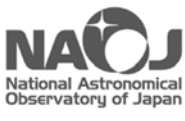
ALMA Science Pipeline Reference Manual: CASA 4.7.0

Interferometric and Single-Dish Data



www.almascience.org

ALMA, an international astronomy facility, is a partnership of ESO (representing its member states), NSF (USA) and NINS (Japan), together with NRC (Canada), NSC and ASIAA (Taiwan), and KASI (Republic of Korea), in cooperation with the Republic of Chile. The Joint ALMA Observatory is operated by ESO, AUI/NRAO and NAOJ.

User Support:

For further information or to comment on this document, please contact your regional Helpdesk through the ALMA User Portal at **www.almascience.org**. Helpdesk tickets will be directed to the appropriate ALMA Regional Center at ESO, NAOJ or NRAO.

Revision History:

Version	Date	Editors
3.14v1.0 CASA 4.5.1	January 2016	Pipeline Team
4.14v1.0 CASA 4.7.0	October 2016	Pipeline Team

In publications, please refer to this document as:
ALMA Pipeline Team, 2016, ALMA Science Pipeline Reference Manual CASA 4.7.0, ALMA Doc 4.14v1.0

Table of Contents

1 Purpose and Scope

The purpose of this document is to describe the tasks available for the calibration and imaging of interferometry datasets using the ALMA Science Pipeline.

2 Pipeline Task Types

There are 4 types of Pipeline tasks. This document provides descriptions of the task types: h_, hif_, hifa_ and hsd_.

Table 1: Pipeline Task Types

Task pre-fix	Task type	Description
h_	Common tasks	Pipeline tasks used in the calibration and imaging of both interferometry and single-dish datasets
hif_	Interferometry common tasks	Pipeline tasks used in the calibration and imaging of both ALMA and EVLA interferometry datasets
hifa_	Interferometry ALMA tasks	Pipeline tasks used in the calibration and imaging of ALMA interferometry datasets only
hsd_	Single-dish tasks	Pipeline tasks used in the calibration and imaging of single-dish datasets only

3 Pipeline Context

The Pipeline state is stored in its context e.g. which calibration tables need to be used at each stage. Several Pipeline tasks are associated with initialising and editing (rarely needed) the context.

4 Pipeline Task List

Commissioned tasks are those used in the current ALMA standard recipes (casa_pipescript.py and casa_piperestorescript.py). Tasks which do not form part of the standard recipes are currently experimental. To assess which tasks were used in the processing of an ALMA dataset, please see the casa_pipescript.py and casa_piperestorescript.py included in ALMA deliveries for Pipeline-processed data.

Table 2: Common Tasks

	Task Name	Description
1	h_init	Initialise the interferometry pipeline
2	h_resume	Restore a save pipeline state from disk
3	h_save	Save the pipeline state to disk
4	h_weblog	Open the pipeline weblog in a browser

Table 3: Interferometry Common Tasks

	Task Name	Description
1	hif_antpos	Derive an antenna position calibration table
2	hif_applycal	Apply the calibration(s) to the data
3	hif_atmflag	Flag channels with bad atmospheric transmission
4	hif_bandpass	Compute bandpass calibration solutions
5	hif_bpflagchans	Flag deviant channels in bandpass calibration
6	hif_cleanlist	Compute clean map
7	hif_clean	Compute clean map
8	hif_export_calstate	Save the pipeline calibration state to disk
9	hif_exportdata	Prepare interferometry data for export
10	hif_findcont	Find continuum frequency ranges
11	hif_gaincal	Determine temporal gains from calibrator observations
12	hif_gainflag	Flag antennas with deviant gain
13	hif_import_calstate	Import a calibration state from disk
14	hif_importdata	Imports data into the interferometry pipeline
15	hif_lowgainflag	Flag antennas with low or high gain
16	hif_makecleanlist	Compute list of clean images to be produced
17	hif_makeimages	Compute clean map
18	hif_makeimlist	Compute list of clean images to be produced
19	hif_mstransform	
20	hif_normflux	Average calibrator fluxes across measurement sets
21	hif_rawflagchans	Flag deviant channels in raw data
22	hif_refant	Select the best reference antennas
23	hif_restoredata	Restore flagged and calibration interferometry data from a pipeline run
24	hif_setjy	Fill the model column with calibrated visibilities
25	hif_setmodels	Set calibrator source models
26	hif_show_calstate	Show the current pipeline calibration state
27	hif_tclean	Compute clean map
28	hif_uvcontfit	Fit the continuum in the UV plane
29	hif_uvcontsub	Subtract the fitted continuum from the data

Table 4: Interferometry ALMA Tasks

	Task Name	Description
1	hifa_antpos	Derive an antenna position table
2	hifa_bandpass	Compute bandpass calibration solutions
3	hifa_bpsolint	Compute optimal bandpass calibration solution intervals
4	hifa_flagdata	Do basic flagging of a list of measurement sets
5	hifa_flagtargets	Do science target flagging
6	hifa_fluxcalflag	Locate line regions in solar system flux calibrator spws
7	hifa_fluxdb	Connect to flux calibrator database
8	hifa_gaincalsnr	Compute gaincal signal to noise ratios per spw
9	hifa_gfluxscale	Derive flux density scales from standard calibrators
10	hifa_importdata	Imports data into the interferometry pipeline
11	hifa_linpolcal	Compute polarization calibration
12	hifa_spwphaseup	Compute wide to narrow spectral window mapping and per spectral window phase offsets
13	hifa_timegaincal	Determine temporal gains from calibrator observations
14	hifa_tsyscal	Derive a Tsys calibration table
15	hifa_tsysflag	Flag deviant system temperature measurements
16	hifa_wvrgcalflag	Calculate WVR corrections
17	hifa_wvrgcal	Compute the WVR calibration

Table 5: Single-Dish Tasks

	Task Name	Description
1	hsd_applycal	Apply calibration tables to the science target data
2	hsd_baseline	Detect and validate spectral lines, subtract a spectral baseline by masking detected lines
3	hsd_blflag	Flag spectra based on the pre-defined criteria of the single dish pipeline
4	hsd_exportdata	Export the data products into the product directory
5	hsd_flagdata	Perform a-priori flagging of a list of measurement sets (MS)
6	hsd_imaging	Apply flag tables to the data, convert Scantables to MS format, apply the K-to-Jy factor and perform imaging
7	hsd_importdata	Import data into the single dish pipeline
8	hsd_k2jycal	Derive Kelvin to Jansky calibration tables
9	hsd_skycal	Calibrate data

5 Common Task Descriptions

5.1 h_init

h_init must be called before any other interferometry pipeline task. The pipeline can be initialised in one of two ways: by creating a new pipeline state (h_init) or be loading a saved pipeline state (h_resume). h_init creates an empty pipeline context but does not load visiblity data into the context. hif_importdata or hsd_importdata can be used to load data.

Task Description

Initialise the interferometry pipeline
The h_init task initialises the interferometry pipeline.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context fined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in'interactive mode' or 'getinputs' modes

loglevel -- Pipeline log level threshold: (debug|info|warning|error|critical). Log messages below this threshold will not be displayed.
default: 'info'

plotlevel -- Pipeline plot level threshold: (all|default|summary). Toggle generation of detail plots in the web log. A level of 'all' generates all plots; 'summary' omits detail plots; 'default' generates all plots apart from for the hif_applycal task.
default: 'default'

output_dir -- Working directory for pipeline processing. Some pipeline processing products such as HTML logs and images will be directed to subdirectories of this path.
default: './' (current directory)
weblog -- Toggle web log generation.
overwrite -- Overwrite existing MSs on input.

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Create the pipeline context
h_init()

Parameter List

Table 6: h_init default settings

Parameter	Type	Default	Description
pipelinemode	string	automatic	The pipeline operating mode
loglevel	string	info	Log level for pipeline messages
plotlevel	string	default	Level for pipeline plots
output_dir	string	./	The output working directory
weblog	bool	True	Generate the web log
overwrite	bool	True	Overwrite existing files on import
dryrun	bool	False	Run the task (False) or display the task command (True)
acceptresults	bool	True	Add the results into the pipeline context

5.2 h_resume

h_resume restores a named pipeline state from disk allowing a suspended pipeline reduction session to be resumed.

Task Description

Restore a save pipeline state from disk
h_resume restores a name pipeline state from disk allowing a suspended pipeline reduction session to be resumed.

Keyword parameters:

filename -- Name of the saved pipeline state. Setting filename to 'last' restores the most recently saved pipeline state whose name begins with 'context*'.
default: 'last'
example: filename='context.s3.2012-02-13T10:49:11'
filename='last'

Examples

1. Resume the last saved session
h_resume()

2. Resume the named saved session
h_resume(filename='context.s3.2012-02-13T10:49:11')

Parameter List

Table 7: h_resume default settings

Parameter	Type	Default	Description
filename	string	last	Filename of saved state to be restored

5.3 h_save

h_save saves the current pipeline state to disk under a unique name. If no name is supplied one is generated automatically from a combination of the rootname 'context', the current stage number, and a timestamp.

Task Description

Save the pipeline state to disk
h_save saves the current pipeline state to disk under a unique name.

Keyword arguments:

filename -- Name of the saved pipeline state. If filename is '' then a unique name will be generated computed from the root 'context', the current stage number, and the timestamp.
default: ''

Examples

1. Save the current state in the default file
h_save()

2. Save the current state to a user named file
h_save(filename='savestate_1')

Parameter List

Table 8: h_save default settings

Parameter	Type	Default	Description
filename	string	None	Name for saved state

5.4 h_weblog

Task Description

Open the pipeline weblog in a browser

Parameter List

No parameters

6 Interferometry Common Task Descriptions

6.1 hif_antpos

The hif_antpos task corrects the antenna positions recorded in the ASDMs using updated antenna position calibration information determined after the observation was taken. Corrections can be input by hand, read from a file on disk, or in future by querying an ALMA database service. The corrections are used to generate a calibration table which is recorded in the pipeline context and applied to the raw visibility data, on the fly to generate other calibration tables, or permanently to generate calibrated visibilities for imaging.

Task Description

Derive an antenna position calibration table

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context dependent pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

hm_antpos -- Heuristics method for retrieving the antenna position corrections. The options are 'online' (not yet implemented), 'manual', and 'file'.
default: 'manual'
example: hm_antpos='file'

antenna -- The list of antennas for which the positions are to be corrected if hm_antpos is 'manual'
default: none
example 'DV05,DV07'

offsets -- The list of antenna offsets for each antenna in 'antennas'. Each offset is a set of 3 floating point numbers separated by commas, specified in the ITRF frame.
default: none
example: [0.01, 0.02, 0.03, 0.03, 0.02, 0.01]

antposfile -- The file(s) containing the antenna offsets. Used if hm_antpos is 'file'. The default file name is 'antennapos.csv'

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- List of input visibility files
default: []
example: ['ngc5921.ms']
caltable -- Name of output gain calibration tables
default: []
example: caltable=['ngc5921.gcal']

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

List if sample antennapos.csv file
ms,antenna,xoffset,yoffset,zoffset,comment
uid___A002_X30a93d_X43e.ms,DV11,0.000,0.010,0.000,"No comment"
uid___A002_X30a93d_X43e.dup.ms,DV11,0.000,-0.010,0.000,"No comment"
Issues

The hm_antpos 'online' option will be implemented when the observing system provides an antenna position determination service.

Examples

1. Correct the position of antenna 5 for all the visibility files in a single pipeline run.
hif_antpos (antenna='DV05', offsets=[0.01, 0.02, 0.03])

2. Correct the position of antennas for all the visibility files in a single pipeline run using antenna positions files on disk. These files are assumed to conform to a default naming scheme if 'antposfile' is unspecified by the user.
hif_antpos (hm_antpos='myantposfile.csv')

Parameter List

Table 9: hif_antpos default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
caltable	stringArray	None	List of output caltable(s)
hm_antpos	string	manual	The antenna position determination method

antenna	string	None	List of antennas to be corrected
offsets	doubleArray	None	List of position corrections one set per antenna
antposfile	string	None	File containing antenna position corrections
pipelinemode	string	automatic	The pipeline operation mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically accept results into context

6.2 hif_applycal

hif_applycal applies the precomputed calibration tables stored in the pipeline context to the set of visibility files using predetermined field and spectral window maps and default values for the interpolation schemes.
Users can interact with the pipeline calibration state using the tasks
hif_export_calstate and hif_import_calstate.

Task Description

Apply the calibration(s) to the data
Apply precomputed calibrations to the data.

---- pipeline parameter arguments which can be set in any pipeline mode

applymode -- Calibration apply mode
''='calflagstrict': calibrate data and apply flags from solutions using the strict flagging convention
'trial': report on flags from solutions, dataset entirely unchanged
'flagonly': apply flags from solutions only, data not calibrated
'calonly': calibrate data only, flags from solutions NOT applied
'calflagstrict':
'flagonlystrict':same as above except flag spws for which calibration is unavailable in one or more tables (instead of allowing them to pass uncalibrated and unflagged)
default: ''

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets in the pipeline context.
default: []
example: ['X227.ms']

field -- A string containing the list of field names or field ids to which the calibration will be applied.

Defaults to all fields in the pipeline context.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a the list of intents against which the selected fields will be matched. Defaults to all supported intents in the pipeline context.
default: ''
example: '*TARGET*'

spw -- The list of spectral windows and channels to which the calibration will be applied. Defaults to all science windows in the pipeline context.
default: ''
example: '17', '11, 15'

antenna -- The list of antennas to which the calibration will be applied. Defaults to all antennas. Not currently supported.

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Issues

There is some discussion about the appropriate values of calwt. Given properly scaled data, the correct value should be the CASA default of True. However at the current time ALMA is suggesting that calwt be set to True for applying observatory calibrations, e.g. antenna postions, WVR, and system temperature corrections, and to False for applying instrument calibrations, e.g. bandpass, gain, and flux.

Examples

1. Apply the calibration to the target data
hif_applycal (intent='TARGET')

Parameter List

Table 10: hif_applycal default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets

field	string	None	Set of data selection field names or ids
intent	string	None	Set of data selection observing intents
spw	string	None	Set of data selection spectral window/channels
antenna	string	None	Set of data selection antenna ids
applymode	string	None	Calibration mode: "="calflagstrict", "calflag", "calflagstrict", "trial", "flagonly", "flagonlystrict", or "calonly"
calwt	boolArray	True	Calibrate the weights as well as the data
flagbackup	bool	True	Backup the flags before the apply
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run task (False) or display the command(True)
acceptresults	bool	True	Automatically accept results into the context

6.3 hif_atmflag

Spectral window channels with low atmospheric transmission are identified and flagged. The flagging view comprises a transmission spectrum for each spectral window calculated using the CASA atmosphere model.
Flags are generated by running the following rules on each spectrum:
If flag_minabs = True then channels with transmission below fmin_limit are flagged.
If flag_nmedian = True then channels with transmission below fnm_limit * median transmission are flagged.
The flagging limits are set by frequency rather than by channel number. The frequency frame is the native one of the spectral windows, usually TOPO.

Task Description

Flag channels with bad atmospheric transmission hif_atmflag flags channels where the atmospheric transmission is low

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

intents -- Specifies the data intents whose channels are to be flagged if they have low atmospheric transmission. This string is inserted into the flagcmd given to the flagdata task applying the flags; it must have a valid flagcmd format.
default '*AMP*,*BANDPASS*,*PHASE*'

flag_minabs -- True to flag channels with transmission < fmin_limit.
default False

fmin_limit -- The atmospheric transmission below which channels are to be flagged if flag_minabs is True.
default 0.1

flag_nmedian -- True to flag channels with transmission < fnm_limit * median transmission.
default: False

fnm_limit -- Flag channels with transmission < fnm_limit * median transmission, if flag_nmedian is True.
default: 0.5

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- List of input measurement sets
default: [] - Use the measurement sets currently stored in the pipeline context.
example: vis=['X132.ms']

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- This parameter has no effect. The Tsyscal file is already in the pipeline context and is flagged in situ.

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Flag channels with transmission below 0.1 in each SpW.
hif_atmflag()
equivalent to:
hif_atmflag(flag_minabs=True, fmin_limit=0.1)

2. Flag channels with transmission below 0.4 * median transmission across the spectral window.
hif_atmflag(flag_nmedian=True, fnm_limit=0.4)

Parameter List

Table 11: hif_atmflag default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets

intent	string	*AMP*, *BANDPASS*, *PHASE*	Data intents to which flags are to be applied
flag_minabs	bool	False	True to flag channels where transmission < fmin_limit
fmin_limit	double	0.1	Transmission limit below which channels are to be flagged
flag_nmedian	bool	False	True to flag channels where transmission < fnm_limit * median transmission
fnm_limit	double	0.5	If flag_nmedian then flag channels where transmission < fnm_limit * median transmission
pipelinemode	string	automatic	The pipeline operations mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically apply results to context

6.4 hif_bandpass

hif_bandpass computes a bandpass solution for every specified science spectral window. By default a 'phaseup' pre-calibration is performed and applied on the fly to to the data, before the bandpass is computed. The hif_refant task may be used to precompute a prioritized list of reference antennas.

Task Description

Compute bandpass calibration solutions.
Compute amplitude and phase as a function of frequency for each spectral window in each measurement set.
Previous calibration can be applied on the fly.

Keyword arguments:

--- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

phaseup -- Do a phaseup on the data before computing the bandpass solution
default: True

phaseupsolint -- The phase correction solution interval in CASA syntax. Used when phaseup is True.
default: 'int'
example: 300

phaseupbw -- Bandwidth to be used for phaseup. Defaults to 500MHz. Used when phaseup is

True.
default: ''
example: '' default to entire bandpass, '500MHz' use centreal 500MHz

hm_bandtype -- The type of bandpass. The options are 'channel' and 'polynomial' for CASA bandpass types = 'B' and 'BPOLY' respectively.

solint -- Time and channel solution intervals in CASA syntax.
default: 'inf,7.8125MHz'
example: 'inf,10ch', 'inf'

combine -- Data axes to combine for solving. Axes are '', 'scan','spw','field' or any comma-separated combination.
default; 'scan'
example: combine='scan,field'

minblperant -- Minimum number of baselines required per antenna for each solve Antennas with fewer baselines are excluded from solutions. Used for hm_bandtype='channel' only.
default: 4

minsnr -- Solutions below this SNR are rejected. Used for hm_bandtype= 'channel' only
default: 3.0

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the pipeline context.
default: ''
example: ['M51.ms']

caltable -- The list of output calibration tables. Defaults to the standard pipeline naming convention.
default: ''
example: ['M51.bcal']

field -- The list of field names or field ids for which bandpasses are computed. Defaults to all fields.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a comma delimited list of intents against which the the selected fields are matched. Defaults to all data with bandpass intent.
default: ''
example: '*PHASE*'

spw -- The list of spectral windows and channels for which bandpasses are computed. Defaults to all science spectral windows.
default: ''
example: '11,13,15,17'

refant -- Reference antenna names. Defaults to the value(s) stored in the pipeline context. If undefined in the pipeline context defaults to the CASA reference antenna naming scheme.
default: ''
example: refant='DV01', refant='DV06,DV07'

solnorm -- Normalise the bandpass solutions
default: False

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Issues

There is currently some discussion about whether or not to do an 'ampup' operations at the same time as the 'phaseup'. This is not required for the bandpass computation but the amplitude information may provide a useful quality assessment measure.

The specified minsnr parameter is currently applied to the bandpass solution computation but not the 'phaseup' computation. Some noisy solutions in the phaseup may not be properly rejected.

Examples

1. Compute a channel bandpass for all visibility files in the pipeline context using the CASA reference antenna determination scheme.
hif_bandpass()

2. Same as the above but precompute a prioritized reference antenna list
hif_refant()
hif_bandpass()

Parameter List

Table 12: hif_bandpass default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurment sets
caltable	stringArray	None	List of output caltables
field	string	None	Set of data selection field names or ids
intent	string	None	Set of data selection intents
spw	string	None	Set of data selection spectral window/channels

antenna	string	None	Set of data selection antenna IDs
phaseup	bool	True	Phaseup before computing the bandpass
phaseupsolint	any	int	Phaseup correction solution interval
phaseupbw	string	None	Bandwidth to use for phaseup
hm_bandtype	string	channel	Bandpass solution type
solint	any	inf	Solution intervals
combine	string	scan	Data axes which to combine for solve (scan, spw, and/or field)
refant	string	None	Reference antenna names
solnorm	bool	True	Normalise the bandpass solution
minblperant	int	4	Minimum baselines per antenna required for solve
minsnr	double	3.0	Reject solutions below this SNR
degamp	variant	None	Degree for polynomial amplitude solution
degphase	variant	None	Degree for polynomial phase solution
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

6.5 hif_bpflagchans

Task Description

Flag deviant channels in bandpass calibrated data
hif_bpflagchans flags deviant channels in the bandpass corrected data.

The flagging views used derive from a bandpass calibration of PHASE data with the current context calibrations preapplied; in a normal run these would be Tsys, wvrgcal and bandpass. The 'view bandpass' results are folded into a 2d image for each spectral window with axes 'Channel' and 'Antenna ID'.

If the PHASE calibrator has a flat spectrum and the context calibration is working properly then the view bandpass results should be flat for each spectral window.

Bad channels are flagged in the underlying datasets for all intents, not just the one forming the basis of the flagging views.

Two flagging methods are available:

If parameter flag_hilo is set True then outliers from the median of each flagging view will be flagged.

If parameter flag_tmf is set True then all channels for a particular antenna/spw will be flagged if more than a specified proportion of them are already flagged for another reason.

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

flag_hilo -- True to flag channel/antenna data further from the view median than fhl_limit * MAD.
default: True

fhl_limit -- If flag_hilo is True then flag channel/antenna data further from the view median than fhl_limit * MAD.
default: 7

fhl_minsample -- Do no flagging if the view median and MAD are derived from fewer than fhl_minsample view pixels.
default: 5

flag_tmf -- True to flag all channels for an antenna if the proportion of channels already flagged is greater than tmf_limit.
default: True

tmf_limit -- If flag_tmf is True then all channels will be flagged for an antenna if more than tmf_limit of them are already flagged.
default: 0.3

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- List of input measurement sets.
default: [] - Use the measurement sets currently known to the pipeline context.

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- This parameter has no effect. Any flags are applied to the measurement set data and the pipeline context is not modified.

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Flag birdies in the bandpass calibration for each antenna/SpW. Flag the entire calibration spectrum if more than 30 percent of channels are flagged.
hif_bpflagchans()
equivalent to:
hif_bpflagchans(flag_hilo=True, fhl_limit=7, flag_tmf=True,
tmf_limit=0.3)

Parameter List

Table 13: hif_bpflagchans default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
flag_hilo	bool	True	True to flag outlier channels
fhl_limit	double	7	Flag channels further from median than limit * MAD
fhl_minsample	double	5	Minimum number of points in sample
flag_tmf	bool	True	True to flag all channels if proportion of channels flagged > tmf_limit
tmf_limit	double	0.3	Fraction of channels flagged that triggers flagging of all channels
pipelinemode	string	automatic	The pipeline operations mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically apply results to context

6.6 hif_cleanlist

Task Description

Compute clean map
Compute a cleaned image for a particular target source/intent and spectral window.

Keyword arguments:

--- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the h_init or hif_importdata sets.
example: vis='ngc5921.ms'
vis=['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']
default: use all measurement sets in the context

weighting -- Weighting to apply to visibilities:
default='natural';
example: weighting='uniform';
Options: 'natural','uniform','briggs', 'superuniform','briggsabs','radial'

weighting_robust -- For weighting='briggs' and 'briggsabs'
default=0.0;
example: robust=0.5;
Options: -2.0 to 2.0; -2 (uniform)/+2 (natural)

weighting_noise -- For weighting='briggsabs' noise parameter to use for Briggs "abs" weighting example noise='1.0mJy'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Parameter List

Table 14: hif_cleanlist default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
target_list	any	{}	Dictionary specifying targets to be imaged; blank will read list from context
weighting	string	natural	Weighting of uv (natural, uniform, briggs, ...)
robust	double	0.0	Briggs robustness parameter
noise	any	1.0Jy	noise parameter for briggs abs mode weighting

npixels	int	1	number of pixels for superuniform or briggs weighting
hm_masking	string	None	Pipeline heuristics masking option
hm_cleaning	string	None	Pipeline cleaning mode
tlimit	double	2.0	Times the sensitivity limit for cleaning
masklimit	int	4	Times good mask pixels for cleaning
maxncleans	int	1	Maximum number of clean task calls
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

6.7 hif_clean

Task Description

Compute clean map
Compute a cleaned image for a particular target source/intent and spectral window.

Keyword arguments:

--- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets in the context.
default: ''
example: vis=['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']

imagename -- Prefix of output images. Defaults to one of the following options depending on the availability of project information.
'{ousstatus uid}.{field}.[{intent}.]s{stage number}.spw{spw}'
'multivis.{field}.[{intent}.]s{stage number}.spw{spw}'
cleanboxes and thresholds to use as it goes. For each iteration the output images are:
{prename}.iter{n}.image; cleaned and restored image
{prename}.iter{n}.psf; point spread function (dirty beam)
{prename}.iter{n}.flux; relative sky sensitivity over field
{prename}.iter{n}.flux.pbcoverage; relative pb coverage over field

(only for mosaics)
{prename}.iter{n}.model; image of clean components
{prename}.iter{n}.residual; image of residuals
{prename}.iter{n}.cleanmask; image of cleanmask used
default: ''
example: 'test1'

intent -- An intent against which the selected fields are matched. Default means select all data from fields specified by 'field' paramete
default: ''
example: '', 'TARGET'

field -- Fields id(s) or name(s) to image or mosaic. Must be set.
default:
example: '3C279', 'Centaurus*'

spw -- Spectral window/channels to image. \'\' for all science data.
default: ''
example: '9', '9,11'

spwsel -- Spectral window frequency selection. \'\' for all science data.
default: ''
example: '89.1~89.5GHz'

mode -- Frequency imaging mode, 'mfs', 'frequency'. \'\' defaults to 'frequency' if intent parameter includes 'TARGET' otherwise 'mfs'.
default: ''
example: 'mfs', 'frequency'

imagermode -- Advanced imaging mode e.g. mosaic or Cotton-Schwab clean.
Derived as follows:
1. The 'field' parameter is converted into a list of field_ids for each measurement set in 'vis'.
2. If there is more than 1 field_id in the list for any measurement set then imagermode is set to 'mosaic', otherwise it will be set to 'csclean'.
default: ''

outframe -- The reference frame of the output image. The only supported option is 'LSRK'
default: ''
example: 'LSRK'

imsize -- X and Y image size in pixels). Must be even and contain factors 2,3,5,7 only.
Default derived as follows:
1. Determine 'phasecenter' value and spread of field centres around it.
2. Set size of image to cover spread of field centres plus a border of width 0.75 * beam radius (to first null).
3. Divide x and y extents by 'cell' values to arrive at the numbers of pixels required.
default: ''
example: [320,320]

cell -- X and Y cell size. Derived from maximum UV spacing. Details TBD
default ''
example: ['0.5arcsec', '0.5arcsec']

phasecenter -- Direction measure or field id for the mosaic center.
Default derived as follows:
1. Make an array containing all the field centers to be imaged together.
2. Derive the mean direction from the directions array.
default: \'\'
example: 2

nchan -- Number of channels or planes in the output image, -1 for all
default: -1
example: 128

width -- Width of spectral dimension in frequency, \'\' for default.
default: \'\'
example: '7.8125MHz'

weighting -- Weighting to apply to visibilities. Options are: 'natural', 'uniform','briggs', 'superuniform','briggsabs','radial'
default='natural'
example: weighting='uniform'
robust -- Parameter for 'briggs' and 'briggsabs' weighting. Ranges from -2.0 to 2.0. -2 for uniform +2 for natural.
default=0.0
example: 0.5

noise -- Parameter for 'briggsabs' weighting
default: '1.0Jy'
example: '0.5Jy'

npixels -- Parameter for 'briggs' and 'briggsabs; weighting
default: 1
example: 1

restoringbeam -- Gaussina sestoring beam for clean, \'\' for default
default: \'\'
example:

hm_masking -- Clean masking mode. Options are 'none', 'centralquarter' 'psf', 'psfiter' and 'manual'
default: 'centralquarter'
example: 'manual'

mask -- Image mask for hm_masking manual mode. User responsible for matching image sizes, coordinates, etc.
default: \'\'
example: 'mymask.mask'

niter -- Maximum number of iterations per clean call
default: 500
example: 100

threshold -- Threshold for cleaning
default: '0.0'

example: '0.05'

maxncleans -- Maximum number of clean calls
default: 1
example: 10

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

Make an 'mfs' image of calibrator 3c279 using data in spectral window 1. The cell size is set to 0.2 arcsec in RA and Dec. Other clean parameters are derived from heuristics:
hif_clean(field='3c279', cell='0.2arcsec', spw='1', mode='mfs')

Make a cube of calibrator 3c279 using data in spectral window 1. The cube planes will be evenly spaced in frequency in the LSRK frame. Other clean parameters are derived from heuristics.
hif_clean(field='3c279', cell='0.2arcsec', spw='1', mode='frequency', outframe='LSRK')

Parameter List

Table 15: hif_clean default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets, \'\' for default
imagename	string	None	Prefix for image filenames, \'\' for default
intent	string	None	Set of data selection intents, \'\' for all
field	string	None	Set of data selection field names or ids
spw	string	None	Set of data selection spectral window/channels \'\' for all
spwsel	string	None	Set of spw frequency selections \'\' for all
uvrange	any	None	Set of uv ranges, \'\' for all
mode	string	None	Spectral gridding type (mfs, frequency, \'\' for default)
imagermode	string	None	Imaging mode (csclean, mosaic, \'\' for default)

outframe	string	None	velocity frame of output image (LSRK, \'\' for default)
imsize	intArray	None	X and Y image size in pixels, single value same for both, \'\' for default
cell	stringArray	None	X and Y cell size(s), single value same for both, \'\' for default
phasecenter	any	None	Image center (direction or field index), \'\' for default
nchan	int	-1	Number of channels or planes in output image, -1 = all
start	any	None	Start of output spectral dimension
width	any	None	Width of output spectral channels, \'\' for default
weighting	string	natural	Type of weighting
robust	double	0.0	Briggs weighting robustness parameter
noise	any	1.0Jy	Briggs weighting noise parameter
npixels	int	1	Weighting algorithm parameter
restoringbeam	stringArray	None	Gaussian restoring beam, \'\' for default
hm_masking	string	none	Pipeline heuristics masking option
hm_cleaning	string	manual	Pipeline clean control heuristics
mask	any	None	User mask, \'\' for whole image
niter	int	500	Maximum number of clean iterations
threshold	double	0.0	Flux level to stop cleaning, must include units: \'1.0mJy\'
tlimit	double	2.0	Times the sensitivity limit for cleaning
masklimit	int	4	Times good mask pixels for cleaning
maxncleans	int	1	Maximum number of clean task calls
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

6.8 hif_export_calstate

hif_export_calstate saves the current pipeline calibration state to disk in the form of a set of equivalent applycal calls. If filename is not given, hif_export_calstate saves the calibration state to disk with a filename based on the pipeline context creation time, using the extension '.calstate'. One of two calibration states can be exported: either the active calibration state (those calibrations currently applied on-the-fly but scheduled for permanent application to the measurement set in a subsequent hif_applycal call) or the applied calibration state (calibrations that were previously

applied to the measurement set using hif_applycal). The default is to export the active calibration state.

Task Description

Save the pipeline calibration state to disk
hif_export_calstate saves the current pipeline calibration state to disk in the form of a set of equivalent applycal calls.

Keyword arguments:

filename -- Name for the saved calibration state.
state -- calibration state to export

Issues

If run several times in one pipeline session does the automatic export file naming scheme, overwrite previous versions?

Examples

1. Save the calibration state.
hif_export_calstate()

2. Save the active calibration state with a custom filename
hif_export_calstate(filename='afterbandpass.calstate')

3. Save the applied calibration state with a custom filename
hif_export_calstate(filename='applied.calstate', state='applied')

Parameter List

Table 16: hif_export_calstate default settings

Parameter	Type	Default	Description
filename	string	None	Name for saved calibration state
state	string	active	The calibration state to export

6.9 hif_exportdata

The hif_exportdata task exports the data defined in the pipeline context and exports it to the data products directory, converting and or packing it as necessary. The current version of the task exports the following products

- o an XML file containing the pipeline processing request
- o a tar file per ASDM / MS containing the final flags version
- o a text file per ASDM / MS containing the final calibration apply list
- o a FITS image for each selected calibrator source image
- o a FITS image for each selected science target source image

- o a tar file per session containing the caltables for that session
- o a tar file containing the file web log
- o a text file containing the final list of CASA commands

Task Description

Prepare interferometry data for export

The hif_exportdata task exports the data defined in the pipeline context and exports it to the data products directory, converting and or packing it as necessary.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode'

vis -- List of visibility data files for which flagging and calibration information will be exported. Defaults to the list maintained in the pipeline context.
default: []
example: vis=['X227.ms', 'X228.ms']

session -- List of sessions one per visibility file. Currently defaults to a single virtual session containing al the visibility files in vis. In future will default to set of observing sessions defined in the context.
default: []
example: session=['session1', 'session2']

pprfile -- Name of the pipeline processing request to be exported. Defaults to a file matching the template 'PPR_*.xml'.
default: []
example: pprfile=['PPR_GRB021004.xml']

calintents -- List of calibrator image types to be exported. Defaults to all standard calibrator intents 'BANDPASS', 'PHASE', 'FLUX'
default: ''
example: calintents='PHASE'

calimages -- List of calibrator images to be exported. Defaults to all calibrator images recorded in the pipeline context.
default: []
example: calimages=['3C454.3.bandpass', '3C279.phase']

targetimages -- List of science target images to be exported. Defaults to all science target images recorded in the pipeline context.
default: []

example: targetimages=['NGC3256.band3', 'NGC3256.band6']

products_dir -- Name of the data products subdirectory. Defaults to './'
default: ''
example: products_dir='../products'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Issues

Support for merging the calibration state information into the pipeline context / results structure and retrieving it still needs to be added.

Support for merging the clean results into the pipeline context / results structure and retrieving it still needs to be added.

Support for creating the final pipeline results entity still needs to be added.

Session information is not currently handled by the pipeline context. By default all ASDMs are combined into one session.

Examples

1. Export the pipeline results for a single sessions to the data products directory
!mkdir ../products
hif_exportdata (products_dir='../products')

2. Export the pipeline results to the data products directory specify that only the gain calibrator images be saved.
!mkdir ../products
hif_exportdata (products_dir='../products', calintents='*PHASE*')

Parameter List

Table 17: hif_exportdata default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input visibility data

session	stringArray	None	List of sessions one per visibility file
pprfile	string	None	The pipeline processing request file to be exported
calintents	string	None	The calibrater source target intents to be exported
calimages	stringArray	None	List of calibrator images to be exported
targetimages	stringArray	None	List of target images to be exported
products_dir	string	None	The data products directory
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display task command (True)
acceptresults	bool	True	Add the results into the pipeline context

6.10 hif_findcont

Task Description

Find continuum frequency ranges
Compute continuum ranges for all sources and spectral windows.

Keyword arguments:

--- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the h_init or hif_importdata sets.
example: vis='ngc5921.ms'
vis=['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']
default: use all measurement sets in the context

parallel -- use multiple CPU nodes to compute dirty images
default: \'automatic\'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Parameter List

Table 18: hif_findcont default settings

Parameter	type	default	description
vis	stringArray	None	List of input measurement sets
target_list	any	{}	Dictionary specifying targets to be imaged; blank will read list from context
parallel	string	automatic	Compute dirty images using MPI cluster
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

6.11 hif_gaincal

The complex gains are derived from the data column (raw data) divided by the model column (usually set with hif_setjy). The gains are obtained for a specified solution interval, spw combination and field combination. Good candidate reference antennas can be determined using the hif_refant task. Previous calibrations that have been stored in the pipeline context are applied on the fly. Users can interact with these calibrations via the hif_export_calstate and hif_import_calstate tasks.

Task Description

Determine temporal gains from calibrator observations
Compute the gain solutions.

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

hm_gtype -- The type of gain calibration. The options are 'gtype' and 'gspline' for CASA gain types = 'G' and 'GSPLINE' respectively.

calmode -- Type of solution, The options are 'ap' (amp and phase), 'p' (phase only) and 'a' (amp only)
default: 'ap'
options: 'p','a','ap'

solint -- Time solution intervals in CASA syntax. Works for hm_gtype='gtype' only.
default: 'inf'
example: 'inf', 'int', '100sec'

combine -- Data axes to combine for solving. Options are '','scan','spw',field' or any comma-separated combination. Works for hm_gtype='gtype' only.
default; ''
example: combine=''

minblperant -- Minimum number of baselines required per antenna for each solve Antennas with fewer baaselines are excluded from solutions. Works for hm_gtype='gtype' only.
default: 4
example: minblperant=2

minsnr -- Solutions below this SNR are rejected. Works for hm_gtype= 'channel' only
default: 3.0

splinetime -- Spline timescale (sec). Used for hm_gtype='gspline'. Typical splinetime should cover about 3 to 5 calibrator scans.
default: 3600 (1 hour)
example: splinetime=1000

npointaver -- Tune phase-unwrapping algorithm. Used for hm_gtype='gspline'
default: 3 (Keep at this value)

phasewrap -- Wrap the phase for changes larger than this amount (degrees) Used for hm_gtype='gspline'.
default: 180 (Keep at this value)

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the pipeline context.
default: ''
example: ['M82A.ms', 'M82B.ms']

caltable -- The list of output calibration tables. Defaults to the standard pipeline naming convention.
default: ''
example: ['M82.gcal', 'M82B.gcal']

field -- The list of field names or field ids for which gain solutions are to be computed. Defaults to all fields with the standard intent.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a comma delimited list of intents against which the the selected fields are matched. Defaults to *PHASE*.

default: ''
example: '', '*AMP*,*PHASE*'

spw -- The list of spectral windows and channels for which gain solutions are computed. Defaults to all science spectral windows.
default: ''
example: '3C279', '3C279, M82'

smodel -- Point source Stokes parameters for source model (experimental). Defaults to using standard MODEL_DATA column data.
default: []
example: [1,0,0,0] (I=1, unpolarized)

refant -- Reference antenna name(s) in priority order. Defaults to most recent values set in the pipeline context. If no reference antenna is defined in the pipeline context use the CASA defaults.
default: ''
example: refant='DV01', refant='DV05,DV07'

solnorm -- Normalise the gain solutions
default: False

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Issues

The 'gspline' (smooth) option is still under development in CASA.

Examples

1. Compute standard per scan gain solutions that will be used to calibrate
the target.
hif_gaincal()

Parameter List

Table 19: hif_gaincal default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets

caltable	stringArray	None	List of output caltables
field	string	None	Set of data selection field names or ids
intent	string	None	Set of data selection observing intents
spw	string	None	Set of data selection spectral window/channels
antenna	string	None	Set of data selection antenna ids
hm_gaintype	string	gtype	The gain solution type (gtype or gpsline)
calmode	string	ap	Type of solution" (ap, p, a)
solint	any	inf	Solution intervals
combine	string	None	Data axes which to combine for solve (scan, spw, and/or field)
refant	string	None	Reference antenna names
solnorm	bool	False	Normalize average solution amplitudes to 1.0
minblperant	int	4	Minimum baselines per antenna required for solve
minsnr	double	3.0	Reject solutions below this SNR
smodel	doubleArray	None	Point source Stokes parameters for source model
splinetime	double	3600.0	Spline timescale(sec)
npointaver	int	3	The phase-unwrapping algorithm
phasewrap	double	180.0	Wrap the phase for jumps greater than this value (degrees)
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run task (False) or display the command(True)
acceptresults	bool	True	Automatically accept results into the context

6.12 hif_gainflag

Deviant antennas are detected by analysis of a view showing their calibration gains. Three flagging metrics are available (mediandeviant, rmsdeviant, nrmsdeviant) and a flagging view is created for each metric that has been enabled. Each view is a list of 2D images with axes 'Time' and 'Antenna'; there is one image for each spectral window and intent. If any of the flaggingmetrics exceeds their corresponding limit (fmeddev_limit, frmsdev_limit, fnrmsdev_limit) for a given antenna in a given spw, then all data for that
antenna and for all spws within the same baseband will be flagged with a flagcmd.

The following heuristics are used for the flagging metrics:
mediandeviant:
abs(median(antenna) - median(all antennas)) / MAD(all antennas) > fmeddev_limit
rmsdeviant:

stdev(antenna) / MAD(all antennas) > frmsdev_limit
nrmsdeviant:
deviation (ant_i) = (sm(ant_i) - med_sm_allant) / sigma_sm_allant
with:
sm(ant_i) = sigma(ant_i) / median(ant_i) sigma_sm_allant = 1.4826 * mad({sm(ant_1), sm(ant_2), .., sm(ant_nants)})
med_sm_allant = median({sm(ant_1), sm(ant_2), ..., sm(ant_nants)})
where MAD is the median absolute deviation from the median.

Task Description

Flag antennas with deviant gain
hif_gainflag flags data for antennas with deviant median gains and/or high gain rms.

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

flag_mediandeviant -- True to flag antennas with deviant median gain, calculated as:
abs(median(antenna) - median(all antennas)) / MAD(all antennas) > fmeddev_limit
default False

fmeddev_limit -- Flag antennas with \'mediandeviant\' metric larger than fmeddev_limit.
default: 3.0

flag_rmsdeviant -- True to flag antennas with deviant gain rms, calculated as:
stdev(antenna) / MAD(all antennas) > frmsdev_limit
default: False

frmsdev_limit -- Flag antennas with 'rmsdeviant' metric larger than frmsdev_limit.
default: 8.0

flag_nrmsdeviant -- True to flag antennas with deviant normalised gain rms, calculated as:
deviation (ant_i) = (sm(ant_i) - med_sm_allant) / sigma_sm_allant
where:
sm(ant_i) = sigma(ant_i) / median(ant_i)
sigma_sm_allant = 1.4826 * mad({sm(ant_1), sm(ant_2), .., sm(ant_nants)})
med_sm_allant = median({sm(ant_1), sm(ant_2), ..., sm(ant_nants)})
default: True

fnrmsdev_limit -- Flag antennas with 'nrmsdeviant' metric larger than fnrmsdev_limit.
default: 6.0

metric_order -- Order in which the flagging metrics are evaluated.
default: 'mediandeviant, rmsdeviant, nrmsdeviant'

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- List of input measurement sets.
default: [] - Use the measurement sets currently known to the pipeline context.

intent -- A string containing the list of intents to be checked for antennas with deviant gains. The default is blank, which causes the task to select the 'BANDPASS' intent.
default: ''
example: '*BANDPASS*'

spw -- The list of spectral windows and channels to which the calibration will be applied. Defaults to all science windows in the pipeline context.
default: ''
example: '17', '11, 15'

refant -- A string containing a prioritized list of reference antenna name(s) to be used to produce the gain table. Defaults to the value(s) stored in the pipeline context. If undefined in the pipeline context defaults to the CASA reference antenna naming scheme.
default: ''
example: refant='DV01', refant='DV06,DV07'

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Parameter List

Table 20: hif_gainflag default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
intent	string	None	Data intent whose gains are to checked
spw	string	None	Spectral window ids whose gains are to be checked
refant	string	None	Reference antenna names
flag_mediandeviant	bool	False	True to flag antennas with deviant median gains
fmeddev_limit	double	3.0	Flag antennas with \'mediandeviant\' metric above fmeddev_limit

flag_rmsdeviant	bool	False	True to flag antennas with deviant gain rms
frmsdev_limit	double	8.0	Flag antennas with \'rmsdeviant\' metric above frmsdev_limit
flag_nrmsdeviant	bool	True	True to flag antennas with deviant normalised gain rms
fnrmsdev_limit	double	6.0	Flag antennas with \'nrmsdeviant\' metric above fnrmsdev_limit
metric_order	string	mediandeviant, rmsdeviant, nrmsdeviant	Order in which the flagging metrics are evaluated
pipelinemode	string	automatic	The pipeline operations mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically apply results to context

6.13 hif_import_calstate

hif_import calstate clears and then recreates the pipeline calibration statebased on the set of applycal calls given in the named file. The applycalstatements are interpreted in additive fashion; for identically specified
data selection targets, caltables specified in later statements will be added to the state created by earlier calls.

Task Description

Import a calibration state from disk
Import a calibration state to disk.

Keyword arguments:

filename -- Name of the saved calibration state.

Example

1. Import a calibration state from disk.
hif_import_calstate(filename='aftergaincal.calstate')

Parameter List

Table 21: hif_import_calstate default settings

Parameter	Type	Default	Description
filename	string	None	Name of the saved calibration state

6.14 hif_importdata

Task Description

Imports data into the interferometry pipeline
The hif_importdata task loads the specified visibility data into the pipeline context unpacking and / or converting it as necessary.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

vis -- List of visisbility data files. These may be ASDMs, tar files of ASDMs, MSs, or tar files of MSs, If ASDM files are specified, they will be converted to MS format.
default: []
example: vis=['X227.ms', 'asdms.tar.gz']

session -- List of sessions to which the visibility files belong. Defaults to a single session containing all the visibility files, otherwise a session must be assigned to each vis file.
default: []
example: session=['session_1', 'session_2']

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline
context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode'

asis -- ASDM tables to convert as is
default: 'Antenna Station Receiver CalAtmosphere'
example: 'Receiver', ''

process_caldevice -- Ingest the ASDM caldevice table
default: False
example: True

overwrite -- Overwrite existing MSs on output.
default: False

bdfflags -- Apply BDF flags on import
default: True

lazy -- Use the lazy import option
default: False

dbservice -- Use online flux catalog on import
default: False

createmms -- Create a multi-measurement set ('true') ready for parallel processing, or a standard measurement set ('false'). The default setting ('automatic') creates an MMS if running in a cluster environment.
default: automatic

clearcals -- Clear pipeline calibrations as needed by resetting the corrected data column to the data column and setting the model column to unity. For normal pipeline operations clearclas should be left on, and the pipeline will choose when it needs to reset the calibrations. In some reprocessing applications clearcals should be turned off.
default: True

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Load an ASDM list in the ../rawdata subdirectory into the context.
hif_importdata (vis=['../rawdata/uid___A002_X30a93d_X43e',
'../rawdata/uid_A002_x30a93d_X44e'])

2. Load an MS in the current directory into the context.
hif_importdata (vis=[uid___A002_X30a93d_X43e.ms])

3. Load a tarred ASDM in ../rawdata into the context.
hif_importdata (vis=['../rawdata/uid___A002_X30a93d_X43e.tar.gz'])

4. Check the hif_importdata inputs, then import the data
myvislist = ['uid___A002_X30a93d_X43e.ms', 'uid_A002_x30a93d_X44e.ms']
hif_importdata(vis=myvislist, pipelinemode='getinputs')
hif_importdata(vis=myvislist)

5. Load an ASDM but check the results before accepting them into the context.
results = hif_importdata (vis=['uid___A002_X30a93d_X43e.ms'], acceptresults=False)
results.accept()

6. Run in dryrun mode before running for real
results = hif_importdata (vis=['uid___A002_X30a93d_X43e.ms'], dryrun=True)
results = hif_importdata (vis=['uid___A002_X30a93d_X43e.ms'])

Parameter List

Table 22: hif_importdata default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input visibility data
session	stringArray	None	List of visibility data sessions
pipelinemode	string	automatic	The pipeline operating mode
asis	string	None	ASDM to convert as is
process_caldevice	bool	False	Import the caldevice table from the ASDM
overwrite	bool	False	Overwrite existing files on import
bdfflags	bool	True	Apply BDF flags on import
lazy	bool	False	Use the lazy import option
dbservice	bool	False	Use the online flux catalog
createmms	string	automatic	Create a MMS
clearcals	bool	True	Reinitialize pipeline calibrations as needed
dryrun	bool	False	Run the task (False) or display task command (True)
acceptresults	bool	True	Add the results into the pipeline context

6.15 hif_lowgainflag

Deviant antennas are detected by analysis of a view showing their calibration gains. This view is a list of 2D images with axes 'Time' and 'Antenna'; there is one image for each spectral window and intent. A flagcmd to flag all data for an antenna will be generated by any gain that is outside the range [fnm_lo_limit * median, fnm_hi_limit * median].

Task Description

Flag antennas with low or high gain
hif_lowgainflag flags data for antennas with unusually low or high gains.

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

flag_nmedian -- True to flag figures of merit greater than fnm_hi_limit * median or lower than

fnm_lo_limit * median.
default True

fnm_lo_limit -- Points lower than fnm_lo_limit * median are flagged.
default 0.7

fnm_hi_limit -- Points greater than fnm_hi_limit * median are flagged.
default 1.3

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- List of input measurement sets.
default: [] - Use the measurement sets currently known to the pipeline context.

intent -- A string containing the list of intents to be checked for antennas with deviant gains. The default is blank, which causes the task to select the 'BANDPASS' intent.
default: ''
example: '*BANDPASS*'

spw -- The list of spectral windows and channels to which the calibration will be applied. Defaults to all science windows in the pipeline context.
default: ''
example: '17', '11, 15'

refant -- A string containing a prioritized list of reference antenna name(s) to be used to produce the gain table. Defaults to the value(s) stored in the pipeline context. If undefined in the pipeline context defaults to the CASA reference antenna naming scheme.
default: ''
example: refant='DV01', refant='DV06,DV07'

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Parameter List

Table 23: hif_lowgainflag default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets

intent	string	None	Data intent whose gains are to checked
spw	string	None	Spectral window ids whose gains are to be checked
refant	string	None	Reference antenna names
flag_nmedian	bool	True	True to flag values outside range [fnm_lo_limit * median, fnm_hi_limit*nmedian]
fnm_lo_limit	double	0.7	Flag values lower than fnm_lo_limit * median
fnm_hi_limit	double	1.3	Flag values higher than fnm_hi_limit * median
pipelinemode	string	automatic	The pipeline operations mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically apply results to context

6.16 hif_makecleanlist

Generate a list of images to be cleaned. By default the list will include one image per science target per spw. Calibrator targets can be selected by setting appropriate values for itent. By default the output image cellsize is set to the minimum cell size consistent with the UV coverage. By default the image size in pixels is set to values determined by the cell size and the single dish beam size. If a calibrator is being imaged (intents 'PHASE', 'BANDPASS', 'FLUX' or 'AMPLITUDE') then the image dimensions are limited to 'calmaxpix' pixels.
By default science target images are cubes and calibrator target images are single channel.
Science target images may be mosaics or single fields.

Task Description

Compute list of clean images to be produced
Create a list of images to be cleaned.

Keyword Arguments

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

--- pipeline parameter arguments which can be set in any pipeline mode

mode -- Frequency specification:
default: 'mfs'
example:
mode='mfs' produce one image from all specified data
mode='frequency', channels are specified in frequency
mode='velocity', channels are specified in velocity
cell -- Cell size (x, y)

default '' Compute cell size based on the UV coverage of all the fields to be imaged.
example: ['0.5arcsec', '0.5arcsec']

imsize -- Image X and Y size in pixels. The sizes must be even and divisible by 2,3,5,7 only.
default: '' The default values are derived as follows:
1. Determine phase center and spread of field centers around it.
2. Set the size of the image to cover the spread of field centers plus a border of width 0.75 * beam radius, to first null.
3. Divide X and Y extents by cell size to arrive at the number of pixels required.
example: [120, 120]
calmaxpix -- Maximum image X or Y size in pixels if a calibrator is being
imaged ('PHASE', 'BANDPASS', 'AMPLITUDE' or 'FLUX').
default: 300
example: 300

width -- Output channel width.
default: '' Difference in frequency between first 2 selected channels. for frequency mode images.
example: '24.2kHz'

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets specified in the h_init or hif_importdata sets.
default '': use all measurement sets in the context
example: 'ngc5921.ms', ['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']

intent -- Select intents for which associated fields will be imaged.
default: 'TARGET'
example: 'PHASE,BANDPASS'

field -- Select fields to image. Use field name(s) NOT id(s). Mosaics are assumed to have common source / field names. If intent is specified only fields with data matching the intent will be selected. The fields will be selected from measurement sets in 'vis'.
default: '' Fields matching matching intent, one image per target source.
example: '3C279', 'Centaurus*', '3C279,J1427-421'

spw -- Select spectral window/channels to image.
default: '' Individual images will be computed for all science spectral windows.
example: '9'

linesfile -- Name of file with line regions to exclude for continuum images.
default: 'lines.dat'
example: 'mylines.dat'

uvrange -- Select a set of uv ranges ro image.
default: '' All uv data is included
example: '0~1000klambda', ['0~100klambda', 100~1000klambda]

phasecenter -- Direction measure or field id of the image center.
default: '' The default phase center is set to the mean of the field directions of all fields that are to be image together.
example: 0, 'J2000 19h30m00 -40d00m00'

nchan -- Total number of channels in the output image(s)
default: -1 Selects enough channels to cover the data selected by spw consistent with start and width.
example: 100

start -- First channel for frequency mode images.
default '' Starts at first input channel of the spw.
example: '22.3GHz'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Make a list of science target images to be cleaned, one image per science spw.
hif_makecleanlist()

2. Make a list of PHASE and BANDPASS calibrator targets to be imaged, one image per science spw.
hif_makecleanlist(intent='PHASE,BANDPASS')

3. Make a list of PHASE calibrator images observed in spw 1, images limited to 50 pixels on a side.
hif_makecleanlist(intent='PHASE',spw='1',calmaxpix=50)

Parameter List

Table 24: hif_makecleanlist default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
imagename	string	None	Prefix for output image names, \'\' for default.
intent	string	TARGET	Set of data selection intents
field	string	None	Set of data selection field names or ids, \'\' for all
spw	string	None	Set of data selection spectral window/channels, \'\' for all

linesfile	string	None	Name of file with line regions to exclude for continuum images.
uvrange	string	None	Set of data selection uv ranges, \'\' for all.
mode	string	None	Spectral gridding type (mfs, frequency, \'\' for default)
outframe	string	None	velocity frame of output image (LSRK, \'\' for default)
imsize	intArray	None	Image X and Y size(s) in pixels, \'\' for default. Single value same for both.
cell	stringArray	None	Image X and Y cell size(s), \'\' for default. Single value same for both
calmaxpix	int	300	Maximum X and Y size of calibrator images in pixels
phasecenter	any	None	Image center (direction or field index, \'\' for default)
nchan	int	-1	Number of channels, -1 = all
start	any	None	Channel start, \'\' for default
width	any	None	Channel width, \'\' for default.
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

6.17 hif_makeimages

Task Description

Compute clean map
Compute a cleaned image for a particular target source/intent and spectral window.

Keyword arguments:

--- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the h_init or hif_importdata sets.
example: vis='ngc5921.ms'
vis=['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']
default: use all measurement sets in the context

weighting -- Weighting to apply to visibilities:
default='briggs';
example: weighting='uniform';
options: 'natural','uniform','briggs', 'superuniform','briggsabs','radial'

weighting_robust -- For weighting='briggs' and 'briggsabs'
default=-999.0;
example: robust=0.7;
options: -2.0 to 2.0; -2 (uniform)/+2 (natural)

weighting_noise -- For weighting='briggsabs' noise parameter to use for Briggs "abs" weighting
example noise='1.0mJy'

hm_masking -- Clean masking mode. Options are 'centralregion', 'psf', 'psfiter', 'auto', 'auto-thresh', 'manual' and 'none'
default: 'centralregion'
example: 'manual'

hm_maskthreshold -- Auto-boxing mask threshold. See tclean for options.

cleancontranges -- Clean continuum frequency ranges in cubes
default=False
options: False, True

subcontms -- Subtract continuum in MS
Caveat: if enabled, repeated continuum subtraction will lead to erroneous negative fluxes.
default=False
options: False, True

parallel -- use multiple CPU nodes to clean images
default: \'automatic\'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Parameter List

Table 25: hif_makeimages default settings

Parameter	type	default	description
vis	stringArray	None	List of input measurement sets
target_list	any	{}	Dictionary specifying targets to be imaged; blank will read list from context
weighting	string	briggs	Weighting of uv (natural, uniform, briggs, ...)
robust	double	-999.0	Briggs robustness parameter
noise	any	1.0Jy	noise parameter for briggs abs mode weighting
npixels	int	0	number of pixels for superuniform or briggs weighting
hm_masking	string	centralregion	Pipeline heuristics masking option
hm_maskthreshold	string	None	Auto-boxing mask threshold
hm_cleaning	string	None	Pipeline cleaning mode
tlimit	double	4.0	Times the sensitivity limit for cleaning
masklimit	int	4	Times good mask pixels for cleaning
maxncleans	int	1	Maximum number of clean task calls
cleancontranges	bool	False	Clean continuum frequency ranges in cubes
subcontms	bool	False	Subtract continuum in MS
parallel	string	automatic	Clean images using MPI cluster
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

6.18 hif_makeimlist

Generate a list of images to be cleaned. By default the list will include one image per science target per spw. Calibrator targets can be selected by setting appropriate values for itent. By default the output image cellsize is set to the minimum cell size consistent with the UV coverage. By default the image size in pixels is set to values determined by the cell size and the single dish beam size. If a calibrator is being imaged (intents 'PHASE', 'BANDPASS', 'FLUX' or 'AMPLITUDE') then the image dimensions are limited to 'calmaxpix' pixels. By default science target images are cubes and calibrator target images are single channel. Science target images may be mosaics or single fields.

Task Description

Compute list of clean images to be produced
Create a list of images to be cleaned.

Keyword Arguments

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

--- pipeline parameter arguments which can be set in any pipeline mode

specmode -- Frequency imaging mode, 'mfs', 'cont', 'cube'. \'\' defaults to 'cube' if intent parameter includes 'TARGET' otherwise 'mfs'.
default: ''
example: 'mfs', 'cont', 'cube'
example: mode='mfs' produce one image per source and spw
mode='cont' produce one image per source and aggregate over all specified spws
mode='cube' produce an LSRK frequency cube, channels are specified in frequency

cell -- Cell size (x, y)
default '' Compute cell size based on the UV coverage of all the fields to be imaged.
example: ['0.5arcsec', '0.5arcsec']

imsize -- Image X and Y size in pixels. The sizes must be even and divisible by 2,3,5,7 only.
default: '' The default values are derived as follows:
1. Determine phase center and spread of field centers around it.
2. Set the size of the image to cover the spread of field centers plus a border of width 0.75 * beam radius, to first null.
3. Divide X and Y extents by cell size to arrive at the number ofpixels required.
example: [120, 120]

calmaxpix -- Maximum image X or Y size in pixels if a calibrator is being imaged ('PHASE', 'BANDPASS', 'AMPLITUDE' or 'FLUX').
default: 300
example: 300

width -- Output channel width.
default: '' Difference in frequency between first 2 selected channels. for frequency mode images.
example: '24.2kHz' 'pilotimage' for 15 MHz / 8 channel heuristic

nbins -- Channel binning factors per spw
default: '' Binning factors for each spw. Format: 'spw1:nb1,spw2:nb2,...' Optional wildcard: '*:nb'
example: '9:2,11:4,13:2,15:8' '*:2'

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets specified in the h_init or hif_importdata sets.
default '': use all measurement sets in the context
example: 'ngc5921.ms', ['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']

intent -- Select intents for which associated fields will be imaged.
default: 'TARGET'

example: 'PHASE,BANDPASS'

field -- Select fields to image. Use field name(s) NOT id(s). Mosaics are assumed to have common source / field names. If intent is specified only fields with data matching the intent will be selected. The fields will be selected from measurement sets in 'vis'.
default: '' Fields matching matching intent, one image per target source.
example: '3C279', 'Centaurus*', '3C279,J1427-421'

spw -- Select spectral window/channels to image.
default: '' Individual images will be computed for all science spectral windows.
example: '9'

contfile -- Name of file with frequency ranges to exclude for continuum images.
default: 'cont.dat'
example: 'mycont.dat'

linesfile -- Name of file with line frequency ranges to exclude for continuum images.
default: 'lines.dat'
example: 'mylines.dat'

uvrange -- Select a set of uv ranges ro image.
default: '' All uv data is included
example: '0~1000klambda', ['0~100klambda', 100~1000klambda]

phasecenter -- Direction measure or field id of the image center.
default: '' The default phase center is set to the mean of the field directions of all fields that are to be image together.
example: 0, 'J2000 19h30m00 -40d00m00'

nchan -- Total number of channels in the output image(s)
default: -1 Selects enough channels to cover the data selected by spw consistent with start and width.
example: 100

start -- First channel for frequency mode images.
default '' Starts at first input channel of the spw.
example: '22.3GHz'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise
the results object for the pipeline task is returned.

Examples

1. Make a list of science target images to be cleaned, one image per science spw.
hif_makeimlist()

2. Make a list of PHASE and BANDPASS calibrator targets to be imaged, one image per science spw.
hif_makeimlist(intent='PHASE,BANDPASS')

3. Make a list of PHASE calibrator images observed in spw 1, images limited to 50 pixels on a side.
hif_makeimlist(intent='PHASE',spw='1',calmaxpix=50)

Parameter List

Table 26: hif_makeimlist default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
imagename	string	None	Prefix for output image names, \'\' for default.
intent	string	TARGET	Set of data selection intents
field	string	None	Set of data selection field names or ids, \'\' for all
spw	string	None	Set of data selection spectral window/channels, \'\' for all
contfile	string	None	Name of file with frequency ranges to use for continuum images.
linesfile	string	None	Name of file with line frequency ranges to exclude for continuum images.
uvrange	string	None	Set of data selection uv ranges, \'\' for all.
specmode	string	None	Spectral gridding type (mfs, cont, cube, \'\' for default)
outframe	string	None	velocity frame of output image (LSRK, \'\' for default)
imsize	intArray	None	Image X and Y size(s) in pixels, \'\' for default. Single value same for both.
cell	stringArray	None	Image X and Y cell size(s), \'\' for default. Single value same for both
calmaxpix	int	300	Maximum X and Y size of calibrator images in pixels
phasecenter	any	None	Image center (direction or field index, \'\' for default)
nchan	int	-1	Number of channels, -1 = all
start	any	None	Channel start, \'\' for default
width	any	None	Channel width, \'\' for default.
nbins	any	None	Channel binning factors per spw, \'\' for default.

pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

6.19 hif_mstransform

Create new measurement sets for imaging from the corrected column of the input measurmenet set. By default all science target data is copied to the new ms. The new measurement set is not re-indexed to the selected data in the new ms will have the same source, field, and spw names and ids as it does in the parent ms.

Task Description

Select data from calibrated MS(s) to form new MS(s) for imaging
Create a list of science target MS(s) for imaging

Keyword Arguments

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

--- pipeline parameter arguments which can be set in any pipeline mode

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets to be transformed. Defaults to the list of measurement sets specified in the pipeine import data task.
default '': Transform all calibration measurement sets in the context.
example: 'ngc5921.ms', ['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']

outputvis -- The list of output transformed measurement sets to be used for imaging. The output list must be the same length as the input list.
default '', The output name defaults to _target.ms
example: 'ngc5921.ms', ['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']

field -- Select fields name(s) or id(s) to transform. Only fields with data matching the intent will be selected.
default: '', Fields matching matching intent.
example: '3C279', 'Centaurus*', '3C279,J1427-421'

intent -- Select intents for which associated fields will be imaged.
default: '', Only TARGET data is selected.
example: 'PHASE,BANDPASS'

spw -- Select spectral window/channels to image.

default: '', All science spws for which the specified intent is valid are selected
example: '9'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Create a science target ms from the corrected column in the input ms.
hif_mstransform()

2. Make a phase and bandpass calibrator targets ms from the corrected column in the input ms.
hif_mstransform(intent='PHASE,BANDPASS')

Parameter List

Table 27: hif_mstransform default settings

Parameter	Type	Default	Description
vis	stringArray	None	The list of input measurement sets
outputvis	stringArray	None	The list of transformed measurement sets to be used for imaging
field	string	None	Set of data selection field names or ids, \'\' for all
intent	string	None	Set of data selection intents
spw	string	None	Set of data selection spectral window ids \'\' for all
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

6.20 hif_normflux

Task Description

Average calibrator fluxes across measurement sets
Derive flux densities for point source transfer calibrators using flux models for reference calibrators.

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the users can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

phaseupsolint -- Time solution intervals in CASA syntax for the phase solution.
default: 'inf'
example: 'inf', 'int', '100sec'

solint -- Time solution intervals in CASA syntax for the amplitude solution.
default: 'inf'
example: 'inf', 'int', '100sec'

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the pipeline context
default: ''
example: ['M32A.ms', 'M32B.ms']

reference -- A string containing a comma delimited list of field names defining the reference calibrators. Defaults to field names with intent '*AMP*'.
default: ''
example: 'M82,3C273'

transfer -- A string containing a comma delimited list of field names defining the transfer calibrators. Defaults to field names with intent '*PHASE*'.
default: ''
example: 'J1328+041,J1206+30'

refintent -- A string containing a comma delimited list of intents used to select the reference calibrators. Defaults to *AMP*.
default: ''
example: '', '*AMP*'

refspwmap -- Vector of spectral window ids enabling scaling across spectral windows. Defaults to no scaling
default: [-1]
example: [1,1,3,3] (4 spws, reference fields in 1 and 3, transfer fields in 0,1,2,3

transintent -- A string containing a comma delimited list of intents defining the transfer calibrators. Defaults to *PHASE*.
default: ''
example: '', '*PHASE*'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Derive flux densities for point source transfer calibrators using flux models for reference calibrators.

Flux values are determined by:
o computing complex gain phase only solutions for all the science spectral windows using the calibrator data selected by the 'reference' and 'refintent' parameters and the 'transfer' and 'transintent' parameters, and the value of the 'phaseupsolint' parameter.
o computing complex amplitude only solutions for all the science spectral windows using calibrator data selected with 'reference' and 'refintent' parameters and the 'transfer' and 'transintent' parameters, the value of the 'solint' parameter.
o transfering the flux scale from the reference calibrators to the transfer calibrators using refspwmap for windows without data in the reference calibrators
o extracted the computed flux values from the CASA logs and inserting them into the MODEL_DATA column.

Note that the flux corrected calibration table computed internally is not used in later pipeline apply calibration steps.

Issues

Should be add a spw window selection option here?

The code which extracts the flux scales from the logs needs to be replaced with code which uses the values returned from the CASA fluxscale task.

Examples

1. Compute flux flux values for the phase calibrator using model data from the amplitude calibrator.
hif_gfluxscale ()

Parameter List

Table 28: hif_normflux default settings

Parameter	Type	Default	Description
vis	string	None	List of input measurements sets
refintent	string	None	Observing intent of reference fields

transintent	string	None	Observing intent of transfer fields
reference	variant	None	Reference calibrator field name(s)
transfer	variant	None	Transfer calibrator field name(s)
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display commands (True)
acceptresults	bool	True	Automatically accept results into context

6.21 hif_rawflagchans

Task Description

Flag deviant baseline/channels in raw data hif_rawflagchans flags deviant baseline/channels in the raw data.
The flagging views used are derived from the raw data for the specified intent - default is BANDPASS.

Bad baseline/channels are flagged for all intents, not just the one that is the basis of the flagging views.

For each spectral window the flagging view is a 2d image with axes 'channel' and 'baseline'. The pixel for each channel, baseline is the time average of the underlying unflagged raw data.

The baseline axis is labelled by numbers of form id1.id2 where id1 and id2 are the IDs of the baseline antennas. Both id1 and id2 run over all antenna IDs in the observation. This means that each baseline is shown twice but has the benefit that 'bad' antennas are easily identified by eye.

Three flagging methods are available:

If parameter flag_hilo is set True then outliers from the median of each flagging view will be flagged.

If parameter flag_bad_quadrant is set True then a simple 2 part test is used to check for bad antenna quadrants and/or bad baseline quadrants. Here a 'quadrant' is defined simply as one quarter of the
channel axis. The first part of the test is to note as 'suspect' those points further from the view median than fbq_hilo_limit * MAD.
The second part is to flag entire antenna/quadrants if their fraction of suspect points exceeds fbq_antenna_frac_limit. Failing that, entire baseline/quadrants may be flagged if their fraction of suspect points exceeds fbq_baseline_frac_limit. Suspect points are not flagged unless as part of a bad antenna or
baseline quadrant.

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of

all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

flag_hilo -- True to flag channel/baseline data further from the view median than fhl_limit * MAD.
default: True

fhl_limit -- If flag_hilo is True then flag channel/baseline data further from the view median than fhl_limit * MAD.
default: 20

fhl_minsample -- Do no flagging if the view median and MAD are derived from fewer than fhl_minsample view pixels.
default: 5

flag_bad_quadrant -- True to search for and flag bad antenna quadrants and baseline quadrants. Here a /'quadrant/' is one quarter of the channel axis.
default: True

fbq_hilo_limit -- If flag_bad_quadrant is True then channel/baselines further from the the view median than fbq_hilo_limit * MAD will be noted as 'suspect'. If there are enough of them to indicate that an antenna or baseline quadrant is bad then all channel/baselines in that quadrant will be flagged.
default: 8.0

fbq_antenna_frac_limit -- If flag_bad_quarant is True and the fraction of suspect channel/baselines in a particular antenna/quadrant exceeds fbq_antenna_frac_limit then all data for that antenna/quadrant will be flagged.
default: 0.2

fbq_baseline_frac_limit -- If flag_bad_quarant is True and the fraction of suspect channel/baselines in a particular baseline/quadrant exceeds fbq_baseline_frac_limit then all data for that baseline/quadrant will be flagged.
default: 1.0 (i.e. no flagging)

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- List of input measurement sets.
default: [] - Use the measurement sets currently known to the pipeline context.

intent -- A string containing the list of intents to be checked for antennas with deviant gains. The default is blank, which causes the task to select the 'BANDPASS' intent.
default: ''
example: '*BANDPASS*'

spw -- The list of spectral windows and channels to which the calibration will be applied. Defaults to all science windows in the pipeline context.
default: ''
example: '17', '11, 15'

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- This parameter has no effect. The Tsyscal file is already in the pipeline context and is flagged in situ.

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Flag bad quadrants and wild outliers, default method.
hif_rawflagchans()
equivalent to:
hif_rawflagchans(flag_hilo=True, fhl_limit=20,
flag_bad_quadrant=True, fbq_hilo_limit=8,
fbq_antenna_frac_limit=0.2, fbq_baseline_frac_limit=1.0)

Parameter List

Table 29: hif_rawflagchans default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
spw	string	None	Set of data selection spectral windows, \'\' for all
intent	string	None	Data intent to use in creating flagging view
flag_hilo	bool	True	True to flag outlier baseline/channels
fhl_limit	double	20.0	Flag baseline/channels further from median than limit * MAD
fhl_minsample	double	5	Minimum number of points in sample
flag_bad_quadrant	bool	True	True to flag bad quadrants in antennas
fbq_hilo_limit	double	8.0	Note as \'suspect\' baseline/channels further from median than limit * MAD
fbq_antenna_frac_limit	double	0.2	Flag antenna quadrant if its fraction of \'suspect\' baseline/channels > limit
fbq_baseline_frac_limit	double	1.0	Flag baseline quadrant if its fraction of \'suspect\' baseline/channels > limit
pipelinemode	string	automatic	The pipeline operations mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically apply results to context

6.22 hif_refant

The hif_refant task selects a list of reference antennas and stores themin the pipeline context in priority order. The priority order is determined by a weighted combination of scores derived by the antenna selection heuristics. In manual mode the reference antennas can be set by hand.

Task Description

Select the best reference antennas
The hif_refant task selects a list of reference antennas and outputs them in priority order. The priority order is determined by a weighted combination of scores derived by the antenna selection heuristics.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

hm_refant -- The heuristics method or mode for selection the reference antenna. The options are 'manual' and 'automatic. In manual mode a user supplied referenence antenna refant is supplied. In 'automatic' mode the antennas are selected automatically.
default: 'automatic'

refant -- The user supplied reference antenna for 'manual' mode. If no antenna list is supplied an empty list is returned.
default: ''
example: 'DV05'

geometry -- Score antenna by proximity to the center of the array. This option is quick as only the ANTENNA table must be read.
default: True

flagging -- Score antennas by percentage of unflagged data. This option requires computing flagging statistics.
default: True

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets in the pipeline context.
default: ''
example: ['M31.ms']

field -- The list of field names or field ids for which flagging scores are computed if hm_refant='automatic' and flagging = True

default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a comma delimited list of intents against which the the selected fields are matched. Defaults to all supported intents.
default: ''
example: '*BANDPASS*'

spw -- The list of spectral windows and channels for which flagging scores are computed if hm_refant='automatic' and flagging = True.
default: ''
example: '11,13,15,17'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Compute the references antennas to be used for bandpass and gain calibration.
hif_refant()

Parameter List

Table 30: hif_refant default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
field	string	None	Set of data selection field names or ids
spw	string	None	Set of data selection spectral windows / channels
intent	string	None	Set of data selection intents
hm_refant	string	automatic	The referance antenna heuristics mode
refant	string	None	List of reference antennas
geometry	bool	True	Score by proximity to center of the array
flagging	bool	True	Score by percentage of good data

pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command (True)
acceptresults	bool	True	Add the results into the pipeline context

6.23 hif_restoredata

The hif_restoredata restores flagged and calibrated data from archived ASDMs and pipeline flagging and calibration data products. Pending archive retrieval support hif_restore data assumes that the required products are available in the rawdata_dir in the format produced by the hif_exportdata task.

hif_restoredata assumes that the following entities are available in the raw
data directory

o the ASDMs to be restored
o for each ASDM in the input list
o a compressed tar file of the final flagversions file, e.g.
uid___A002_X30a93d_X43e.ms.flagversions.tar.gz
o a text file containing the applycal instructions, e.g. uid___A002_X30a93d_X43e.ms.calapply.txt
o a compressed tar file containing the caltables for the parent session, e.g.
uid___A001_X74_X29.session_3.caltables.tar.gz

hif_restore data performs the followinga operations

o imports the ASDM(s))
o removes the default MS.flagversions directory created by the filler
o restores the final MS.flagversions directory stored by the pipeline
o restores the final set of pipeine flags to the MS
o restores the final calibration state of the MS
o restores the final calibration tables for each MS
o applies the calibration tables to each MS

Task Description

Restore flagged and calibration interferometry data from a pipeline run
The hif_restoredata task restores flagged and calibrated measurements sets from archived ASDMs and pipeline flagging and calibration date products.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode'

vis -- List of raw visibility data files to be restored. Assumed to be in the directory specified by rawdata_dir.
default: None
example: vis=['uid___A002_X30a93d_X43e']

session -- List of sessions one per visibility file.
default: []
example: session=['session_3']

products_dir -- Name of the data products directory. Currently not used.
default: '../products'
example: products_dir='myproductspath'

rawdata_dir -- Name of the rawdata subdirectory.
default: '../rawdata'
example: rawdata_dir='myrawdatapath'

lazy -- Use the lazy filler option
default: False
example: lazy=True

bdfflags -- Set the BDF flags
default: True
example: bdfflags=False

ocorr_mode -- Set ocorr_mode
default: 'ca'
example: ocorr_mode='ca'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Restore the pipeline results for a single ASDM in a single session
hif_restoredata (vis=['uid___A002_X30a93d_X43e'], session=['session_1'], ocorr_mode='ca')

Parameter List

Table 31: hif_restoredata default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input visibility data
session	stringArray	None	List of sessions one per visibility file
products_dir	string	../products	The archived pipeline data products directory
copytoraw	bool	True	Copy calibration and flagging tables to raw data directory
rawdata_dir	string	../rawdata	The rawdata directory
lazy	bool	False	Use the lazy filler option
bdfflags	bool	True	Set the BDF flags
ocorr_mode	string	ca	ALMA default set to ca
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display task command (True)
acceptresults	bool	True	Add the results into the pipeline context

6.24 hif_setjy

Fills the model column with the model visibilities.

Task Description

Fill the model column with calibrated visibilities
Fills the model column with the model visibilities.

b-- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

fluxdensity -- Specified flux density [I,Q,U,V] in Jy. Uses [1,0,0,0] flux density for unrecognized sources, and standard flux densities for ones recognized by 'standard', including 3C286, 3C48, 3C147, and several planets, moons, and asteroids.
default=-1
example: [3.06,0.0,0.0,0.0]

reffile -- Path to a file containing flux densities for calibrators unknown to CASA. Values given in this file take precedence over the CASA-derived values for all calibrators except solar system calibrators. By default the path is set to the CSV file created by h_importdata, consisting of

catalogue fluxes extracted from the ASDM.
default: ''
example: '', 'working/flux.csv'

spix -- Spectral index for fluxdensity S = fluxdensity * (freq/reffreq)**spix Only used if fluxdensity is being used. If fluxdensity is positive, and spix is nonzero, then reffreq must be set too. It is applied in the same way to all polarizations, and does not account for Faraday rotation or depolarization.
default: 0

reffreq -- The reference frequency for spix, given with units. Provided to avoid division by zero. If the flux density is being scaled by spectral index, then reffreq must be set to whatever reference frequency is correct for the given fluxdensity and spix. It cannot be determined from vis. On the other hand, if spix is 0, then any positive frequency can be used and will be ignored.
default: '1GHz'
examples: '86.0GHz', '4.65e9Hz'

scalebychan -- This determines whether the fluxdensity set in the model is calculated on a per channel basis. If False then only one fluxdensity value is calculated per spw.
default: True

standard -- Flux density standard, used if fluxdensity[0] less than 0.0. The options are: 'Baars','Perley 90','Perley-Taylor 95', 'Perley-Taylor 99', 'Perley-Butler 2010' and 'Butler-JPL-Horizons 2010'.
default: 'Butler-JPL-Horizons 2012' for solar system object 'Perley-Butler 2010' otherwise

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets defined in the pipeline context.
default: []
example:

field -- The list of field names or field ids for which the models are to be set. Defaults to all fields with intent '*AMPLITUDE*'.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a comma delimited list of intents against which the the selected fields are matched. Defaults to all data with amplitude intent.
default: ''
example: '*AMPLITUDE*'

spw -- The list of spectral windows and channels for which bandpasses are computed. Defaults to all science spectral windows.
default: ''
example: '11,13,15,17'

model -- Model image for setting model visibilities. Not fully supported.
default: ''
example: see details in help for CASA setjy task

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Issues

Support for the setjy spix parameter needs to be added.

Examples

1. Set the model flux densities for all the amplitude calibrators.
hif_setjy()

Parameter List

Table 32: hif_setjy default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
field	string	None	List of field names or ids
intent	string	None	Observing intent of flux calibrators
spw	string	None	List of spectral window ids
model	string	None	File location for field model
reffile	string	None	Path to file with fluxes for non-solar system calibrators
normfluxes	bool	False	Normalize lookup fluxes
reffreq	string	1GHz	Reference frequency for spix
fluxdensity	any	-1	Specified flux density [I,Q,U,V]; -1 will lookup values
spix	double	0.0	Spectral index of fluxdensity
scalebychan	bool	True	Scale the flux density on a per channel basis or else on a per spw basis
standard	variant	None	Flux density standard
pipelinemode	string	automatic	The pipeline operating mode

dryrun	bool	False	Run the task (False) or display the commands(True)
acceptresults	bool	True	Automatically accept results into the context

6.25 hif_setmodels

Set model fluxes values for calibrator reference and transfer sources using lookup values. By default the reference sources are the flux calibrators and the transfer sources are the bandpass, phase, and check source calibrators. Reference sources which are also in the transfer source list are removed from the transfer source list.

Builtin lookup tables are sued to compute models for solar system object calibrators. Point source models for other calibrators are provided in the reference file. Normalize fluxes are computed for transfer sources if the normfluxes parameter is set to True.

The reference file default to a file called 'flux.csv' in the current working directory. This file is normal created in the importdata step. The file is in 'csv' format and contains the following comma delimited columns.

vis,fieldid,spwid,I,Q,U,V,pix,comment

Task Description

Set calibrator source models
Derive flux densities for point source transfer calibrators using flux models for reference calibrators.

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the users can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

reffile -- The reference file containing a lookup table of point source models This file currently defaults to 'flux.csv' in the working directory. This file must conform to the standard pipeline 'flux.csv' format
default: ''
example: 'myfluxes.csv'

normfluxes -- Normalize the transfer field lookup fluxes to 1.0. The reference field fluxes are never normalized.
default: True
example: False

scalebychan -- Scale the flux density on a per channel basis or else on a per spw basis
default: True
example: False

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the pipeline context
default: ''
example: ['M32A.ms', 'M32B.ms']

reference -- A string containing a comma delimited list of field names defining the reference calibrators. Defaults to field names with intent 'AMPLITUDE'.
default: ''
example: 'M82,3C273'

refintent -- A string containing a comma delimited list of intents used to select the reference calibrators. Defaults to 'AMPLITUDE'.
default: 'AMPLITUDE'. '' Means no sources.
example: 'BANDPASS'

transfer -- A string containing a comma delimited list of field names defining the transfer calibrators. Defaults to field names with intent ''.
default: 'BANDPASS,PHASE,CHECK'
example: 'J1328+041,J1206+30'

transintent -- A string containing a comma delimited list of intents defining the transfer calibrators. Defaults to 'BANDPASS,PHASE,CHECK'.'' stands for no transfer sources.
default: 'BANDPASS,PHASE,CHECK'
example: 'PHASE'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Examples

1. Set model fluxes for the flux, bandpass, phase, and check sources.
hif_setmodels()

Parameter List

Table 33: hif_setmodels default settings

Parameter	Type	Default	Description

vis	string	None	List of input measurements sets
reference	variant	None	Reference calibrator field name(s)
refintent	string	AMPLITUDE	Observing intent of reference fields
transfer	variant	None	Transfer calibrator field name(s)
transintent	string	BANDPASS, PHASE, CHECK	Observing intent of transfer fields
reffile	string	None	Path to file with fluxes for non-solar system calibrators
normfluxes	bool	True	Normalize lookup fluxes
scalebychan	bool	True	Scale the flux density on a per channel basis or else on a per spw basis
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display commands (True)
acceptresults	bool	True	Automatically accept results into context

6.26 hif_show_calstate

hif_show_calstate displays the current on-the-fly calibration state of the pipeline as a set of equivalent applycal calls.

Task Description

Show the current pipeline calibration state

Keyword arguments:
None

Parameter List

No parameter

6.27 hif_tclean

Task Description

Compute clean map
Compute a cleaned image for a particular target source/intent and spectral window.

Keyword arguments:

--- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets in the context.
default: ''
example: vis=['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']

imagename -- Prefix of output images. Defaults to one of the following options depending on the availability of project information.
'{ousstatus uid}.{field}.[{intent}.]s{stage number}.spw{spw}'
'multivis.{field}.[{intent}.]s{stage number}.spw{spw}'
cleanboxes and thresholds to use as it goes. For each iteration the output images are:
{prename}.iter{n}.image; cleaned and restored image
{prename}.iter{n}.psf; point spread function (dirty beam)
{prename}.iter{n}.flux; relative sky sensitivity over field
{prename}.iter{n}.flux.pbcoverage; relative pb coverage over field (only for mosaics)
{prename}.iter{n}.model; image of clean components
{prename}.iter{n}.residual; image of residuals
{prename}.iter{n}.cleanmask; image of cleanmask used
default: ''
example: 'test1'

intent -- An intent against which the selected fields are matched. Default means select all data from fields specified by 'field' parameter.
default: ''
example: '', 'TARGET'

field -- Fields id(s) or name(s) to image or mosaic. Must be set.
default:
example: '3C279', 'Centaurus*'

spw -- Spectral window/channels to image. \'\' for all science data.
default: ''
example: '9', '9,11'

spwsel_lsrk -- Spectral window LSRK frequency selection for continuum. {} for all science data.
default: {}
example: {'spw16': '89.1~89.5GHz;90.2~90.3GHz', 'spw18': '101.2~102.1GHz'}

spwsel_topo -- Per MS spectral window TOPO frequency selection for continuum. [] for all science data.
default: {}
example: {['spw16:89.1~89.5GHz;90.2~90.3GHz']}

specmode -- Frequency imaging mode, 'mfs', 'cont', 'cube'. \'\' defaults to 'cube' if intent parameter

includes 'TARGET' otherwise 'mfs'.
default: ''
example: 'mfs', 'cont', 'cube'

gridder -- Gridding options, 'standard', 'mosaic'. Derived as follows:
1. The 'field' parameter is converted into a list of field_ids for each measurement set in 'vis'.
2. If there is more than 1 field_id in the list for any measurement set then gridder is set to 'mosaic', otherwise it will be set to 'standard'.
default: ''
'standard'

deconvolver -- Minor cycle algorithm e.g. hogbom or clark clean. \'\' defaults to 'hogbom'

outframe -- The reference frame of the output image. The only supported option is 'LSRK'
default: ''
example: 'LSRK'

imsize -- X and Y image size in pixels). Must be even and contain factors 2,3,5,7 only.
Default derived as follows:
1. Determine 'phasecenter' value and spread of field centres around it.
2. Set size of image to cover spread of field centres plus a border of width 0.75 * beam radius (to first null).
3. Divide x and y extents by 'cell' values to arrive at the numbers of pixels required.
default: ''
example: [320,320]

cell -- X and Y cell size. Derived from maximum UV spacing. Details TBD
default ''
example: ['0.5arcsec', '0.5arcsec']

phasecenter -- Direction measure or field id for the mosaic center.
Default derived as follows:
1. Make an array containing all the field centers to be imaged together.
2. Derive the mean direction from the directions array.
default: \'\'
example: 2

nchan -- Number of channels or planes in the output image, -1 for all
default: -1
example: 128

width -- Width of spectral dimension in frequency, \'\' for default.
default: \'\'
example: '7.8125MHz'

nbin -- Channel binning factor
default: -1
example: 2

weighting -- Weighting to apply to visibilities. Options are: 'natural', 'uniform','briggs', 'superuniform','briggsabs','radial'
default='briggs'

example: weighting='uniform'

robust -- Parameter for 'briggs' and 'briggsabs' weighting. Ranges from -2.0 to 2.0. -2 for uniform +2 for natural.
default=-999.0
example: 0.7

noise -- Parameter for 'briggsabs' weighting
default: '1.0Jy'
example: '0.5Jy'

npixels -- Parameter for 'briggs' and 'briggsabs; weighting
default: 0
example: 0

restoringbeam -- Gaussina sestoring beam for clean, \'\' for default
default: \'\'
example:

hm_masking -- Clean masking mode. Options are 'centralregion', 'psf', 'psfiter', 'auto', 'auto-thresh', 'manual' and 'none'
default: 'centralregion'
example: 'manual'

hm_maskthreshold -- Auto-boxing mask threshold. See tclean for options.

mask -- Image mask for hm_masking manual mode. User responsible for matching image sizes, coordinates, etc.
default: \'\'
example: 'mymask.mask'

niter -- Maximum number of iterations per clean call
default: 5000
example: 500

threshold -- Threshold for cleaning
default: '0.0'
example: '0.05'

maxncleans -- Maximum number of clean calls
default: 1
example: 10

cleancontranges -- Clean continuum frequency ranges in cubes
default=False
options: False, True

subcontms -- Subtract continuum in MS
Caveat: if enabled, repeated continuum subtraction will lead to erroneous negative fluxes.
default=False
options: False, True

parallel -- use MPI cluster to clean images
default: \'automatic\'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

Make an 'mfs' image of calibrator 3c279 using data in spectral window 1. The cell size is set to 0.2 arcsec in RA and Dec. Other clean parameters are derived from heuristics:
hif_tclean(field='3c279', cell='0.2arcsec', spw='1', specmode='mfs')

Make a cube of calibrator 3c279 using data in spectral window 1. The cube planes will be evenly spaced in frequency in the LSRK frame. Other clean parameters are derived from heuristics.
hif_tclean(field='3c279', cell='0.2arcsec', spw='1', specmode='cube', outframe='LSRK')

Parameter List

Table 34: hif_tclean default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets, \'\' for default
imagename	string	None	Prefix for image filenames, \'\' for default
intent	string	None	Set of data selection intents, \'\' for all
field	string	None	Set of data selection field names or ids
spw	string	None	Set of data selection spectral window/channels \'\' for all
spwsel_lsrk	any	{}	Dictionary of LSRK spw frequency selections, {} for automatic
spwsel_topo	any	{}	List of TOPO spw frequency selections per MS, [] for automatic
uvrange	any	None	Set of uv ranges, \'\' for all
specmode	string	None	Spectral gridding type (mfs, cont, cube, \'\' for default)
gridder	string	None	Gridding options (standard, mosaic, \'\' for default)

deconvolver	string	None	Minor cycle algorithm (hogbom, clark, mtmfs, \'\' for default)
outframe	string	None	velocity frame of output image (LSRK, \'\' for default)
imsize	intArray	None	X and Y image size in pixels, single value same for both, \'\' for default
cell	stringArray	None	X and Y cell size(s), single value same for both, \'\' for default
phasecenter	any	None	Image center (direction or field index), \'\' for default
nchan	int	-1	Number of channels or planes in output image, -1 = all
start	any	None	Start of output spectral dimension
width	any	None	Width of output spectral channels, \'\' for default
nbin	int	-1	Channel binning factor, -1 for default.
weighting	string	briggs	Type of weighting
robust	double	-999.0	Briggs weighting robustness parameter
noise	any	1.0Jy	Briggs weighting noise parameter
npixels	int	0	Weighting algorithm parameter
restoringbeam	stringArray	None	Gaussian restoring beam, \'\' for default
hm_masking	string	centralregion	Pipeline heuristics masking option
hm_maskthreshold	string	None	Auto-boxing mask threshold
hm_cleaning	string	rms	Pipeline clean control heuristics
mask	any	None	User mask, \'\' for whole image
niter	int	5000	Maximum number of clean iterations
threshold	double	0.0	Flux level to stop cleaning, must include units: \'1.0mJy\'
tlimit	double	4.0	Times the sensitivity limit for cleaning
masklimit	int	4	Times good mask pixels for cleaning
maxncleans	int	1	Maximum number of clean task calls
cleancontranges	bool	False	Clean continuum frequency ranges in cubes
subcontms	bool	False	Subtract continuum in MS
parallel	string	automatic	Clean images using MPI cluster
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)

acceptresults	bool	True	Add the results to the pipeline context

6.28 hif_uvcontfit

Task Description

Fit the continuum in the UV plane
This task estimates the continuum emission by fitting polynomials to the real and imaginary parts of the spectral windows and channels selected by spw and exclude spw. This fit represents a model of the continuum in all channels. Fit orders less than 2 are strongly recommended. Spw window combination is not currently supported.

Keyword Arguments

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

--- pipeline parameter arguments which can be set in any pipeline mode

solint --
default: 'int'
example: solint='30s'

fitorder -- The fit order of the polynomials.
default: 1
example: fitorder = 0

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets for which the UV continuum fits are to be generated. Defaults to the list of imaging measurement sets specified in the pipeline import data task.
default '': Compute the continuum fit for all calibration measurement sets in the context.
example: 'ngc5921.ms', ['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']

caltable -- The list of output calibration tables one per input MS.
default: '', The output name defaults to the standard pipeline name scheme
example: ['M51.uvcont']

contfile -- The file containing the continuum frequency ranges used for the continuum fit.
default: '', Defaults first to the file named in the context, next to a file called 'cont.dat' in the pipeline working directory, or ''
example: contfile = 'mycontfile'

field -- The list of field names or field ids for which UV continuum fits are computed. Defaults to all fields.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a comma delimited list of intents against which the the selected fields are matched.
default: '', Defaults to all data with TARGET intent.
example: 'PHASE'

spw -- The list of spectral windows and channels for which uv continuum fits are computed.
default: '', Defaults to all science spectral windows.
example: '11,13,15,17'

combine -- Data axes to be combined for solving. Axes are 'scan', 'spw', or ''. This option is currently not supported.
default: '', None.
example: combine= 'scan'

Parameter List

Table 35: hif_uvcontfit default settings

Parameter	Type	Default	Description
vis	stringArray	None	The name of the input visibility file
caltable	stringArray	None	Name of output mueller matrix calibration table
contfile	string	None	Name of the input file of per source / spw continuum regions
field	string	None	Select field(s) using id(s) or name(s)
intent	string	None	Select intents
spw	string	None	Spectral window / channels for fitting the continuum
combine	string	None	Data axes to combine for the continuum estimation (none, spw and/or scan)
solint	any	int	Time scale for the continuum fit
fitorder	int	1	Polynomial order for the continuum fits
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

6.29 hif_uvcontsub

hif_uvconsub applies the precomputed uv continuum fit tables stored in the pipeline context to the set of visibility files using predetermined field and spectral window maps and default values for the interpolation schemes. Users can interact with the pipeline calibration state using the tasks hif_export_calstate and hif_import_calstate.

Task Description

Subtract the fitted continuum from the data
Apply the UV continuum fit stored in the callibrary to the data.

---- pipeline parameter arguments which can be set in any pipeline mode

applymode -- Calibration apply mode
''='calflagstrict': calibrate data and apply flags from solutions using the strict flagging convention
'trial': report on flags from solutions, dataset entirely unchanged
'flagonly': apply flags from solutions only, data not calibrated
'calonly': calibrate data only, flags from solutions NOT applied
'calflagstrict':
'flagonlystrict':same as above except flag spws for which calibration is unavailable in one or more tables (instead of allowing them to pass uncalibrated and unflagged)
default: '', defaults to 'calonly'

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets in the pipeline context.
default: []
example: ['X227.ms']

field -- A string containing the list of field names or field ids to which the calibration will be applied. Defaults to all fields in the pipeline context.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a the list of intents against which the selected fields will be matched. Defaults to all supported intents in the pipeline context.
default: ''
example: '*TARGET*'

spw -- The list of spectral windows and channels to which the calibration will be applied. Defaults to all science windows in the pipeline context.
default: ''
example: '17', '11, 15'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).

default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Examples

1. Apply the calibration to the target data
hif_uvcontsub()

Parameter List

Table 36: hif_uvcontsub default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
field	string	None	Set of data selection field names or ids
intent	string	None	Set of data selection observing intents
spw	string	None	Set of data selection spectral window/channels
applymode	string	None	Calibration mode: ""="calflagstrict", "calflag", "calflagstrict", "trial", "flagonly", "flagonlystrict", or "calonly"
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run task (False) or display the command(True)
acceptresults	bool	True	Automatically accept results into the context

7 Interferometry ALMA Task Descriptions

7.1 hifa_antpos

The hifa_antpos task corrects the antenna positions recorded in the ASDMs using updated antenna position calibration information determined after the observation was taken. Corrections can be input by hand, read from a file on disk, or in future by querying an ALMA database service. The antenna positions file is in 'csv' format containing 6 comma delimated columns as shown below. The default name of this file is 'antennapos.csv'

List if sample antennapos.csv file

ms,antenna,xoffset,yoffset,zoffset,comment
uid___A002_X30a93d_X43e.ms,DV11,0.000,0.010,0.000,"No comment"
uid___A002_X30a93d_X43e.dup.ms,DV11,0.000,-0.010,0.000,"No comment"

The corrections are used to generate a calibration table which is recorded in the pipeline context and applied to the raw visibility data, on the fly to generate other calibration tables, or permanently to generate calibrated visibilities for imaging.

Task Description

Derive an antenna position calibration table

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context dependent pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

hm_antpos -- Heuristics method for retrieving the antenna position corrections. The options are 'online' (not yet implemented), 'manual', and 'file'.
default: 'file'
example: hm_antpos='manual'

antenna -- The list of antennas for which the positions are to be corrected if hm_antpos is 'manual'
default: none
example 'DV05,DV07'

offsets -- The list of antenna offsets for each antenna in 'antennas'. Each offset is a set of 3 floating point numbers separated by commas, specified in the ITRF frame.
default: none
example: [0.01, 0.02, 0.03, 0.03, 0.02, 0.01]

antposfile -- The file(s) containing the antenna offsets. Used if hm_antpos is 'file'. The default file name is 'antennapos.csv'

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- List of input visibility files
default: []
example: ['ngc5921.ms']

caltable -- Name of output gain calibration tables
default: []
example: caltable=['ngc5921.gcal']

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute

(False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Issues

The hm_antpos 'online' option will be implemented when the observing system
provides an antenna position determination service.

Example

1. Correct the position of antenna 5 for all the visibility files in a single pipeline run.
hifa_antpos (antenna='DV05', offsets=[0.01, 0.02, 0.03])

2. Correct the position of antennas for all the visibility files in a single pipeline run using antenna positions files on disk. These files are assumed to conform to a default naming scheme if 'antposfile' is unspecified by the user.
hifa_antpos (hm_antpos='myantposfile.csv')

Parameter List

Table 37: hifa_antpos default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
caltable	stringArray	None	List of output caltable(s)
hm_antpos	string	file	The antenna position determination method
antenna	string	None	List of antennas to be corrected
offsets	doubleArray	None	List of position corrections one set per antenna
antposfile	string	None	File containing antenna position corrections
pipelinemode	string	automatic	The pipeline operation mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically accept results into context

7.2 hifa_bandpass

hif_bandpass computes a bandpass solution for every specified science spectral window. By default a 'phaseup' pre-calibration is performed and applied on the fly to to the data, before the bandpass is computed. The hif_refant task may be used to precompute a prioritized list of reference antennas.

Task Description

Compute bandpass calibration solutions
Compute amplitude and phase as a function of frequency for each spectral window in each measurement set.
Previous calibration can be applied on the fly.

Keyword arguments:

--- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

hm_phaseup -- The pre-bandpass solution phaseup gain heuristics. The options are 'snr' (compute solution required to achieve the specified SNR), 'manual' (use manual solution parameters), and '' (none).
default: 'snr'
example: hm_phaseup='manual'

phaseupsolint -- The phase correction solution interval in CASA syntax. Used when hm_phaseup='manual' or as a default if the hm_phasup='snr' heuristic computation fails.
default: 'int'
example: phaseupsolint='300s'

phaseupbw -- Bandwidth to be used for phaseup. Defaults to 500MHz. Used when hm_phaseup='manual'.
default: ''
example: '' default to entire bandpass, '500MHz' use centreal 500MHz

phaseupsnr -- The required SNR for the phaseup solution. Used only if hm_phaseup='snr'
default: 20.0
example: phaseupsnr=10.0

phaseupnsols -- The minimum number of phaseup gian solutions. Used only if hm_phaseup='snr'.
default: 2
example: phaseupnsols=4

hm_bandpass -- The bandpass solution heuristics. The options are 'snr' (compute the solution required to achieve the specified SNR), 'smoothed' (simple smoothing heuristics), and 'fixed' (use the user defined parameters for all spws).

solint -- Time and channel solution intervals in CASA syntax.
default: 'inf' Used for hm_bandpass='fixed', and as a default for the 'snr' and 'smoothed' options.

default: 'inf,7.8125MHz'
example: solint='inf,10ch', solint='inf'

maxchannels -- The bandpass solution smoothing factor in channels. The solution interval is bandwidth / 240. Set to 0 for no smoothing. Used if hm_bandpass='smoothed".
default: 240
example: 0

evenbpints -- Force the per spe frequency solint to be evenly divisible into the spw bandpass if hm_bandpass='snr'
default: True
example: evenbpints=False

bpsnr -- The required SNR for the bandpass solution. Used only if hm_bandpass='snr'
default: 50.0
example: bpsnr=20.0

bpnsols -- The minimum number of bandpass solutions. Used only if hm_bandpass='snr'.
default: 8

hm_bandtype -- The type of bandpass. The options are 'channel' and 'polynomial' for CASA bandpass types = 'B' and 'BPOLY' respectively.

combine -- Data axes to combine for solving. Axes are '', 'scan','spw','field' or any comma-separated combination.
default; 'scan'
example: combine='scan,field'

minblperant -- Minimum number of baselines required per antenna for each solve. Antennas with fewer baselines are excluded from solutions. Used for hm_bandtype='channel' only.
default: 4

minsnr -- Solutions below this SNR are rejected. Used for hm_bandtype='channel' only
default: 3.0

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the pipeline context.
default: ''
example: ['M51.ms']

caltable -- The list of output calibration tables. Defaults to the standard pipeline naming convention.
default: ''
example: ['M51.bcal']

field -- The list of field names or field ids for which bandpasses are computed. Defaults to all fields.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a comma delimited list of intents against which the the selected fields

are matched. Defaults to all data with bandpass intent.
default: ''
example: '*PHASE*'

spw -- The list of spectral windows and channels for which bandpasses are computed. Defaults to all science spectral windows.
default: ''
example: '11,13,15,17'

refant -- Reference antenna names. Defaults to the value(s) stored in the pipeline context. If undefined in the pipeline context defaults to the CASA reference antenna naming scheme.
default: ''
example: refant='DV01', refant='DV06,DV07'

solnorm -- Normalise the bandpass solutions
default: False

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but
do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Issues

There is currently some discussion about whether or not to do an 'ampup' operations at the same time as the 'phaseup'. This is not required for the bandpass computation but the amplitude information may provide a useful quality assessment measure.

The specified minsnr parameter is currently applied to the bandpass solution computation but not the 'phaseup' computation. Some noisy solutions in the phaseup may not be properly rejected.

Examples

1. Compute a channel bandpass for all visibility files in the pipeline context using the CASA reference antenna determination scheme.
hif_bandpass()

2. Same as the above but precompute a prioritized reference antenna list
hif_refant()
hif_bandpass()

Parameter List

Table 38: hifa_bandpass default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurment sets
caltable	stringArray	None	List of output caltables
field	string	None	Set of data selection field names or ids
intent	string	None	Set of data selection intents
spw	string	None	Set of data selection spectral window/channels
antenna	string	None	Set of data selection antenna IDs
hm_phaseup	string	snr	Phaseup before computing the bandpass
phaseupsolint	any	int	Phaseup correction solution interval
phaseupbw	string	None	Bandwidth to use for phaseup
phaseupsnr	double	20.0	SNR for phaseup solution
phaseupnsols	int	2	Minimum number of phaseup gain solutions
hm_bandpass	string	snr	Bandpass solution heuristics
solint	any	inf	Solution intervals
maxchannels	int	240	The smoothing factor in channels
evenbpints	bool	True	Force frequency solint to even bandpass intervals
bpsnr	double	50.0	SNR for bandpass solution
bpnsols	int	8	Minimum number of bandpass solutions
hm_bandtype	string	channel	Bandpass solution type
combine	string	scan	Data axes which to combine for solve (scan, spw, and/or field)
refant	string	None	Reference antenna names
solnorm	bool	True	Normalise the bandpass solution
minblperant	int	4	Minimum baselines per antenna required for solve
minsnr	double	3.0	Reject solutions below this SNR
degamp	variant	None	Degree for polynomial amplitude solution
degphase	variant	None	Degree for polynomial phase solution
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)

acceptresults	bool	True	Add the results to the pipeline context

7.3 hifa_bpsolint

The phaseup gain time and bandpass frequency intervals are determined as follows.

o For each data set the list of source(s) to use for bandpass solution signal to noise estimation is compiled based on the values of the field, intent, and spw parameters.
o Source fluxes are determined for each spw and source combination.
o Fluxes in Jy are derived from the pipeline context.
o Pipeline context fluxes are derived from the online flux calibrator catalog, the ASDM, or the user via the flux.csv file.
o If no fluxes are available the task terminates.
o Atmospheric calibration and observations scans are determined for each spw and source combination.
o If intent is set to 'PHASE' are there are no atmospheric scans associated with the 'PHASE' calibrator, 'TARGET' atmospheric scans will be used in stead.
o If atmospheric scans cannot be associated with any of the spw and source combinations the task terminates.
o Science spws are mapped to atmospheric spws for each science spw and source combinations.
o If mappings cannot be determined for any of the spws the task terminates
o The median Tsys value for each atmospheric spw and source combination is determined from the SYSCAL table. Medians are computed first by channel, then by antenna, in order to reduce sensitivity to deviant values.
o The science spw parameters, exposure time(s), and integration time(s) are determined.
o The phase up time interval, in time units and number of integrations required to meet the phaseupsnr are computed, along with the phaseup sensitivity in mJy and the signal to noise per integration. Nominal Tsys and sensitivity values per receiver band provide by the ALMA project are used for this estimate.
o Warnings are issued if estimated phaseup gain time solution would contain fewer than minphasupints solutions
o The frequency interval, in MHz and number of channels required to meet the bpsnr are computed, along with the per channel sensitivity in mJy and the per channle signal to noise. Nominal Tsys and sensitivity values per receiver band provide by the ALMA project are used for this estimate.
o Warnings are issued if estimated bandpass olution would contain fewer than minbpnchan solutions

Task Description

Compute optimal bandpass calibration solution intervals
Compute the bandpass phaseup time solution interval and bandpass frequency solution interval.

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

phaseupnsr -- The required phaseup gain time interval solution signal to noise
default: 20.0
example: phaseupsnr = 10.0

minphaseupints -- The minimum number of time intervals in the phaseup gain solution.
default: 2
example: minphaseupints=4

bpnsr -- The required bandpass frequency interval solution signal to noise
default: 50.0
example: phaseupsnr = 20.0

minbpnchan -- The minimum number of frequency intervals in the bandpass solution.
default: 8
example: minbpnchans=16

hm_nantennas -- The heuristics for determines the number of antennas to use in the signal to noise estimate. The options are 'all' and 'unflagged'. The 'unflagged' options is not currently supported.
default: 'all'
example: hm_nantennas='unflagged'

maxfracflagged -- The maximum fraction of an antenna that can be flagged before its is excluded from the signal to noise estimate.
default: 0.90
example: maxfracflagged=0.80

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets specified in the pipeline context
default: ''
example: ['M82A.ms', 'M82B.ms']

field -- The list of field names of sources to be used for signal to noise estimation. Defaults to all fields with the standard intent.
default: ''
example: '3C279'

intent -- A string the intent against which the the selected fields are matched.
default: 'BANDPASS'
example: intent='PHASE'

spw -- The list of spectral windows and channels for which gain solutions are computed. Defaults to all the science spectral windows for which there are both 'intent' and TARGET intents.
default: ''
example: '13,15'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).

default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Examples

1. Estimate the phaseup gain time interval and the bandpass frequency interval required to match the desired signal to noise for bandpass solutions.
hifa_bpsolint()

Parameter List

Table 39: hifa_bpsolint default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
field	string	None	Set of data selection field names
intent	string	BANDPASS	Set of data selection observing intents
spw	string	None	Set of data selection spectral windowi ids
phaseupsnr	double	20.0	The required bandpass phaseup signal to noise
minphaseupints	int	2	The minimum number of phaseup intervals in the time solution
evenbpints	bool	False	Force the bandpass frequency solution intervals to be an even number of channels
bpsnr	double	50.0	The required bandpass frequency solution signal to noise
minbpnchan	int	8	The minimum number of channels in the frequency solution
hm_nantennas	string	all	The antenna selection heuristic (unsupported)
maxfracflagged	double	0.90	The maximum fraction of data flaggeded per antenna (unsupported)
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run task (False) or display the command(True)
acceptresults	bool	True	Automatically accept results into the context

7.4 hifa_flagdata

The hifa_flagdata data performs basic flagging operations on a list of measurements including:

o applying online flags
o apply a flagging template
o autocorrelation data flagging
o shadowed antenna data flagging
o scan based flagging by intent or scan number
o edge channel flagging

Task Description

Do basic flagging
The hifa_flagdata data performs basic flagging operations on a list of measurement sets.

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

autocorr -- Flag autocorrelation data.
default: True

shadow -- Flag shadowed antennas.
default: True

scan -- Flag a list of specifed scans.
default: True

scannumber -- A string containing a comma delimited list of scans to be flagged.
example: '3,5,6'
default: ''

intents -- A string containing a comma delimited list of intents against which the scans to be flagged are matched.
example: '*BANDPASS*'
default: 'POINTING,FOCUS,ATMOSPHERE,SIDEBAND'

edgespw -- Flag the edge spectral window channels.
default: True

fracspw -- Fraction of the baseline correlator TDM edge channels to be flagged.
default: 0.0625

fracspwfps -- Fraction of the ACS correlator TDM edge channels to be flagged.
default: 0.48387

online -- Apply the online flags.

default: True

fileonline -- File containing the online flags. These are computed by the h_init or hif_importdata data tasks. If the online flags files are undefined a name of the form 'msname_flagonline.txt' is assumed.
default: ''

template -- Apply flagging templates
default: True

filetemplate -- The name of an text file that contains the flagging template for RFI, birdies, telluric lines, etc. If the template flags files is undefined a name of the form 'msname_flagtemplate.txt' is assumed.
default: ''

hm_tbuff -- The heuristic for computing the default time interval padding parameter. The options are 'halfint' and 'manual'. In 'halfint' mode tbuff is set to half the maximum of the median integration time of the science and calibrator target observations. The value of 0.048 seconds is subtracted from the lower time limit to accomodate the behavior of the ALMA Control system.
default: 'halfint'

tbuff -- The time in seconds used to pad flagging command time intervals if hm_tbuff='manual'. The default in manual mode is no flagging
default: [0.0,0.0]

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement defined in the pipeline context.
example:
default: ''

flagbackup -- Back up any pre-existing flags.
default: False

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Do basic flagging on a measurement set

hifa_flagdata()

2. Do basic flagging on a measurement set flaggin additional scans selected by number as well.
hifa_flagdata(scannumber='13,18')

Parameter List

Table 40: hifa_flagdata default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets to flag
autocorr	bool	True	Flag autocorrelation data
shadow	bool	True	Flag shadowed antennas
scan	bool	True	Flag specified scans
scannumber	string	None	List of scans to be flagged
intents	string	POINTING, FOCUS, ATMOSPHERE, SIDEBAND	List of intents of scans to be flagged
edgespw	bool	True	Flag edge channels
fracspw	double	0.0625	Fraction of baseline correlator edge channels to be flagged
fracspwfps	double	0.048387	Fraction of ACA correlator edge channels to be flagged
online	bool	True	Apply the online flags
fileonline	string	None	File of online flags to be applied
template	bool	True	Apply a flagging template
filetemplate	stringArray	None	File that contains the flagging template
hm_tbuff	string	halfint	The time buffer computation heuristic
tbuff	any	[0.0,0.0]	List of time buffers (sec) to pad timerange in flag commands
qa0	bool	True	QA0 flags
pipelinemode	string	automatic	The pipeline operating mode
flagbackup	bool	False	Backup prexistings flags before applying new ones
dryrun	bool	False	Run the task (False) or display the command (True)
acceptresults	bool	True	Add the results into the pipeline context

7.5 hifa_flagtargets

The hifa_flagdata data performs basic flagging operations on a list of measurements including:
o apply a flagging template

Task Description

Do science target flagging
The hifa_flagtargets task performs basic flagging operations on a list of science target measurement sets.

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

template -- Apply flagging templates
default: True

filetemplate -- The name of an text file that contains the flagging template for issues with the science target data etc. If the template flags files is undefined a name of the form 'msname_flagtargetstemplate.txt' is assumed.
default: ''

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement defined in the pipeline context.
default: ''

flagbackup -- Back up any pre-existing flags.
default: False

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Do basic flagging on a science target measurement set
hifa_flagtargets()

Parameter List

Table 41: hifa_flagtargets default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets to flag
template	bool	True	Apply a flagging template
filetemplate	stringArray	None	File that contains the flagging template
pipelinemode	string	automatic	The pipeline operating mode
flagbackup	bool	False	Backup prexistings flags before applying new ones
dryrun	bool	False	Run the task (False) or display the command (True)
acceptresults	bool	True	Add the results into the pipeline context

7.6 hifa_fluxcalflag

Search the bultin solar system flux calibrater line catalog for overlaps with the science spectral windows. Generate a list of line overlap regions and flagging commands.

Task Description

Locate and flag line regions in solar system flux calibrators
Fills the model column with the model visibilities.

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

threshold -- If the fraction of an spw occupied by line regions is greater then threshold flag the entire spectral window.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets defined in the pipeline context.

default: []
example:

field -- The list of field names or field ids for which the models are to be set. Defaults to all fields with intent 'AMPLITUDE'.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a comma delimited list of intents against which the the selected fields are matched. Defaults to all data with amplitude intent.
default: ''
example: 'AMPLITUDE'

spw -- The list of spectral windows and channels for which bandpasses are computed. Defaults to all science spectral windows.
default: ''
example: '11,13,15,17'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Locate known lines in any solar system object flux calibrators.
hifa_fluxcalflag()

Parameter List

Table 42: hifa_fluxcalflag default settings

Parameter	type	default	description
vis	stringArray	None	List of input measurement sets
field	string	None	List of field names or ids
intent	string	None	Observing intent of flux calibrators
spw	string	None	List of spectral window ids
pipelinemode	string	automatic	The pipeline operating mode

threshold	double	0.75	Threshold for flagging the entire spw
appendlines	bool	False	Append user defined line regions to the line dictionary
linesfile	string	None	File containing user defined lines
applyflags	bool	True	Apply the computed flag commands
dryrun	bool	False	Run the task (False) or display the commands(True)
acceptresults	bool	True	Automatically accept results into the context

7.7 hifa_fluxdb

Connect to the ALMA flux calibrator database.

Task Description

Connect to flux calibrator database
Connect to the ALMA flux calibrator database

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

vis -- List of input visibility files
default: none;
example: vis='ngc5921.ms'

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Example

1. Connect to the ALMA flux calibrator database
hifa_fluxdb()

Parameter List

Table 43: hifa_fluxdb default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
pipelinemode	string	automatic	The pipeline operations mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically apply results to context

7.8 hifa_gaincalsnr

The gaincal solution signal to noise is determined as follows follows.
o For each data set the list of source(s) to use for the per scan gaincal solution signal to noise estimation is compiled based on the values of the field, intent, and spw parameters.
o Source fluxes are determined for each spw and source combination.
o Fluxes in Jy are derived from the pipeline context.
o Pipeline context fluxes are derived from the online flux calibrator catalog, the ASDM, or the user via the flux.csv file.
o If no fluxes are available the task terminates.
o Atmospheric calibration and observations scans are determined for each spw and source combination.
o If intent is set to 'PHASE' are there are no atmospheric scans associated with the 'PHASE' calibrator, 'TARGET' atmospheric scans will be used in stead.
o If atmospheric scans cannot be associated with any of the spw and source combinations the task terminates.
o Science spws are mapped to atmospheric spws for each science spw and source combinations.
o If mappings cannot be determined for any of the spws the task terminates
o The median Tsys value for each atmospheric spw and source combination is determined from the SYSCAL table. Medians are computed first by channel, then by antenna, in order to reduce sensitivity to deviant values.
o The science spw parameters, exposure time(s), and integration time(s) are determined.
o The per scan sensitivity and signal to niose estimates are computed per science spectral window. Nominal Tsys and sensitivity values per receiver band provide by the ALMA project are used for this estimate.
o The QA score is based on how many signal to noise estimates greater then the requested singal to noise ration can be computed.

Task Description

Compute gaincal signal to noise ratios per spw
Compute the per scan gaincal solution signal to noise ratio per science spw

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the

values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

phasensr -- The required gaincal solution signal to noise
default: 25.0
example: phaseupsnr = 20.0

bwedgefrac -- The fraction of the bandwidth edges that is flagged
default: 0.03125
example: bwedgefrac = 0.0

hm_nantennas -- The heuristics for determines the number of antennas to use in the signal to noise estimate. The options are 'all' and 'unflagged'. The 'unflagged' options is not currently supported.
default: 'all'
example: hm_nantennas='unflagged'

maxfracflagged -- The maximum fraction of an antenna that can be flagged before its is excluded from the signal to noise estimate.
default: 0.90
example: maxfracflagged=0.80

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets specified in the pipeline context
default: ''
example: ['M82A.ms', 'M82B.ms']

field -- The list of field names of sources to be used for signal to noise estimation. Defaults to all fields with the standard intent.
default: ''
example: '3C279'

intent -- A string the intent against which the the selected fields are matched.
default: 'PHASE'
example: intent='BANDPASS'

spw -- The list of spectral windows and channels for which gain solutions are computed. Defaults to all the science spectral windows for which there are both 'intent' and TARGET intents.
default: ''
example: '13,15'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).

default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Examples

1. Estimate the per scan gaincal solution sensitivies and signal to noise ratios for all the science spectral windows.
hifa_gaincalsnr()

Parameter List

Table 44: hifa_gaincalsnr default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
field	string	None	Set of data selection field names
intent	string	PHASE	Set of data selection observing intents
spw	string	None	Set of data selection spectral windowi ids
phasesnr	double	25.0	The signal to noise minimum
bwedgefrac	double	0.03125	The fraction of the bandwidth edge that is flagged
hm_nantennas	string	all	The antenna selection heuristic (unsupported)
maxfracflagged	double	0.90	The maximum fraction of data flaggeded per antenna (unsupported)
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run task (False) or display the command(True)
acceptresults	bool	True	Automatically accept results into the context

7.9 hifa_gfluxscale

Derive flux densities for point source transfer calibrators using flux models for reference calibrators. Flux values are determined by:
o computing complex gain phase only solutions for all the science spectral windows using the calibrator data selected by the 'reference' and 'refintent' parameters and the 'transfer' and 'transintent' parameters, and the value of the 'phaseupsolint' parameter.
o computing complex amplitude only solutions for all the science spectral windows using calibrator data selected with 'reference' and 'refintent' parameters and the 'transfer' and 'transintent' parameters, the value of the 'solint' parameter.
o transfering the flux scale from the reference calibrators to the transfer calibrators using refspwmap

for windows without data in the reference calibrators
o extracted the computed flux values from the CASA logs and inserting them into the MODEL_DATA column.

Resolved calibrators are handled via antenna selection either automatically, hm_resolvedcals='automatic' or manually, hm_resolvedcals='manual'. In the former case antennas closer to the reference antenna than the uv distance where visibilities fall to 'peak_fraction' of the peak are used. In manual mode the antennas specified in 'antenna' are used.

Note that the flux corrected calibration table computed internally is not currently used in later pipeline apply calibration steps.

Task Description

Derive flux density scales from standard calibrators
Derive flux densities for point source transfer calibrators using flux models for reference calibrators.

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the users can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

phaseupsolint -- Time solution intervals in CASA syntax for the phase solution.
default: 'int'
example: 'inf', 'int', '100sec'

solint -- Time solution intervals in CASA syntax for the amplitude solution.
default: 'inf'
example: 'inf', 'int', '100sec'

minsnr -- Minimum signal to noise ratio for gain calibration solutions.
default: 2.0
example: 1.5, 0.0

hm_resolvedcals - Heuristics method for handling resolved calibrators. The options are 'automatic' and 'manual'. In automatic mode antennas closer to the reference antenna than the uv distance where visibilities fall to 'peak_fraction' of the peak are used. In manual mode the antennas specified in 'antenna' are used.

antenna -- A comma delimited string specifying the antenna names or ids to be used for the fluxscale determination. Used in hm_resolvedcals='manual' mode.
default: ''.
example: 'DV16,DV07,DA12,DA08'

peak_fraction -- The limiting UV distance from the reference antenna forantennas to be included in the flux calibration. Defined as the point where the calibrator visibilities have fallen to 'peak_fraction' of the peak value.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the pipeline context
default: ''
example: ['M32A.ms', 'M32B.ms']

reference -- A string containing a comma delimited list of field names defining the reference calibrators. Defaults to field names with intent '*AMP*'.
default: ''
example: 'M82,3C273'

transfer -- A string containing a comma delimited list of field names defining the transfer calibrators. Defaults to field names with intent '*PHASE*'.
default: ''
example: 'J1328+041,J1206+30'

refintent -- A string containing a comma delimited list of intents used to select the reference calibrators. Defaults to *AMP*.
default: ''
example: '', '*AMP*'

refspwmap -- Vector of spectral window ids enabling scaling across spectral windows. Defaults to no scaling
default: []
example: [1,1,3,3] (4 spws, reference fields in 1 and 3, transfer fields in 0,1,2,3

reffile -- Path to a file containing flux densities for calibrators unknown to CASA. Values given in this file take precedence over the CASA-derived values for all calibrators except solar system calibrators. By default the path is set to the CSV file created by hifa_importdata, consisting of catalogue fluxes extracted from the ASDM and / or edited by the user.
default: ''
example: '', 'working/flux.csv'

transintent -- A string containing a comma delimited list of intents defining the transfer calibrators. Defaults to *PHASE*.
default: ''
example: '', '*PHASE*'

refant -- A string specifying the reference antenna(s). By default this is read from the context.
default: ''
example: 'DV05'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Issues

Should we add a spw window selection option here?

The code which extracts the flux scales from the logs needs to be replaced
with code which uses the values returned from the CASA fluxscale task.

Examples

1. Compute flux flux values for the phase calibrator using model data from the amplitude calibrator.
hifa_gfluxscale ()

Parameter List

Table 45: hifa_gfluxscale default settings

Parameter	Type	Default	Description
vis	string	None	List of input measurements sets
reference	variant	None	Reference calibrator field name(s)
transfer	variant	None	Transfer calibrator field name(s)
refintent	string	None	Observing intent of reference fields
transintent	string	None	Observing intent of transfer fields
refspwmap	intArray	None	Map accross spectral window boundaries
reffile	string	None	Path to file with fluxes for non-solar system calibrators
phaseupsolint	any	int	Phaseup correction solution interval
solint	any	inf	Amplitude correction solution interval
minsnr	double	2.0	Minimum SNR for gain solutions
refant	string	None	The name or ID of the reference antenna
hm_resolvedcals	string	automatic	The resolved calibrators heuristics method
antenna	string	None	Antennas to be used in fluxscale
peak_fraction	double	0.2	Fraction of peak visibility at uv-distance limit of antennas to be used
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display commands (True)
acceptresults	bool	True	Automatically accept results into context

7.10 hifa_importdata

Task Description

Imports data into the interferometry pipeline
The hifa_importdata task loads the specified visibility data into the pipeline context unpacking and / or converting it as necessary.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

vis -- List of visisbility data files. These may be ASDMs, tar files of ASDMs, MSs, or tar files of MSs, If ASDM files are specified, they will be converted to MS format.
default: []
example: vis=['X227.ms', 'asdms.tar.gz']

session -- List of sessions to which the visibility files belong. Defaults to a single session containing all the visibility files, otherwise a session must be assigned to each vis file.
default: []
example: session=['session_1', 'session_2']

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline
context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode'

asis -- ASDM tables to convert as is
default: 'Antenna Station Receiver Source CalAtmosphere CalWVR'
example: 'Receiver', ''

process_caldevice -- Ingest the ASDM caldevice table
default: False
example: True

overwrite -- Overwrite existing MSs on output.
default: False

bdfflags -- Apply BDF flags on line
default: True

ocorr_mode -- Read in cross- and auto-correlation data(ca), cross- correlation data oonly (co), or autocorrelation data only (ao).
default: ca

lazy -- Use the lazy filter import

default: False

dbservice -- Use online flux catalog on import
default: False

ocorr_mode -- Read in cross- and auto-correlation data(ca), cross-correlation data oonly (co), or autocorrelation data only (ao).
default: ca

createmms -- Create a multi-measurement set ('true') ready for parallel processing, or a standard measurement set ('false'). The default setting ('automatic') creates an MMS if running in a cluster environment.
default: automatic

clearcals -- Clear pipeline calibrations as needed by resetting the corrected data column to the data column and setting the model column to unity. For normal pipeline operations clearclas should be left on, and the pipeline will choose when it needs to reset the calibrations. In some reprocessing applications clearcals should be turned off.
default: True

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Load an ASDM list in the ../rawdata subdirectory into the context.
hifa_importdata (vis=['../rawdata/uid___A002_X30a93d_X43e',
'../rawdata/uid_A002_x30a93d_X44e'])

2. Load an MS in the current directory into the context.
hifa_importdata (vis=[uid___A002_X30a93d_X43e.ms])

3. Load a tarred ASDM in ../rawdata into the context.
hifa_importdata (vis=['../rawdata/uid___A002_X30a93d_X43e.tar.gz'])

4. Check the hif_importdata inputs, then import the data myvislist =
['uid___A002_X30a93d_X43e.ms', 'uid_A002_x30a93d_X44e.ms']
hifa_importdata(vis=myvislist, pipelinemode='getinputs')
hifa_importdata(vis=myvislist)

5. Load an ASDM but check the results before accepting them into the context.

results = hifa_importdata (vis=['uid___A002_X30a93d_X43e.ms'], acceptresults=False)
results.accept()

6. Run in dryrun mode before running for real
results = hifa_importdata (vis=['uid___A002_X30a93d_X43e.ms'], dryrun=True)
results = hifa_importdata (vis=['uid___A002_X30a93d_X43e.ms'])

Parameter List

Table 46: hifa_importdata default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input visibility data
session	stringArray	None	List of visibility data sessions
pipelinemode	string	automatic	The pipeline operating mode
asis	string	Antenna Station Receiver Source CalAtmosphere CalWVR	ASDM to convert as is
process_caldevice	bool	False	Import the caldevice table from the ASDM
overwrite	bool	False	Overwrite existing files on import
bdfflags	bool	True	Apply BDF flags on import
lazy	bool	False	Use the lazy filler import
dbservice	bool	False	Use the online flux catalog
ocorr_mode	string	ca	ALMA default set to ca
createmms	string	automatic	Create a MMS
clearcals	bool	True	Reinitialize pipeline calibrations as needed
dryrun	bool	False	Run the task (False) or display task command (True)
acceptresults	bool	True	Add the results into the pipeline context

7.11 hifa_linpolcal

Task Description

Compute polarization calibration
Compute a polarization calibration.

Keyword arguments:

--- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets in the context.
CURRENTLY THE LIST MUST CONTAIN 1 MEASUREMENT SET.
default: ''
example: vis=['ngc5921a.ms', ngc5921b.ms', 'ngc5921c.ms']

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples
TBD

Parameter List

Table 47: hifa_linpolcal default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets, \'\' for default
field	string	None	Set of data selection field names or ids
intent	string	None	Set of data selection intents
g0table	string	None	Name of table holding G0 gain - not accounting for source pol
delaytable	string	None	Name of table holding cross-hand delay
xyf0table	string	None	Name of table holding residual X-Y phase spectrum and source Q and U
g1table	string	None	Name of table holding G1 gain - accounting for source pol

df0table	string	None	Name of table holding instrument polarization gain
refant	string	None	Reference antenna names
spw	string	None	Set of data selection spectral window/channels
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

7.12 hifa_spwphaseup

hif_spwphaseup performs tow functions
o determines the spectral window mapping mode for the phase vs time calibrations and computes spectral window map that will be used to apply those calibrations
o computes the per spectral window phase offset table that will be applied to the data to remove mean phase differences beteween the spectral windows

If hm_spwmapmode = 'auto' the spectral window map is computed using the following algorithm
o estimate the per spectral window per scan signal to noise ratio of the phase calibrator observations
o if the signal to noise of any single phase calibration spectral window is less than the value of 'phasesnr' hm_spwmapmode defaults to 'combine'
o if all phase calibrator spectral windows meet the low signal to noise criterion then hm_spwmapmode defaults to default'
o if the phase calibrator signal to noise values cannot be computed for any reason, for example there is no flux information, then hm_spwmapmode defaults to 'combine'

If hm_spwmapmode = 'combine' hifa_spwphaseup maps all the science windows to a single science spectral window. For example if the list of science spectral windows is [9, 11, 13, 15] then all the science spectral windows in the data will be combined and mapped to the science window 9 in the combined phase vs time calibration table.

If hm_spwmapmode = 'simple', a mapping from narrow science to wider science spectral windows is computed using the following algorithms:
o construct a list of the bandwidths of all the science spectral windows
o determine the maximum bandwidth in this list maxbandwidth
o for each science spectral window with bandwidth less than maxbandwidth
o construct a list of spectral windows with bandwidths greater than minfracmaxbw * maxbandwidth
o select the spectral window in this list whose band center most closely matches the band center of the narr spectral window
o prefentially match within the same baseband if samebb is True

If hm_spwmapmode = 'default' the spw mapping is assumed to be one to one.

Phase offsets per specral window are determined by computing a phase only gain calibration on the selected data, normally the high signal to noise bandpass calibrator observations, using the solution interval 'inf'.

At the end of the task the spectral window map and the phase offset calibration table in the pipeline are stored in the context for use by later tasks.

Task Description

Compute phase calibration spw map and per spw phase offsets
Compute the gain solutions.

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

hm_spwmapmode -- The spectral window mapping mode. The options are: 'auto', 'combine', 'simple', and 'default'. In 'auto' mode hifa_spwphaseup estimates the SNR of the phase calibrator observations and uses these estimates to choose between 'combine' mode (low SNR) and 'default' mode (high SNR). In combine mode all spectral windows are combined and mapped to one spectral window. In 'simple' mode narrow spectral windows are mapped to wider ones sing an algorithm defined by 'maxnarrowbw', 'minfracmaxbw', and 'samebb'. In 'default' mode the spectral window map defaults to the standard one to one mapping.
default: 'auto'
example: hm_spwmapmode='combine'

maxnarrowbw -- The maximum bandwidth defining narrow spectral windows. Values must be in CASA compatible frequency units.
default: '300MHz'
example: maxnarrowbw=''

minfracmaxbw -- The minimum fraction of the maximum bandwidth in the set of spws to use for matching.
default: 0.8
example: minfracmaxbw=0.75

samebb -- Match within the same baseband if possible ?
default: True
example: samebb=False

phasesnr -- The required gaincal solution signal to noise
default: 25.0
example: phaseupsnr = 20.0

bwedgefrac -- The fraction of the bandwidth edges that is flagged
default: 0.03125
example: bwedgefrac = 0.0

hm_nantennas -- The heuristics for determines the number of antennas to use in the signal to noise estimate. The options are 'all' and 'unflagged'. The 'unflagged' options is not currently supported.
default: 'all'

example: hm_nantennas='unflagged'

maxfracflagged -- The maximum fraction of an antenna that can be flagged before its is excluded from the signal to noise estimate.
default: 0.90
example: maxfracflagged=0.80

combine -- Data axes to combine for solving. Options are '','scan','spw',field' or any comma-separated combination.
default: ''
example: combine=''

minblperant -- Minimum number of baselines required per antenna for each solve Antennas with fewer baselines are excluded from solutions.
default: 4
example: minblperant=2

minsnr -- Solutions below this SNR are rejected.
default: 3.0

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets specified in the pipeline context
default: ''
example: ['M82A.ms', 'M82B.ms']

caltable -- The list of output calibration tables. Defaults to the standard pipeline naming convention.
default: ''
example: ['M82.gcal', 'M82B.gcal']

field -- The list of field names or field ids for which phase offset solutions are to be computed. Defaults to all fields with the default intent.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a comma delimited list of intents against which the the selected fields are matched. Defaults to the BANDPASS observations/
default: ''
example: intent='PHASE'

spw -- The list of spectral windows and channels for which gain solutions are computed. Defaults to all the science spectral windows.
default: ''
example: '13,15'

refant -- Reference antenna name(s) in priority order. Defaults to most recent values set in the pipeline context. If no reference antenna is defined in the pipeline context the CASA defaults are used.
default: ''
example: refant='DV01', refant='DV05,DV07'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Examples

1. Compute the default spectral window map and the per spectral window phase offsets.
hif_spwphaseup()

2. Compute the default spectral window map and the per spectral window phase offsets set the spectral window mapping mode to 'simple'.
hif_spwphaseup(hm_spwmapmode='simple')

Parameter List

Table 48: hifa_spwphaseup default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
caltable	stringArray	None	List of output caltables
field	string	None	Set of data selection field names or ids
intent	string	None	Set of data selection observing intents
spw	string	None	Set of data selection spectral window/channels
hm_spwmapmode	string	auto	The spw mapping mode
maxnarrowbw	string	300MHz	The maximum bandwidth defining narrow spectral windows
minfracmaxbw	double	0.8	The minimum fraction of the maximum bandpass for spw matching
samebb	bool	True	Match within the same baseband if possible ?
phasesnr	double	25.0	The minimum snr for triggering spw combination in auto spw mapping mode
bwedgefrac	double	0.03125	The fraction of the bandwidth edge that is flagged
hm_nantennas	string	all	The antenna selection heuristic

maxfracflagged	double	0.90	The maximum fraction of data flagged per antenna
combine	string	None	Data axes which to combine for solve (scan, spw, and/or field)
refant	string	None	Reference antenna names
minblperant	int	4	Minimum baselines per antenna required for solve
minsnr	double	3.0	Reject solutions below this SNR
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run task (False) or display the command(True)
acceptresults	bool	True	Automatically accept results into the context

7.13 hifa_timegaincal

The complex gains are derived from the data column (raw data) divided by the model column (usually set with hif_setjy). The gains are obtained for the specified solution intervals, spw combination and field combination. One gain solution is computed for the science targets and one for the calibrator targets.
Good candidate reference antennas can be determined using the hif_refant task. Previous calibrations that have been stored in the pipeline context are applied on the fly. Users can interact with these calibrations via the hif_export_calstate and hif_import_calstate tasks.

Task Description

Determine temporal gains from calibrator observations
Compute the gain solutions.

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

calsolint -- Time solution interval in CASA syntax for calibrator source solutions.
default: 'int'
example: 'inf', 'int', '100sec'

targetsolint -- Time solution interval in CASA syntax for target source solutions.
default: 'inf'
example: 'inf', 'int', '100sec'

combine -- Data axes to combine for solving. Options are '','scan','spw',field' or any comma-separated combination.
default; ''
example: combine=''

minblperant -- Minimum number of baselines required per antenna for each solve Antennas with fewer baaselines are excluded from solutions.
default: 4
example: minblperant=2

calminsnr -- Solutions below this SNR are rejected for calibrator solutions.
default: 2.0

targetminsnr -- Solutions below this SNR are rejected for science target solutions.
default: 3.0

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurment sets specified in the pipeline context
default: ''
example: ['M82A.ms', 'M82B.ms']

calamptable -- The list of output diagnostic calibration amplitude tables for the calibration targets. Defaults to the standard pipeline naming convention.
default: ''
example: ['M82.gacal', 'M82B.gacal']

calphasetable -- The list of output calibration phase tables for the calibration targets. Defaults to the standard pipeline naming convention.
default: ''
example: ['M82.gcal', 'M82B.gcal']

amptable -- The list of output calibration amplitude tables for the calibration and science targets. Defaults to the standard pipeline naming convention.
default: ''
example: ['M82.gcal', 'M82B.gcal']

targetphasetable -- The list of output phase calibration tables for the science targets. Defaults to the standard pipeline naming convention.
default: ''
example: ['M82.gcal', 'M82B.gcal']

field -- The list of field names or field ids for which gain solutions are to be computed. Defaults to all fields with the standard intent.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a comma delimited list of intents against which the the selected fields are matched. Defaults to the equivalent of 'AMPLITUDE,PHASE,BANDPASS'.
default: ''
example: '', 'PHASE'

spw -- The list of spectral windows and channels for which gain solutions are computed. Defaults to all science spectral windows.
default: ''

example: '3C279', '3C279, M82'

smodel -- Point source Stokes parameters for source model (experimental) Defaults to using standard MODEL_DATA column data.
default: []
example: [1,0,0,0] (I=1, unpolarized)

refant -- Reference antenna name(s) in priority order. Defaults to most recent values set in the pipeline context. If no reference antenna is defined in the pipeline context use the CASA defaults.
default: ''
example: refant='DV01', refant='DV05,DV07'

solnorm -- Normalise the gain solutions
default: False

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Examples

1. Compute standard per scan gain solutions that will be used to calibratethe target.
hifa_timegaincal()

Parameter List

Table 49: hifa_timegaincal default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
calamptable	stringArray	None	List of diagnostic output amplitude caltables for calibrator targets
calphasetable	stringArray	None	List of output phase caltables for calibrator targets
targetphasetable	stringArray	None	List of output phase caltables for science targets
amptable	stringArray	None	List of output amp caltables for science targets
field	string	None	Set of data selection field names or ids
intent	string	None	Set of data selection observing intents

spw	string	None	Set of data selection spectral window/channels
antenna	string	None	Set of data selection antenna ids
calsolint	any	int	Phase solution interval for calibrator sources
targetsolint	any	inf	Phase solution interval for science target sources
combine	string	None	Data axes which to combine for solve (scan, spw, and/or field)
refant	string	None	Reference antenna names
solnorm	bool	False	Normalize average solution amplitudes to 1.0
minblperant	int	4	Minimum baselines per antenna required for solve
calminsnr	double	2.0	Reject solutions below this SNR for calibrator solutions
targetminsnr	double	3.0	Reject solutions below this SNR for science solutions
smodel	doubleArray	None	Point source Stokes parameters for source model
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run task (False) or display the command(True)
acceptresults	bool	True	Automatically accept results into the context

7.14 hifa_tsyscal

Derive the Tsys calibration for list of measurement sets

Task Description

Derive a Tsys calibration table
Derive the Tsys calibration for list of measurement sets

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

chantol -- The tolerance in channels for mapping atmospheric calibration windows (TDM) to science windows (FDM or TDM)
default: 1
example: 5

---- pipeline parameter arguments which can be set in any pipeline mode

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- List of input visibility files
default: none;
example: vis='ngc5921.ms'

caltable -- Name of output gain calibration tables
default: none;
example: caltable='ngc5921.gcal'

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Example

1. Compute the tsys calibration tables for a list of measurement sets
hif_tsyscal()

Parameter List

Table 50: hifa_tsyscal default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
caltable	stringArray	None	List of output caltable(s)
chantol	int	1	Tsys spectral window map channel tolerance
pipelinemode	string	automatic	The pipeline operations mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically apply results to context

7.15 hifa_tsysflag

Task Description

Flag deviant system temperature measurements
hif_tsysflag tries to flag all deviant system temperature measurements in the system temperature calibration table. It does this by running a sequenceof flagging tests, each designed to look for a different type of error.

The tests are:
1. Flag Tsys spectra with high median values
2. Flag Tsys spectra with high median derivatives. This is meant to spot spectra that are 'ringing'.
3. Flag the edge channels of the Tsys spectra in each SpW.
4. Flag Tsys spectra whose shape is different from that associated with the BANDPASS intent.
5. Flag 'birdies'.
6. Flag the Tsys spectra of all antennas in a timestamp and spw if proportion of antennas already flagged in this timestamp and spw exceeds a threshold, and flag Tsys spectra for all antennas and all timestamps in a spw, if proportion of antennas that are already entirely flagged in all timestamps exceeds a threshold.

Keyword arguments:

--- Pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

flag_nmedian -- True to flag Tsys spectra with high median value.
default: True

fnm_limit -- Flag spectra with median value higher than fnm_limit * median of this measure over all spectra.
default: 2.0

fnm_byfield -- Evaluate the nmedian metric separately for each field.
default: False

flag_derivative -- True to flag Tsys spectra with high median derivative.
default: True

fd_max_limit -- Flag spectra with median derivative higher than fd_max_limit * median of this measure over all spectra.
default: 5.0

flag_edgechans -- True to flag edges of Tsys spectra.
default: True

fe_edge_limit -- Flag channels whose channel to channel difference > fe_edge_limit * median across spectrum.
default: 3.0

flag_fieldshape -- True to flag Tsys spectra with a radically different shape to those of the

ff_refintent.
default: True

ff_refintent -- Data intent that provides the reference shape for 'flag_fieldshape'.
default: BANDPASS

ff_max_limit -- Flag Tsys spectra with 'fieldshape' metric values > ff_max_limit.
default: 5.0

flag_birdies -- True to flag channels covering sharp spectral features.
default: True

fb_sharps_limit -- Flag channels bracketing a channel to channel difference > fb_sharps_limit.
default: 0.05

flag_toomany -- True to flag Tsys spectra for which a proportion of antennas for given timestamp and/or proportion of antennas that are entirely flagged in all timestamps exceeds their respective thresholds.
default: True

tmf1_limit -- Flag Tsys spectra for all antennas in a timestamp and spw if proportion of antennas already flagged in this timestamp and spw exceeds tmf1_limit.
default: 0.666

tmef1_limit -- Flag Tsys spectra for all antennas and all timestamps in a spw, if proportion of antennas that are already entirely flagged in all timestamps exceeds tmef1_limit.
default: 0.666

metric_order -- Order in which to evaluate the flagging metrics that are enables. Disabled metrics are skipped.
default: 'nmedian,derivative,edgechans,fieldshape,birdies,toomany'

normalize_tsys -- True to create a normalized Tsys table that is used to evaluate the Tsys flagging metrics. All newly found flags are also applied to the original Tsys caltable that continues to be used for subsequent calibration.
default: False

--- Pipeline context defined parameter arguments which can be set only in 'interactive mode'

caltable -- List of input Tsys calibration tables
default: [] - Use the table currently stored in the pipeline context.
example: caltable=['X132.ms.tsys.s2.tbl']

--- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Flag Tsys measurements using currently recommended tests:
hif_tsysflag()

2. Flag Tsys measurements using all recommended tests apart from that using the 'fieldshape' metric.
hif_tsysflag(flag_fieldshape=False)

Parameter List

Table 51: hifa_tsysflag default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets (Not used)
caltable	stringArray	None	List of input caltables
flag_nmedian	bool	True	True to flag Tsys spectra with high median value
fnm_limit	double	2.0	Flag spectra with median greater than fnm_limit * median over all spectra
fnm_byfield	bool	False	Evaluate the nmedian metric separately for each field.
flag_derivative	bool	True	True to flag Tsys spectra with high median derivative
fd_max_limit	double	5.0	Flag spectra with median derivative higher than fd_max_limit * median of this measure over all spectra
flag_edgechans	bool	True	True to flag edges of Tsys spectra
fe_edge_limit	double	3.0	Flag channels whose channel to channel difference greater than fe_edge_limit * median across spectrum
flag_fieldshape	bool	True	True to flag Tsys spectra with a radically different shape to those of the ff_refintent
ff_refintent	string	BANDPASS	Data intent providing the reference shape for \'flag_fieldshape\'
ff_max_limit	double	5.0	Flag Tsys spectra with \'fieldshape\' metric greater than ff_max_limit
flag_birdies	bool	True	True to flag channels covering sharp spectral features
fb_sharps_limit	double	0.05	Flag channels bracketing a channel to channel difference greater than fb_sharps_limit
flag_toomany	bool	True	True to flag Tsys spectra for which a proportion of timestamps or proportion of antennas that are entirely flagged exceeds their respective thresholds.

tmf1_limit	double	0.666	Flag all Tsys spectra within a timestamp for an antenna if proportion flagged already exceeds tmf1_limit
tmef1_limit	double	0.666	Flag all Tsys spectra for all antennas in a spw, if proportion of antennas that are already entirely flagged in all timestamps exceeds tmef1_limit
metric_order	string	nmedian, derivative, edgechans, fieldshape, birdies, toomany	Order in which to evaluate the flagging metric(s); inactive metrics are skipped.
normalize_tsys	bool	False	Normalize Tsys prior to computing the flagging metric(s)
pipelinemode	string	automatic	The pipeline operations mode
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	Bool	True	Automatically apply results to context

7.16 hifa_wvrgcalflag

Task Description

First, generate a gain table based on the Water Vapour Radiometer data in each vis file.
Second, apply the wvr calibration to the data specified by 'flag_intent', calculate flagging 'views' showing the ratio phase-rms with wvr / phase-rms without wvr for each scan. A ratio < 1 implies that the phase noise is improved, a score > 1 implies that it is made worse.
Third, search the flagging views for antennas with anomalous high values. If any are found then recalculate the wvr calibration with the 'wvrflag' parameter set to ignore their data and interpolate results from other
antennas according to 'maxdistm' and 'minnumants'.
Fourth, if the overall QA score for the final wvr correction of a vis file is greater than the value in 'accept_threshold' then make available the wvr calibration file for merging into the context and use in the
subsequent reduction.

vis -- List of input visibility files
default: none, in which case the vis files to be used will be read from the context.
example: vis=['ngc5921.ms']

caltable -- List of output gain calibration tables
default: none, in which case the names of the caltables will be generated automatically.
example: caltable='ngc5921.wvr'

hm_toffset -- If 'manual', set the 'toffset' parameter to the user-specified value. If 'automatic', set the 'toffset' parameter according to the date of the measurement set; toffset=-1 if before 2013-01-21T00:00:00 toffset=0 otherwise.
default: 'automatic'

toffset -- Time offset (sec) between interferometric and WVR data

default: 0

segsource -- If True calculate new atmospheric phase correction coefficients for each source, subject to the constraints of the 'tie' parameter. 'segsource' is forced to be True if the 'tie' parameter is set to a non-empty value by the user or by the automatic heuristic.
default: True

hm_tie -- If 'manual', set the 'tie' parameter to the user-specified value. If 'automatic', set the 'tie' parameter to include with the target all calibrators that are within 15 degrees of it: if no calibrators are that close then 'tie' is left empty.
default: 'automatic'

tie -- Use the same atmospheric phase correction coefficients when calculating the wvr correction for all sources in the 'tie'. If 'tie' is not empty then 'segsource' is forced to be True. Ignored unless hm_tie='manual'.
default: []
example: ['3C273,NGC253', 'IC433,3C279']

sourceflag -- Flag the WVR data for these source(s) as bad and do not produce corrections for it. Requires segsource=True
default: []
example: ['3C273']

nsol -- Number of solutions for phase correction coefficients during this observation, evenly distributed in time throughout the observation. It is used only if segsource=False because if segsource=True then the coefficients are recomputed whenever the telescope moves to a new source (within the limits imposed by 'tie').
default: 1

disperse -- Apply correction for dispersion
default: False

wvrflag -- Flag the WVR data for these antenna(s) as bad and replace its data with interpolated values
default: []
example: ['DV03','DA05','PM02']

hm_smooth -- If 'manual' set the 'smooth' parameter to the user-specified value. If 'automatic', run the wvrgcal task with the range of 'smooth' parameters required to match the integration time of the wvr data to that of the interferometric data in each spectral window.

smooth -- Smooth WVR data on this timescale before calculating the correction. Ignored unless hm_smooth='manual'.
default: ''

scale -- Scale the entire phase correction by this factor.
default: 1

maxdistm -- Maximum distance in meters of an antenna used for interpolation from a flagged antenna.
default: 500
example: 550

minnumants -- Minimum number of nearby antennas (up to 3) used for interpolation from a flagged antenna.
default: 2
example: 3

mingoodfrac -- Minimum fraction of good data per antenna
default: 0.8
example: 0.7

refant -- Ranked comma delimited list of reference antennas
default: ''
example: 'DV02,DV06'

flag_intent -- The data intent(s) on whose wvr correction results the search for bad wvr antennas is to be based. A 'flagging view' will be calculated for each specified intent, in each spectral window in each vis file. Each 'flagging view' will consist of a 2-d image with dimensions ['ANTENNA', 'TIME'], showing the phase noise after the wvr correction has been applied. If flag_intent is left blank, the default, the flagging views will be derived from data with the default bandpass calibration intent i.e. the first in the list BANDPASS, PHASE, AMPLITUDE for which the measurement set has data.
default ''

qa_intent -- The list of data intents on which the wvr correction is to be tried as a means of estimating its effectiveness. A QA 'view' will be calculated for each specified intent, in each spectral window in each vis file. Each QA 'view' will consist of a pair of 2-d images with dimensions ['ANTENNA', 'TIME'], one showing the data phase-noise before the wvr application, the second showing the phase noise after (both 'before' and 'after' images have a bandpass calibration applied as well). An overall QA score is calculated for each vis file, by dividing the 'before' images by the 'after' and taking the median of the result. An overall score of 1 would correspond to no change in the phase noise, a score > 1 implies an improvement. If the overall score for a vis file is less than the value in 'accept_threshold' then the wvr calibration file is not made available for merging into the context for use in the subsequent reduction.
default: 'BANDPASS,PHASE'

qa_bandpass_intent -- The data intent to use for the bandpass calibration in the qa calculation. The default is blank to allow the underlying bandpass task to select a sensible intent if the dataset lacks BANDPASS data.
default: ''

accept_threshold -- The phase-rms improvement ratio (rms without wvr / rms with wvr) above which the wrvg file will be accepted into the context for subsequent application.
default: 1.0

Example

1. Compute the WVR calibration for all the measurement sets.
hifa_wvrgcalflag (hm_tie='automatic')

Parameter List

Table 52: hifa_wvrgcalflag default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input visibility files
caltable	stringArray	None	List of output gain calibration tables
hm_toffset	string	automatic	Toffset computation heuristic method
toffset	double	0	Time offset (sec) between IF and WVR data
segsource	bool	True	Compute new coefficient calculation for each source
sourceflag	stringArray	None	Flag the WVR data for these source(s)
hm_tie	string	automatic	Tie computation heuristics method
tie	stringArray	None	Sources for which to use the same atmospheric phase correction coefficients
nsol	int	1	Number of solutions for phase correction coefficients
disperse	bool	False	Apply correction for dispersion
wvrflag	stringArray	None	Flag the WVR data for these antenna(s) replace with interpolated values
hm_smooth	string	automatic	Smoothing computation heuristics method
smooth	string	None	Smooth WVR data on the given timescale before calculating the correction
scale	double	1.	Scale the entire phase correction by this factor
maxdistm	double	500.	Maximum distance (m) of an antenna used for interpolation for a flagged antenna
minnumants	int	2	Minimum number of near antennas (up to 3) required for interpolation
mingoodfrac	double	0.8	Minimum fraction of good data per antenna
refant	string	None	Ranked list of reference antennas
flag_intent	string	None	Data intents to use in detecting and flagging bad wvr antennas
qa_intent	string	BANDPASS, PHASE	Data intents to use in estimating the effectiveness of the wvr correction
qa_bandpass_intent	string	None	Data intent to use for the bandpass calibration in the qa calculation
accept_threshold	double	1.0	Improvement ratio (phase-rms without wvr / phase-rms with wvr) above which wvrg calibration file will be accepted
flag_hi	bool	True	True to flag high figure of merit outliers
fhi_limit	double	10.0	Flag figure of merit values higher than limit * MAD
fhi_minsample	int	5	Minimum number of samples for valid MAD estimate

pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

7.17 hifa_wvrgcal

Task Description

Generate a gain table based on the Water Vapour Radiometer data in each vis file. By applying the wvr calibration to the data specified by 'qa_intent' and 'qa_spw', calculate a QA score to indicate its effect on interferometric data; a score > 1 implies that the phase noise is improved, a score < 1 implies that it is made worse. If the score is less than 'accept_threshold' then the wvr gain table is not accepted into the context for subsequent use.

vis -- List of input visibility files
default: none, in which case the vis files to be used will be read from the context.
example: vis=['ngc5921.ms']

caltable -- List of output gain calibration tables
default: none, in which case the names of the caltables will be generated automatically.
example: caltable='ngc5921.wvr'

hm_toffset -- If 'manual', set the 'toffset' parameter to the user-specified value. If 'automatic', set the 'toffset' parameter according to the date of the measurement set; toffset=-1 if before 2013-01-21T00:00:00 toffset=0 otherwise.
default: 'automatic'

toffset -- Time offset (sec) between interferometric and WVR data
default: 0

segsource -- If True calculate new atmospheric phase correction coefficients for each source, subject to the constraints of the 'tie' parameter. 'segsource' is forced to be True if the 'tie' parameter is set to a non-empty value by the user or by the automatic heuristic.
default: True

hm_tie -- If 'manual', set the 'tie' parameter to the user-specified value. If 'automatic', set the 'tie' parameter to include with the target all calibrators that are within 15 degrees of it: if no calibrators are that close then 'tie' is left empty.
default: 'automatic'

tie -- Use the same atmospheric phase correction coefficients when calculating the wvr correction for all sources in the 'tie'. If 'tie' is not empty then 'segsource' is forced to be True. Ignored unless hm_tie='manual'.
default: []
example: ['3C273,NGC253', 'IC433,3C279']

sourceflag -- Flag the WVR data for these source(s) as bad and do not produce corrections for it. Requires segsource=True.

default: []
example: ['3C273']

nsol -- Number of solutions for phase correction coefficients during this observation, evenly distributed in time throughout the observation. It is used only if segsource=False because if segsource=True then the
coefficients are recomputed whenever the telescope moves to a new source (within the limits imposed by 'tie').
default: 1

disperse -- Apply correction for dispersion
default: False

wvrflag -- Flag the WVR data for the listed antennas as bad and replace their data with values interpolated from the 3 nearest antennas with unflagged data.
default: []
example: ['DV03','DA05','PM02']

hm_smooth -- If 'manual' set the 'smooth' parameter to the user-specified value. If 'automatic', run the wvrgcal task with the range of 'smooth' parameters required to match the integration time of the wvr data to that of the interferometric data in each spectral window.

smooth -- Smooth WVR data on this timescale before calculating the correction. Ignored unless hm_smooth='manual'.
default: ''

scale -- Scale the entire phase correction by this factor.
default: 1

maxdistm -- Maximum distance in meters of an antenna used for interpolation from a flagged antenna.
default: 500
example: 550

minnumants -- Minimum number of nearby antennas (up to 3) used for interpolation from a flagged antenna.
default: 2
example: 3

mingoodfrac -- Minimum fraction of good data per antenna
default: 0.8

refant -- Ranked comma delimited list of reference antennas.
default: ''
example 'DV01,DV02'

qa_intent -- The list of data intents on which the wvr correction is to be tried as a means of estimating its effectiveness. A QA 'view' will be calculated for each specified intent, in each spectral window in each vis file. Each QA 'view' will consist of a pair of 2-d images with dimensions ['ANTENNA', 'TIME'], one showing the data phase-noise before the wvr application, the second showing the phase noise after (both 'before' and 'after' images have a bandpass calibration applied as well). An overall QA score is calculated for each vis file, by dividing the 'before' images by the

'after' and taking the median of the result. An overall score of 1 would correspond to no change in the phase noise, a score > 1 implies an improvement. If the overall score for a vis file is less than the value in 'accept_threshold' then the wvr calibration file is not made available for merging into the context for use in the subsequent reduction. If you do not want any QA calculations then set qa_intent=''.
default: ''
example: 'PHASE'

qa_bandpass_intent -- The data intent to use for the bandpass calibration in the qa calculation. The default is blank to allow the underlying bandpass task to select a sensible intent if the dataset lacks BANDPASS data.
default: ''

qa_spw -- The SpW(s) to use for the qa calculation, in the order that they should be tried. Input as a comma-separated list. The default is blank, in which case the task will try SpWs in order of decreasing median sky opacity.
default: ''

accept_threshold -- The phase-rms improvement ratio (rms without wvr / rms with wvr) above which the wrvg file will be accepted into the context for subsequent application.
default: 1.0

Example

1. Compute the WVR calibration for all the measurement sets.
hifa_wvrgcal (hm_tie='automatic')

Parameter List

Table 53: hifa_wvrgcal default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input visibility files
caltable	stringArray	None	List of output gain calibration tables
hm_toffset	string	automatic	Toffset computation heuristic method
toffset	double	0	Time offset (sec) between IF and WVR data
segsource	bool	True	Compute new coefficient calculation for each source
sourceflag	stringArray	None	Flag the WVR data for these source(s)
hm_tie	string	automatic	Tie computation heuristics method
tie	stringArray	None	Sources for which to use the same atmospheric phase correction coefficients
nsol	int	1	Number of solutions for phase correction coefficients
disperse	bool	False	Apply correction for dispersion

wvrflag	stringArray	None	Flag the WVR data for these antenna(s) replace with interpolated values
hm_smooth	string	automatic	Smoothing computation heuristics method
smooth	string	None	Smooth WVR data on the given timescale before calculating the correction
scale	double	1.	Scale the entire phase correction by this factor
maxdistm	double	500.	Maximum distance (m) of an antenna used for interpolation for a flagged antenna
minnumants	int	2	Minimum number of near antennas (up to 3) required for interpolation
mingoodfrac	double	0.8	Minimum fraction of good data per antenna
refant	string	None	Ranked list of reference antennas
qa_intent	string	None	Data intents to use in estimating the effectiveness of the wvr correction
qa_bandpass_intent	string	None	Data intent to use for the bandpass calibration in the qa calculation
qa_spw	string	None	Data SpW(s) to use in estimating the effectiveness of the wvr correction
accept_threshold	double	1.0	Improvement ratio (phase-rms without wvr / phase-rms with wvr) above which wvrg calibration file will be accepted
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display the command(True)
acceptresults	bool	True	Add the results to the pipeline context

8 Single-Dish Task Descriptions

8.1 hsd_applycal

hif_applycal applies the precomputed calibration tables stored in the pipeline context to the set of visibility files using predetermined field and spectral window maps and default values for the interpolation schemes. Users can interact with the pipeline calibration state using the tasks hif_export_calstate and hif_import_calstate.

Task Description

Apply the calibration(s) to the data
Apply precomputed calibrations to the data.

---- pipeline parameter arguments which can be set in any pipeline mode

applymode -- Calibration apply mode
''='calflagstrict': calibrate data and apply flags from solutions using the strict flagging convention
'trial': report on flags from solutions, dataset entirely unchanged
'flagonly': apply flags from solutions only, data not calibrated
'calonly': calibrate data only, flags from solutions NOT applied
'calflagstrict':
'flagonlystrict':same as above except flag spws for which calibration is unavailable in one or more tables (instead of allowing them to pass uncalibrated and unflagged)
default: ''

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement sets in the pipeline context.
default: []
example: ['X227.ms']

field -- A string containing the list of field names or field ids to which the calibration will be applied. Defaults to all fields in the pipeline context.
default: ''
example: '3C279', '3C279, M82'

intent -- A string containing a the list of intents against which the selected fields will be matched. Defaults to all supported intents in the pipeline context.
default: ''
example: '*TARGET*'

spw -- The list of spectral windows and channels to which the calibration will be applied. Defaults to all science windows in the pipeline context.
default: ''
example: '17', '11, 15'

antenna -- The list of antennas to which the calibration will be applied. Defaults to all antennas. Not currently supported.

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: False

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned

Issues

There is some discussion about the appropriate values of calwt. Given properly scaled data, the correct value should be the CASA default of True. However at the current time ALMA is suggesting that calwt be set to True for applying observatory calibrations, e.g. antenna postions, WVR, and system temperature corrections, and to False for applying instrument calibrations, e.g. bandpass, gain, and flux.

Examples

1. Apply the calibration to the target data
hsd_applycal (intent='TARGET')

Parameter List

Table 54: hsd_applycal default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets
field	string	None	Set of data selection field names or ids
intent	string	None	Set of data selection observing intents
spw	string	None	Set of data selection spectral window/channels
antenna	string	None	Set of data selection antenna ids
applymode	string	None	Calibration mode: ""="calflagstrict", "calflag", "calflagstrict", "trial", "flagonly", "flagonlystrict", or "calonly"
calwt	boolArray	True	Calibrate the weights as well as the data
flagbackup	bool	True	Backup the flags before the apply
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run task (False) or display the command(True)
acceptresults	bool	True	Automatically accept results into the context

8.2 hsd_baseline

Task Description

Detect and validate spectral lines, subtract baseline by masking detected lines. The hsd_baseline task subtracts baseline from calibrated spectra. By default, the task tries to find spectral line feature

using line detection and validation algorithms. Then, the task puts a mask on detected lines and perform baseline subtraction. The user is able to turn off automatic line masking by setting linewindow parameter, which specifies pre-defined line window. Fitting order is automatically determined by default. It can be
disabled by specifying fitorder as non-negative value. In this case, the value specified by fitorder will be used.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

fitfunc -- fitting function for baseline subtraction. You can only choose cubic spline ('spline' or 'cspline')
default: 'cspline'.

fitorder -- Fitting order for polynomial. For cubic spline, it is used to determine how much the spectrum is segmented into. Default (-1) is to determine the order automatically.
default: -1 (auto determination)

linewindow -- Pre-defined line window. If this is set, specified line windows are used as a line mask for baseline subtraction instead to determine masks based on line detection and validation stage. Two types of format are acceptable. One is channel-based specification, [min_chan,max_chan] and the other is specification by central frequency in GHz plus line range as velocity in km/s, [center_freq, min_vel, max_vel] You can set multiple line windows by using nested list. However, the above notation must not be mixed in the list for multiple line windows.
default: [] (do line detection and validation)
example: [100.0,200.0], [115.0,-10.0,10.0]

edge -- number of edge channels to be dropped from baseline subtraction. The value must be a list with length of 2, whose values specifies left and right edge channels respectively.
default: [] ([0,0])
example: [10,10]

broadline -- Try to detect broad component of spectral line if True.
default: True

clusteringalgorithm -- selection of the algorithm used in the clustering analysis to check the validity of detected line features. 'kmean' algorithm and hierarchical clustering algorithm 'hierarchy' are so far implemented.
default: 'kmean'.

deviationmask -- Apply deviation mask in addition to masks determined by the automatic line detection.
default: True

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode'

infiles -- List of data files. These must be a name of Scantables that are registered to context via hsd_importdata task.
default: []
example: vis=['X227.PM01.asap', 'X227.PM02.asap']

field -- Data selection by field.
default: '' (all fields)
example: '1' (select by FIELD_ID)
'M100*' (select by field name)

antenna -- Data selection by antenna.
default: '' (all antennas)
example: '1' (select by ANTENNA_ID)
'PM03' (select by antenna name)

spw -- Data selection by spw.
default: '' (all spws)
example: '3,4' (generate caltable for spw 3 and 4)
['0','2'] (spw 0 for first data, 2 for second)

pol -- Data selection by pol.
default: '' (all polarizations)
example: '0' (generate caltable for pol 0)
['0~1','0'] (pol 0 and 1 for first data, only 0 for second)

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

Parameter List

Table 55: hsd_baseline default settings

Parameter	Type	Default	Description
fitfunc	string	cspline	Fitting function for baseline subtraction
fitorder	int	-1	Fitting order for baseline subtraction

linewindow	intArray	None	Pre-defined line window
edge	intArray	None	Edge channels to be dropped
broadline	bool	True	Try to detect broad component of the line
clusteringalgorithm	string	kmean	Algorithm for line validation clustering algorithm
deviationmask	bool	True	Apply deviation mask in addition to detected line masks
pipelinemode	string	automatic	The pipeline operating mode
infiles	stringArray	None	List of input files to be calibrated (default all)
field	string	None	select data by field
antenna	string	None	select data by antenna
spw	any	None	select data by IF IDs (spectral windows), e.g. \'3,5,7\' (\'\'=all)
pol	any	None	select data by polarizations, e.g. \'0~1\' (\'\'=all)
dryrun	bool	False	Run the task (False) or display task command (True)
acceptresults	bool	True	Add the results into the pipeline context

8.3 hsd_blflag

Data are flagged based on several flagging rules. Available rules are: expected rms, calculated rms, and running mean of both pre-fit and post-fit spectra. Tsys flagging is also available. In addition, the heuristics script creates many plots for each stage. Those plots are included in the weblog.

Task Description

Flag spectra based on predefined criteria of single-dish pipeline

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

iteration -- Number of iterations to perform sigma clipping to calculate threshold value of flagging.
default: 5

edge -- Number of channels to be dropped from the edge. The value must be a list of integer with length of one or two. If list length is one, same number will be applied both side of the band.
default: [0,0]
example: [10,20], [10]

flag_tsys -- Activate (True) or deactivate (False) Tsys flag.
default: True

tsys_thresh -- Threshold value for Tsys flag.

default: 3.0

flag_weath -- Activate (True) or deactivate (False) weather flag. Since weather flagging is not implemented yet. Setting True has no effect at the moment.
default: False

weath_thresh -- Threshold value for weather flag.
default: 3.0

flag_prfre -- Activate (True) or deactivate (False) flag by expected rms of pre-fit spectra.
default: True

prfre_thresh -- Threshold value for flag by expected rms of pre-fit spectra.
default: 3.0

flag_pofre -- Activate (True) or deactivate (False) flag by expected rms of post-fit spectra.
default: True

pofre_thresh -- Threshold value for flag by expected rms of post-fit spectra.
default: 1.3333

flag_prfr -- Activate (True) or deactivate (False) flag by rms of pre-fit spectra.
default: True

prfr_thresh -- Threshold value for flag by rms of pre-fit spectra.
default: 4.5

flag_pofr -- Activate (True) or deactivate (False) flag by rms of post-fit spectra.
default: True

pofr_thresh -- Threshold value for flag by rms of post-fit spectra.
default: 4.0

flag_prfrm -- Activate (True) or deactivate (False) flag by running mean of pre-fit spectra.
default: True

prfrm_thresh -- Threshold value for flag by running mean of pre-fit spectra.
default: 5.5

prfrm_nmean -- Number of channels for running mean of pre-fit spectra.
default: 5

flag_pofrm -- Activate (True) or deactivate (False) flag by running mean of post-fit spectra.
default: True

pofrm_thresh -- Threshold value for flag by running mean of post-fit spectra.
default: 5.0

pofrm_nmean -- Number of channels for running mean of post-fit spectra.
default: 5

flag_user -- Activate (True) or deactivate (False) user-defined flag. Since user flagging is not

implemented yet. Setting True has no effect at the moment.
default: False

user_thresh -- Threshold value for flag by user-defined rule.
default: 3.0

plotflag -- True to plot result of data flagging.
default: True

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode' or 'getinputs' modes

infiles -- ASDM or MS files to be processed. This parameter behaves as data selection parameter. The name specified by infiles must be registered to context before you run hsd_blflag.
default: [] (process all data in context)

antenna -- Data selection by antenna names or ids.
default: '' (all antennas)
example: 'PM03,PM04'

field -- Data selection by field names or ids.
default: '' (all fields)
example: '*Sgr*,M100'

spw -- Data selection by spw IDs.
default: '' (all spws)
example: '3,4' (spw 3 and 4)

pol -- Data selection by pol.
default: '' (all polarizations)
example: 'XX,YY' (correlation XX and YY)

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Parameter List

Table 56: hsd_blflag default settings

Parameter	Type	Default	Description
iteration	int	5	Number of iteration to perform sigma clipping to calculate threshold
edge	intArray	0,0	Number of edge channels to be excluded from statistic calculation to flag data
flag_tsys	bool	True	Flag data by Tsys value
tsys_thresh	double	3.0	Threshold for Tsys flag
flag_weath	bool	False	Flag data by weather (not implemented yet)
weath_thresh	double	3.0	Threshold for weather flag
flag_prfre	bool	True	Flag data by EXPECTED RMS of pre-fit spectra
prfre_thresh	double	3.0	Threshold for EXPECTED RMS of pre-fit spetra flag
flag_pofre	bool	True	Flag data by EXPECTED RMS of post-fit spectra
pofre_thresh	double	1.3333	Threshold for EXPECTED RMS of post-fit spectra flag
flag_prfr	bool	True	Flag data by RMS of pre-fit spectra
prfr_thresh	double	4.5	Threshold for RMS of pre-fit flag
flag_pofr	bool	True	Flag data by RMS of post-fit spectra
pofr_thresh	double	4.0	Threshold for RMS of post-fit spectra flag
flag_prfrm	bool	True	Flag data by running mean of pre-fit spectra
prfrm_thresh	double	5.5	Threshold for running mean of pre-fit spectra flag
prfrm_nmean	int	5	Number of channel for running mean of pre-fit spectra flag
flag_pofrm	bool	True	Flag data by running mean of post-fit spectra
pofrm_thresh	double	5.0	Threshold for running mean of post-fit spectra flag
pofrm_nmean	int	5	Number of channel for running mean of post-fit spectra flag
flag_user	bool	False	Flag data by user flag (not implemented yet)
user_thresh	double	5.0	Threshold for user flag
plotflag	bool	True	Create plots for flagging
pipelinemode	string	automatic	The pipeline operating mode
infiles	stringArray	None	List of input files to be flagged (\'\'=all)

antenna	string	None	select data by antenna names or ids, e.g. \'PM03,PM04\' (\'\'=all)
field	string	None	select data by field names or ids, e.g. \'M100,Sgr*\' (\'\'=all)
spw	string	None	select data by spectral windows, e.g. \'3,5,7\' (\'\'=all)
pol	string	None	select data by polarizations, e.g. \'XX,YY\' (\'\'=all)
dryrun	bool	False	Run the task (False) or display the task command (True)
acceptresults	bool	True	Add the results into the pipeline context

8.4 hsd_exportdata

The hsd_exportdata task exports the data defined in the pipeline context and exports it to the data products directory, converting and or packing it as necessary. The current version of the task exports the following products:
o a FITS imgae for each selected science target source image
o a tar file per ASDM containing the final flags version and blparam
o a tar file containing the file web log
TBD
o a file containing the line feature table(frequency,width,spatial distribution)
o a file containing the list of identified transitions from line catalogs

Task Description

Prepare singledish data for export
The hsd_exportdata task exports the data defined in the pipeline context and exports it to the data products directory, converting and or packing it as necessary.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode'

pprfile -- Name of the pipeline processing request to be exported. Defaults to a file matching the template 'PPR_*.xml'.
default: []
example: pprfile=['PPR_GRB021004.xml']

targetimages -- List of science target images to be exported. Defaults to all
science target images recorded in the pipeline context.
default: []

example: targetimages=['r_aqr.CM02.spw5.line0.XXYY.sd.im', 'r_aqr.CM02.spw5.XXYY.sd.cont.im']

products_dir -- Name of the data products subdirectory. Defaults to './'
default: ''
example: products_dir='../products'

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Export the pipeline results for a single sessions to the data products directory
!mkdir ../products
hsd_exportdata (products_dir='../products')

Parameter List

Table 57: hsd_exportdata default settings

Parameter	Type	Default	Description
pprfile	string	None	The pipeline processing request(PPR) file to be exported
targetimages	stringArray	None	List of target CASA images to be exported
products_dir	string	None	The data products directory
pipelinemode	string	automatic	The pipeline operating mode
dryrun	bool	False	Run the task (False) or display task command (True)
acceptresults	bool	True	Add the results into the pipeline context

8.5 hsd_flagdata

The hsd_t_flagdata data performs basic flagging operations on a list of measurements including:
o applying online flags
o apply a flagging template
o autocorrelation data flagging
o shadowed antenna data flagging

o scan based flagging by intent or scan number
o edge channel flagging

Task Description

Do basic flagging of a list of measurement sets
The hsd_flagdata data performs basic flagging operations on a list of measurement sets.

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline parameter arguments which can be set in any pipeline mode

autocorr -- Flag autocorrelation data.
default: False

shadow -- Flag shadowed antennas.
default: True

scan -- Flag a list of specifed scans.
default: True

scannumber -- A string containing a comma delimited list of scans to be flagged.
example: '3,5,6'
default: ''

intents -- A string containing a comma delimited list of intents against which the scans to be flagged are matched.
example: '*BANDPASS*'
default: 'POINTING,FOCUS,ATMOSPHERE,SIDEBAND'

edgespw -- Flag the edge spectral window channels.
default: True

fracspw -- Fraction of the baseline correlator TDM edge channels to be flagged.
default: 0.0625

fracspwfps -- Fraction of the ACS correlator TDM edge channels to be flagged.
default: 0.48387

online -- Apply the online flags.
default: True

fileonline -- File containing the online flags. These are computed by the h_init or hif_importdata data tasks. If the online flags files are undefined a name of the form 'msname_flagonline.txt' is assumed.
default: ''

template -- Apply flagging templates
default: True

filetemplate -- The name of an text file that contains the flagging template for RFI, birdies, telluric lines, etc. If the template flags files is undefined a name of the form 'msname_flagtemplate.txt' is assumed.
default: ''

hm_tbuff -- The heuristic for computing the default time interval padding parameter. The options are 'halfint' and 'manual'. In 'halfint' mode tbuff is set to half the maximum of the median integration time of the science and calibrator target observations.
default: 'halfint'

tbuff -- The time in seconds used to pad flagging command time intervals if hm_tbuff='manual'.
default: 0.0

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

vis -- The list of input measurement sets. Defaults to the list of measurement defined in the pipeline context.
default: ''

flagbackup -- Back up any pre-existing flags.
default: False

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Do basic flagging on a measurement set
hsd_flagdata()

2. Do basic flagging on a measurement set flaggin additional scans selected by number as well.
hsd_flagdata(scannumber='13,18')

Parameter List

Table 58: hsd_flagdata default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input measurement sets to flag
autocorr	bool	False	Flag autocorrelation data
shadow	bool	True	Flag shadowed antennas
scan	bool	True	Flag specified scans
scannumber	string	None	List of scans to be flagged
intents	string	POINTING, FOCUS, ATMOSPHERE, SIDEBAND, CHECK	List of intents of scans to be flagged
edgespw	bool	True	Flag edge channels
fracspw	any	1.875GHz	Fraction of baseline correlator edge channels to be flagged
fracspwfps	double	0.048387	Fraction of ACA correlator edge channels to be flagged
online	bool	True	Apply the online flags
fileonline	string	None	File of online flags to be applied
template	bool	True	Apply a flagging template
filetemplate	stringArray	None	File that contains the flagging template
hm_tbuff	string	halfint	The time buffer computation heuristic
tbuff	any	0.0	List of time buffers (sec) to pad timerange in flag commands
qa0	bool	True	QA0 flags
pipelinemode	string	automatic	The pipeline operating mode
flagbackup	bool	False	Backup prexistings flags before applying new ones
dryrun	bool	False	Run the task (False) or display the command (True)
acceptresults	bool	True	Add the results into the pipeline context

8.6 hsd_imaging

Task Description

Generate single dish images
The hsd_imaging task generates single dish images per antenna as well as combined image over whole antennas for each field and spectral window. Image configuration (grid size, number of pixels, etc.) is automatically determined based on meta data such as antenna diameter, map extent, etc. Note that generated images are always in LSRK frame.

Keyword arguments:

mode -- imaging mode controls imaging parameters in the task. Accepts either 'line' (spectral line imaging) or 'ampcal' (image settings for amplitude calibrator)
default: 'line'
options: 'line', 'ampcal',

---- pipeline parameter arguments which can be set in any pipeline mode

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline
context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode'

infiles -- List of data files. These must be a name of Measurementsets that are registered to context via hsd_importdata task.
default: []
example: vis=['uid___A002_X85c183_X36f.ms', 'uid___A002_X85c183_X60b.ms']

field -- Data selection by field names or ids.
default: '' (all fields)
example: '*Sgr*,M100'

spw -- Data selection by spw IDs.
default: '' (all spws)
example: '3,4' (generate images for spw 3 and 4)

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Parameter List

Table 59: hsd_imaging default settings

Parameter	Type	Default	Description
mode	string	line	Imaging mode [\'line\'|\'ampcal\']

pipelinemode	string	automatic	The pipeline operating mode
infiles	stringArray	None	List of input files to be calibrated (default all)
field	string	None	Field to be imaged, e.g., \'M100,Sgr*\' (default all)
spw	any	None	select data by spectral window IDs, e.g. \'3,5,7\' (default all)
dryrun	bool	False	Run the task (False) or display task command (True)
acceptresults	bool	True	Add the results into the pipeline context

8.7 hsd_importdata

Task Description

Imports data into the single dish pipeline
The hsd_importdata task loads the specified visibility data into the pipeline context unpacking and / or converting it as necessary.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

vis -- List of visisbility data files. These may be ASDMs, tar files of ASDMs, MSs, or tar files of MSs, If ASDM files are specified, they will be converted to MS format.
default: []
example: vis=['X227.ms', 'asdms.tar.gz']

session -- List of sessions to which the visibility files belong. Defaults to a single session containing all the visibility files, otherwise a session must be assigned to each vis file.
default: []
example: session=['Session_1', 'Sessions_2']

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode'

asis -- ASDM tables to convert as is
default: 'Antenna Station Receiver CalAtmosphere'
example: 'Receiver', ''

process_caldevice -- Ingest the ASDM caldevice table
default: False
example: True

overwrite -- Overwrite existing MSs on output.

default: False

bdfflags -- Apply BDF flags on line
default: True

lazy -- Use the lazy filter import
default: False

dbservice -- Use online flux catalog on import
default: False

with_pointing_correction -- add (ASDM::Pointing::encoder - ASDM::Pointing::pointingDirection) to the value to be written in MS::Pointing::direction
default: True

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Load an ASDM list in the ../rawdata subdirectory into the context.
hsd_importdata (vis=['../rawdata/uid___A002_X30a93d_X43e',
'../rawdata/uid_A002_x30a93d_X44e'])

2. Load an MS in the current directory into the context.
hsd_importdata (vis=[uid___A002_X30a93d_X43e.ms])

3. Load a tarred ASDM in ../rawdata into the context.
hsd_importdata (vis=['../rawdata/uid___A002_X30a93d_X43e.tar.gz'])

4. Check the hsd_importdata inputs, then import the data myvislist =
['uid___A002_X30a93d_X43e.ms', 'uid_A002_x30a93d_X44e.ms']
hsd_importdata(vis=myvislist, pipelinemode='getinputs')
hsd_importdata(vis=myvislist)

5. Load an ASDM but check the results before accepting them into the context.
results = hsd_importdata (vis=['uid___A002_X30a93d_X43e.ms'],
acceptresults=False)
results.accept()

6. Run in dryrun mode before running for real

results = hsd_importdata (vis=['uid___A002_X30a93d_X43e.ms'], dryrun=True)
results = hsd_importdata (vis=['uid___A002_X30a93d_X43e.ms'])

Parameter List

Table 60: hsd_importdata default settings

Parameter	Type	Default	Description
vis	stringArray	None	List of input visibility data
session	stringArray	None	List of visibility data sessions
pipelinemode	string	automatic	The pipeline operating mode
asis	string	Antenna Station Receiver CalAtmosphere CalWVR	ASDM to convert as is
process_caldevice	bool	False	Import the caldevice table from the ASDM
overwrite	bool	False	Overwrite existing files on import
bdfflags	bool	True	Apply BDF flags on import
lazy	bool	False	Use the lazy import option
dbservice	bool	False	Use the online flux catalog
with_pointing_correction	bool	True	Apply pointing correction to DIRECTION
createmms	string	automatic	Create a MMS
dryrun	bool	False	Run the task (False) or display task command (True)
acceptresults	bool	True	Add the results into the pipeline context

8.8 hsd_k2jycal

Derive the Kelvin to Jy calibration for list of measurement sets.

Task Description

Derive Kelvin to Jy calibration tables
Derive the Kelvin to Jy calibration for list of measurement sets

Keyword arguments:

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In interactive mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.

default: 'automatic'.

reffile -- Path to a file containing Jy/K factors for science data, which must be provided by associating calibrator reduction or the observatory measurements. Jy/K factor must take into account all efficiencies, i.e., it must be a direct conversion factor from Ta* to Jy. The file must be in either MS-based or session-based format. The MS-based format must be in an CSV format with five fields: MS name, antenna name, spectral window id, polarization string, and Jy/K conversion factor. Example for the file is as follows:

```
MS,Antenna,Spwid,Polarization,Factor
 uid___A002_X316307_X6f.ms,CM03,5,XX,10.0
 uid___A002_X316307_X6f.ms,CM03,5,YY,12.0
 uid___A002_X316307_X6f.ms,PM04,5,XX,2.0
 uid___A002_X316307_X6f.ms,PM04,5,YY,5.0
```

The first line in the above example is a header which may or may not exist. Example for the session-based format is as follows:

```
 #OUSID=XXXXXX
 #OBJECT=Uranus
 #FLUXJY=yy,zz,aa
 #FLUXFREQ=YY,ZZ,AA

#sessionID,ObservationStartDate(UTC),ObservationEndDate(UTC),Antenna,BandCenter(MHz),Ba
ndWidth(MHz),POL,Factor
1,2011-11-11 01:00:00,2011-11-11 01:30:00,CM02,86243.0,500.0,I,10.0
1,2011-11-11 01:00:00,2011-11-11 01:30:00,CM02,86243.0,1000.0,I,30.0
1,2011-11-11 01:00:00,2011-11-11 01:30:00,CM03,86243.0,500.0,I,50.0
1,2011-11-11 01:00:00,2011-11-11 01:30:00,CM03,86243.0,1000.0,I,70.0
1,2011-11-11 01:00:00,2011-11-11 01:30:00,ANONYMOUS,86243.0,500.0,I,30.0
1,2011-11-11 01:00:00,2011-11-11 01:30:00,ANONYMOUS,86243.0,1000.0,I,50.0
2,2011-11-13 01:45:00,2011-11-13 02:15:00,PM04,86243.0,500.0,I,90.0
2,2011-11-13 01:45:00,2011-11-13 02:15:00,PM04,86243.0,1000.0,I,110.0
2,2011-11-13 01:45:00,2011-11-13 02:15:00,ANONYMOUS,86243.0,500.0,I,90.0
2,2011-11-13 01:45:00,2011-11-13 02:15:00,ANONYMOUS,86243.0,1000.0,I,110.0
```

The line starting with '#' indicates a meta data section and header. The header must exist. The factor to apply is identified by matching the session ID, antenna name, frequency and polarization of data in each line of the file. Note the observation date is supplementary information and not used for the matching so far. The lines whose antenna name is 'ANONYMOUS' are used when there is no meaurement for specific antenna in the session. In the above example, if science observation of session 1 contains the antenna PM04, Jy/K factor for ANONYMOUS antenna will be applied since there is no measurement for PM04 in session 1. If no file name is specified or specified file doesn't exist, all Jy/K factors are set to 1.0.
default: 'jyperk.csv'
example: '', 'working/jyperk.csv'

---- pipeline parameter arguments which can be set in any pipeline mode

---- pipeline context defined parameter arguments which can be set only in 'interactive mode'

infiles -- List of input visibility files
default: none;
example: vis='ngc5921.ms'

caltable -- Name of output gain calibration tables
default: none;
example: caltable='ngc5921.gcal'

-- Pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Example

1. Compute the Kevin to Jy calibration tables for a list of measurement sets
hsd_k2jycal()

Parameter List

Table 61: hsd_k2jycal default settings

Parameter	Type	Default	Description
reffile	string	jyperk.csv	File of Jy/K conversion factor
pipelinemode	string	automatic	The pipeline operations mode
infiles	stringArray	None	List of input measurement sets
caltable	stringArray	None	List of output caltable(s)
dryrun	bool	False	Run the task (False) or list commands(True)
acceptresults	bool	True	Automatically apply results to context

8.9 hsd_skycal

Task Description

Calibrate data
The hsd_calsky task generates a caltable for sky calibration that stores reference spectra, which is

to be subtracted from on-source spectra to filter out non-source contribution.

Keyword arguments:

---- pipeline parameter arguments which can be set in any pipeline mode

calmode -- Calibration mode. Available options are 'auto' (default), 'ps', 'otf', and 'otfraster'. When 'auto' is set, the task will use preset calibration mode that is determined by inspecting data. 'ps' mode is simple position switching using explicit reference scans. Other two modes, 'otf' and 'otfraster', will generate reference data from scans at the edge of the map. Those modes are intended for OTF observation and the former is defined for generic scanning pattern such as Lissajous, while the later is specific use for raster scan.
default: 'auto'
options: 'auto', 'ps', 'otf', 'otfraster'

fraction -- Subparameter for calmode. Edge marking parameter for 'otf' and 'otfraster' mode. It specifies a number of OFF scans as a fraction of total number of data points.
default: '10%'
options: String style like '20%', or float value less than 1.0. For 'otfraster' mode, you can also specify 'auto'.

noff -- Subparameter for calmode. Edge marking parameter for 'otfraster' mode. It is used to specify a number of OFF scans near edge directly instead to specify it by fractional number by 'fraction'. If it is set, the value will come before setting by 'fraction'.
default: -1 (use setting by 'fraction')
options: any positive integer value

width -- Subparameter for calmode. Edge marking parameter for 'otf' mode. It specifies pixel width with respect to a median spatial separation between neighboring two data in time. Default will be fine in most cases.
default: 0.5
options: any float value

elongated -- Subparameter for calmode. Edge marking parameter for 'otf' mode. Please set True only if observed area is elongated in one direction.
default: False

pipelinemode -- The pipeline operating mode. In 'automatic' mode the pipeline determines the values of all context defined pipeline inputs automatically. In 'interactive' mode the user can set the pipeline context defined parameters manually. In 'getinputs' mode the user can check the settings of all pipeline parameters without running the task.
default: 'automatic'.

---- pipeline context defined parameter argument which can be set only in 'interactive mode'

infiles -- List of data files. These must be a name of Scantables that are registered to context via hsd_importdata task.
default: []
example: vis=['X227.PM01.asap', 'X227.PM02.asap']

field -- Data selection by field name.
default: '' (all fields)

spw -- Data selection by spw.
default: '' (all spws)
example: '3,4' (generate caltable for spw 3 and 4)
['0','2'] (spw 0 for first data, 2 for second)

scan -- Data selection by scan number.
default: '' (all scans)
example: '22,23' (use scan 22 and 23 for calibration)
['22','24'] (scan 22 for first data, 24 for second)

pol -- Data selection by pol.
default: '' (all polarizations)
example: '0' (generate caltable for pol 0)
['0~1','0'] (pol 0 and 1 for first data, only 0 for second)

--- pipeline task execution modes

dryrun -- Run the commands (True) or generate the commands to be run but do not execute (False).
default: True

acceptresults -- Add the results of the task to the pipeline context (True) or reject them (False).
default: True

Output

results -- If pipeline mode is 'getinputs' then None is returned. Otherwise the results object for the pipeline task is returned.

Examples

1. Generate caltables for all data managed by context.
default(hsd_skycal)
hsd_skycal()

Parameter List

Table 62: hsd_skycal default settings

Parameter	Type	Default	Description
calmode	string	auto	Calibration mode (default auto)
fraction	any	10%	fraction of the OFF data to mark
noff	int	-1	number of the OFF data to mark
width	double	0.5	width of the pixel for edge detection
elongated	bool	False	whether observed area is elongated in one direction or not

pipelinemode	string	automatic	The pipeline operating mode
infiles	stringArray	None	List of input files to be calibrated (default all)
field	string	None	Field to be calibrated (default all)
spw	any	None	select data by IF IDs (spectral windows), e.g. \'3,5,7\' (\'\'=all)
scan	any	None	select data by scan numbers, e.g. \'21~23\' (\'\'=all)
dryrun	bool	False	Run the task (False) or display task command (True)
acceptresults	bool	True	Add the results into the pipeline context

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of the European Organization for Astronomical Research in the Southern Hemisphere (ESO), the U.S. National Science Foundation (NSF) and the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Republic of Chile. ALMA is funded by ESO on behalf of its Member States, by NSF in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC) and by NINS in cooperation with the Academia Sinica (AS) in Taiwan and the Korea Astronomy and Space Science Institute (KASI).

ALMA construction and operations are led by ESO on behalf of its Member States; by the National Radio Astronomy Observatory (NRAO), managed by Associated Universities, Inc. (AUI), on behalf of North America; and by the National Astronomical Observatory of Japan (NAOJ) on behalf of East Asia. The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction, commissioning and operation of ALMA.