

Introduction to CASA, Calibration & Basic Imaging



Nineteenth Synthesis Imaging Workshop

13 June – June 21, 2023

Atacama Large Millimeter/submillimeter Array

Expanded Very Large Array

Robert C. Byrd Green Bank Telescope

Very Long Baseline Array



Tutorial download link – for people using their own computers

The data for this tutorial can be downloaded from this link:

https://bulk.cv.nrao.edu/almadata/public/SIS2023/ALMA_Manual_Tutorial/

Download all the files to a directory named **SDP8I**

Untar the files using the following command (change file name as needed):

```
tar xvzf SDP8I_B4_uncalibrated.ms.split.tgz
```



How to set up your Directory

In your SDP8I directory create two sub-directories labeled /Calibration and /Imaging and move the files you downloaded (or copied) as follows:

In /Calibration you should have:

- **SDP8I_B4_uncalibrated.ms.split** (the data file containing uncalibrated data with minor initial processing applied)
- **data_prep.py** (script detailing the initial processing that has already been applied)
- **calibration.py** (the script we will work through together to calibrate the data)

In /Imaging you should have:

- **SDP.8I_Band4_continuum.ms** (fully calibrated continuum measurement set ready for imaging)
- **SDP.8I_Band4.ms** (fully calibrated measurement set containing both continuum and line emission ready for imaging)
- **SDP.8I_Band4_COline.ms.contsub** (fully calibrated line-only measurement set)
- **imaging.py** (the script we will work through together to image the data)
- **combination.py** (a script detailing the steps taken to create the measurement sets ready for imaging: this is just for reference **we won't be using it!**)

CASA version – 6.4.1.12

The **CASA** version used for this tutorial can be downloaded from this link:

https://casa.nrao.edu/casa_obtaining.shtml

Also download the **Analysis Utilities** package and edit **CASA** initialization file following instructions here:

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

Tutorial Startup

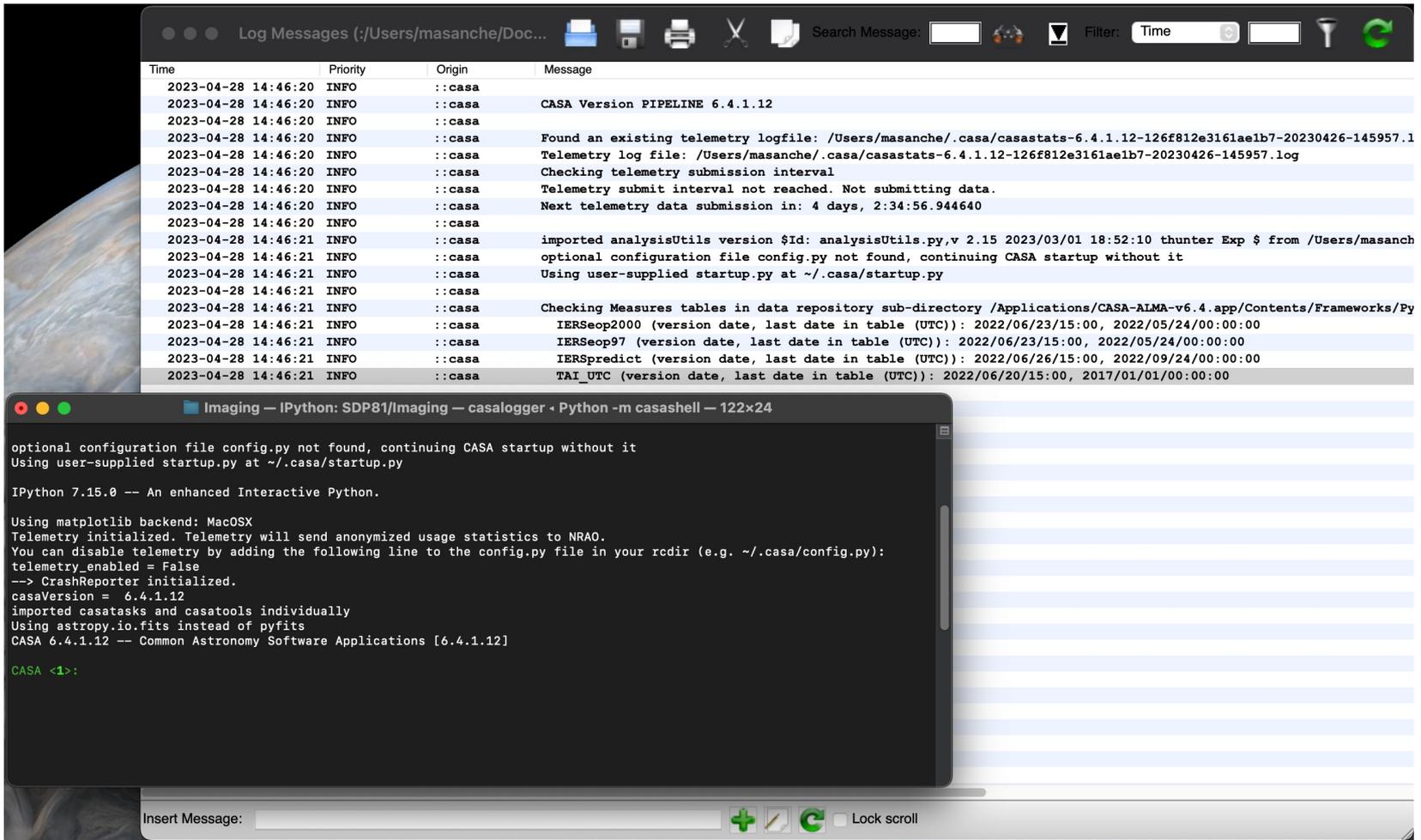
Everyone:

```
> cd /SDP81
```

```
> cd Calibration
```

CASA Startup

\$ `casa` (or `casa -r version`, e.g. `casa -r 6.4.1` if you have multiple `casa` versions installed)



```
Log Messages (/Users/masanche/Doc...)
```

Time	Priority	Origin	Message
2023-04-28 14:46:20	INFO	::casa	
2023-04-28 14:46:20	INFO	::casa	CASA Version PIPELINE 6.4.1.12
2023-04-28 14:46:20	INFO	::casa	
2023-04-28 14:46:20	INFO	::casa	Found an existing telemetry logfile: /Users/masanche/.casa/casastats-6.4.1.12-126f812e3161aeb7-20230426-145957.1
2023-04-28 14:46:20	INFO	::casa	Telemetry log file: /Users/masanche/.casa/casastats-6.4.1.12-126f812e3161aeb7-20230426-145957.log
2023-04-28 14:46:20	INFO	::casa	Checking telemetry submission interval
2023-04-28 14:46:20	INFO	::casa	Telemetry submit interval not reached. Not submitting data.
2023-04-28 14:46:20	INFO	::casa	Next telemetry data submission in: 4 days, 2:34:56.944640
2023-04-28 14:46:21	INFO	::casa	imported analysisUtils version \$Id: analysisUtils.py,v 2.15 2023/03/01 18:52:10 thunter Exp \$ from /Users/masanch
2023-04-28 14:46:21	INFO	::casa	optional configuration file config.py not found, continuing CASA startup without it
2023-04-28 14:46:21	INFO	::casa	Using user-supplied startup.py at ~/.casa/startup.py
2023-04-28 14:46:21	INFO	::casa	
2023-04-28 14:46:21	INFO	::casa	Checking Measures tables in data repository sub-directory /Applications/CASA-ALMA-v6.4.app/Contents/Frameworks/Py
2023-04-28 14:46:21	INFO	::casa	IERSeop2000 (version date, last date in table (UTC)): 2022/06/23/15:00, 2022/05/24/00:00:00
2023-04-28 14:46:21	INFO	::casa	IERSeop97 (version date, last date in table (UTC)): 2022/06/23/15:00, 2022/05/24/00:00:00
2023-04-28 14:46:21	INFO	::casa	IERSpredict (version date, last date in table (UTC)): 2022/06/26/15:00, 2022/09/24/00:00:00
2023-04-28 14:46:21	INFO	::casa	TAI.UTC (version date, last date in table (UTC)): 2022/06/20/15:00, 2017/01/01/00:00:00

```
Imaging - IPython: SDP81/Imaging - casalogger + Python -m casashell - 122x24
```

```
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
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 rcdir (e.g. ~/.casa/config.py):
telemetry_enabled = False
--> CrashReporter initialized.
casaVersion = 6.4.1.12
imported casatasks and casatools individually
Using astropy.io.fits instead of pyfits
CASA 6.4.1.12 -- Common Astronomy Software Applications [6.4.1.12]

CASA <1>:
```

An Overview of your Directory

To begin, if you haven't already done so ... start casa:

```
casa
```

Note that you can run system commands from within casa via:

```
os.system("ls")
```

```
!ls
```

The dataset we will be working with is large, so there is likely not enough memory to save the data at various steps throughout the reduction process. Should your dataset get corrupted, you can untar **SDP8I_B4_uncalibrated.ms.split.tgz**.