

ALMA Visibility Calibration

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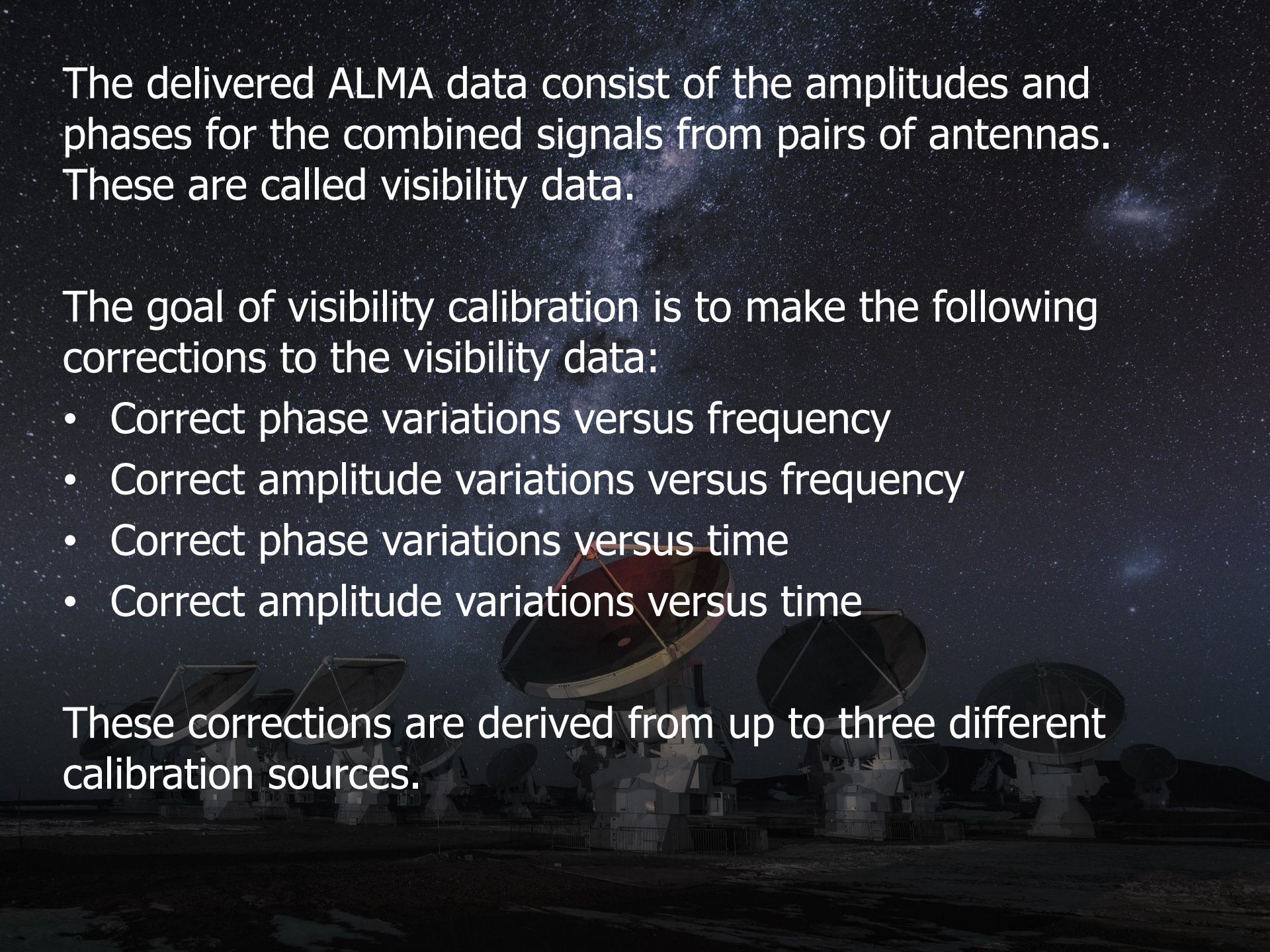
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The delivered ALMA data consist of the amplitudes and phases for the combined signals from pairs of antennas. These are called visibility data.

The goal of visibility calibration is to make the following corrections to the visibility data:

- Correct phase variations versus frequency
- Correct amplitude variations versus frequency
- Correct phase variations versus time
- Correct amplitude variations versus time

These corrections are derived from up to three different calibration sources.



The archive is accessible at <http://almascience.eso.org/aq/> .

The web interface allows for multiple types of searches that will be shown in the next slide.

Data can be selected by individual Scheduling Blocks (SBs), which are observations with an individual array that achieve individual Science Goals.

The downloads come in tar format. The processed data as well as quality control and



ALMA Science Archive

Query Form Results Table Search Reset Query Help

Position

- Source name (Resolver)
- Source name (ALMA)
- RA Dec
- Galactic
- Target list
- Angular resolution
- Largest angular scale
- Field of view

Energy

- Frequency
- Bandwidth
- Spectral resolution
- Band

Time

- Observation date
- Integration time

Polarisation

- Polarisation type

Observation

- Line sensitivity (10 km/s)
- Continuum sensitivity
- Water vapour

Project

- Project code
- Project title
- PI name
- Proposal authors
- Project abstract
- Publication count
- Science keyword

Publication

- Bibcode
- Title
- First author
- Authors
- Abstract
- Year

Options

View:

- observation
- project
- publication
- public data only
- science observations only

ALMA Science Archive

Query Form Results Table Search Reset Query Help

Position

Source name (Resolver)
IRAS16293-2422 ✓

Source name (ALMA)
RA Dec
Galactic
Target list
Angular resolution
Largest angular scale
Field of view

Energy

Frequency
Bandwidth
Spectral resolution
Band

Time

Observation date
Integration time

Polarisation

Polarisation type

Observation

Line sensitivity (10 km/s)
Continuum sensitivity
Water vapour

Project

Project code
Project title
PI name
Proposal authors
Project abstract
Publication count
Science keyword

Publication

Bibcode
Title
First author
Authors
Abstract
Year

Options

View:

- observation
- project
- publication
- public data only
- science observations only

Query Form Results Table **ALMA Science Archive**

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More columns Showing 104 of 104 rows.

<input type="checkbox"/>	Project code	Source name	RA	Dec	Band	Integration	Release date	Velocity resolution	Frequency support	Pub
<input type="checkbox"/>	2012.1.00712.S	IPAS_16293-2422	16:32:22.72	-24:28:34.3	6	2963.520	2015-06-12	291.90	231.03_250.74GHz	4
<input type="checkbox"/>	2012.1.00712.S	IPAS_16293-2422	16:32:22.72	-24:28:34.3	6	2903.040	2015-07-10	304.14	221.77_240.65GHz	4
<input type="checkbox"/>	2013.1.00061.S	IPAS16293_AB	16:32:22.75	-24:28:34.4	7	604.800	2015-07-25	230.73	303.88_319.00GHz	1
<input type="checkbox"/>	2013.1.00061.S	IPAS16293_AB	16:32:22.75	-24:28:34.4	7	786.240	2015-07-29	226.90	310.48_324.04GHz	1
<input type="checkbox"/>	2012.1.00712.S	IPAS_16293-2422	16:32:22.72	-24:28:34.3	3	1663.200	2015-07-30	353.87	89.49_103.41GHz	4
<input type="checkbox"/>	2013.1.00061.S	IPAS16293-AB	16:32:22.75	-24:28:34.4	6	393.120	2015-11-13	302.43	225.82_243.13GHz	1
<input type="checkbox"/>	2012.1.00178.S	L1689N	16:32:29.32	-24:28:59.3	7	847.198	2015-12-25	27.27	332.64_347.45GHz	1
<input type="checkbox"/>	2012.1.00178.S	L1689N	16:32:29.32	-24:28:59.2	7	1450.414	2015-12-27	29.51	307.06_310.88GHz	1
<input type="checkbox"/>	2013.1.00278.S	IPAS16293-2422	16:32:22.72	-24:28:34.3	7	2842.560	2016-02-05	411.82	353.51_355.46GHz	10
<input type="checkbox"/>	2013.1.00352.S	IPAS16293-2422	16:32:22.72	-24:28:34.3	4	1874.880	2016-02-25	130.78	138.61_140.61GHz	1
<input type="checkbox"/>	2013.1.00018.S	IPAS_16293-2422	16:32:22.78	-24:28:35.3	7	3749.760	2016-02-28	211.63	330.51_345.85GHz	0
<input type="checkbox"/>	2013.1.00187.S	163223-24284	16:32:22.90	-24:28:37.1	3	60.480	2016-03-30	317.30	99.75_115.33GHz	1
<input type="checkbox"/>	2013.1.00187.S	163229-24291	16:32:29.10	-24:28:07.2	3	60.480	2016-03-30	317.30	99.75_115.33GHz	1
<input type="checkbox"/>	2013.1.00278.S	IPAS16293-2422	16:32:22.72	-24:28:34.3	7	1512.000	2016-04-16	432.35	336.67_338.58GHz	10
<input type="checkbox"/>	2013.1.00278.S	IPAS16293-2422	16:32:22.72	-24:28:34.3	7	1179.360	2016-04-17	414.02	351.69_353.56GHz	10
<input type="checkbox"/>	2013.1.00278.S	IPAS16293-2422	16:32:22.72	-24:28:34.3	7	786.240	2016-04-28	418.46	347.84_349.81GHz	10

Query Form Results Table **ALMA Science Archive**

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More columns Showing 104 of 104 rows.

<input type="checkbox"/>	Project code	Source name	RA	Dec	Band	Integration	Release date	Velocity resolution	Frequency support	Pub
Filter:										
<input checked="" type="checkbox"/>	2011.0.00007.SV	IPAS16293-2422	16:32:22.74	-24:28:32.5	4	3659.040	In Progress	248.55	145.11_159.16GHz	8
<input checked="" type="checkbox"/>	2011.0.00007.SV	IPAS16293-2422-a	16:32:22.74	-24:28:32.5	9	2104.574	In Progress	415.16	686.56_705.19GHz	8
<input type="checkbox"/>	2012.1.00178.S	L1689N	16:32:29.32	-24:28:59.3	7	847.198	2015-12-25	27.27	332.64_347.45GHz	1
<input type="checkbox"/>	2012.1.00178.S	L1689N	16:32:29.32	-24:28:59.2	7	1450.414	2015-12-27	29.51	307.06_310.88GHz	1
<input type="checkbox"/>	2012.1.00178.S	L1689N	16:32:29.32	-24:29:00.3	7	264.838	2016-07-14	54.53	332.77_347.42GHz	1
<input type="checkbox"/>	2012.1.00178.S	L1689N	16:32:29.32	-24:29:01.1	7	160.701	2016-09-22	29.52	307.12_310.81GHz	1
<input type="checkbox"/>	2012.1.00178.S	L1689N	16:32:29.17	-24:28:56.6	7	23218.560	2016-12-18	29.52	307.03_310.85GHz	1
<input type="checkbox"/>	2012.1.00178.S	L1689N	16:32:29.17	-24:28:56.6	7	15553.728	2017-04-01	54.53	332.74_347.42GHz	1
<input type="checkbox"/>	2012.1.00712.S	IPAS_16293-2422	16:32:22.72	-24:28:34.3	3	1663.200	2015-07-30	353.87	89.49_103.41GHz	4
<input type="checkbox"/>	2012.1.00712.S	IPAS_16293-2422	16:32:22.72	-24:28:34.3	6	2963.520	2015-06-12	291.90	231.03_250.74GHz	4
<input checked="" type="checkbox"/>	2012.1.00712.S	IPAS_16293-2422	16:32:22.72	-24:28:34.3	6	2903.040	2015-07-10	304.14	221.77_240.65GHz	4
<input type="checkbox"/>	2013.1.00018.S	IPAS_16293-2422	16:32:22.78	-24:28:35.3	7	3749.760	2016-02-28	211.63	330.51_345.85GHz	0
<input type="checkbox"/>	2013.1.00018.S	IPAS_16293-2422	16:32:22.78	-24:28:35.3	7	967.680	2016-05-04	210.67	334.53_350.03GHz	0
<input type="checkbox"/>	2013.1.00018.S	IPAS_16293-2422	16:32:22.78	-24:28:35.3	7	937.440	2016-05-11	211.60	330.56_345.89GHz	0
<input type="checkbox"/>	2013.1.00018.S	IPAS_16293-2422	16:32:22.78	-24:28:35.3	7	1905.120	2016-10-22	210.71	334.47_349.97GHz	0
<input type="checkbox"/>	2013.1.00018.S	IPAS_16293-2422	16:32:22.78	-24:28:35.3	7	3749.760	2016-10-30	211.63	330.51_345.85GHz	0

ALMA Request Handler

Login

Anonymous User: Request #2145093268107 ✓
Request Title: [Click to edit](#)

Download Selected

readme product auxiliary raw raw (semipass)

Project / OUSet / Executionblock	File	Size	Accessible
Request 2145093268107			
Project 2012.1.00712.S			
readme	2012.1.00712.S.readme.txt		
Science Goal OUS uid://A002/X609170/X14a			
Group OUS uid://A002/X609170/X14b			
Member OUS uid://A002/X609170/X14c			
SB IRAS_16293-2422_B6_1			
<input checked="" type="checkbox"/> product	2012.1.00712.S_uid_A002_X609170_X14c_001_of_001.tar	441.9MB	✓
<input checked="" type="checkbox"/> raw	2012.1.00712.S_uid_A002_X7fb89e_X6e1.asdm.sdm.tar	25.4GB	✓
<input type="checkbox"/> raw (semipass)	2012.1.00712.S_uid_A002_X826a79_X910.asdm.sdm.tar	22.7GB	✓
<input checked="" type="checkbox"/> raw	2012.1.00712.S_uid_A002_X84187d_X1347.asdm.sdm.tar	25.4GB	✓

Total: 73.9GB

The SB that contain the example dataset come in three files:

```
2012.1.00712.s_uid___A002_x609170_x14c_001_of_001.tar
```

```
2012.1.00712.s_uid___A002_x7fb89e_x6e1.asdm.sdm.tar
```

```
2012.1.00712.s_uid___A002_x84187d_x1347.asdm.sdm.tar
```

The first file contains the results from data processing and supporting files, including final images, logs, and quality assurance results.

The second and third files contain the raw data from individual Execution Blocks (EBs), which are self-contained observations.

This observations has two EBs (and a third semipass EB that did not pass quality assurance). For this tutorial, we will use the one ending in X6e1.

Directory structure after untarring files:

2012.1.00712.s

 science_goal.uid___A002_x609170_x14a

 group.uid___A002_x609170_x14b

 member.uid___A002_x609170_x14c

 calibration

 log

 product

 qa

 raw

 README

 script



Directory contents:

calibration: Calibration plots and tables.

Log: Log files.

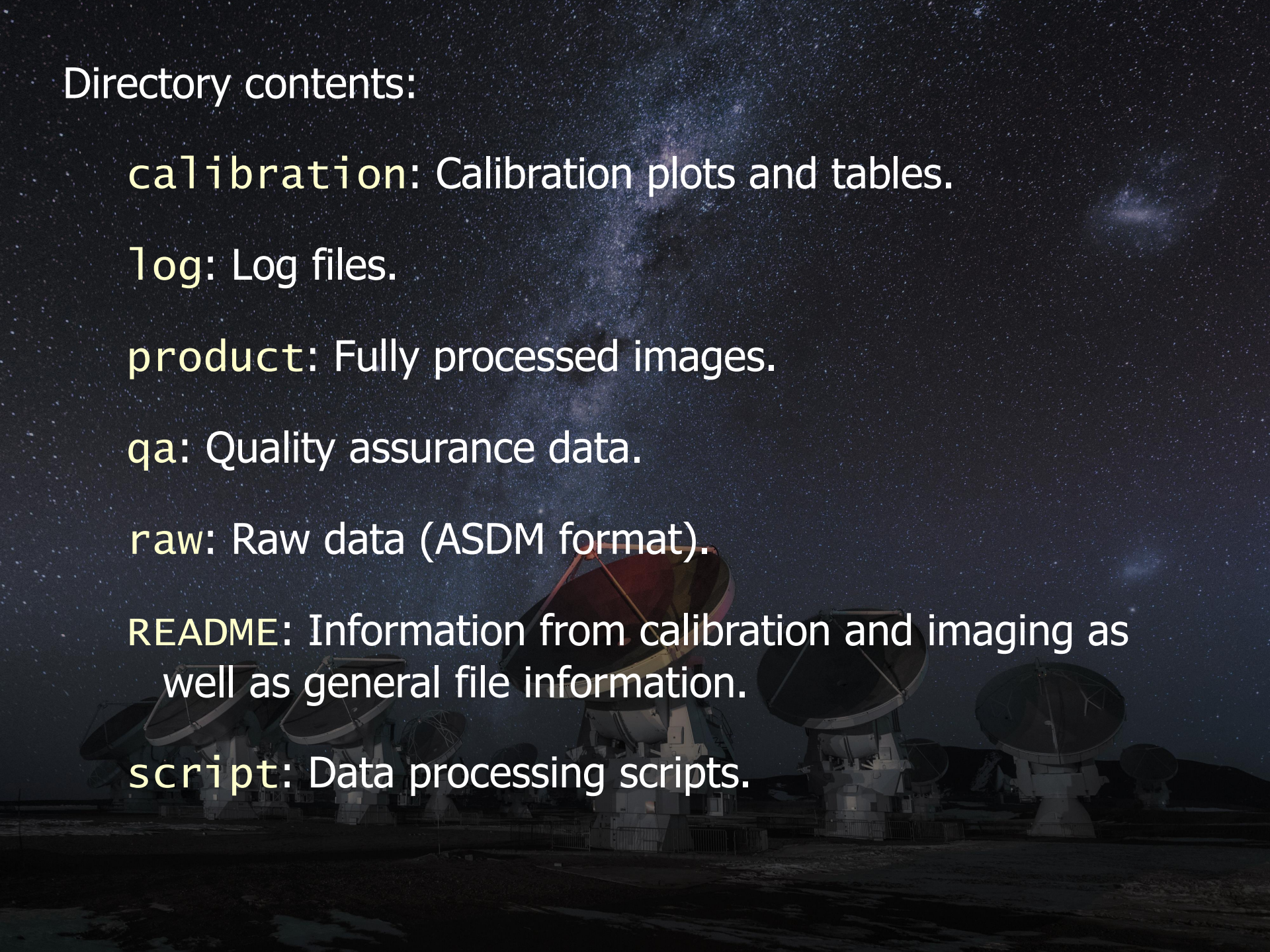
product: Fully processed images.

qa: Quality assurance data.

raw: Raw data (ASDM format).

README: Information from calibration and imaging as well as general file information.

script: Data processing scripts.



Data downloaded from the archive can be reprocessed using the following command:

```
execfile('scriptForPI.py')
```

If the data were manually calibrated and imaged, these scripts will be available and can also be applied (after renaming some files).

If the data were pipeline-calibrated, executing `scriptForPI.py` is the fastest way to produce calibrated measurement sets.

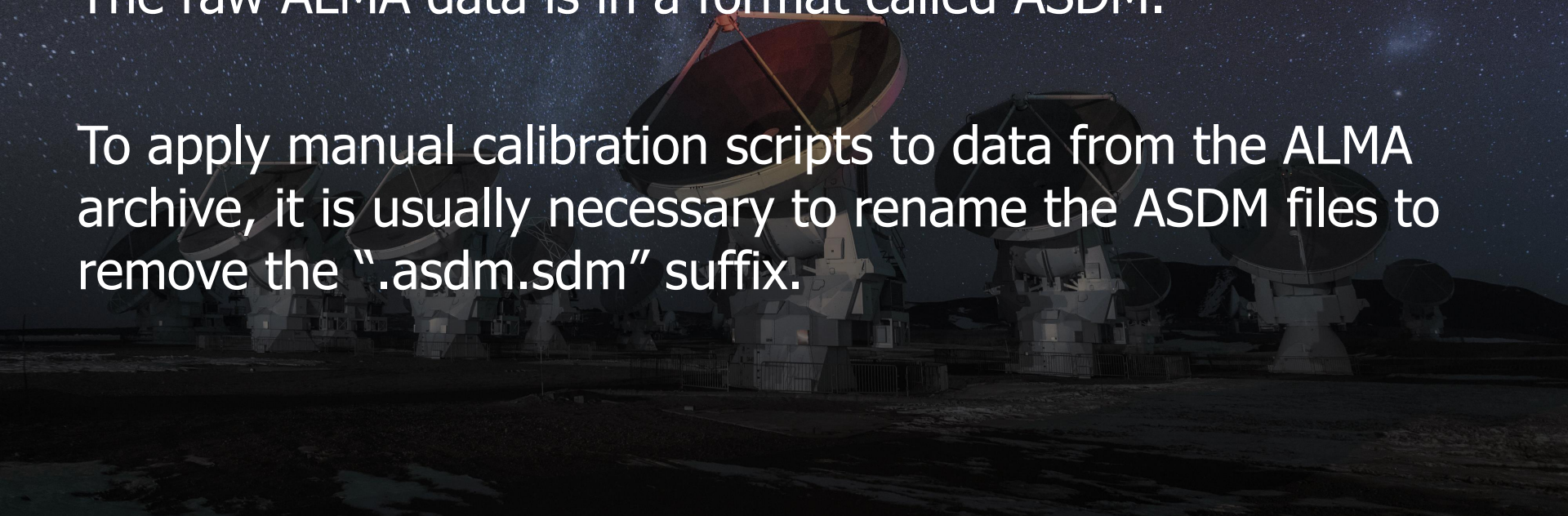
If the data were pipeline-imaged, images are expected to be produced using `scriptForPI.py`.

ALMA and CASA data are stored in object oriented file systems, where a "file" is a directory that actually contains a series of ascii and binary files (some in subdirectories).

The scientific data in these datasets are the phases and amplitudes produced by the signals from pairs of antennas. These data are referred to as visibility data.

The raw ALMA data is in a format called ASDM.

To apply manual calibration scripts to data from the ALMA archive, it is usually necessary to rename the ASDM files to remove the ".asdm.sdm" suffix.



Contents of the example ASDM file:

AlmaRadiometer.xml
Antenna.xml
ASDMBinary/
ASDM.xml
CalAmpli.xml
CalAtmosphere.bin
CalAtmosphere.xml
CalCurve.xml
CalData.xml
CalDevice.xml
CalFlux.xml
CalPhase.xml
CalPointing.xml
CalReduction.xml

CalSeeing.xml
CalWVR.xml
ConfigDescription.xml
CorrelatorMode.xml
DataDescription.xml
ExecBlock.xml
Feed.xml
Field.xml
Flag.xml
FocusModel.xml
Focus.xml
Main.xml
Pointing.bin
PointingModel.xml

Pointing.xml
Polarization.xml
Processor.xml
Receiver.xml
SBSummary.xml
Scan.xml
Source.xml
SpectralWindow.xml
State.xml
Station.xml
Subscan.xml
SwitchCycle.xml
SysCal.xml
weather.xml



The calibration scripts we are using contain a series of steps. To execute individual step "N", enter the following commands into CASA:

```
mysteps=[N]  
execfile('uid___A002_x7fb89e_x6e1.ms.scriptForCalibration.py')
```

Multiple commands can be executed at once.

Not specifying anything will execute all of the commands.



The rest of this presentation describes each calibration step in more detail.

The data processing steps can be divided into three broad groups:

0-1: Data import

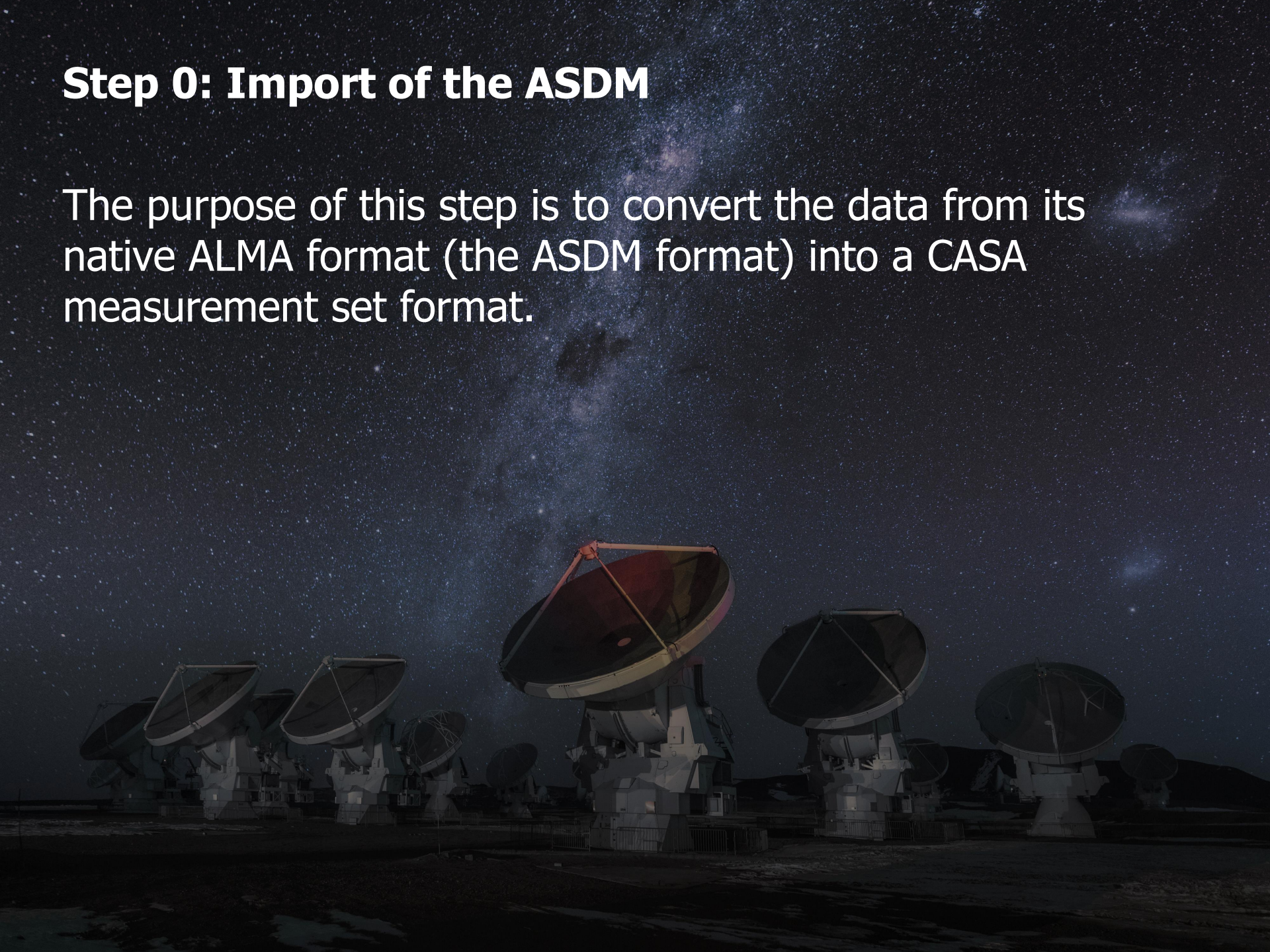
2-8: A priori calibration

9-19: Calibration



Step 0: Import of the ASDM

The purpose of this step is to convert the data from its native ALMA format (the ASDM format) into a CASA measurement set format.



Contents of the example measurement set:

ANTENNA/	OBSERVATION/	table.f14	table.f22_TSM1
ASDM_ANTENNA/	POINTING/	table.f15	table.f22_TSM2
ASDM_CALATMOSPHERE/	POLARIZATION/	table.f16	table.f23
ASDM_CALWVR/	PROCESSOR/	table.f17asdmindex	table.f23_TSM1
ASDM_CORRELATORMODE/	SOURCE/	table.f18	table.f23_TSM2
ASDM_RECEIVER/	SPECTRAL_WINDOW/	table.f19	table.f3
ASDM_SBSUMMARY/	STATE/	table.f2	table.f4
ASDM_SOURCE/	SYSCAL/	table.f20	table.f5
ASDM_STATION/	SYSPower/	table.f20_TSM0	table.f6
CALDEVICE/	table.dat	table.f21	table.f7
DATA_DESCRIPTION/	table.f1	table.f21_TSM1	table.f8
FEED/	table.f10	table.f21_TSM2	table.f9
FIELD/	table.f11	table.f21_TSM3	table.info
FLAG_CMD/	table.f12	table.f21_TSM4	table.lock
HISTORY/	table.f13	table.f22	WEATHER/



Step 1: Fix SYSCAL table times

The system temperature (T_{sys}) measurements may include recording errors. Occasionally, multiple measurements have the same timestamp. This step corrects these errors.



Step 2: Listobs

The listobs command will list a large amount of information about the observations. We run this step again later in step 9, so we will look at the listobs file in more detail then.



At this point in time, it would be useful to use `plotants` to produce a plot showing the locations of antennas in the array.

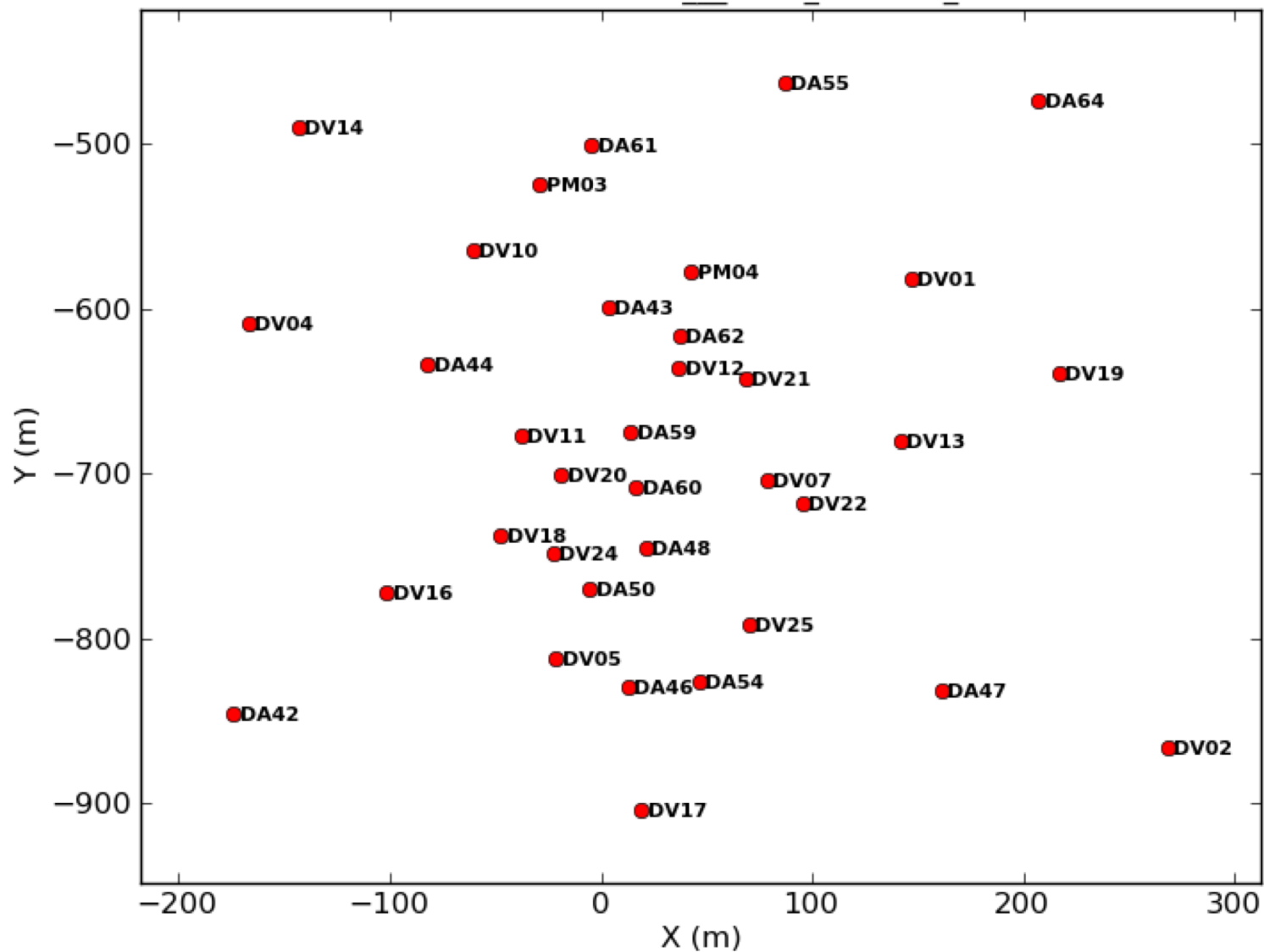
This is not included in standard calibration scripts, but it should be.

To execute this command, type the following:

```
plotants(vis='uid___A002_x7fb89e_x6e1.ms')
```

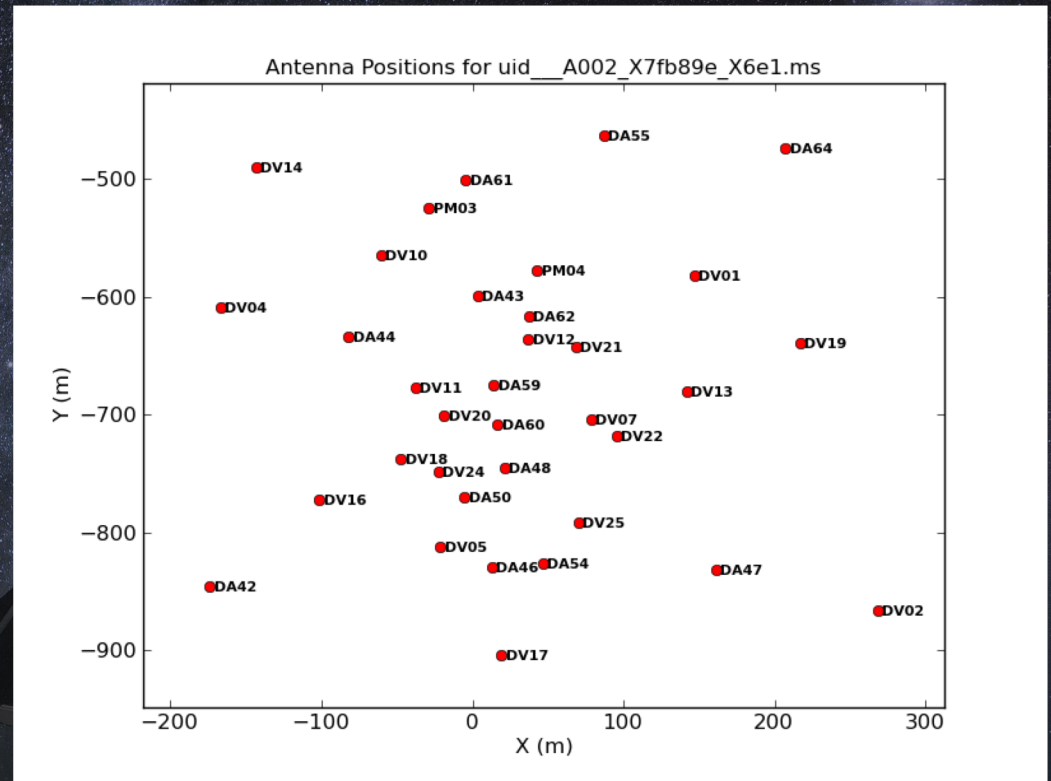


Antenna Positions for uid__A002_X7fb89e_X6e1.ms



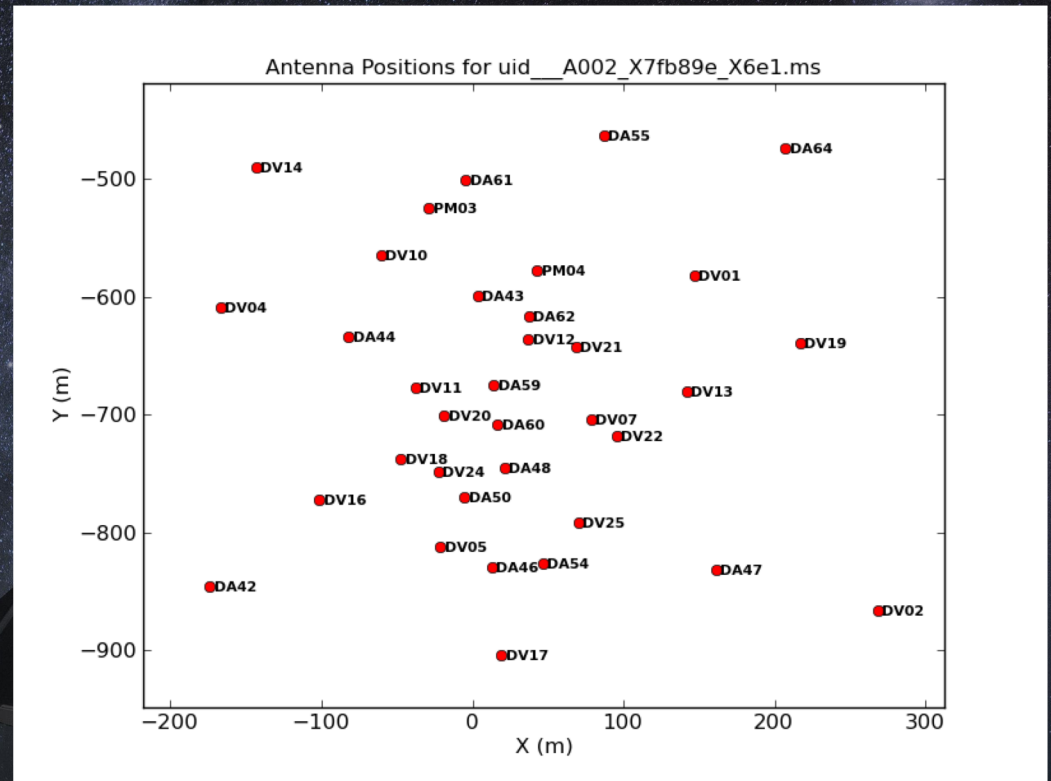
This plot can be used to select the reference antenna, which is used in many of the data processing steps.

The antenna needs to be from the centre of the array.



Antennas on long baselines will tend to produce noisier data than antennas on short baselines.

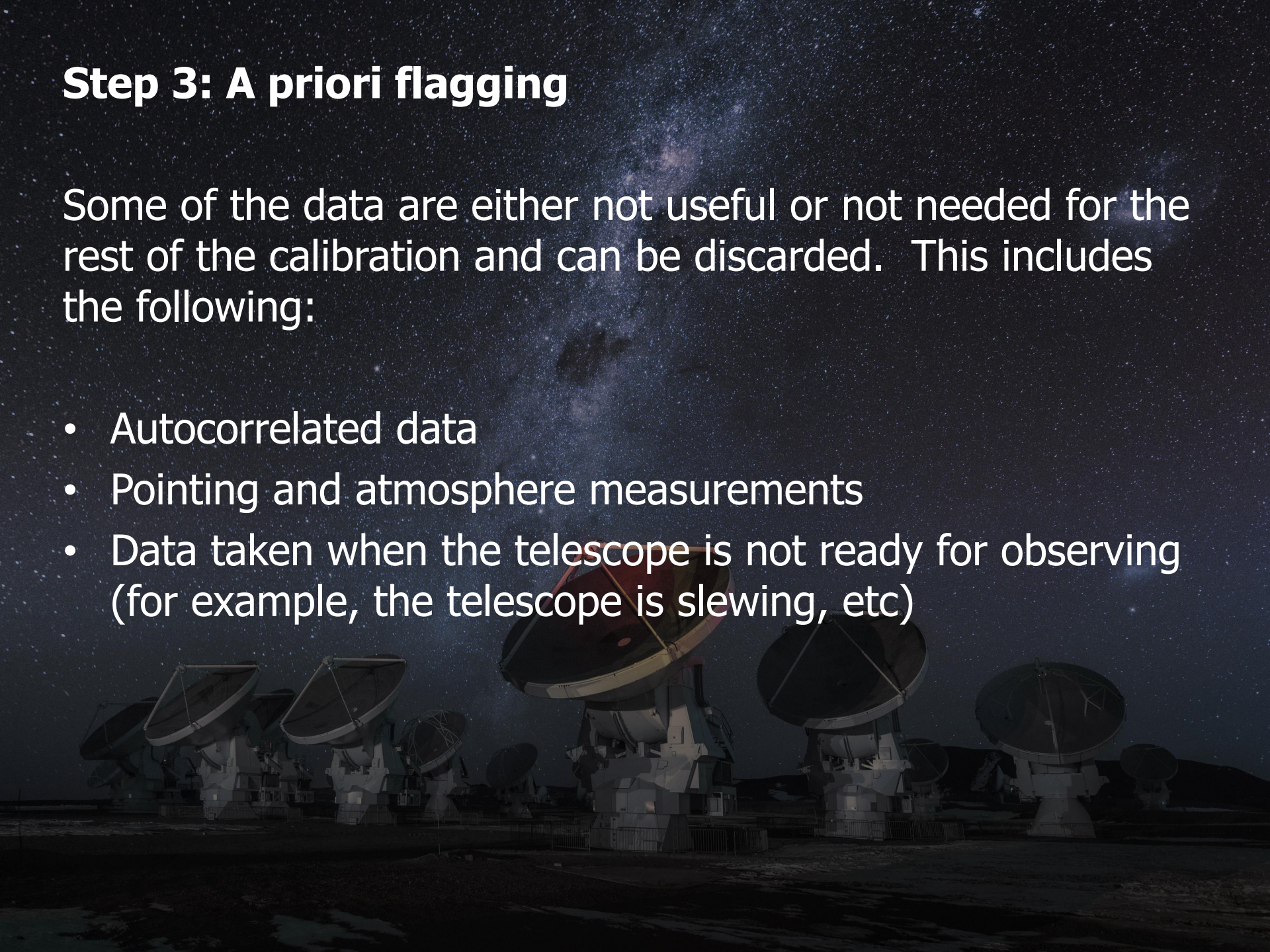
This figure can be used to diagnose these types of issues.



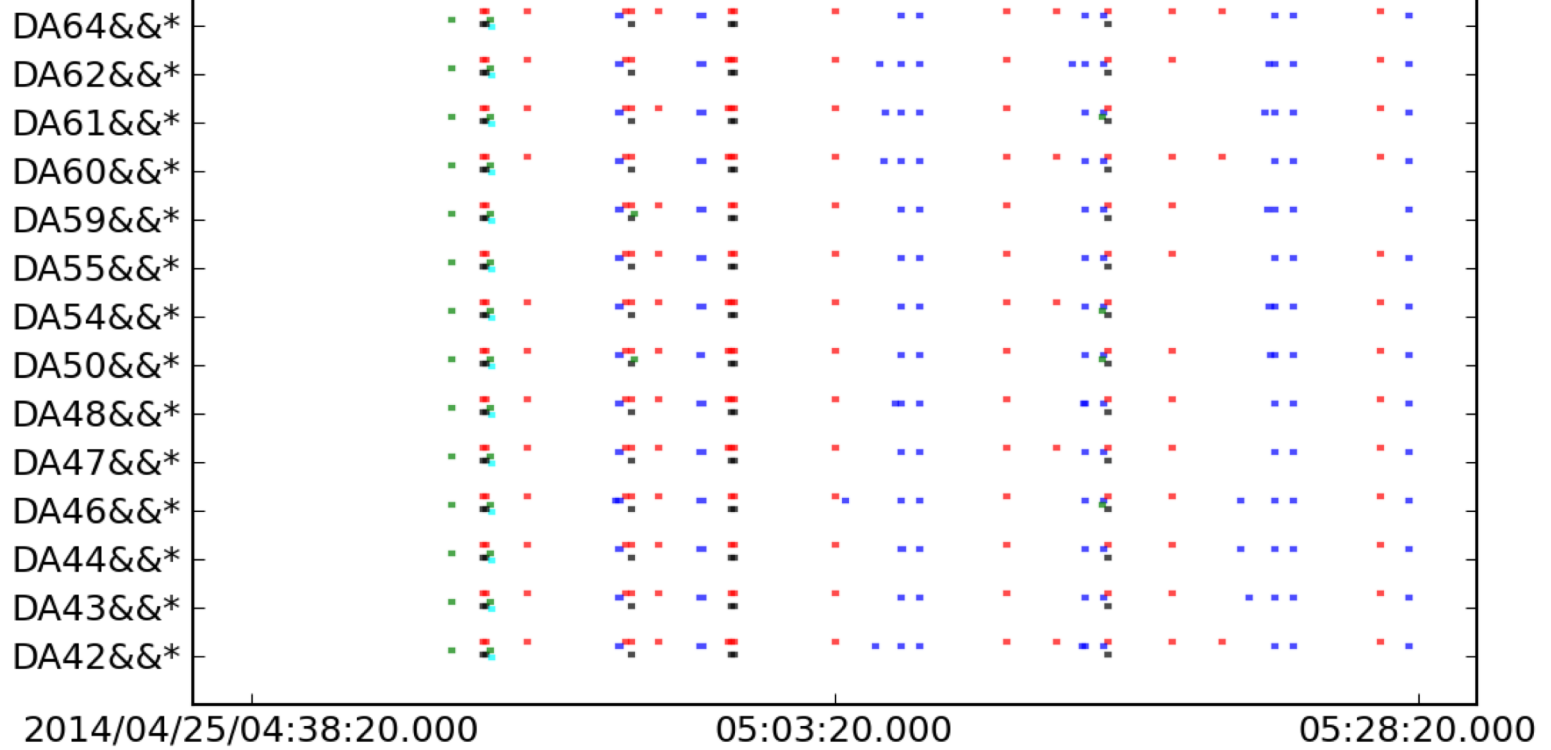
Step 3: A priori flagging

Some of the data are either not useful or not needed for the rest of the calibration and can be discarded. This includes the following:

- Autocorrelated data
- Pointing and atmosphere measurements
- Data taken when the telescope is not ready for observing (for example, the telescope is slewing, etc)



Mount_is_off_source
 ACD_does_not_have_the_correct_load_in_position
 ACD_is_not_over_commanded_band_cartridge
 Power_levels_are_being_optimized.
 The_WCA_is_not_locked.
 ACD_motors_are_not_in_position.
 FrontEnd_LO_Amps_not_optimized



Step 4: Generation of the WVR calibration table

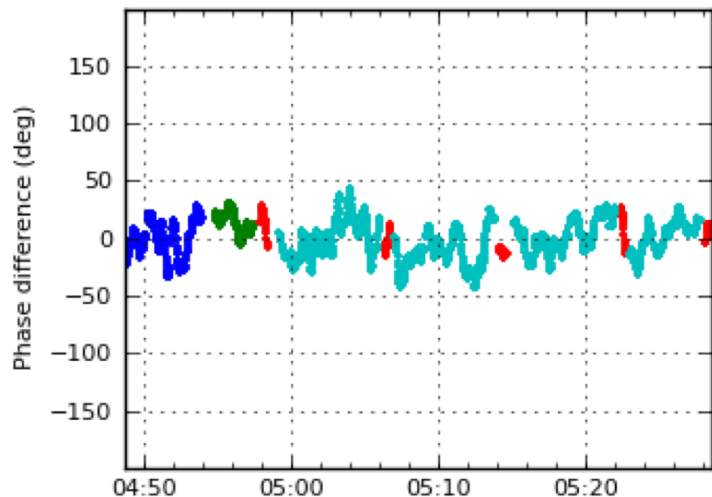
The water vapour radiometers (WVRs) produce measurements of the water vapour content of the atmosphere that can be used to correct for phase variations related to this.

This step generates calibration tables that correct the phases. The corrections are applied in step 7.

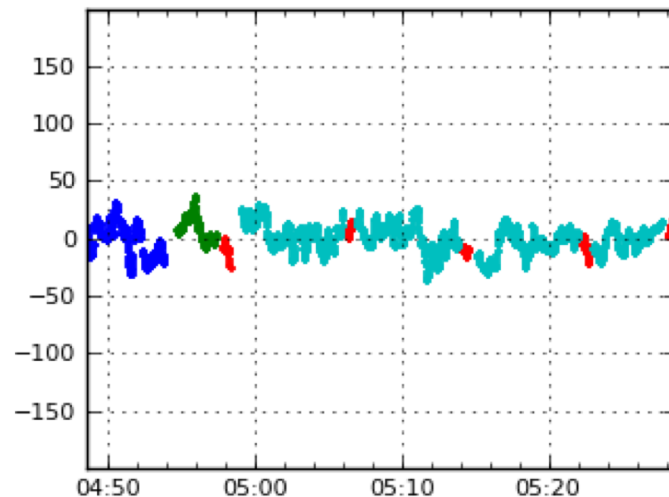


uid__A002_X7fb89e_X6e1.ms.wvr computed for uid__A002_X7fb89e_X6e1.ms

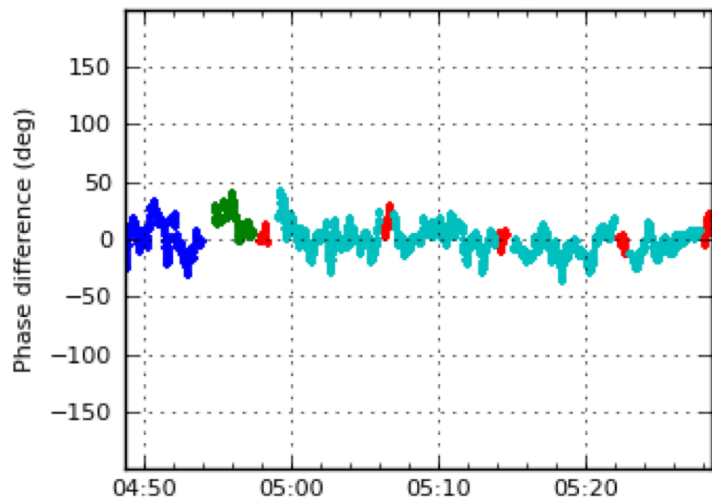
235m Baseline 0-10=DA42-DA60, spw17=239.7GHz



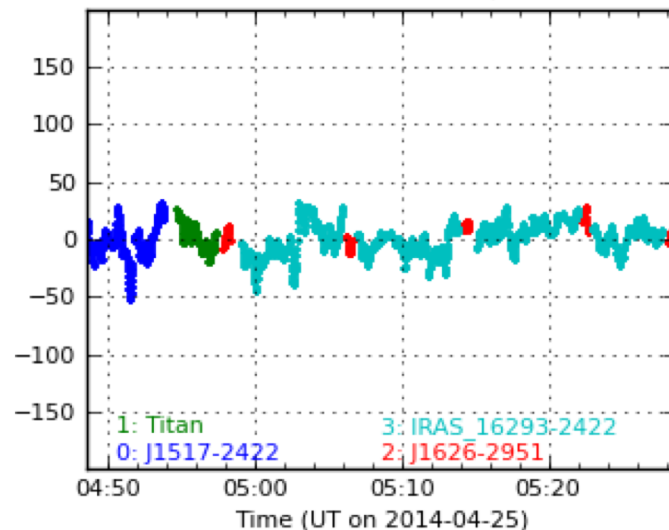
110m Baseline 1-10=DA43-DA60, spw17=239.7GHz



124m Baseline 2-10=DA44-DA60, spw17=239.7GHz



120m Baseline 3-10=DA46-DA60, spw17=239.7GHz



Step 5: Generation of the Tsys calibration table

The system temperature (T_{sys}) measurements include measurements of the emission from the atmosphere and telescope.

This step generates calibration tables that correct the amplitudes based on the T_{sys} data. The corrections are applied in step 7.



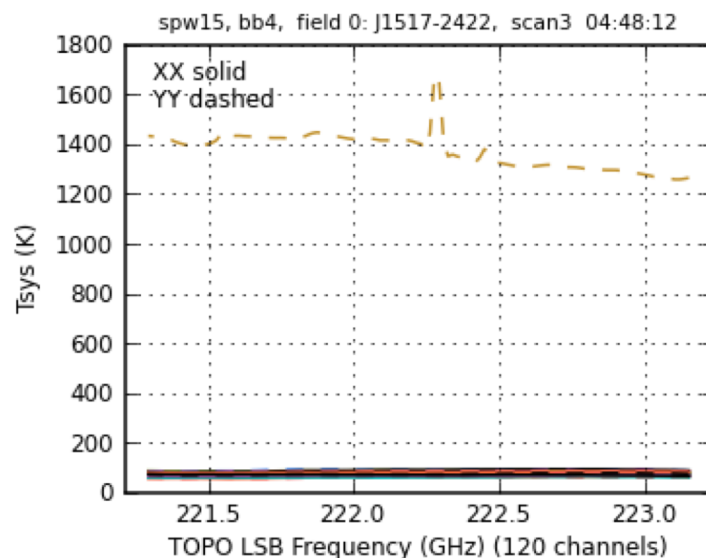
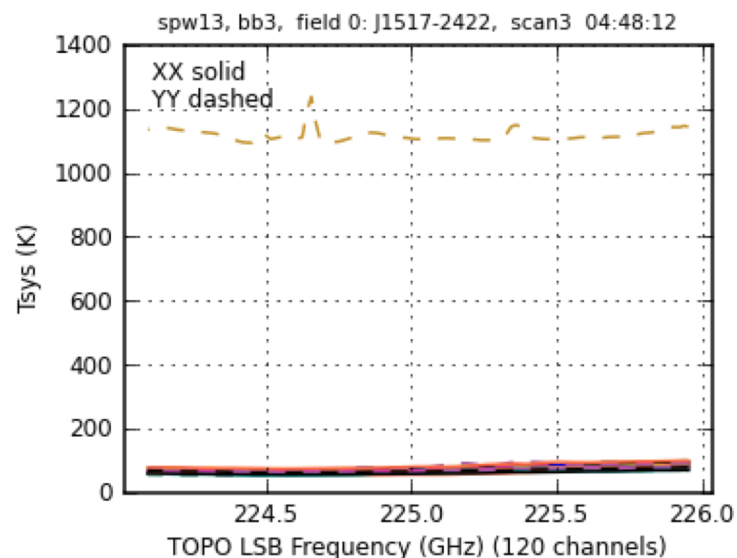
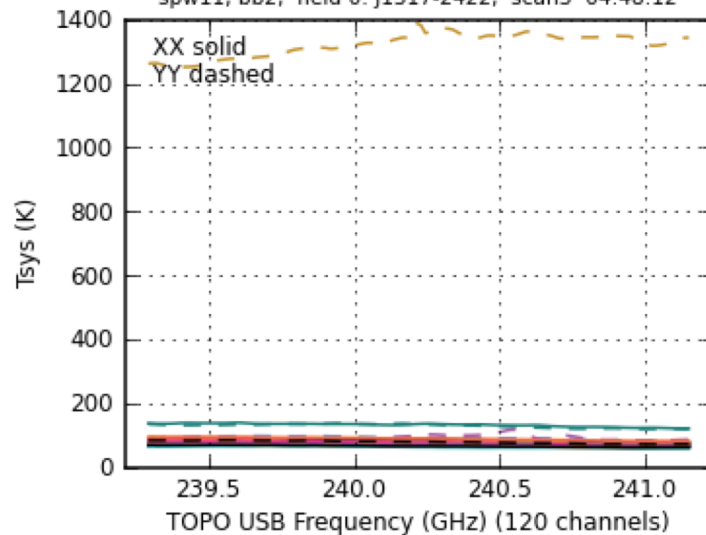
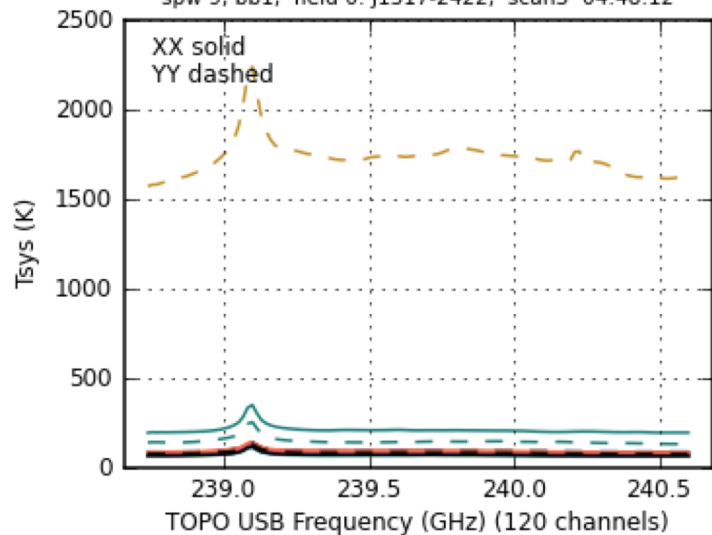
uid__A002_X7fb89e_X6e1.ms.tsys

DA42 DA43 DA44 DA46 DA47 DA48 DA50 DA54 DA55 DA59 DA60 DA61 DA62 DA64 DV01 DV02 DV04

spw 9, bb1, field 0: J1517-2422, scan3 04:48:12

spw11, bb2, field 0: J1517-2422, scan3 04:48:12

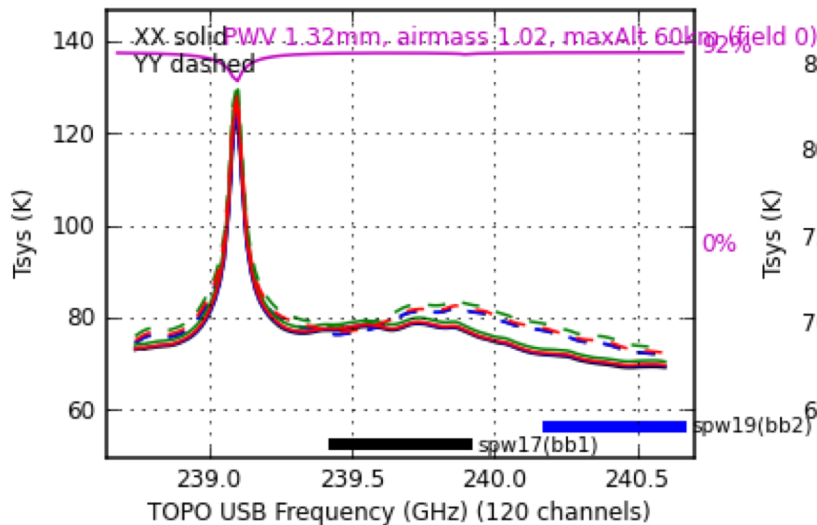
DV05
DV07
DV10
DV11
DV12
DV13
DV14
DV16
DV17
DV18
DV19
DV20
DV21
DV22
DV24
DV25
PM03
PM04



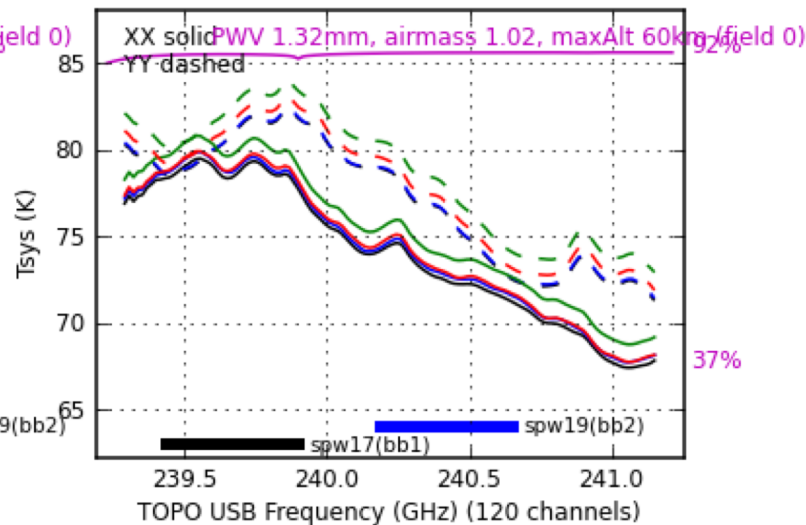
uid__A002_X7fb89e_X6e1.ms.tsys

UT 04:48:12 04:54:23 04:58:47 05:14:49

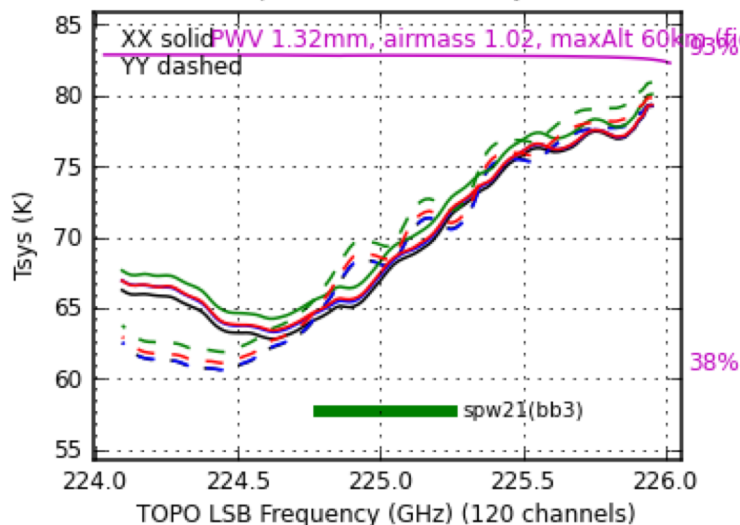
Ant 0: DA42, spw 9, bb1, fields 0,1,3: J1517-2422,T...



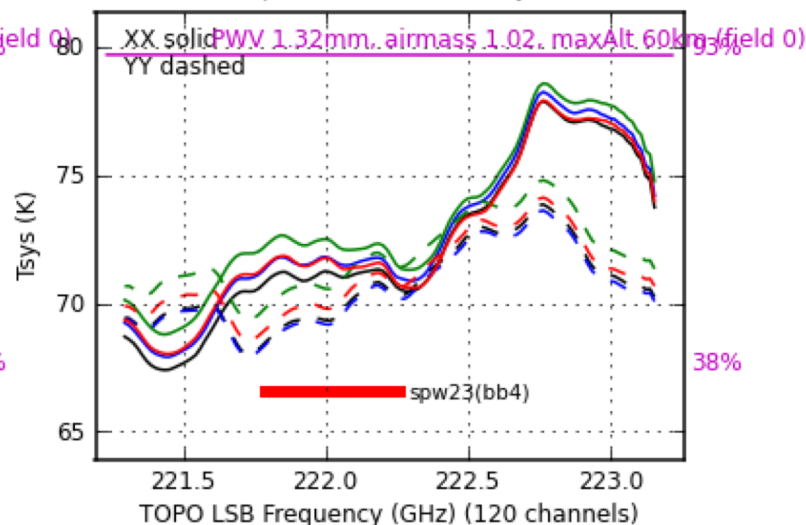
Ant 0: DA42, spw11, bb2, fields 0,1,3: J1517-2422,T...



Ant 0: DA42, spw13, bb3, fields 0,1,3: J1517-2422,T...



Ant 0: DA42, spw15, bb4, fields 0,1,3: J1517-2422,T...



Step 6: Generation of the antenna position calibration table

Corrections to antenna positions can be very important if the antennas are on long baselines. This step generates a calibration table that corrects the positions.

Sometimes, the corrections may be unnecessary. In this situation, a table filled with zeroes is created.



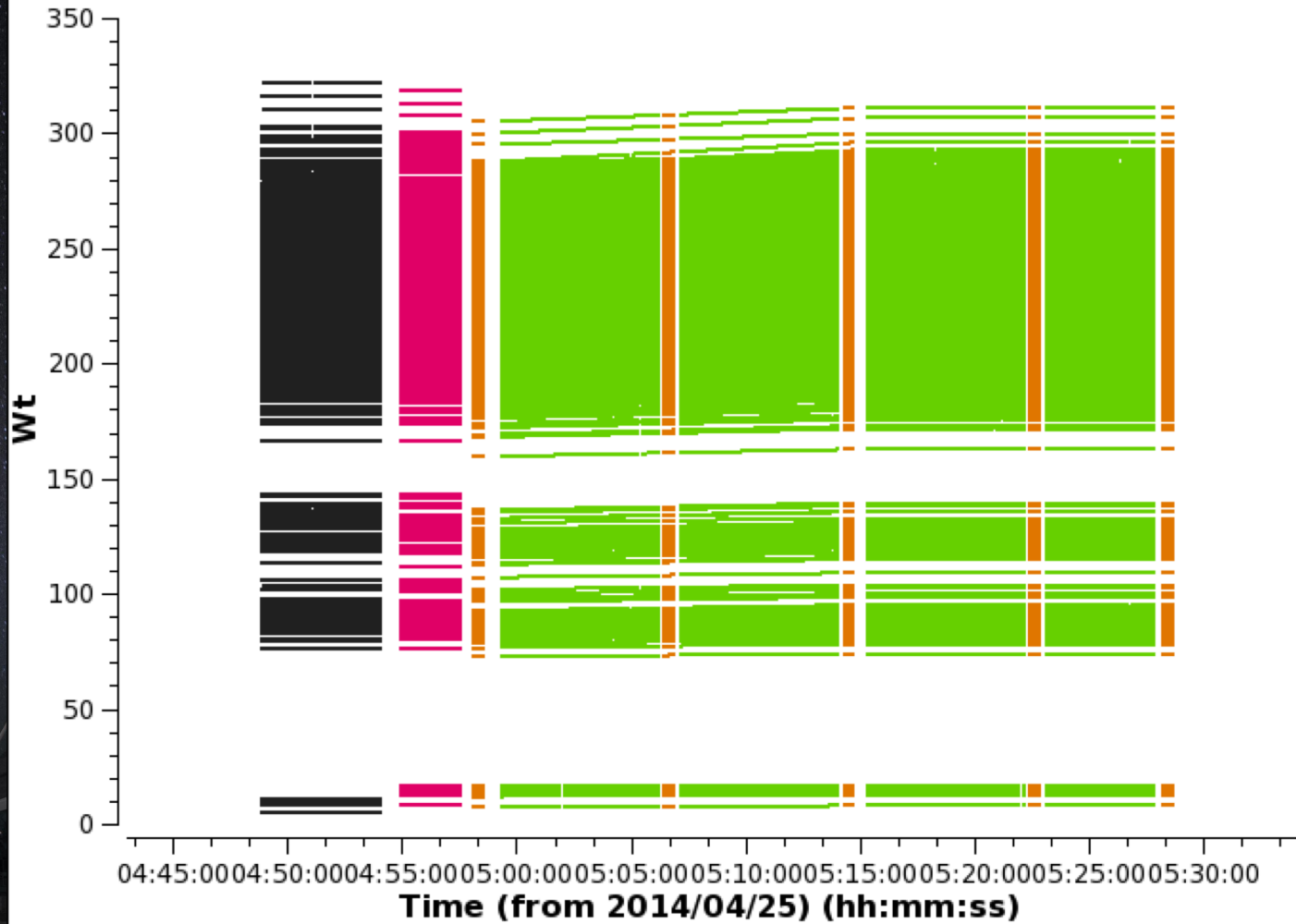
Step 7: Application of the WVR, T_{sys} , and antenna position calibration tables

The tables generated in steps 4, 5, and 6 are applied in this step.

This step also generates a plot of the weights for the data (which are applied when final images are created).



Wt vs. Time



Step 8: Split out science spws

In this step, the data for the science and calibration sources is separated from the other data.

For the example dataset, the original measurement set included 25 spectral windows (spws), while the output from this step has only 4 spws.

This is the end of the a priori calibration.



Step 9: Listobs and save initial flags

The listobs command will list a large amount of information about the observations, including the following:

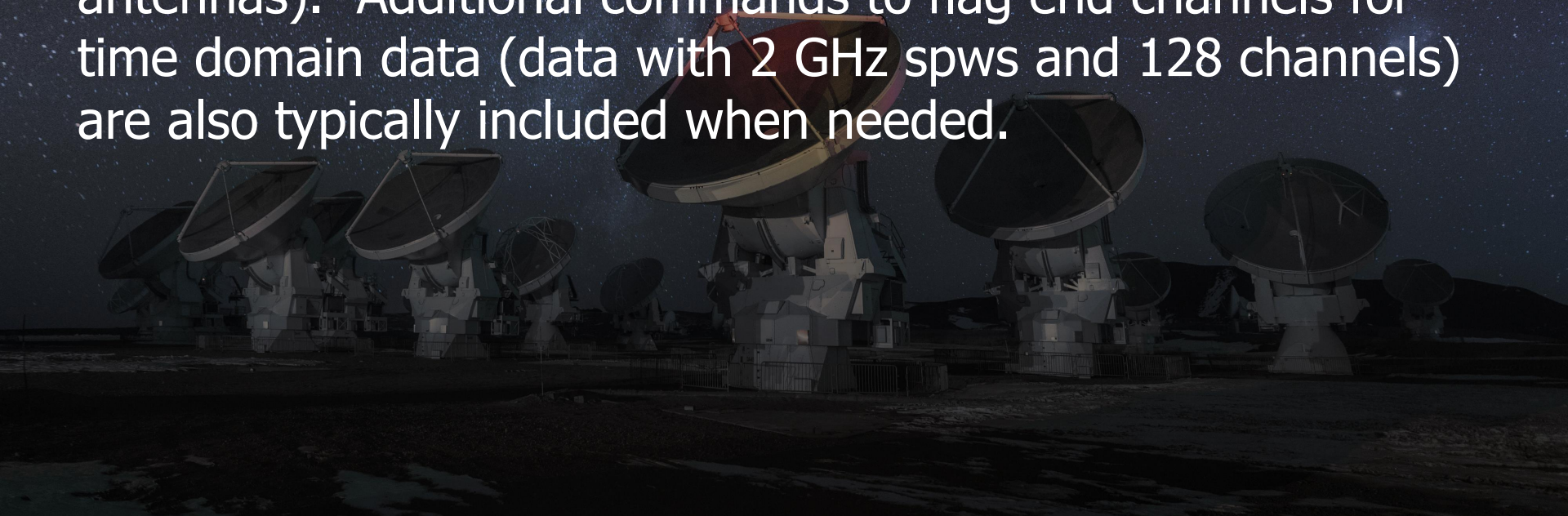
- Basic observation information (PI, project ID, dates, etc)
- List of the sequence of observations performed
- List of the fields
- List of the spectral windows
- List of the sources (the spectral windows for each field)
- List of the antennas

The other part of this step saves data related to flagging. This is done several times throughout the script.

Step 10: Initial flagging

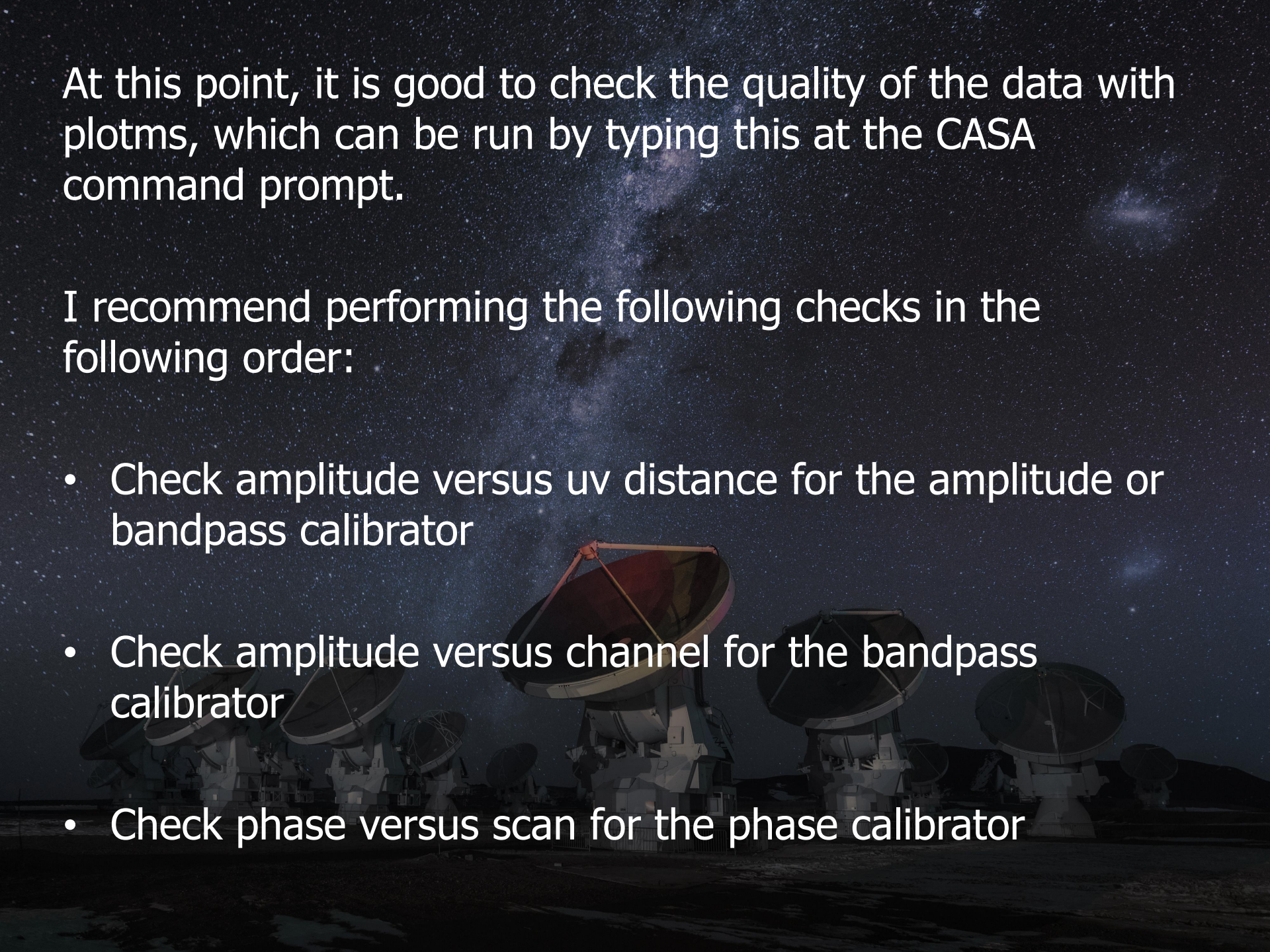
Any data that look abnormally noisy or are that are otherwise unusable are flagged (identified as bad) in this step and not used in any subsequent steps.

Standard scripts include flagdata commands to flag shadowed antennas (antennas that are blocked by other antennas). Additional commands to flag end channels for time domain data (data with 2 GHz spws and 128 channels) are also typically included when needed.



At this point, it is good to check the quality of the data with `plotms`, which can be run by typing this at the CASA command prompt.

I recommend performing the following checks in the following order:

- Check amplitude versus uv distance for the amplitude or bandpass calibrator
 - Check amplitude versus channel for the bandpass calibrator
 - Check phase versus scan for the phase calibrator
- 
- A row of radio telescope dishes is visible in the lower half of the image, set against a dark night sky filled with stars and the Milky Way galaxy. The dishes are arranged in a line, with the largest one in the center. The sky is a deep blue-black, and the stars are scattered throughout, with a prominent band of light representing the Milky Way stretching across the upper portion of the frame.

Data

File
 Browse...

Selection

field

spw

timerange

uvrange

antenna

scan

corr

array

observation

intent

feed

msselect

Averaging

Channel channels

Time seconds

Scan Field

All Baselines Per Antenna

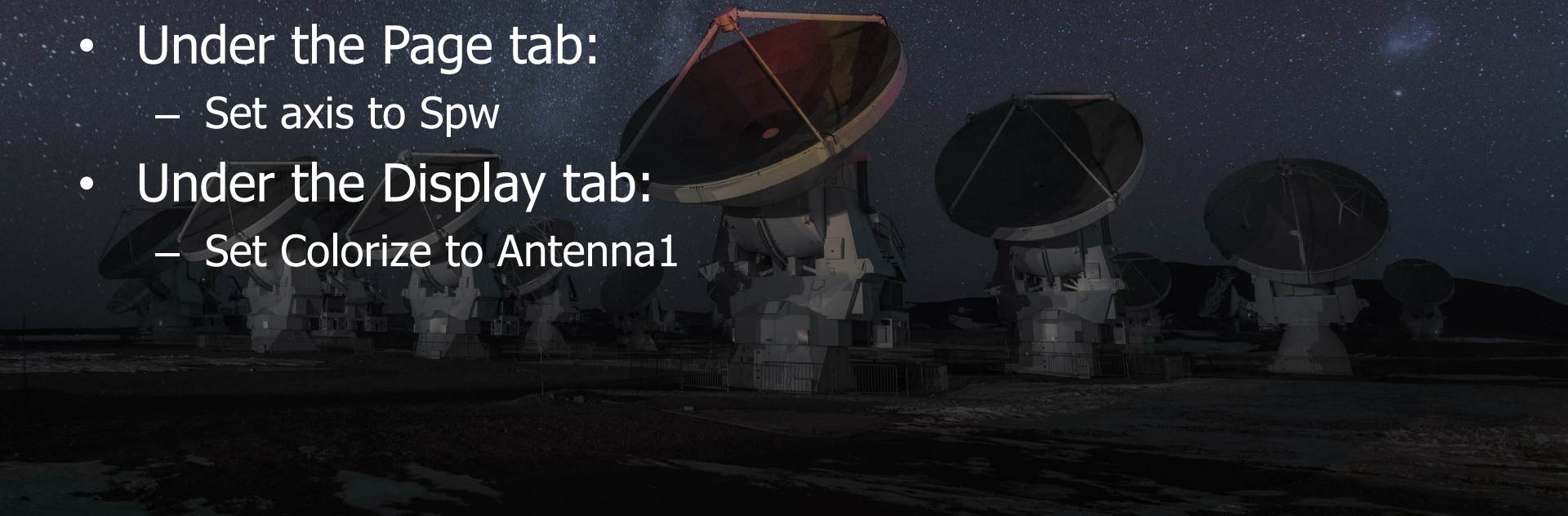
All Spectral Windows

Vector Scalar

Add Plot Reload Plot

To check *amplitude versus uv distance*, set the following:

- Under the Data tab:
 - Set the file to the ms.split file created in step 8
 - Set the field to the number of the amplitude calibrator
 - Set channel averaging to 4100
 - Set time averaging to 1e11
- Under the Axes tab:
 - Set the x-axis to UVdist
 - Set the y-axis to Amp
- Under the Page tab:
 - Set axis to Spw
- Under the Display tab:
 - Set Colorize to Antenna1



Plot Flag Tools Annotate Options

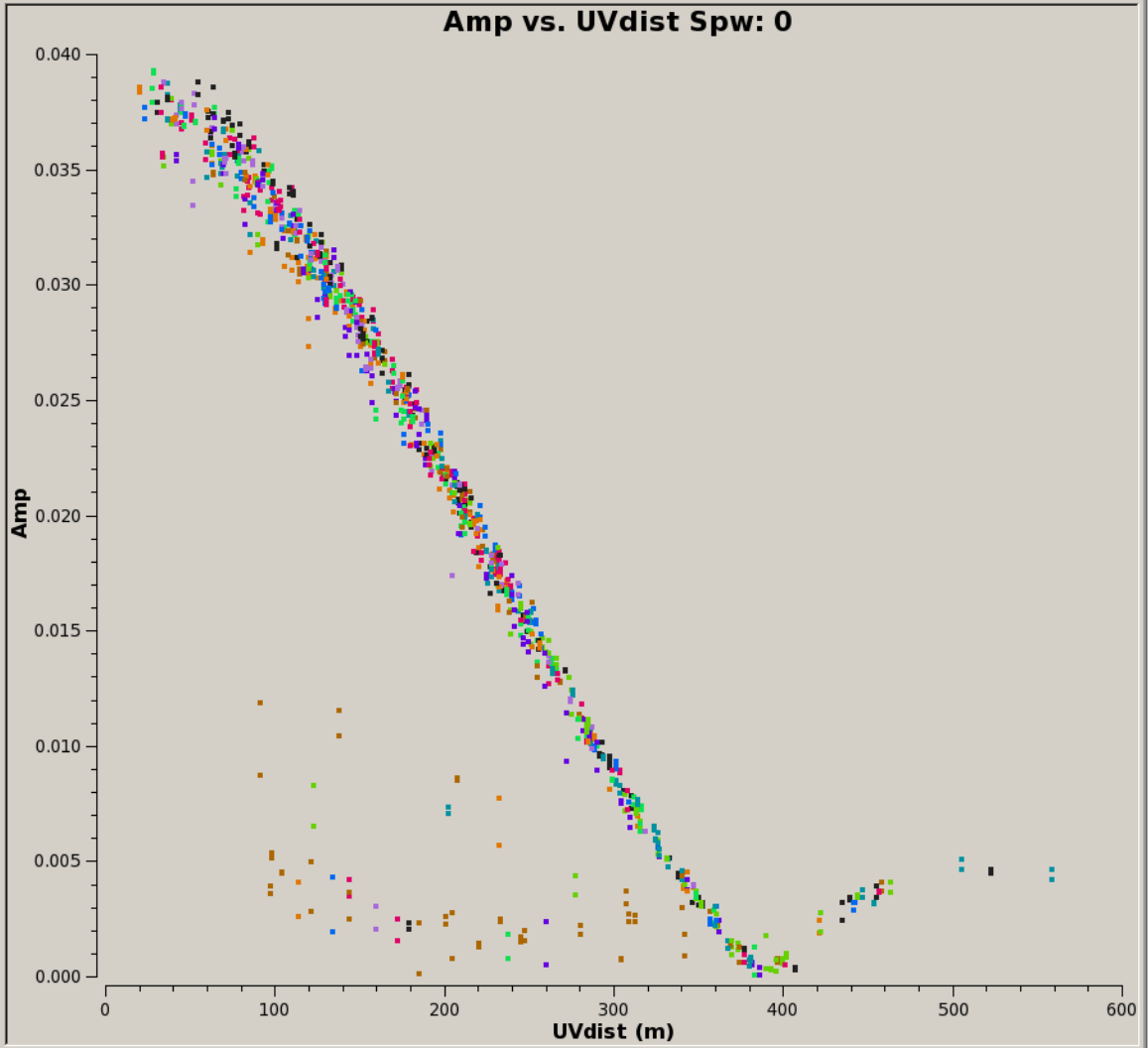
Data
File
02_X7fb89e_X6e1.ms.split

Selection

field 1
spw
timerange
uvrange
antenna
scan
corr
array
observation
intent
feed
msselect

Averaging

Channel 4100 channels
 Time 1e+11 seconds
 Scan Field
 All Baselines Per Antenna
 All Spectral Windows
 Vector Scalar



Add Plot Reload Plot

Data

X Axis: UVdist Cached

Attach: Bottom Top

Range:

Automatic

to

Overlay: None Atm Tsky

Canvas

Data: Amp Cached

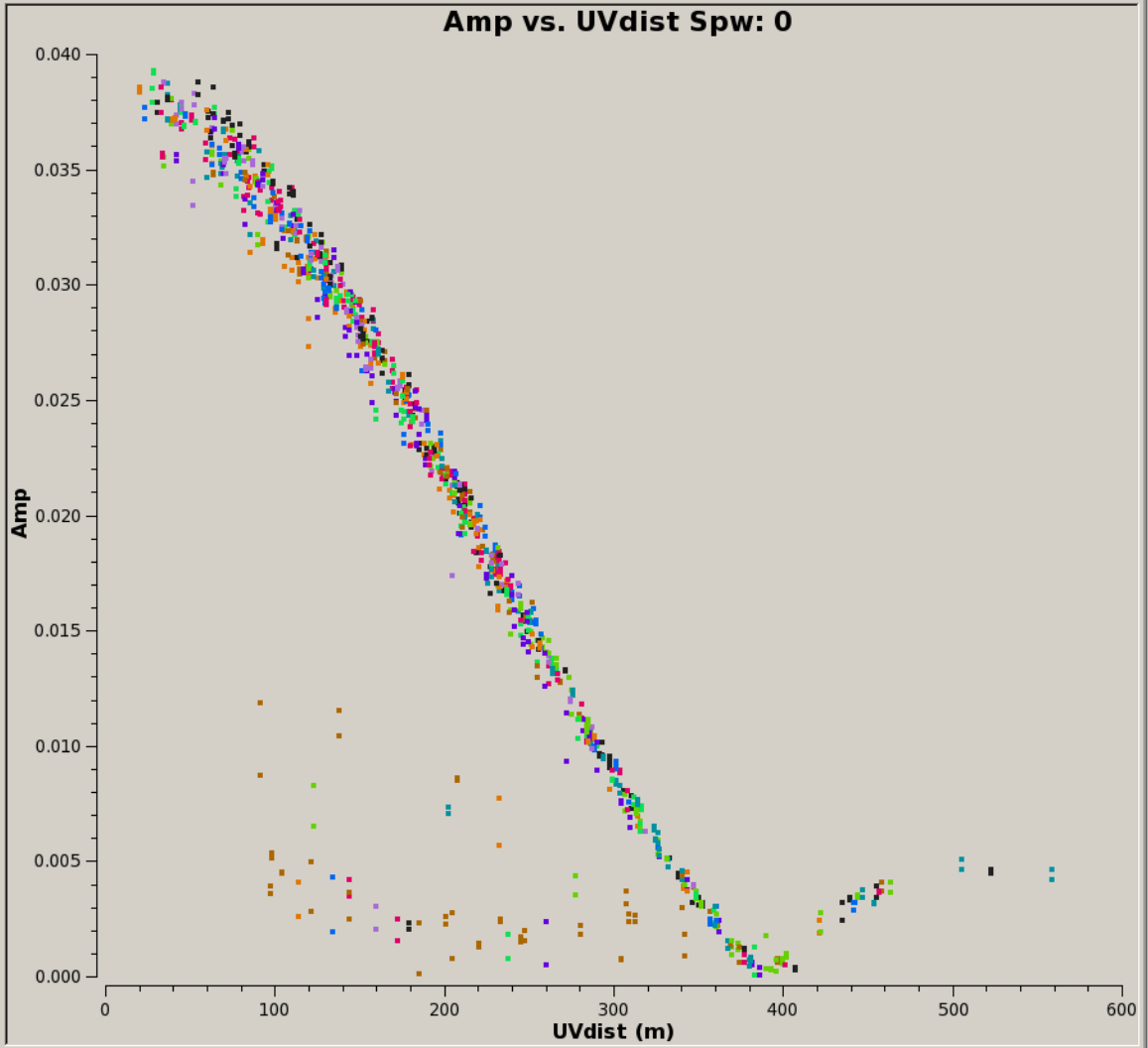
Data Column: data Cached

Attach: Left Right

Range:

Automatic

to



Iteration

Axis: Spw

Global Axis Scale: X Y

Shared Axis: X Y

Page Header

Contents

Filename

Y Column(s)

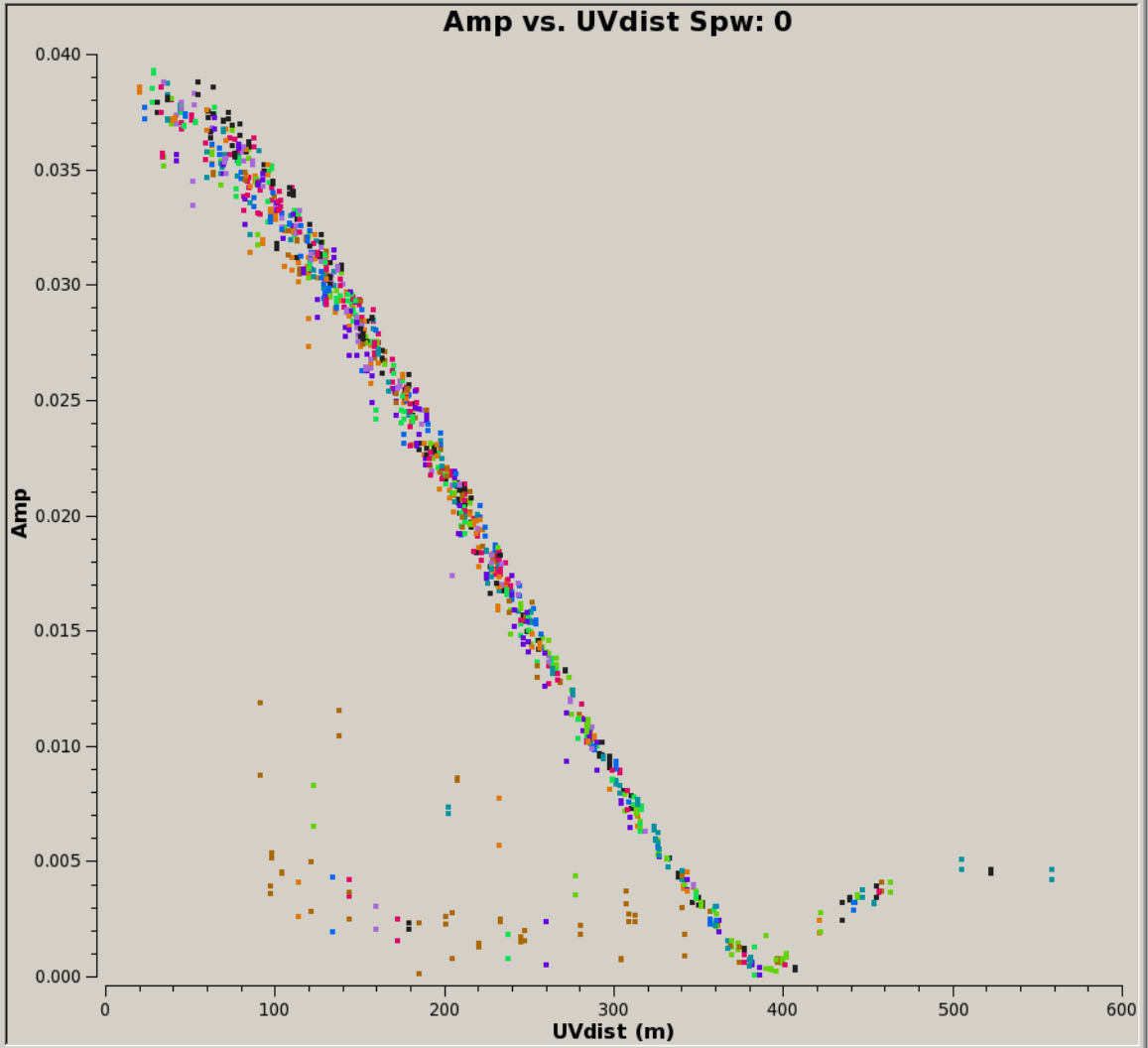
Observation Start Date

Observation Start Time

Observer

Project ID

Add Plot Reload Plot



Y Axis Data: Amp

Colorize: Antenna1

Unflagged Points Symbol

None Default Custom

Style: 2 px, autoscaling

Fill: 0000ff fill

Outline: None Default

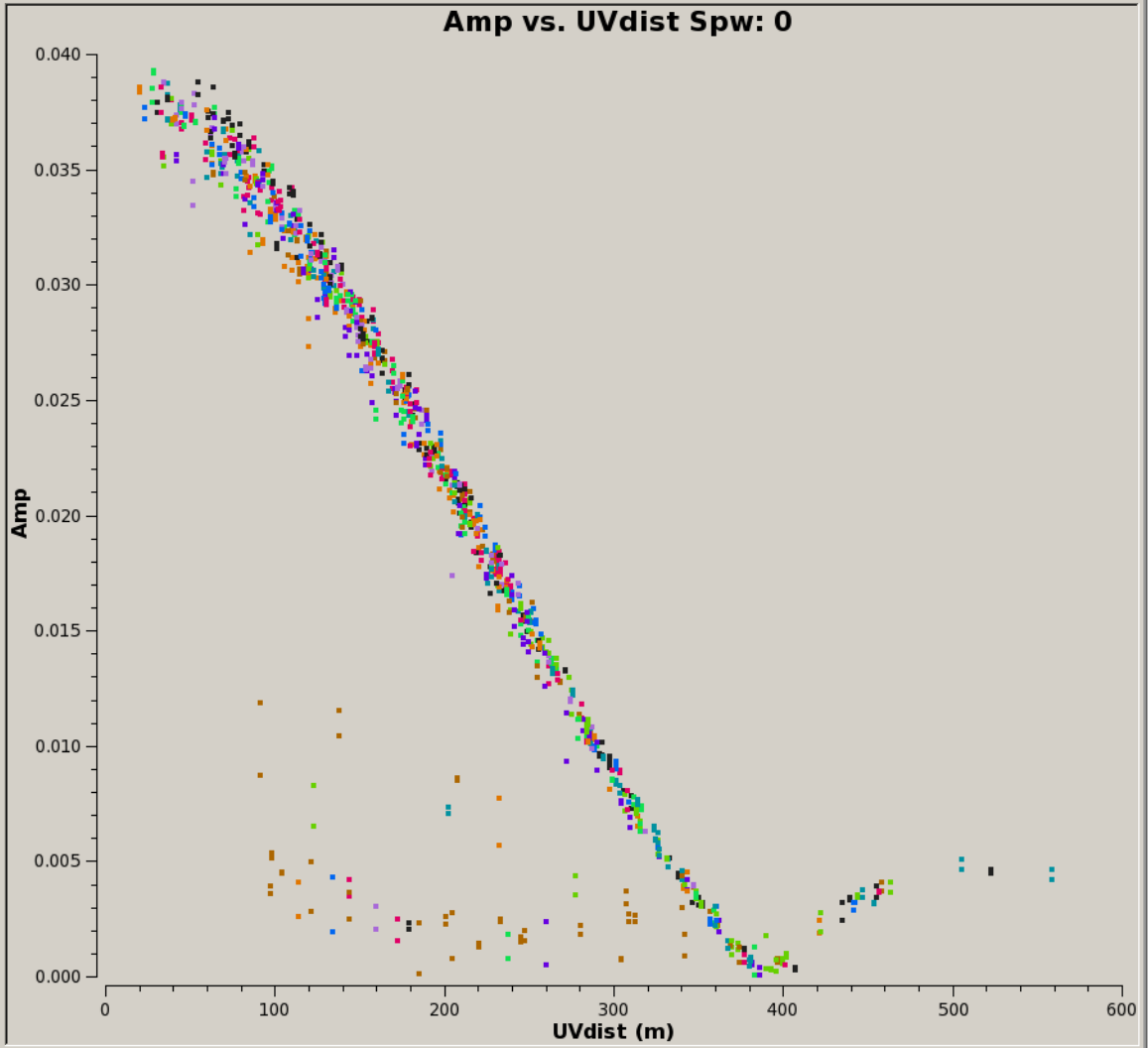
Flagged Points Symbol

None Default Custom

Style: 2 px, circle

Fill: ff0000 fill

Outline: None Default



In the amplitude versus uv distance plots, most of the data should fall along a straight line (for unresolved or marginally resolved sources) or should follow something similar to a sinc^2 function (for resolved objects like Solar System objects).

Data from bad antennas or baselines will appear as outliers from these trends.



Plot Flag Tools Annotate Options

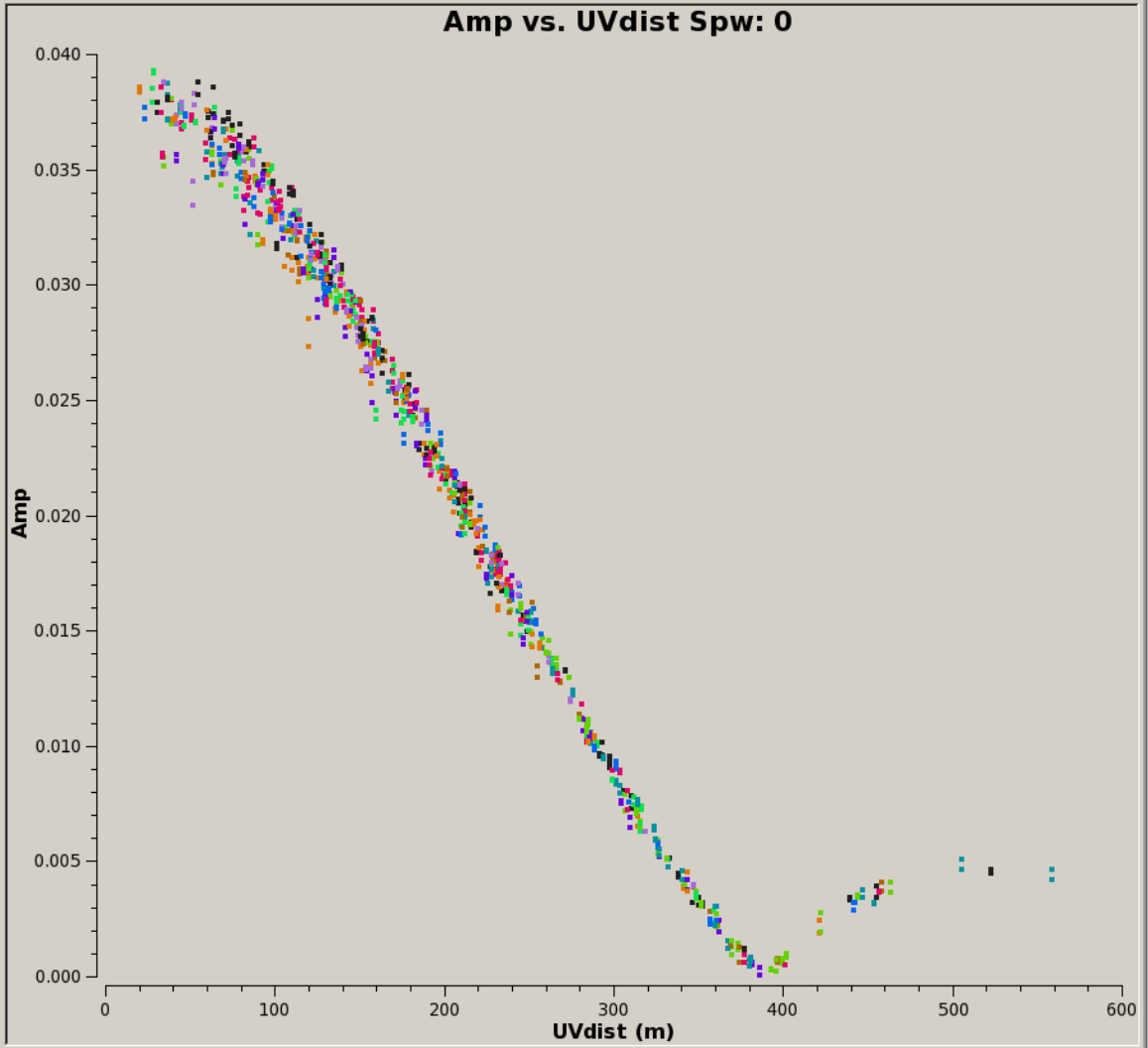
Data
File: 02_X7fb89e_X6e1.ms.split

Selection

field: 1
spw:
timerange:
uvrange:
antenna:
scan:
corr:
array:
observation:
intent:
feed:
msselect:

Averaging

Channel: 4100 channels
 Time: 1e+11 seconds
 Scan Field
 All Baselines Per Antenna
 All Spectral Windows
 Vector Scalar



Add Plot Reload Plot

To check *amplitude versus channel*, set the following:

- Under the Data tab:
 - Set the file to the ms.split file created in step 8
 - Set the field to the number of the bandpass calibrator
 - Set time averaging to 1e11
- Under the Axes tab:
 - Set the x-axis to Channel
 - Set the y-axis to Amp
- Under the Page tab:
 - Set axis to Spw
- Under the Display tab:
 - Set Colorize to Corr (which will produce different colours for the XX and YY data)



Plot | Flag | Tools | Annotate | Options

Data
File
02_X7fb89e_X6e1.ms.split

Selection

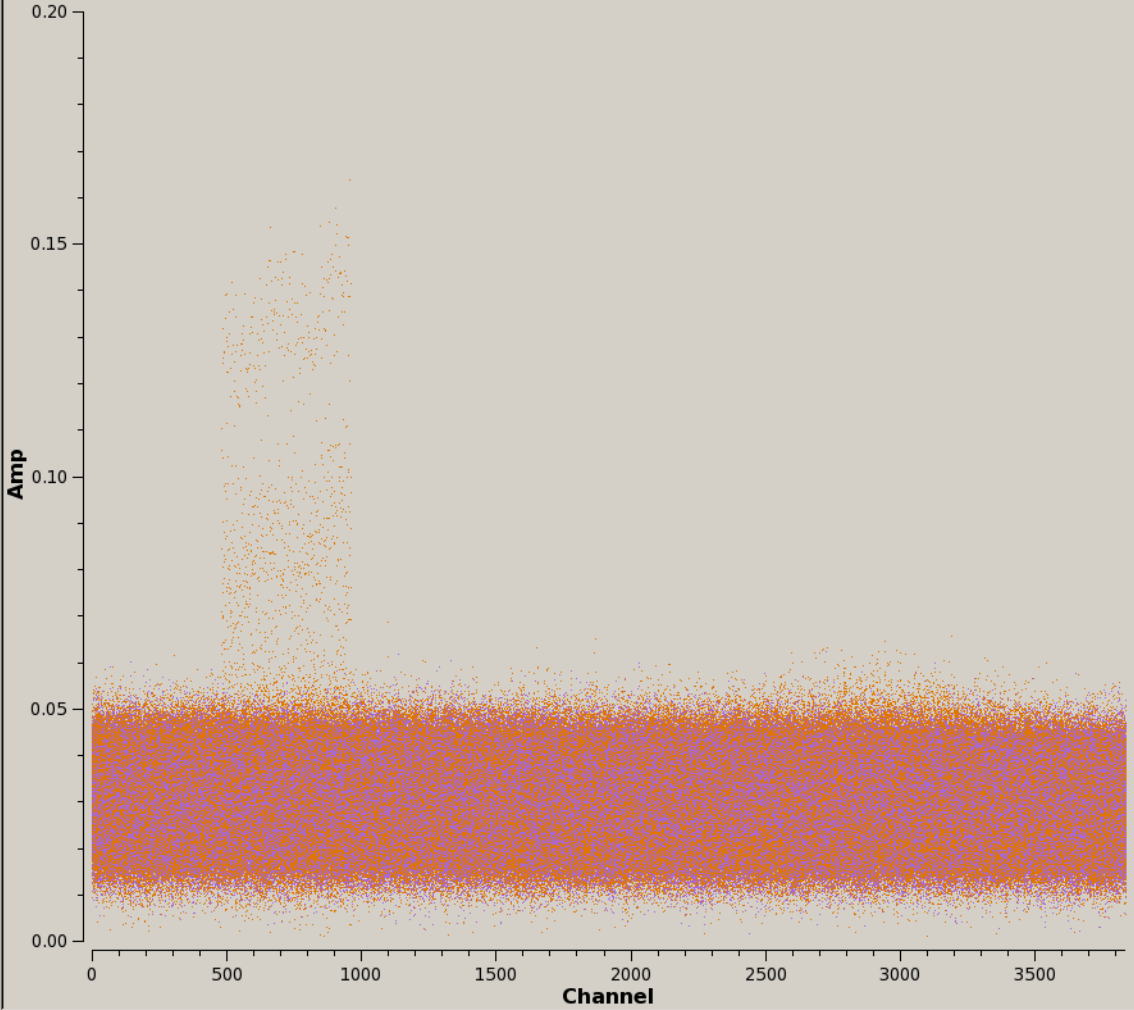
field 0
spw
timerange
uvrange
antenna
scan
corr
array
observation
intent
feed
msselect

Averaging

Channel 0 channels
 Time 1e+11 seconds
 Scan Field

All Baselines Per Antenna
 All Spectral Windows
 Vector Scalar

Amp vs. Channel Spw: 1



Reload

Data

Calibration
X Axis: Channel
Cached:

Attach: Bottom Top

Range:
 Automatic
0 to 0

Axes

Page

Transform

Display
Overlay: None Atm Tsky

Canvas

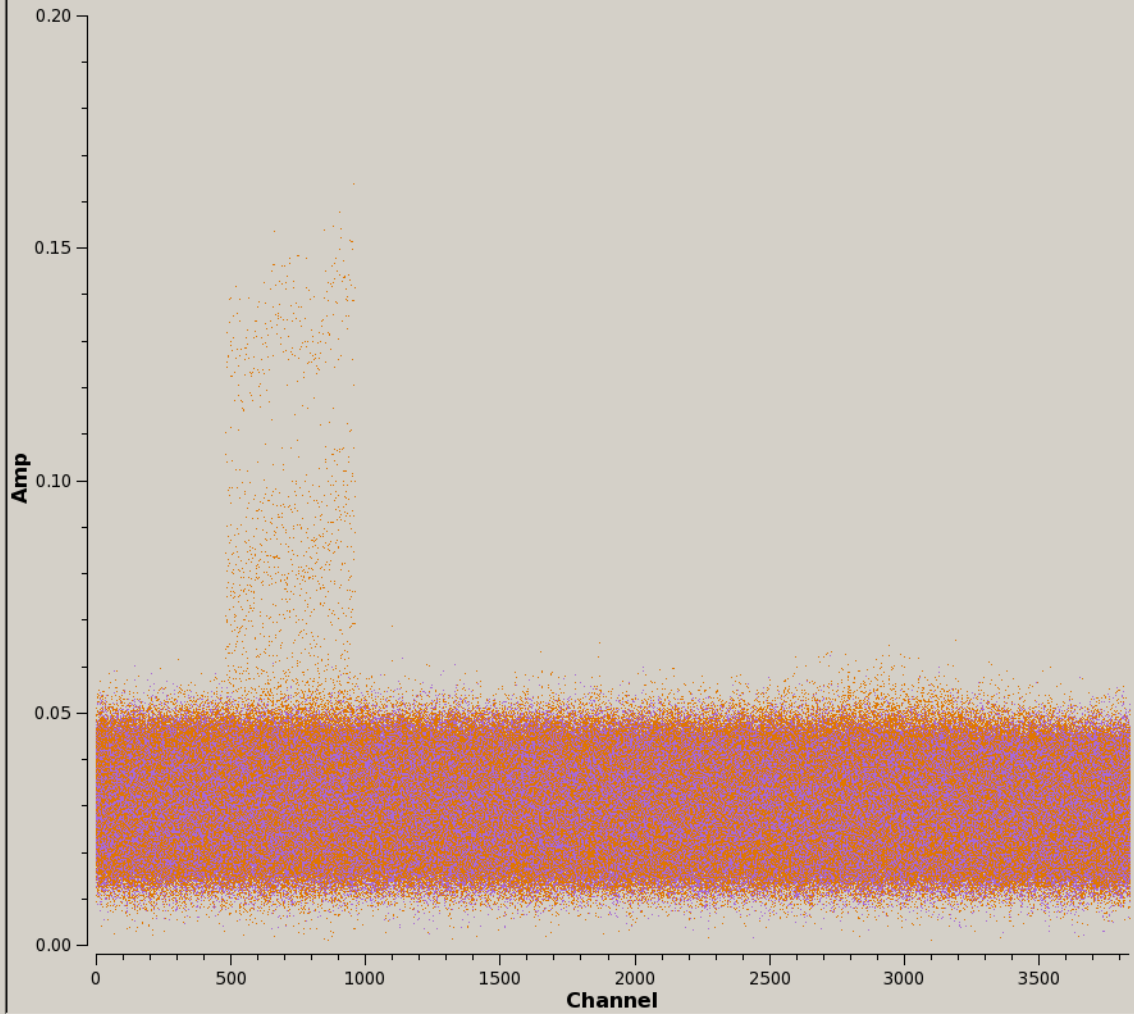
Data: Amp
Data Column: data
Cached:

Attach: Left Right

Range:
 Automatic
0 to 0

Add Y Axis Data

Amp vs. Channel Spw: 1



Iteration

Axis: Spw

Global Axis Scale: X Y

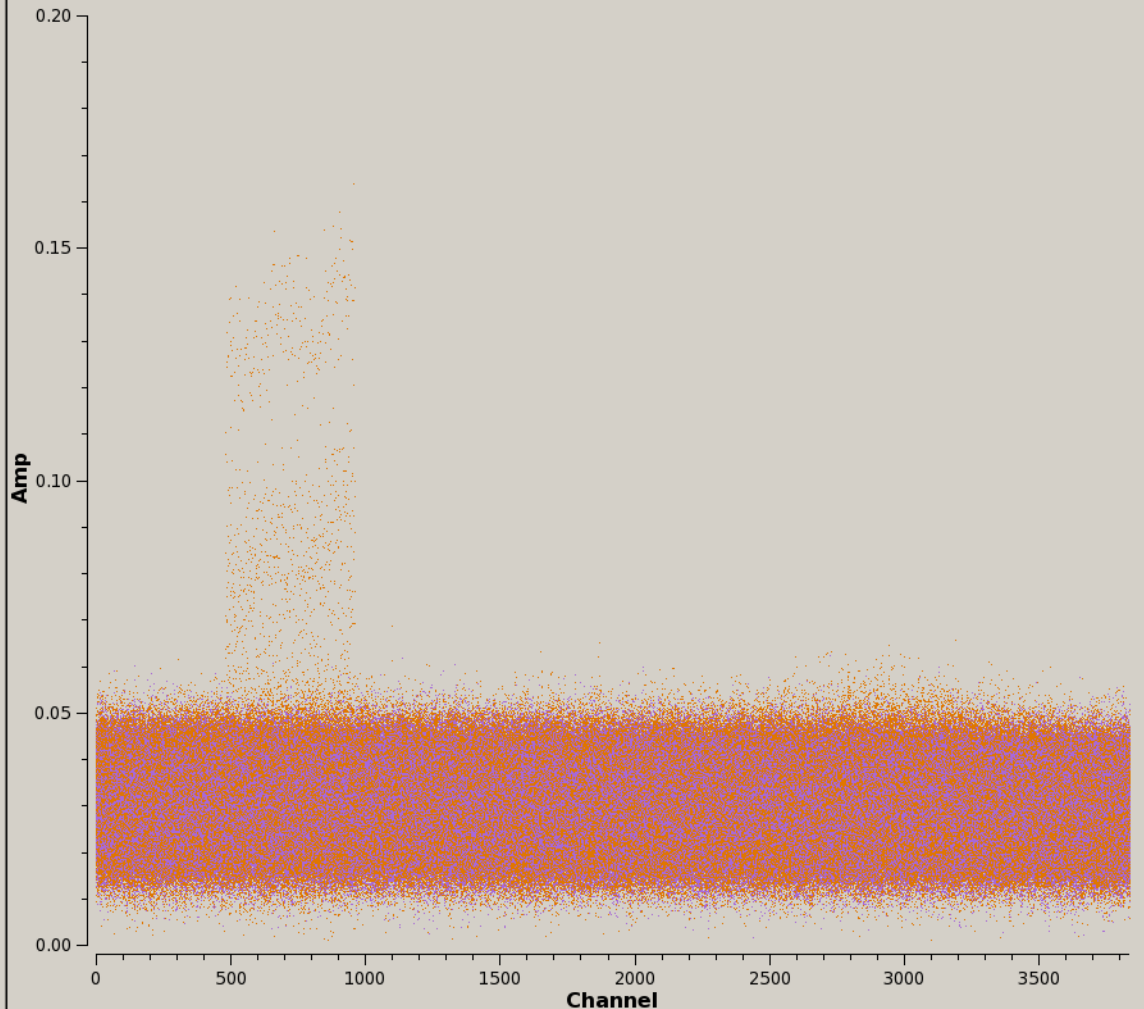
Shared Axis: X Y

Page Header

Contents

Filename
Y Column(s)
Observation Start Date
Observation Start Time
Observer
Project ID

Amp vs. Channel Spw: 1



Y Axis Data: Amp

Colorize: Corr

Unflagged Points Symbol

None Default Custom

Style: 2 px, autoscaling

Fill: 0000ff fill

Outline: None Default

Flagged Points Symbol

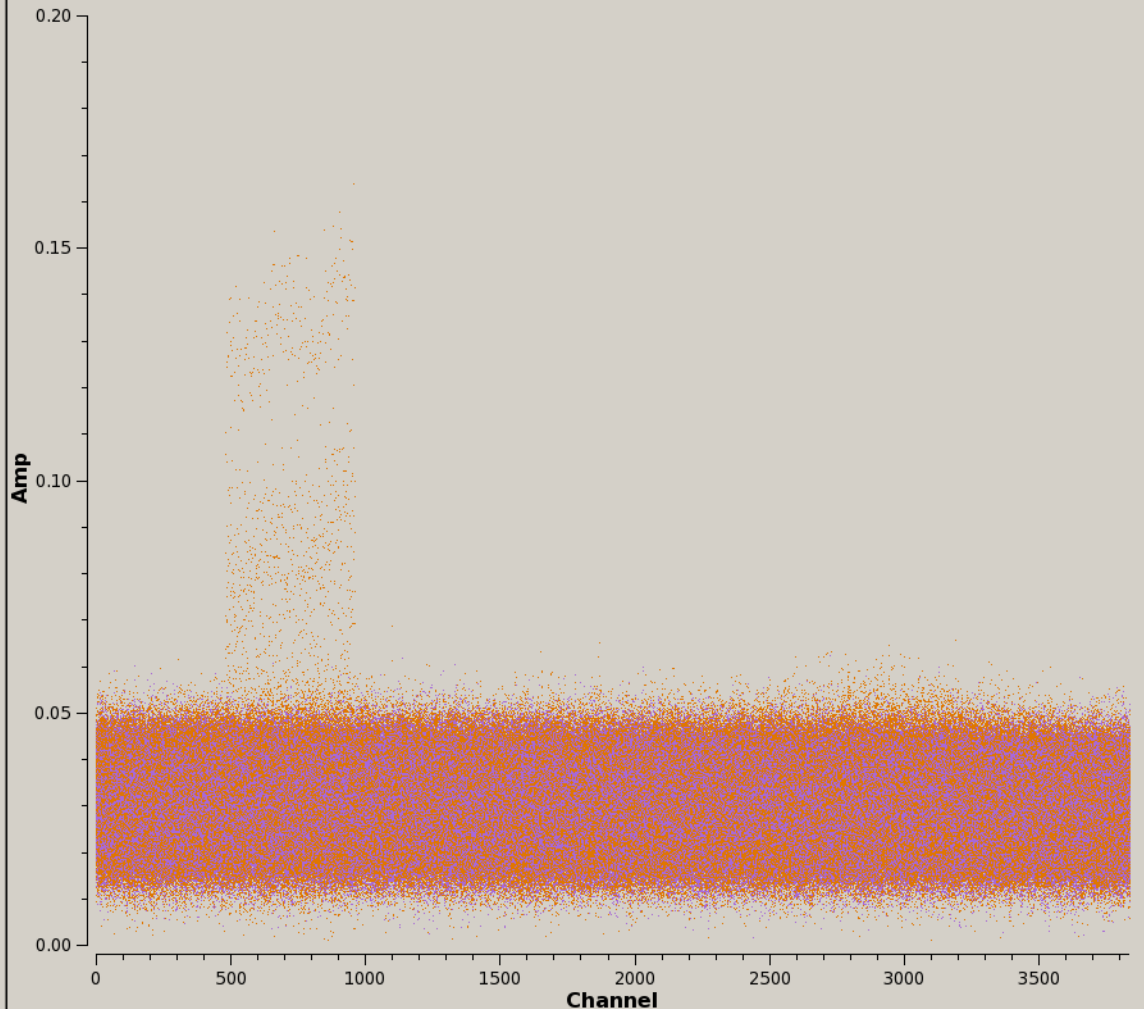
None Default Custom

Style: 2 px, circle

Fill: ff0000 fill

Outline: None Default

Amp vs. Channel Spw: 1



In the amplitude versus channel plots, most of the data should fall along a relatively straight line or should at least look smooth.

Data from the end channels will often appear either abnormally high or low. So will data from bad channels.

Additionally, atmospheric absorption features can be identified using these plots.



Plot Flag Tools Annotate Options

Data
File
02_X7fb89e_X6e1.ms.split

Selection

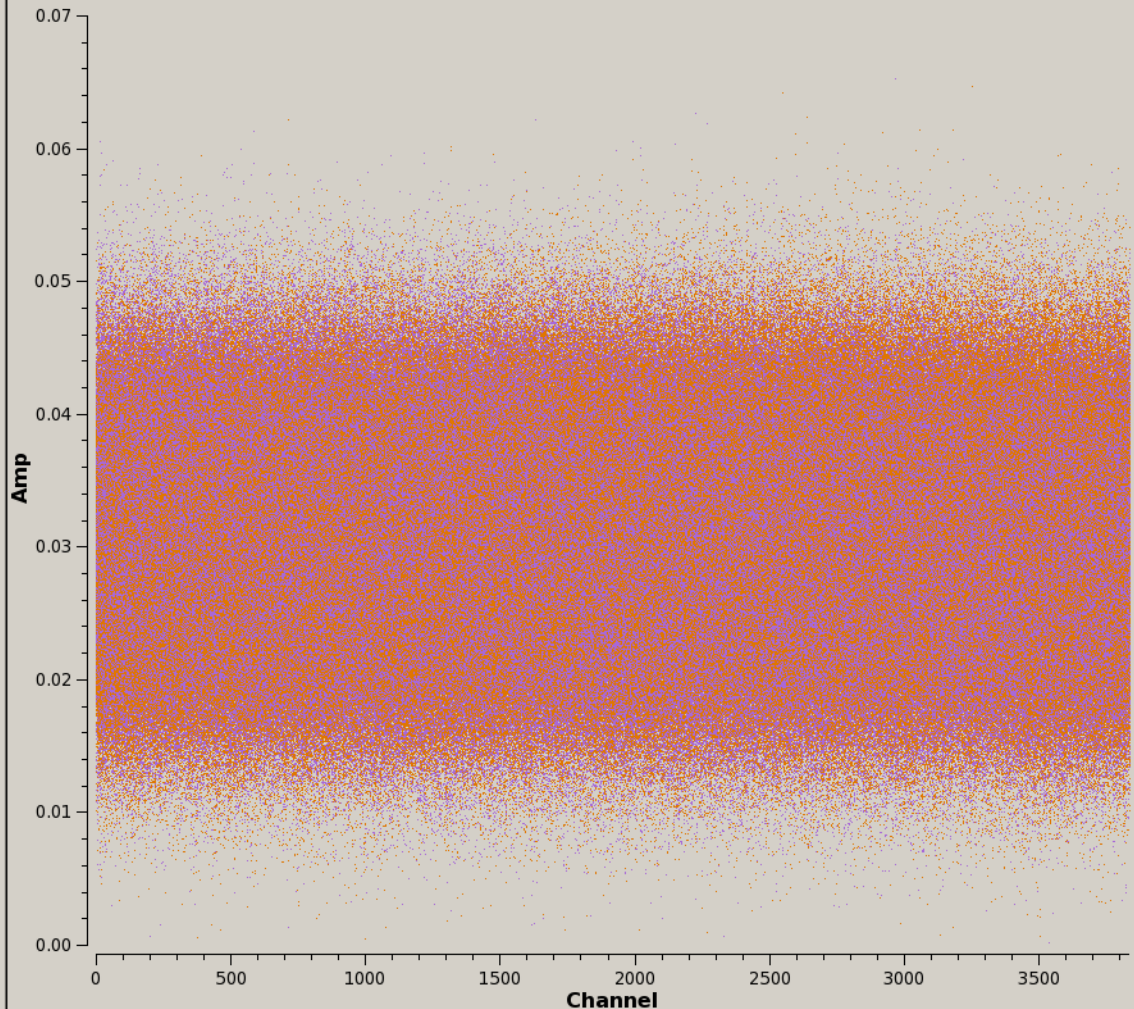
field 0
spw
timerange
uvrange
antenna
scan
corr
array
observation
intent
feed
msselect

Averaging

Channel 0 channels
 Time 1e+11 seconds
 Scan Field

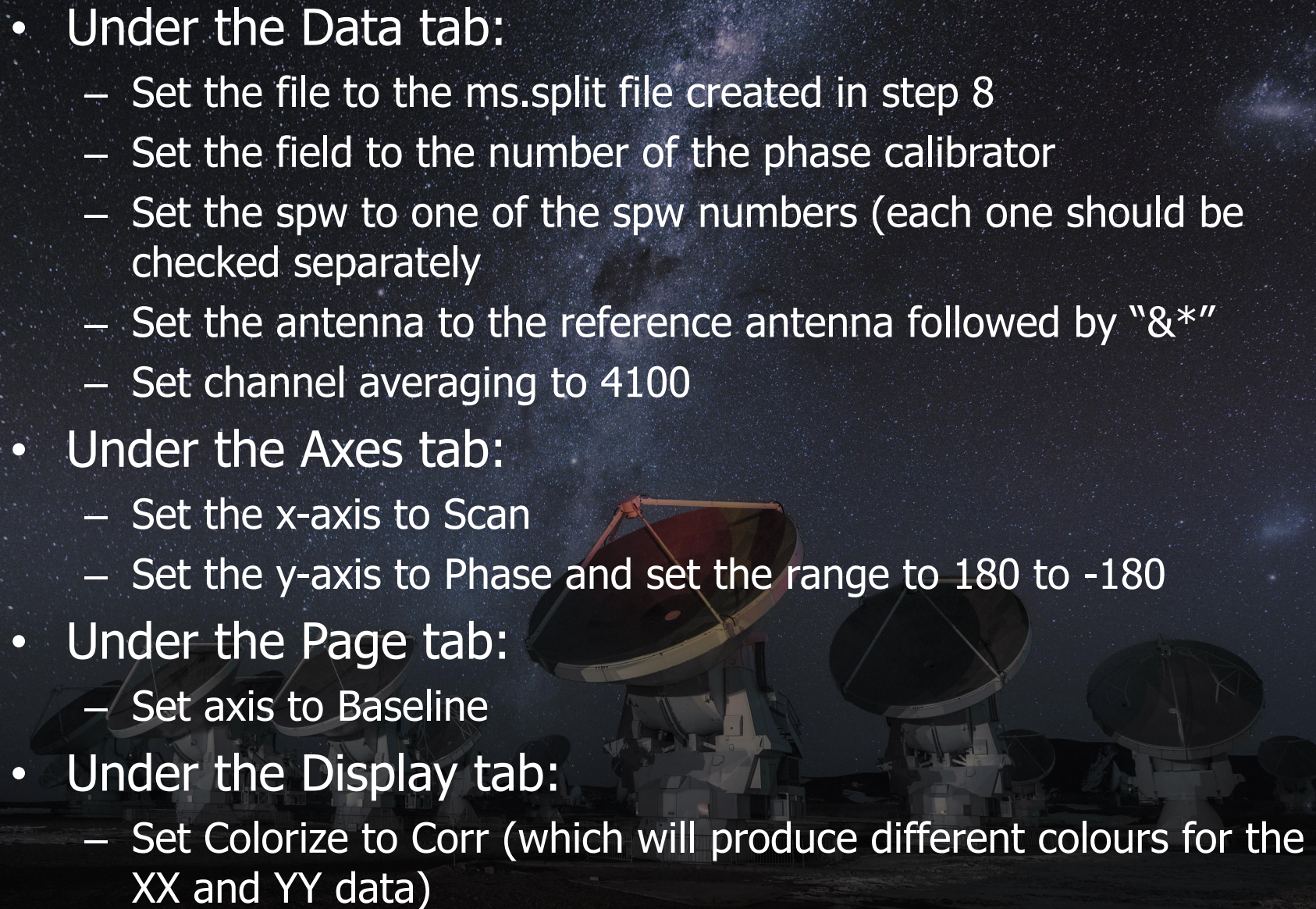
All Baselines Per Antenna
 All Spectral Windows
 Vector Scalar

Amp vs. Channel Spw: 0



Add Plot Reload Plot

To check *phase versus scan*, set the following:

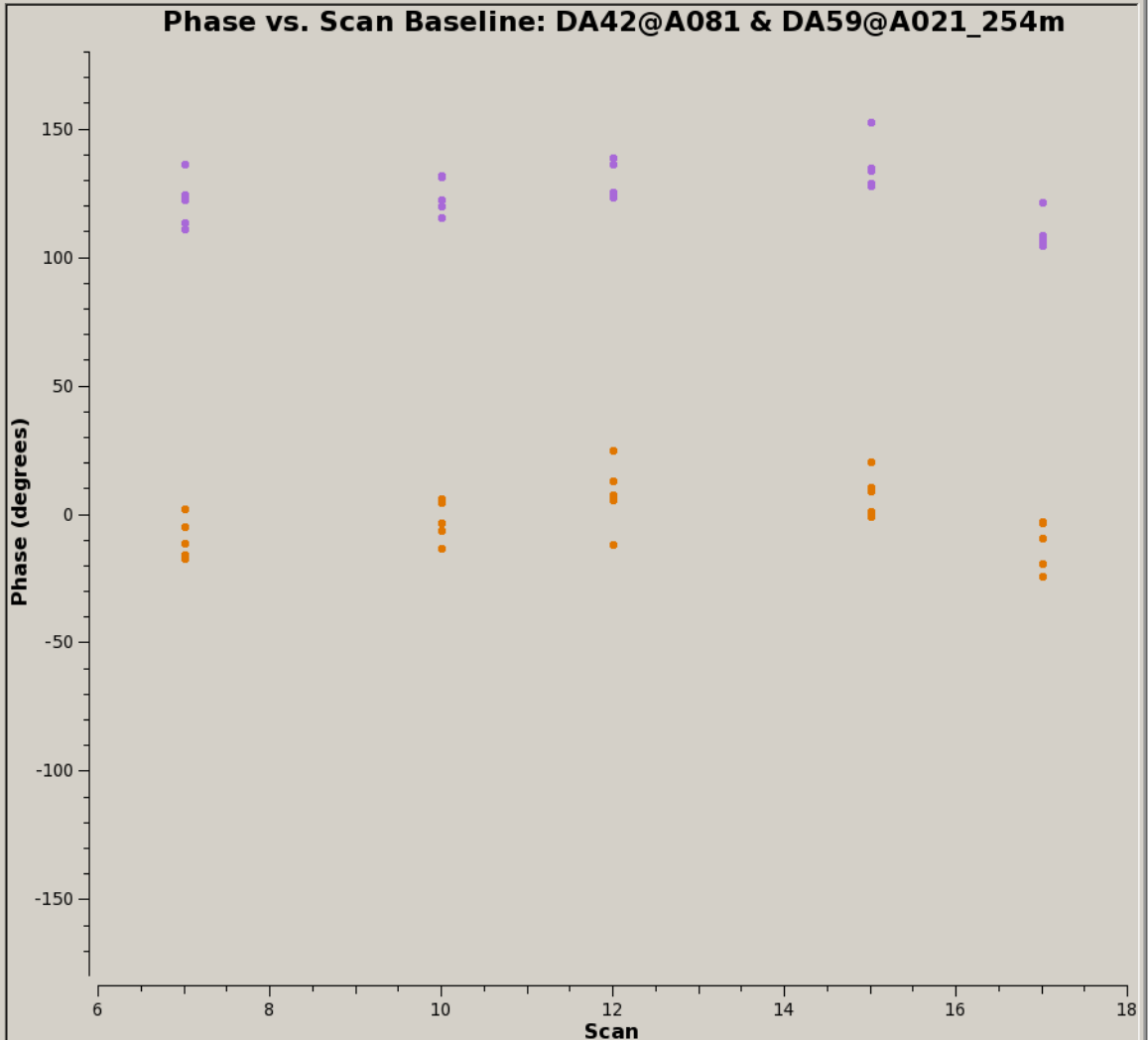
- Under the Data tab:
 - Set the file to the ms.split file created in step 8
 - Set the field to the number of the phase calibrator
 - Set the spw to one of the spw numbers (each one should be checked separately)
 - Set the antenna to the reference antenna followed by "&*"
 - Set channel averaging to 4100
 - Under the Axes tab:
 - Set the x-axis to Scan
 - Set the y-axis to Phase and set the range to 180 to -180
 - Under the Page tab:
 - Set axis to Baseline
 - Under the Display tab:
 - Set Colorize to Corr (which will produce different colours for the XX and YY data)
- 

Plot Flag Tools Annotate Options

Data
File: 02_X7fb89e_X6e1.ms.split

Selection
field: 2
spw: 0
timerange:
uvrange:
antenna: DA59&*
scan:
corr:
array:
observation:
intent:
feed:
msselect:

Averaging
 Channel: 1e+11 channels
 Time: 0 seconds
 Scan Field
 All Baselines Per Antenna
 All Spectral Windows
 Vector Scalar



Add Plot Reload Plot

Iteration

Axis: Baseline

Global Axis Scale: X Y

Shared Axis: X Y

Page Header

Contents

Filename

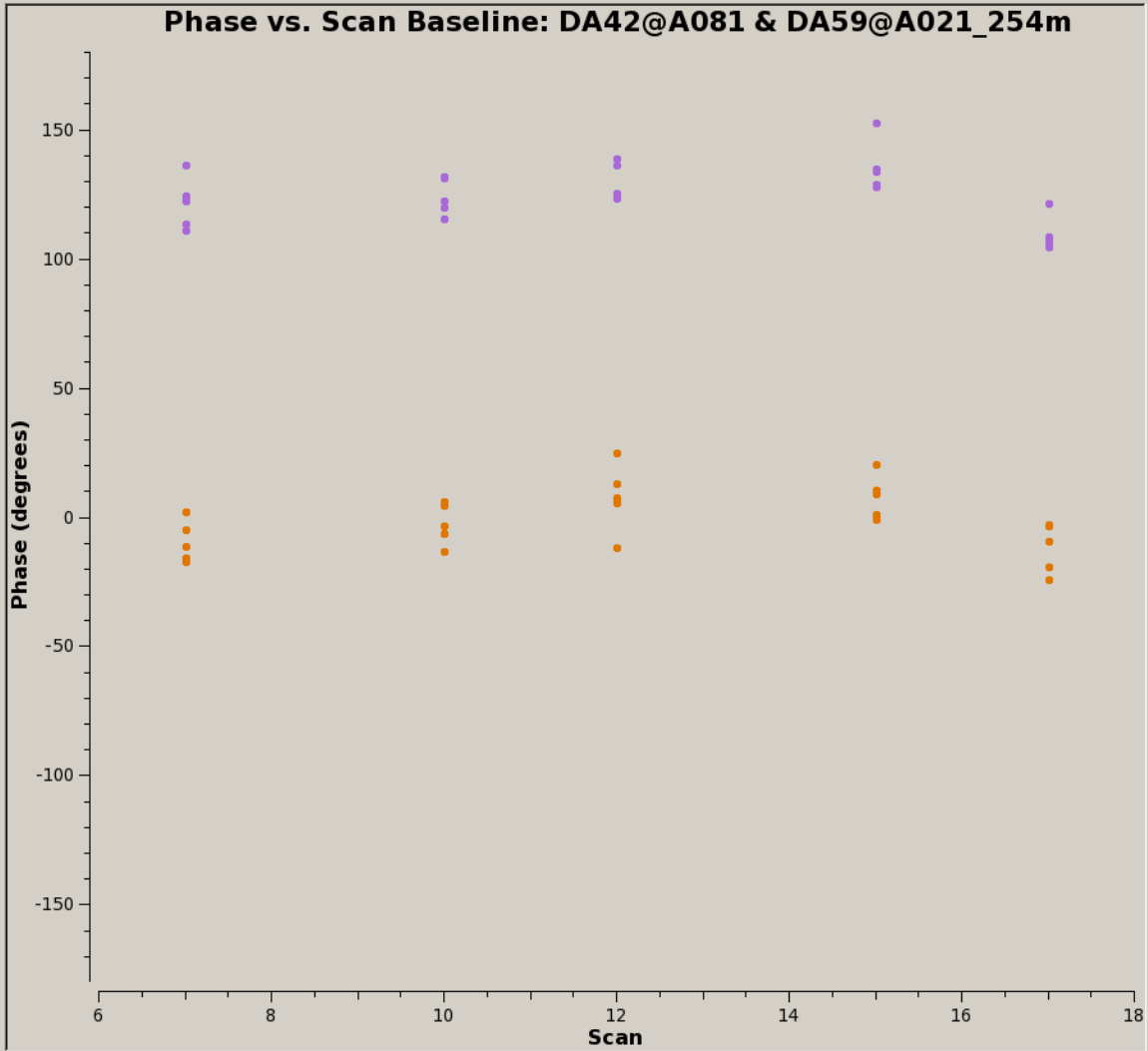
Y Column(s)

Observation Start Date

Observation Start Time

Observer

Project ID



Y Axis Data: Phase

Colorize: Corr

Unflagged Points Symbol

None Default Custom

Style: 2 px, autoscaling

Fill: 0000ff fill

Outline: None Default

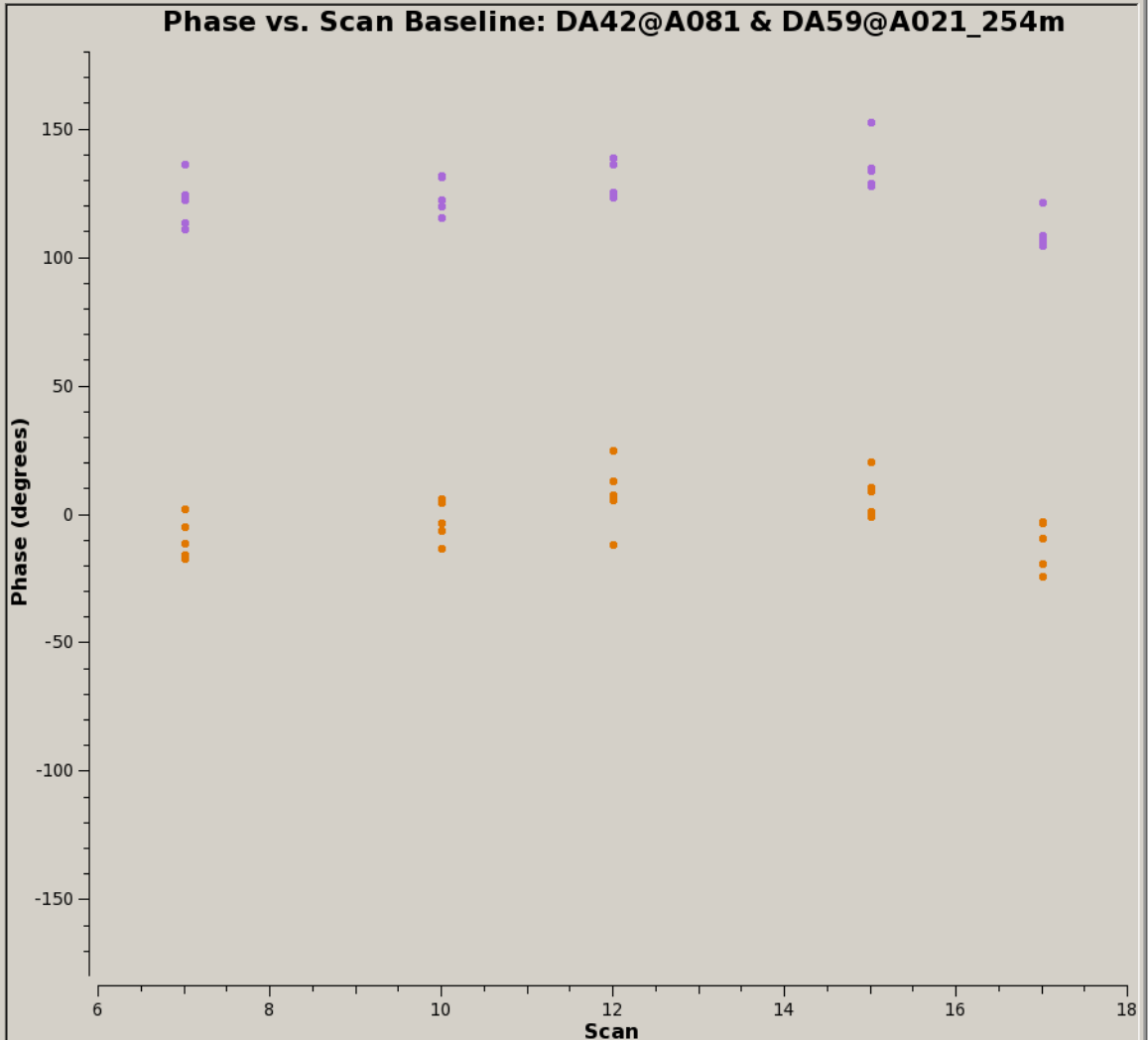
Flagged Points Symbol

None Default Custom

Style: 2 px, circle

Fill: ff0000 fill

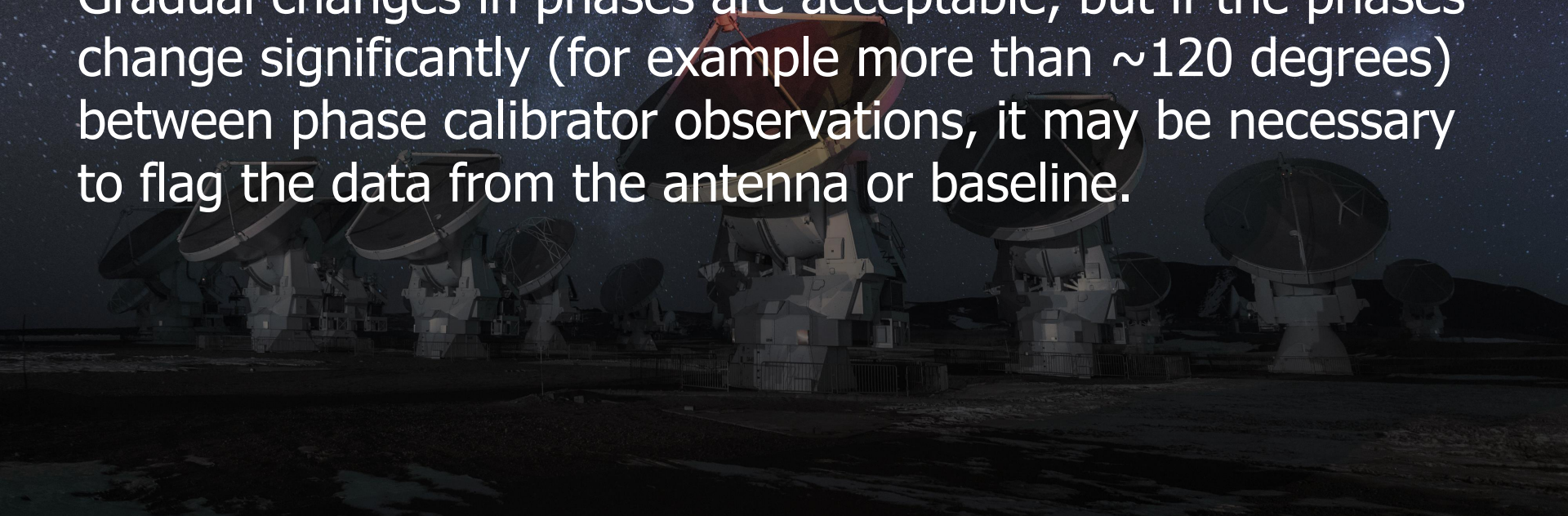
Outline: None Default



In the phase versus scan plots, the phase data should look smooth enough that it appears possible to interpolate between the phase calibration observations.

Data from bad scans will show abnormal scatter. (The data will also appear to have a high scatter if you forget to set the range for the y-axis).

Gradual changes in phases are acceptable, but if the phases change significantly (for example more than ~ 120 degrees) between phase calibrator observations, it may be necessary to flag the data from the antenna or baseline.



Step 11: Put a model for the flux calibrator into the measurement set

This step adds information indicating the flux density of one of the sources in the data (typically the amplitude calibrator, although a different source can be used if necessary).

Either a Solar System object or a quasar is used in this step.

The flux densities for Solar System objects are based on well-calibrated models (although the Ceres and Pallas models are suspect).

The quasar flux densities are based on a catalog of periodic measurements calibrated against Solar System objects.

Step 12: Save flags

This is one of several steps where the flagging information is saved.

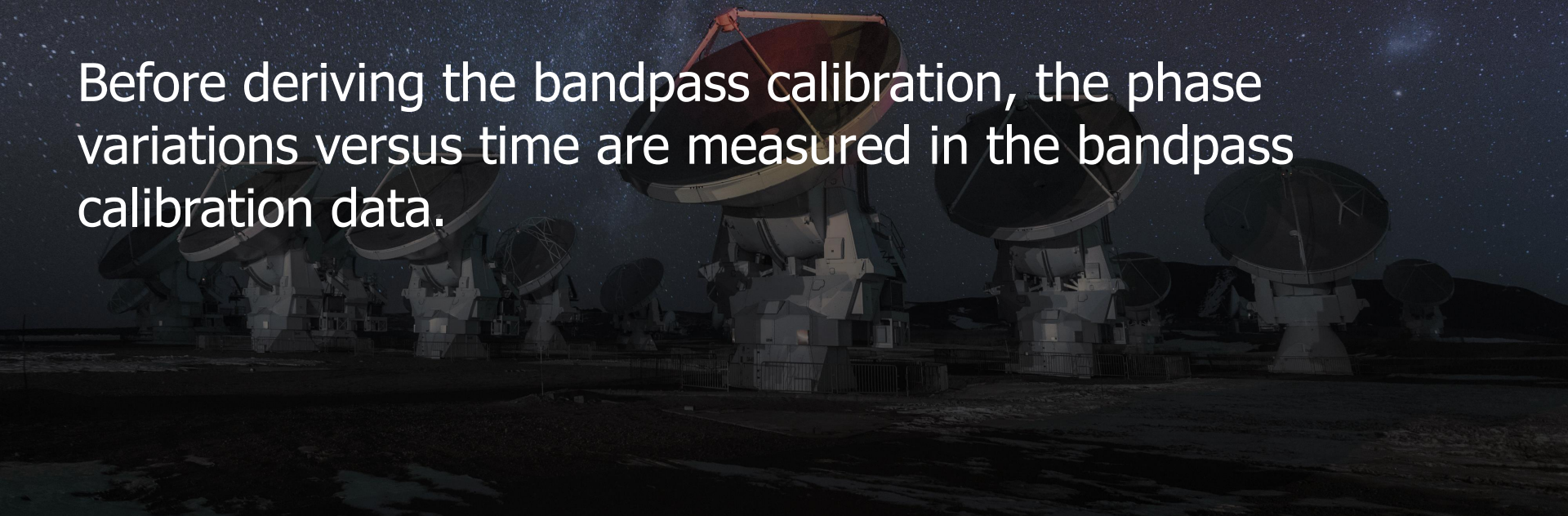


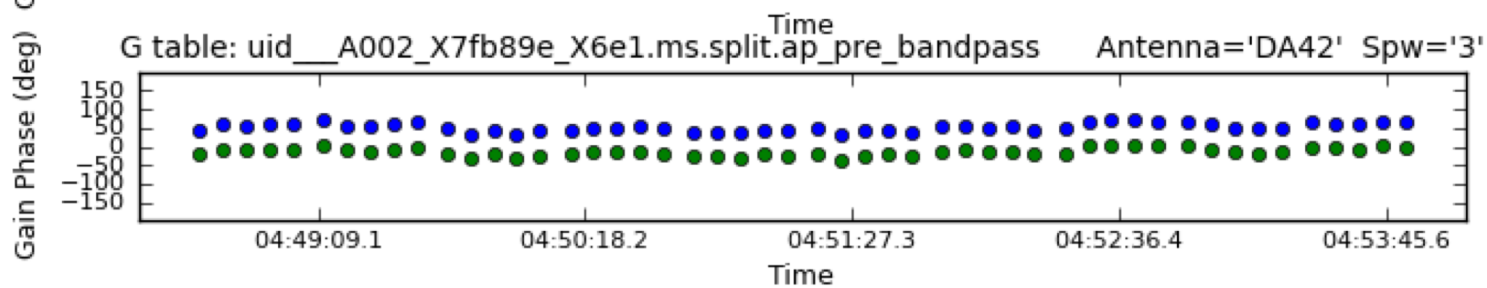
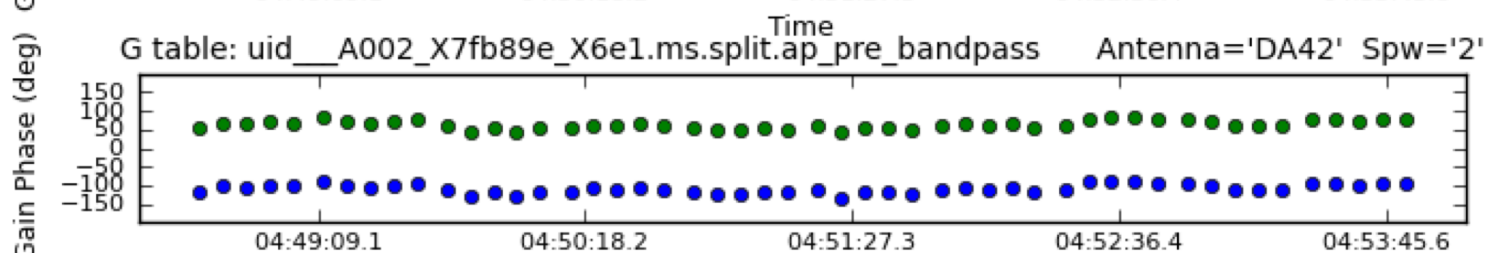
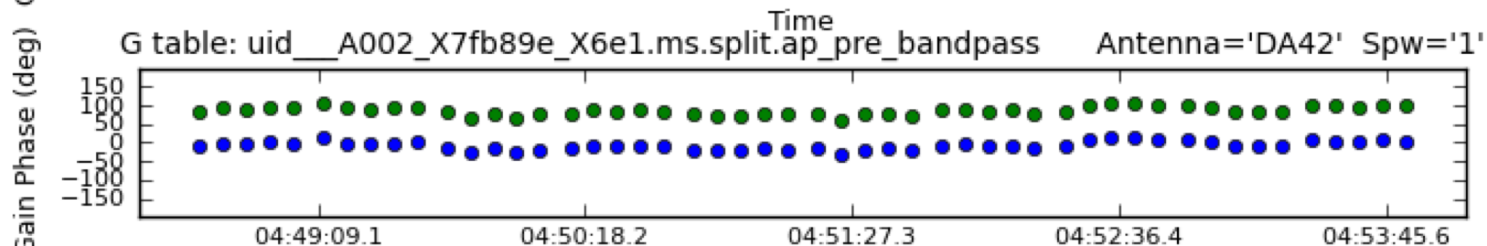
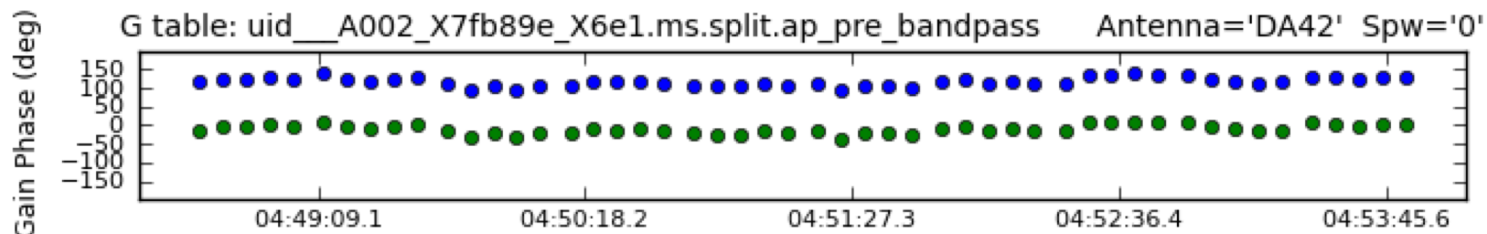
Step 13: Bandpass calibrations

In this step, variations in phase and amplitude versus channel are measured and stored in a bandpass calibration table.

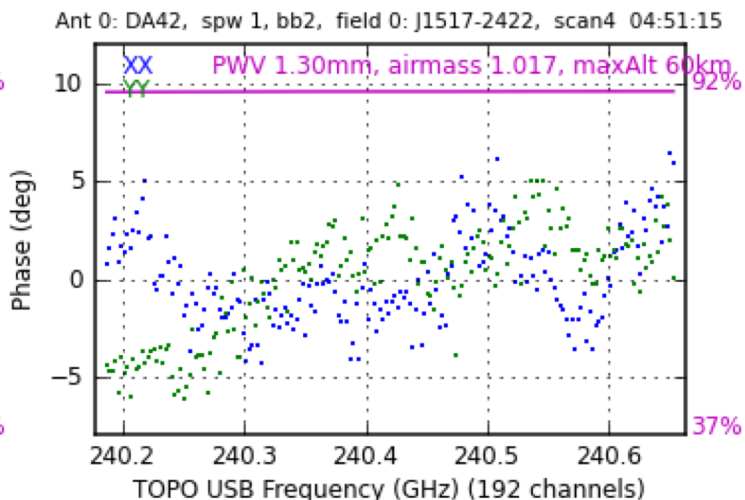
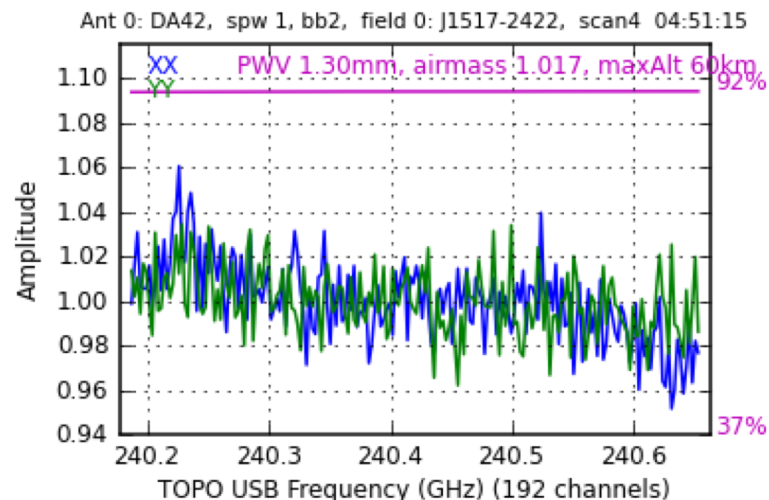
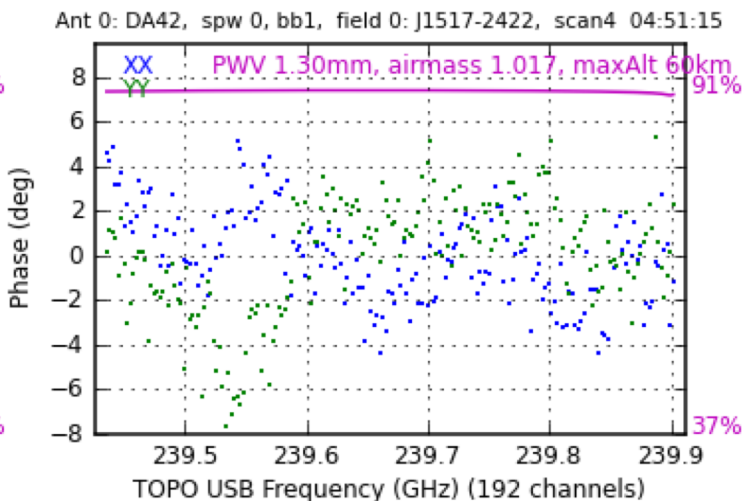
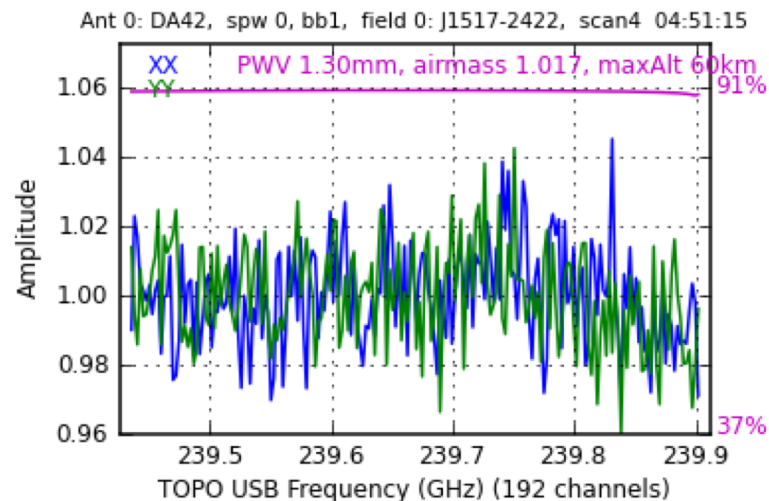
The calibration source used for this is typically a very bright quasar with a featureless spectrum.

Before deriving the bandpass calibration, the phase variations versus time are measured in the bandpass calibration data.





uid__A002_X7fb89e_X6e1.ms.split.bandpass_smooth20ch



Step 14: Save flags

This is one of several steps where the flagging information is saved.



Step 15: Gain calibrations

In this step, variations in phase and amplitude versus time are measured and stored in multiple calibration tables.

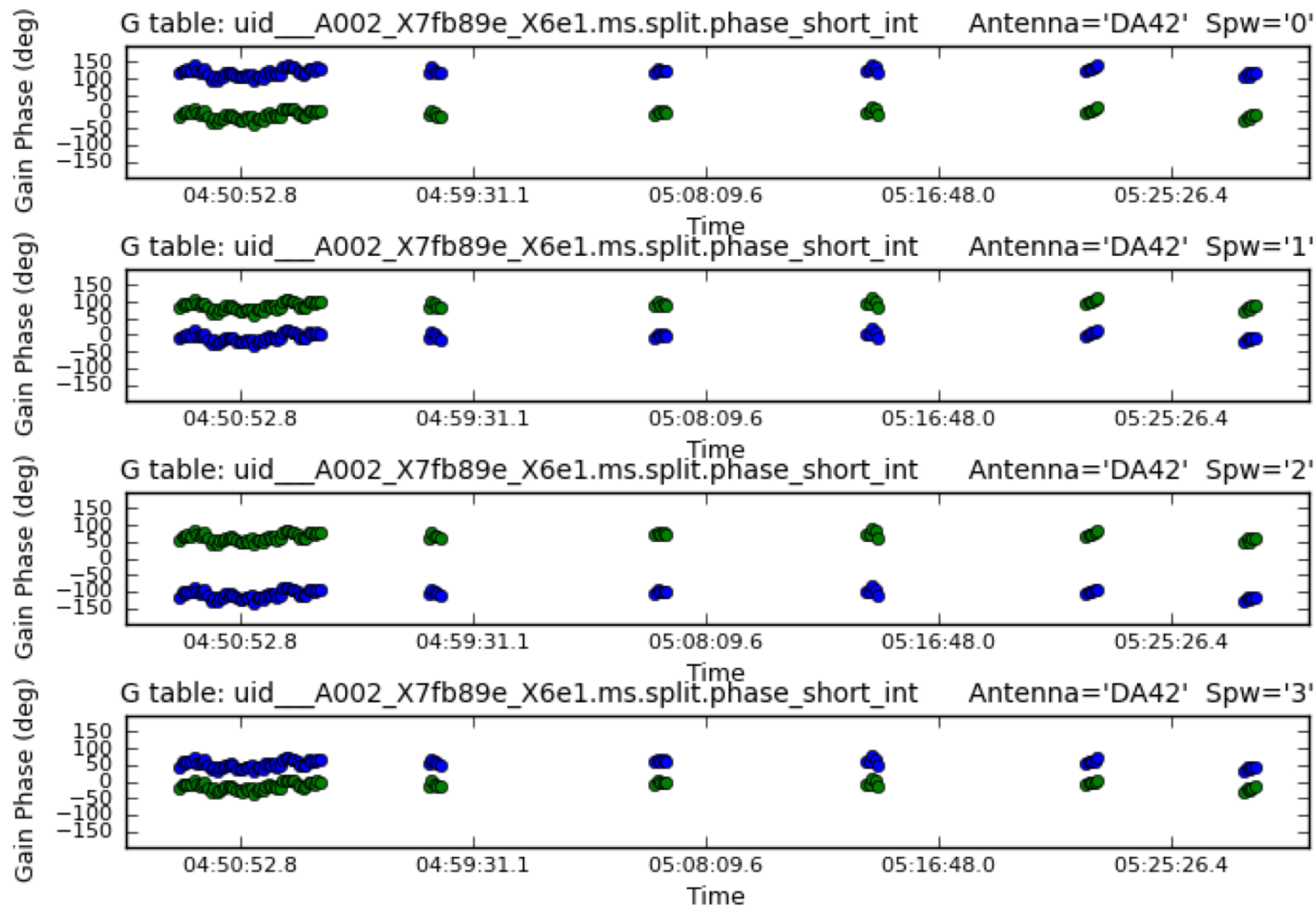
This step is complicated by the use of a resolved object as a flux calibrator. The Solar System object has more reliably-modelled fluxes, but the signal is not detected on some of the longer baselines.

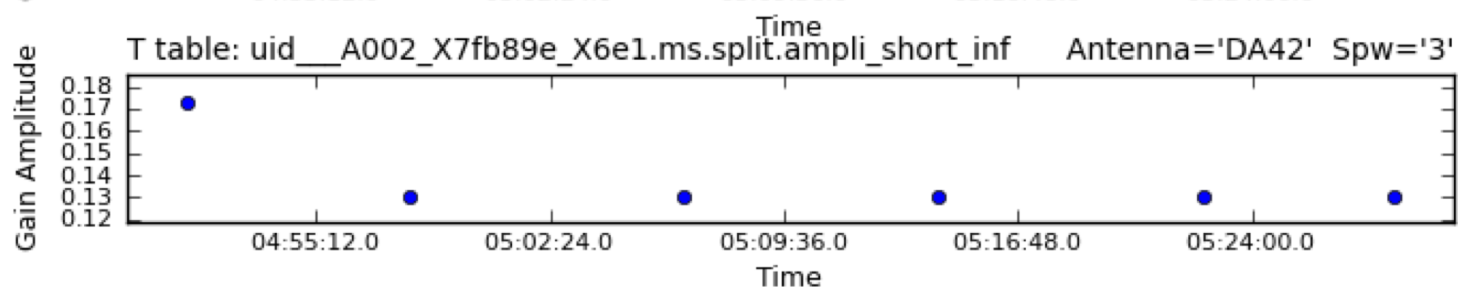
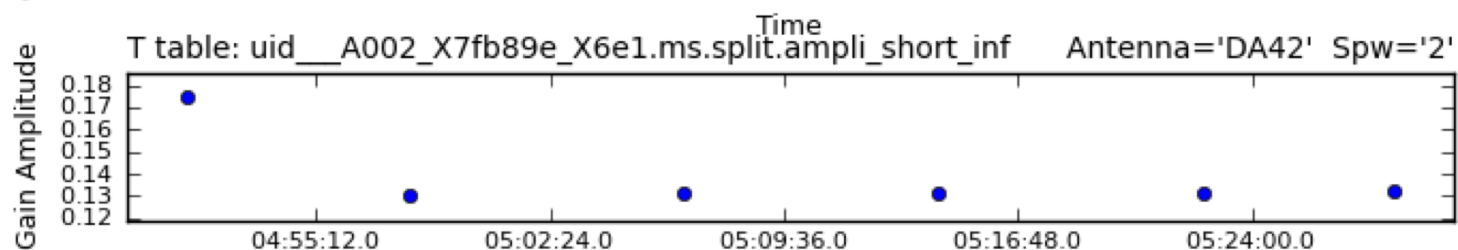
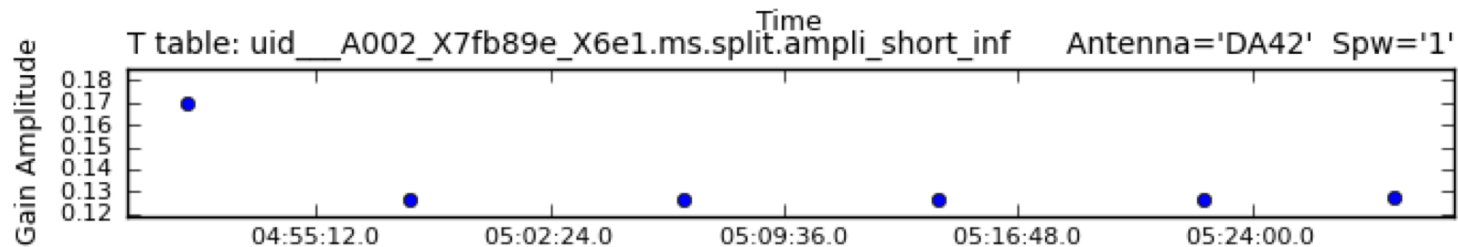
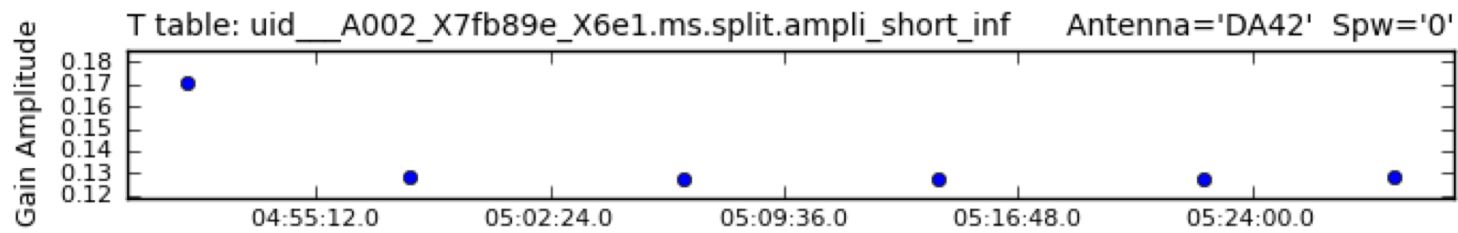
To properly calibrate the data, the flux calibration for the phase calibrator needs to be derived using the short baselines data for the flux calibrator. After that, the phase and amplitude calibration versus time can be derived for the science fields.

The first half of the steps used in this script are as follows:

- The phase variations versus time are measured for every integration on short baselines
- The amplitude variations versus time are measured on short baselines
- The fluxes for the phase calibrator are rescaled using the amplitudes for the flux calibrator



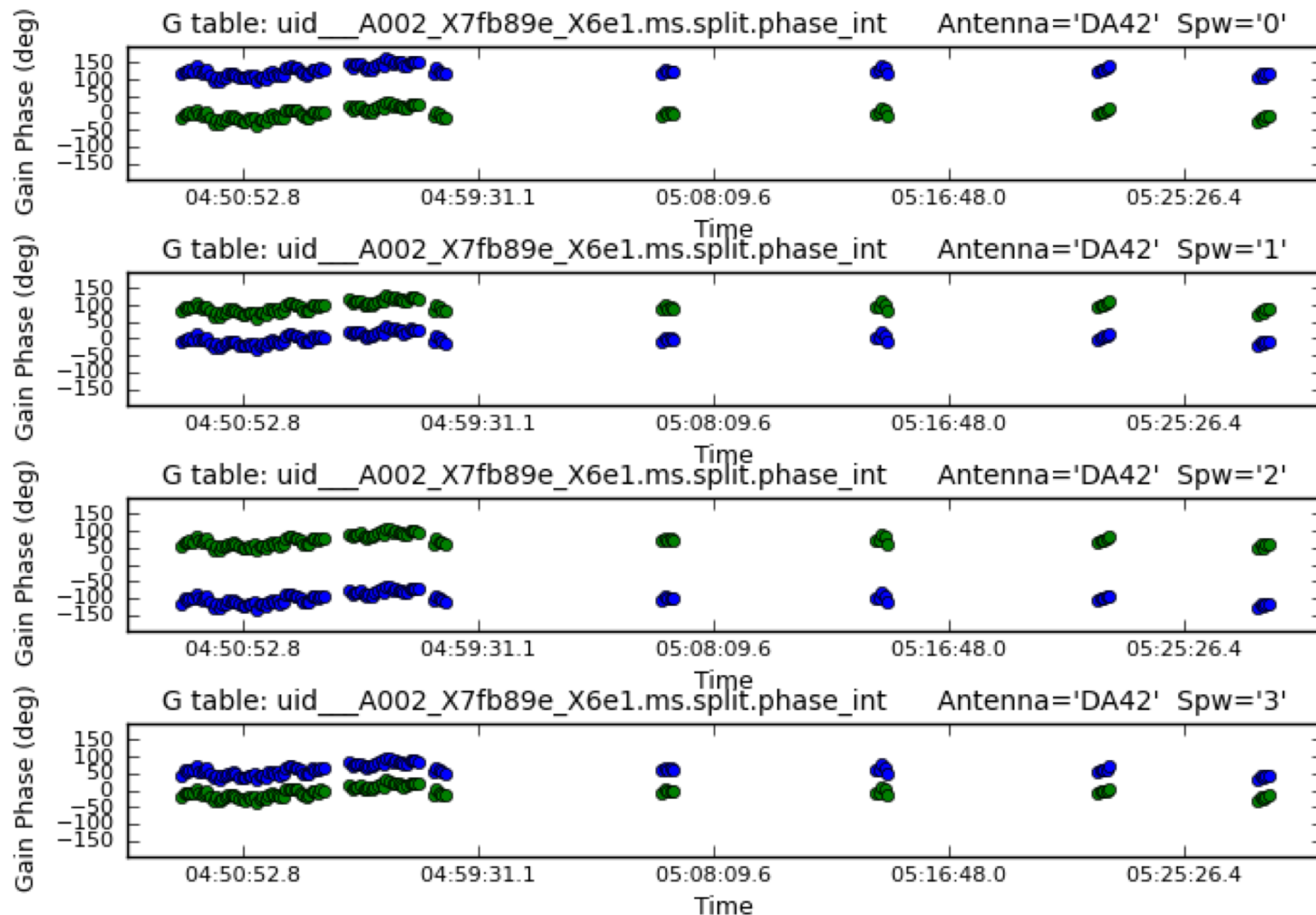


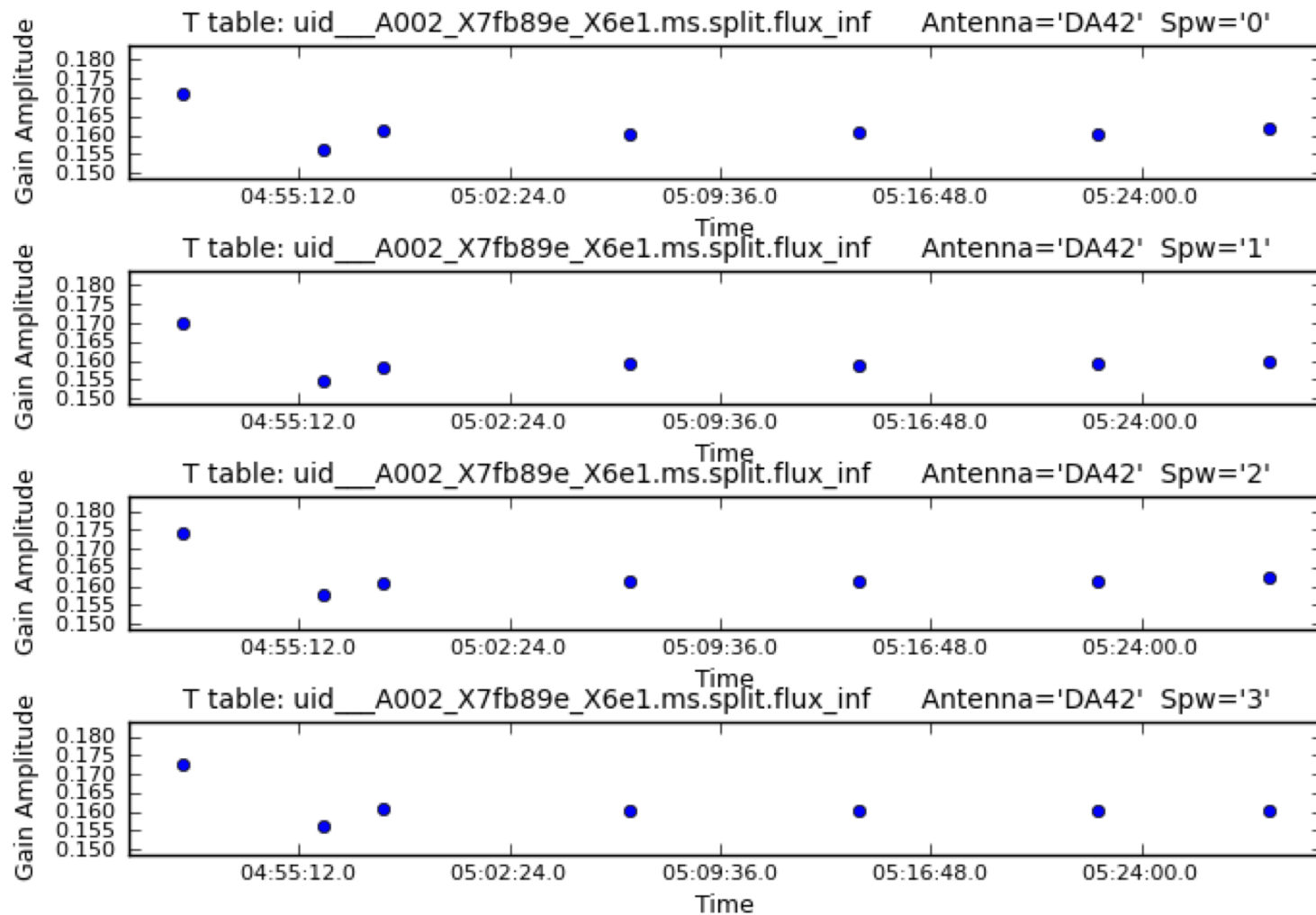


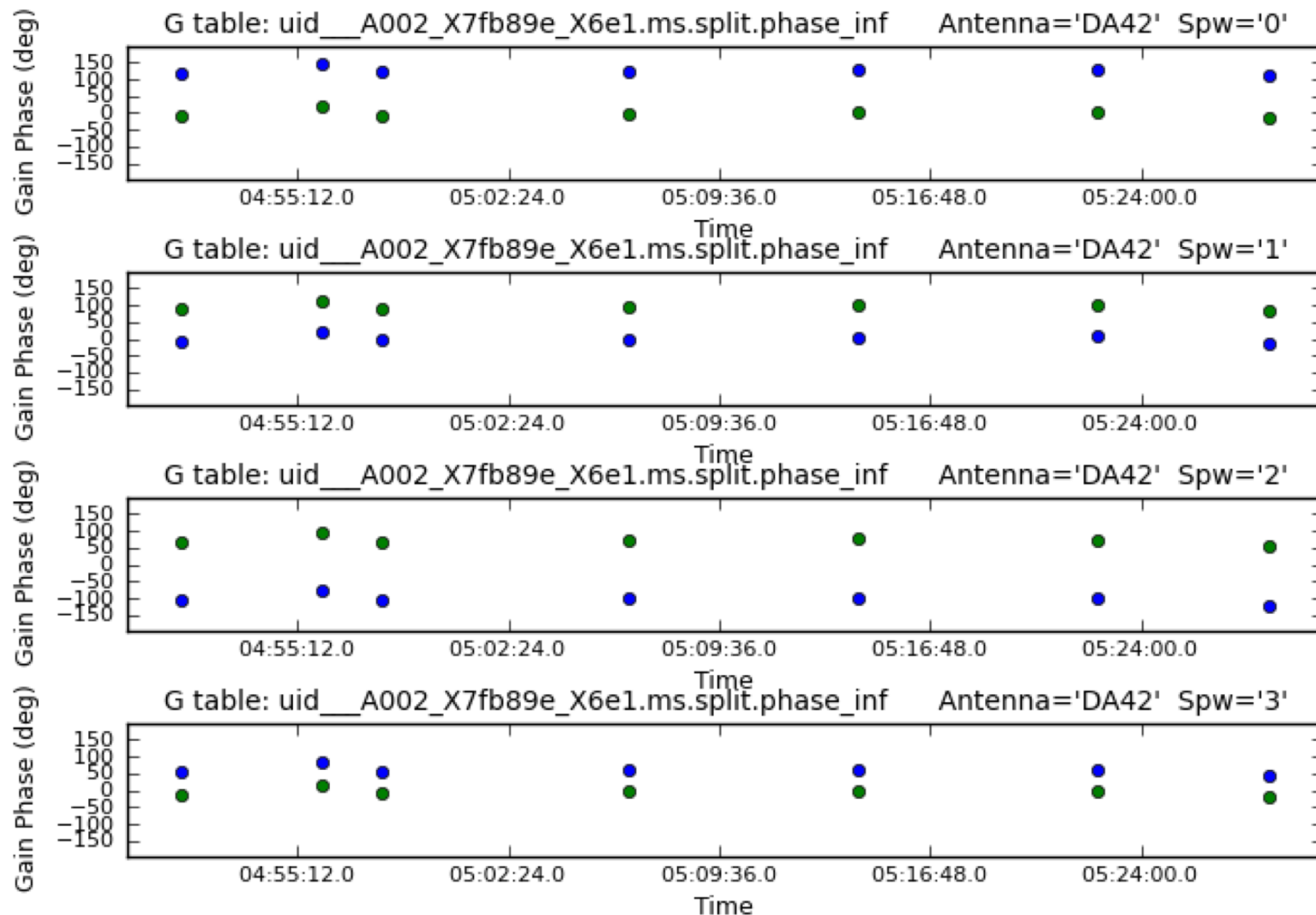
The second half of the steps used in this script are as follows:

- The phase variations versus time are measured for every integration
- The amplitude variations versus time are measured
- The phase variations versus time are measured by averaging over each scan









Step 16: Save flags

This is one of several steps where the flagging information is saved.



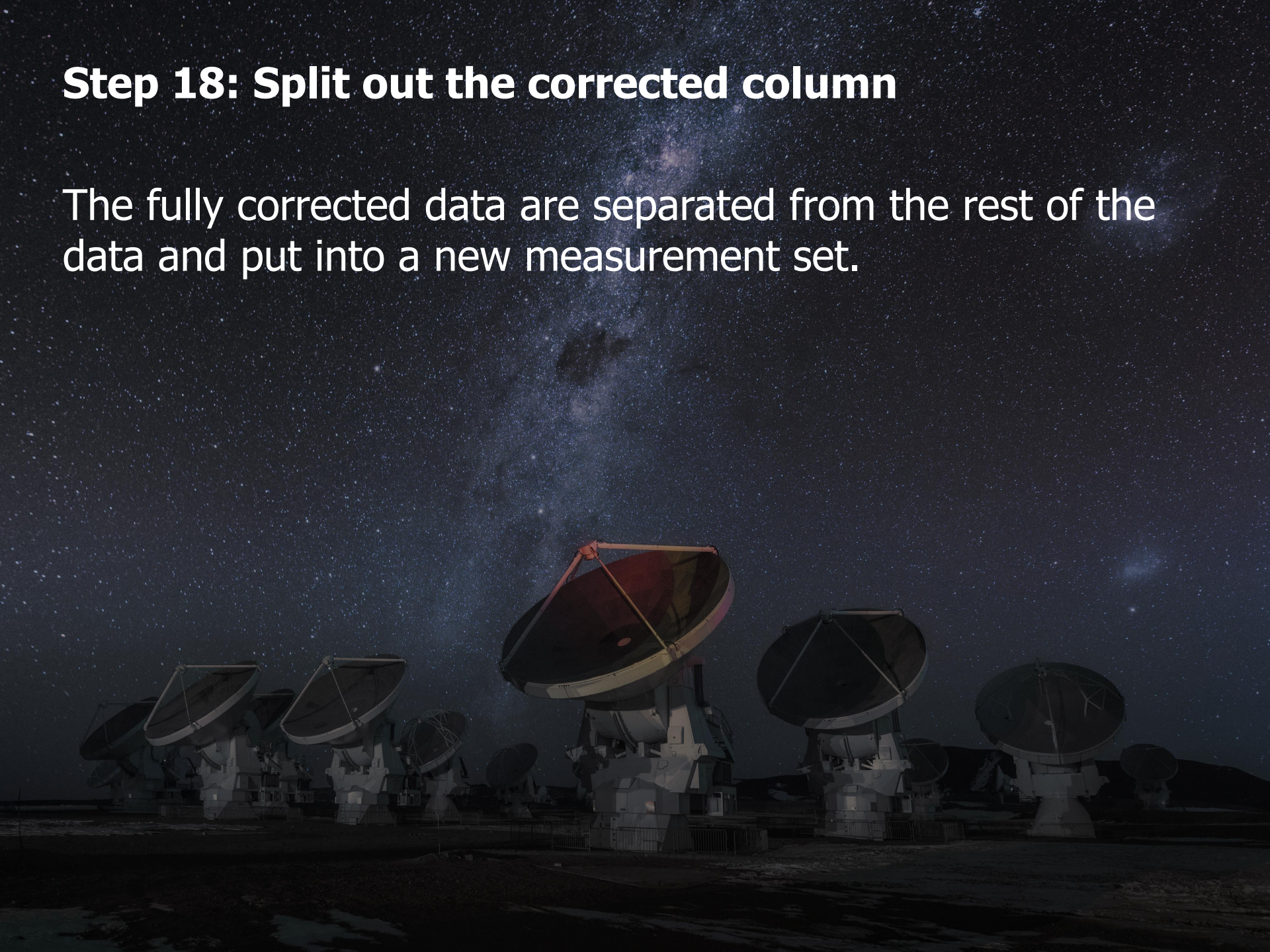
Step 17: Application of the bandpass and gain calibration tables

The tables generated in steps 13 and 15 are applied to the data.



Step 18: Split out the corrected column

The fully corrected data are separated from the rest of the data and put into a new measurement set.



Step 19: Save flags

This is one of several steps where the flagging information is saved.

