ALMA Observing Tool

Phase I: Observing Proposal

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Introduction

- What is Observing Tool (OT) ?
  - provides a comprehensive set of interfaces (form and tool) to
    - **define observing proposals at ALMA (Phase I)**
    - prepare observing programs at ALMA (Phase II)

The Current Status of OT

- The current release of the OT is configured for the Early Science Capabilities of ALMA as described in the Cycle 3 Call For Proposals
- Note that in order to submit proposals you will have to register with the ALMA Science Portal beforehand

Download & Installation

- The latest version of OT can be downloaded form ALMA Science Portal
- To run OT, Java 7 must be installed
  - java - version -> 1.7.x
- Webstart
  - The OT is installed and run automatically on your computer
- Tarball
  - Download and install the OT manually

Documents & Tutorials

- Extensive documentation is available to help you work with the OT and optimally prepare your proposal:
  - OT Quickstart Guide
  - OT video tutorials
  - OT user manual & reference manual

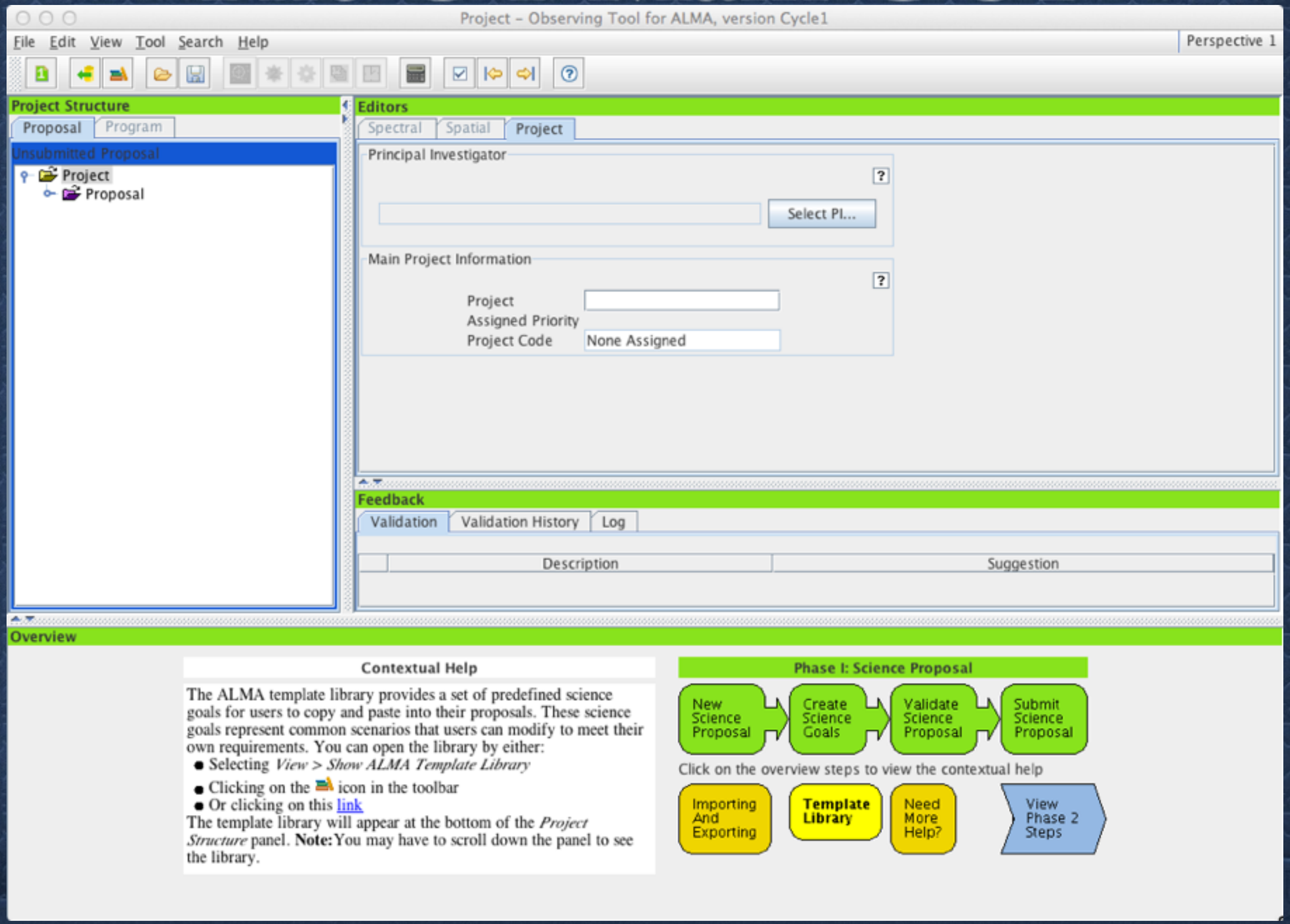
Troubleshooting

- If you have problems with the installation and/or startup of the OT, please see
  - http://almascience.nao.ac.jp/call-for-proposals/observing-tool/troubleshooting
- Know issues:
  - https://almascience.nao.ac.jp/documents-and-tools/cycle3/known-issues
- Further information can be found from Helpdesk
  - https://help.almascience.org/index.php?/Knowledgebase/List/Index/1/alma-observing-tool-ot

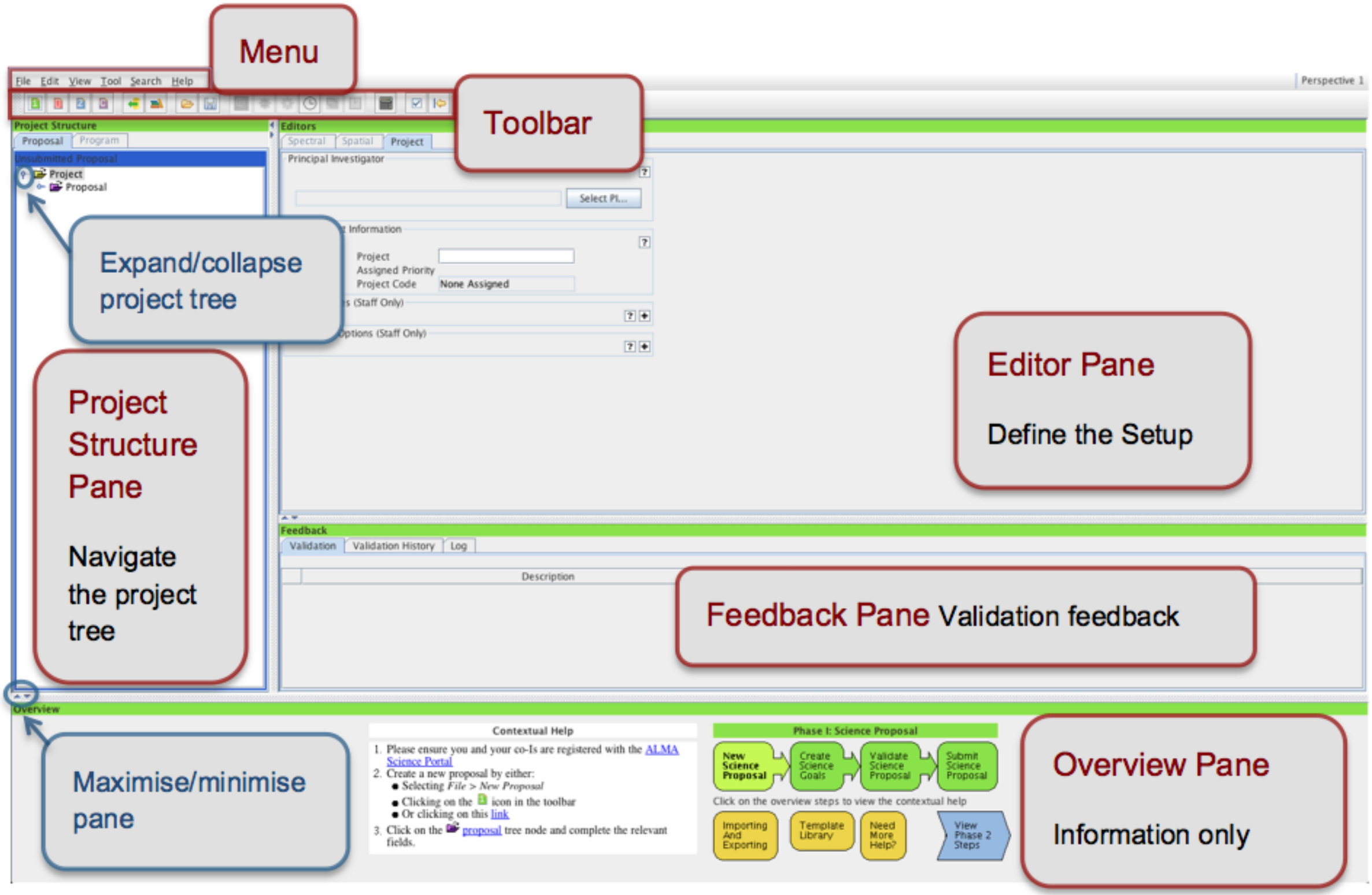
Known Issues

Issue	Description
C1_001	Although it is indicated that copy and paste operations in a Mac use the "command" key, often the "control" key is required, particularly for text copy/paste.
C1_023	Calibration searches may crash due to problems with the database. Reducing the number of results may avoid the problem.
C1_032	Leaving the OT open for days at a time can cause an error upon saving. Saving to another file, closing the OT and re-opening produces a "ZLIB input stream" error i.e. the project is unreadable. This issue is yet to be satisfactorily characterised.
C2_009	Placing spectral windows that are exactly as far apart as they can possibly be can cause an error, the text of which is also misleading.

The OT Main GUI



The OT Main GUI

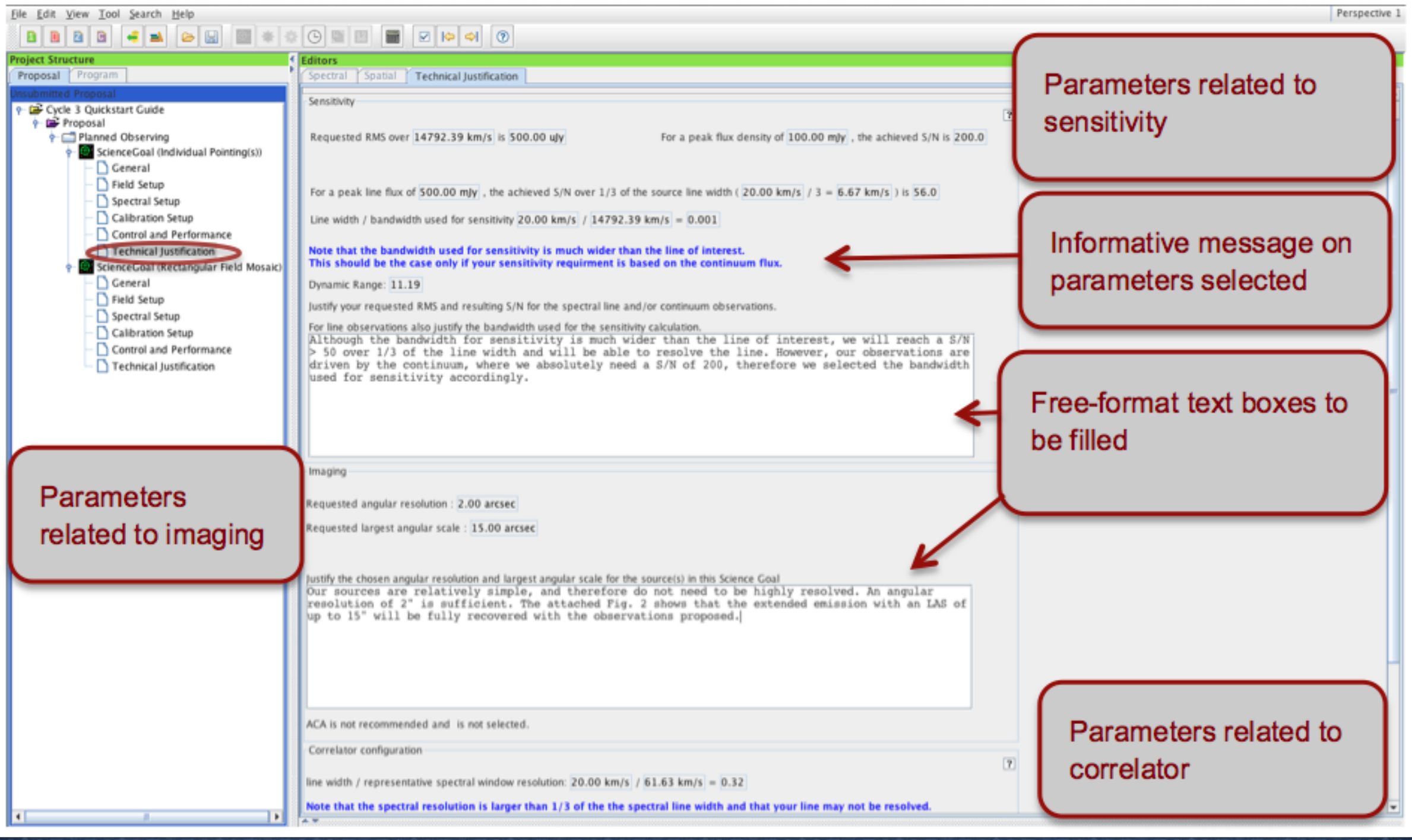


Proposal creation and submission in 10 easy steps

1. Enter the basic information for your proposal
2. Attach supporting material
3. Create a Science Goal
4. Add the source information
5. Configure the spectral setup
6. Finalise the spatial setup
7. Select the calibration strategy
8. Enter the control and performance parameters
9. Enter the technical justification
10. Validate and submit your proposal

Technical Justification

- Enter the technical justification directly into OT
  - Each science goal needs one
  - Although the Technical Justification for each SG is entered in the OT, any figure required for it still needs to be placed in the Science Justification PDF document (max. 4 pages).
  - The TJ node contains three main sections: sensitivity, imaging and correlator configuration. Each section includes at least one free-format text box that must be filled (50 characters minimum).
  - An incomplete or incomprehensible Technical Justification will lead to the rejection of the proposal on technical grounds.


File Edit View Tool Search Help
Perspective 1
Project Structure
Proposal
Program
Unsubmitted Proposal
Cycle 3 Quickstart Guide
Proposal
Planned Observing
ScienceGoal (Individual Pointing(s))
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
ScienceGoal (Rectangular Field Mosaic)
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
Editors
Spectral
Spatial
Technical Justification
Sensitivity
Requested RMS over 14792.39 km/s is 500.00 uJy
For a peak flux density of 100.00 mJy , the achieved S/N is 200.0
For a peak line flux of 500.00 mJy , the achieved S/N over 1/3 of the source line width (20.00 km/s / 3 = 6.67 km/s) is 56.0
Line width / bandwidth used for sensitivity 20.00 km/s / 14792.39 km/s = 0.001
Note that the bandwidth used for sensitivity is much wider than the line of interest.
This should be the case only if your sensitivity requirment is based on the continuum flux.
Dynamic Range: 11.19
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.
Although the bandwidth for sensitivity is much wider than the line of interest, we will reach a S/N > 50 over 1/3 of the line width and will be able to resolve the line. However, our observations are driven by the continuum, where we absolutely need a S/N of 200, therefore we selected the bandwidth used for sensitivity accordingly.
Imaging
Requested angular resolution : 2.00 arcsec
Requested largest angular scale : 15.00 arcsec
Justify the chosen angular resolution and largest angular scale for the source(s) in this Science Goal
Our sources are relatively simple, and therefore do not need to be highly resolved. An angular resolution of 2" is sufficient. The attached Fig. 2 shows that the extended emission with an LAS of up to 15" will be fully recovered with the observations proposed.
ACA is not recommended and is not selected.
Correlator configuration
line width / representative spectral window resolution: 20.00 km/s / 61.63 km/s = 0.32
Note that the spectral resolution is larger than 1/3 of the the spectral line width and that your line may not be resolved.
Parameters related to sensitivity
Informative message on parameters selected
Free-format text boxes to be filled
Parameters related to imaging
Parameters related to correlator

Technical Justification

- The following requests/mistakes will lead to proposal **rejection** on technical grounds:
  - Underestimation of the required observing time by more than a factor of 2 due to mistakes in the input parameters
  - Smoothing of the data to resolutions that are comparable to those of a 12−m single−dish telescope.
  - Technical Justifications based on data unavailable at the time of writing the proposal
  - Omission of ALMA simulations that are integral to the justification of the observing requirements (see Section 6.2.1).

Technical Justification

- The following requests/mistakes will lead to proposal **rejection** on technical grounds (cont.):
  - Target of Opportunity (ToO) proposals that do not give full details on the number of triggers needed to reach the science goals of the proposal, what the trigger will be, and the necessary reaction time for scheduling the observation after it is triggered.
  - Observations that cannot be set up in the OT
  - Observations that are not fully defined in terms of Science Goals at Phase 1

Configurations

- The two most extended configurations (5 km and 10 km) will be offered alone, it will not be possible to combine them in the same Science Goal with another configuration, either from the 12-m Array or the ACA.
- The six more compact configurations of the 12-m Array will be offered either alone, or in combination with another 12-m configuration and/or the 7-m Array and/or the TP Array. The OT will suggest the optimum combination.

Configuration	7-m	C36-1	C36-2	C36-3	C36-4	C36-5	C36-6	C36-7	C36-8
Minimum baseline (m)	8.7	14.7	14.7	14.7	38.6	47.9	77.3	248.3	346.5
Maximum baseline (m)	32.1	160.7	376.9	538.9	969.4	1396.4	2299.6	6074.2	9743.7

Table 7.2: Basic parameters of the 7-m Array configuration and the eight 12-m Array configurations offered during Cycle 3. The baselines are projected for a transiting source (HA $= \pm$ 0.5h) at a declination of $-23°$. Note that C36-7 will not be available for Bands 8-10, and C36-8 will not be available for Bands 7-10.

Configurations

	Band	3	4	6	7	8	9	10
	Frequency (GHz)	100	150	230	345	460	650	870
Configuration								
7-m	θ_{res} (arcsec)	15.0	10.0	6.5	4.3	3.3	2.3	1.7
	θ_{MRS} (arcsec)	42.8	28.6	18.6	12.4	9.3	6.6	4.9
C36-1	θ_{res} (arcsec)	3.4	2.3	1.5	1.0	0.7	0.5	0.4
	θ_{MRS} (arcsec)	25.3	16.9	11.0	7.3	5.5	3.9	2.9
C36-2	θ_{res} (arcsec)	1.8	1.2	0.8	0.5	0.4	0.3	0.2
	θ_{MRS} (arcsec)	25.2	16.8	11.0	7.3	5.5	3.9	2.9
C36-3	θ_{res} (arcsec)	1.2	0.8	0.5	0.4	0.3	0.2	0.1
	θ_{MRS} (arcsec)	25.2	16.8	10.9	7.3	5.5	3.9	2.9
C36-4	θ_{res} (arcsec)	0.7	0.5	0.3	0.2	0.15	0.1	0.08
	θ_{MRS} (arcsec)	9.6	6.4	4.2	2.8	2.1	1.5	1.1
C36-5	θ_{res} (arcsec)	0.5	0.3	0.2	0.14	0.1	0.07	0.06
	θ_{MRS} (arcsec)	7.8	5.2	3.4	2.2	1.7	1.2	0.9
C36-6	θ_{res} (arcsec)	0.3	0.2	0.1	0.08	0.06	0.04	0.03
	θ_{MRS} (arcsec)	4.8	3.2	2.1	1.4	1.0	0.7	0.5
C36-7	θ_{res} (arcsec)	0.1	0.08	0.05	0.034	-	-	-
	θ_{MRS} (arcsec)	1.5	1.0	0.65	0.43	-	-	-
C36-8	θ_{res} (arcsec)	0.075	0.05	0.03	-	-	-	-
	θ_{MRS} (arcsec)	1.1	0.7	0.5	-	-	-	-

Configurations

- Observations with a requested angular resolution either coarser or finer than the values listed in Table A 1 (scaled to the appropriate frequency) are not allowed.
  - Coarsest allowed angular resolution is twice the resolution of the most compact 12-m Array configuration (maximum baseline of 166 meters).

Table A-1: Maximum Recoverable Scale[1] and Coarsest and Finest Angular Resolutions[1] for the Cycle 3 12-m Array configurations

Frequency	Maximum Recoverable Scale without ACA[2,3]	Coarsest allowed angular resolution[2,3,4]	Finest achievable angular resolution[2,3,5]
(GHz)	(arcsec)	(arcsec)	(arcsec)
100	25.3	6.8	0.075
150	16.9	4.6	0.050
230	11.0	3.0	0.030
345	7.3	2.0	0.034
460	5.5	1.4	0.060
650	3.9	1.0	0.040
870	2.9	0.8	0.030

Configurations

Table 3: 12-m Array Configuration Schedule for Cycle 3

Start Dates	Configuration	Night LST	Not recommended
2015 October 1	C36-8	~17h - 9h	High frequency projects especially during day time (LST ~10h-16h)
2015 November 10	C36-7	~19h - 11h	High frequency projects especially during day time (LST ~12h-18h)
2015 December 29 (Maintenance in February)	C36-1	~00h - 16h	High frequency projects any time , specially during day time (LST ~17h-23h)
2016 March 22	C36-2	~04h - 20h	High frequency projects day time (LST ~21h-03h)
2016 April 19	C36-3	~07h - 23h	High frequency projects day time (LST ~00h-06h)
2016 May 10	C36-4	~08h - 00h	High frequency projects day time (LST ~01h-07h)
2016 May 31	C36-5	~10h - 02h	High frequency projects day time (LST ~03h-09h)
2016 July 5	C36-6	~13h - 05h	High frequency projects especially during day time (LST ~06h-12h)
2016 August 30	C36-7	~16h - 08h	High frequency projects especially during day time (LST ~09h-15h)

Notes for Table 3: Dates include relocation time at the end of every configuration

Time estimates for multi-configuration observations

Table A 4. Total Time multiplication factors for multi-array observations

Array Components needed (based on θ and LAS)	Total Time estimate
Single 12-m Array configuration	1.0 $\Delta t_{extended}$
Two 12-m Array configurations	1.5 $\Delta t_{extended}$
Single 12-m Array configuration and 7-m Array	3.0 $\Delta t_{extended}$
Two 12-m Array configurations and 7-m Array	3.5 $\Delta t_{extended}$
One 12-m Array configuration and 7-m Array and TP Array (spectral line, Bands <9)	5.0 $\Delta t_{extended}$
Two 12-m Array configurations and 7-m Array and TP Array (spectral line, Bands <9)	5.5 $\Delta t_{extended}$

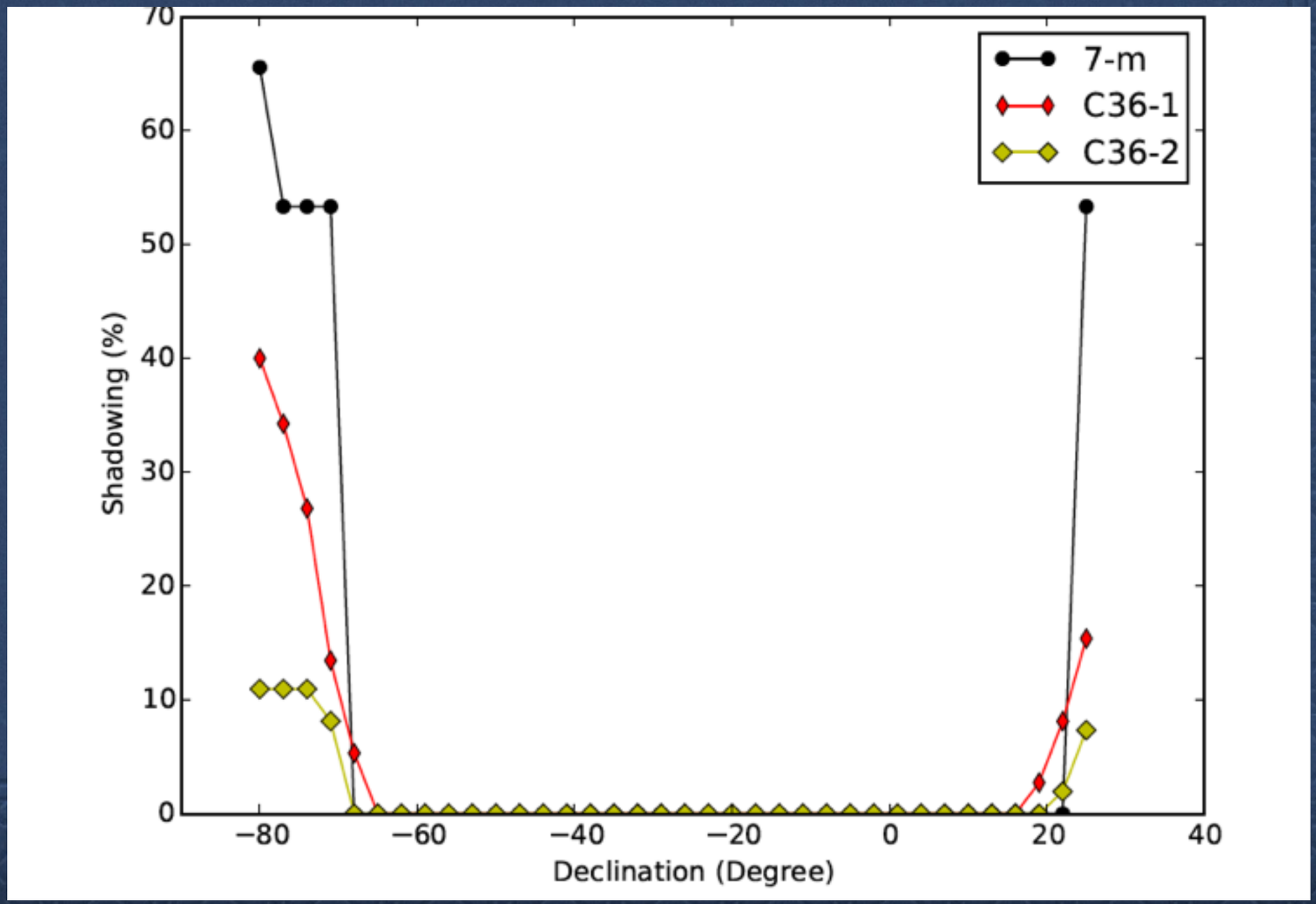
Time estimates for multi-configuration observations

- The PI should be very careful to set the angular properties (i.e, desired angular resolution and largest angular structure in source) of their proposed ALMA observations since they have a strong impact on the way they will be planned and executed.
  - desired angular resolution -> the (most extended) configuration of 12m array
  - sensitivity -> required observing time for this configuration
  - largest angular structure in source -> another (compact) configuration of 12-m array and/or ACA
  - Based on the LAS, the OT will advise whether the ACA is needed for a given project. If the user chooses not to follow this recommendation, it must be explained in the Technical Justification.

θ_{res} (arcsec)	θ_{LAS} (arcsec)	Array combination	Time ratios	Total Time
0.075	< 1.1	C36-8	1	$1.0 \times \Delta_{extended}$
0.075	> 1.1	-	-	-
0.1	< 1.5	C36-7	1	$1.0 \times \Delta_{extended}$
0.1	> 1.5	-	-	-
0.3	< 4.8	C36-6	1	$1.0 \times \Delta_{extended}$
0.3	4.8-25.2	C36-6 + C36-3	1 : 0.5	$1.5 \times \Delta_{extended}$
0.3	25.2-42.8	C36-6 + C36-3 + 7-m	1 : 0.5 : 2	$3.5 \times \Delta_{extended}$
0.3	> 42.8	C36-6 + C36-3 + 7-m + TP	1 : 0.5 : 2 : 4	$5.5 \times \Delta_{extended}$
0.5	< 7.8	C36-5	1	$1.0 \times \Delta_{extended}$
0.5	7.8-25.2	C36-5 + C36-2	1 : 0.5	$1.5 \times \Delta_{extended}$
0.5	25.2-42.8	C36-5 + C36-2 + 7-m	1 : 0.5 : 2	$3.5 \times \Delta_{extended}$
0.5	> 42.8	C36-5 + C36-2 + 7-m + TP	1 : 0.5 : 2 : 4	$5.5 \times \Delta_{extended}$
0.7	< 9.6	C36-4	1	$1.0 \times \Delta_{extended}$
0.7	9.6-25.3	C36-4 + C36-1	1 : 0.5	$1.5 \times \Delta_{extended}$
0.7	25.3-42.8	C36-4 + C36-1 + 7-m	1 : 0.5 : 2	$3.5 \times \Delta_{extended}$
0.7	> 42.8	C36-4 + C36-1 + 7-m + TP	1 : 0.5 : 2 : 4	$5.5 \times \Delta_{extended}$
1.2	< 25.2	C36-3	1	$1.0 \times \Delta_{extended}$
1.2	25.2-42.8	C36-3 + 7-m	1 : 2	$3.0 \times \Delta_{extended}$
1.2	> 42.8	C36-3 + 7-m + TP	1 : 2 : 4	$5.0 \times \Delta_{extended}$
1.8	< 25.2	C36-2	1	$1.0 \times \Delta_{extended}$
1.8	25.2-42.8	C36-2 + 7-m	1 : 2	$3.0 \times \Delta_{extended}$
1.8	> 42.8	C36-2 + 7-m + TP	1 : 2 : 4	$5.0 \times \Delta_{extended}$
3.4	< 25.3	C36-1	1	$1.0 \times \Delta_{extended}$
3.4	25.3-42.8	C36-1 + 7-m	1 : 2	$3.0 \times \Delta_{extended}$
3.4	> 42.8	C36-1 + 7-m + TP	1 : 2 : 4	$5.0 \times \Delta_{extended}$

Shadowing & Extra Time

- *Shadowing fraction (%)with respect to declination*



Antenna and Receivers

- The use of the TP Array is limited to spectral line observations in Bands 3-8, to the exclusion of continuum observations and no spectral line observations using Band 9/10.
- Angular scales greater than those listed in the table cannot be recovered for any observations in Band 9 and 10, or for continuum observations in any band.

Table A-2: Maximum Recoverable Scales for ACA 7-m observations

Frequency (GHz)	Maximum Recoverable Scale[1,2] (arcsec)
100	42.8
150	28.5
230	18.6
345	12.4
460	9.3
650	6.6
870	4.9

Spectral Scan

- All targets are separated by less than 10 degrees on the sky
- Angular resolution and LAS are computed for the Representative Frequency of each SG
- No more than 5 frequency tunings are used, all in the same band
- Only one pointing per target (no mosaics or offsets allowed)
- The sum, for all targets, of the number of separate tunings required per target does not exceed 150 (i.e., the maximum number of targets, for 5 tuning for all targets in a SG, is 30);
- Only 12-m Array observations are required (the ACA is not

Data Rate

- In Cycle 3, if the spectral setup ends up with a data rate that is higher than twice the expected average of 6 MB/s (i.e, 12 MB/s), the user will need to technically justify this.
  - Note that the limit is reached quite easily if more than two FDM spectral windows are defined. The data rate of a full, non-preaveraged FDM baseband is 5.4 MB/s
- The easiest way to lower the data rate is by using spectral averaging. A spectral averaging factor of 2 will halve the data rate, but only marginally lower (~15%) the spectral resolution of your observations.

Spectral Setups

- The Band 6 IF frequency has been chosen to allow for multiple simultaneous line observations1; it now covers the range 5.0–10.0 GHz.
- There is 10-25% excess noise below 5.5 GHz due to LO1, however this multi-transitionsetup is still considerably more efficient than observing each line separately.
- Since OT does not take this issue into account, extra time should be requested....