ALMA Observing Tool (OT)

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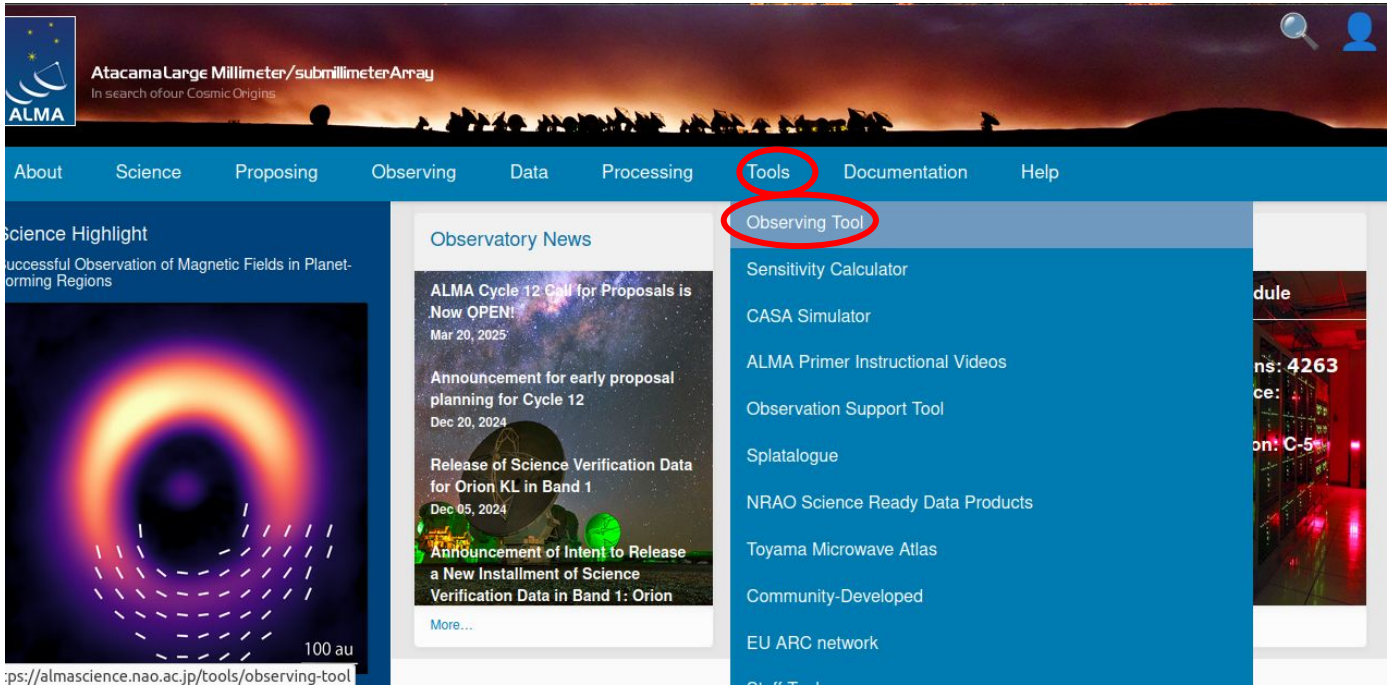
What is the OT?

- the ALMA Observing Tool (OT) is the software used to submit an ALMA proposal
- information entered in the OT:
  - general information (PI, co-Is, proposal title,...)
  - technical parameters (target coordinates, spectral setup, angular resolution...)
  - Technical Justification

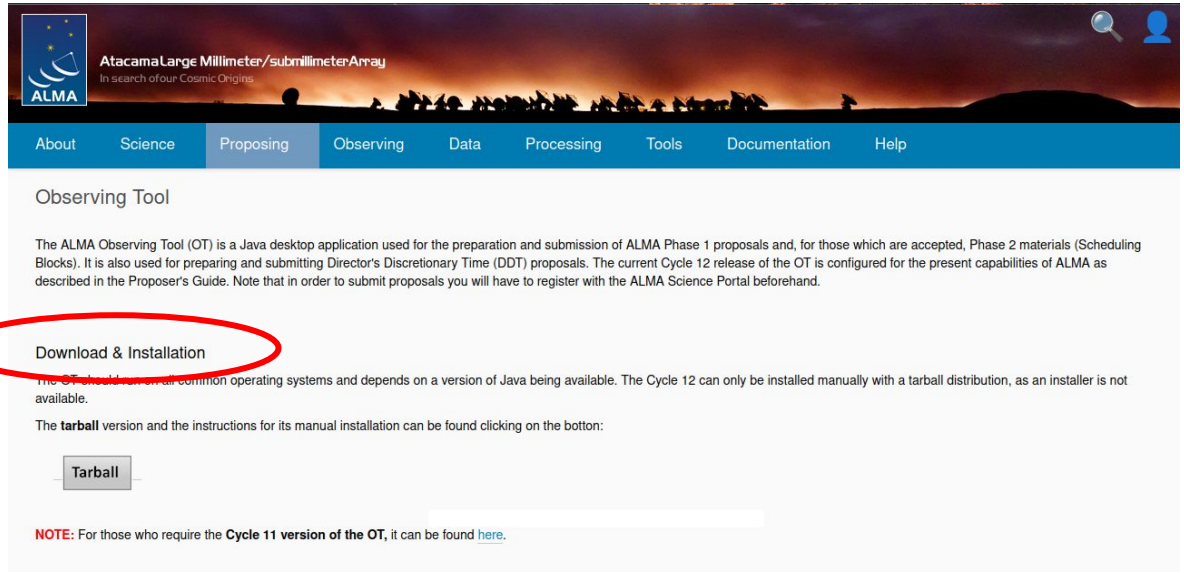
Where can I download the OT?

- Science Portal
- make sure you use the cycle 12 version of the OT!

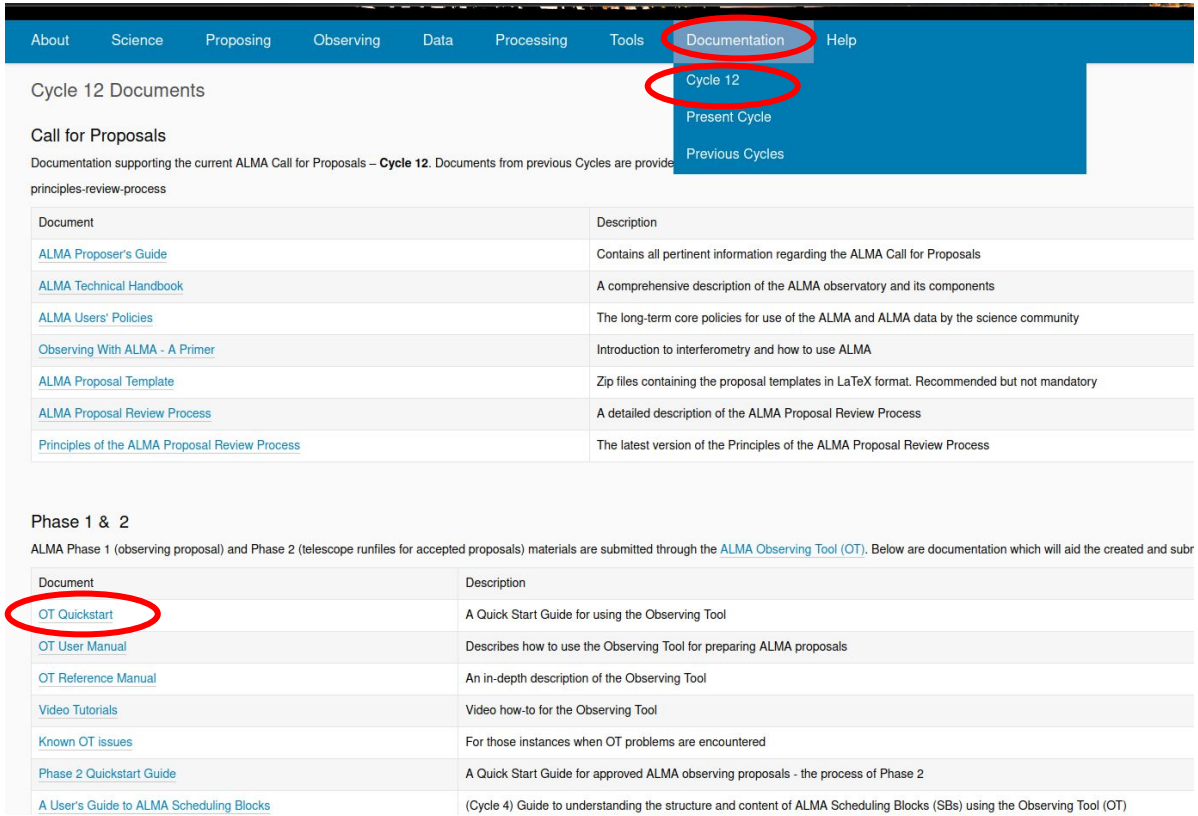


Installation

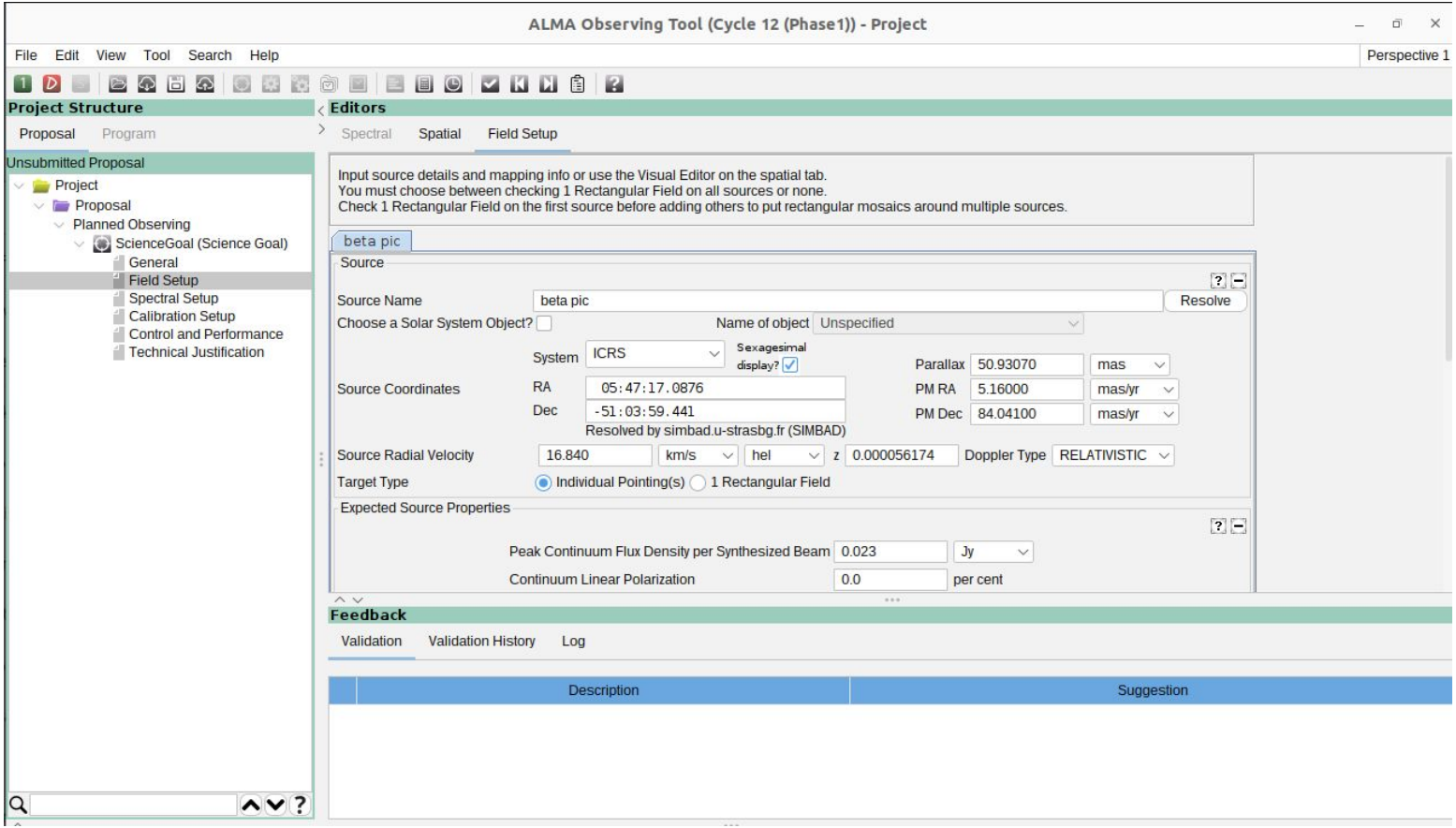
- the OT is available for Windows, Mac and Linux
- please follow the instructions on the download webpage
- if you have problems, feel free to contact the helpdesk



OT documentation

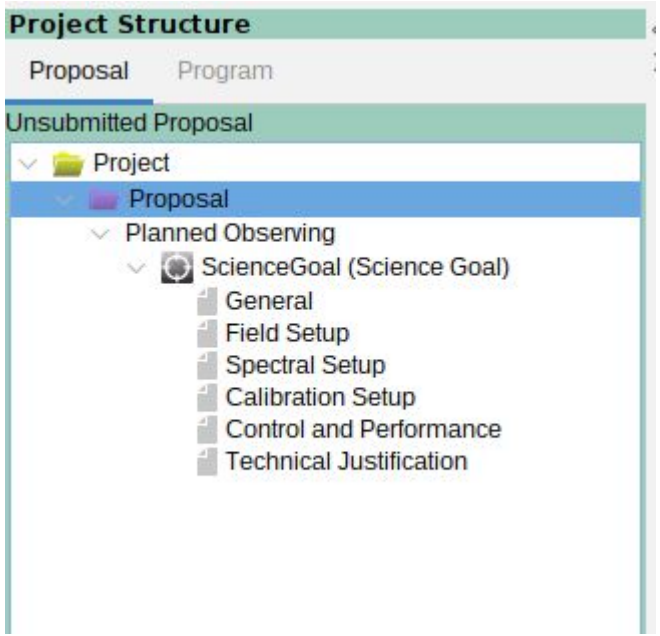


Overview


ALMA Observing Tool (Cycle 12 (Phase1)) - Project
File Edit View Tool Search Help
Perspective 1
Project Structure
Proposal Program
Unsubmitted Proposal
Project
Proposal
Planned Observing
ScienceGoal (Science Goal)
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification
Editors
Spectral Spatial Field Setup
Input source details and mapping info or use the Visual Editor on the spatial tab.
You must choose between checking 1 Rectangular Field on all sources or none.
Check 1 Rectangular Field on the first source before adding others to put rectangular mosaics around multiple sources.
beta pic
Source
Source Name beta pic
Resolve
Choose a Solar System Object?
Name of object Unspecified
System ICRS
Sexagesimal display?
Source Coordinates
RA 05:47:17.0876
Dec -51:03:59.441
Resolved by simbad.u-strasbg.fr (SIMBAD)
Parallax 50.93070 mas
PM RA 5.16000 mas/yr
PM Dec 84.04100 mas/yr
Source Radial Velocity 16.840 km/s hel z 0.000056174 Doppler Type RELATIVISTIC
Target Type Individual Pointing(s) 1 Rectangular Field
Expected Source Properties
Peak Continuum Flux Density per Synthesized Beam 0.023 Jy
Continuum Linear Polarization 0.0 per cent
Feedback
Validation Validation History Log
Description
Suggestion

Proposal information

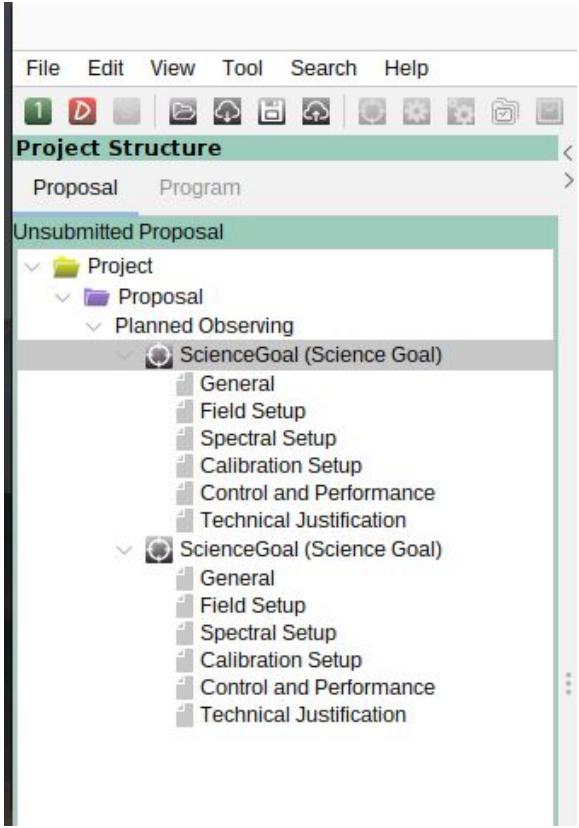
- here you enter general information about your proposal such as
  - Title
  - Abstract
  - Proposal type
  - Science category
  - PI / co-Is
  - Reviewer information
  - Justification for duplicated observations



Tip:
you can open your previous proposal as template (doesn't matter whether it was accepted or not):
"File -> Open Project as New Proposal"

Science Goals (SGs)

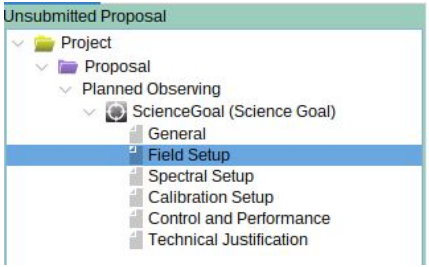
- your proposal consists of one or several Science Goals
- a Science Goal can have several targets, but only one spectral setup and only one set of “Control and Performance” parameters
  - Example: observe 10 sources with the same spectral setup, sensitivity and resolution: one SG
  - Example: observe a source in Band 3 and Band 6: two SGs

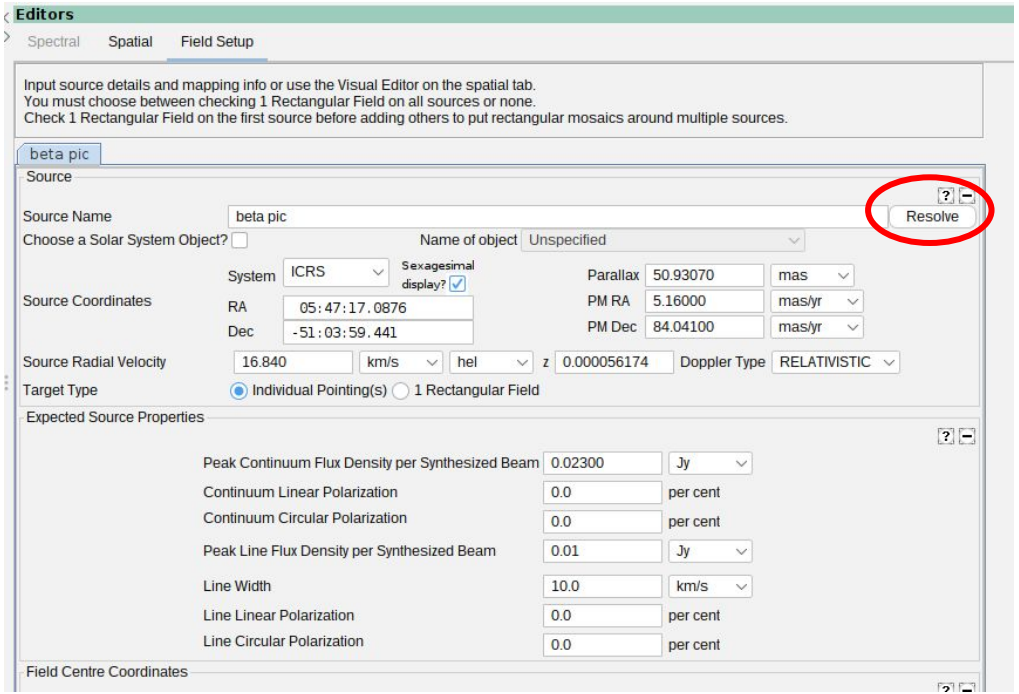


Tip:
you can copy / paste whole Science Goals and certain nodes within a Science Goal!

Field Setup

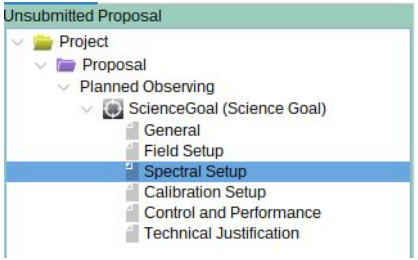
- define properties of your sources (coordinates, velocity,…)
- there are two types of sources:
  - Individual Pointing(s)
  - Rectangular Field
- Expected Source Properties:
  - Peak continuum flux
  - Peak line flux and line width (for line observations)
  - Polarisation properties (only for polarisation observation)





Tip:
Use “Resolve” to automatically fill target coordinates etc.

Spectral Setup



- define the frequencies and spectral resolution of your observations
- Spectral Type:
  - *Spectral Line*
  - *Single Continuum* (shortcut to define 4 continuum spectral windows)
  - *Spectral Scan* (to cover a wide, uninterrupted frequency range)

Tip:
90° Walsh switching available in Bands 9 and 10, see OT Quickstart Guide for details

Tip:
4-bit mode can improve the efficiency of your observations, see Proposer's Guide for details

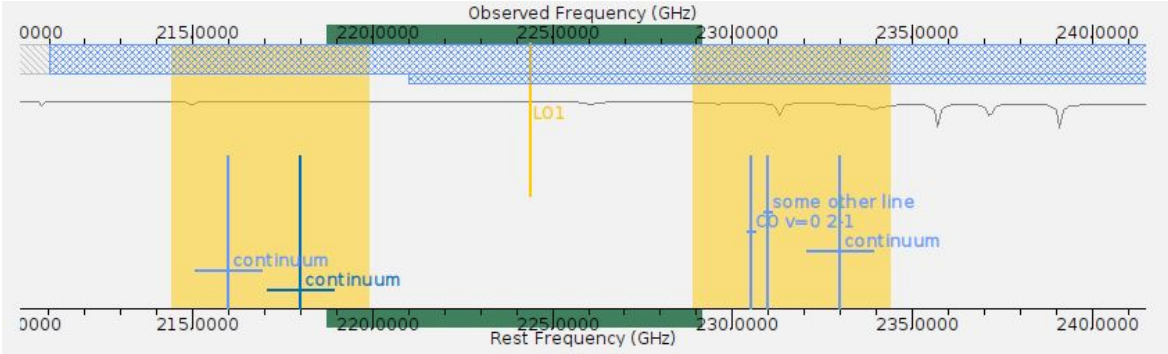
Spectral Line

- 4 basebands of ~2 GHz each
- each baseband can contain up to 4 spectral windows (i.e. up to 16 spectral windows in total)
- the higher the spectral resolution, the lower the bandwidth of the spectral window
- basebands not needed for spectral line observations should be used for continuum to maximise total bandwidth (helps calibration)!

Bandwidth, Resolution (smoothed)			
58.594 MHz(	76 km/s),	35.278 kHz(0.046 km/s)	(2-bit)
58.594 MHz(	76 km/s),	141.113 kHz(0.184 km/s)	(4-bit)
117.188 MHz(	152 km/s),	70.557 kHz(0.092 km/s)	(2-bit)
117.188 MHz(	152 km/s),	282.227 kHz(0.367 km/s)	(4-bit)
234.375 MHz(	305 km/s),	141.113 kHz(0.184 km/s)	(2-bit)
234.375 MHz(	305 km/s),	564.453 kHz(0.734 km/s)	(4-bit)
468.750 MHz(	610 km/s),	282.227 kHz(0.367 km/s)	(2-bit)
468.750 MHz(	610 km/s),	1.129 MHz(1.468 km/s)	(4-bit)
937.500 MHz(	1219 km/s),	564.453 kHz(0.734 km/s)	(2-bit)
937.500 MHz(	1219 km/s),	2.258 MHz(2.936 km/s)	(4-bit)
1875.000 MHz(	2438 km/s),	1.129 MHz(1.468 km/s)	(2-bit)
1875.000 MHz(2438 km/s),		**36.125 MHz(46.978 km/s)**	**(2-bit)**

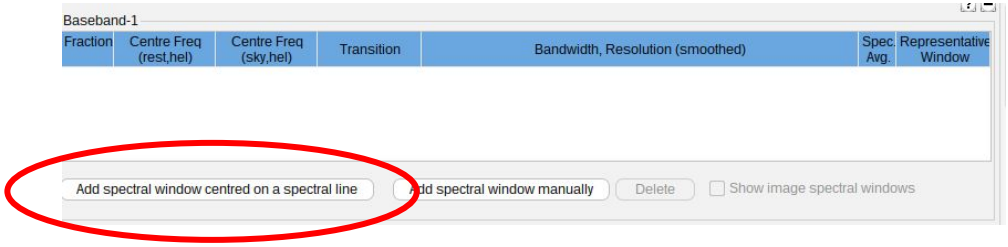
The higher the spectral resolution, the lower the bandwidth of the spectral window

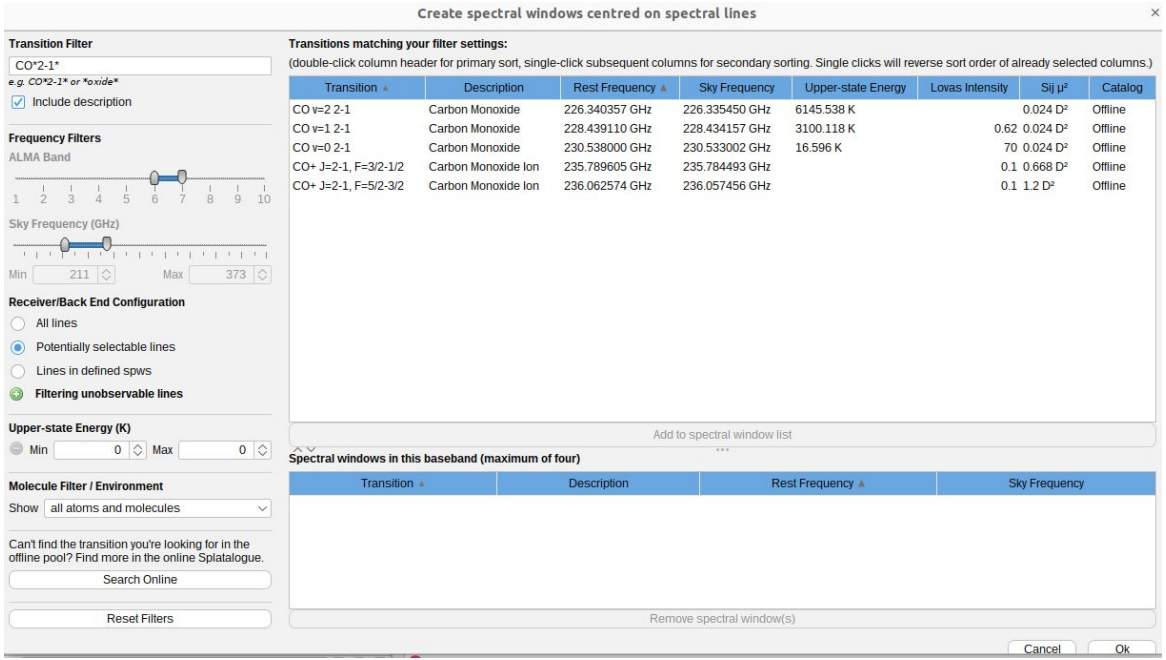
Example of a setup using continuum spectral windows to maximise the total bandwidth



Spectral Line

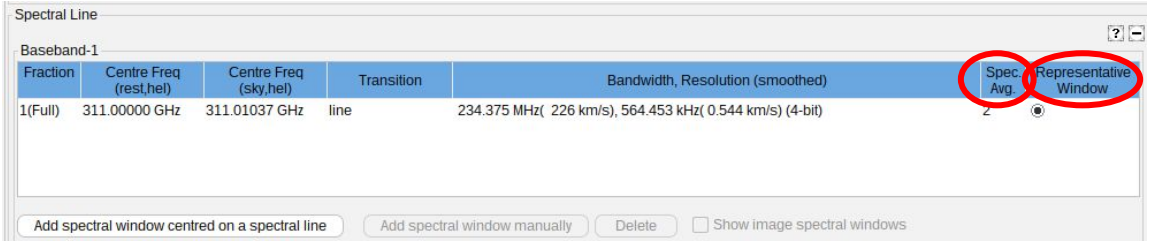
- you can use the line frequency catalog to center spectral windows on emission lines

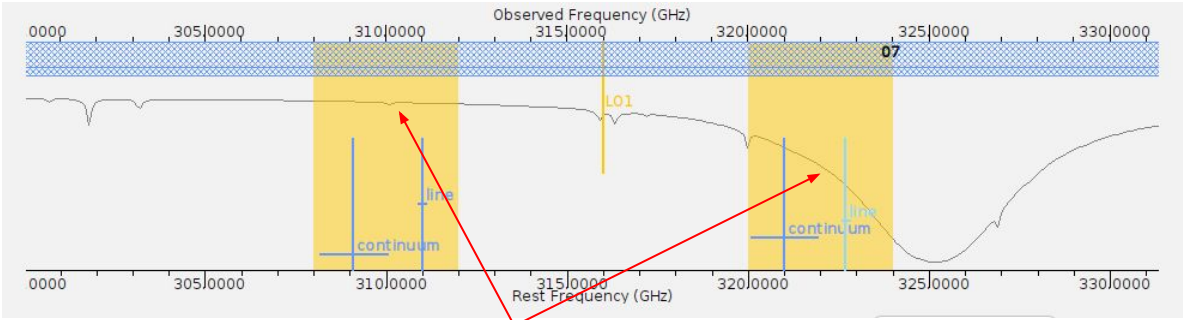




Representative window / Spectral Averaging

- pay attention to the representative window / frequency, because it affects the time estimate! (e.g. if the atmospheric transmission is very different for different windows)
- usually choose the window most important for your science
- Spectral Averaging can be used to reduce the data rate if necessary (see OT Quickstart Guide for details)

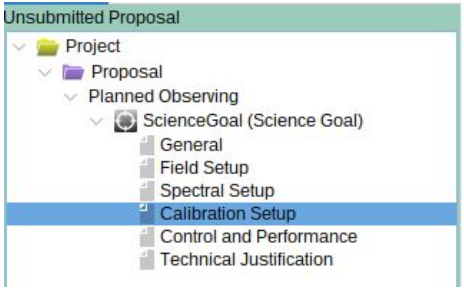


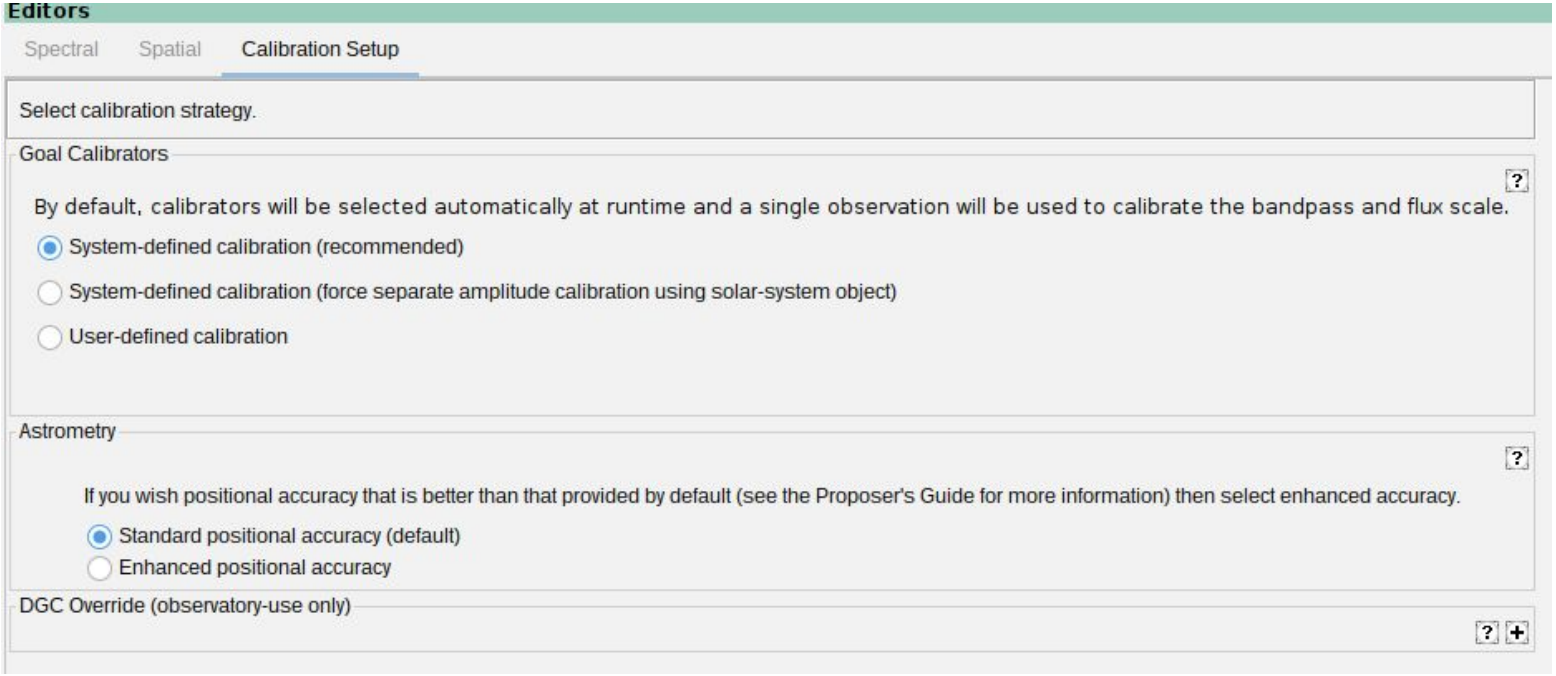


Very different atmospheric transmission. Choice of representative window will affect time estimate!

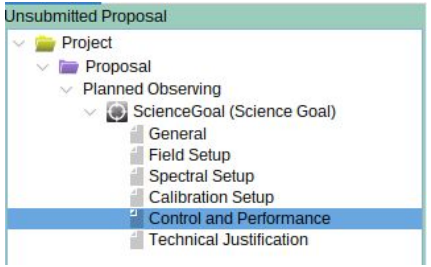
Calibration Setup

- normally, just use the defaults!

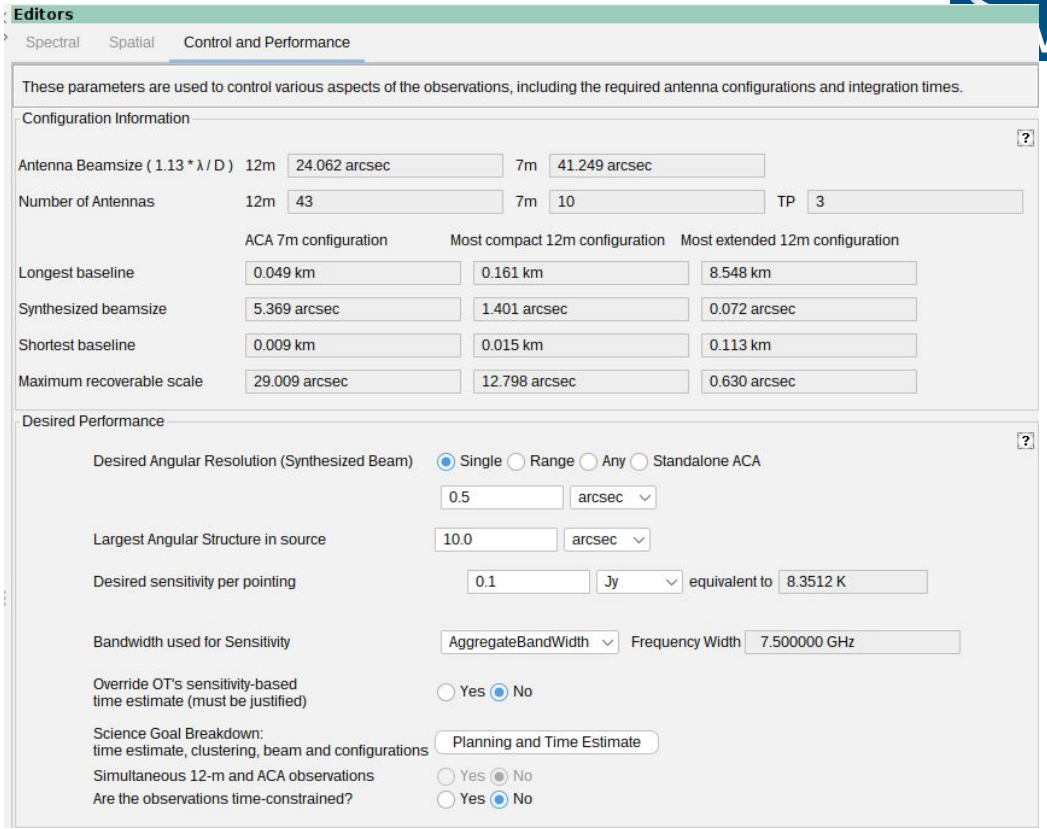




Control and Performance

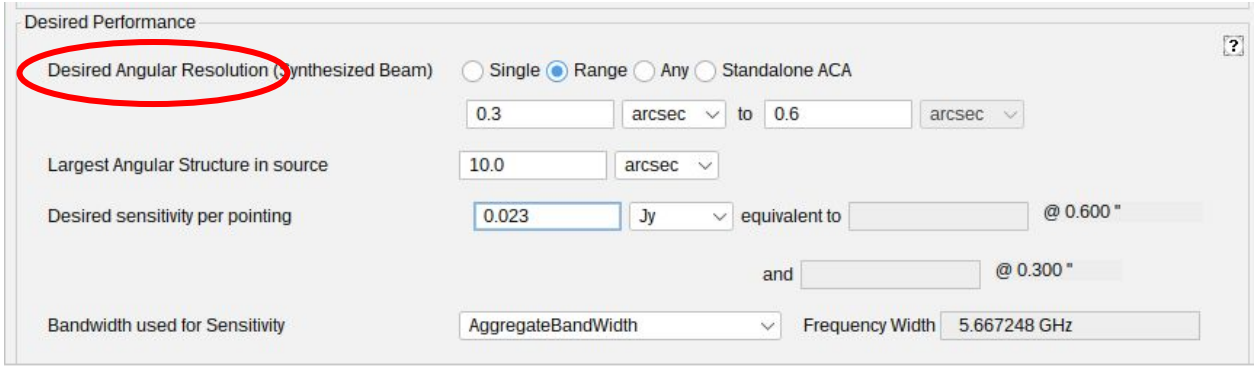


- requested angular resolution
- largest angular structure you want to recover
- requested sensitivity
- (time-constraints)



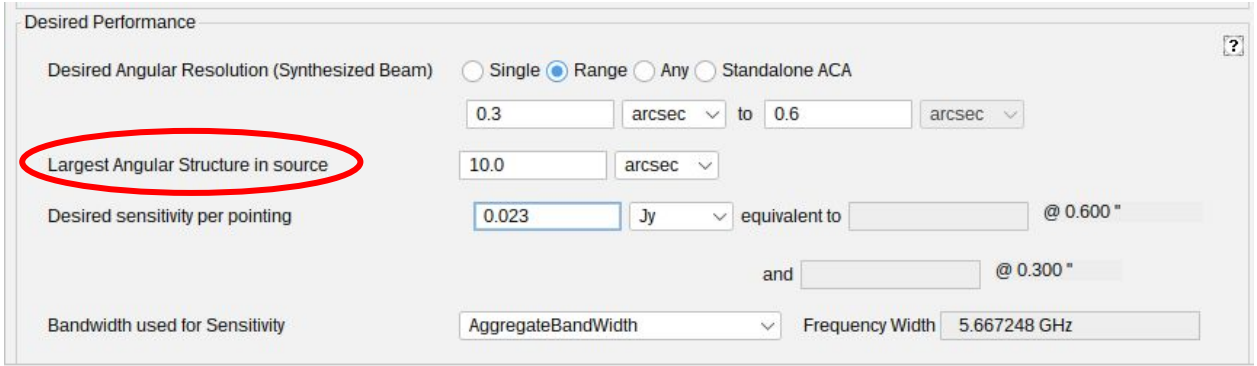
Angular resolution

- *Single*: a single value (although in practice +-20% is considered)
- *Range*: if science can be done with several configurations (might increase chances of observation), a range of angular resolutions can be defined
- *Any*: science can be done with any configuration (in practice, long baselines will not be used)
- *Standalone ACA*: use only ACA, no 12m array



Largest angular structure

- interferometers filter out large scale emission (maximum recoverable scale is approximately $0.6\lambda/L_{min}$, where L_{min} is the shortest baseline)
- you have to define the largest angular scale that you need to recover for your science
- the OT will automatically add compact configurations if necessary
- see https://www.youtube.com/watch?v=9iDNq82t7gs



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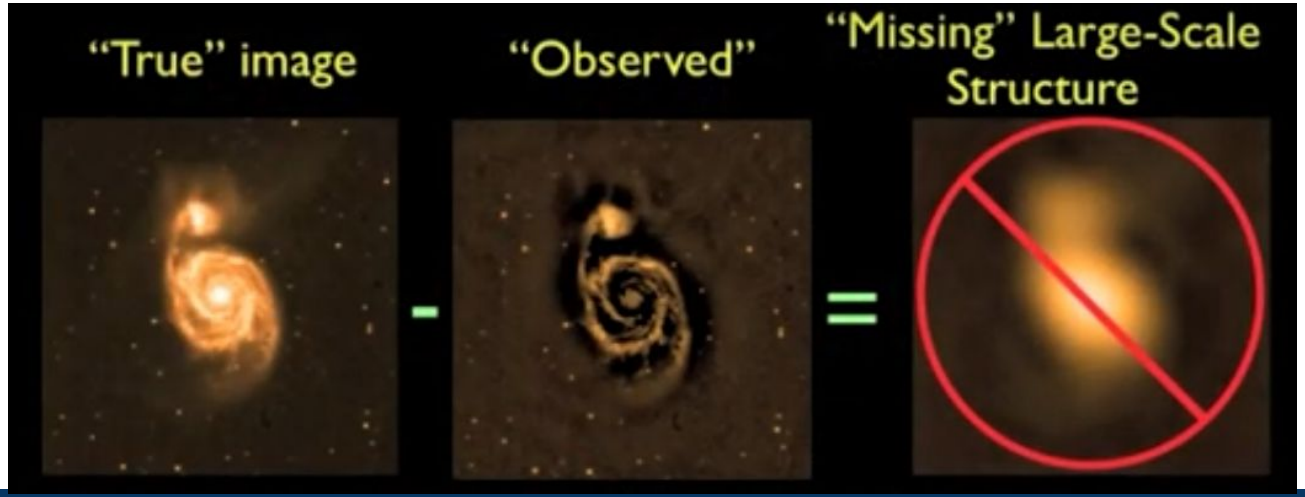
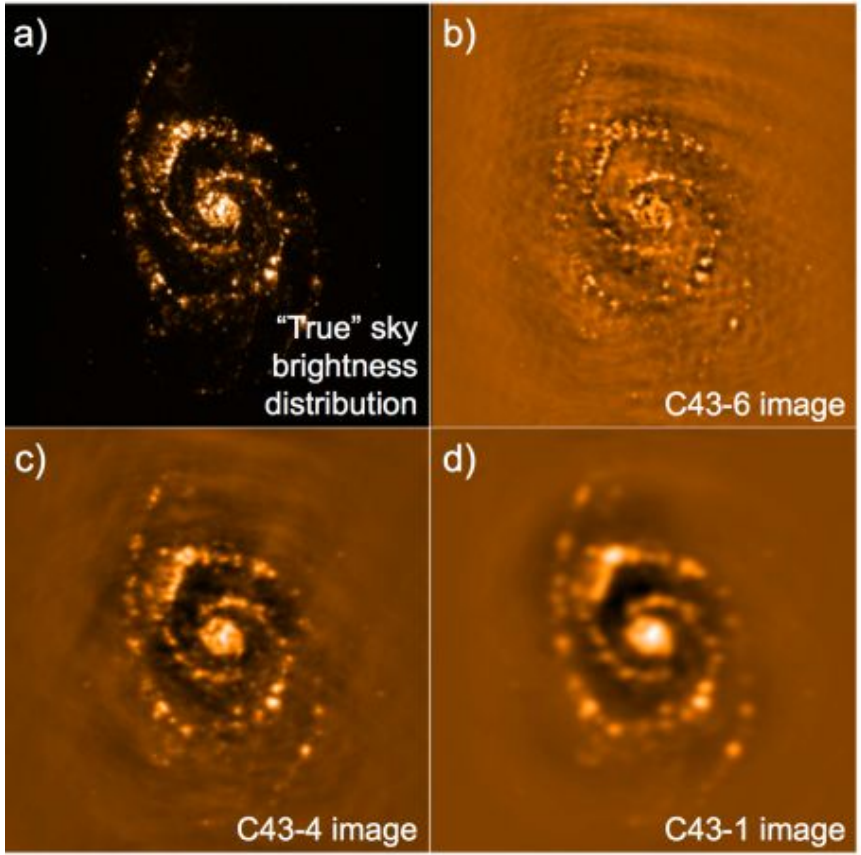


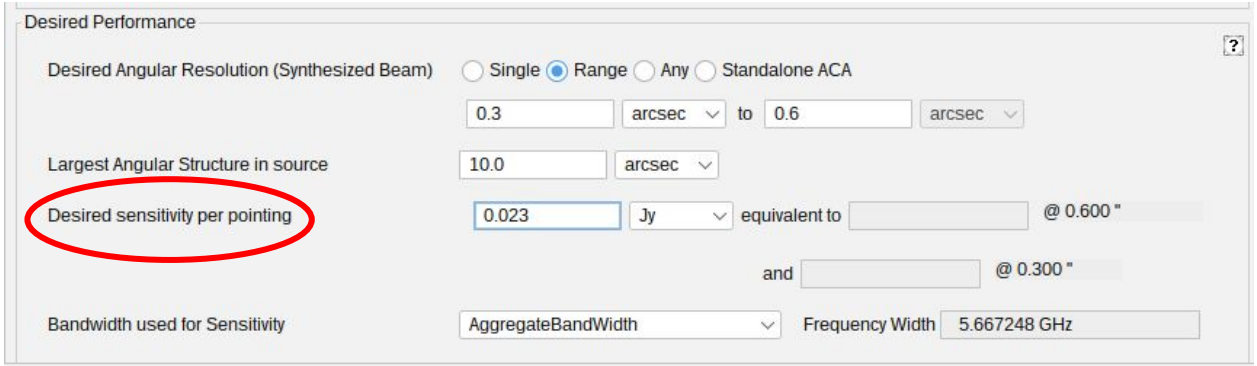
Largest angular structure

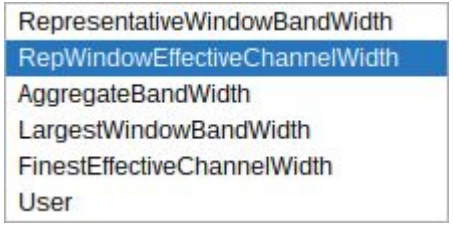


Simulated observations illustrating spatial filtering (Fig. 3.6 in Technical Handbook cycle 11)

Sensitivity

- enter the sensitivity (1σ) you need for your science
- pay attention to the “Bandwidth used for Sensitivity”



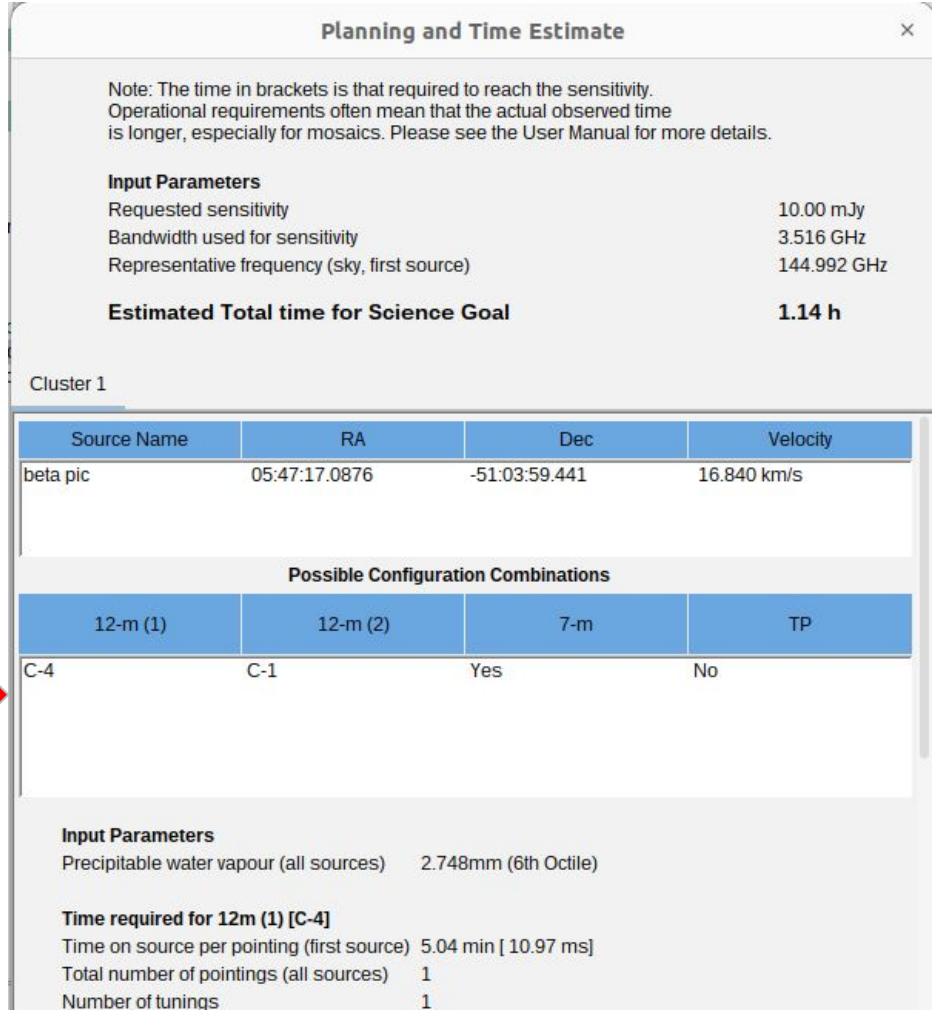


Possible choices for the “Bandwidth used for Sensitivity”

Time Estimate

- “Planning and Time Estimate” gives you an overview of the required observing time and antenna configurations

In this example, two 12m configurations are used to achieve the requested angular resolution and recover emission on the largest angular structure



Planning and Time Estimate

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.

Input Parameters

Requested sensitivity	10.00 mJy
Bandwidth used for sensitivity	3.516 GHz
Representative frequency (sky, first source)	144.992 GHz
Estimated Total time for Science Goal	**1.14 h**

Cluster 1

Source Name	RA	Dec	Velocity
beta pic	05:47:17.0876	-51:03:59.441	16.840 km/s

Possible Configuration Combinations

12-m (1)	12-m (2)	7-m	TP
C-4	C-1	Yes	No

Input Parameters

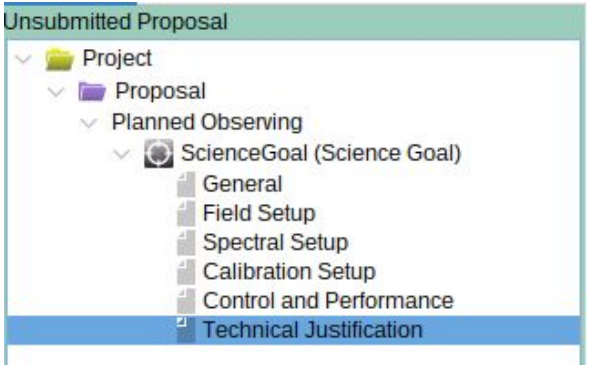
Precipitable water vapour (all sources)	2.748mm (6th Octile)

Time required for 12m (1) [C-4]

Time on source per pointing (first source)	5.04 min [10.97 ms]
Total number of pointings (all sources)	1
Number of tunings	1

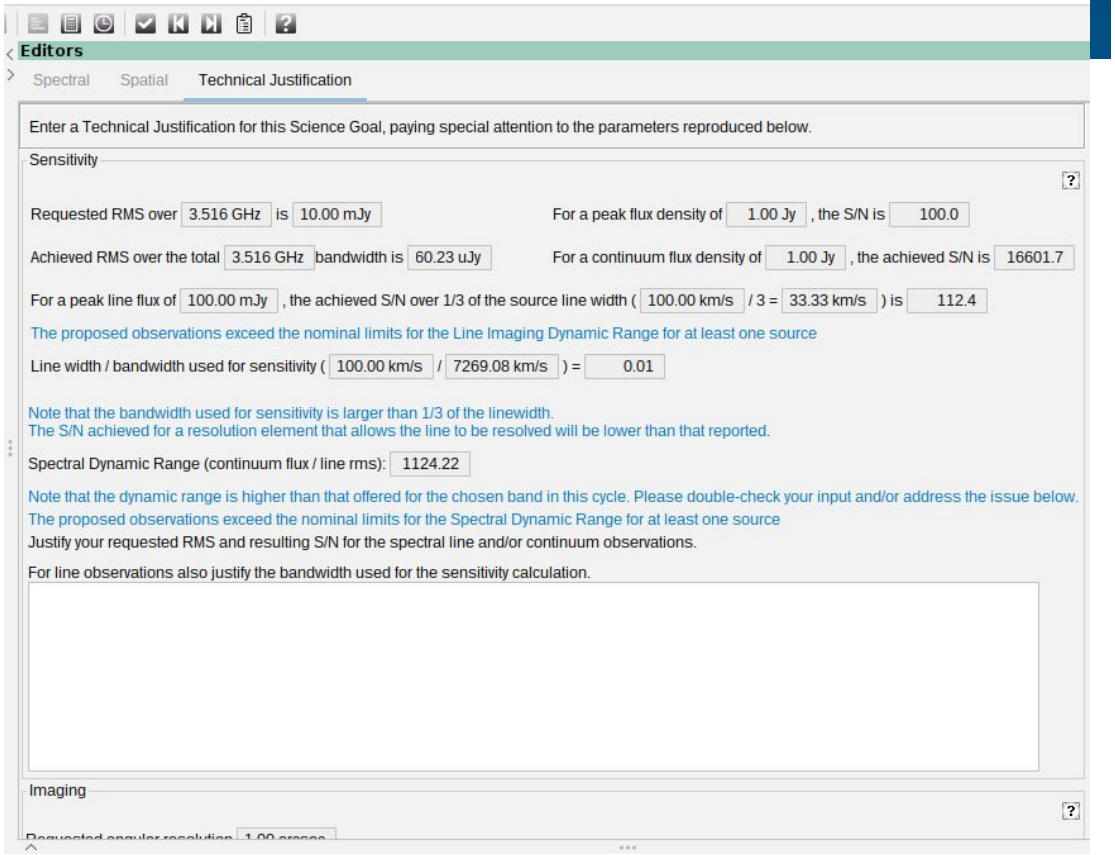
Technical Justification (TJ)

- **quantitatively** justify your technical setup (usually three text boxes):
  - Sensitivity
  - Imaging (angular resolution, largest angular scale)
  - Correlator Setup (=Spectral Setup)
- you need to convince the reviewers that your setup
  - can achieve your scientific goals
  - uses ALMA time efficiently
- the Technical Justification is important!
  - If you have a weak science case, a good TJ will not save you
  - ...but if you write a bad TJ, your proposal might be rejected even though you have a great science case（もったいない！）
- look at examples from your colleagues!

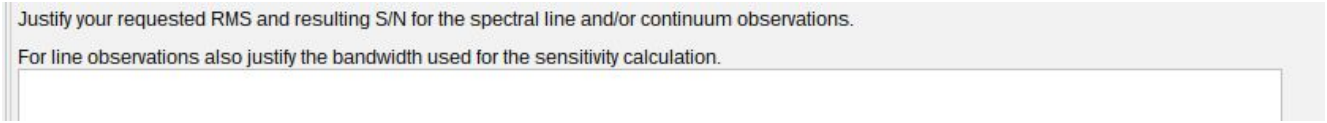


Technical Justification (TJ)

- pay particular attention to the blue text and be sure to include the corresponding justifications in your TJ (or change your setup)

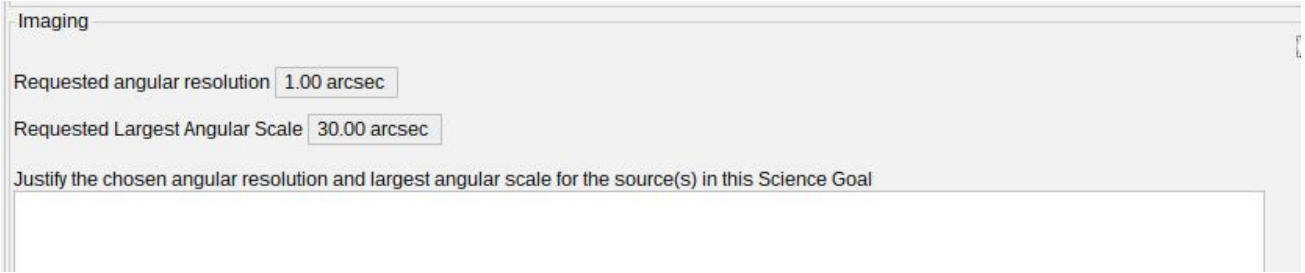


Technical Justification: Sensitivity



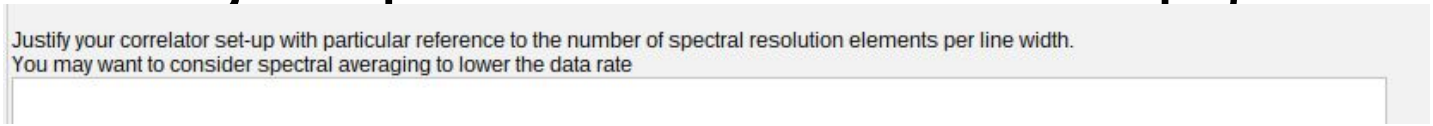
- What is the justification for the requested sensitivity?
  - What is the expected source brightness?
  - What S/N ratio do you need, and why?
  - Example: “To measure the disk size with an error of ~20%, our simulated observations indicate that we need a peak S/N of at least 10 in a single beam. Considering the total flux of the source measured by Camelot (1999), we expect a flux of 1 mJy/beam. Thus, we request a sensitivity of 0.1 mJy/beam…”
- For line observations, justify also the bandwidth used for the sensitivity calculation
  - Example: “As described in the Scientific Justification, to distinguish between our two hypotheses, we need to measure the CO 2-1 spectrum with a peak S/N of at least 5. Our models predict a CO 2-1 peak flux larger than 20 mJy. Thus, we request a sensitivity of 4 mJy over the bandwidth of a single channel.”
- If you do both line and continuum observations, be sure to discuss both

Technical Justification: Imaging



- Why do you need to achieve the requested angular resolution for your science?
  - What do you want to resolve?
  - Example: “To accurately characterise the ring morphology, we need to resolve it with at least 5 beams. Given the ring width of 0.5” measured by Lancelot (1988), we thus request an angular resolution of 0.1”...”
- What is the maximum angular scale you need to recover for your science, and why?
  - Example: “For our science, we need to recover the large scale emission of our source. Therefore, we set the largest angular scale equal to the galaxy diameter...”

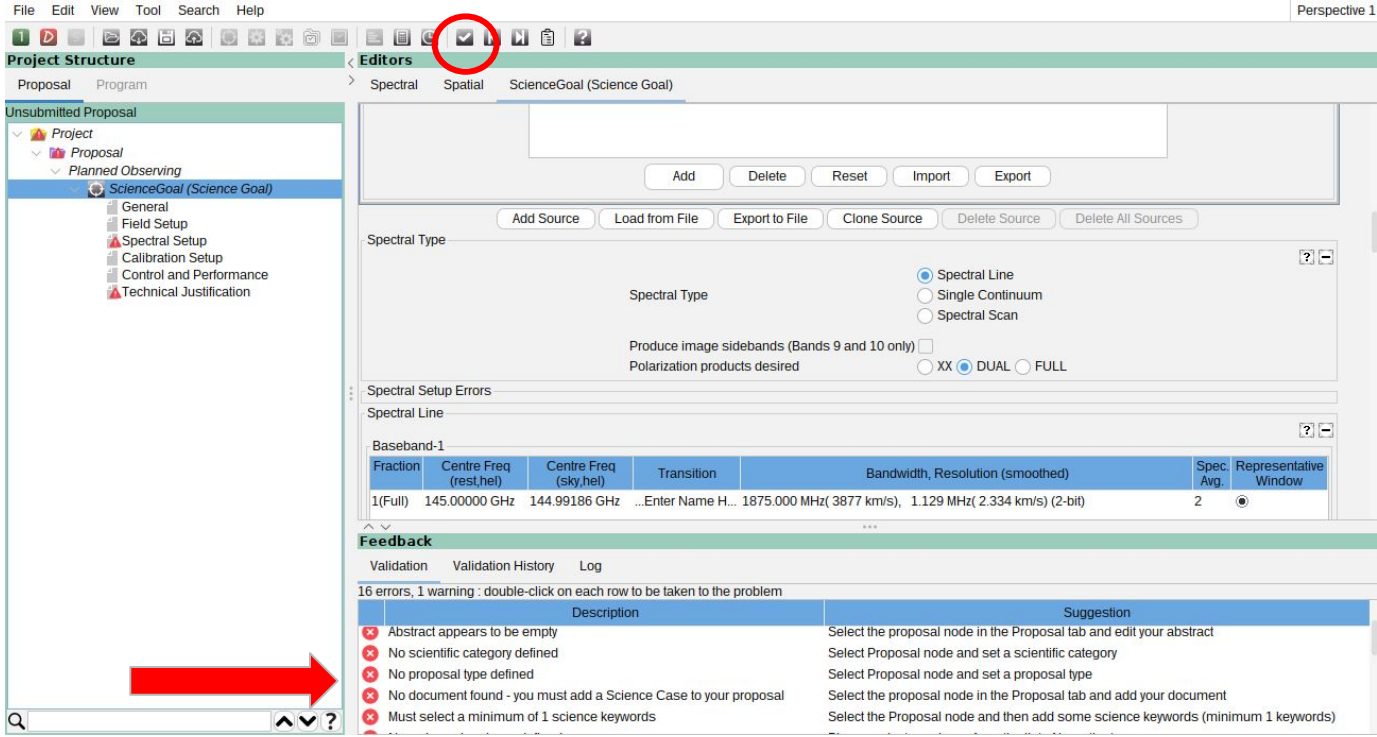
Technical Justification: Correlator configuration



- What is the idea behind your spectral setup?
  - Example: “We place one spectral window onto the CO 2-1 line, while the remaining three spectral windows will observe the continuum to aid calibration. The continuum spectral windows will observe in FDM mode to allow serendipitous line detection…”
- What spectral resolution do you need, and why?
  - Example: “We want to resolve the line shape with at least 10 resolution elements to characterise the kinematics of the source in detail. Given the known line width of 10 km/s (Robin et al. 2000), we thus need a spectral resolution of 1 km/s.”
- Why did you choose Band X?
  - Example: “Observations in Band X give best tradeoff between the achieved S/N and the required observing time…”

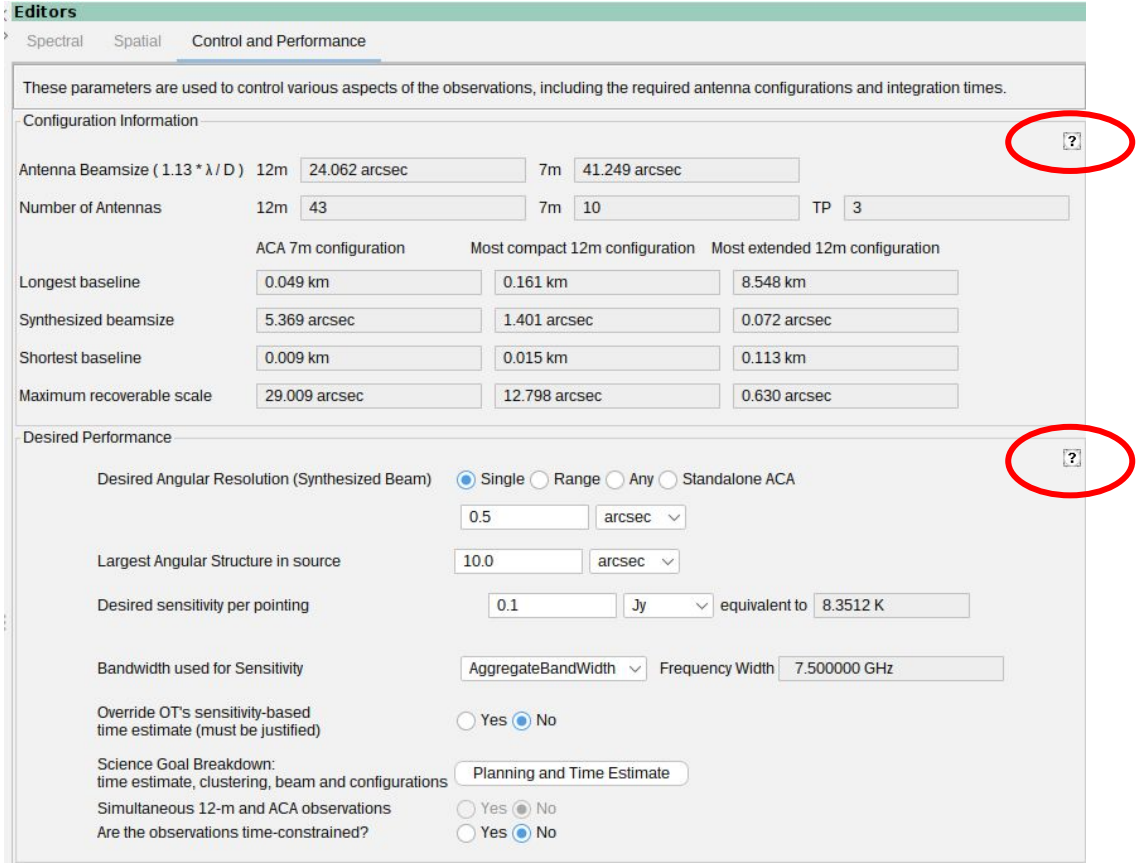
Validation

- Before submission, proposal needs to be validated
- double-click on any errors to be taken to the problem



Tip: help function

- Use the help function!



Tip: help function

- Use the help function!