

DemolitionCrew Milestones

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What we did since milestones

Fluid improvements

- Tried out reseeding
- Ghost fluid for pressure
- Variable viscosity

Link fluid and temperature simulation

- Particles carry temperature

Optimization:

- Use `Eigen::MatrixXd` instead of `Array2D`
- Tried out float vs double, no noticeable improvements

(Clean up, bug fixes, document, improve UI)

UI

The image shows a vertical UI control panel with a dark background and blue accents. It is organized into several sections, each with a dropdown arrow on the left:

- Simulation Parameters:** Contains three numeric controls with minus and plus buttons:
 - dt: 0.02828
 - Pressure accuracy: 0.00010000
 - Pressure iter: 400
- Fluid Properties:** Contains three numeric controls with minus and plus buttons:
 - Viscosity: 1.000
 - Temp. Diffusivity: 1.000
 - Particle Temp. Tran: 0.125 (with a blue slider bar)Below this is a toggle switch labeled "Reseed Particles" which is currently off.
- Visual:** Contains a dropdown menu set to "Fluid" and a "Show Field" dropdown. Below are three checked checkboxes: "Show Velocity", "Show Velocity", and "Show Velocity". At the bottom of this section are three numeric controls with minus and plus buttons:
 - Particle Size: 3.000
 - Particles: 0 153 230 (with a blue square)
 - Fluid: 0 153 230 0 (with a blue square)
 - Air: 230 255 250 0 (with a light blue square)
 - Boundary: 31 38 41 13 (with a dark grey square)
- Interaction:** Contains three dropdown menus: "Fluid Brush", "Rect", and "Brush Mode". Below are three numeric controls with minus and plus buttons:
 - Brush Texture: Brush Texture
 - Brush Size: 0.100 (with a blue slider bar)
 - Base Temperature: 0.000
 - Brush Temperature: 100.000
 - Brush Force: 2.500

Viscosity: 1

Simulation Control

Run Simulation

Reset Simulation

Clear Screen

60 Steps/Second

-1 Max Steps

Overlays

Simulation Parameters

0.04000 dt

0.00010000 Pressure accuracy

400 Pressure iter

Fluid Properties

1.000 Viscosity

1.000 Temp. Diffusivity

0.125 Particle Temp. Trar

Reseed Particles

Visual

Fluid Show Field

Show Velocity

3.000 Particle Size

0 153 230 Particles

0 153 230 0 Fluid

230 255 250 0 Air

31 38 41 255 Boundary

Interaction

Fluid Brush Brush Mode

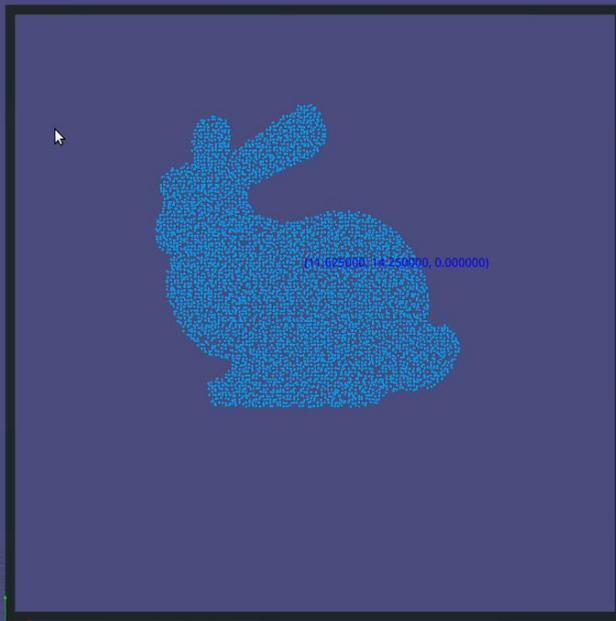
Bunny Brush Texture

0.500 Brush Size

0.000 Base Temperature

100.000 Brush Temperature

Recording



Iteration: 0
 Current time: 0.00000
 Average time per iteration: 0.00ms
 FPS: inf
 Particles: 4673
 Fluid Cells: 0

Viscosity: 1k

Simulation Control

Run Simulation

Reset Simulation

Clear Screen

60 Steps/Second

-1 Max Steps

Overlays

Simulation Parameters

0.04000 dt

0.00010000 Pressure accuracy

400 Pressure iter

Fluid Properties

100.000 Viscosity

1.000 Temp. Diffusivity

0.125 Particle Temp. Trar

Reseed Particles

Visual

Fluid Show Field

Show Velocity

3.000 Particle Size

0 153 230 Particles

0 153 230 0 Fluid

230 255 250 0 Air

31 38 41 255 Boundary

Interaction

Fluid Brush Brush Mode

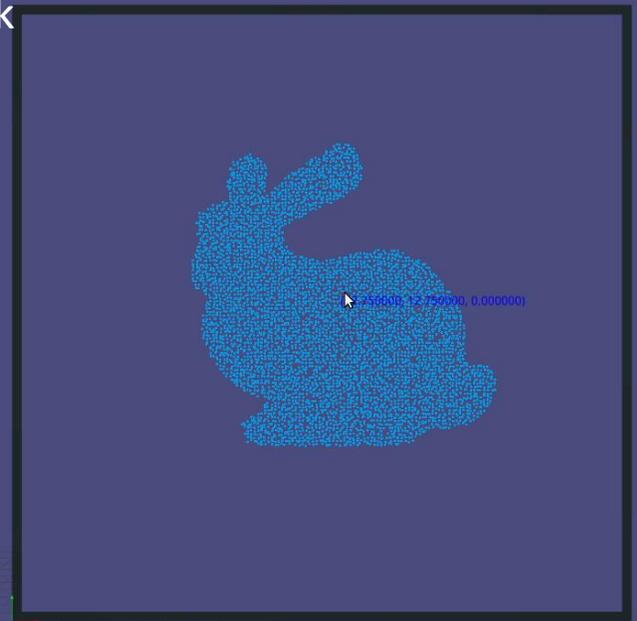
Bunny Brush Texture

0.500 Brush Size

0.000 Base Temperature

100.000 Brush Temperature

Recording



Iteration: 0
 Current time: 0.00000
 Average time per iteration: 0.00ms
 FPS: inf
 Particles: 4715
 Fluid Cells: 0

Viscosity: 10k

Simulation Control

Run Simulation

Reset Simulation

Clear Screen

60 Steps/Second

-1 Max Steps

Overlays

Simulation Parameters

0.04000 dt

0.00010000 Pressure accuracy

400 Pressure iter

Fluid Properties

10000.000 Viscosity

1.000 Temp. Diffusivity

0.125 Particle Temp. Trar

Reseed Particles

Visual

Fluid Show Field

Show Velocity

3.000 Particle Size

0 153 230 Particles

0 153 230 0 Fluid

230 255 250 0 Air

31 38 41 255 Boundary

Interaction

Fluid Brush Brush Mode

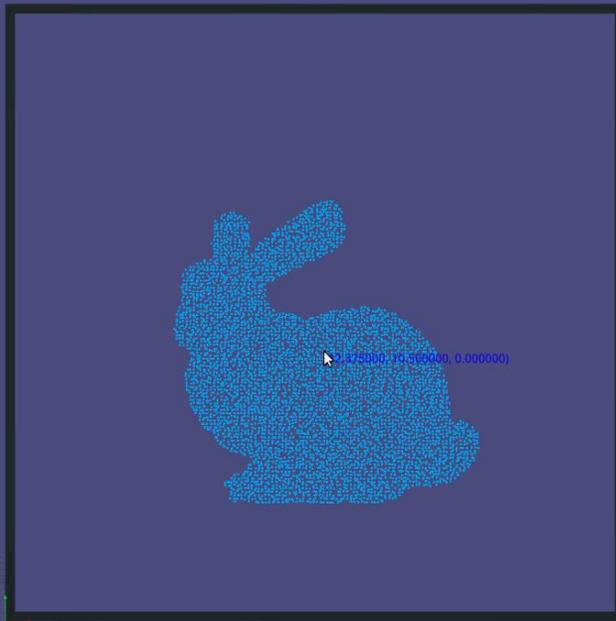
Bunny Brush Texture

0.500 Brush Size

0.000 Base Temperature

100.000 Brush Temperature

Recording



Iteration: 0
 Current time: 0.00000
 Average time per iteration: 0.00ms
 FPS: inf
 Particles: 4698
 Fluid Cells: 0

Viscosity: 100m

Simulation Control

Run Simulation

Reset Simulation

Clear Screen

60 Steps/Second

-1 Max Steps

Overlays

Simulation Parameters

0.04000 dt

0.00010000 Pressure accuracy

400 Pressure iter

Fluid Properties

10000000.0 Viscosity

1.000 Temp. Diffusivity

0.125 Particle Temp. Trar

Reseed Particles

Visual

Fluid Show Field

Show Velocity

3.000 Particle Size

0 153 230 Particles

0 153 230 0 Fluid

230 255 250 0 Air

31 38 41 255 Boundary

Interaction

Fluid Brush Brush Mode

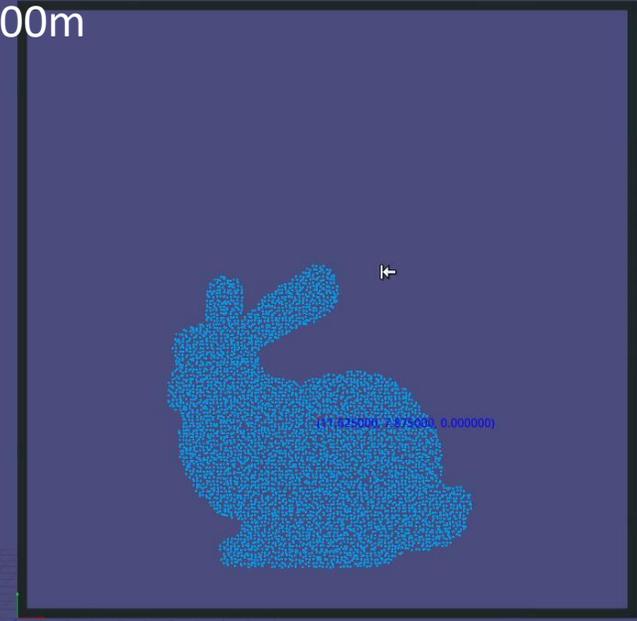
Bunny Brush Texture

0.500 Brush Size

0.000 Base Temperature

100.000 Brush Temperature

Recording



Iteration: 0
 Current time: 0.00000
 Average time per iteration: 0.00ms
 FPS: inf
 Particles: 4704
 Fluid Cells: 0

Temperature linked with fluid

Simulation Control

Run Simulation

Single Step

Reset Simulation

Clear Screen

60 Steps/Second

-1 Max Steps

Overlays

Simulation Parameters

0.04000 dt

0.00010000 Pressure accuracy

400 Pressure iter

Fluid Properties

1.000 Viscosity

1.000 Temp. Diffusivity

0.125 Particle Temp. Trar

Reseed Particles

Visual

Temperature Show Field

Show Velocity

3.000 Particle Size

0 153 230 Particles

0 153 230 0 Fluid

230 255 250 0 Air

31 38 41 255 Boundary

Interaction

Fluid Brush Brush Mode

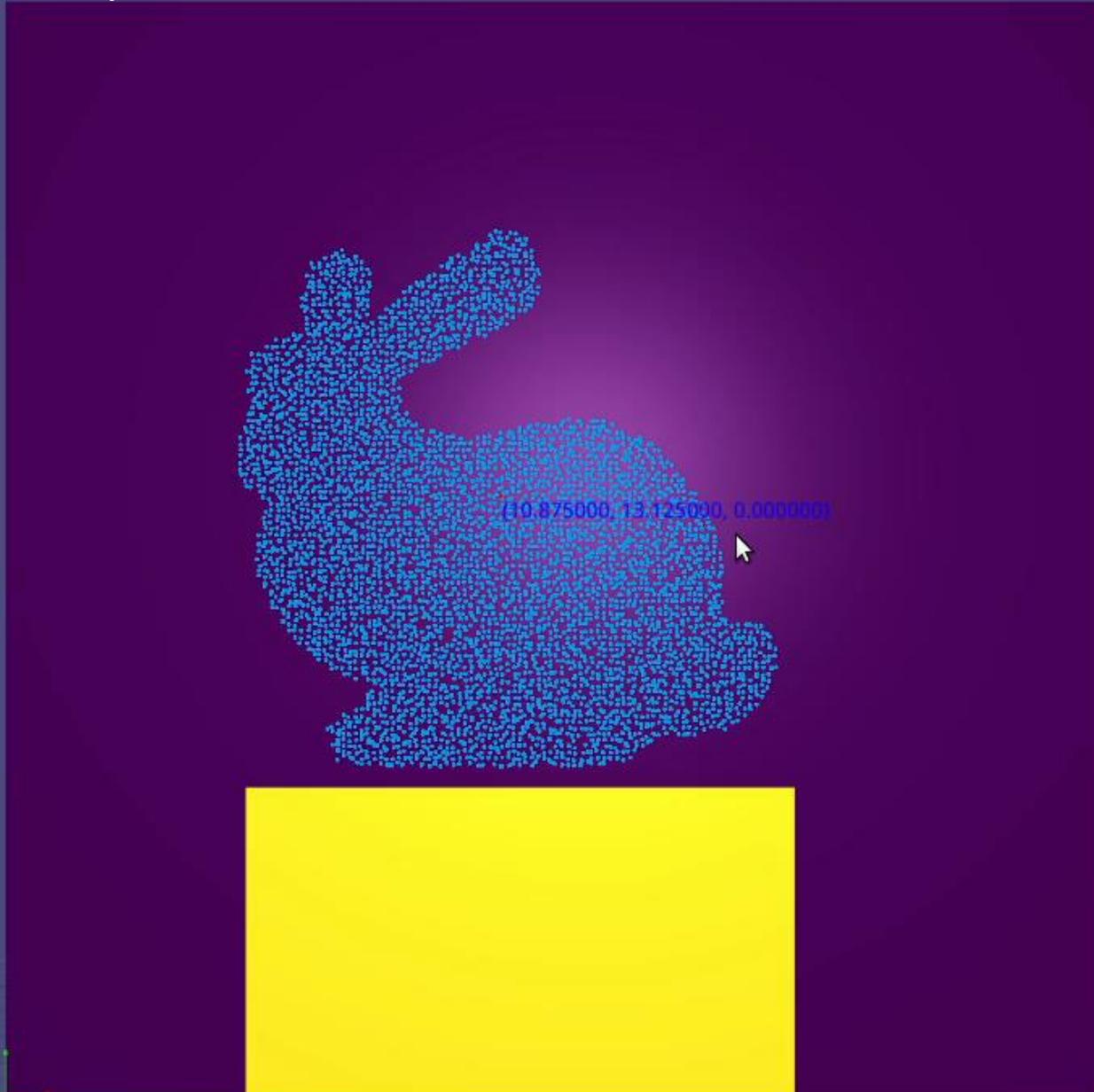
Bunny Brush Texture

0.500 Brush Size

0.000 Base Temperature

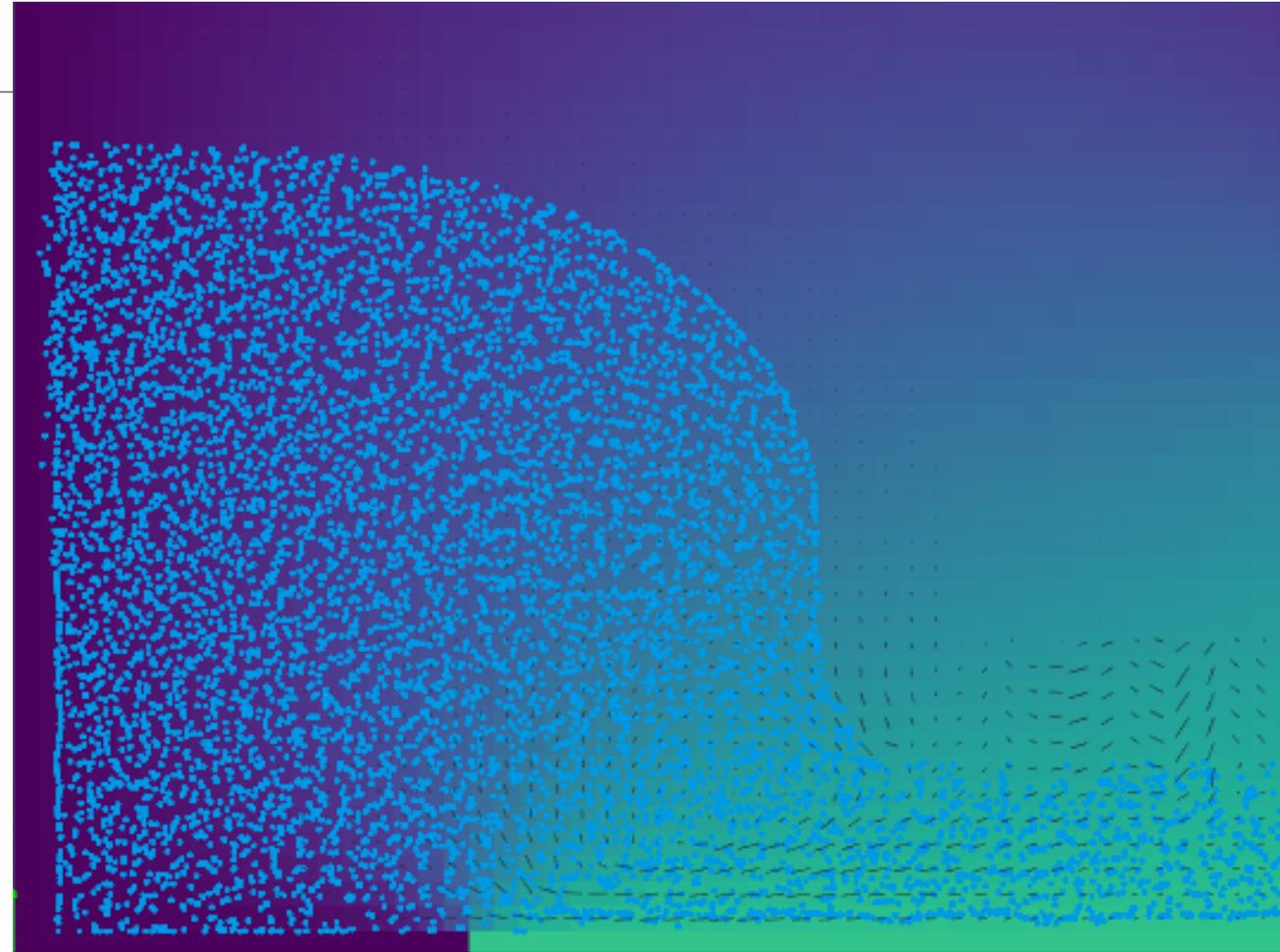
100.000 Brush Temperatur

Recording



Iteration: 0
Current time: 0.00000
Average time per iteration: 0.00ms
FPS: inf
Particles: 4715
Fluid Cells: 0

Ghost pressure gives smoother boundary



Side effect

Leave out pressure solver

Strange behaved viscosity solver

Viscosity: 10m

The screenshot displays a simulation interface with a control panel on the left and a status panel on the right. The central area shows a bunny-shaped fluid simulation rendered as a dense field of blue particles. The control panel includes sections for Simulation Control, Simulation Parameters, Fluid Properties, Visual, and Interaction. The status panel on the right shows simulation statistics.

Simulation Control

- Run Simulation
- Single Step
- Reset Simulation
- Clear Screen
- 60 Steps/Second
- 1 Max Steps

Simulation Parameters

- 0.04000 dt
- 0.00010000 Pressure accuracy
- 1 Pressure iter

Fluid Properties

- 10000000.0 Viscosity
- 1.000 Temp. Diffusivity
- 0.104 Particle Temp. Tra

Reseed Particles

Visual

- Fluid Show Field
- Show Velocity
- 3.000 Particle Size
- 0 153 230 Particles
- 0 153 230 0 Fluid
- 230 255 250 0 Air
- 31 38 41 255 Boundary

Interaction

- Fluid Brush Brush Mode
- Bunny Brush Texture
- 0.812 Brush Size
- 0.000 Base Temperature
- 100.000 Brush Temperatur

Recording

Status Panel

- Iteration: 0
- Current time: 0.00000
- Average time per iteration: 0.00ms
- FPS: inf
- Particles: 7189
- Fluid Cells: 0

Coordinates: (21.750000, 1.500000, 0.000000)

Profiling Runtime

- Mostly `Eigen::ConjugateGradient` solvers
- Could be improved with an adaptive domain
- May not make sense due to the overhead

Method	Samples
▼ 93.3% <code>inlined`__GI__clone</code>	119,211
▼ 93.2% <code>libpthread-2.27.so`start_thread</code>	119,146
▼ 88.8% <code>libgomp.so.1.0.0`[unknown]</code>	113,446
88.3% <code>libgomp.so.1.0.0`[unknown]</code>	112,772
▶ < 1% <code>main`igl::per_face_normals</code>	659
▼ 4.5% <code>libstdc++.so.6.0.25`[unknown]</code>	5,691
▼ 4.5% <code>main`Simulator::runSimThread</code>	5,691
▼ 4.4% <code>main`FluidSim::advance</code>	5,564
▼ 4.4% <code>main`FluidSolver::stepPICFLIP</code>	5,564
▶ 2.2% <code>main`FluidSolver::solvePoissonCorrectVelocity</code>	2,874
▶ 1.0% <code>main`FluidSolver::applyViscosity</code>	1,330
▶ < 1% <code>main`FluidSolver::temperatureSolve</code>	672
▶ < 1% <code>main`FluidSolver::advectVelocityField</code>	213

What we left out

- 3D -> focused on real-time and interactivity instead
- SDF for solids

Simulation Control

Pause Simulation

Single Step

Reset Simulation

Clear Screen

60 Steps/Second

-1 Max Steps

Overlays

Simulation Parameters

0.04000 dt

0.00010000 Pressure accuracy

800 Pressure iter

Fluid Properties

10000000.0 Viscosity

1.000 Temp. Diffusivity

0.125 Particle Temp. Trar

Reseed Particles

Visual

Temperature Show Field

Show Velocity

3.000 Particle Size

0 153 230 Particles

0 153 230 0 Fluid

230 255 250 0 Air

31 38 41 255 Boundary

Interaction

Fluid Brush Brush Mode

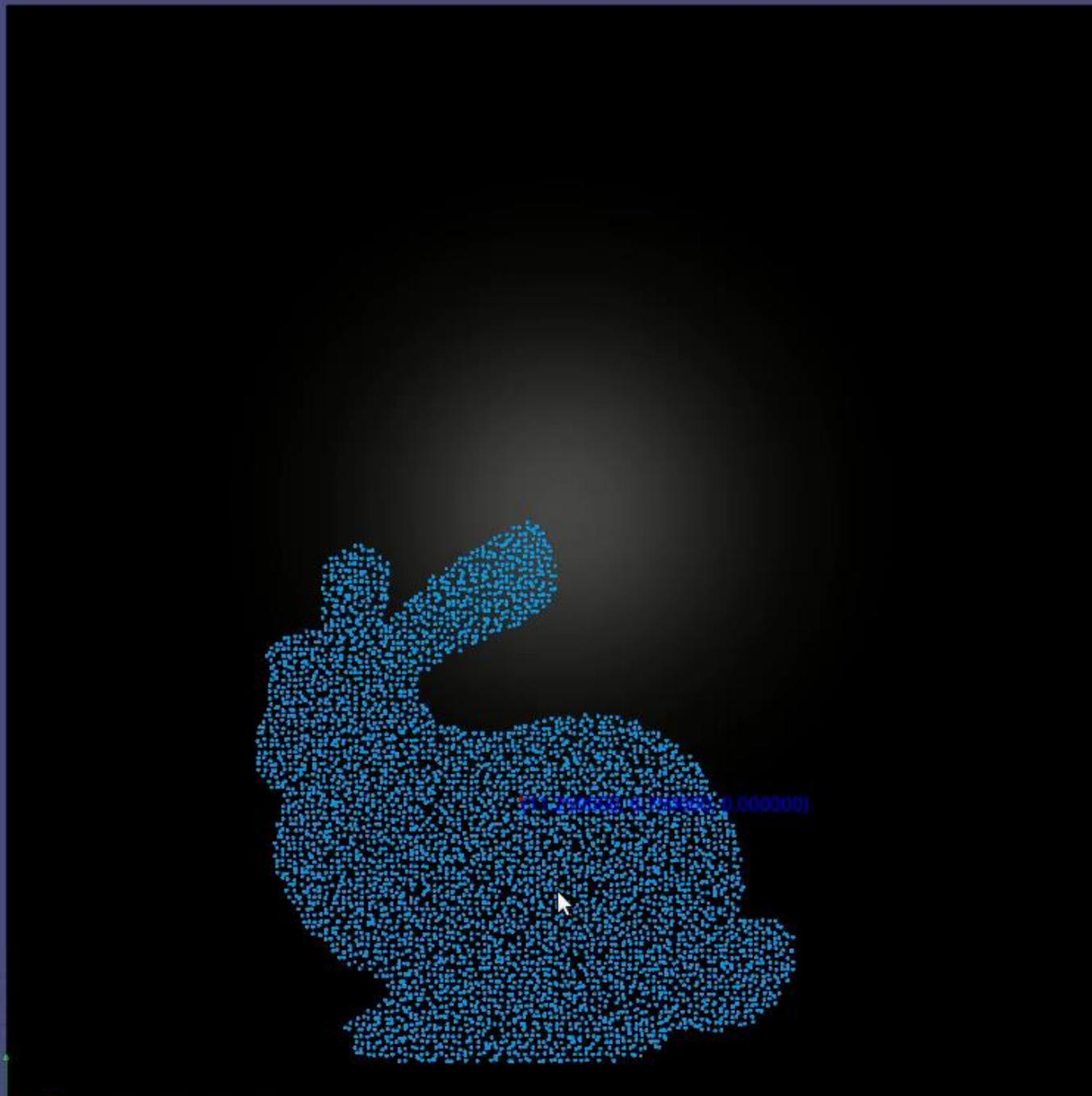
Bunny Brush Texture

0.500 Brush Size

0.000 Base Temperature

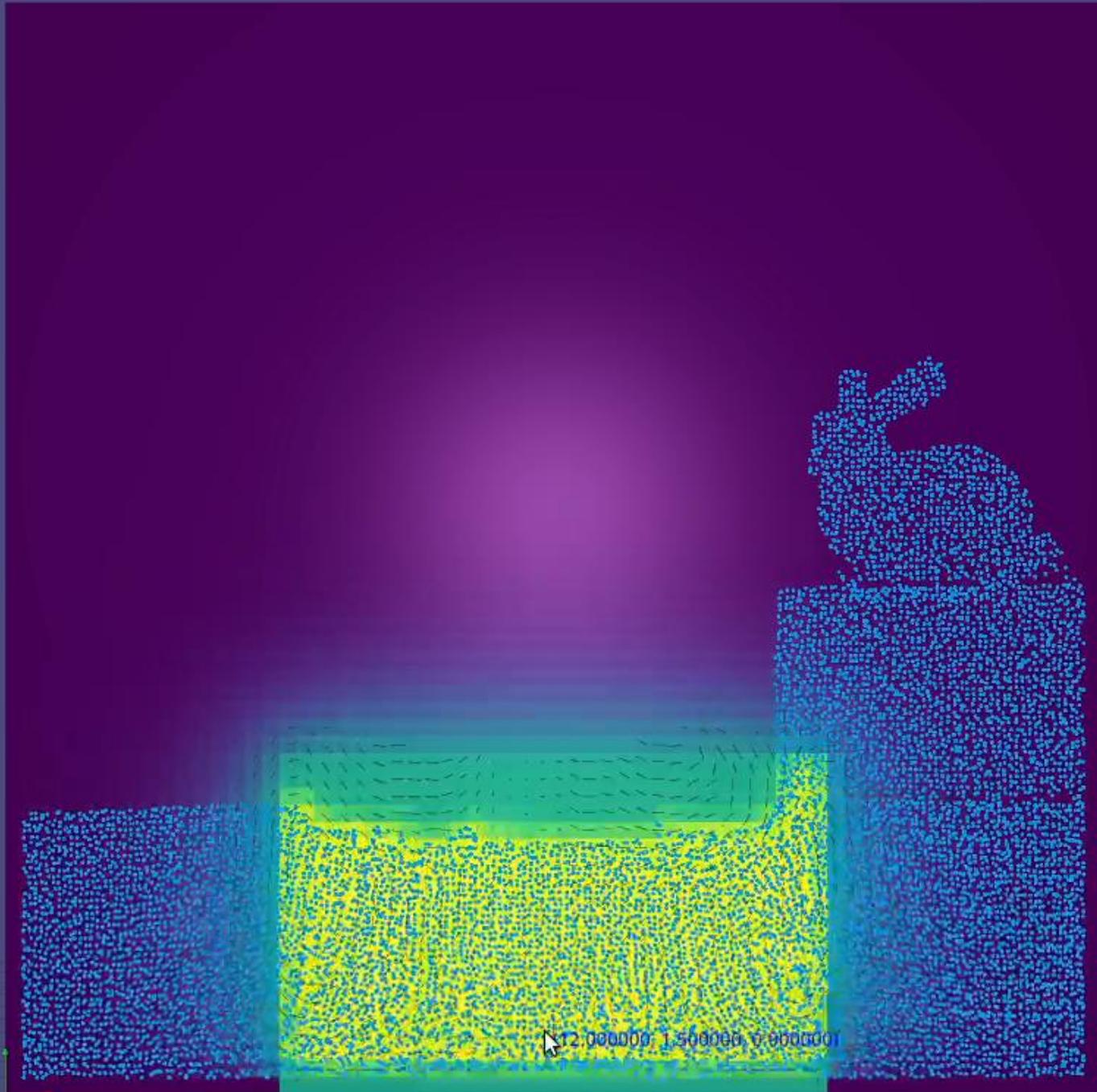
100.000 Brush Temperature

Recording



Iteration: 25
Current time: 1.00000
Average time per iteration: 47.70ms
FPS: 20.96
Particles: 4674
Fluid Cells: 708

Simulation Control
 Pause Simulation
 Single Step
 Reset Simulation
 Clear Screen
 60 Steps/Second
 -1 Max Steps
 Overlays
 Simulation Parameters
 0.04000 dt
 0.00010000 Pressure accuracy
 800 Pressure iter
 Fluid Properties
 10000000.0 Viscosity
 1.000 Temp. Diffusivity
 0.125 Particle Temp. Trar
 Reseed Particles
 Visual
 Temperature Show Field
 Show Velocity
 3.000 Particle Size
 0 153 230 Particles
 0 153 230 0 Fluid
 230 255 250 0 Air
 31 38 41 255 Boundary
 Interaction
 Fluid Brush Brush Mode
 Rect Brush Texture
 0.479 Brush Size
 0.000 Base Temperature
 100.000 Brush Temperaturi
 Recording



Iteration: 164
 Current time: 6.56000
 Average time per iteration: 85.57ms
 FPS: 11.69
 Particles: 10823
 Fluid Cells: 1384