SurfelPlus Milestone 1

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CIS 5650 – Final Project

Penn Engineering

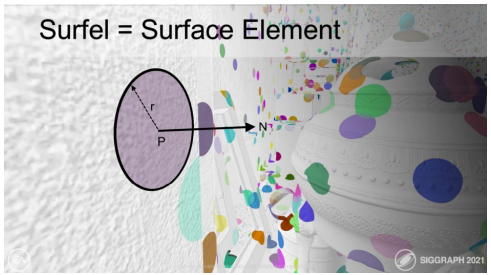
Introduction

Surfel based Global Illumination

- ***SIGGRAPH Advances 2021 - Surfel GI.pptx***
- ***SIGGRAPH 2024 - Shipping Dynamic Global Illumination in Frostbite***

Overview:

- An solution for calculating *indirect diffuse illumination* in real-time.
  - Scene is discretized into *surfels*
  - Indirect illumination is calculated, cached, and amortized *across space and time*



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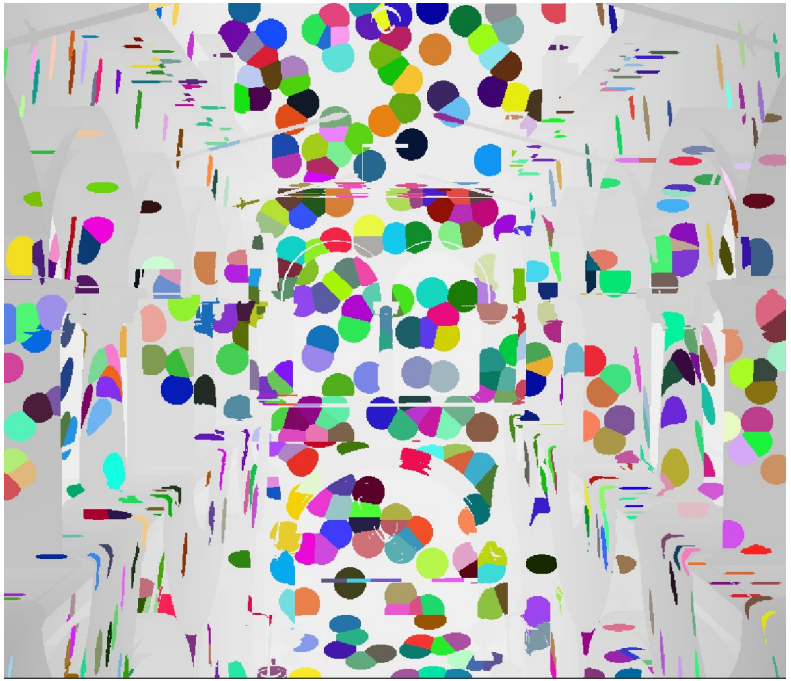
What we have done so far

- Many meetings & discussions
  - Summarized all required render passes
  - Discussed possible implementation details
- Get familiar with the code base and Vulkan
  - Ray query feature
  - How to manage resources
- Created some basic render passes
  - With only naive or empty implementation
- Added a gbuffer pass
  - Visibility & Normal & Depth
- Naive surfelization

Current Progress

- Desired Output



- Slowed generation for better visualization

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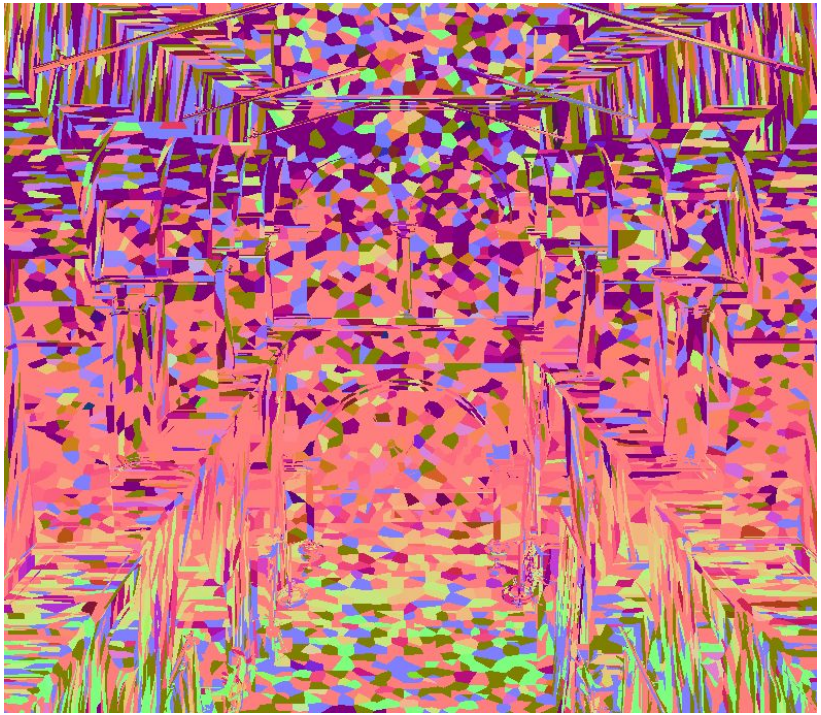
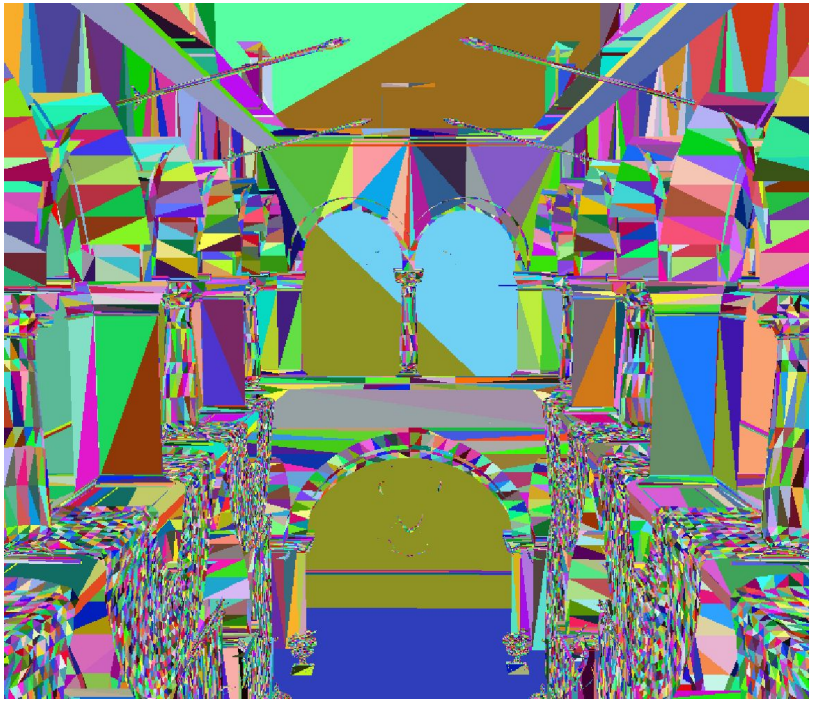
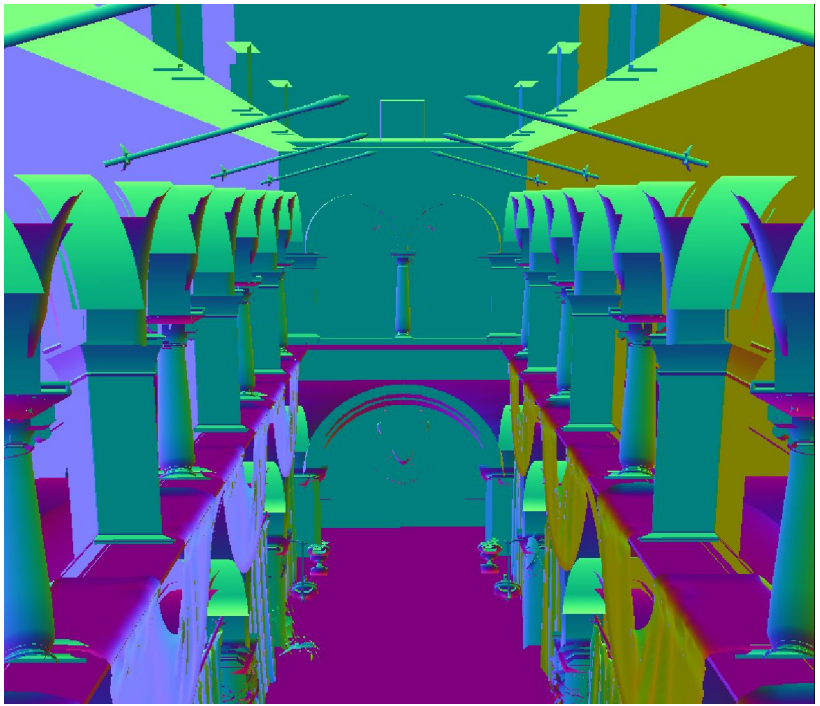
Current Progress



Buggy output
When surfels overwhelm the screen

Current Progress





- Visibility & Normal buffer

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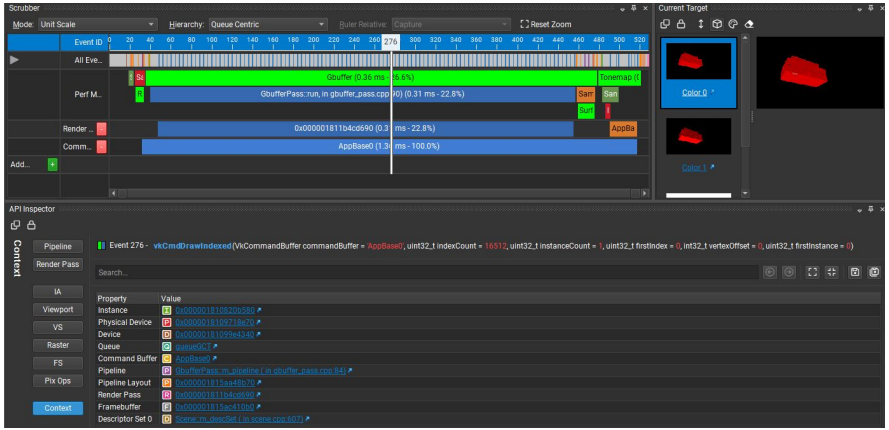
Current Progress

- Render passes we have currently:
  - G-buffer Pass
  - Surfel Prepare Compute Pass
  - Surfel Generation Compute Pass
  - Surfel Update Compute Pass
  - Direct lighting pass
  - Post Processing Pass



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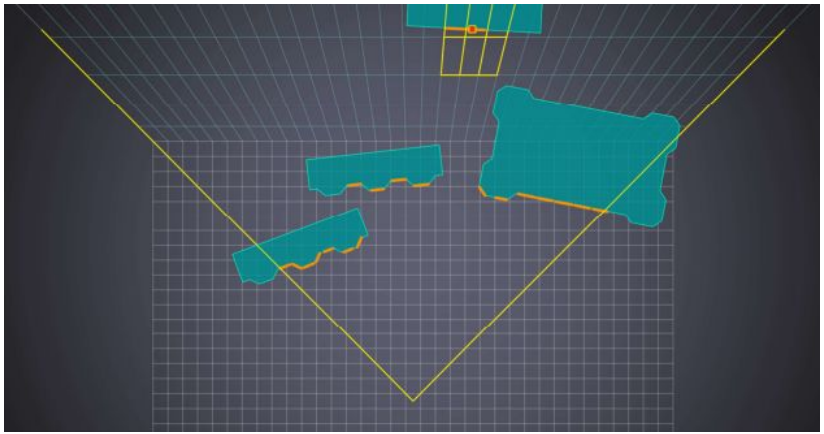
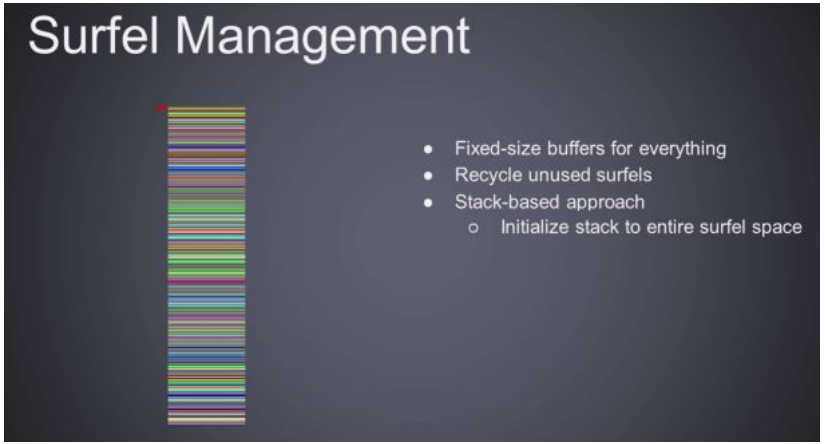
Goals

- Milestone 2:
  - Better surfelization
  - Surfel recycle
  - Surfel acceleration structure
  - Surfel raygen & ray trace(if possible)

Goals

- Milestone 2:
  - Direct lighting pass
  - Surfel recycle
  - Surfel acceleration structure
  - Multiple lights sampling acceleration (if possible)





Resources

- SIGGRAPH 21: Global Illumination Based on Surfels
- A quick breakdown of lighting in the `restir-meets-surfel` branch of my renderer
- Advances in Real-Time Rendering in Games course SIGGRAPH 2024