ALMA WebLog Review

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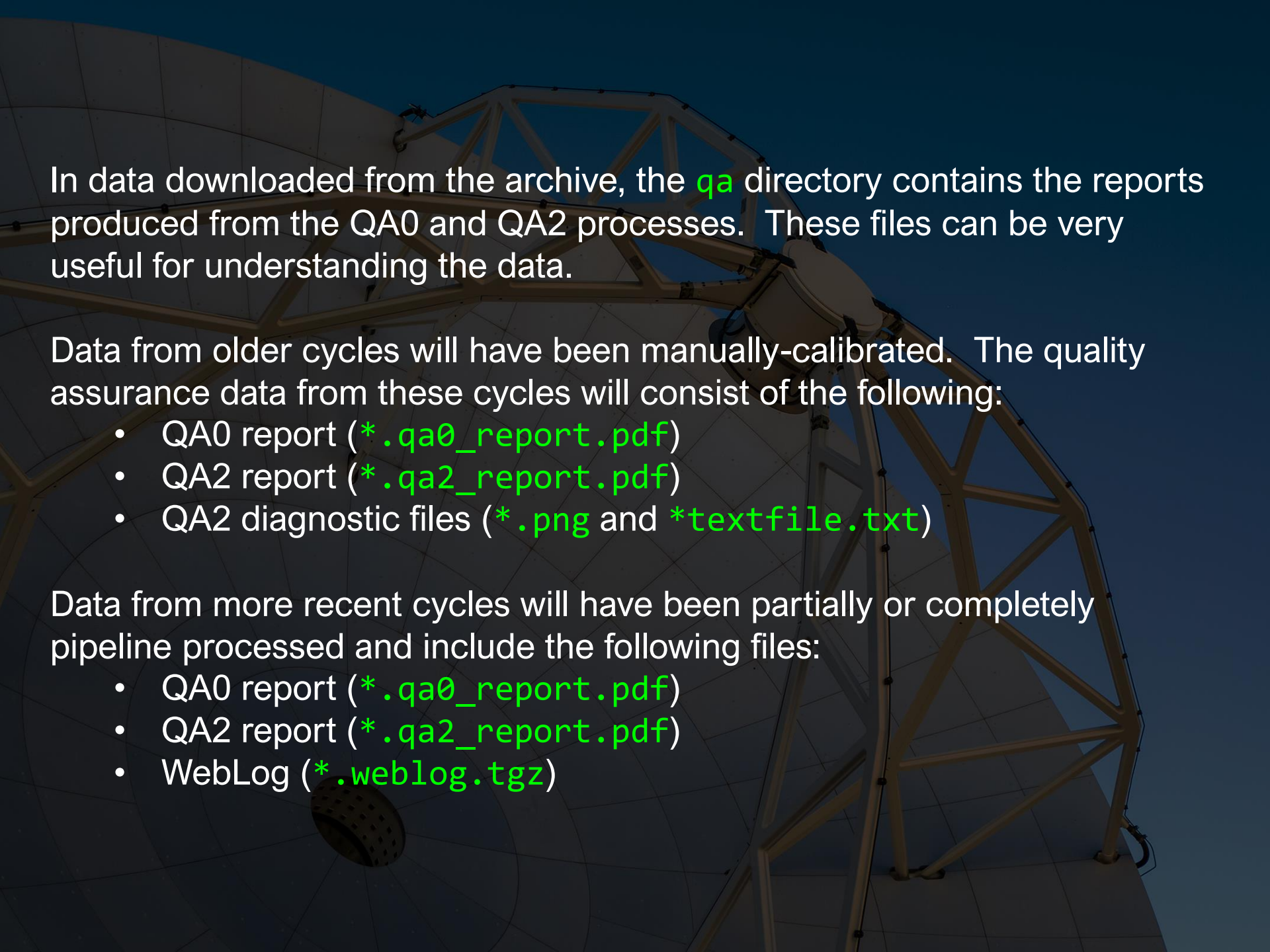
In the context of ALMA, QA stands for quality assurance. ALMA has four phases of quality assurance:

QA0 Simple quality checks performed at the observatory as soon as the data are acquired

QA1 Long-term monitoring of the performance of the observatory (not specific to any project)

QA2 A complete quality assessment performed on the data after completely calibrating and imaging the data

QA3 Re-assessment of data after they are delivered to users triggered when someone discovers a previously-unidentified problem



In data downloaded from the archive, the `qa` directory contains the reports produced from the QA0 and QA2 processes. These files can be very useful for understanding the data.

Data from older cycles will have been manually-calibrated. The quality assurance data from these cycles will consist of the following:

- QA0 report (`*.qa0_report.pdf`)
- QA2 report (`*.qa2_report.pdf`)
- QA2 diagnostic files (`*.png` and `*textfile.txt`)

Data from more recent cycles will have been partially or completely pipeline processed and include the following files:

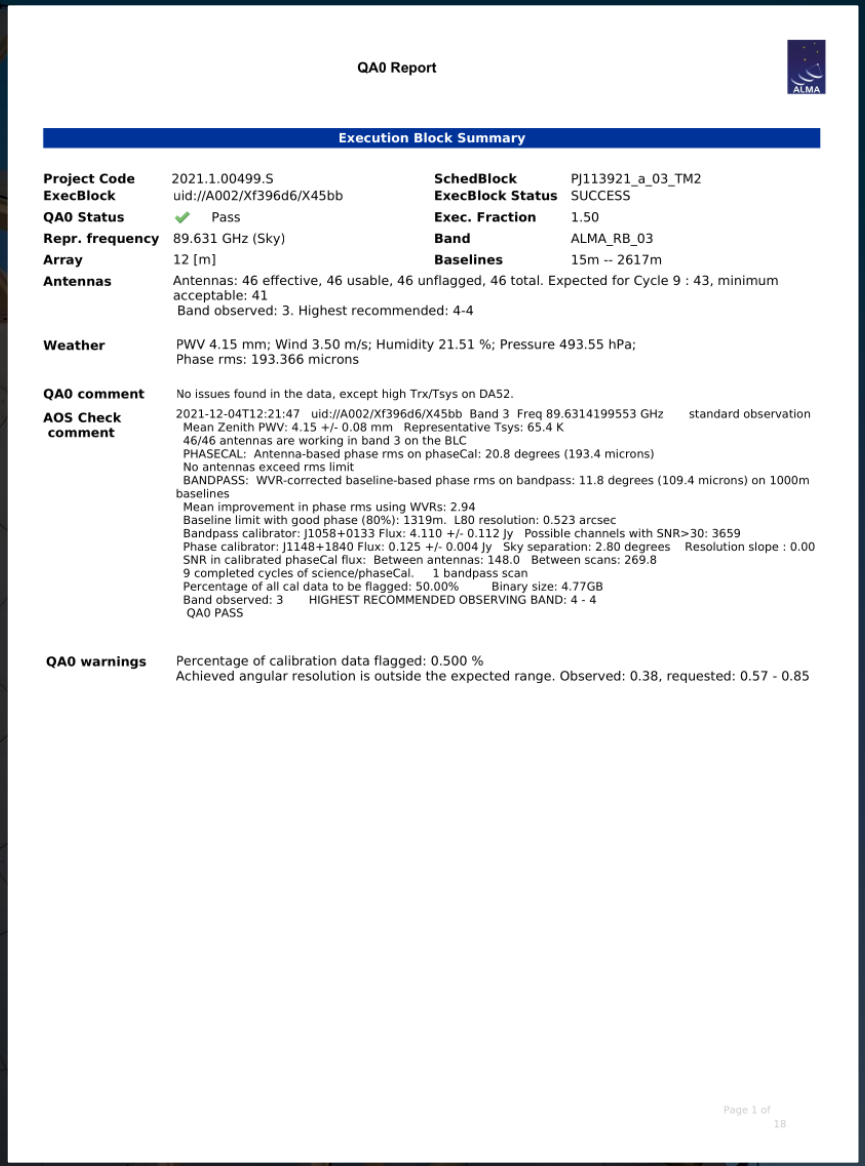
- QA0 report (`*.qa0_report.pdf`)
- QA2 report (`*.qa2_report.pdf`)
- WebLog (`*.weblog.tgz`)

The QA0 PDF provides a summary of comments from the astronomer who acquired the data. Each Execution Block (EB) will have its own report.

Versions of this document from earlier cycles contain just some simple diagnostic plots.

Versions from recent cycles contain several new sets of diagnostic plots as well as preview images.

These documents are most useful for understanding whether any problems were encountered during the observations.



QA0 Report

ALMA

Execution Block Summary

Project Code	2021.1.00499.S	**SchedBlock**	PJ113921_a_03_TM2
ExecBlock	uid://A002/Xf396d6/X45bb	**ExecBlock Status**	SUCCESS
QA0 Status	✔ Pass	**Exec. Fraction**	1.50
Repr. frequency	89.631 GHz (Sky)	**Band**	ALMA_RB_03
Array	12 [m]	**Baselines**	15m -- 2617m

Antennas
Antennas: 46 effective, 46 usable, 46 unflagged, 46 total. Expected for Cycle 9 : 43, minimum acceptable: 41
Band observed: 3. Highest recommended: 4-4

Weather
PWV 4.15 mm; Wind 3.50 m/s; Humidity 21.51 %; Pressure 493.55 hPa;
Phase rms: 193.366 microns

QA0 comment
No issues found in the data, except high Trx/Tsys on DA52.

AOS Check comment
2021-12-04T12:21:47 uid://A002/Xf396d6/X45bb Band 3 Freq 89.6314199553 GHz standard observation
Mean Zenith PWV: 4.15 +/- 0.08 mm Representative Tsys: 65.4 K
46/46 antennas are working in band 3 on the BLC
PHASECAL: Antenna-based phase rms on phaseCal: 20.8 degrees (193.4 microns)
No antennas exceed rms limit
BANDPASS: WVR-corrected baseline-based phase rms on bandpass: 11.8 degrees (109.4 microns) on 1000m baselines
Mean improvement in phase rms using WVRs: 2.94
Baseline limit with good phase (80%): 1319m. L80 resolution: 0.523 arcsec
Bandpass calibrator: J1058+0133 Flux: 4.110 +/- 0.112 Jy Possible channels with SNR>30: 3659
Phase calibrator: J1148+1840 Flux: 0.125 +/- 0.004 Jy Sky separation: 2.80 degrees Resolution slope : 0.00
SNR in calibrated phaseCal flux: Between antennas: 148.0 Between scans: 269.8
9 completed cycles of science/phaseCal. 1 bandpass scan
Percentage of all cal data to be flagged: 50.00% Binary size: 4.77GB
Band observed: 3 HIGHEST RECOMMENDED OBSERVING BAND: 4 - 4
QA0 PASS

QA0 warnings
Percentage of calibration data flagged: 0.500 %
Achieved angular resolution is outside the expected range. Observed: 0.38, requested: 0.57 - 0.85

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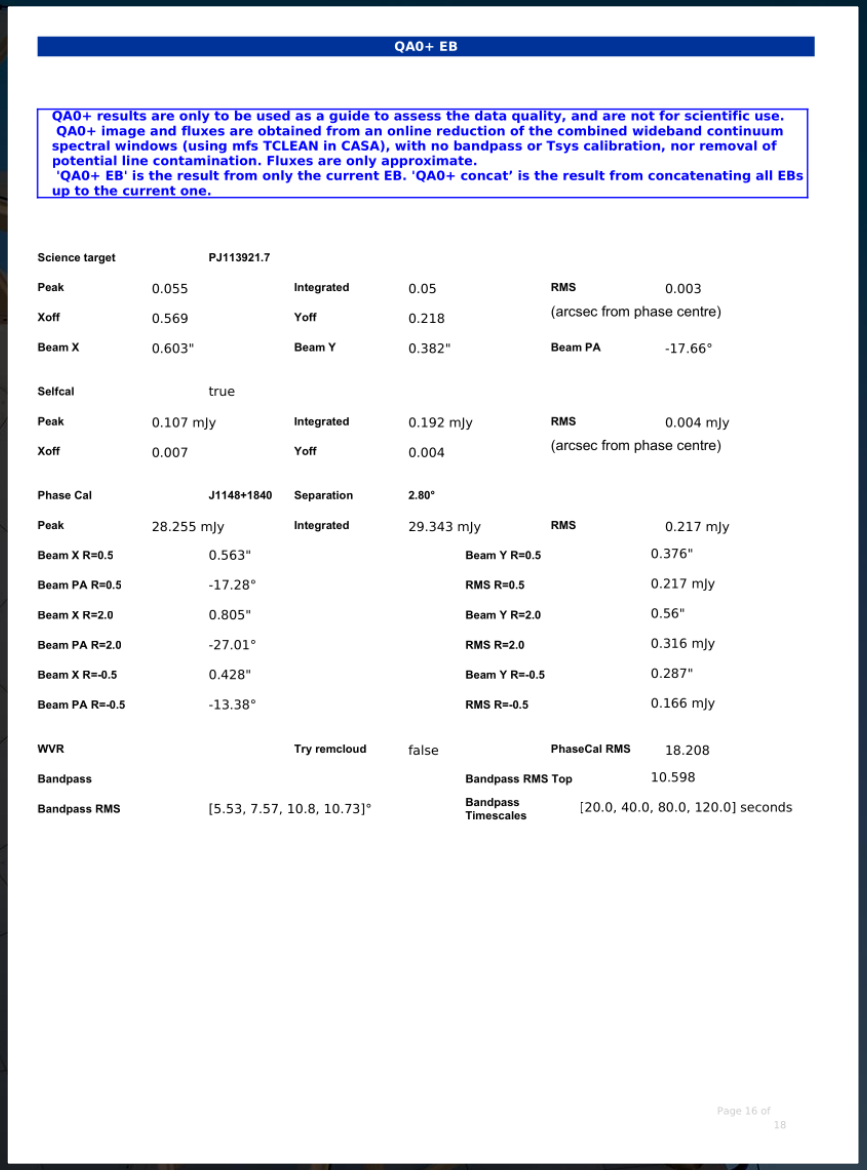
The QA0+ section shows some very quick (but very rough) images produced from the data soon after the observations were performed as well as some measurements from those images.

While these images and data are useful for providing a preliminary view of the results, they may be inaccurate compared to what is in the WebLogs.



QA0+ EB

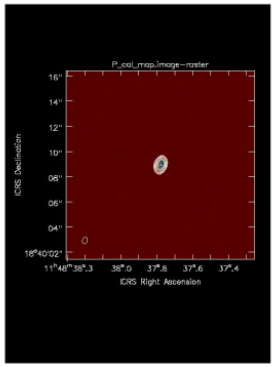
QA0+ results are only to be used as a guide to assess the data quality, and are not for scientific use. QA0+ image and fluxes are obtained from an online reduction of the combined wideband continuum spectral windows (using mfs TCLEAN in CASA), with no bandpass or Tsys calibration, nor removal of potential line contamination. Fluxes are only approximate.
'QA0+ EB' is the result from only the current EB. 'QA0+ concat' is the result from concatenating all EBs up to the current one.

Science target	**PJ113921.7**				
Peak	0.055	**Integrated**	0.05	**RMS**	0.003
Xoff	0.569	**Yoff**	0.218	(arcsec from phase centre)	
Beam X	0.603"	**Beam Y**	0.382"	**Beam PA**	-17.66°
Selfcal	true				
Peak	0.107 mJy	**Integrated**	0.192 mJy	**RMS**	0.004 mJy
Xoff	0.007	**Yoff**	0.004	(arcsec from phase centre)	
Phase Cal	**J1148+1840**	**Separation**	**2.80°**		
Peak	28.255 mJy	**Integrated**	29.343 mJy	**RMS**	0.217 mJy
Beam X R=0.5	0.563"			**Beam Y R=0.5**	0.376"
Beam PA R=0.5	-17.28°			**RMS R=0.5**	0.217 mJy
Beam X R=2.0	0.805"			**Beam Y R=2.0**	0.56"
Beam PA R=2.0	-27.01°			**RMS R=2.0**	0.316 mJy
Beam X R=-0.5	0.428"			**Beam Y R=-0.5**	0.287"
Beam PA R=-0.5	-13.38°			**RMS R=-0.5**	0.166 mJy
WVR		**Try remcloud**	false	**PhaseCal RMS**	18.208
Bandpass				**Bandpass RMS Top**	10.598
Bandpass RMS	[5.53, 7.57, 10.8, 10.73]°			**Bandpass Timescales**	[20.0, 40.0, 80.0, 120.0] seconds

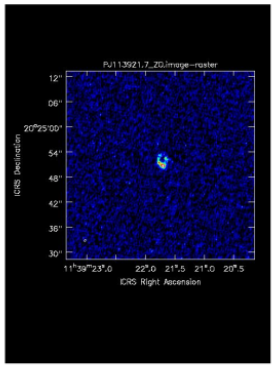
The QA0+ section shows some very quick (but very rough) images produced from the data soon after the observations were performed as well as some measurements from those images.

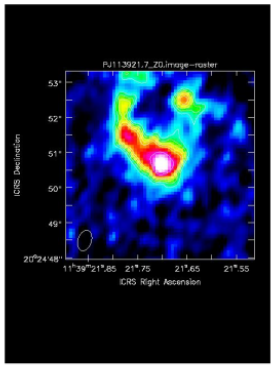
While these images and data are useful for providing a preliminary view of the results, they may be inaccurate compared to what is in the WebLogs.

Phase Cal (left).



Target images





The QA0+ EB section contains the images created using just one Execution Block (EB).

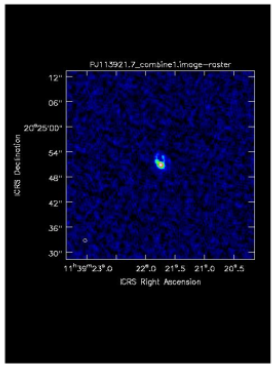
The QA0+ concat section contains images based on combining the data from this EB with previously-executed EBs (if they exist).

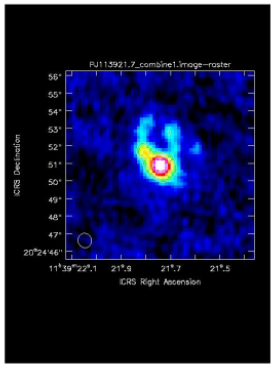
QA0+ concat

N EBs	1	**ExecBlock UIDs**	[]		
Beam X R=0.5	0.829"			**Beam Y R=0.5**	0.76"
Beam PA R=0.5	16.24°			**RMS R=0.5**	0.003 mJy
Beam X R=2.0	1.254"			**Beam Y R=2.0**	1.131"
Beam PA R=2.0	-26.32°			**RMS R=2.0**	0.003 mJy
Beam X R=-0.5	0.593"			**Beam Y R=-0.5**	0.407"
Beam PA R=-0.5	4.93°			**RMS R=-0.5**	0.005 mJy

Science target	PJ113921.7	**RA**	11:39:21.745	**Dec**	+020:24:50.9136
Xoff	-0.044	**Yoff**	-0.014	**Offset (fraction of beam)**	0.058
Peak	0.117 mJy	**Integrated**	0.253 mJy	**RMS**	0.003 mJy

Concatenated target images

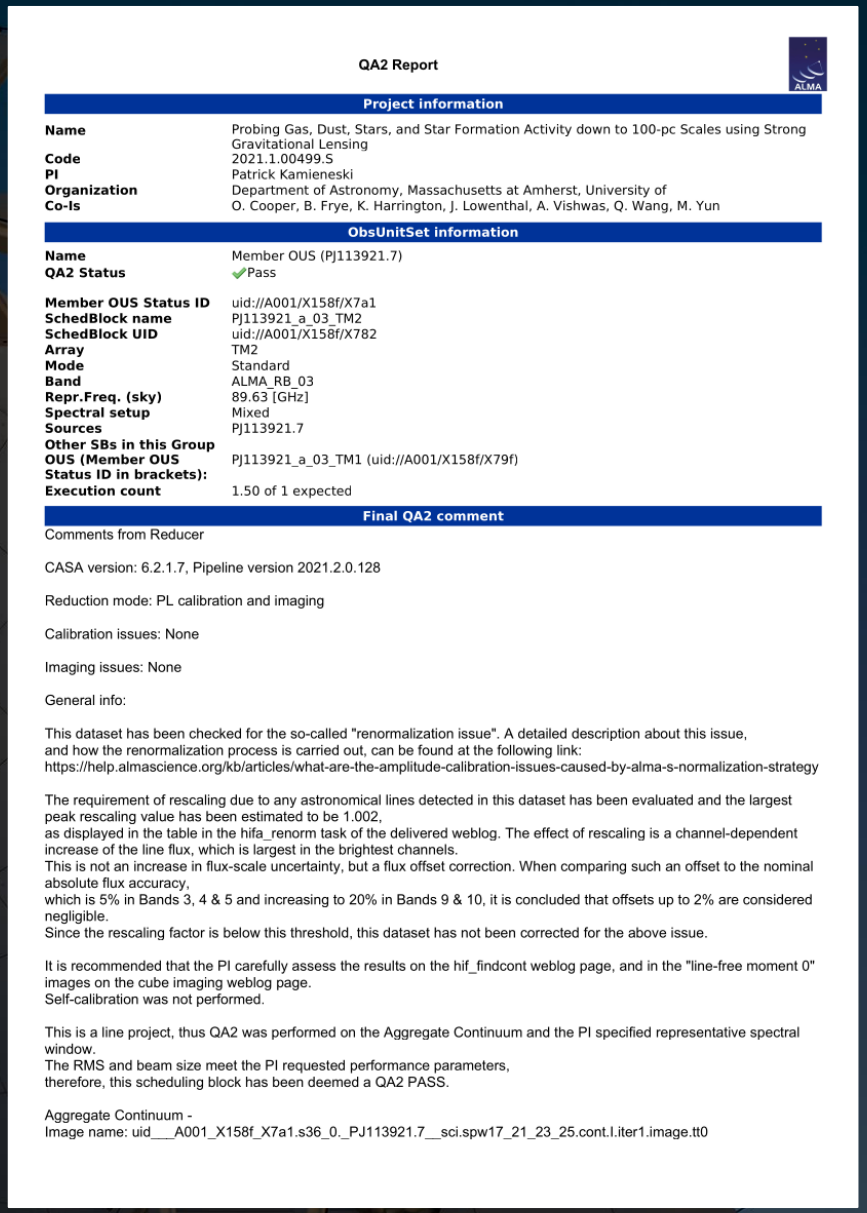




The QA2 PDF includes some comments on the data processing and summary information about the observations.

The last few pages of the document include standard instructions sent to all users.

The first part of the section under "Final QA2 comment" may be useful to read in case something went wrong with the observations.



QA2 Report

Project information

Name	Probing Gas, Dust, Stars, and Star Formation Activity down to 100-pc Scales using Strong Gravitational Lensing
Code	2021.1.00499.S
PI	Patrick Kamieneski
Organization	Department of Astronomy, Massachusetts at Amherst, University of
Co-Is	O. Cooper, B. Frye, K. Harrington, J. Lowenthal, A. Vishwas, Q. Wang, M. Yun

ObsUnitSet information

Name	Member OUS (PJ113921.7)
QA2 Status	Pass
Member OUS Status ID	uid://A001/X158f/X7a1
SchedBlock name	PJ113921_a_03_TM2
SchedBlock UID	uid://A001/X158f/X782
Array	TM2
Mode	Standard
Band	ALMA_RB_03
Repr.Freq. (sky)	89.63 [GHz]
Spectral setup	Mixed
Sources	PJ113921.7
Other SBs in this Group OUS (Member OUS Status ID in brackets):	PJ113921_a_03_TM1 (uid://A001/X158f/X79f)
Execution count	1.50 of 1 expected

Final QA2 comment

Comments from Reducer

CASA version: 6.2.1.7, Pipeline version 2021.2.0.128

Reduction mode: PL calibration and imaging

Calibration issues: None

Imaging issues: None

General info:

This dataset has been checked for the so-called "renormalization issue". A detailed description about this issue, and how the renormalization process is carried out, can be found at the following link: https://help.almascience.org/kb/articles/what-are-the-amplitude-calibration-issues-caused-by-alma-s-normalization-strategy

The requirement of rescaling due to any astronomical lines detected in this dataset has been evaluated and the largest peak rescaling value has been estimated to be 1.002,
as displayed in the table in the hifa_renorm task of the delivered weblog. The effect of rescaling is a channel-dependent increase of the line flux, which is largest in the brightest channels.
This is not an increase in flux-scale uncertainty, but a flux offset correction. When comparing such an offset to the nominal absolute flux accuracy,
which is 5% in Bands 3, 4 & 5 and increasing to 20% in Bands 9 & 10, it is concluded that offsets up to 2% are considered negligible.
Since the rescaling factor is below this threshold, this dataset has not been corrected for the above issue.

It is recommended that the PI carefully assess the results on the hif_findcont weblog page, and in the "line-free moment 0" images on the cube imaging weblog page.
Self-calibration was not performed.

This is a line project, thus QA2 was performed on the Aggregate Continuum and the PI specified representative spectral window.
The RMS and beam size meet the PI requested performance parameters,
therefore, this scheduling block has been deemed a QA2 PASS.

Aggregate Continuum -
Image name: uid___A001_X158f_X7a1.s36_0._PJ113921.7__sci.spw17_21_23_25.cont.I.iter1.image.tt0

The WebLog contains most of the useful diagnostic information from the QA2 process.

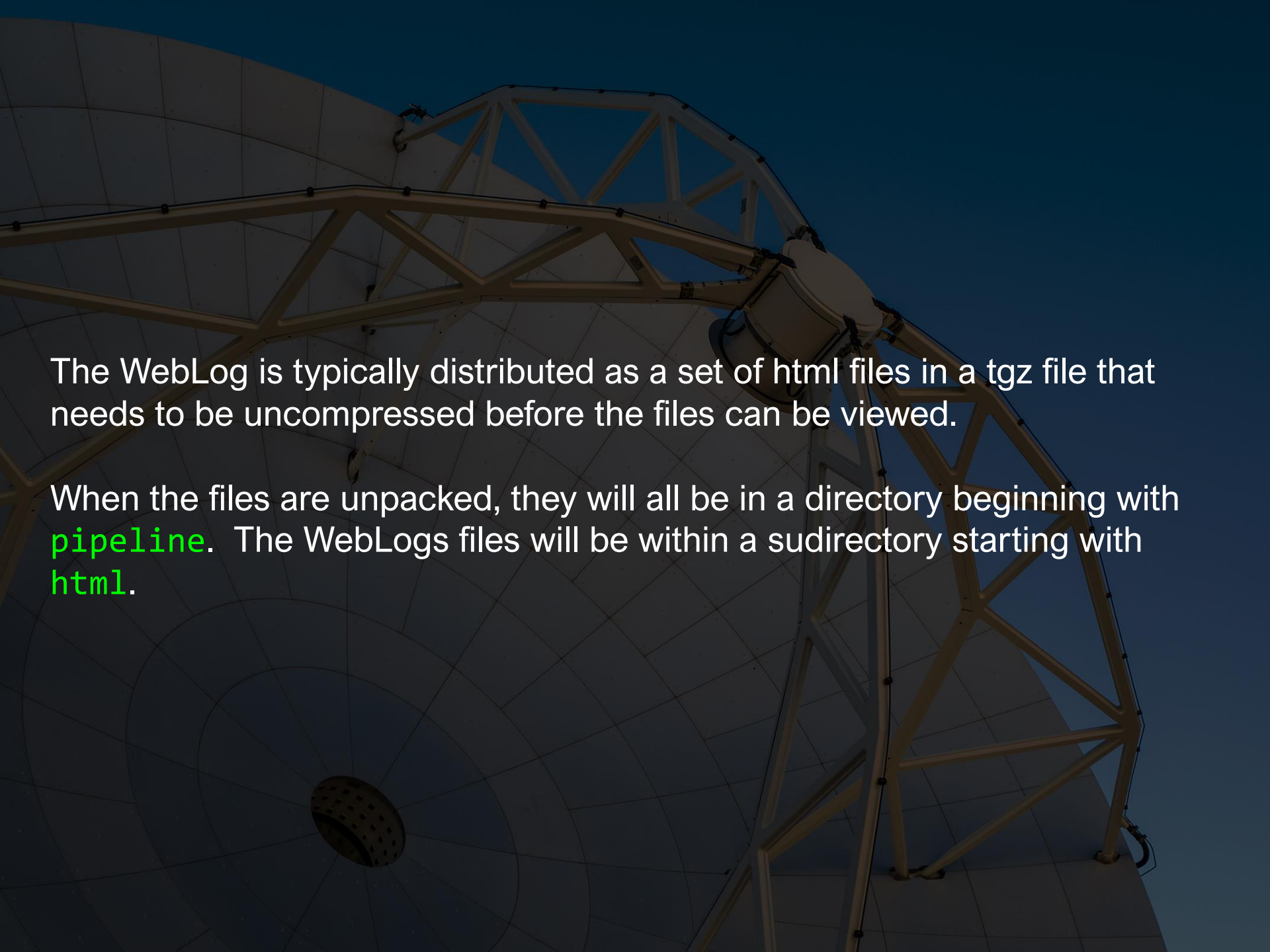
This is produced by the ALMA pipeline as the data are being calibrated and imaged.

The calibration part of the pipeline will calibrate the following in the visibility data:

- Phase versus frequency
- Amplitude versus frequency
- Phase versus time
- Amplitude versus time

The imaging pipeline produces the following:

- Image cubes
- Continuum flux images for each spw
- Aggregate continuum image for all spws



The WebLog is typically distributed as a set of html files in a tgz file that needs to be uncompressed before the files can be viewed.

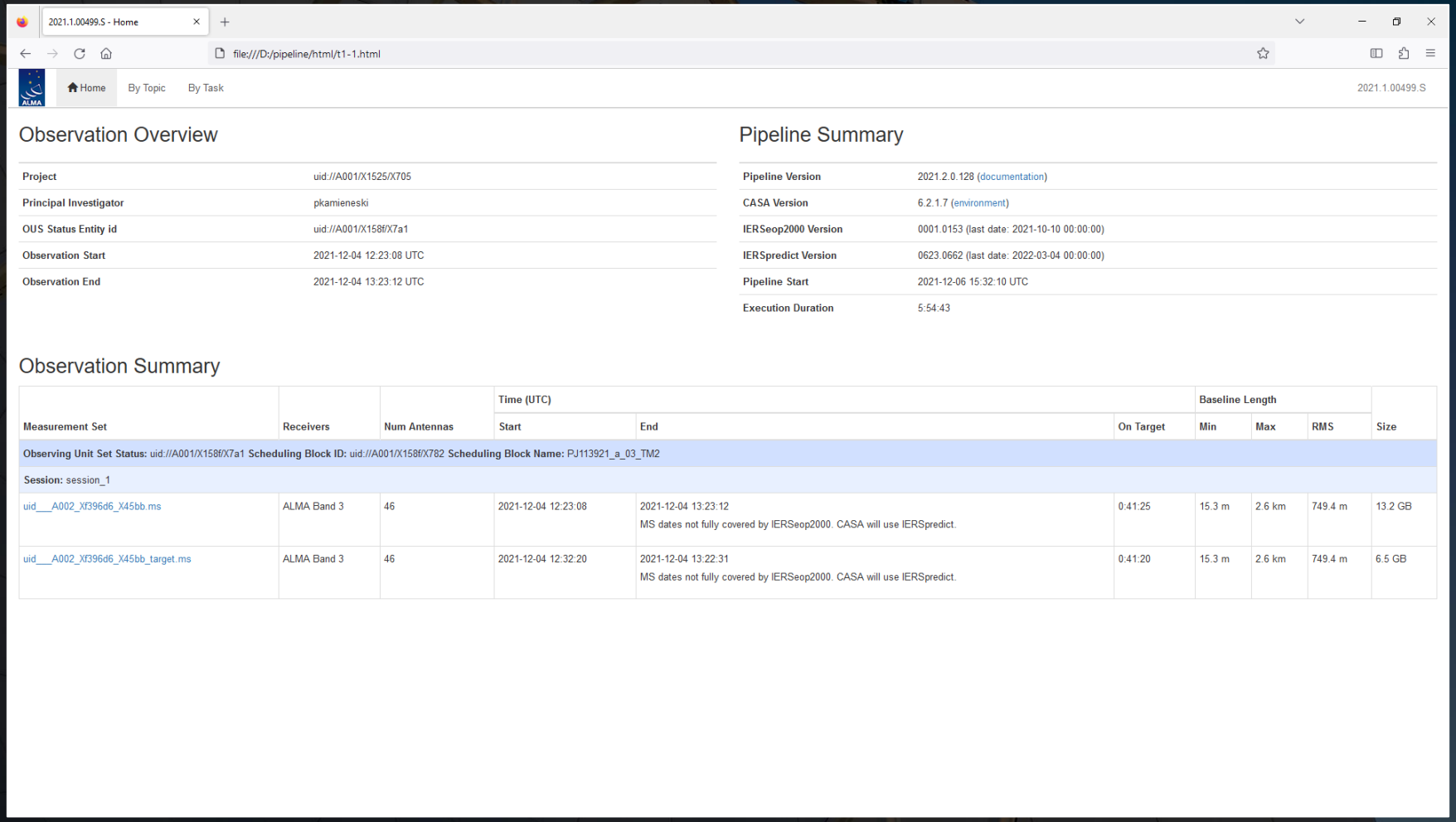
When the files are unpacked, they will all be in a directory beginning with `pipeline`. The WebLogs files will be within a sudirectory starting with `html`.

Most web browsers may not open the WebLogs correctly because of issues with their security settings.

The current recommendation is to use the following steps to open a WebLog:

1. In a terminal, go to the `pipeline*/html` directory with the WebLog.
2. Start CASA in pipeline mode using the `--pipeline` option.
3. At the CASA prompt, type `h_weblog()`.
4. Copy the url printed by this command into the address bar of a web browser.

The main index (or Home) page provides an overview of the observations. The page has three tabs at the top. The Home tab is currently displayed. Clicking on a measurement set in the bottom table leads to a page with more detailed information about those data.



Observation Overview

Project	uid://A001/X1525/X705
Principal Investigator	pkamieneski
OUS Status Entity id	uid://A001/X158f/X7a1
Observation Start	2021-12-04 12:23:08 UTC
Observation End	2021-12-04 13:23:12 UTC

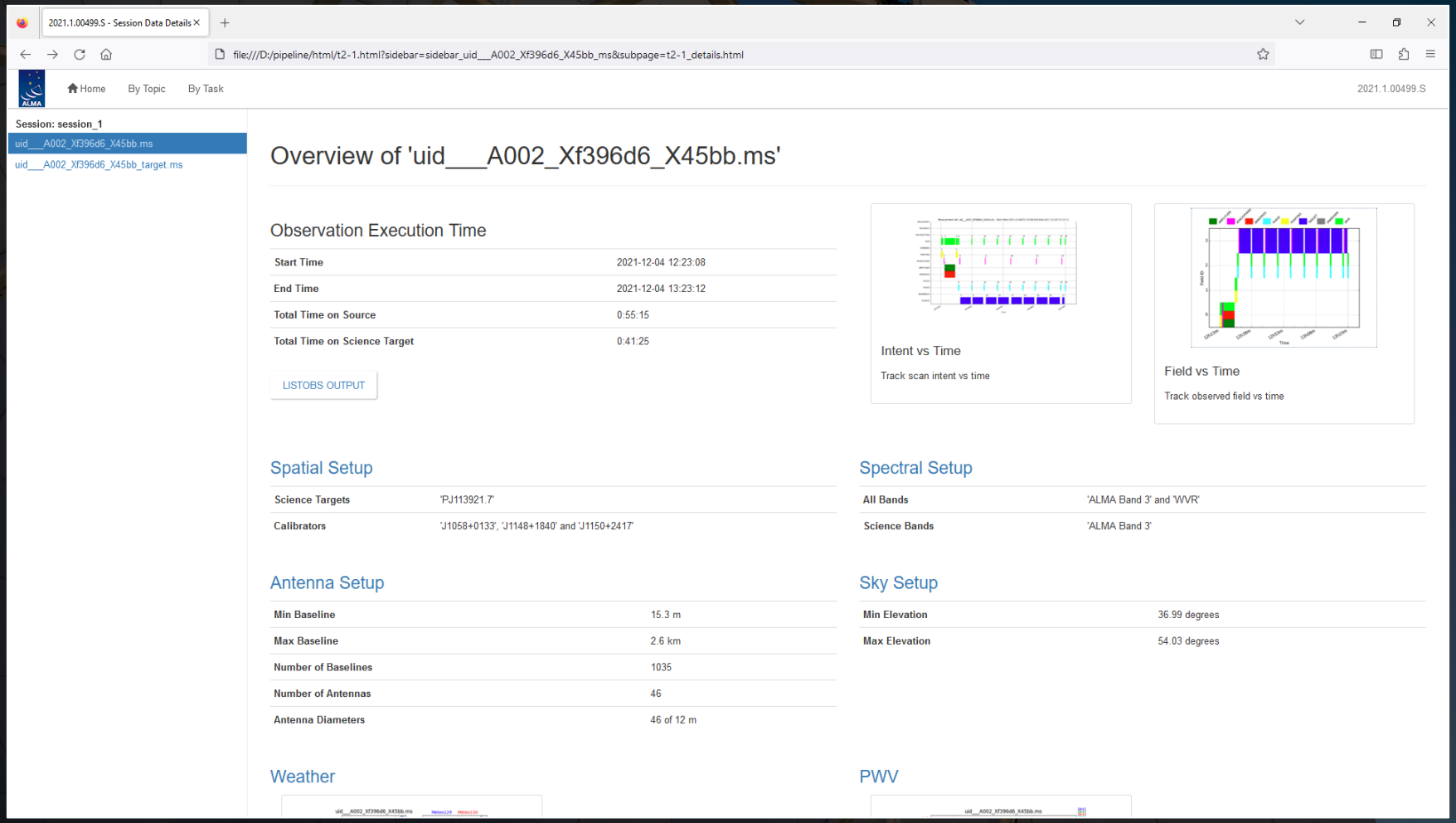
Pipeline Summary

Pipeline Version	2021.2.0.128 (documentation)
CASA Version	6.2.1.7 (environment)
IERSeop2000 Version	0001.0153 (last date: 2021-10-10 00:00:00)
IERSpredict Version	0623.0662 (last date: 2022-03-04 00:00:00)
Pipeline Start	2021-12-06 15:32:10 UTC
Execution Duration	5:54:43

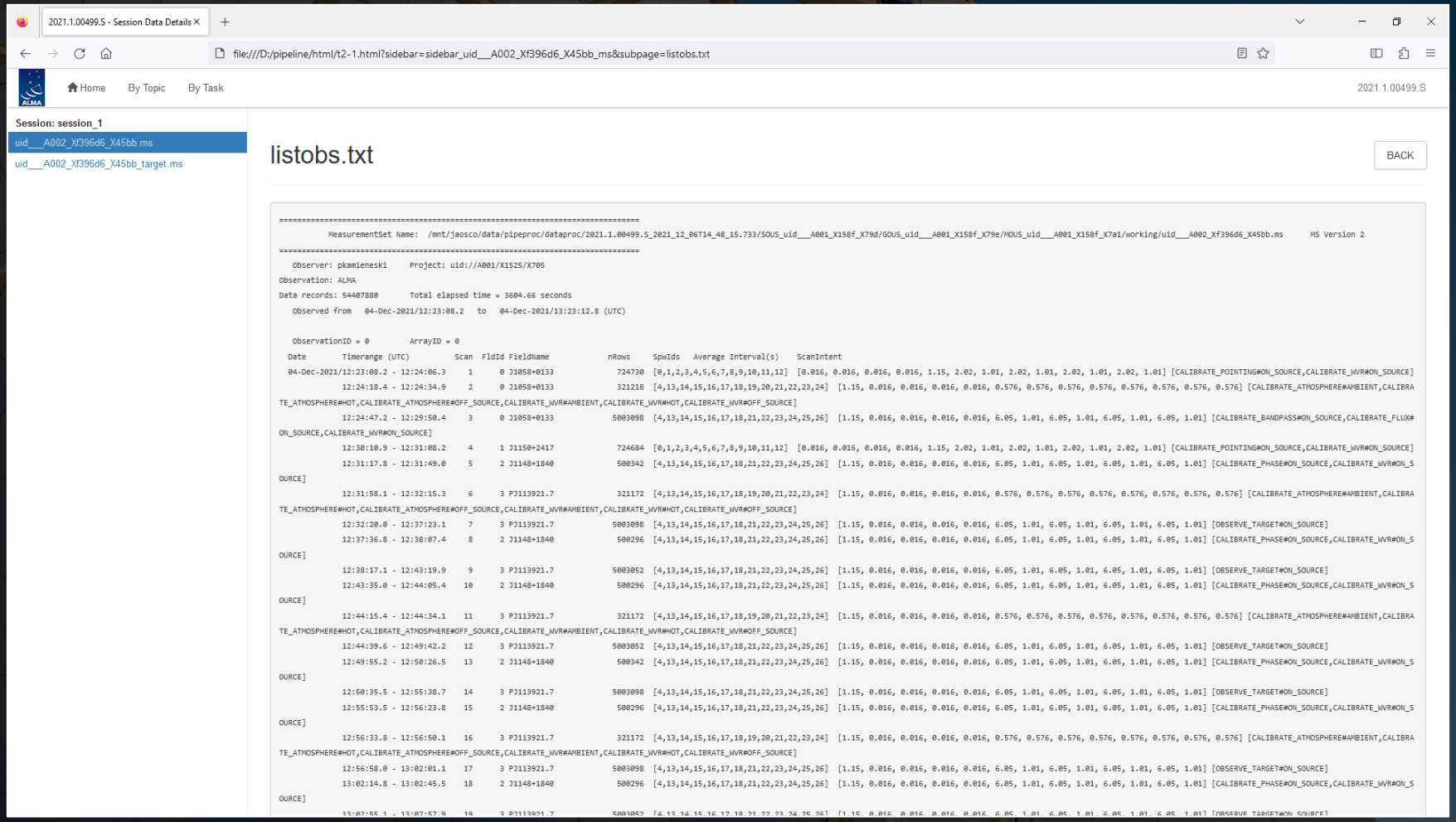
Observation Summary

			Time (UTC)			Baseline Length			
Measurement Set	**Receivers**	**Num Antennas**	**Start**	**End**	**On Target**	**Min**	**Max**	**RMS**	**Size**
Observing Unit Set Status: uid://A001/X158f/X7a1 **Scheduling Block ID:** uid://A001/X158f/X782 **Scheduling Block Name:** PJ113921_a_03_TM2									
Session: session_1									
uid___A002_Xf396d6_X45bb.ms	ALMA Band 3	46	2021-12-04 12:23:08	2021-12-04 13:23:12 MS dates not fully covered by IERSeop2000. CASA will use IERSpredict.	0:41:25	15.3 m	2.6 km	749.4 m	13.2 GB
uid___A002_Xf396d6_X45bb_target.ms	ALMA Band 3	46	2021-12-04 12:32:20	2021-12-04 13:22:31 MS dates not fully covered by IERSeop2000. CASA will use IERSpredict.	0:41:20	15.3 m	2.6 km	749.4 m	6.5 GB

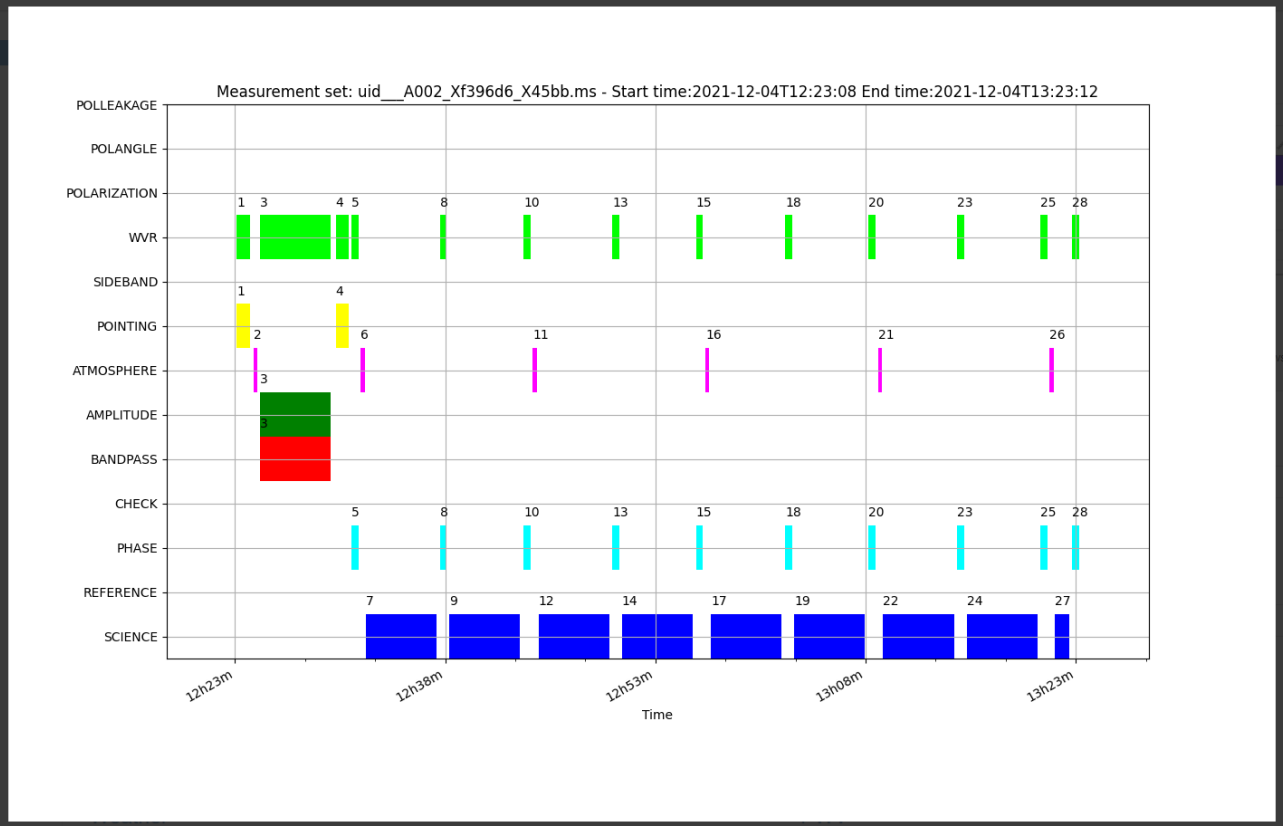
The overview page lists a lot of basic information about the observations themselves.



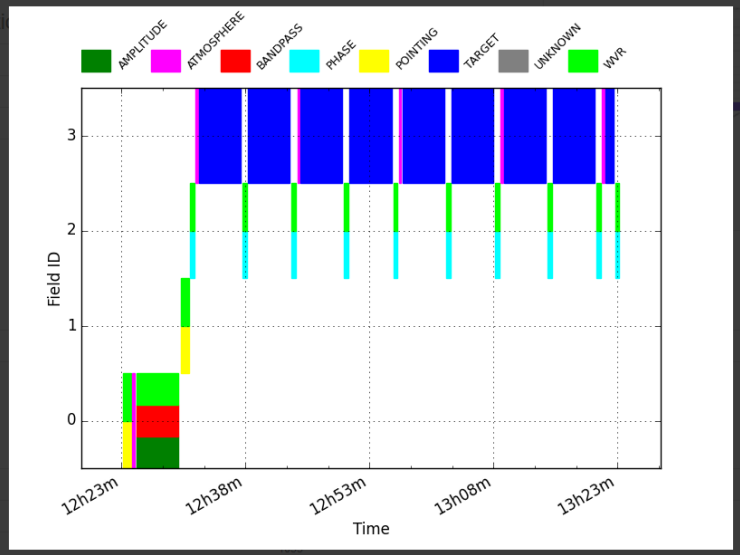
The listobs output button displays a text file with summary information about the sequence of observations, the fields, the spectral windows, and the antennas. Versions of this file can also be created using the `listobs` command in CASA.



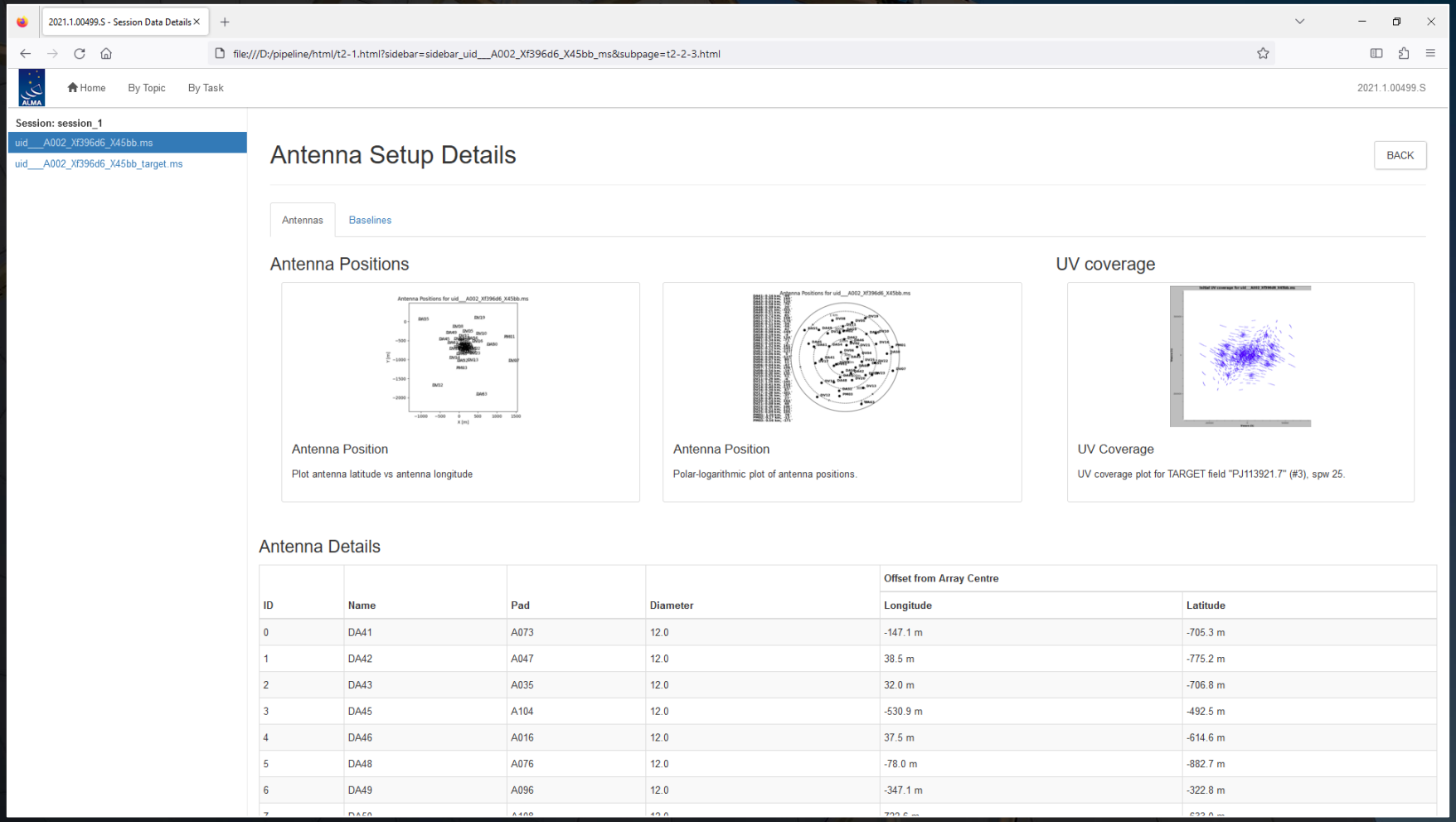
The intent versus time plot shows the sequence of the observations as well as the purpose of those observations. Some observations have multiple purposes.



The field versus time plot is similar except that the y-axis indicates the field ID. In this case, 0 is field for the bandpass calibrator, 1 is the field for the phase calibrator, and 2 is the field for the science target (Z CMa).

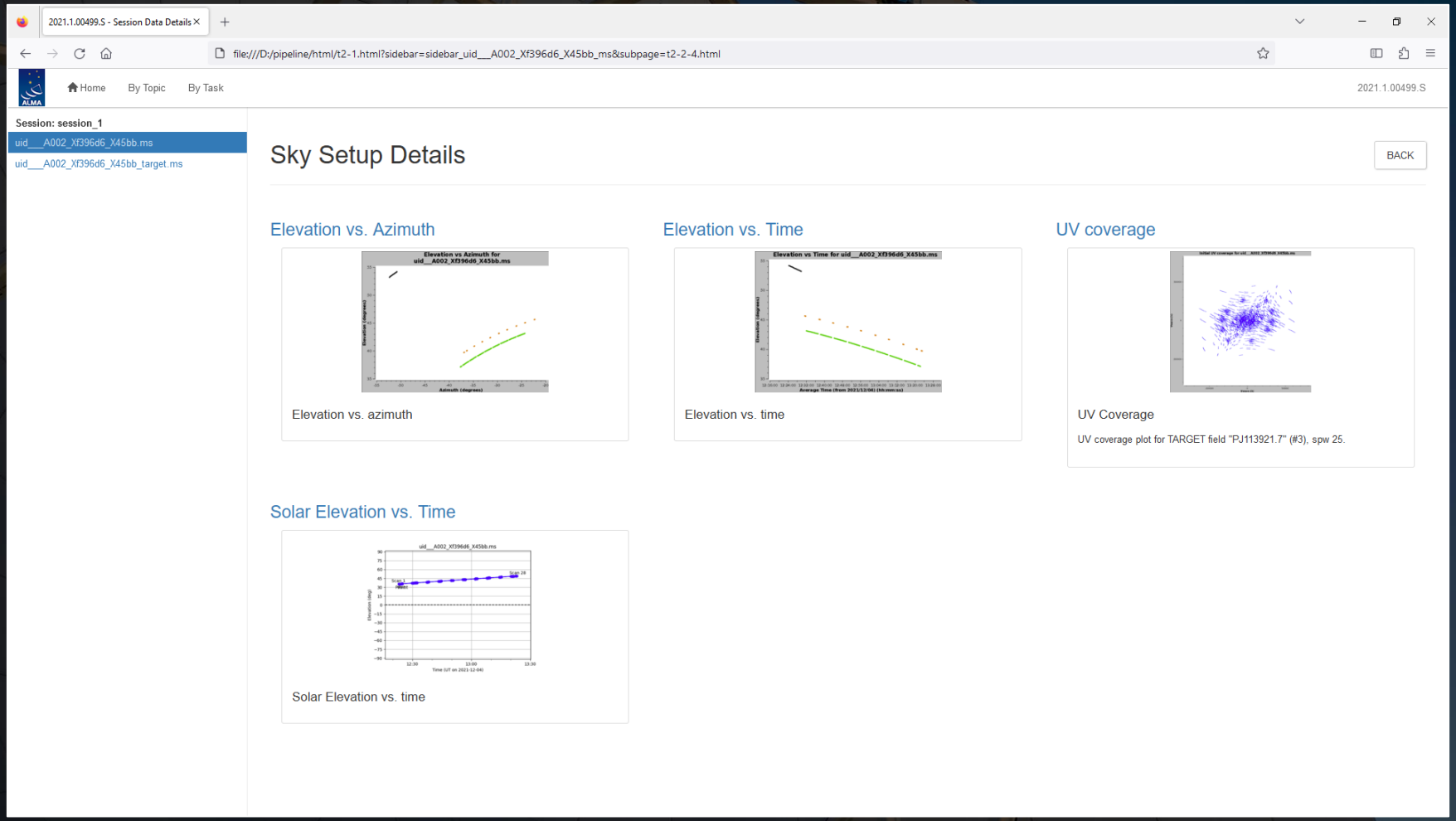


The antenna setup page shows the location of the antennas and the resulting uv coverage (which is related to the final angular resolution and maximum recoverable scale of the data).

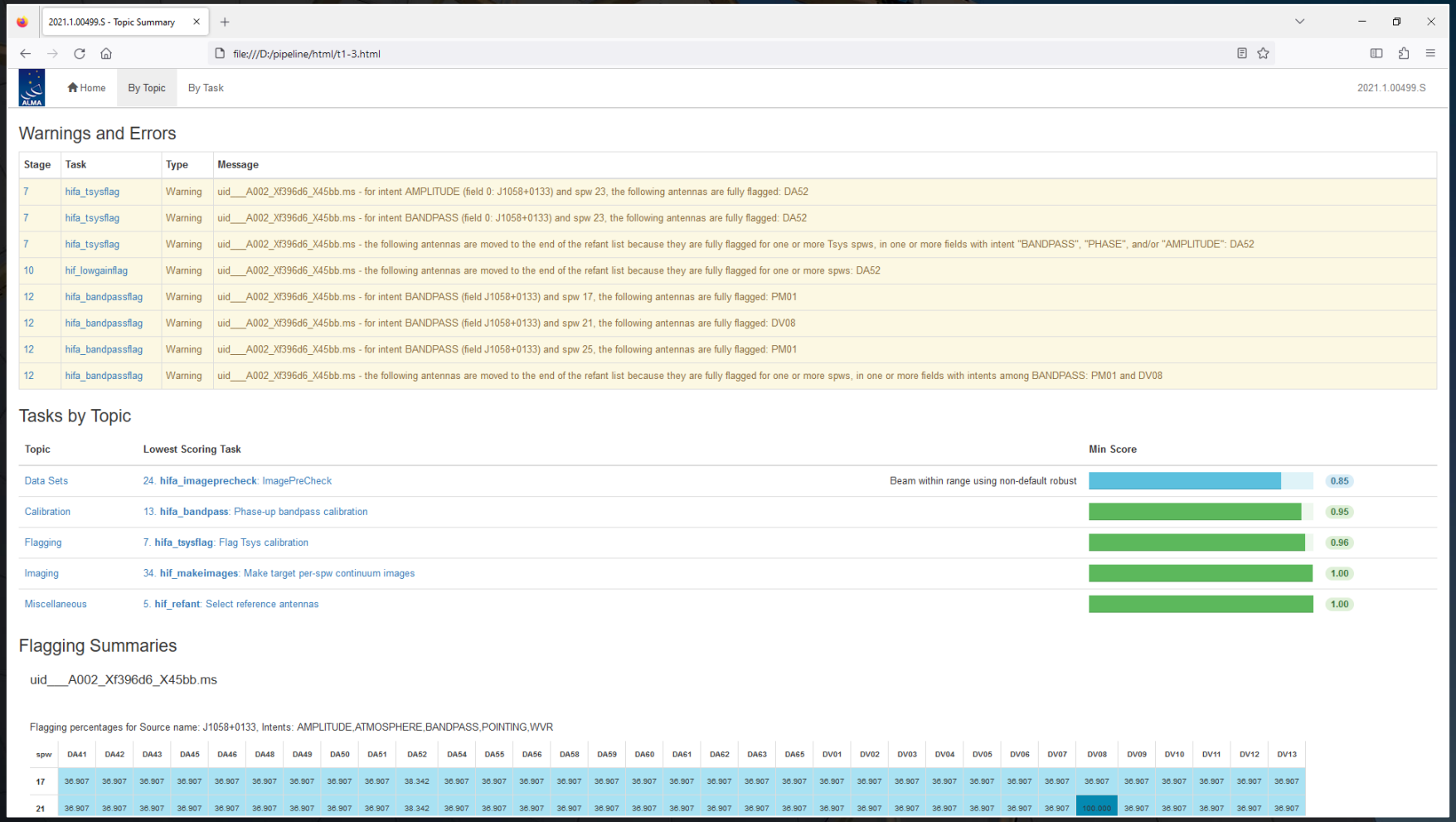


ID	Name	Pad	Diameter	Offset from Array Centre	
				Longitude	Latitude
0	DA41	A073	12.0	-147.1 m	-705.3 m
1	DA42	A047	12.0	38.5 m	-775.2 m
2	DA43	A035	12.0	32.0 m	-706.8 m
3	DA45	A104	12.0	-530.9 m	-492.5 m
4	DA46	A016	12.0	37.5 m	-614.6 m
5	DA48	A076	12.0	-78.0 m	-882.7 m
6	DA49	A096	12.0	-347.1 m	-322.8 m

The sky setup shows the elevation and azimuth of the fields during the observations. The beam for sources observed at low elevations (<45°) could appear elongated. Calibration problems may occur if the phase calibrator and science target are too far apart (>10°).



The By Topic page lists warnings that were produced by the pipeline along with grades for those warnings and tables showing the amount of data flagged for each antenna in each field. This page is more important for reviewing the quality of the data.



2021.1.00499.S - Topic Summary

file:///D:/pipeline/html/t1-3.html

Home | By Topic | By Task | 2021.1.00499.S

Warnings and Errors

Stage	Task	Type	Message
7	hifa_tsysflag	Warning	uid___A002_Xf396d6_X45bb.ms - for intent AMPLITUDE (field 0: J1058+0133) and spw 23, the following antennas are fully flagged: DA52
7	hifa_tsysflag	Warning	uid___A002_Xf396d6_X45bb.ms - for intent BANDPASS (field 0: J1058+0133) and spw 23, the following antennas are fully flagged: DA52
7	hifa_tsysflag	Warning	uid___A002_Xf396d6_X45bb.ms - the following antennas are moved to the end of the refant list because they are fully flagged for one or more Tsys spws, in one or more fields with intent "BANDPASS", "PHASE", and/or "AMPLITUDE": DA52
10	hif_lowgainflag	Warning	uid___A002_Xf396d6_X45bb.ms - the following antennas are moved to the end of the refant list because they are fully flagged for one or more spws: DA52
12	hifa_bandpassflag	Warning	uid___A002_Xf396d6_X45bb.ms - for intent BANDPASS (field J1058+0133) and spw 17, the following antennas are fully flagged: PM01
12	hifa_bandpassflag	Warning	uid___A002_Xf396d6_X45bb.ms - for intent BANDPASS (field J1058+0133) and spw 21, the following antennas are fully flagged: DV08
12	hifa_bandpassflag	Warning	uid___A002_Xf396d6_X45bb.ms - for intent BANDPASS (field J1058+0133) and spw 25, the following antennas are fully flagged: PM01
12	hifa_bandpassflag	Warning	uid___A002_Xf396d6_X45bb.ms - the following antennas are moved to the end of the refant list because they are fully flagged for one or more spws, in one or more fields with intents among BANDPASS: PM01 and DV08

Tasks by Topic

Topic	Lowest Scoring Task		Min Score
Data Sets	24. **hifa_imageprecheck**: ImagePreCheck	Beam within range using non-default robust	0.85
Calibration	13. **hifa_bandpass**: Phase-up bandpass calibration		0.95
Flagging	7. **hifa_tsysflag**: Flag Tsys calibration		0.96
Imaging	34. **hif_makeimages**: Make target per-spw continuum images		1.00
Miscellaneous	5. **hif_refant**: Select reference antennas		1.00

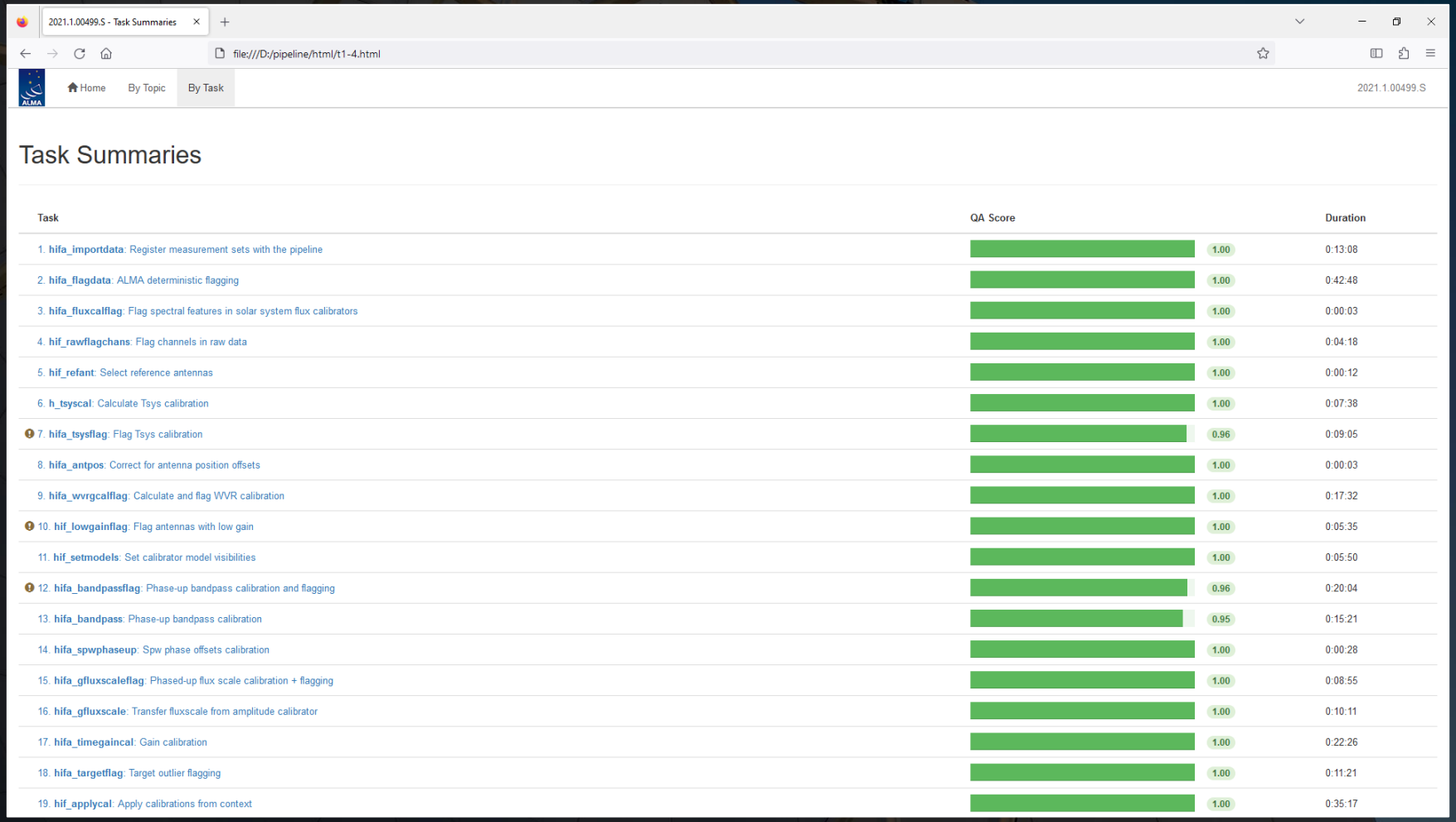
Flagging Summaries

uid___A002_Xf396d6_X45bb.ms

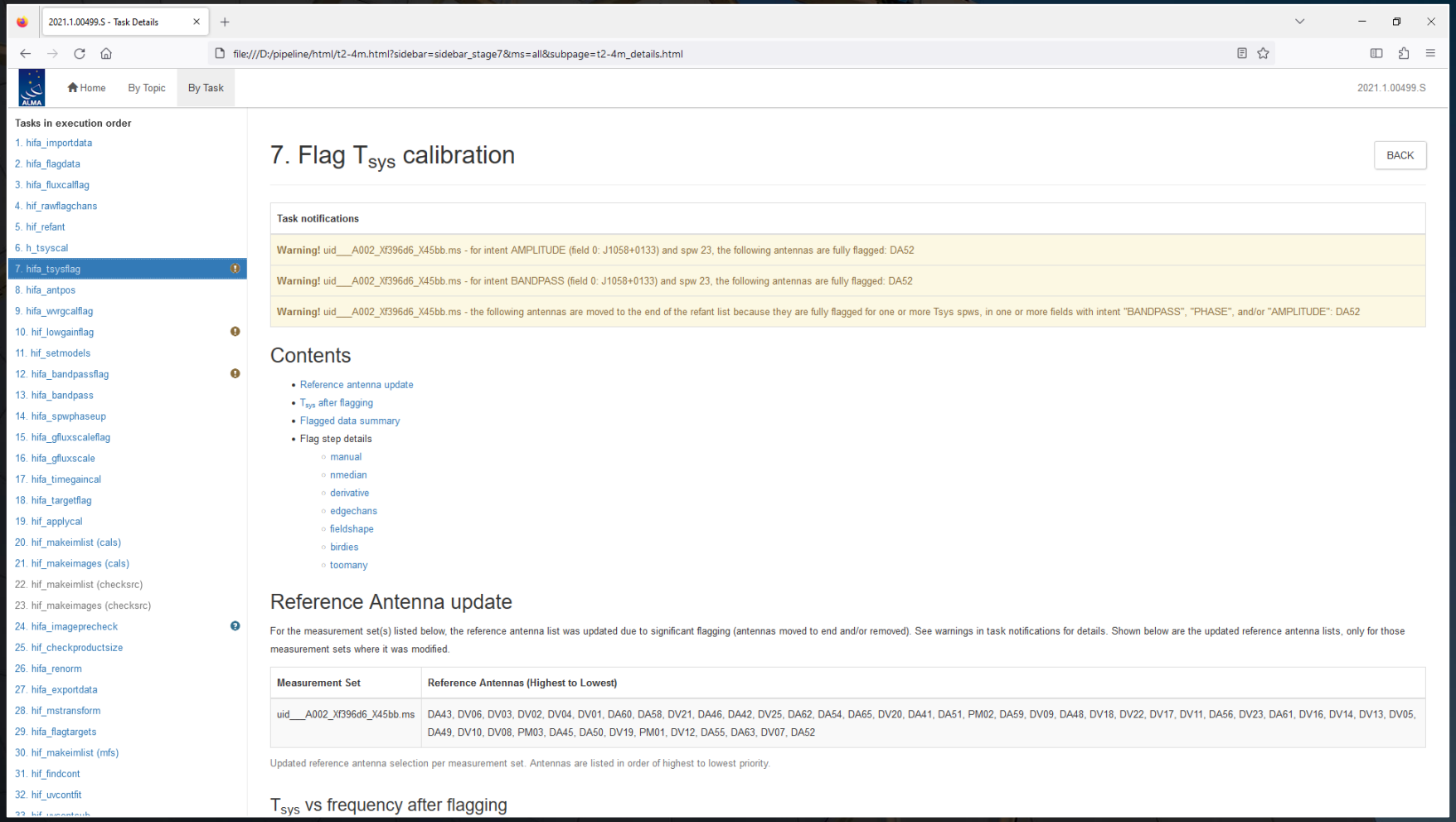
Flagging percentages for Source name: J1058+0133, Intents: AMPLITUDE,ATMOSPHERE,BANDPASS,POINTING,WVR

spw	DA41	DA42	DA43	DA45	DA46	DA48	DA49	DA50	DA51	DA52	DA54	DA55	DA56	DA58	DA59	DA60	DA61	DA62	DA63	DA65	DV01	DV02	DV03	DV04	DV05	DV06	DV07	DV08	DV09	DV10	DV11	DV12	DV13
17	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	38.342	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907
21	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	38.342	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	36.907	100.000	36.907	36.907	36.907	36.907	36.907

The By Task page lists each of the calibration and imaging steps that were applied in the pipeline. Not all of these steps need to be checked. Many of these have diagnostic information primarily used for quality assessment.



hifa_tsysflag: This step includes plots of the T_{sys} data (used to correct amplitudes) as a function of frequency. It is useful to check these plots to understand the atmospheric transmission. Spectral features in these data could potentially reappear in the final spectra of the science targets.



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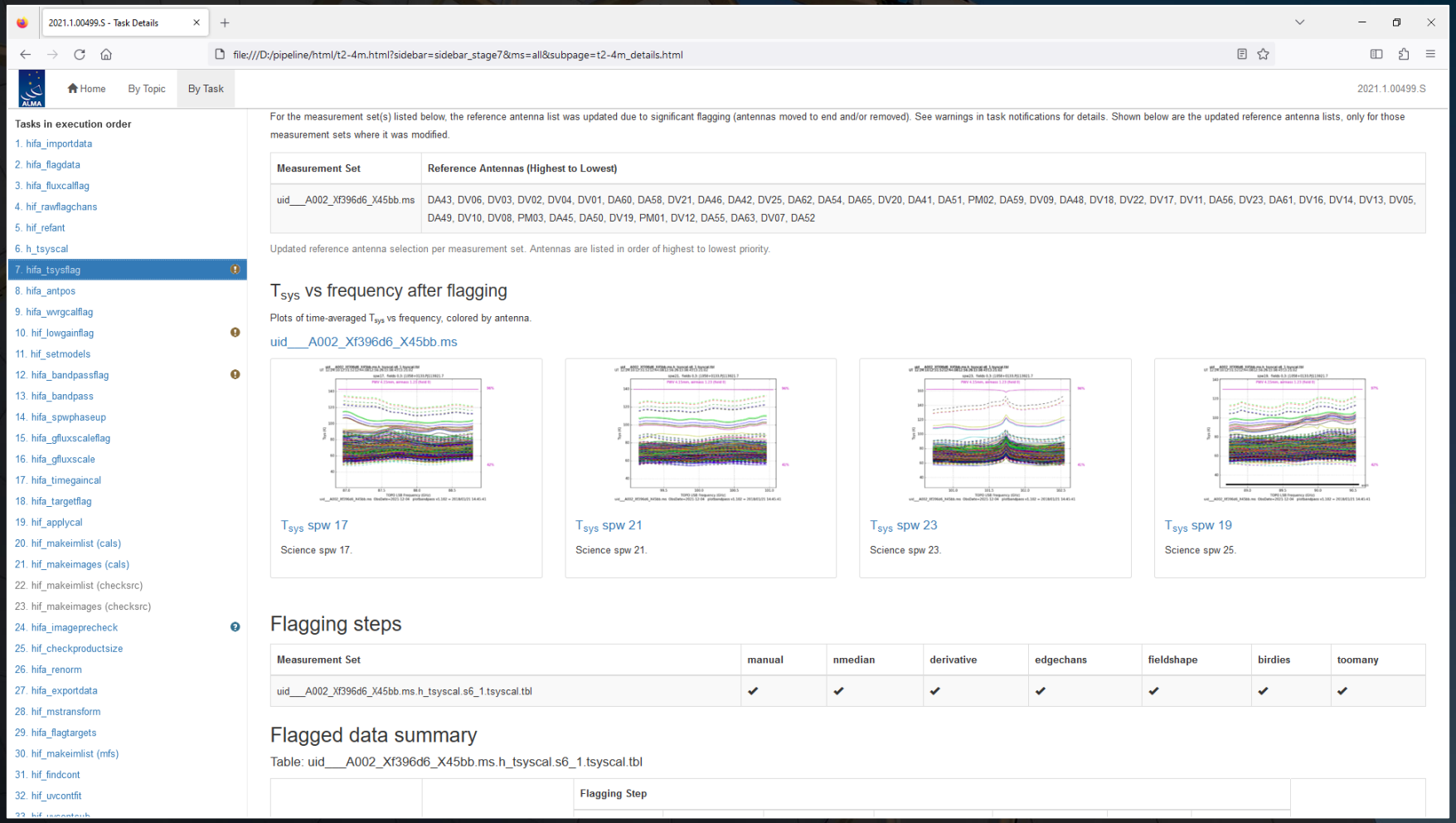

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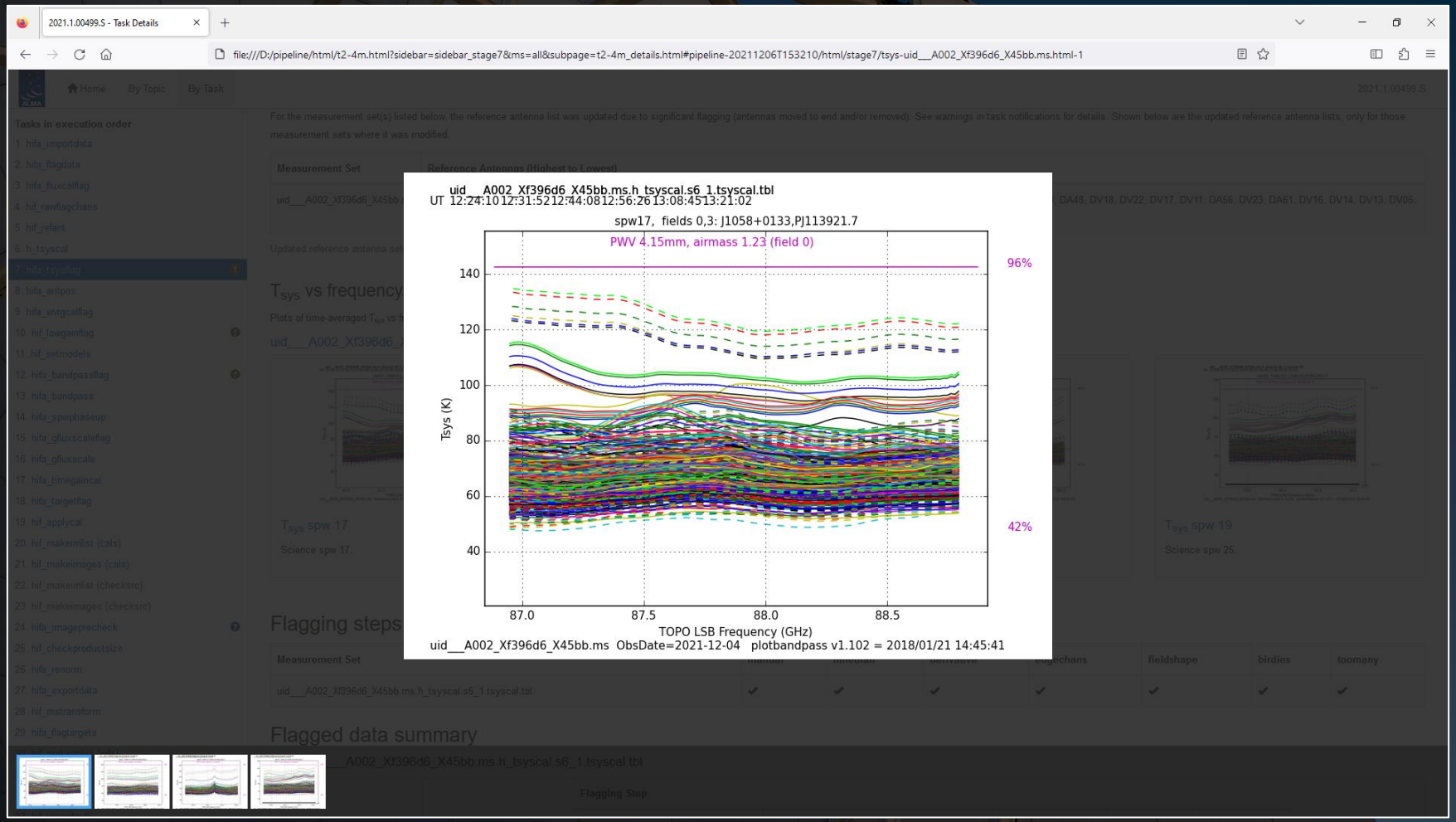
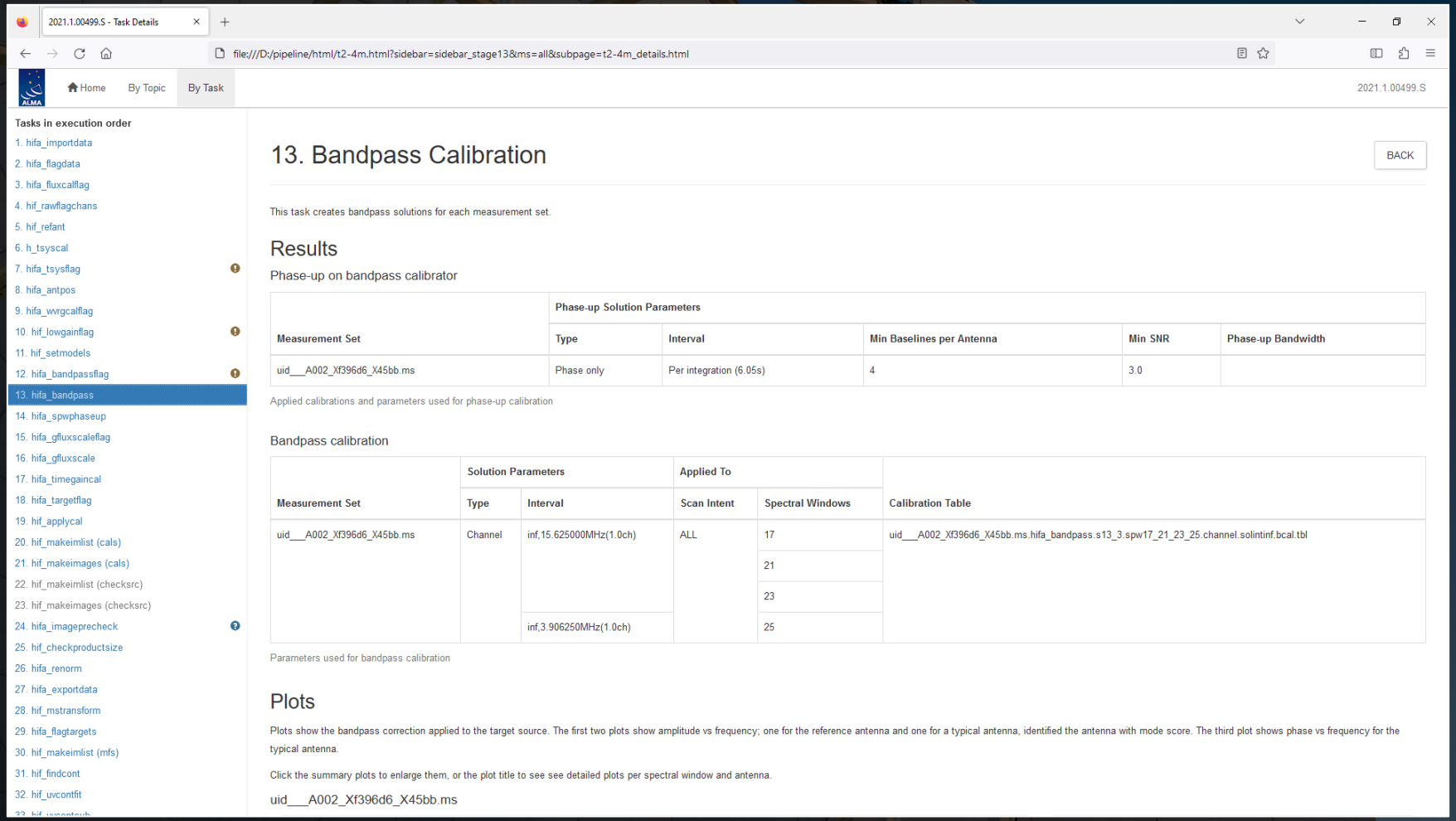
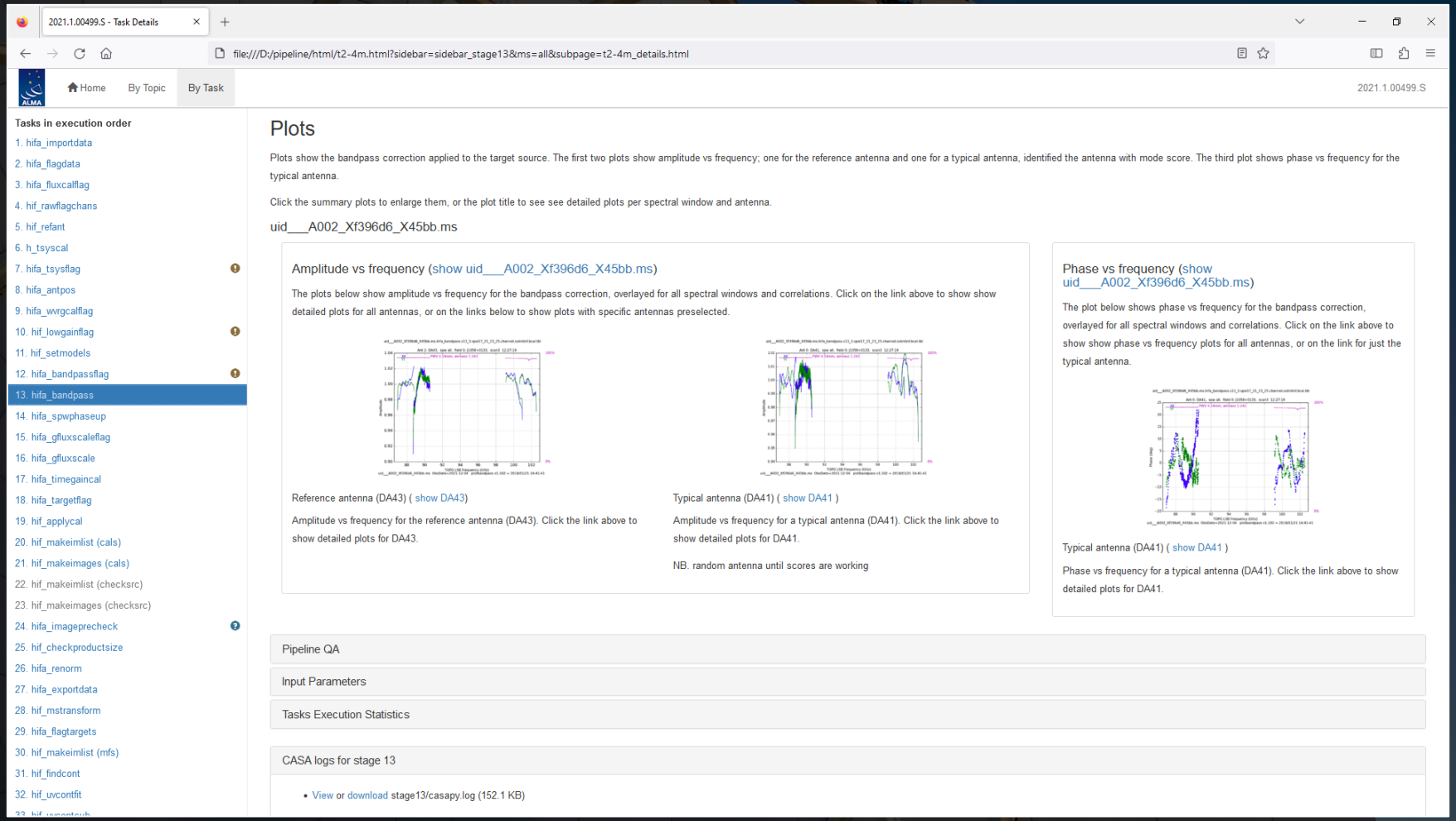


hifa_bandpass: Corrections for the phase and amplitude versus frequency are derived in this step.



The plots of these quantities versus frequency should be smooth. Any strong spikes or dips in the data could create false spectral lines in the final image cubes.



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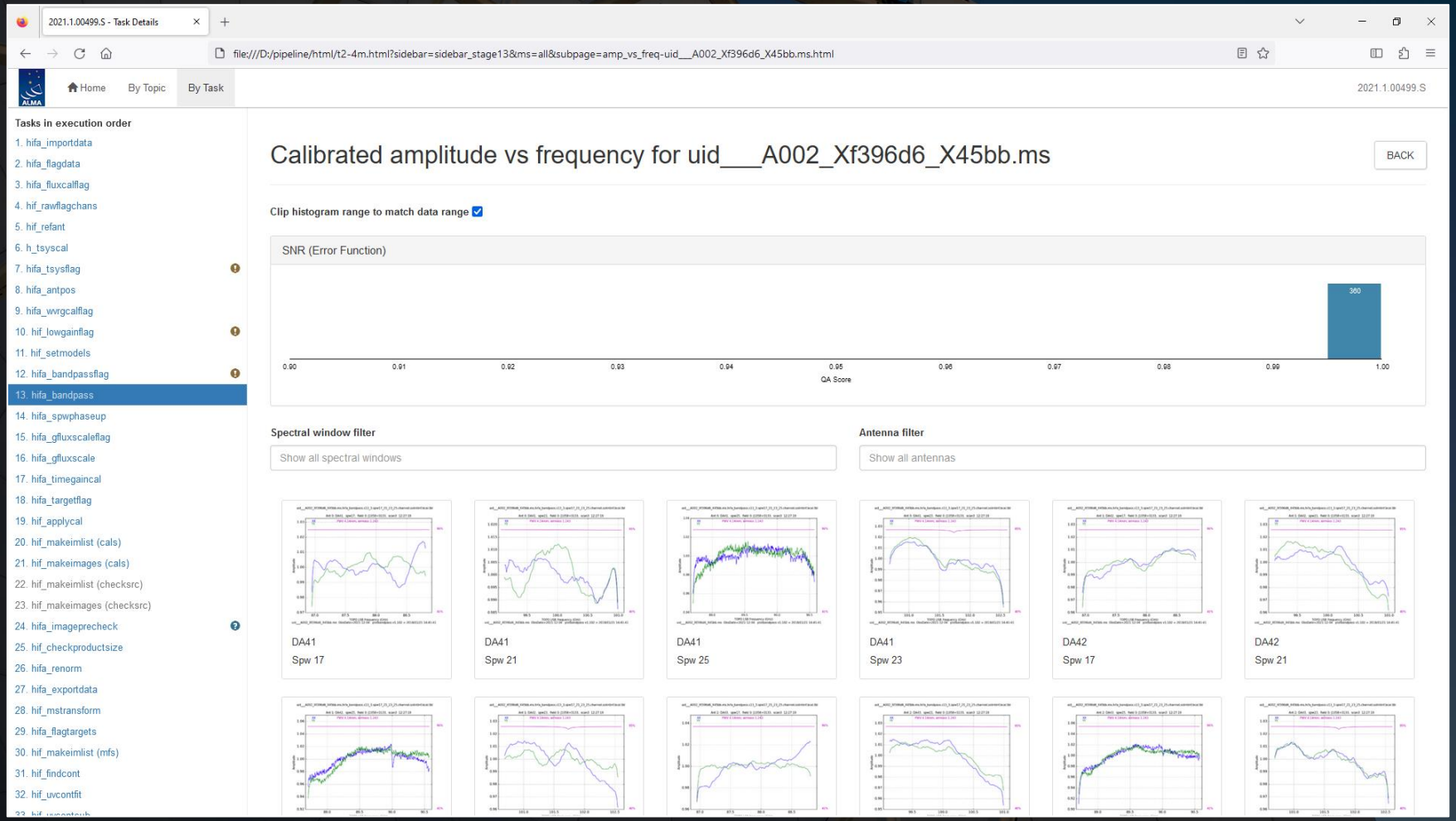

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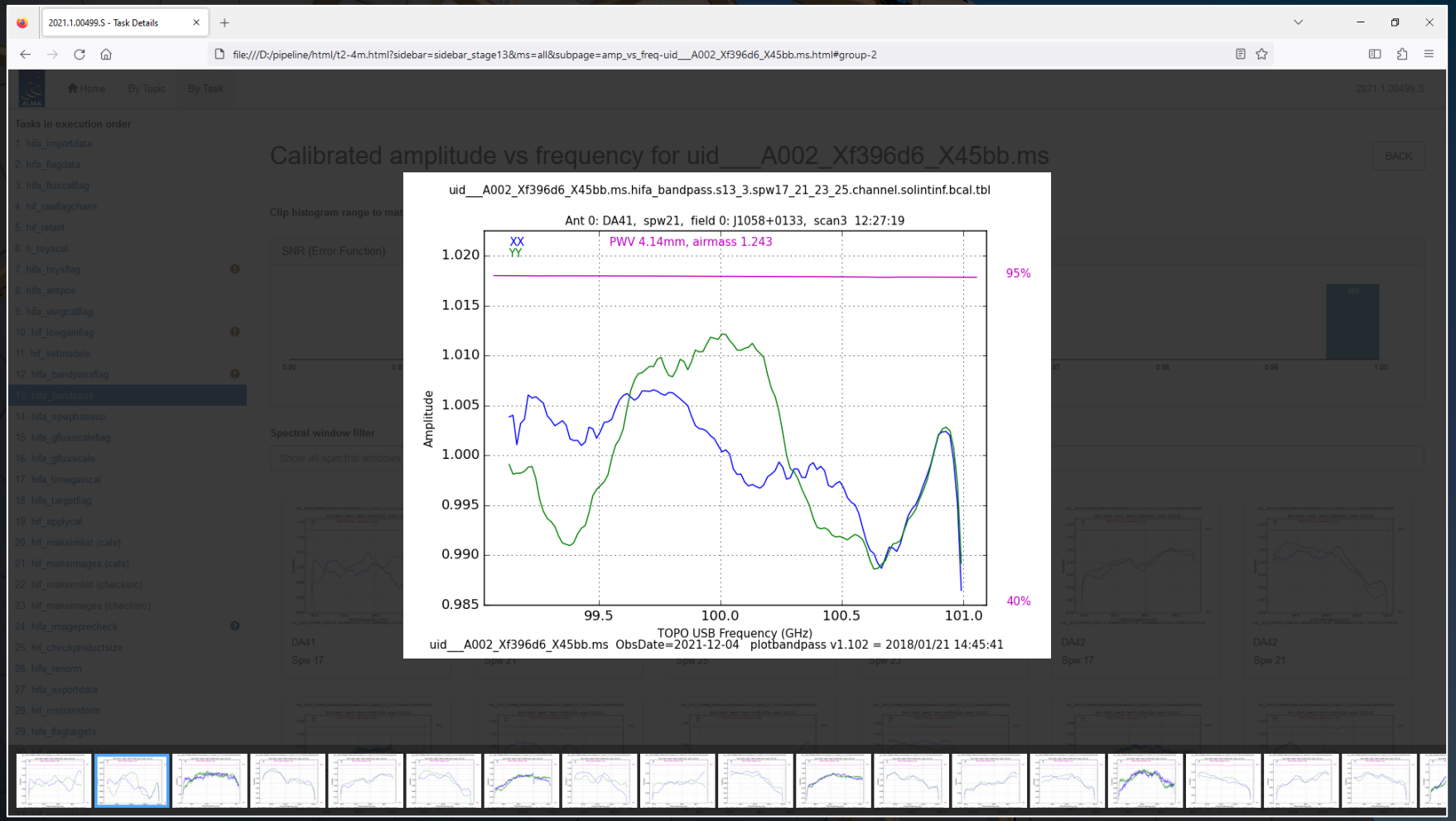
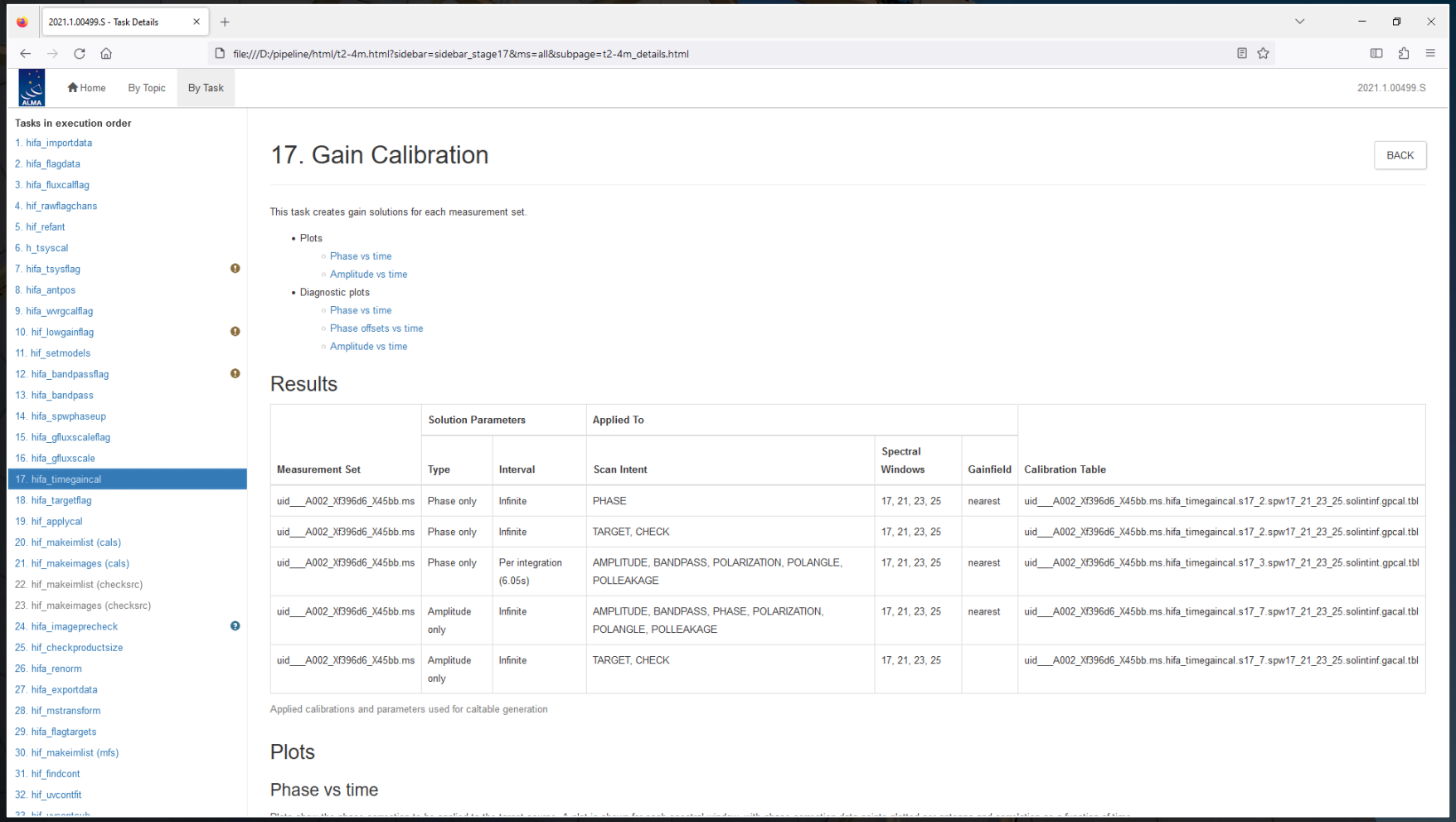


hifa_timegaincal: This module derives phase and amplitude corrections versus time. The output from this module only needs to be reviewed when problems arise with the data.



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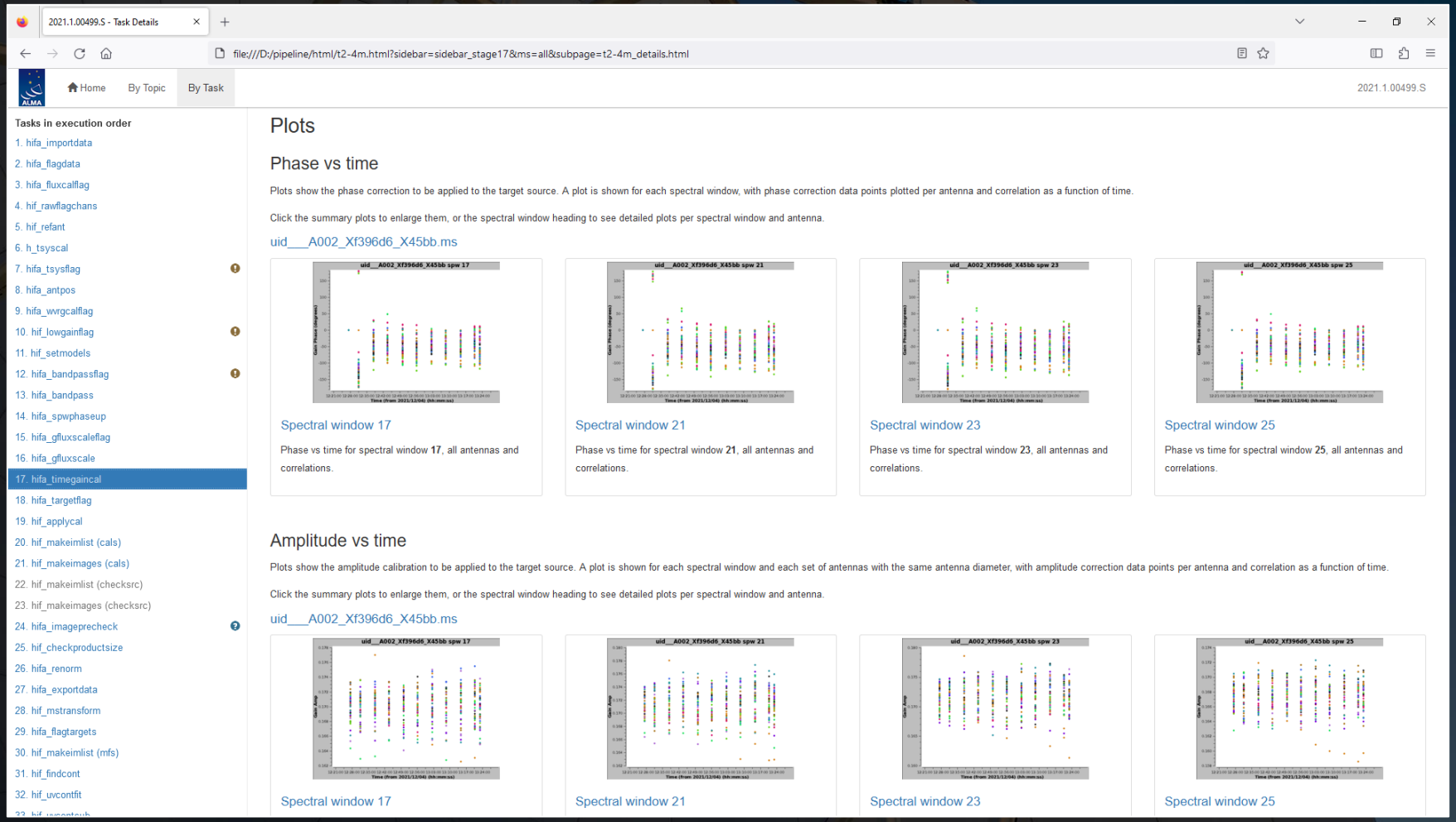

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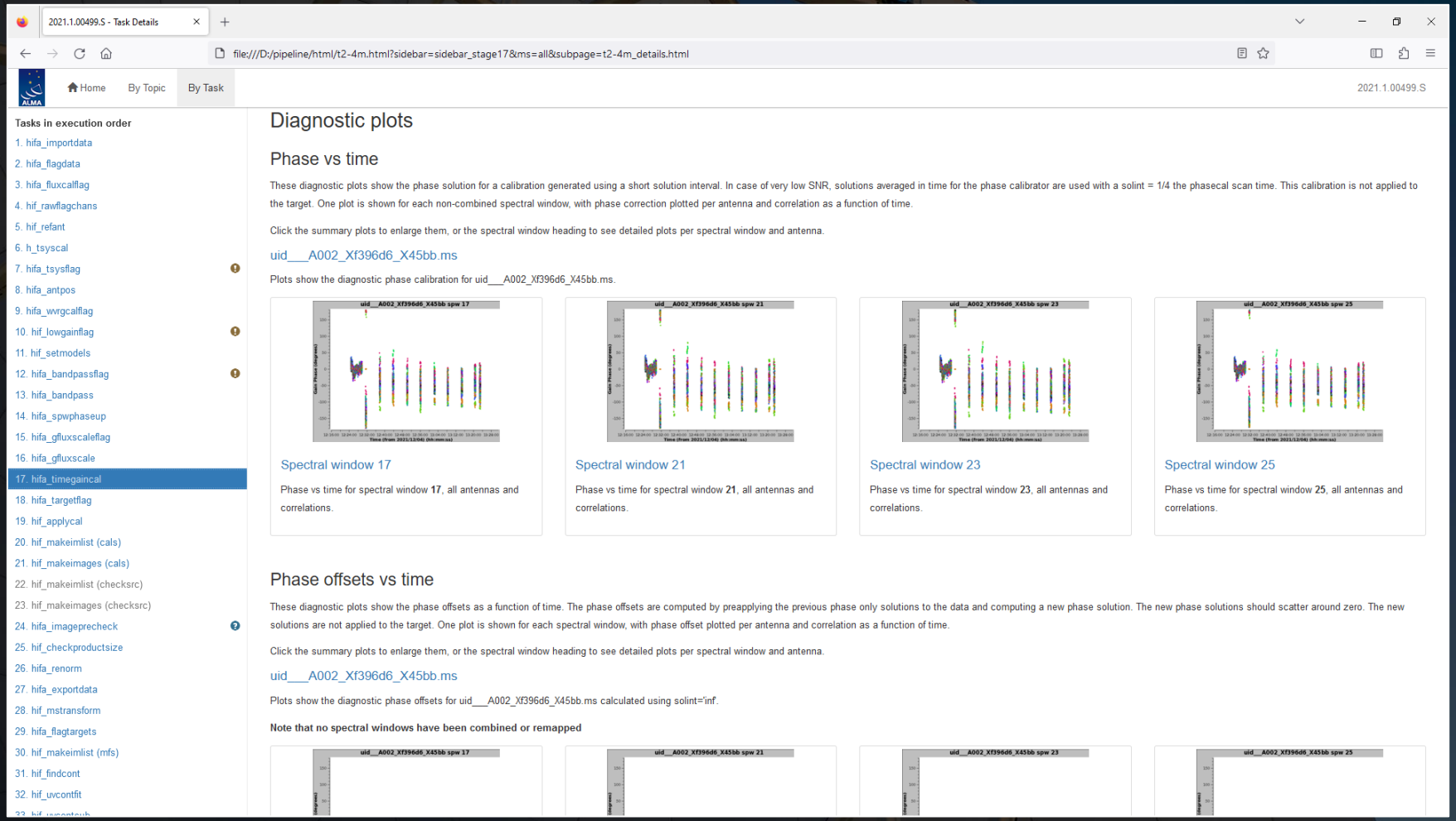
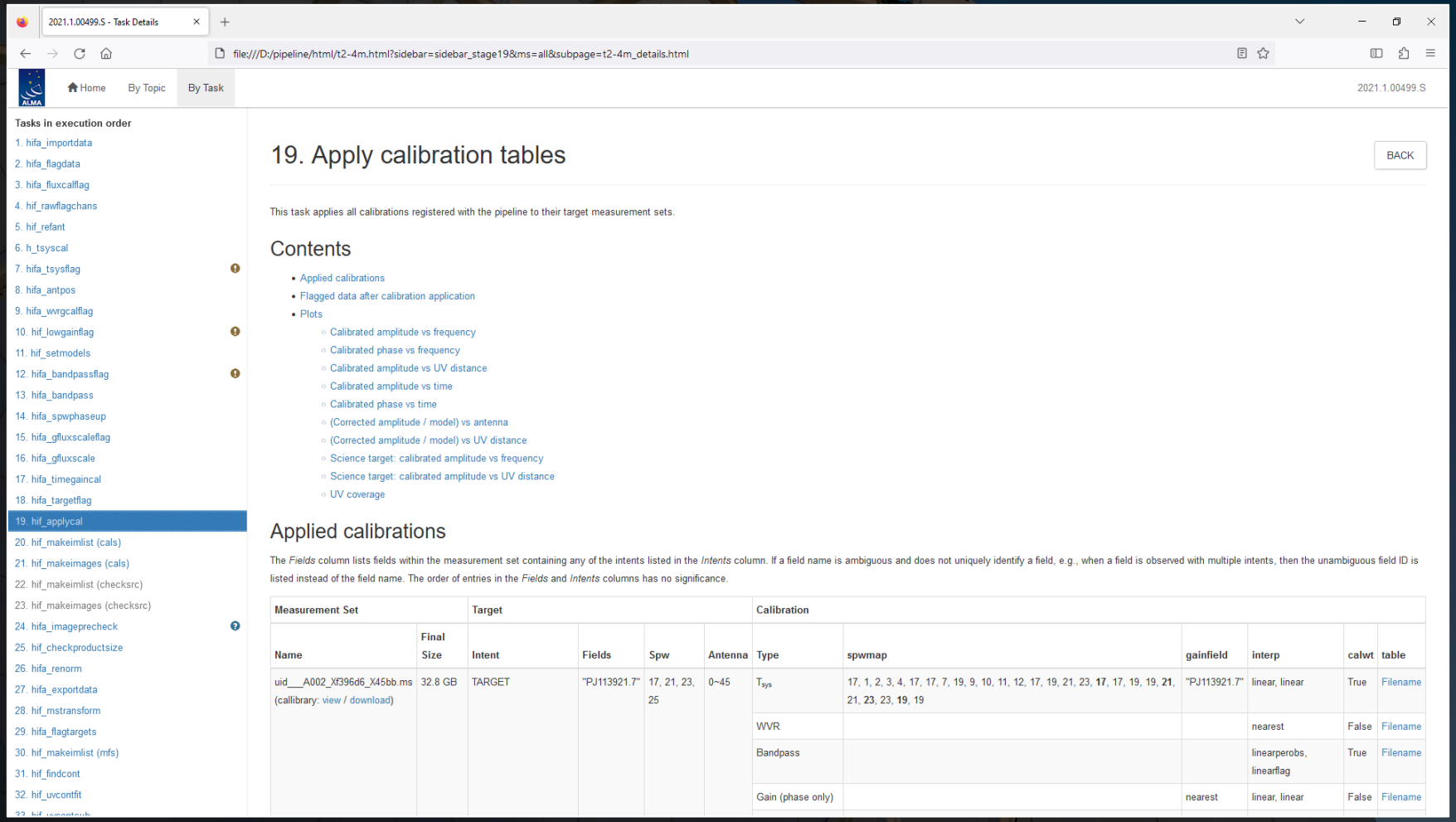


hifa_applycal: This step applies the calibration tables and created plots of the phases and amplitudes afterwards. Most of the output from this module only needs to be reviewed when problems arise with the data.



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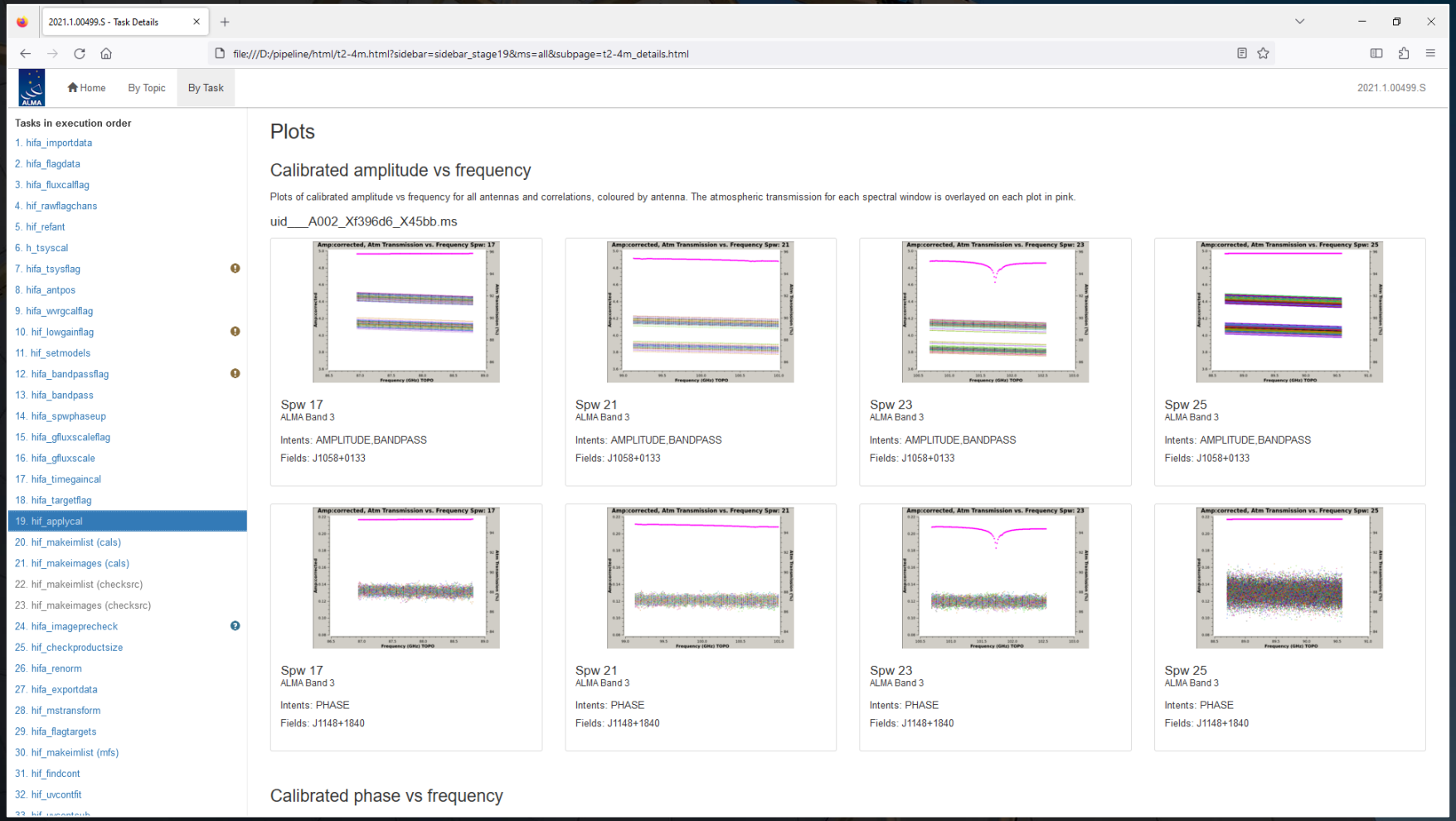

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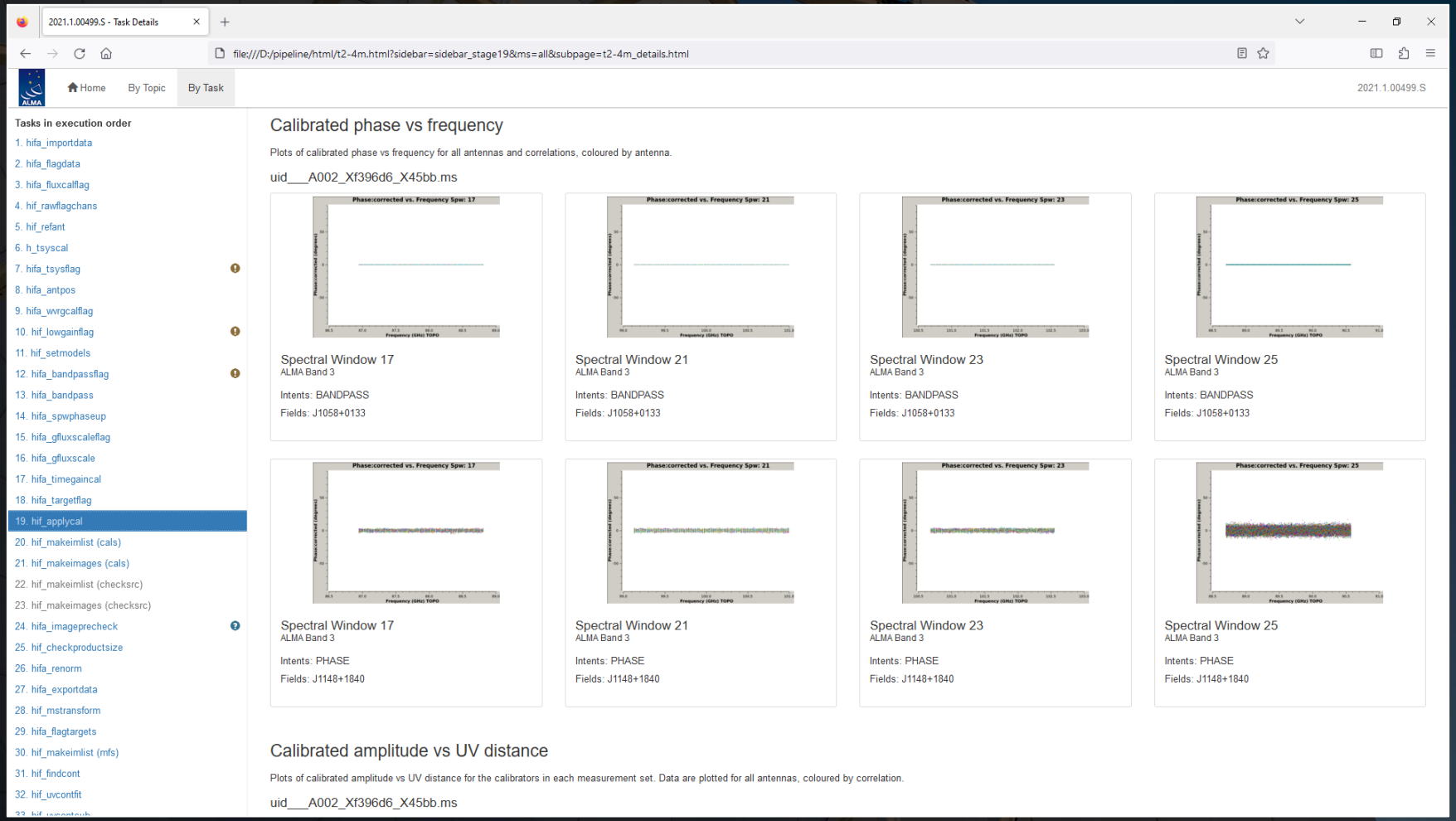

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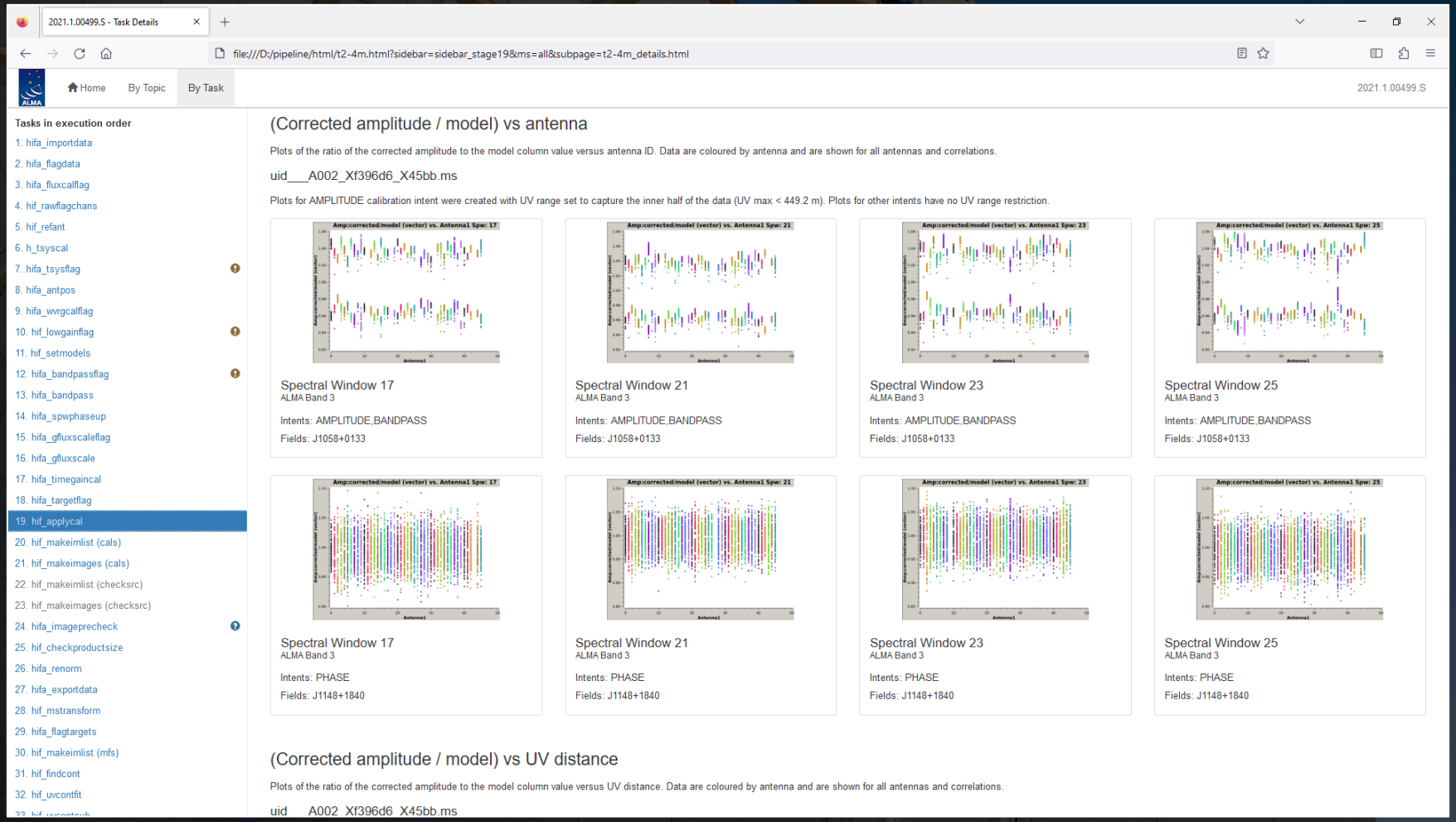
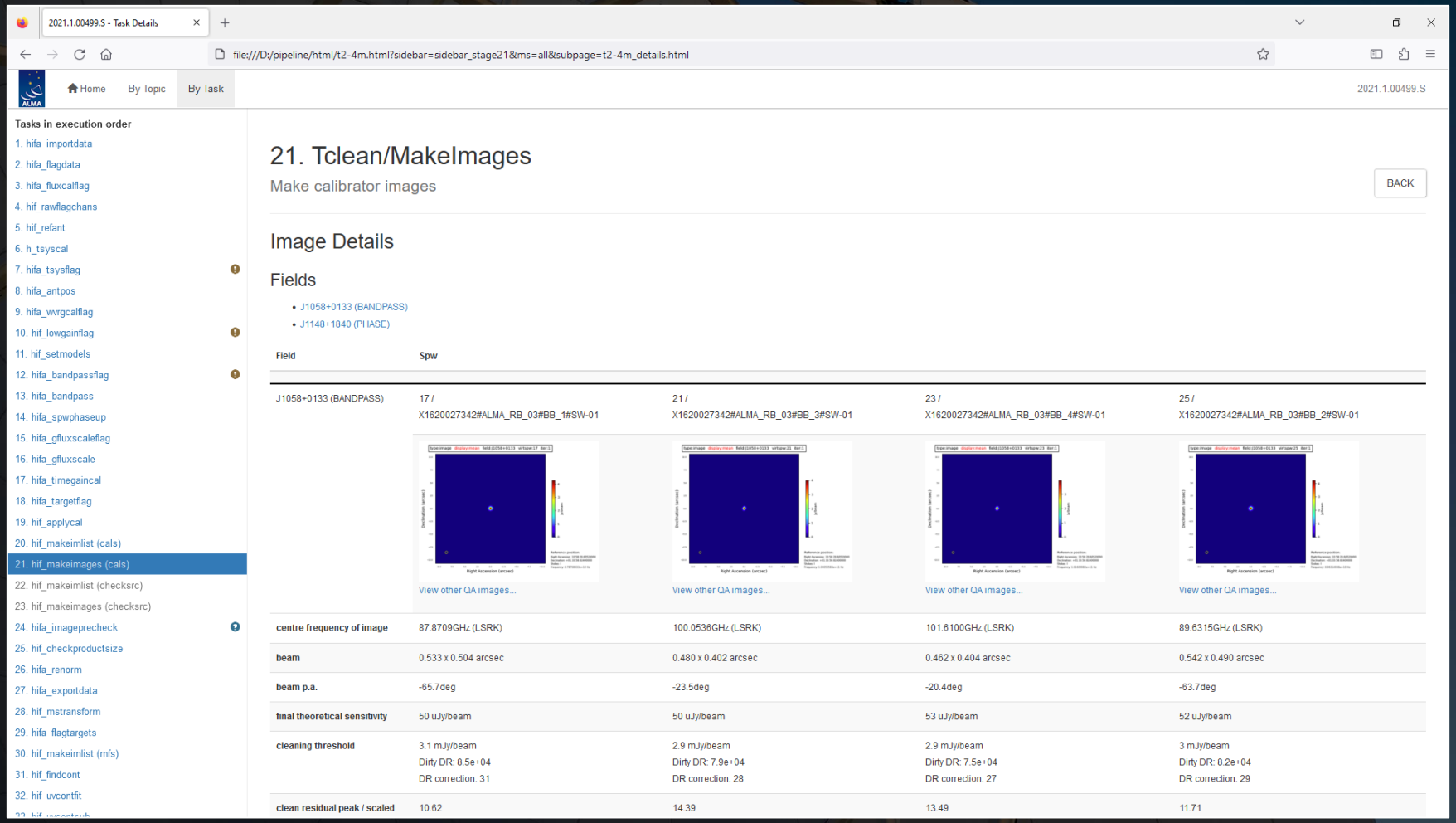


hif_makeimages (cals): When this is first called, it makes continuum images of each calibrator in each spw for quality assessment. The images of the phase calibrator (which is near the science targets) are useful to look at to understand the beam size and shape.



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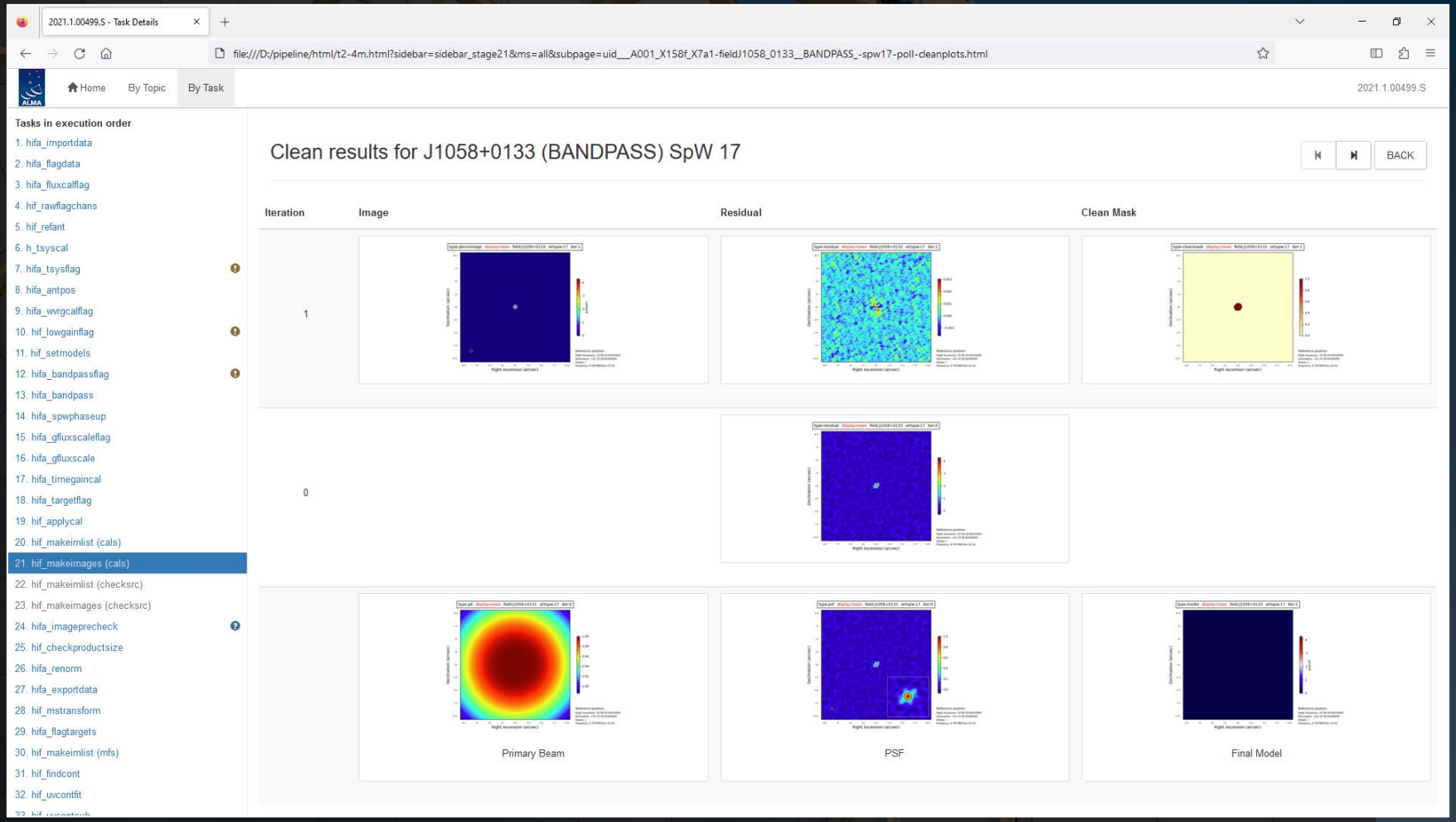
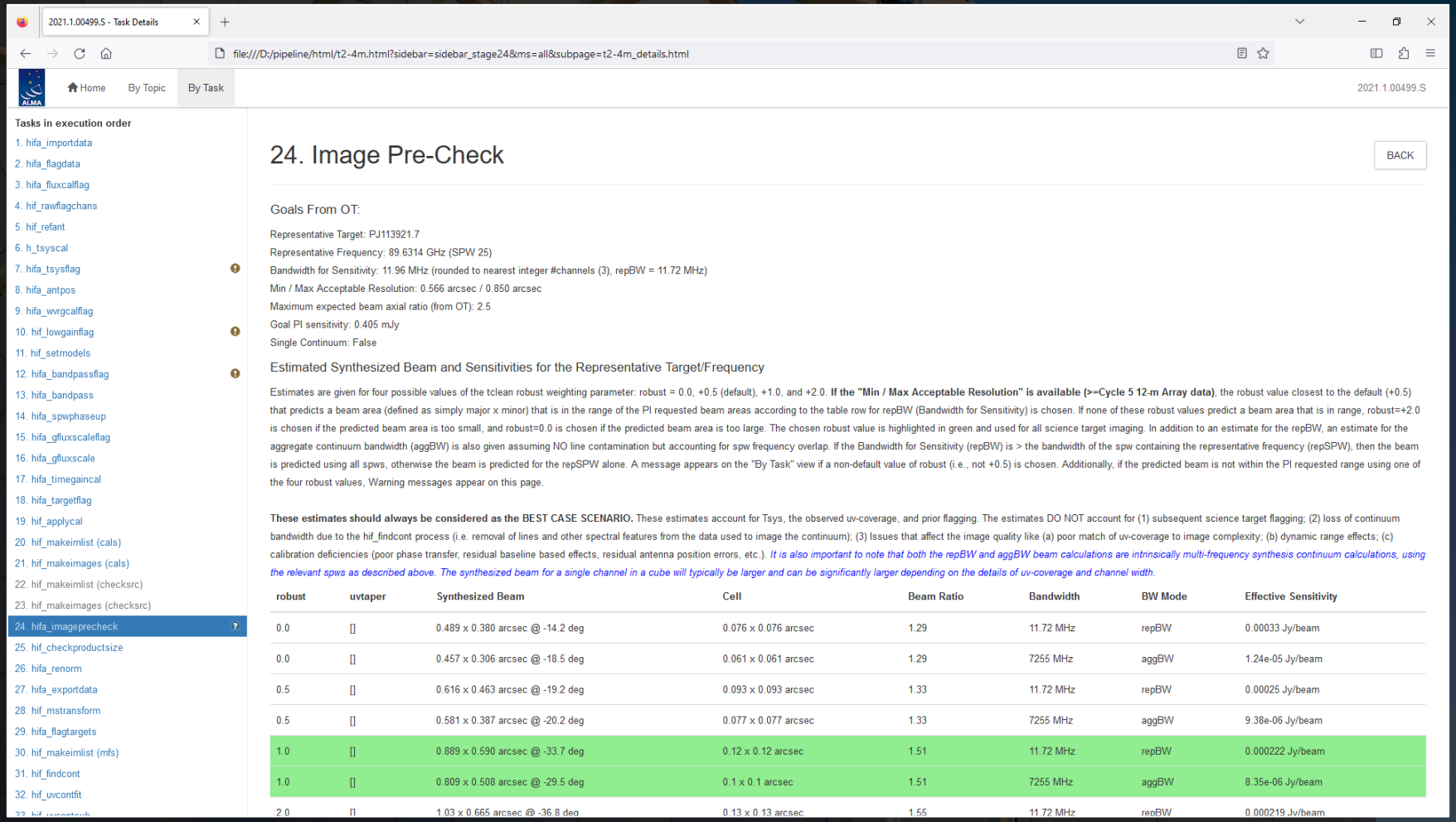


hifa_imageprecheck: This module estimates beam sizes using different robust factors for imaging, which is useful to refer to when re-imaging the data. The row in green is selected for subsequent imaging steps.



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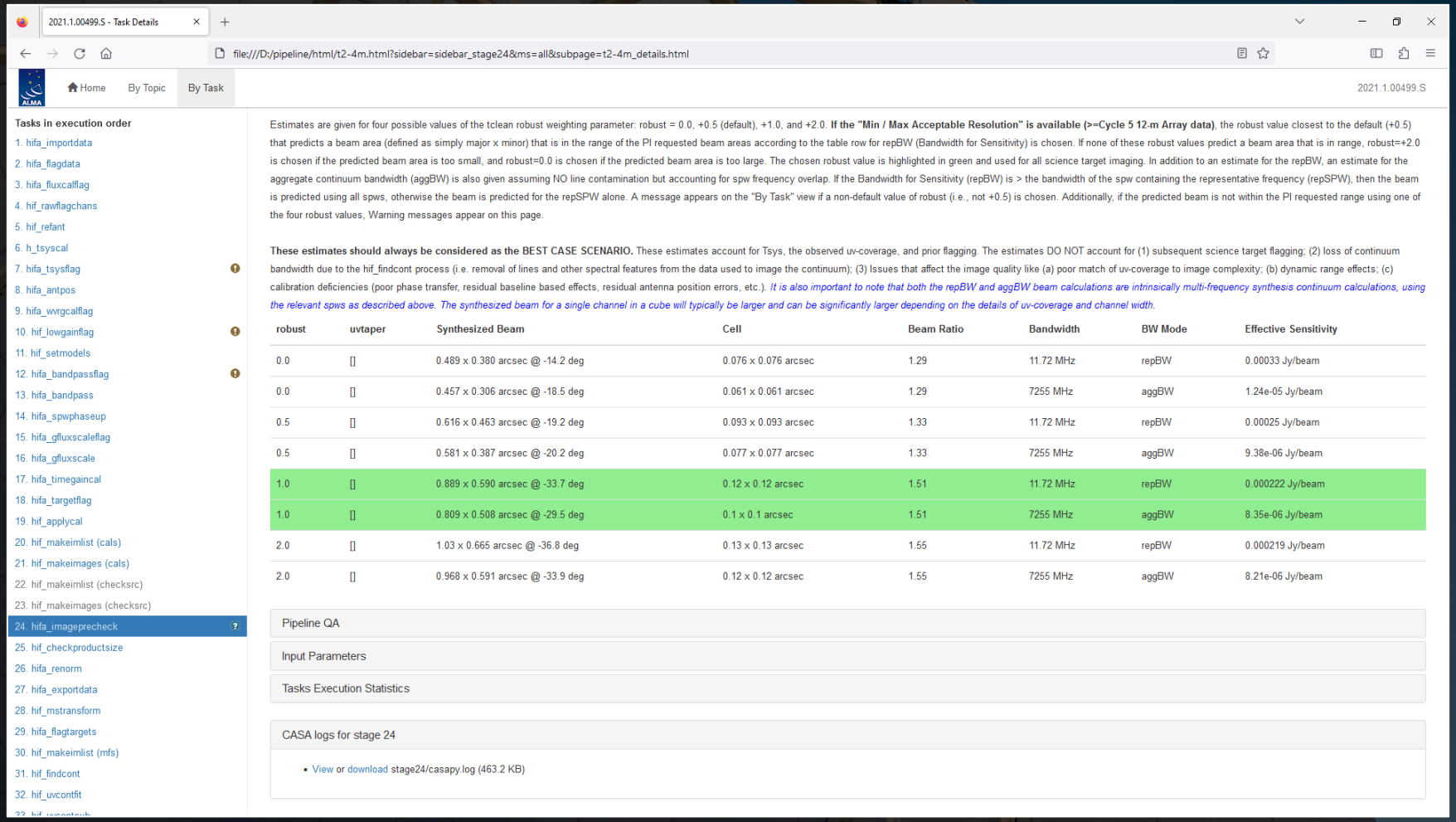
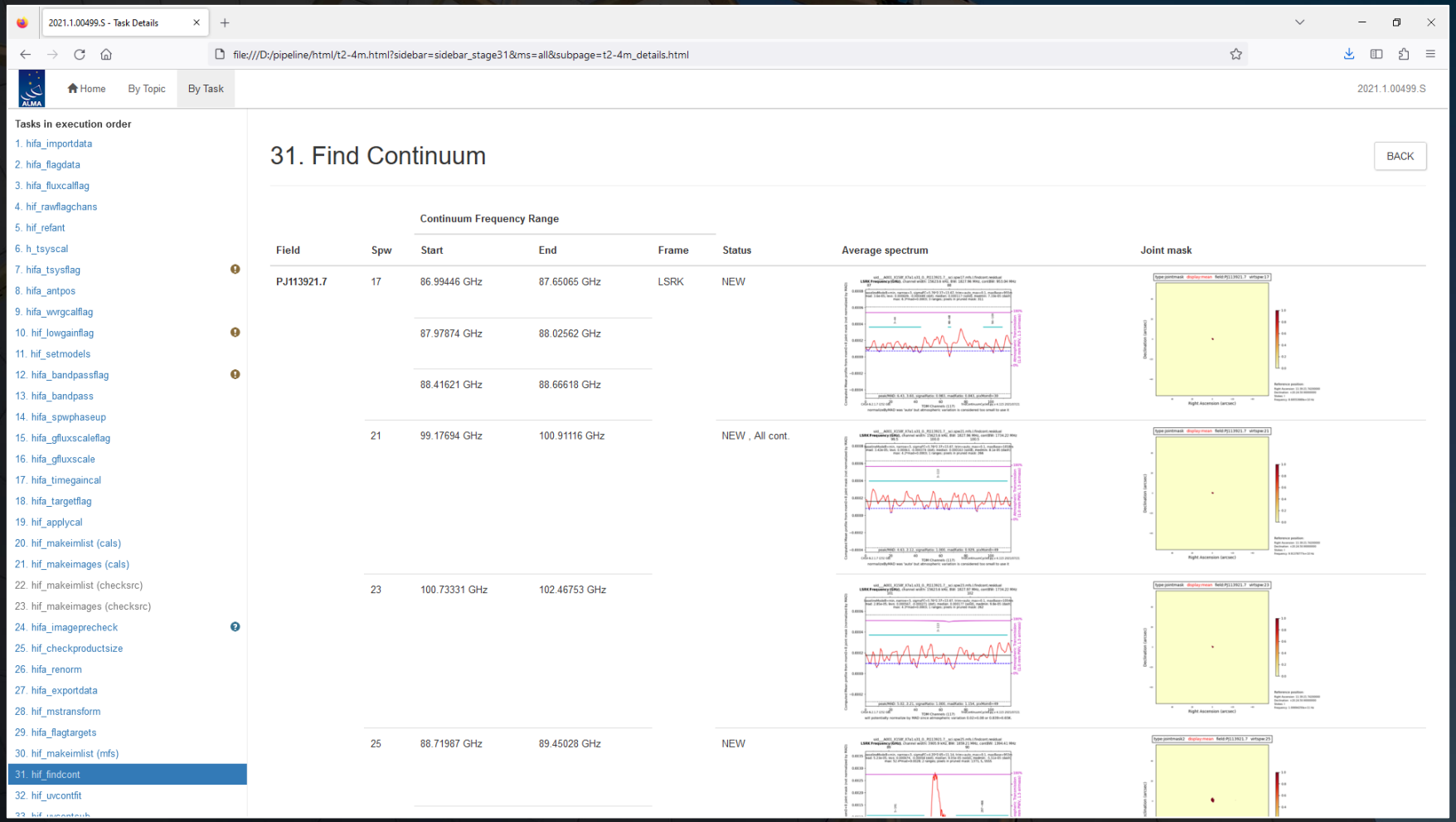
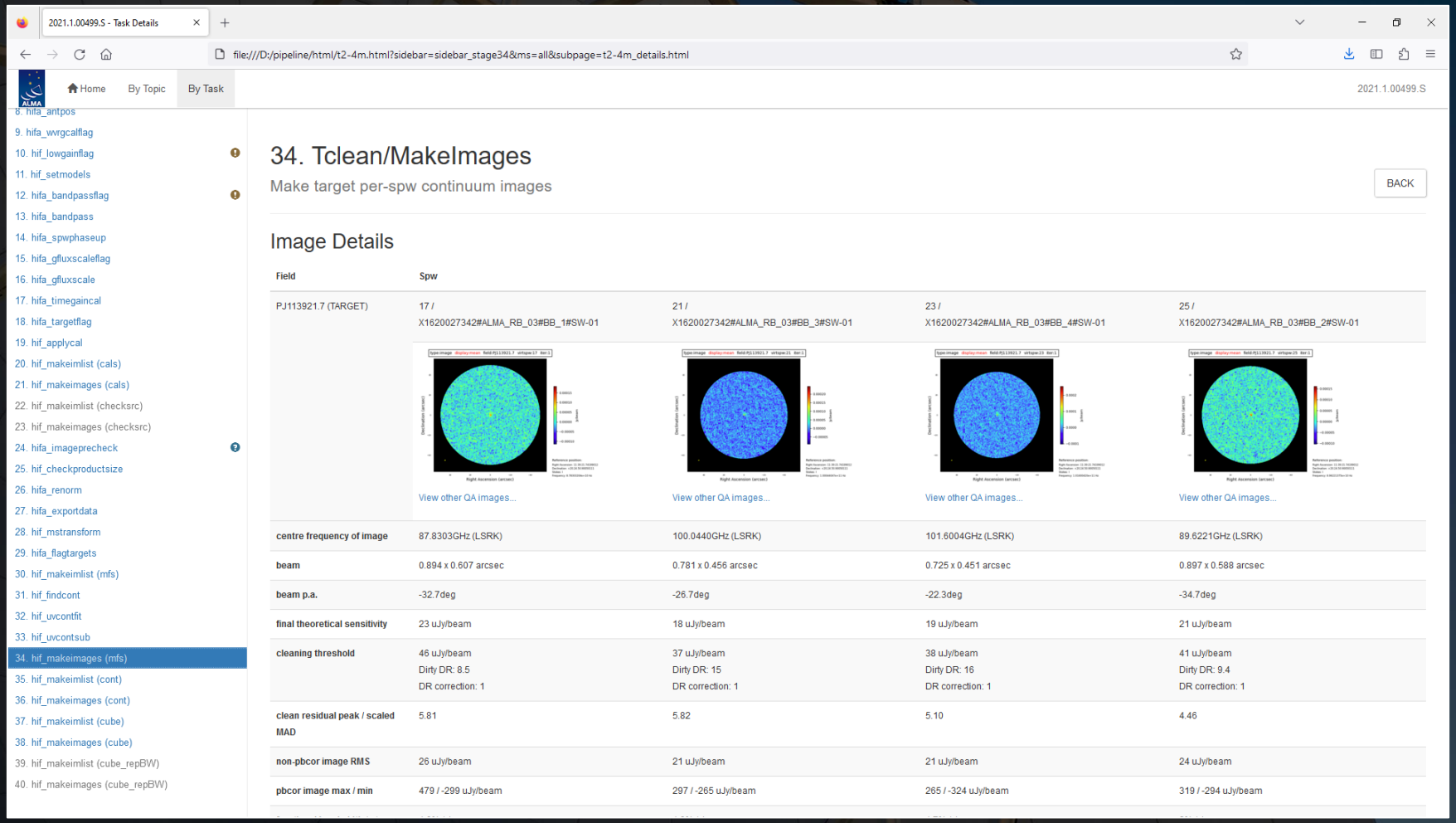


hif_findcont: This is where the pipeline creates initial image cubes and identifies continuum channels (although the identification is not always optimal). This is useful as a first look at the spectra, although re-imaging the data may be much more effective for identifying spectral lines.



hif_makeimages: Several steps near the end of the pipeline (for multiple different types of output images) have this name. These pages are useful for seeing an overview of the imaging results, particularly with regards to information like beam sizes and noise levels.



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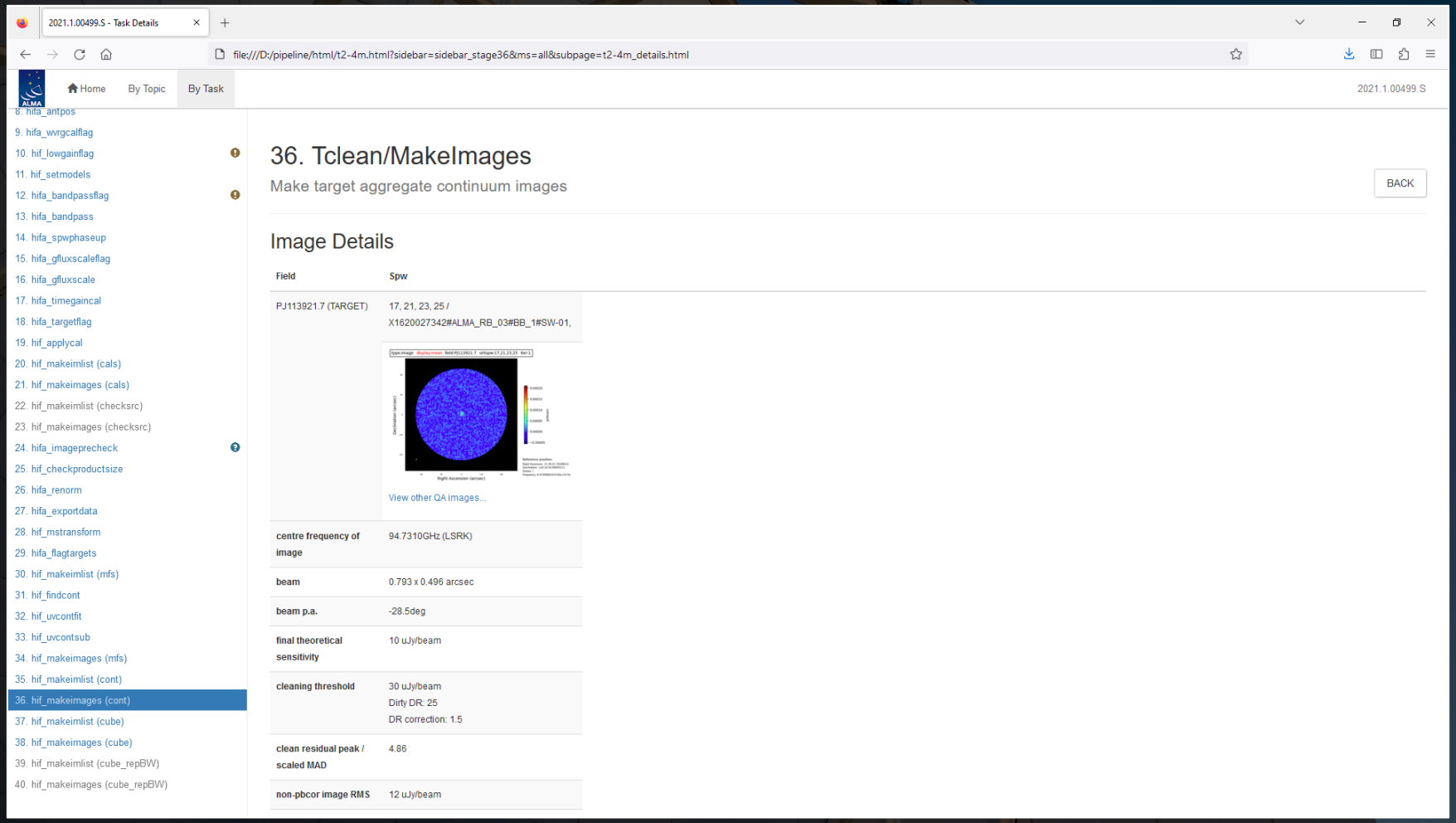

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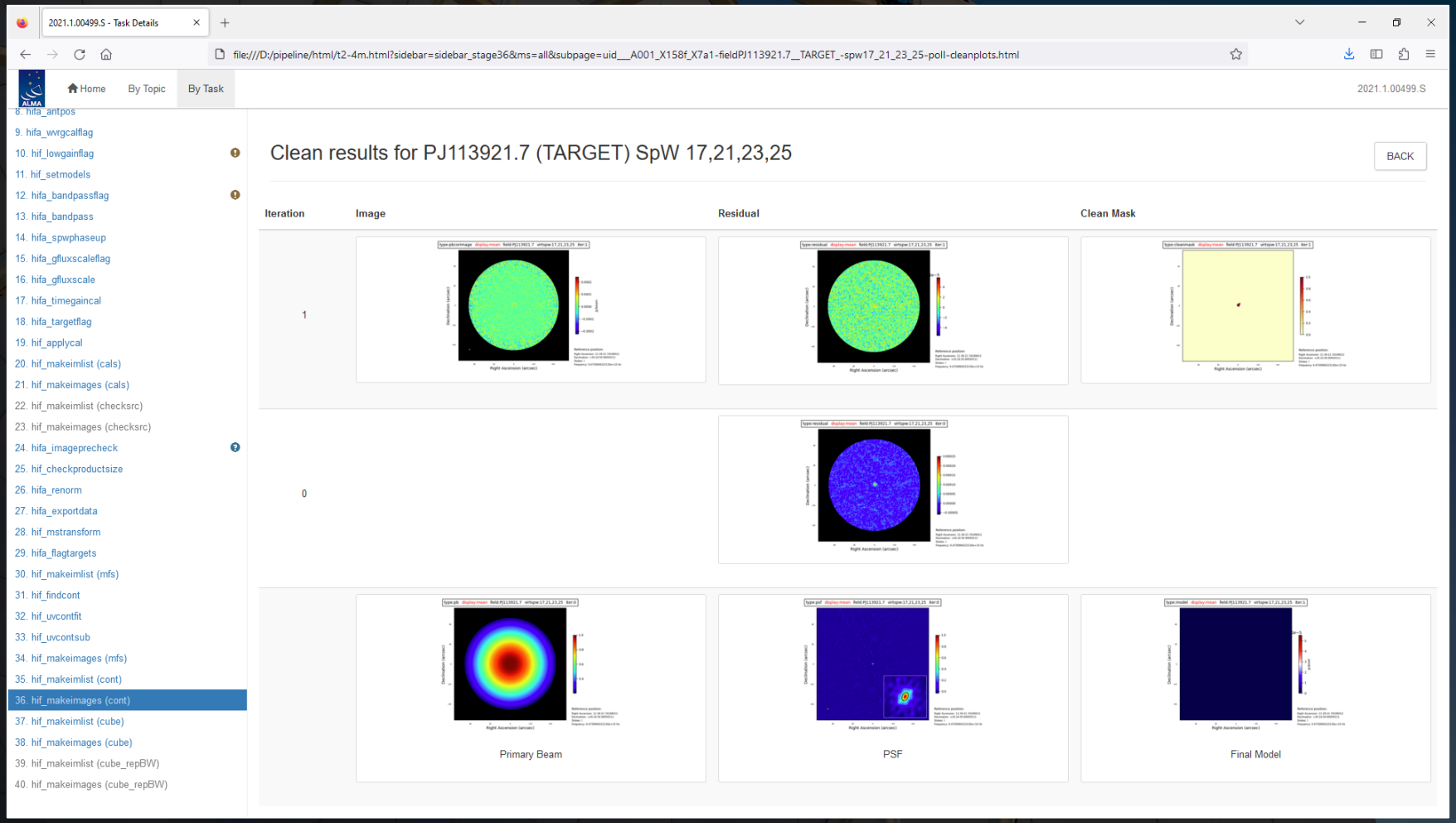

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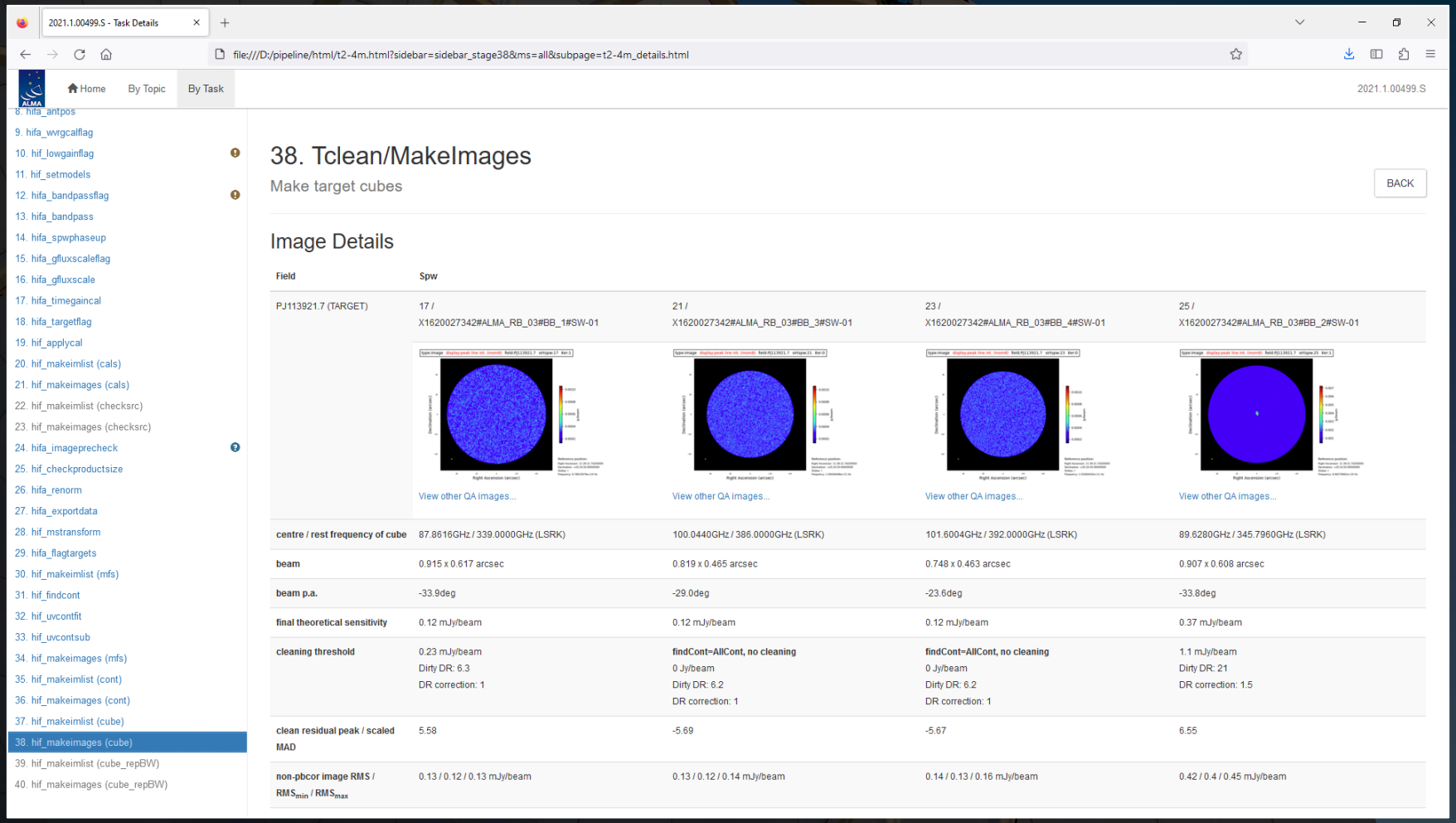

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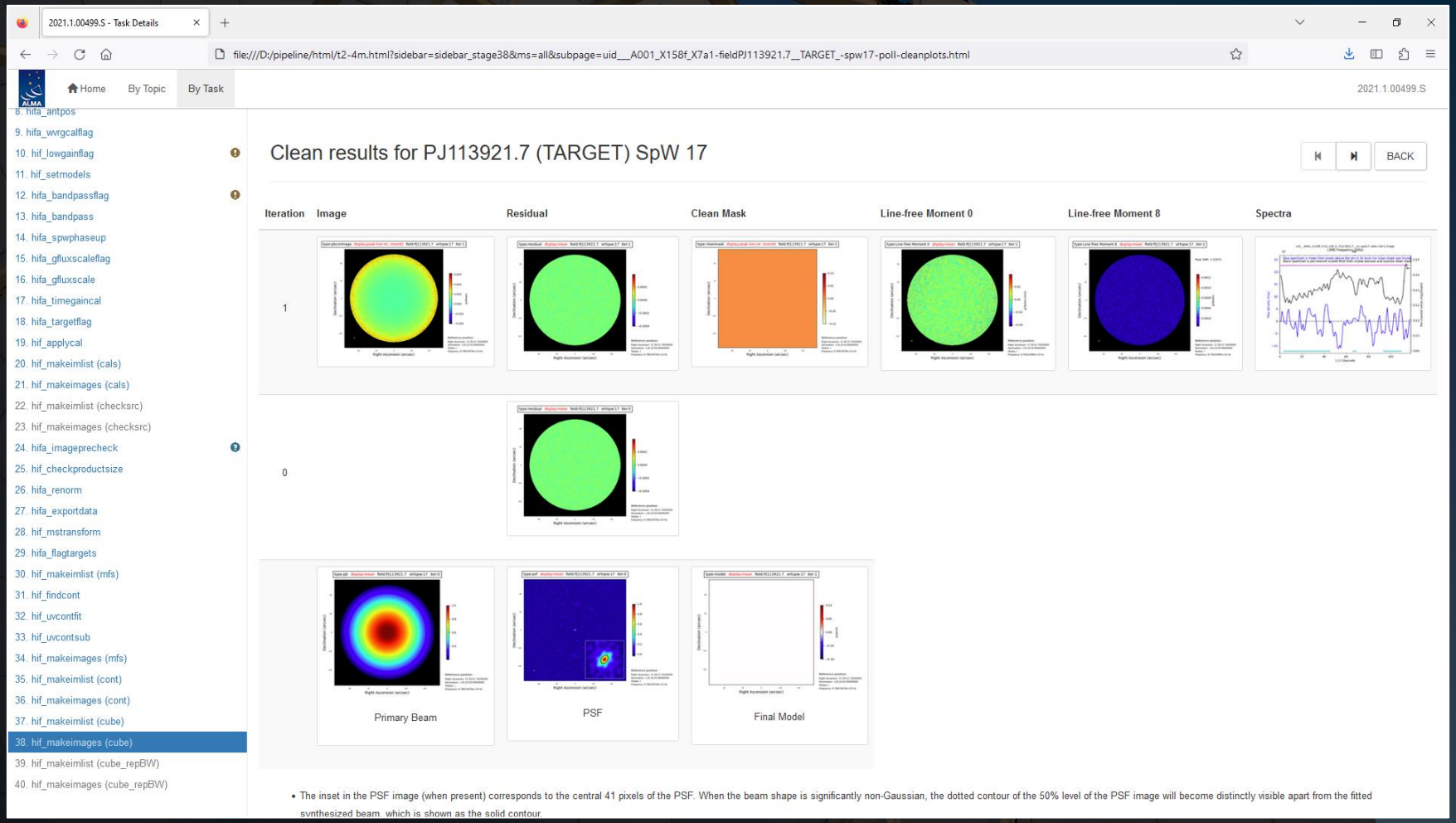

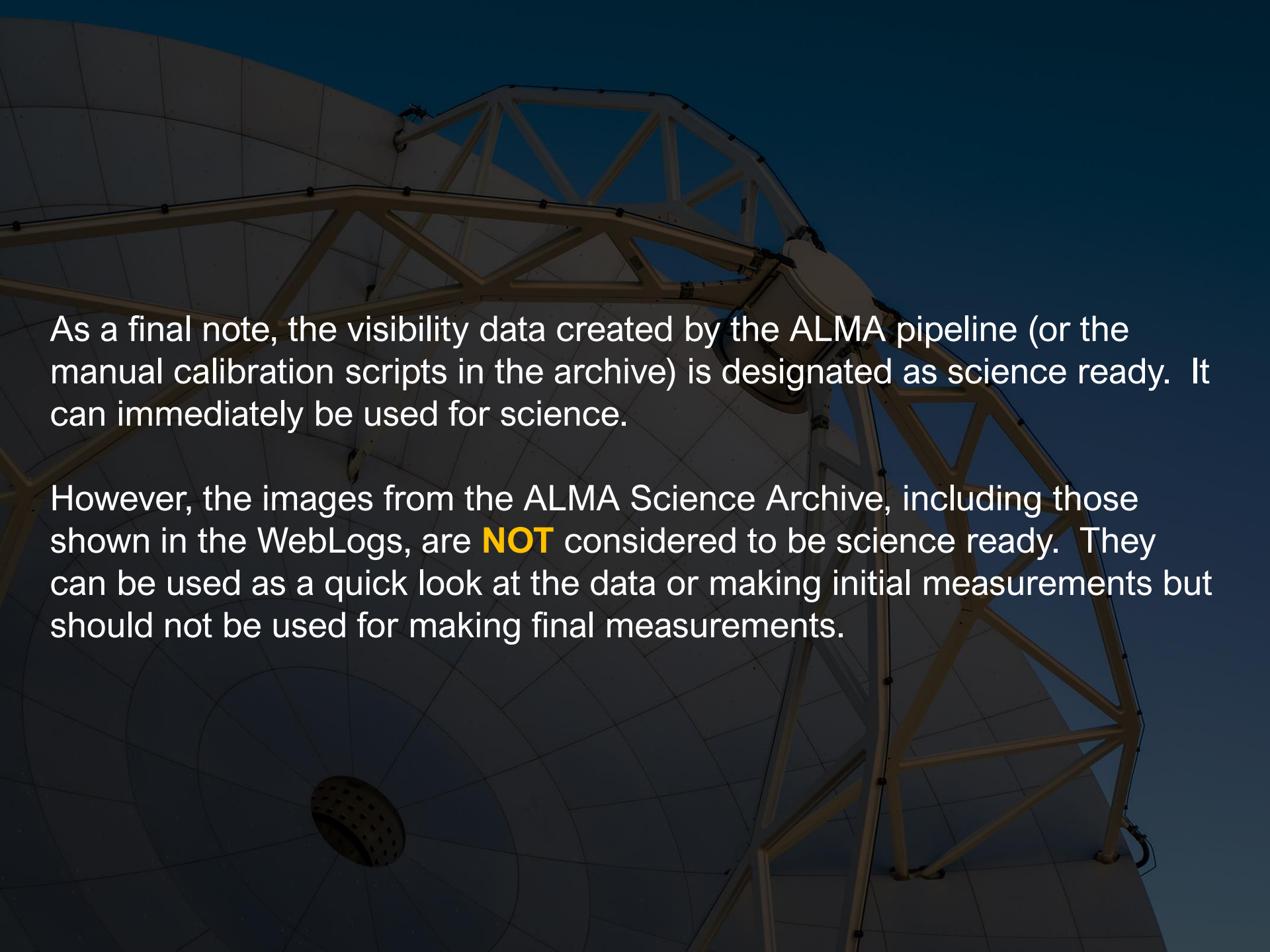

As a final note, the visibility data created by the ALMA pipeline (or the manual calibration scripts in the archive) is designated as science ready. It can immediately be used for science.

However, the images from the ALMA Science Archive, including those shown in the WebLogs, are **NOT** considered to be science ready. They can be used as a quick look at the data or making initial measurements but should not be used for making final measurements.