2025 ALMA Proposal Preparation Workshop

# How to prepare Technical Justification (TJ)

2025. 1. 14. Seokho Lee (KASI)

### **Technical Justification**

- convinces the reviewer that the observation setups: Sensitivity, Scales, Correlator (Band, lines)
  - > can achieve the scientific goals (SGs)
  - is the best setup to achieve the SGs
  - uses ALMA time in the most efficient way

### **Observing Tool** (https://almascience.nao.ac.jp/proposing/o bserving-tool/installer-page)

🗋 🔣 🖸 almascience.nao.ac.jp/proposing/observing-tool/installer-page C AtacamaLarge Millimeter/submillimeterArray In search of our Cosmic Origin ALMA A WAY AS HOMENOW IN ALL A CONTRACT About Science Proposing Observing Data Processing Tools Documentation Help Installer Page Mac OS Installer Linux Installer **Observin** 

Click on one of the links next to the OT Logo to download the Cycle 11 OT Installer for your particular operating system. The Installer is an executable file which can be started by double-clicking in a file-manager window or started from a shell's command line. Once started, it will take you through a number of screens which, for example, allow you to change the default amount of memory available to the OT. In most cases you can just accept all the defaults using the 'Next' button and click 'Install' when you are happy.

Windows Installe

After the Installer has finished, an executable file ('ALMA-OT.sh' on Linux and 'ALMA-OT.command' on Macs) should be found inside a directory named 'ALMAOT-C11-2024'. This can be run from the command line or by double-clicking in a file manager if this is configured in this way. We recommend that the name of this directory not be changed so that multiple versions of the OT (for use in different cycles) can be maintained on your computer. On Macs, a shortcut will be created on your Desktop with the name 'ALMAOT-C11-2024' - the OS will probably ask to control your Finder for this to happen. In the case of macOS, if the ALMA OT is started via clicking on the desktop icon, a separate terminal window opens which should not be shut down whilst the OT is running.

#### Additional Information

- The Mac download is a zip archive which must first be opened in order to extract the installer. This will often be done automatically for you or a suitable program will be suggested ('Archive Utility').
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- . There may be various issues related to security when running the Installer. Mac users may need to give permission to run the tool by opening the 'Security & Privacy' menu of 'System Preferences' and this menu should also be set to allow the use of apps from 'identified developers'. Alternatively, running the installer by right-clicking and choosing 'Open' (maybe twice) might work. On Windows, we are aware of 'Defender SmartScreen' - this can be bypassed by clicking on 'More Info'
- . It also appears that the installer will not work on older versions of macOS. So far, we only know that this is the case for 10.10 Yosemite. Users of this OS will have to use the tarball version.
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Reduce a Number of **Science Goal Observing Tool** 

**S.G.** : a set of observational parameters in a single goal. Mulitple lines are observed simultanueously.



### Parameters

### Scales

Beam size, Largest Angular Scale (LAS), and Field of View (FoV)

### Expected Source Properites

Intensities and Line width (Systemic velocity)

### Spectral Setups

Bands and lines

### Parameters (I)

- Scales (Control and Performance; Field Setup)
  - Angular Resolution (beam size) ~ depend on the longest baseline and frequency.
  - Maximum Recoverable Scale (MRS)
    - depends on the shortest baseline (~ 10 x beam size)
    - ▶ When the scale is loger than MRS, the emission is resolve out
    - ► Largest Angular Structure (LAS)< MRS → single configuration
    - ▶ LAS > MRS  $\rightarrow$  multiple configuration or ACA and TP are added.
  - Field of View (FOV)
    - FWHM of the 12m telescope primary beam
    - ~19 arcsec (33 arcsec) @ 300 GHz for 12m (7m)
    - Area of target is larger than 1/3 FOV, mosaic is needed

Cycle 12								1925							
Start Date	Configuration	Longest baseline	LST: Best		-	Band	1	3	4	5	6	7	8	9	10
1-Oct-2025	C-8	8.5 km	22-10	Config.	$\mathbf{L}_{\max}$	Freq. (GHz)	40	100	150	185	230	345	460	650	870
1 00. 2020		0.0 1411	22.10		$\mathbf{L}_{\min}$										
20-Oct-2025	C-7	3.6 km	23-11	7-m	45 m	$\theta_{res}$ (arcsec)	31.5	12.5	8.35	6.77	5.45	3.63	2.72	1.93	1.44
10-Nov-2025	C-6	2.5 km	1-13		9 m	$\theta_{MRS}$ (arcsec)	167	66.7	44.5	36.1	29.0	19.3	14.5	10.3	7.67
1-Dec-2025	C-5	1.4 km	2-14	C-1	161 m	$\theta_{res}$ (arcsec)	8.45	3.38	2.25	1.83	1.47	0.98	0.74	0.52	0.39
20-Dec-2025	C-4	0.78 km	4-15		15 m	$\theta_{MRS}~({\rm arcsec})$	71.2	28.5	19.0	15.4	12.4	8.25	6.19	4.38	3.27
40.1	0.0	0.501	5.47	C-2	<b>314</b> m	$\theta_{res}$ (arcsec)	5.75	2.30	1.53	1.24	1.00	0.67	0.50	0.35	0.26
10-Jan-2026	C-3	0.50 km	5-17		15 m	$\theta_{MRS}$ (arcsec)	56.5	22.6	15.0	12.2	9.81	6.54	4.90	3.47	2.59
1-Feb-2026	No observations due to	maintenance		C-3	500 m	$\theta_{res}~({\rm arcsec})$	3.55	1.42	0.94	0.77	0.62	0.41	0.31	0.22	0.16
1-Mar-2026	C-1	0.16 km	8-21		15 m	$\theta_{MRS}$ (arcsec)	40.5	16.2	10.8	8.73	7.02	4.68	3.51	2.48	1.86
26-Mar-2026	C-2	0.31 km	9-23	C-4	784 m	$\theta_{res}$ (arcsec)	2.30	0.92	0.61	0.50	0.40	0.27	0.20	0.14	0.11
20-Apr-2026	C-3	0.50 km	11-0		15 m	$\theta_{MRS}$ (arcsec)	28.0	11.2	7.50	6.08	4.89	3.26	2.44	1.73	1.29
10-May-2026	C-4	0.78 km	12-2	C-5	$1.4 \mathrm{km}$	$\theta_{res}$ (arcsec)	1.38	0.55	0.36	0.30	0.24	0.16	0.12	0.084	0.063
10 may 2020		0.70 Mil	12 2		15 m	$\theta_{MRS}$ (arcsec)	16.8	6.70	4.47	3.62	2.91	1.94	1.46	1.03	0.77
31-May-2026	C-5	1.4 km	13-4	C-6	$2.5~\mathrm{km}$	$\theta_{res}$ (arcsec)	0.78	0.31	0.20	0.17	0.13	0.089	0.067	0.047	0.035
23-Jun-2026	C-6	2.5 km	15-6		15 m	$\theta_{MRS}$ (arcsec)	10.3	4.11	2.74	2.22	1.78	1.19	0.89	0.63	0.47
28-Jul-2026	C-5	1.4 km	17-7	C-7	3.6 km	$\theta_{res}$ (arcsec)	0.53	0.21	0.14	0.11	0.092	0.061	0.046	0.033	0.024
18-Aug-2026	C-4	0.78 km	19-8		64 m	$\theta_{MRS}$ (arcsec)	6.45	2.58	1.72	1.40	1.12	0.75	0.56	0.40	0.30
10-Sep-2026	C-3	0.50 km	20-9	C-8	$8.5 \mathrm{km}$	$\theta_{res}$ (arcsec)	0.24	0.096	0.064	0.052	0.042	0.028	0.021	0.015	0.011
					110 m	$\theta_{MRS}$ (arcsec)	3.55	1.42	0.95	0.77	0.62	0.41	0.31	0.22	0.16

Band 5 (around 183GHz) and Bands 7-10 are recommended within LST ranges (not Dec-March)

### Parameters (I)

- Scales (Control and Performance; Field Setup)
  - Angular Resolution (beam size) ~ depend on the longest baseline and frequency.
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    - depends on the shortest baseline (~ 10 x beam size)
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Most Extended configuration	Allowed Compact configuration pairings	Extended Multiplier I 12-m if compact i Array 12-m A Multiplier Array n needed		Multiplier if 7-m Array needed	Multiplier if TP Array needed and allowed (with 7-m Array in 4x4-bit mode)	Multiplier if TP Array needed and allowed (with 7-m Array in 2x2-bit mode)
7-m Array	тр			1	1.7	1.4
C-1	7-m Array & TP	1		7.0	11.9	9.5
C-2	7-m Array & TP	1		4.7	7.9	6.3
C-3	7-m Array & TP	1		2.4	4.1	3.3
C-4	C-1 & 7-m Array & TP	1	0.34	2.4	4.0	3.2
C-5	C-2 & 7-m Array & TP	1	0.26	1.2	2.1	1.7
C-6	C-3 & 7-m Array & TP	1	0.25	0.6	1.0	0.8
C-7	C-4	1	0.23			
C-8	C-5	1	0.22			
C-9	C-6	1	0.21			
C-10	-	1				

**Table A-2:** Allowed Array Combinations and Time Multipliers. See Chapter 7 of the Technical Handbook for relevant equations and detailed considerations. If the array configuration that meets the AR request according to Table A-1 has a MRS that is smaller than the LAS request, the OT checks if adding more compact array configurations, following the restrictions of this Table, fulfills the LAS request. If so, the final setup consists of the selected combination of arrays. Otherwise, the OT returns a validation error.



### Field of View (FOV)

- FWHM of the 12m telescope primary beam
- ~19 arcsec (33 arcsec) @ 300 GHz for 12m (7m)
- ► Area of target is larger than 1/3 FOV, mosaic is needed

### Parameters (II)

Expected Source properties (Field Setup)

- Position, souce velocity
- Peak Flux Density per beam (SNR > 3)
  - $\blacktriangleright$  RMS ( $\rightarrow$  integration time)
- Polarization
  - linear > 0.1% (< 0.3 FOV)</pre>
  - circular > 1.8 % (<0.1 FOV)</pre>
- Line width > 3 x spectral resolution

You should describe how to derive/adopt these values in Technical Justification

### Parameters (III)

- Spectral Setup
  - LSB and/or USB
  - 4 basebands (with 2GHz max. width)
  - 2 or 4 basebands in the one sideband



LSB/USB (<4GHz, ≤4 basebands) Baseband (<2GHz, ≤4spws) Spectral window(spw)

Band	Frequency range	Wavelength range	IF range	Type
	(GHz)	(mm)	$(\mathrm{GHz})$	
1	35-50	8.5-6	4-12	SSB
3	84-116	3.6-2.6	4-8	2SB
4	125 - 163	2.4 - 1.8	4 - 8	2SB
5	158-211	1.9-1.4	4-8	2SB
6	211-275	1.4-1.1	4.5 - 10	2SB
7	275-373	1.1 - 0.8	4-8	2SB
8	385-500	0.78 - 0.60	4-8	2SB
9	602 - 720	0.50-0.42	4-12	DSB
10	787-950	0.38-0.32	4 - 12	DSB

Spws in a baseband
one faction 1
two fraction ½
► four faction ¼
one fraction ½ + two fraction ¼
Spectral windows (SPW) should have the same resolution.

Bandwidth	Channel	$\mathbf{Spectral}$	Number of	Correlator	Bit
	spacing	resolution	channels	mode	Mode
(MHz)	(MHz)	(MHz)			
1875	15.6	31.2	120	TDM	
938	0.976	1.952	1024	FDM	4x4 *
1875	0.488	0.976	3840	FDM	2x2
469	0.488	0.976	1024	FDM	4x4
938	0.244	0.488	3840	FDM	2x2
234	0.244	0.488	1024	FDM	4x4
469	0.122	0.244	3840	FDM	2x2
117	0.122	0.244	1024	FDM	4x4
234	0.061	0.122	3840	FDM	2x2
58.6	0.061	0.122	1024	$\operatorname{FDM}$	4x4
117	0.0305	0.061	3840	FDM	2x2
58.6	0.0153	0.0305	3840	FDM	2x2

Table 5.1: Available spectral windows in multi-region mode (dual polarization). Each time the fraction is changed, the number of channels and bandwidth of a particular correlator mode is halved. Each row corresponds to a particular spectral resolution.

### Spectral resolution $\propto$ 1/ fraction for a given bandwidth

Fraction =	= 1	Fraction =	1/2	Fraction = 1/4			
Bandwidth $(MHz)$	#  channels	Bandwidth (MHz) $\#$ channels		Bandwidth (MHz)	# channels		
1875	4096	937.5	2048	468.75	1024		
937.5	4096	468.75	2048	234.375	1024		
468.75	4096	234.375	2048	117.118	1024		
234.375	4096	117.118	2048	58.594	1024		
117.118	4096	▶ 58.594	2048	not availa	ble		
58.594	4096	not availa	ble	not available			

# Example

# TW Hya with CO observation

## ALMA Sensitivity calculator

### ← → C 😋 almascience.nao.ac.jp/proposing/sensitivity-calculator

	Declination	00:00:00.00							✓	
	Polarisation	Dual 🗸								
	Observing Frequency	345						GH	iz 🔻	
	Observing Band	ALMA_RB_07 V								
	Bandwidth per Polarization	0.1						km/s	-	
	Water Vapour	Automatic Ch	noice	O Manual Choice						
	Column Density	0.913mm (3rd Oc	tile) 🗸							
	Trx, tau, Tsky	72 K, 0.158, 39.	538 K							
	Tsys	153.278 K								
Individual Parameters										
	12 m Array		7 m Array			Total Power Array				
Number of Antennas		<b>·</b>		10 🗸			(	3		
Number of Antennas	43		~	10		<u> </u>	3			1
Number of Antennas Resolution	43	•	arcsec 🔻	0	arcs	✓ ec ▼	3 9.5		-	arcsec 🔻
Number of Antennas Resolution Sensitivity (rms)	43 0.3 1	~	arcsec 🗸	10       0       ∠.4826852653365648	arcs	✓ ec ▼ nJy ▼	3 9.5 4.85010668201	1959	*	arcsec
Number of Antennas Resolution Sensitivity (rms) Equivalent to	43 0.3 1 8.761179	*	arcsec V KV mJy V	10 0	arcs	✓ iec ▼ nJy ▼ K ▼	3 9.5 4.85010668201 0.174	1959	~	arcsec mJy mK
Number of Antennas Resolution Sensitivity (rms) Equivalent to Integration Time	43 0.3 1 8.761179 31.61216	*	arcsec V KV mJy V	10 0 ✓ 2.4826852653365648 Unknown (43.12316	arcs	✓ sec ▼ hJy ▼ K ▼ d ▼	3 9.5 4.85010668201 0.174 34.99973	1959	~	arcsec mJy mK d
Number of Antennas Resolution Sensitivity (rms) Equivalent to Integration Time	43 0.3 1 8.761179 31.61216	*	arcsec V KV mJy V min V	10 0 • 2.4826852653365648 • Unknown 43.12316 Integration Time Unit Option	arcs	✓ Hec ▼ Hy ▼ K ▼ d ▼ matic	3 9.5 4.85010668201 0.174 34.99973	1959	~	arcsec



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WARNING: Oracle have reported a serious incompatibility between macOS Sonoma 14.4 and Java which may result in the OT terminating unexpectedly – there is no workaround. Users are advised to avoid using Sonoma 14.4 and the OT if possible. If this is not possible and a user encounters this problem, the OT does have a project auto-backup facility which can be used as a recovery mechanism. Please contact the helpdesk should more information be required.

### Integration time for CO with 1 K

CO transition	Freq. (GHz)	ALMA Band	RMS (mJy) @0.3" w/ 1K	Integration time (0.1km/s)	ALMA configuration
1-0	115.271	3	0.98	3.7d/ 2.68 d/ 9.2 d	C-7 (0.092 km/s)
2-1	230.538	6	3.9	1.47h/1.13h/3.59 h	C-5 ( 0.092 km/s)
3-2	345.796	7	8.8	31.5m/23.7m/ 1.36h	C-5 (0.122 km/s)
4-3	461.041	8	15.6	76.9 min/55.4m/2.75h	C-4 (0.092km/s)
5-4	576.267	Х			
6-5	691.473	9	35.2	2.93h/1.58h/5.22h	C-3 (0.122 km/s)
7-6	806.652	10	47.8	3.85h/2.48h/7.37h	C-3 (0.105km/s)
8-7	921.7997	10	62.5	30.7h/16.35h/1.96d (A/ B/ C)	C-2 (0.092km/s)

### Integration time:

- A: on-source time using sentitivity calucator
- B: on-source time using OT
- C: total observing time (B + time for calibration + etc)

### Which band is chosen?

- CO transitions can be convered in the Bands 3, 6, and 7. You should describe why the band is chosen.
  - ▶ For a given integration time, band # provides the highest SNR.
  - Other interesting lines can be covered within 1 S.G.s.
  - ► A relation use the CO 1-0 line..
  - Optically thin line is located only in Band #.
  - When considering of interstellar extinction (optical depth of continuum emission), the line in Band # can trace the midplane of target ...

TW Hya/ Band 7/ 0.15" Assuming Line Width (FWHM) = 0.3 km/s

You are interested in the continuum peak or 40-60 au:

	0 au	40-60 au
Continuum	30 mJy/beam	7 mJy/beam
13CO	60 K /130 mJy	26 K / 57 mJy



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Overview

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		ALMA	Observing Tool (Cycle 11 (	Phase 2 Patch 1)) - Project				×	
File Edit View Tool Search Help							Planning	and Time Estimate	×
1 D B B A B A B B B	🗑 🖬 🖻 🗎 💽 🗹 K < Editors	X 🔒 🖓			_	Note: The tir Operational	me in brackets is that req requirements often mea	uired to reach the sensitivity n that the actual observed tir	me
Proposal Program	> Spectral Spatial Contro	ol and Performance				is longer, es	specially for mosaics. Ple	ase see the User Manual fo	r more details.
Unsubmitted Proposal	These parameters are used to Configuration Information	o control various aspects of the	observations, including the requ	Input Paran Requested Bandwidth u Representa	5.000 mJy 0.195 MHz 330 574 GHz				
<ul> <li>Planned Observing</li> <li>ScienceGoal (Science Goal)</li> <li>General</li> </ul>	Antenna Beamsize ( 1.13 * λ / [	D) 12m 17.615 arcsec	7m 30.197 arcs	ec	?	Estimated	d Total time for Scie	nce Goal	4.46 h
Field Setup Spectral Setup Calibration Setup	Number of Antennas	12m 43 7m 10 ACA 7m configuration Most compact 12m configuration		TP 3		Cluster 1			
Control and Performance	Longost basolino	ACA /m conliguration	Most compact 12m conligue	alion Most extended 12m conliguration		Source Name	RA	Dec	Velocity
recinical susuication	Synthesized beamsize	3.800 arcsec	0.981 arcsec	0.016 arcsec		TW Hya	11:01:51.9053	-34:42:17.033	12.335 km/s
	Shortest baseline	0.009 km	0.015 km	0.256 km					
	Maximum recoverable scale	20.279 arcsec	8.777 arcsec	0.151 arcsec			Possible Config	guration Combinations	
	Desired Performance				_	12-m (1)	12-m (2)	7-m	TP
	Largest Angular Structure Desired sensitivity per poi Bandwidth used for Sensi Override OT's sensitivity-b time estimate (must be ju Science Goal Breakdown: time estimate, clustering, Simultaneous 12-m and A Are the observations time-	in source 0.3 nting tivity Re assed stified) beam and configurations F ACA observations -constrained?	00000 arcsec v 5.00000 mJy pWindowEffectiveChannelWidth Yes  No No Yes  No Yes  No	<ul> <li>equivalent to 2.4864 K</li> <li>Frequency Width 0.195313 MHz</li> </ul>		Input Parameters Precipitable wate Time required for Time on source p Total number of tuning Total time on sou Total calibration ti Other overheads Total time for 1 St Number of SB exe Total time to com	s r vapour (all sources) r 12m (1) [C-6] ver pointing (first source) vointings (all sources) is rce ime B execution ecutions plete SB	0.913mm (3rd Octile) 1.41 h [ 1.41 h] 1 1.41 h [ 1.41 h] 2.90 h 9.20 min 1.49 h 3 4.46 h	
L	ine : Represe Continum : Ag	ine : RepresentativWindowChannelWidth ontinum : AggregateBandWidth						8.00 min 10.00 min 5.70 min 2.00 min 8.00 min 6.67 min 5.00 min Close	
	Feedback Validation Validation Histor	nv log							n model
Q		., Log							Hya dust
Quantian									valagular.

## **Technical** Justificaiton

If the blue text appears, you should describe why that parameter is requested, Or change the parameter.

File Edit View Tool Search Help		
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Project Structure	Editors	
Proposal Program	Spectral Spatial Technical Justification	
Unsubmitted Proposal	Fater a Taphaisal Justification for this Salaran Coal, paving appoint attention to the appropriate sourced word holow	
V Project		
<ul> <li>Planned Observing</li> </ul>	Sensitivity	
<ul> <li>ScienceGoal (Science Goal)</li> </ul>	Descripted DMS even 177106 m/s in 5.00 m ly	
c deneral	Requested RMS over 177.120 m/s is 5.00 mJy For a peak itux density of 45.00 mJy , the S/N is 9.0	
Spectral Setup	Achieved RMS over the total 468.750 MHz bandwidth is 101.97 uJy For a continuum flux density of 30.00 mJy , the achieved S/N is 294.2	
Control and Performance	For a peak line flux of 45.00 mJy, the achieved S/N over 1/3 of the source line width ( 300.00 m/s / 3 = 100.00 m/s ) is 6.8	
Technical Justinication	Line width / bandwidth used for sensitivity ( 300.00 m/s / 177.13 m/s ) = 1.69	
	Note that the bandwidth used for sensitivity is larger than 1/3 of the linewidth. The S/N achieved for a resolution element that allows the line to be resolved will be lower than that reported.	
	Spectral Dynamic Range (continuum flux / line rms): 6.01	
·	Justify your requested RMS and resulting S/N for the spectral line and/or continuum observations.	
r l	For line observations also justify the bandwidth used for the sensitivity calculation.	
a		
DU U		
	imaging [?]	
	Requested angular resolution 150.00 mas	
	Degraphed Lorgest Approved Scale 200.00 mas	
	Requested Largest Angular Scale 300.00 mas	
	Justify the chosen angular resolution and largest angular scale for the source(s) in this Science Goal	
1		
	Correlator configuration	
	?	
	line width / representative spectral window resolution: 300.00 m/s / 127.97 m/s = 2.34	
	Feedback	
	Validation Validation History Log	
Overview		

ALMA Observing Tool (Cycle 11 (Phase 2 Patch 1)) - Project

Perspective 1

#### ALMA Observing Tool (Cycle 11 (Phase 2 Patch 1)) - Project File Edit View Tool Search Help 6 A 8 A 🗏 🖸 🗹 K X 🕯 🤶 🗘 🌣 🗘 1 D ð 1.5 **Project Structure** Editors Proposal Program > Spectral Spatial Spectral Setup To zoom in/out, click on the visualizer and then click left/right, grab sliding bar to pan Unsubmitted Proposal 📄 Project 🗸 📄 Proposal V Planned Observing ScienceGoal (Science Goal) General Field Setup Spectral Setup Calibration Setup Control and Performance Technical Justification

Validation Validation History Log

Reduce the spectral resolution

Note: Moving	LO1 here is for experimer	ntation only - the actual setu	p is determined by the spec	tral windows				
1	300,0000	320,000	0	40,0000	360,0000	380,0000	400,000	
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<u> </u>		w	13C0 v=0 :	LO1 γ γ 3-2 C0 v=0 3-	2		~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~	
1	30010000	320/000	00 34	10,0000 Rest Frequency	з6010000 v (GHz)	38010000	400/0000	)
		Overlays:	Receiver Bands	✓ Transmissi	on 🗸 DSB Image 🗌 Sp	ectral Lines Select Lines to Overlay		
		Water Vapour Column E	ensity: ( ) Automatic Choic	e 🔿 Manual Choice 0.9	13mm (3rd Octile)			
		Viewport:	Pan to Spectral W	/indow Zoom to Ban	d Reset			
nostral Type								
			Spectral Type		<ul> <li>Spectral Line</li> <li>Single Continuu</li> <li>Spectral Scan</li> </ul>	m		?
			Produce image si Polarization produ	debands (Bands 9 and 1 Icts desired	0 only) 🗌 🔵 XX 💿 DUAL 🔵	FULL		
pectral Setup E	irrors							
pectral Line								
Baseband-1								<u>, r</u>
Fraction	Centre Freq (rest hel)	Centre Freq	Transition		Bandwidth, Resolu	tion (smoothed)	Spec.	Representative Window
L(Full)	345.79599 GHz	345.78176 GHz	CO v=0 3-2	234.375 MHz( 203 k	.m/s), 141.113 kHz( 0.122 k	(m/s) (2-bit)	2	0
Add spectral	window centred on a spec	ctral line Add spectra	al window manually	Delete Show ima	ge spectral windows			
Baseband-2								
L(Full)	330.58797 GHz	330.57436 GHz	13CO v=0 3-2	117.188 MHz( 106 k	m/s), 70.557 kHz( 0.064 k	m/s) (2-bit)	2	۲
∨ adback				***				

ALMA Observing Tool (Cycle 11 (Phase 2 Patch 1)) - Project			Planning and Time Estimate					
File       Edit       View       Tool       Search       Help         1 <th colspan="4">Note: The time in brackets is that required to reach the sensitivity. Operational requirements often mean that the actual observed time is longer, especially for mosaics. Please see the User Manual for more details.</th>				Note: The time in brackets is that required to reach the sensitivity. Operational requirements often mean that the actual observed time is longer, especially for mosaics. Please see the User Manual for more details.				
Proposal Program Unsubmitted Proposal	Spectral       Spectral       Spectral       Spectral       Control and Performance         These parameters are used to control various aspects of the observations, including the required antenna configurations and integration times.         Configuration Information         Antenna Beamsize (1.13 * λ/D)       12m       17.615 arcsec       7m       30.197 arcsec				Input Parameters Requested sensitivity Bandwidth used for sensitivity Representative frequency (sky, first source) Estimated Total time for Science Goal			7.070 mJy 0.098 MHz 330.574 GHz <b>4.46 h</b>
Field Setup Spectral Setup	Number of Antennas	12m 43	7m 10	TP 3	Cluster 1			
Control and Performance		ACA 7m configuration	Most compact 12m configurati	on Most extended 12m configuration	Source Name	RA	Dec	Velocity
lechnical Justification	Longest baseline	0.049 km	0.161 km	16.197 km	TW Hya	11:01:51.9053	-34:42:17.033	12.335 km/s
	Synthesized beamsize	3.800 arcsec	0.981 arcsec	0.016 arcsec				
	Shortest baseline	0.009 km	0.015 km	0.256 km		Possible Configu	ration Combinations	
	Maximum recoverable scale	20.279 arcsec	8.777 arcsec	0.151 arcsec	12-m (1)	12-m (2)	7-m	ТР
	Largest Angular Structure in	0.1500 a source 0.3000	0 arcsec v	aguivelant to 2 5157 K	Input Parameters	vapour (all sources) 0	913mm (3rd Octile)	
For the same in	Bandwidth used for Sensitiv Override OT's sensitivity-bas time estimate (must be just Science Goal Breakdown: time estimate, clustering, be Simultaneous 12-m and AC Are the observations time-co <b>itegration tim</b>	th used for Sensitivity     RepWindowEffectiveChannelWidth    Frequency Width 0.097656 MHz   OT's sensitivity-based   mate (must be justified)     Goal Breakdown:   imate, clustering, beam and configurations   Planning and Time Estimate   neous 12-m and ACA observations   Yes    No        Yes    No           tion time.			Time required for Time on source per Total number of por Number of tunings Total time on sour Total calibration tim Other overheads Total time for 1 SB Number of SB exe Total time to comp Calibration Breaky	<b>12m (1) [C-6]</b> er pointing (first sources)         pointings (all sources)         is         is	.41 h [ 1.41 h] .41 h [1.41 h] .90 h .20 min .49 h .46 h	
RMS(NEW RMS(OLD)	$\frac{D}{D} = \sqrt{\frac{\Delta v(old)}{\Delta v(new)}}$	<u>)</u>			4 x Pointing 1 x Amplitude/ban 19 x Phase 4 x CheckSource 2 x DGC 10 x Atmospheric 1 x DGC Bandpas	8 dpass 1 5 2 8 8 6 5 5	.00 min 0.00 min .70 min .00 min .00 min .67 min .00 min Close	

 $\cap$ 

Sensitivity						
	?					
Requested RMS over 88.563 m/s is 7.07 mJy	A For a peak flux density of 45.00 mJy , the S/N is 6.4					
Achieved RMS over the total 4.102 GHz bandwidth is 34.29 uJy	For a continuum flux density of 0.00 mJy , the achieved S/N is 0.0					
For a peak line flux of 45.00 m ly p the achieved S/N over 1/3 of the s	source line width ( $200.00 \text{ m/s}$ / $2 - 100.00 \text{ m/s}$ ) is 6.8					
For a peak line liux of 45.00 mJ B the achieved 5/10 over 1/5 of the s	Source line width ( 300.00 m/s 7 3 - 100.00 m/s ) is 0.8					
Line width / bandwidth used for sensitivity ( 300.00 m/s / 88.56 m/	s ) = 3.39 C Integrated Intensity					
Justify your requested RMS and resulting S/N for the spectral line and/	or continuum observations.					
For line observations also justify the bandwidth used for the sensitivity	calculation.					
1 How the expected intensity is calculated (Vun						
T. How the expected intensity is calculated (full	IS LAIK)					
2. Which SNR is used among A, B, and C.						
3 Why is the SNR enough to achieve the Science	Goal?					
J. Why is the SMR chough to demeve the Science Godt:						
- the fine spectral resolution can be chosen because of the kinematics, but analysis will be done with						
poor spectral resolution (B)						
poor spectral resolution (D)						
- Although it is a line observation, describe the information and arguments for the continnum						
Tip: You can refer the figures in S. J. and/or cite references (XX et al. Ap.J. ###, ###)						
	, (,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,					

Sensitivity	2
Requested RMS over 88.563 m/s is 7.07 mJy For a peak flux density of 45.00 mJy , the S/N is	6.4
Achieved RMS over the total 4.102 GHz bandwidth is 34.29 uJy For a continuum flux density of 0.00 mJy, the ac	hieved S/N is 0.0
For a peak line flux of $45.00 \text{ mJy}$ , the achieved S/N over 1/3 of the source line width ( $300.00 \text{ m/s}$ / 3 = $100.00 \text{ m/s}$ ) is	6.8
Line width / bandwidth used for sensitivity ( 300.00 m/s / 88.56 m/s ) = 3.39 Spectral dynamic range	
Justify your requested RMS and resulting S/N for the spectral line and/or continuum observations.	
For line observations also justify the bandwidth used for the sensitivity calculation.	
Spectral dynamic range is related with the bandpass accuracy. It is 1000 (B3-B6), 400 (B7), 250 (B8), 170 (B9), and 150 (B10).	

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Requested angular resolution 150.00 mas

Requested Largest Angular Scale 300.00 mas

Justify the chosen angular resolution and largest angular scale for the source(s) in this Science Goal

- 1. Why the requestd beam size is needed?
  - 1. To resolve the emitting region
  - 2. You need several points for analysis
- 2. LAS
  - 1. Garantees No flux missing, i.e., if the total flux is important in your science, you shoud set LAS as the largest emitting area

?

2. If not, LAS can be smaller than the latter, but you describe that you are interested in just morphorology, ....

The expected emitting area is ~0.3", thus the requested angular resolution **can resolve** the emitting area by a factor of two, which can ...

The disk is extended up to 0.3", and we set LAS of 0.3".

Correlator configuration		
line width / representative spectral window resolution: 300.00 m/s / 63.99 m/s = 4.69	?	
Representative spectral window width : 106.28 km/s		
Justify your correlator set-up with particular reference to the number of spectral resolution elements per line width. You may want to consider spectral averaging to lower the data rate		
<ul> <li>The spectral resolution is based on</li> <li>flux measurement ( 3 points within Line width)</li> <li>Kinematics (more fine resolution is needed)</li> <li>ex) resolution of 0.065 km/s is enough to resolve the line width of 0.3.</li> </ul>		
Goals of each targeted lines and why the transitions are selected CO and 13CO lines are chosen for Furthermore, the lines in the Band 7 provide the highest SNR for a given observing time SO and HCO+ are set for bonous lines, which can provide	2.	

Tips) Atleast One baseband is set to continnum for the (self) calibration

# Thank you!