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# Interactive Lighting of Effects Using Point Clouds in “BOLT”

Dale Mayeda

SIGGRAPH 2009





# The Challenge





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- **Quality of lighting and bounce light is fundamental in art direction**





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- Interactive illumination from organic effects is difficult to achieve





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- **Quality of lighting and bounce light is fundamental in art direction**
- **Interactive illumination from organic effects is difficult to achieve**
- **Believable lighting from organic effects onto volume smoke is also difficult to achieve**





# The Challenge

- Quality of lighting and bounce light is fundamental in art direction
- Interactive illumination from organic effects is difficult to achieve
- Believable lighting from organic effects onto volume smoke is also difficult to achieve
- How can we efficiently generate interactive lighting from any effects element?





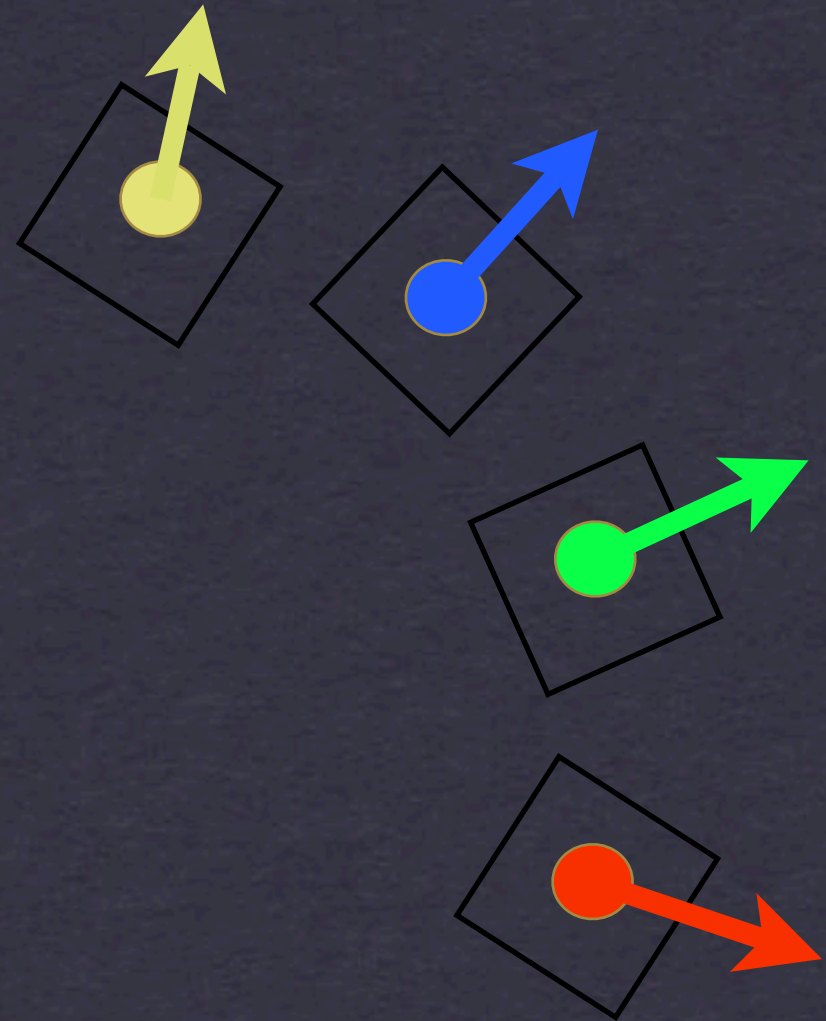
# Generating Indirect Bounce Light Using Point Clouds in Renderman





# Generating Indirect Bounce Light Using Point Clouds in Renderman

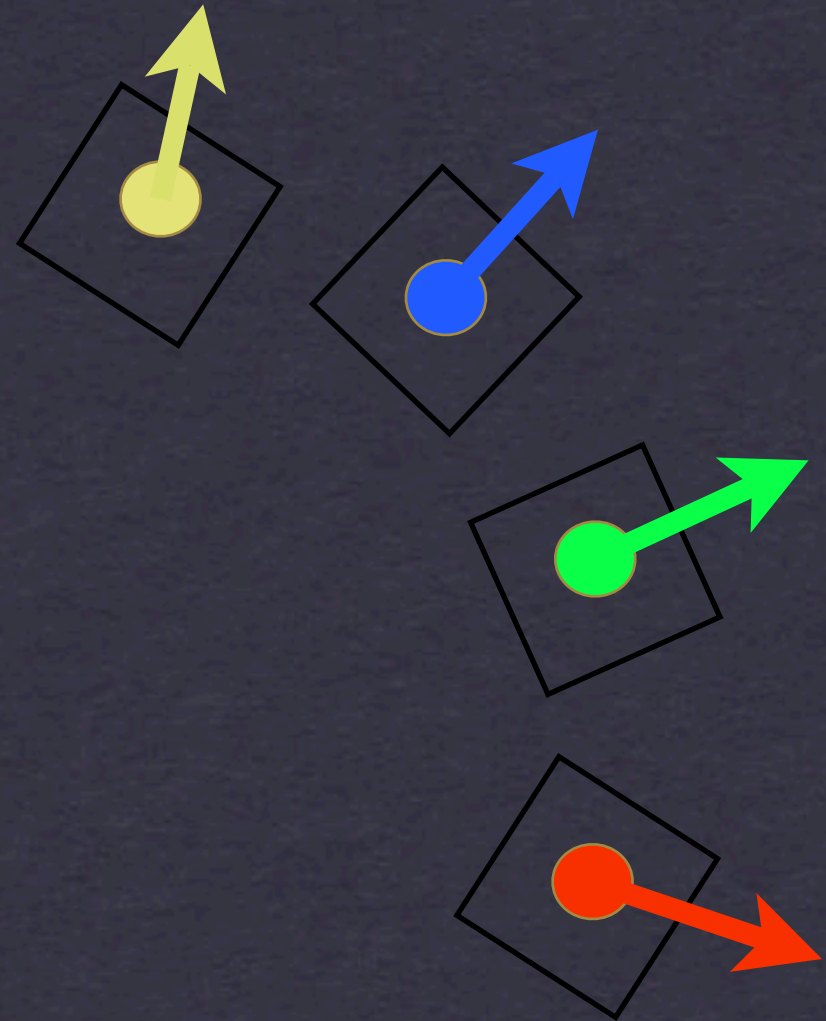
- Data stored in point clouds:
  - Position, Normal, Radiosity and Area





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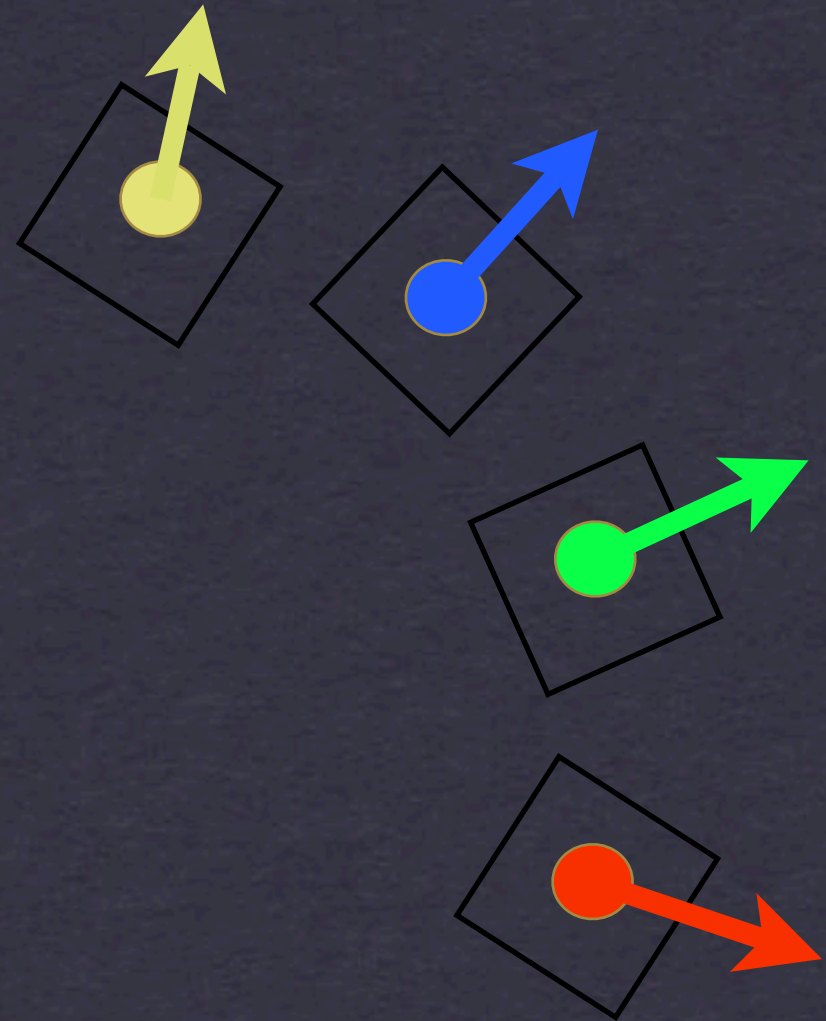
- Data stored in point clouds:
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- “bake3d” bakes data into point clouds





# Generating Indirect Bounce Light Using Point Clouds in Renderman

- Data stored in point clouds:
  - Position, Normal, Radiosity and Area
- “bake3d” bakes data into point clouds
- “indirectdiffuse” function reads the point cloud and treats each point as a small light emitter in the direction of the normal





# Typical Point Cloud Usage

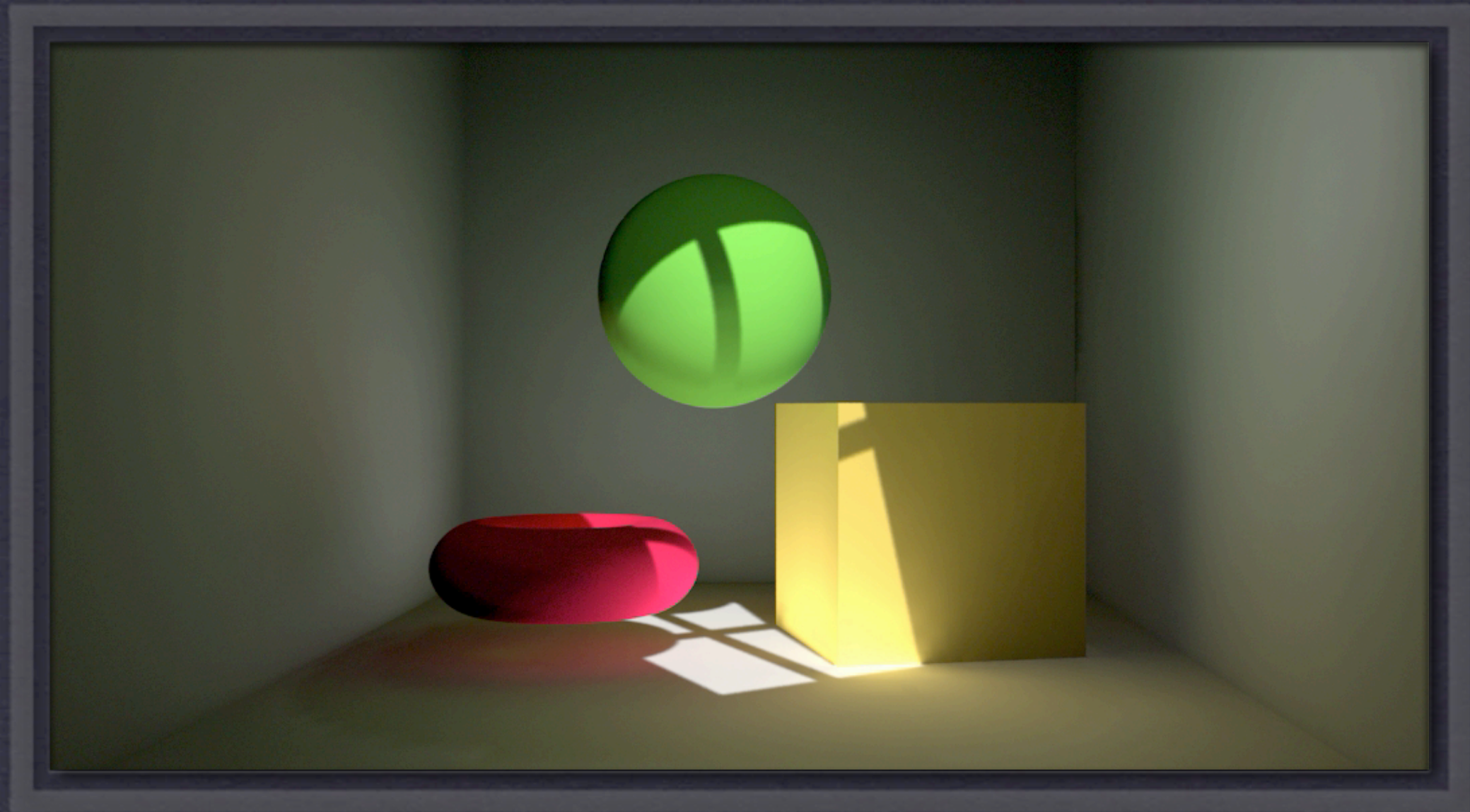
## Indirect Bounce Illumination





# Typical Point Cloud Usage

## Indirect Bounce Illumination





# Initial Inspiration

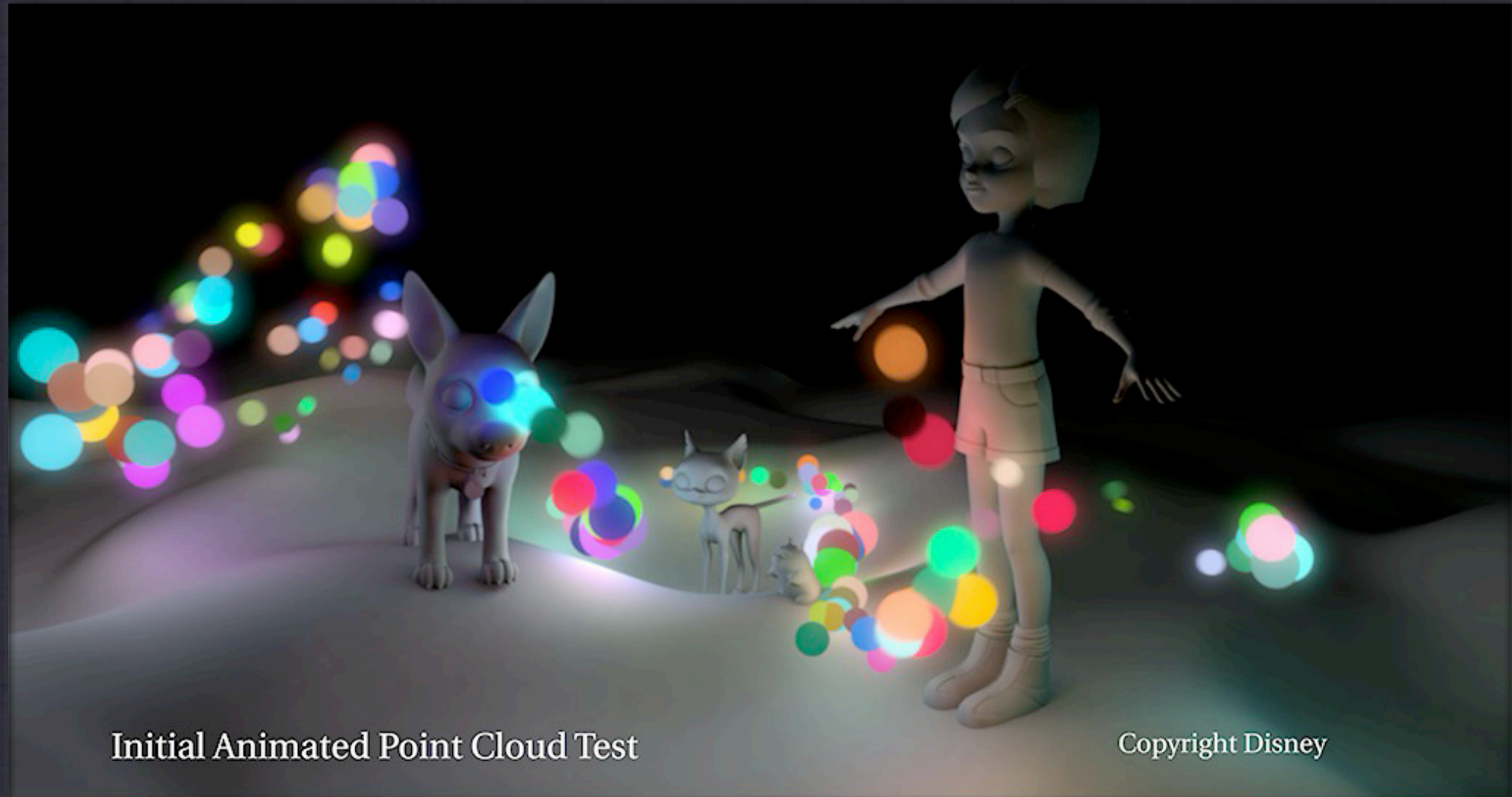
Animated Point Clouds Generated From Particles





# Initial Inspiration

## Animated Point Clouds Generated From Particles



Initial Animated Point Cloud Test

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# Generation of Point Clouds





# Generation of Point Clouds

- Integrate “bake3d” into all effects surface shaders





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- Integrate “bake3d” into all effects surface shaders
- Integrate “bake3d” into all effects volume shaders





# Generation of Point Clouds

- Integrate “bake3d” into all effects surface shaders
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  - Randomly jitter normal for baked points





# Generation of Point Clouds

- Integrate “bake3d” into all effects surface shaders
- Integrate “bake3d” into all effects volume shaders
  - Randomly jitter normal for baked points
- Houdini plug-in to directly write out point clouds





# Tools Developed for Flexibility





# Tools Developed for Flexibility

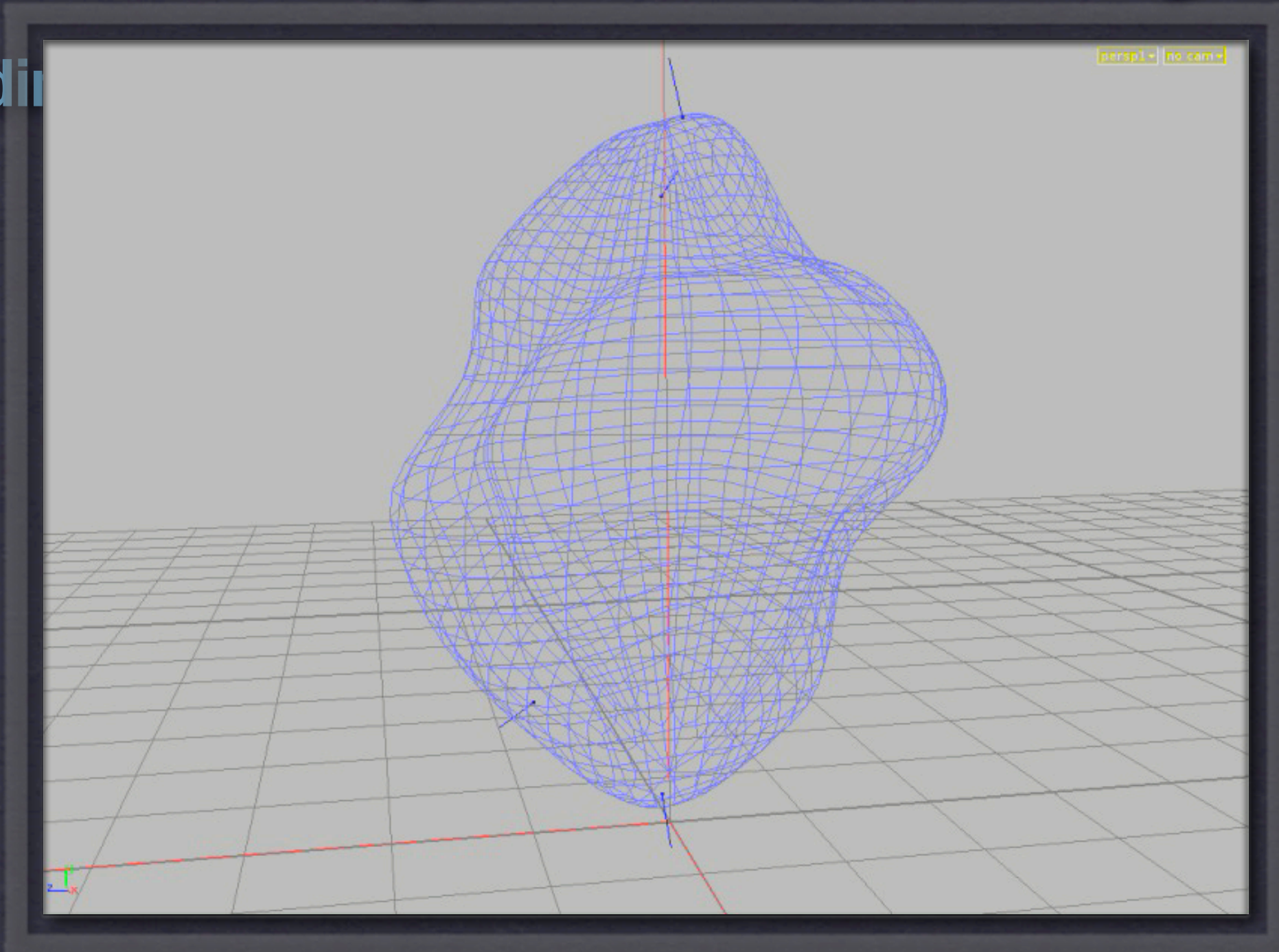
- Houdini point cloud reader and writer





# Tools Developed for Flexibility

- Houdini





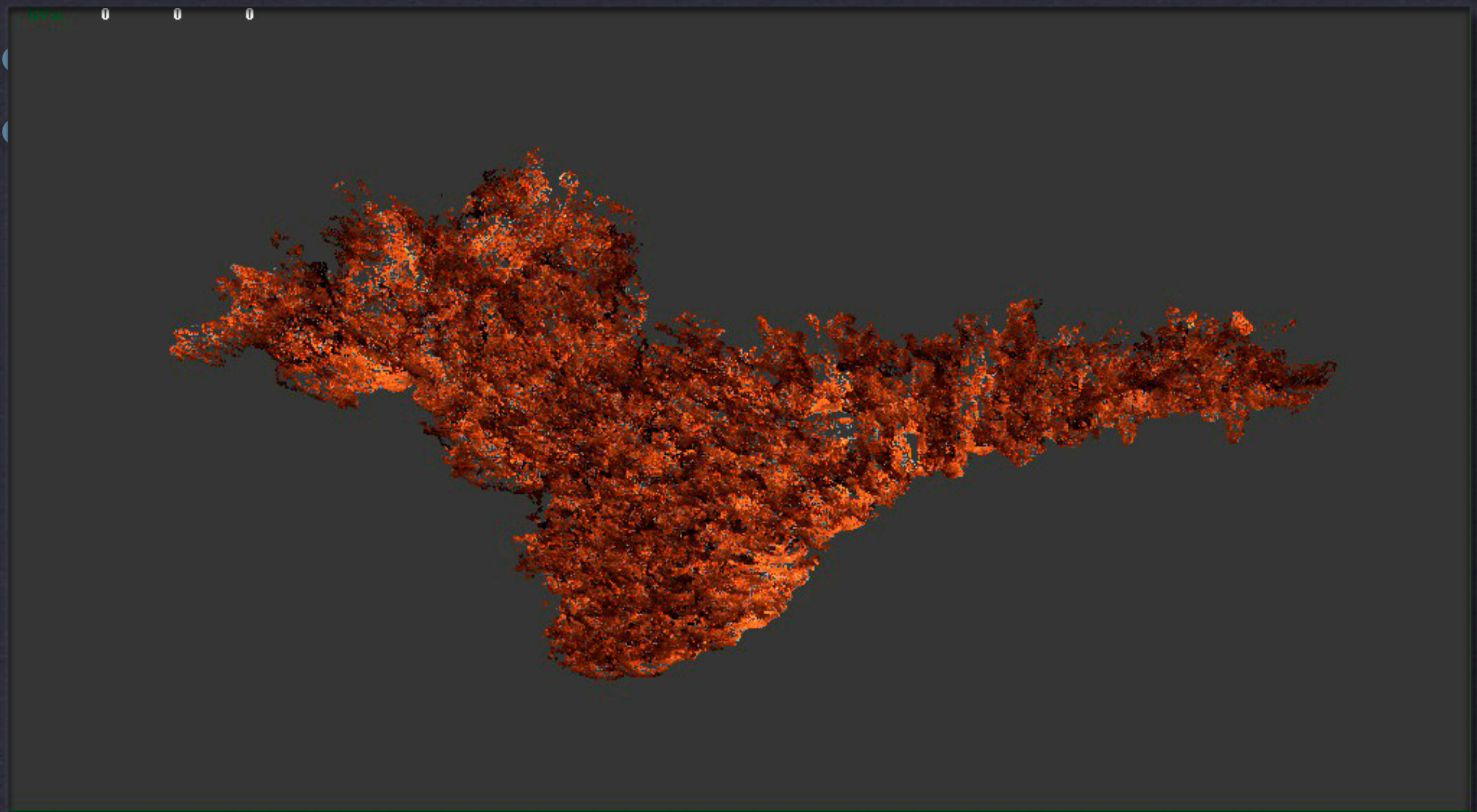
# Tools Developed for Flexibility

- Houdini point cloud reader and writer
- Visualization of point clouds in maya



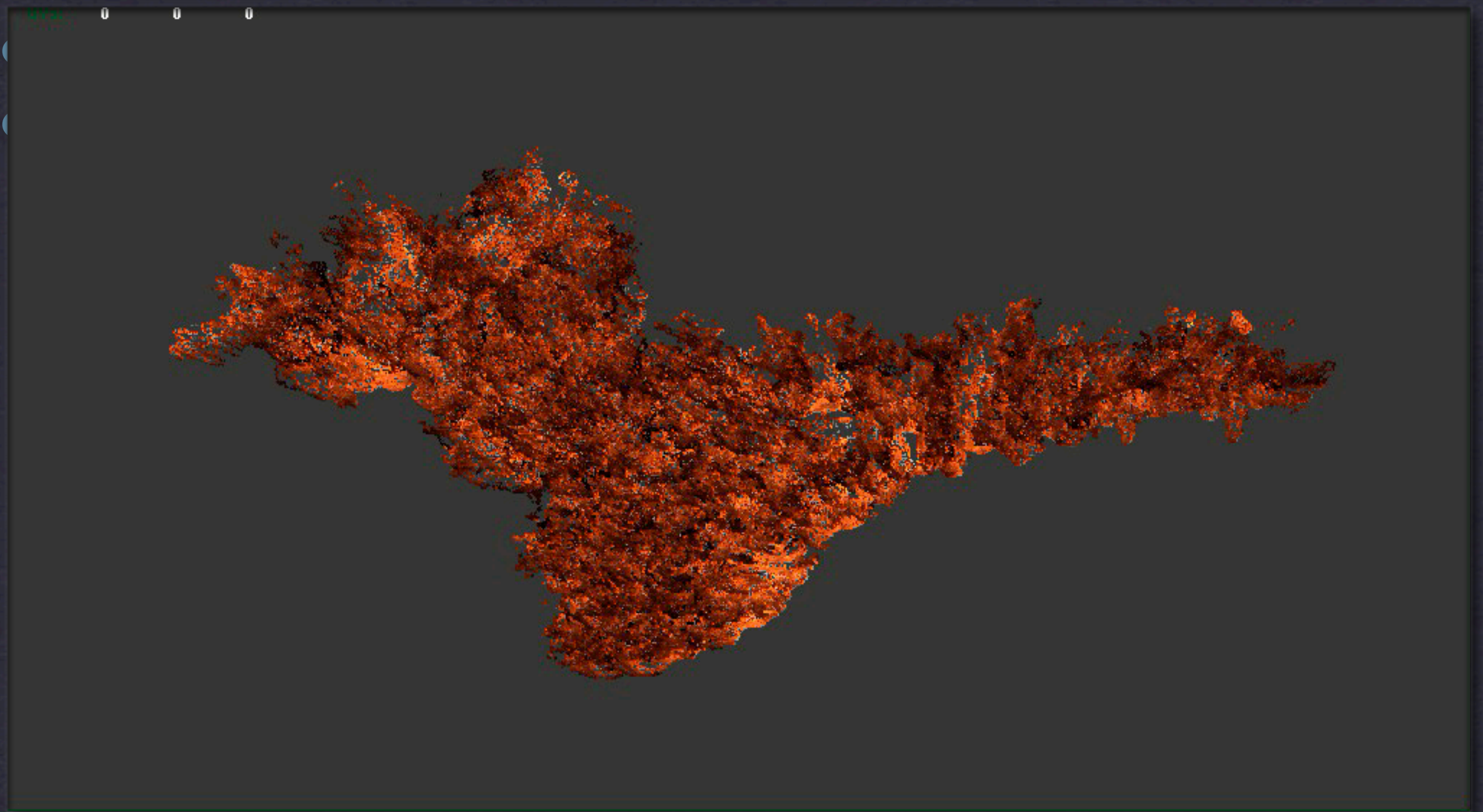


# Tools Developed for Flexibility





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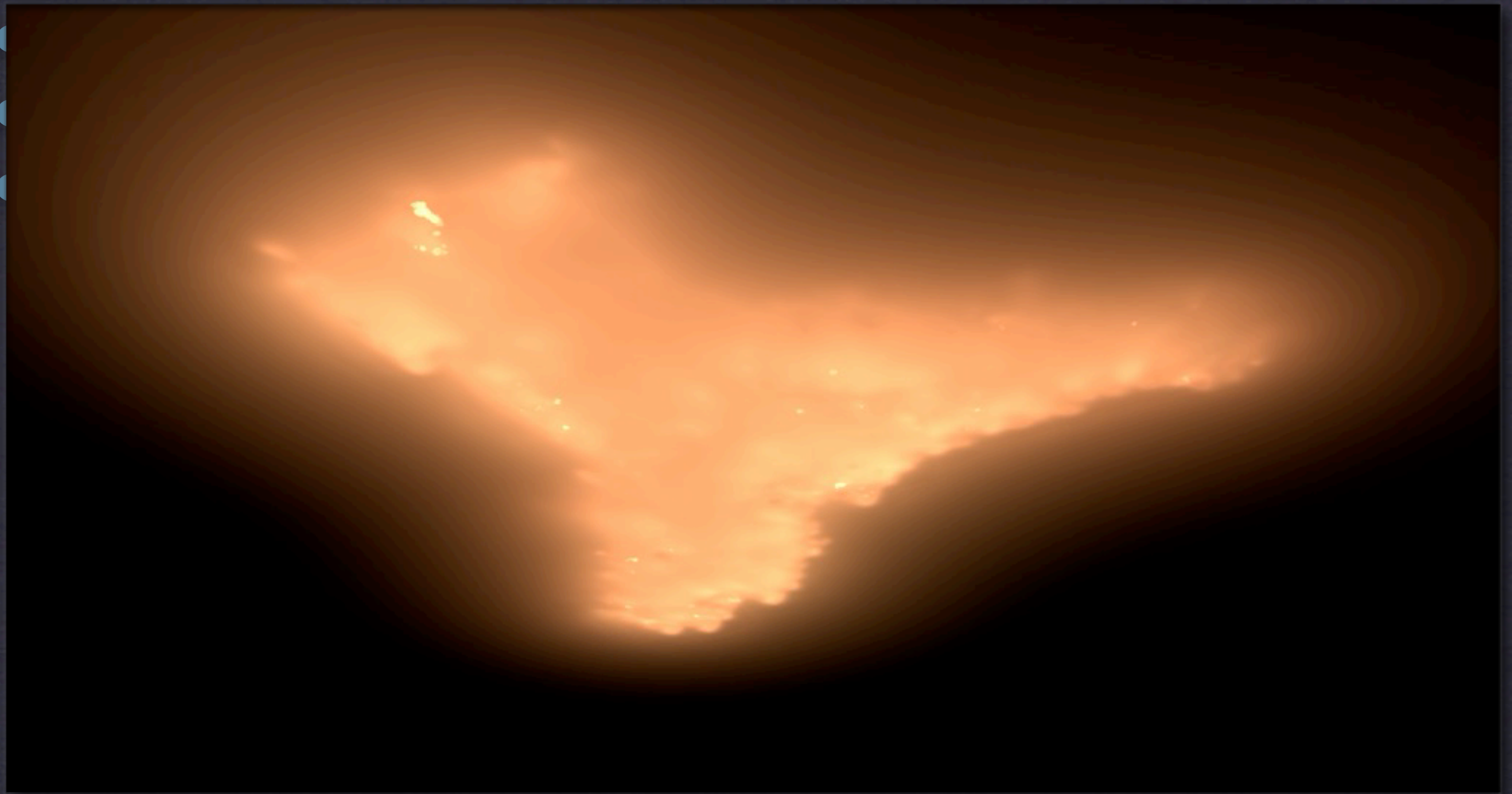
# Tools Developed for Flexibility

- Houdini point cloud reader and writer
- Visualization of point clouds in maya
- Point cloud filtering to decrease heavy point clouds



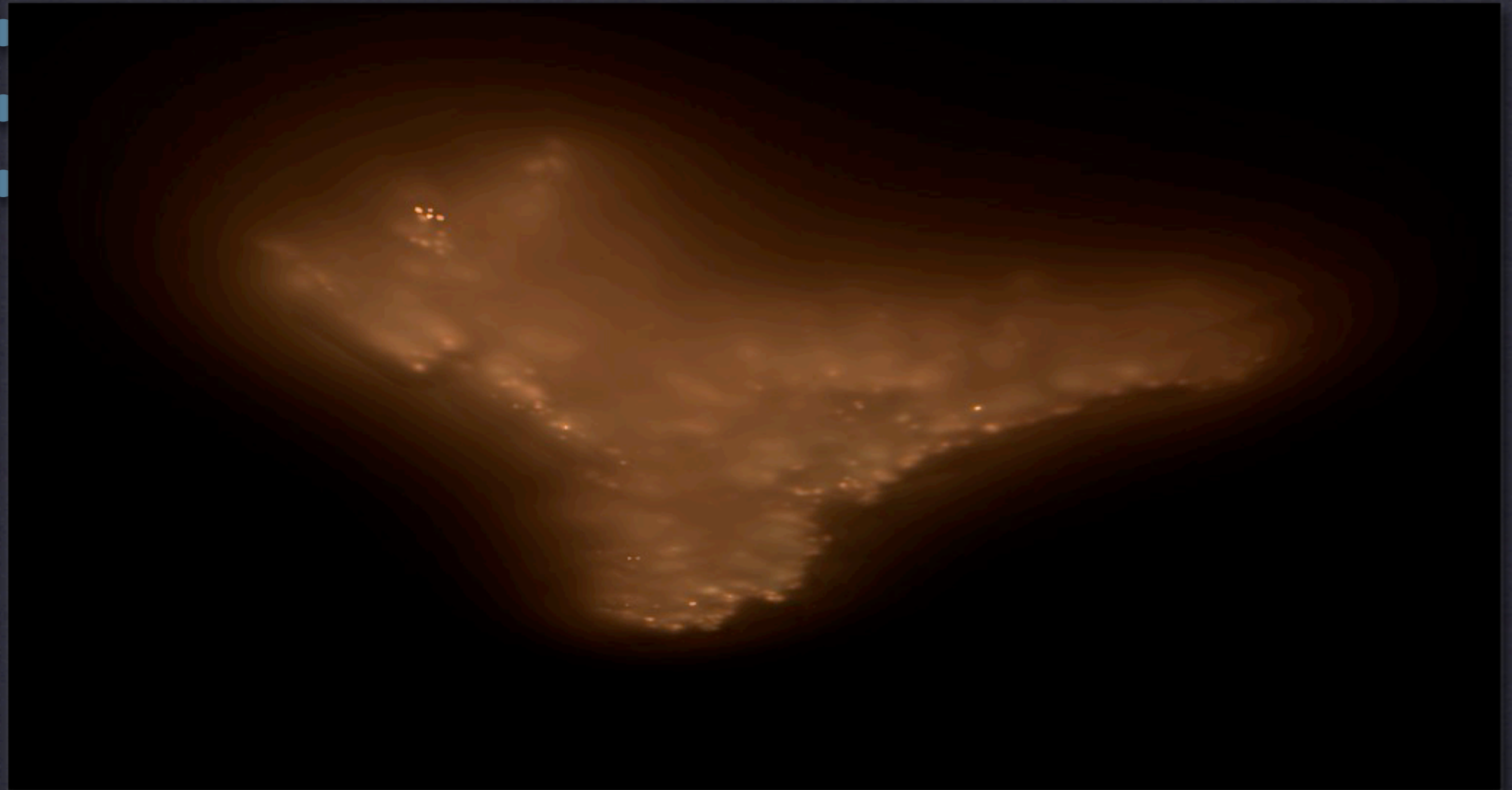


# Tools Developed for Flexibility



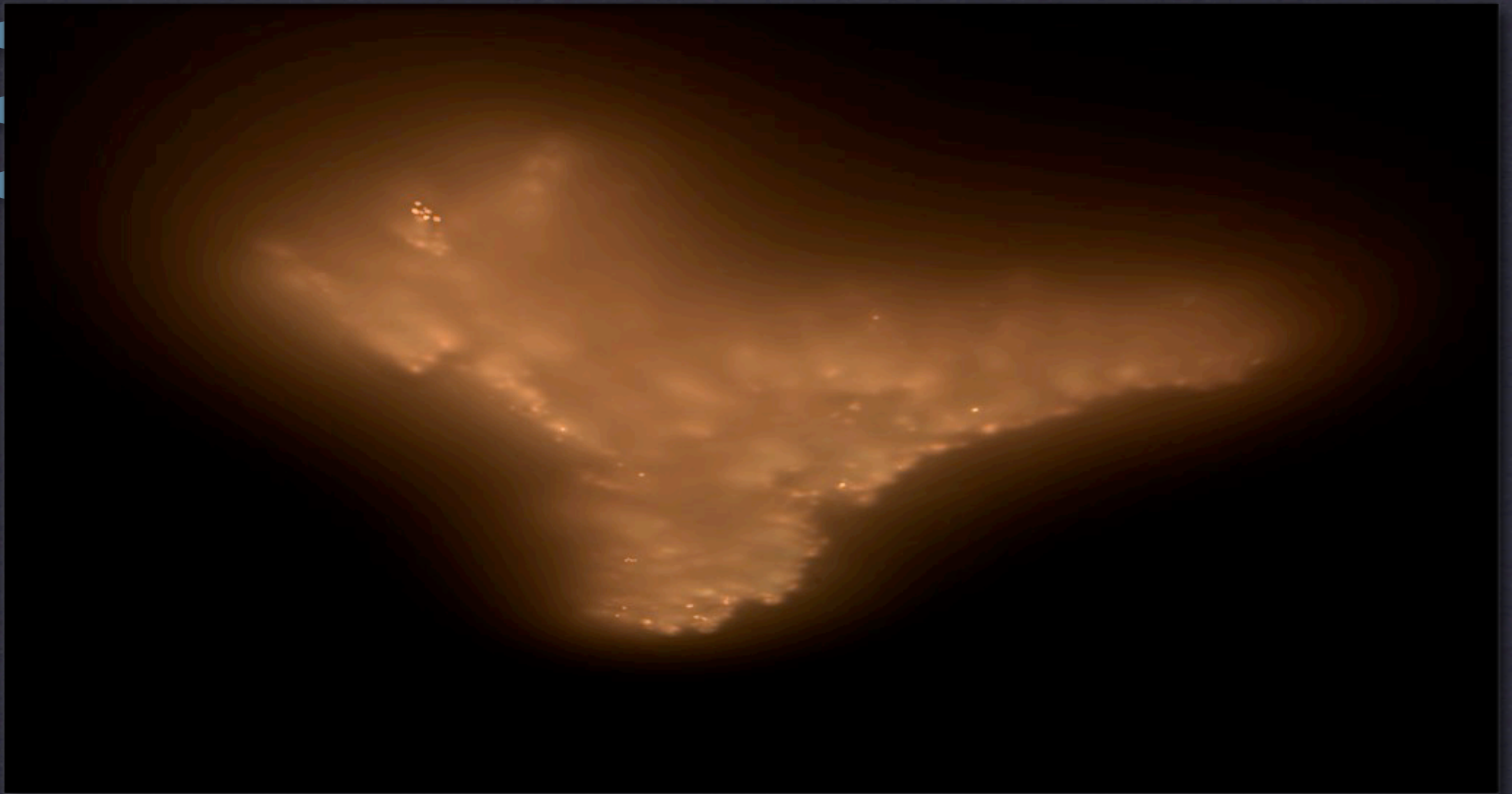


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# Volume Illumination in Effects Pipeline





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- indirectdiffuse function integrated into all effects surface and volume shaders





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- Uniform lighting
  - “distribution” “uniform”





# Volume Illumination in Effects Pipeline

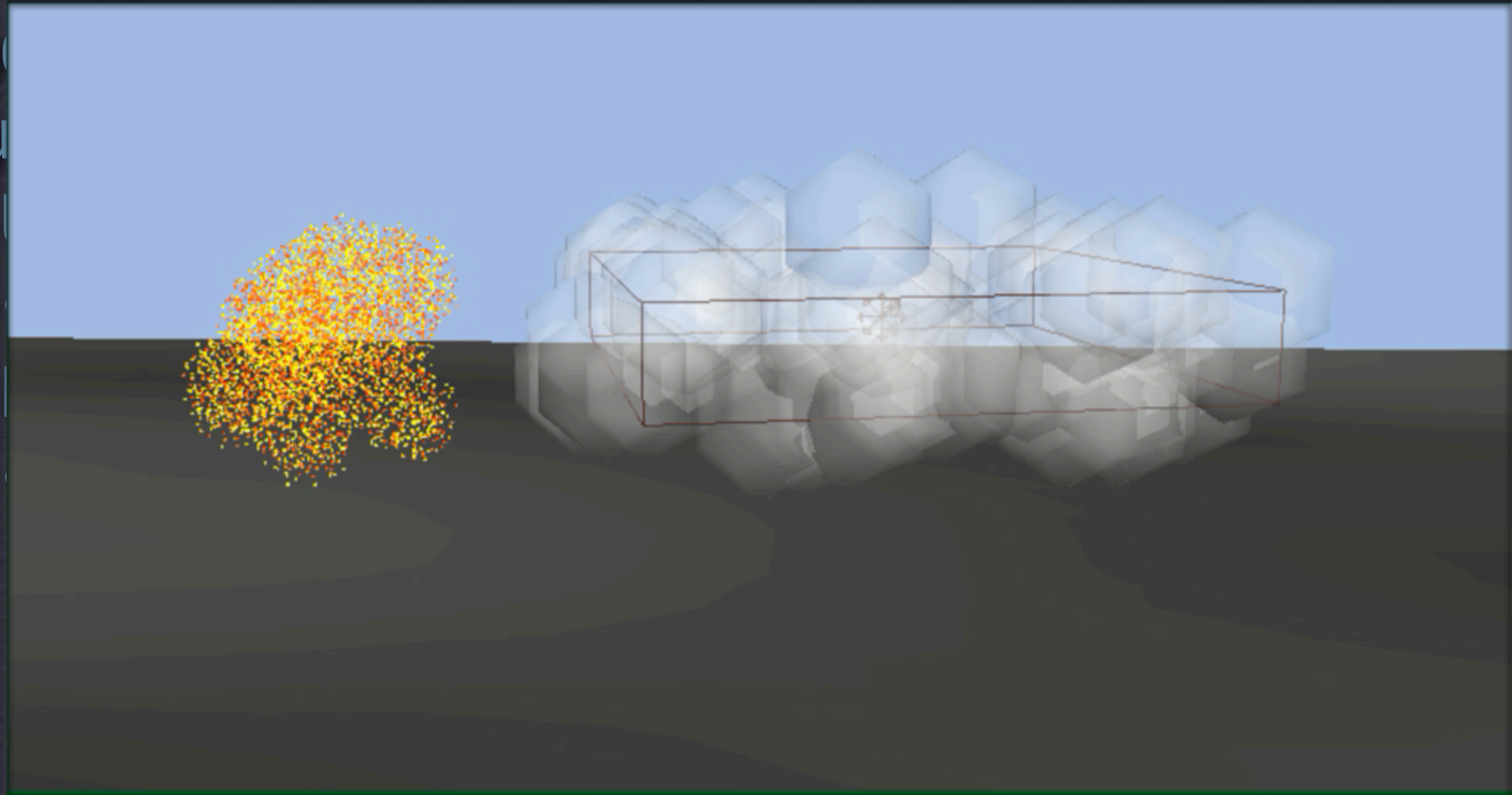
- indirectdiffuse function integrated into all effects surface and volume shaders
  - Uniform lighting
    - “distribution” “uniform”
  - Lighting from all directions
    - sum indirectdiffuse twice with  $N$  and  $-N$





# Volume Illumination in Effects Pipeline

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# Point Cloud Consumption in Lighting





# Point Cloud Consumption in Lighting

- Lighting receives effects point clouds





# Point Cloud Consumption in Lighting

- Lighting receives effects point clouds
  - ptfilter with -filter colorbleeding
    - Source and receiving geometry point clouds





# Surface and Volume Illumination

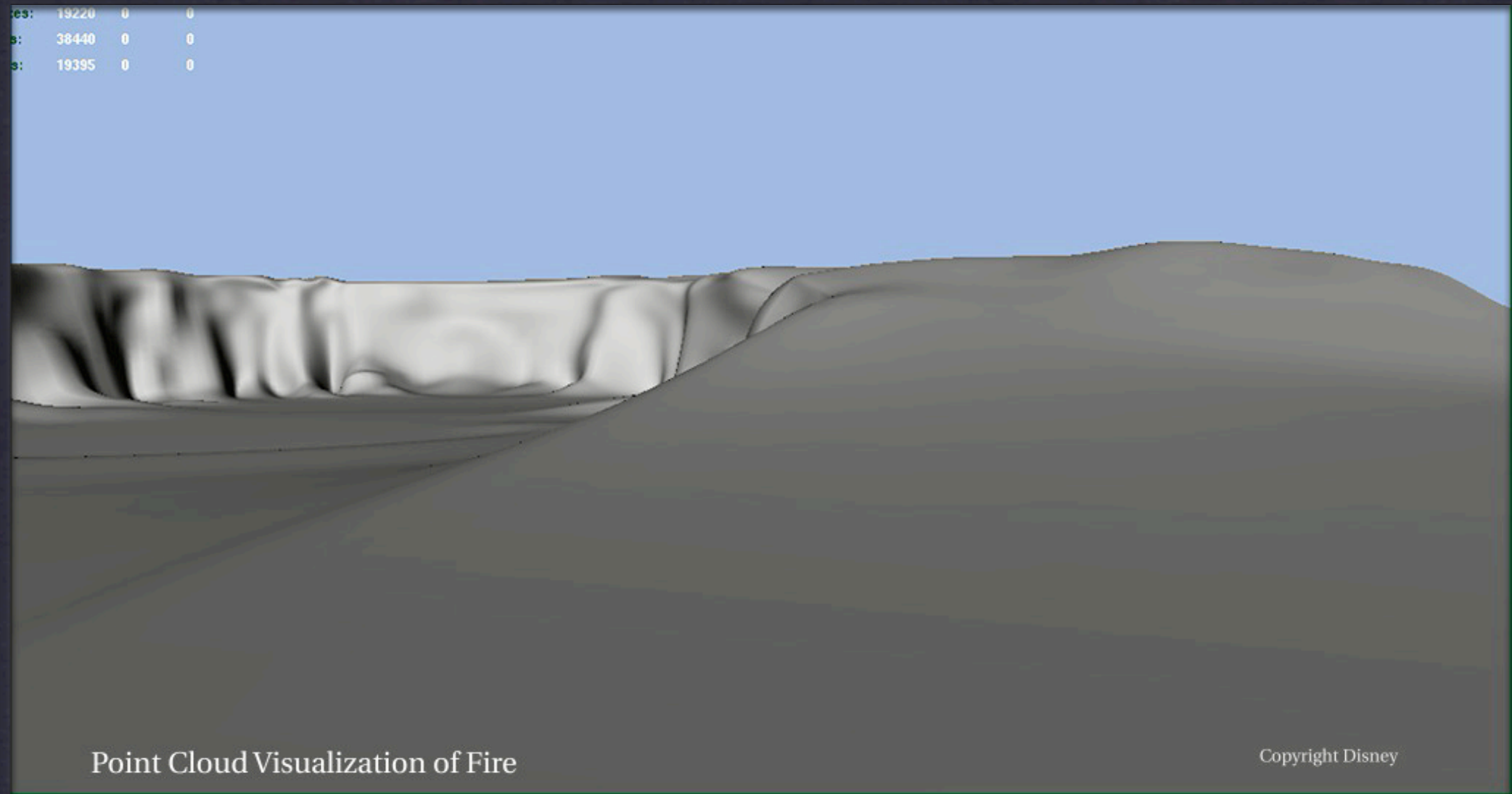
Point Clouds from Fire Illuminating Surfaces and Volume Smoke





# Surface and Volume Illumination

Point Clouds from Fire Illuminating Surfaces and Volume Smoke





# Fiery Ceiling and Helicopter

Fire Point Clouds Illuminating Ceiling Smoke Pass



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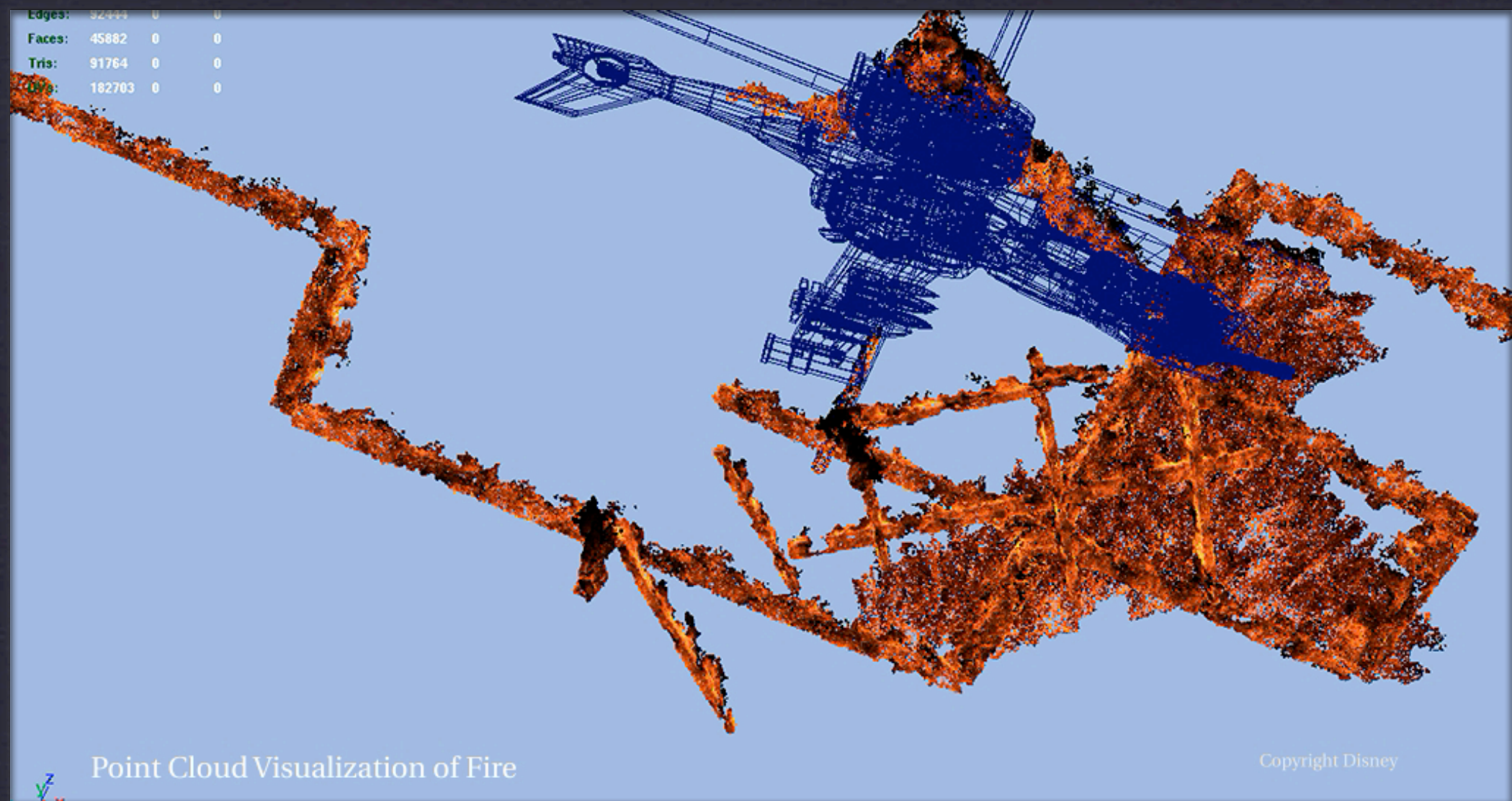


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# Fiery Ceiling and Helicopter

Fire Point Clouds Illuminating Ceiling Smoke Pass





# Animal Shelter Explosion

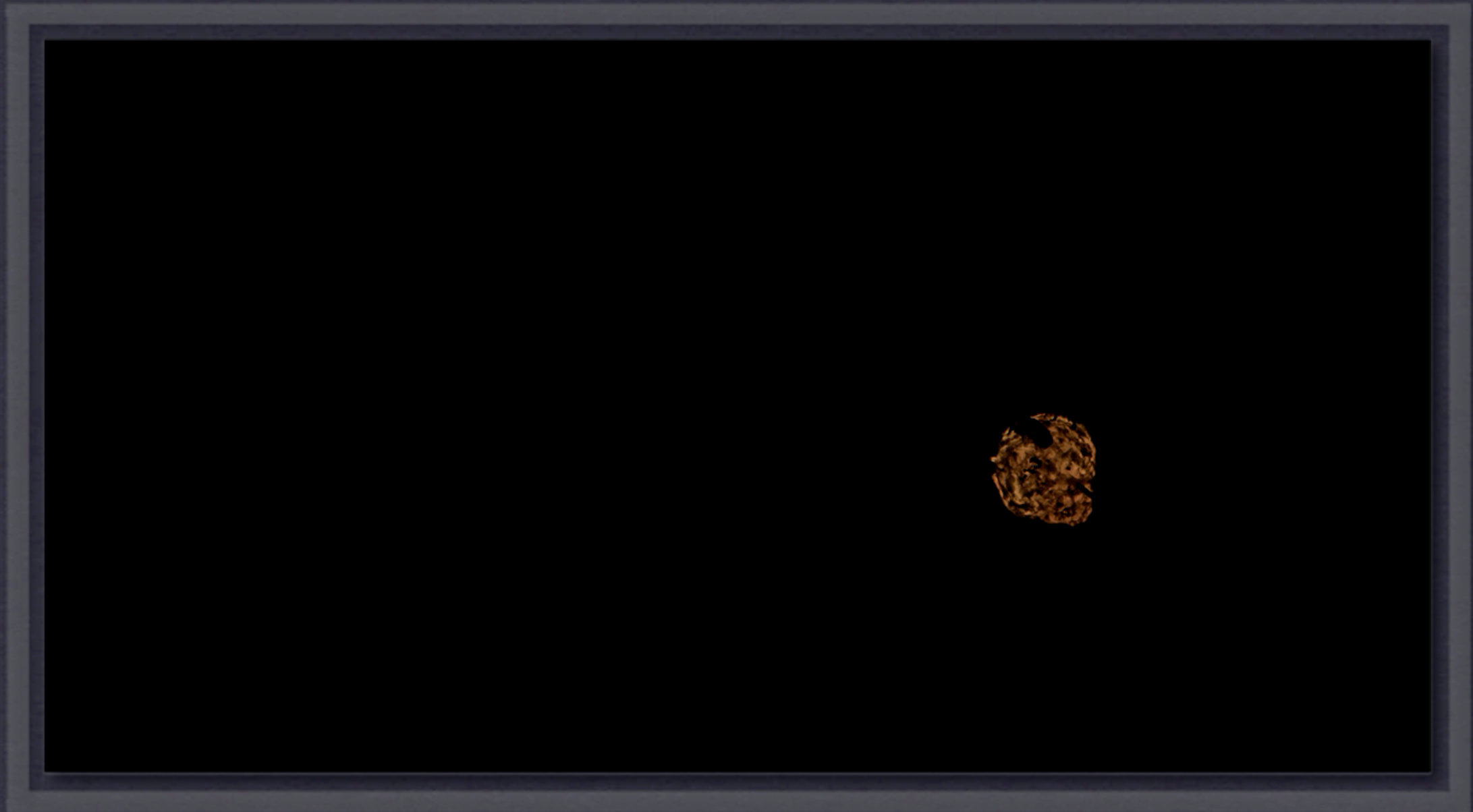
Point Cloud from Volume Illumination Passes





# Animal Shelter Explosion

Point Cloud from Volume Illumination Passes





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Point Cloud from Volume Illumination Passes





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Point Cloud from Volume Illumination Passes





# Bolt Transformation

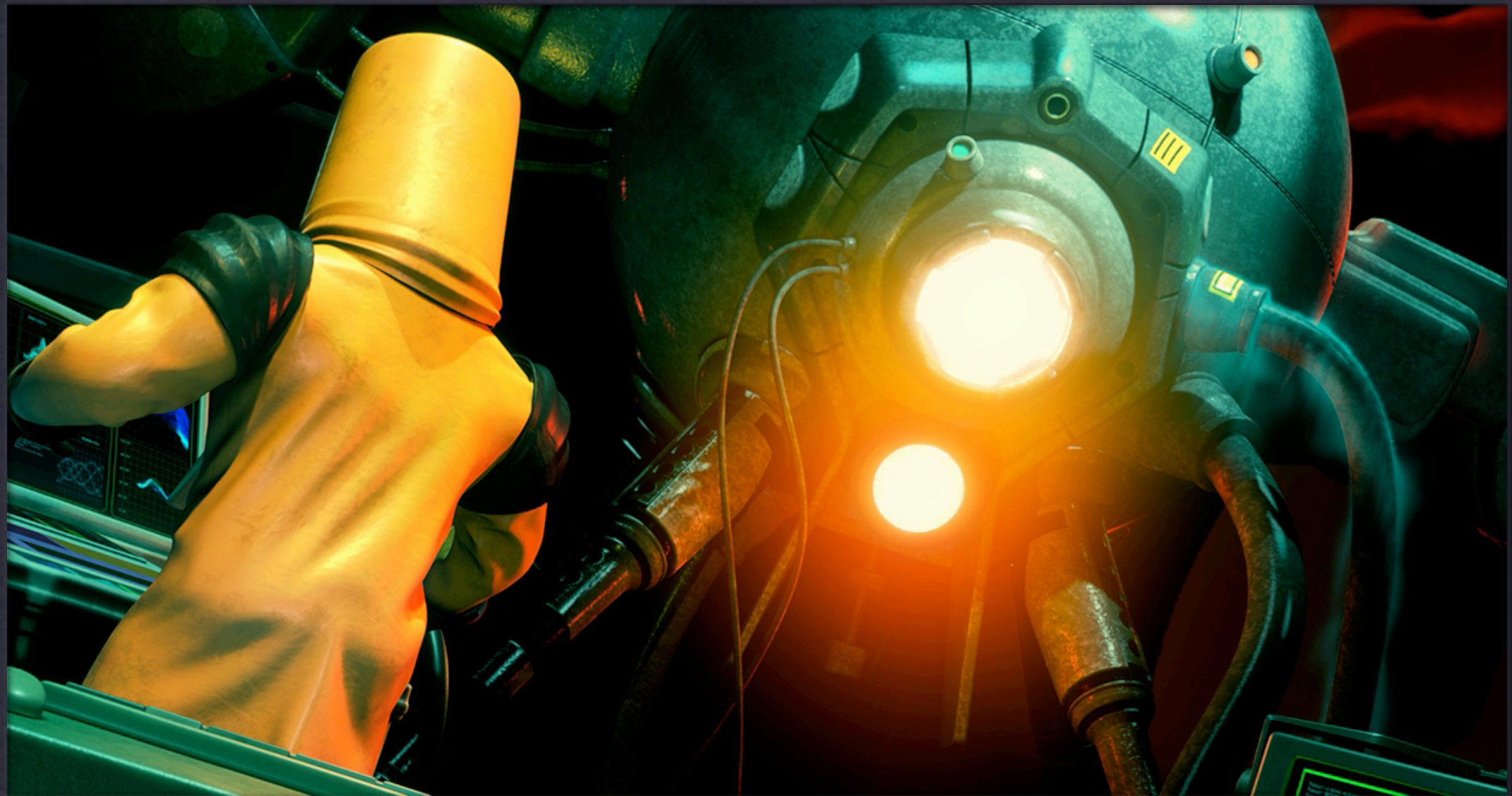
Effects Illumination on Fur





# Bolt Transformation

Effects Illumination on Fur





# Fireworks

Fireworks Illuminating smoke





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Fireworks Illuminating smoke





# Fireworks

Fireworks Illuminating smoke





# Illumination in Fire Sequence

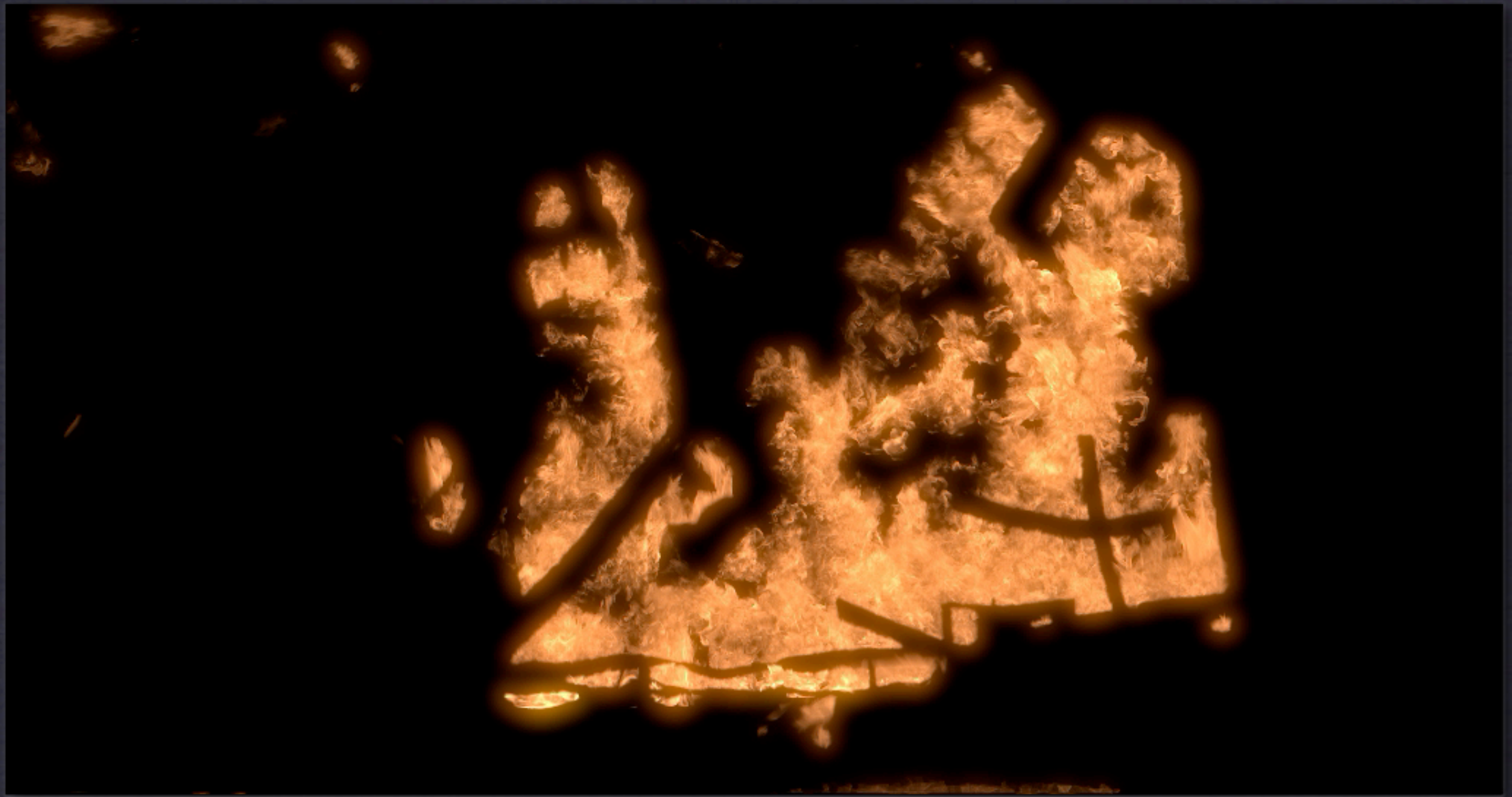
## Illumination of Surfaces and Volumes





# Illumination in Fire Sequence

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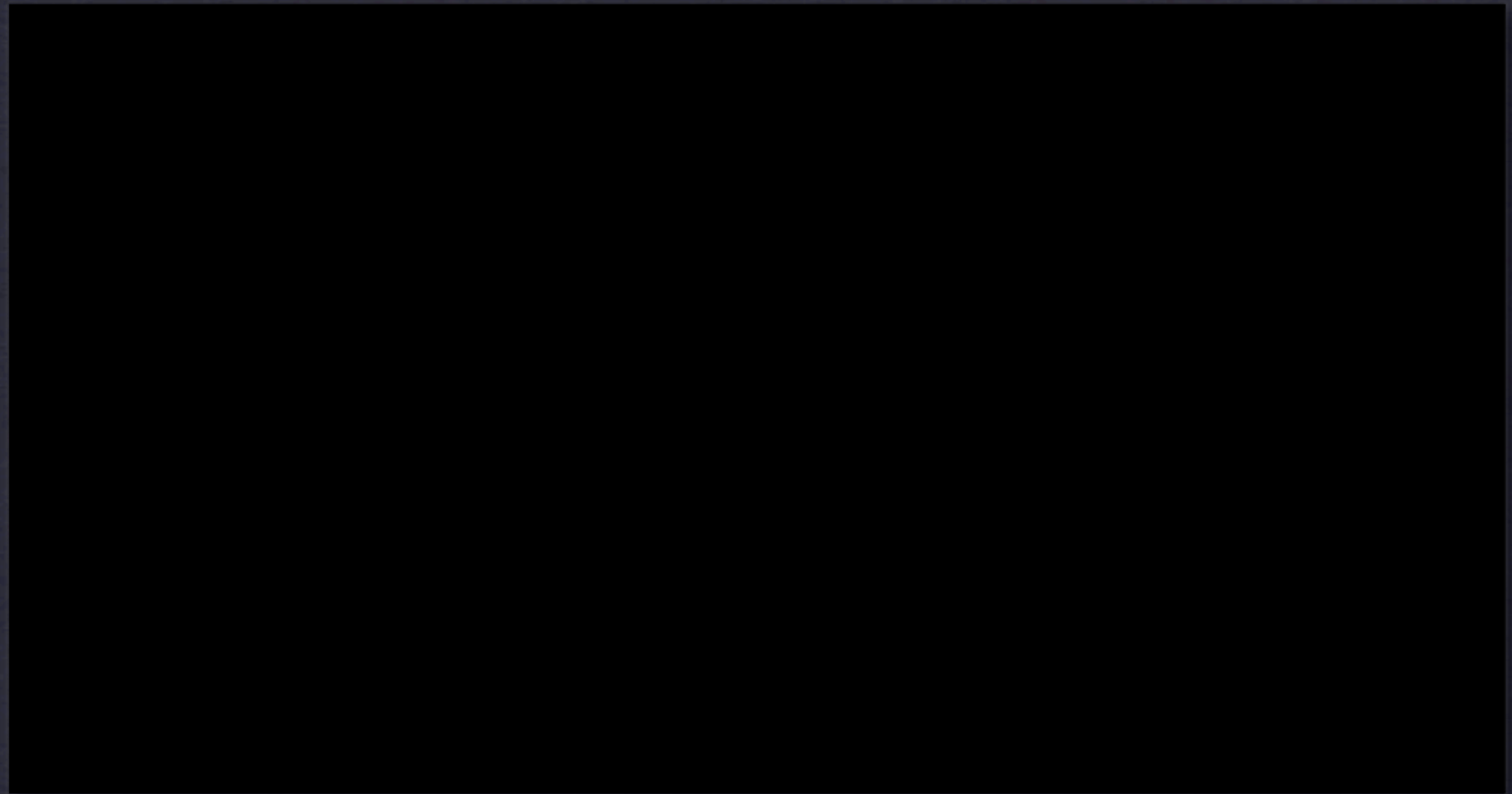
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# Conclusions





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# Thanks

Arthur Shek, Technology Manager  
Lawrence Chai, Software Engineer





# Questions?





