



GI = Global Illumination

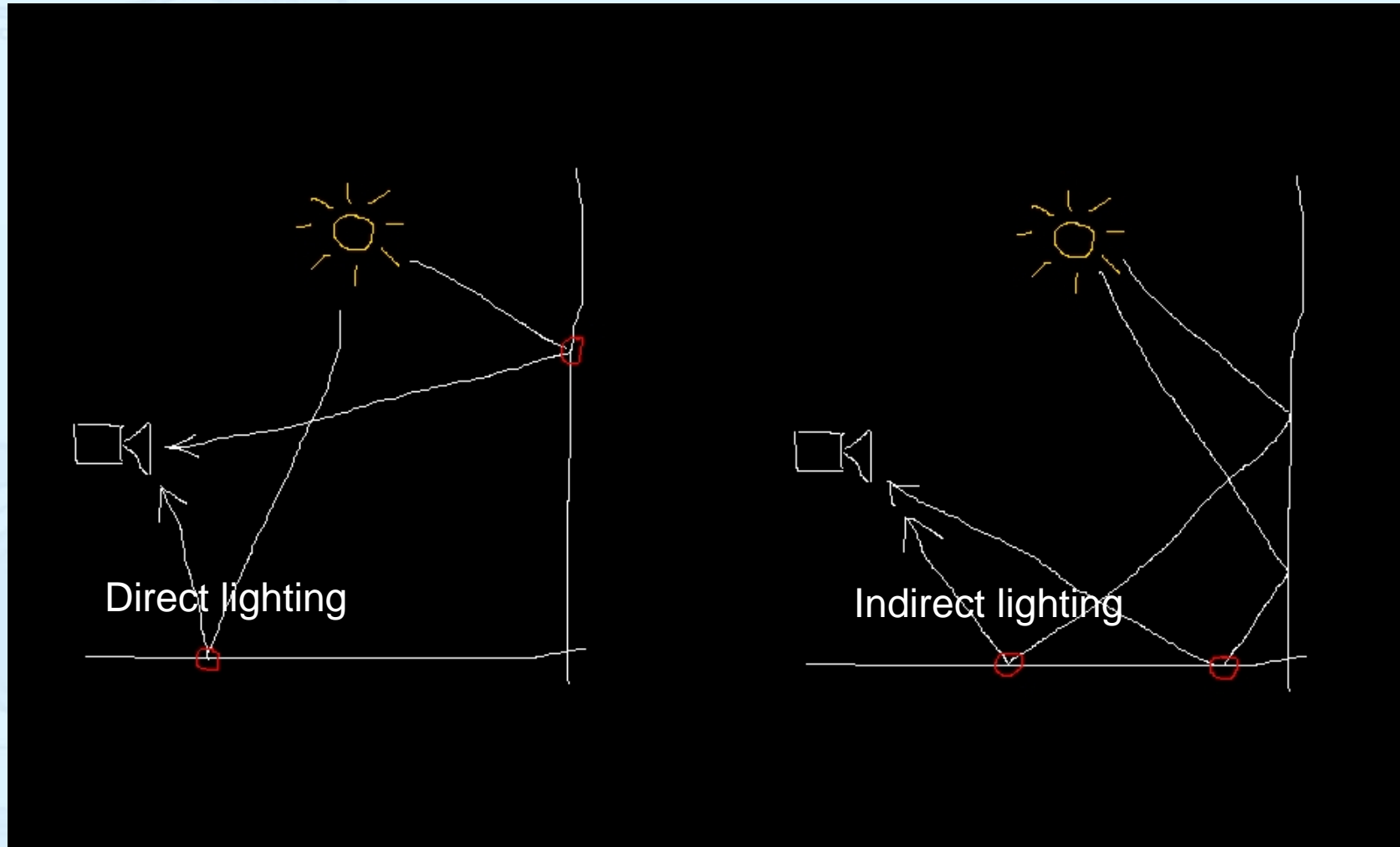
Why GI?



Why GI?

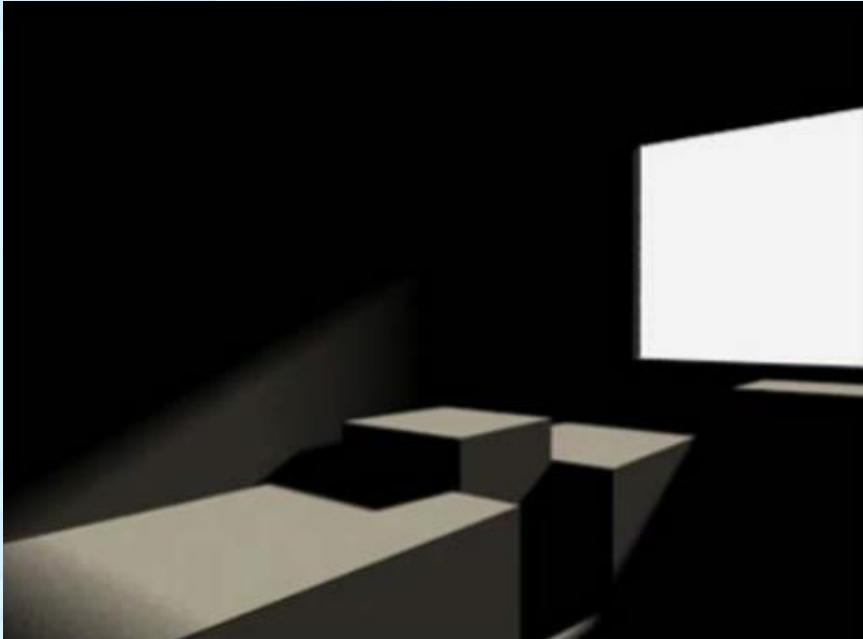


What is GI?

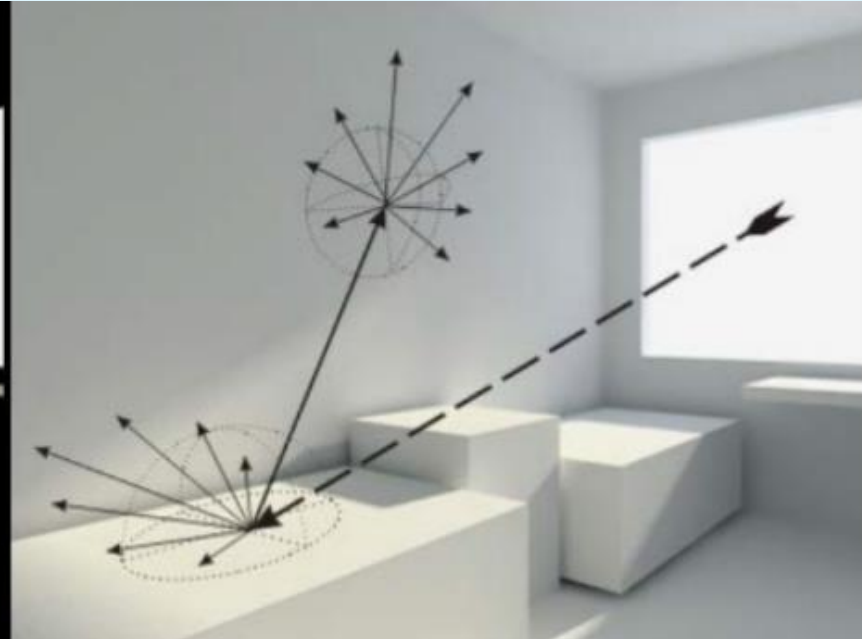


What is GI?

What is GI?



Only Direct Lighting



Direct + Indirect

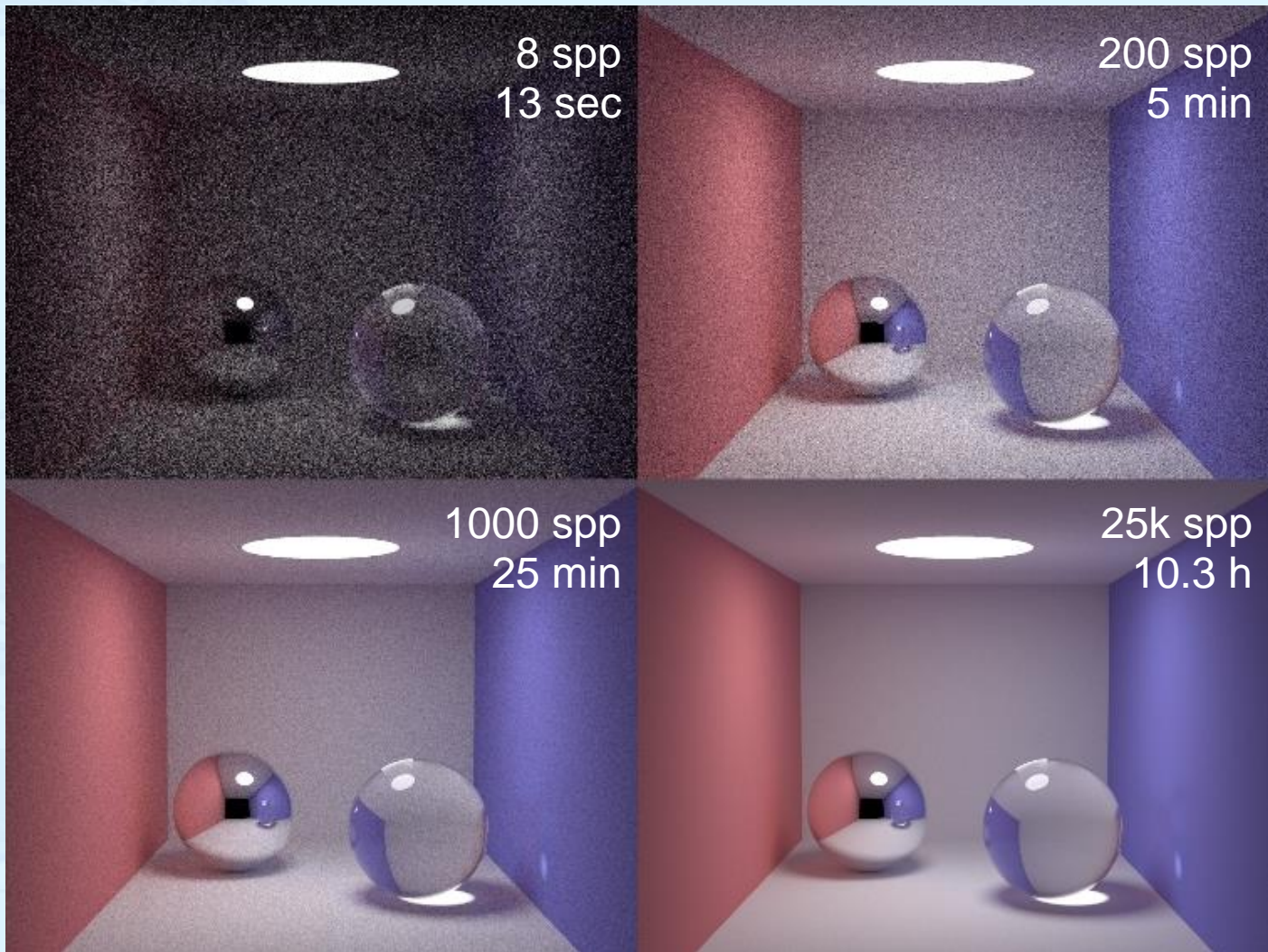
What is GI?



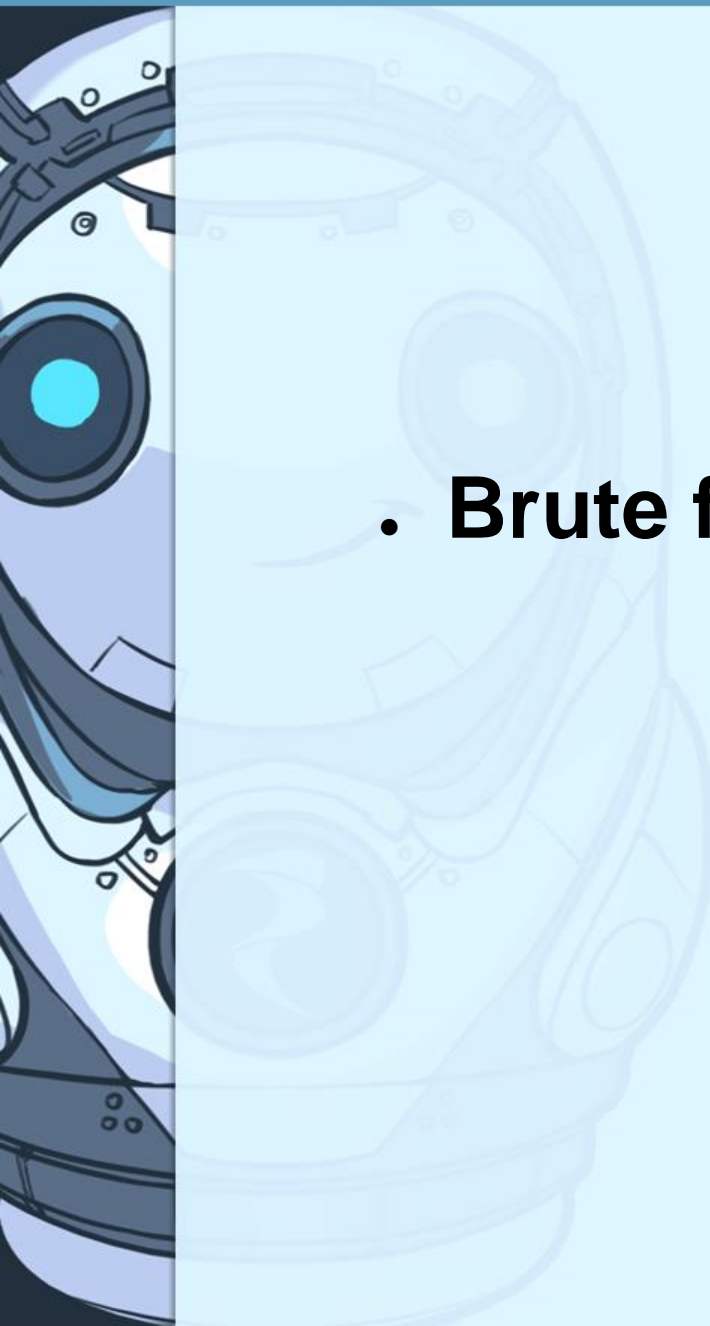
- **Direct lighting – sucks**
- **Direct + Indirect lighting – cool**

What is GI?

GI in 99 Lines of C++



2.4 GHz Intel Core 2 Quad, 1024 x 768, by Kevin Beason

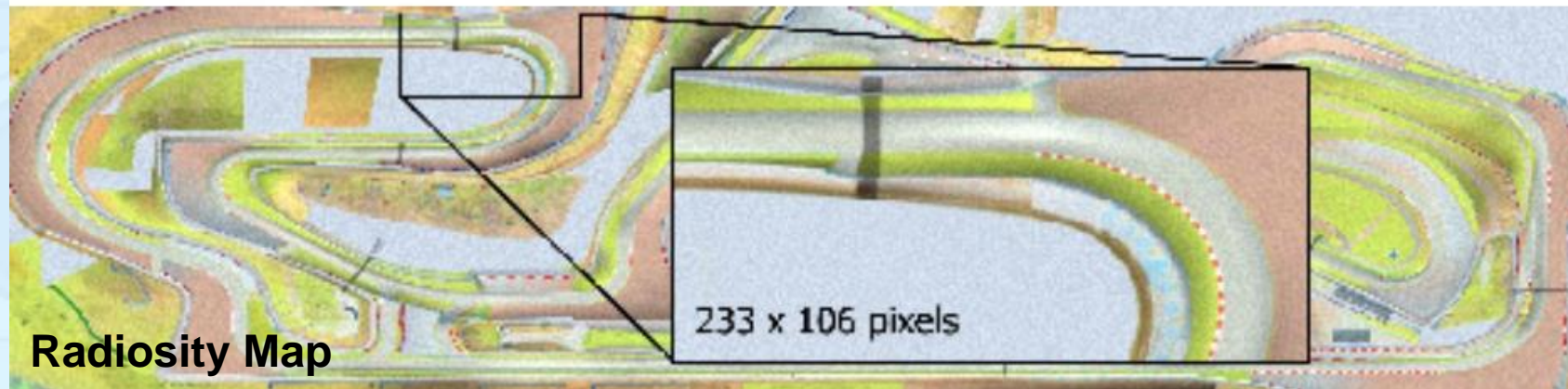
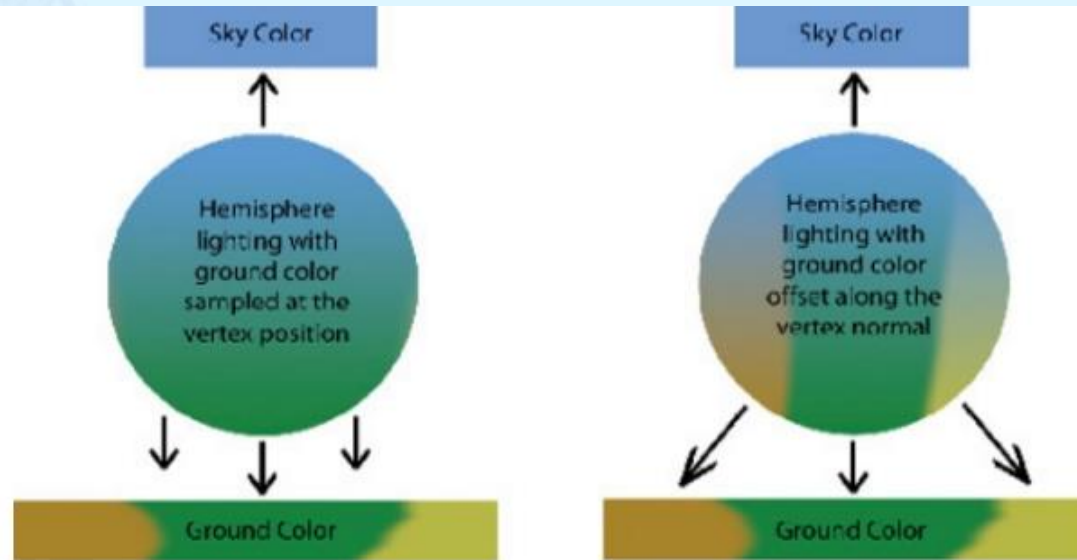
- 
- **Brute force – really heavy**

Hemisphere Lighting



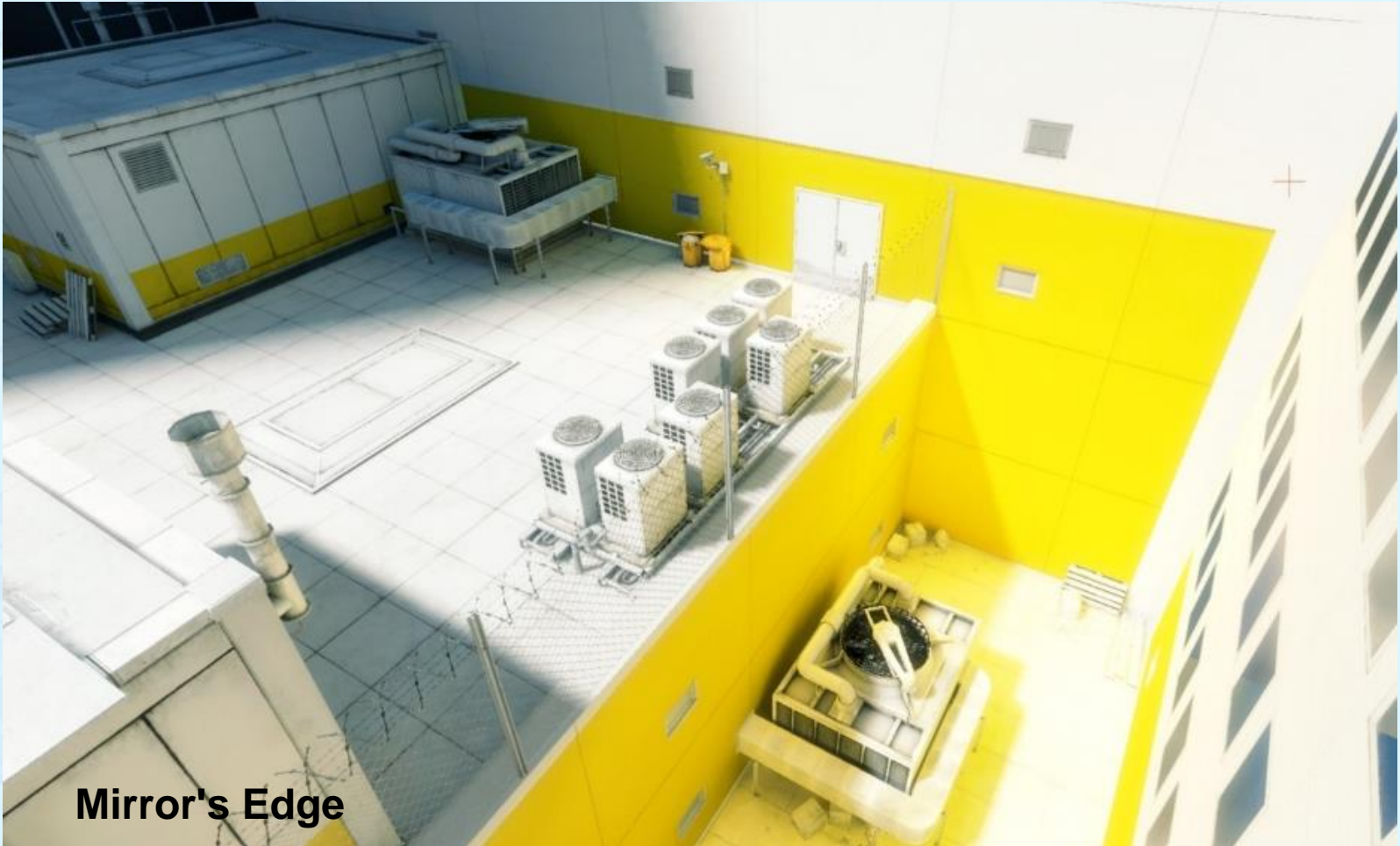
MotoGP

Hemisphere Lighting



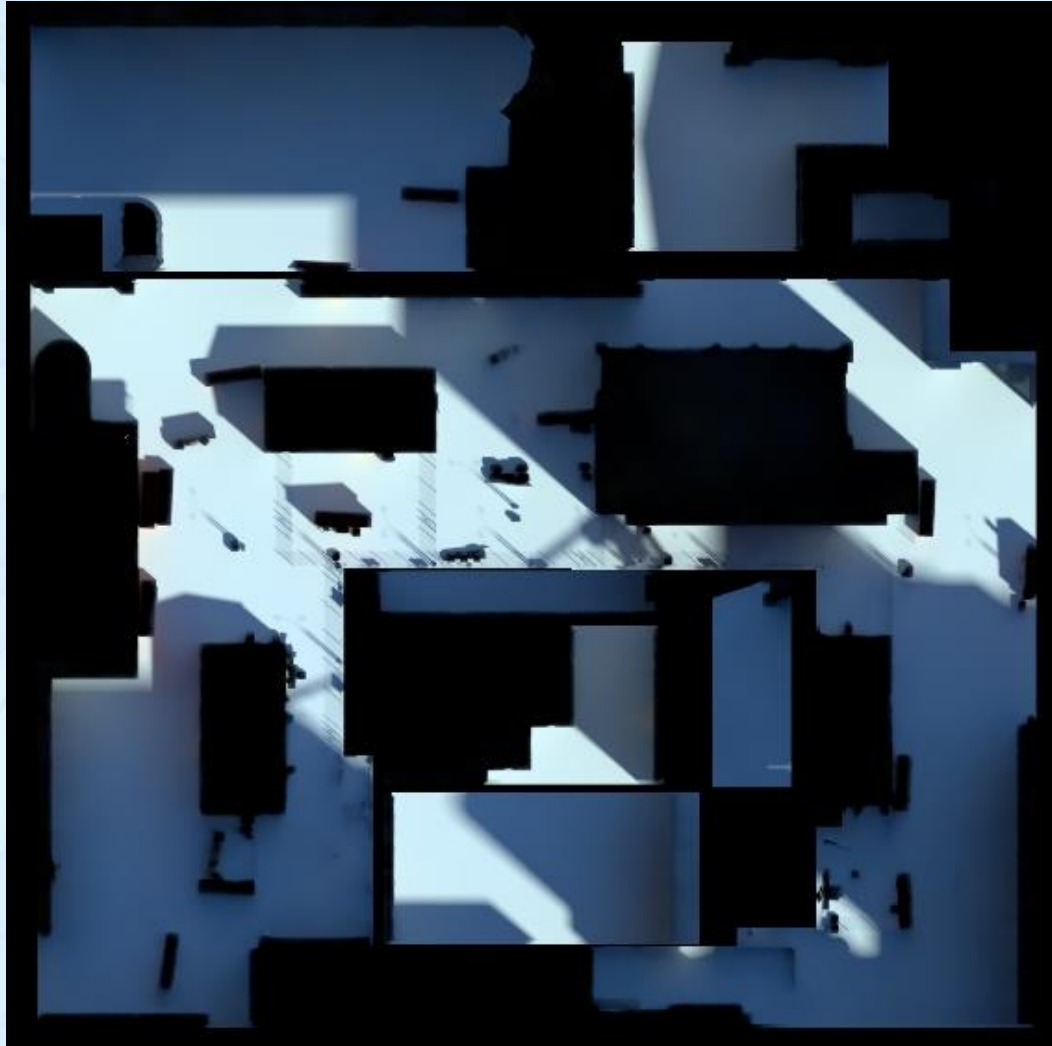
- 
- **Fast & simple**
 - **Too simple**

Hemisphere Lighting



Mirror's Edge

Lightmaps



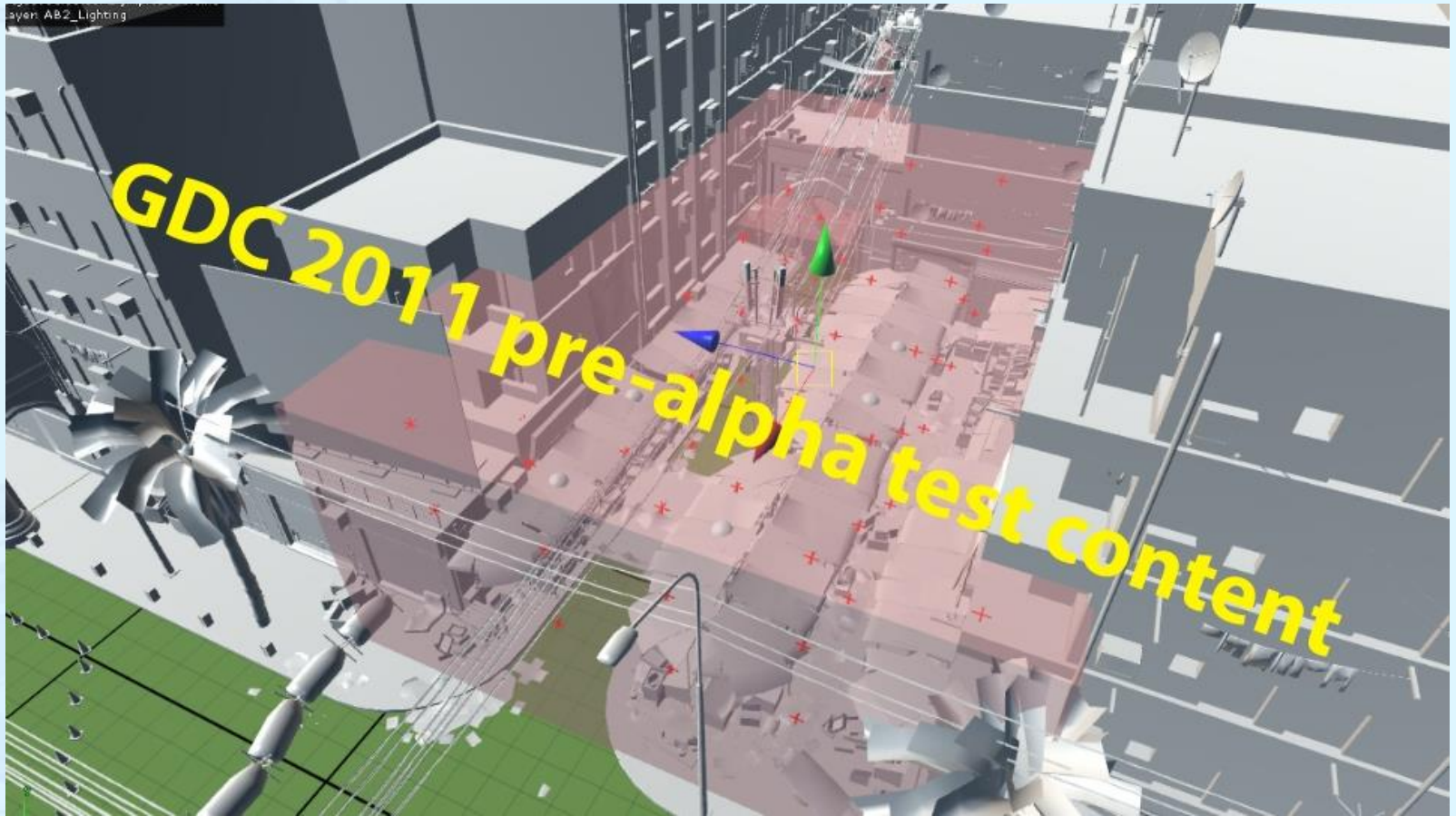


- . Only static objects**

Light Probes



Killzone 2







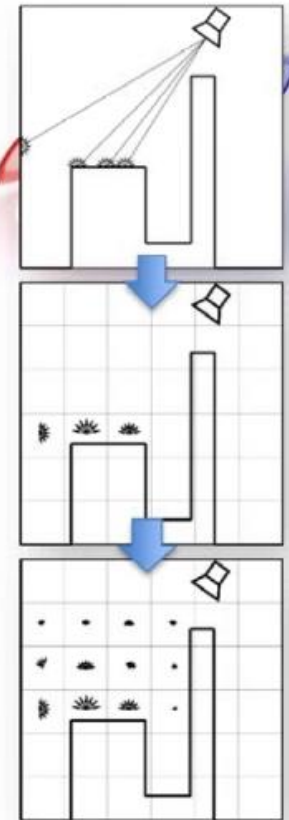
- 
- **No dynamic lights**
 - **No self-illumination of dynamic objects**

Diffuse Global Illumination in Crysis 2™

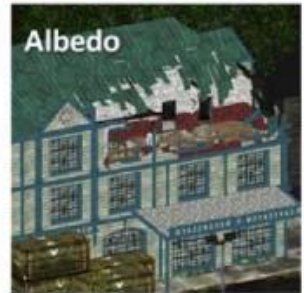
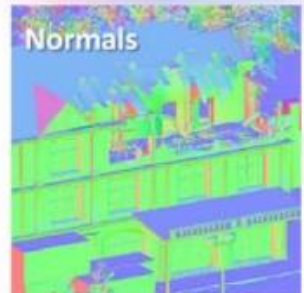
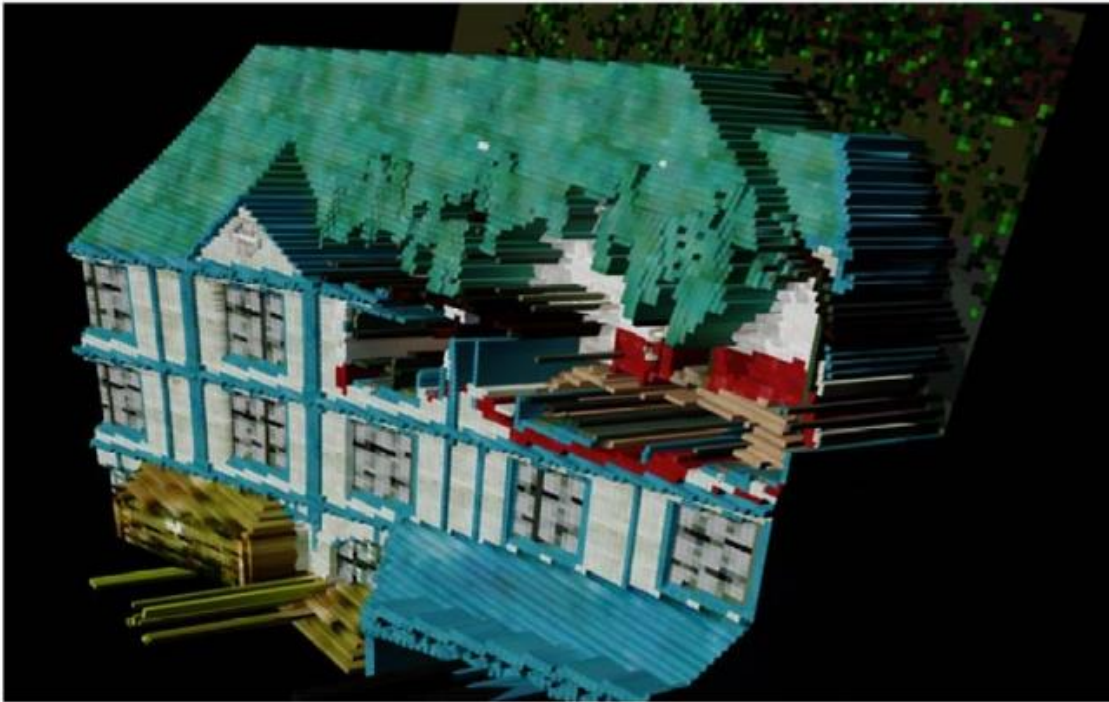


Core Idea

1. Sample lit surfaces
 - Treat them as secondary light sources
2. Cluster samples into a uniform coarse 3D grid
 - Sum up and average radiance in each cell
3. Iteratively propagate radiance to adjacent cells, works only for diffuse
4. Lit the scene with the resulting grid



Sampling the scene for GI

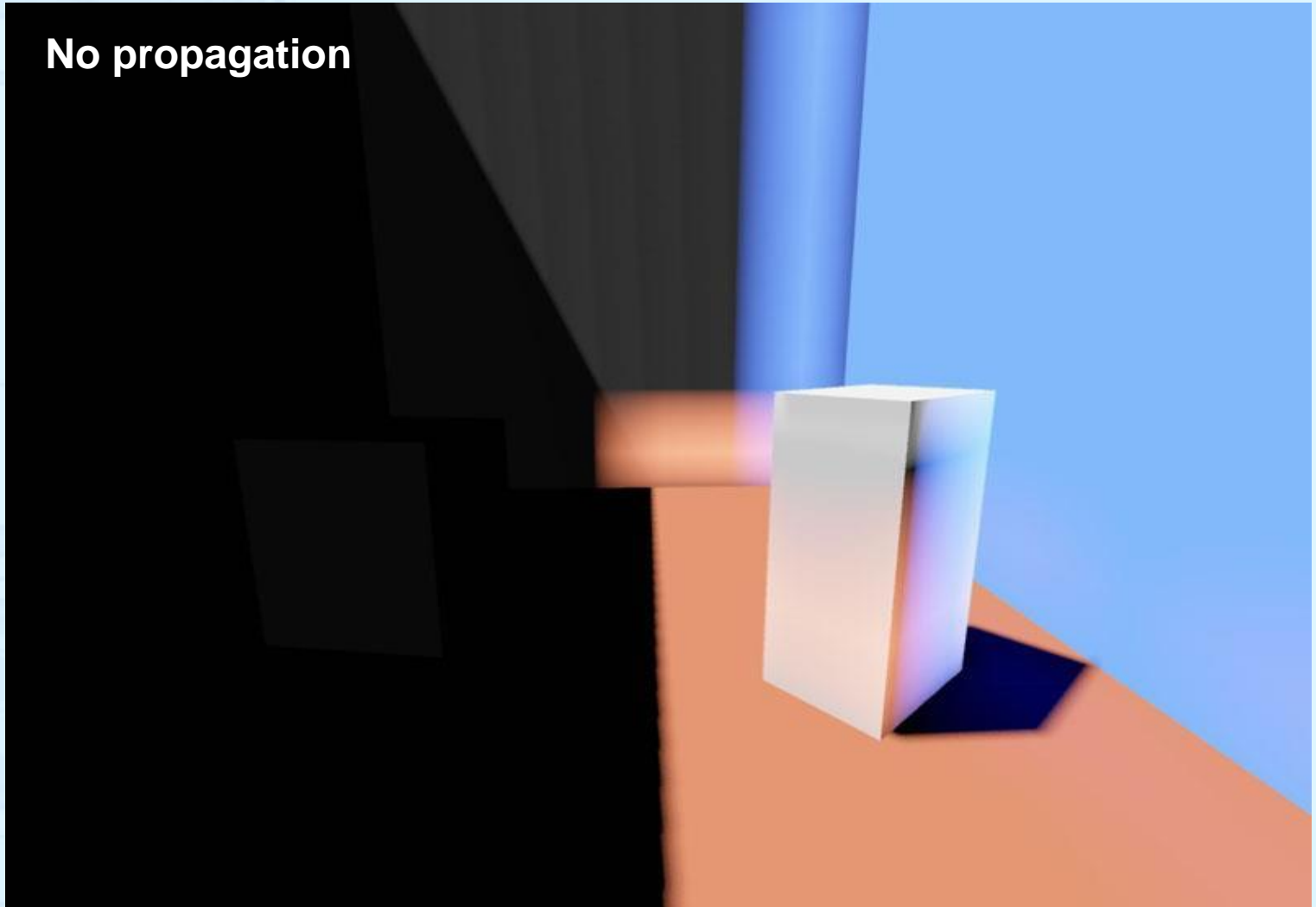


Light Propagation Volumes



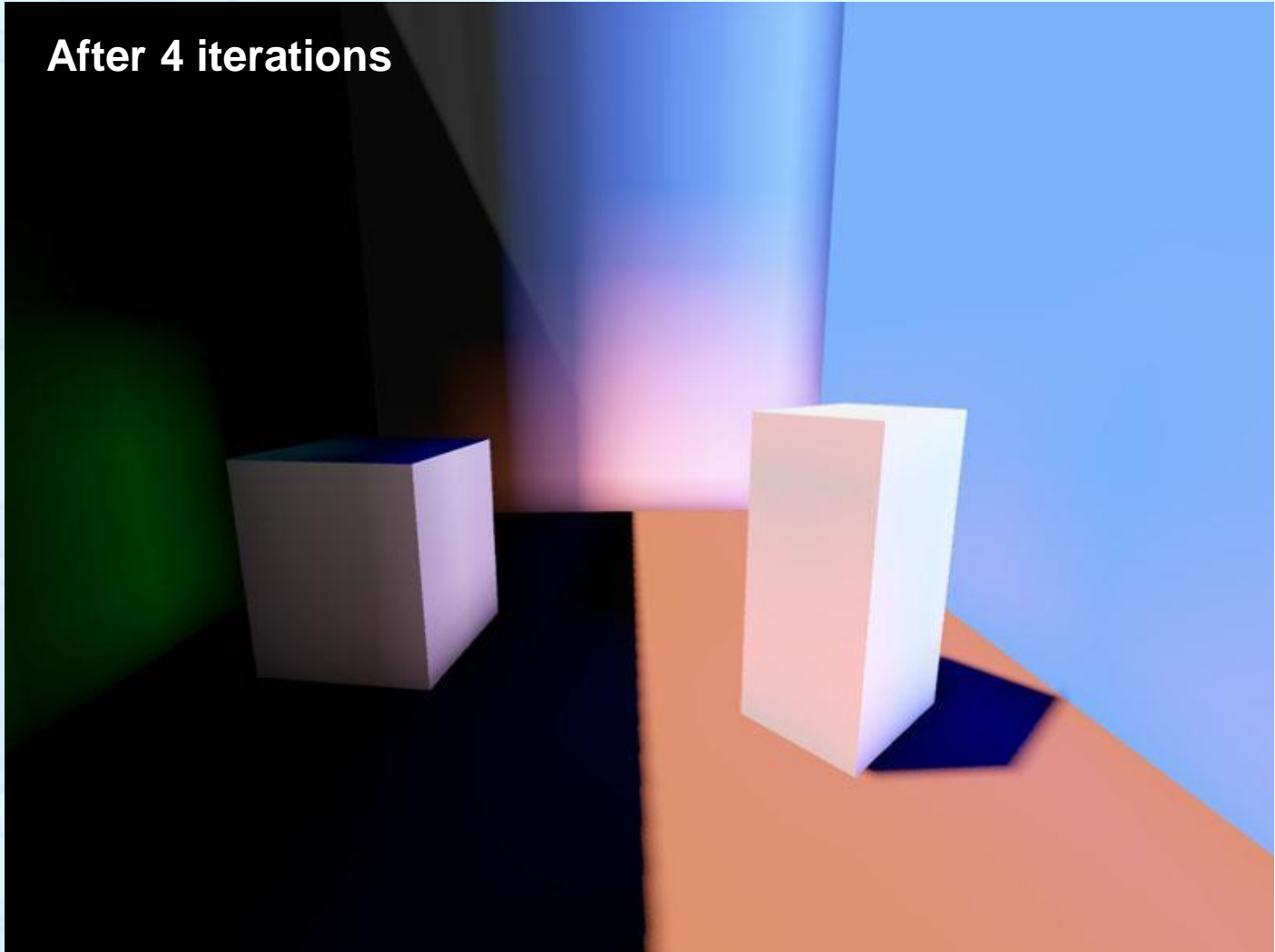
Light Propagation Volumes

No propagation

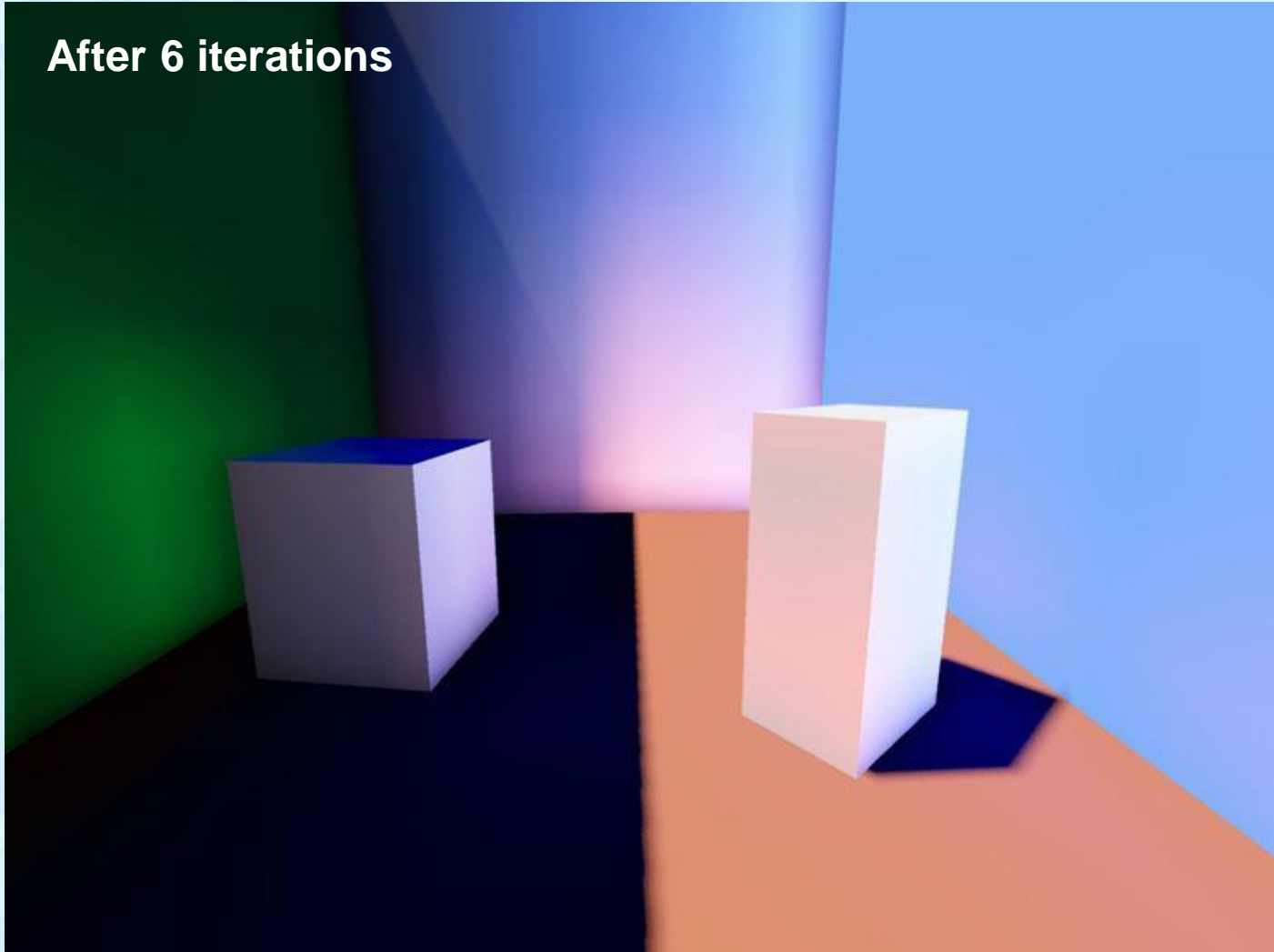


Light Propagation Volumes

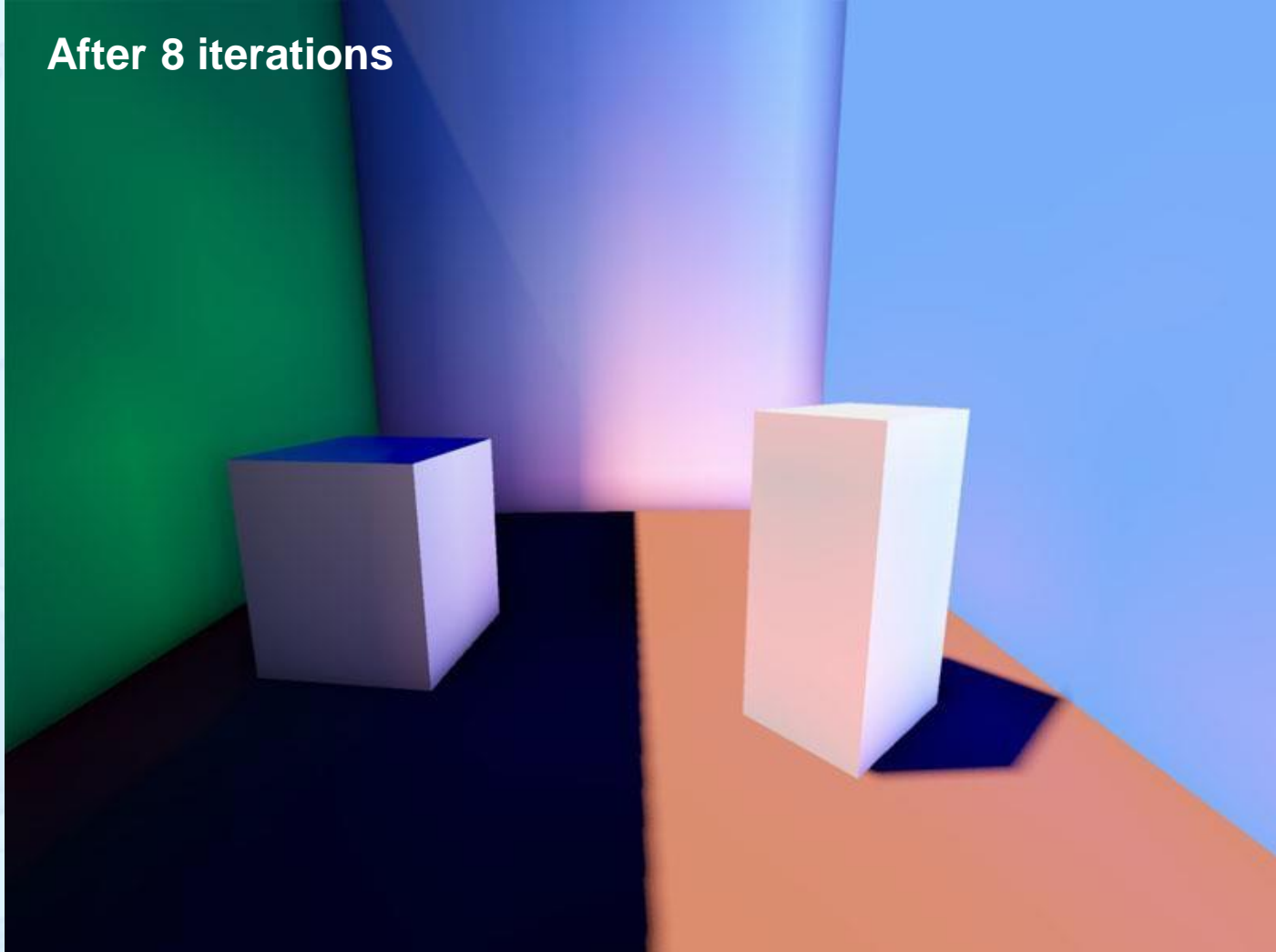
After 4 iterations



After 6 iterations



After 8 iterations



Comparison with photon mapping



Light Propagation
Volumes



Photon Mapping

Diffuse Global Illumination in Crysis 2™



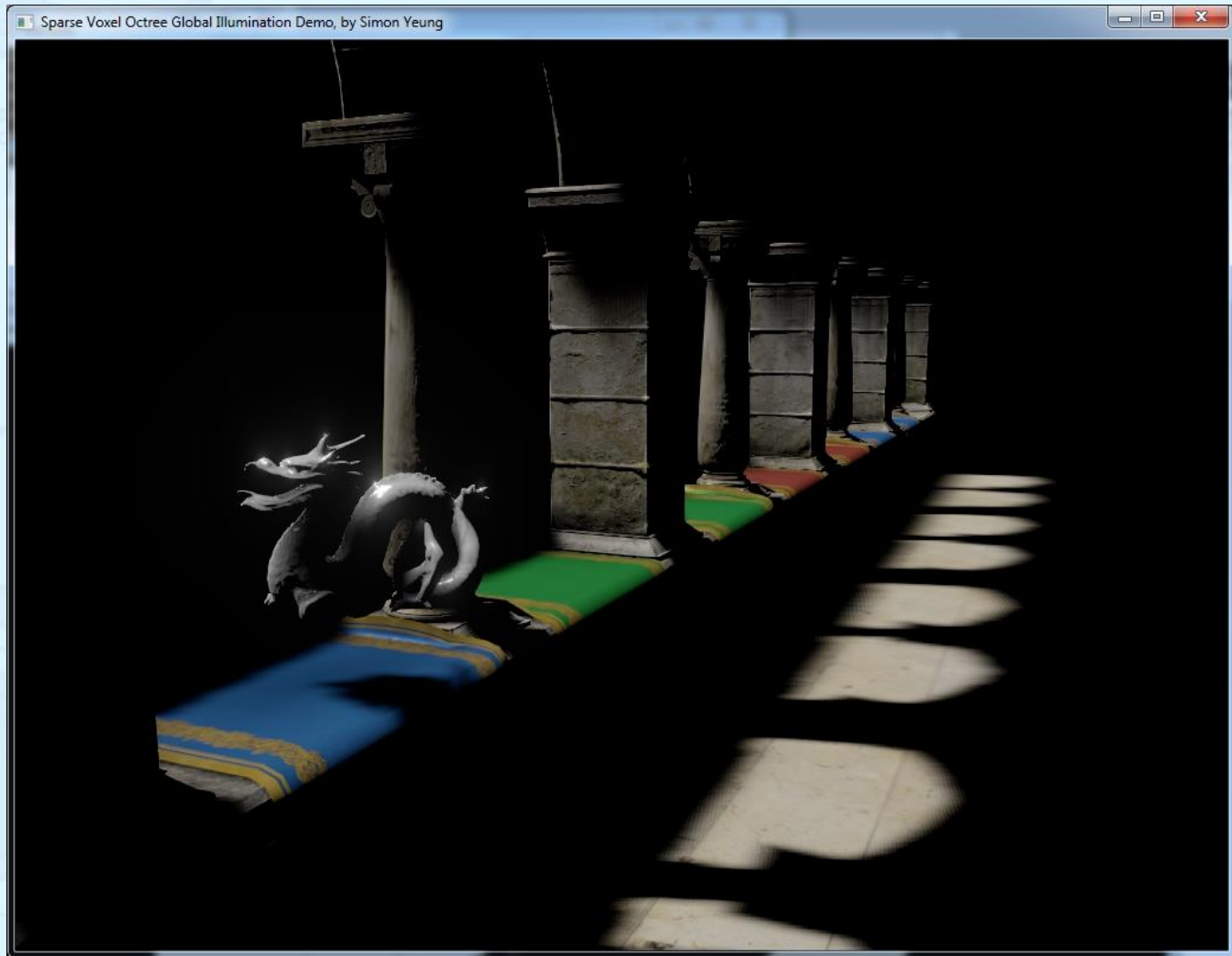
- **Dynamic lights**
- **No indirect shadows**

Light Propagation Volumes

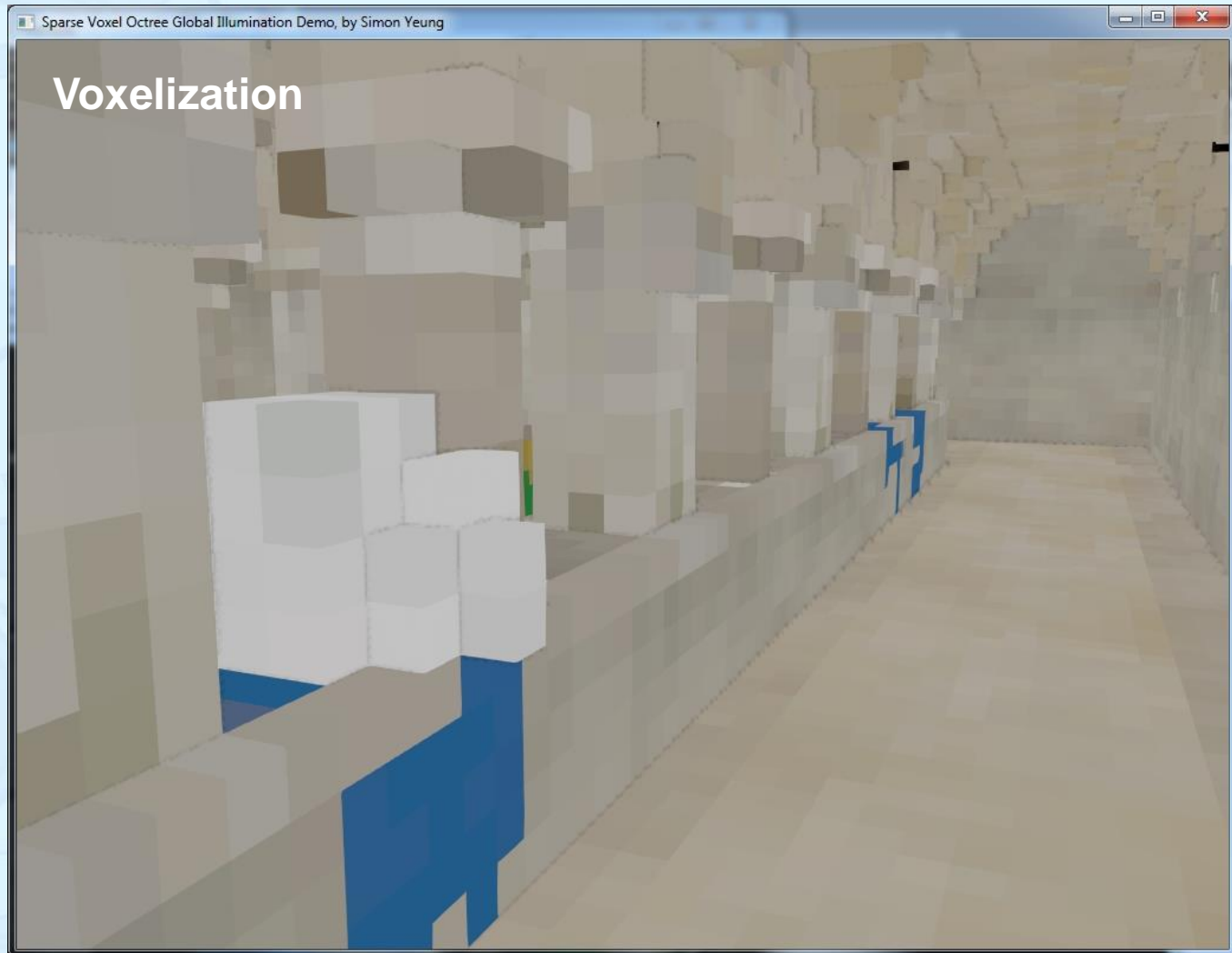
Algorithm

- Voxelize the geometry
- Construct sparse voxel octree (SVO)
- Inject direct lighting into the octree
- Propagate radiance
- Gather radiance by cone tracing

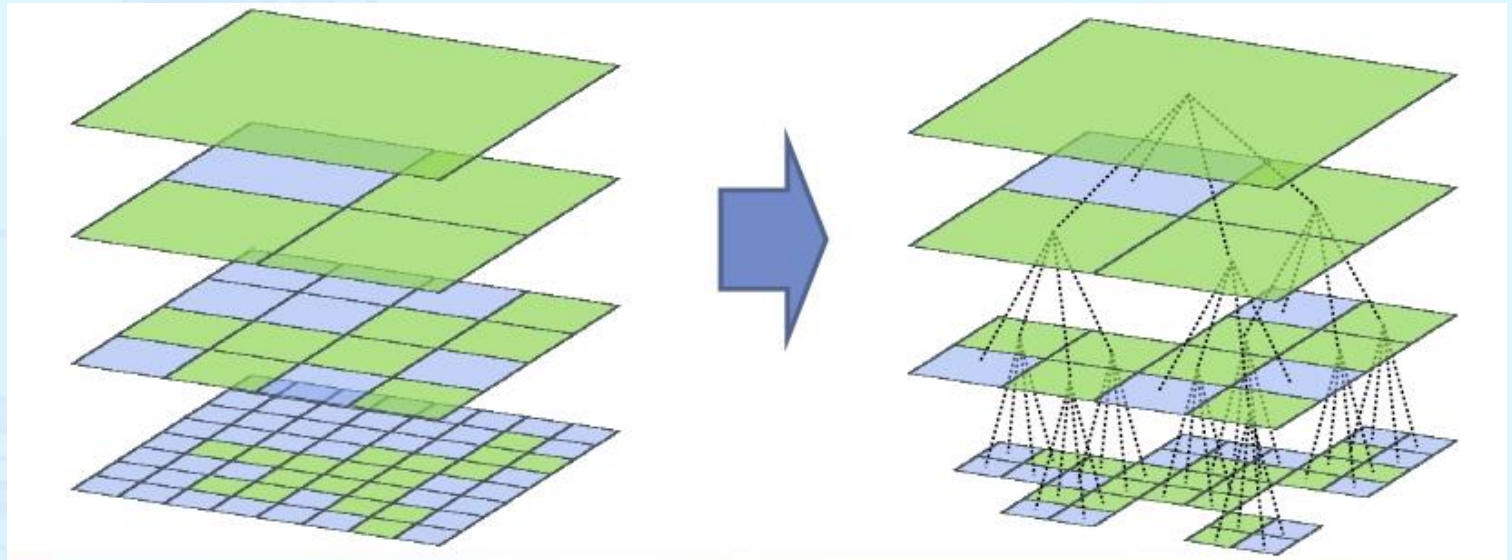
Voxel Cone Tracing



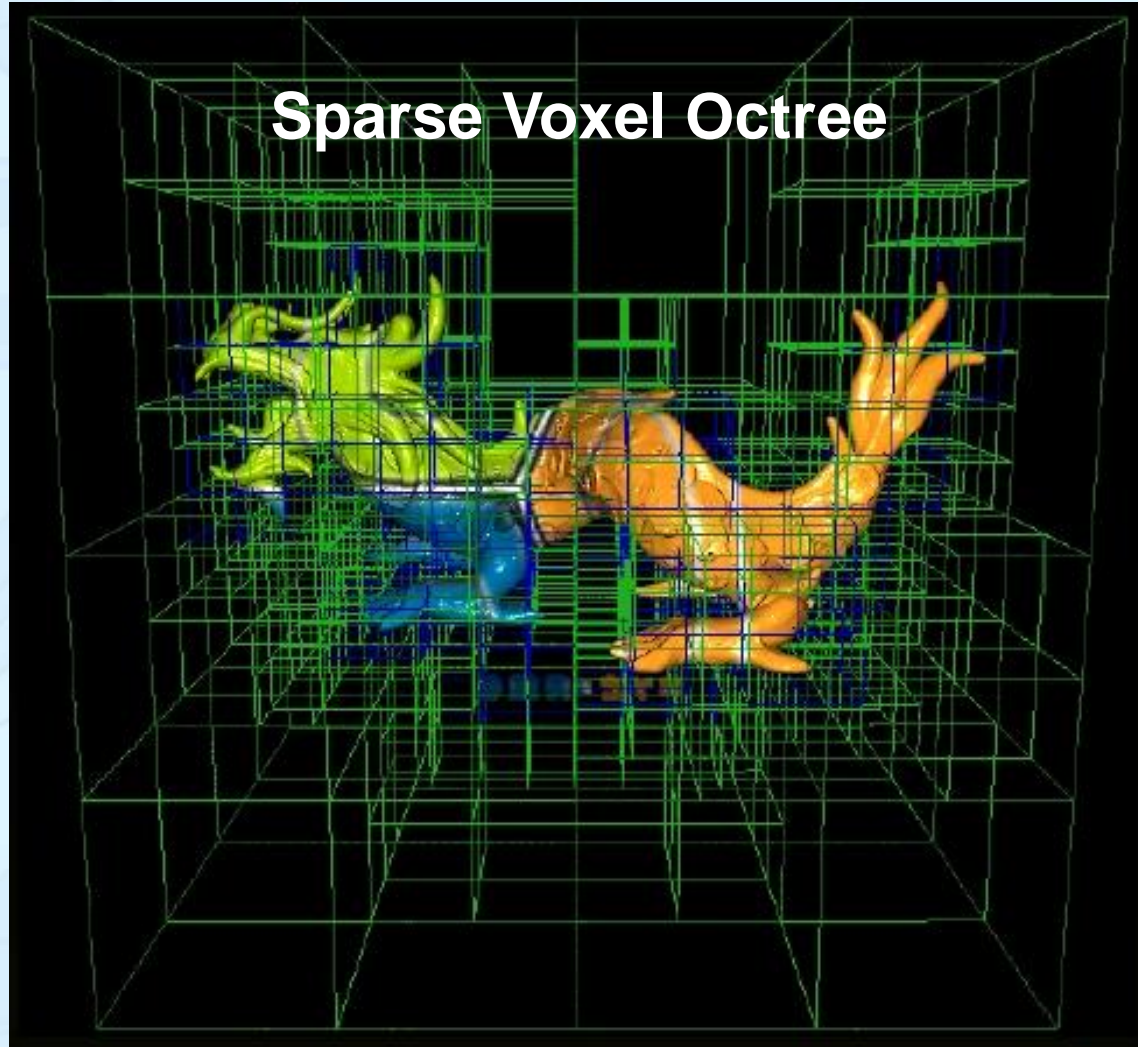
Voxel Cone Tracing



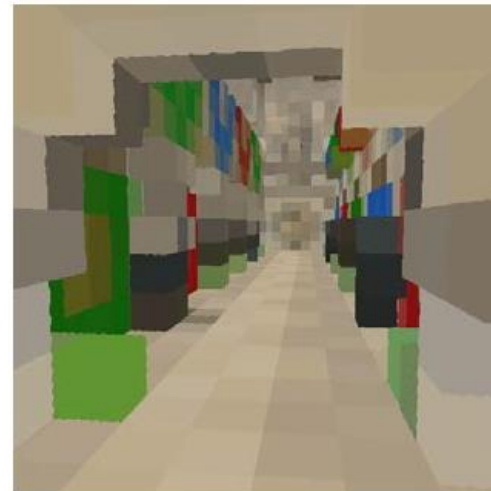
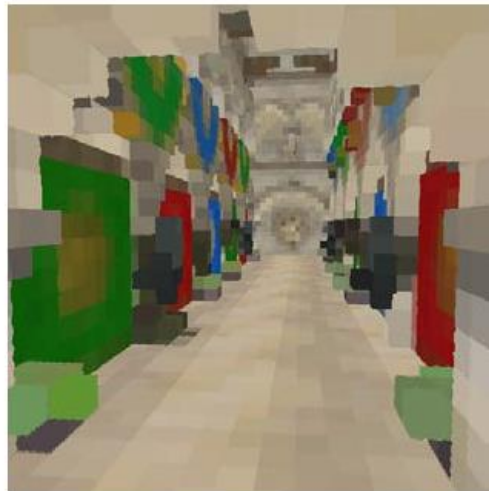
Sparse Quad-tree



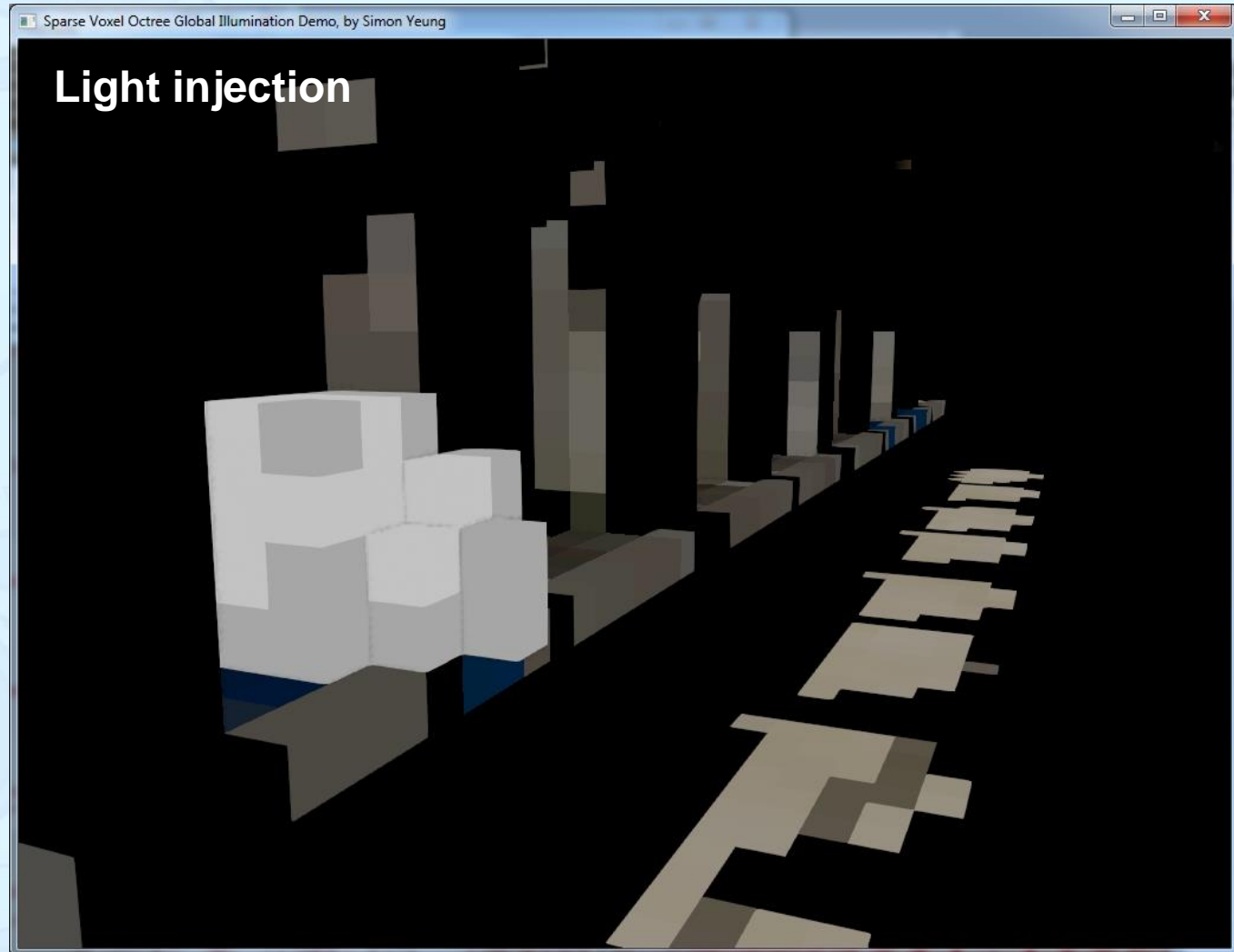
Sparse Voxel Octree



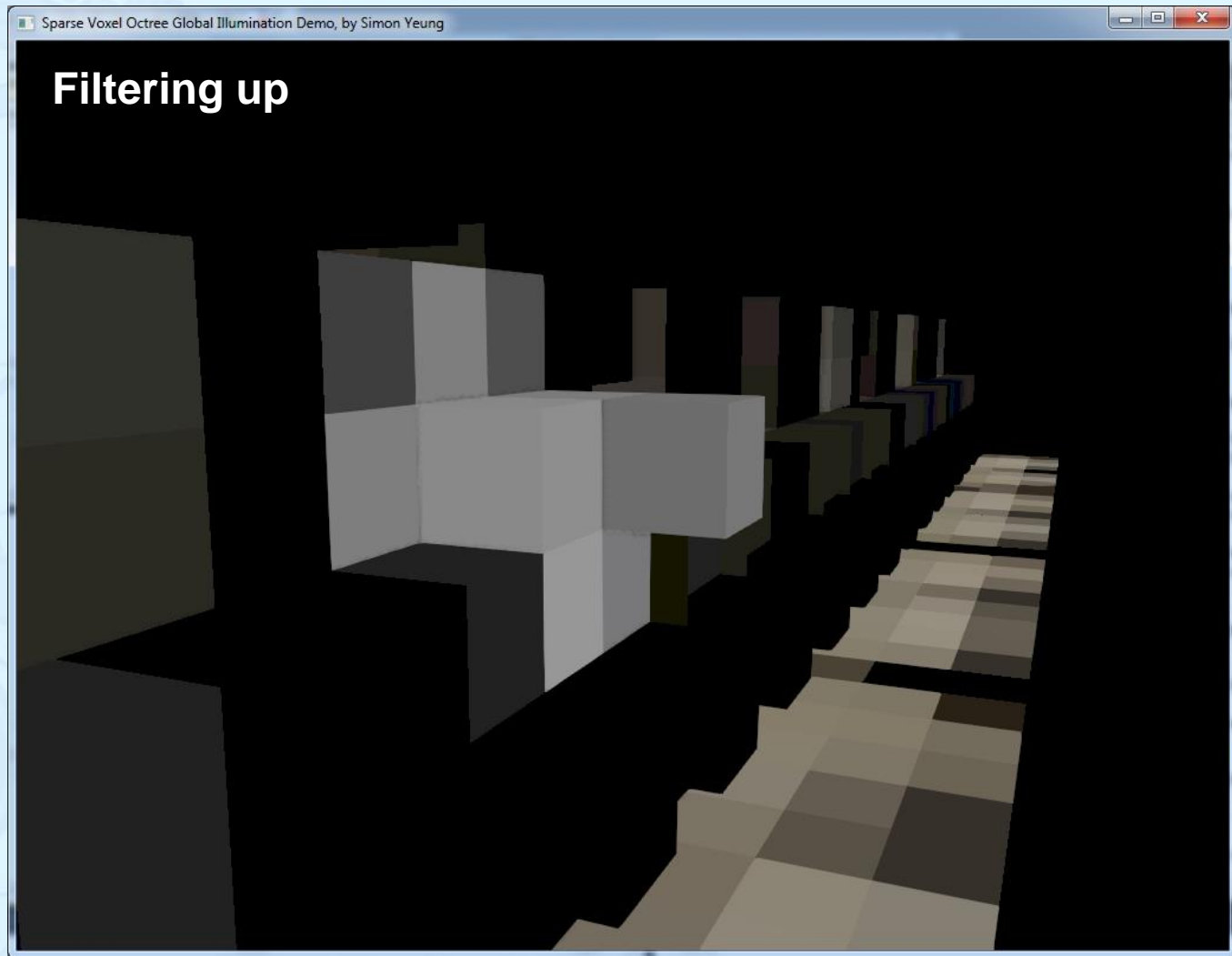
Voxel Cone Tracing



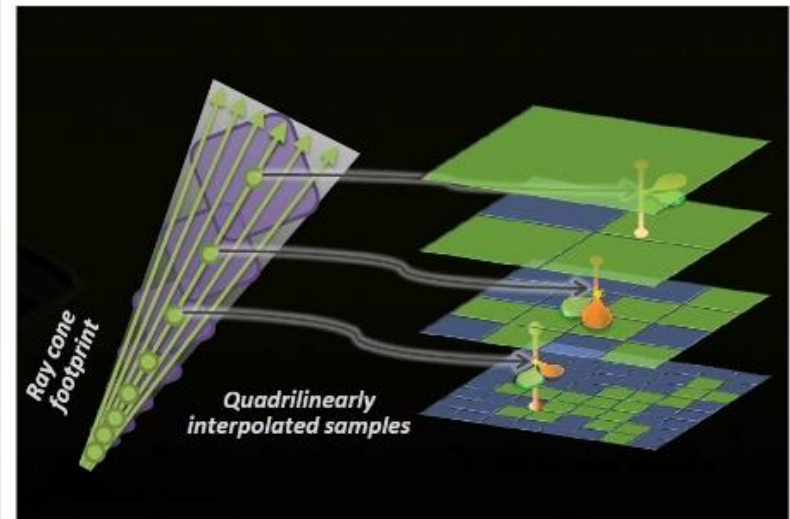
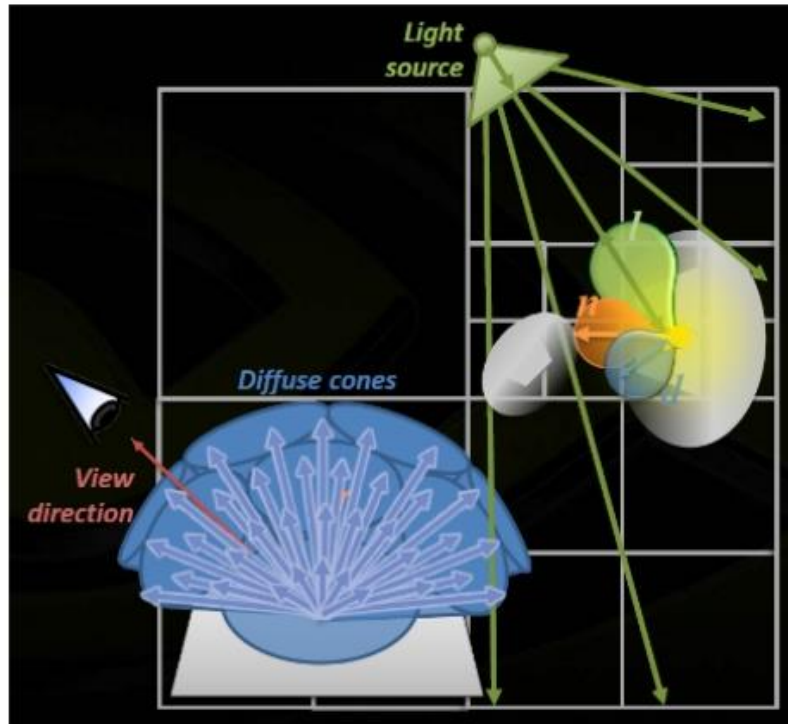
Voxel Cone Tracing



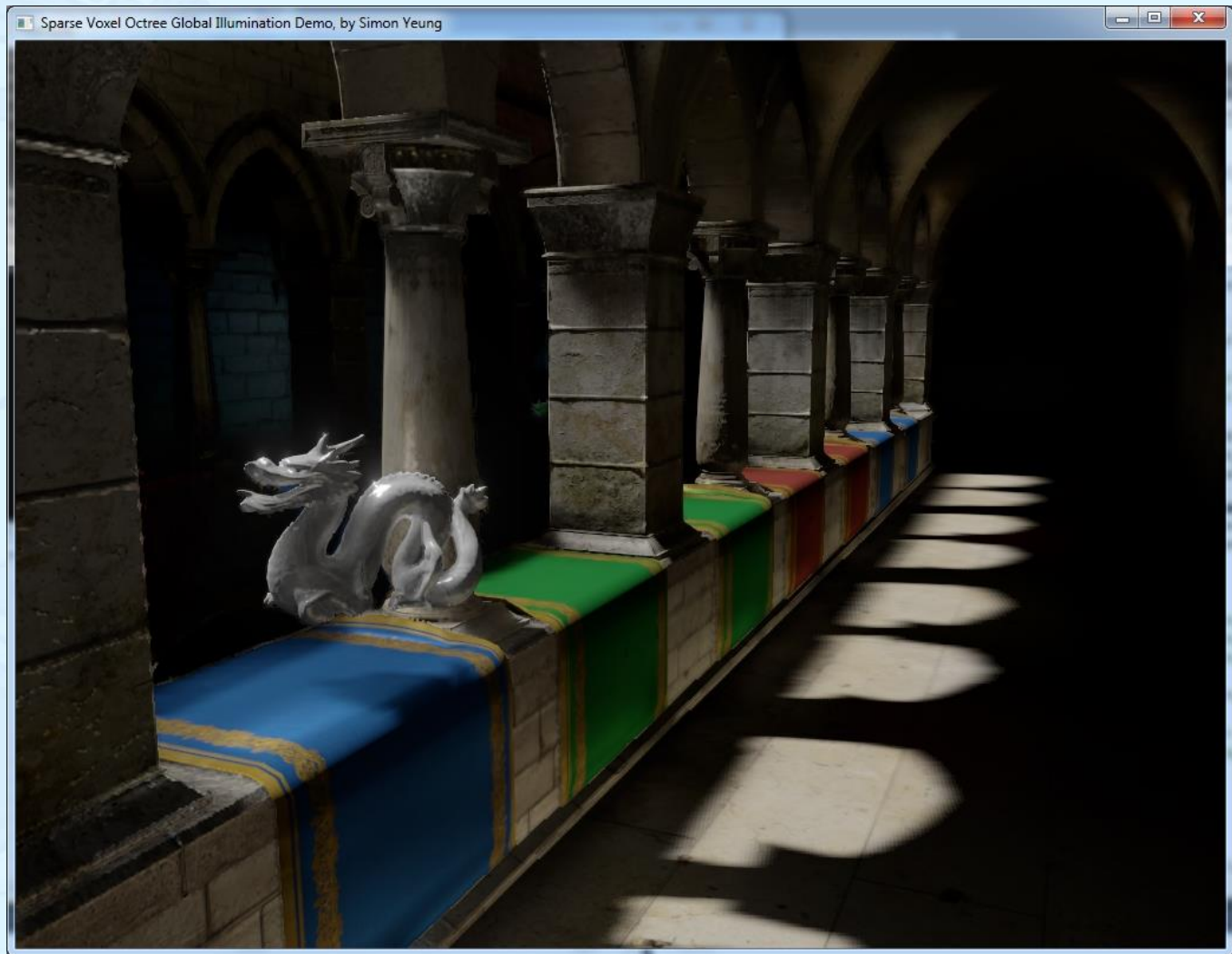
Voxel Cone Tracing



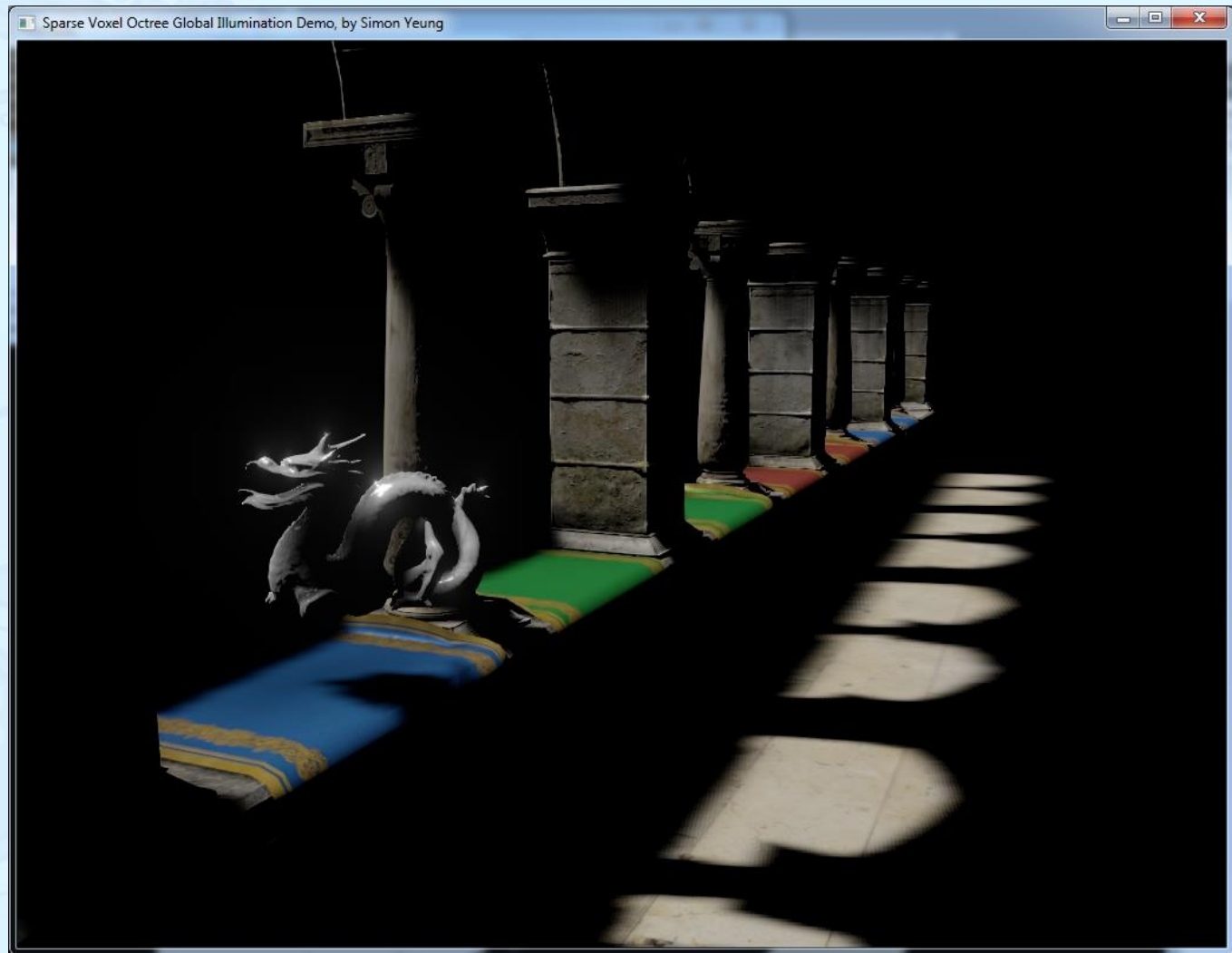
Voxel Cone Tracing



Voxel Cone Tracing



Voxel Cone Tracing



Voxel Cone Tracing



Light propagation
volumes

37 ms



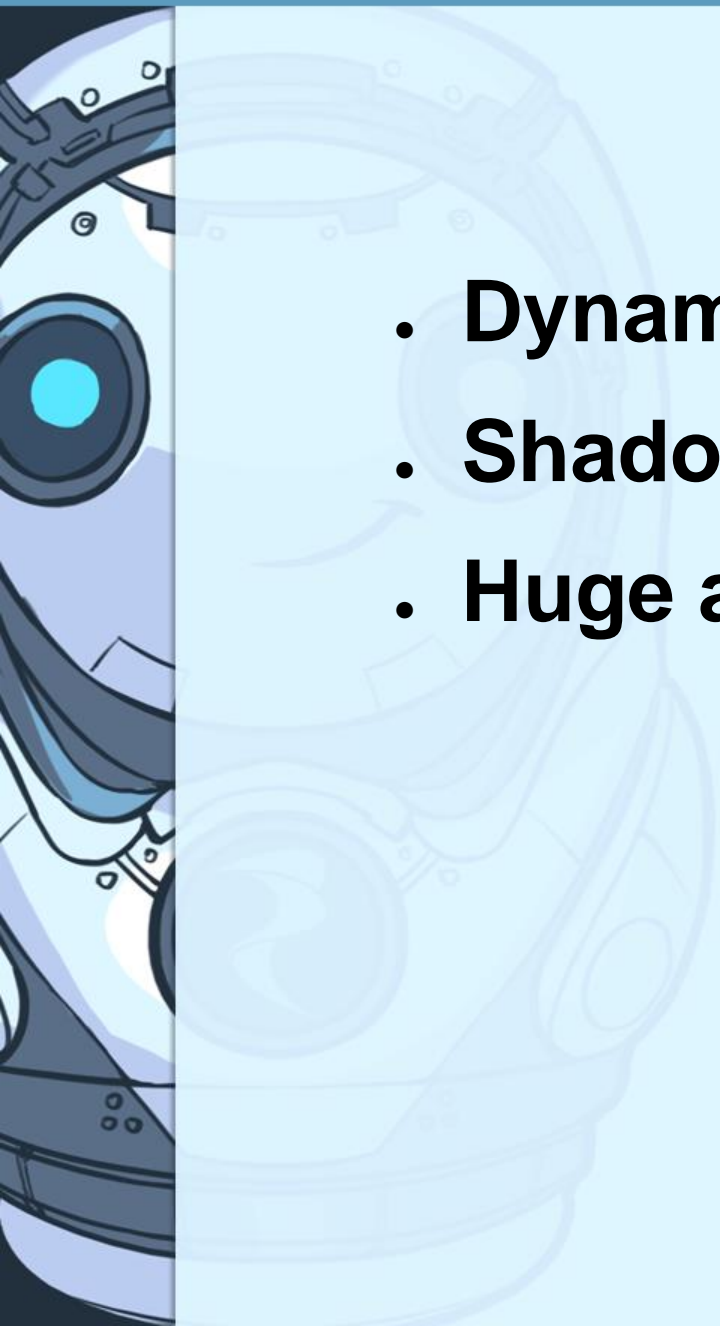
Voxel cone tracing

32 ms



Reference

14 min

- 
- **Dynamic lights & objects**
 - **Shadow casting**
 - **Huge amount of memory**

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- Slideshare - <https://www.slideshare.net/Sperasoft/>
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