

Vulkan Forward Plus Renderer

Milestone 1

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Forward Plus Renderer

Forward Plus = Forward + Light Culling

- Extension of forward rendering & deferred rendering
- In the light pass, each light in the scene is sorted into screen space tiles. The light list generated from the light culling pass is used to compute the lighting for geometry.
- In the pass, not all lights need to be considered for lighting, only the lights that were previously sorted into the current fragment's screen space tile need to be considered when computing the lighting.

FORWARD RENDERING PIPELINE

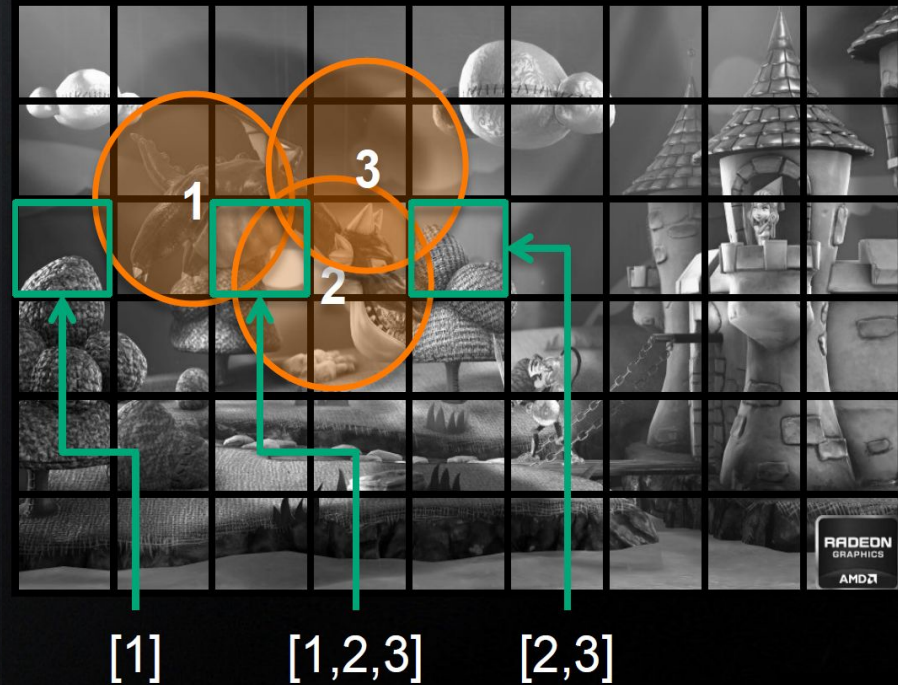
- Depth prepass
 - Fills z buffer
 - Prevent overdraw for shading
- Shading
 - Geometry is rendered
 - Pixel shader
 - Iterate through light list **set for each object**
 - Evaluates materials for the lights

FORWARD+ RENDERING PIPELINE

- Depth prepass
 - Fills z buffer
 - Prevent overdraw for shading
 - Used for pixel position reconstruction for light culling
- Light culling
 - Culls light per tile basis
 - Input: z buffer, light buffer
 - Output: light list per tile
- Shading
 - Geometry is rendered
 - Pixel shader
 - Iterate through light list **calculated in light culling**
 - Evaluates materials for the lights

FORWARD+ RENDERING PIPELINE

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Credit : TAKAHIRO HARADA (AMD)

What we have done

- Basic Vulkan Framework including:
 - a. texture mapping
 - b. mesh loading
 - c. rendering pipeline
 - d. lambert shading
- Cross Platform using GLFW & CMake (Windows, Linux)

windy@windy-Blade: ~/projects/github/Vulkan_HelloWorld/build

```
windy@windy-Blade:~/projects/github/Vulkan_HelloWorld/build$ byzanz-record --duration=5 --x=1600 --y=900 --width=1600 --height=900 output.gif
```

```
windy@windy-Blade:~/projects/github/Vulkan_HelloWorld/build$ byzanz-record --duration=5 --x=800 --y=450 --width=500 --height=500 output.gif
```

```
windy@windy-Blade:~/projects/github/Vulkan_HelloWorld/build$ byzanz-record --duration=5 --x=0 --y=0 --width=500 --height=500 output.gif
```

```
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```

```
windy@windy-Blade:~/projects/github/Vulkan_HelloWorld/build$ ./vulkan_hello_world
```

available extensions:

- VK_KHR_xlib_surface
- VK_EXT_debug_report
- VK_KHR_xcb_surface
- VK_KHR_surface

Current Device: GTX 970M

FPS: 745.565

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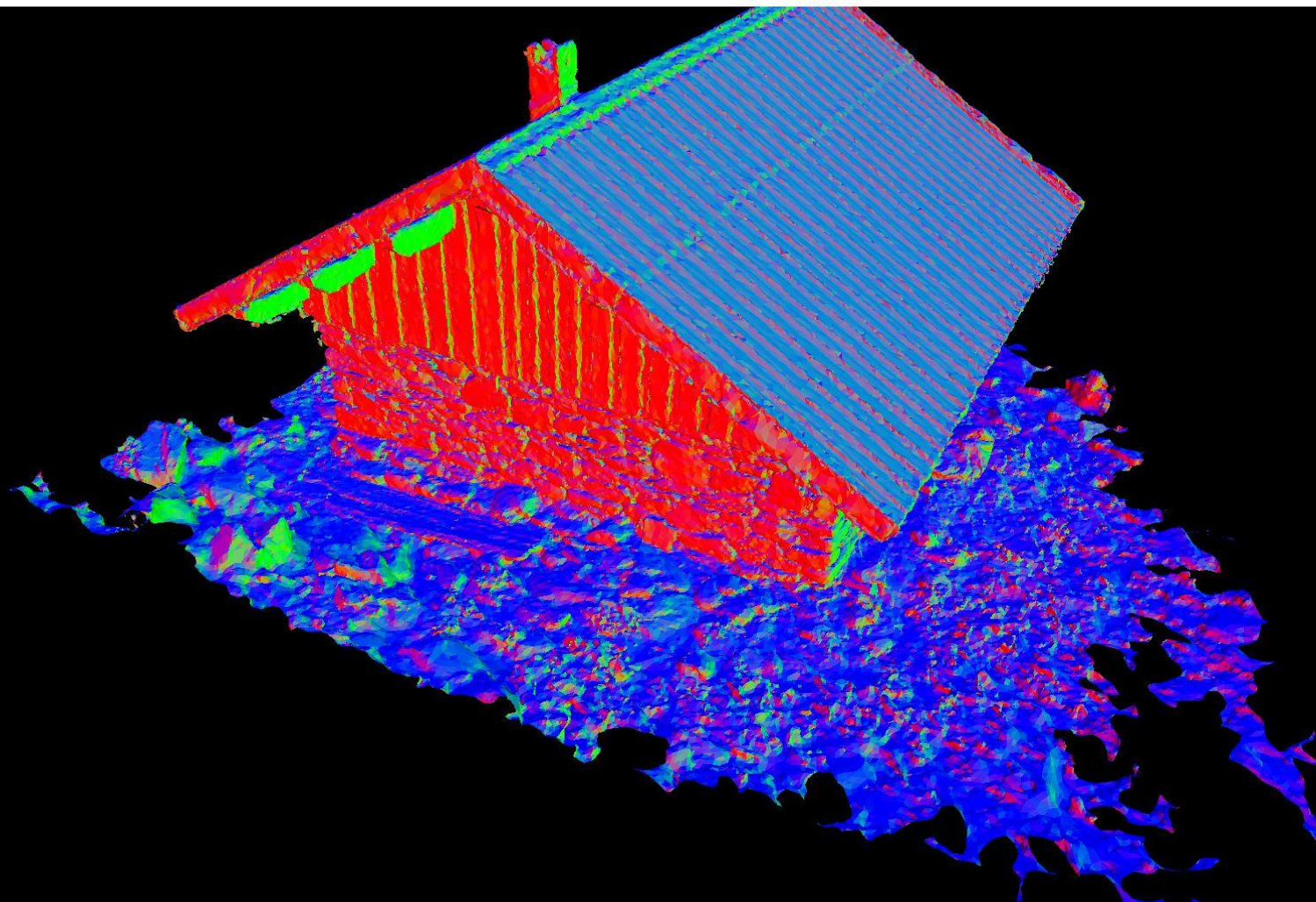
windy@windy-Blade: ~

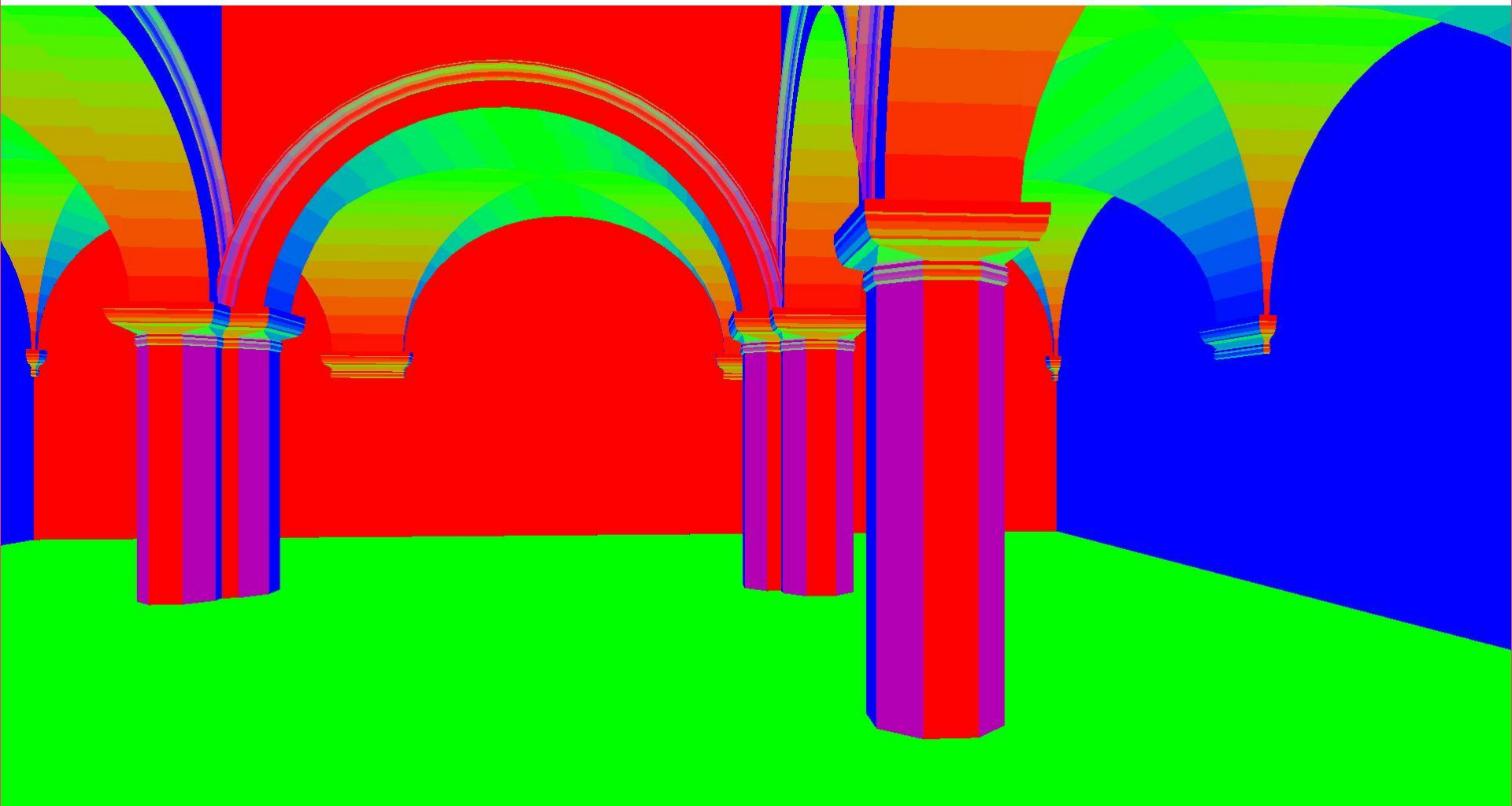
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windy@windy-Blade:~$ byzanz-record --duration=5 --x=0 --y=0 --width=1600 --height=900 output.gif
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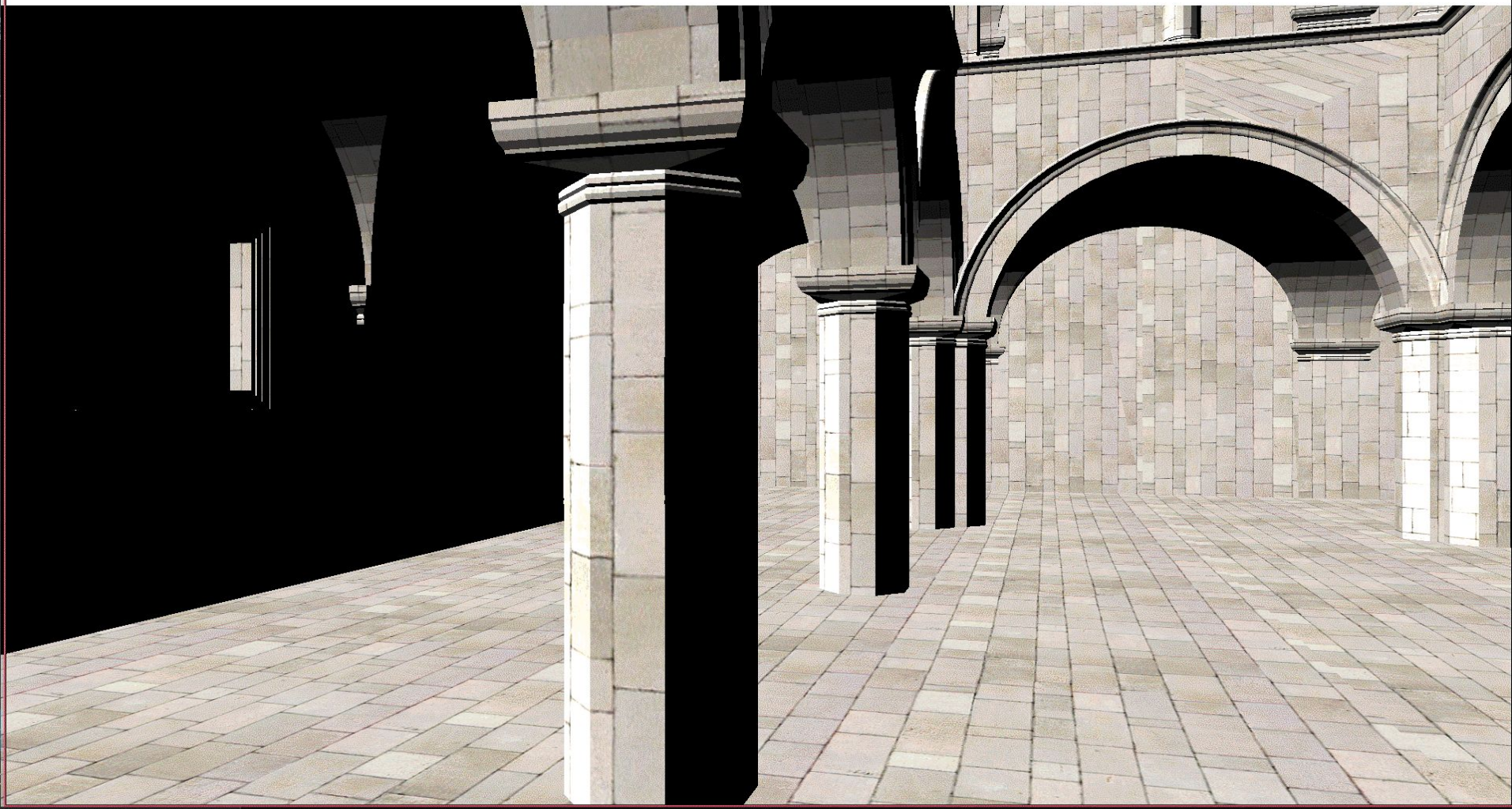
```
windy@windy-Blade:~$ byzanz-record --duration=5 --x=0 --y=0 --width=1600 --height=900 output.gif
```

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windy@windy-Blade:~$ byzanz-record --duration=5 --x=0 --y=0 --width=1600 --height=900 output.gif
```









Future Milestones

11/21 - 11/28: working Forward+ renderer.

- Tile based pipeline
- Light culling

11.28 - 12/11: all other works.

- Optimization & comparision;
- Possibly add more fancy features to our renderer: material variety, bloom, SSAO, MSAA, TAA, etc.

References

Vulkan Tutorial: <https://vulkan-tutorial.com/>

Vulkan examples and demos from Sascha Willems:

<https://github.com/SaschaWillems/Vulkan>

Forward vs Deferred vs Forward+ Rendering: <http://www.3dgep.com/forward-plus/>

Forward+: Bringing Deferred Lighting to the Next Level:

https://takahiroharada.files.wordpress.com/2015/04/forward_plus.pdf