

# Milestone 2: DDGI Minecraft

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# Project Overview & This Week's Goals

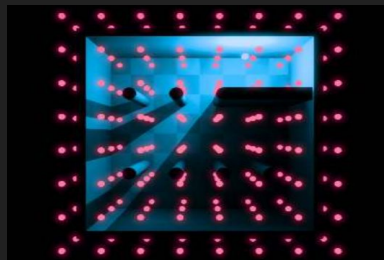
**Final Goal:** Generate a real-time dynamic Minecraft-inspired scene illuminated by Dynamic Diffuse Global Illumination (DDGI) Probes as described in this [paper](#) using Vulkan.



Example Dynamic Scene with Diffuse Global Illumination (Source: [paper](#))

## Weekly Goals:

1. Sample information at a probe & save it to a texture
2. Procedurally generate minecraft scene
3. Visualize Probes and Find Closest Probes around Intersection



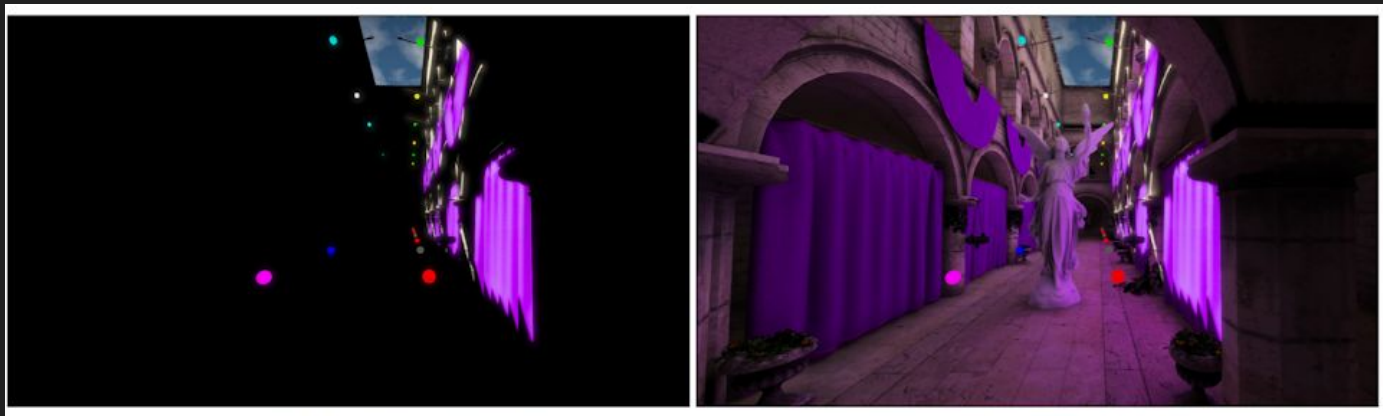
Example placement of probes in scene (Source: [paper](#))



Example terrain generation. (Source: [online](#))

# What are probes?

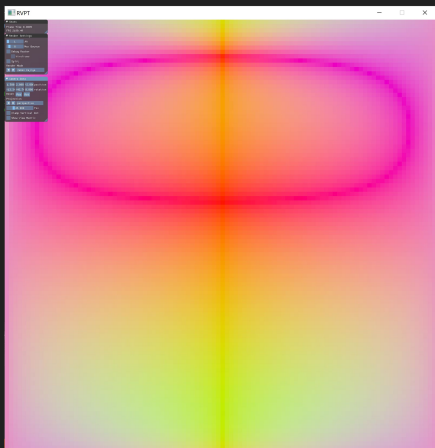
Probes sample color and normals of objects around them for indirect shading.



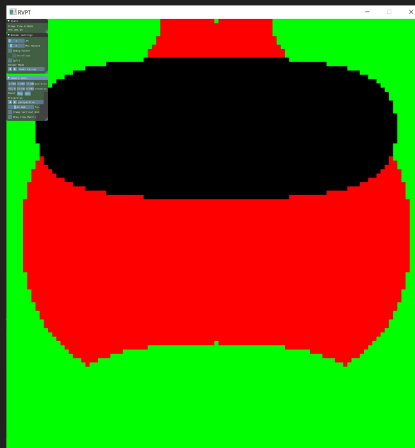
Example of probe usage to achieve global illumination. (Source: [Paper](#))

# Probe Texture Data

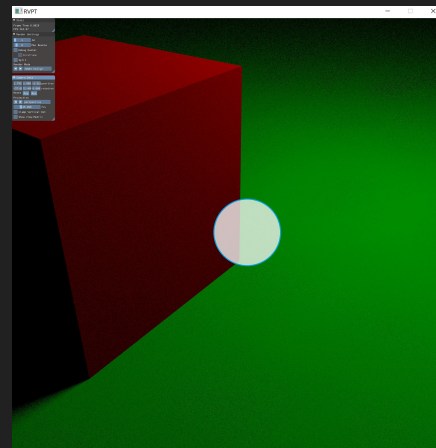
- Implemented the data to texture pipeline
- Generates rays in uniform samples around sphere



Visualization of ray directions



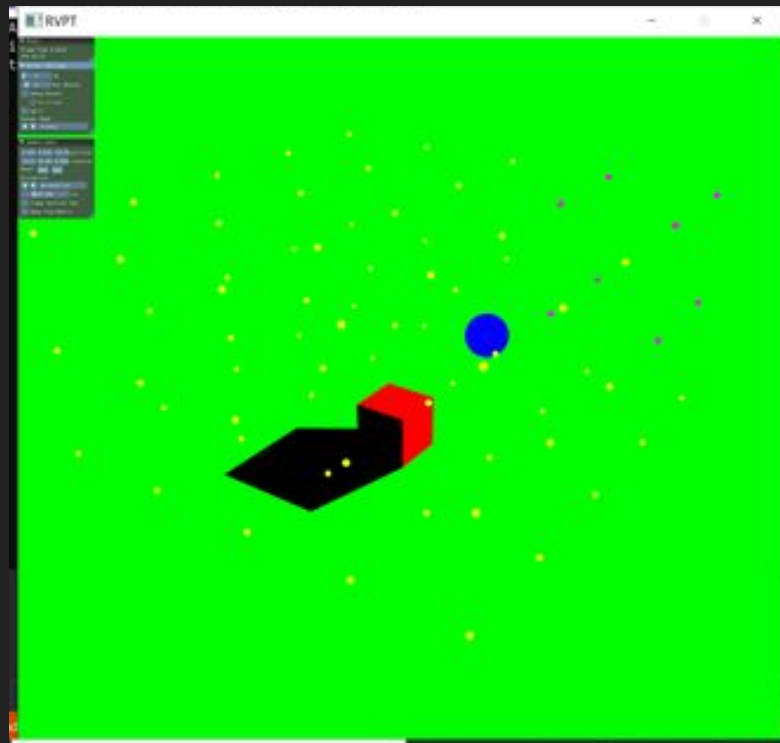
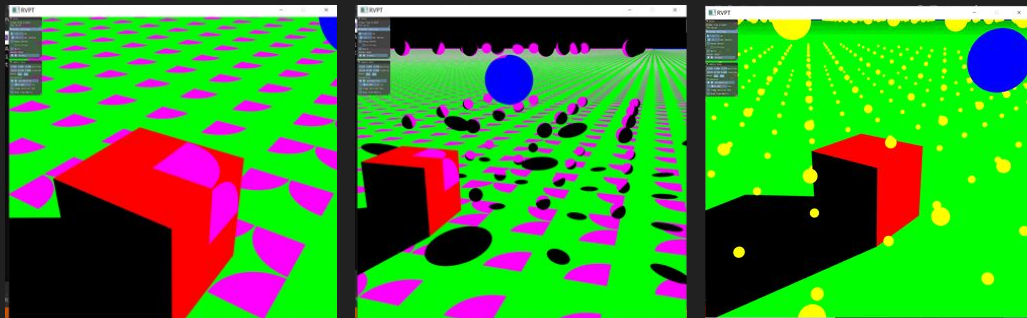
Albedos as stored in texture



Approximate probe location

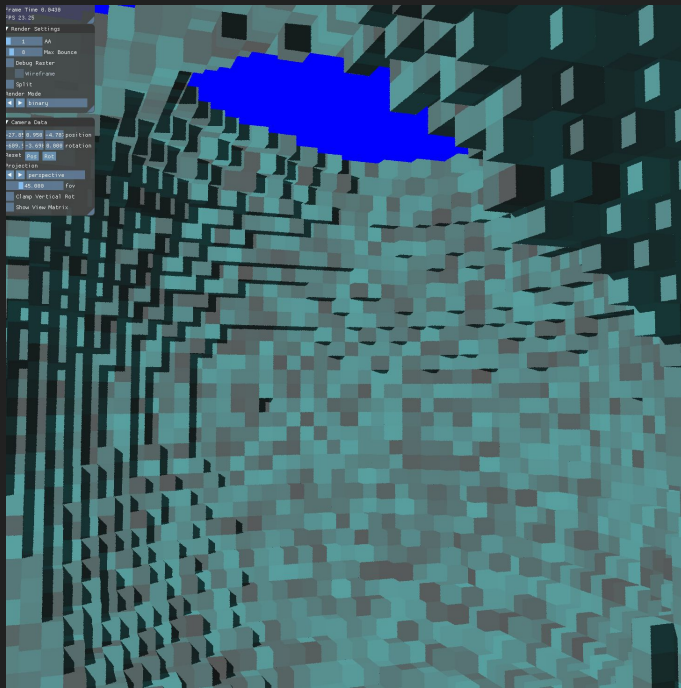
# Probe Visualization & Neighbor Check

- Irradiance field (grid-aligned collection of probes) initialized on the CPU and sent to the GPU
- Probes were visualized using signed distance functions
- Given a position, the indices of the 8 nearest probes are calculated

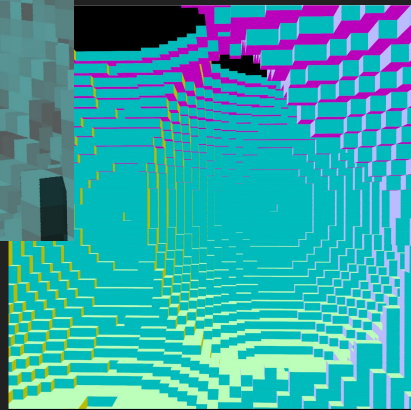


# Scene Generation

- March down a ray, and for every x number of grid cells the ray passes through, check if cell has block via procedural generation.
- Supports Grid Marching up to 200 blocks!
- Runs at constant 90 FPS with 1k \* 1k window



Generated scene in direct lighting (from the small blue sphere) & colored with noise



Generated scene in normals mode

# Goals for Milestone 3

- Probe interpretation (a.k.a. implement the paper)
  - Read from probe texture data and interpret for diffuse shading
  - Combine Diffuse shading and direct lighting
  - Dynamically update probe information from frame to frame
  - Factor in visibility test to prevent light leaks
- Scene completion
  - Generate multiple interesting scenes
  - Add dynamic lights
  - Maybe incorporate textures

**Thank you!**