

The Snail

Absolute Tuning

User Manual



Bb

User Manual

The Snail - Absolute Tuning

A

SEE WHAT YOU HEAR

Aimed at musicians, sound engineers or composers of all ages, this application will help you to :

- **Analyse** your music more precisely than a standard spectrum analyser
- **Fine tune** your instruments with outstanding precision.

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WHAT IS THE SNAIL ?

The Snail is a high-precision frequency analyser that delivers an easy to read representation of sounds based on a chromatic (music scale base) alignment, showing the notes and harmonics as 'light-spots' in real-time. It offers new ways of tuning an instrument, in an extremely accurate way; displaying intonation, and visualising music and sounds. It can help anyone improve their listening and intonation!

This system is based on a recent patented technology, conceived at the laboratory of Science and Technology of Music and Sound IRCAM-CNRS-UPMC

A REDEFINED HIGH PRECISION ANALYSIS

Compared to standard spectrum analysers based on Fourier-type analysis, the frequency accuracy is enhanced by a process based on the demodulated phase.

Basically, the exploited principle is as follows : if a sound includes a sinusoidal component with frequency 440Hz, the demodulated phase, stemming from a Fourier analysis at frequency 440Hz, will remain exactly constant (as a synchronised stroboscope renders a rotating object immobile).

Think of a film camera turning at 24 frames per second filming a bicycle wheel turning at 24 revolutions a second, the spokes will appear to be standing still.

That means, for a Fourier analysis at frequency 439Hz and the same sound, the demodulated phase will turn at 1Hz (as a slightly desynchronised stroboscope makes a rotating object have a slow movement). This principle is used to build a coherency index in the software in such a way that a high value is associated with an acceptable deviation, typically adjustable from 1Hz to 10Hz. A dedicated algorithm exploits this coherency index in several ways to:

1. **Improve** the frequency precision at an adjustable rate. Letting you fine-tune the accuracy of the Snail
2. **Go beyond the global stroboscopic techniques** used in some high-quality tuners by *analysing all the local spectral components and rendering this information in a convenient visual form*. You see all the surrounding frequencies and overtones as well as the basic fundamentals
3. **Exploit the local information to deliver a new notion of tuning** (available for slightly or highly inharmonic sounds) and to visualise the *harmonicity quality* (a “bad string” can be immediately identified or a resonance that is out of tune in your instrument, or resonances that cause some notes to be more present (ringing) than other - which might be desirable or not).



4. **Propose a robust extraction of the sustained stationary components** from a perturbed environment (like a surrounding noise or speech) which facilitates tuning operations, without damaging accuracy. Filtering out unwanted frequencies are not part of the object of the tuning.

A HIGH PRECISION MUSICAL VISUALISATION

As it will be detailed in the following documentation, the spectral information and its enhanced frequency accuracy are displayed according to several layouts.

The “Snail” visualiser shows the active zones of the spectral content, represented as light spots on a spiral skeleton built such that :

1. *One turn is one octave.* Low notes are close to the center, high notes are far from the center. The reference tuning frequency (default : 440Hz) is symbolised by the blue point attached to the skeleton. This provides an abacus adapted to the twelve-tone equal temperament.
2. *For each analysed frequency, magnitude is converted into loudness [1] and mapped to brightness : double the loudness of a component, it doubles the brightness of the spot. The spot thickness increases with respect to both the loudness and the coherency index in such a way that spectral components can*

be selected in an adjustable and relevant way (according to targeted operation: tuning, music visualisation, etc). Additional information is conveyed by colours, according to selected modes (loudness, demodulated phase, or “coherency index” described later).

When the tuner layout mode is displayed a rotating hexagonal is oriented, respecting the demodulated phase associated with the exact targeted frequency : its rotation allows the estimation of the very refined tuning! One turn in 2 seconds means that the tuning deviation corresponds to 0.5Hz.

[1] *Based on a psychoacoustic scale without considering any mask effect (international standard ISO 226:2003).*



Installation / Setup

INSTALLATION

1. Mac Installation

2. Windows Installation

3. Audio Setup

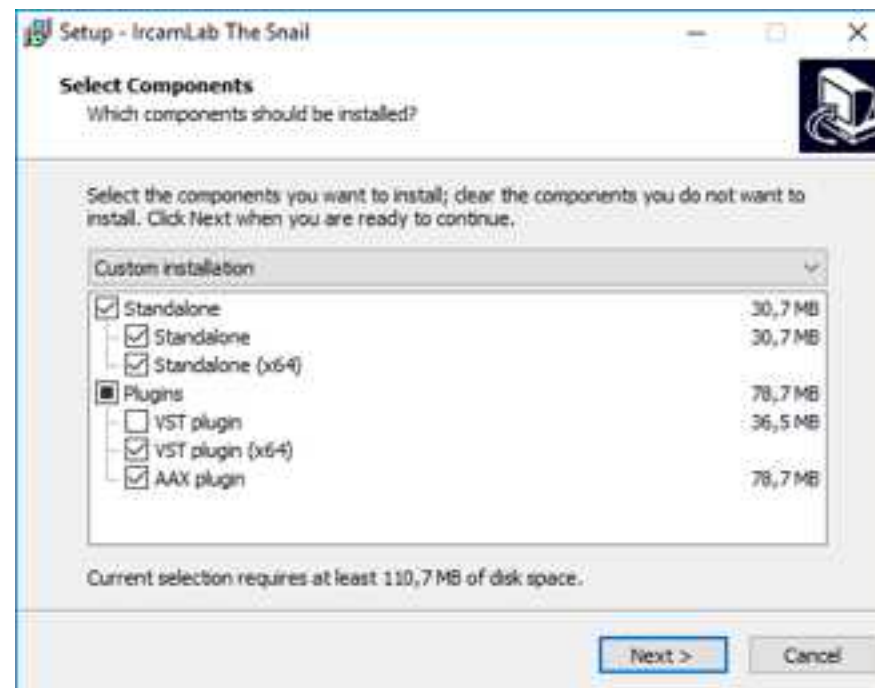
1. Mac Installation

Open or double-click the Disk Image and run the Snail installer inside of it.

The installer will install the standalone The Snail.app and the plugins in /Library/Audio/Plugins/Components (for Audio Units), /Library/Audio/Plugins/VST (for VST), /Library/Application Support/Avid/Audio/Plug-Ins (for AAX)

2. Windows Installation

Launch the IRCAMLab TheSnail-setup.exe file you previously downloaded.



A configuration panel should allow you to choose the files you want to install or not. If it is your first installation we recommend you to click **Next** directly to stick with a standard installation.

However if you do not wish to install a specific type of third party plugins of The Snail then deselect the one you do not want. The Snail installer contains the VST plugin, compatible with most DAWs, and the AAX plugin dedicated for Pro Tools only.

3. Audio Setup

Click on the File icon in the application toolbar and select '*Audio Setup*'.

A new dialog will then allow you to configure the

input source (your real time input source), output source (needed to hear your input - BEWARE of feedback loops !), the audio card buffer size and audio card sample rate to use is set here as well.



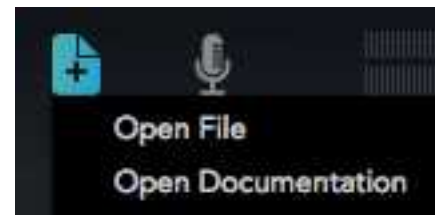
Quick Start Guide - Standalone app

DESCRIPTION

1. Play an audio file
2. Monitor audio input

1. Play an Audio File

To play an audio file, click on the File icon of the application toolbar and select 'Open File'



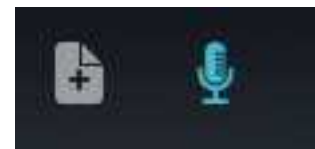
On Mac platform, you can also press Command-O.

On Windows platform, you can also press Control-O

2. Monitor the audio input (real-time)

If you need to properly set your input source (Microphone or Sound card input channel) then click on the *Audio Setup* first.

In order to activate the Monitor Input, click on the Microphone Icon in the toolbar.



User Interface And Parameters Description

DESCRIPTION

1. Overview

2. The Main Menu

3. The Settings Panel

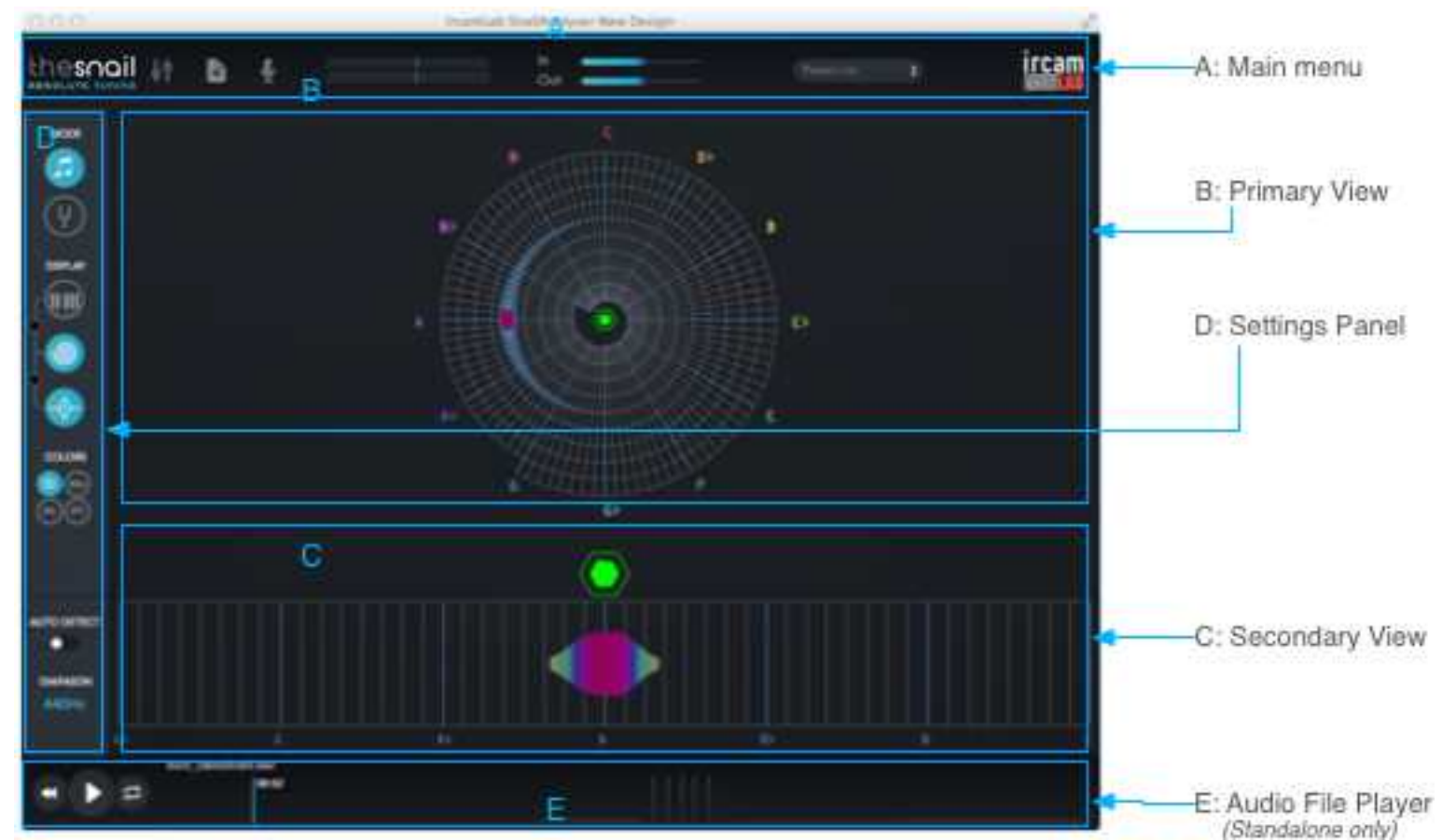
4. The Primary View

5. The Secondary View

6. The Audio File Player

1. Overview

The Snail interface is divided in 5 sections for the standalone applications, 4 for the plugin version which does not include the Audio File Player (E).



2. The Main Menu



Open/Close the advanced settings panel.



Open the application menu.



Activate / Deactivate the Monitor Input.

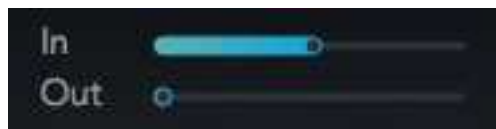
If the audio file player was running this will pause the player until you deactivate the monitor input.



Freeze the display of the snail so it will only display the last frame analysed by the engine.



Audio Input/Output Amplitude meter.



Input and Output Gain controls



Presets management menu.

You can load & save presets

from this menu.



Click on this icon to go to the **IrcamLab** website.

3. The Settings

The settings contains all the parameters of the Snail those parameters are standalone and plugin version. shown always in the side panel.

Parameters are shown only in the advanced settings panel.



engine and visual
Analyser Tuner. All
accessible in the
Basic parameters are
Advanced

a. MODE

Two MODES are available:

the first is the TUNER MODE (selected by default) which configure the Snail in a TUNER precision. You should set this MODE on when you need to tune an instrument or when you

need to see only stable frequency content and eliminate unstable notes or noise.

The MUSIC MODE (icon) is a more relaxed mode which will be more preferable for the other applications, like looking for non sustained notes or frequency content. Use this mode when you play real time or when you listen to a musical content.

b. DISPLAY



You can activate/deactivate a view by clicking on its corresponding icon.

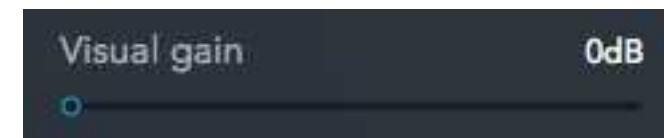
SNAIL ICON : shows the snail in the primary view (no secondary view).

SONOGRAM ICON : shows a vertical sonogram with a keyboard if no other view are selected. Shows a horizontal sonogram (as a secondary view) if the snail view is activated.

TUNER VIEW ICON : Shows the tuner view when you want to zoom around a specific note.

5 view layouts are accessible using the display options. You can use the shortcut buttons on the left of the icons to quickly select a configuration using two views at the same time.

c. SETTINGS



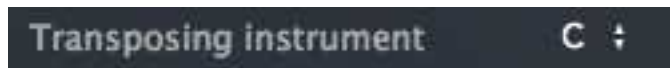
Visual Gain : increase or decrease in decibels the signal fed to the analyser. Usefull if a signal is too low to see it properly. This parameter does not affect the input or the output signal gain.



Tuning Reference : Your instrument or your music has a different tuning ? You can setup the Tuning Reference to work with using this slider/entry.



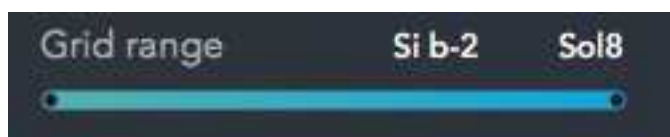
Center Note : Setup which note to see at the top of the Snail (default is C/Do).



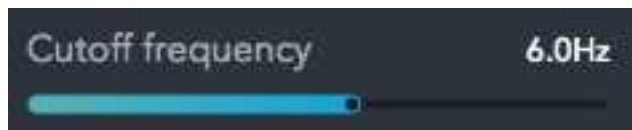
Transposing Instrument : This parameter is aimed at people who use instrument set in a specific key. Select the root note of instrument you have from the menu and the snail will rotate its display to take into account the transposition..



Notes Language : Choose which notation to use. (French: Do Ré Mi...etc... Si) or English : C D E ...etc.. B)

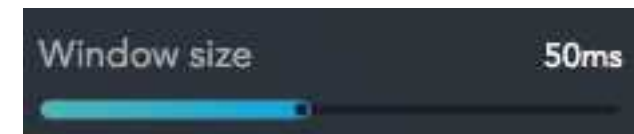


Grid Range : Change the grid of the snail so it display the notes as they are defined by this range slider.



Cutoff Frequency (Advanced Parameter) : This control helps the internal phase filter frequency precision. This parameter is

adjusted both by the MODE controls (TUNER or MUSIC). The lower this parameter is, the more precise (and also discriminative) the Snail Analyser will be as the fundamental is accentuated.

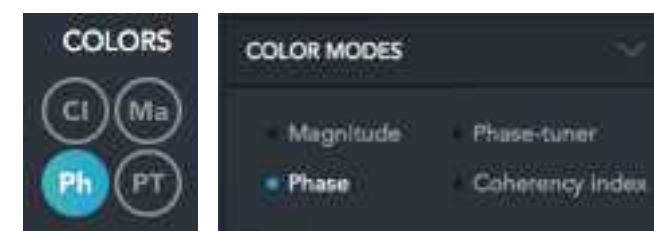


Window Size (Advanced Parameter) : Set the window size of the analysis engine. Large windows will enhance the low frequency range but will slow down the reactivity.



Window Type (Advanced Parameter) : Set the window type of the analysis engine. See https://en.wikipedia.org/wiki/Window_function for more information regarding the different window functions. The blackmann window is the default one.

d. COLOUR MODES



The colour modes are both accessible from the side panel and in the advanced settings panel.



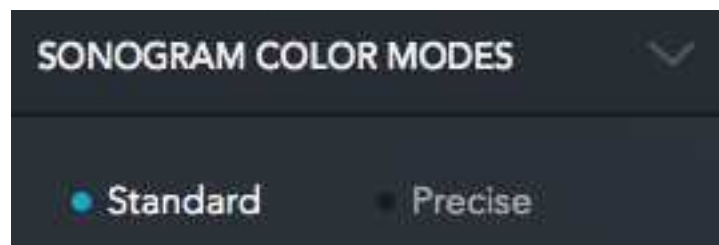
COHERENCY INDEX (CI): the SNAIL mode which indicates both phase coherency and intensity (THIS IS THE DEFAULT MODE).

PHASE TUNER (PT): Shows both the demodulated phase and the intensity

MAGNITUDE (Ma): The colour is a function of the magnitude only (this limits the quantity of information to be processed by the human eye).

PHASE (Ph) : Shows the raw phase of the input sound.

d. SONOGRAM COLOUR MODES



STANDARD : Shows the normal information of the spectrum

PRECISE : Shows a detailed spectrum with the non-stationary informations of the signal removed so it acts as a precise harmonic analyser.

4. The PRIMARY View (see picture)

The Primary view (B) is the main view, You can configure it from the Settings Panel to display either the SNAIL, SONOGRAM or the TUNER VIEW

5. The SECONDARY View (see picture)

The Secondary view (C) is the optional view, placed below the Primary View, You can configure it from the Settings Panel to display the SONOGRAM (Horizontal mode), or the TUNER view.

Double-clicking on this view will make it disappear and show only the primary view.

6. The Audio File Player



The audio file player (E) is a simple player which allows you to load and seek in an audio file. WAV, AIF, MP3, AAC formats are supported.

You can PLAY, PAUSE and LOOP the current audio file.

A simple rectified waveform amplitude is displayed.

Click on the waveform to jump to the specific region to cue.



TUNING WITH THE SNAIL

USE THE SNAIL TO TUNE INSTRUMENTS

1. Setup
2. Temperament
3. Configuration
4. Select The Target Note
5. Using The Phase Demodulation Indicator

1. Setup the Tuner Mode

The Snail Analyser can be used to tune instruments. Two modes are available in the settings panel to setup the precision of the analysis. For the tuning, we need to activate the Tuner mode in the Settings Panel. To activate it, open the Settings Panel and click on the Tuner Mode icon on the top of the panel.



2. Temperament

The Snail shows the note on an **equal tempered scale**.

for more information you can read the Wikipedia page about the temperament :

https://en.wikipedia.org/wiki/Musical_temperament

https://en.wikipedia.org/wiki/Equal_temperament



Most Western instruments are tuned to this temperament of scale, but some are not. So you should be aware of this if the temperament of your instrument you are using is not equal tempered when you use with the snail.

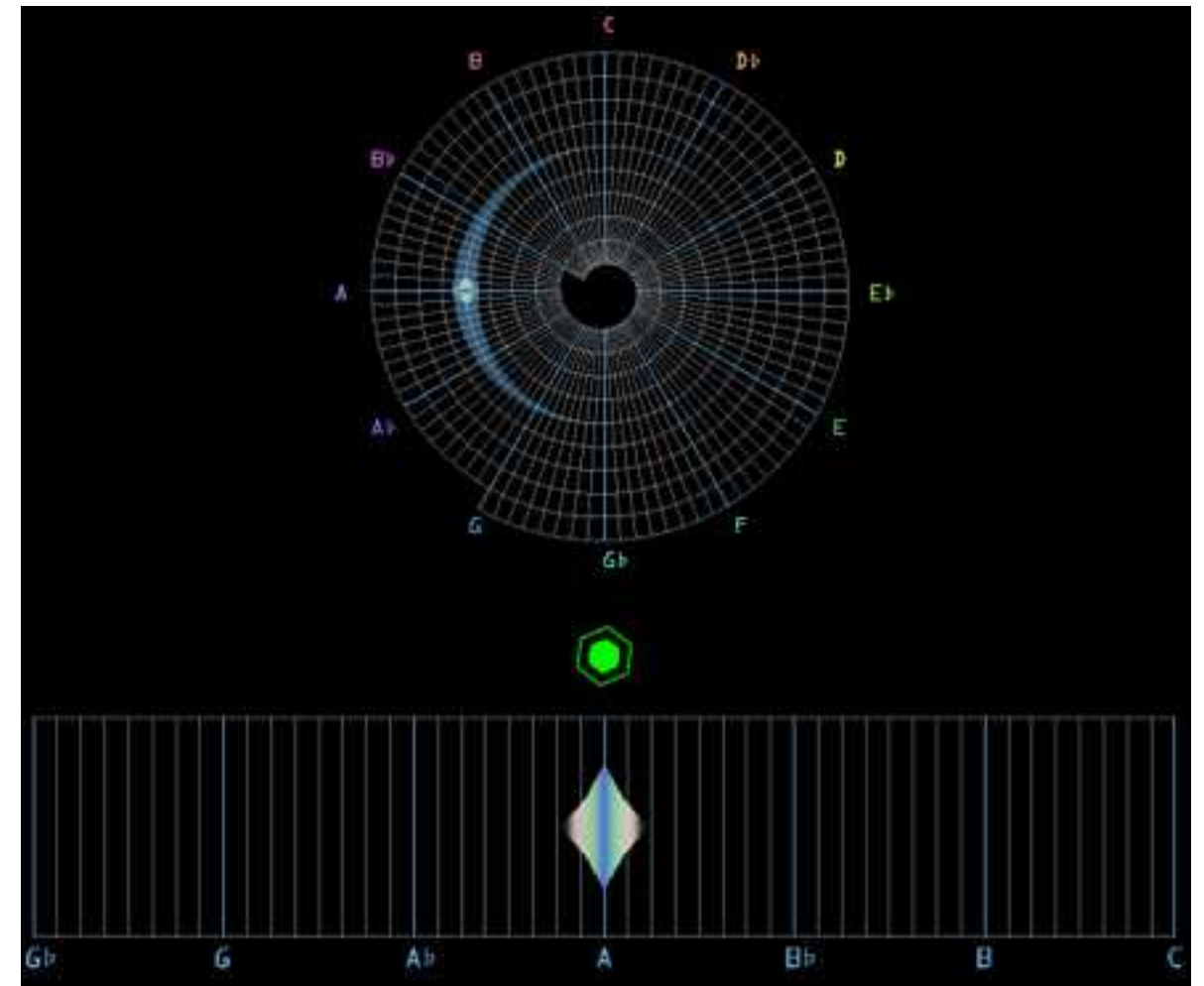
3. Configuration

If you are not using the SNAIL view, then you can click on the SNAIL icon to make it appear, or on the small button on the left of both the snail view and the tuner view, which will light and activate both views.



4. Select The Target Note

DOUBLE CLICK on the Snail and *DRAG* your mouse to select the target note. It will make it appear in the center of the TUNER view just below the SNAIL (see image on the right).



From there you can play and adjust the note on your instrument with the help of the hexagonal shape above the TUNER VIEW rectangular grid.

5. Using The Phase Demodulation Indicator

The TUNE VIEW shows a rectified grid with a **rotating hexagonal shape** on top of the target note.



This shape indicates the phase constancy and phase demodulation :

- Phase demodulation drives the rotation : the faster it rotates, the further the signal is from the target of being absolutely in tune.
- Phase constancy drives the colour of the shape as well. The rotating hexagon shape will become green as the sound starts to come close to the target note.

These two indicators gives you information in a way that no other tuner or analyser can. It is very sensitive to least variation in the tuning, very precise, you may even find it too precise for some applications, but in the end, once you get used to this precision, you will begin to see how sound reacts in terms of amplitude, pitch and stability to form music !

To Tune your sound correctly, you just have to play a SIMPLE GAME with only 2 RULES :

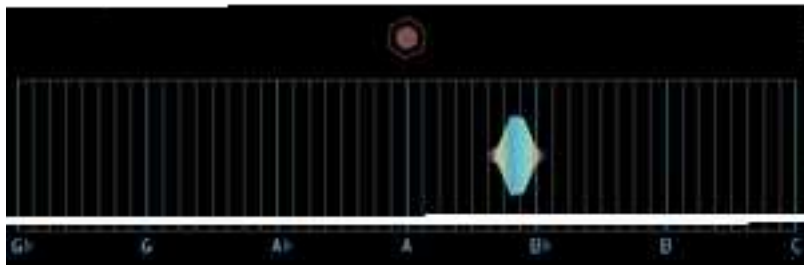
- 1 - Tune your sound frequency to be on the right spot at the center of the target note (GREEN COLOUR)
- 2 - Watch the **rotating hexagonal shape** and SLOW IT DOWN as much as possible to fine tune it, trying to make it as stationary as possible !

The images on the left shows the different colour states of the hexagon when you're getting close to the **right spot** !

Note : For a synthesizer's oscillator with no pitch modulation, fine tuning it mean that you can completely stop the rotation of the shape. (Try for example to feed the Snail Analyser with a pure sinusoid at 440Hz for example to see what happens).

For string instruments like a guitar, it is not possible to stop completely the rotation as the strings moves and its pitch changes quite a lot from stroke phase to release phase, so - for string instruments -try to slow down the rotation as much as possible when the note reaches its climax.

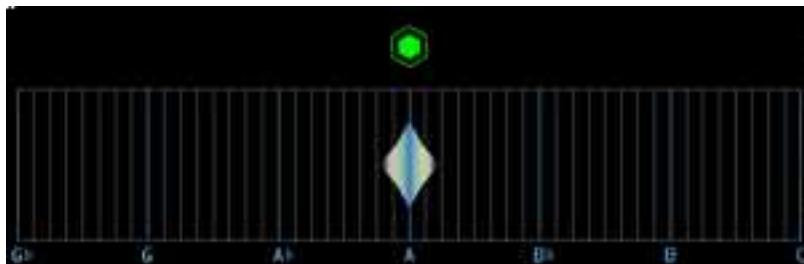




FAR : the hexagon is RED and will have a fast rotation



CLOSE : the hexagon is close to ORANGE and starts to slow down.



ON SPOT : the hexagon is really close. Its colour is now GREEN and its rotation is slow. Move the shape as close as possible to the center to slow down completely the rotation (if possible).

