Simulating Wildfire Spread Using Physically Accurate Models

Stephen Lee, Anthony Mansur, and Lindsay Smith

Quick Recap

- Already implemented the computations for our simulation and are in the debug stage
- We were behind on rendering last milestone, so we made that our focus for this milestone

Goals for this milestone

★ Generate an **actual forest** ~~small “forest”~~ to test code

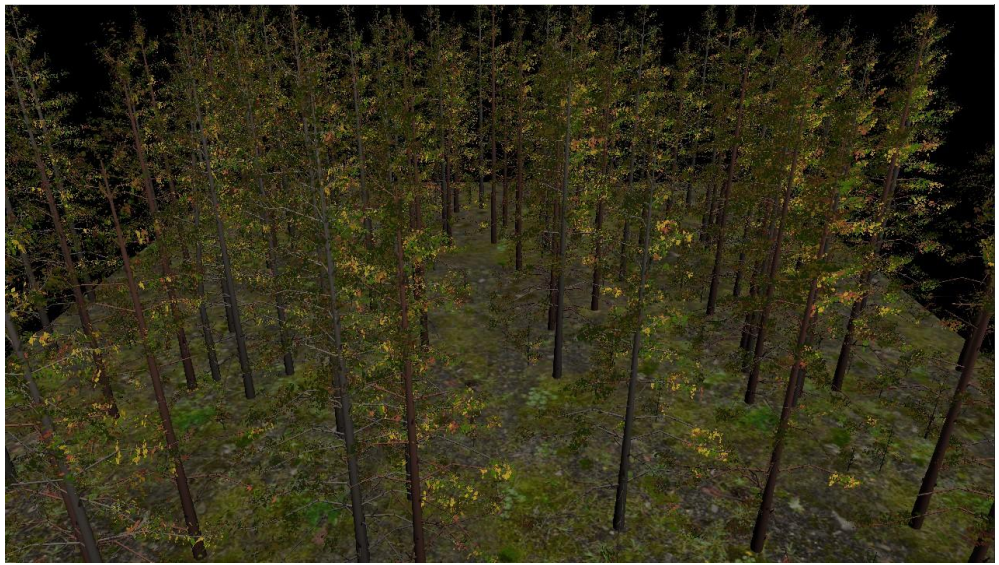
✓ Tree Rendering (**branches** & **leaves**)

✓ Module culling

✓ Terrain texturing

✓ Fluid Rendering (**smoke**)

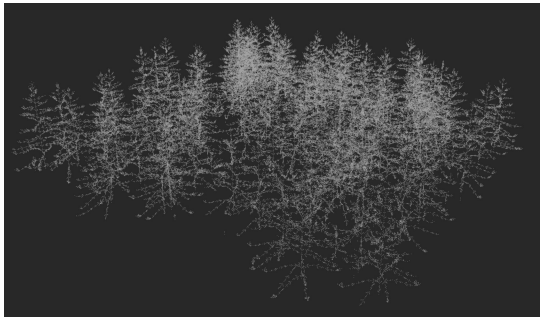
x Simulation Combustion



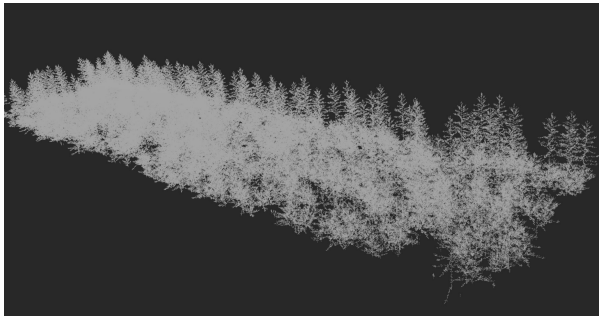
Scene Loader

- Researcher sent two scenes
  - Scene 1 **(~40fps)**
    - # of trees: 336
    - # of modules: **25,589**
    - # of branches: 192,085
    - # of grid cells: **4,608**
  - Scene 2 **(~4fps)**
    - # of trees: 3,102
    - # of modules: **204,690**
    - # of branches: 1,784,435
    - # grid cells: **120,000**

Scene 1 (vertices only)



Scene 2 (vertices only)

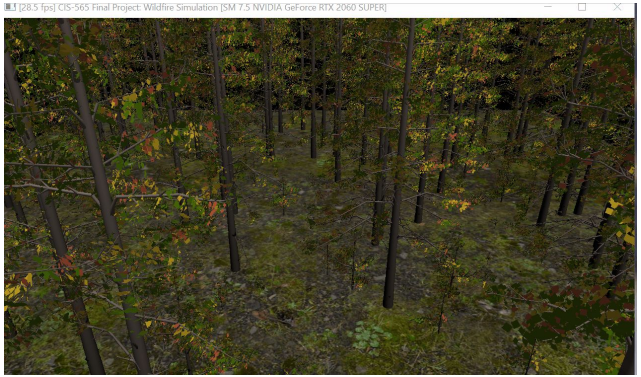


Tree Render

- **OpenGL:** Vertex, Geometry, Fragment Shaders
- Pipeline
  - VBOs connected with CUDA buffers
  - Generate cones & leaves
  - User inputs
  - Lambertian shading

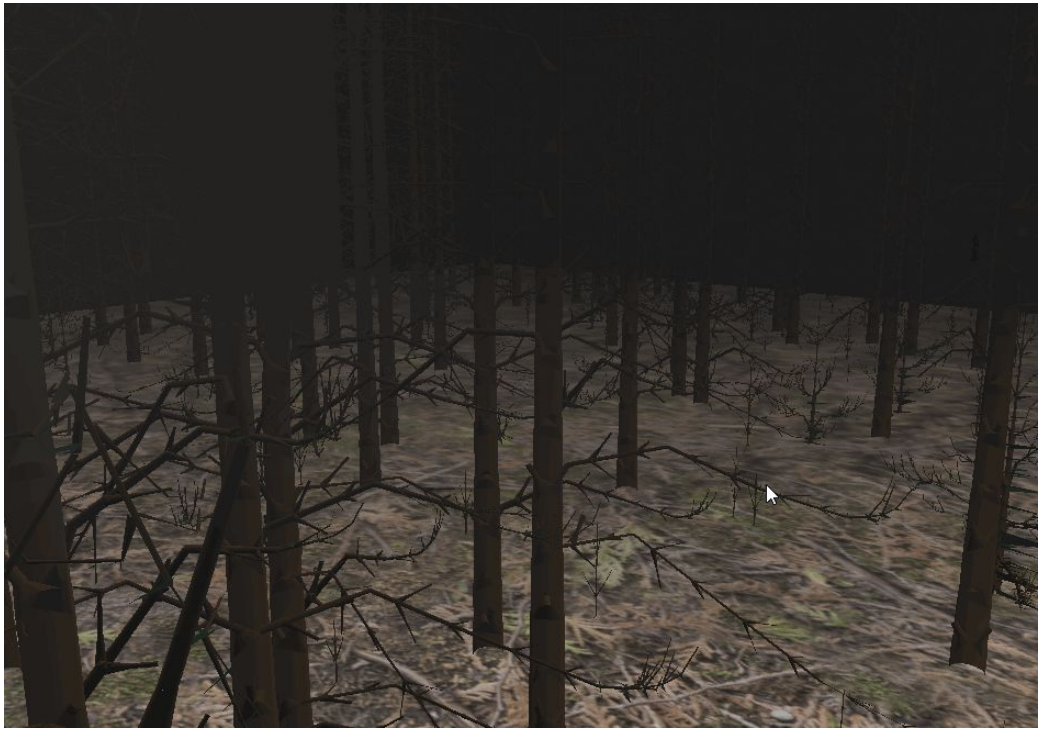
Basic combustion testing

User Interface Demoing



Smoke Render

- ✓ Implement kernels for ray marching algorithm and VBO color update
- ✓ Create new data structures to maintain position and color data for smoke



Next Steps

1. **TOP PRIORITY:** Test combustion simulation with our render by tuning physics parameters
2. Test simulation on the larger scene
3. Add fire color to grid cells based on heat map