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Introduction

Figure 1 - Regen Tracks View

Regen is at its heart a looper plugin. It features four independent loopers, called **tracks**, that are built up from individually recorded audio segments, called **layers**. Recorded material in the tracks and layers can be manipulated post-recording for creative playback.

All tracks and layers in Regen are stereo. Regen receives stereo input and supports up to 4 stereo output busses.

Regen supports Undo and Redo of recorded material.

Tracks and Layers

A Track is a stack of Layers. A Layer is an individually recorded audio segment. Layers are "mixed" on the fly to produce Track output during playback. Changes to individual layer playback settings (rate,

direction, pan, start offset, level, blend) affect the output of the Track. Changes to Track playback settings affect all layers in the track.

Recording Time and Memory Usage

Regen does not impose a preset maximum recording time. Recorded material is held in memory buffers (i.e., not streamed to/from disk) so the maximum recording time is limited by the available memory of your host. Regen processes audio internally as 64-bit double precision floating point values so a stereo track at 48k sampling rate takes about 0.76 megabytes per second of recording time. A 60 second recording at 48k requires about 46 megabytes of RAM. A Gigabyte of RAM provides about 23 minutes of total recording time at 48k sampling rate. The recording rate defaults to the sampling rate of the host DAW but can be adjusted to conserve memory or for effect.

The Memory Usage Display at the bottom of the plugin GUI shows the amount of RAM in use and the amount of RAM required per second while recording.

Figure 2 - Memory Usage Display

Playback and Recording Focus

Regen can be operated as a simple looper but also provides controls to dive a little deeper and manipulate or creatively replay the recorded material. Regen has two types of track **Track Focus**:

- **Playback Focus** tells which track is affected when controls affecting playback are manipulated.
- **Recording Focus** tells which track gets recorded to when recording begins.

By default the Recording Focus and Playback Focus are synchronized to refer to the same track (when one focus is changed the other changes to match it) thus keeping operation simple and predictable. It is possible and useful to de-synchronize the focus values, especially during a creative playback session, but it can be confusing so use with care.

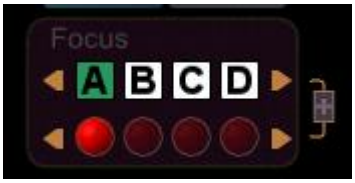

Figure 3 - Playback and Recording Focus

Views

Regen has two main **Views**:

- **Tracks View** shows a summary of the four tracks, A, B, C and D. Each track has Track Summary controls that affect playback of that track.

- **Layers View** shows greater detail about a selected track. The Playback Focus track is shown along with a **Layer Edit** panel. Using the Layers View, individual layers of recorded material may be shifted in time, reversed, panned, gain adjusted, or restored to original (as recorded) state. See the Layer Edit panel section for a description of the Layer Edit panel.

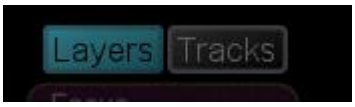

Figure 4 - View Selector

Tracks View

Track Summary Controls

The Track Summary controls affect the playback of a track. The controls affect/scale the values of the individual layers.

Figure 5 - Track Summary Controls

The following table describes the Track Summary controls:

Regen	Regeneration gain, applied on each iteration of the loop. Values less then 1.0 case loop to fade out, values greater than 1.0 cause loop to fade in
Phase	Shifts the starting point of the loop
Blend	Bleed-through from lower layers .. an 'opaqueness' control
Rate	Playback Rate (0.5 .. 2.0).

	You may notice some aliasing artifacts from playback rate changes, depending on the amount of change and the high frequency content of the material being played back. Regen applies internal low-pass filters to reduce the aliasing but the filters are not always sufficient to eliminate all aliasing artifacts.
Dir	Playback Direction
Default	Restore track and layers to default (as recorded) state
Progress Circle	Shows the playback position of the *longest layer* in the track
Level	Output level
Bus	Output Bus (1..4)
Pan	Stereo panorama
+	Inspector Control - click to bring up the Layer View and assign Playback Focus to selected track
|<	Rewind
>	Play
O	Record
M	Mute
S	Solo

Layers View

The Layers View shows details about the track with Playback Focus. The other tracks are displayed in the view with a narrow "sliver" form that shows a few controls useful for playback. Select the Inspector button [+] under a Track to assign it Playback Focus and show its details in the Layers View.

Figure 6 - Layers View

Layer Edit Panel

The Layers View shows the Track Summary controls for the track with Playback Focus. To the right of the Track Summary controls is the Layer Edit panel showing a graphical representation (thumbnails) of the layers in the track, along with up/down arrows to select the **Layer Focus**. To the right of the thumbnails are the Layer Edit Controls that affect the playback of the layer with **Layer Focus**.

Figure 7 - Layer View with Layer Edit Panel

The thumbnails show a graphical representation of the layers in the track. The layers are shown in the order that they were recorded with the oldest/earliest layers at the bottom of the stack. The Gray bars (... goal posts) represent the length of the longest layer in the track. The colored bands of each layer indicate the length of the layer, relative to the longest layer. The red vertical bar represents the start point of a layer. The little square to the left of the layer number indicates which layer is the layer in focus (the layer that is being affected by the layer edit controls).

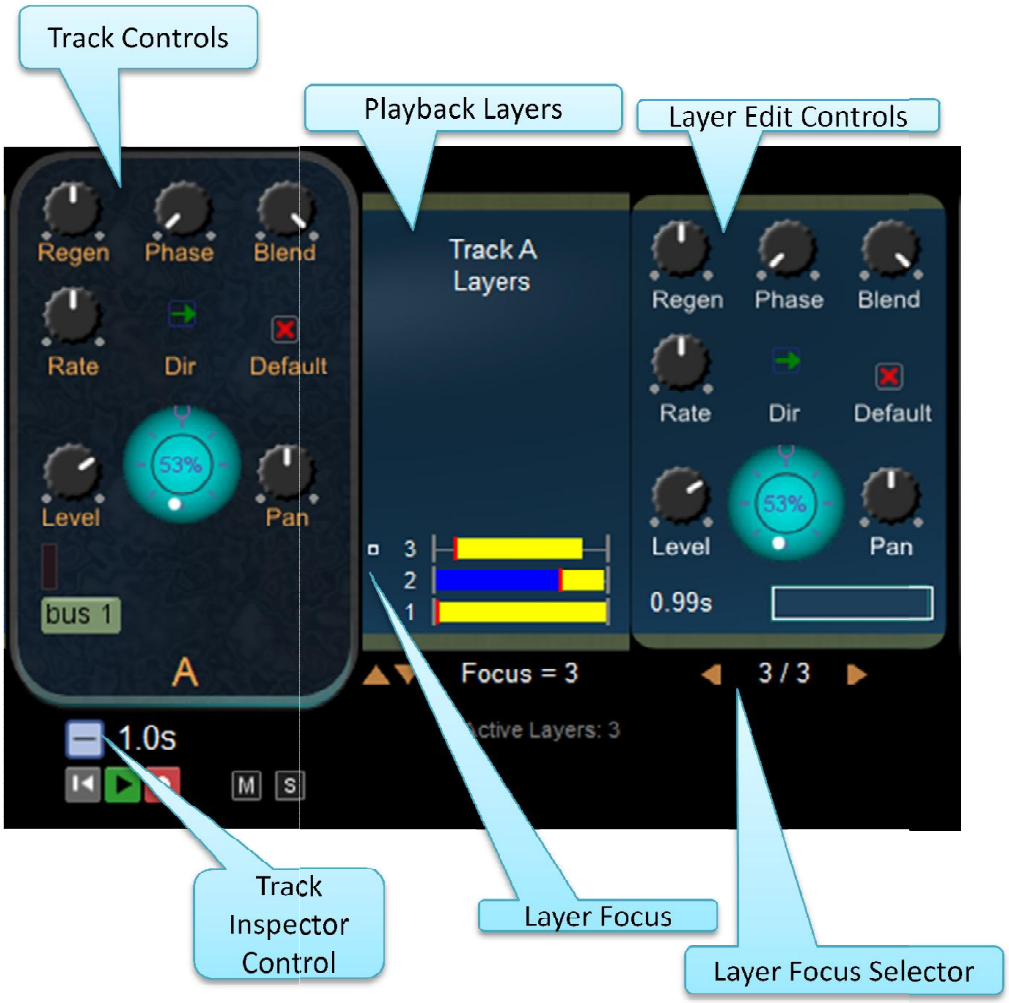

Figure 8 - Layer Edit Panel with Hints

Layer Edit Controls

The following table describes the Layer Edit controls.

Regen	Regeneration gain, applied on each iteration of the loop. Values less than 1.0 case loop to fade out, values greater than 1.0 cause loop to fade in.
Phase	Shifts the starting point of the loop.
Blend	Bleed-through from lower layers, a sort of 'opaqueness' control that controls how much gain reduction is applied to previously recorded layers before mixing them with the layer in focus. A value of 0 blocks out all audio from previously recorded layers for the duration of the layer - this is the value assigned by default when a recording is started in Replace mode. A value of 1 mixes previously recorded layers in with the layer in focus at full gain.
Rate	Playback Rate. Ranges from half to twice the host sampling rate.
Dir	Playback Direction
Default	Restore layer to its default (as recorded) state
Progress Circle	Shows the playback position of the layer

Level	Output level
Pan	Stereo panorama

Recording

To record, set the Recording Focus to the desired track, click the Record button to begin recording, click the Record button again (or click the Stop button) to stop. The **Recording Panel** provides controls that affect the recording and/or set the default values for the recorded material when recording stops.

Figure 9 - Recording Panel

Recording Controls

The following table describes the Recording Panel controls:

Rate	The recording sample rate. Defaults to host sample rate. Can be reduced to conserve memory, or varied during recording for creative effect.
Length	Match Track: limits the recording length to not exceed the length of the longest layer in the track with Recording Focus. When the maximum length is met the recorder continues recording in overdub mode, wrapping at layer end, mixing previous material with new material (see the overdub attenuation). Free Length: the layer length is not limited by the track length. The layer length grows as long as the recording continues.
Blend	Bleed-through from lower layers, a sort of 'opaqueness' control that controls how much gain reduction is applied to previously recorded layers before mixing them with the layer in focus. This value affects playback only and is assigned as the layer default at end of recording. All layers are recorded at nominal gain.
Overdub	The amount of gain reduction to apply to existing material in a layer when recording in Match Track length mode and recording has wrapped the full length of the loop.
Dir	The Playback Direction to assign to the loop for playback.
Level	The Playback Level to assign to the loop for playback
Regen	The Regen gain to assign to the loop for playback
Autoplay	When enabled, a track being recorded starts playback when recording is

	ended. When disabled, the track is stopped when recording is ended.
Waveform	The box above the 'Recording' label shows a very approximate waveform of the recorded material.

Record vs. Replace

Recording and Replacing are similar operations. When Recording, the Blend value for the recorded material is set according to the Blend value in the Recording controls and the recording length mode is set according to the Length mode in the Recording controls. When Replacing, the Blend value for the recorded material is set to 0 to indicate that the layer replaces any previously recorded material (i.e. is 'opaque') and the Length mode is set to match the existing track length.

Undo and Redo

Regen supports Undo and Redo of recorded material. After recording, an Undo operation deactivates the recorded material (effectively silencing it) and a Redo operation reactivates the previously undone material. Undo and Redo are not destructive, you can undo and redo as often as you like. Starting a new recording on a track with undone material is destructive however, all undone material on a Track is discarded when Recording starts.

Multiply and Divide

Regen supports Multiply and Divide operations on recorded material. A multiply operation increases the layer length by the length of the original layer. The layer content is repeated to fill the extra layer length. For example, if a layer is recorded with 2 seconds of material and then multiplied, the layer length is increased to 4 seconds and the original 2 seconds of material is repeated to fill the new length. Multiplying again increases the length by its original size (2 secs) so the layer length would become 6 seconds and the original material is repeated 3 times to fill the multiplied layer length. A Divide is the opposite of a Multiply - the layer length is reduced by its original length.

Quick Loop Controls

The Quick Loop Controls provide controls for simple looping.

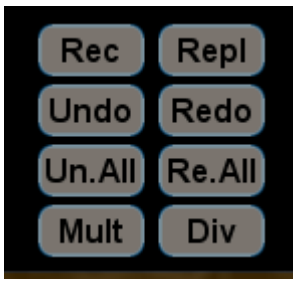

Figure 10 - Looper Controls

Rec	Record
Repl	Replace - records a new layer with Blend set to 0 to suppress material recorded in lower/previous layers.
Undo	Disable the top most active layer
Redo	Re-enable a previously undone layer.
Un.All	Undo all layers
Re.All	Redo all layers
Mult	Multiply the layer in focus
Div	Divide (un-multiply) the layer in focus

Transport

The Transport Controls below the Recording Panel control the playback and recording state of the plugin.

Figure 11 - Transport Controls

The following table describes the Recording Controls:

|<	Rewind
>	Play - starts playback
| |	Pause
[]	Stop
o	Record
-	Replace
Sync to Host	When enabled the transport plays when the host transport plays.

Global Controls

The Global Controls affect all Tracks, regardless of focus.

Figure 12 - Global Controls

The following table describes the Global Controls:

Rate	Playback Rate (0.5 .. 2.0)
Regen	Regeneration Gain
Blend	Gain for mixing lower layers with newer layers
Default	Restore all tracks and layers to their default (as recorded) states

Output Controls

The Output Controls set the dry gain, wet gain and overall level of the plugin output.

Figure 13 - Output Controls

The following table describes the Output Controls:

Dry	The level of the dry input passed through
Dry bus	The output bus to send the dry signal to
Wet	The level of the wet (playback) signal
Level	Overall output level

MIDI Support

Regen reads MIDI control mapping information from the **RegenMidiMap.ini** file in the plugin installation folder. Midi control can be assigned as notes or CC on omni or specific channel per control target.

Installation

Installation

To install Regen:

1. Select the version that is compatible with your system and copy it to your VST DLL directory:
   tcRegen_32.dll is a 32-bit version of Regen (no SSE)
   tcRegen_64.dll is a 64-bit version of Regen (SSE2)
2. Copy the RegenMidiMap.ini file to the same directory.

License

Credits

This plugin was written for the KvR Developer Challenge 2014.

Kudos to the creators of these freeware tools/libs that made it possible for me to make this plugin:

WDL/IPlug Framework - http://www.cockos.com/wdl
KnobMan - http://www.g200kg.com/en/software/knobman.html
SkinMan - http://www.g200kg.com/en/software/skinman.html

History

July 31, 2014 - Version 1.0

Aug 4, 2104 - Version 1.1
- bugfix: each layer has a maximum size of about 2 billion samples (about 13 hours @ 44.1k) to prevent index rollover.