ALMA Archive, Data Products & Weblogs
what to expect after your observations are made

Sarah Wood

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Atacama Large Millimeter/submillimeter Array
Expanded Very Large Array

The Condensed Version

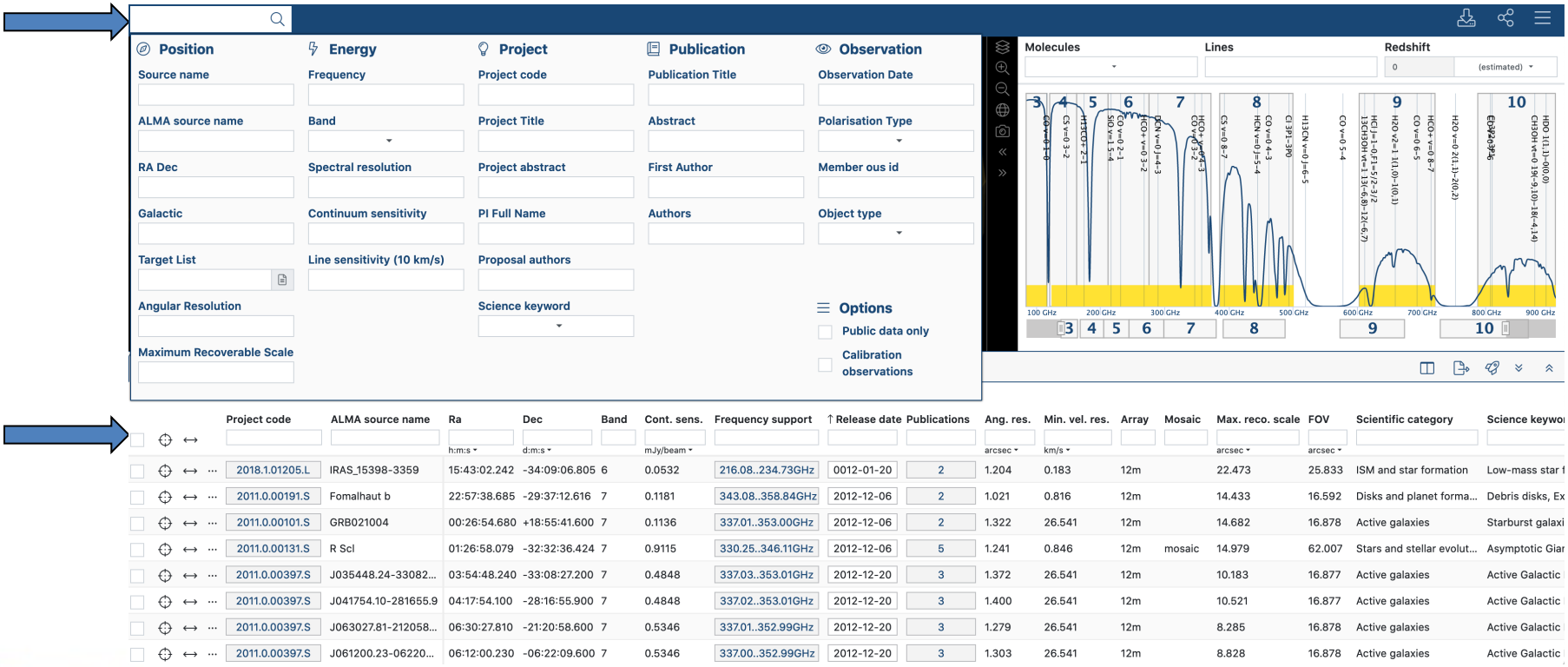
- Download data from *Archive Query* and *Request Handler* tools on the ALMA Science Portal
- Data delivered after passing Quality Assurance (QA)
- The Pipeline Weblog–Calibration and Imaging Information
- Project tracking – SnooPI

Exploring the ALMA Archive

- All projects should start with the ALMA Archive
- Check for duplications
  - Same Target
  - Angular resolution is within a factor of 2
  - RMS is better by a factor of 2
  - See Appendix A of the Users' Policies for complete definition
- Use archival data! No need to apply!
- Archive interface
  - https://almascience.org/aq

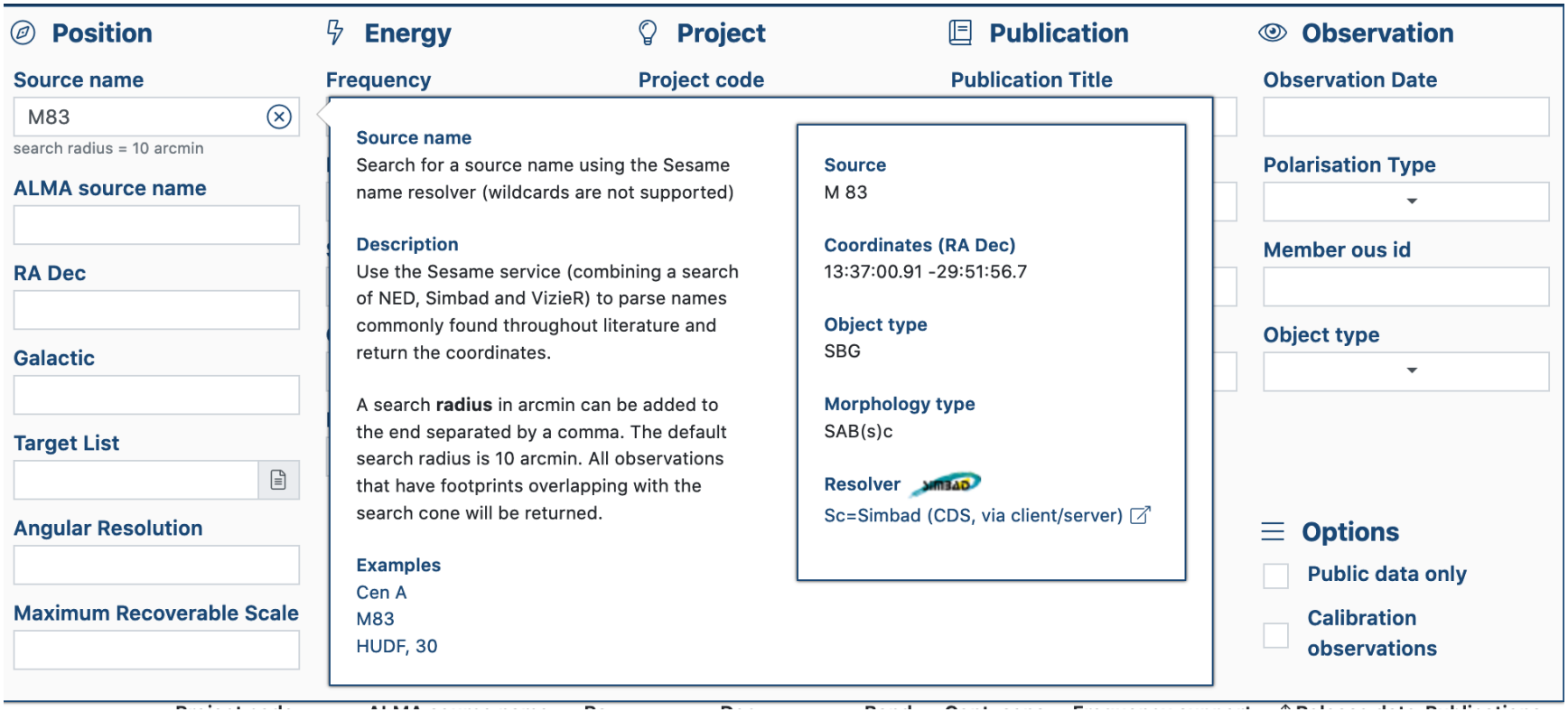
Searching the Archive

- Filter columns based on target, project, or publication
- Hover over the top left search bar for expanded search fields

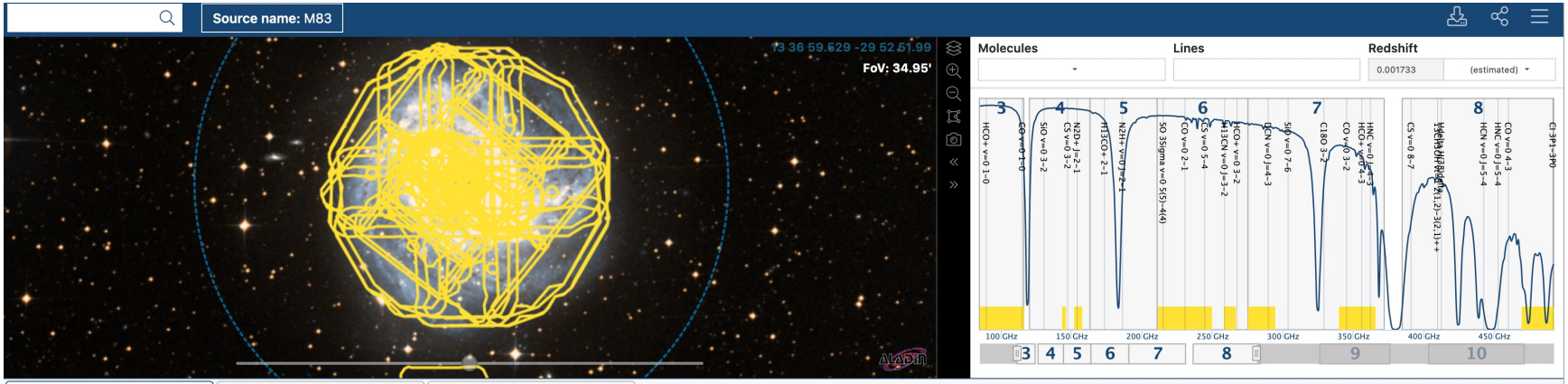


Project code	ALMA source name	Ra	Dec	Band	Cont. sens.	Frequency support	↑ Release date	Publications	Ang. res.	Min. vel. res.	Array	Mosaic	Max. reco. scale	FOV	Scientific category	Science keywo
		h:m:s	d:m:s		mJy/beam				arcsec	km/s			arcsec	arcsec		
2018.1.01205.L	IRAS_15398-3359	15:43:02.242	-34:09:06.805	6	0.0532	216.08..234.73GHz	0012-01-20	2	1.204	0.183	12m		22.473	25.833	ISM and star formation	Low-mass star f
2011.0.00191.S	Fomalhaut b	22:57:38.685	-29:37:12.616	7	0.1181	343.08..358.84GHz	2012-12-06	2	1.021	0.816	12m		14.433	16.592	Disks and planet forma...	Debris disks, Ex
2011.0.00101.S	GRB021004	00:26:54.680	+18:55:41.600	7	0.1136	337.01..353.00GHz	2012-12-06	2	1.322	26.541	12m		14.682	16.878	Active galaxies	Starburst galaxi
2011.0.00131.S	R Scl	01:26:58.079	-32:32:36.424	7	0.9115	330.25..346.11GHz	2012-12-06	5	1.241	0.846	12m	mosaic	14.979	62.007	Stars and stellar evolut...	Asymptotic Giar
2011.0.00397.S	J035448.24-33082...	03:54:48.240	-33:08:27.200	7	0.4848	337.03..353.01GHz	2012-12-20	3	1.372	26.541	12m		10.183	16.877	Active galaxies	Active Galactic
2011.0.00397.S	J041754.10-281655.9	04:17:54.100	-28:16:55.900	7	0.4848	337.02..353.01GHz	2012-12-20	3	1.400	26.541	12m		10.521	16.877	Active galaxies	Active Galactic
2011.0.00397.S	J063027.81-212058...	06:30:27.810	-21:20:58.600	7	0.5346	337.01..352.99GHz	2012-12-20	3	1.279	26.541	12m		8.285	16.878	Active galaxies	Active Galactic
2011.0.00397.S	J061200.23-06220...	06:12:00.230	-06:22:09.600	7	0.5346	337.00..352.99GHz	2012-12-20	3	1.303	26.541	12m		8.828	16.878	Active galaxies	Active Galactic

Search for your Favorite Source

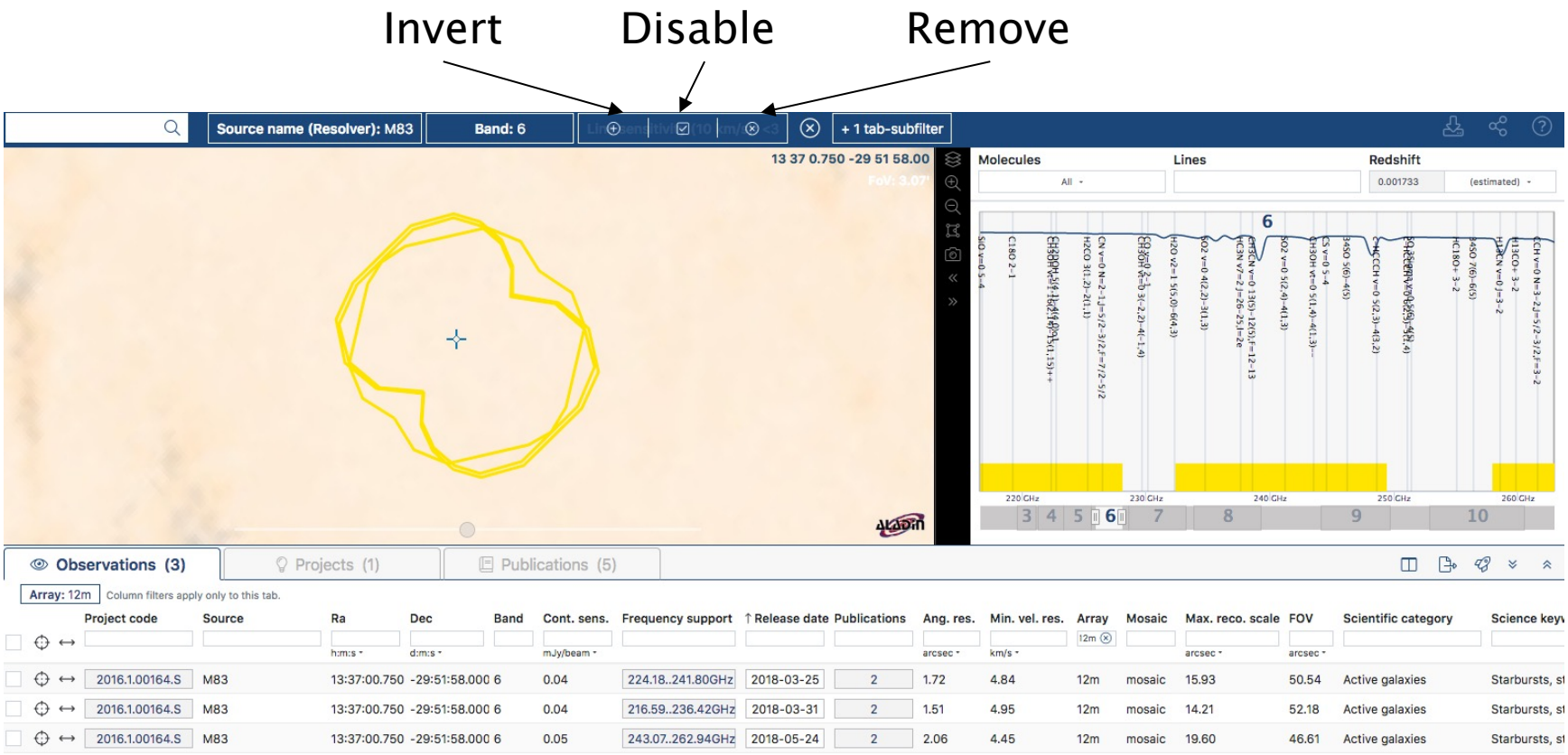


Apply Column Sub-Filters



Project code	ALMA source name	Ra	Dec	Band	Cont. sens.	Frequency support	↑ Release date	Publications	Ang. res.	Min. vel. res.	Array	Mosaic	Max. reco. scale	FOV	Scientific category	Science keywo
		h:m:s	d:m:s		mJy/beam				arcsec	km/s			arcsec	arcsec		
2011.0.00772.S	M83	13:37:04.763	-29:51:45.340	3	0.2781	100.63..115.39GHz	2013-09-28	4	1.145	1.269	12m	mosaic	11.612	196.704	ISM and star formation	Giant Molecular
2012.1.00762.S	m83	13:37:04.534	-29:50:23.433	3	0.2201	99.91..115.55GHz	2015-05-16	4	0.527	1.267	12m	mosaic	10.051	390.160	Local Universe	Spiral galaxies,
2013.1.01312.S	M83	13:37:03.885	-29:51:36.973	3	0.0376	85.64..101.39GHz	2016-05-09	1	2.762	3.274	12m	mosaic	40.480	176.743	Local Universe	Spiral galaxies,
2012.1.00762.S	m83	13:37:04.458	-29:50:23.465	3	1.2334	99.85..115.58GHz	2016-05-12	4	10.294	1.266	7m	mosaic	80.615	402.933	Local Universe	Spiral galaxies,
2013.1.01161.S	M83	13:37:00.742	-29:51:57.876	6	0.4043	229.31..247.13GHz	2016-07-31	11	1.298	2.369	12m	mosaic	21.264	250.960	Active galaxies	Starbursts, star
2013.1.00889.S	M83	13:37:05.500	-29:51:23.550	3	0.0218	95.92..111.56GHz	2016-08-05	0	1.714	5.249	12m	mosaic	48.802	121.175	Galaxy evolution	Galaxy chemistr
2013.1.00889.S	M83	13:37:05.500	-29:51:23.550	3	0.0288	87.83..91.46GHz	2016-08-05	0	1.791	6.402	12m	mosaic	26.816	130.000	Galaxy evolution	Galaxy chemistr
2013.1.00889.S	M83	13:37:05.500	-29:51:23.550	3	0.0155	84.56..100.11GHz	2016-08-05	0	1.389	5.849	12m	mosaic	19.049	128.108	Galaxy evolution	Galaxy chemistr

Modify Searches



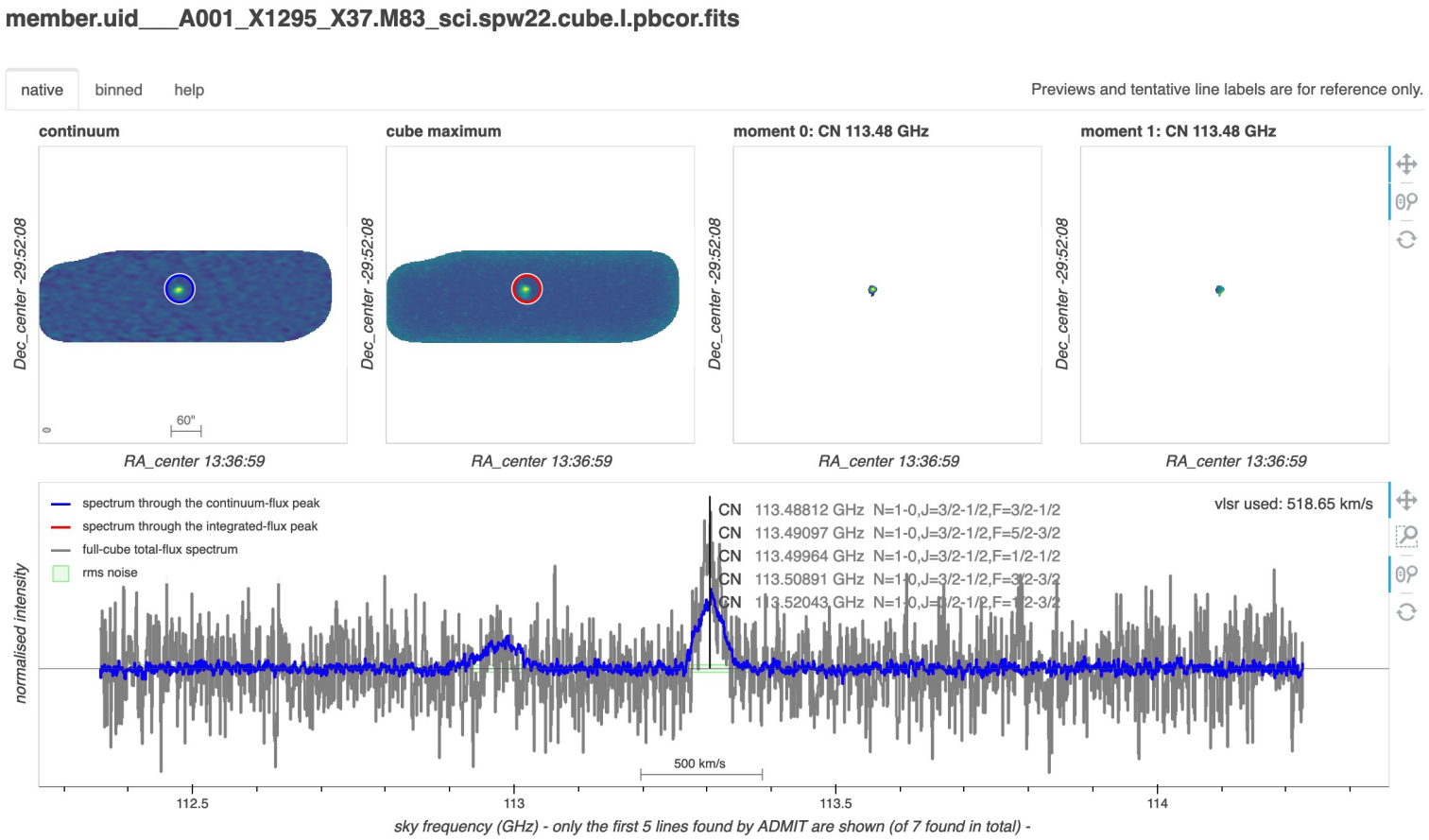
Project code	Source	Ra	Dec	Band	Cont. sens.	Frequency support	↑ Release date	Publications	Ang. res.	Min. vel. res.	Array	Mosaic	Max. reco. scale	FOV	Scientific category	Science keyw
		h:m:s	d:m:s		mJy/beam				arcsec	km/s	12m		arcsec	arcsec		
2016.1.00164.S	M83	13:37:00.750	-29:51:58.000	6	0.04	224.18..241.80GHz	2018-03-25	2	1.72	4.84	12m	mosaic	15.93	50.54	Active galaxies	Starbursts, st
2016.1.00164.S	M83	13:37:00.750	-29:51:58.000	6	0.04	216.59..236.42GHz	2018-03-31	2	1.51	4.95	12m	mosaic	14.21	52.18	Active galaxies	Starbursts, st
2016.1.00164.S	M83	13:37:00.750	-29:51:58.000	6	0.05	243.07..262.94GHz	2018-05-24	2	2.06	4.45	12m	mosaic	19.60	46.61	Active galaxies	Starbursts, st

New: Quick Look Images and Spectra

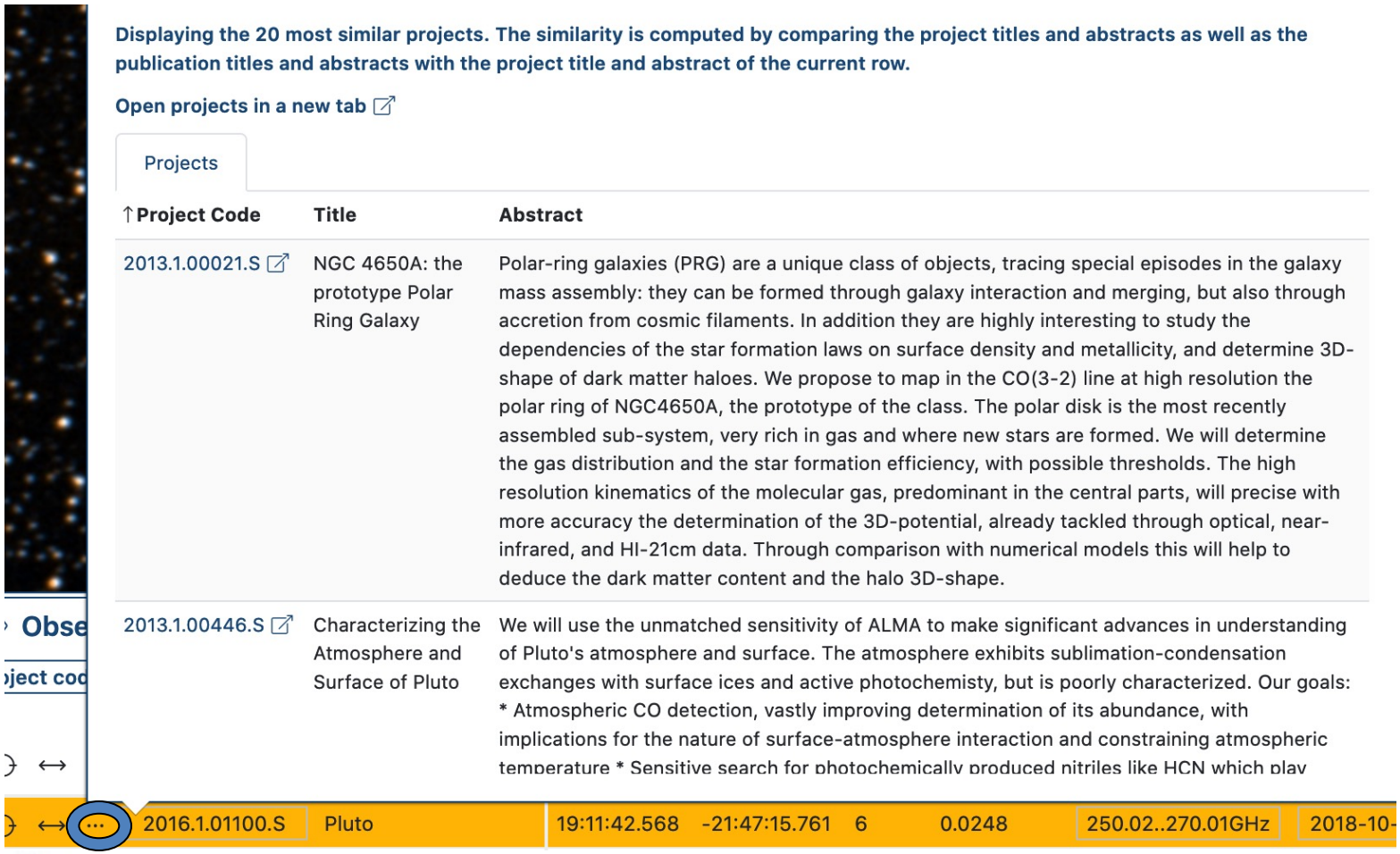
Click on links for direct download of files

Hover over for quick look

New: Interactive Exploration



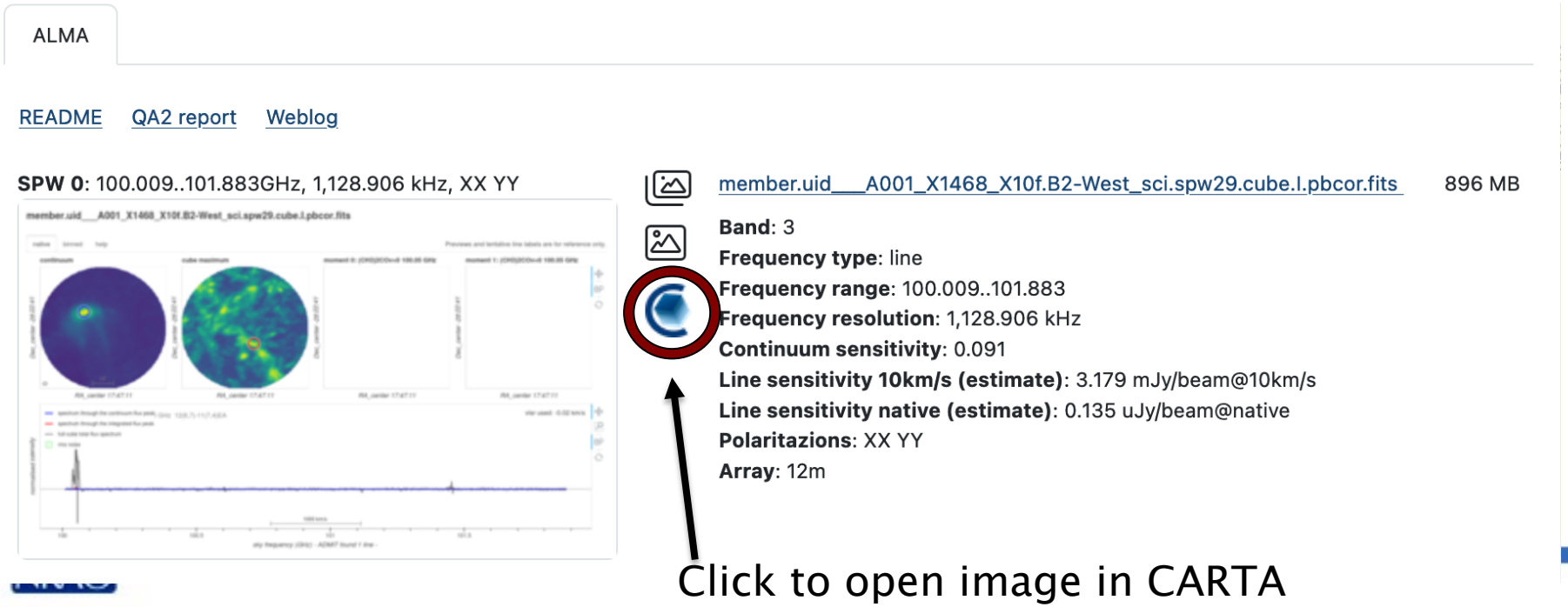
New: Generate List of Similar Projects



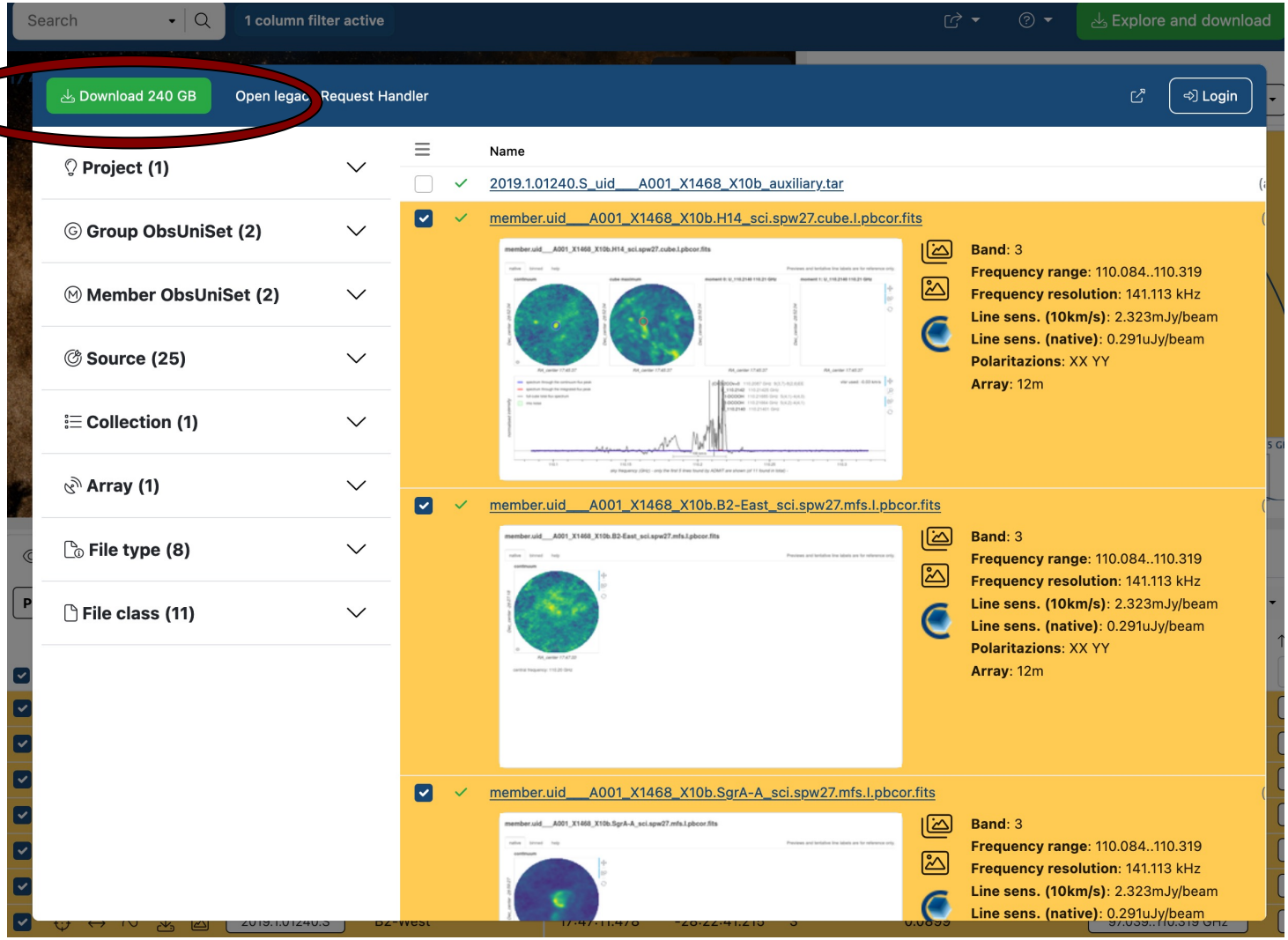
Hover over for similar projects and publications

Aside: CARTA (Cube Analysis and Rendering Tool for Astronomy)

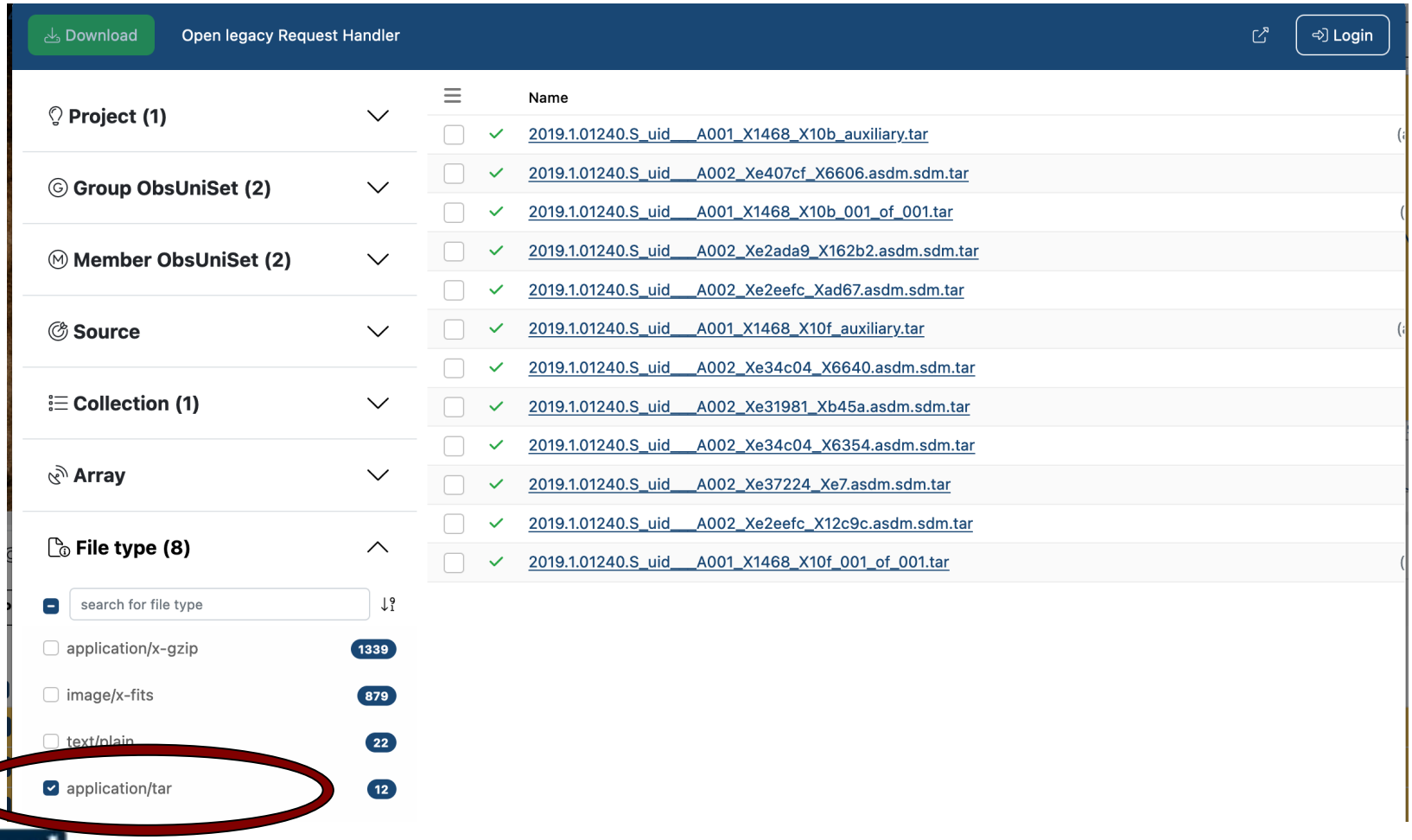
- FITS pb-corrected (*.pbcor) images available to open in CARTA (web hosted)
- For quick exploration
  - For science, we recommend downloading the cube and using CARTA on your own computer



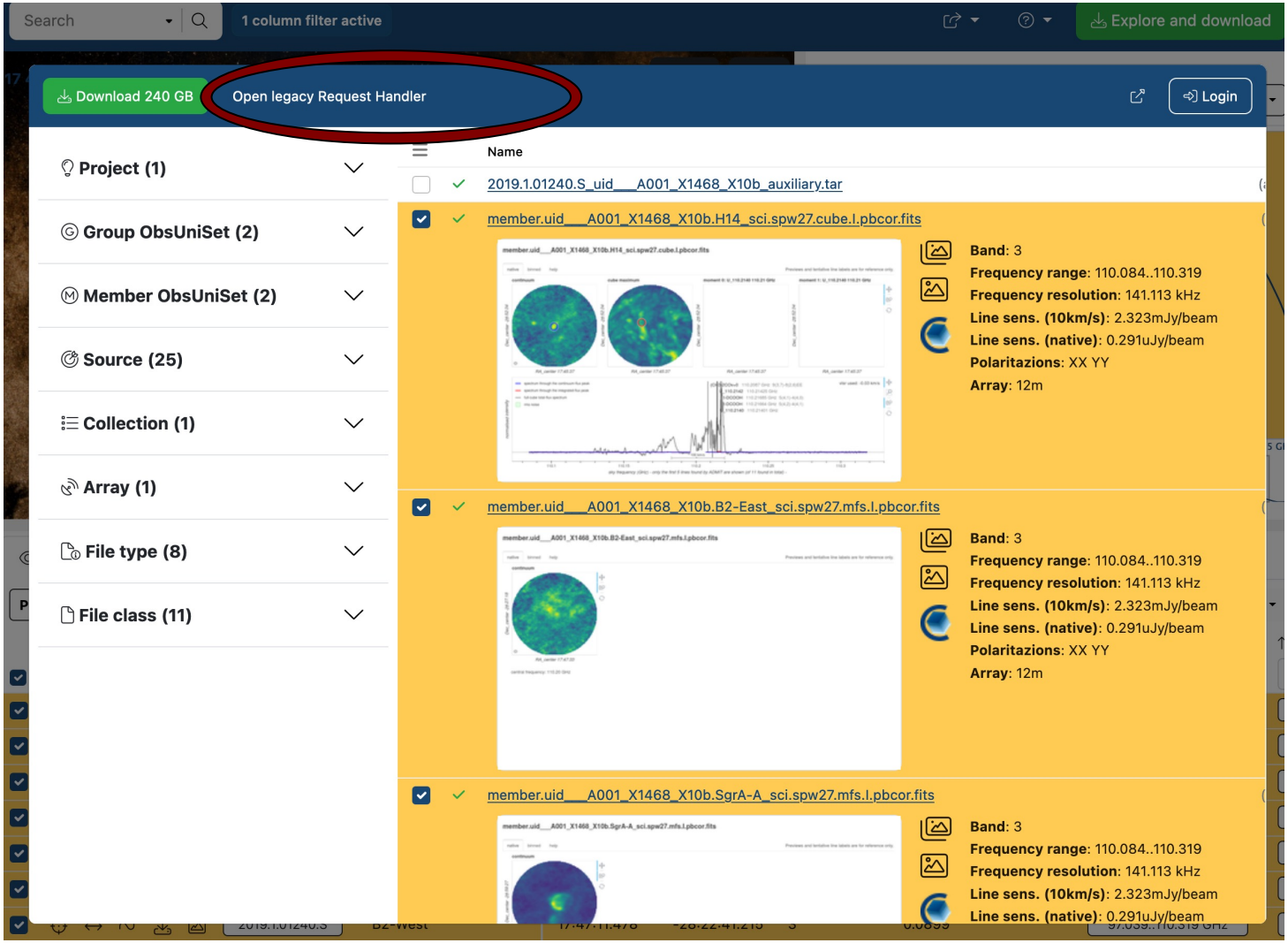
Find Data to Download



Find Data to Download

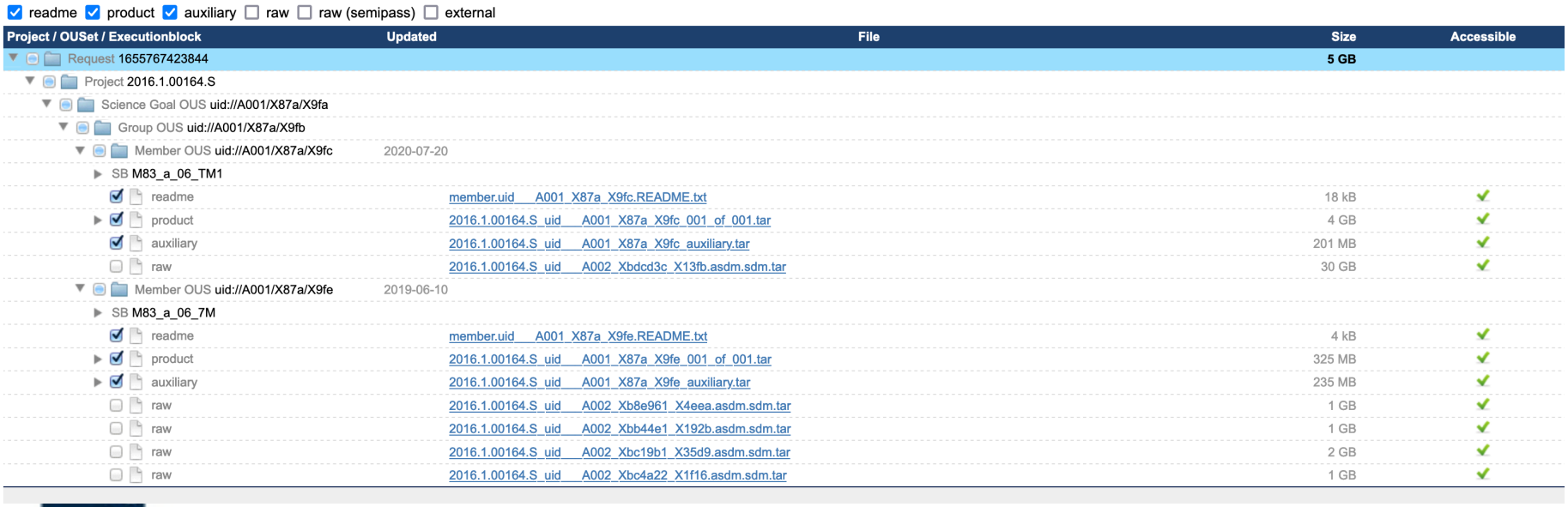


Find Data to Download



Select Files to Download

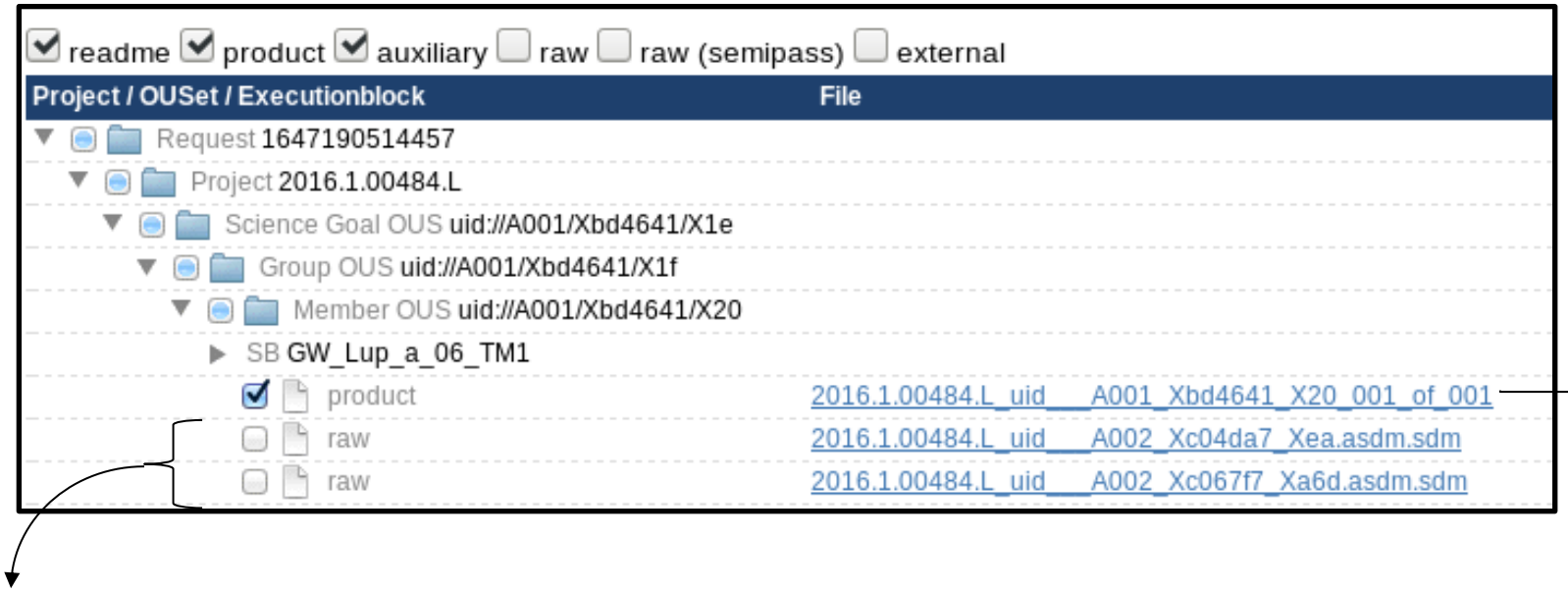
- Cycle 1+ files can be downloaded individually
  - Download auxiliary and raw tar files to restore calibrated data and work with visibilities
  - Download the products for just Fits files
  - Expand “product” to see link to open fits files in CARTA[1]



1 https://carta.readthedocs.io/en/latest/index.html

QA2 Data Products Package:

Some Cycle 0 and 1 Packages

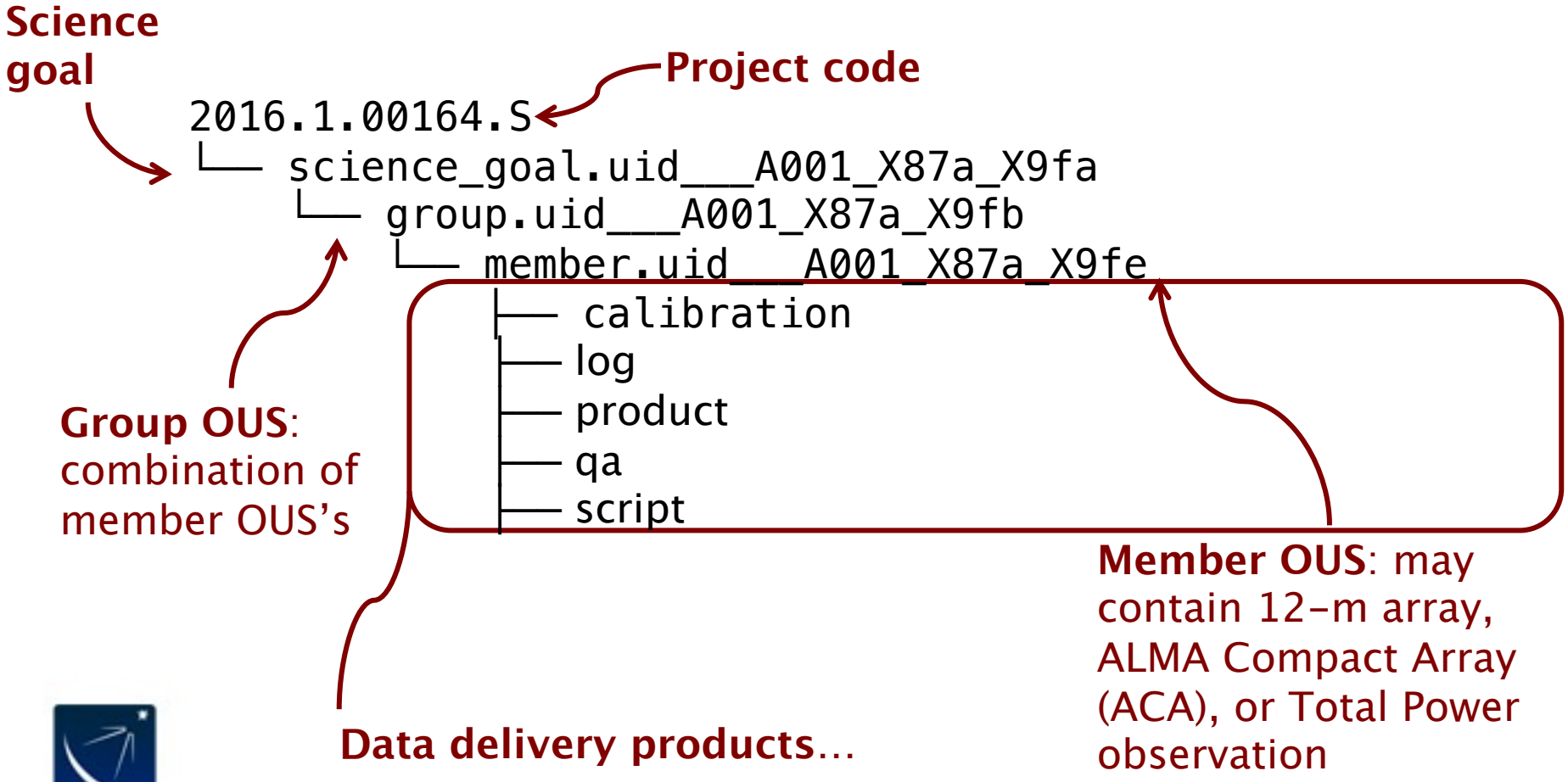


Raw data tar balls.

Tar ball with the processed data.

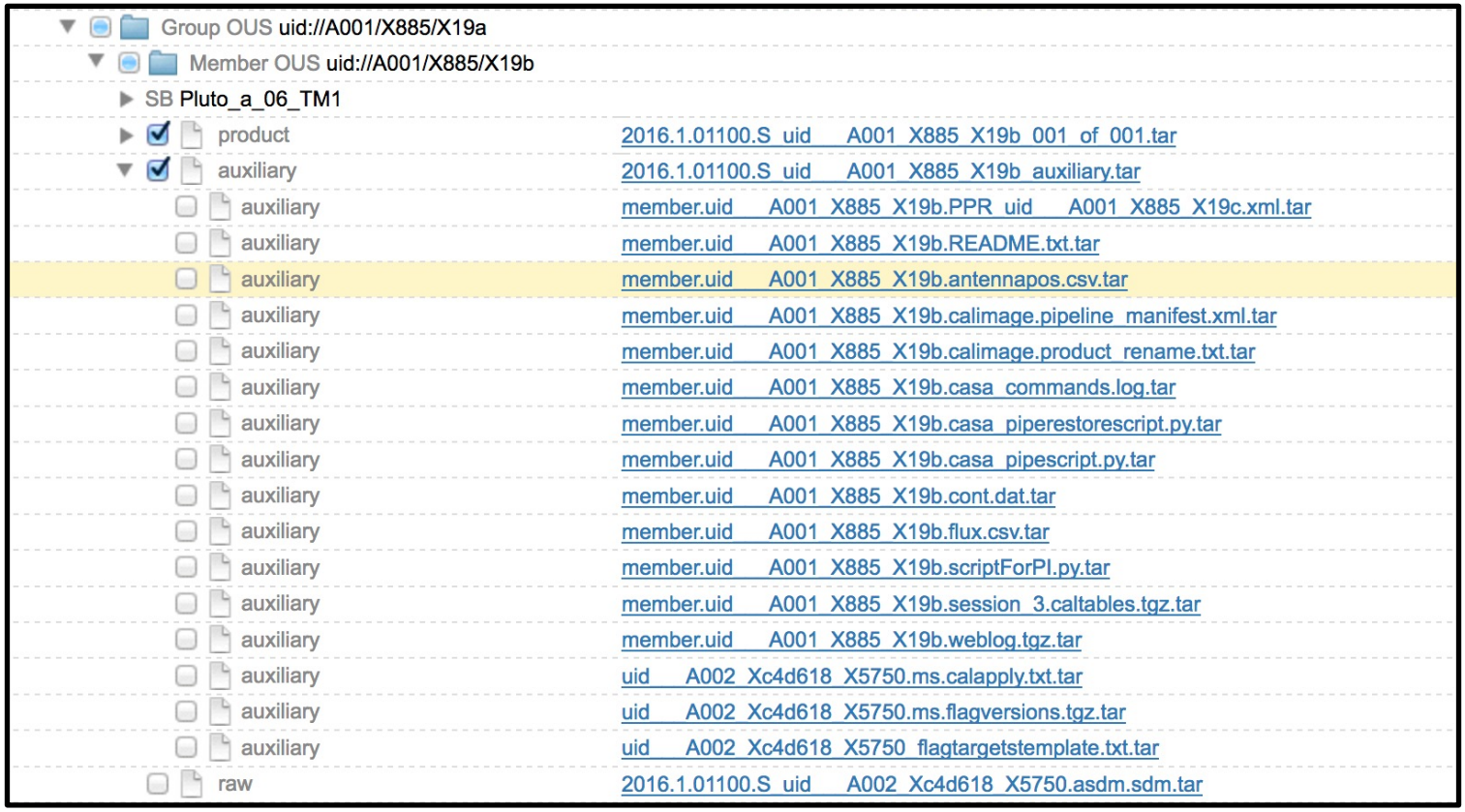
QA2 Data Products Package: Directory Structure

After un-tarring the processed data we have a directory tree:



QA2 Data Products Package:

Cycles 5-Present



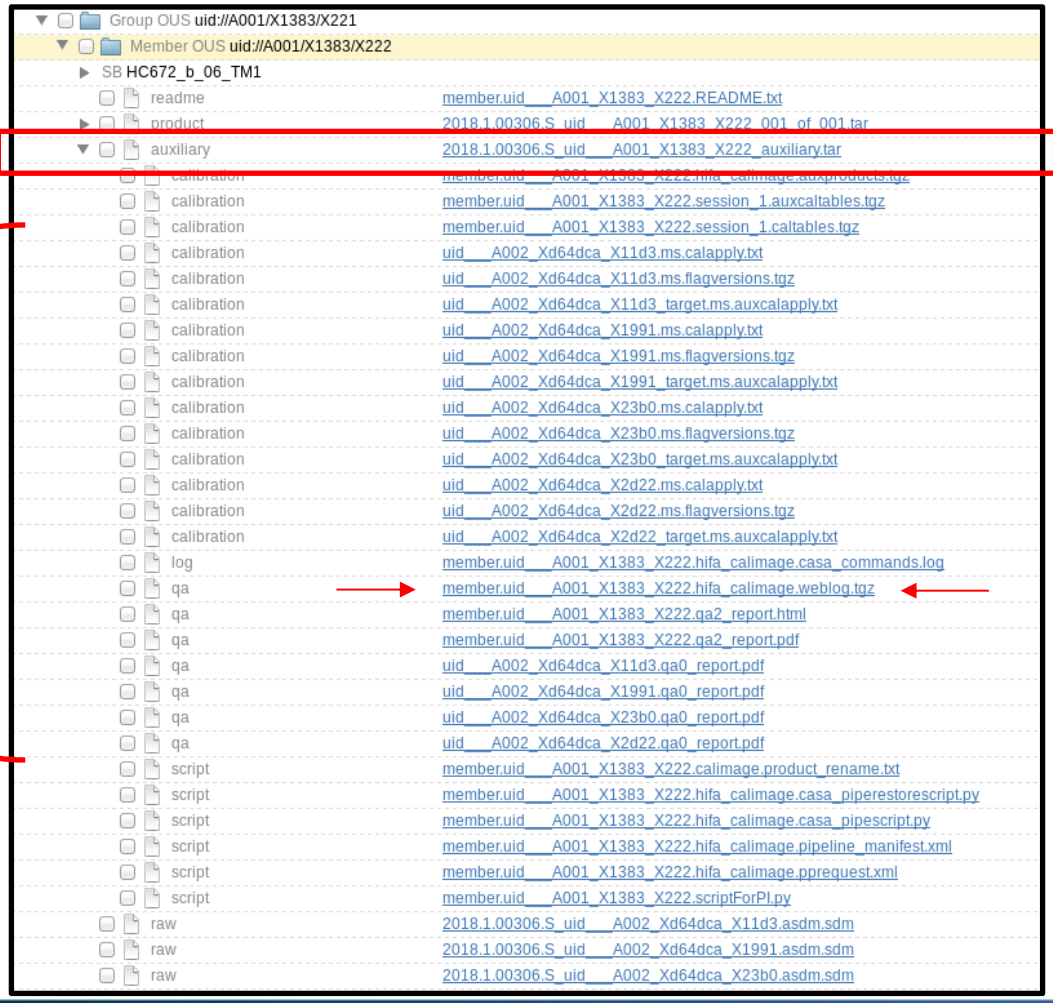
QA2 Data Products Package:

Cycles 4-Present: Auxiliary Tarball

Tar ball

OR

Individual file download



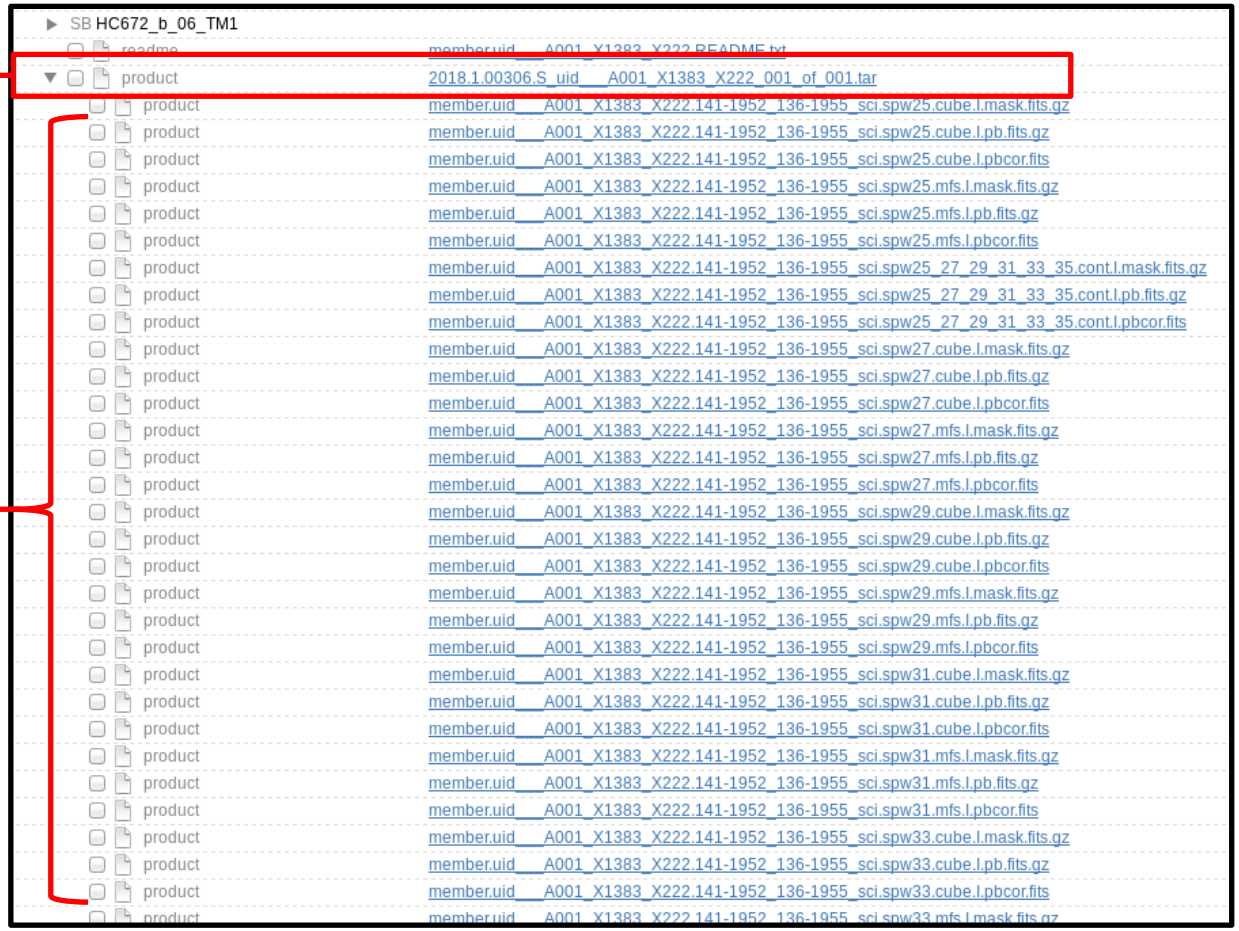
QA2 Data Products Package:

Cycles 5-Present: Product Tarball

Tar ball

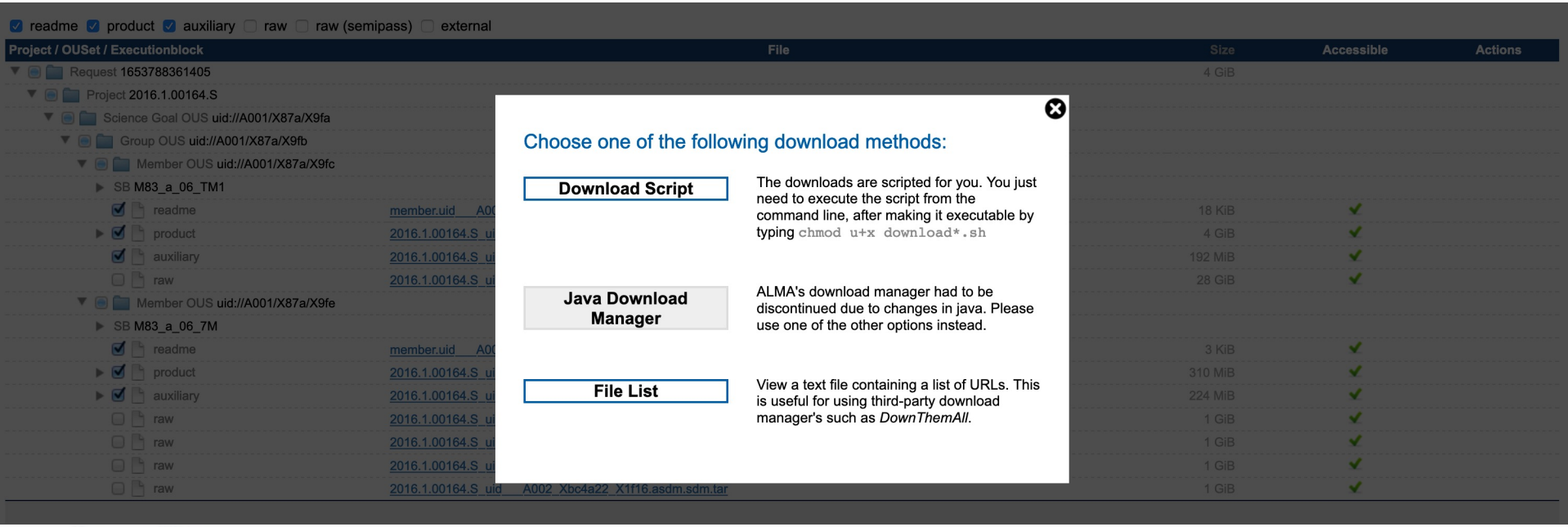
OR

Individual file download



Select the Download Method

- Download Script or File List
  - If you have errors, run the script again and it will resume
  - Combine File List with DownThemAll browser extension
  - File a Helpdesk ticket if problems persist!



Did you know?

- You can search for unpublished data by filtering on 0 Publications

- You can use astroquery[1] to programmatically search for and download data

1 https://astroquery.readthedocs.io/en/latest/alma/alma.html

Goals of Quality Assurance (QA) Process

- Ensure reliable final data product
  - Desired sensitivity (as specified by PI)
  - Desired resolution (as specified by PI)
- Ensure calibration and QA imaging free from major artifacts

- Warning: Errors in PI-supplied parameters are outside scope of QA process, including:
  - Incorrect source coordinates
  - Inadequate frequency specification
  - Inadequate sensitivity limits

See ALMA Technical Handbook for details.

During Observations – QA0

- Monitoring of on-the-fly calibration and system performance
- Rapidly-varying parameters (~SB/EB timescales)
  - Atmospheric effects
  - Antenna issues
  - Front-end issues
  - Connectivity issues
  - Back-end issues
- Tolerances for each are explicitly laid out
  - No fewer than 34 antennas in 12m array
  - Bandpass calibrator is strong enough
- Quick reduction may be run to check flux measurements and phase stability

QA0 Report

QA0 Report

Project Code	2016.1.00164.S
Session	uid://A001/X87a/X9fe
SchedBlock	uid://A001/X87a/X9e2 (M83_a_06_7M)
ExecBlock	uid://A002/Xb8e961/X4eea ✔ Pass
Sources	Callisto, J12200203, J13512912, J14273305, J15172422, M83
# Antennas	10 (90.0 % for Cycle 4)
Array	7 [m]
Baselines	8m -- 48m
Band	ALMA_RB_06
Weather	null
Atmosphere	Tsys (Min/Avg/Max) : 78.6/84.9/96.9 Trec (Min/Avg/Max) : 29.4/41.6/56.6

Final QA0 comment

```
 === QA0 summary for id___A002_Xb8e961_X4eea ===
| Usable antennas: 9
| Phase rms (Antenna,phaseCal): 5.9 deg (=21.1um)
| Baseline limit with good phase: 5078m. Longest baselines (80%): 34m.
| No online WVR-corrected data available: assuming correction factor of 1.0 in above
| Bandpass cal:  J1517-2422   flux: 3.25 Jy
| Phase cal:  J1351-2912   flux: 0.201 +/- 0.004 Jy
| Number of cycles of science/phaseCal: 8
| Band observed: 6   Highest recommended: 10-10 based only on phase rms
|  QA0 PASS
|  no significant problems
 == == == == == == == == == == == ==
```

Between Observations – QA I

- "Regular array maintenance" timescales
- Slowly Varying Parameters (~MOUS timescales)
- General array calibration
  - Baseline measurements
  - Delays
- Antenna Calibrations
  - All-sky pointing
  - Focus curves
  - Beam patterns, etc.
- Observatory Calibrator Surveys
  - Solar-system and quasar flux monitoring

After Observations – QA2

- Calibration by pipeline (~90%) or DA/staff.
- Final QA checks include
  - RMS of complex antenna-based gains
  - Absolute flux calibration scale
  - T_{sys} within acceptable range
  - Proper phase transfer cadence
  - Proper bandpass corrections
- Assessment of Imaging Products
  - Signal-to-noise and angular resolution
  - No strong artifacts
  - Performed on the reference source/spectra
- Information about QA review is aggregated for delivery in the QA2 Report

The QA2 Report:

QA2 Report

Project information

Name	Chemical Diagnostics of Extragalactic ISM: Shock-Induced Evolution in M83 Nucleus
Code	2016.1.00164.S
PI	Nanase Harada
Organization	Institute of Astronomy and Astrophysics, Academia Sinica
Co-Is	S. Aalto, R. Aladro, F. Costagliola, S. Martin, D. Riquelme, K. Sakamoto, Y. Watanabe

ObsUnitSet information

Name	Member OUS (M83)
QA2 Status	✔Pass
Member OUS Status ID	uid://A001/X87a/X9fe
SchedBlock name	M83_a_06_7M
SchedBlock UID	uid://A001/X87a/X9e2
Array	7M
Mode	Standard
Band	ALMA_RB_06
Repr.Freq. (sky)	217.12 [GHz]
Spectral setup	ACA
Sources	M83
Other SBs in this Group OUS (Member OUS Status ID in brackets):	M83_a_06_TM1 (uid://A001/X87a/X9fc)
Execution count	4.00 of 4 expected

Final QA2 comment

Comments from Reducer

CASA version: 5.4.0-70, Pipeline:42254M (Pipeline-CASA54-P1-B)

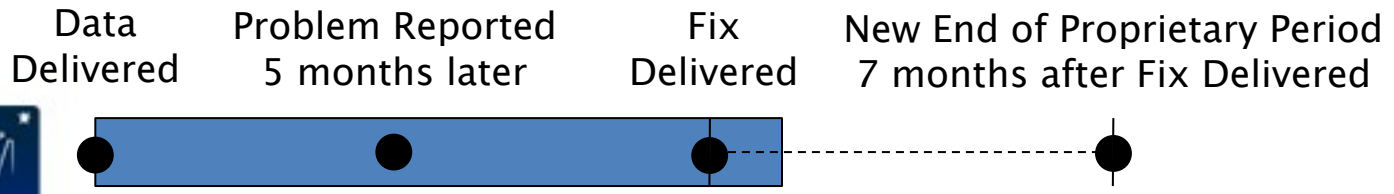
Reduction mode: PL calibration and imaging

Calibration issues: None.

Imaging issues:
This SB has been reprocessed with CASA 5.4.0 due to the issues in previous versions of CASA described at the following links:
See the "Imaging" section at: https://casa.nrao.edu/casadocs/casa-5.4.0 <https://casa.nrao.edu/casadocs/casa-5.4.0>

After Delivery – QA3

- Additional QA stage possibly triggered by PI reporting any issues underlying:
  - Data, observing procedure, calibration
- Re-evaluation of calibrated data products
  - Only occurs if QA0 -> QA2 miss something
- Likely results in fix being implemented and products re-ingested into ALMA archive
- Reported within 2 months of delivery
  - Full 12 month proprietary extension after fix delivered
- Reported more than 2 months after delivery
  - Remaining proprietary period extended after fix delivered



Open the Weblog

- Run the command:

tar -xvzf member.uid___A001_X87a_X9fe.hifa_calimage.weblog.tgz

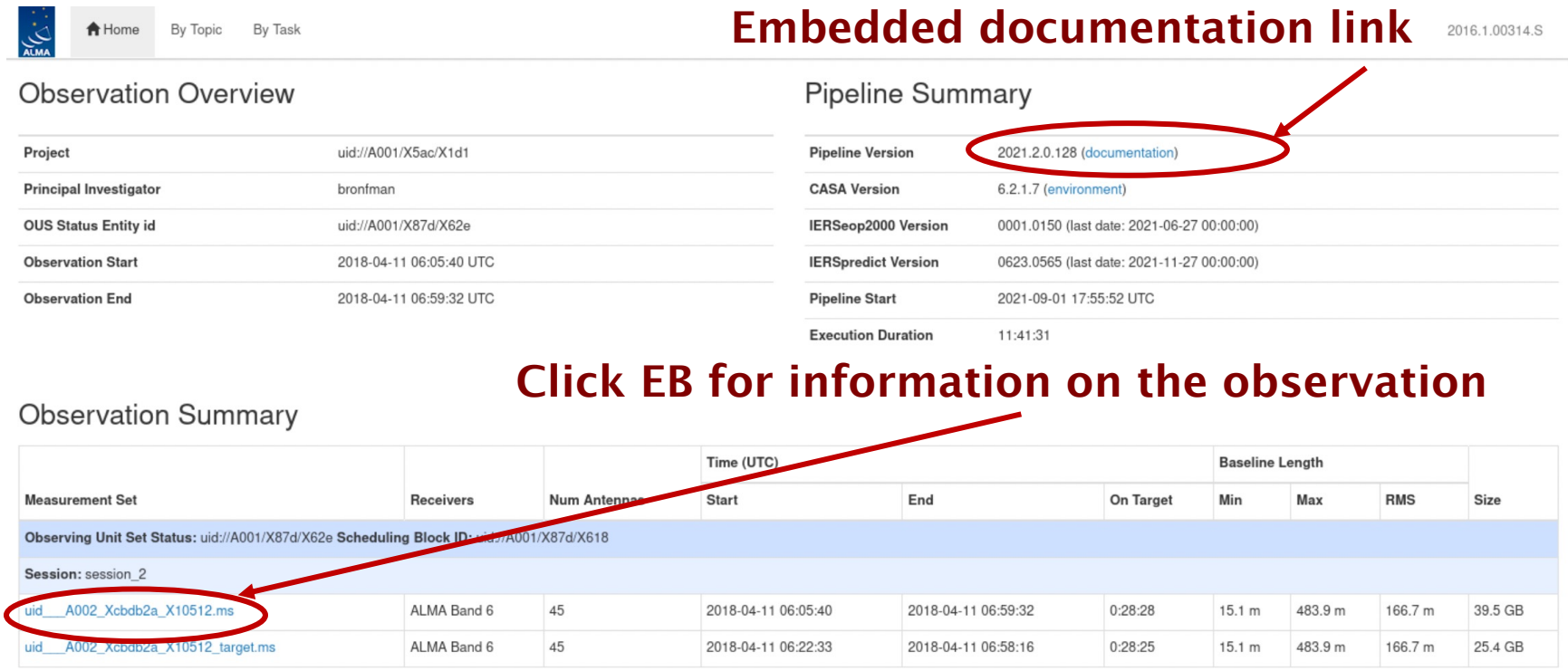
- Open pipeline-20190312T041124/html/index.html using one of the methods in https://help.almascience.org/kb/articles/what-is-the-best-way-to-view-the-weblog

- Recommended method is h_weblog in the pipeline version of CASA

The Wonderous Weblog!

Your guide to QA2

See Pipeline Users Guide, Chapter 8 for more information.



The Wonderous Weblog!

Pipeline Users Guide, Chapter 8 for more information.

Home | By Topic | By Task

Click By Task for breakdown of pipeline tasks

2016.1.00164.S

Session: session_1
uid___A002_Xb8e961_X4eea.ms
uid___A002_Xb8e961_X4eea_target.ms

Session: session_2
uid___A002_Xbb44e1_X192b.ms
uid___A002_Xbb44e1_X192b_target.ms

Session: session_3
uid___A002_Xbc19b1_X35d9.ms
uid___A002_Xbc19b1_X35d9_target.ms

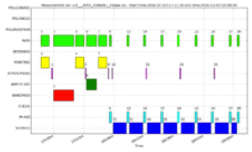
Session: session_4
uid___A002_Xbc4a22_X1f16.ms
uid___A002_Xbc4a22_X1f16_target.ms

Overview of 'uid___A002_Xb8e961_X4eea.ms'

Observation Execution Time

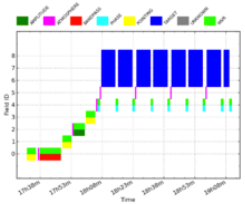
Start Time	2016-10-02 17:31:39
End Time	2016-10-02 19:09:44
Total Time on Source	1:28:09
Total Time on Science Target	0:49:10

LISTOBS OUTPUT



Intent vs Time

Track scan intent vs time



Field vs Time

Track observed field vs time

Spatial Setup

Science Targets	'M83'
Calibrators	'Callisto', 'J1220+0203', 'J1351-2912', 'J1427-3305' and 'J1517-2422'

Spectral Setup

All Bands	'ALMA Band 6'
Science Bands	'ALMA Band 6'

Antenna Setup

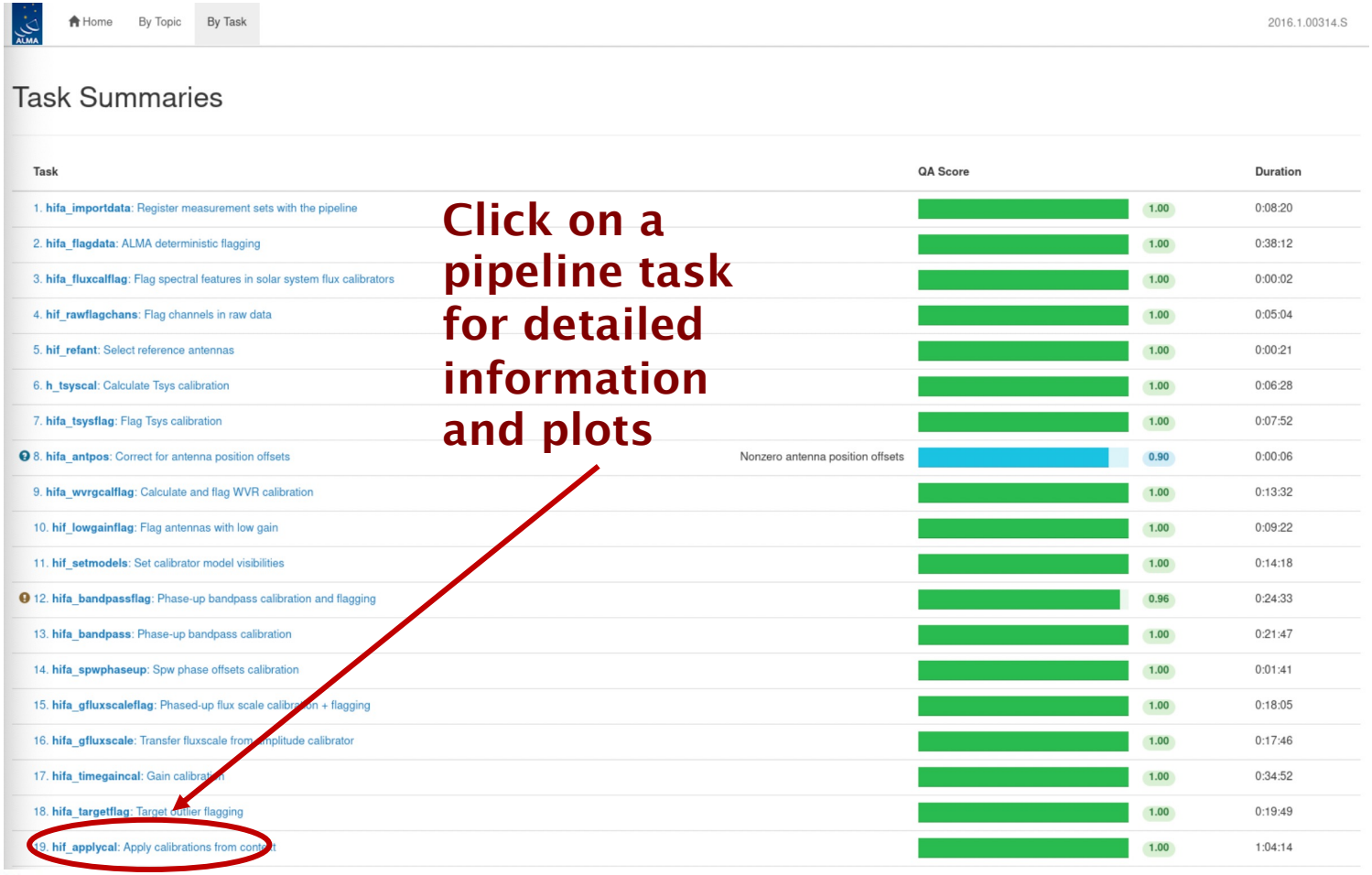
Min Baseline	8.9 m
Max Baseline	48.9 m
Number of Baselines	36
Number of Antennas	9

Sky Setup

Min Elevation	54.39 degrees
Max Elevation	80.88 degrees

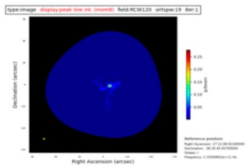
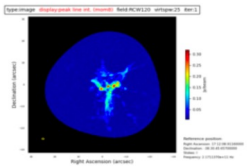
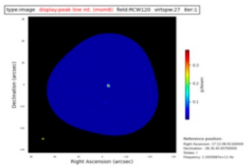
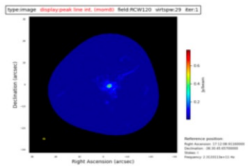
The Wonderous Weblog!

Pipeline Users Guide, Chapter 8 for more information.



The Wonderous Weblog!

Pipeline Users Guide, Chapter 8 for more information.

RCW120 (TARGET)	19 / X642486343#ALMA_RB_06#BB_2#SW-01	25 / X642486343#ALMA_RB_06#BB_1#SW-01	27 / X642486343#ALMA_RB_06#BB_3#SW-01	29 / X642486343#ALMA_RB_06#BB_4#SW-01
	 View other QA images...	 View other QA images...	 View other QA images...	 View other QA images...
centre / rest frequency of cube	215.5009GHz / 215.5000GHz (LSRK)	217.1137GHz / 217.1050GHz (LSRK)	229.3569GHz / 229.3476GHz (LSRK)	231.3311GHz / 231.3218GHz (LSRK)
beam	0.776 x 0.706 arcsec	0.778 x 0.720 arcsec	0.737 x 0.685 arcsec	0.728 x 0.680 arcsec
beam p.a.	61.5deg	62.4deg	59.3deg	61.3deg
final theoretical sensitivity	0.37 mJy/beam	4.2 mJy/beam	4.4 mJy/beam	5.2 mJy/beam
cleaning threshold	3.6 mJy/beam Dirty DR: 7.3e+02 DR correction: 4.8	17 mJy/beam Dirty DR: 71 DR correction: 2	18 mJy/beam Dirty DR: 86 DR correction: 2	26 mJy/beam Dirty DR: 1.5e+02 DR correction: 2.5
clean residual peak / scaled MAD	-15.92	7.93	6.38	-9.48
non-pbcor image RMS / RMS_{min} / RMS_{max}	0.28 / 0.19 / 0.31 mJy/beam	3.9 / 3.7 / 4.2 mJy/beam	4.1 / 3.9 / 4.4 mJy/beam	4.5 / 4.1 / 6 mJy/beam
pbcor image max / min	279 / -21.9 mJy/beam	331 / -78.4 mJy/beam	386 / -73.7 mJy/beam	779 / -105 mJy/beam
channels	115 x 15.6236MHz (LSRK)	1916 x 0.1221MHz (LSRK)	1916 x 0.1221MHz (LSRK)	1916 x 0.1221MHz (LSRK)
score	0.65	1.00	1.00	1.00
image file	uid___A001_X87d_X62e.s38_0.RCW120_sci.spw19.cube.I.iter1.image	uid___A001_X87d_X62e.s38_0.RCW120_sci.spw25.cube.I.iter1.image	uid___A001_X87d_X62e.s38_0.RCW120_sci.spw27.cube.I.iter1.image	uid___A001_X87d_X62e.s38_0.RCW120_sci.spw29.cube.I.iter1.image

Moment 8 maps shown for cubes: Click on "View other QA images…" for the dirty image, mask, PSF, spectrum and other diagnostic images.

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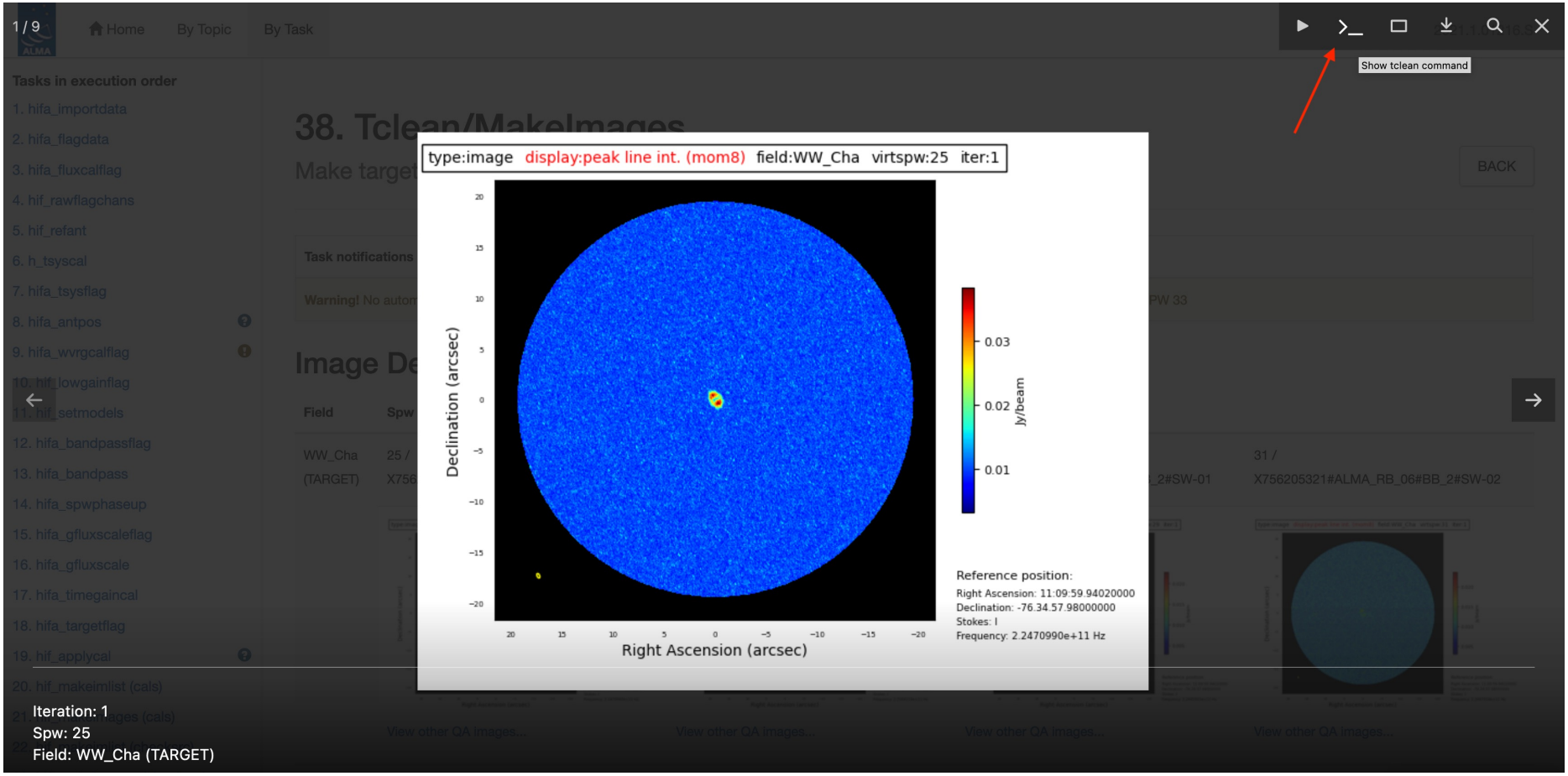

Click on the image to view more information and show tclean commands

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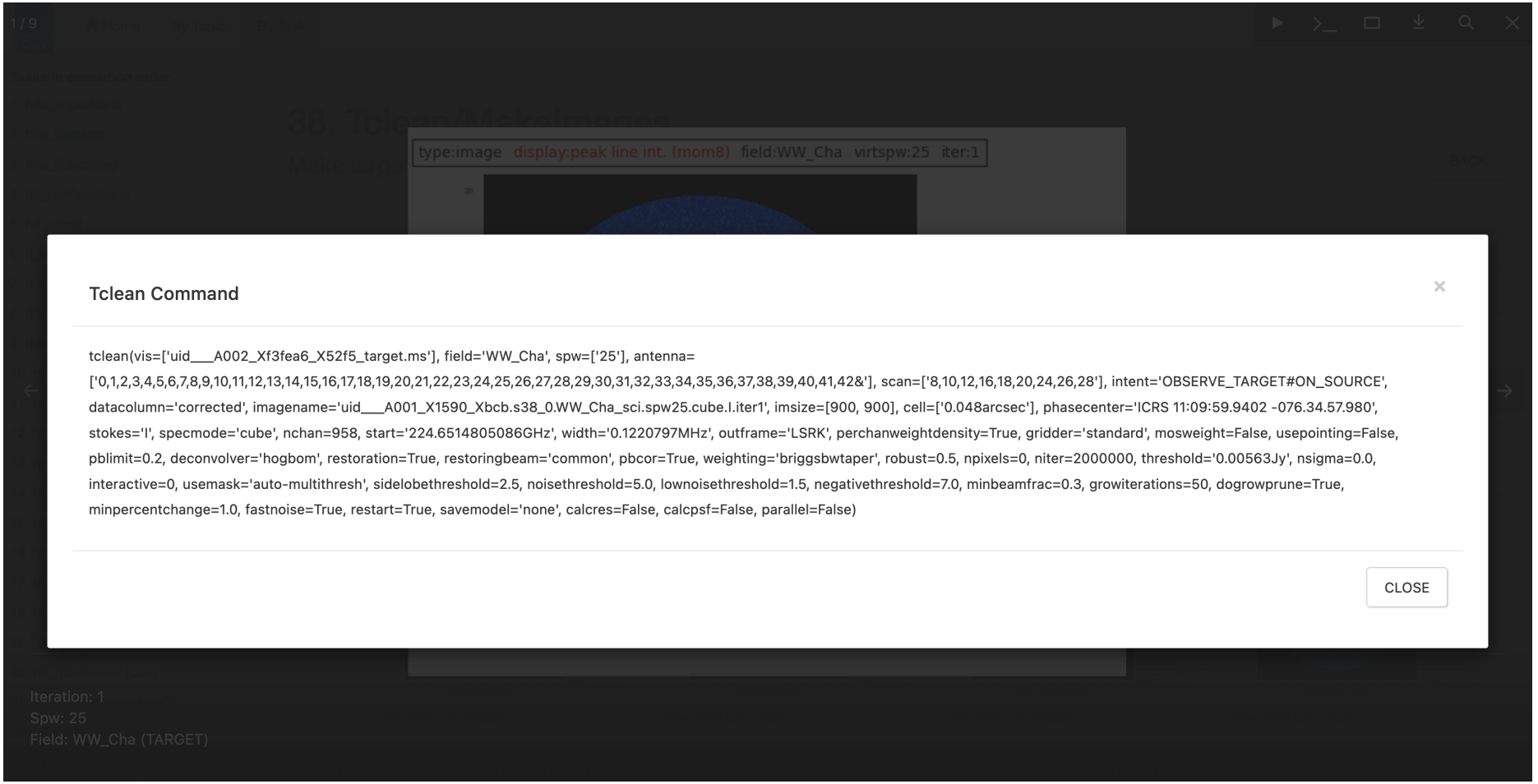
Pipeline Users Guide, Chapter 8 for more information.



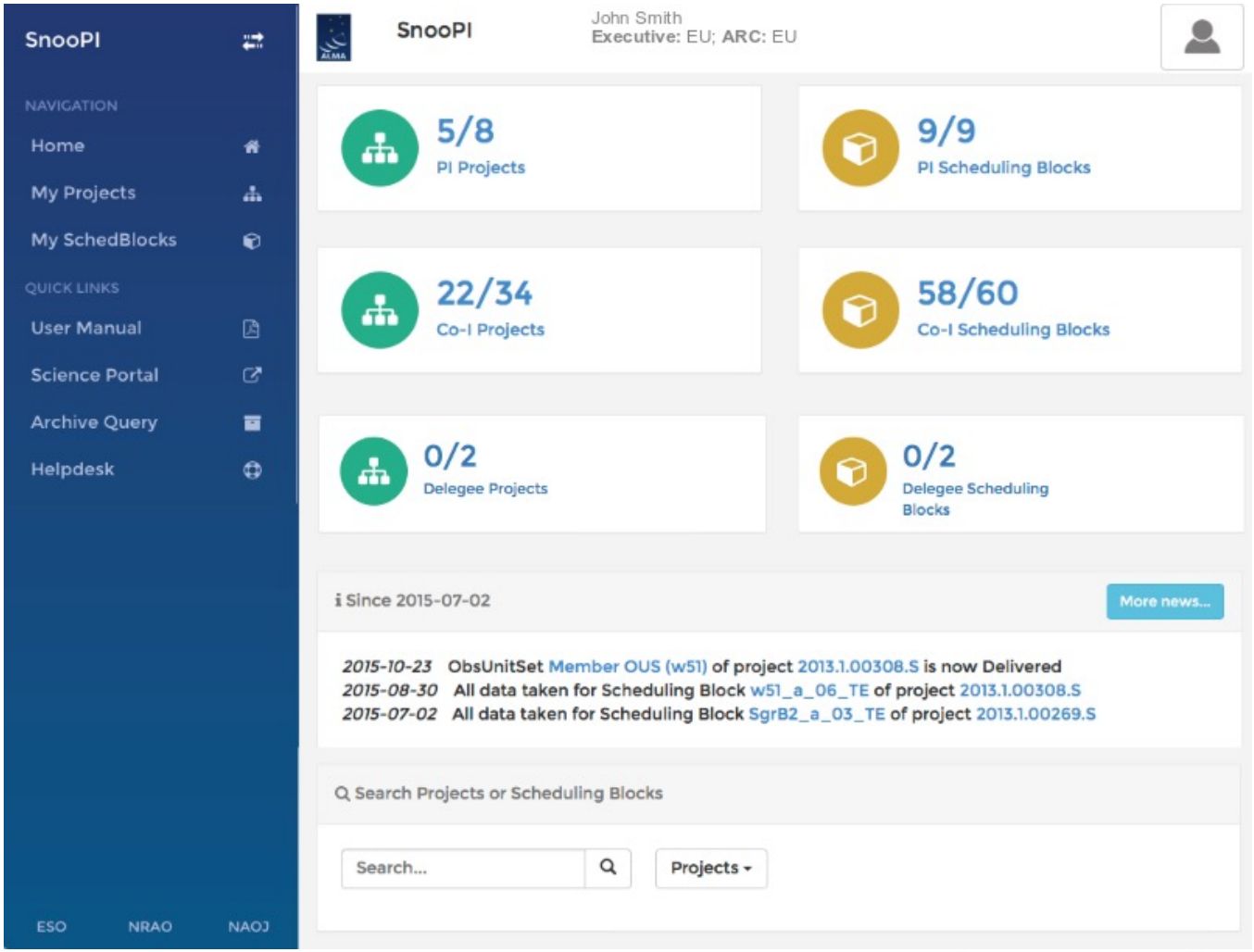
Click on the image to view more information and show tclean commands

Pipeline & Weblog Information

- See https://almascience.nrao.edu/processing/science-pipeline for Pipeline User's Guide, Reference Manual, and Known Issues
- Table also includes tarballs for past and current pipeline versions

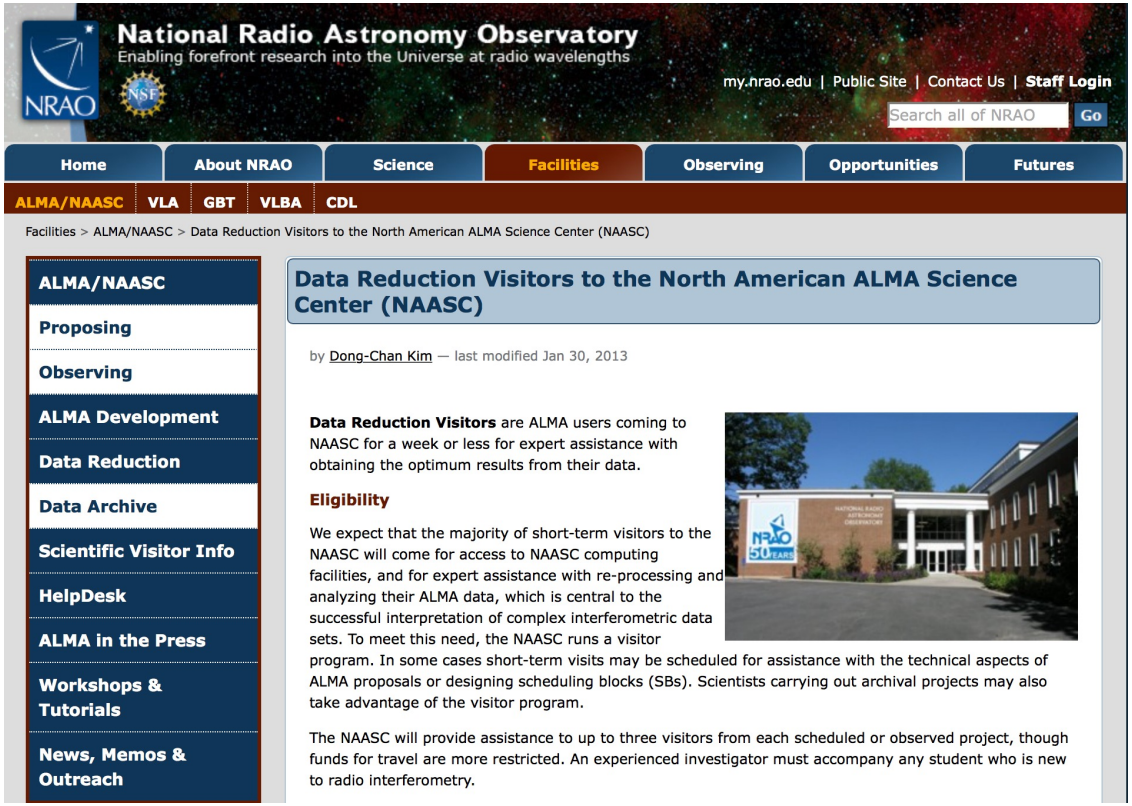
Monitor Project Status: *SnooPI*

https://asa.alma.cl/snoopi



Resources After Delivery

- HelpDesk: help.almascience.org
- Face to Face visits in Charlottesville- Now also virtual over Slack/Zoom: science.nrao.edu/facilities/alma/visitors-shortterm



ALMA

For more info:

https://almascience.nrao.edu/

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