POCAS

Minimal Manual

1. Introduction

POCAS is a VST instrument which combines additive synthesis with a chaotic particle system as a comprehensive modulation generator. It is written by Alexis Glass and distributed through dsp.mutagene.net. The interface for version 0.9 is shown in figure 1.
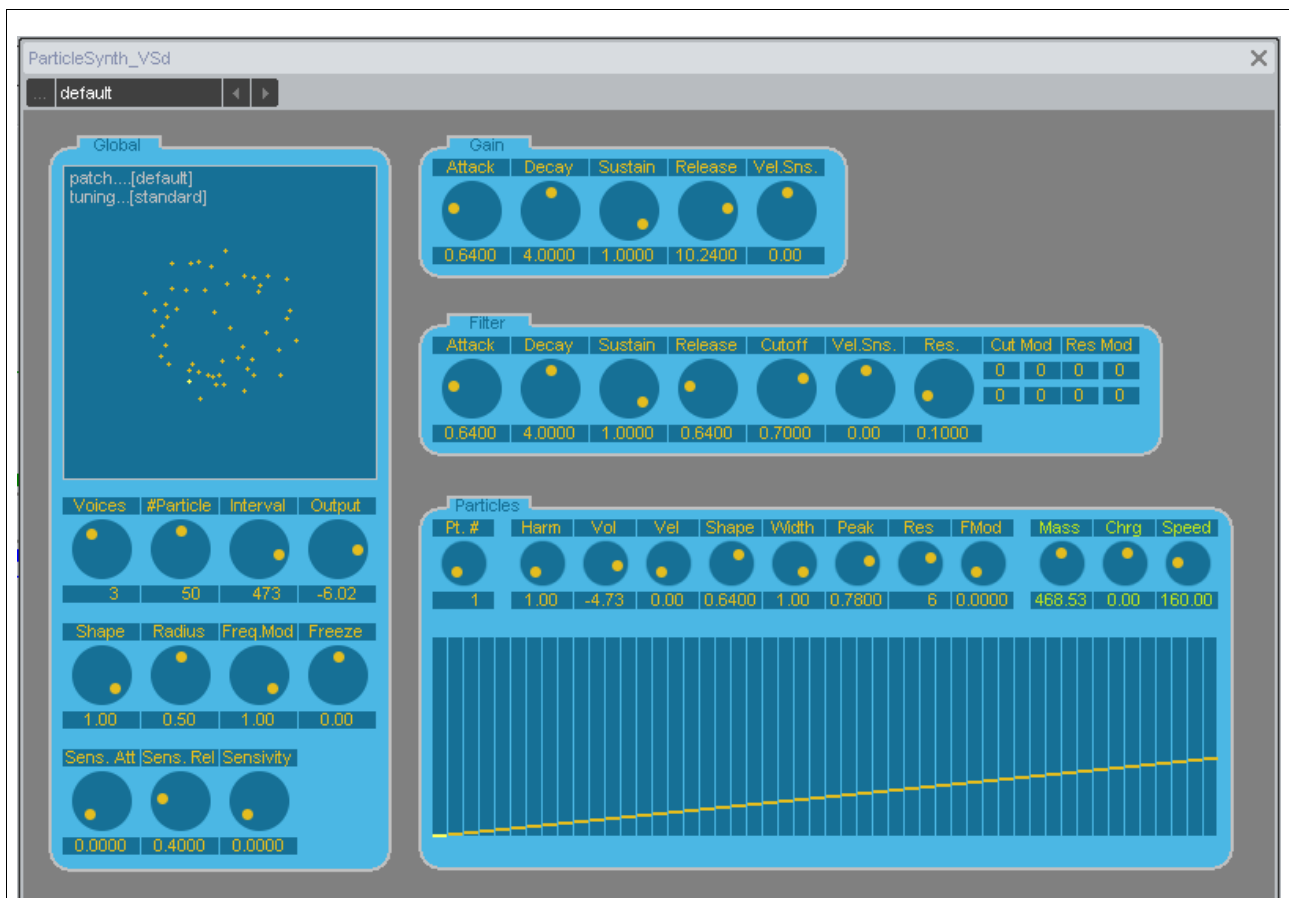

Illustration 1: POCAS main interface (v0.9).

The interface is divded into 4 main panels, **Global**, **Gain**, **Filter**, and **Particles**. The **Global** panel contains controls for global parameters such as the maximum number of voices, the number of particles to be used, the output gain, etc.. The **Gain** panel has controls for an ADSR which is applied to per-voice gain, the **Filter** likewise, along with **Cutoff** and **Resonance**, and the **Particles** panel contains controls for particle/partial properties.

2. Global controls

Voices	Maximum number of simultaneous voices (instrument polyphony)
# Particle	The number of particles (=partials) to be used. More partials can create more

	complex sounds, but requires more CPU and, depending on settings, can create sounds that are simply too chaotic.
Interval	The number of samples in between updates of the particle system simulation. A value of one means that for every sample of audio generated, the particle simulation is updated. 1024 means that the particle simulation is updated once every 1024 samples of audio.
Output	The output gain.
Shape	Partials can take on individual "Shapes" between sine wave and square waves. The global "Shape" control provides a single control by which to scale the per-partial shape levels. See the Particle panel section for more detail.
Radius	Each particle/partial is, via the Particle panel, assigned a radius which corresponds to it having a maximum volume. The global radius allows you to quickly scale all of these radii. Set it to 0 to make particles reach maximum volume when they intersect the origin, or set it (and the corresponding per-partical control) to 1 to make the particle to reach maximum volume when it is furthest from the origin.
Freq.Mod.	Partials can be frequency modulated by the corresponding particle's position (x coordinate, intuitively enough...). Freq. Mod scales the frequency modulation being applied to all partials. If none of the partials have frequency modulation enabled via the particle panel, this control will do nothing.
Freeze	Freeze allows you to progressively freeze particle movement to either the x or y axis. With careful particle placement (not possible with POCAS without painful XML editing) this could allow rough physical modelling of e.g. strings. Practically speaking, it can allow systems with a greater degree of periodicity to be created by forcing each particle to follow a one-dimensional trajectory in the 2-d space.
Sens. Att.	This is the attack time of the envelope follower used for the Sensitivity control.
Sens. Rel.	This is the release time for the enelope follower used for the Sensitivity control.
Sensitivity	Sensitivity allows the user to modulate the "speed" of the system by the amplitude of the synthesizer's output. Using this control, you can make it so that systems become more chaotic the louder they get (or, in some cases, less chaotic).

The system view, in which you can see + and – signs indicating the various charged particles' positions, is also home to a useful context menu, shown in Illustration 2.
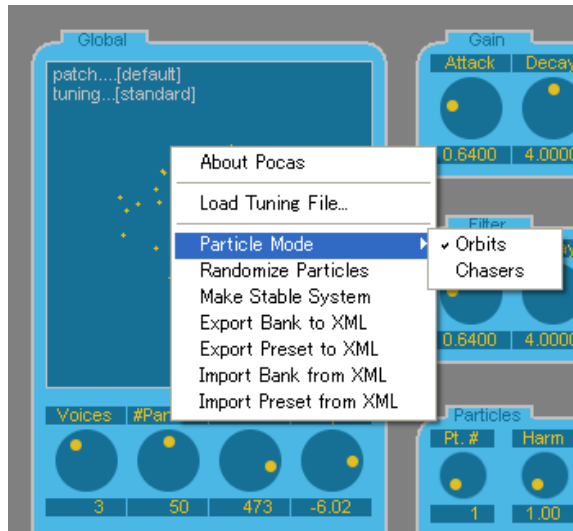
Illustration 2: Right-click in the system view to open a utility context menu.

Load Tuning File... opens up a file browser from which you can select a .TUN file for arbitrary microtuning.

Under the **Particle Mode** submenu, you can select from two basic modes – **Orbits** and **Chasers**. In **Orbits**, all particles are subject to a central attractor (like a black hole) and all particle charges act on all other particle charges. In **Chasers**, the central attractor only acts on the first particle, and electric forces only act between consecutive particles (i.e., the force caused by the charges of particles 1 and 2 acts on particle #2, between 2 and 3 acts on particle #3, and so on). Furthermore, whereas in **Orbits** mode, where opposites attract and likes repel, in **Chasers** mode, likes attract and opposites repel. So if you want all the particles to cluster around, following each other, make them all positive or all negative.

Randomize Particles gives all the particles random positions and velocities within the particle box, and **Make Stable System** makes a (barely) stable orbiting system IF the mode is set to **Orbits** and speed/charge settings are not extreme.

3. Gain

The **Gain** panel contains controls for an ADSR envelope, along with velocity sensitivity for the EG. These are quite standard, and will not be documented here.

4. Filter

The **Filter** panel contains controsl for an ADSR envelope, along with cutoff and resonance controls. In addition, there is a **Cut Mod** and a **Res Mod** matrix by which you can set front-right, front-left, back-right, and back-left modulation of cutoff frequency and resonance. Right click on a box here to choose the particle which will modulate the cutoff or resonance, left click and drag up/down to set the amount of modulation.
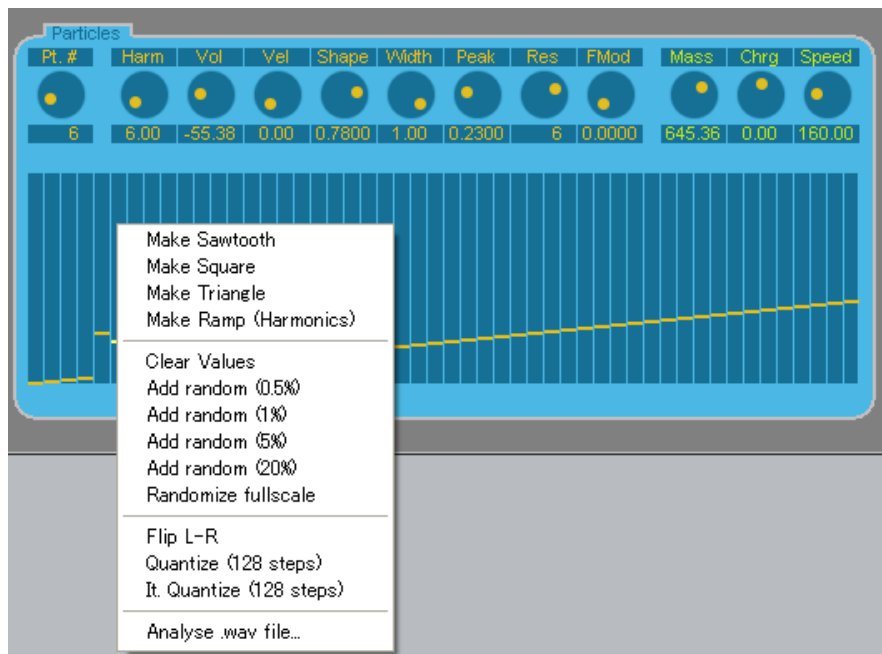
5. Particle

The **Particle** panel sets parameters corresponding to particle/partials used in the simulation/synthesis. Along the top are knob controls, allowing you to see at a glance the various

parameter settings for the current particle, while the lower portion of the panel has an edit control which allows you to edit the current parameter over all particles. (e.g., if the last selected parameter was **Vol** (volume), the control at the bottom shows the volumes for each of the partials.

Pt #	Selects the particle to be edited (the properties of which will be reflected in the other knobs across the top of the Particle panel)
Harm	The ratio of the partial, as compared to the fundamental frequency defined in the .TUN tuning file.
Vol	The level/volume of the partial
Vel	Velocity sensititivity of the partial level
Shape	0 = a sine wave, 1 = something like a square wave
Width	The stereo spread of the panning of the partial, as modulated by the particle's position. Useful e.g. for more stable timbres, it might be desirable to have decreased stereo width for the lower partials.
Peak	Corresponds to the "Radius" control in the Global panel; sets the radius at which the volume reaches it's peak level.
Res	The rate at which volume falls off from the peak level. Make this 0 to make volume constant for all positions, increase it to make partial volume high dependent on particle position.
Fmod	Frequency modulation of the partial. See Global for more details.
Mass	Mass of the particle. Force = Mass * Aceleration; massive particles accelerate more slowly due to the influence of other charged particles.
Charge	Particle charge. Note that in Orbits mode, negatives repel negatives and positives repel positives, but in Chasers mode negatives attract negatives and positives attract positives.
Speed	Speed is a bit of a cheat, allowing you to increase or decrease the speed of any given particle inside of the simulation without changing its mass or charge.

Right clicking on the bar conrol at the bottom of the panel brings up a context menu, as seen in Illustration 3.

Illustration 3: Context menu for particle/partial settings.

The first three options, **Make Sawtooth**, **Make Square** and **Make Triangle** set the harmonic ratios and volume settings so that (all else being equal – without modulation) the sound produced will be a sawtooth, square or triangle wave. **Make Ramp** simply sets the harmonics to increasing hole number ratio values (1,2,3,4...). In the next section, **Clear Values** sets all the particles to the current parameter's default value. For Harmonics, this would be 1, for Shape it would be 0, and so on. The various **Add Random ...**/**Randomize Fullscale** add some random perturbation. **Flip L-R** flips left-right, **Quantize (128 steps)** is primarily for the harmonics parameter, so that you can force all the values to lock to the nearest whole number harmonic ratio. **Iterative Quantize** is similar, but only moves 20% of the way there, allowing you to get arbitrarily close to a whole number ratio without actual making the values entirely harmonic.

Finally, **Analyse .wav file** sets the harmonic levels from a .WAVfile. It's not exactly precise, is unlikely to sound much like the .WAV file analysed, but can be a quickway to get some new timbres.

6. Miscellaneous

Midi Learn can be enabled for a control by clicking on its label and selecting **Midi Learn**. This is only enabled for the knob controls, not the bar controller used for setting multiple particle/partials at once.