



Particle

A Comprehensive User's Guide

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C H A P T E R O N E

Introducing Particle

SOFTIMAGE® Particle offers a broad set of tools for creating 3D animation that simulates natural phenomena containing particles. This guide provides steps and examples for using these tools.

What is Particle?

Particle is a pixel-based particle generation system that lets you create three-dimensional animation that simulates natural phenomena containing many particles. For example, Particle makes it easy to animate sparks rising from a campfire, fireworks, or the tail of a comet trailing off into space.

Particle lets you create systems of particles, emitted from a given source. You can then link the particle system to a hierarchy imported from SOFTIMAGE 3D, and render a scene. For example, you can create a stream of particles that looks like spraying water, and link the source of the particle stream to a model of a garden hose that you built in SOFTIMAGE 3D. When you composite and render the scene, it will look like the hose is spraying water.

Particle does not animate geometrical objects: it creates a uniform series of small shapes that represent points in 3D space. The rendering process applies a spot of color at the location of the particle, much like a brush stroke. This process permits many particles to be in a scene without making the scene too large.

For information on other types of animation, see the *SOFTIMAGE 3D Animating User's Guide*. Refer to the chapter in it called *Particles and Custom Effects* for information about particle-like object animation and to the chapter called *Dynamics* for information about dynamics-based object animation.

The Physics of Particle Animation

Particle offers a realistic simulation of particle dynamics. It applies forces and recreates events that happen to natural particles. You can define how the particles are emitted and how they will interact with their environment and with other particles, according to the parameters you set. These are the basic types of effects you can control: natural forces, disintegration, and collisions.

Natural Forces

Particle recreates the natural forces of gravity, resistance in a medium, magnetism, and electrostatic forces. You can apply any of these forces to a stream of particles to recreate natural phenomena. These forces can act upon a particle in any direction in three-dimensional space. How a stream of particles behaves depends on how these natural forces are applied.

Disintegration

At the end of its lifetime, a particle can either disappear or decay into one or more different particles. At the time of decay, the particle becomes a source point, and emits one or more particles from its current location.

Collisions

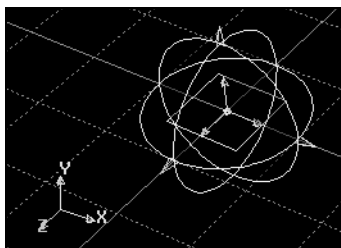
Particle can recreate three types of collisions involving one or more types of particles:

- **Internal collisions** occur when the particles within a stream (that is, the stream of particles being emitted from one source) collide with each other. Internal collisions also happen when identical particles from different sources collide.
- **Simple collisions** happen between two different types of particles coming from different sources.
- **Complex collisions** occur when other particles are created as two or more different types of particles from different sources collide. The number of new particles created is independent of the number of particles that are colliding.

Understanding 3D Space

To represent the geometry of an object in 3D space with a 2D user interface, 3D software uses the Cartesian coordinate system. This is based on three perpendicular axes x , y , z intersecting at one point. This reference point is called the *origin*.

When you create a new element in Particle, by default it is located at the origin, which is the centre $(0,0,0)$ of the reference grid in the 3D viewing area.



X, Y, and Z Axes

Use the “right-hand” rule to remember the direction of the x , y , z axes. Hold your right hand so that your palm is facing you, then extend your thumb to the right, hold your index finger up (pointing towards the sky), and point your middle finger towards you. Your thumb is pointing in the positive x direction, your index finger in positive y , and your middle finger in positive z . The opposite directions represent negative x , y , and z . See the *Working with SOFTIMAGE 3D User's Guide* for more information on Cartesian space and x , y , z coordinates.

Before You Start

The README file in your Particle home directory provides information about environment variables.

After you have installed the software, you can get more information about the Particle command line by typing the following line in a shell:

```
particle -R
```

To start Particle, type

```
particle
```

An Overview of How to Use Particle

This is an overview of the procedure you use to create particle animation:

1. **Define the source** of the particle emission. You can position the source within a scene imported from SOFTIMAGE 3D, or choose an element from the scene hierarchy to use as the source. The source can also be defined directly in Particle, without using a scene from SOFTIMAGE 3D. For more information, see *Source Module* on page 45.
2. **Define the particle type.** Set the characteristics of the individual particles, which include the lifetime of the particles in the stream, their rendering attributes, their physical attributes, and their internal collision rate. For more information, see *Particle Module* on page 51.
3. **Link the particle type to the source.** This is the step where you assign a particle type to a source, and choose the method in which the particles will be emitted. For more information, see *Source Module* on page 45.
4. **Create obstacles for the particle stream.** If desired, obstacles can be set to interact with the particle stream. The particles can be made to bounce off or stick to the obstacle. They can also be made to disappear or decay after they strike the obstacle. A model from a scene imported from SOFTIMAGE 3D can be used as an obstacle, or you can create one directly in Particle. For more information, see *Obstacle Module* on page 62.
5. **Define collisions and events.** If desired, simple and complex collisions can be created in scenes containing multiple particle streams. Simple collisions happen between two different types of particles coming from different sources. Complex collisions or events occur when other particles are created as two or more different types of particles collide. The number of new particles created is independent of the number of particles that are colliding. For more information, see *Collision Module* on page 68.

6. **Render and composite the Particle scene.** If you are incorporating the particle system within a SOFTIMAGE 3D scene, you must follow this procedure:
 - Render the SOFTIMAGE 3D scene within SOFTIMAGE 3D, using the SOFTIMAGE renderer with the Render Z Channel option selected in the Render Setup dialogue box.
 - Load the SOFTIMAGE 3D rendered images into the Particle renderer as background images.
 - Render the particle animation. Then composite the particle animation using the depth information from the z-channel of the SOFTIMAGE 3D rendered images to create seamless three-dimensional animation with a particle effect. For more information, see *Compositing with a 3D Scene* on page 87.

C H A P T E R T W O

Exploring the Interface

This chapter describes each element in the Particle interface.

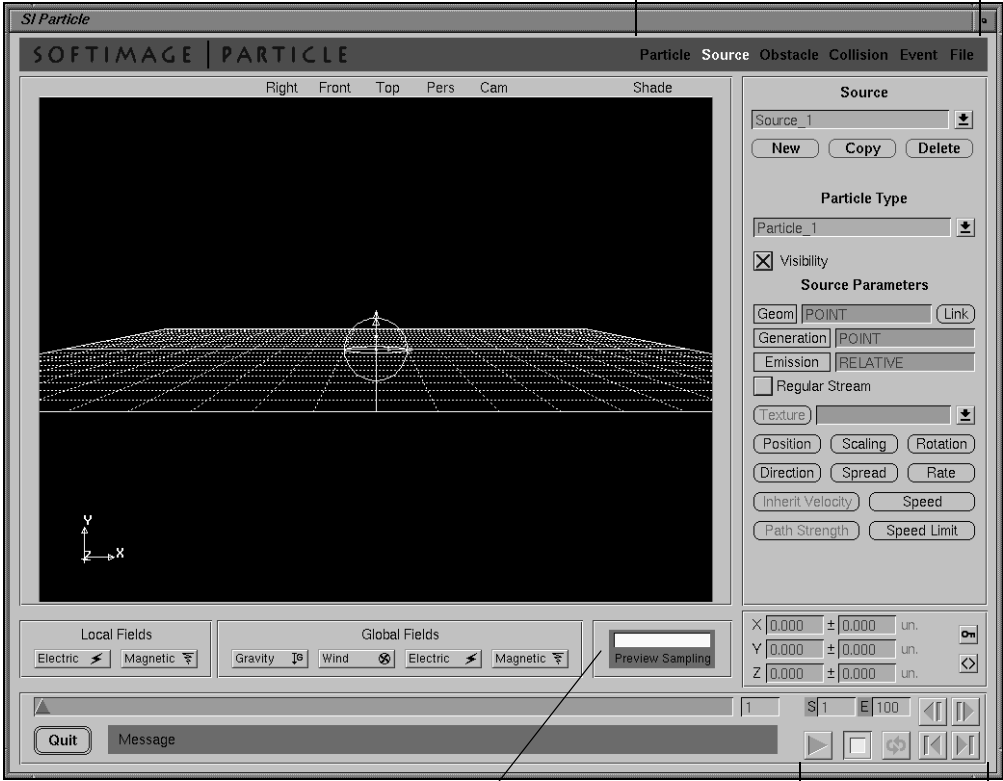
The Particle Interface

The Particle user interface consists of eight areas:

3D Viewing Area.
This window resembles the Perspective window in SOFTIMAGE 3D.

Modules.
These modules let you choose between groups of commands for defining the particle animation. When you click on a module, its parameters appear in the parameters area.

Parameter Area.
This area contains commands that edit the parameters for each of the modules.



The screenshot shows the SOFTIMAGE PARTICLE application window. At the top is a menu bar with 'Particle', 'Source', 'Obstacle', 'Collision', 'Event', and 'File'. Below the menu bar is a toolbar with view modes: 'Right', 'Front', 'Top', 'Pers', 'Cam', and 'Shade'. The main 3D viewing area displays a wireframe landscape with a grid and a coordinate system (X, Y, Z). To the right of the 3D area is a 'Source' panel with fields for 'Source_1', 'Particle Type' (set to 'Particle_1'), and a 'Visibility' checkbox. Below these are 'Source Parameters' including 'Geom' (POINT), 'Generation' (POINT), 'Emission' (RELATIVE), 'Regular Stream' (unchecked), 'Texture', 'Position', 'Scaling', 'Rotation', 'Direction', 'Spread', 'Rate', 'Inherit Velocity', 'Speed', 'Path Strength', and 'Speed Limit'. At the bottom of the window is a 'Status Bar' containing 'Local Fields' (Electric, Magnetic), 'Global Fields' (Gravity, Wind, Electric, Magnetic), a 'Preview Sampling' button, a timeline slider, and a 'Message' field. Callout lines connect descriptive text blocks to these specific interface elements.

Natural Forces Buttons.
These buttons let you simulate forces found in the real world and apply them to the particle animation.

Preview Sampling Rate Slider.
This slider allows you to interactively determine how many particles are displayed when previewing your animation. This helps speed up playback when you have a complex scene containing many particle sources.

Playback Area.
This area allows you to visualize animation in various ways.

Parameter Editing Area.
This area allows you to enter values for the parameters you choose in the parameters area.

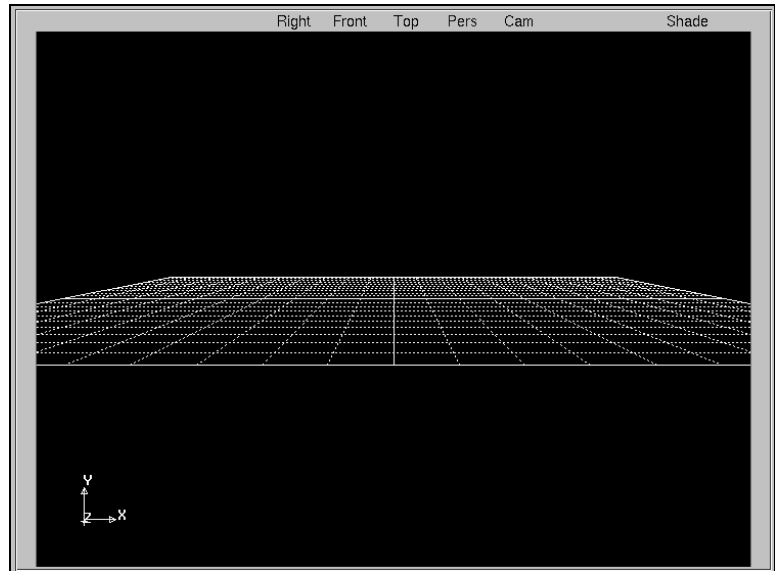
Summary of the Particle Interface

The following is a list of the eight main areas of the Particle interface and a brief description of each one. A detailed description of each area's function follows this list.

- **3D Viewing Area:** This is the largest region in the Particle interface, in which your 3D particle animation is displayed. For details, see *3D Viewing Area* on page 13.
- **Modules:** Each of the six modules has a unique set of parameters used to define your 3D particle animation. For details, see *Modules* on page 14.
- **Parameter Area:** This is where you select module-specific properties for editing. For details, see *Parameter Area* on page 15.
- **Parameter Editing Area:** When you choose parameters from the Parameters Area, this is where the values appear and can be edited. For details, see *Parameter Editing Area* on page 16.
- **Playback Area:** This is where the controls are located for displaying your animation. For details, see *Playback Area* on page 17.
- **Status Bar:** This displays the length of the animation sequence (the time line) on the top and information about current operations on the bottom (message line). For details, see *The Status Bar* on page 18.
- **Preview Sampling Rate Slider:** This allows you to determine how many particles are displayed when previewing your animation. For details, see *Preview Sampling Rate Slider* on page 19.
- **Natural Forces Area:** These buttons let you apply and simulate local or global natural forces to your particle animation. For details, see *Natural Forces Area* on page 20.

3D Viewing Area

The 3D viewing area is where you view and manipulate elements. It contains one Perspective projection window and three parallel projection windows (Right, Front, and Top). It also contains a camera (Cam) view, which is used only when camera information from a SOFTIMAGE 3D scene is loaded. By default, the Perspective window is displayed when you open Particle.



You can change the default window by clicking on one of the five window types, which are located at the top of the 3D viewing area.

Right, Front, and Top Windows

The orientation of the camera in the Right, Front, and Top windows is perpendicular to the global coordinate planes (xy , xz , yz). For example, in the Top window, the camera is perpendicular to the xz plane.

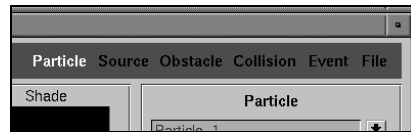
In the Right, Front, and Top windows, an object's projection lines do not converge. For example, if you drew lines extending from a cube's edges, they would never meet. Because of this, the distance between an object and the camera has no influence on the scale of the object. If one object is closer to the camera than another object, they both appear to be the same size.

Perspective Window

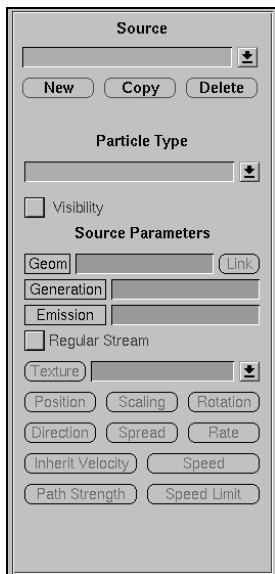
The Perspectives window shows objects in a scene realistically from the virtual camera's point of view. An objects edges appear to converge towards the central vanishing point, and object's nearer to the point of view appear larger than those further away.

Modules

There are six modules: **Particle**, **Source**, **Obstacle**, **Collision**, **Event**, and **File**.



These modules let you choose between groups of parameters for defining the particle animation. Each module has a unique set of parameter controls. When you select a module, the corresponding parameter controls appear in the parameters area on the right side of the interface. Modifications made to a particular module's parameters affect only the element corresponding to that module. For example, if you change the value of a parameter in the **Source** module, that change is applied only to the source emitter.

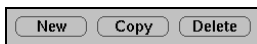


Parameter Area

With the exception of the three command buttons (**New**, **Copy**, and **Delete**) at the top of the Parameter area, each module has its own unique set of parameters. Parameters are important tools for interacting with the software: they contain the various rules that govern the behaviour of the different elements contained in your scene. Some parameters open dialogue boxes, while others open lists of elements that you have created. These parameter types are described later in this chapter.

Command Buttons

The **New**, **Copy**, and **Delete** command buttons are found in the parameter area. These operations can be performed on particles, sources, obstacles, collisions, and events.



New

To create a new particle type, source, obstacle, collision or event, click **New** in the appropriate module. To rename your new element, enter any string of characters (no spaces) in the text box.

Copy

To make a copy of the current element, click **Copy** in the appropriate module. Again, you can rename the copy by entering any string of characters (no spaces) in the text box.

Delete

This button lets you delete the selected object in your scene. To delete an object, click **Delete** in the appropriate module. For example, if you want to delete an obstacle you must be in the Obstacle module.

The **File** module contains a unique set of command buttons (**Load**, **Merge**, **Save**, **Sequence**, and **Reset**) that are available only when **File** is selected. They are used to launch and control the preview of the Particle effects.



Load

This button lets you load a previously saved Particle session. When you click **Load**, a browser appears allowing you to navigate to the directory where your file is located.

Merge

This button lets you merge a second particle system with the current one. When you click **Merge**, a browser appears allowing you to navigate to the directory where your file is located.

Save

This button lets you save the current particle session. Any 3D elements that your system contains are written in the system files as reference elements. 3D elements are never saved with the Particle system, but remain as a reference saved in the 3D scene.

Sequence

This button is not yet available (dimmed).

Reset

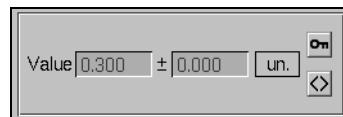
Click **Reset** when you want to remove the current particle session and begin again.



If you want to keep your changes, be sure to save your session before clicking **Reset**.

Parameter Editing Area

When you select a parameter in the Parameters area, the corresponding value text box appears in the parameters editing area.



Units appear beside the text boxes. For **Size**, you can change Units (**un.**) to Pixels (**pix.**) by clicking the **un.** button in the Parameter Editing area.

- When **Units** is selected, the particle dimensions change depending on their position in space according to the camera.
- When **Pixels** is selected, the particles always have the same pixel size

regardless of their position in 3D space.

The following is a list of abbreviations you will find in the Parameter Editing Area and to the right of the parameter text boxes:

%	Percent
un.	SOFTIMAGE units
un/s	Units per second
un./s/s	Units per second square
pix.	Pixels
frm	Frames
frm/s	Frames per second
sec.	Seconds
prt.	Particles
prt./s	Particles per second
deg.	Degrees

Playback Area

The playback controls allow you to visualize your animation in different ways using various techniques. The playback area is located in the lower-right corner of the interface.

Using the Playback Controls



Starting frame text box (S): Sets the starting frame number. Click in the text box to insert a number. Middle or right-click to replace the starting frame number.



End frame text box (E): Sets the end frame number. Click in the text box to insert a frame number. Middle or right-click to replace the end frame number.



Set the end frame number to 9999 to extend the duration of your animation playback time. However, remember to reset the end frame value before rendering your scene.



Forward arrow: Plays back the scene from start to end frame. Click to view the particle emission while editing the different parameters.



Stop button: Interrupts the playback. Click the forward arrow to restart the playback.



Loop button: Loops the sequence playback from the start frame to the end frame. Click it and then click the forward arrow.



Frame advance arrow: Advances the animation one frame at a time. Click this arrow to move from the current frame to the next frame in the sequence.



Frame back arrow: Plays the animation backward one frame at a time. Click this arrow to move from the current frame to the previous frame in the sequence.

Note Particles are emitted only during playback (that is, when you click the forward arrow). In other words, you cannot view the particles frame by frame.



Start frame arrow: Returns to the starting frame of your animation.



End frame arrow: Advances to the last frame of your animation.

The Status Bar

The status bar is located at the bottom of the display. It contains the time line and the message line.



Time Line

The top line in the status bar is the time line. Its width represents the entire length of an animation sequence. The triangular pointer (time line pointer) can be moved back and forth along the time line, causing the animated sequence to be displayed in the 3D viewing area. Note that only 3D scene elements are updated.

Click anywhere along the time line to move the pointer to that position, or drag the pointer with the mouse.

Dragging the pointer while pressing the left mouse button updates the 3D scene sequence frame by frame.

The current frame number is displayed on the right side of the time line. Click in the box to insert a number; middle or right-click to replace the current frame number.

Message Line

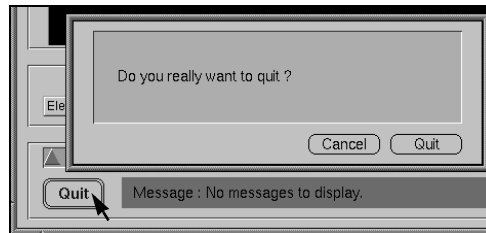
The bottom line in the status bar is the message line. It displays information about current operations, and sometimes warnings or error messages.

Note

If you click on the word “Message” in the status bar with any mouse button, a window opens displaying every message recorded during the current session (that is, from the time you started Particle).

Quit

The **Quit** button is located in the lower-left corner of the display. When you click it, a message box appears requiring confirmation that you wish to exit the Particle system. **Cancel** returns you to your session. The **Quit** option exits Particle without saving the scene to disk.



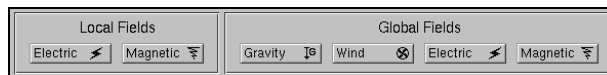
Preview Sampling Rate Slider



The sampler slider is located below the right corner of the 3D viewing area. The slider lets you interactively reduce the number of particles that are displayed when previewing your animation. If your animation contains a complex scene, reducing the number of particles that are displayed helps speed up playback. The information you set here is not calculated at render time, it applies only to previewing.

Natural Forces Area

This area is located at the bottom of the 3D viewing area. It includes, **Local** controls that can be applied to a specific particle stream, and **Global** controls that affect your scene as a whole.



There are four global natural force controls and two local natural force controls — **Electric** and **Magnetic** can be applied locally and globally, while **Gravity** and **Wind** can only be applied globally. When you select one of the natural force controls, a dialogue box appears and a corresponding icon appears in the 3D viewing area.

For more information on using Natural Forces, see *Applying Natural Forces* on page 92.



- Gravity simulates a gravitational field acting on the particle.
- Wind simulates the effects of drag acting on the particle.
- Electric simulates an electric field acting on the particle.
- Magnetic simulates a magnetic field acting on the particle.

The local and global **Magnetic** and **Electric** forces have a unique association with the **Magnetic** and **Electric** buttons in the **Particle** module. The global forces are only valid on particle types where the associated parameter has a value other than 0. For example, if your scene contains many particle types, the global **Magnetic** value only affects the particle types that also have a value set in the **Magnetic** parameter text box in the Parameters area.

Although there is an association between the global **Wind** force and the **Friction** parameter, it does not have the same dependency as the other natural forces.

Unique Parameter Types

Within the parameter area, there are three parameters which have unique properties:



- Buttons with names that end in ellipses (...)
- Rectangular buttons with right angle corners
- Parameters followed by an arrow button

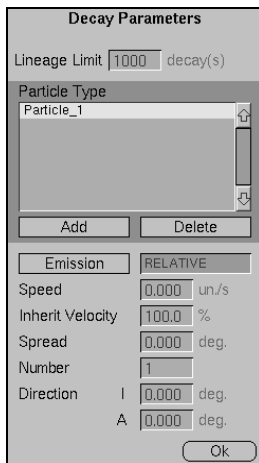
Each of these parameters lets you access different types of tasks and selection menus that are only available when they are selected.

Parameter Text Boxes



Parameter text boxes are located in the parameter editing area. When you click on a parameter, the corresponding text box(s) appears, letting you modify the value or move to the next box. You can use the Tab or Enter key to move between text boxes, or position your cursor over the text box and click one of the mouse buttons.

Dialogue Boxes



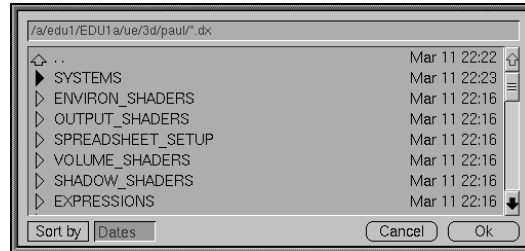
A dialogue box appears when you select a control button with ellipses (...), as well as when you select one of the natural force buttons. A dialogue box lets you enter values or text, control settings, and choose an element from a scroll box. Dialogue boxes are interactive meaning that as you make changes in the dialogue box, they have an immediate effect on your scene – you don't have to close the box first. This allows you to test out different values before accepting the final ones.

Repositioning a Dialogue Box

1. Place your cursor in the dialogue box.
2. Press Alt and right-click on the **Move** menu command.
3. Release the Alt key and the mouse button, then drag the mouse until the window is in the desired location.
4. Click outside the dialogue box to end the “move” mode.

Browsers

A browser appears when you select parameters that are followed by an arrow button and when you select certain buttons such as **File**, **Merge**, **Load**, and **Save**. Browsers are a type of dialogue box used specifically to load a saved scene or save files. Browsers include a scroll box and three buttons – **Sort by**, **Cancel**, and **Ok**.



The scroll box displays the list of chapters or files. Above the scroll box, the current database and chapter name are shown. You can move out of other chapters or databases by double-clicking the arrow followed by two dots (..) – this moves you to the next highest level. The current database and chapter name are updated, and the chapters or files they contain are listed. You can then double-click on the chapter or file you want.

Tip You can move directly into a database by typing the name of the database in the text box at the top of the browser – the system finds the entire path.

Click on the top or bottom scroll arrow to move the list up or down. The grey slider between the scroll arrows shows which part of the list page is being displayed. Drag the slider up and down to move in the page. Clicking above the slider moves the list one page up; clicking below it moves the list one page down.

Menus



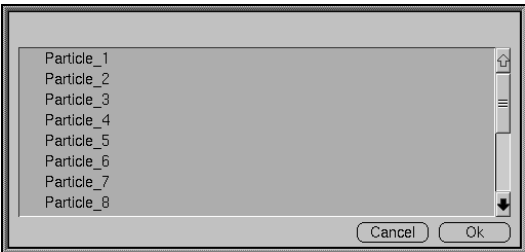
Clicking on a button with right-angle corners displays a menu. To select one of the options:

1. Click on the button. A menu appears, usually below the button.
2. Drag your cursor to the desired option.
3. When you have highlighted your choice, click on it. The menu disappears and the option that you selected is displayed in the text box beside the button.

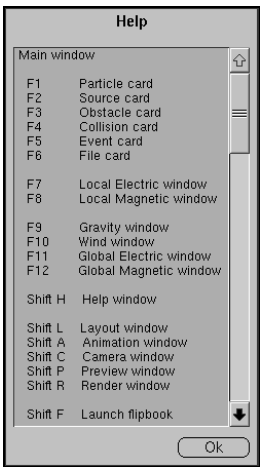
Scroll Boxes



The arrow button to the right of some parameter text boxes indicates that you can enter text, or select text from a scroll box. When you click and hold on the arrow button, a scroll box of selectable items is displayed.



Help Window



When Particle is running, the keyboard is used to enter text in dialogue boxes that are displayed. Certain keys, combination of keys, and mouse and keyboard combinations, can also perform the equivalent of some command operations and mouse functions.

Pressing Shift-h opens a Help window that displays a list of mouse and keyboard shortcuts (like Supra key functions in SOFTIMAGE 3D).

You can leave the Help window open for the duration of your Particle session until you are familiar with the various shortcuts.

Note To reposition the Help window, follow the instructions in *Repositioning a Dialogue Box* on page 21.

The following is a list of keyboard shortcuts:

Main Window

Shortcut	Function
F1	Opens the Particle module.
F2	Opens the Source module.
F3	Opens the Obstacle module.
F4	Opens the Collision module.
F5	Opens the Event module.
F6	Opens the File module.

Local/Global Dialogue Boxes

Shortcut	Function
F7	Opens the Local Electric dialogue box.
F8	Opens the Local Magnetic dialogue box.
F9	Opens the Gravity dialogue box.
F10	Opens the Wind dialogue box.
F11	Opens the Global Electric dialogue box.
F12	Opens the Global Magnetic dialogue box.

File Module Dialogue Boxes

Shortcut	Function
Shift-l	Opens the Layout dialogue box.
Shift-a	Opens the Animation dialogue box.
Shift-c	Opens the Camera dialogue box.
Shift-p	Opens the Preview dialogue box.
Shift-r	Opens the Render dialogue box.

Flipbook

Shortcut	Function
Shift-f	Launches flipbook.
Esc	Stops playback.
Left	Goes to previous frame.
Right	Goes to next frame.
Up	Goes to first frame.
Down	Goes to last frame.

Flipbook Window

Shortcut	Function
p	Plays.
s	Stops.
r	Reverses.
f or Right arrow	Plays forward frame by frame.
b or Left arrow	Plays backward frame by frame.
u or Up arrow	Speeds up.
d or Down arrow	Slows down.
1 to 4	Sets zoom factor

All Windows

Shortcut	Function
Shift-h	Opens the Help window.
Esc	Closes the window.
Shift-ds	Deletes all and repositions the camera.

3D Window

Shortcut	Function
o - M1	Orbits the camera.
o - M2	Orbits the camera horizontally.
o - M3	Orbits camera vertically.
p - M1	Dollies the camera slowly.
p - M2	Dollies the camera.
p - M3	Dollies the camera quickly.
z - M1	Tracks the camera.
z - M2	Zooms in.
z - M3	Zooms out.
Shift-z - M1, M2, or M3	Frames in.
f	Frames the selection.
a	Frames all objects.
Shift-v	Resets views.

Working in the Particle Interface

The basic concepts of the Particle software are described in this section.

If you are a first-time user of Particle, you should know some of the basic terminology and concepts of Particle before you begin your session.

Resizing the Particle Window

When Particle's window appears on your monitor, you can resize it by using your mouse and mouse buttons the same way you resize other windows in a graphical user interface.

1. Position your cursor in any corner of the main window. The shape of the cursor changes to an arrow pointing to a corner.
2. Hold down the left mouse button while dragging the mouse toward its diagonally opposite corner.
3. Release the mouse button when you have resized the window to the desired size.

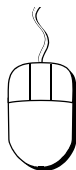
Note

You can resize this window to its default size at any time during your session without affecting your work.

Non-modal User Interface

This feature allows you to interact with the scene while editing parameters in a window or sub-menu.

Using the Mouse



You can perform most of your tasks in the Particle interface using a mouse. There are two basic ways to use the mouse: clicking and dragging. Clicking means that you quickly press and release one of the mouse buttons. Dragging means that you hold down a mouse button while moving the mouse, and then you release the button.

Unless otherwise stated, always assume that these actions mean using the left mouse button.

Mouse and Keyboard Notation

This guide uses notation for mouse and keyboard actions. The following table explains this notation:

This instruction	Means this
Choose	Use your mouse or a key combination to pick a menu command that begins an action or pick from a menu of options.
Select	Mark or select an item by clicking it with the mouse.
Click	Quickly press and release the left mouse button.
Middle-click	Quickly press and release the middle mouse button.
Right-click	Quickly press and release the right mouse button.
Click and drag	Hold down one of the mouse buttons while you move the mouse. This is usually the left mouse button.
Double-click	Click the left mouse button twice in rapid succession.

Mouse Button Functions

The mouse buttons function in the following ways:

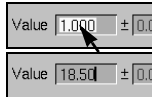
This instruction	Does this
Click	Selects graphic entities, menus, text entries, and tasks.
Click and drag	Modifies text box values.
Middle-click	Replaces text box data.
Middle-click and drag	Quick method for modifying text box values.
Right-click and drag	Quickest method for modifying text box values.

Entering and Editing Data

Besides typing the numeric value directly into a parameter's text box or in a dialogue box, you can also modify a value using the slider.

Typing Data into Text Boxes

To set a numeric value by typing it, follow these instructions:



1. Middle-click in a text box. The current value is highlighted.
2. Enter the new value by typing it in.
3. Press Enter after typing in all values within Particle, or they might not get accepted.

Note

You can also click the left or right mouse buttons and use the Backspace key to delete the current value. The mouse buttons are configured so that clicking allows you to insert characters at the cursor location.

Using the Virtual Slider

This is how you activate and edit a text box using a slider:



1. Click on the name of the parameter you want to edit: the parameter text turns blue indicating that it is selected. The associated value box or boxes appear at the bottom of the parameter editing area.
2. Click on the parameter name again: the parameter text turns red indicating that you can edit the value in the text box.
3. With the mouse button held down, drag the mouse to the right or to the left. Moving the mouse to the right increases the value in the text box, while moving it to the left decreases the value.

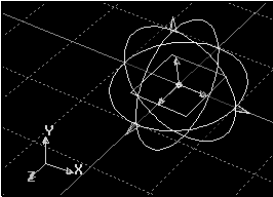
Note

Each mouse button changes the value in the text box at a different speed. The left button is the slowest, the middle button is faster, and the right mouse button is the fastest.

Using Particle Elements

The term *element* refers to objects that make up your scene. The Particle, Source, Obstacle, and File modules have elements that can be customized in a variety of ways. The way in which an element affects your scene is determined by the parameters that you define in each module. To create an element in one of the modules, click the **New** button or load the scene or an object that was created with SOFTIMAGE 3D. For more information, see *Loading a SOFTIMAGE 3D Scene* on page 75.

The Geometrical Parts of the Source



In 3D space, an element can be manipulated by scaling, rotating, or translating it. Besides editing values in the parameter editing area, you can also make changes directly in the 3D viewing area. Each element that can be edited has three yellow circles around it, one for each axis.

The mechanism that makes up the geometric appearance of these elements is called the *source*.

It consists of:

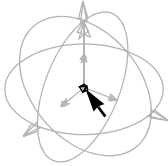
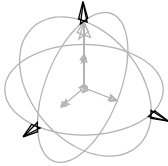
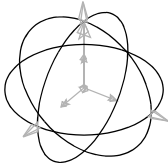
- Three yellow circles, each with an arrowhead attached, and each pointing in the direction of the global coordinate axes (located in the lower-left corner of the viewing area).

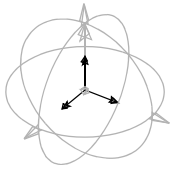
These circles allow you to rotate the element along the corresponding axis. Note that the local origin rotates with the object, but the surrounding arrowheads maintain their original positions, aligned to the global coordinates.

The outer colored arrowheads let you translate the element along the three coordinate axes.

- The element's origin, which is a green cube-shaped (default shape) centre.

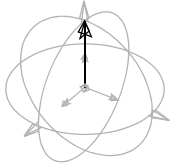
The origin allows you to translate the element freely anywhere in the x, y, z plane. To do this, position your cursor on the origin then, hold the left mouse button down and drag.





- Three arrows extending from the origin, which point in the direction of the element's local x, y, and z axes.

The three colored arrows extending from the origin are used to scale elements along the corresponding local axes.



- In addition to the other parts, a white vector arrow extends from the origin when you select the source module.

The white vector arrow allows you to control the direction in which the particles are emitted. You can edit the direction of the emissions by either clicking on the arrowhead of the vector and dragging your mouse, or by selecting the **Direction** parameter and setting the desired inclination and azimuth values.

When you click the **New** button in the **Source** or **Obstacle** module, the source appears.

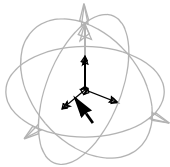
Note Elements can only be manipulated by the source's geometrical parts when you are working in the **Source** and **Obstacle** modules.

Scaling, Rotating, and Translating Elements

The colors of the three arrows associated with scaling manipulate the element along the same axes as the arrows associated with translating an element.

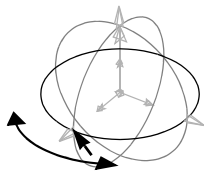
Scaling

To scale an element, use the colored arrows that extend from the origin.



1. Click on the arrow that scales the element in the desired direction.
2. Hold down the mouse button and drag along the x, y, or z axes. Each of the three arrows scales the element in the direction of the axis to which it corresponds.

Tip The red arrow scales the element on the x-axis, the green arrow on the y-axis, and the blue arrow on the z-axis.



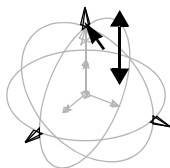
Rotating

1. Click on the circle corresponding to the axis along which you want to rotate the element.
2. Hold down the mouse button and drag along the x, y, or z axes. Each of the three circles rotates the element in the direction of the axis to which it corresponds.



The red arrow rotates the element around the x-axis, the green arrow around the y-axis, and the blue arrow around the z-axis.

Translating



The red arrow moves the element on the x-axis, the green arrow on the y-axis, and the blue arrow on the z-axis.

Keyframing

In traditional animation, *keyframes* are drawn showing the animated subject at a critical moment of a given action. The intermediate frames are then filled in to complete the action. This is called *in-betweening*.

The process of keyframing in Particle follows the same principle as traditional keyframing with one important difference: once you define the keyframes for the animation, Particle automatically calculates the in-between frames for you, which is known as *interpolation*. The interpolation between the parameters for each keyframe generates a function curve.

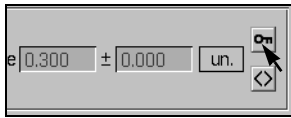


Whenever a parameter text box has a key button next to it, it means that the value can be keyframed.

Animating with Keyframes

When entering keyframes for a parameter, remember to follow this procedure:

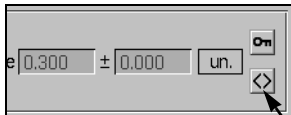
1. Move the time line pointer in the status bar to the frame where you want the animation to begin.
2. Adjust the value of the parameter that you want to keyframe (with the slider or by typing data into the text box).
3. Save a keyframe for the current frame by clicking the parameter's key button.
4. Move the time line pointer to the next keyframe position.
5. Once again, adjust the value of the selected parameter.
6. Click the key button.



Note

You must have at least two keyframes before you can open the **Graph Editor**.

7. Continue adjusting parameters, moving to a new frame, and clicking the key button until you have the number of keyframes you want for the sequence.
8. Click the forward arrow in the playback area to view the animation.
9. Open the **Graph Editor** by middle-clicking the key button. The **Graph Editor** appears allowing you to edit the function curve that describes the animation. See *Graph Editor* on page 98 for more information.



The left and right arrow button (<>) below the key button allows you to navigate between keyframes. If you left-click on the arrow button, it takes you to the previous keyframe; if you right-click on the arrow button, it takes you to the next keyframe.

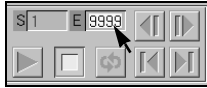
C H A P T E R T H R E E

Introductory Level Tutorials

These tutorials are designed to help you learn Particle by teaching you the basic concepts. You will learn unique features that make it easy to create realistic simulation of particle dynamics.

La Fontaine de Jouvence, Part 1

In this tutorial, you will learn the basics of Particle by creating the fountain of youth. In Part 2 of this tutorial, you will add more details to your fountain.



1. In the Particle program, set the **End** frame to 9999. By entering this in the **E** text box at the end of the time line, the playback keeps going.

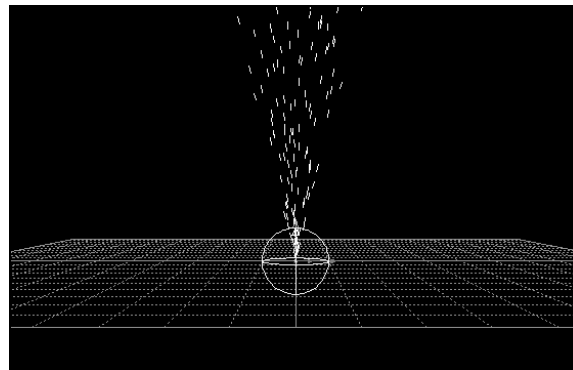


2. Select the **Source** module. Create a new source by clicking **New** and renaming it **S1** in the **Source** text box.



3. Click on the forward arrow in the playback area to begin the particle emission.
4. To adjust the spread of your Particle emission, click the **Spread** button and type **3.0** in the **Value** text box. Press Enter.

Your Particle emission should look similar to the one shown below.



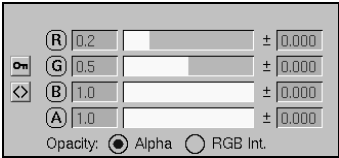
Make sure to press Enter after typing in all values in text boxes or they might not get accepted.

5. To adjust the speed of your Particle emission, click on **Speed** and type **6.0** in the text box. Press Enter.

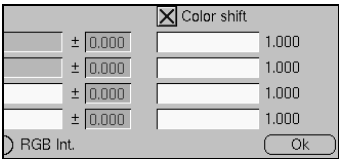
Define the Particle Attributes



6. Open the Particle module and click the **Color** button. In the Color dialogue box, set the color to a light blue by typing the following values into the R, G, B, and A text boxes: R = 0.2, G = 0.5, B = 1.0, and A = 1.0.



7. Select the **Color shift** option to animate the color of your particles over their lifetime.

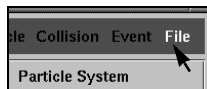
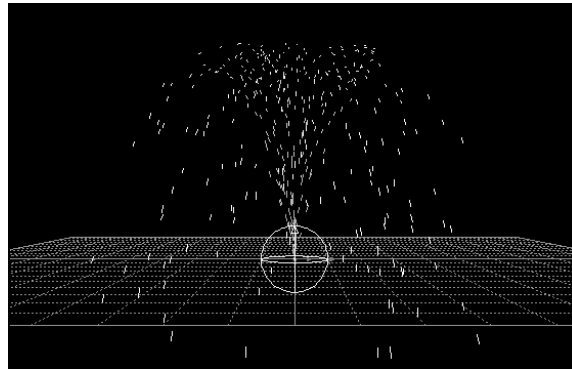


8. Change the **Color shift** values to create pure white: set each R, G, B, and A value to 1.0.
9. Click Ok to accept these values and exit the Color dialogue box.
10. Click the **Life Time** button and change the value to 4.25.
11. Add a gravity field by clicking the **Gravity** button in the Global Forces area of the interface. Set the **Strength** to 3, press Enter, and click Ok to accept the values.



You can also open the Gravity dialogue box by pressing F9.

The particles should now be falling back toward the grid, as shown below.



12. Open the File module and click the **Layout** button.

13. In the Layout dialogue box that appears, deactivate the **Display** option so that the grid disappears, and click Ok.

Create a Ground by Adding an Obstacle

14. Open the Obstacle module. Click the New button and name the new obstacle **first** in the **Obstacle** text box.

In this example, the default shape for the obstacle geometry (SQUARE) is used. There are, however, several other options available in the GEOM menu.

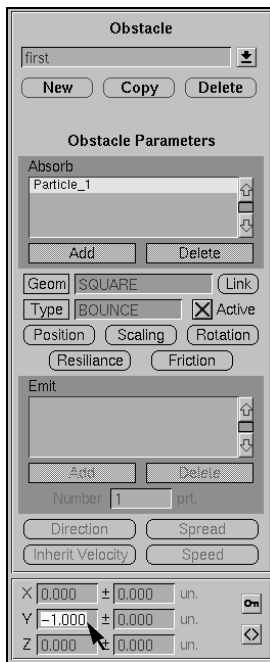
15. To scale the obstacle geometry, click the **Scaling** button and change the X, Y, Z values to the following: X = 12, Y = 1, Z = 12.

16. Change the position of the SQUARE obstacle by clicking the **Position** button and changing the X, Y, Z values to the following: X = 0, Y = -1, Z = 0.

Make sure that the Y position is negative 1 (-1), so that the obstacle is below the source.

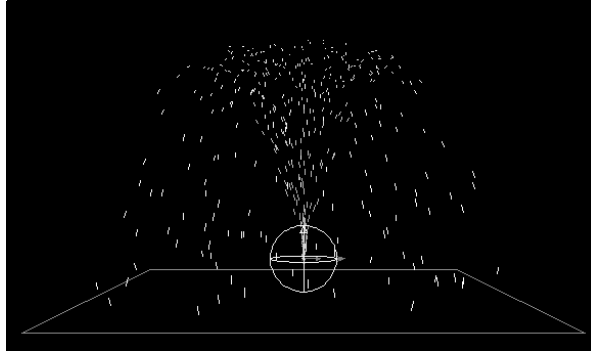
17. Add Particle_1 to the list in the **Absorb** scroll box by clicking the **Add** button below this scroll box and selecting Particle_1 from the window that appears.

The **Absorb** scroll box gives you the option of applying obstacle parameters to some particles, but not to others.



18. Play back the sequence by dragging the time line pointer back to frame 1 and clicking the forward arrow.

At this point, the source should be emitting particles and the particles should be bouncing off the square obstacle while the color changes from blue to white.



Save Your Scene to Use in Part 2

19. Open the File module. In the **System Name** text box, enter the name **fontaine**.
20. Click the **Save** button.

La Fontaine, Part 2

In this part of the tutorial, you will change the color of the particles, reduce the bounce off the obstacle, and add another source. When you're finished creating, you will learn how to preview the scene and then render it.

Copy the Previous Particle and Change Its Color

1. Open the Particle module and rename Particle_1 to P1.
2. Click **Copy** and rename Particle_2 to P2.
3. Click the **Color** button and deactivate the **Color shift** option. Set all color sliders to a value of 1.0 (pure white). Click **Ok** and exit the Color dialogue box.
4. Click the **Life Time** button and set it to 0.3.

There should now be very little bounce after the particles hit the obstacle.

Modify the Particles that Bounce up from the Obstacle

5. Open the Obstacle module and change the **Type** to **EMIT**.
6. Add the P2 particle to the list in the **Emit** scroll box.
7. Click the **Number** button and set it to 3.
8. Click the **Speed** button and set it to 2.

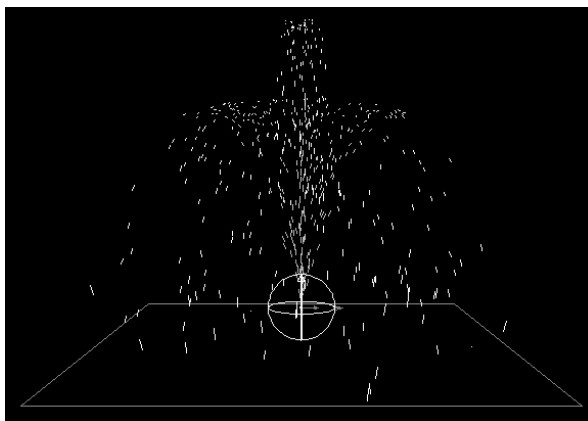
Note

The **Emit** command allows you to apply different characteristics to particles that are generated from collisions with specific obstacles. In this case, you have specified that the new particles to be emitted (P2) from the obstacle are white, have a **Life Time** of 0.3, have a **Spread** of 3, and a **Speed** of 2.

Add a New Source

9. Open the Source module, click **New**, and rename the source S2.
10. Set the **Rate** to 40, the **Spread** to 0.05, and the **Speed** to 7.0.
11. Select P1 as the Particle Type.

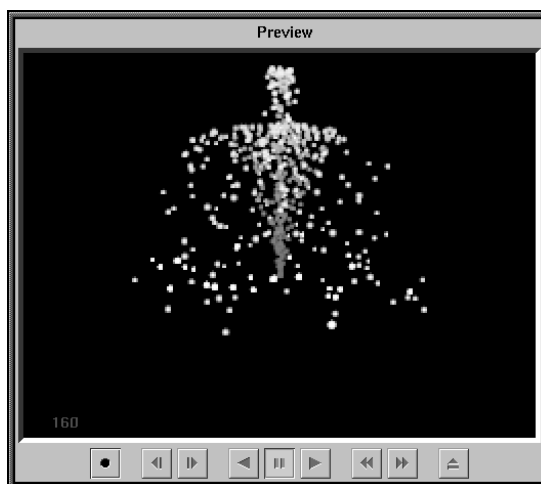
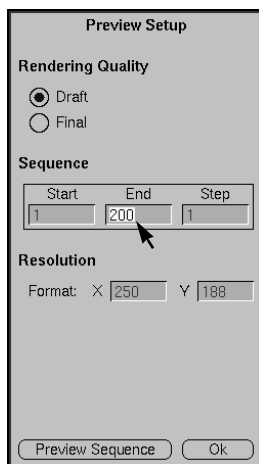
12. Play back the sequence: two streams should be created.



Preview with a Flipbook

13. Open the File module.

14. Click the Preview button. Set the End frame to 200 and click Preview Sequence.



Render to Disk

If you have time, render the sequence of images to your disk:

15. Still in the File module, click the **Render** button.

16. Set the **End** frame to 200 and click **Render Sequence**.

C H A P T E R F O U R

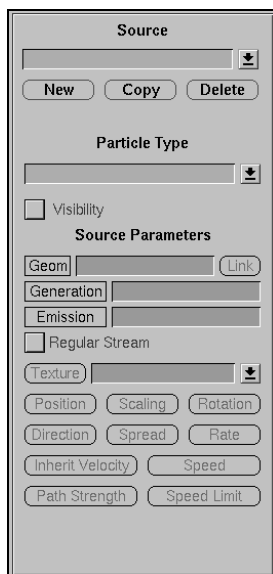
Using Particle Commands

This chapter is designed to show you, module by module, how to create a particle animation. It describes the unique features of the parameters in each module. It also includes instructions describing how to use the parameters and some examples of how you might apply a specific function.

Source Module



When you start Particle, the Source module is opened by default. If you are starting a new Particle session, you begin by defining parameters for the source emitter in this module. If, however, you wish to load a previously saved session, you must open the **File** module and select **Load**.



The Source module lets you create and define sources of particles. Each source is classified according to its name and the type of particle it emits. The nature of the source is determined by its geometry, generation, and emission parameters. For more information, see *The Geometrical Parts of the Source* on page 30.

When you open the Source module (or press the F2 key), the source controls appear in the parameters area, as shown on the left. The parameters are dimmed, indicating that they cannot be accessed. To access the parameters, you must click **New**.

Source

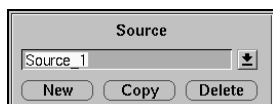
When you click **New**, **Source_1** is the default name that appears in the **Source** text box. The arrow button beside the text box opens a scroll box that lists the sources that you create in this session.

To choose a different source, click the arrow button beside the text box. From the scroll box that opens, choose a source.

Creating a New Source

1. Click **New** to access and modify the default parameter values in the parameter editing area.

The source emitter appears in the 3D viewing area.



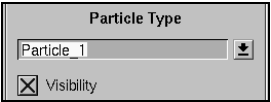
2. The source's name appears in the text box. You can change it to one that is more meaningful to you, or leave the software default name. The name you choose can be any string of characters, as long as there are no spaces between the letters.
3. To modify the geometry, generation, and emission parameter text boxes of your source, follow the instructions in *Entering and Editing Data* on page 29.

You can now define the geometry and emission parameters for your source.

Note

Each time you create a new source, it appears at the origin (0, 0, 0) in the 3D viewing area. If you have not changed the location of a source, the most recent one you create is superimposed on it. To see both sources, move one of them.

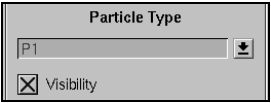
Particle Type



When you click New in the Source module, Particle_1 is the default name that appears in the **Particle Type** text box. This is the particle type that the source emits. The arrow button beside the text box opens a scroll box that lists the particles that you created in this session.

To choose a different particle type, click the arrow button beside the text box. From the scroll box that opens, choose one of the other particle types that you have created. See *Particle Module* on page 51 for more information.

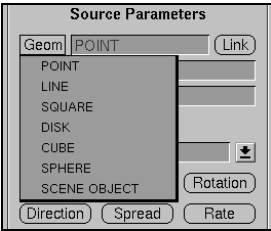
Visibility



Deselect the **Visibility** option when you have a complex session containing many different sources. The particles from these sources are not displayed on the screen, allowing you to concentrate on one source at a time.

Source Parameters

Geom



This parameter lets you select the basic geometry of the source area. You can choose between procedural objects from Particle (such as a **POINT**, **LINE**, **SQUARE**, **DISK**, **CUBE**, or **SPHERE**) to define the source geometry, or you can select **SCENE OBJECT**. Prior to selecting **SCENE OBJECT**, you must load a 3D object from SOFTIMAGE 3D, which is described as follows.

Using a SOFTIMAGE 3D Object as the Source

1. Click **Load** in the File module and choose the SOFIMAGE 3D scene you want to use as the source.

From the scene you load, select the object you want to use as the source object.

2. Click **New** in the Source module.
3. Select **SCENE OBJECT** from the **Geom** menu.

4. Select the object directly from the viewing area by dragging the cursor diagonally across it, or select it from the scroll box that opens.
5. Select **SURFACE** from the **Generation** menu.
6. Choose the type of emission you want from the **Emission** menu.

Link

The **Link** button beside the **Geom** text box lets you link a procedural emitter to a 3D object in a loaded scene.

Creating a Link Between a 3D Object and the Source

1. Click **Load** in the **File** module and choose the SOFTIMAGE 3D scene from the browser that opens.
2. Click **New** in the **Source** module.
3. Click **Link** and choose the 3D scene from the browser that opens.



To unlink a source from a 3D object, you simply click on **Link** and select **Unlink** from the browser that opens.

Generation

This parameter specifies where the particles are generated from according to the geometry of the source. When you click on **Generation**, the following options appear in the menu:

- **POINT**: Particles are generated from the centre of the source.
- **LINEAR**: Particles are generated along the x-axis of the source.
- **SURFACE**: Particles are generated across the surface of the source.
- **VOLUME**: Particles are generated inside the source.

Emission

This parameter controls the direction of particle emissions according to conditions that you assign. When you click on **Emission**, the following options appear in the menu:

- **RELATIVE**: Particle emission is relative to the source direction which is represented by the white vector that extends from the source's origin.
- **ABSOLUTE**: Particles are emitted relative to the world reference.

When you select **ABSOLUTE**, a white vector appears in the lower-right corner of the 3D viewing area. You can manipulate it by clicking on it and dragging in the desired direction.

- **NORMAL**: Particles are emitted according to the geometric normal.
- **PATH**: Particles are emitted along a named path.

Note

Path is a major feature of the Particle program. Particles can be assigned to a given path, and Particle computes the forces needed to apply to the particles so they follow the path. This process is called *inverse dynamics*. Whatever path you choose, the computation of the particle stream is performed with the path translated to the position of the source. You can position the source at any location in space and the particles continue to follow the shape of the path. You can also keyframe the force on the path.

Assigning a Particle Stream to a Path

1. Load a SOFTIMAGE 3D scene that includes a curve.
2. Click **New** in the **Source** module.
3. Select **PATH** from the **Emission** menu.
4. Select the curve from the browser that opens.
5. Click the playback button to view the animation.

Regular Stream

This parameter generates a more uniform flow of particles by emitting them in an evenly spaced manner in time.

Creating a Uniform Stream of Particle Emissions

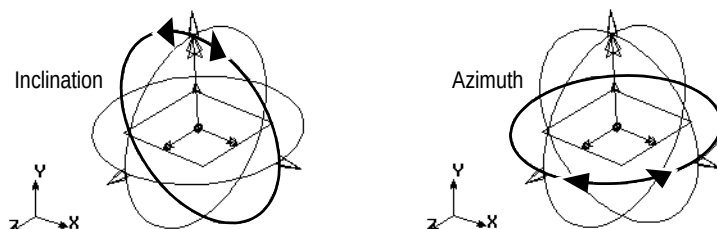
1. Select **Regular Stream**.
2. Click **Rate**.
3. Enter a value other than 0 in the parameter text box located in the **Parameters Editing** area.

Position, Scaling, and Rotation

These parameters allow you to reposition, resize (scale), or reorient (rotate) the source in the 3D world, or in relation to its parent object (if a parent object exists).

Direction

This parameter determines the inclination (I) and the azimuth (A), in degrees of rotation, of the vector along which the particles are emitted.



The Inclination is the angle measured in a vertical plane between the emission vector and the horizontal plane. **Inclination**, measured in degrees, is the angle between the emission vector and the y-axis.

The azimuth of the emissions is the angle between the vertical plane that contains the emissions and the plane from north to east (xz axis). **Azimuth** is the angle of rotation of the emission vector about the y-axis.

Spread

This parameter controls the aperture through which the particles are emitted from the source, according to the direction of emission. The spread is measured in degrees.

Rate

This parameter determines the number of particles emitted per second.

Inherit Velocity

This parameter controls the velocity of the particle emissions from a moving source, or from an animated 3D object that you are using as a source, or from moving vertices of shape-animated objects.

You apply a percentage value which is relative to the velocity of the source, or to the velocity of the moving vertices. That is, the emitted particles inherit the specified velocity from the moving source or vertices.

If you specify a value greater than 100, the particles are emitted at a greater velocity than the emitter's velocity, causing them to speed ahead of the emitter. If the value is less than 100, the particles does not inherit the velocity of the emitter, causing them to trail behind the emitter.

Speed

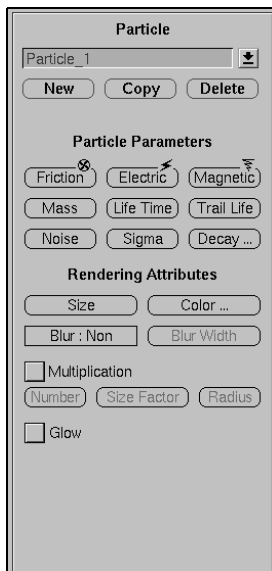
This parameter determines the initial speed of the particles in units per second.

Path Strength

This parameter is a percentage value that allows you to control how precisely the particles are translated along the profile of a curve that has been imported from SOFTIMAGE 3D.

Speed Limit

This parameter allows you to set a range between the maximum/minimum speed that the source emits the particles. This control is useful when the particle's speed increases due to high local or global field values such as for Magnetic or Electric. Setting a maximum speed with **Speed Limit** eliminates this problem.



Particle Module

The parameters in the Particle module let you define and characterize the different types of particles that are emitted by the sources in your animation. You can define as many particle types as you want. To activate this module, click on **Particle** in the module area, or press the F1 key.

You can use the **New**, **Copy**, and **Delete** commands at the top of the parameter area to delete, duplicate, or define a particle type.

Particle

When you click **New**, **Particle_1** is the default name that appears in the **Particle** text box. The arrow button beside the text box opens a scroll box that lists the particles that you created in this session.

To choose a different particle, click the arrow button beside the text box. From the scroll box that opens, choose a particle type.

Creating a New Particle

1. Click **New** to access and modify the default parameter values in the parameter editing area.
2. You can change the particle name that appears in the text box, or leave the default name.
3. To modify the parameter text boxes for your particle, see *Entering and Editing Data* on page 29.

Physical Particle Parameters

When you open the Particle module or press the F1 key, the particle controls appear in the parameters area, as shown above on the left. These controls include the following physical parameters:

Friction

This parameter controls the effect of drag on the particle to simulate a particle travelling through a medium. The **Friction** parameter dictates how much the particle slows down as it travels through the medium. The effect of friction can be influenced by the **Wind** global force button, which represents the speed at which the medium is travelling (see *Applying Natural Forces* on page 92).

Electric

This parameter controls the amount of influence an electrical field has on the particle. A global electrical field can then be applied with the **Electric** button after the particle stream is defined. You can also apply a local electric field with the Local **Electric** button after the particle stream is defined (see *Applying Natural Forces* on page 92).

Magnetic

This parameter controls the amount of influence a magnetic field has on the particle. A global magnetic field can then be applied with the **Magnetic** button after the particle stream is defined. You can also apply a local magnetic field with the Local **Magnetic** button after the particle stream is defined (see *Applying Natural Forces* on page 92).



The local and global **Magnetic** and **Electric** force buttons are associated to the **Magnetic** and **Electric** parameter control buttons. If your scene has many particle types, these global forces are only valid for particle types with a value other than 0.

Applying a Natural Force Effect

1. Click **New** in the Source module and set a value for the **Spread** parameter.
2. In the playback area, change the end frame (E) value to 9999, then click the playback button (see *Using the Playback Controls* on page 17). This eliminates the need for repeatedly clicking the playback button during the modification stage of your session.
3. Click **New** in the Particle module.
4. Select the **Magnetic** parameter in the parameters area and set a value using the slider, or by typing the value into the parameter's text box.

You will notice that the particles are not affected. You must also set a value for the parameters in the Local or Global **Magnetic** force dialogue box. The **Magnetic** parameter is not valid unless a value other than 0 has been set in either the Local or Global **Magnetic** force dialogue box.

5. Click on the Local or Global **Magnetic** force button.
6. In the dialogue box that appears, set a value for the **Strength** and **Direction** parameters.

Mass

This parameter controls the behaviour of particles in collisions. When two particles with different masses collide, the “heavier” particle’s momentum displaces the lighter particle.

Life Time

This parameter determines the amount of time, in seconds, that the particle exists after which it decays (dies away).

Trail Life

This parameter determines the amount of time, in seconds, that a trail effect remains behind the particle, like the trail of light traced in the air from a spark rising from a fire.

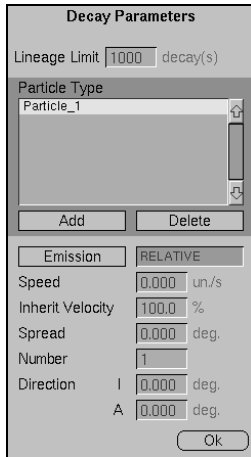
Noise

This parameter adds a jitter effect to a particle. This affects the position (P), velocity (V), and acceleration (A) of the emitted particle.

Sigma

This parameter determines the internal collision rate between particles of the same type (see *Collision Module* on page 68).

The sigma value is set between 0 and 100, and determines the probability of collision among particles of the same type, regardless of the source from which they are emitted. Even if a particle’s size has been set for the rendering process, the rendered size of the particle is not taken into account for computing the internal collisions. When the software computes collisions, it uses spatial subdivision (see *Rendering Attributes* on page 55).



Decay

This parameter permits the current particle to become another type of particle once it reaches the end of its lifetime. When you click the **Decay** button, the **Decay Parameters** dialogue box appears:

Decay Parameters

- **Lineage Limit** sets the number of decaying particle generations, of the same type, that are generated from your original particle. Subsequent generations inherit the physical properties of your original particle.
- **Particle Type** contains a list of the particle types into which the current particle can decay.
- **Add** opens a scroll box that lets you add particle types to your decay particle list. To add a particle type to this list, click the **Add** button, select a particle type from the displayed scroll box, and click **Ok**.

Note For each particle type added to the list, you can modify certain parameters. To do this, select the particle type in the **Particle Type** box, then edit the desired parameters as appropriate.

- **Delete** removes a particle type from the **Particle Type** scroll box. To do this, select the particle type and click **Delete**.
- **Emission** controls the direction of emissions.
- **Speed** determines the speed of the particle in units per second.
- **Inherit Velocity** determines at what percentage the particles have the original particle's velocity added to their own.
- **Spread** controls the degree that the particle travels according to the direction of the original particle.
- **Number** determines how many particles are generated from the decayed particle.
- **Direction** determines the degree of the inclination and azimuth vector along which the particle instances are generated. For more information, see *Direction* on page 49

When you are satisfied with the parameters you have set for the decay particles, click **Ok** to close the dialogue box.

Rendering Attributes

The following rendering parameters appear in the parameter area of the Particle module:

Size

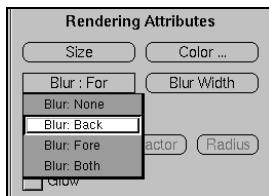
This parameter determines the size of the rendered particle. The size of the particle is computed only at rendering time.

Times are expressed in seconds, and the size is expressed in scene units. The size of the rendered particles is affected by the perspective transformation; that is, the farther away a particle appears in the viewing area, the smaller it appears when it is rendered.

Color

This parameter opens the Color dialogue box (see *Color Dialogue Box* on page 57) that applies colors to the particle and to its trail, if it has one.

Blur



This parameter allows you to define the relative blur for fast moving particles. It simulates the effect of a slow shutter speed, creating a uniform oblong blur around the particle and in the direction of the velocity of the particle. There are four options to choose from in the Blur menu: **None** (default), **Back**, **Fore**, and **Both**.

- **Back** is effective for simulating particles travelling at a high velocity. If you select this option, the front part of the motion blur is not rendered.
- **Fore** does not render the back part of the motion blur.
- **Both** renders both the front and the back part of the motion blur.

Blur Width

This parameter allows you to define the length of the stretching effect based on the length of the velocity.

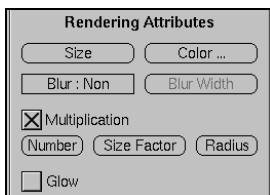
The **Blur Width** is the amount of the segment going from the previous position of a particle to the present position that you use to stretch the shape of the particle during the rendering. This value is a percentage.

For example, in wireframe the particles are drawn as a line. The bottom of the line is the previous position and the top is the present

position. To create this effect, set a value of 1 or 2 for the **Size** parameter, set the **Blur** parameter to **Back**, and the **Blur Width** parameter to 100.

Multiplication

Select **Multiplication** to define the number of instances you wish to reference to the original particle, and the physical relationship – **Size Factor**, and **Radius** – the instances have to the original particle. This is called *instantiation*. By default, the instances inherit the physical characteristics of the original particle. Changes made to the original particle are reflected globally in the instances.



Note

The effects of instantiation are only visible when you render your animation.

Number

This parameter lets you specify the number of instances generated from the original particle.

Size Factor

This parameter controls the size of the instances, which are defined as a percentage relative to the original particle (100% is the actual size of the original particle). The instances have a one-to-one size relationship with the original particle. If you edit the size of the original particle, the instances are altered by the same percentage.

Radius

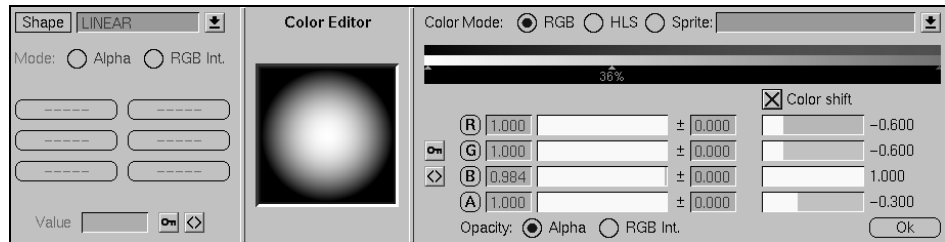
This parameter determines the distance in units that the instances are positioned relative to the original particle.

Glow

When you select the **Glow** parameter, the RGBA value of each particle is added. At the source, the color contains the full saturation of its RGB value since the maximum number of particles exist at this position. When the particle reaches the end of its **Life Time** value, there are fewer particles to add, so the color is less saturated, resulting in the glow effect.

Color Dialogue Box

When you click on the **Color** button in the Particle module, the Color dialogue box appears:



Colors can be expressed according to RGBA or HSLA values.

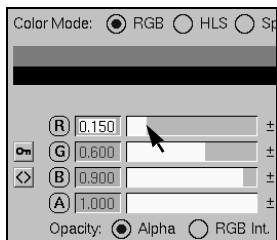
Additionally, the **Sprite** option allows you to map a picture file onto each particle. When you select the **Sprite** option, a database browser appears letting you load a 2D image or a sequence of images. The image you select is then mapped to each particle. There are three ways in which you can assign color to a particle:

- The color of the particle can be constant for the duration of its lifetime (the color does not change after the particle is emitted).
- The color of the particle can be keyframed.
- Colored particles and their trails can also be animated according to different time references in the particle's lifetime causing the color of the particle to change over time. This is called animating the color shift of the particle.

Adding a Constant Color to the Particle

To add a constant color to the particle (one that won't change over time), simply edit the R, G, B, and A (or H, L, S, and A) color values.

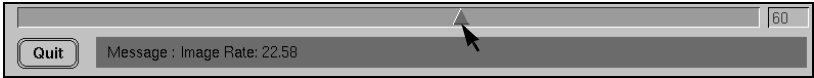
1. To edit the RGBA color values, select the **RGB** as the color mode.
2. Holding down the mouse button, drag the slider associated with the color you want to modify.



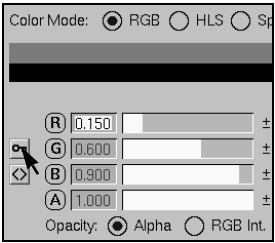
You can also edit the RGBA values by typing directly into each color's text box.

Keyframing the Particle's Color

1. Move the time line pointer, located below the 3D viewing area, to the desired frame.



2. Select the **Color** button. In the Color dialogue box, adjust the color for the current frame.
3. Click the key button. This affects the color of the particles emitted from the current keyframe until the next.



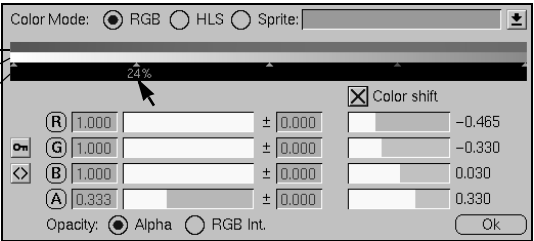
Tip If you are keyframing multiple color changes along the time line, move the Color dialogue box (Alt-left mouse button) so that you can access the time line while keyframing the color changes. This lets you keep the Color dialogue box while keyframing.

Animating the Particle's Color Shift

When you are in **Color shift** mode, the color bar represents the lifetime of the particle. To edit the color bar, follow these steps:

1. Select **Color shift**.
2. Position your cursor on the black strip that appears under the color bar.

The top bar represents the shift in the alpha channel over time.
The middle bar represents the color of the particle over time.
The bottom bar indicates each point in time when a shift in the particle's color occurs.



The percentage value that appears represents a point in the particle's lifetime.

3. To add a key to the location where you want a color shift to occur, position the cursor on the desired location, then click the left mouse button.

A red arrow appears to represent a color shift key.

4. Use the color sliders under the **Color shift** option to offset the color components up or down for the color shift key. The effect appears in the bar above the black bar.

5. You can continue to add color shift keys as desired.

The selected key appears as a red arrow, and deselected keys appear green.

- To add another key, click on the black strip.
- To select a key, middle-click on the corresponding green arrow.
- To move a key, middle-click and drag the corresponding green arrow. When the key is in the desired location, release the mouse button.
- To delete a key, right-click on its arrow.

Opacity



Opacity can be expressed according to the **Alpha** channel or **RGB int.** (intensity). At the bottom of the **RGBA** editing area, you can choose between two options, depending on the effect you wish to create:

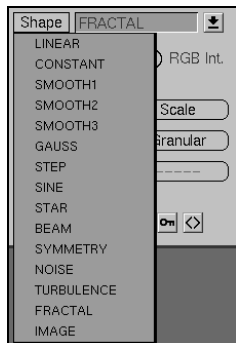
- **Alpha** uses the alpha channel of the color to create transparency in the particle.
- **RGB Int.** uses the RGB color intensity to create transparency in the particle. It produces a dull effect on the particle.



Color Editor

The **Color Editor** displays the color and shape that you choose for the particles. When you modify a color value, or select a shape, it is displayed in the **Color Editor** immediately.

Shape



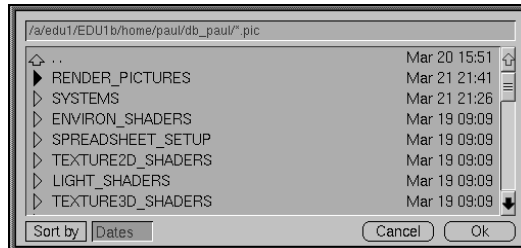
This parameter lets you select a shape to be used as an alpha channel for the particles. When you click on **Shape**, a menu opens containing predefined geometric shapes. Various parameters can be edited depending on the shape you select. You can choose from among 14 different shapes, or you can select **Image** and load a 2D image from the database browser that appears. The **Shape** menu contains these shapes:

- **LINEAR** gives the particle a smooth illuminated effect, with the centre more brilliant than the edges. It is the default setting and cannot be edited.

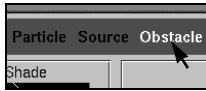
- **CONSTANT** gives the particle a solid brilliant effect with no shading.
- **SMOOTH1** gives the particle a tiny, bright centre with a falloff dulling effect toward the outer perimeter.
- **SMOOTH2** gives the particle an overall hazy effect with gradual dulling toward the outer perimeter.
- **SMOOTH3** gives the particle an overall flat, dull, matte effect.
- **GAUSS** gives the particle a tiny, bright centre with an evenly dull, illuminated effect that ends with crisp, definite edges. With **GAUSS**, you can set and keyframe the **Scale** value.
- **STEP** gives the particle a medium-sized, bright centre with evenly illuminated edges. With **STEP**, you can set and keyframe the **Step** value.
- **SINE** creates a particle with an editable number of rings that are equally spaced from one another. With **SINE**, you can set and keyframe the **Offset** value. The lower the **Offset** value, the fewer the number of rings.
- **STAR** creates a particle with a star-like configuration. With **STAR**, you can set and keyframe the number of **Branches** that make up the star shape (default is four branches).
- **BEAM** gives the particle a long beam shape with a bright centre surrounded by a glow effect. With **BEAM**, you can set and keyframe the **Width** value.
- **SYMMETRY** gives the particle a cube shape with an overall hazy effect. Two slightly brighter lines extend diagonally across the surface. With **SYMMETRY**, you can set and keyframe the **Width** value.
- **NOISE** can be used to create an infinite variety of patterned effects. Based on one basic pattern, you can modify the spacing and the level of detail. The higher the **Scale**, the more compressed the pattern becomes. With **NOISE**, you can set and keyframe the **Z channel** and the **Scale** value.
- **TURBULENCE** is a cut of a 3D texture applied to a cylinder at a given “Z.” With **TURBULENCE**, you can set and keyframe the **Z channel**, **Low Frequency**, **High Frequency**, and the **Scale** value.
- **FRACTAL** is a cut of a 3D texture applied to a cylinder at a given Z

channel. With FRACTAL, you can set and keyframe **Scale** (controls the texture), **Granular** (refines the grain), and **Weight** (controls the luminosity) values.

- **IMAGE** opens a browser that displays the picture chapter of the active database. From here, you can select an image that is in SOFTIMAGE file format (.pic), or navigate to the location where your images are stored.



Obstacle Module



Any number of obstacles can be created in a scene. Obstacles can be models imported from SOFTIMAGE 3D, or procedural objects from the Particle system linked to hierarchies in SOFTIMAGE 3D (a SOFTIMAGE 3D model has to exist in the associated scene when you render).

Obstacle Parameters



The parameters in the Obstacle module allow you to create interactions between particle streams and an obstacle. The particle can be made to bounce off or stick to the obstacle. It can also be made to disappear or to decay upon contact with the obstacle.

At the time of contact, the obstacle behaves like a source and emits one or more new particle types from its surface. The number of new particle types emitted is independent of the number of particle types that collide with the obstacle.

When you open the **Obstacle** module (or press F3), the obstacle controls appear in the parameters area as shown on the left.

Absorb

The **Absorb** scroll box allows you to specify how different particle types interact with an obstacle. Once you have added a particle type to the Absorb list, you can then specify physical properties for the obstacle. The physical properties, below the **Type** parameter, control only the obstacle. You can add as many particle types to the **Absorb** list as you have defined in your session.

Adding Particle Types to the Absorb Scroll Box

Before starting, make sure you have defined the physical parameters for more than one particle type.

1. In the **Obstacle** module, click **New**.
2. To access the **Absorb** scroll box, click **Add** below it.

A window opens listing all the particle types that you have defined in this session.

3. From the list, choose the particle type(s) that you want to interact with the obstacle. The chosen particles appear in the **Absorb** scroll box.

To add more than one particle type at time, use the Shift key while selecting.

4. To close the window, click Ok.
5. Define the **Position**, **Scaling**, and **Rotation** parameters for the obstacle.

Note

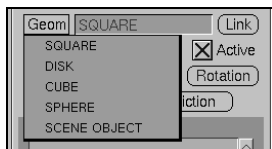
The parameters below the **Type** parameter are associated with the obstacle, not the particle types listed in the Absorb scroll box.

If you have chosen **BOUNCE** from the **Type** list, you may want to set values for the obstacle's **Resilience** and **Friction** parameters.

Note

To delete a particle type from the **Absorb** scroll box, select the particle type, and click the **Delete** button.

Geom



This parameter selects the basic geometry of the source area. When you click the **Geom** button, a menu appears allowing you to choose the geometry to define your source's shape. The menu includes the following procedural objects:

- **SQUARE**
- **DISK**
- **CUBE**
- **SPHERE**

If you select **SCENE OBJECT**, you must first load a SOFTIMAGE 3D scene. When you select **SCENE OBJECT**, all the objects that make up the scene are listed in a browser that opens. From here, you can choose the desired object.

Note

When you load a SOFTIMAGE 3D scene into your Particle scene, the objects that make up the SOFTIMAGE 3D scene are listed in the **SCENE OBJECT** browser.

Selecting a 3D Scene Object as Your Obstacle's Geometry

1. Click **Load** in the 3D Scene area of the File module and choose the SOFTIMAGE 3D scene from the browser that opens.
2. Select **New** in the Obstacle module.

3. Select **SCENE OBJECT** from the **Geom** menu.
4. From the browser that opens, select the 3D object from the scene that you loaded.

Link

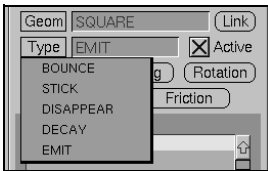
The **Link** button beside the **Geom** text box lets you link a procedural obstacle to an animated or static object in a loaded SOFTIMAGE 3D scene. When you select **Link**, a browser opens listing the objects from the SOFTIMAGE 3D scene.

Creating a Link between an Obstacle and a 3D Object

1. Click **Load** in the 3D Scene area of the **File** module and choose the SOFTIMAGE 3D scene from the browser that opens.
2. Select **New** in the Obstacle module.
3. Click **Link** and from the browser that opens, select the 3D object from the scene that you loaded.

Note To unlink an obstacle from a 3D object, simply click on **Link** and select **Unlink** from the browser that opens.

Type



This parameter allows you to choose the physical property of the obstacle and how it interacts with the particle when it is struck. When you click the **Type** button, a menu appears allowing you to choose from the following list of obstacle options:

- **BOUNCE** causes the particles to bounce off the obstacle when they strike it. The particle's speed after striking the obstacle is modified according to the dampening factors (**Resilience** and **Friction**) of the obstacle (the normal and tangent component of the incoming speed vector are multiplied by the respective dampening factors). See *Friction* on page 65 and *Resilience* on page 65 for more information on these factors.
- **STICK** causes the particles to stick to the surface of the obstacle until the particles decay (die off).
- **DISAPPEAR** causes the particles to disappear when they strike the obstacle.

- **DECAY** makes the particles decay at the point of collision with the obstacle.
- **EMIT** allows you to access the **Emit** scroll box as well as the parameters associated with the particle types that you add to the **Emit** list (see *Emit* on page 66).

Active

When **Active** is selected, the obstacle is visible to the particle types that you add to the **Absorb** list. If **Active** is not activated, the obstacle is transparent to all the particle types.

Position, Scaling, Rotation

These three parameters are used to reposition, resize (scale), or reorient (rotate) the obstacle in the 3D world, or in relation to its parent object (if a parent object exists).

Resilience

This feature works only with the **BOUNCE** and **EMIT** type obstacles. Resilience controls how particles bounce off the obstacle when they strike it. The particle's speed after striking the obstacle is modified according to the resilience of the obstacle (the normal and tangent component of the incoming speed vector are multiplied by the respective dampening factors of the resilience level).

By default, Resilience is set to 100, which means that 100% of the energy of the particle striking the obstacle is transmitted back into the rebounding particle, so the particle does not lose speed after it strikes the obstacle.

Friction

This parameter works only with the **BOUNCE** and **EMIT** type obstacles. It controls whether particles stick to the surface of the obstacle when they strike it. By default, the friction is set to 100, which causes the particles to stick to the obstacle. A low friction level causes the particle to rebound along the vertical axis of the obstacle. A higher friction level causes the particle to rebound almost parallel to the obstacle.



Emit

To access the **Emit** scroll box, you must choose the **EMIT** option from the **Type** menu. You can then choose the particle types that are generated from the collisions between the particle types you chose from the **Absorb** list and the specified obstacle.

Particle types that you add to the **Emit** scroll box are the particles that are generated from the collision between the particle types in the **Absorb** list and the specified obstacle.

The parameter controls below the **Emit** scroll box are used to define physical properties for the particle type that is selected in the **Emit** scroll box.

Tip To add more than one particle type at a time to the **Emit** scroll box, use the Shift key while selecting. To delete a particle type from the **Emit** scroll box, select it and click the **Delete** button.

Number

To set the number of particles of a given type that are generated from the collision, select the particle type in the **Emit** scroll box, then set the desired number in the **Number** text box.

Direction

The **Direction** button determines the direction (Inclination – I and Azimuth – A) of the particle type selected in the **Emit** list. There can only be one direction for each emitted particle type. For more information, see *Direction* on page 49.

Note **Inclination**, measured in degrees, is the angle between the emission vector and y-axis. **Azimuth** is the angle of rotation of the emission vector about the y-axis.

Spread

The **Spread** button determines the angle of the spread of the particle type selected in the **Emit** scroll box. There can only be one spread angle per emitted particle type.

Inherit Velocity

This parameter controls the velocity of the particles that are generated from the collision with the obstacle. You apply a percentage value which is relative to the velocity of the source

emission, meaning that the emitted particles inherit the specified velocity from the selected particle type in the **Absorb** scroll box.

If you specify a value greater than 1, the particles are emitted at a greater velocity than the emitter's velocity. If the value is less than 1, the particles do not inherit the velocity of the emitter.

Speed

The **Speed** parameter determines the velocity of the particle type that is selected (highlighted) in the **Emit** scroll box.

Generating Obstacle Emissions

1. Choose **EMIT** from the **Type** menu. This opens the **Emit** scroll box and the parameters associated with it.
2. Click **Add** at the bottom of the **Emit** scroll box.

A window appears listing all the particle types you have defined in this session.

3. From the list, choose the particle type(s) that you want to add to the **Emit** scroll box.

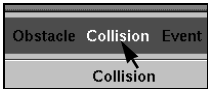
Particle types that you add to the **Emit** scroll box are the particles that are generated from the collision between the particle types in the **Absorb** list, and the specified obstacle.

4. For the particle type selected in the **Emit** scroll box, you can set values for its physical properties, which are located below the **Number** text box.

Note

If you have added more than one particle type to the **Emit** scroll box, you must change some of the parameter values because the particle type you select is superimposed on the previously selected particle type.

Collision Module



The **Collisions** module simulates simple collisions. Simple collisions happen between two types of particles coming from different sources.

Note When two particles with different masses collide, the “heavier” particle’s momentum displaces the lighter particle.

The collisions and events generated by Particle are based on probabilities and densities. When the animation is playing, the volume occupied by the particles at each frame is divided into elementary cubes of a given volume. You can adjust this volume by changing the **Range** value in the **Animation** dialogue box in the File module, as described on page 77. Within each elementary volume, the density of each type of particle is computed, taking into account changes from collisions or particle decay.

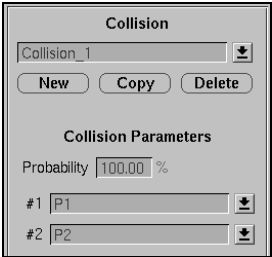
Note The **Range** value you use has a direct effect on the results of your particle animation. The lower the rate, the more realistic the animated effect, but your computer’s performance is slowed.

Collision

When you click **New**, Collision_1 is the default name that appears in the **Collision** text box. The arrow button beside the text box opens a scroll box that lists the collisions that you created in this session.

To choose a different collision, click the arrow button beside the text box. From the scroll box that opens, choose a collision.

Collision Parameters



When you open the **Collision** module (or press F4), the collision controls appear in the parameters area, as shown on the left.

Probability

The **Probability** text box determines the probability of a collision between the particles in the two streams. Within each elementary volume, if the density of the particles is greater than zero, a collision may occur according to the density of the smallest particle, the rate of particle emission, and the value specified in this text box.

Text Boxes

The **Collision Parameters** area contains two text boxes labelled #1 and #2, in which you specify the names of the particle streams that you want to collide.

Creating Simple Collisions between Different Particle Streams

Before starting, make sure you have defined the emission and geometry parameters for at least two sources.

1. Click **New** in the Collision module.
2. Click the #1 text box arrow button. From the browser that opens, choose the first particle stream for the collision.
3. Click the #2 text box arrow button. From the browser that opens, choose the second particle stream for the collision.



Since #2 particle is superimposed on #1 particle, you must reposition the second particle stream. Click and drag the origin of the top source emitter anywhere in the window. Both particle streams are now visible.

4. In the **Source** module, adjust the value for the **Direction** parameter of the particle emissions until collisions occur between the two particle types.

Creating Simple Collisions between Same Type Particles

Assuming you have defined at least one particle type and set values for the desired parameters, follow these steps:

1. Open the Particle module, then click **Copy**.

You can change the name that appears in the **Particle** text box or leave the default name.

2. Open the Source module, then click **Copy**.
3. Click the **Particle Type** text box arrow button and choose the particle type that was created in Step 2.
4. Open the Collision module and click the **New** button.
5. Click the #1 text box arrow button. A browser opens allowing you to choose the first particle stream for the collision.
6. Select the particle type from which you made a copy.

7. Click the arrow button beside the #2 text box and select the copied particle type.



Since #2 particle is superimposed on #1 particle you must reposition the second particle stream. Click and drag the origin of the top source emitter anywhere on your screen. Both particle streams are now visible.

8. In the Source module, adjust the value for the **Direction** parameter of the particle emissions until collisions occur between the two particle streams.

Event Module

Creating Events (Complex Collisions)



The Event module lets you create complex collisions. A complex collision happens when two different types of particles collide and their collision creates new particles. The number of new particles created is independent of the number of particles that are colliding.

You can specify any number of different particle types emitted from separate sources and collide them, generating any number of new particles. The number of new particles created is also independent from the number of particles that are colliding.

An event is defined as the probability that a given number of particles of a given type will interact under certain conditions. For example, events can be compared to chemical reactions: when two types of molecules are present under certain conditions, you get a chemical reaction producing a new type of molecule. The Particle program lets you simulate these conditions: you can have two sources emitting different types of particles, which collide and create an entirely new stream of particles.

The events generated by the Particle program are based on probabilities and densities. When the animation is playing, the volume occupied by the particles at each frame is divided into elementary cubes of a given volume. You can adjust this volume by changing the **Range** value in the **Animation Setting** dialogue box in the File module, as described on page 77. Within each elementary volume, the density of each type of particle is computed, taking into account changes from collisions or particle decay.

Event

When you click **New**, Event_1 is the default name that appears in the **Event** text box. The arrow button beside the text box opens a scroll box that lists the events that you create in this session.

To choose a different event, click the arrow button beside the text box. From the scroll box that opens, choose an event.

Event Parameters

When you open the Event module (or press F5), the event controls appear in the parameters area as shown on the left.

Probability

The **Probability** value determines the probability of a collision between the particles in the two streams. The higher the rate, the more likely that particles in the two streams will collide with each other.

Absorb and Emit

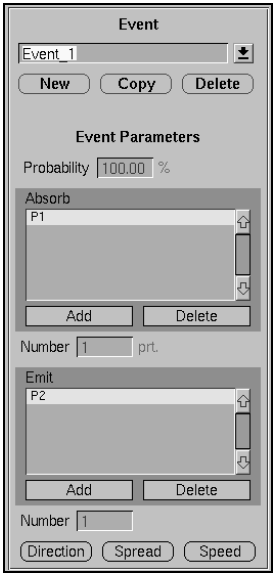
The **Absorb** scroll box contains the name of the particle type that will be colliding. The **Emit** scroll box contains the name of the particle type(s) that are created from the complex collision. For more information, see *The Physics of Particle Animation* on page 4.

Adding a Particle Type to the Absorb and Emit Scroll Boxes

1. Click the appropriate **Add** button. From the browser, choose a particle type.
2. Click **Ok**.
3. To set the number of particles of a given type that is absorbed or emitted from each particle collision, choose a particle type from the **Absorb** or **Emit** scroll box, then set the number in the appropriate **Number** text box.

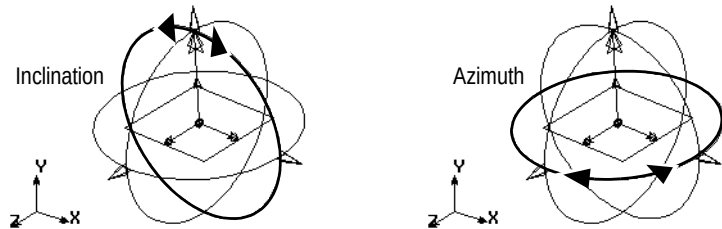
Note To delete a particle type from an event, select it in the **Absorb** or **Emit** scroll box, then click the appropriate **Delete** button.

4. You can set values for three parameters (**Direction**, **Spread**, and **Speed**) for the particles that appear in the **Emit** scroll box.



Direction

The **Direction** button determines the direction (Inclination – I and Azimuth – A) of the particle type selected in the **Emit** list. There can only be one direction for each emitted particle type.



Inclination, measured in degrees, is the angle between the emission vector and y-axis. **Azimuth** is the angle of rotation of the emission vector about the y-axis.

Spread

The **Spread** button determines the angle of spread of the particle type selected in the **Emit** list, it is based on degrees (deg.).

Speed

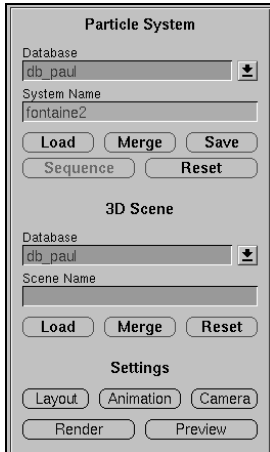
The **Speed** button determines the velocity of the particle type selected in the **Emit** list in units per second.

File Module



The File module is used to launch and control the preview of the Particle effects. It is also used to start the first pass of the rendering process, and to set up the general configuration of the software.

When you open the File module (or press the F6 key), the file controls appear in the parameters area, as shown on the left.



Particle System Parameters

Database

If you click the arrow button beside the **Database** text box, a browser appears in which you can choose the database where your particle animation is located. Similar to SOFTIMAGE 3D, you need to set the `SI_DBDIR` environment variable and have a valid `DatabaseDir.rsrc` file. For more information see the *SOFTIMAGE 3D Installation Guide*.

System Name

The **System Name** text box lets you specify the name of the particle system or your whole particle scene. There are four buttons below the **System Name** text box:

- **Load** lets you load a previously saved particle system.
- **Merge** lets you merge the current particle system with a previously saved system.
- **Save** lets you save the current particle system. If you loaded any 3D elements into your scene, they are not saved as part of the scene, since Particle is merely referencing them.
- **Sequence** is not yet available (dimmed).
- **Reset** removes the current particle system and lets you begin anew. If you have a SOFTIMAGE 3D scene loaded, it is not affected. To remove the 3D scene, click the **Reset** button in the 3D Scene area.



To reset both the particle system and the 3D scene, use the keyboard shortcut Shift-ds.

3D Scene Parameters

Database

If you click the arrow button beside the **Database** text box, a browser appears in which you can choose the database where your 3D scene is located.

Scene Name

If you click the arrow button beside the **Scene Name** text box, a browser appears in which you can select a scene from the current SOFTIMAGE 3D database. You can then choose the SOFTIMAGE 3D scene that you want to incorporate in your particle simulation. There are three buttons below the **Scene Name** text box:

- **Load** lets you load a SOFTIMAGE 3D scene from the current database.
- **Merge** lets you merge a SOFTIMAGE 3D scene with another SOFTIMAGE 3D scene from the current database.
- **Reset** removes any SOFTIMAGE 3D scene elements that you have incorporated into your particle system without affecting the particle system elements, such as sources or obstacles.

Loading a SOFTIMAGE 3D Scene

1. Click **Load** in the 3D Scene area of the **File** module. A browser opens.
2. From the browser, select the SOFTIMAGE 3D scene that you wish to load.
3. Click **Ok**. The 3D scene appears in the 3D viewing area.

Settings Parameters

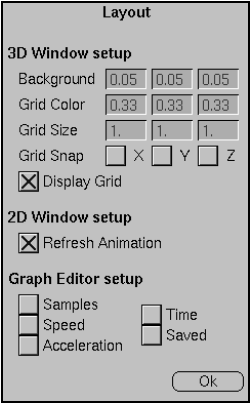
Each of the five buttons in the **Settings** area opens a dialogue box containing various parameter settings for controlling the preview and rendering effects, as well as the general configuration of Particle. The following is a brief description of each button's function. A detailed description for each follows this list.

- **Layout** allows you to customize the interface to suit your needs. See *Layout Settings* on page 76 for more information.
- **Animation** allows you to customize various parameters for your particle animation. See *Animation Settings* on page 77 for more information.

- **Camera** allows you to set the parameters that govern the camera preferences for the 3D viewing area. See *Camera Settings* on page 79 for more information.
- **Render** allows you to set the parameters for and initialize the final rendering of a frame or a sequence of frames. See *Render Settings* on page 80 for more information.
- **Preview** allows you to set the parameters for previewing your scene on the screen. See *Preview Settings* on page 84 for more information.

Layout Settings

When you click the **Layout** button in the Settings area of the File module, the Layout dialogue box appears. It contains three categories of settings:



3D Window Setup

- **Background** sets the color of the background in the 3D viewing window. Acceptable values are 0 to 1 for R, G, and B.
- **Grid Color** lets you change the color of the display grid in the 3D viewing window. Acceptable values are 0 to 1 for R, G, and B.
- **Grid Size** lets you set the dimensions of the display grid in X, Y, and Z, in SOFTIMAGE units.
- **Grid Snap** locks the translation of any source or obstacle to one, two, or all three axes on the grid.
- **Display Grid** allows you to show or hide the grid.

2D Window Setup

- **Refresh Animation.** By default, when you play back a particle scene, all the values in the text boxes and dialogue boxes are refreshed during the playback. For example, assume you have keyframed the mass of a particle, and the **Mass** parameter is selected in the Particle module. If you are playing back your animation, the numbers in the parameter editing area are updated or “refreshed” as the scene is played back to display the changing value of the mass of the particles. You can activate or deactivate the refresh.

Note Deactivating the refresh speeds up your playback if you have a very complex scene, but you do not get an interactive update of the dialogue box and command values during the playback.

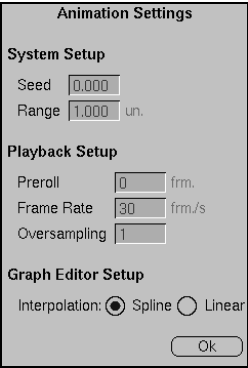
Graph Editor Setup

The display preferences contain options which control the following display parameters in the Graph Editor:

Samples	Displays curve values (1 per frame).
Speed	Displays speed curve of the function curve.
Acceleration	Displays the acceleration curve of the function curve.
Time	Displays the time line and time scale in seconds, and displays the function curve's corresponding value at the current frame.
Saved	Displays the last saved function curve (the one saved in the buffer).

Animation Settings

When you click the **Animation** button in the Settings area, the Animation Settings dialogue box appears. It contains three categories of settings:



System Setup

- **Seed** determines how the random number generator inside the software is initialized. For particle systems with the same seed, an effect applied to a particle simulation is always the same. With different seeds, the random number changes, producing slightly different effects. The seed is linked to the jitter numbers assigned to different parameters, working globally for all the jitter effects in a scene.

For example, assume you have a particle system animated to look like a water fountain. You can load the same system and change the seed. Now the jitter parameters are changed so that when the fountain is played back, it appears slightly different from the first one. You can then composite the two systems to create a realistic effect of two separate water fountains in the same image.

- **Range** determines the precision of the particle collision detection. The range represents the maximum distance (in SOFTIMAGE units) between particles for them to interact. The range you use has a direct effect on the results of your particle animation. The **Range** does not affect collisions with obstacles.



Avoid using a very low **Range** value. The lower the rate, the more realistic the animated effect, but your computer's performance is slowed. If you are not using Collision or

Event parameters in your particle simulation, set the range to a high value like 5 or 6, which ensures that you'll get the maximum performance from Particle.

Playback Setup

- **Preroll** is used if you want your particle stream to begin at the first frame, but exhibit the behaviour of the particle stream at a later frame.

For example, assume you want to animate a water fountain at full intensity from the first frame of your animation. You would advance to the frame in your animation where all the particles in the fountain are spraying at an even rate. You then enter the number of that frame in the Preroll text box. When you render the animation, the first frame of the animation renders the image at the later frame.

- **Frame Rate** determines the number of frames per second in your animation. The default is 30.
- **Oversampling** is a temporal antialiasing calculation for fast-moving particles in continuous emission. During the rendering process, oversampling determines the number of antialiasing calculations the Particle system performs when rendering between two frames. You can choose from values between 0 to 5.

If oversampling is set to 1, only one antialiasing calculation is made between each rendered frame. If you set the Oversampling value to 3, two calculations are made between each rendered frame.

For example, assume you have a stream of particles striking an obstacle. Particle calculates collisions on the basis of probability, so if you set the **Oversampling** to a higher rate, there is a better chance that the particle will detect the obstacle since more than one calculation is performed.



Avoid using a very high **Oversampling** value. The higher the rate, the more precise the rendered effect, but the slower the rendering speed.

Graph Editor Setup

The Graph Editor is a window where you edit the function curves to change the animation for parameters for which you have set at least two keyframes. Function curves are graphic representations of the relationship between time and the value of an animated parameter.

See *Graph Editor* on page 98 for more information. Each function curve can be interpolated in one of two ways:

Interpolation lets you choose between two preferences:

- **Linear** creates a regular interpolation between key points making the function curve appear as a straight line.
- **Spline** uses a spline to interpolate between key points making the function curve a smooth transition between the points with an ease-in at the beginning of the curve and an ease-out at the end.

Camera Settings

When you click the **Camera** button in the Settings area, the Camera Settings dialogue box appears.

The screenshot shows a 'Camera Settings' window with the following values:

Parameter	X	Y	Z	Unit/Label
Position	0.000	2.000	20.00	
Interest	0.000	0.000	0.000	
Roll	0.000			deg.
Near Plane	0.100			un.
Far Plane	32768			un.
Angle of View	43.70			deg.
Aspect Ratio	1.333			

Buttons: Reset, Ok

In this dialogue box, you can set the parameters related to the camera used for the 3D viewing area:

- **Position** is the location of the camera in x, y, z coordinates.
- **Interest** is the location of where the camera is pointing (the camera's interest) in x, y, z coordinates.
- **Roll** is the angle of lateral inclination of the camera.
- **Near Plane** and **Far Plane** let you set the closest and farthest distance (SOFTIMAGE units) from the camera that objects appear when rendered. For example, assume you have the **Near Plane** value set at 2, and the **Far Plane** value set at 200. When you render the particle simulation, particles are not rendered if they come closer than 2 SOFTIMAGE units to the camera, or extend farther than 200 SOFTIMAGE units from the camera.

Tip Use the **Near Plane** and **Far Plane** options to avoid having large particles flash full screen during an animation. This is a result of the particles coming too close to the camera.

- **Angle of View** calculates the camera angle depending on its current attributes. If you zoom in to the Perspective window, the camera angle automatically increases.
- **Aspect ratio** specifies the ratio between the height and width dimensions of the rendered image (1.333 by default). This value is set in the Render Setup dialogue box and cannot be edited from here.
- **Reset** resets the Camera settings default values.

Render Settings

When you click the **Render** button in the Settings area, the Rendering Setup dialogue box appears. It contains six categories of settings:

The **Render Setup** dialog box is divided into several sections. On the left, the **Output Type** section has two radio buttons: **Render Picture** (selected) and **Binary Particle File**. Below it, the **Sequence** section contains a table with columns **Start**, **End**, and **Step**, with values 1, 100, and 1 respectively. The **Resolution** section shows **Format** with X: 250 and Y: 188, and two radio buttons: **Y according format** (selected) and **Specify Y**. Below are **Aspect Ratio** (1.330) and **Pixel Ratio** (1.000). The **Output** section has **Rendering in Database** (db_paul) and **Output Filename** (default). On the right, the **Options** section includes checkboxes for **Render Z Channel**, **Depth Fading** (with Start: 0.000 and End: 20.000), **Field Rendering** (with Dominant: Even/Odd), **Depth Sorting**, and **Desaturate**. The **Compositing** section has checkboxes for **Background Color** (with R: 0.00, G: 0.00, B: 0.00) and **Background Image** (with Database and Filename fields). A **Z Channel** section also has Database and Filename fields. At the bottom are buttons for **Render Sequence**, **Preview Sequence**, and **Ok**.

Output Type

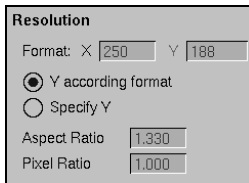
This close-up shows the **Output Type** section of the dialog. It features two radio buttons: **Render Picture**, which is selected with a black dot, and **Binary Particle File**, which is unselected.

Under **Output Type**, you can choose to render your picture with **Render Picture**, the default setting, or output your rendered scene to disk in a binary file format with the **Binary Particle File (BPF)** option. For every particle in your scene, the **BPF** option creates a file containing all the 3D information (color, position, speed, and velocity) for each frame. You can then import your **.bpf** file into **SOFTIMAGE 3D**.

Sequence

This close-up shows the **Sequence** section of the dialog. It contains a table with three columns: **Start**, **End**, and **Step**. The values entered are 1, 100, and 1 respectively.

You can determine the first and last frames and the step value for the rendering with the **Start**, **End**, and **Step** parameters. These three values determine the first and last frames to render. The **Step** value lets you skip frames. For example, if you define a value of 4, every fourth frame is rendered.



Resolution

Format: X Y

☒ Y according format
☐ Specify Y

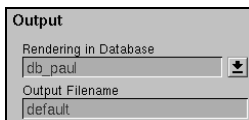
Aspect Ratio

Pixel Ratio

Resolution

These parameters lets you set the number of horizontal pixels (X) and vertical pixels (Y) to determine the resolution of the rendered image.

- **Y According Format** automatically sets the y-resolution (vertical) of the image according to the x-resolution (horizontal) entered and the format currently selected.
- **Specify Y** allows you to set the y-resolution independently of the x-resolution.
- **Aspect ratio** sets the ratio between the height and width dimensions of the rendered image. This is 1.333 by default.
- **Pixel Ratio (X/Y)**. Some devices use rectangular pixels rather than square, so Pixel Ratio ensures compatibility of images with these devices. This is 1.0 by default.



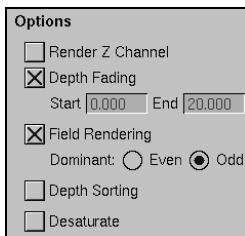
Output

Rendering in Database
 

Output Filename

Output

- The **Rendering in Database** text box contains the path of the location of the database where the rendered pictures are saved.
- The **Output File Name** text box contains the name you want to assign to the sequence of images to be rendered.



Options

☐ Render Z Channel

☒ Depth Fading
Start End

☒ Field Rendering
Dominant: ☐ Even ☒ Odd

☐ Depth Sorting

☐ Desaturate

Options

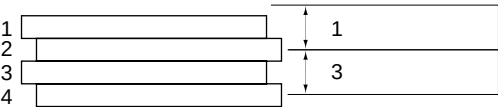
- The **Render Z channel** option outputs depth information so that you can position an object in front of and behind the background image in a composite. The Z channel information allows for more advanced compositing operations. One useful application is to use the Z channel information to allow an object in a scene to interact with a background image. Without the Z channel information, the compositor can only decide which layer should be placed on top, confining selected objects to the front of the background image.
- The **Depth Fading** option allows you to realistically simulate a fog-like effect over the entire scene. The **Start** and **End** text boxes let you set the distance from the camera where the depth-fading starts and ends. These two value are measured in grid units.
- The **Field Rendering** option is used to reduce the flickering effect that results from fast moving objects when rendering to video.

Particle uses a wide-pixel rendering technique. Internally, the

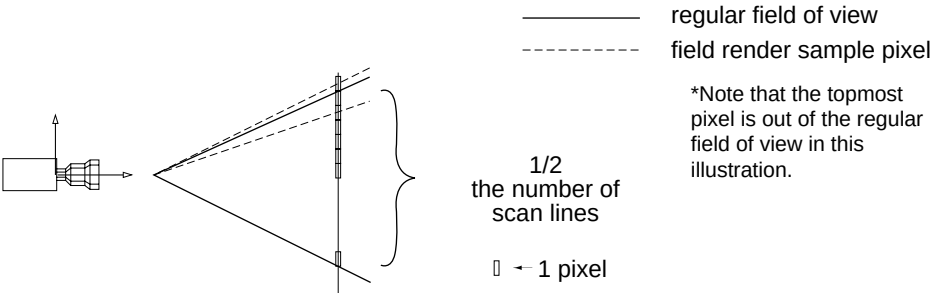
camera's field of view is perceived as being half as high, but each scan line is amplified to twice its thickness. The sampling of the pixel, therefore, is estimated over a larger area than normal. The camera first considers the even and then the odd lines. It is raised or lowered to ensure that the two different images have the correct visual orientation. Two files are generated for each frame's field: an even and an odd. The **Even** and **Odd** options define which of the two files is rendered first.

- **Even** field is used for PAL output, which is used by the U.K. and most European countries. If you select **Even**, the **A.1.1.pic** image is defined as the even file (dominant field) and is rendered first. The **A.1.2.pic** image is defined as the odd file and is rendered second.
- **Odd** field is used for NTSC output, which is used by North America, Japan, and parts of South America. If you select **Odd**, the **A.1.1.pic** image is defined as the odd file (dominant field) and is rendered first. The **A.1.2.pic** image is defined as the even file and is rendered second.

The following figure illustrates the use of the wide-pixel rendering technique.



The following example shows how the scene is viewed by the camera at render time. The direction of compensation corresponds to your dominant field setting (even and odd). Each line is scanned in a 50% wider than the normal sample line to ensure correct picture proportions.



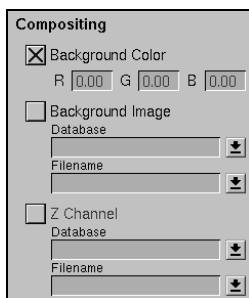
There are two versions of the post-frame script files that ensure that merging occurs after each full frame (two fields) has been processed.

The standalone post-processing program called **interleave** processes the two fields to output one frame.

- The **Depth Sorting** option tracks the x, y, z coordinates of every particle from the first moment it is emitted in your scene. This option eliminates the flickering effects that may occur due to particles popping in front of and behind other particles during an animation sequence. This is a valuable option when you require a close-up view of your session, or when you have defined very opaque RGBA values for your particles. Using this option increases calculation time since it must determine the location for each particle for every frame.
- The **Desaturate** option clips the RGB value to a maximum of 1 (this is equal to 255 on the standard scale used to measure the RGB value). This option is necessary if you have activated the **Glow** option in the Particle module. When **Glow** is activated, the RGB value might exceed 1 (255) causing undesirable render results due to the oversaturated value.

Compositing

These options let you composite a Particle scene with a SOFTIMAGE 3D scene:



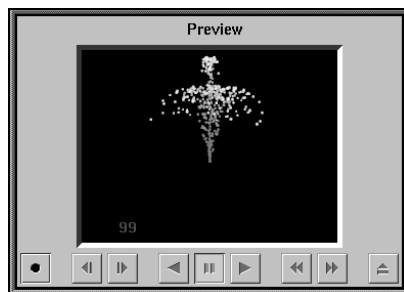
- **Background Color** lets you define a background color for your Particle 3D viewing area. The background color is then composited with the particle. The file layout (**Background** parameter in the Layout dialogue box) is not rendered with the scene.
- **Background Image** lets you load a sequence of rendered images in the background which are composited with the Particle render or the preview. This is useful for compositing the particle animation with a 3D scene. See *Compositing with a 3D Scene* on page 87 for more information.
- **Z Channel** lets you load a **.Zpic** file containing a depth channel (Z channel). This can be used for compositing the particle animation with a 3D scene. For more information, see *Options* on page 81.

Render Sequence

When you have entered all the information for rendering your scene, click the **Render Sequence** button to start the rendering process.

Preview Sequence

This button allows you to display an animation sequence on the screen.

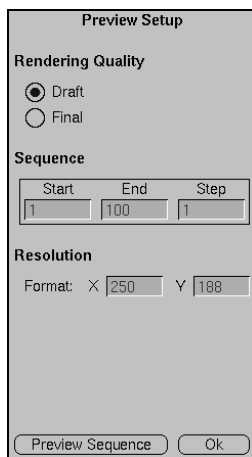


The previewed image is not saved to file. For the final rendering of the scene, you must use the **Render Sequence** button. For more information, see *Preview Sequence* on page 85.

Preview Settings

When you click the **Preview** button, the **Preview Setup** dialogue box appears. It contains three categories of settings.

You can set the parameters for previewing your scene on the screen. The preview controls do not affect the render setup and the previewed image is not saved to a file. For the final rendering of the scene, use the **Render Sequence** button in the Render Setup dialogue box.



Rendering Quality

You can choose between two rendering methods:

- **Draft** displays the particles in a linear shape. If you have selected a shape other than linear from the **Shape** menu in the Color dialogue box, it is not taken into account and appears linear. **Draft** is used to preview the motion and the flow of the particles.
- **Final** previews the rendered image using the results from the **Render Setup** settings. The shape that you have chosen for your particles is previewed.

Sequence

You can determine the first and last frames and the step value for the previewing with the **Start**, **End**, and **Step** commands. These three values determine the first and last frames to preview. The **Step** value lets you skip frames. For example, if you define a value of 4, every fourth frame is previewed.

Resolution

This sets the x and y frame resolution in pixels. A higher resolution produces a more detailed image, but the sequence might not be displayed in real time (30 frames per second).

Preview Sequence

When you click the **Preview Sequence** button, the preview browser appears, displaying your animation according to the parameter settings defined in the Preview Setup dialogue box. You can increase or decrease the size of the window by typing numbers between 1 and 4. Since 2 is the default setting, typing 1 decreases the window size while 3 and 4 increase the window size.

Using the Flipbook Controls

The controls at the bottom of the window allow you to visualize the sequence in various ways:



- **Rendering to Memory button** turns red to indicate that the frames are being loaded to memory.



- **Backward Frame arrow** moves the animation back one frame at a time. Click the arrow to move from the current frame to the previous one in the sequence.



- **Frame Advance arrow** advances the animation one frame at a time. Click the arrow to move from the current frame to the next one in the sequence.



- **Backward arrow** plays the sequence from end to start frame. Click to view the sequence backward.



- **Stop button** interrupts the preview. Click one of the arrow buttons to restart the preview.



Press the Esc key to stop loading frames into the flipbook.



- **Forward arrow** plays the sequence from the start to the end frame.



- **Increase Frame Speed** increases the rate at which the sequence is previewed.



- **Decrease Frame Speed** decreases the rate at which the sequence is previewed.



- **Escape button** exits the flipbook. Pressing the Esc key twice also exits the flipbook.

Compositing with a 3D Scene

If you are incorporating the particle system within a 3D scene, you must follow this procedure:

Render the SOFTIMAGE 3D Scene

1. Select the **Z Channel** option in the Render Setup dialogue box. This creates a series of .Zpic files (one per rendered frame) that contain depth channel information. This is necessary only if particles are travelling behind 3D objects.

 **Tip** Z-channel files tend to be very large. Make sure you have enough disk space before rendering.

2. Render the 3D scene within SOFTIMAGE 3D, using the SOFTIMAGE renderer.
3. Start Particle.
4. Open the File module.
5. Click the arrow button beside the **Database** text box. A browser appears in which you can choose the database where your 3D scene is located.
6. Click the arrow button beside the **System Name** text box. A browser appears in which you can load your 3D scene. Click **Ok**: the wireframe models of the 3D scene appears in the 3D viewing area.
7. Set up your particle animation. You can use scene objects as sources (see *Source Module* on page 45) and obstacles (see *Obstacle Module* on page 62) if you desire.

Render the Particle Scene

8. When you are ready to render your particle animation, open the **File** module and click the **Render** button. The **Render Setup** dialogue box appears.
9. Make sure you have defined the correct path to the location where you want the rendered images to be saved. This is specified in the **Rendering in Database** text box located in the lower-left corner of the dialogue box.
10. Set the name of the images to render in the **Output Filename** text box.

11. Click the **Render Sequence** button.

Compositing the Two Scenes

12. In the Render Setup dialogue box, select the **Background Image** option. A browser opens.
13. From the browser, select the previously rendered SOFTIMAGE 3D image file. Click Ok.
14. In the **Filename** browser, add the frame number that you want, followed by a period (.).

For example, when the browser opens, files from **B.1.pic** (frame 1) to **B.100.pic** (frame 100) are listed. Regardless of the .pic file you select, Particle uses the entire database of images. To eliminate this from happening, enter the number of the frame that you want followed by a period (.).

15. Select the **Z Channel** option. A browser opens.
16. From the browser, select the .Zpic files associated with the .pic files. Click Ok.
17. Click the **Render Sequence** button in Render Setup dialogue box.

The particle animation is composited with the previously rendered background images and the .Zpic files. The depth information from the .Zpic files creates a seamless link between the 3D rendered pictures and the particle effect.

Previewing with the Flipbook

18. Open the File module.
 19. Click the **Preview** button.
 20. In the Preview Setup dialogue box, set the **End frame** to 200.
 21. Click the **Preview Sequence** button. The Flipbook appears.
- Play the sequence to see the results!

For more information on previewing, see *Preview Sequence* on page 85.

Rendering from the Command Line

Besides saving you time, rendering from the command line also gives you much more control over your system.

The following advantages to rendering like this are only a few ways to optimize your time and computer resources:

- If you need to perform another task and the rendering process is using most of the CPU, you can pause the rendering process, perform the task, then resume rendering where it left off.
- If you need to render a complex scene, you don't need to start Particle to render it.
- If you have access to more than one computer, you can render on those machines while continuing to work as usual on your own.

Rendering Options

When you type `particle -R` in a shell, the following options appear:

```
particle [<resource path>] [-R <system>]
```

where

`<resource path>` is the name of the path where your resource files for the particle reside.

`-R` starts the rendering process.

`<system>` is the name of the file you want to render.

Options

These are other options you can include on the command line:

```
[-d <input database>]  
[-D <output database>]  
[-b <background image>]  
[-B <background image database>]  
[-j]  
[-n <image name>]  
[-o <image path>]  
[-r <x> <y>]  
[-s <first> <last> <step>]  
[-t <type of rendering>]  
[-z <Z image>]  
[-Z <Z image database>]
```

Where:

- d: <input database> Name of the database where the scene must be read from. If none is given the default database is used.
- D: <output database> Name of the database where the rendered images will be stored. If none is given the default database is used.
- b: <background image> Render image with background.
- B: <background image database> Name of the database where the background image must be read from. If none is given, the input database is used.
- j: Render only missing images of the sequence.
- n: <image name> Specify the name of the output image.
- o: <image path> Specify path to save rendered images.
- r: <x> <y> X and Y image resolution.
- s: First <first> and last <last> frames, with a step <step> increment.
- t: <type of rendering> Specify the type of rendering needed (default 1).
 - 1 - Brush render type.
 - 2 - Bpf (Binary Particle File) render type.
- z: <Z image> Render image with Z channel, unused if no background.
- Z: <Z image database> Name of the database where the Z image must be read from. If none is given the background database is used.

Initializing Rendering

1. Open the File module.
2. Save your scene.
3. Open a shell.
4. Type `particle -R` to get a list of the options and the syntax for rendering from the command line.
5. To initialize rendering, you *must* include the following information on the command line:
 - the full path where your Particle system executable is located.
 - the path where your resource files are located.
 - `-R` which starts the rendering process.

The name of the particle system that you want to render (the name of the file that you entered in the **System Name** text box in the File module). Do not include the suffix on the command line.

For example:

```
/user/softimage/particle/bin/particle /user/softimage/particle/rsrc -R fire
```

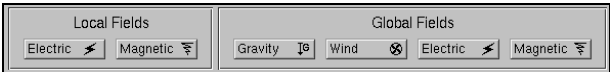
6. Type the options that you require for rendering your specific scene.

Note

If the `-d` option followed by the name of the database is not included on the command line, the default database is used. The default database is the current database, which is the first database listed in the **DatabaseDir.rsrc** file.

Applying Natural Forces

There are six buttons beneath the 3D viewing area: **Electric**, **Magnetic**, **Gravity**, **Wind**, **Electric**, and **Magnetic**.



These buttons let you apply natural forces to the particle animation. When you click one of the Natural Force buttons, a dialogue box appears. The parameter controls in the dialogue box allow you to edit the characteristics of the forces that act upon the particles.

The motion of the particles in a particle stream can be altered by applying simulations of natural forces to the environment surrounding the particles. Forces can be global (uniform throughout the environment) or local (applied to a specific point in the environment which is defined by the position and the drop rate of the icon).

Local Force Fields



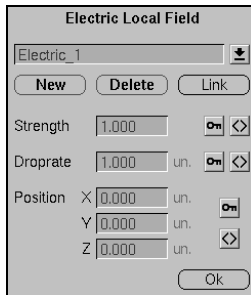
The **Electric** and **Magnetic** buttons represent local force fields. A local field has a position, a strength, and a drop rate (global fields do not have a drop rate).

You can add any number of local fields, **Electric** and **Magnetic**, to your particle simulation and specify the location in the environment that it affects (sphere of influence).

The sphere of influence depends on the values you specify for the force field's strength, drop rate, position, and direction.

Note The local and global **Magnetic** and **Electric** force buttons are associated to the **Magnetic** and **Electric** parameter control buttons in the Particle module. These global forces are only valid for particle types with a value other than 0.

Local field	Associated physical parameter	Effect
Electric	Electric button - Particle module	Particles converge to the centre of the local field.
Magnetic	Magnetic button - Particle module	Particles swirl when approaching the centre of the local field.



Electric

The **Electric** button simulates a local electric field acting upon the particle as it passes through its sphere of influence. When you click the Local **Electric** button (or press F7), the Electric Parameters dialogue box appears and the **Electric** icon appears in the 3D Viewing area.

You can animate and keyframe the **Strength**, **Droprate**, and **Position** of the Electric parameters. Local electric fields can be animated and linked to SOFTIMAGE 3D objects using the **Link** button that appears in the dialogue box. You exit the dialogue box by clicking the **Ok** button.

Strength

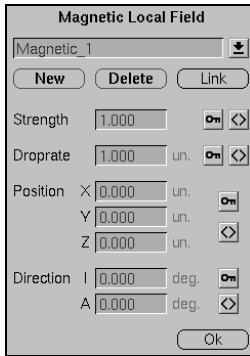
This parameter affects the velocity of the particles and the attraction to the centre point of the Electric icon. As you increase the default value of 0, which has no affect, the greater the attraction of the particles to the centre of the Electric icon. A negative value increases the repulsion of the particles from the centre of the electric icon. This force field diminishes as the particles move further from the centre of the icon.

Droprate

The drop rate defines the influence of the local field on the particles. The higher the drop rate, the greater the influence of the force field on the particle. The value you set for this parameter defines the magnitude of repulsion or attraction that the particles have to the centre of the Electric icon. The higher the drop rate, the greater the attraction to the centre point and the greater the repulsion once the particle has passed by the centre point.

Position

Use this to specify the position of the icon using the global x, y, z coordinates.



Magnetic

The **Magnetic** button simulates a local magnetic field acting upon the particle as it passes through its sphere of influence. The influence that this field has on the stream of particles is a rotational motion similar to the eye of a hurricane. When you click the Local **Magnetic** button (or press F8), the Magnetic Parameters dialogue box appears and the **Magnetic** icon appears in the 3D Viewing area.

You can animate and keyframe the **Strength**, **Dropate**, **Position**, and **Direction** parameters. Magnetic simulation can be animated and linked to SOFTIMAGE 3D objects using the **Link** button that appears in the dialogue box. You exit the dialogue box by clicking the **Ok** button.

Strength

This parameter affects the velocity of the particles. As you increase the default value of 0, which has no affect, the particles' velocity increases and the particle stream rotates in an increasingly outward moving spiral. This force field diminishes as the particles move further from the centre of the icon.

Dropate

This parameter affects the influence of the local field on the particles. The higher the drop rate, the broader the circumference of the spiral and the greater the distance of influence the magnetic field has.

Position

Use this to specify the position of the icon using the global x, y, z coordinates.

Direction

This parameter determines the inclination (I) and the azimuth (A), in degrees of rotation, of the vector along which the particle stream flows. The greater the angle of Inclination, the greater the influence on the direction of the particle stream.

Global Force Fields

There are four built-in global fields in the particle system. The global fields are defined by the **Gravity**, **Wind**, **Electric**, and **Magnetic** buttons.



The strength and direction of each global field can be specified. In addition, the strength and direction of the global fields can be animated.

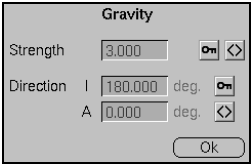
Note

Global fields cannot be deleted, duplicated, or added to the particle system. For example, you cannot have two gravitational forces concurrently in the same particle environment.

The way in which a given global field affects a particle depends on a specific physical parameter of the particle. For a particle to react to a global field, its corresponding physical parameter must be set. For example, if you apply a global **Electric** field to a particle type, you must also define a value for that particle's **Electric** parameter that is located in the parameter area of the Particle module. See *Particle Module* on page 51 for more information on setting the physical parameters of a particle.

This table shows the physical parameters associated with global fields:

Global field applied	Associated physical parameters
Wind	Friction button - Particle module
Magnetic	Magnetic button - Particle module
Electric	Electric button - Particle module



Gravity

The **Gravity** button simulates a global gravitational field acting upon a particle. When you click the **Gravity** button (or press F9), the Gravity dialogue box appears and the **Gravity** icon appears in the 3D Viewing area. You can set and keyframe the **Strength** and **Direction** (inclination and azimuth).

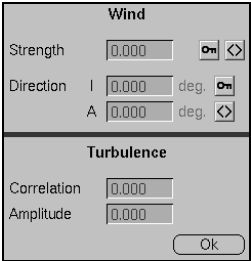
Strength

The greater the strength, the further and faster the particles fall. If you define a negative value, the particle's velocity increases, as well as the drag effect along the positive y-axis.

Direction

This parameter determines the inclination (I) and the azimuth (A), in degrees of rotation, of the vector along which the particle stream flows. The greater the angle of Inclination the greater the influence on the direction of the particle stream.

Tip A good way to learn the effect these parameters have is to use a simple particle stream defining only a value for the **Spread** parameter in the Source module. Then set a value for **Strength** in the Gravity dialogue box and experiment with different values for the **Friction** parameter in the Particle module.



Wind

The **Wind** button simulates the effects of drag, as if the particle was travelling through a moving medium, such as wind or a stream of water. When you click the **Wind** button, or press F10, the Wind dialogue box appears and the **Wind** icon appears in the 3D Viewing area. You can set and keyframe the **Strength** and **Direction** (inclination and azimuth). You can also set values for two turbulence parameters: **Correlation** and **Amplitude**. The resulting effect of these two parameters simulates a gaseous phenomenon.

Correlation

This indicates what percentage of a particle's position and speed at a given frame is used to compute the next position and speed. If **Correlation** is equal to 0, the random influence of the medium is not considered. If **Correlation** is equal to 100, the position is used to compute the movement of the medium (strength and direction) and

the speed is not considered. The next position and speed of the particle is equal to this movement. Between these two values, a linear interpolation is applied between the input position and the speed, and the movement of the medium.

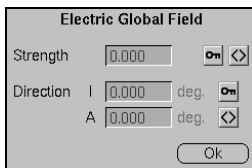
Amplitude

This indicates how important the random movement of the medium will be. It is the maximum strength of the medium applied on a particle in a random direction.

Note

Correlation and **Amplitude** are only valid for particle types that have a value other than 0 defined for the **Friction** parameter in the Particle module.

Electric

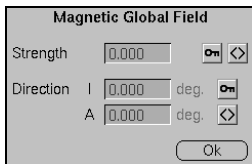


The **Electric** button simulates an electric field acting upon the particle. When you click the **Electric** button (or press F11), the Electric dialogue box appears and the **Electric** icon appears in the 3D Viewing area. You can set and keyframe the **Strength** and **Direction** (inclination and azimuth). See *Electric* on page 93 for more information.

Note

If your scene has more than one particle stream, **Strength** and **Direction** are only valid for particle streams that have a value other than 0 defined for the **Electric** parameter in the Particle module.

Magnetic



The **Magnetic** button simulates a magnetic field acting upon the particle. The influence that this field has on the stream of particles is a rotational motion similar to the eye of a hurricane. When you click the **Magnetic** button (or press F12), the Magnetic dialogue box appears and the **Magnetic** icon appears in the 3D Viewing area. You can set and keyframe the **Strength** and **Direction** (inclination and azimuth). See *Magnetic* on page 94 for more information.

Note

If your scene has more than one particle stream, **Strength** and **Direction** are only valid for particle streams that have a value other than 0 defined for the **Magnetic** parameter, in the Particle module. See *Applying a Natural Force Effect* on page 52 for more information.

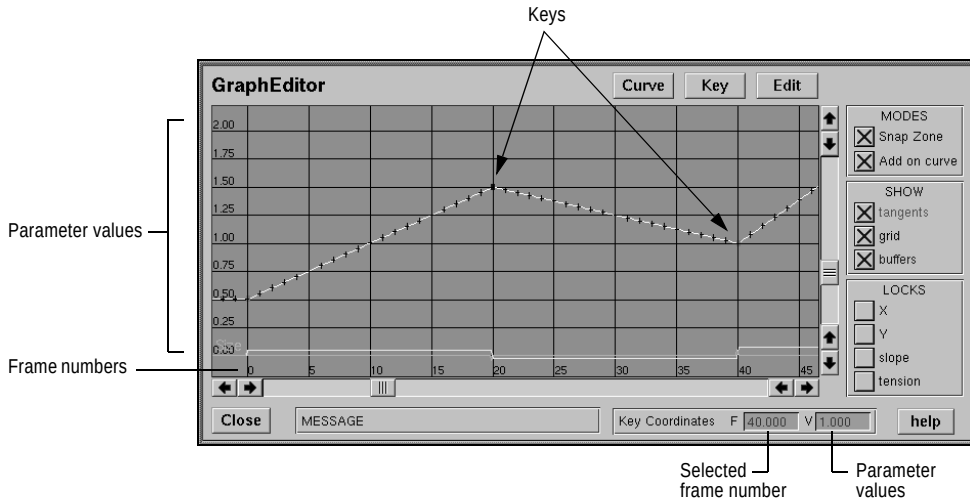
Graph Editor

The Graph Editor displays function curves for the parameter of any keyable values for the selected particle type. Function curves are graphic representations of the relationship between time and the value of an animated parameter.

In the Graph Editor, you can modify the function curves to change the animation for parameters you have keyframed.

To open the Graph Editor, make sure you have set at least two keyframes for the parameters you want to animate. Then middle-click the key button.

The Graph Editor window consists of the following areas.



Basic Concepts

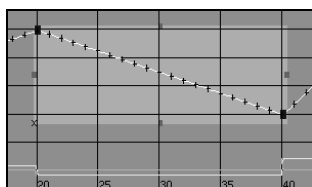
The following is a list of some basic concepts that will make it easier for you to use the Graph Editor.

- Before editing a function curve in the Graph Editor, be sure to save your scene. The modifications you make cannot be cancelled because there is no Undo button.
- To obtain information on a particular key, select the key (it turns blue), click on the **Key** button at the top of the Graph Editor window, then select **Info** by clicking the mouse button.

- As with other Particle windows, it is not necessary to close the Graph Editor window to access other controls. This is very useful when you want to view the function curve of another parameter. You simply select the desired parameter from the parameter area of one module, and the Graph Editor immediately updates the screen to display the corresponding function curve.
- A zone is an area of keyframes that you have selected in the Graph Editor window.

Selecting a Zone of Keyframes

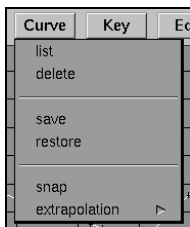
1. Position your cursor beside the left-most key that you want included in your zone.
2. Click the middle mouse button and drag diagonally across the zone of keys that you want to select.
3. Release the mouse button. The selected zone has three different visual attributes:
 - The light grey section indicates the zone that you have selected.
 - The pink key markers indicate zones that can be edited.
 - The blue key markers indicate the boundaries that can be edited.
4. You can edit a zone using one of three methods:
 - To add keys to the selected zone, pick one of the pink keys; continue holding the mouse button while dragging horizontally or vertically.
 - To reposition the entire selected zone, click anywhere in the selected zone; continue holding down the mouse button while dragging the selected zone to the desired location.
 - Click the **Edit** menu button at the top of the Graph Editor window, then select the task that you want to perform.



To deselect a zone, middle-click outside the selected area.

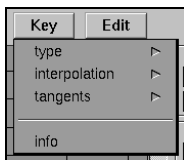
Graph Editor Menu Commands

Curve Menu



These functions apply to the selected function curves in the Graph Editor window. The selected function curve and its name appear in white.

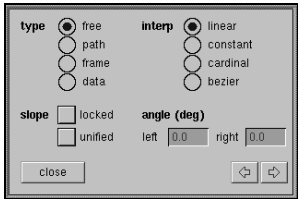
Command	Function
list	Opens the Curves selection scroll box to select function curves and change show/hide curve status.
delete	Deletes selected curves.
save	Saves selected curves (Show saved) to curve private buffer.
restore	Restores a saved copy of selected curves from the buffer.
snap	Snaps curve keys to integer values.
extrapolation	Sets the selected curves' extrapolation mode to either constant (the value of extrapolated curve is given by the first/last key) or gradient (the curve follows first/last slope).



Key Menu

These commands apply to selected (tagged) keys.

type	
free	Unlocks the key from both axes. The key appears blue.
keyframe	Locks the key on both axes. The key appears yellow.
keypath	Locks the key on the y-axis. The key appears green.
data	Locks the key on the x-axis. The key appears black.
interpolation	
linear	Uses linear interpolation between keyframes.
spline	Uses spline interpolation between keyframes. The curve type may be Bezier, Cardinal, B-Spline, or Hermite.
constant	Uses constant interpolation between keyframes.



tangents

release Breaks slope at spline interpolation keys. This lets you move the key's handles (tangents) independently.

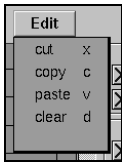
unify left Unifies the handles using left slope value.

unify right Unifies the handles using right slope value.

info Opens a group information window which contains the type, interpolation, slope, and angle of a selected function curve. These parameters can be redefined from within the information window.

Edit Menu

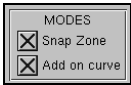
Editing functions apply to selected function curves. Each function curve has its own edit buffer. You can cut and paste between function curves using the general buffer. The function curve's buffer can be displayed or hidden using the **buffers** option.

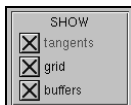


Command	Function
cut (x)	Cuts a portion of the function curve(s) included in the zone.
copy (c)	Copies a portion of the function curve(s) included in the zone
paste (v)	Pastes what is in the memory buffer at the insertion point. After pasting, the insertion point is moved to the end of the pasted curve and "offset" value.
clear (d)	Deletes a portion of the function curve(s) included in the zone.

Modes

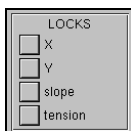
Commands	Function
Snap Zone	Snaps the selection zone of the function curve to the key's position on the x-axis.
add on curve	Ensures that added keys do not modify the shape of the function curve.





Show

Commands	Function
tangents	Displays tangent handles on the function curve.
grid	Displays grid.
buffer	Displays function curve's edit buffer (cut/copy).



Locks

Commands	Function
X	Locks the function curve on the x-axis.
Y	Locks the function curve on the y-axis.
slope	Locks the function curve's slope.
tension	Locks the function curve's tension.

Curves Scroll Box

The Curves scroll box is accessed by choosing the **list** command in the **Curves** menu. It can be open for single and group function curve selection. The following table lists the mouse commands:



Mouse command	Function
Left mouse button	Selects a single item.
Alt - left mouse button	Shows a single selected item.
Shift - left mouse button or Alt - Shift - left mouse button	Shows the selected items.
Middle mouse button	Deselects a single item.
Shift - middle mouse button	Deselects the selected items.
Alt - middle mouse button	Hides a single selected item.
Alt - Shift - middle mouse button	Hides selected items.
Right mouse button	Toggles the select status of a single item.
Shift - right mouse button	Toggles the select status of selected items.
Alt - right mouse button	Toggles the show status of a selected item.
Alt - Shift - right mouse button	Toggles the show status of selected items.

Mouse and Keyboard Controls

The following mouse and keyboard controls are used when editing function curves in the Graph Editor.

Key Selection

Command	Function
m - left mouse button	Selects a key (drag to move the key).
Shift - left mouse button	Adds a key to the zone.
Middle mouse button	Defines a rectangle zone.
Shift - middle mouse button	Tags all curves.
Shift - right mouse button	Removes a key from the zone.

Zone Translation

Command	Function
Left mouse button	Translates the zone.

Zone Scaling

Command	Function
Marker left	Scales up and down on the x-axis (left and right).
Marker right	Scales up and down on the x-axis (left and right).
Marker bottom	Scales down on the y-axis (up and down).
Marker top	Scales up on the y-axis (up and down).

Camera Controls

Command	Function
z - left mouse button	Tracks.
z - middle mouse button	Zooms in.
z - Shift - middle mouse button	Frames in.
z - Ctrl - middle mouse button	Zooms in horizontally.
z - right mouse button	Zooms out.
z - Shift - right mouse button	Zooms out horizontally.

Curve Selection

Command	Function
Space bar - left mouse button	Selects single function curve.
Space bar - Shift - left mouse button	Selects multiple function curves.
Space bar - right mouse button	Deselects all function curves.

Key Editing

Command	Function
k - left mouse button	Adds a key.
m - left mouse button	Moves a key.
k - right mouse button	Removes a key.

Key Interpolation

Command	Function
i - left mouse button	Spline interpolation of slope.
i - middle mouse button	Linear interpolation of slope.
i - right mouse button	Constant interpolation of slope.

Particle Scene File Format

A Particle file is essentially a list of paragraphs, with each paragraph delimited by the key words **def** and **enddef**.

The system paragraph encloses all the other paragraphs. In the prototype, only one system paragraph is allowed in each file. All the paragraphs are defined by the delimiters, the paragraph type keyword, and an optional name. For example:

```
def system "my_system"
    fields
    ....
    def particle "my_particle"
    fields
    ....
    enddef
enddef
```

Types of Paragraphs

particle	emit
decay	absorb
source	magnetic
transform	attract
collision	

Convention and Syntax

A field can be repeated several times, but only the latest value is taken into account.

These symbols are used to define the various key words in the paragraphs:

F represents a floating point value: 10.0 or 10 or -10. A floating point value can be preceded by the keyword "jitter box" which indicates that the value affects only the random behaviour of the field.

I is an integer value (no decimal points allowed)

A represents an array of two, three, or four floating point values, according to the following conventions: {**F**, **F**} or {**F**, **F**, **F**}.

An array can be preceded by the keyword "jitter box" which indicates that the array affects only the random behaviour of the field.

S is a string between quotes that represents a name or a file name (such as “Photon” or “/usr/tmp/test”).

C is a constant whose possible values are listed right after the string. The constants are written without quotes.

Key Words

In the following lists, some key words affect the same physical parameter of the particle. For example, `color`, `color_mean`, `color_var`, and `color_curve` are different ways of specifying the color of the particle. Only the last key word is taken into account, and only one of them needs to be written in the file.

System Paragraph Key Words

<code>seed</code>	F	
<code>range</code>	F	
<code>preroll</code>	F	
<code>preview_rate</code>	F	
<code>gravity_dir</code>	A	
<code>gravity_strength</code>	F	
<code>electric_dir</code>	A	
<code>electric_strength</code>	F	
<code>magnetic_dir</code>	A	
<code>magnetic_strength</code>	F	
<code>drag_dir</code>	A	(Drag is the medium velocity. This is a direction [x, y, z] array of three values.)
<code>drag_strength</code>	F	
<code>frame_rate</code>	F	

Particle Paragraph Key Words

lifetime	F	
mass	F	
electric	F	
magnetic	F	
drag	F	
noise	F	
size	F	
collision	F	
color_model	C	COLOR_AGE COLOR_BIRTH COLOR_IMAGE
color	A	
trail_type	C	TRAIL_DYNAMIC TRAIL_STATIC TRAIL_NONE
trail_life	F	
trail_color	A	
trail_color_model	C	COLOR_INHERIT COLOR_DYNAMIC

Decay Paragraph Key Words

decay

emit paragraph

One decay paragraph can be embedded in the particle paragraph. It describes what happens when a particle decays or dies. The decay paragraph contains one or more emit paragraphs. One particle type is emitted per emit paragraph.

Emit Paragraph Key Words

particle	S	(particle name)
speed	F	
spread	F	
dir	A	

Source Paragraph Key Words

particle	S	
type	C	SOURCE_POINT
		SOURCE_LINE
		SOURCE_SQUARE
		SOURCE_CUBE
		SOURCE_SPHERE
pos	A	
pos_curve	S	
scale	A	
scale_curve	S	
rot	A	
rot_curve	S	
dir	A	
dir_curve	S	
speed	F	
speed_mean	F	
speed_var	F	
speed_curve	S	
rate	F	
rate_mean	F	
rate_var	F	
rate_curve	F	
spread	F	
spread_curve	S	
emission	C	ABSOLUTE
		NORMAL
		PATH
gen	C	GEN_0_DIM
		GEN_1_DIM
		GEN_2_DIM
		GEN_3_DIM

Magnetic Paragraph Key Words

strength	F
strength_curve	S
droprate	F
droprate_curve	S
pos	A
pos_curve	S
dir	A
dir_curve	S

Electric Paragraph Key Words

strength	F
strength_curve	S
droprate	F
droprate_curve	S
pos	A
pos_curve	S

Collision Paragraph Key Words

particle	S
rate	F

Note

The collision paragraph requires **only** two names of different particle types.

Transformations

A transformation can be defined. It requires that the collision of a number of particles is detected, and each particle type and number is defined by an **absorb** paragraph. When this happens, the events described in the **emit** paragraphs are triggered. The particles defined in the **absorb** paragraphs disappear – they do not decay. The particles defined in **emit** are then emitted.

A **transform** paragraph is therefore a list of **emit** and **absorb** paragraphs. The **calc_emit** keyword forces the processor to compute the speed of the particle to which it was associated according to the energy conservation law. This law states that energy cannot be created nor destroyed, only transformed.

Transform Paragraph Key Words

Transform paragraphs consist of embedded emit and absorb paragraphs plus:

calc_emit	S	(the string is a valid particle name)
rate	I	

Absorb Paragraph Key Words

particle	S	(the type of particle)
count	I	(number of particles required to trigger the transformation)

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