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DIG 4206C New Imagery in Motion

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Utilizing the Roto Node for Special Effects

Nuke is a powerful node based compositing program used as an industry standard in both film and commercial environments. One of the many useful tools the program offers is rotoscoping. Rotoscoping is the rotated projection of a sequence of action image frames so that the artist can trace from the frame or create an image to superimpose on it. Nuke allows its users to utilize two nodes, the Roto Node and the RotoPaint node to do this. The two nodes share many similarities with the main difference being that the Roto node is the optimal choice if rotoscoping is the only work that needs to get done. It allows you to create and edit Bezier and B-spline shapes. This differs from RotoPaint, which allows you to create and edit Bezier and B-spline shapes, as well as draw paint strokes with various brushes and gives you a broader scale of tools to use.

Stick to Manual utilizes the Roto node for some special effects to mask areas, create rays of light and more. In particular, the short film uses rotoscoping to create a glowing eyes effect and the start of a hologram technique; both of which are important to the Boss Lady's appearance in the film.

*This paper will go over how to import a 3D object into Nuke and apply textures, lighting, and a camera to the 3D scene. In addition, it goes over rotoscoping, volume rays, and cryptomatte's, as well as a glossary of all the merge node operations.

Using Roto Nodes to create a 3D Hologram Effect

The Boss Lady is first introduced as a hologram existing as a portrait in the office for a majority in the film. In order to achieve this effect, a combination of compositing in Nuke and Houdini Particles was used. This tutorial will only cover the Nuke portion of the effect which utilizes Roto nodes to mask off areas where Volume Rays will emit beams of light.

1. Open Nuke and go to the 3D display by clicking V on your keyboard while hovering over the viewport, using the dropdown shown below to select 3D view, or pressing tab in the viewport to switch between 2D and 3D. There are many ways to access different nodes in Nuke. It's most beneficial to workflow speed to learn as many hotkeys as you can.

2. Create a ReadGeo node. This can be found by pressing Tab in the Node Graph and typing "ReadGeo" or right clicking in the Node Graph, navigating to 3D>Geometry>ReadGeo. Navigate to the .obj or. fbx model that you'll be turning into a hologram.
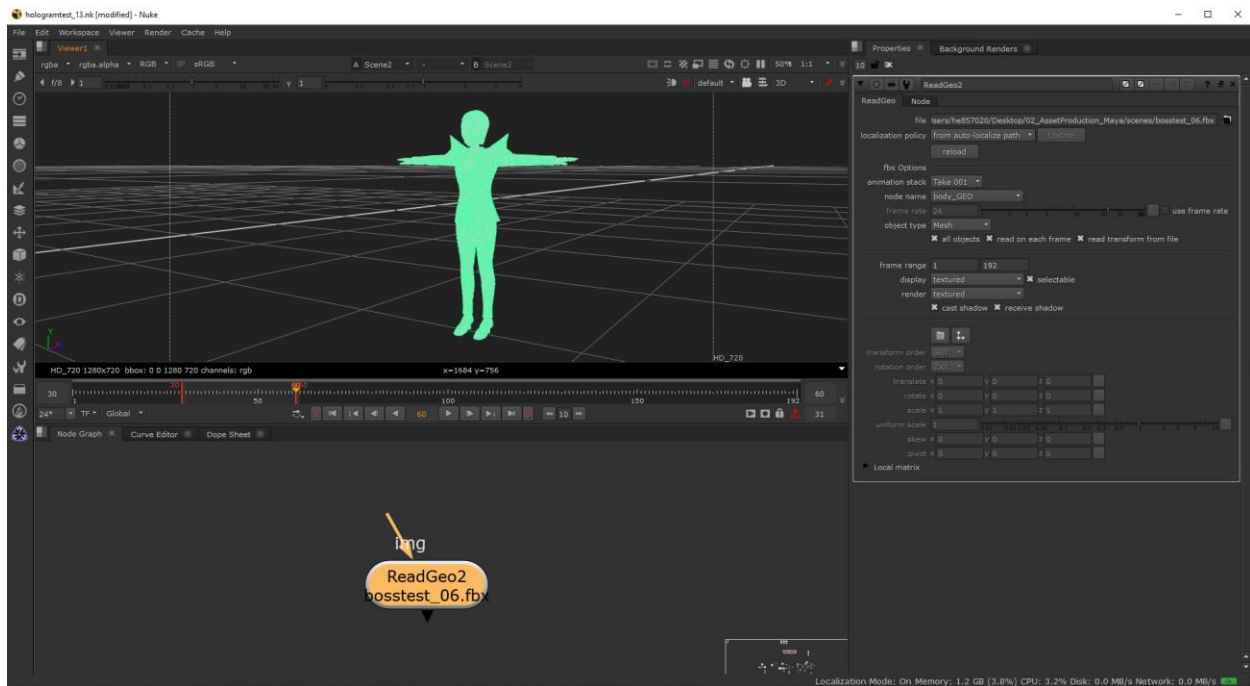
3. Using Read Nodes, import the diffuse map(s) that make up your .fbx object. If you have multiple diffuse maps, create a UVTile Node by pressing Tab in the Node Graph and typing "UVTile" or right clicking in the Node Graph, navigating to 3D>Shader>UVTile. In the properties panel of the UVTile node, enable the udim number by checking off the enable button. Input the udim number of the associated diffuse map to ensure each map gets placed in its proper place.

4. Use MergeMat Nodes to merge the different diffuse maps by pressing Tab in the Node Graph and typing "MergeMat" or right clicking in the Node Graph, navigating to 3D>Shader>MergeMat. If there are more than two diffuse maps, merge two of them together in the A and B Channels, then create another MergeMat node and merge the MergeMat node with the remaining diffuse map. Connect the img input from your ReadGeo node into the output of the MergeMat node.
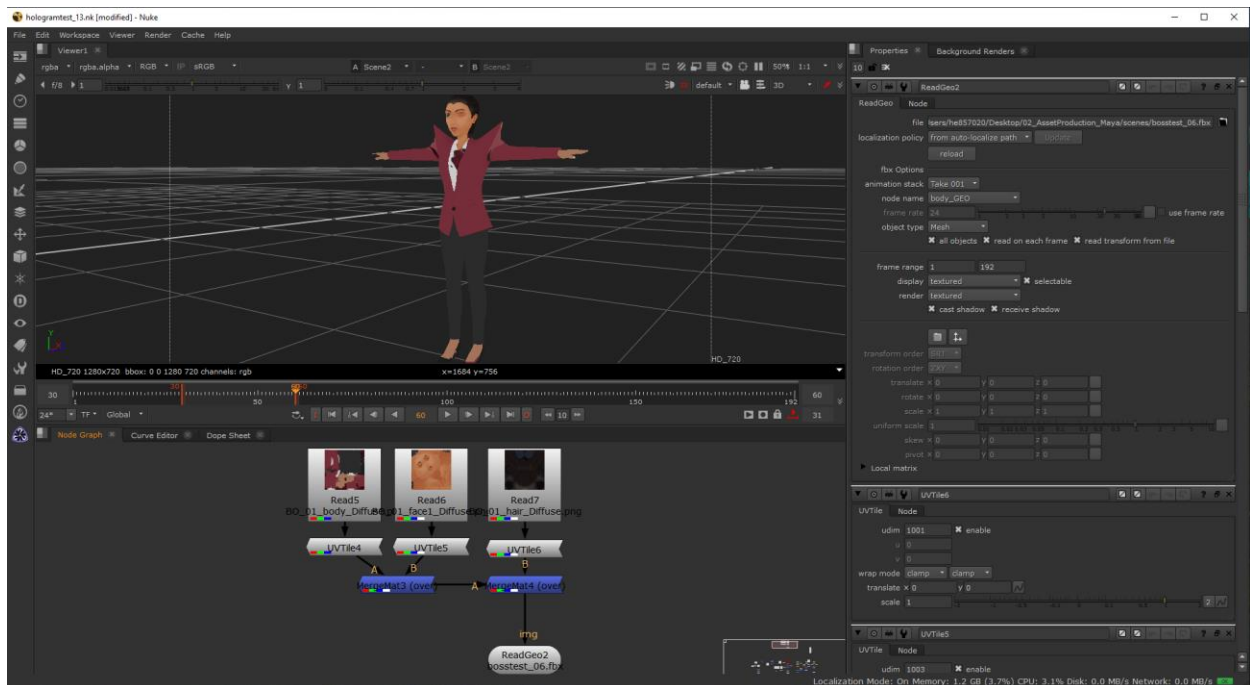
5. Create a Scene node by pressing Tab in the Node Graph and typing "Scene" or right clicking in the Node Graph, navigating to 3D>Scene. Connect the output from your ReadGeo node into your Scene node.

6. Create a Camera Node by pressing Tab in the Node Graph and typing "Camera" or right clicking in the Node Graph, navigating to 3D>Camera. In the properties panel of the Camera node, check off the "read from file" box in the "Camera" tab. Navigating to the "File" tab, check off the "read from file" box. Click on the small folder icon next to the reload button and import the camera used by your. fbx model. To export a. fbx model with a camera, select both your geometry and camera in Maya, and navigate to File>Export Selection. Name your file, change the file type to FBX export, and click Export Selection.

7. Create a ScanlineRender Node by pressing Tab in the Node Graph and typing "ScanlineRender" or right clicking in the Node Graph, navigating to 3D>ScanlineRender. Connect the output of your Camera node to the ScanlineRender node. Connect the output from your Scene node into the obj/scn input of the ScanlineRender
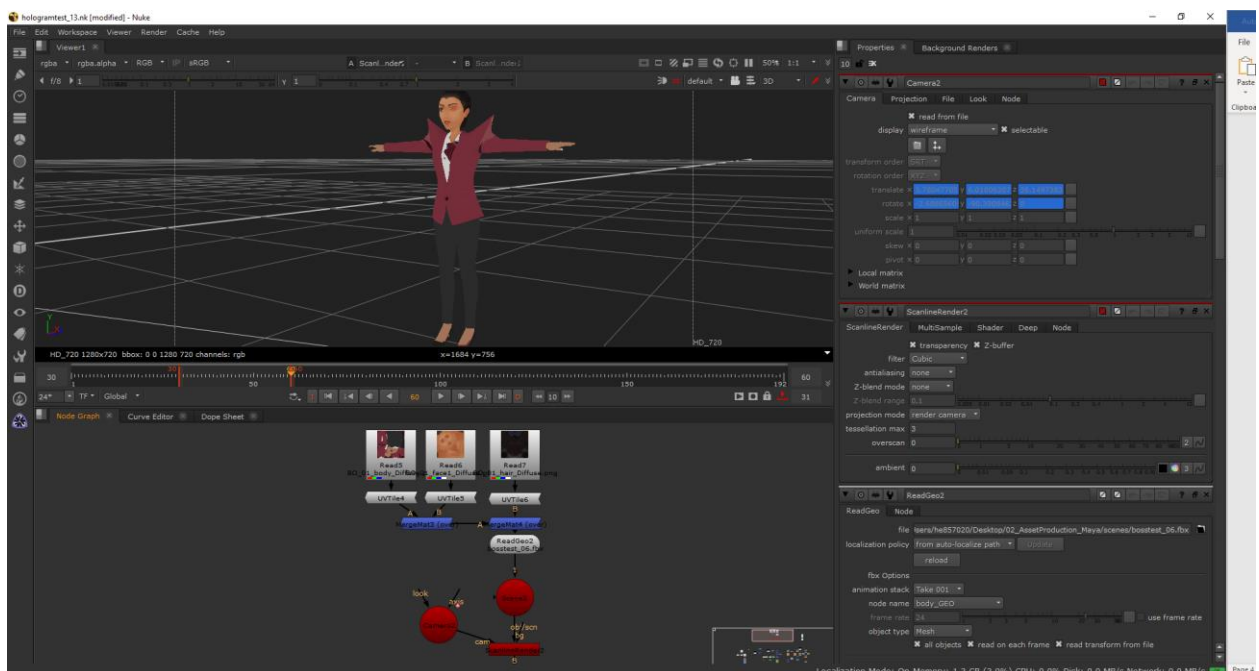
8. Create three lights Node by pressing Tab in the Node Graph and typing "Light" or right clicking in the Node Graph, navigating to 3D>Lights>Light. Create a three-point lighting system around your .fbx model and/or light the object in whichever way you'd like. Connect the outputs of your lights into your Scene node.
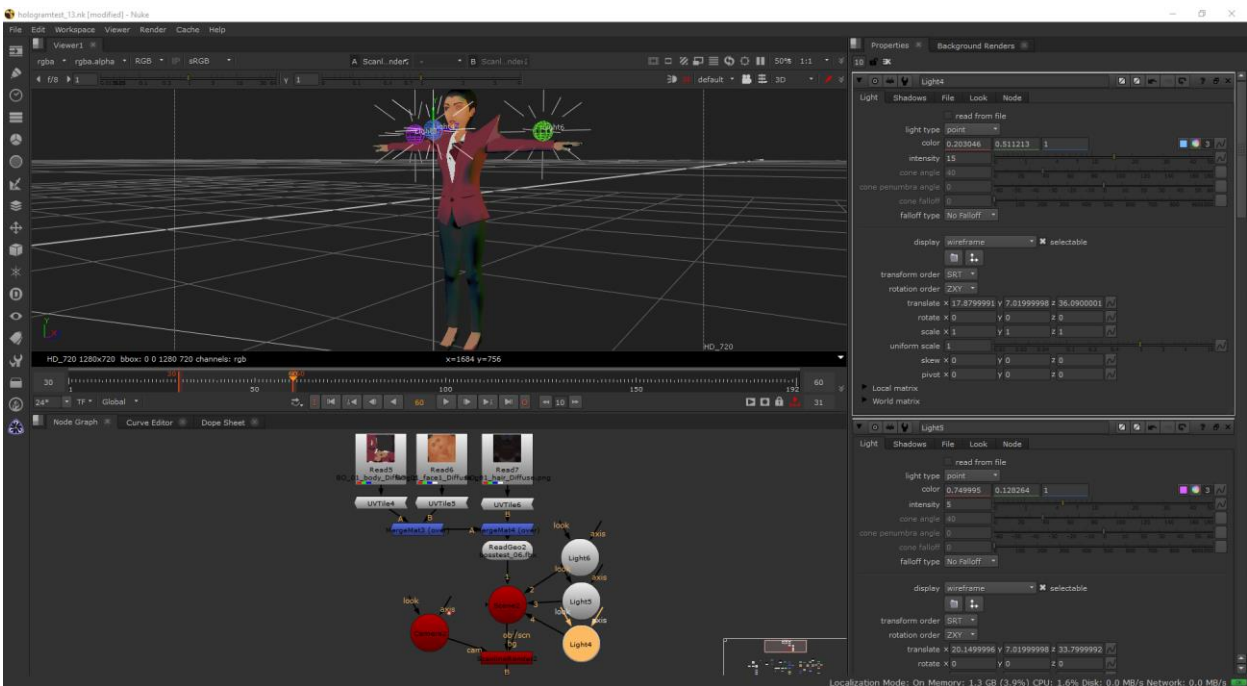
The Finished Tree and Rendered Shot
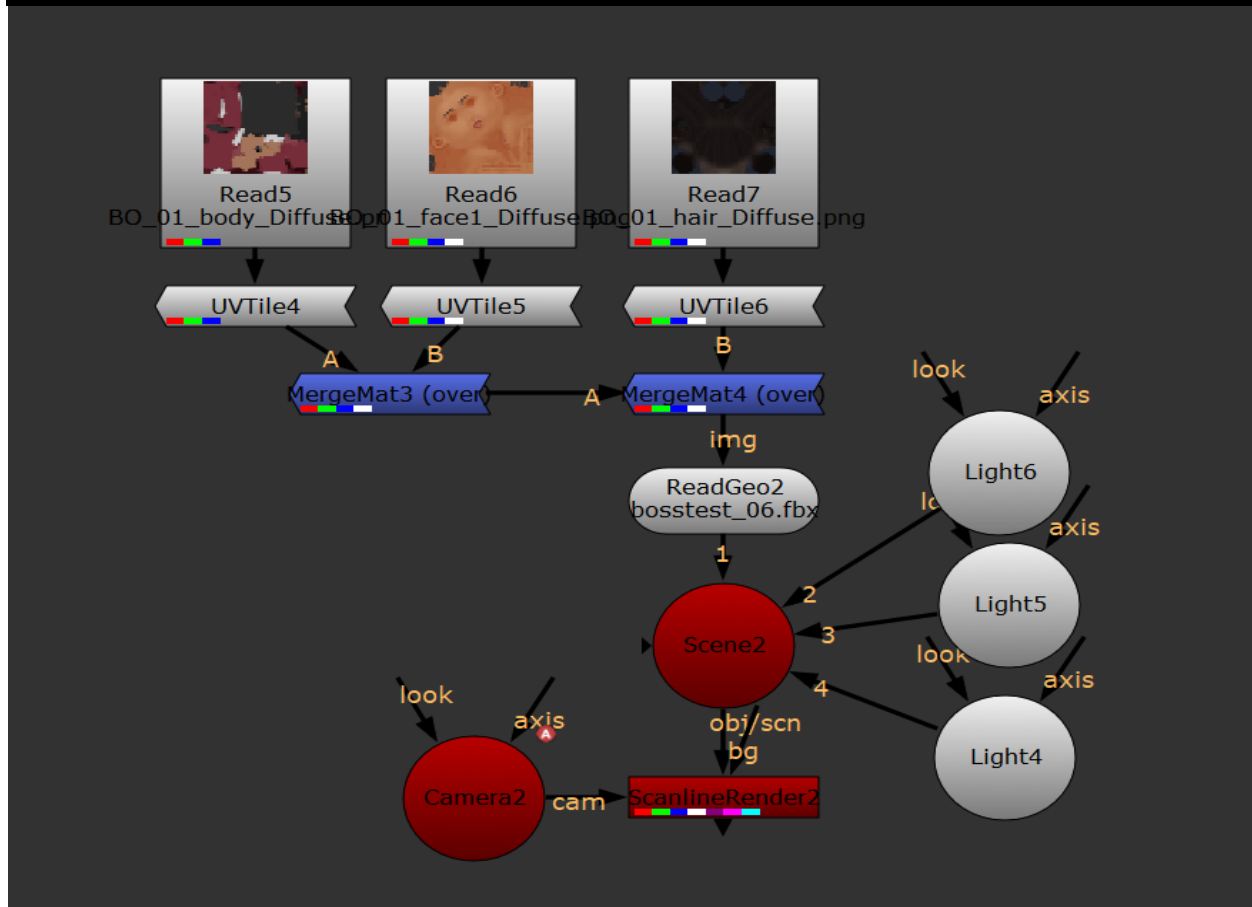
Using Roto Nodes to create a 3D Hologram Effect

The Boss Lady is first introduced as a hologram existing as a portrait in the office for a majority in the film. In order to achieve this effect, a combination of compositing in Nuke and Houdini Particles was used. This tutorial will only cover the Nuke portion of the effect which utilizes Roto nodes to mask off areas where Volume Rays will emit beams of light.

1. Create a Read node by pressing Tab on the keyboard and typing "Read" and pressing enter, or by using the "R" hotkey in the Node Graph. You can also create a new Read Node by navigating to the sidebar under File, clicking on the Image icon and navigating to "Read". There are many ways to access different nodes in Nuke. It's most beneficial to workflow speed to learn as many hotkeys as you can.

2. Navigate to your .exr file's beauty pass.

3. Create a Grade node by pressing Tab on the keyboard and typing "Grade" and pressing enter, or right clicking in the Node Graph, navigating to Color>Grade. You can also press the "G" hotkey in the Node Graph. The Grade node defines white and black points by sampling pixels from the Viewer. You can use this node for matching foreground plates to background plates.
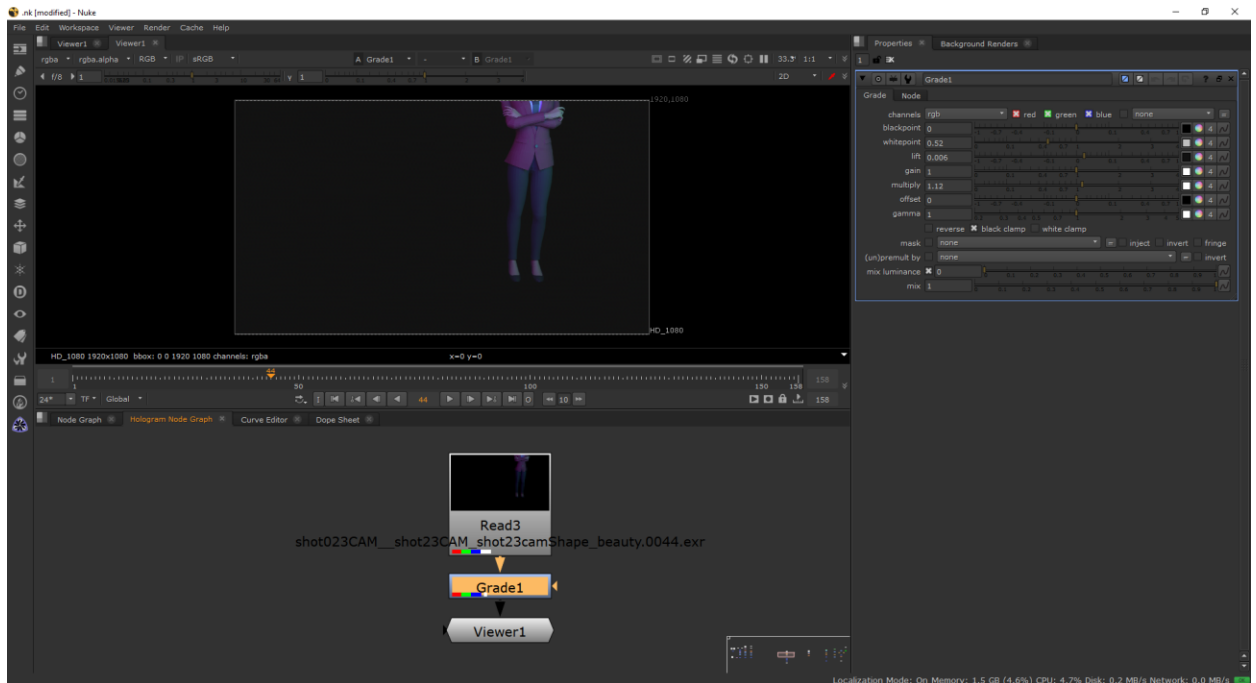
4. Copy and paste the Read node and Grade node by pressing CTRL+C and pasting with CTRL+V.

5. Create a Blur node by pressing Tab on the keyboard and typing "Blur" and pressing enter, or right clicking in the Node Graph, navigating to Filter>Blur. You can also use the "B" hotkey in the Node Graph. Connect the input pipe to the output of the Grade node.

6. Create a Glow node by pressing Tab on the keyboard and typing "Glow" and pressing enter, or right clicking in the Node Graph, navigating to Filter>Glow. Connect the input pipe to the output of the Blur node.
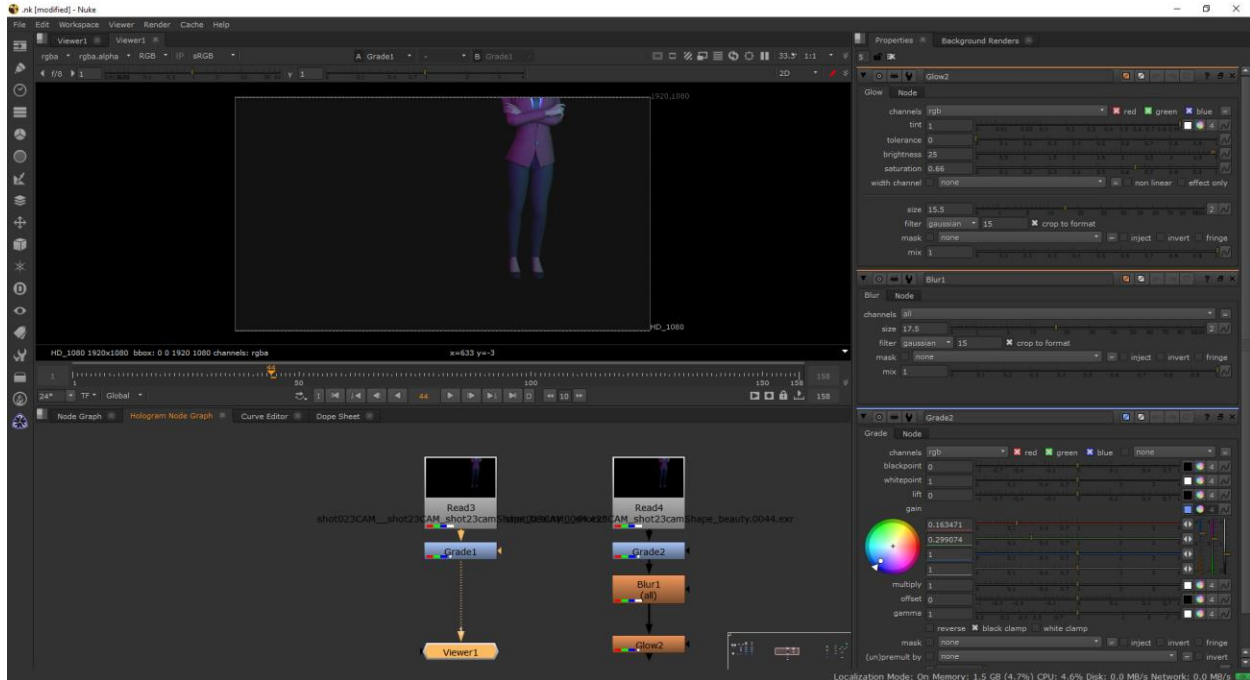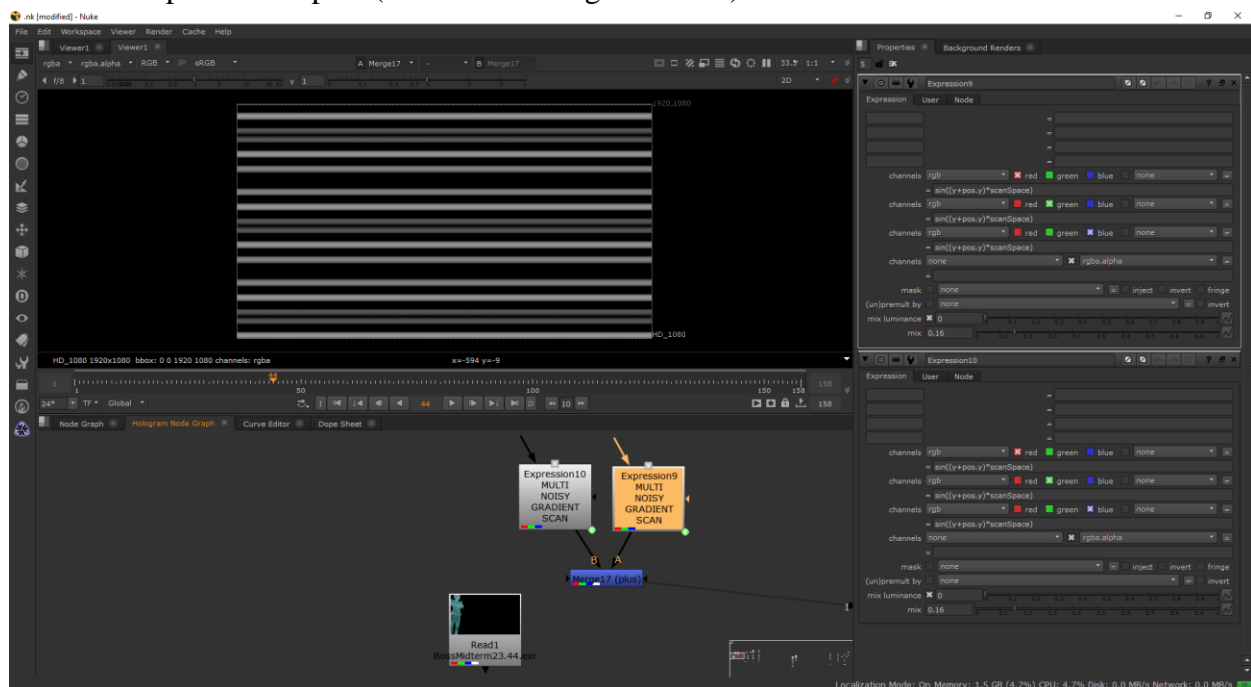
7. Create a Merge node by pressing Tab in the Node Graph and typing "Merge" or right clicking in the Node Graph, navigating to Merge>Merge. You can also use the "M" hotkey on your keyboard. Set your first Read and Grade node to the B pipe and the Glow node to the A pipe. In the properties panel of your Merge node, set the operation to under. The resulting image will have the glow underneath the rendered image (layers image B over A according to the matte of image B)
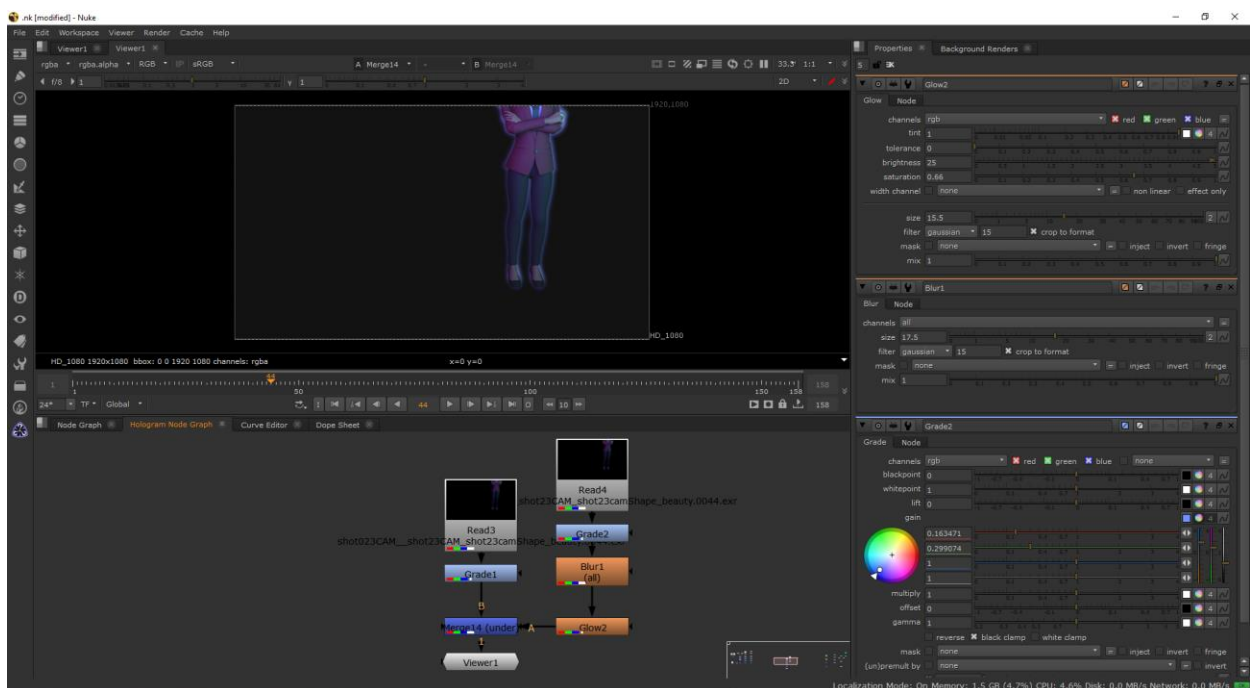
Adding Houdini Particles

The particle effect was created using Houdini Particles and a glitch effect that utilizes
expressions. This paper will not go into detail in creating the expressions or particles as they
were not made by me. All the Transform nodes mentioned are to adjust the positioning of the
pre-rendered particles and glitch expressions to match the shot the hologram is being rendered
into. You can create Transform nodes by pressing Tab in the Node Graph and typing
"Transform" or right clicking in the Node Graph, navigating to Transform>Transform. You can
also use the "T" hotkey on your keyboard. It is recommended that the particles are pre-rendered
with the proper camera angle matching the beauty .exr's to avoid having to adjust in
compositing.

1. Create a Read node with the. exr of the rendered particle effect in Houdini.

2. Create an Expression node by pressing Tab in the Node Graph and typing
   "Expression".

3. Create another Expression node.

4. Create a Merge node to merge the two Expression nodes together. Set the merge
   operation to plus (The sum of image A and B).

5. Copy and Paste the above Expression and Merge nodes.

6. Create a Merge node. Set the output of the first set of expressions to the B pipe and the output of the second set of expressions to the A pipe. Set the merge operation to over (this is the default operation. layers image A over B according to the alpha of image A).
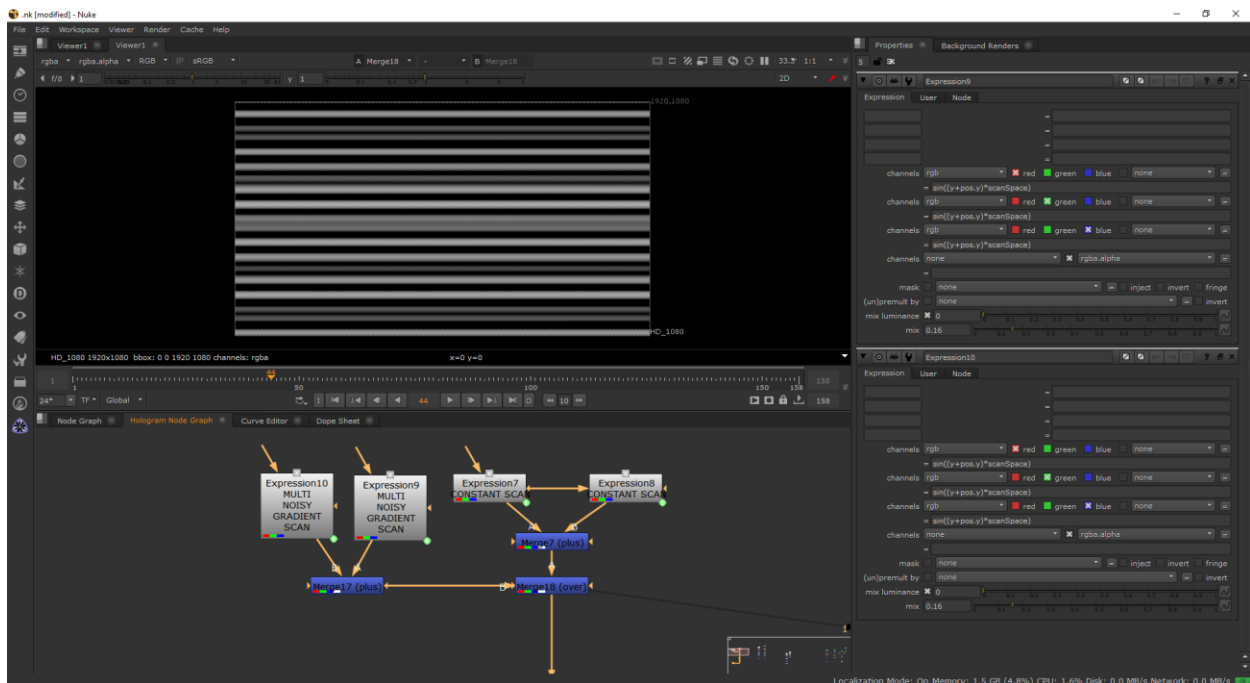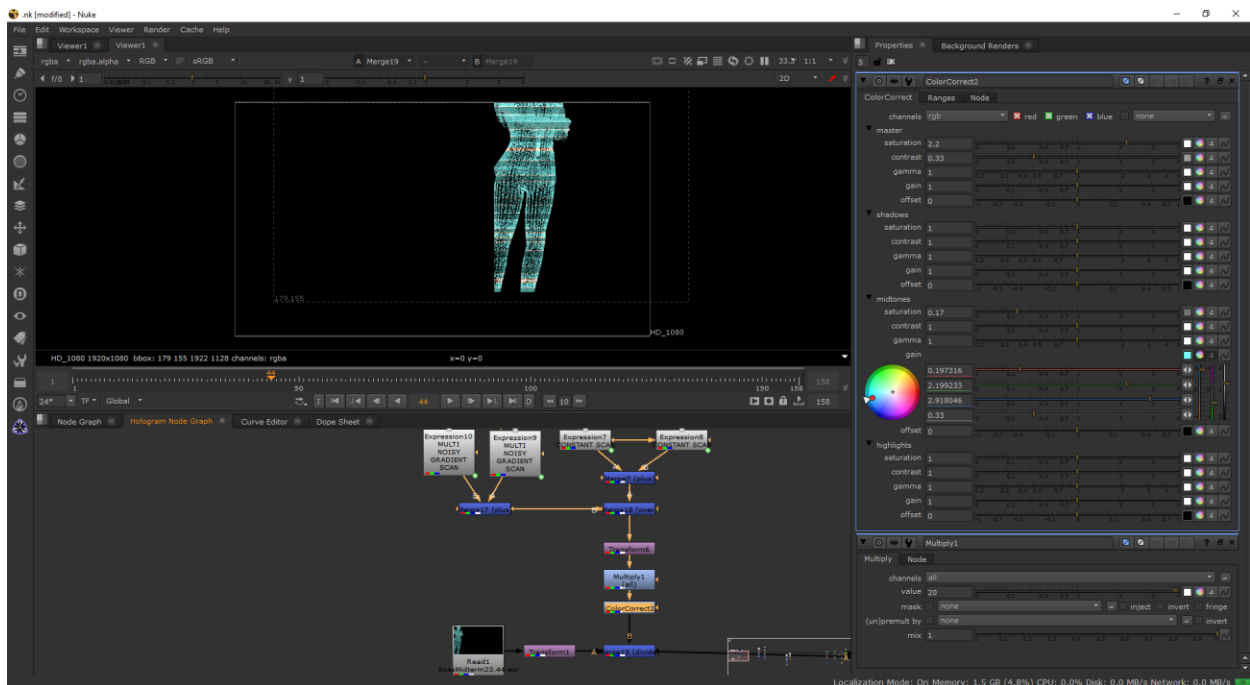

7. Create a Multiply node by pressing Tab in the Node Graph and typing "Multiply" or right clicking in the Node Graph, navigating to Merge>Merges>Multiply. The multiply node multiplies a channel's values by a given factor, which has the effect of lightening the channel while preserving the black point. This operation is also known as gain. Connect the input pipe to the output of the merge node.

8. Create a Color Correct node by pressing Tab on the keyboard and typing "Color Correct" and pressing enter, or right clicking in the Node Graph, navigating to Color>Color Correct. You can also use the "C" hotkey in the Node Graph. The Color

Correct node is used to make quick adjustments to contrast, gamma, gain, and offset. Connect the input pipe to the output of the Multiply node.
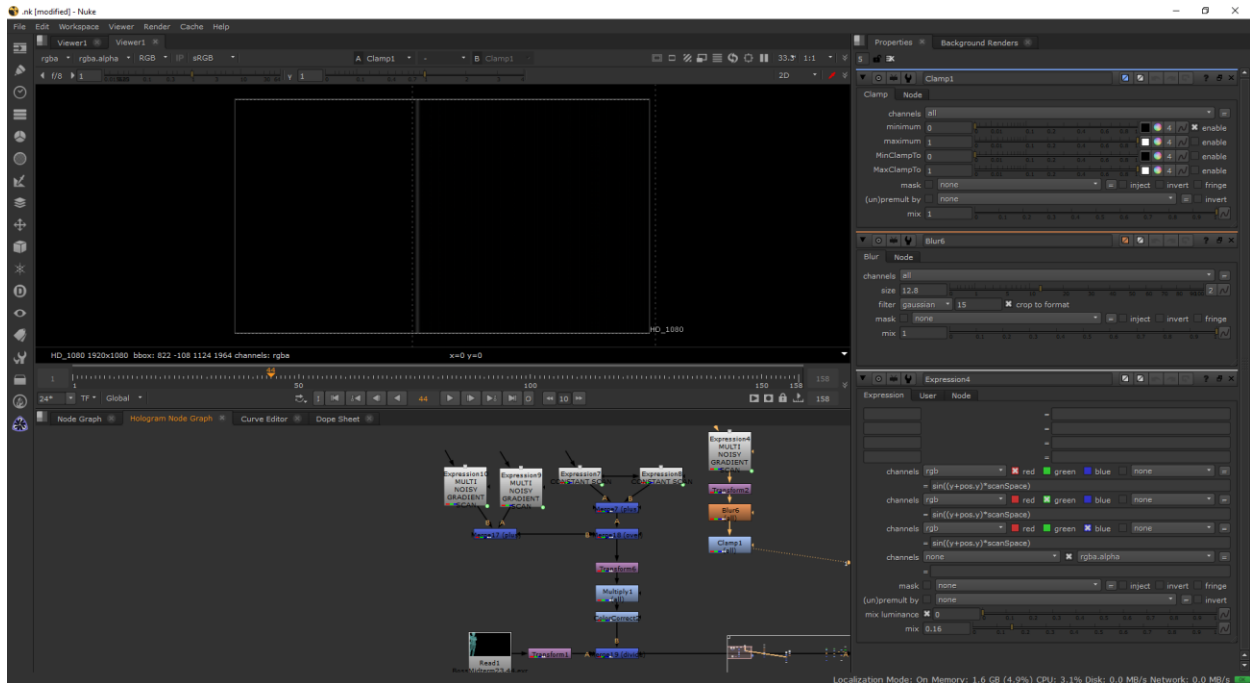
9. Create a Merge node. Set the output of the second glitch effect to the B pipe and the output of the particle read node to the A pipe. Set the merge operation to divide (divides the values but stops two negative values from becoming a positive number).

10. Create an Expression node.
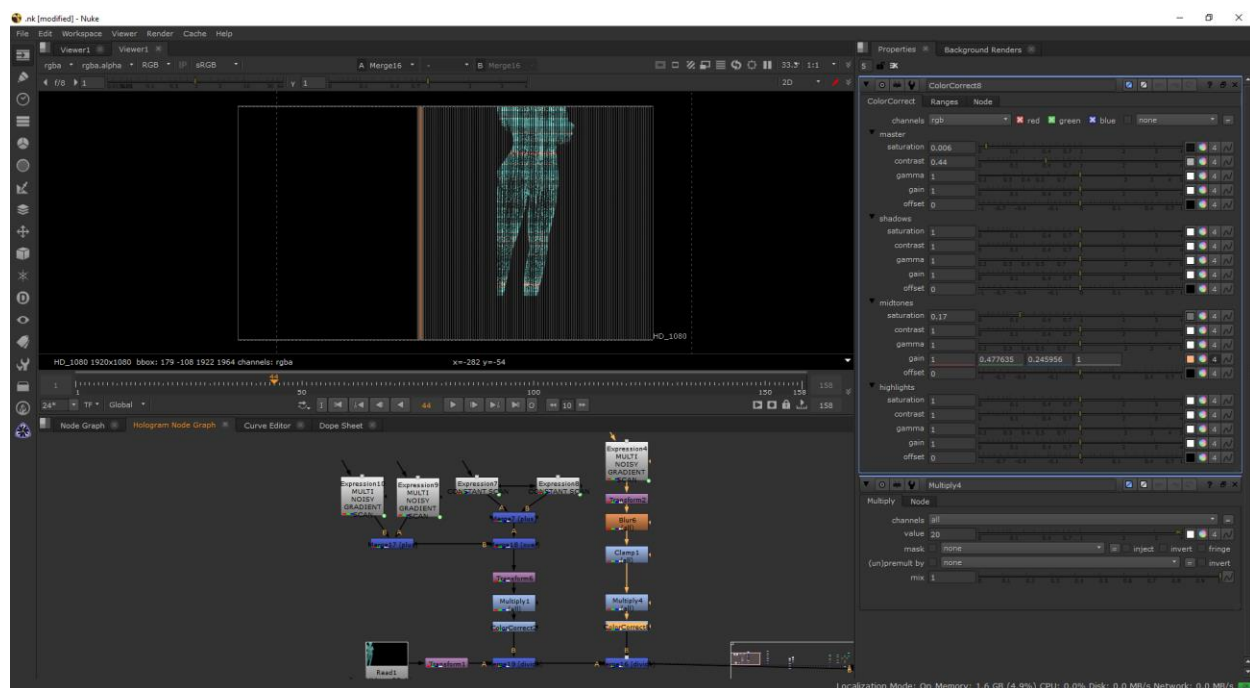
11. Create a Blur node. Connect the input pipe to the output of the Expression node.

12. Create a Clamp node by pressing Tab in the Node Graph and typing "Clamp" or right clicking in the Node Graph, navigating to Color>Clamp. The Clamp node constrains values in the selected channels to a specified range. Connect the input pipe to the output of the Blur node.

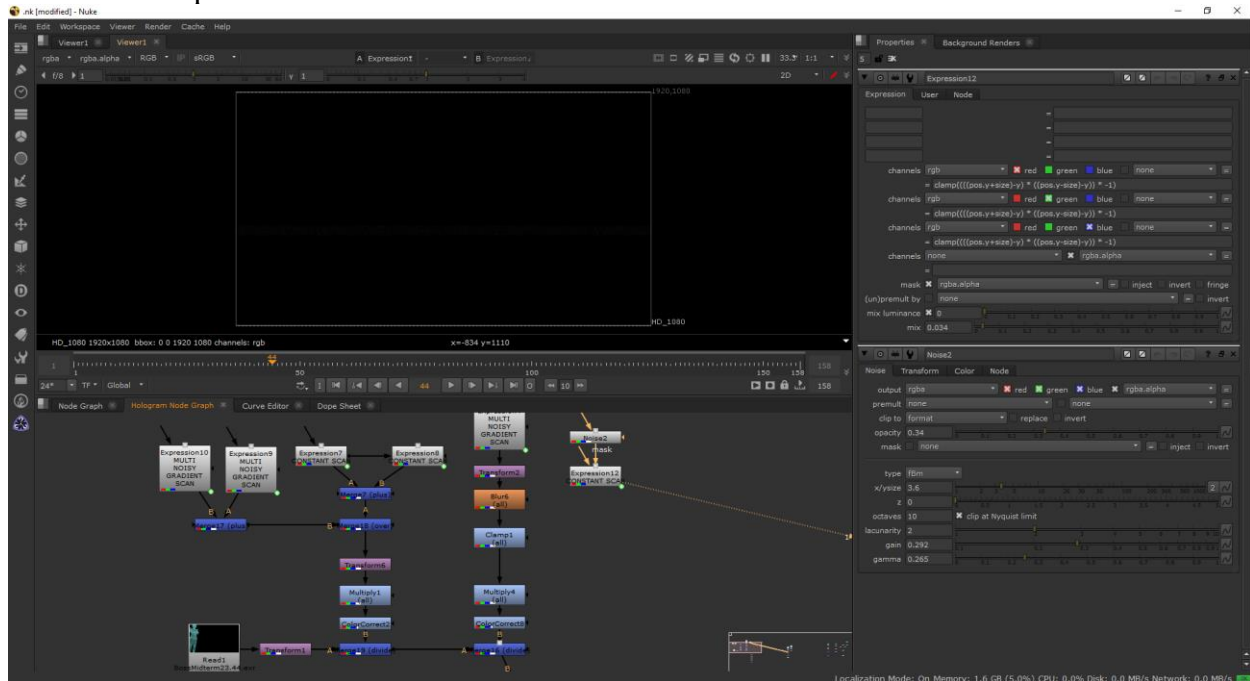13. Create a Multiply node. Connect the input pipe to the output of the Clamp node.

14. Create a Color Correct node. Connect the input pipe to the output of the Multiply node.

15. Create a Merge node. Set the output of the second glitch effect to the B pipe and the output of the first set of the glitch effect to the A pipe. Set the merge operation to divide.

16. Create a Noise node by pressing Tab in the Node Graph and typing "Noise" or right clicking in the Node Graph, navigating to Draw>Noise.
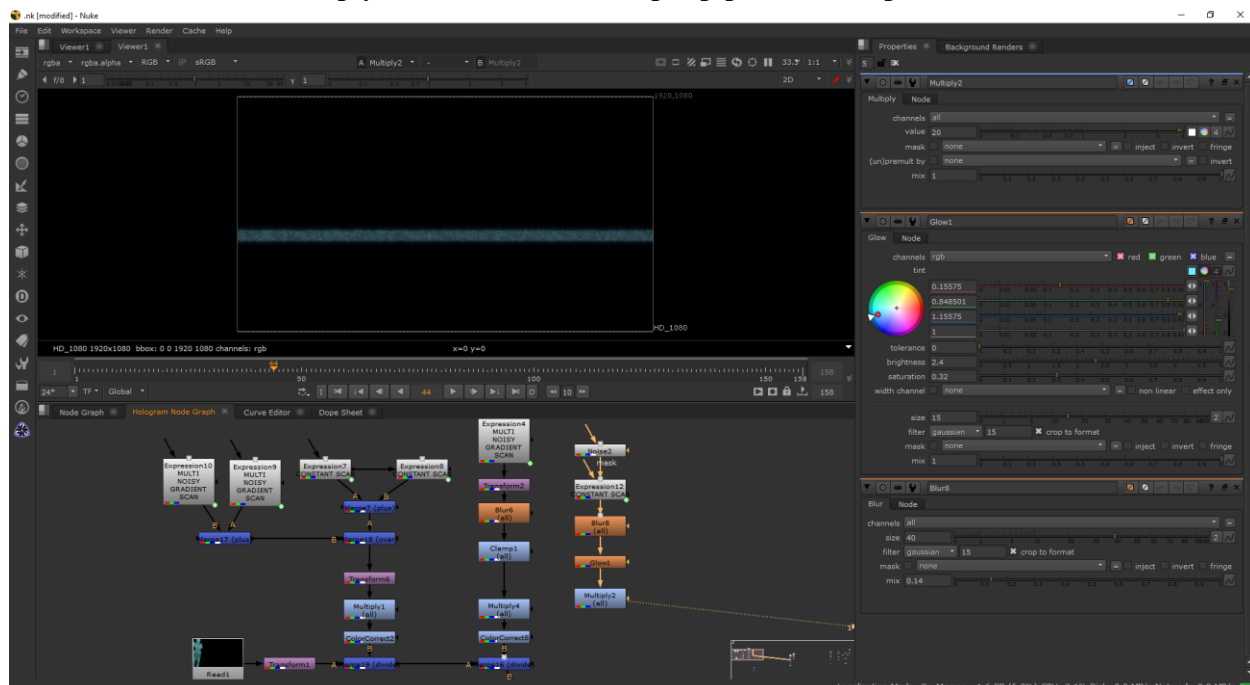
17. Create an Expression node. Connect the mask input put of the Expression node to the output of the Noise node.

18. Create a Blur node. Connect the input pipe to the output of the Expression node.

19. Create a Glow node. Connect the input pipe to the output of the Blur node.

20. Create a Multiply node. Connect the input pipe to the output of the Glow node.

22. Create a Merge node. Set the output of the third set of expressions to the A pipe and the output of the first and second set of expressions to the B pipe. Set the merge operation to over.

23. Create another Merge node. Set the output of the particles to the A pipe and the output of the Hologram object to the B pipe. Set the merge operation to over.
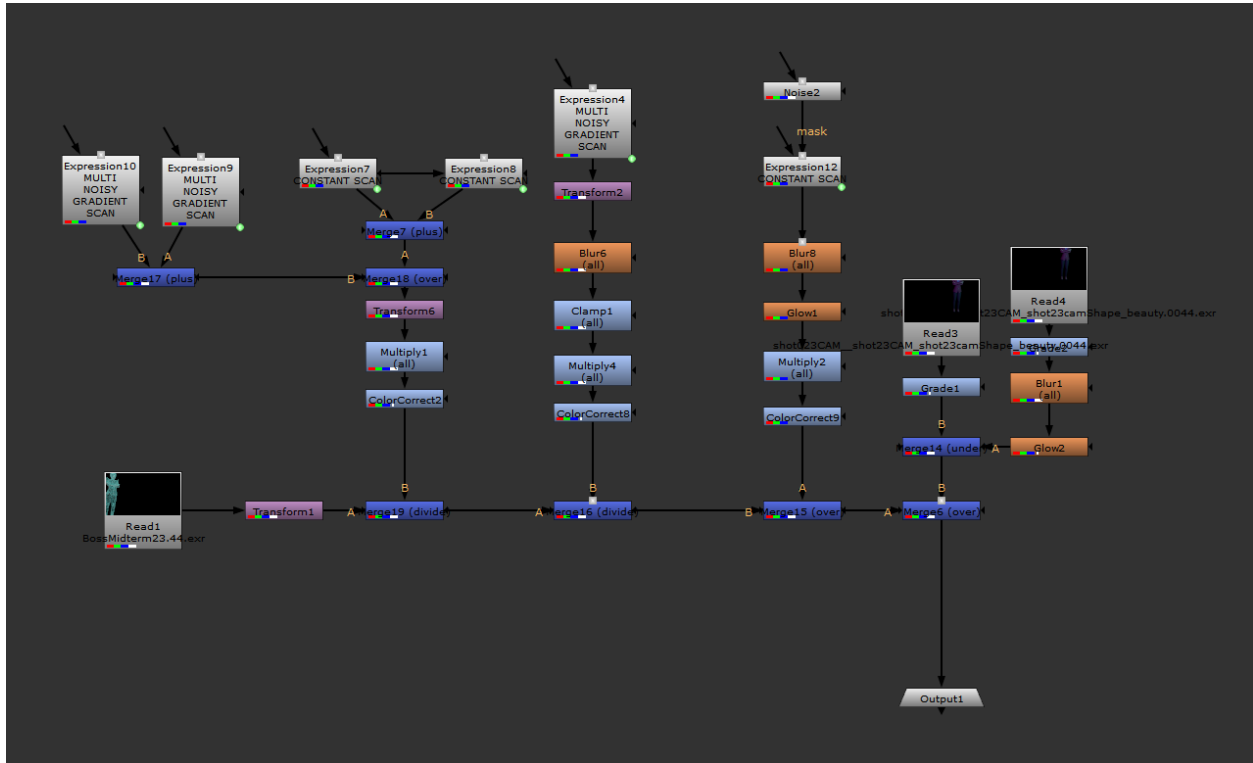
Creating Volume Rays

1. Create a Roto node by pressing Tab on the keyboard and typing "Roto" and pressing
   enter, or by using the "O" hotkey in the Node Graph. On the side bar, create an
   Eclipse Curve.

2. Create a Grade node. Attach the output of the Roto node into the input of the Grade
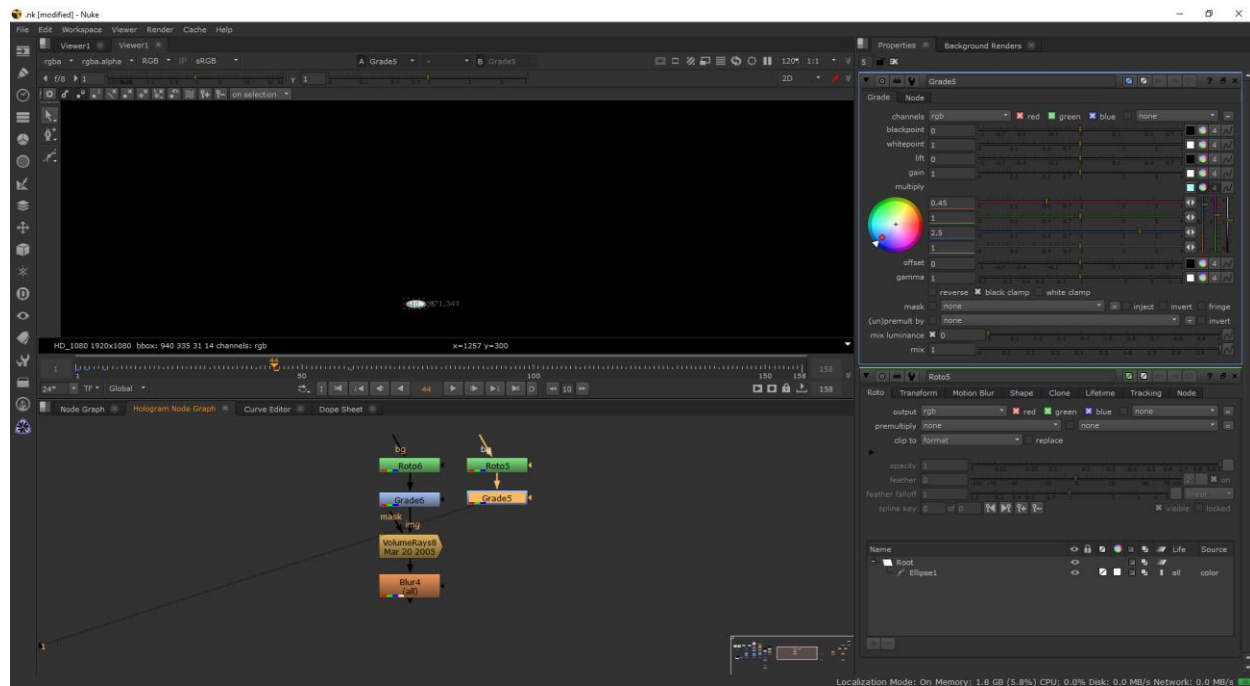   node.
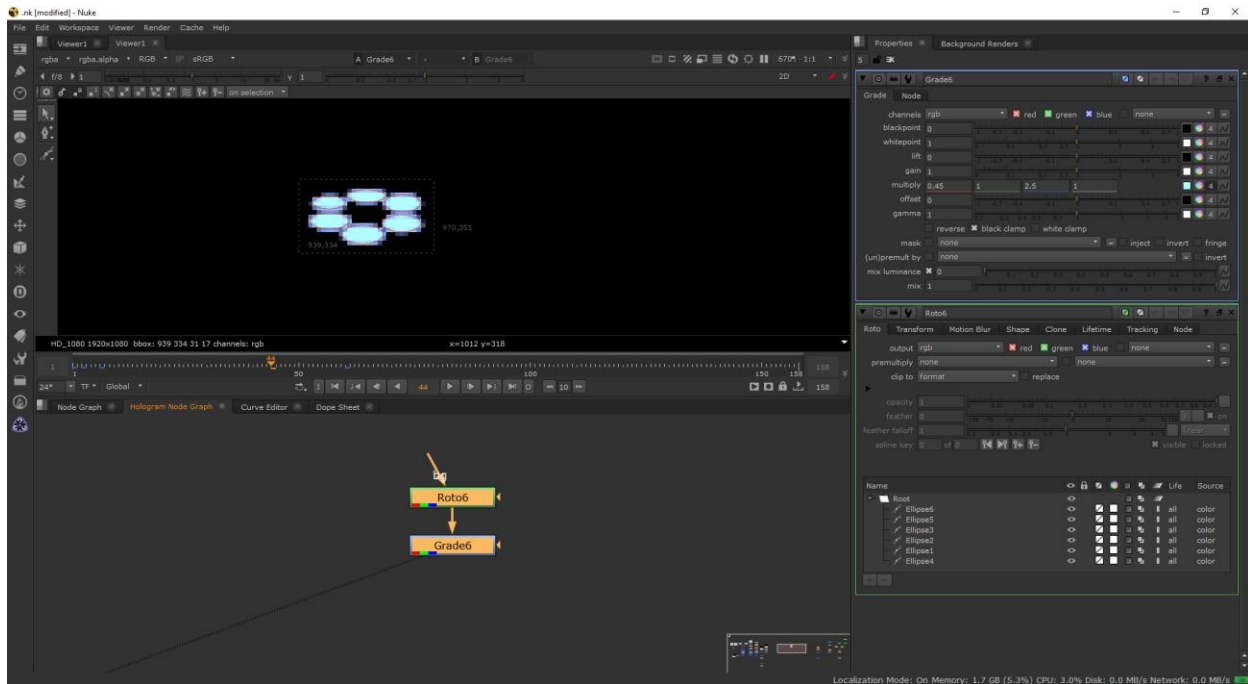
3. Create Volume Rays by pressing Tab on the keyboard and typing "Volume Rays" and
   pressing enter. Attached the img pipe to the output of the Grade node.

4. Create a Blur node.
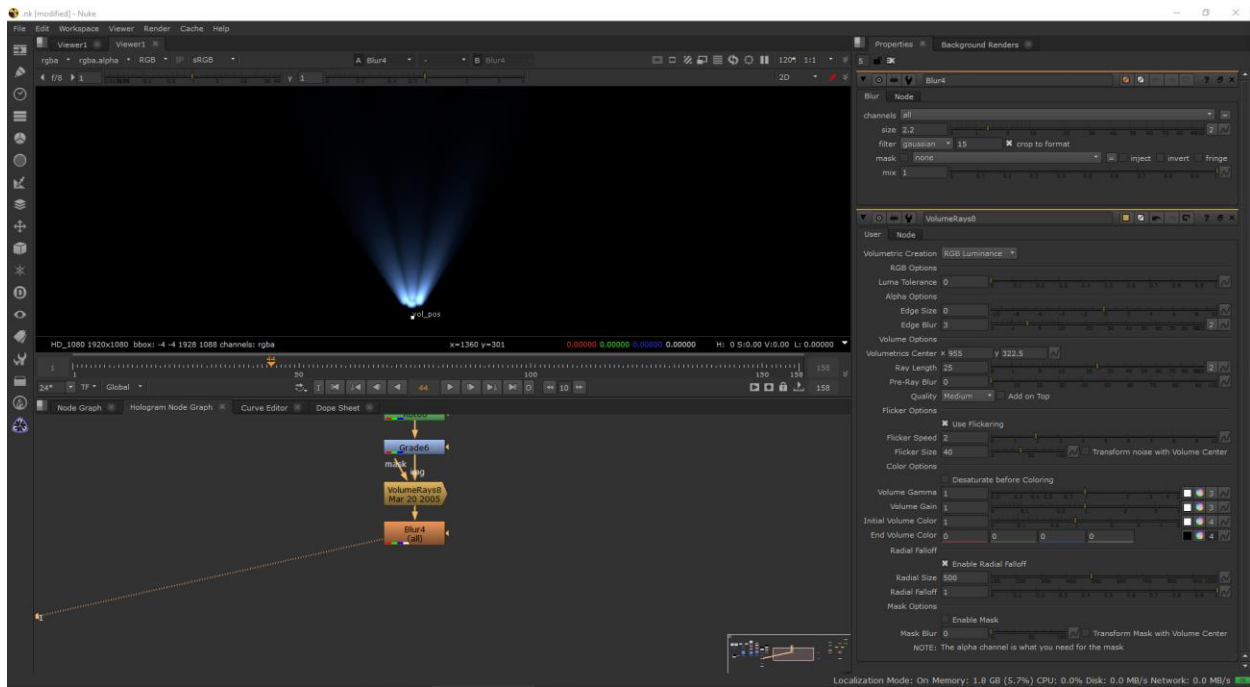
5. Create a Roto node and create an Eclipse curve.

6. Create a Grade Node.

7. Create a Volume Ray node. Connect the img pipe to the output of the Grade node.

8. Create a Color Correct node. Connect the output of the Volume Ray node to the input of the Color Correct node.

9. Create a Merge node and set the output of the Blur node to pipe A and the output of the Color Correct node to pipe B.
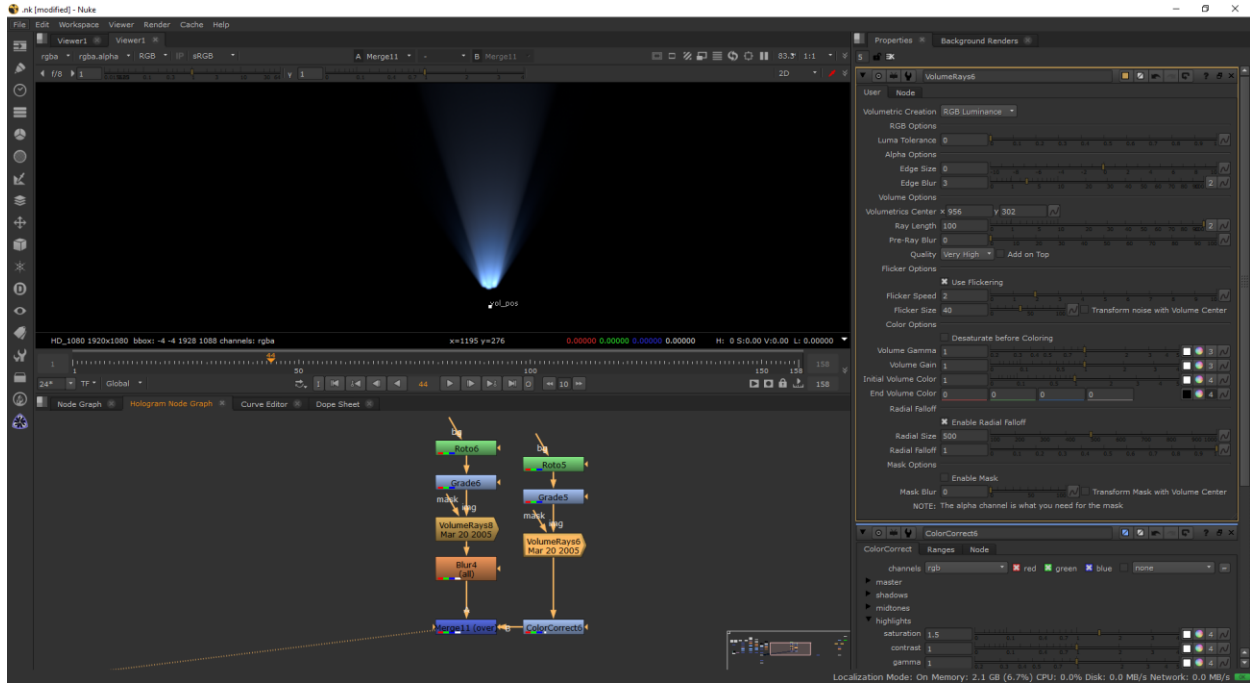

10. Create a Cryptomatte node by pressing Tab on the keyboard and typing "Cryptomatte". This paper covers Cryptomatte usage at a surface level later on. Tanice Arnold's paper goes into further detail on how to utilize Cryptomatte's to their full potential.

11. Create a Grade node.
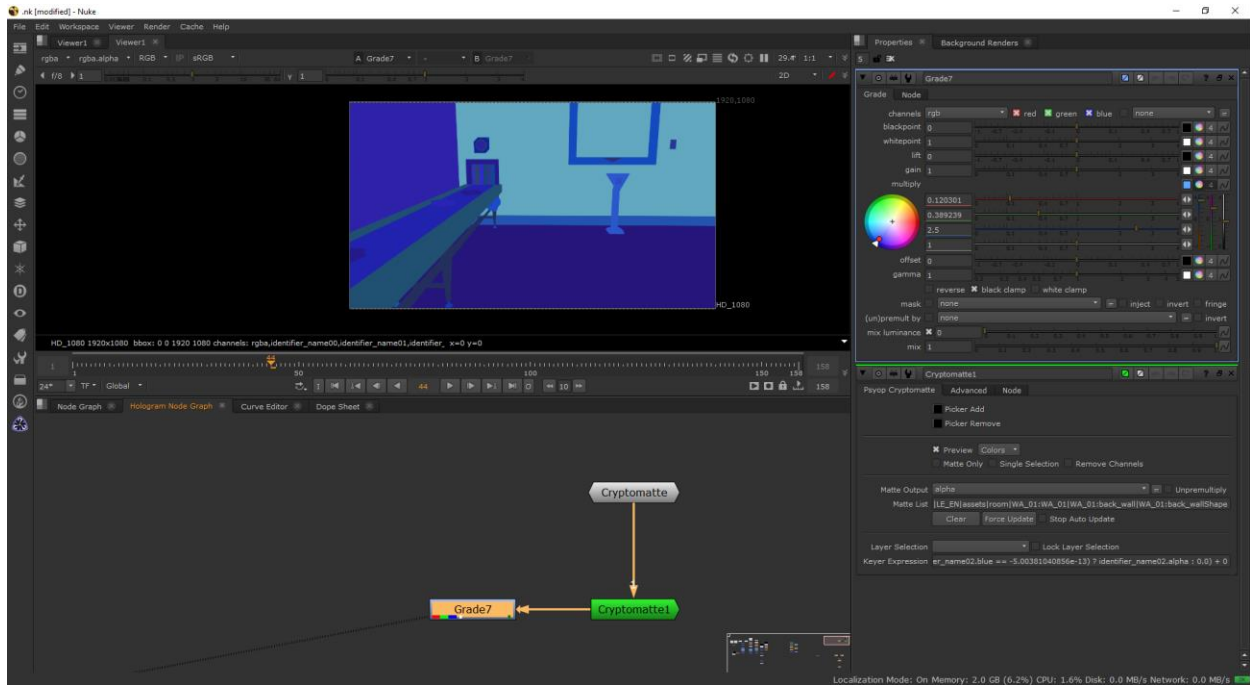
12. Create a Volume Rays node.

13. Create another Volume Rays node.

14. Merge the two Volume Ray nodes together.
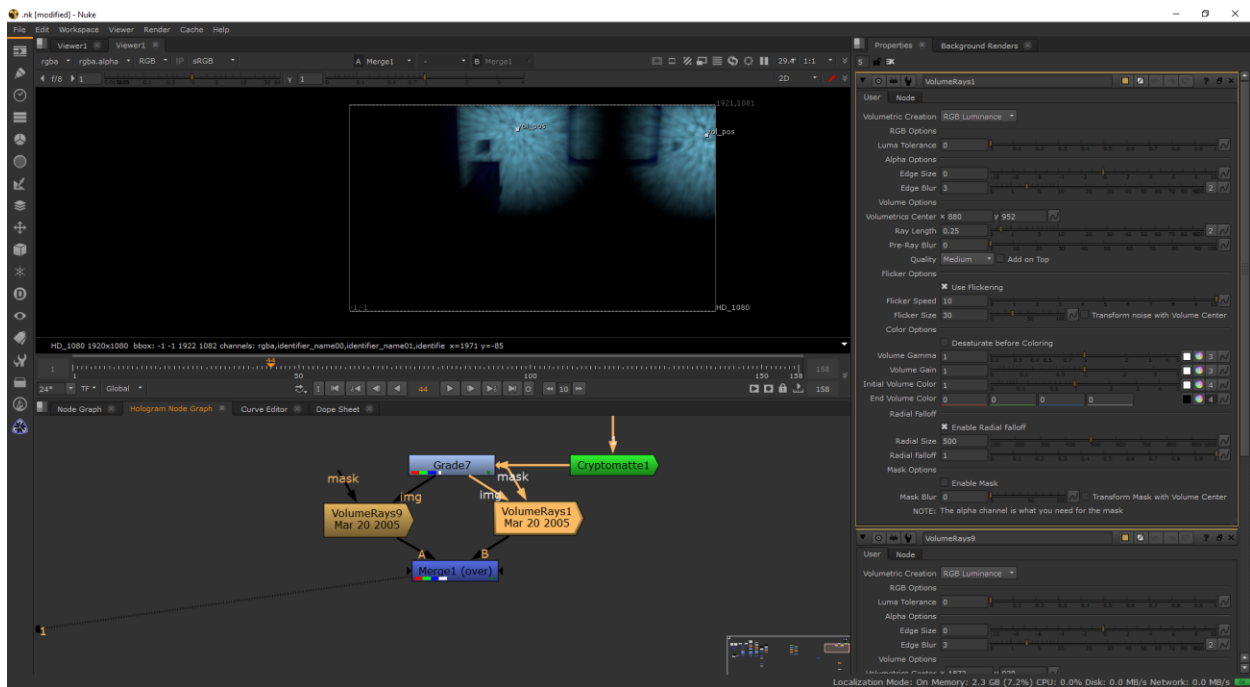
15. Create a Blur node.

16. Create a Noise node by pressing Tab on the keyboard and typing "Noise" and pressing enter, or by using the "N" hotkey in the Node Graph.

17. Create a Merge node and set the operation to over. Merge the third set of Volume Rays with the merged output of the first and second set.
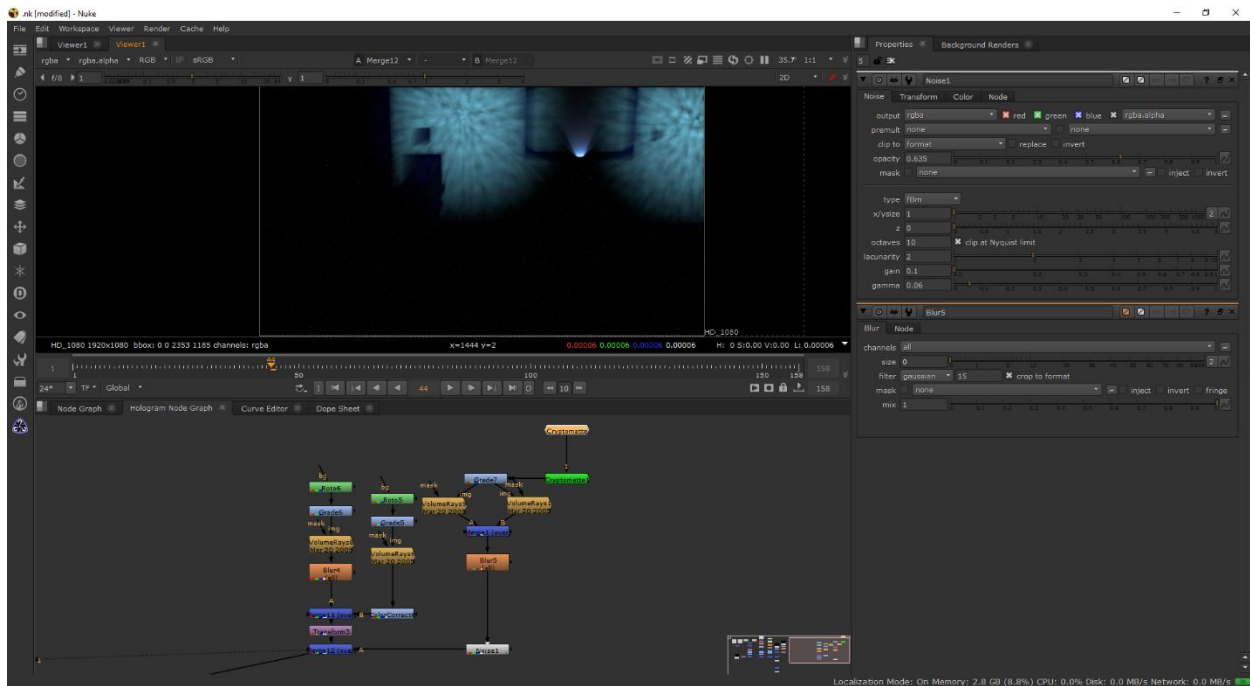
18. Create another Merge node and merge the three sets of Volume Rays with the hologram with particles. Set the Volume Rays to pipe A and the Hologram with particles to pipe B. Set the merge operation to over.
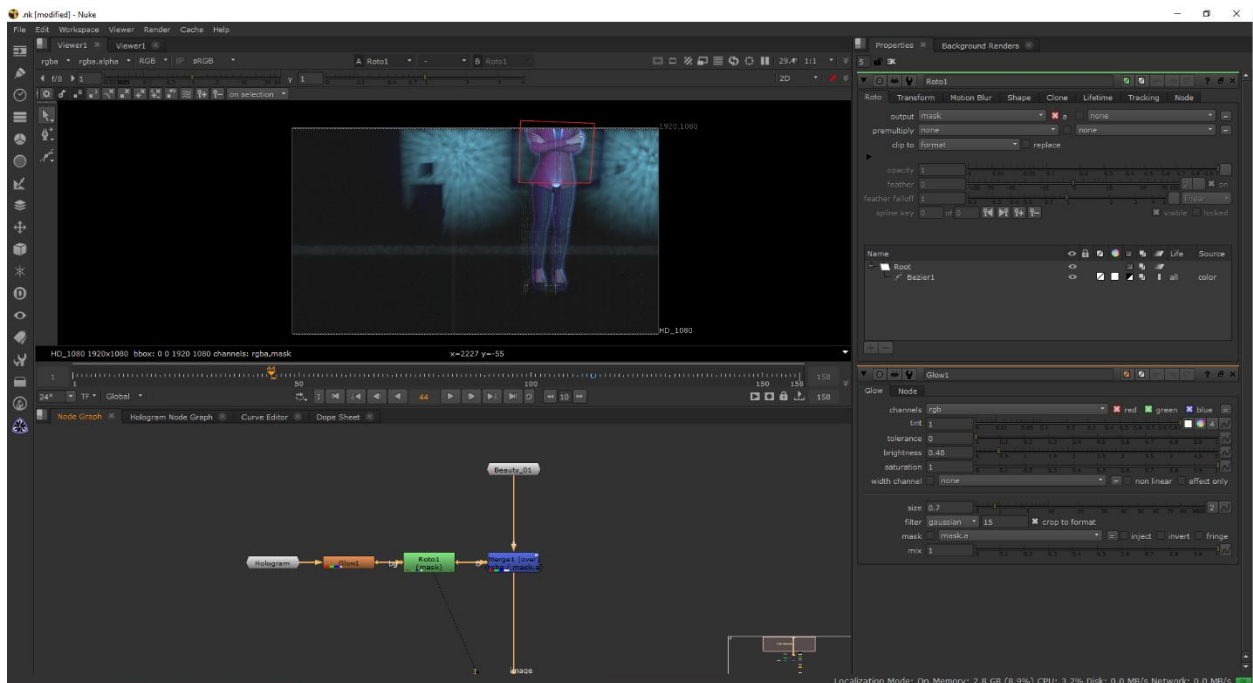
Finished Node Tree
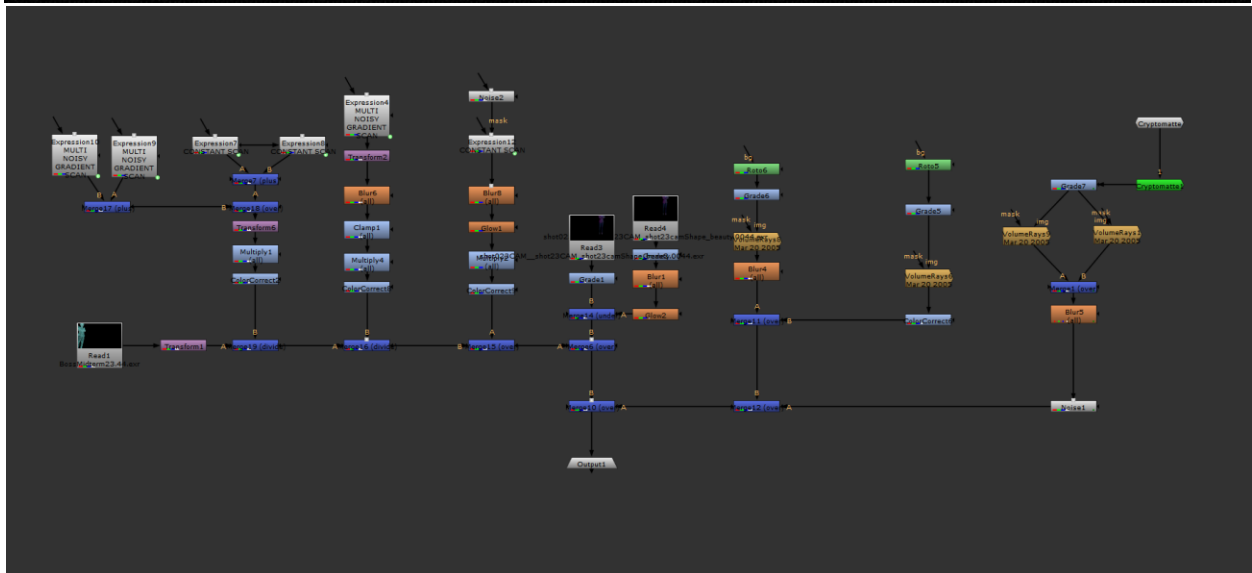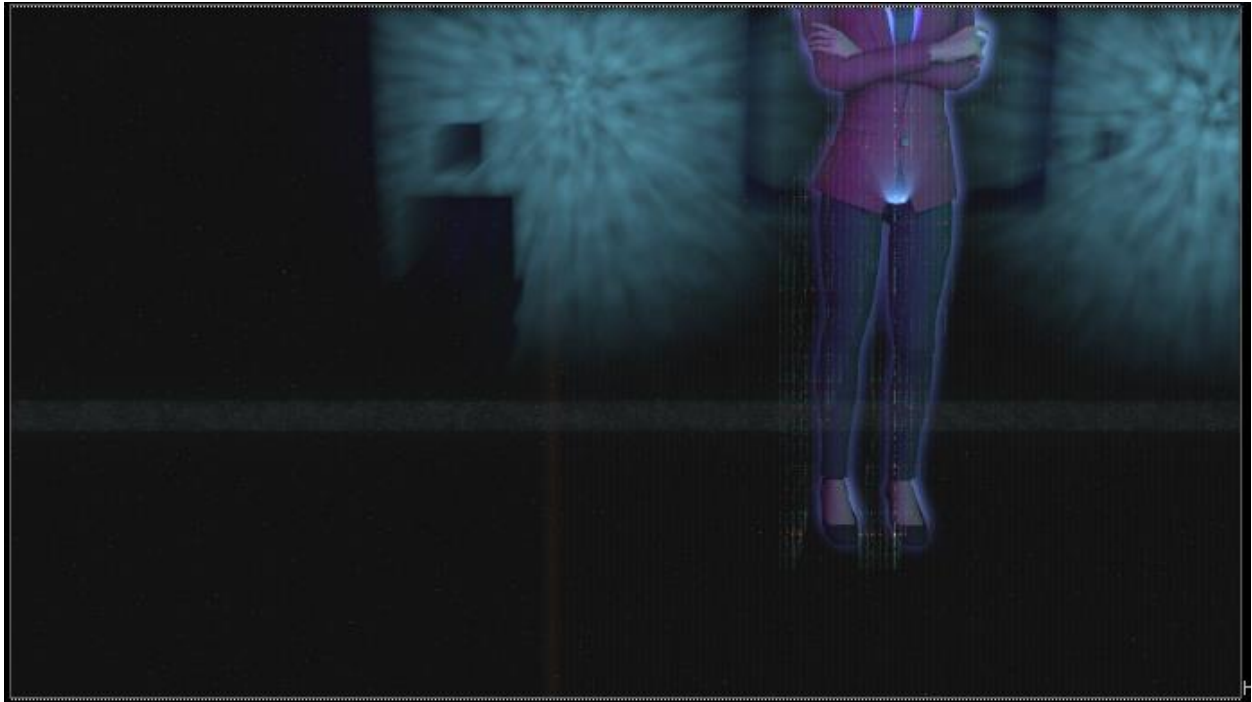
Merging Hologram to Rendered Environment

1. Create a Read node with the. exr of the rendered environment.

2. Create a Glow node.

3. Create a Roto node and roto around the area that needs to be masked out. Set the roto
   to Mask. Connect the output of the Glow node to the input of the bg pipe in the Roto
   node.

4. Create a Merge node and set the operation to over. Click the box next to the word mask and select mask.a from the drop down. You may find it in the other channels drop down. Merge the output from the hologram effect with the output of the Read node of the rendered environment.

5. Create a ZDefocus node for added depth and dimension in the environment. This paper does not cover ZDepth in detail, it is an additional render pass that you can add to your film to bring more realism to your shots.
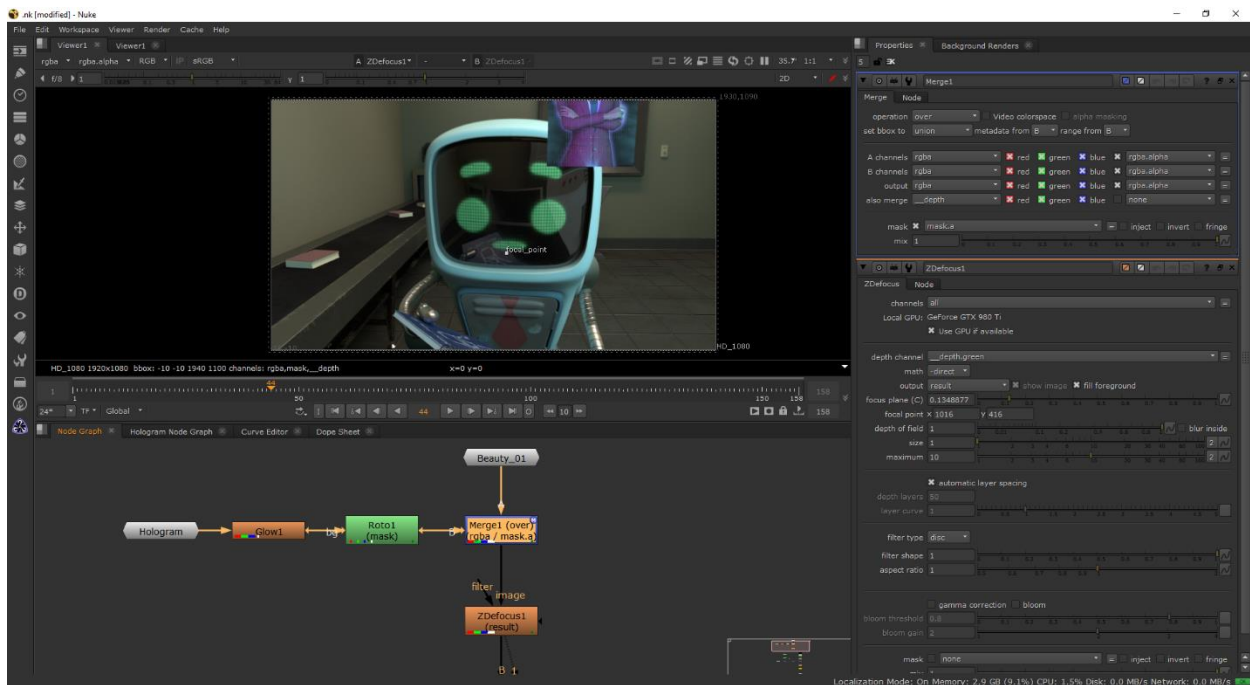

6. Create a Read node of the rendered environment.

7. Create a Reade node of the Cryptomatte pass of the rendered environment.

8. Cryptomatte out the object that will need to be in front of the hologram. Since Boss Lady is a Hologram on the wall, Benfolio is constantly passing in front of her. Rather than rotoscoping Benfolio out, Cryptomattes allow for quick automatic masking.
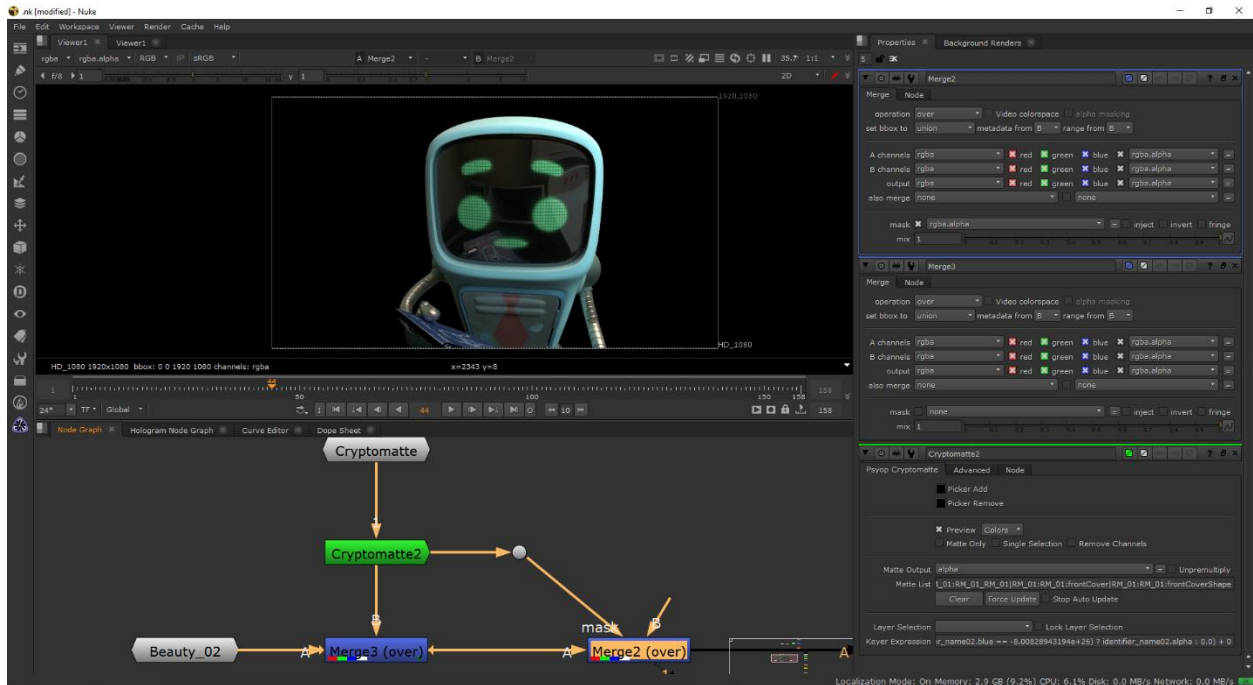
9. Merge the rendered environment beauty pass with the Cryptomatte output.

10. Create a Merge node. Connect the output of the Merge node's mask pipe with the Cryptomatte. Set the output to the merged beauty and Cryptomatte to input pipe A, and the output of the ZDefocus node to input pipe B. Set the Merge operation to over.
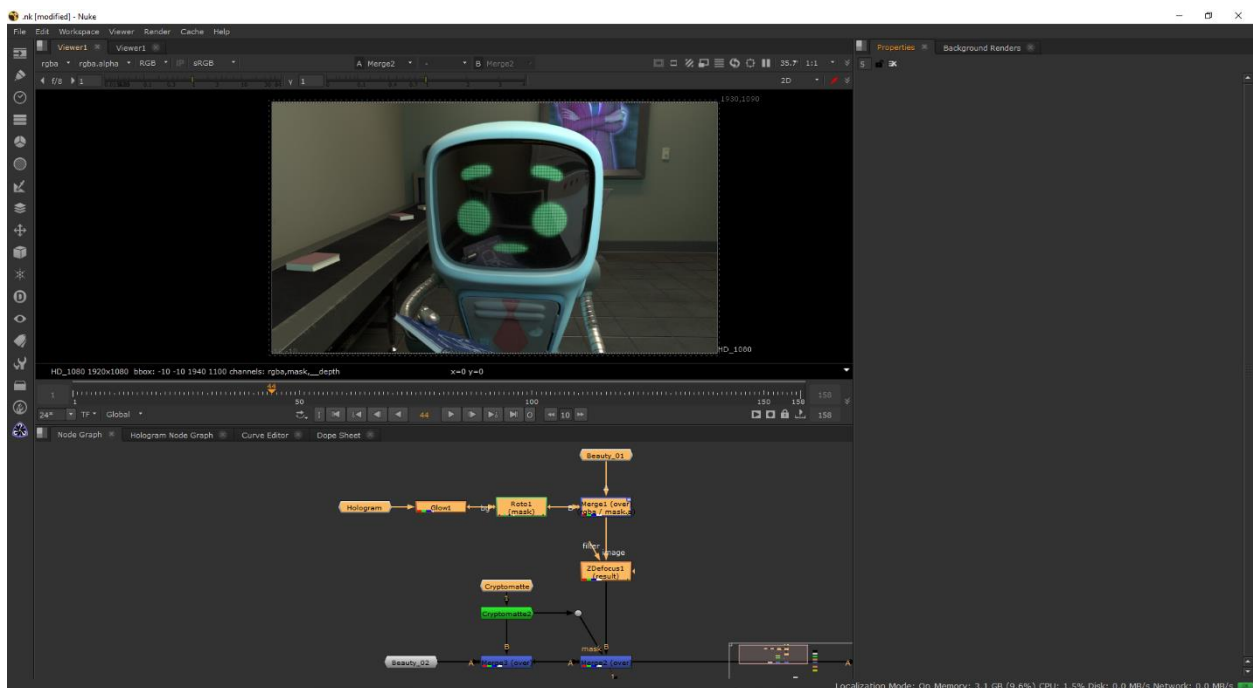
Lastly, a Glow effect was added to Benfolio's eyes by using Cryptomatte's for his face geometry and adding a Glow and Blur node. This paper will not cover how to do so in greater detail than what is stated above, see Christian Antonini's paper for more information. Merge the Glow effect with the output of the finished hologram effect composited into the environment.

Finished Node Tree and Rendered Shot
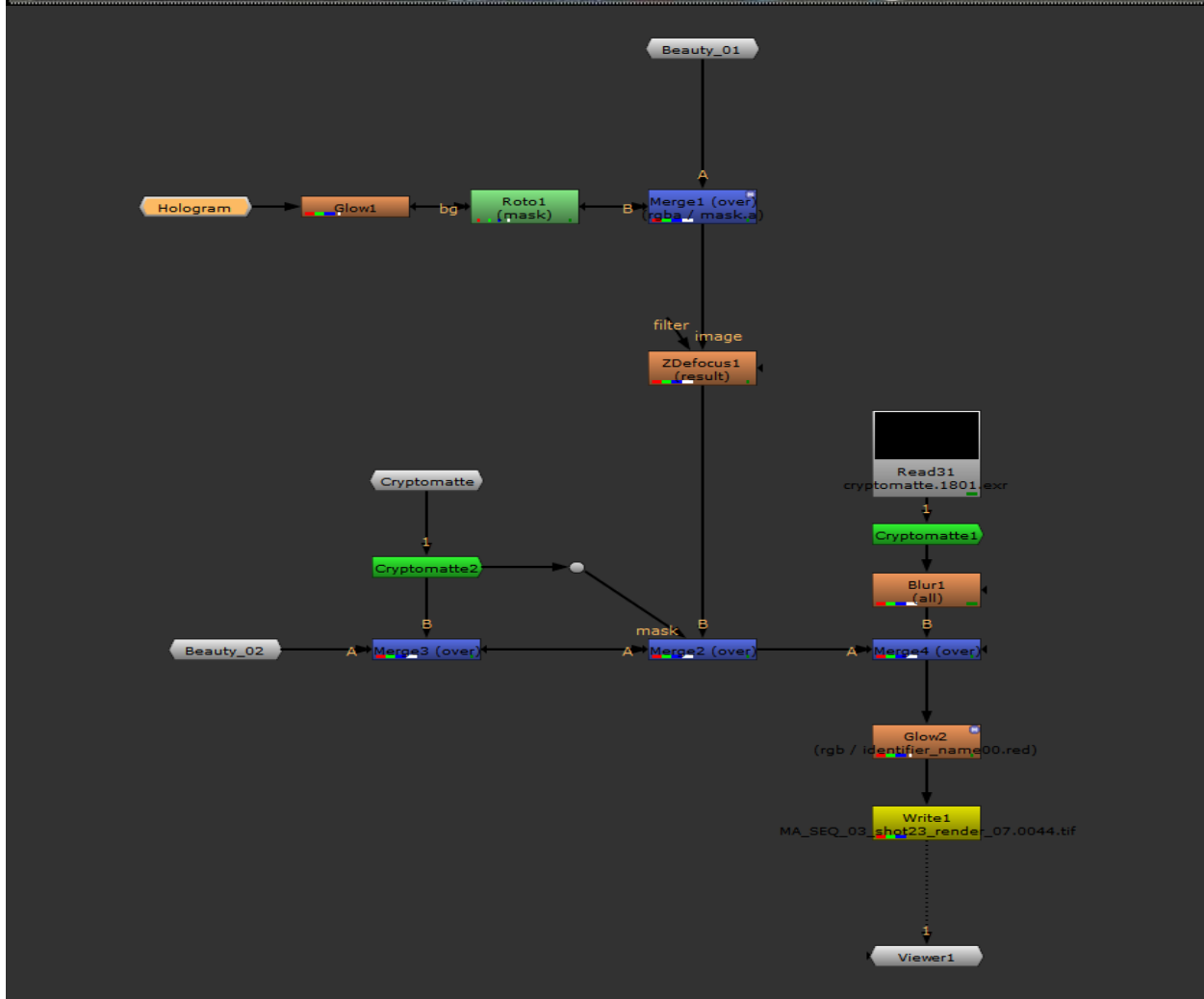
Merge Node Operations Glossary

Atop-Shows the shape of image B, with A covering B where the images overlap.

Average-The average of the two images. The result is darker than the original images.

Color burn-Image B gets darker based on the luminance of A.

Color dodge-Image B gets brighter based on the luminance of A.

Conjoint over-Similar to the over operation, except that if a pixel is partially covered by both A and B, conjoint-over assumes A completely hides B. For instance, two polygons where A and B share some edges but A completely overlaps B. Normal over produces a slightly transparent seam here.

Copy-Only shows image A.

Difference-How much the pixels differ. Also available from Merge > Merges > Absminus.

Disjoint over-Similar to the over operation, except that if a pixel is partially covered by both a and b, disjoint-over assumes the two objects do not overlap. For instance, two polygons that touch and share an edge. Normal over produces a slightly transparent seam here.

Divide-Divides the values but stops two negative values from becoming a positive number.

Exclusion-A more photographic form of difference.

From-Image A is subtracted from B.

Geometric-Another way of averaging two images.

Hard light-Image B is lit up by a very bright and sharp light in the shape of image A.

Hypot (Previously Diagonal)-Resembles the plus and screen operations. The result is not as bright as plus, but brighter than screen.Hypot works with values above 1.

In-Only shows the areas of image A that overlap with the alpha of B. Also available from Merge > Merges > In.

Mask-This is the reverse of the in operation. Only shows the areas of image B that overlap with the alpha of A.

Matte-Premultiplied over. Use unpremultiplied images with this operation. Also available from Merge > Merges > Matte.

Max-Takes the maximum values of both images. Also available from Merge > Merges > Max.

Min-Takes the minimum values of both images. Also available from Merge > Merges > Min.

Minus-Image B is subtracted from A.

Multiply-Multiplies the values but stops two negative values from becoming a positive number. Also available from Merge > Merges > Multiply.

Out-Only shows the areas of image A that do not overlap with the alpha of B. Also available from Merge > Merges > Out.

Over-This is the default operation. Layers image A over B according to the alpha of image A.

Overlay-Image A brightens image B.

Plus-The sum of image A and B. Also available from Merge > Merges > Plus. Note that the plus algorithm may result in pixel values higher than 1.0.

Screen-If A or B is less than or equal to 1 the screen else use the maximum example, resembles Plus. Also available from Merge > Merges > Screen.

Soft light-Image B gets lit up. Not as extreme as the hard-light operation.

Stencil-This is the reverse of the out operation. Only shows the areas of image B that do not overlap with the alpha of A.

Under-This is the reverse of the over operation. Layers image B over A according to the matte of image B.

Xor-Shows both image A and B where the images do not overlap.