



Archive Access / Data Inspection

Post-Observing, Pre-Calibration

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Outline

- After the observations:
 - Obtaining your data from the archive
 - Which CPU processes the data? (Home or NRAO)
 - Examine your data
 - Structure and potential issues: all expected data present, RFI, calibrators, reference antenna...
 - Prepare for calibration steps
 - Use examination to flag bad data upfront
- Better preparation eases the process!**

Assumptions (for all these lectures)

This presentation assumes that you are familiar with
the basics of:

- radio interferometry
- flux density calibration, *antenna-based* calibration (complex gain, bandpass), and self-calibration
- imaging and deconvolution

For references on the above, please check: (these 5 are web links...)

- The lectures of the synthesis imaging workshops:
<https://science.nrao.edu/science/meetings/2014/14th-synthesis-imaging-workshop/>
<https://science.nrao.edu/science/meetings/2016/15th-synthesis-imaging-workshop/>
<https://science.nrao.edu/science/meetings/2018/16th-synthesis-imaging-workshop/>
- Synthesis Imaging for Radio Astronomy II
(eds. Taylor, Carilli, and Perley).
- Interferometry and Synthesis in Radio Astronomy
(by Thompson, Moran, and Swenson).

NRAO versus Local/home computing

- Note that NRAO offers computing facilities for **demanding** projects upon request
 - Registered user (portal <https://my.nrao.edu>)
 - Limited capacity, compete with others, no guarantee
 - See computing policy page
<https://info.nrao.edu/computing/guide/cluster-processing/>
- Here assume **processing at home institute**
 - Data transfer over internet (up to couple of 100 GB)
 - Data shipped on disk (purchase, up to 1.8 TB/disk)

Observing operator logs are available

Sent by email to proposers directly after observation

Stored on web servers:

<http://www.vla.nrao.edu/cgi-bin/oplogs.cgi>

VLA Operators Logs - Mozilla Firefox

VLA Operators Logs

www.vla.nrao.edu/cgi-bin/oplogs.

National Radio Astronomy Observatory

Search NRAO

NRAO Home VLA Tools for Array Operators > Operator Logs

The array operator logs are being merged with the new e2e archive system, this lookup tool has been provided as a stopgap measure to tide us over until the work is done. The logs here are from October 2003 onwards, older logs can be found using the previous tool, [here](#).

To use this tool, select the range of dates you wish to see logs for and hit the 'Show Logs' button. By default it will display logs for the last week.

Start Year 2018 Month Oct Day 04

Stop Year 2018 Month Oct Day 04

Show Logs

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Date	Time	Code	File
2018-10-04	13:57	SOFTWARE	pdf
2018-10-04	13:21	18A-498	pdf
2018-10-04	12:03	18A-342	pdf
2018-10-04	09:32	18A-131	pdf
2018-10-04	08:32	18A-389	pdf
2018-10-04	05:41	TDRW0001	pdf
2018-10-04	04:59	18A-146	pdf
2018-10-04	03:41	18A-342	pdf
2018-10-04	03:12	STARTUP	pdf
2018-10-04	02:12	18A-354	pdf

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Observing operator logs are available

Sent by email to proposers directly after observation

Stored on web servers:

<http://www.vla.nrao.edu/cgi-bin/oplogs.cgi>

VLA OBSERVING LOG 2018-10-04_0541_TDRW0001

Observing Date:	04-Oct-2018	Project:	TDRW0001	# Subarrays:	1	Observation Type:	Test
Configuration:	D	Observer(Pi):	Dr Emmanuel Homijan			Band(s) used:	C S
Decomposition:	27	SBID(s):	35624494				
		Source File(s):	TDRW0001_35624494_1_1				
		Observer E-mail:	emc@jan@nrao.edu				
		Operator(s):	Kenneth Gibson				

Adobe PDF version of this log is located at: <https://www.vla.nrao.edu/operators/logs/>
Visibility data is updated continuously. LST/UT highlight and is available from the online archive at: <https://archive.nrao.edu/>

Time (UTC)	Dew Point (C)	Temp. (C)	Wind Speed & Direction (avg)	Bar. Pressure (millibars)	API RMS Phase (deg/s)	Remarks
04Oct 5:46:30	6.2	17.2	SW at 6.7 m/s	799.7	4.3	Sky cover 20%. Cumuliform clouds.
04Oct 6:46:31	7.0	14.3	SW at 4.7 m/s	799.4	4.7	Sky cover 10%. Striform clouds.

Number of antennas used: 27

Start Time	End Time	Comments/Outages	Form #	#Ants	Down Time (in minutes)
04Oct 5:41:30		Starting project TDRW0001.			
04Oct 5:41:30		The band(s) used is/are: C S.			
04Oct 5:44:06		On source 0137+1331-3C48 with all available antennas.			
04Oct 5:41:30		To access your data from the NRAO archive visit: https://science.nrao.edu/facilities/vla/docs/manuals/obsguide/modes/rf All VLA science data are processed through the VLA calibration pipeline. Details are at: https://science.nrao.edu/facilities/vla/docs/manuals/obsguide/modes/rf For further questions please use the NRAO helpdesk at: https://science.nrao.edu/observinghelpdesk/ Note: To support our ongoing RFI monitoring efforts, any feedback from your program on RFI can be sent to: nrao-rfi@nrao.edu . The key information to provide is: - Observations/project code - Frequency and Time of the observations - The characteristics of the RFI signal, in particular if it is continuous or			

VLA OBSERVING LOG 2018-10-04_0541_TDRW0001

Time (UTC)	Antenna(s)	Comments/Outages	Form #	#Ants	Down Time (in minutes)
04Oct 5:41:30		Intermittent? - If possible, a spectrum of the RFI should be included in the e-mail. Thanks very much for your support; this information will be continuously updated on the EVLA science pages at: https://science.nrao.edu/facilities/vla/docs/manuals/obsguide/modes/rf Antennas in the D-array may be shadowed at low elevations. If shadowing occurs, sensitivity will be affected.			
04Oct 5:41:30		NOTE: The VLA is still recovering from a power outage, and these data may have some artifacts, missing antennas or RFs, etc., in them. NRAO staff will examine the data closely after observing to determine if they meet the criteria for a successful observation.			
04Oct 5:41:30	04Oct 8:32:51	Antenna(s) 5 (Data: Corrupted): S-band receiver cooling after work performed, currently 65/177K.		PHD111100	WD-950 0.97 165.4
04Oct 5:41:30	04Oct 8:32:51	Antenna(s) 12 (Data: Corrupted): C-band receiver warm for cool head replacement. Your new operator(s) is/are: Sam Gilmore		CRYOGEN00	PM 0.03 5.8
04Oct 5:57:00					
Project End Time		Total Project Time (minutes x 27 antennas)		Down Time % of Total Time	Total Down Time
04Oct 8:32:51	End of project TDRW0001	4626.5		3.7%	171.2

Antenna 5 (&12) potential issues

Obtaining data from the NRAO archive

The *current* archive tool and
the *new* archive tool

(improvements in progress)

The NRAO Data Archive Tool

<https://science.nrao.edu/facilities/vla/>

→ Data Archive (left menu), VLA/VLBA Archive

The screenshot shows a Mozilla Firefox browser window displaying the NRAO website. The browser's address bar shows the URL <https://science.nrao.edu/facilities/vla/>. The website header includes the NRAO logo, the text "National Radio Astronomy Observatory", and navigation links for "Home", "About NRAO", "Science", "Observing", "Opportunities", "SRDP", "VLASS", and "ngVLA". A search bar is also present. The main content area is titled "Facilities > VLA" and features a sidebar menu on the left. The "Data Archive" option in this menu is circled in red. A secondary menu is open over "Data Archive", with the "VLA/VLBA Archive" option also circled in red. The main content area displays information about "The Karl G. Jansky Very Large Array", including a byline "by VLA SUS — last modified Jul 31, 2019 by Emmanuel Momjian" and a status indicator "Status of the VLA :: UP". A "News" section on the right contains two articles: "19 March 2019: Astronomers Find 'Cannonball Pulsar' Speeding Through Space" and "2 April 2019: VLA Makes First Direct Image of Key Feature of Powerful Radio Galaxies". A "VLA Events" section is visible at the bottom right.

The NRAO Data Archive Tool

<https://science.nrao.edu/facilities/vla/>

→ Data Archive (left menu), VLA/VLBA Archive

Facilities > VLA > Data Archive > VLA Data Archive

VLA Data Archive

by [Gustaaf Van Moorsel](#) — last modified Feb 25, 2021 by [Frank Schinzel](#)

Locating and unlocking data

Newly observed data are transferred to the archive and available for retrieval to those with the appropriate privileges approximately 10 minutes after the end of the observations. The archive content can be accessed via the "legacy" Archive Access Tool (AAT) or via a next generation AAT. On request, NRAO will ship data on physical hard disks, subject to the conditions of our [Data Shipment Policy](#). **NOTE: The NRAO has temporarily suspended the option to ship data on hard disks during the COVID-19 pandemic.**

Contents

1. [Locating and unlocking data](#)
2. [Data Formats and Data Retrieval](#)
3. [New Archive Access Tool](#)
4. [Creating UVFITS Formatted Files](#)

Instructions to create UVFITS from the SDM or CASA format are given below.

New Archive Access Tool

NRAO continues to recommend using the "[legacy archive](#)" to retrieve data from all VLA observations. However, pipeline and SRDP data products can only be accessed through the [new archive access tool](#).

The NRAO is currently developing a new portal for accessing data from VLA and VLBA observations. Observers are welcome to try using the "[new archive](#)" to retrieve their VLA data.

The [new archive](#) will eventually become the only tool for accessing all VLA and VLBA data. Any observers who decide to try using the new archive while it is under development and find problems are asked to try the legacy archive and report their issues to the NRAO via the [helpdesk](#).

Current known [limitations/features](#) include:

- All visitor computing account holders can no longer request data directly to be deposited in their accounts, as is possible with the legacy archive tool.

https://data.nrao.edu

National Radio Astronomy Observatory
Enabling forefront research into the Universe at radio wavelengths

Archive Access Tools Book

Log In Legacy Archive About

Search

Show Search Inputs

View Projects View Observations View Images



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Show 25 of 8251 Projects

Project	Instrument	Title	First Obs	Last Obs	Execution Blocks
BF119	VLBA	An Optimal Search Strategy For FRBs	2016-08-18 20:51	2017-06-05 16:34	274 execution blocks
UF001	VLBA	No title found	2017-01-16 23:28	2017-10-22 13:48	20 execution blocks
BD192	VLBA	MSPSRPI: VLBI astrometry of millisecond pulsars	2016-08-03 00:09	2018-01-09 01:07	419 execution blocks
DQ718	VLBA	No title found	2017-05-04 07:45	2017-05-04 09:11	1 execution blocks
BT139	VLBA	Magnetic Fields and Exoplanets in AGB Environments: Deep Observations with HSA	2017-05-21 20:15	2017-07-09 02:05	4 execution blocks
BB379	VLBA	SN 2016coi: A Rare Chance to Resolve a Nearby Supernova	2017-05-22 06:30	2017-05-22 14:29	1 execution blocks
UD001	VLBA	No title found	2017-01-08 23:57	2018-07-23 10:35	24 execution blocks
TR031	VLBA	No title found	2017-04-26 18:00	2017-09-27 20:35	5 execution blocks
TC026	VLBA	No title found	2017-05-25 13:00	2017-05-25 13:39	1 execution blocks
DQ720	VLBA	No title found	2017-05-18 06:30	2017-05-18 07:55	1 execution blocks
BP221	VLBA	Mrk1018: Binary black hole interaction of transient jet ejection?	2017-05-12 18:19	2018-03-02 00:03	12 execution blocks

https://data.nrao.edu

▲ Hide Search Inputs ▲

Dates From:  **Dates To:** 

Start Frequency: GHz ▾ **End Frequency:** GHz ▾

Coordinate Frame: ▾ **Equinox:** ▾ **Right Ascension** **Resolver** 🔍 **Declination** **Resolver** 🔍

HMS ▾ DMS ▾

Radius: " ▾ **Source Name:**

Telescope: **Array Configuration:** **Receivers:** **Polarizations:**

Project Code: **Archive Filename:** **PI Name:** **Title Text:**

Abstract Text:

Project Code:

Archive Filename:

PI Name:

Title Text:

tdrw0001

Abstract Text:

Search

Clear

▲ Hide Search Inputs ▲

View Projects

View Observations

View Images

Project

Instrument

Title

First Obs

Last Obs

TDRW0001

VLA

No title found

2018 10 03 05:22

2018 11 07 13:43

3 execution blocks

Title: No title found

Abstract: No abstract found

PI: Emmanuel Momjian

Co-Authors: Frank Schinzel, Emmanuel Momjian

Observations

Images

0/10: selected (0/10.0 TB)

View Selection(s)

Clear All

Download

Archive File

Project

Instrument

Observation Start

Observation Stop

File Size

Array Config

Bands

Type

Cals

Scans

TDRW0001.sb35770743.eb35774735.58429.44719293981

TDRW0001

VLA

18-11-07 10:44:06

18-11-07 13:43:32

15.927 GB

D

Ka, X

visibility

59

TDRW0001.sb35624494.eb35628826.58395.23719237269

TDRW0001

VLA

18-10-04 05:41:34

18-10-04 08:32:43

12.446 GB

D

C, S

visibility

25

TDRW0001.sb35624494.eb35625702.58394.22234046296

TDRW0001

VLA

18-10-03 05:22:58

18-10-03 05:54:22

567.555 MB

D

C, S

visibility

8

<https://data.nrao.edu>

Observation ID: TDRW0001.sb35770743.eb35774735.58429.44719293981

Obs ID: TDRW0001.sb35770743.eb35774735.58429.44719293981

Project Code: TDRW0001

Estimated Size: 15.927 GB

Obs Release Date: 2018-11-07T13:43:32.001Z

Data Product Type: visibility

Receiver Band: Ka, X

Array Configuration: D



Longitude	Latitude	Target Name	Min Frequency	Max Frequency	Scan Intent	Polarizations	Temporal Res
13h31m8.288s	30°30'32.959"	1331+305=3C286	8.3320000 GHz	8.4600000 GHz	["CALIBRATE_POINTING"]	["RR, RL, LR, LL"]	1.044
9h54m56.824s	17°43'31.222"	J0954+1743	8.3320000 GHz	8.4600000 GHz	["CALIBRATE_POINTING"]	["RR, RL, LR, LL"]	1.053
9h47m57.382s	13°16'40.660"	IRC+10216	36.3115447 GHz	36.8677209 GHz	["OBSERVE_TARGET"]	["RR, RL, LR, LL"]	3.053
9h47m57.382s	13°16'40.660"	IRC+10216	36.3115447 GHz	36.8677209 GHz	["OBSERVE_TARGET"]	["RR, RL, LR, LL"]	3.022
9h54m56.824s	17°43'31.222"	J0954+1743	36.3115447 GHz	36.8677209 GHz	["SYSTEM_CONFIGURATION"]	["RR, RL, LR, LL"]	3.322
9h47m57.382s	13°16'40.660"	IRC+10216	36.3115447 GHz	36.8677209 GHz	["OBSERVE_TARGET"]	["RR, RL, LR, LL"]	3.022
9h54m56.824s	17°43'31.222"	J0954+1743	36.3115447 GHz	36.8677209 GHz	["CALIBRATE_AMPLI","CALIBRATE_PHASE"]	["RR, RL, LR, LL"]	3.095
9h47m57.382s	13°16'40.660"	IRC+10216	36.3115447 GHz	36.8677209 GHz	["OBSERVE_TARGET"]	["RR, RL, LR, LL"]	3.022
9h47m57.382s	13°16'40.660"	IRC+10216	36.3115447 GHz	36.8677209 GHz	["OBSERVE_TARGET"]	["RR, RL, LR, LL"]	3.053
9h54m56.824s	17°43'31.222"	J0954+1743	36.3115447 GHz	36.8677209 GHz	["CALIBRATE_AMPLI","CALIBRATE_PHASE"]	["RR, RL, LR, LL"]	3.095
9h54m56.824s	17°43'31.222"	J0954+1743	36.3115447 GHz	36.8677209 GHz	["CALIBRATE_AMPLI","CALIBRATE_PHASE"]	["RR, RL, LR, LL"]	3.097
9h47m57.382s	13°16'40.660"	IRC+10216	36.3115447 GHz	36.8677209 GHz	["OBSERVE_TARGET"]	["RR, RL, LR, LL"]	3.053

<https://data.nrao.edu>

Project Code:

Archive Filename:

PI Name:

Title Text:

tdrw0001

Abstract Text:

Launch Workflow Task on: TDRW0001

User Email (required):

Isjouwer@nrao.edu

Request Description:

VLA Processing Request

Destination Directory:

Specify directory (must be logged in & staff)

/lustre/

Create tar file:

Return results as a tar file

Choose download data format:

- SDM tables only (metadata only)
- SDM-BDF dataset (metadata + visibilities)
- Basic Measurement Set (uncalibrated)
- Calibrated Measurement Set

Apply telescope flags:

Apply flags generated during observing

Scan Intents:

Click to Select

CASA Version:

5.4.2-8 (recommended) ▾

Cancel

Submit Request

0/10: selected (0/10.0 TB)

View Selection(s)



Clear All



Download

Archive File

TDRW0001.sb35770743.eb35774735.58429.4471929

TDRW0001.sb35624494.eb35628826.58395.2371923

TDRW0001.sb35624494.eb35625702.58394.2223404

Cals Scans

59

25

8

Science Data Model

Launch Workflow Task on: 19B-225

- SDM native VLA data format
 - Header tables (XML, meta)
 - Scan data (BDF, binary)
- CASA Measurement Set (MS)
 - Basic (SDM \implies MS, with flags?)
 - Online, Shadow, Zero
 - Calibrated (VLA CASA pipeline)
 - CASA version dependent !
- SDM/MS are data directories
 - “tar” for downloading over internet
(but requires twice the disk space)
 - Alternatively, use “wget”

User Email (required):

Request Description:

EVLA Processing Request

Destination Directory:

Specify directory (must be logged in & staff)

/lustre/

Create tar file:

Return results as a tar file

Choose download data format:

- SDM tables only (metadata only)
 SDM-BDF dataset (metadata + visibilities)
 Basic Measurement Set (uncalibrated)
 Calibrated Measurement Set

Apply telescope flags:

Apply flags generated during observing

CASA|Pipeline Version:

6.1.2-7 | 2020.10.36 (recommended) ▾

Restore previous CMS

19B-225_2020_01_07_T17_01_05.711.tar ▾

Estimated Processing Time: 10

Cancel

Submit Request

The Archive Tool

<https://archive.nrao.edu/>

Log in for **proprietary data** here →

Unlock my data : [Login to My NRAO.edu](#) | [Logout](#)

[Archive Home](#) | [Basic Search](#) | [Advanced Search](#) | [Image Search](#) | [Description](#) | [Archive Policy](#) | [Archive Status](#) | [Archive Tools](#) | [Future Goals](#) | [VLA Images](#) | [VLBA Sources](#) | [Downloads](#) | [Hard Disks](#)

In order to unlock your proprietary data and have access to other archive tools, you must log in to your My.NRAO account.

NRAO Science Data Archive : Advanced Search Tool

Historical VLA, Jansky VLA, VLBA and GBT Data Products

Submit Query

Check Query

Clear Form

Output Control Parameters :

Choose Query Return Type :

- Download Archive Data Files
- VLA Observations Summary
- List of Observation Scans
- List of Projects

Output Tbl Format: Sort Order Column 1: Asc ↓
Max Output Tbl Rows: Sort Order Column 2: Asc ↓

General Search Parameters :

Telescopes: All Jansky VLA Historical VLA VLBA GBT

Project Code: Project Session: Dates From:
Observer Name: Archive File ID: To:
(partial strings allowed)

Position Search :

Target Name: Search Type: Min. Exposure: (secs)
RA or Longitude: DEC or Latitude: Equinox: ↓
Search Radius: - OR - Check for automatic VLA field-of-view, freq. dependent.??
(1d00'00" or 0.2d)

Observing Configurations Search :

Telescope: All A AB BnA B BC CnB
Config: C CD DnC D DA E
Sub_array: All 1 2 3 4 5
Polarization: ↓
Data Type: ↓
Observing Bands: All 4 P L S C
 X U K Ka Q W
Frequency Range: (In MHz : 1665.401 - 1720.500)

Query return

- For each match, the archive query return presents per observation (i.e. per row):
 - The observing run identifier (i.e., the SB name)
 - Any data quality issues (highlighted in yellow/red)
 - The SDM-BDF set (content of the SDM directory)
 - The individual scans with their details
 - The operator log (usually, also sent by email)

Archive File	Status	Project	Seg	Obs. Data Starts	Obs. Data Stops	File Size	Telescope: config:sub"	Bands	Format	Type	Data Qual	View Scans	Logs etc.
<input type="checkbox"/> 11A-291.sb4911125.eb4924302.55782.00136674769	public	11A-291	x	11-Aug-09 00:02:01	11-Aug-09 01:01:45	42.46GB	VLA:A:0	L	SDMset	raw	OK	Scans	Logs
<input type="checkbox"/> 11A-291.sb4911125.eb4944094.55784.99251239583	public	11A-291	x	11-Aug-11 23:50:07	11-Aug-13 02:14:44	30.29GB	VLA:A:0	L	SDMset	raw	OK	Scans	Logs
<input type="checkbox"/> 11A-291.sb4910900.eb4947827.55787.6933925	public	11A-291	x	11-Aug-14 16:39:27	11-Aug-14 18:39:07	78.96GB	VLA:A:0	L	SDMset	raw	info	Scans	Logs
<input type="checkbox"/> 11A-291_sb4911125_2.55795.922649976856	public	11A-291	x	11-Aug-22 22:08:44	11-Aug-22 23:08:30	36.44GB	VLA:A:0	L	SDMset	raw	OK	Scans	Logs
<input type="checkbox"/> 11A-291_sb4911125_3_000.55804.894766516205	public	11A-291	x	11-Aug-31 21:28:29	11-Aug-31 22:28:18	39.47GB	VLA:A:0	L	SDMset	raw	OK	Scans	Logs

Scan listing:

Scan details (source, date, setup, etc)

Project	Scan :sub	Source	Cal Code	Start Time	Stop Time	Sys	TOS (sec)	Intrvl (sec)	Scan Intent	Spect Win	Obs_Freq (MHz)	Bandw (MHz)	Polar	Spect chans	Corr Mode	Tele:config :sub:nants	RA(J2000)	DEC(J2000)	Archive File
11A-291	1:1	J1120+1420		11-Aug-09 00:02:01	11-Aug-09 00:02:54	UTC	53.5	1	OBS	CD_0:SW_0 CD_0:SW_1 CD_0:SW_2 CD_0:SW_3 CD_0:SW_4 CD_0:SW_5 CD_0:SW_6 CD_0:SW_7 CD_0:SW_8 CD_0:SW_9 CD_0:SW_10 CD_0:SW_11 CD_0:SW_12 CD_0:SW_13 CD_0:SW_14 CD_0:SW_15	998.000000 1062.000000 1126.000000 1190.000000 1254.000000 1318.000000 1382.000000 1446.000000 1506.000000 1570.000000 1634.000000 1698.000000 1762.000000 1826.000000 1890.000000 1954.000000	64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000	RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL	128 128 128 128 128 128 128 128 128 128 128 128 128 128 128 128	WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR	EVLA:A:1:27	11h20m27.807s	+14d20'54.99"	11A-291_sb4911125_eb4924302.55782.00136674769 uid____evla_bdf_1312848123251.bdf
11A-291	2:1	J1120+1420		11-Aug-09 00:02:54	11-Aug-09 00:03:54	UTC	59.8	1	CAL	CD_0:SW_0 CD_0:SW_1 CD_0:SW_2 CD_0:SW_3 CD_0:SW_4 CD_0:SW_5 CD_0:SW_6 CD_0:SW_7 CD_0:SW_8 CD_0:SW_9 CD_0:SW_10 CD_0:SW_11 CD_0:SW_12 CD_0:SW_13 CD_0:SW_14 CD_0:SW_15	998.000000 1062.000000 1126.000000 1190.000000 1254.000000 1318.000000 1382.000000 1446.000000 1506.000000 1570.000000 1634.000000 1698.000000 1762.000000 1826.000000 1890.000000 1954.000000	64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000	RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL	128 128 128 128 128 128 128 128 128 128 128 128 128 128 128 128	WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR	EVLA:A:1:27	11h20m27.807s	+14d20'54.99"	11A-291_sb4911125_eb4924302.55782.00136674769 uid____evla_bdf_1312848123257.bdf
11A-291	3:1	J1120+1420		11-Aug-09 00:03:54	11-Aug-09 00:05:24	UTC	89.8	1	CAL	CD_0:SW_0 CD_0:SW_1 CD_0:SW_2 CD_0:SW_3 CD_0:SW_4 CD_0:SW_5 CD_0:SW_6 CD_0:SW_7 CD_0:SW_8 CD_0:SW_9 CD_0:SW_10 CD_0:SW_11 CD_0:SW_12 CD_0:SW_13 CD_0:SW_14 CD_0:SW_15	998.000000 1062.000000 1126.000000 1190.000000 1254.000000 1318.000000 1382.000000 1446.000000 1506.000000 1570.000000 1634.000000 1698.000000 1762.000000 1826.000000 1890.000000 1954.000000	64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000 64.000	RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL RR,LL	128 128 128 128 128 128 128 128 128 128 128 128 128 128 128 128	WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR WIDR	EVLA:A:1:27	11h20m27.807s	+14d20'54.99"	11A-291_sb4911125_eb4924302.55782.00136674769 uid____evla_bdf_1312848174961.bdf

Download options: data format

- Same data formats:
 - SDM or MS, tar?
- Flagging and averaging options only apply to CASA MS format
 - Decreases data size
 - Apply the flags!
 - May cause coherence loss:
See discussion in VLA Observational Status Summary ([OSS](#))

Jansky VLA datasets

Choose download data format :

CASA MS
 SDM-BDF dataset (all files)
 SDM tables only (no visibilities)

Create tar file : Create MS or SDM tar file

Apply telescope flags : Apply flags generated during observing

Choose online averaging for CASA MS or AIPS FITS : Spectral Averaging (chans)
 Time Averaging (secs)

Select scans for MS or AIPS FITS :

Some final archive notes

- The native SDM-BDF data is always good:
 - May take a while & disk space to convert to MS at home
 - Should be usable for any CASA version available
 - Can also be used for AIPS
- Archive or Pipeline (averaged/flagged/calibrated) data and/or products must use the same CASA version to proceed
 - Calibration tables specific to CASA version
 - Version used should be listed in a file in the download directory in *__asdm2MS.log or *__casalog.log

Requesting data on a hard disk

- NRAO can ship data on hard disks upon request, e.g.:
 - when the size of the data is large (over a few 100 GB)
 - when the internet connection cannot handle the request
- Disk-ordering process is done through the archive/helpdesk
- Data is shipped on a 2 TB disk (which holds 1.8 TB of data)
- Cost: USD **125** per disk, potentially plus shipping cost
- Disk shipment information and policies are posted at <https://science.nrao.edu/facilities/vla/archive/shipment>

COVID-19: suspended

Getting CASA Pipeline Calibrated Data

- Upcoming VLA CASA pipeline talks...
- Note that VLA CASA calibration pipeline products are only available through the new archive
- Request pipelined data products through the *VLA Pipeline department* of the NRAO help desk (<https://help.nrao.edu/>)
 - Download through the internet or ask for a hard disk (purchase)

Loading data into AIPS

- Conversion from the native SDM into UV FITS format is no longer supported through the archive
 - Download the native SDM-BDF from the archive.
 - Use OBIT to load into AIPS using task '*bdf2aips*'.
<http://www.cv.nrao.edu/~bcotton/Obit.html>
 - For more details on the VLA data archive, see
<https://science.nrao.edu/facilities/vla/archive/index>

Examine the visibility data (in CASA)

CASA



- See previous lecture..
- Documentation is available at <http://casa.nrao.edu/> → ‘Using CASA’
- Training material is available at <http://casaguides.nrao.edu>
- For help, use the NRAO help desk at: <http://help.nrao.edu>

CASA 6.1.2-7 will be used at this workshop

- Type “*casa -ls*” to find the exact string
- Then “*casa [-r <version-string>]*” to start

Loading The Data: *importasdm*

If one chooses to download the SDM-BDF (not CASA MS)

- Task *importasdm* converts the SDM-BDF to MS
- *importasdm* only understands VLA online flags:
 - It converts the data into a MS while applying flags.

```
> default importasdm
> inp
> asdm           = 'archive_sdm_directory_name'
> vis           = 'output MS name'
> occur_mode    = 'co'      (or load ca, ao)
> applyflags    = True
> inp
> go
```

Loading The Data: *flagdata*

Additional flags for VLA data:

- Note that if `applyflags = False` (the default in *importasdm*), the flags are written to a `FLAG_CMD` MS table. They can be examined (listed, plotted) and applied by using the task *flagcmd*
- VLA data needs additional flags for shadowing and pure zero data; these flags are applied using the *flagdata* task:

```
> default flagdata
> vis                =          'drw.ms'
> mode               =          'shadow'
> inp
> go
> mode               =          'clip'
> correlation        =          'ABS_ALL'
> clipzeros          =          True
> go
```

Examining Your Data

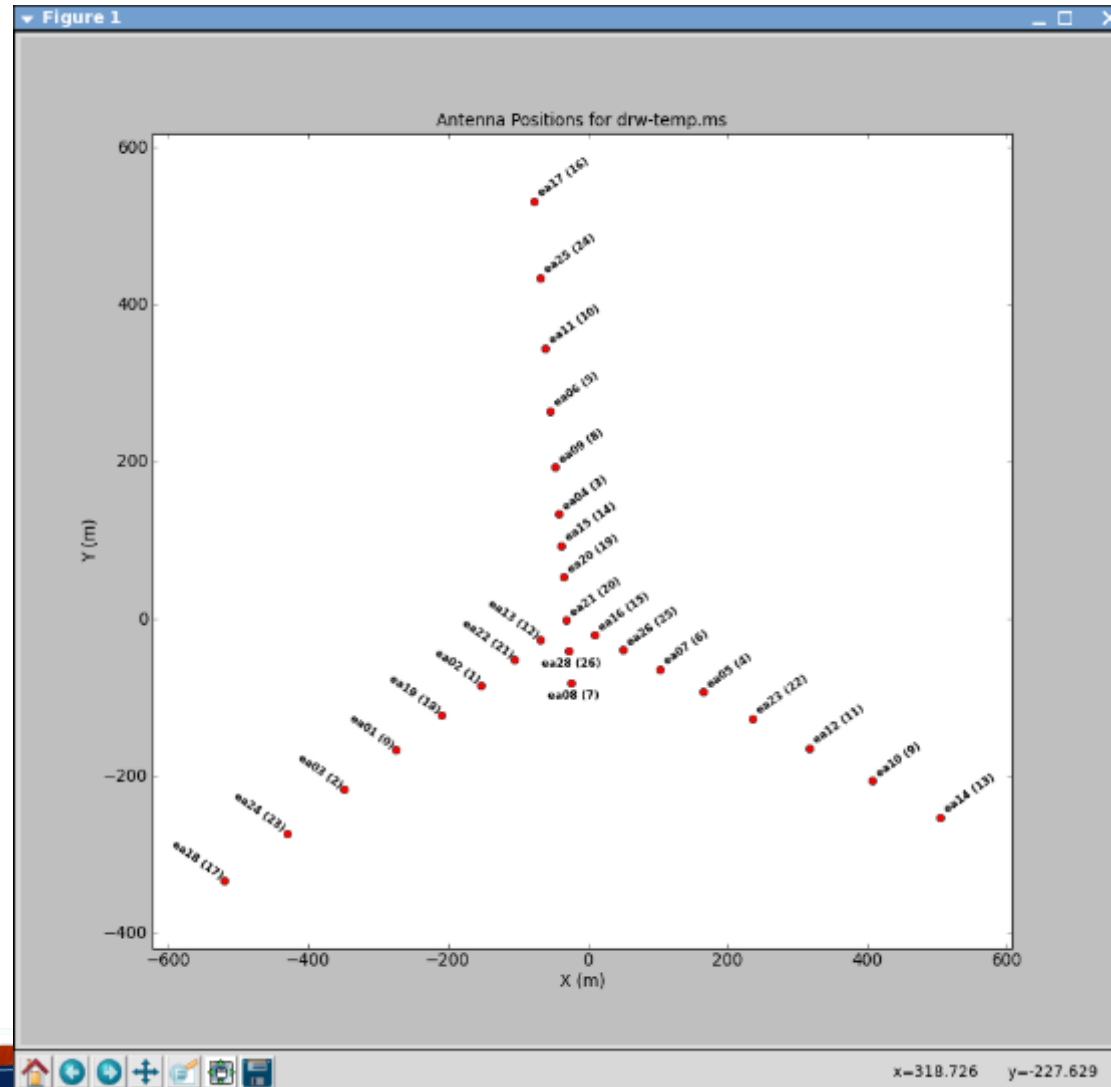
- Operator observing log (email, posted on web)
- Plotting the antenna positions: *plotants*
(potential reference antennas)
- Observing summary: *listobs*
(sources, scans, spectral windows, antennas, etc...)
- Plotting/displaying/editing data: *plotms*

Examine your data carefully before flagging:
That is, know your data content

Plotting the antennas: *plotants*

```
> default plotants  
> inp  
> vis = 'drw.ms'  
> antindex = True  
> inp  
> go
```

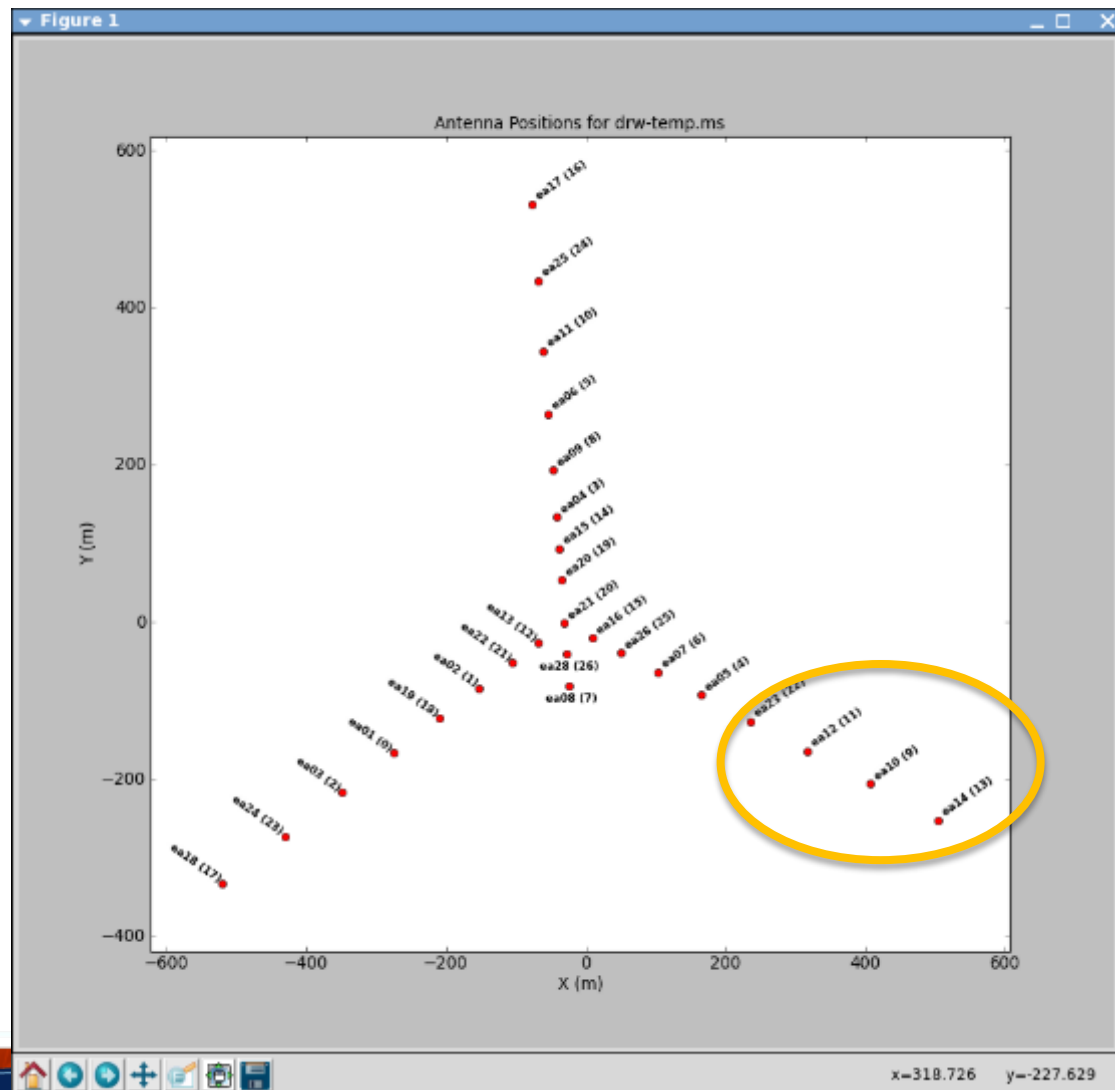
Find a reference antenna for
use in data processing



Choosing the reference antenna

Hints:

- Must have good data on **all calibrator** sources (target scans irrelevant)
 - No antenna “issues”
 - Clean from RFI
- Baselines not too long
 - **Near** physical center of array
(use *listobs/vishead*)
 - e.g. 08-pad [WNE]
A: inner antennas
D: no shadowing
Also don't move..
- Here: **ea10**
(D array, E08, #=9)



Observing summary: *listobs*

```
> Default listobs
> vis = 'drw-temp.ms'
> inp
> go
```

Note:

```
> listfile =
```

ObservationID = 0	ArrayID = 0	Date	Timerange (UTC)	Scan	FldId	FieldName	nRows	SpwIds	Average	Interval (s)
04-Oct-2018/	05:41:35.0 - 05:42:31.0	1	0	0137+331=3C48	39317	[0,1]	[1, 1]	[SYSTEM_CONFIG]		
	05:42:32.0 - 05:47:30.0	2	0	0137+331=3C48	209195	[0,1]	[1, 1]	[SYSTEM_CONFIG]		
	05:47:35.0 - 05:48:30.0	3	0	0137+331=3C48	30881	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	05:48:35.0 - 05:49:00.0	4	0	0137+331=3C48	14040	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	05:49:05.0 - 05:53:25.0	5	0	0137+331=3C48	146016	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	05:53:30.0 - 05:57:55.0	6	1	J2355+4950	148824	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	05:58:00.0 - 06:03:55.0	7	2	J0259+0747	199368	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	06:04:00.0 - 06:18:55.0	8	3	3C75	502632	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	06:19:00.0 - 06:20:10.0	9	2	J0259+0747	39312	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	06:20:15.0 - 06:35:05.0	10	3	3C75	499824	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	06:35:10.0 - 06:36:20.0	11	2	J0259+0747	39312	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	06:36:25.0 - 06:51:20.0	12	3	3C75	502632	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	06:51:25.0 - 06:52:30.0	13	2	J0259+0747	36504	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	06:52:35.0 - 07:07:30.0	14	3	3C75	502632	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	07:07:35.0 - 07:08:45.0	15	2	J0259+0747	39312	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	07:08:50.0 - 07:23:40.0	16	3	3C75	499824	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	07:23:45.0 - 07:26:25.0	17	2	J0259+0747	89856	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	07:26:30.0 - 07:41:25.0	18	3	3C75	502632	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	07:41:30.0 - 07:42:40.0	19	2	J0259+0747	39312	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	07:42:45.0 - 07:57:35.0	20	3	3C75	499824	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	07:57:40.0 - 07:58:50.0	21	2	J0259+0747	39312	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	07:58:55.0 - 08:13:50.0	22	3	3C75	502632	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	08:13:55.0 - 08:15:05.0	23	2	J0259+0747	39312	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	08:15:10.0 - 08:30:00.0	24	3	3C75	499824	[2,3,4,5,6,7,8,9]		[5, 5, 5,		
	08:30:05.0 - 08:32:45.0	25	2	J0259+0747	89856	[2,3,4,5,6,7,8,9]		[5, 5, 5,		

(nRows = Total number of rows per scan)

Field#	ID	Code Name	RA	Decl	Epoch	SrcId	nRows
0	NONE	0137+331=3C48	01:37:41.299431	+33.09.35.13299	J2000	0	439452
1	NONE	J2355+4950	23:55:09.458169	+49.50.08.34001	J2000	1	148824
2	NONE	J0259+0747	02:59:27.076633	+07.47.39.64322	J2000	2	651456
3	NONE	3C75	02:57:42.630000	+06.01.04.80000	J2000	3	4512456

Spectral Windows: (10 unique spectral windows and 1 unique polarization setups)

SpwID	Name	#Chans	Frame	Ch0 (MHz)	ChanWid (kHz)	TotBW (kHz)	CtrFreq (MHz)	BBC	Num	Corrs
0	EVLA_C#A0C0#0	64	TOPO	4832.000	2000.000	128000.0	4895.0000	12	RR	RL LR LL
1	EVLA_C#B0D0#1	64	TOPO	4960.000	2000.000	128000.0	5023.0000	15	RR	RL LR LL
2	EVLA_S#A0C0#2	64	TOPO	2488.000	2000.000	128000.0	2551.0000	12	RR	RL LR LL
3	EVLA_S#A0C0#3	64	TOPO	2616.000	2000.000	128000.0	2679.0000	12	RR	RL LR LL
4	EVLA_S#A0C0#4	64	TOPO	2744.000	2000.000	128000.0	2807.0000	12	RR	RL LR LL

Observing summary: *listobs*

Summary, for example:

- Four sources:
 - 0137+331=3C48
 - 5 scans of which 4 are setup, i.e. 1 scan on Flux calibrator
 - J2355+4950, 1 scan, some calibrator
 - J0259+0747, 10 scans, Gain/phase calibrator
 - **3C75**, 9 scans, source with the most time on source, has the most visibilities so this would be the **target source**
- 8 spectral windows (spw), full polarization products (RR,RL,LR,LL)
 - Ranging 2488 to (3384+128=) 3512 MHz, centered at 3000 MHz
 - 64 channels per spw/pol, each 2 MHz wide
- Using 27 antennas (ea27 is not used)
 - Highest numbered antenna pad is E09/N09/W09: D-array

Data Review: *plotms*

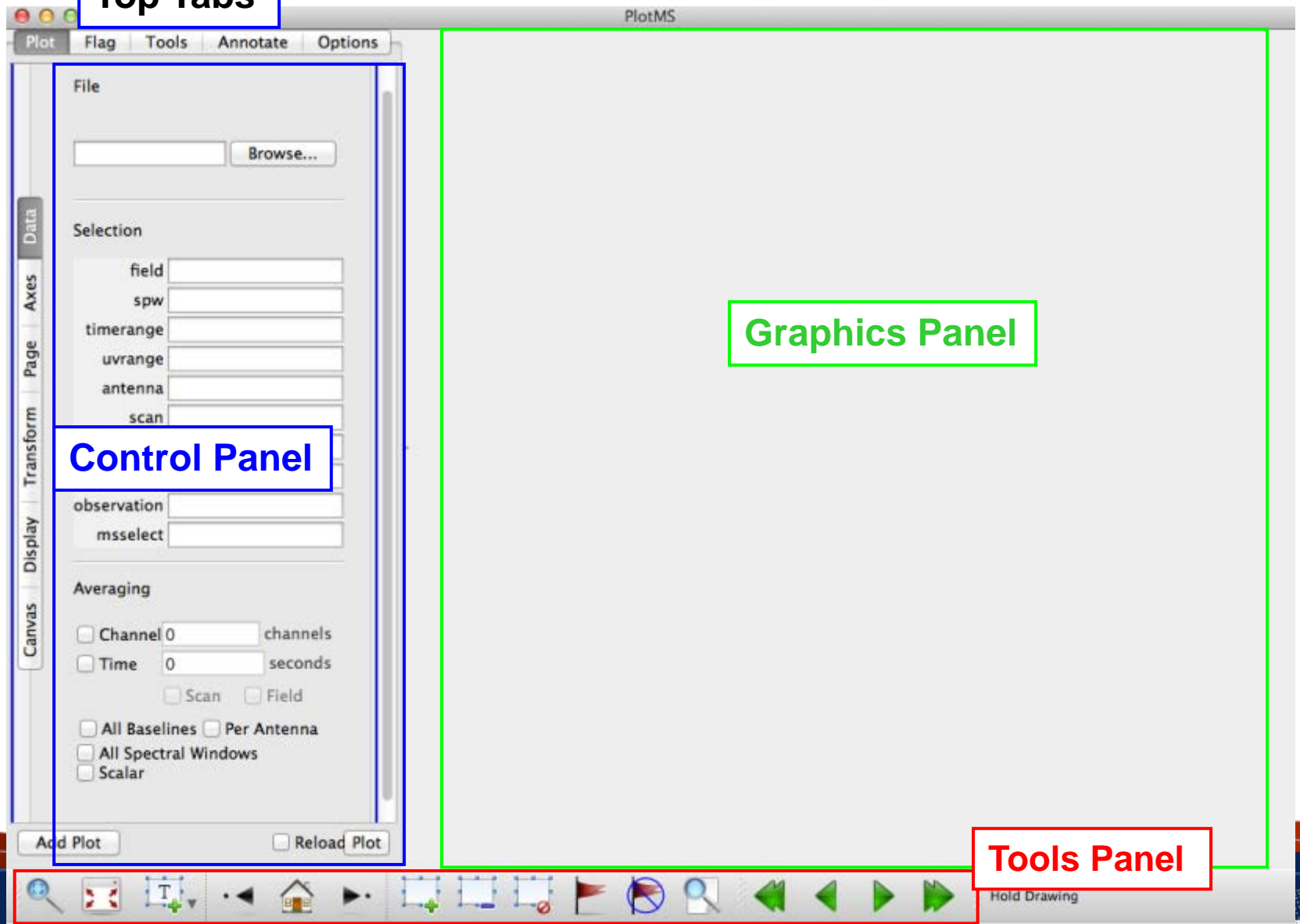
Top Tabs

Side Tabs

Control Panel

Graphics Panel

Tools Panel



Data Review: *plotms*

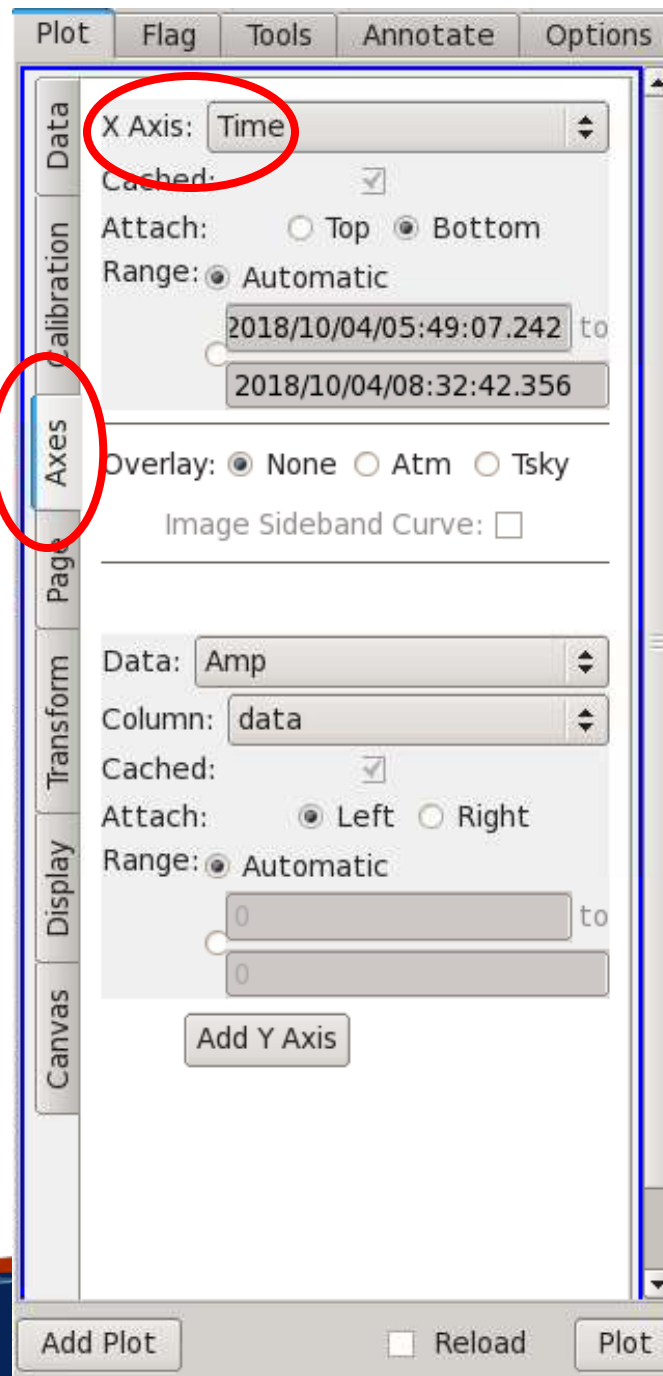
MS Ids and other meta info:

- 'scan' (number)
- 'field' (index)
- 'time',
- 'interval'='timeint'='timeinterval'='time_interval'
- 'spw' (index)
- 'chan'='channel' (index)
- 'freq'='frequency' (GHz)
- 'vel'='velocity' (km/s)
- 'corr'='correlation' (index)
- 'ant1'='antenna1' (index)
- 'ant2'='antenna2' (index)
- 'baseline' (a baseline index)
- 'row' (absolute row Id from the MS)

Visibility values, flags:

- 'amp'='amplitude'
- 'phase' (deg)
- 'real'
- 'imag'='imaginary'
- 'wt'='weight'
- 'flag'
- 'flagrow'

Axes

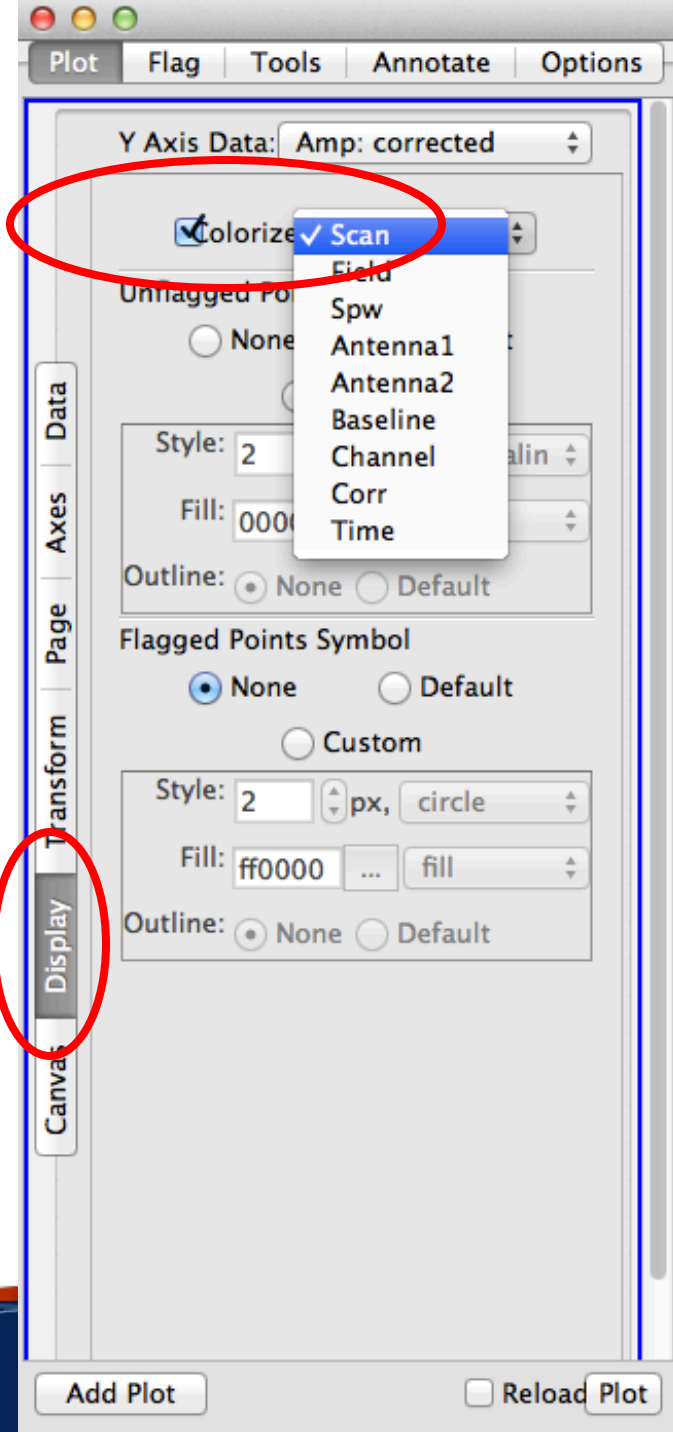


Data Review: *plotms*

Display

Colorize by:

- Scan
- Field
- Spw
- Antenna1
- Antenna2
- Baseline
- Channel
- Correlation
- Time
- Observation
- Intent



Data Review: *plotms*

Multi-page, cycling through/iterate

- Scan
- Field
- Spw
- Baseline
- Antenna
- Time
- Correlation



Tool panel

Plot | Flag | Tools | Annotate | Options

Data
Iteration
Axis: None
Global Axis S Y
Scan
Field Y
Spw
Baseline
Antenna
Time
Corr

Calibration
Shared Y

Page Header
Contents
Filename

Page

Transform

Display

Canvas

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

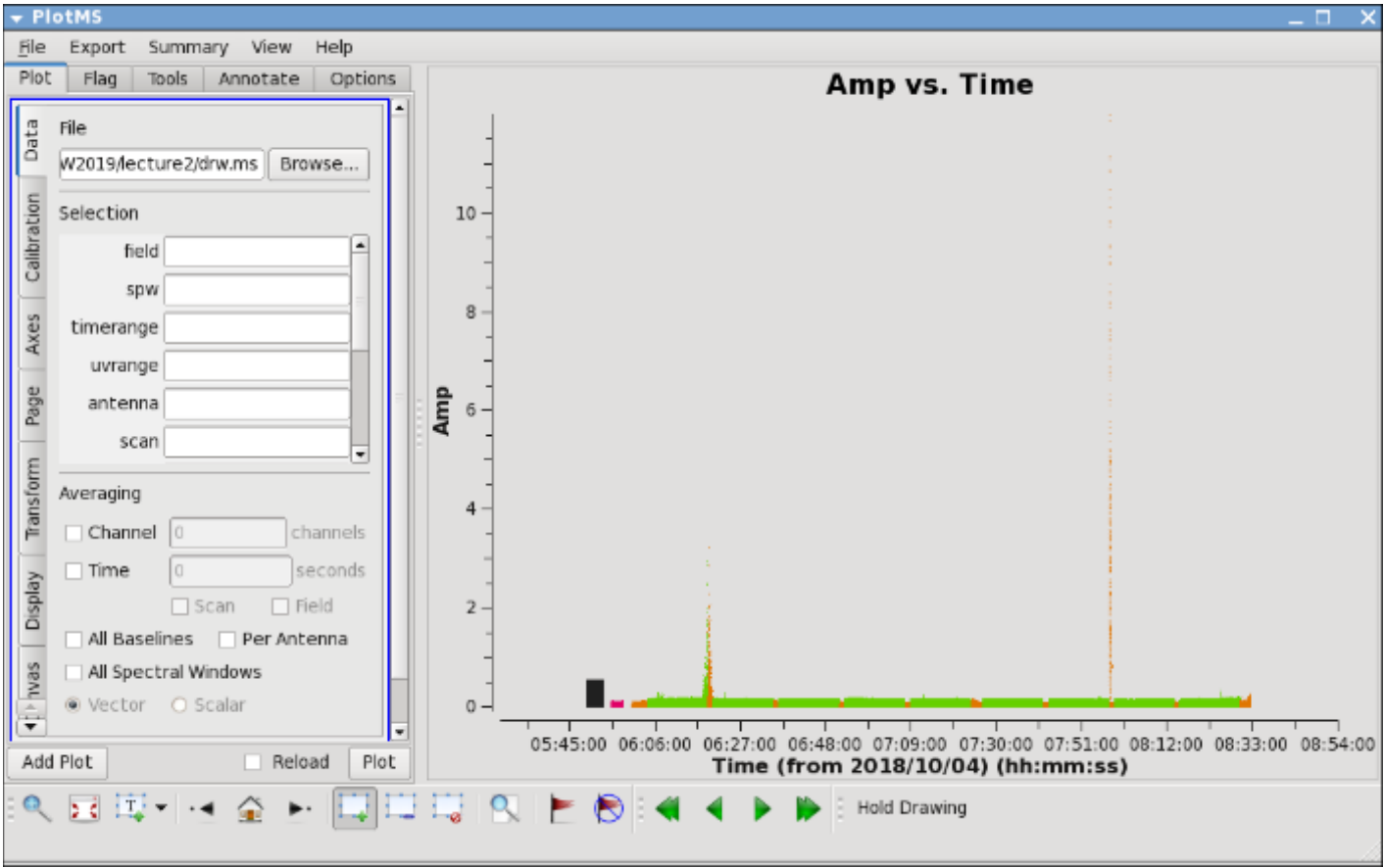
Add Plot | Reload | Plot

What are we looking for?

- A feel of the overall structure of the data (see also the OPT schedule):
 - Calibrators and target visibilities, frequency setup
 - Observing conditions, instrumental response
- Where to expect bad data
 - Specific ill-performing antennas/baseline(boards)
 - In time
 - Start of scans
 - Bad weather/pointing/RFI (observing conditions)
 - In frequency
 - Bandpass, subband edges
 - RFI – not your line!

Data Review: *plotms*

Example: xaxis='time', yaxis='amp,' coloraxis='field'



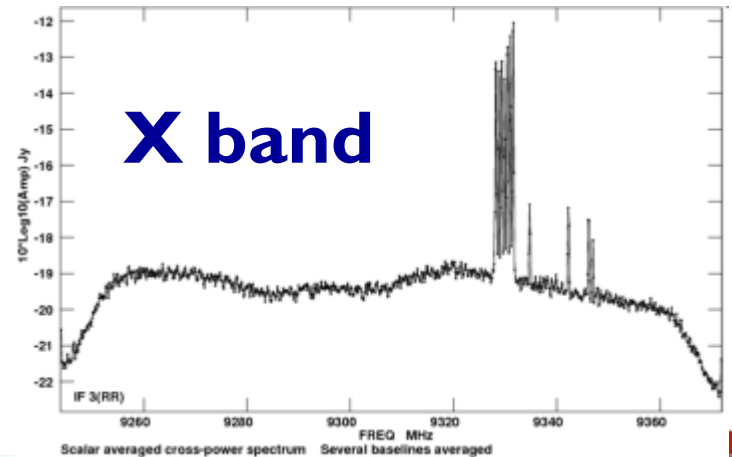
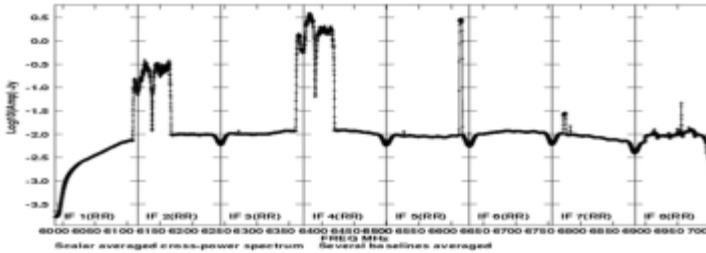
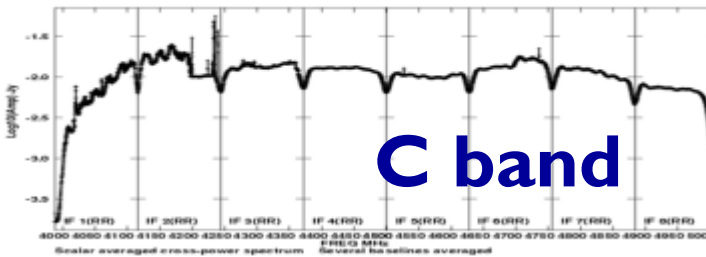
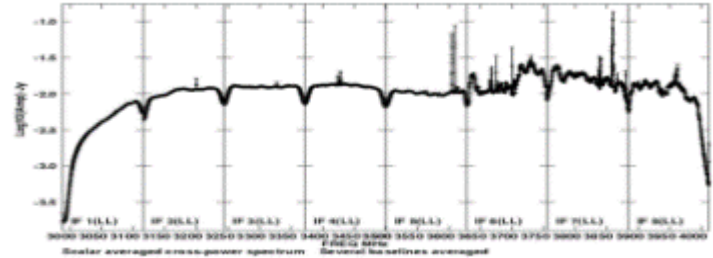
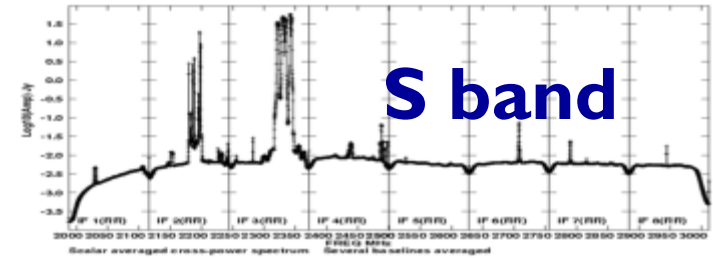
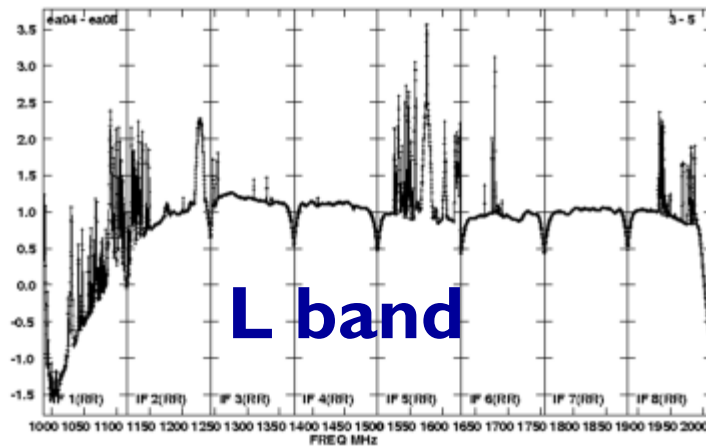
Radio Frequency Interference (RFI)

1. VLA observations, particularly at the lower frequency bands, will be severely affected by RFI.
2. VLA RFI information is available at:

<https://science.nrao.edu/facilities/vla/> → Observing → VLA Observing Guide → #5: Radio Frequency Interference

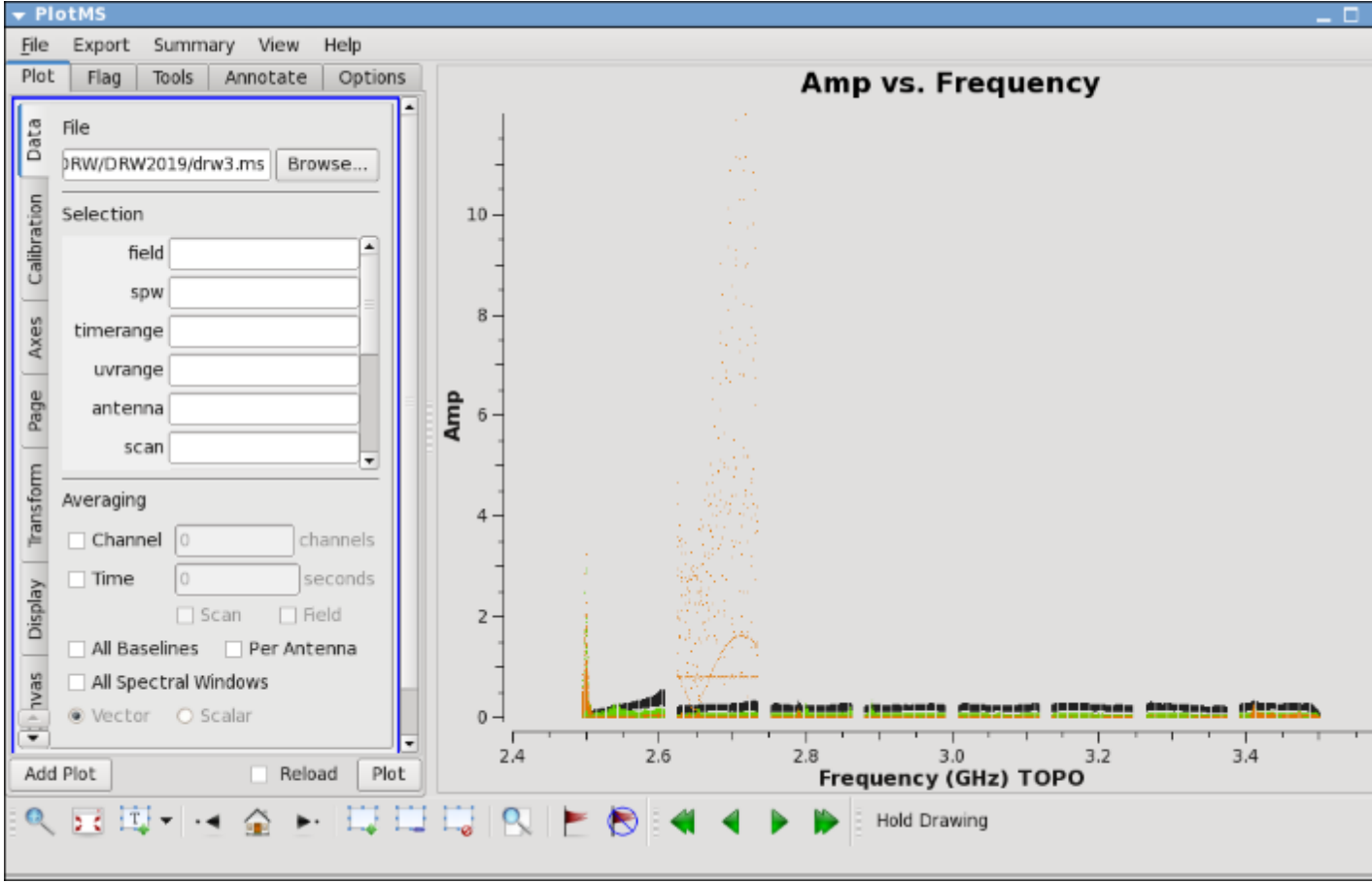
- RFI listings per frequency band.
- Spectra of various RFI sweeps between 1-50 GHz.

RFI is present at lower frequency bands



Data Review: *plotms*

Example: xaxis='frequency', yaxis='amp', coloraxis='field'



Preparing for calibration: editing

Editing/Flagging (or unflagging) Data

1. *flagdata*: All purpose flagging task based on selection.
 - Includes RFI flagging capabilities (RFLAG,TFCROP).
2. *flagcmd*: All purpose flagging task based on commands (alternative to *flagdata* for certain types of flagging).
3. *plotms*: Interactive flagging

Review the VLA operator's log carefully.

Certain issues (e.g., antennas without receivers), do not end up in the online flags, and may need to be flagged manually.

Editing/Flagging (or unflagging) Data

A few important notes

- Data in CASA are either flagged or not flagged.
 - Every MS has a flag column.
 - Every bit of data has its own flag (set either to True or False).
 - Applying flags means setting the flag column entries of the selected bits of data to True – there is no record of what it was before setting to True.
 - Unflagging sets it to False, *regardless* it's immediate previous setting
- **Most** flagging tasks have the option to create a flag backup.
 - In particular *plotms* does not have this option!
- A flag backup is an MS table and contains the state of the flags before running the flagging task.
- With *flagmanager* flag back-ups can be restored (and made)

Editing Data: *flagdata* - Modes

- *list* = apply a list of flagging commands
- *manual* = flagging based on specific selection parameters [default]
- *clip* = clip data according to values
- *quack* = remove/keep specific time range at scan beginning/end
- *shadow* = remove antenna-shadowed data
- *elevation* = remove data below/above given elevations
- *tfcrop* = auto identification of outliers on the time-freq plane
- *rflag* = auto detection of outliers based on sliding-window RMS filters
- *extend* = extend and/or grow flags
- Also *summary* (per antenna, correlation, field, scan, total), and *unflag*.
- Can also flag calibration tables.

Editing Data: *flagcmd*

- It allows listing, plotting, saving, applying, or un-applying flags.
- Flagging modes (*inpmode*) are:
 - *table*: uses the FLAG_CMD MS table (created by *importasdm*)
 - *list*: uses an ASCII file that contains a set of flagging commands.
 - *xml*: uses the online flags from Flag.xml in the MS.
- It allows the user to save the flag records in the FLAG_CMD MS table or a file.

Editing Data: *flagdata* vs. *flagcmd*

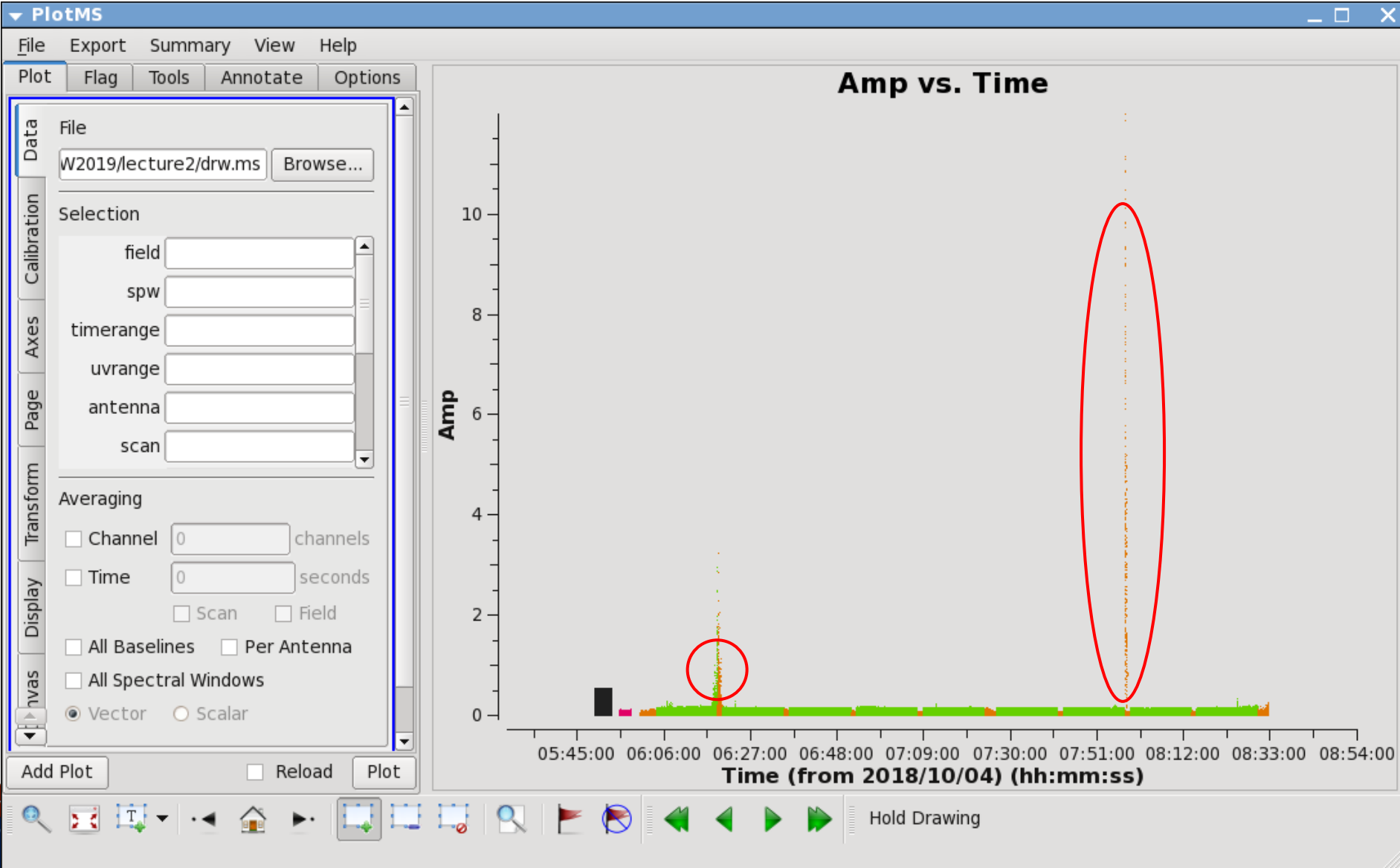
- Complementary flagging tasks.
- Have several common features.
- Some of the important differences:

Flagdata	Flagcmd
RFI flagging (tfcrop, rflag)*	Access to the Flag.xml
Runtime displays* (before and after flagging)	Apply the online (and other) flags in FLAG_CMD MS table
	Plot Flags

* More details on Tuesday (RFI talk)



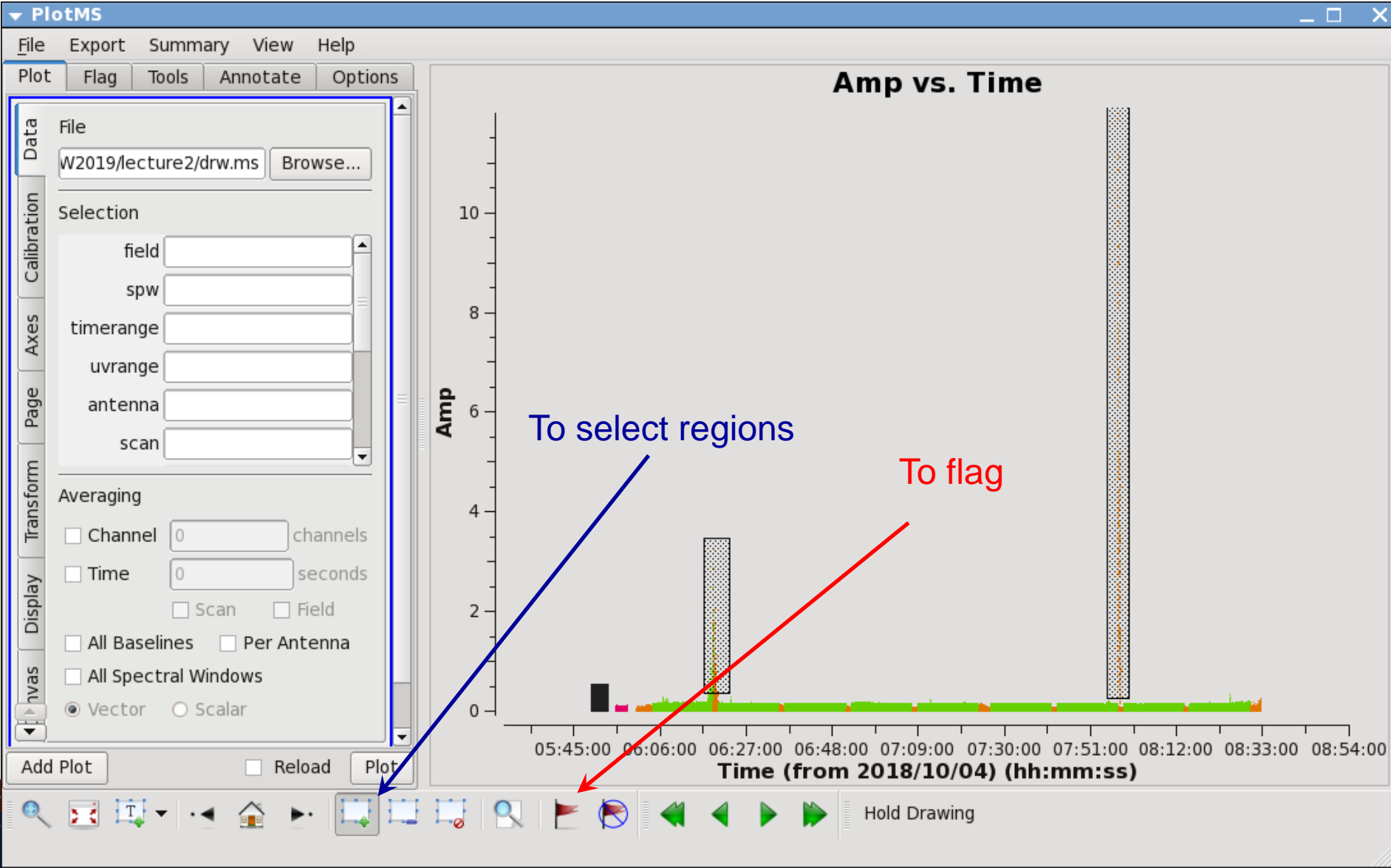
Editing Data: *plotms*



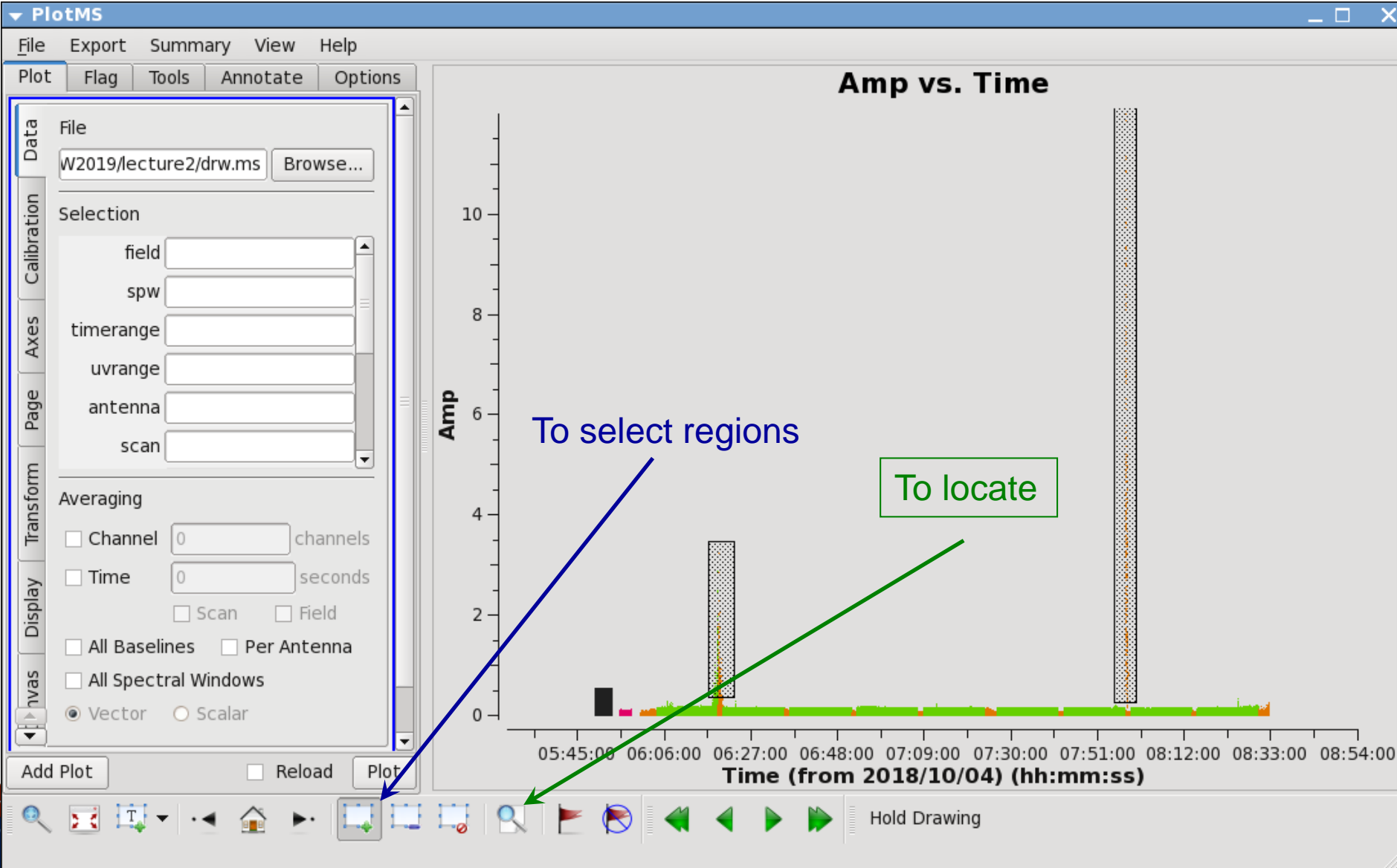
Editing Data: *plotms*

The screenshot displays the PlotMS software interface. On the left is a control panel with several sections: 'Data' (File: W2019/lecture2/drw.ms), 'Calibration' (Selection: field, spw, timerange, uvrage, antenna, scan), 'Averaging' (Channel: 0, Time: 0, Scan, Field, All Baselines, Per Antenna, All Spectral Windows), and 'Display' (Vector, Scalar). Below the control panel are 'Add Plot', 'Reload', and 'Plot' buttons. The main plot area is titled 'Amp vs. Time' and shows a graph of amplitude (Amp) on the y-axis (0 to 10) versus time on the x-axis (05:45:00 to 08:54:00). Two vertical shaded regions are present: a smaller one at approximately 06:27:00 and a larger one at approximately 07:51:00. A blue arrow points from the text 'To select regions' to the 'Plot' button in the toolbar. The toolbar also includes various navigation and editing icons and a 'Hold Drawing' label.

Editing Data: *plotms*

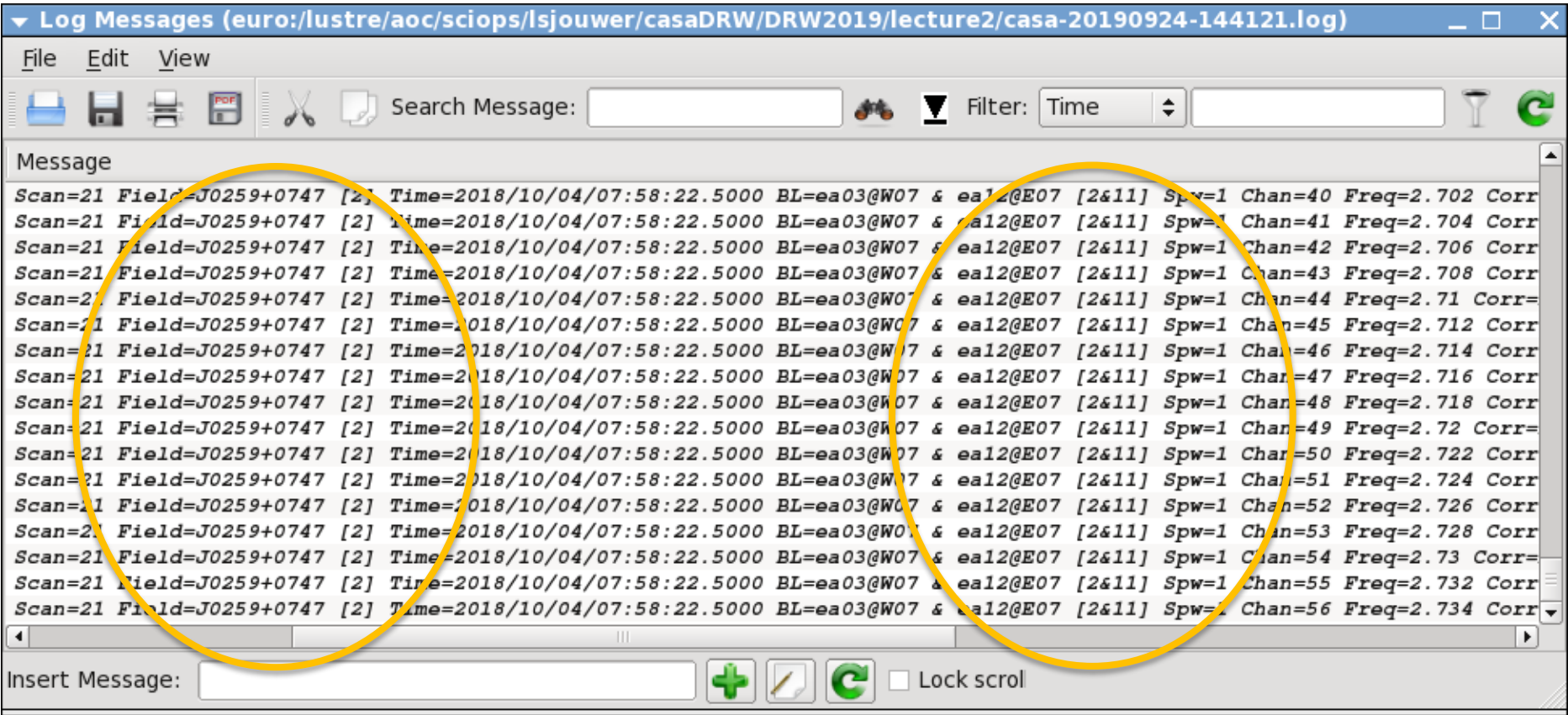


Editing Data: *plotms*



Editing Data: *plotms*

The output of “locate” in the logger – look for common lines



Editing Data: *plotms*

A few important notes

- Use *plotms* carefully for editing data.
- Keep in mind that editing data with *plotms* often requires extending the flags (through the Flag tab).
- *plotms* does not produce a flag backup (*flagmanager* has to be used).
- Use *plotms* to identify bad data (through the locate option). Then flag the bad data using *flagcmd* or *flagdata*.

Ready to calibrate the data?

- ✓ The data structure is understood, reference antenna picked
- ✓ Calibrators (flux density, bandpass, gain) are identified
- ✓ Bad antennas and bad basebands are flagged
- ✓ RFI is removed (as much as possible), Hanning smooth?
- ✓ Bad individual visibilities/baselines/times are flagged
- Maybe inspect (some parts of) the data again to make sure
Likely more flagging may need to be done during/after calibration steps
- **Ready to start with data calibration**
Next lecture...



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