

# (Raceca)r (R)enderer

## Milestone 3

CIS 5650, Team 6

Anthony Ge, Charles Wang, Saahil Gupta, Aaron Jiang

<https://github.com/upgrade-central-tech/racecar>

# Recap

Goals:

- High fidelity, real-time car rendering
- Nice lighting, materials, atmospheres, scenery...

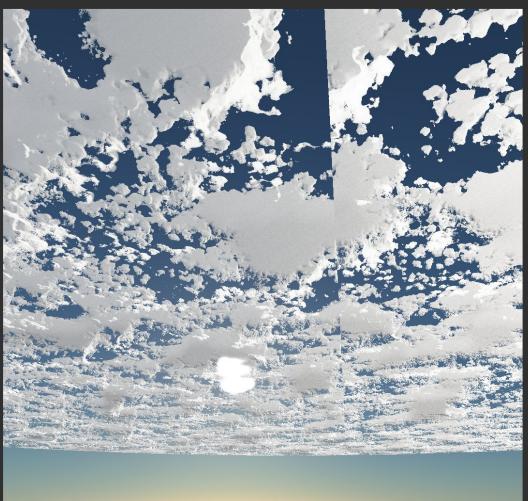


Image from Gran Turismo 7



Image from Forza Horizon 5





Before

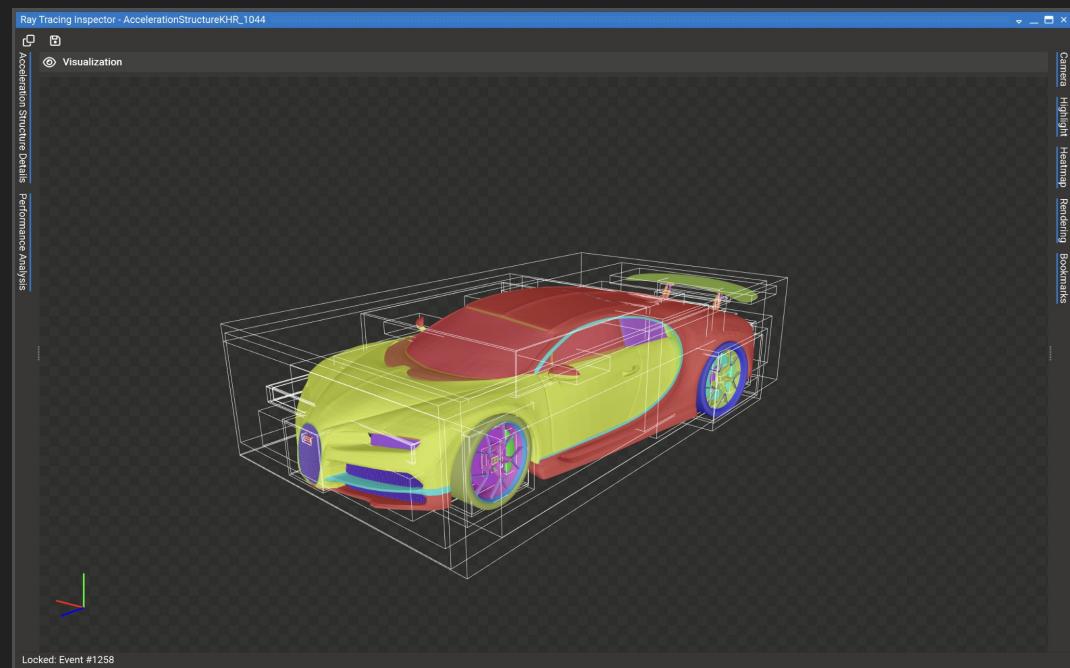
## Cloud Fixes

- Fixed tiling issues
- Warped to fit horizon and better blending
- Integrated with sun direction, background sky color.



# Raytracing

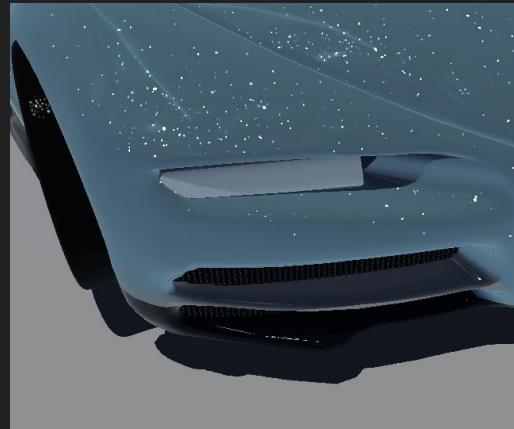
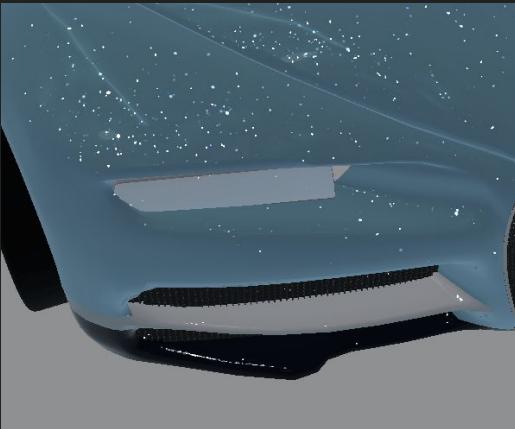
- Completed BLAS + TLAS construction of low LOD car
- Using RayQuery components for full ray-traced shadows
- Generated data to connect to GPUOpen stochastic SSR implementation



# Ray Traced Shadows



# Ray Traced Shadows



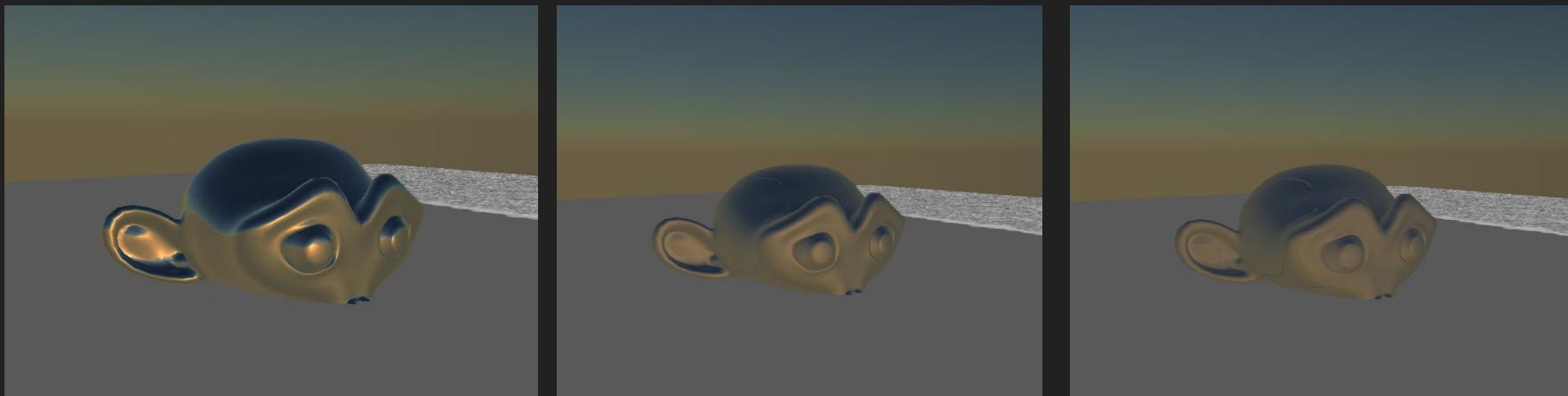


# More Cars



# Rough Glossy

- Compute-shader based baking, per frame
  - Really slow ATM (~2ms on 4070 mobile)! Plans to simplify map further
- Obstacles:
  - Mipmapping
  - Dynamic sky code, reducing high-freq details

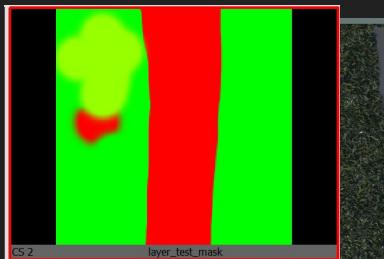


# Rougher Bugatti side

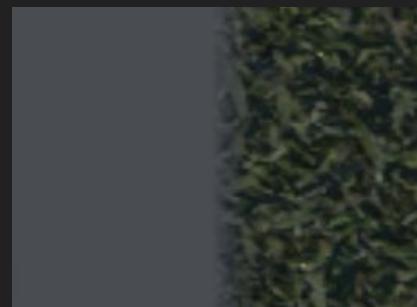
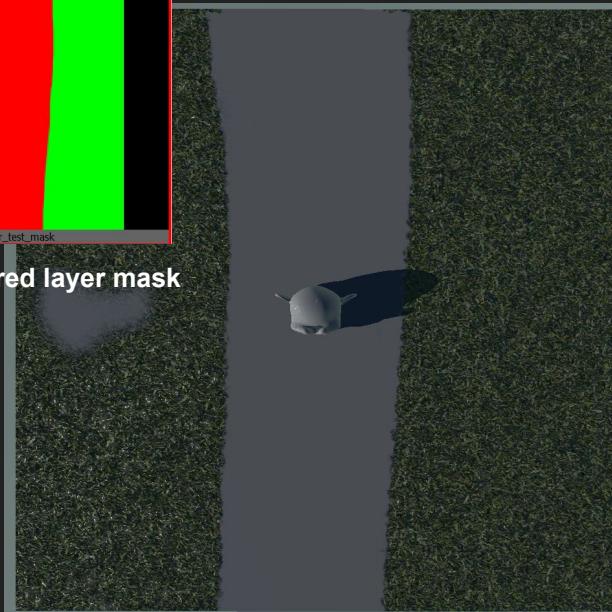


# Terrain Rendering

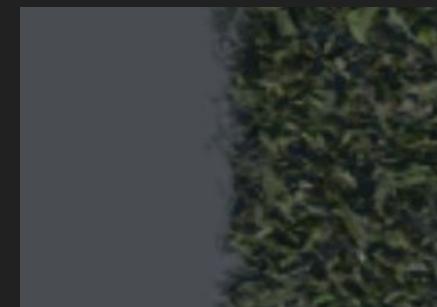
- Simple quad for now
- Relies on a layer mask, which can be blended



Artist-authored layer mask



No UV distortion, linear transition

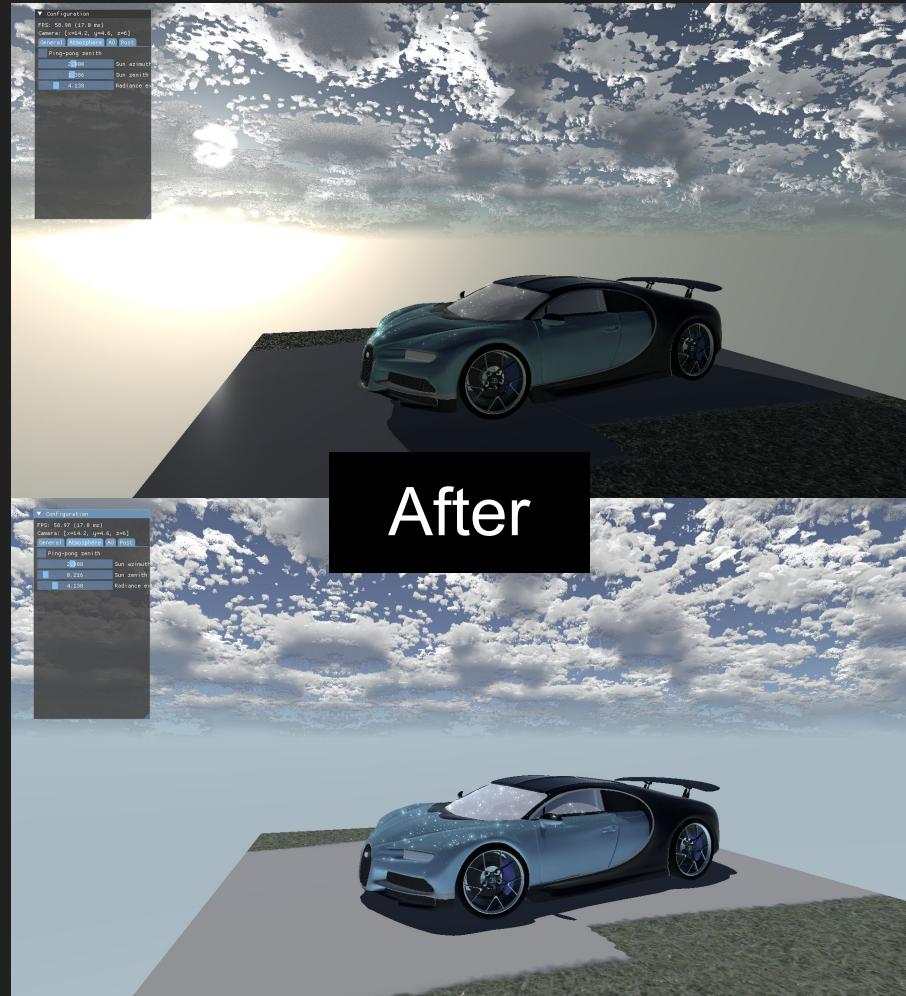


With UV distortion, better transition

# In progress GT 7 tonemapping



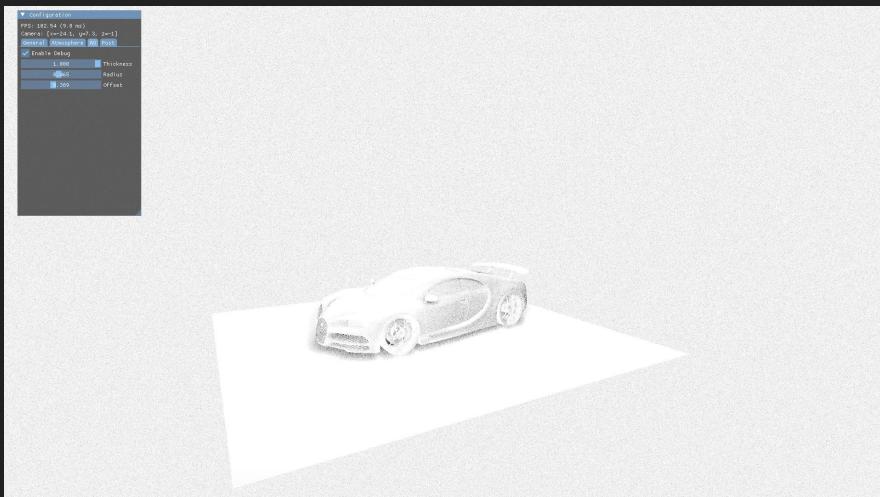
Before



After

# Bloopers - SSAO

Made as a fallback to RT. Here's what it looked like before I broke it



# Bloopers - Tessellation

- While creating a dynamic tessellation pipeline for our terrain, we encountered a Slang compiler bug
- Domain shader issues with OutputPatch parameter
- Report filed *two weeks ago*

Domain shader fails to compile after 2025.16 #8920 New issue ⌂

Closed Bug

andreasschultes opened last month

**Issue Description**

The domain shaders don't compile after update from Slang 2025.16(assumed) to 2025.17.2, 2025.20 and 2025.21  
Domain shaders fails to compile after the update.

**Reproducer Code**

```
C:\VulkanSDK\1.4.328.1\Bin\slangc.exe G:/source/repos/andreasschultes/tns/libraries/space/src/Terrain/Renderer/Shader/TES.slang -target spirv -IG:/source/repos/andreasschultes/tns/libraries/space/src -g3 -DdebugPrintfEXT -dprofile G:/source/repos/andreasschultes/tns/cmake-build-debug-asan/data/Shaders/Terrain/Renderer/Shader/TES.spv -o G:/source/repos/andreasschultes/tns/cmake-build-debug-asan/data/Shaders/Terrain/Renderer/Shader/TES.spv
```

```
struct QuadTess {  
    float edgeTess[4] : SV_TessFactor;  
    float insideTess[2] : SV_InsideTessFactor;  
}  
  
struct PatchOut {
```

Assignees  
skiminki-nv

Labels  
Dev Reviewed regression

Type  
Bug

Projects  
No projects

Milestone  
Q4 2025 (Fall)  
Due by December 30, 2025, 31% complete

Relationships  
None yet

# Next Steps

Our demo will be a real-time drivable car in procedural terrain that can have its materials and environment customized.

## Materials

- Add more material params
  - Orange peel, etc.
- Terrain rendering (wet, snowy, muddy surfaces)
- Optimize glossy IBL

## Terrain

- Tessellation for LODs
- Weather and Deformable geometry

# Next Steps

## RT

- Reflections & AO
- RayQuery => Ray Tracing Pipeline

## Post-processing

- GT7 tonemapping
- Rain effects on camera
- Motion-blur

Look into SSR via AMD FidelityFX

## Interactivity

- Drivable car