

SOUNDMORPH

DUST

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Introduction

Dust is a synthesizer and effect plugin based on a real-time particle simulation, where each particle is a separate granulating sound source. The motion of each particle is determined by the *flow field*, which is a position and time varying function that determines the force applied to each particle at each point - just like how the flow of a river determines the path of a leaf floating down it.

Each particle emits a sound based on a granular resynthesis of either a loaded sample or a real-time audio input, and is binaurally panned according to its position allowing for the creation of rich, three-dimensional textures and soundscapes.

Installation

1. Download Dust from within your SoundMorph account.
2. Launch the PC or Mac installer depending on your system, and follow the instructions from there.
3. To activate, launch Dust and enter your serial number in the Activation Window that appears on launch. You can find your Serial Number from within your SoundMorph Account in the 'Your Products' section (underneath the Dust download link).

System Requirements

An Intel® Mac with Mac OS X 10.9 (or later), **OR** a PC with Windows 7 (or later); Multicore processor.

Key Concepts

Particles.

In Dust, each particle is a distinct granular synthesizer. Granular synthesis is a method of sound generation in which a source sound is split up into smaller *grains* which are then repitched and repositioned arbitrarily to form another sound. For more information, see this video.

The audio output of each particle is panned binaurally based on the particle's position relative to the center, with up and down in the simulation corresponding to forward and backward in the sound field.

The particle will stay moving around the flow field for a time given by its amplitude envelope, after which it is removed from the simulation and can no longer be heard.

All parameters of the particle sound can be modulated per-particle based on properties of the particle's motion, such as the speed, the x and y position and the distance from the center.

Particle Emitters

Particles are created by *particle emitters* which are little particle factories that can be independently positioned around the simulation space. Emitters emit particles either automatically based on a given frequency, or triggered manually based on MIDI input. When a particle is created, its initial properties are set by the emitter that produced it, such as the initial particle speed and direction, or granulizer parameters.

There are eight emitters in total.

Flow Field

The flow field is a two-dimensional force field that determines how the particles move around the space. The flow field is defined by both a set of *effectors* and an equation.

Effectors are points in space that attract or repel the particles, similar to customisable magnets. Effectors can be individually positioned and each one has a customizable *strength* and *fall-off*. The strength represents how much particles are attracted or repelled by the effector - a positive strength repels and a negative strength attracts. The fall-off determines the reach of the effector's influence.

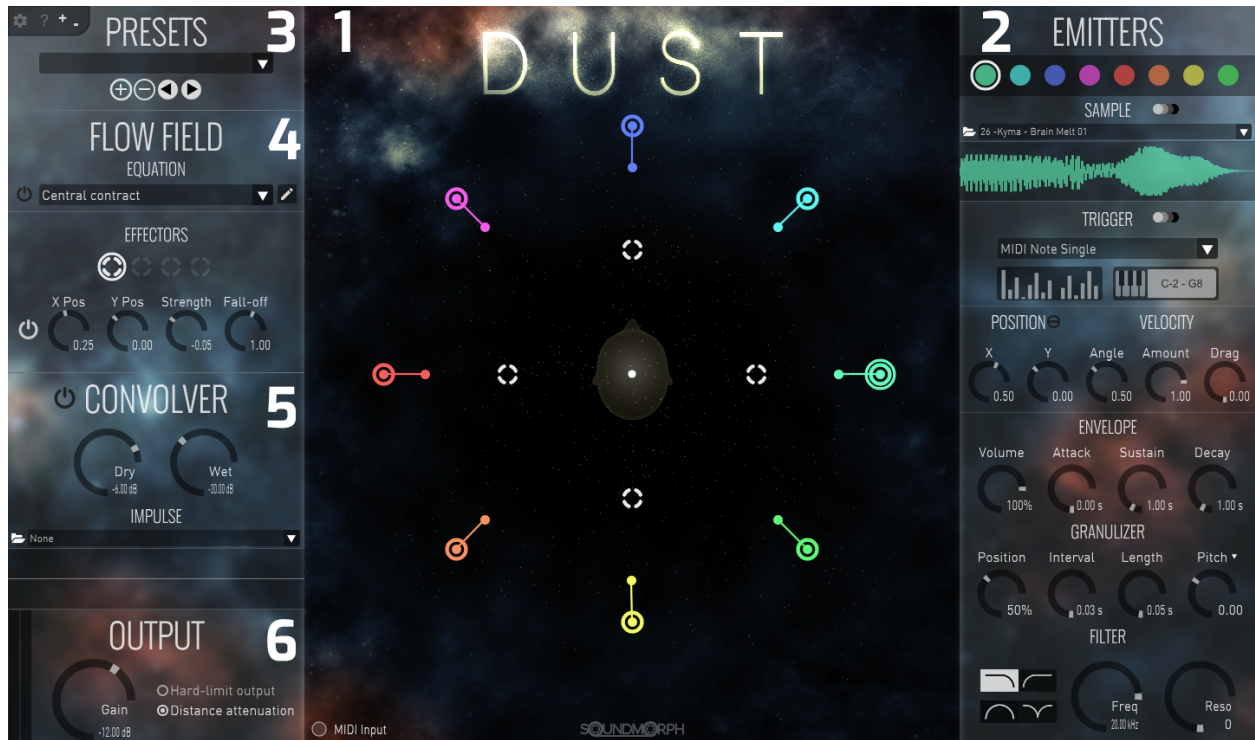
The flow field can also be generated by a user-defined equation. To understand how this works, a deeper understanding of the flow field is needed. The flow field is essentially a flat field of vectors that indicate the direction and strength of the force at each point. Imagine a classic weather report, with arrows showing the wind speed at each point - the flow field is exactly like this. The force vectors (the wind speed arrows) are made of a horizontal component and a vertical component, and the flow field has one expression for each. For example, the flow field equation $f_x = 10, f_y = 0$ means that the horizontal force (f_x) is 10 and the vertical force (f_y) is 0. Thus particles in this field will accelerate to the right. The expression can also vary based on the position. For example $f_x = -x, f_y = -y$, means that as the x and y positions increase the force gets more and more strongly negative, thus creating a flow field where all force vectors point towards the center. Appendix I further details the flow field equations.

Convolver

Dust comes with a built-in convolution reverb. A convolution reverb is a reverb that takes its tonal, textural and temporal characteristics from a loaded audio file, instead of computing them algorithmically. Any audio file can be loaded into as the impulse, allowing for radically different effects, ranging from the natural to the alien.

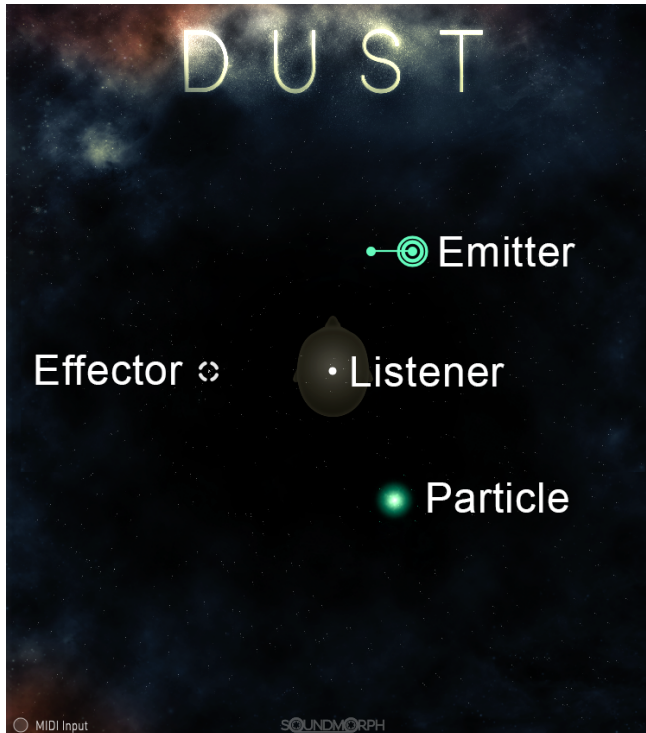
Interface

The interface of Dust is split into 6 principal sections.



1. Particle View

This view shows the particle simulation.



Emitters are represented as coloured rings, with a protruding line that shows the speed and direction it will emit particles. Particles are shown as glowing blobs, with the same colour as the emitter that created it. The size of the particle is an indicator of its sound output level. Effectors are drawn as dashed white rings, slightly larger than the emitters. The little 'dust' particles in the background show the flow field.

Emitters and effectors can be dragged around with the mouse, and the emit velocity of emitters can be changed in a similar manner. The mouse wheel zooms the view in and out.

You can make the emitter/emitters look at the mouse cursor by holding shift(selected emitter only) or holding shift+ctrl (all emitters), when inside the particle's view.

2. Emitters Panel

The emitters panel is used to set the properties of each of the 8 emitters.

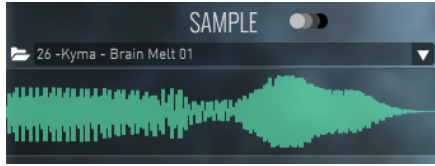
The coloured circular buttons at the top are used to select the emitter that you want to modify.



The buttons glow to show the total sound output level of all particles produced by that emitter. Shift-clicking on a button will mute that emitter. Control/command-click will solo it.

You can copy paste, or reset an emitter by right-clicking on a button to access a popup menu.

Emitters that are not used (trigger mode is off) have their tab button desaturated.



The drop-down menu can be used to change whether the particle emitted by this emitter uses a pre-selected sample, or a real-time input. Real-time input is only available with the 'effect' version of Dust. If using a sample as the input, the sample view is where you choose the sample. To load a sample either click on the folder icon to select one from disk, select one from the Dust samples folder using the drop-down menu, or drag on in from the file system. The Dust samples folder is located at `<user documents folder>/SoundMorph/Dust/Samples`.



clicking this button will copy the current sample to all other emitters.

The next section contains options to set when and how the emitter creates new particles.



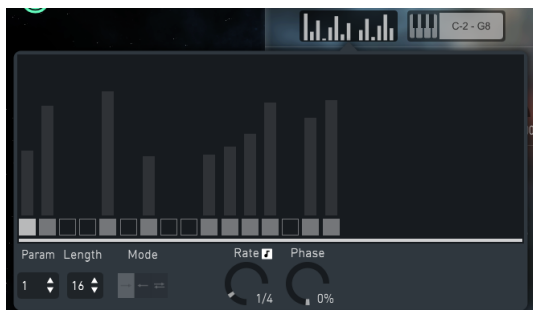
The *trigger mode* determines when a particle is released. The following options are available:

- *MIDI Note Single*: the emitter releases a single particle when a MIDI note within the emitters note range is received
- *Sequencer Auto*: the emitter continuously releases particles in a pattern determined by a step sequencer
- *Sequencer MIDI Note*: the same as *Sequencer Auto*, but only while a note within the emitters note range is held
- *Off*: the emitter is disabled
-



clicking this button will copy the current trigger mode to all other emitters.

The *edit sequence* button opens a step sequencer for editing the sequence used in the *Sequencer Auto* and *Sequencer MIDI Note* trigger modes.



The sequencer editor is a typical step sequencer with every step consisting of a slider with a square toggle below it. The toggle sets whether a particle should be emitted that step, and the slider above it sets a *param*

value that can be mapped to arbitrary particle parameters (see the Mapping section). Each step has four *param values*. The other settings are described below.

- Param: sets which of the four param values is currently shown
- Length: sets the length of the sequence
- Mode: sets the direction of the sequence
- Sync: sets whether the sequence rate is locked to the host tempo
- Rate: the length of each steps
- Phase: the offset of the sequence. Useful for staggering particle releases

The MIDI range button can be clicked to bring up a graphic of a keyboard, where you can choose the range of notes that trigger particle releases when the *MIDI Note Single* or *Sequencer MIDI Note* trigger modes are selected.



The high and low note number boxes are used to select range. Clicking *Auto layout* shows a popup that can be used to change the MIDI note trigger range of all eight emitters simultaneously by either spreading the ranges out over the keyboard back-to-back by using “Split Range”, or set all emitters with the same range. *Start note* sets the starting note for the auto layout. *Notes per emitter* sets how many notes should be assigned to each emitter. When not using “Split Range” the *Notes per emitter* setting is replaced with *End note* which sets the end note for all emitters, and the *Start Note* will be the starting note for all emitters. *Set as default* makes the selected layout the default one when loading the plugin.

The following section is where the position and the launch velocity of the emitted particles can be edited.



The *position* controls set the x and y position of the emitter.

 Clicking this button will change the position Parameters to be Angle-Magnitude instead of X-Y.

The velocity controls set the direction, speed and drag (the rate the particle slows) of emitted particles.

The controls in the final section determine the various synthesis properties of the emitted particles.



The envelope controls change the envelope of the particle during its lifetime.

- Attack: how long the particle takes to fade in up to the maximum amplitude
- Sustain: how long the particle stays at the maximum amplitude
- Decay: the time it takes for the particle amplitude to decay to zero

The granulizer section has the following controls:

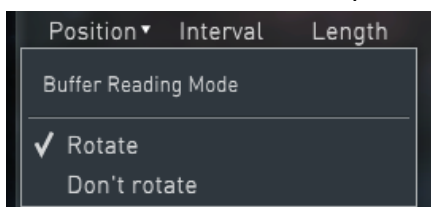
- Position: the position in the source to take the grains from
- Interval: the inter-grain interval
- Length: the length of the grains
- Pitch: the pitch of each plane. The pitch can be locked to a certain scale using the drop-down menu

The filter section can be used to tweak the properties of the filter:

- Type: the filter type. Can be low-pass, high-pass, band-pass or notch
- Frequency: the cutoff frequency
- Resonance: the amount of resonance

Buffer Reading Mode for Live Input (FX Version only)

In the FX version, the Position parameter will have a dropdown menu when the title is clicked:

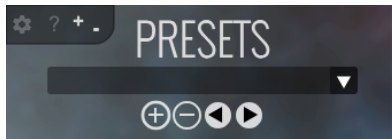


This will decide the way the Live Input buffer is read.

When rotate is selected, the reading location of the buffer will move forward as the buffer gets filled.

When don't rotate is selected, the reading location will not change, giving a sound closer to when using Sample as a source input.

3. Presets Panel



Presets can be saved with the + symbol and deleted with the - symbol, and can be selected with the drop-down menu, or with the browse arrow buttons.

Presets are saved in the Dust presets folder. The Dust presets folder is located at

PC: <user documents folder>/SoundMorph/Dust/Presets.

MAC: <user documents folder>/Music/Music Audio Apps/SoundMorph/Dust/Presets.

4. Flow Field Panel



The flow field is defined by a set of effectors and/or an equation as discussed in the *Key Concepts* section of this manual. The circular toggle enabled the flow field equation. The selected equation can be changed with the drop-down menu. To edit the equation, click the pencil icon. For more information on custom flow field equations see Appendix I.

The selected effector is changed with circular buttons. The other controls are detailed below.

- On: sets whether the effector is active or not
- X/Y Pos: sets the x/y position of the effector
- Strength: sets the strength of the effector
- Fall-off: sets the fall-off of the effector

For more information on the strength and fall-off parameters see the Key Concepts section of this manual.

5. Convolver Panel



To load a file to use as the impulse response, either click on the folder icon to select one from disk, select one from the Dust impulses folder using the drop-down menu, or drag on in from the file system. The Dust impulses folder is located at `<user documents folder>/SoundMorph/Dust/Impulses`.

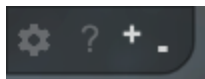
The wet and dry dials determine how much of the original and affected signal are present in the output. For more information on convolution see the Key Concepts section of this manual.

6. Output Panel



The output panel has a master gain control and some meters. The setting *hard-limit output* enables a hard-limiter to reduce the chance of clipping.

Settings Buttons



-Settings

Clicking on the gear icon in the corner of the toolbar opens the settings window. The following settings are available:

- Maximum number of particles: if the active particle count goes higher than this number, they start getting automatically removed, starting with the oldest first. Use this to control the CPU usage of the plugin
- License: enter the serial code here to authorize Dust

-HELP(?) Makes help bubbles appear for 8 seconds.

-Minimize/Maximize(- +) Changes window size.

Modulation

Parameters in Dust can of course be set manually, but get a more dynamic sound they can be modulated. Only parameters with a dial control can be modulated. To open the modulation panel, right-click (or control-click on a Mac) on the dial. There are four ways to modulate a parameter: LFOs, MIDI mapping, sequencers and particle property mapping. Particle property mapping is only available on the per-particle dials which are shown in the particle section of the Emitters panel.

You can return a parameter to its default value by double-clicking it.

Note: All modulation is additive. This means it adds to the manually set value rather than replacing it, and multiple modulations can be applied simultaneously with the result being the sum of all of them. For this reason all modulation sources have ranges that go from negative to positive, for example LFOs go from -1 to +1.

The different modulation types in the modulation panel are detailed below.

LFOs

This type modulates the parameter with a low-frequency oscillating signal with a variety of different shapes.



The options are as follows:

- On: enables/disables the LFO
- Type: the shape of the LFO
- Sync: synchronizes the rate the tempo
- Rate: sets the rate of oscillation either as the period in seconds or the beat division depending on the sync setting
- Phase: sets the phase
- PW: sets the pulse width. If the type is set to *Noise*, this sets the smoothness
- Scale: sets the scale of the oscillations
- Offset: sets the offset

MIDI

This type modulates the parameter with a given MIDI input.



The following properties can be mapped:

- Note - Full Range: maps the parameter to the incoming MIDI note in relation to the full range of MIDI notes (88 notes)
- Note - Selected Range: as Note Full Range but only with the selected trigger note range. For more details on the trigger note range see the *Emitters Panel* section above
- Velocity: maps the parameter to the velocity of the most recent MIDI note received
- CC Value: maps the parameter to a given MIDI CC number. To automatically select the CC number, select *MIDI Learn* and move the desired control

The drop-down menu sets the MIDI input that is being mapped. The toggle control activates the mapping. The envelope graph shows the mapping between the MIDI input and the output value. The input value is on the x-axis and goes from 0 to 1. The output value on the y-axis goes from -1 to 1. Click to add points. Shift-click on a point to delete it.

Sequencer

This type modulates the parameter with a sequenced value.



It has the following settings:

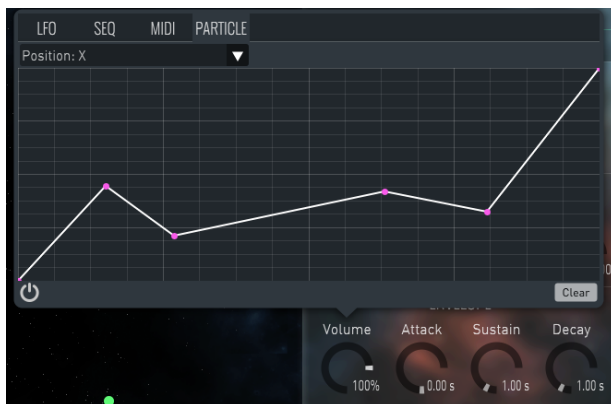
- On: enables/disables the LFO

- Length: sets the length of the sequence
- Mode: sets the direction of the sequence
- Sync: sets whether the sequence rate is locked to the host tempo
- Rate: the rate the sequence is stepped through
- Phase: the offset of the sequence
- Scale: sets the scale of the sequencer
- Ease in/out: changes the way each set value blends into the next

The sliders above each step determine the output value at that step. The white line shows the shape of the final output sequence.

Particle Property Mapping

Use this to map properties of each particle to the parameter.



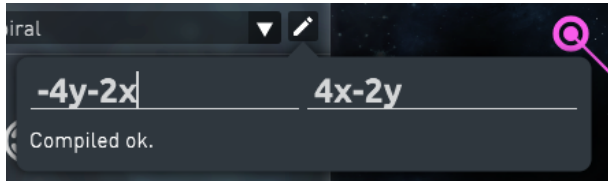
The following properties can be mapped:

- X/Y position: the position of the particle
- Distance from center: the distance of the particle from the center point
- Angle about center: the angle of the particle about the center point
- Speed: the absolute speed of the particle as it moves through space
- Age: the fraction of the age of the particle
- Random: a random value assigned to each particle at birth. Map this to randomize the parameter for each particle
- Sequencer parameter 1 - 4: the values of the step in the step sequencer that triggered the release of this particle. See the sequencer editor in the particle emitters panel for more information
- MIDI velocity: if the particle was triggered with a MIDI note, the velocity of that note

The drop-down menu sets the mapped property. The toggle control activates the mapping. See above for more information on the mapping envelope control. **Note: this mode is only available for the controls in the audio parameters section of the Emitters Panel.**

Appendix I - Flow Field Equations

Dust comes with an equation parser for writing custom flow fields. To open the equation editor, click on the pencil icon next to the selected flow field equation in the flow field panel.



The equation editor has two text inputs - the left one for defining the horizontal force, and the right for the vertical force. In these fields you can write an equation and if it parses ok, you'll see the effect immediately in the flow field dust.

Below is a list of the variables and math that the parser understands. All variables and functions are lowercase.

Variables

- x - the x position of a point in the flow field. 0 is the center.
- y - the y position of a point in the flow field. 0 is the center.
- $time$ - the amount of time in seconds since starting the plugin. Useful for creating dynamic flow fields.

Mathematical operators

- $+$ - add
- $-$ - subtract
- $*$ - multiply
- $/$ - divide
- $\%$ - modulo
- $^$ - power

Functions

Functions take a varying number of comma separated parameters enclosed in brackets. For example, look in the plugin.

- \min - take the minimum of two values
- \max - take the maximum of two values
- avg - take the average value
- sum - sum the values
- abs - remove the negative sign from a value

- `ceil` - *round the input up*
- `floor` - *round the input down*
- `round` - *round the input to the nearest whole number*
- `exp` - *take the exponential*
- `log` - *take the log*
- `log10` - *round*
- `sqrt` - *compute the square root*
- `clamp` - *clamp the input to a given range*

Trigonometry

- `sin`
- `cos`
- `tan`
- `acos`
- `asin`
- `atan`
- `atan2`
- `cosh`
- `cot`
- `csc`
- `sec`
- `sinh`
- `tanh`
- `d2r`
- `r2d`
- `d2g`
- `g2d`
- `hyp`