

## Getting Started on AIPS

- Log onto swift as “observer”
  - `ssh -X observer@swift` (pass wd will be distributed later)
  - `cd astro731/casa` (or `m51` or `sgra`)
  - `ls` (check which files are in that directory)
  - `setenv CASA /home/observer/astro731/casa`
  - `aips tv=local:0`

This should start AIPS and several other windows on your computer screen, including a “TV” device. It will ask for an AIPS number. Enter `701` if you are working on Project 1 (`702` or `703` for the others)

This should start your AIPS session

## Loading the data

```
> task 'uvlod'
```

```
> datain 'CASA:CASA.CBAND.UVFITS'
```

```
> outname '';outcl '';outs 0;go
```

This should read in the CASA.CBAND.UVFITS file from the disk into the AIPS virtual disk, which you can verify this by typing

```
> ucat
```

Read in the second data file as well.

## Get some useful info on the data files

> *imhead*

This prints out the file header information

> *task 'listr'; input*

> *docrt 1;optype 'scan';go*

This should print a scan summary data, i.e. time sequence of sources observed, observational settings, etc.

> *go prtan*

This will print the AN table, which tells you where the 28 antennae are located. You will see the Y-shaped layout of the telescopes when you scroll down all the way to the end of the listing. Take note of an antenna near the center of the array on either the East or West Arm as your “reference” antenna (*refant*) during the data reduction.

## Calibration

From your HW:

$$4. V'_{ij}(t) = g_i(t)g_j^*(t)G_{ij}(t)V_{ij}(t) + \epsilon_{ij}(t)$$

(a)  $G_{i,j}$  is a constant and can be set to 1. For a point source calibrator of flux density  $A$ ,  $V_{ij} = A$  (amplitude  $A$  and zero phase). In the absence of noise,

$$V'_{ij}(t) = Ag_i(t)g_j^*(t) \quad \text{or} \quad g_i(t)g_j^*(t) = V'_{ij}(t)/A$$

With  $N$  antennas, there are  $N \times g_i$  terms and  $N(N-1)/2 \times V'_{ij}$  visibility measurements. For  $N=3$ , there are 3 complex gain terms and 3 measured complex visibilities, and thus three  $g_i$  terms can be deduced from the 3 visibility measurements. Since all real measurements include noise, the three  $g_i$  terms derived are subject to the measurement noise. For  $N > 3$ , the problem is over-determined (i.e.  $N=4$ ,  $N(N-1)/2=6$ ), and one can determine the  $N \times g_i$  terms (e.g. using a  $\chi^2$  minimization) by minimizing the quantity

$$S = \sum_{i \neq j} w_{ij}(t) |V'_{ij}(t)/A - g_i(t)g_j^*(t)|^2,$$

where  $w_{ij}$  is the weight associated with the visibility  $V'_{ij}$ .

## Calibration

> *run vlaprocs*

This sets up the calibration procedures.

> *task 'setjy'*

> *source '0134+329'; opcode 'calc'; go*

This task will compute the flux density of the primary flux calibrator 0134+329 (or 1328+307) from the internal database and report it on your screen. Make note of the reported fluxes.

> *input vlocalib*

This procedure vlocalib will compute the gain solution. Read the AIPS cookbook to figure out how to set this up and run it. Keep in mind that this program will produce a new gain table called "SN" (see it by typing *imhead*) each time you run it but does not actually apply this gain to all data. **Check the qualification of your gain calibrator in the VLA calibrator list and whether there are any *uvrange* limitations.**

## Calibration (cont)

Basically you need to run vlocalib twice: once for your flux calibrator and once for the gain calibrator, creating two SN tables at the end. Make sure the *uvrange* is set correctly for each source.

> *task 'getjy'; sources ''; calsou '0134+329'; go*

If all of your gain and flux calibrators are properly calibrated, then this program will compute the flux density of your gain calibrators and report them. If their fluxes agree with those listed in the VLA calibrator list, then your calibration is done correctly.

*If you suspect something went wrong horribly with the calibration at some stage, type 'vlareset' to delete all SN tables and restart the calibration from scratch.*

> *input vlocalcal*

This procedure vlocalcal will combine all SN tables (created for each calibrator you processed) and create a new master gain table called CL table. Read about how this procedure works in the AIPS cookbook.

> *task 'split'*

This program will apply the gain solution (CL table) to your source data (CASA) and write a new, fully calibrated uvdata file containing only the main source data. You will use this file to produce your calibrated images.

## Imaging using IMAGR

> *task 'imagr'; input*

This is a very complex imaging and deconvolution program that will do the FT of your uvdata and create an image restored after applying the CLEAN algorithm. Read the cookbook very carefully to understand what the key program input parameters are. You should probably try several different combinations of input parameters for the best results.

Read the project instruction carefully and thoroughly so that all of the required variations are tested out.

## Project Report

- Collaborate with your partner and other team members on the calibration and data reduction
- Each person has to write his/her own report
- A general outline of an ApJ paper
  - Introduction
  - Calibration and imaging
  - Results
  - Discussions
- 10 pages plus references, figures, captions