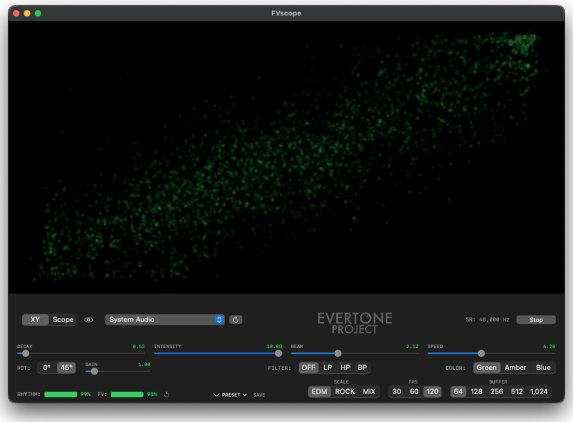
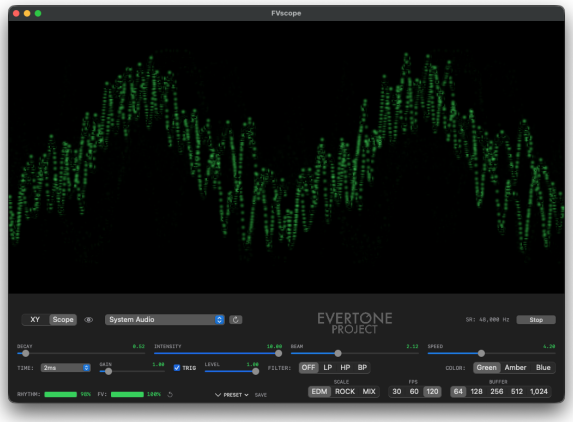
FVscope

User Manual

Analog CRT Oscilloscope Simulator
Force Voltage Visualization Tool



XY Mode



Scope Mode

EVERTONE PROJECT

EVERTONE PROJECT

Version 1.3.0

What FVscope Reveals

Seeing the "Force That Moves a Speaker"

When music plays, the cone (diaphragm) inside a speaker moves back and forth to push air, creating sound. The way the cone is driven, however, varies dramatically between signals.

A signal that **pushes firmly against the cone** delivers force continuously, accelerating the cone with vigor. In contrast, a signal that **taps from a distance** delivers force only momentarily, resulting in gentler cone movement. Even at the same volume, this difference in how force is transmitted determines the **"punch" and "presence"** of the sound coming from the speaker.

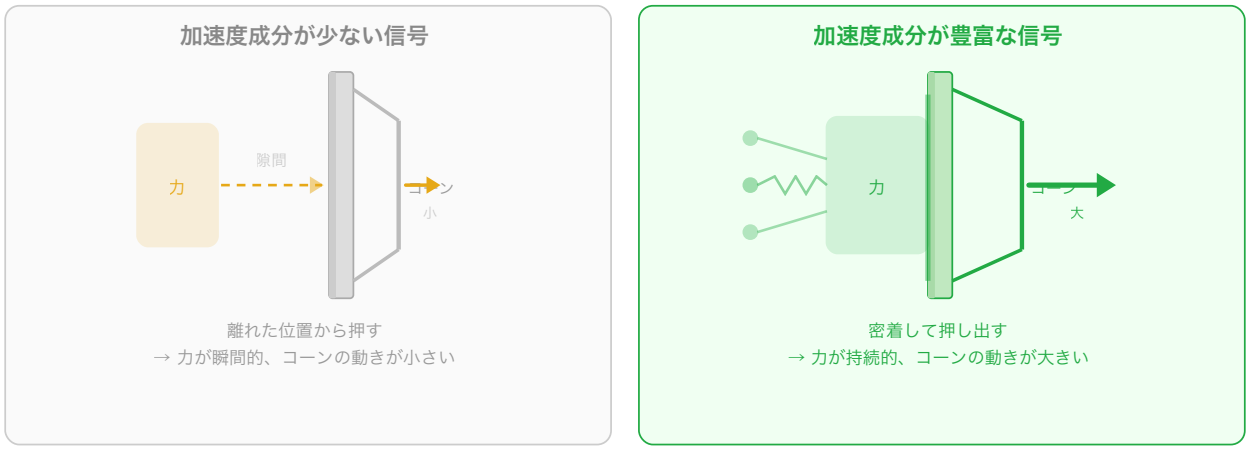
FVscope quantifies and displays this "pushing force" -- the **acceleration component** contained in the signal.

Values Invisible to Conventional Meters

RMS, peak, LUFS, and crest factor -- the meters widely used in music production -- measure the "size" or "loudness" of a signal. However, **how vigorously** the signal moves a speaker cone -- the acceleration component -- cannot be read from these values.

FV (Force Voltage) is a proprietary metric defined by FVscope. It evaluates signals from a perspective that has not been defined by conventional meters. Even among tracks at the same loudness, FV values can differ significantly.

What Happens at the Speaker



The left diagram shows force delivered momentarily, as if tapping from a distance. The force duration is short, and cone movement becomes uniform. The right diagram shows force delivered continuously, as if pressing firmly against the cone. Sharp rises and deep valleys emerge, and this "acceleration momentum" is quantified as FV.

When a reference track shows a high FV meter reading, that signal contains rich acceleration components, and powerful reproduction from the speaker can be expected. This is one of the factors behind the "clarity" and "impact beyond mere loudness" felt in professional mastering.

Is a Low Value Bad?

No, not necessarily.

A low FV value may be the result of intentionally controlling dynamics with limiters or compressors. EDM sidechain compression, smooth ambient pads, delicate film score strings -- the appropriate dynamics vary by genre and artistic intent.

FVscope is not a tool that judges "good or bad." It is a **monitoring tool that objectively visualizes signal characteristics**. In addition to "listening through speakers and judging by ear," it provides a new perspective: "objectively monitoring at the signal stage."

What is FVscope

FVscope is a macOS application that recreates the XY mode of an analog CRT oscilloscope in software.

It visually displays the acceleration components in audio signals and the components related to Newton force generation at the speaker (Force Voltage) as evaluation values.

System Requirements

- macOS 12.3 or later (system audio capture requires macOS 13.0 or later)
- Apple Silicon or Intel Mac
- Virtual audio device (for DAW integration)

Installation

1. Open `FVscope-1.3.0-macOS.dmg`
2. Drag `FVscope.app` to the `Applications` folder
3. On first launch, grant permission when prompted for system audio capture

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Audio Setup

Analyzing System Audio Directly (macOS 13.0+)

On macOS 13.0 or later, no special setup is required. FVscope uses ScreenCaptureKit to capture system audio directly. It can analyze playback from any application -- Spotify, Apple Music, web browsers, and more.

Grant permission for system audio capture when prompted on first launch.

macOS 12.3-12.x / Analyzing DAW Output

On macOS 12.x, system audio capture is not directly supported, so audio must be routed through a virtual audio device. Even on macOS 13.0+, the same setup is needed if you want to analyze DAW output directly.

What is a virtual audio device: A software "invisible cable" that routes audio output from one application directly to another application's input.

Setup (using BlackHole):

1. Install BlackHole 2ch (`brew install --cask blackhole-2ch`)
2. In macOS "Audio MIDI Setup," create a "Multi-Output Device"
3. Add BlackHole 2ch + your speakers (or headphones)
4. Set your system output (or DAW output) to the "Multi-Output Device"
5. In FVscope, select "BlackHole 2ch" as the input device

This allows you to listen through speakers while simultaneously analyzing with FVscope.

Other methods:

- **Loopback** (Rogue Amoeba) -- Commercial software with an intuitive GUI for routing
- **Pro Tools AUX output** -- Some versions allow selecting AUX output as a virtual device, routing directly from Pro Tools to FVscope without BlackHole
- **Audio interface physical loopback** -- Connect an output jack to an input jack with a cable. No additional software required

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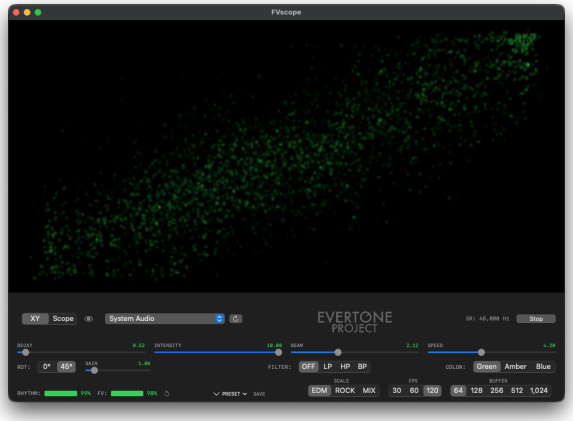
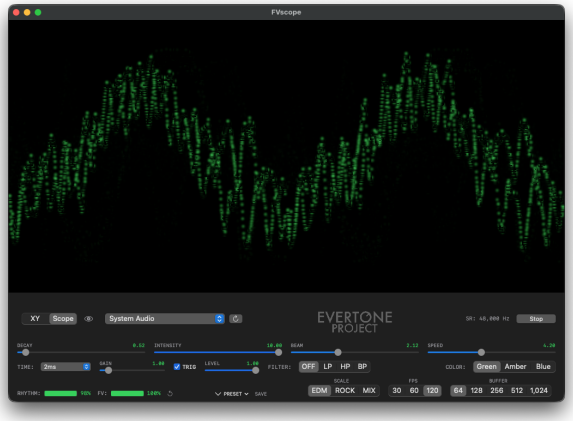
Screen Layout



XY Mode — Lissajous Display



Scope Mode — Waveform Display

Scope Display (Upper Area)

The area where audio signals are drawn in real time. It simulates the behavior of phosphor on an analog oscilloscope.

- **Bright beam areas** = Slow signal change (low velocity)
- **Dim beam areas** = Fast signal change (high velocity)

This brightness characteristic allows you to intuitively see the acceleration components in the signal.

Control Panel (Lower Area)

Contains various parameters and meters.

Control Details

Display Mode (Row 1)

Control	Description
XY / Scope	Display mode switch. XY = Lissajous display, Scope = Waveform display
Eye icon	Scope display ON/OFF. Analysis continues even when OFF
Source	Input device selection
SR	Current sample rate display
Start / Stop	Start/stop audio capture

Phosphor Parameters (Row 2)

Parameter	Description	Recommended Range
DECAY	Phosphor afterglow duration. Higher values retain trails longer	0.85-0.95
INTENSITY	Beam brightness	3.0-8.0
BEAM	Beam width	1.5-3.5
SPEED	Brightness sensitivity to velocity. Higher values increase contrast	3.0-8.0

Mode-Specific Controls (Row 3)

XY Mode:

Control	Description
ROT	XY display rotation. 0 deg = standard, 45 deg = L/R rotated 45 deg (mono content appears at 45 deg)
GAIN	XY signal magnification. Useful for enlarging display when source is quiet

Scope Mode:

Control	Description
TIME	Time base (display time per screen)
GAIN	Vertical waveform magnification
TRIG	Trigger (synchronized waveform display) ON/OFF
LEVEL	Trigger level setting

Common:

Control	Description
FILTER	Display frequency filter (OFF / LP / HP / BP). Does not affect RHYTHM or FV analysis
Frequency	Filter cutoff frequency (shown when FILTER is not OFF)
COLOR	Beam color (Green / Amber / Blue)

About FILTER

The display filter is a Biquad filter applied only to the waveform drawn on the scope. RHYTHM and FV analysis always uses the full-band signal, so turning the filter ON/OFF does not change analysis values.

Type	Description
OFF	No filter (full bandwidth displayed)
LP	Low-pass -- displays only frequencies below the cutoff
HP	High-pass -- displays only frequencies above the cutoff
BP	Band-pass -- displays only frequencies around the cutoff

Available frequencies: 20, 30, 40, 50, 60, 100, 200, 300, 500, 800, 1k, 2k, 3k, 5k, 8k, 12k, 16k, 20kHz

Filter presets (Sub Bass, Bass, Low-Mid, Hi-Mid, Treble, Air) are also available from the "FILTER" submenu in the PRESET menu.

Meters & Performance (Row 4)

Item	Description
RHYTHM	Meter evaluating rhythmic periodicity of the signal
FV	Force Voltage -- meter evaluating acceleration components in the signal
Reset button	Instantly resets RHYTHM and FV meter values
PRESET	Preset menu (see below)
SAVE	Save current settings as a preset
SCALE	FV meter display scale (EDM / ROCK / MIX)
FPS	Rendering frame rate (30 / 60 / 120)
BUFFER	Audio buffer size (64-1024)

Presets

All FVscope settings (display mode, phosphor settings, filter settings, SCALE, FPS, BUFFER, etc.) can be saved and recalled as named presets.

Saving

1. Adjust parameters to your preference
2. Click the **SAVE** button
3. Enter a preset name and click "Save"

Recalling

Click a saved preset name in the **PRESET** menu to instantly restore all settings.

DEFAULT

Select "DEFAULT" from the **PRESET** menu to reset all parameters to factory settings.

FILTER Presets

The "FILTER" submenu within the **PRESET** menu lets you quickly apply display filter settings. Filter presets change only the filter settings, leaving all other parameters unchanged.

Preset Name	Filter	Purpose
Sub Bass (< 100Hz)	LP 100Hz	Observe sub-bass range
Bass (< 300Hz)	LP 300Hz	Observe bass range
Low-Mid (< 1kHz)	LP 1kHz	Observe low-mid range
Hi-Mid (> 1kHz)	HP 1kHz	Observe upper-mid range
Treble (> 5kHz)	HP 5kHz	Observe treble range
Air (> 12kHz)	HP 12kHz	Observe ultra-high range

Deleting

Select "Delete..." in the **PRESET** menu to remove unwanted presets.

Auto-Save

Settings are automatically saved and restored on the next launch.

Reading the Meters

RHYTHM Meter

Evaluates the periodicity of the input signal's envelope curve (BPM alignment, etc.).

Color	Range	Meaning
Red	0-39%	Low periodicity
Yellow	40-69%	Periodicity detected
Green	70-99%	Clear rhythmic pattern detected

FV Meter

Evaluates the amount of acceleration components in the audio signal and the components related to Newton force generation at the speaker (Force Voltage). It indicates the force that drives a speaker, based on transients, envelope curves, and the dynamics of the recording.

FV is a proprietary metric that cannot be derived from existing audio metrics such as RMS, peak, LUFS, or crest factor. While existing metrics measure signal amplitude and loudness, FV captures the acceleration characteristics of the signal. No meter or numerical definition for this perspective previously existed -- FV is a unique unit defined by FVscope. It allows you to "objectively monitor at the signal stage" the way a speaker will respond, separate from "listening through monitor speakers and judging by ear."

Color	Range	Meaning
Red	0-40%	Low acceleration content (heavy limiting, compressed dynamics)
Yellow	41-64%	Acceleration content detected (some dynamics preserved)
Green	65-99%	Rich acceleration content (clear transients, expressive signal)

Reading Tips

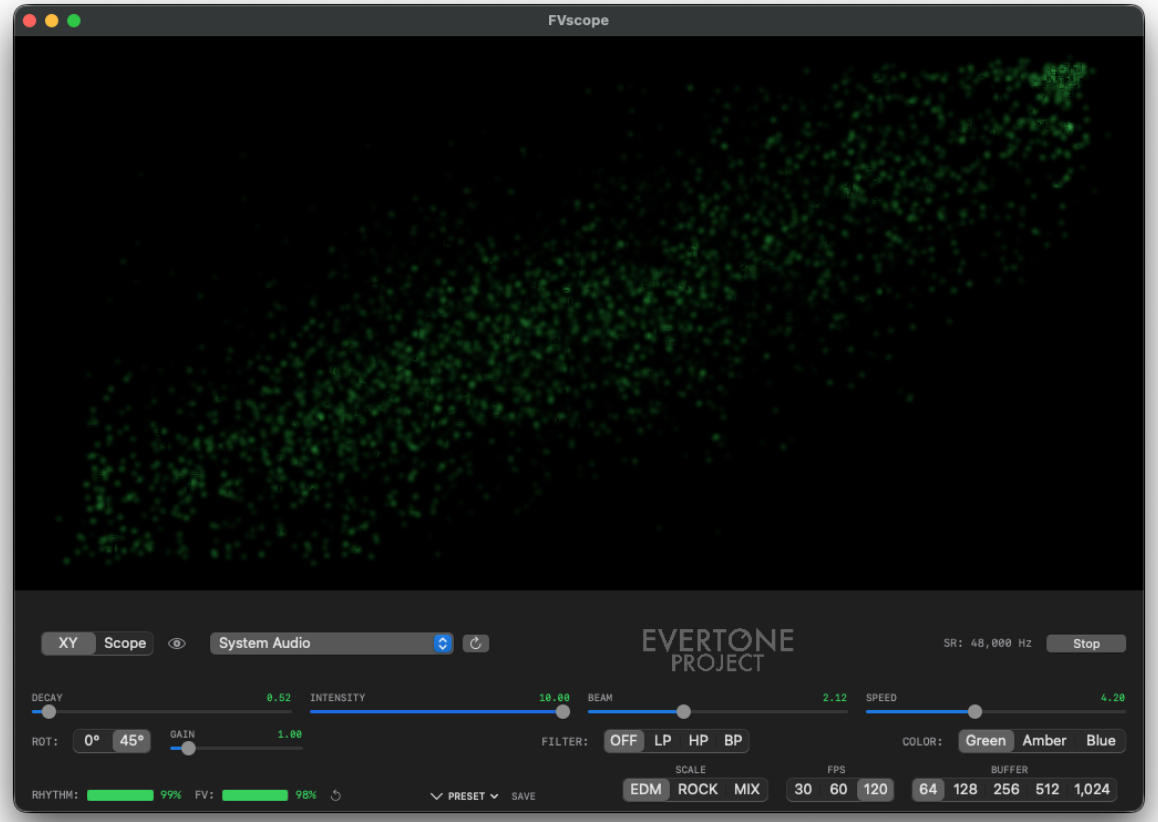
The RHYTHM and FV meters continuously analyze the last few seconds of signal and display smoothed values. They do not reflect instantaneous values directly. For comparisons, play back for at least 10 seconds and use the displayed percentage as a guide. When switching tracks or comparing different sources, press the reset button next to the FV meter to clear values before starting playback for more accurate comparison.

SCALE Selection

Switches the FV meter display scale to match the music genre.

- **EDM**: For electronic dance music. Displays raw values as-is
- **ROCK**: For rock and pop music. Expands mid-range display for genre-appropriate evaluation
- **MIX**: For individual instrument checking. Adds envelope shape analysis for individual track and solo instrument FV evaluation

Understanding XY Mode



In XY mode, the left channel (L) is mapped to the X axis and the right channel (R) to the Y axis.

Typical Patterns

- **Circle / Ellipse**: Stereo signal. Rotation direction and shape indicate phase relationship
- **Diagonal line (45 deg)**: Mono signal (L = R)
- **Complex figures**: Signal containing rich stereo information
- **Bright points or lines**: Slow beam areas (small signal change)

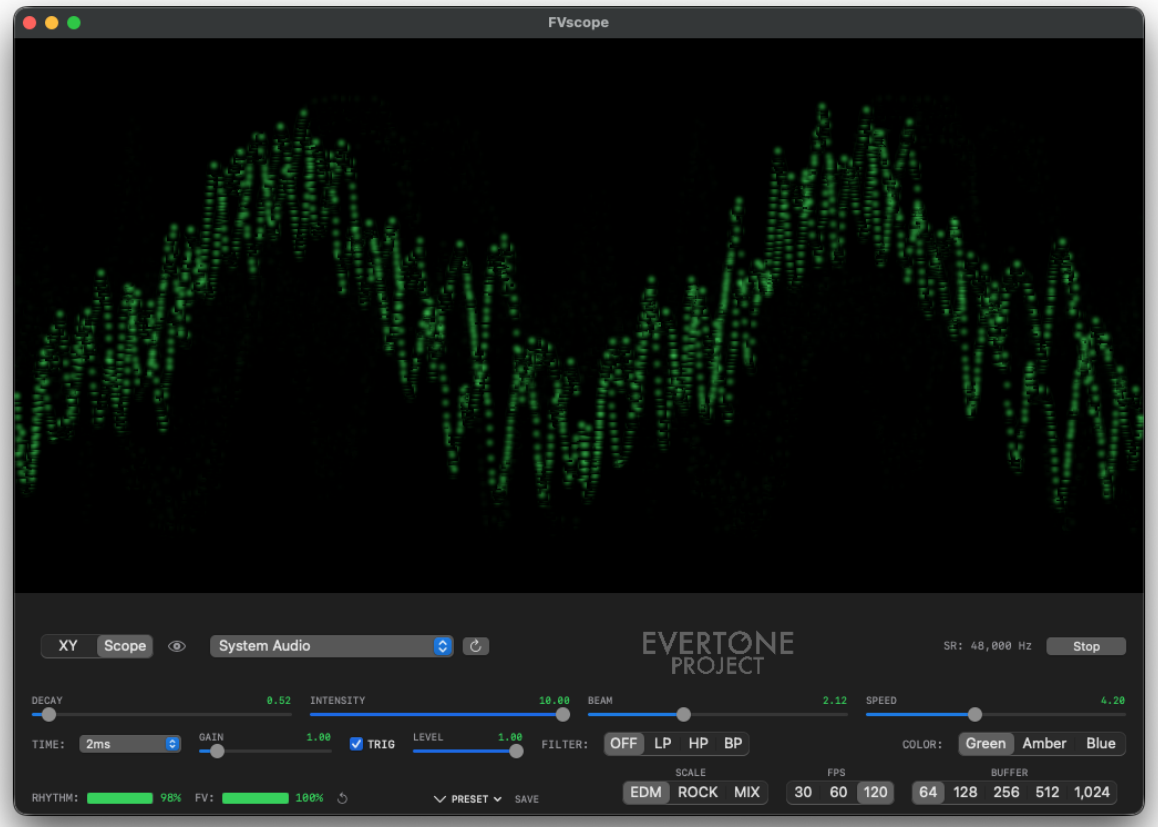
Recognizing Acceleration Components

The beam appears brighter when slow and dimmer when fast. In signals rich with acceleration components, the beam races across during sharp attacks (dim) and momentarily pauses at peaks (bright). Pay attention to this **brightness contrast**:

- **High contrast** = Rich acceleration content. Rapid acceleration and deceleration driving the speaker forcefully
- **Relatively uniform brightness** = Low acceleration content. Beam moving at constant velocity, indicating compressed dynamics

Increasing the SPEED parameter makes this contrast more pronounced.

Understanding Scope Mode



Like a conventional oscilloscope, the horizontal axis represents time and the vertical axis represents amplitude.

- **Upper trace**: L channel
- **Lower trace**: R channel
- **TRIG**: Synchronizes the waveform at a specific level for stable display

Window Controls

- **Resize**: Drag the window edge (cannot go smaller than the default size)
- **Reset to default size**: Double-click inside the window

Performance Settings

Setting	Low Load	Standard	High Quality
FPS	30	60	120
BUFFER	1024	256	64

- **FPS**: Higher values give smoother rendering. Increases CPU/GPU load
- **BUFFER**: Smaller values reduce latency. Increases CPU load

Recommended: FPS: 120 / BUFFER: 256

Troubleshooting

No Audio Input

1. Confirm capture has started by pressing the "Start" button
2. Verify the correct input device (Source) is selected
3. Check System Settings > Privacy & Security > Screen Recording to ensure FVscope is permitted

Scope Not Displaying

- Check that the eye icon is not OFF (orange)
- Start capture with the "Start" button

Performance Issues

- Lower FPS to 30 or 60
- Increase BUFFER to 512 or 1024

Terms of Use

Disclaimer

FVscope is free software. Use of this application is entirely at the user's own risk. The developer assumes no liability for any damages arising from its use.

About the FV Metric

FV (Force Voltage) is a proprietary metric not currently defined as a standard in the audio industry. The detection algorithm combines multiple analysis layers in a complex configuration, and depending on the input signal characteristics or genre, unexpected values may be displayed. Please treat the displayed values as reference only.

Inquiries

Technical inquiries regarding this application are accepted only from individuals with professional expertise in audio engineering or acoustic signal processing, **under their real name**. We are unable to provide individual support for general usage questions.

Notes

- When using built-in speakers, macOS speaker DSP processing may cause slight volume changes during system audio capture. This does not occur with external speakers or headphones.
- The analysis algorithms and evaluation methods in this application are proprietary technology of EVERTONE PROJECT.

EVERTONE PROJECT https://evertone.jp/