

Science Ready Data Products

Author: John Tobin - SRDP Project Scientist

<https://science.nrao.edu/srdp/>



Overview

- Major NRAO initiative to provide higher quality data products to ALMA and VLA users
 - Current Capabilities
 - Quality Assurance for VLA pipeline calibration
 - Currently continuum projects, C-band and higher freq.
 - New NRAO archive interface serving data and images
 - Calibrated visibility download for ALMA¹ and VLA¹
 - ALMA User-Defined Imaging
 - VLA Sky Survey - All-Sky S-band (10 cm) Survey
 - Planned
 - VLA User-Defined Imaging²

¹ For data successfully processed by calibration pipeline, manual calibration not supported

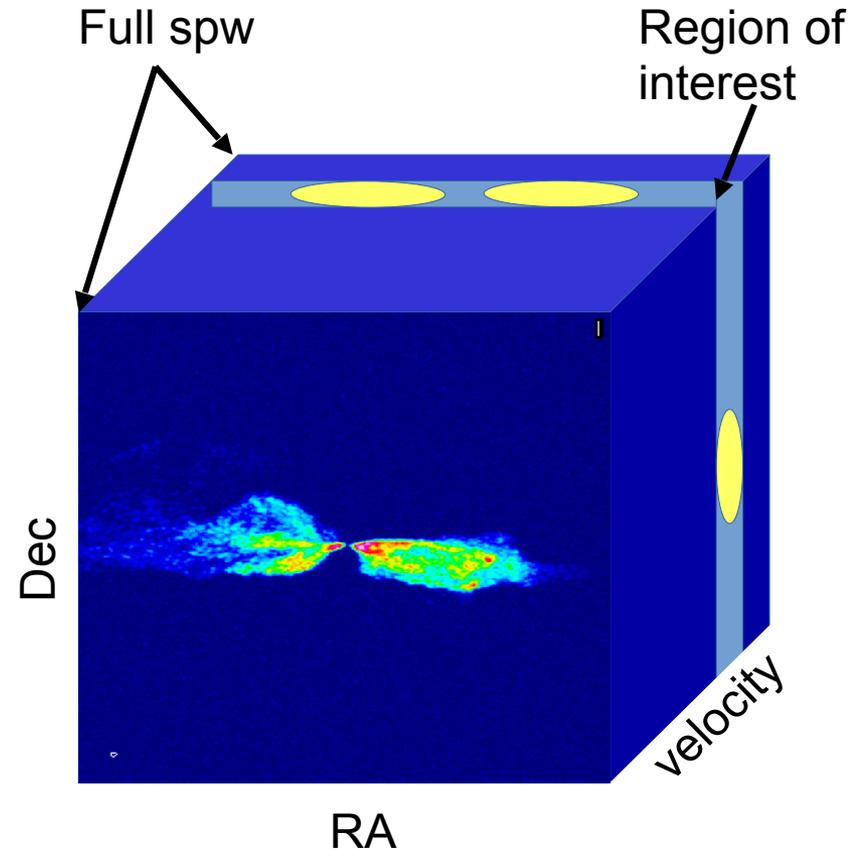
² Capability exists in pipeline, not yet used in operations nor available via NRAO archive

Caveats

- Focus is on pipeline-able features
 - Some user-defined settings, non-interactive execution
- ALMA Features supported for Cycle 5+ only; pipeline-calibrated data only
 - limitation of how data were archived previously
- Cycle 5 data sometimes need special settings
 - CASA 5.1.1 for restoration
 - Imaging will get re-run if necessary by DAs
- VLA data might have a calibration, but possibly not science quality
 - Science quality calibrations started ~June 2019 (select bands)
 - Still useful but some additional flagging likely needed
 - Images may still be 'ok' thanks to statwt task
- VLA data back to late 2016 supported for restoration

ALMA User Defined Imaging

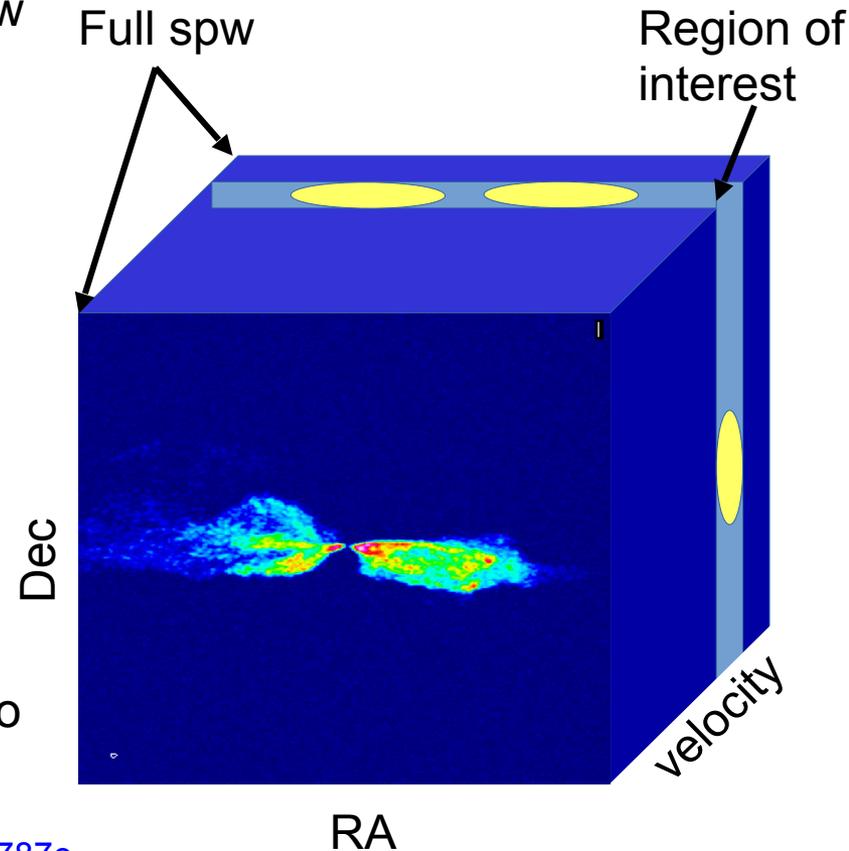
- Make new ALMA images without downloading all the data or running CASA
- ALMA imaging pipeline with automasking becoming mature with science-quality output however...
 - Archived cubes are generated for full spw at native resolution
 - 10s of GB cubes possible/frequent
 - Size mitigation may prevent all sources/spws from being imaged



ALMA User Defined Imaging

- User-triggered imaging enables creation of new images using archive interface

- User specifies cube they want
 - Frequency/velocity
 - Rest Frequency
 - Spectral averaging
 - Angular resolution*
- Calibrated measurement set restored
- Imaging pipeline runs
- Image is quality assured and ingested into NRAO archive
- Video Demo: <https://vimeo.com/513590322/81ee77787e>



* The pipeline does the best it can within the limits of the data (i.e., no magic)

Future SRDP Developments

- Improved Flagging in VLA pipeline
- VLA spectral line calibration
- VLA Imaging Pipeline
 - Automasking
 - Cubes
- Large project support in archive
- SelfCal in ALMA/VLA Imaging Pipeline
- Multi-configuration imaging
- Recalibration of VLA and ALMA data
 - new pipelines on previous data
- Suggestions welcome
 - e-mail: jtobin@nrao.edu



Accessing SRDP Capabilities

- User-facing features accessed through NRAO archive
- <https://data.nrao.edu>
- New NRAO archive, distinct from legacy archive



Accessing SRDP Capabilities

We will now
continue
with a live
demo 😊





science.nrao.edu
public.nrao.edu
ngvla.nrao.edu

***The National Radio Astronomy Observatory is a facility of the National Science Foundation
operated under cooperative agreement by Associated Universities, Inc.***

ALMA data served from NRAO archive

The screenshot shows a web browser window with the URL <https://data.nrao.edu/portal/#/>. The page header features the NRAO logo and the text "National Radio Astronomy Observatory Enabling forefront research into the Universe at radio wavelengths". The version number "version: 3.9.3.1" is displayed in the top right corner. Navigation links include "Archive Access Tool", "Back", "Log In", "Legacy Archive", and "About".

A search bar contains the query "2018.1.01038". Below the search bar, the "Active Search Inputs" section shows "Text Search 2018.1.01038". A blue button labeled "Show Search Inputs" is visible.

Three tabs are present: "View Projects", "View Observations", and "View Images". The "View Projects" tab is active, displaying a table of search results.

Project	Instrument	Title	First Obs	Last Obs	Execution Blocks
2018.1.01038.S	ALMA	Hunting For Companionship: Constraining the Close Binary Formation Mechanism in Orion Protostars	2018-10-02 09:39	2018-11-23 04:25	17 execution blocks

At the bottom of the page, there are logos for NRAO, NSF, and AUI, along with the text: "The National Radio Astronomy Observatory is a facility of the National Science Foundation operated under cooperative agreement by Associated Universities, Inc."

▼ Show Search Inputs ▼

View Projects View Observations View Images

↕ Project	↕ Instrument	Title	↕ First Obs	↕ Last Obs	
<input type="checkbox"/> 2018.1.01038.S	ALMA	Hunting For Companionship: Constraining the Close Binary Formation Mechanism in Orion Protostars	2018-10-02 09:39	2018-11-23 04:25	17 execution blocks

Title: Hunting For Companionship: Constraining the Close Binary Formation Mechanism in Orion Protostars

Abstract: A significant fraction of all main-sequence star are found in binary/multiple systems, and this high fraction of multiplicity must manifest itself during the star formation process. Using ALMA in Cycle 3, we surveyed 331 protostars in the Orion molecular clouds at 0.08" (30 AU) resolution at 0.87mm and we have obtained complementary data with the VLA at 9mm toward the 102 youngest, Class 0 protostars. From this complete sample, we have identified 40 close multiple systems with companion protostars separated by < 500 AU, in addition to more widely separated companions. Close companion protostars are thought to form either directly at these < 500 AU scales via disk fragmentation, or they form on ~1000 AU scales via turbulent fragmentation and migrate. With this sample of 40 close multiples, we aim to determine the dominant mechanism for the formation of close companion stars by searching for Keplerian circum-multiple disks and aligned outflows toward these systems. This survey of a complete sample of close protostellar multiples in the most populous nearby star forming region will provide a definitive answer to the question of how most close multiple systems form.

PI: John Tobin

Co-Authors: Magnus Persson, Maria Schutte, Stella Offner, Michael Dunham, Dominique Segura-Cox, Patrick Sheehan, Nadia Murillo, Robert Harris, Rajeeb Sharma, Dan Watson, Brian Mazur, Lisa Patel, Lukasz Tychoniec, Marina Kounkel, Nickalas Reynolds, Claire Chandler, Nicole Karnath, Laura Perez, Amelia Stutz, Elise Furlan, William Fischer, Zhi-Yun Li, Merel van 't Hoff, Erin Cox, Mayra Osorio, Sarah Sadavoy, Leslie Looney, Tom Megeath, Mihkel Kama, Kaitlin Kratter, Friedrich Wyrowski, Ana Karla Diaz Rodriguez, Guillem Anglada, Hector Arce, James Di Francesco

MOUSes Images

MOUS	↕ Observation Start	↕ Observation Stop	File Size	Array Config	Ang Res	Bands	EBs		
<input type="checkbox"/> HH270VLA_a_06_TM1	2018-11-23 03:12	2018-11-23 04:25	429.183 GB		0.252"	06	8	Download Restored MS	Re-Imaging
<input type="checkbox"/> HOPS-182_a_06_TM1	2018-10-19 10:12	2018-10-19 11:38	493.365 GB		0.156"	06	9	Download Restored MS	Re-Imaging

Launch Workflow Task on: 2018.1.01038.S

User Email (required):

Request Description:

Destination Directory: Specify directory (must be logged in & staff)

Create tar file: Return results as a tar file

Choose download data format:

- SDM tables only (metadata only)
- ALMA SDM+BDF (metadata + visibilities)
- Basic Measurement Set (uncalibrated)
- Calibrated Measurement Set

Apply telescope flags: Apply flags generated during observing

CASA|Pipeline Version:

Restore previous CMS:

Estimated Processing Time: 2 days

View Projects View Observations

Project	Instrument
2018.1.01038.S	ALMA

Title: Hunting For Companionship: Co
Abstract: A significant fraction of all r
 formation process. Using ALMA in Cyc
 complementary data with the VLA at 9
 companion protostars separated by <
 500 AU scales via disk fragmentation,
 the dominant mechanism for the forma
 of a complete sample of close protoste
 systems form.
PI: John Tobin
Co-Authors: Magnus Persson, Maria
 Watson, Brian Mazur, Lisa Patel, Luka
 Fischer, Zhi-Yun Li, Merel van 't Hoff, E
 Rodriguez, Guillem Anglada, Hector A

MOUSes Images

MOUS

HH270VLA_a_06_TM1												
HOPS-182_a_06_TM1	2018-10-19 10:12	2018-10-19 11:38	493.365 GB	0.156"	06	9						

Launch User Imaging on: 2018.1.01038.S

User Email (required):

Request Description:

SPW:

Field:

Angular Resolution:
Use Default (0.263)

Frequency Space Velocity Space

Rest Frequency:

Start:

Width:

N Channels:

End:

Using CASA version 6.1.2-7 | 2020.1.0.36

View Projects View Observations

Project	Instrument
2018.1.01038.S	ALMA

Title: Hunting For Companionship: C...
Abstract: A significant fraction of all t...
formation process. Using ALMA in Cy...
complementary data with the VLA at s...
companion protostars separated by <...
500 AU scales via disk fragmentation...
the dominant mechanism for the form...
of a complete sample of close protost...
systems form.
PI: John Tobin
Co-Authors: Magnus Persson, Maria...
Watson, Brian Mazur, Lisa Patel, Luka...
Fischer, Zhi-Yun Li, Merel van 't Hoff,...
Rodriguez, Guillem Anglada, Hector A...

MOUSes Images

- MOUS**
- HH270VLA_a_06_TM1
 - HOPS-182_a_06_TM1

ast Obs

3-11-23 17 execution blocks

5

t manifest itself during the star...
7mm and we have obtained...
40 close multiple systems with...
ght to form either directly at these <...
close multiples, we aim to determine...
ows toward these systems. This survey...
the question of how most close multiple

y, Robert Harris, Rajeeb Sharma, Dan...
Amelia Stutz, Elise Furlan, William...
er, Friedrich Wyrowski, Ana Karla Diaz

Download Restored MS Re-Imaging

Download Restored MS Re-Imaging

Improved interface to VLA data

Browser address bar: <https://data.nrao.edu/portal/#/> | 130% | Search

version: 3.9.3.1



National Radio Astronomy Observatory
Enabling forefront research into the Universe at radio wavelengths

Archive Access Tool Back Log In Legacy Archive About

Search:

Active Search Inputs: Text Search Tobin ✕

Show Search Inputs

View Projects View Observations View Images Page 1 Show 25 of 123 Projects

Project	Instrument	Title	First Obs	Last Obs	Execution Blocks	Lock
+ 20B-080	EVLA	The Origin of the Unresolved Radio Emission of Radio-Quiet Quasars	2020-11-25 22:08	2021-02-14 17:58	7 execution blocks	🔒
+ 20B-173	EVLA	Are Embedded Disks with Substructures Hiding Young Binaries?	2020-12-18 03:45	2021-02-07 03:48	10 execution blocks	🔒
+ 20B-322	EVLA	eDisk: Early Planet Formation in Embedded Disks - A Long Wavelength Perspective	2020-12-10 00:38	2021-02-01 02:54	11 execution blocks	🔒
+ 20B-373	EVLA	Disk Fragmentation around the Serpens-FIRS1 Intermediate Mass Protostar	2021-01-01 19:56	2021-01-29 16:55	5 execution blocks	🔒
+ 20B-323	EVLA	Mapping the Two Dimensional Temperature of HH 212MMS	2020-12-24 03:07	2021-01-17 07:38	3 execution blocks	🔒

Improved interface to VLA data

	Project	Instrument	Title	First Obs	Last Obs	
+	20B-080	EVLA	The Origin of the Unresolved Radio Emission of Radio-Quiet Quasars	2020-11-25 22:08	2021-02-14 17:58	7 execution blocks
-	20B-173	EVLA	Are Embedded Disks with Substructures Hiding Young Binaries?	2020-12-18 03:45	2021-02-07 03:48	10 execution blocks

Title: Are Embedded Disks with Substructures Hiding Young Binaries?

Abstract: Recent high resolution observations of protostellar disks in Orion have shown that substructures similar to those found in older (1 - 10 Myr) protoplanetary disks are present at early times (<1 Myr). Though it seems likely at early times that those substructures are the result of dynamical interactions with large bodies hiding within the cavities, it remains unclear, whether those large bodies are stellar or substellar. To test whether these sources may be young binaries, we propose high resolution, long wavelength observations to search for free-free emission that is expected to come from the base of jets driven by young protostars. If found, such emission would indicate that we are indeed seeing young binary systems during their formation, which would place constraints on how such systems form. Alternatively, if no such evidence can be found, it would strengthen the case that we are observing planet formation at very early times, which would challenge current models of planet formation.

PI: Patrick Sheehan

Legacy ID: AS1635

Co-Authors: Laura Perez, John Tobin

Proposal: [Click to search](#)

Observations

Images

0/10: selected (0/10.0 TB)

View Selection(s)
 Clear All
 Download

	Archive File	Project	Instrument	Observation Start	Observation Stop	File Size	Array Config	Bands	Type	Cals	Scans
	20B-173.sb38913102.eb39278624.59252.05836896991	20B-173	EVLA	2021-02-07 01:24:03	2021-02-07 03:48:34	155.387 GB	A	Q, X	visibility	1	128
	20B-173.sb38915627.eb39266267.59246.20760625	20B-173	EVLA	2021-02-01 04:58:57	2021-02-01 07:23:29	161.074 GB	A	Q, X	visibility	1	128
	20B-173.sb38915433.eb39266415.59237.11258260676	20B-173	EVLA	2021-01-13	2021-01-13	142.000	A	Q, X	visibility	1	128

Improved interface to VLA data

The screenshot displays a web browser window at <https://data.nrao.edu/portal/#/>. The main content area shows a table of observation data with columns for Project, Instrument, Title, First Obs, and Last Obs. A modal window titled "Launch Workflow Task on: 20B-173" is open, containing the following fields and options:

- User Email (required):**
- Request Description:**
- Destination Directory:** Specify directory (must be logged in & staff)
- Create tar file:** Return results as a tar file
- Choose download data format:**
 - SDM tables only (metadata only)
 - SDM-BDF dataset (metadata + visibilities)
 - Basic Measurement Set (uncalibrated)
 - Calibrated Measurement Set
- Apply telescope flags:** Apply flags generated during observing
- CASA|Pipeline Version:**
- Restore previous CMS:**

Estimated Processing Time: 19 hours

Buttons:

Project	Instrument	Title	First Obs	Last Obs
20B-080	EVLA	The Or		2021-02-14 17:58
20B-173	EVLA	Are Em		2021-02-07 03:48

Title: Are Embedded Disks with Substructures H
Abstract: Recent high resolution observations o
times (<1 Myr). Though it seems likely at early ti
large bodies are stellar or substellar. To test whe
expected to come from the base of jets driven by
place constraints on how such systems form. Alt
challenge current models of planet formation.
PI: Patrick Sheehan
Legacy ID: AS1635
Co-Authors: Laura Perez, John Tobin
Proposal: Click to search

Observations | Images

1/10: selected (15)

View Selection(s) Clear

Archive File

File	Project	Instrument	Start	Stop	Size	Band	Type	Cals	Scans
20B-173.sb38913102.eb392786			01:24:03	03:48:34	GB	Q, X	visibility	1	128
20B-173.sb38915627.eb39266267.59246.20760625	20B-173	EVLA	2021-02-01 04:58:57	2021-02-01 07:23:29	161.074 GB	Q, X	visibility	1	128



science.nrao.edu
public.nrao.edu
ngvla.nrao.edu

***The National Radio Astronomy Observatory is a facility of the National Science Foundation
operated under cooperative agreement by Associated Universities, Inc.***