



Next Steps: Houdini Procedural Modeling

M08: Developing Assets for a Project

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Goal of this Module

- ▶ An Approach to Asset Development
- ▶ Breaking Down a Large Model into Functional Units
- ▶ Calculate Curvature of the Terrain
- ▶ Building the “Hero” Whiskey Barrel
- ▶ Building a Versatile Wheel Spoke Asset

Agenda



- ▶ Look at reference Material for a Steam Punk Horseless Carriage
- ▶ Look at References for Old Cars
- ▶ Build a Whiskey Barrel
- ▶ Build a Wheel Spoke Asset

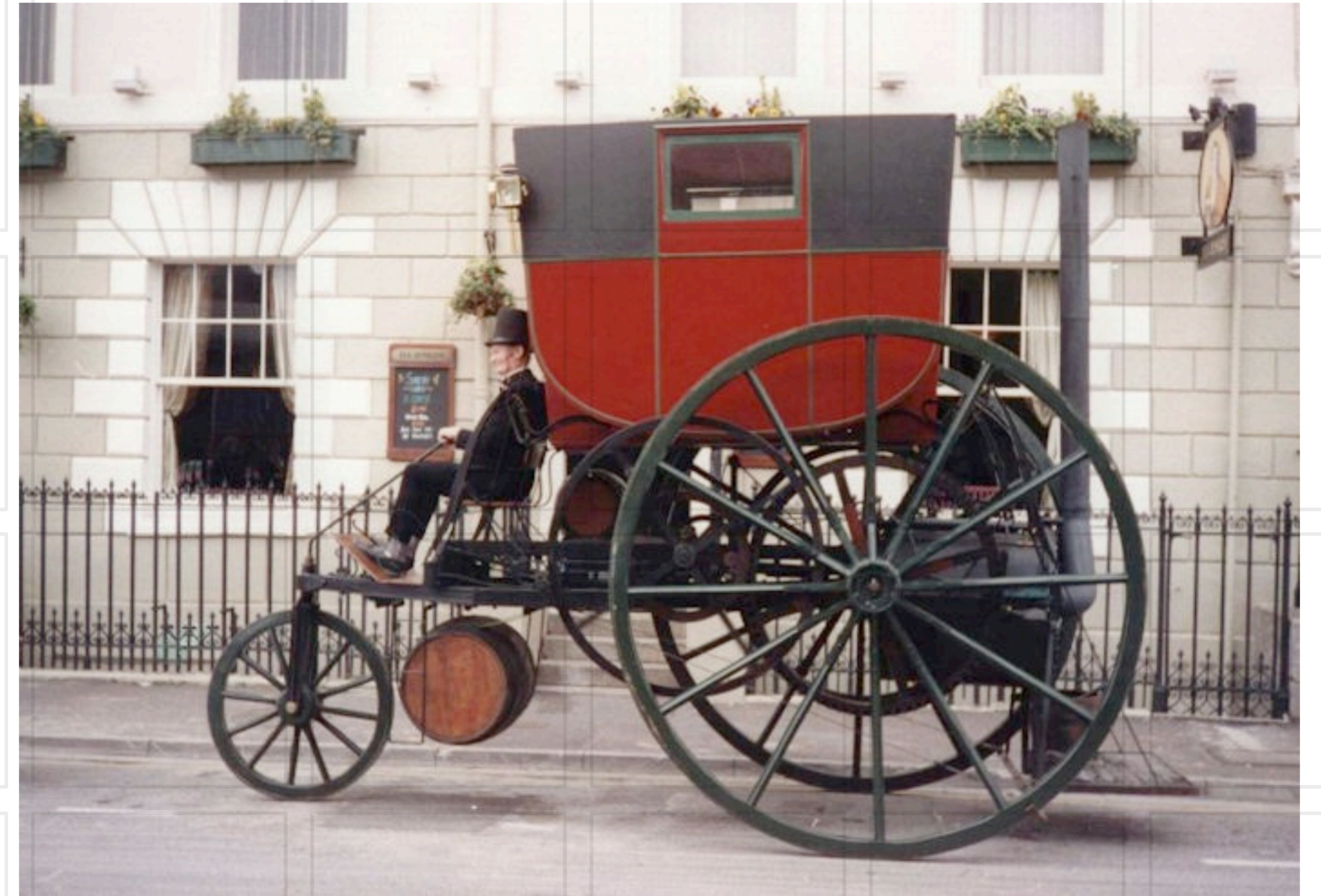


Reference Material

For Steam Punk Horseless Carriage

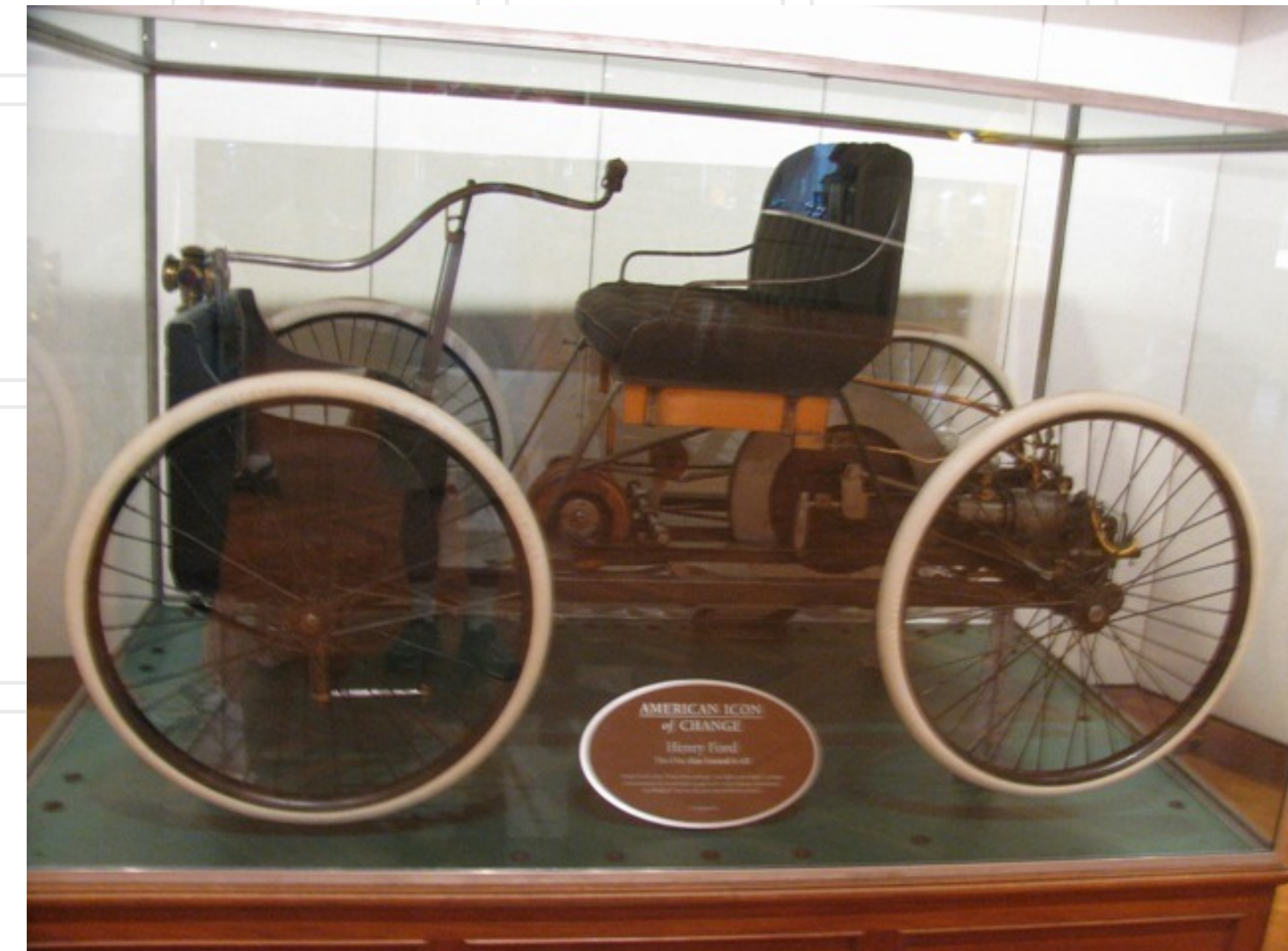
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Reference Material



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Reference Material (cont.)



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Making the Whiskey Barrel

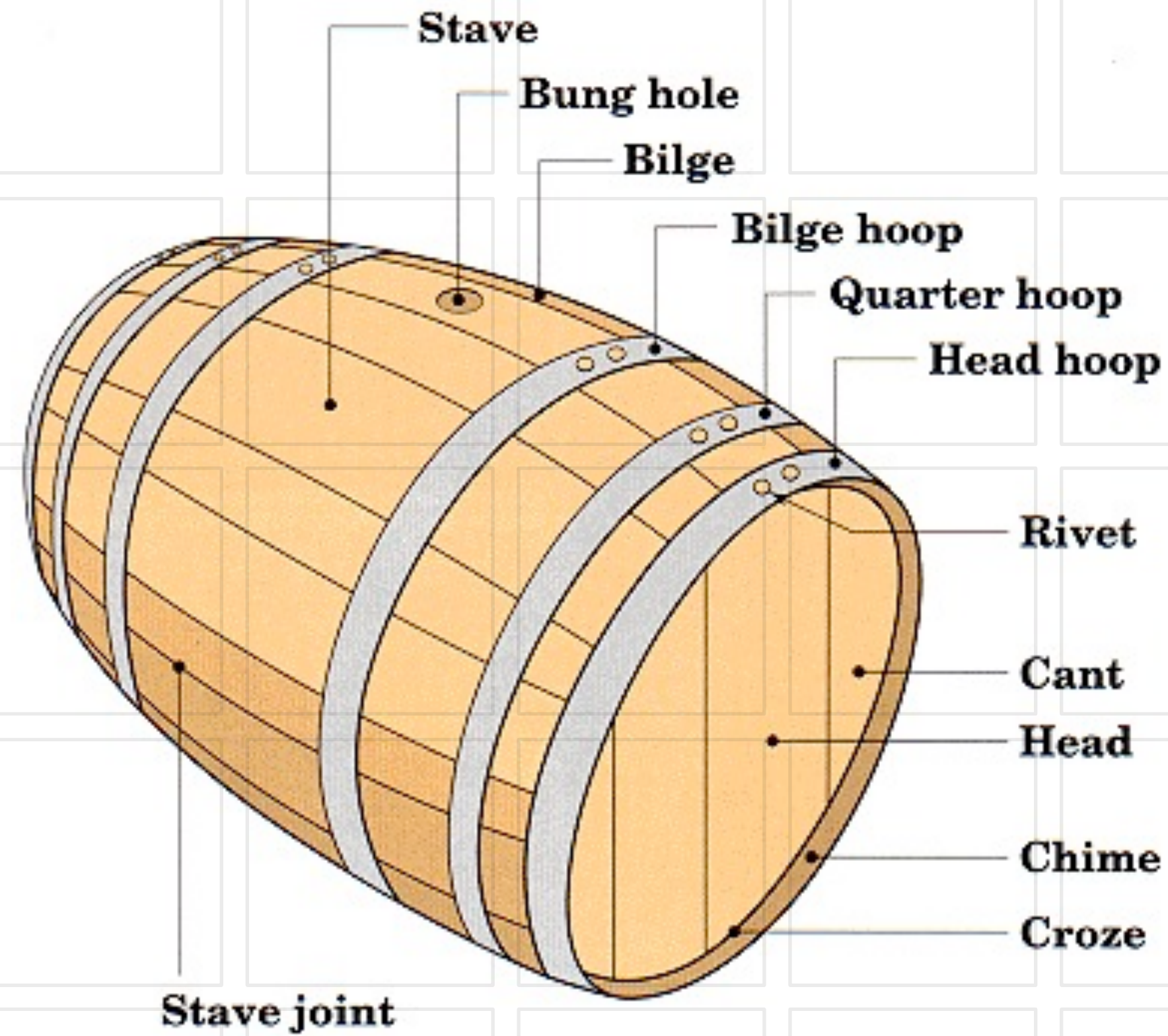
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Reference Material for Whiskey Barrel

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Anatomy of a Whiskey Barrel



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Whiskey Barrel Reference



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Requirements

Barrel

- ▶ Heads or No Heads Toggle
- ▶ Variable Barrel Head Radius Opening

- ▶ Curvature of Barrel

Staves

- ▶ Number of Staves
- ▶ Size of Stave Gap
- ▶ Random Stave Gap

Bung Hole

- ▶ Radius
- ▶ Visibility

Hoops

- ▶ Width
- ▶ Depth
- ▶ Visible or Hidden per Hoop

Materials

- ▶ Staves
- ▶ Hoops
- ▶ Heads

Get it Right, Then Get it Tight...

In Programming there is a concept when writing code. First you right the code and make sure the features work. Only when it works to you go back and optimize for speed, memory, and elegance.

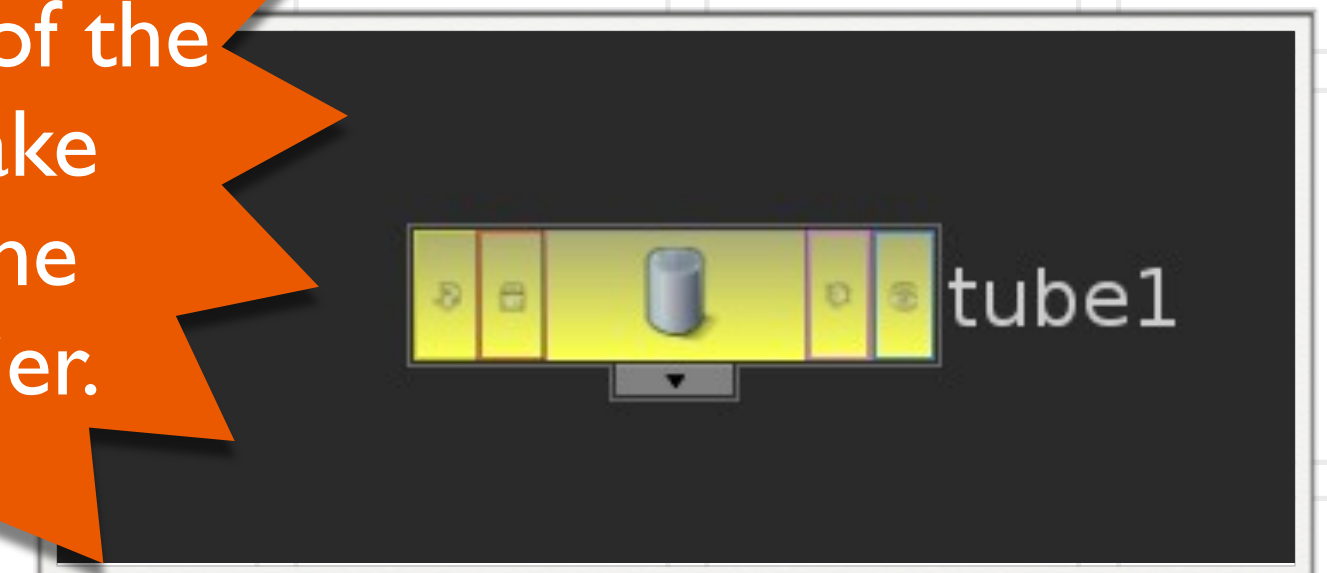
We will be following the same principles for this project. We will slap together a barrel. In art this will be the “ugly phase.” Then we will go back and refine it to make it elegant.

Roughing Out the Barrel

- ▶ Drop down a Geometry Object and rename it “Barrel”
- ▶ Dive Inside
 - ▶ For now since we are just roughing the barrel out give it some constants
 - ▶ Primitive Type - NURBS
 - ▶ Height - 1 (This will always be constant)
 - ▶ Radius 03, 0.3
 - ▶ Center - 0, 0.5, 0 (This will also be constant)

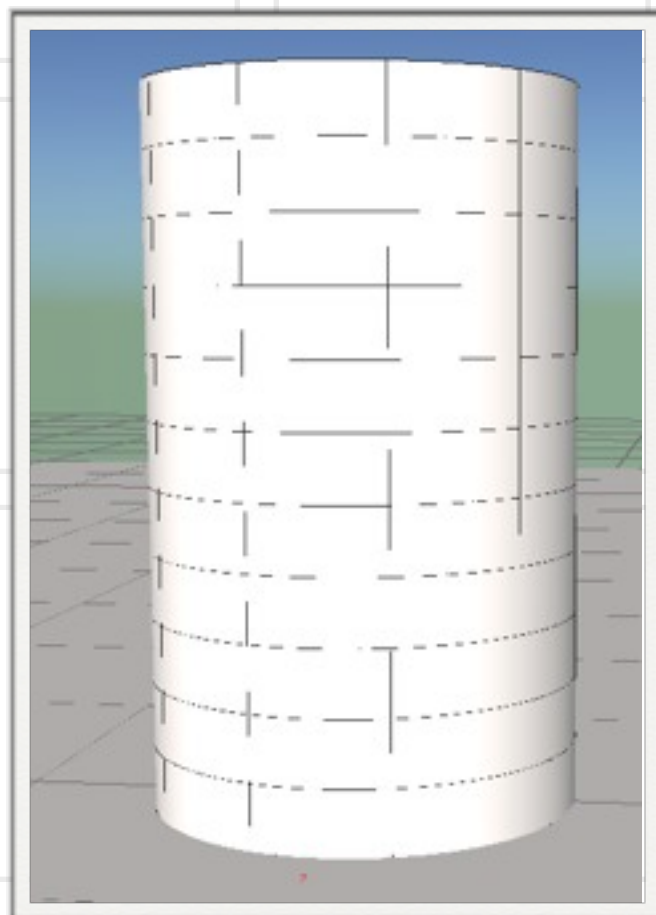
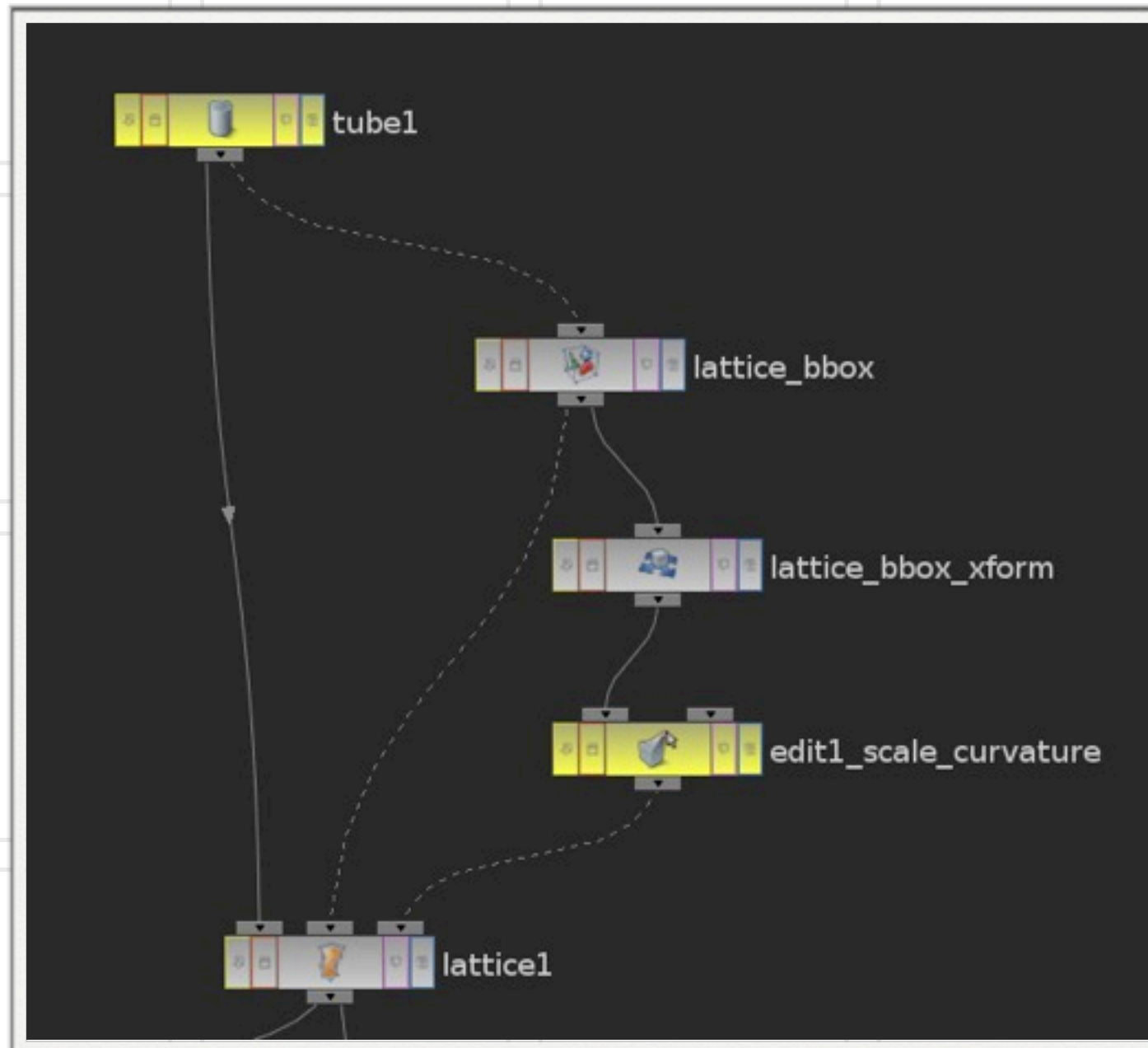
Remember to Color Code your Node Yellow so you will remember you want some parameter in the Digital Asset

Remember to Scale with Unity in Mind. The Height of the Tube is 1 to make scaling down the road much easier.



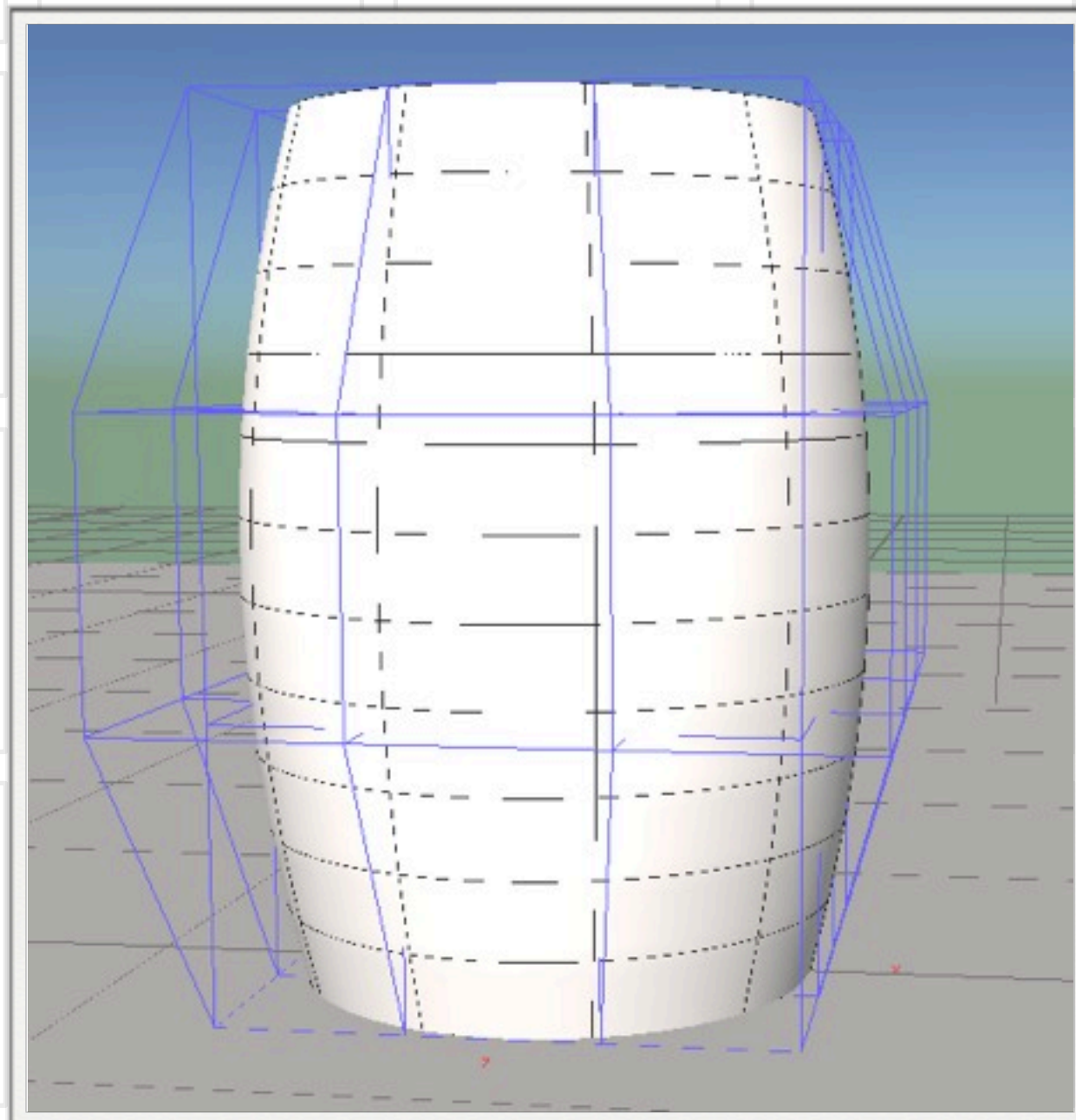
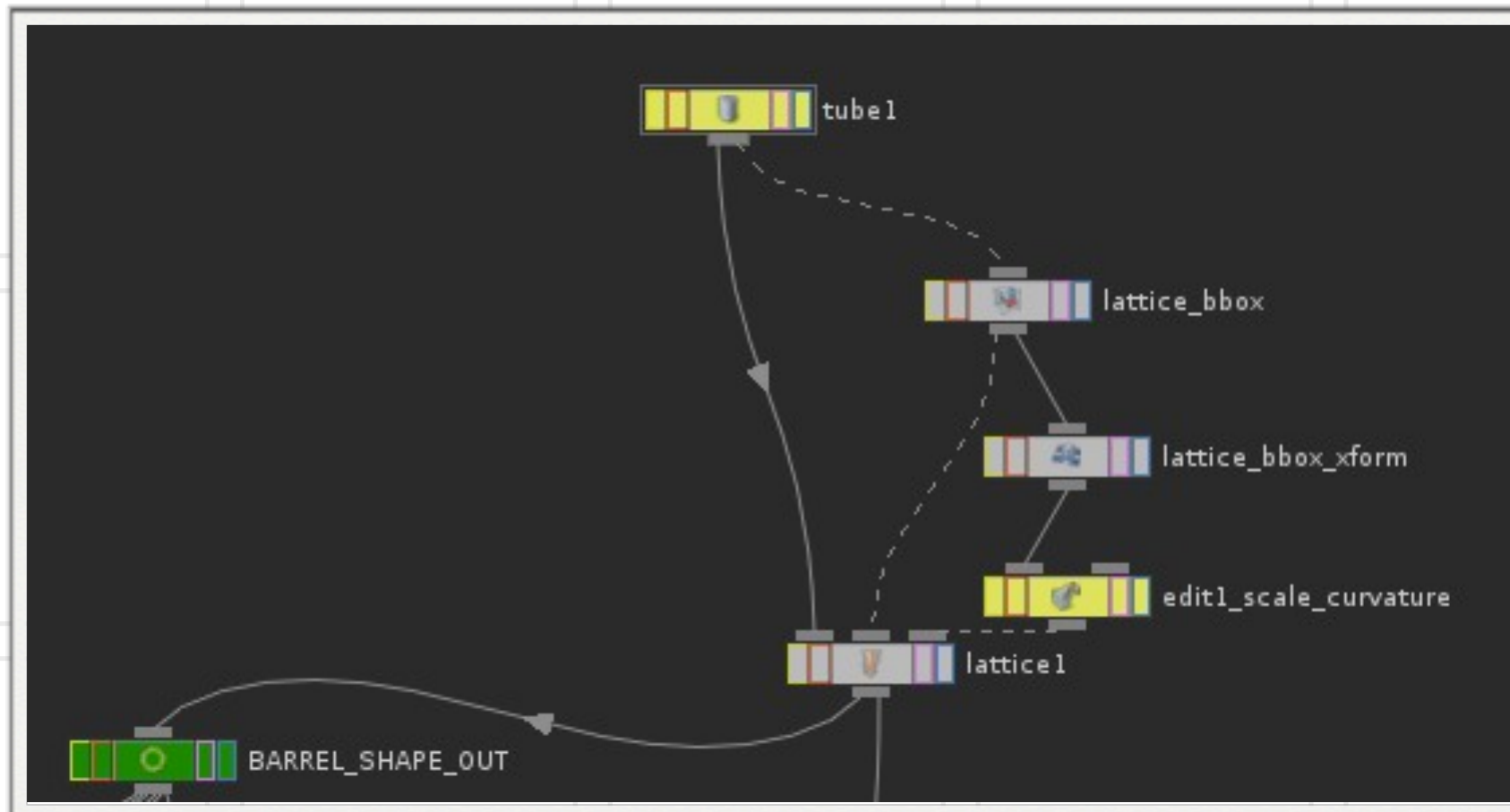
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Roughing Out the Barrel (Cont.)



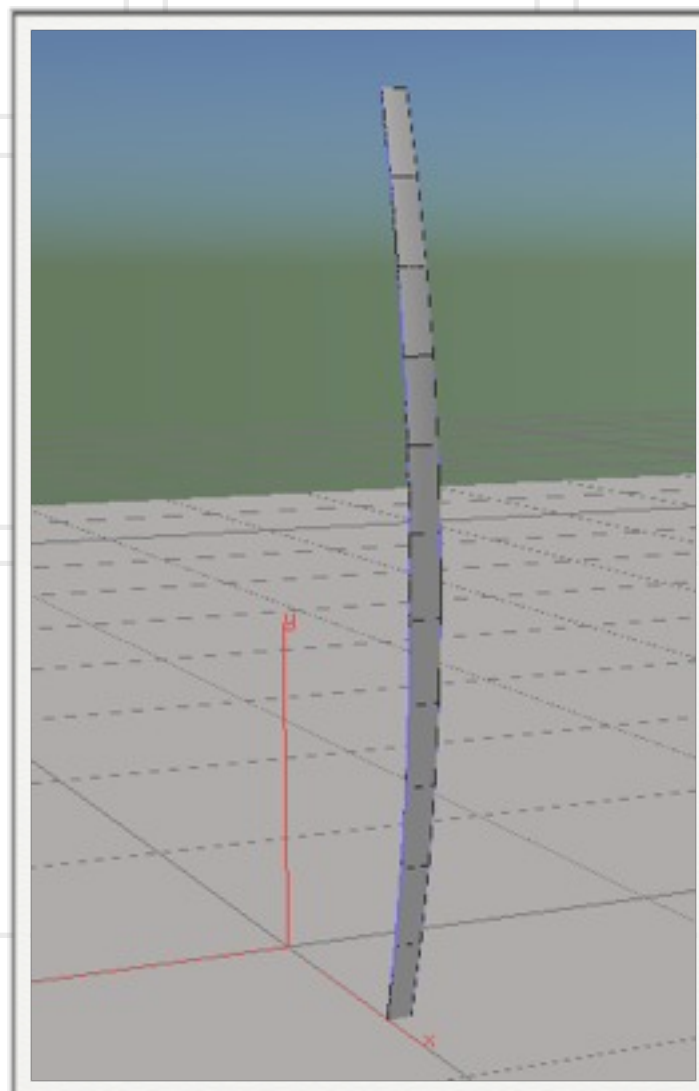
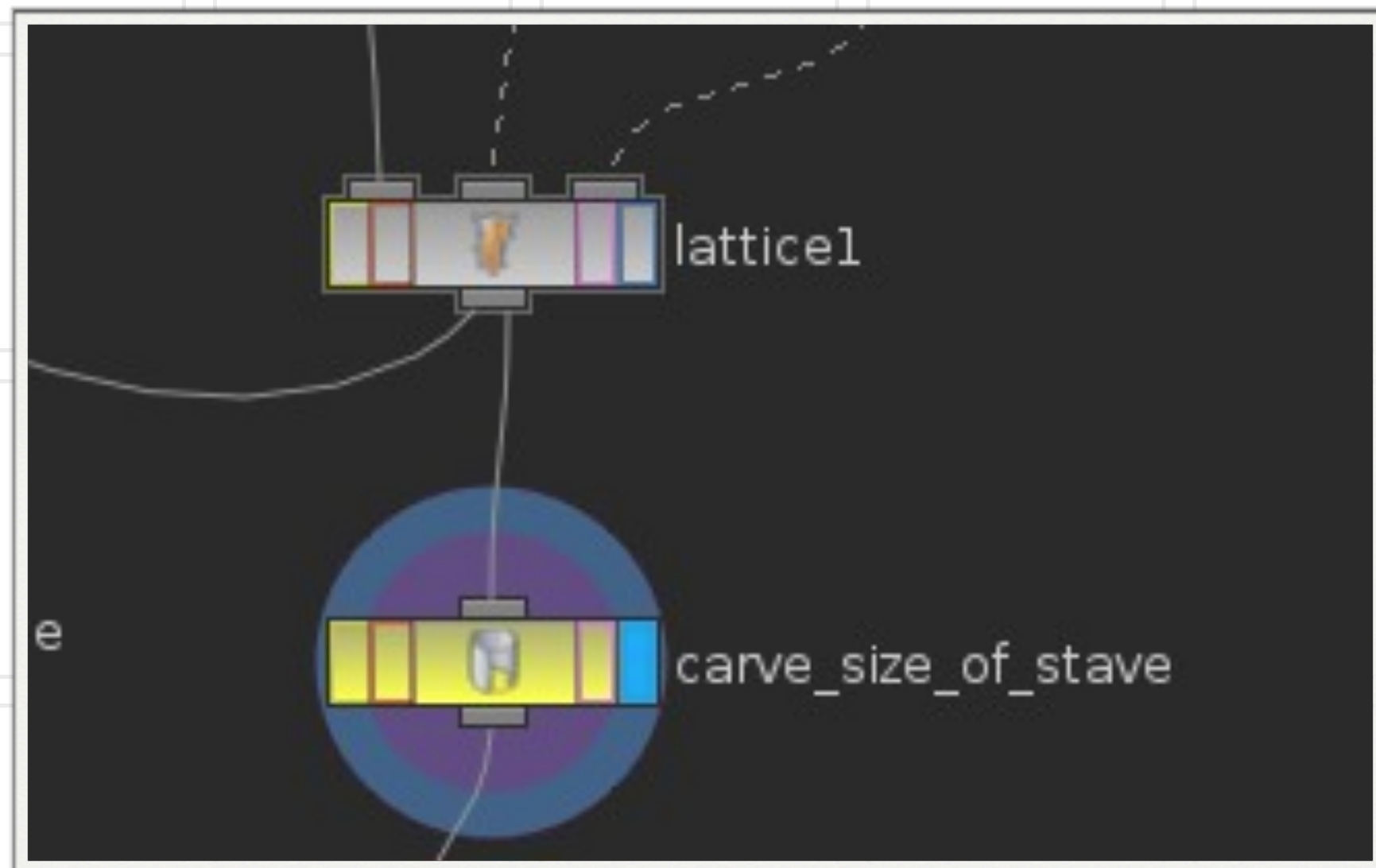
- ▶ With the Tube Selected
 - ▶ Select the Lattice Deformer Tool in the Deform Tab of the Shelf Tools
 - ▶ Drag a Marquee around all the points of the Tube to select them
 - ▶ Hit Enter
- ▶ Three Nodes are Added to Your Network
 - ▶ Lattice BBOX, Lattice BBOX XFORM, and Lattice
- ▶ Select the Lattice BBOX XFORM
 - ▶ continued on next slide...

Roughing Out the Barrel (Cont.)



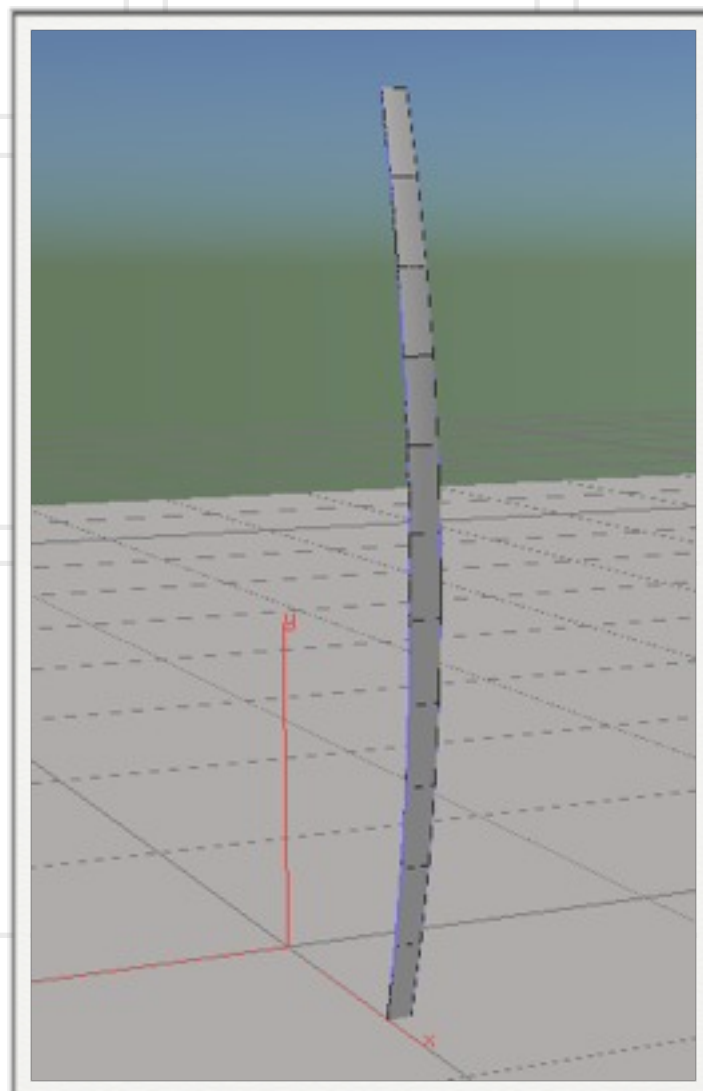
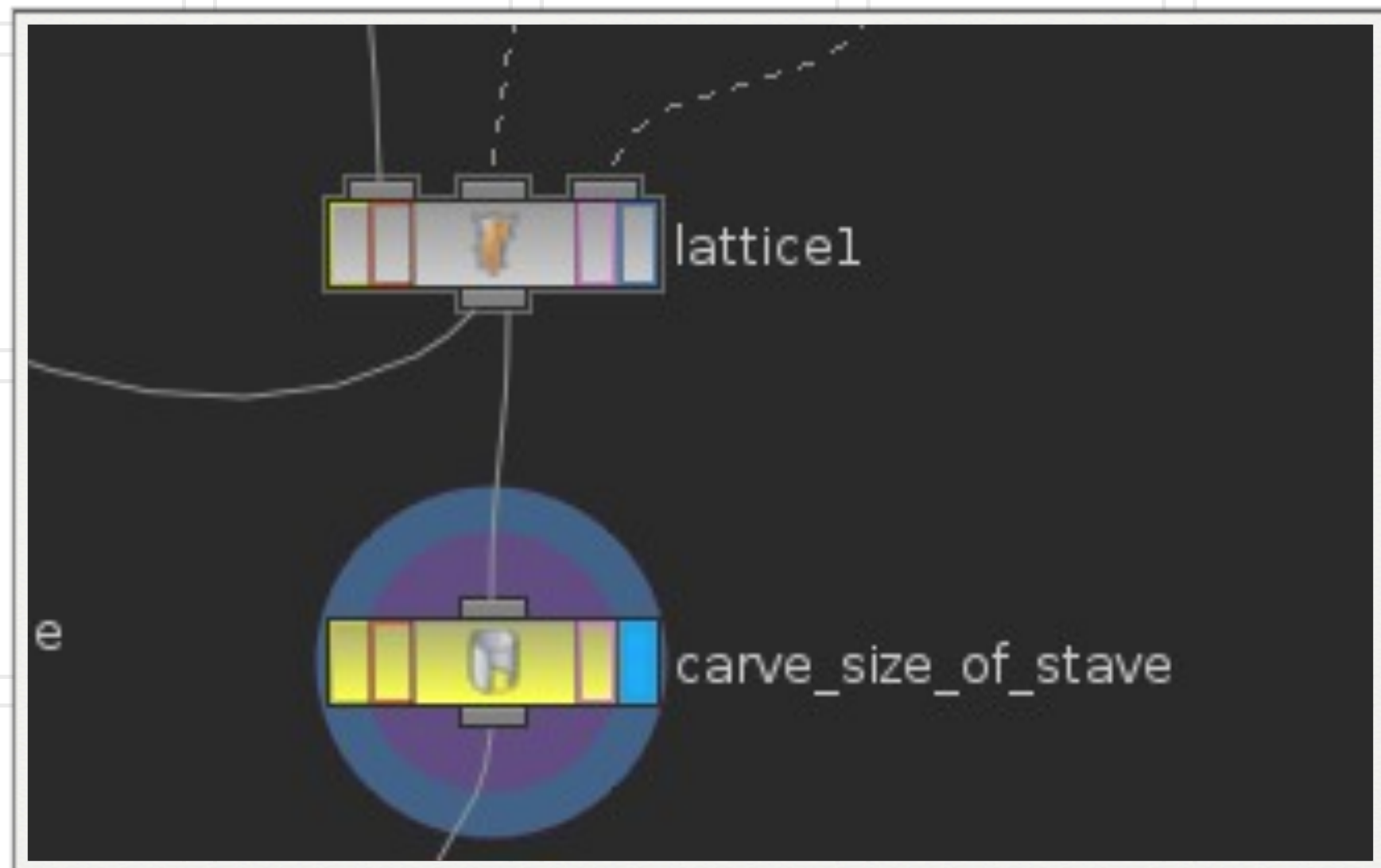
- ▶ With the Lattice BBOX XForm selected drag a Marque around the two middle rows of points in the Lattice
- ▶ Using the Scale Tool scale out the points to make the shape of a barrel
 - ▶ Notice that an edit note has been appended
- ▶ You will want to highlight the edit Node as yellow because the scale-x and scale-z parameters will be controlled by the artist
- ▶ Append a Null
 - ▶ name - Barrel_Shape_Out
 - ▶ color code - green

Creating the Staves



- ▶ Append a Carve SOP to the Lattice
 - ▶ Select First U - 0 (this will remain constant)
 - ▶ Select Second U - 0.1 (We are just roughing out the Stave and will let the artist determine this width of the Stave)
 - ▶ Color Code - Yellow

Creating the Staves (cont.)

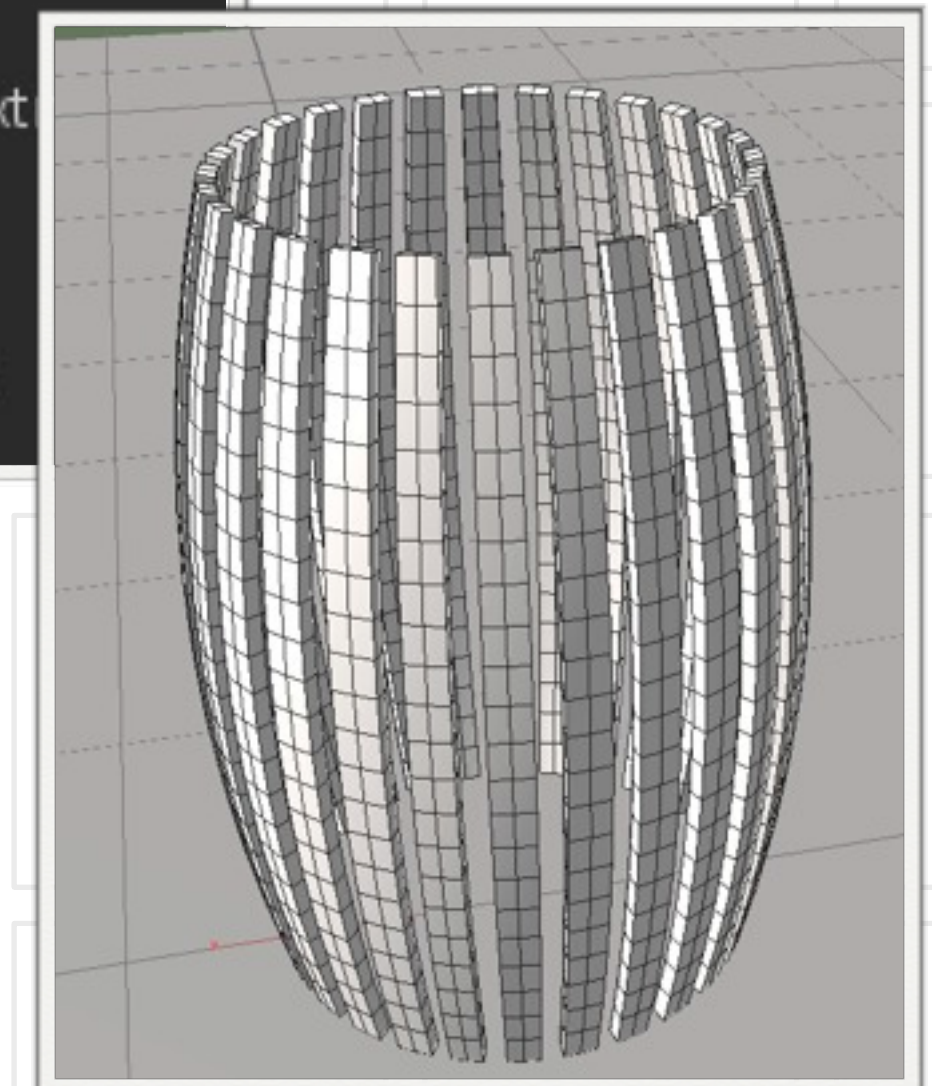
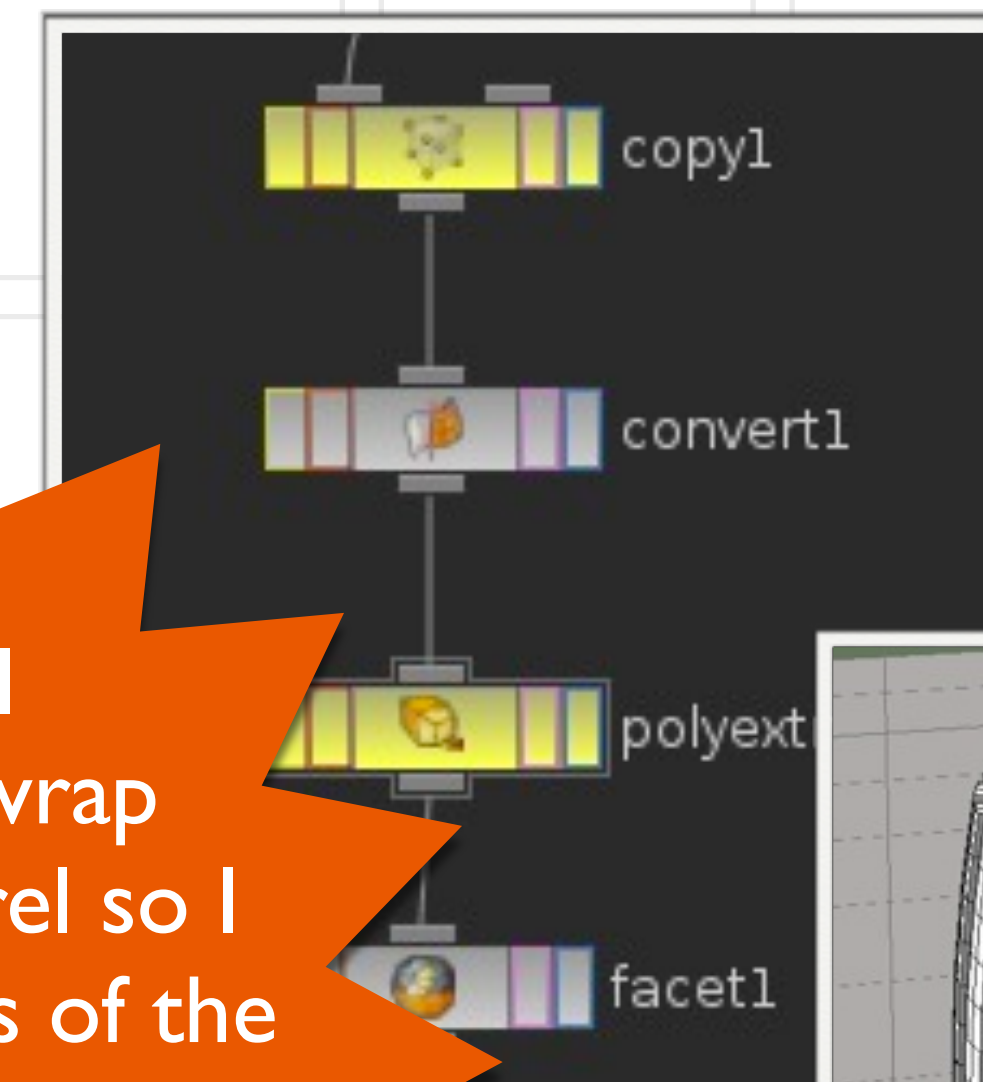


- ▶ Append a COP SOP to the Carve SOP
 - ▶ Select First U - 0 (this will remain constant)
 - ▶ Select Second U - 0.1 (We are just roughing out the Stave and will let the artist determine this width of the Stave)
 - ▶ Color Code - Yellow
- ▶ Append a Copy SOP to the Carve SOP
 - ▶ Number of Copies - 10
 - ▶ Rotate-y - $360/\text{ch}(\text{"ncy"})$

Creating the Staves (cont.)

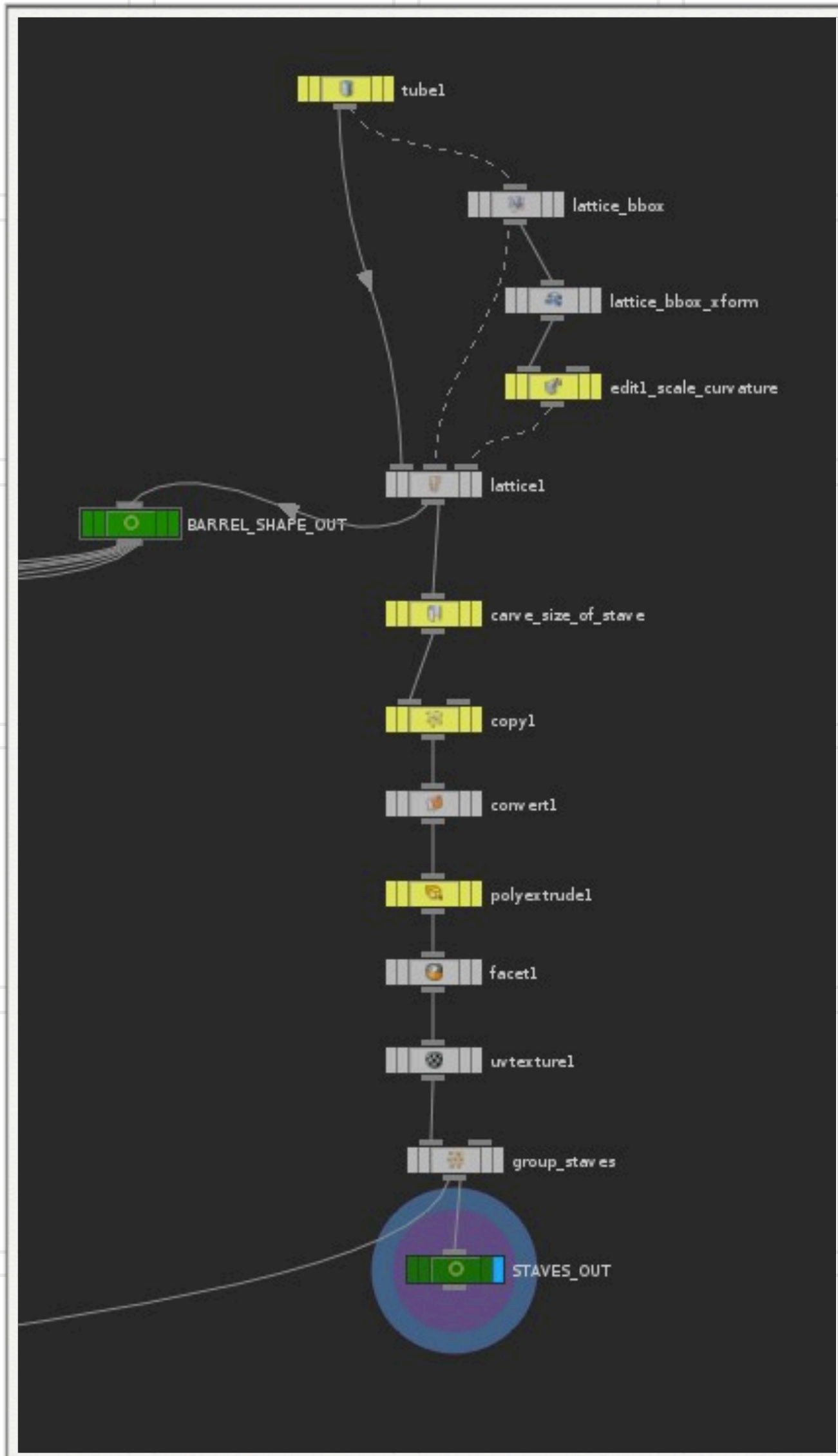
- ▶ Next Append a Convert SOP
 - ▶ NURBS to Polygon
- ▶ Append a PolyExtrude
 - ▶ Translate-Z - -0.2
 - ▶ color code - yellow
- ▶ The staves look mushy
- ▶ Append a Facet SOP
 - ▶ Cusp Polygons - Angle 30

Thinking ahead - I know I will need to wrap Hoops around the barrel so I need to know the radius of the Barrel. Negative extrusion makes this easy since I can use the Null Out of the Original Lattice Deform



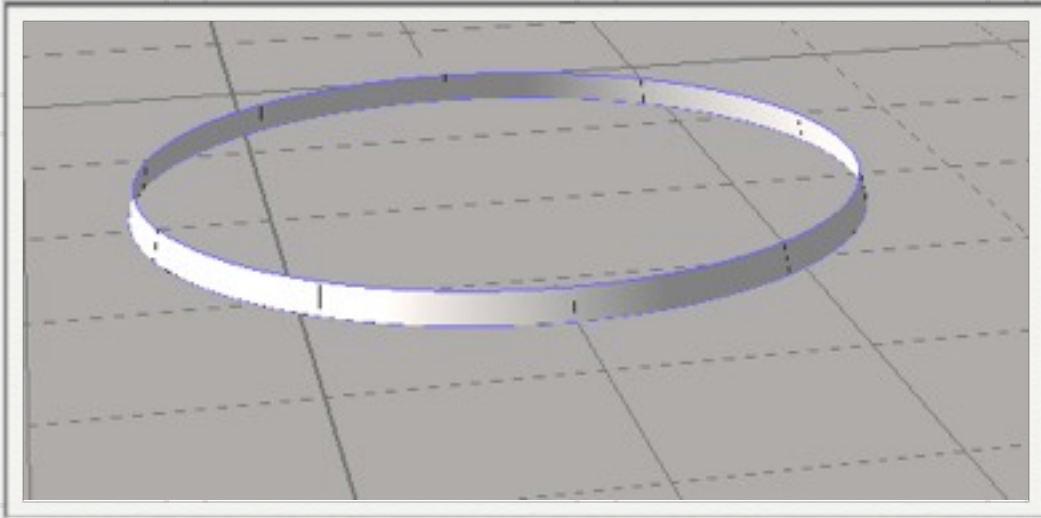
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Creating the Staves (cont.)

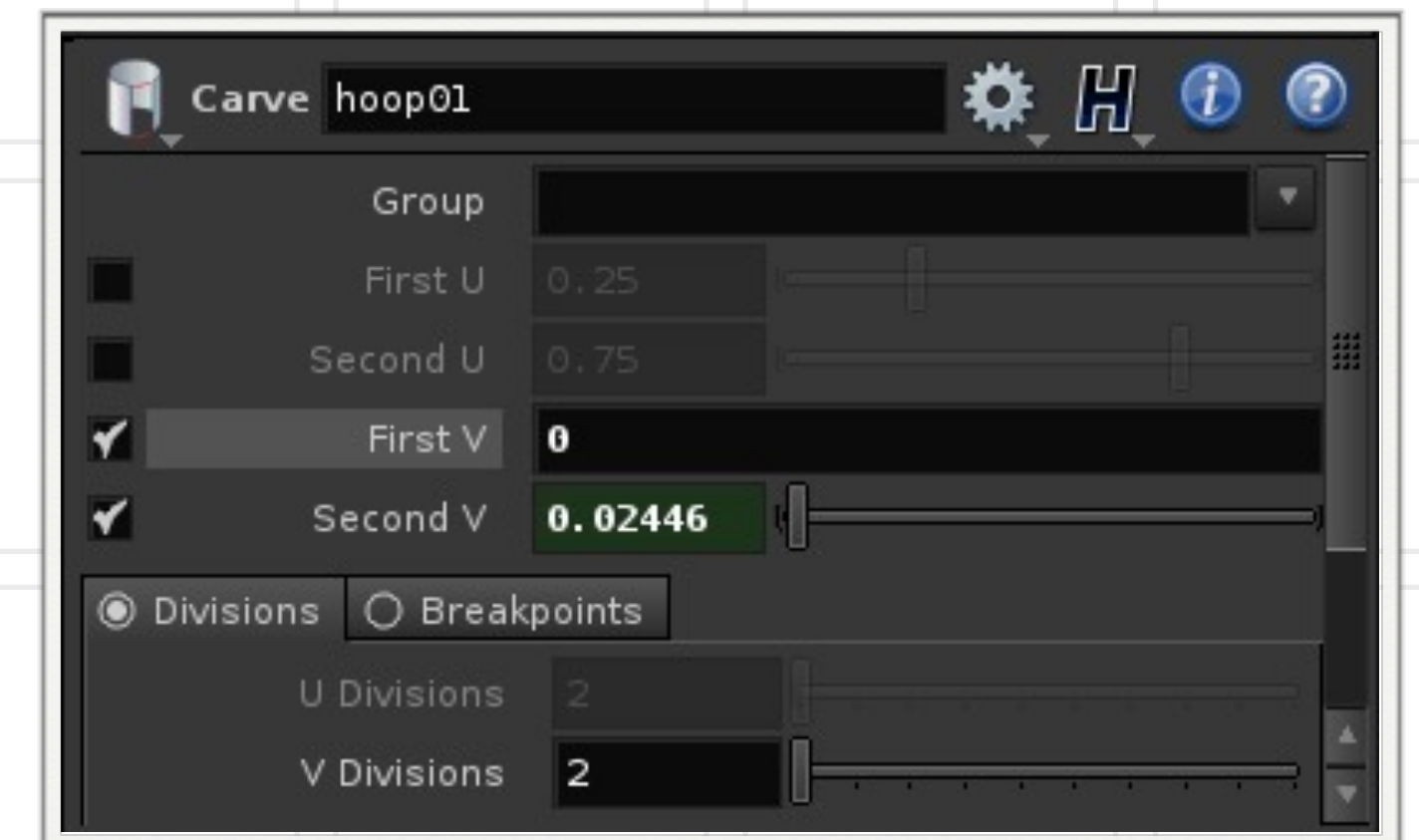
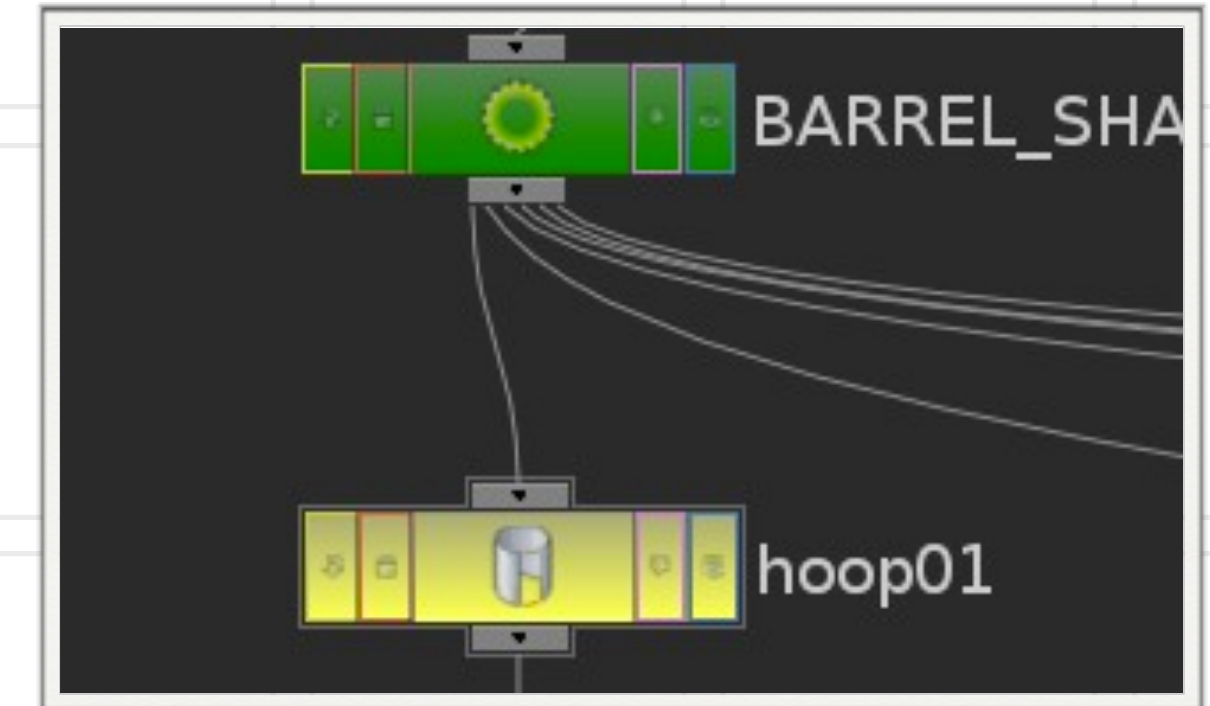


- ▶ Append a UV Texture
 - ▶ type - Cylindrical
 - ▶ projection axis - y
- ▶ Append A Group SOP
 - ▶ group name - staves
 - ▶ type - Primitives
- ▶ Append a NULL SOP
 - ▶ name - STAVES_OUT
 - ▶ color code - green

Creating the Hoops



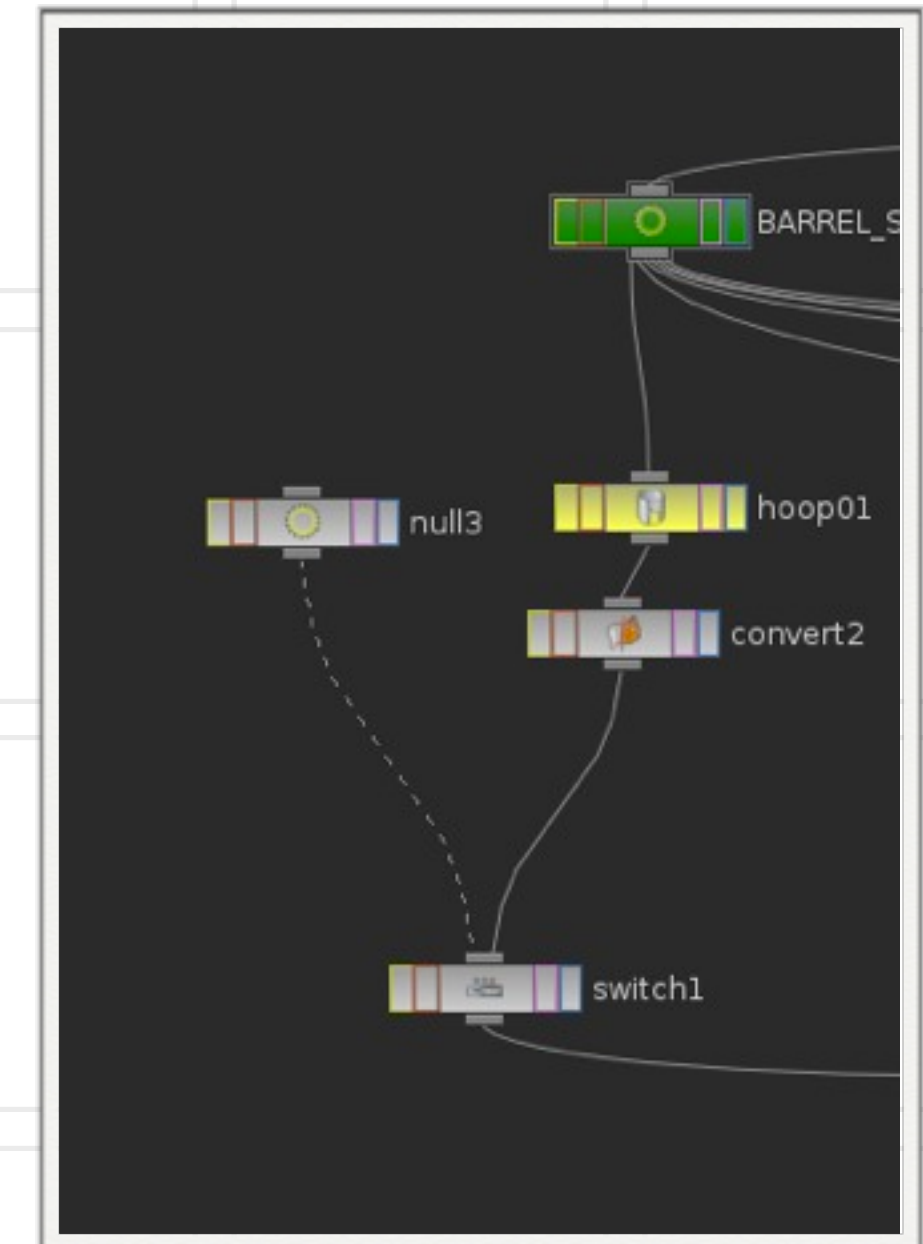
- ▶ From the Barrel Shape Out Null Append a Carve SOP
- ▶ To make the Hoops we will use the v coordinated of the NURBS surface to carve just the areas we want
- ▶ For the Top Hoop
 - ▶ First V - 0 (will remain constant)
 - ▶ Second V - 0.25 (will want artist to be able to control width of hoop)
- ▶ Color Code - yellow
- ▶ label it - hoop01



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Creating the Hoops

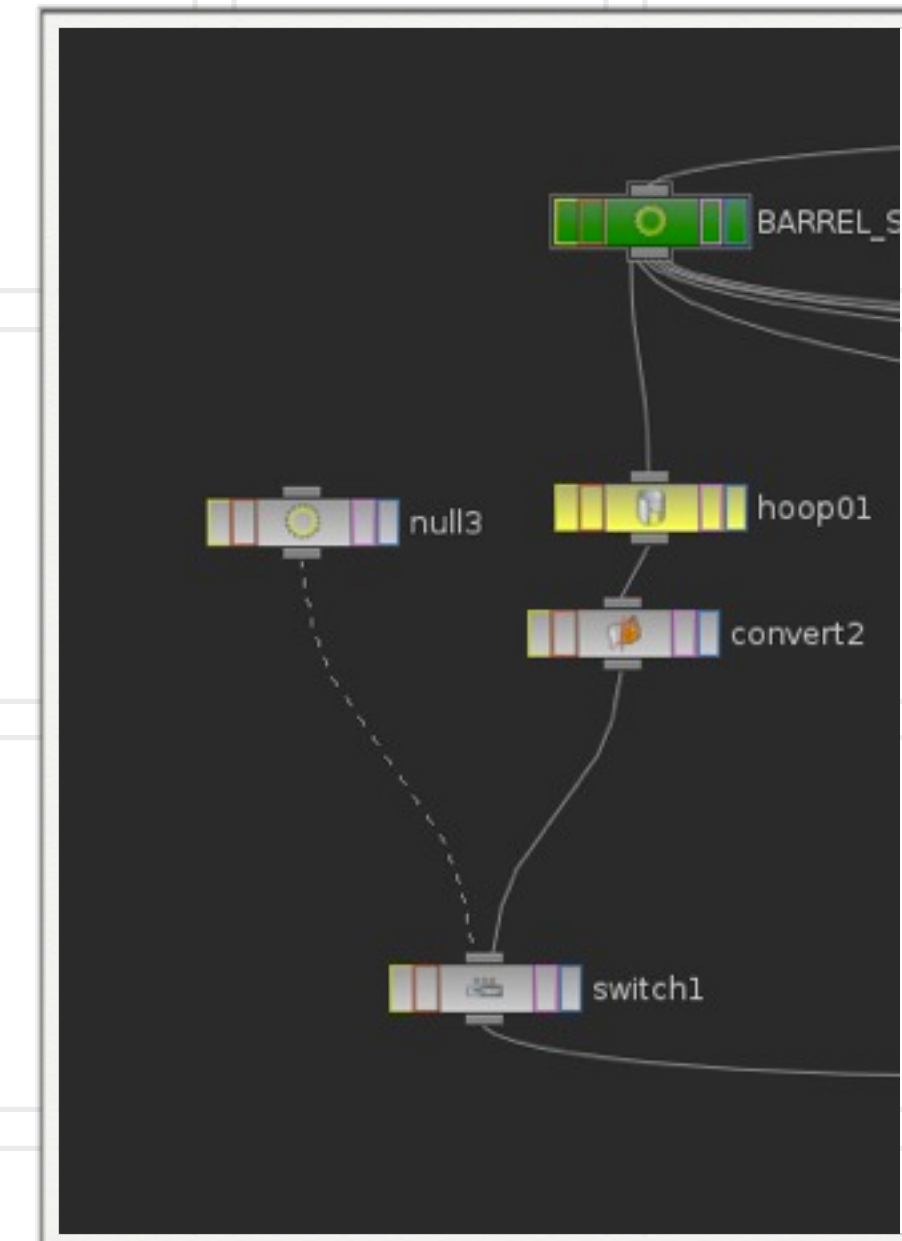
- ▶ We will want the artist to be able to have the individual hoops on or off
 - ▶ Drop down a NULL this will be our input to a SWITCH to either have the Hoop visible or not
 - ▶ Append a Convert SOP - NURBS to Polygons
- ▶ Input 1 of Switch - Null
- ▶ Input 2 of Switch Convert SOP



Creating the Hoops

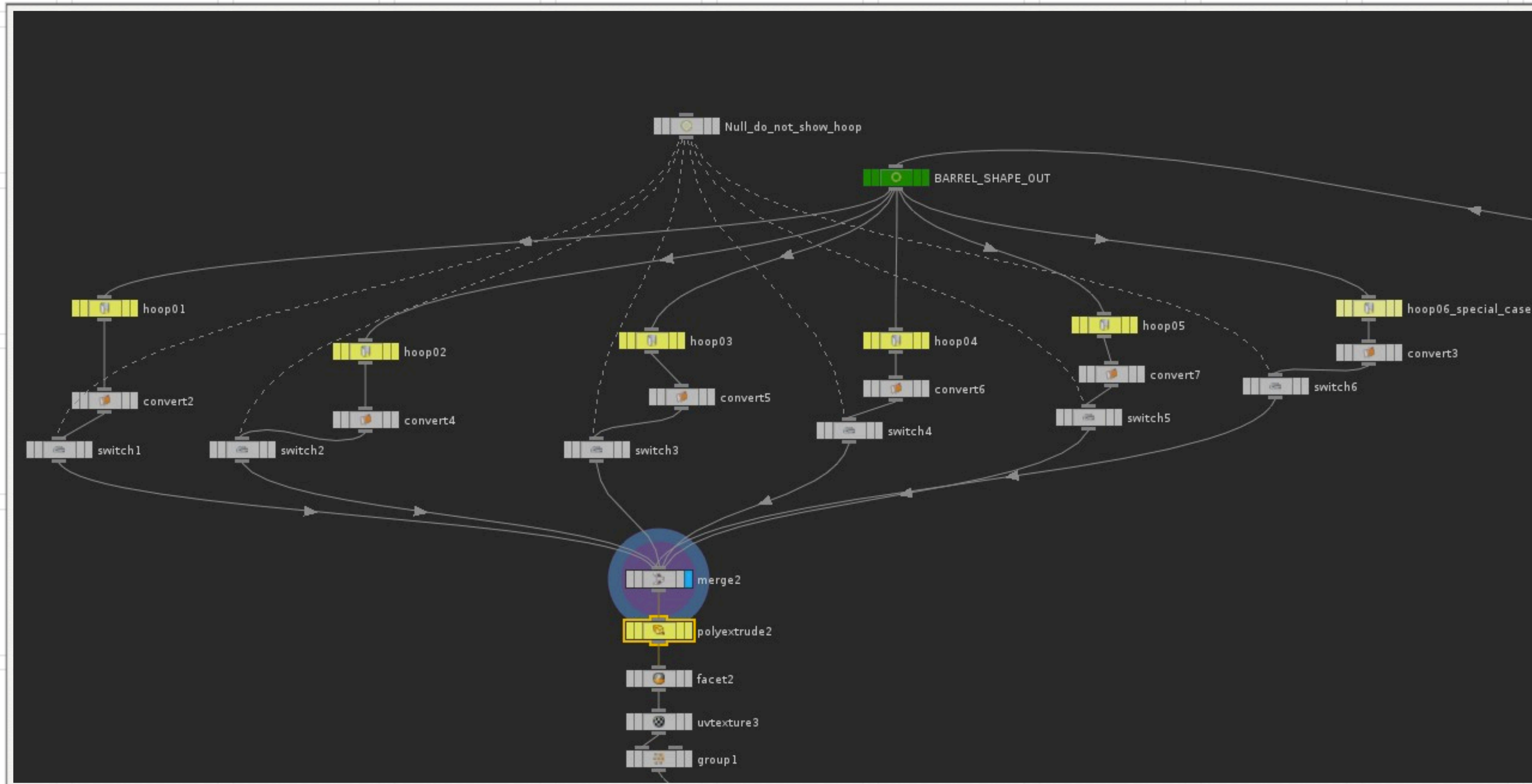
- ▶ Repeat the last step for as many hoops as you want on the barrel. I used six.
- ▶ Append a Merge SOP and Join all the Hoops
- ▶ Append a PolyExtrude. This time we will extrude in the positive direction

Hoop	V1	V2
1	0.0	0.025
2	0.2	0.225
3	0.4	0.425
4	0.6	0.625
5	0.8	0.825
6	0.975	1.0



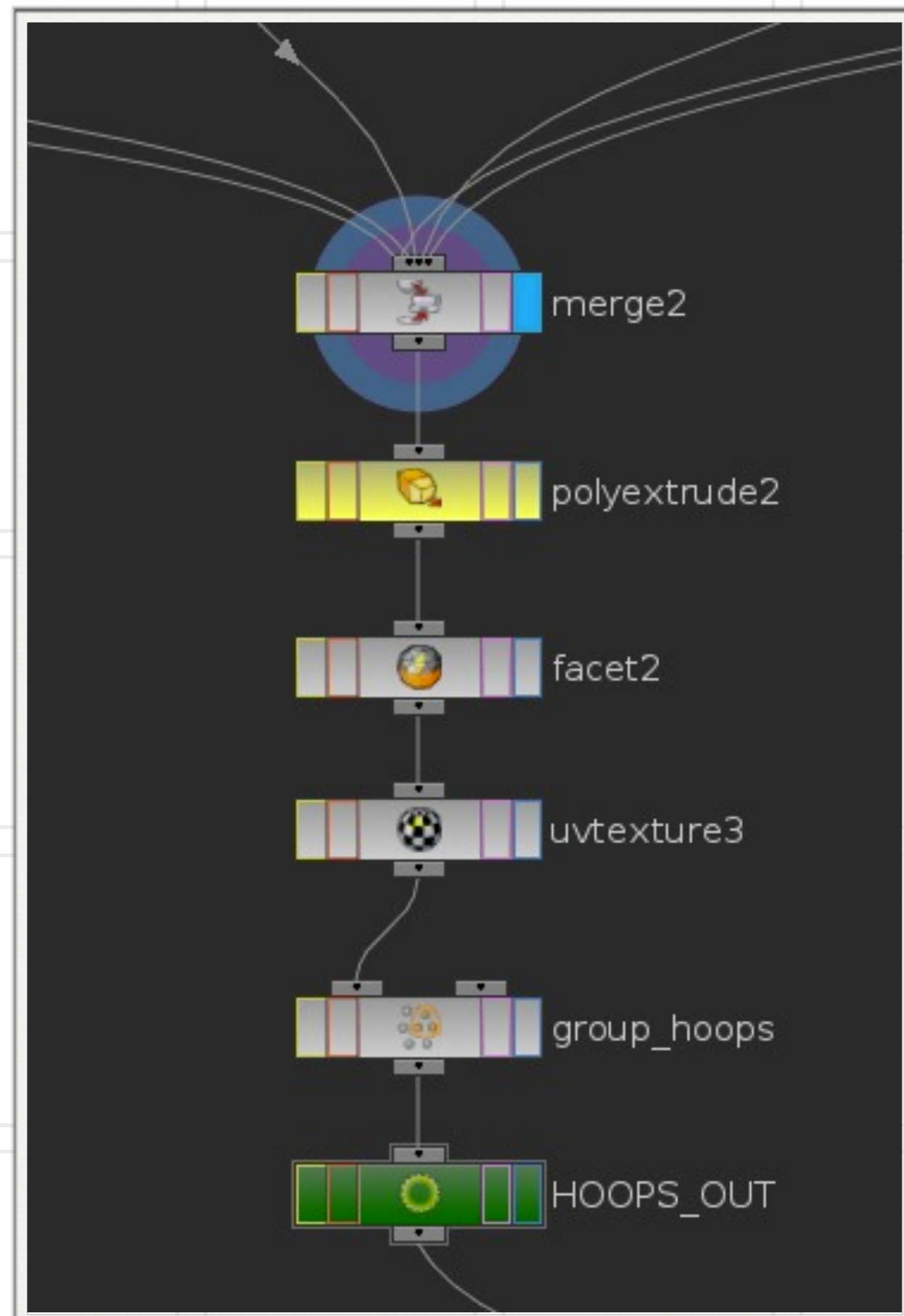
Special Case - We will have to deal with later

Hoop Network So Far



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Finishing Off the Hoop Network



- ▶ Very much like the staves we need to use the Facet SOP to clean up the edges of the hoops
- ▶ Then we apply a uv texture - cylindrical will do for now
- ▶ Create a group
 - ▶ name - hoops
 - ▶ type - primitive
- ▶ Append a NULL
 - ▶ name - HOOPS_OUT
 - ▶ color code - green

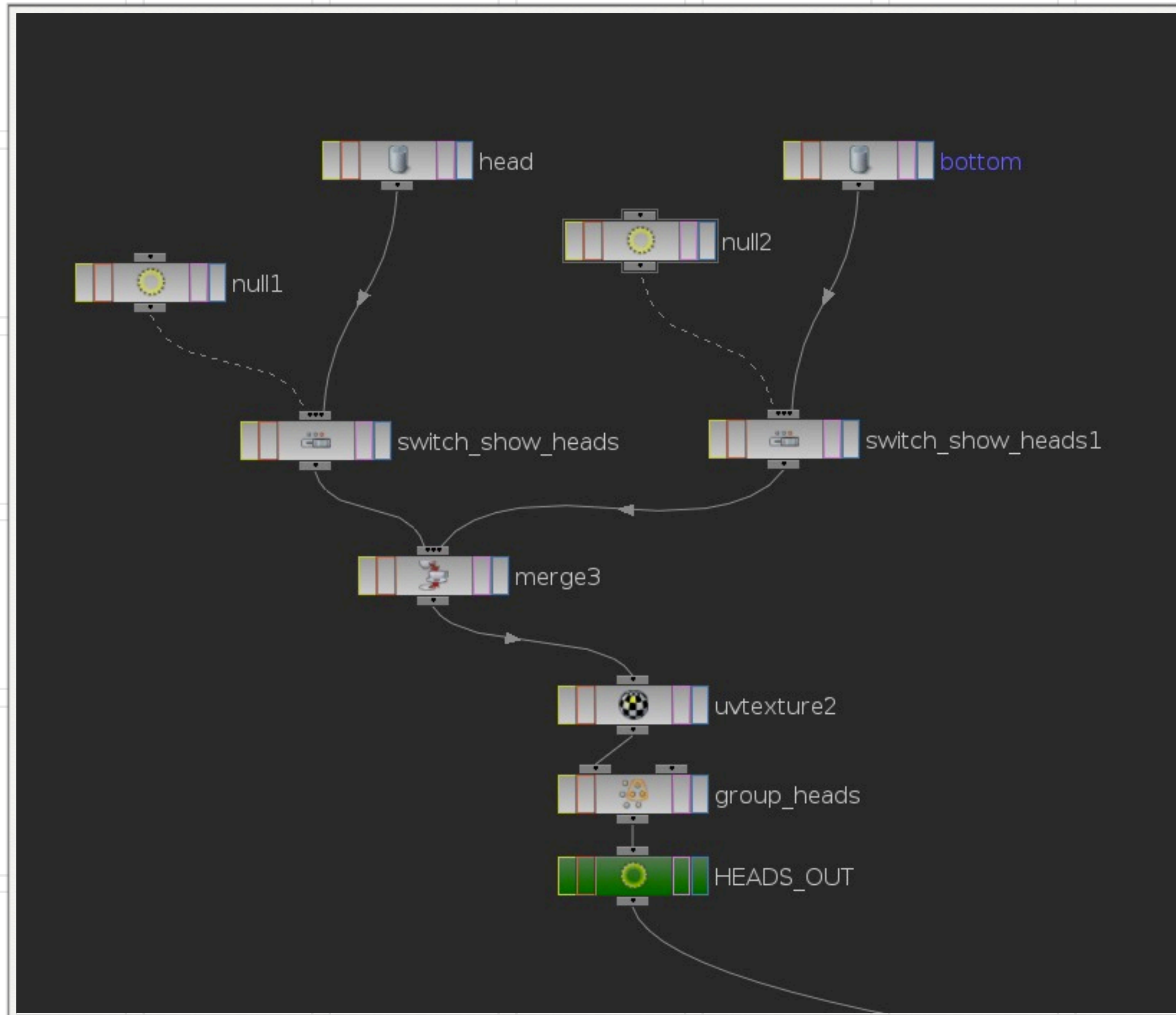
Creating the Heads

- ▶ Creating the heads is even simpler then creating the Hoops
- ▶ Drop down a Tube SOP
- ▶ Just like the Hoops we want the artist to be able to show the head or not
 - ▶ Add the Null and Switch

	Height	Center - x	Center - y	Center - z
Top	0.2	0	0.98	0
Bottom	0.2	0	0.02	0

Head Network

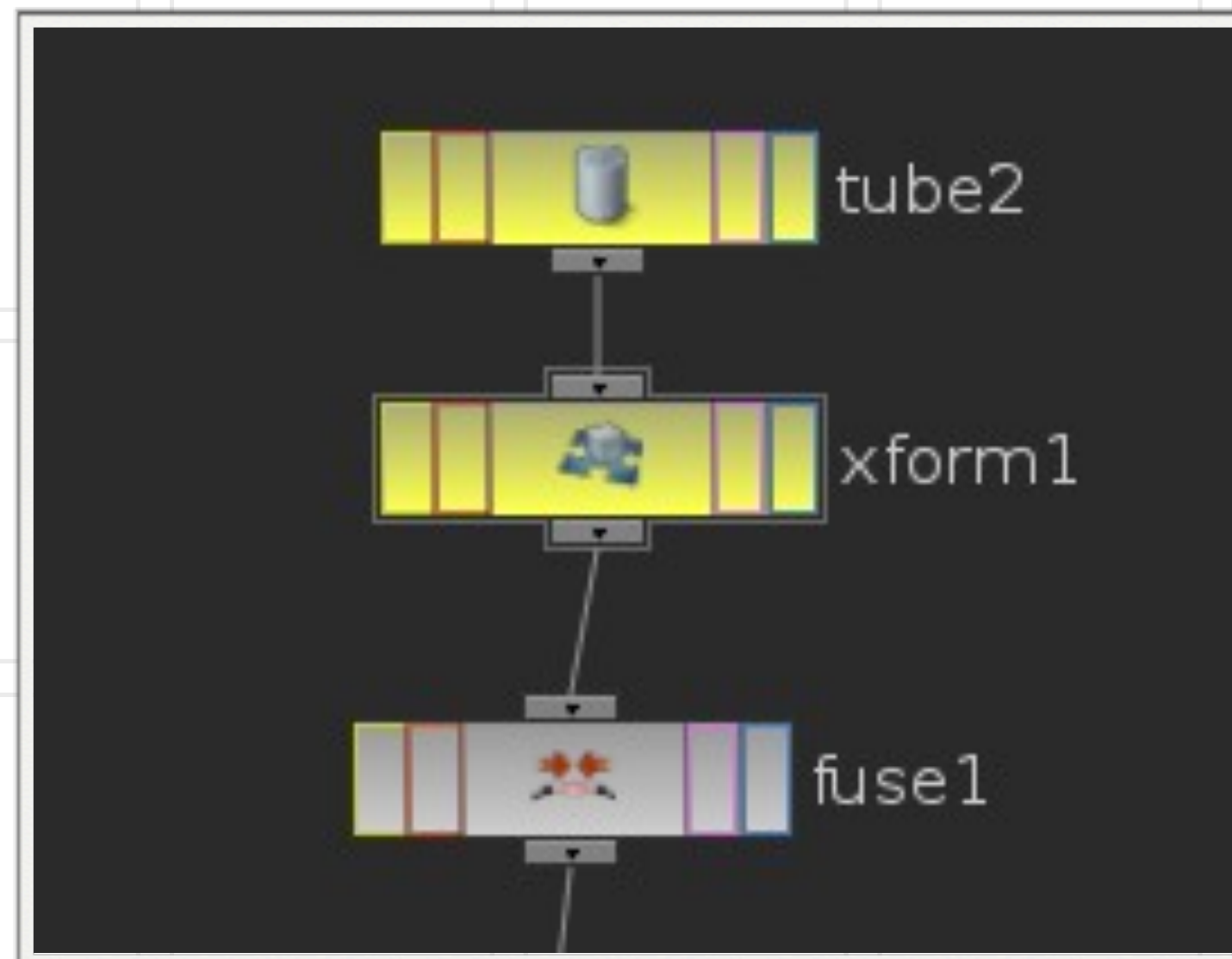
► For both Top and Bottom Heads



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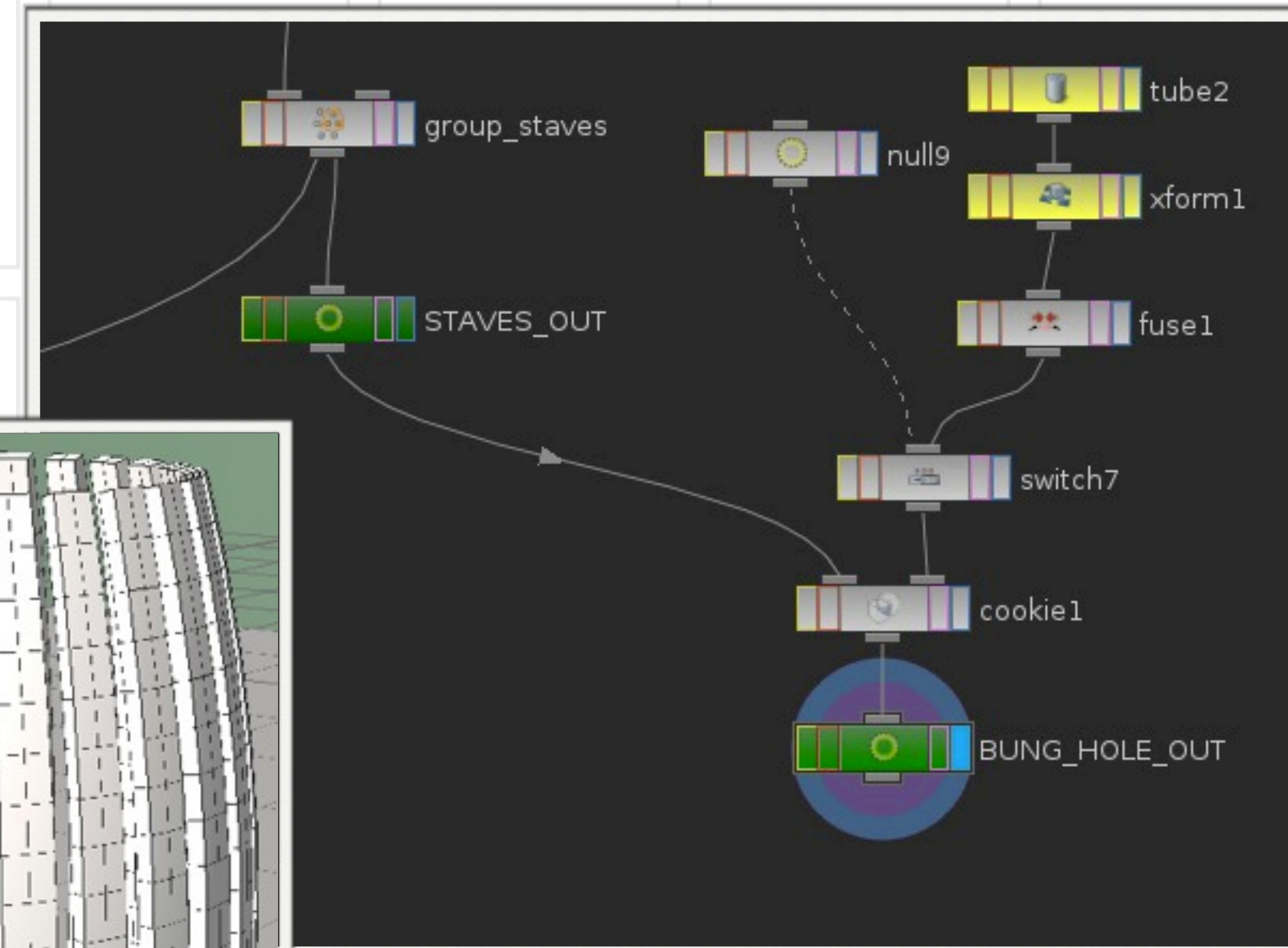
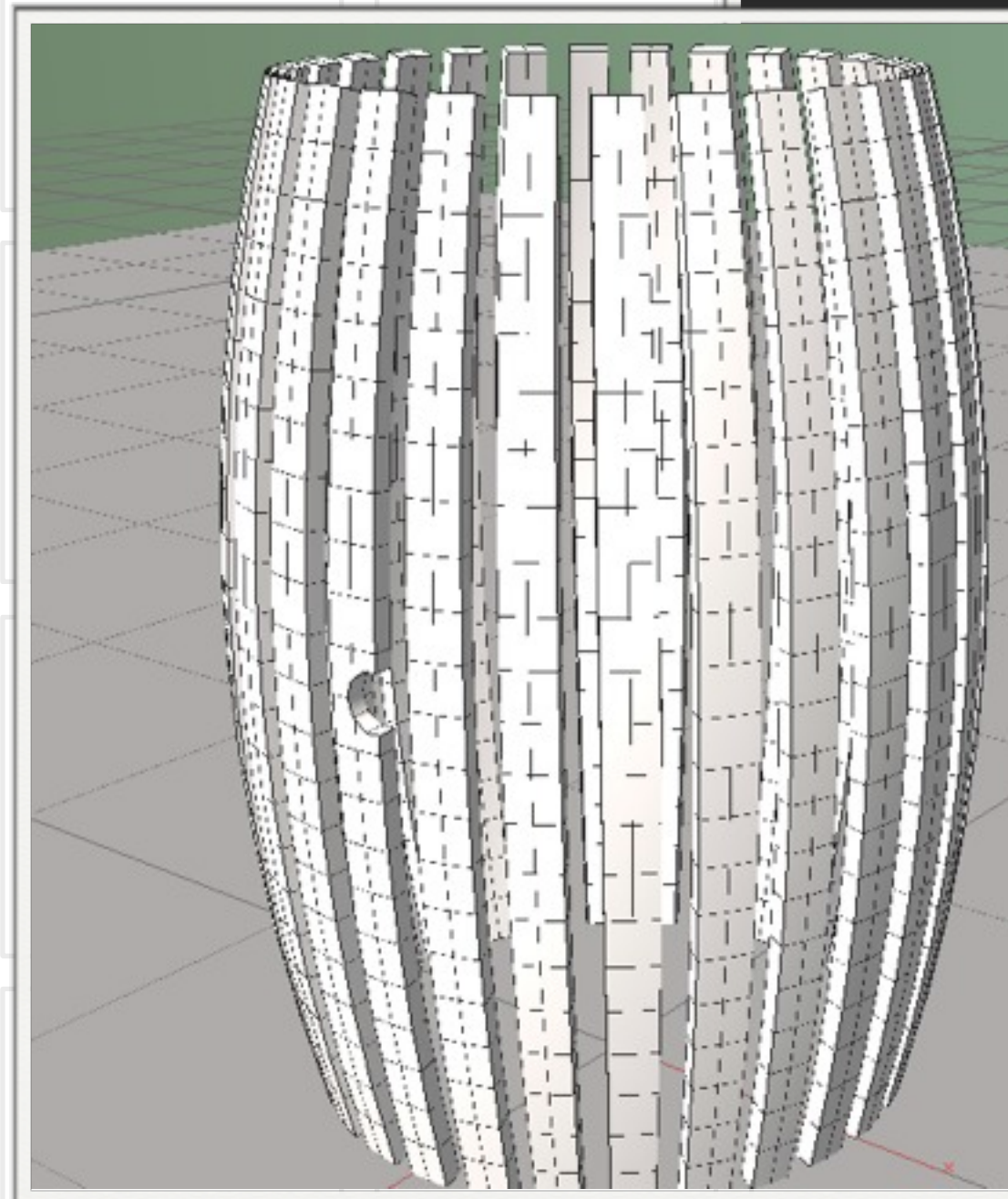
Creating the Bung Hole

- ▶ We will use a Cookie Operator to create the Bung Hole
 - ▶ Drop down a tube
 - ▶ orientation - Z-axis
 - ▶ height - 1
 - ▶ center - 0, 0.5, 0
 - ▶ radius - 0.3, 0.3
 - ▶ Select - Caps on
 - ▶ color code - yellow
 - ▶ Append a Transform (for future needs to rotate bung hole)
 - ▶ color code - yellow
 - ▶ Append a Fuse



Creating the Bung Hole (cont.)

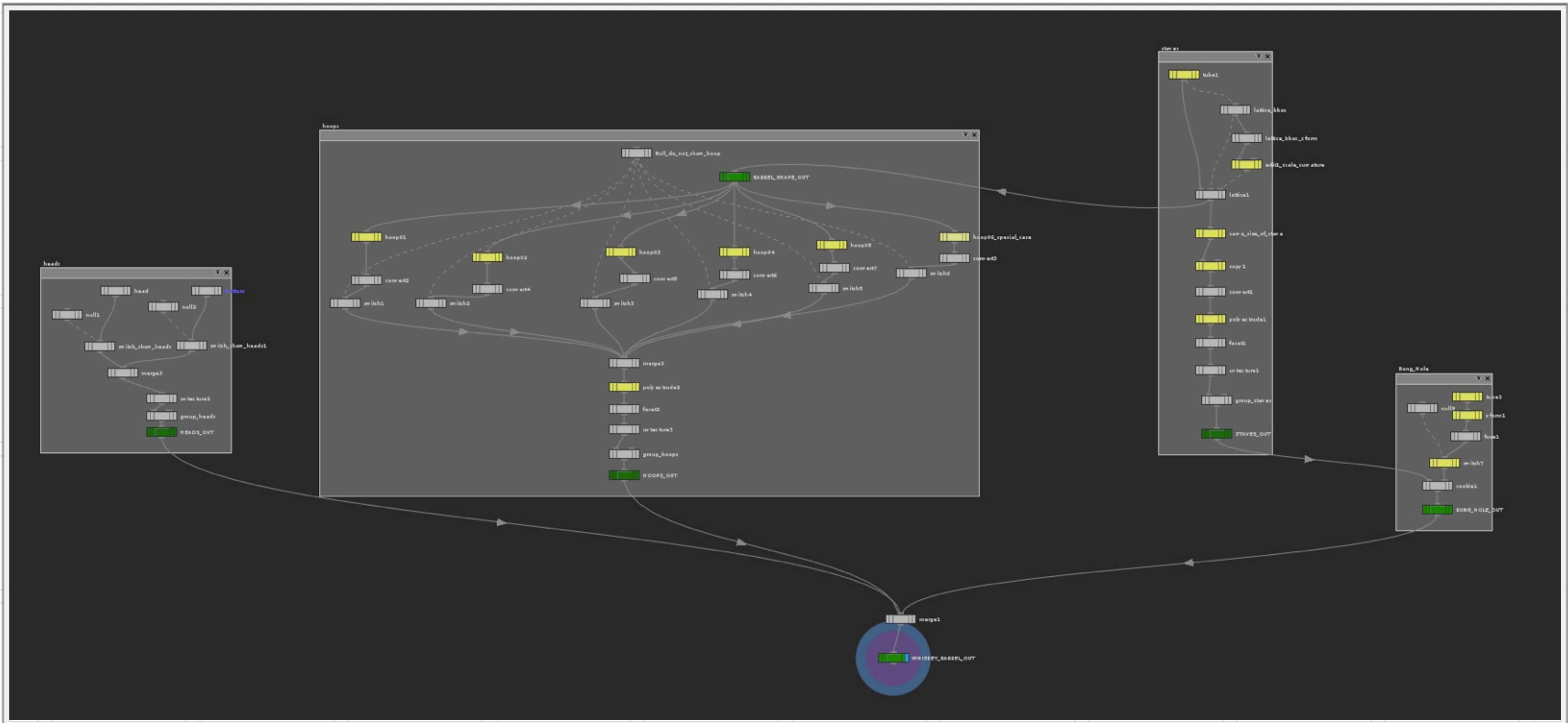
- ▶ Getting repetitive - Artist should be able to toggle between having a bung hole or not
- ▶ To make the Cookie
 - ▶ Drop down a COOKIE SOP
 - ▶ Wire the STAVES OUT to input 1
 - ▶ The Switch to Input 2



Putting it All Together

- ▶ Just merge everything together for the final Rough Build.
- ▶ This is what we will use to start building the Digital Asset

Final Roughed Out Network



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Creating the Digital Asset



► The User Interface we will want

Creating the Digital Asset

Select all nodes

Make them into a Sub-Network

- ▶ name - Whiskey_Barrel

Right Click - Create Digital Asset

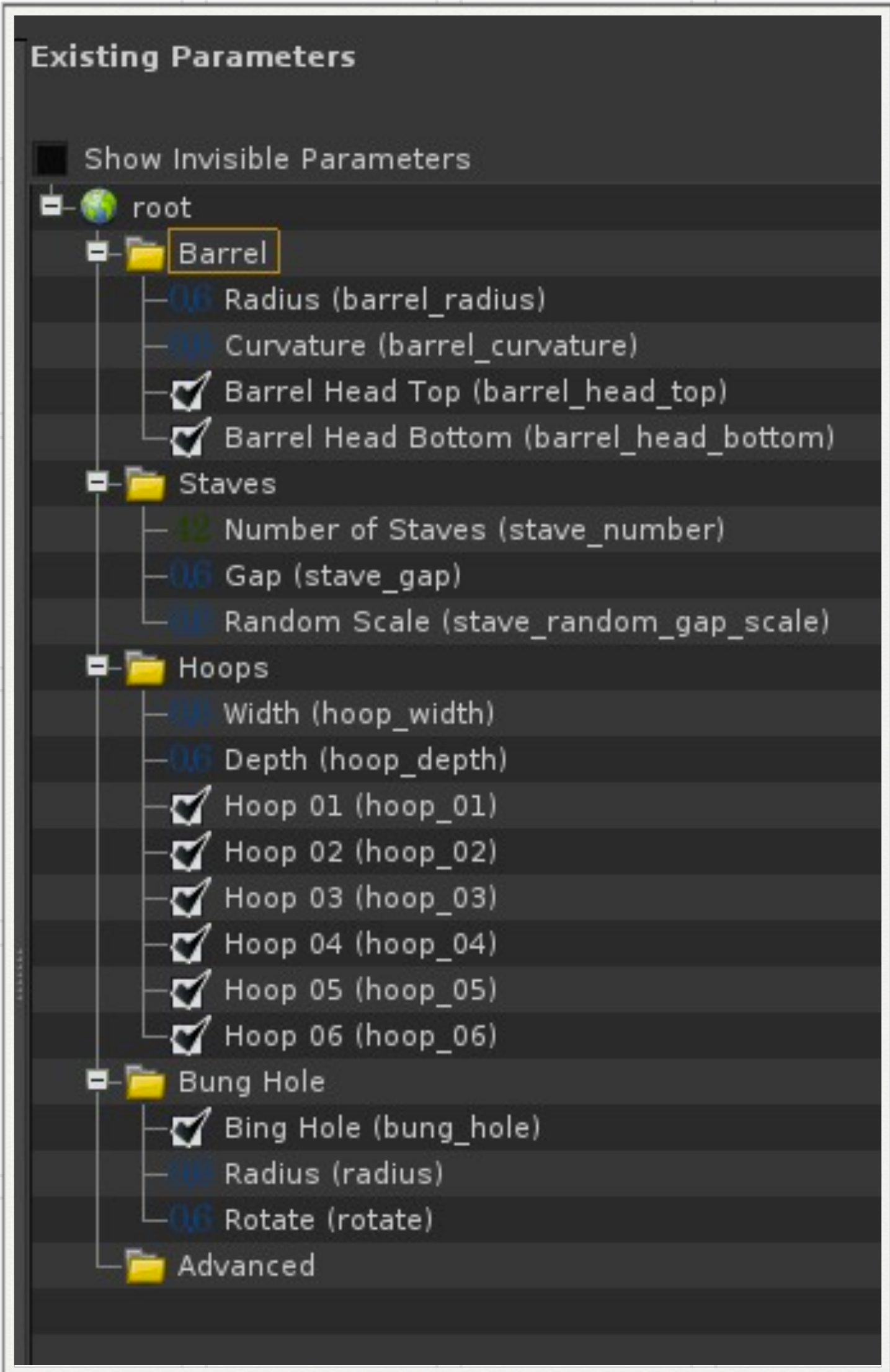
- ▶ name - Whiskey Barrel

- ▶ Location \$HIP/otls

Save Asset

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Type Property Parameters



Barrel Parameters

Parameter Description

Parameter Channels Menu Import

Name `barrel_radius`

☒ Label Radius

Type Float

Op Filter

RMan Type

Browse Mode

Units

Size 1

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range 0.1 2

Show Parm In Main Dialog Only

Disable When

Hide When

Help

Parameter Description

Parameter Channels Menu Import

Size 1

Add Links Drop parameters here to add new links

	Defaults	Linked Channels
1	0.3	tubel/rad1
2		

Parameter Description

Parameter Channels Menu Import

Name `barrel_curvature`

☒ Label Curvature

Type Float

Op Filter

RMan Type

Browse Mode

Units

Size 1

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range 0.1 2

Show Parm In Main Dialog Only

Disable When

Hide When

Help

Parameter Description

Parameter Channels Menu Import

Size 1

Add Links Drop parameters here to add new links

	Defaults	Linked Channels
1	1.3	edit1_scale_curvatur

Parameter Description

Parameter Channels Menu Import

Name `barrel_head_top`

☒ Label Barrel Head Top

Type Toggle

Op Filter

RMan Type

Browse Mode

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range 0 1

Show Parm In Main Dialog Only

Disable When

Hide When

Help

Parameter Description

Parameter Channels Menu Import

Name `barrel_head_bottom`

☒ Label Barrel Head Bottom

Type Toggle

Op Filter

RMan Type

Browse Mode

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range 0 1

Show Parm In Main Dialog Only

Disable When

Hide When

Help

Stave Parameters

Parameter Description

Parameter

Channels

Menu

Import

Name

stave_number

☒ Label

Number of Staves

Type

Integer

Op Filter

RMan Type

Browse Mode

Units

Size

1

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range

8

128

Show Parm In

Main Dialog Only

Disable When

Hide When

Help

Parameter Description

Parameter

Channels

Menu

Import

Size

1

Add Links

Drop parameters here to add new links

Defaults

Linked Channels

1

16

2

Parameter Description

Parameter

Channels

Menu

Import

Name

stave_gap

☒ Label

Gap

Type

Float

Op Filter

RMan Type

Browse Mode

Units

Size

1

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range

0

0.9

Show Parm In

Main Dialog Only

Disable When

Hide When

Help

Parameter Description

Parameter

Channels

Menu

Import

Size

1

Add Links

Drop parameters here to add new links

Defaults

Linked Channels

1

0

2

Parameter Description

Parameter

Channels

Menu

Import

Name

stave_random_gap_scale

☒ Label

Random Scale

Type

Float

Op Filter

RMan Type

Browse Mode

Units

Size

1

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range

0

1

Show Parm In

Main Dialog Only

Disable When

Hide When

Help

Parameter Description

Parameter

Channels

Menu

Import

Size

1

Add Links

Drop parameters here to add new links

Defaults

Linked Channels

1

0

2

Hoop Parameters

Parameter Description

Parameter Channels Menu Import

Name **hoop_width**

☒ Label **Width**

Type **Float**

Op Filter

RMan Type

Browse Mode

Units

Size **1**

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range **0.01** **0.05**

Show Parm In **Main Dialog Only**

Disable When

Hide When

Help

Parameter Description

Parameter Channels Menu Import

Size **1**

Add Links **Drop parameters here to add new links**

	Defaults	Linked Channels
1	0.025	hoop01/domainv2
2		

Parameter Description

Parameter Channels Menu Import

Name **hoop_depth**

☒ Label **Depth**

Type **Float**

Op Filter

RMan Type

Browse Mode

Units

Size **1**

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range **0.001** **0.03**

Show Parm In **Main Dialog Only**

Disable When

Hide When

Help

Parameter Description

Parameter Channels Menu Import

Size **1**

Add Links **Drop parameters here to add new links**

	Defaults	Linked Channels
1	0.01	polyextrude2/ltz
2		

Parameter Description

Parameter Channels Menu Import

Name **hoop_01**

☒ Label **Hoop 01**

Type **Toggle**

Op Filter

RMan Type

Browse Mode

Callback Script

☐ Suppress Quotes in VOP Code Blocks

☒ Available For Import

Interface Options

☐ Invisible

☐ Horizontally Join to Next Parameter

☒ Range **0** **1**

Show Parm In **Main Dialog Only**

Disable When

Hide When

Help

Repeat for Each Hoop

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Bung Hole Parameters

Parameter Description

Parameter

Channels

Menu

Import

Name

bung_hole

✓

Label

Bing Hole

Type

Toggle

▲▼

Op Filter

RMan Type

Browse Mode

Callback Script

H

☐

Suppress Quotes in VOP Code Blocks

✓

Available For Import

Interface Options

☐

Invisible

☐

Horizontally Join to Next Parameter

✓

Range

0

1

🔒

Show Parm In

Main Dialog Only

▲▼

Disable When

Hide When

Help

Parameter Description

Parameter

Channels

Menu

Import

Name

radius

✓

Label

Radius

Type

Float

▲▼

Op Filter

RMan Type

Browse Mode

Units

▼

Size

1

Callback Script

H

☐

Suppress Quotes in VOP Code Blocks

✓

Available For Import

Interface Options

☐

Invisible

☐

Horizontally Join to Next Parameter

✓

Range

0.01

0.2

🔒

Show Parm In

Main Dialog Only

▲▼

Disable When

Hide When

Help

Parameter Description

Parameter

Channels

Menu

Import

Name

bung_hole

✓

Label

Bing Hole

Type

Toggle

▲▼

Op Filter

RMan Type

Browse Mode

Callback Script

H

☐

Suppress Quotes in VOP Code Blocks

✓

Available For Import

Interface Options

☐

Invisible

☐

Horizontally Join to Next Parameter

✓

Range

0

1

🔒

Show Parm In

Main Dialog Only

▲▼

Disable When

Hide When

Help

Key Expressions

- ▶ Carve Size of Stave

- ▶ $(1/\text{ch}("../\text{stave_number}))* (1-\text{ch}("../\text{stave_gap}))* \text{stamp}("../\text{copy1}", \text{"randGap"}, 1)$

- ▶ Hoop 06 - Special case

- ▶ $v1 - \text{ch}(\text{"domainv2"}) - \text{ch}("../\text{hoop_width"})$

- ▶ $v2 - 1$



Project 2 - Spokes for Wheels

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Reference Material for Wheel Spokes

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Wheel Reference

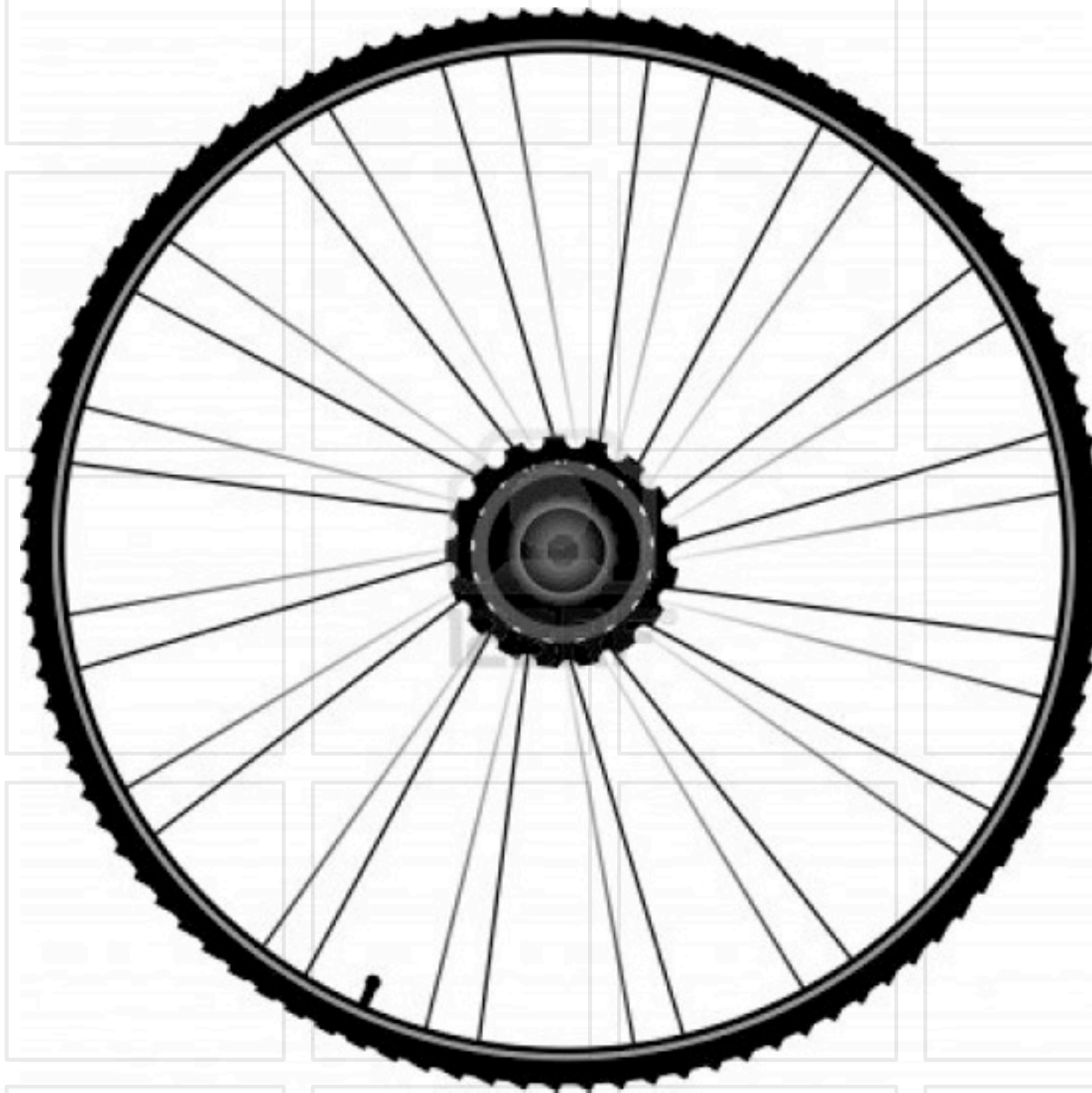


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Wheel Reference (cont.)



Straight Spokes



Skewed Spokes



Crossed Spokes

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Requirements

Hub

- ▶ Outer Hub - remains constant at 0.5
- ▶ Inner Hub - variable radius up to 0.45
- ▶ Offset - variable offset from center

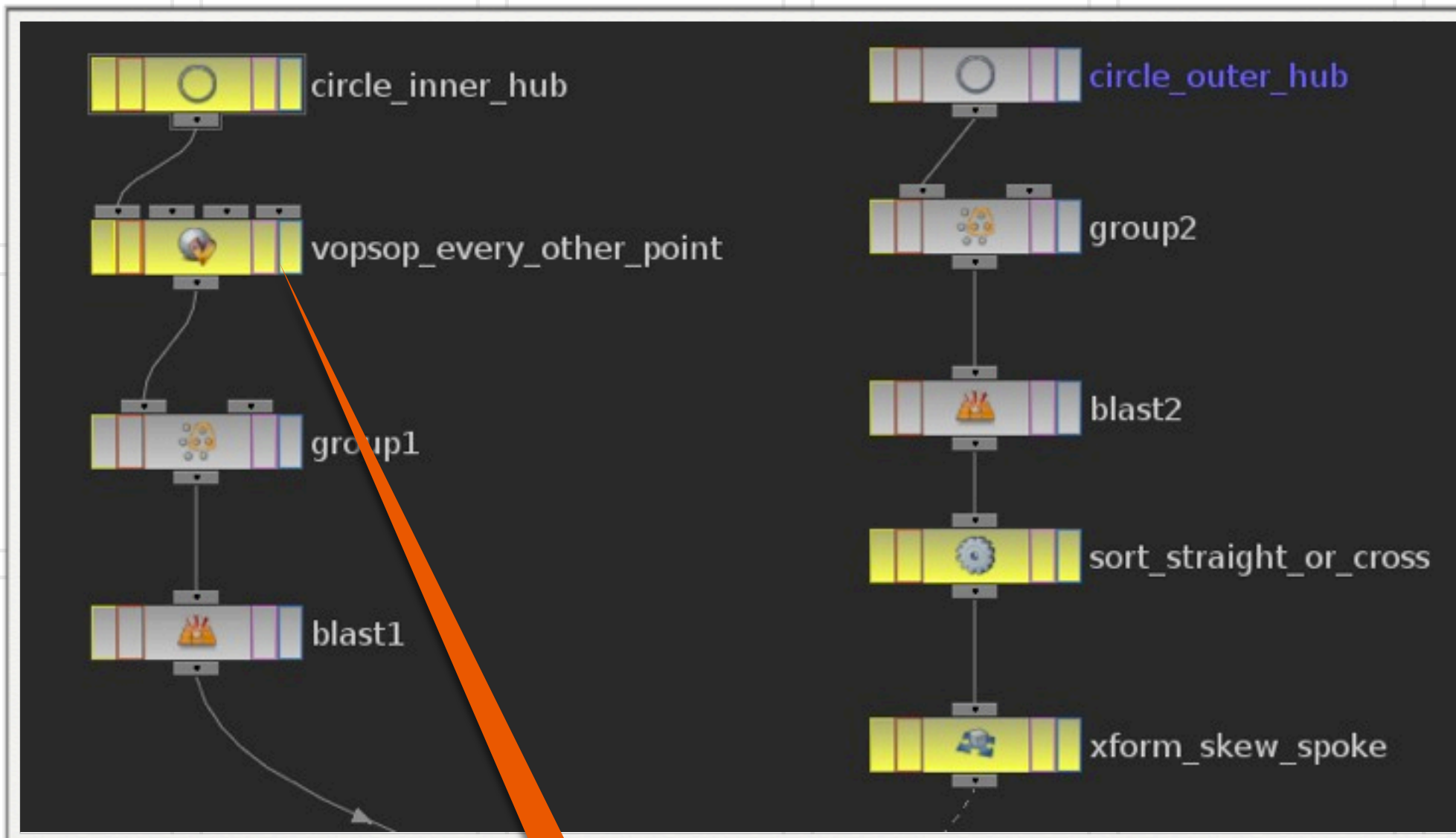
Nubs

- ▶ Length
- ▶ Thickness

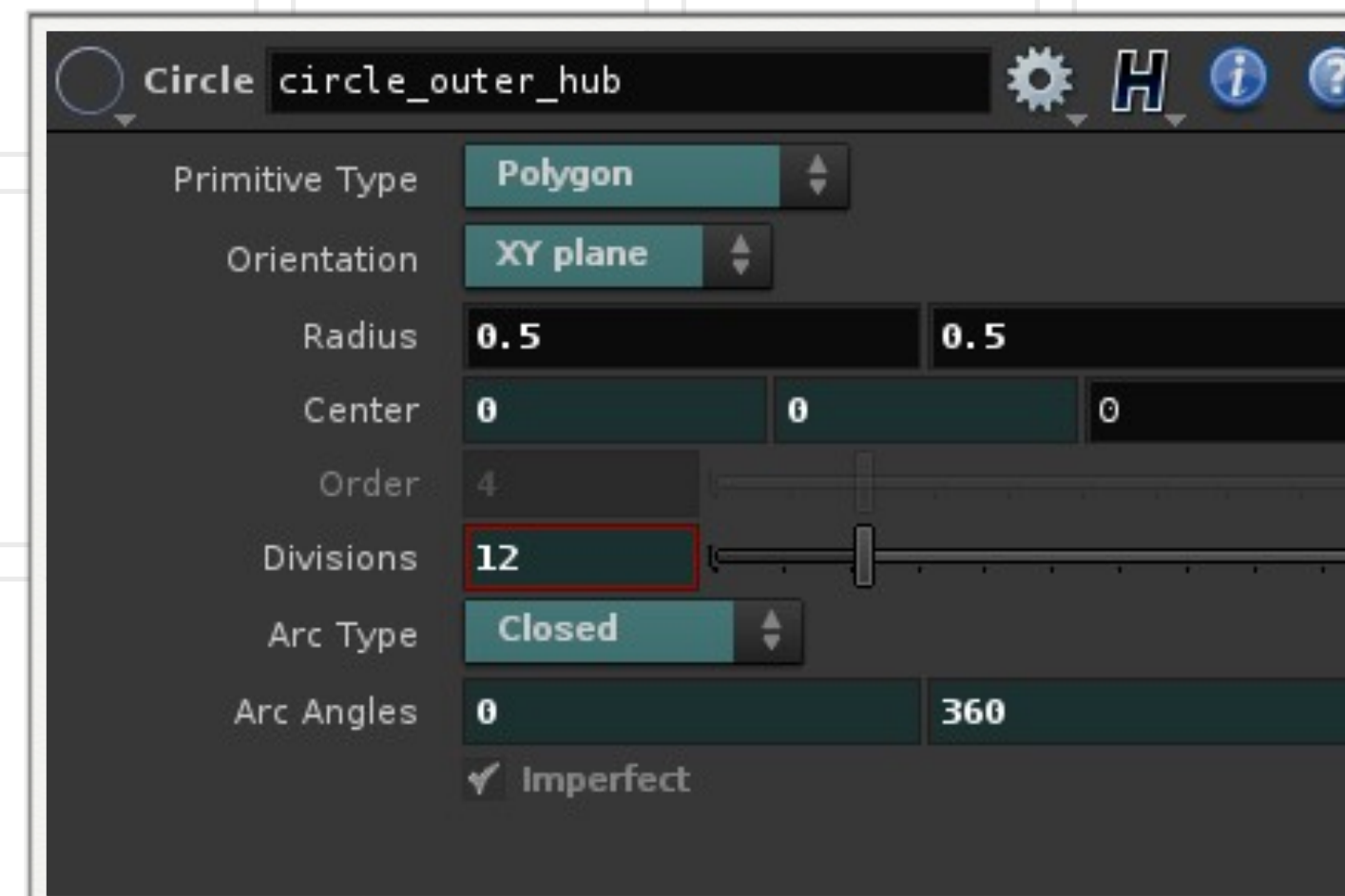
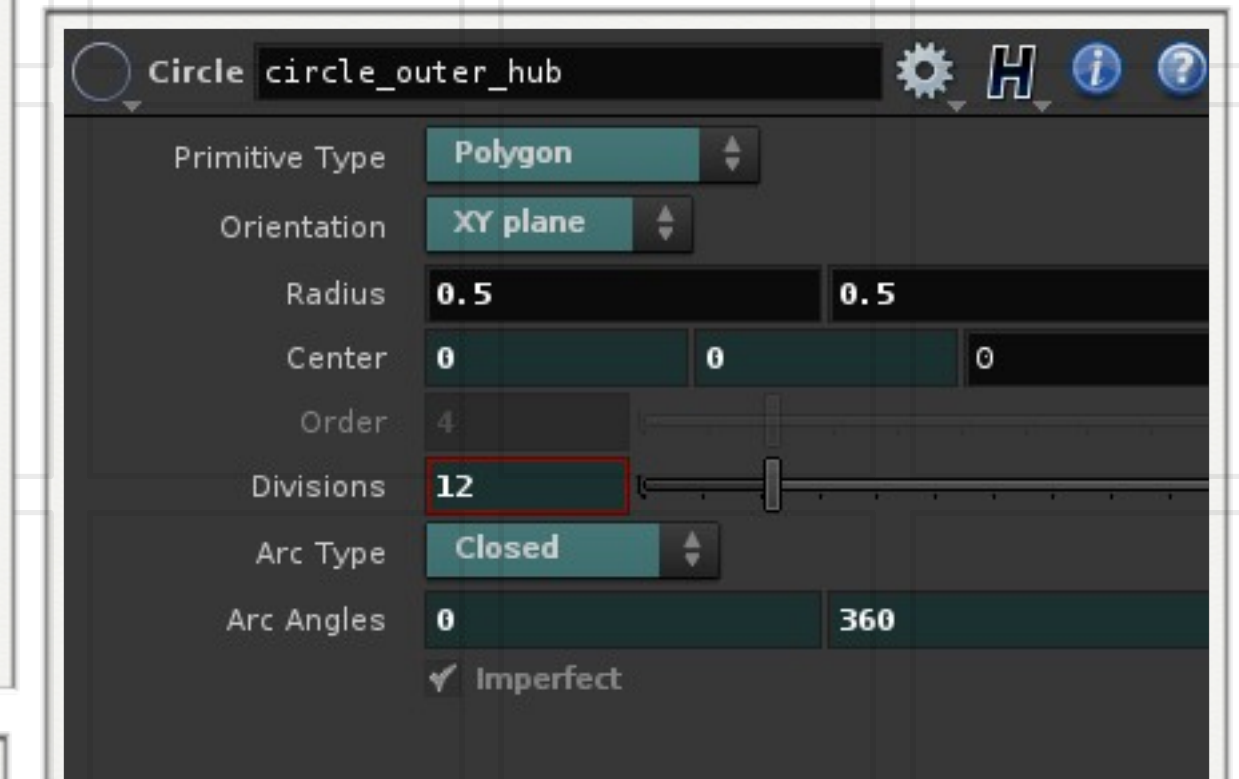
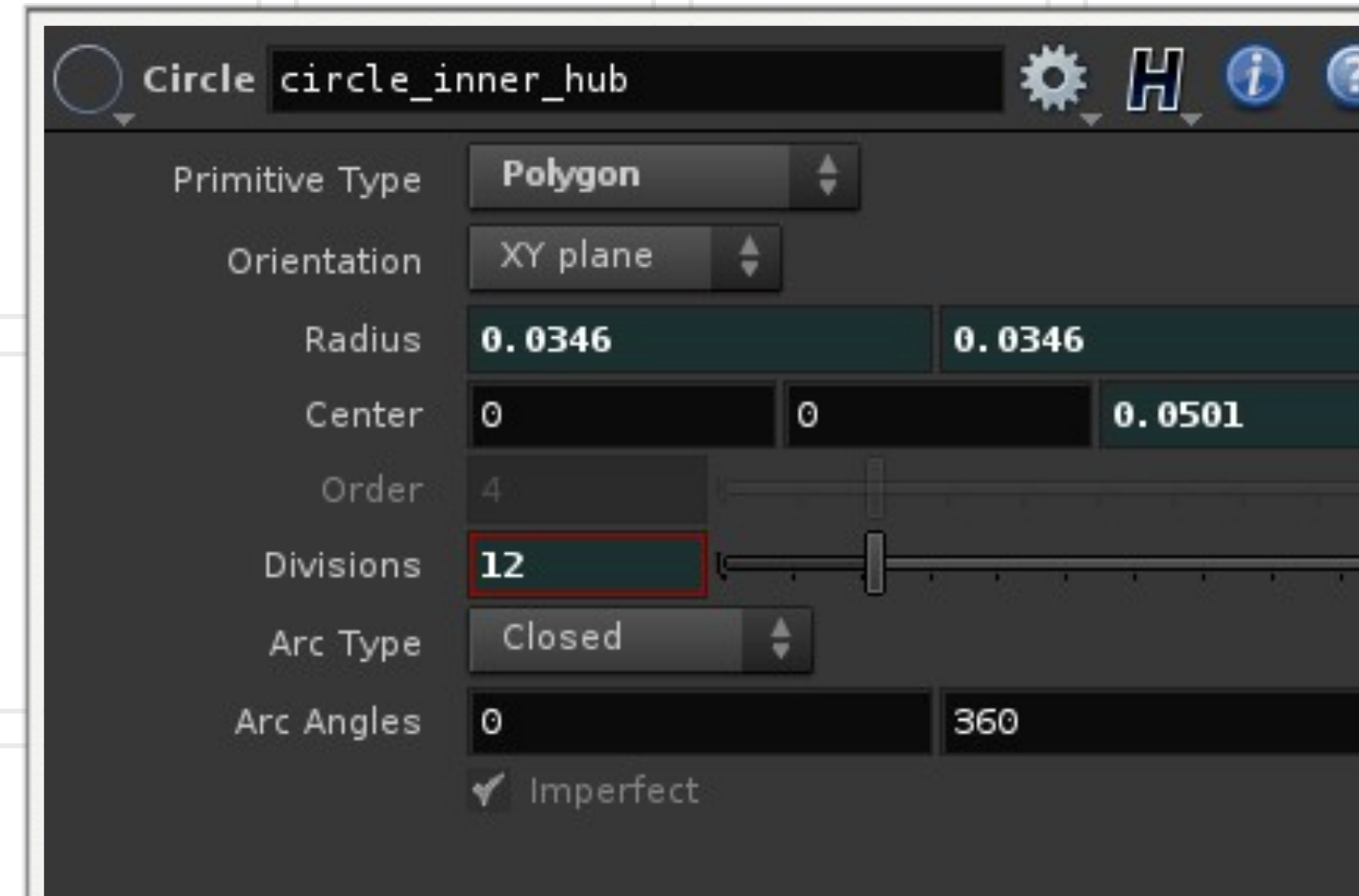
Spokes

- ▶ Thickness
- ▶ Pattern - Straight, Skewed, Cross
- ▶ Jitter - Distance every other spoke is from each other
- ▶ Spoke Rotation - Difference in angle between two sides of spokes

Building the Inner and Outer Hub Distance

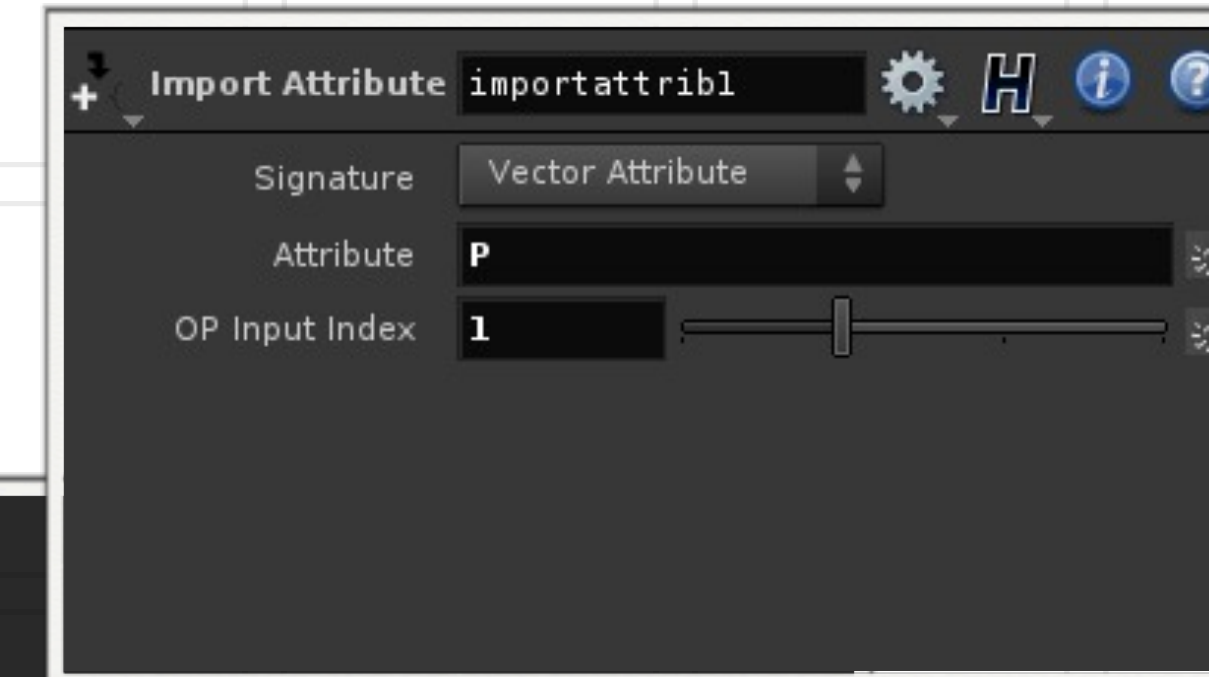
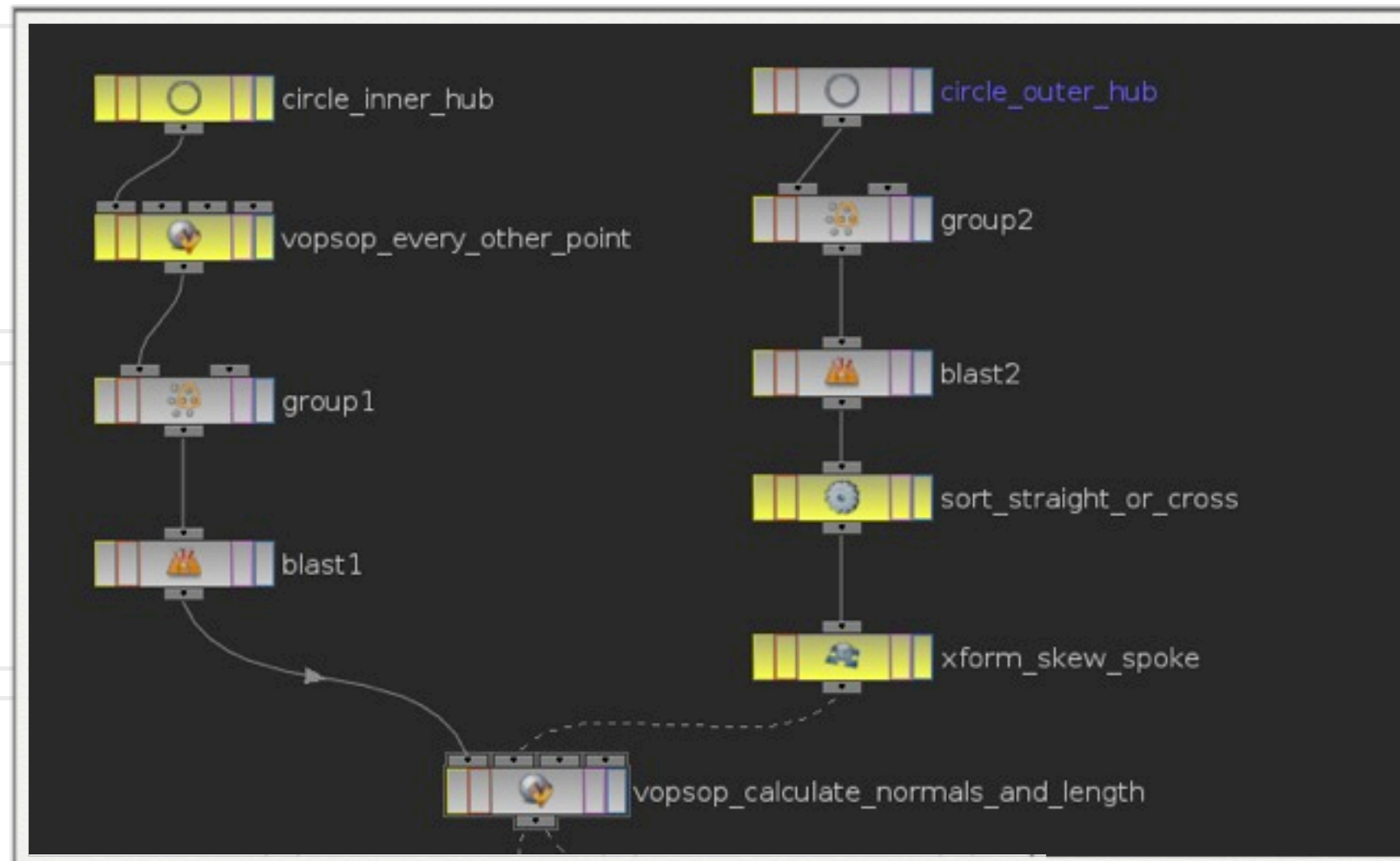


VOPSOP will be created later in lesson

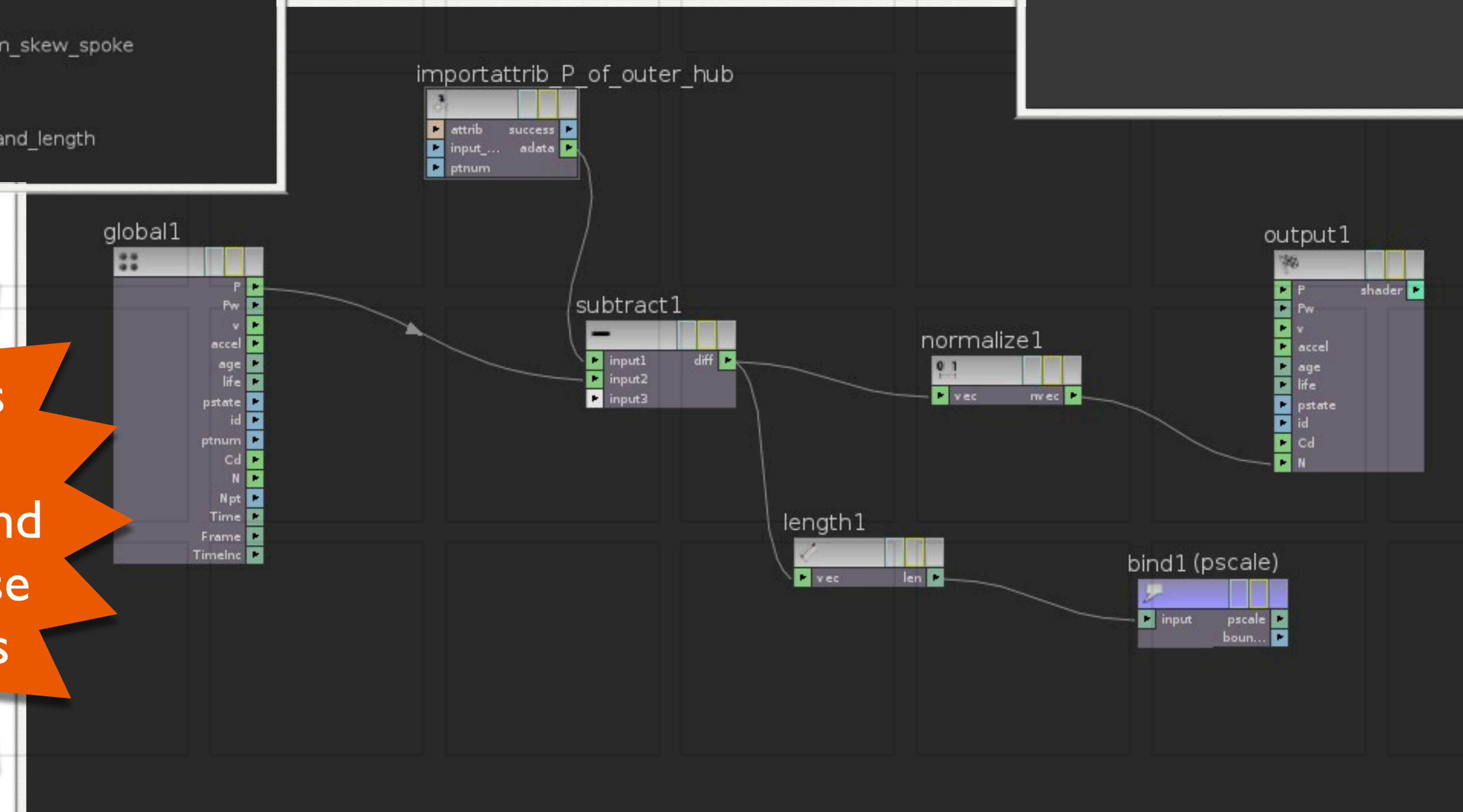


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SOFTWARE

VOPSOP to Calculate Normals and Length of Spokes

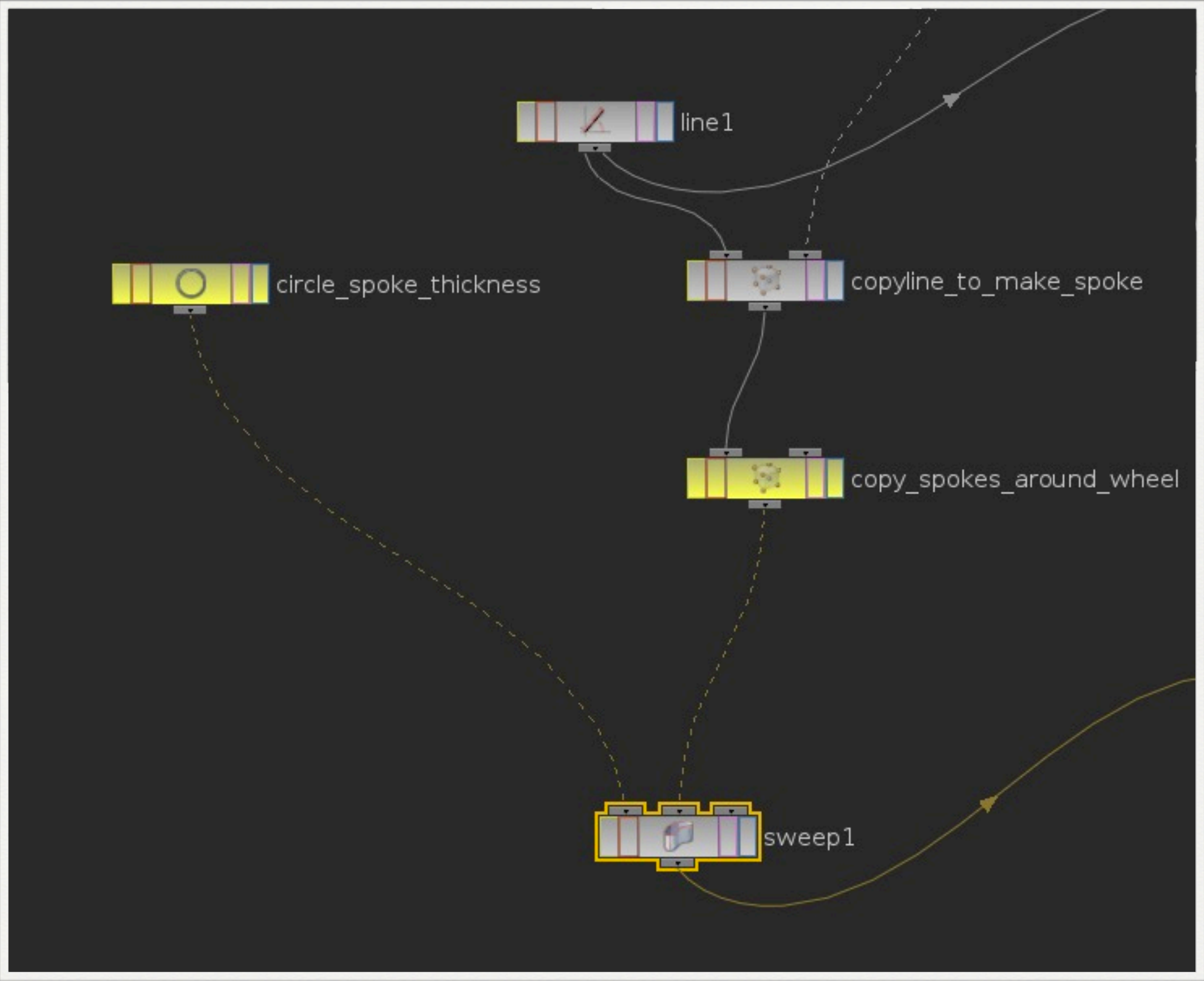
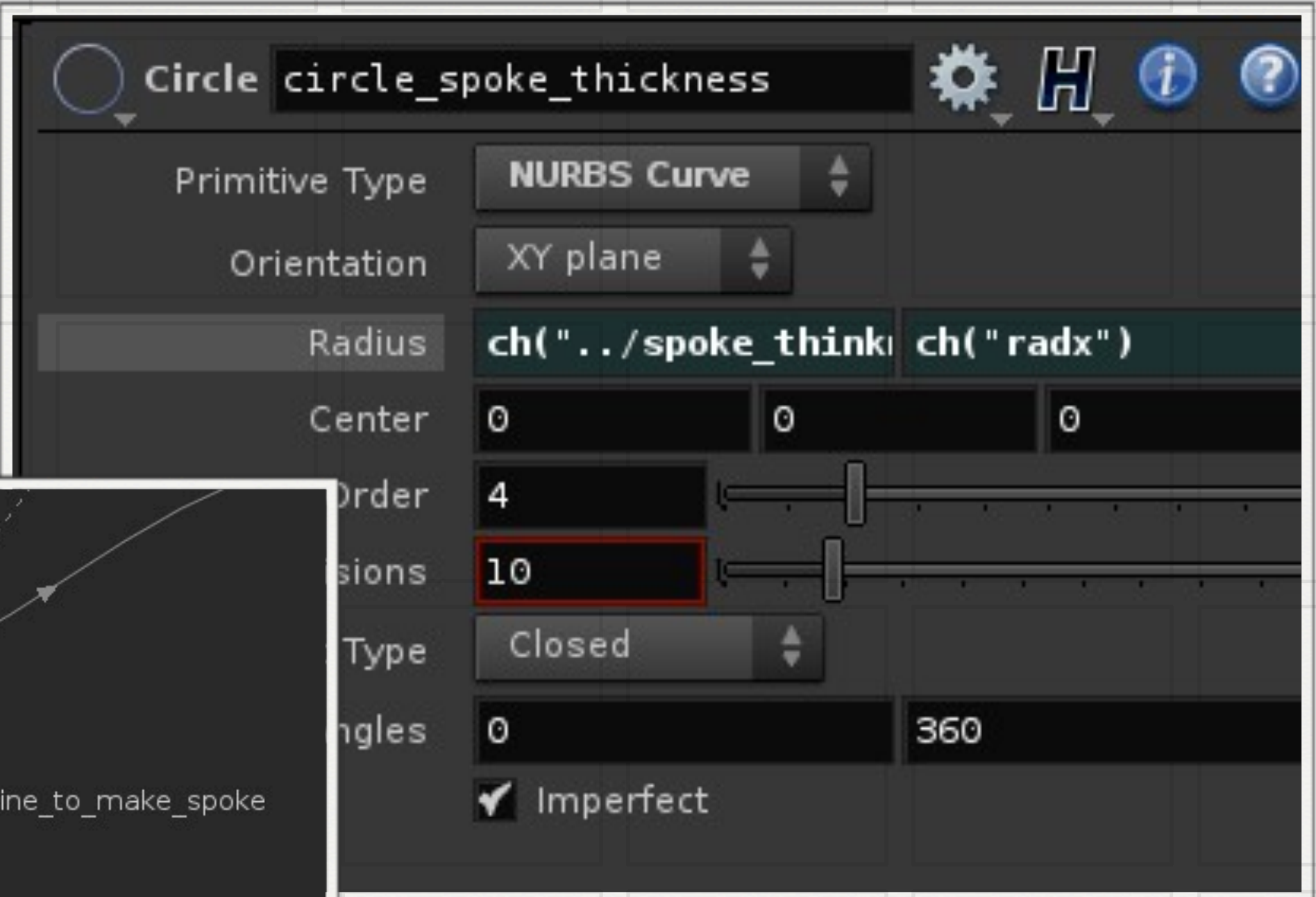
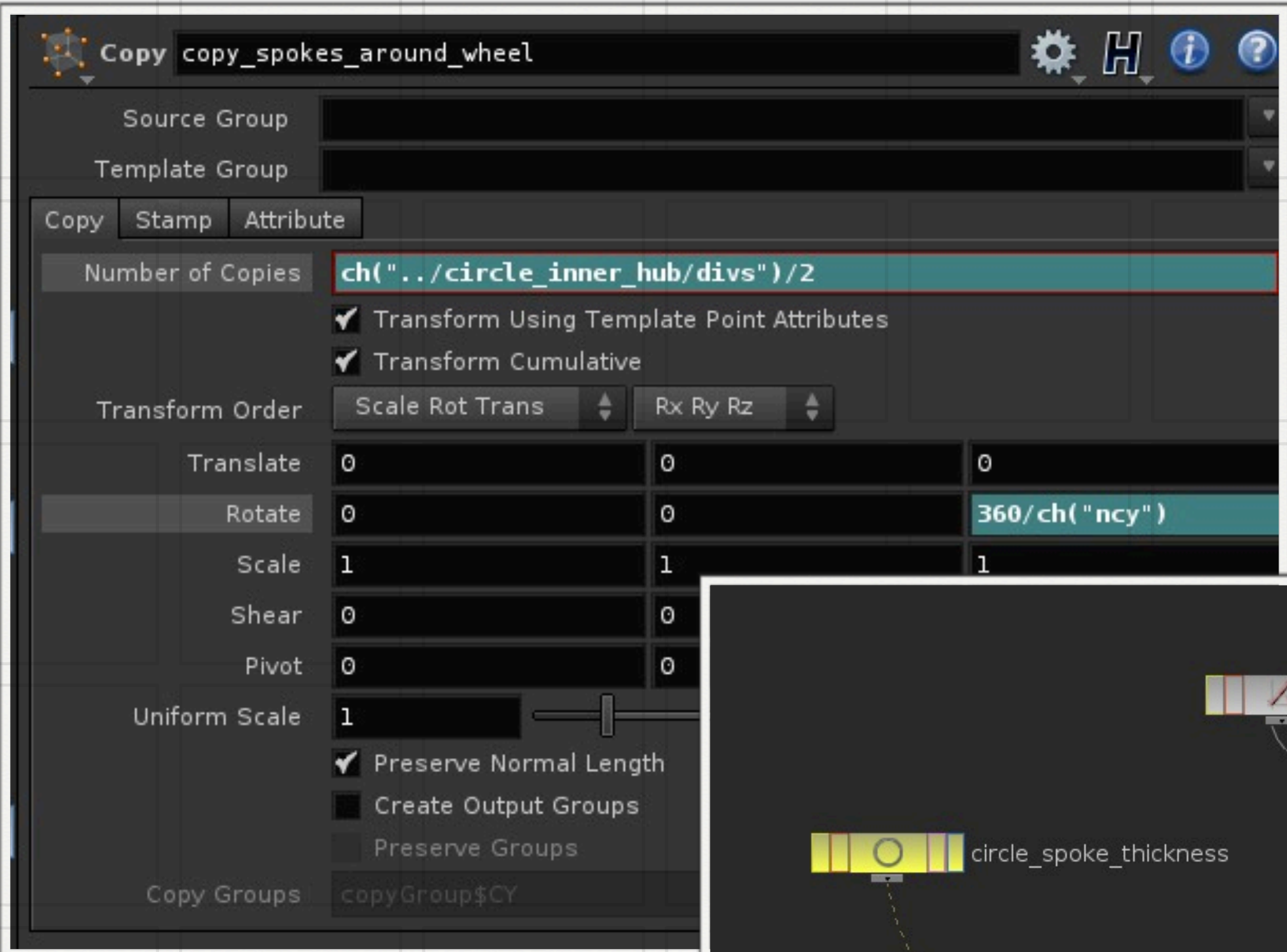


The SORT SOP is used to switch between Straight and Cross pattern - Use Reverse for Cross



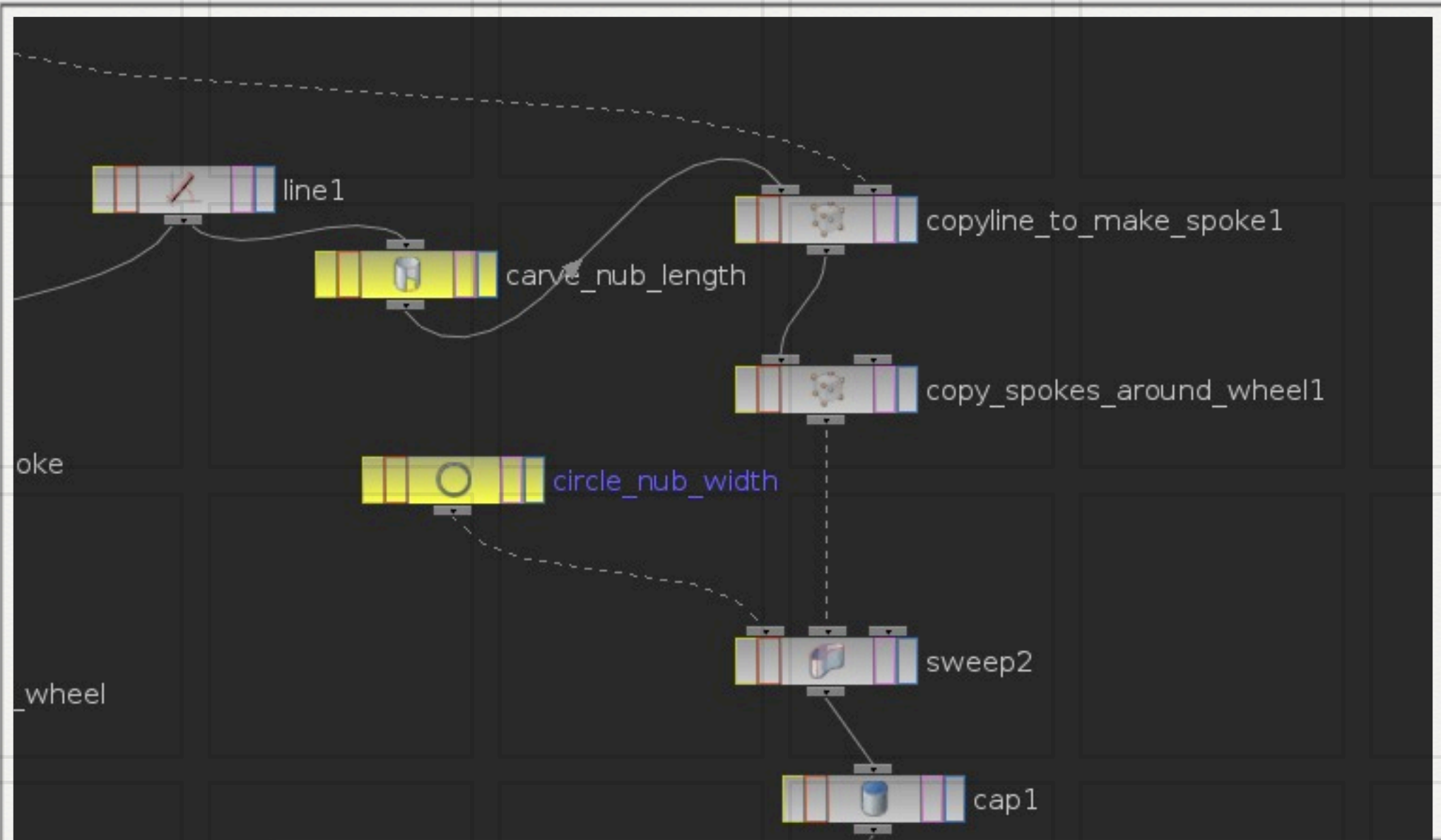
SIDE EFFECTS
SOFTWARE

Creating the Spoke



`ch("../spoke_thinkness")`

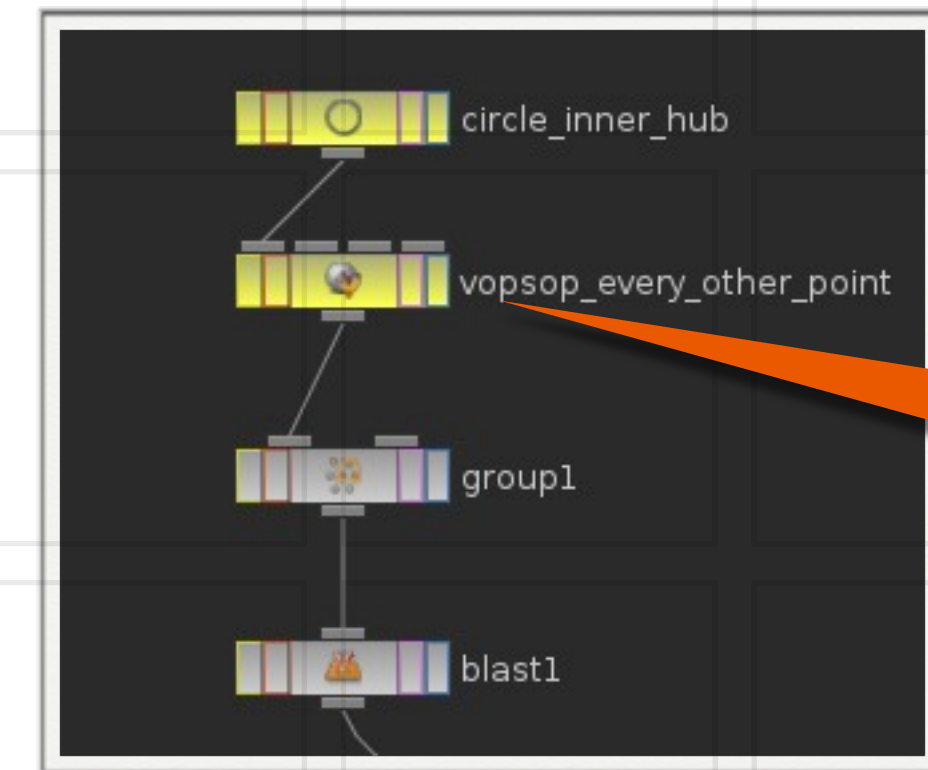
Creating the Nubs



Carve `carve_nub_length`

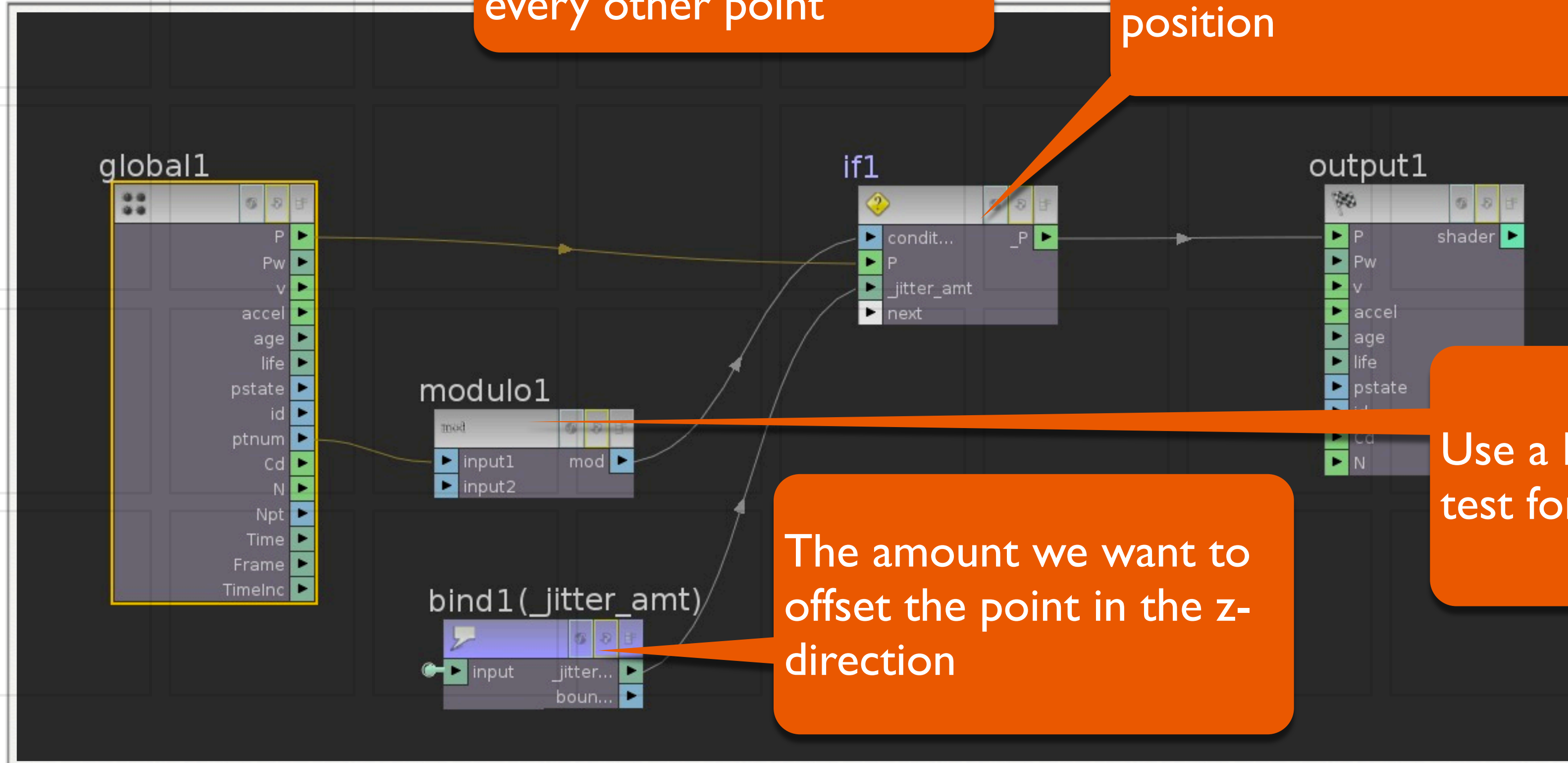
<input type="checkbox"/>	Group	
<input checked="" type="checkbox"/>	First U	<code>1-ch("../spoke_length_of_nub")</code>
<input checked="" type="checkbox"/>	Second U	<code>1</code>
<input type="checkbox"/>	First V	<code>0.25</code>
<input type="checkbox"/>	Second V	<code>0.75</code>

Making Sure the Spokes Do Not Intersect



Back at the top of the network we will now create the VOP to jitter every other point

If true we want to dive inside and alter the point position



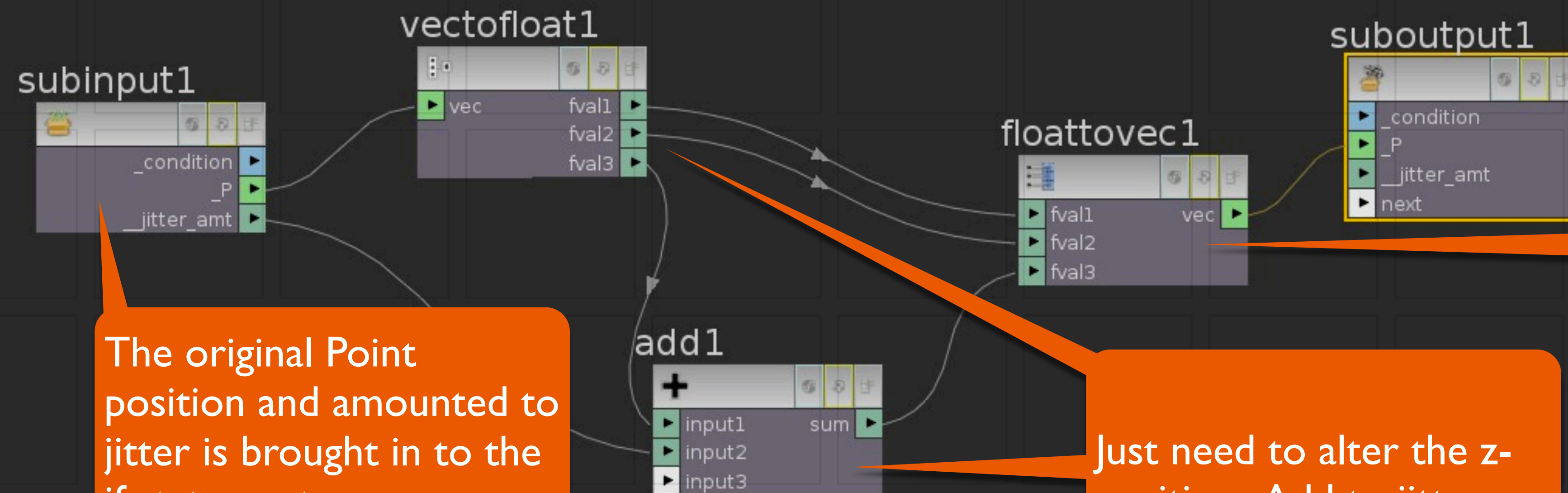
Use a Modulus of 2 to test for every other point

The amount we want to offset the point in the z-direction

SIDE EFFECTS
SOFTWARE

Making Sure the Spokes Do Not Intersect (cont.)

Inside the If Statement



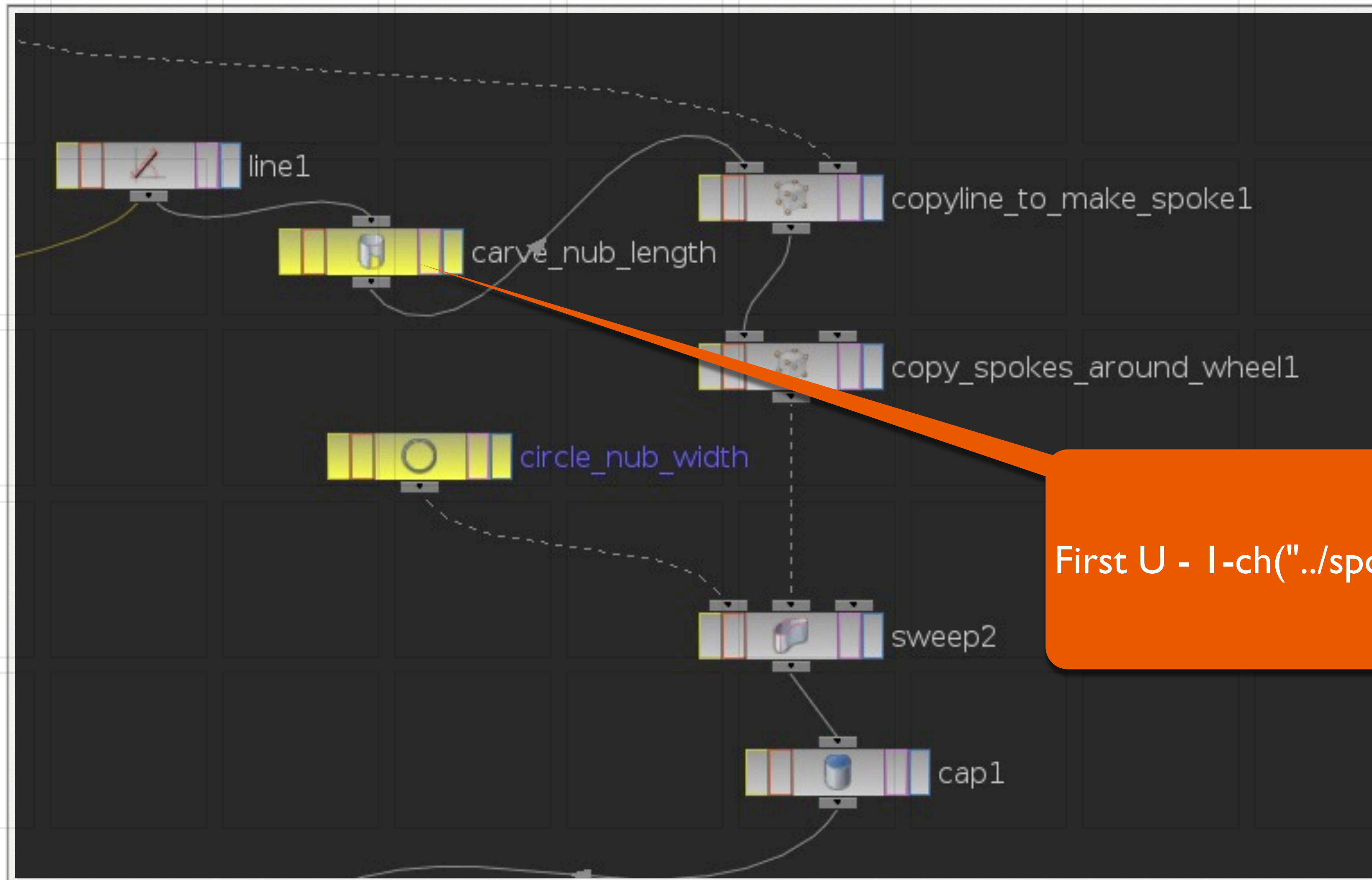
Convert back to vector with altered z value

Just need to alter the z-position. Add to jitter

The original Point position and amounted to jitter is brought in to the if statement

SIDE EFFECTS
SOFTWARE

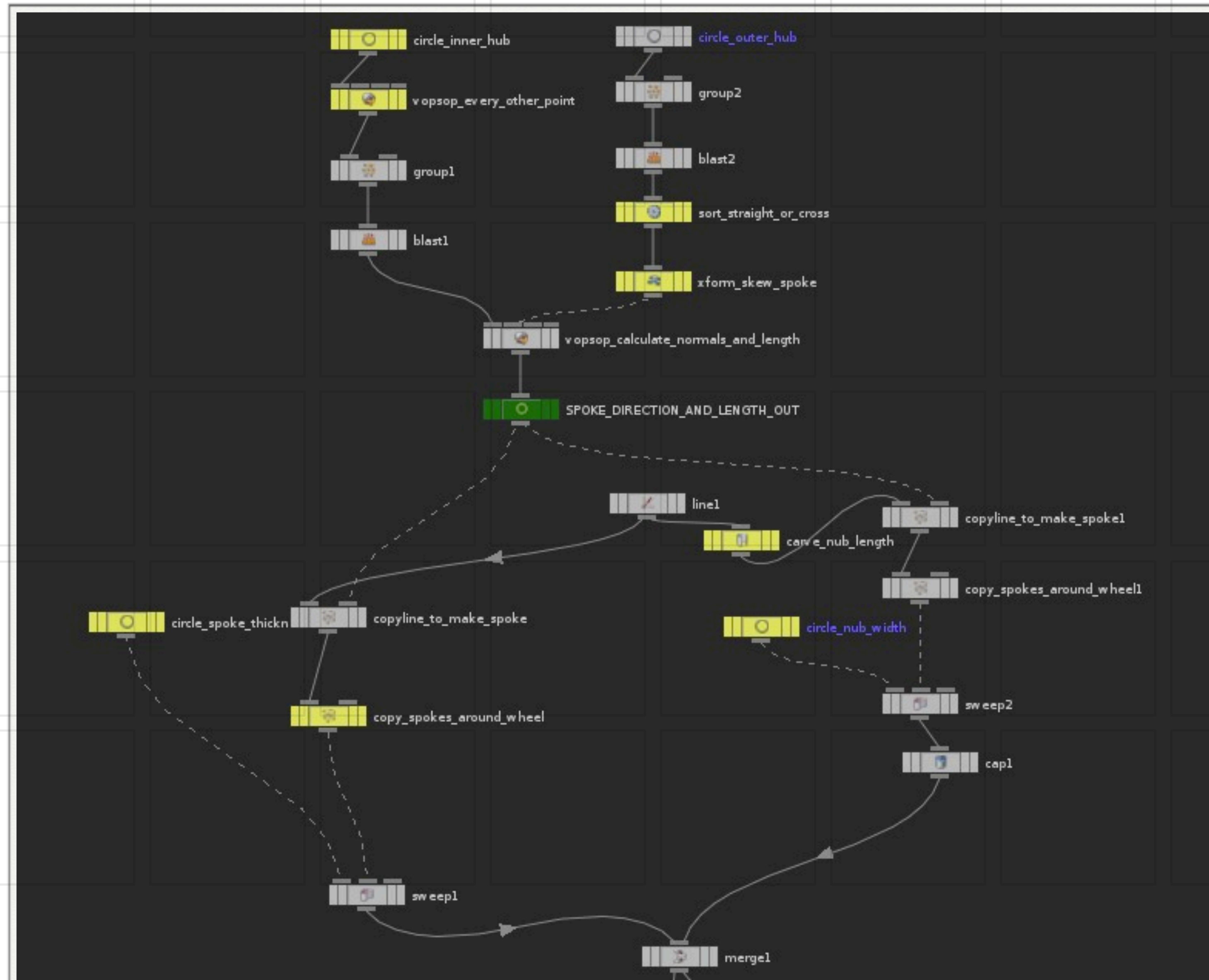
Creating the Nubs - Same as the Spokes with a Carve thrown in..



First U - I-ch("../spoke_length_of_nub")

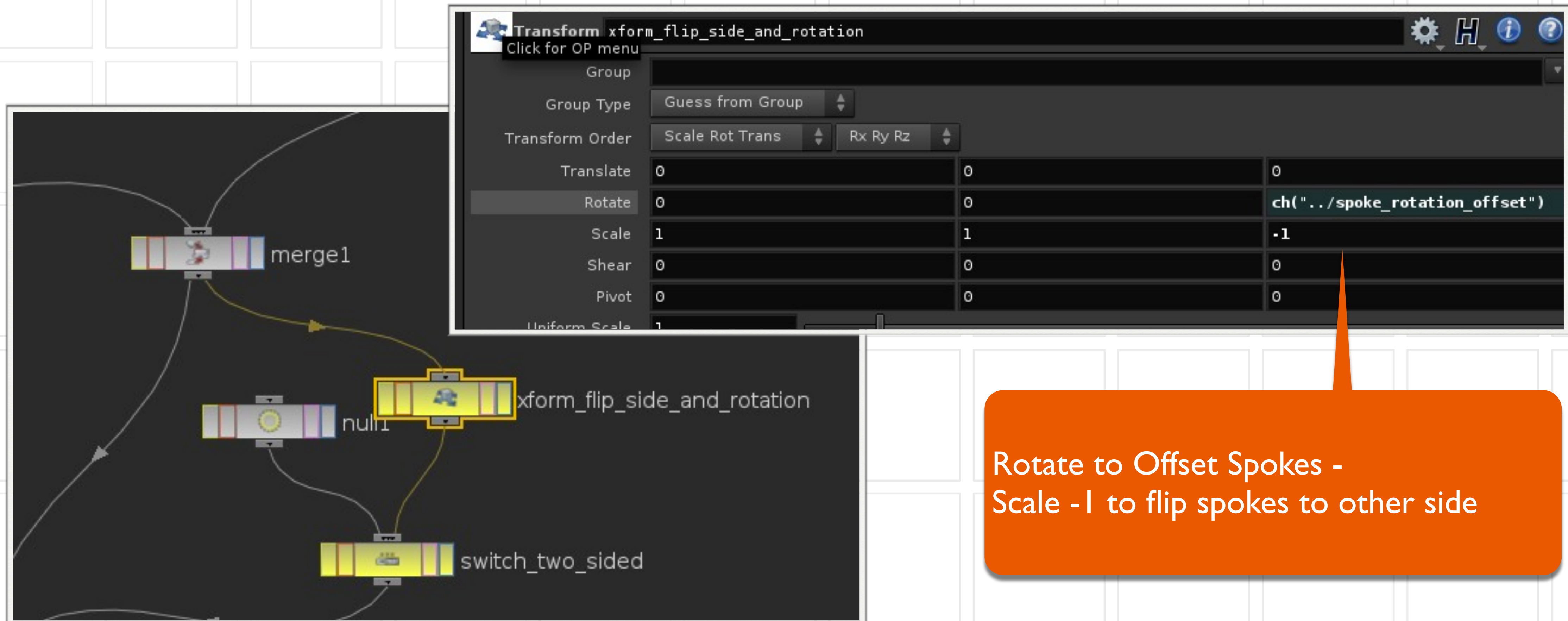
SIDE EFFECTS
SOFTWARE

Spokes and Nubs Merged Together



**SIDE EFFECTS
SOFTWARE**

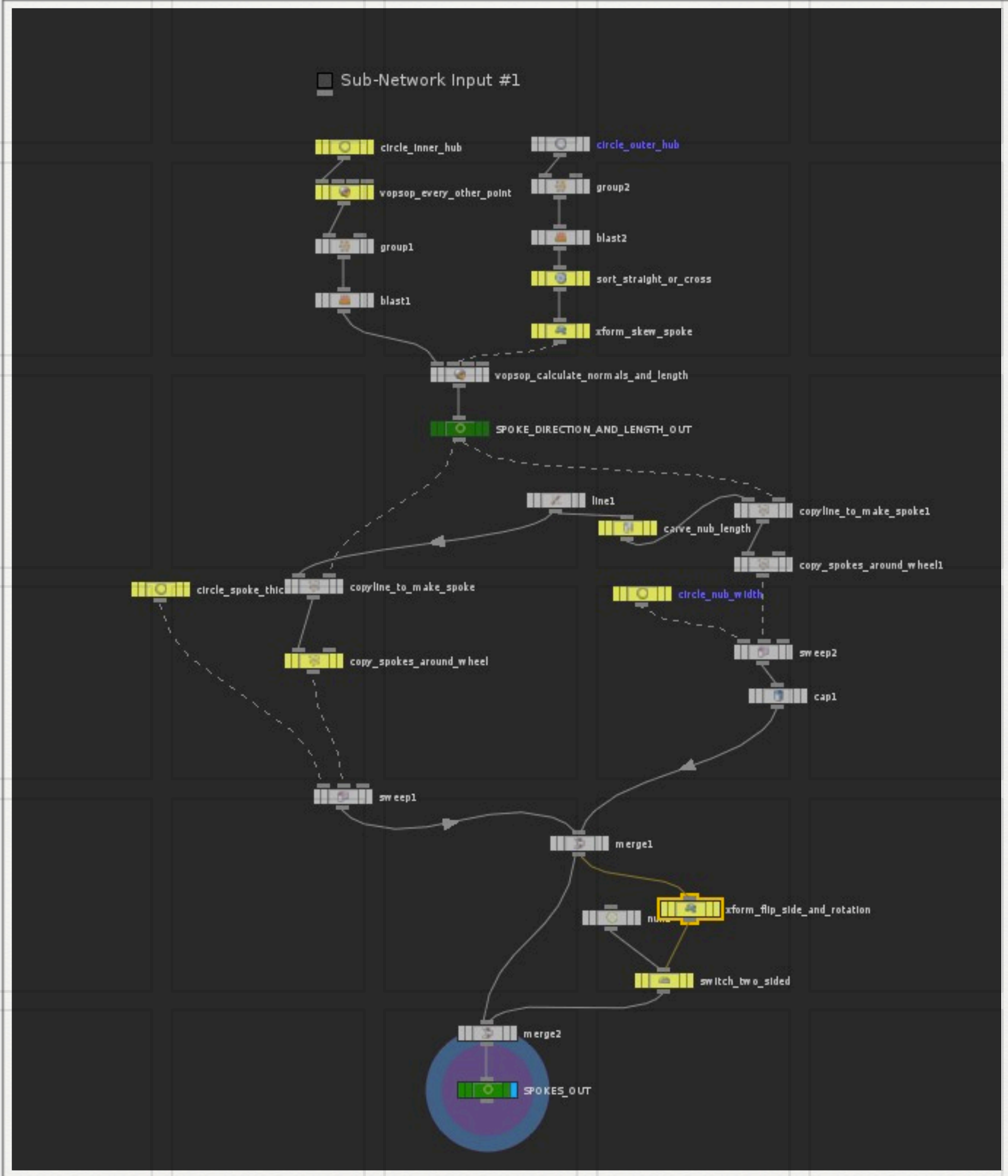
Adding the Other Side of Rims



Rotate to Offset Spokes -
Scale -1 to flip spokes to other side

**SIDE EFFECTS
SOFTWARE**

Final Network





Assignment

Wrap Network into Digital Asset

**SIDE EFFECTS
SOFTWARE**



End Module 08

**SIDE EFFECTS
SOFTWARE**