



Integrating Water Elements into Architectural Renderings Using Particle Flow

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VI5194-L Many architectural structures incorporate a water feature as a prominent visual component of the structure. This exciting class explains how to implement 3ds Max Particle Flow for architectural use. This class takes you through the creating water fountains, waterfalls, and other water features architects like to use. We will cover creating particle flow networks to simulate water flow and using space warps to affect the motion of the particles. We will also cover the point cache and particle rendering.

Learning Objectives

At the end of this class, you will be able to:

- Create particle flows to simulate fountains and other water features.
- Use space warps to create custom effects with particle flows.
- Add point cache to effectively work with large numbers of particles.
- Apply materials and render particle systems using the mental ray® renderer.

About the Speaker

Steven attended R.I.T.'s film/animation in 1989 & A-B Tech's Entrepreneurship in 2011. Opened Spectralight Images in 1989 to deliver 3D training and animation. Moved to Orlando, FL in 1990. As VP of Computer Animators Plus (1995) began teaching 3D at Seminole State College. With a love of art, opened Gallery 611 in 1997, and formed the Orlando Visual Artists League in 2000, president until 2004. In 1998 he became an Autodesk® training specialist, and has contributed to Autodesk's certified training material for 9 releases of 3ds Max®. He was a co-developer of Autodesk's ACI Program, and Autodesk's 3ds Max® fundamental standards. Now he develops 3ds Max / Maya training courseware for CAD Learning's online training. Spectra3D Technologies provides 3ds Max, Maya & AutoCAD training. Steven teaches classes for end users, companies, Autodesk University, & others. Past trainees: Disney, Guess, US Army, and more. In 2014 Spectra3D Technologies expanded into 3D printer sales and support offering an array of 3D printers, design services and 3D printing training.

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Introduction

As an architect or designer Autodesk's design software allows you to create buildable fountain designs for anything from simple water pools to highly complex articulated multi water jet fountains. There are many times when it is helpful to see a design animated in order to see how the water features will look when assembled and functioning. While you can create a static model of the water streams that shoot from the jets, in order to visualize the actual fountain, the water jets can be animated using particles.

Particle Flow is a tool that can be used for creating a visual simulation of water jets and other water features in a fountain. 3ds Max Design is the ideal environment for creating animated versions of fountain designs. Whether the model is built within 3ds Max Design or imported from another program, such as Autodesk Revit, You can create the animation for the water using the Particle Flow particle system built into 3ds Max Design. You are also able to add physically based simulation as well as realistic water materials. All this can be used to create what appears to be a complex animated fountain system.

Controlling the animation of the particles that make up the water flows is what makes Particle Flow in 3ds Max a better solution than simply using a standard particle system. While a single particle system can portray the motion of water spraying from a jet and colliding with another surface, presenting a compelling animation involves being able to coordinate the animation of multiple particle streams within the same scene. This is where Particle Flow's unique ability to use MassFX tools for simulating particles interacting with each other and with objects in the scene makes creating fountains with multiple flows possible.

Once the particle flow is complete you need have the ability to output both a preview animation and a fully rendered sequence. In many cases, animated sequence is rendered to a video file that can be played back at full speed. The level of quality of final rendering is based on certain requirements. If you're running a test to see if the animation looks the way you want it to, you can save a preview rendering of the viewport. When it comes time to creating a final, high quality rendering, rendering with mental ray can create a high quality realistic rendered animation.

This class will discuss and outline the steps you would take to create the water features in an architectural fountain and then render the animation to a fully rendered sequence using 3ds Max Design.

This course is based on the course I created for the CAD Learning's 3ds Max Design online course. Learn more about the 3ds Max course and other courses available at <http://www.spectra3d.com/training>

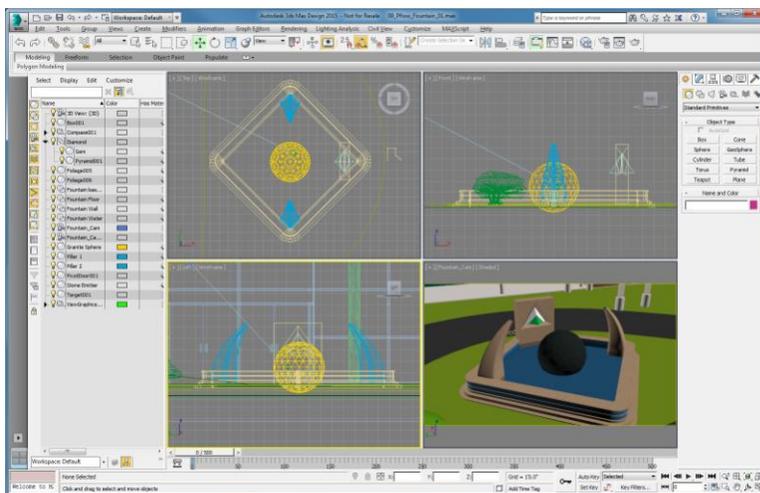
Setting up the Scene

The scene being used in this lesson is an architectural fountain that contains two water spouts in the pool area, a spherical stone located in the middle of the fountain. When determining what needs to happen in this scene, the water is to shoot out of the two jets that are in the pool, and bounce off of the spherical stone in the center. The water must arc and bounce off of the stone in the center. The water should not just completely bounce away; some of the water should run down the spherical stone. To accomplish this using the simulation tools available in Particle Flow, you will add a special modifier to two objects in the scene.

Collision Shapes

The water is supposed to bounce off of the stone sphere and into the pool below. This requires two different collision objects, these objects will be used to deflect the particles and in Particle Flow, trigger an event. If you're wondering why two! There will be one for the sphere that is in the pool; and one that will be used for the water in the pool.

The PFlow Collision Shape modifier, will be used to make the particles interact with the objects in the scene. By setting the sphere and the water surface as collision objects, if a particle collides with the either surface object it will test as true.



Gravity

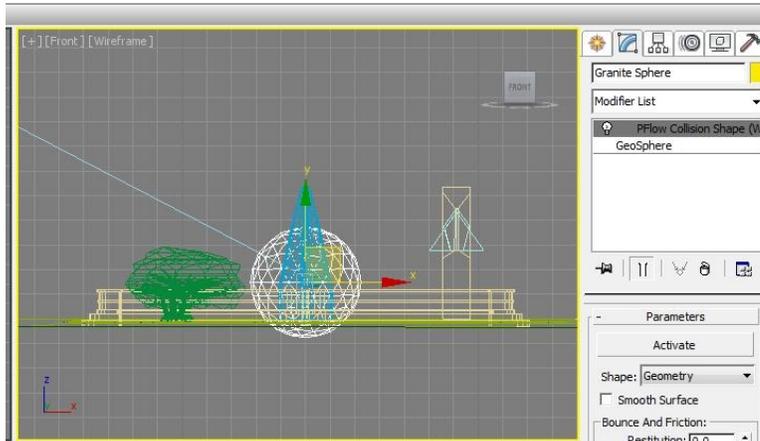
If gravity is not added into the scene, the water shooting out of the jets in the pool and the top of the stone will continue moving infinitely in the same direction. When using the mParticle simulation framework within Particle Flow allows for the addition of realistic gravity simulation without the need to add additional Spacewarps.

Configuring the Collision Objects

The objects you want to add the modifiers to are the objects that will collide with the particles. The first object will be the sphere in the middle of the pool. The modifier you will add is specific to the mParticles that are used for the simulation. mParticles use the MassFX dynamics simulation system to accurately simulate the motion of the particles. By using this modifier, you are able to incorporate the granite sphere into the simulation of the particles.

1. Open **09_Pflow_Fountain_01.max**.
2. Select the **Granite Sphere** object in the middle of the fountain.
3. In the Command panel, click the Modify tab.

- Expand the Modifier List drop-down and choose the **PFlow Collision Shape World Space** Modifier.



When a particle hits a deflector, there are a number of options to set how it deflects off of that object's surface. Using this modifier allows you to assign bounce and friction parameters that will affect the particles. In this example, these parameters will control how the water particles interact with the sphere.

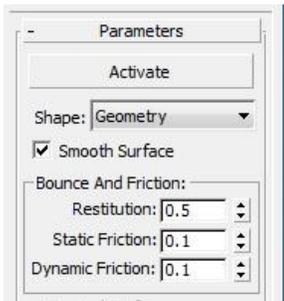
There are several parameters that the PFlow collision shape contains; however, there are two primary parameters that dramatically affect how particles interact with the surface. The first one is the Restitution amount. This parameter determines how much particles bounce off of the surface. Restitution determines the percentage of bounciness for the particle when it collides. A high value makes the surface more bouncy, whereas a low value will cause particles to hit the surface and not bounce as much. By changing the Restitution amount, you can obtain a realistic effect of water bouncing off of a stone surface.

- Set the **Restitution** to a value of 0.5.

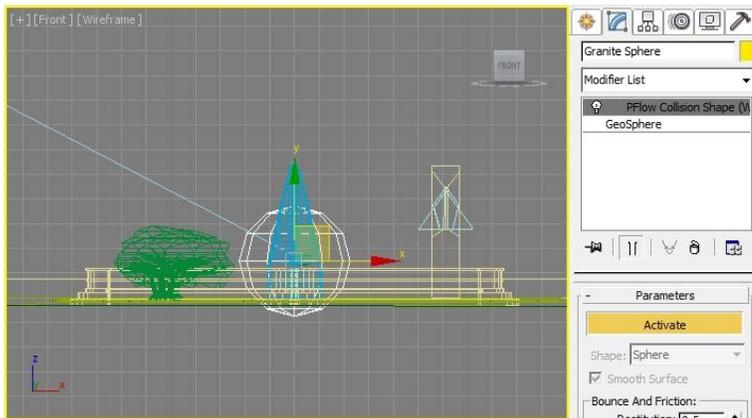
That will set the amount of bounce off of the surface and cause particles to bounce only a little, and skim the surface.

The other parameter is Friction. This parameter determines how slowly the particles move along the surface. A surface with a higher friction value will cause particles to be more sticky to the surface, and lower values will cause particles to slide more easily along the surface.

- Keep the friction extremely low; set the value for the **Static Friction** to 0.1.
- Set the **Dynamic Friction** to 0.1 as well. This will allow particles to gently slide along the surface of the sphere.

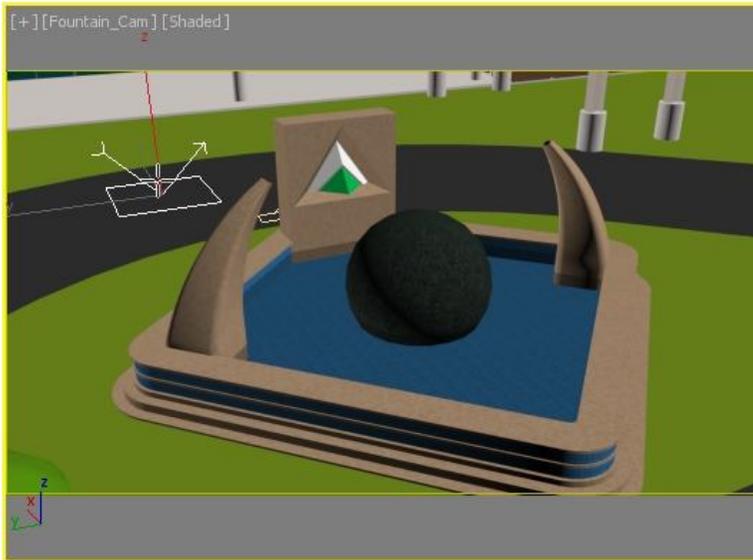


8. Before activating this modifier, make sure the Shape is set to **Sphere**. This will use a mathematically defined sphere to calculate the collisions.
9. Once those options are set, click **Activate** to turn this into an active Particle Flow simulation object.

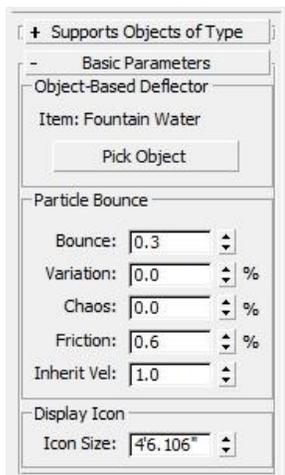


The other object, the water in the fountain, will be used as a deflector. Even though the particles will not be bouncing off of the water, you want to be able to use this as a way to trigger an event.

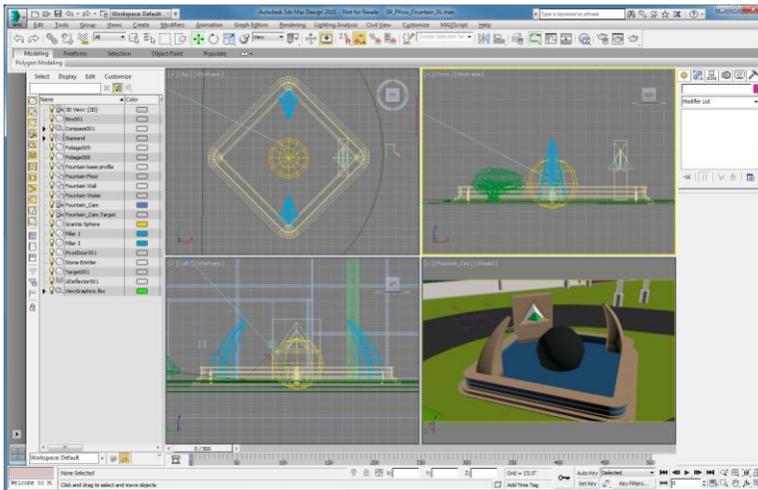
10. Click the **Create Panel, Spacewarps**, then select **Deflectors** from the Spacewarps dropdown.
11. Select the **UDeflector** object type.
12. In the **Fountain_Cam** viewport, click and drag to create a **UDeflector** Object.



13. Change the **Modify** panel..
14. In the **UDeflector Basic Parameters**, Click the **Pick Object** button and select the **Fountain Water** object that is in the fountain.
15. Set the **Bounce** value to 0.3.
16. Change the **Friction** value to 0.6.



This sets the scene up for the next step, creating the Particle Flow itself.

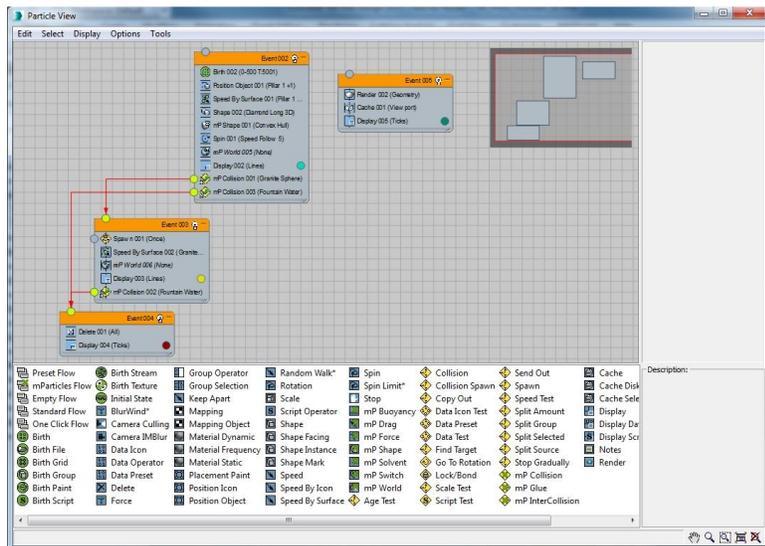


Creating a Particle Flow

The particle flow particle system built into 3ds Max Design is a highly capable particle animation system. With particle flow, you can create particle animations ranging from simple water drops; to highly complex animated systems that create elements like helicopter rotor wash over water. Unlike other particle systems that only allow you to create one particle event, such as the rain falling down or spray from a garden hose, Particle flow allows you to create multiple events. Particle flow is significantly different from single particle systems, it is what is known as an event driven particle system.

Event driven particles allow you to work with multiple events in the same particle system. For example, you can still have the rain falling down, or the water coming of the garden hose; but we can add an event that occurs once the water hits an object. For example, the water coming of the garden hose hits a wall and splashes off, with the initial splash both bouncing off of the wall, and dripping down the wall.

A particle flow is created using different types of actions within the Particle View dialog box. Flows allow you to create different kinds of initial particle flows. For example a preset flow gives you the ability to merge in particle flow's that are available in the preset directory. An operator is a basic element of a particle system. By combining operators into events, you create the particles characteristics for a given period of time. There are two types of operators available within the particle flow particle system. The first is a series of operators that affect the particle behavior directly, and the second, provide more of the utility function. A test is used to figure out if a particle satisfies a specific condition. When you use a test, for example a collision test, you can create a branch to a new event if the test for the collision is true. By using a combination of flows, operators and tests, you can build an unlimited variety of particle systems.

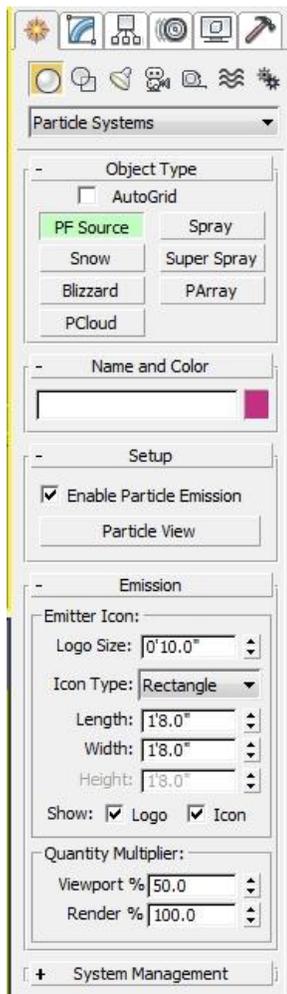


To start here use: **09_Pflow_Fountain_02.max**

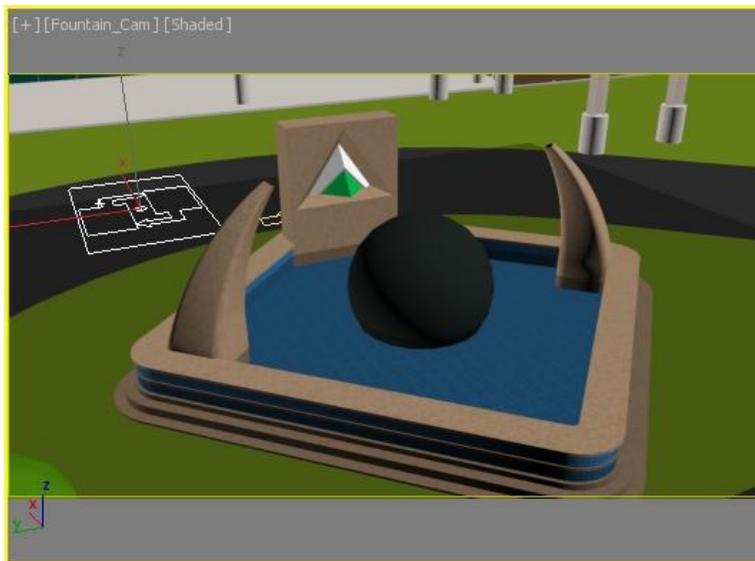
Add a PFlow object

Once the scene is setup, it's time to create the Particle Flow particle system. The first step is to add a particle flow source object into the scene, once added particle view needs to be opened in order to begin creating the particle flow.

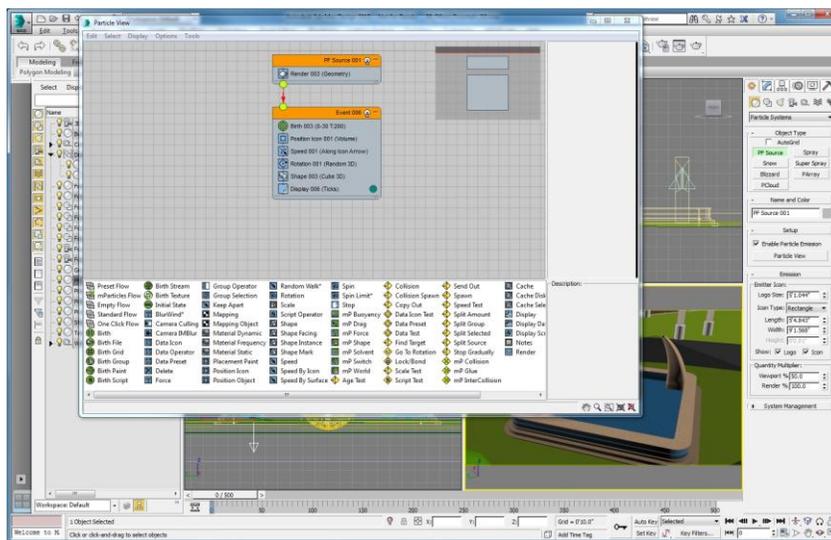
1. In the **Command** panel, click the **Create** tab.
2. In the **Create Geometry** drop-down, choose **Particle Systems**.
3. Expand the **Object Type** rollout and select **PF Source**.



4. In the **Fountain Cam** viewport, click and drag on the **upper left side** to create a small **Particle Flow Source** object. In this case, the size does not make any difference.



5. Now in the **Command** panel, switch over to the **Modify** panel.
6. With the particle flow **Source Object** selected, click **Particle View** in the **Setup** rollout to open the **Particle View** dialog box.

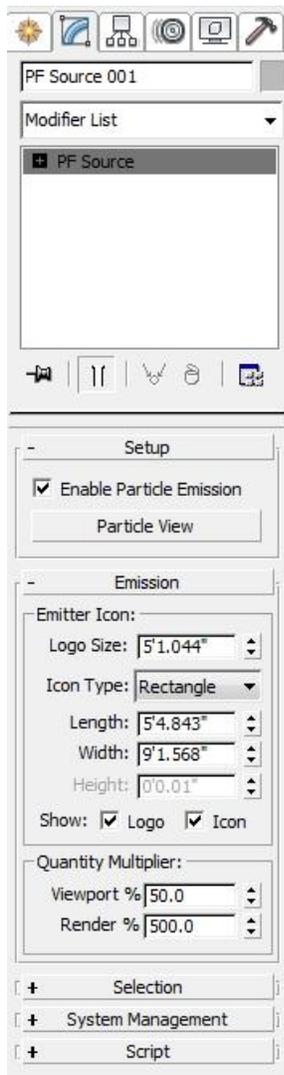


Event setup

When creating particle flows, one important option that you should look at is the Quantity Multiplier for the viewport and the renderer. When working with particles in 3ds Max Design, you can quickly create a large number of particles. In order to keep the viewport display from becoming slow and unusable the Viewport Quantity Multiplier option can be reduced to a level that shows only a fraction of the total particles. In this scene, the Viewport percentage can be reduced to about 50% in order to both see the result and still be able to work in the view.

The Rendering Quality Multiplier determines the quantity of particles that will be used for rendering the Particle Flow animation. The render quantity multiplier provides a way of increasing the quality of

certain types of particle animation. In this case, the ability to increase the value to 500% provides for 5 times the number of particles when the Particle Flow is evaluated at render time.

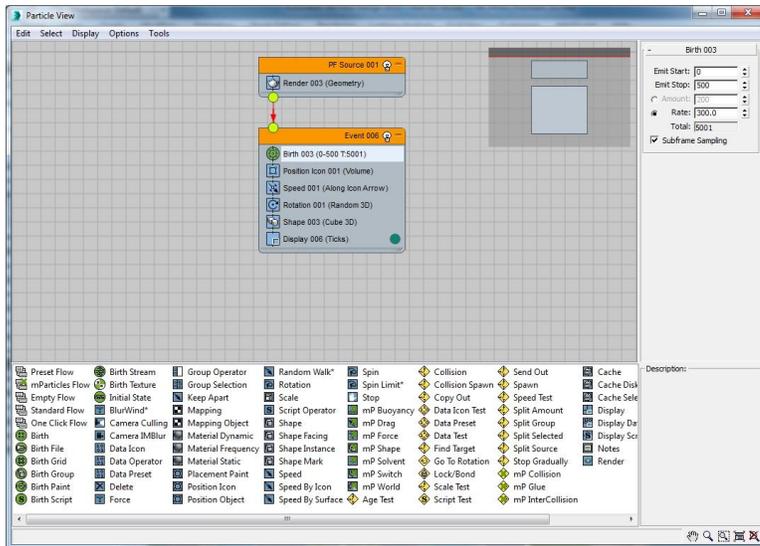


Editing events

Once a particle flow is created, you need to begin by editing the events that are part of the flow. One of the first operators to modify is the birth operator. Start out with the standard flow, then add operators or change operators in the current flow.

7. Click the **Birth** operator in the first event.
8. Set the **Emit Start** to **frame 0**.
9. Then, set the **Emit Stop** to **frame 500**.

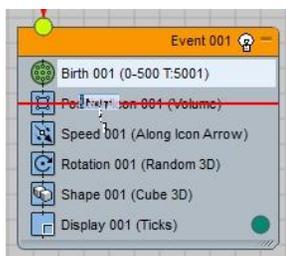
10. Since this particle system will be a fountain, you use a particle rate instead of the total amount of particles.
11. Under **Options**, select **Rate**, then set the Rate value to **300**.
12. Make sure the **Subframe Sampling** option is selected. This will cause 3ds Max to sample the particles between frames, making the birth of the particles more consistent.



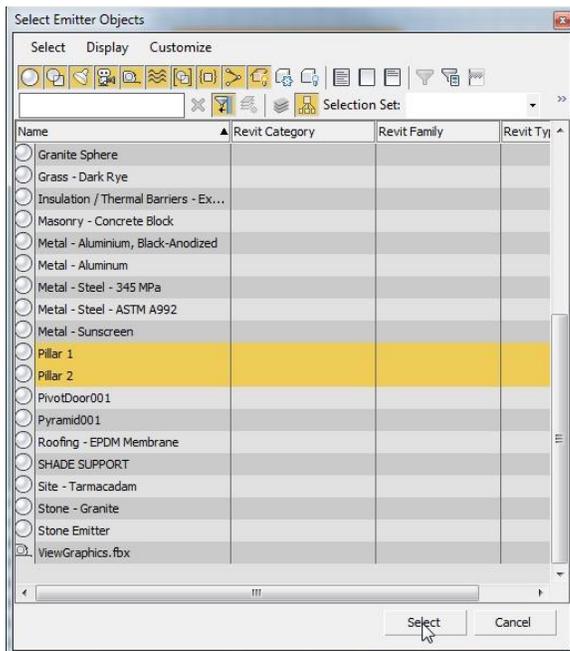
Adding Operators

Now you need change the position of the particles when they are emitted. The position defaults to the “position icon” operator, which tells the particles to emit from the icon that was created in the viewport. In order to have particles emitted from objects in the scene, you need to replace the operator.

13. From the **Operator** toolbox, click and drag the **Position Object** operator on top of the **Position Icon Operator** in the event. You'll see a red line going through that operator, which means that operator will be overwritten.



14. Click the **Position Object** operator you just added.
15. In the **Position Object** rollout, you need to add emitter objects.
16. Click **By List** just under **Emitter Objects**.
17. In the **Select Emitter** objects list, hold **CTRL** and choose both the **Pillar 1** object and the **Pillar 2** object, and then click **Select** in the lower right corner of the dialog.



18. That adds these two objects into the **Emitter Objects** list.

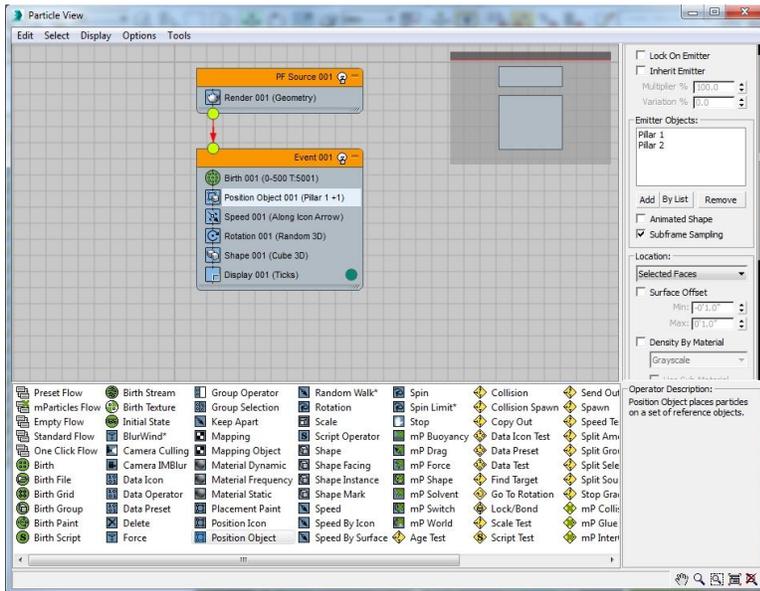
19. Check the **Subframe Sampling** checkbox to make the particle emission smoother and more consistent.

Once added, you set the location the particles will be emitted from.

20. In the **Location** group, expand the **Location** drop-down and choose **Selected Faces**.

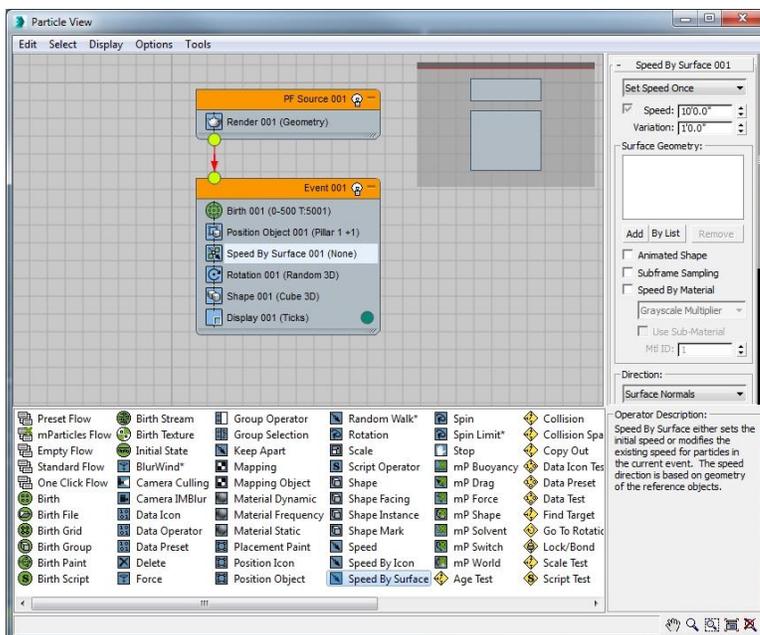
This will cause the particles to be emitted from the black circle, which represents the water pipe on the top of the pillars. The reason this works is because the geometry for the water pipe circle has been selected in the polygon object.

Integrating Water Elements into Architectural Renderings Using Particle Flow



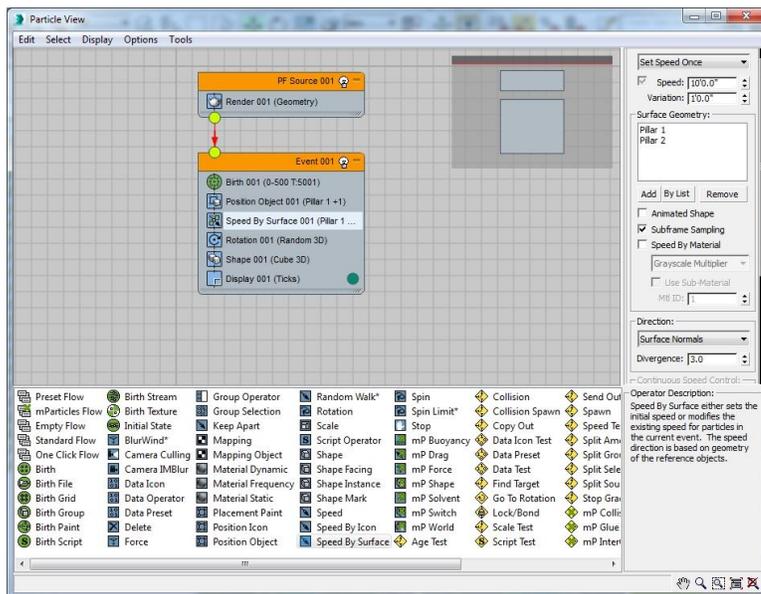
Once the Position Object operator is added, it can be configured to emit particles from the geometry in the scene. More specifically, the particles will be emitted from the selected faces of the geometry.

21. Next, click and drag the **Speed By Surface** operator on top of the **Speed** operator in the **Event** and overwrite it.
22. Now click the **Speed By Surface** operator in the event. Here, you set the speed of the particles that will be emitted from each pillar.
23. In the **Speed By Surface** rollout, expand the **Set Speed** drop-down and choose **Set Speed Once**.
24. Set the **Speed** to a value of **10 feet** and the **Variation** to a value of **1 foot**.



Next, you need to tell the operator what surface geometry the particles will be coming from.

25. Click **By List**.
26. From the **Select Surface Objects** dialog box, press **CTRL** and select both **Pillar 1** and **Pillar 2**, and then click **Select**. This adds the two pillars to the Surface Geometry list.
27. Check **Subframe Sampling**.
28. In the **Direction** group, expand the **Direction** drop-down and choose **Surface Normals**.
29. Set the **Divergence** value to **3.0**.

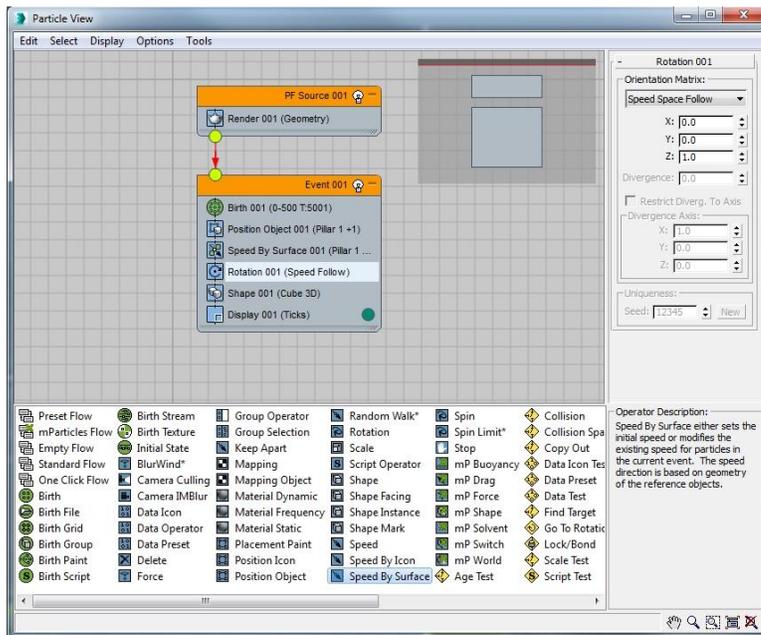


This now sets the direction of each particle based on the normal of the surface it's being emitted from, which will shoot the particles out at the ends of the pillars.

For the water to look like it is shooting out of the pillars, the direction of each particle needs to be set so that they are oriented properly and not just randomly rotating.

30. Now select the **Rotation** operator in the event.
31. In the **Orientation Matrix** drop-down, change the **Orientation Matrix** option to **Speed Space Follow**.
32. Change the **Z** value to **1.0**.

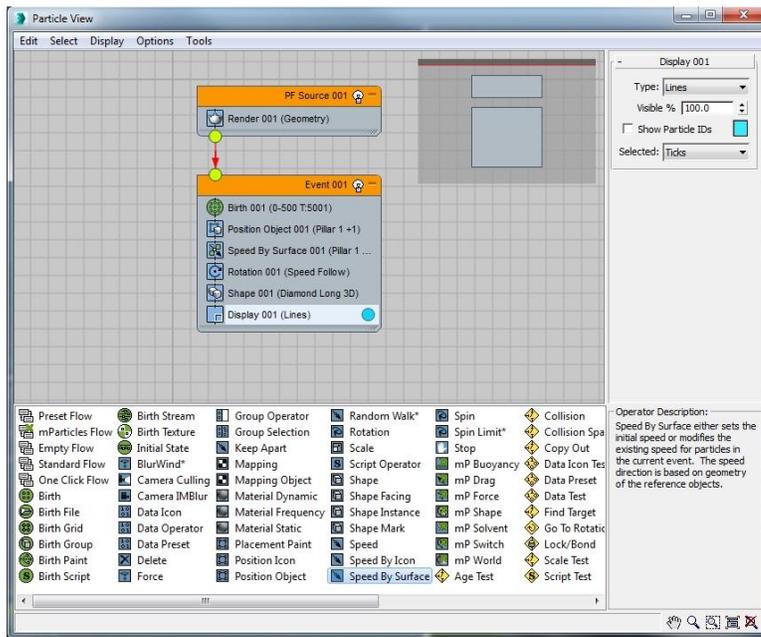
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This will cause the particles to follow the arc of their travel as they are emitted from pillars.

In order to have the particles render and display like a water fountain, the shape of each particle needs to be set and the display properties configured.

33. Select the **Shape** operator from the **Event**.
34. In the **Shape Operator** parameters expand the **3-D Shape** drop-down and choose **Diamond Long**. This is a simple shape with eight faces, which will help reduce the polygon overhead when the scene is rendered.
35. Change the **Size** to **0.5 inches**.
36. Select the **Scale** checkbox and leave the **Scale** value at **100%**, but change the **Variation** to **5%**.
37. Now click the **Display** operator in the **Event**.
38. Expand the **Type** drop-down and select **Lines**.
39. Click the color swatch and set the color to a light cyan by setting the **Red** value to **9**, the **Green** value to **215**, and the **Blue** value to **180**.
40. Then click **OK** to accept the color.



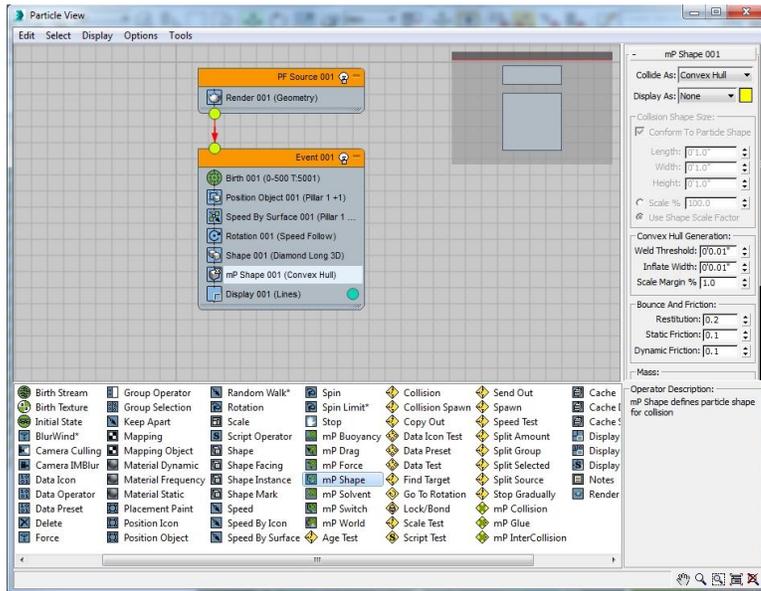
Particle Simulation and MassFX

Once the operators for the initial event are added and configured, the next step is to create the collision and the splash of the water off the stone. This will be handled by the MassFX operators within Particle Flow. MassFX is a simulation framework built into 3ds Max that provides an easy way to setup and create flexible simulations of objects and particles.

To start here use: 09_Pflow_Fountain_03.max

1. From the **Operator** list, click and drag the **MP Shape** operator beneath the shape operator in the particle flow **Event**; you will see a blue line appear at the bottom of the shape operator.
2. Make sure the **MP Shape** operator is selected, and from the **Collide As** drop-down, make sure **Convex Hull** is selected.
3. Next, set the bounce and friction values.
4. Set the **Restitution** value to **0.2**.
5. Set the **Static Friction** to **0.1**, and the **Dynamic Friction** to **0.1** as well.

Integrating Water Elements into Architectural Renderings Using Particle Flow



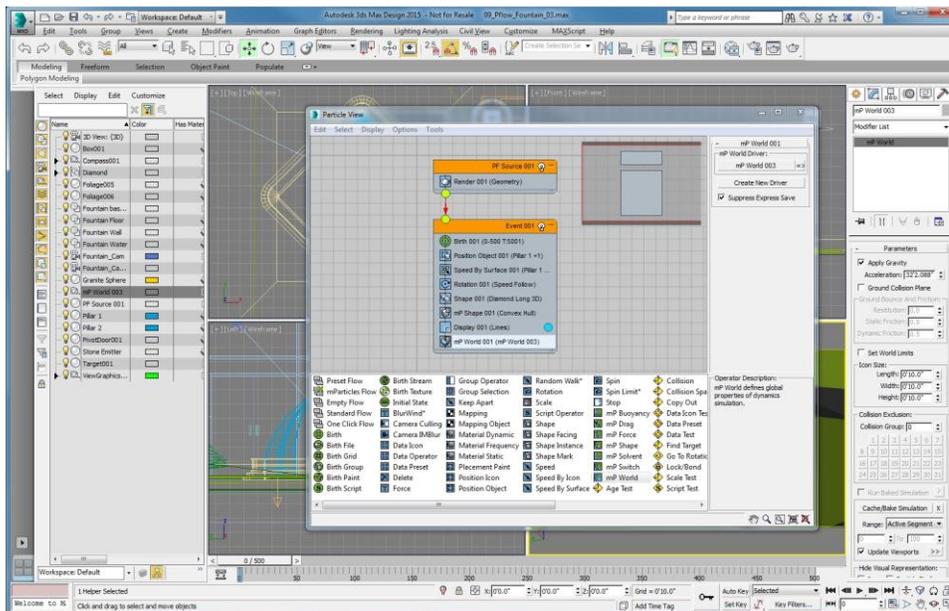
The next operator to add is the MP World operator. This operator is extremely important to the functioning of mParticles because it sets the parameters for the world these particles exist in.

6. Click and drag the **MP World** operator to the bottom of the event.
7. Select the **MP World** operator.
8. If the option in the **MP World Driver** says "**None**," click the **Create New Driver** button.
9. Once a **New World Driver** has been created, click the **arrow** icon, which is the **More** button, to the right of the world driver name.

This opens the options for this world in the Modify panel. The world for mParticles allows you to apply gravity and set its acceleration, as well as set a ground plane for ground collisions and the limits to the size of the world, if there are any.

10. In the **mP World** parameters, make sure the **Apply Gravity** option is checked.

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11. Minimize the **Particle View** dialog box.
12. Click the **Play** button and watch the particle flow as it is currently configured.
13. **Stop** the animation, and go to **frame 0**.

Adding Collisions and Tests

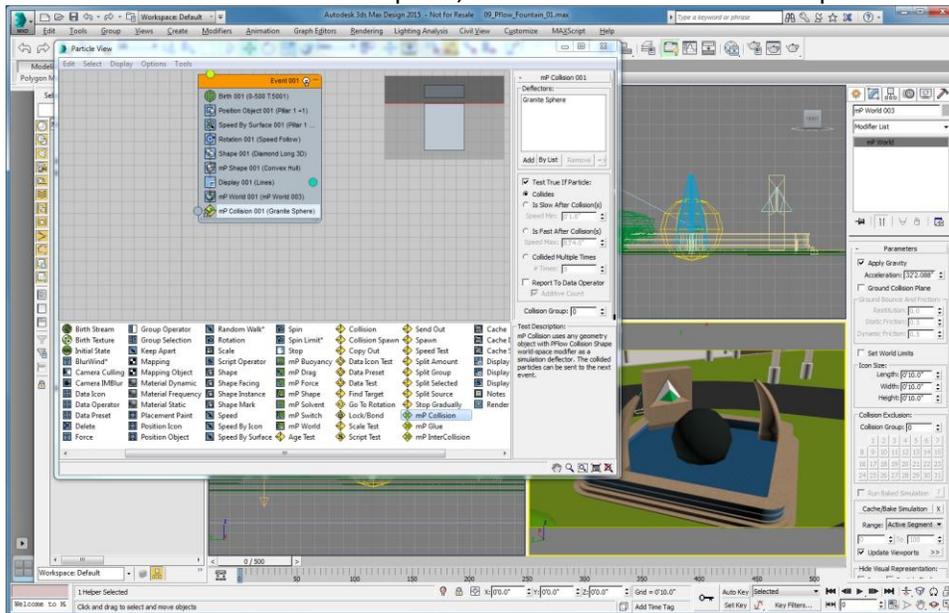
The basic flow of the fountain is configured, adding collisions will allow the particles to bounce off of the granite sphere in the scene and eventually be deleted. You may ask, why delete the particles? For one simple reason: the more particles you have, the longer it takes to calculate. And at a certain point, the particles don't need to be seen anymore. Once they bounce off the granite sphere and into the water, they effectively disappear. You will be adding two different collision test operators: one for the granite sphere, and a second for the fountain water.

14. Make sure the **Particle Flow** object is selected, and the **Particle View** dialog box is open.

Two separate tests are needed because when the particles bounce off the granite sphere, they need to go to a new event that will create additional particles. The second test will determine when the particles land in the fountain water. That will allow you to route those particles to an event that will delete the particles.

15. From the **Operators** list, click and drag the **MP Collision** operator to the bottom of the **Event** in the particle flow.
16. Click the new **MP Collision** operator.
17. In the **MP Collision** parameters, click the **Add** button.
18. This allows you to click directly on the **Granite Sphere** in the **Fountain Cam** viewport.
19. Click the **sphere**, and it is added to the **Deflectors** list.

20. Select the **Test True If Particles** option, make sure that the **Collides** option is chosen.



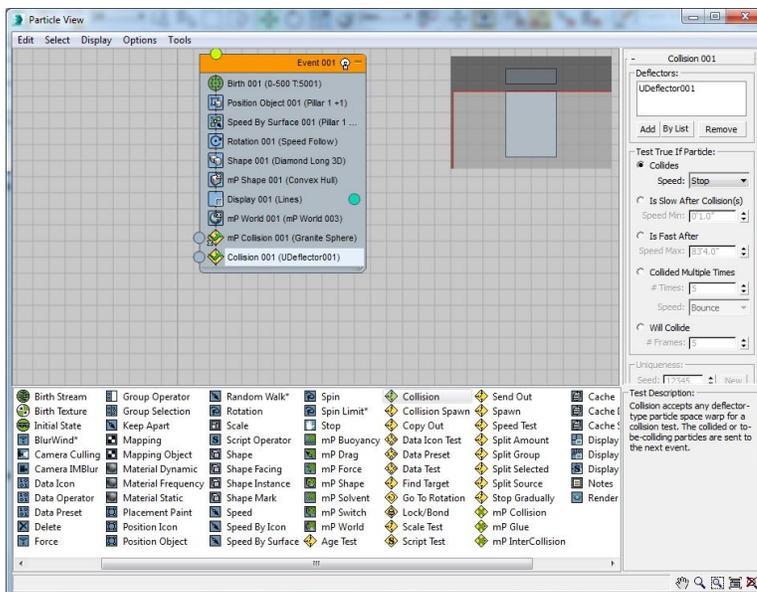
The second collision is for the water surface.

21. Click and drag a standard **Collision** operator below the **mP Collision Operator**.

22. Click the second **Collision** operator.

23. This time, click **By List**, select the **UDeflector** object and click **Select**.

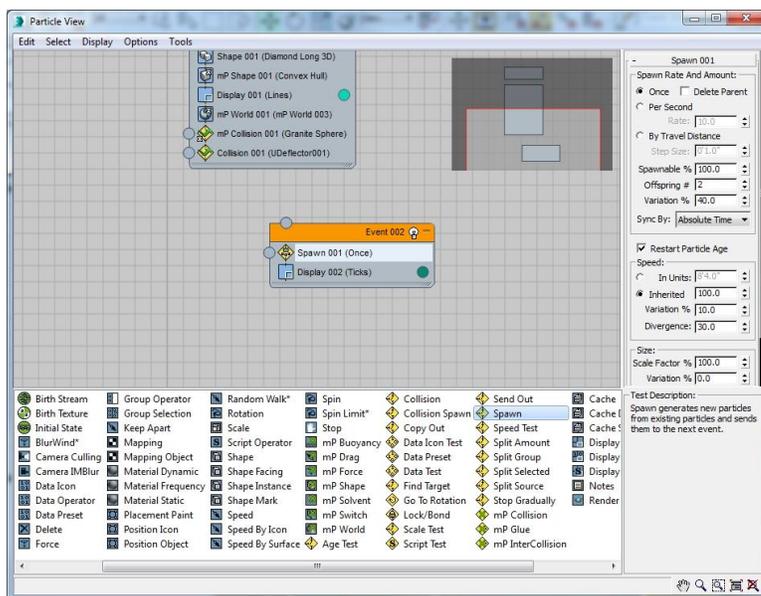
24. In the Test True If Particles group, make sure the **Collides** option is set and the **Speed** option is set to **Stop**.



That completes the first event, now you need a new event for the particles that will spawn when the water hits the sphere.

To start here use: 09_Pflow_Fountain_04.max

25. Click and drag a **Spawn Test Event** to an **open area** underneath the initial **Event**. This will create a new spawn event that contains a spawn operator, as well as a display operator.
26. Click the **Spawn** operator in the new **Event**.
27. In the **Spawn Rate and Amount** group, select the **Once** option.
28. Set the **Offspring** number to **2**, and set the **Variation** percentage to **40%**. This will create two particles for every one particle that collides with the sphere.
29. Expand the **Sync By** drop-down and select **Particle Age**.
30. In the **Speed** group, choose the **Inherited** option to set the speed to be inherited from its parent particle.
31. Leave the **Inherited** number set to **100**.
32. Set the **Variation** percent to a value of **10%**.
33. And set the **Divergence** to a value of **30**.

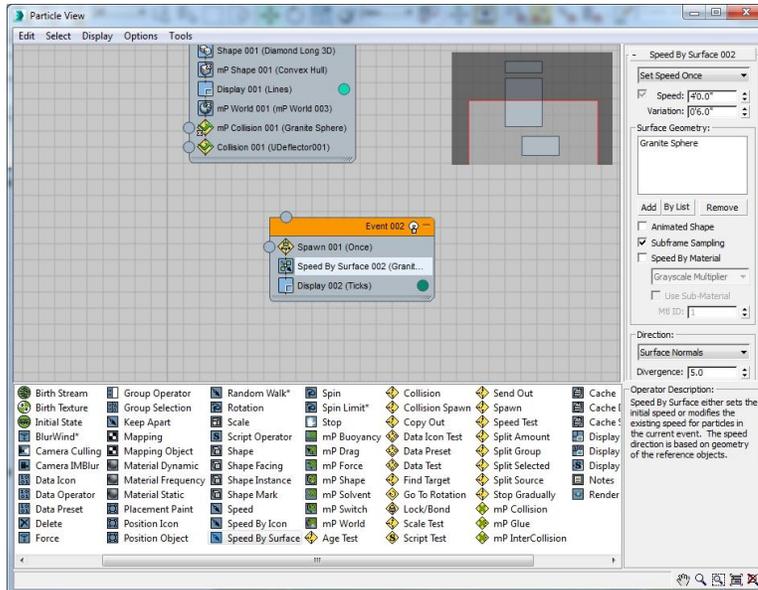


Since the particles are bouncing off of the sphere, add a **Speed by Surface** to enhance the bounce of the particles off the sphere.

34. Click and drag a new **Speed By Surface** operator into the second **Event** beneath the **Spawn** operator.
35. Select the **Speed By Surface Event**.
36. Expand the **Speed By Surface** drop-down and select **Set Speed Once** if it is not already selected.
37. Set the **Speed** value to **4 feet**, and the **Variation** to **6 inches**.
38. Click the **Add** button, and choose the **Granite Sphere** to add it to the **Surface Geometry** list.

39. Check **Subframe Sampling**.

40. From the **Direction** drop-down, choose **Surface Normals**, and set the **Divergence** value to **5.0**.



41. Select the **Display** operator in the second **Event**, and change the **Type** to **Lines**.

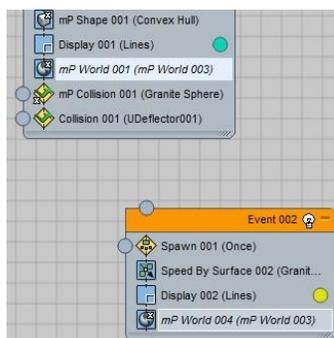
42. Choose the **Color** swatch, set the color to a bright yellow.

43. Change the **Red** value to **225**, the **Green** value to **225**, and the **Blue** value to **10**, and then click **OK** to accept the color.

Now copy the MP world from the first event and instance it into the second event. This way the particles in the first event and the particles in the second event share the same world parameters.

44. To accomplish this, click the **MP World** operator in the first **Event**, then right-click and select **Copy**.

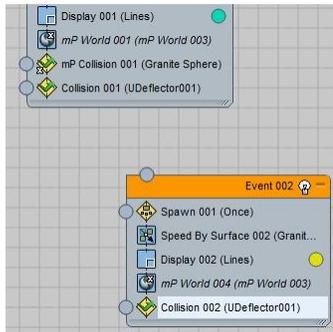
45. In the second **Event**, right-click just below the **Speed By Surface** operator and choose **Paste Instanced**. You should now see that both MP World operators are in italic, indicating they are instances of each other.



Do the same thing with the collision for the fountain water. This time, make a regular copy.

46. Left-click the **Collision** for the fountain water in the first **Event**, then right-click and select **Copy**.

- Right-click at the bottom of the second **Event** and **Paste** the Collision operator.

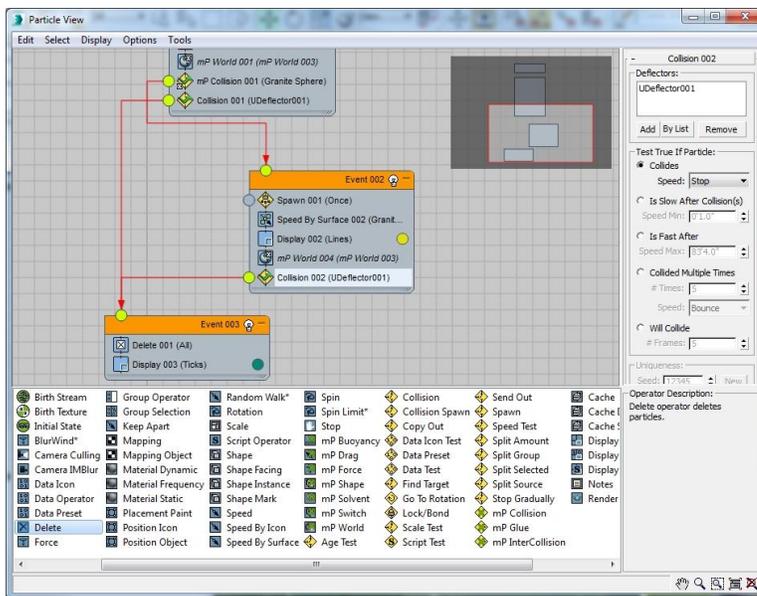


These are two different ways of copying and pasting operators from one event to another.

Adding a delete event.

For this event, you don't have to edit anything; you just want to delete particles that are going into the event. Where the real power of particle flow comes in, is being able to connect a test operator to a new event, which creates a flow of particles from one event to the next.

- Click and drag **Delete** to an open area below the second **Event**.
- From the first **MP collision** operator in the first Event for the granite sphere, click and drag from the **Output** of the **Test** to the **Input** of the second **Event**.
- Then, click and drag from the **Output** of the **Collision** for the fountain water in the second **Event** to the **Input** for the third **Event** in order to delete the particles.
- Lastly, **drag** from the **Collision** operator for the fountain water in the first **Event** down to the **Input** of the third **Event**. This will delete any stray particles that bounce off of the sphere and hit the water directly.



Before playing back the animation, you want to make a change to how the particle system tracks the position of each particle. One of the issues with particle systems in an animation is identifying the position of a particle in space with any degree of accuracy. This is handled in Particle Flow by the System Management, Integration Steps options for both the viewport and render calculations. At one sample per frame, a particle may move too far to have the collision or other particle interaction properly calculated. By increasing the number of samples per frame, you can have Particle Flow track the location of each particle more accurately, causing fewer errors due to the change in location.

52. In any viewport, click to select the **PF Source** object.
53. Open the **Modify** Panel, then open the **System Management** rollout.
54. Change the **Integration Steps** for the **Viewport** to **1/4 Frame**, and the **Render** to **1/8 Frame**. This will provide adequate temporal resolution for the current particle flow. Keep in mind that you don't need the same quality for the viewport, since it is just a preview of the rendered particle system.
55. To see this particle flow in action, **minimize** the **Particle View** dialog box and click **Play**.

At this point, it's running fairly slowly.

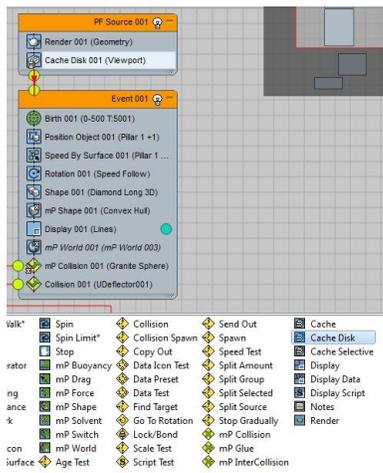
56. **Stop** the animation and go back to **frame 0**.

Caching particles

As particle systems generate more particles, the computer needs to spend more time calculating how those particles are going to move and interact. This can cause particle systems to be evaluated slower and slower as your frames progress in the viewport, and during rendering as well. One way to make a particle systems operate more efficiently is to save a particle cache down to the hard drive. This cache precalculates the particles in the particle system, allowing you to scrub through the timeline more smoothly and reduces processing time when you go to render the animation.

Add one last operator, a Cache operator that will cache the particle flow down to the hard drive and speed up playback dramatically.

57. You may have to scroll to the right in the **Operator** list.
58. Click and drag the **Cache Disk** operator to the **PF Source Event** just below the **Render** operator. This will cause the cache to work on the entire flow.



59. Select the **Cache Disk** operator.

In Particle View, you can see that there are quite a few options available for what can be cached, how the cache is updated, and how frames are sampled. To speed things up, sample every other frame.

60. From the **Sampling** drop-down, choose **Every Nth Frame**.

61. Change the **N** value to **2** and select **Save Cache With File**.

62. For this cache, Click the Select Files button.

63. Navigate to the **Scenes/Cache** folder, enter **Fountain** into the **File Name** and click **Save**.

64. In the Particle Flow Tools dialog, click **Yes** to use the current location at the default cache location.

65. In the **Update and Reset** group, click **Update** to update the cache. At this point a cache generation progress dialog opens to show you the elapsed time and time remaining for the cache process.

Now, 3ds Max will play back the animation and create a cache for the particles. This may take a few minutes, but when the animation is finished, you'll be able to scrub through the timeline with much better viewport performance.

Applying materials

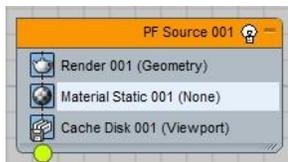
There are several ways to apply materials to particle systems in particle flow. For this fountain you are looking to create realistic water from a simple material. When applying the material you can use the material type is known as a static material. Because it's a static material, use the material static operator in order to apply it to the particle geometry.

One important part of applying materials in particle flow is where the material operator is placed. If you want a particular event to use a certain material, place the material within that event. For the purposes of this lesson, all of the particles in this entire particle flow should be the same water material.

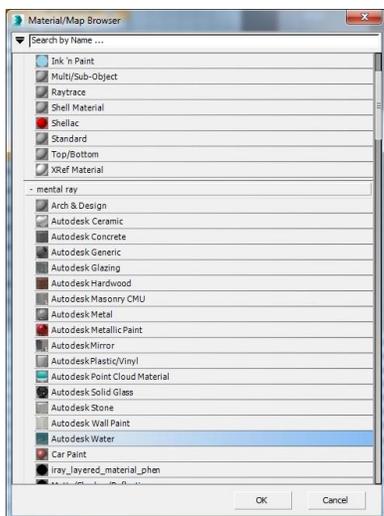
Creating and assigning a water material

To start here use: **09_Pflow_Fountain_05.max**

1. Click and drag the **Material Static** operator into the **PF Source** event just below the **Render** operator. This will apply the same material to all the events with in this particle flow.



2. To choose the **Material Static** operator, click the **Assign Material** button on the parameters panel. This will open the Material/Map Browser.
3. From the **Material/Map Browser**, in the **Mental Ray** material rollout choose the **Autodesk Water** material.



In order to edit the material itself, the slate material editor needs to be open.

4. From the Main Toolbar, open the Slate Material Editor.



5. Click and drag the material from the Material Static operator into the slate material editor.

6. Choosing Instance from the Instance (Copy) dialog. Using the instance option, any changes made will affect the look of the particles.
7. In the Material Editor, double-click the Water material.
8. Set the wave height to 0.0. This will set the water to work better for the particles in the fountain.

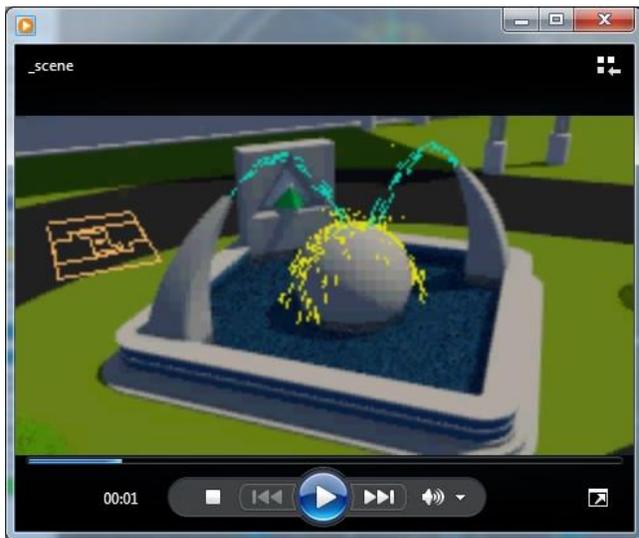
Rendering the Fountain

Now that the particle system has been completed, you're ready to render the particle system. First, to save time create a viewport preview of the particle system so you can see the particle system as a will look in real time. This is a much faster way to preview your particle animation than any other kind of test rendering. Once the particle flow has been setup to meet your needs, you can move on to a low quality test render using Mental Ray to provide a more Photoreal look at the fountain.

Creating a preview

1. Right click in the camera viewport to make it the active view port.
2. In the **Tools** menu, **Preview - Grab Viewport** option, select **Create Preview Animation** option to open the Make Preview dialog box.
3. In the **Make Preview** dialog, **Preview Range**, keep the **Active Time Segment** selected, and leave everything else at the defaults. You can change the Visual Style to render the viewport using a style like Color Ink or Wireframe.
4. In the **Output** section click on the **Choose Codec...** button.
5. From the **Video Compression** dialog that pops up, use the **Microsoft Video One** codec and click OK. You can choose a different CoDec if desired, depending on what is installed on your particular computer.
6. Make sure the **Render Viewport** is set to **Fountain_Cam**.
7. Click the **Create** button. 3ds Max will take a little while, and you'll see the time slider progressing through the frames while the preview is created.

Once the preview is complete 3ds Max will open a media player associated with the AVI file. Playing the animation back in real-time allows you to see what the particle animation will look like and how the particle flow is being evaluated over time.



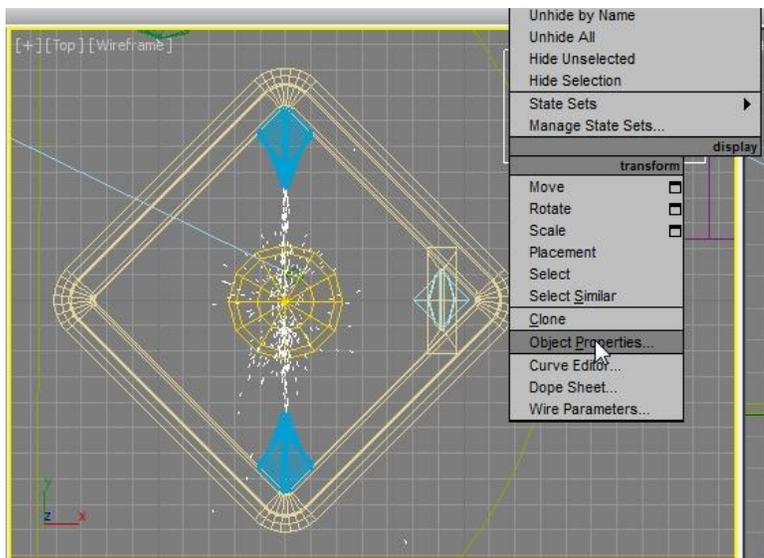
Rendering with Mental Ray

Once you like the way the particle flow is setup, you can precede with setting up mental ray as the render.

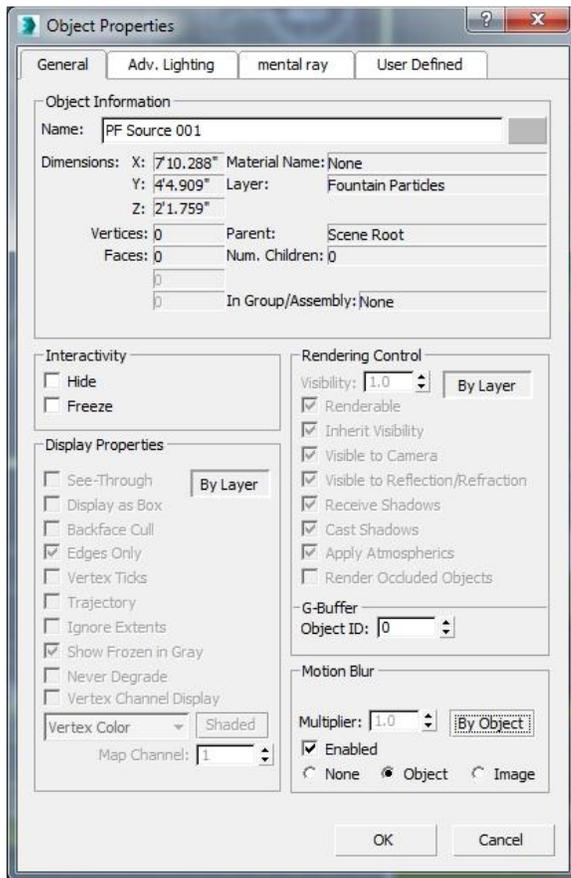
Setting Motion Blur

When rendering particles particularly water, you may want to use motion blur on the particles to make them look more visually realistic.

8. To setup motion blur, select the **PF Source** object.
9. Right-click on the particle system, and choose **Object Properties** from the right click menu.



10. At the lower right of the **Object Properties** dialog, set the motion blur to **By Object**. This will override the layer settings and use the objects motion blur options.



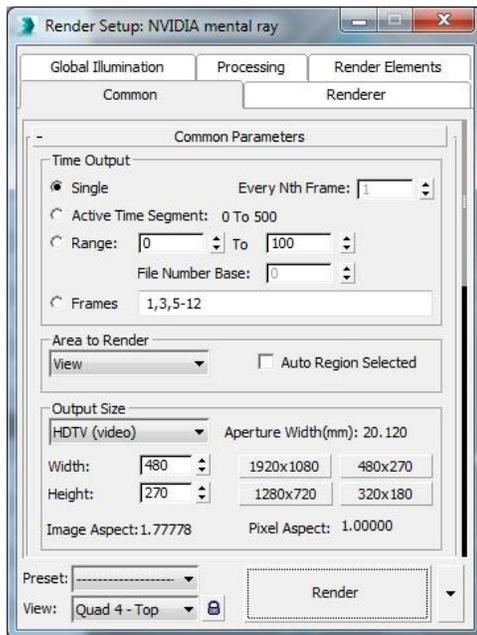
11. Make sure the **Enabled** checkbox is checked, and the **Object** option is chosen, click OK to close the dialog.

Render a Low Resolution Animation

Now that the Particle Flow is configured, the material is applied and the motion Blur is active, it is time to prepare a first pass, low resolution test render of the final animation. This is going to be test render that will give you a good idea of what the particle system and animation will look like. Mental ray is already the current renderer so there is no need to select it.

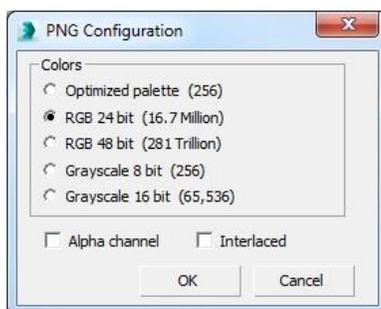
12. Click **Render Setup** from the Main menu to open the Render Setup dialog. 

13. In the **Time Output** section of the Common panel click the **Active Time Segment** option.



The output size is already configured for HDTV at a resolution of 480 by 270; a small animation but a good preview size.

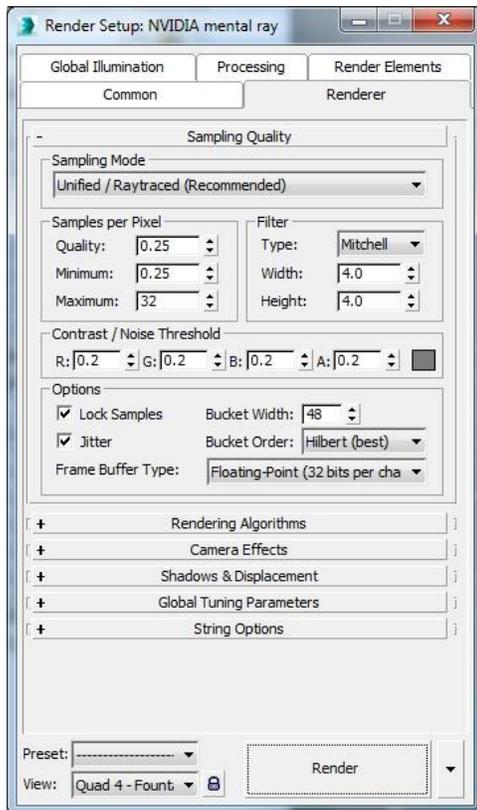
14. Set the file location in the **Render Output** section by clicking on the **Files...** button.
15. This opens directly into the render output directory of the current project folder.
16. Navigate to the **renderoutput** folder of the **3ds Max Project** folder.
17. In the file name, type in **Fountain_.png**, then click save.
18. In the **PNG Configuration** dialog, set the colors to **RGB 24 bit**, and since there will be no need to render with an alpha channel, uncheck the **Alpha channel** option and click OK.



That now sets the file name and path for the files that will be saved to the hard drive once rendering begins.

19. Switch over to the **Renderer** tab.
20. Make sure the **Sampling Mode** is set to **Unified / Raytraced**.
21. In the **Samples per Pixel** area, leave the **Quality** set to 0.25, set the **Minimum** value to 0.25 and the **Maximum** value to 32.

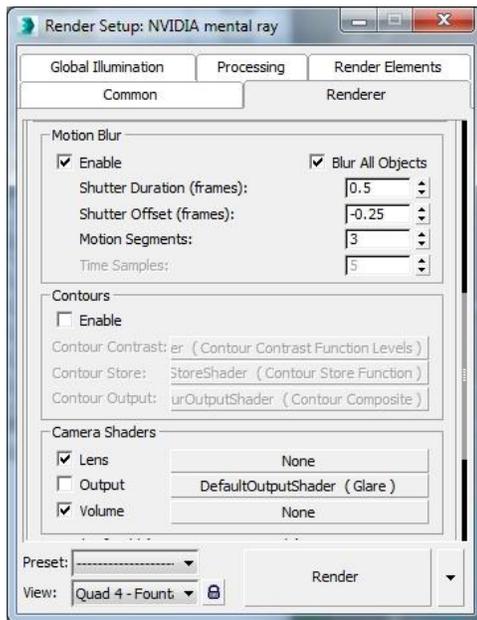
22. Leave the **Contrast / Noise Threshold** values at 0.2 for all the channels.



The current render setting in the file reflect a lower sampling quality. This lower sampling will reduce the time it takes to render the scene at the cost of noise and detail.

23. Open the Camera Effects rollout, ensure that the **Motion Blur** option is enabled.
24. Change the number of **Motion Segments** to 3. This will increase the accuracy of the motion blur at render time. Keep in mind that higher values will increase rendering time.
25. Make sure the Fountain_Cam viewport is the current render view and click the render button.

Integrating Water Elements into Architectural Renderings Using Particle Flow



For the first several frames you won't see very much happening because the particles start emitting at frame zero and you won't see too much for a least a few frames. When the animation is finished rendering, you can play back the image sequence using the ram player, or bring the sequence into your favorite video editing or compositing program.

