How to use ALMA Pipeline when you have only raw data

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CAUSION

Pipeline will expect only processing QA0_PASS data, and ALMA defined standard mode data. If you want to use Pipeline reduction on other data, you need to run Pipeline on your responsibility. Observatory will not do further support even when you have problems and Pipeline errors.

How to use ALMA Pipeline

1. Start CASA Pipeline
   $casa --pipeline
2. Confirm your CASA version that you intent to use.
   e.g. CASA Version 4.5.0-REL (r35147)
3. Confirm your Pipeline version that you intent to use.
   CASA <**4**>: pipeline.revision
   Out[**4**]: 'r35156 (Pipeline-Cycle3-R3-B)'

You can check the latest version of Pipeline in Science Portal (https://almascience.nao.ac.jp/documents-and-tools).

4. Import ASDMs and Check calibrator sources

1) Import ASDMs to convert MS, Generate WebLog.

   CASA<1>: h_init()

   CASA<2>:hifa_importdata(vis=['*ASDMName*'],pipelinemode='automatic')

   CASA<3>:h_save()

2) Confirm that you have the converted MS, "flux.csv", "*flagonline.txt", "*flagtemplate.txt", and "*flagcmds.txt" in the working directory.

3) Open WebLog

   A WebLog (directory) named "pipeline-*" should be generated in your working directory.

   (e.g. $firefox pipeline-2015XXXXTXXXXXX/html/index.html)

5a. Fix MSes (Cycle 0-2 data)

Some Cycle 0 - 2 data need to be *fixed* before running through Pipeline. But you may want to run all these commands if you are not sure whether it is affected or not.

NOTE: you need to install analysisUtils package to run these commands (see https://casaguides.nrao.edu/index.php?title=Analysis_Utilities).

```
CASA<1>: import analysisUtils as aU
CASA<2>: es = aU.stuffForScienceDataReduction()
```

1. Fix field & source ID (for relatively old data)
   CASA<1>: es.fixForCSV2555('uid___A002_X273b43_X146.ms')
2. Fix SYSCAL tables:
   CASA<2>: from recipes.almahelpers import fixsyscaltimes
   CASA<3>: fixsyscaltimes(vis = 'uid___A002_X273b43_X146.ms')
3. Fix planets's coordinate:
   CASA<4>: fixplanets(vis = 'uid___A002_X273b43_X146.ms', field = '1', fixuvw = T) ←----- Select "fieldID" of a planet in "filed".

5b. Fix MSes (Cycle 3 data)

Some Cycle3 data may need be *fixed* before running through Pipeline. But you must *NOT* run all these commands unless you are sure whether it is needed. The following script is to apply fixes only when necessary (provided by R. Indebetouw).

1. Fix planets' coordinate (if necessary):

```
SSOforfix = es.getFieldsForFixPlanets(thisvis)
if (len(SSOforfix) > 0):
    print('Running fixplanets...')
    for ssofield in SSOforfix:
        fd.write("    fixplanets(vis = '" + thisvis + "', field = '" + str(ssofield) +
"', fixuvw = T)")
        print("# SACM/JAO - Fixes", file=fd)
        fixplanets(vis = thisvis, field = str(ssofield), fixuvw = T)
```

2. Get correct Antenna Position correction info which will be used for hifa_antpos stage.

```
x=os.getcwd()
if x.count("2015.1")>0:
    print("getting antenna positions")
    es.correctMyAntennaPositions(mslist,lbc=True)
```

5c. Fix MSes (Cycle 4 & 5 data)

- mslist = glob.glob('uid___A00*_X*_X*.ms')
- es.correctMyAntennaPositions(mslist)

6. Prepare flux.csv file

- hifa_importdata Search flux values on the calibrators, and fill in “flux.csv”. If Pipeline create flux.csv with some values (calculated using the database stored in CASA) and needs to be updated, you may want to use:
  CASA<1>:aU.getALMAFluxcsv(‘flux.csv’)

- Sometimes Pipeline generate flux.csv with blank values, in that case you need to fill in by hand. You may want to use:
  CASA<2>:aU.getALMAFlux(source,frequency, date=‘YYYY-MM-DD’)

- $cat flux.csv (WARN: Do not use any *space* in the lines)

```
ms,field,spw,I,Q,U,V,comment
uid___A002_X273b43_X146.ms,2,1,14.1017,0.0,0.0,0.0,"intent=ATMOSPHERE,BANDPASS,WVR # +-0.903Jy, freq=114.664GHz"
uid___A002_X273b43_X146.ms,2,3,14.2698,0.0,0.0,0.0,"intent=ATMOSPHERE,BANDPASS,WVR # +-0.929Jy, freq=112.789GHz"
uid___A002_X273b43_X146.ms,2,5,15.2610,0.0,0.0,0.0,"intent=ATMOSPHERE,BANDPASS,WVR # +-1.088Jy, freq=102.726GHz"
uid___A002_X273b43_X146.ms,2,7,15.4575,0.0,0.0,0.0,"intent=ATMOSPHERE,BANDPASS,WVR # +-1.105Jy, freq=100.914GHz"
uid___A002_X273b43_X146.ms,3,1,1.74095,0.0,0.0,0.0,"intent=ATMOSPHERE,PHASE,WVR # +-0.113Jy, freq=114.664GHz"
uid___A002_X273b43_X146.ms,3,3,1.77152,0.0,0.0,0.0,"intent=ATMOSPHERE,PHASE,WVR # +-0.114Jy, freq=102.789GHz"
uid___A002_X273b43_X146.ms,3,5,1.95524,0.0,0.0,0.0,"intent=ATMOSPHERE,PHASE,WVR # +-0.125Jy, freq=102.726GHz"
uid___A002_X273b43_X146.ms,3,7,1.99233,0.0,0.0,0.0,"intent=ATMOSPHERE,PHASE,WVR # +-0.127Jy, freq=100.914GHz"
uid___A002_X273b43_X146.ms,4,1,14.1017,0.0,0.0,0.0,"intent=ATMOSPHERE,PHASE,WVR # +-0.903Jy, freq=114.664GHz"
uid___A002_X273b43_X146.ms,4,3,14.2698,0.0,0.0,0.0,"intent=ATMOSPHERE,PHASE,WVR # +-0.929Jy, freq=102.789GHz"
uid___A002_X273b43_X146.ms,4,5,15.2610,0.0,0.0,0.0,"intent=ATMOSPHERE,PHASE,WVR # +-1.088Jy, freq=102.726GHz"
uid___A002_X273b43_X146.ms,4,7,15.4575,0.0,0.0,0.0,"intent=ATMOSPHERE,PHASE,WVR # +-1.105Jy, freq=100.726GHz"
```

NOTE

If the absolute flux calibrator is solar system object, the flux.csv will be not be used in the Pipeline processing. The flux density of solar system is calculated using a model. Even though, the expected flux values of other calibrators in flux.csv are useful to compare to the derived one.

We recommend to use the updated flux values to appropriate ones, rather than blindly believing the automatically generated values.

7. Run Pipeline and check results with WebLog

- Confirm that you have all ingredients before running Pipeline:

  $ls

  uid___A002_X273b43_X146.ms
  uid___A002_X273b43_X146.ms.flagversions

  flux.csv

- Start Pipeline (from MS)

  CASA<1>:import pipeline.recipereducer as recipereducer

  CASA<2>:recipereducer.reduce(vis=['*uid___A002_X273b43_X146*.ms'],procedure='procedure_hifa_cal.xml')

  – Note: if procedure='procedure_hifa_cal.xml', it will terminate after calibration, does not do imaging of targets. See the next page for more detail.

- After completion of Pipeline, check WebLog. A WebLog (directory) named "pipeline-procedure_hifa_cal" should be generated in your working directory.

  (e.g. $firefox pipeline-procedure_hifa_cal/html/index.html)

Note: procedure name

- To check which procedures are availble by listing up …/casa-release-XXX/pipeline/pipeline/recipes/procedure*.xml
- (before CASA 5.1.1-pipe) e.g. in CASA 4.7-pipe
  - procedure_hifa.xml … Do calibration, imaging of calibrators and targets
  - procedure_hifacal.xml … Do calibration, imaging of calibrators
  - procedure_hifatargets.xml … Do restoration, imaging of targets
  - procedure_hsd.xml … [SD] Do calibration, imaging of targets
- from CASA 5.1.1-pipe
  - procedure_hifa_calimage.xml … Do calibration, imaging of calibrators and targets
  - procedure_hifa_cal.xml … Do calibration, imaging of calibrators
  - procedure_hifa_image.xml … Do restoration, imaging of targets
  - procedure_hsd_calimage.xml … [SD] Do calibration, imaging of targets
- Note: even though you choose “procedure_hifa_calimage.xml” to do target imaging, if the estimated product size is too large, pipeline run may terminate without doing target imaging (see description of hif_checkproductsize in User’s guide)

7a. Run Imaging Pipeline after Calibration Pipeline

- procedure_hifa_image.xml does not work?
  - likely a bug in CASA 5.1.1
- instead, use hifatargets
  - from pipeline.recipes import hifatargets as hifatargets
  - h_init()
  - hifatargets.hifatargets(vislist=[‘uid*.ms'])
  - h_save()
- hifatargets
  - does not combine weblog for calibration and imaging
  - does not create products (e.g. FITS files, casa_pipescript.py), i.e. no hifa_exportdata

Useful Pipeline Documents

- Brief description for Pipeline products and WebLog contents:
  - "ALMA Science Pipeline User's Guide" (available in Science Portal)
- List of Pipeline commands and descriptions for each Pipeline task:
  - "ALMA Science Pipeline Reference Manual" (available in Science Portal)
- When you need tweaking Pipeline after first run:
  - "Tweaking the Pipeline" (http://alma-intweb.mtk.nao.ac.jp/~saigo/EAARC_CASA/reference/TweakPipeline.pptx.pdf)