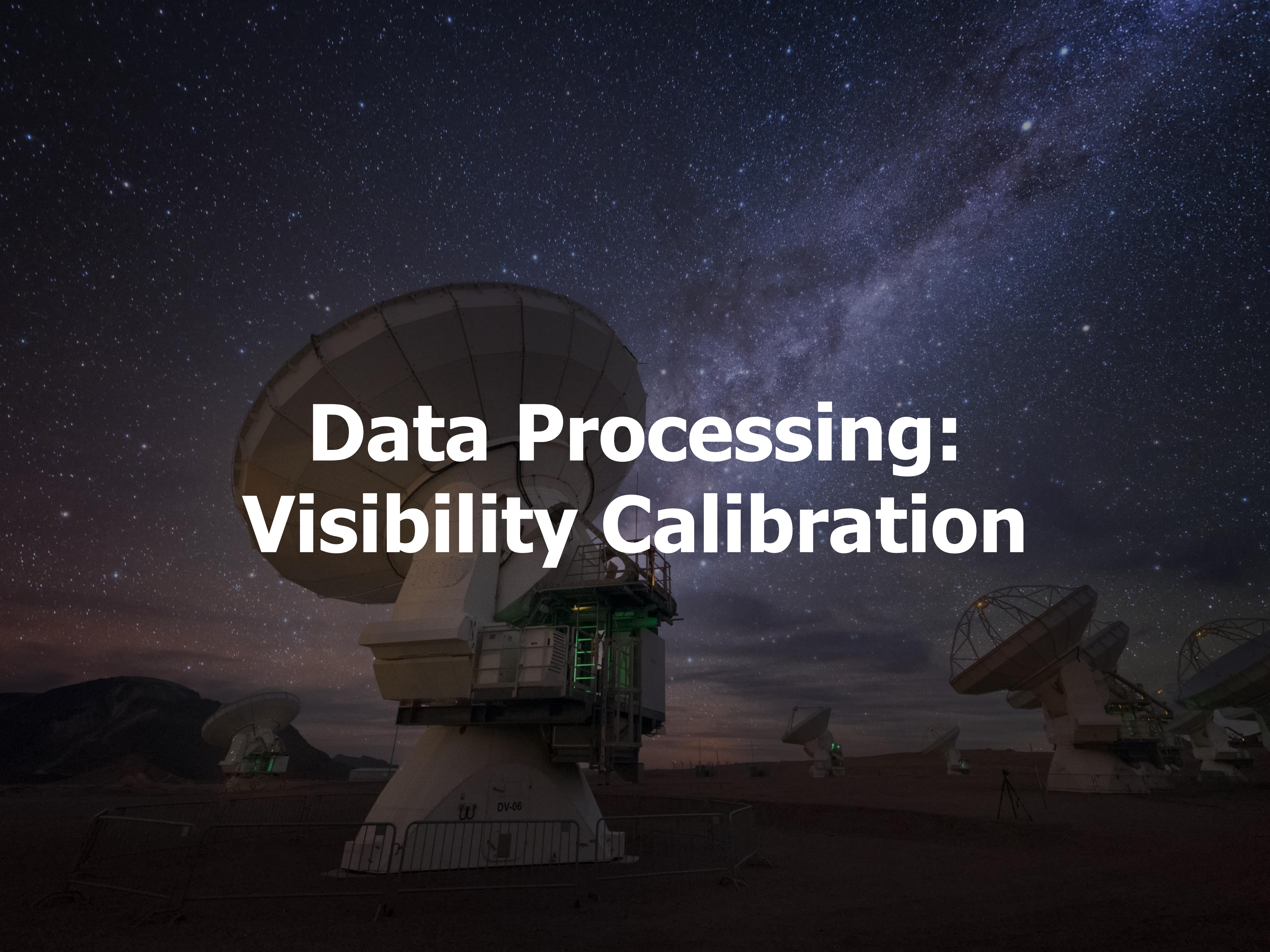
Data Processing: Visibility Calibration



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

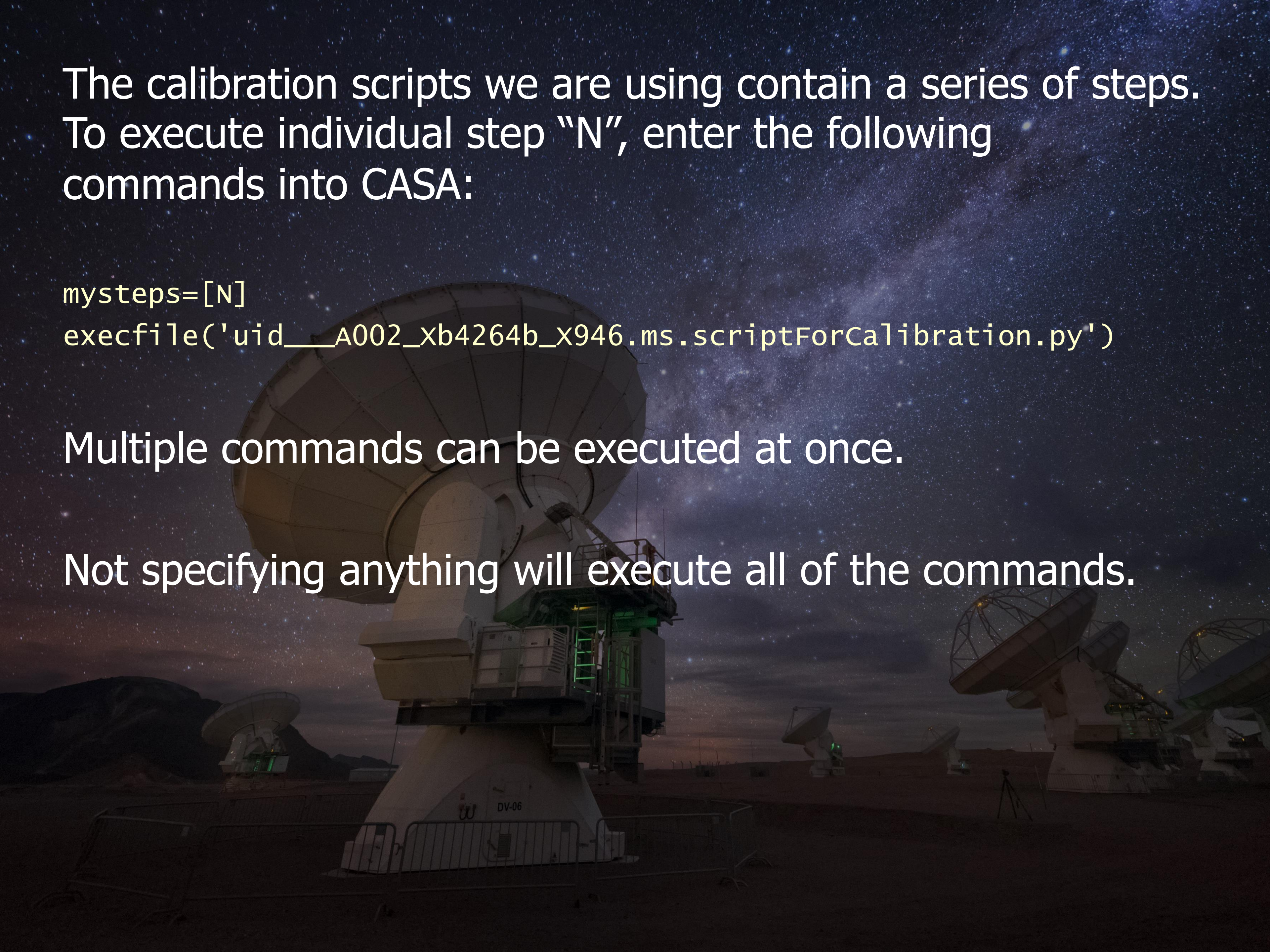
These corrections are derived from up to three different calibration sources.

The 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_Xb4264b_X946.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 standard CASA measurement set.

Both the ASDM format and the CASA data format use an object oriented file system. The input and output to ALMA commands are actually directories that contain multiple binary tables.

Contents of the example measurement set:

ANTENNA/	PROCESSOR/	table.f17_TSM3	table.f24
ASDM_ANTENNA/	SOURCE/	table.f17_TSM4	table.f24_TSM1
ASDM_CALATMOSPHERE/	SPECTRAL_WINDOW/	table.f18	table.f24_TSM2
ASDM_CALWVR/	STATE/	table.f19	table.f24_TSM3
ASDM_CORRELATORMODE/	SYSCAL/	table.f2	table.f24_TSM4
ASDM_RECEIVER/	SYSPOWER/	table.f20	table.f3
ASDM_SBSUMMARY/	table.dat	table.f20_TSM0	table.f4
ASDM_SOURCE/	table.f1	table.f21	table.f5
ASDM_STATION/	table.f10	table.f21_TSM1	table.f6
CALDEVICE/	table.f11	table.f21_TSM2	table.f7
DATA_DESCRIPTION/	table.f12	table.f21_TSM3	table.f8
FEED/	table.f13	table.f21_TSM4	table.f9
FIELD/	table.f14	table.f22	table.info
FLAG_CMD/	table.f15	table.f22_TSM1	table.lock
HISTORY/	table.f16	table.f22_TSM2	WEATHER/
OBSERVATION/	table.f17	table.f23	
POINTING/	table.f17_TSM1	table.f23_TSM1	
POLARIZATION/	table.f17_TSM2	table.f23_TSM2	

Step 1: Fix SYSCAL table times

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

Step 2: Listobs

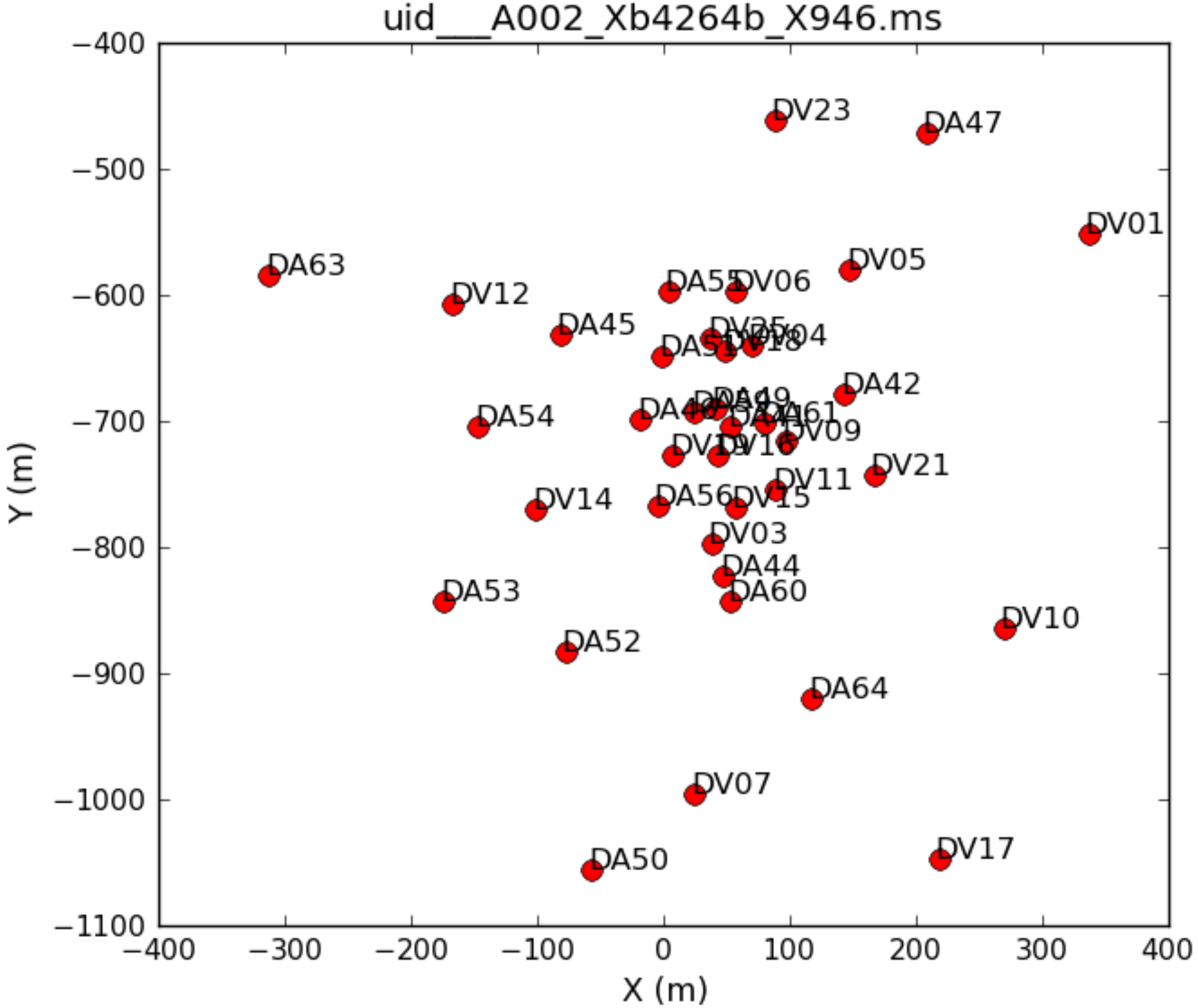
The listobs command will list a large amount of information about the observations. We run this step again later in step 9, so we will look at the listobs file in more detail then.

The demonstration script also includes an additional command that will plot antenna positions (plotants). This is not included in standard calibration scripts, but it should be.

This command produces a plot showing the locations of antennas in the array.

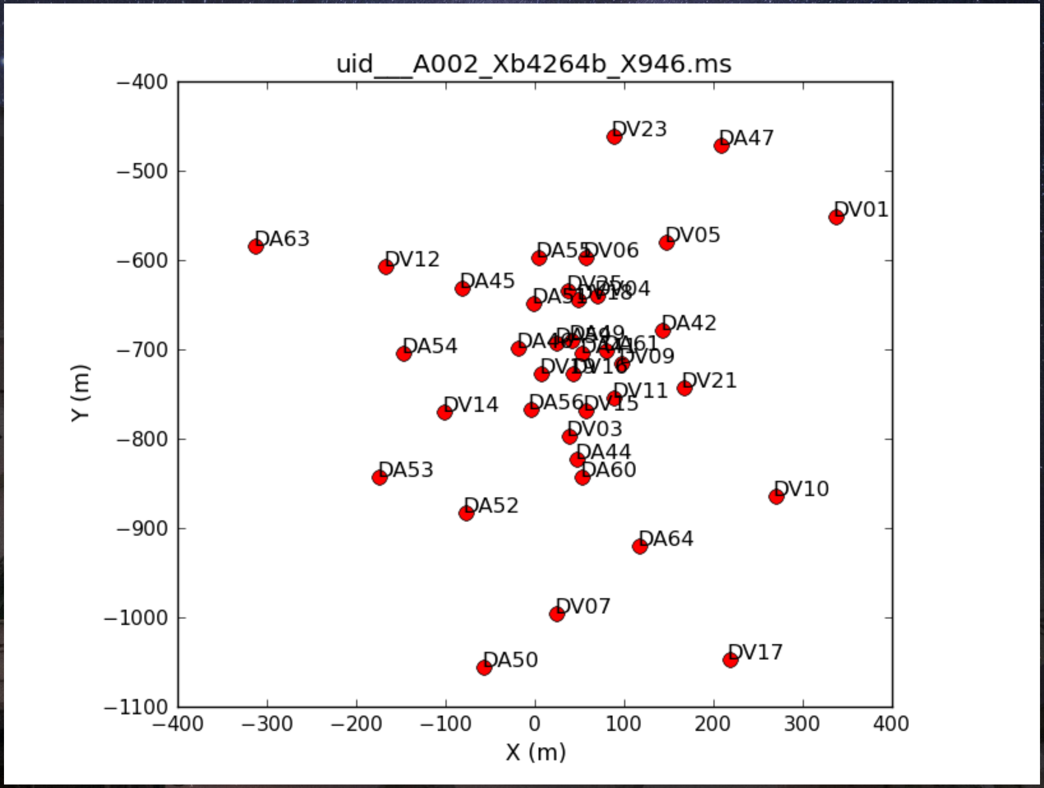
To execute this command, type the following:

```
plotants(vis='uid___A002_Xb4264b_X946.ms‘)
```


uid___A002_Xb4264b_X946.ms
Y (m)
X (m)
−400
−500
−600
−700
−800
−900
−1000
−1100
−400
−300
−200
−100
0
100
200
300
400
DV23
DA47
DV01
DA63
DV05
DV12
DV06
DA45
DA42
DA54
DV09
DV21
DV11
DV14
DA56
DV03
DA44
DA60
DA53
DV10
DA52
DA64
DV07
DV17
DA50

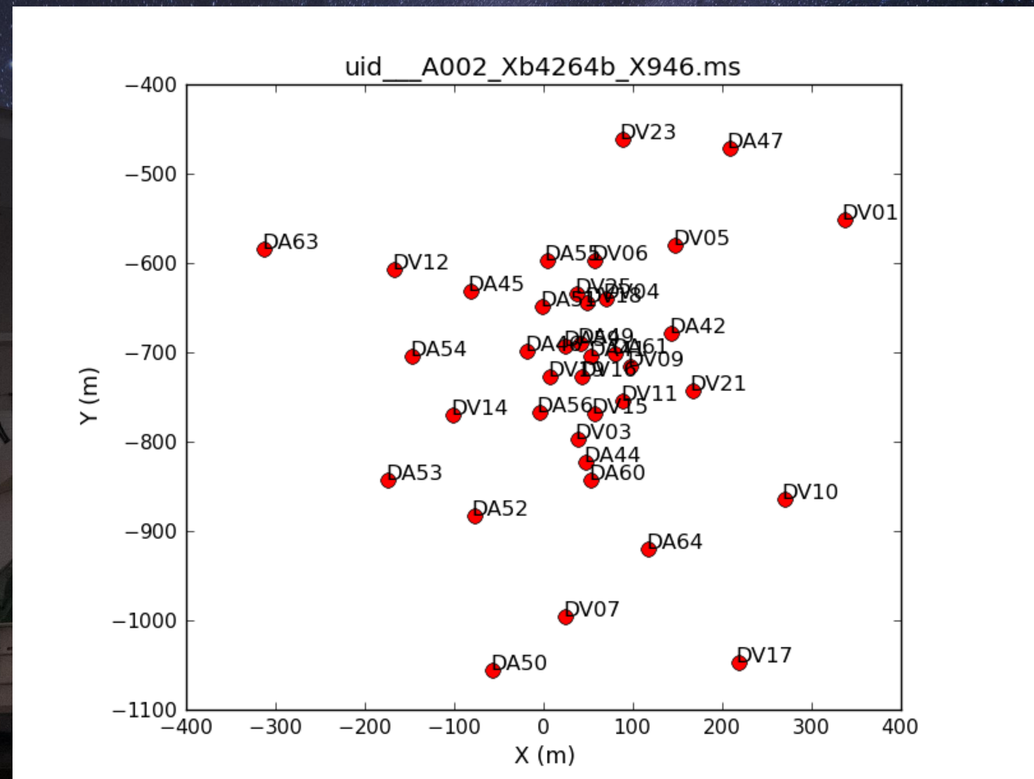
This plot can be used to select the reference antenna, which is used in many of the data processing steps.

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.

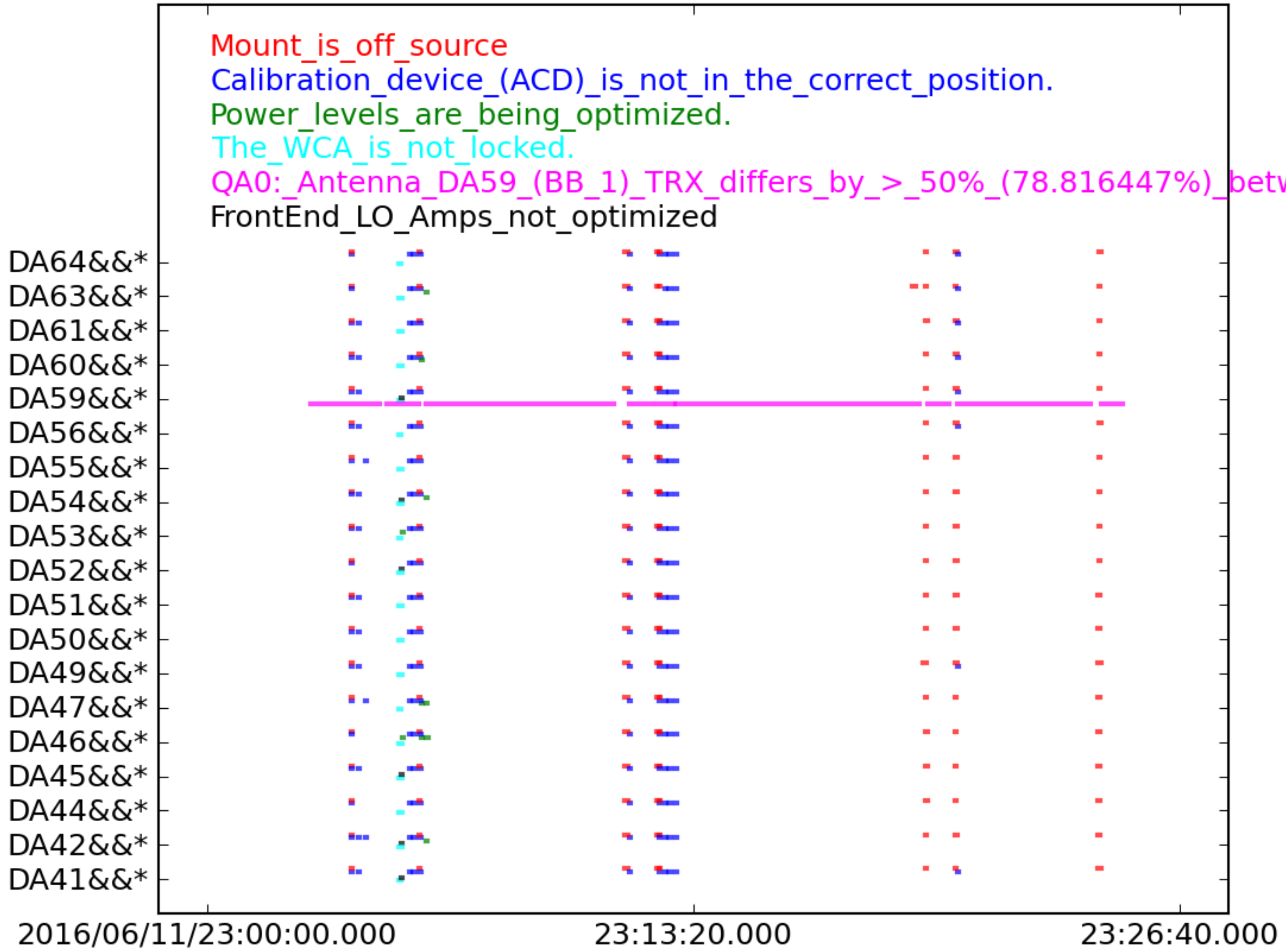
This figure can be used to diagnose these types of issues.



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)

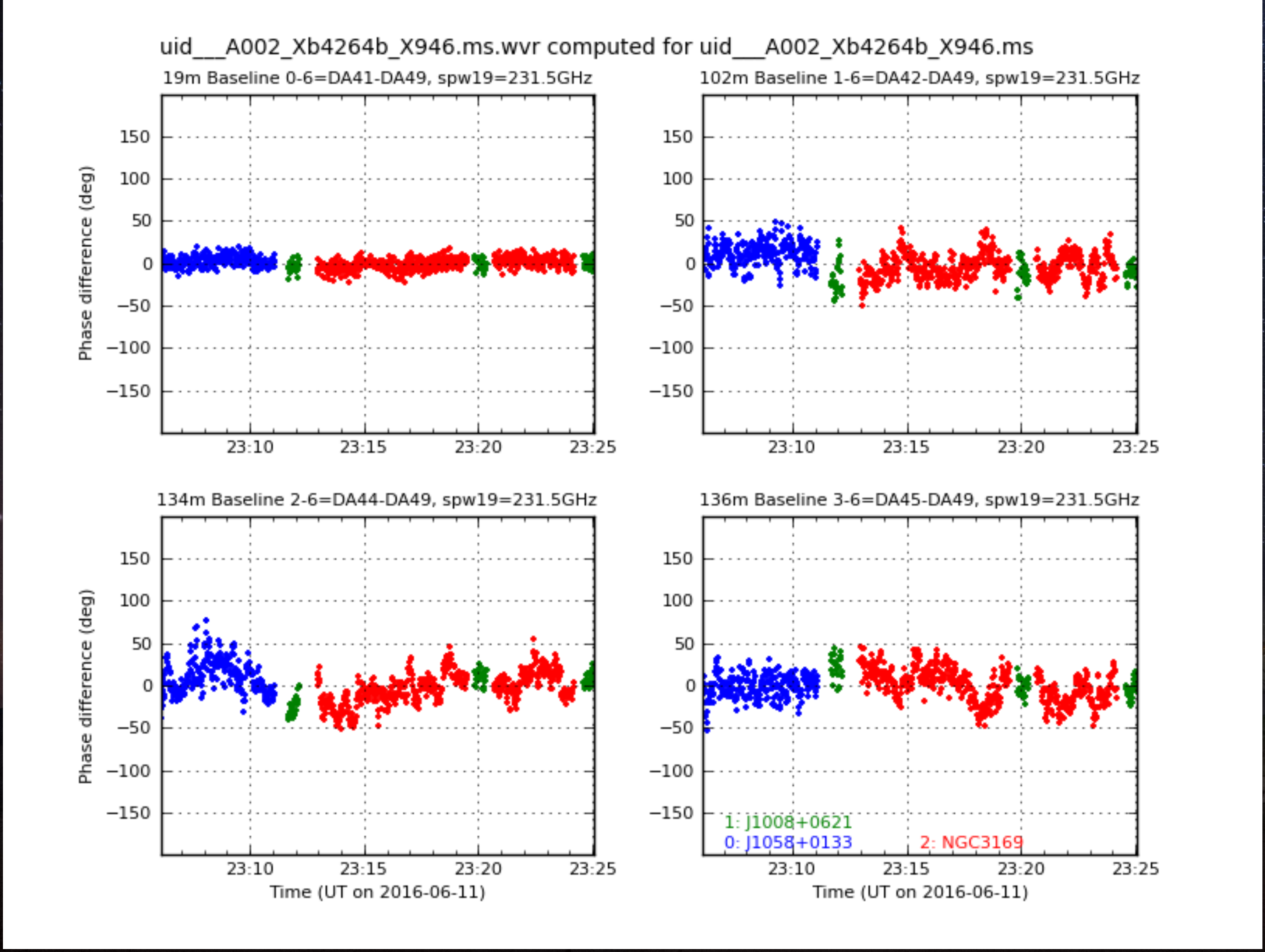


Mount_is_off_source
Calibration_device_(ACD)_is_not_in_the_correct_position.
Power_levels_are_being_optimized.
The_WCA_is_not_locked.
QA0:_Antenna_DA59_(BB_1)_TRX_differs_by_>_50%_(78.816447%)_between_
FrontEnd_LO_Amps_not_optimized
DA64&&*
DA63&&*
DA61&&*
DA60&&*
DA59&&*
DA56&&*
DA55&&*
DA54&&*
DA53&&*
DA52&&*
DA51&&*
DA50&&*
DA49&&*
DA47&&*
DA46&&*
DA45&&*
DA44&&*
DA42&&*
DA41&&*
2016/06/11/23:00:00.000
23:13:20.000
23:26:40.000

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

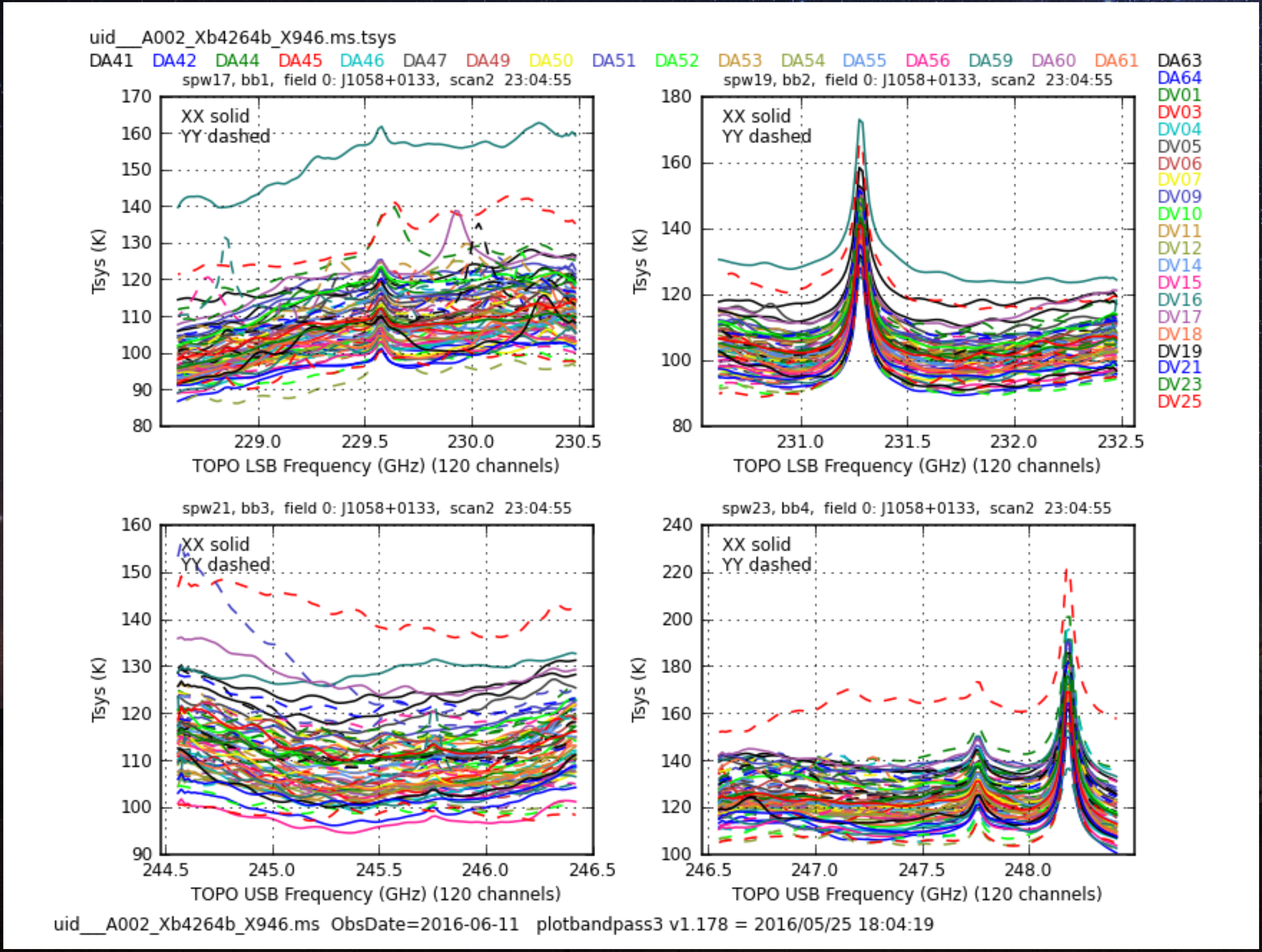


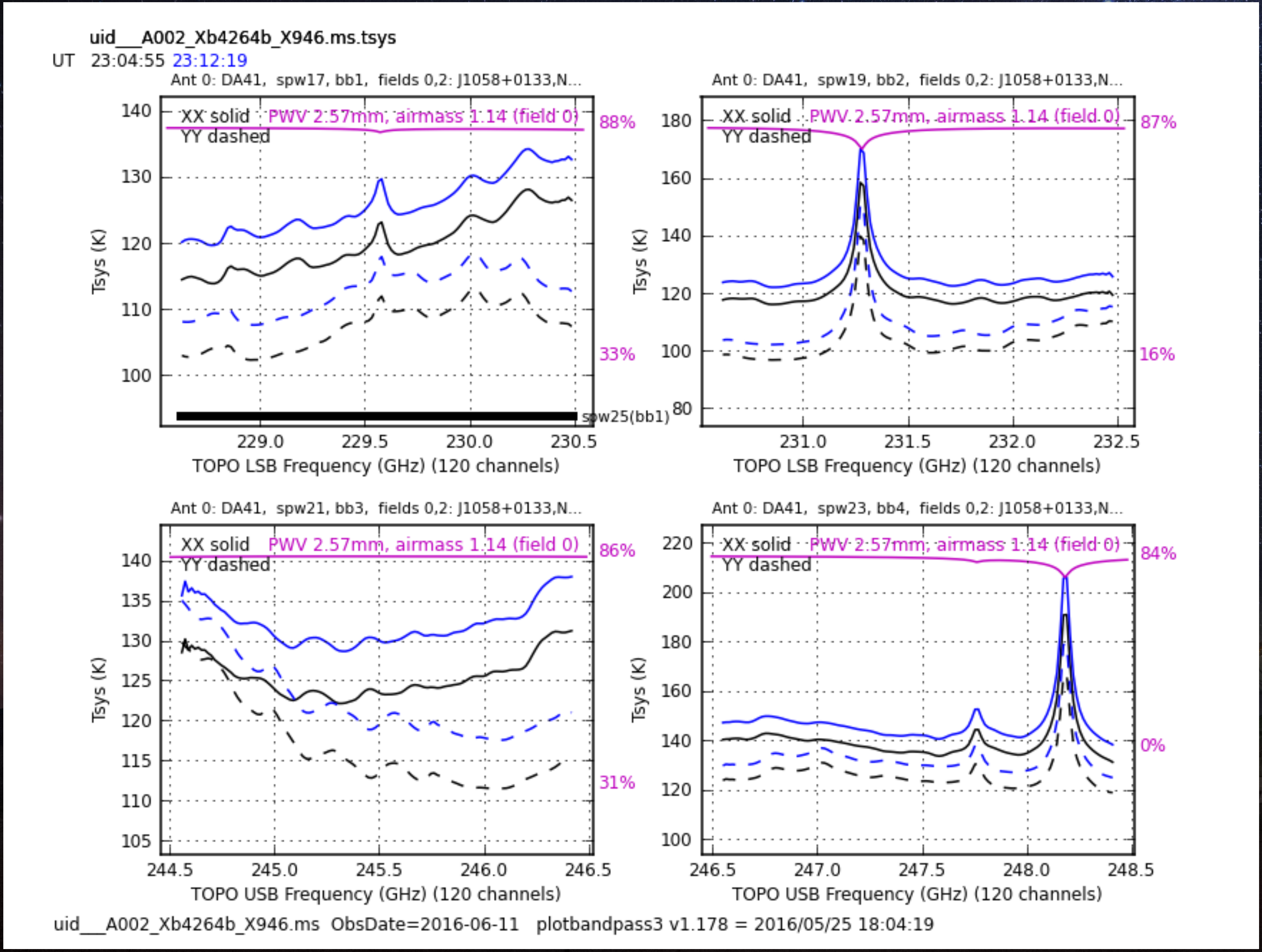
uid___A002_Xb4264b_X946.ms.wvr computed for uid___A002_Xb4264b_X946.ms
19m Baseline 0-6=DA41-DA49, spw19=231.5GHz
102m Baseline 1-6=DA42-DA49, spw19=231.5GHz
134m Baseline 2-6=DA44-DA49, spw19=231.5GHz
136m Baseline 3-6=DA45-DA49, spw19=231.5GHz
Phase difference (deg)
150
100
50
0
−50
−100
−150
23:10
23:15
23:20
23:25
Time (UT on 2016-06-11)
1: J1008+0621
0: J1058+0133
2: NGC3169

Step 5: Generation of the Tsys calibration table

The system temperature (Tsys) measurements include measurements of the emission from the atmosphere and telescope.

This steps generates calibration tables that correct the amplitudes based on the Tsys data. The corrections are applied in step 7.


uid___A002_Xb4264b_X946.ms.tsys
DA41 DA42 DA44 DA45 DA46 DA47 DA49 DA50 DA51 DA52 DA53 DA54 DA55 DA56 DA59 DA60 DA61 DA63 DA64 DV01 DV03 DV04 DV05 DV06 DV07 DV09 DV10 DV11 DV12 DV14 DV15 DV16 DV17 DV18 DV19 DV21 DV23 DV25
spw17, bb1, field 0: J1058+0133, scan2 23:04:55
spw19, bb2, field 0: J1058+0133, scan2 23:04:55
spw21, bb3, field 0: J1058+0133, scan2 23:04:55
spw23, bb4, field 0: J1058+0133, scan2 23:04:55
XX solid
YY dashed
Tsys (K)
TOPO LSB Frequency (GHz) (120 channels)
TOPO USB Frequency (GHz) (120 channels)
uid___A002_Xb4264b_X946.ms ObsDate=2016-06-11 plotbandpass3 v1.178 = 2016/05/25 18:04:19


uid___A002_Xb4264b_X946.ms.tsys
UT 23:04:55 23:12:19
Ant 0: DA41, spw17, bb1, fields 0,2: J1058+0133,N...
Ant 0: DA41, spw19, bb2, fields 0,2: J1058+0133,N...
Ant 0: DA41, spw21, bb3, fields 0,2: J1058+0133,N...
Ant 0: DA41, spw23, bb4, fields 0,2: J1058+0133,N...
XX solid
YY dashed
PWV 2.57mm, airmass 1.14 (field 0)
Tsys (K)
spw25(bb1)
TOPO LSB Frequency (GHz) (120 channels)
TOPO USB Frequency (GHz) (120 channels)
88%
33%
87%
16%
86%
31%
84%
0%
uid___A002_Xb4264b_X946.ms ObsDate=2016-06-11 plotbandpass3 v1.178 = 2016/05/25 18:04:19

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.

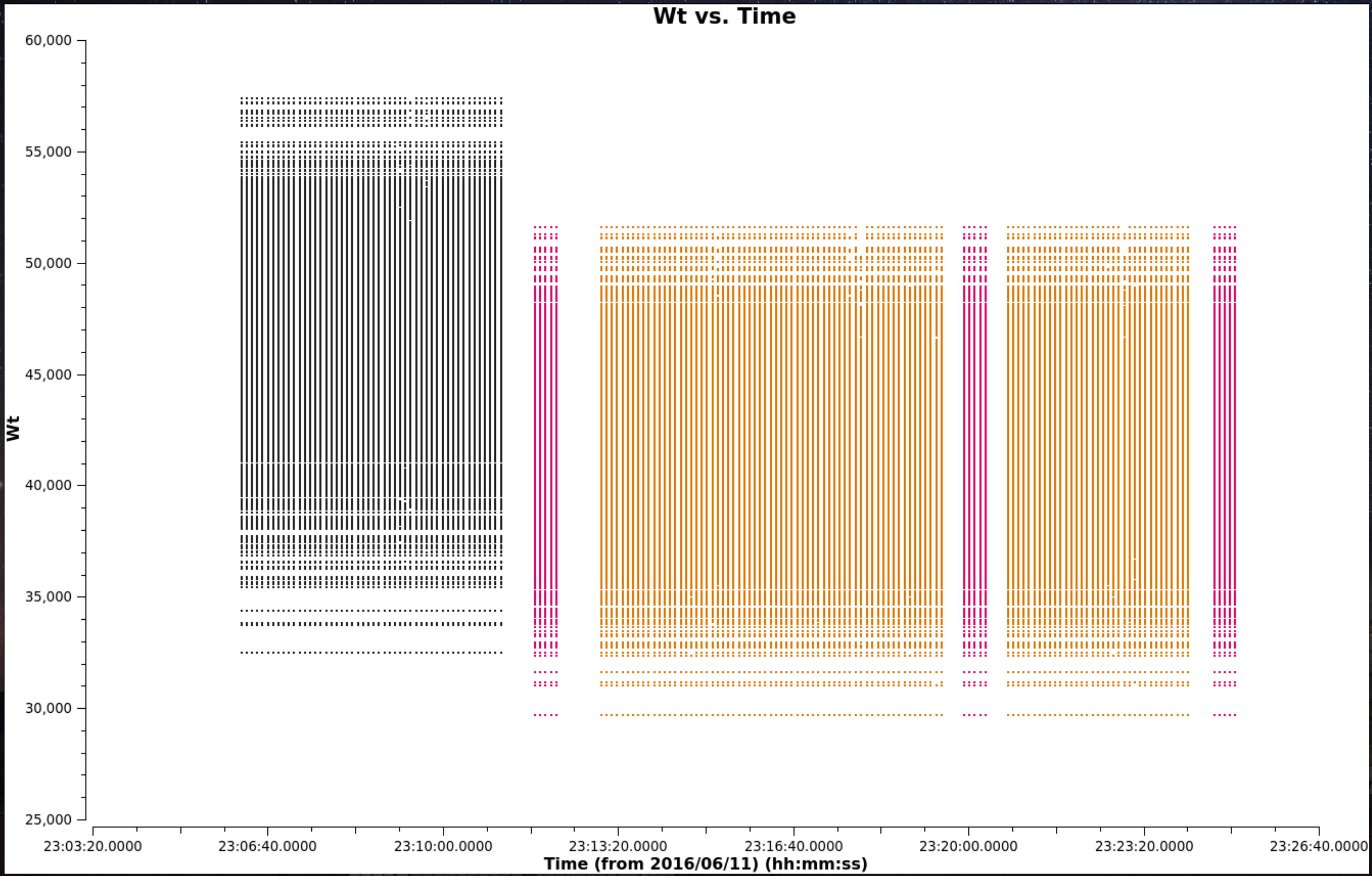
For most other data, though, the corrections may be unnecessary. In this situation, a table filled with zeroes is created.

(Depending on when the data are generated, the corrections may have already been incorporated into the measurement set.)

Step 7: Application of the WVR, Tsys, 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
Wt
60,000
55,000
50,000
45,000
40,000
35,000
30,000
25,000
23:03:20.0000
23:06:40.0000
23:10:00.0000
23:13:20.0000
23:16:40.0000
23:20:00.0000
23:23:20.0000
23:26:40.0000
Time (from 2016/06/11) (hh:mm:ss)

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 over 20 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

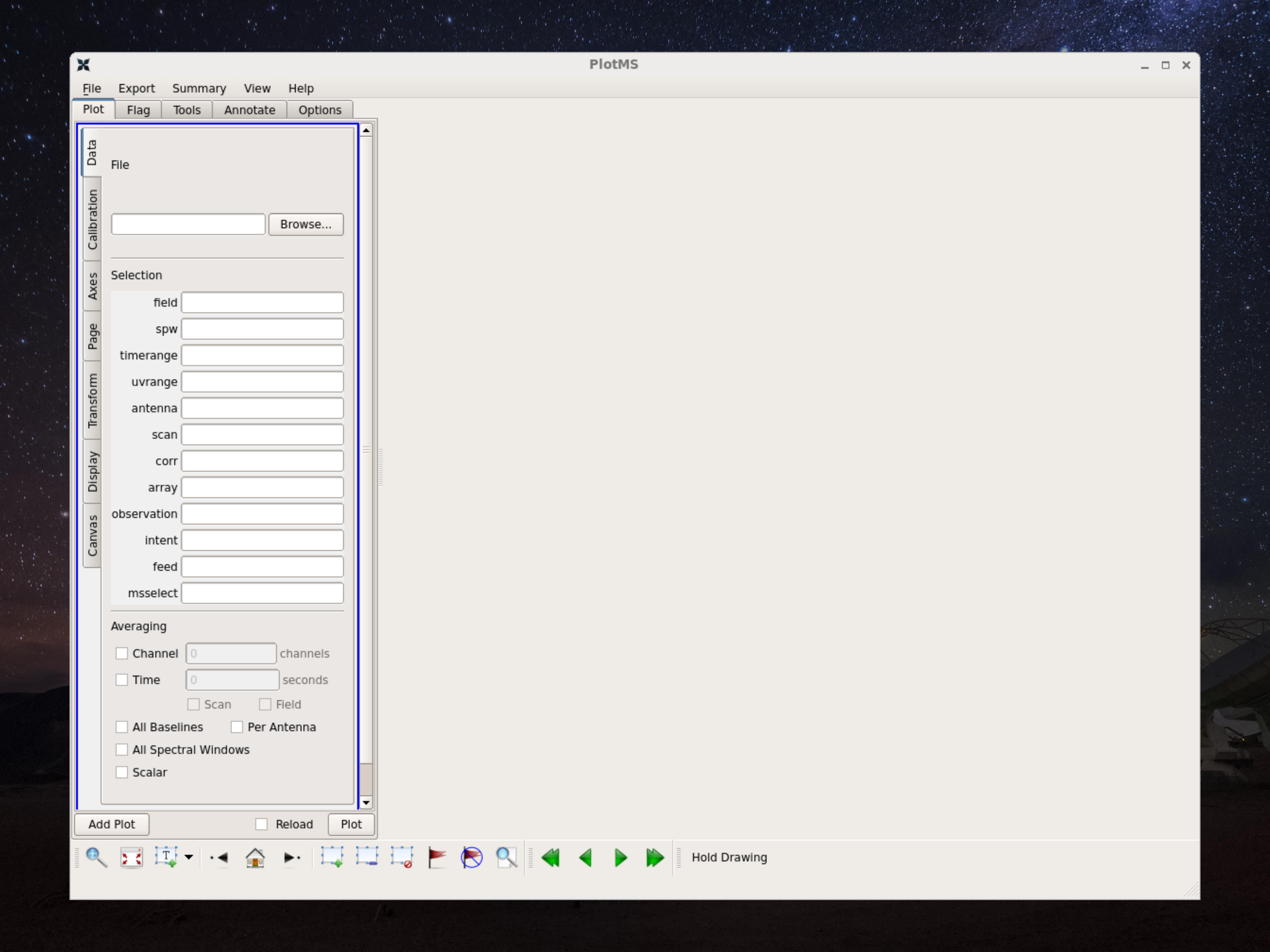
Any data that look abnormally noisy or are that are otherwise unusable are flagged (identified as bad) in this step and not used in any subsequent steps.

Standard scripts include flagdata commands to flag shadowed antennas (antennas that are blocked by other antennas) and edge channels in each of the spws.

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.

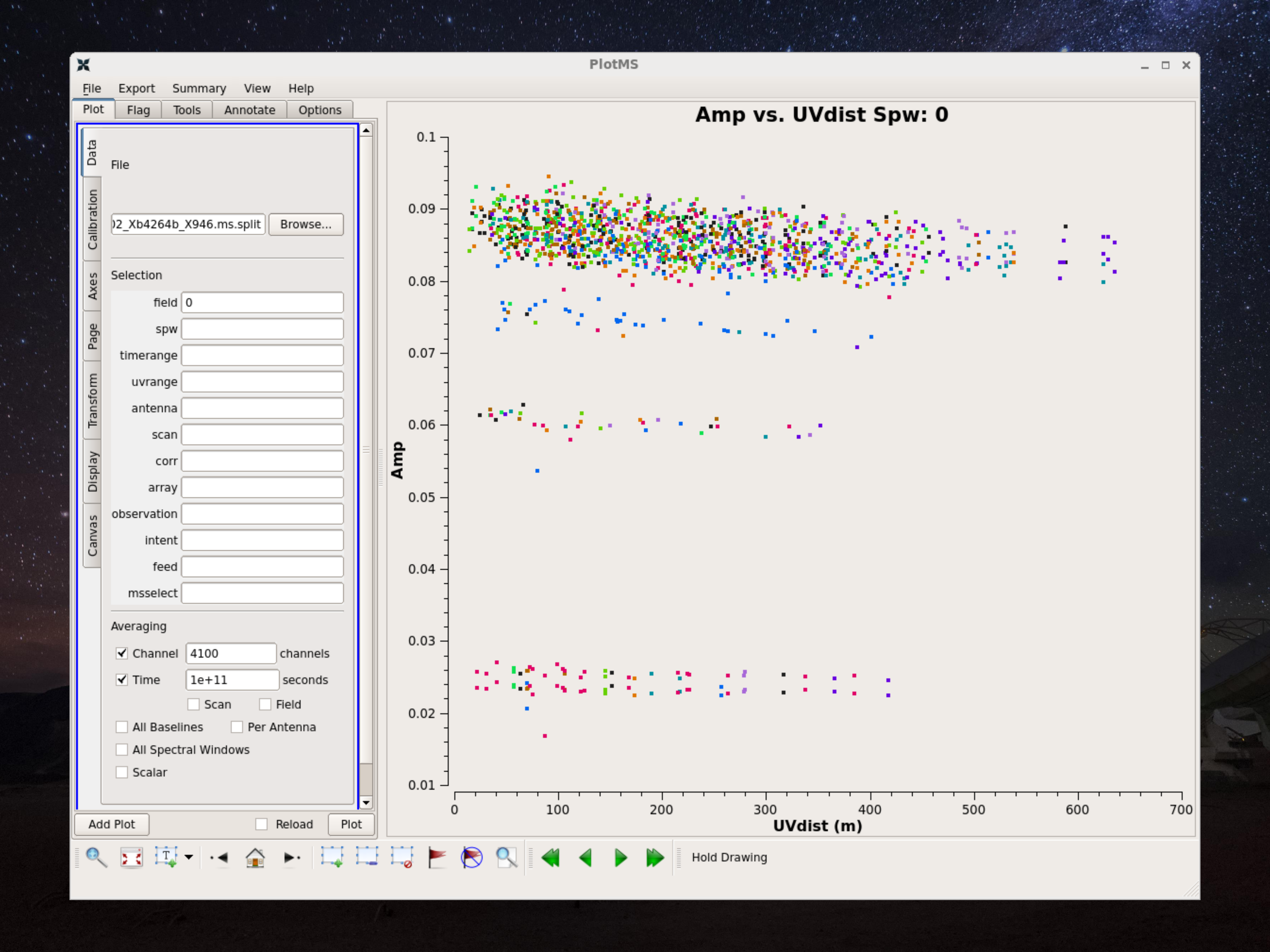
I recommend performing the following checks in the following order:

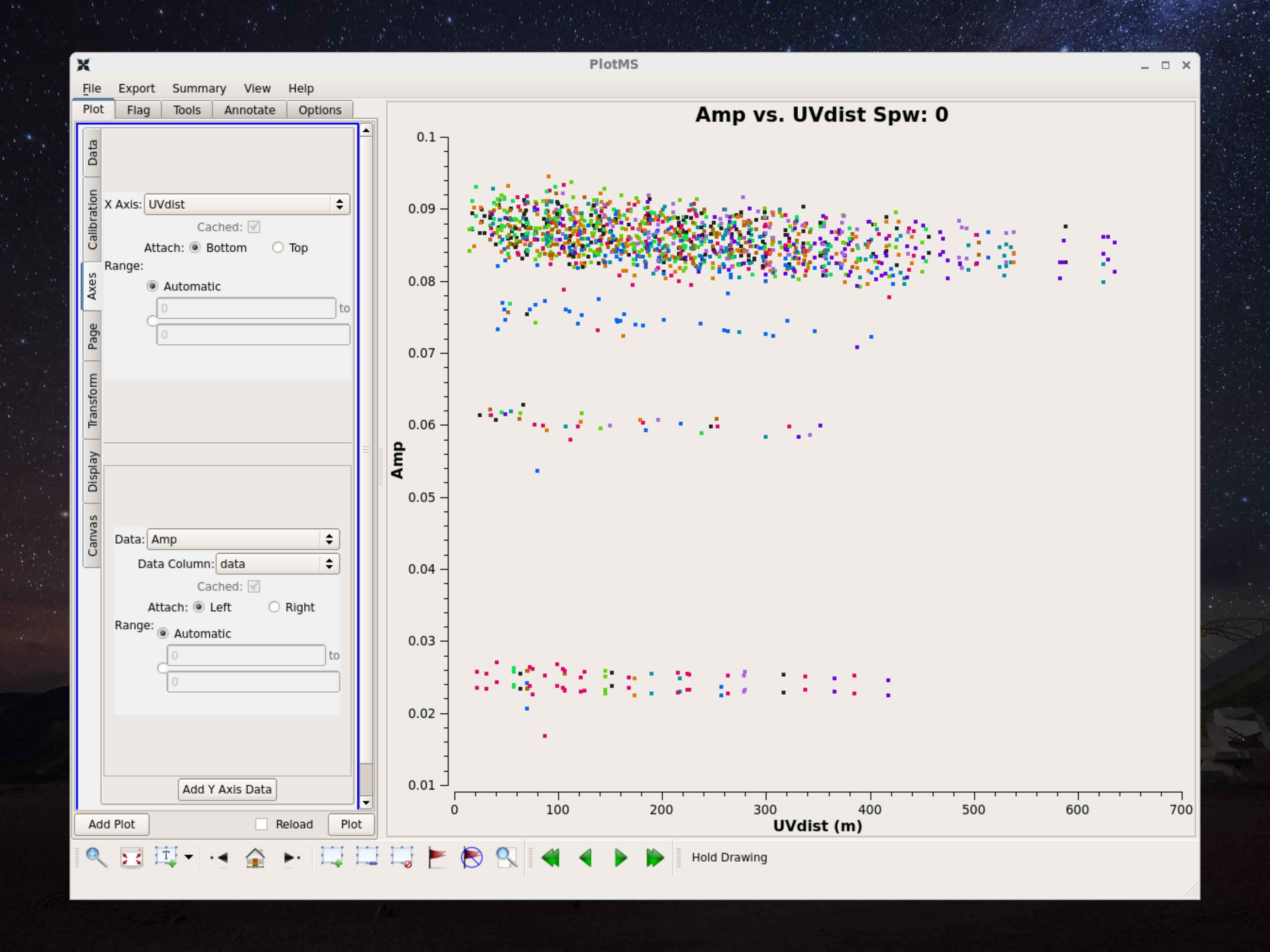
- Check amplitude versus uv distance for the amplitude or bandpass calibrator
- Check amplitude versus channel for the bandpass calibrator
- Check phase versus scan for the phase calibrator

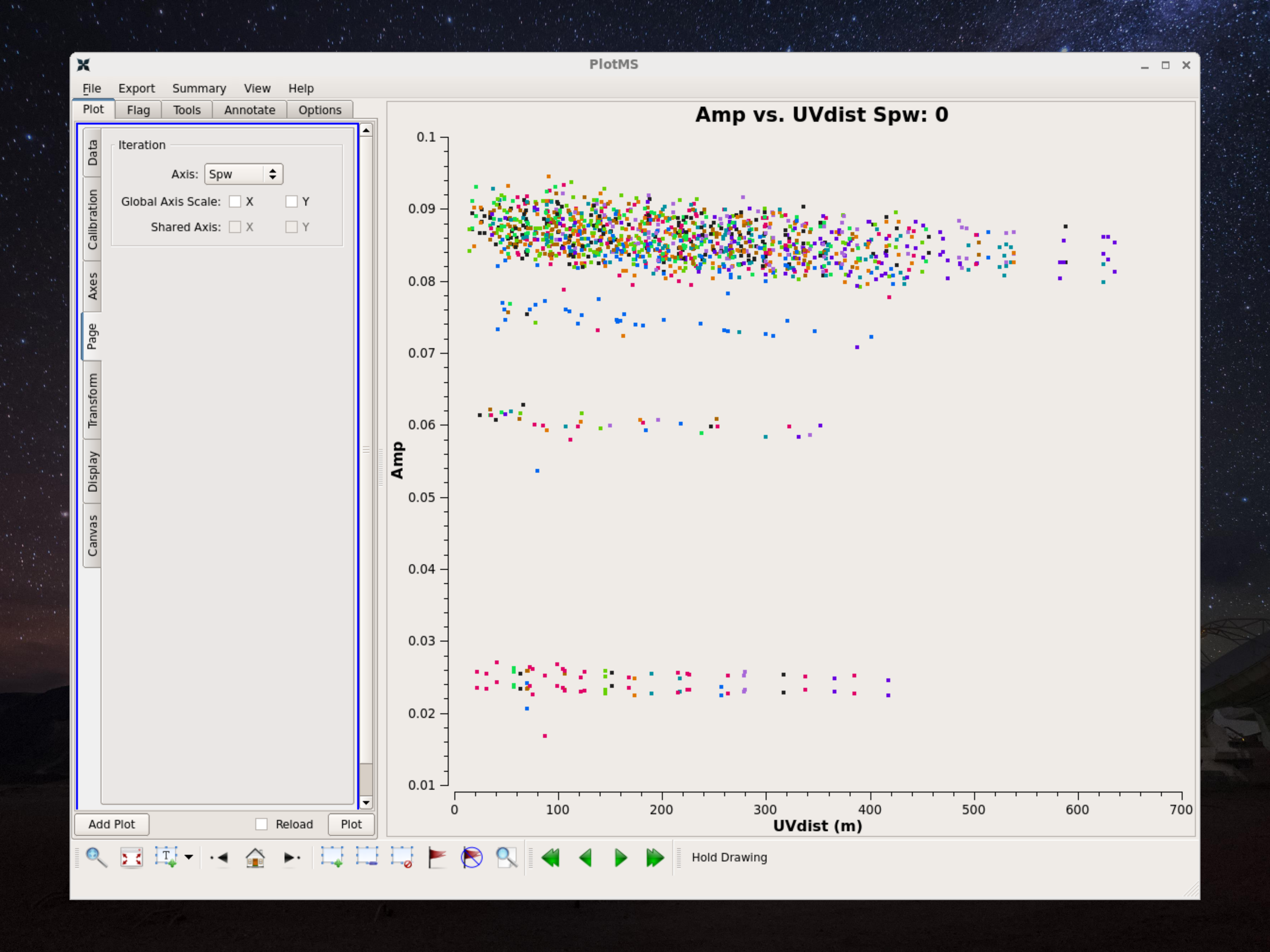

PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
File
Browse...
Selection
field
spw
timerange
uvrange
antenna
scan
corr
array
observation
intent
feed
msselect
Averaging
Channel
channels
Time
seconds
Scan
Field
All Baselines
Per Antenna
All Spectral Windows
Scalar
Add Plot
Reload
Plot
Hold Drawing

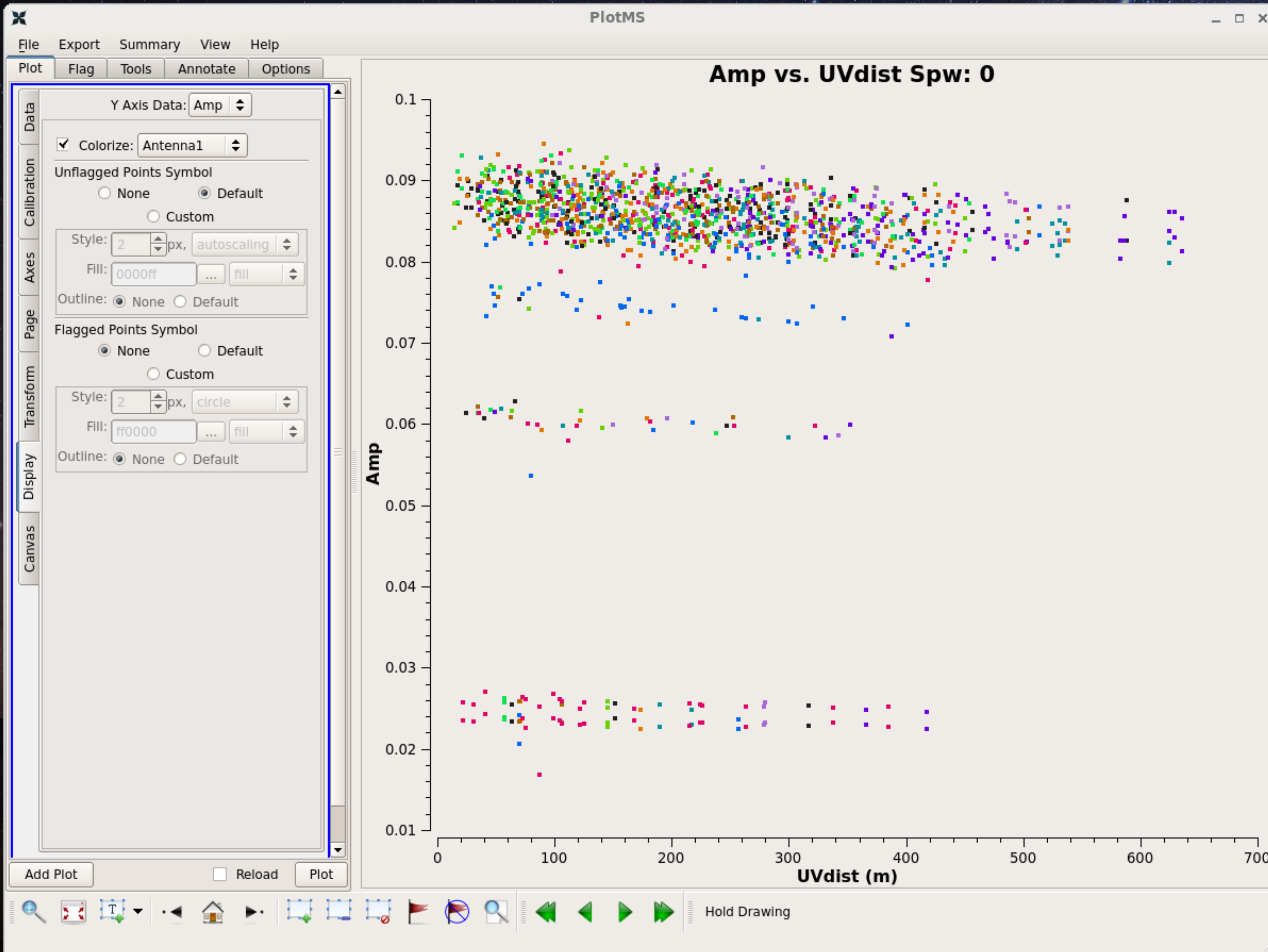
To check *amplitude versus uv distance*, set the following:

- 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


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
File
)2_Xb4264b_X946.ms.split
Browse...
Selection
field
0
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
Scalar
Add Plot
Reload
Plot
Amp vs. UVdist Spw: 0
Amp
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
100
200
300
400
500
600
700
UVdist (m)
Hold Drawing

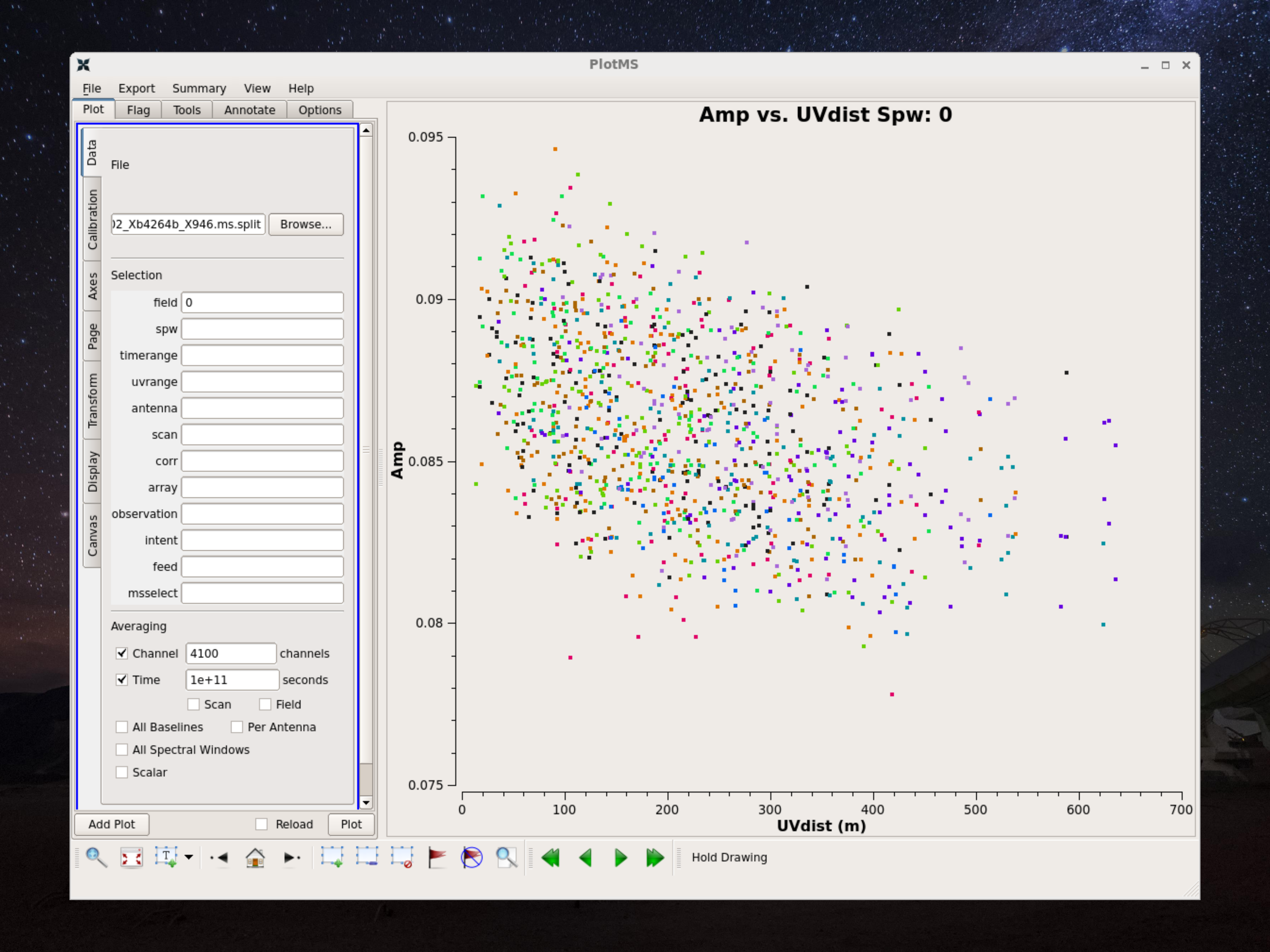

PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
X Axis: UVdist
Cached:
Attach: Bottom
Top
Range:
Automatic
0
to
0
Data: Amp
Data Column: data
Cached:
Attach: Left
Right
Range:
Automatic
0
to
0
Add Y Axis Data
Add Plot
Reload
Plot
Amp vs. UVdist Spw: 0
Amp
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
100
200
300
400
500
600
700
UVdist (m)
Hold Drawing


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
Iteration
Axis: Spw
Global Axis Scale: X Y
Shared Axis: X Y
Add Plot
Reload
Plot
Amp vs. UVdist Spw: 0
Amp
UVdist (m)
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
100
200
300
400
500
600
700
Hold Drawing


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
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
Add Plot
Reload
Plot
Amp vs. UVdist Spw: 0
Amp
0.1
0.09
0.08
0.07
0.06
0.05
0.04
0.03
0.02
0.01
0
100
200
300
400
500
600
700
UVdist (m)
Hold Drawing

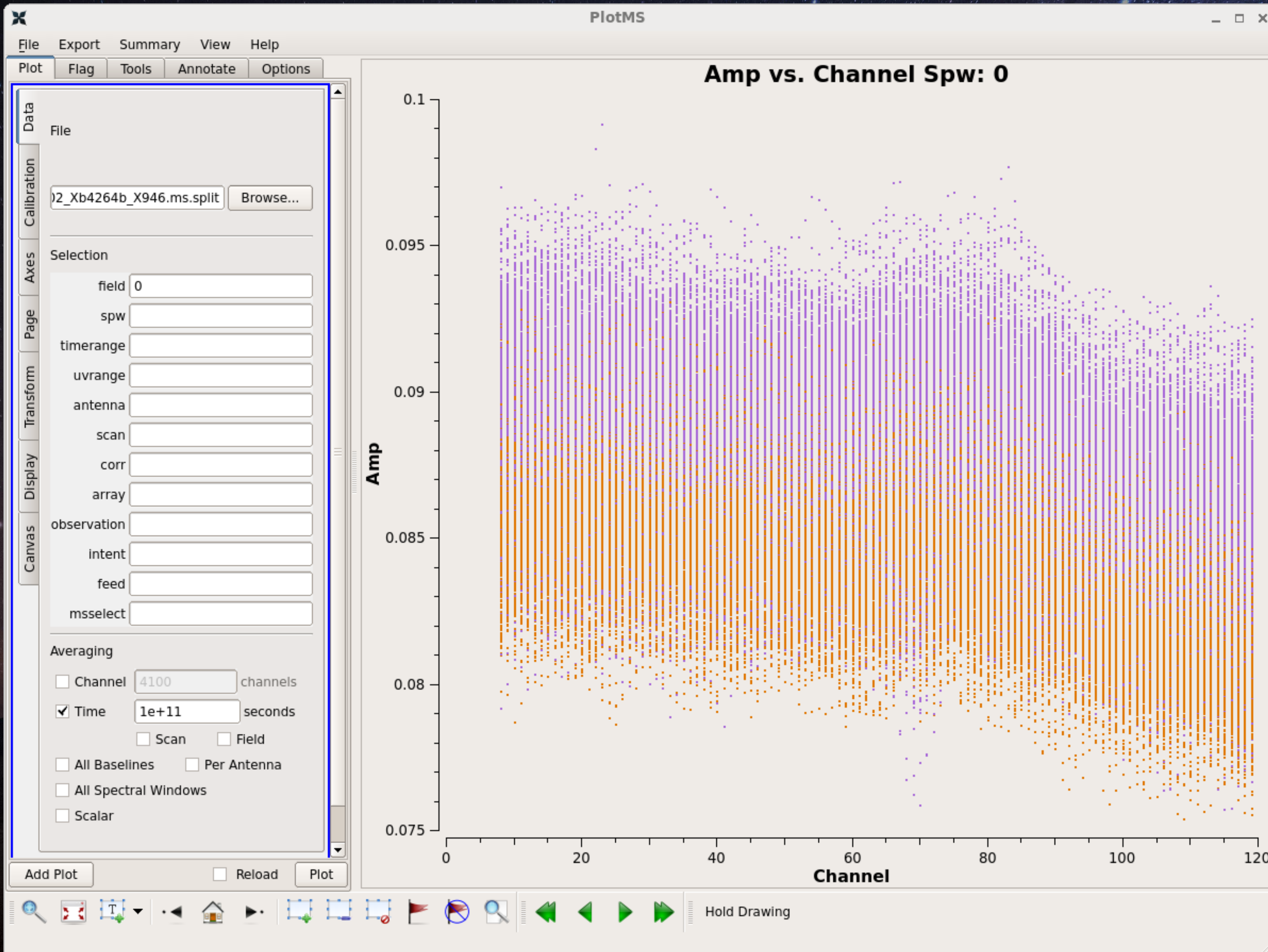
In the amplitude versus uv distance plots, most of the data should fall along a straight line (for unresolved or marginally resolved sources) or should follow something similar to a sinc^2 function.

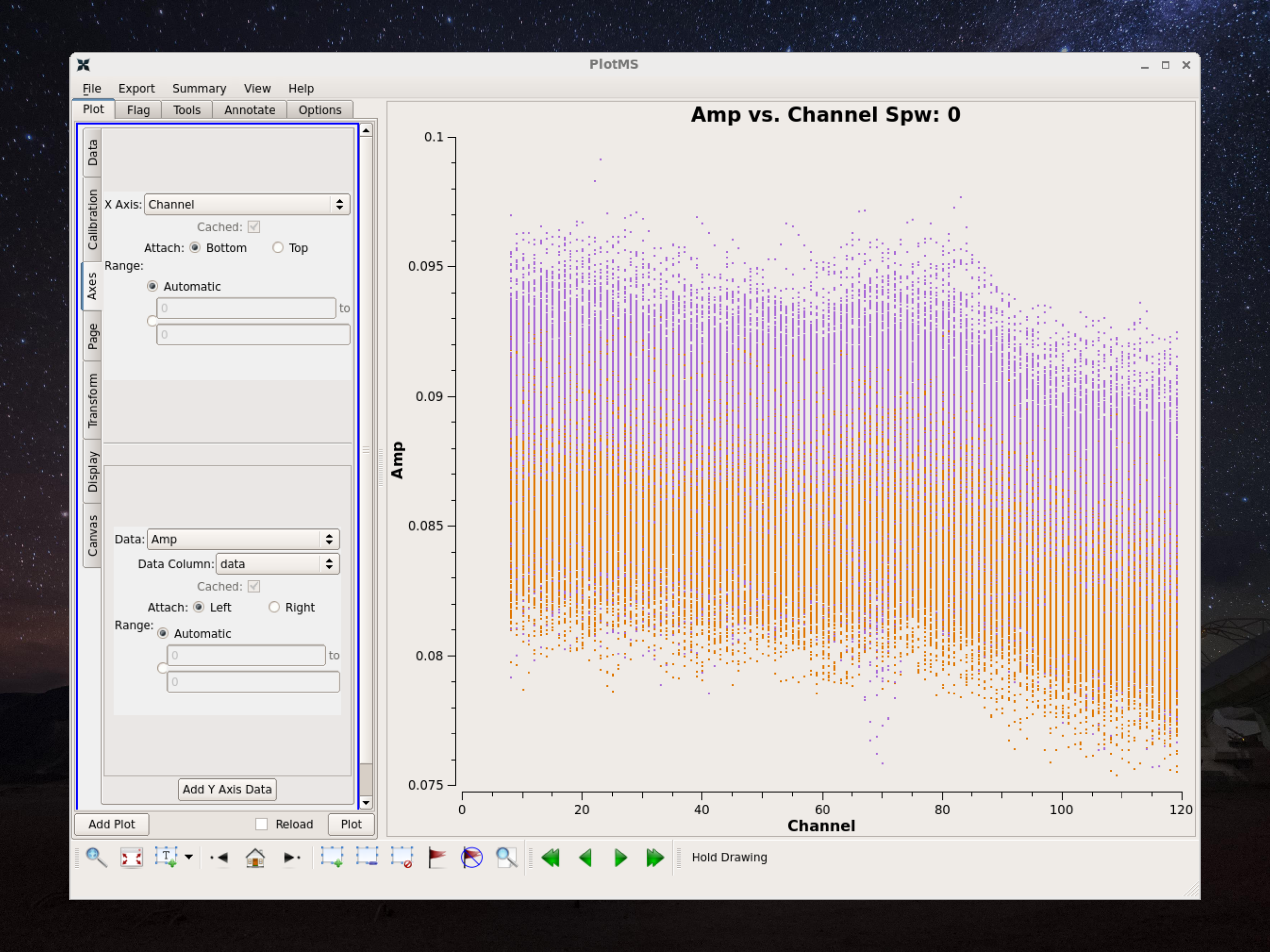
Data from bad antennas or baselines will appear as outliers from these trends.

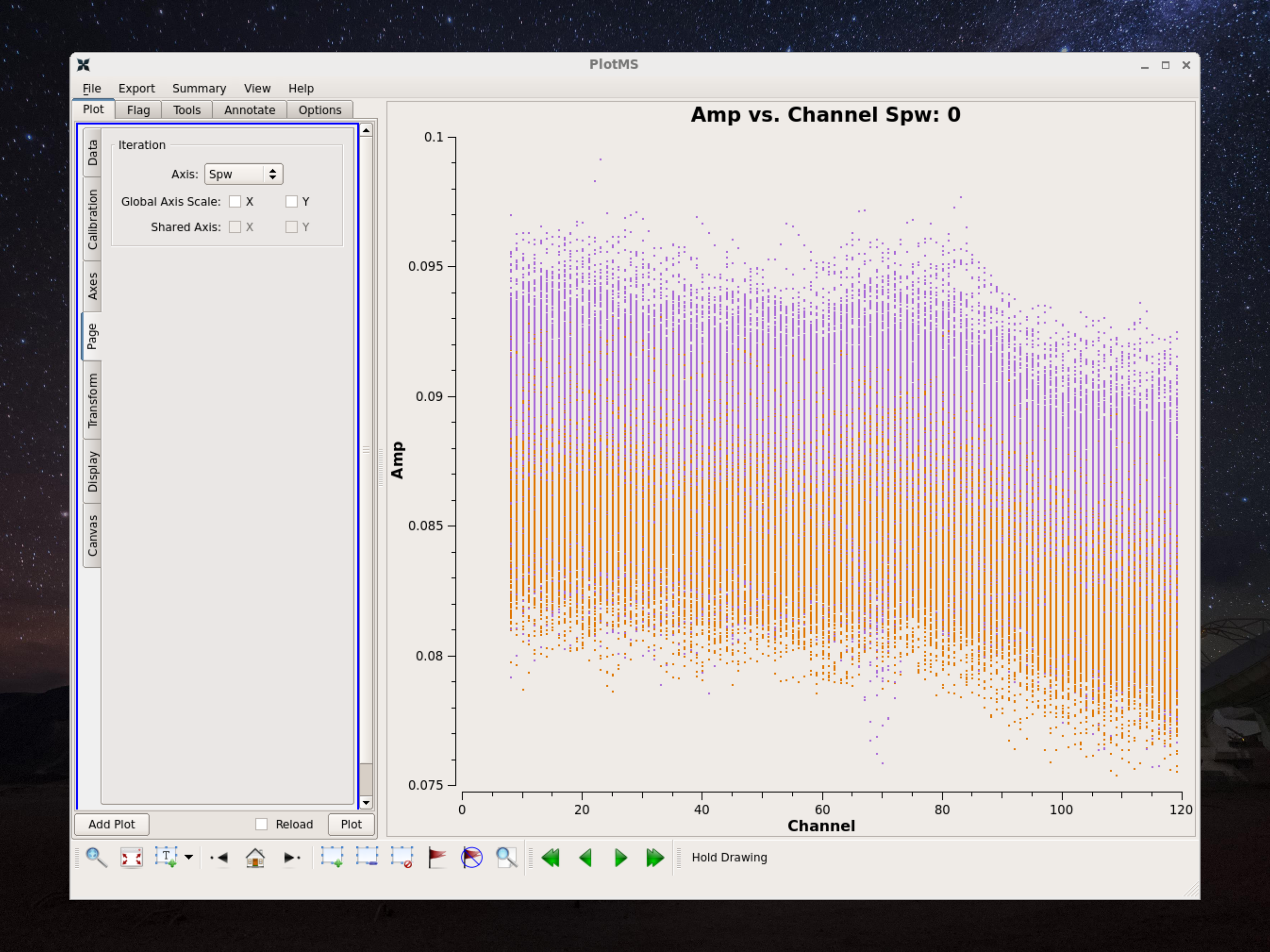

PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
File
)2_Xb4264b_X946.ms.split
Browse...
Selection
field
0
spw
timerange
uvrange
antenna
scan
corr
array
observation
intent
feed
msselect
Averaging
Channel
4100
channels
Time
1e+11
seconds
Scan
Field
All Baselines
Per Antenna
All Spectral Windows
Scalar
Add Plot
Reload
Plot
Hold Drawing
Amp vs. UVdist Spw: 0
Amp
0.095
0.09
0.085
0.08
0.075
UVdist (m)
0
100
200
300
400
500
600
700

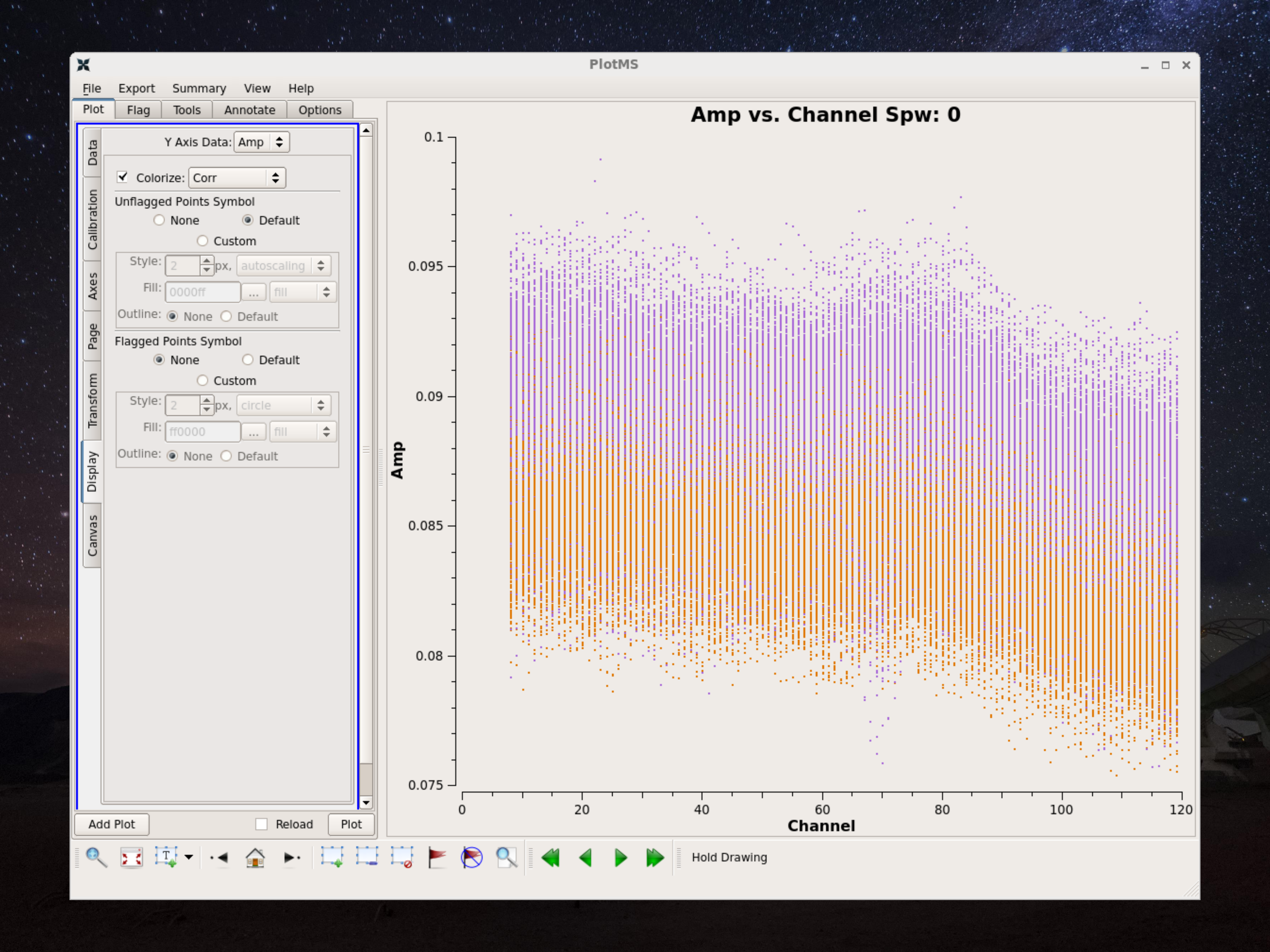
To check *amplitude versus channel*, set the following:

- 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)


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
File
)2_Xb4264b_X946.ms.split
Browse...
Selection
field
0
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
Scalar
Add Plot
Reload
Plot
Amp vs. Channel Spw: 0
Amp
Channel
0.1
0.095
0.09
0.085
0.08
0.075
0
20
40
60
80
100
120
Hold Drawing


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
X Axis: Channel
Cached:
Attach: Bottom
Top
Range:
Automatic
to
Data: Amp
Data Column: data
Cached:
Attach: Left
Right
Range:
Automatic
to
Add Y Axis Data
Add Plot
Reload
Plot
Hold Drawing
Amp vs. Channel Spw: 0
Amp
Channel
0.1
0.095
0.09
0.085
0.08
0.075
0
20
40
60
80
100
120


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
Iteration
Axis:
Spw
Global Axis Scale:
X
Y
Shared Axis:
X
Y
Add Plot
Reload
Plot
Amp vs. Channel Spw: 0
Amp
Channel
0.1
0.095
0.09
0.085
0.08
0.075
0
20
40
60
80
100
120
Hold Drawing


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
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
Add Plot
Reload
Plot
Amp vs. Channel Spw: 0
Amp
0.1
0.095
0.09
0.085
0.08
0.075
Channel
0
20
40
60
80
100
120
Hold Drawing

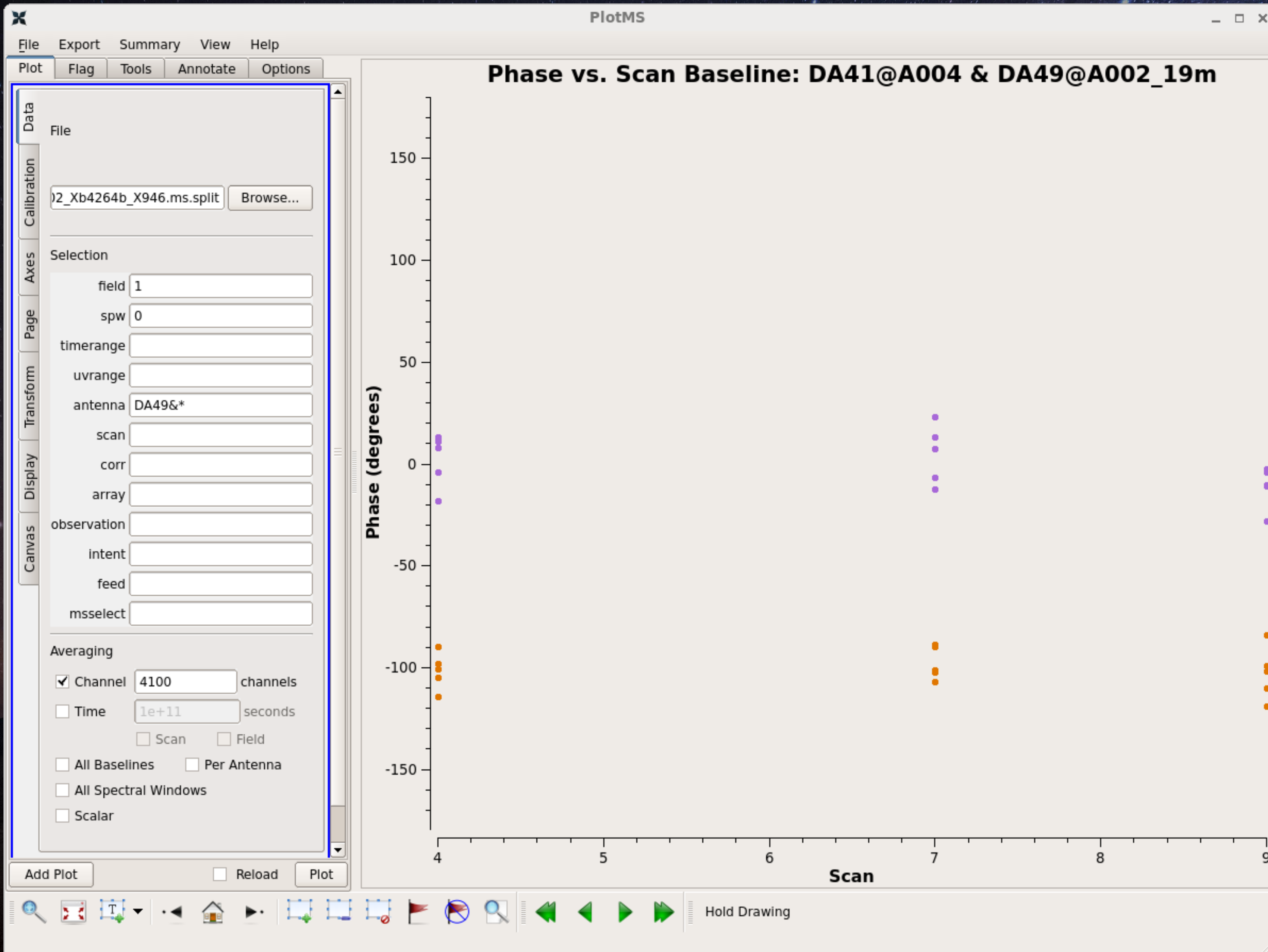
In the amplitude versus channel plots, most of the data should fall along a relatively straight line or should at least look smooth.

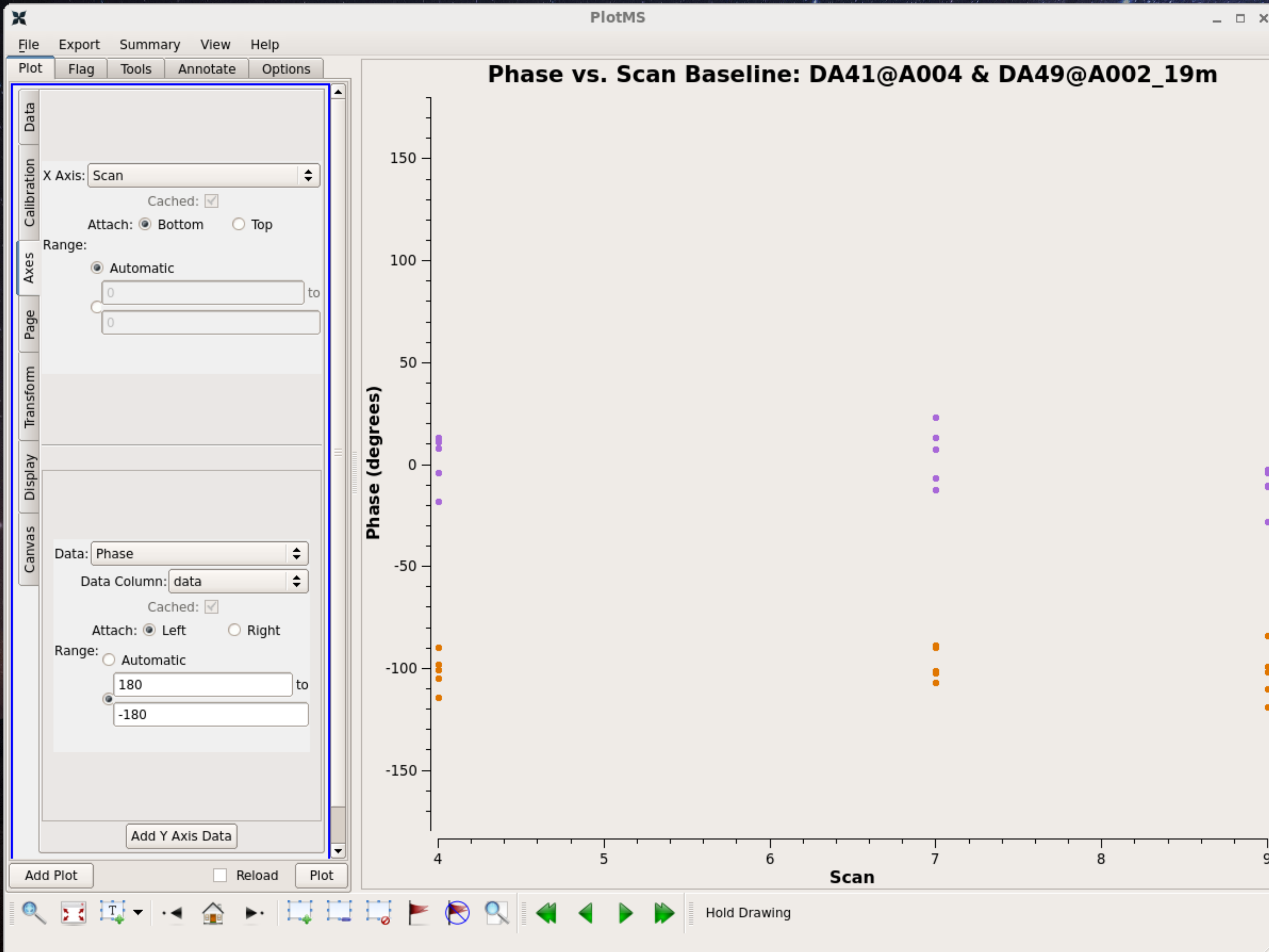
Data from the end channels will often appear either abnormally high or low. So will data from bad channels.

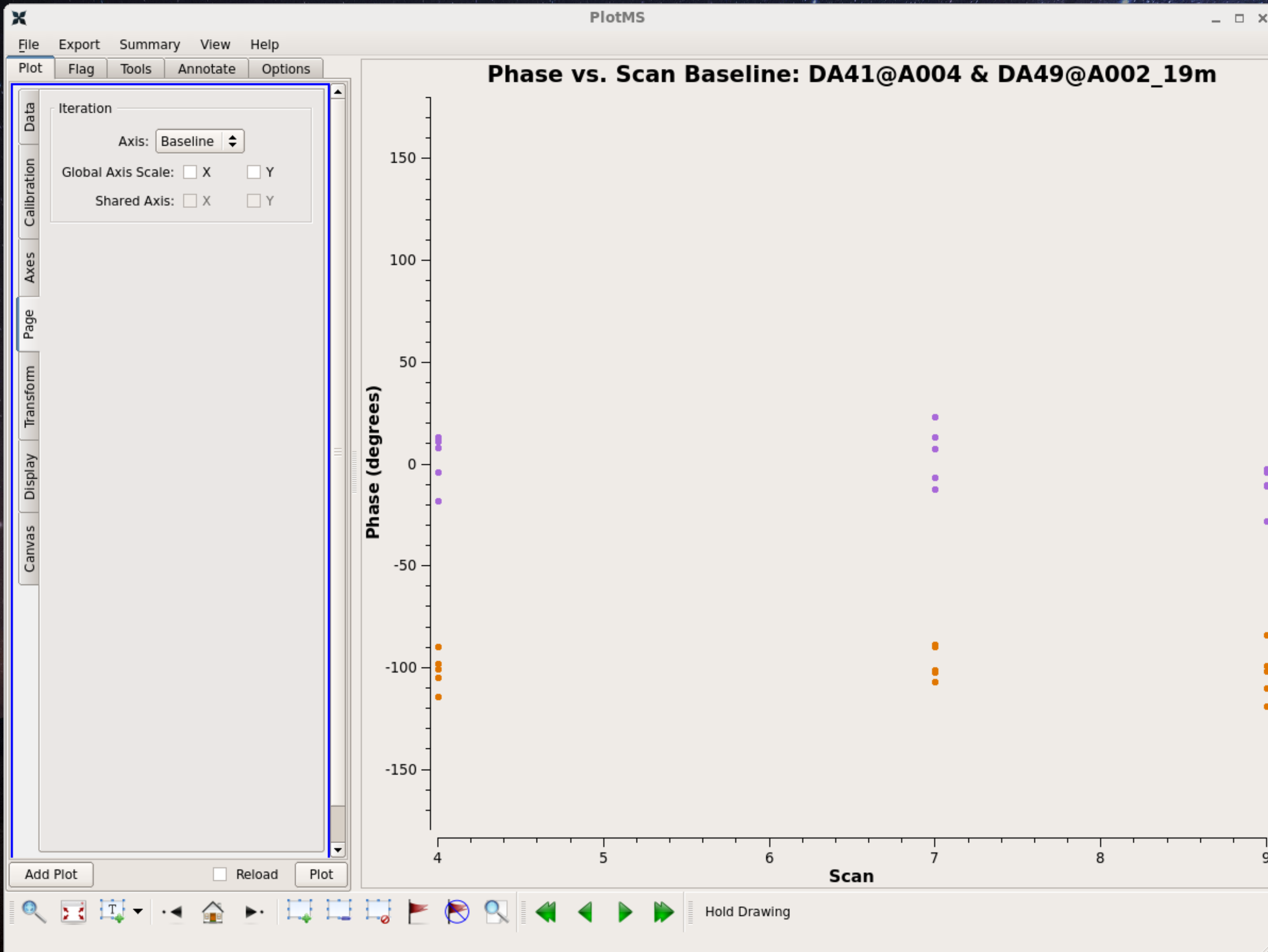
Additionally, atmospherioc absorption features can be identified and flagged using these plots.

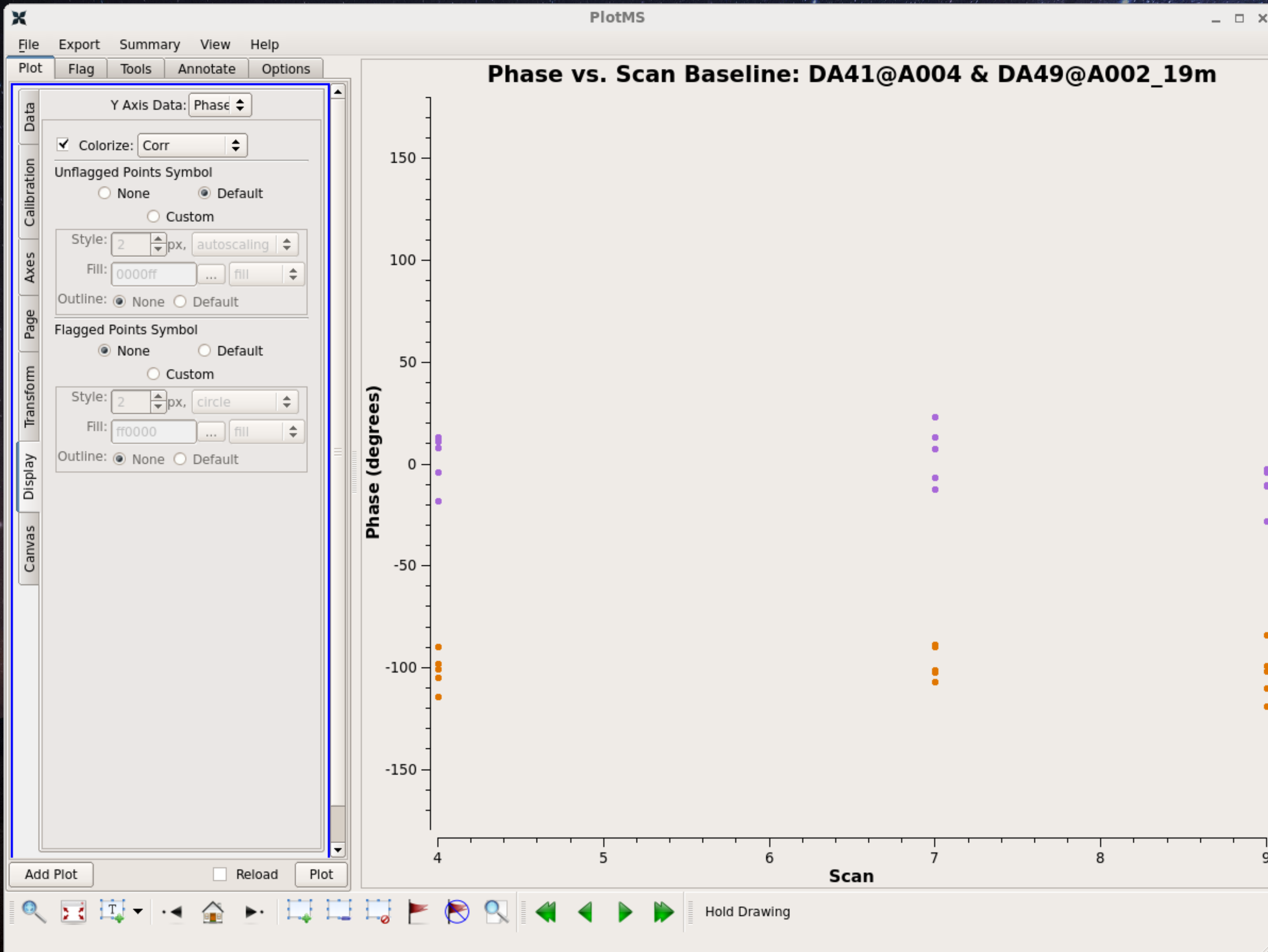
To check *phase versus scan*, set the following:

- 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)


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
File
)2_Xb4264b_X946.ms.split
Browse...
Selection
field
1
spw
0
timerange
uvrange
antenna
DA49&*
scan
corr
array
observation
intent
feed
msselect
Averaging
Channel
4100
channels
Time
1e+11
seconds
Scan
Field
All Baselines
Per Antenna
All Spectral Windows
Scalar
Add Plot
Reload
Plot
Phase vs. Scan Baseline: DA41@A004 & DA49@A002_19m
Phase (degrees)
150
100
50
0
-50
-100
-150
4
5
6
7
8
9
Scan
Hold Drawing


PlotMS
File Export Summary View Help
Plot Flag Tools Annotate Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
X Axis: Scan
Cached:
Attach: Bottom Top
Range:
Automatic
0 to
0
Data: Phase
Data Column: data
Cached:
Attach: Left Right
Range: Automatic
180 to
-180
Add Y Axis Data
Add Plot
Reload
Plot
Phase vs. Scan Baseline: DA41@A004 & DA49@A002_19m
Phase (degrees)
150
100
50
0
-50
-100
-150
4
5
6
7
8
9
Scan
Hold Drawing


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
Iteration
Axis: Baseline
Global Axis Scale: X Y
Shared Axis: X Y
Add Plot
Reload
Plot
Phase vs. Scan Baseline: DA41@A004 & DA49@A002_19m
Phase (degrees)
150
100
50
0
-50
-100
-150
4
5
6
7
8
9
Scan
Hold Drawing


PlotMS
File
Export
Summary
View
Help
Plot
Flag
Tools
Annotate
Options
Data
Calibration
Axes
Page
Transform
Display
Canvas
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
Add Plot
Reload
Plot
Phase vs. Scan Baseline: DA41@A004 & DA49@A002_19m
Phase (degrees)
150
100
50
0
-50
-100
-150
4
5
6
7
8
9
Scan
Hold Drawing

In the phase versus scan plots, the phase data should look smooth enough that it should appear 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

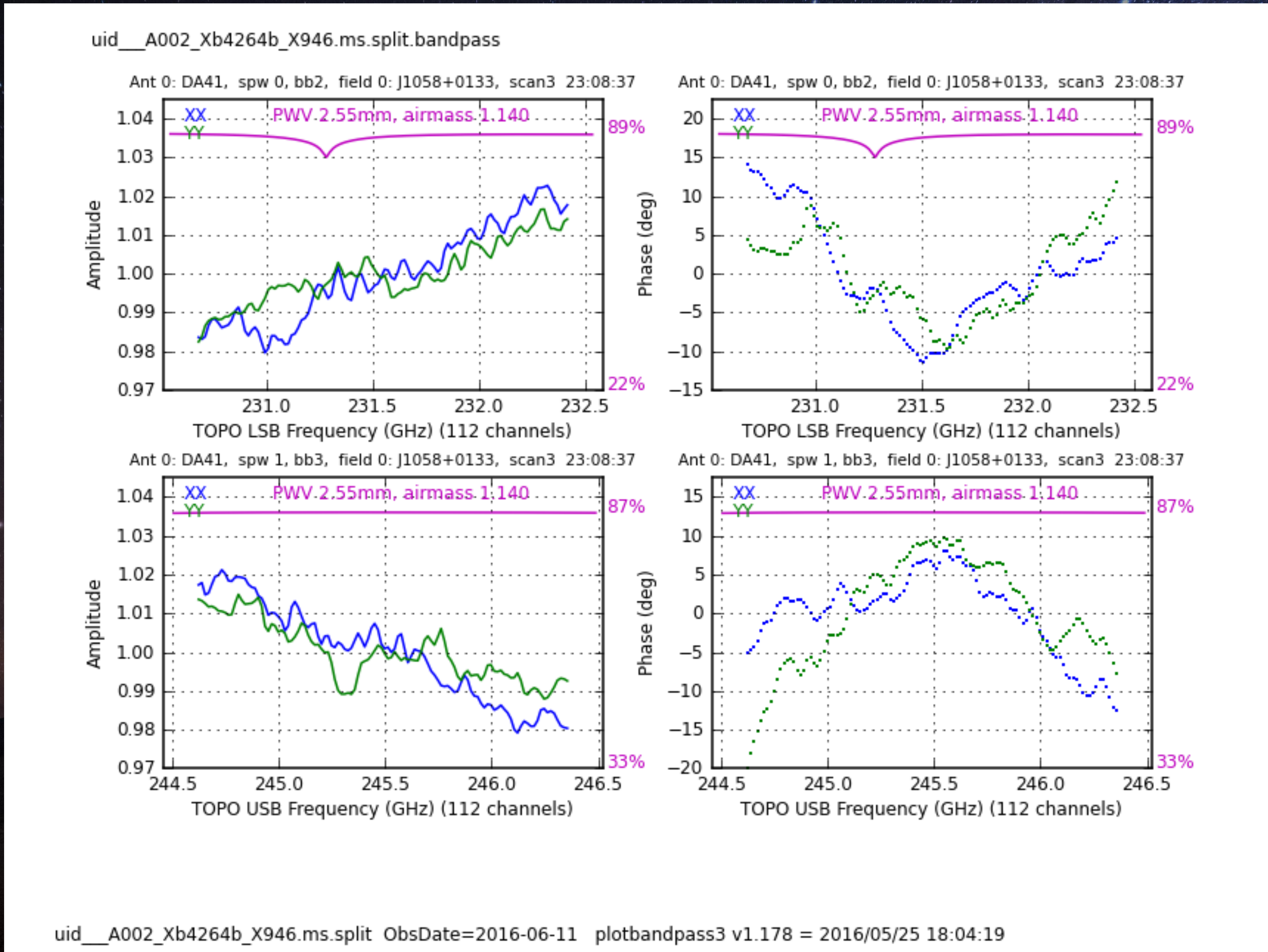
This is one of several steps where the flagging information is saved.

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_Xb4264b_X946.ms.split.bandpass
Ant 0: DA41, spw 0, bb2, field 0: J1058+0133, scan3 23:08:37
Ant 0: DA41, spw 1, bb3, field 0: J1058+0133, scan3 23:08:37
XX
YY
PWV 2.55mm, airmass 1.140
89%
22%
87%
33%
Amplitude
Phase (deg)
TOPO LSB Frequency (GHz) (112 channels)
TOPO USB Frequency (GHz) (112 channels)
uid___A002_Xb4264b_X946.ms.split ObsDate=2016-06-11 plotbandpass3 v1.178 = 2016/05/25 18:04:19

Step 14: Save flags

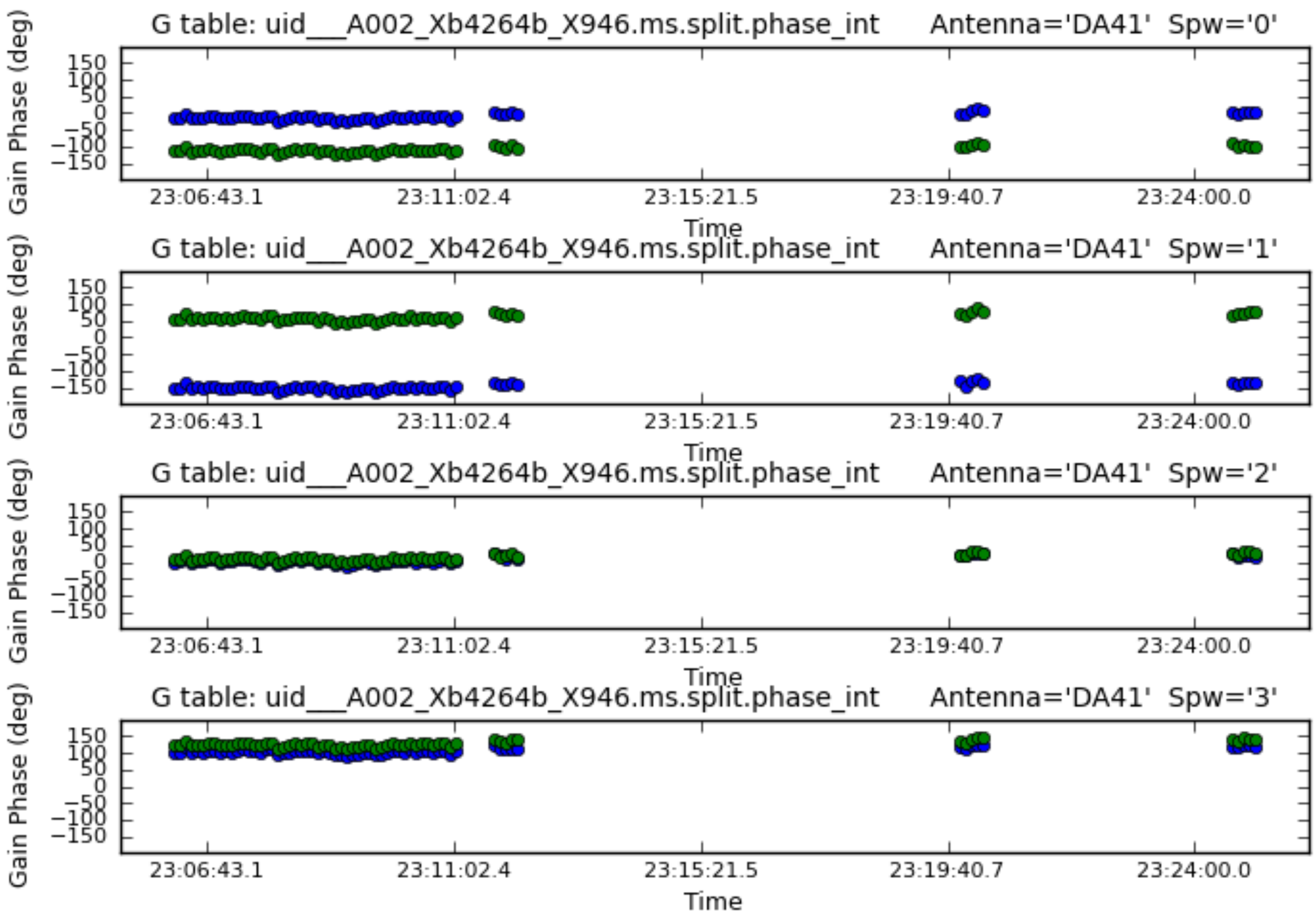
This is one of several steps where the flagging information is saved.

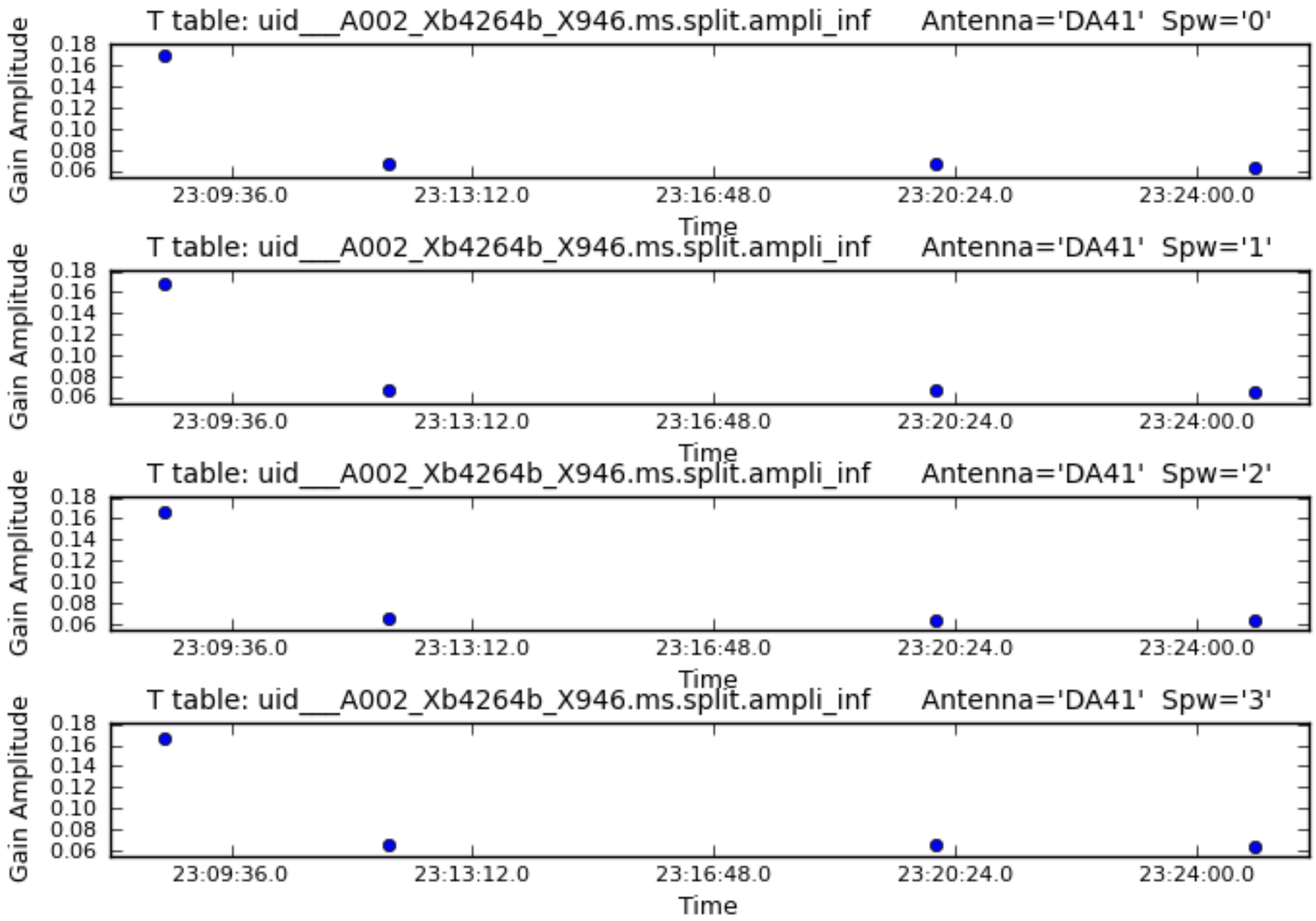
Step 15: Gain calibrations

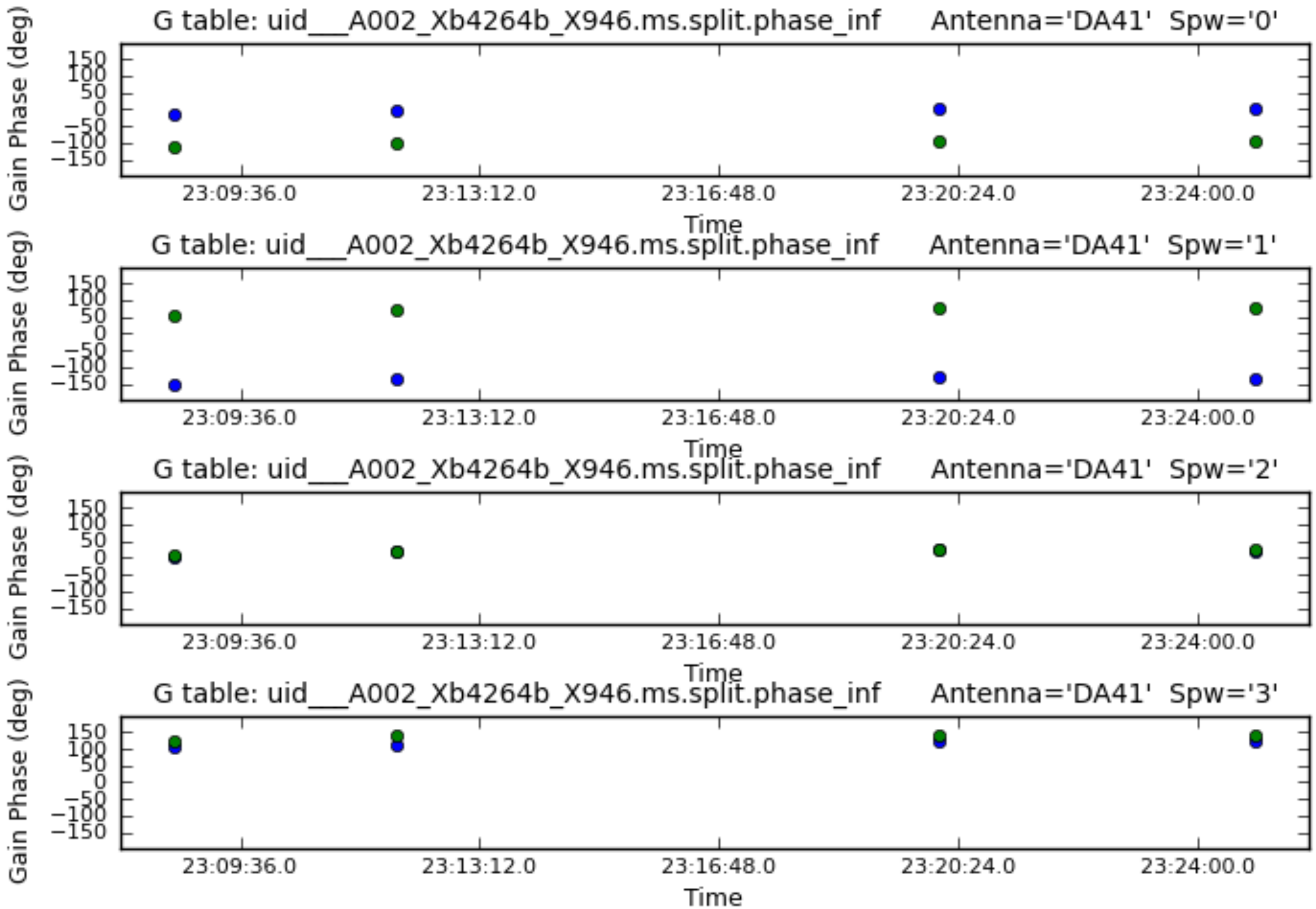
In this step, variations in phase and amplitude versus time are measured and stored in multiple calibration tables.

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 amplitude calibration table is rescaled using the flux data from step 11
- The phase variations versus time are measured by averaging over each scan


G table: uid___A002_Xb4264b_X946.ms.split.phase_int Antenna='DA41' Spw='0'
G table: uid___A002_Xb4264b_X946.ms.split.phase_int Antenna='DA41' Spw='1'
G table: uid___A002_Xb4264b_X946.ms.split.phase_int Antenna='DA41' Spw='2'
G table: uid___A002_Xb4264b_X946.ms.split.phase_int Antenna='DA41' Spw='3'
Gain Phase (deg)
150
100
50
0
−50
−100
−150
23:06:43.1
23:11:02.4
23:15:21.5
23:19:40.7
23:24:00.0
Time


T table: uid___A002_Xb4264b_X946.ms.split.ampli_inf Antenna='DA41' Spw='0'
T table: uid___A002_Xb4264b_X946.ms.split.ampli_inf Antenna='DA41' Spw='1'
T table: uid___A002_Xb4264b_X946.ms.split.ampli_inf Antenna='DA41' Spw='2'
T table: uid___A002_Xb4264b_X946.ms.split.ampli_inf Antenna='DA41' Spw='3'
Gain Amplitude
0.18
0.16
0.14
0.12
0.10
0.08
0.06
23:09:36.0
23:13:12.0
23:16:48.0
23:20:24.0
23:24:00.0
Time



G table: uid___A002_Xb4264b_X946.ms.split.phase_inf Antenna='DA41' Spw='0'
G table: uid___A002_Xb4264b_X946.ms.split.phase_inf Antenna='DA41' Spw='1'
G table: uid___A002_Xb4264b_X946.ms.split.phase_inf Antenna='DA41' Spw='2'
G table: uid___A002_Xb4264b_X946.ms.split.phase_inf Antenna='DA41' Spw='3'
Gain Phase (deg)
150
100
50
0
−50
−100
−150
23:09:36.0
23:13:12.0
23:16:48.0
23:20:24.0
23:24:00.0
Time

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.