



Next Steps: Procedural Animation

M07 - POPs in DOPs Part 01

Agenda

Basic POP in DOP

Streams - What are they

Standard things you have always done in POPSOP

POP Axis Force

POP Curve Force

POP Replicate

POP Collisions

Smoke Advecting Particles

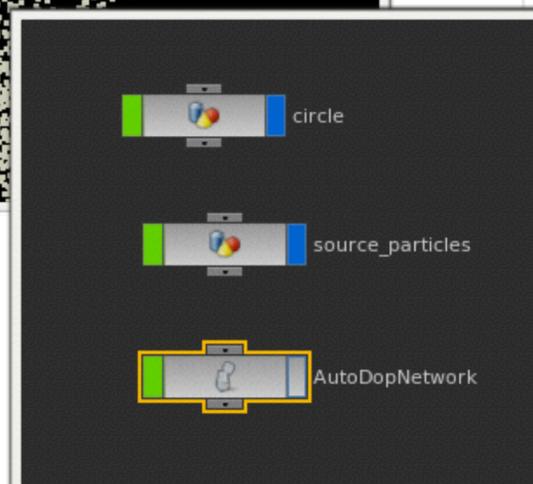
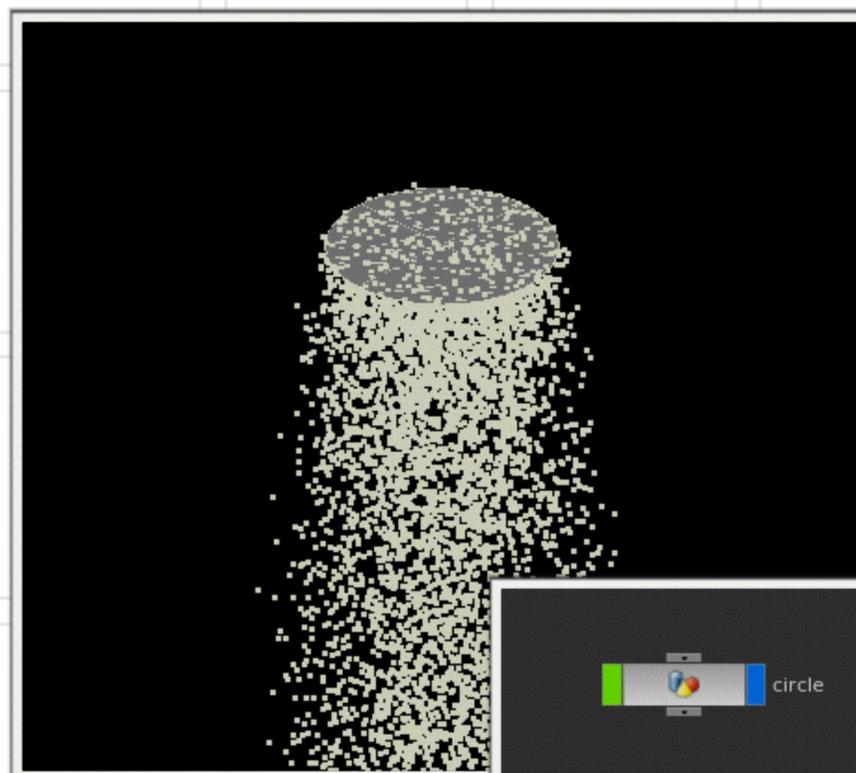
POP Flock

POP Bullet



Basic Setup

A Simple Tesbed



Drop Down a Circle - Orientation zx plane

Select the Particles Tab

Select the Source Particles Button

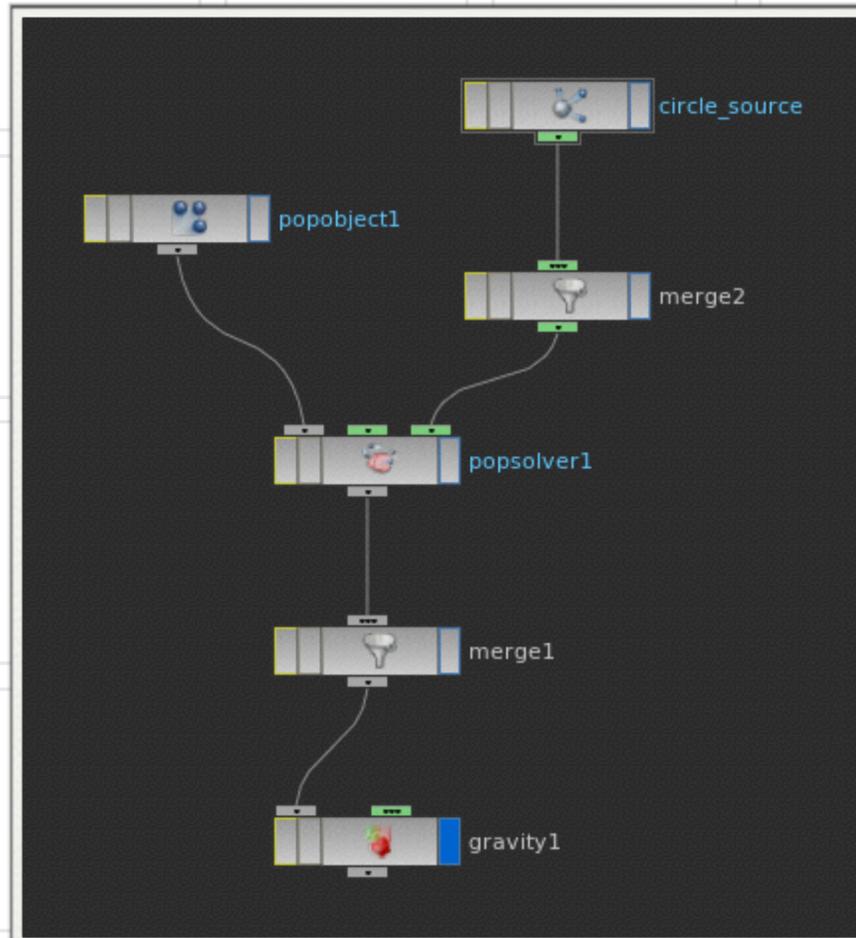
You have particles

Go up to the object level and notice that there are now three objects. The original circle, AutoDopNetwork, and source particles

Dive into the circle. Nothing has been added

Dive into the source particles - Notice a DOP I/O node has been added. Remember you have to extract the information from the DOP network to render. The Source Particle Node Does that for you.

AutoDOPNetwork



Dive into the AutoDOP Network

Two Objects are wired into the POPSolver

POP Object and a POP Source

You will rarely touch the POP Object - Just for Bounce and Friction

The Magic occurs in the POP Source

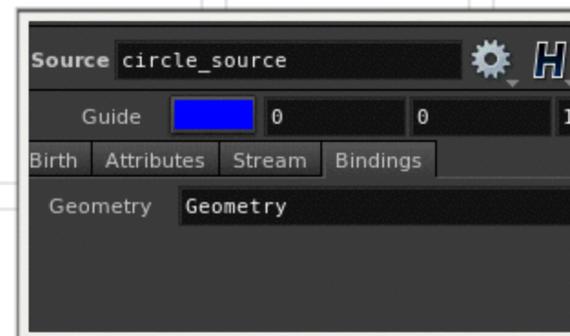
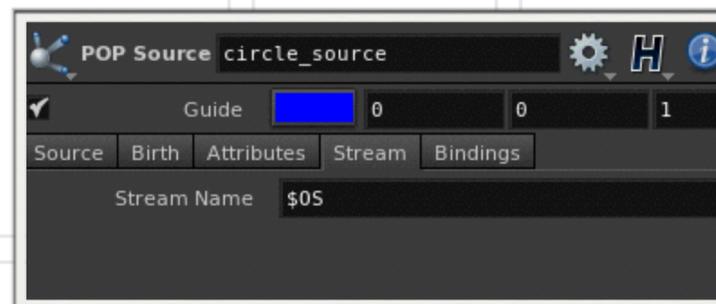
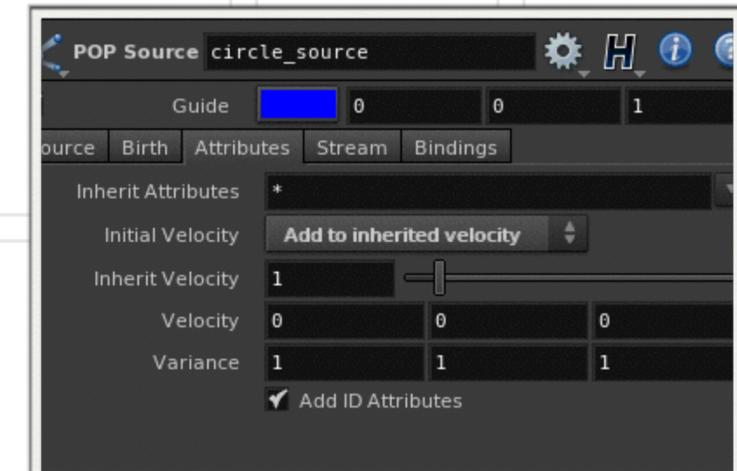
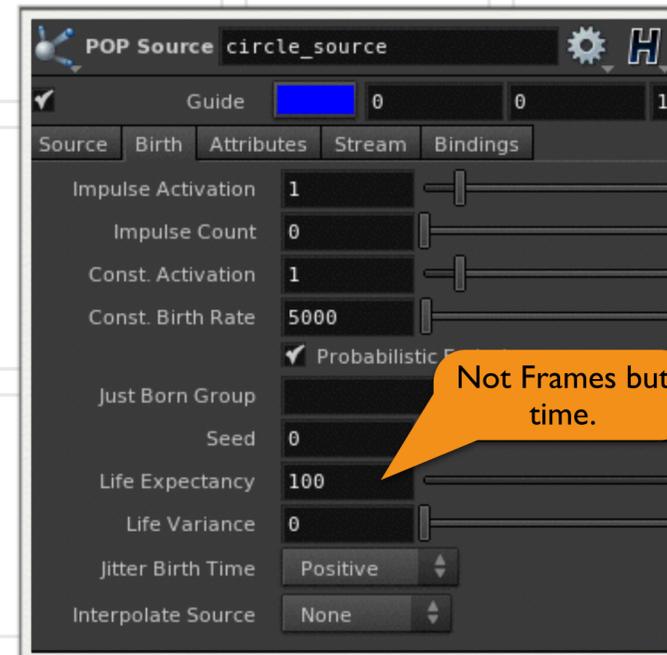
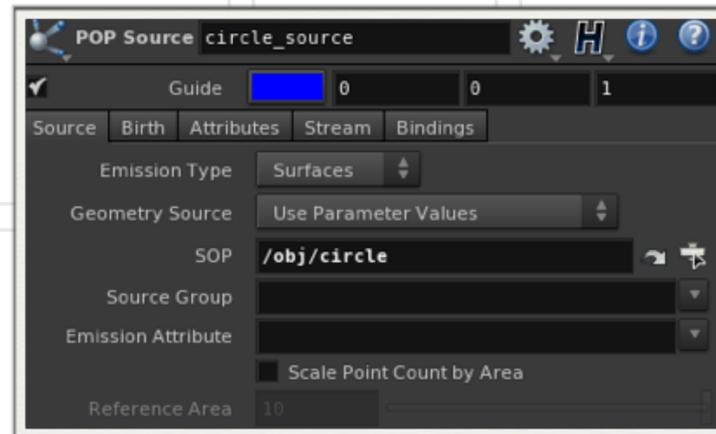
The POP Solver takes three inputs.

Left - Object to be manipulated

Right - Particle Sources

Middle - Pre-solve

Particle Source



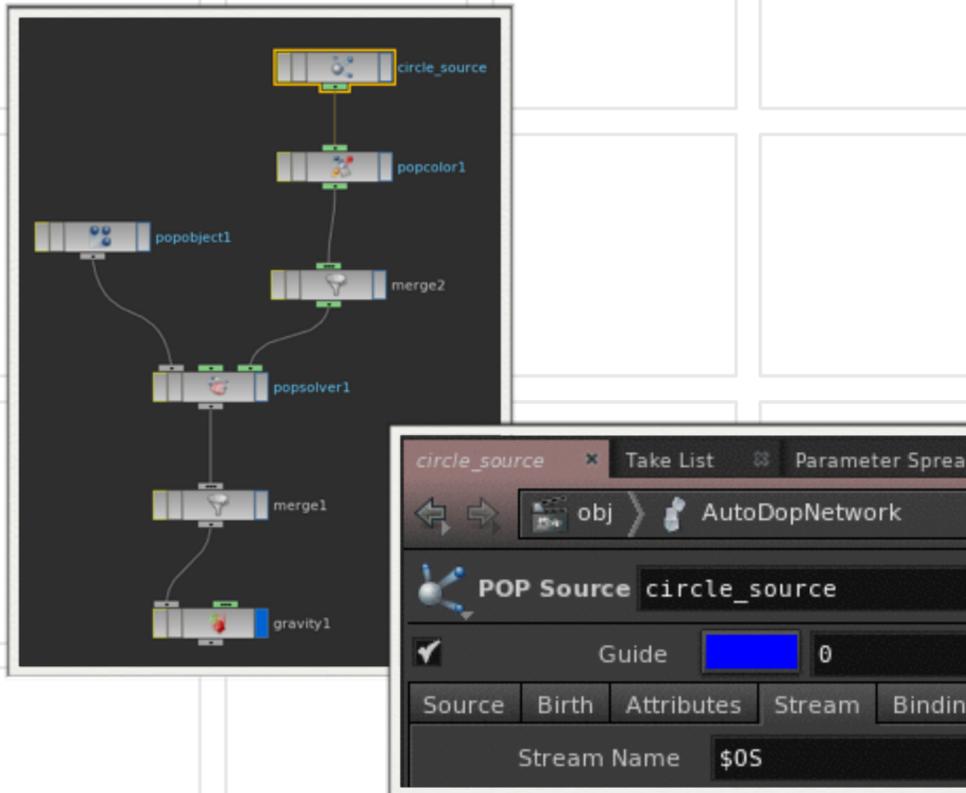
You should feel right at home with the Particle Source. Much work has been put into it to make it feel just like a POP Source in a POPNet



Streams

What are They?

Streams



In a nutshell streams are POP in DOPs equivalent to what a Group is in SOPs

Append a POP COLOR to the POP Source

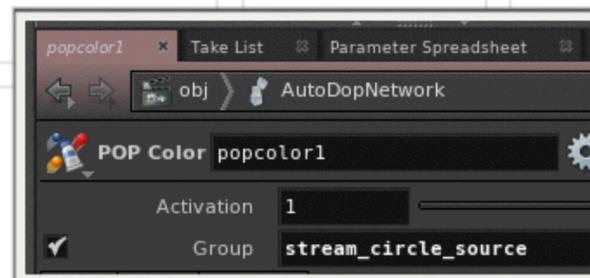
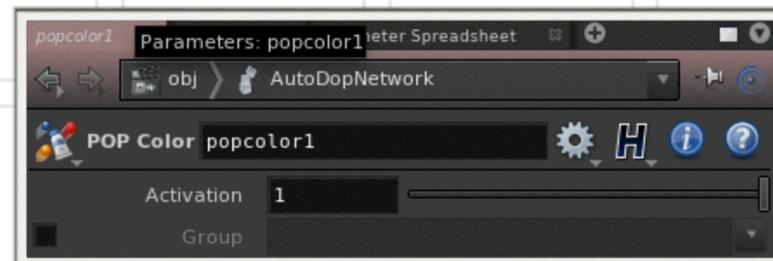
Select the POP Source and go to the Stream Tab

Notice that a stream has been created name \$OS (circle_source)

Now select the POPColor node

Notice that there is a check box for "Group"

Select the Group checkbox and look at the drop down menu stream_circle_source which is a stream works as a group

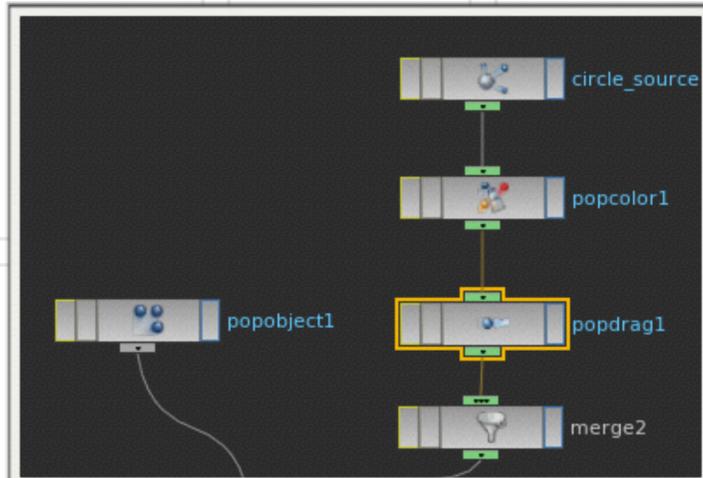




Things You Expect

Standard Things You Have Always Done in a POPSOP

POP Drag



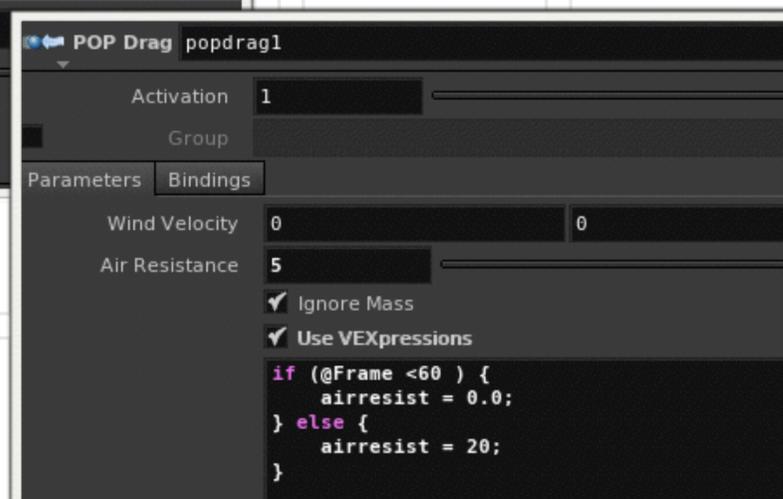
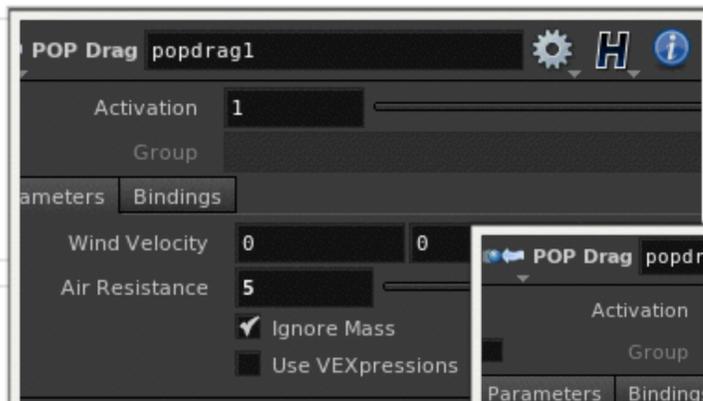
Hit the TAB key and start typing POP. Notice all the POP nodes start with “POP”

Append a POP Drag to the POP Color

Increase Air resistance and run sim

Notice there is a VEXpression Option at the bottom

Use VEXpressions instead of HSCRIPT (much faster)



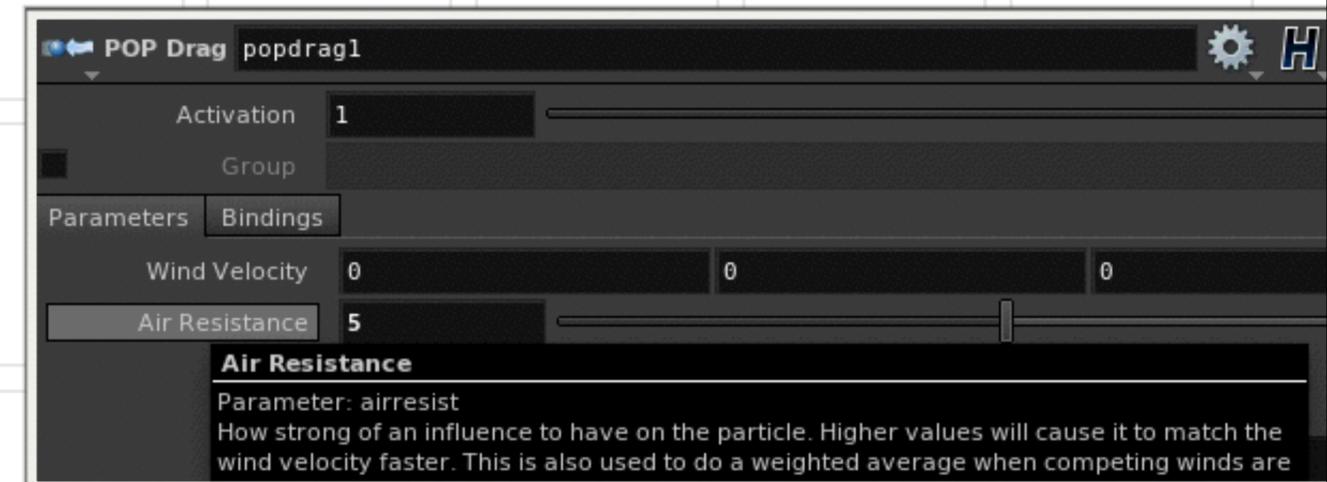
```
if (@Frame <60 ) {  
    airresist = 0.0;  
} else {  
    airresist = @nage*10;  
}
```

Vexpressions

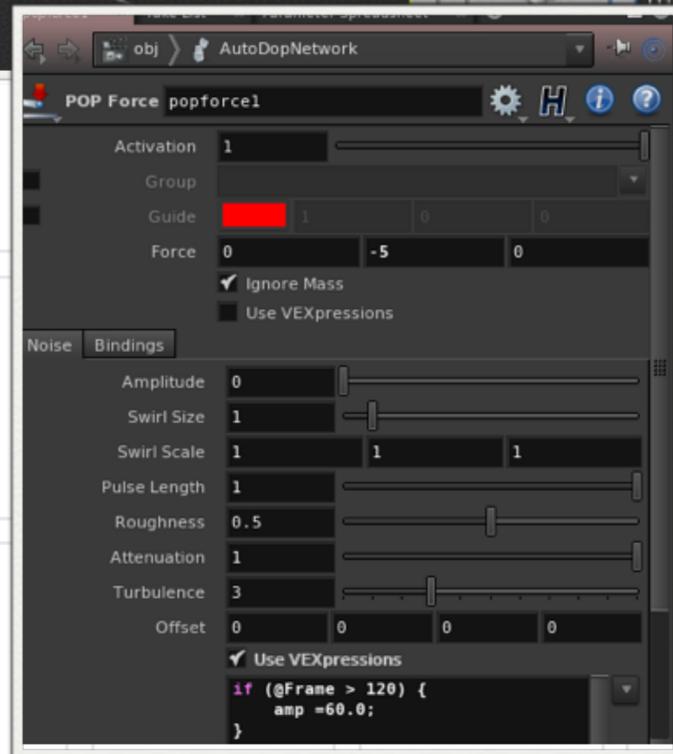
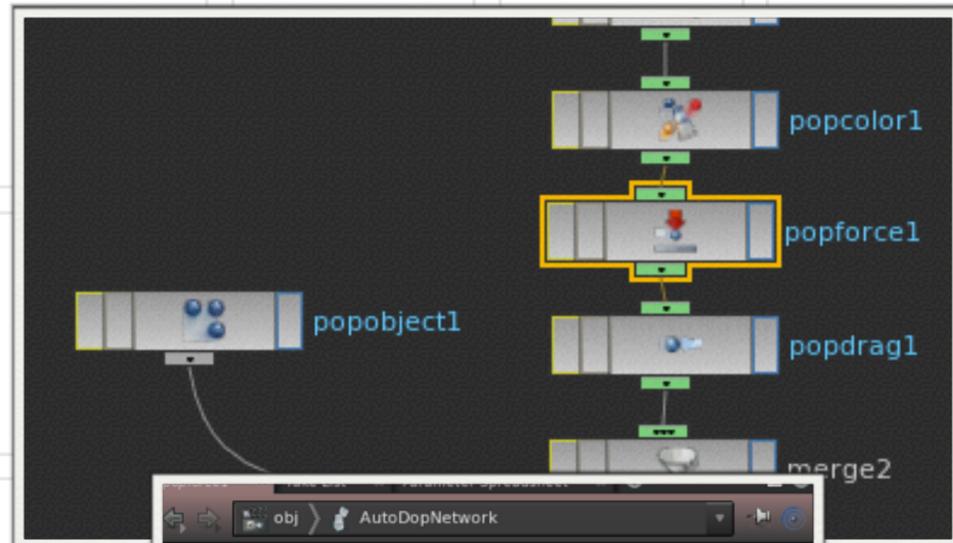
VEXPressions use the same syntax as wrangle nodes

They can also use the names of parameters in the panel without using the “@” sign

```
Air Resistance 5
   Ignore Mass
   Use VEXpressions
  if (@Frame <60 ) {
    airresist = 0.0;
  } else {
    airresist = 20;
  }
```



POP Force



Append a POP FORCE to the POP Color

Increase the Amplitude to 10 - This is your curl noise

Bring it back to 2

Add a force in the x- direction

Notice there are two sets of Vexpressions

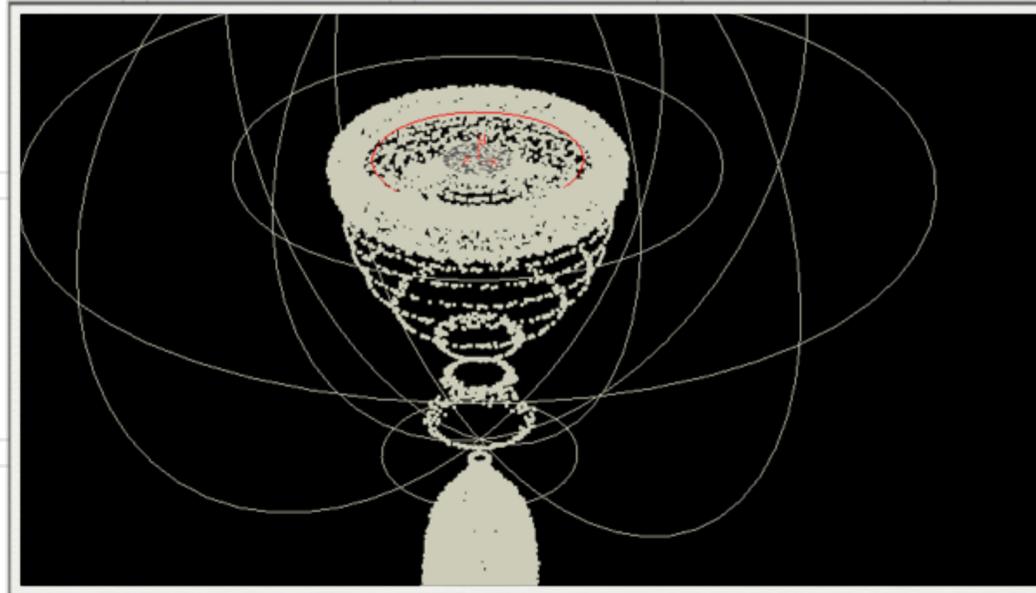
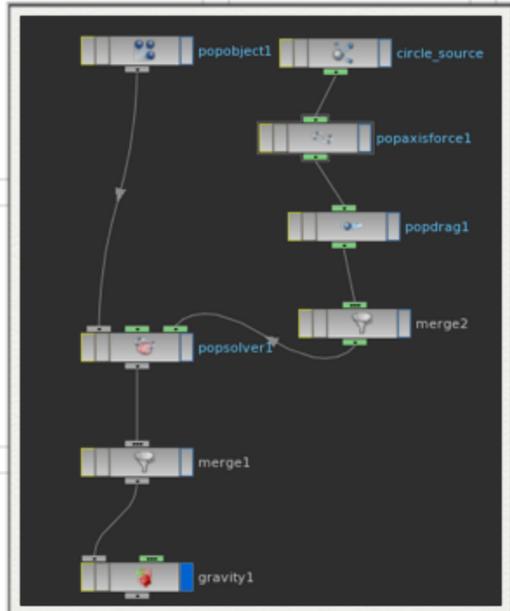
The Vexpressions only work on the parameters that lie above the expression



POP Axis Force

Maya Users will Love this

Setup



Drop down a circle on the zx plane

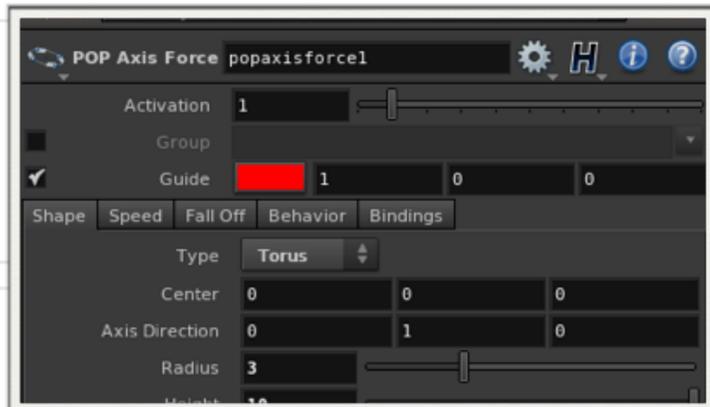
Apply Source Particle

Dive inside the AutoDOPNetwork

Append a Axis Force

Append a Drag

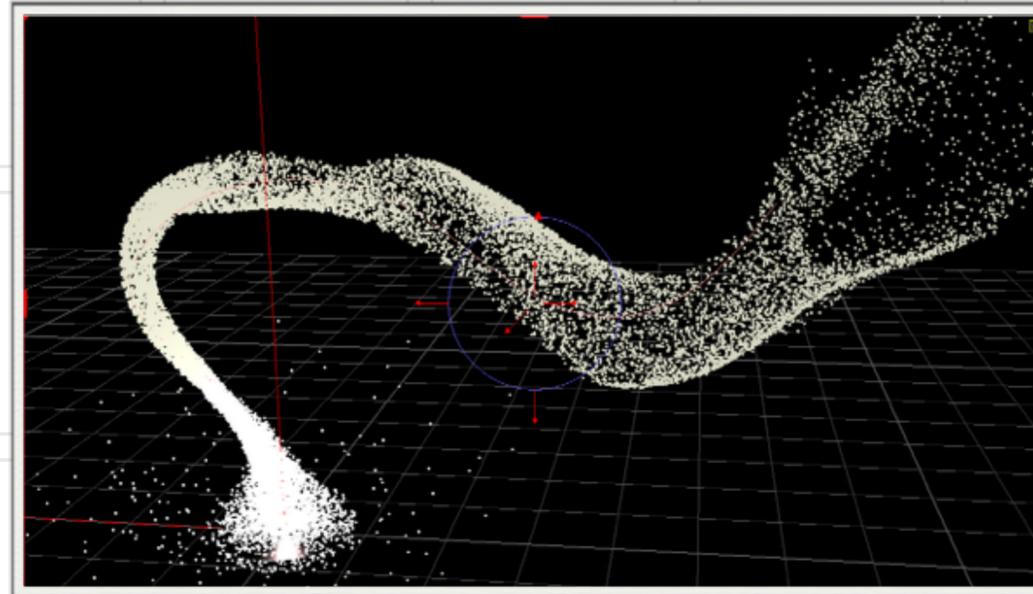
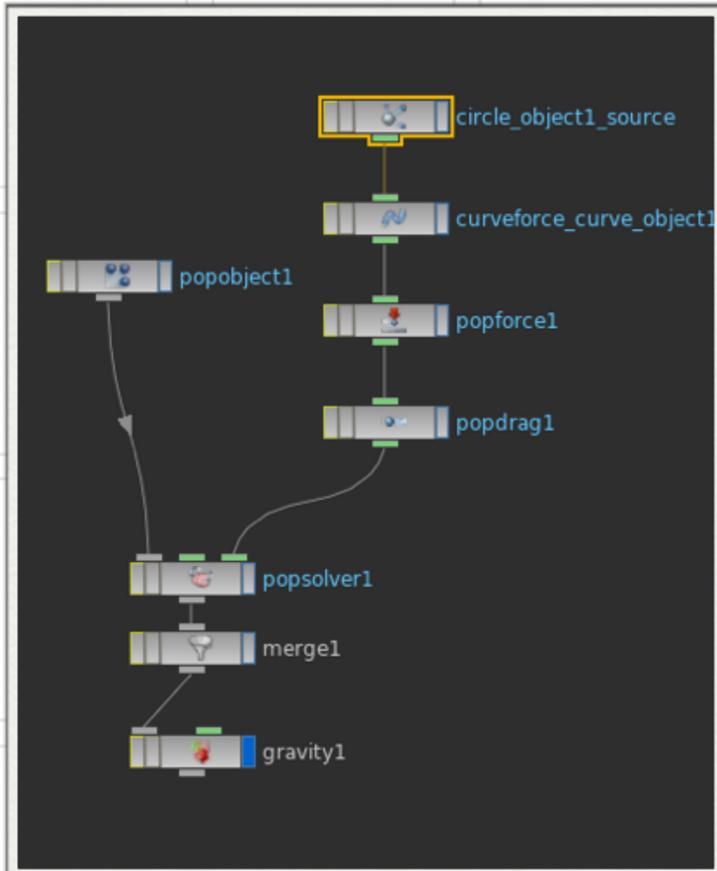
An Axis Force can be in the hale of a circle - which produces a line or a tours which produces a circle





CURVE FORCE

Setup



Drop down a circle on the zx plane

Apply Source Particle

At the Object Level create a Curve (Make it a NURB)

Dive inside the Curve a do a resample

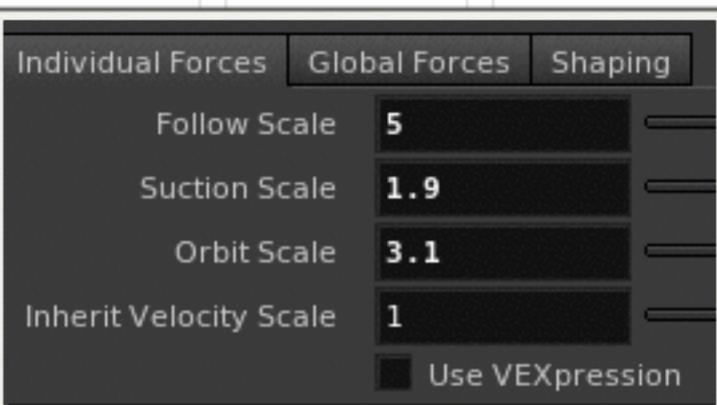
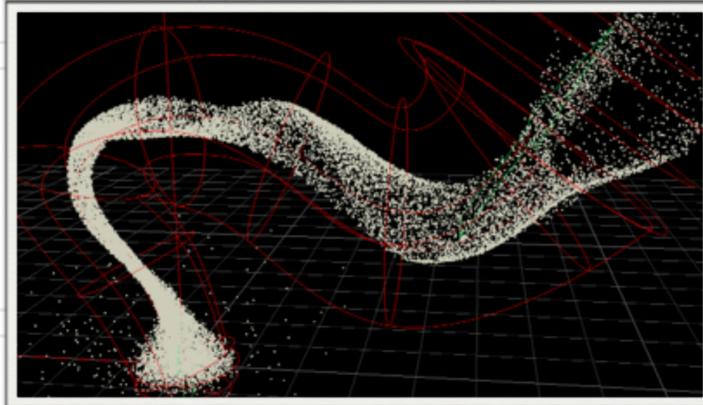
Dive inside the AutoDOPNetwork

Append a Curve Force to the POP Source

Append a POP Force

Append a POP DRAG

Curve Force



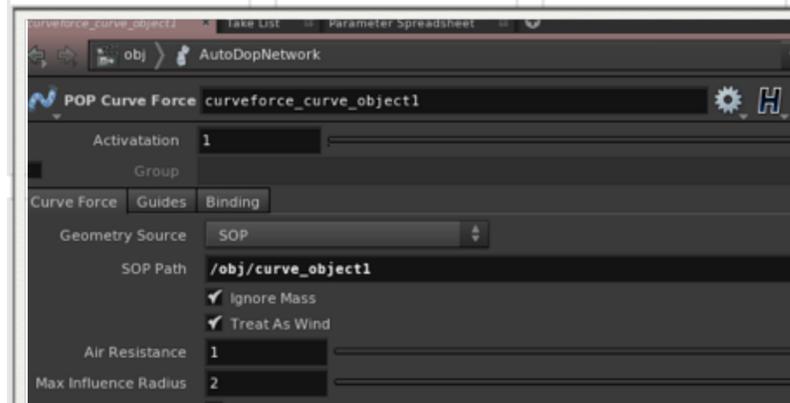
Select the Curve Force

Set the SOP Path to you Curve Object

Notice the Guides the Curve Force Makes

Set the Individual Forces to the image on the left

Notice you can control the radius of influence





POP Curve Force dynamics node

A POP node that creates forces generated from a curve.

The POP Curve Force node applies a force to particles to steer them along, toward, or around a curve.

This operator modifies the `force` attribute.

Note

This node creates forces which can cause the particles to get pushed away from the curve and outside the **Max Influence Radius**. For curves with sharp turns or complex shapes, the **Suction Force** will need to be balanced with the other forces to keep the particles near the curve and under the influence of the Curve Forces.

Note

For convenience, this node creates an `oncurve` attribute whose value is 1 for particles on the curve and 0 for particles beyond the **Max Influence Radius**. This attribute can be used to influence other forces or to create particle groups.

oncurve

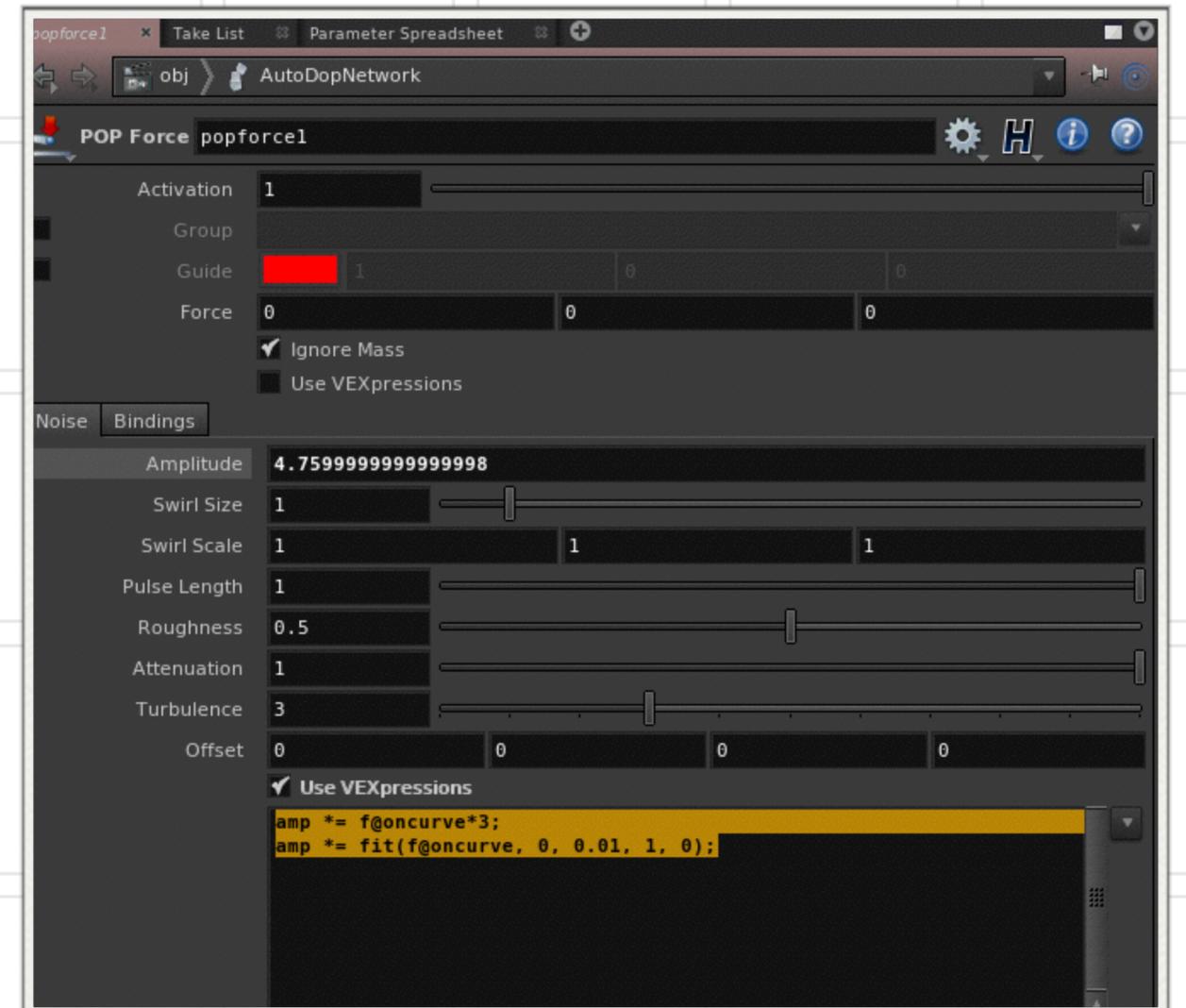
the curve force generates an attribute “onforce” that we can use later on with other forces

Another Vexpression

On the POP Force

```
amp *= f@oncurve*3;
```

```
amp *= fit(f@oncurve, 0, 0.01, 1, 0);
```





POP Interact

POP Interact dynamics node

A node that applies forces between particles.

POP Interact node applies a forces to particles based on their closest neighbors. This can be used to keep particles apart or to make them magnetic.

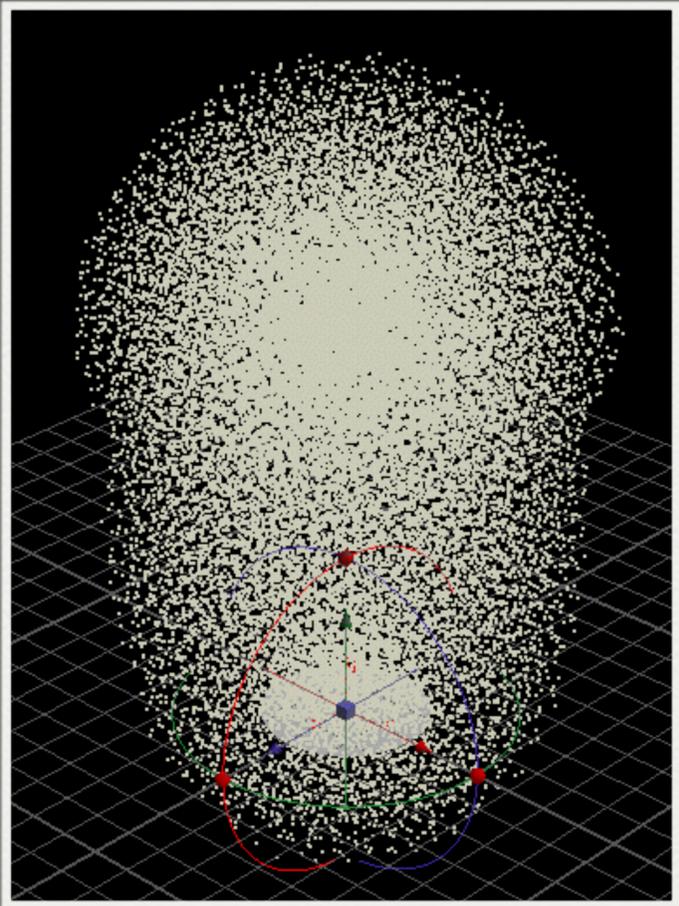
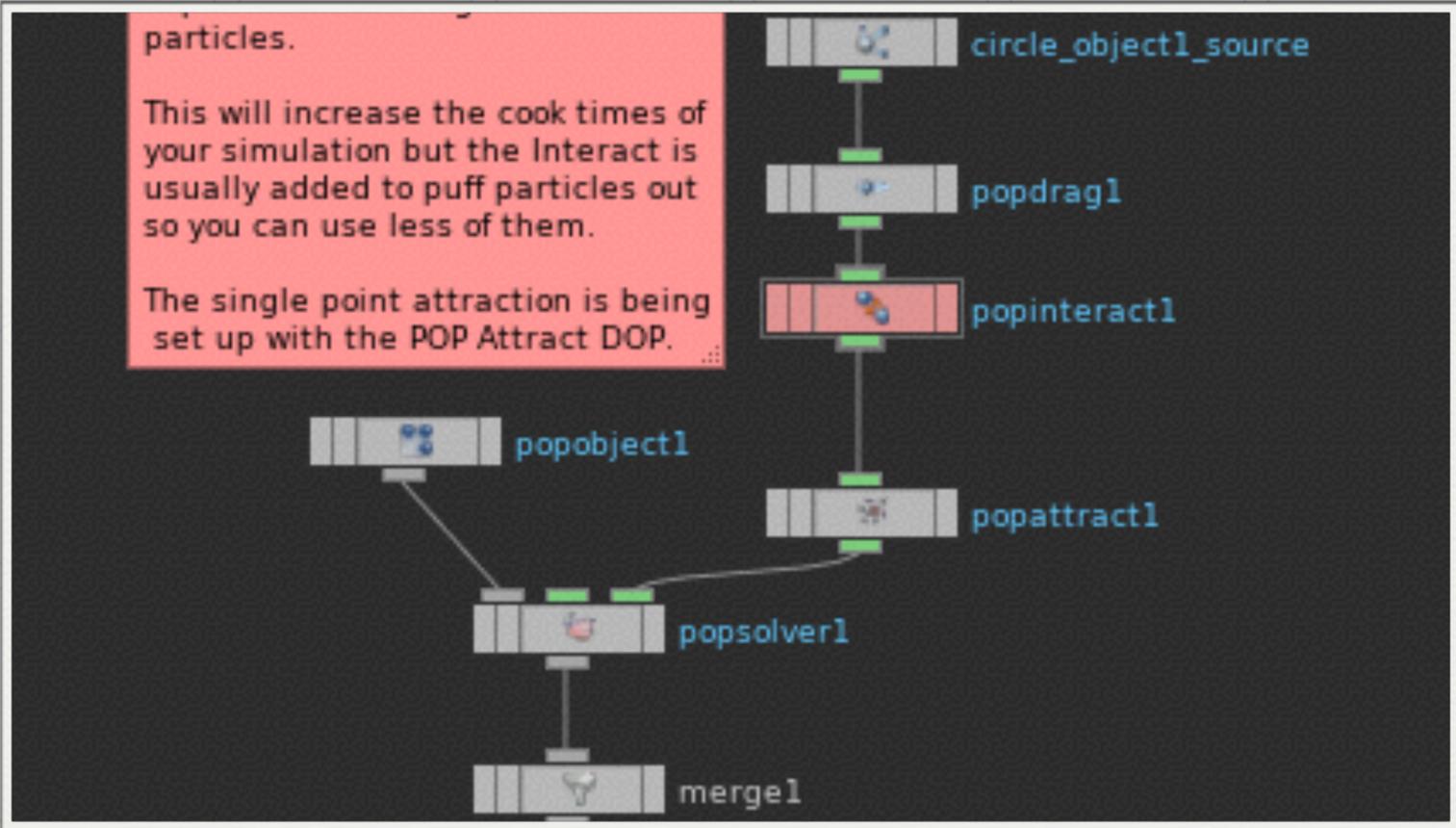
The operator modifies the `force` attribute.

How to use POP Interact

- 1. Create a particle system along the curve using the  `Location` or  `Source` shelf tools.
- 2. Click the  `Interact` tool on the **Particles** tab.

Make Particles Puffy

POP Interact



POP Attract



POP Attract dynamics node

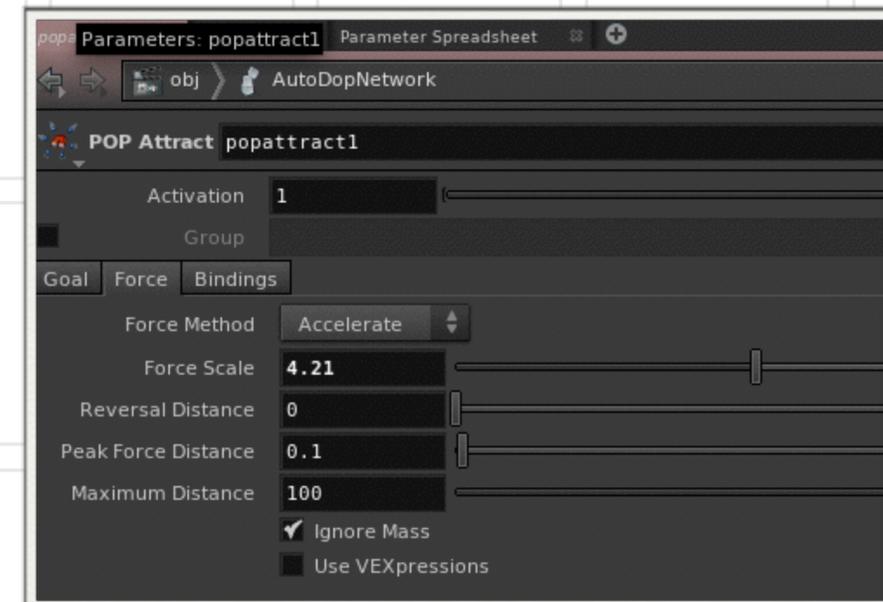
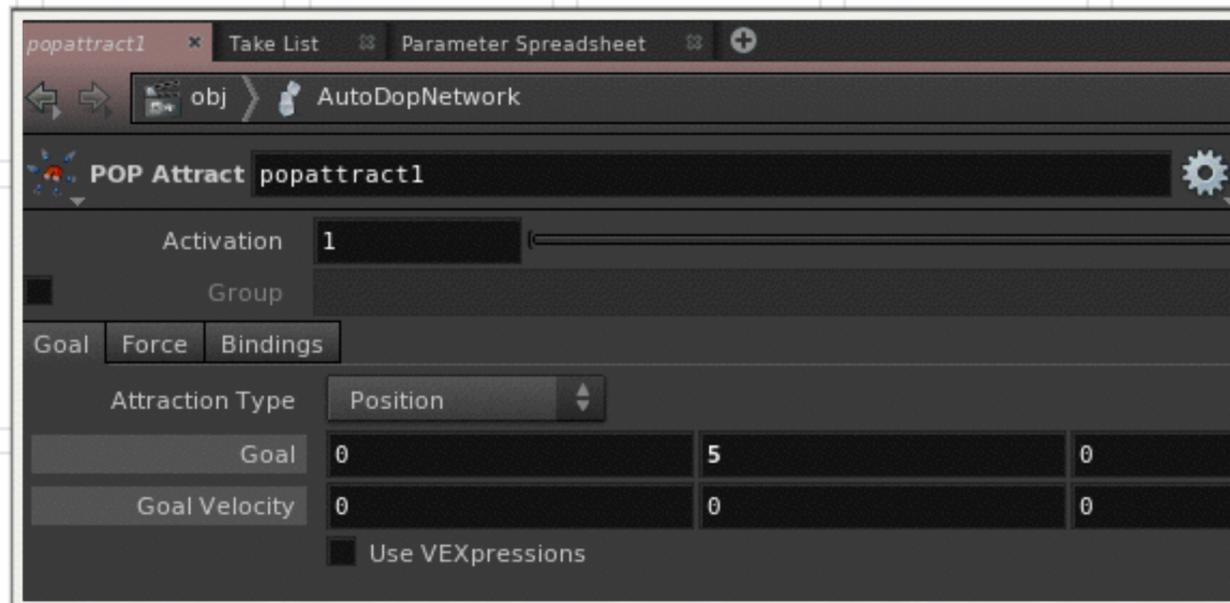
A POP node that attracts particles to positions and geometry.

The POP attract node applies a force to particles to steer them towards a target location.

This operator modifies the `force` attribute.

Using Point/Curve Attract

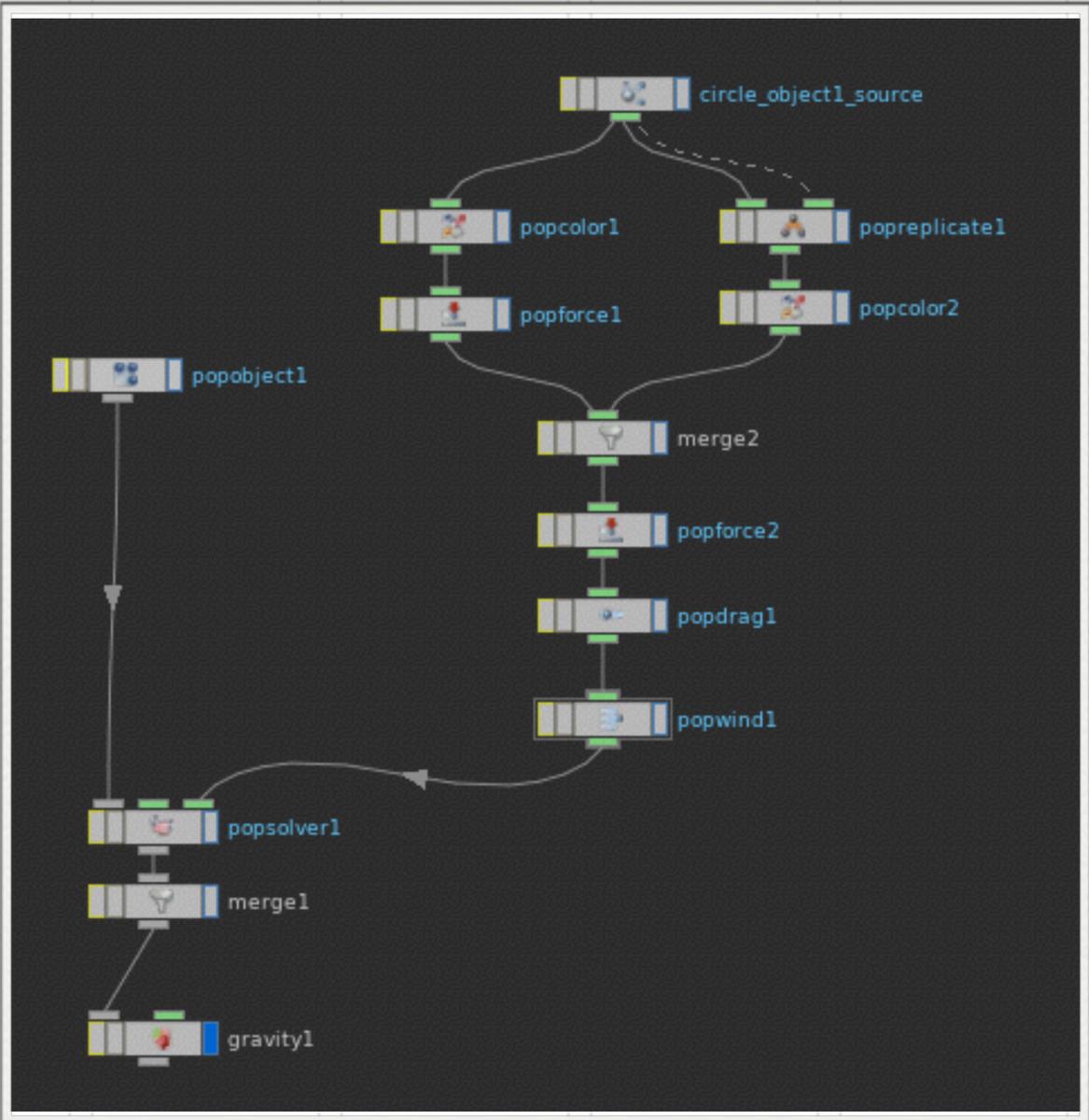
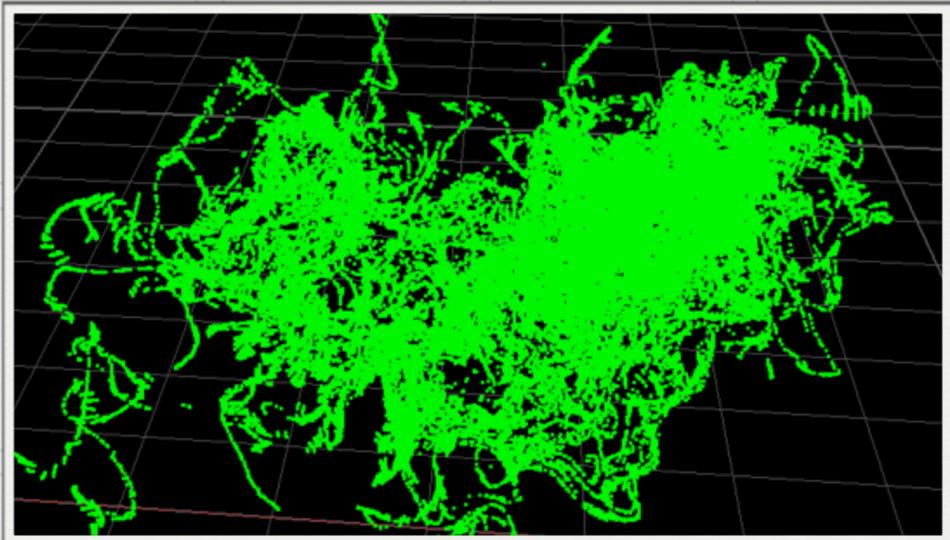
1. Create a particle system using the Location or Source shelf tools.
2. Select the particle system you want to be affected.
3. Click the Point Attract or Curve Attract tool on the **Particles** tab.
4. Select the object or curve you want to affect your particles.





POP Replicate

Overall Network



POP Replicate



POP Replicate dynamics node

A POP Node that generates particles from incoming particles.

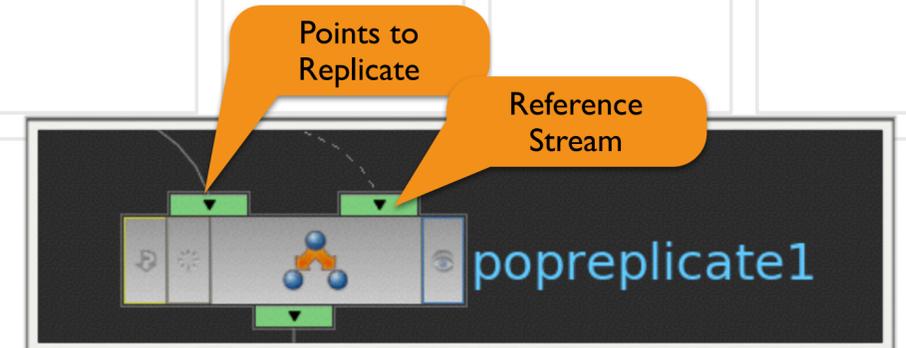
POP Replicate node designed generate particles for a POP network. It does this by replicating given particles in the input stream.

It uses the up-stream set of particles to generate a new stream of particles by replicating the source particles.

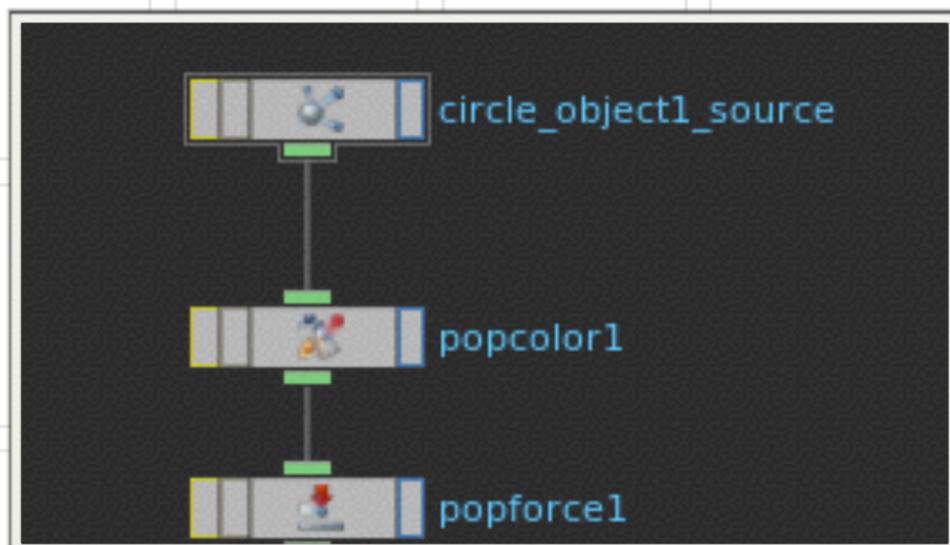
Using Replicate

1. Create a  particle system using the  Location or  Source shelf tools.
2. Click  Replicate on the **Particles** tab.

The particle system will attach itself to the particle system you have selected.
3. Click  play on the **playbar** to see the particles.



Setup



At the Object Level Drop down a circle in the zx axis and make it a particle source

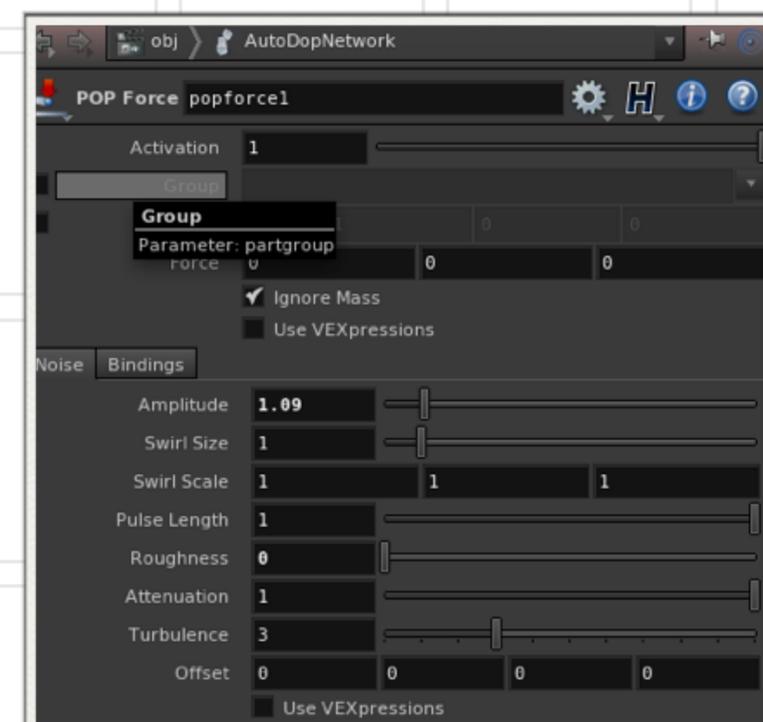
Dive into the AutoDOP Network

Append to the POP Source a POP Color and a POP Force

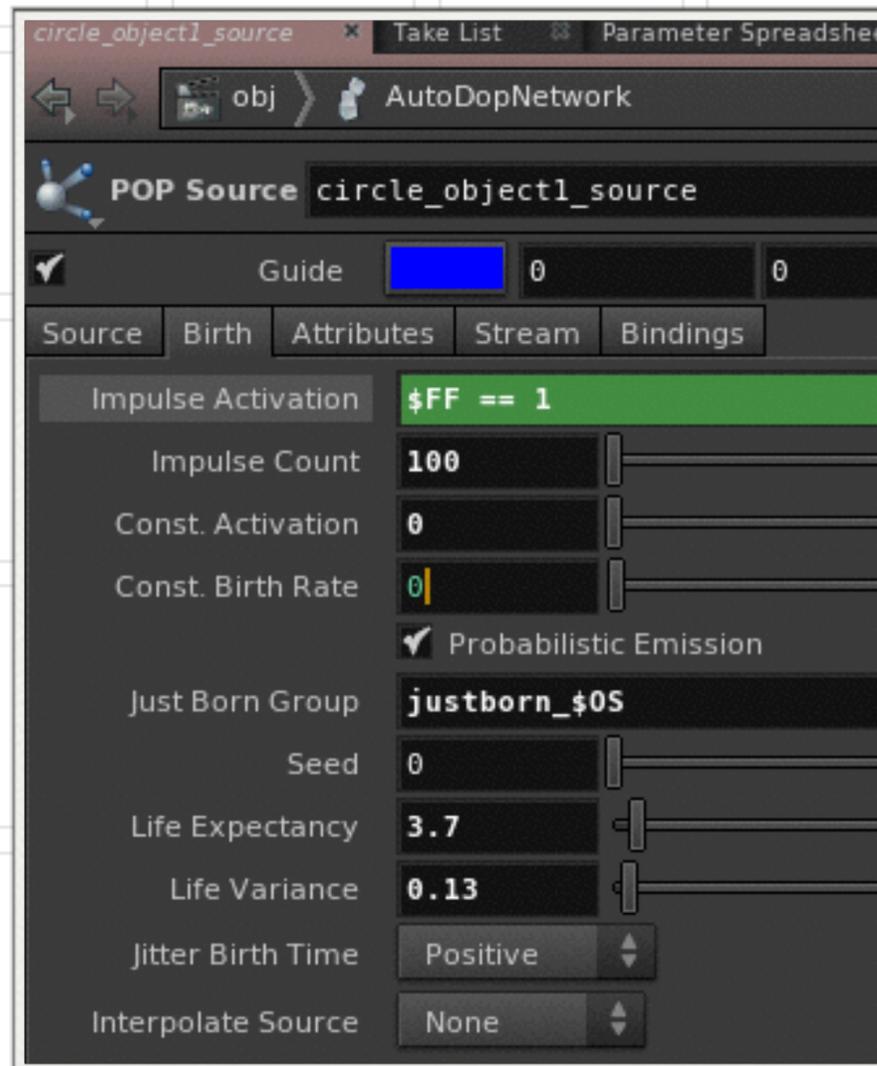
color - red

amp = 1.1

turb = 3



Birth Setup

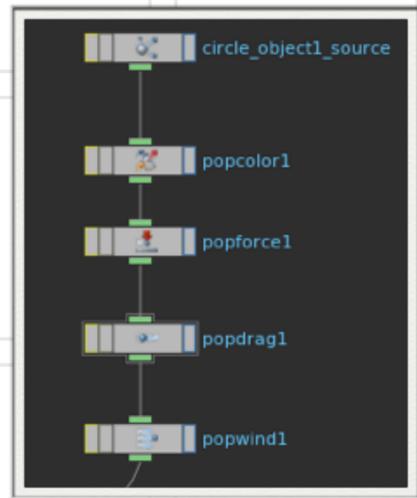


Notice Particles are created just on Frame 1

The Life Expectancy is around 4 seconds

We create a “Just Born Group” called `justborn_$OS`

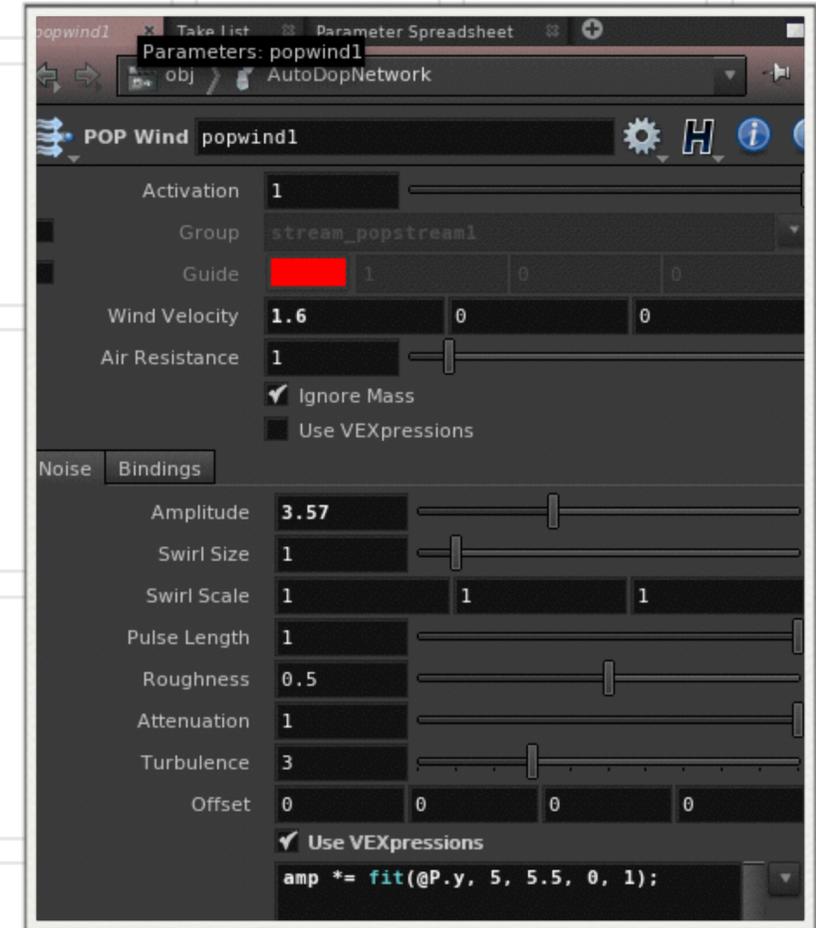
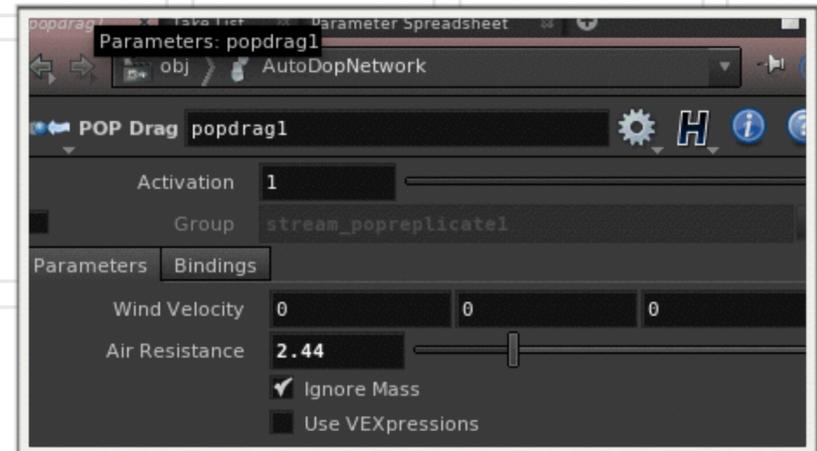
Drag and Wind



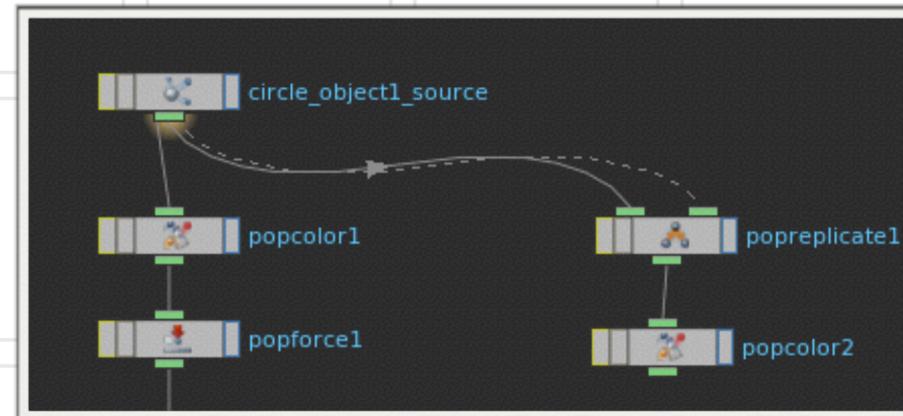
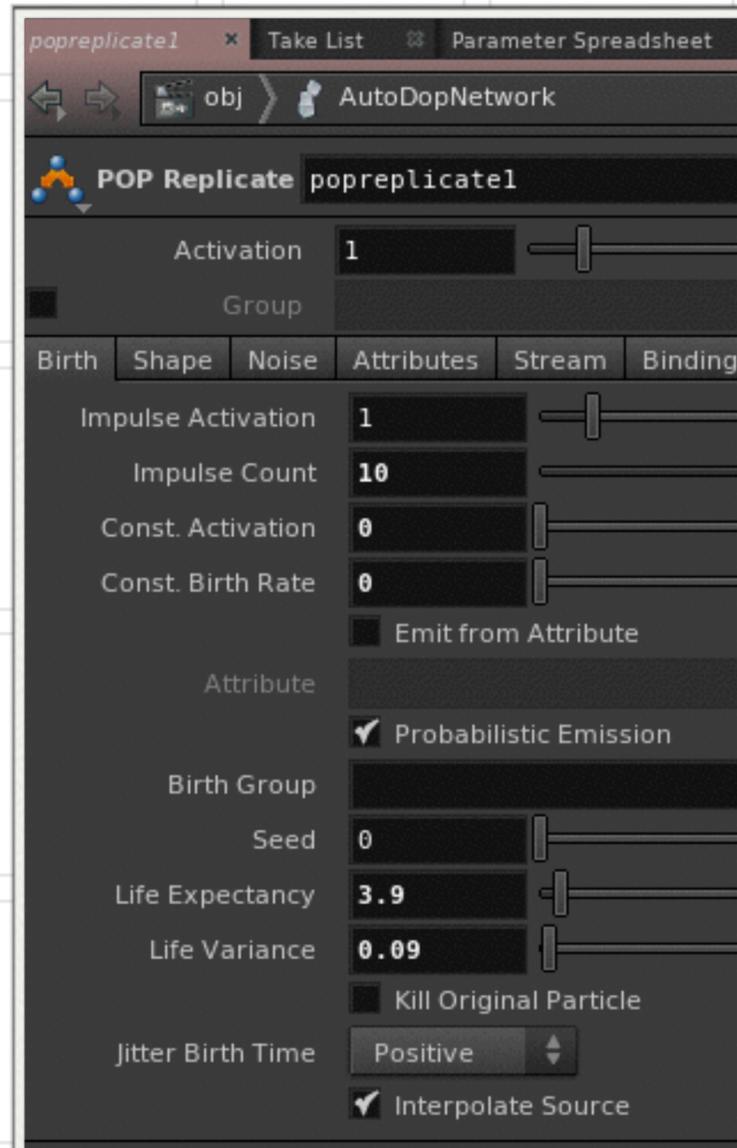
To the POP Force append a POP Drag

Also Append a POP Wind

Run the sim



POP Replicate

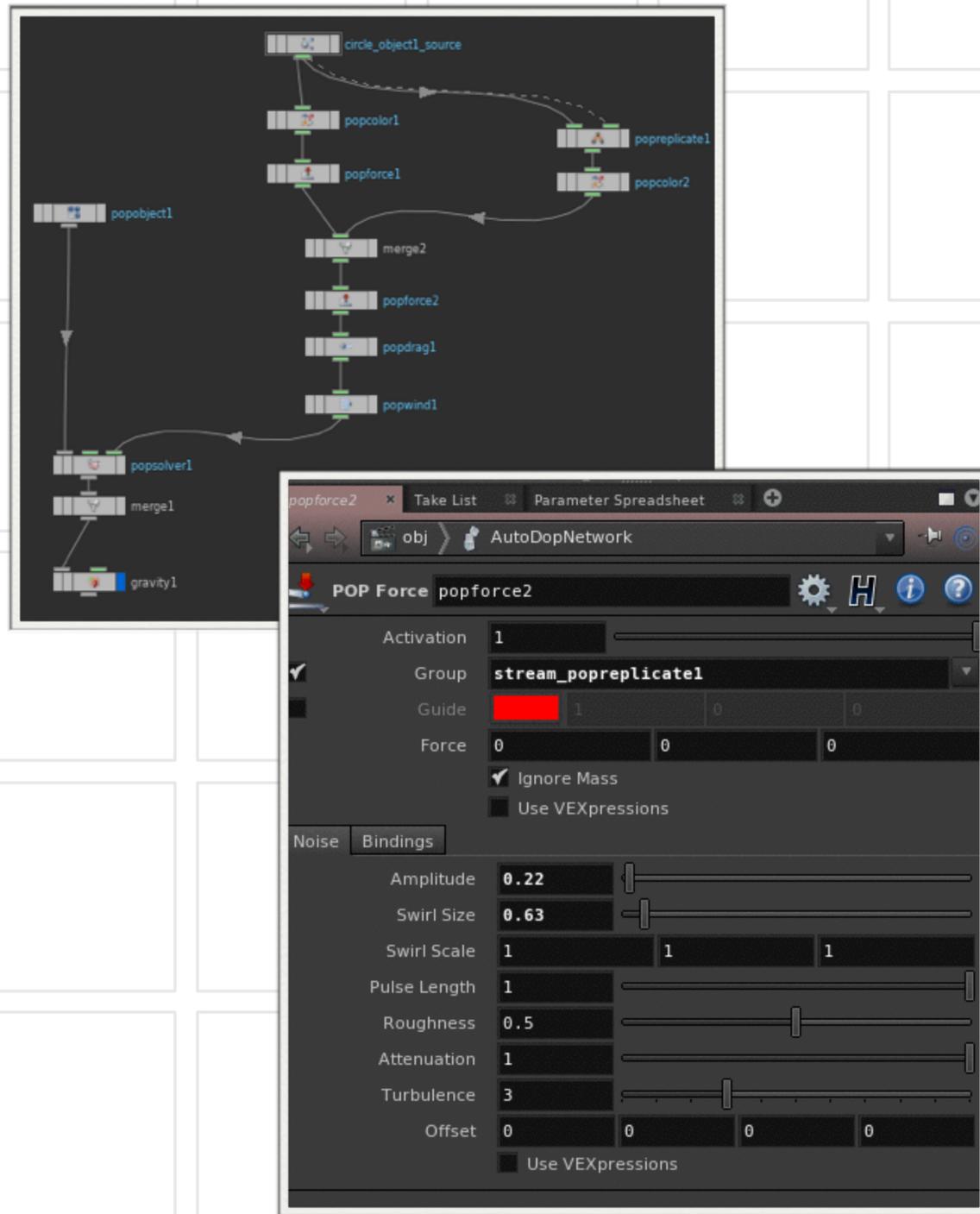


Split off from the POP Source a POP Replicate

Notice we are using the POP source as both the point source and reference stream to the replicate

Append a POP Color - green

POP Replicate (cont.)



Append a merge to the pop drag and merge the POP Color

Notice we are using the POP source as both the point source and reference stream to the replicate

Append a POP Force to the merge. We need some more noise. Notice we are only applying noise to the Replicate Group

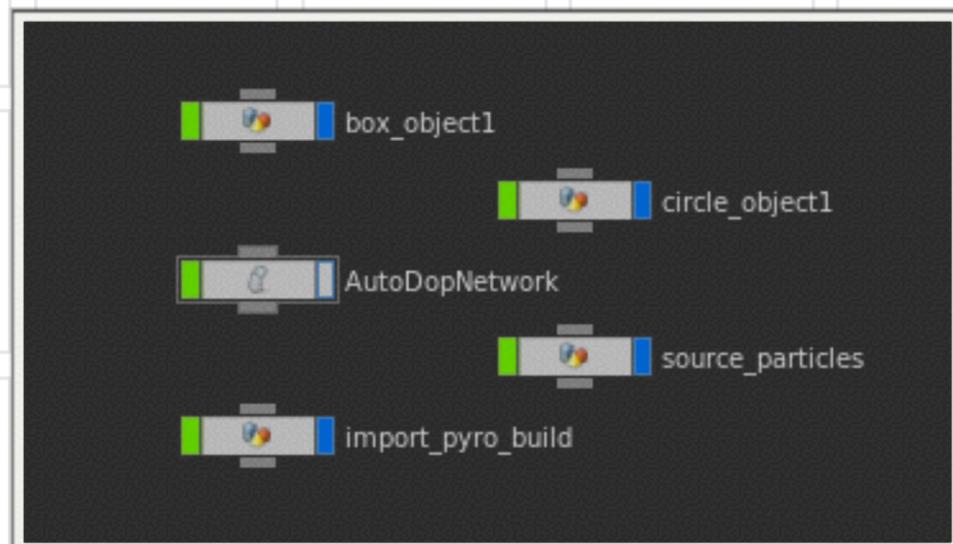
Notice I moved the Drag to after the Merge



Advecting Particles with Smoke

This is Cool

Setup



Drop down a box

Apply wispy smoke to it

Drop down a circle

Apply a Particle Source to the Circle

Run the sim

POP Advect Volumes



POP Advect by Volumes dynamics node

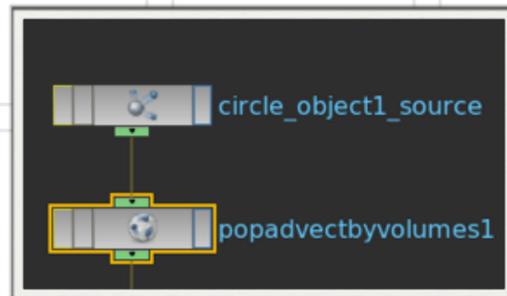
A POP node that uses velocity volumes to move particles.

The Advect by Volumes POP is designed to make it easy to advect a particle system by a fluid simulation. Often the fluid simulation will be simulated as a separate pass and the velocity fields read off disk. However, the particles can be live-linked to an existing simulation.

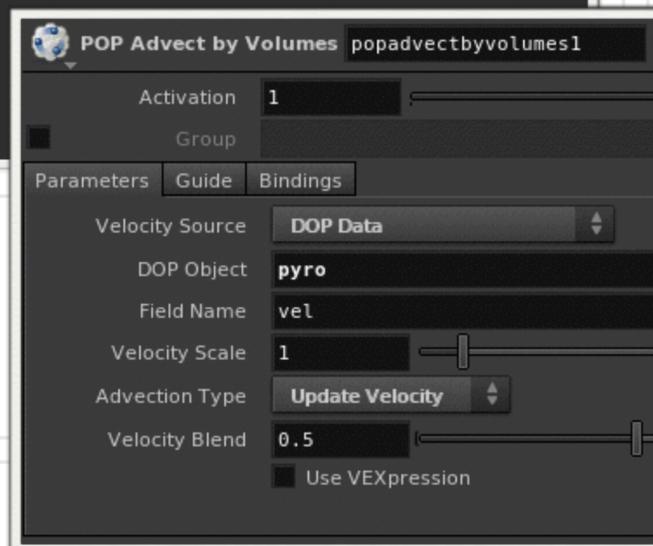
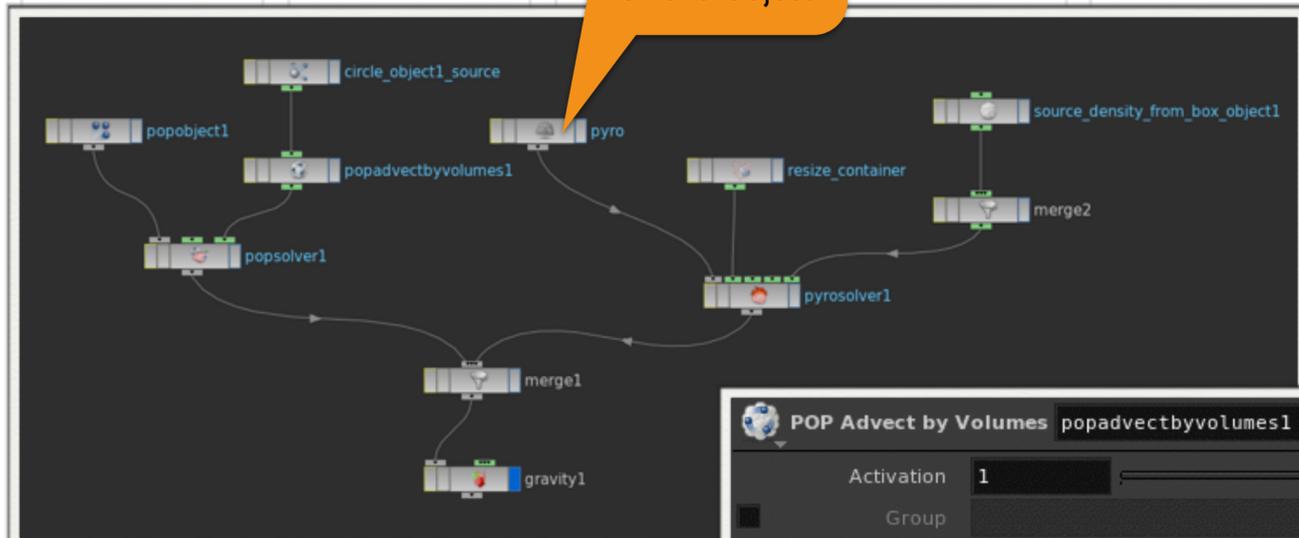
This operator modifies the **force**, **vel**, and **P** attributes.

Parameters

POP Advect Volumes (cont.)



Smoke Object



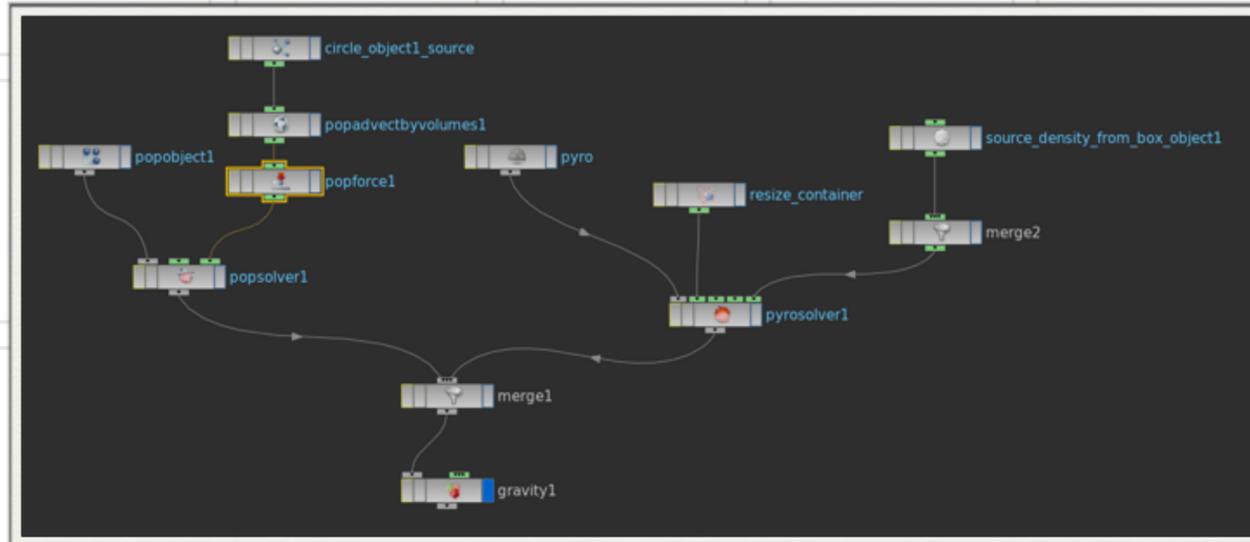
Append a POP Advect Volume to the particle source

Notice the Smoke Object in the AutoDOPNetwork named "Pyro"

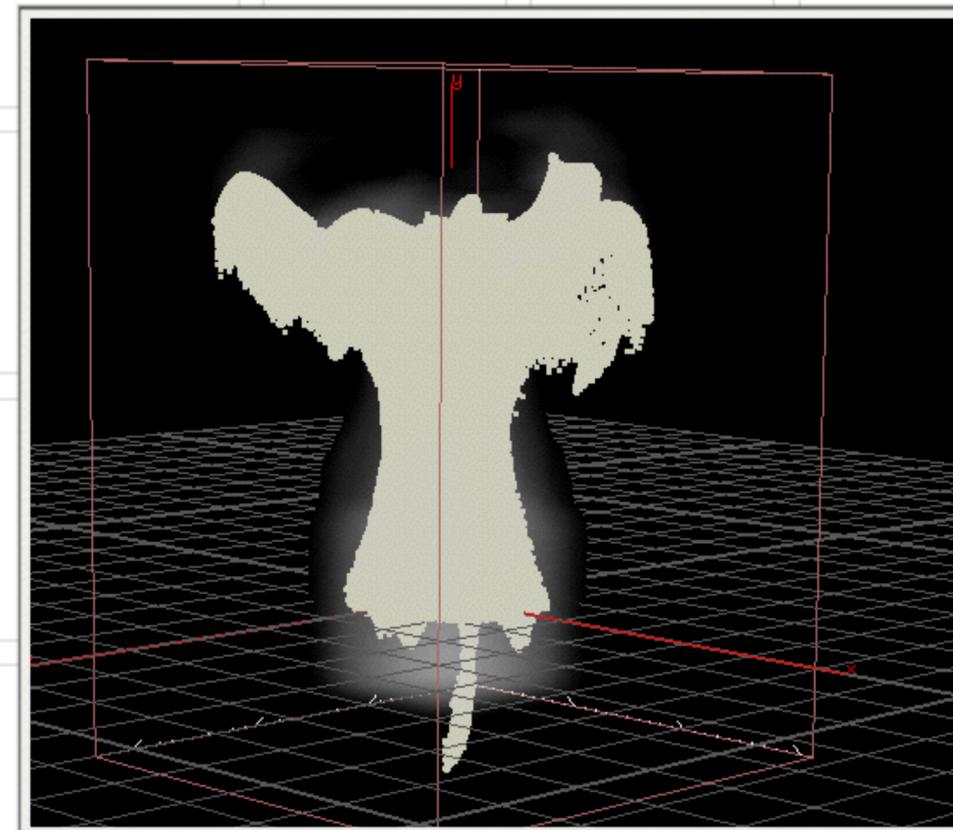
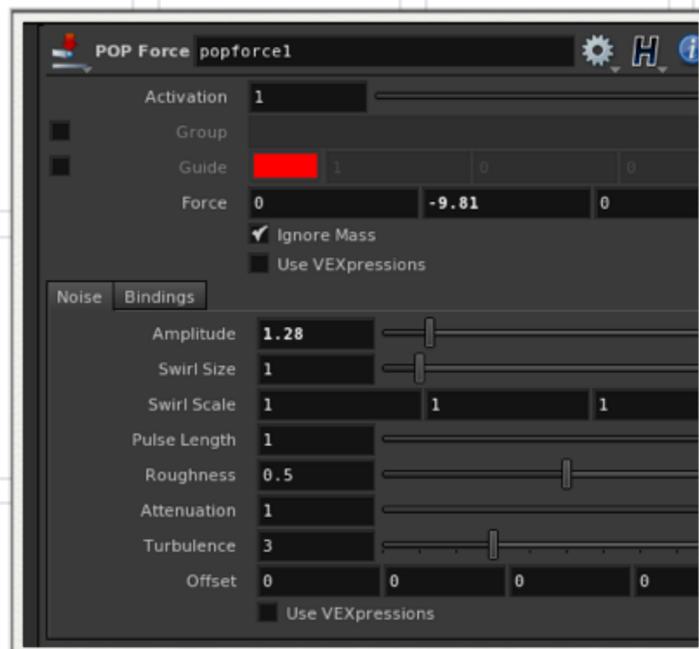
The POP Advect needs to know what type is the velocity source. In our case "DOP Data" and the DOP Object "Pyro"

Run the simulation

Add Some Noise



Append a Force SOP and add some Curl Noise
Run the simulation





POP Bullet

Using a Bullet Source for Advecting Particles

Setup

Create a Grid - 50 rows and 50 columns

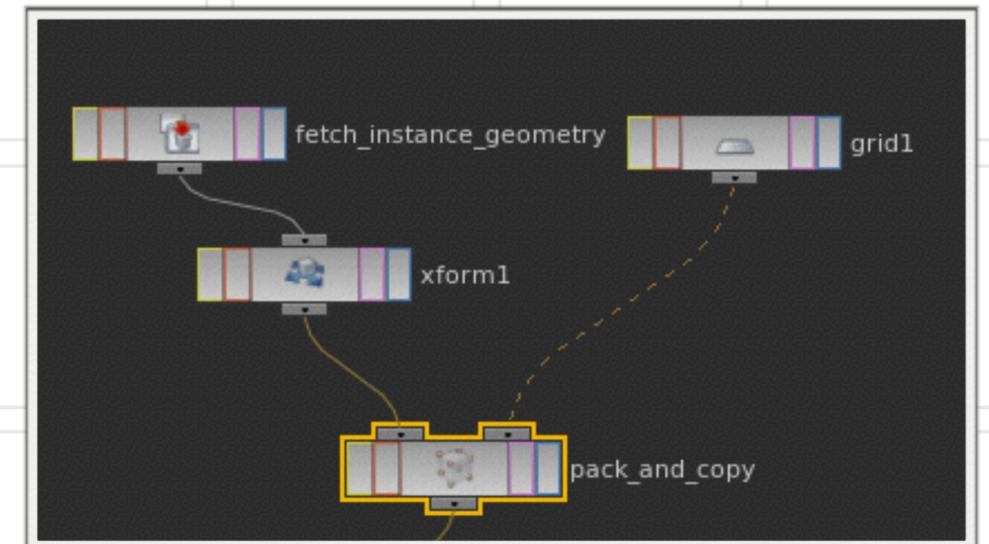
Create a Box

Dive inside the grid and add an Object Merge

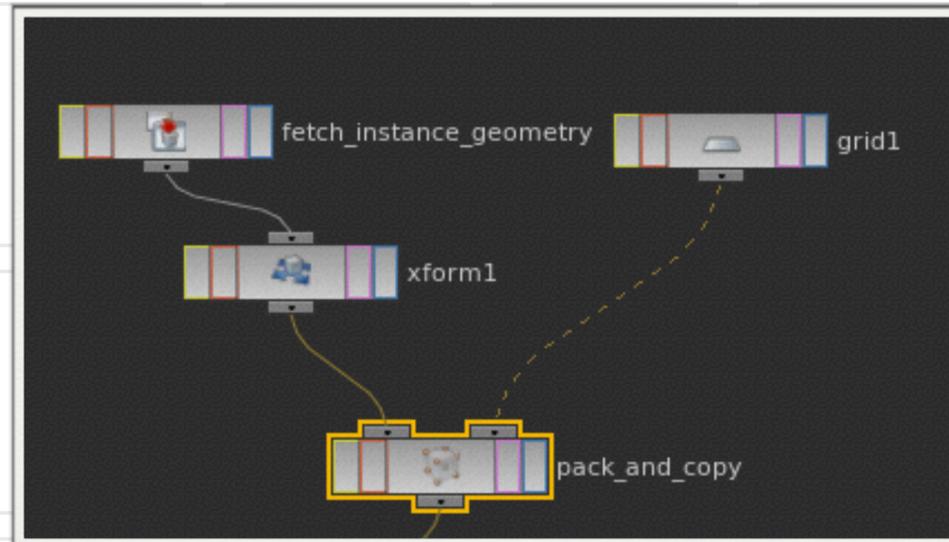
Bring in the Box

**Copy the Box and use a Pack Geometry before COPY
in the Stamp tab**

Transform the box so it fits nicely



Setup (cont.)



for this sim to work each box must have a unique name
append an attribute wrangle

Run Over - points

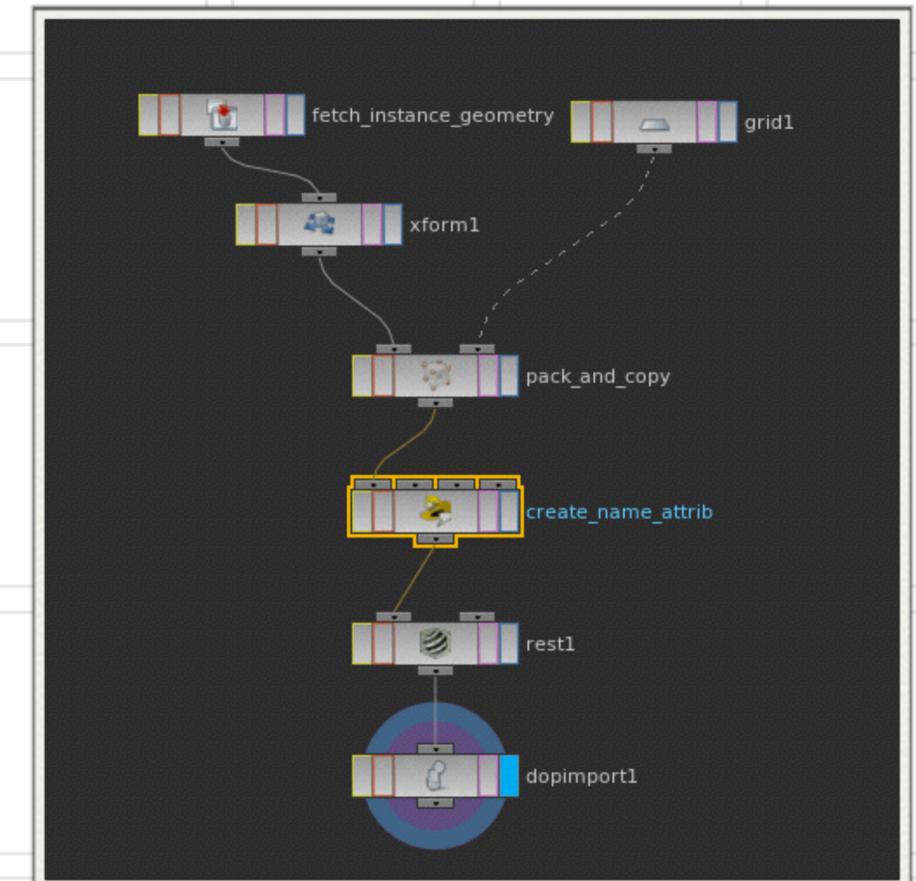
We have to create a string parameter called "prefix"

name - prefix, Label -prefix

Value of prefix is `opname("../")`

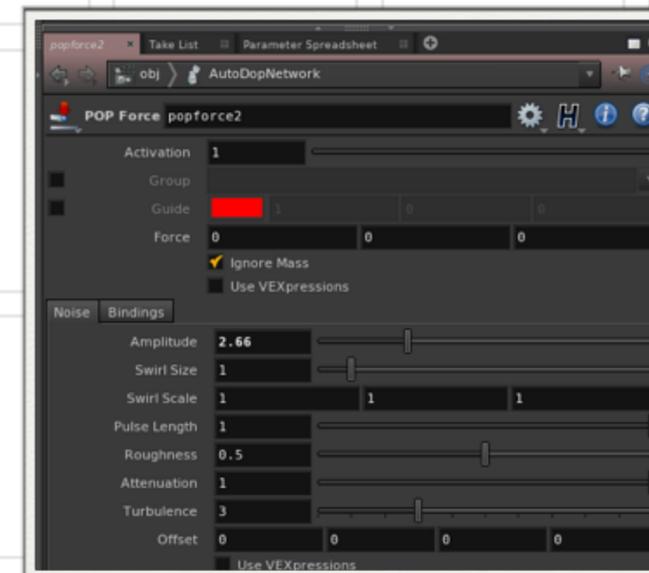
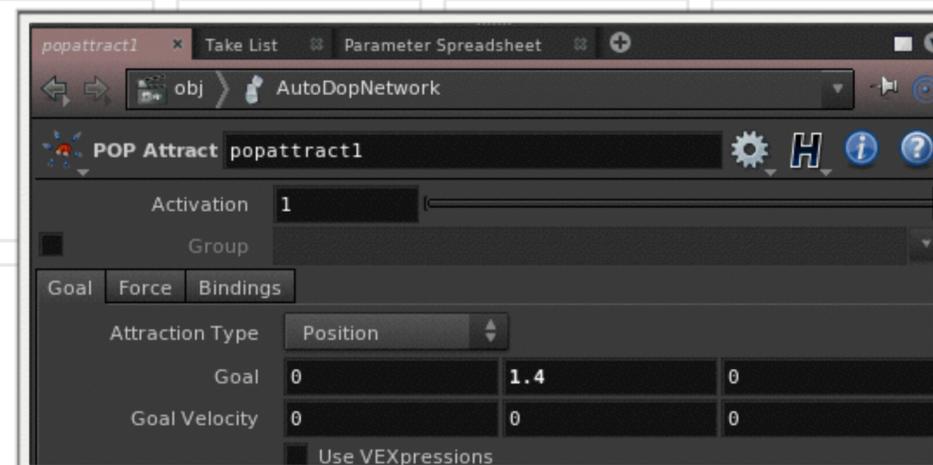
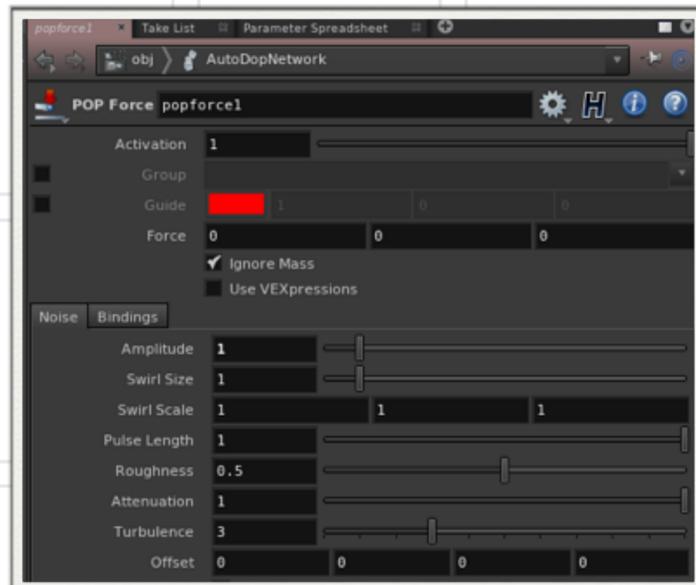
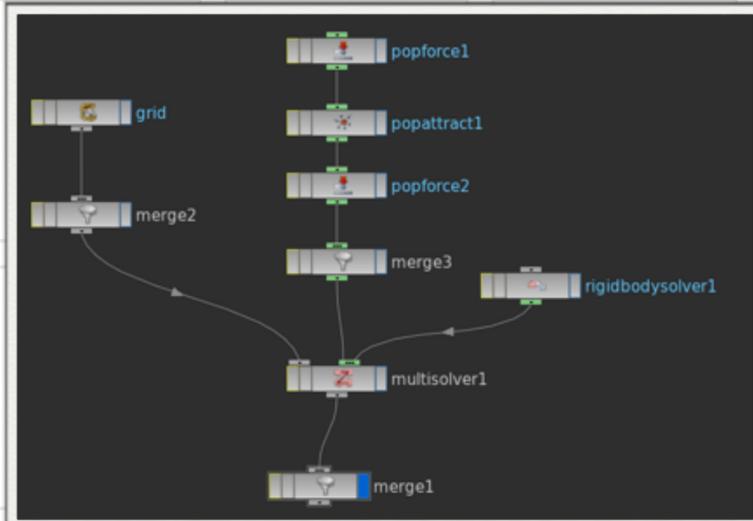
```
s@name = concat(chs("prefix"), "_", itoa(@primnum));
```

Go to the object level and make the Grid an RBD

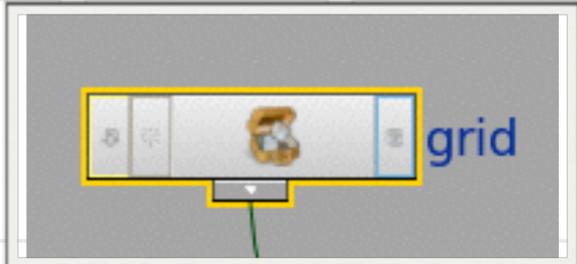


AutoDOPNetwork

We are going to use a multi solver and apply POP forces to it
Rearrange your network to match the network on the left
Use a POP Attract to bring the cubes up
Use forces to add noise
Run Sim

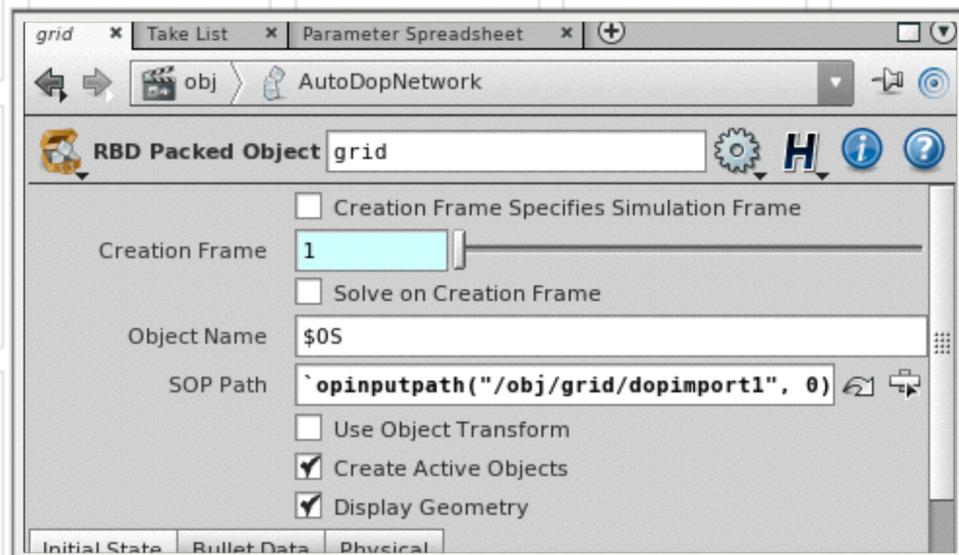


AutoDOPNetwork (cont.)



The RBD Object does not work because we used “pack before copy”

Replace the RBD Object with a RBD Packed Object





End M07