Milestone 3: 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.
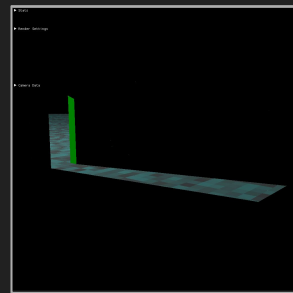

Example Dynamic Scene with Diffuse Global Illumination (Source: paper)
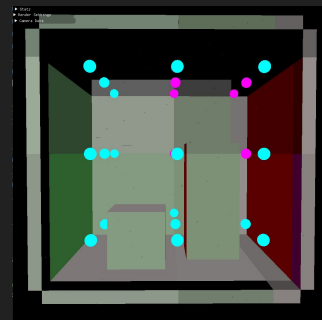
Weekly Goals:

1. Read from probe textures and interpret data for diffuse shading
2. Dynamically update probes from frame to frame
3. Dynamic lighting
4. Make new scenes with UI additions
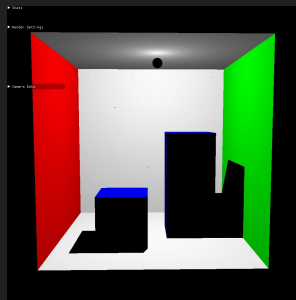
Cornell Box Scene we made using Grid Marching (direct lighting)

House Scene we made using Grid Marching (direct lighting)

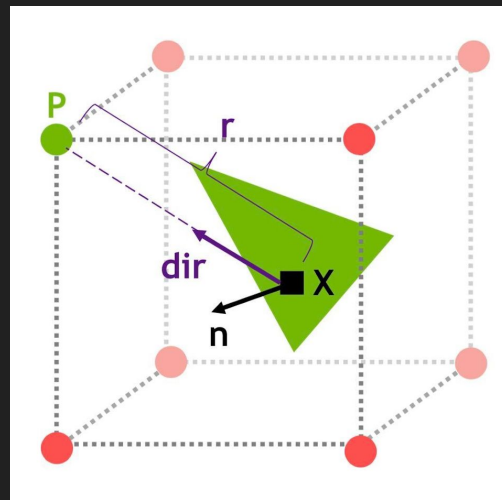Example placement of probes in Cornell Box scene (Debug Mode)

Generating & Sampling Probes

Generating Probe Textures (From Last Week)

- Stratify sample texture & warp sample
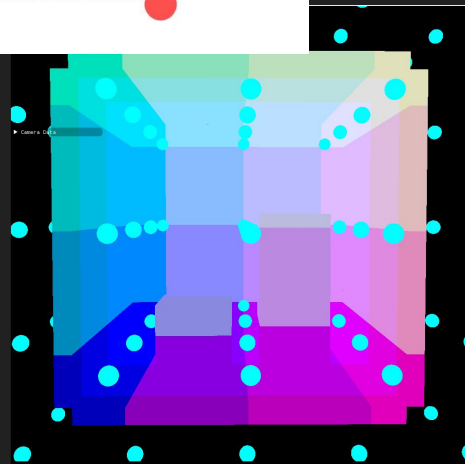- Save indirect lighting we get from ray

Sampling Probes

- Find the 8 closest probes
- Sample probe textures using the normal
 - Convert normal back into 2D texture coord

Top: figure for sampling probes for point X

Right: debug view of the probe indices that the surface samples from
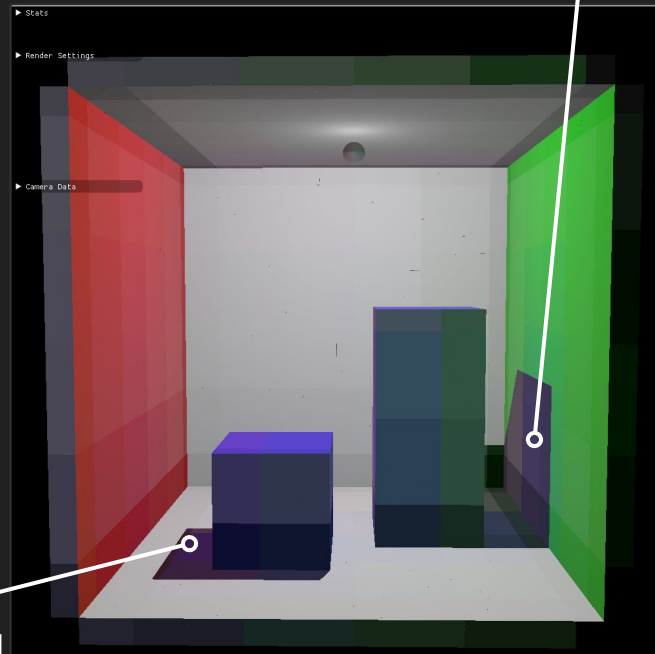
Probe Data Interpretation

- Originally storing material color at first bounce
- Now storing the indirect light values we see at first bounce
- Factor in lambert shading / energy loss per bounce

Blue GI Reflected from cube

Close Up of Right Picture

Blue GI Reflected from cube
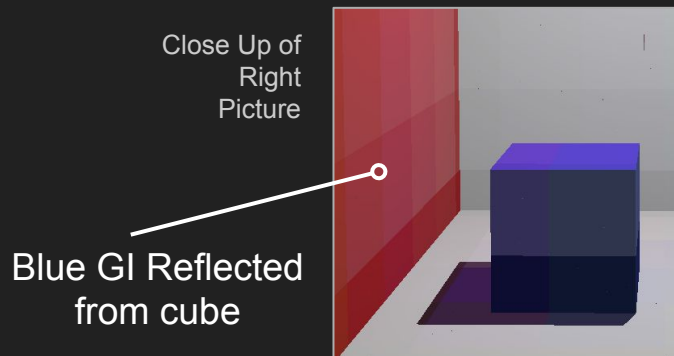
Red GI Reflected from wall

Debug view: average of the colors sampled from the eight probes

Blending Probes

- Smooth backface weights
  - Culls contribution of invisible probes
- Trilinear adjacency weights
  - Distance-based weights
- Chebyshev visibility test
  - Variance shadow mapping
- Log perception weight
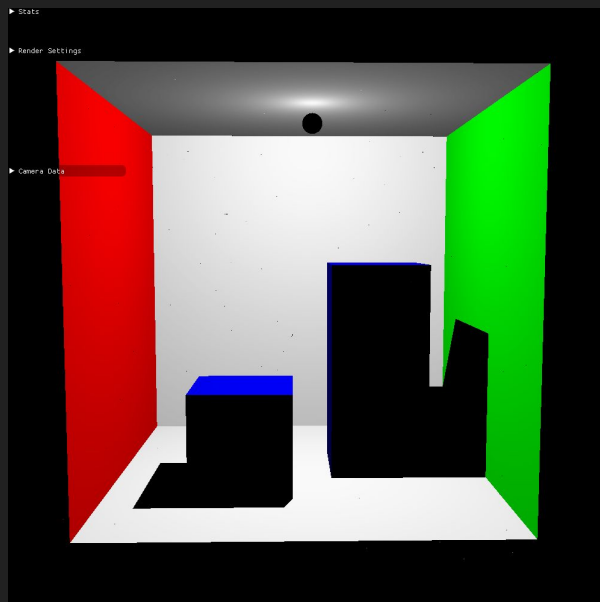 - Counters human sensitivity to low light conditions by scaling down dim lighting
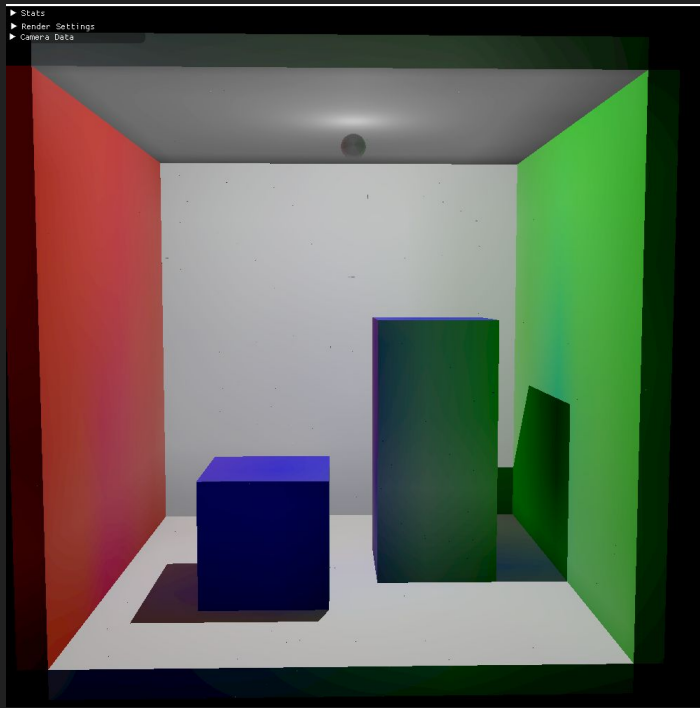
Left: weights applied

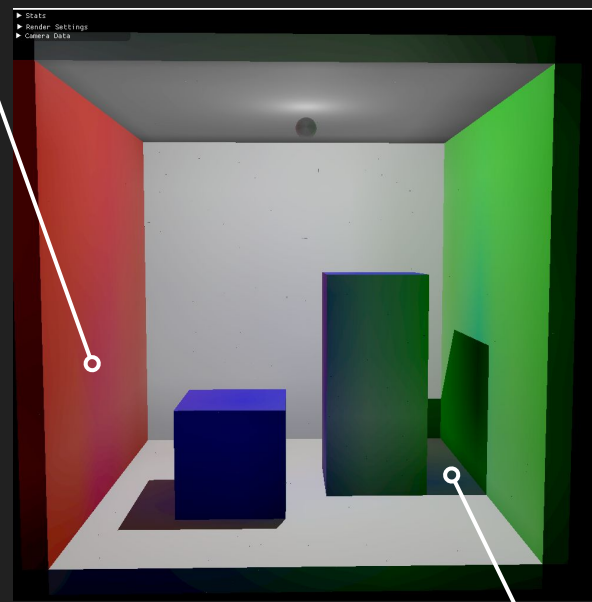Bottom: no weights applied to indirect lighting
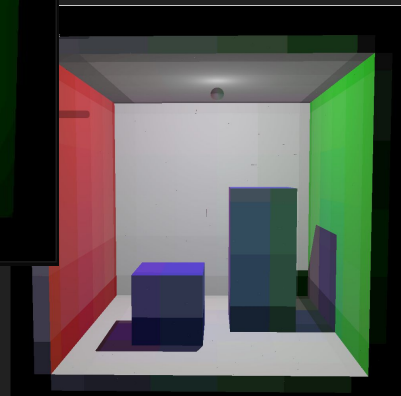
Results

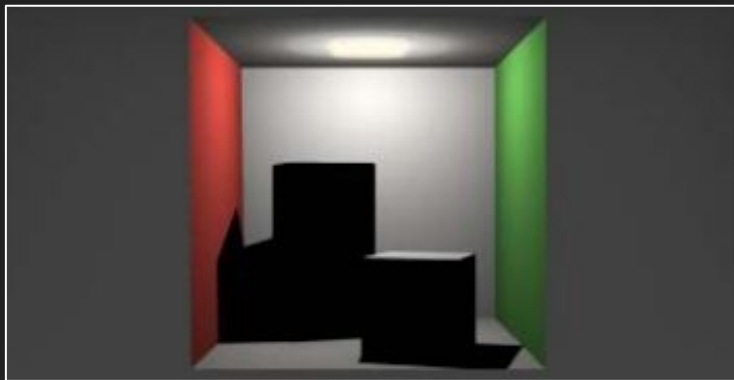Blue Diffuse GI from cube on Red Wall

Direct lighting only

With DDGI
(80-90 fps)

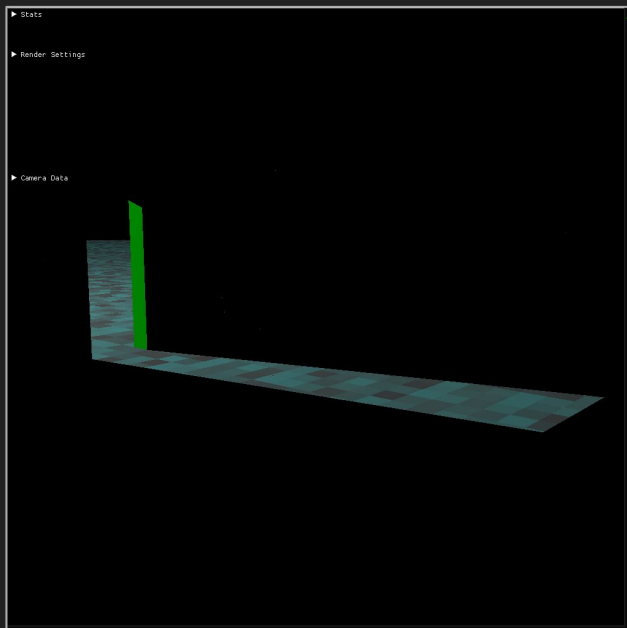Green GI from wall
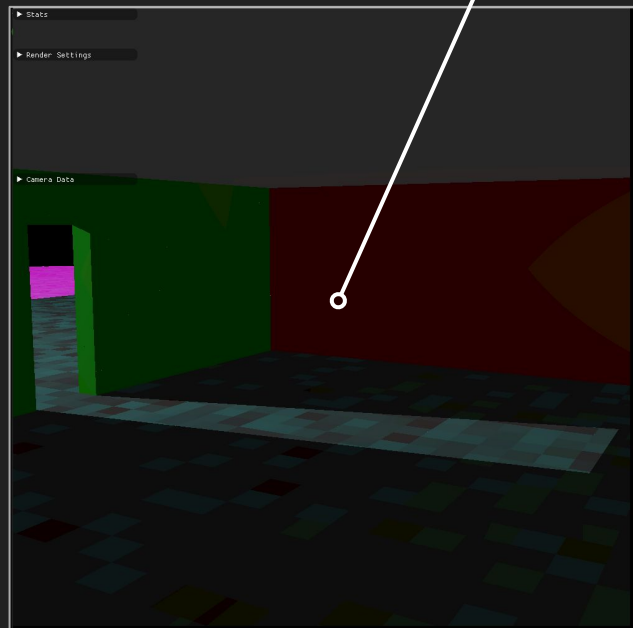
Paper Reference

Direct lighting only

With DDGI

Dark Room Scene

A lot brighter!
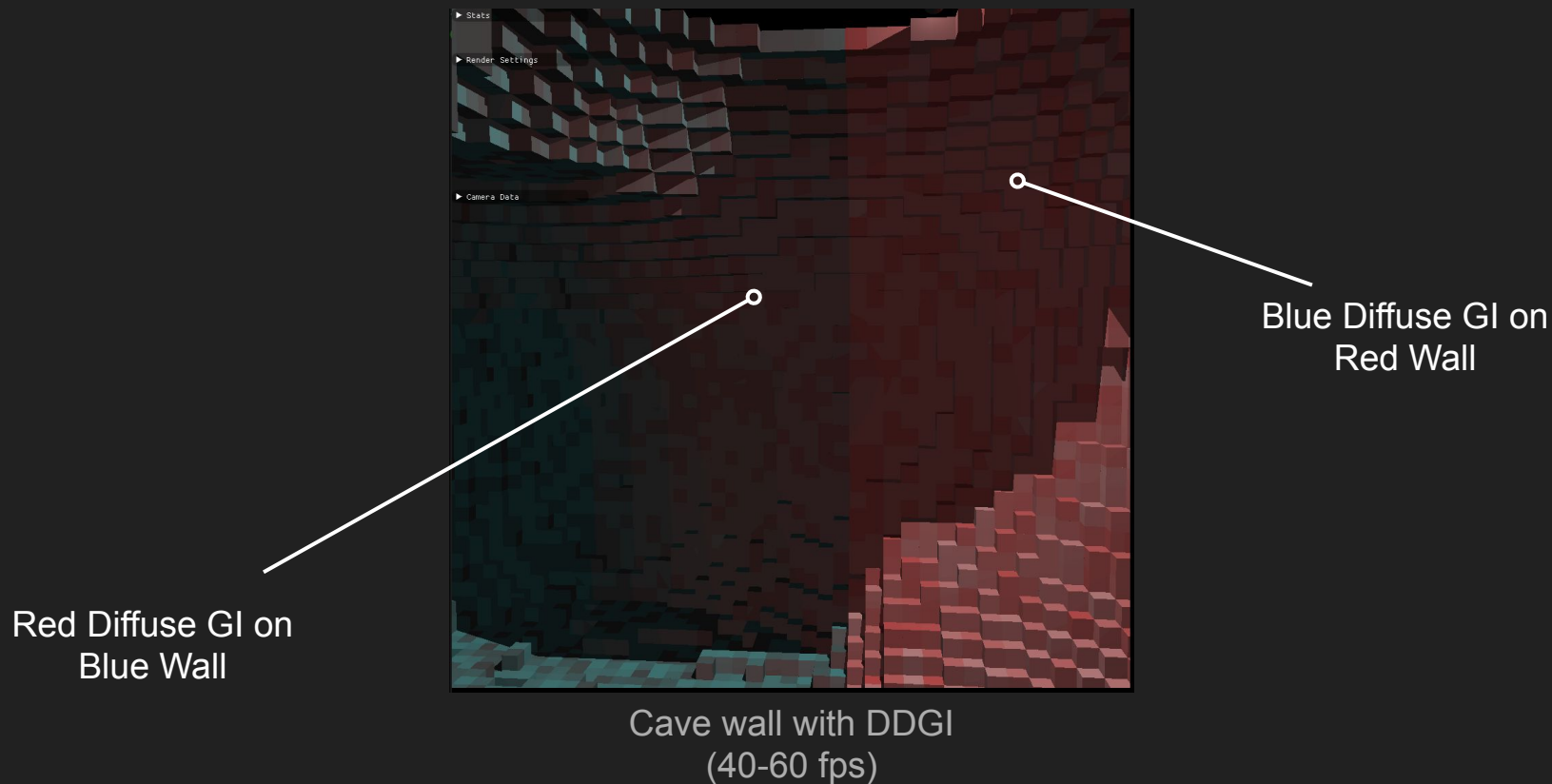
Direct lighting only

With DDGI

Live Demo

▶ Stats

▶ Render Settings

▶ Camera Data

Blue Diffuse GI on
Red Wall

Red Diffuse GI on
Blue Wall

Cave wall with DDGI
(40-60 fps)

Goals for Final Presentation

- Add performance optimizations to increase frame rate
- Tune parameters for indirect lighting
- Polish scenes
  - Work on cave scene and others
  - Add dynamic lights
- Maybe incorporate textures
- Performance analysis

Some of Our Bloopers…
Welcome to our abstract MOMA exhibition

Thank you!