used with ALMA Cycle 3 data (manual or Pipeline) CASA 4.5



Pipeline Task Types



Prefix	Task type	Purpose
h_	Common	Interferometry and single-dish, ALMA & VLA
hif_	Interferometry	ALMA & VLA
hifa_	Interferometry	ALMA only
hifv_	Interferometry	VLA only
hsd_	Single-dish	ALMA single-dish

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Pipeline Tasks vs CASA Tasks



Pipeline	CASA
hifa_importdata	importasdm
hifa_flagdata	flagdata
hifa_wvrgcalflag	wvrgcal
hifa_bandpass	bandpass
hifa_gfluxscale	fluxscale
hifa_timegaincal	gaincal
hif_applycal	applycal

Pipeline tasks use CASA tasks where possible

Pipeline tasks can also contain heuristics and may be multiple CASA tasks bundled together

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Pipeline Mode



```
CASA <12>: inp hifa_importdata
-----> inp(hifa_importdata)
# hifa_importdata :: Imports data into the interferometry pipeline
vis          =      ['']          # List of input visibility data
session      =      ['']          # List of visibility data sessions
pipelinemode = 'automatic'        # The pipeline operating mode
async        =      False         # If true the taskname must be started using hifa_importdata(...)
```

```
CASA <13>: pipelinemode='interactive'
```

```
CASA <14>: inp hifa_importdata
-----> inp(hifa_importdata)
# hifa_importdata :: Imports data into the interferometry pipeline
vis          =      ['']          # List of input visibility data
session      =      ['']          # List of visibility data sessions
pipelinemode = 'interactive'      # The pipeline operating mode
  asis        = 'Antenna Station Receiver CalAtmosphere' # ASDM to convert as is
  process_caldevice = False      # Import the caldevice table from the ASDM
  overwrite   = False           # Overwrite existing files on import
  bdf_flags   = False           # Apply BDF flags on import
  dryrun      = False           # Run the task (False) or display task command (True)
  acceptresults = True          # Add the results into the pipeline context

async        =      False         # If true the taskname must be started using hifa_importdata(...)
```

```
CASA <15>: □
```



Pipeline Design



- Pipeline reduces data automatically by
 - Selecting the best processing strategies → **Heuristics**
 - Organizing the reduction environment / book-keeping → **Context**
- ALMA pipeline implements the two aspects using the “separation of concerns” design principle
 - Mix and match of steps is possible

Pipeline Implementation



- **Heuristics** and **Context** are implemented as Python Classes
- The variables for heuristics are “parameters”, the ones for context are “inputs”
- Pipeline runs handle the context automatically
- User interaction mainly via heuristics parameters
- However the context can be edited to insert own calibration tables


```
__rethrow_casa_exceptions = True

h_init()

try:
    hifa_importdata(dbservice=False, vis=['uid__A002_X877e41_X452'],
session=['session_1'])

    hifa_flagdata(pipelinemode="automatic")
    hifa_fluxcalflag(pipelinemode="automatic")
    hif_rawflagchans(pipelinemode="automatic")
    hif_refant(pipelinemode="automatic")
    hifa_tsyscal(pipelinemode="automatic")
    hifa_tsysflag(pipelinemode="automatic")
    hifa_wvrgcalflag(pipelinemode="automatic")
    hif_lowgainflag(pipelinemode="automatic")
    hif_setjy(pipelinemode="automatic")
    hifa_bandpass(pipelinemode="automatic")
    hifa_spwphaseup(pipelinemode="automatic")
    hifa_gfluxscale(pipelinemode="automatic")
    hifa_timegaincal(pipelinemode="automatic")
    hif_applycal(pipelinemode="automatic")
    hif_makecleanlist(intent='PHASE,BANDPASS,CHECK')
    hif_cleanlist(pipelinemode="automatic")
    hif_exportdata(pipelinemode="automatic")

finally:
    h_save()
```

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ALMA Pipeline Script

casapipescript.py



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```

__rethrow_casa_exceptions = True
h_init()
try:
    hifa_importdata(dbservice=False, vis=['uid__A002_X877e41_X452'],
session=['session_1'])

    hifa_flagdata(pipelinemode="automatic")
    hifa_fluxcalflag(pipelinemode="automatic")
    hif_rawflagchans(pipelinemode="automatic")
    hif_refant(pipelinemode="automatic")
    hifa_tsyscal(pipelinemode="automatic")
    hifa_tsysflag(pipelinemode="automatic")
    hifa_wvrgcalflag(pipelinemode="automatic")
    hif_lowgainflag(pipelinemode="automatic")
    hif_setjy(pipelinemode="automatic")
    hifa_bandpass(pipelinemode="automatic")
    hifa_spwphaseup(pipelinemode="automatic")
    hifa_gfluxscale(pipelinemode="automatic")
    hifa_timegaincal(pipelinemode="automatic")
    hif_applycal(pipelinemode="automatic")
    hif_makecleanlist(intent='PHASE,BANDPASS,CHECK')
    hif_cleanlist(pipelinemode="automatic")
    hif_exportdata(pipelinemode="automatic")
finally:
    h_save()

```

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ALMA Pipeline Script

Main Steps

Data Import

Data Flagging

Generate Tsys table & flag

Generate WVR table

Set the absolute fluxscale

Generate bandpass table

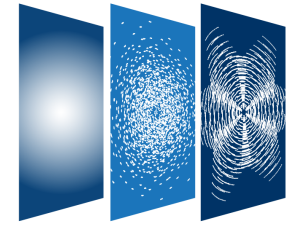
Determine fluxes of 2o cals

Generate gain tables

Apply calibration

Image calibrators

Pipeline CASA Commands Log

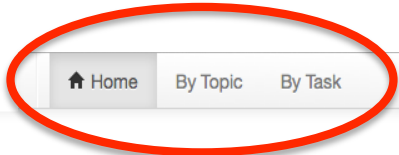


```
# hifa_bandpass(pipelinemode="automatic")
#
# The spectral response of each antenna is calibrated. A short-solint phase
# gain is calculated to remove decorrelation of the bandpass calibrator before
# the bandpass is calculated.
#
```

```
gaincal(field='0', minblperant=4, antenna='0~36', solint='4.502099s',
        caltable='uid___A002_Xa43a0e_X115e.ms.hifa_bandpass.s11_3.spw9_11_13_15.solint4_502s.gpcal.tbl',
        interp=['linear,linear', 'nearest'], minsnr=3.0,
        gaintable=['uid___A002_Xa43a0e_X115e.ms.hifa_tsyscal.s6_1.tsyscal.tbl',
                  'uid___A002_Xa43a0e_X115e.ms.hifa_wvrgcalflag.s8_4.sm2_016s.wvrcal.tbl'],
        spw='9,11,13,15', vis='uid___A002_Xa43a0e_X115e.ms', calmode='p',
        gaintype='G', spwmap=[[0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 9, 11, 11, 13, 13,
                              15, 15, 9, 11, 13, 15], []], intent='*BANDPASS*', solnorm=False,
        refant='DA49,DA59,DV08,DA57,PM02,DV18,DV19,PM03,DV04,DA41,PM01,DA61,DA63,DA53,DV01,etc',
        gainfield=['nearest', "])
```

```
bandpass(field='0', bandtype='B', antenna='0~36', solint='inf,164.524257MHz',
         caltable='uid___A002_Xa43a0e_X115e.ms.hifa_bandpass.s11_3.spw9_11_13_15.channel.solintinf.bcal.tbl',
         interp=['linear,linear', 'nearest', 'linear,linear'], minsnr=3.0,
         gaintable=['uid___A002_Xa43a0e_X115e.ms.hifa_tsyscal.s6_1.tsyscal.tbl',
                   'uid___A002_Xa43a0e_X115e.ms.hifa_wvrgcalflag.s8_4.sm2_016s.wvrcal.tbl',
                   'uid___A002_Xa43a0e_X115e.ms.hifa_bandpass.s11_3.spw9_11_13_15.solint4_502s.gpcal.tbl'],
         spw='9', vis='uid___A002_Xa43a0e_X115e.ms', combine='scan', spwmap=[[0,
                                     1, 2, 3, 4, 5, 6, 7, 8, 9, 9, 11, 11, 13, 13, 15, 15, 9, 11, 13, 15],
                                     [], []], intent='*BANDPASS*', solnorm=True,
         refant='DA49,DA59,DV08,DA57,PM02,DV18,DV19,PM03,DV04,DA41,PM01,DA61,DA63,DA53,DV01,etc',
         gainfield=['nearest', ", 'nearest'], minblperant=4)
```

Pipeline WebLog: Home



Observation Overview

Project	uid://A001/X112/X207
Principal Investigator	
OUS Status Entity id	uid://A001/X11f/X54
Observation Start	2014-07-23 01:01:03 UTC
Observation End	2014-07-23 01:39:31 UTC

Pipeline Summary

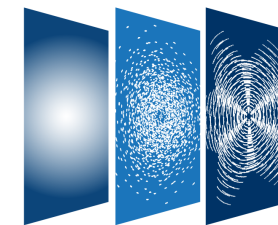
Pipeline Version	33653 (Pipeline-Cycle3-R1-B)
CASA Version	4.3.1 r32491
Pipeline Start	2015-07-04 13:25:27 UTC
Execution Duration	6:02:09

Observation Summary

Measurement Set	Receivers	Num Antennas	Time (UTC)			Baseline Length			Size
			Start	End	On Source	Min	Max	RMS	
Observing Unit Set Status: uid://A001/X11f/X54 Scheduling Block ID: uid://A001/X11f/X48									
Session: session_5									
uid__A002_X877e41_X452.ms	ALMA Band 3	34	2014-07-23 01:01:03	2014-07-23 01:39:30	0:12:40	17.8 m	783.5 m	316.0 m	18.2 GB



WebLog: MS Overview



CASA

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SESSION 'SESSION_5'

uid__A002_X877e41_X452.ms

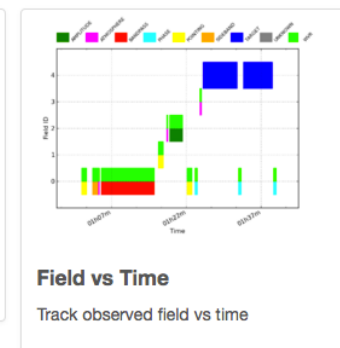
Home By Topic By Task

Overview of 'uid__A002_X877e41_X452.ms'

Observation Execution Time

Start Time	2014-07-23 01:01:03
End Time	2014-07-23 01:39:30
Total Time on Source	0:32:06
Total Time on Science Target	0:12:40

listobs output



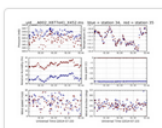
Spatial Setup

Science Targets	'B1730-130'
Calibrators	'Ceres', 'J1354-0206' and 'J1733-1304'

Antenna Setup

Min Baseline	17.8 m
Max Baseline	783.5 m

Weather



Spectral Setup

All Bands	'ALMA Band 3' and 'WVR'
Science Bands	'ALMA Band 3'

Sky Setup

Min Elevation	N/A
Max Elevation	N/A

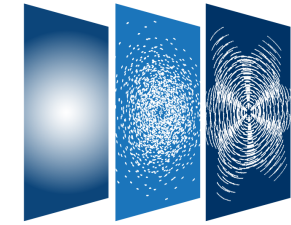
Scans

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WebLog: By Topic



Home **By Topic** By Task

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Flagging Summaries

uid__A002_X836a4d_Xdbd.ms

spw	DA42	DA43	DA44	DA45	DA46	DA47	DA48	DA49	DA51	DA54	DA55	DA57	DA59	DA60	DA61	DA62	DA63	DV01	DV02	DV04	DV07	DV10	DV12
17	16.63	16.99	17.52	16.65	17.90	16.65	16.65	16.65	16.56	18.04	16.58	16.61	16.60	16.65	16.61	16.56	16.60	16.56	17.80	16.63	16.65	17.03	17.23
19	18.98	19.32	19.95	19.00	20.24	18.99	19.00	19.00	18.91	100.00	18.93	18.96	18.95	19.00	18.96	18.91	18.95	18.91	21.66	18.98	19.00	19.36	19.56
21	16.63	17.10	17.60	16.72	17.92	16.70	16.72	16.73	16.61	18.05	16.59	16.65	16.65	16.70	16.65	16.59	16.67	16.58	17.85	16.69	16.70	17.07	17.28
23	16.63	16.99	17.52	16.65	17.90	16.65	16.65	16.65	16.56	18.04	16.58	16.61	16.60	16.65	16.61	16.56	16.60	16.56	17.80	16.63	16.65	17.03	17.23

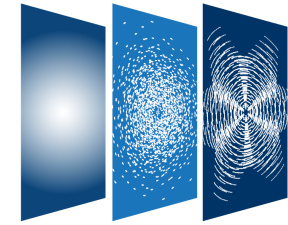
Flagging percentages for Source name: ID3_highz, Intents: WVR,ATMOSPHERE,TARGET

spw	DA42	DA43	DA44	DA45	DA46	DA47	DA48	DA49	DA51	DA54	DA55	DA57	DA59	DA60	DA61	DA62	DA63	DV01	DV02	DV04	DV07	DV10	DV12
17	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	19.54	20.57
19	19.80	19.80	19.91	19.80	19.80	19.80	19.80	19.80	19.80	100.00	19.80	19.80	19.80	19.80	19.80	19.80	19.80	19.80	21.36	19.80	19.80	21.86	22.85
21	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	19.54	20.57
23	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	17.42	19.54	20.57

Flagging percentages for Source name: J2258-279, Intents: ATMOSPHERE,POINTING,AMPLITUDE,WVR

spw	DA42	DA43	DA44	DA45	DA46	DA47	DA48	DA49	DA51	DA54	DA55	DA57	DA59	DA60	DA61	DA62	DA63	DV01	DV02	DV04	DV07	DV10	DV12
17	18.17	17.79	17.94	17.79	19.09	18.17	19.43	17.94	19.06	20.55	17.79	17.94	17.94	17.88	17.79	17.79	19.17	18.17	18.95	17.88	17.88	18.78	17.88

WebLog: By Task



Home

By Topic

By Task

2013.1.0



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Task Summaries

Task	QA Score
1. hifa_importdata : Register measurement sets with the pipeline	1.00
2. hifa_flagdata : ALMA deterministic flagging	24.05% data flagged 0.65
3. hifa_fluxcalflag : Flag spectral features in solar system flux calibrators	1.00
4. hif_rawflagchans : Flag channels in raw data	3.76% data flagged 0.96
5. hif_refant : Select reference antennas	1.00
6. hifa_tsyscal : Calculate Tsys calibration	1.00
7. hifa_tsysflag : Flag Tsys calibration	11.69% data flagged 0.93
8. hifa_wvr calflag : Calculate and flag WVR calibration	1.41x improvement 0.71
9. hif_lowgainflag : Flag antennas with low gain	1.00
10. hif_setjy : Set calibrator model visibilities	1.00
11. hifa_bandpass : Phase-up bandpass calibration	Phase derivative 1.00
12. hifa_spwphaseup : Map narrow to wide spectral windows	1.00
13. hifa_gfluxscale : Transfer fluxscale from amplitude calibrator	Missing derived fluxes 0.75
14. hifa_timegaincal : Gain calibration	X-Y deviation 1.00
15. hif_applycal : Apply calibrations from context	5.75% data flagged 0.99
16. hif_makeimlist : Compile a list of cleaned images to be calculated	1.00
17. hif_makeimages : Calculate clean products	RMS vs. threshold 0.04
18. hif_makeimlist : Compile a list of cleaned images to be calculated	1.00

WebLog: Task Main Pages



Common Astronomy Software Applications



Home By Topic By Task

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_wvr_gainflag
- 9. hif_lowgainflag
- 10. hif_setjy
- 11. hifa_bandpass
- 12. hifa_spwphaseup
- 13. hifa_gfluxscale
- 14. hifa_timegaincal
- 15. hif_applycal
- 16. hif_makecleanlist
- 17. hif_cleanlist
- 18. hif_exportdata

7. Flag T_{sys} calibration

Back

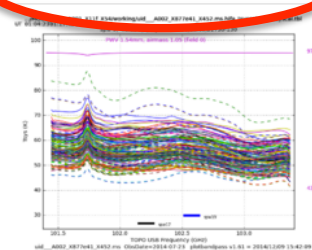
Warning! flag edgechans - uid___A002_X877e41_X452.ms iteration 1 raised 12 flagging commands

Warning! flag birdies - uid___A002_X877e41_X452.ms iteration 1 raised 2 flagging commands

T_{sys} vs frequency after flagging

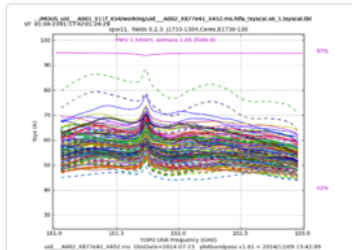
Plots of time-averaged T_{sys} vs frequency, colored by antenna.

uid___A002_X877e41_X452.ms



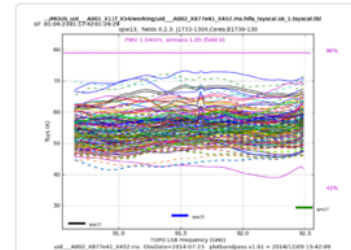
T_{sys} spw 9

Science spws 17 and 19.



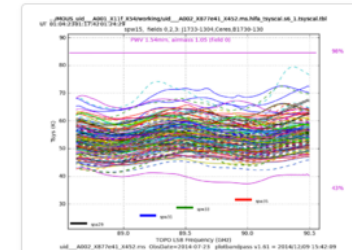
T_{sys} spw 11

Science spw 21.



T_{sys} spw 13

Science spws 23, 25 and 27.

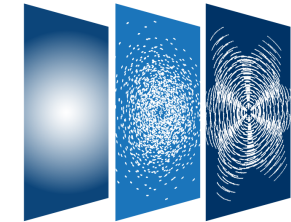


T_{sys} spw 15

Science spws 29, 31, 33 and 35.



WebLog: Task Details Pages



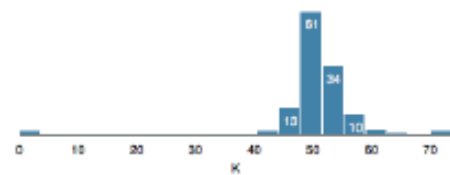
- TASKS IN EXECUTION ORDER
1. hifa_importdata
 2. hifa_flagdata
 3. hifa_fluxcallflag
 4. hif_rawflagchans
 5. hif_refant
 6. hifa_tsyscal
 7. hifa_tsysflag ⚠
 8. hifa_wvrqcallflag ⚠
 9. hif_lowgainflag
 10. hif_selfy
 11. hifa_bandpass
 12. hifa_spwphaseup -
 13. hifa_gfluxscale
 14. hifa_timegaincal -
 15. hif_applycal
 16. hif_makecleanlist
 17. hif_cleanlist
 18. hif_exportdata

T_{sys} plots for uid__A002_X877e41_X452.ms

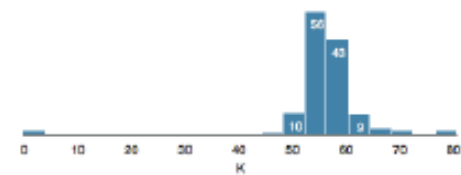
[Back](#)

Clip histogram range to match data

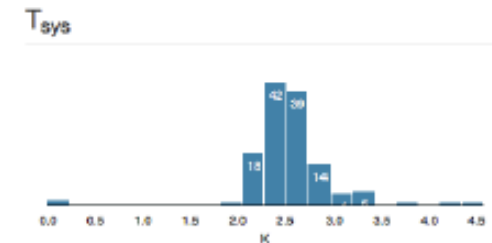
Average of Median T_{sys} over time



Maximum of Median T_{sys} over time

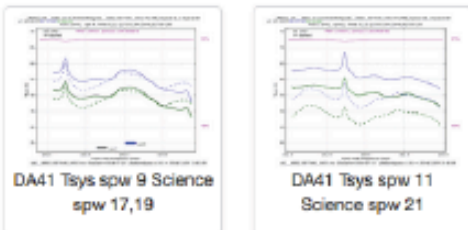


RMS deviation from Average Median



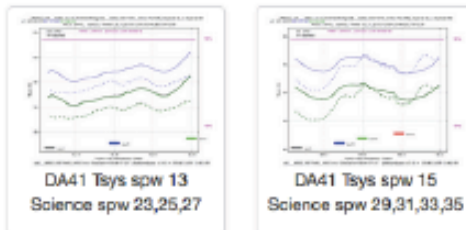
Tsys Spectral Window Filter

Show all spectral windows



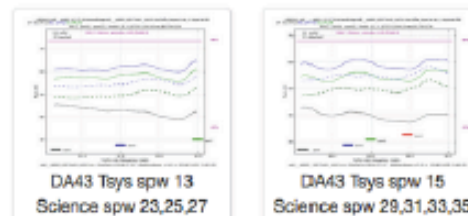
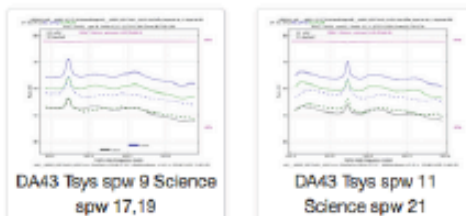
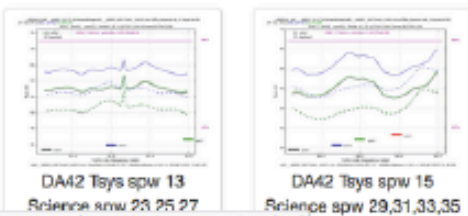
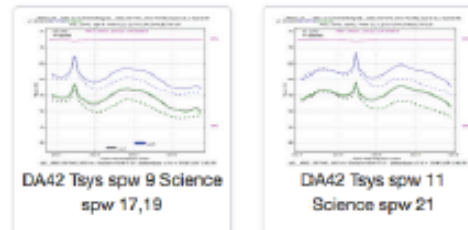
Science Spectral Window Filter

Show all spectral windows



Antenna Filter

Show all antennas



WebLog: Filtering



TASKS IN EXECUTION ORDER

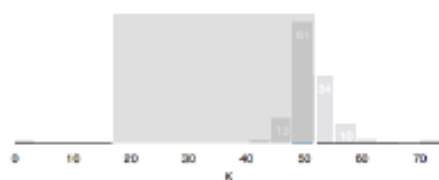
- 1. hifa_importdata
- 2. hifa_flagdata
- 3. hifa_fluxcallflag
- 4. hif_rawflagchans
- 5. hif_refant
- 6. hifa_tsyscal
- 7. hifa_tsysflag** ⚠
- 8. hifa_wvrgcalflag ⚠
- 9. hif_lowgainflag
- 10. hif_setj
- 11. hifa_bandpass
- 12. hifa_spwphaseup
- 13. hifa_gfluxscale
- 14. hifa_timegaincal
- 15. hif_applycal
- 16. hif_makecleanlist
- 17. hif_cleanlist
- 18. hif_exportdata

T_{sys} plots for uid__A002_X877e41_X452.ms

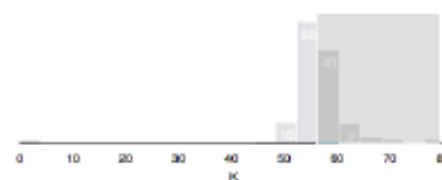
Back

Clip histogram range to match data

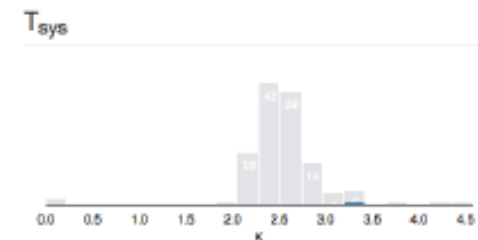
Average of Median T_{sys} over time



Maximum of Median T_{sys} over time

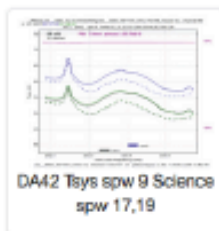


RMS deviation from Average Median



Tsys Spectral Window Filter

Show all spectral windows



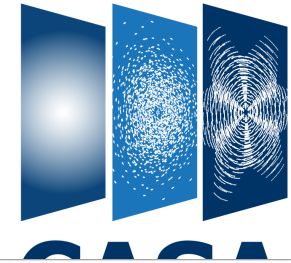
Science Spectral Window Filter

× 17,19

Antenna Filter

× DA42

WebLog: Calibrated Data



ALMA

Home By Topic By Task

TASKS IN E

1. hifa_importdata
2. hifa_flagdata
3. hifa_fluxcalflag
4. hif_rawflagchans
5. hif_refant
6. hifa_tsyscal
7. hifa_tsysflag
8. hifa_wvrgcalflag
9. hif_lowgainflag
10. hif_setjy
11. hifa_bandpass
12. hif_bpflagchans
13. hifa_spwphaseup
14. hifa_gfluxscale
15. hifa_timegaincal
- 16. hif_applycal**
17. hif_makecleanlist
18. hif_cleanlist
19. hif_exportdata

Calibrated amplitude vs time

Plots of calibrated amplitude vs time for all fields, antennas and correlations. Data are coloured by field.

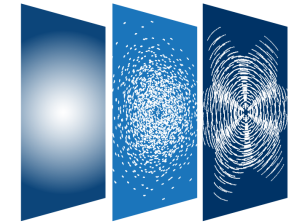
uid__A002_X9d4710_X2c5f.ms

Spectral Window 16 **Spectral Window 18** **Spectral Window 20** **Spectral Window 22**

uid__A002_X9d355b_X15e1.ms

Spectral Window 16 **Spectral Window 18** **Spectral Window 20** **Spectral Window 22**

WebLog: Calibrator Images



AL
Astronomy
ations

- 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_wvrgcalflag
 - 9. hif_lowgainflag
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 - 15. hifa_timegaincal
 - 16. hif_applycal
 - 17. hif_makecleanlist
 - 18. hif_cleanlist**
 - 19. hif_exportdata

field	spw	pol	image details	image result												
J1337-1257 (BANDPASS)	16	I	<table border="1"><tr><td>frequency</td><td>137.9893GHz</td></tr><tr><td>beam</td><td>10.70x8.26arcsec</td></tr><tr><td>beam p.a.</td><td>60.4deg</td></tr><tr><td>image maximum</td><td>4.50e+00 Jy/beam</td></tr><tr><td>residual rms</td><td>5.28e-04 Jy/beam</td></tr><tr><td>channels</td><td>1 x 1937.44MHz</td></tr></table> <p>image file uid__A001_X12f_X2e2.s17_0.J1337_1257_bp.spw16.l.iter1.image</p>	frequency	137.9893GHz	beam	10.70x8.26arcsec	beam p.a.	60.4deg	image maximum	4.50e+00 Jy/beam	residual rms	5.28e-04 Jy/beam	channels	1 x 1937.44MHz	
frequency	137.9893GHz															
beam	10.70x8.26arcsec															
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residual rms	5.28e-04 Jy/beam															
channels	1 x 1937.44MHz															
J1337-1257 (BANDPASS)	18	I	<table border="1"><tr><td>frequency</td><td>139.9267GHz</td></tr><tr><td>beam</td><td>10.62x8.00arcsec</td></tr><tr><td>beam p.a.</td><td>61.2deg</td></tr><tr><td>image maximum</td><td>4.49e+00 Jy/beam</td></tr><tr><td>residual rms</td><td>5.43e-04 Jy/beam</td></tr><tr><td>channels</td><td>1 x 1937.44MHz</td></tr></table> <p>image file uid__A001_X12f_X2e2.s17_0.J1337_1257_bp.spw18.l.iter1.image</p>	frequency	139.9267GHz	beam	10.62x8.00arcsec	beam p.a.	61.2deg	image maximum	4.49e+00 Jy/beam	residual rms	5.43e-04 Jy/beam	channels	1 x 1937.44MHz	
frequency	139.9267GHz															
beam	10.62x8.00arcsec															
beam p.a.	61.2deg															
image maximum	4.49e+00 Jy/beam															
residual rms	5.43e-04 Jy/beam															
channels	1 x 1937.44MHz															
J1337-1257 (BANDPASS)	20	I	<table border="1"><tr><td>frequency</td><td>149.9888GHz</td></tr><tr><td>beam</td><td>9.87x7.48arcsec</td></tr><tr><td>beam p.a.</td><td>61.3deg</td></tr><tr><td>image maximum</td><td>4.41e+00 Jy/beam</td></tr><tr><td>residual rms</td><td>6.18e-04 Jy/beam</td></tr><tr><td>channels</td><td>1 x 1937.44MHz</td></tr></table> <p>image file</p>	frequency	149.9888GHz	beam	9.87x7.48arcsec	beam p.a.	61.3deg	image maximum	4.41e+00 Jy/beam	residual rms	6.18e-04 Jy/beam	channels	1 x 1937.44MHz	
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channels	1 x 1937.44MHz															

ALMA Pipeline

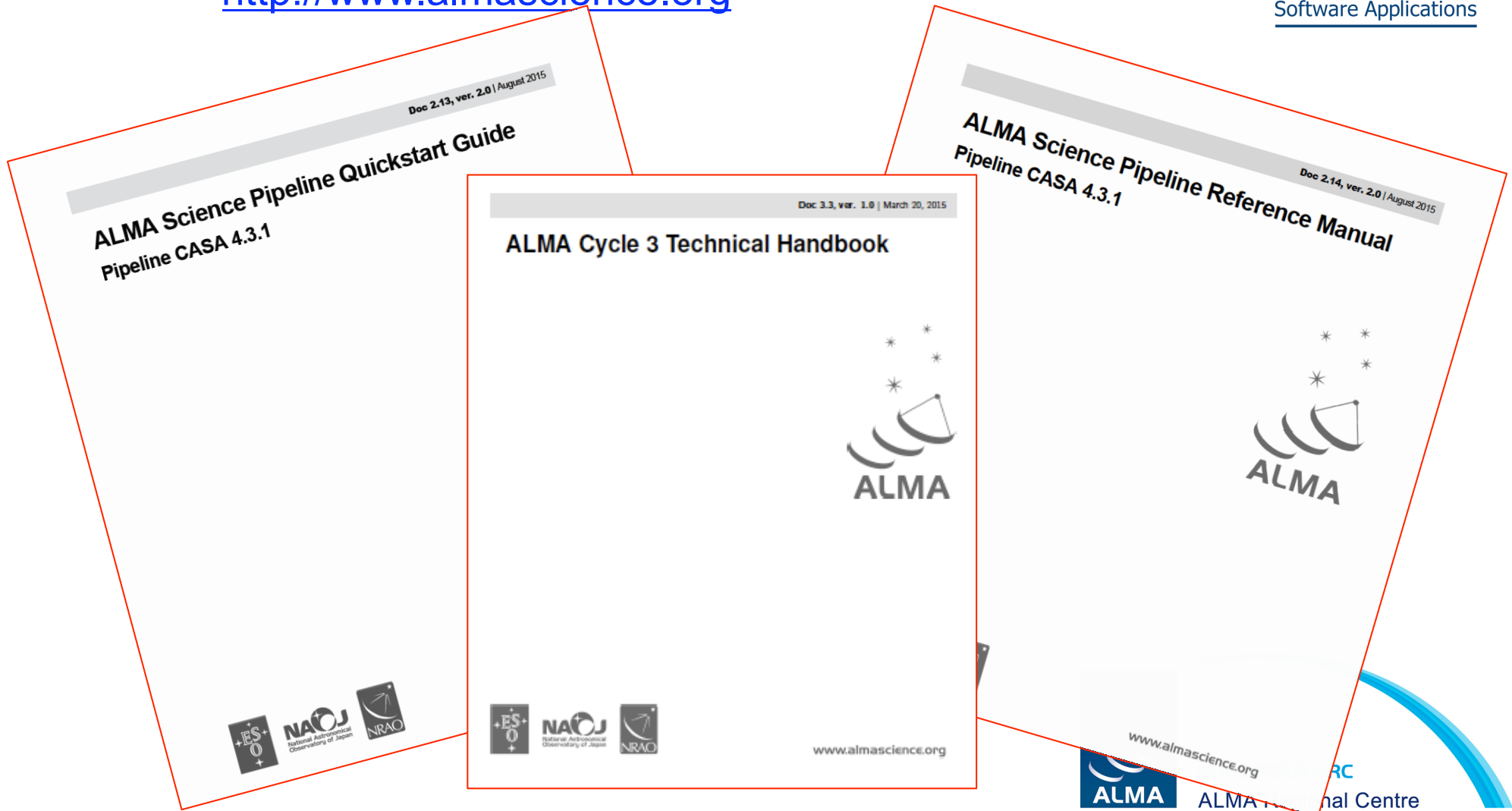


- Pipeline CASA 4.5 commissioned for at least:
 - 12m array calibration (\leq Band 7)
 - 7m array calibration (\leq Band 7)
 - Single-dish end-to-end processing
- ALMA Data Deliveries
 - (1) Keep the same calibration as Observatory
 - Use scriptForPI.py to apply calibration tables (Faster and recommended!)
 - (2) Alter the calibration
 - Use casapipescript.py (Slower)



ALMA Pipeline Information

- Available from the ALMA Science Portal
 - <http://www.almascience.org>



VLA Pipeline Information



- Available from
 - <https://science.nrao.edu/facilities/vla/data-processing/pipeline>
 - https://science.nrao.edu/science/meetings/2014/vla-data-reduction/Pipeline_DRwksHP.pdf

The VLA Calibration Pipeline

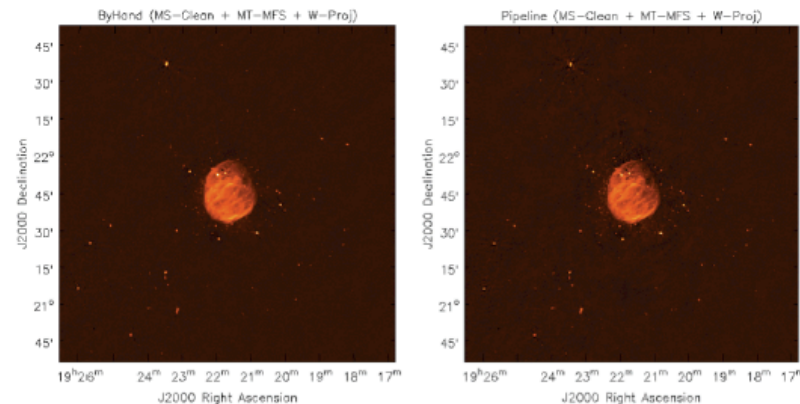
Data Reduction Workshop, October 2014



Claire Chandler

Atacama Large Millimeter/submillimeter Array
Expanded Very Long Baseline Array
Robert C. Byrd Green Bank Telescope
Very Long Baseline Array

Imaging comparison



Left: L-band image of G55.7+3.4 produced from data flagged and calibrated by hand; the rms noise is 11.5 μ Jy/beam. Right: an image made from data flagged and calibrated by the VLA calibration pipeline; the rms noise is 12.2 μ Jy/beam. Differences in the source structure and/or source flux density are dominated by the uncertainty in the deconvolution process, not the calibration and flagging (images provided by Urvashi Rao).



EUROPEAN ARC
ALMA Regional Centre