ZIBRA AI

Zibra Liquids 1.4.4, plugin documentation

ZIBRA LIQUIDS IS A PLUGIN FOR THE UNITY ENGINE. IT ALLOWS THE USE OF REAL-TIME LIQUID SIMULATION (GPU) POWERED BY AI BASED OBJECT APPROXIMATION.

Features	Zibra Liquids Free	Zibra Liquids
Mobile support (iOS)	☒	☑
Particle count limit	2 mln	10 mln
Analytic colliders (simple shapes like cubes, spheres and bowls)	up to 5	unlimited
Neural colliders (arbitrary geometry as collider)	☒	☑
Collider friction	☒	☑
Force interaction setting	☒	☑
Liquid emitters	1	unlimited
Liquid voids	☒	☑
Liquid detectors	☒	☑
Liquid force fields	Radial (only one instance)	Radial, Directional, Swirl (unlimited)
Liquid initial state baking	☒	☑

Table of contents:

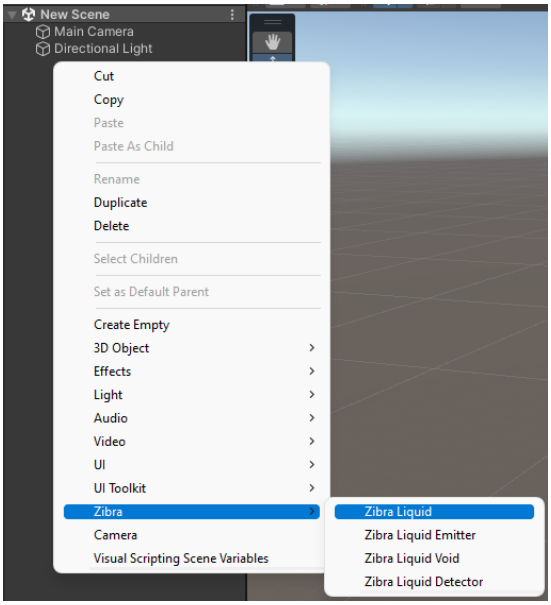
System Requirements

Editor platforms: PC (DX11/DX12, x86 and x64), macOS(Metal, x64 and arm64)
For M1 Mac users, the Apple Silicon version of Unity Editor is strongly recommended.
Build platforms: PC(DX11/DX12, x86 and x64), UWP(DX11/DX12, x86 and x64), macOS(Metal, x64 and arm64), iOS (iOS version 12 or later, iPhone 6s or newer)
Unity version: 2019.4 or later (use the latest feature update)
VR is unsupported
Supported Render Pipelines: SRP, URP, HDRP
URP: 7.5 or later
HDRP: 7.x or later

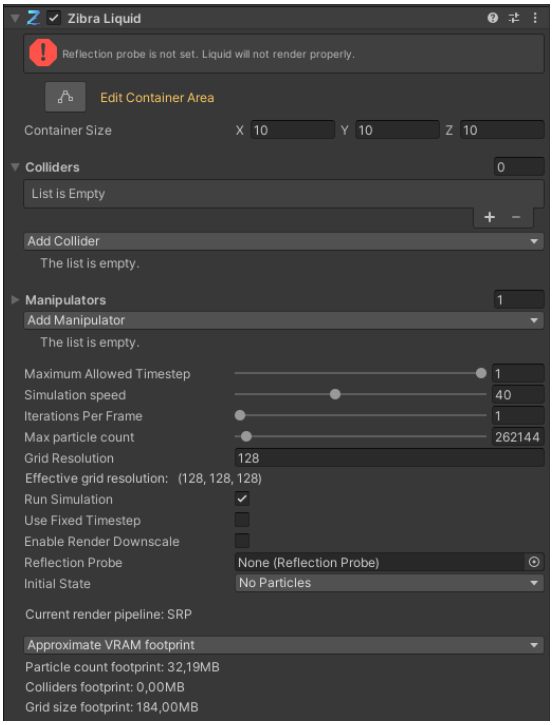
Create Zibra Liquid

To create a Zibra Liquid instance:

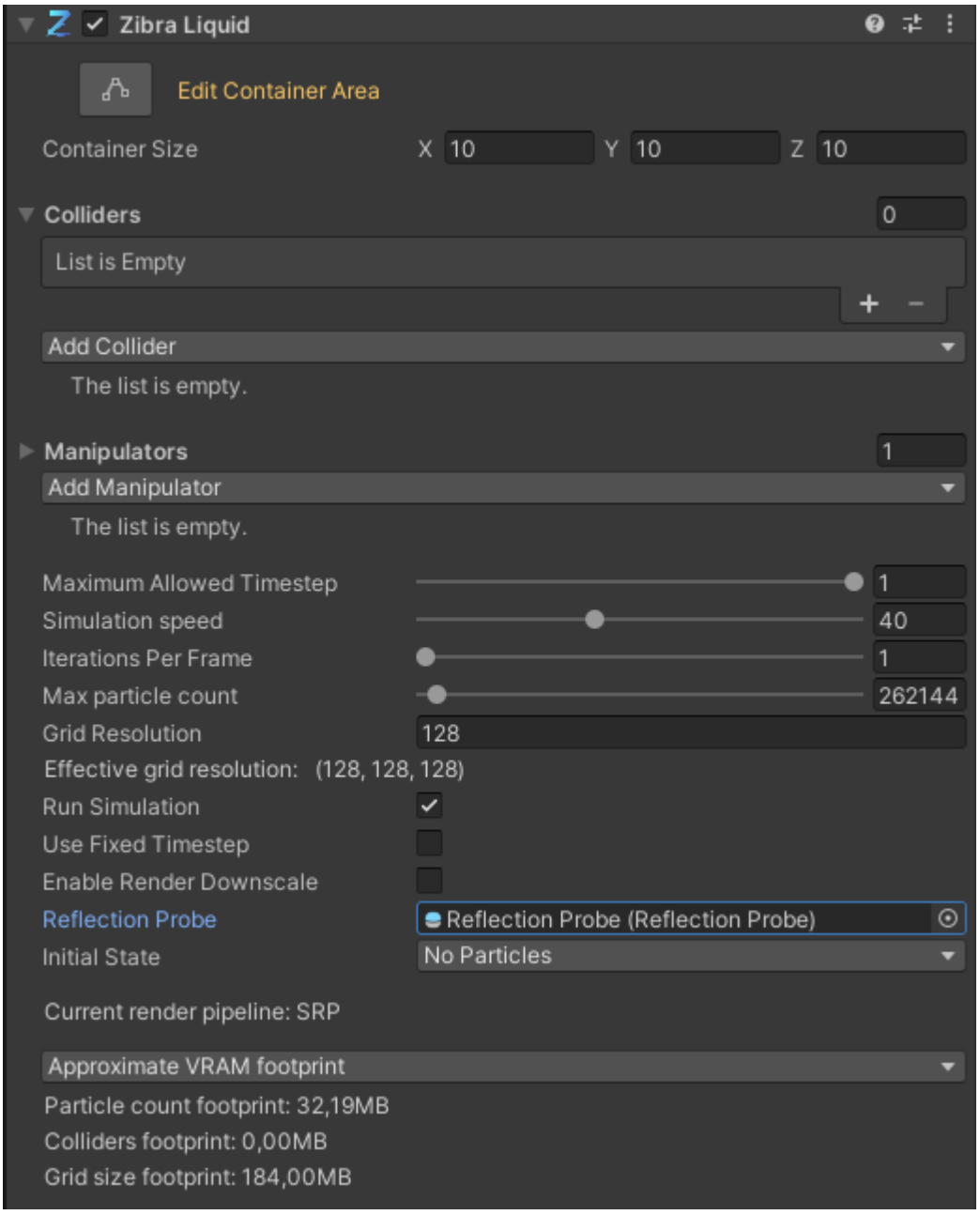
1. Open the Hierarchy window
2. Right click where you want to add a Zibra Liquid instance
3. Click on the *“Zibra -> Zibra Liquid”* option.



After that, In the Inspector window, you’ll see the Zibra Liquid parameters:

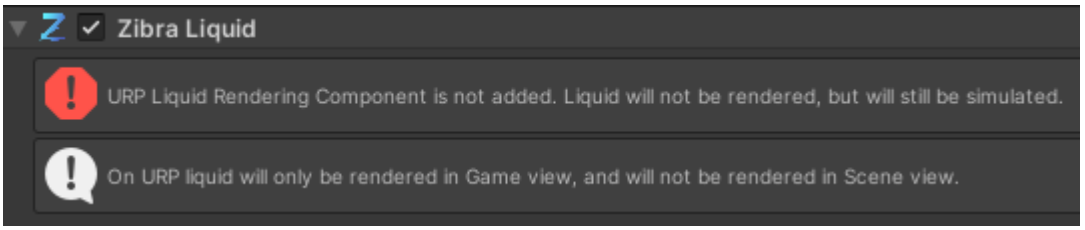


After that you need to set the “Reflection Probe” parameter. On SRP/URP it’s strongly recommended that you set this parameter, but is not strictly necessary. On HDRP you must set a reflection probe before you can use the liquid instance.
You can check which render pipeline you are using by looking at the “Current render pipeline” message - on the screenshot the SRP is shown.
On SRP, after setting the reflection probe, you’ll no longer see any errors/warnings.



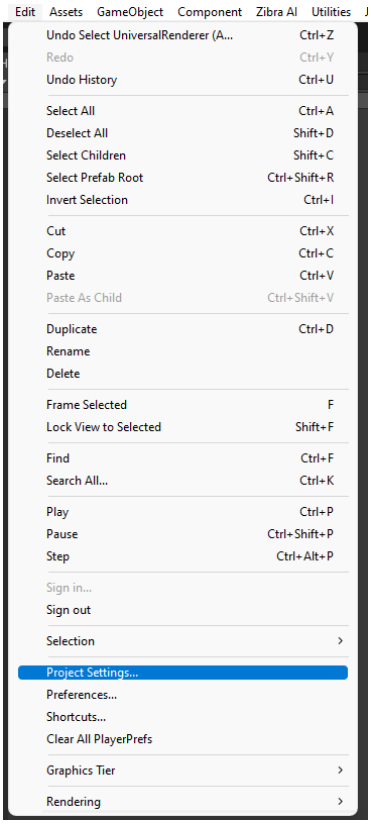
Additional setup on URP

If you are using URP you'll see those messages:

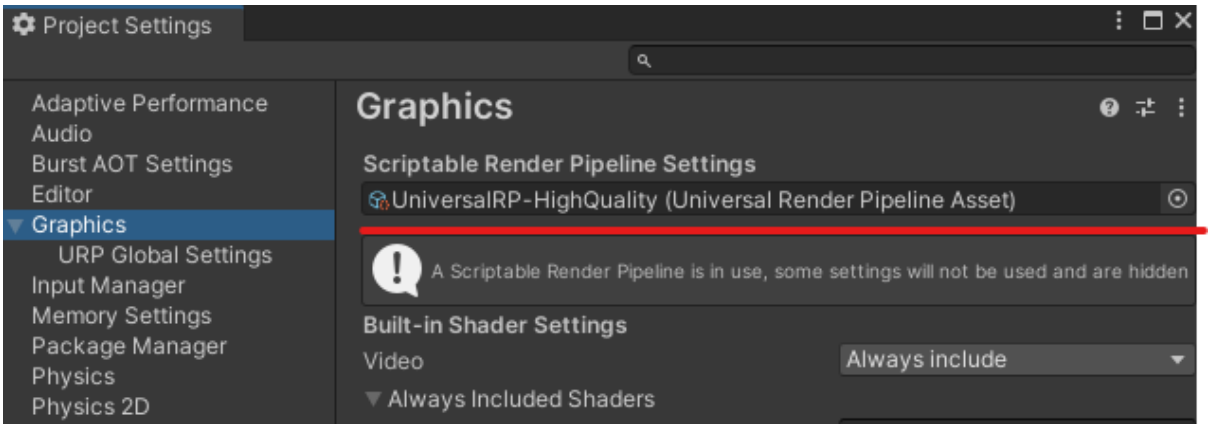


You need to add *"URP Liquid Rendering Component*" to your Universal Renderer asset. You can find your Universal Renderer asset by following these steps:

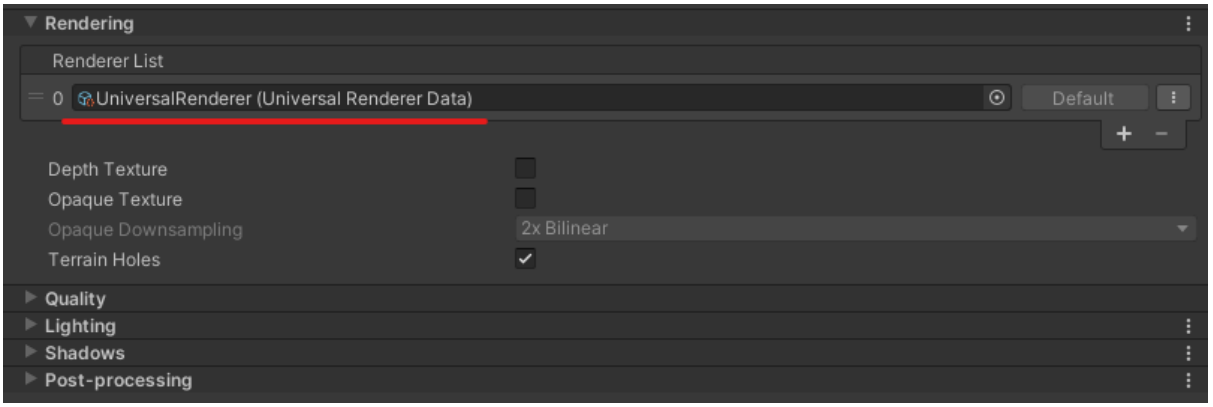
1. Navigate to *"Edit -> Project Settings…"*



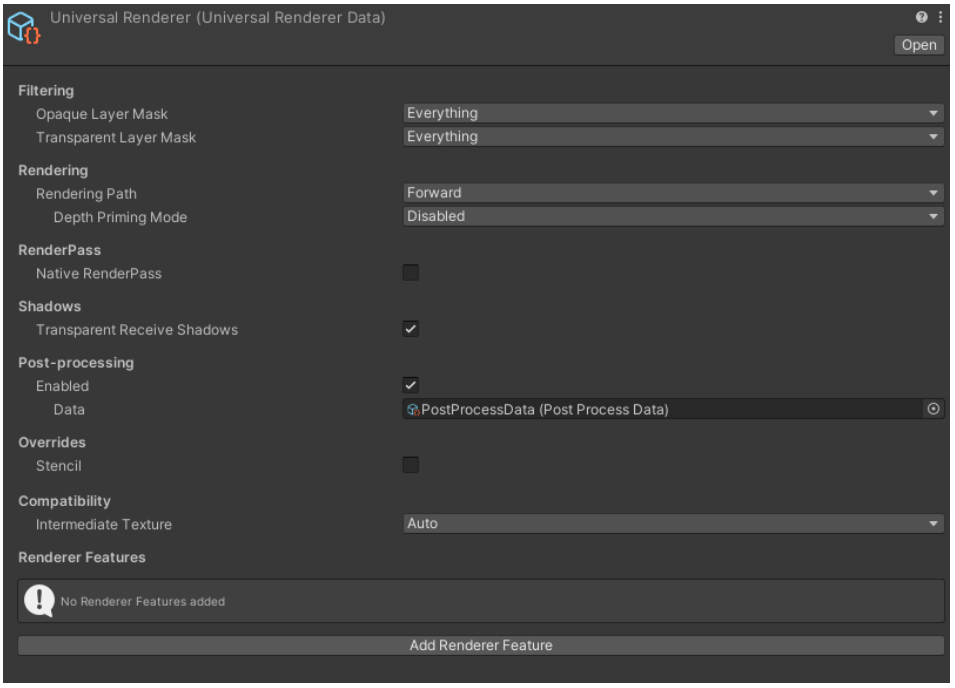
2. From there go to Graphics



3. Scriptable Render Pipeline Settings is your current Universal Render Pipeline Asset. Open that asset in Inspector (*you can do it by double clicking it in project settings*) You'll be able to see your Universal Renderer there

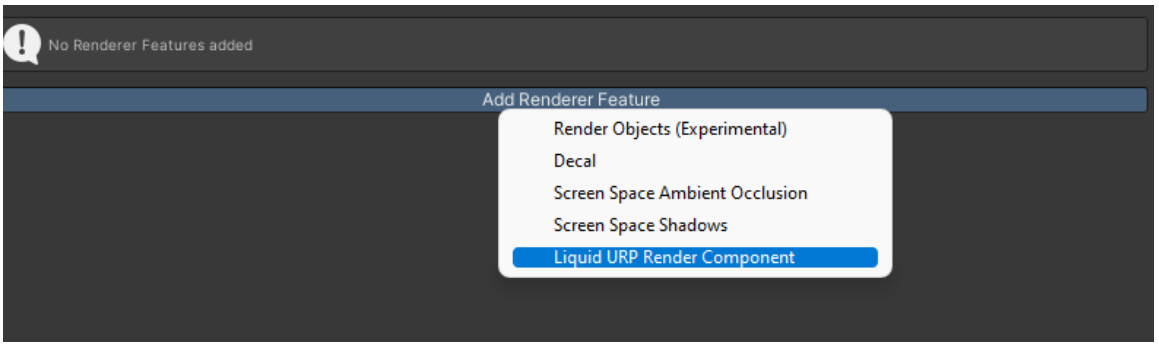


4. Open it in the Inspector *(by double clicking)*

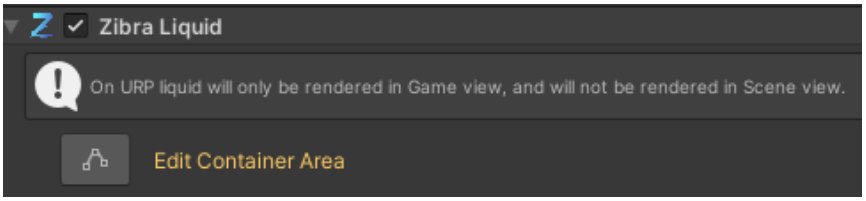


(Specific UI elements can vary from version to version)

From there you can finally add *"URP Liquid Rendering Component"*:



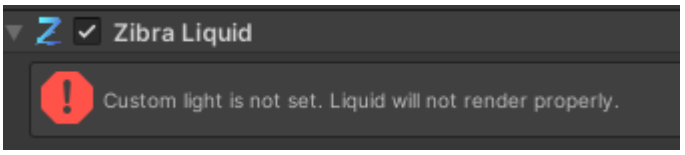
If you did everything correctly, error in Zibra Liquid will disappear:



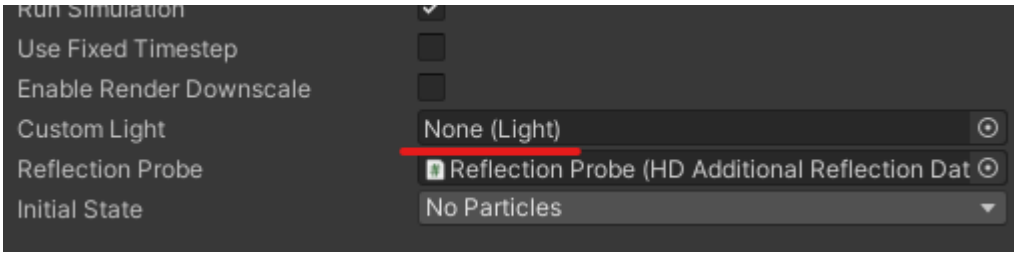
Note that adding *"URP Liquid Rendering Component"* is project wide, and is only needed once.
Lastly: on URP, liquid will only be rendered in Game view, including the baking utility.

Additional setup on HDRP

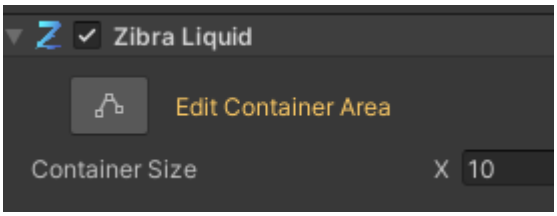
If you are using HDRP you'll see this message:



On HDRP you also need to set the Custom Light parameter.
This parameter sets which light will be used for the liquid lighting.
Currently, only 1 light can be used for lighting the liquid.

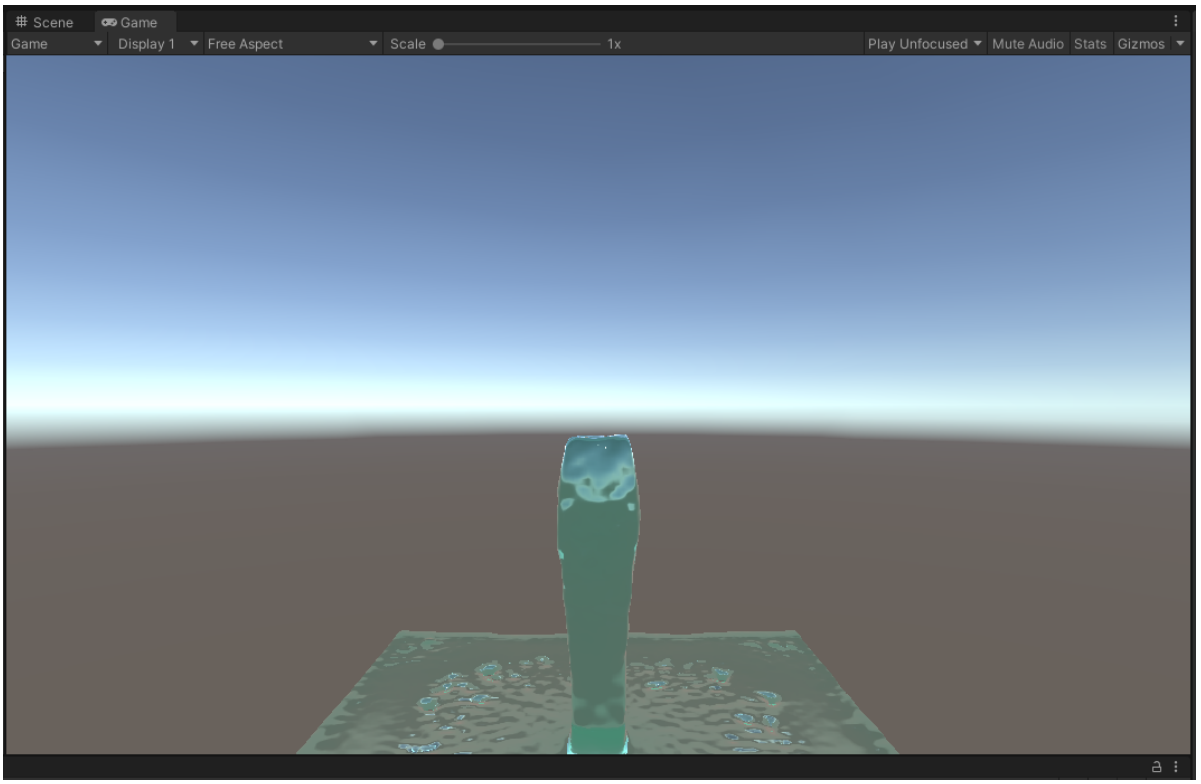


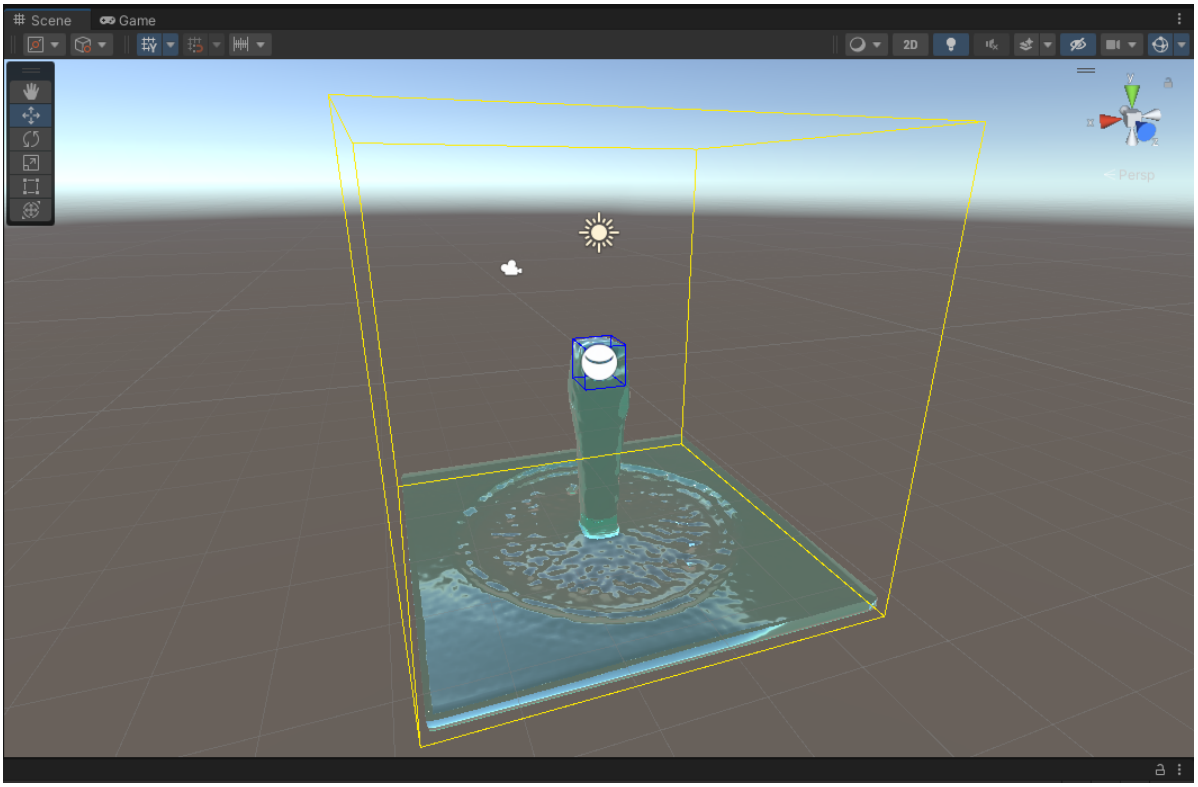
After setting the Custom Light parameter the error message will disappear:



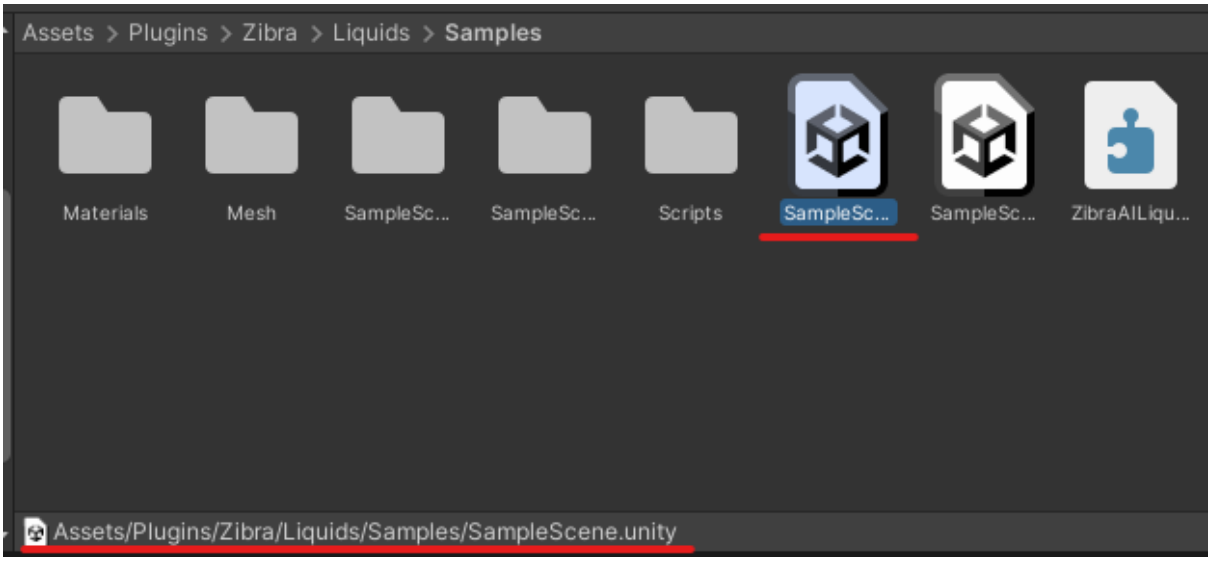
After creating Zibra Liquid

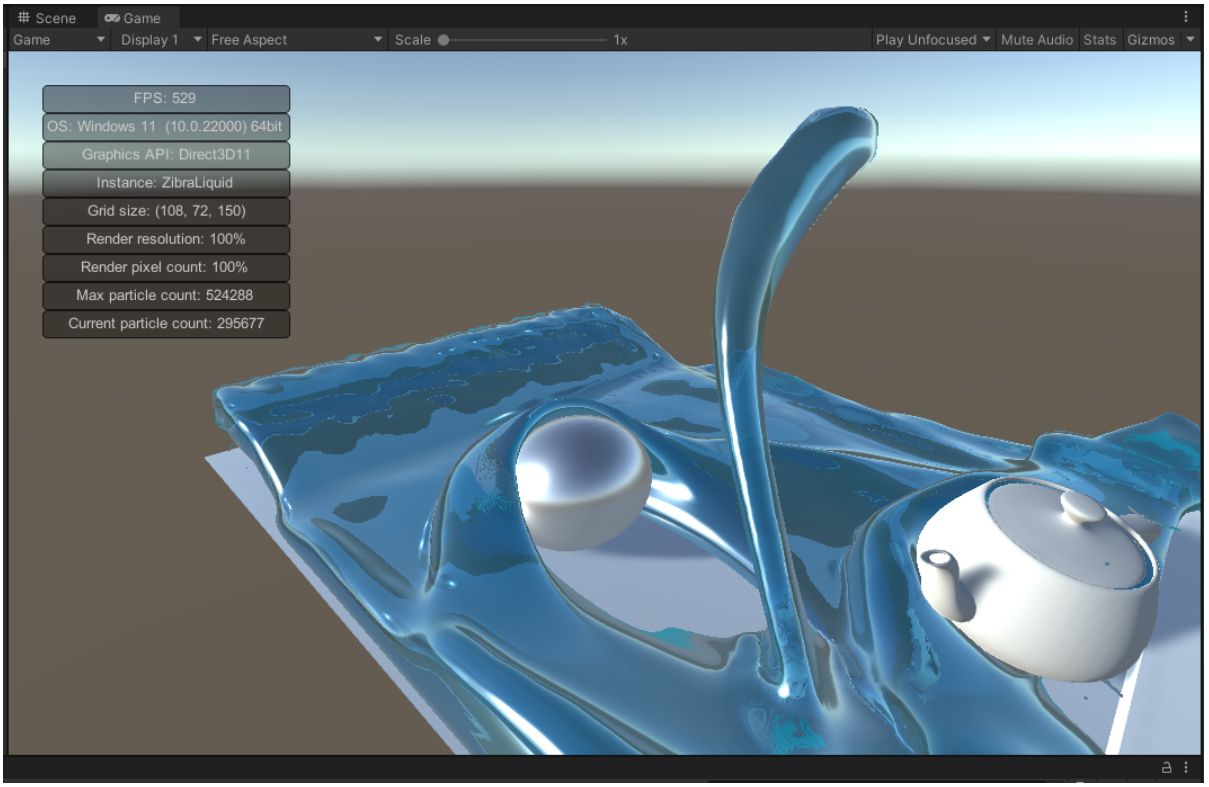
You can now press play, and see liquid (in URP you can only see liquid in Game View, on SRP/HDRP you can see liquid in both the Scene and Game Views)





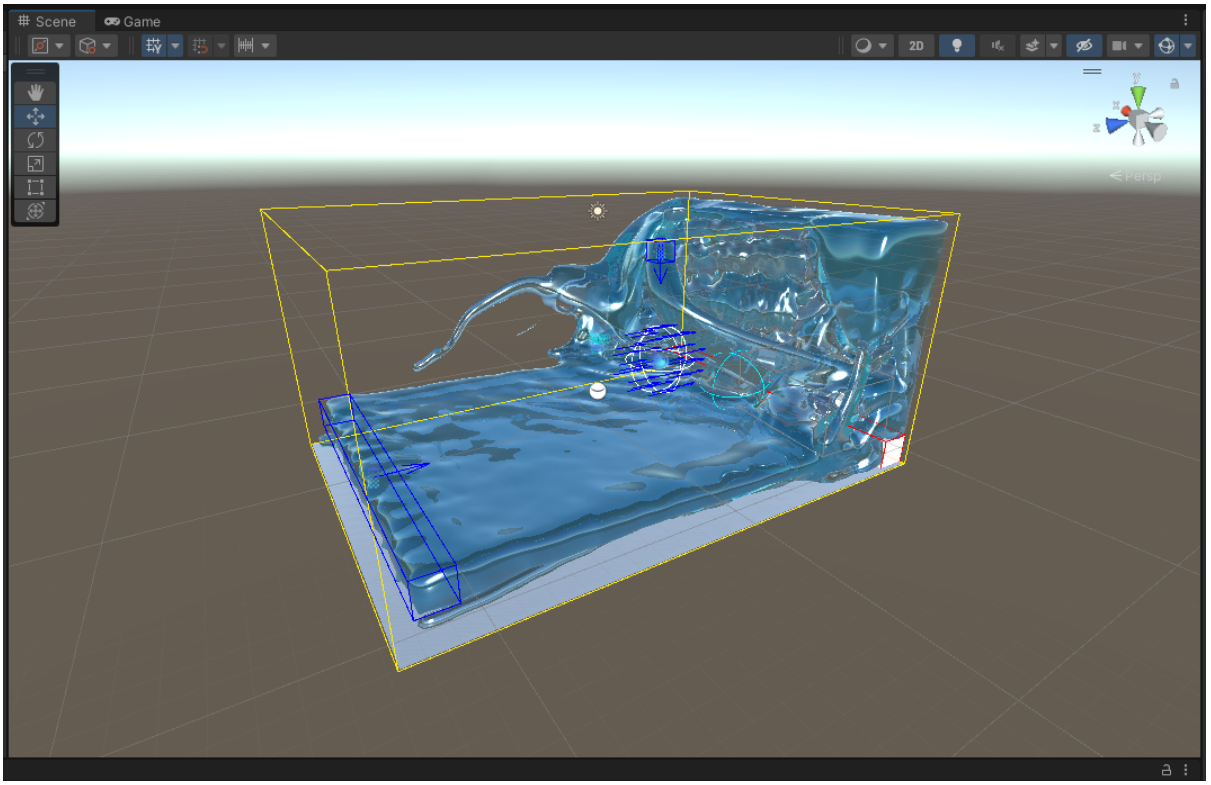
Also, you can check out how the fluid works in the built-in demo scene. To do that, open the Project window and go to *Assets -> Plugins -> Zibra -> Liquids -> Samples* and open the *SampleScene*.
Note that the sample scene is for SRP, and in URP and HDRP non liquid objects may look incorrectly.





In the sample scene you can see various features of Zibra Liquid.

You can move the camera with *WASD*, control gravity with arrows, remove gravity with *O*, increase and decrease gravity with *Shift* and *Ctrl*

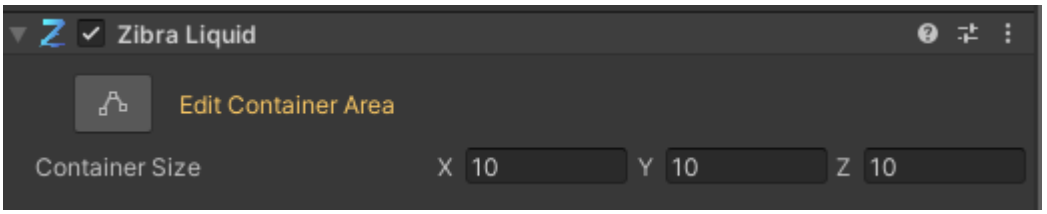


Configure Zibra Liquid

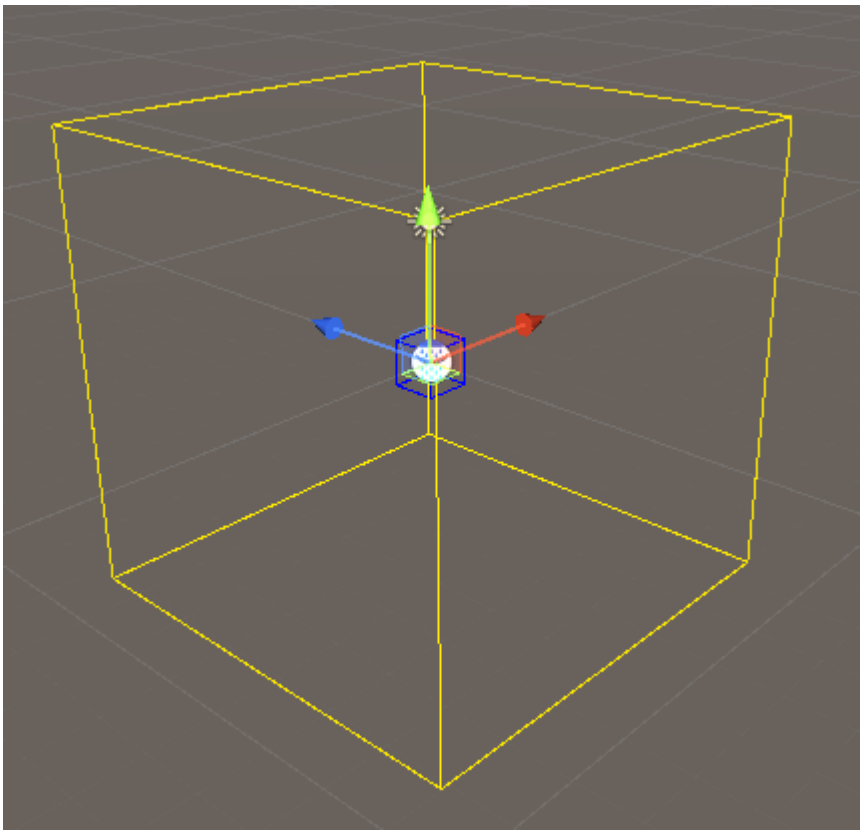
Liquid parameters

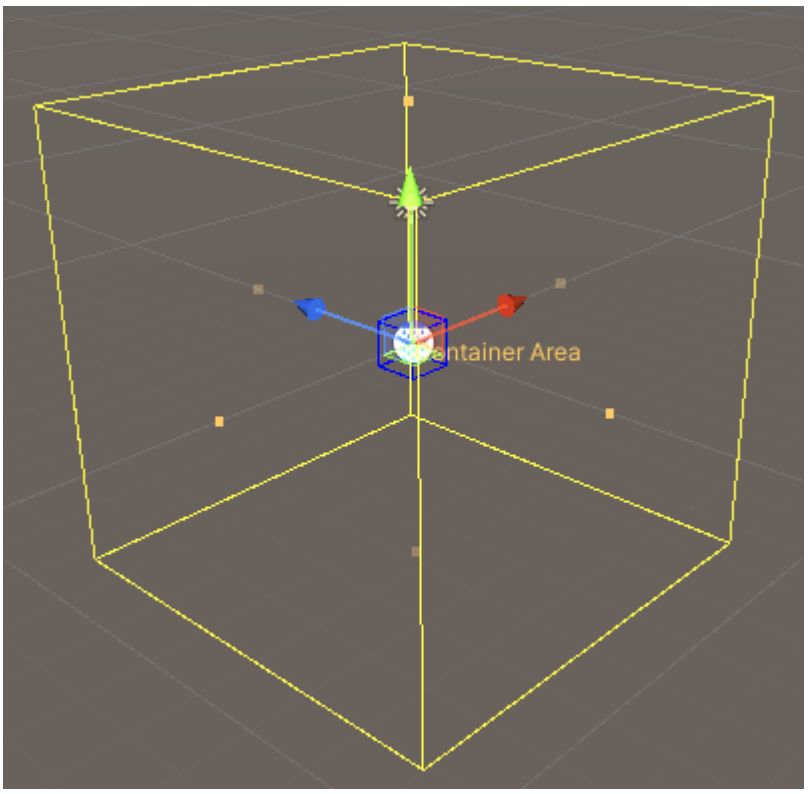
Main parameters

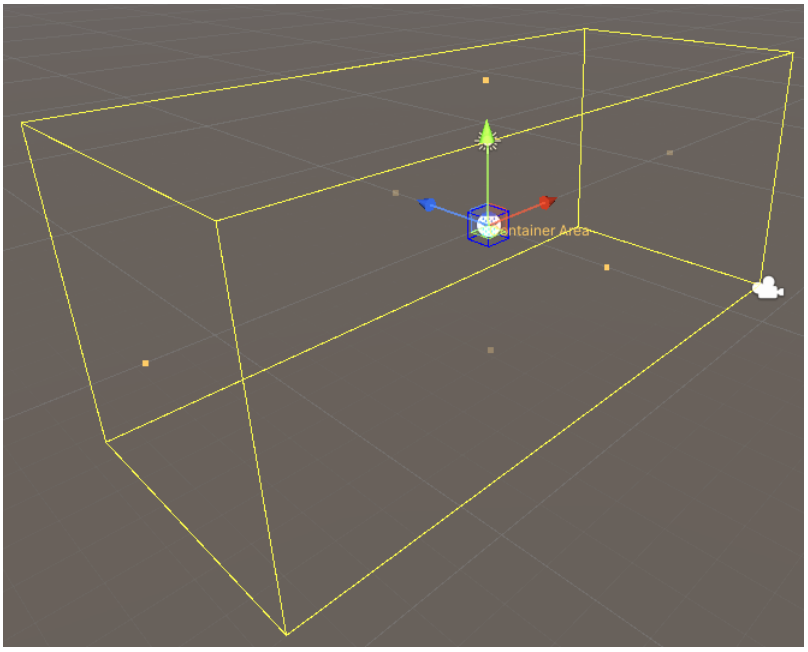
- **Container size**



The Container size parameter changes how large the simulation volume of liquid is.
You can press “Edit Container Area" to enable resizing gizmos.
This parameter cannot be changed on the “live” liquid instance.







- **Maximum allowed timestep**

This parameter specifies what the highest delta time that may be used in simulation is, when the FPS drops. If that limit is hit, liquid simulation will slow down.
Higher values correspond to less stable simulation during FPS drops, but will result in less cases when the liquid noticeably slows down.

- **Simulation speed**

This parameter controls the speed of the liquid simulation. You can slow down or speed up the liquid with this parameter.

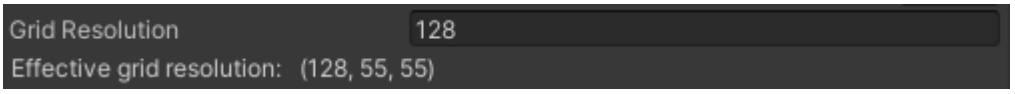
- **Iterations per frame**

Controls how many physic steps will be calculated each time. This severely affects performance, but results in slightly better simulation quality. In most cases you will want to set it to 1.

- **Max particle count**

Controls how many liquid particles a liquid instance can have at the same time. Higher values correspond to a higher possible liquid volume, but results in higher VRAM usage and a higher performance cost.
This parameter cannot be changed on the *“live”* liquid instance.

- **Grid resolution**



This parameter controls the size of the liquid simulation grid.
Higher size of the grid corresponds to a higher quality simulation, and the smaller size of each particle, but results in higher VRAM usage and a higher performance cost.
Effective grid resolution shows you the 3D size of your liquid grid. VRAM usage and performance cost scales with effective grid resolution.This parameter cannot be changed on the “live” liquid instance.

- **Run simulation**

Freezes the liquid when disabled. Also decreases performance cost when disabled, since we don’t do physics simulation.

- **Use Fixed Timestep**

Use Fixed Timestep for physics simulation. Can be used to have almost identical behavior of liquid between different runs and machines. Use with care, if the physics simulation takes more time than Fixed Timestep, performance will be severely affected.

- **Visualize Scene SDF**

Allows you to visualize analytical and neural colliders. Only works when the Current Rendering Mode is set to Particle Render.

- **Enable Render Downscale**

Enables the usage of lower resolution for liquid rendering. The Resolution scale is controlled with the “Downscale Factor”. Recommended for mobile devices.

- **Reflection probe**

Sets reflection probe used for reflection calculation on liquid. Must be set on HDRP, and it’s strongly recommended to be set on SRP/URP.

- **Current Rendering Mode**

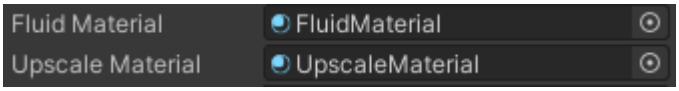
Selects which renderer is going to be used for this instance of the liquid. The default and recommended one is Mesh Render. It has better visuals, especially in regards to semi-transparent liquids. Certain options are only available in specific Render modes.

- **Current Injection Point**

Specify at which point in the render graph should liquid be rendered. Recommended options are: Before Forward Alpha if you want other transparent objects to be rendered on top of the liquid, or After Forward Alpha if you want liquid to be rendered on top of the other transparent objects.

Material parameters

- **Materials**



Materials used to shade liquid surface, and optionally upscale liquid when the Enable Render Downscale is enabled. Most users will not change that option. To use it you will need to create your own custom version of FluidMaterial, and potentially UpscaleMaterial as well. If it is set to None in Editor it will revert back to the default value.

- **Color**

Liquid color.

- **Reflection Color**

Tint for reflections on the water.

- **Roughness**

How rough is the liquid surface. Normally, for liquids that parameter is really low.

- **Metalness**

How metallic (reflective) the liquid surface is.

- **Scattering amount**

Defines how much light gets scattered inside the liquid. Higher values correspond to more opaque murky liquid. Only used in Mesh Render.

- **Absorption amount**

Defines how much light gets absorbed inside the liquid. Higher values correspond to more opaque liquid.

- **Index of Refraction**

Determines how refracted the light coming through the liquid will be.

- **Fluid Surface Blur**

Determines how smooth the surface of liquid will appear.

- **Particle scale**

Scale for particle rendering. Lower values correspond to more detail, but more artifacts. Needs to be at least ~1.5 to achieve a believable render. If set to very low values you'll see each individual particle. Does not affect simulation, it only

affects rendering. Only used in Particle Render.

- **Foam parameters**

Configure what the threshold is for foam appearance and how intensive it is. Only used in Particle Render.

- **Blur radius**

Configures how strong the particle blur is. Lower values result in more detail, but the individual particles become more distinct. Only used in Particle Render.

Advanced Material parameters

- **Refraction Quality**

Configures how the refraction will be calculated, for each vertex or for each pixel. Per Pixel Render has higher quality but also higher performance impact. Only used in Mesh Render.

- **Refraction Bounces**

Configures how many refraction bounces will be calculated. Two Bounces has higher quality, especially when underwater, but also has a higher performance impact. Only used in Mesh Render.

- **JFA Iterations**

Configures how many iterations of the JFA algorithm used for Particle render will be executed. Higher values correspond to less pixel artifacts when close to the liquid. Higher values have a high performance impact. Only used in Particle Render.

- **Vertex/Mesh optimization parameters**

Configures how much smoothing will be applied to the liquid surface. Higher

iterations count corresponds to higher quality but has a slightly higher performance impact. Higher Step values correspond to more smoothing but potentially more artifacts. You can set all those values to 0 to get voxel liquid. Only used in Mesh Render.

- **Iso Surface Level**

Configures how thick the surface of liquid will appear.

- **Raymarching parameters**

Configures how liquid is raymarched for refraction/liquid depth calculations. If misconfigured it can result in opaque liquid or bad refraction. Higher values of Iso Surface parameter correspond to thicker liquid surface for the purpose of that calculation. Higher Max Steps count corresponds to higher quality and less artifacts but has higher performance impact. Higher values of Step Size and Step Factor allow you to decrease Max Steps parameters, but corresponds to more artifacts.

Solver parameters

- **Gravity**

Gravity that affects the entire liquid.

- **Fluid stiffness**

Configures how stiff the liquid appears (how resistant it is to compression). Higher values are not recommended.

- **Particle density**

Configures the resting particle density. Higher values result in smaller particles, which result in higher quality, but smaller liquid volume.

- **Velocity limits**

Limits the maximum/minimum velocity of the particles. Setting minimum velocity to values higher than 0 results in liquid that will never stop.

- **Viscosity**

Configures how viscous the liquid is (how hard it is to change the shape of the liquid)

- **Surface tension**

Configures the surface tension of the liquid. Higher values result in liquid that tries to merge together. Negative values result in liquid that tries to split into as many small liquid parts as possible, resulting in a spaghettification effect.

- **Force interaction strength**

Scales the force that the liquid applies to objects with force interaction enabled. This has a logarithmic scale.

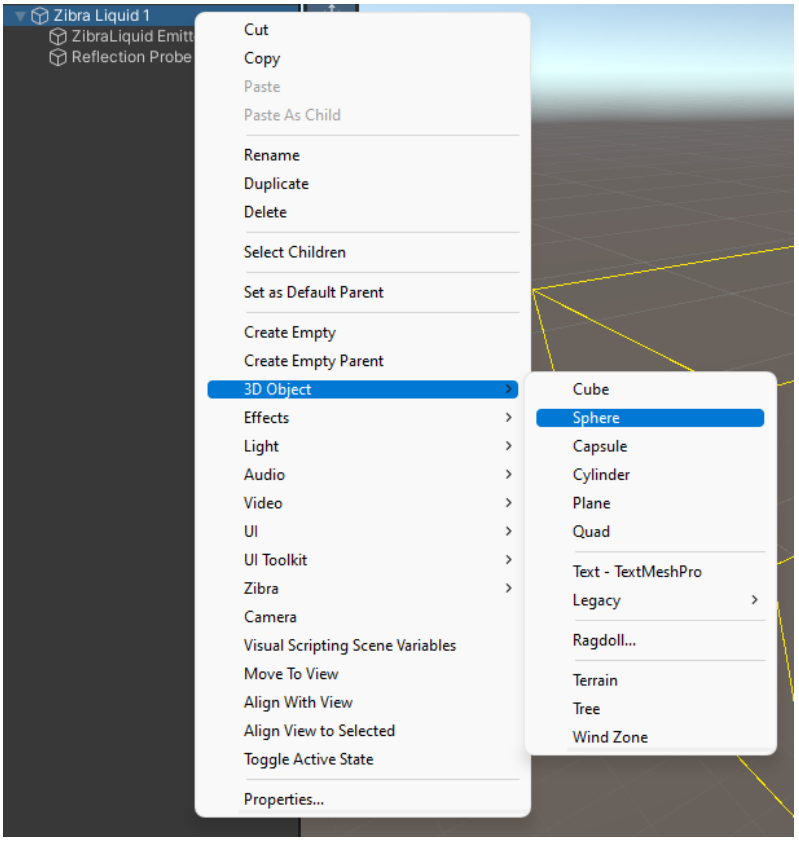
Colliders

Zibra Liquid has 2 types of colliders: Analytic and Neural colliders.
Analytic colliders are simple shapes: cubes, spheres, capsules, torus, cylinders.
Neural colliders are created from arbitrary mesh.

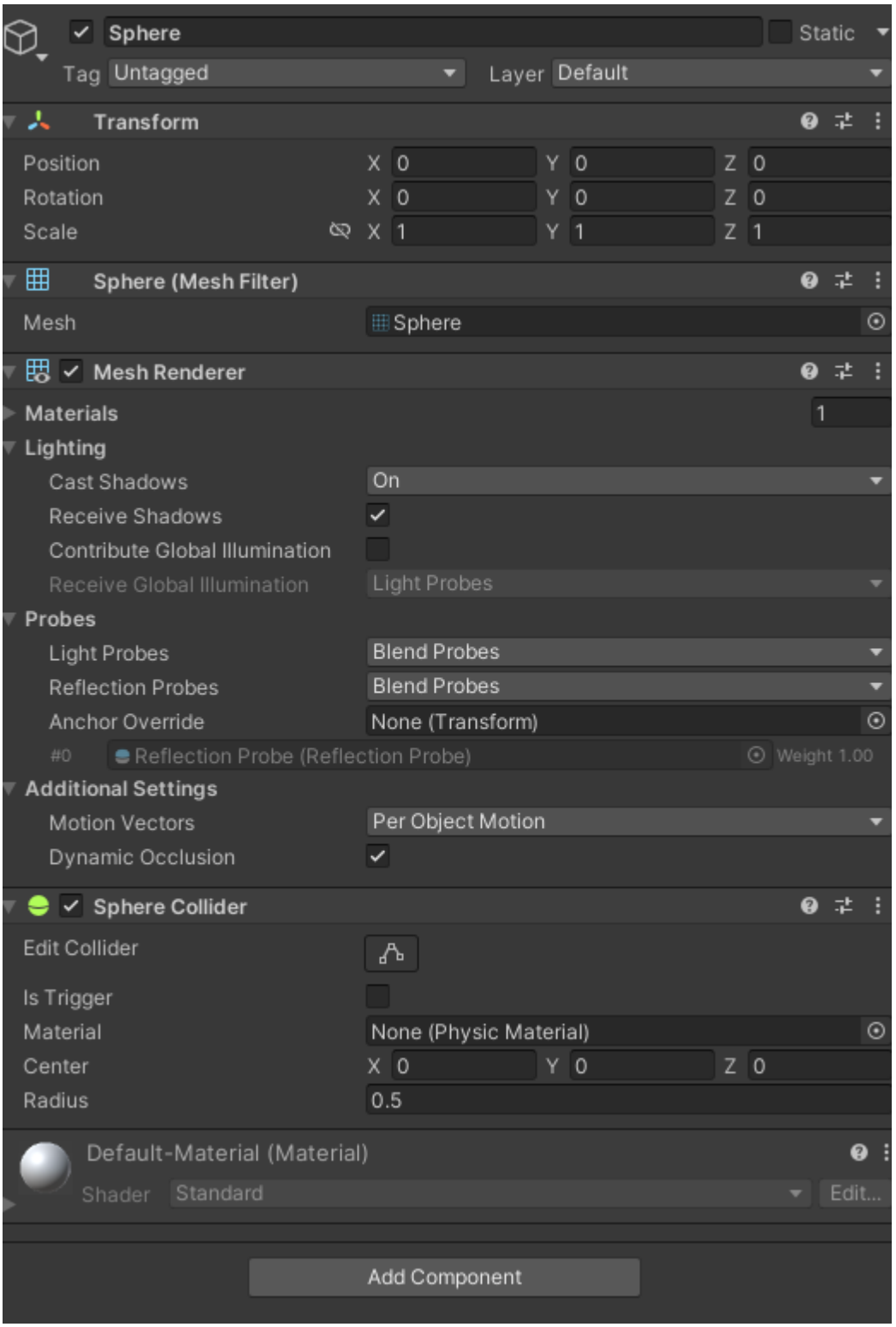
Adding Analytic Colliders

To add analytic collider:

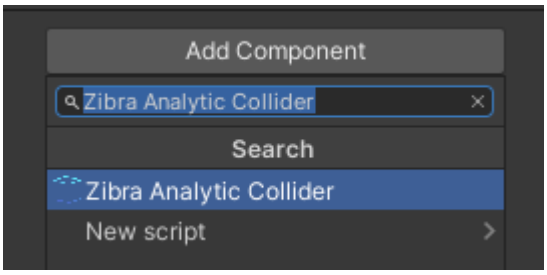
1. Create a new GameObject, either of your selected shape or an empty one:



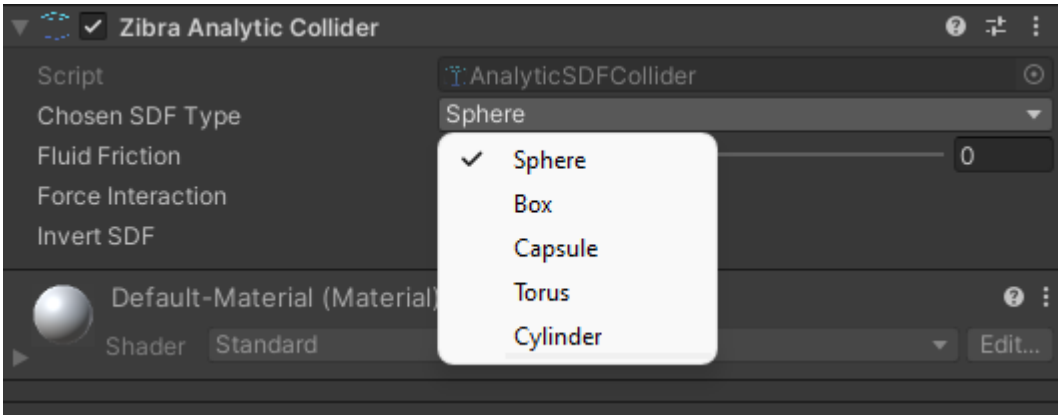
2. Open Inspector for newly created GameObject



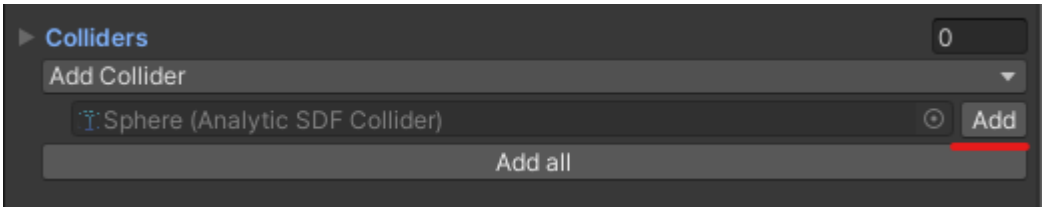
3. Press add component, and add “Zibra Analytic Collider”



4. Select the correct “Chosen SDF Type”

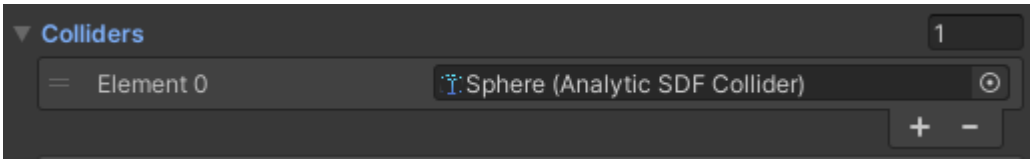


5. Open the Inspector window for Zibra Liquid and Press the Add button for your newly created collider.

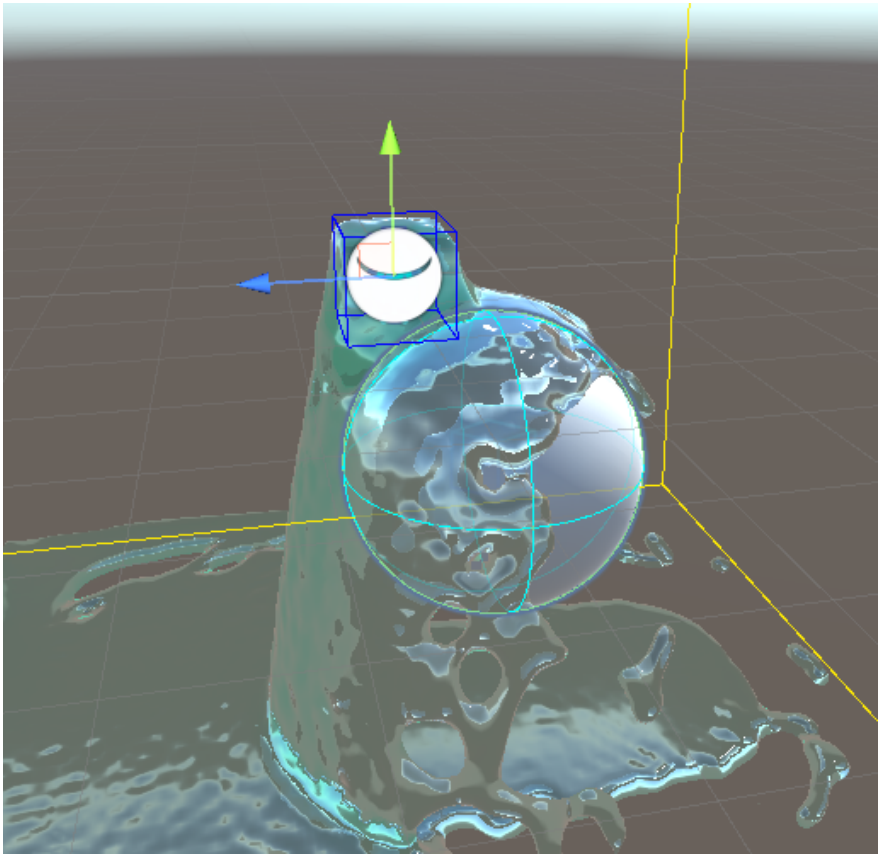


Note that you may have multiple liquid instances within a single scene, with a separate list of colliders. So you don’t necessarily need to add all of the colliders to your liquid instance if you have more than 1 liquid instance.

6. You can now expand the full list of Colliders and see your colliders there



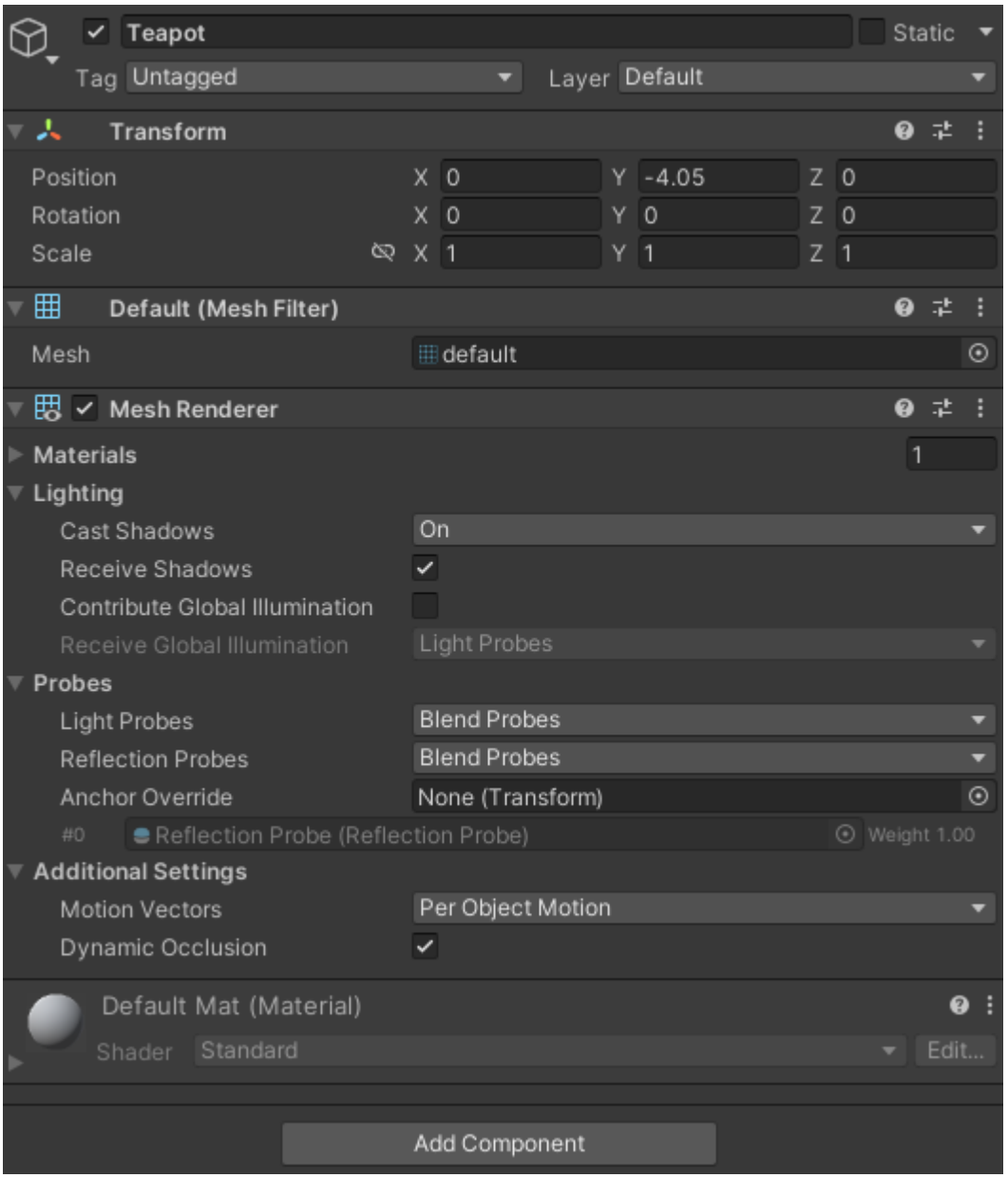
After that your collider is ready to be used. You can set its transform in the editor, or move it at runtime.



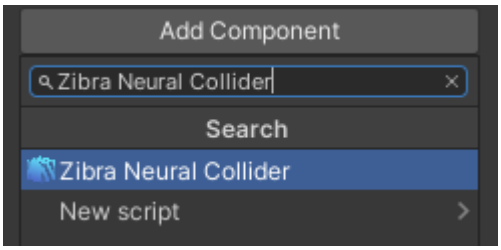
Adding Neural Colliders

Before you can use the Neural Colliders functionality you need to register the plugin: [Registering Zibra Liquids]
To add a neural collider you first need to have the mesh that you want the water to collide with. In this example we'll use a teapot as an example.

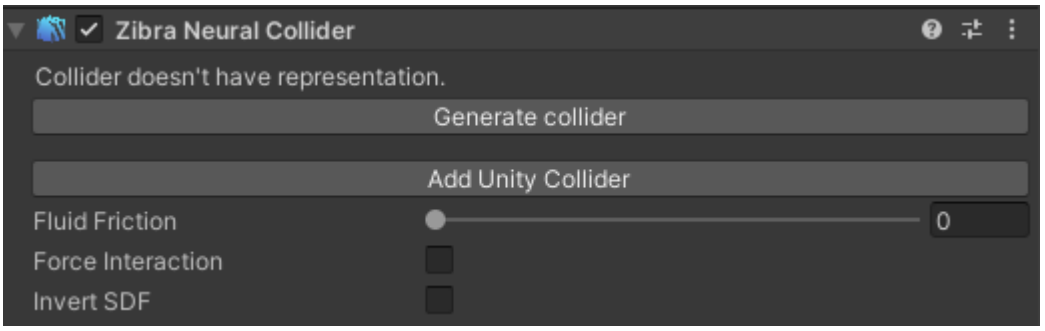
1. Open your GameObject with MeshFilter in Inspector



2. Press “Add Component” and select “Zibra Neural Collider”

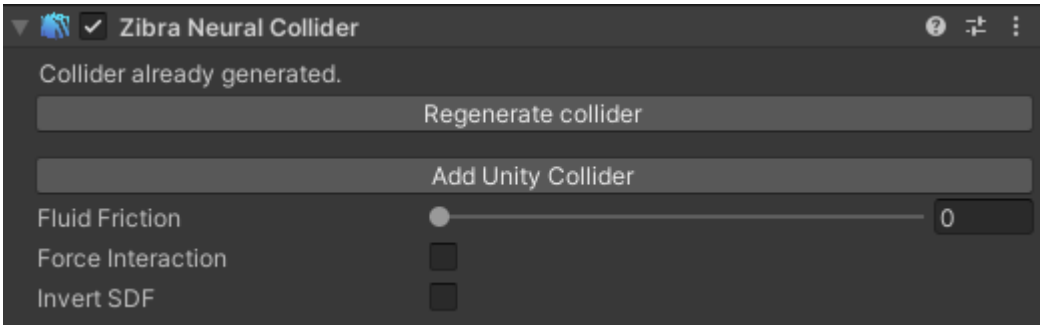


3. You should see these buttons:

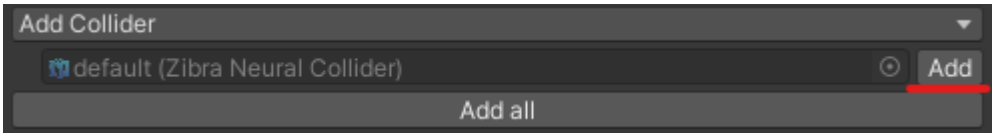


If you don't see them, you probably haven't registered your plugin yet. Register your plugin: Registering Zibra Liquids and try again.

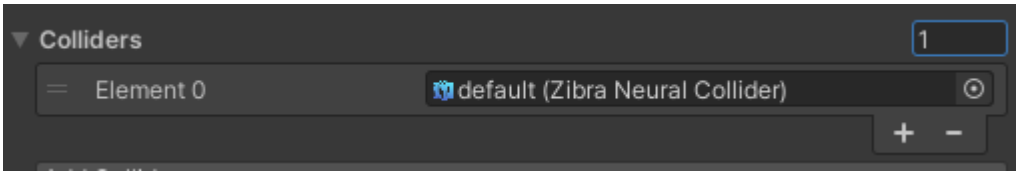
4. Press Generate Collider. This will send your mesh to ZibraAI servers for processing. This will generate neural representation for your mesh. After the generation has finished you'll see a message: "Collider already generated", as well as the VRAM footprint of the collider.



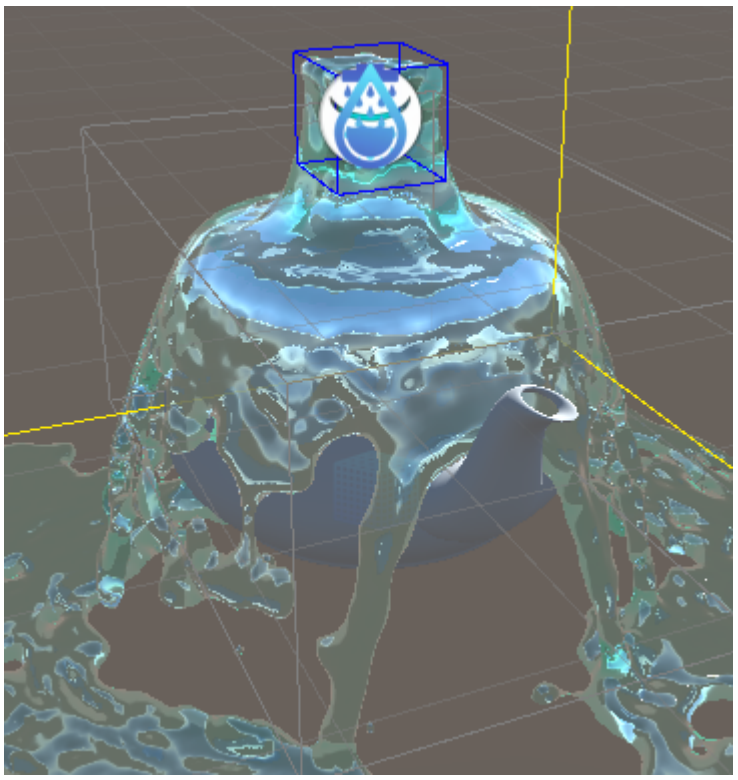
5. Open the Inspector window for Zibra Liquid and Press the Add button for your newly created collider.



6. You can now expand the list of Colliders and see your colliders there



Now your collider is ready to be used. You can set its transform in the editor, or move it at runtime.



Collider parameters

- **Fluid Friction**

  Controls the surface friction of the collider, used for liquid interaction.

- **Force Interaction**

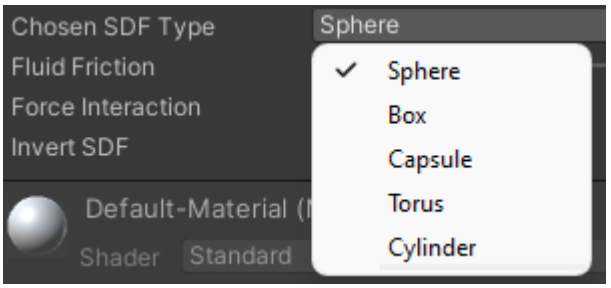
  Controls whether liquid can apply force back to the object. You need to add a rigidbody component to the object that has a collider for liquid to apply force to.

- **Inverse SDF**

  “Inverts” the collider. E.g. in the case of a sphere, liquid will only be allowed inside of that sphere.

- **Chosen SDF Type** ***(Analytic only)***



Select the shape of the Analytic collider.

- **Generate Collider/Regenerate Collider** ***(button, Neural only)***

Generates a new, or regenerates an existing Neural collider. You'll need to manually regenerate the collider if you change the mesh.

- **Add Unity Collider** ***(button, Neural only)***

Adds a Mesh collider, for the GameObject to collide with other meshes. Not required if you don't want liquid colliders to collide with non liquid objects. Only shown if you don't already have a Mesh collider.

Manipulators

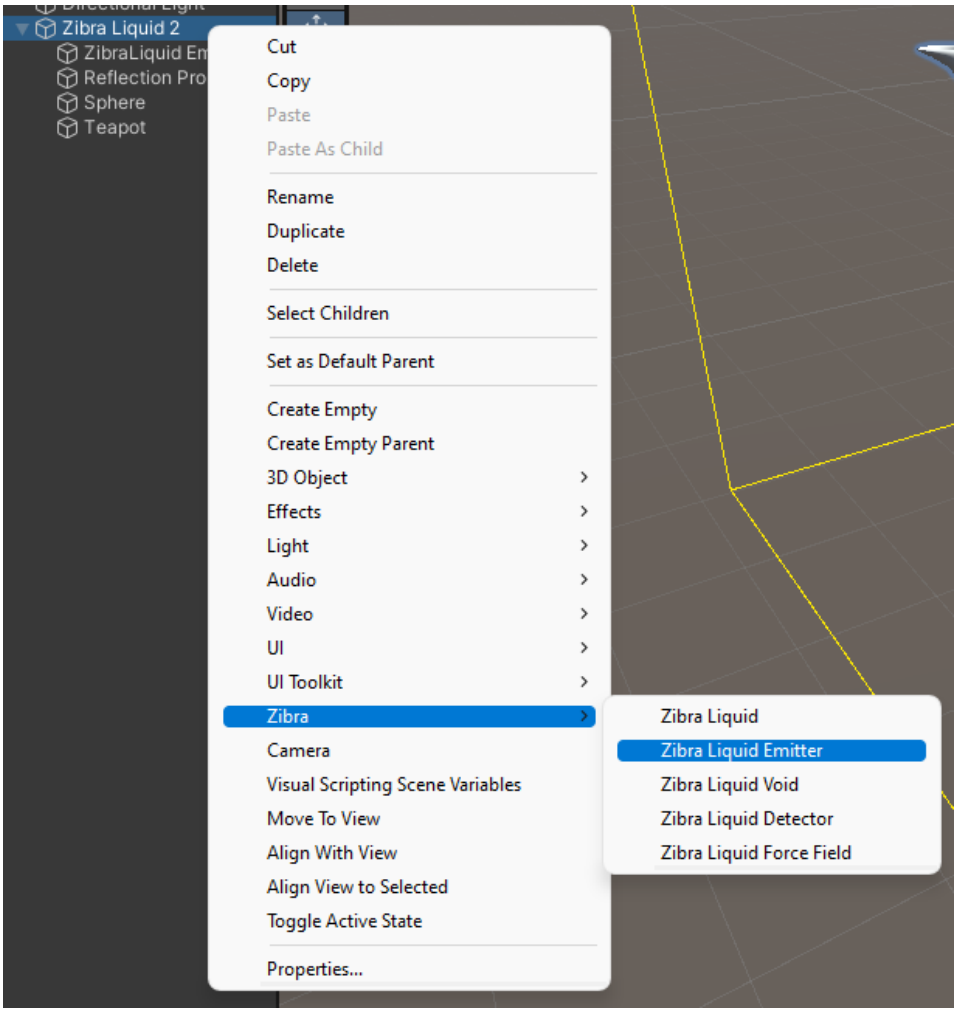
Zibra Liquid has many kinds of manipulators: Emitter, Void, Detector, Force Field

Emitter

Liquid emitters are used for emitting liquid, if you want to spawn liquid you need these. When you first create Zibra Liquid, the Emitter is automatically created and added to it. If you don't need additional ones you can skip adding additional emitters and go right to Emitter parameters

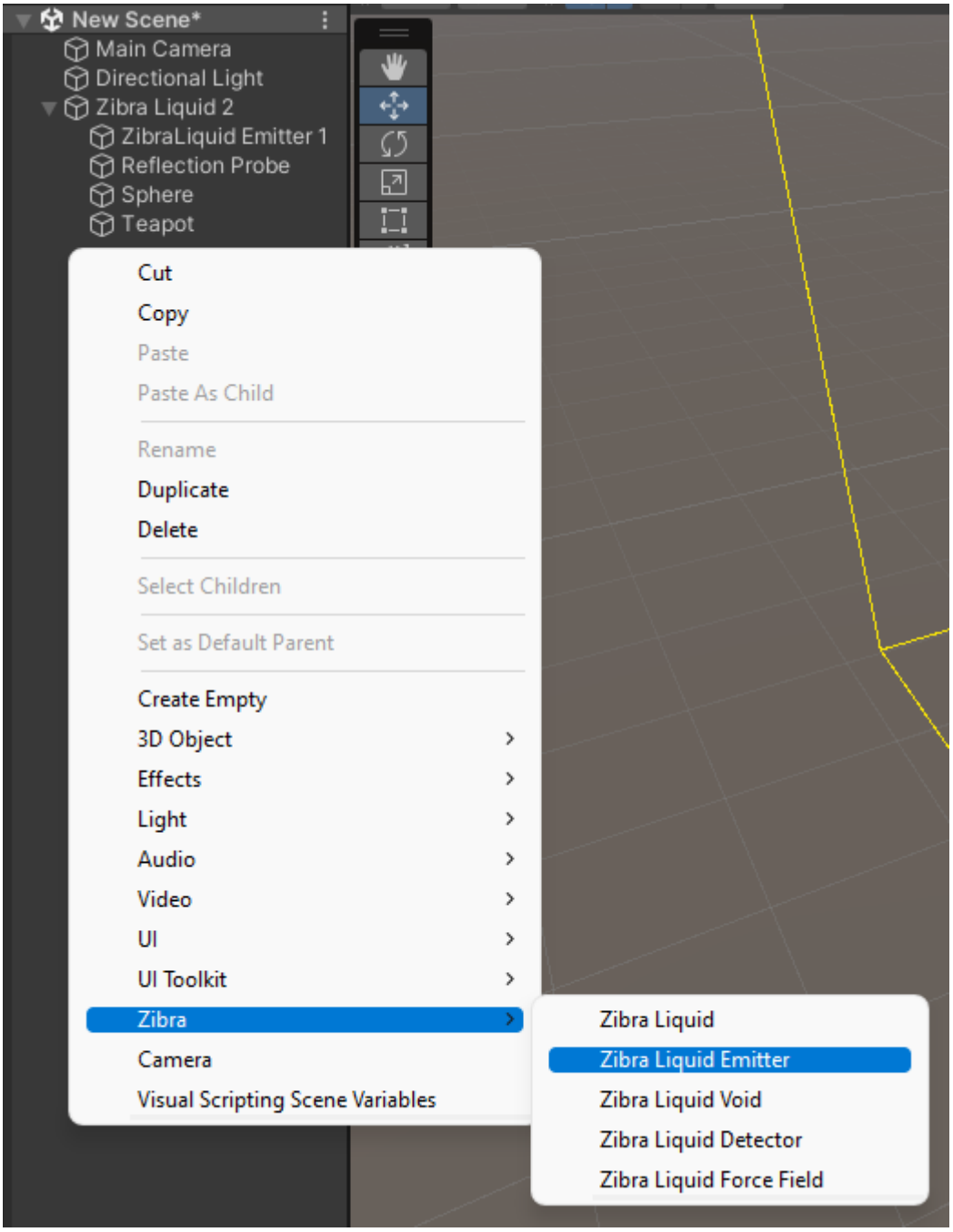
Adding Emitter

1. Right click on your Zibra Liquid instance, and select Zibra -> Zibra Liquid Emitter

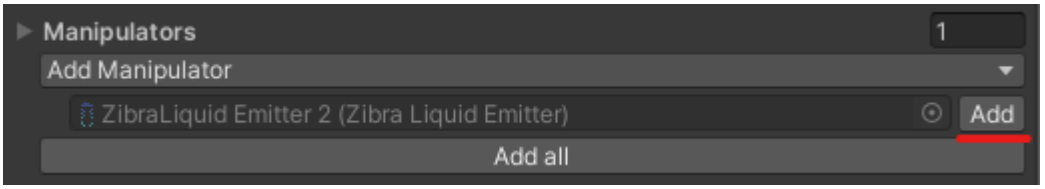


That will automatically add a new emitter to your liquid.
Alternatively, you can:

1. Right click in Hierarchy *(not on the Zibra Liquid instance*) and select *Zibra -> Zibra Liquid Emitter*

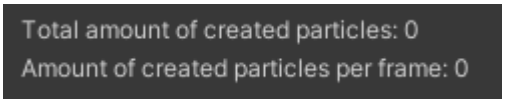


2. Open your Zibra Liquid instance in Inspector, and press the *"Add"* button for your newly created emitter, under the Manipulators list.



Emitter parameters

- **Emitter statistics *(read only)***

  When you start the play mode you'll be able to keep track of how many particles were emitted. You can also access those values via scripts, via *"createdParticlesTotal"* and *"createdParticlesPerFrame"* attributes.

- **Volume Per Sim Time**

  Amount of liquid that is emitted per unit of Simulation Time.

- **Initial Velocity**

  Initial speed of the generated particles.

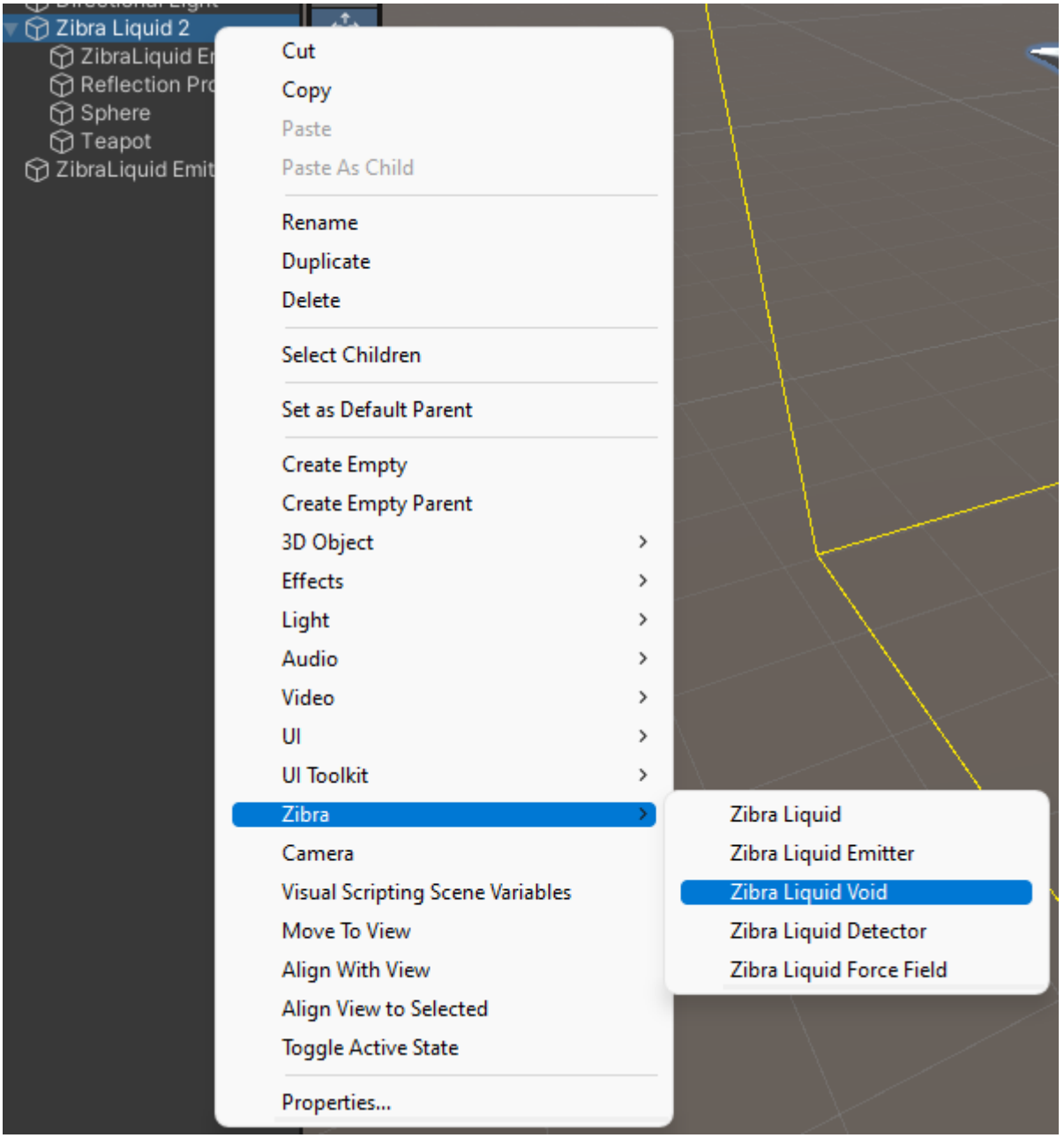
- Emitter's transform changed via changing GameObject's transform.

Void

Voids are used to destroy liquid. Since there's a limit to the maximum number of particles in Zibra Liquid instance, you need to destroy particles for your emitters to keep emitting liquid continuously. But if it's fine for you that the emitters will stop at some point, the usage of voids is optional.

Adding Void

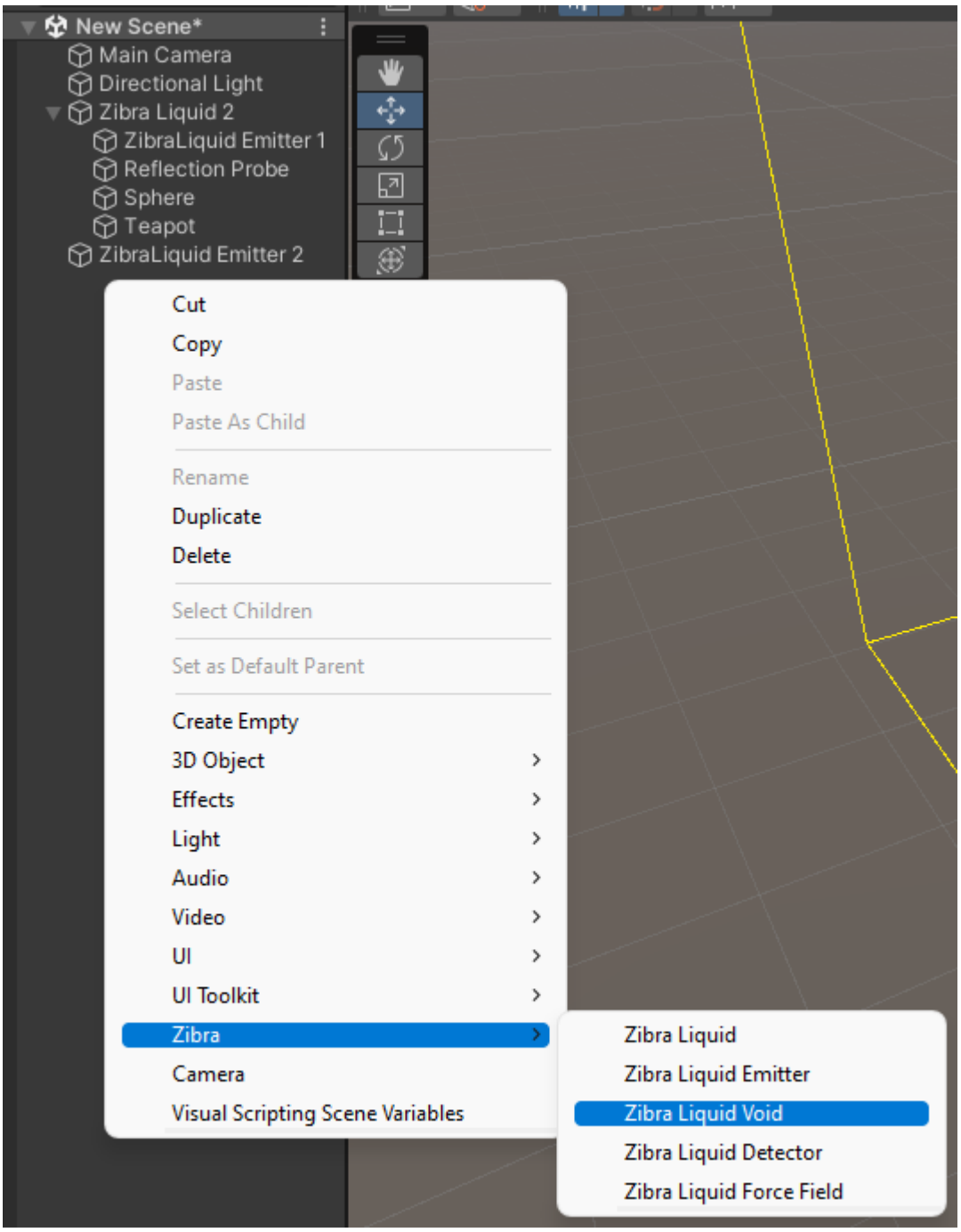
1. Right click on your Zibra Liquid instance, and select *Zibra -> Zibra Liquid Void*



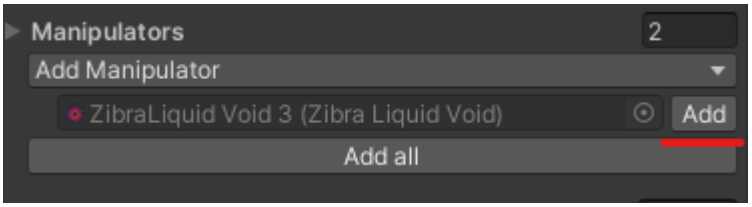
That will automatically add a new void to your liquid.

Alternatively, you can:

1. Right click in Hierarchy *(not on the Zibra Liquid instance)* and select *Zibra -> Zibra Liquid Void.*



2. Open your Zibra Liquid instance in Inspector, and press the “Add” button for your newly created void under the Manipulators list.



Void parameters

- **Void statistics *(readonly)***

  Total amount of deleted particles: 0
  Deleted particles per frame: 0

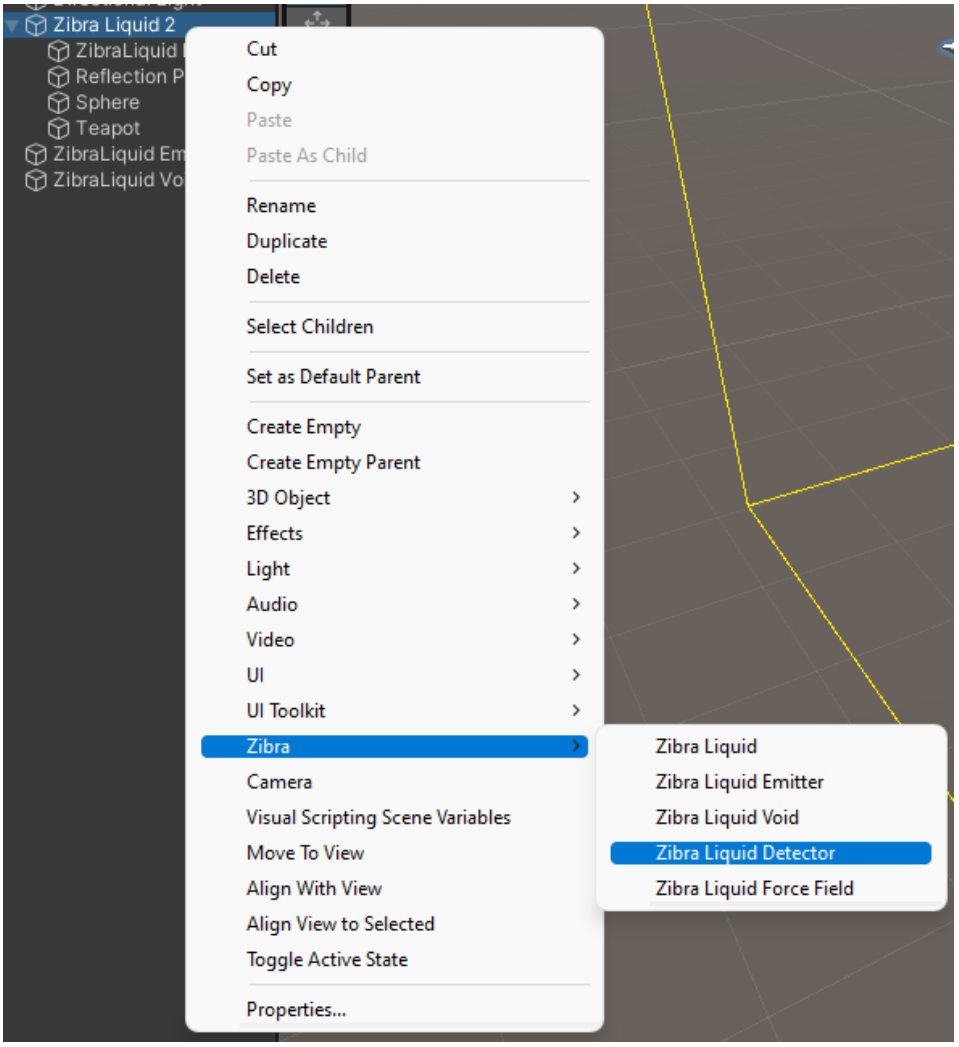
  When you start play mode you'll be able to keep track of how many particles were deleted. You can also access those values via scripts, via *"deletedParticleCountTotal"* and *"deletedParticleCountPerFrame"* attributes.
- Void's transform changed via changing GameObject's transform

Detector

Detector is used to detect how many liquid particles are in a specified volume.

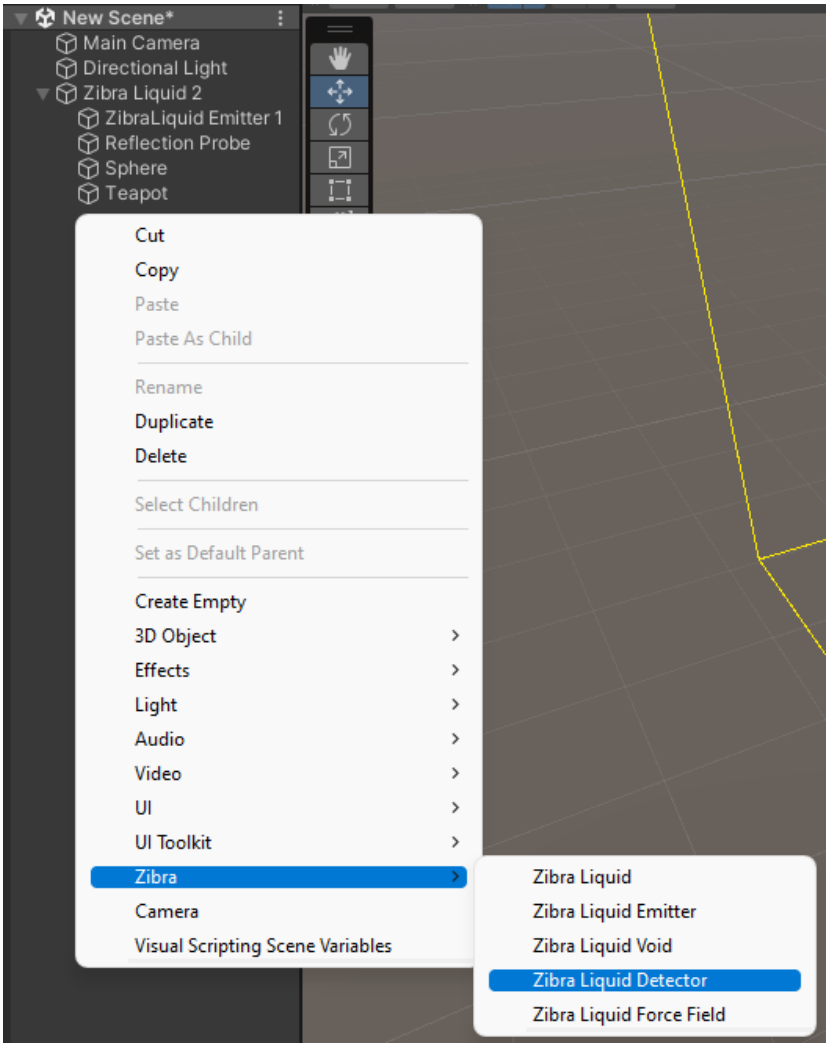
Adding Detector

1. Right click on your Zibra Liquid instance, and select Zibra -> Zibra Liquid Detector

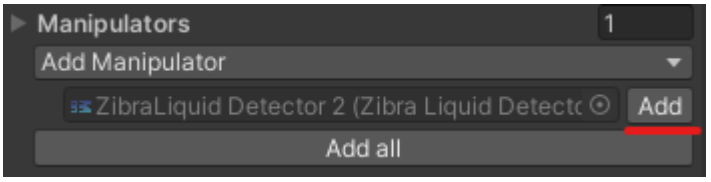


That will automatically add a new detector to your liquid.
Alternatively, you can:

1. Right click in Hierarchy *(not on Zibra Liquid instance)* and select *Zibra -> Zibra Liquid Detector*



2. Open your Zibra Liquid instance in Inspector, and press the *“Add”* button for your newly created Detector under Manipulators list.



Detector parameters

- Detected particle count (read only)

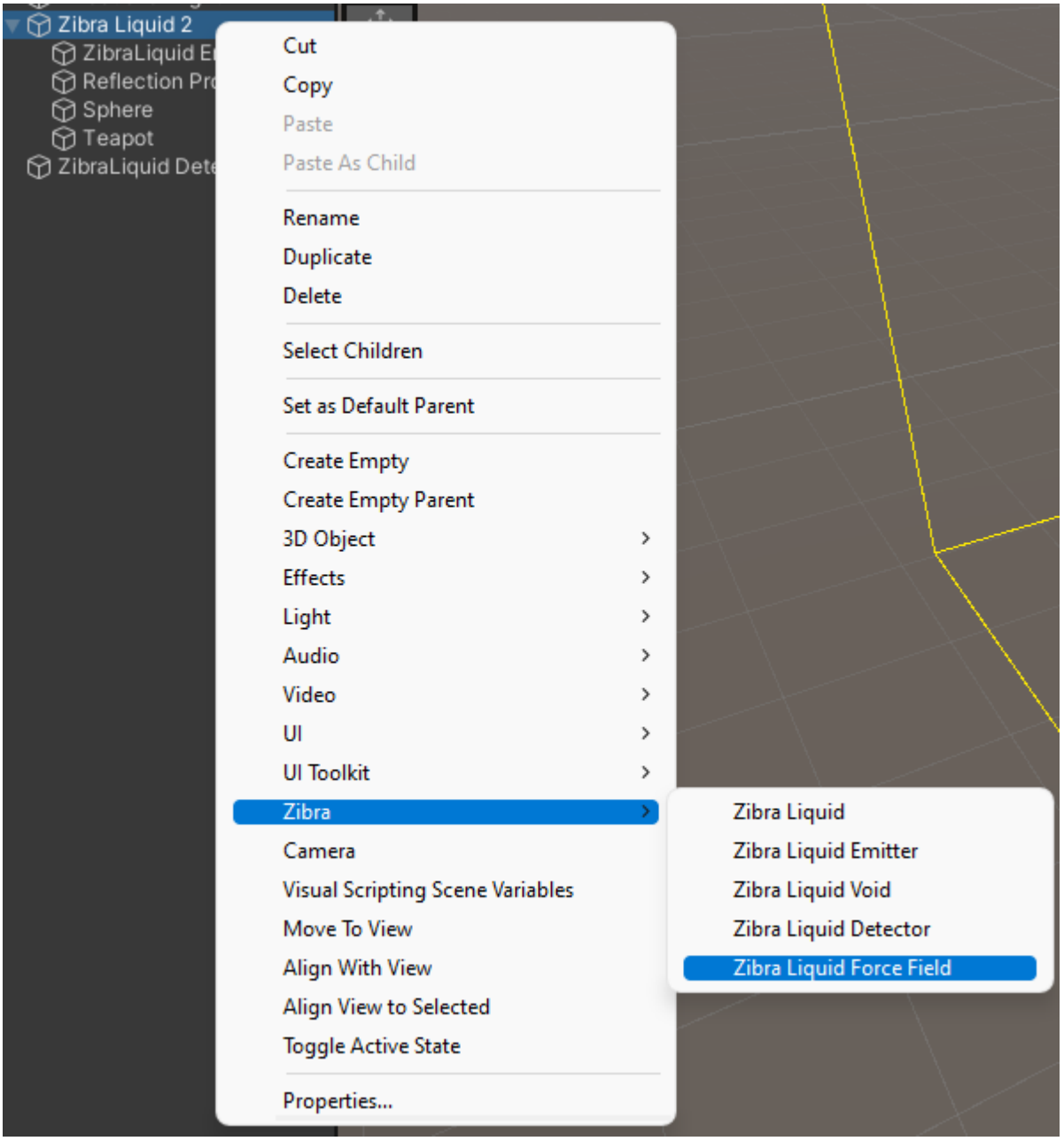
  When you start play mode you’ll be able to keep track of how many particles are inside the detector. You can also access those values via scripts, via the “particlesInside” attribute.
- Detectors' transform changed via changing GameObject’s transform.

Force Field

Force fields are used to apply force to liquid in a specific way, and in a specific region. You can for example use force fields to create radial gravity, to use instead of the default vector one. Or you can create a fountain by putting a force field that pushes liquid up in the body of water.

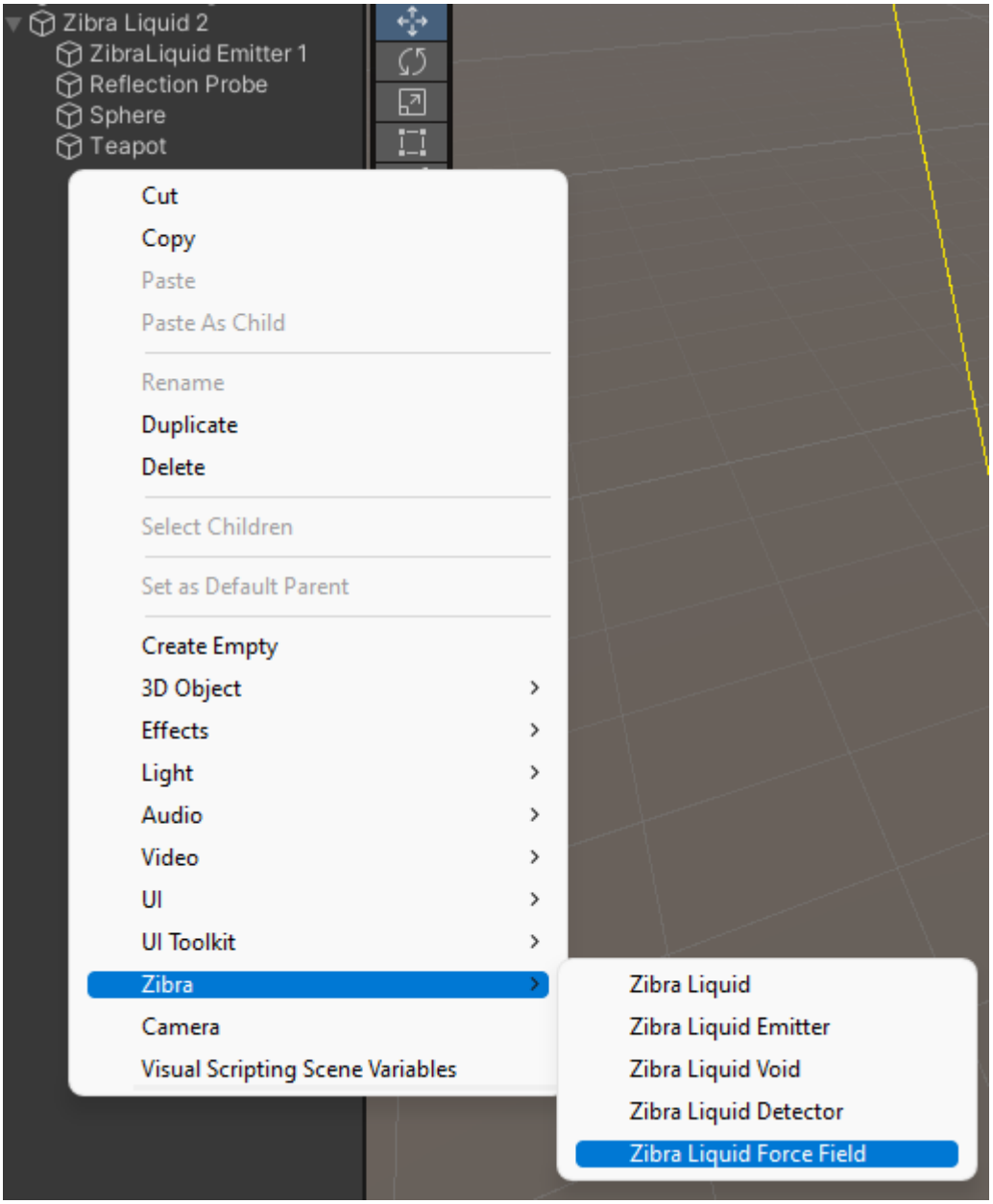
Adding a Force Field

1. Right click on your Zibra Liquid instance, and select Zibra -> Zibra Liquid Force Field

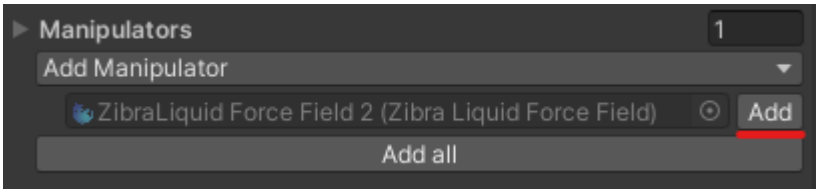


That will automatically add a new detector to your liquid.
Alternatively, you can:

1. Right click in Hierarchy (not on Zibra Liquid instance) and select Zibra -> Zibra Liquid Force Field



2. Open your Zibra Liquid instance in Inspector, and press the “Add” button for your newly created Force Field under Manipulators list.



Force Field parameters

- **Type**

Configures how Force Field applies force to liquid.
Radial - pushes or pulls liquid towards the Force Field.
Directional - pushes liquid in a specified direction.
Swirl - creates a whirlpool force around the Force Field.
In the case of the Directional and Radial settings, the direction can be adjusted by rotating the Force Field.

- **Shape**

Configures which shape the Force Field will have. Important for the distance between the particle and Force Field calculation.

- **Strength**

Configures how strong the strength of the force applied by Force Field will be. Can be negative to reverse direction. (For radial type, positive force is pulling, and negative is pushing)

- **Distance decay**

Configures how fast the force strength decays with the distance from the Force Field.

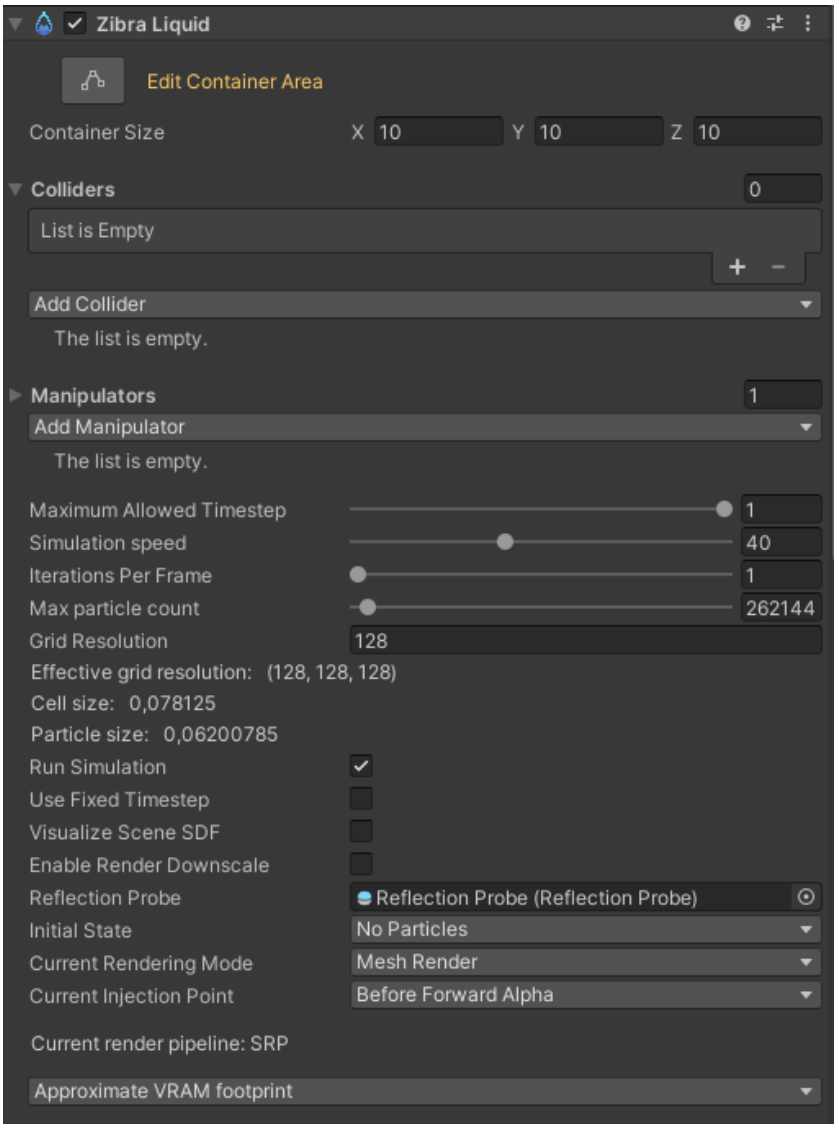
Liquid Initial State Baking (experimental)

If you want to have a Zibra Liquid instance pre-filled on startup you will need to use Initial State baking.
After baking, the Zibra Liquid instance will remember its initial state and will start simulation from it. Note that we do not support baking animation, simulation over time, etc. Simulation itself is always performed on the device in real time, only the initial state is baked.
Initial State Baking will simulate the first N seconds of your liquid instance, save it, and simulation in play mode will start from that point.
Note that after changing some parameters you'll have to rebake your liquid, specifically: Grid Resolution, Container Size (in case you changed the size non-uniformly, and as a result changed the Effective grid resolution), Max particle count (in case your baked state has more particles that the current max number).

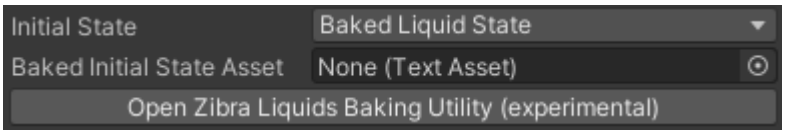
To bake initial state:

1. If you haven't already, add all emitters, voids, and colliders that you are going to have to your liquid.
2. Open the baking utility and select your Zibra Liquid instance to bake.
   There are 2 options to do it:
   2.1. Via the Zibra Liquid Inspector

2.1.1. Open the Zibra Liquid Inspector



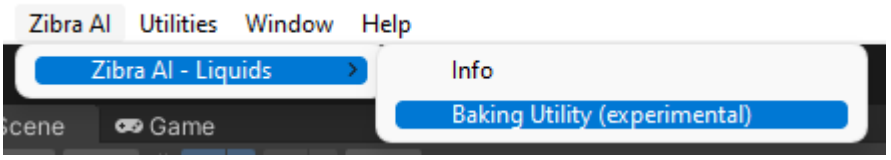
2.1.2. Set Initial State to “Baked Liquid State”. A new button will appear.



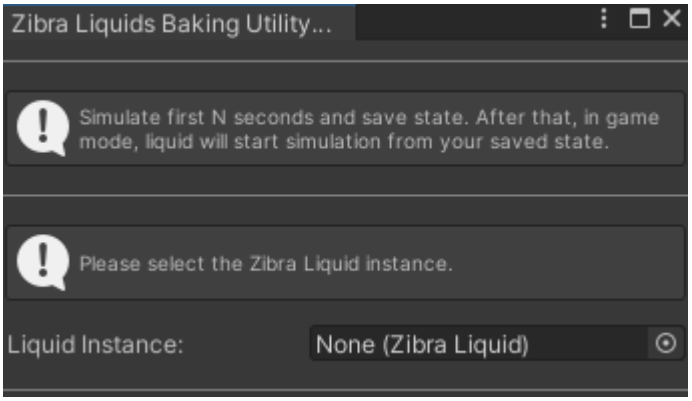
2.1.3. Press *“Open Zibra Liquids Baking Utility (experimental)”*

2.2. Via Unity’s menu

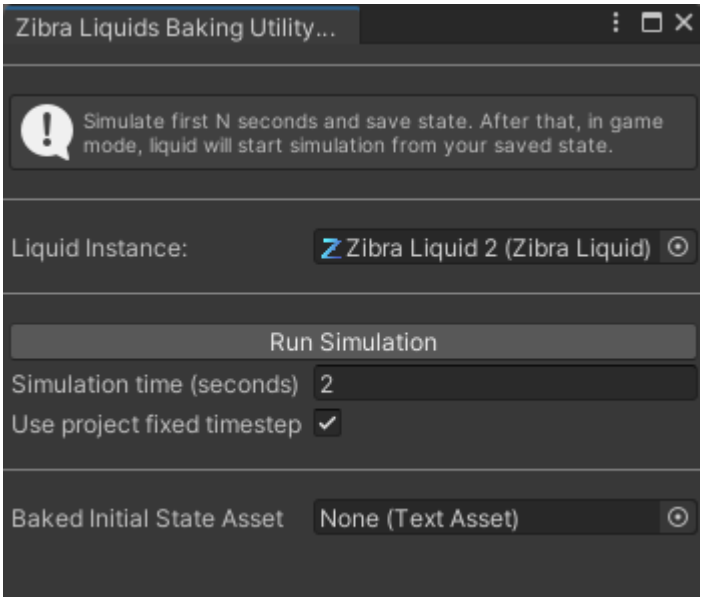
2.2.1. Press *“Zibra AI -> Zibra AI - Liquids -> Baking Utility (experimental)”*



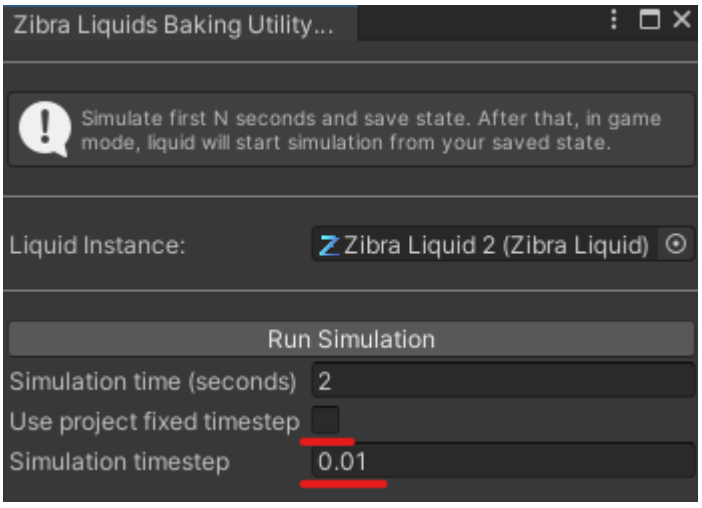
2.2.2. If the Zibra Liquid instance wasn't selected automatically, select the Liquid Instance you want to bake.



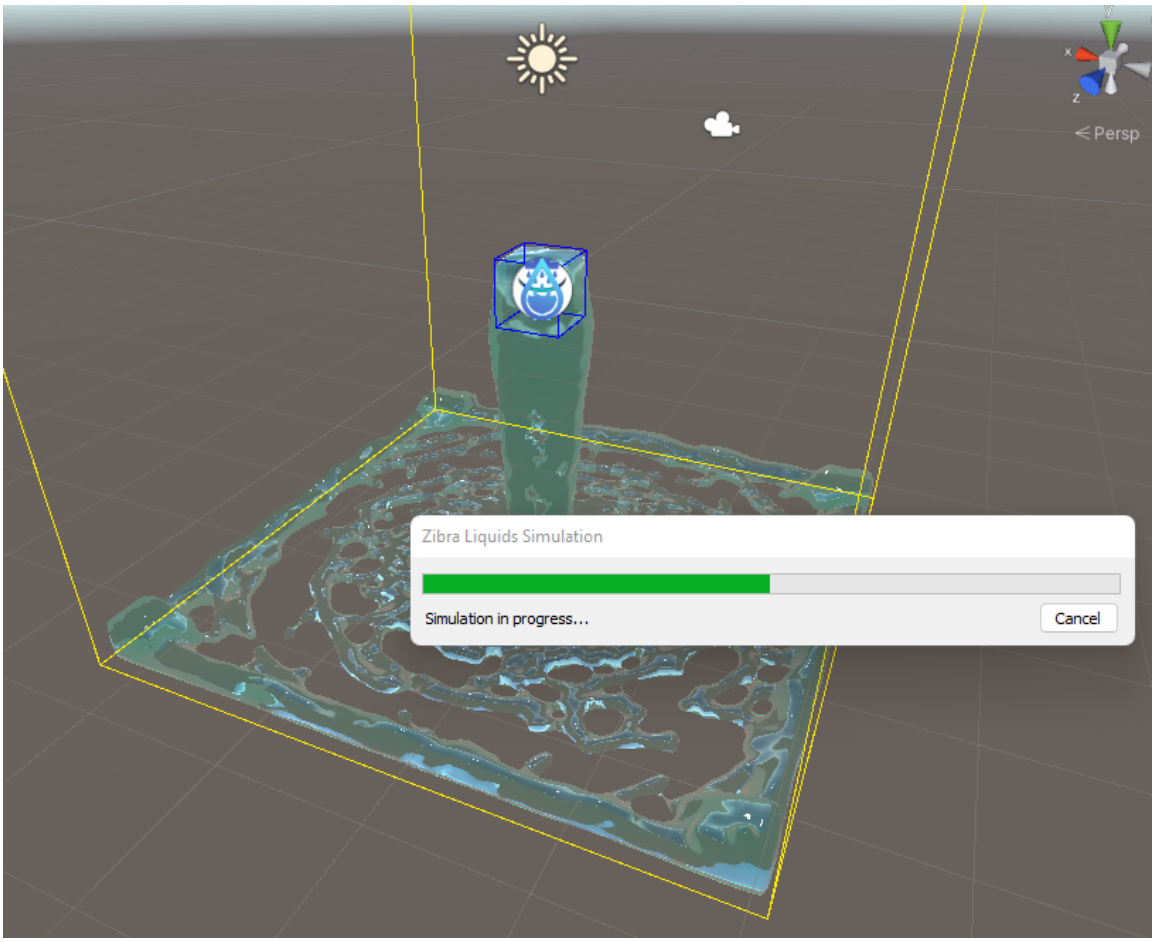
3. Now you see the Baking Utility window



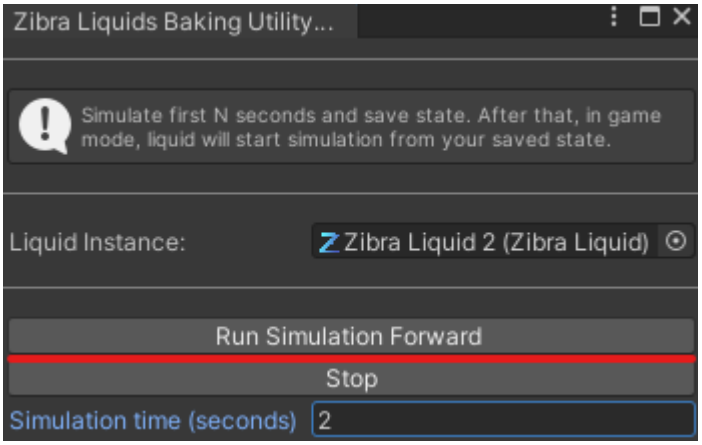
4. Set the Simulation time to the number of seconds you want to simulate.
5. (optional) If you want to run a baking simulation with specific timestamp, you can disable "Use project fixed timestep" and set your desired "Simulation timestep"



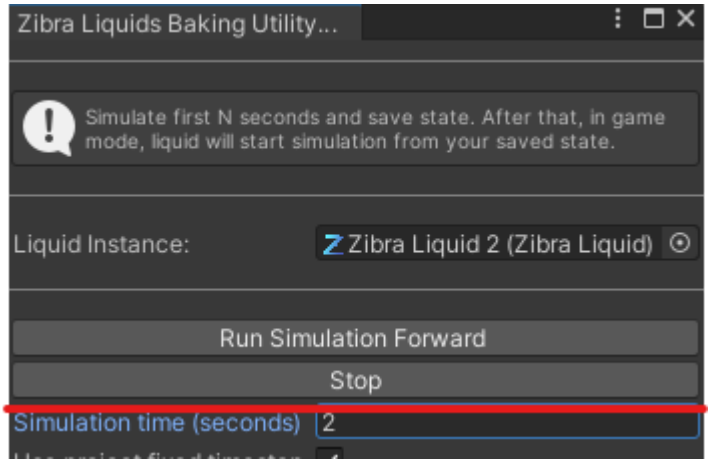
6. Press *“Run Simulation”.*
   You’ll see the simulation running in Scene/Game view *(only Game view on URP)*



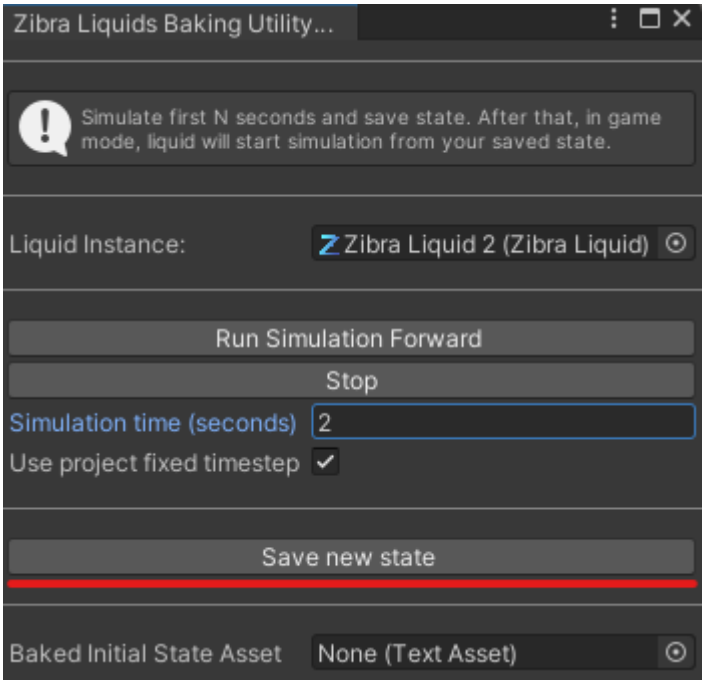
7. *(optional)* If you want to run the simulation further, set the Simulation time to the amount of time you want to run simulation forward, and press *“Run Simulation Forward”.*



8. (optional) If you simulated too far, and want to start over, press *"Stop"* and go back to step 4

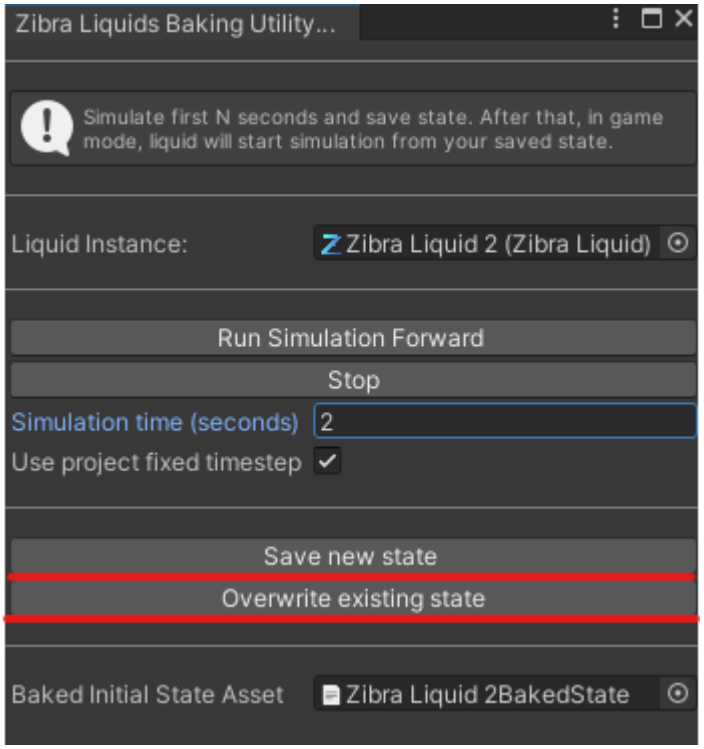


9. Press *"Save new state"* to save baked state.



That will save the new state to the file in the subdirectory next to your scene file. e.g. for Liquid Instance *"ZibraLiquid1"* in *"/Assets/NewScene.unity"* scene, liquid baked state will be saved into *"/Assets/NewScene/"* folder as *"ZibraLiquid1BakedState.bytes"*.

9.1. If you already had a previous saved state you'll have 2 buttons: *"Save new state"* and *"Overwrite existing state"*.



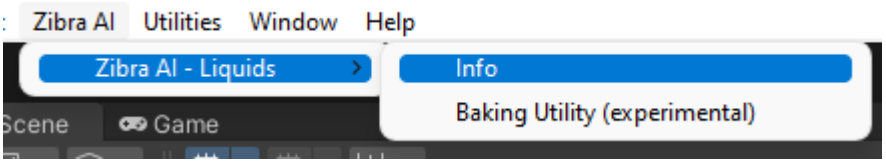
9.2. "Save new state" always creates a new file, while "Overwrite existing state" always overwrites the old file with a new state.

10. (optional) After you are done with baking, press "Stop" to stop the liquid simulation and unlock the parameters that are disabled when the liquid is "live". Next time you'll change a scene or enter playmode this state will reset, so you usually don't need to manually stop it.

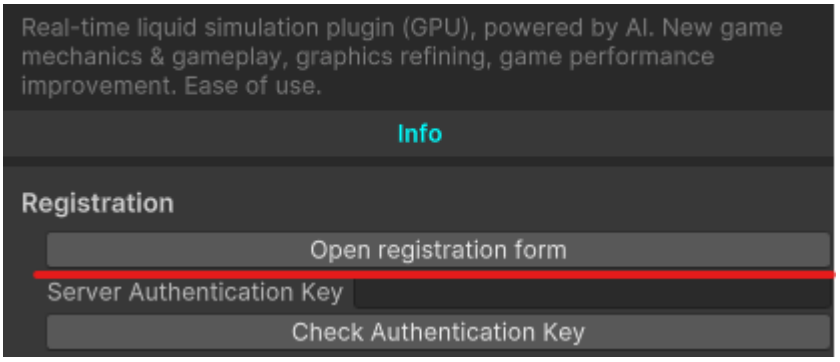
Registering Zibra Liquids

Access to Neural Collider generation requires registering, since that feature requires access to Zibra AI's server for processing.
To register your copy of Zibra Liquids:

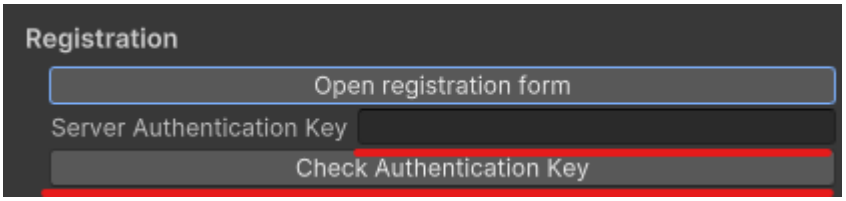
1. Make sure that you launched the Unity Editor via Unity Hub and are logged into the correct Unity account.
2. Press *"Zibra AI -> Zibra AI - Liquids -> Info"*



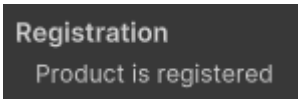
3. In the opened window press *"Open registration form"*



4. Fill out the registration form. Note that you'll need an Invoice number. It is not the same number as the order number. You can find your invoice number in your emails. It has the following format: *"IN012345678901".*
5. After filling out the form, wait for an email with a Server Authentication Key.
6. Enter the key into the *"Server Authentication Key"* field and press Check Authentication Key.



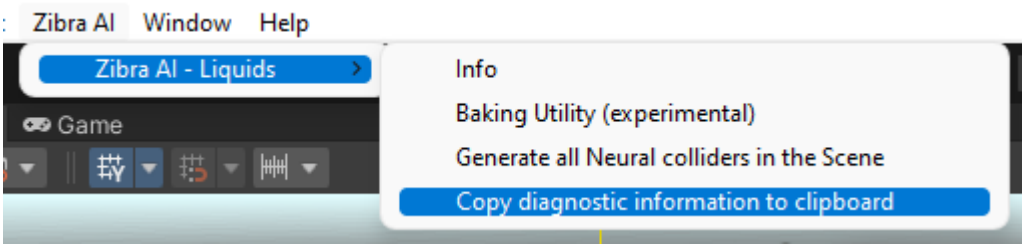
7. After that you should see this message



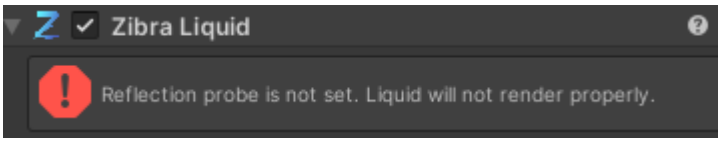
After registration you can generate neural colliders. Note that generating neural colliders sends your mesh to the Zibra AI servers for processing.

Troubleshooting

If you have any issues that you think are the fault of Zibra Liquids, please feel free to contact us on Discord
If you are going to reach out to us for troubleshooting, please export the diagnostics info via this button and send it to us



Some common issues you may have and ways to troubleshoot:

- Check whether you have any errors in the Liquid Instance
  e.g.
  

- On URP, not adding “URP Liquid Rendering Component”
  See Additional setup on URP
- Trying to use Zibra Liquids on an unsupported platform *(Android, Oculus/Meta Quest 2*) or with unsupported features *(VR)*
  See System Requirements.
- On HDRP, the Liquid is too bright
  Decrease *“Reflection color”* in Liquid Instance’s Material Parameters
- Black artifacts on liquid near surface discontinuity
  Decrease *“Blur radius”* in Liquid Instance