VLA Pipeline, Weblog, Data Products

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VLA Calibration Pipeline - Overview

- The ‘real-time’ pipeline is automatically run on all Scheduling Blocks (SBs) as soon as raw data are ingested in the archive:
  - Flagged and calibrated data are delivered to users
  - Pipeline should run correctly on ‘standard’ Stokes I science SBs
  - Output undergoes basic quality assurance (QA) checks by NRAO staff
  - Science-Ready Data Products (SRDP): detailed checks made for C-band and higher (≥ 4 GHz) continuum products; a few other restrictions
    - reports generated from SRDP QA are archived as pipeline products
    - basic images produced with new VLA *imaging* pipeline (more later)
  - For non-SRDP: imaging and self-calibration (if needed) are left to end users to perform at their local institution or on NRAO computing

VLA Calibration Pipeline - Overview

- Current versions available:
  - CASA integrated pipeline: compatible with ALMA pipeline infrastructure; used as real-time pipeline since Sep 2015
    - recommended pipeline version
    - Instructions for installation and operation are available at http://go.nrao.edu/vla-pipe
    - VLA CASA Pipeline Guide at http://go.nrao.edu/vla-casa-tut
  - "scripted" pipeline: collection of python scripts that use CASA tasks wherever possible, but also uses toolkit calls. It was the original VLA pipeline and used in real-time pipeline operations from 2013 until Sep 2015. No longer updated (since CASA 5.3)

Will the Calibration Pipeline work for you?

- The pipeline successfully completes on ~96% of VLA science SBs. Usefulness of output depends on science goals, observing setup
  - Intended for 128-MHz spws (64 MHz for L-band; default setup) but may work for narrower bandwidths as well
  - Requires SNR=3 limit on initial gain calibration *per integration*
  - No polarization calibration (yet) but can use pipeline output as a starting point.*
  - Will probably work for VLA data observed since May 2012. May work for earlier data, but likely that extra flagging/editing needed

* See polarization guide at http://go.nrao.edu/vla-casa-tut
Requires CASA 5.4.1 or later, and correct polarization intents in the SB

Pipeline Requirements

- The pipeline relies on correct scan intents. To run correctly, SB must have *at minimum* the following intents:
  - A flux density scale 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. Determines flux density scaling (reliable to 5-10% depending on observing band).
  - Complex gain calibrator scans: scans should bracket science targets; used to calibrate atmospheric changes over time

**Some (especially 3C48, 3C138) are varying recently, use 3C286 if possible*

Calibration Pipeline Heuristics

- Derives all prior calibrations (antenna position corrections, gain curves, atmospheric opacity, requantizer gains)
- Runs Hanning smoothing*
- Applies deterministic flags ("online" flags, shadowed antennas, spw edges*)
- Iteratively determines initial delay and bandpass solutions, including running RFLAG, and identifying system problems
- Derives initial gain solutions, does flux density bootstrapping and derives spectral index of all calibrators, sets models
- Derives final delay, bandpass, and complex gain calibrations
- Applies all calibration tables
- 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.*

Pipeline weblog - overview

- Pipeline weblog created in realtime (updates while running)
  - located in *pipeline-YYYYMMDDTHHMMSSS/html/index.html* in the working directory
- Diagnostic plots and tables for most stages
- CASA log file per task, or as a whole (can be large)
- Produces calibrator images per observing band
- The following example is used in our pipeline guide: https://casaguides.nrao.edu/index.php?title=VLA-S-CASA_Pipeline-CASA6.4.1

Pipeline Weblog

https://casa.nrao.edu/Data/EVLA/Pipeline/S-CASA6.2.1/html/

Home | By Topic | By Task | Project Code N/A

Observation Overview

Project	uid://evla/pdb/35621723
Principal Investigator	Dr. Emmanuel Momjian
Observation Start	2018-10-04 05:41:35 UTC
Observation End	2018-10-04 08:32:45 UTC

Pipeline Summary

Pipeline Version	2021.2.0.128
CASA Version	6.2.1.7 (environment)
IERSeop2000 Version	0001.0151 (last date: 2021-08-01 00:00:00)
IERSpredict Version	0623.0600 (last date: 2022-01-01 00:00:00)
Pipeline Start	2021-11-16 15:08:01 UTC
Execution Duration	4:31:14

Observation Summary

Measurement Set	Receivers	Num Antennas	Time (UTC)			Baseline Length			Size
			Start	End	On Target	Min	Max	RMS	
Scheduling Block ID: uid://evla/pdbsb/35624494									
Session: default									
TDRW0001.sb35624494.eb35628826.58395.23719237269.ms	13cm (S)	27	2018-10-04 05:41:35	2018-10-04 08:32:45	2:13:55	40.0 m	1.0 km	441.9 m	11.7 GB
TDRW0001.sb35624494.eb35628826.58395.23719237269_target.ms	13cm (S)	27	2018-10-04 06:04:00	2018-10-04 08:30:00	2:13:55	40.0 m	1.0 km	441.9 m	9.2 GB

Pipeline Weblog

Home | By Topic | By Task | Project Code N/A

Session: default

TDRW0001.sb35624494.eb35628826

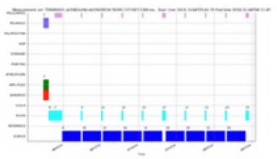
TDRW0001.sb35624494.eb35628826

Overview of 'TDRW0001.sb35624494.eb35628826.58395.23719237269.ms'

Observation Execution Time

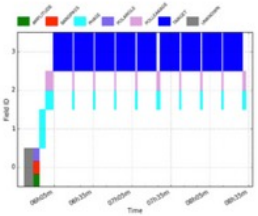
Start Time	2018-10-04 05:41:35
End Time	2018-10-04 08:32:45
Total Time on Source	2:49:14
Total Time on Science Target	2:13:55

LISTOBS OUTPUT



Intent vs Time

Track scan intent vs time



Field vs Time

Track observed field vs time

Spatial Setup

Science Targets	'3C75'
Calibrators	'0137+331=3C48', 'J0259+0747' and 'J2355+4950'

Spectral Setup

All Bands	'13cm (S)' and '6cm (C)'
Science Bands	'13cm (S)'
VLA Bands: Basebands: Freq range: [spws]	S: A0C0: 2.487 GHz to 3.511 GHz: [2,3,4,5,6,7,8,9]

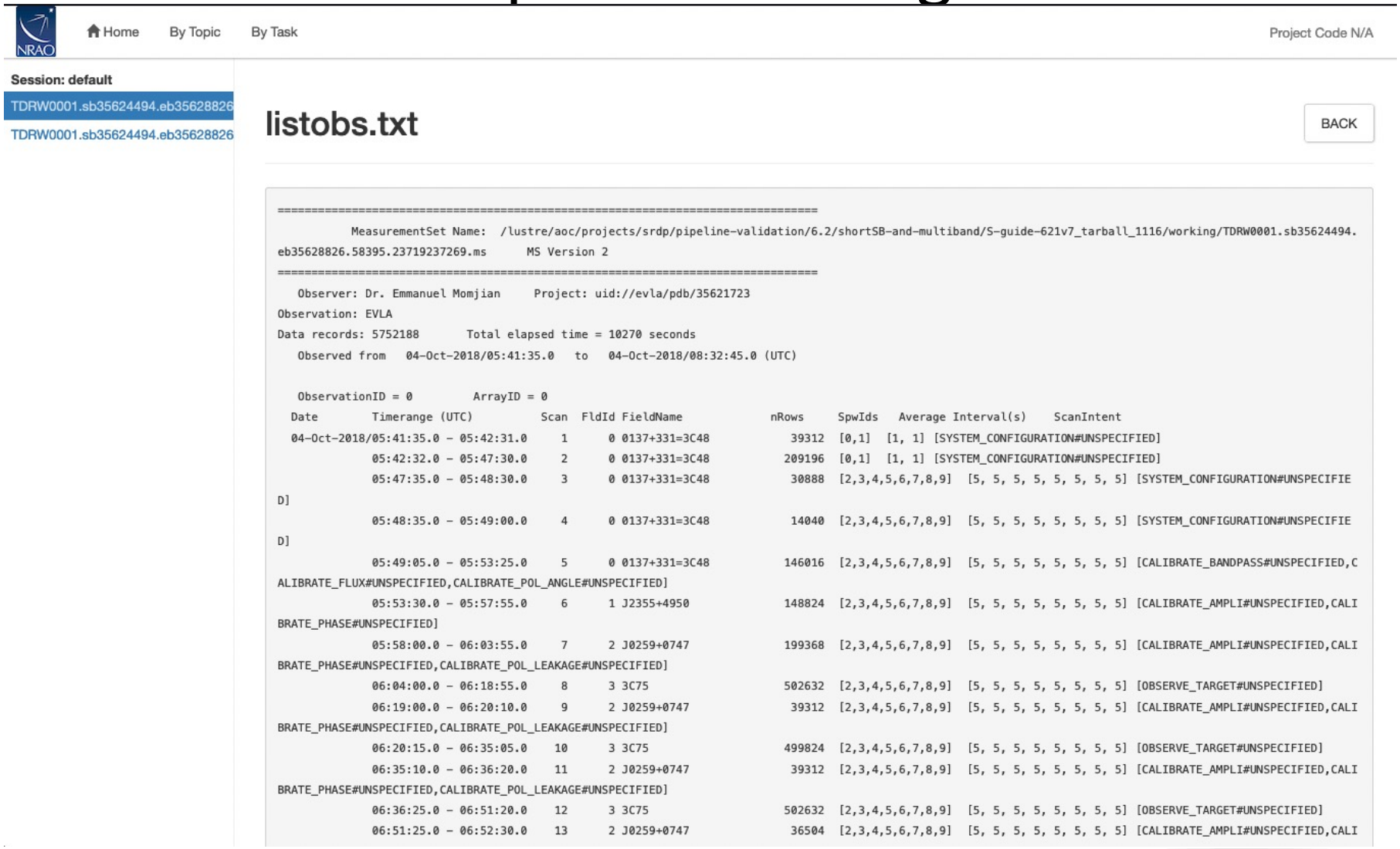
Antenna Setup

Min Baseline	40.0 m

Sky Setup

Min Elevation	36.89 degrees

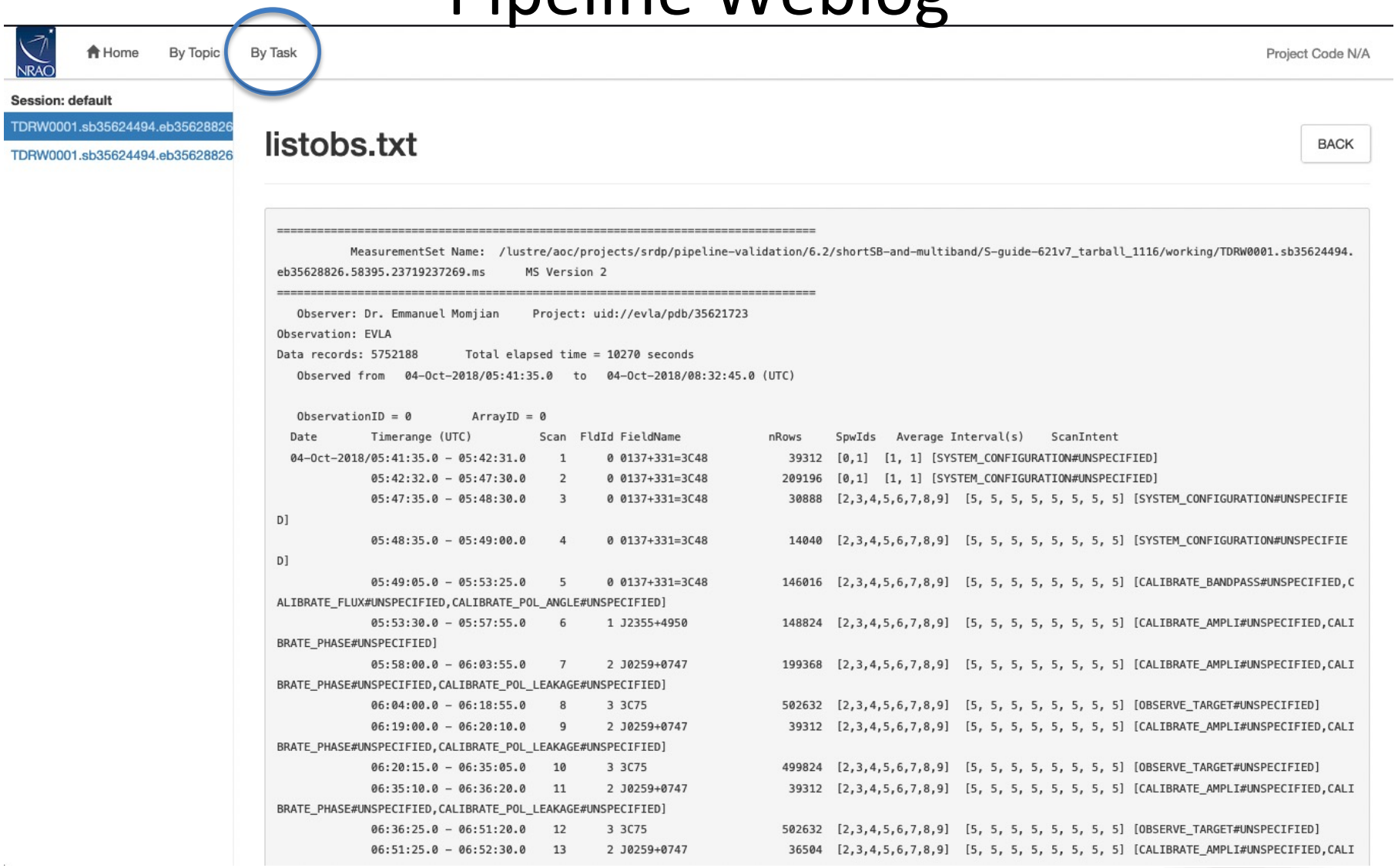
Pipeline Weblog




```
================================================================================
          MeasurementSet Name:  /lustre/aoc/projects/srdp/pipeline-validation/6.2/shortSB-and-multiband/S-guide-621v7_tarball_1116/working/TDRW0001.sb35624494.
eb35628826.58395.23719237269.ms      MS Version 2
================================================================================
   Observer: Dr. Emmanuel Momjian     Project: uid://evla/pdb/35621723
Observation: EVLA
Data records: 5752188       Total elapsed time = 10270 seconds
   Observed from   04-Oct-2018/05:41:35.0   to   04-Oct-2018/08:32:45.0 (UTC)

   ObservationID = 0         ArrayID = 0
  Date        Timerange (UTC)          Scan  FldId FieldName             nRows     SpwIds   Average Interval(s)    ScanIntent
  04-Oct-2018/05:41:35.0 - 05:42:31.0     1      0 0137+331=3C48           39312  [0,1]  [1, 1] [SYSTEM_CONFIGURATION#UNSPECIFIED]
              05:42:32.0 - 05:47:30.0     2      0 0137+331=3C48          209196  [0,1]  [1, 1] [SYSTEM_CONFIGURATION#UNSPECIFIED]
              05:47:35.0 - 05:48:30.0     3      0 0137+331=3C48           30888  [2,3,4,5,6,7,8,9]  [5, 5, 5, 5, 5, 5, 5, 5] [SYSTEM_CONFIGURATION#UNSPECIFIE
D]
              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, 5, 5, 5, 5, 5] [SYSTEM_CONFIGURATION#UNSPECIFIE
D]
              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, 5, 5, 5, 5, 5] [CALIBRATE_BANDPASS#UNSPECIFIED,C
ALIBRATE_FLUX#UNSPECIFIED,CALIBRATE_POL_ANGLE#UNSPECIFIED]
              05:53:30.0 - 05:57:55.0     6      1 J2355+4950             148824  [2,3,4,5,6,7,8,9]  [5, 5, 5, 5, 5, 5, 5, 5] [CALIBRATE_AMPLI#UNSPECIFIED,CALI
BRATE_PHASE#UNSPECIFIED]
              05:58:00.0 - 06:03:55.0     7      2 J0259+0747             199368  [2,3,4,5,6,7,8,9]  [5, 5, 5, 5, 5, 5, 5, 5] [CALIBRATE_AMPLI#UNSPECIFIED,CALI
BRATE_PHASE#UNSPECIFIED,CALIBRATE_POL_LEAKAGE#UNSPECIFIED]
              06:04:00.0 - 06:18:55.0     8      3 3C75                   502632  [2,3,4,5,6,7,8,9]  [5, 5, 5, 5, 5, 5, 5, 5] [OBSERVE_TARGET#UNSPECIFIED]
              06:19:00.0 - 06:20:10.0     9      2 J0259+0747              39312  [2,3,4,5,6,7,8,9]  [5, 5, 5, 5, 5, 5, 5, 5] [CALIBRATE_AMPLI#UNSPECIFIED,CALI
BRATE_PHASE#UNSPECIFIED,CALIBRATE_POL_LEAKAGE#UNSPECIFIED]
              06:20:15.0 - 06:35:05.0    10      3 3C75                   499824  [2,3,4,5,6,7,8,9]  [5, 5, 5, 5, 5, 5, 5, 5] [OBSERVE_TARGET#UNSPECIFIED]
              06:35:10.0 - 06:36:20.0    11      2 J0259+0747              39312  [2,3,4,5,6,7,8,9]  [5, 5, 5, 5, 5, 5, 5, 5] [CALIBRATE_AMPLI#UNSPECIFIED,CALI
BRATE_PHASE#UNSPECIFIED,CALIBRATE_POL_LEAKAGE#UNSPECIFIED]
              06:36:25.0 - 06:51:20.0    12      3 3C75                   502632  [2,3,4,5,6,7,8,9]  [5, 5, 5, 5, 5, 5, 5, 5] [OBSERVE_TARGET#UNSPECIFIED]
              06:51:25.0 - 06:52:30.0    13      2 J0259+0747              36504  [2,3,4,5,6,7,8,9]  [5, 5, 5, 5, 5, 5, 5, 5] [CALIBRATE_AMPLI#UNSPECIFIED,CALI
```

Pipeline Weblog



Pipeline Weblog

Home | By Topic | By Task | Project Code N/A

Task Summaries

Task	QA Score	Duration
1. **hifv_importdata**: Register VLA measurement sets with the pipeline	1.00	0:08:34
2. **hifv_hanning**: VLA Hanning Smoothing	No QA N/A	0:03:42
3. **hifv_flagdata**: VLA Deterministic flagging	1.00	0:06:18
4. **hifv_vlasetjy**: Set calibrator model visibilities	1.00	0:01:35
5. **hifv_priorcals**: Priorcals (gaincurves, opacities, antenna positions corrections, rq gains, and switched power)	No QA N/A	0:27:51
6. **hifv_testBPdcals**: Initial test calibrations	1.00	0:05:35
7. **hifv_checkflag**: Checkflag summary	0.97	0:02:02
8. **hifv_semiFinalBPdcals**: Semi-final delay and bandpass calibrations	1.00	0:05:23
9. **hifv_checkflag**: Checkflag summary	1.00	0:06:41
10. **hifv_solint**: Determine solint and Test gain calibrations	1.00	0:03:01
11. **hifv_fluxboot**: Gain table for flux density bootstrapping	0.96	0:03:40
12. **hifv_finalcals**: Final Calibration Tables	1.00	0:09:42
13. **hifv_applycals**: Apply calibrations from context	1.00	0:05:20
14. **hifv_checkflag**: Checkflag summary	1.00	0:36:18
15. **hifv_targetflag**: Targetflag	1.00	0:06:40
16. **hifv_statwt**: Reweight visibilities	1.00	0:13:01
17. **hifv_plotsummary**: VLA Plot Summary	1.00	0:09:17
18. **hif_makeimlist**: Set-up parameters for phase calibrator & bandpass calibrator imaging	1.00	0:00:35
19. **hif_makeimages**: Make calibrator images	1.00	0:08:05
20. **hifv_exportdata**: Prepare pipeline data products for export	1.00	0:02:27
21. **hif_mstransform**: Create science target MS	1.00	0:05:30
22. **hif_checkproductsize**: Check product size	1.00	0:01:45
23. **hif_makeimlist**: Set-up parameters for target aggregate continuum imaging	1.00	0:01:26
24. **hif_makeimages**: Make target aggregate continuum images	1.00	1:33:50
25. **hifv_pbcor**: Pbcor	No QA N/A	0:00:04
26. **hifv_exportdata**: Prepare pipeline data products for export	1.00	0:02:40

Pipeline Weblog

- The following pipeline steps provide key checks for calibration quality:

  - hifv_flagdata *deterministic flagged data fraction*
  - hifv_testBPdcals *hardware problems and other obs. issues*
  - hifv_solint *solution intervals for phase cals, input gain tables*
  - hifv_fluxboot *fitted calibrator flux densities and spectral indices*
  - hifv_finalcals *final calibration tables applied to the data*
  - hifv_plotsummary *useful diagnostic plots of calibrated data*

Deterministic Flags (hifv_flagdata)

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_checkflag
8. hifv_semiFinalBPdcals
9. hifv_checkflag
10. hifv_solint
11. hifv_fluxboot
12. hifv_finalcals
13. hifv_applycals
14. hifv_checkflag
15. hifv_targetflag
16. hifv_statwt
17. hifv_plotsummary
18. hif_makeimlist (cals)
19. hif_makeimages (cals)
20. hifv_exportdata
21. hif_mstransform
22. hif_checkproductsize
23. hif_makeimlist (cont)
24. hif_makeimages (cont)
25. hifv_pbcor
26. hifv_exportdata

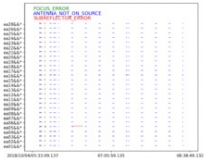
		Flagging Agent (Total Vis)			Flagging Agent (Science Vis)								Measurement Set
Data Selection (by intent)	Before Task	ANOS	Shadowed Antennas	Unwanted Intents	Other Online Flags	Flagging Template	Autocorr	Edge Channels	Clipping	Quack	Baseband	Total Science	TDRW0001.sb35624494.eb35628826.58395.23719237269.ms
All Data	3.125%	7.358%	0.000%	2.892%	0.850%	0.000%	0.000%	0.000%	0.000%	0.000%	3.598%	4.448%	4.448%
Science Spectral Windows	3.125%	5.831%	0.000%	0.595%	0.755%	0.000%	0.000%	0.000%	0.000%	0.000%	3.602%	4.357%	4.357%
Bandpass	3.125%	1.863%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	3.629%	3.629%	3.629%
Flux	3.125%	1.863%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	3.629%	3.629%	3.629%
Phase	3.125%	28.775%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	0.000%	3.629%	3.629%	3.629%
Target	3.125%	1.948%	0.000%	0.000%	0.626%	0.000%	0.000%	0.000%	0.000%	0.000%	3.606%	4.232%	4.232%
TDRW0001.sb35624494.eb35628826.58395.23719237269.ms	3.125%	7.358%	0.000%	2.892%	0.850%	0.000%	0.000%	0.000%	0.000%	0.000%	3.598%	4.448%	

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.

TDRW0001.sb35624494.eb35628826.58395.23719237269.ms



Pipeline QA

Input Parameters

Tasks Execution Statistics

CASA logs for stage 3

- View or download stage3/casapy.log (123.0 KB)

Hardware Issues (hifv_testBPdcals)

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_checkflag
8. hifv_semiFinalBPdcals
9. hifv_checkflag
10. hifv_solint
11. hifv_fluxboot
12. hifv_finalcals
13. hifv_applycals
14. hifv_checkflag
15. hifv_targetflag
16. hifv_statwt
17. hifv_plotsummary
18. hif_makeimlist (cals)
19. hif_makeimages (cals)
20. hifv_exportdata
21. hif_mstransform
22. hif_checkproductsize
23. hif_makeimlist (cont)
24. hif_makeimages (cont)
25. hifv_pbcor
26. hifv_exportdata

6. Initial test calibrations

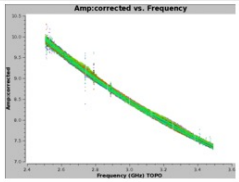
BACK

Initial test calibrations using bandpass and delay calibrators

Plots: Test delay plots | Gain Amplitude | Gain Phase | BP Amp solution | BP Phase solution

testBPdcals summary plot

TDRW0001.sb35624494.eb35628826.58395.23719237269.ms



Initial calibrated bandpass

Flag bad deformatters

Identify and flag basebands with bad deformatters or RFI based on bandpass (BP) table amps and phases.

BP Table Amps

Antenna	SPWs	Band / Basebands
None	None	S

BP Table Phases

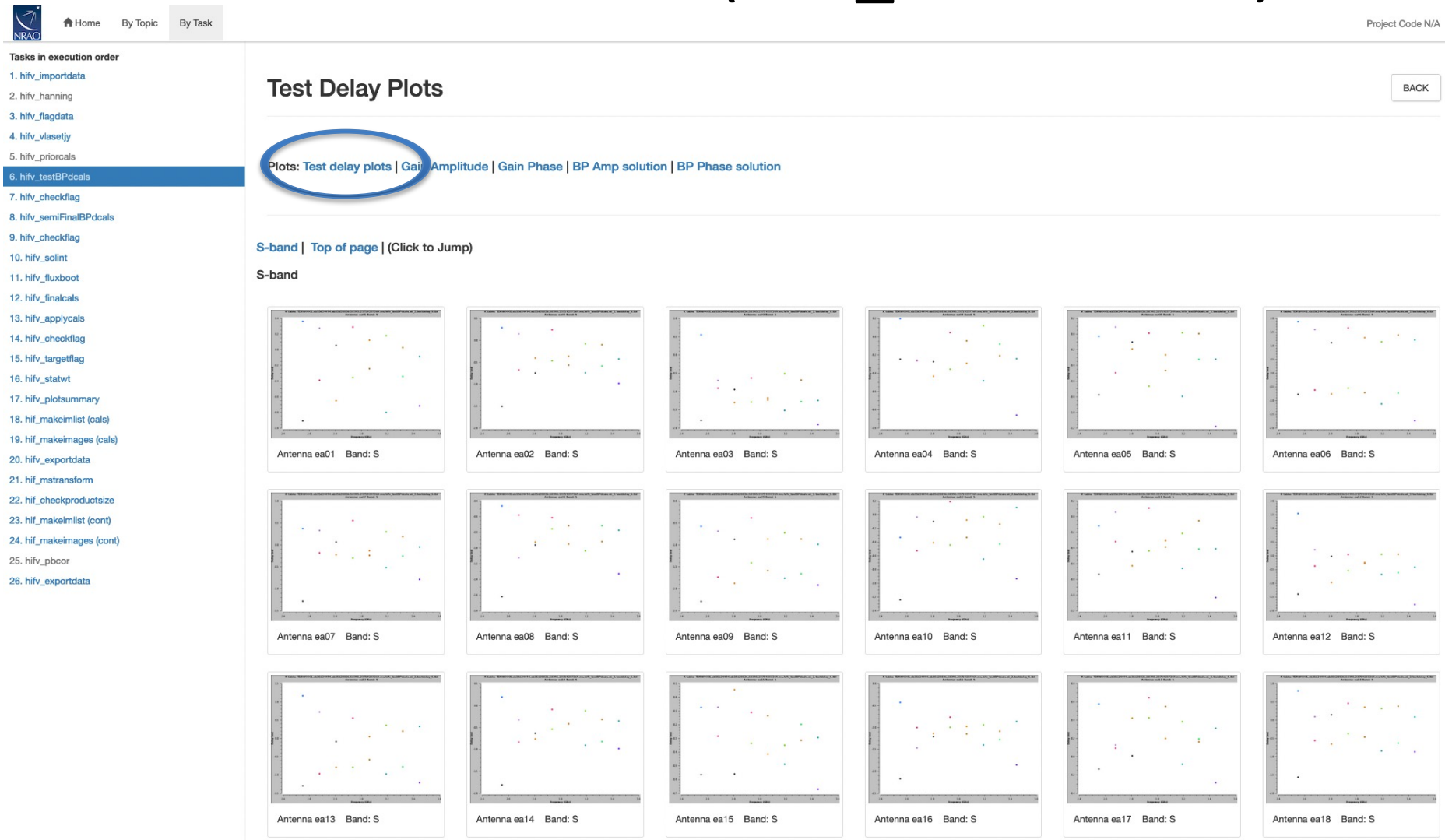
Antenna	SPWs	Band / Basebands
None	None	S

Pipeline QA

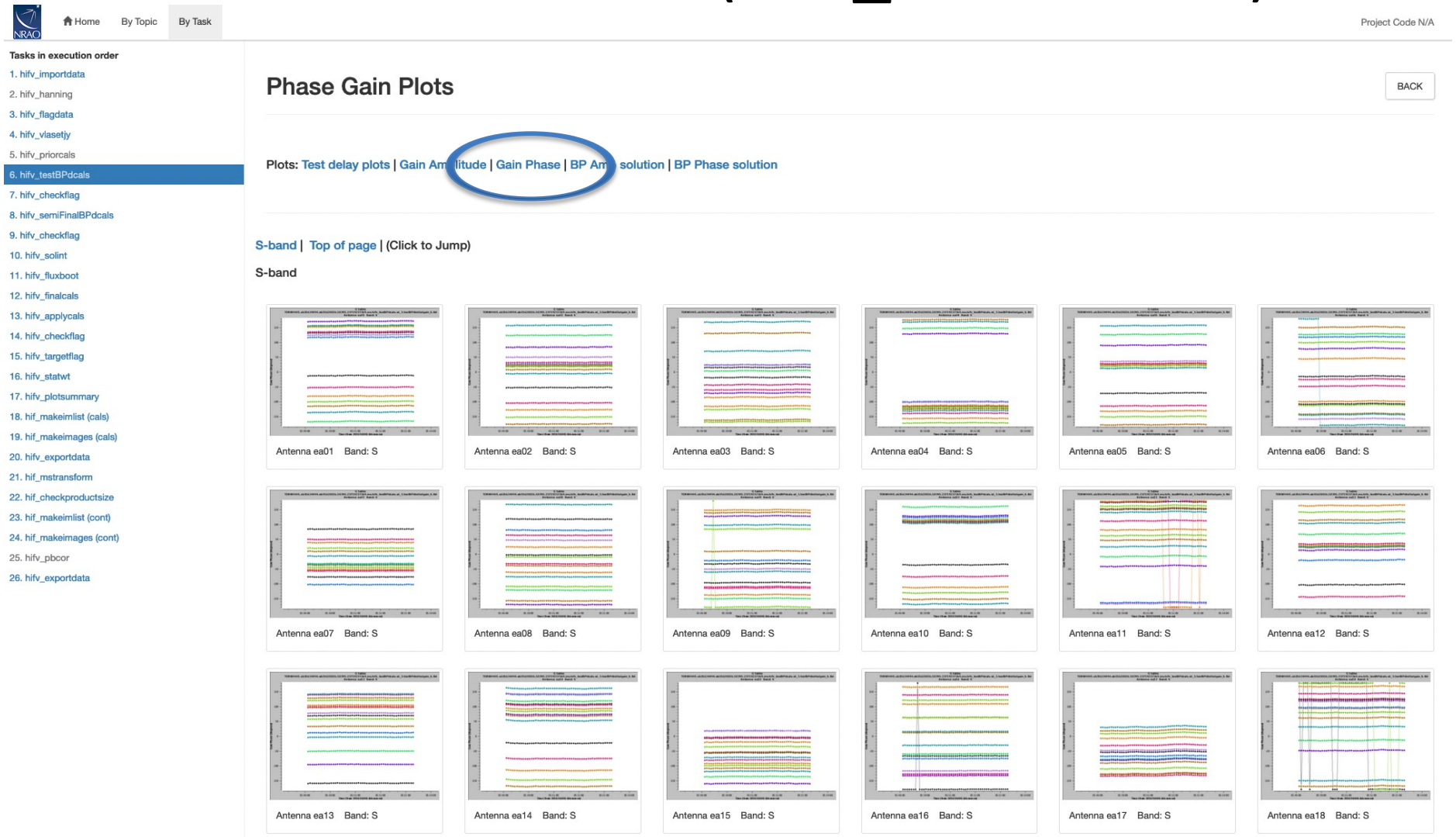
Input Parameters

Tasks Execution Statistics

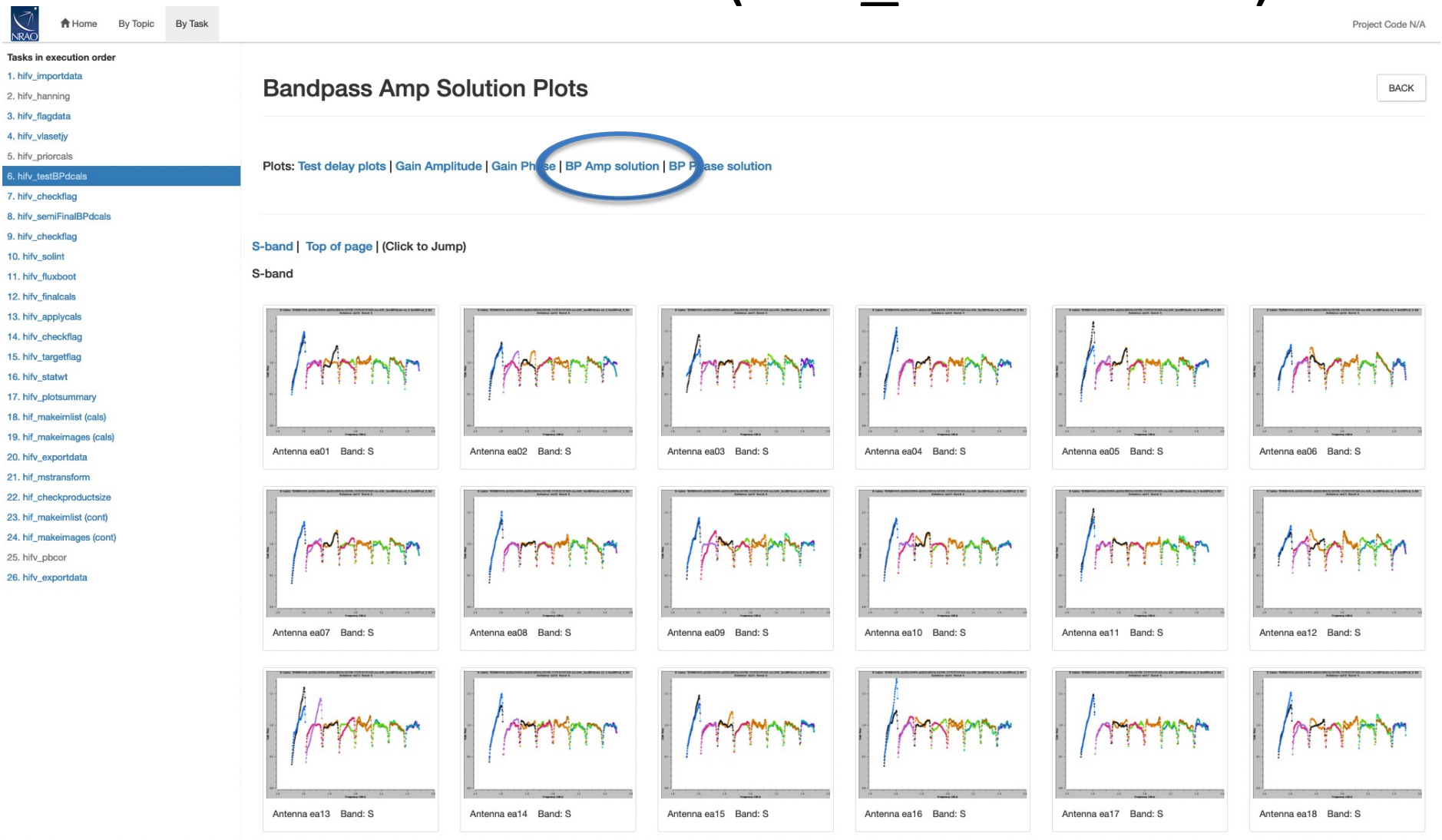
Hardware Issues (hifv_testBPdcals)



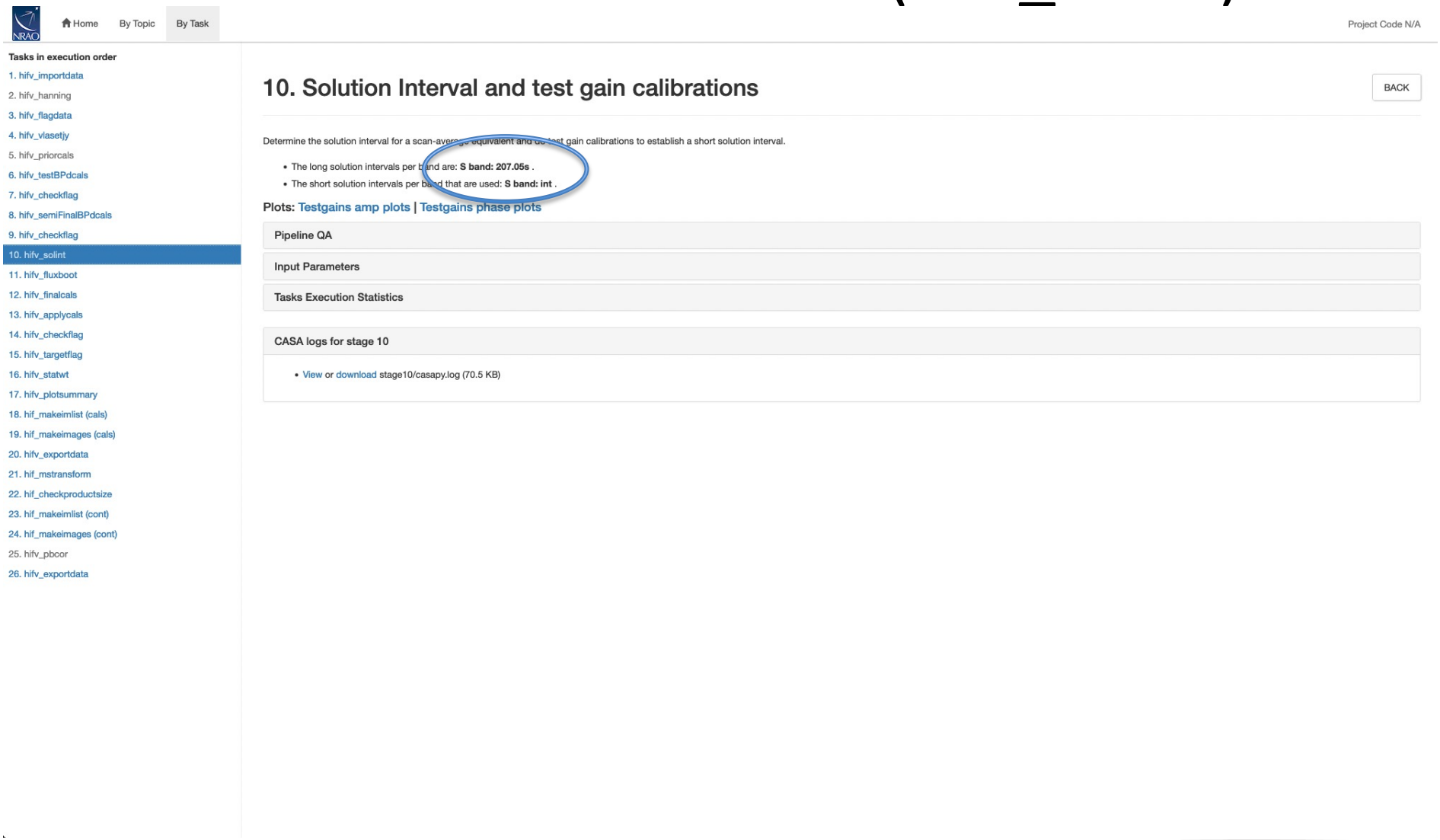
Hardware Issues (hifv_testBPdcals)



Hardware Issues (hifv_testBPdcals)



Gain Solution Intervals (hifv_solint)



Flux Density Bootstrapping (hifv_fluxboot)

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_checkflag
8. hifv_semiFinalBPdcals
9. hifv_checkflag
10. hifv_solint
11. hifv_fluxboot
12. hifv_finalcals
13. hifv_applycals
14. hifv_checkflag
15. hifv_targetflag
16. hifv_statwt
17. hifv_plotsummary
18. hif_makeimlist (cals)
19. hif_makeimages (cals)
20. hifv_exportdata
21. hif_mstransform
22. hif_checkproductsize
23. hif_makeimlist (cont)
24. hif_makeimages (cont)
25. hifv_pbcor
26. hifv_exportdata

11. Flux density bootstrapping and spectral index fitting

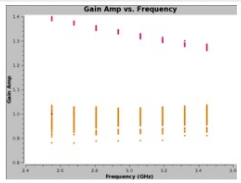
BACK

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

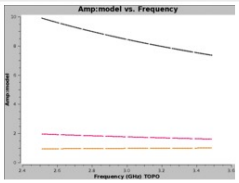
Fit the spectral index of calibrators with a power-law and put the fit in the model column.

Fluxboot summary plots

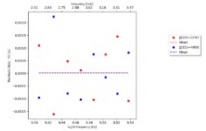
TDRW0001.sb35624494.eb35628826.58395.23719237269.ms



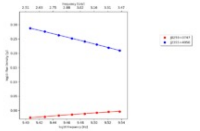
Caltable: fluxgaincal.g. Plot of amp vs. freq.



Model calibrator. Plot of amp vs. freq.



Fluxboot residuals vs. frequency



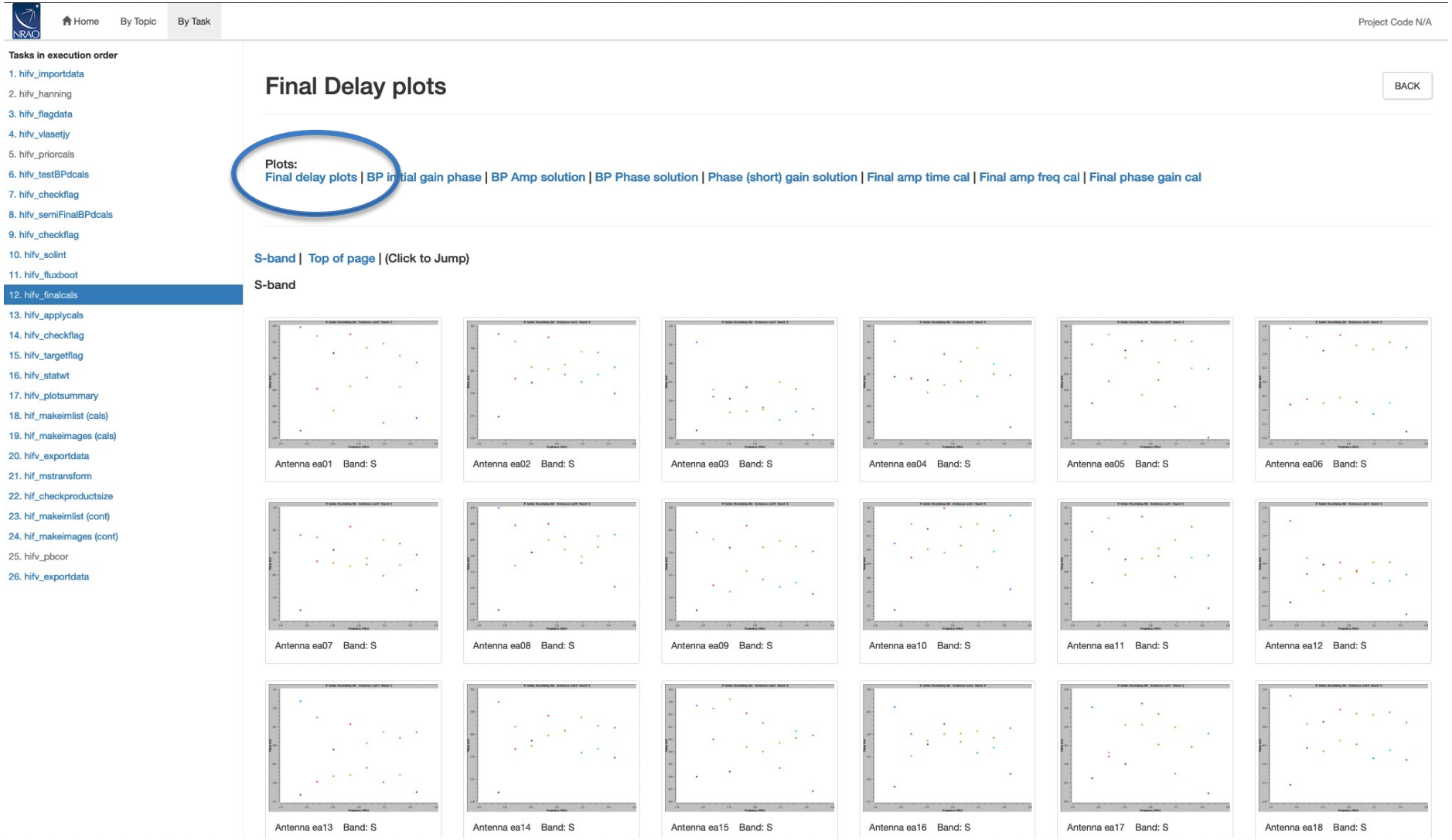
Flux vs. frequency

Source	Fit Order	Band	Band Center [GHz]	Flux density [Jy] (at Band Center)	Spectral Index	2nd order coeff	3rd order coeff	4th order coeff
J0259+0747	2	S	3.00000	0.97152 +/- 0.00072	0.16942 +/- 0.00518	-0.14589 +/- 0.13172	----	----
J2355+4950				1.76341 +/- 0.00077	-0.59833 +/- 0.00333	-0.19761 +/- 0.08241		

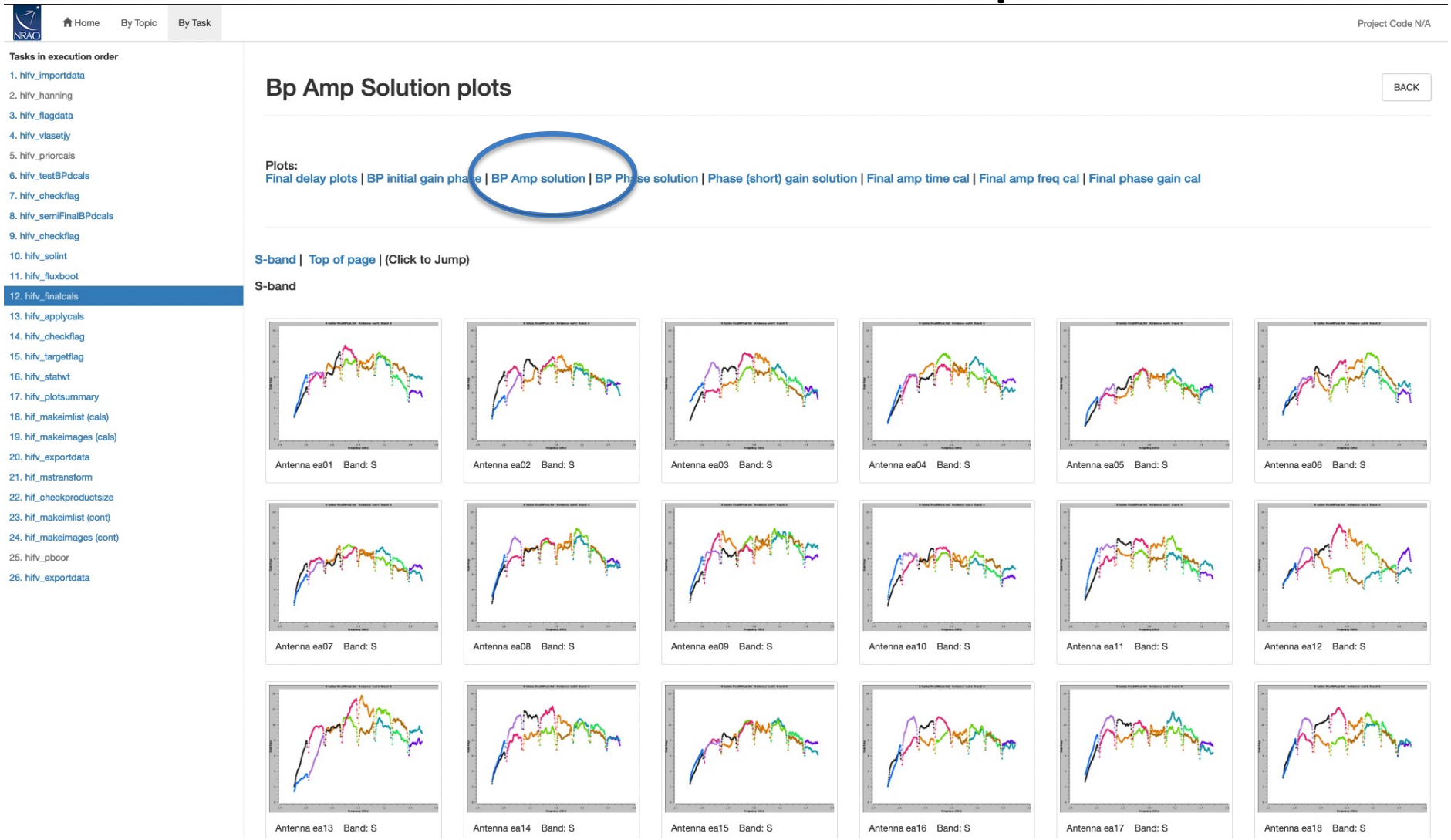
Table showing the flux density and spectral properties computed at each band center, based on the global coefficients of the fit across all bands.

Source	Frequency [GHz]	Data	Error	Fitted Data	Residual: Data-Fitted Data
J0259+0747	2.551	0.9447	0.002792	0.9436	0.001099
	2.679	0.9507	0.002612	0.9523	-0.001609
	2.807	0.9609	0.002617	0.9604	0.000483
	2.935	0.9680	0.002372	0.9679	0.000118
	3.063	0.9739	0.002462	0.9749	-0.001040
	3.191	0.9822	0.002410	0.9815	0.000744
	3.319	0.9891	0.002444	0.9877	0.001460
	3.447	0.9924	0.002332	0.9934	-0.001086
J2355+4950	2.551	1.9377	0.000822	1.9387	-0.000961
	2.679	1.8871	0.000859	1.8849	0.002237

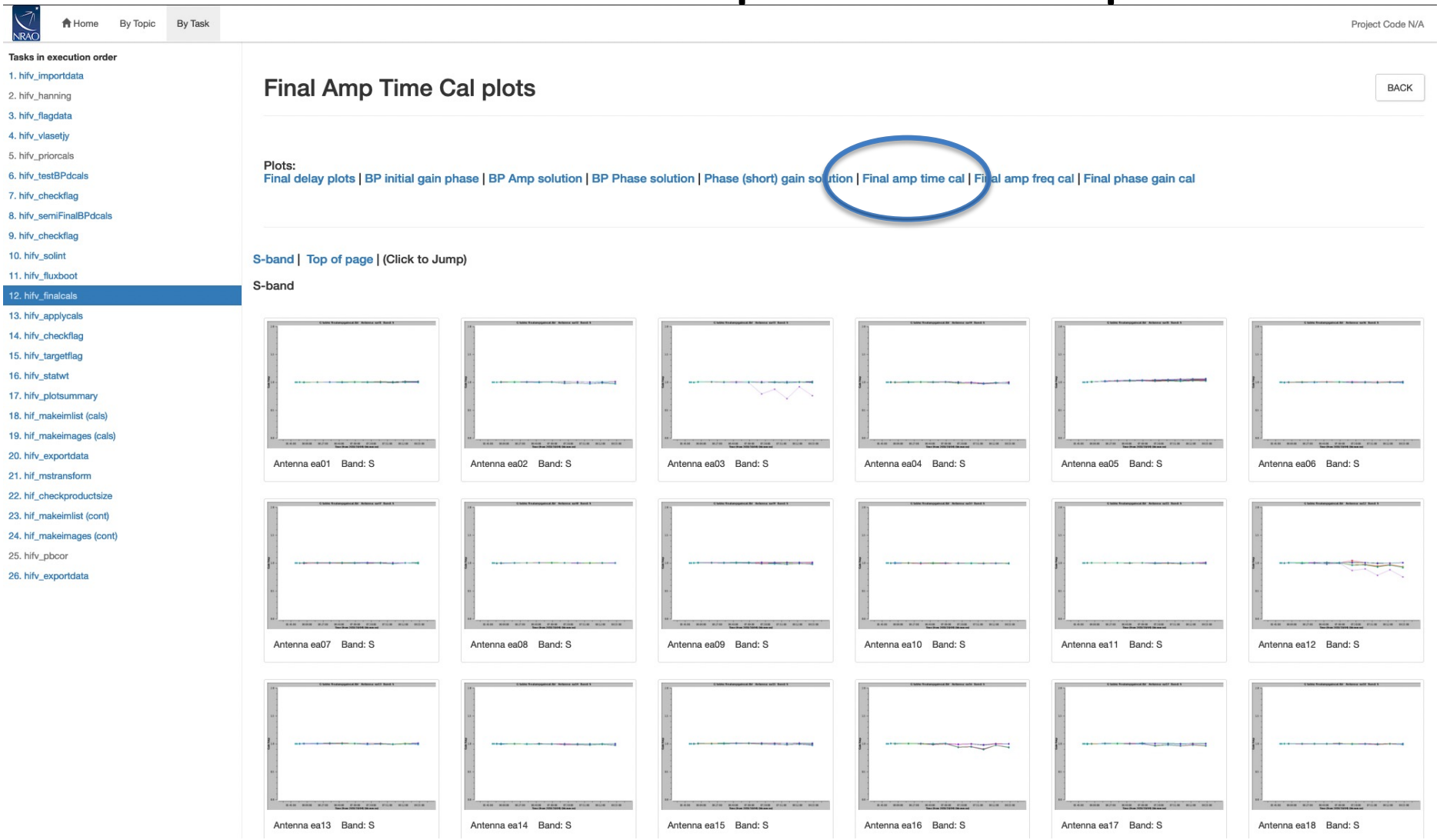
Final Calibration Tables (hifv_finalcals)



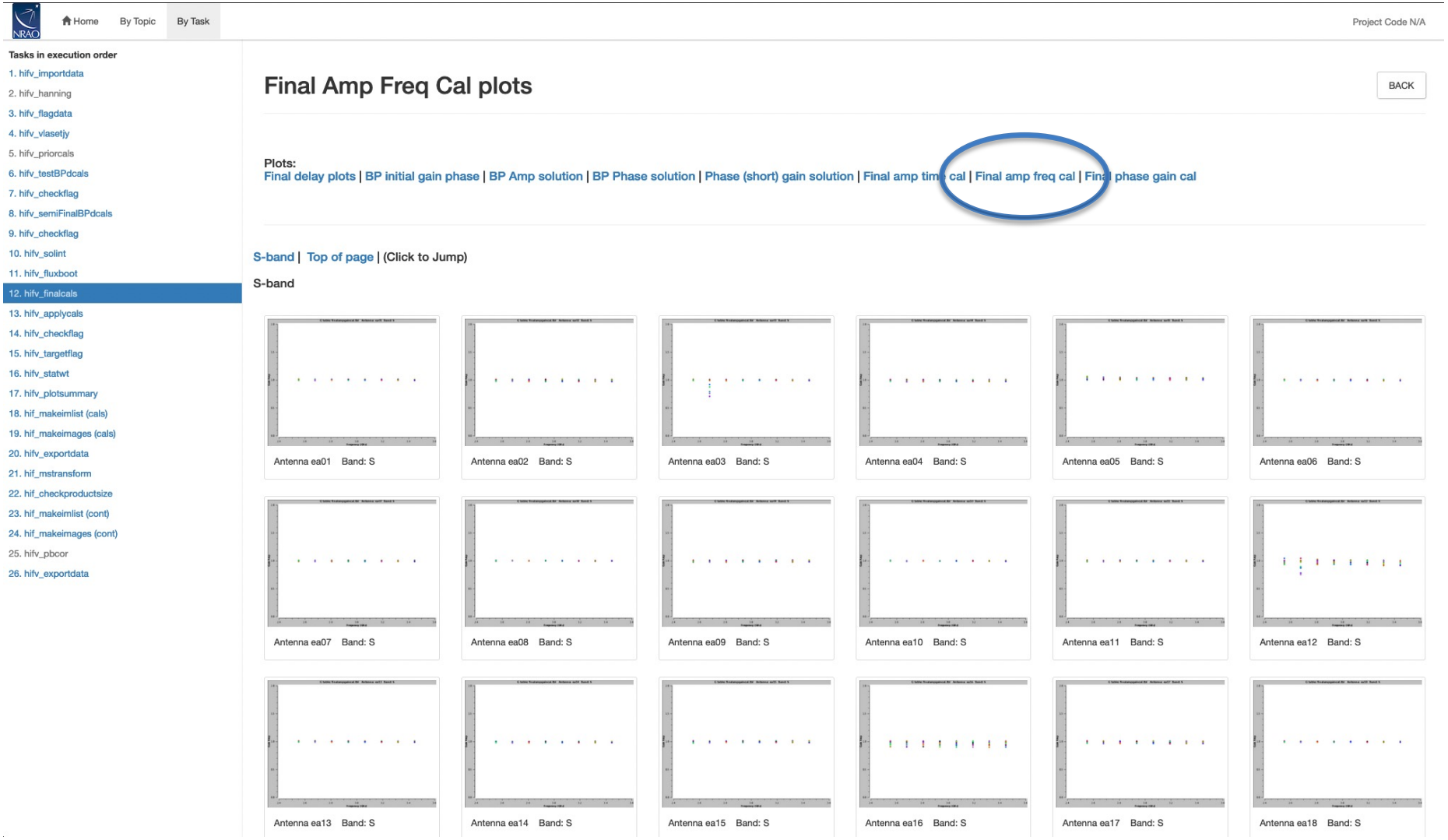
Final Cal Tables: bandpass



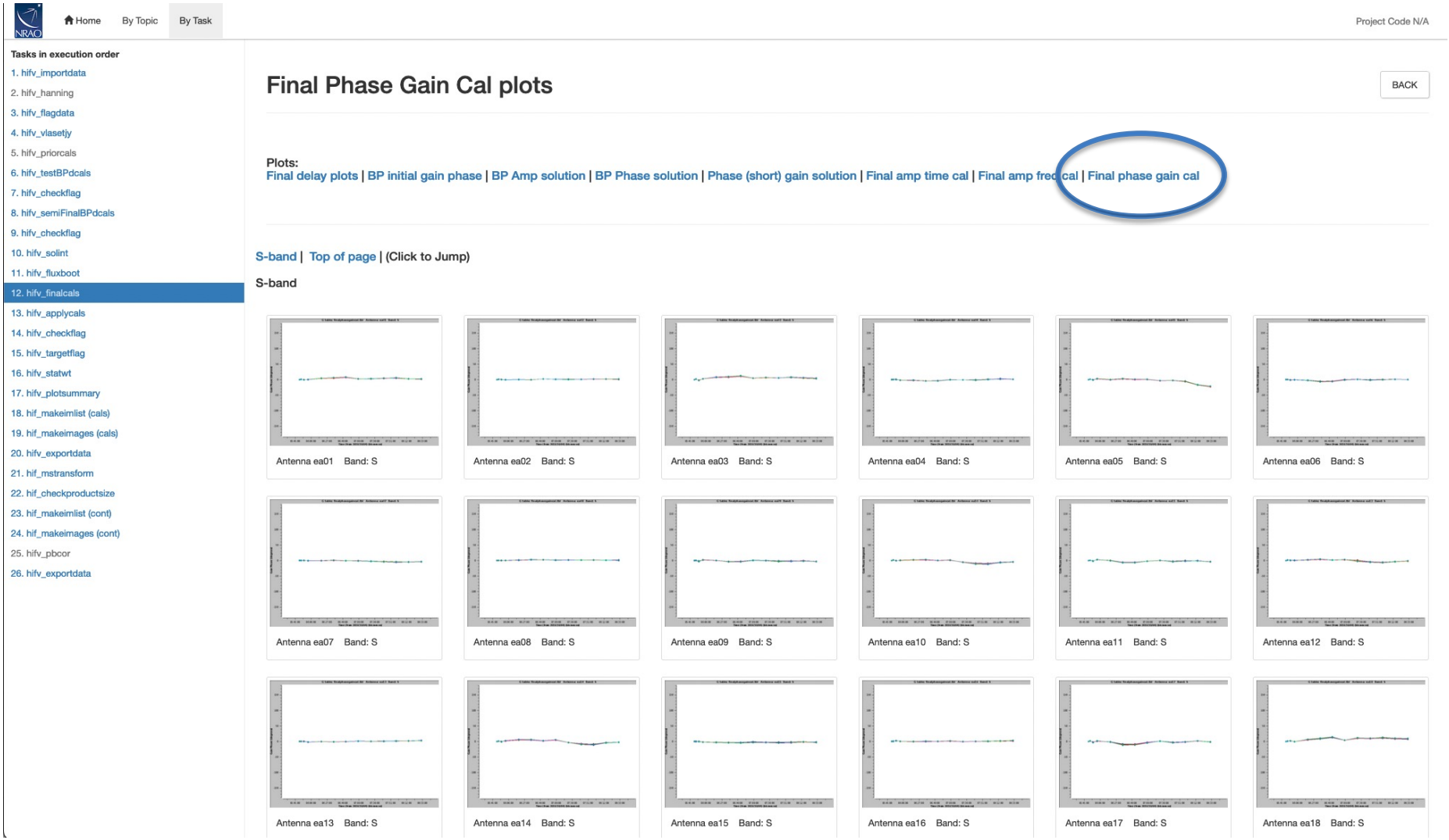
Final Cal Tables: amplitude and phase



Final Cal Tables: amplitude and phase



Final Cal Tables: amplitude and phase



Summary Plots (hifv_plotsummary)

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_checkflag
8. hifv_semiFinalBPdcals
9. hifv_checkflag
10. hifv_solint
11. hifv_fluxboot
12. hifv_finalcals
13. hifv_applycals
14. hifv_checkflag
15. hifv_targetflag
16. hifv_statwt
17. hifv_plotsummary
18. hif_makeimlist (cals)
19. hif_makeimages (cals)
20. hifv_exportdata
21. hif_mstransform
22. hif_checkproductsize
23. hif_makeimlist (cont)
24. hif_makeimages (cont)
25. hifv_pbcor
26. hifv_exportdata

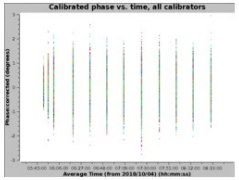
17. Plot Summary

BACK

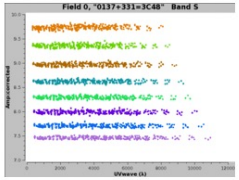
VLA Pipeline Summary Plots

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.

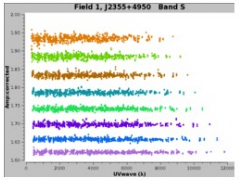
TDRW0001.sb35624494.eb35628826.58395.23719237269.ms



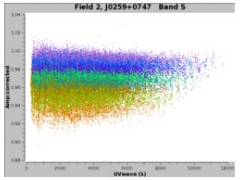
All calibrators Band: All bands



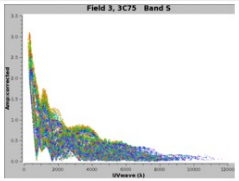
Field 0, "0137+331=3C48" Band: S



Field 1, J2355+4950 Band: S



Field 2, J0259+0747 Band: S

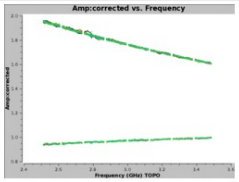


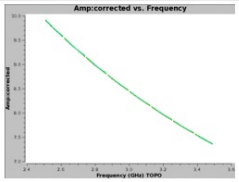
Field 3, 3C75 Band: S

Calibrated amplitude vs frequency

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

TDRW0001.sb35624494.eb35628826.58395.23719237269.ms





Calibration Pipeline Products and Outputs

(1) flagged and calibrated ms (2) final flag version, calibration tables (archived)
(3) logs, weblog used by quality assurance (QA) staff, with QA notes (archived)
(4) casa_pipescript.py, casa_commands.log, casapy log file (archived)

- Accessing/using the calibration products:
  - Calibrated MS may be requested through the archive https://data.nrao.edu
  - You may request a more detailed QA2 report from NRAO staff (help.nrao.edu, Pipeline Department)
  - If you are happy with pipeline calibration, then:
    - Do further flagging if necessary
    - Split out your target and image (imaging pipeline now available!)
  - 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

Considerations for Running

- Not all CASA versions include pipeline: (6.4.1 does)

  https://casa.nrao.edu/casa_obtaining.shtml
- Run on SDM? (MS possible but make sure online flags applied)
- Disk space needed 3-4x raw data size, more if imaging
- Compute time: 30min to … a few days (weeks for some images)
- Changes to casa_pipescript.py ? (Hanning smoothing, etc.)

(shell command line) /path/to/casa/bin/casa --pipeline
(CASA command line) execfile(casa_pipescript.py)

Spectral line data

- Several steps in the real-time pipeline may not be appropriate for spectral line data: *(may want to turn off for spectral line!)*
  - Hanning smoothing (increases effective channel width)
  - Flags 5% of ***each*** spw edge and the first and last 10 channels of each baseband *(if known line position is not near spw edge, flagging okay)*
  - Last run of RFLAG on target ***(can eliminate your line as interference!)***
  - Statwt calculates rms based on scatter of channels per spw, per visibility *(will down-weight strong lines)*

  $\Rightarrow$ *Possible approach: run pipeline once with above options turned off. Then run with "cont.dat" file to avoid known lines for RFI flagging and statwt on*

- With the above modifications, the pipeline will work with spectral line data as long as the calibrators are strong enough

VLA CASA Imaging Pipeline

https://science.nrao.edu/facilities/vla/data-processing/pipeline/VIPL

- Developed for VLA *continuum* data; from ALMA imaging pipeline
- Produces a continuum image per target field, per observed band
- Pixel/cell size samples 4-5 times across synthesized beam
- Uses nterms=2 if fractional continuum bandwidth > 10%
- Uses tclean auto-masking; cleans to 4-sigma (nsigma parameter)
- For targets with significant extended emission: inner 5% of uv-range is omitted (to avoid deconvolution errors from poorly sampled structure)

Create science targets ms (hif_mstransform)

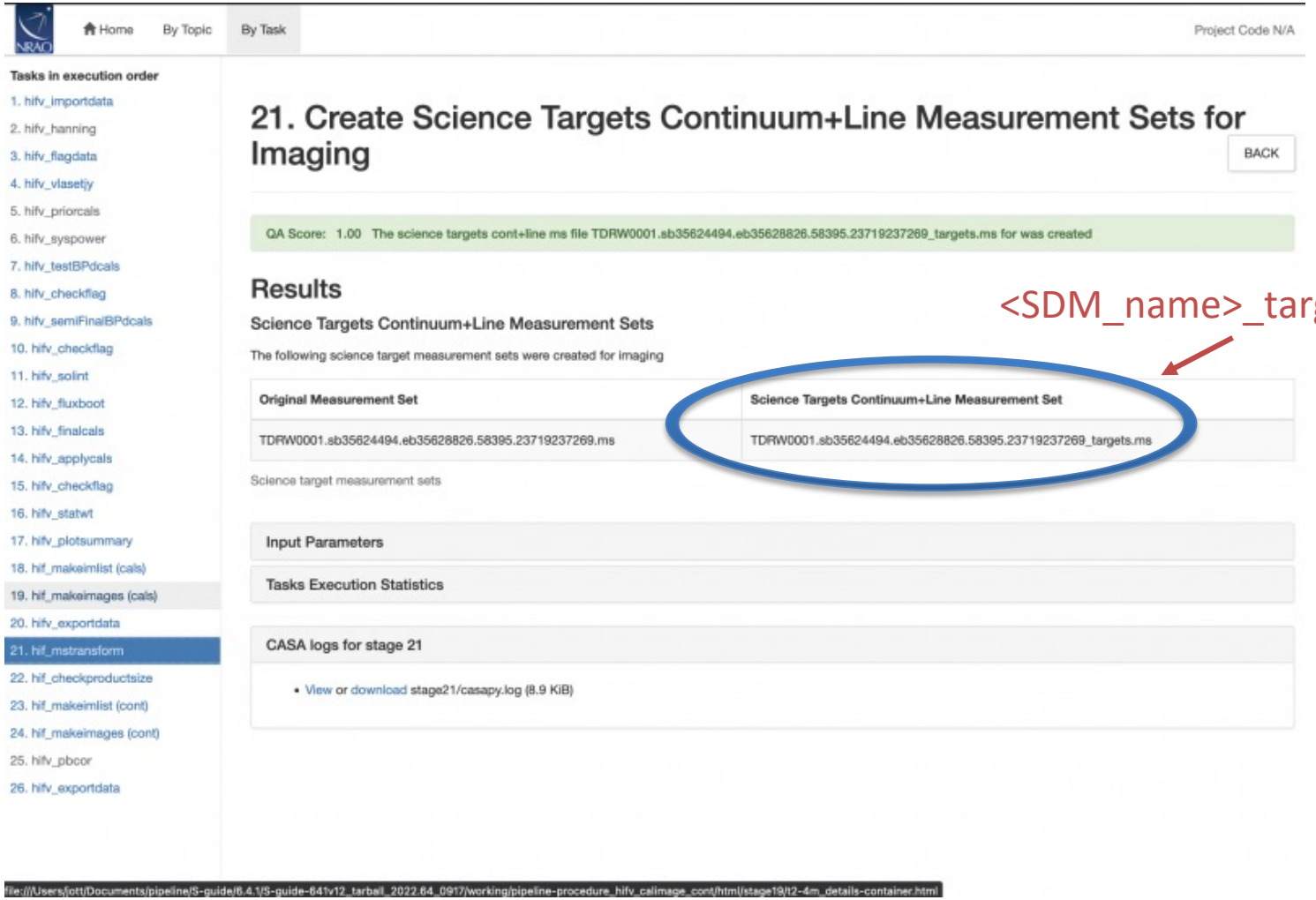
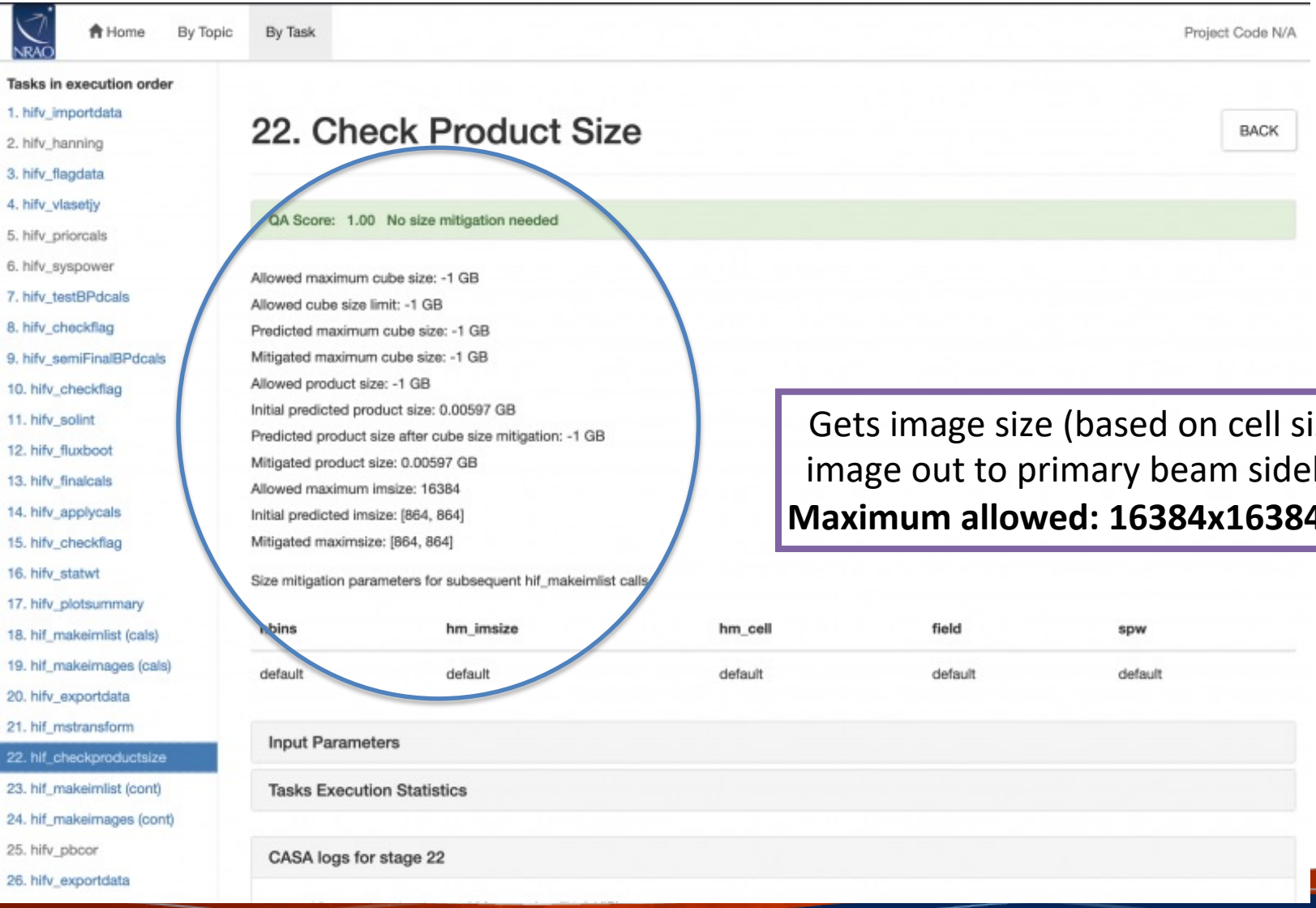
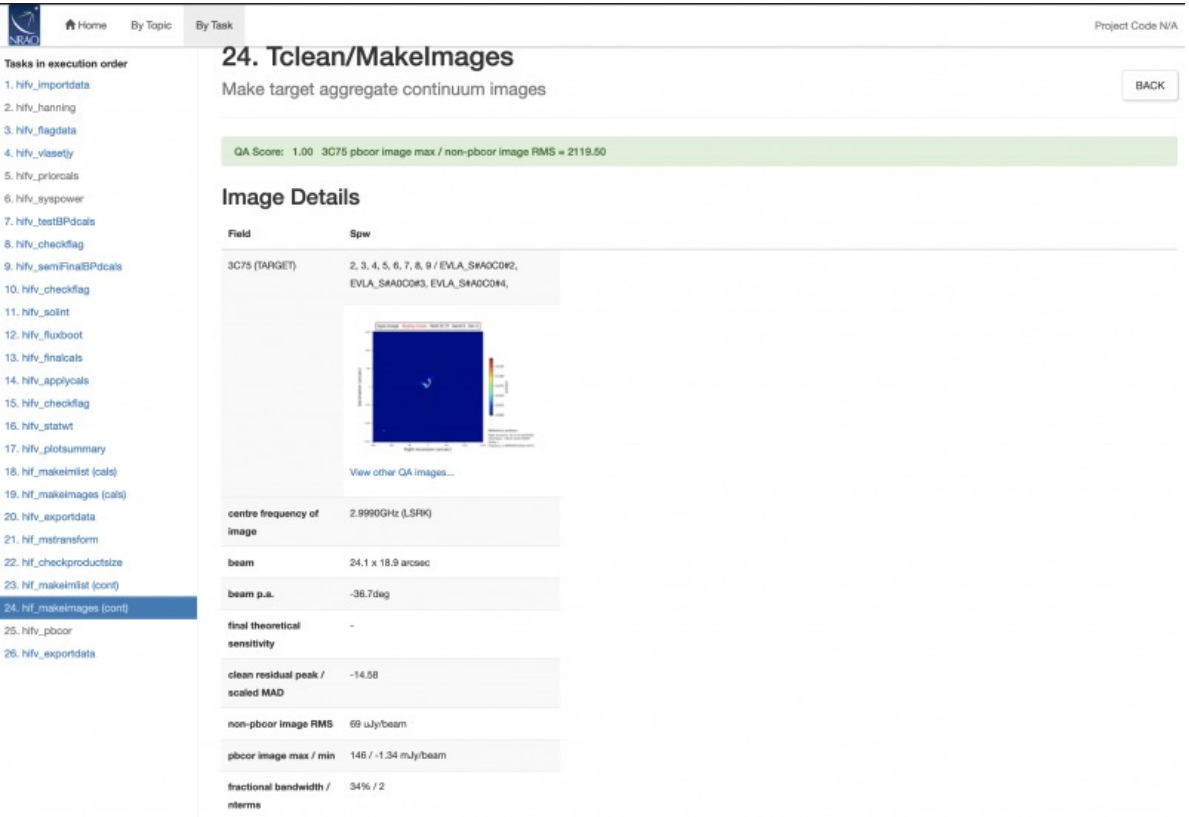


Image size (hif_checkproductsize)

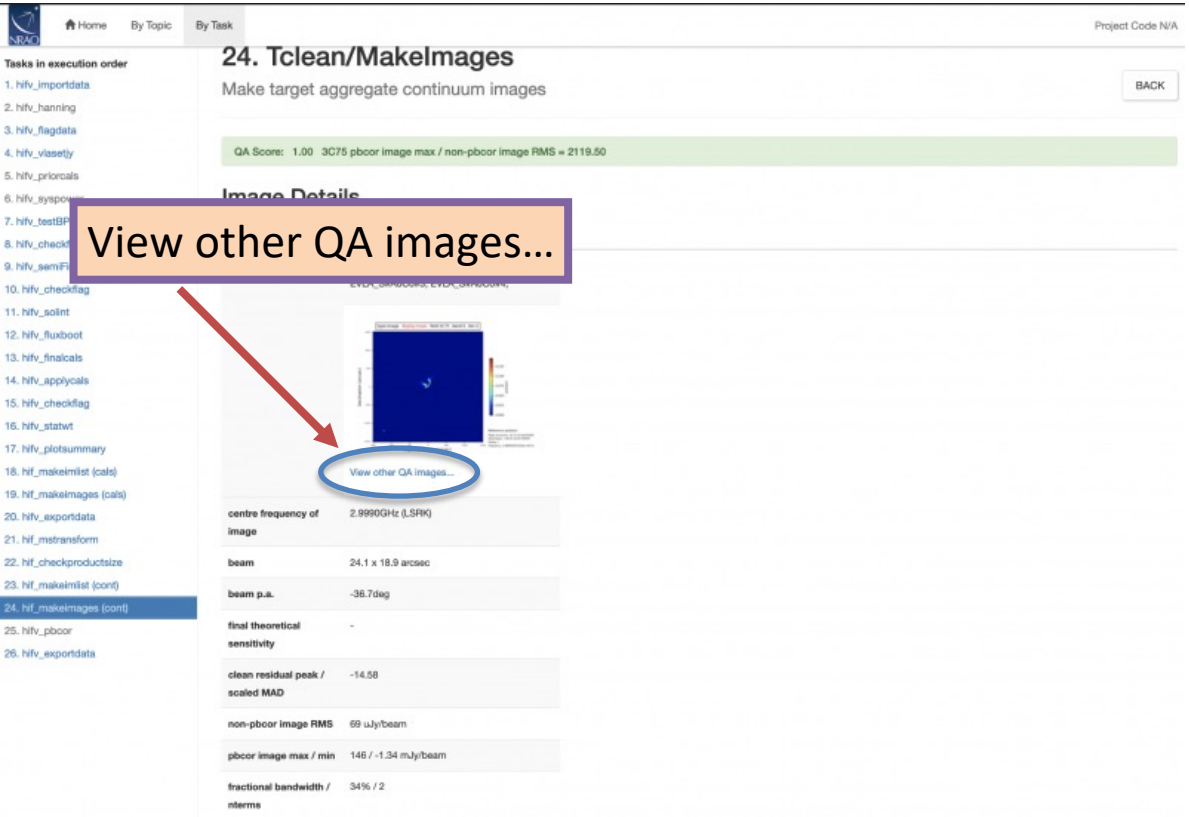


Gets image size (based on cell size) to image out to primary beam sidelobes.
Maximum allowed: 16384x16384 pixels

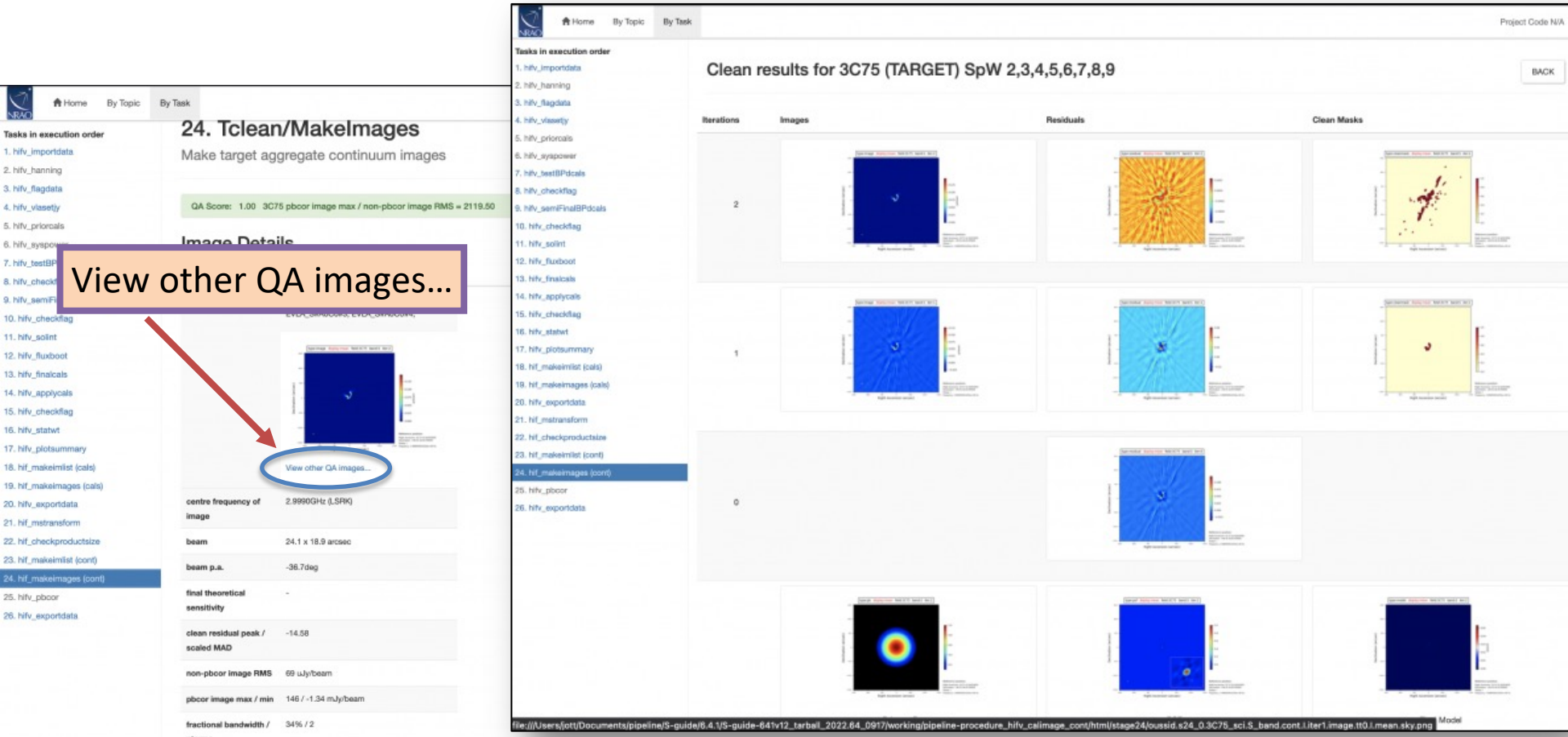
Images & QA images (hif_makeimages)



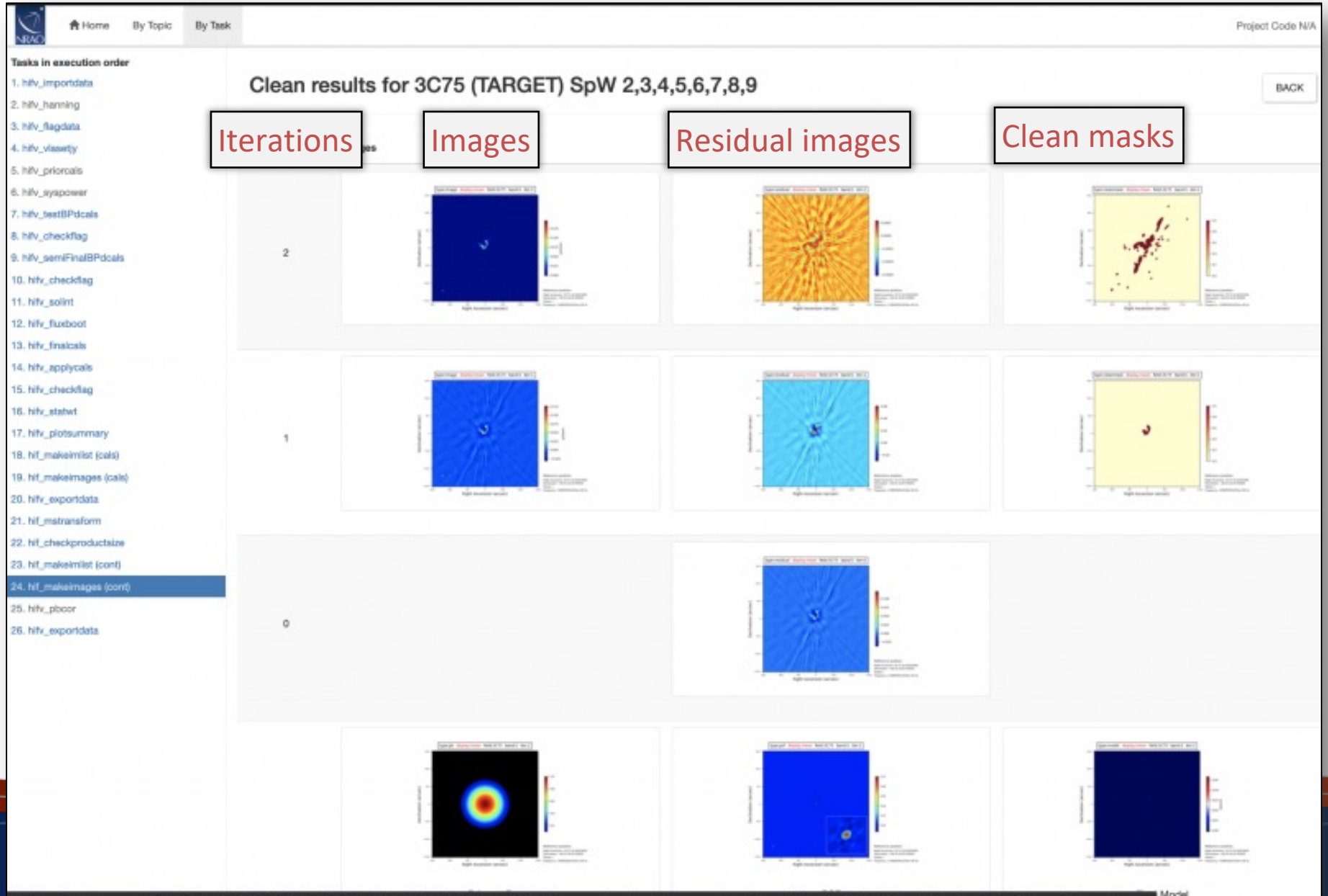
Images & QA images (hif_makeimages)



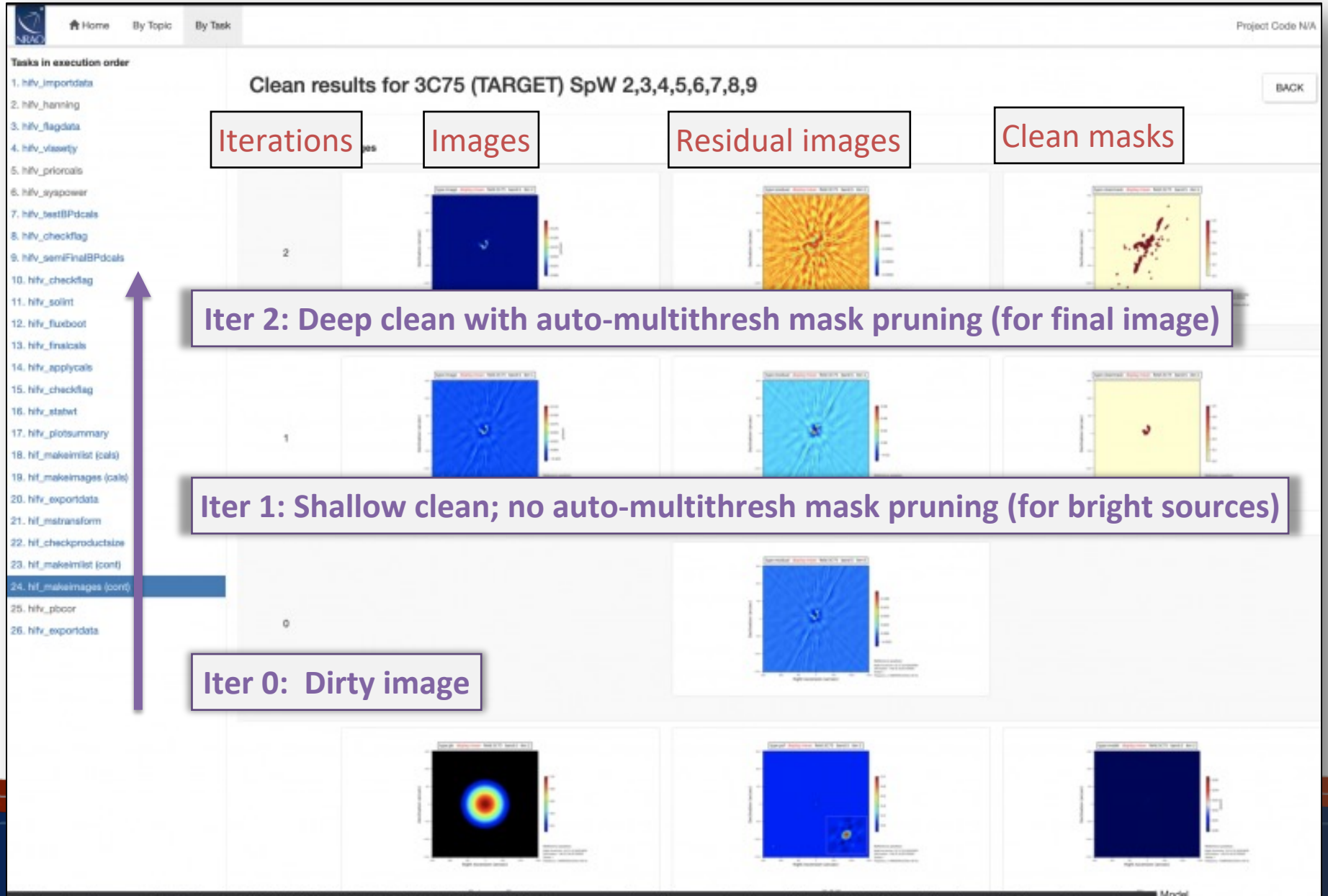
Images & QA images (hif_makeimages)



Images & QA images (hif_makeimages)



Images & QA images (hif_makeimages)



Primary beam corrected images (hifv_pbcor)

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Tasks in execution order

1. hifv_importdata
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4. hifv_vlasetjy
5. hifv_priorcals
6. hifv_testBPdcals
7. hifv_checkflag
8. hifv_semiFinalBPdcals
9. hifv_checkflag
10. hifv_solint
11. hifv_fluxboot
12. hifv_finalcals
13. hifv_applycals
14. hifv_checkflag
15. hifv_targetflag
16. hifv_statwt
17. hifv_plotsummary
18. hif_makeimlist (cals)
19. hif_makeimages (cals)
20. hifv_exportdata
21. hif_mstransform
22. hif_checkproductsize
23. hif_makeimlist (cont)
24. hif_makeimages (cont)
25. hifv_pbcor
26. hifv_exportdata

25. Primary beam corrected images

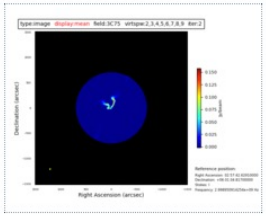
BACK

tt0 when multi-term

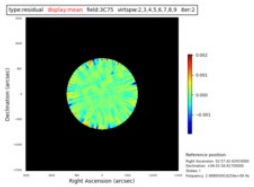
TDRW0001.sb35624494.eb35628826.58395.23719237269.ms

oussid.s24_0.3C75_sci.S_band.cont.I.iter2

	restored	residual
maximum	1.5799e-01 Jy/beam	2.0434e-03 Jy/beam
minimum	-2.1028e-03 Jy/beam	-1.9549e-03 Jy/beam
sigma	8.3015e-03 Jy/beam	3.0272e-04 Jy/beam
MAD rms	2.6704e-04 Jy/beam	2.2466e-04 Jy/beam



oussid.s24_0.3C75_sci.S_band.cont.I.iter2.image.pbcor.tt0.sky.png



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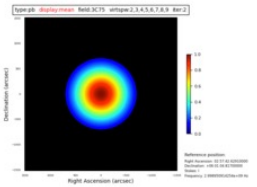

oussid.s24_0.3C75_sci.S_band.cont.I.iter2.pb.tt0.sky.png

Imaging Pipeline Products and Outputs

- *Continuum* images for each science target in each band
  - pb-corrected image, pb image, clean mask, spectral index images (tt1, alpha, alpha-err) if relevant
- pipeline weblog, casa-log file, casa_pipescript.py, casa_commands.log file

- In the archive *(data.nrao.edu):*
  - main images (not primary-beam corrected) viewable with CARTA viewer!
  - data “download” provides the above ancillary images (when available); not visible in archive search (yet)

Future Pipeline Developments

- VLA Calibration pipeline
  - Support for spectral line observations
  - Polarization calibration tested for VLA Sky Survey (S-band), need polarization calibrator models for other bands
  - More robust flux density bootstrapping that flags outliers
  - Use of switched power data for determining data weights

- VLA Imaging pipeline
  - Self-calibration (currently provided for some SRDP imaging)
  - Improved heuristics to avoid including sidelobes in masks

Science Ready Data Products (SRDP)

https://science.nrao.edu/srdp/home

- Calibrated and (basic) imaged science ready data
  - calibrations since June 2019
  - imaging ***NEW*** since January 2023
- Continuum (wide-bandwidth) only
- Currently only C band or higher frequency *(stay tuned…)*
- SB setup and scan intents set correctly for pipeline
- Currently only those using 3C286 or 3C147 as flux calibrator
- Staff check quality in more detail: extra flagging, rerun as needed

Questions?

- VLA CASA Calibration Pipeline information at:

  http://go.nrao.edu/vla-pipe

  CASA Integrated Pipeline & Scripted Pipeline available

- Have Questions?
- Need Help?
- Report a bug?

- Use the **NRAO HelpDesk**: **https://help.nrao.edu/**

- Submit your ticket under the **Pipeline Department.**

- Please include specific details when submitting HelpDesk tickets.
  (Project code, SB number, CASA/PL versions, errors, etc.)

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