Kinesthetic 3D Audio Mixer User Guide

Brief Introduction

Welcome to the Kinesthetic 3D Audio Mixer! We're looking forward to seeing how you use our device! Before we can start playing with sound we need to install a couple of computer programs. This instruction packet outlines all the necessary steps to get the Mixer working. Follow the steps outlined in this packet after plugging the device into your computer.

Once you obtain the Mixer device, you will need the following for the device to work properly:

- A computer with either Windows or MacOS
- Headphones

This instruction packet covers all the steps needed to use the Mixer to its fullest capacity. We'll show you how to install and use the Mixer Control Panel, which is the bridge between the Mixer device and your computer. We'll also show you how to connect the Mixer Control Panel to the digital audio workstation REAPER, and all the necessary installations required. Finally, the steps in REAPER needed to create 3D audio using the Mixer device are explained in detail.

Install Python

To get the Mixer Control Panel running on your computer you will need to have a Python interpreter installed, or really any program which allows you to execute Python scripts. We recommend using Spyder, which can be accessed in the Anaconda Computer Program. The link to download the Anaconda Computer Program is below.

- Anaconda Computer Program

Once you have Anaconda installed, launch Spyder.

Users with alternative means of running python programs may choose to do so; executing the script loads the Mixer Control Panel.

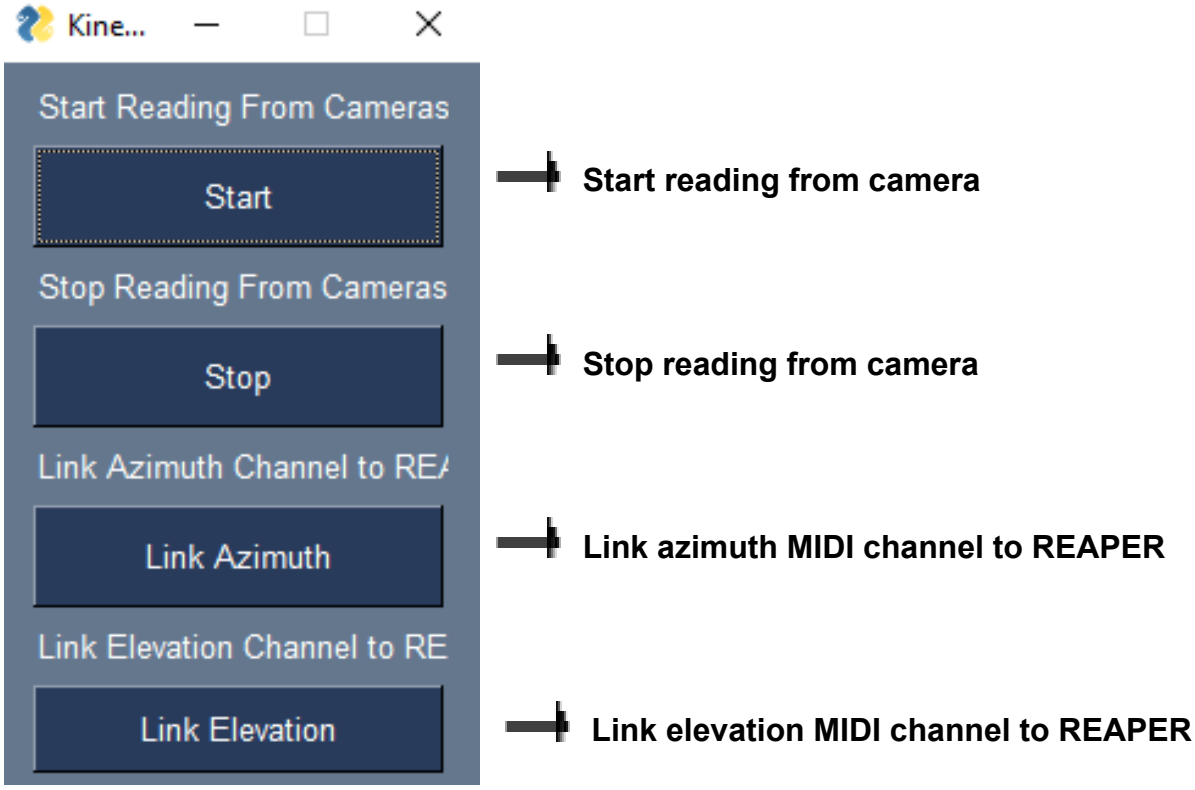
Download Mixer Control Panel

Once you have downloaded Anaconda (or a similar means of executing python files), you're now ready to use the Mixer Control panel. The Mixer Control Panel is a script written in Python that can be executed in Anaconda's Spyder. It can be downloaded through the Google Drive link below.

https://github.com/Mattmulle97/Kinesthetic_3D_Audio_Mixer/edit/master/Ambisphere_GUI_2021.py

Mixer Control Panel Overview

Once you run the program, you should see a window that looks like the image below.



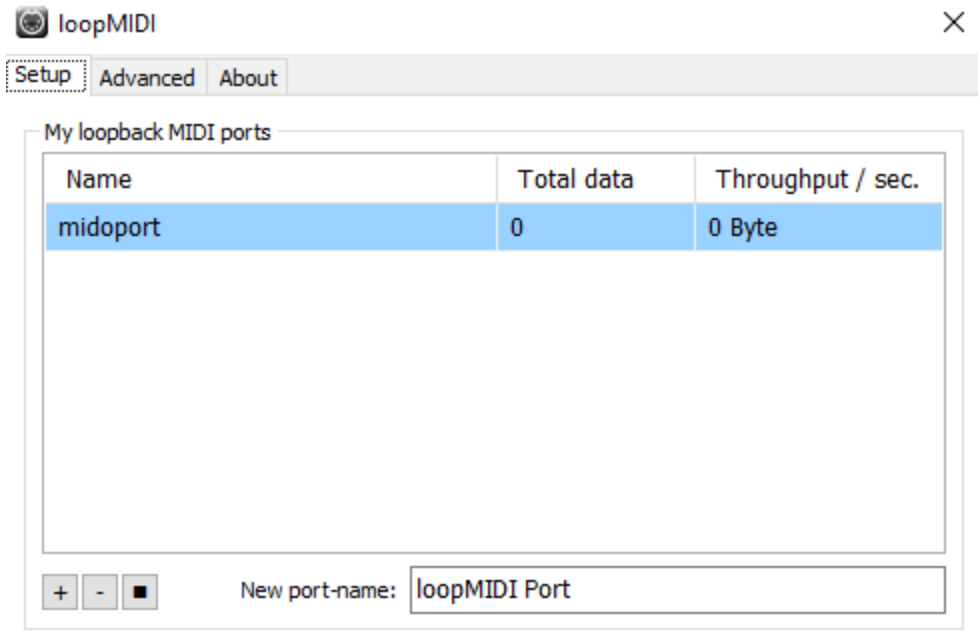
The last two buttons will be explained later.

loopMIDI Download & Configuration (Windows only)

(MacOS users may skip this section) If you are using a Windows computer you will need to install the loopMIDI software to connect the Mixer Control Panel to REAPER (more on this in the next section). The device uses a virtual MIDI port to establish this connection, but such ports are not natively supported by Windows. The loopMIDI software allows the user to create a virtual MIDI port that the Mixer control panel uses to communicate azimuth and elevation data. The download link for loopMIDI is below.

- loopMIDI Software

Once loopMIDI is installed, remove any pre-installed ports and add a port named “midoport” using the “+” in the lower left corner. Your loopMIDI window should look like the image below.



Note: For the Mixer GUI program to work properly on a Windows computer you must have loopMIDI running on your computer. Also, be sure to double-check that the port is named midoport, with no additional characters or spaces.

REAPER/ATK Download & Configuration

Our device is MIDI compatible, which means that it can act as an accessory for audio mixing, like a synthesizer. We recommend using a Digital Audio Workspace (DAW) called REAPER. The link to install REAPER is below.

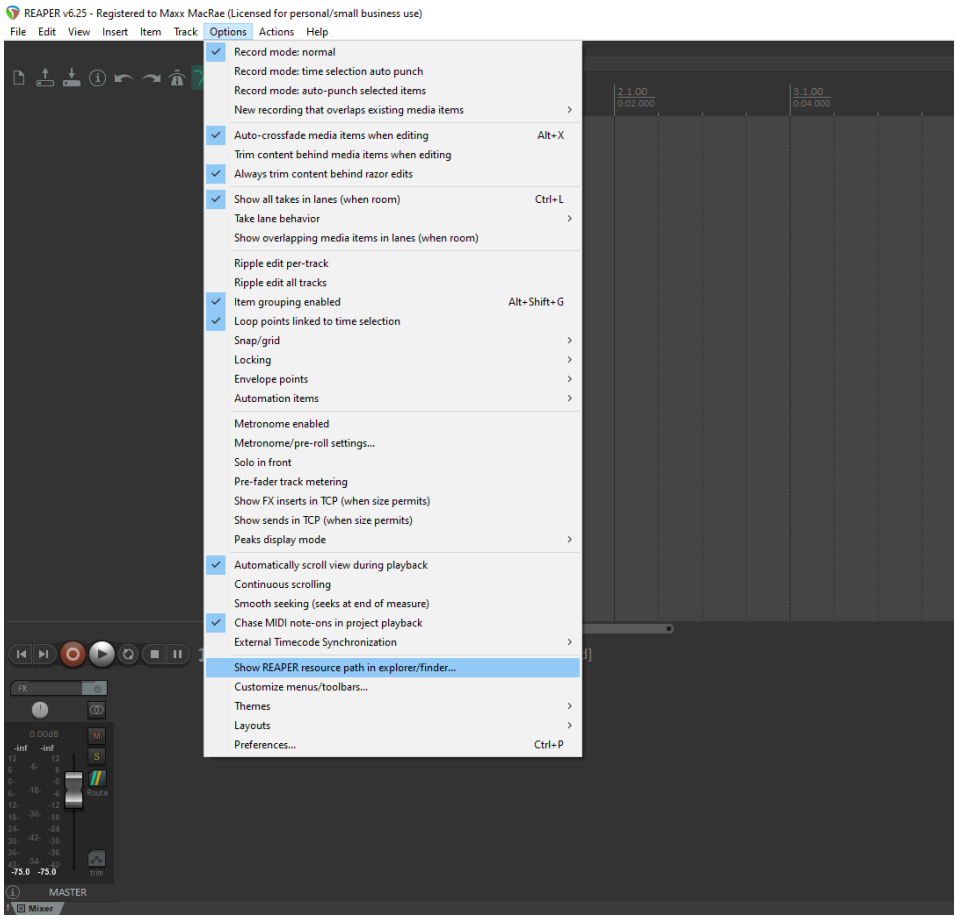
- REAPER Software

Once the software is installed, we will need to configure REAPER to be compatible with our GUI program. First, we need to install the AmbisonicToolKit (ATK). The link to install the toolkit is below.

- ATK for REAPER

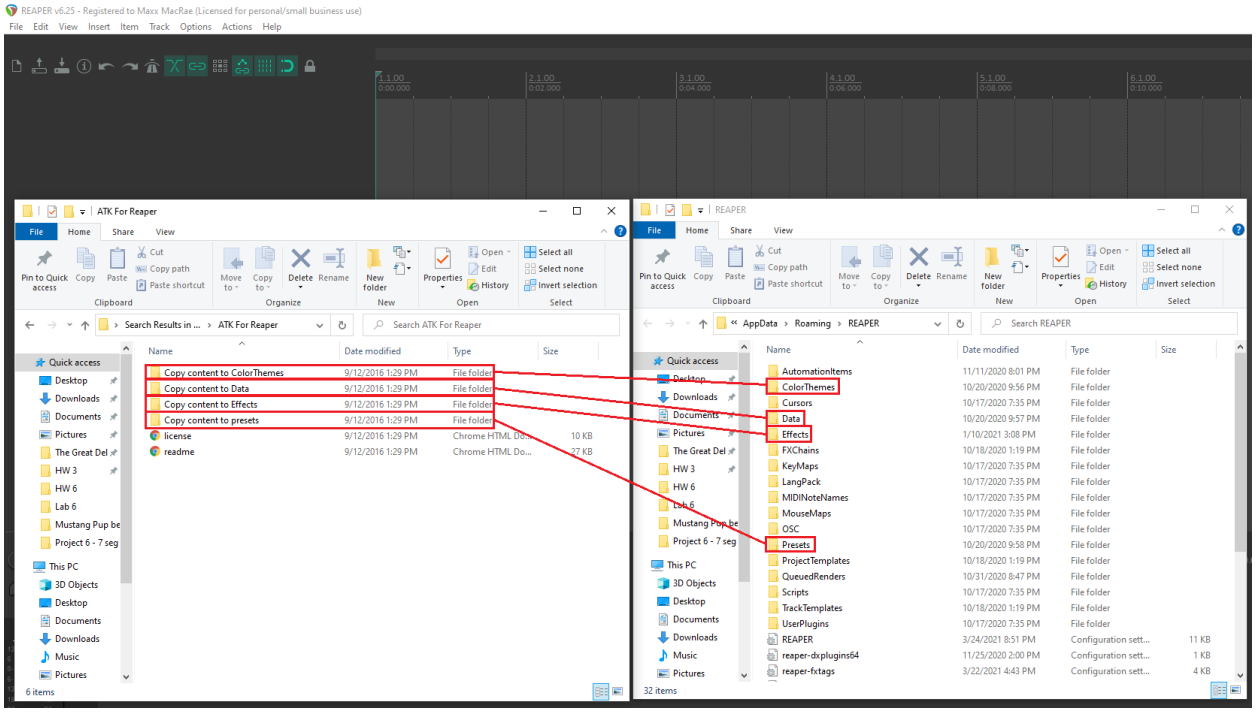
Once the toolkit is installed,

- Start Reaper.



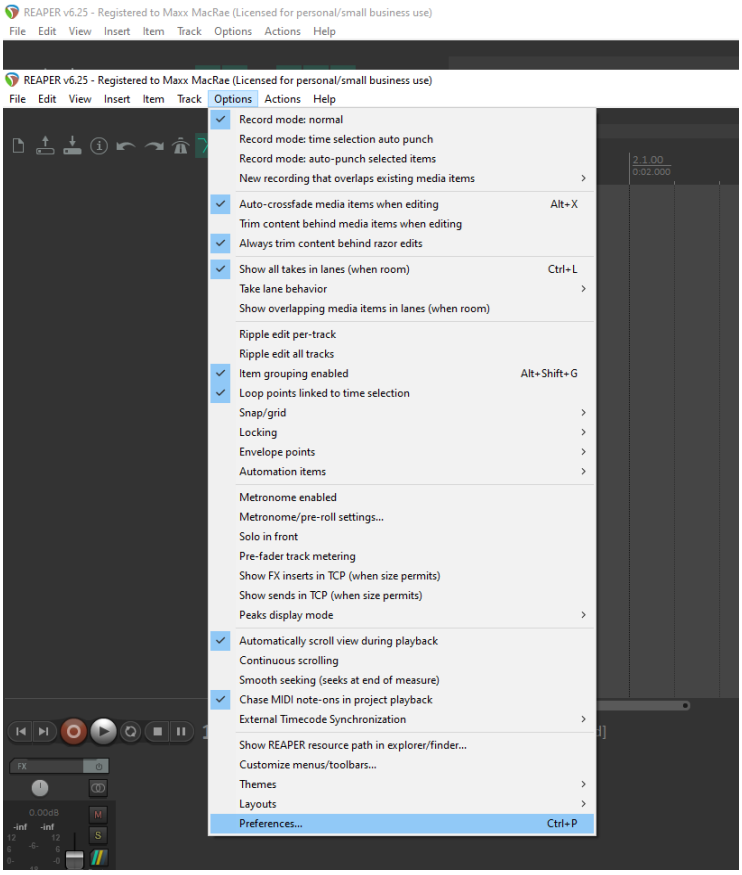
- From the Options menu choose “Show REAPER resource path in explorer/finder”.

- Download and unzip ATK for Reaper.
- In the unzipped folder you will find subfolders with names on where to move their contents. Copy the contents to their corresponding locations in the REAPER resource folder. Once the subfolders’ contents are copied to the appropriate locations, you can delete the unzipped folder from your computer. If the Data and Effects folders already contain ATK subfolders from a previous install, these can safely be deleted before copying.

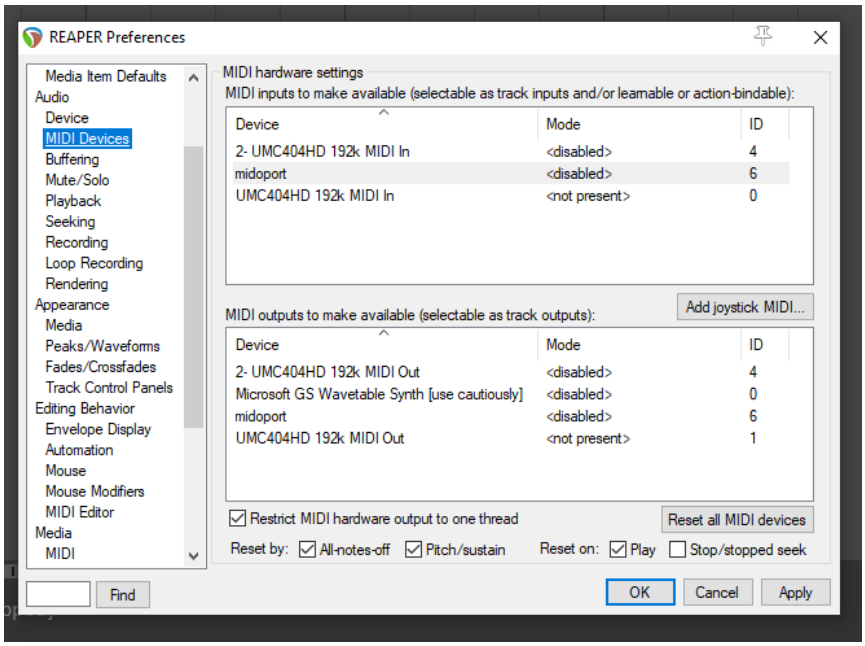


Once the toolkit is properly configured, we must now configure REAPER to accept input from midoport. The necessary steps are outlined below.

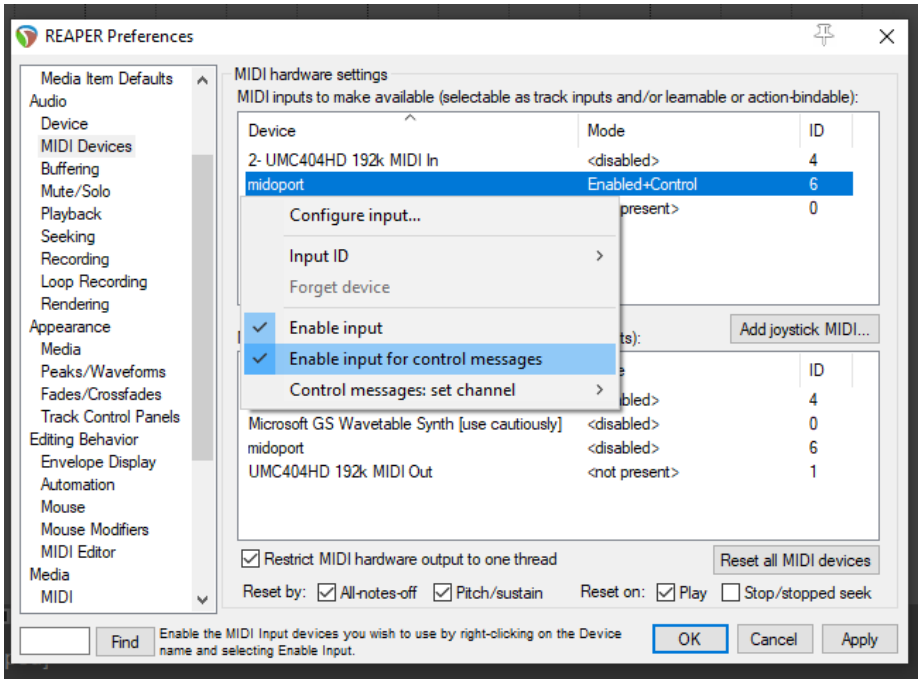
In REAPER, from the Options menu, choose “Preferences”



In the “Preferences” window, navigate to “MIDI Devices”

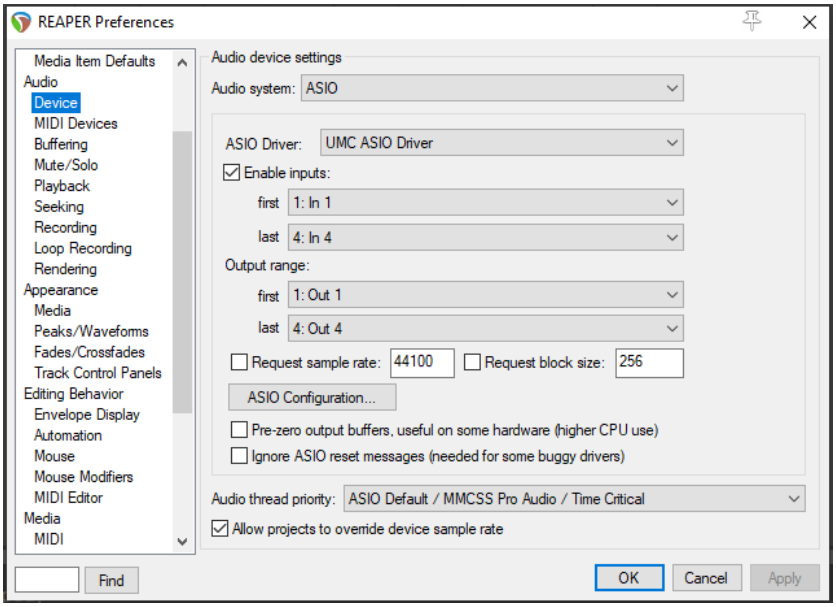


In the “MIDI inputs to make available” window, right click “midoport”, and select “Enable input”. Then, right click “midoport” again and select “Enable input for control messages”. Click “Apply” , “OK”, and exit the Preferences window.



(Optional, if you intend to record your own audio) While in the “Preferences” window, navigate to the “Device” tab under the “Audio” group, and ensure that the desired recording device driver (webcam, microphone, audio interface, etc.) is selected.

You may need to search on the Internet to see what driver is associated with your device.

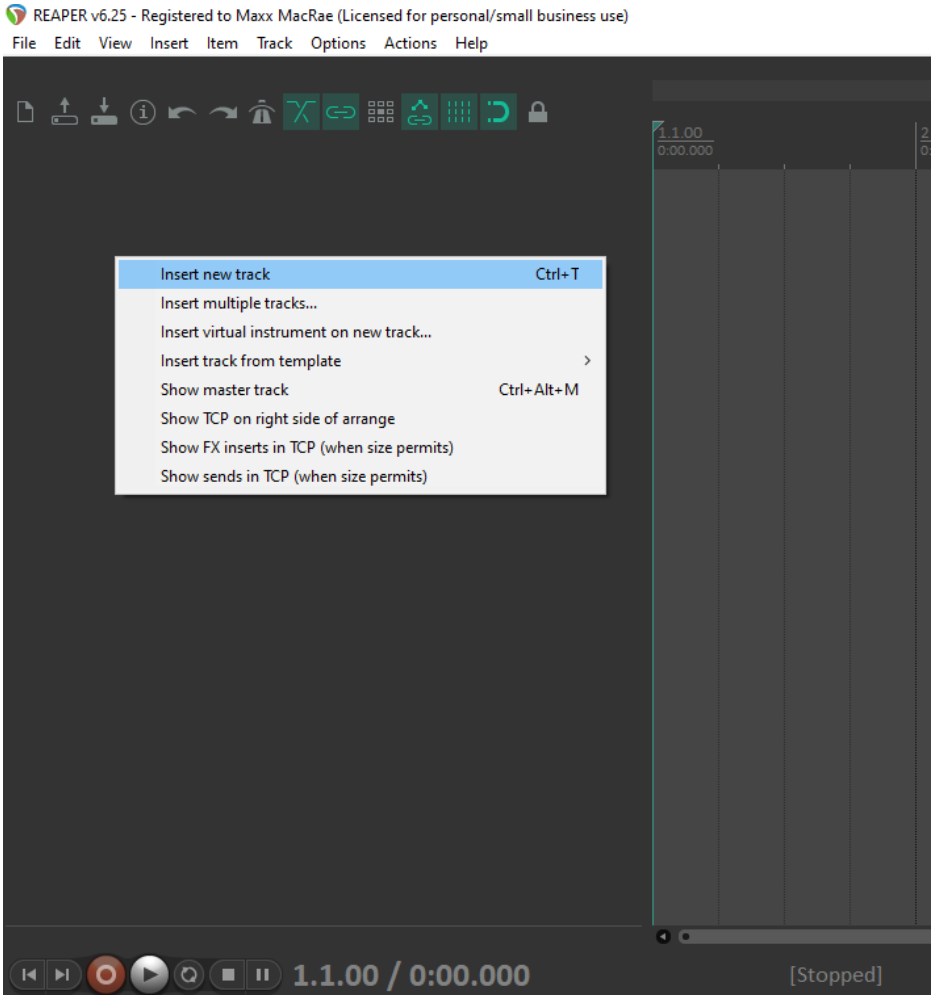


Creating 3D Audio in REAPER

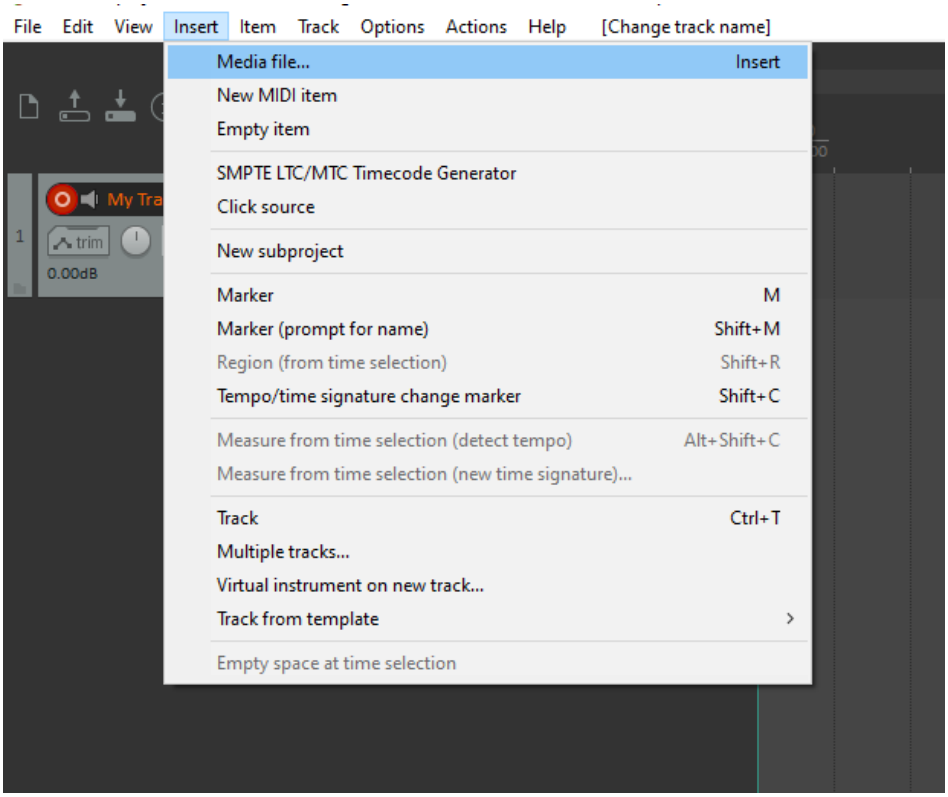
Getting Started

Open REAPER, and be sure to save your project using “File” -> “Save project as…”

Now create a track by right clicking the Track Pane (the dark gray area on the left) and selecting “Insert New Track”.

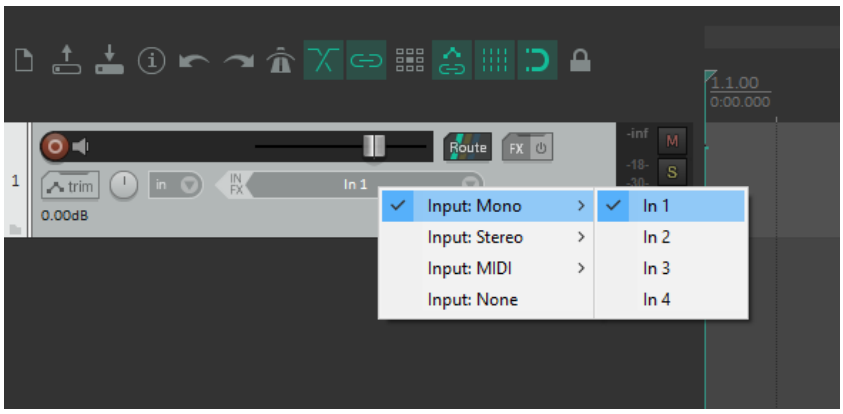


In most situations, you would create 3D audio out of prerecorded audio files, like the sound of an airplane. You can add a pre-recorded track to REAPER by navigating to “Insert” -> “Media File.”



(Optional) Recording Audio in REAPER

However, you may also want to record your own audio and three-dimensionalize it. Ensure the desired recording device is enabled for the track. (In this case, the desired device is Input 1 of the user's audio interface)



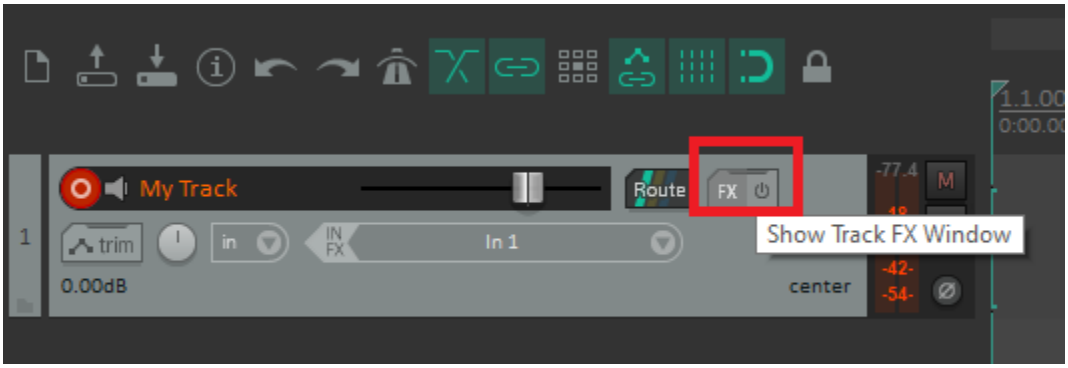
Name the track, and arm it for recording by clicking the red Record Arm icon to the left of the track name.

Now record the desired audio by clicking the “Record” button in the controls group right above the mixer on the bottom of the window. (Keyboard shortcut: Ctrl+R on Windows)

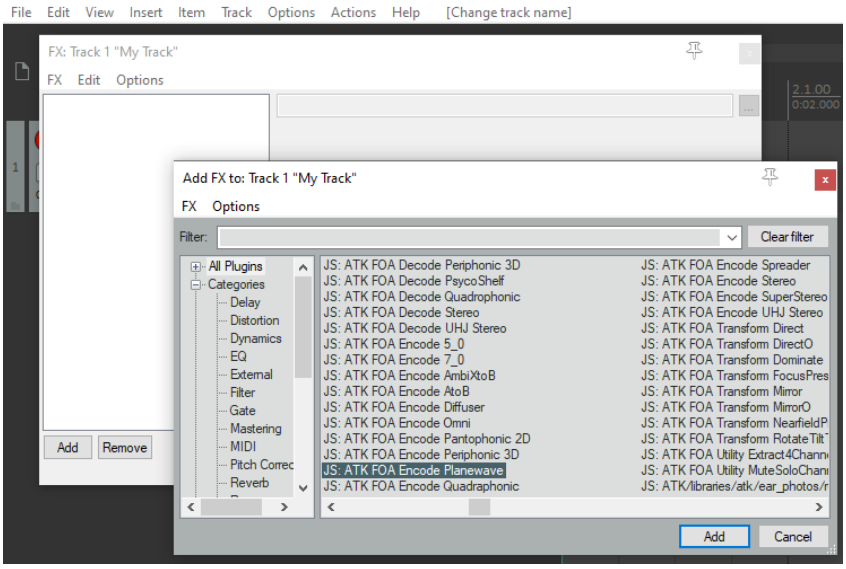
Encoding to Ambisonics

The Ambisonics Toolkit plugin installed earlier allows you to “three-dimensionalize” your audio by encoding it to Ambisonics B-Format. You can encode to Ambisonics by adding an encode FX to your track, shown below.

First, click the “FX” button on your track.



In the FX window, navigate to “JS: ATK FOA Encode Planewave” and double click it. If this window doesn’t show up, right click the white space on the left and select “Add new FX”



You should now see an interface with a circular dial; you are now viewing the ATK Encode Planewave interface. This will encode mono audio to Ambisonics B-Format and allow for positioning of the sound source.

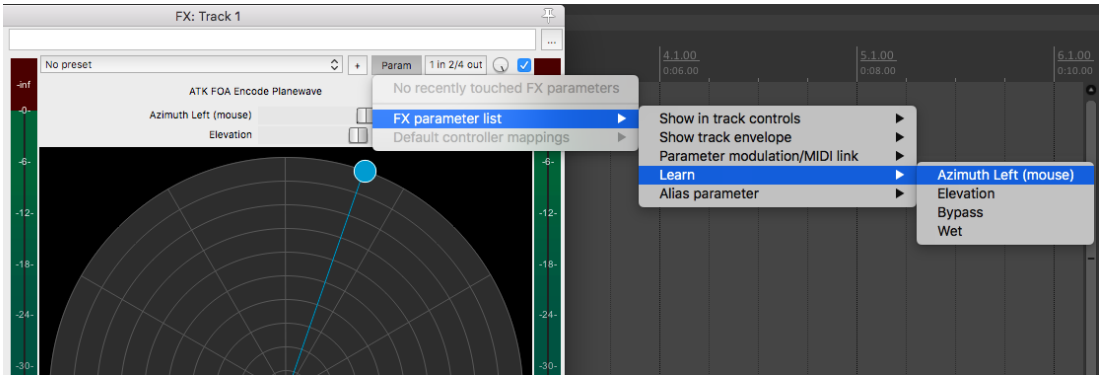
Linking the Control Panel to REAPER via MIDI

The Mixer device sends two streams of data to your computer: a channel for azimuthal angle, and another channel for elevation angle. These two angles uniquely determine the location of your finger, and by extension, the sound source, on the surface of a sphere.

The Control Panel is the bridge to REAPER, allowing the transmission of the incoming azimuth and elevation data over the virtual MIDI port created in loopMIDI. However, first we need to link the Control Panel directly to the Ambisonics Toolkit plugin. Our device has special buttons to accomplish this task.

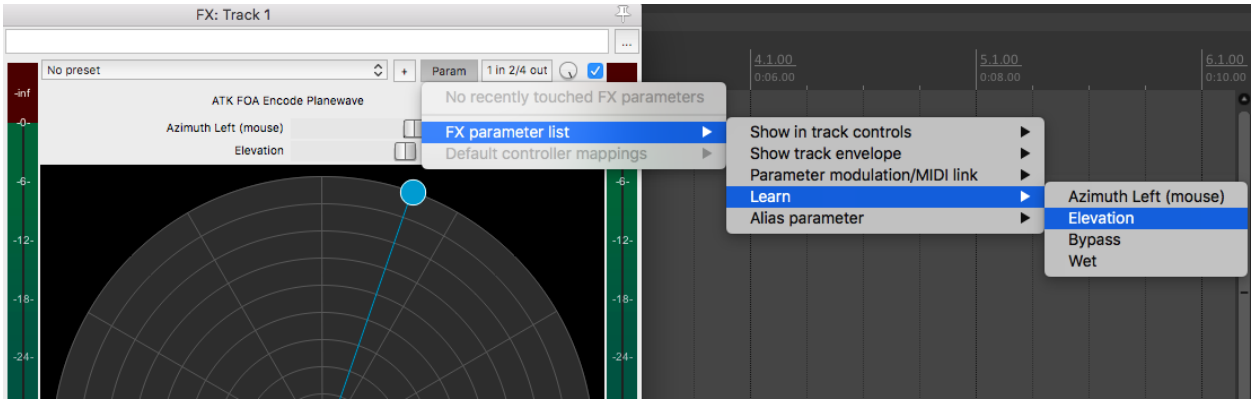
Linking the virtual MIDI port REAPER must be done in two steps, one to link the azimuth channel and another to link the elevation channel.

To link the azimuth channel, click on “Param” → “FX parameter list” → “Learn” → “Azimuth”, then a window titled “MIDI/OSC Learn” will appear.



Open the Mixer GUI (the python program), and click the “Link Azimuth” button. In the white box within the “MIDI/OSC Learn” window, “MIDI Chan 1 Pitch” should appear. Click OK.

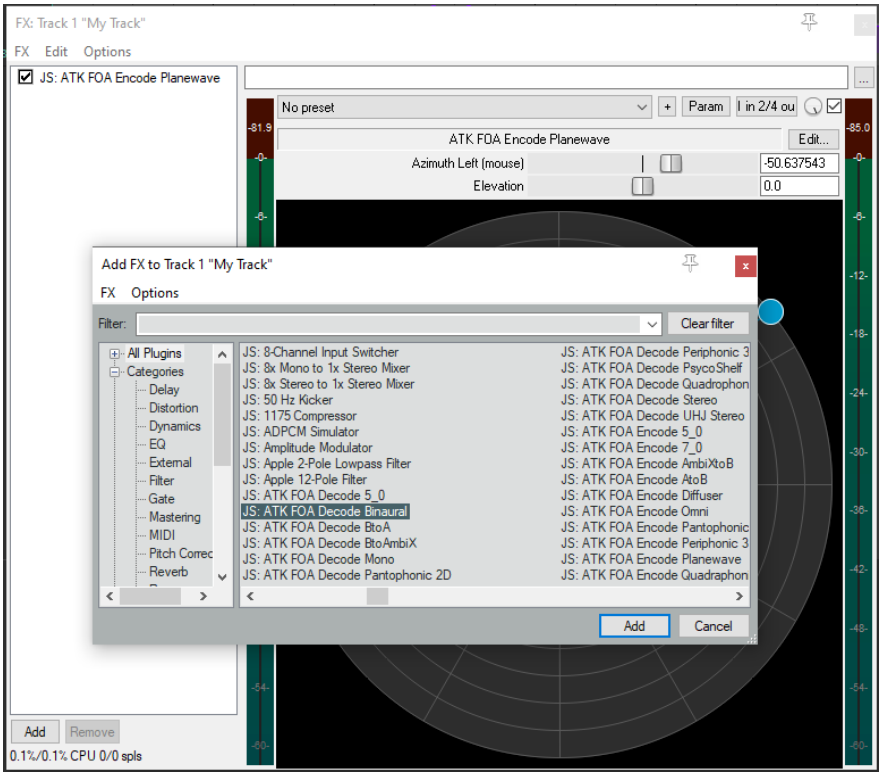
Linking the elevation channel repeats the same process: click on “Param” → “FX parameter list” → “Learn” → “Elevation”, then a window titled “MIDI/OSC Learn” will appear.



Open the Mixer GUI (the python program), and click the “Link Elevation” button. In the white box within the “MIDI/OSC Learn” window, “MIDI Chan 2 Pitch” should appear. Click OK.

Decoding for Headphone Listening

While in the FX window, add the “JS: ATK FOA Decoder Binaural” plugin to decode the signal for headphones. This decodes the Ambisonics B-Format audio to make it suitable for headphone listening. (Reminder: Right click the white space under the Encode Planewave FX and choose “Add FX”)

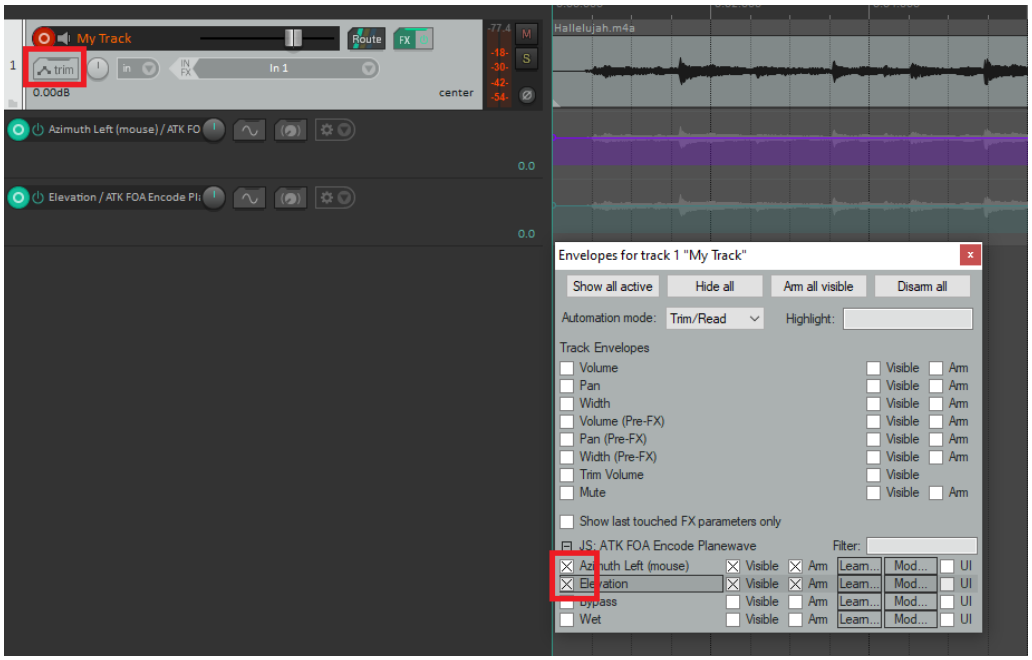


Positioning the Sound Using Automation Envelopes

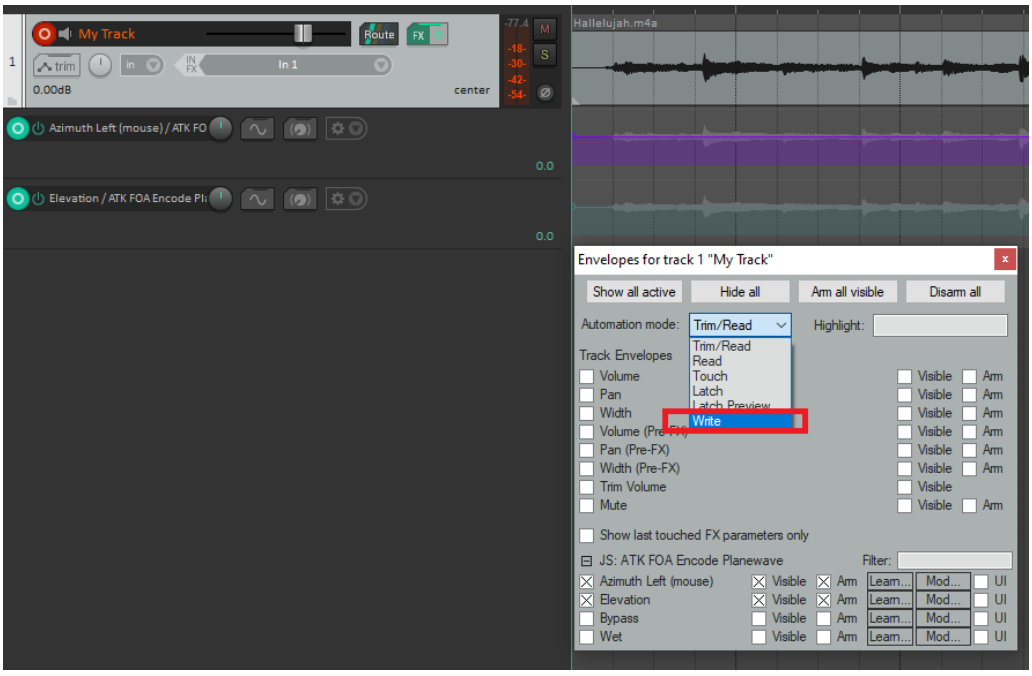
We must first arm the azimuth and elevation channels for recording. This can be accomplished using automation envelopes.

On your track, click the “trim” button, which will pull up a list of automation lanes.

- Select the boxes for “Azimuth Left (mouse)” and “Elevation”.



In the same window, Change “Automation Mode” from “Trim/Read” to “Write”.



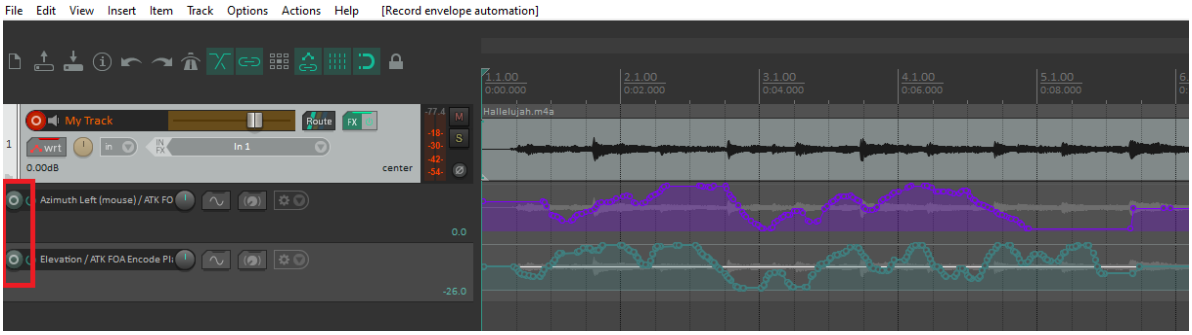
Now you are ready to write automation points to the track!

The first step is to turn the cameras on by pressing the Start button on the Mixer Control Panel.

Then, navigate to REAPER and select the point at which you wish to start recording envelope points (change the position of the sound source), and play the track using either the “Play” button in the controls group, or by hitting the spacebar.

While the track plays, you can use the sphere to position your sound source in real time.

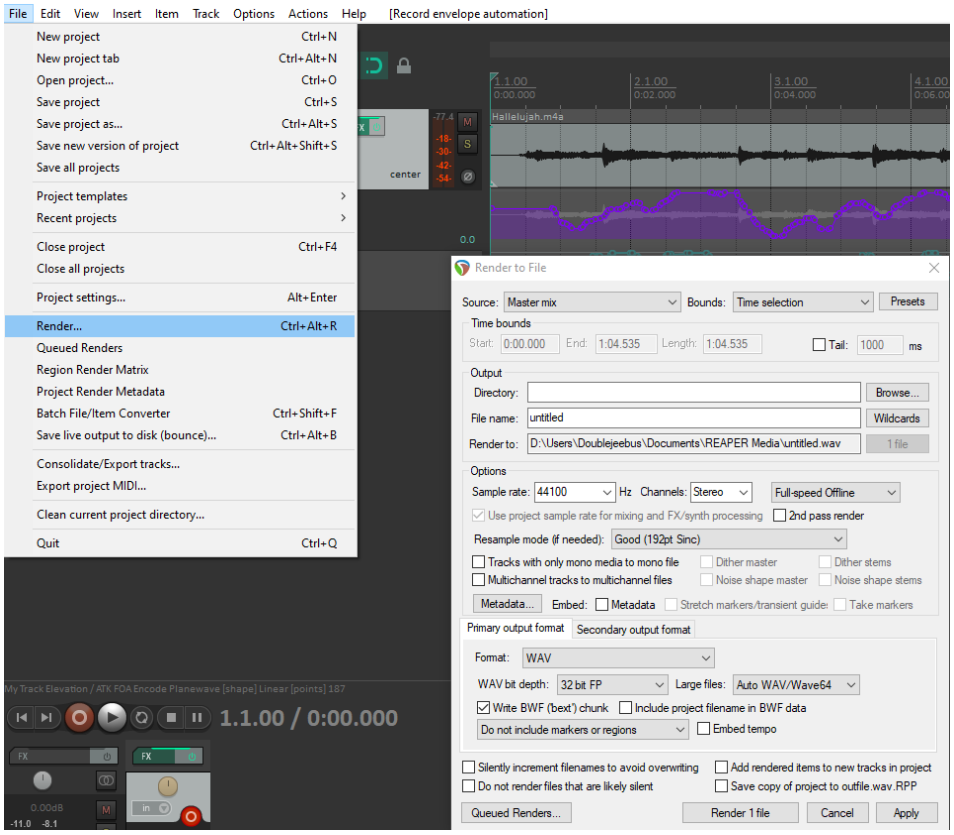
After you are finished recording envelope points, you may hit the spacebar again to cease recording, or use the Stop button in the controls group.



To preview the modified track, be sure to DISARM the envelope tracks for recording by clicking the “Arm For Recording” circles on the respective envelope tracks (highlighted in red above”. If you do not disarm these tracks for recording, upon playback, your envelope points will be erased.

Export Your 3D Audio

To render your track for listening outside of REAPER, select “File” -> “Render...”



- Be sure to name your file and place it in the desired directory.
- At the bottom half of this window, you can select the format of your rendered file.
    - FLAC = Highest Quality, Largest File Size
    - WAV = High Quality, Large File Size
    - MP3 = Standard Quality, Standard File Size

NOTE: For optimum listening experience, headphones are strongly recommended.