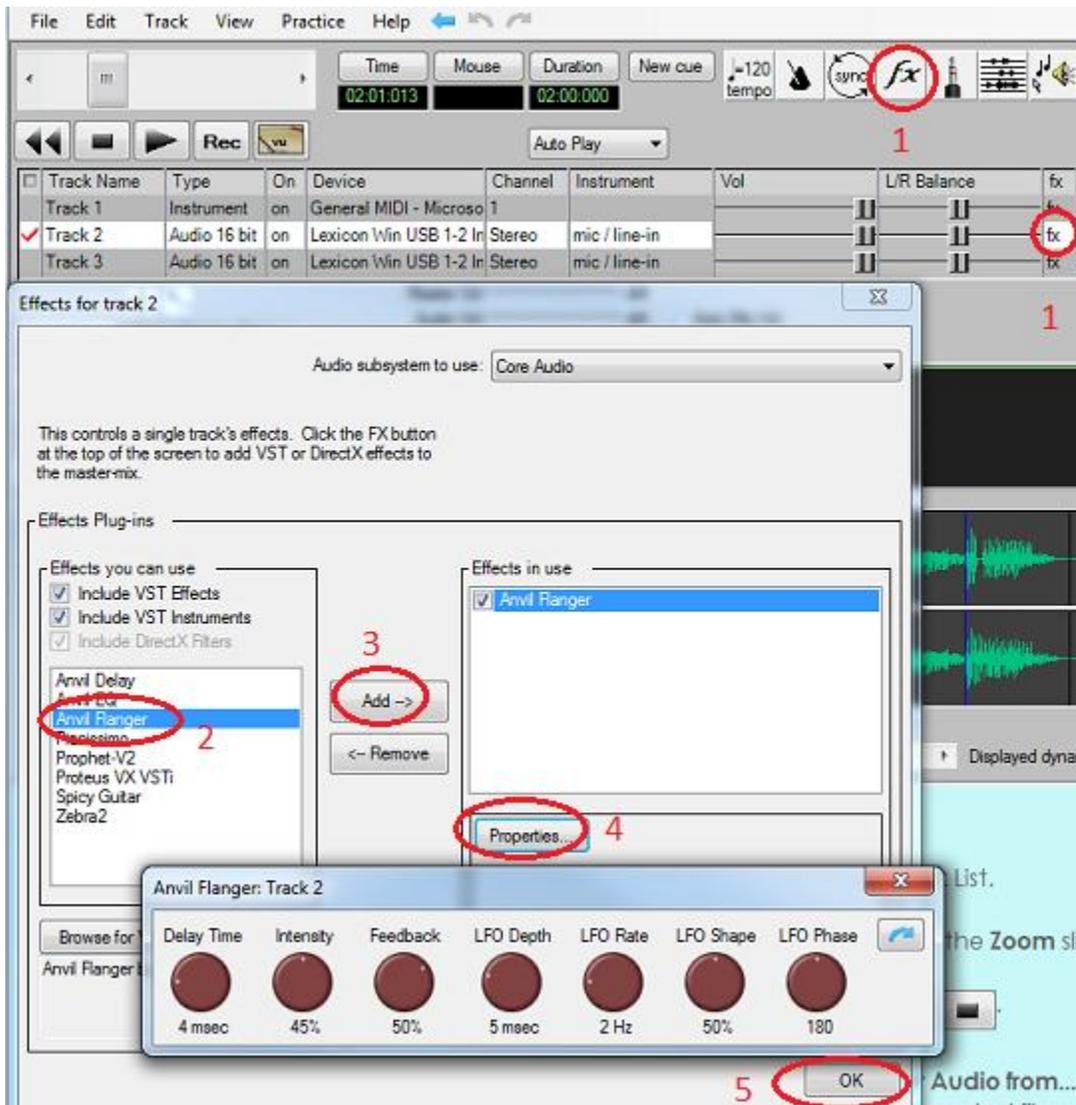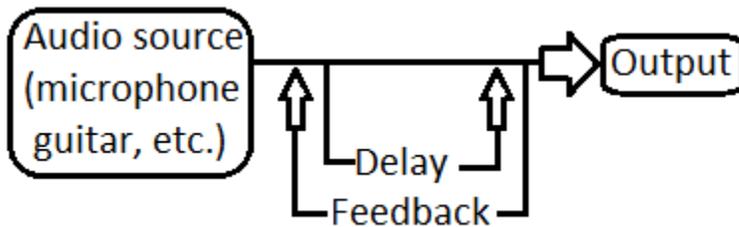This tutorial describes the **<u>flanger</u>** effect, how it functions and what it is best used for.

The best way to learn what a flanger does is by adding it to a song you have already recorded.
First, load a song with audio tracks or Instrument/Rhythm tracks that are played by a VST-Instrument.
Referring to the diagram below,

1. If you want the flanger to alter the *master mix*, i.e. the output after all tracks have been mixed together, click the ***fx*** button at the top of the screen.
   If you only want it to alter a single track, press that track's ***fx*** button.
2. To add this effect to this track's or master mix's set of effects, click the Anvil Flanger, and
3. Press the Add→ button.
4. To edit the flanger's properties, press Properties.
5. To leave the flanger's properties window open, so you can make adjustments while the song is playing, press the OK button.

The diagram below describes the signal flow through the flanger. A copy of an input signal is delayed, and mixed with the undelayed signal. The output is fed back to the input circuit, as shown in this diagram:

Audio source (microphone guitar, etc.) → Delay → Feedback → Output

The primary characteristic of the flanger is a Low Frequency Oscillator (LFO) that sweeps back and forth altering the Delay. **LFO Rate** controls the frequency of this oscillator and ranges from 0 to 10 Hz, or 10 times per second. The oscillator causes the Delay to range from a minimum of **Delay Time** to a maximum of **Delay Time** + **LFO Depth**. **Intensity** controls how much of the output signal comes from the undelayed source input signal, and how much comes from the delayed signal. **Feedback** controls how much of the output signal gets routed back to and mixed with the input signal. It affects how long the signal takes to die out after the source signal becomes quiet. **LFO Shape** controls the shape of the oscillator. When set to 0%, it acts as a smooth sin wave. When set to 100%, it acts as a triangle wave. When set to 50%, it is half way between a sin wave and a triangle wave. **LFO Phase** only appears for stereo tracks. When set to 0, the left and right channels are in perfect synchronization. When set to 180^0, they are completely out of sync, i.e. the left channel's delay is at a maximum when the right channel's delay is at a minimum, and vice versa. The phase control can control the apparent *width* of the stereo image.

A flanger can add a feeling of motion to a static sound. It can also make a mono sound seem wider, or spread out across the stereo spectrum.

If the Delay Time + LFO Depth reaches 36 milliseconds or longer, a percussion sound can sound like 2 distinct events.

When **Intensity** is set to 20% or less, it makes it sound like a real space. More than that tends to result in an artificial or synthetic sound.

Too much **Feedback** can cause the signal to become metallic; not good if a natural sound is what you're going for.

This effect can result in a **comb filter**, where a large number of frequencies are filtered out of the signal at evenly-spaced intervals across the frequency spectrum. As the LFO alters the delay times, it results in a swept comb filter with peaks and troughs that move and are in a linear harmonic series.

A flanger can cause a single singer to sound like a couple of singers singing slightly different tunes. If two instruments have similar frequencies or pitches, and they are in the same area of the stereo range, a chorus can move one of them out to the side so it is easier to distinguish between the two. The pitch changes are due to the Doppler effect, similar to the pitch change when a train or car is approaching vs. departing.

If **Delay Time** is set to 6 msec, and LFO Depth is set to 4 msec, the delay oscillates between 6 and 10 msec. Shorter delay times cause Flanging and longer times result in a doubling effect or a general thickening of the sound.

Again, the best way to learn what a flanger does is by adding it to a song you have already recorded and playing around with the controls. The current value of all of the controls are saved with your song file, so that every time the song is played, it sounds the same. If you play the song with a different MIDI file player, the effects are not used. To hear the effects on other music players, you need to select Export Mixed Audio from the File menu.