ReSTIR - Vulkan

CIS 565 Final Project Milestone 3

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MS2 Progress

- **Milestone 3 (Pitch)**
  - Unbiased ReSTIR algorithm

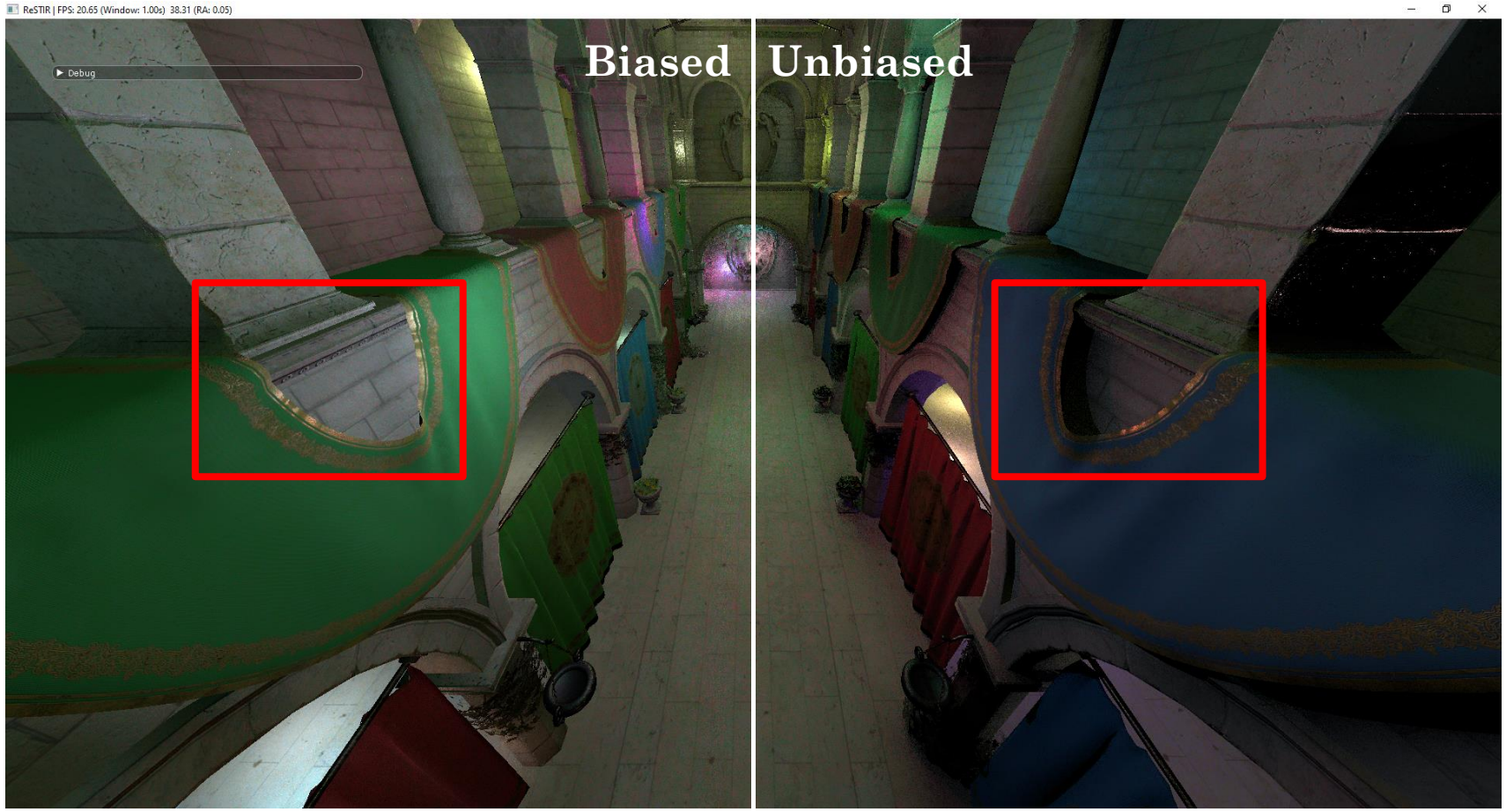
- **Milestone 3 (Done)**
  - Unbiased ReSTIR algorithm

- **Milestone 3 (Extra)**
  - Experiments and data collection

- **Enviroment**
  - CPU: Intel Core i7-9700K
  - GPU: RTX 2070 super
  - Main Memory: 16GB DDR4 3200Mhz
  - OS: Windows 10 x64
  - Render Resolution: 2560 * 1440 (2K)

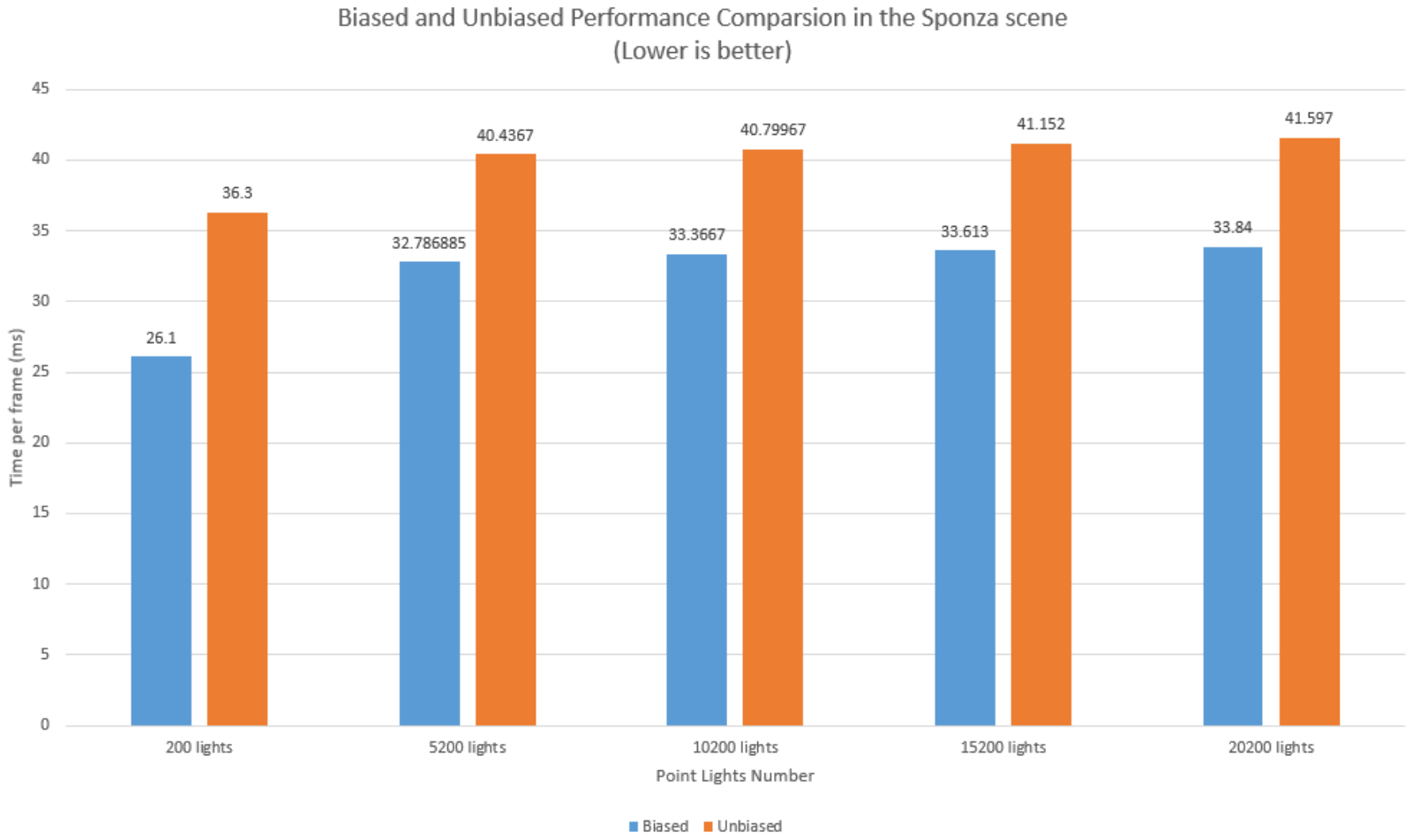
Unbiased ReSTIR (Effects)

Unbiased ReSTIR algorithm includes a visibility check to samples when it tries to combine reservoirs from Spatiotemporal reuse. As a result, it can achieve more accurate result by comparing to the Biased one. Here, you can find out that the Unbiased one can give more accurate shadow.



Unbiased ReSTIR (Performance)

As we know, the Unbiased algorithm is relatively more expensive than the Biased one since the Unbiased algorithm needs to check whether a sample reused can be seen for a pixel. Here is a simple performance comparison for them.

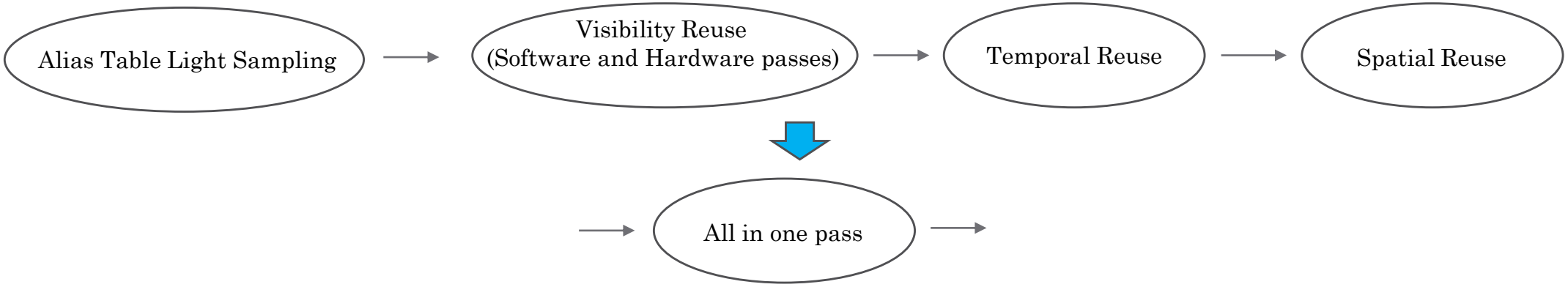


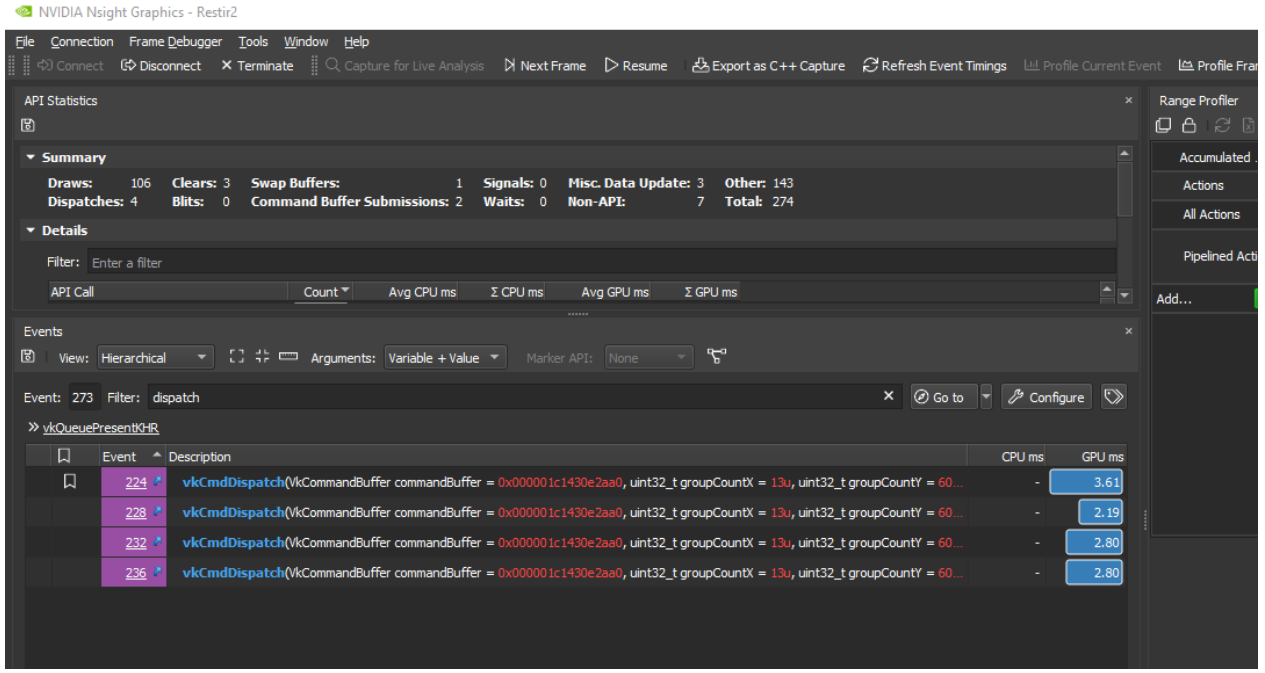
Support more cool scenes

We also improve our support to emissive materials and change our normal map algorithm to MikkTSpace. As a result, we can support more complex scene with lots of triangle lights. Here is the BistroInterior scene that we download from Nvidia site. It includes 44,024 emissive triangles and everything can be rendered in real time (Biased) under 2K resolution.

Single pass optimization

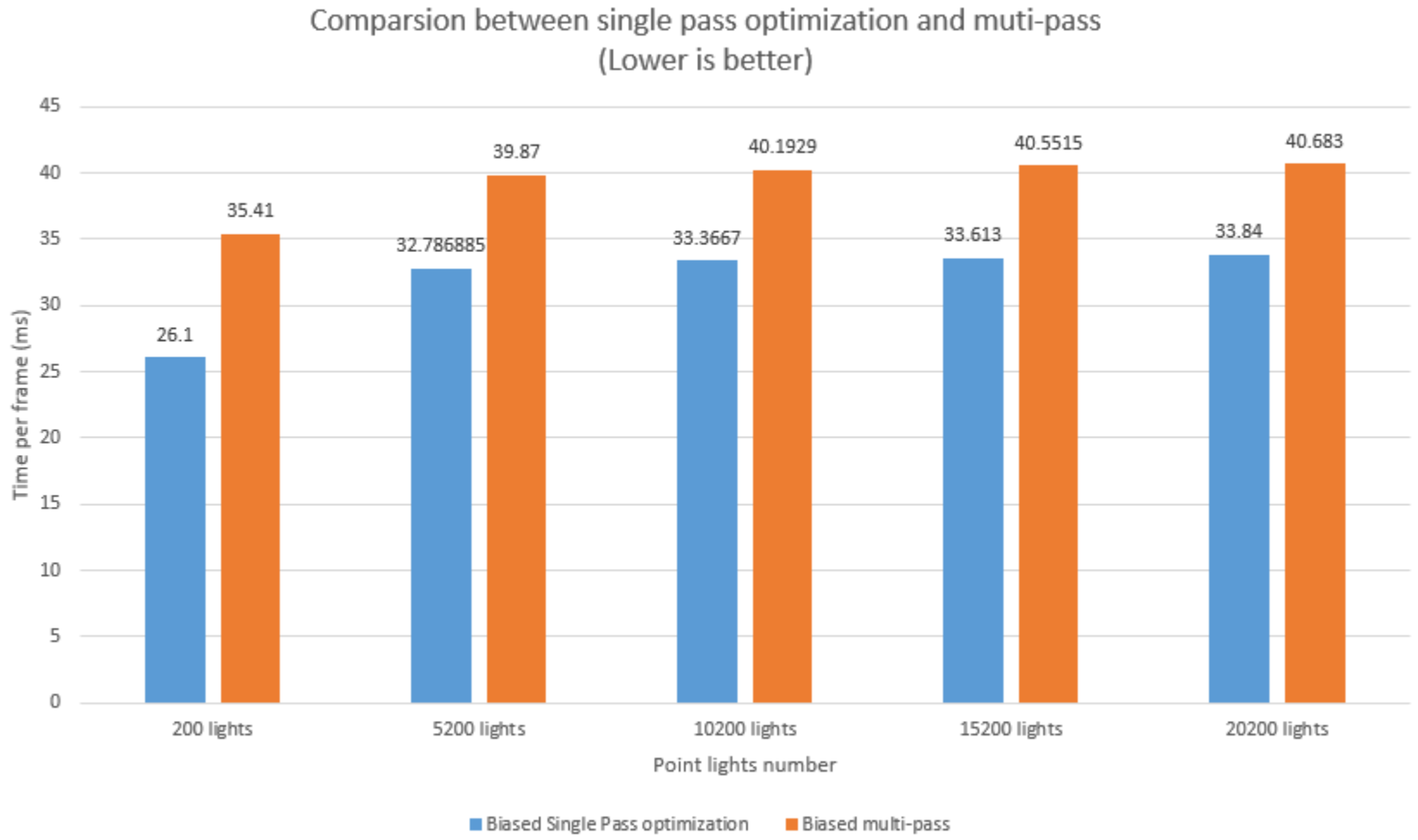
[Wait for integration]





Single pass optimization

As we can see from the performance analysis below, the single pass optimization can significantly reduce the rendering time.



Proposed Timeline

- **Milestone 1**
  - Basic hardware and software Vulkan path tracer
  - GLTF scene loader.
- **Milestone 2**
  - Well-functioned hardware and software Vulkan path tracer
  - GLTF PBR support for rasterization rendering and two kinds of ray tracing
  - Biased ReSTIR
- **Milestone 3**
  - Unbiased ReSTIR algorithm
- **Final Presentation**
  - Improving one pass optimization [Add the Spatial reuse pass to the optimization]
  - Testing, doing performance analysis and debugging
  - Preparing for the final presentation.

Live demo

(With and without Spatial reuse, Biased and Unbiased)

Thank you
Q&A