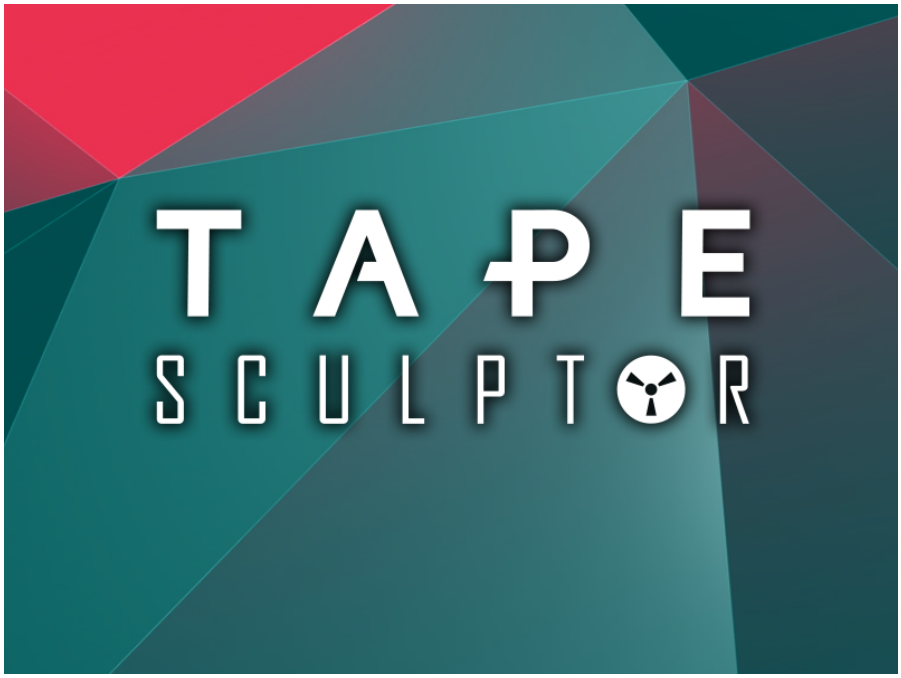


Tape Sculptor
Plugin Version 1.0.0
Created by Jatin Chowdhury with Impact Soundworks

Introduction

The subtle saturation and compression associated with reel-to-reel tape has been coveted by producers and engineers for many years... *well after* tape itself fell out of favor in modern studios.

At its heart, **Tape Sculptor** is designed to give you this **warmth**, **clarity,** and **analog character** of an authentic reel-to-reel tape machine. We collaborated with DSP master Jatin Chowdhury, who based its DNA on his widely-acclaimed Chow Tape Model plugin.

Rather than being limited to a narrow range of possible sounds, **Tape Sculptor** *also* offers sonic capabilities far exceeding a single real tape machine. This versatility and utility is what makes the plugin so special, standing out from a sea of other tape emulations out there.

You can of course achieve **subtle**, **musical**, and very pleasing results for mastering by using the Compressor and Saturation modules. Or you can push the parameters into **extreme settings** for intense waveshaping and harmonic distortion.

You can leave the sound (relatively) **clean** - like a fully-functioning machine - or **degrade**, mangle, modulate, and wobble your audio until it's well into the realm of experimental sound design.

All of this possible with **Tape Sculptor**, in a single UI that places every control at your fingertips laid out in an easily-understood fashion.

Whether you want to dive first into the rich preset bank of over 128 sounds, or sculpt your own tone from scratch, we hope this plugin will give you lots of inspiration and joy!

Installation

Online Activation (Recommended)

1. Install the **Pulse** application if you don't already have it. Pulse is a cross-platform desktop app that lets you **download and install** your libraries with **blazing speed**! You'll need to create an account here, but once you do, you can access your purchases from any developers using Pulse, any time, from any computer:

https://pulsedownloader.com/

2. Once Pulse is installed, open it and enter your **Tape Sculptor** product code. The plug-in will then be downloaded and the installer will automatically run; follow the installer instructions to finish.

3. When the **Tape Sculptor** plug-in is first opened in your DAW, you will be prompted for an email and product code. You must use the email address you used when ordering the plug-in on the Impact Soundworks website!

Offline Activation

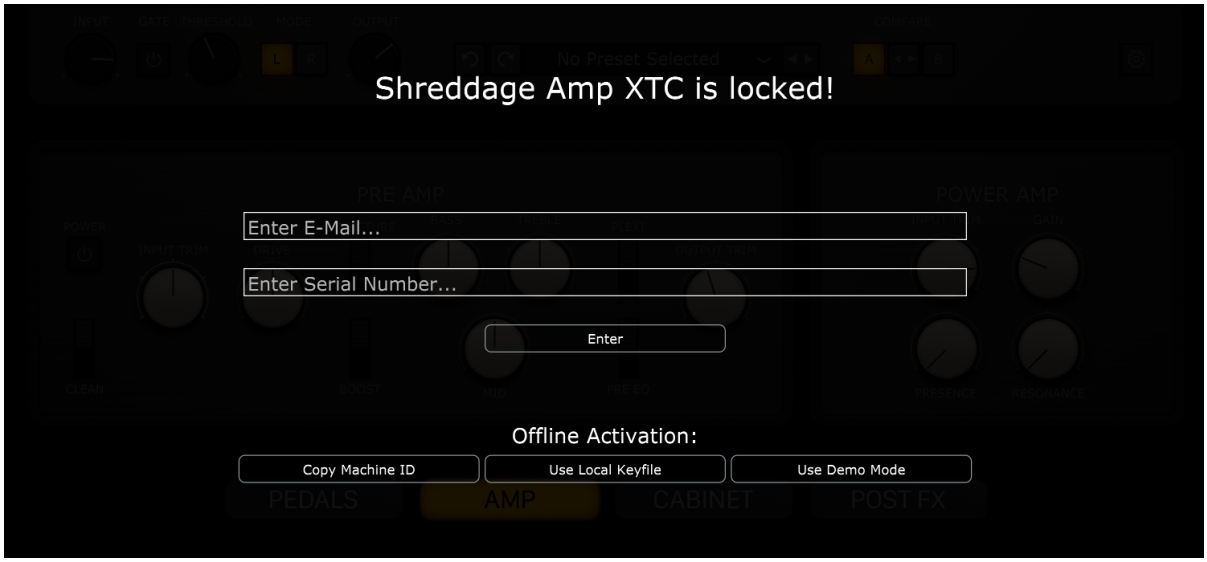
If you would prefer to not connect your studio computer to the internet, it is still possible to activate and use Tape Sculptor. However, you will still need at least one internet-connected computer to proceed. For these instructions, we'll use the terms Offline PC and Online PC:

1. Follow the Online Installation & activation steps, as outlined above, on your Online PC.

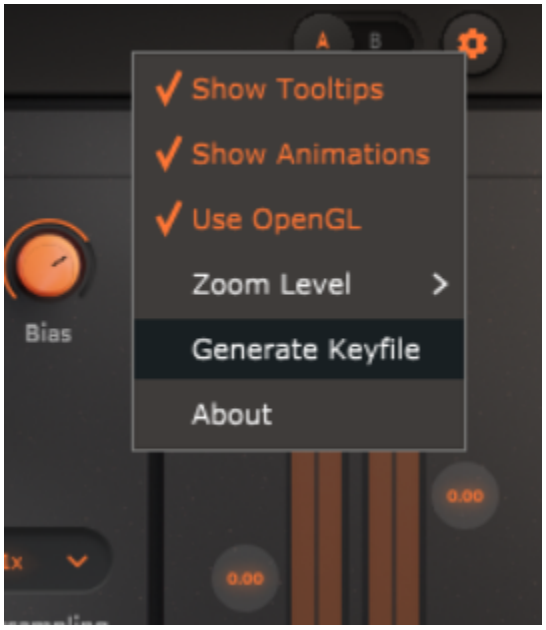
2. Copy the Tape Sculptor plug-in installer file to your Offline PC, and run the installation on your Offline PC.

3. Open the Tape Sculptor on your Offline PC. Select the Copy Machine ID button, which will copy the Offline PC's unique machine ID to the clipboard. Paste this ID in a text file.

The image below uses our Shreddage Amp XTC plugin as an example; Tape Sculptor uses the same activation method.


Shreddage Amp XTC is locked!
Enter E-Mail...
Enter Serial Number...
Enter
Offline Activation:
Copy Machine ID
Use Local Keyfile
Use Demo Mode

4. On your Online PC, open the plug-in and go to the settings menu. Select Generate Keyfile. You will be prompted to enter a machine ID; input the ID generated from the previous step.



5. Transfer the generated Keyfile to your Offline PC.

6. On your Offline PC, in the **Tape Sculptor** plug-in, select Use Local Keyfile and select the Keyfile you generated in the previous step. ***That's it!***

Global Controls

These controls are located in the **top bar** of the plugin.

Bypass
When enabled, completely bypasses all plugin processing including input/output volume trim.

Presets Menu
Allows for loading of factory presets, reset the plugin to its default parameter settings, save user presets, and choose the location that user presets are saved to.

The left and right arrows next to the preset menu and preset name will toggle through factory and custom user presets one at a time.

Factory presets are divided into the categories of "Bus", "Extreme", "Lo-Fi", "Mastering", "Saturation", and "Spatial & Modulation"

If the active preset has a “*” next to it, there are unsaved settings. Be sure to save your work!

If you load a factory preset and save it under the same name, note that it will **not** overwrite the actual factory preset. It will be saved to the user folder.

A/B Switch
The A/B switch allows the user to toggle between two different sets of plugin parameters. In other words, you can load a preset in slot A, and another preset in slot B, then use these buttons to quickly toggle between them and compare their sound. Right-click on the button to transfer A’s settings to B or vice versa.

Settings Menu
Allows for toggling of tooltips and animations, changing the GUI zoom level,and generation of a keyfile for offline activations.

- Disabling animations will improve CPU usage when many instances of the plugin are open with UI visible.
- Disabling OpenGL is not recommended as it typically improves performance, but if the UI is sluggish (e.g. on an older computer) disabling OpenGL may *improve* performance.

Output Section

Mix
Blends between the dry signal (no plugin processing) and wet signal. Note that depending on your processing chain, lowering the mix below 100% can cause interesting phase cancelation and comb effects (for example, if you are using the filter module). Whether this is desirable or not depends on how you’re using the plugin!

Input/Output Sliders
Adjusts input and output volume. Note that input volume **greatly** affects the sound and processing of the Compressor and Saturation modules!

Balance
Changes left/right or mid/side balance.

L/R to M/S Toggle
Switches between left/right and mid/side stereo processing modes.

Makeup
At values above 0%, will increase or decrease output gain automatically to adjust for plugin processing effects on volume.

Signal Processing Overview

At the heart of Tape Sculptor is a set of deep, detailed circuit models of a reel-to-reel tape machine. This means that just like an actual tape machine, Tape Sculptor will process and transform audio in interesting, pleasing, and sometimes unexpected ways.

For example, the Compressor (explained in more detail later) does not behave like a typical digital compressor. It instead emulates the properties of magnetic tape, which does happen to reduce dynamic range, but can also add saturation *itself* (separate from the Saturation module) and alter the shapes of transients.

You don't need to understand the internal functions of every module to enjoy this plugin. That said, if you're confused about a control function or range, or unsure of *what* exactly a module is doing, read on!

Audio Signal Flow Overview

- Signal In
- Input Gain
- Filters
- Input Stereo Processor
- Input Delay
- Emphasis pre-saturation
- Compression
- Saturation
- Emphasis post-saturation
- Degrade
- Chew
- Wow
- Flutter
- Loss
- Output Delay
- Output Stereo Processor
- Makeup from Filters
- Global Makeup
- Output Gain
- Dry / Wet Mix
- Signal Out

Modules and Controls

Filters

The filters section can be used to cut out some of the high or low frequencies from the incoming sound before applying the tape processing. The filter slope can be controlled to make the filter roll-off either shallower or more steep.

When "Makeup" is turned on, the part of the signal that was filtered out at the plugin's **input** will be added back to the plugin **output**. This can result in musically-interesting notches, combs, and boosts.

The filters are designed for "perfect reconstruction", so if "Makeup" is turned on, and all of the other processors in the plugin are turned off, then filters will essentially have no effect.

Emphasis (Emph)

The emphasis section applies a set of pre-/post-emphasis filters to the signal **before the Compressor** and **after the Saturator** processing is applied. This means if the Compressor & Saturator are disabled, this section **has no effect**.

The filters work similar to RIAA filters, in that the pre- and post-filters have exact opposite frequency responses. The "Bass" and "Treble" knobs control the frequency response of the pre-emphasis filter, and the post-emphasis filter will automatically adjust. The Frequency knob controls the transition frequency (crossover) between the bass and treble sections of the filter.

More on RIAA Filters: https://en.wikipedia.org/wiki/RIAA_equalization

Compressor

The compressor section of Tape Sculptor is unique. Rather than typical dynamic range compression, the compression algorithm in Tape Sculptor is designed to emulate the compression characteristics of analog tape.

The “Threshold", which is controlled by dragging down or up on the Compressor display, applies a gain to the incoming signal so that more of the signal lies within the “compression window” of the tape.

The “Ratio” and “Knee” controls can be used to tweak the characteristics of the compression happening within the compression window.

“Attack” and “Release” can be used to control how quickly the compression algorithm responds to volume changes in the incoming signal.

Finally, “Blend” can be used to mix between the compressed and un-compressed signal.

Saturation

Tape Sculptor's Tape Saturation algorithm uses an in-depth physical model to accurately simulate the saturating behavior that occurs when the magnetic domains in the tape are being magnetized, otherwise known as magnetic hysteresis.

The "Drive" parameter affects the slope of the hysteresis curve. This has a similar effect to the input gain, but differs in that it affects the nonlinear characteristic of the hysteresis process.

"Saturation" controls the level at which the hysteresis function saturates. Higher values correspond to a lower saturation point, resulting in a more distorted sound.

"Bias" controls the level of the bias signal used in the tape recording process. At lower bias levels, the hysteresis curve becomes “wider”, thus creating the “deadzone” effect often associated with underbiased tape.

The Oversampling controls can be used to reduce the aliasing of the saturation processing, at the expense of additional CPU usage. There are options available for using different oversampling settings during offline rendering.

The "Mode" options can be used to select different equation solvers to be used for computing the physical model.

The "Hysteresis Mode" switches between different equation solvers to solve the hysteresis equations needed to produce the saturation effect.

- **RK2**: 2nd-order Runge-Kutta Solver. Runge-Kutta is an "explicit" equation solver, resulting in relatively constant (and low) CPU usage. However, it is not very accurate, especially when the signal is changing quickly.

- **RK4**: 4th-order Runge-Kutta Solver. A more accurate (but more CPU-hungry) version of the RK2 solver..

- **NR4**: Newton-Raphson Solver with maximum of 4 iterations. Newton-Raphson is an "iterative" equation solver, resulting in slightly more variable CPU usage. If the equation is "solved" after one iteration, then the solver can "exit early", meaning less CPU will be used. If the signal is changing quickly, more iterations will be necessary, and the higher the CPU usage will be. The accuracy of this mode is similar to RK4, but will result in less CPU for more static signals.

- **NR8**: Newton-Raphson Solver with maximum of 8 iterations. A more accurate (and CPU-hungry) version of the NR4 solver; it is generally the most accurate option of all.
  .
- **STN**: State Trajectory Network solver. This method uses a small neural network to solve the equation. This is technically the least accurate solver, especially at more extreme parameter settings, but it is “inaccurate” in a way that can sound interesting and be musically useful.

For more information on hysteresis functions, please consult the following:

https://www.dafx.de/paper-archive/2019/DAFx2019_paper_42.pdf
https://en.wikipedia.org/wiki/Hysteresis
https://en.wikipedia.org/wiki/Jiles%E2%80%93Atherton_model

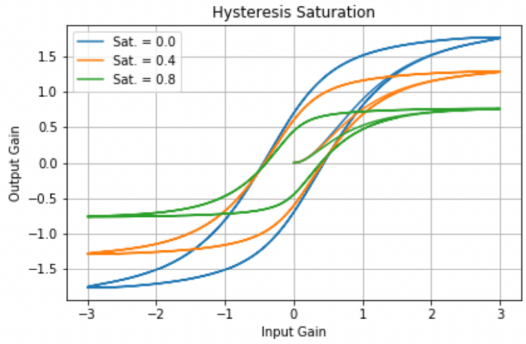


Figure 7: *Hysteresis curves with varying saturation*

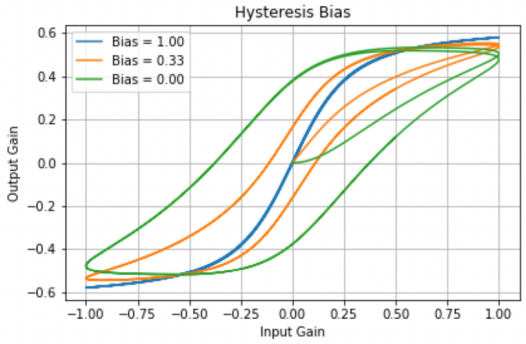


Figure 8: *Hysteresis curves with varying bias*

More info on tape biasing: https://hccc.org.uk/acbias.html

Degrade

This module is a simulation of old tape that has been used over and over, and has started to degrade.

“Depth” controls the intensity of the wear on the tape, resulting in a quieter and slightly noisier signal. Enable the “Soft” option to make this control more subtle.

“Amount” controls the amount of wear, typically corresponding to the age of the tape. Higher values result in a gentle lowpassing effect.

“Variance” adds a time-varying randomness to the degradation.

“Envelope” applies an amplitude envelope to the tape noise; without an envelope, the noise will be constant even with no plugin input.

“Hiss” controls the level of tape hiss generated by the tape machine.

Chew

This unique module simulates tape that has been chewed up by a broken tape machine, resulting in intermittent dropouts between sections of the tape.

“Depth” controls how deep the tape is chewed. Higher values result in a larger level dropout during the dropout section.

“Frequency” controls how much space there is between bits of tape that have been chewed up

“Variance” determines how much randomness there is in determining the amount of space between chewed up sections.

Loss

This section models the complex physical behavior of the playhead and tape, which depending on gap, width, and tape thickness results in a natural change to frequency response.

The frequency responses of each of these “loss effects” is also dependent on the tape speed.

“Spacing” controls the amount of space between the playhead and the tape, measured in centimeters.

“Thickness” controls the thickness of the tape, measured in centimeters.

“Gap” controls the width of the playhead gap, measured in millimeters.

Increasing any of the three of “Spacing,” “Thickness,” and “Gap” result in the loss of high-frequency energy in the electromagnetic signal, leading to a lowpass filtering effect. The “Gap” control also controls a low-frequency resonance created by the playhead gap (also known as the “Head Bump”).

“Azimuth” controls the playhead alignment angle. A misalignment between the playhead and the tape causes a corresponding time misalignment between the two stereo tracks on the tape, resulting in a stereo “widening” effect.

“Speed” controls the tape speed as it affects the above loss effects, measured in inches per second (ips). Standard speeds for reel-to-reel tape machines are 3.75, 7.5, 15, and 30 ips.

More info on Azimuth

https://www.weareavp.com/azimuth-adjustment-for-magnetic-audio-recordings-by-audrey-young-and-peter-oleksik/

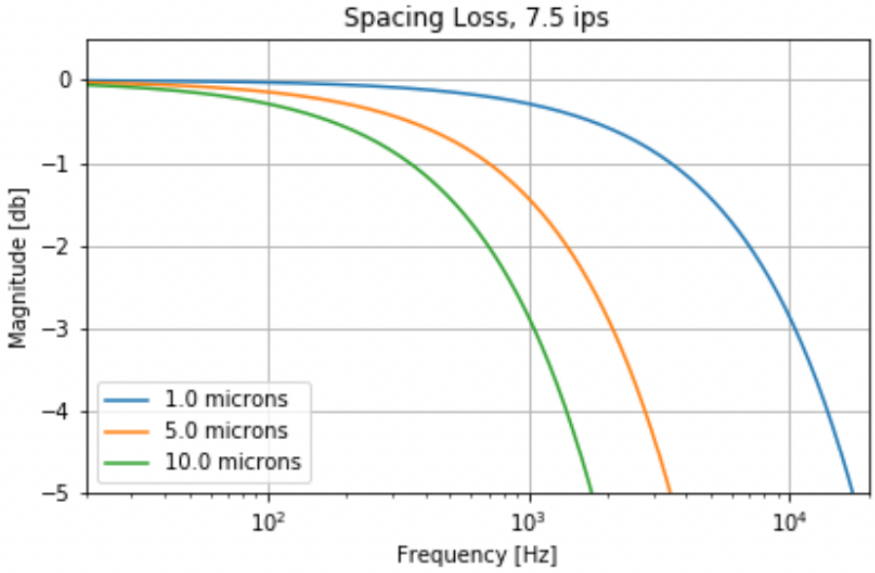


Figure 12: *Spacing loss at 7.5 ips*

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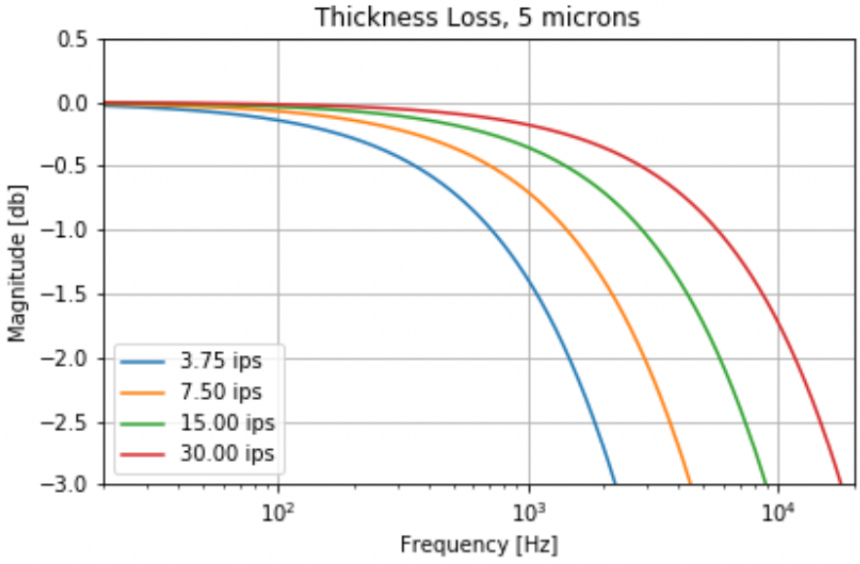

Figure 13: *Thickness loss for 5 micron tape*

Flutter

Tape machines also exhibit timing irregularities, often due to small imperfections in the mechanics of the machine causing the tape to subtly speed up and slow down while

being played back, creating a “pitch modulation” type of effect. The flutter characteristic in Tape Sculptor is based on measurements from Jatin’s own tape machine.

“Depth” controls the depth of the effect

“Rate” controls how fast the flutter occurs.

Wow

Wow is similar to Flutter but on a much longer time scale, and also contains “Variance” and “Drift” controls which adjust some random characteristics of the wow process.

Delay
A 4-tap tape delay processor, each of which has three controls: Time, Pan, and Level.

Time can be a direct time value, or it can be synchronized to the tempo of the DAW, using the “Sync” switch.

“Feedback” control adds the outputs from the delay taps back to the input of the “Emphasis Pre-Saturation” section, for a true tape delay effect.

Finally, the “Mix” control adjusts the amount of the delayed signal which is mixed in the output of the plugin.

Credits & Acknowledgements

Executive Producers: Andrew Aversa & Jatin Chowdhury
Lead Programmer & DSP: Jatin Chowdhury
Additional Programming: Ori Zur
UI Design: Kovdra Bureau
Preset Design: Andrew Aversa
Logo & Artwork: Paulo Nunes

Troubleshooting

Having trouble with Tape Sculptor? Use it in a project you want to tell us about? Drop us a line via our **Support Center**.

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