Fusion: GPU-accelerated PBD simulator for Unity

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Project Goal

- A physics simulation plugin for Unity implemented with position based dynamics

- Flexible enough to handle both cloth and fluid simulation

- Well integrated into the engine

- Intuitive user interface

Position Based Dynamics

- Non-physically-accurate simulation algorithm
- Simulates real physics using inter-particle constraints
- Different constraints can achieve different effects
- Cloth
    - Distance constraint
    - Bending constraint
- Fluids
    - Density constraint
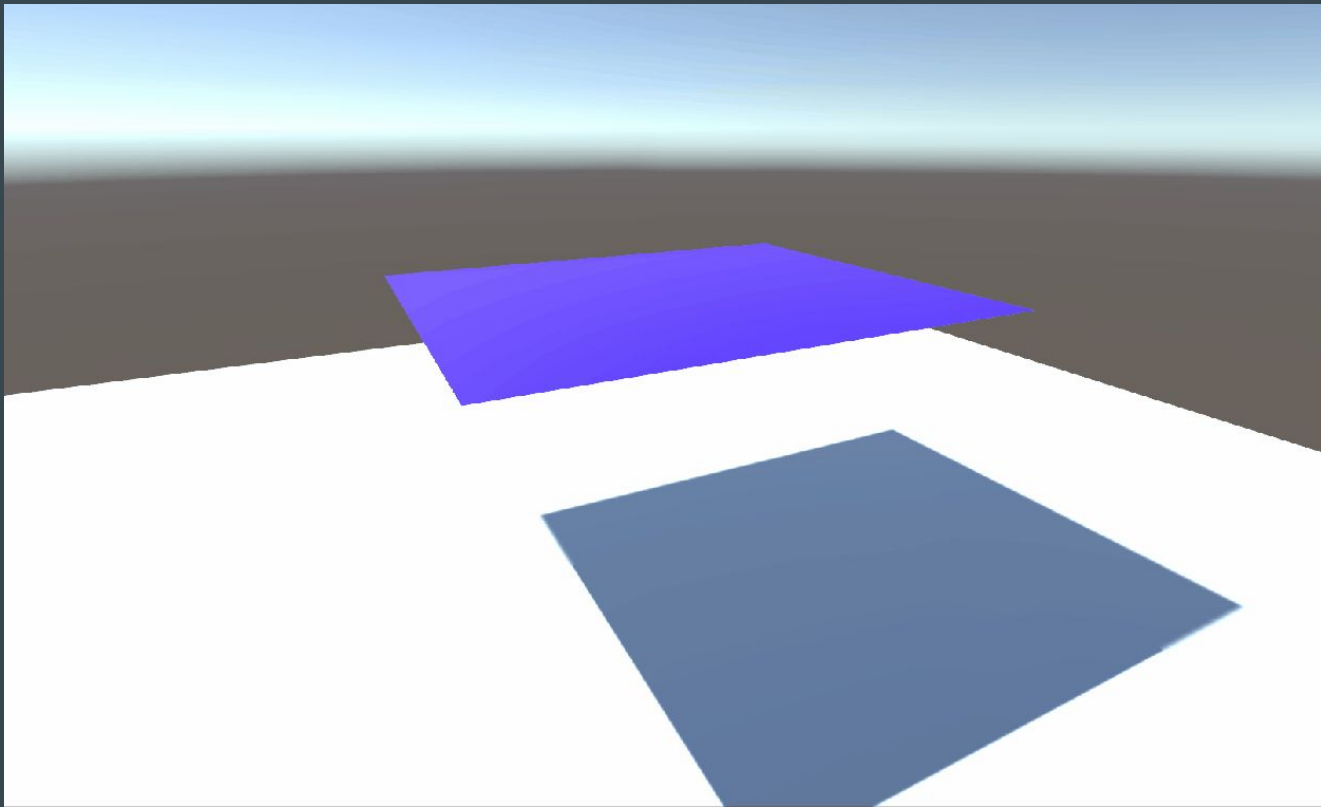   - Viscosity constraint
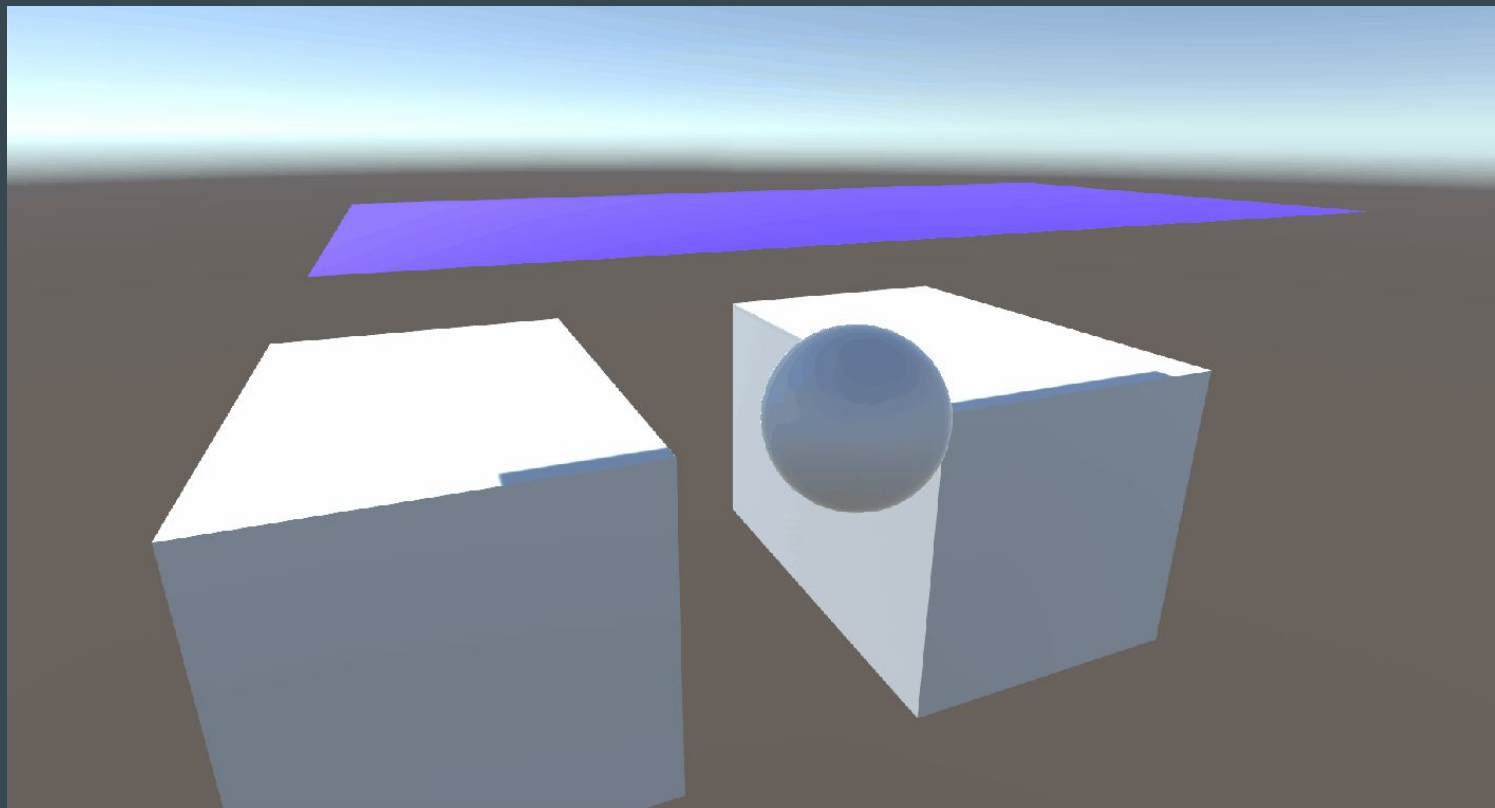
PBD Cloth Sim Demos

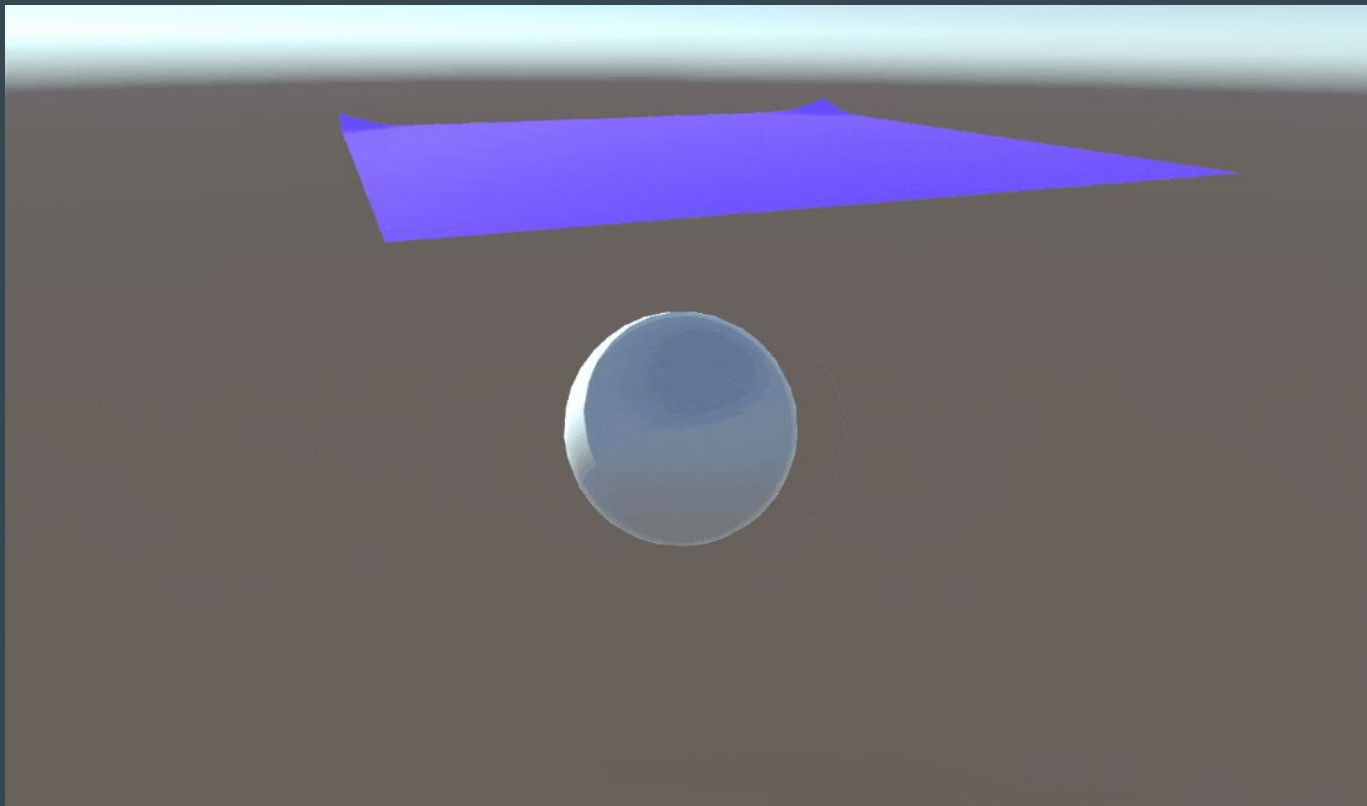# PBD Cloth Sim - Sphere Collisions
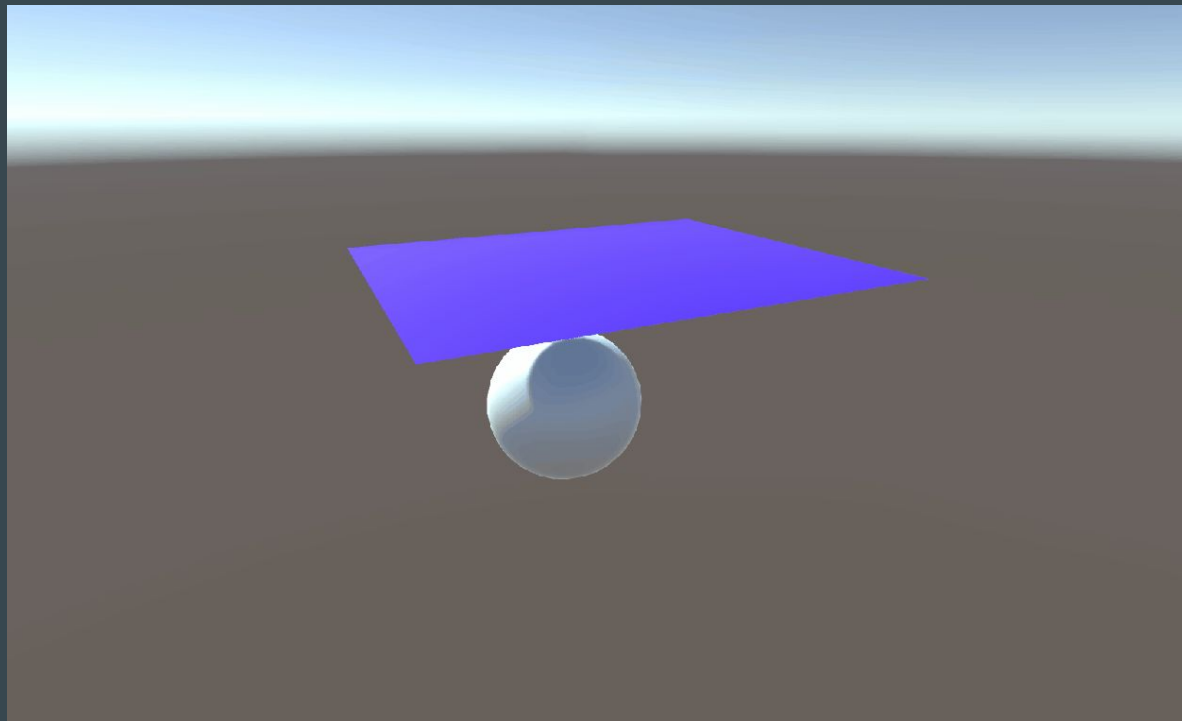
PBD Cloth Sim - Box Collisions
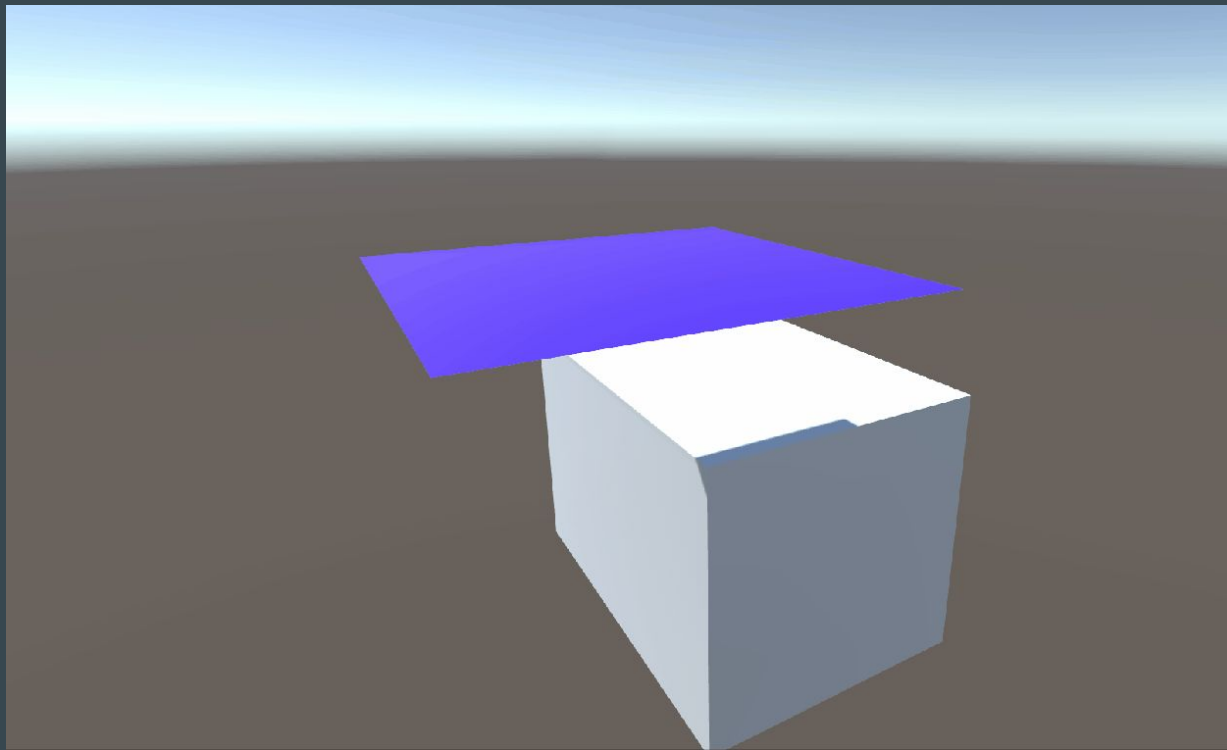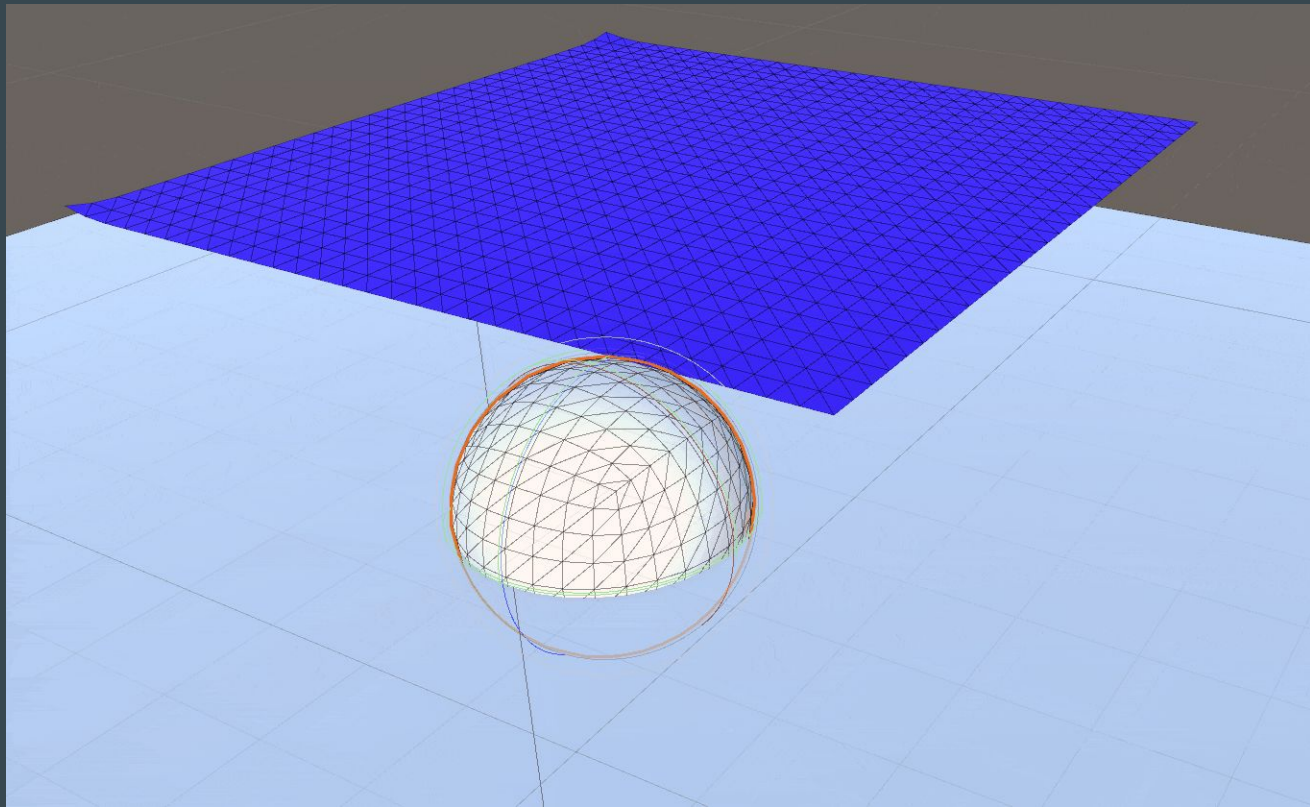
PBD Cloth Sim - Plane Collisions

PBD Cloth Sim - Custom Resolution
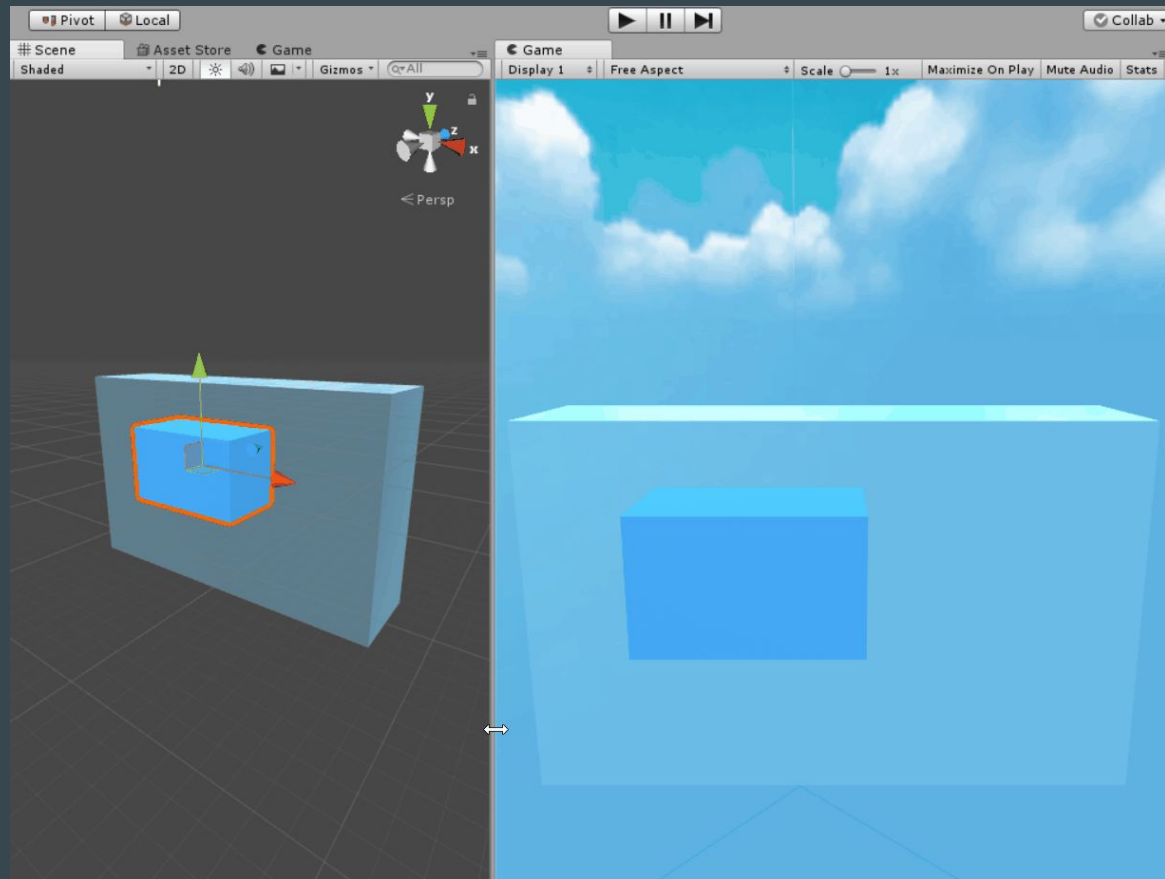
PBD Cloth Sim - Point Constraints

PBD Cloth Sim - Unity Integration

PBD Fluid Sim Demos
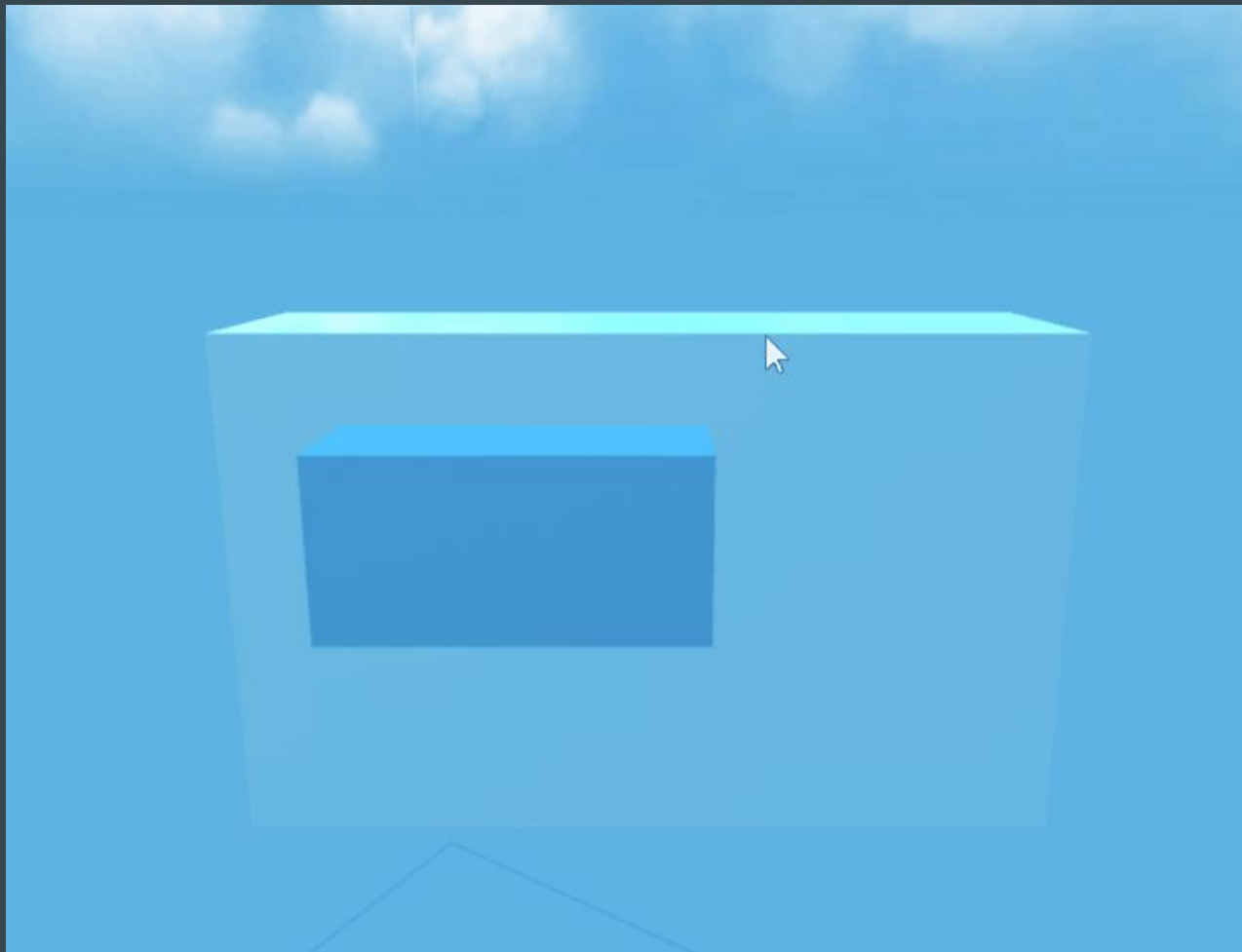
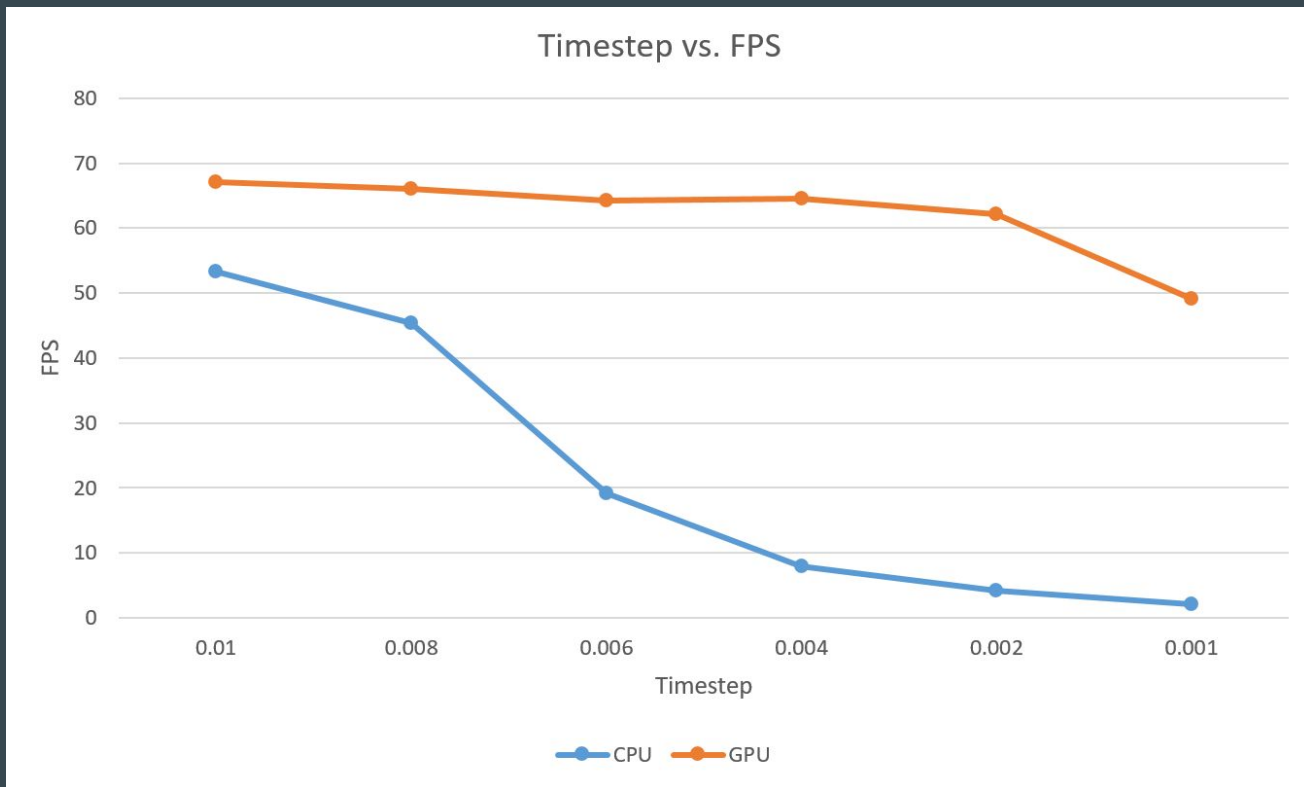# PBD Fluid Sim

Start the
simulation

PBD Fluid Sim

Create blasts

PBD Fluid Sim

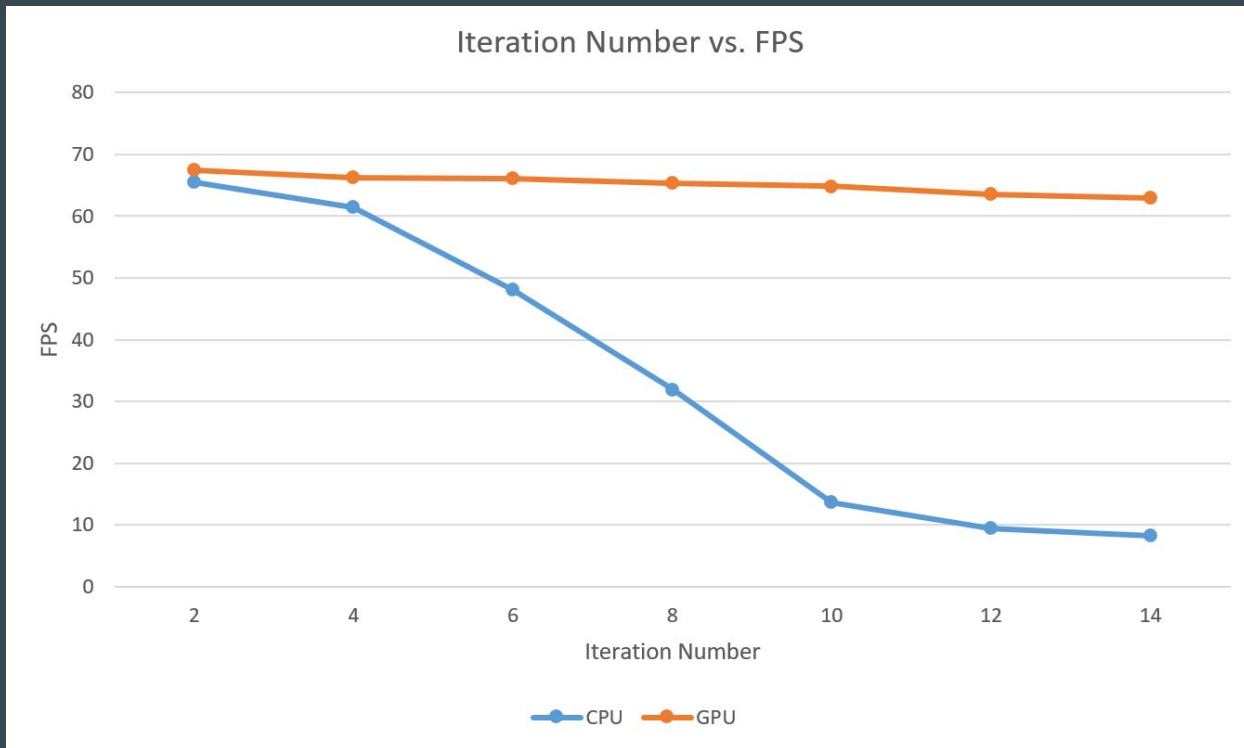Resize the container

Performance Analysis - Cloth

Timestep vs. FPS

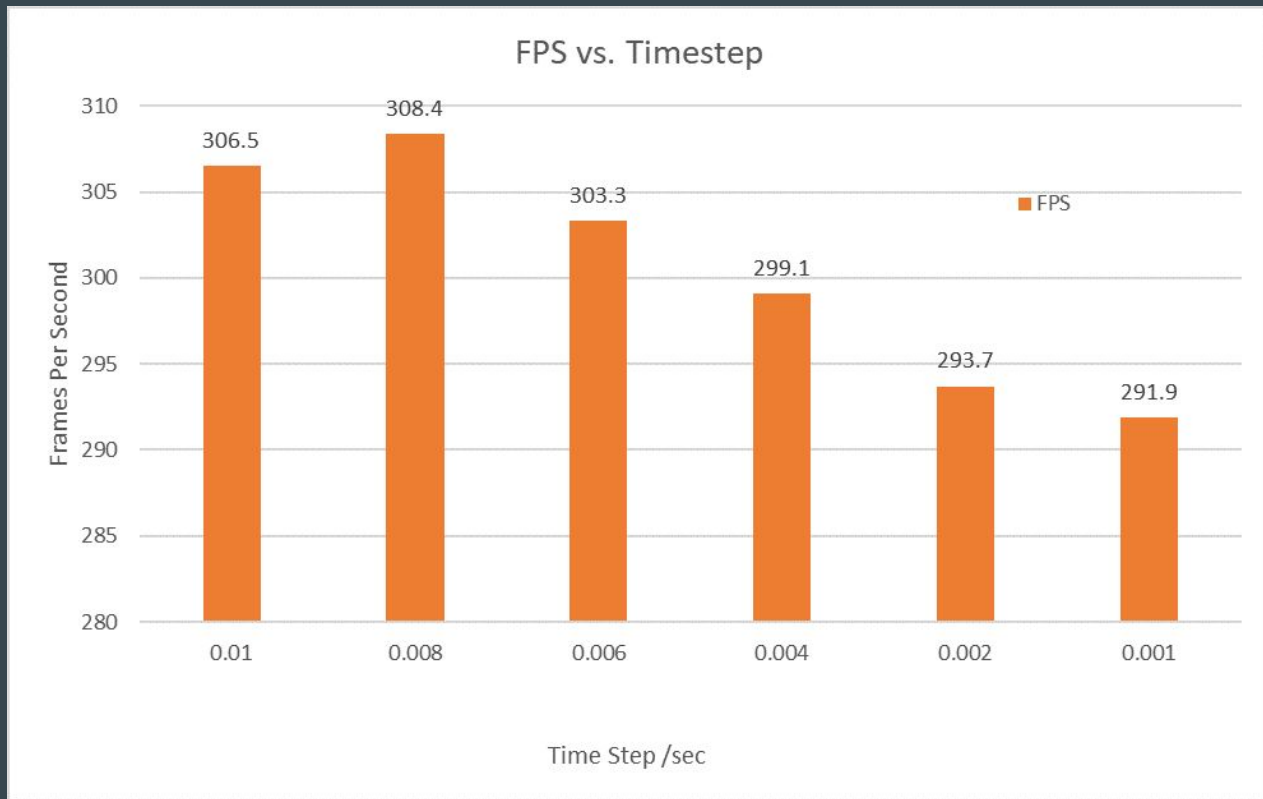# Performance Analysis - Cloth

Performance Analysis - Cloth

Performance Analysis - Fluids

Performance Analysis - Fluids

FPS vs. Numbers of Particles

Performance Analysis - Fluids
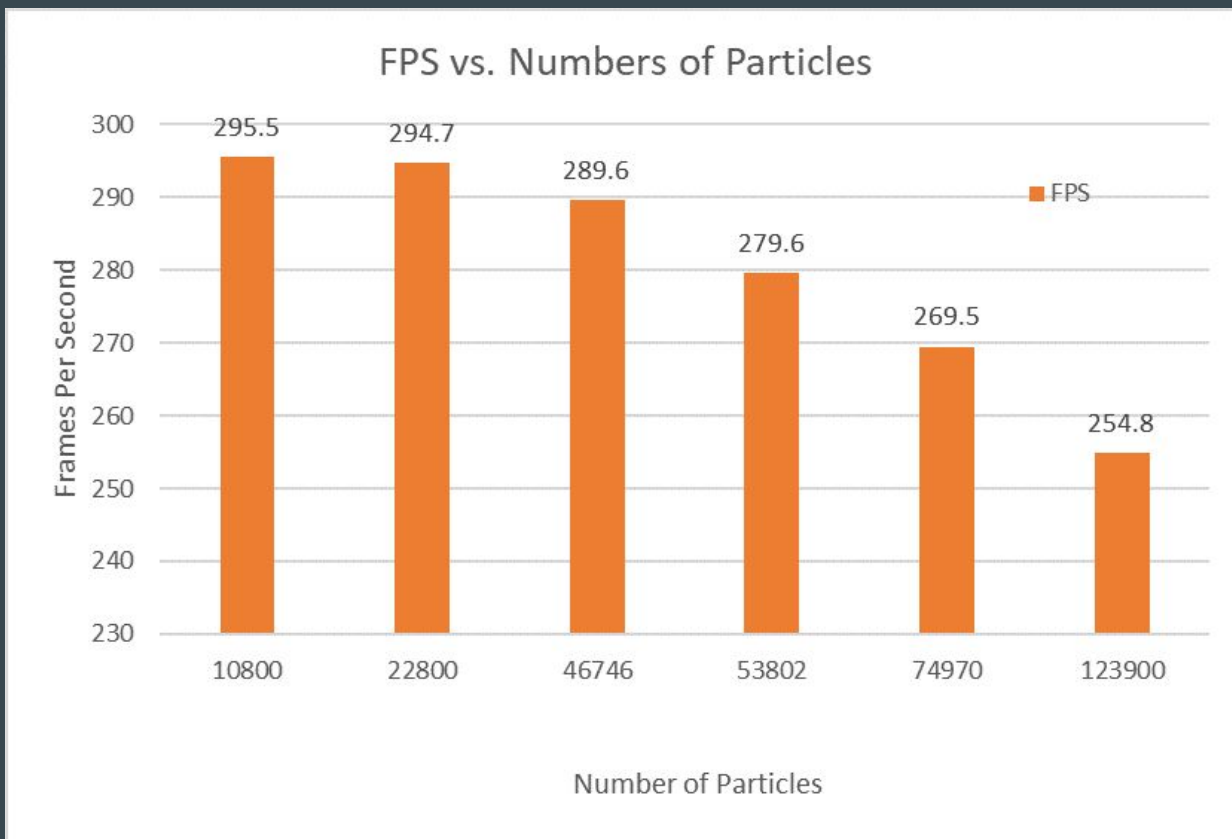
FPS vs. Solver Iterations
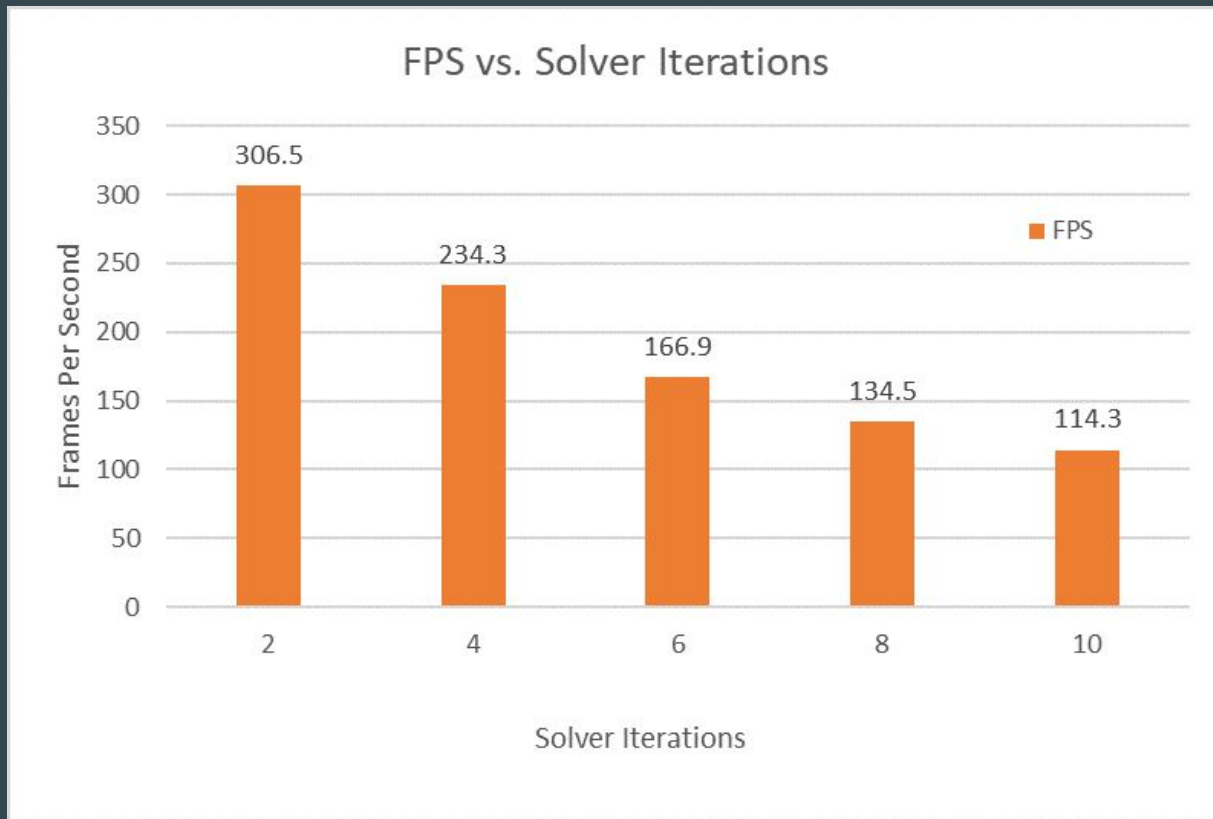
Shortcomings of PBD Cloth

- Simulation can blow up some times

- Need high resolution to look good

- Requires a good amount of parameter-tuning

- No Unity triangle collisions on the GPU

Shortcomings of PBD Fluid

- GPU instancing is Hardware sensitive

- Particle leaks

- Only capable of <100k particles

Thanks for your attention!