EUROPEAN ARC
ALMA Regional Centre || Italian

Observing Tool for Cycle 3

OT presentation
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Hands on session
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9 April, 2015
Italian ALMA Region Centre
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Observing Tool (OT)

- The **only** way how to submit ALMA proposals
- The OT helps the user to write a proposal with a valid technical setup. Some important aspects:

1. A spatial tool to visualize your pointings or define your mosaics
2. A spectral tool to visualize your spectral setting - with error messages if the settings are outside of ALMA capabilities which will prohibit the validation of your proposal
3. OT will estimate the data rate, and integration time, which **if too high, are reasons to discard the proposal**
4. Before submitting, one needs to **validate the proposal**

Getting the OT

Requires Java 7 or 8

➡ **Webstart:**

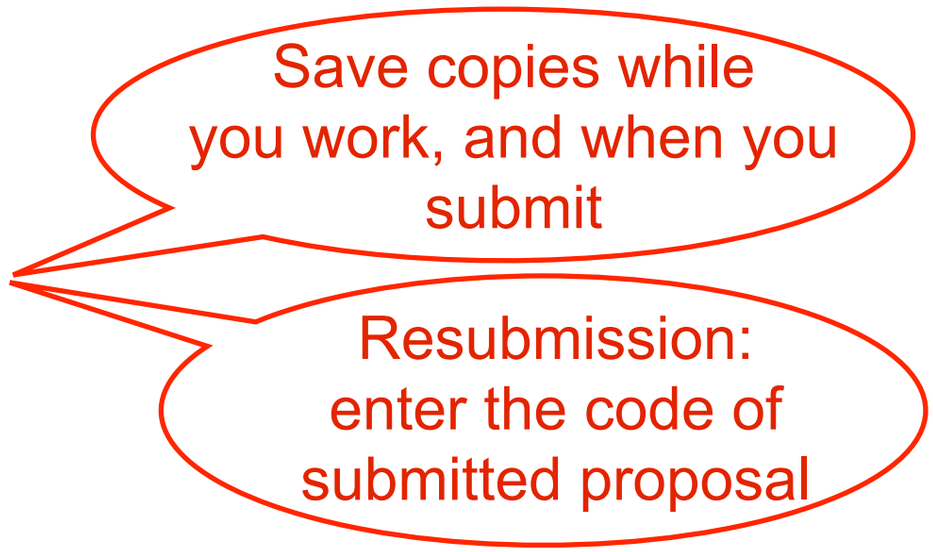
- Always updated
- Requires internet connection
- Recommended version

➡ **Download tarball:**

- No internet connection required, but may be outdated

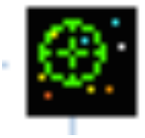
Starting up the OT

- Allows to start a:
  - new project
  - an existing project from disk
  - open a submitted proposal
  - a DDT proposal



- PI and Co-I's have to have **an ALMA account**
- Proposal type:
  - Regular
  - Target of Opportunity (ToO) or Director Discretionary Time (DDT)
- Add abstract and upload the Scientific Justification

Add a Science Goal



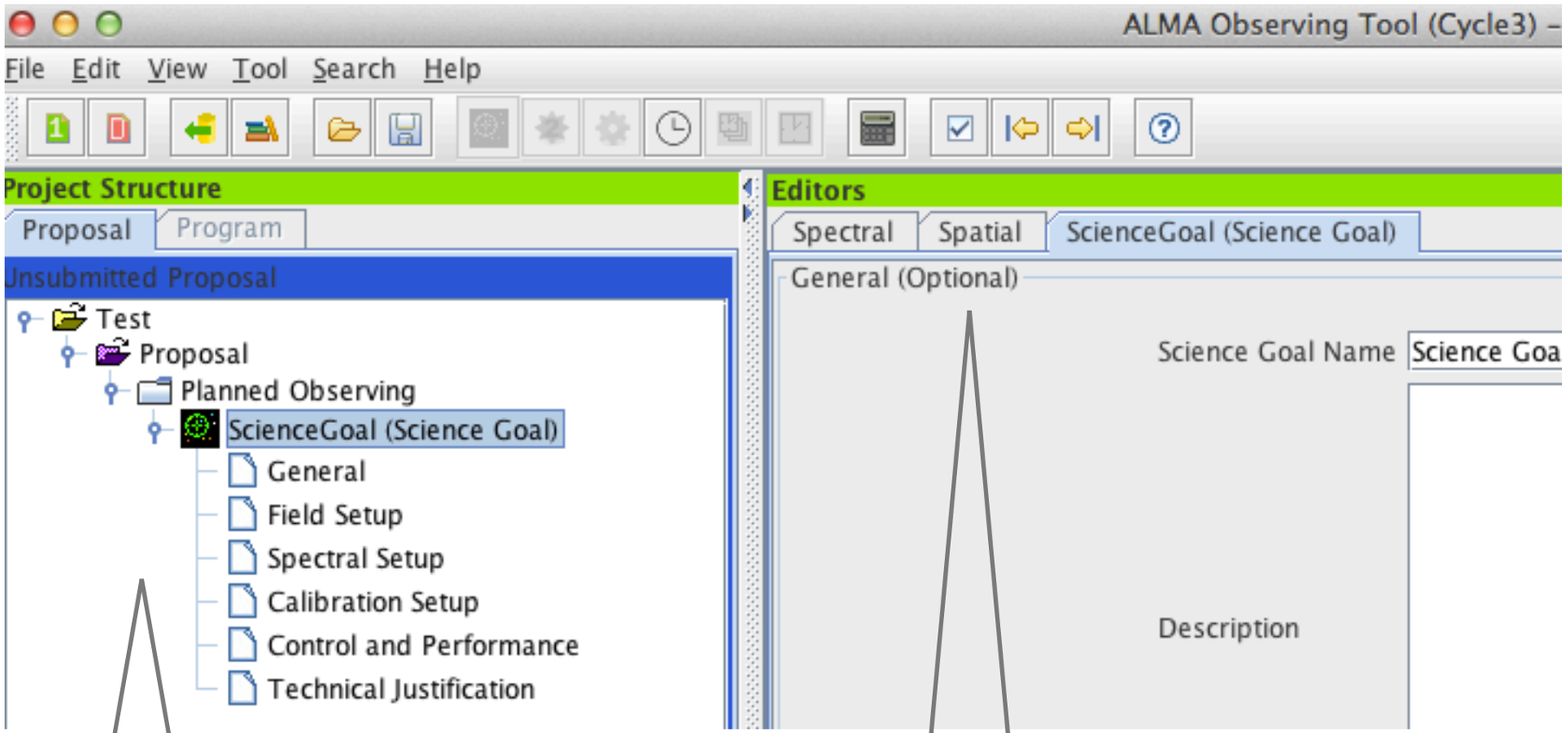
Definition of Science Goal:

- sources that share the same observational setup (incl. spectral setup, calibration setup, correlator setup)
- within 10 deg in the sky
- max. 5 frequency setting within the same receiver band (i.e., max. 5 objects with different V_{LSR} or Z)
- max. 150 pointings

>1 bands means
>1 SG

A proposal can have more than one Science Goal

Science goal setups



A Science Goal contains various setups

A setup can have additional spectral or spatial tabs

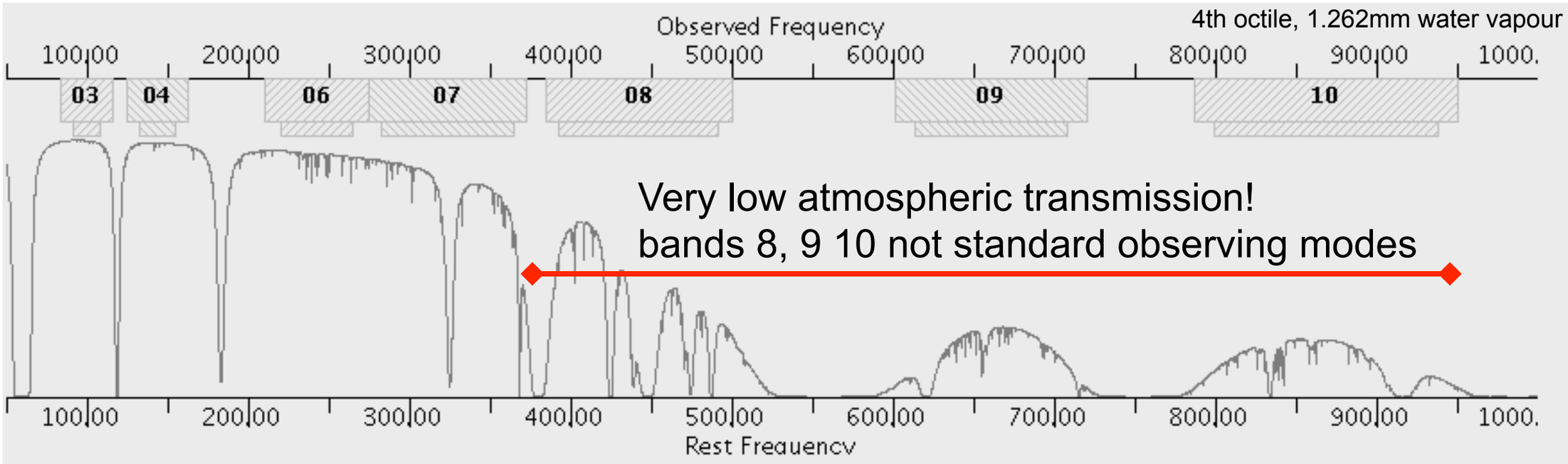
Field setup

- Enter source coords, astrometry, V_{LSR}
- Enter **expected source properties at ALMA frequency and resolution**: line and cont. flux, polarization, line width
- Expected source properties are taken into account by OT in technical justification, which will show the S/N and notify when below 3
- Enter the observing positions, but pointing(s) or mosaic (rectangle) require beamsizes >> set first the **spectral setup**

Bad S/N proposals **pass** verification, but can be **rejected** on technical grounds depending on the justification

Spectral setup / spectral tab

The spectral tab includes the visualization of the **ALMA bands**, the **transmission curve**, and allows also to **overlay spectral lines** from the archive



When you choose your spectral setup, it will be visualized in this plot: important is to NOT observe lines at frequencies with a transmission (as the middle of in band 7) since the exposure time will go to infinite.

Selecting your spectral setup

Types of spectral settings:

- **continuum observations** (single continuum, 4x1.875GHz BW)
- **spectral line** (user selected spectral windows)
- spectral scan (not a standard observing mode)

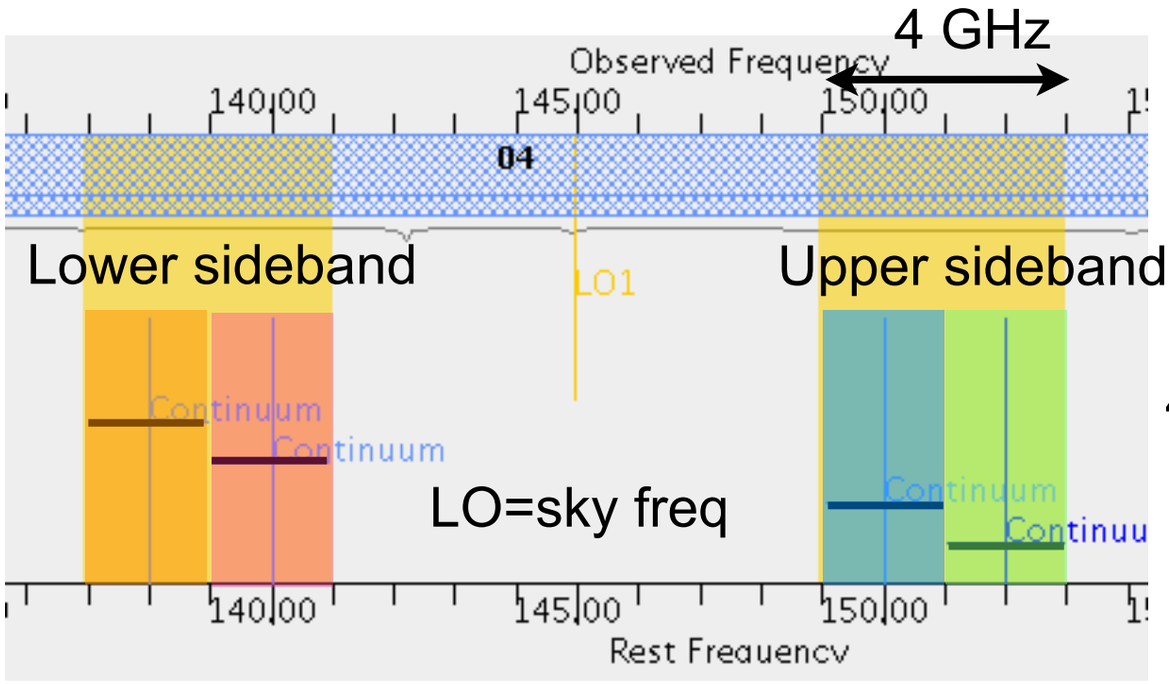
Types of polarization products that can be chosen:

- DUAL polarization (standard)
- single polarization (sqrt(2) more noise, but higher freq. resolution)
- full polarization (only for continuum pointings, non-standard mode)

Continuum observations

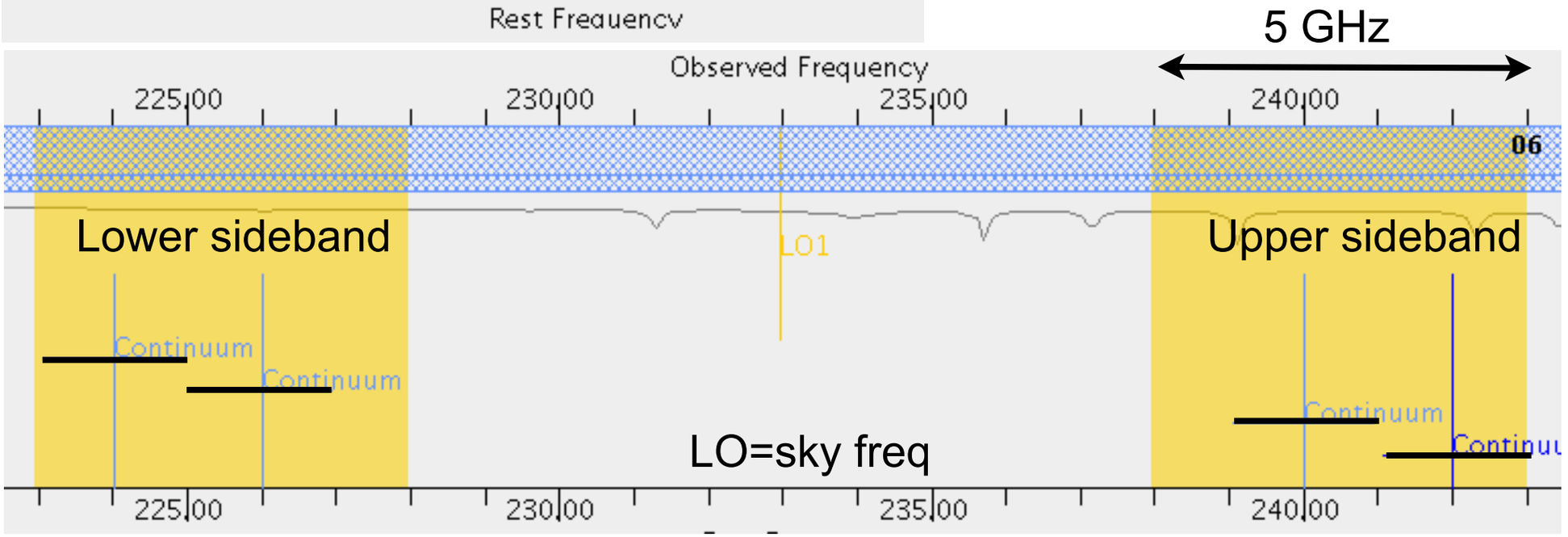
Uses the entire bandwidth available of 4 basebands (7.5 GHz)

Set **sky freq** (=representative freq used for FOV, θ_{synth}, LAS), and the four 1.875 GHz basebands are set by the OT, depending on the receiver specifics



4 basebands

Bands 3, 4, 7, 8 (2SB): available sky frequencies of [LO-8,LO-4] GHz for LSB and [LO+4,LO+8] GHz for USB.



Band 6 (2SB): available sky frequencies of [LO-10,LO-5] GHz for LSB and [LO+5,LO+10] GHz for USB.

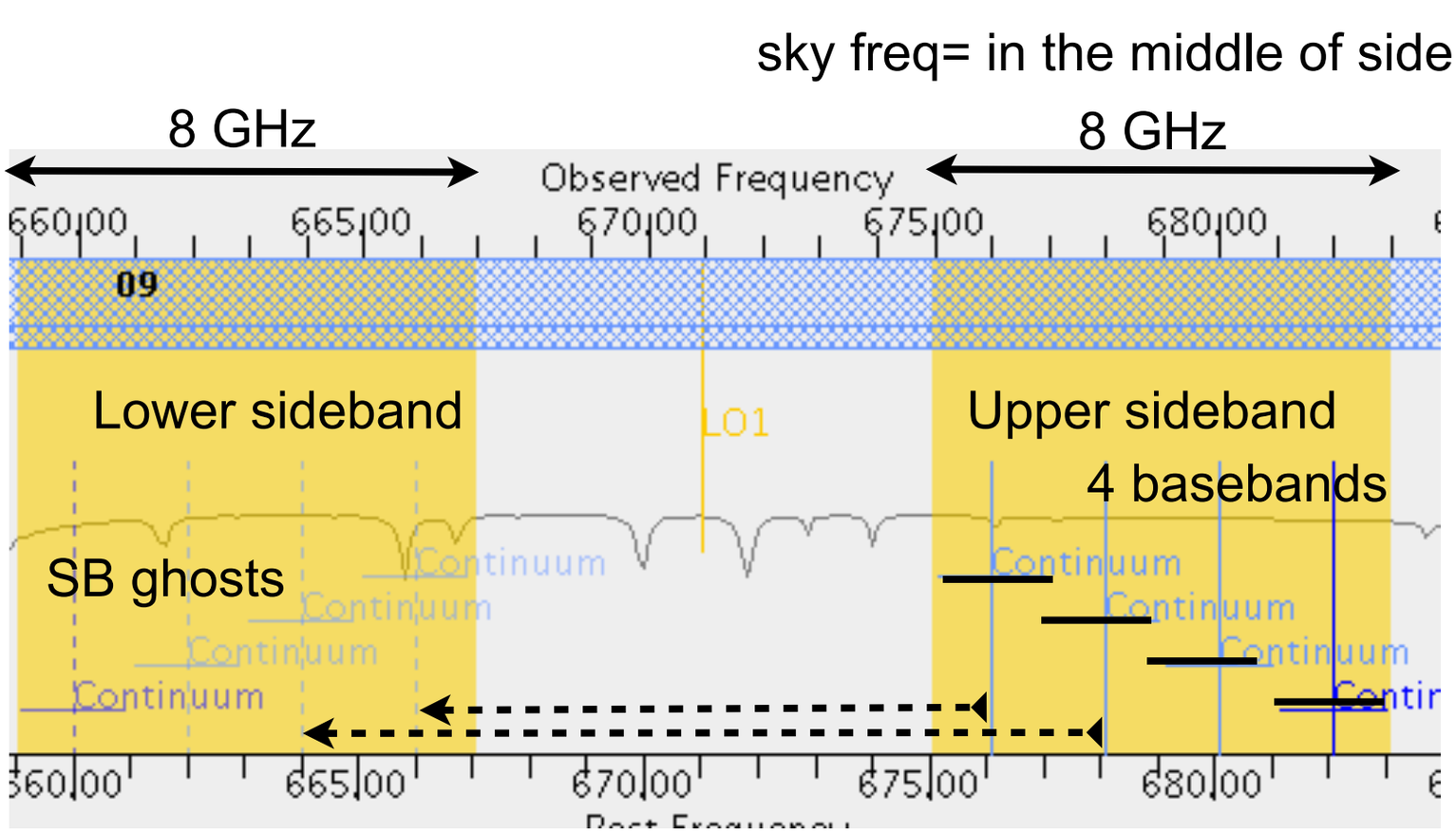
Continuum observations II

Band 9 & 10 have a DSB receiver - Information from LSB and USB is not independent is for 2SB receivers.

Quality of chosen spw depends *also* on the spw ghost in the other sideband. Check carefully the atmospheric transmission or for the presence of a strong line at the mirrored frequency.

Bands 9,10 (DSB): available sky frequencies of [LO-12, LO-4] GHZ for LSB or [LO+4,LO+12] GHz for USB.

sky freq= in the middle of sideband



Under the spectral line settings one can adjust the center frequencies of the (also continuum) basebands with more freedom (incl. using a mixed spectral line and continuum setup).

Spectral line observations

Tot fraction=1

Vres the same

3 SPW

Baseband-1

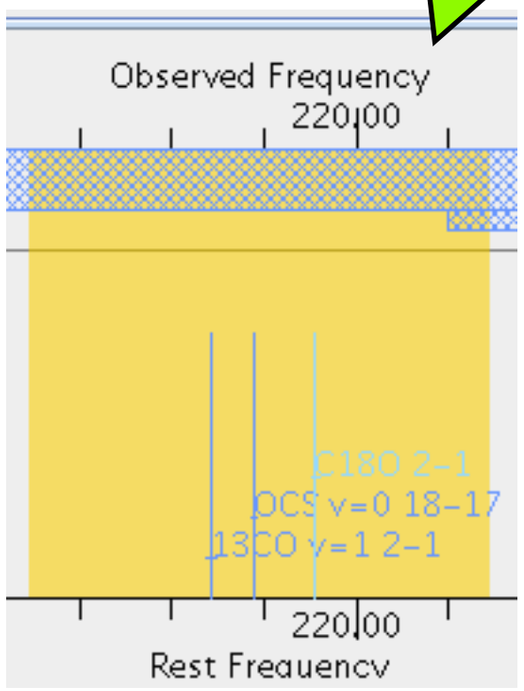
Fraction	Center Freq (Rest)	Center Freq (Sky)	Transition	Bandwidth, Resolution (smoothed)	Spec Avg.	Representative Window
1/2	218.43703 G...	218.43703 G...	13CO v=1 2-1	117.188 MHz(161 km/s), 122.070 kHz(0.168 km/s)	1	◉
1/4	218.90336 G...	218.90336 G...	OCS v=0 18-17	58.594 MHz(80 km/s), 122.070 kHz(0.167 km/s)	1	○
1/4	219.56036 G...	219.56036 G...	C18O 2-1	58.594 MHz(80 km/s), 122.070 kHz(0.167 km/s)	1	○

58.594 MHz(80 km/s), 122.070 kHz(0.167 km/s)
117.188 MHz(160 km/s), 244.141 kHz(0.333 km/s)
234.375 MHz(320 km/s), 488.281 kHz(0.667 km/s)
468.750 MHz(640 km/s), 976.563 kHz(1.333 km/s)

Select Lines to Observe in Baseband-1...

Add

lines in spectral viewer

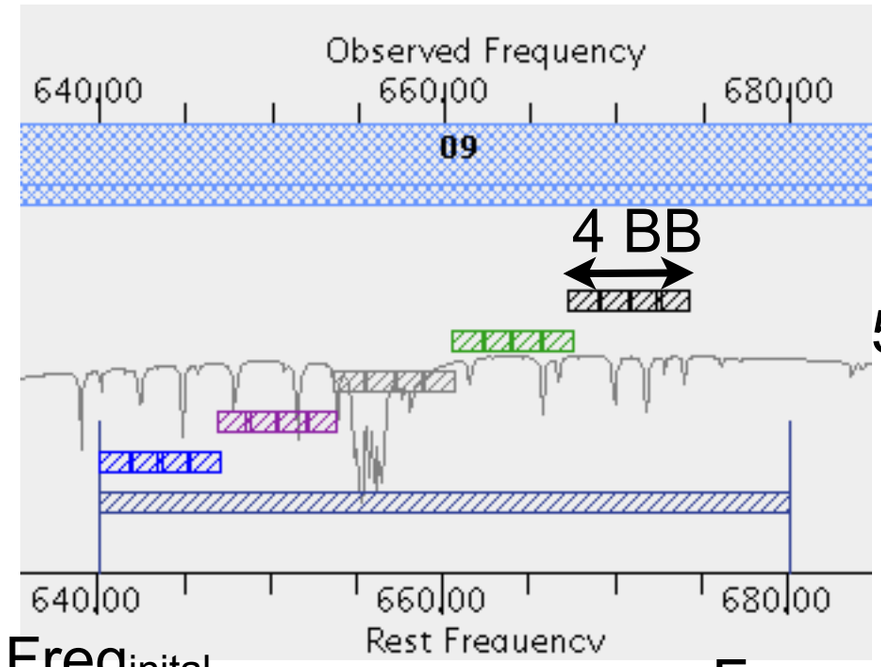


- Choose spectral windows (max 4) within the 1.875 GHz baseband. Spws of one baseband must have same Vres.
- Spectral windows can overlap
- OT will set representative freq. = freq of representative window
- Set unused basebands to continuum (BW=1.875 GHz, Vres=31.25 MHz) or ‘high-res’ continuum (BW=1.875 GHz, Vres=976 kHz) if strong lines expected.
- OT has a spectral database: import the spectral lines directly into the baseband!

Spectral scan (non-standard)

Five spectral tunings from a beginning and end frequency for all four basebands given a selected bandwidth to give continuous frequency coverage

Bandwidth=1875 MHz

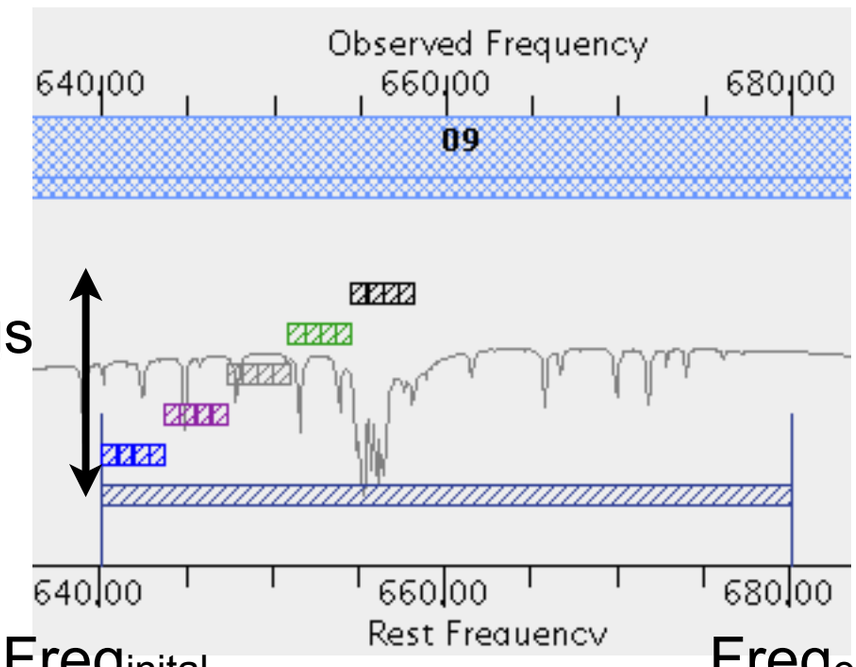


$Freq_{inital}$

$Freq_{end}$

5 tunings

Bandwidth=937.5 MHz



$Freq_{inital}$

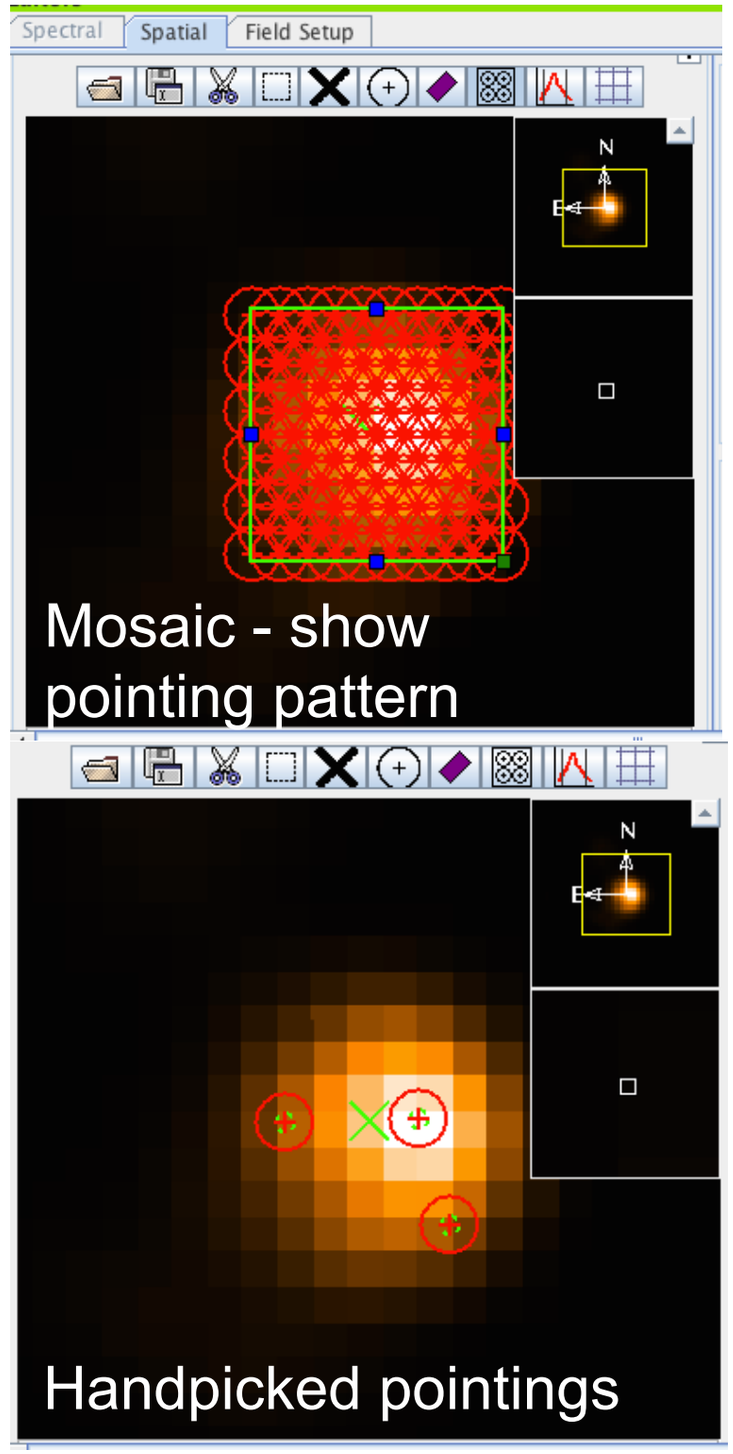
$Freq_{end}$

Having finished the spectral setup, the representative frequency is defined and one can return to the Field setup / spatial tab

Field setup / spatial tab

Only for fits files in radec - J2000 coords!

- Beam sizes from representative frequency
- Allows to **define and visualize the pointings or to define a mosaic** by choosing a rectangle on the spatial image viewer
- You can load your own or a catalog fits file (like Aladin) for the background to ease the selection of the spatial coverage
- With mosaics OT calculates sensitivity taking into account overlapping pointings
- With multiple single pointings OT **does not** consider overlaps >> unnecessary high int. time



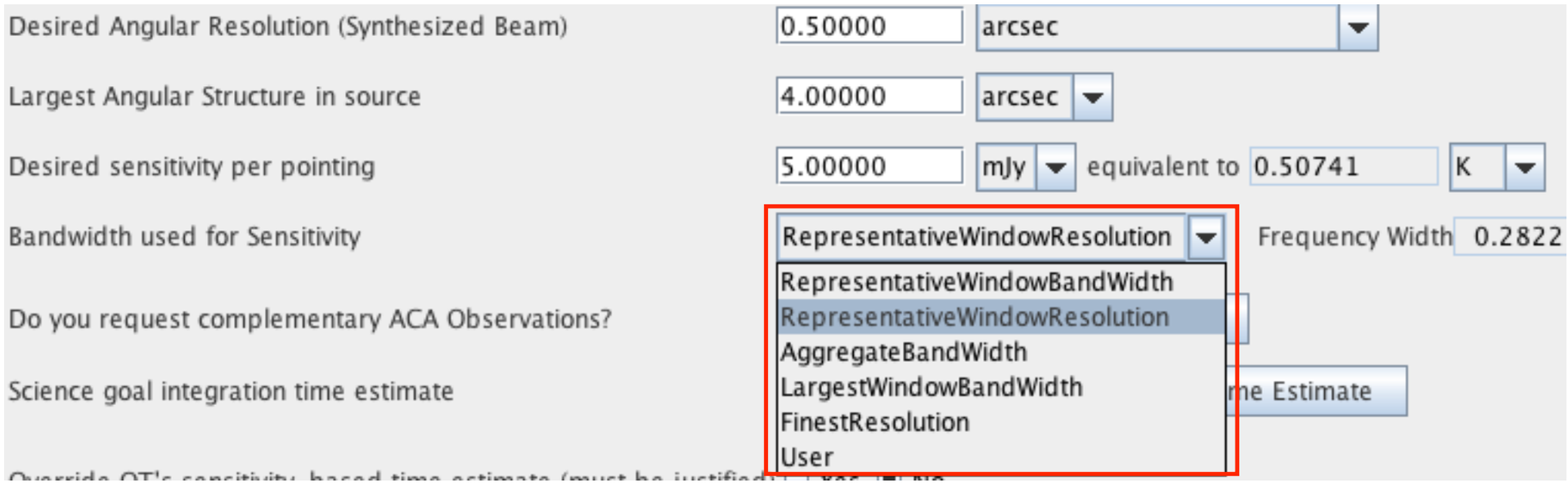
Calibration setup

- Default: system defined calibrators
- ALMA will select suitable calibrators given the proposed observation
- User selected: for e.g., astrometry

Control & Performance

- Summarizes configuration information based repr. freq
- Insert YOUR desired resolution and LAS
- Insert YOUR desired sensitivity *per pointing and per bandwidth*

Simulations can help to estimate these values (include sims in Scientific Justification!)



- Check if OT suggests **ACA observations** - will take longer obs. time!
- Check the **time estimate** of the proposal
- Define time constraints (e.g., monitoring proposal)

Estimated Time

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	5.000 mJy
Bandwidth used for sensitivity	0.141 MHz
Representative frequency (sky, first source)	219.53 GHz
Precipitable water vapour (all sources)	1.262mm (4th Octile)

Time required for largest 12-m array

Time on source per pointing (first source)	31.25 min [30.25 min]
Total number of pointings (all sources)	3
Number of tunings	1
Total time on source	1.56 h [1.51 h]
Total calibration time	49.37 min
Other overheads	14.65 min
Total time for 1 SB execution	1.31 h
Number of SB executions	2
Total time to complete SB	2.63 h

Calibration Breakdown per SB execution

3 x Pointing	36.00 s
1 x SidebandRatio	1.58 min
1 x Amplitude	2.50 min
1 x Bandpass	5.00 min
6 x Phase	3.00 min
3 x Phase reference check source	1.50 min
7 x Atmospheric	4.67 min
Calibration overheads	5.83 min

Additional Arrays

Number of additional 12-m configurations	1
Time required for additional 12-m	1.31 h
ACA 7-m time (t_12m x 2)	5.26 h
Total ACA time (max[t_7-m,t_TP])	5.26 h

Estimated total time for science goal 9.20 h

Adding ACA increases time estimate

Technical Justification

- Summary of S/N for continuum, line, and per 1/3 of linewidth based on expected signal/requested rms values
- Warnings when S/N <3, when spectral dynamic range too high (band 3-6 <1000, band 7-10 < 500) *but does not prohibit validation*
- Justifications for sensitivity and bandwidth for sensitivity, angular resolution, spectral resolution, data rate (if above 12 MB/s), and *other OT-overriding decisions*
- If simulations are used in the justification, they **have** to be included in the Scientific Justification. Omission leads to proposal **rejection.**
- Proposals with a bad Technical Justification are rejected, *even if the Scientific Justification is excellent*

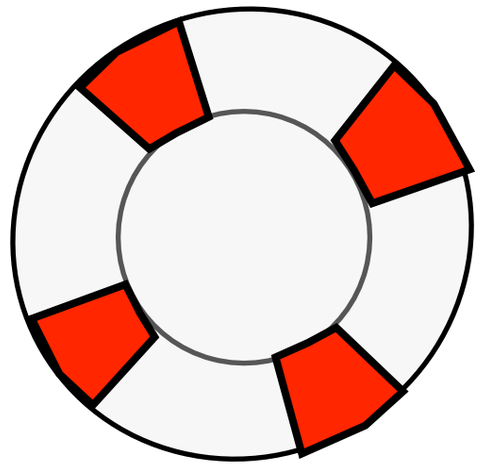
Judged by a different panel than the Scientific Justification

OT Tips

- Save copies while working, also when submitting
- Pay attention to OT comments > invalid/irrelevant settings will cause **proposal rejection**
- Choose carefully spectral settings (Vres, repr. freq.), sensitivity, and angular scales (AR, LAS) as all of these determine your **total observing time**
- spectral setup determines your **data rate,** in project time summary
- Check project or proposal summary if your proposal is **standard or non-standard**

REPRESENTATIVE SCIENCE GOALS (UP TO FIRST 30)						
SCIENCE GOAL	POSITION	FREQUENCY	BAND	ANG.RES.(")	ACA?	NON-STANDARD MODE
Science Goal	J2000: 19:01:48.0000, 01:13:04.008	219.52960 GHz	6	0.500	Y	N
Total # Science Goals : 1						
SCHEDULING TIME CONSTRAINTS	NONE	TIME ESTIMATES OVERRIDDEN ?				No

Help!



- Manual, reference guide available in the OT
- Call/mail our ARC
- Raise a ticket through the ALMA Helpdesk
- Check out the documentation online:

in OT Help

- **OT quick-start guide** - shows all basic OT steps
- OT manual - description of the OT and its tools/viewers
- OT reference manual - highly detailed reference work

- **ALMA OT tutorials**
- **ALMA cycle 3 proposal guide** - cycle 3 capabilities, proposal guidelines
- ALMA cycle 3 handbook - highly detailed reference ALMA guide

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