

Cycle 2 ALMA Proposal Preparation: **The Observing Tool (OT)**

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In collaboration with ARC's Team

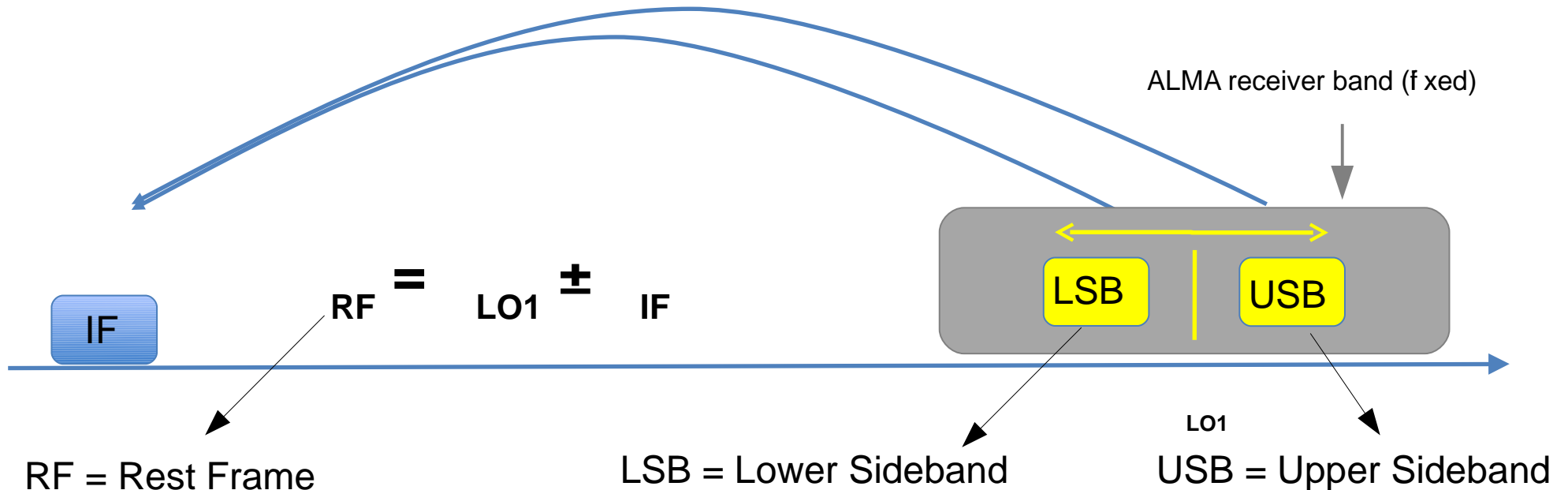
ALMA Proposal Preparation Day-Cycle 2
Bologna, November 21th, 2013

Outline

- ◆ Glossary
- ◆ *ALMA* Early Science *Cycle 2* in the OT
- ◆ Phases of an ALMA Proposal (Phase I and Phase II)
- ◆ ALMA SCIENCE PORTAL

Sidebands

- ◆ Radio astronomy receivers have 2 sidebands: caused by mixing the sky signal with a local oscillator (LO)
- ◆ Sidebands are mapped to a lower frequency band
 - IF (Intermediate Frequency) range sets width and separation of sidebands
 - Differs for different bands
- ◆ Varying LO1 causes the sidebands to move
- ◆ **ALMA: 8 GHz total Bandwidth available**



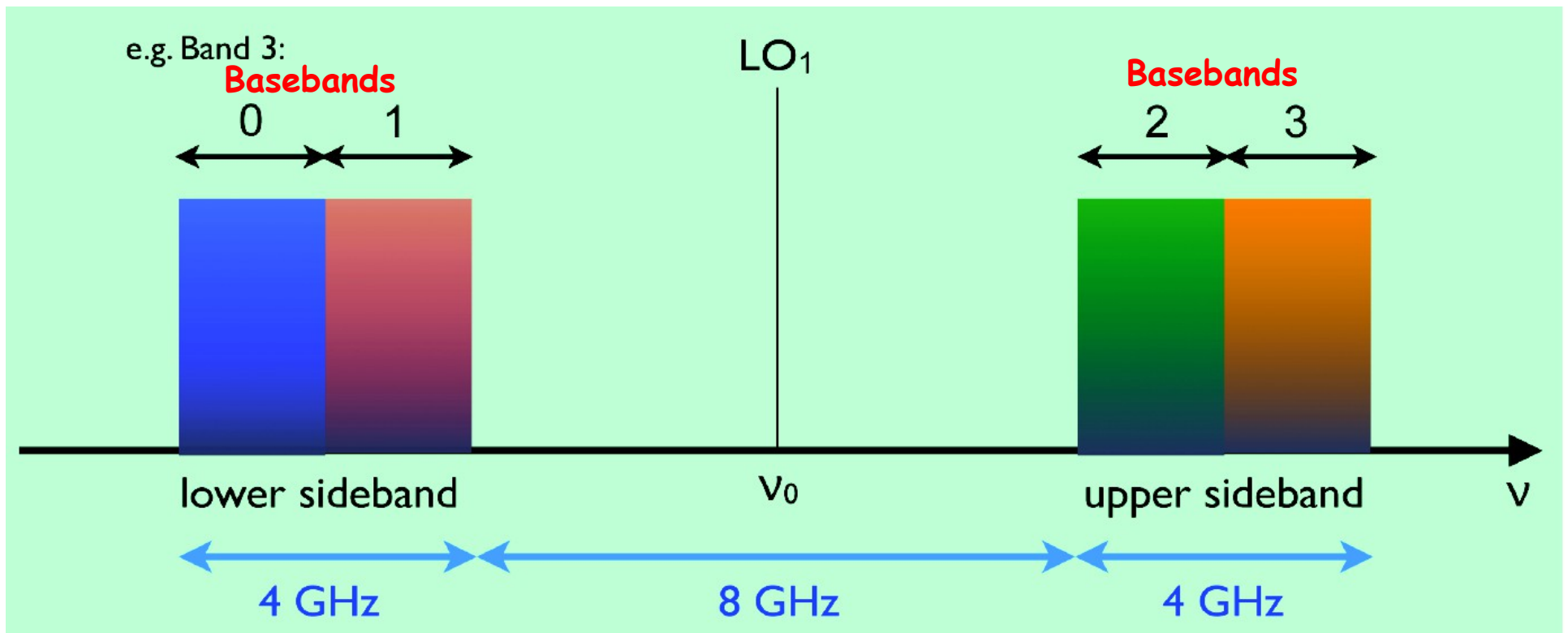
Sidebands

- ◆ ALMA allows both sidebands (LSB & USB) to be used

- ◆ ALMA has two kinds of receivers with two sidebands
 - i. Dual Sidebands (2SB: B3, **B4**, B6, B7, **B8**)
 - ii. Double Sideband (DSB: B9)
 - iii. Both are present at *Early Science (ES) Cycle 2*

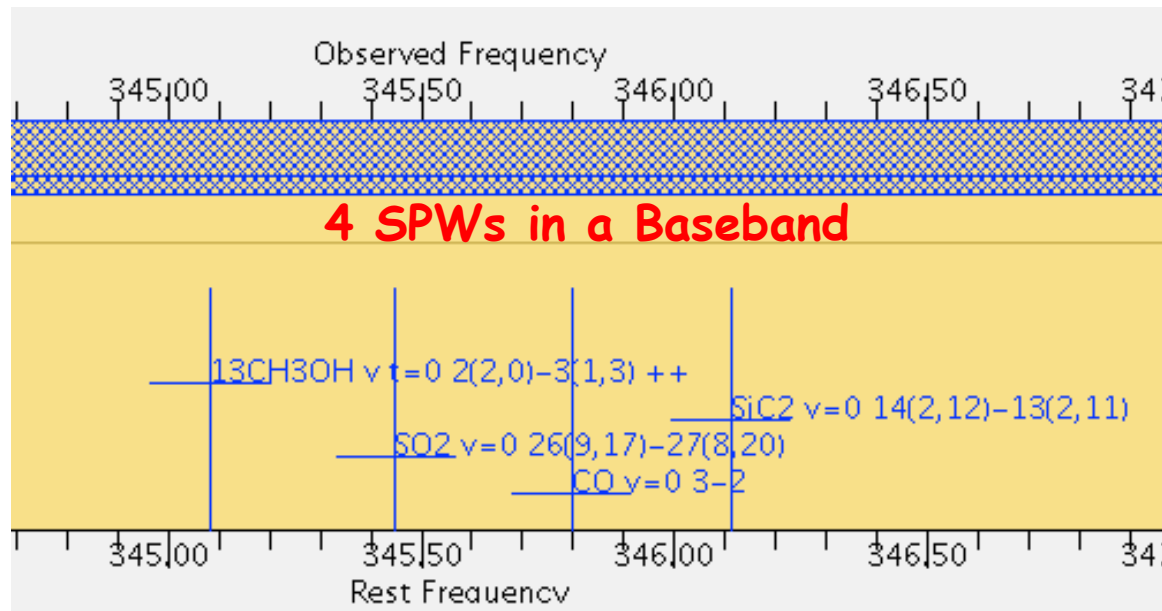
Basebands

- ◆ A **2 GHz** wide portion of the available signal which is digitized at the antenna
- ◆ The **4 x 2 GHz-wide Basebands** can be placed in one sideband or distributed between the 2 Sidebands
- ◆ The **maximum available 8 GHz bandwidth** is achieved when the 4 basebands are chosen not to overlap



Spectral Window (SPW)

- ◆ A Spectral Window is a frequency subrange of a Baseband
- ◆ **ES Cycle 2:** up to four SPWs per Baseband, with the same bandwidth and spectral resolution in each SPW, but the **Basebands are independent**
- ◆ SPWs can overlap in frequency



ALMA Correlator Modes

Two kinds of operation

- ◆ Time Division Mode (**TDM**)
 - i. Modest Frequency Resolution
 - ii. Continuum/wide spectral line observations
 - iii. SPW always 2-GHz wide with 128 or 256 channels

- ◆ Frequency Division Mode (**FDM**)
 - i. High Frequency Resolution
 - ii. High-resolution spectral line observations
 - iii. SPWs can be 58.6-1875 MHz wide with up to 7680 channels

ALMA ES *Cycle 2* Correlator Modes

Bandwidth (MHz)	Dual Polarization		Single Polarization		Correlator mode
	Ch Spacing (MHz) *	Number of channels	Ch Spacing (MHz) *	Number of channels	
2000 *	15.6	128	7.8125	256	TDM
58.6	0.0153	3840	0.00763	7680	FDM
117	0.0305	3840	0.0153	7680	FDM
234	0.061	3840	0.0305	7680	FDM
469	0.122	3840	0.061	7680	FDM
938	0.244	3840	0.122	7680	FDM
1875	0.488	3840	0.244	7680	FDM

* Spectral Resolution is 2 x the Channel Spacing

* The bandwidth is limited to 1875 MHz

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Full Stokes polarization mode has half of the number of channels available for dual polarization

Spectral Type & Polarization

Spectral Type

Spectral Line  FDM & TDM

Single Continuum

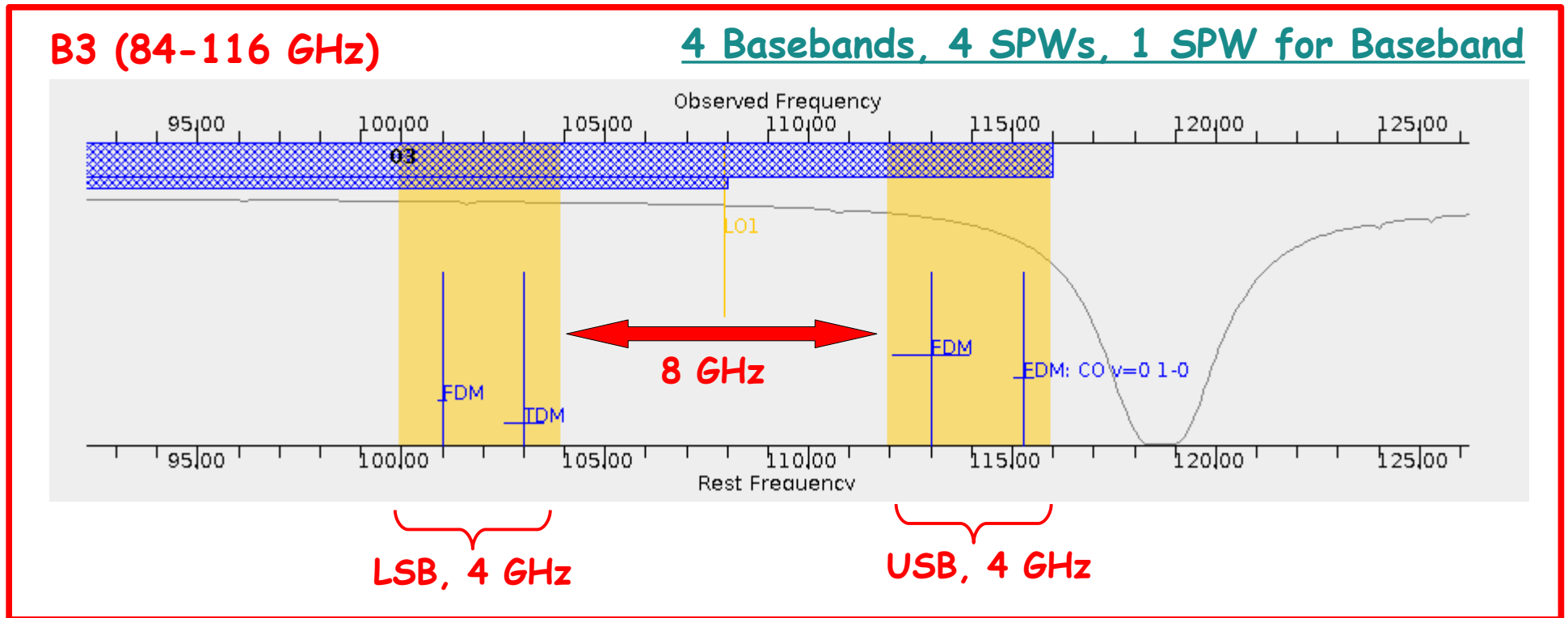
Spectral Scan

Polarization products desired XX DUAL FULL

- ◆ **Dual Polarization:** Separate spectra for each linear parallel-hand polarization (**XX, YY**) of the input signal
- ◆ **Single Polarization:** A single input polarization (**XX**)
- ◆ **Full Polarization:** Full intrinsic polarization (**XY, YX, XX, YY**) only in continuum, in Band 3, 6 and 7, and only for specific frequency settings present in the OT

2SB receivers (B3, B4, B6, B7, B8)

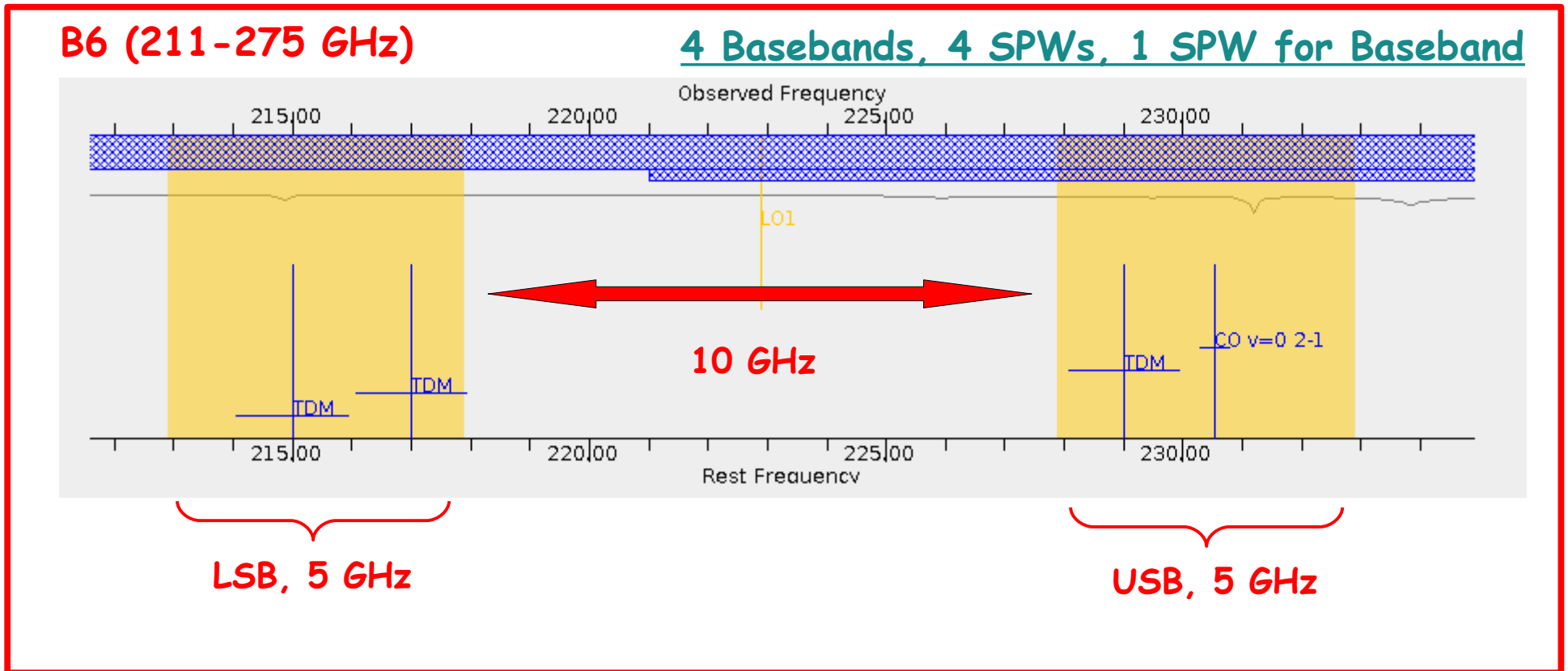
- ◆ Sidebands are separated in the receiver
- ◆ Sidebands are generally 4 GHz wide and separated by 8 GHz



Observations of spectral lines within about 0.2 GHz of a Receiver Band edge are not possible at present.

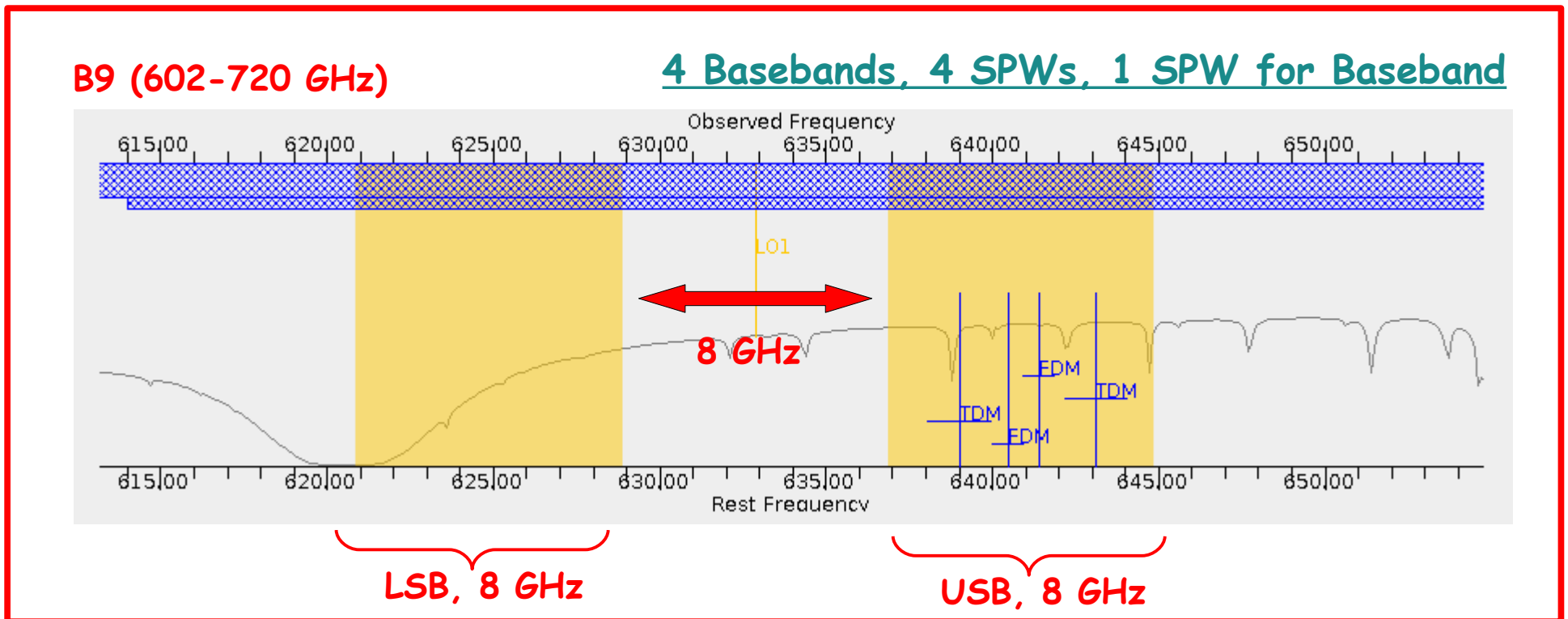
2SB receivers (B3, B4, B6, B7, B8)

- But in **Band 6** sidebands are 5 GHz wide and separated by 10 GHz



DSB receivers (B9)

- ◆ Sidebands are separated in the correlator
- ◆ Sidebands are 8 GHz wide and separated by 8 GHz

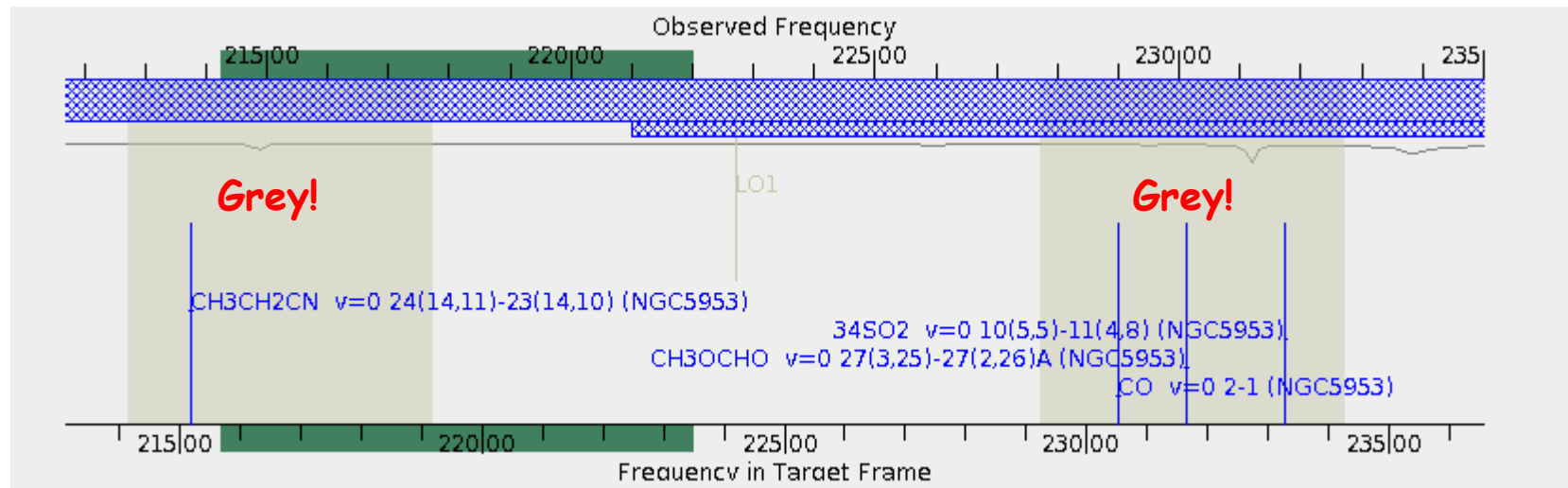


Basebands Constraints (1)

- ◆ 2SB receivers (B3, B4, B6, B7, B8)
 - i. All (for a maximum of 4 Basebands) in USB or LSB
 - ii. 2 in USB and 2 in LSB
 - iii. A 3/1 split is **not possible**

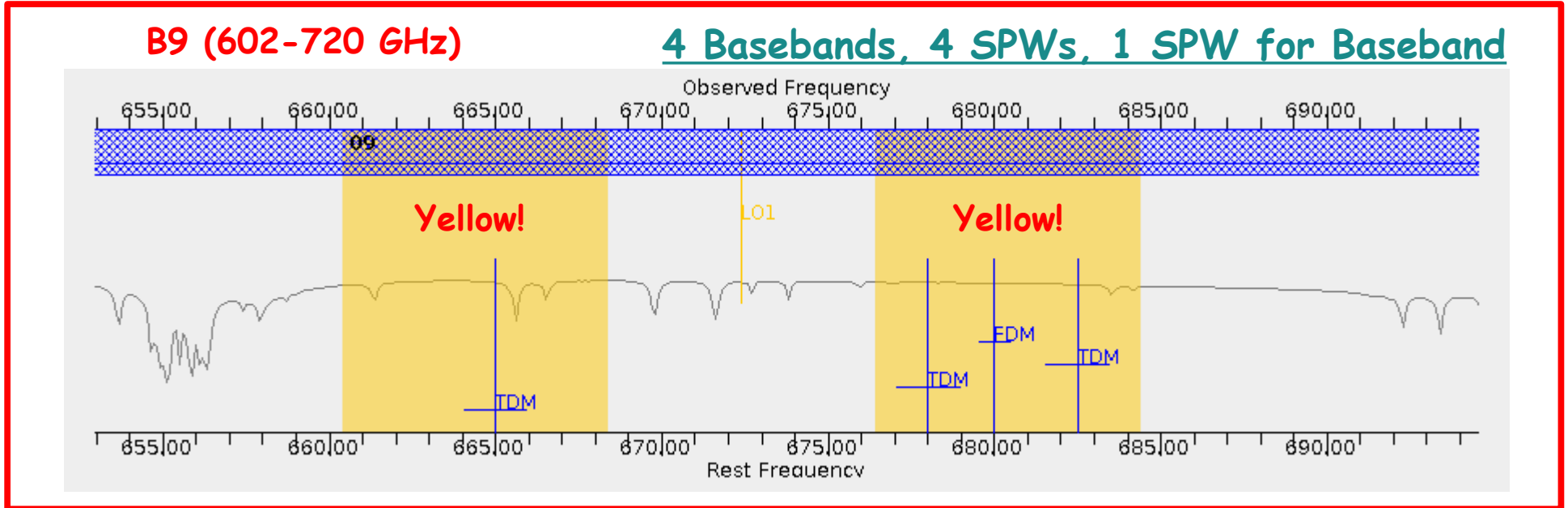
B6 (211-275 GHz)

4 Basebands, 4 SPWs, 1 SPW for Baseband



Basebands Constraints (2)

- ◆ DSB receivers (B9): A 3/1 split is **possible**

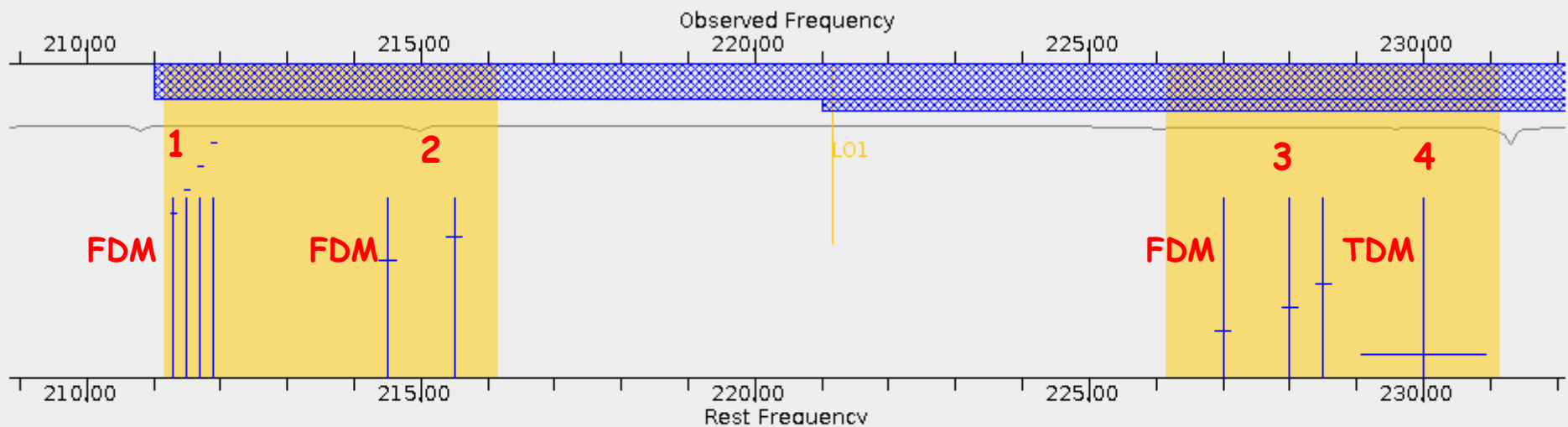


The Correlator Resources

- ◆ A fraction of the Correlator Resources is assigned to each SPW
- ◆ The fractions 1, 1/2 and 1/4 within a Baseband are allowed
- ◆ The sum of the these fractions within a Baseband must be less or equal to 1

B6 (211-275 GHz)

4 Independent Basebands



Overlays:

Receiver Bands Transmission Overlay Lines DSB Image

Select Lines to Overlay

Water Vapour Column Density: Automatic Choice Manual Choice 1.262mm (4th Octile)

Viewport:

Pan to Line

Zoom to Band

Reset

Spectral Averaging (1)

- ◆ **Cycle 2** allows the data to be pre-smoothed in the correlator
- ◆ Averaging (or binning) spectral channels in powers of 2 up to 16
- ◆ **Cycle 2: Max data rate = 60 MB/s, average data rate = 6 MB/s**
- ◆ **If data rate > 12 MB/s: the user must technically justify this!**

Spectral Line Data Rate = 5.4 MB/s

Baseband-1

Fraction	Center Freq (Rest)	Center Freq (Sky)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1/4	211.30000 GHz	211.30000 GHz		58.594 MHz(83 km/s), 61.035 kHz(0.087 km/s)	1	<input checked="" type="radio"/>
1/4	211.50000 GHz	211.50000 GHz		58.594 MHz(83 km/s), 61.035 kHz(0.087 km/s)	1	<input type="radio"/>
1/4	211.70000 GHz	211.70000 GHz		58.594 MHz(83 km/s), 61.035 kHz(0.086 km/s)	1	<input type="radio"/>
1/4	211.90000 GHz	211.90000 GHz		58.594 MHz(83 km/s), 61.035 kHz(0.086 km/s)	1	<input type="radio"/>

Select Lines to Observe in Baseband-1... Add Delete

Baseband-2

Spectral Line Data Rate = 2.7 MB/s

Baseband-1

Fraction	Center Freq (Rest)	Center Freq (Sky)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1/4	211.30000 GHz	211.30000 GHz		58.594 MHz(83 km/s), 70.557 kHz(0.100 km/s)	2	<input checked="" type="radio"/>
1/4	211.50000 GHz	211.50000 GHz		58.594 MHz(83 km/s), 70.557 kHz(0.100 km/s)	2	<input type="radio"/>
1/4	211.70000 GHz	211.70000 GHz		58.594 MHz(83 km/s), 70.557 kHz(0.100 km/s)	2	<input type="radio"/>
1/4	211.90000 GHz	211.90000 GHz		58.594 MHz(83 km/s), 70.557 kHz(0.100 km/s)	2	<input type="radio"/>

Select Lines to Observe in Baseband-1... Add Delete

Spectral Averaging (2)

- ◆ Independent spectral averaging factor within the same Baseband

Spectral Line

Baseband-1 Data Rate = 2.3 MB/s

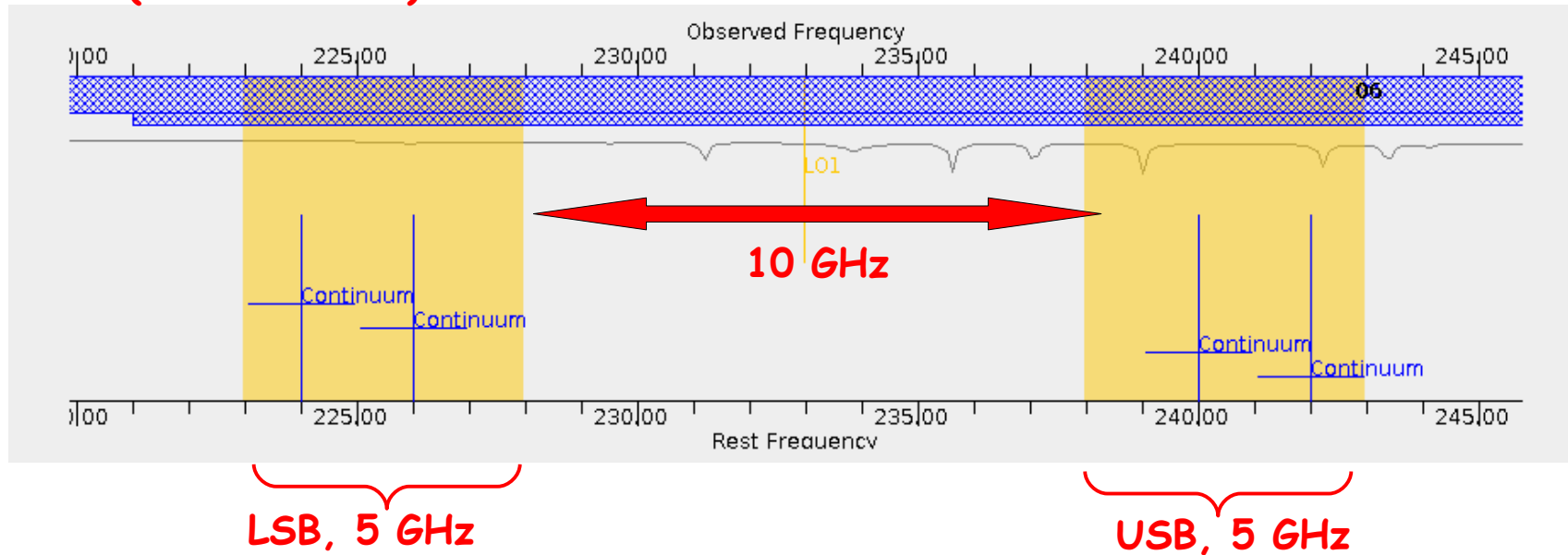
Fraction	Center Freq (Rest)	Center Freq (Sky)	Transition	Bandwidth, Resolution (smoothed)	Spec. Avg.	Representative Window
1/4	211.30000 GHz	211.30000 GHz		58.594 MHz(83 km/s), 61.035 kHz(0.087 km/s)	1	<input checked="" type="radio"/>
1/4	211.50000 GHz	211.50000 GHz		58.594 MHz(83 km/s), 70.557 kHz(0.100 km/s)	2	<input type="radio"/>
1/4	211.70000 GHz	211.70000 GHz		58.594 MHz(83 km/s), 244.019 kHz(0.346 km/s)	8	<input type="radio"/>
1/4	211.90000 GHz	211.90000 GHz		58.594 MHz(83 km/s), 488.281 kHz(0.691 km/s)	16	<input type="radio"/>

Select Lines to Observe in Baseband-1... Add Delete

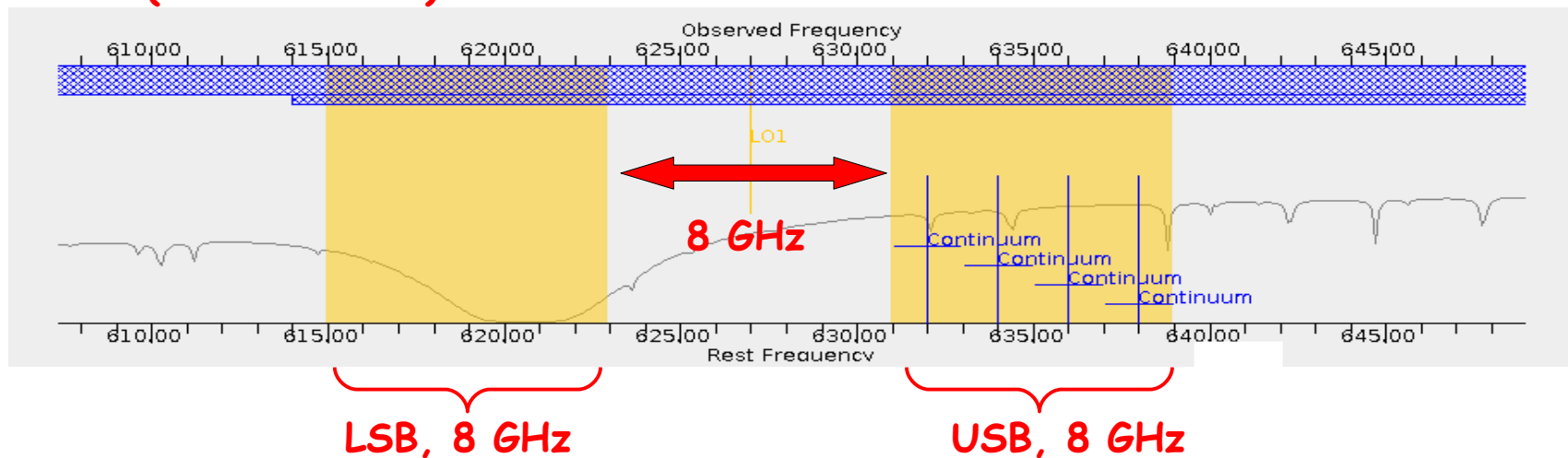
Single Continuum Observations

- ◆ It covers the maximum possible bandwidth with the lowest possible spectral resolution
- ◆ Only define a single frequency

B6 (211-275 GHz)

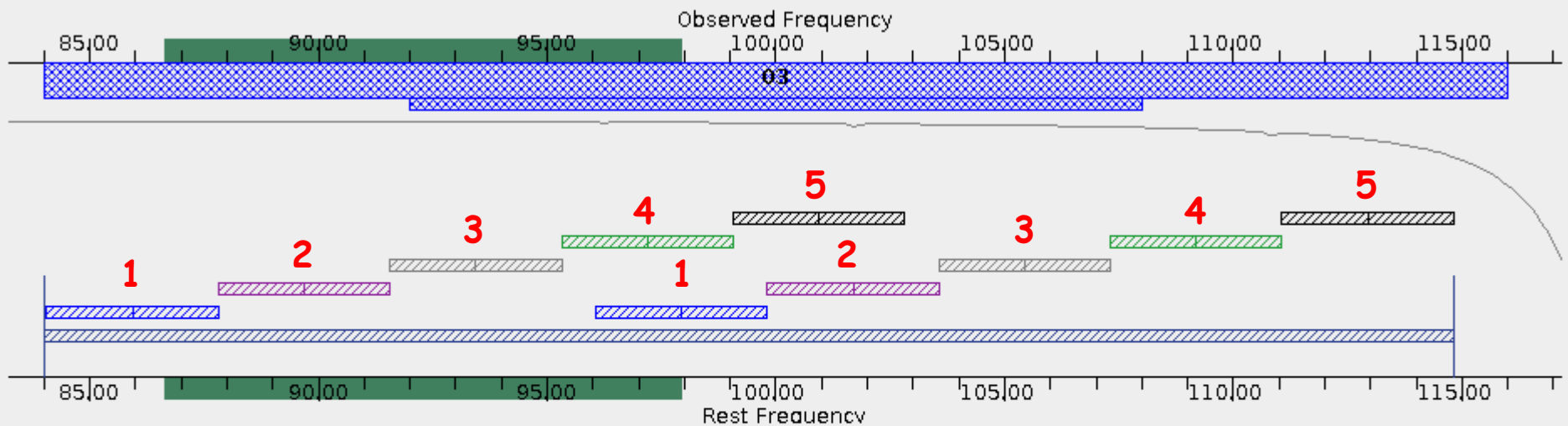


B9 (602-720 GHz)



Spectral Scan Observations

- ◆ The OT automatically sets up a set of contiguous SPWs to cover a specific frequency range
- ◆ **No more than 5 frequency tunings in a Science Goal**
- ◆ **4 SPWs per tuning** --> 4 SPWs X 5 tunings = 20 SPWs
- ◆ 4 Correlator Modes + Spectral Averaging



Overlays: Receiver Bands Transmission Overlay Lines DSB Image

Spectral Scan: Requested Scan Tuning 1 Tuning 2 Tuning 3 Tuning 4 Tuning 5

Water Vapour Column Density: Automatic Choice Manual Choice

Viewport:

Phases of Proposal Submission

2 Phases:

- ◆ Phase I: Proposal Submission
- ◆ Phase II: Submission of Observing Program

The Observing Tool (OT) is used for both phases:

- Phase I
- ◆ Fill in PI, co-Is, etc ... (**ALL REGISTERED**)
 - ◆ Attach scientific justification (single PDF)
 - ◆ Define Science Goals
 - ◆ Submit

- Phase II
- ◆ If your project has been approved for scheduling, generate Scheduling Blocks from Science Goals and submit

Science Goal (SG)

- ◆ Scientific requirements of the observations

- ◆ A user must enter:
 - i. Science Targets
 - ii. Spectral line and/or continuum frequencies
 - iii. Angular resolution, largest angular scale
 - iv. Required sensitivity

- ◆ **Cycle 2:** There is no restriction on the number of SGs

Source Restrictions

- ◆ Sources can be designed by fixed RA and Dec, or can include moving targets (NO Sun observations)
- ◆ Sources selected:
 - i. by specifying a **Single Rectangular Field** (= **Mosaic**)
 - ii. by specifying **Individual Pointings**:
Pointing Pattern or **Custom Mosaic**
- ◆ **The total number of pointings in a SG must be ≤ 150**
ACA pointings do not count against the 150 pointing SG limit
- ◆ **All pointings must lie within 10 deg of each other in a SG**

Rectangular Field (= Mosaic) Constraints

- ◆ One Mosaic is allowed per SG
- ◆ A single Spectral Setup (placement and properties SPWs)
- ◆ If ACA observations are requested as part of a mosaic, then a corresponding 7-m Array mosaic will also be observed

Individual Pointings Constraints

- ◆ **A single Spectral Setup** (placement and properties SPWs)
- ◆ **No more than 5 separate velocities** that fall within the same Receiver Band

Proposal Preparation: Cycle 2 News

- ◆ A single PDF file: **limited to 4 pages** (NOT 5 pages)
LateX template recommended, not mandatory
- ◆ **Technical Justification for each SG is entered in the OT:** everything must be justified!

ALMA: Instrument in Sensitivity

- ◆ The OT reports an estimated time based on likely weather:
Observations will proceed until requested sensitivity is reached

- ◆ Calibration sources
 - i. The observatory will provide all necessary calibration:
Choose "system-defined" calibration
STRONGLY RECOMMENDED

 - ii. Own calibrators can be requested:
You must fully justify it in the proposal!

OT

- ◆ The OT is a Java application
 - i. Java 6 or 7 must be installed on your computer
- ◆ Download and run locally
 - i. Web Start (**recommended**) and Tarball versions
- ◆ Internet connection required intermittently
 - i. PI/co-Is information from user database
 - ii. Source catalogues and images servers
 - iii. Spectral line catalogues
 - iv. Submission

ALMA SCIENCE PORTAL -----> <http://almascience.org>

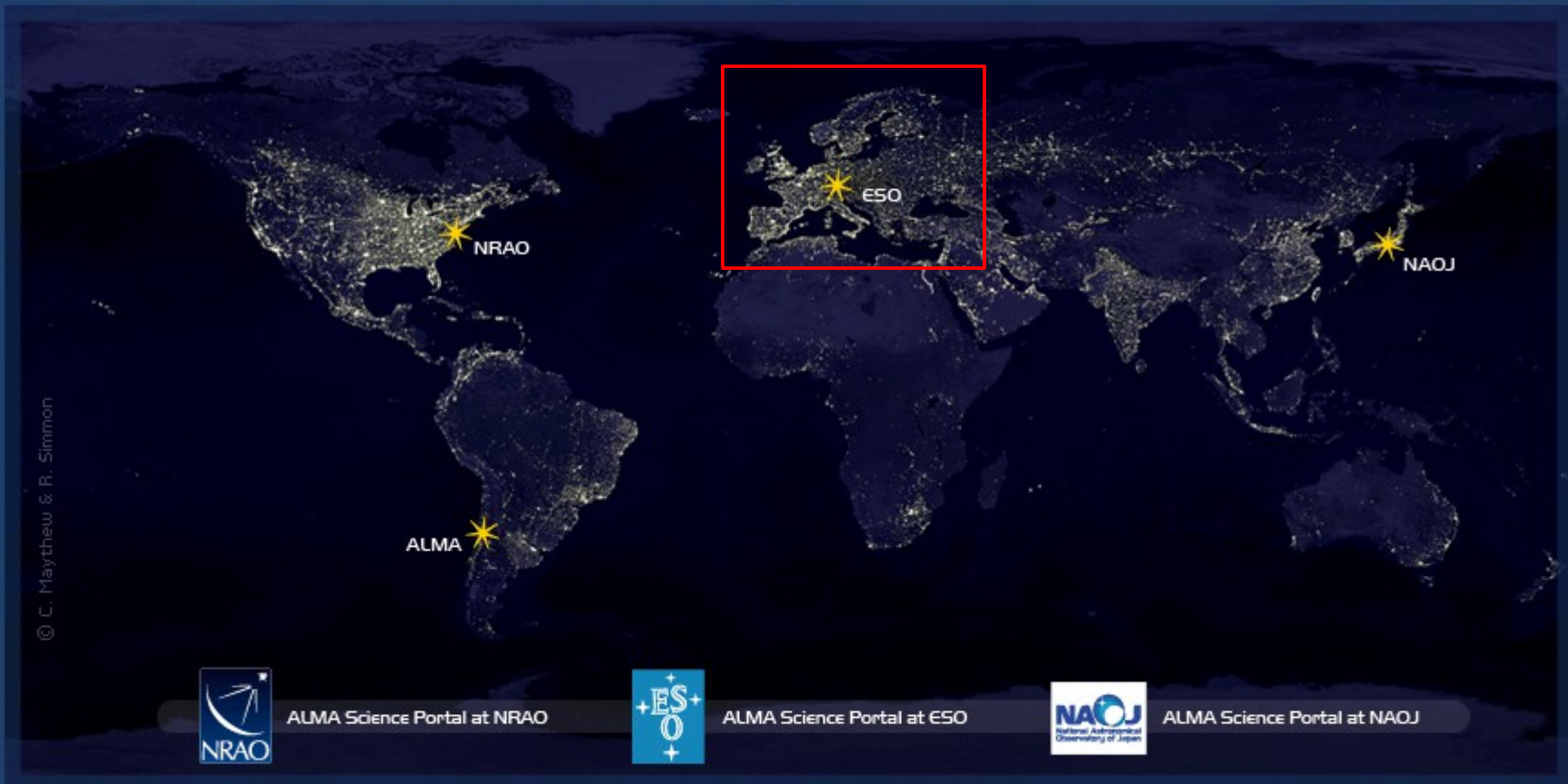
The interaction between science users and ALMA is done through the ARCs.
The ALMA Science Portal allows this interaction.



Atacama Large Millimeter/submillimeter Array

In search of our Cosmic Origins

Please select your preferred ALMA Regional Centre (ARC). Alternatively you will be redirected in 3 seconds to the closest ARC which in your case is at



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ALMA SCIENCE PORTAL @ ESO

Login & Registration

Atacama Large Millimeter/submillimeter Array
In search of our Cosmic Origins

Search Site

ESO NRAO NAOJ

Log in | Register | Reset Password | Forgot Account

About
Science
Proposing
Observing
Data
Documents & Tools
Knowledgebase/FAQ

User Services at ARCs
Helpdesk

You are here: Home

Welcome to the Science Portal at JAO

Atacama Large Millimeter/submillimeter Array

This is the website for **The ALMA Science Portal**, served from one of the **ALMA Regional Centers (ARCs)** of the ALMA partner organizations: ESO, NRAO or NAOJ. You may switch between the different instances of the portal through the links to the appropriate ALMA partner at the top banner. Through this portal you can find details about the technical capabilities of ALMA, how to propose for observing time, and how to access ALMA data. It includes links to all official

General News

- ALMA Cycle 2 Call for Proposals is now open
Oct 19, 2013
- Cycle 1 Update and Transfer to Cycle 2
Oct 07, 2013
- ALMA Cycle 2 Pre-announcement
Sep 17, 2013
- ALMA Cycle 1 Status Update
Sep 10, 2013
- ALMA Cycle 0 final report
Jun 19, 2013

OT