RAGNARÖK

Custom build Performance/Lead Synthesizer

32bit/64bit VST™ plugin for Windows OS

© 2013 - 2014
Björn Arlt, Full Bucket Music
Hans Peter Willems, CrimsonWarlock aka TechnoGremlin

Table of Contents

Introduction & background

RAGNARÖK... what it is, and what it isn't

RAGNARÖK is a software reincarnation of an existing, custom build (and therefore one of a kind) hardware analog synthesizer.

RAGNARÖK is NOT the next big thing in digital synthesis, nor is it a faithfully modeled equivalent of a real hardware analog synthesizer. The RAGNARÖK-synthesizer is basically a standard architecture VA-synthesizer, consisting of an oscillator section running into a dynamically controlled filter that is followed by an envelope-controlled amplifier or output section. It has some additional sound-shaping options by means of an overdrive on the filter output and an additional 7-band static filter (also known as a Graphic EQ).

Where RAGNARÖK shines is in it's combination of 3 stacked and (slightly) detuned oscillators with a divide-down array that replicates these 3 oscillators over four octaves. This means it can do 3 (slightly) detuned oscillators AND 4 octave-tuned oscillators AT THE SAME TIME, the equivalent of 12 oscillators on one voice. The oscillators offer square and pulse waves simultaneously, so even those can be mixed up. In addition to this there is yet another array of square wave oscillators available that are tuned to an interval (default set at a fifth).

Although the original RAGNARÖK was purely monophonic, modern software technology has made it possible to have a polyphonic version now. This adds tremendously to the usefulness of the instrument.

History

The hardware version of RAGNARÖK was build in the early eighties (by Hans Peter), and solely aimed at using on stage. Hence the 'performance/lead' designation on the plugin instrument. In those days, Moog-sounds where still in high demand, and the more oscillators you could stack for a solo-sound, the better it was. A DIY synthesizer kit, called the Chorosynth, played into this idea by delivering the combined stacked and octaved oscillators into a pretty cheap package. However, to keep the price low, there was only an amplitude envelope and no filters whatsoever. It also had no real keyboard but used a stylus on an etched circuit board. The first incarnation of the RAGNARÖK synth was merely the Chorosynth with a bolt-on real keyboard.

After about two years use on stage, the first version was rebuild into a new case, and augmented with several modules from the Elektor Formant Modular synthesizer. It got a very complete multi-pole filter section, real envelope-generators and several other goodies that where available as DIY-kits. Although the Formant Modular was, well... modular, in the RAGNARÖK synthesizer everything was hard-wired for stage use.

After several years the synthesizer was decommissioned and replaced with a Teisco 110F (another beautiful instrument). The hardware RAGNARÖK is still in Hans Peter's possession, but (sadly) no longer in working order.

Collaboration

When Hans Peter (known as CrimsonWarlock on the KVR-forum) asked on the KVR-forum for a developer who would be interested to bring this eighties rarity back to life, secretly he was hoping that Björn (Full Bucket) would take up the challenge. As a user of VST-instruments, Hans Peter really liked the stuff Björn was doing, but additionally it seemed that the RAGNARÖK synthesizer was really fitting into the line of stuff Björn had made so far. To cut a long story short; Björn indeed saw this project as a nice opportunity and the resulting collaboration delivered what you are now looking at.

- DSP-coding by Björn Arlt (Full Bucket Music).

- Synthesizer concept, GUI-design and User-manual by Hans Peter Willems (CrimsonWarlock aka TechnoGremlin).

- Additional functional concepts by Björn Arlt.

- Patch-programming (default bank) by Hans Peter & Björn.

The original RAGNARÖK synthesizer – Image courtesy of Hans Peter Willems.

Oscillator section

The oscillators are actually found in the 'Voice Selection panels' (see next chapter). However, this section has some 'global' setting for the oscillators.

Source Mix

Besides the big stack of oscillators/waves in this synthesizer, there is additional white noise available as a sound source. This caters to percussion sounds, nature sounds (water, wind, thunder), and can add some character to oscillator-based sounds when mixed in subtly.

The 'Source Mix' knob will deliver only oscillator signal when set fully counter clockwise, and only the noise signal when set fully clockwise. In between you can mix both signals to the desired mix-ratio.

Pitch Modulation

This part of the oscillator section has the setting for modulating the oscillator pitch with an LFO (low frequency oscillator). Because the RAGNARÖK synth is aimed at performance play and much less (or totally not, depending on your view) at experimental sounds and/or sound-effects, the LFO has only one waveform: sine-wave. This is the traditional waveform used for vibrato.

Speed: This sets the frequency of the LFO, in effect the speed of the vibrato-effect. The speed can be set between 0.001 Hz and 100 Hz.

Amount: This sets the 'depth' of the vibrato-effect, also known as the modulation depth. Oscillator modulation depth can be set from zero (no modulation) to +/- 12 semitones (one full octave up and down).

Ramp: This is a delay time that makes the vibrato-effect fade in after a short delay. This makes it possible to create mod-wheel like vibrato effect without actually using a mod-wheel. As a side-note; the original RAGNARÖK did not have a mod-wheel and this functionality was used as a substitute for that.

NOTE: The LFO signal is also available in the Filter-section for Filter Cutoff modulation. Both 'Speed' and 'Ramp' are affecting the Filter modulation when used there.

Voice Selection panels

The voice selection panels is where the original architecture of the hardware (and the underlying Chorosynth) is most visible, and specific for the sound character of RAGNARÖK. There are separate sections for the waveforms (square and pulse), interval tones and multi-voice option.

Square Wave & Pulse Wave

There are four octaves available for both square waves and pulse waves. You can mix both octaves and waves at will. Stacking the same octave for both square and pulse gives a different timbre than either one of those apart.

Interval

The interval octave buttons add an additional (square) voice for the selected octave, that is by default set to an interval of a 'fifth'. You can change the interval in the 'settings' section with the 'int' knob. The interval can also be set to (close to) the base tuning, for additional chorus/phaser like effects.

Multi Voice

This is the most important section of the voices: it handles RAGNARÖK's 3-voice spread/detune option for all the square and pulse voices. By switching on an octave in this section, it will set both the square and pulse for that octave (if in use) to 3 oscillators that are slightly detuned for a big chorus effect. The amount of detuning can be set in the settings section with the 'spr.' knob. This setting is patch dependent.

Filter Envelope & Volume Envelope sections

The filter envelope generator and volume envelope generator are identical and hard-wired to their respective destinations. The envelope generators are of the traditional ADSR-type, meaning Attack, Decay, Sustain and Release. They can be switched from ADSR to AD mode for percussive sounds.

Attack

Sets the attack-time of the envelope. This is basically the time it takes for the sound to go to full volume and/or filter cutoff, from the start of a note.

Decay

The decay is the time it takes to 'fall back' to a lower level (of sustain), directly after the 'attack' part reaches it's maximum level. Decay is used for example for percussive and brass-like sounds, or anything that needs some sort of 'peak' in the sound or volume.

NOTE: This setting is obviously only 'doing something' if 'sustain' is set to less then 100% (full right). If sustain is set to full, there is no level to 'decay to'.

Sustain

The sustain level is the level where the envelope will 'hold', after the two previous stages, when a note is held for a longer time. You can set the sustain from 0% (meaning 'no sustain' but sometimes useful) to 100% meaning the note is sustained at it's maximum level of volume and/or timbre.

Release

The release time is the time it takes the envelope to 'fall back' to zero, after the release of the note. It is used when we want a sound to (slowly) fade away when the keys are released, instead of abruptly being 'switched off' after the note ending.

ADSR/AD switch

This switch sets the envelope to either ADSR mode (default) or AD mode.

ADSR-mode: The envelope behaves basically as described above. When combined with a zero sustain level you can have a different release based on how long you hold a note. Holding a note will give you the decay time, releasing the note before the decay time is done will go to the release time.

AD-mode: This switches off the sustain level and gives you only the decay time. When combined with a sustain level higher then zero, this switch let you move quickly (performance) between a percussive or a sustained version of the sound.
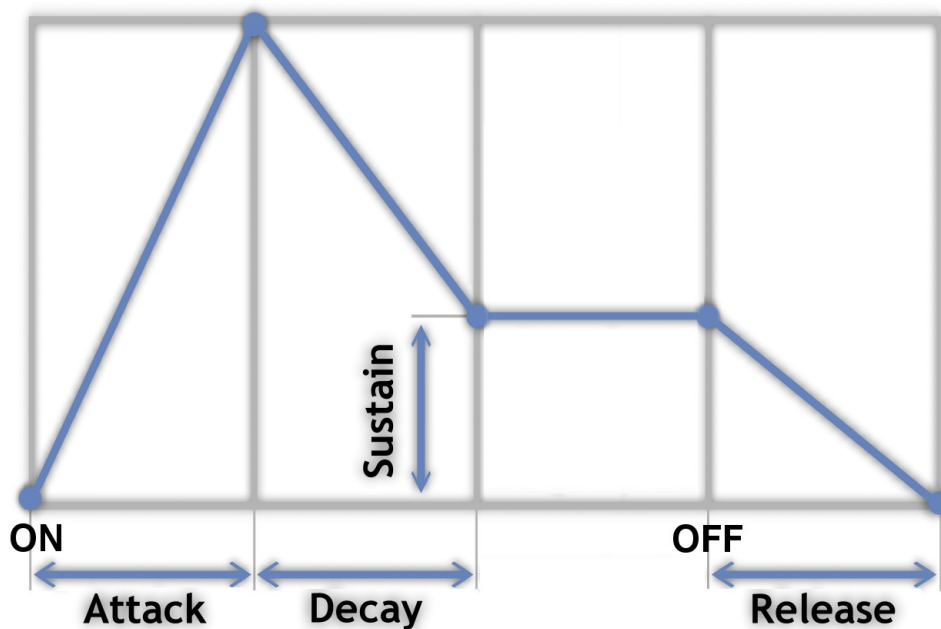
The typical ADSR-envelope curve.

Dynamic Filter section

The dynamic filter is a traditional multi-pole VCF architecture with several modulation options and variable key-tracking. In addition the filter has an overdrive-stage on the output, before going in to the 7-band static filter.

dB/oct. Switch

You can set the filter between 1 and 4 poles, meaning you can choose 6, 12, 18 or 24 dB slope for the filter cutoff. The 24 dB filter sound was made famous mainly by the Moog synthesizers, while 18 and 12 dB are more sounding like (old) Korg and Roland synthesizers. Basically more poles gives a 'rounder' sound while less poles gives a more aggressive and electronic sound.

HP/LP switch

You can choose between a high-pass filter and a low-pass filter (default). Both filter types cater for completely different sounds, especially in combination with the envelope generator.

Cutoff

The cutoff frequency determines the 'brightness' (or lack thereof) of the sound. In combination with modulation by the envelope and/or the LFO, all kinds of very characteristic sounds can be made. The cutoff together with the envelope modulation basically define the fundamental character of a patch/sound.

Reso

Resonance (Reso) determines how much the frequency at the cutoff point is hyped. High resonance settings gives very aggressive and electronic sounding effects.

NOTE: The filter is capable of self-oscillation.

Key Track

This knob determines how much the cutoff frequency is 'tracking' with the keyboard. When using 'key track', the filter will adjust the cutoff frequency when playing higher or lower notes. This is mainly used for lead sounds, but can also be very effective when playing polyphonic with high notes and accompanying low notes that you want to sound 'lower'.

Modulation

LFO: This knob sets the amount of LFO-modulation for the cutoff frequency. You can use this for wah-wah effects and more subtle spectral movement in a sound.

Envelope: This knob sets the amount of envelope modulation for the cutoff frequency. This knob has two directions: you can set the envelope signal as normal or as inverted. When the envelope is inverted, all envelope slopes move in opposite direction (attack goes down, decay goes up, etc.).

Overdrive

RAGNARÖK has a nice overdrive stage at the end of the filter, to add some grit and dirt if needed. This gives traditional overdrive/distortion like sounds, but can also be used to get even more aggressive, ring-modulator like sounds when combined with the interval setting for the voice selection.

NOTE: There is only one overdrive that is shared by all voices. This is similar to having an overdive-effect on the output of the synthesizer. The hardware-version of RAGNARÖK was actually used in combination with an overdrive stomp-box.

Output

This is just a final output level that sets the amount of signal that is coming out of the synthesizer. With all the voice stacking, filter options and distortion, a sound can get pretty loud and you might want/need to dial it down to prevent the input channel of your DAW from clipping.

Static 7-band Filter section
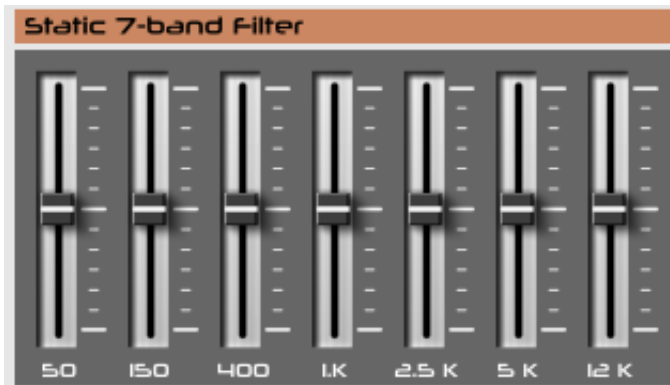
The static 7-band filter is basically a tuned 7-band EQ. Frequency bands are tuned for sound shaping as opposed to basic equalization duties, although it can obviously be used that way as well.

The filter works and behaves as a 'normal' graphic EQ. The frequency response is flat when the sliders are at the mid-position. Above the mid-position frequencies are boosted, while below the mid-position they are dampened.

NOTE¹: Although there are no modulation options for the 7-band filter within RAGNARÖK, all parameters of the synthesizer are externally automate-able.

NOTE²: There is only one 7-band filter that is shared by all the voices.

Performance section

The performance section holds all the settings for keyboard performance (portamento, legato and envelope re-trigger) and external trigger/repeat options.

Portamento

Speed: This knob sets the time it takes to 'glide' from one note to another, when portamento is active (depending on the legato switch, see below).

Legato: With this switched on, you only have portamento when playing 'legato', meaning 'holding the previous note while playing the new note'. This is most obvious when playing monophonic or with '1 voice' set.

NOTE: RAGNARÖK has polyphonic portamento. However, this is pretty hard to achieve with more then 4 voices, so legato should better be switched off in that case.

Envelope

Mode switch: This sets the 'trigger behavior' of the synthesizer, meaning how the envelopes are being triggered.

- **Normal** means that a note plays when a key is played (or sequenced).

- **Repeat** sets the key-trigger in repeat from the LFO. The speed of the repeating notes is set with the LFO-speed knob. The length of the repeated notes is set with the 'len.' knob in the settings section.

- **Host** sets the repeat locked to the host tempo. Same as 'repeat', the length of the repeated notes is set with the 'len.' knob in the settings section. Also, the host sync can be set to several time signatures with the … option in the settings popup-menu (button besides the 'len.' knob in the settings section).

NOTE: The repeat and host sync options only sync the tempo of the repeated notes but NOT the exact timing of the notes: this makes for the possibility of creating arpegiator-like patterns in a performance, based on the timing of the notes played (or sequenced). Try this with any (slow) repeat or host sync and playing notes with different timings (use polyphony) to hear the effect and experiment with the possibilities.

Retrig switch (re-trigger): This switch determines if the envelopes are re-triggered when a new note is played in legato mode. Re-trigger 'on' means that any noted played will re-trigger the envelopes, off means that the envelopes will only re-trigger when all previous notes are released.

NOTE: Retrig also works in polyphonic mode, but might be hard to use with more then 4 voices.

Voices section

The voices section sets the amount of available voices for the synthesizer. Using less voices means using less CPU for the synthesizer. Setting this to '1' voice means the synthesizer behaves as a monophonic synthesizer, which activates all the portamento, legato and re-trigger options in the performance section.

Voices amount can be set to several presets: 1 (monophonic), 2, 4, 8, 16, 32 and 64.

Patch Memory
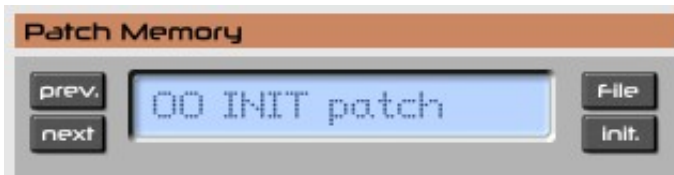
The patch management section makes it easy to manage and organize patches inside a (loaded) patch bank. Especially when doing sound-design or tweaks, having patch management inside RAGNARÖK makes it simple to name, rename and organize patches.

Prev./Next buttons

Especially for auditioning patch banks, these buttons make it easy to quickly step through the available sounds in a (loaded) patch bank. Previous and Next are self-explanatory.

Bank button

IMPORTANT: File-related functions (load/save) are <u>not working when RAGNARÖK is used in Reaper</u> DAW (and probably other DAW software that has it's own patch management). In this case you need to use the patch/bank load/save options in Reaper's own patch manager.

Copy Program: This option copies the current patch to an internal clipboard, so you can paste it into another location in the bank. Handy for rearranging and if you want to start a new patch based on an existing patch, without overwriting the existing patch.

Paste Program: This option is only active if the 'copy' function was used and the internal clipboard holds a copied patch. Using this option will write the copied patch into the currently selected slot.

NOTE: you get a confirmation warning, asking if you are sure to overwrite the currently selected patch.

Load Program: If your DAW does not support patch management, you can use this option to load an individual patch in FXP-format.

Save Program: This option let you save the currently loaded patch as an individual FXP-file. Make sure to name the patch first; the FXP-filename is NOT the same as the patch name (although you would probably name them similar).

Load Bank: This option will load a full RAGNARÖK patch-bank in FXB-format. This will replace the default patch-bank in the currently loaded instance only.

Save Bank: This option will save the complete patch-bank from RAGNARÖK into a standard FXB-file.

Init Program: This option will reset all controls to the default 'INIT' setting. The INIT-setting is meant to help when creating new sounds from scratch, and gives a 'clean slate' to start from.

Reload Configuration: RAGNARÖK comes with a INI-file that makes it possible to have a default mapping for MIDI-controllers (also see the manual section: INI-file). This menu-option will reload the INI-file in case you made changes to it and want to use/test it right away.

Init. Button

This button initializes the current patch/position in the bank, so you can start a new sound from scratch. All synthesizer settings are set to a default position and the actual patch is renamed to 'INIT'.

Renaming patches

You can simply rename a patch by clicking in the name-display. ESC-key while editing reverts to the name that was there, ENTER-key writes the changed name into the patch-bank.

NOTE: Writing the patch name into the bank does not mean 'storing on disk'. You need to save the patch/bank to store any changes (name and/or parameters) for later retrieval.

Settings

The settings section contains several options for performance, host-sync and basic settings for the synthesizer like pitchbend-range and base-tuning. There are also setting that influence the spread/detune and interval options in the voice-selection panels.

Tun.

Tuning: This is the basic tuning of the instrument. Default tuning is A-440Hz. Tuning is stored for each patch, so you need to (re)tune each patch that you want to use with that tuning.

Len.

Trigger length: The knob sets the trigger length (duty-cycle) of the repeat function in the performance section. This is equal to the time a key is pressed if you would repeat a note on a keyboard.

Int.

Interval: This knob sets the note-interval for the 'Interval' voices in the voice selection panel. Default interval is a 'fifth'. You can tune the interval back to center tuning (and both above or under that) for additional chorus-like effects in addition to the 'Spread' option (see below).

Spr.

Spread/Detune: This is where the RAGNARÖK magic happens: the knob sets the spread/detune of the three oscillators (for each octave) that you can switch on in the 'multi-voice' section of the voice selection panels. Detune goes from 'exact tune' to 1 semitone detune where the three voices are detuned at equal distances between -/+ 1 semitone.

Button […]

The settings-button opens a popup-menu with several options. These options are also patch-dependant.

Sync-to-Host Rate: This sets the timing 'interval' in relation to the host-sync trigger (if used). There are many options including triplets.

Pitch Bend Range: This sets the maximum range of the pitchbend wheel, in semitones. Available options are 2 (one whole note), 3, 5, 7 and 12 (one full octave).

Mod Wheel → Filter: This sets the 'amount' of how much the mod-wheel influences the filter-cutoff frequency. The mod-wheel adds or subtracts from the value set by the filter-cutoff knob and the other modulation signals (envelope and LFO). There are four slopes available: 25%, 50%, 75% and 100%.

Mod Wheel → LFO to Osc: This switches the mod-wheel to control the LFO-to-Oscillator behavior. This works in a specific way:

- If the 'pitch modulation' amount is zero, the mod-wheel has no effect.

- If there is a certain amount of 'pitch modulation' set, the mod-wheel modulates between zero and the set amount.

- If there is a 'ramp-time' set, the mod-wheel again will modulate between zero and the set amount of 'pitch-modulation'. However, the mod-wheel takes the ramp-time into account, meaning there is zero mod-wheel influence at the start of the ramp-time, going up to the full pitch-modulation amount at the end of the ramp-time.

Mod Wheel → LFO to Filter: This switches the mod-wheel to control the LFO-to-Filter behavior. This works in a specific way:

- If the 'LFO modulation' (in the filter-section) amount is zero, the mod-wheel has no effect.

- If there is a certain amount of 'LFO modulation' set, the mod-wheel modulates between zero and the set amount.

- If there is a 'ramp-time' set, the mod-wheel again will modulate between zero and the set amount of 'LFO-modulation'. However, the mod-wheel takes the ramp-time into account, meaning there is zero mod-wheel influence at the start of the ramp-time, going up to the full LFO-modulation amount at the end of the ramp-time.

INI-file

RAGNARÖK is able to read some settings from a configuration file (ragnarok.ini), located in the same directory as the RAGNARÖK VST DLL (ragnarok.dll or ragnarok64.dll) itself. After you have edited this INI file in a text editor, you have to reload it using the Reload Configuration command from the File menu (see section Patch Memory).

NOTE: If you don't want automatic MIDI-CC mapping, for example when you want to use the parameter learn function in your DAW, simply remove or comment-out all the mappings in the INI-file.

MIDI Control Change Messages

All parameters of RAGNARÖK can be controlled by MIDI controllers, or more precise: Each MIDI controller (except Modulation Wheel and Sustain Pedal) can control one of RAGNARÖK's parameters. The mapping is defined in the ragnarok.ini for example like this:

```
[MIDI Control]
# General Purpose controllers
CC16 = 2  # Synth Volume
CC17 = 4  # Strings Volume
CC18 = 44 # Delay Time
CC19 = 45 # Delay Feedback
# trying to follow GM2 definitions here ;-)
CC7  = 1  # Volume
CC8  = 3  # Synth Pan
CC10 = 5  # Strings Pan
...
```

The syntax is straightforward:

```
CC<controller number> = <parameter ID>
```

Given the above example, controller 7 directly controls the overall Volume parameter, controller 44 the Delay Time etc. As you can see, comments are introduced by the Pound sign (#); they are here just for description purposes and completely optional. The parameter ID of one of the RAGNARÖK's parameters is given in the section Parameters below. Note that the controller number can run from 0 to 119, with the exception of 1 (Modulation Wheel) and 64 (Sustain Pedal); the latter two are simply ignored.

Parameters

ID	parameter	ID	parameter
0	Polyphony	30	Filter Envelope amount
1	Portamento	31	Filter LFO amount
2	Legato (Portamento)	32	Filter Key track
3	Pitch Bend Range	33	LFO Rate
4	Volume	34	LFO Ramp time (delay)
5	Master Tune	35	Envelope Trigger mode
6	Spread/detune	36	Envelope Trigger length
7	Interval Tune	37	Envelope Re-trigger on/off
8	Vibrato amount (LFO → Pitch)	38	Filter Envelope mode (AD/ADSR)
9	Square 16 on/off	39	Filter Envelope attack (time)
10	Square 8 on/off	40	Filter Envelope decay (time)
11	Square 4 on/off	41	Filter Envelope sustain (level)
12	Square 2 on/off	42	Filter Envelope release (time)
13	Pulse 16 on/off	43	Amp Envelope mode (AD/ADSR)
14	Pulse 8 on/off	44	Amp Envelope attack (time)
15	Pulse 4 on/off	45	Amp Envelope decay (time)
16	Pulse 2 on/off	46	Amp Envelope sustain (level)
17	Interval 16 on/off	47	Amp Envelope release (time)
18	Interval 8 on/off	48	Overdrive
19	Interval 4 on/off	49	EQ1 Gain
20	Interval 2 on/off	50	EQ2 Gain
21	Multivoice 16 on/off	51	EQ3 Gain
22	Multivoice 8 on/off	52	EQ4 Gain
23	Multivoice 4 on/off	53	EQ5 Gain
24	Multivoice 2 on/off	54	EQ6 Gain
25	Osc/Noise mix	55	EQ7 Gain
26	Filter Mode	56	Sync-to-host Rate
27	Filter Poles	57	Mod-wheel to Pitch modulation (Osc)
28	Filter Cutoff	58	Mod-wheel to Filter LFO modulation
29	Filter Resonance	59	Mod-wheel to Filter cutoff

Frequently Asked Questions

How to install RAGNARÖK (32 bit)?

Simply copy the ragnarok.dll and ragnarok.ini files to your preferred VST-directory and make sure your DAW is pointing to this directory for loading VST-plugins.

How to install RAGNARÖK (64 bit)?

Simply copy the ragnarok64.dll and ragnarok.ini files to your preferred VST-directory and make sure your DAW is pointing to this directory for loading VST-plugins.

How to install RAGNARÖK on the V-Machine?

1. Make sure that you have installed the latest V-Machine firmware and VFX software (available from www.smproaudio.com). RAGNARÖK is known to work with version 2.0.20101204. :-)

2. I will not take any responsibility if the following install procedure does not work for you, corrupts or damages your V-Machine, or bores you! :-P
   I do have a V-Machine and tested RAGNARÖK against it. Have faith! ;-)

3. Export the files ragnarok.dll, ragnarok.ini, and ragnarok.vfxwizard from the ZIP archive to a temporary folder on your PC/Mac. Run the VFX software and import the ragnarok.dll plug-in from this folder; select the ragnarok.vfxwizard under the Wizard File option (this will ensure that the ragnarok.ini is copied to the V-Machine as well).

4. Create a preset for your V-Machine using RAGNARÖK and you're done!

Why is there no saw and no triangle/sine available?

The main component of the hardware RAGNARÖK was a DIY-kit called Chorosynth. This was specifically aimed a doing large lead-sounds with three slightly detuned oscillators. The original designers of that synth coupled the fact that triangle/sine waves where not (at that time) obvious choices for synth-leads, to the technical choice to use divide-down circuits (which where cheap to implement) and not implement wave-shaping (which was pretty costly in hardware back then, and still is) to recreate sine/triangle waves. This technical implication also regarded saw-waves by the way. As we decided that the 'new' RAGNARÖK should be close to it's hardware precedent, it also has only square and pulse waves.

Why does RAGNARÖK not use keyboard velocity and/or aftertouch?

We have thought about implementing at least velocity, but finally decided against it because it would have taken the software too far away from the original hardware specification.

The RAGNARÖK logo takes up a lot of space… ?

This has been discussed (on the KVR-forum) at least briefly: The RAGNARÖK GUI is not really that big (there are much bigger VST GUIs around), and the controls are already nicely spaced. The GUI is certainly not crowded. So taking it off to make space for something else didn't make much sense. The choices made for the GUI (and the logo) are very much based on the original hardware: knobs and switches are oriented very close to the original hardware faceplate, and adding the patch-management section simple created the place for the logo.

Release notes

Version 1.0

- Initial stable release.