

Creating particle animations

Mastering 3D Graphics ~ issue #2

Soft F/X Pro ~ Kent Shum

I remember the first day that I'd started doing 3D digitally on my Amiga. Whilst it was just a simple program with limited primitive selections, a very basic tool set that allowed movement, rotation and scaling of the polygonal geometry and a minimal set of lighting controls, I was rather fascinated by the creativity that my 3D application could produce. No one really knew what particle systems were, and I certainly had no idea what they had to do within a 3D program, not to mention the possibility of having such a system built right in during those times. I remember I used to ask myself how I could make fire with the program I was using, my ultimate answer was to start saving money and get a real workstation, and then worry about making fire.



Lens Flares used to be (and may still be) a very hot feature that many 3D artists constantly discussed. And, whichever application had it implemented first, it would make that program a killer tool, almost automatically. I still remember those days when I tried so painfully to fake the concentric rings around a light source. However, I learnt something while doing it; “forget about it” was what I learnt. It just couldn’t live up to my expectations.

As the digital 3D world matures, our programs get very sophisticated. As with Lens Flares, particle animation features are becoming very common in today’s 3D applications. Many artists no longer need to save a bundle in order to create powerful particle effects. They can use the systems to make, for instance, smoke that comes out from steaming pipes, water that is pouring down from a tap, or in this case, fire from a burning torch. Many applications come with particle generation systems while others require extra plug-ins to do these tricks. In BytebyByte’s Soft F/X Pro, although no real particle system support is provided, there are actually two ways to do particle tricks; there is an easy way and a hard way.

Approximate the fact

To determine whether you would like to deal with the easy way or the hard way, you have to know a few factors before you begin your task. The scene that you are

going to do probably has elements that need particles to achieve certain results, say a fire pot or a torch and of course, a camera. Depending on your camera’s position and where it points, you will decide what camera-viewing angle is interesting when the final rendering is done. If you are to animate the scene, the distance between the camera and the animated element – the fire pot – will help you determine whether to choose the easy way or the hard way to build the particle effect, whichever is appropriate. When the fire pot is a great distance from the camera, you may save yourself valuable time by doing the effect the easy way. But, if the fire pot turns out to be your focus, or the main character in the scene and your camera is located in close proximity, then it would be better if the fire particle effect is built using the harder method.

The major differences between the two methods are, time and quality. When you build the scene the easy way, it could save you time (as much as ten fold) than if you were to use the hard way. Therefore, it is important that you approximate the distance from the main camera to the particle element(s). If time is of essence, move your camera away from it as much as possible while maintaining the interest of the scene. When a particle element is placed so far out that the camera can barely see it, then animating it could even be unnecessary. The drawback to saving time is to sacrifice the quality. The easy way is fast, but

not as flexible or adjustable as the hard one. Building the particles the hard way will result in better fluid motions, increased randomness, more control of life spans of the particles and thus, look more natural and believable.

Just exactly how do the two methods differ, you may well ask? I will demonstrate one after the other.

The easy way

Since Soft F/X Pro still does not provide a particle animation system, you will have to do it with other methods, either the easy or the hard one. First, you will find

many plug-ins that are very useful in Soft F/X Pro; the easy way to do particle animations is through the use of the Explosion effect plug-in module. The advantage of this method is speed; you can crank out a particle effect in less than 10 minutes. The disadvantage is however, very limited control. Since you cannot get real particles, you will have to build them yourself. For a moderate particle animation (say doing a fireworks effect) a sphere primitive is well suited to the task. We will use the many polygons of a sphere primitive to serve as particles in this instance.

Create a sphere primitive and subdivide it twice or more to provide enough polygons to “blow” into believably sized particles. By pressing the F7 key, Soft F/X Pro will display a Build Primitives dialog. Switch to the Sphere tab and select a high Face polygon count setting; choose the 1280 selection and then press the Make button (Figure 1). You will see instantly, that your sphere primitive is smooth in the OpenGL window at the upper right quadrant of the screen. In order to make the polygons of the sphere to act as if they were particles and to work with the Explosion effect module, you will have to shatter the sphere by choosing Separate Polygons under the Action pull down menu. Your sphere then becomes many separated triangulated polygons and is ready for you to give it some glowing magic.

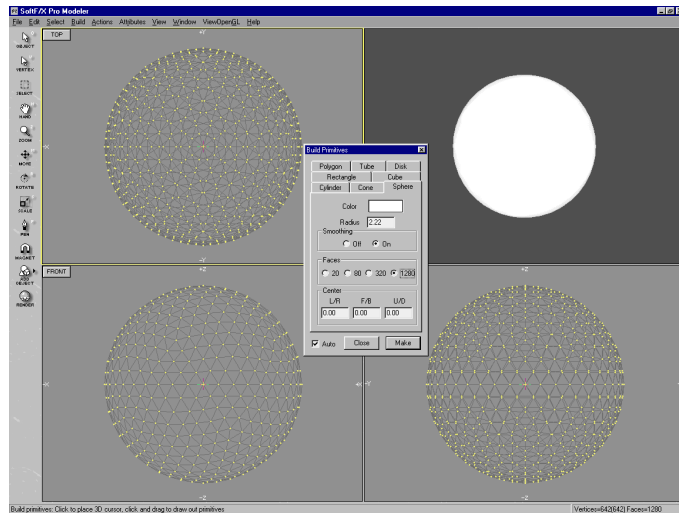


Figure 1: A sphere with dense polygons makes plenty of particles.

Born to glow

Fireworks glow in the dark, therefore your sphere needs to be treated with another Soft F/X Pro plug-in; the Glow post process plug-in. The name says it all, this plugin will cause the polygons of the sphere to glow. However, in order for the plug-in to work with your sphere, you have to assign a surface color as the key color to all the polygons. This color will let the glow plug-in do its duty when the model is imported into the Soft F/X Pro Animator, which I will detail later. Now select your shattered sphere with the Select tool to highlight it, then press the F8 key and you can set the model's surface color by clicking on

the color chip box in the dialog (Figure 2). Choose a preset color (pick an orange one in this case) and memorize it, because you will need to recall it in the Animator when the plug-in asks for it. The next thing you have to do is to give the sphere a luminous shader. The glow effect plug-in will cease to work without the luminous shader assigned. Click on the Shader tab and click on the Edit button to choose the luminous shader (Figure 3). The modeling part of the fireworks particle effect is now completed; it is incredibly simple, is it not? Now save the sphere model and name it "fireworks1.sce". Now it is time to make use of it in the Animator.

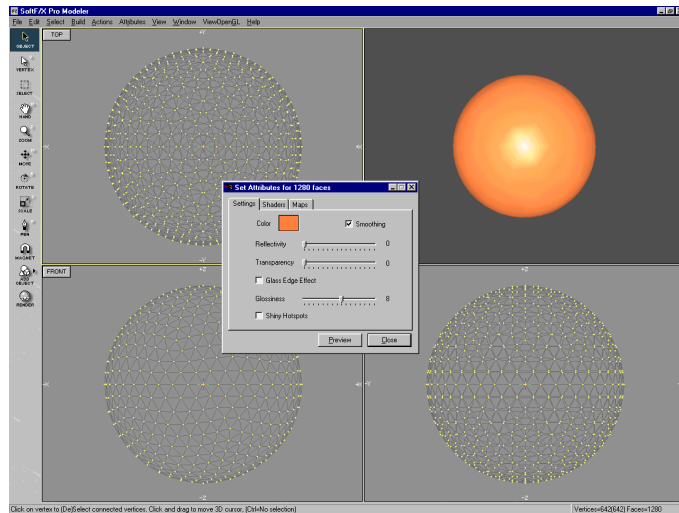


Figure 2: Give the sphere a surface color so that it works with the glow effect.

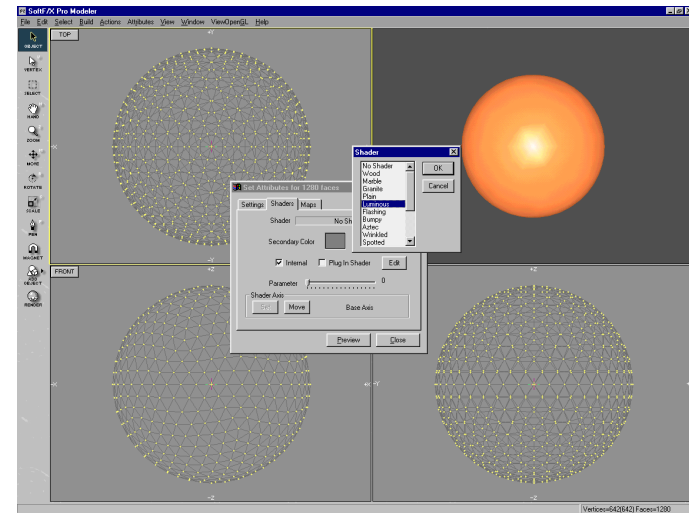


Figure 3: Give the sphere a luminous shader so that it works with the glow effect.

Let it glow

Load the Soft F/X Pro Animator (if it is not already loaded) and insert the model you just saved by pressing CTRL A; out of all those different actor types, you just choose the Model actor, give it a name right away (Figure 4). After picking the right model from the dialog box, you should see your sphere being imported right in the center of the camera window, as well as the others.

The moment for seeing the sphere glow has arrived, now point to the Edit pull down menu and choose “Image Process All Frames...”, or simply press the I key. Click

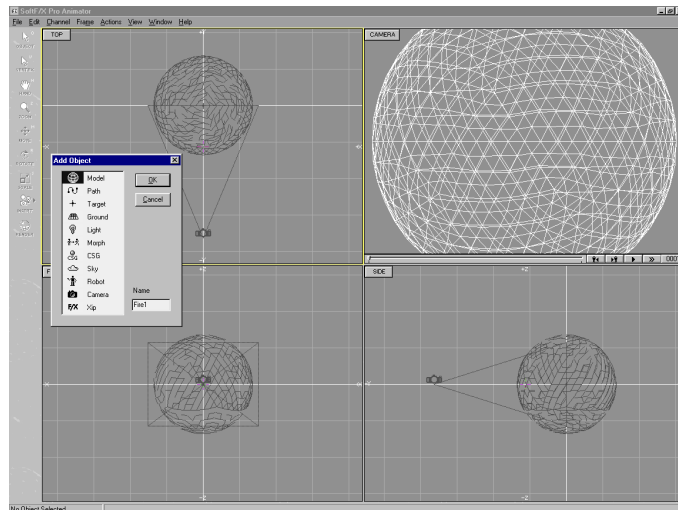


Figure 4: Inserting and naming the particle model in the Animator.

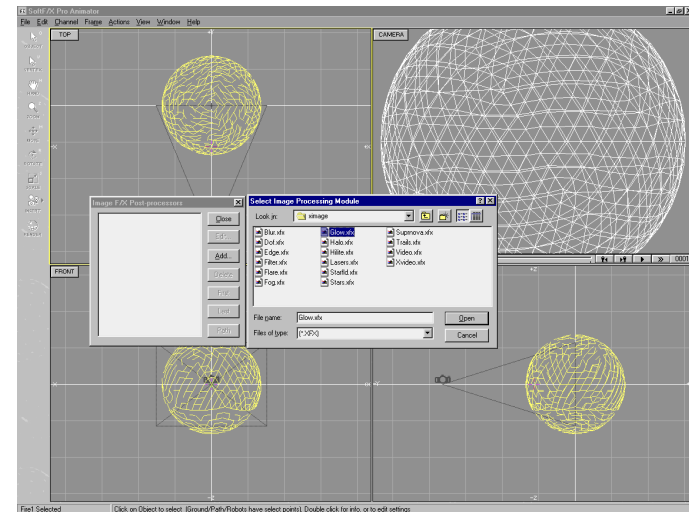


Figure 5: Adding the Glow image processing effect module.

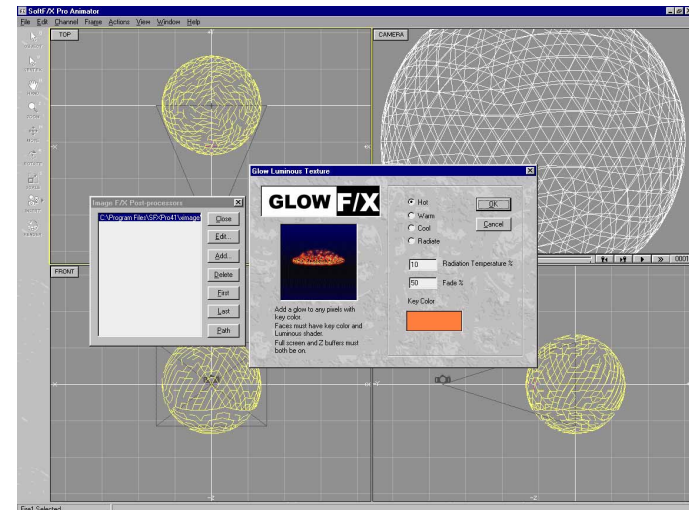


Figure 6: Adjusting the Glow effect module to suite the particle.

Add and load the Glow.XFX file; this is the Glow plug-in (Figure 5). On the Glow Luminous Texture plug-in panel, click on the Key Color chip box and choose the color that was assigned to the sphere's polygons when in the Modeler; this is the color that you should have remembered. Then select the following settings: Hot, 10% for radiation temperature and 50% for Fade (Figure 6). Of course, you are welcome to test other possible settings if you do not find the aforementioned suit your taste. And now, you are ready for action.

Let it blow

Before being able to see the shattered sphere in its explosive state, you have to give it the "energy". This is achieved by the use of yet another plug-in; the Explode plug-in. There are many ways to assign a plug-in module to any specific model in the Soft F/X Pro Animator, but I find it quicker to double-click on the model in any view window except the camera's. The Model Keyframe panel should be displayed by double clicking.

Hey, watch where you're pointing!

Whenever you try to access the Model Keyframe panel of any particular object in the Soft F/X Pro Animator, watch where you are pointing your mouse cursor. If your stage is complex, or filled with different objects of vari-

ous sizes and shapes (especially when they are very close to each other) be sure to move the mouse cursor to the object where it is not overlapping or being overlapped by other objects, before double-clicking it. The consequences of not following this rule will bring unexpected results to your final rendering or animation. If you were to assign a special effect plugin module to object "A" while you inadvertently accessing object "B" (unaware of your mistake) it could take considerable time to trouble-shoot the error when you perceived it later during final rendering. The way the Animator handles a double-click on a model, means a model does not have to be selected to access its Keyframe panel. If object "A" is your designated model while object "B" is the currently selected or highlighted one, you only need to move the mouse cursor on top of object "A" and double-click. There is no requirement to select before double-clicking. Consequently, be sure to comprehend where you are pointing before double-clicking a model.

The lower portion of the Model Keyframe panel shows the Effect section where it initially describes "No Effect in Use". Click on the Set button to look for the file Explode.EFX and load the explosion plug-in (Figure 7). Once the plugin is loaded, try setting the explosion parameters with the following:

- ♦ Explode From Model Center
- ♦ Explode Under Gravity and Fall
- ♦ Distance to Fall is 6

- Maximum Size is 1
- Shock Wave % is 0
- Tumble While Falling is checked
- Tumble Along Projection

See **Figure 8**. Explore other possibilities by varying the parameters; you never know when a more surprising result could be just a few settings away.

Length, camera, action!

As an animation cannot be animated if it only consists of 1 frame – it is a fact regardless of any kind of project

including this fireworks effect – the next step you need to do is to give the animation a length, say 60 frames for the effect to take place. Press CTRL L to display the Animation Length dialog and set your animation to 60 keyframes in the Frames field and select OK.

And lastly, change the camera's location by pulling it back to increase the distance between the sphere and the camera itself. Doing this will ensure the camera captures every polygon when the explosion takes place. Pull back the camera with the Move tool or by pressing the M key and drag it to a position that is far enough away to view all the fireworks. Open the Coordinates window to see the

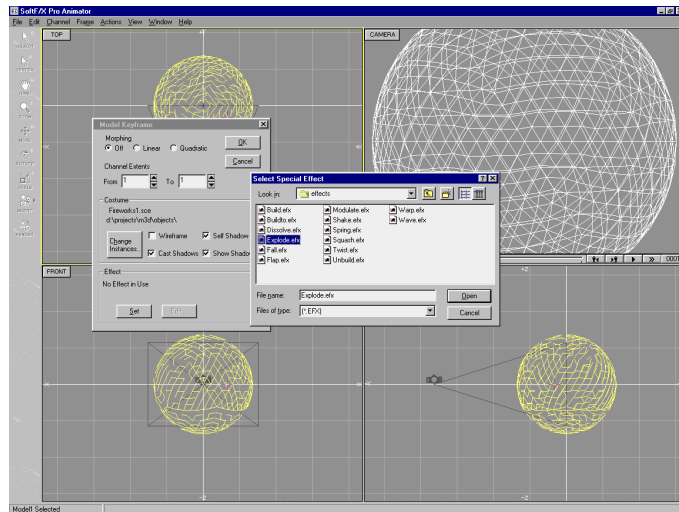


Figure 7: Adding the *Explode* special effect module to the particle sphere.

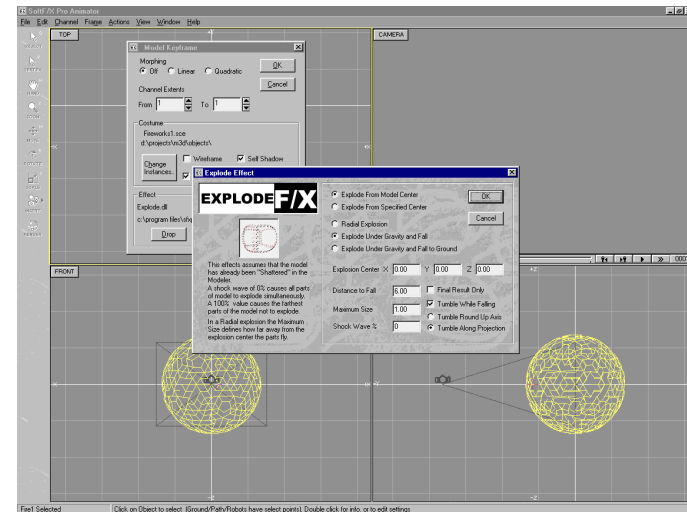


Figure 8: Adjusting the *Explode* effect module to suite the particle.

numeric changes by choosing the pull down menu View>Coordinates selection (Figure 9).

Now is a good time to test your animation by doing a preview. Hitting the W key will bring up the Wireframe Preview panel. Click on the Make Preview button with it set at 30 fps (Figure 10) to start creating a preview of the animation. You should be able to see your wireframe fireworks in just a few short moments. If the view misses some parts of the action, move the camera further away and remake the preview. When everything looks good and the camera position is set, you can render the whole 60 frame animation to see the fireworks with the glow

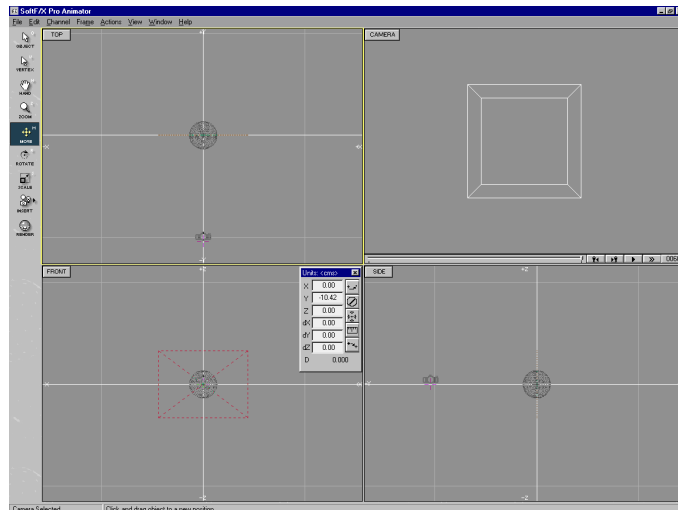


Figure 9: Using the coordinate window to help determine the camera location.

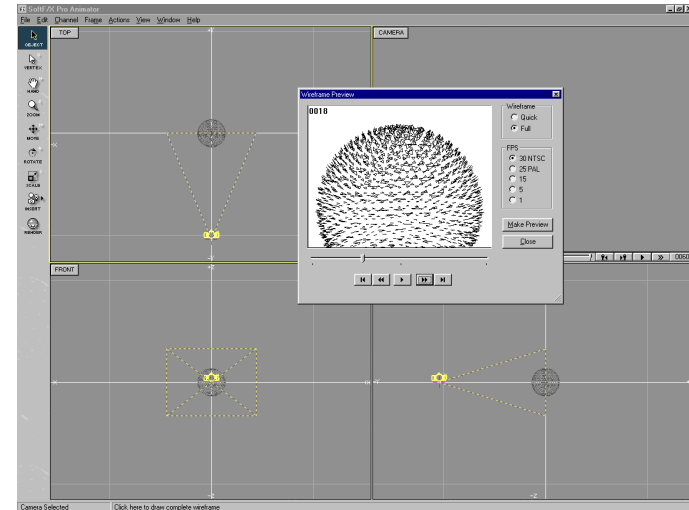


Figure 10: Making an animation preview for the fireworks.

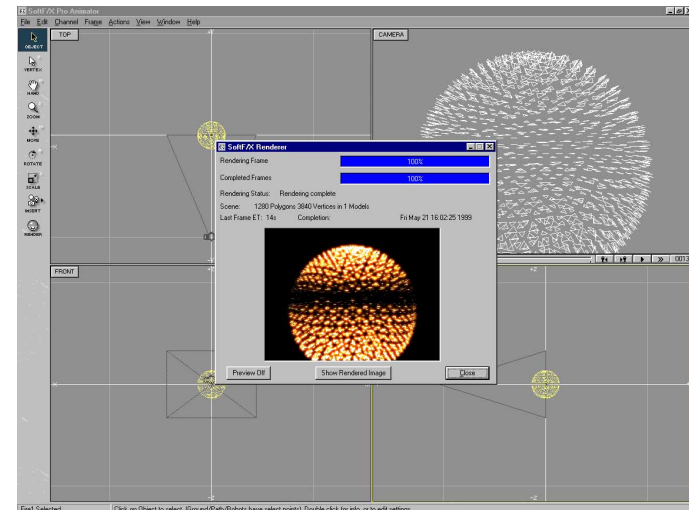


Figure 11: Rendering the final fireworks animation while watching the Glow effect being applied.

effect (Figure 11). However, don't forget to test render a few selected frames before spending the time generating the animation.

That is all there is to it; nothing fancy or complicated. You may wonder if you can have more controls to a particle effect, such as the life span of a particular particle. The answer is yes, but it is harder.

The hard way

The difference between this hard method and the previous easy one is that it requires a high degree of patience, precise positioning, keyframing and time. The results can

however, be very rewarding. It is much more flexible, customizable and looks as good as, or even better than, the one achieved using the easy method.

The easier side

Unlike the previous method, this time you build your particles one at a time. Yes, you read it right, one after another.

However, you only need to build one model of a particle in the Soft F/X Pro Modeler. We will be multiplying it in the Animator, as mentioned before, one after another. In the Modeler, press F7 and make a sphere again; this time use the one with the least polygon count setting; select 20 in the Faces section and click Make. Resize the sphere to be elongated along the Y-axis (press the S key, then press and hold the SHIFT key before you click and drag the mouse in the TOP window to stretch the sphere) see Figure 12. Again, while it is highlighted, assign a surface color with the F8 key, give the sphere a luminous shader, but this time do not shatter it as we no longer need to accommodate it with the explosion plug-in. Save the model and name it "fireworks2.sce".

Motion over time

Building the model particle is easy; but multiplying and animating it is another story. Unlike the previous opera-

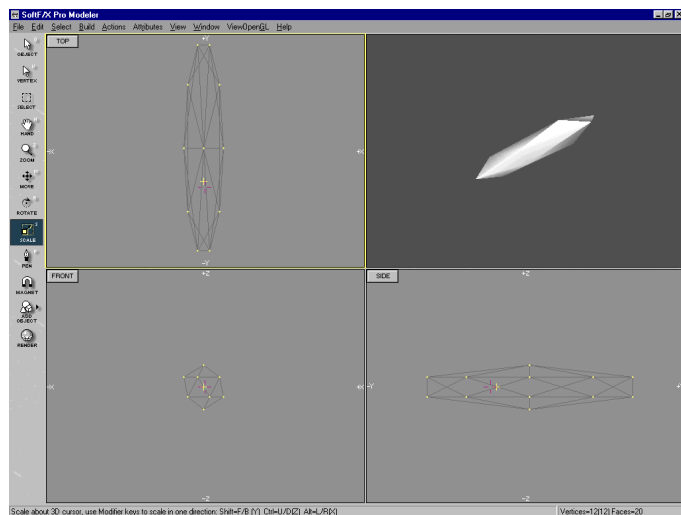


Figure 12: A low polygon sphere being stretched along the Y-axis.

tion, where the polygons of a sphere object are treated as particles and are moved over time by a special effect plug-in, you need to move each particle one at a time using hard method. Load the Soft F/X Pro Animator and import the newly saved particle model by hitting the CTRL A keys. Select Model actor and name it “Seed1” in the Add Object panel. Now you should see your new particle model centered on the stage. Again, give the particle the Glow post process effect by pressing the “I” key; technically you can use the same settings provided in the easy method. Since you are not applying the explosion plug-in, but still need to make the particle travel through space, the trick is to make a path for it to move along over time. Soft F/X Pro comes with a few prefabricated 2D paths. Therefore, building one may not be necessary. Load a path by pressing CTRL A again and choose the Path actor, naming it “seed1path”. The Path Object dialog should pop up prompting you to choose a path model. In order to access the ones that come with the program, click on the Filed

button and choose the parabola.pth path file. You should see the path in all three parallel windows (as well as the camera window) after you click OK (Figure 13).

Now that you have your particle model and a path for it to move along, it is time to put them together. In order to make the particle instance travel along the path, we have to use the Keyframer. By pressing the K key, the Keyframer will be displayed at the bottom of the screen (if it is not already loaded). Now click on the particle model to highlight it and you should see the Keyframer automatically jump to the particle model’s channels. Double-click on the particle model’s “Position” keyframe to display the Movement Channel dialog, then click on the Select button and choose the path actor “seed1path” we

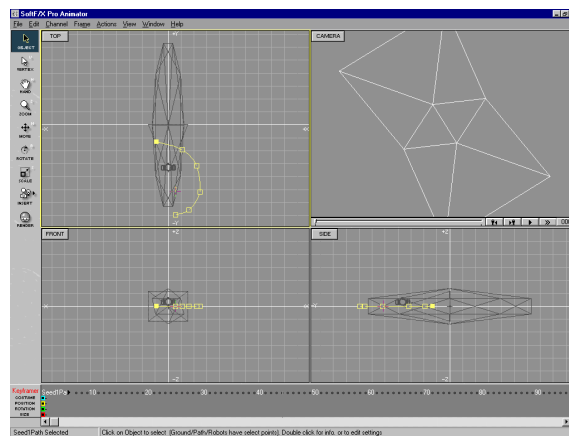


Figure 13: A 2D path is added in the Animator for the fire particle to follow.

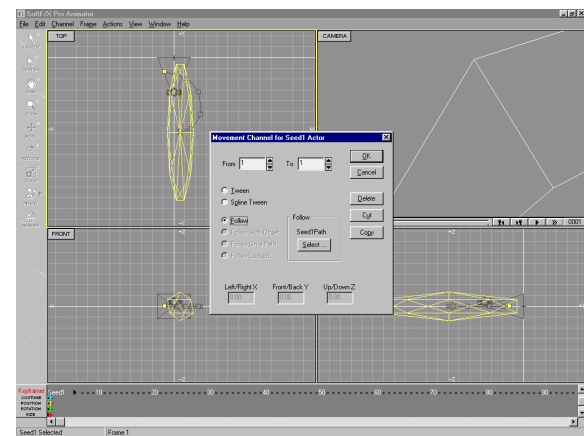


Figure 14: Making the fire particle follow the path using its movement channel.

just imported. Now, the ghosted Follow selection on the dialog will become available. Click on it to allow the particle to follow the path actor (Figure 14).

The next step is pretty similar; double-click the particle's "Rotation" keyframe to display the Rotation Channel dialog. This time you need to click on "Align to Path" before you can click the ghosted Select button. Choose the same path actor as you did with the movement channel. Selecting "Align to Path" will make the particle align to the path actor as it travels (Figure 15). To test how the particle works with the path, give your animation a length. Press CTRL L to display the Animation Length Panel and extend the animation to 20 frames. Once the OK button is clicked, you should be able to see your particle model aligning to the path model in the Top view window (Figure 16).

Now rotate the path model so that you can see its curve in the Front view window instead of the Top, since

this is the same direction that the camera is facing (Figure 17). If your camera view is out of range, move it back so that it sees both the particle and the path models. You may have to adjust the camera's location in conjunction with the particle model – when the particle moves to the top of the path during an animation preview, you may or may not see it. Move the camera further back to see where the particle stops its movement. Furthermore, if you find the particle model to be out of scale, resize it so it fits well with the path (Figure 18). Now play a preview of the animation by clicking on the Play button underneath the camera window. You should be able to see the preview in real time.

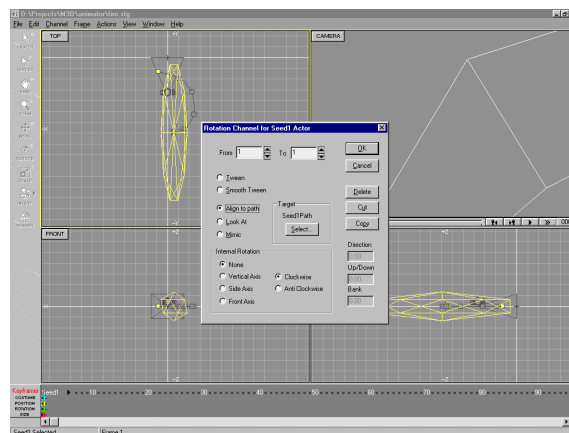


Figure 15: Making the fire particle align with the path using its rotation channel.

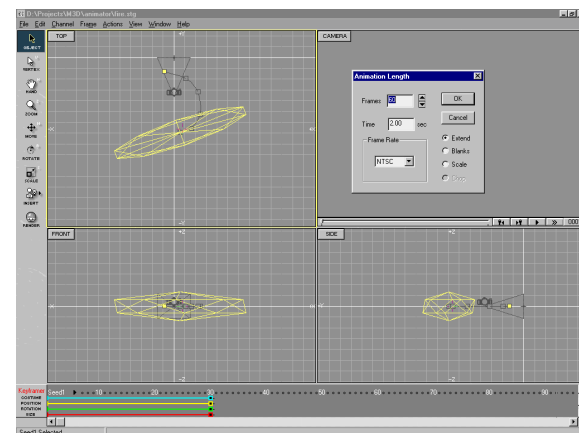


Figure 16: Extend the animation length in frames.

Die! Particle... Die!

When the fire particle reaches the top of the path, that's where it should disappear. This is to simulate the life span of a real fire particle, therefore in order to make it evaporate, we have to find a way to make it vanish at the end of its cycle. The easiest way is to scale the fire particle to a very tiny dot, small enough so that the camera cannot "see" it. Again, from the Keyframer click on the Size channel of the fire particle at frame 1; it will add a keyframe for the particle with the original or begin size. Hit Enter when the program prompts you to confirm this action. Then press CTRL F to go to frame 20 (where the particle "dies") and resize the model to its minimum size by using the Scale tool or

hitting the S key. Once done, you can just click on the Play button below the camera view window again and view the animation. The first particle instance is completed.

Multiple instances

What you have to do in order to create a full length burning fire show is to add more particles using the same model and, add more paths to them, so they can travel along their own paths and individual timing (Figure 19). You

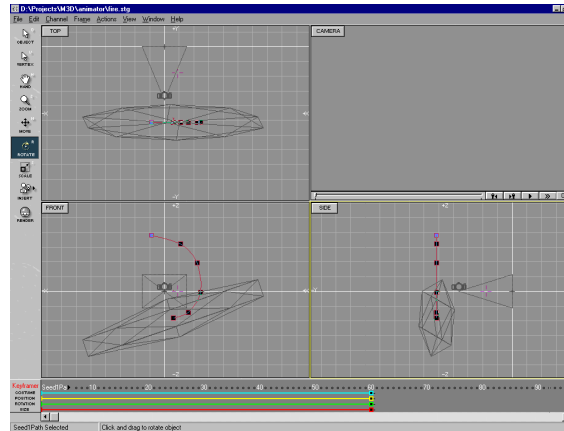


Figure 17: Rotate the path model so that the camera can see its curve.

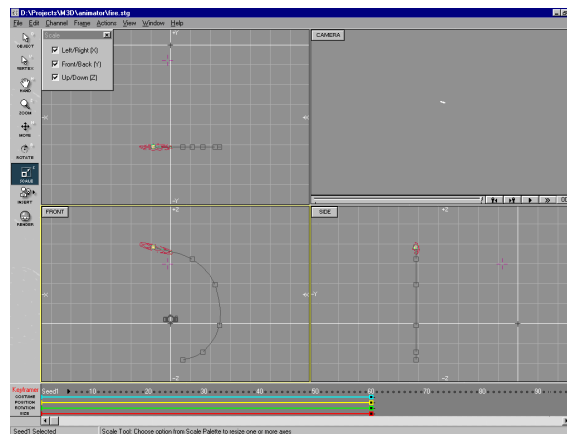


Figure 18: Scale down the fire particle if it is too big.

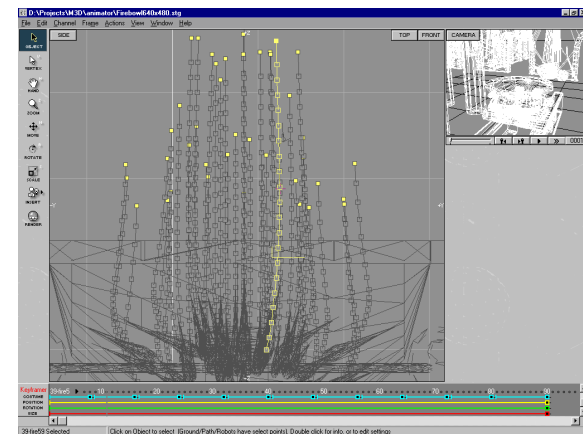


Figure 19: Adding more paths and fire particle instances to create a full length burning fire show.

must wonder when you'll ever finish an animation using this method! However, the plus side to this method is that all models and paths can be individually tweaked in anyway you want. You can move some of the paths to different locations, reshape them, make shorter life spans for specific particle instances by working out the Keyframer, have more than one particle travel on the same path, etc (Figure 20). The result can be very believable and more dynamic compared to the easy method since almost all the movements of all objects are customizable to your own liking; hence, many possible effects can be achieved with this "hard" method (Figure 21).



Figure 20: Vary the lengths, shapes and sizes, and locations of different particle instances will get better and more believable results.

For a rather simple animated example that was achieved with this method, see Figure 22. You can download the animation that I did to accompany this tutorial (or [Click Here](#)). Or, if you would like to see a more finished effect, you can find one on the MindWorks Interactive's website at:

<ftp://members.aol.com/mindwrks2/fire1.mpg>.

Biography

Kent Shum is a freelance digital 3D artist and animator who produces materials for games, architects and multi-

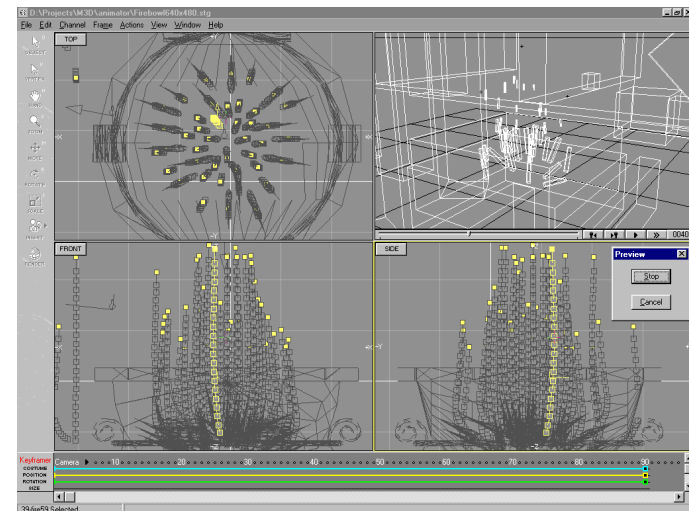


Figure 21: See what can be achieved with the "hard" method!

media developers. While residing in New York City, his works have been displayed at the Siggraph trade shows and in magazines. Among his clients are Pepsi Cola and Spencer Gifts. Visit his website at:

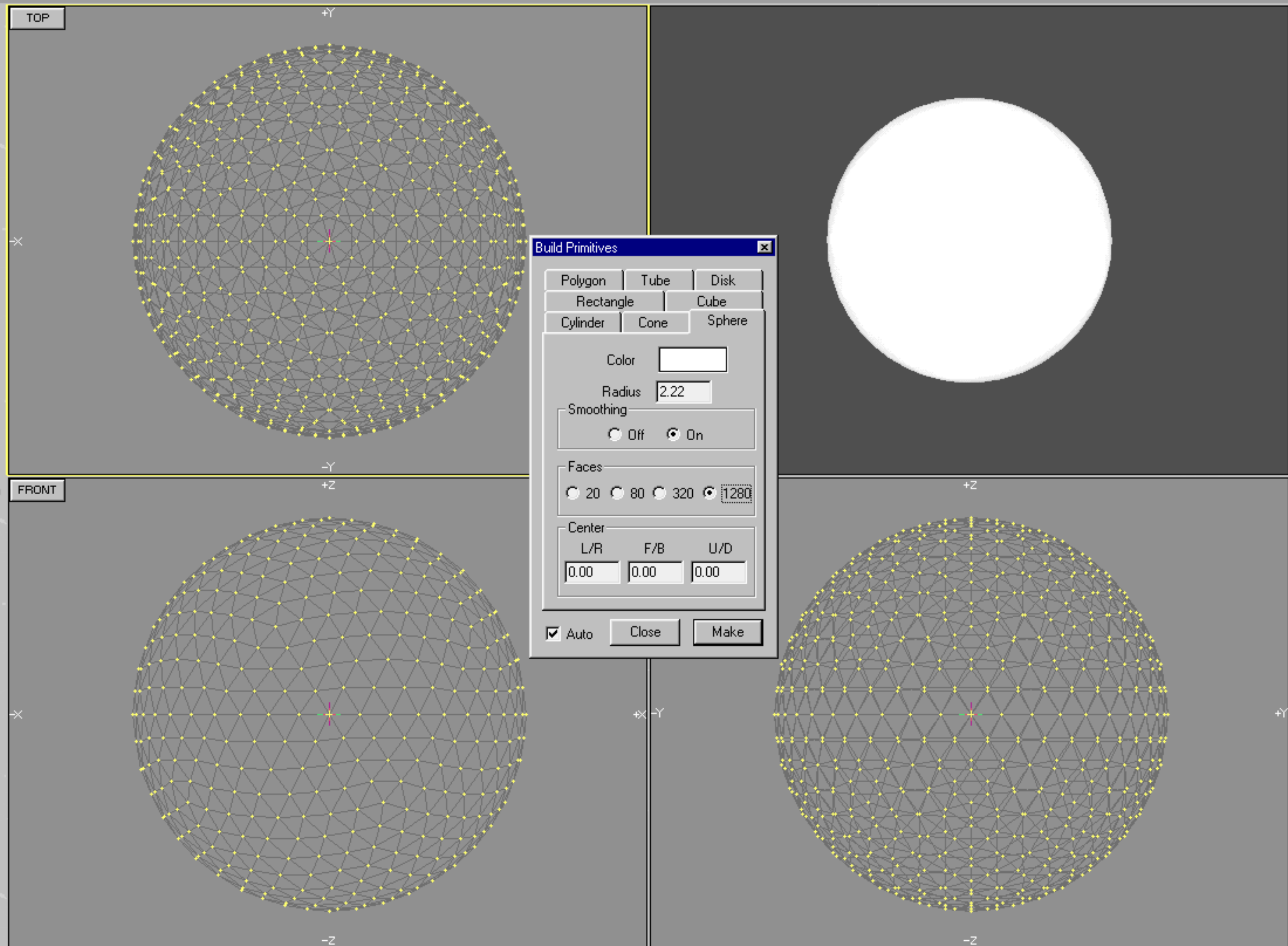
<http://members.aol.com/mindwksint>

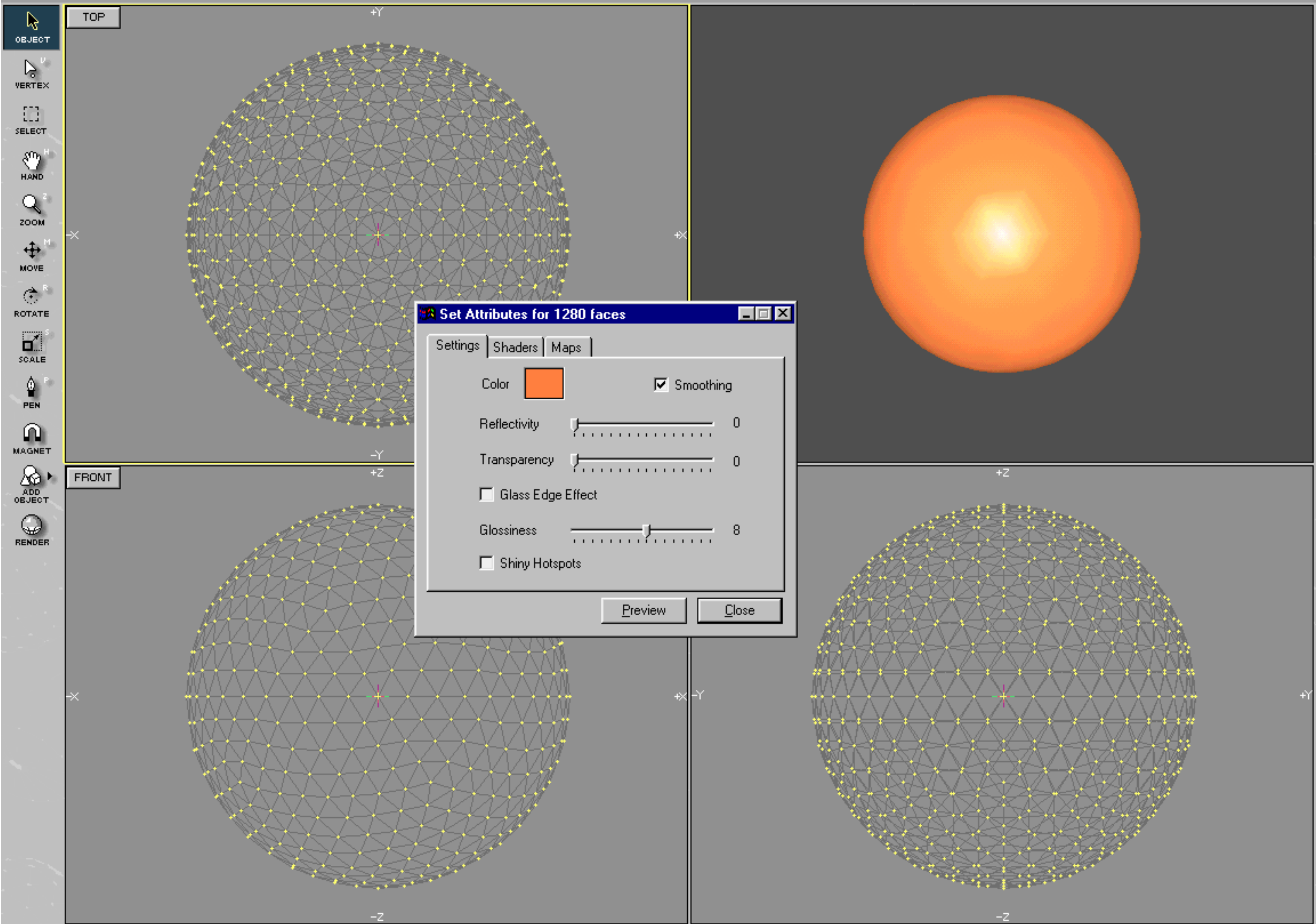
for the render and animation of the Soft F/X Pro particle animations and many others. He can be reached at mindwksint@aol.com or 7189968931 by phone.

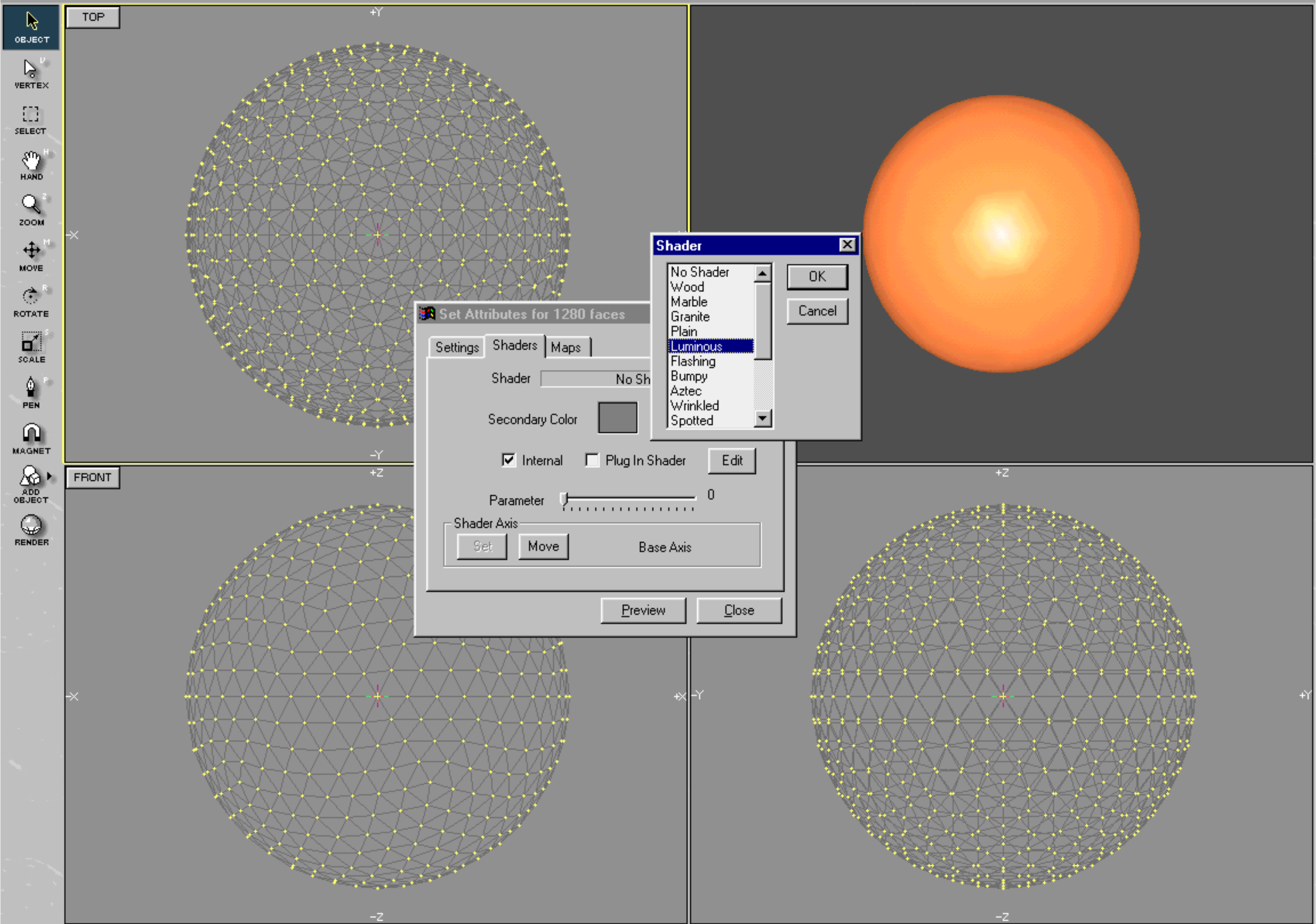


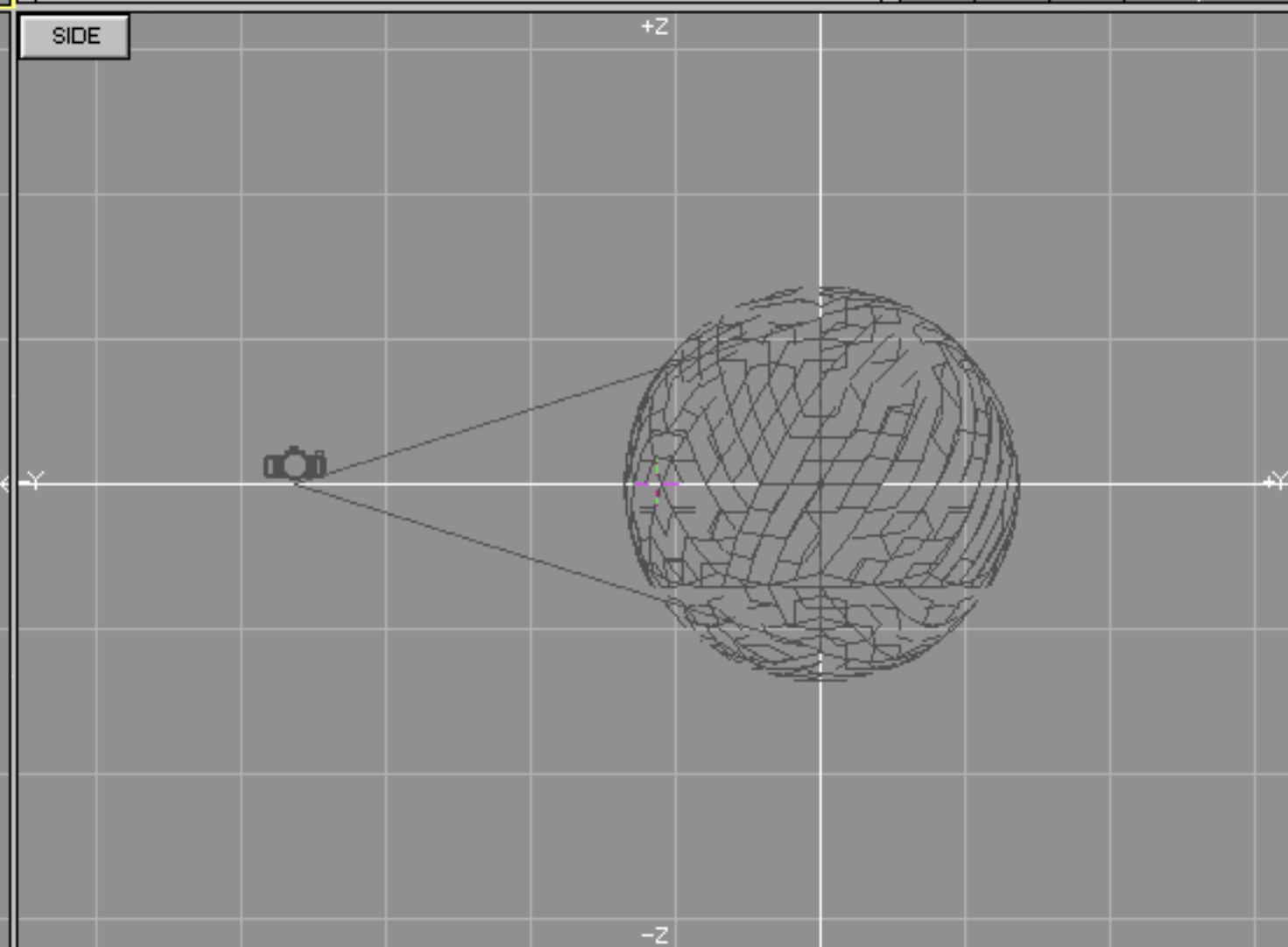
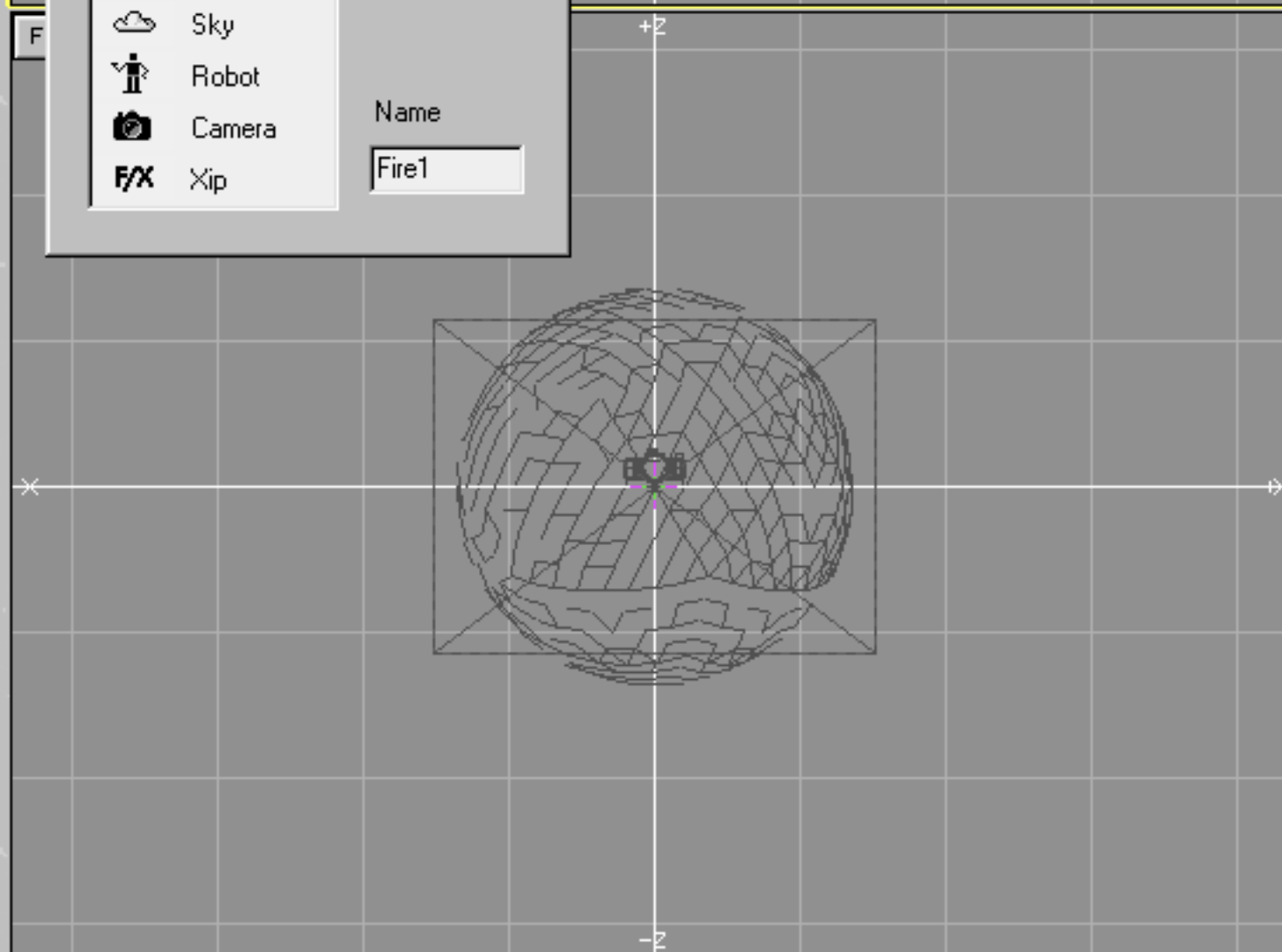
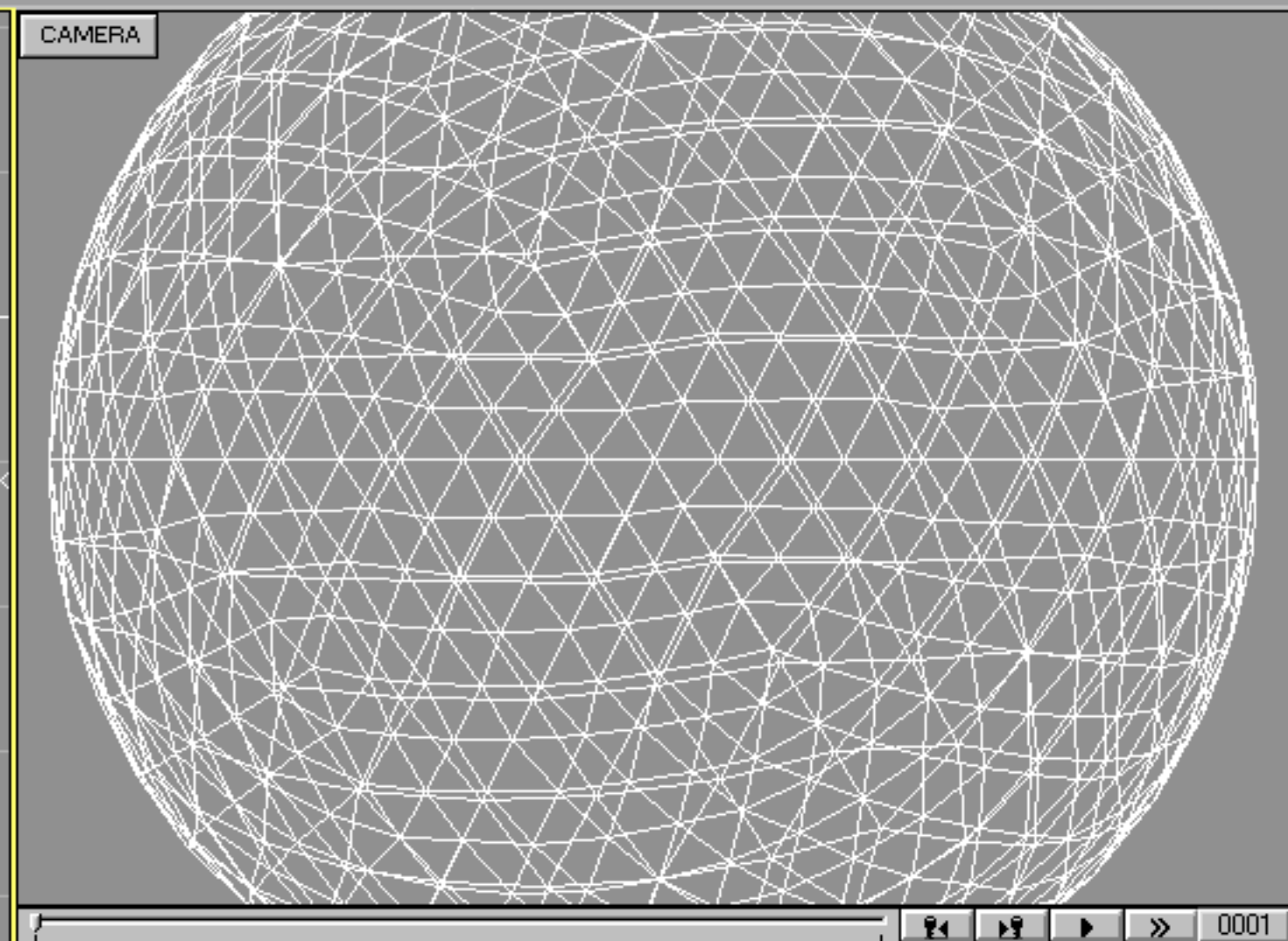
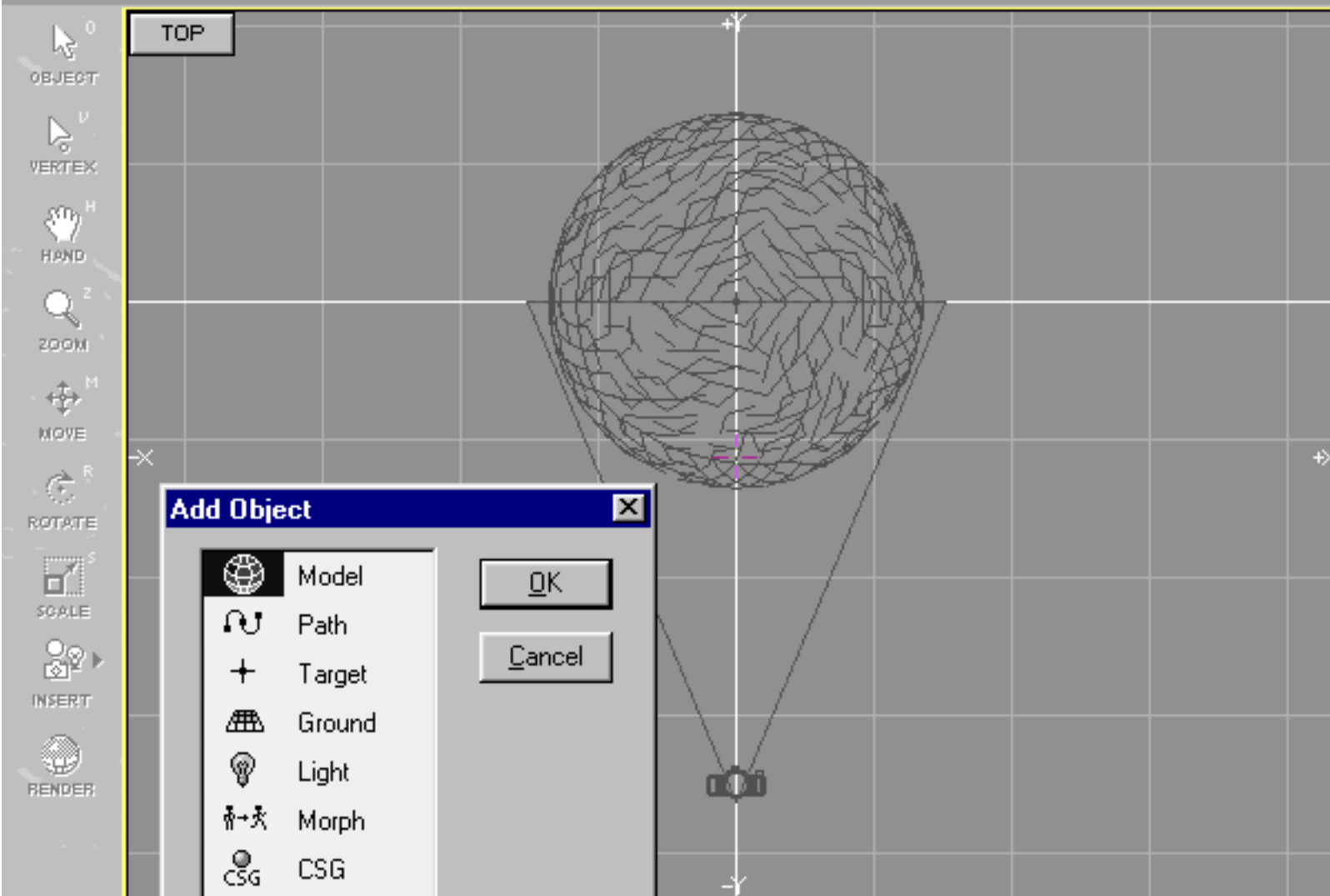
Figure 22: A render of the final burning fire.

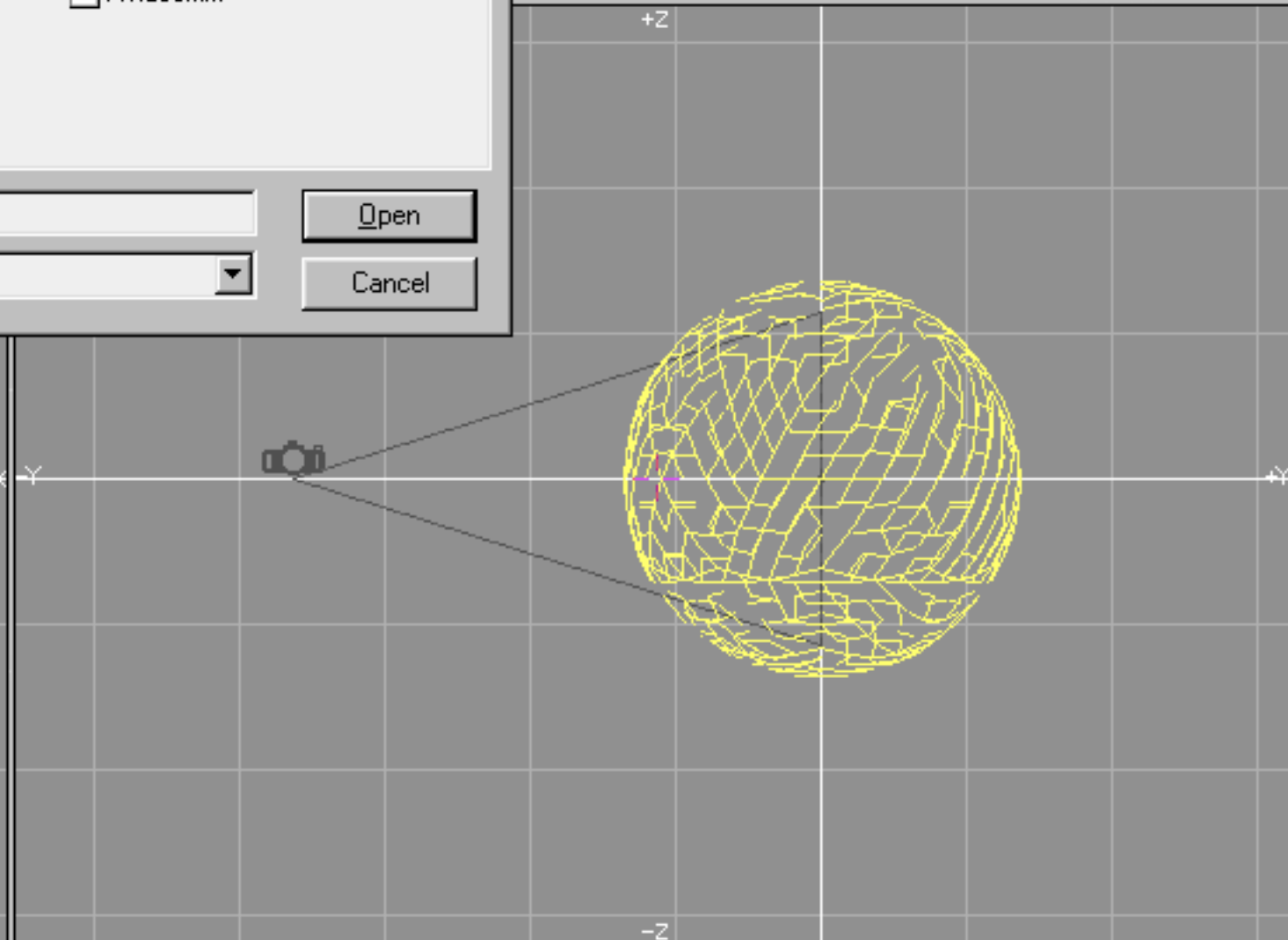
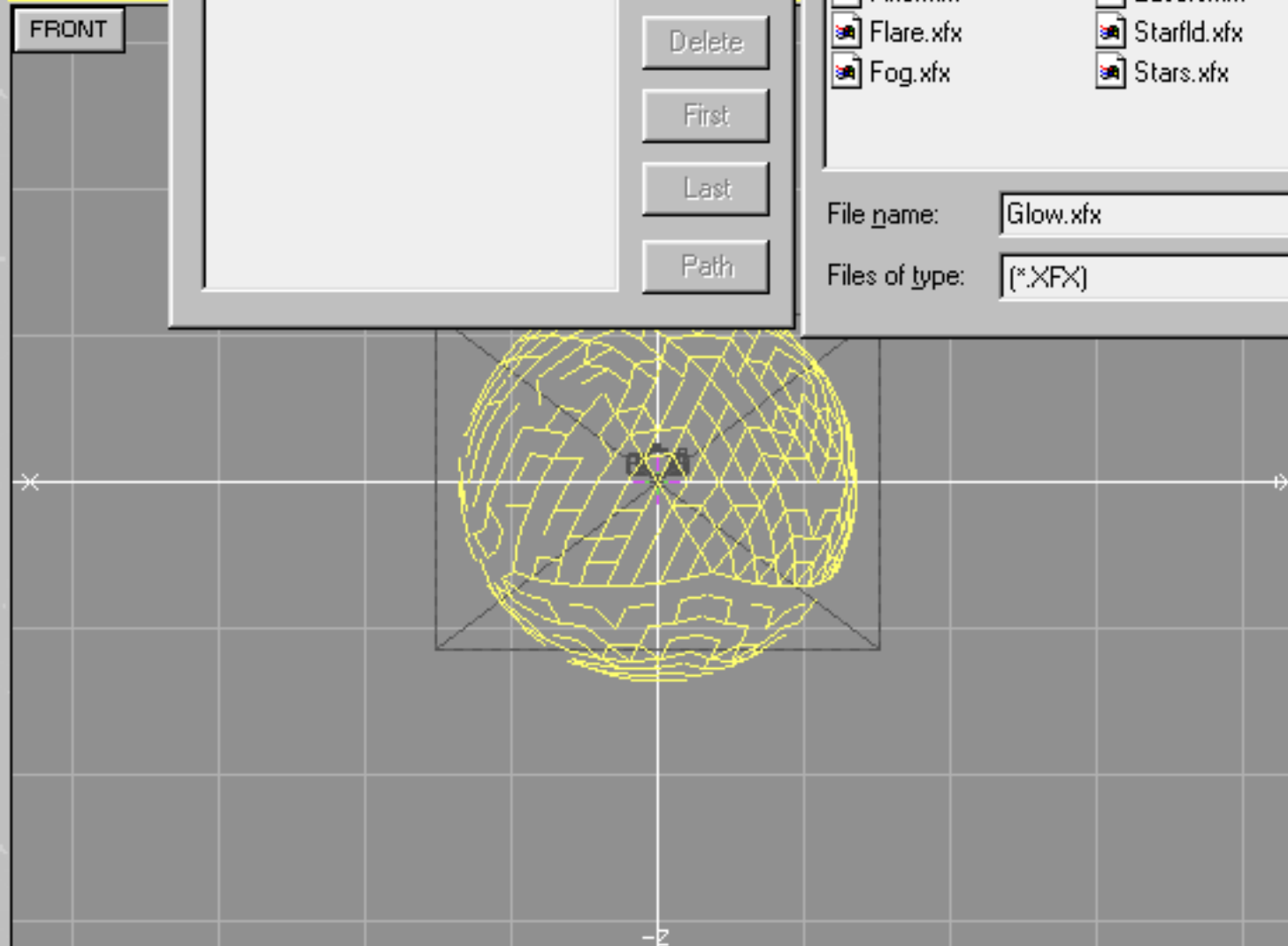
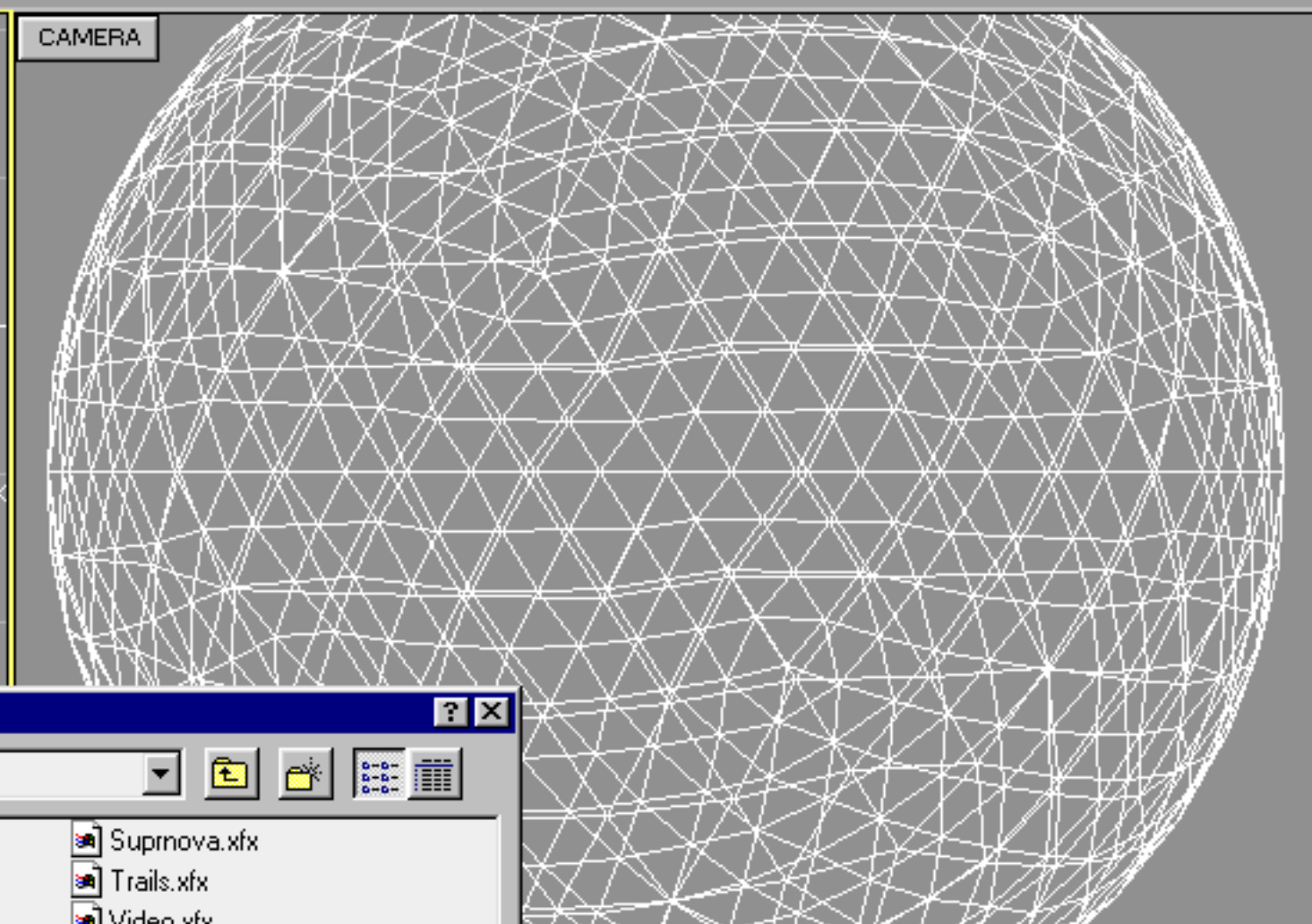
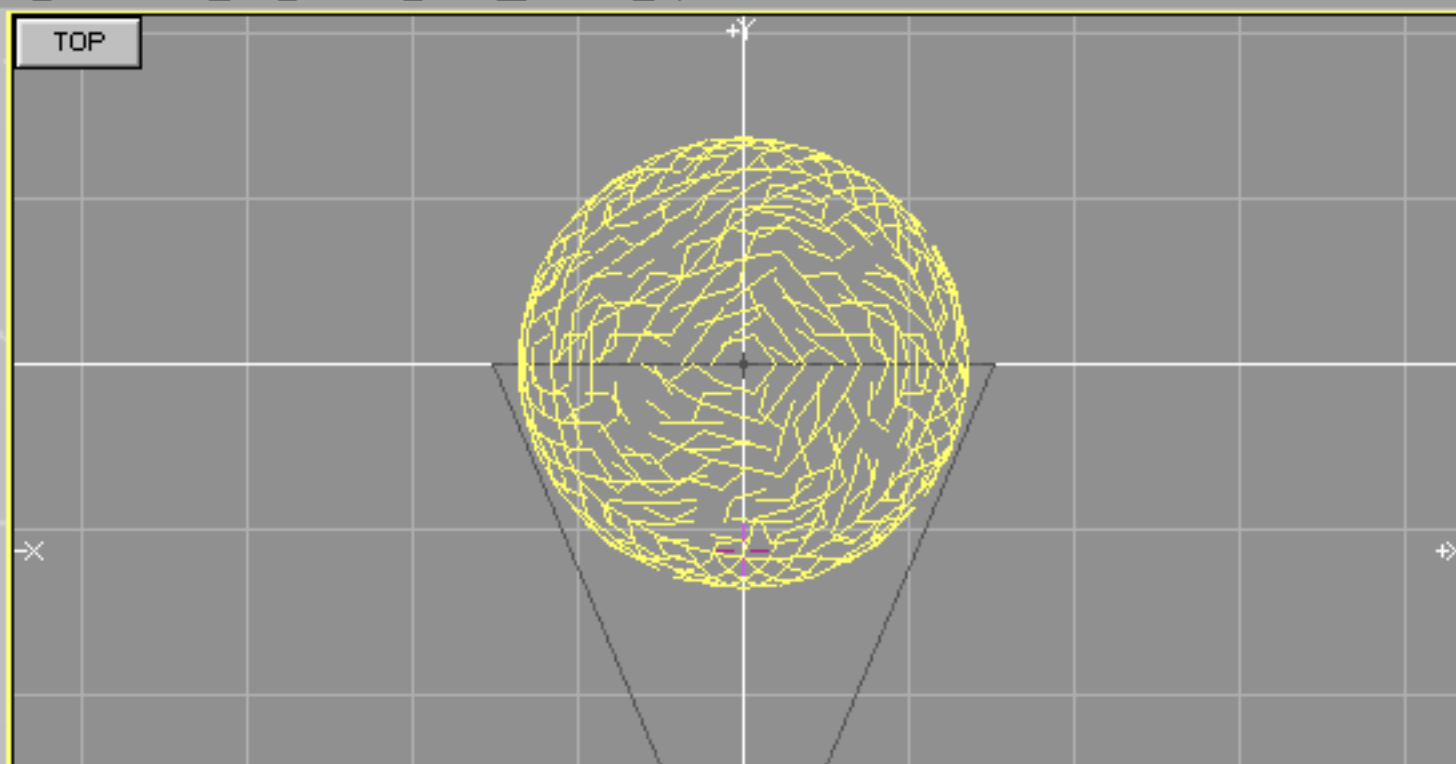


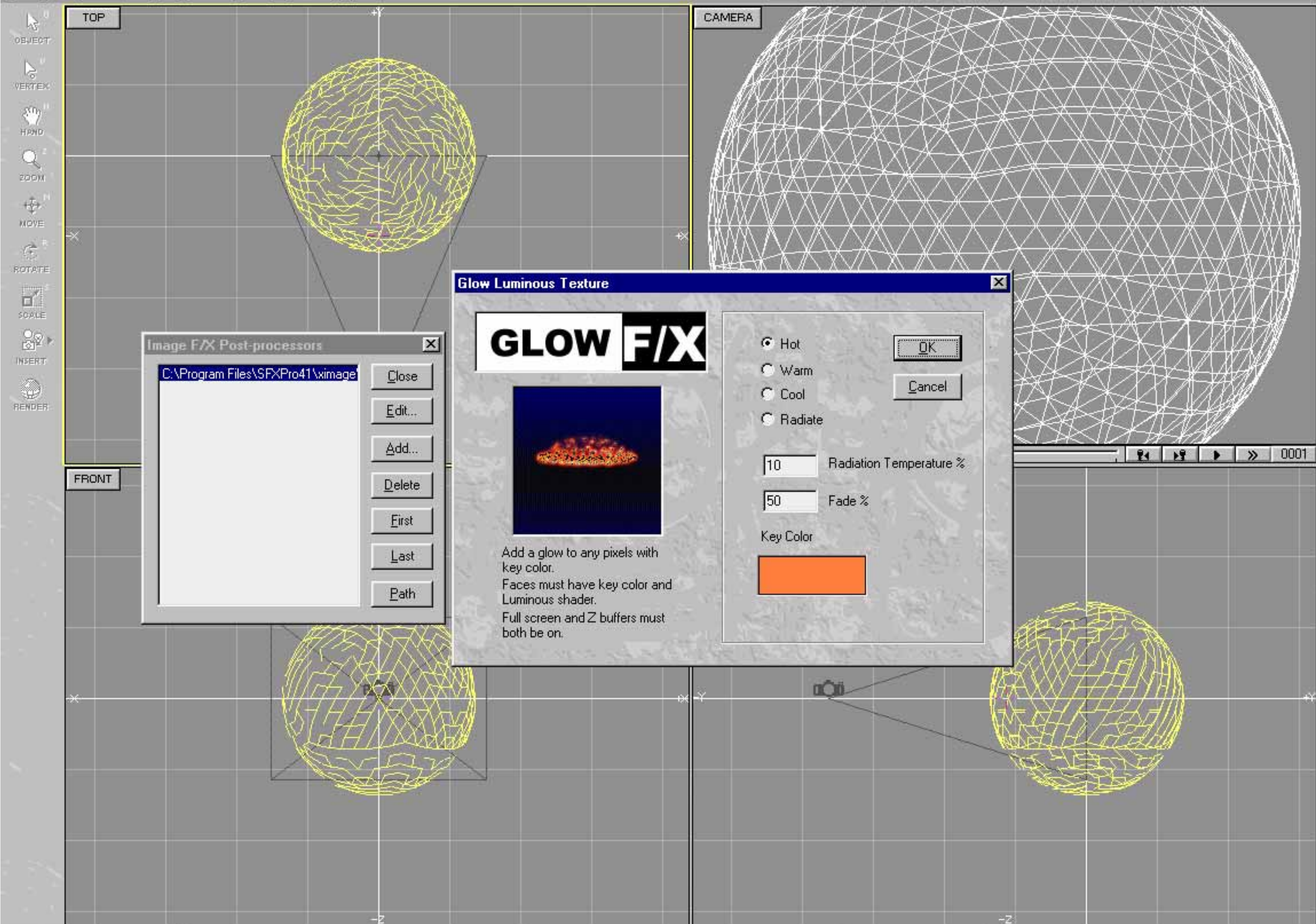


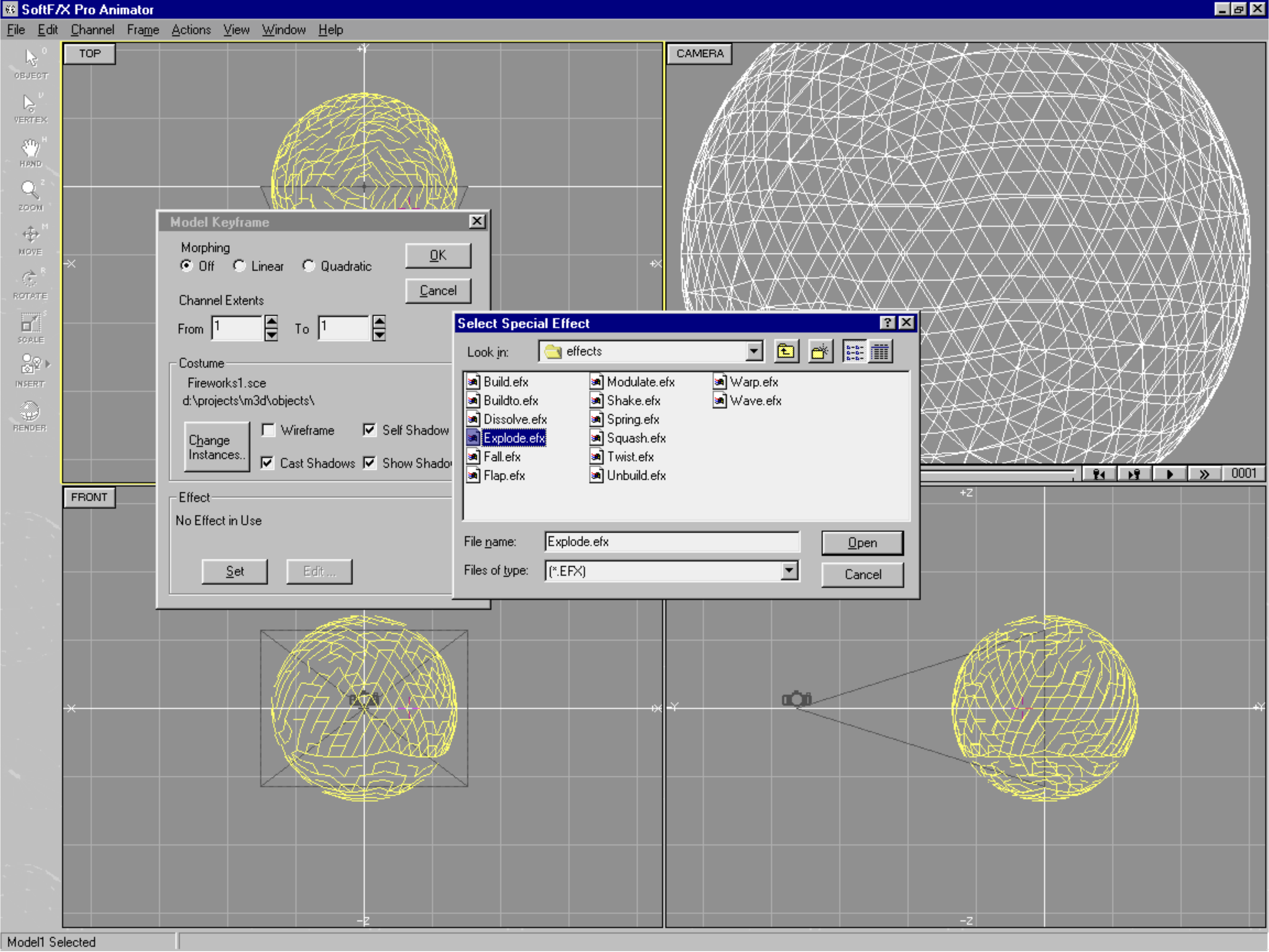














Model Keyframe

Morphing
☒ Off ☐ Linear ☐ Quadratic

Channel Extents
From 1 To 1

Costume
Fireworks1.sce
d:\projects\m3d\objects\
Change Instances..

☐ Wireframe ☒ Self Shadow

Effect
Explode.dll
c:\program files\sfx\
Drop

OK
Cancel

EXPLODE F/X



This effects assumes that the model has already been "Shattered" in the Modeler.
A shock wave of 0% causes all parts of model to explode simultaneously.
A 100% value causes the farthest parts of the model not to explode.
In a Radial explosion the Maximum Size defines how far away from the explosion center the parts fly.

☒ Explode From Model Center
☐ Explode From Specified Center
☐ Radial Explosion
☒ Explode Under Gravity and Fall
☐ Explode Under Gravity and Fall to Ground

Explosion Center X 0.00 Y 0.00 Z 0.00

Distance to Fall 6.00 ☐ Final Result Only

Maximum Size 1.00 ☒ Tumble While Falling
☐ Tumble Round Up Axis
☒ Tumble Along Projection

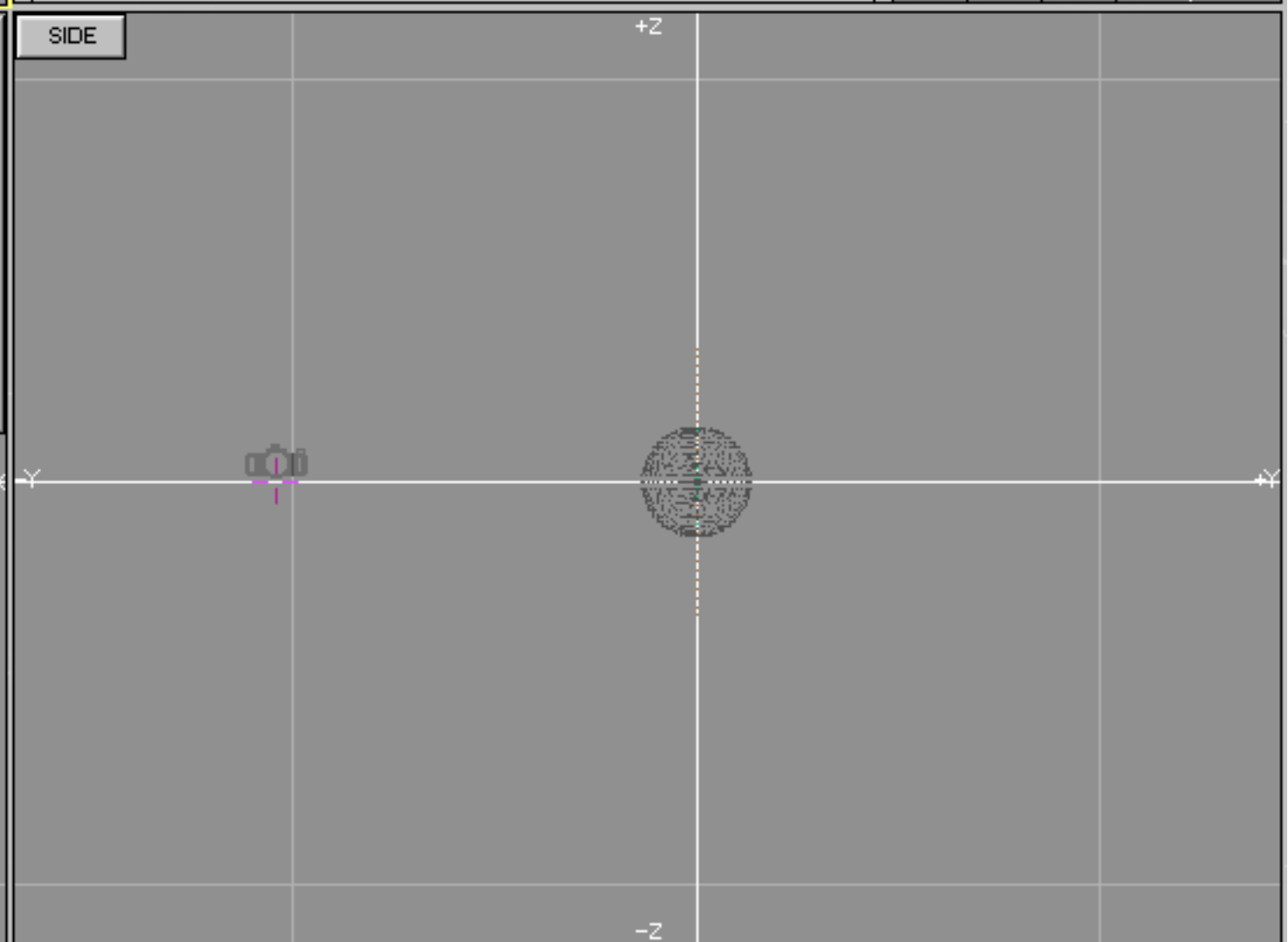
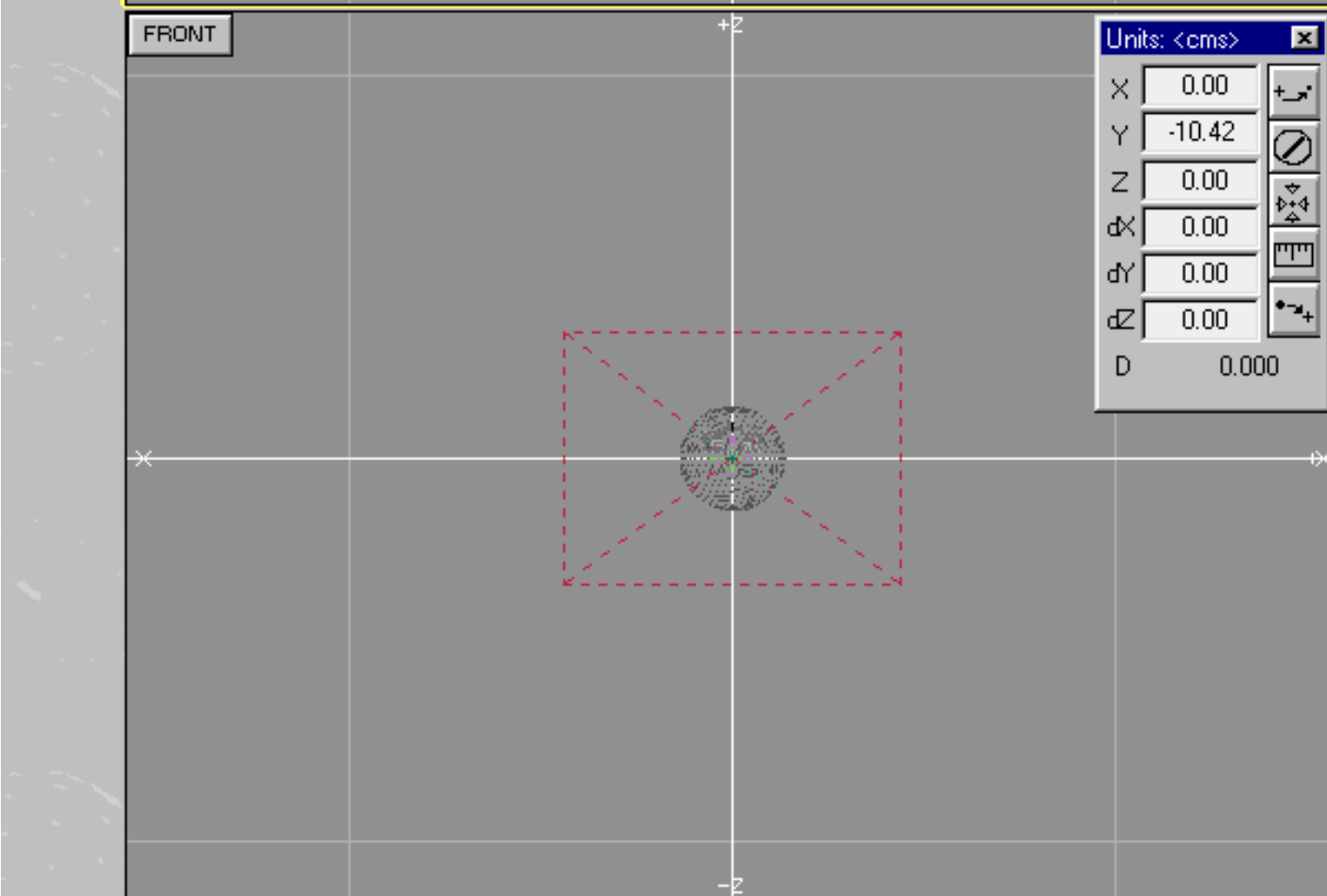
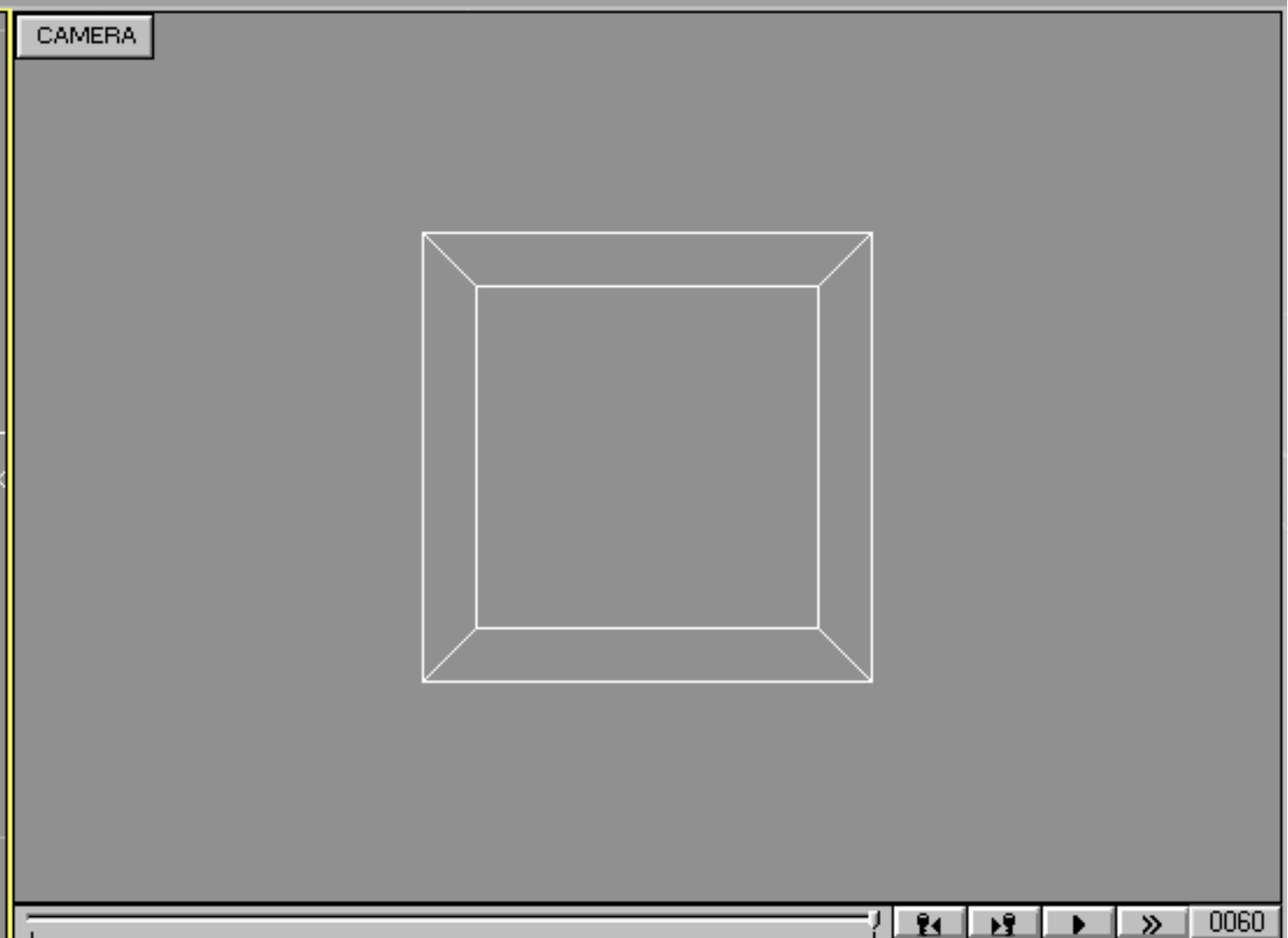
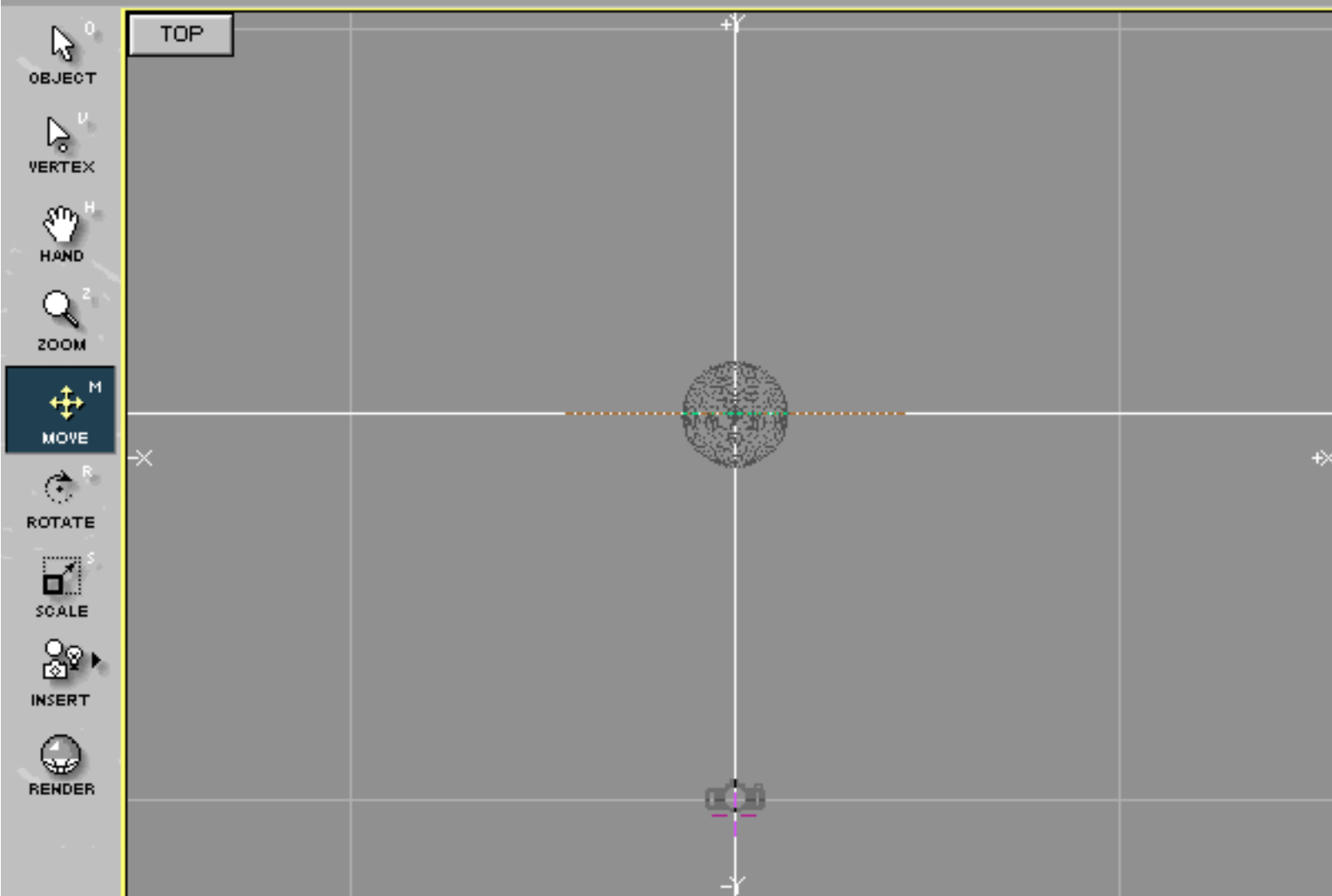
Shock Wave % 0

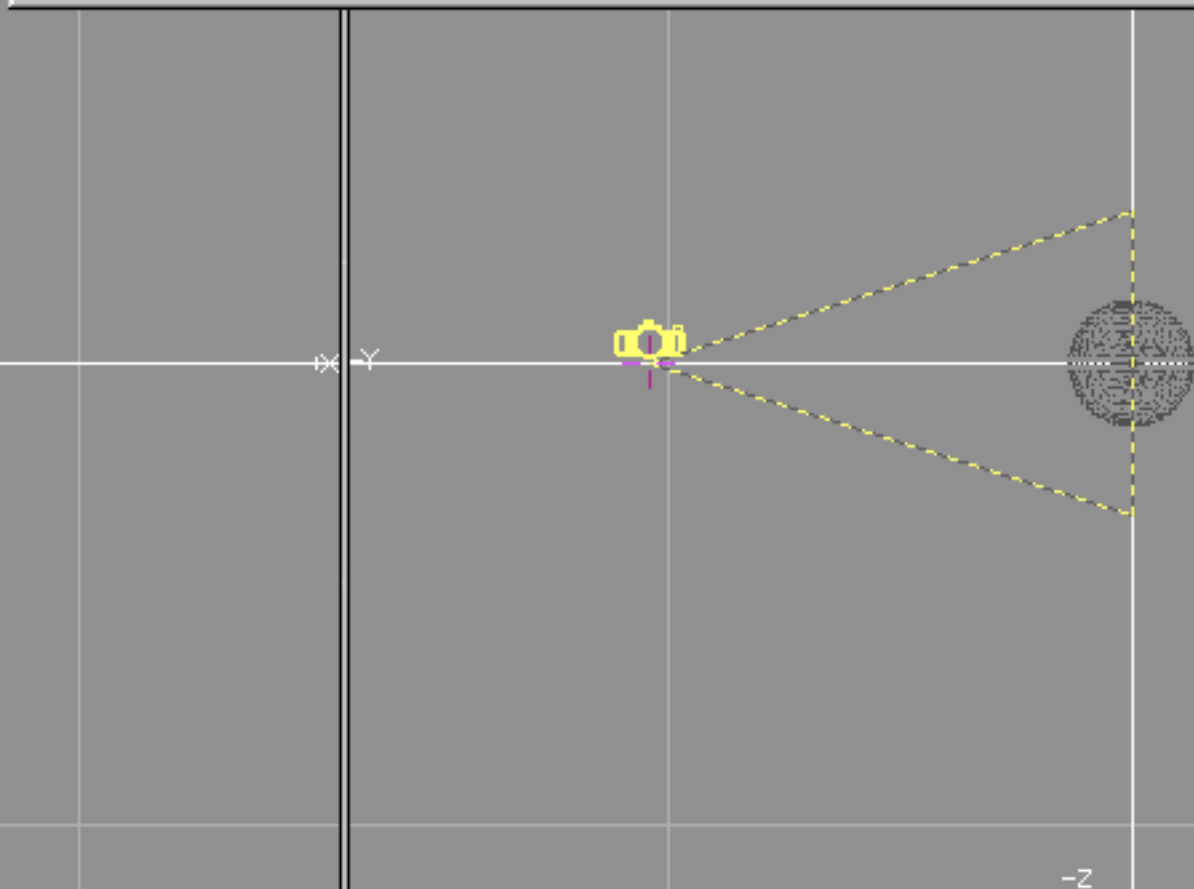
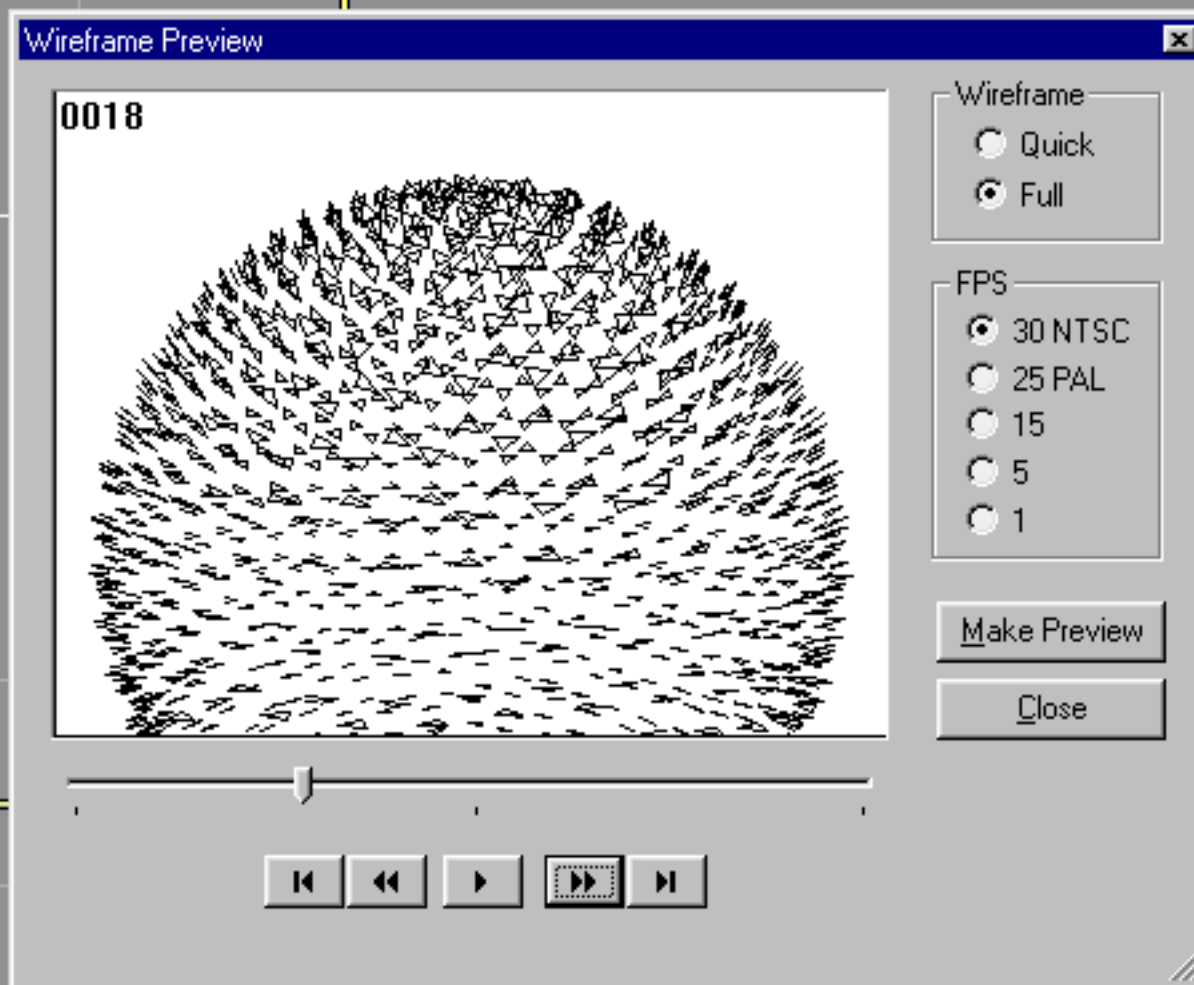
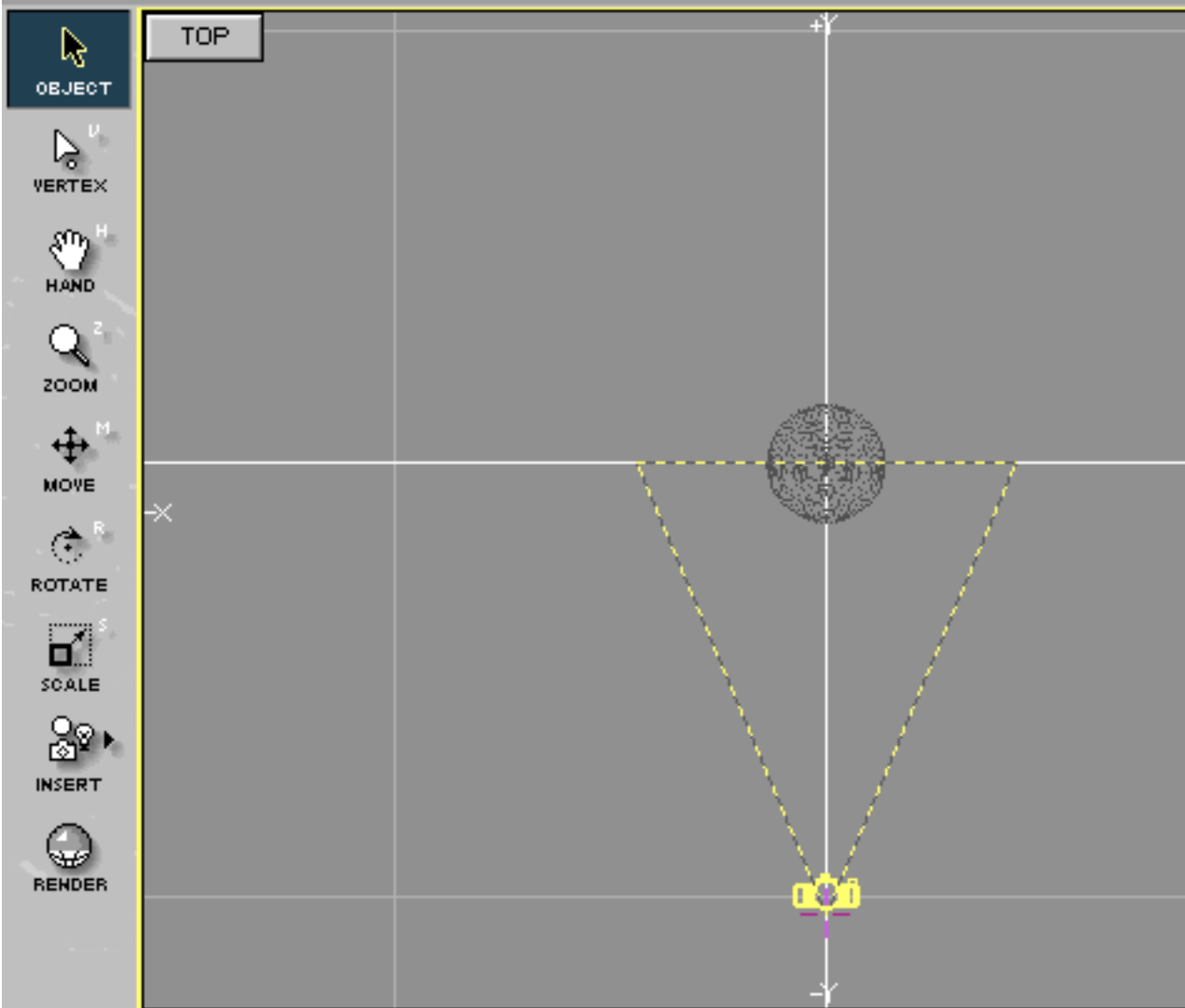
OK
Cancel

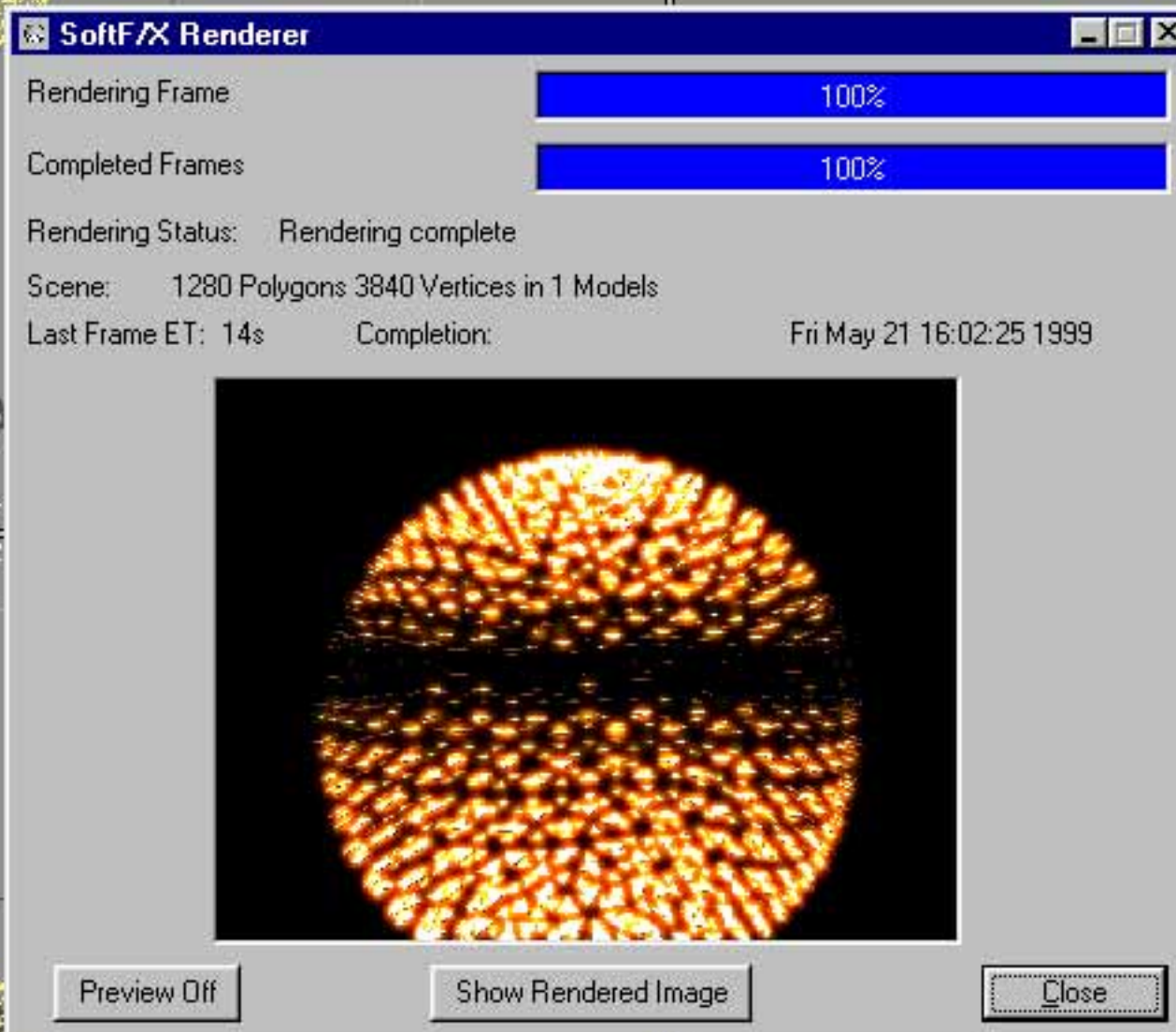
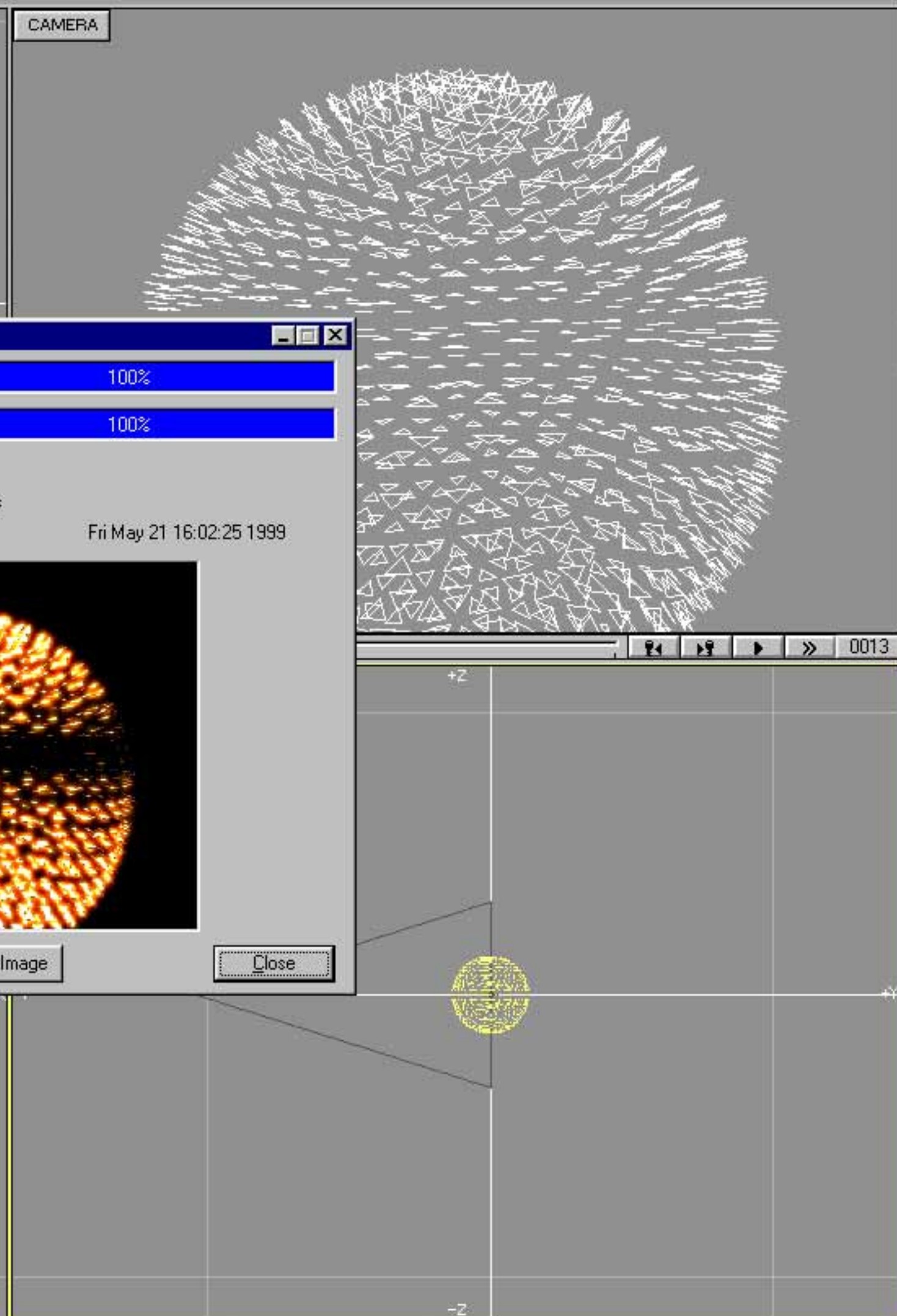
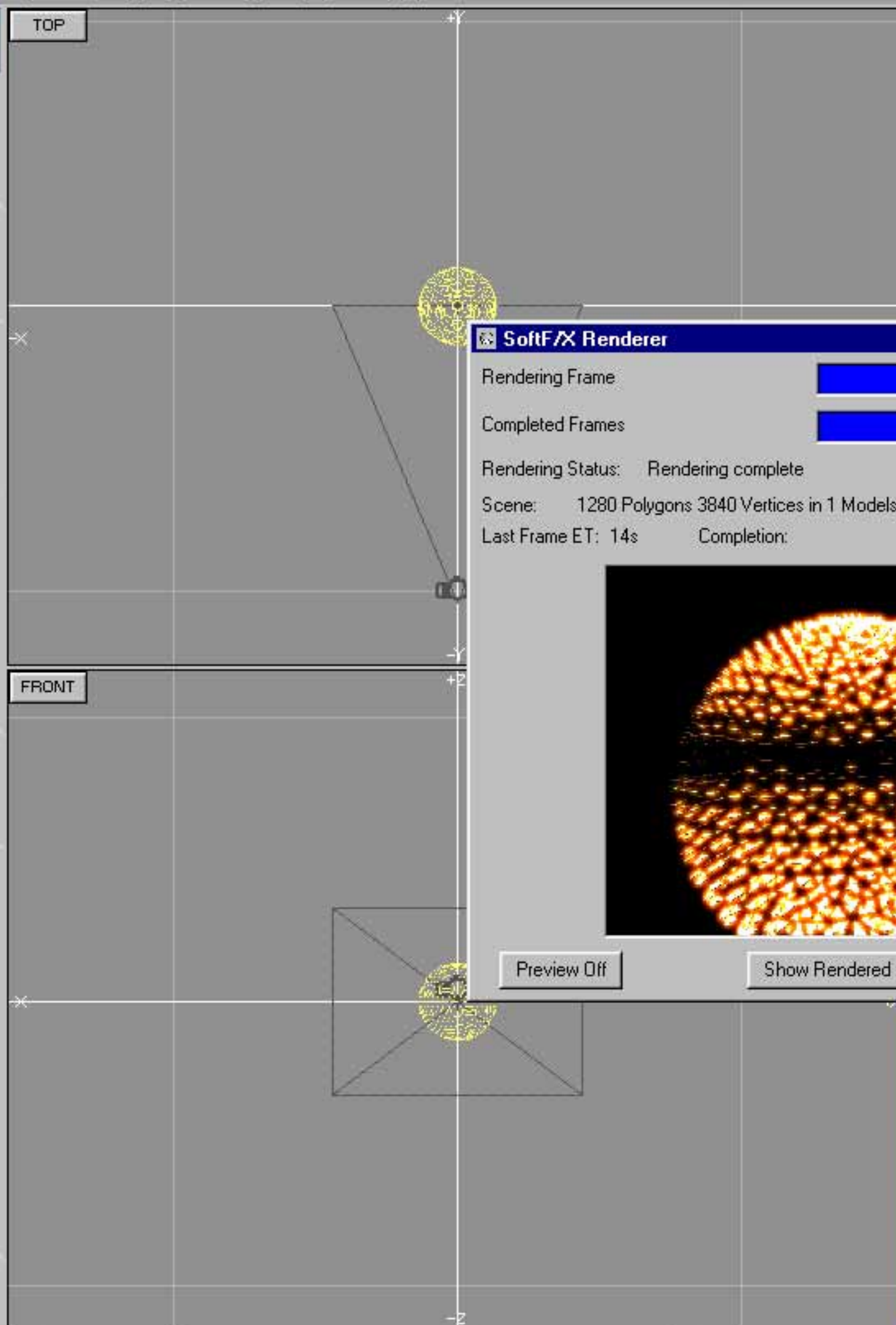
TOP

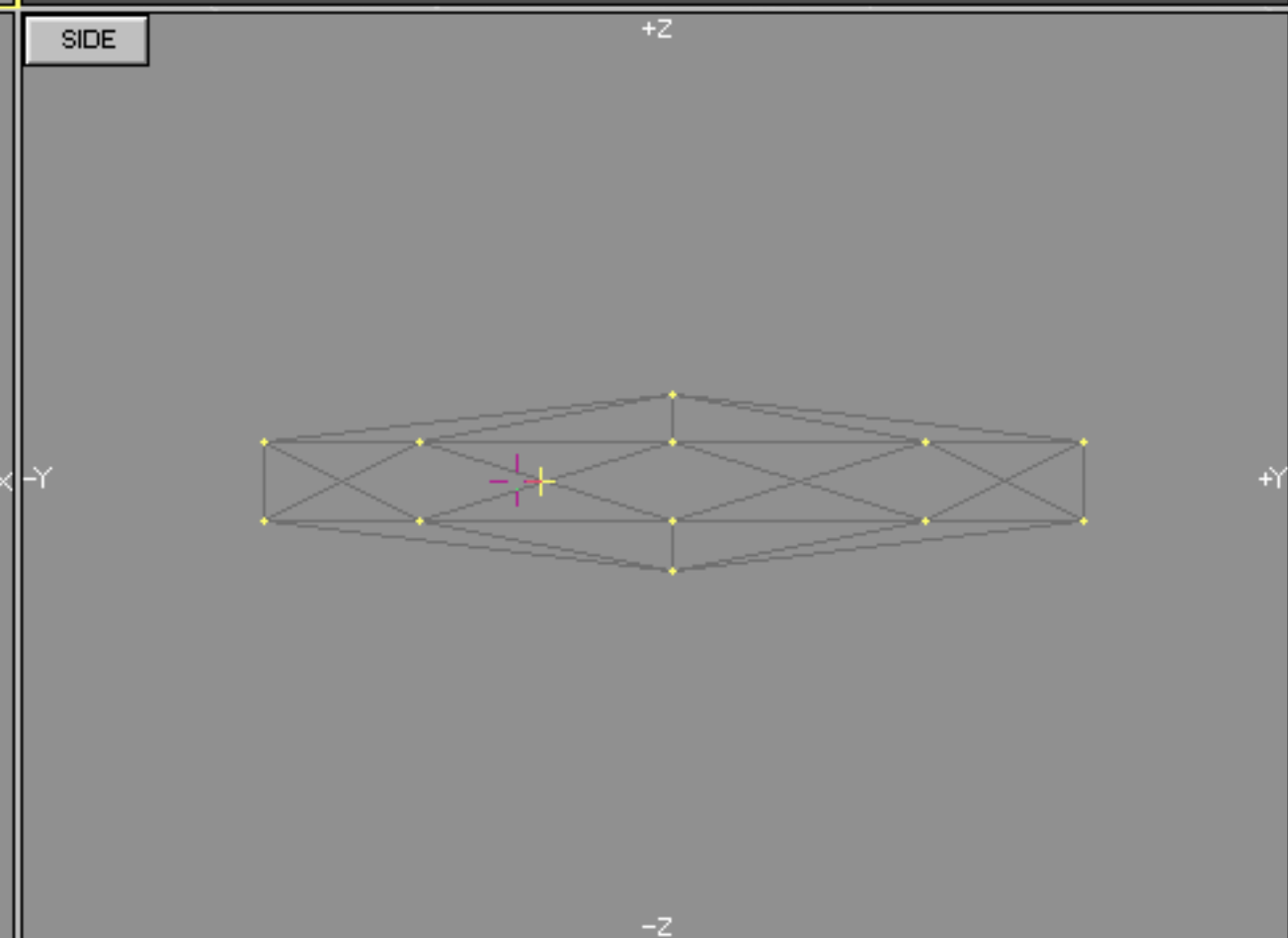
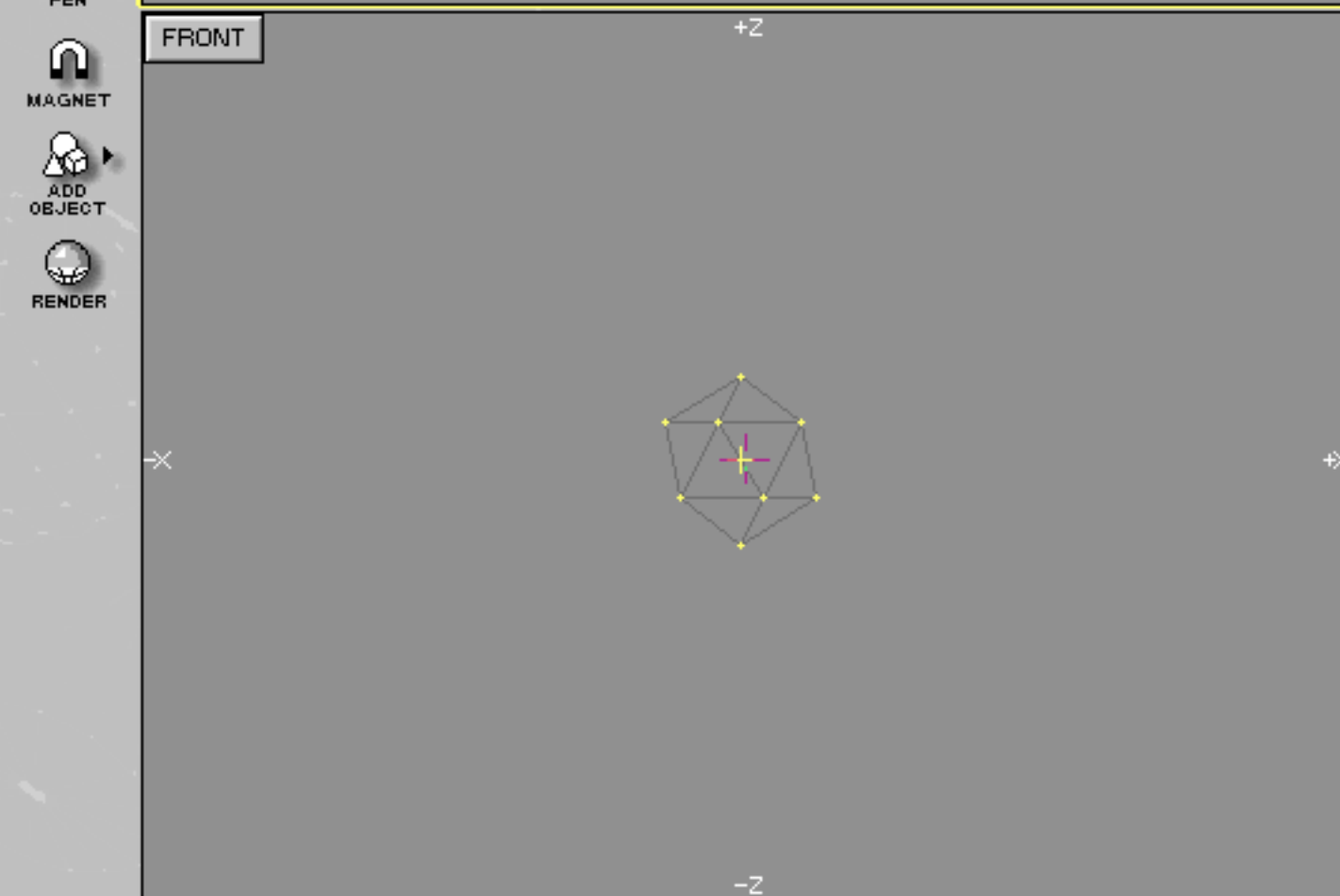
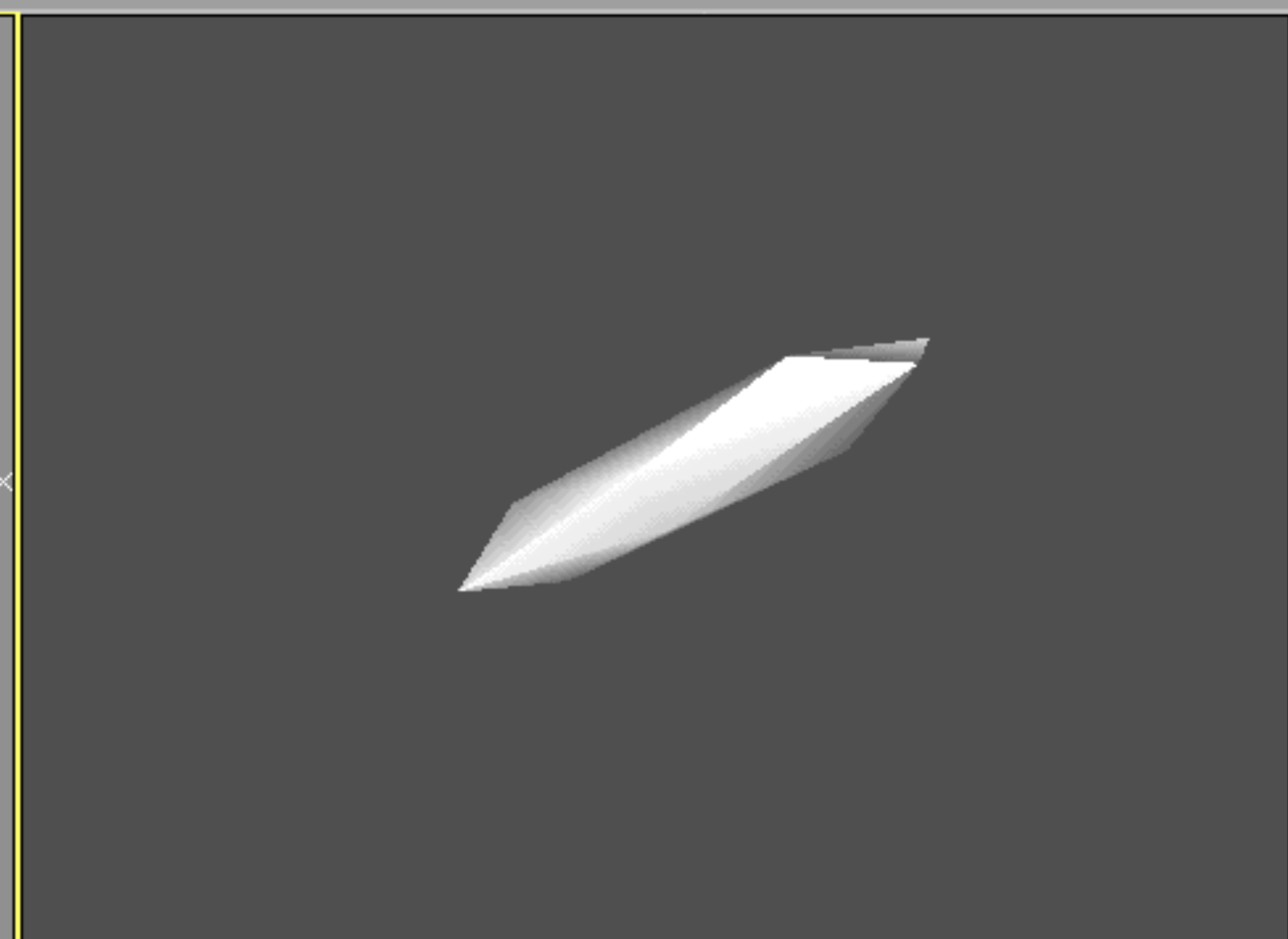
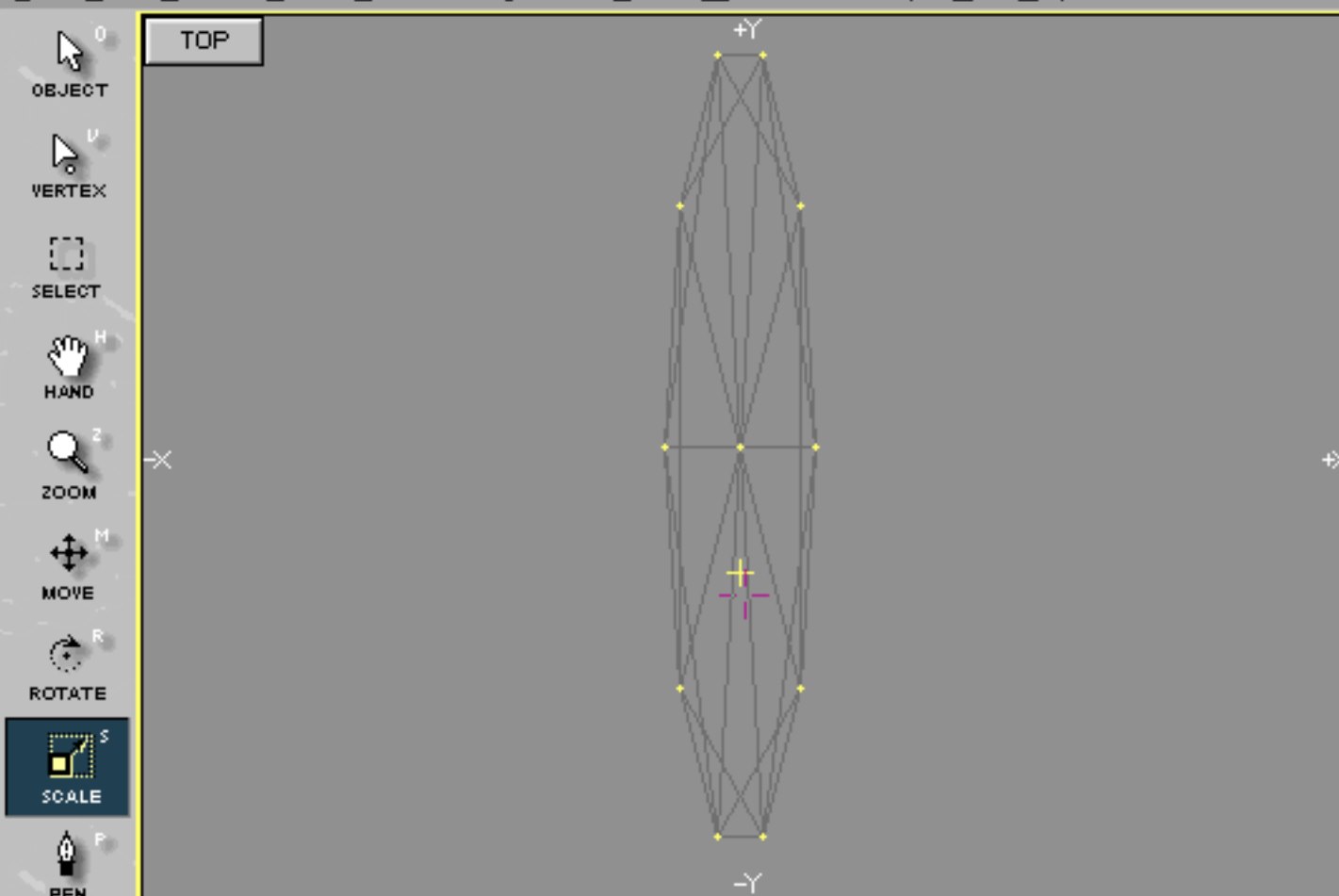
CAMERA

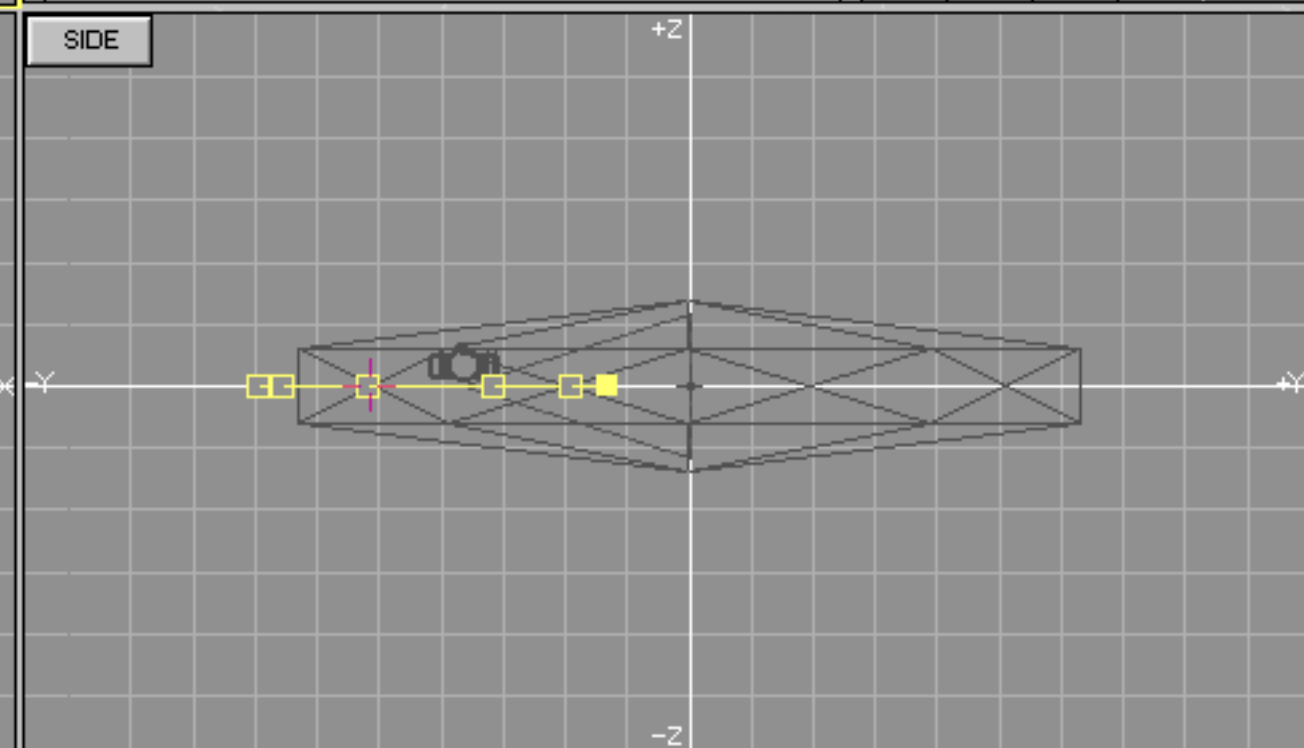
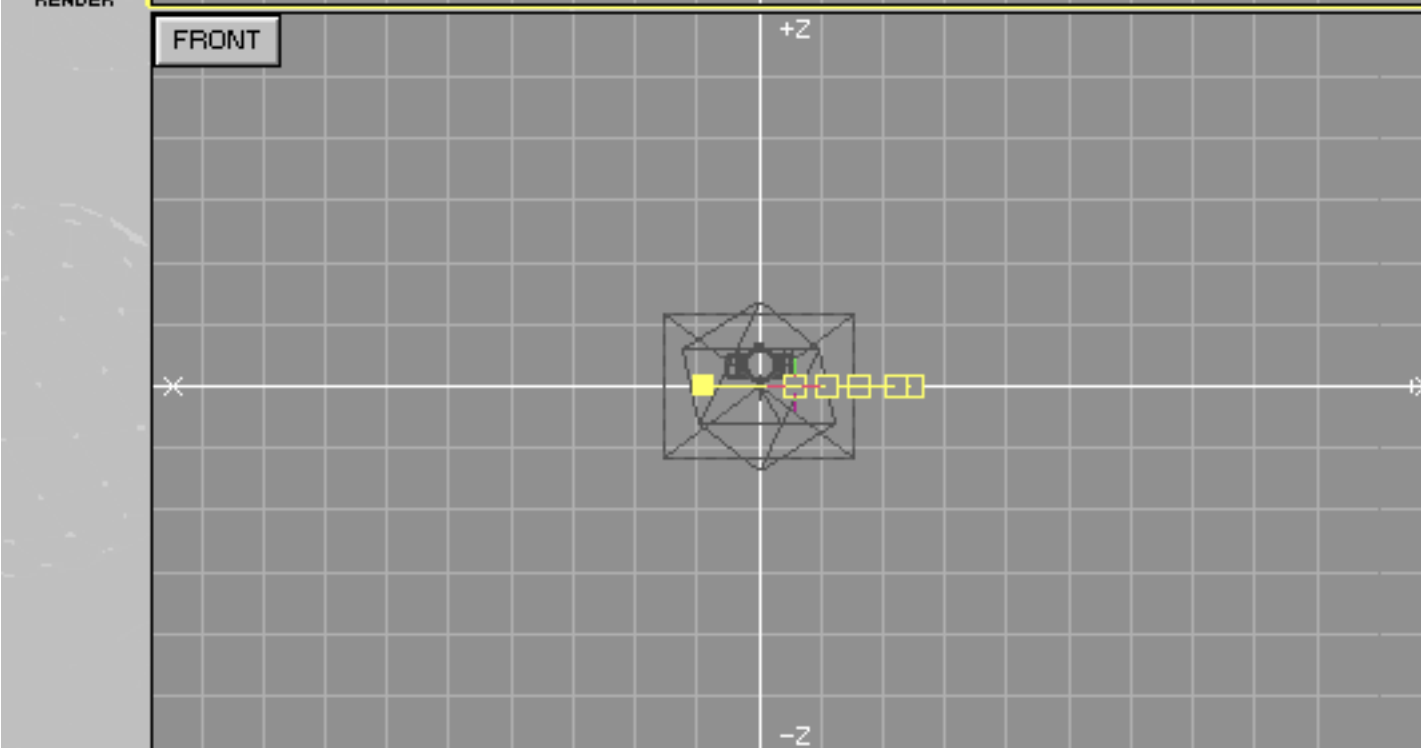
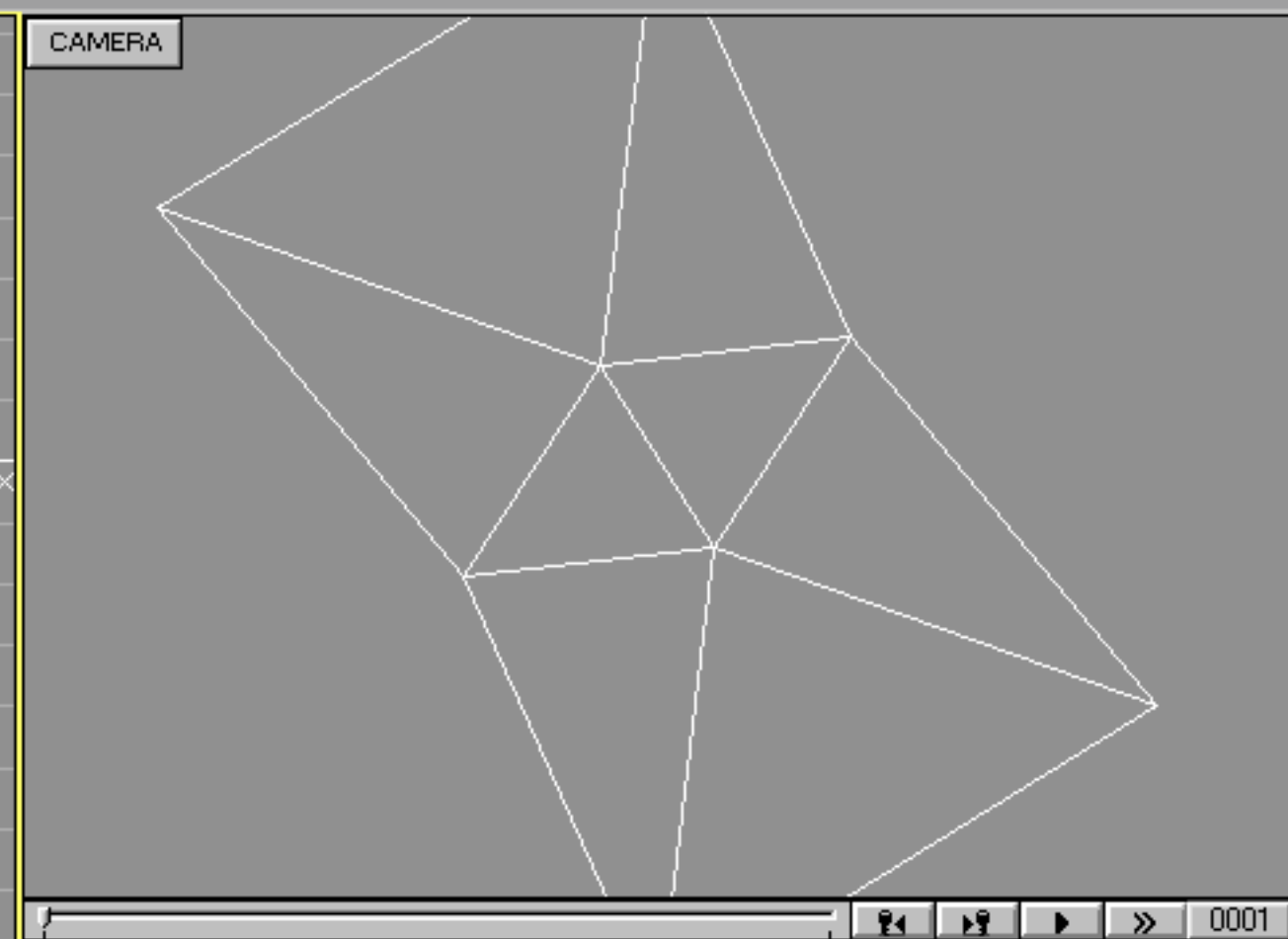
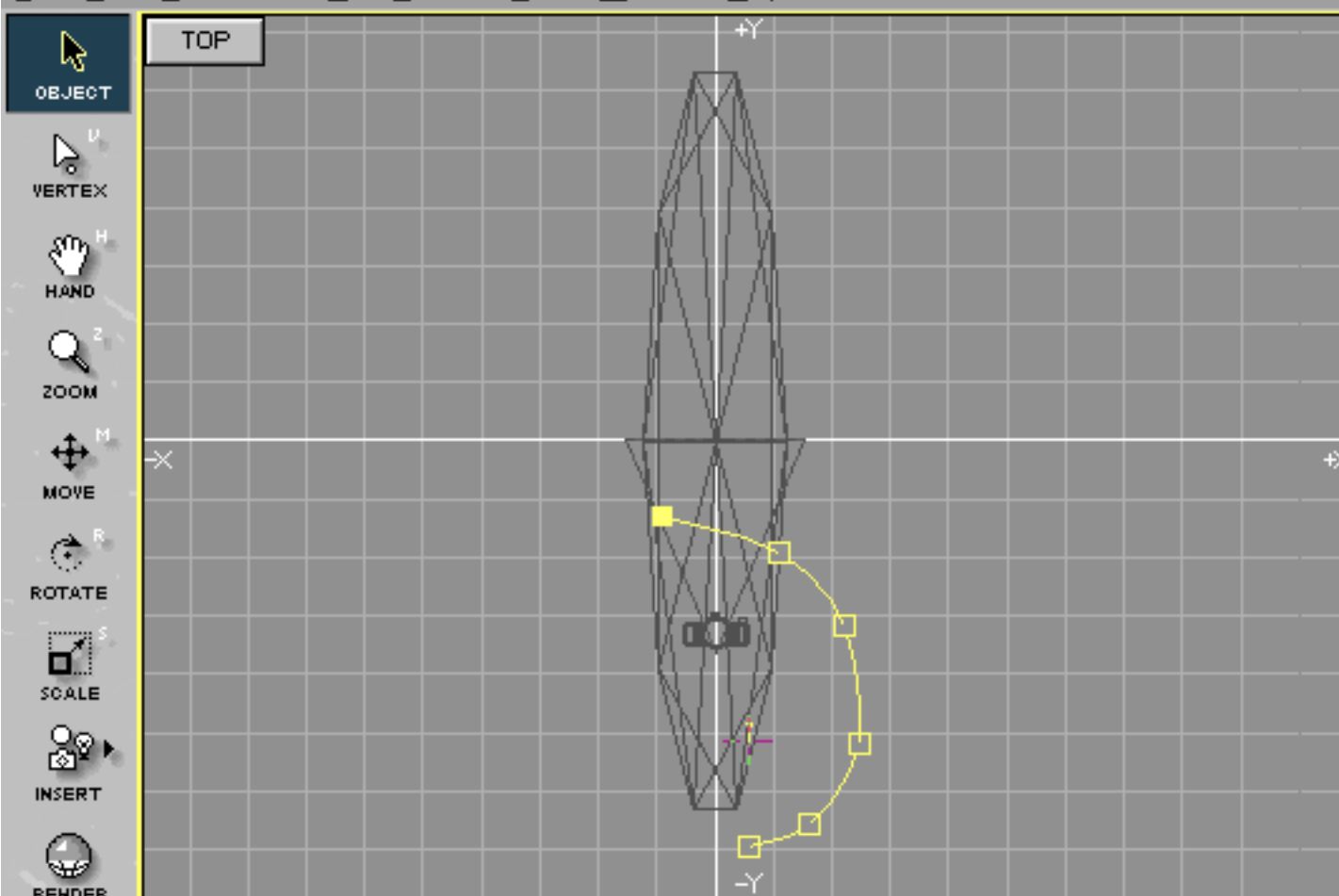
FRONT











Keyframer Seed1Pa

COSTUME
POSITION
ROTATION
SIZE

10 20 30 40 50 60 70 80 90

0
OBJECT

U
VERTEX

H
HAND

2
ZOOM

M
MOVE

R
ROTATE

S
SCALE

INSERT

RENDER

TOP

CAMERA

FRONT

Keyframer

Seed1

COSTUME

POSITION

ROTATION

SIZE

Seed1 Selected

Frame 1

0001

Movement Channel for Seed1 Actor

From 1 To 1

☐ Tween

☐ Spline Tween

☒ Follow

☐ Follow With Offset

☐ Follow On a Path

☐ Follow Locked

Follow

Seed1Path

Select ...

OK

Cancel

Delete

Cut

Copy

Left/Right X 0.00

Front/Back Y 0.00

Up/Down Z 0.00

0
OBJECT

U
VERTEX

H
HAND

2
ZOOM

M
MOVE

R
ROTATE

S
SCALE

INSERT

RENDER

TOP

CAMERA

FRONT

Keyframer

Seed1

COSTUME

POSITION

ROTATION

SIZE

Seed1 Selected

Frame 1

Rotation Channel for Seed1 Actor

From 1 To 1

OK

Cancel

Delete

Cut

Copy

Target

Seed1Path

Select...

☐ Tween

☐ Smooth Tween

☒ Align to path

☐ Look At

☐ Mimic

Internal Rotation

☒ None

☐ Vertical Axis

☐ Side Axis

☐ Front Axis

☒ Clockwise

☐ Anti Clockwise

Direction

0.00

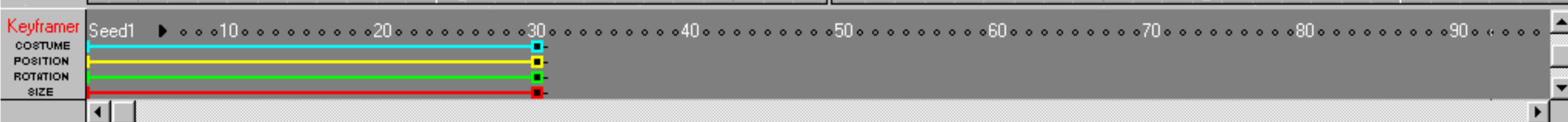
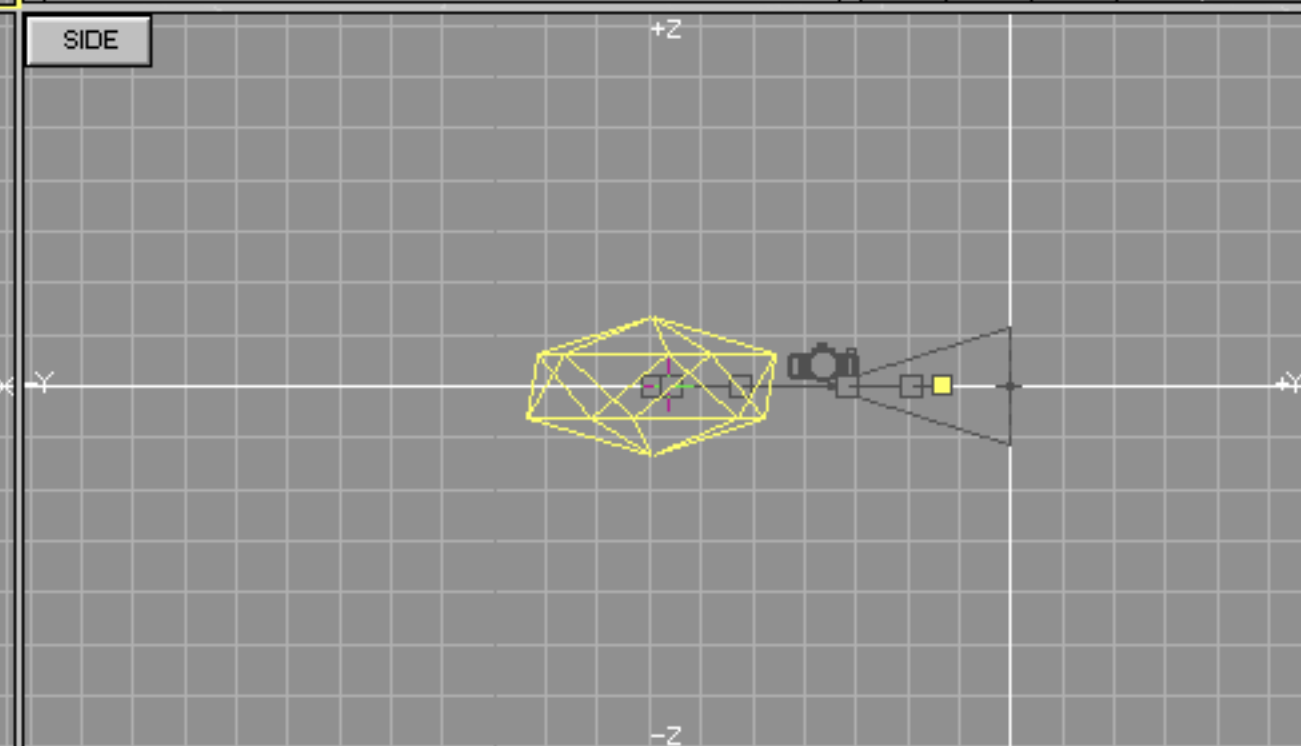
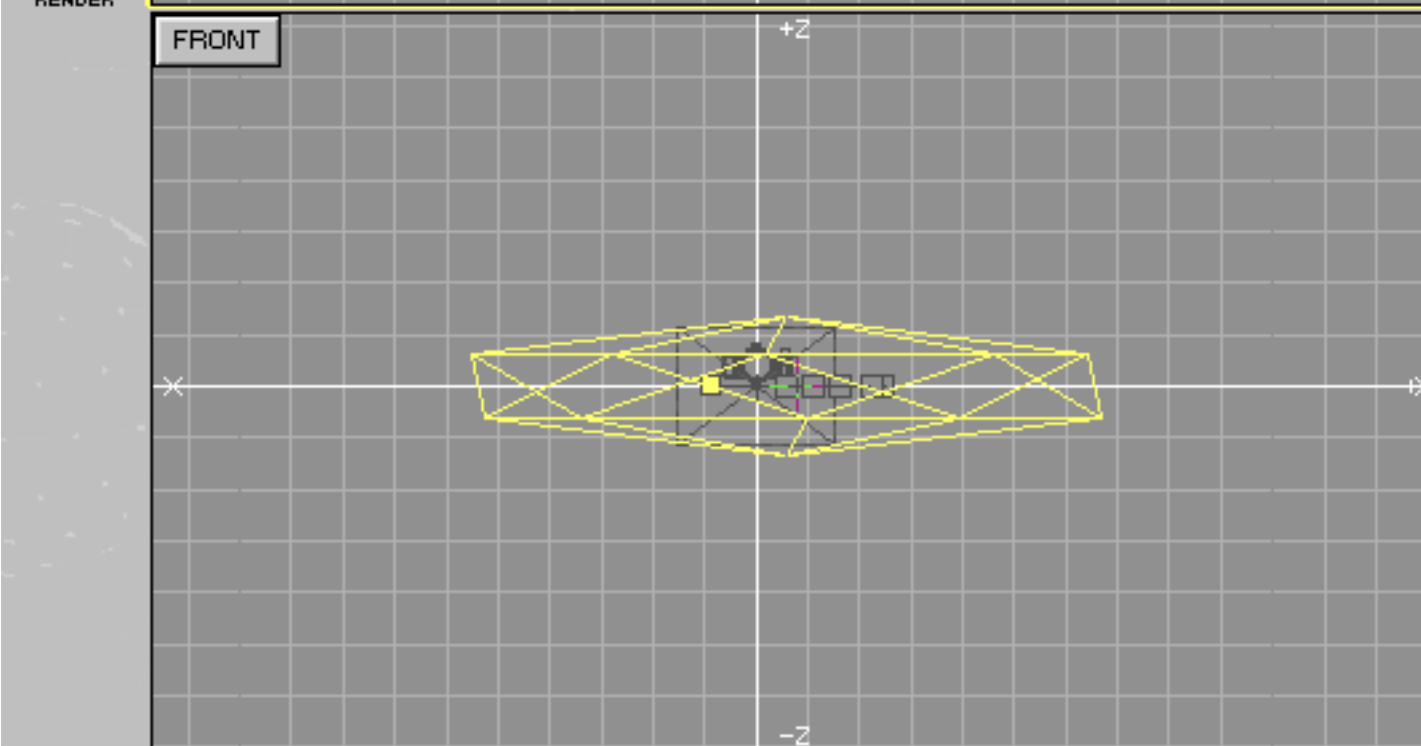
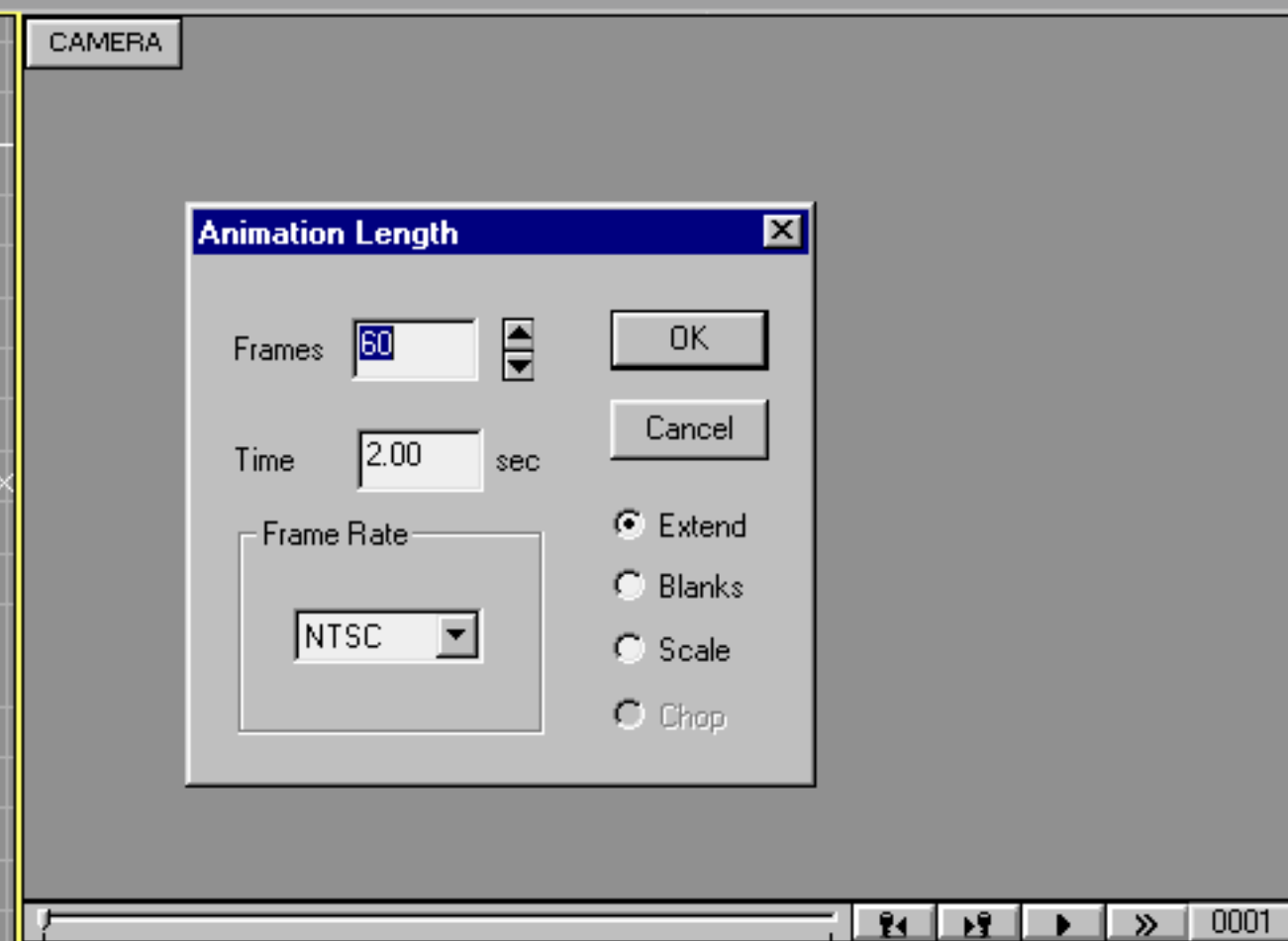
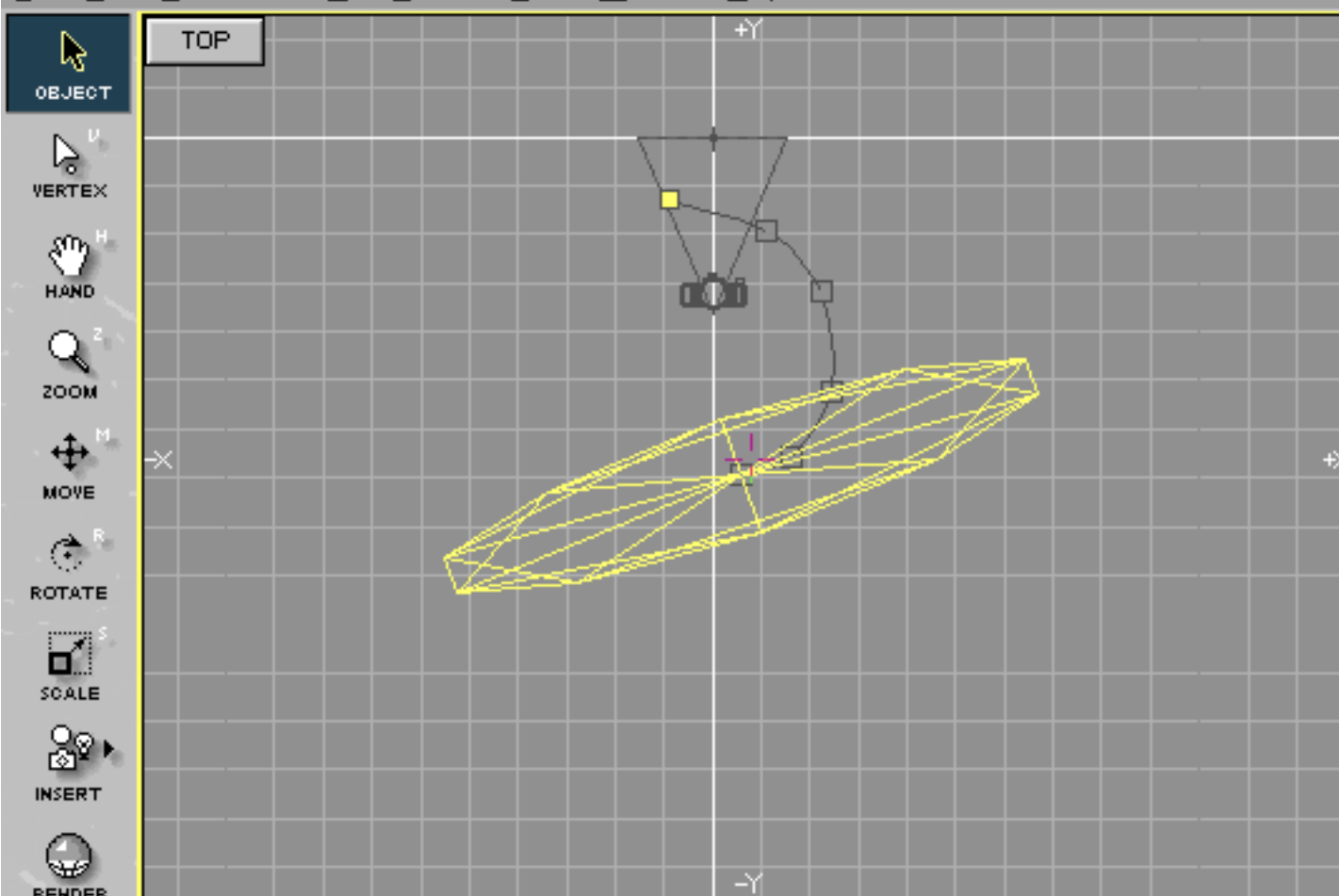
Up/Down

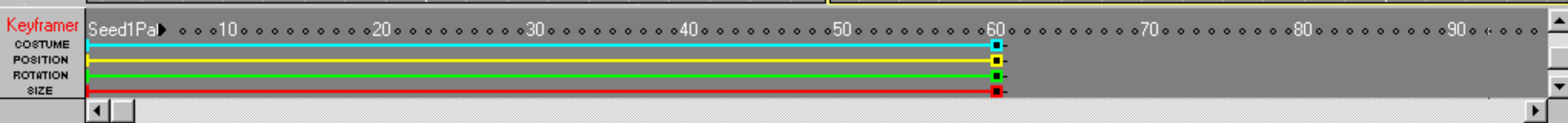
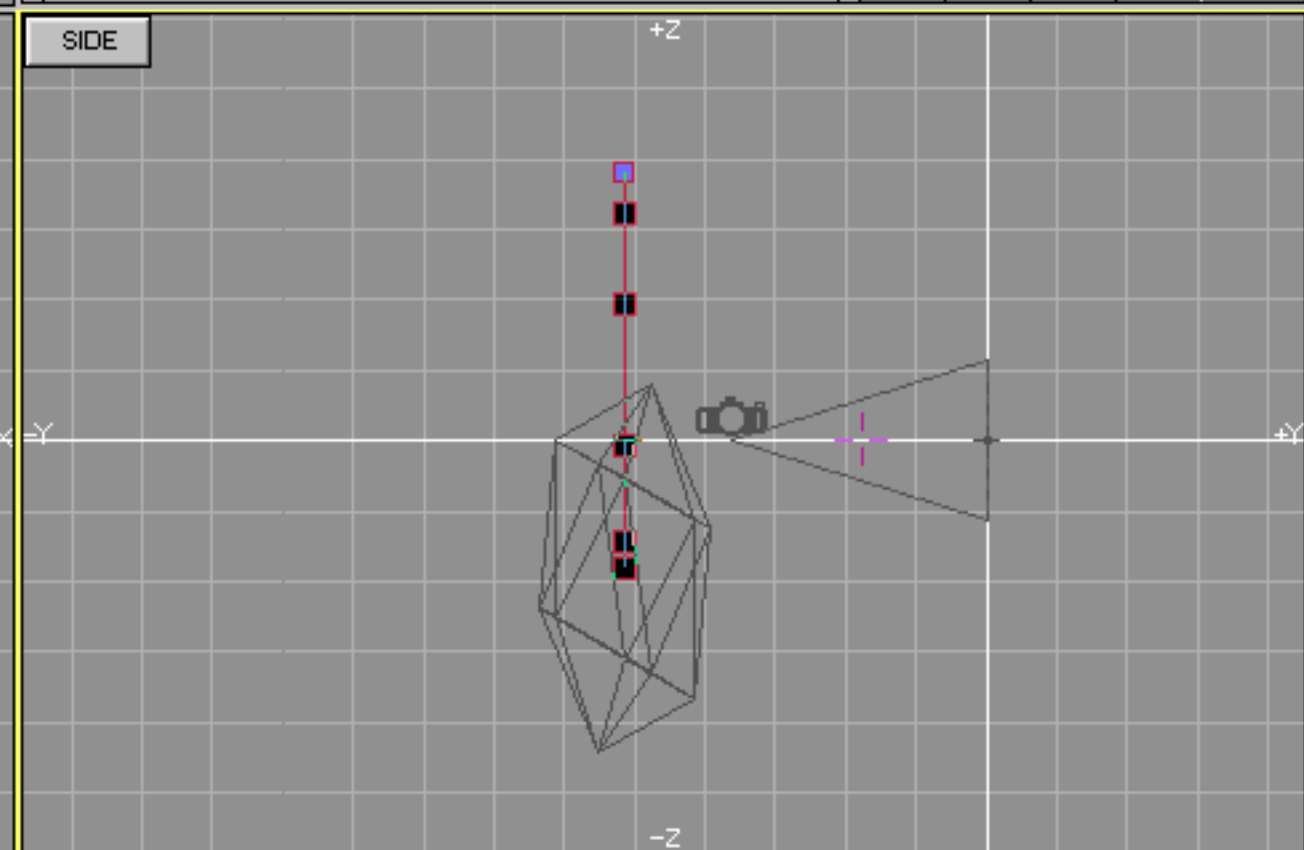
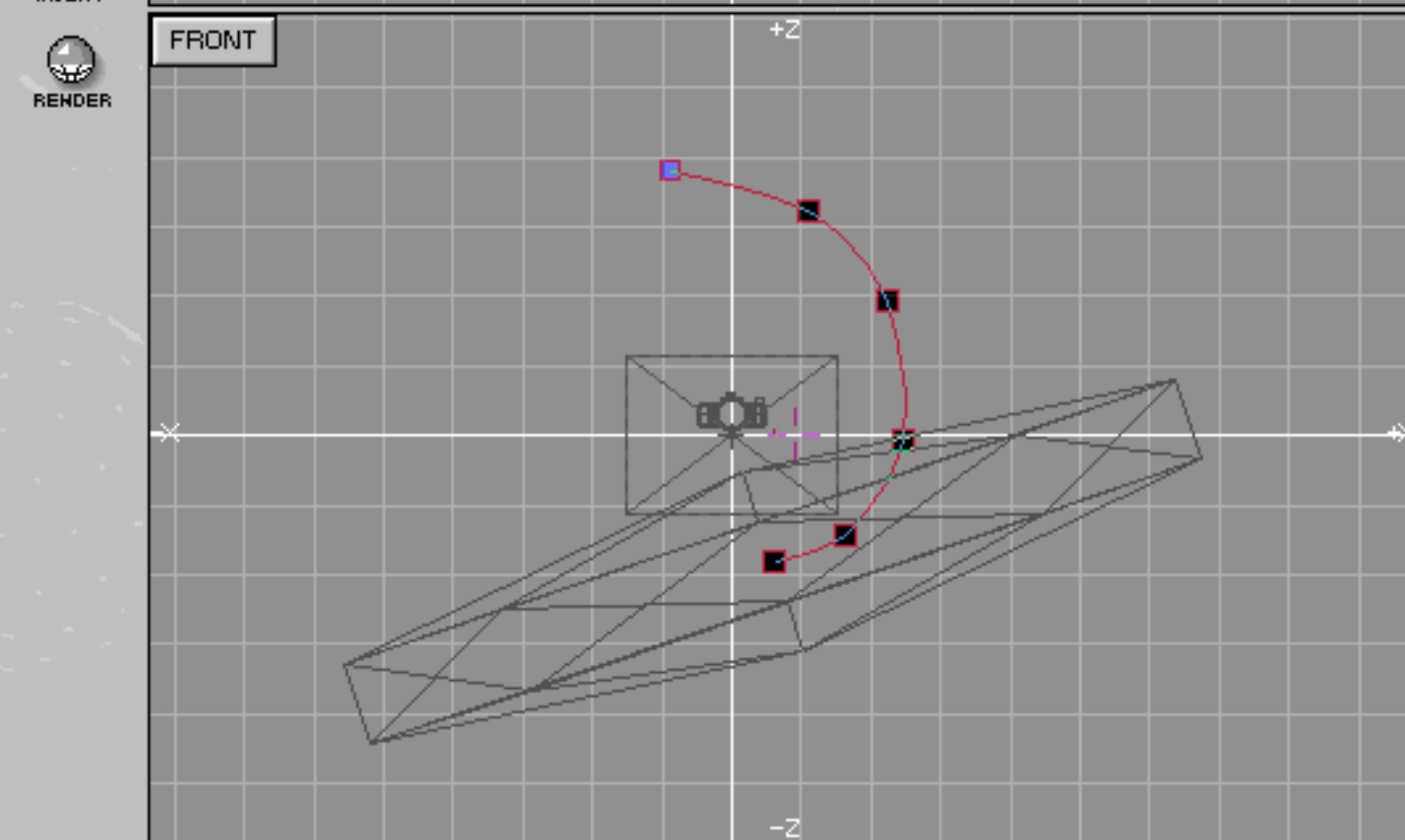
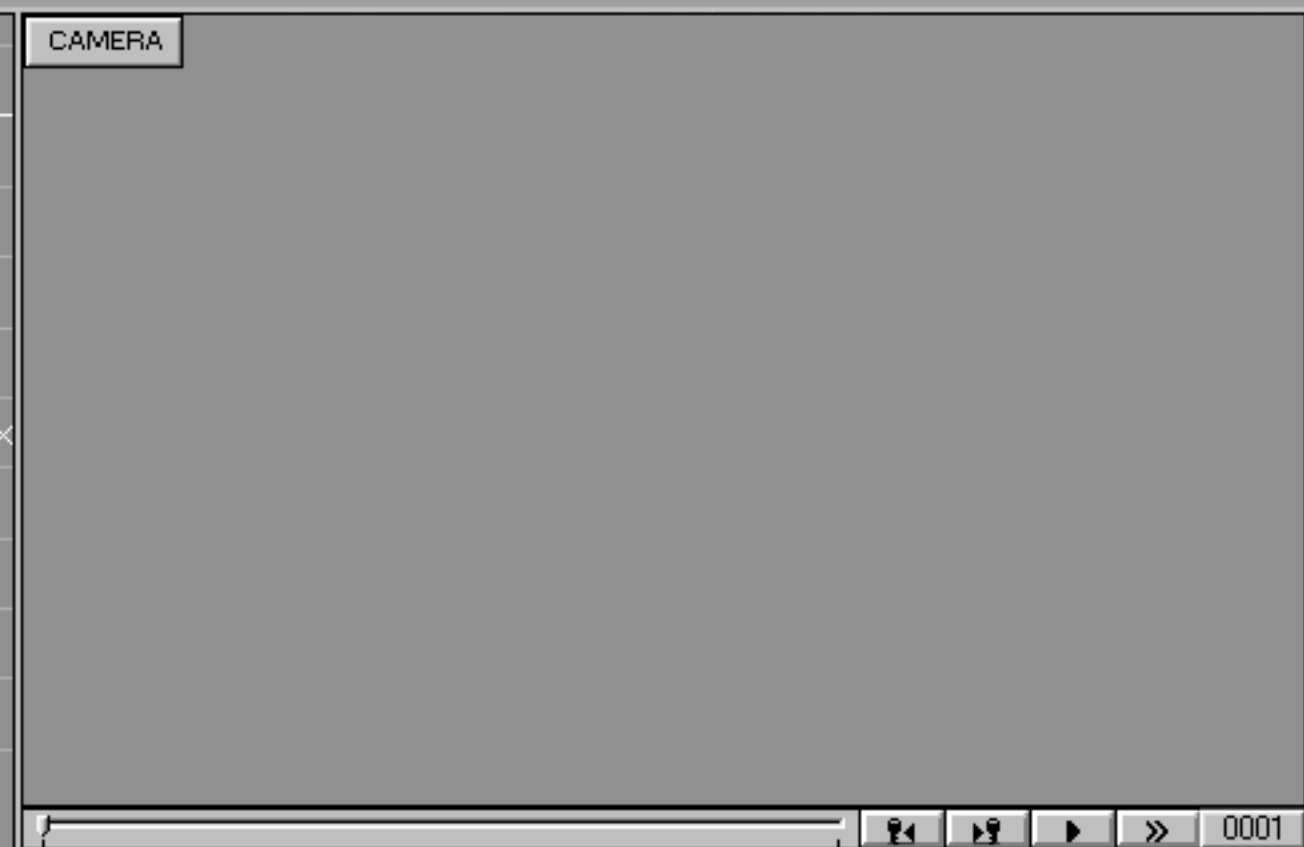
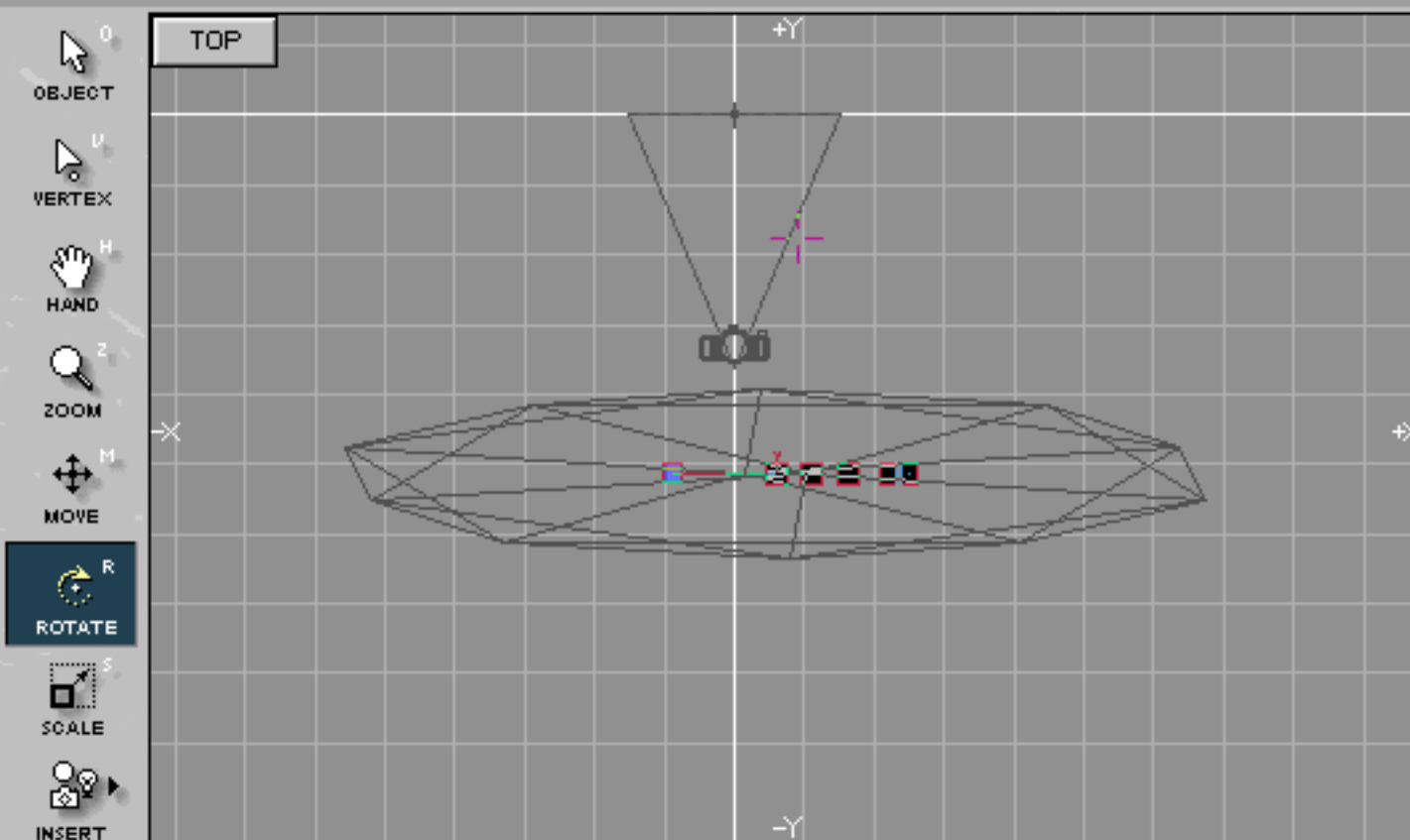
0.00

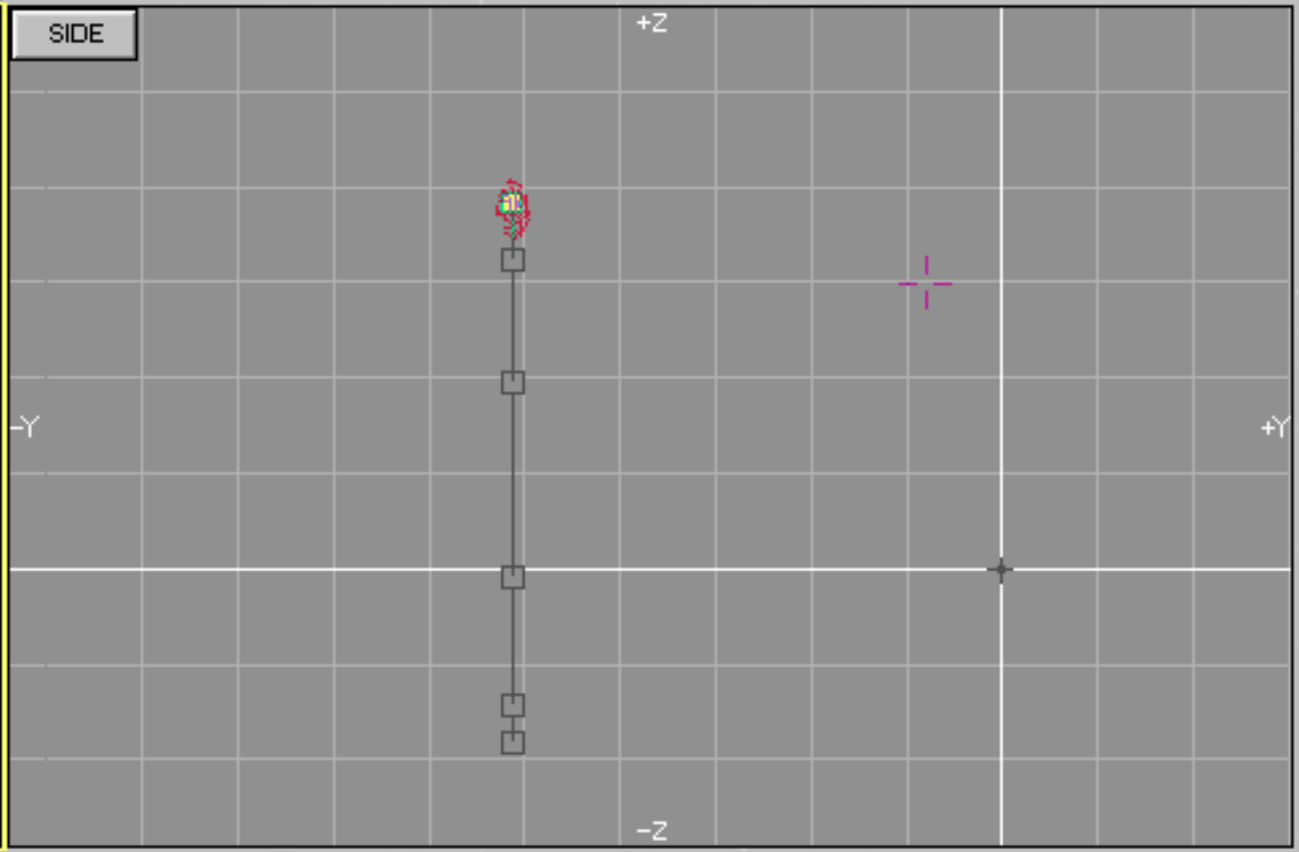
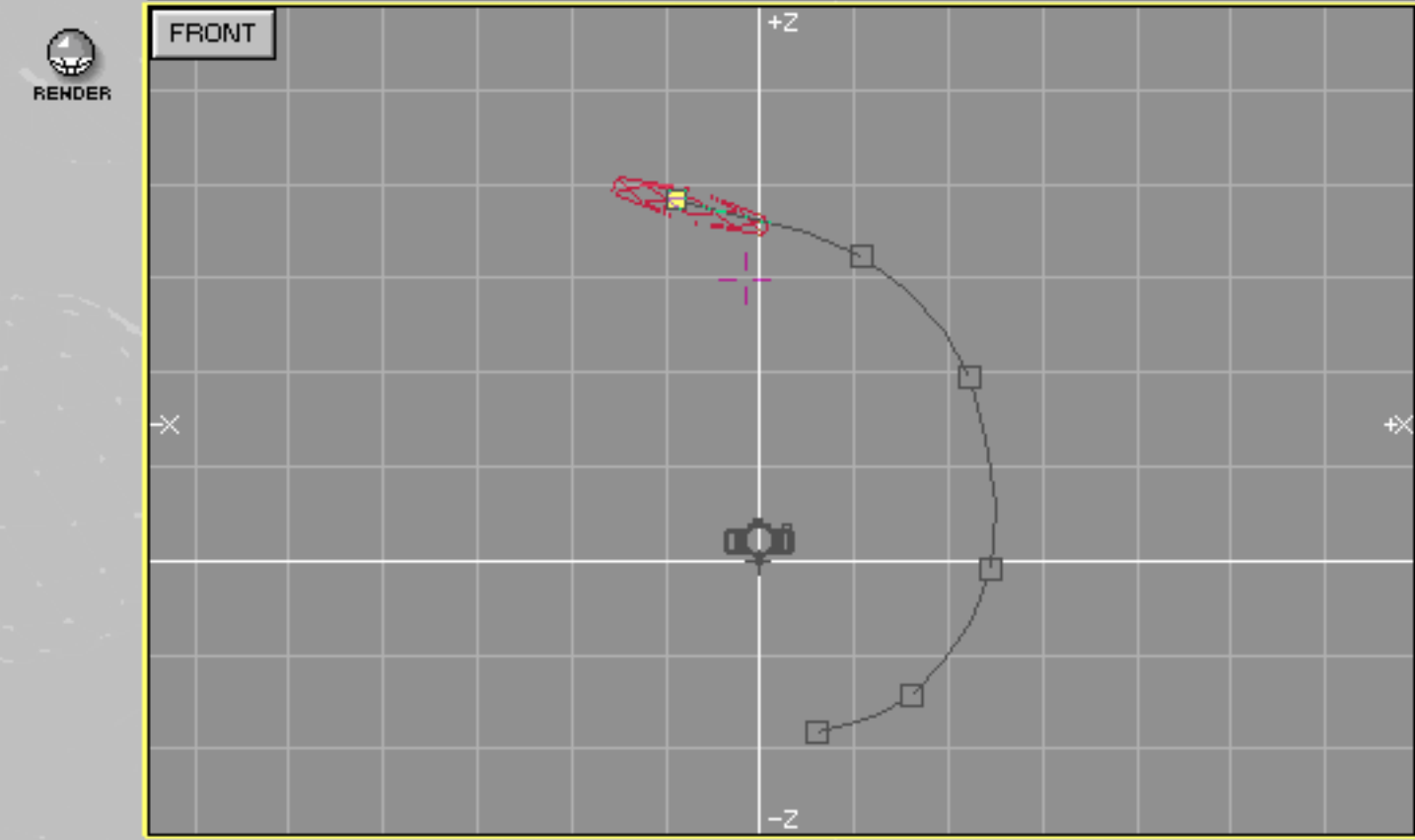
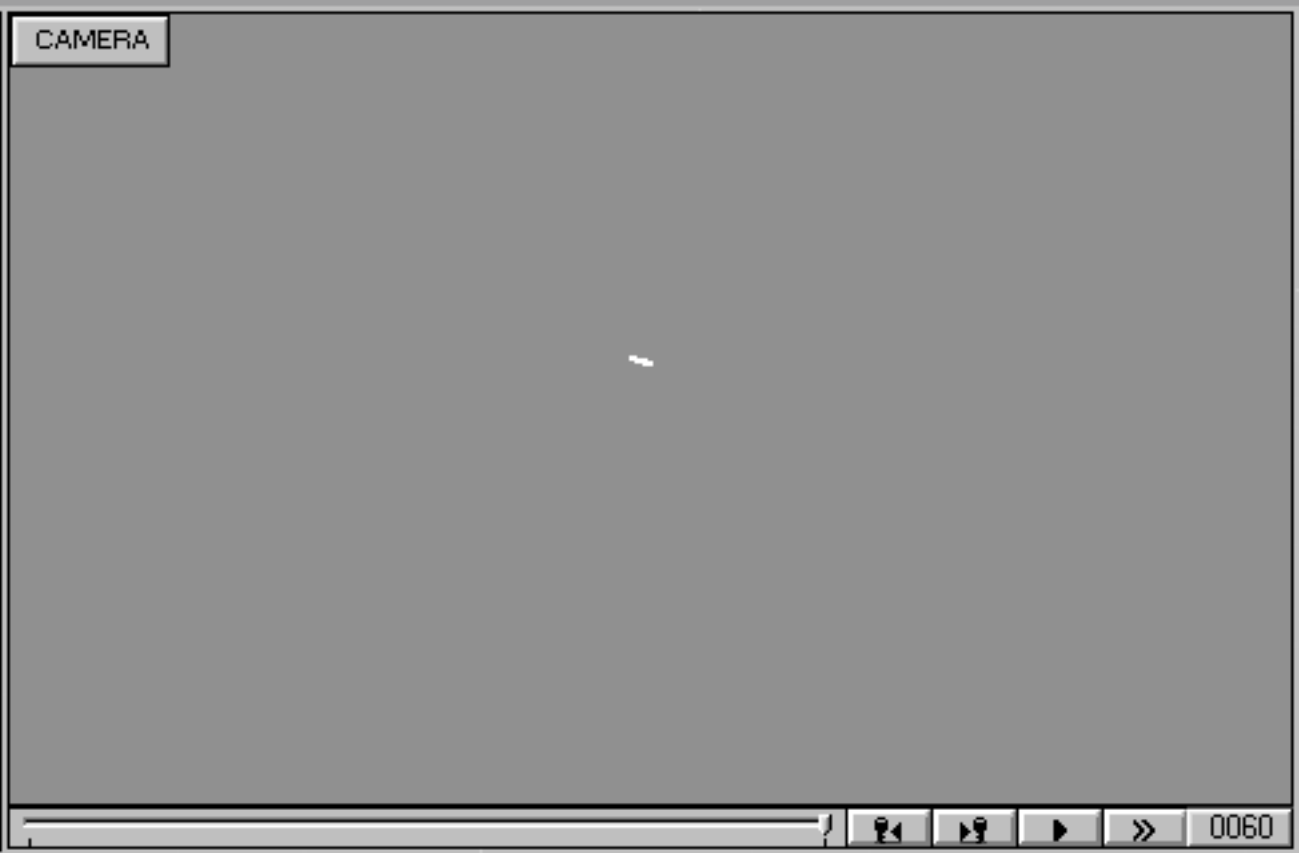
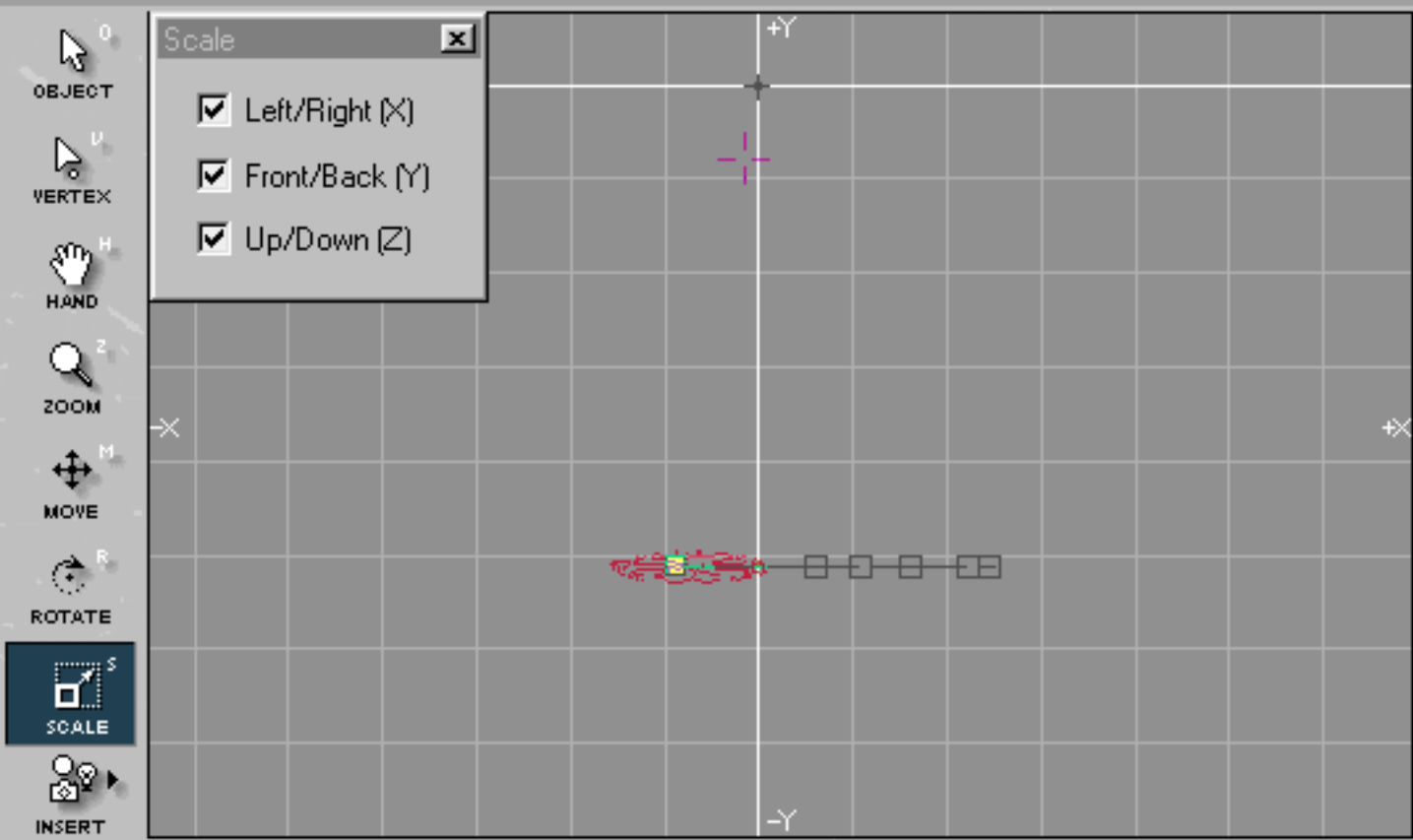
Bank

0.00

0001







Keyframer

Seed1

COSTUME

POSITION

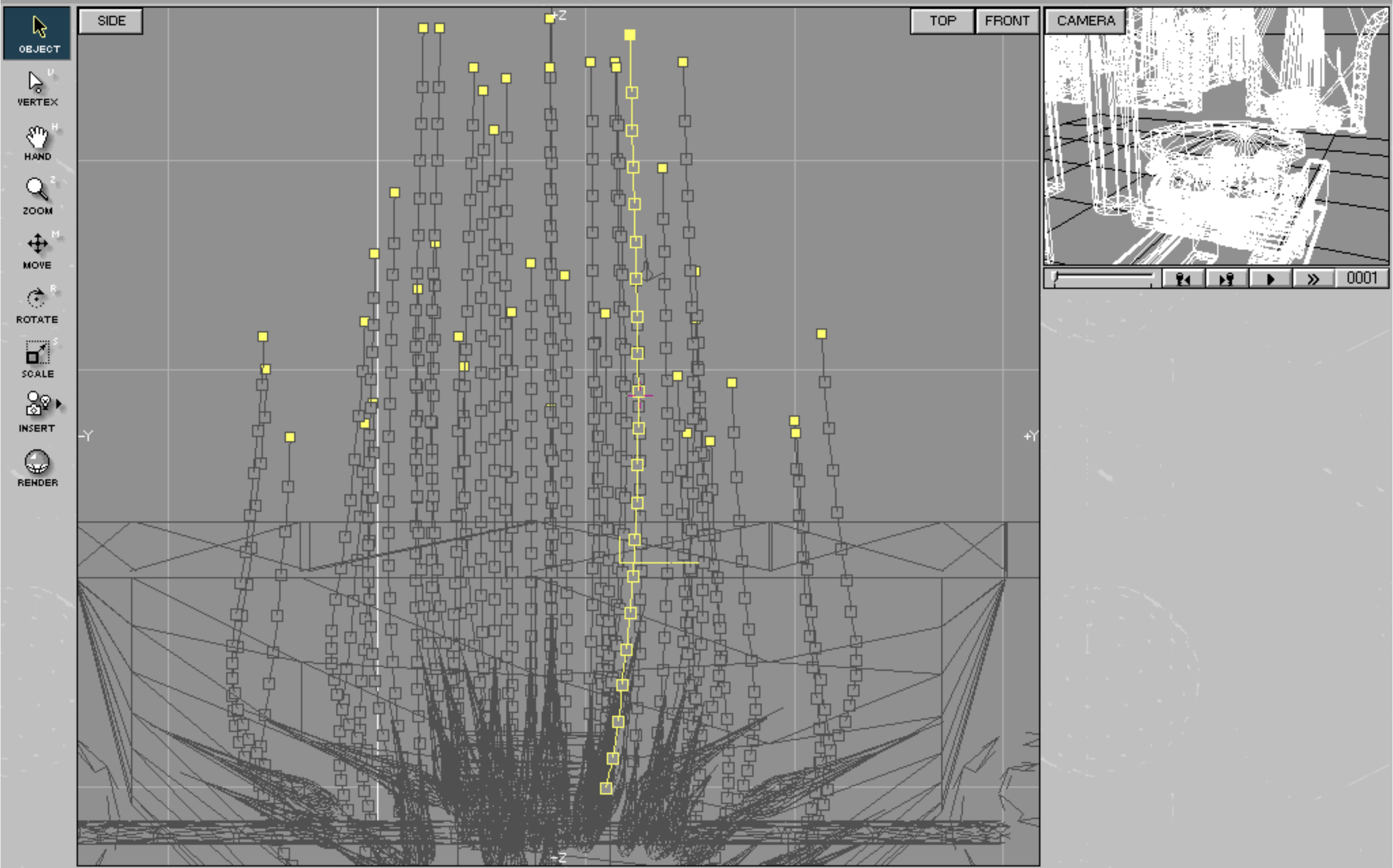
ROTATION

SIZE

Timeline: 10 20 30 40 50 60 70 80 90

Seed1 Selected

Scale Tool: Choose option from Scale Palette to resize one or more axes



Keyframer

	39-fire5	10	20	30	40	50	60	70	80	90
COSTUME										
POSITION										
ROTATION										
SIZE										

39-fire59 Selected

OBJECT

VERTEX

HAND

ZOOM

MOVE

ROTATE

SCALE

INSERT

RENDER

SIDE

TOP FRONT CAMERA

Keyframer

Edit

Fire57

38-fire5

Fire58

39-fire5

Fire59

40-fire6

Fire60

41-fire6

Fire61

42-fire6

0001

39-fire59 Selected

