

Preparation and setup instructions for ALMA Data Reduction Workshop on October 5th, 2023



Checklist

- Download imaging data
- Download imaging tutorial commands
- Download weblog data
- Get Firefox ready to view weblog
- Download and install CASA
- Test CASA install
 - Plotms()
 - h_weblog()
- Download and install CARTA

Download Data For Tutorials

1. Download the data for imaging tutorial: https://bulk.cv.nrao.edu/almadata/public/working/sis14_twhya_calibrated_flagged.ms.tar
 - This dataset is ~520 MBs
2. Untar the imaging data set using the following command:
 - `tar -xvzf sis14_twhya_calibrated_flagged.ms.tar`
3. Download imaging tutorial commands:
4. Download the data for weblog tutorial: https://almascience.nrao.edu/dataPortal/member.uid___A001_X3570_Xa3.hifa_calimage.weblog.tgz
 1. This folder is ~710 MBs
5. Untar the imaging data set using the following command:
 - `tar -xvzf member.uid___A001_X3570_Xa3.hifa_calimage.weblog.tgz`

Get Firefox Ready to View Weblog

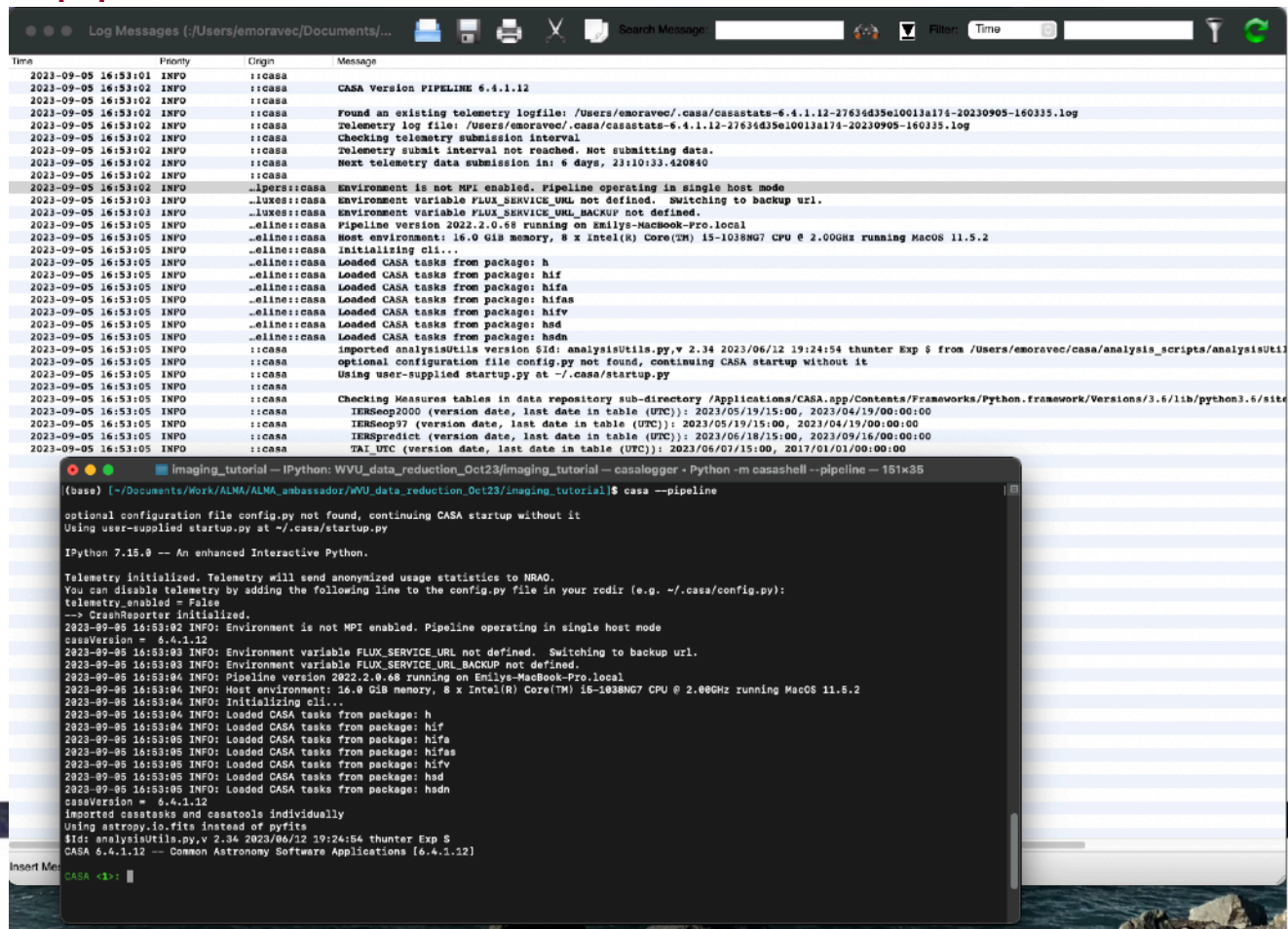
- In the workshop we will view a weblog from the ALMA pipeline (see <https://help.almascience.org/kb/articles/what-is-the-best-way-to-view-the-weblog>).
- One way that we do this is through opening up a .html file using a browser. **Firefox** is the preferred browser for this. Please have Firefox on your machine.
- But Firefox settings need to be configured to view weblog (see <https://almascience.eso.org/euarcdata/itrain04/weblog.pdf> for screenshots).
 - In Firefox, type “about:config” in the address bar. (This may display a warning page, but click continue to exit the page.)
 - On this page, search for the “privacy.file_unique_origin” preference and set it toFalse. After this, restart Firefox for the fix to take effect.

Download and Install CASA 6.4.1

- In preparation for the workshop, please have CASA installed on your laptop (preferably the latest ALMA pipeline version, 6.4.1):
 - https://casa.nrao.edu/casa_obtaining.shtml
- We recommend that you make the symlink as suggested in the download process so that you can start CASA from the command line
- ***(optional)*** : Download the Analysis Utilities package and edit CASA initialization file following instructions here : https://casaguides.nrao.edu/index.php/Analysis_Utilities
 - Analysis utilities is a very useful package of CASA tasks that can be used for various types of analysis

Test CASA Install - Part 1

- \$cd into the directory where you downloaded and unzipped your data - you are looking for `sis14_twhya_calibrated_flagged.ms`
- Start casa and load in the pipeline tasks
 - \$casa —pipeline



```
Log Messages (/Users/emoravec/Documents/...)
```

Time	Priority	Origin	Message
2023-09-05 16:53:01	INFO	::casa	CASA Version PIPELINE 6.4.1.12
2023-09-05 16:53:02	INFO	::casa	Found an existing telemetry logfile: /Users/emoravec/.casa/casastats-6.4.1.12-2763d35e10013a174-20230905-160335.log
2023-09-05 16:53:02	INFO	::casa	Telemetry log file: /Users/emoravec/.casa/casastats-6.4.1.12-2763d35e10013a174-20230905-160335.log
2023-09-05 16:53:02	INFO	::casa	Checking telemetry submission interval
2023-09-05 16:53:02	INFO	::casa	Telemetry submit interval not reached. Not submitting data.
2023-09-05 16:53:02	INFO	::casa	Next telemetry data submission in: 6 days, 23:10:33.420840
2023-09-05 16:53:02	INFO	::casa	Environment is not MPI enabled. Pipeline operating in single host mode
2023-09-05 16:53:03	INFO	..luxes::casa	Environment variable FLUX_SERVICE_URL not defined. Switching to backup url.
2023-09-05 16:53:03	INFO	..luxes::casa	Environment variable FLUX_SERVICE_URL_BACKUP not defined.
2023-09-05 16:53:05	INFO	..elline::casa	Pipeline version 2022.2.0.68 running on EmLynx-MacBook-Pro.local
2023-09-05 16:53:05	INFO	..elline::casa	Host environment: 16.0 GiB memory, 8 x Intel(R) Core(TM) i5-1038NG7 CPU @ 2.00GHz running MacOS 11.5.2
2023-09-05 16:53:05	INFO	..elline::casa	Initializing cli...
2023-09-05 16:53:05	INFO	..elline::casa	Loaded CASA tasks from package: h
2023-09-05 16:53:05	INFO	..elline::casa	Loaded CASA tasks from package: hif
2023-09-05 16:53:05	INFO	..elline::casa	Loaded CASA tasks from package: hifa
2023-09-05 16:53:05	INFO	..elline::casa	Loaded CASA tasks from package: hifas
2023-09-05 16:53:05	INFO	..elline::casa	Loaded CASA tasks from package: hifv
2023-09-05 16:53:05	INFO	..elline::casa	Loaded CASA tasks from package: hsd
2023-09-05 16:53:05	INFO	..elline::casa	Loaded CASA tasks from package: hsdn
2023-09-05 16:53:05	INFO	::casa	Imported analysisUtils version \$ID: analysisUtils.py,v 2.34 2023/06/12 19:24:54 thunder Exp \$ from /Users/emoravec/casa/analysis_scripts/analysisUtils.py
2023-09-05 16:53:05	INFO	::casa	optional configuration file config.py not found, continuing CASA startup without it
2023-09-05 16:53:05	INFO	::casa	Using user-supplied startup.py at ~/.casa/startup.py
2023-09-05 16:53:05	INFO	::casa	Checking Measures tables in data repository sub-directory /Applications/CASA.app/Contents/Frameworks/Python.framework/Versions/3.6/lib/python3.6/site-packages/ALMA/ALMA_ambassador/WVU_data_reduction_Oct23/Imaging_tutorial -- casalogger - Python -m casashell --pipeline -- 151x35
2023-09-05 16:53:05	INFO	::casa	IERSop2000 (version date, last date in table (UTC)): 2023/05/19/15:00, 2023/04/19/00:00:00
2023-09-05 16:53:05	INFO	::casa	IERSop97 (version date, last date in table (UTC)): 2023/05/19/15:00, 2023/04/19/00:00:00
2023-09-05 16:53:05	INFO	::casa	IERSpredict (version date, last date in table (UTC)): 2023/06/18/15:00, 2023/09/16/00:00:00
2023-09-05 16:53:05	INFO	::casa	TAI_UTC (version date, last date in table (UTC)): 2023/06/07/15:00, 2017/01/01/00:00:00

```
(base) [~/Documents/Work/ALMA/ALMA_ambassador/WVU_data_reduction_Oct23/Imaging_tutorial]$ casa --pipeline
optional configuration file config.py not found, continuing CASA startup without it
Using user-supplied startup.py at ~/.casa/startup.py

IPython 7.15.0 -- An enhanced Interactive Python.

Telemetry initialized. Telemetry will send anonymized usage statistics to NRAO.
You can disable telemetry by adding the following line to the config.py file in your rodir (e.g. ~/.casa/config.py):
telemetry_enabled = False
-> CrashReporter initialized.
2023-09-05 16:53:02 INFO: Environment is not MPI enabled. Pipeline operating in single host mode
casaVersion = 6.4.1.12
2023-09-05 16:53:03 INFO: Environment variable FLUX_SERVICE_URL not defined. Switching to backup url.
2023-09-05 16:53:04 INFO: Environment variable FLUX_SERVICE_URL_BACKUP not defined.
2023-09-05 16:53:04 INFO: Pipeline version 2022.2.0.68 running on EmLynx-MacBook-Pro.local
2023-09-05 16:53:04 INFO: Host environment: 16.0 GiB memory, 8 x Intel(R) Core(TM) i5-1038NG7 CPU @ 2.00GHz running MacOS 11.5.2
2023-09-05 16:53:04 INFO: Initializing cli...
2023-09-05 16:53:04 INFO: Loaded CASA tasks from package: h
2023-09-05 16:53:04 INFO: Loaded CASA tasks from package: hif
2023-09-05 16:53:04 INFO: Loaded CASA tasks from package: hifa
2023-09-05 16:53:04 INFO: Loaded CASA tasks from package: hifas
2023-09-05 16:53:04 INFO: Loaded CASA tasks from package: hifv
2023-09-05 16:53:04 INFO: Loaded CASA tasks from package: hsd
2023-09-05 16:53:04 INFO: Loaded CASA tasks from package: hsdn
casaVersion = 6.4.1.12
Imported casatasks and casatools individually
Using astropy.io.fits instead of pyfits
$ID: analysisUtils.py,v 2.34 2023/06/12 19:24:54 thunder Exp $
CASA 6.4.1.12 -- Common Astronomy Software Applications [6.4.1.12]
```



Update the CASA Data Repository

- https://casaguides.nrao.edu/index.php/Updating_the_CASA_Data_Repository
- CASA data repositories contain our current best knowledge of, e.g., observatory coordinates, leap seconds, ephemerides, calibrator models, etc. ...Some of this information, like leap seconds, can go out of date since at any time they can only be predicted for a certain time into the future. So, one may need to manually update the data repository on an existing CASA version if the version is used on data which was taken much later than the CASA release date"
- On the CASA prompt, run
 - `!update-data`

Test CASA Install - Part 2

- Test plotms in the casa prompt
 - `plotms(vis='sis14_twhya_calibrated_flagged.ms', xaxis='u', yaxis='v', avgchannel='10000', avgspw=False, avgtime='1e9', avgscan=False, coloraxis='field', showgui=True)`

The screenshot displays a terminal window and the PlotMS GUI. The terminal window shows the execution of the `plotms` command and the resulting output, including a warning message from the `MSTransformManager`.

```
2023-09-05 16:53:03 INFO: Environment variable FLUX_SERVICE_URL_BACKUP not defined.
2023-09-05 16:53:04 INFO: Pipeline version 2022.2.0.68 running on Emilys-MacBook-Pro.local
2023-09-05 16:53:04 INFO: Host environment: 16.0 GiB memory, 8 x Intel(R) Core(TM) i5-1038NG7 CPU @ 2.00GHz running MacOS 11.5.2
2023-09-05 16:53:04 INFO: Initializing cli...
2023-09-05 16:53:04 INFO: Loaded CASA tasks from package: h
2023-09-05 16:53:04 INFO: Loaded CASA tasks from package: hif
2023-09-05 16:53:05 INFO: Loaded CASA tasks from package: hifa
2023-09-05 16:53:05 INFO: Loaded CASA tasks from package: hifas
2023-09-05 16:53:05 INFO: Loaded CASA tasks from package: hifv
2023-09-05 16:53:05 INFO: Loaded CASA tasks from package: hsd
2023-09-05 16:53:05 INFO: Loaded CASA tasks from package: hsdn
casaVersion = 6.4.1.12
imported casatasks and casatools individually
Using astropy.io.fits instead of pyfits
$Id: analysisUtils.py,v 2.34 2023/06/12 19:24:54 thunter Exp $
CASA 6.4.1.12 -- Common Astronomy Software Applications [6.4.1.12]

CASA <$> plotms(vis='sis14_twhya_calibrated_flagged.ms', xaxis='u', yaxis='v', avgchannel='10000', avgspw=False, avgtime='1e9', avgscan=False, colorax
.... is='field', showgui=True)

CASA <2> 2023-09-05 16:56:05 WARN MSTransformManager::checkDataColumns
2023-09-05 16:56:05 WARN MSTransformManager::initDataSelectionParams
nbin 10000
2023-09-05 16:56:05 WARN MSTransformManager::initDataSelectionParams
]
```

The PlotMS GUI shows the following settings:

- File: `alibrated_flagged.ms`
- Selection: `field`
- Averaging: `Channel 10000` channels, `Time 1e+09` seconds
- Display: `Vector` (selected), `Scalar`

The plot shows a V vs U plot with data points colored by field. The x-axis is labeled 'U (m)' and the y-axis is labeled 'V (m)'. The plot shows a dense distribution of points forming a circular pattern.

Test CASA Install - Part 3

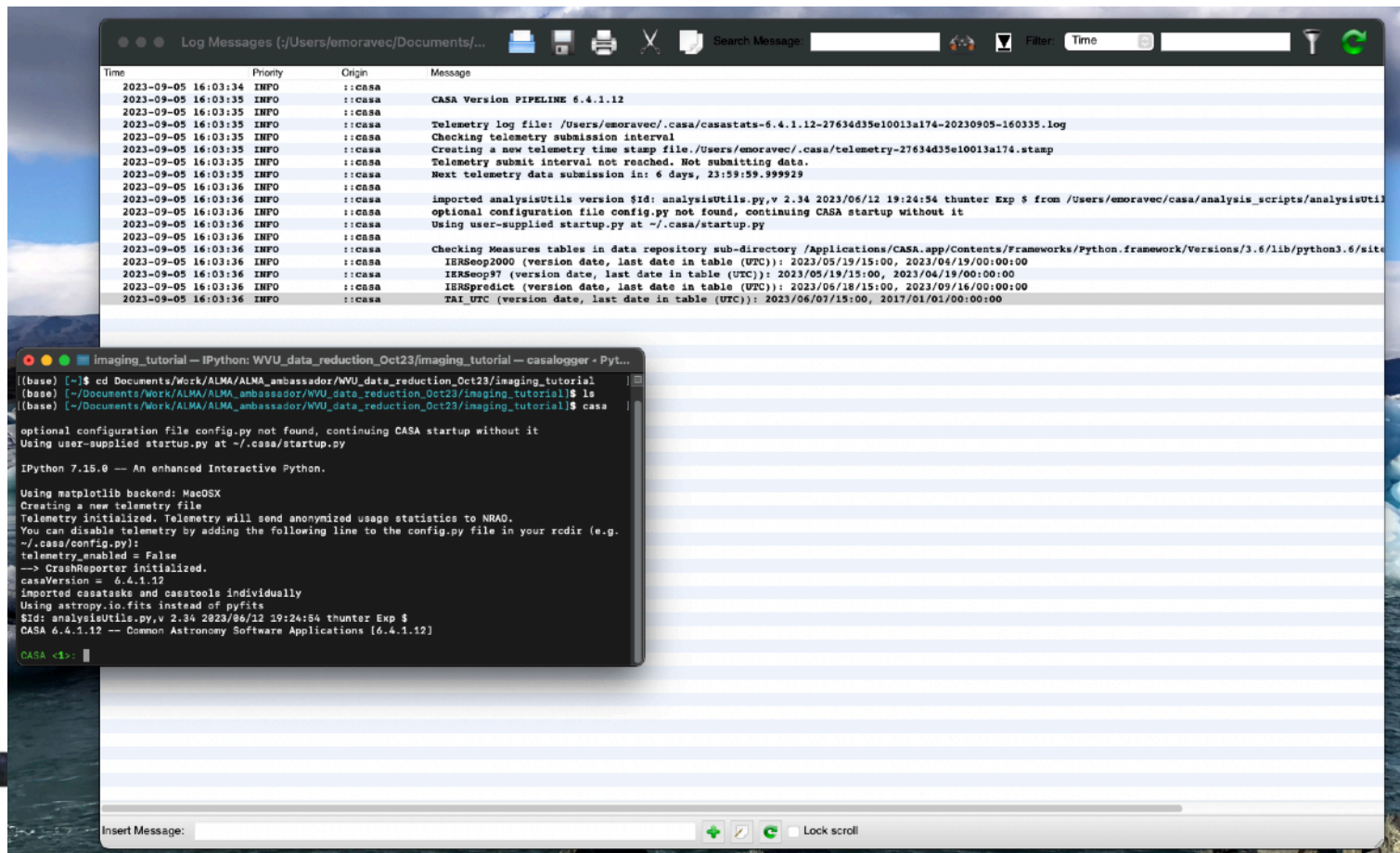
- Exit out of the plotms GUI by hitting the red X and hit enter once or twice on the casa prompt to clear it

Test CASA Install - Part 3

- Exit out of casa by typing the following into the casa-prompt
- `exit()`

Trouble Shooting - Test CASA Install

- If `$casa` —pipeline doesn't work for you, you can just try to open CASA
- Start casa and try the plotms command
 - `$casa`



The image shows two overlapping windows from a macOS desktop. The background window is titled "Log Messages (/Users/emoravec/Documents/...)" and displays a list of system logs. The foreground window is a terminal titled "imaging_tutorial - IPython: WVU_data_reduction_Oct23/imaging_tutorial - casalogger - Pyt..." and shows the execution of the `casa` command and its output.

```
Time Priority Origin Message
2023-09-05 16:03:34 INFO ::casa
2023-09-05 16:03:35 INFO ::casa CASA Version PIPELINE 6.4.1.12
2023-09-05 16:03:35 INFO ::casa
2023-09-05 16:03:35 INFO ::casa Telemetry log file: /Users/emoravec/.casa/casastats-6.4.1.12-27634d35e10013a174-20230905-160335.log
2023-09-05 16:03:35 INFO ::casa Checking telemetry submission interval
2023-09-05 16:03:35 INFO ::casa Creating a new telemetry time stamp file: /Users/emoravec/.casa/telemetry-27634d35e10013a174.stamp
2023-09-05 16:03:35 INFO ::casa Telemetry submit interval not reached. Not submitting data.
2023-09-05 16:03:35 INFO ::casa Next telemetry data submission in: 6 days, 23:59:59.999929
2023-09-05 16:03:36 INFO ::casa
2023-09-05 16:03:36 INFO ::casa imported analysisutils version $Id: analysisutils.py,v 2.34 2023/06/12 19:24:54 thunter Exp $ from /Users/emoravec/casa/analysis_scripts/analysisUtil
2023-09-05 16:03:36 INFO ::casa optional configuration file config.py not found, continuing CASA startup without it
2023-09-05 16:03:36 INFO ::casa Using user-supplied startup.py at ~/.casa/startup.py
2023-09-05 16:03:36 INFO ::casa
2023-09-05 16:03:36 INFO ::casa Checking Measures tables in data repository sub-directory /Applications/CASA.app/Contents/Frameworks/Python.framework/Versions/3.6/lib/python3.6/site
2023-09-05 16:03:36 INFO ::casa IERSecp2000 (version date, last date in table (UTC)): 2023/05/19/15:00, 2023/04/19/00:00:00
2023-09-05 16:03:36 INFO ::casa IERSecp97 (version date, last date in table (UTC)): 2023/05/19/15:00, 2023/04/19/00:00:00
2023-09-05 16:03:36 INFO ::casa IERSpredict (version date, last date in table (UTC)): 2023/06/18/15:00, 2023/09/16/00:00:00
2023-09-05 16:03:36 INFO ::casa TAI UTC (version date, last date in table (UTC)): 2023/06/07/15:00, 2017/01/01/00:00:00
```

```
((base) [~]$ cd Documents/Work/ALMA/ALMA_ambassador/WVU_data_reduction_Oct23/imaging_tutorial
(base) [~/Documents/Work/ALMA/ALMA_ambassador/WVU_data_reduction_Oct23/imaging_tutorial]$ ls
(base) [~/Documents/Work/ALMA/ALMA_ambassador/WVU_data_reduction_Oct23/imaging_tutorial]$ casa
optional configuration file config.py not found, continuing CASA startup without it
Using user-supplied startup.py at ~/.casa/startup.py

IPython 7.15.0 -- An enhanced Interactive Python.

Using matplotlib backend: MacOSX
Creating a new telemetry file
Telemetry initialized. Telemetry will send anonymized usage statistics to NRAO.
You can disable telemetry by adding the following line to the config.py file in your rdcr (e.g.
~/casa/config.py):
telemetry_enabled = False
-> CrashReporter initialized.
casaVersion = 6.4.1.12
imported casataste and casatools individually
Using astropy.io.fits instead of pyfits
Sid: analysisutils.py,v 2.34 2023/06/12 19:24:54 thunter Exp $
CASA 6.4.1.12 -- Common Astronomy Software Applications [6.4.1.12]

CASA <1>:
```



Trouble Shooting

- Trouble shooting and CASA known issues:
<https://casadocs.readthedocs.io/en/stable/notebooks/introduction.html#Known-Issues>
 - Ctrl + f your issue
- If you have issues feel free to contact me at emoravec@nrao.edu or talk to me during the allotted time for CASA debugging during the workshop.

Trouble Shooting - Common Known Issues

- For Mac users
 - Plotms will not work -> some error about class runtime error and display variable
 - Fix: You need to have XQuartz installed (<https://www.xquartz.org/>)
 - Plotms window will not resize
 - Fix: None at the moment. Guidance is don't resize window :O
- Fedora/Ubuntu -> OS library issue.
 - Need to install **libnsl**. See <https://casadocs.readthedocs.io/en/stable/notebooks/introduction.html#Prerequisite-OS-Libraries> for details.
- Note that currently CASA does not work with RedHat 9.

Download and Install CARTA v4.0-beta

- Go to <https://cartavis.org/#download> and download CARTA v4.0-beta

CASA Guides

- CASA guides are a great tool for learning radio interferometric imaging. They are tutorials on how to image interferometric data using CASA.
 - All CASA guides: https://casaguides.nrao.edu/index.php?title=Main_Page
 - General ALMA CASA Guides: <https://casaguides.nrao.edu/index.php/ALMAGuides>
- The guide we will be going through: https://casaguides.nrao.edu/index.php?title=First_Look_at_Imaging_CASA_6.4

Checklist

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See you October 5th!

