SPEC-OPS SPEC OPS DEMO

BULLSEYE AUDIO SPEC-OPS Spec Ops Demo User Manual

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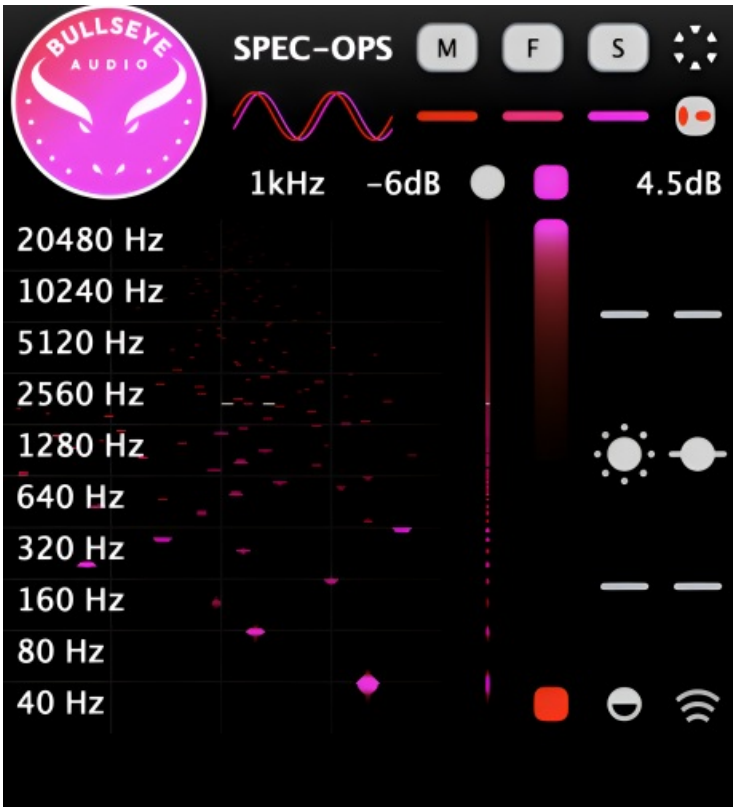
BULLSEYE AUDIO SPEC-OPS Spec Ops Demo



Specifications

- Plugin Formats: VST3, AU and AAX
- Operating Systems: MacOS and Windows
- Free Trial Period: 14 days

Product Usage Instructions

Installation

1. Open the installer, select your file types, and click continue.
2. Click install, and the installer will complete the installation process.
3. After installation, perform a new plugin scan if required by your DAW.

Activation

1. Open the SPEC-OPS plugin.
2. Click on the button labeled Demo or Enter License.
3. Enter your email and/or license key to start using SPEC-OPS.

Usage Overview

SPEC-OPS is an audio analyzer that visually represents sound frequencies. It uses a Short-Time Fourier Transform (STFT) algorithm optimized for performance and efficiency. Here are some key features:

- Nuttall Window Preprocessing
- Individual Left and Right Channel STFT

- Window length: 8192 samples
- Multithreaded processing
- High-precision peak detection

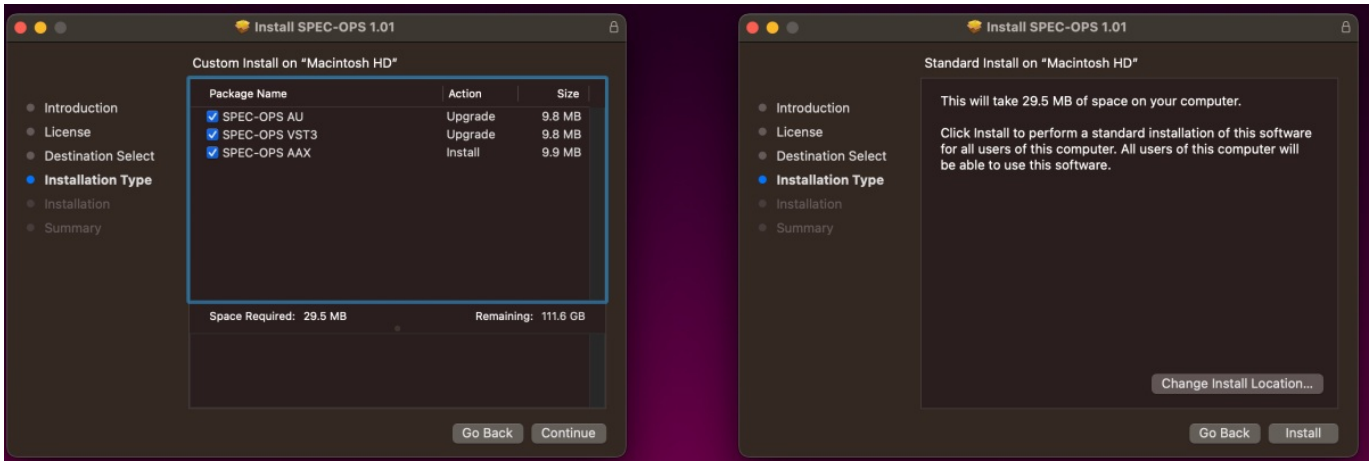
X-Axis Display

SPEC-OPS displays frequency bins along the x-axis based on their location on the lateral plane. It calculates the x-axis location using differences in amplitude and phase characteristics of left and right channels. The plugin aims to simulate natural auditory perceptions by reverse-engineering these processes.

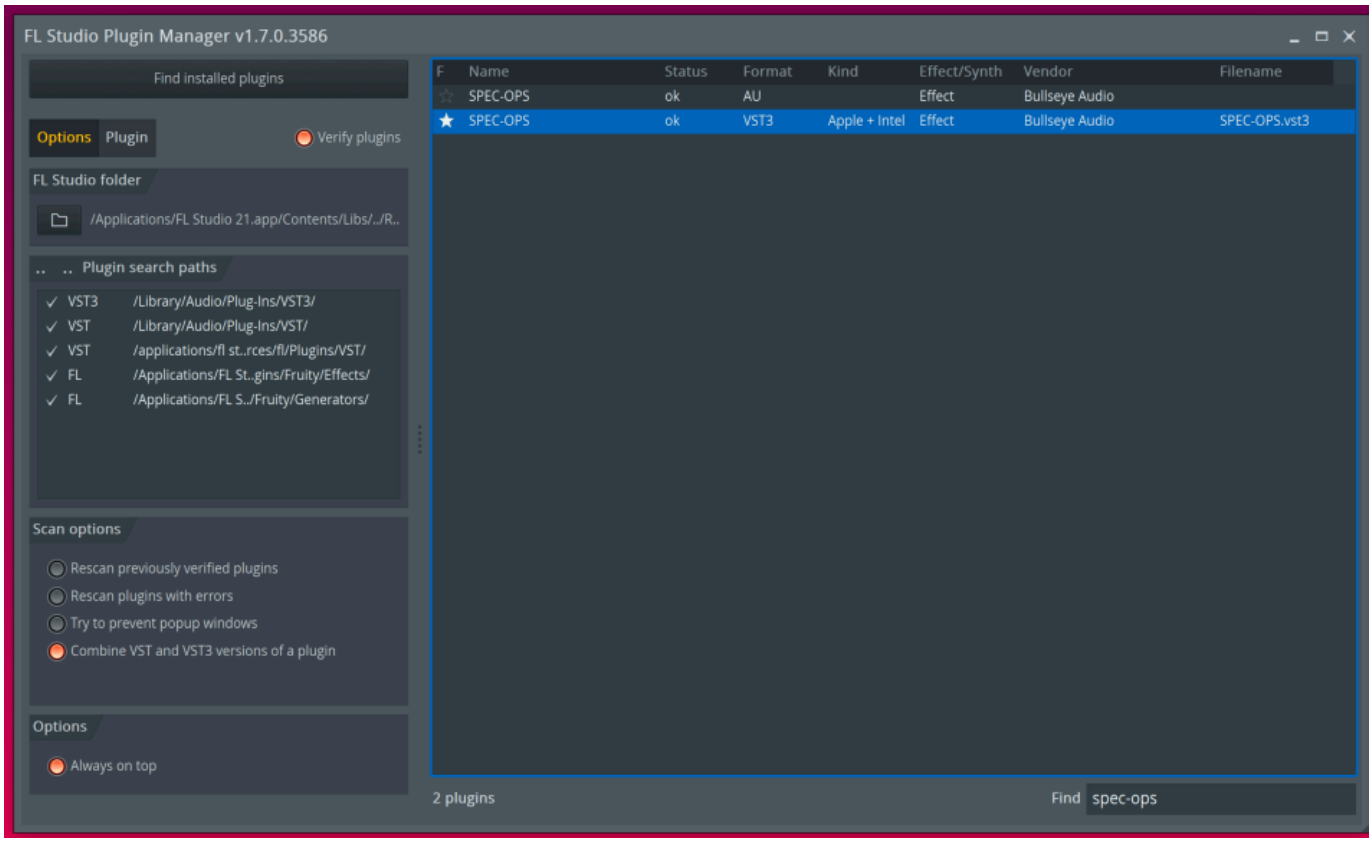
Installation

Open the installer, select your file types, and click continue

Then click install, and our installer will do the rest

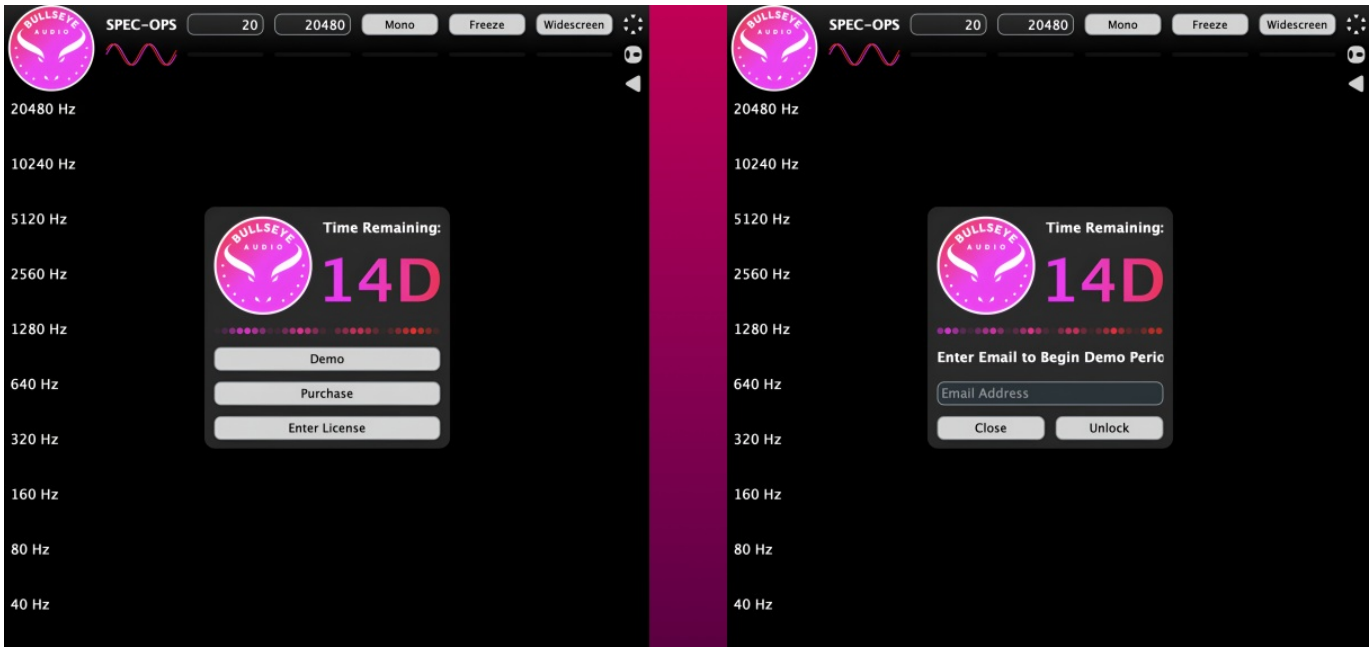


After installation, run a new plugin scan if your DAW requires it



Open your plugin and click the button labeled “Demo” or “Enter License”

Then simply enter your email and or license key to begin using SPEC-OPS



System Requirements

Plugin Formats: VST3, AU and AAX

Operating Systems: MacOS and Windows

Note: All Bullseye Audio Software has a 14 day fully functional free trial period

Overview

SPEC-OPS is an audio analyzer that displays sound visually as you perceive it sonically. Every frequency that is audible to you will appear within the spectrogram window with its coordinates corresponding to the frequency's pitch on the y-axis and the stereo field location on the x-axis. The colors and width of each frequency represent its overall loudness.
SPEC-OPS is powered by a custom-designed Short-Time Fourier Transform (STFT) algorithm which has been heavily optimized for CPU performance and time efficiency.

Understanding our STFT Implementation

- Nuttall Window Preprocessing
- Individual Left and Right Channel STFT
- Window length: 8192 samples
- Multithreaded
- Advanced Interpolation Technique for Inter-Frequency Bin Analysis
- High precision peak detection ~ Optimized Lanczos interpolation

Visual Translation

- Perceptually Relevant Frequency Bin Representation
- Based on psychoacoustic principles such as auditory masking and binaural localization
- Adjustable slope weighting and input volume
- Customizable color, transparency, and width
- Dynamically Adjustable Minimum and Maximum Frequency Bounds
- Designed for High FPS Display Updates
- Fully Resizable Window
- Note: For high FPS, reduce the buffer size in your DAW. A buffer size of 512 samples is recommended for optimal performance.

X-Axis

- SPEC-OPS displays each frequency bin from a given point along the x-axis, corresponding to its perceptual location on the lateral plane. The calculation for determining the x-axis location primarily depends on differences in the amplitude and phase characteristics of the left and right channels of the frequency bin being displayed.
- The human auditory system is exceptionally skilled at locating and distinguishing multiple frequencies simultaneously from left to right. Human hearing leverages consistent, naturally occurring auditory patterns to achieve this. In an effort to accurately simulate our natural perceptions, SPEC-OPS reverse-engineers the basic processes that make them possible.
- STFT calculations are performed for both the left and right channels, and each bin is then compared against the same bin in the opposite channel. For each bin, two ratios are calculated: one representing the difference in amplitude and the other representing the phase difference of the left and right channels.
- Below approximately 1280Hz, the human auditory system weighs the perceptual impact of amplitude and phase differences equally. In an effort to align with our perceptions, SPEC-OPS takes an average of the amplitude and phase difference ratios and maps them to the corresponding position on the x-axis.

- As the wavelengths of frequencies above 1280Hz become shorter, they turn into less reliable indicators of spatial positioning. In an effort to align with our perceptions, SPEC-OPS gives relatively more weight to the amplitude difference ratio than the phase difference ratio up to 2560Hz. Above this frequency, only the amplitude difference ratio is considered.
- Note: SPEC-OPS has both Headphone and Speaker Modes. Headphone Mode processes the raw audio input, while Speaker Mode applies a crossfeed algorithm (the same algorithm featured in Neptune and Crossfire) to simulate the perceptual effects of listening through speakers. These differences, which occur primarily in the low frequencies, can be significant.
- SPEC-OPS displays frequencies within the range of 20Hz to 20480Hz from the bottom to the top of the display. The minimum and maximum frequency can be dynamically adjusted by mouse wheel scrolling, clicking and dragging within the display, or manually adjusting the Minimum and/or Maximum Frequency Textboxes on the top bar above the spectrogram window.
- The human auditory system is exceptionally skilled at resolving frequency pitch and distinguishing multiple frequencies simultaneously. It achieves this with an approximate frequency resolution of about 0.25%. Given the audible range as defined by SPEC-OPS of 20Hz to 20480Hz, this resolution allows us to identify approximately 2775 distinct logarithmically spaced frequencies.
- In an effort to maximize the resolution of the display (which has limited pixel resolution), SPEC-OPS assigns each frequency bin to an individual pixel and then displays the loudest frequency that is assigned to that pixel. This closely mirrors the psychoacoustic phenomenon known as frequency masking.
- STFT calculations are performed with linearly spaced frequency bins. In order to achieve proper perceptual alignment, we must use an interpolation method at lower frequencies where there are fewer unique frequency bins per pixel available. Processing with 8192 bins allows us enough low frequency resolution to sufficiently interpolate.
- SPEC-OPS is fully resizable, ranging from a minimum size of 300×300 pixels to a maximum of 6000×6000 pixels. The raw frequency resolution is directly tied to the number of Y-Axis pixels dedicated to the spectrogram window. The more Y-Axis pixels SPEC-OPS has to work with, the more frequency bins can be represented by their own dedicated pixel.
- Note: Although the processing has been highly optimized, resizing to a smaller Y-Axis reduces the processing load, as there are fewer calculations and less drawing required.

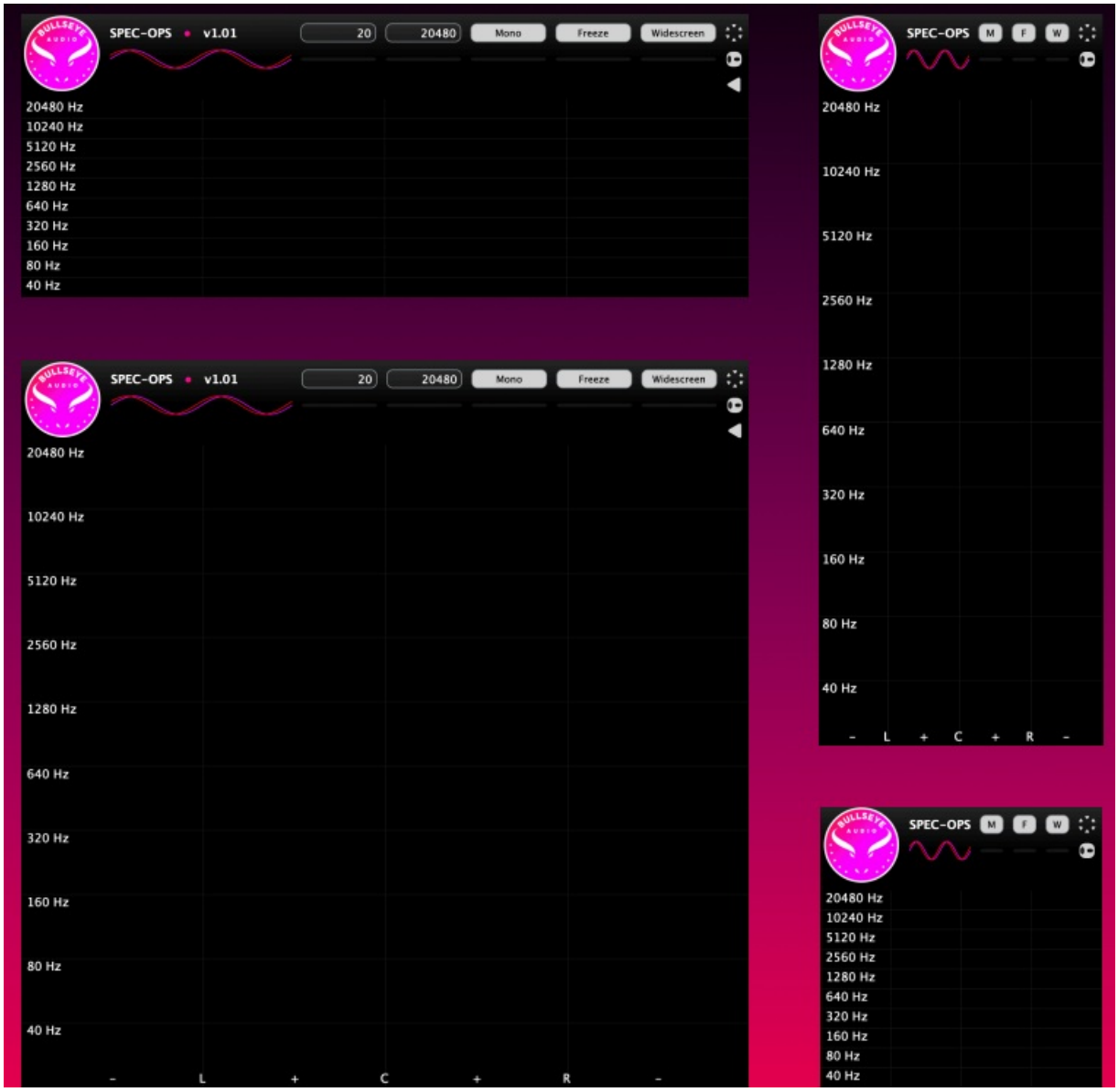
Z-Axis

- SPEC-OPS displays each frequency bin at a given color, transparency, and width dependent on its perceptual loudness. All three of these values can be refined and tailored to the user's preferences.
- The human auditory system is adept at perceiving the amplitude at individual frequencies. SPEC-OPS displays frequency loudness analogously to our perceptions. Relatively loud frequencies appear large and bright, while relatively quiet frequencies appear small and fade into the background.
- STFT calculations are performed for both the left and right channels and summed to determine the combined amplitude at each frequency bin. The amplitude value is then weighted by the frequency-dependent slope weight of the spectrogram (defined by the Slope Weight Slider in the Sidebar).
- The color of each frequency bin is defined by the primary and secondary colors, the dynamic range, and the brightness factor. The primary color is assigned to frequencies with an amplitude greater than or equal to 0dB, and will gradually blend with the secondary color at amplitudes lower than 0dB. The dynamic range determines the minimum amplitude a frequency bin must have to be displayed on the spectrogram. The brightness factor

determines the transparency value at a given loudness.

- The width of each frequency bin is determined by the Pixel Width Textbox (located in the top bar after clicking the Settings Gear), which defines the width in pixels from its x-axis location at 0dB. The width will extend beyond this value when the amplitude is greater than 0dB.
- Note: The Sliders found in the sidebar along with the Pixel Width Textbox have useful default values, but are meant to be adjusted to account for perceptual differences and/or aesthetic preferences.

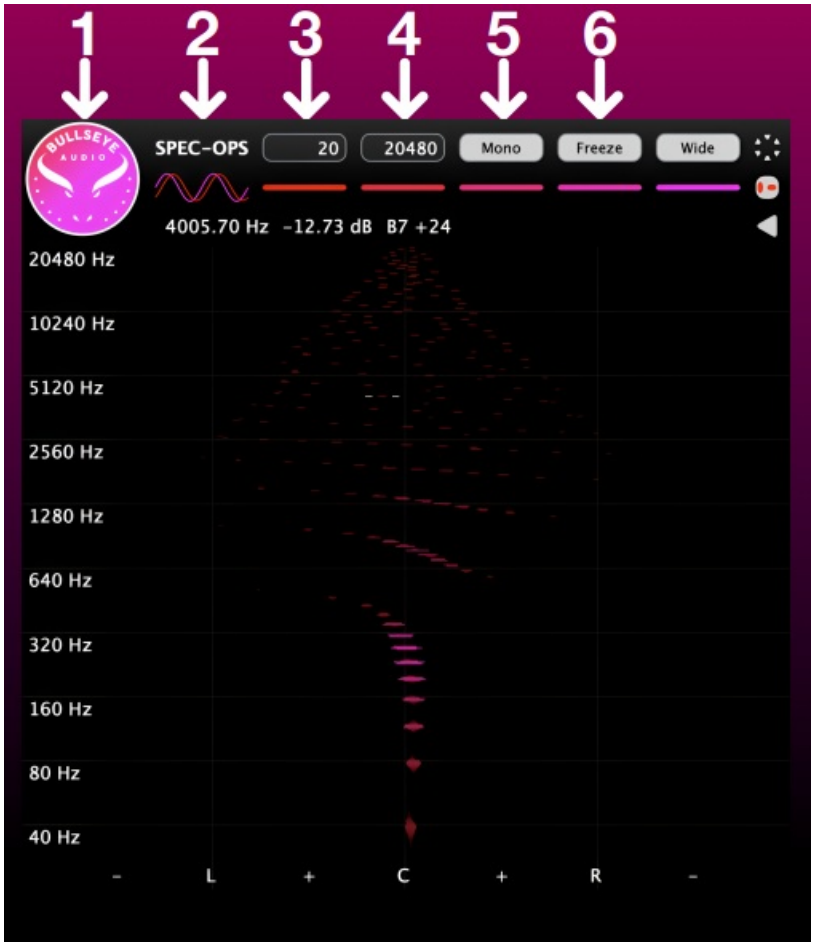
GUI Scaling



Interface Part 1 of 5

1. Bullseye Audio Logo: Clicking this minimizes the top bar for a full screen display
2. SPEC-OPS Logo: Clicking this will open the registration or account window
3. 3 & 4 – Minimum and Maximum Frequency Textboxes: Changing these will change the range of frequencies displayed
4. (note: the smallest interval is 30Hz)

5. Mono Button: Clicking this will display your audio as if the audio input was mono (note: does not alter the audio output)
6. Freeze Button: Clicking this will pause the spectrogram from updating until further user action



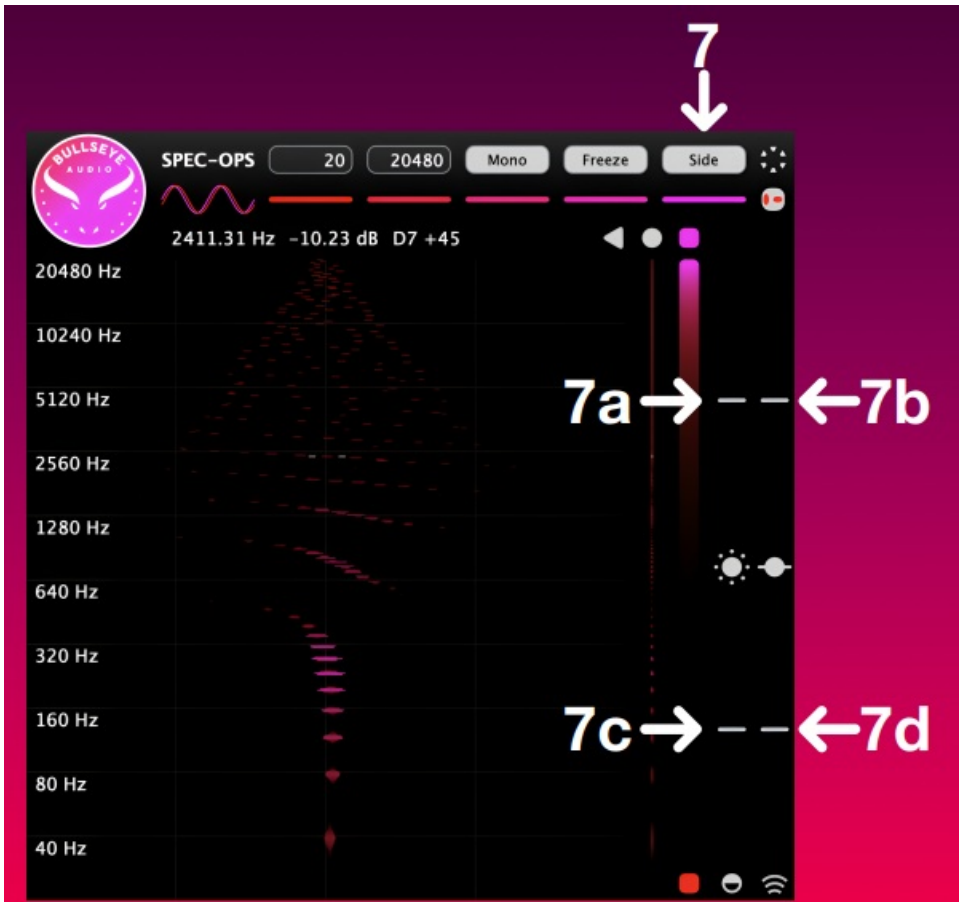
Interface Part 2 of 5

7. Sidebar/Widescreen Button: Clicking this opens and closes the sidebar 7a – Brightness Slider: Controls the brightness of frequencies louder than the dynamic range floor

   7b – Slope Weight Slider: Controls the amplitude weighting from low to high frequencies (note: the default 4.5dB is recommended)

   7c – Dynamic Range Slider: Controls the lowest amplitude to be displayed on the spectrogram

   7d – Volume Slider: Controls the volume of the audio input (note: this does not affect the audio output volume



Interface Part 3 of 5

7e – Primary Color Button: Clicking this opens the color slider for the primary color

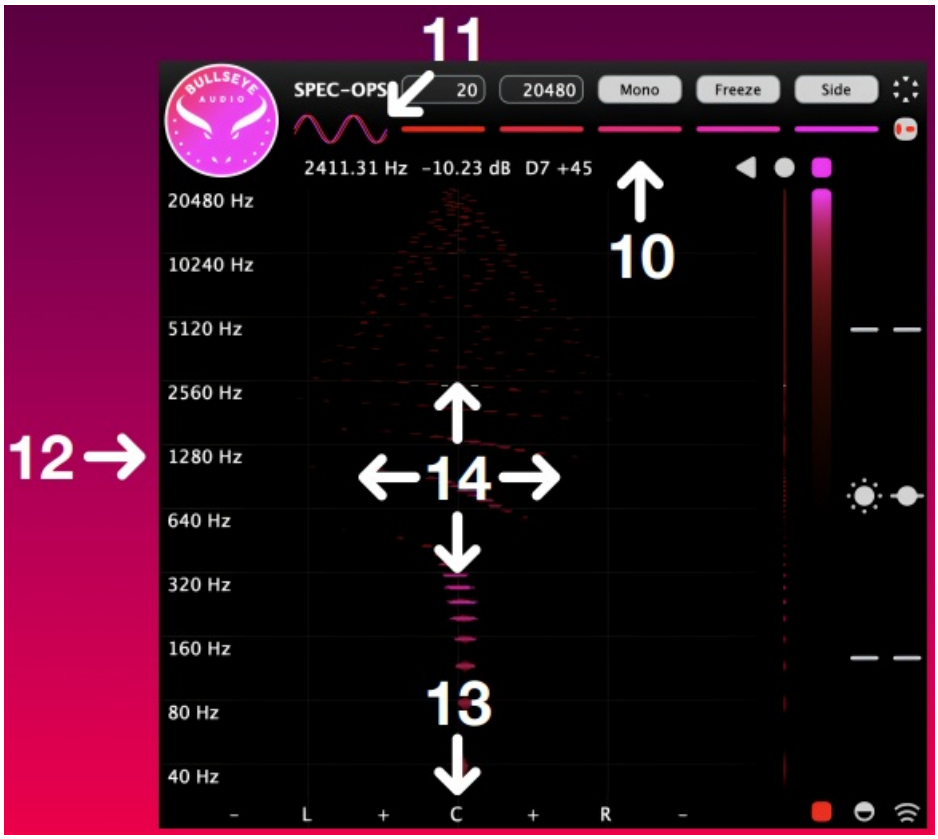
7f – Secondary Color Button: Clicking this opens the color slider for the secondary color

7g – Sidebar Mono Reference: A fixed width mono display bar

8. Frequency Statistics Pointer: Clicking this toggles where the frequency, amplitude and note value of the selected frequency will appear
9. Headphone/Speaker Button: Clicking this will determine how the stereo imaging will be calculated (note: speaker mode applies the same crossfeed from Crossfire and Neptune to the audio input to emulate stereo positioning)

Interface Part 4 of 5

10. Amplitude Bars: Displays the audio input volume with each bar representing 6dB increments from -30dB on the left to 0dB on the right (note: the headphone/speaker button will light up with the secondary color when the audio input is clipping)
11. Stereo Waveform: Displays the amplitude and phase differences of the selected frequency's left and right channel
12. Frequency Labels: Show the upper frequency bound of the grid they exist within (note: toggle the labels by clicking them)
13. LCR Labels: Show the stereo positioning of the grid (note: toggle the labels by clicking them)
14. Grid Lines: Toggle the grid lines by double clicking within the spectrogram



Interface Part 5 of 5

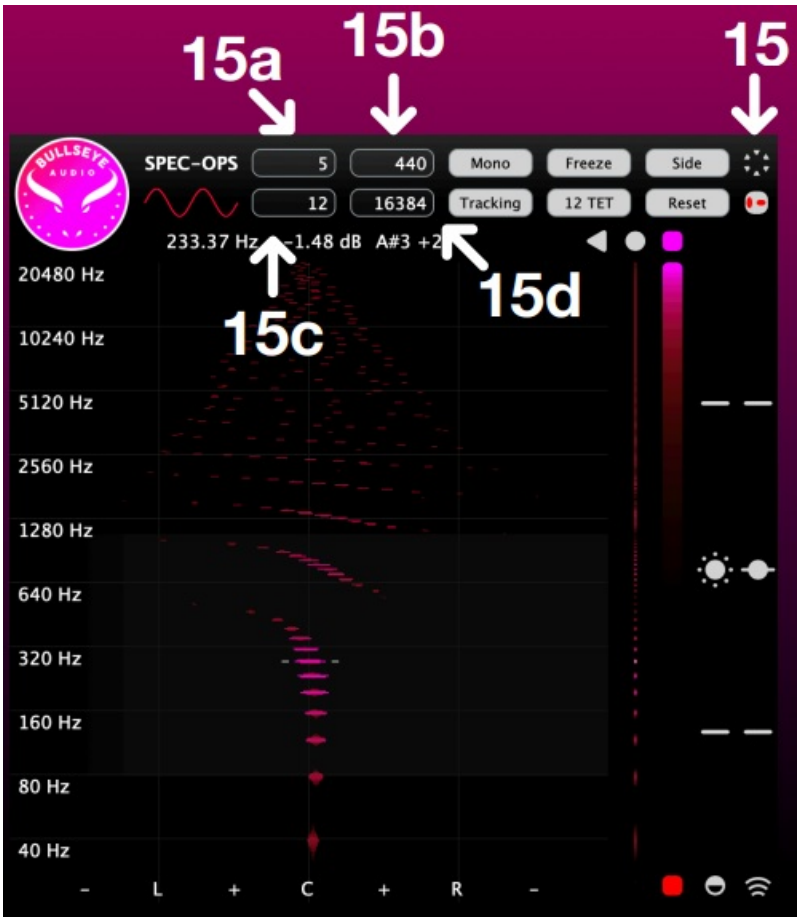
15. Settings Gear Button: Clicking this reveals additional settings

    15a – Buffer Speed Textbox: Changing this will determine how many samples are used for averaging of frequency statistics

    15b – A4 Tuning Textbox: Changing this will alter how the frequency note values are calculated (note: 440Hz is standard)

    15c – Pixel Width Textbox: Changing this will determine the width of a given frequency at 0dB

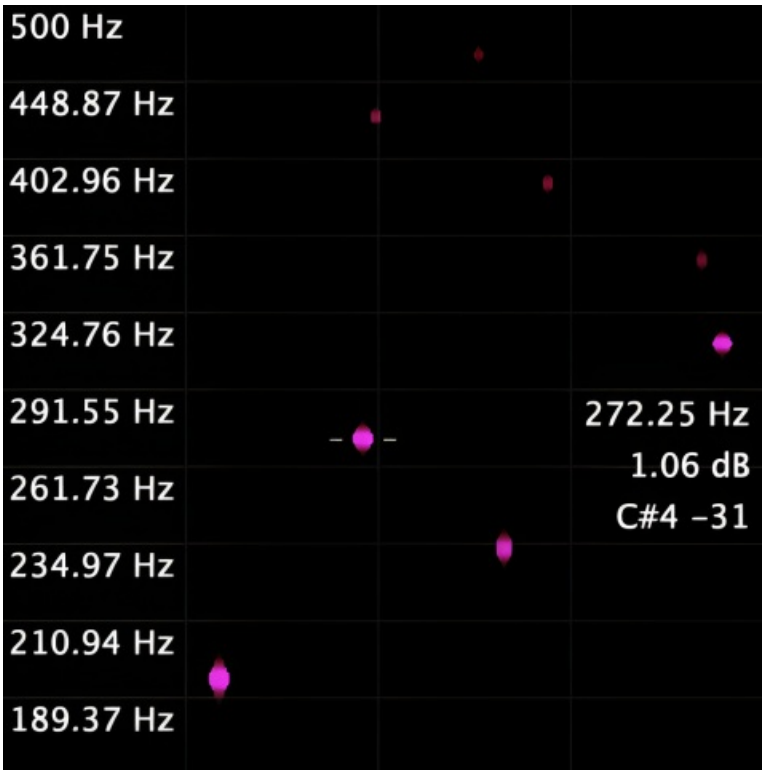
    15d – Latency Alignment: Changing this will set the latency of the plugin in samples (note: some DAWs require additional user action)



Mouse Events

SPEC-OPS is designed to update seamlessly as you make changes. Below is a list of things SPEC-OPS will respond to.

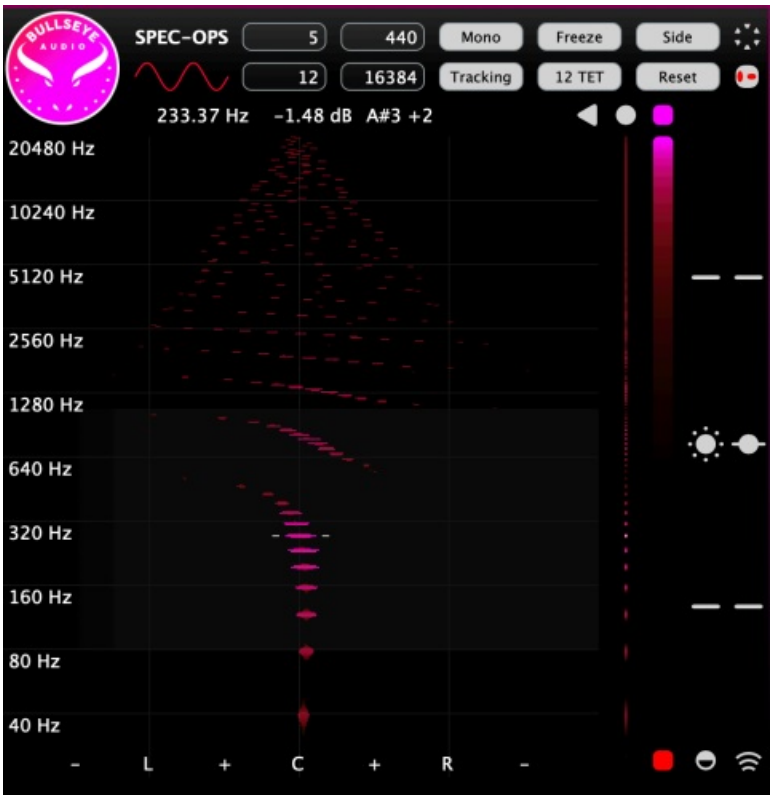
- Clicking inside the spectrogram locks/unlocks the frequency tracker within its defined range
- Clicking and dragging or scrolling inside the spectrogram will dynamically modify the frequency bounds
- Double clicking inside of the spectrogram toggles grid lines
- Clicking towards the left of the spectrogram toggles frequency labels
- Clicking towards the bottom of the spectrogram toggles LCR labels
- Hovering over the current color bar will reveal the amplitude associated with the color you are hovering over



Frequency Tracking

With frequency tracking enabled, SPEC-OPS will scan within a frequency range and identify the frequency with the highest relative amplitude. The frequency, dB and note value associated with that peak are then displayed in realtime.

- Frequency tracking is turned on by default with a range of approximately +/-1 octave from your mouse's y-position
- To toggle frequency tracking, click the settings gear and the tracking button ~ While the tracking button is visible, scrolling inside of the spectrogram window will adjust the tracking range (note: to adjust the minimum and maximum frequency bounds while the tracking range is visible, click and drag inside of the spectrogram or scroll while hovering over the frequency labels) ~ Clicking inside of the spectrogram will lock in the tracking range



FAQ

What are the supported Plugin Formats for SPEC-OPS?

SPEC-OPS supports VST3, AU, and AAX formats.

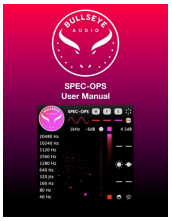
Can SPEC-OPS be used on both MacOS and Windows operating systems?

Yes, SPEC-OPS is compatible with both MacOS and Windows.

Is there a free trial period for SPEC-OPS?

Yes, all Bullseye Audio Software products, including SPEC-OPS, offer a 14-day fully functional free trial period.

Documents / Resources

	BULLSEYE AUDIO SPEC-OPS Spec Ops Demo [pdf] User Manual SPEC-OPS Spec Ops Demo, SPEC-OPS, Spec Ops Demo, Ops Demo, Demo

References

- User Manual