

A photograph of the ALMA radio telescope array at night. The sky is dark and filled with stars. In the foreground, several large, white, parabolic radio telescope dishes are visible, mounted on pedestals. The dishes are arranged in a line, with some larger than others. The ground is dark and appears to be a desert or high-altitude plain.

Data mining: Making the most of the ALMA archive

Benjamin Magnelli
German ALMA Regional Centre

What can I do with the ALMA archive ?

- See the list of all observed ALMA projects, i.e., previous and current cycles
- Download publicly available datasets (i.e., delivered more than a year ago)

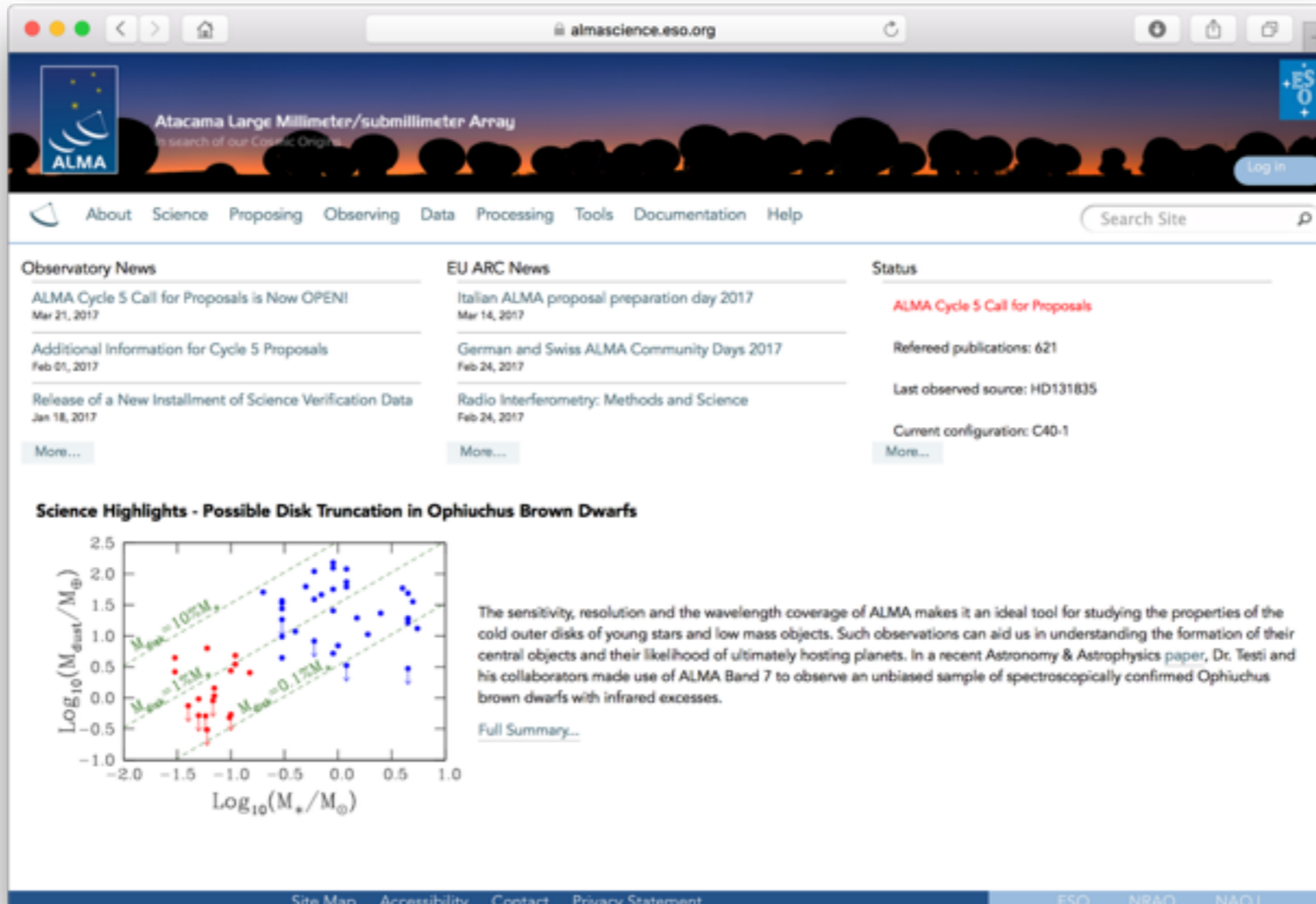
Why should I use the ALMA archive ?

- To verify possible duplication issues before submitting your proposal
- To retrieve your proprietary ALMA observations
- To make the most of the ALMA observations not yet exploited by their PI

How can I access the ALMA archive ?

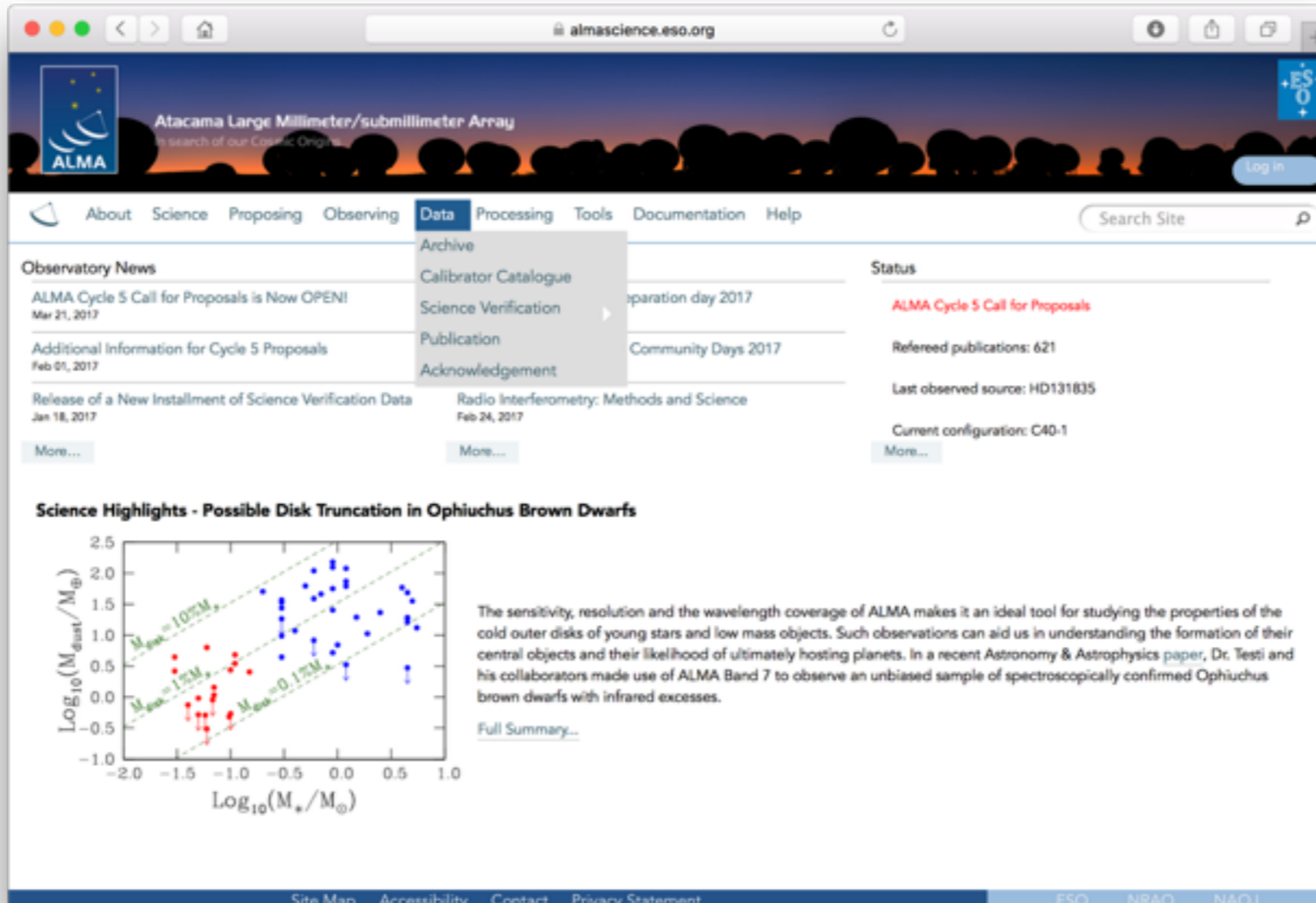
- via its web interface on the ALMA science portal (WWW.ALMASCIENCE.ESO.ORG)
- via the python package **ASTROQUERY**

Everything start, of course, from the ALMA science portal !



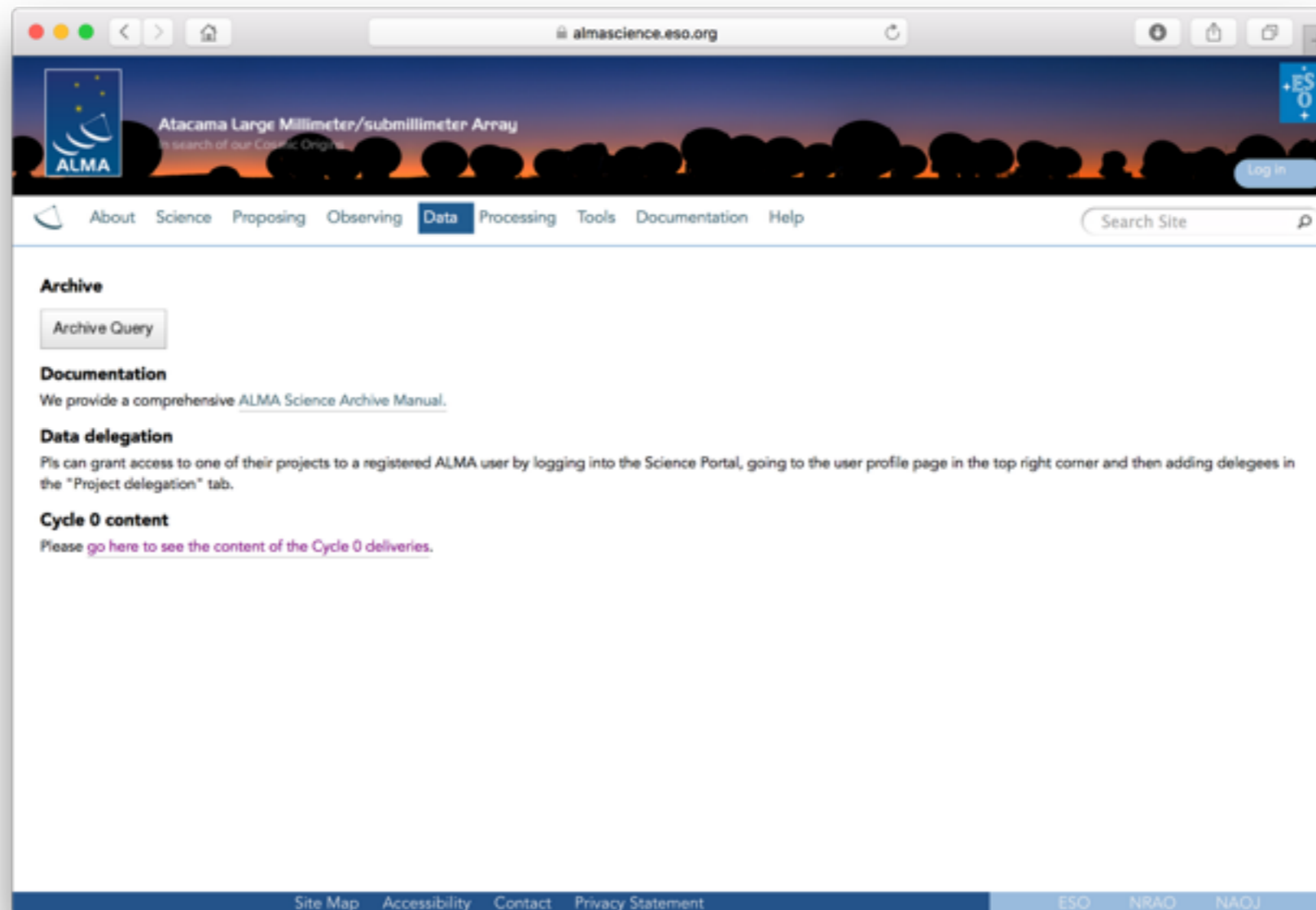
The screenshot shows the ALMA science portal at almascience.eso.org. The page features a navigation menu with links for About, Science, Proposing, Observing, Data, Processing, Tools, Documentation, and Help. A search bar is located in the top right corner. The main content area is divided into three columns: Observatory News, EU ARC News, and Status. The Observatory News section includes announcements such as 'ALMA Cycle 5 Call for Proposals is Now OPEN!' (Mar 21, 2017) and 'Additional Information for Cycle 5 Proposals' (Feb 01, 2017). The EU ARC News section lists events like 'Italian ALMA proposal preparation day 2017' (Mar 14, 2017) and 'German and Swiss ALMA Community Days 2017' (Feb 24, 2017). The Status section provides key metrics: 'ALMA Cycle 5 Call for Proposals', 'Refereed publications: 621', 'Last observed source: HD131835', and 'Current configuration: C40-1'. A 'Science Highlights' section features a plot titled 'Possible Disk Truncation in Ophiuchus Brown Dwarfs'. The plot shows $\text{Log}_{10}(M_{\text{dust}}/M_{\oplus})$ on the y-axis (ranging from -1.0 to 2.5) versus $\text{Log}_{10}(M_{\star}/M_{\odot})$ on the x-axis (ranging from -2.0 to 1.0). Three dashed lines represent different dust-to-stellar mass ratios: $M_{\text{dust}} = 10\% M_{\star}$ (green), $M_{\text{dust}} = 1\% M_{\star}$ (red), and $M_{\text{dust}} = 0.1\% M_{\star}$ (blue). Data points are plotted as blue dots, showing a general trend of decreasing dust mass with increasing stellar mass. A text box to the right of the plot explains that ALMA's sensitivity and resolution make it ideal for studying the cold outer disks of young stars and low mass objects, and mentions a recent paper by Dr. Testi and his collaborators. A 'Full Summary...' link is provided below the text. The footer of the website includes links for Site Map, Accessibility, Contact, and Privacy Statement, along with logos for ESO, NRAO, and NAOJ.

Everything start, of course, from the ALMA science portal !

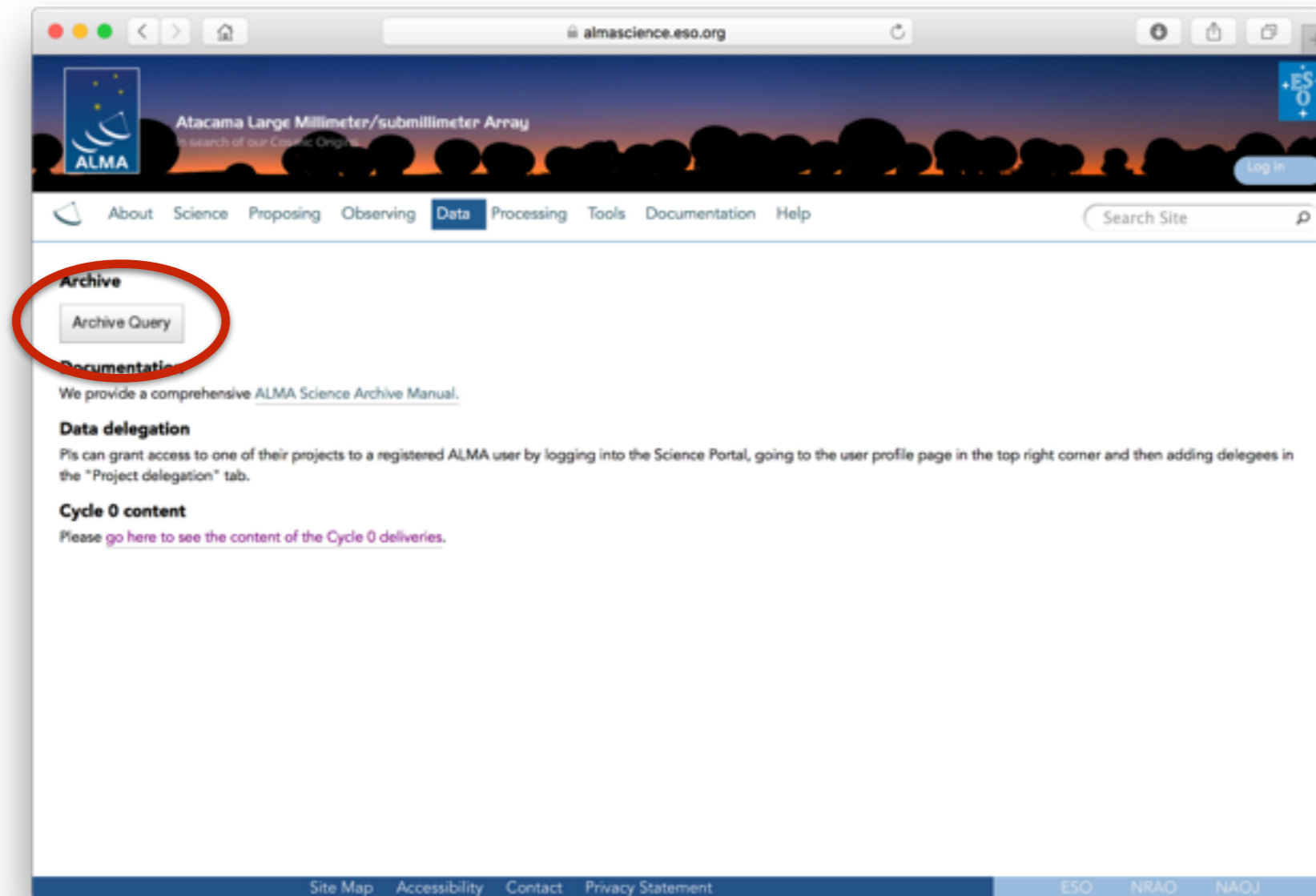


The screenshot shows the ALMA science portal at almascience.eso.org. The navigation menu includes: About, Science, Proposing, Observing, **Data**, Processing, Tools, Documentation, Help. The 'Data' menu is open, showing options: Archive, Calibrator Catalogue, Science Verification, Publication, and Acknowledgement. The main content area features 'Observatory News' with articles like 'ALMA Cycle 5 Call for Proposals is Now OPEN!' and 'Release of a New Installment of Science Verification Data'. A 'Science Highlights' section is titled 'Possible Disk Truncation in Ophiuchus Brown Dwarfs' and includes a plot of $\text{Log}_{10}(M_{\text{dust}}/M_{\oplus})$ vs $\text{Log}_{10}(M_{\star}/M_{\odot})$ with three dashed lines representing $M_{\text{dust}} = 10\% M_{\star}$, $M_{\text{dust}} = 1\% M_{\star}$, and $M_{\text{dust}} = 0.1\% M_{\star}$. The plot shows data points for various brown dwarfs, with some points falling below the $1\% M_{\star}$ line, indicating disk truncation. The text explains that ALMA's sensitivity and resolution are ideal for studying these objects.

Everything start, of course, from the ALMA science portal !

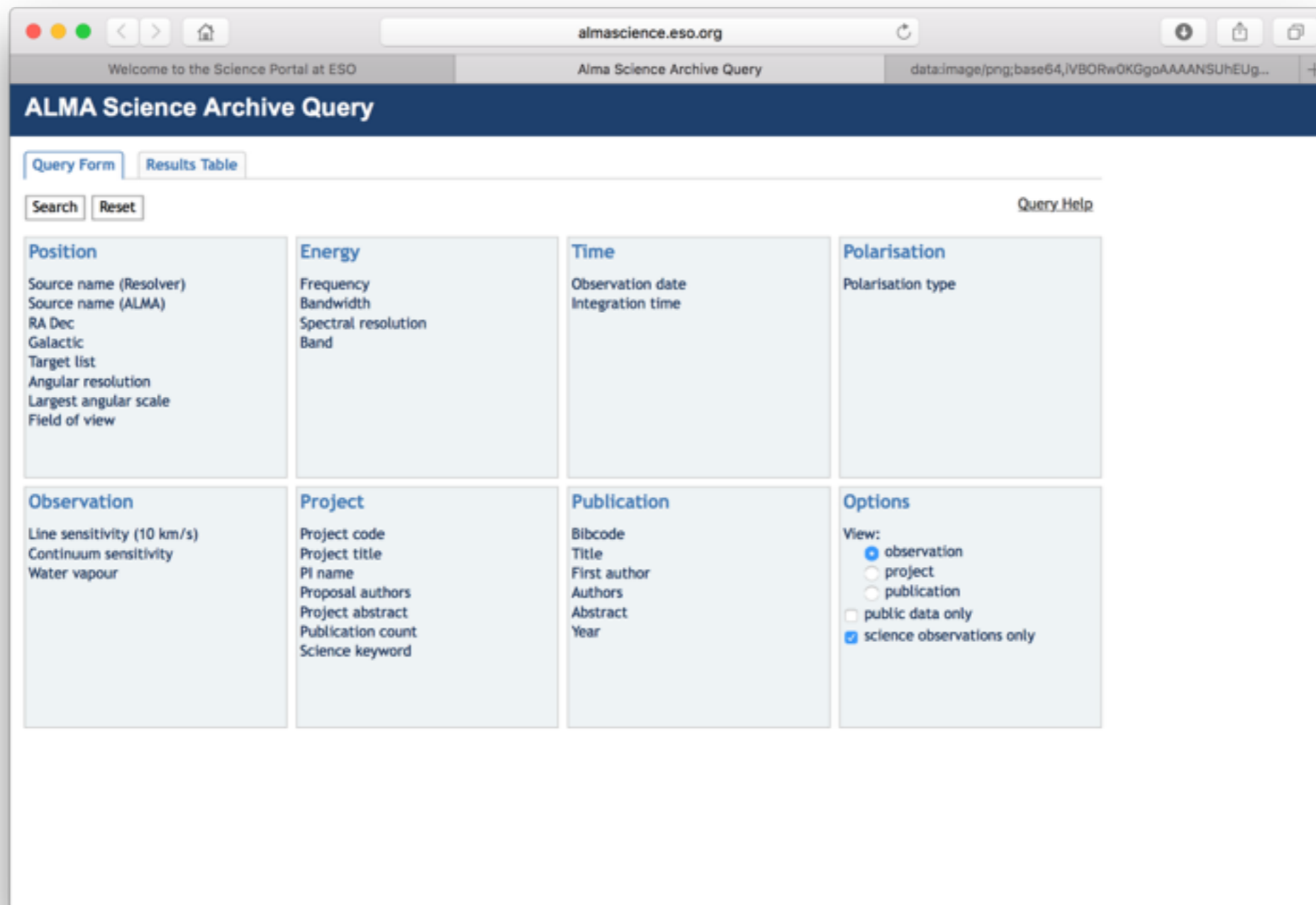


Everything start, of course, from the ALMA science portal !



Exploring the ALMA archive

Queries can be performed in many different ways and can be combined.

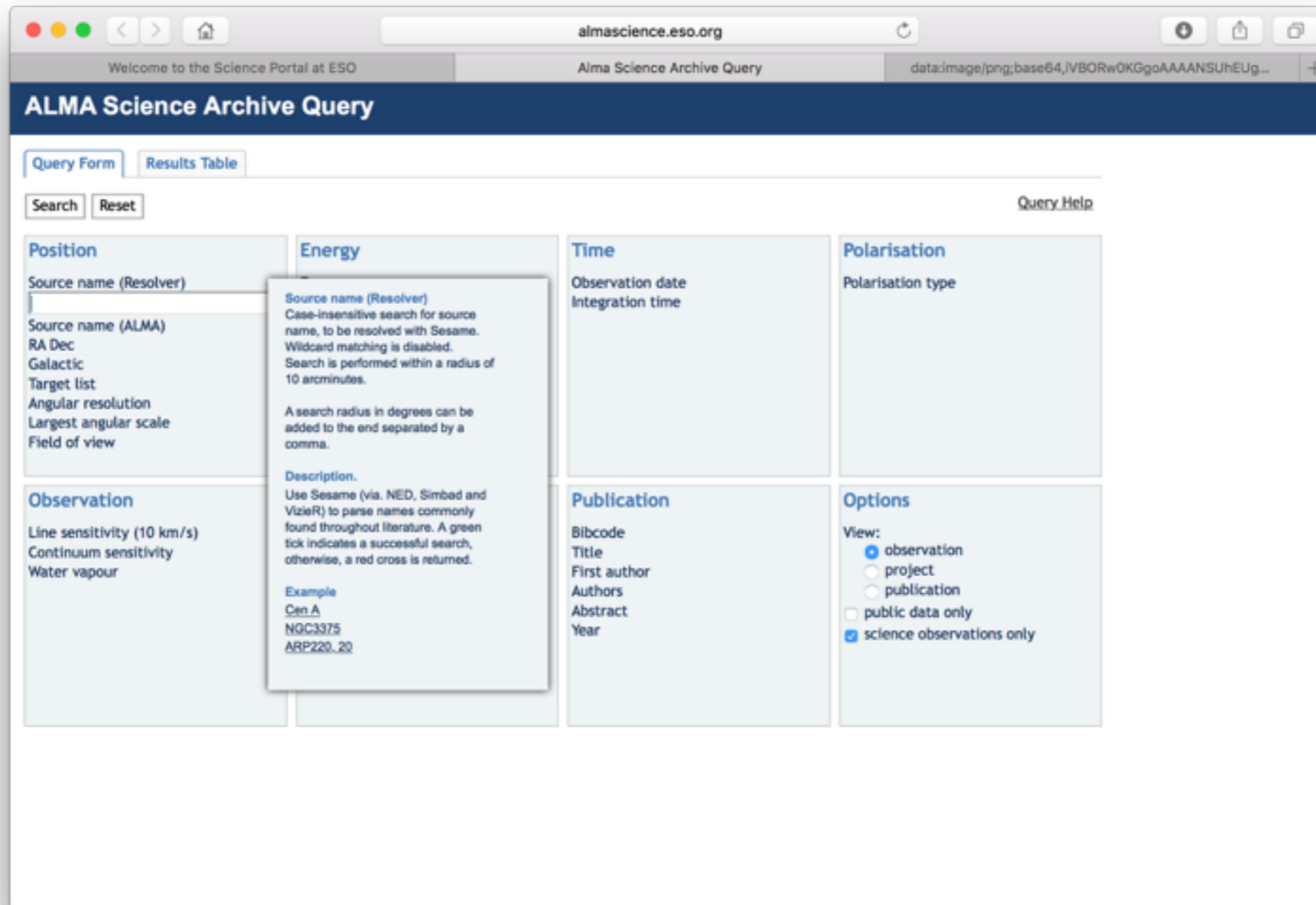


The screenshot shows the ALMA Science Archive Query web interface. The browser address bar is `almascience.eso.org`. The page title is "ALMA Science Archive Query". There are two tabs: "Query Form" (active) and "Results Table". Below the tabs are "Search" and "Reset" buttons, and a "Query Help" link. The main content area is divided into eight panels:

- Position:** Source name (Resolver), Source name (ALMA), RA Dec, Galactic, Target list, Angular resolution, Largest angular scale, Field of view.
- Energy:** Frequency, Bandwidth, Spectral resolution, Band.
- Time:** Observation date, Integration time.
- Polarisation:** Polarisation type.
- Observation:** Line sensitivity (10 km/s), Continuum sensitivity, Water vapour.
- Project:** Project code, Project title, PI name, Proposal authors, Project abstract, Publication count, Science keyword.
- Publication:** Bibcode, Title, First author, Authors, Abstract, Year.
- Options:** View: observation, project, publication, public data only, science observations only.

Exploring the ALMA archive

To start just hover over the appropriate search box
(Tips and examples will also appear)



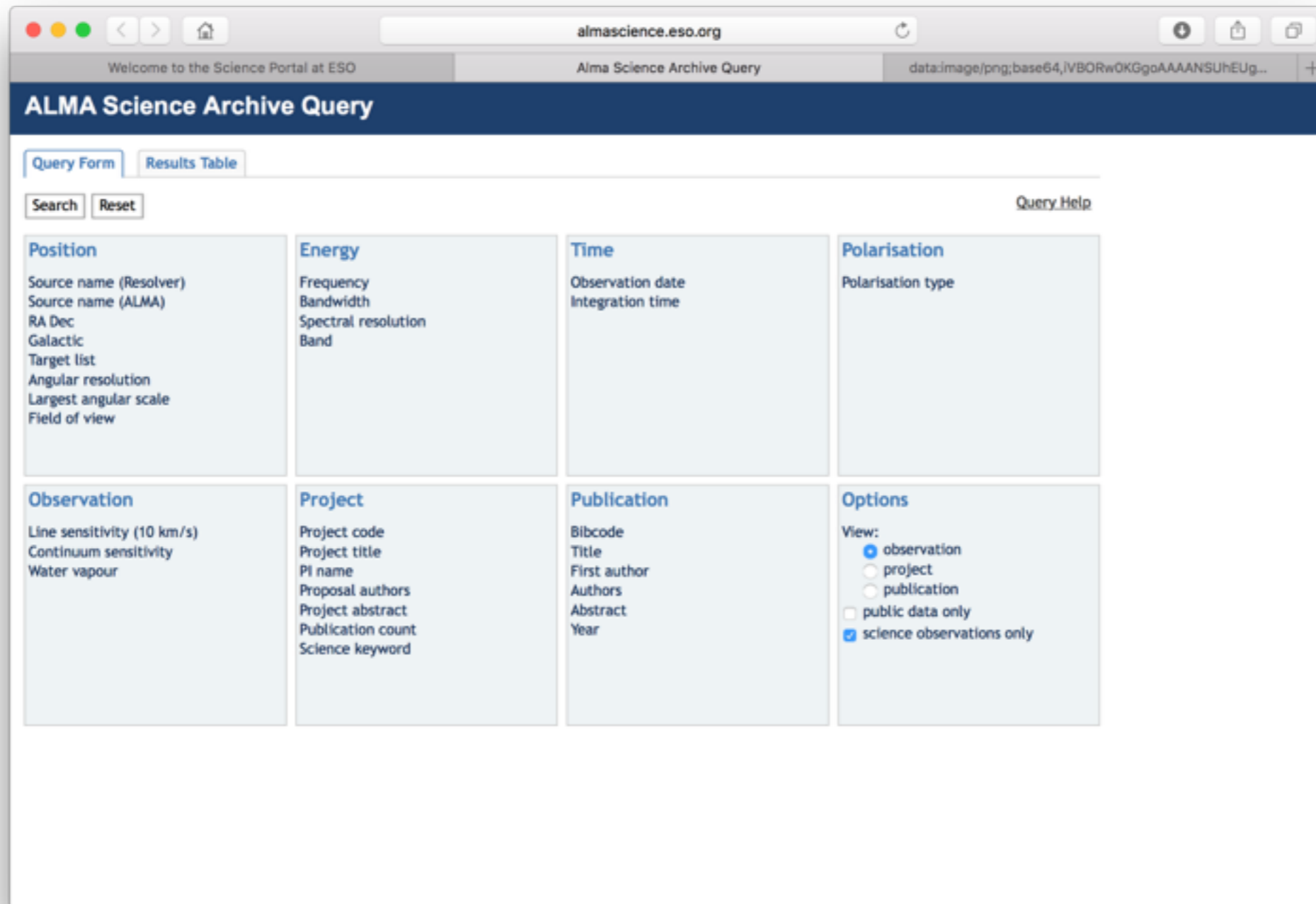
The screenshot shows the ALMA Science Archive Query interface in a browser window. The URL is `almascience.eso.org`. The page title is "ALMA Science Archive Query". There are two tabs: "Query Form" (selected) and "Results Table". Below the tabs are "Search" and "Reset" buttons, and a "Query Help" link.

The interface is divided into several search filter categories:

- Position:** Source name (Resolver), Source name (ALMA), RA Dec, Galactic, Target list, Angular resolution, Largest angular scale, Field of view.
- Energy:** Source name (Resolver). A tooltip is visible over this field, providing details: "Case-insensitive search for source name, to be resolved with Sesame. Wildcard matching is disabled. Search is performed within a radius of 10 arcminutes. A search radius in degrees can be added to the end separated by a comma. Description. Use Sesame (via, NED, Simbad and Vizier) to parse names commonly found throughout literature. A green tick indicates a successful search, otherwise, a red cross is returned. Example: Cen A, NGC3375, ARP220_20".
- Time:** Observation date, Integration time.
- Polarisation:** Polarisation type.
- Observation:** Line sensitivity (10 km/s), Continuum sensitivity, Water vapour.
- Publication:** Bibcode, Title, First author, Authors, Abstract, Year.
- Options:** View: observation, project, publication, public data only, science observations only.

Exploring the ALMA archive

To start just hover over the appropriate search box
(Tips and examples will also appear)



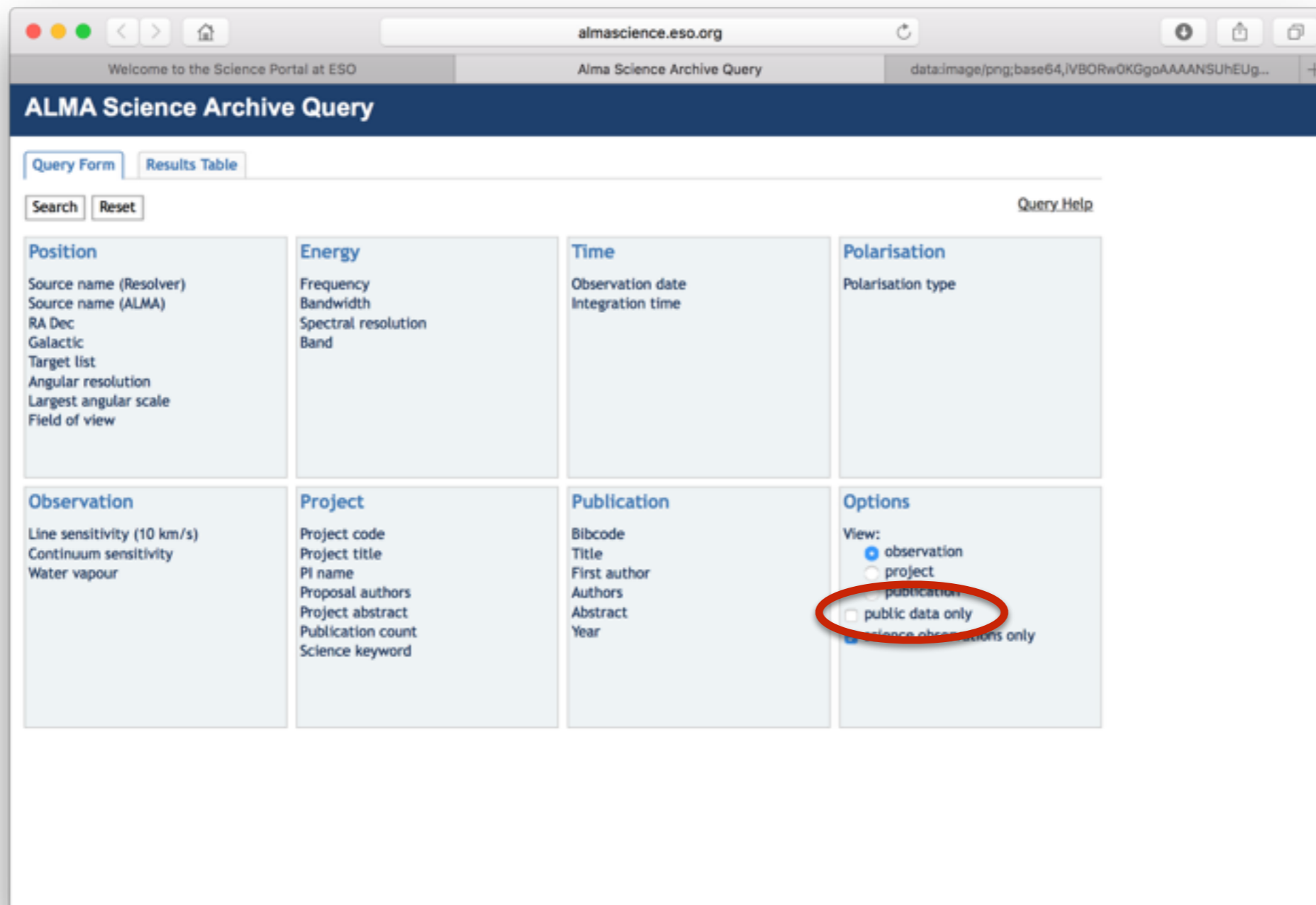
The screenshot shows a web browser window at almascience.eso.org. The page title is "ALMA Science Archive Query". At the top, there are navigation tabs for "Query Form" (selected) and "Results Table". Below the tabs are "Search" and "Reset" buttons, and a "Query Help" link on the right.

The main content area is divided into eight search criteria boxes:

- Position:** Source name (Resolver), Source name (ALMA), RA Dec, Galactic, Target list, Angular resolution, Largest angular scale, Field of view.
- Energy:** Frequency, Bandwidth, Spectral resolution, Band.
- Time:** Observation date, Integration time.
- Polarisation:** Polarisation type.
- Observation:** Line sensitivity (10 km/s), Continuum sensitivity, Water vapour.
- Project:** Project code, Project title, PI name, Proposal authors, Project abstract, Publication count, Science keyword.
- Publication:** Bibcode, Title, First author, Authors, Abstract, Year.
- Options:** View: observation, project, publication, public data only, science observations only.

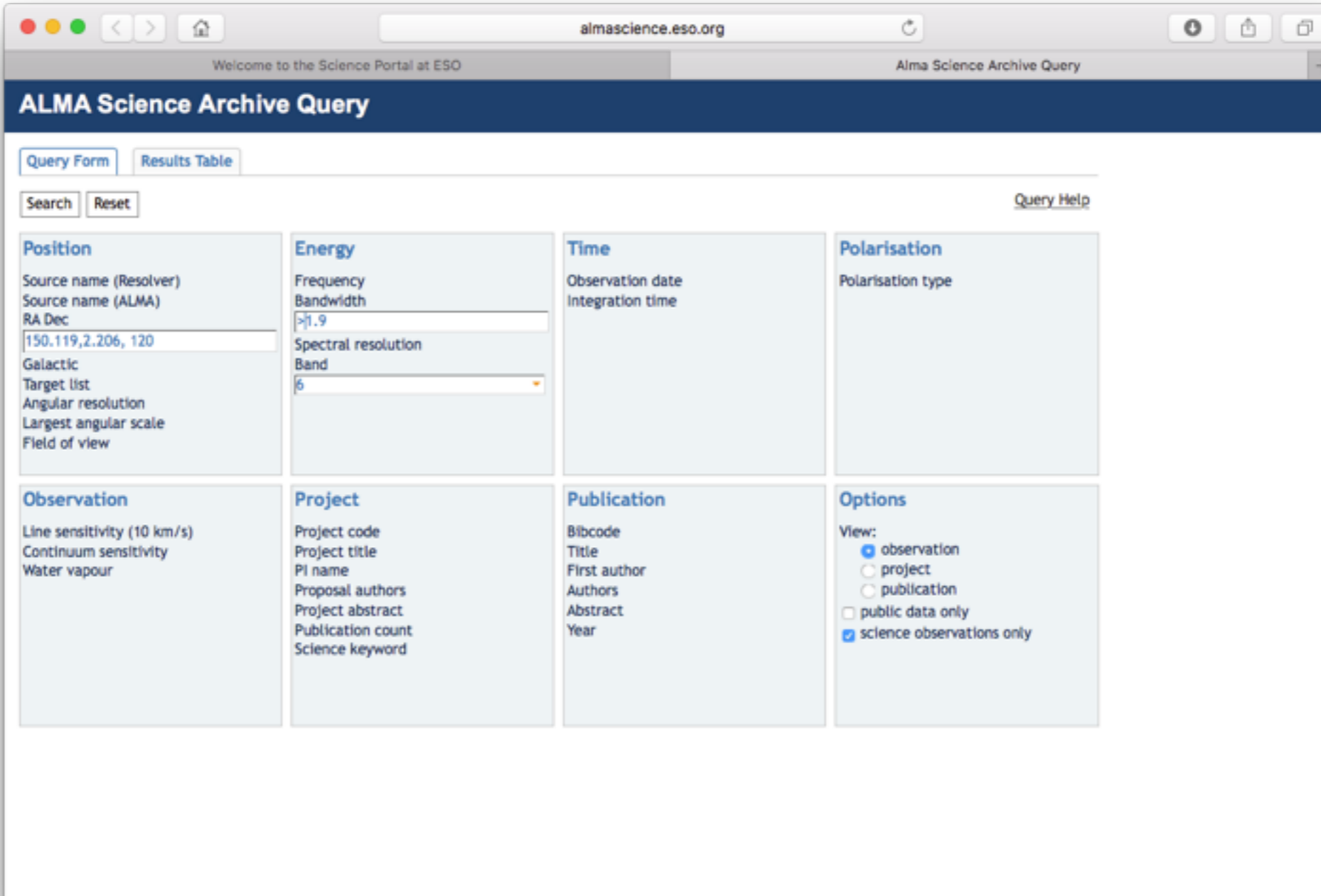
Exploring the ALMA archive

To start just hover over the appropriate search box
(Tips and examples will also appear)



Exploring the ALMA archive

To start just hover over the appropriate search box
(Tips and examples will also appear)

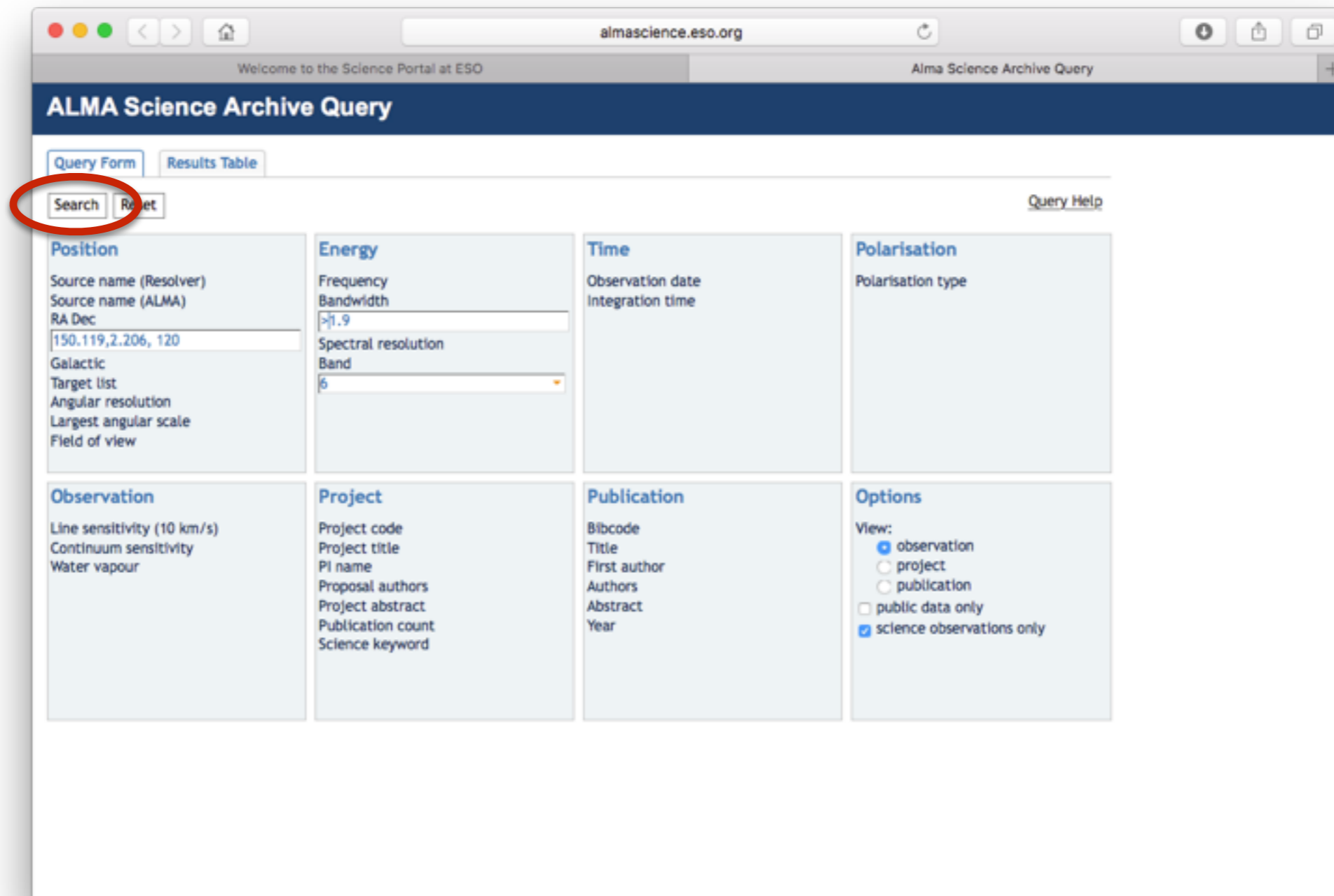


The screenshot shows the ALMA Science Archive Query web interface. The browser address bar displays 'almascience.eso.org'. The page title is 'ALMA Science Archive Query'. Below the title, there are tabs for 'Query Form' and 'Results Table', with 'Query Form' selected. A 'Search' button and a 'Reset' button are visible. A 'Query Help' link is located in the top right corner. The main content area is divided into eight panels:

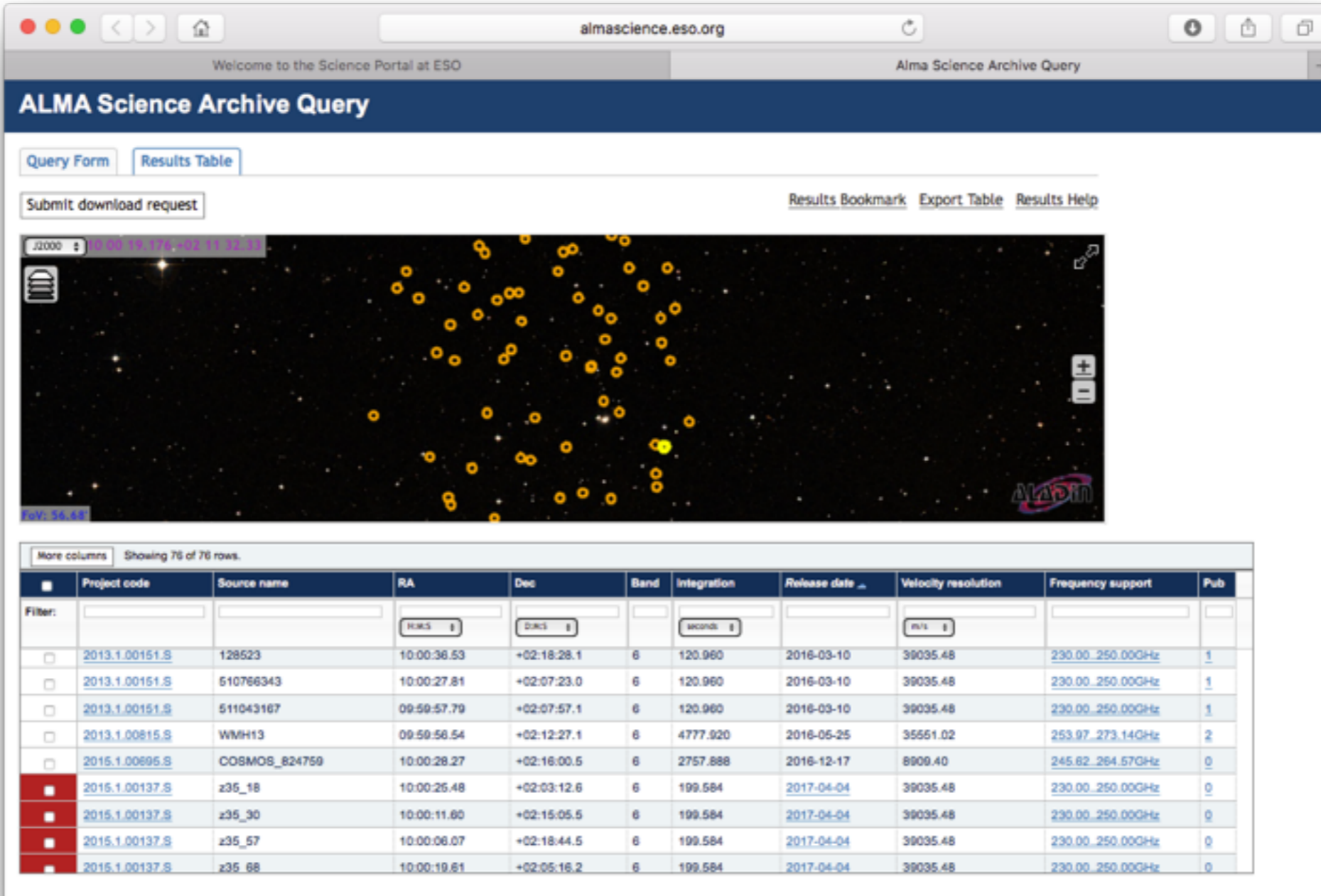
- Position:** Source name (Resolver), Source name (ALMA), RA Dec (input field with '150.119,2.206, 120'), Galactic, Target list, Angular resolution, Largest angular scale, Field of view.
- Energy:** Frequency, Bandwidth (input field with '>1.9'), Spectral resolution, Band (dropdown menu with '6').
- Time:** Observation date, Integration time.
- Polarisation:** Polarisation type.
- Observation:** Line sensitivity (10 km/s), Continuum sensitivity, Water vapour.
- Project:** Project code, Project title, PI name, Proposal authors, Project abstract, Publication count, Science keyword.
- Publication:** Bibcode, Title, First author, Authors, Abstract, Year.
- Options:** View: observation, project, publication, public data only, science observations only.

Exploring the ALMA archive

To start just hover over the appropriate search box
(Tips and examples will also appear)



Exploring the ALMA archive



almascience.eso.org

Welcome to the Science Portal at ESO Alma Science Archive Query

ALMA Science Archive Query

Query Form Results Table

Submit download request Results Bookmark Export Table Results Help

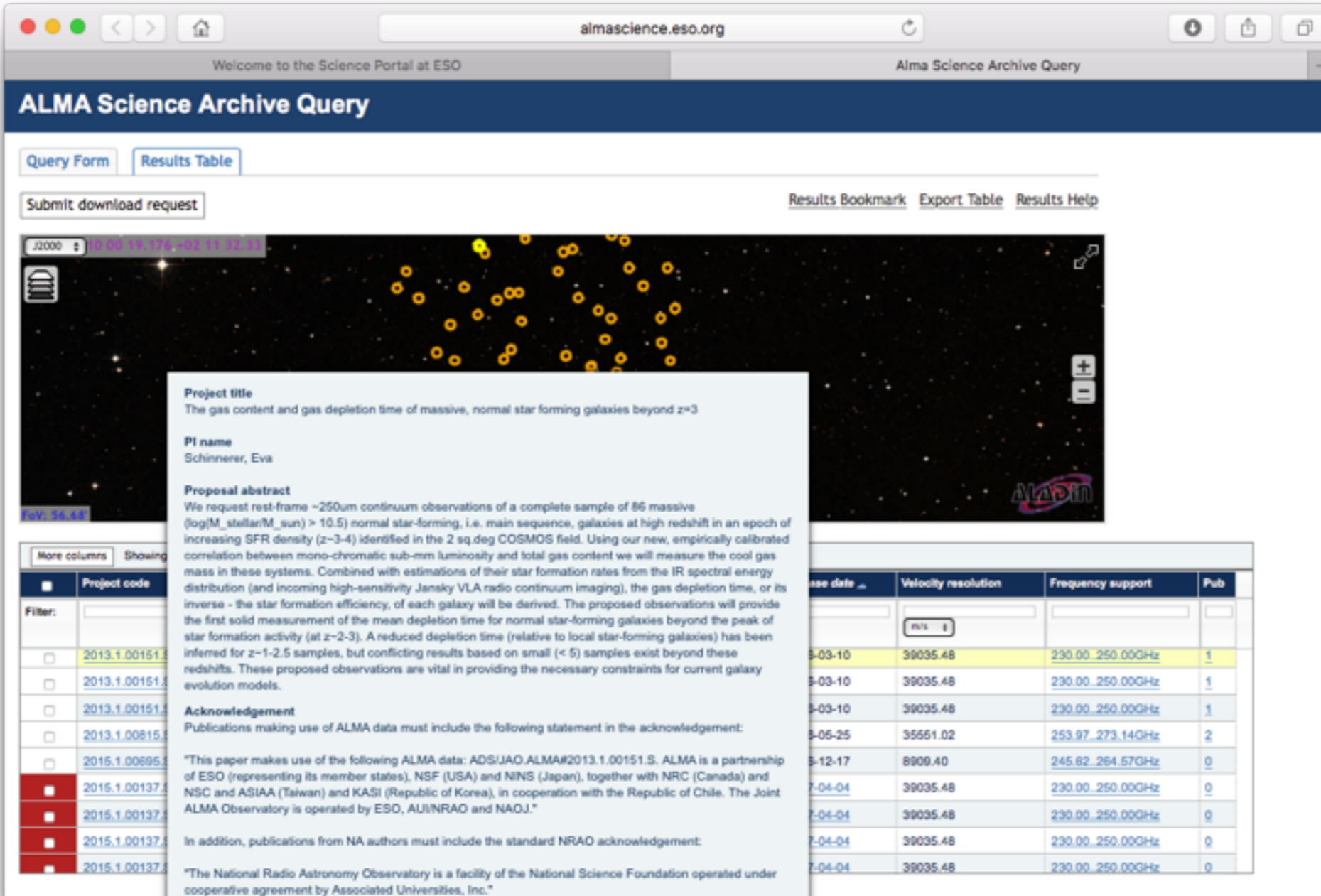
J2000: 10 00 19.178 +02 11 32.31

RA: 10h 00m 19.178s Dec: +02d 11m 32.31s

Filter:

	Project code	Source name	RA	Dec	Band	Integration	Release date	Velocity resolution	Frequency support	Pub
<input type="checkbox"/>	2013.1.00151.S	128523	10:00:36.53	+02:18:28.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/>	2013.1.00151.S	510766343	10:00:27.81	+02:07:23.0	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/>	2013.1.00151.S	511043167	09:59:57.79	+02:07:57.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/>	2013.1.00815.S	WMH13	09:59:58.54	+02:12:27.1	6	4777.920	2016-05-25	35551.02	253.97_273.14GHz	2
<input type="checkbox"/>	2015.1.00895.S	COSMOS_824759	10:00:28.27	+02:16:00.5	6	2757.888	2016-12-17	8909.40	245.62_264.57GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_18	10:00:25.48	+02:03:12.6	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_30	10:00:11.60	+02:15:05.5	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_57	10:00:06.07	+02:18:44.5	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_68	10:00:19.61	+02:05:16.2	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0

Exploring the ALMA archive



almascience.eso.org

Welcome to the Science Portal at ESO Alma Science Archive Query

ALMA Science Archive Query

Query Form Results Table

Submit download request Results Bookmark Export Table Results Help

J2000: 18 00 19.178 +32 11 32.31

FOV: 34.48"

Project title
The gas content and gas depletion time of massive, normal star forming galaxies beyond $z=3$

PI name
Schinnerer, Eva

Proposal abstract
We request rest-frame $\sim 250\mu\text{m}$ continuum observations of a complete sample of 86 massive ($\log(M_{\text{stellar}}/M_{\text{sun}}) > 10.5$) normal star-forming, i.e. main sequence, galaxies at high redshift in an epoch of increasing SFR density ($z=3-4$) identified in the 2 sq.deg COSMOS field. Using our new, empirically calibrated correlation between mono-chromatic sub-mm luminosity and total gas content we will measure the cool gas mass in these systems. Combined with estimations of their star formation rates from the IR spectral energy distribution (and incoming high-sensitivity Jansky VLA radio continuum imaging), the gas depletion time, or its inverse - the star formation efficiency, of each galaxy will be derived. The proposed observations will provide the first solid measurement of the mean depletion time for normal star-forming galaxies beyond the peak of star formation activity (at $z=2-3$). A reduced depletion time (relative to local star-forming galaxies) has been inferred for $z=1-2.5$ samples, but conflicting results based on small (< 5) samples exist beyond these redshifts. These proposed observations are vital in providing the necessary constraints for current galaxy evolution models.

Acknowledgement
Publications making use of ALMA data must include the following statement in the acknowledgement:
"This paper makes use of the following ALMA data: ADS/JAO.ALMA#2013.1.00151.S. ALMA is a partnership of ESO (representing its member states), NSF (USA) and NINS (Japan), together with NRC (Canada) and NSC and ASIAA (Taiwan) and KASI (Republic of Korea), in cooperation with the Republic of Chile. The Joint ALMA Observatory is operated by ESO, AUI/NRAO and NAOJ."
In addition, publications from NA authors must include the standard NRAO acknowledgement:
"The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc."

Proposal ID	Velocity resolution	Frequency support	Pub
2013-03-10	39035.48	230.00_250.00GHz	1
2013-03-10	39035.48	230.00_250.00GHz	1
2013-03-10	39035.48	230.00_250.00GHz	1
2013-05-25	35551.02	253.97_273.14GHz	2
2013-12-17	8909.40	245.62_264.57GHz	0
2017-04-04	39035.48	230.00_250.00GHz	0
2017-04-04	39035.48	230.00_250.00GHz	0
2017-04-04	39035.48	230.00_250.00GHz	0

Exploring the ALMA archive

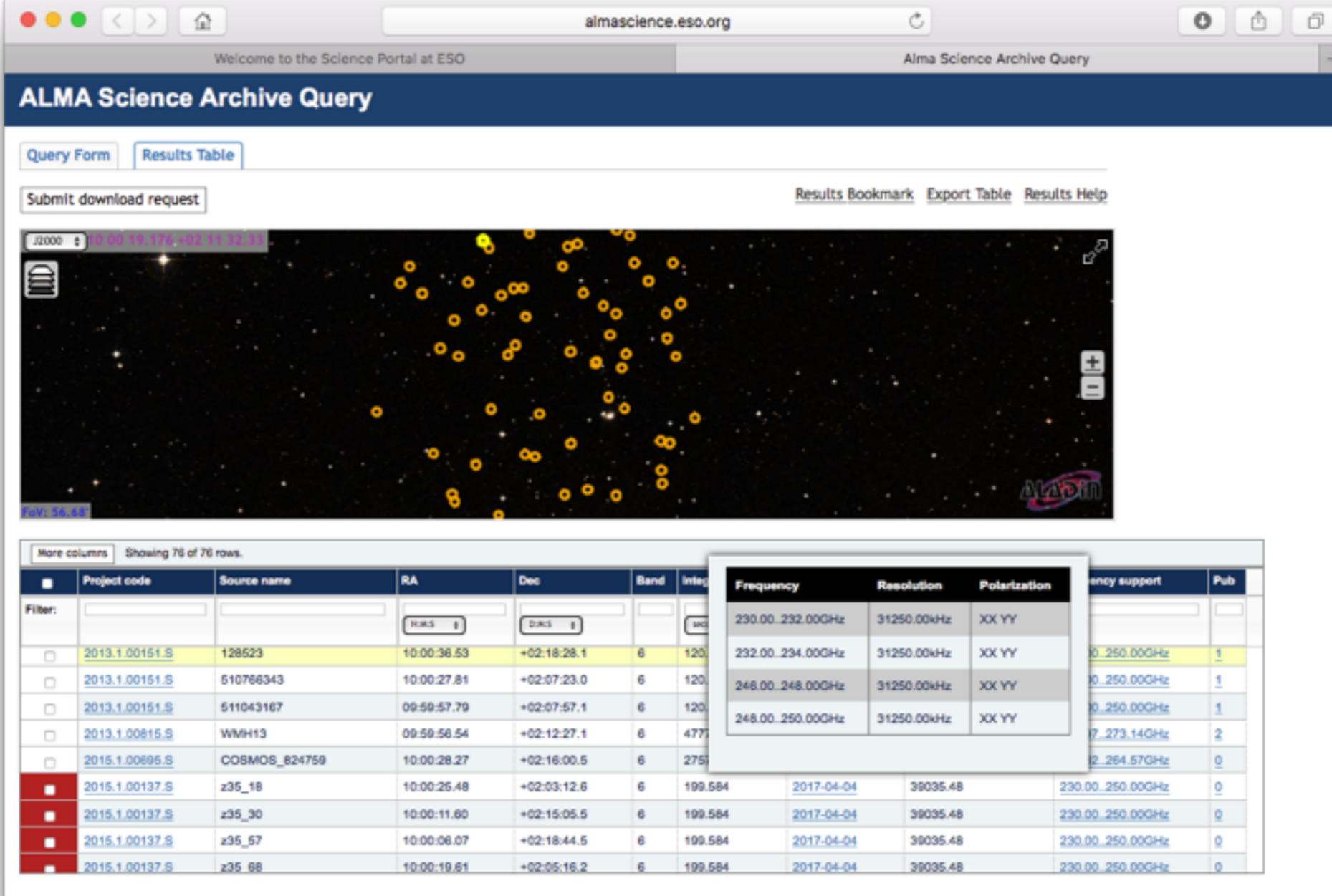
almascience.eso.org

Welcome to the Science Portal at ESO Alma Science Archive Query

ALMA Science Archive Query

Query Form Results Table

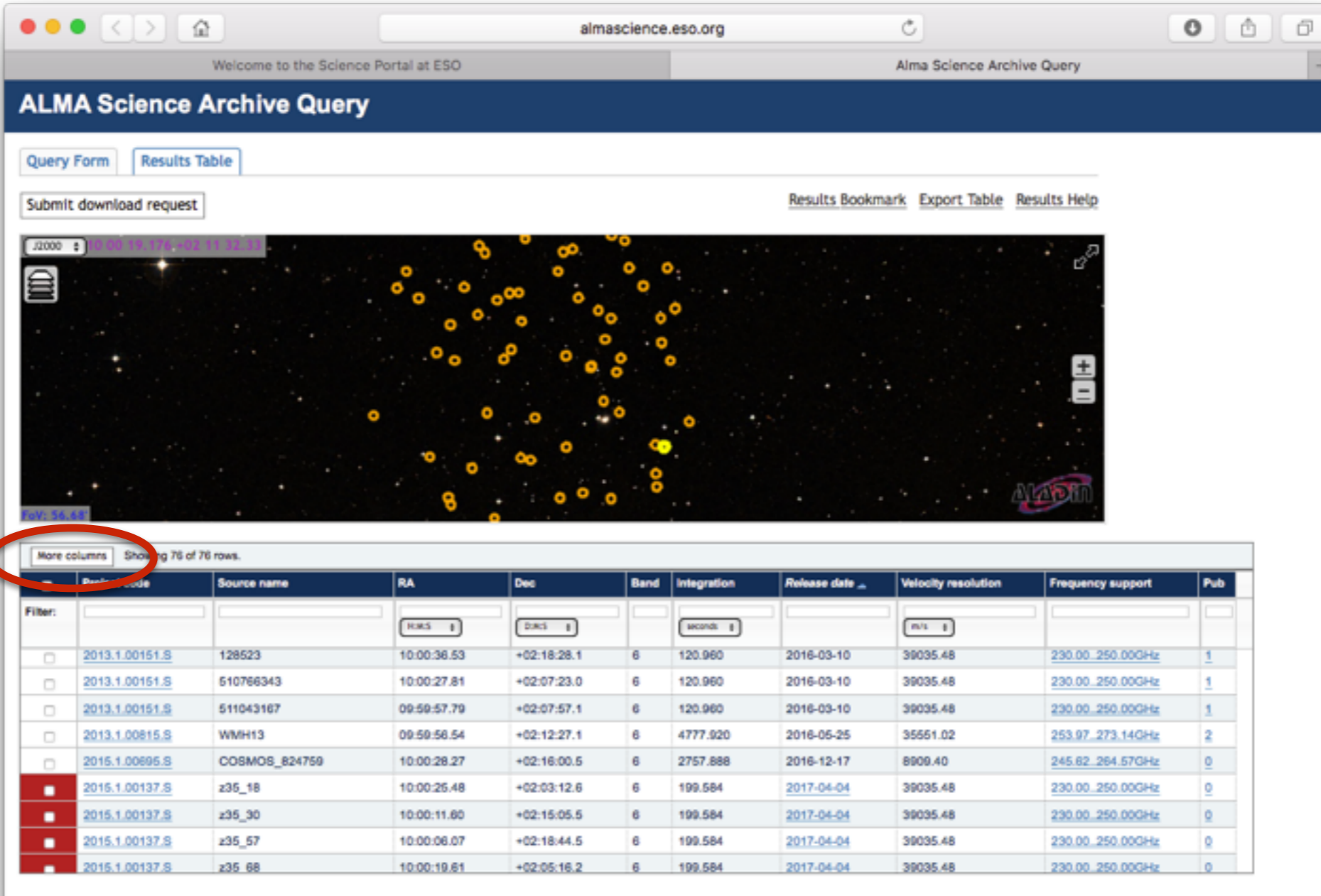
Submit download request Results Bookmark Export Table Results Help



Showing 76 of 76 rows.

Project code	Source name	RA	Dec	Band	Integ	Frequency	Resolution	Polarization	Frequency support	Pub
2013.1.00151.S	128523	10:00:36.53	+02:18:28.1	6	120	230.00_232.00GHz	31250.00kHz	XX YY	230.00_250.00GHz	1
2013.1.00151.S	510766343	10:00:27.81	+02:07:23.0	6	120	232.00_234.00GHz	31250.00kHz	XX YY	230.00_250.00GHz	1
2013.1.00151.S	511043167	09:59:57.79	+02:07:57.1	6	120	246.00_248.00GHz	31250.00kHz	XX YY	230.00_250.00GHz	1
2013.1.00815.S	WMH13	09:59:56.54	+02:12:27.1	6	477	248.00_250.00GHz	31250.00kHz	XX YY	230.00_250.00GHz	1
2015.1.00895.S	COSMOS_824759	10:00:28.27	+02:16:00.5	6	275	248.00_250.00GHz	31250.00kHz	XX YY	230.00_250.00GHz	0
2015.1.00137.S	z35_18	10:00:25.48	+02:03:12.6	6	199.584	2017-04-04	39035.48		230.00_250.00GHz	0
2015.1.00137.S	z35_30	10:00:11.60	+02:15:05.5	6	199.584	2017-04-04	39035.48		230.00_250.00GHz	0
2015.1.00137.S	z35_57	10:00:06.07	+02:18:44.5	6	199.584	2017-04-04	39035.48		230.00_250.00GHz	0
2015.1.00137.S	z35_68	10:00:19.61	+02:05:16.2	6	199.584	2017-04-04	39035.48		230.00_250.00GHz	0

Exploring the ALMA archive



ALMA Science Archive Query

Query Form Results Table

Submit download request Results Bookmark Export Table Results Help

J2000: 10 00 19 178 +02 11 32.31

RA: 10 00 19.178 Dec: +02 11 32.31

Filter: RA: Dec: Band: Integration: Release date: Velocity resolution: Frequency support: Pub:

	Request code	Source name	RA	Dec	Band	Integration	Release date	Velocity resolution	Frequency support	Pub
<input type="checkbox"/>	2013.1.00151.S	128523	10:00:36.53	+02:18:28.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/>	2013.1.00151.S	510766343	10:00:27.81	+02:07:23.0	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/>	2013.1.00151.S	511043167	09:59:57.79	+02:07:57.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/>	2013.1.00815.S	WMH13	09:59:58.54	+02:12:27.1	6	4777.920	2016-05-25	35551.02	253.97_273.14GHz	2
<input type="checkbox"/>	2015.1.00895.S	COSMOS_824759	10:00:28.27	+02:16:00.5	6	2757.888	2016-12-17	8909.40	245.62_264.57GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_18	10:00:25.48	+02:03:12.6	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_30	10:00:11.60	+02:15:05.5	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_57	10:00:06.07	+02:18:44.5	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_68	10:00:19.61	+02:05:16.2	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0

Exploring the ALMA archive

almascience.eso.org

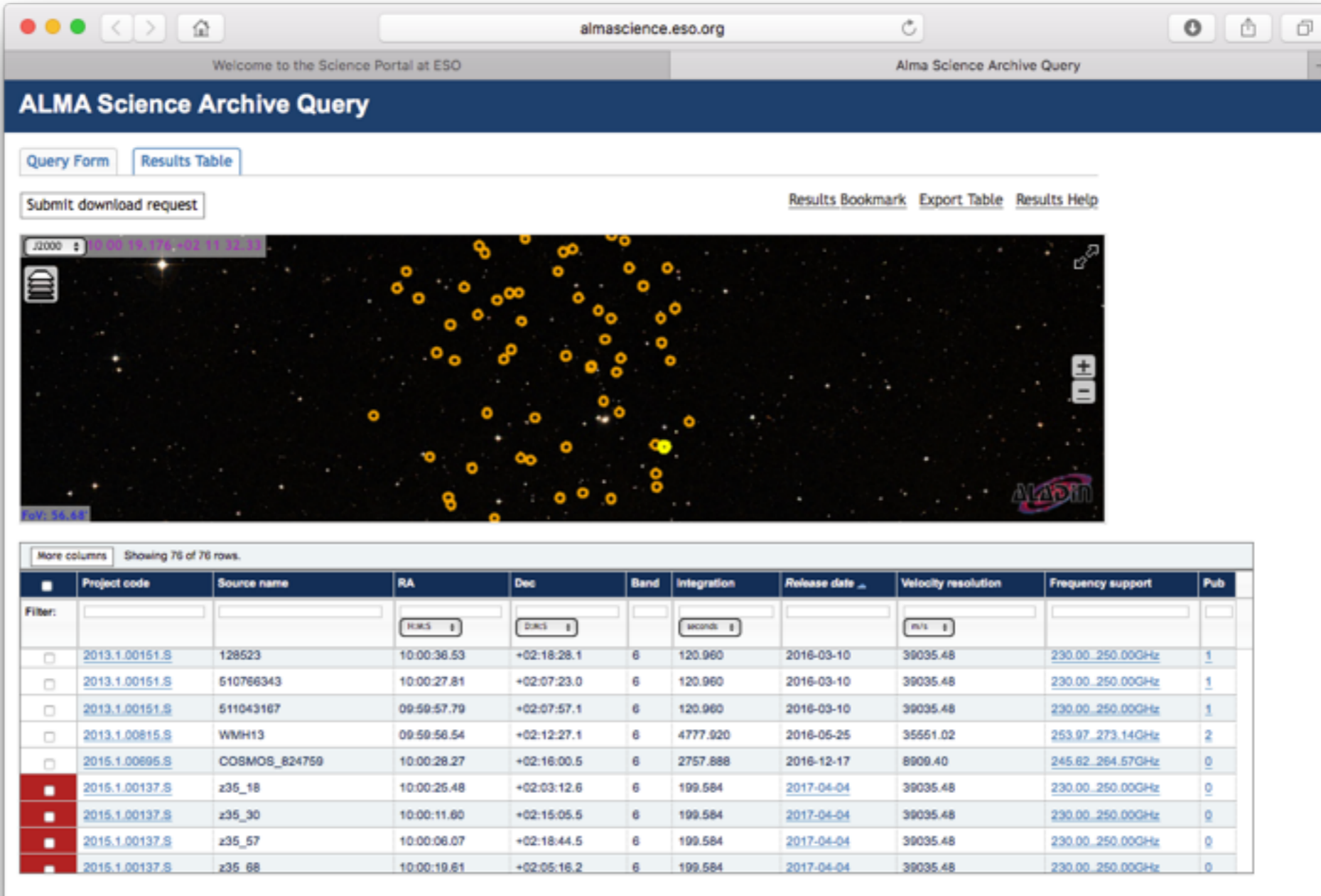
Welcome to the Science Portal at ESO

Alma Science Archive Query

Filter:	Field	Description
<input checked="" type="checkbox"/>	Project code	Project code, in the form YYYYNNNN.C.AAA, where:
<input checked="" type="checkbox"/>	Source name	Name of the source as registered in the ASDM. Partial matches through wildcards (? , *), and boolean OR expressions (" "), can be used.
<input checked="" type="checkbox"/>	RA	deg Right Ascension of the field pointing.
<input checked="" type="checkbox"/>	Dec	deg Declination of the field pointing.
<input checked="" type="checkbox"/>	Band	ALMA receiver band.
<input checked="" type="checkbox"/>	Integration	s Aggregated integration time for the field in the ASDM.
<input checked="" type="checkbox"/>	Release date	
<input checked="" type="checkbox"/>	Velocity resolution	m/s Estimated velocity resolution from all the spectral windows, from frequency resolution.
<input checked="" type="checkbox"/>	Frequency support	GHz All frequency ranges used by the field
<input checked="" type="checkbox"/>	Pub	Number of Publications
<input type="checkbox"/>	Footprint	
<input type="checkbox"/>	Galactic longitude	deg Galactic longitude of the observation for RA/Dec. Estimated using PyEphem and RA/Dec.
<input type="checkbox"/>	Galactic latitude	deg Galactic latitude of the observation for RA/Dec. Estimated using PyEphem and RA/Dec.
<input type="checkbox"/>	Angular resolution	
<input type="checkbox"/>	Frequency resolution	kHz Estimated frequency resolution from all the spectral windows, using median values of channel widths.
<input type="checkbox"/>	Array	Type(s) of ALMA antenna(s) used for that observation.
<input type="checkbox"/>	Mosaic	Indicates if the observation is a combination of overlapping beams.
<input type="checkbox"/>	Pol products	Polarisation products provided.
<input type="checkbox"/>	Observation date	
<input type="checkbox"/>	PI name	case-insensitive partial match over the full PI name. Wildcards can be used
<input type="checkbox"/>	SB name	Name of the Scheduling Block used as a template for executing the ASDM containing this Field.
<input type="checkbox"/>	Proposal authors	Full name of CoIs .
<input type="checkbox"/>	Line sensitivity (10 km/s)	Line sensitivity.
<input type="checkbox"/>	Continuum sensitivity	Continuum sensitivity.
<input type="checkbox"/>	PWV	mm Estimated precipitable water vapour from the XML_CALWVR_ENTITIES table.
<input type="checkbox"/>	Group ous id	GROUP_OUS_UID generating this ASDM.
<input type="checkbox"/>	Member ous id	MEMBER_OUS_UID generating this ASDM.
<input type="checkbox"/>	Asdm uid	UID of the ASDM containing this Field.
<input type="checkbox"/>	Project title	Case-insensitive search over the project title
<input type="checkbox"/>	Project type	Project type.
<input type="checkbox"/>	Scan intent	Scan intent list for the observed field.
<input type="checkbox"/>	Field of view	arcsec Field of view (arcsec). Estimated from the frequency and antennas
<input type="checkbox"/>	Largest angular scale	Due to the fact that radio antennas can not be placed infinitely close, measurements do have a smallest separation which translates into a maximal angular distance beyond which features can not be resolved reliably any more. Adding observations with the ALMA Total Power array can add those missing largest scales.
<input type="checkbox"/>	QA2 Status	QA2_PASSED
<input type="checkbox"/>	Science keyword	Science keyword.
<input type="checkbox"/>	Scientific category	Scientific category.

Velocity resolution	Frequency support	Pub
39035.48	230.00_250.00GHz	1
39035.48	230.00_250.00GHz	1
39035.48	230.00_250.00GHz	1
35561.02	253.97_273.14GHz	2
8909.40	245.62_264.57GHz	0
39035.48	230.00_250.00GHz	0
39035.48	230.00_250.00GHz	0
39035.48	230.00_250.00GHz	0
39035.48	230.00_250.00GHz	0

Exploring the ALMA archive



almascience.eso.org

Welcome to the Science Portal at ESO Alma Science Archive Query

ALMA Science Archive Query

Query Form Results Table

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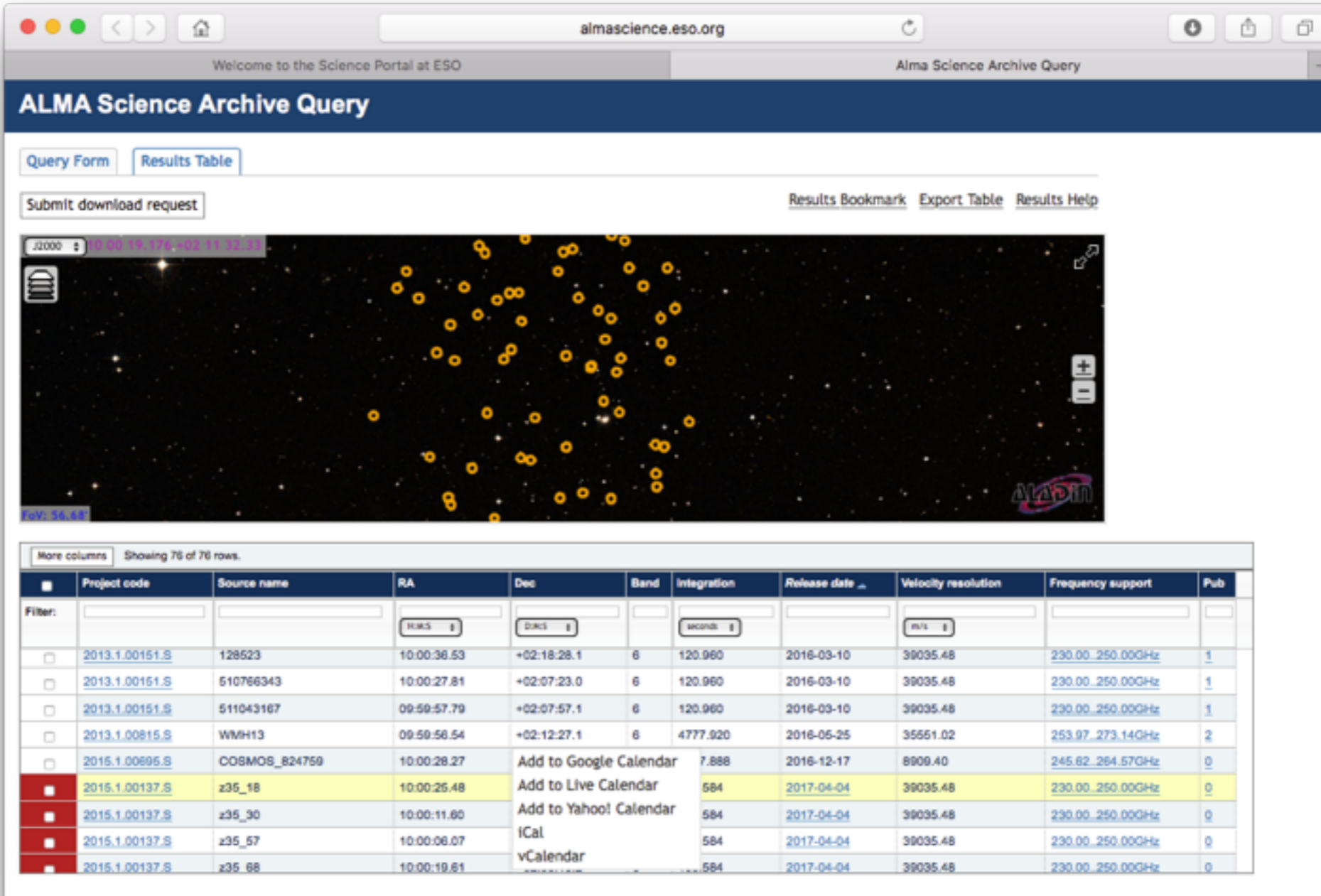
J2000: 10 00 19.178 +02 11 32.31

RA: 10h 00m 19.178s Dec: +02d 11m 32.31s

Filter:

Project code	Source name	RA	Dec	Band	Integration	Release date	Velocity resolution	Frequency support	Pub
<input type="checkbox"/> 2013.1.00151.S	128523	10:00:36.53	+02:18:28.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/> 2013.1.00151.S	510766343	10:00:27.81	+02:07:23.0	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/> 2013.1.00151.S	511043167	09:59:57.79	+02:07:57.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/> 2013.1.00815.S	WMH13	09:59:58.54	+02:12:27.1	6	4777.920	2016-05-25	35551.02	253.97_273.14GHz	2
<input type="checkbox"/> 2015.1.00895.S	COSMOS_824759	10:00:28.27	+02:16:00.5	6	2757.888	2016-12-17	8909.40	245.62_264.57GHz	0
<input checked="" type="checkbox"/> 2015.1.00137.S	z35_18	10:00:25.48	+02:03:12.6	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/> 2015.1.00137.S	z35_30	10:00:11.60	+02:15:05.5	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/> 2015.1.00137.S	z35_57	10:00:06.07	+02:18:44.5	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/> 2015.1.00137.S	z35_68	10:00:19.61	+02:05:16.2	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0

Exploring the ALMA archive



ALMA Science Archive Query

Query Form Results Table

Submit download request Results Bookmark Export Table Results Help

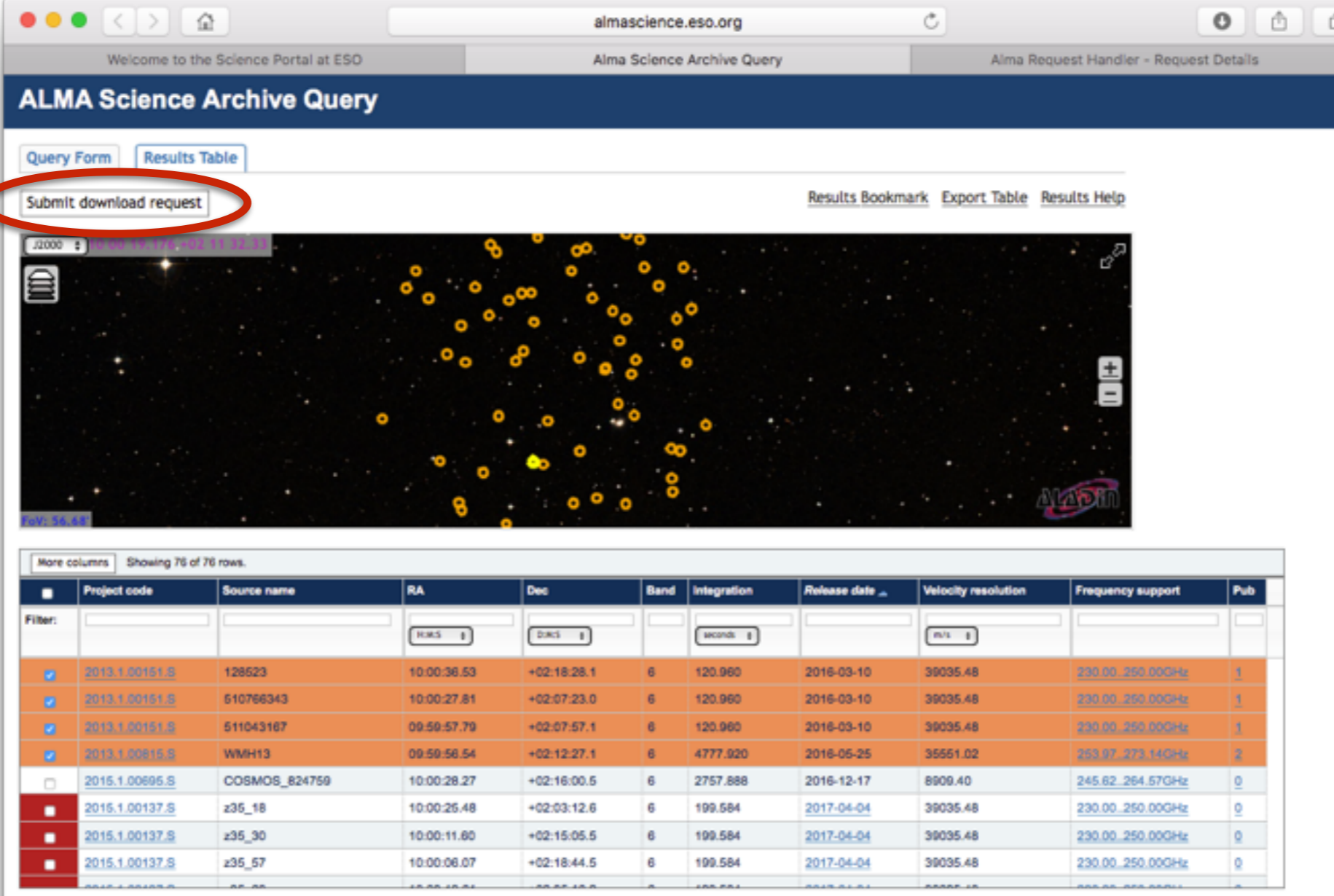
J2000: 10 00 19.178 +02 11 32.31

RA: 10h 00m 19.178s Dec: +02° 11' 32.31"

More columns Showing 76 of 76 rows.

	Project code	Source name	RA	Dec	Band	Integration	Release date	Velocity resolution	Frequency support	Pub
<input type="checkbox"/>	2013.1.00151.S	128523	10:00:36.53	+02:18:28.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/>	2013.1.00151.S	510766343	10:00:27.81	+02:07:23.0	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/>	2013.1.00151.S	511043167	09:59:57.79	+02:07:57.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input type="checkbox"/>	2013.1.00815.S	WMH13	09:59:58.54	+02:12:27.1	6	4777.920	2016-05-25	35551.02	253.97_273.14GHz	2
<input type="checkbox"/>	2015.1.00695.S	COSMOS_824759	10:00:28.27			7.888	2016-12-17	8909.40	245.62_264.57GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_18	10:00:25.48			584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_30	10:00:11.60			584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_57	10:00:06.07			584	2017-04-04	39035.48	230.00_250.00GHz	0
<input checked="" type="checkbox"/>	2015.1.00137.S	z35_68	10:00:19.61			584	2017-04-04	39035.48	230.00_250.00GHz	0

Exploring the ALMA archive

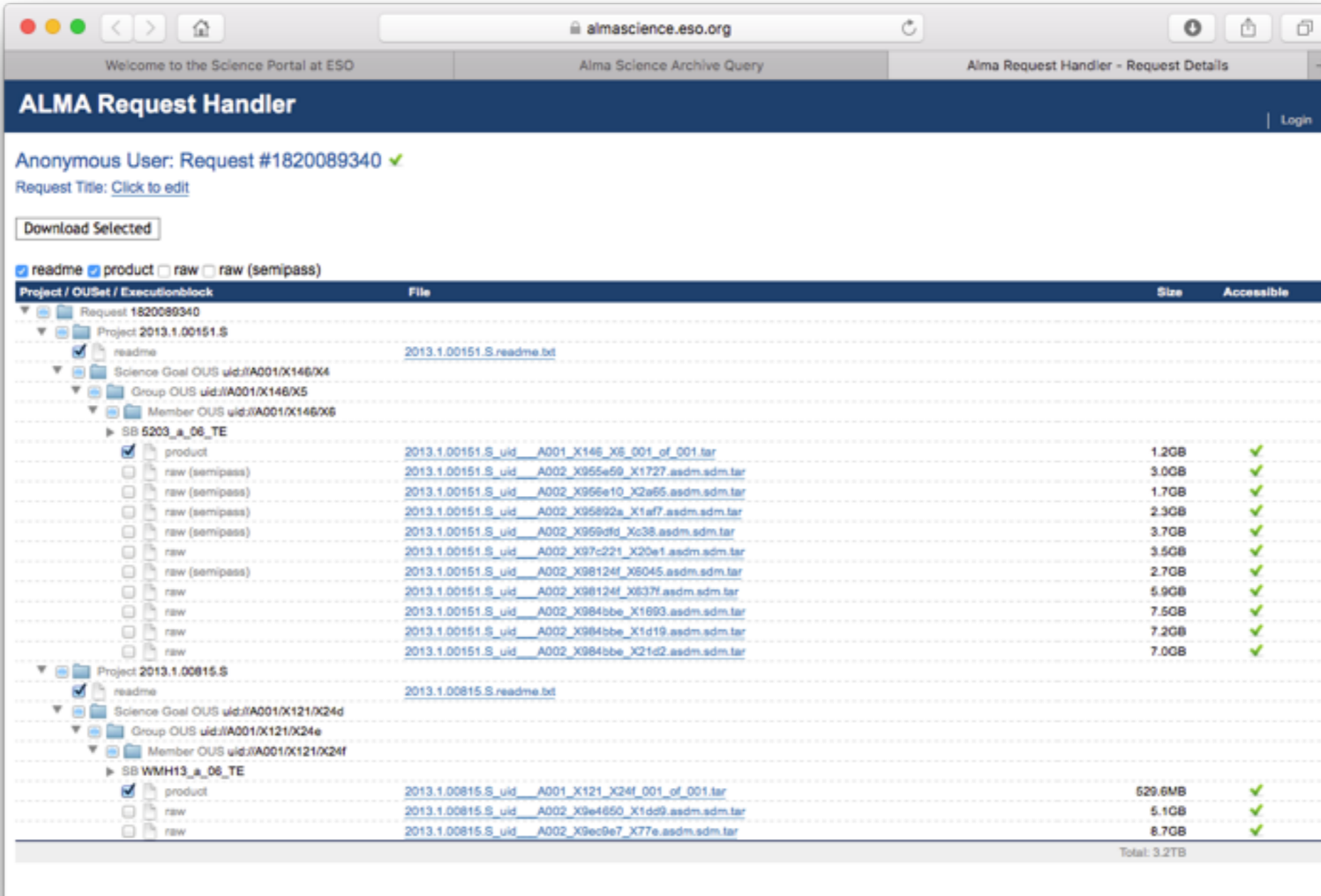


ALMA Science Archive Query

Submit download request

Project code	Source name	RA	Dec	Band	Integration	Release date	Velocity resolution	Frequency support	Pub	
<input checked="" type="checkbox"/>	2013.1.00151.S	128523	10:00:36.53	+02:18:28.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input checked="" type="checkbox"/>	2013.1.00151.S	510766343	10:00:27.81	+02:07:23.0	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input checked="" type="checkbox"/>	2013.1.00151.S	511043167	09:59:57.79	+02:07:57.1	6	120.960	2016-03-10	39035.48	230.00_250.00GHz	1
<input checked="" type="checkbox"/>	2013.1.00815.S	WMH13	09:59:56.54	+02:12:27.1	6	4777.920	2016-05-25	35551.02	253.97_273.14GHz	2
<input type="checkbox"/>	2015.1.00695.S	COSMOS_824759	10:00:28.27	+02:16:00.5	6	2757.888	2016-12-17	8909.40	245.62_264.57GHz	0
<input type="checkbox"/>	2015.1.00137.S	z35_18	10:00:26.48	+02:03:12.6	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input type="checkbox"/>	2015.1.00137.S	z35_30	10:00:11.60	+02:15:05.5	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0
<input type="checkbox"/>	2015.1.00137.S	z35_57	10:00:06.07	+02:18:44.5	6	199.584	2017-04-04	39035.48	230.00_250.00GHz	0

Exploring the ALMA archive



Welcome to the Science Portal at ESO | Alma Science Archive Query | Alma Request Handler - Request Details

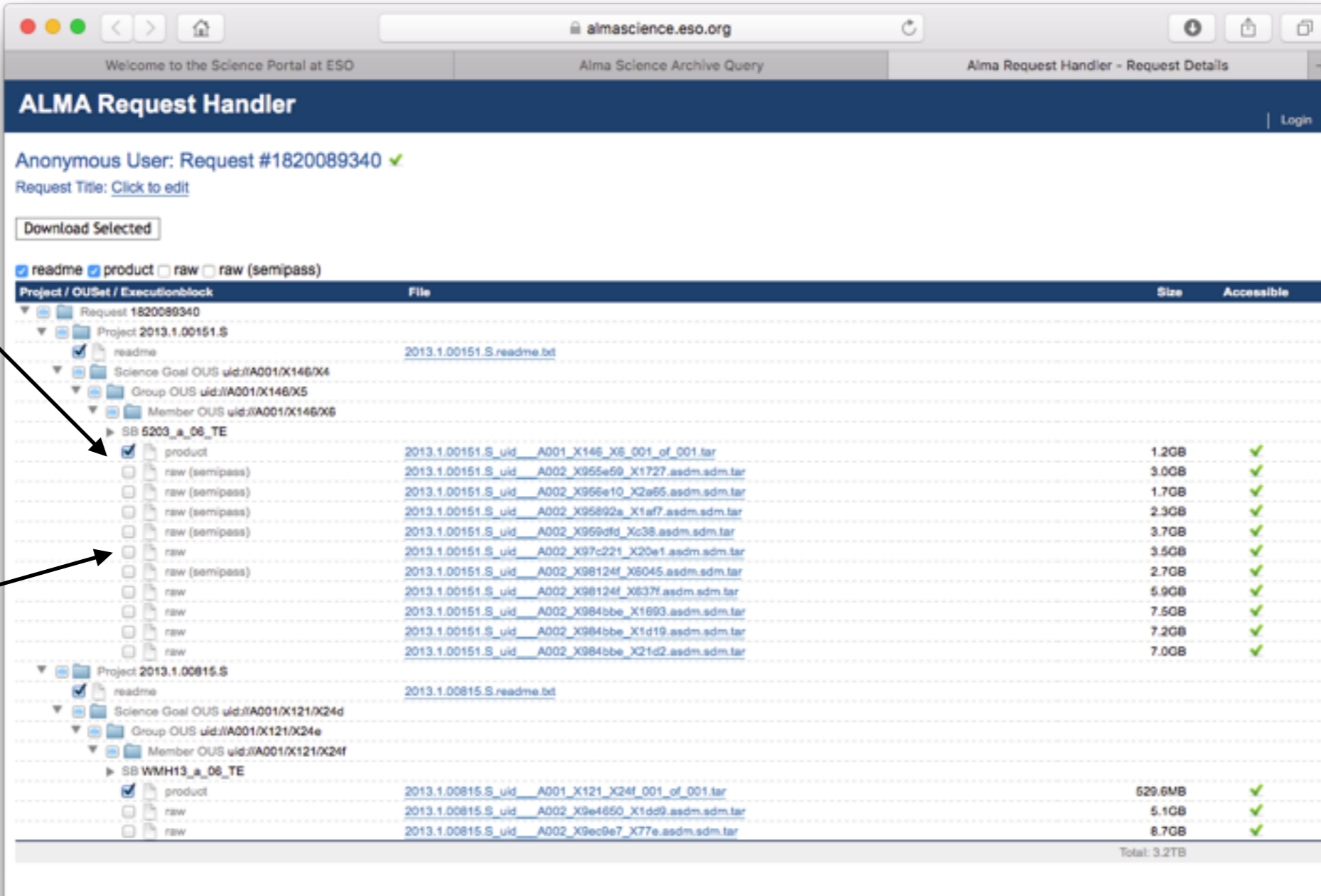
ALMA Request Handler

Anonymous User: Request #1820089340 ✓
Request Title: [Click to edit](#)

readme product raw raw (semipass)

Project / OUSet / Executionblock	File	Size	Accessible
Request 1820089340			
Project 2013.1.00151.S			
readme	2013.1.00151.S.readme.bt		
Science Goal OUS uid://A001/X146/X4			
Group OUS uid://A001/X146/X5			
Member OUS uid://A001/X146/X6			
SB 5203_a_06_TE			
<input checked="" type="checkbox"/> product	2013.1.00151.S_uid_A001_X146_X6_001_of_001.tar	1.2GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X955e59_X1727.asdm.sdm.tar	3.0GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X956e10_X2a65.asdm.sdm.tar	1.7GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X95892a_X1af7.asdm.sdm.tar	2.3GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X959dfd_Xc38.asdm.sdm.tar	3.7GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X97c221_X20e1.asdm.sdm.tar	3.5GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X98124f_X6045.asdm.sdm.tar	2.7GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X98124f_X837f.asdm.sdm.tar	5.9GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X984bbe_X1893.asdm.sdm.tar	7.5GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X984bbe_X1d19.asdm.sdm.tar	7.2GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X984bbe_X21d2.asdm.sdm.tar	7.0GB	✓
Project 2013.1.00815.S			
readme	2013.1.00815.S.readme.bt		
Science Goal OUS uid://A001/X121/X24d			
Group OUS uid://A001/X121/X24e			
Member OUS uid://A001/X121/X24f			
SB WMH13_a_06_TE			
<input checked="" type="checkbox"/> product	2013.1.00815.S_uid_A001_X121_X24f_001_of_001.tar	529.6MB	✓
<input type="checkbox"/> raw	2013.1.00815.S_uid_A002_X9e4650_X1dc9.asdm.sdm.tar	5.1GB	✓
<input type="checkbox"/> raw	2013.1.00815.S_uid_A002_X9ec9e7_X77e.asdm.sdm.tar	8.7GB	✓
		Total: 3.2TB	

Exploring the ALMA archive



ALMA Request Handler

Anonymous User: Request #1820089340 ✓
Request Title: [Click to edit](#)

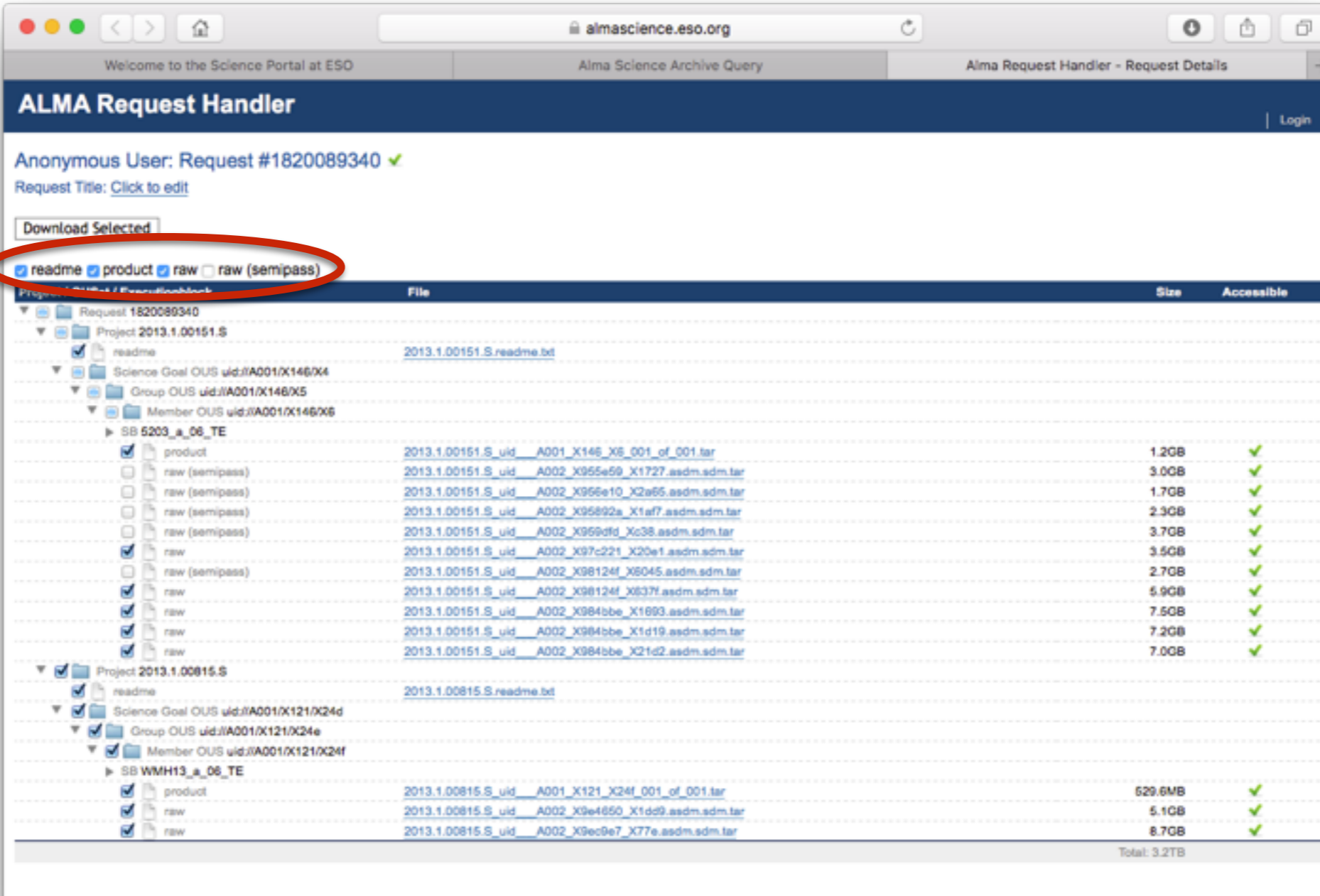
readme product raw raw (semipass)

Project / OUSet / Executionblock	File	Size	Accessible
Request 1820089340			
Project 2013.1.00151.S			
readme	2013.1.00151.S.readme.bt		
Science Goal OUS uid://A001/X146/X4			
Group OUS uid://A001/X146/X5			
Member OUS uid://A001/X146/X6			
SB 5203_a_06_TE			
<input checked="" type="checkbox"/> product	2013.1.00151.S_uid_A001_X146_X6_001_of_001.tar	1.2GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X955e59_X1727.asdm.sdm.tar	3.0GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X956e10_X2a65.asdm.sdm.tar	1.7GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X95892a_X1af7.asdm.sdm.tar	2.3GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X959dfd_Xc38.asdm.sdm.tar	3.7GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X97c221_X20e1.asdm.sdm.tar	3.5GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X98124f_X6045.asdm.sdm.tar	2.7GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X98124f_X837f.asdm.sdm.tar	5.9GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X984bbe_X1693.asdm.sdm.tar	7.5GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X984bbe_X1d19.asdm.sdm.tar	7.2GB	✓
<input type="checkbox"/> raw	2013.1.00151.S_uid_A002_X984bbe_X21d2.asdm.sdm.tar	7.0GB	✓
Project 2013.1.00815.S			
readme	2013.1.00815.S.readme.bt		
Science Goal OUS uid://A001/X121/X24d			
Group OUS uid://A001/X121/X24e			
Member OUS uid://A001/X121/X24f			
SB WMH13_a_06_TE			
<input checked="" type="checkbox"/> product	2013.1.00815.S_uid_A001_X121_X24f_001_of_001.tar	529.6MB	✓
<input type="checkbox"/> raw	2013.1.00815.S_uid_A002_X9e4650_X1dc9.asdm.sdm.tar	5.1GB	✓
<input type="checkbox"/> raw	2013.1.00815.S_uid_A002_X9ec9e7_X77e.asdm.sdm.tar	8.7GB	✓
			Total: 3.2TB

“Product” contains the scripts, images and cubes produced by the QA2 analyst

“Raw” contain the raw data, it is needed if you want to re-calibrate and/or re-image

Exploring the ALMA archive



Welcome to the Science Portal at ESO | Alma Science Archive Query | Alma Request Handler - Request Details

ALMA Request Handler

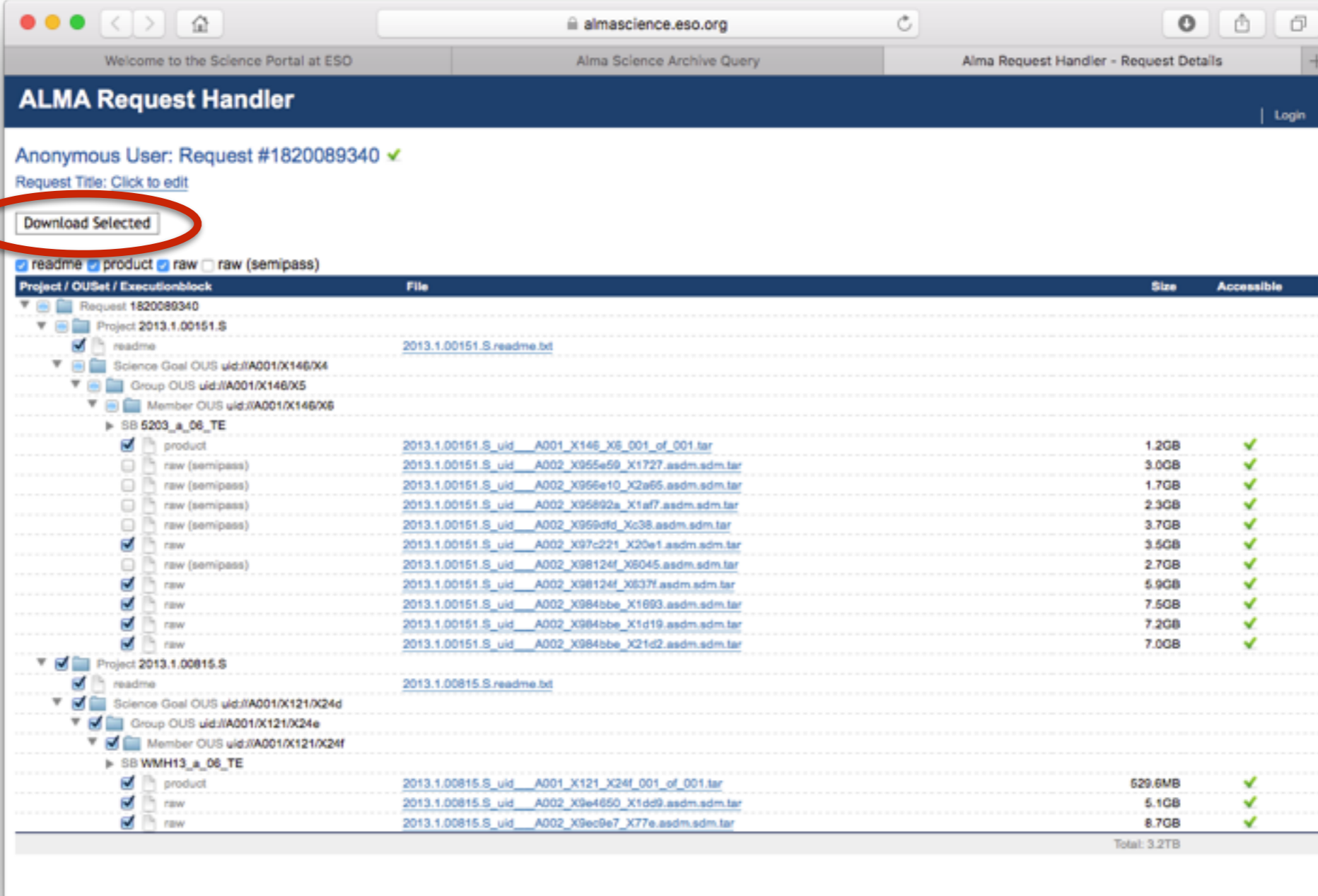
Anonymous User: Request #1820089340 ✓
Request Title: [Click to edit](#)

[Download Selected](#)

readme product raw raw (semipass)

File	Size	Accessible
Request 1820089340		
Project 2013.1.00151.S		
readme	2013.1.00151.S.readme.bt	
Science Goal OUS uid://A001/X146/X4		
Group OUS uid://A001/X146/X5		
Member OUS uid://A001/X146/X6		
SB 5203_a_06_TE		
product	2013.1.00151.S_uid_A001_X146_X6_001_of_001.tar	1.2GB ✓
raw (semipass)	2013.1.00151.S_uid_A002_X955e59_X1727.asdm.sdm.tar	3.0GB ✓
raw (semipass)	2013.1.00151.S_uid_A002_X956e10_X2a65.asdm.sdm.tar	1.7GB ✓
raw (semipass)	2013.1.00151.S_uid_A002_X95892a_X1af7.asdm.sdm.tar	2.3GB ✓
raw (semipass)	2013.1.00151.S_uid_A002_X959dfd_Xc38.asdm.sdm.tar	3.7GB ✓
raw	2013.1.00151.S_uid_A002_X97c221_X20e1.asdm.sdm.tar	3.5GB ✓
raw (semipass)	2013.1.00151.S_uid_A002_X98124f_X6045.asdm.sdm.tar	2.7GB ✓
raw	2013.1.00151.S_uid_A002_X98124f_X837f.asdm.sdm.tar	5.9GB ✓
raw	2013.1.00151.S_uid_A002_X984bbe_X1893.asdm.sdm.tar	7.5GB ✓
raw	2013.1.00151.S_uid_A002_X984bbe_X1d19.asdm.sdm.tar	7.2GB ✓
raw	2013.1.00151.S_uid_A002_X984bbe_X21d2.asdm.sdm.tar	7.0GB ✓
Project 2013.1.00815.S		
readme	2013.1.00815.S.readme.bt	
Science Goal OUS uid://A001/X121/X24d		
Group OUS uid://A001/X121/X24e		
Member OUS uid://A001/X121/X24f		
SB WMH13_a_06_TE		
product	2013.1.00815.S_uid_A001_X121_X24f_001_of_001.tar	529.6MB ✓
raw	2013.1.00815.S_uid_A002_X9e4650_X1dc9.asdm.sdm.tar	5.1GB ✓
raw	2013.1.00815.S_uid_A002_X9ec9e7_X77e.asdm.sdm.tar	8.7GB ✓
		Total: 3.2TB

Exploring the ALMA archive



Welcome to the Science Portal at ESO | Alma Science Archive Query | Alma Request Handler - Request Details

ALMA Request Handler

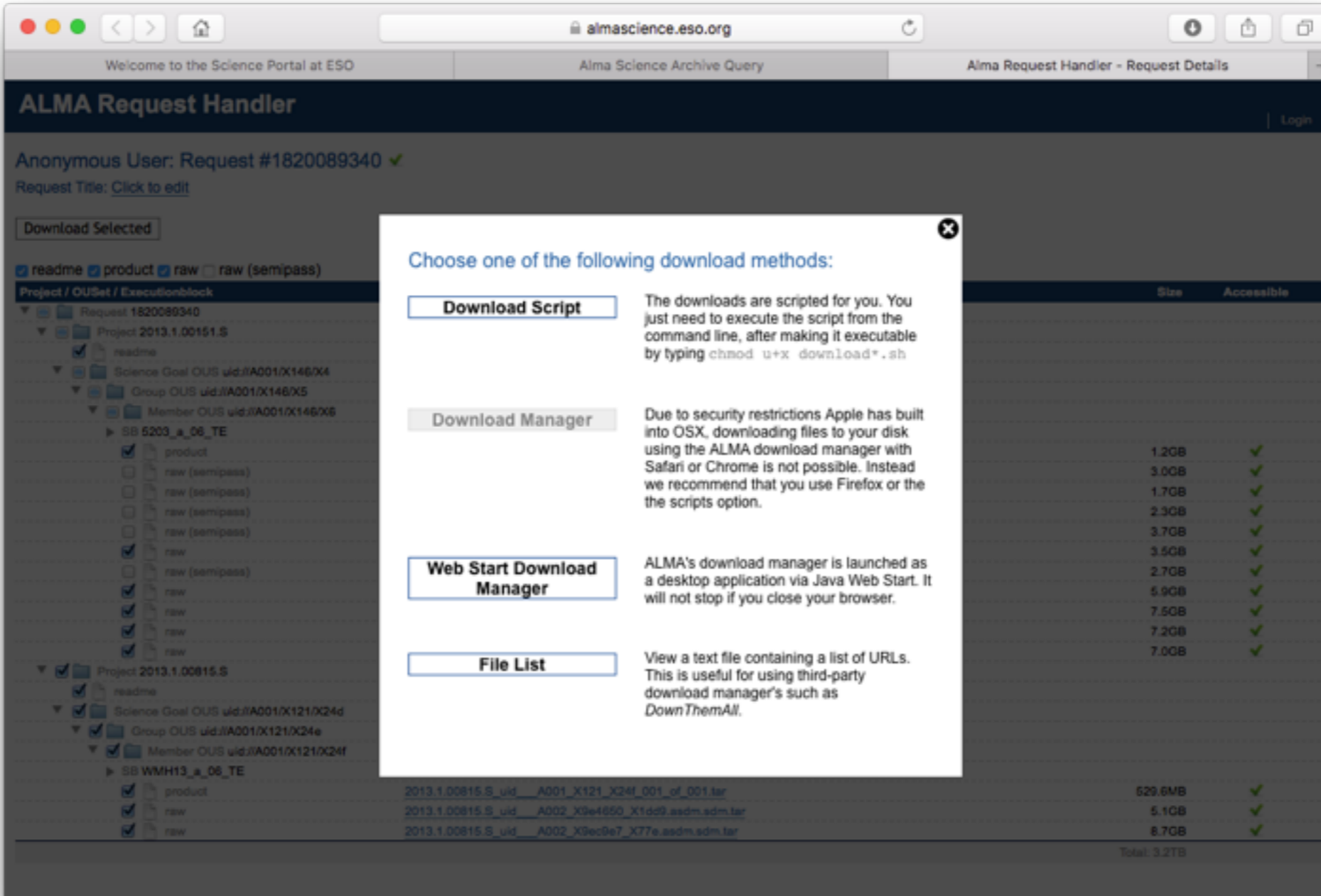
Anonymous User: Request #1820089340 ✓
Request Title: [Click to edit](#)

Download Selected

readme product raw raw (semipass)

Project / OUSet / Executionblock	File	Size	Accessible
Request 1820089340			
Project 2013.1.00151.S			
readme	2013.1.00151.S.readme.bt		
Science Goal OUS uid://A001/X146/X4			
Group OUS uid://A001/X146/X5			
Member OUS uid://A001/X146/X6			
SB 5203_a_06_TE			
<input checked="" type="checkbox"/> product	2013.1.00151.S_uid_A001_X146_X6_001_of_001.tar	1.2GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X955e59_X1727.asdm.sdm.tar	3.0GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X956e10_X2a65.asdm.sdm.tar	1.7GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X95892a_X1af7.asdm.sdm.tar	2.3GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X959dfd_Xc38.asdm.sdm.tar	3.7GB	✓
<input checked="" type="checkbox"/> raw	2013.1.00151.S_uid_A002_X97c221_X20e1.asdm.sdm.tar	3.5GB	✓
<input type="checkbox"/> raw (semipass)	2013.1.00151.S_uid_A002_X98124f_X6045.asdm.sdm.tar	2.7GB	✓
<input checked="" type="checkbox"/> raw	2013.1.00151.S_uid_A002_X98124f_X837f.asdm.sdm.tar	5.9GB	✓
<input checked="" type="checkbox"/> raw	2013.1.00151.S_uid_A002_X984bbe_X1693.asdm.sdm.tar	7.5GB	✓
<input checked="" type="checkbox"/> raw	2013.1.00151.S_uid_A002_X984bbe_X1d19.asdm.sdm.tar	7.2GB	✓
<input checked="" type="checkbox"/> raw	2013.1.00151.S_uid_A002_X984bbe_X21d2.asdm.sdm.tar	7.0GB	✓
Project 2013.1.00815.S			
<input checked="" type="checkbox"/> readme	2013.1.00815.S.readme.bt		
<input checked="" type="checkbox"/> Science Goal OUS uid://A001/X121/X24d			
<input checked="" type="checkbox"/> Group OUS uid://A001/X121/X24e			
<input checked="" type="checkbox"/> Member OUS uid://A001/X121/X24f			
SB WMH13_a_06_TE			
<input checked="" type="checkbox"/> product	2013.1.00815.S_uid_A001_X121_X24f_001_of_001.tar	529.6MB	✓
<input checked="" type="checkbox"/> raw	2013.1.00815.S_uid_A002_X9e4650_X1dc9.asdm.sdm.tar	5.1GB	✓
<input checked="" type="checkbox"/> raw	2013.1.00815.S_uid_A002_X9ec9e7_X77e.asdm.sdm.tar	8.7GB	✓
			Total: 3.2TB

Exploring the ALMA archive



The screenshot shows the ALMA Request Handler interface. A modal dialog titled "Choose one of the following download methods:" is open in the center. The dialog offers four options: "Download Script", "Download Manager", "Web Start Download Manager", and "File List".

Download Script: The downloads are scripted for you. You just need to execute the script from the command line, after making it executable by typing `chmod u+x download*.sh`

Download Manager: Due to security restrictions Apple has built into OSX, downloading files to your disk using the ALMA download manager with Safari or Chrome is not possible. Instead we recommend that you use Firefox or the the scripts option.

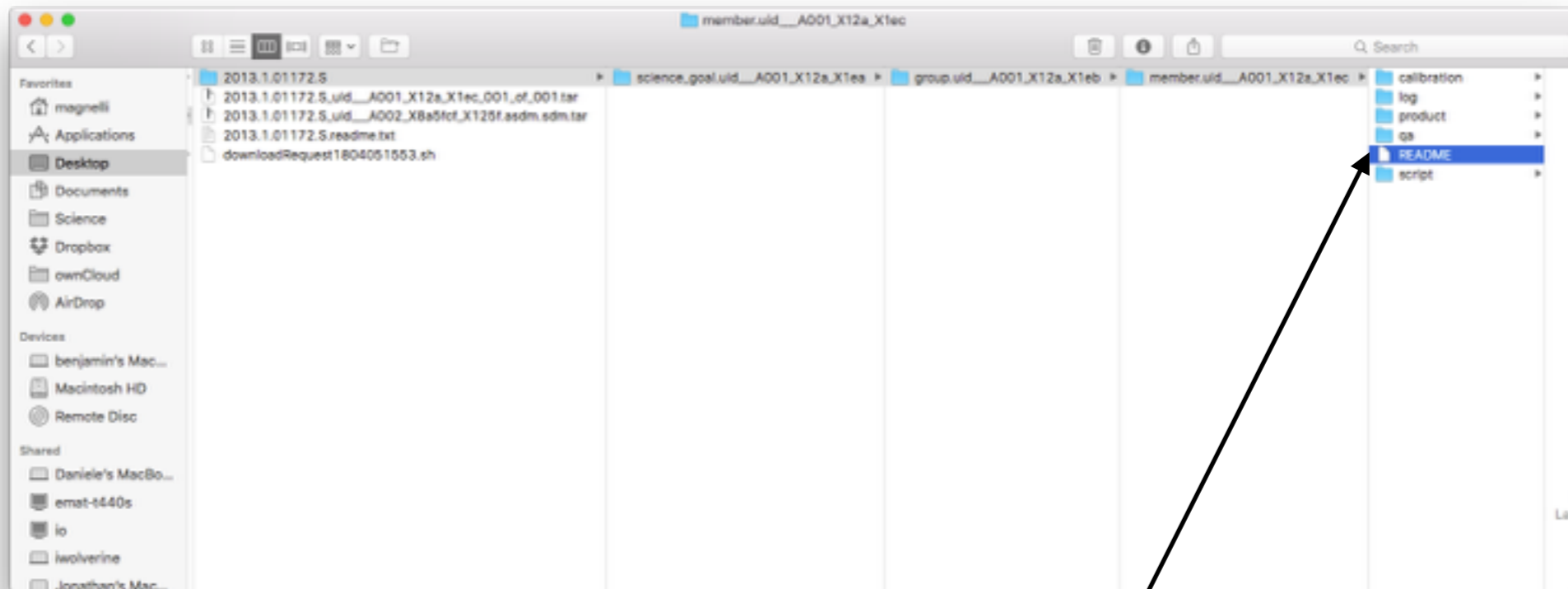
Web Start Download Manager: ALMA's download manager is launched as a desktop application via Java Web Start. It will not stop if you close your browser.

File List: View a text file containing a list of URLs. This is useful for using third-party download manager's such as *DownThemAll*.

In the background, a table lists files with columns for "Size" and "Accessible".

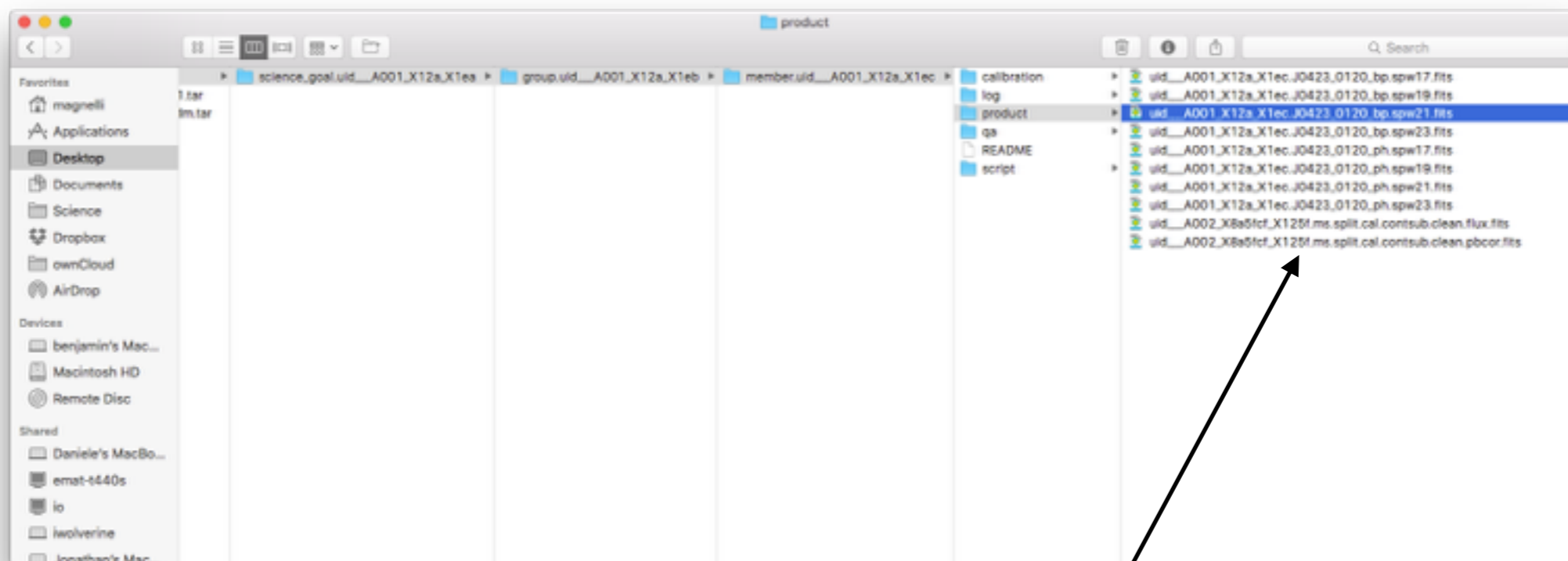
File Name	Size	Accessible
2013.1.00815.S_uid_A001_X121_X24f_001_of_001.tar	529.6MB	✓
2013.1.00815.S_uid_A002_X3e4650_X1dd9.asdm.adm.tar	5.1GB	✓
2013.1.00815.S_uid_A002_X3ec9e7_X77e.asdm.adm.tar	6.7GB	✓
Total: 3.2TB		

Exploring the ALMA archive



This “README” contains information about the delivered products as well as about the way to re-calibrate and/or re-image the data

Exploring the ALMA archive



Cube produced by the QA2 analyst

The ALMA archive can also be access programatically using the external python package **ASTROQUERY**

<https://astroquery.readthedocs.org/en/latest/>

ASTROQUERY allows querying and retrieving data from many large observatories including ALMA.

As a simple example, querying the ALMA Archive for the source M83 and retrieving all the corresponding data is done by

```
from astroquery.alma import Alma
import numpy
# Querying the ALMA Science Archive for source M83
result = Alma.query_object('M83')
# Extracting a list of Member ObsUnitSets
member_ous = numpy.unique(result['Member ous id'])
# Creating an ALMA astroquery instance and downloading all data the identified Member OUS
myAlma = Alma()
myAlma.cache_location = '/big/external/drive/'
myAlma.retrieve_data_from_uid(member_ous[0])
```

ASTROQUERY is the preferred way to query the ALMA archive for long lists of sources. Examples on the usage of the package for ALMA data are available at :

<https://astroquery.readthedocs.org/en/latest/alma/alma.html>

- The **ALMA** archive is a ever growing database, containing already several thousands of hours of observations
- The web interface and astroquery package render queries and retrieval of data from the **ALMA** archive very easy
- Many scientific breakthroughs are certainly hidden in the **ALMA** archive !