



The VLA Calibration Pipeline

Claire Chandler, NRAO



Pipeline Overview

- With the start of Jansky VLA Full Operations (January 2013), we started a new operational model:
 - Deliver automatically-flagged and calibrated visibility data
 - You will check the calibration, do additional flagging if needed, then self-calibrate and image visibility data to meet science goals, using resources at home institution or NRAO computing resources
- Automated pipeline should run correctly on all “standard” continuum Stokes I science SBs, may work for other set-ups as well
- Current versions available:
 - CASA integrated pipeline is compatible with ALMA pipeline infrastructure, improved diagnostics in weblog, used as real-time pipeline since Sep 2015
 - “scripted” pipeline is a collection of python scripts that use CASA tasks wherever possible, but also uses toolkit calls; readable and easy to modify



Pipeline Operation

- Real-time pipeline:
 - Minimal human intervention
 - Pipeline is run automatically on every science SB as it completes (not just “continuum”)
 - Pipeline output undergoes basic quality assurance checks by NRAO staff, and detailed checks upon request; reports generated are archived as pipeline products
- At your home institution:
 - Instructions for installation and operation of the VLA CASA Calibration Pipeline are available at <http://go.nrao.edu/vla-pipe>
 - Uses CASA 5.1.1, similar to current real-time pipeline
 - See the VLA CASA pipeline guide at <http://go.nrao.edu/vla-casa-tut>
- Scripted pipelines for CASA versions through 5.0.0 also available
 - Provides more flexibility in how to use the pipeline, options suitable for spectral line datasets, mixed correlator set-ups, multi-band observations, etc.



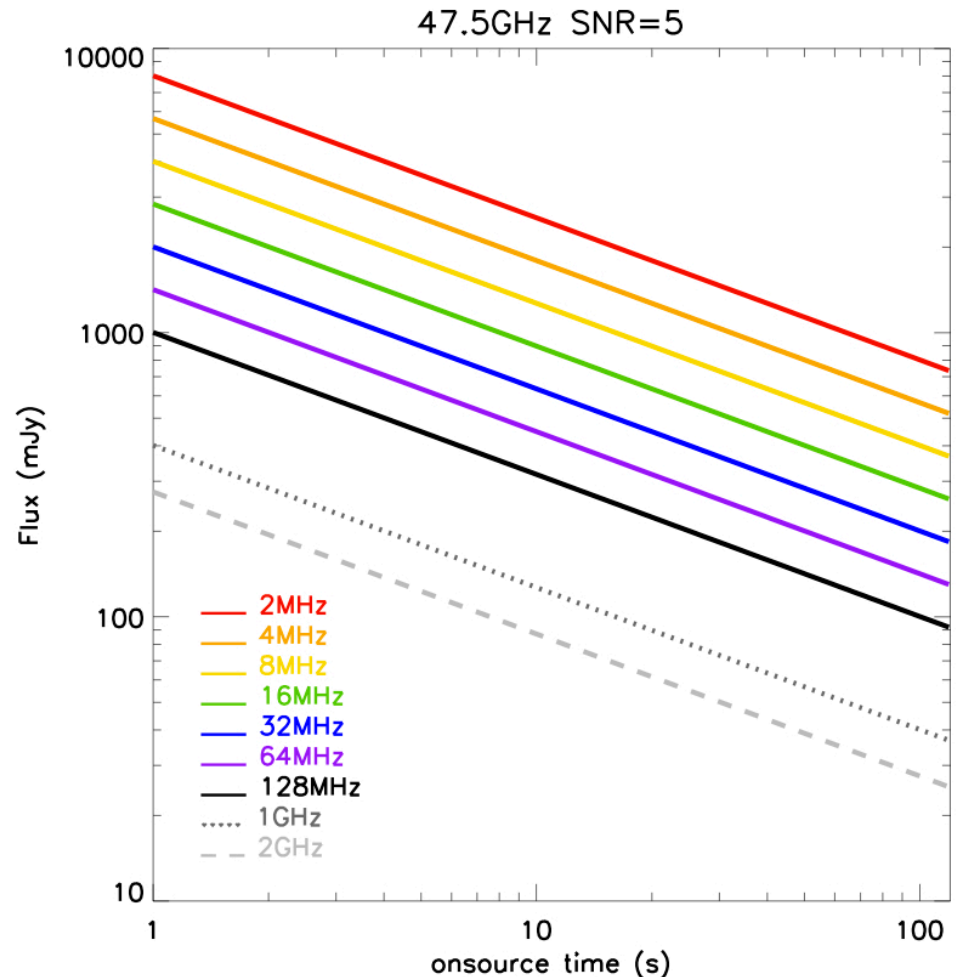
Pipeline Requirements

- Will the pipeline work for you?
 - The pipeline successfully completes on >90% of all science SBs observed on the VLA; whether the output can be used for science depends on the science goal, and whether the observation was correctly set up
 - Pipeline includes Hanning smoothing, RFI flagging, and weight calculations that may not be appropriate for spectral line projects (but can modify scripted pipeline)
 - No polarization calibration in default pipeline yet (but see later...)
 - Will probably work well for data taken since May 2012, may work for earlier EVLA data, likely that extra flagging may be needed in these cases
- “Standard” continuum Stokes I science SB means:
 - 128 MHz spws, but may work on other set-ups as well
 - Can work for narrower BWs, depends on the strength of the calibrators
 - Heuristics currently make some assumptions about the strength of the calibrators, in particular, the delay calibrator
 - Contains correctly labeled and complete scan intents
 - And also that the observation has been set up correctly!



Pipeline Requirements

- Calibrator strength:
 - Conservative limit on strength of BP and complex gain calibrators can be derived from requirement for initial gain calibration to work at high end of Q-band
 - Heuristic for delay calibration currently requires the SNR=3 limit on initial gain calibration *per integration*



Pipeline Requirements

- Correct observation set-up
 - Independent of whether you want to run the pipeline!
 - Remember: simple observing set-ups are always easier to calibrate
 - Do not skimp on calibration to spend more time on your target – you may end up not being able to calibrate the target data at all
 - Spending 3 minutes pointing could buy you more sensitivity than doubling the time on your target
- Scan intents
 - The pipeline relies entirely on correct *scan intents* to be defined in each SB
 - In order for the pipeline to run successfully on an SB it must contain, *at minimum*, scans with the following intents:
 - A flux density calibrator scan that observes one of the primary calibrators (3C48, 3C138, 3C147, or 3C286) – this will also be used as the delay and bandpass calibrator if no bandpass or delay calibrator is defined
 - Complex gain calibrator scans

(Real-Time) Heuristics (I)

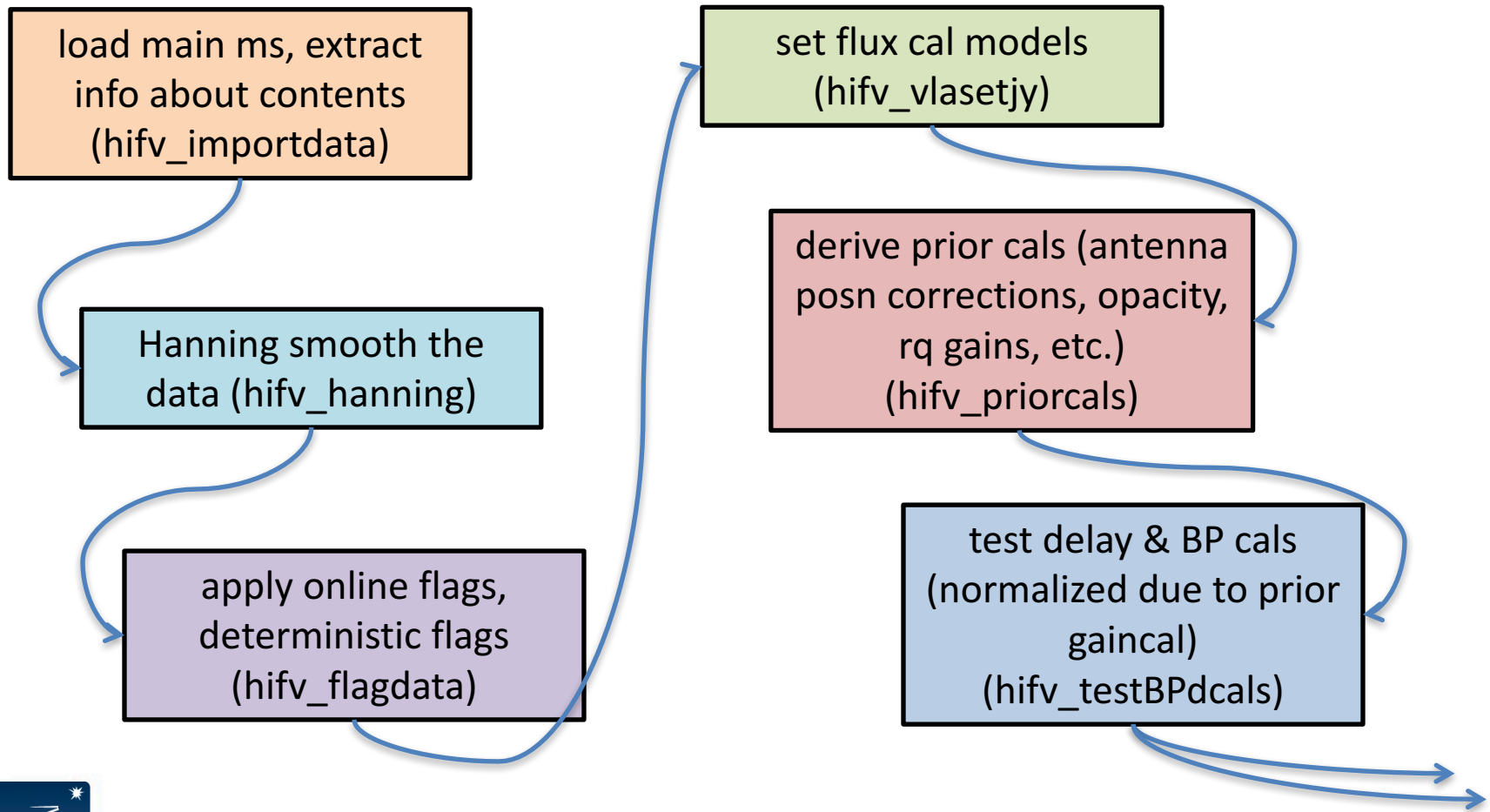
- Assuming requirements are met, the pipeline:
 - Loads the data
 - Hanning smooths*
 - Retrieves information about the observing set-up from the data
 - Applies deterministic flags (online flags, shadowed data, end channels of sub-bands, etc.)
 - Identifies primary calibrators and loads models
 - Derives all prior calibrations (antenna position corrections, gain curves, atmospheric opacity, requantizer gains)
 - Iteratively determines initial delay and bandpass solutions, including running RFLAG (RFI flagging algorithm), and identifying other system (deformatter) problems
- *May want to modify inputs and/or omit entirely for spectral line reductions, depending on level of Gibbs ringing due to RFI or strong emission lines

(Real-Time) Heuristics (II)

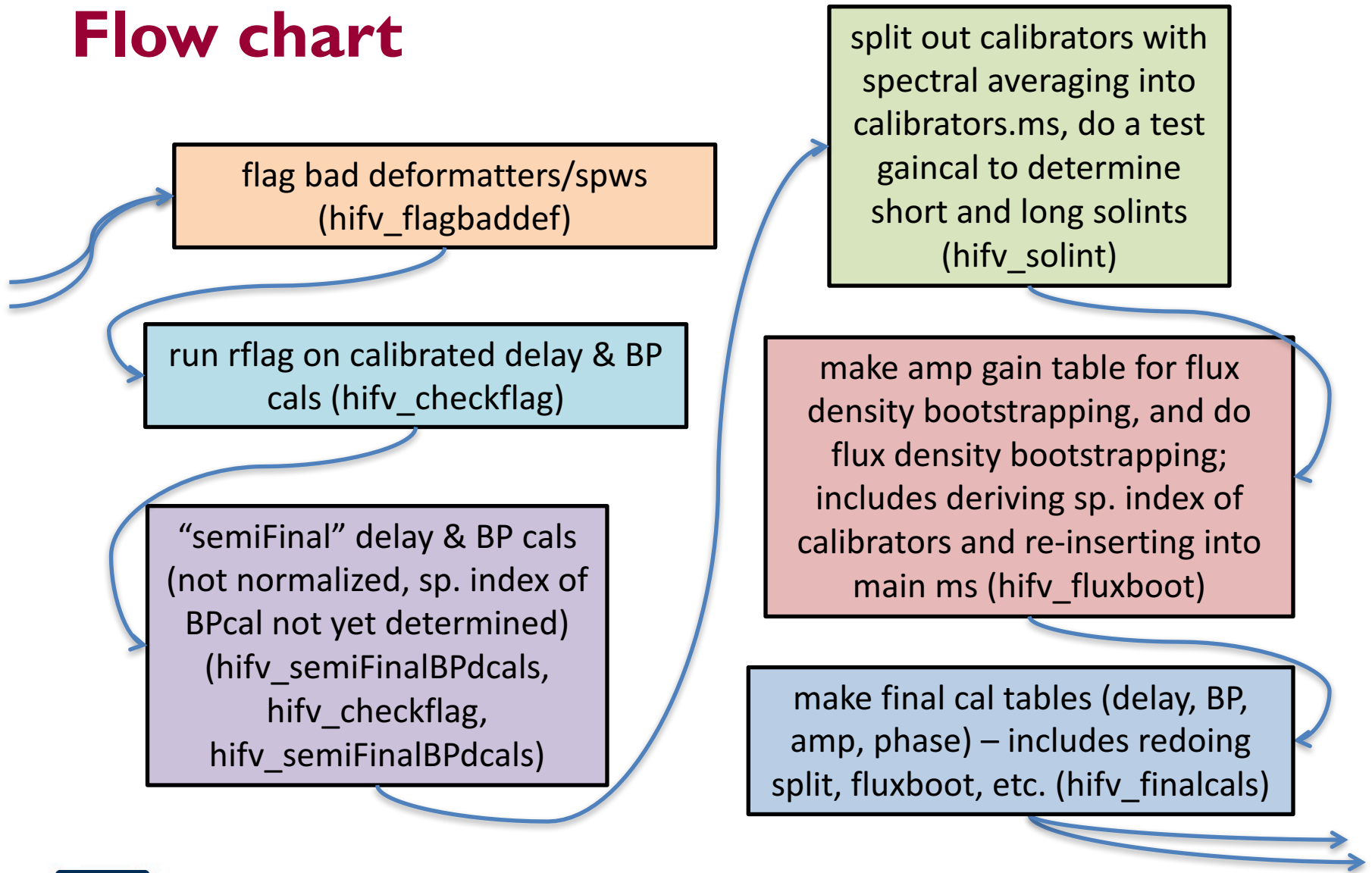
- Heuristics (cont.): the pipeline:
 - Derives initial gain solutions, does flux density bootstrapping and derives spectral index of all calibrators
 - Derives final delay, bandpass, and gain calibrations
 - Applies all calibrations to the MS
 - Runs RFLAG algorithm on all fields, including target**
 - Runs statwt to derive proper relative weights per antenna/spw**
- **May want to modify inputs and/or omit entirely for spectral line reductions

Flow chart (CASA pipeline)

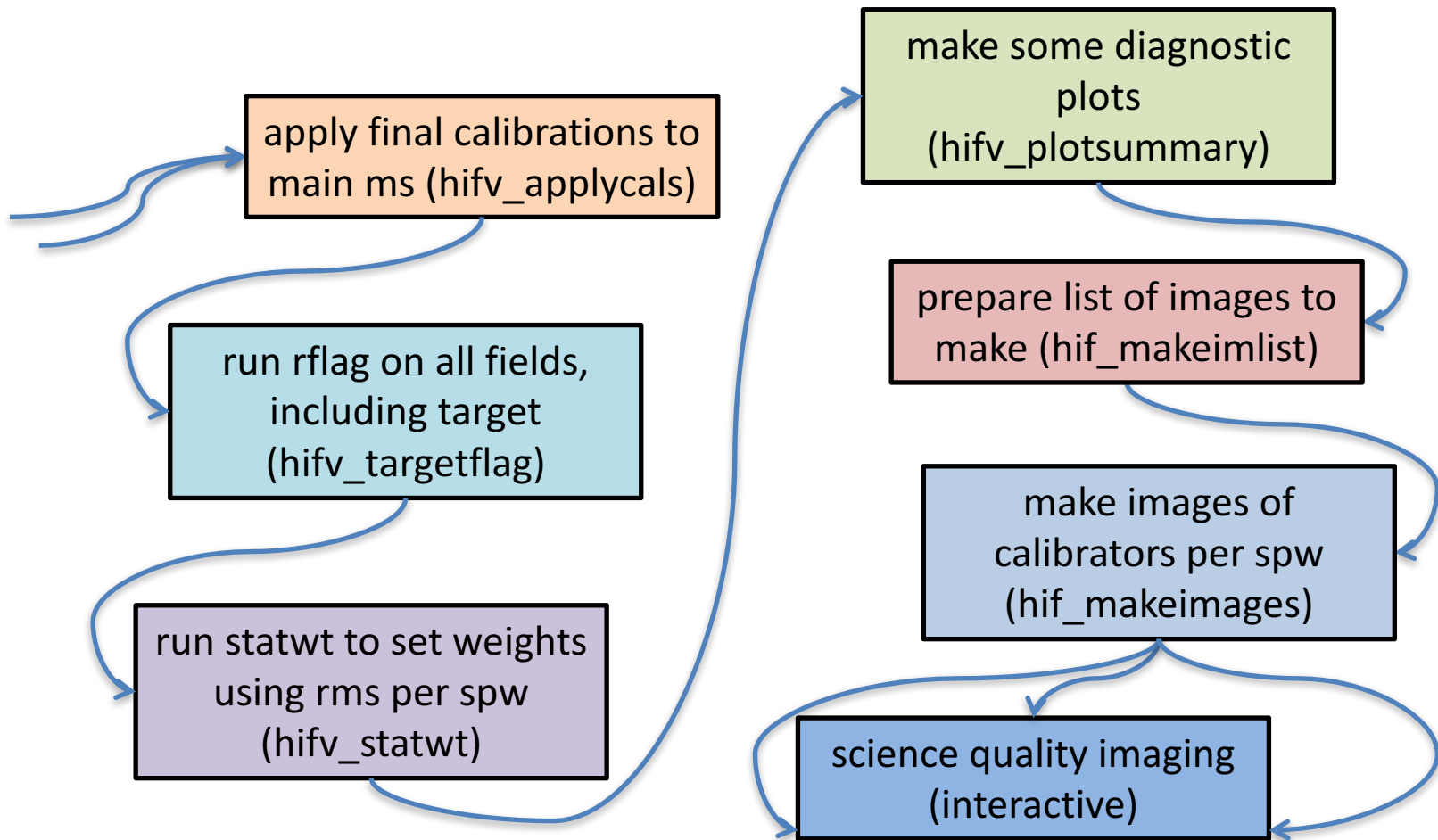
- Each major step is executed as a separate pipeline task:



Flow chart



Flow chart



Pipeline Weblog



Observation Overview

Project	uid://evla/pdb/30673845
Principal Investigator	Dr. Tim Bastian
Observation Start	2015-08-02 17:16:40 UTC
Observation End	2015-08-02 17:52:28 UTC

Pipeline Summary

Pipeline Version	40896 (Pipeline-CASA51-P2-B)
CASA Version	5.1.1-5 r40000
Pipeline Start	2017-10-18 16:20:16 UTC
Execution Duration	1:52:33

Observation Summary

Measurement Set	Receivers	Num Antennas	Time (UTC)			Baseline Length			Size	
			Start	End	On Source	Min	Max	RMS		
Scheduling Block ID: uid://evla/pdbsb/31019491										
Session: session_1										
15A-397.sb31019491.eb31020561.57236.7198700463.ms	20cm (L)	26	2015-08-02 17:16:40	2015-08-02 17:52:27	0:14:56	793.4 m	34.4 km	14.8 km	6.2 GB	



Pipeline Weblog

file:///Users/cch...2-1_details.html x +

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-1.html?sidebar=sidebar_15A_397_sb31019491_eb31020561... Search

Most Visited

Home By Topic By Task Project Code N/A

Session: session_1

15A-397_sb31019491_eb31020561.572

Overview of '15A-397.sb31019491.eb31020561.57236.7198700463.ms'

Observation Execution Time

Start Time	2015-08-02 17:16:40
End Time	2015-08-02 17:52:27
Total Time on Source	0:39:36
Total Time on Science Target	0:14:56

[LISTOBS OUTPUT](#)

Spatial Setup

Science Targets	'J0842+1835'
Calibrators	'J0542+4951' and 'J0738+1742'

Antenna Setup

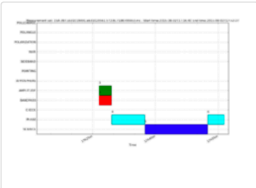
Min Baseline	793.4 m
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Spectral Setup

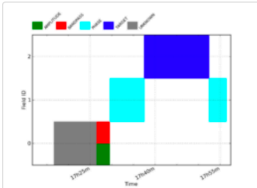
All Bands	'20cm (L)'
Science Bands	'20cm (L)'
VLA Bands: Basebands: Freq range: [spws]	L: A0C0: 1.493 GHz to 2.005 GHz: [0,1,2,3] L: B0D0: 993.000 MHz to 1.505 GHz: [4,5,6,7]

Sky Setup

Min Elevation	64.31 degrees
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Intent vs Time
Track scan intent vs time



Field vs Time
Track observed field vs time



Pipeline Weblog

file:///Users/cch...2-1_details.html x +

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-1.html?sidebar=sidebar_15A_397_sb31019491_eb31020561... Search

Most Visited

Home By Topic B Task

Session: session_1

15A-397_sb31019491_eb31020561.572

listobs.txt

BACK

```
=====  
MeasurementSet Name: /lustre/aoc/sciops/jott/pipeline/5.1.1-5/L/15A-397_sb31019491_eb31020561.57236.7198700463.ms MS Version 2  
=====  
Observer: Dr. Tim Bastian Project: uid://evla/pdb/30673845  
Observation: EVLA  
Data records: 3088800 Total elapsed time = 2386 seconds  
Observed from 02-Aug-2015/17:16:40.0 to 02-Aug-2015/17:56:26.0 (UTC)  
  
ObservationID = 0 ArrayID = 0  
Date Timerange (UTC) Scan FldId FieldName nRows SpwIds Average Interval(s) ScanIntent  
02-Aug-2015/17:16:40.0 - 17:25:30.0 1 0 J0542+4951 689000 [0,1,2,3,4,5,6,7] [2, 2, 2, 2, 2, 2, 2] [SYSTEM_CONFIGURATION#UNSPECIFIED]  
17:25:32.0 - 17:26:30.0 2 0 J0542+4951 75400 [0,1,2,3,4,5,6,7] [2, 2, 2, 2, 2, 2, 2] [SYSTEM_CONFIGURATION#UNSPECIFIED]  
17:26:32.0 - 17:29:30.0 3 0 J0542+4951 231400 [0,1,2,3,4,5,6,7] [2, 2, 2, 2, 2, 2, 2] [CALIBRATE_BANDPASS#UNSPECIFIED,CALIBRA  
TE_FLUX#UNSPECIFIED]  
17:29:32.0 - 17:37:28.0 4 1 J0738+1742 618800 [0,1,2,3,4,5,6,7] [2, 2, 2, 2, 2, 2, 2] [CALIBRATE_AMPLI#UNSPECIFIED,CALIBRATE_  
PHASE#UNSPECIFIED]  
17:37:30.0 - 17:52:26.0 5 2 J0842+1835 1164800 [0,1,2,3,4,5,6,7] [2, 2, 2, 2, 2, 2, 2] [OBSERVE_TARGET#UNSPECIFIED]  
17:52:28.0 - 17:56:26.0 6 1 J0738+1742 309400 [0,1,2,3,4,5,6,7] [2, 2, 2, 2, 2, 2, 2] [CALIBRATE_AMPLI#UNSPECIFIED,CALIBRATE_  
PHASE#UNSPECIFIED]  
(nRows = Total number of rows per scan)  
Fields: 3  
ID Code Name RA Decl Epoch SrcId nRows  
0 NONE J0542+4951 05:42:36.137916 +49.51.07.23356 J2000 0 995800  
1 NONE J0738+1742 07:38:07.393747 +17.42.18.99827 J2000 1 928200  
2 NONE J0842+1835 08:42:05.094400 +18.35.40.98699 J2000 2 1164800  
Spectral Windows: (8 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_L#A0C0#0 64 TOPO 1494.000 2000.000 128000.0 1557.0000 12 RR RL LR LL  
1 EVLA_L#A0C0#1 64 TOPO 1622.000 2000.000 128000.0 1685.0000 12 RR RL LR LL  
2 EVLA_L#A0C0#2 64 TOPO 1750.000 2000.000 128000.0 1813.0000 12 RR RL LR LL
```



Pipeline Weblog

Topic Summary

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t1-3.html

Most Visited

Home By Topic By Task

Project Code N/A

Warnings and Errors

No warnings or errors.

Tasks by Topic

Topic	Lowest Scoring Task	Min Score
Data Sets	15. hifv_applycals: Apply calibrations from context	1.00
Calibration	No scoring tasks in this topic	N/A
Flagging	15. hifv_applycals: Apply calibrations from context	1.00
Imaging	19. hif_makeimlist: Compile a list of cleaned images to be calculated	1.00

Flagging Summaries

15A-397.sb31019491.eb31020561.57236.7198700463.ms

Flagging percentages for Source name: J0542+4951, Intents: SYSTEM_CONFIGURATION,AMPLITUDE,BANDPASS

spw	ea01	ea02	ea03	ea04	ea06	ea07	ea08	ea09	ea10	ea11	ea12	ea13	ea14	ea15	ea16	ea17	ea18	ea19	ea20	ea21	ea23	ea24	ea25	ea26	ea27	ea28
0	79.78	80.49	79.66	79.55	80.35	79.46	79.39	80.72	79.72	80.56	80.34	80.62	81.02	79.91	79.83	80.44	79.42	79.85	79.99	79.52	80.40	80.23	79.39	79.48	80.68	79.78
1	79.41	79.85	79.49	79.47	79.46	79.39	79.42	79.71	79.50	79.51	79.48	79.54	79.68	79.49	79.89	79.53	79.42	79.48	79.44	79.43	79.50	79.50	79.45	79.44	79.96	79.43
2	79.22	79.40	79.22	79.23	79.23	79.22	79.22	79.46	79.23	79.24	79.24	79.26	79.40	79.23	79.89	79.28	79.21	79.23	79.23	79.22	79.23	79.23	79.22	79.22	79.72	79.23
3	79.25	79.94	79.24	79.30	79.40	79.23	79.86	79.92	79.26	79.40	79.52	79.70	79.78	79.25	79.68	79.67	79.22	79.25	79.34	79.24	79.32	79.28	79.24	79.27	80.20	79.26
4	80.09	80.45	80.04	80.29	80.24	79.93	79.95	80.52	80.53	80.69	80.31	80.66	81.00	80.37	80.44	80.33	79.92	80.11	80.17	80.00	80.77	80.14	80.06	80.05	80.70	80.16



Pipeline Weblog

Task	QA Score
1. hifv_importdata : Register VLA measurement sets with the pipeline	No QA N/A
2. hifv_hanning : VLA Hanning Smoothing	No QA N/A
3. hifv_flagdata : VLA Deterministic flagging	0.98
4. hifv_vlasetj : Set calibrator model visibilities	No QA N/A
5. hifv_priorcal s: Priorcal (gaincurves, opacities, antenna positions corrections, rq gains, and switched power)	No QA N/A
6. hifv_testBPdcals : Initial test calibrations	No QA N/A
7. hifv_flagbaddef : Flag bad deformatters	No QA N/A
8. hifv_checkflag : Flag possible RFI using rflag and tfcrop	No QA N/A
9. hifv_semiFinalBPdcals : Semi-final delay and bandpass calibrations	No QA N/A
10. hifv_checkflag : Flag possible RFI using rflag and tfcrop	No QA N/A
11. hifv_semiFinalBPdcals : Semi-final delay and bandpass calibrations	No QA N/A
12. hifv_solint : Determine solint and Test gain calibrations	No QA N/A
13. hifv_fluxboot : Gain table for flux density bootstrapping	No QA N/A
14. hifv_finalcals : Final Calibration Tables	No QA N/A



Pipeline Weblog

- The following pipeline steps provide key checks for calibration quality:
 - hifv_flagdata *deterministic flagged data fraction*
 - hifv_priorcals *gain compression due to RFI (or the Sun)*
 - hifv_solint *solution intervals used for short/long phase cals*
 - hifv_fluxboot *fitted calibrator flux densities and spectral indices*
 - hifv_finalcals *final calibration tables to be applied to the data*
 - hifv_plotsummary *some useful diagnostic plots of calibrated data*
- If something funny shows up in these steps you can look at the intermediate steps to see what might have gone wrong

Deterministic Flags (hifv_flagdata)

3. hifv_flagdata

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage3&ms=all&subpage=t2-4m_x

Most Visited

Home By Topic By Task Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetjy
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotsummary
19. hif_makeimlist
20. hif_makeimages

3. VLA Deterministic Flagging

BACK

Flagging agents

Measurement Set	ANOS	Shadowed Antennas	Unwanted Intents	Other Online Flags	Flagging Template	Autocorr	Edge Channels	Clipping	Quack	Baseband	Agent Commands
15A-397.sb31019491.eb31020561.57236.7198700463.ms	✓	✓	✓	✓	✓	✓	✓	✓	✓	✗	View

Flagging agent status per measurement set.

Template Files

Measurement Set	Other Online Flags		Flagging Template	
	File	Number of Statements	File	
15A-397.sb31019491.eb31020561.57236.7198700463.ms	15A-397.sb31019491.eb31020561.57236.7198700463.flagonline.txt	165	15A-397.sb31019491.eb31020561.57236.7198700463.flagonline.txt	

Files used for template flagging steps.

Flagged data summary

	Flagging Agent (Total Vis)		Flagging Agent (Science Vis)	
			Other	



Deterministic Flags (hifv_flagdata)

3. hifv_flagdata

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage3&ms=all&subpage=t2-4m_

Most Visited

Home By Topic By Task Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

15A-397.sb31019491.eb31020561.57236.7198700463.ms 3.12% 19.83% 0.00% 18.02% 4.86% 0.00% 0.00% 6.14% 0.00% 0.00% 0.00% 11.00%

Summary of flagged data. Each cell states the amount of data flagged as a fraction of the specified data selection, with the *Flagging Agent* columns giving this information per flagging agent.

Flagging reason vs time

Plots of flagging reason vs time. The reasons for flagging the data are defined in the plot legend.

15A-397.sb31019491.eb31020561.57236.7198700463.ms

Pipeline QA

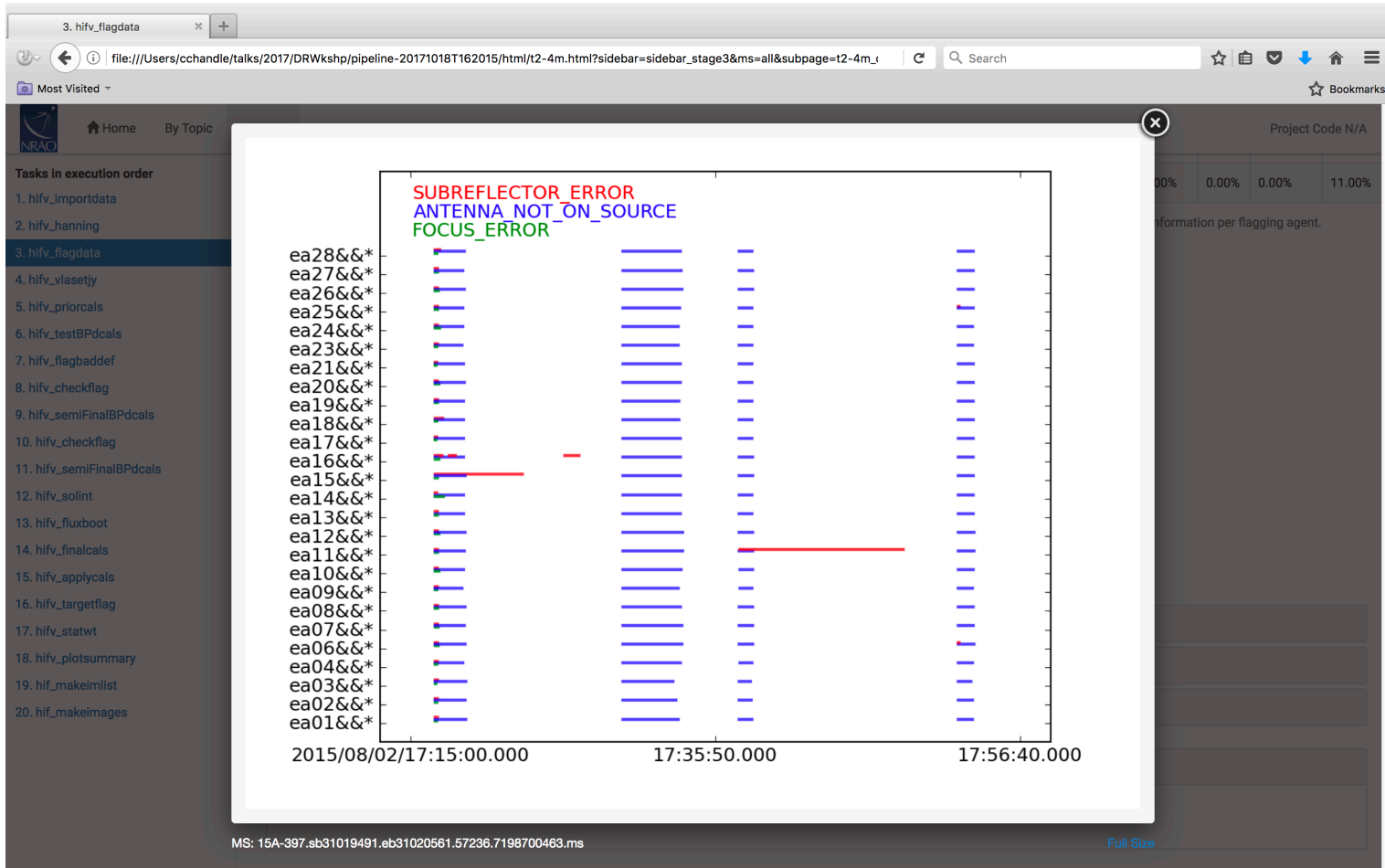
Input Parameters

Tasks Execution Statistics

CASA logs for stage 3

- [View or download](#) stage3/casapy.log (194.4 KB)

Deterministic Flags (hifv_flagdata)



Prior Calibrations (hifv_priorcals)

5. hifv_priorcals

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage5&ms=all&subpage=t2-4m_x

Most Visited

Home By Topic By Task Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
- 5. hifv_priorcals**
6. hifv_testBPDcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPDcals
10. hifv_checkflag
11. hifv_semiFinalBPDcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

5. Prior calibrations

Gain curves, opacities, antenna position corrections, requantizer gains, TEC maps, and switched power plots using the CASA task **gencal**.

Gain Curves

Gain curve table written to:
15A-397.sb31019491.eb31020561.57236.7198700463.ms.hifv_priorcals.s5_3.gc.tbl

Opacities

Opacities written to:
15A-397.sb31019491.eb31020561.57236.7198700463.ms.hifv_priorcals.s5_4.opac.tbl

15A-397.sb31019491.eb31020561.57236.7198700463.ms

Opacities

SPW	Frequency [GHz]	Opacity [Nepers]
.....

Prior Calibrations (hifv_priorcals)

5. hifv_priorcals

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage5&ms=all&subpage=t2-4m_x

Most Visited

Home By Topic By Task Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
- 5. hifv_priorcals**
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

Order	Frequency [MHz]	Opacity [percent]
0	1.558	0.00545710661572
1	1.686	0.00551242134818
2	1.814	0.00555492920696
3	1.942	0.00559696968377
4	1.058	0.00510908118063
5	1.186	0.0052441318621
6	1.314	0.00532648915642
7	1.442	0.00540697763943

Summary of general opacities

Antenna positions

No antenna position corrections to apply.

Requantizer gains

Requantizer gains written to:
15A-397.sb31019491.eb31020561.57236.7198700463.ms.hifv_priorcals.s5_5.rq.tbl

Switched Power plots

Switched Power table written to:
15A-397.sb31019491.eb31020561.57236.7198700463.ms.hifv_priorcals.s5_6.swpow.tbl

This table is NOT applied, added to the pipeline context callibrary.

Switched Power Plots: [SwPower SPgain plots](#) | [SwPower Tsys plots](#)

Prior Calibrations (hifv_priorcals)

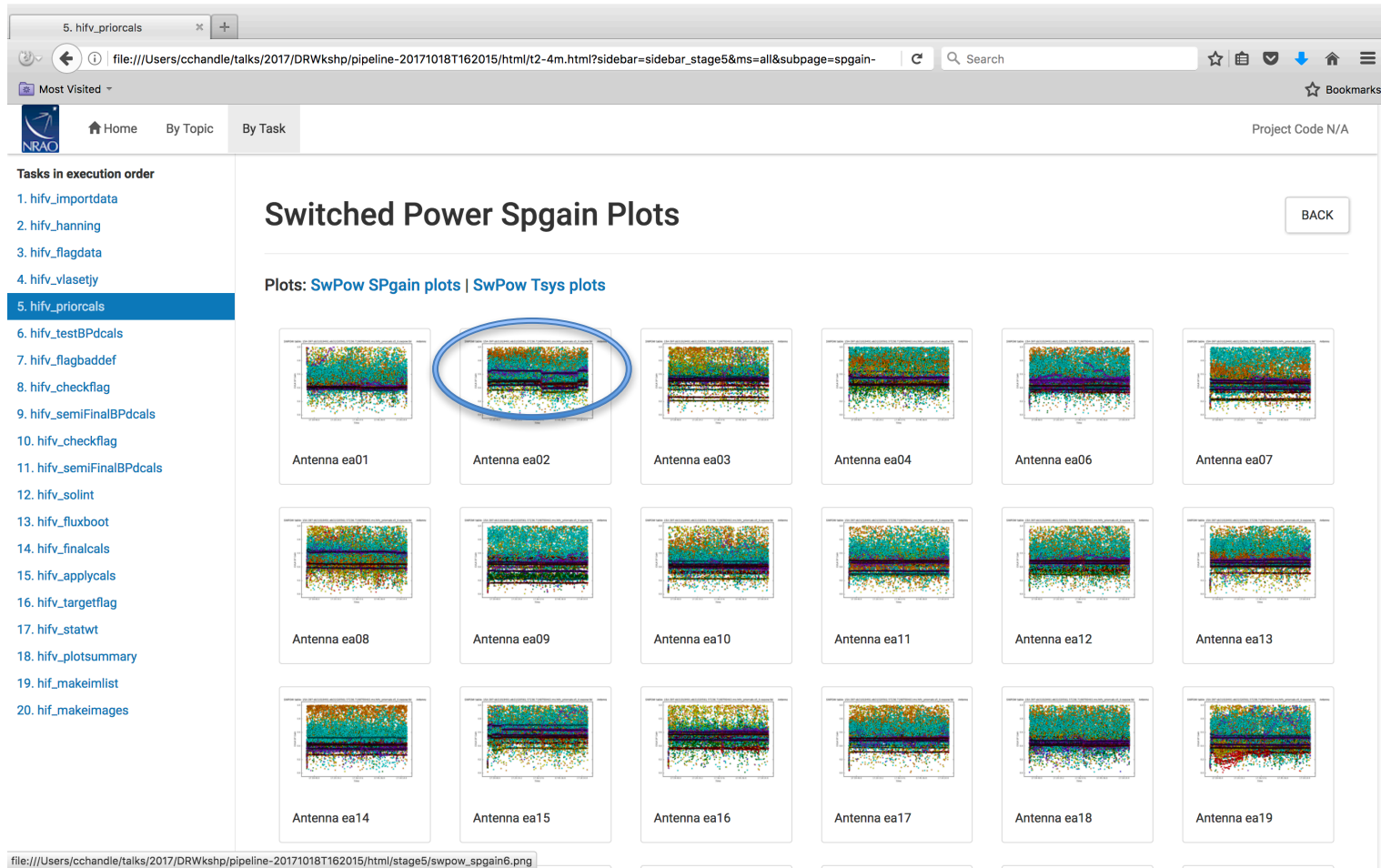
The screenshot shows a web browser window with the address bar containing the file path: `file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage5&ms=all&subpage=tsys-15`. The browser interface includes a search bar, navigation icons, and a 'Bookmarks' section.

On the left side of the page, there is a sidebar with the NRAO logo and navigation options: 'Home', 'By Topic', and 'By Task'. Below these is a list of tasks in execution order, with '5. hifv_priorcals' highlighted in blue. The list includes tasks from 1 to 20, such as 'hifv_importdata', 'hifv_hanning', 'hifv_flagdata', 'hifv_vlasetj', 'hifv_testBPdcals', 'hifv_flagbaddef', 'hifv_checkflag', 'hifv_semiFinalBPdcals', 'hifv_solint', 'hifv_fluxboot', 'hifv_finalcals', 'hifv_applycals', 'hifv_targetflag', 'hifv_statwt', 'hifv_plotssummary', 'hif_makeimlist', and 'hif_makeimages'.

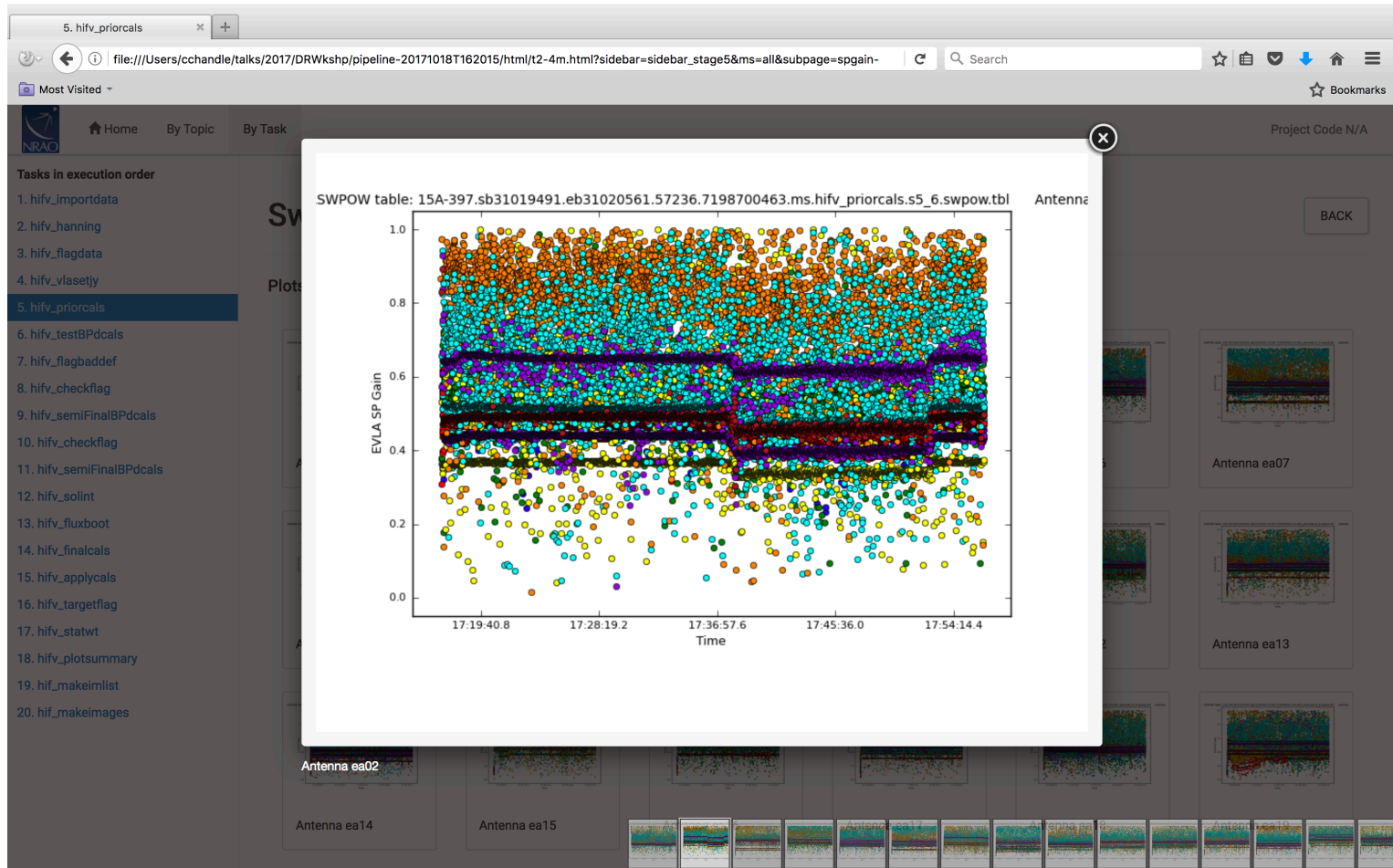
The main content area is titled 'Switched Power Tsys Plots' and features a 'BACK' button in the top right corner. Below the title, there is a sub-header: 'Plots: SwPow SPgain plots | SwPow Tsys plots'. The main area displays a grid of 19 plots, each representing an antenna from 'Antenna ea01' to 'Antenna ea19'. Each plot shows a complex, multi-colored pattern of data points, likely representing the power spectrum and system temperature for that antenna.

At the bottom of the browser window, the file path is visible: `file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/stage5/swpow_tsys6.png`.

Prior Calibrations (hifv_priorcals)



Prior Calibrations (hifv_priorcals)



Gain Solution Intervals (hifv_solint)

12. hifv_solint

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage12&ms=all&subpage=t2-4m

Most Visited

Home By Topic By Task

Project Code N/A

12. Solution Interval and test gain calibrations

BACK

Determine the solution interval for a mean-average equivalent and do test gain calibrations to establish a short solution interval.

- The long solution interval is: 254.519998544s.
- The short solution interval used is: 2.0s.

Plots: [Testgains amp plots](#) | [Testgains phase plots](#)

Pipeline QA

Input Parameters

Tasks Execution Statistics

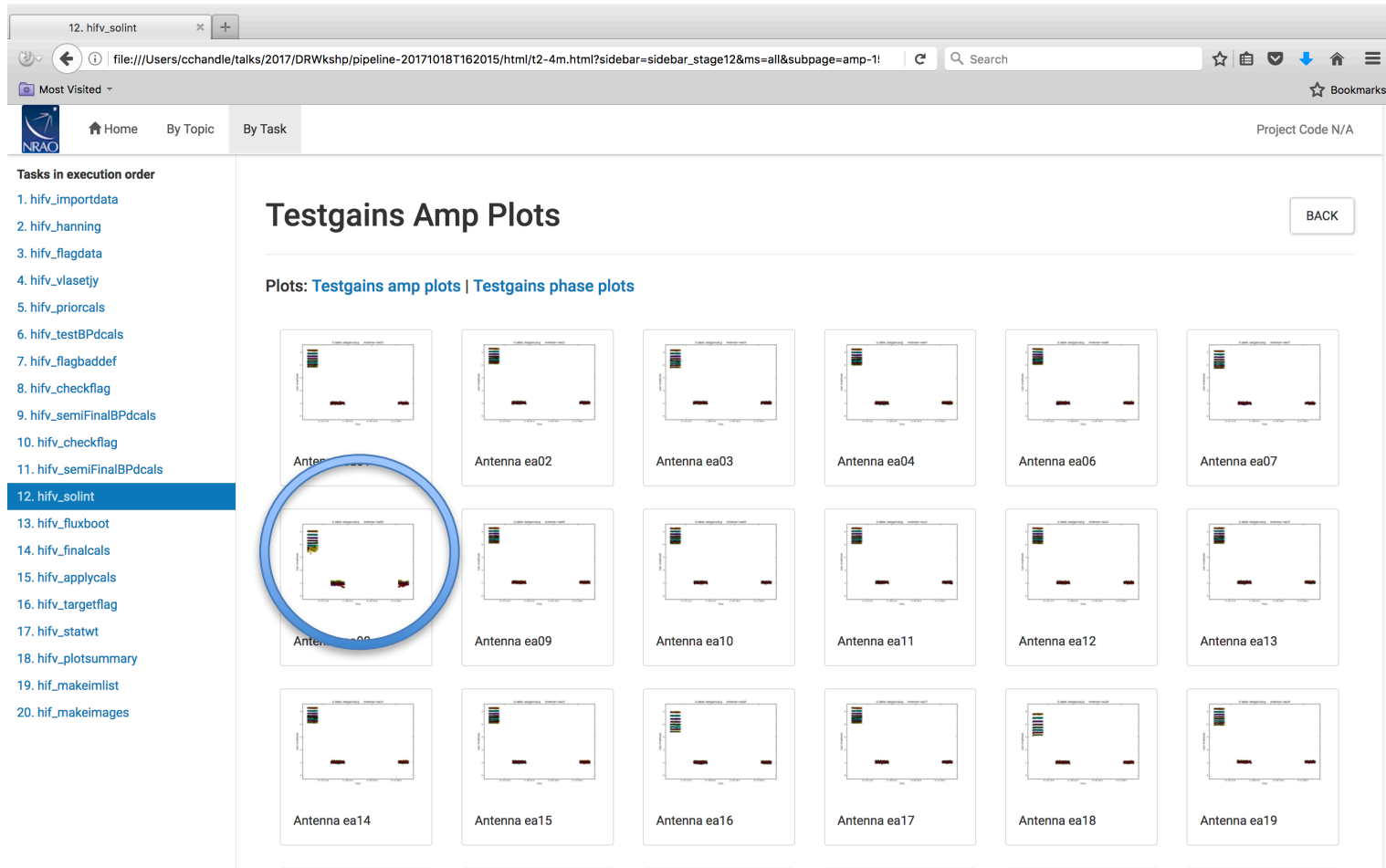
CASA logs for stage 12

- [View or download stage12/casapy.log](#) (28.0 KB)

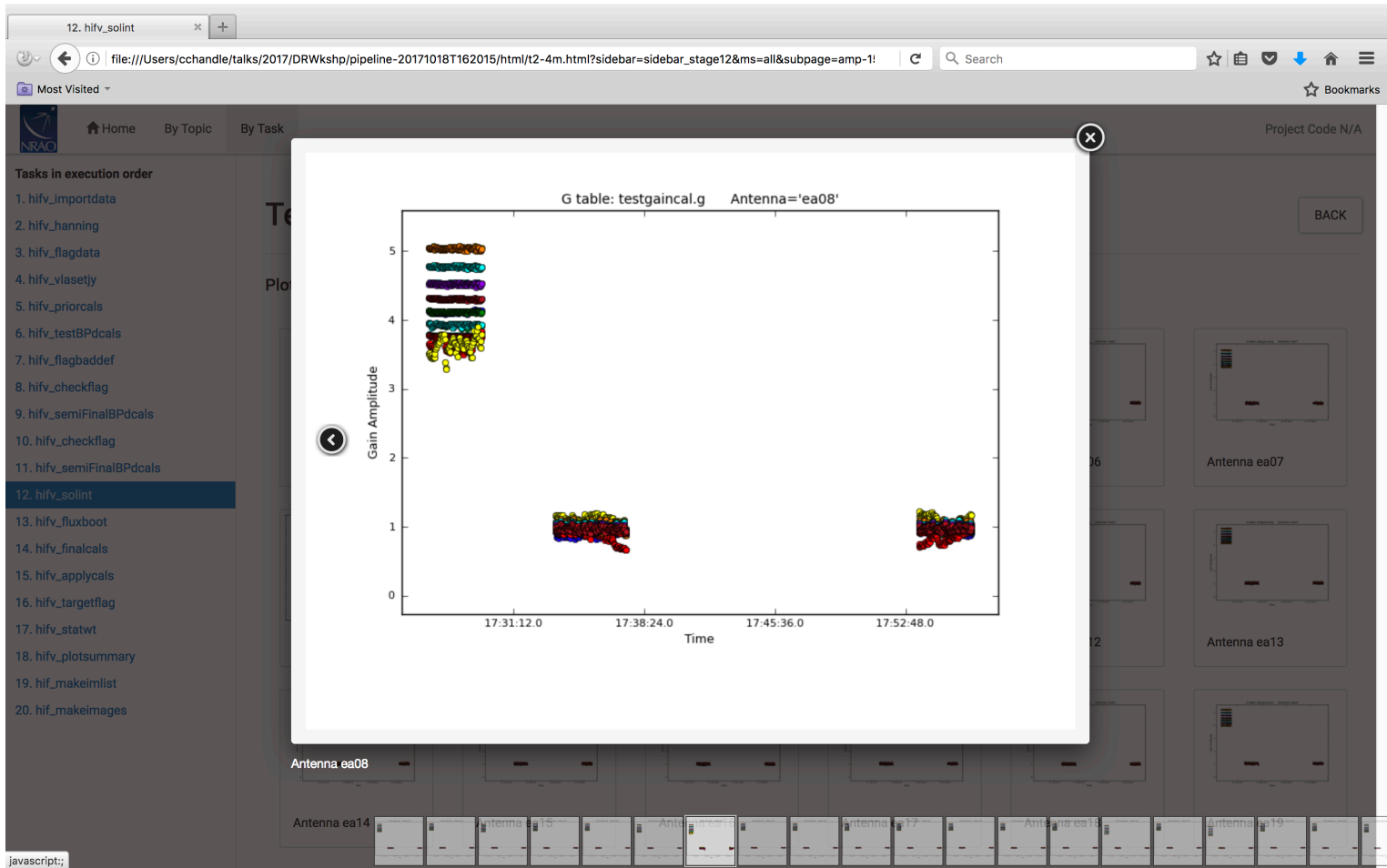
Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

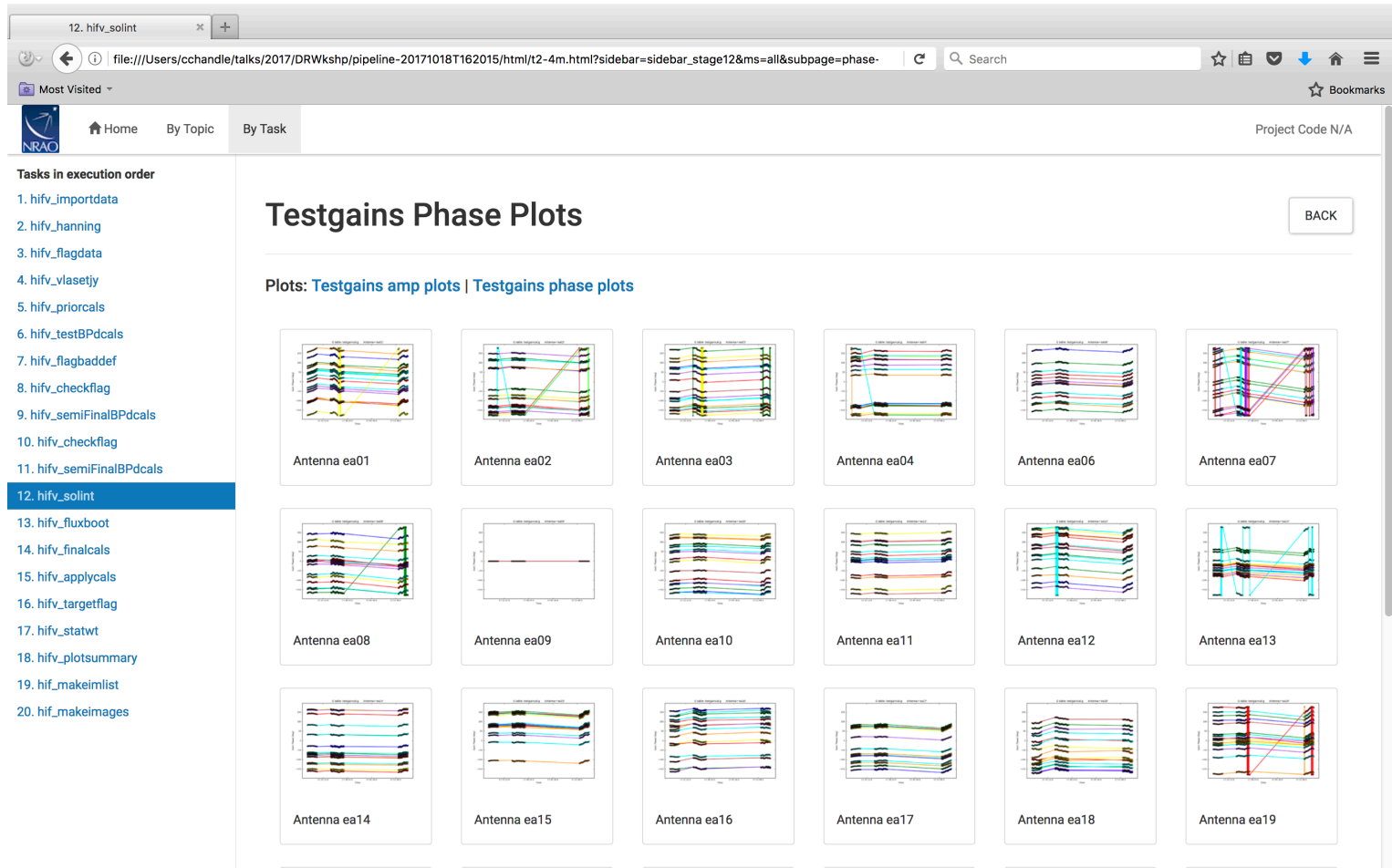
Gain Solution Intervals (hifv_solint)



Gain Solution Intervals (hifv_solint)



Gain Solution Intervals (hifv_solint)



Flux Density Bootstrapping (hifv_fluxboot)

13. hifv_fluxboot

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage13&ms=all&subpage=t2-4m

Most Visited

Home By Topic By Task

Project Code N/A

13. Flux density bootstrapping and spectral index fitting

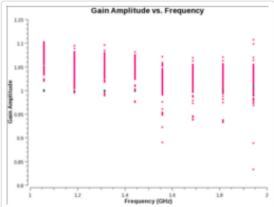
BACK

Make a gain table that includes gain and opacity corrections for final amp cal and for flux density bootstrapping.

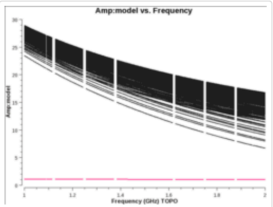
Fit the spectral index of calibrators with a power-law and put the fit in the model column.

Fluxboot summary plots

15A-397.sb31019491.eb31020561.57236.7198700463.ms



Gain Amplitude vs. Frequency



Amp-model vs. Frequency

Caltable: fluxgaincal.g Model calibrator

Source	Band	Fitted Spectral Index
J0738+1742	L	-0.1494 +/- 0.000

Spectral Indices

Source	Frequency [GHz]	Data	Error	Fitted Data	Residual: Data-Fitted Data

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/stage13/fluxgaincalFluxDensities-15A-397.sb31019491.eb31020561.57236.7198700463.ms-summary.png

Flux Density Bootstrapping (hifv_fluxboot)

13. hifv_fluxboot

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage13&ms=all&subpage=t2-4m

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priorcals
6. hifv_testBPDcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPDcals
10. hifv_checkflag
11. hifv_semiFinalBPDcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotsummary
19. hif_makeimlist
20. hif_makeimages

J0738+1742 L -0.1494+/- 0.0000

Spectral Indices

Source	Frequency [GHz]	Data	Error	Fitted Data	Residual: Data - Fitted Data
J0738+1742	1.058	1.1639	0.005610	1.1488	0.015065
	1.186	1.1064	0.005962	1.1294	-0.022962
	1.314	1.1174	0.005814	1.1122	0.005171
	1.442	1.1093	0.006198	1.0969	0.012440
	1.558	1.0420	0.007649	1.0843	-0.042261
	1.686	1.0659	0.006993	1.0716	-0.005730
	1.814	1.0709	0.007629	1.0599	0.010995
1.942	1.0716	0.009435	1.0492	0.022429	

Fitting data with a power law

Pipeline QA

Input Parameters

Tasks Execution Statistics

CASA logs for stage 13

- [View or download](#) stage13/casapy.log (58.5 KB)

Final Calibration Tables (hifv_finalcals)

14. hifv_finalcals

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage14&ms=all&subpage=t2-4m

Most Visited

Home By Topic By Task

Project Code N/A

14. Final calibration tables

BACK

Make the final calibration tables.

Plots:
[Final delay plots | BP Initial gain phase | BP Amp solution | BP Phase solution | Phase \(short\) gain solution | Final amp time cal | Final amp freq cal | Final phase gain cal](#)

Pipeline QA

Input Parameters

Tasks Execution Statistics

CASA logs for stage 14

- [View or download stage14/casapy.log \(123.6 KB\)](#)

Final Calibration Tables (hifv_finalcals)

14. hifv_finalcals

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage14&ms=all&subpage=finalde

Most Visited

Home By Topic By Task

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
- 14. hifv_finalcals**
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

Final Delay plots

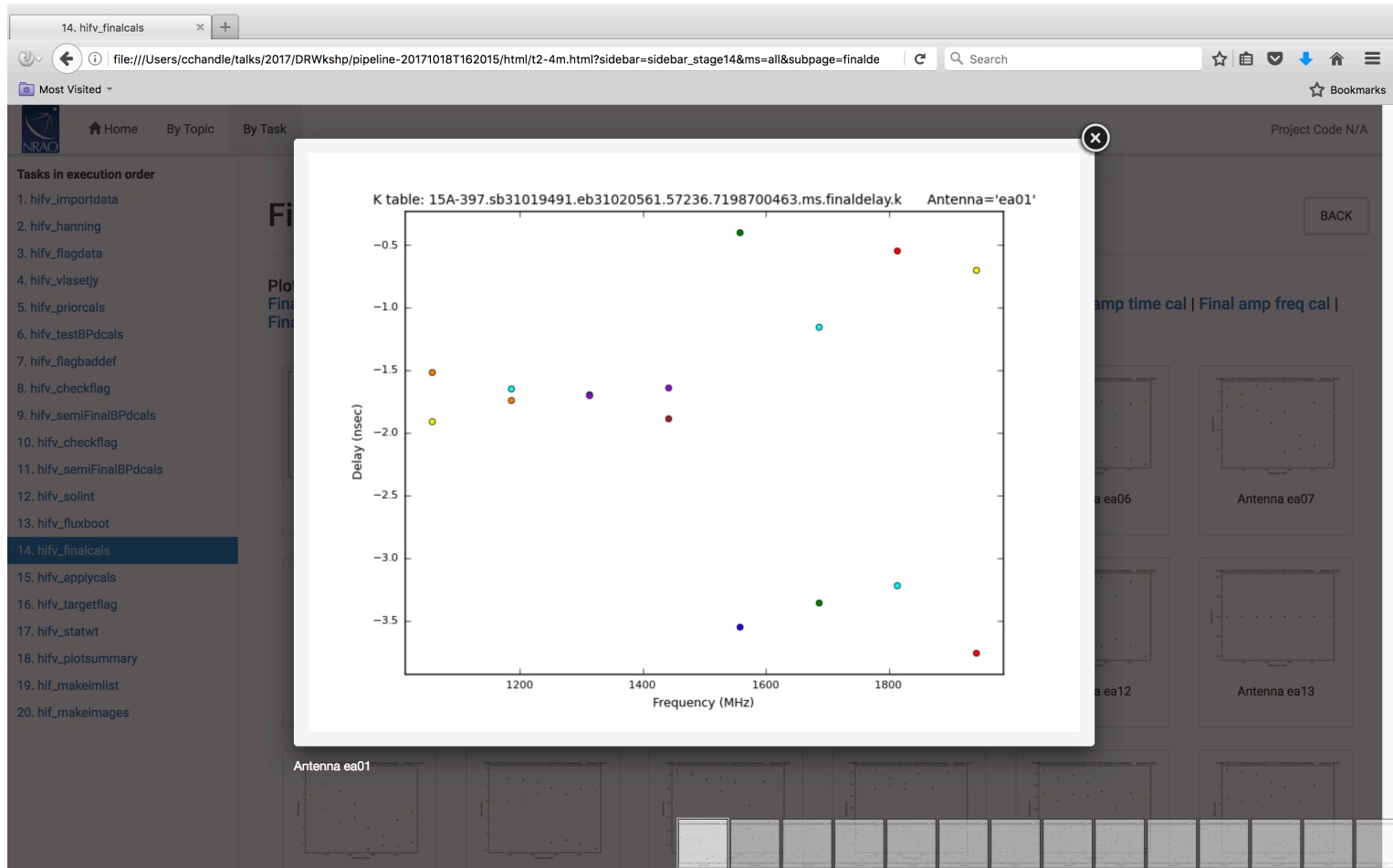
BACK

Plots:
[Final delay plots](#) | [BP initial gain phase](#) | [BP Amp solution](#) | [BP Phase solution](#) | [Phase \(short\) gain solution](#) | [Final amp time cal](#) | [Final amp freq cal](#) | [Final phase gain cal](#)

Antenna ea01 Antenna ea02 Antenna ea03 Antenna ea04 Antenna ea06 Antenna ea07

Antenna ea08 Antenna ea09 Antenna ea10 Antenna ea11 Antenna ea12 Antenna ea13

Final Calibration Tables (hifv_finalcals)



Final Cal Tables: bandpass

14. hifv_finalcals

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage14&ms=all&subpage=bpsola

Most Visited

Home By Topic By Task

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
- 14. hifv_finalcals**
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

Bp Amp Solution plots

BACK

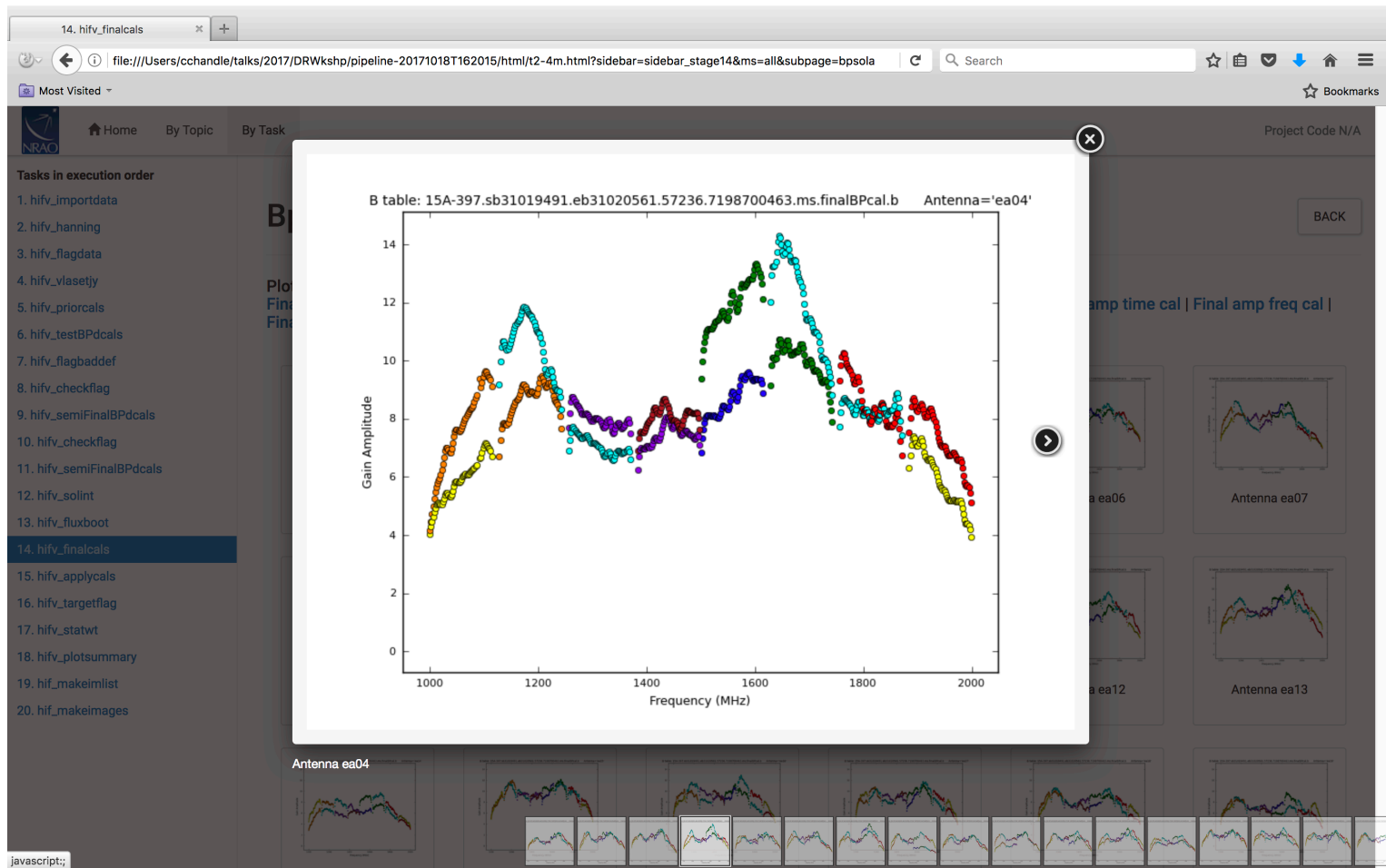
Plots:
[Final delay plots](#) | [BP initial gain phase](#) | [BP Amp solution](#) | [BP Phase solution](#) | [Phase \(short\) gain solution](#) | [Final amp time cal](#) | [Final amp freq cal](#) | [Final phase gain cal](#)

Antenna ea01 Antenna ea02 Antenna ea03 Antenna ea04 Antenna ea06 Antenna ea07

Antenna ea08 Antenna ea09 Antenna ea10 Antenna ea11 Antenna ea12 Antenna ea13

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/stage14/finalBPcal_amp10.png

Final Cal Tables: bandpass



Final Cal Tables: bandpass

14. hifv_finalcals

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage14&ms=all&subpage=bpsolp

Search

Most Visited

Home By Topic By Task

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetyj
5. hifv_priorcals
6. hifv_testBPDcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPDcals
10. hifv_checkflag
11. hifv_semiFinalBPDcals
12. hifv_solint
13. hifv_fluxboot
- 14. hifv_finalcals**
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

Bp Phase Solution plots

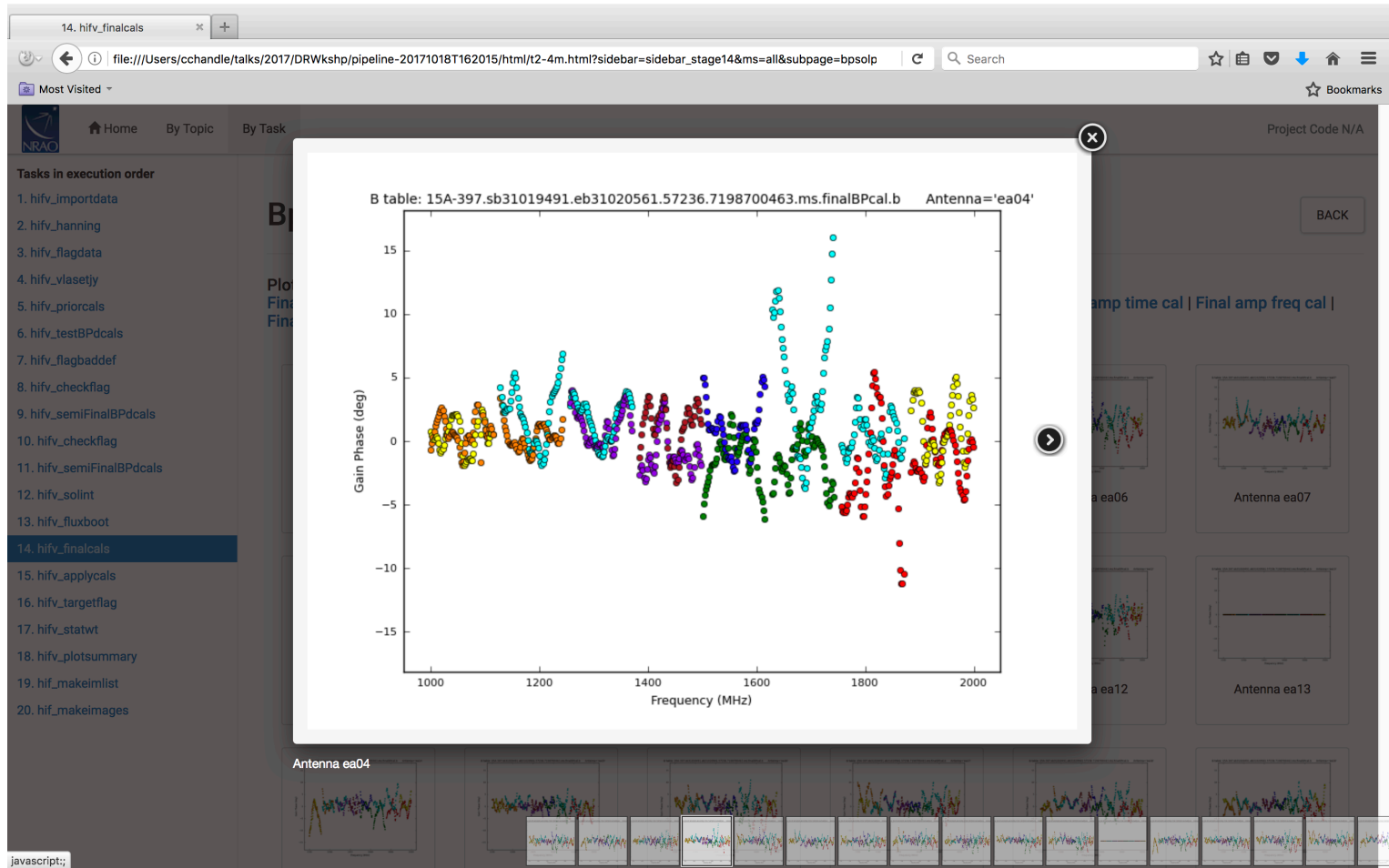
BACK

Plots:
[Final delay plots](#) | [BP initial gain phase](#) | [BP Amp solution](#) | [BP Phase solution](#) | [Phase \(short\) gain solution](#) | [Final amp time cal](#) | [Final amp freq cal](#) | [Final phase gain cal](#)

Antenna ea01 Antenna ea02 Antenna ea03 Antenna ea04 Antenna ea06 Antenna ea07

Antenna ea08 Antenna ea09 Antenna ea10 Antenna ea11 Antenna ea12 Antenna ea13

Final Cal Tables: bandpass



Final Cal Tables: amplitude

14. hifv_finalcals

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage14&ms=all&subpage=finalan

Most Visited

Home By Topic By Task

Project Code N/A

Final Amp Time Cal plots

BACK

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
- 14. hifv_finalcals**
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

Plots:

[Final delay plots](#) | [BP initial gain phase](#) | [BP Amp solution](#) | [BP Phase solution](#) | [Phase \(short\) gain solution](#) | [Final amp time cal](#) | [Final amp freq cal](#) | [Final phase gain cal](#)

Antenna ea01

Antenna ea02

Antenna ea03

Antenna ea04

Antenna ea06

Antenna ea07

Antenna ea08

Antenna ea09

Antenna ea10

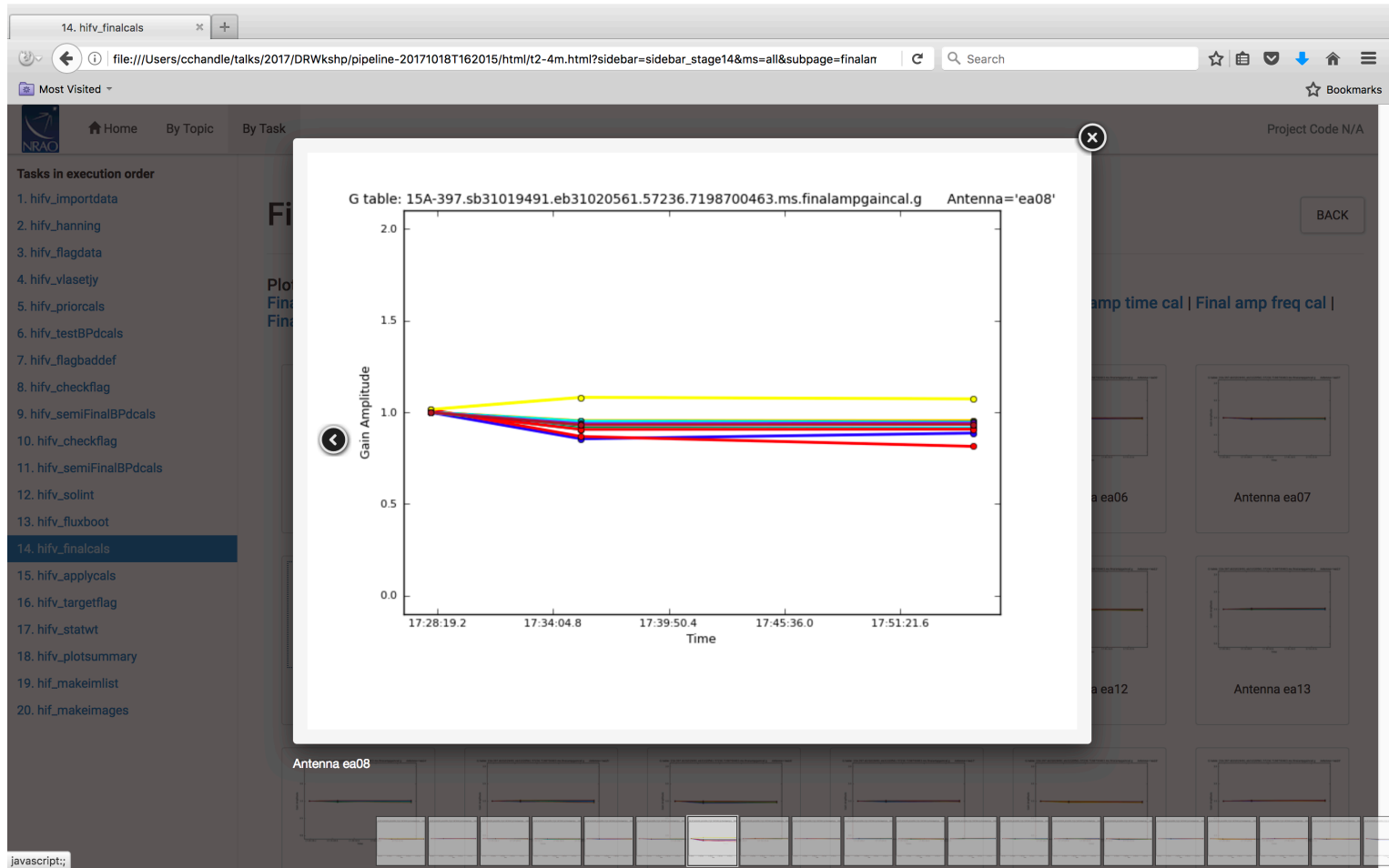
Antenna ea11

Antenna ea12

Antenna ea13

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/stage14/finalamptimecal2.png

Final Cal Tables: amplitude



Final Cal Tables: amplitude

14. hifv_finalcals

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage14&ms=all&subpage=finalan

Most Visited

Home By Topic By Task

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
- 14. hifv_finalcals**
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

Final Amp Freq Cal plots

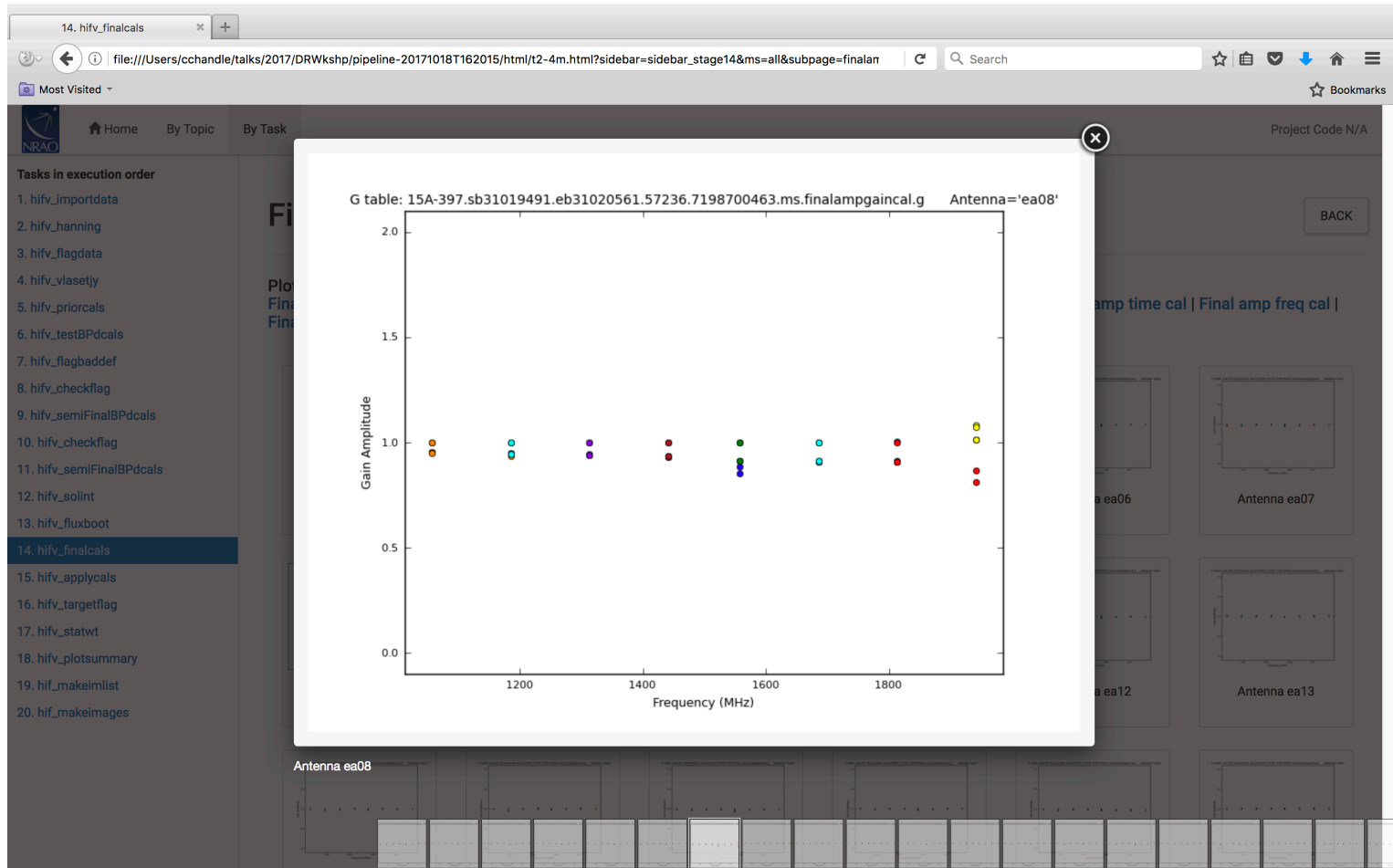
BACK

Plots:
[Final delay plots](#) | [BP initial gain phase](#) | [BP Amp solution](#) | [BP Phase solution](#) | [Phase \(short\) gain solution](#) | [Final amp time cal](#) | [Final amp freq cal](#) | [Final phase gain cal](#)

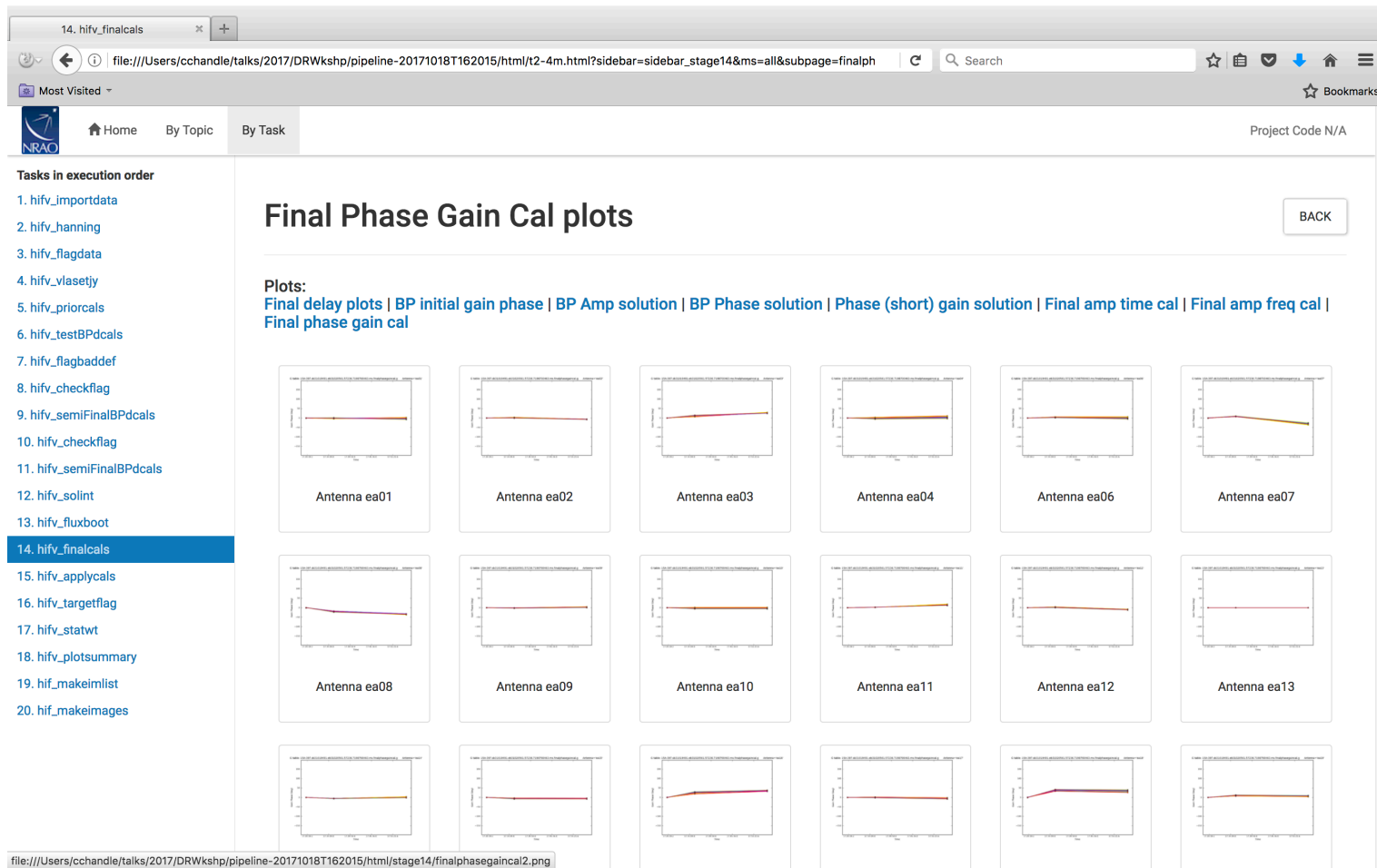
Antenna ea01 Antenna ea02 Antenna ea03 Antenna ea04 Antenna ea06 Antenna ea07

Antenna ea08 Antenna ea09 Antenna ea10 Antenna ea11 Antenna ea12 Antenna ea13

Final Cal Tables: amplitude



Final Cal Tables: phase



Summary Plots (hifv_plotsummary)

18. hifv_plotsummary

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage18&ms=all&subpage=t2-4m

Most Visited

Home By Topic By Task

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priors
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
- 18. hifv_plotsummary**
19. hif_makeimlist
20. hif_makeimages

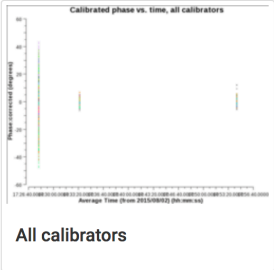
18. Plot Summary

BACK

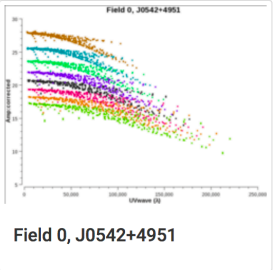
VLA Pipeline Summary Plots

Phase vs. time for all calibrators, Amp vs. UVwave for all calibrators, as well as a representative selection of fields with intent="TARGET" with Amp vs. UVwave plots.

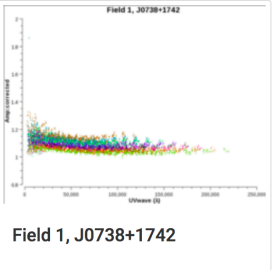
15A-397.sb31019491.eb31020561.57236.7198700463.ms



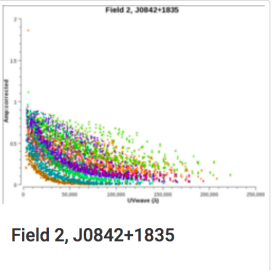
All calibrators



Field 0, J0542+4951



Field 1, J0738+1742

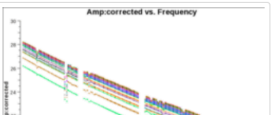
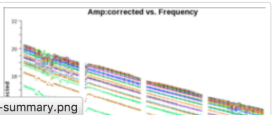
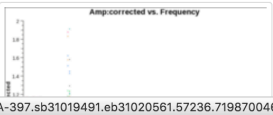
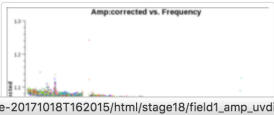


Field 2, J0842+1835

Calibrated amplitude vs frequency

Plots of calibrated amplitude vs frequency for all antennas and correlations, coloured by antenna.

15A-397.sb31019491.eb31020561.57236.7198700463.ms



file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/stage18/field1_amp_uvdist-15A-397.sb31019491.eb31020561.57236.7198700463.ms-summary.png

Summary Plots (hifv_plotsummary)

18. hifv_plotsummary

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage18&ms=all&subpage=t2-4m

Most Visited

Home By Topic By Task

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priors
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
- 18. hifv_plotsummary**
19. hif_makeimlist
20. hif_makeimages

Calibrated amplitude vs frequency

Plots of calibrated amplitude vs frequency for all antennas and correlations, coloured by antenna.

15A-397.sb31019491.eb31020561.57236.7198700463.ms

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 0, 1, 2 and 3)
Phase calibrator: J0738+1742.

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 4, 5, 6 and 7)
Phase calibrator: J0738+1742.

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 0, 1, 2 and 3)
Bandpass calibrator: J0542+4951.

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 4, 5, 6 and 7)
Bandpass calibrator: J0542+4951.

Calibrated phase vs frequency

Plots of calibrated phase vs frequency for all antennas and correlations, coloured by antenna.

15A-397.sb31019491.eb31020561.57236.7198700463.ms

Phase corrected vs. Frequency

Phase corrected vs. Frequency

Phase corrected vs. Frequency

Phase corrected vs. Frequency

Phase corrected vs. Frequency

Phase corrected vs. Frequency

Phase corrected vs. Frequency

Phase corrected vs. Frequency

Summary Plots (hifv_plotsummary)

18. hifv_plotsummary

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage18&ms=all&subpage=t2-4m

Most Visited

Home By Topic By Task

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
- 18. hifv_plotsummary**
19. hif_makeimlist
20. hif_makeimages

Calibrated amplitude vs frequency

Plots of calibrated amplitude vs frequency for all antennas and correlations, coloured by antenna.

15A-397.sb31019491.eb31020561.57236.7198700463.ms

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 0, 1, 2 and 3)
Phase calibrator: J0738+1742.

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 4, 5, 6 and 7)
Phase calibrator: J0738+1742.

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 0, 1, 2 and 3)
Bandpass calibrator: J0542+4951.

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 4, 5, 6 and 7)
Bandpass calibrator: J0542+4951.

Calibrated phase vs frequency

Plots of calibrated phase vs frequency for all antennas and correlations, coloured by antenna.

15A-397.sb31019491.eb31020561.57236.7198700463.ms

Phase.corrected vs. Frequency

Phase.corrected vs. Frequency

Phase.corrected vs. Frequency

Phase.corrected vs. Frequency

Phase.corrected vs. Frequency

Phase.corrected vs. Frequency

Phase.corrected vs. Frequency

Phase.corrected vs. Frequency

Summary Plots (hifv_plotsummary)

18. hifv_plotsummary

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage18&ms=all&subpage=t2-4m

Most Visited

Home By Topic By Task

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priors
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
- 18. hifv_plotsummary**
19. hif_makeimlist
20. hif_makeimages

Science target: calibrated amplitude vs frequency

Calibrated amplitude vs frequency plots for a representative science field in each measurement set. The science field displayed here is the one with the brightest average amplitude over all spectral windows.

Note: due to a technical problem with visstat, the science field displayed here not the brightest field for the source but the first field for the source.

Data are plotted for all antennas and correlations, with different spectral windows shown in different colours.

15A-397.sb31019491.eb31020561.57236.7198700463.ms

Plots for 15A-397.sb31019491.eb31020561.57236.7198700463.ms were created with UV range set to capture the inner half of the data (UV max < 11.9 km).

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 0, 1, 2 and 3)

Source #2 (J0842+1835)

Amp.corrected vs. Frequency

Receiver bands: 20cm (L)
(Spws 4, 5, 6 and 7)

Source #2 (J0842+1835)

Pipeline QA

Input Parameters

Tasks Execution Statistics

Calibrator Images (hif_makeimages)

20. hif_makeimages

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20171018T162015/html/t2-4m.html?sidebar=sidebar_stage20&ms=all&subpage=t2-4m

Most Visited

Home By Topic By Task

Project Code N/A

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priocals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_semiFinalBPdcals
12. hifv_solint
13. hifv_fluxboot
14. hifv_finalcals
15. hifv_applycals
16. hifv_targetflag
17. hifv_statwt
18. hifv_plotssummary
19. hif_makeimlist
20. hif_makeimages

20. Tclean/Makelmages

Make calibrator images BACK

Image Details

Field	Spw	Pol	Image details	Image result
J0542+4951 (BANDPASS)	0	I	centre frequency of image 1.5569GHz (LSRK)	<p>View other QA images...</p>
			beam 1.33 x 1.08 arcsec	
			beam p.a. -58.0deg	
			final theoretical sensitivity -	
			cleaning threshold -	
			clean residual peak / scaled MAD 13.84	
			non-pbcor image RMS 0.016 Jy/beam	
			pbcor image max / min 18.7 / -0.128 Jy/beam	
			fractional bandwidth / nterms 8.2% / 1	
			aggregate bandwidth 0.128 GHz (LSRK)	
			score 1.00	
			image file oussid.s20_0.J0542+4951_bp.spw0.mfs.l.iter1.image	
J0542+4951 (BANDPASS)	1	I	centre frequency of image 1.6849GHz (LSRK)	



Calibrator Images (hif_makeimages)



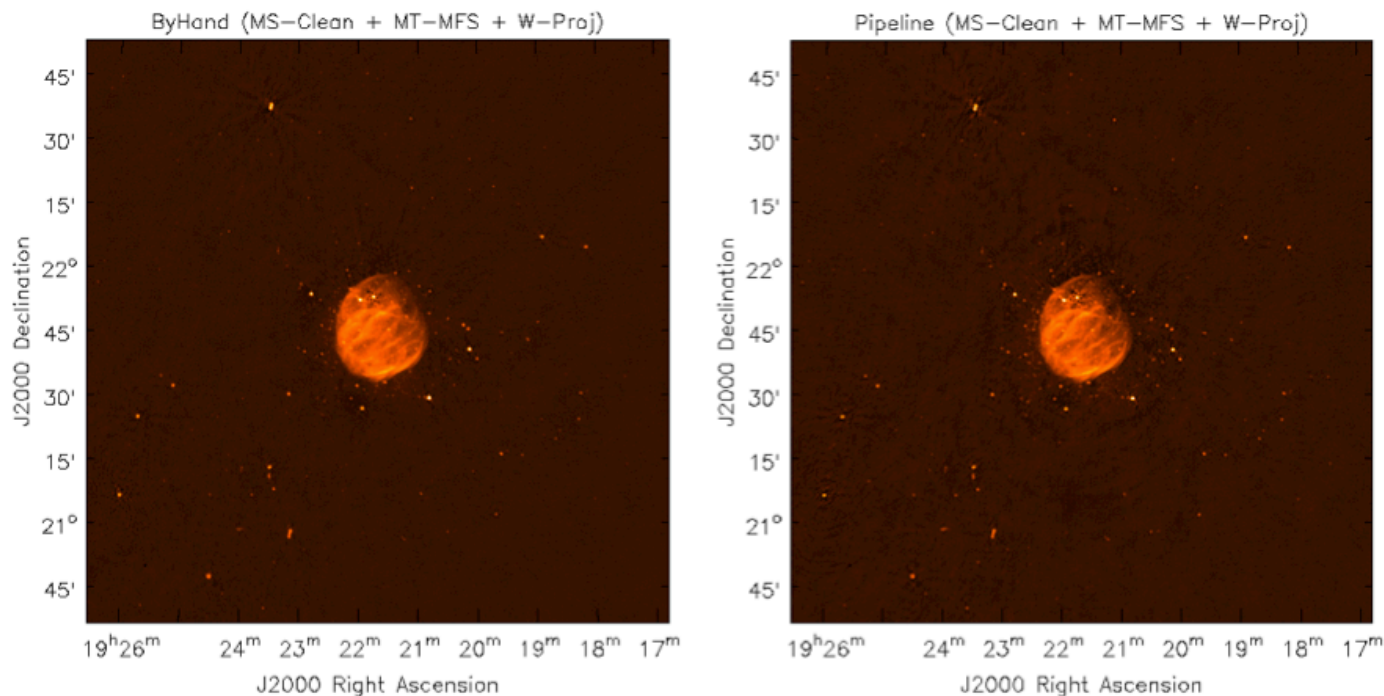
Pipeline Products and Outputs

- Real-time pipeline products and output
 - Flag and calibration tables
 - Calibrated and flagged MS (available for 15 days, not archived)
 - Logs, including weblog used by quality assurance (QA) staff and QA report if requested
 - Products can be requested through the helpdesk (<https://help.nrao.edu>, VLA Pipeline Department), for download via FTP or shipping on hard disk(s)
- You may request a detailed QA report from the data analysts
- If you are happy with the pipeline calibration, then:
 - Do further flagging if necessary
 - Split out your target and image

Pipeline Products and Outputs

- If you have the SDM or uncalibrated MS and the calibration and flag tables, instructions for applying flags and calibration tables may be found at <http://go.nrao.edu/vla-pipe>; see *Drew's talk!*
- In some cases the pipeline and/or the MS may need to be modified
 - Download the SDM from the archive plus pipeline scripts
 - Follow the directions at above link
- In some cases the pipeline heuristics may not be appropriate for your data (e.g., some L-band set-ups do not work well with the pipeline yet)
 - Reduce data by hand

Imaging comparison



Left: L-band image of G55.7+3.4 produced from data flagged and calibrated by hand; the rms noise is $11.5 \mu\text{Jy}/\text{beam}$. Right: an image made from data flagged and calibrated by the VLA calibration pipeline; the rms noise is $12.2 \mu\text{Jy}/\text{beam}$. Differences in the source structure and/or source flux density are dominated by the uncertainty in the deconvolution process, not the calibration and flagging (images provided by Urvashi Rao).

Known failure modes and issues

- In general the pipeline does very well, but there are possible failure modes:
 - No flux density or gain calibrator intents defined, or flux density calibrator not one for which we have models
 - *work around in scripted pipeline*
 - Wrong scan intents
 - *work around in scripted pipeline*
 - Does not always identify deformatter problems (but does NOT usually have false positives – L-band may be an exception)
 - *flag remaining bad spws*
 - Calibrators are too weak for given spw bandwidth
 - *heuristics have been developed for the case of a weak bandpass calibrator, you are welcome to try them on your data!*

Spectral line data

- Several steps in the real-time pipeline may not be appropriate for spectral line data:
 - Hanning smoothing (increases effective channel width)
 - Last run of RFLAG on target (may eliminate your line as interference!)
 - Statwt calculates rms based on scatter of channels per spw, per visibility; may want to run manually with channel selection turned on to eliminate use of channels containing line emission in calculating the rms
- With the above modifications, the pipeline will work with spectral line data as long as the calibrators are strong enough

Mixed correlator set-ups

- With the new WIDAR capabilities it is common to observe both wide and narrow spws to obtain both continuum and spectral line data simultaneously, or multiple receiver bands
 - A single heuristic (e.g., gain calibration solution interval) for entire dataset may not be appropriate
- Solution:
 - Run pipeline through application of deterministic flags, including Hanning smoothing if you are going to use it
 - Split the MS by spw and/or scans
 - Run pipeline on split MSs WITHOUT Hanning smoothing (you have already applied it, if you are going to use it)
 - Warning: output flagging statistics may not be correct

Special cases

- Incorrect scan intents
 - Best to use the scripted pipeline (otherwise have to edit SDM)
 - Can run through msinfo.py, then re-set the following string variables to refer to the correct scan and field IDs:

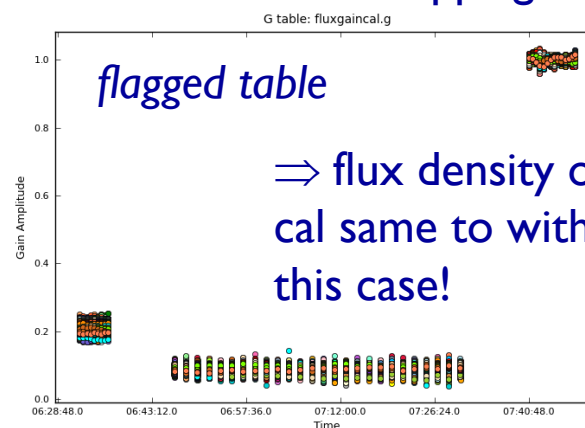
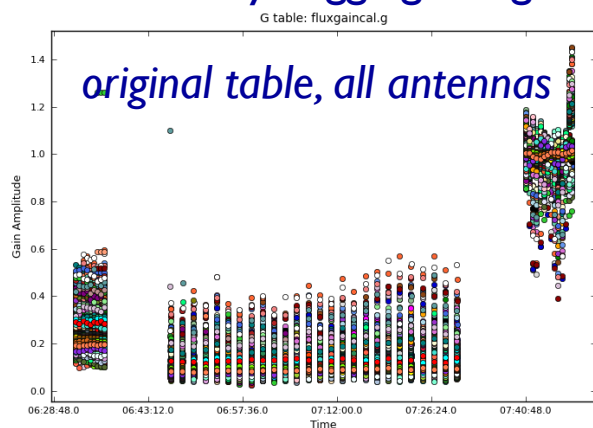
```
flux_field_select_string='2'  
bandpass_scan_select_string='8'  
bandpass_field_select_string='4'  
delay_scan_select_string='8'  
delay_field_select_string='4'  
calibrator_scan_select_string='4,5,7,8,10,11,12'  
calibrator_field_select_string='1,2,3,4,5,6,7'  
phase_scan_list=[1,3,5,7,9,11,13,15]
```

- If a standard flux density calibrator was not observed, you may still be able to use the pipeline IF you know the flux density and spectral index of one of your other calibrators, with a bit more work – contact the NRAO helpdesk



Special cases

- Accurate flux density bootstrapping
 - hifv_fluxboot uses medians to bootstrap flux densities: fairly robust, but in some cases (e.g., high frequencies with pointing, elevation dependent gains) you can do better by flagging the gain table used for the bootstrapping



- Run pipeline through hifv_fluxboot
- In a separate instance of CASA, flag input gain table using “plotcal” or “plotms”
- Re-run hifv_fluxboot specifying name of input gain table, then continue with the rest of the pipeline
- With care (match elevation of flux cal, flag bad data), can reproduce flux density scale to a few % at Q-band

Summary and VLASS Developments

- Heuristics for Stokes I continuum now well-tested, stable, minor modifications allow the pipeline to be used for certain spectroscopy projects as well
- Heuristics available for user-testing:
 - Weak bandpass calibrators
- Development for the VLA Sky Survey available for user-testing:
 - Improved RFI flagging
 - Uses cross-hands to help identify and flag RFI
 - More robust flux density bootstrapping (single-band only)
 - Flags input data to remove bad solutions before fitting
 - Polarization calibration
 - Makes some assumptions about calibrator strengths
 - Supports unpolarized and unknown polarization leakage calibrators
- [VLASS imaging pipeline, specific to VLASS observing mode]



Polarization Calibration (hifv_circfeedpolcal)

20. hifv_makeimages x 14. hifv_circfeedpolcal x +

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20170910T171832/html/t2-4m.html?sidebar=sidebar_stage14&ms=all&subpage=t2-4m

Most Visited

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VLA/TSKY0001

14. Circular Feed Polarization Calibration

BACK

Polarization Cal Tables written to disk and added to the pipeline callibrary:

- VLASS1.1.sb34356210.eb34369329.58006.08368738426.ms.kcross
- VLASS1.1.sb34356210.eb34369329.58006.08368738426.ms.D2
- VLASS1.1.sb34356210.eb34369329.58006.08368738426.ms.X1

Using Calibration Strategy C4: 3 or more slices CALIBRATE_POL_LEAKAGE, KCROSS, Df+QU, XF.

- Using standard calibrator 3C286: Field name = 3C286, Field ID = 0
- POLANGLE Field = 3C286
- POLLEAKAGE Field = J1944+5448

Polarization Plotcal Plots

Plots resulting from polarization calibration.

VLASS1.1.sb34356210.eb34369329.58006.08368738426.ms

RL delay vs. freq. for RefAnt ea17

RL phase offset vs. freq. for RefAnt ea17

Inst. pol. amp vs. antenna

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20170910T171832/html/stage14/plotssummary_phase_vs_freq-VLASS1.1.sb34356210.eb34369329.58006.08368738426.ms-plotcal.png

Polarization Calibration (hifv_circfeedpolcal)

The screenshot shows a web browser window with the URL `file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20170910T171832/html/t2-4m.html?sidebar=sidebar_stage14&ms=all&subpage=t2-4m`. The page is titled "VLA/TSKY0001" and features a sidebar with "Tasks in execution order" and a main content area with three plots and a section for "D-term Amplitude vs. Frequency Plots".

Tasks in execution order:

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetjy
5. hifv_priors
6. hifv_testBPDcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPDcals
10. hifv_checkflag
11. hifv_solint
12. hifv_fluxboot2
13. hifv_finalcals
14. hifv_circfeedpolcal
15. hifv_flagcal
16. hifv_applycals
17. hifv_checkflag
18. hifv_statwt
19. hifv_plotssummary

Plots:

- RL delay vs. freq. for RefAnt ea17
- RL phase offset vs. freq. for RefAnt ea17
- Inst. pol. amp vs. antenna

D-term Amplitude vs. Frequency Plots

Cal table used:
VLASS1.1.sb34356210.eb34369329.58006.08368738426.ms.D2

[Amplitude vs. Frequency \(per antenna plots\)](#)

Pipeline QA

Input Parameters

Tasks Execution Statistics

CASA logs for stage 14

- [View or download](#) stage14/casapy.log (161.4 KB)



Polarization Calibration (hifv_circfeedpolcal)

20. hif_makeimages x 14. hifv_circfeedpolcal x +

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20170910T171832/html/t2-4m.html?sidebar=sidebar_stage14&ms=all&subpage=ampfr Search ☆ ☆ ☆ ☆ ☆

Most Visited

NRAO Home By Topic By Task VLA/TSKY0001

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPdcals
10. hifv_checkflag
11. hifv_solint
12. hifv_fluxboot2
13. hifv_finalcals
- 14. hifv_circfeedpolcal**
15. hifv_flagcal
16. hifv_applcals
17. hifv_checkflag
18. hifv_statwt
19. hifv_plotssummary

Amp vs. Frequency Plots

BACK

Plots: [Amp vs. Frequency plots](#)

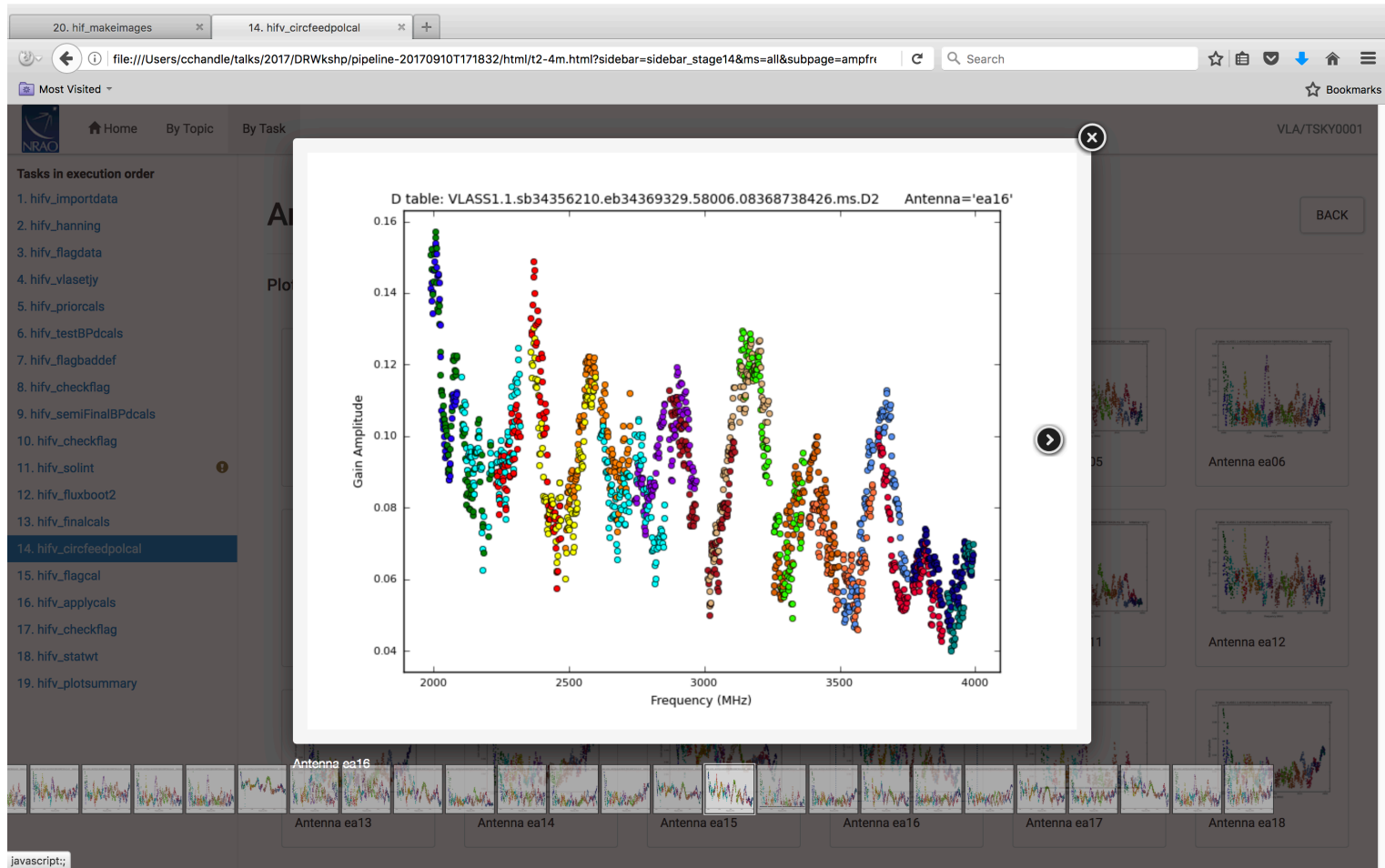
Antenna ea01 Antenna ea02 Antenna ea03 Antenna ea04 Antenna ea05 Antenna ea06

Antenna ea07 Antenna ea08 Antenna ea09 Antenna ea10 Antenna ea11 Antenna ea12

Antenna ea13 Antenna ea14 Antenna ea15 Antenna ea16 Antenna ea17 Antenna ea18

file:///Users/cchandle/talks/2017/DRWkshp/pipeline-20170910T171832/html/stage14/ampfreq_2.png

Polarization Calibration (hifv_circfeedpolcal)



Additional polcal plotsummary plots

20. hif_makeimages x 21. hifv_plotssummary x +

file:///Users/cchandle/talks/2017/DRWkshp/pipeline2-20170910T171832/html/t2-4m.html?sidebar=sidebar_stage21&ms=all&subpage=t2-4r Search ☆ ☆ ☆ ☆ ☆

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NRAO Home By Topic By Task VLA/TSKY0001

Tasks in execution order

1. hifv_importdata
2. hifv_hanning
3. hifv_flagdata
4. hifv_vlasetj
5. hifv_priors
6. hifv_testBPDcals
7. hifv_flagbaddef
8. hifv_checkflag
9. hifv_semiFinalBPDcals
10. hifv_checkflag
11. hifv_solint
12. hifv_fluxboot2
13. hifv_finalcals
14. hifv_cirfeedpolcal
15. hifv_flagcal
16. hifv_applycals
17. hifv_checkflag
18. hifv_statwt
19. hifv_plotssummary
20. hifv_exportdata
21. hifv_plotssummary

Calibrated phase vs frequency, intent='POLANGLE, POLLEAKAGE, BANDPASS, PHASE'

Plots of calibrated phase vs frequency for all antennas and correlation='RL,LR', intent=POLANGLE, POLLEAKAGE, BANDPASS and PHASE.

VLASS1.1.sb34356210.eb34369329.58006.08368738426.ms

<p>Phase-corrected vs. Frequency</p> <p>Receiver bands: 13cm (S) (Spws 2, 3, 4, 5, 6, 7, 8 and 9)</p> <p>Polangle calibrator: 3C286.</p>	<p>Phase-corrected vs. Frequency</p> <p>Receiver bands: 13cm (S) (Spws 10, 11, 12, 13, 14, 15, 16 and 17)</p> <p>Polangle calibrator: 3C286.</p>	<p>Phase-corrected vs. Frequency</p> <p>Receiver bands: 13cm (S) (Spws 2, 3, 4, 5, 6, 7, 8 and 9)</p> <p>Polleakage calibrator: J1944+5448.</p>	<p>Phase-corrected vs. Frequency</p> <p>Receiver bands: 13cm (S) (Spws 10, 11, 12, 13, 14, 15, 16 and 17)</p> <p>Polleakage calibrator: J1944+5448.</p>
<p>Phase-corrected vs. Frequency</p> <p>Receiver bands: 13cm (S) (Spws 2, 3, 4, 5, 6, 7, 8 and 9)</p> <p>Phase calibrator: J1944+5448.</p>	<p>Phase-corrected vs. Frequency</p> <p>Receiver bands: 13cm (S) (Spws 10, 11, 12, 13, 14, 15, 16 and 17)</p> <p>Phase calibrator: J1944+5448.</p>	<p>Phase-corrected vs. Frequency</p> <p>Receiver bands: 13cm (S) (Spws 2, 3, 4, 5, 6, 7, 8 and 9)</p> <p>Bandpass calibrator: 3C286.</p>	<p>Phase-corrected vs. Frequency</p> <p>Receiver bands: 13cm (S) (Spws 10, 11, 12, 13, 14, 15, 16 and 17)</p> <p>Bandpass calibrator: 3C286.</p>

file:///Users/cchandle/talks/2017/DRWkshp/pipeline2-20170910T171832/html/stage21/VLASS1.1.sb34356210.eb34369329.58006.08368738426.ms-3C286-bb15-BANDPASS-phase_vs_freq-RL_LR.png

Future Developments

- Heuristics being developed for:
 - Multi-band delays
 - Gain compression
 - Low-frequencies (<1 GHz)
 - Self-calibration and imaging for PI science
- Heuristics developed in consultation with expert users and staff; testing, feedback, suggestions welcome!

For how to run the pipeline see Drew's talk next! Or go to <http://go.nrao.edu/vla-pipe>