ALMA Observing Tool (AOT)

Ciro Pappalardo (IA – CAAUL – OA Lisboa)

SFRH/BPD/90559/2012
Pest-OE/FIS/UI2751/2014
PTDC/FIS-AST/2194/2012

Motivation:

In the past optical and radio astronomer did not have a big interaction:

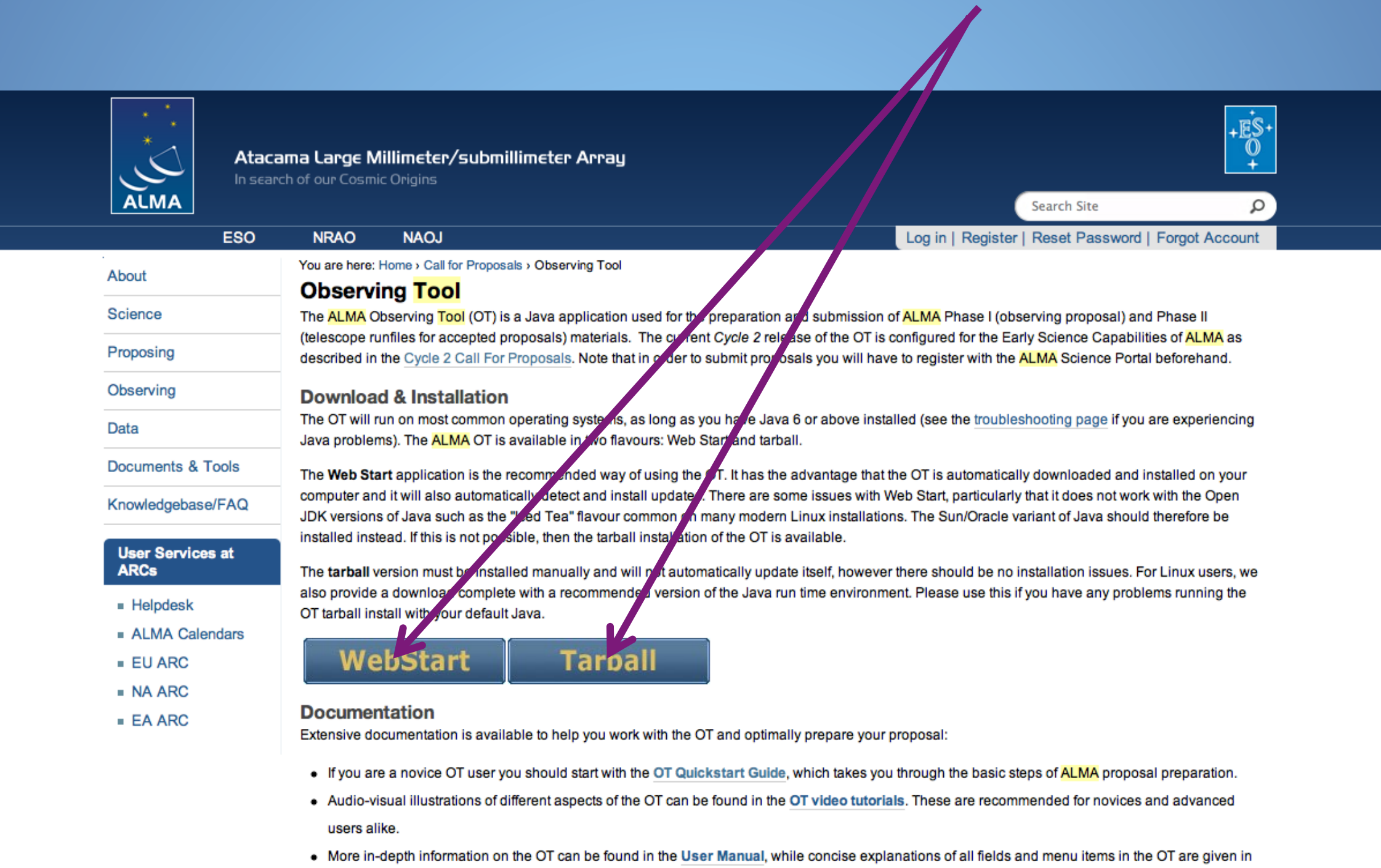
E. Hubble formulated the Hubble's law in 1929. He was a lawyer but did not have a big motivation to practice.
After the construction of the 5.1m Hale Telescope in Mount Palomar he worked there as astronomer

K. Jansky discovered radio waves in 1933. He wanted to continue the exploration of this signal, but Bell Labs was not interested in the project. They gave him another assignment and he never worked as a radio astronomer.

ALMA is an interferometer conceived to be used by the entire scientific community. For this reason the software developer managed to build a user friendly tool to explore the potential of the ALMA's antennae and the feasibility of a project:

ALMA Observing Tool (AOT)

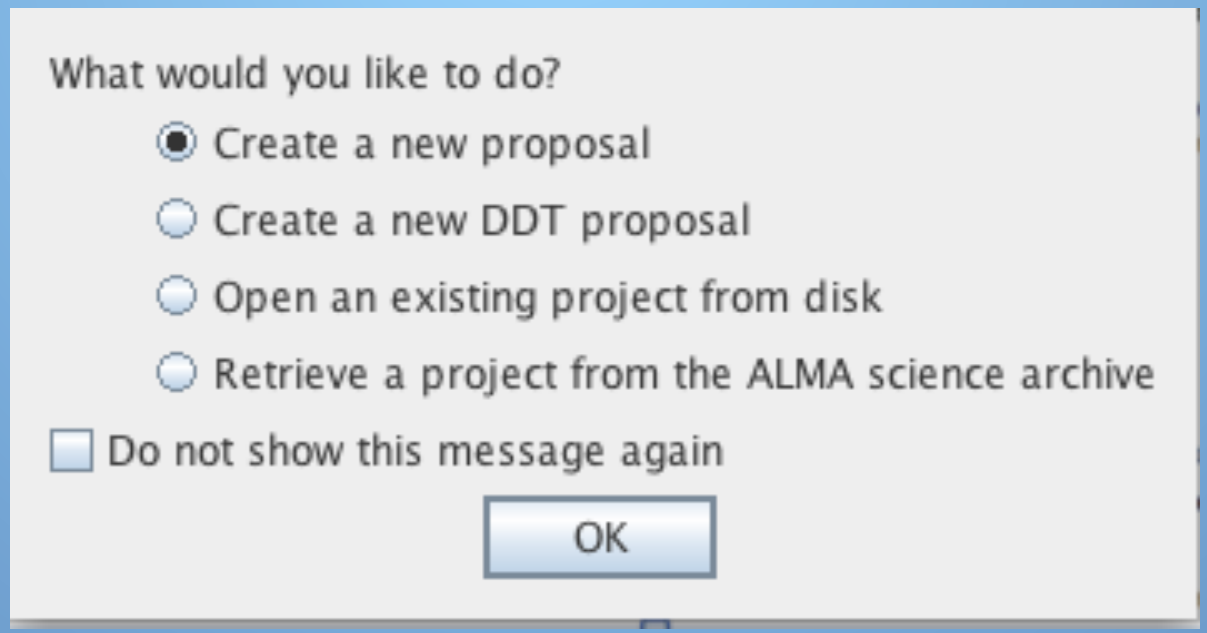
Step 1: Download the AOT from the ALMA website



Installation

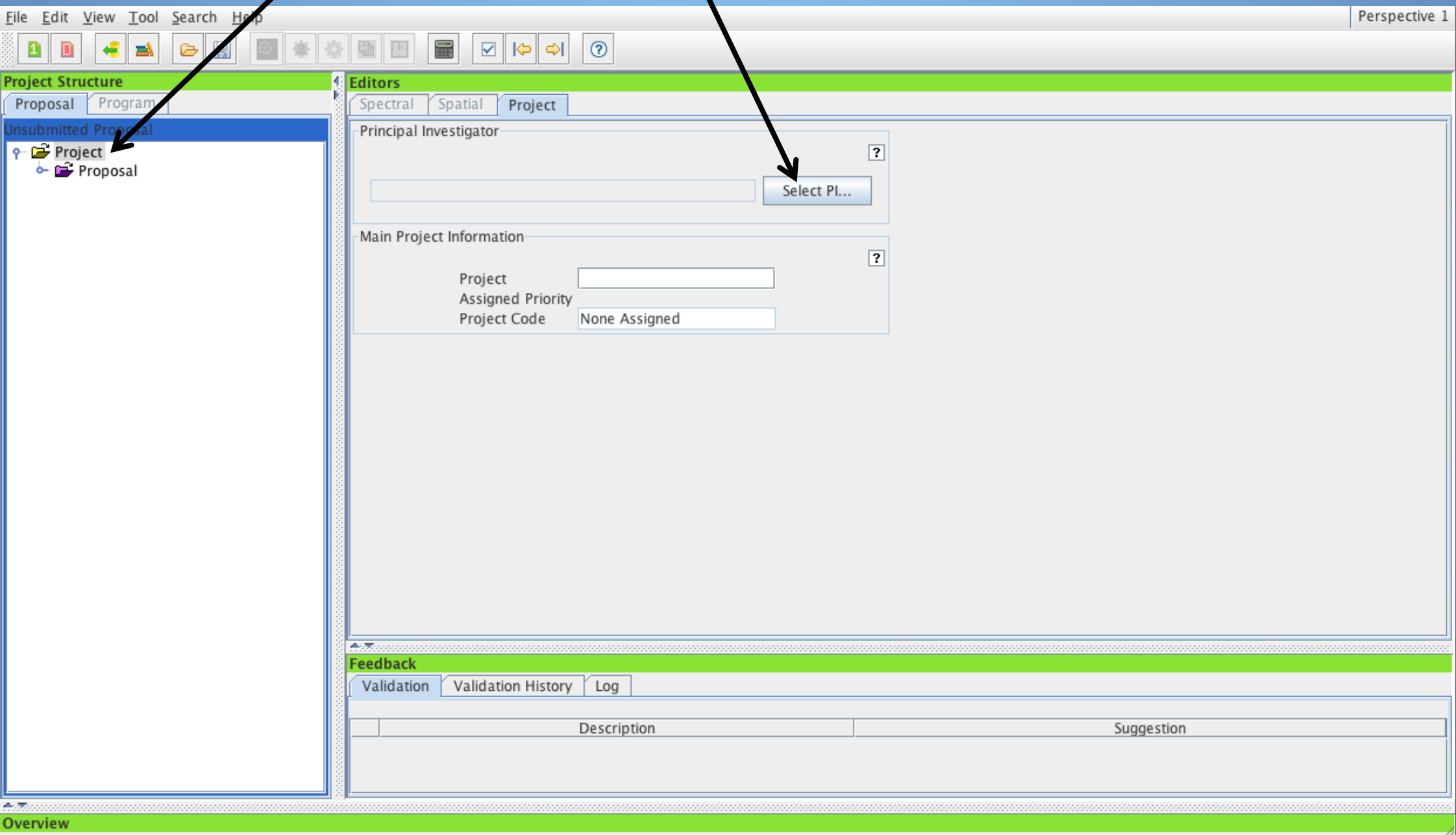
Download AlmaOT.tar
(is a standalone version)

```
> tar -xvf AlmaOT.tar
> cd ALMAOT-Cycle2/setup
> ./Setup-Linux.sh
> cd ..
> ./ALMA-OT.sh
```

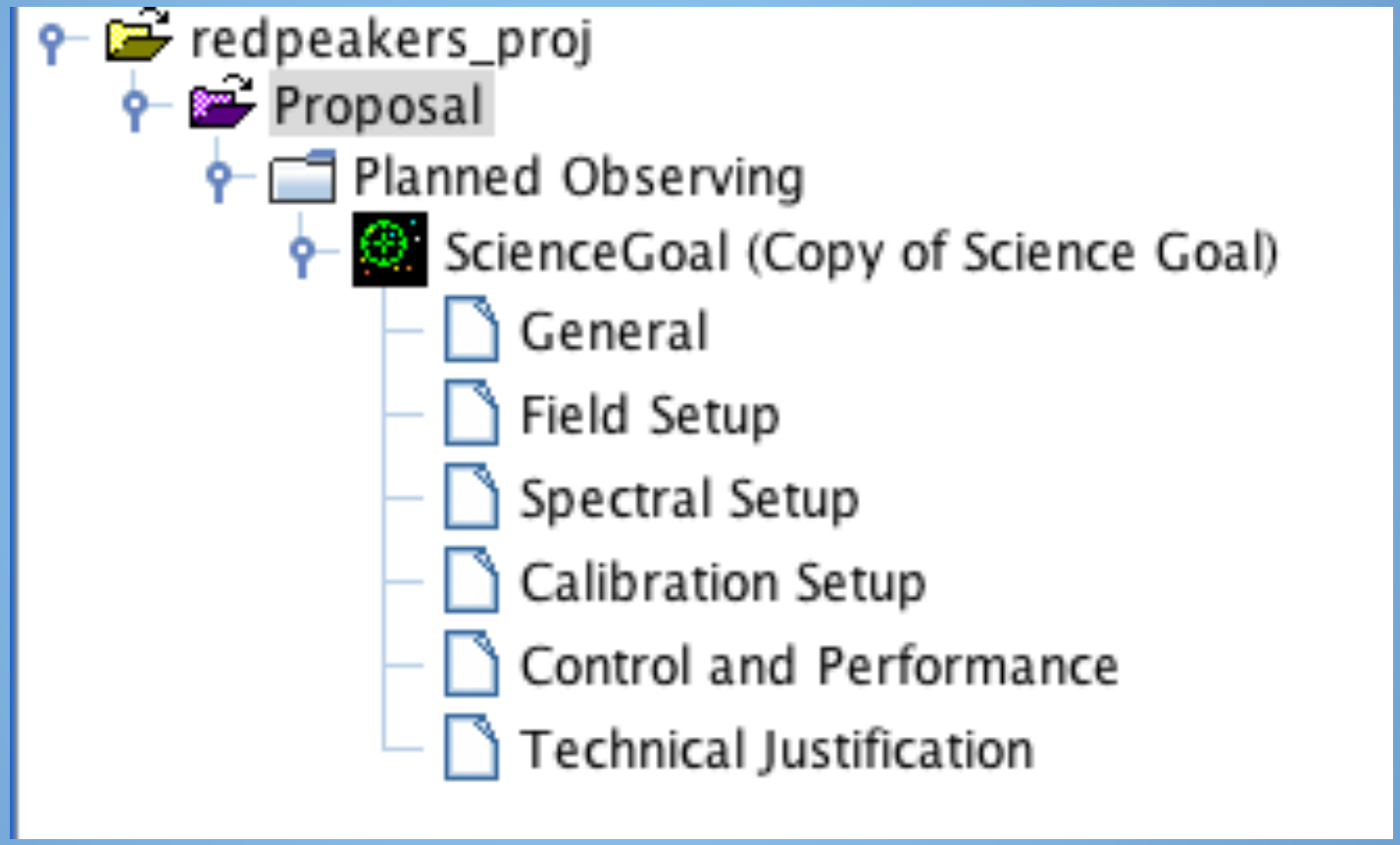


Start

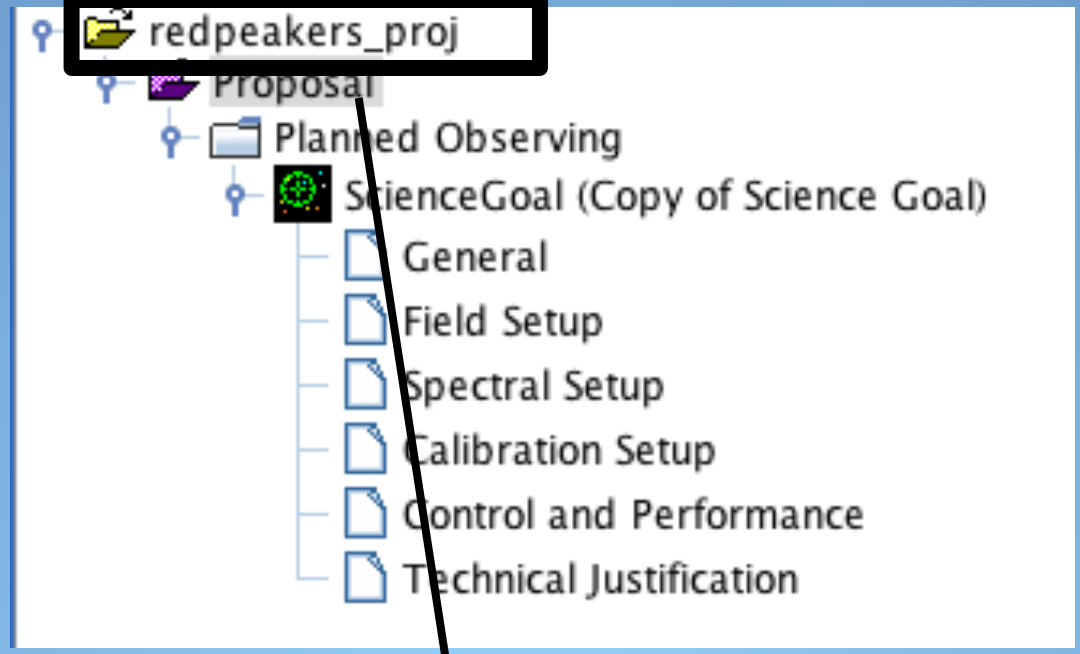
Menu **Project Tree** **PI Selection (NEED TO BE REGISTERED)**



Menu’:


redpeakers_proj
Proposal
Planned Observing
ScienceGoal (Copy of Science Goal)
General
Field Setup
Spectral Setup
Calibration Setup
Control and Performance
Technical Justification

Menu':



Project Structure

Proposal | Program

SUBMITTED

redpeakers_proj

Proposal

Editors

Spectral | Spatial | redpeakers_proj

Principal Investigator

Ciro Pappalardo (ciro@oal.ul.pt) Select PI...

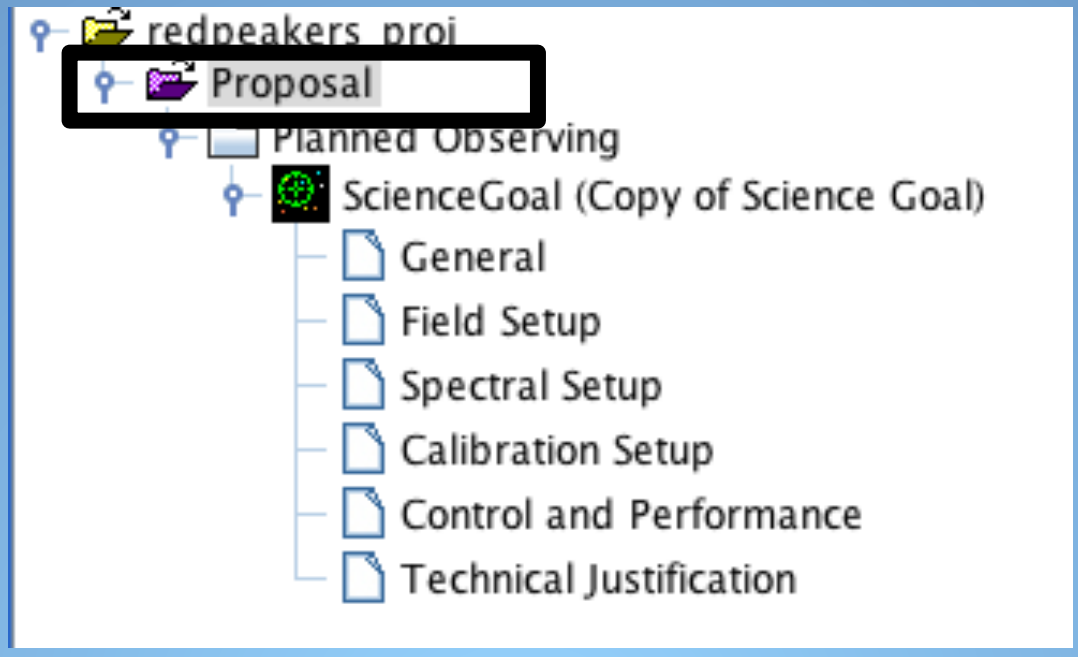
Main Project Information

Project: redpeakers_proj

Assigned Priority:

Project Code: 2013.1.01373.S

Menu':



File Edit View Tool Search Help

Perspective 1

Project Structure

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SUBMITTED

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      - ScienceGoal (Copy of Science
        - General
        - Field Setup
        - Spectral Setup
        - Calibration Setup
        - Control and Performance
        - Technical Justification

Editors

Spectral | Spatial | Proposal

Proposal Information

Proposal Title: redpeakers_proj

Proposal Cycle: 2013.1

Abstract (max. 1200 characters):

We propose to observe a sample of 15 background galaxies detected with the Herschel Space Observatory in which there are clearly signs of alien life.
Using the enhanced ALMA capabilities of Cycle 2 we will determine the age of these targets and with these data we will put a new constraint on the possibility of the existence of the alien.

Launch Editor

Proposal Type

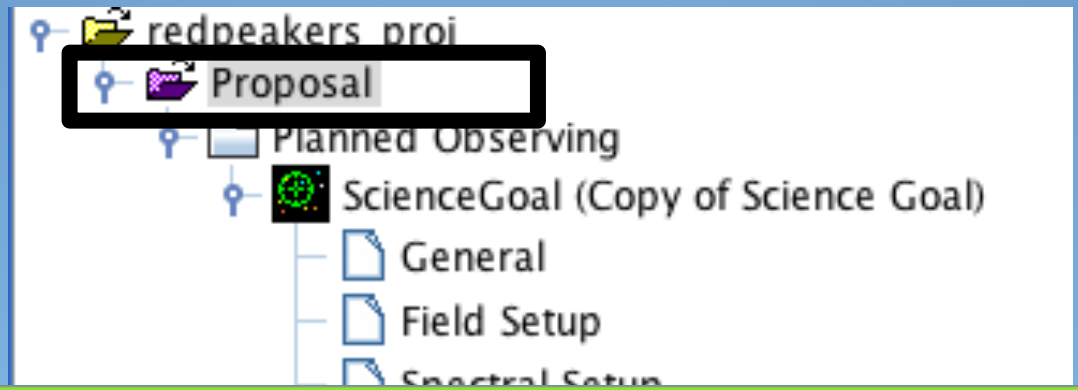
(•) Standard ( ) Target Of Opportunity

Scientific Category

(•) Cosmology and the High Redshift Universe ( ) Galaxies and Galactic Nuclei ( ) ISM, star formation and astrochemistry

( ) Circumstellar disks, exoplanets and the solar system ( ) Stellar Evolution and the Sun

Menu':



Editors

Spectral | Spatial | Proposal

Related Proposals

Previous Proposals

Investigators

Type	Full name	Email	Affiliation	ALMA ID	Executive
PI	Ciro Pappalardo	ciro@oal.ul.pt	Centre for Astronomy...	ciropappalardo	Europe

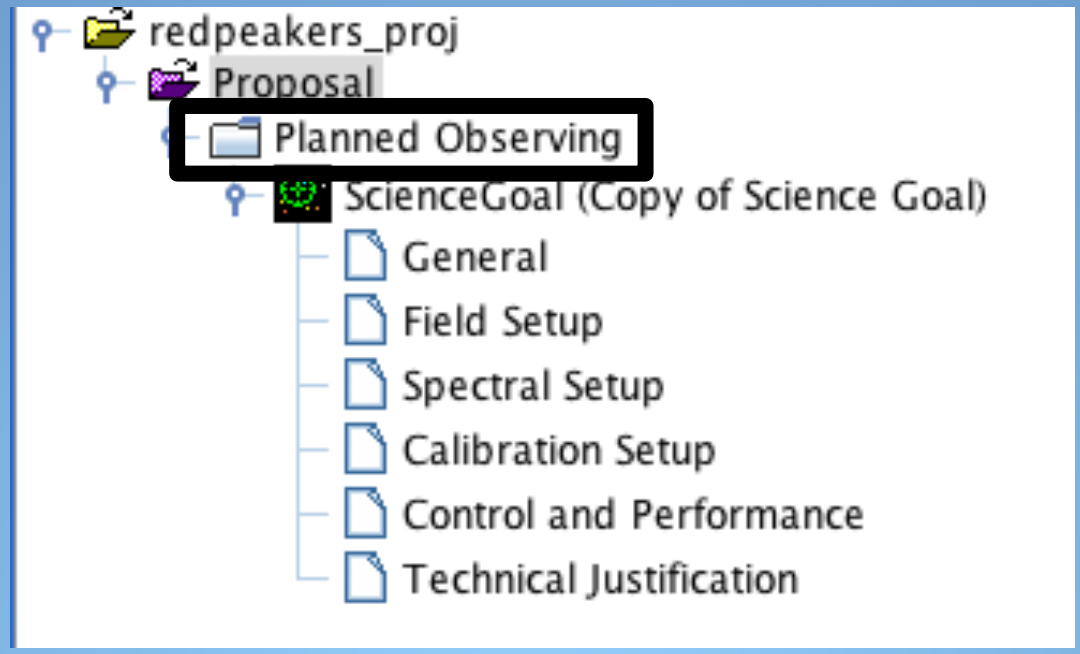
Select PI... | Add Col... | Remove Col | Add from Proposal...

Science & Technical Case

Science & Technical Case (Mandatory, PDF, 4 pages max.) prop_carma.pdf | Attach... | Detach | View...

Observatory Use Only

Menu’:



Project Structure

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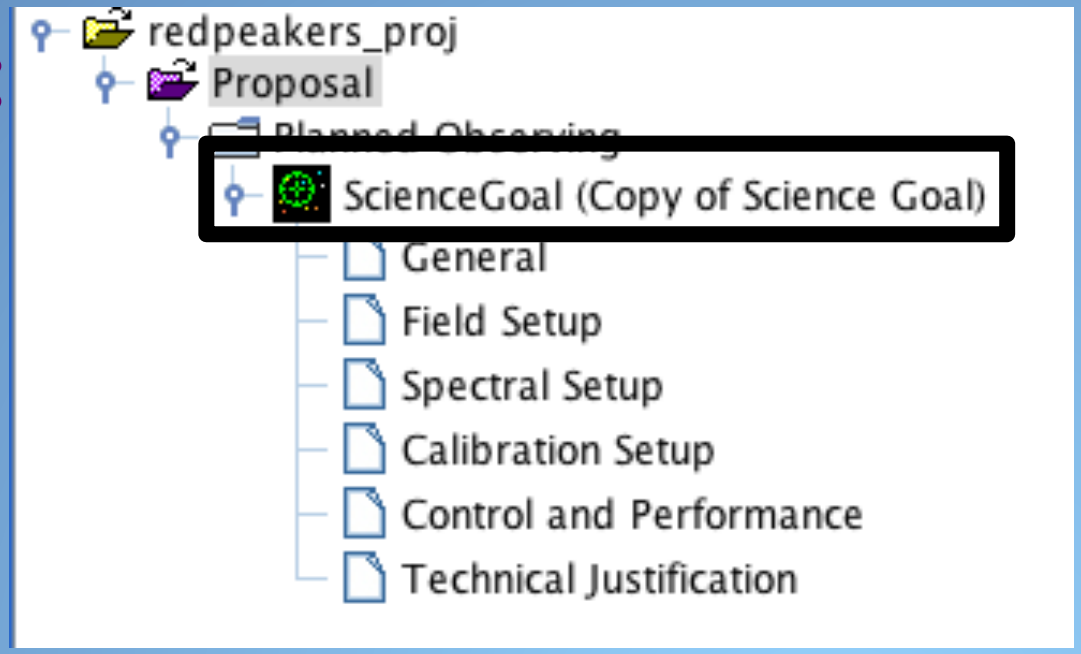
Editors

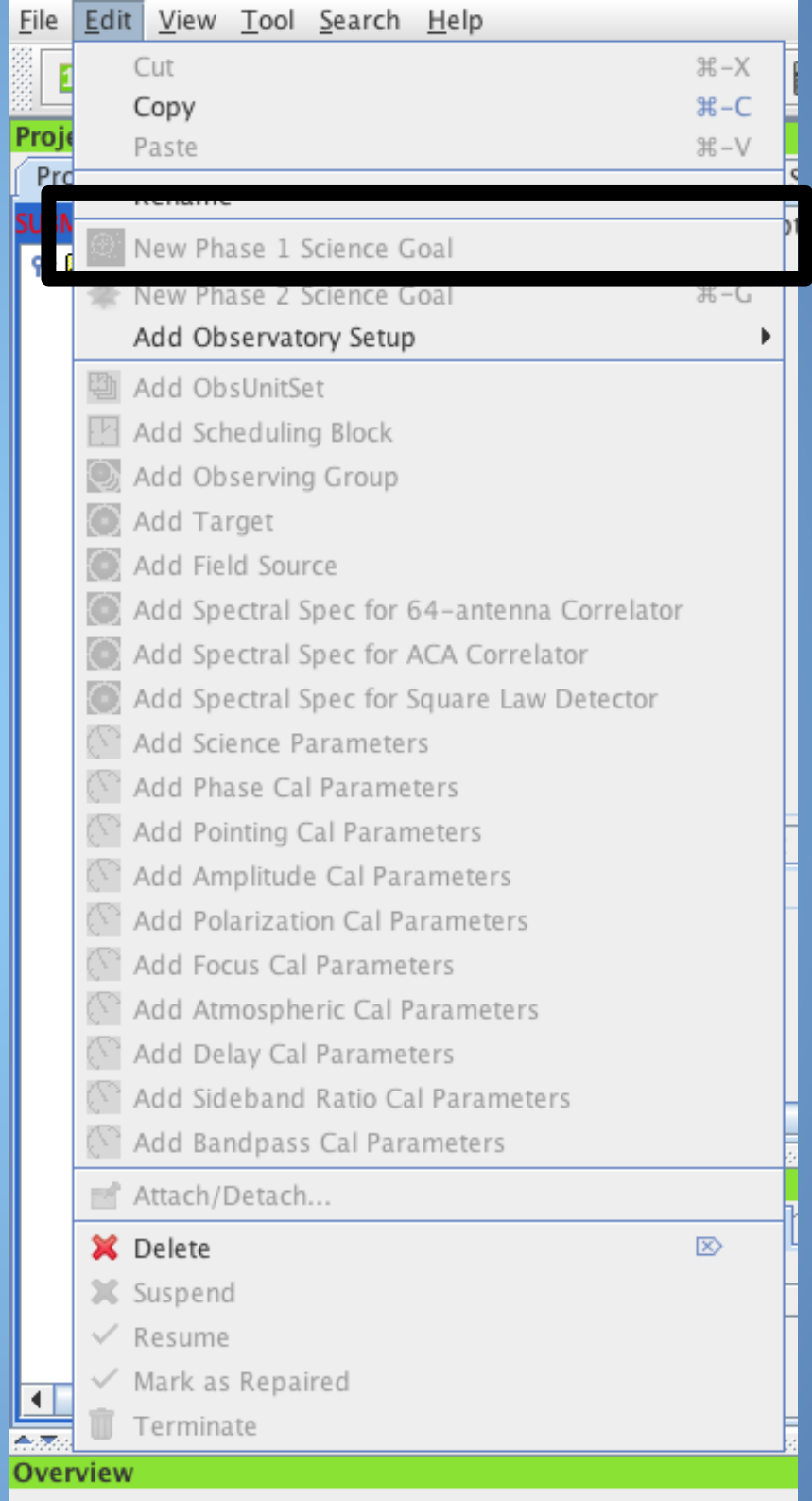
Spectral | Spatial | Planned Observing

Table of the science goals. Double click on table to select science goal in project tree.

Science Goal	No. Sources	Band	Spec. Type	No. Spec. Win.	Pol.	Cal. Setup	Ang. Res.	Largest Scale	Rep. Freq.	Sens.
Copy of Science Goal	15	3	Scan	20	Dual	System	3.754 arc...	0.0 arcsec	99.438 GHz	1 mJy

Menu':

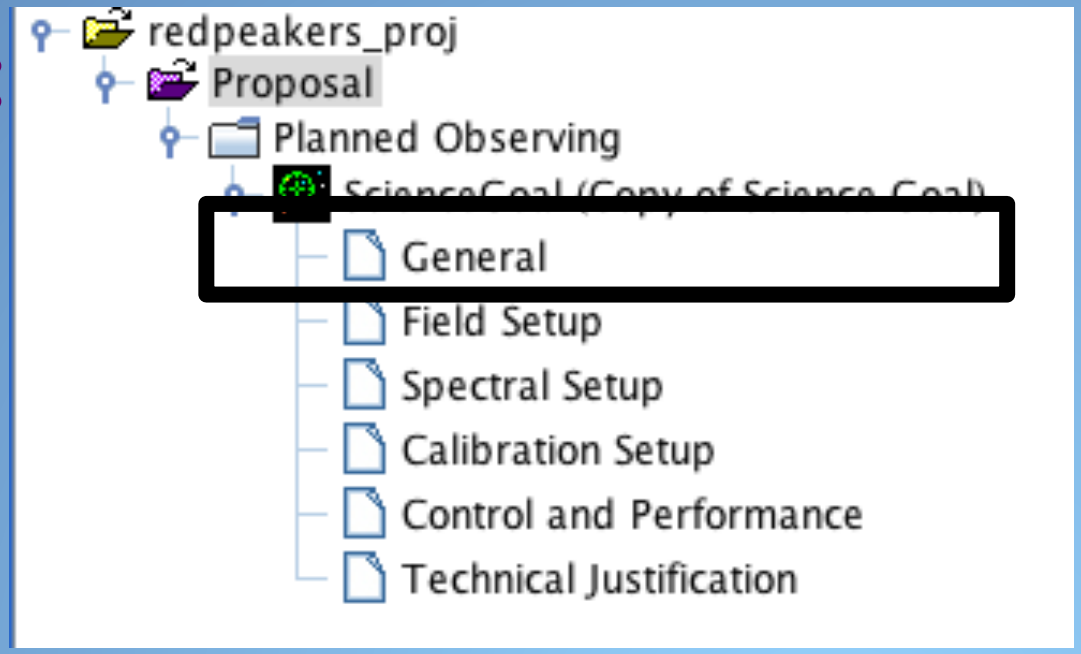




Science goal describes the observations necessary to achieve the scientific objective. If you plan to observe different bands you need to create a Science goal for each band. If you plan to observe with the Atacama Compact Array (ACA) you need a different science goal:

Each observation needs a SCIENCE GOAL

Menu’:



File Edit View Tool Search Help

Perspective 1

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Editors

Spectral | Spatial | General

Enter a name and description for the purpose of this science goal.
This text is optional but you may find it useful to keep a note.

General (Optional)

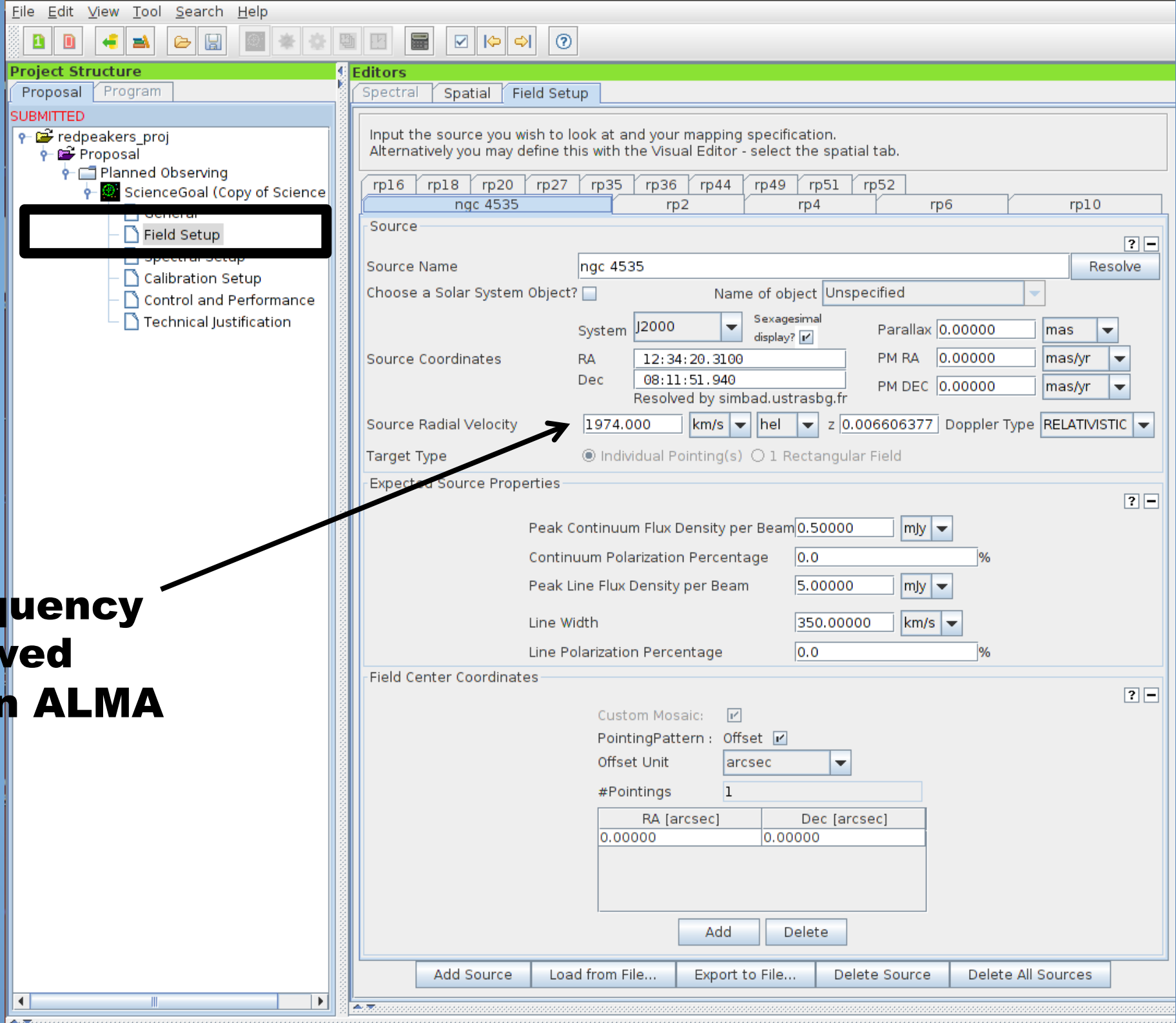
Science Goal Name: Copy of Science Goal

Description

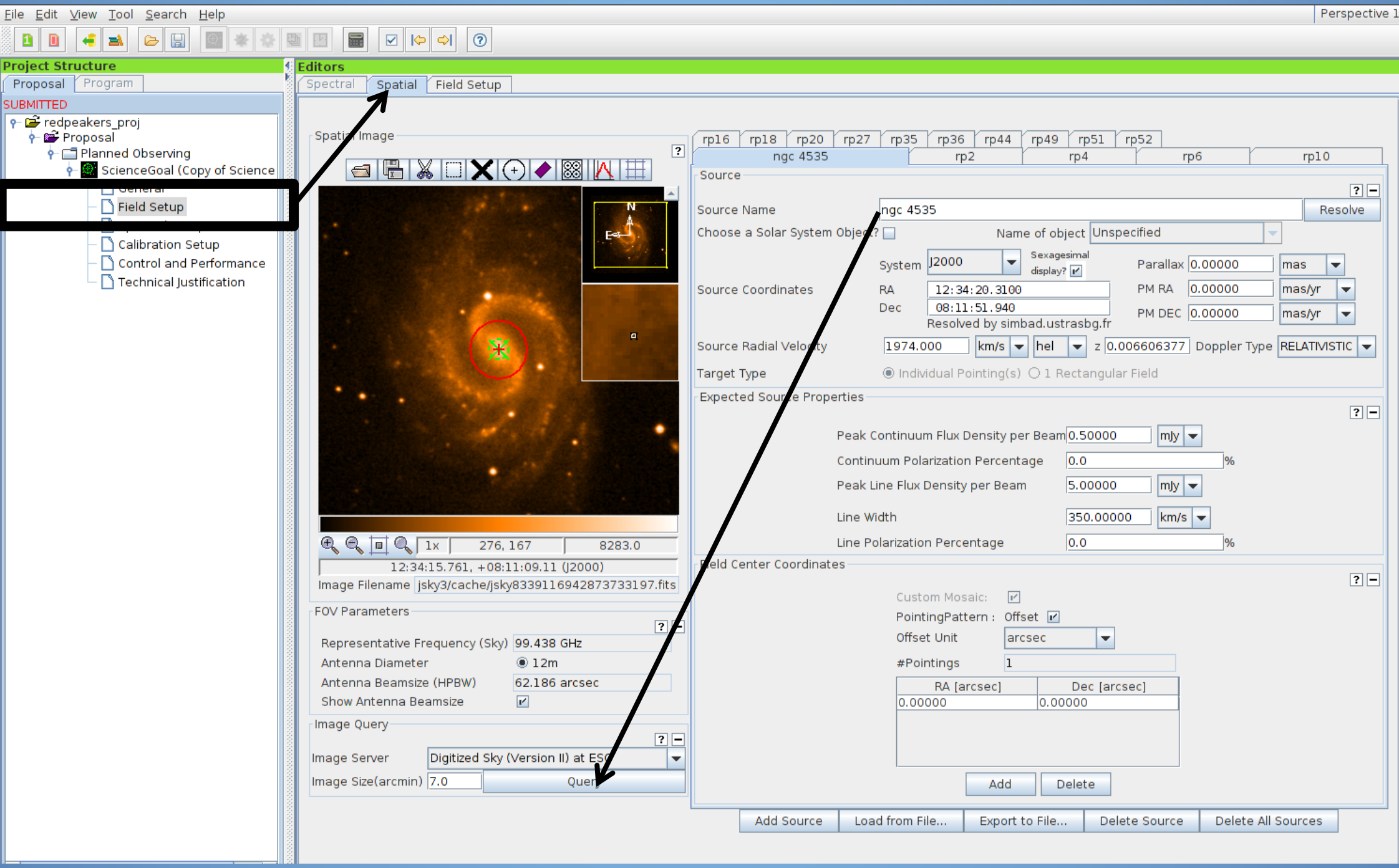
Launch Editor

Menu':

Up to 5 frequency tuning allowed all within an ALMA band



Menu':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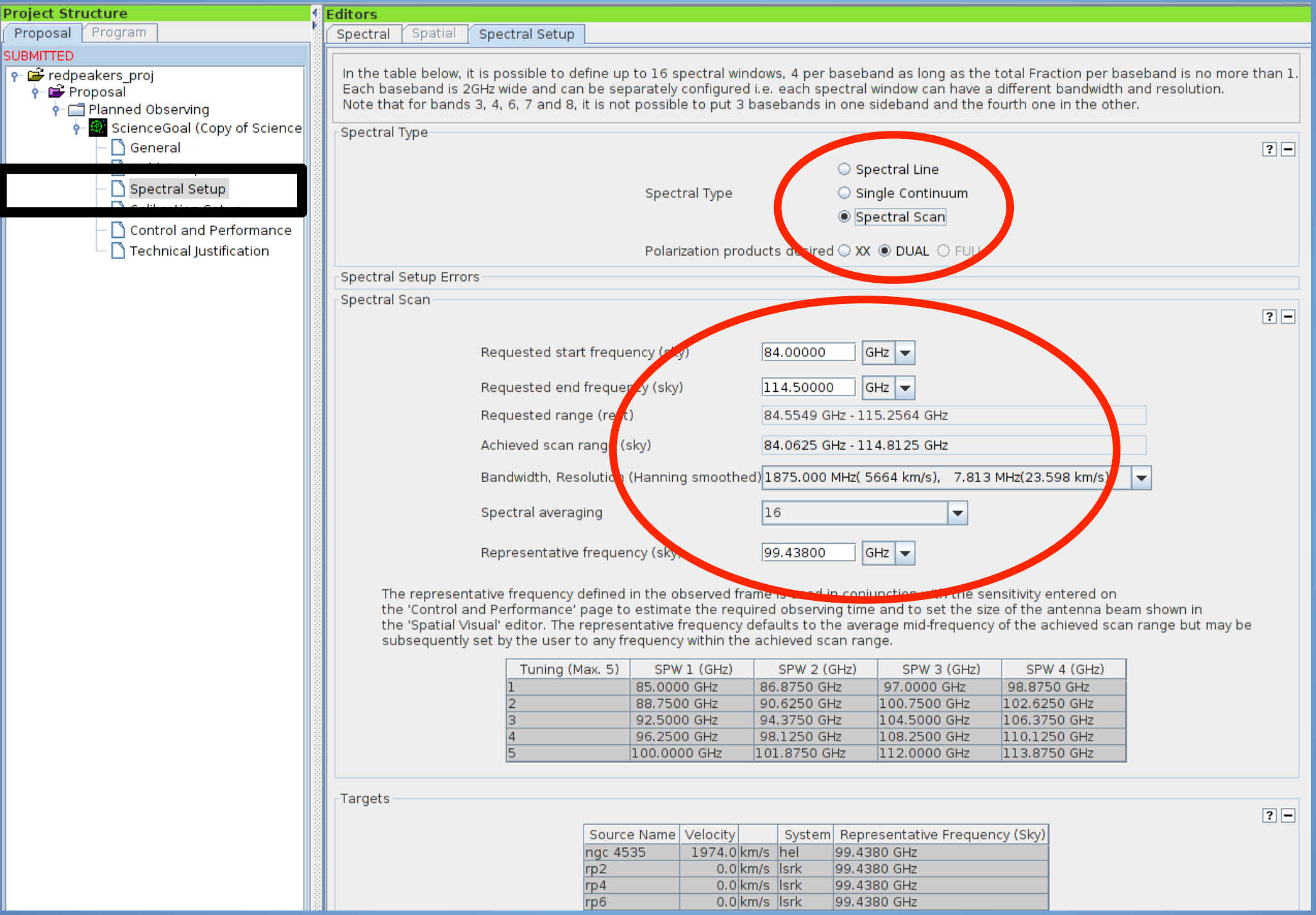
Spectral Spatial Field Setup
Spatial Image
N
E
1x 276, 167 8283.0
12:34:15.761, +08:11:09.11 (J2000)
Image Filename jsky3/cache/jsky8339116942873733197.fits
FOV Parameters
Representative Frequency (Sky) 99.438 GHz
Antenna Diameter 12m
Antenna Beamsize (HPBW) 62.186 arcsec
Show Antenna Beamsize
Image Query
Image Server Digitized Sky (Version II) at ES
Image Size(arcmin) 7.0
Query
rp16 rp18 rp20 rp27 rp35 rp36 rp44 rp49 rp51 rp52
ngc 4535 rp2 rp4 rp6 rp10
Source
Source Name ngc 4535
Resolve
Choose a Solar System Object?
Name of object Unspecified
System J2000
Sexagesimal display?
Parallax 0.00000 mas
Source Coordinates
RA 12:34:20.3100
Dec 08:11:51.940
PM RA 0.00000 mas/yr
PM DEC 0.00000 mas/yr
Resolved by simbad.ustrasbg.fr
Source Radial Velocity 1974.000 km/s hel
z 0.006606377
Doppler Type RELATIVISTIC
Target Type
Individual Pointing(s)
1 Rectangular Field
Expected Source Properties
Peak Continuum Flux Density per Beam 0.50000 mJy
Continuum Polarization Percentage 0.0 %
Peak Line Flux Density per Beam 5.00000 mJy
Line Width 350.00000 km/s
Line Polarization Percentage 0.0 %
Field Center Coordinates
Custom Mosaic:
PointingPattern : Offset
Offset Unit arcsec
#Pointings 1
RA [arcsec] Dec [arcsec]
0.00000 0.00000
Add Delete
Add Source Load from File... Export to File... Delete Source Delete All Sources

Menu’: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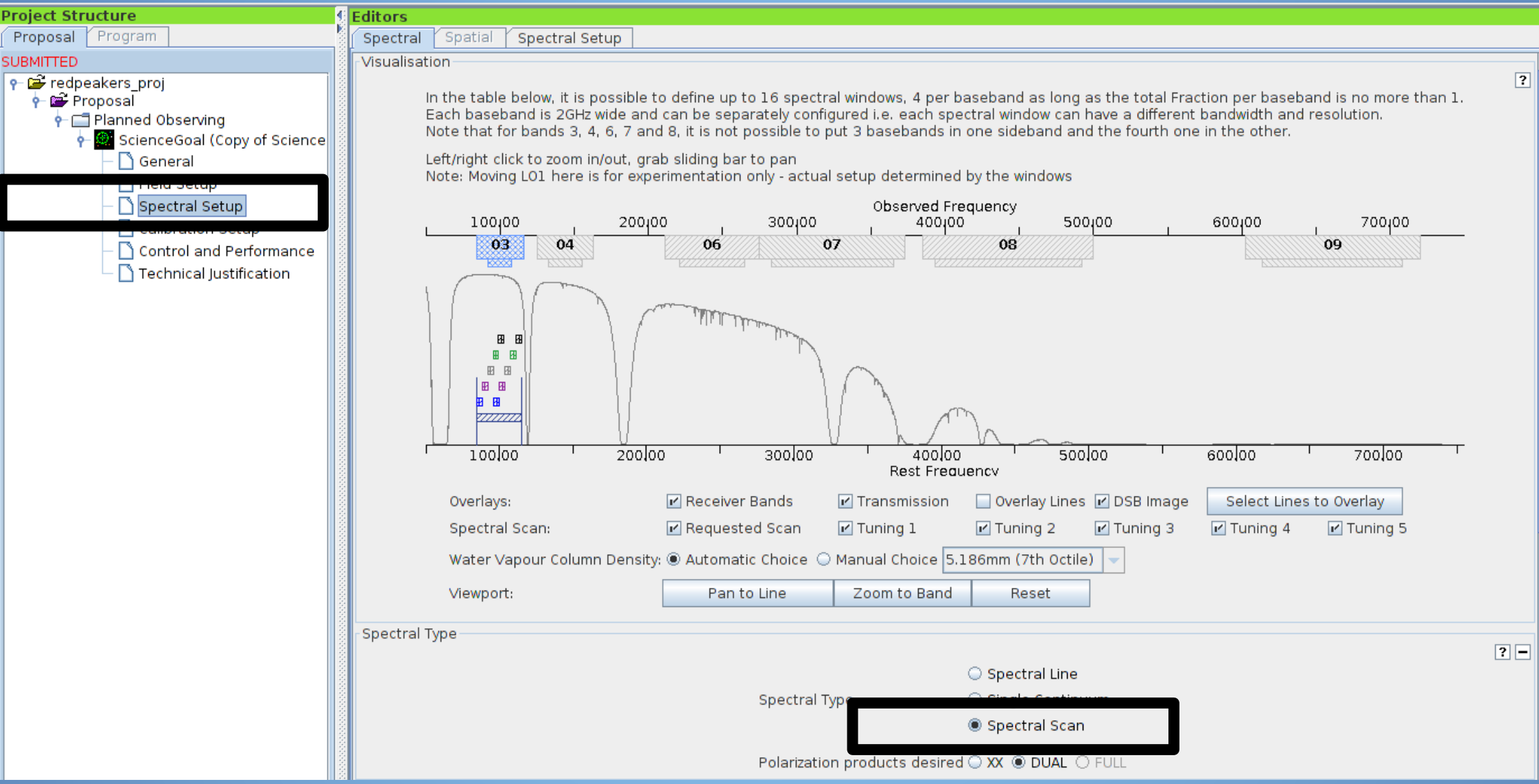
Spectral Setup
In the table below, it is possible to define up to 16 spectral windows, 4 per baseband as long as the total Fraction per baseband is no more than 1.
Each baseband is 2GHz wide and can be separately configured i.e. each spectral window can have a different bandwidth and resolution.
Note that for bands 3, 4, 6, 7 and 8, it is not possible to put 3 basebands in one sideband and the fourth one in the other.
Spectral Type
Spectral Type
Spectral Line
Single Continuum
Spectral Scan
Polarization products desired
XX
DUAL
FULL
Spectral Setup Errors
Spectral Scan
Requested start frequency (sky)
84.00000
GHz
Requested end frequency (sky)
114.50000
GHz
Requested range (rest)
84.5549 GHz - 115.2564 GHz
Achieved scan range (sky)
84.0625 GHz - 114.8125 GHz
Bandwidth, Resolution (Hanning smoothed)
1875.000 MHz(5664 km/s), 7.813 MHz(23.598 km/s)
Spectral averaging
16
Representative frequency (sky)
99.43800
GHz
The representative frequency defined in the observed frame is used in conjunction with the sensitivity entered on
the 'Control and Performance' page to estimate the required observing time and to set the size of the antenna beam shown in
the 'Spatial Visual' editor. The representative frequency defaults to the average mid-frequency of the achieved scan range but may be
subsequently set by the user to any frequency within the achieved scan range.
Tuning (Max. 5) SPW 1 (GHz) SPW 2 (GHz) SPW 3 (GHz) SPW 4 (GHz)
1 85.0000 GHz 86.8750 GHz 97.0000 GHz 98.8750 GHz
2 88.7500 GHz 90.6250 GHz 100.7500 GHz 102.6250 GHz
3 92.5000 GHz 94.3750 GHz 104.5000 GHz 106.3750 GHz
4 96.2500 GHz 98.1250 GHz 108.2500 GHz 110.1250 GHz
5 100.0000 GHz 101.8750 GHz 112.0000 GHz 113.8750 GHz
Targets
Source Name Velocity System Representative Frequency (Sky)
ngc 4535 1974.0 km/s hel 99.4380 GHz
rp2 0.0 km/s lsrk 99.4380 GHz
rp4 0.0 km/s lsrk 99.4380 GHz
rp6 0.0 km/s lsrk 99.4380 GHz

Menu':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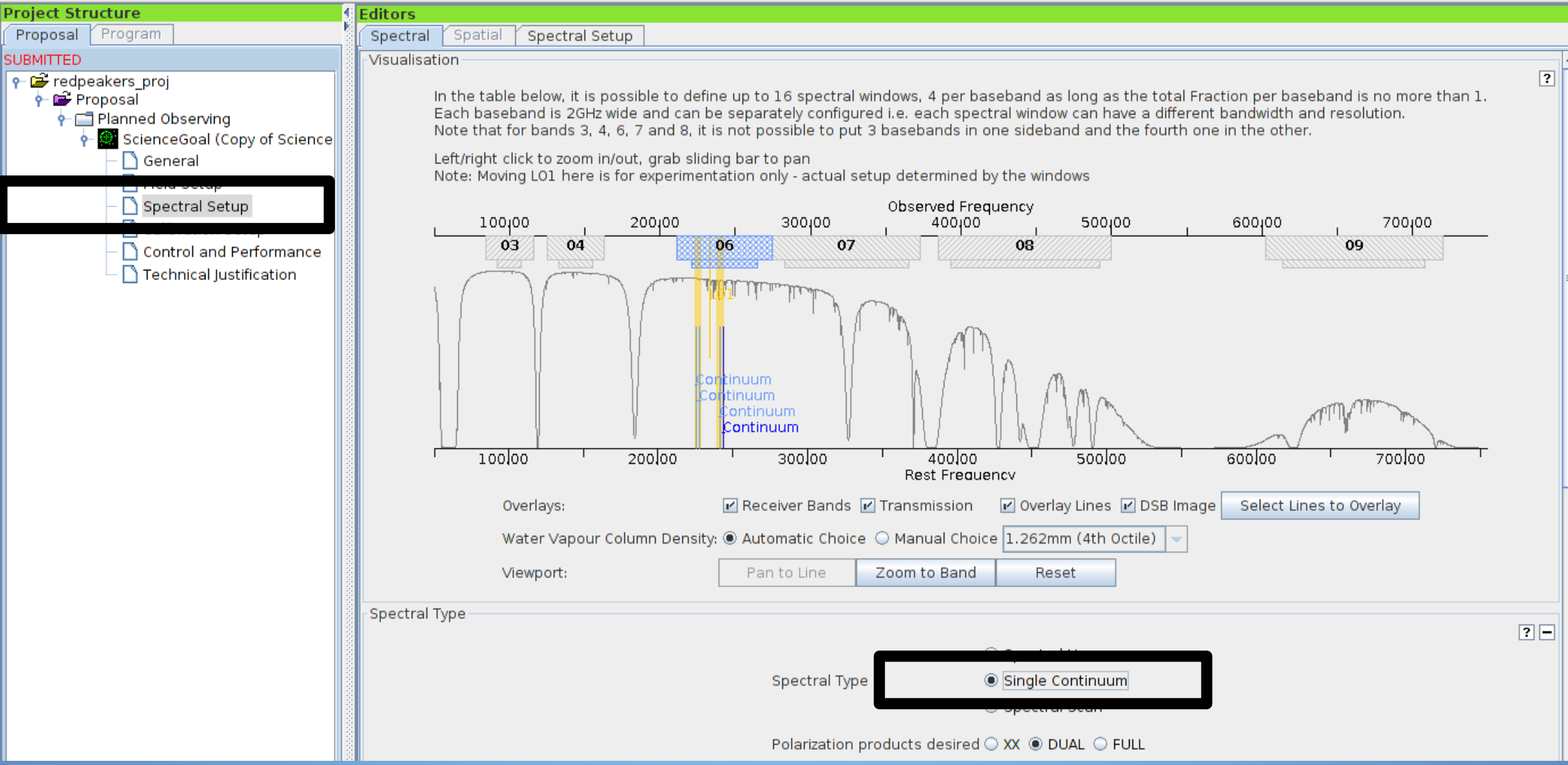
Left/right click to zoom in/out, grab sliding bar to pan
Note: Moving LO1 here is for experimentation only - actual setup determined by the windows
Observed Frequency
100|00
200|00
300|00
400|00
500|00
600|00
700|00
03
04
06
07
08
09
Rest Frequency
Overlays:
Receiver Bands
Transmission
Overlay Lines
DSB Image
Select Lines to Overlay
Spectral Scan:
Requested Scan
Tuning 1
Tuning 2
Tuning 3
Tuning 4
Tuning 5
Water Vapour Column Density:
Automatic Choice
Manual Choice
5.186mm (7th Octile)
Viewport:
Pan to Line
Zoom to Band
Reset
Spectral Type
Spectral Line
Spectral Type
Spectral Scan
Polarization products desired
XX
DUAL
FULL

Menu’: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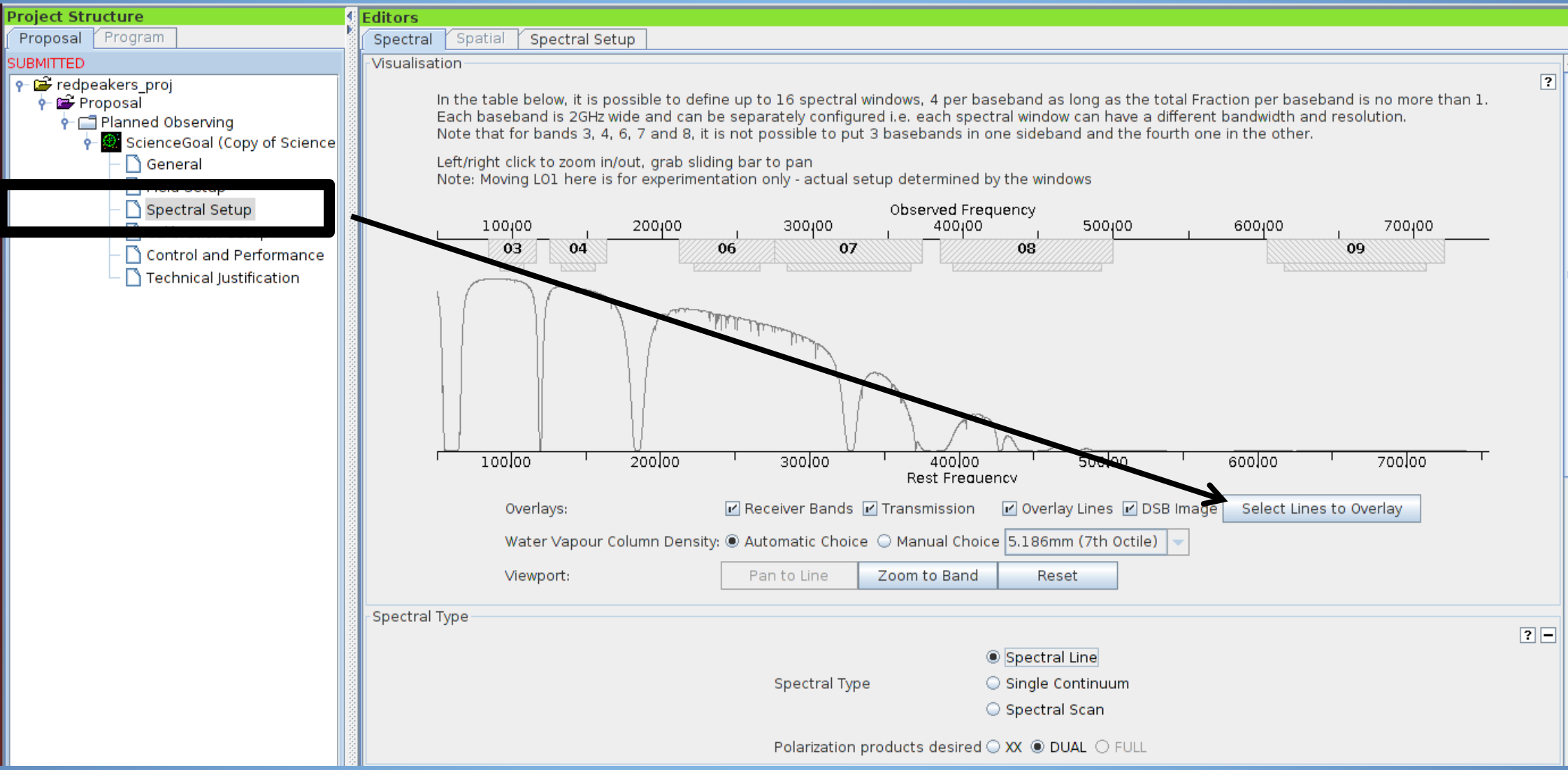
Observed Frequency
100,00
200,00
300,00
400,00
500,00
600,00
700,00
03
04
06
07
08
09
LO1
Continuum
Continuum
Continuum
Continuum
Rest Frequency
Overlays:
Receiver Bands
Transmission
Overlay Lines
DSB Image
Select Lines to Overlay
Water Vapour Column Density:
Automatic Choice
Manual Choice
1.262mm (4th Octile)
Viewport:
Pan to Line
Zoom to Band
Reset
Spectral Type
Spectral Type
Single Continuum
Polarization products desired
XX
DUAL
FULL

Menu’: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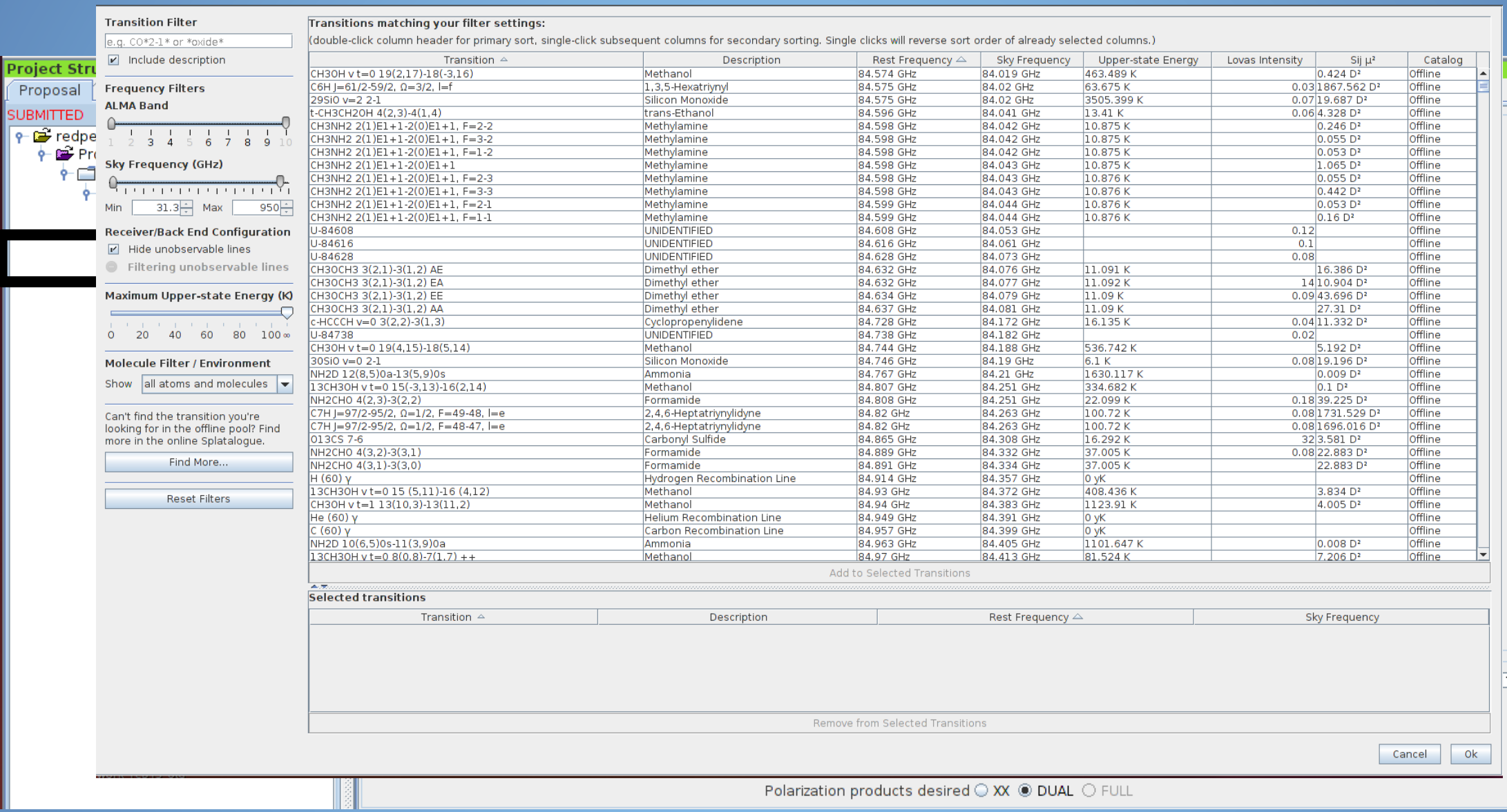
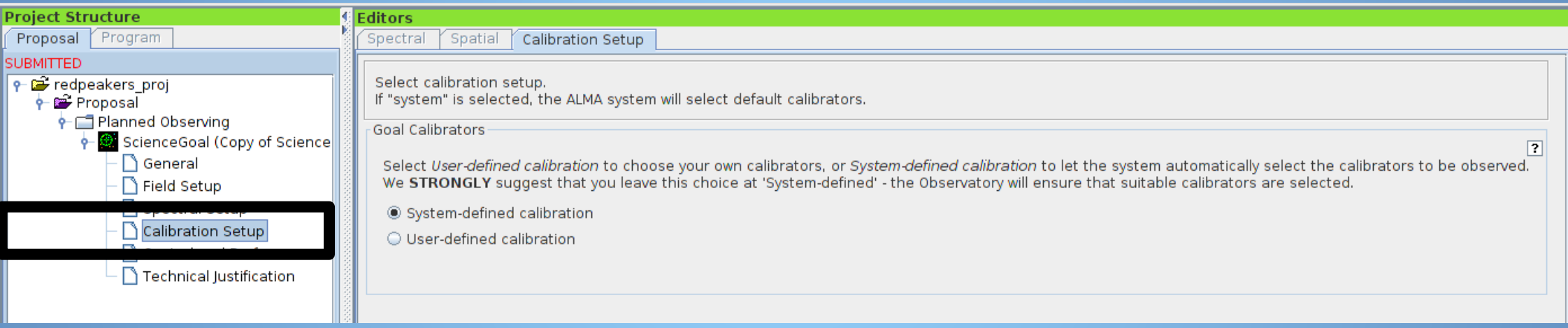
Observed Frequency
100,00
200,00
300,00
400,00
500,00
600,00
700,00
03
04
06
07
08
09
Rest Frequency
Overlays:
Receiver Bands
Transmission
Overlay Lines
DSB Image
Select Lines to Overlay
Water Vapour Column Density:
Automatic Choice
Manual Choice
5.186mm (7th Octile)
Viewport:
Pan to Line
Zoom to Band
Reset
Spectral Type
Spectral Type
Spectral Line
Single Continuum
Spectral Scan
Polarization products desired
XX
DUAL
FULL

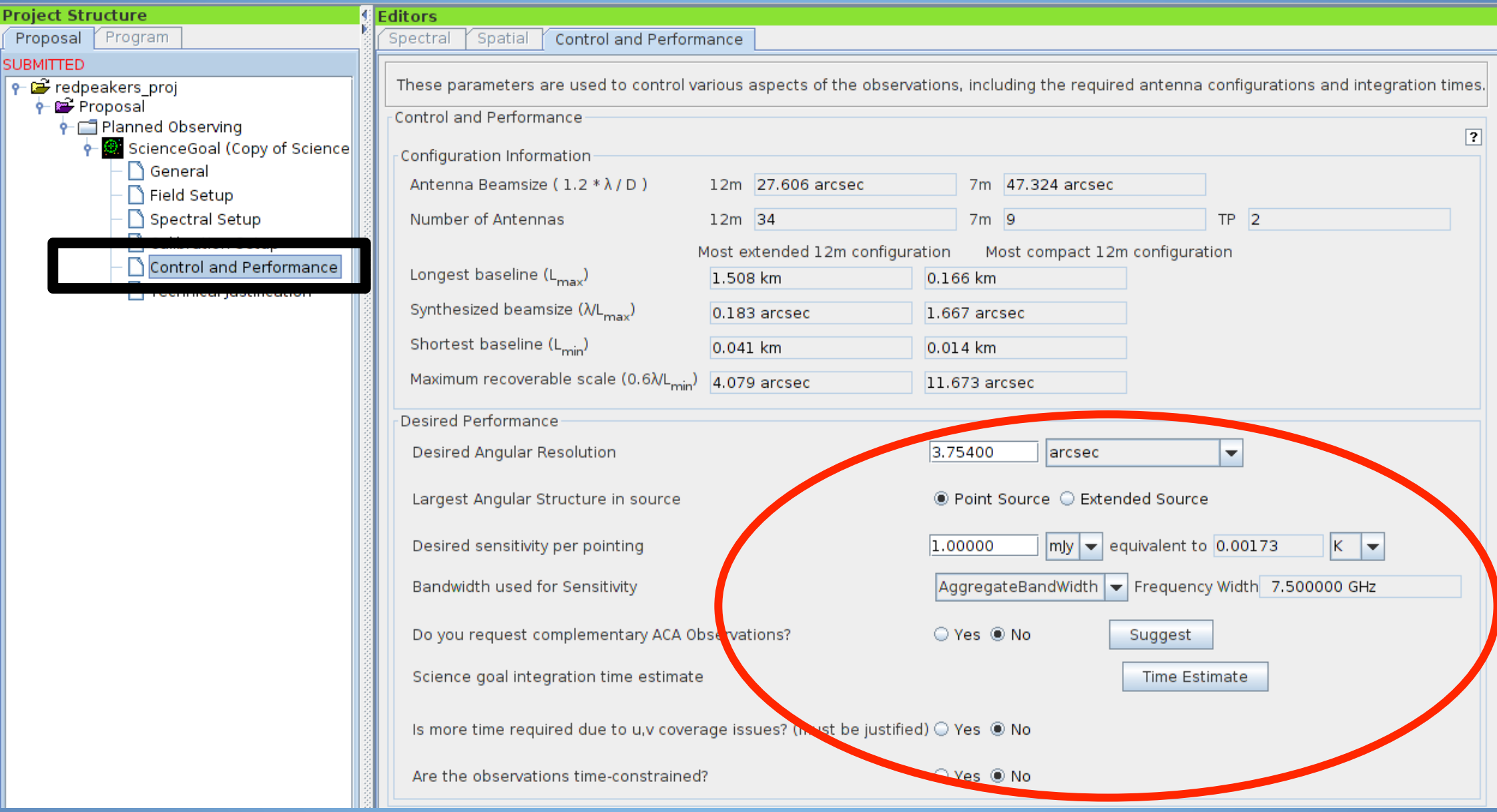
Menu':


Transition Filter
e.g. CO*2-1* or *oxide*
Include description
Frequency Filters
ALMA Band
1 2 3 4 5 6 7 8 9 10
Sky Frequency (GHz)
Min 31.3 Max 950
Receiver/Back End Configuration
Hide unobservable lines
Filtering unobservable lines
Maximum Upper-state Energy (K)
0 20 40 60 80 100 ∞
Molecule Filter / Environment
Show all atoms and molecules
Can't find the transition you're looking for in the offline pool? Find more in the online Splatalogue.
Find More...
Reset Filters
Transitions matching your filter settings:
(double-click column header for primary sort, single-click subsequent columns for secondary sorting. Single clicks will reverse sort order of already selected columns.)
Transition | Description | Rest Frequency | Sky Frequency | Upper-state Energy | Lovas Intensity | Sij μ² | Catalog
CH3OH v t=0 19(2,17)-18(-3,16) | Methanol | 84.574 GHz | 84.019 GHz | 463.489 K | | 0.424 D² | Offline
C6H J=61/2-59/2, Ω=3/2, l=f | 1,3,5-Hexatriynyl | 84.575 GHz | 84.02 GHz | 63.675 K | 0.03 | 1867.562 D² | Offline
29SiO v=2 2-1 | Silicon Monoxide | 84.575 GHz | 84.02 GHz | 3505.399 K | 0.07 | 19.687 D² | Offline
t-CH3CH2OH 4(2,3)-4(1,4) | trans-Ethanol | 84.596 GHz | 84.041 GHz | 13.41 K | 0.06 | 4.328 D² | Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=2-2 | Methylamine | 84.598 GHz | 84.042 GHz | 10.875 K | | 0.246 D² | Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=3-2 | Methylamine | 84.598 GHz | 84.042 GHz | 10.875 K | | 0.055 D² | Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=1-2 | Methylamine | 84.598 GHz | 84.042 GHz | 10.875 K | | 0.053 D² | Offline
CH3NH2 2(1)E1+1-2(0)E1+1 | Methylamine | 84.598 GHz | 84.043 GHz | 10.875 K | | 1.065 D² | Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=2-3 | Methylamine | 84.598 GHz | 84.043 GHz | 10.876 K | | 0.055 D² | Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=3-3 | Methylamine | 84.598 GHz | 84.043 GHz | 10.876 K | | 0.442 D² | Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=2-1 | Methylamine | 84.599 GHz | 84.044 GHz | 10.876 K | | 0.053 D² | Offline
CH3NH2 2(1)E1+1-2(0)E1+1, F=1-1 | Methylamine | 84.599 GHz | 84.044 GHz | 10.876 K | | 0.16 D² | Offline
U-84608 | UNIDENTIFIED | 84.608 GHz | 84.053 GHz | | 0.12 | | Offline
U-84616 | UNIDENTIFIED | 84.616 GHz | 84.061 GHz | | 0.1 | | Offline
U-84628 | UNIDENTIFIED | 84.628 GHz | 84.073 GHz | | 0.08 | | Offline
CH3OCH3 3(2,1)-3(1,2) AE | Dimethyl ether | 84.632 GHz | 84.076 GHz | 11.091 K | | 16.386 D² | Offline
CH3OCH3 3(2,1)-3(1,2) EA | Dimethyl ether | 84.632 GHz | 84.077 GHz | 11.092 K | 14 | 10.904 D² | Offline
CH3OCH3 3(2,1)-3(1,2) EE | Dimethyl ether | 84.634 GHz | 84.079 GHz | 11.09 K | 0.09 | 43.696 D² | Offline
CH3OCH3 3(2,1)-3(1,2) AA | Dimethyl ether | 84.637 GHz | 84.081 GHz | 11.09 K | | 27.31 D² | Offline
c-HCCCH v=0 3(2,2)-3(1,3) | Cyclopropenylidene | 84.728 GHz | 84.172 GHz | 16.135 K | 0.04 | 11.332 D² | Offline
U-84738 | UNIDENTIFIED | 84.738 GHz | 84.182 GHz | | 0.02 | | Offline
CH3OH v t=0 19(4,15)-18(5,14) | Methanol | 84.744 GHz | 84.188 GHz | 536.742 K | | 5.192 D² | Offline
30SiO v=0 2-1 | Silicon Monoxide | 84.746 GHz | 84.19 GHz | 6.1 K | 0.08 | 19.196 D² | Offline
NH2D 12(8,5)0a-13(5,9)0s | Ammonia | 84.767 GHz | 84.21 GHz | 1630.117 K | | 0.009 D² | Offline
13CH3OH v t=0 15(-3,13)-16(2,14) | Methanol | 84.807 GHz | 84.251 GHz | 334.682 K | | 0.1 D² | Offline
NH2CHO 4(2,3)-3(2,2) | Formamide | 84.808 GHz | 84.251 GHz | 22.099 K | 0.18 | 39.225 D² | Offline
C7H J=97/2-95/2, Ω=1/2, F=49-48, l=e | 2,4,6-Heptatriynylidyne | 84.82 GHz | 84.263 GHz | 100.72 K | 0.08 | 1731.529 D² | Offline
C7H J=97/2-95/2, Ω=1/2, F=48-47, l=e | 2,4,6-Heptatriynylidyne | 84.82 GHz | 84.263 GHz | 100.72 K | 0.08 | 1696.016 D² | Offline
O13CS 7-6 | Carbonyl Sulfide | 84.865 GHz | 84.308 GHz | 16.292 K | 32 | 3.581 D² | Offline
NH2CHO 4(3,2)-3(3,1) | Formamide | 84.889 GHz | 84.332 GHz | 37.005 K | 0.08 | 22.883 D² | Offline
NH2CHO 4(3,1)-3(3,0) | Formamide | 84.891 GHz | 84.334 GHz | 37.005 K | | 22.883 D² | Offline
H (60) γ | Hydrogen Recombination Line | 84.914 GHz | 84.357 GHz | 0 yK | | | Offline
13CH3OH v t=0 15 (5,11)-16 (4,12) | Methanol | 84.93 GHz | 84.372 GHz | 408.436 K | | 3.834 D² | Offline
CH3OH v t=1 13(10,3)-13(11,2) | Methanol | 84.94 GHz | 84.383 GHz | 1123.91 K | | 4.005 D² | Offline
He (60) γ | Helium Recombination Line | 84.949 GHz | 84.391 GHz | 0 yK | | | Offline
C (60) γ | Carbon Recombination Line | 84.957 GHz | 84.399 GHz | 0 yK | | | Offline
NH2D 10(6,5)0s-11(3,9)0a | Ammonia | 84.963 GHz | 84.405 GHz | 1101.647 K | | 0.008 D² | Offline
13CH3OH v t=0 8(0,8)-7(1,7) ++ | Methanol | 84.97 GHz | 84.413 GHz | 81.524 K | | 7.206 D² | Offline
Add to Selected Transitions
Selected transitions
Transition | Description | Rest Frequency | Sky Frequency
Remove from Selected Transitions
Cancel
Ok
Polarization products desired XX DUAL FULL

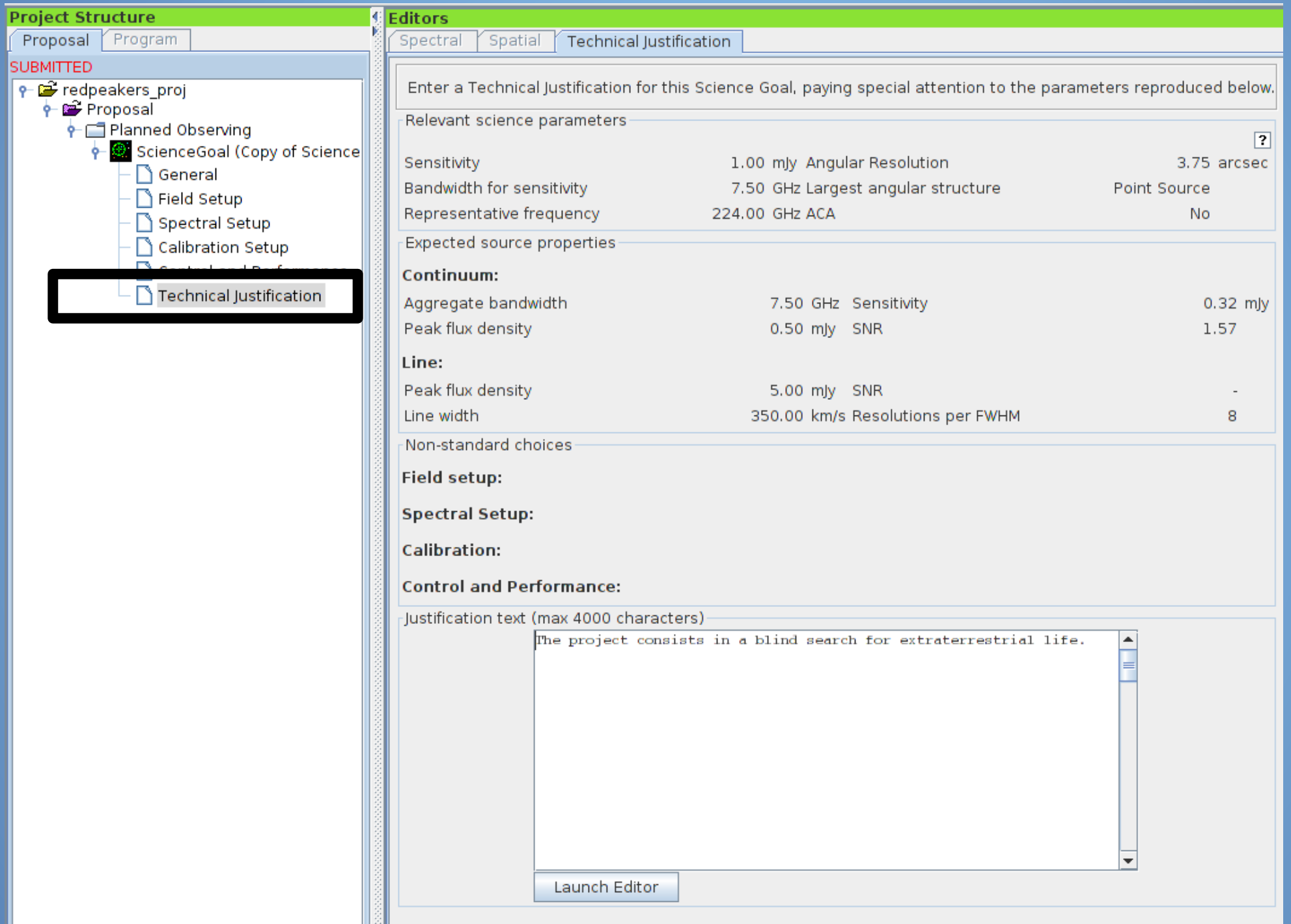
Menu’:


Project Structure
Proposal
Program
SUBMITTED
redpeakers_proj
Proposal
Planned Observing
ScienceGoal (Copy of Science
General
Field Setup
Calibration Setup
Technical Justification
Editors
Spectral
Spatial
Calibration Setup
Select calibration setup.
If "system" is selected, the ALMA system will select default calibrators.
Goal Calibrators
Select User-defined calibration to choose your own calibrators, or System-defined calibration to let the system automatically select the calibrators to be observed.
We STRONGLY suggest that you leave this choice at 'System-defined' - the Observatory will ensure that suitable calibrators are selected.
System-defined calibration
User-defined calibration

Menu':


Project Structure
Proposal
Program
SUBMITTED
redpeakers_proj
Proposal
Planned Observing
ScienceGoal (Copy of Science
General
Field Setup
Spectral Setup
Control and Performance
Editors
Spectral
Spatial
Control and Performance
These parameters are used to control various aspects of the observations, including the required antenna configurations and integration times.
Control and Performance
Configuration Information
Antenna Beamsize (1.2 * λ / D)
12m 27.606 arcsec
7m 47.324 arcsec
Number of Antennas
12m 34
7m 9
TP 2
Most extended 12m configuration
Most compact 12m configuration
Longest baseline (Lmax)
1.508 km
0.166 km
Synthesized beamsize (λ/Lmax)
0.183 arcsec
1.667 arcsec
Shortest baseline (Lmin)
0.041 km
0.014 km
Maximum recoverable scale (0.6λ/Lmin)
4.079 arcsec
11.673 arcsec
Desired Performance
Desired Angular Resolution
3.75400
arcsec
Largest Angular Structure in source
Point Source
Extended Source
Desired sensitivity per pointing
1.00000
mJy
equivalent to
0.00173
K
Bandwidth used for Sensitivity
AggregateBandWidth
Frequency Width
7.500000 GHz
Do you request complementary ACA Observations?
Yes
No
Suggest
Science goal integration time estimate
Time Estimate
Is more time required due to u,v coverage issues? (must be justified)
Yes
No
Are the observations time-constrained?
Yes
No

Menu':


Project Structure
Proposal
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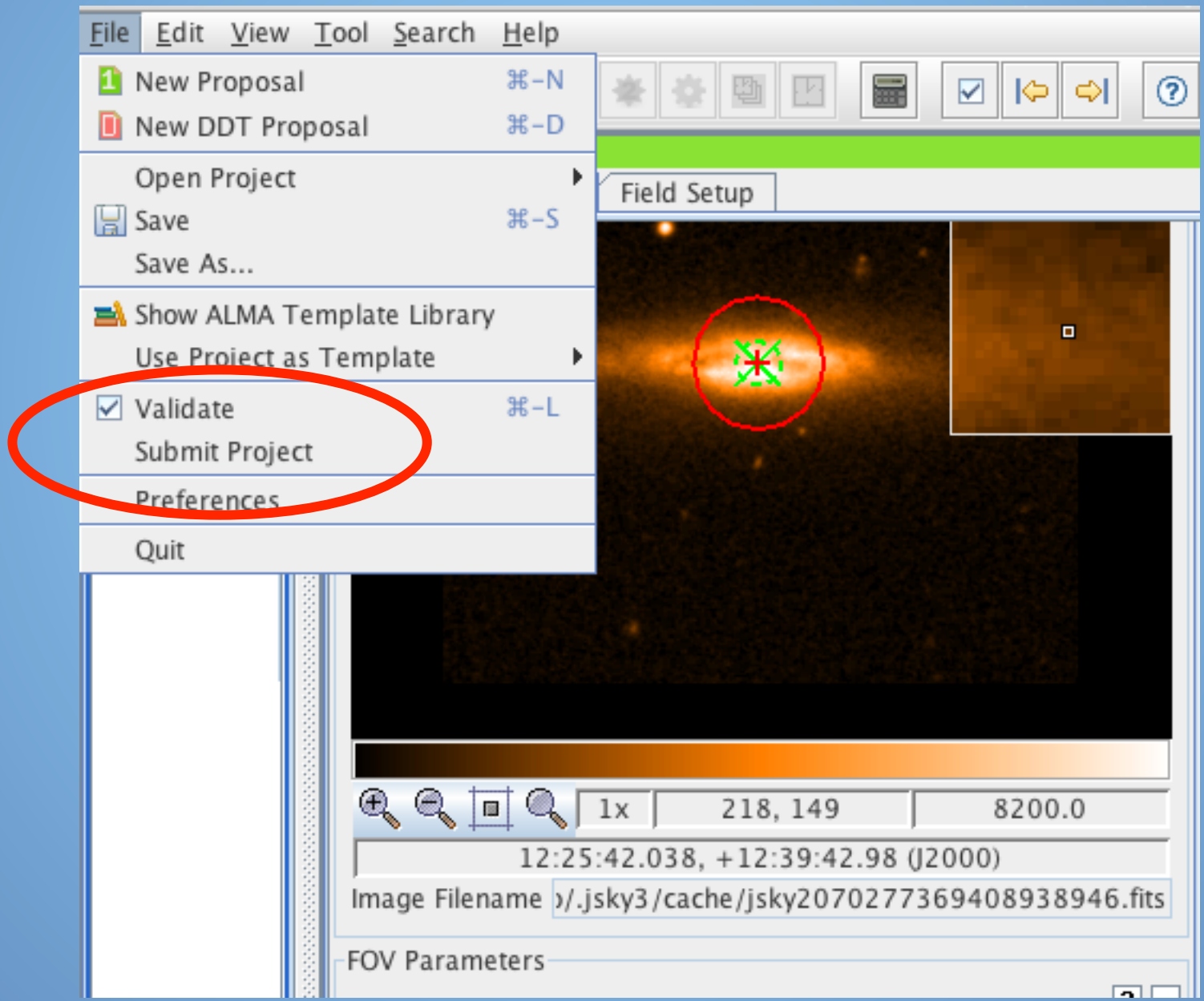
SUBMITTED
redpeakers_proj
Proposal
Planned Observing
ScienceGoal (Copy of Science
General
Field Setup
Spectral Setup
Calibration Setup
Technical Justification
Editors
Spectral
Spatial
Technical Justification
Enter a Technical Justification for this Science Goal, paying special attention to the parameters reproduced below.
Relevant science parameters
Sensitivity 1.00 mJy
Bandwidth for sensitivity 7.50 GHz
Representative frequency 224.00 GHz
Angular Resolution 3.75 arcsec
Largest angular structure Point Source
ACA No
Expected source properties
Continuum:
Aggregate bandwidth 7.50 GHz
Peak flux density 0.50 mJy
Sensitivity 0.32 mJy
SNR 1.57
Line:
Peak flux density 5.00 mJy
Line width 350.00 km/s
SNR -
Resolutions per FWHM 8
Non-standard choices
Field setup:
Spectral Setup:
Calibration:
Control and Performance:
Justification text (max 4000 characters)
The project consists in a blind search for extraterrestrial life.
Launch Editor

Submit?


File
Edit
View
Tool
Search
Help
New Proposal ⌘-N
New DDT Proposal ⌘-D
Open Project
Save ⌘-S
Save As...
Show ALMA Template Library
Use Project as Template
Validate ⌘-L
Submit Project
Preferences
Quit
Field Setup
1x
218, 149
8200.0
12:25:42.038, +12:39:42.98 (J2000)
Image Filename
)/.jsky3/cache/jsky2070277369408938946.fits
FOV Parameters

FOR ANY QUESTION DON'T HESITATE TO CONTACT THE PACE THROUGH THE WEBSITE:

For the rest:

ENJOY!