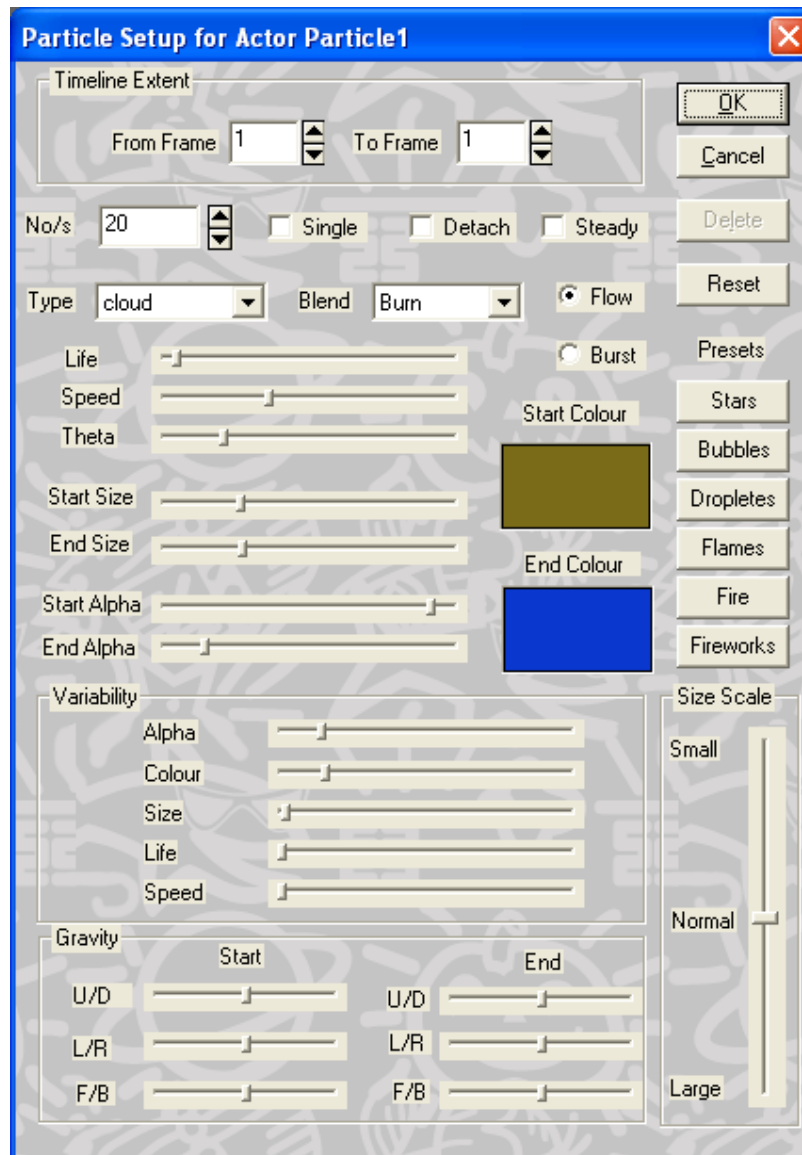


## Controlling Particle Systems

All elements of a particle system are controlled through this dialog:

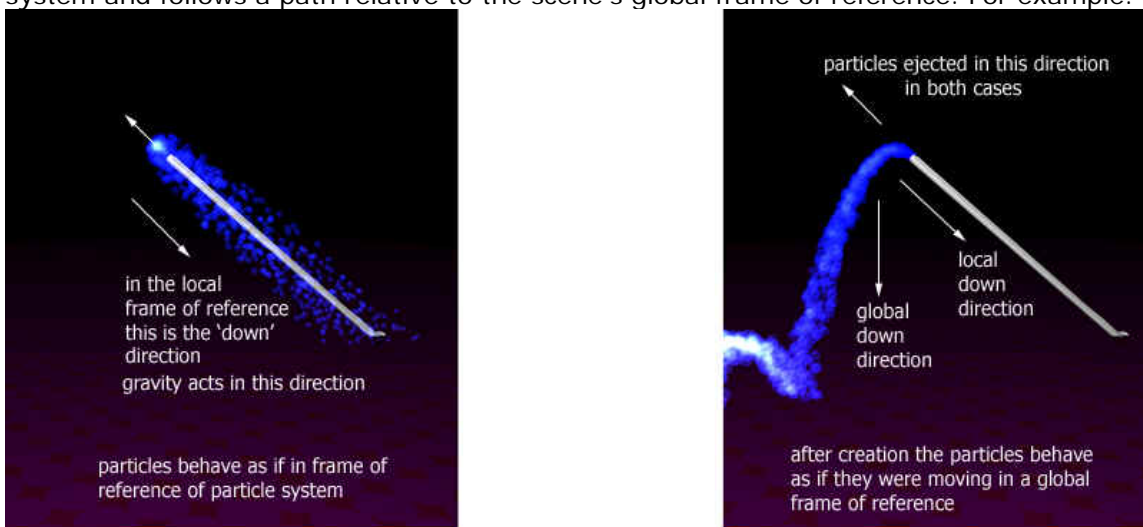


**There are several key parts to this dialog:**

- The timeline extent - OK, Cancel and Delete buttons are common with all the other actor's costume dialogs.
- The Reset button will return the dialog settings to a typical default value.
- The Preset buttons will assign to the particle system's other settings values that could typically be used to simulate various effects such as: A moving starfield, bubbles, water drops, flames, a fire and fireworks.
- The other particle systems settings are considered as four major groups:
  - System settings, No/S, flow, burst, etc.
  - Properties: life, speed, colour etc.
  - Variability
  - Gravity

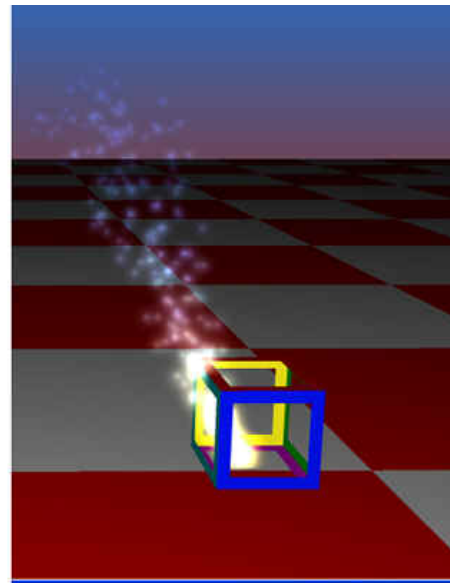
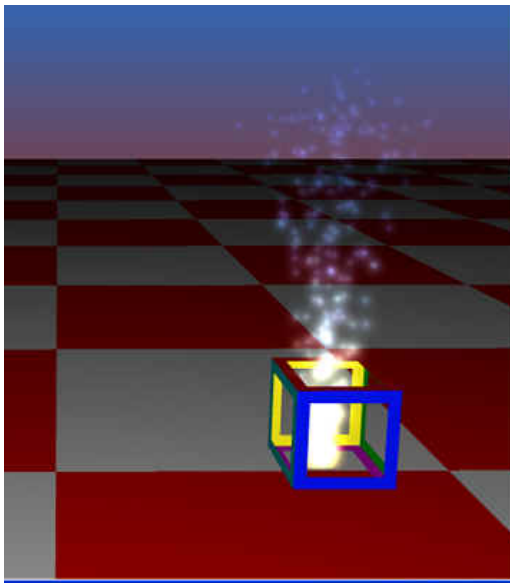
### System Settings

- *Number per second*  
This setting specifies the number of particles in the particle system that are created, per second. A larger number of particles will lead to a denser looking effect. The total number of particles that require to be rendered depend on this setting and the particle's *lifetime* (see below.) For example, if we set up a particle system that generates 20 particles per second and the particles lifetime is on average 10 seconds then we will typically always have about 200 particles that need to be rendered. If we change the lifetime to 5 seconds our particle system will typically require about 100 particles to be rendered. Many very realistic looking effects can be obtained with as few as 50-80 visible particles.
- *Single*  
This flag changes the form of the particle system completely. A single particle of one of the *types* given below is rendered within the bounding volume of the effect. This appearance of this single particle gradually changes from the setting of starting colour, size and alpha too the settings for the ending colour etc, and then back again to the starting values. This takes place in the time interval (frames) spanned by the costume time line for the particle system.
- *Detach*  
When this flag is clear the particles in a particle system always behaves as if it were performing within a frame of reference attached to the particle actor. Thus, for example, if the particle actor were to turn on its side the down direction in the particle system would appear to point to the side.  
When the flag is set, a particle, once it has been created, breaks free from the particle system and follows a path relative to the scene's global frame of reference. For example:

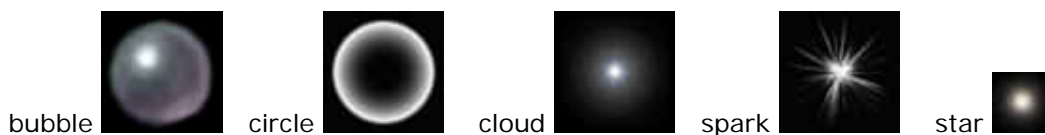


When a particle system moves during an animation the particles will keep their positions relative to the moving particle system unless this flag is set. For example in the image below we see a particle system representing a fire at the centre of the 'framework', the 'framework' which is moving from left to right.

On the left the particle system remains attached to the local co-ordinate system of the moving object. On the right we see the result of setting the *detach* flag (here the particles are detached from the local co-ordinate system and are free to drift off from the moving object.)



- *Steady*  
When this option is selected the particle system is allowed to reach a steady state before rendering begins. Thus for example, a fire effect will look like it has been burning for some time. When this option is NOT selected the particle system goes through its transient stage, starting from the location of the particle emitter, and then reaching its steady state.
- *Flow/Burst*  
A particle system will normally appear to be continuous (to flow). To produce effects like fireworks which appear to eject a stream of particles in bursts we use the burst setting. The burst settings ejects a stream of particles for a short time (5% of the lifetime of a particle) , after that, no more particles are generated and those that have been produced are allowed to live out their lives in the usual way.
- *Type*  
This dropdown listbox offers a selection of the bitmap images to be used to render the particles in the particle system. The images are loaded from a set of .BMP image files in the OpenFX program folder. There are 5 presets:



There are also 3 additional type, User1, User2 and User3. These correspond to bitmap files PBM\_USER1.BMP, PBM\_USER2.BMP and PBM\_USER3.BMP, you can use these and your favourite painting program to design your own particle images. The images should be 32bit bitmaps, mainly greyscale and you use the alpha channel in the image to specify the transparency (in the alpha colour a white colour implies that the RGB pixels in the particle image will be rendered, a black colour implies that the particle image will be transparent.)

- *Blend*  
This settings is used to specify how the particles are blended together and into the scene.
  - The *burn* settings carries out an additive mix so that if two particles overlap the particle brightnesses add together to form a visible element that is twice as bright. Use this setting for fire, fireworks, flames etc. because it will give the illusion of a 'white hot' centre to the flame where many particles overlap.
  - The *blend* settings carries out a blend which averages the brightnesses where particles overlap. Use this effect for things like smoke (with a darkish colour) and fluid droplets.

## Properties

- *Life (lifetime)*  
This property determines for how long any one particle will be visible (i.e. its lifetime.). A

short lifetime is useful for things like small flickering flames. A longer lifetime is useful for large raging infernos and fluid flows. ([see the examples...](#))

- *Speed*  
This property gives the particle an initial velocity in the direction set by the *Theta* parameter below. Once the particle has been created it continues to travel with this speed. The speed will increase or decrease depending on the [gravity settings](#).
- *Theta*  
The theta settings controls the dispersion with which the particles are ejected from the particle emitter. When theta is zero, ALL the particles, are ejected from the particle system in the UP direction. This UP direction is LOCAL to the particle system. Thus if you want the particles to be ejected in different direction add a rotation timeline for the particle actor and orientate it accordingly (i.e. with the top lying at right angles to the direction you want the particles to be fired in.)  
As you increase *theta* the particles are fired off at random in an increasingly wider angle. If theta is set to about 1/2 of its maximum the particles would appear to be dispatched (with speed set by the speed property) into a hemisphere covering the top half of the particle actor. When *theta* is set at its maximum value the particles are dispatched at random in all possible directions (use this to simulate fireworks and explosions for example.)

The remaining sets of properties determine how a particle's appearance will change over its lifetime. They do this by allowing you to provide a value for them at the instant of time when the particle is created and at the later time just as the particle disappears ( '*life*' second later.) A linear interpolation is used to determine the value of these settings at any intermediate time. (Note: this same interpolation is used for the gravity settings, as a result particles can be given and additional acceleration as well as a final retardation.)

- *Start Size - End Size*  
Simply determines how big each particle appears. The result of this setting is further scaled by the *Size Scale* slider (on the right of the dialog) if desired.
- *Start Alpha - End Alpha*  
These settings determine the transparency of the particles, thus giving them the illusion of appearing to fade away or to appear. A scrolling star field would use a start alpha of 0 and an end alpha of 1.
- *Start Colour - End Colour*  
The colour given to the particles as they are emitted and fade away. When designing flame/fire effects you should choose a colour with a small component of all the colour components R,G & B because when the particles overlap these build up to give the illusion of a flame with a 'white hot' centre and outer edge of the more predominant colour given to the particles.
- *Size Scale*  
Acts as a multiplication on the size of the particle once it has been projected onto the viewing plane in the renderer. It can be used to scale the size of the rendered particle image by a factor of between 1/10 and 10 times.

## Variability

These settings add some variation to the properties as set above. When each particle is created its properties are modified by adding a random variation. If these sliders are set at their minimum values then all the particles are generated with the same properties. (Reminder: Once a particle is generated it carries with it the properties given when it was created, the particle continues to behave as an independent object until the time elapsed since its creation exceeds its lifetime.

## Gravity

These settings essentially apply an acceleration to the particle once it has been created at the particle emitter. The acceleration acts along the co-ordinate axis Up/Down, etc. A negative value gives an acceleration in an opposite direction. If the *detach* flag is set the direction of the

acceleration vector is specified with respect to the global (world) frame of reference. If the *detach* flag is NOT set the the direction of the acceleration is specified relative to the local frame of reference of the particle actor.