Basic Emitter Attributes

Emitter Name: The name helps you identify the emitter object in the Outliner. If you don't enter a name, the emitter object receives a default name such as *emitter1*.

Solver: (**For nParticles only.**) Specifies which Maya Nucleus solver the nParticle emitter object belongs to. Select a solver from the drop-down list (existing Maya Nucleus solvers are listed), or select Create New Solver to create a new Maya Nucleus solver for the new nParticle emitter object.

Emitter type: Select one of these choices from the pop-up menu:

Omni: Sets the emitter type to an omnidirectional point emitter. Particles emit in all directions.

Directional: Sets the emitter type to a directional point emitter. Particles emit in the direction you specify with the Direction X, Y, and Z attributes.

Surface: Emits particles from randomly distributed positions on or near a NURBS or polygonal surface.

Curve: Emits particles from randomly distributed positions on or near a curve.

Volume: Emits particles from a closed volume. You pick the shape from the Volume Shape pulldown.

Rate (Particle/Sec): Sets the average rate at which particles are emitted per second. The rate is absolute, unless you turn on [Scale Rate by Object Size](#), see below. Emission occurs only if your animation plays two or more consecutive frames with the emitter rate set to a positive value. If you want to see how many particles have been emitted, select the emitted particle object and examine the Count in the General Control section of the Attribute Editor.

Note: When you set Rate (Particle/Sec) to low values, the actual number of particles emitted may be less than the set value due to round-off errors in the emission computation. For example, if you set a rate that emits one particle per-frame, you may need to increase the Rate (Particle/Sec) by a very small amount (1.0001) to ensure that particles are emitted at specific frames.

Scale Rate by Object Size: Only available when the current Emitter Type is Surface, Curve, or Volume. If you turn on this attribute, the

size of the object emitting the particles affects the rate of particles emitted per frame. The larger the object, the greater the rate of emission. The attribute is off by default.

For surface emission, the rate is particles per centimeter of area per second. For example, a 2 cm by 2 cm plane has an area of 4 square cm. If the emission rate is 3, the plane emits roughly 12 particles each second. If you use inches or other units, Maya converts the units to centimeters to make the rate calculation.

For curve emission, the rate is particles per cm length per time unit. For example, a 4 cm curve with a rate of 3 emits roughly 12 particles per second.

If this attribute is turned off (the default), the emission rate is absolute, instead of relative to object size, which is how previous versions of Maya behave.

Use Per-Point Rates(Rate PP): See [Vary emission from different points of point emitters](#).

Vary emission from different points of point emitters

You can use a different emission rate for each particle, CV, vertex, edit point, or lattice point of Omni or Directional point emitters. For example, you can emit a ring of fire from a circle's edit points and vary the emission at each point to enhance the irregularity found in natural fire. *You cannot vary emission on a per-point basis for objects whose Emitter Type is either Surface or Curve.*
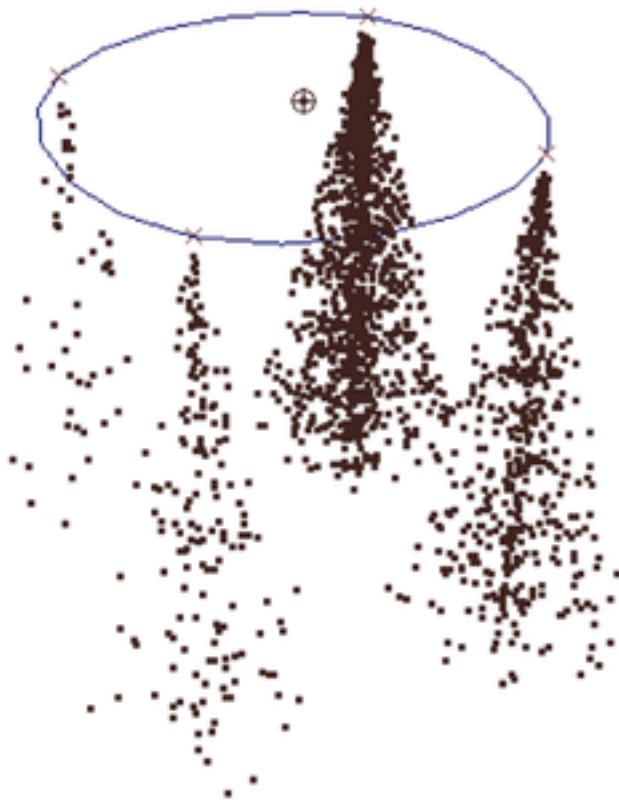
This NURBS circle emits from its edit points at rates of 50, 150, 1000, and 500.

This three-particle object emits at a rate of 50, 150, and 300.

Tip: If you emit from a particle object, you can use an expression or MEL command to obtain the id of all particles that emit the particles. You can use the id to query the emitting object's attribute values, for example, acceleration, velocity, and finalLifespanPP. To do this, you must add the parentId attribute to the emitted particle shape node.

Note that if you use the MEL emit command to create the particles that emit, the parentId attribute of those emitted particles is always o.

To vary emission from particles

1   Create and select the emitting particle object.
2   Select [Particles > Per-Point Emission Rates](#).This creates an attribute named *emitter*RatePP for the particle object that emits. This attribute lets you vary emission rates on a per particle basis.
3   In the Attribute Editor, open the Per Particle (Array) Attributes section.
4   Without breaking the connection to *emittername*RatePP, right click the *emitterName*RatePP box and select the desired method to set its value. See [Set attributes on a per particle basis](#).Note that you can turn the emitter's Use Per-Point Rate attribute on or off to toggle per-point emission rates. In the Outliner, the emitter is indented under the emitting object.

To vary emission from a NURBS or polygonal point emitter
1   Finish modeling the geometry before adding a point emitter.
2   Select the emitting geometry.
3   Select [Particles > Per-Point Emission Rates](#) .
4   Select the emitting object's shape node.
5   In the Extra Attributes section of the Attribute Editor, open the *emitterName* Rate PP section.For the *emitterName*RatePP attributes, enter values in the Attribute Editor boxes corresponding to the CVs, vertices, edit points, or lattice points. To learn which box corresponds to a point, experiment with a large value in a box. You can also use an expression, ramp, or Artisan to set individual rates.
    Note: If you add CVs, vertices, or edit points after you add and tune per-point emission rates, you can select Per-Point Emission Rates a second time to set the additional entries for *emitterName*RatePP. However, the Attribute Editor*emitterName*RatePP entries no longer correspond to the same identifiers for CVs, vertices, or edit points. You'll need to correct the *emitterName*RatePP entries.

If you delete CVs, vertices, or edit points, delete the emitter, create a new emitter, and choose Per-Point Emission Ratesagain.

Need Parent UV: (NURBS *Surface emitters only*.) If you turn this on in the Emitter Options window (before you create the emitter), Maya adds parentU and parentV attributes to the particle shape and sets the needparentUV attribute to on. You can use parent UVs to

drive the value of some other parameter such as color or opacity. If you turn this on in the Attribute Editor or Channel Box (after you create the emitter). Maya sets the needParentUVattribute to on, it does not add the attributes.Cycle Emission: Cycle Emission lets you restart the random number sequence of the emission. You can use it to create simple cycles for games work. If you set it to Frame, the sequence is restarted after the number of frames you specify in Cycle Interval. If you set it to None, the random number generator is not restarted.Cycle Interval: Defines the interval in frames for restarting the random number sequence when using Cycle Emission. Only available when Frame in selected in the Cycle Emission drop-down menu.

Distance/Direction Attributes

Min Distance: Sets the minimum distance from the emitter at which emission occurs. You can enter a value of 0 or greater. Particles are emitted randomly and uniformly between the Min Distance and Max Distance.

Max Distance: Sets the maximum distance from the emitter at which emission occurs. You can enter a value of 0 or greater, but it must be greater than Min Distance.

Direction X, Y, Z: Sets the emission direction relative to the emitter's position and orientation. Available only for directional, curve, and volume emitters. Note: With point emitters, the emitter's position and orientation are set by its Translate and Rotate attributes—Scaleand Shear have no effect. The original speed of particles emitted by a Directional emitter is equal to the Speed attribute of the emitter, which, by default, is 1 unit (cm) per second. The Direction X, Y and Z attributes do not affect the speed. The original speed of particles emitted by an Omni emitter is 1 unit per second in whatever direction the particles are emitted, unless it's been modified by the Speed Random attribute.

Spread

Sets the emission spread angle. This angle defines a conical region where the particles are emitted randomly. You can enter any value between 0 and 1. A value of 0.5 is 90 degrees, a value of 1 is 180 degrees. Available for onlyDirectional and Curve emitters.

Spread angle

Particles are randomly distributed within the conical area.
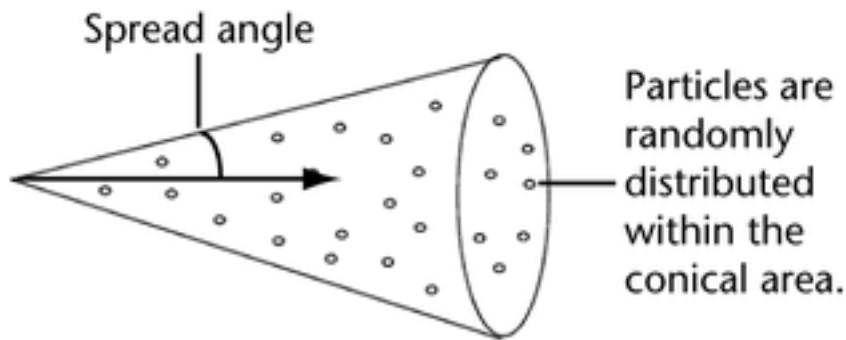
Basic Emission Speed Attributes

Speed: Sets a speed multiplier for the original emission speed of the emitted particles. You can enter a value of 0 or more. A value of 1 leaves the speed as is. A value of 0.5 reduces the speed by half. A value of 2 doubles the speed. Speed doesn't affect velocity resulting from expressions, fields, or other dynamics.

Speed Random: The Speed Random attribute lets you add randomness to your emission speeds without using expressions. If you setSpeed Random to a positive value, the emitter generates random speeds for each particle. The Speed value is the mean speed; Speed Random defines the range of the speed variation. Each particle's speed is a random value between:

Speed - Speed Random/2 Speed + Speed Random/2

Tangent Speed: Sets the magnitude of the tangent component of emission speed for surface and curve emission (see the following figures). The default value is 0. You can enter a value of 0 or greater. *Valid for surface and curve emitters only.*


Direction

Normal Speed

Surface
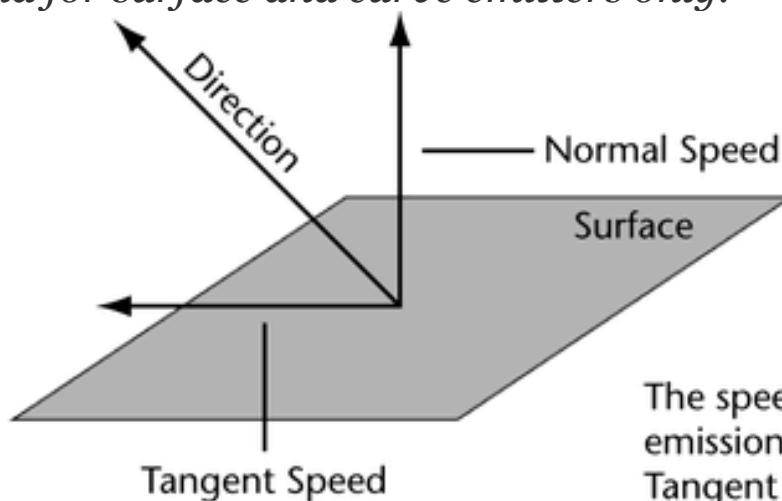
Tangent Speed

The speed and direction of surface emission is a result of Normal and Tangent Speed vectors (in addition to a randomness factor).
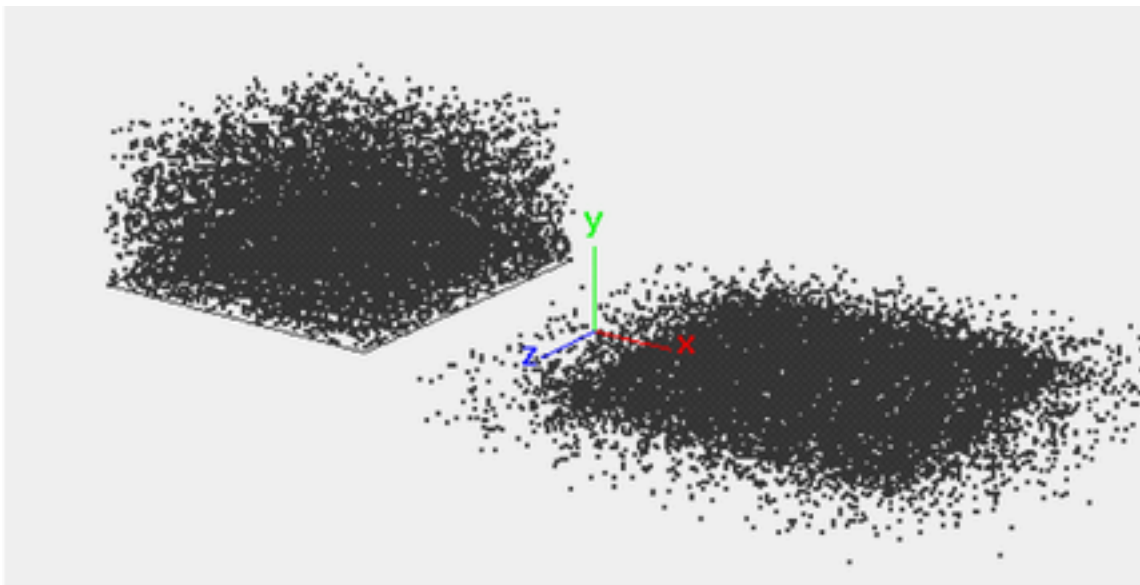
Normal Speed 2   Normal Speed 0
Tangent Speed 0   Tangent Speed 2

Normal Speed: Sets the magnitude of the normal component of emission speed for surface and curve emission (see the following figures). The default value is 1. You can enter a value of 0 or greater. *Valid for surface and curve emitters only.*

Volume Emitter Attributes

In the Attribute Editor and the Create Emitter option window, attributes not applicable to a volume emitter are dimmed. However, the Channel Box does not support dimming. We recommend you use the Attribute Editor instead of the Channel Box to edit volume field attributes until you become familiar with the attributes that apply to each volume shape.

Volume Shape: Specifies the shape of the volume that the particles are emitted into. Choose Cube, Sphere, Cylinder, Cone, or Torus.

Volume Offset: Offsets the emitting volume from the location of the emitter. If you rotate the emitter, you also rotate the offset direction because it operates in local space.

Volume Sweep: Defines the extent of rotation for all volumes except cubes. This can be a value between 0 and 360 degrees.
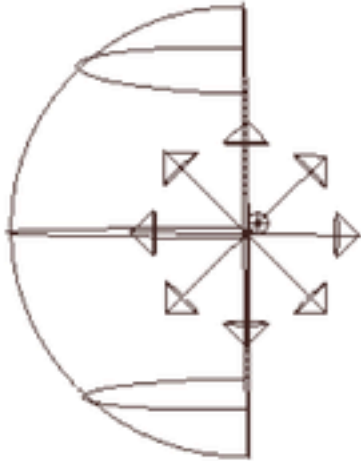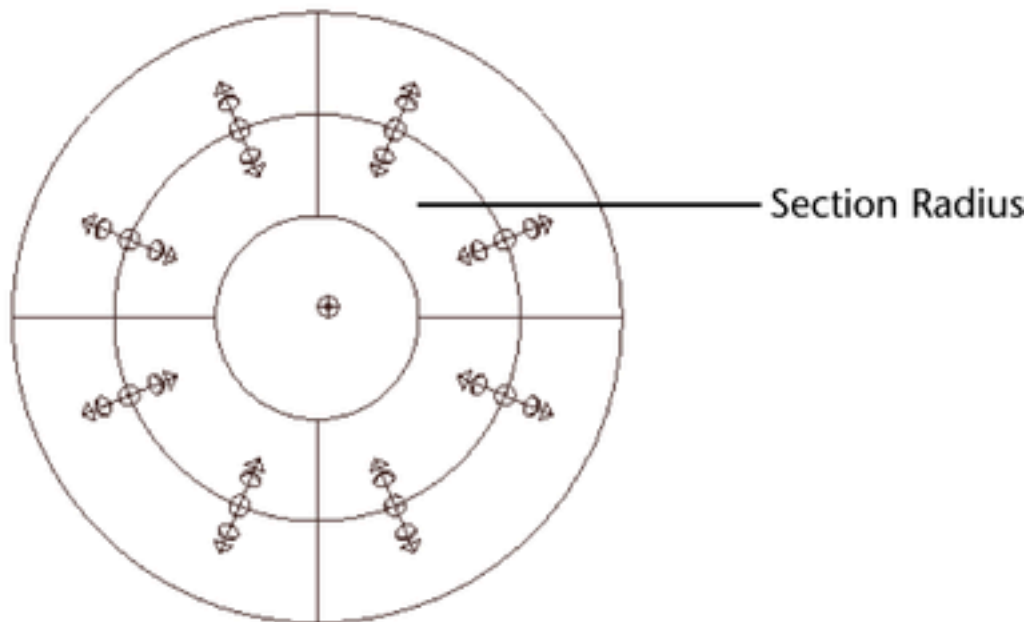
Volume Sweep
of 180o
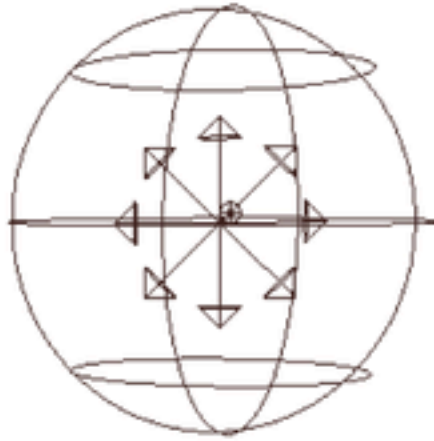
Volume Sweep
of 360o

Section Radius: (*Torus only*) Defines the thickness of the solid portion of the torus, relative to the radius of the torus's central ring. The radius of the central ring is determined by the emitter's scale. If you scale the emitter, the Section Radius will maintain its proportion relative to the central ring.

Section Radius

Die on Emission Volume Exit: If you turn this attribute on, the emitted particles die when they exit the volume. Although this is a particle shape attribute, you can initially set it using the Emitter options window. If you want to edit this attribute after you create

the emitter, display the particle shape attributes in the Attribute Editor Volume Exit (under Emission Attributes).

Volume Speed Attributes

The Volume Speed Attributes apply only to the initial velocity of the particles. To affect particles as they move through the volume, use the Volume Axis field (see [Work with volume axis fields](#)).

Away From Center: Specifies the speed at which particles move away from the center point of cube or sphere volumes.

Away From Axis: Specifies the speed at which particles move away from the central axis of cylinder, cone, or torus volumes.

Along Axis: Specifies the speed at which particles move along the central axis of all volumes. The central axis is defined as positive-Y for cube and sphere volumes.

Around Axis: Specifies the speed at which particles move around the central axis of all volumes.

Random Direction: Adds irregularity to the direction and initial speed of the particle's Volume Speed attributes, somewhat like Spread does for other emitter types.

Directional Speed: Adds speed in the direction specified by the Direction XYZ attributes of all volume emitters.

Scale Speed by Size: If you turn this attribute on, when you increase the size of the volume, the speed of the particles increases.

Display Speed: Turns on the display of arrows indicating speed.

Texture Emission Attributes

You can cause emitted particles to inherit the velocity of a moving emitter. Select the emitted particles and display the Attribute Editor. Set Inherit Factor greater than 0 to have the emitted particles inherit a decimal fraction of the emitter's velocity. For example, 0.5 makes the emitted particles inherit half the emitter's velocity.

When you create a NURBS or polygonal surface emitter, you can use a 2D or 3D texture to scale the emission rate at parts of the surface. For instance, you can scale the emitter Rate to 90% at the most luminous parts of a texture, and to 0% at the least luminous parts. Luminance is the measurable brightness of a surface.

You can also color emitted particles with a 2D or 3D texture. The texture can be the same as the underlying surface or any other texture you create in the scene.

Use a 3D texture with emission

You cannot use a 3D texture to control surface emission, but you can convert it to a 2D texture and then use it to control surface emission For information on converting a 3d texture to a 2D file texture, see [Convert a texture or shading network to a File Texture](#).

Examples of how to use a texture with emission

Examples of how to use a texture with emission follow:
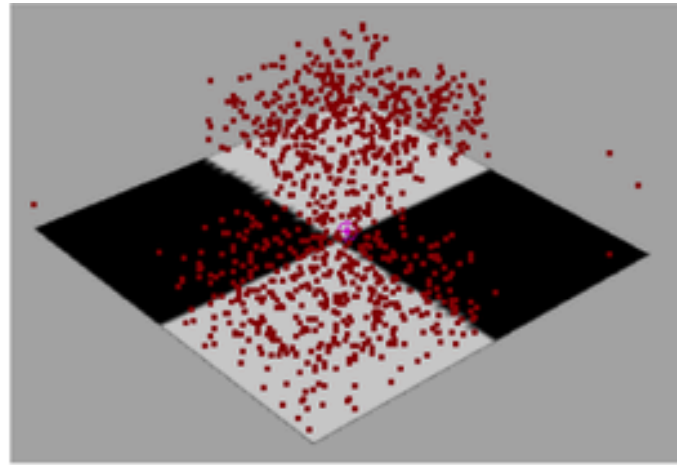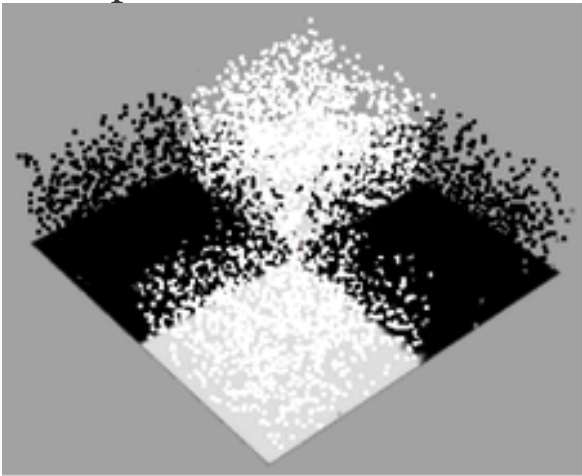
Black particles emit from the black parts, and white particles from the white parts (left). Red particles emit from the white parts (right).
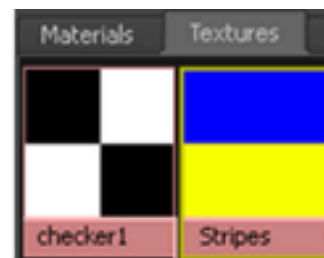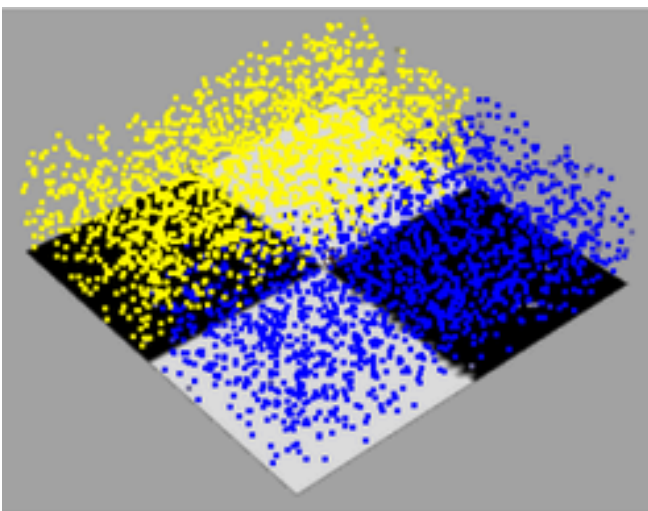
Particles emit from a striped texture not assigned to the plane. The plane's surface has a checker texture that's unused in emission. Note that you can also emit from a hidden plane or from a plane without a texture.

You can display particles as any render type, for example, spheres.
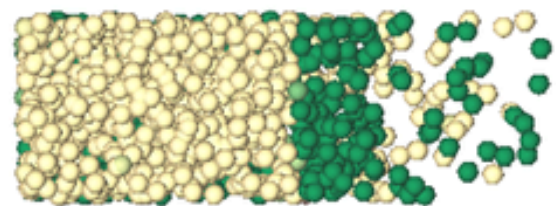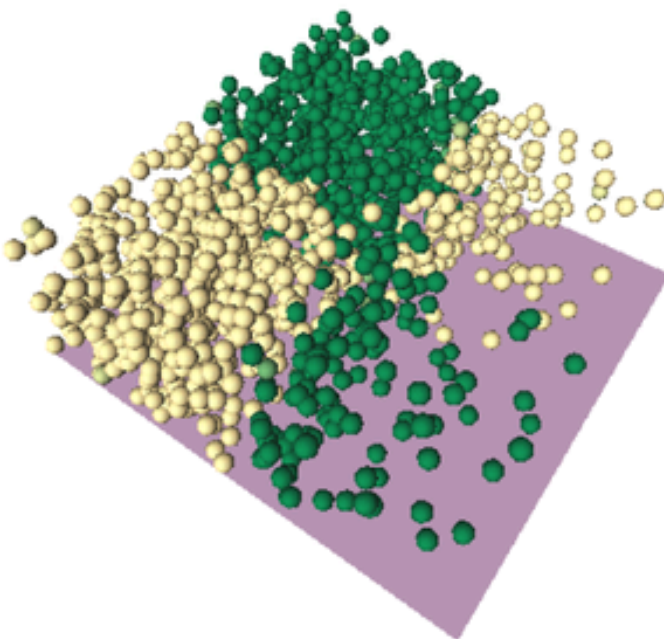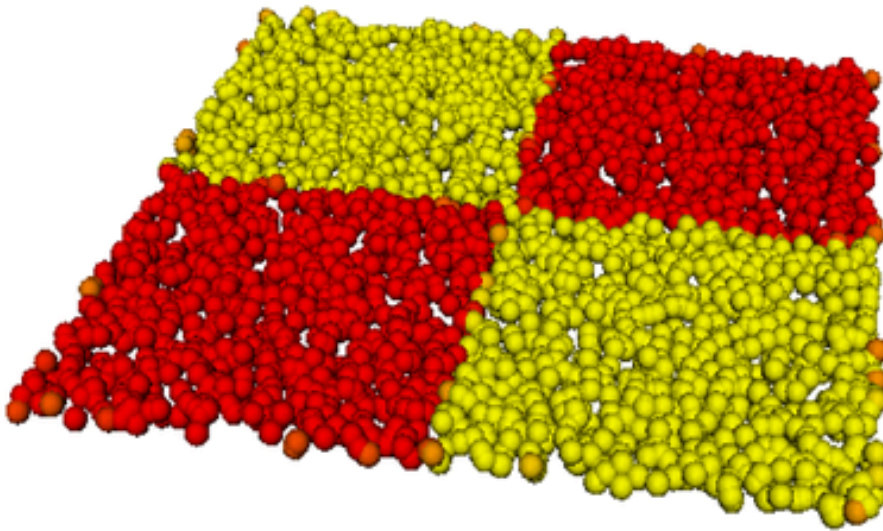
Side view of image

While a checker texture colors the emitted particles, a ramp texture scales the emission rate where the ramp's luminance is low.

To use a texture to scale the emission rate

1. Add a surface emitter to the surface.
2. Select the emitted particles and add a per particle color attribute (rgbPP) from the Add Dynamic Attributes section of theAttribute Editor.
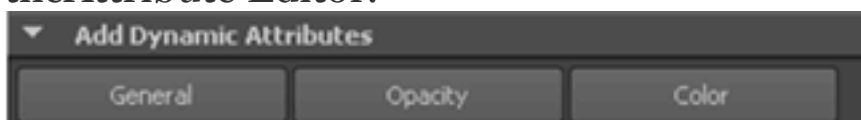
Click the Color button to display a window that lets you add a per particle color attribute.

3. Select Window > Rendering Editor > Hypershade.If you need to create the texture, do so now. See Rendering for details. You don't need to make the texture a part of a shading group. After

you create the texture, make sure it's visible in the Hypershade. Leave the Hypershade displayed on your screen.

4   In the Outliner, select the emitter; it's indented under the emitting surface object.

5   Display the Texture Emission Attributes section of the Attribute Editor.

6   Middle-drag the texture's icon from the Hypershade onto the Texture Rate attribute in the Attribute Editor.

7   Turn on Enable Texture Rate.

8   Set the Emit From Dark attribute as desired:When Emit From Dark is off, fully luminous parts of the texture emit at 100% of the specified emitter rate. Parts of the texture that lack luminance don't emit at all. Other parts emit between 0 and 100% in proportion to the luminance. In simple terms, bright colors emit more than dark colors.

    When Emit From Dark is turned on, the opposite luminance scheme applies. Parts of the texture that lack luminance emit at 100% of the specified rate, while fully luminous parts don't emit at all.

    Tip: To emit at distinctly different rates from parts of the surface, use a texture with sharp contrast in luminance. For instance, use a striped black and white texture.

If you see a few particles emitted from a seemingly wrong position of the texture, check that the coloring in that area has consistent luminance.

You can figure the exact luminance value of a color by adding its RGB components and dividing by 3. For instance, the luminance of RGB value 1, 0, 0 equals 1/3, or 0.33. The luminance of RGB value 0, 0, 1 also equals 1/3, or 0.33. In other words, a saturated red has the same luminance as a saturated blue.

•   Rewind and play the scene to see the texture-scaled emission rate.Note that you must turn on Shading > Smooth Shade All to see particle colors in your scene.

To color emitted particles with a texture

1   Add a surface emitter to the surface.

2   Select the emitted particles and add a per particle color attribute (rgbPP) and a per particle opacity attribute

(opacityPP) from the Add Dynamic Attributes section of the Attribute Editor.

Add Dynamic Attributes

General	Opacity	Color
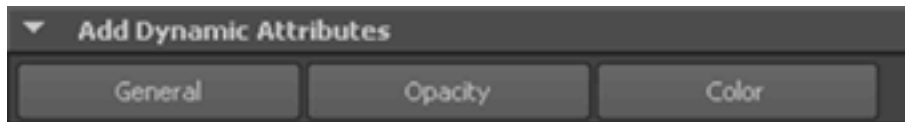
Click the Opacity and Color buttons to add per particle opacity and color attributes.

3   Select Window > Rendering Editor > Hypershade.If you need to create the texture, do so now. See Rendering for details. You don't need to make the texture a part of a shading group. After you create the texture, make sure it's visible in the Hypershade. Leave the Hypershade displayed on your screen.

4   In the Outliner, select the emitter; it's indented under the emitting surface object.

5   Display the Texture Emission Attributes section of the Attribute Editor.

6   Middle-drag the texture's icon from the Hypershade onto the Particle Color attribute in the Attribute Editor.

7   Turn on Inherit Color.When you rewind and play the scene, the particles emit from the texture with the same color and position as the texture. Note that you must turn on Shading > Smooth Shade All to see particle colors in your scene.

8   Turn on the following attributes as desired: Inherit Opacity, Use Luminance, and Invert Opacity.Note:

If you set the opacityPP attribute of the emitted particle with an expression or other technique, the attribute value overrides the above attributes.