ALMA Data Products

Adele Plunkett
NRAO

Associated Universities, Inc.

Atacama Large Millimeter/submillimeter Array

This talk is for you if…

- You are PI or co-I of an ALMA project with data in hand, or soon to be delivered (i.e. Cycle 5 and/or Cycle 6) .
- You want to start searching the ALMA archive for data.
- You have a fabulous science case that will be essential to follow-up with ALMA in future cycles.

This talk will be available online for reference after this workshop.

The condensed version

- Data are delivered after passing Quality Assurance (QA)
- Download data from *Archive Query* and *Request Handler* tools on the ALMA Science Portal
- Delivered data include:
  - Calibration tables and diagnostics
  - Preliminary images (better products may be possible with more careful continuum identification & interactive cleaning)
  - Instructions on how to proceed (weblog!)
- See Sections 11- 13, and Appendix C of ALMA Technical Handbook (Cycle 6)

The reference I often use (or refer others to):

https://help.almascience.org/index.php?/Knowledgebase/Article/View/375/

Knowledgebase:

What Cycle 4 or Cycle 5 Calibration and Imaging products will be delivered to me?

Posted by Catarina Ubach, Last modified by Sarah Wood on 24 May 2018 03:12 PM

What you see in your data package when you download it from the archive will depend on whether the imaging and calibration have been performed by the pipeline, or one or both via a manual process. Except for datasets that were put through the imaging pipeline, the data products are similar to those for Cycle 3, discussed in detail in http://almascience.org/documents-and-tools/cycle3/ALMAQA2Products3.0.pdf .

For Cycle 4 Imaging pipeline data and all of Cycle 5 data, the products are discussed in detail in http://almascience.org/documents-and-tools/cycle5/ALMAQA2Productsv5.1.pdf

In this article we give a quick guide to the data packages, and more detailed information on the imaging pipeline products for data processed after October 1 2016.

More details here:
https://almascience.nrao.edu/documents-and-tools/cycle5/ALMAQA2Productsv5.1.pdf

Goals of Quality Assurance (QA) Process

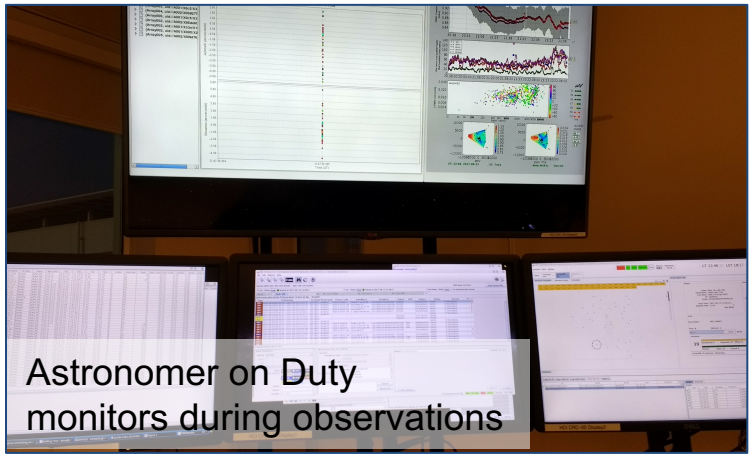
- Ensure reliable final data product
  - Desired sensitivity (as specified by PI)
  - Desired resolution (as specified by PI)
- Ensure calibration and QA imaging free from major artifacts

- 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 40 antennas in 12m array
  - Bandpass calibrator is strong enough
- Quick reduction may be run to check flux measurements and phase stability



Astronomer on Duty monitors during observations

Between Observations – QA1

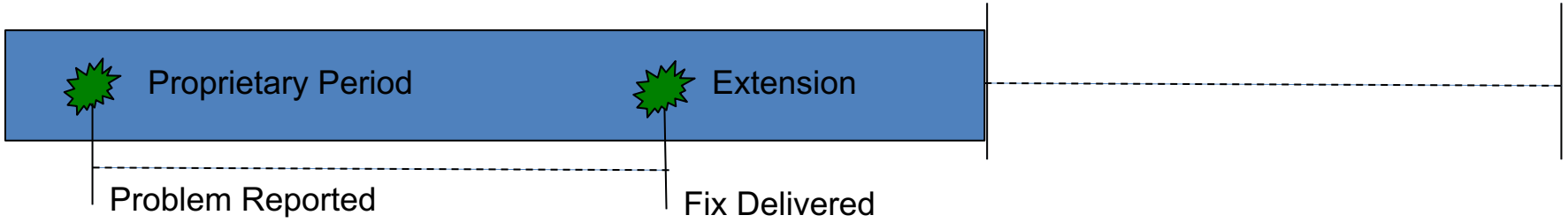
- “Regular array maintenance” timescales
- Slowly Varying Parameters (~MOUS timescales)
- General array calibration
  - Baseline measurements
  - Delays
- Antenna Calibrations
  - All-sky pointing
  - Focus curves
  - Beam patterns, etc.
- Observatory Calibrator Surveys
  - Solar-system and quasar flux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

After Observations – QA2

- Calibration by pipeline (~70%) 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

After Delivery – QA3

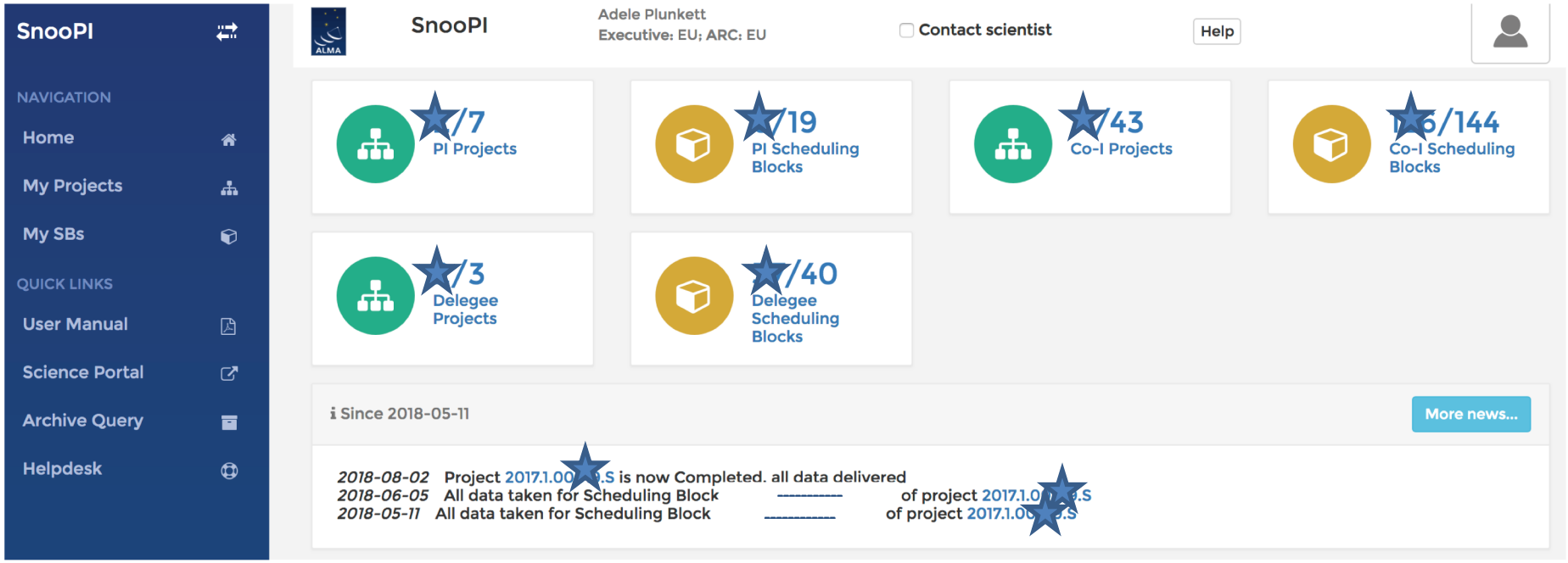
- Additional QA stage possibly triggered by PI reporting any issues underlying:
  - Data, observing procedure, calibration
- Re-evaluation of calibrated data products
  - Only occurs if QA0 -> QA2 miss something
- Likely results in fix being implemented and products re-ingested into ALMA archive
- Proprietary period extension *(within two months of delivery)*



- After two months, extension only until fix is delivered

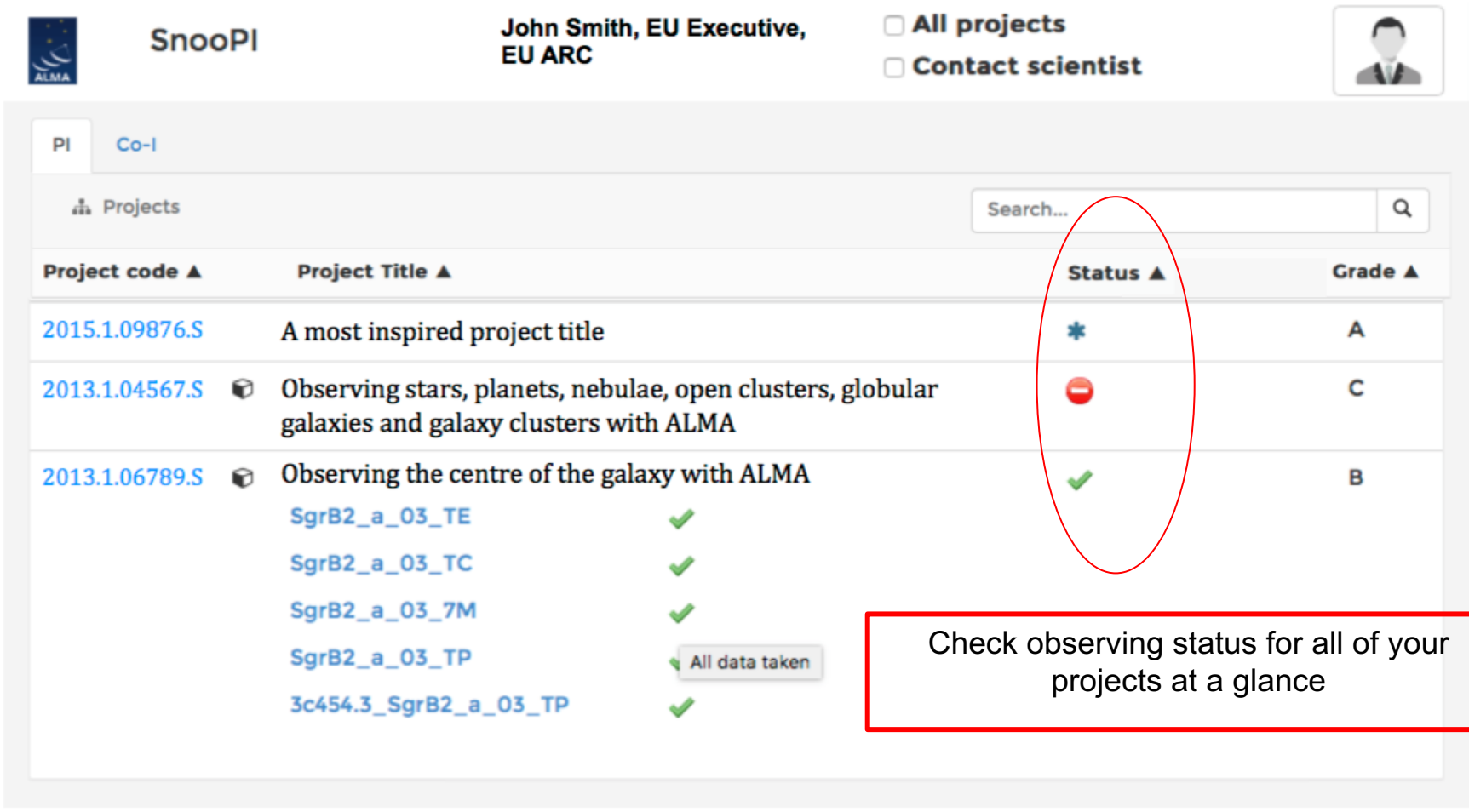
Monitor Project Status: *SnooPI*

https://almascience.nrao.edu/observing/snoopi



Monitor Project Status: *SnooPI*

Listing of PI (or co-PI) projects



Check observing status for all of your projects at a glance

Monitor Project Status: *SnooPI*

Listing of PI (or co-PI) projects


Approved but SBs not yet prepared


SBs prepared but are not yet in the observing queue

SBs are in the observing queue but not yet taken


Some data has been taken


All the data has been taken


Completed and delivered

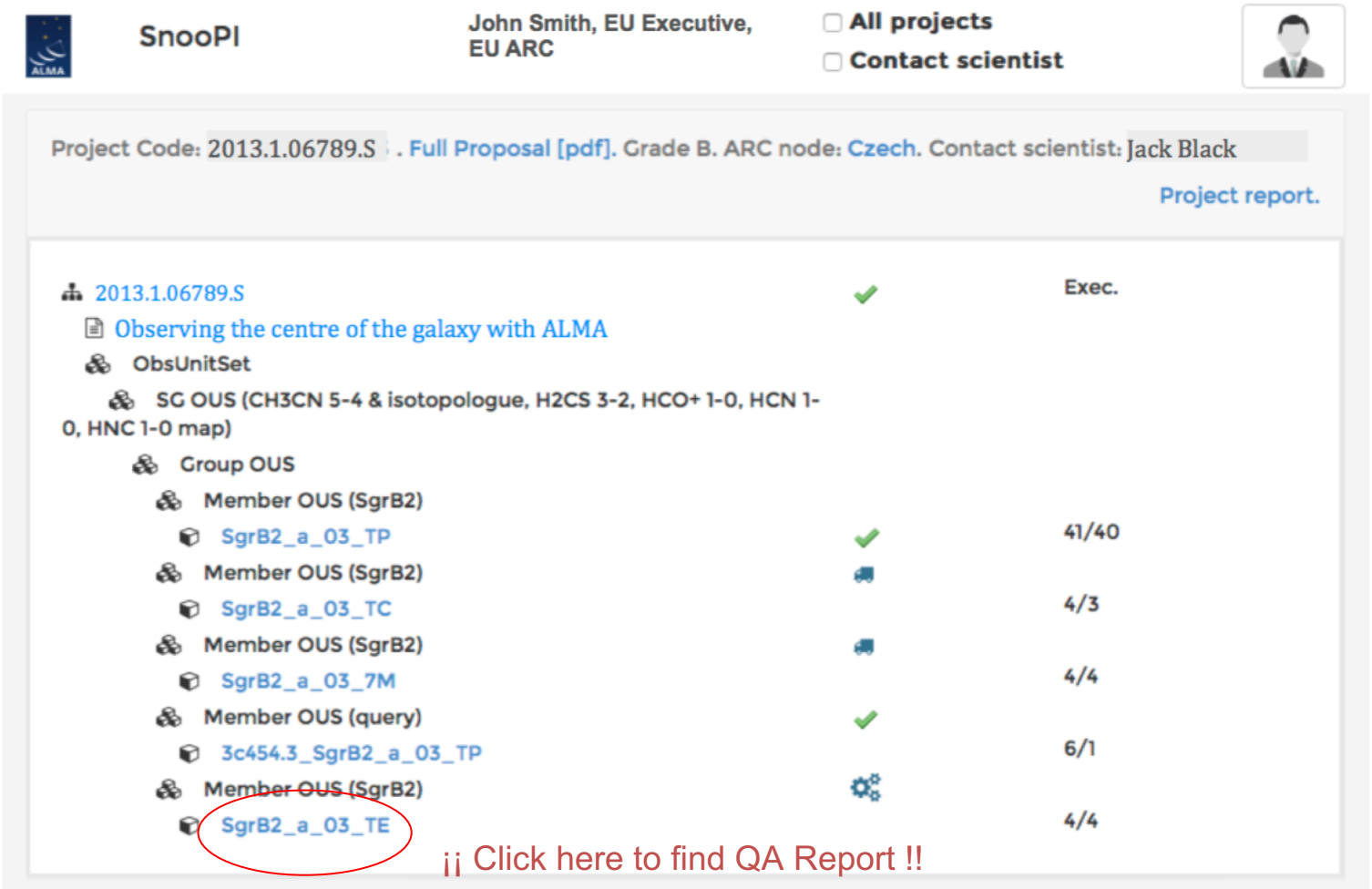
Project is timed out


Rejected at proposal review stage


Unknown status

Monitor Project Status: *SnooPI*

Single project view



Monitor Project Status: *SnooPI*

Single project view

 a set of gears indicate that the MOUS is being processed;

 a smiling face shows that the MOUS are ready to be delivered;

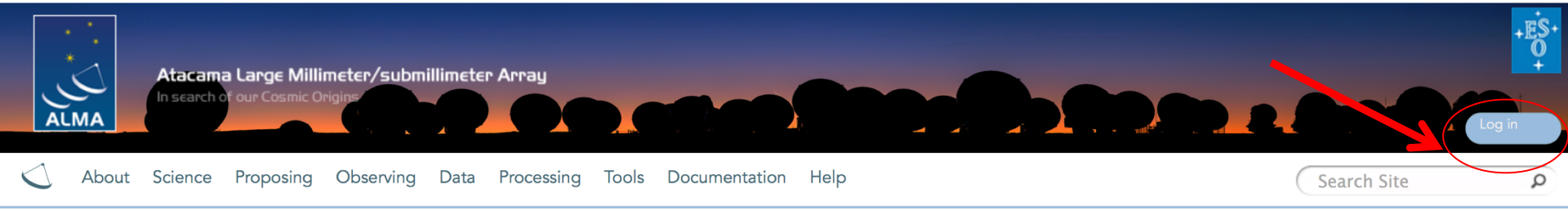
 a truck indicates that the MOUS has been delivered

Monitor Project Status:

Optional Emails

- Subscribe to email notification for updates on changes to project status through your Science Portal user profile
  - …
  - Phase2Submitted
  - Running
  - Partially Observed
  - Fully Observed
  - Pipeline Processing
  - …
- With or without optional emails, PIs always receive notification when new data are available

Optional emails



Observatory News

Additional Information for Cycle 6 Proposals
Feb 01, 2018

New Science Verification data are now available for download
Jan 22, 2018

Announcement of intent to release a new installment of Science Verification data

More...

EU ARC News

Researcher position available at the Nordic ARC node
Jan 10, 2018

Post-doc position available at the Italian ARC-node
Dec 20, 2017

2017 European Radio Interferometry School
May 11, 2017

More...

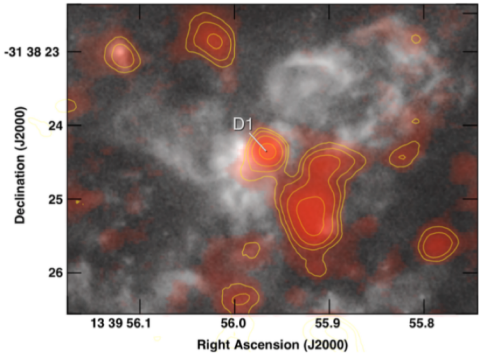
Status

ALMA Cycle 5 Config Schedule

Refereed publications: 916
Last observed source: W43-MM1
Current configuration: C43-5

More...

Science Highlights - Molecular Gas Within the Supernebula of the Dwarf Galaxy NGC 5253



One of the areas of extragalactic research which makes great use of ALMA's resolution and sensitivity is the study of the molecular gas properties of dwarf galaxies. In a recent study by Dr. Jean Turner and her collaborators, they make use of Band 7 ALMA observations to detect warm ^{12}CO(3-2) and ^{13}CO(3-2) emission (Cloud D1) from the core of a giant star-forming region, in the dwarf galaxy NGC 5253. This "supernebula" is the source of one-third of the galaxy's infrared luminosity and is in proximity to optical clusters with measured stellar ages of ~ 1 Myr. From radio recombination line analysis, the region is estimated to have 1400-1800 O stars..

Full Summary...

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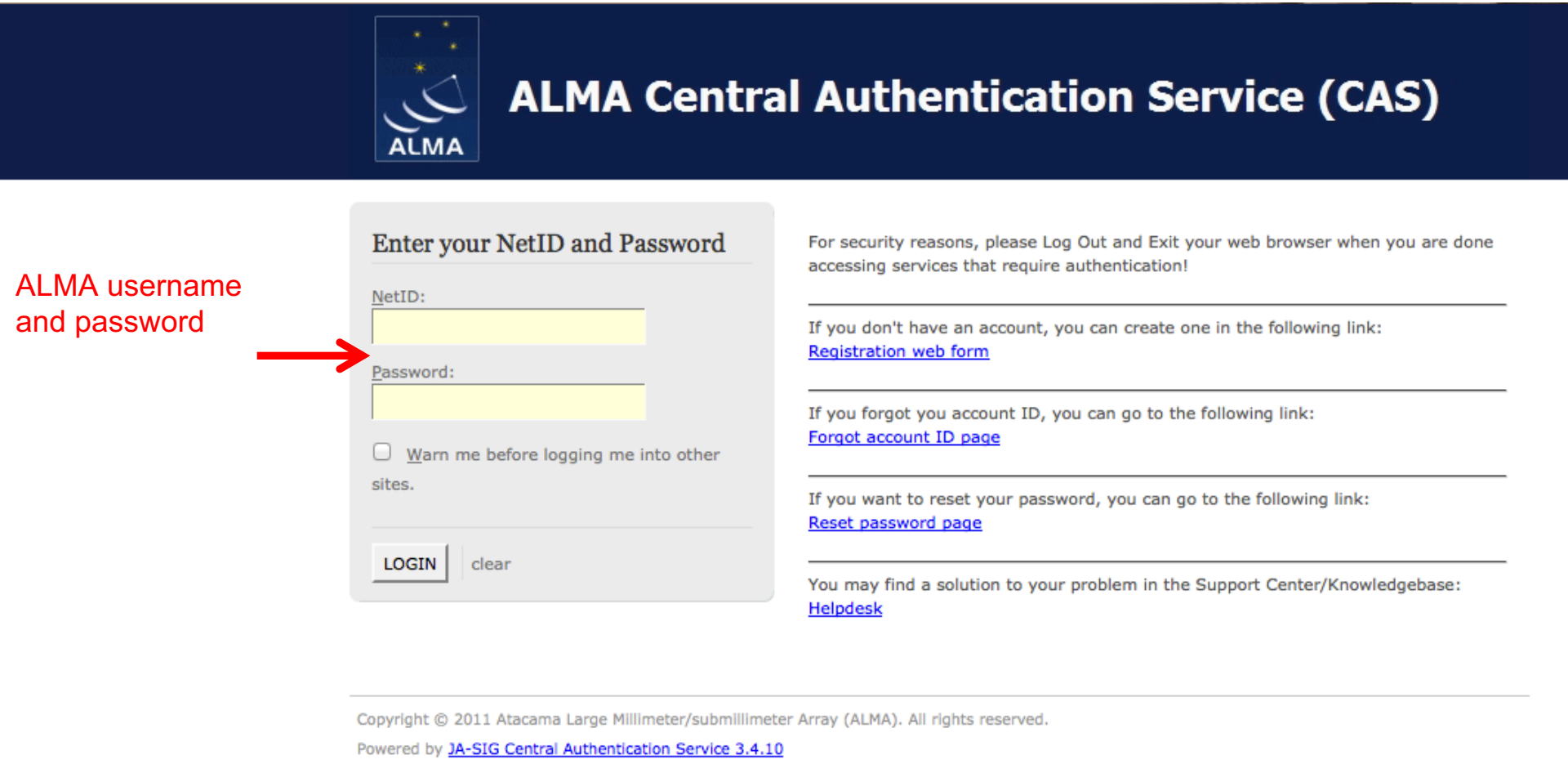
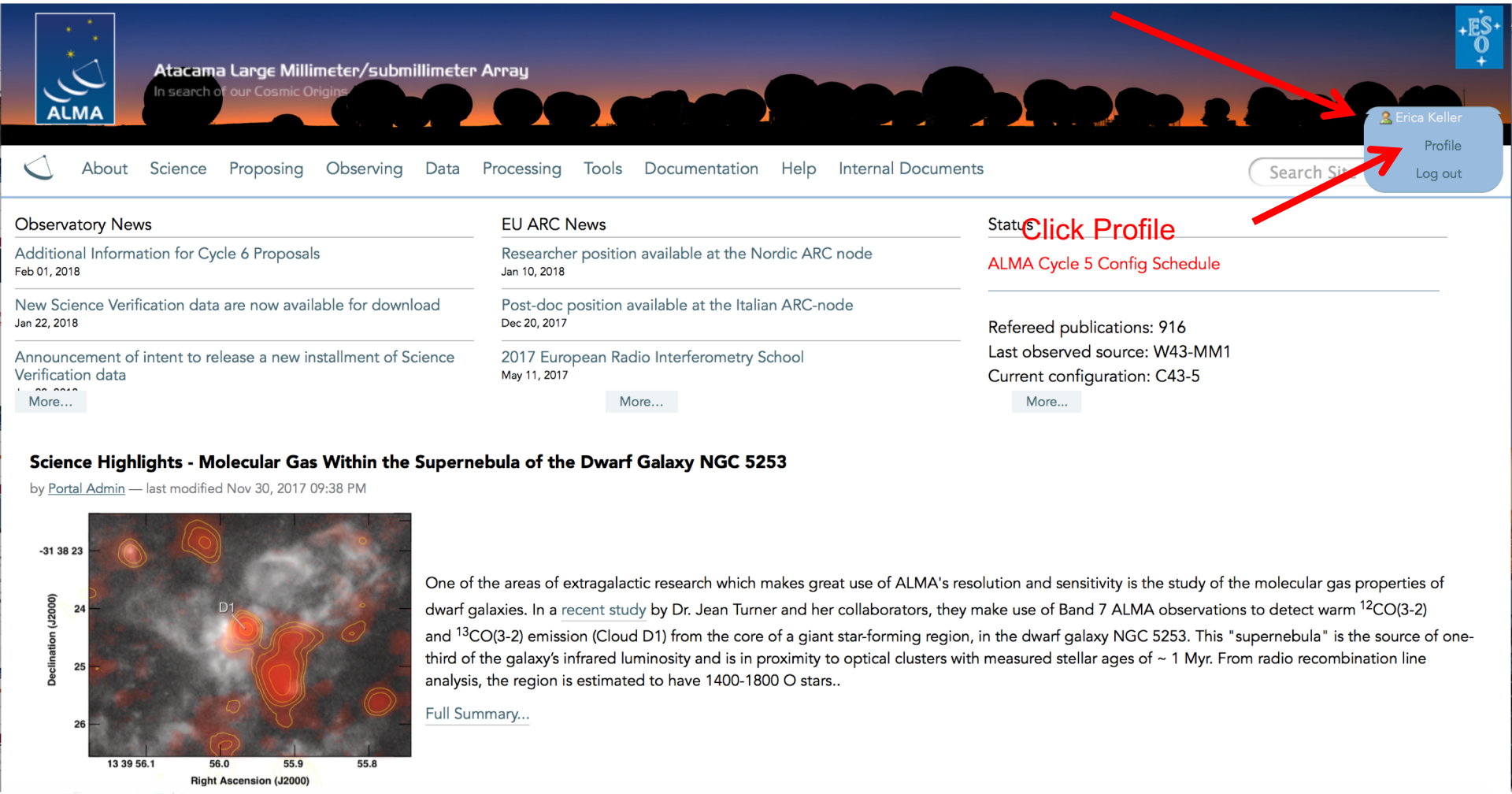
Optional emails



Optional emails

Click Name

Click Profile



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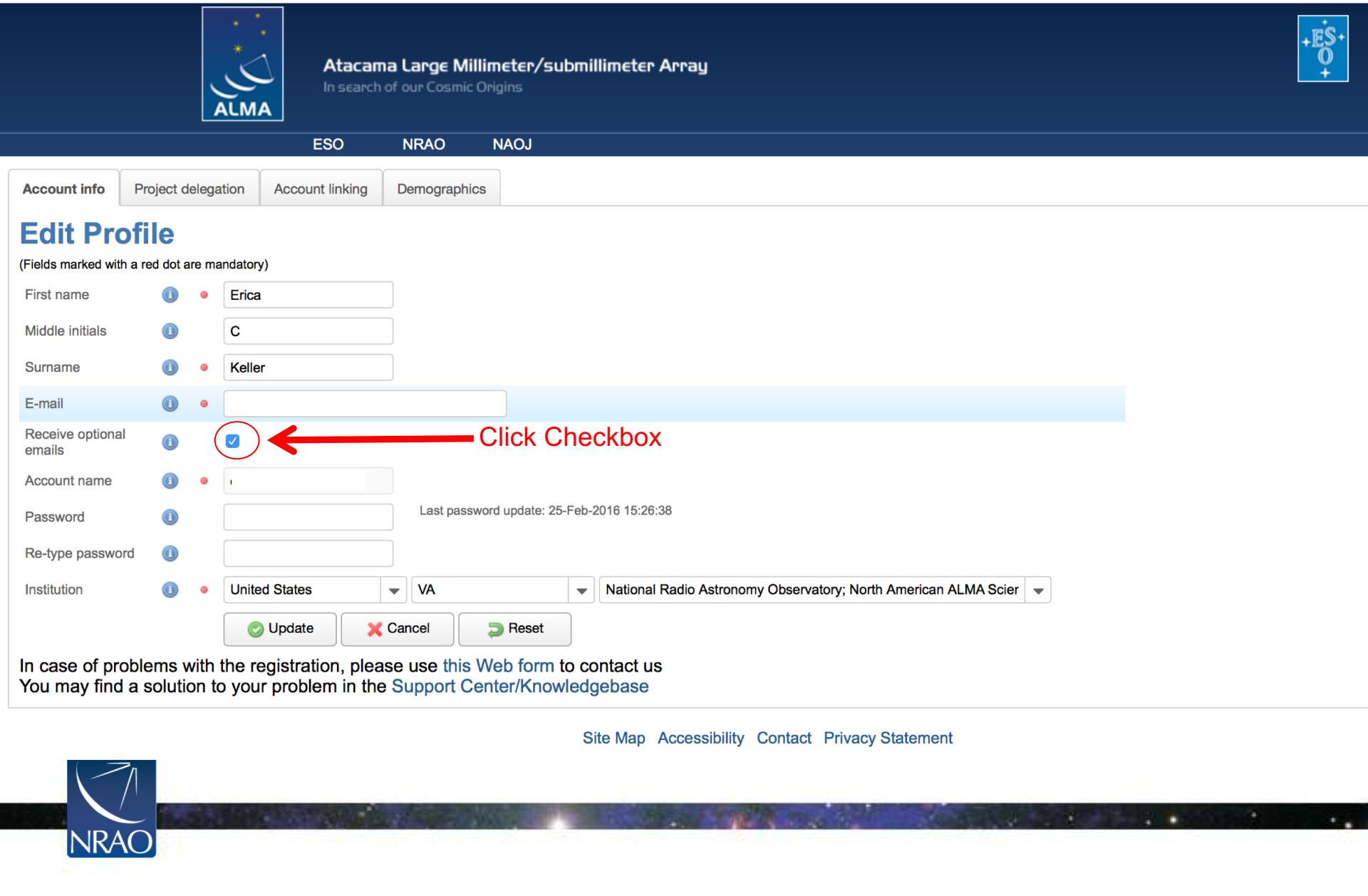
Optional emails



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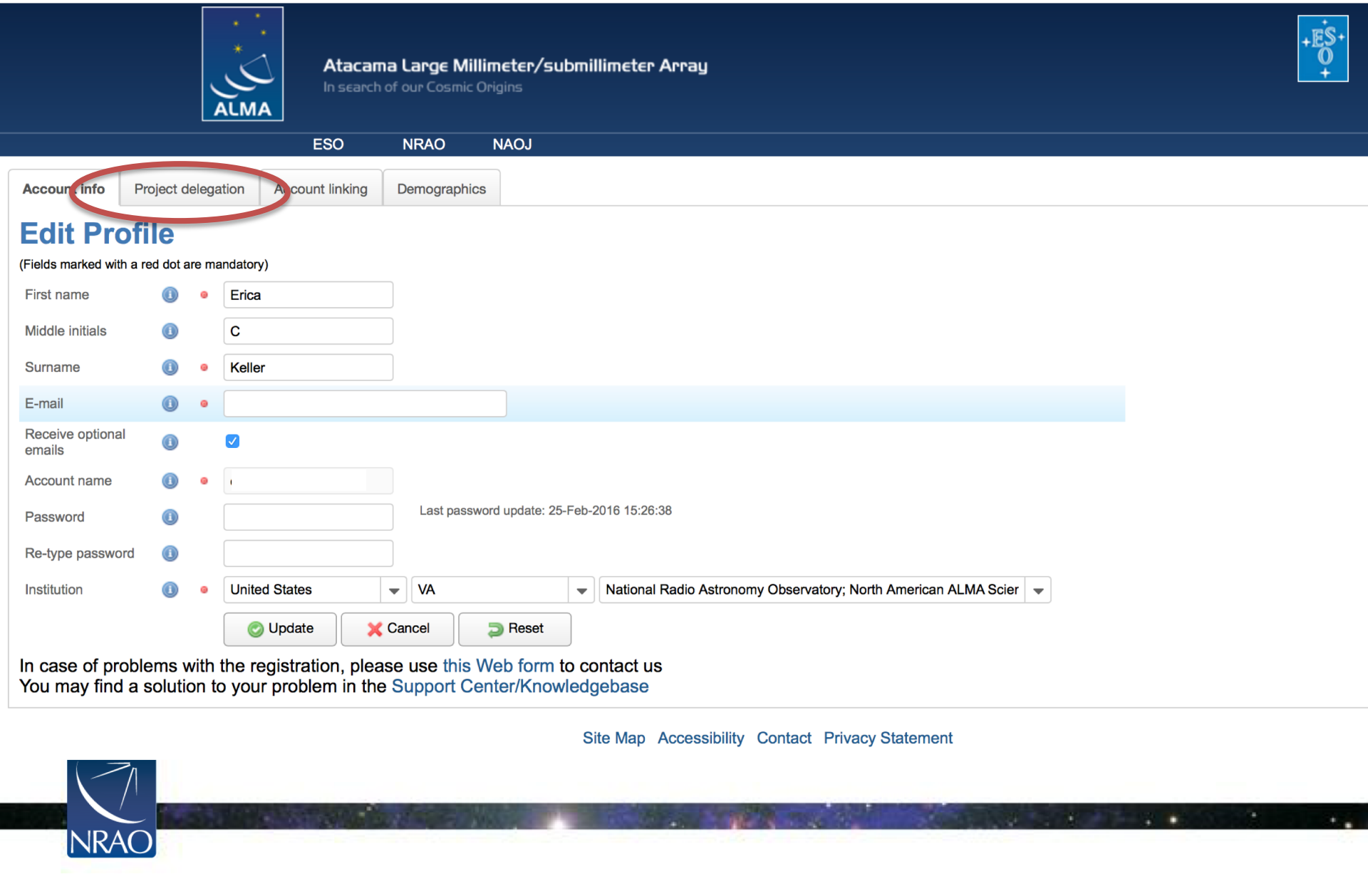
Data Delivery Email

- Sent when an individual MOUS passes QA2
- Data are ingested into the archive and made available at all Regional Centers
- This email only Sent to PI

- Included Metadata:
  - MOUS ID, Scheduling Block (SB) name, project title
- Included Instructions:
  - Downloading data
  - Delegating access for registered ALMA users
- Included Descriptions:
  - Proprietary period
  - *Note: Triggers start of proprietary period (Usually 12 months)*

Project delegation: how to



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Data Delivery Email (cont'd)

- Includes Links:
  - Archive query for MOUS package
  - Fully-calibrated MS (North America Only)
  - CASA download and mailing lists

- Publication Requirements:
  - ALMA acknowledgement
  - ARC specific acknowledgement
- Additional Support:
  - Funded face-to-face reduction visits to your home ARC
  - Contact info for your ARC Helpdesk

QA2 Data Products Package

After untarring the processed data we have a directory tree like this:

Project code
-- Science goal
-- Group OUS: Combination of member OUS's
-- Member OUS: May contain 12m, 7m, or Total Power observations
| -- **DATA DELIVERY PRODUCTS**

For example:

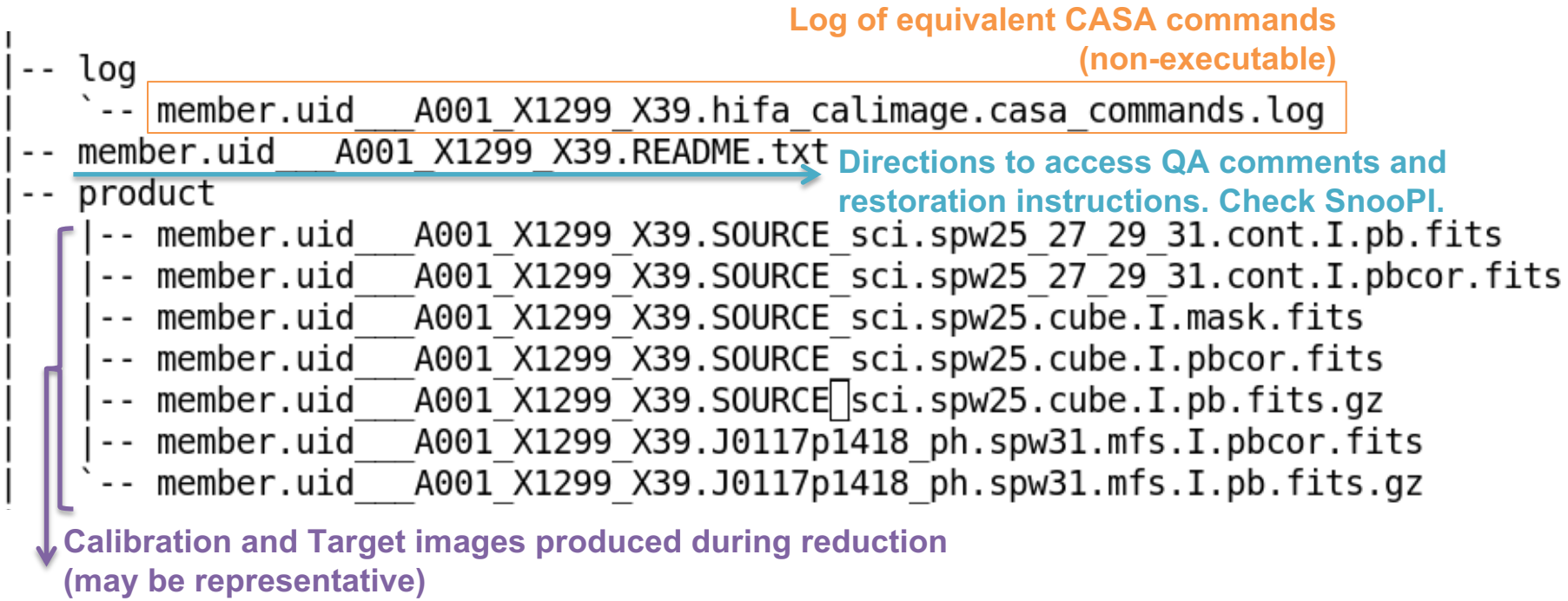
```
2017.1.05267.S/
`-- science_goal.uid___A001_X1299_X2z
    `-- group.uid___A001_X1299_X25
        `-- member.uid__A001_X1299_X39
            |-- calibration
            |-- log
            |-- member.uid___A001_X1299_X39.README.txt
            |-- product
            |-- qa
            |-- script
```

DATA DELIVERY PRODUCTS

Note, the exact structure of the data delivery products (especially README) depends on cycle and dataset (i.e. pipeline or manual).

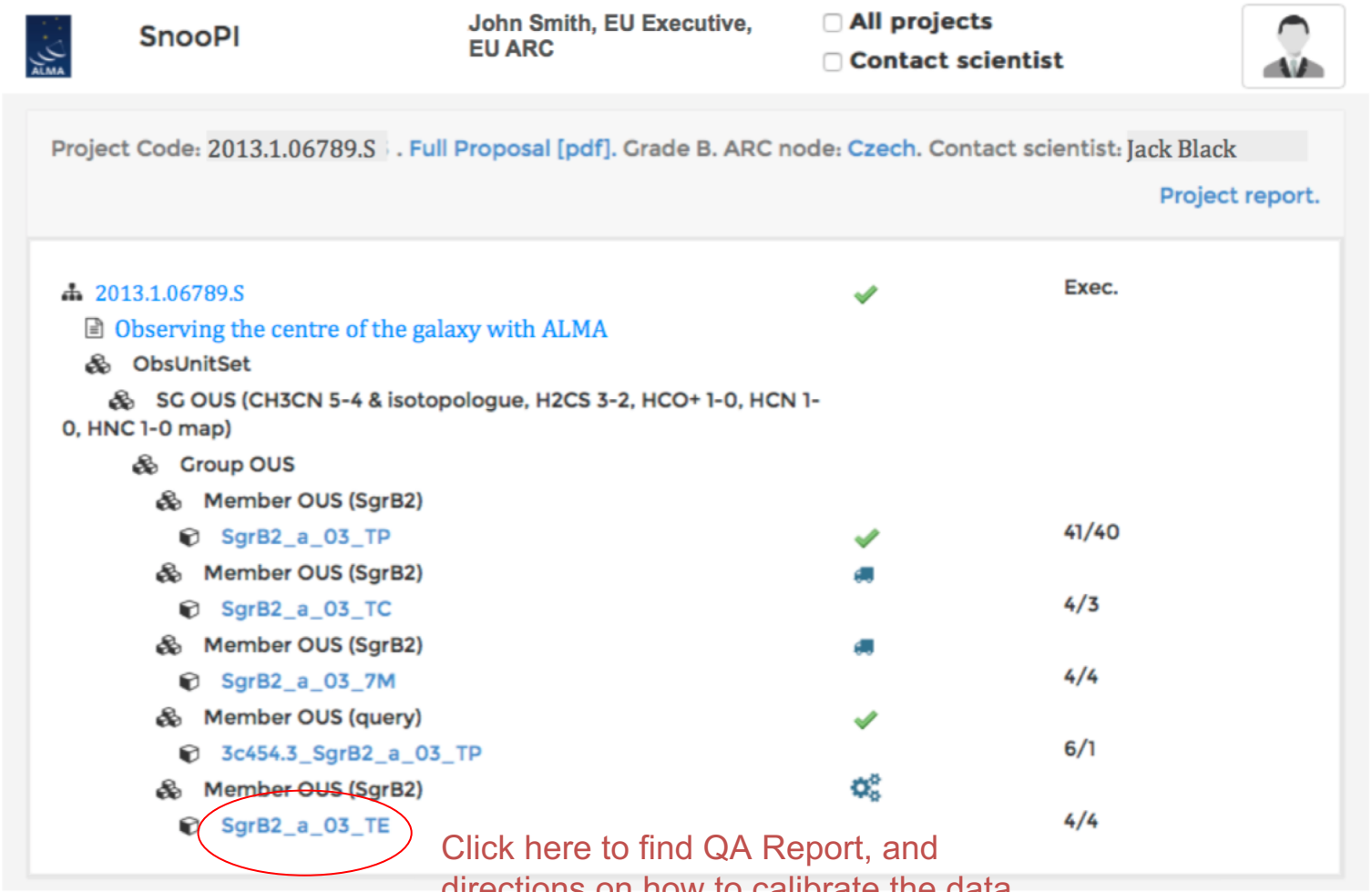
QA2 Data Products Package

The log and product directories



Monitor Project Status: *SnooPI*

Remember the project view



QA2 Data Products Package

The calibration directory

Contains manual flagging commands, continuum selection, flux measurements for calibrators

```
|-- calibration
|   |-- member.uid___A001_X1299_X39.hifa_calimage.auxproducts.tgz
|   |-- member.uid___A001_X1299_X39.session_1.auxcaltables.tgz
|   |-- member.uid___A001_X1299_X39.session_1.caltables.tgz
|   |-- uid___A002_Xc8ed15_X1a9.ms.calapply.txt
|   |-- uid___A002_Xc8ed15_X1a9.ms.flagversions.tgz
|   `-- uid___A002_Xc8ed15_X1a9_target.ms.auxcalapply.txt
```

Calibration tables generated by the pipeline

All flags will be restored during calibration

QA2 Data Products Package

The weblog, and calibration scripts

Weblog contains plots and images from reduction and imaging. Unpack this for lots of information!

```
|-- qa
|   `-- member.uid___A001_X1299_X39.hifa_calimage.weblog.tgz
`-- script
    |-- member.uid___A001_X1299_X39.calimage.pipeline_manifest.xml
    |-- member.uid___A001_X1299_X39.calimage.product_rename.txt
    |-- member.uid___A001_X1299_X39.hifa_calimage.casa_piperestorescript.py
    |-- member.uid___A001_X1299_X39.hifa_calimage.casa_pipescript.py
    |-- member.uid___A001_X1299_X39.hifa_calimage.pprequest.xml
    `-- member.uid___A001_X1299_X39.scriptForPI.py
```

Commands to re-run the pipeline

Run scriptForPI.py to restore calibration (and get calibrated measurement set data in directory called “calibrated”)

QA2 Data Products Package

Processed ALMA Data

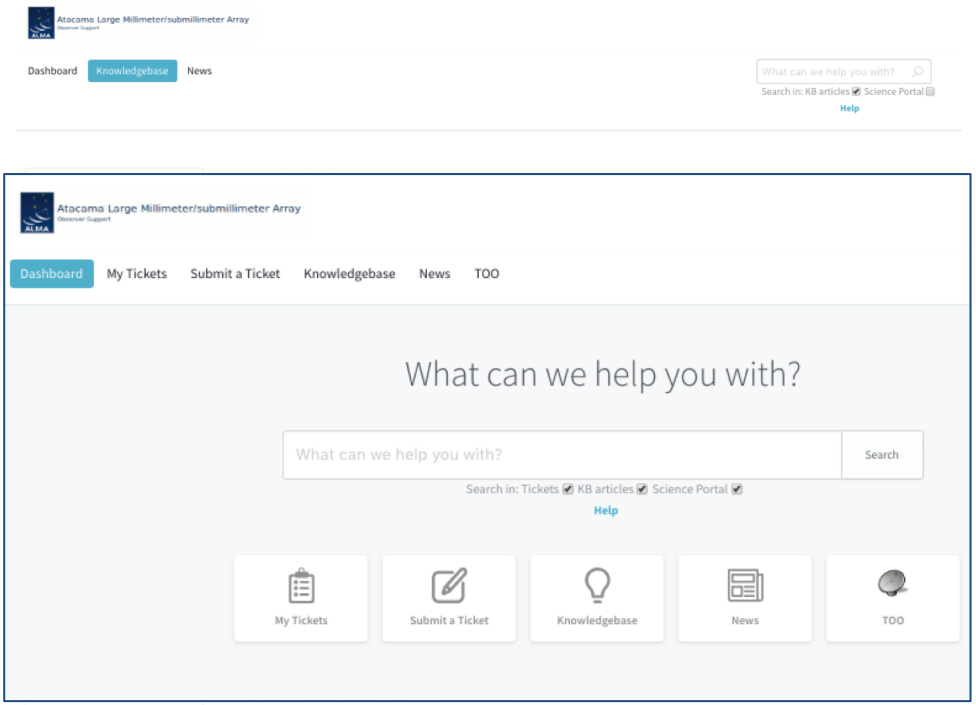
- **Summary:**
  - Check the README, access SnooPI
  - Image products are delivered to you in the “product” directory
  - Calibration/flagging files are saved in the “calibration” directory, but these *you* do not need to change or access directly.
  - You can run “script/scriptForPI.py” to obtain the *.ms calibrated data, for further imaging (** NA delivers the calibrated *.ms to PI)
- If the **imaging pipeline** has been run, the weblog includes the imaging steps. For **manual calibrations**, the QA information is in several files that together constitute a QA summary for the data.

At the beginning of Cycle 4, the Science Pipeline was enabled to also perform imaging. This increased the processing capacity of the QA2 team significantly. We refer to data processed by the imaging section of the Science Pipeline as **“pipeline-imaged”.** If it was processed by an analyst using CASA directly without the help of the pipeline, we call it **“manually imaged”**. In Cycle 5, ca. 60% of all science data is pipeline-imaged. The approval of the imaging products remains in the hands of the analysts and Data Reduction Managers. Note that manual imaging is sometimes performed on pipeline-calibrated datasets, occasionally in addition to pipeline-imaging. See https://almascience.org/processing/science-pipeline and chapter 13 of the Cycle 5 ALMA Technical Handbook for more details on the pipeline.

Resources After Delivery

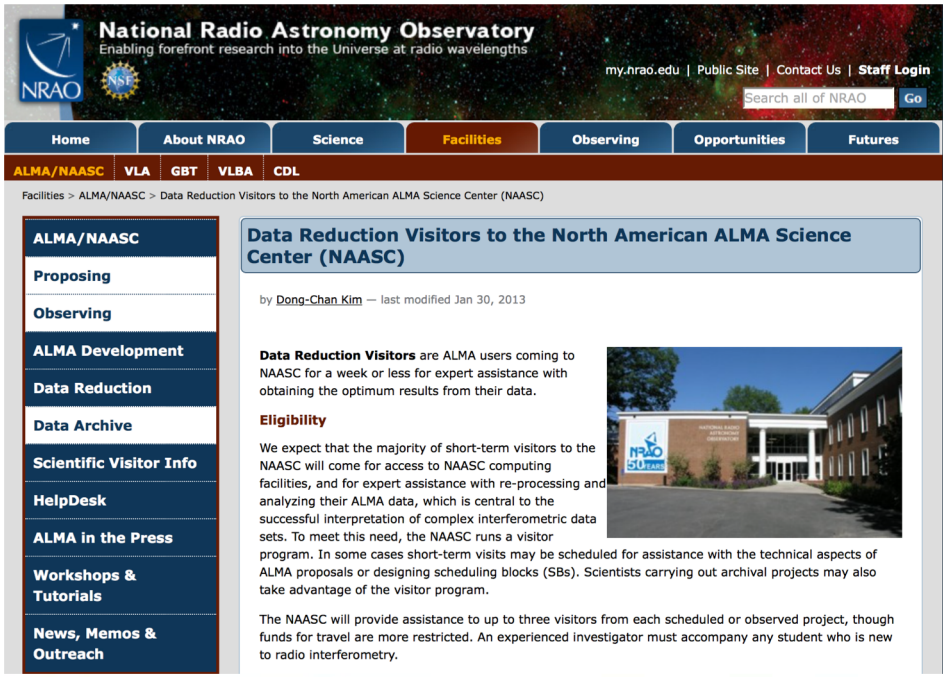
HelpDesk & Knowledgebase:

help.almascience.org



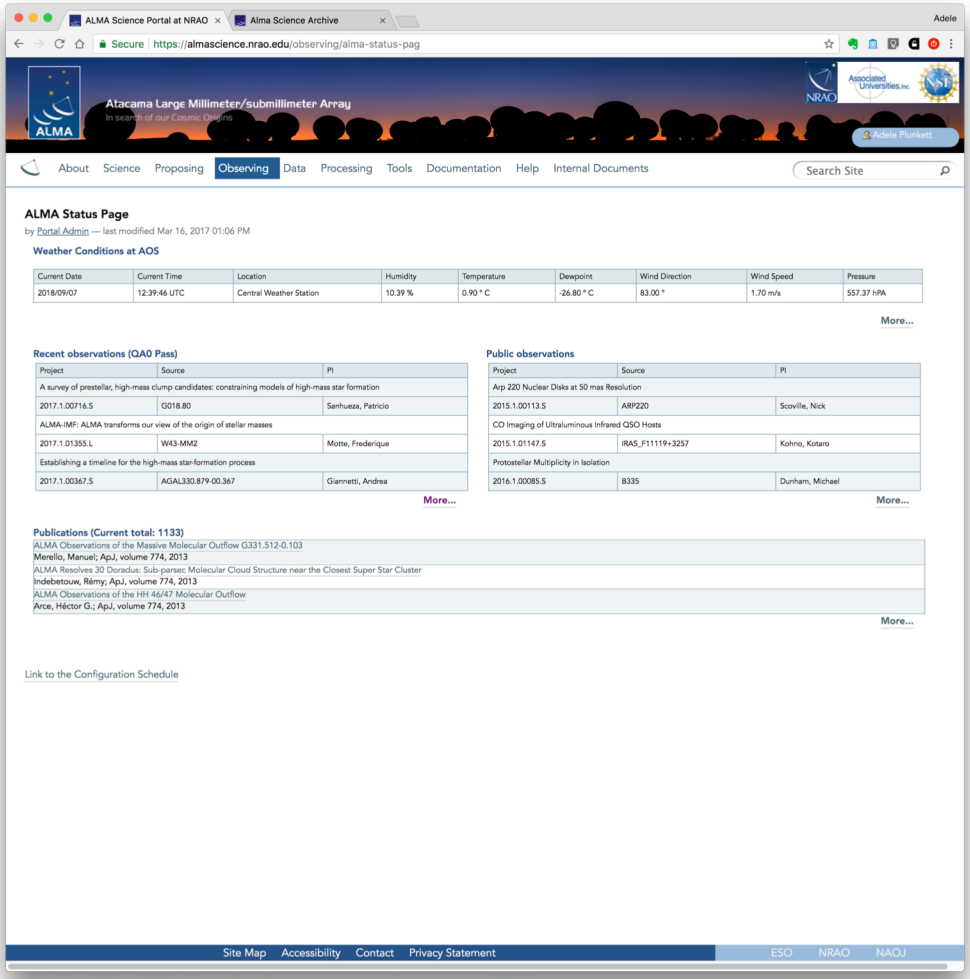
Face-to-Face visits in Charlottesville:

https://science.nrao.edu/facilities/alma/visitors-shortterm



Remember, you can monitor the current observations at ALMA.

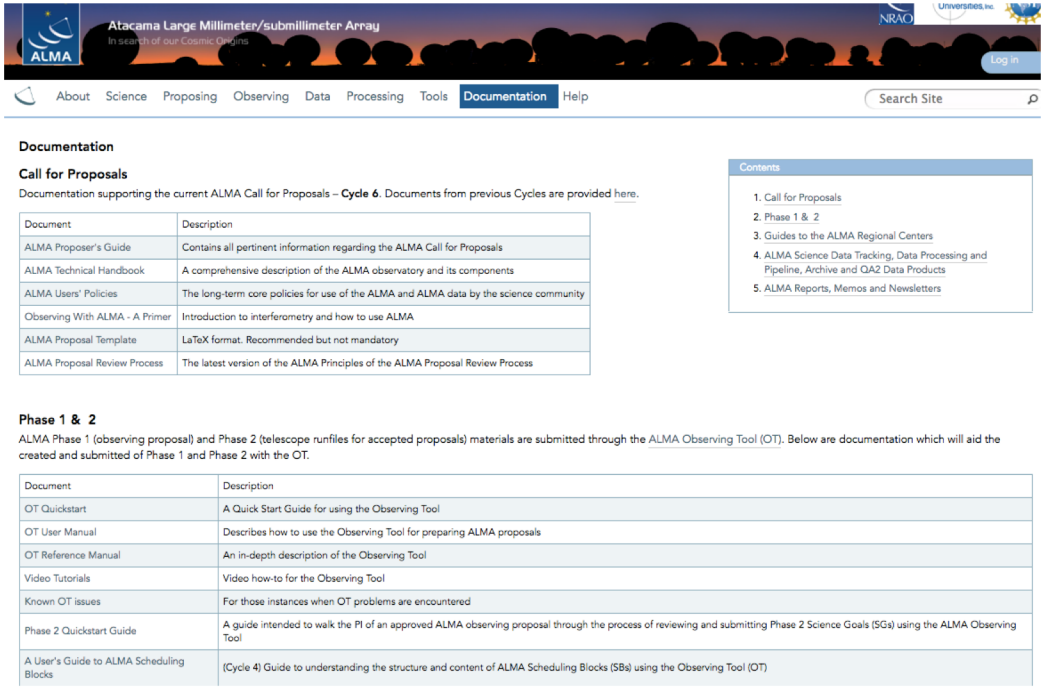
https://almascience.nrao.edu/observing/alma-status-pag



Wait, what about setting up my proposal/observations?

- Check out other ALMA Community Day events, includes *Proposal Preparation Process and Strategies + ALMA Data Products:*https://science.nrao.edu/facilities/alma/naasc-workshops/nrao-cd-chile18/program

- Search documentation online: https://almascience.nrao.edu/proposing/documents-and-tools

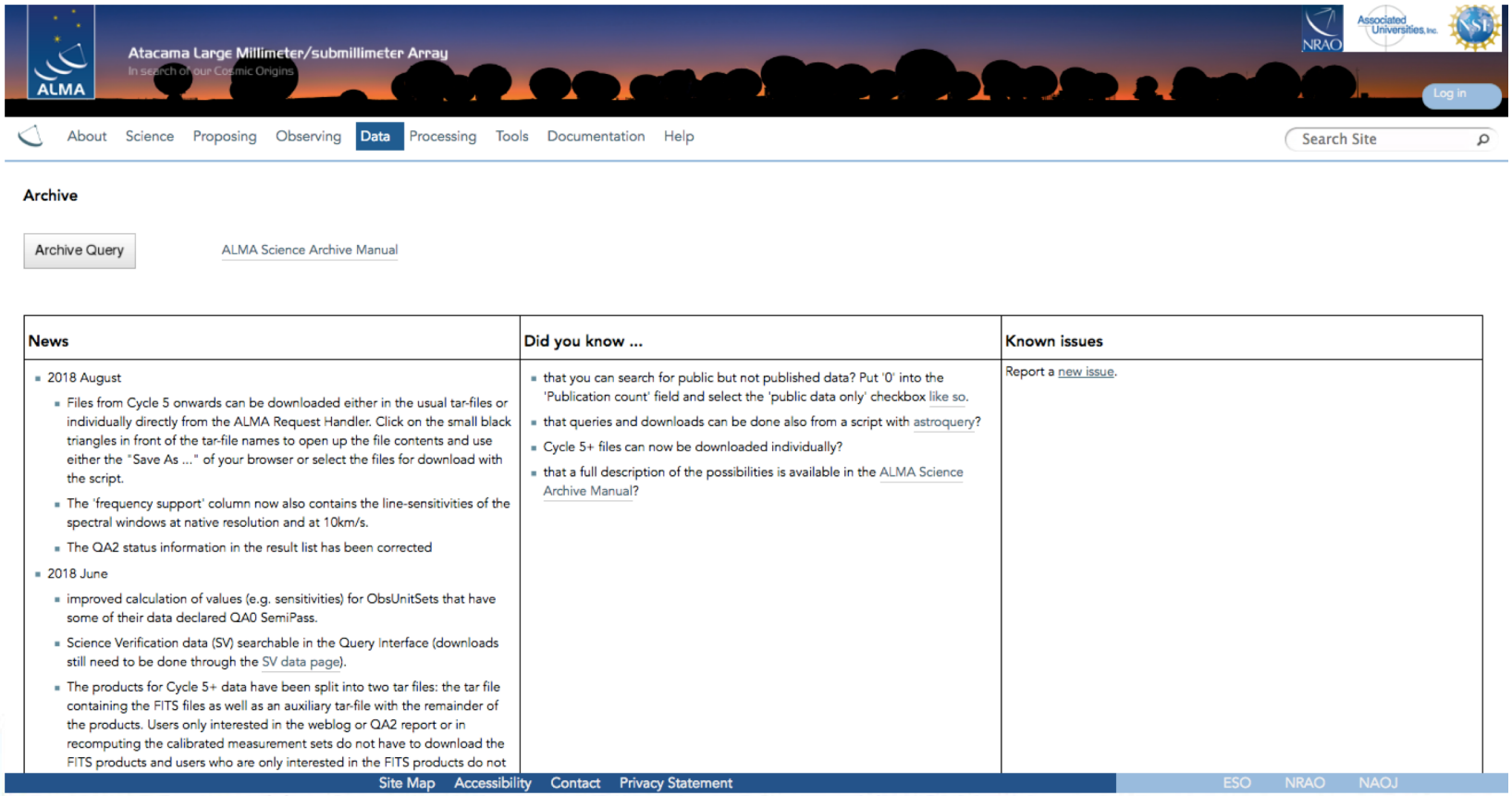


Retrieving ALMA Archival Data

** In case of lack of time, this will be available online.

How to find the archive

Go to the science portal: https://almascience.nrao.edu
(Later, it will prompt you to log-in to download your proprietary data.)
- Click on "Data" and select "Archive"



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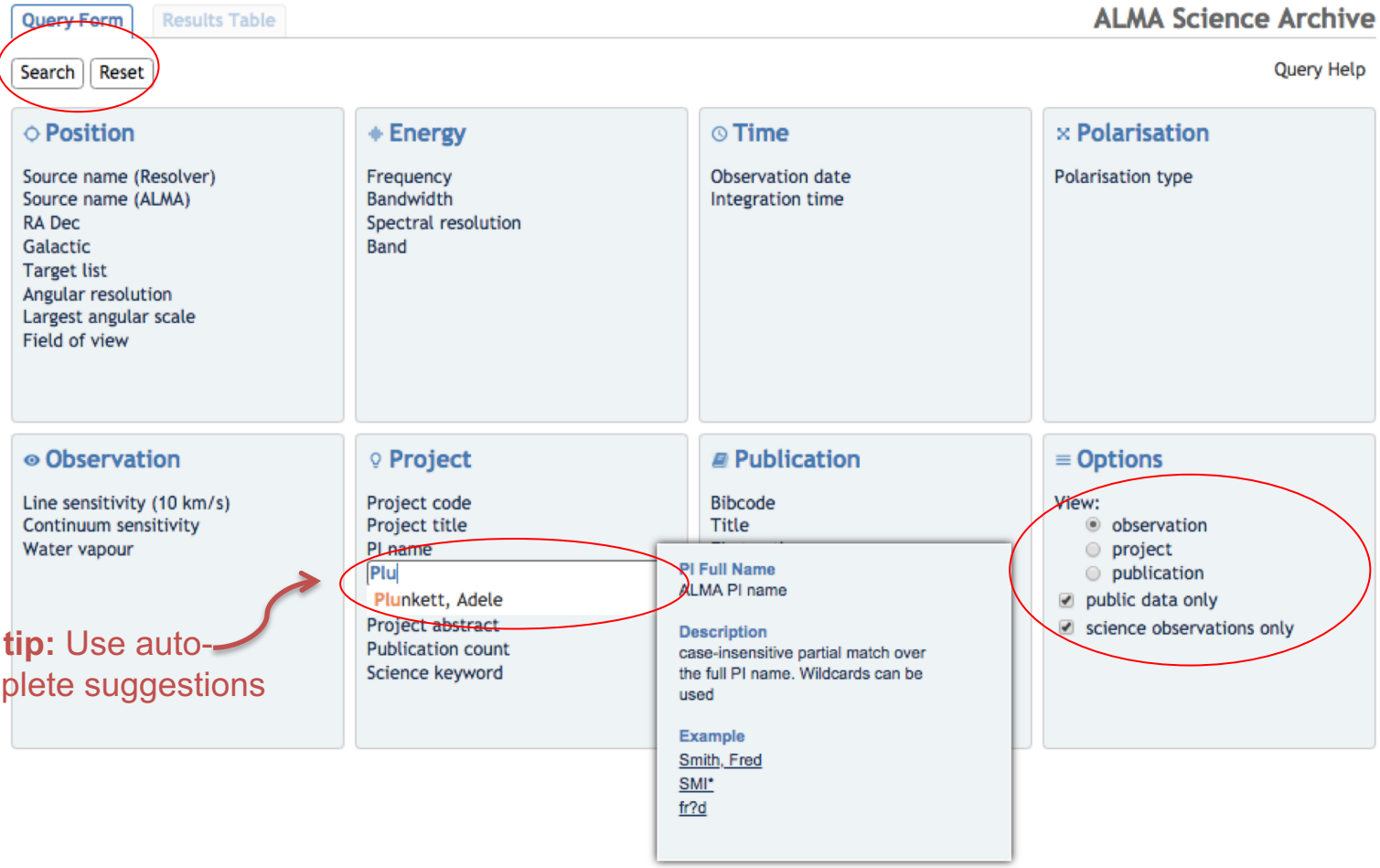
Find data in archive:

Archive Query http://almascience.nrao.edu/aq/



Archive Query

Query Form | Results Table

Submit download request

Results Bookmark | Export Table | Results Help

Showing 30 rows (30 before filtering). More columns

	Project code	Source name	RA	Dec	Band	Integration	*Release date* ▲	Velocity resolution	Frequency support
Filter:								m/s	
☑	2012.1.00090.S	S2CLS_UDS110	02:18:48.44	-05:18:05.0	7	9.326	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☑	2012.1.00090.S	S2CLS_UDS156	02:18:24.23	-05:22:53.4	7	8.836	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☑	2012.1.00090.S	S2CLS_UDS160	02:18:23.86	-05:11:36.2	7	8.842	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS168	02:18:20.34	-05:31:41.6	7	8.843	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☑	2012.1.00090.S	S2CLS_UDS199	02:18:07.38	-04:44:11.7	7	8.812	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS204	02:18:03.01	-05:28:39.8	7	8.873	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS216	02:17:56.80	-04:52:39.6	7	8.82	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS252	02:17:37.79	-05:20:10.2	7	8.827	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS286	02:17:25.76	-05:25:36.5	7	9.657	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS292	02:17:21.85	-05:19:03.3	7	8.815	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS298	02:17:19.90	-05:09:36.4	7	9.55	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS334	02:17:02.81	-04:57:24.9	7	8.856	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS408	02:16:22.59	-05:11:06.0	7	8.819	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS421	02:16:17.62	-05:09:02.0	7	8.803	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz
☐	2012.1.00090.S	S2CLS_UDS47	02:19:24.97	-05:09:19.9	7	8.785	2014-11-07T09:35:00.000	27236.96	336.00..351.99GHz

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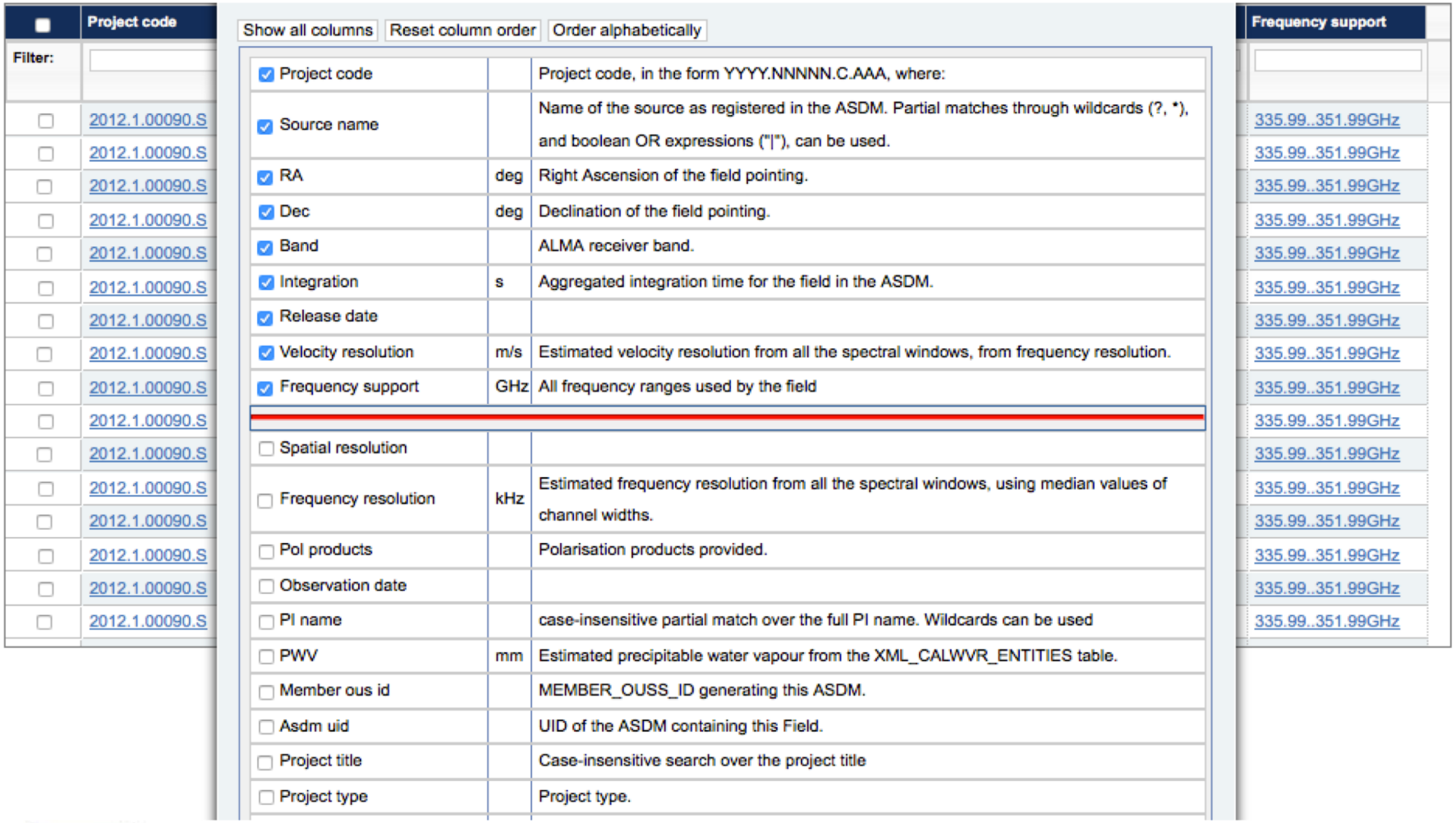
Archive Query: more columns



Project code	Frequency support
Filter:	
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz
2012.1.00090.S	335.99..351.99GHz

Show all columns | Reset column order | Order alphabetically

☑ Project code		Project code, in the form YYYY.NNNNN.C.AAA, where:
☑ Source name		Name of the source as registered in the ASDM. Partial matches through wildcards (?, *), and boolean OR expressions ("|"), can be used.
☑ RA	deg	Right Ascension of the field pointing.
☑ Dec	deg	Declination of the field pointing.
☑ Band		ALMA receiver band.
☑ Integration	s	Aggregated integration time for the field in the ASDM.
☑ Release date		
☑ Velocity resolution	m/s	Estimated velocity resolution from all the spectral windows, from frequency resolution.
☑ Frequency support	GHz	All frequency ranges used by the field
☐ Spatial resolution		
☐ Frequency resolution	kHz	Estimated frequency resolution from all the spectral windows, using median values of channel widths.
☐ Pol products		Polarisation products provided.
☐ Observation date		
☐ PI name		case-insensitive partial match over the full PI name. Wildcards can be used
☐ PWV	mm	Estimated precipitable water vapour from the XML_CALWVR_ENTITIES table.
☐ Member ous id		MEMBER_OUSS_ID generating this ASDM.
☐ Asdm uid		UID of the ASDM containing this Field.
☐ Project title		Case-insensitive search over the project title
☐ Project type		Project type.

Downloading the data:
Request Handler

- All data downloaded as tar files
- Large data sets may be broken into several pieces
  - Name is `[project_code]_[OUS_ID]_m_of_n.tar`
  - Raw data packaged as one tar file per execution block (EB)
    - name is [project_code]_[EB_ID].asdm.sdm.tar
- For Cycle 0-5 projects, cannot directly download individual data products but potentially coming in Cycle 6…
  - FITS images
  - Diagnostic plots, etc.

Request Handler

Request Handler prompts an email

From do-not-reply@nrao.edu
Subject **ALMA Archive at NRAO: Request 223292105**
Reply to [redacted]
To [redacted]

Reply | Reply All | Forward | Archive | Junk | Delete
1:24 PM
Other Actions

Dear [redacted],

Thank you for using the ALMA archive.

Your data selection (4.3GB) is available from this link

https://almascience.nrao.edu/rh/requests/nbrunett/223292105

We hope they meet your expectations and will lead to a successful completion of your scientific program.

Publications making use of these data must include the following statement in the acknowledgment:

"This paper makes use of the following ALMA data: ADS/JAO.ALMA#2012.1.00090.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), in cooperation with the Republic of Chile. The Joint ALMA Observatory is operated by ESO, AUI/NRAO and NAOJ."

Please submit your requests for help, for a visit to the ARC, or to report any problems discovered in your data through the ALMA Helpdesk at https://help.almascience.org.

Best regards,

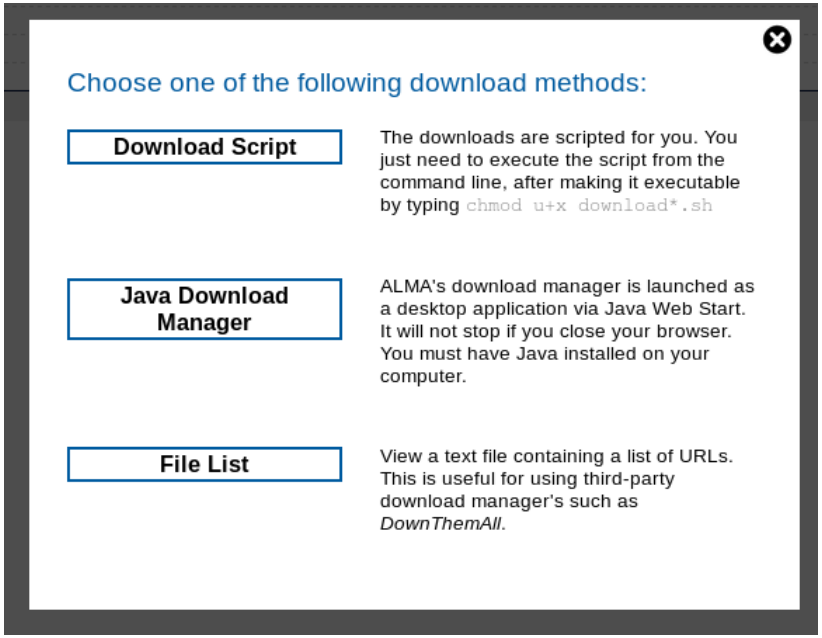
The North American ALMA Archive at the NAASC

Summary:
Files available: 2 (4.3GB)
Files under proprietary period: 0 (-)
Files not available: 0 (-)

Details:
Files available:
- 2012.1.00090.S_uid___A002_X5eed86_X2b_001_of_001.tar : AUTHORIZED
- 2012.1.00090.S_uid___A002_X7143f6_Xf9b.asdm.sm.tar : AUTHORIZED

Files under proprietary period:

Request Handler: Download options



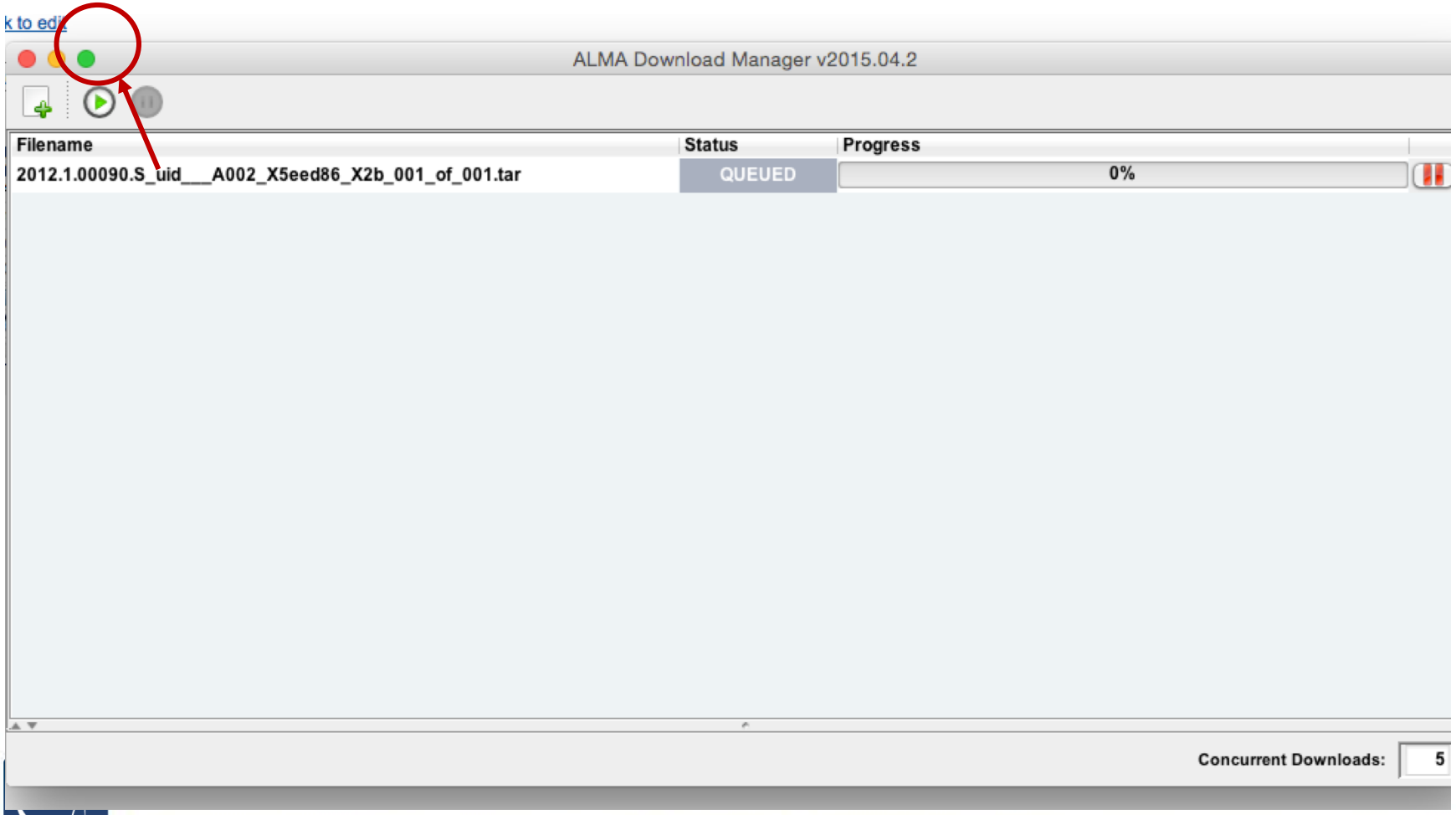
Request Handler:
script

```
#!/bin/bash
#Please use the current script to download the whole content of request
223732763

echo "Please provide a password"
read -s PASSWORD

wget   --auth-no-challenge  --no-check-certificate  --http-user="nbrunett" --
http-password=$PASSWORD
https://almascience.nrao.edu/dataPortal/api/requests/nbrunett/223732763/ALMA/2
012.1.00090.S_uid___A002_X5eed86_X2b_001_of_001.tar/2012.1.00090.S_uid___A002_
X5eed86_X2b_001_of_001.tar
.
.
.
```

Request Handler:
Java Download Manager



Resources related to the Archive

Check the science portal for possible maintenance message.
https://almascience.nrao.edu

There are 3 versions of the ALMA archive. If one is down, it is possible 1 of the other two are available.

- NRAO: http://almascience.nrao.edu/aq/
- ESO: http://almascience.eso.org/aq/
- NAOJ: almascience.nao.ac.jp/aq/

Contact your local helpdesk and provide:

- Project ID
- SBname
- ASDM
- What method you are using to download?

For more info:

https://almascience.nrao.edu/

The Atacama Large Millimeter/submillimeter Array (ALMA), an international astronomy facility, is a partnership of Europe, North America and East Asia in cooperation with the Republic of Chile. ALMA is funded in Europe by the European Organization for Astronomical Research in the Southern Hemisphere (ESO), in North America by the U.S. National Science Foundation (NSF) in cooperation with the National Research Council of Canada (NRC) and the National Science Council of Taiwan (NSC), and in East Asia by the National Institutes of Natural Sciences (NINS) of Japan in cooperation with the Academia Sinica (AS) in Taiwan. ALMA construction and operations are led on behalf of Europe by ESO, on behalf of North America by the National Radio Astronomy Observatory (NRAO), which is managed by Associated Universities, Inc. (AUI), and on behalf of East Asia by the National Astronomical Observatory of Japan (NAOJ). The Joint ALMA Observatory (JAO) provides the unified leadership and management of the construction and operation of ALMA.

www.nrao.edu
science.nrao.edu

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