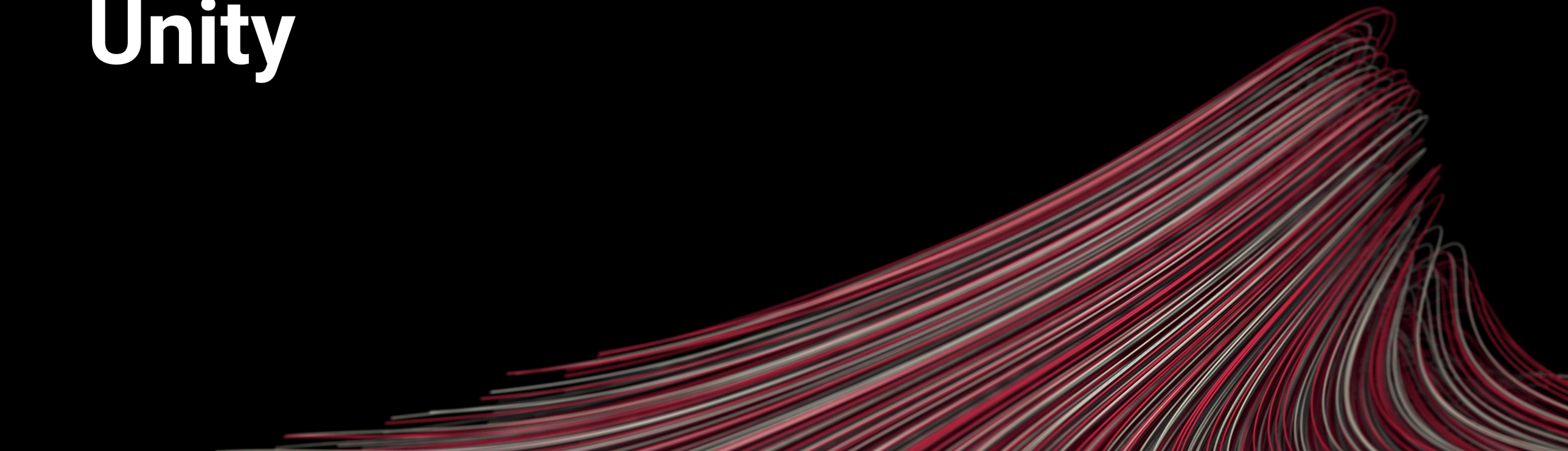
Jack He

Technical Director
miHoYo Technology Co., LTD

From mobile to high-end PC

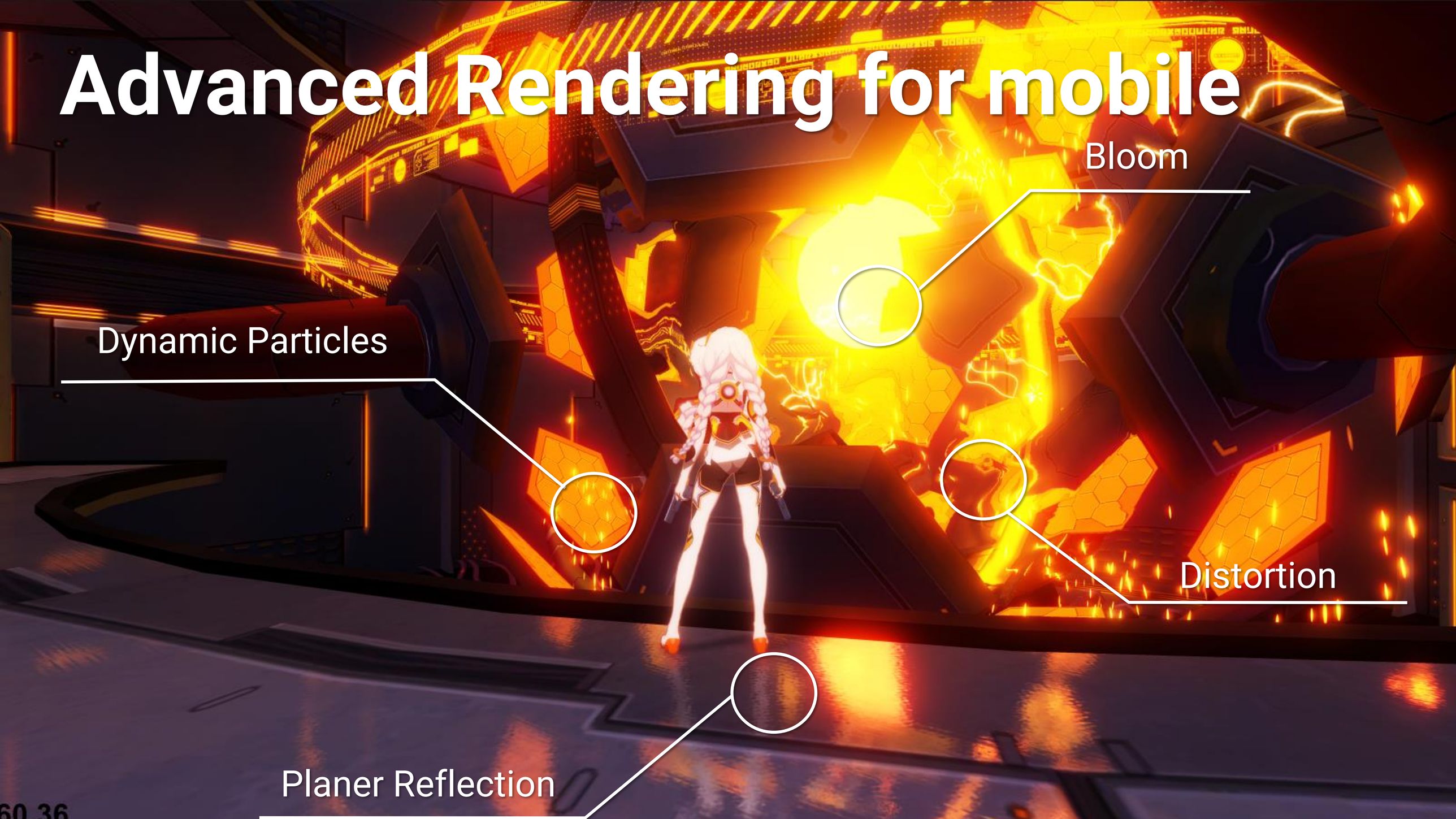
Achieving high quality Anime style rendering on Unity

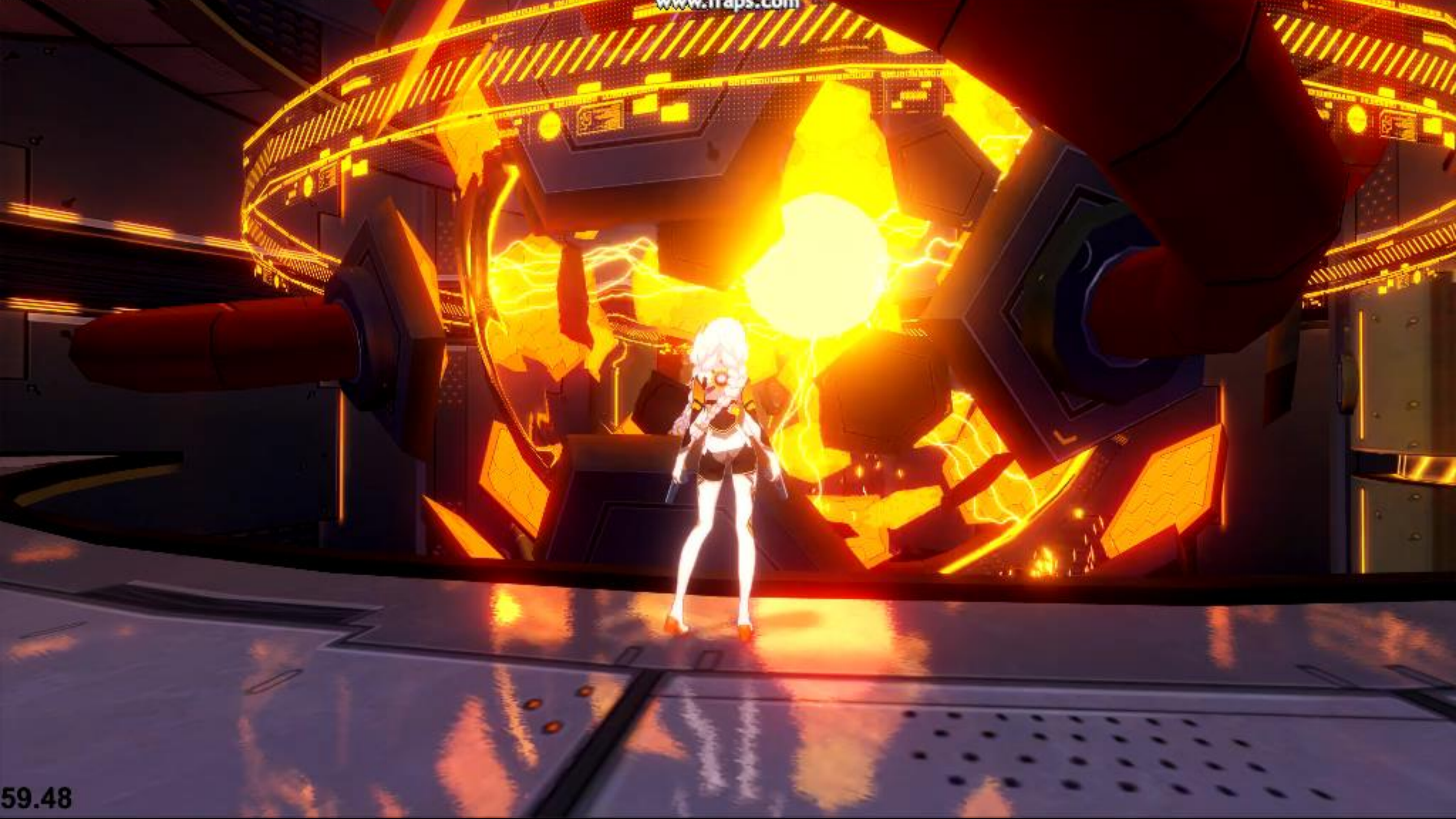


Main Topic

- Advanced rendering features for mobile
- Special effects & PostFX for mobile
- Illustration style character shading
- Anime style Shading FX
- Stylized Scene & Lighting
- Miscellaneous stuff and future works

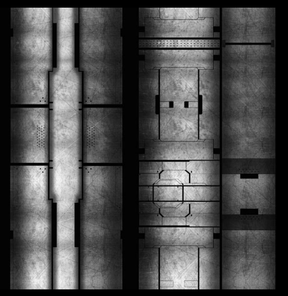
Advanced Rendering for mobile



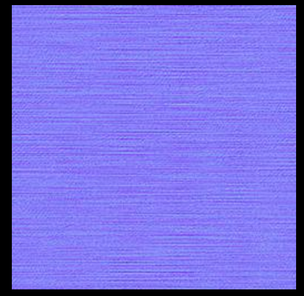

www.fraps.com
59.48

High quality reflection

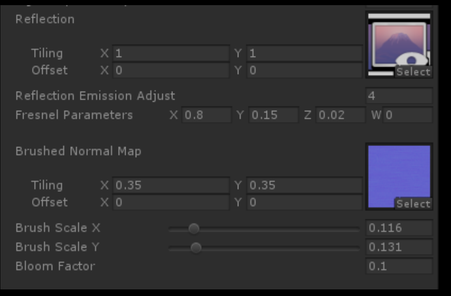
- Rendered at 1/3 or lower resolution
- Optional blur pass
- Fresnel reflection
- Metal brush distortion
- Specular sketch Mask



Specular mask



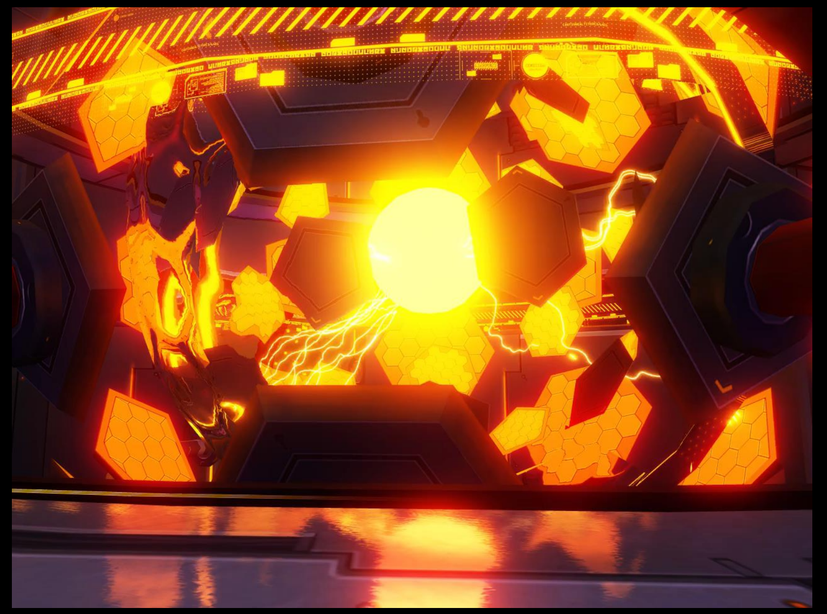
Metal brush

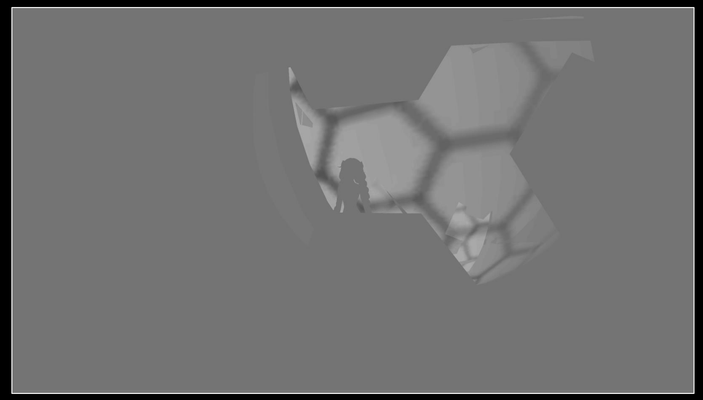


Material Panel

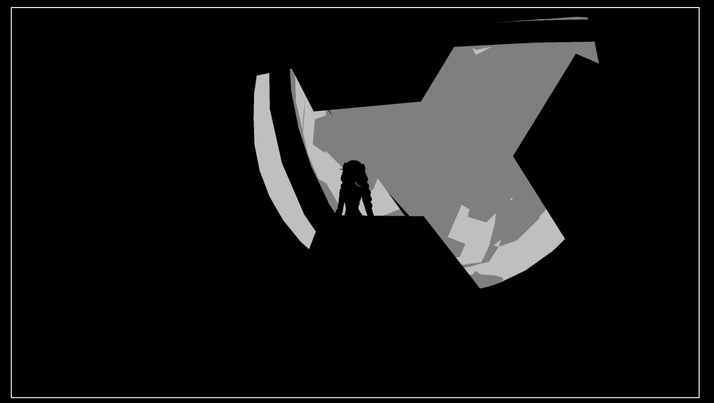
Full screen distortion

- Applied with post processing
- Depth clipping Mask
- Distance based intensity





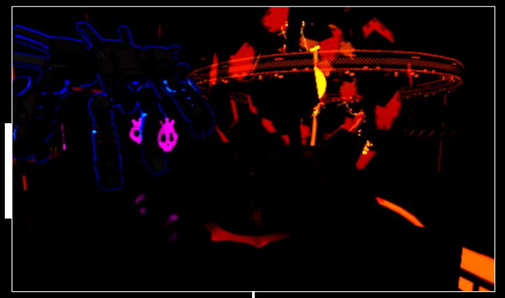
Distortion Offset



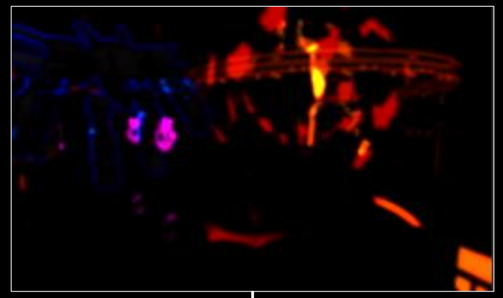
Depth Intensity Mask

Bloom

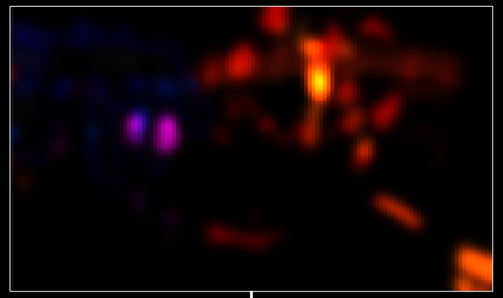
1/4 size



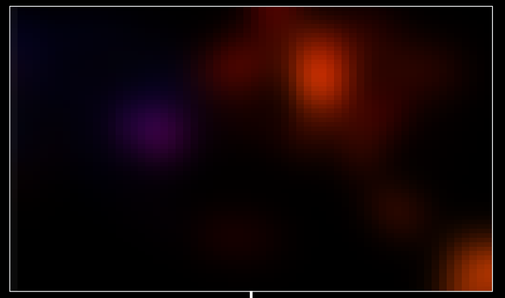
1/8 size



1/16 size

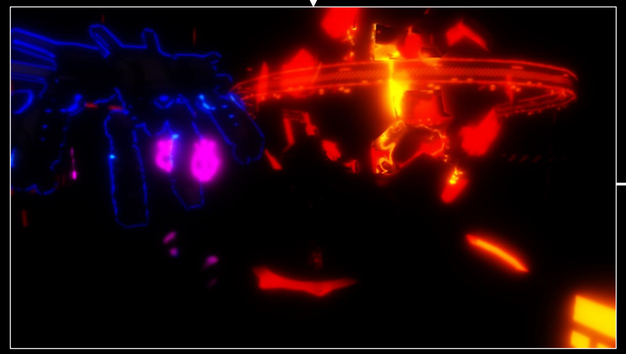


1/32 size



Original image

+



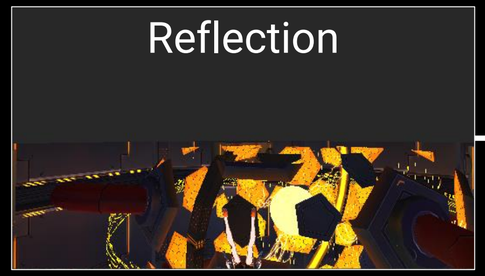
Extracted Layer

Composed

Synthesis


Bloom

+


Reflection


Scene Combined


Final Scene

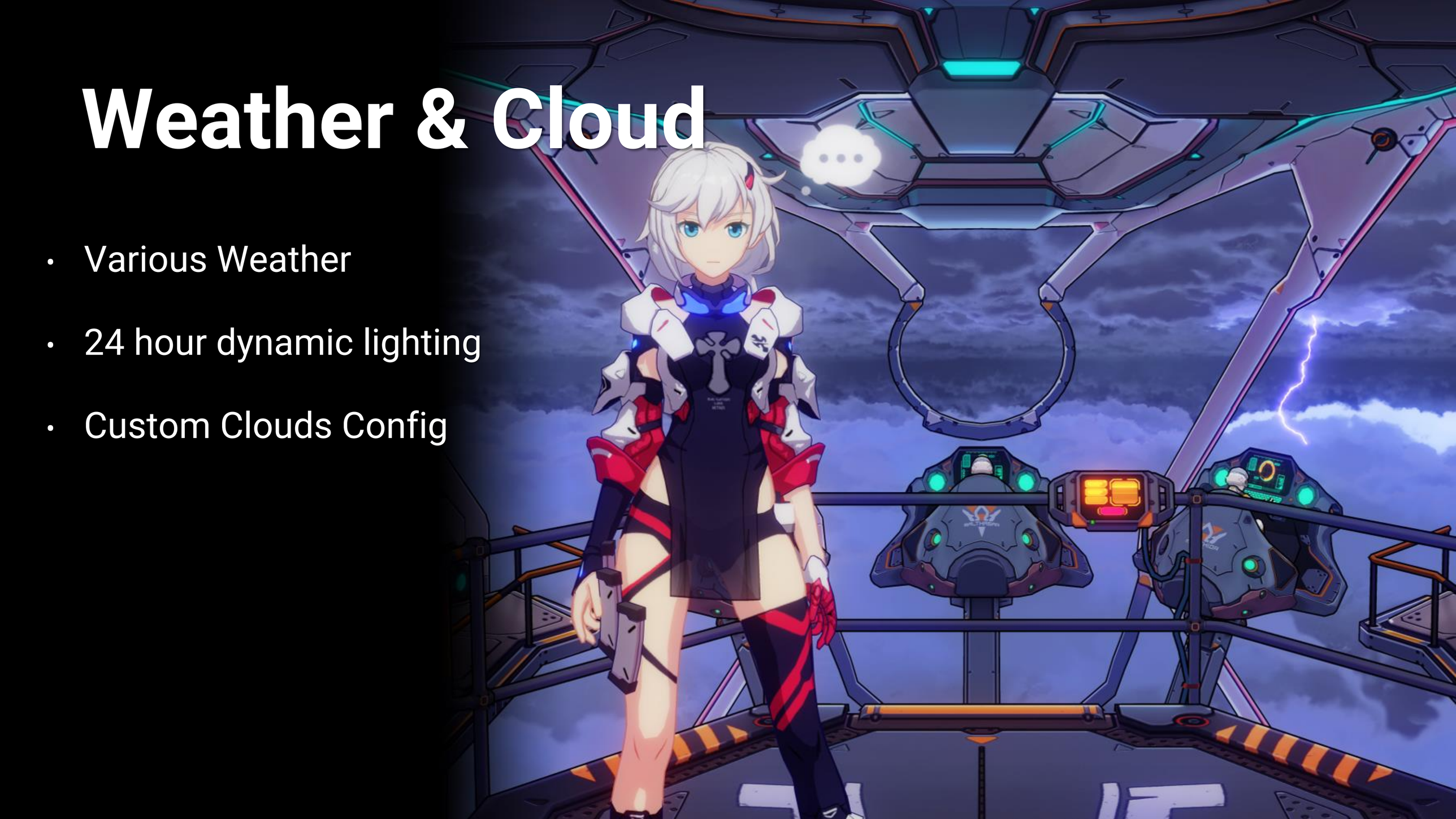

Scene

+


Distortion

Weather & Cloud

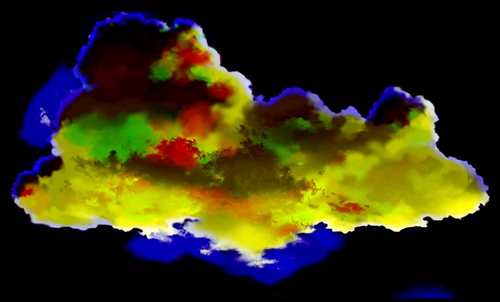
- Various Weather
- 24 hour dynamic lighting
- Custom Clouds Config



Cloud shading

- Multi-channel Layered shading
- 8 Cloud template

Cloud Color Scheme



Cloud Texture
(RGBA)

R:Shadow Layer1

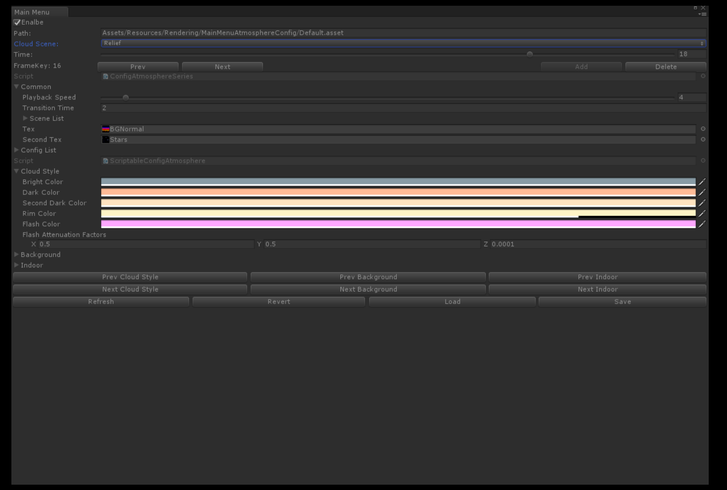
G:Shadow Layer2

B:Rim Layer

Cloud Landscape editor

- Billboard particles
- Custom Cloud type
- KeyFrame Definition
- Time of day editor

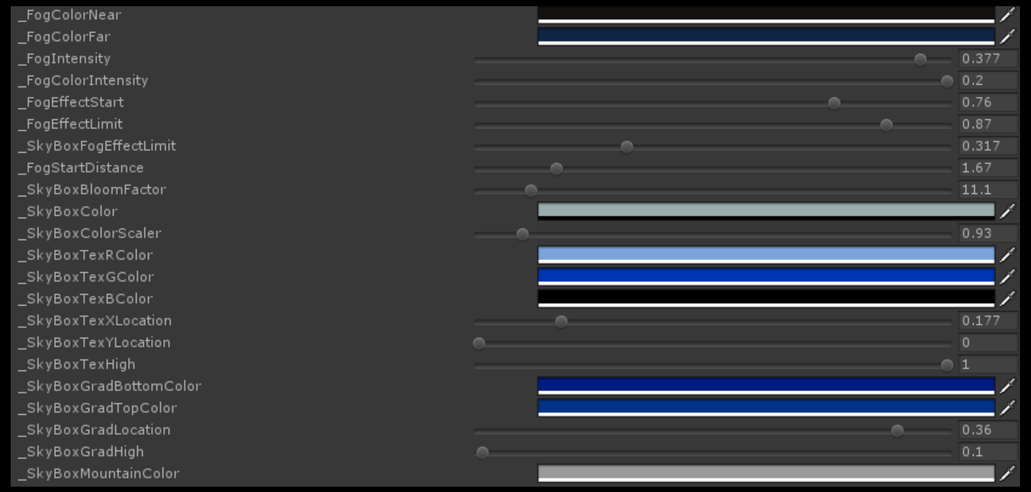
Scene Window



Weather editor panel

Weather System

- Refined atomsphere Fog control
- Skybox color configuration
- Character Lighting Volume

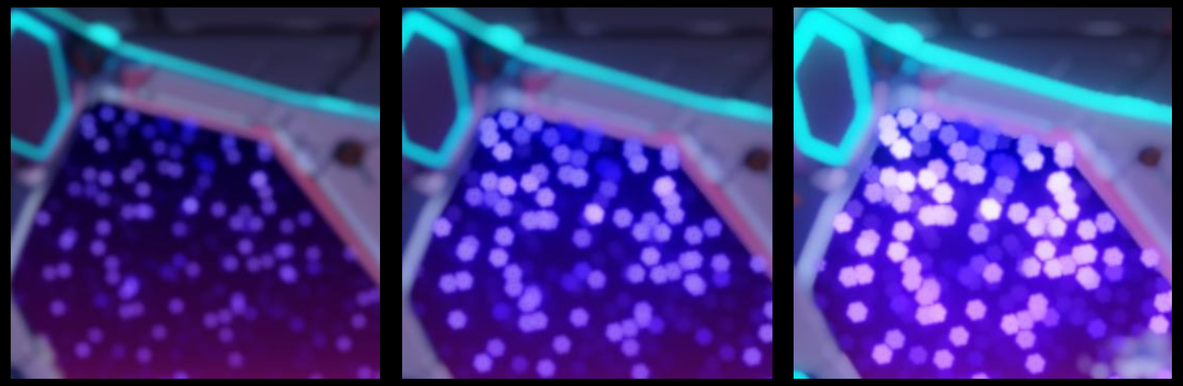


Fog Configuration Panel

Layered Depth of Field

- Hexagon gather pattern
- Dynamic Res based on blur size
- Bokeh Intensity & Rotation

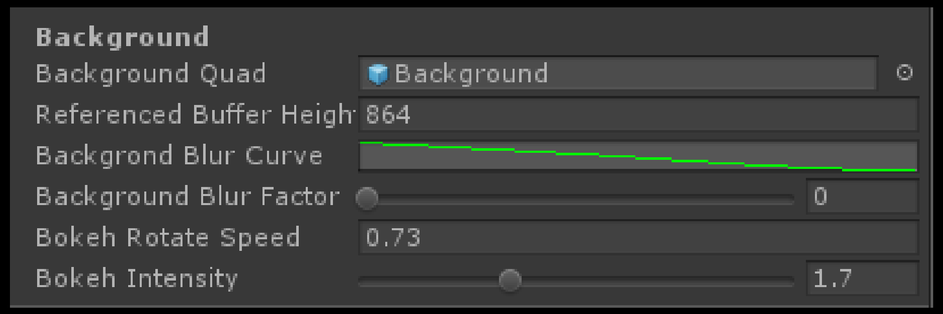
Bokeh Intensity



0.5 1.5 2.5

```
float BokehFactor(float3 val)
{
    float lum = dot(val, float3(0.32, 0.3, 0.38));
    lum = max(lum, 0.001f);
    return pow(lum,blurScale.w);
}
```

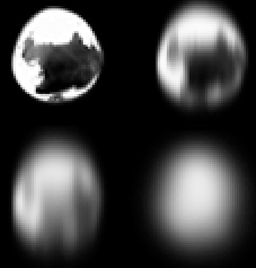
Enhance Bokeh by luminance



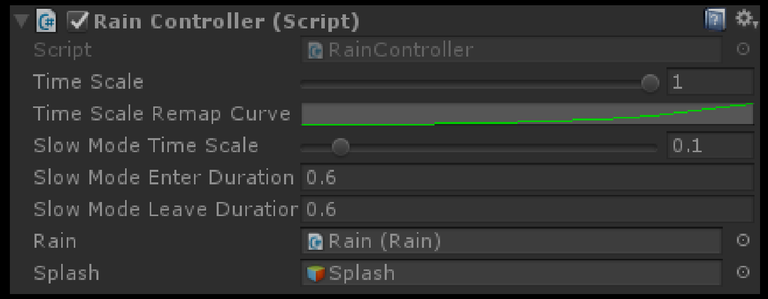
DOF Panel

Slow-motion raindrop effect

- Time scale slow motion
- 4 shapes for different time scale
- Stretched on speed
- Shape from Speed Curve mapping



Rain drop at different Speed



Rain drop Control

Anime style CG rendering

www.bilibili.com/video/av14260225/

Anime style CG rendering

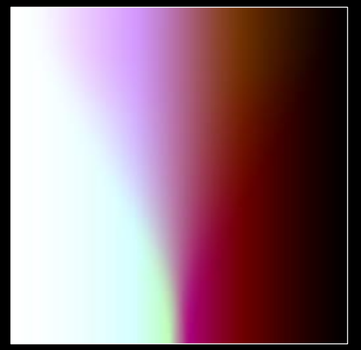
www.bilibili.com/video/av7244731

Character shading

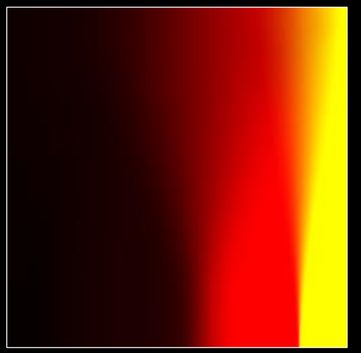
- Multi ramp shading with Brush style
- Anisotropic material, refraction & blur
- Main Light, IBL, Rim light
- PCSS soft shadows
- High quality outline

Multi-Channel 2D Ramp

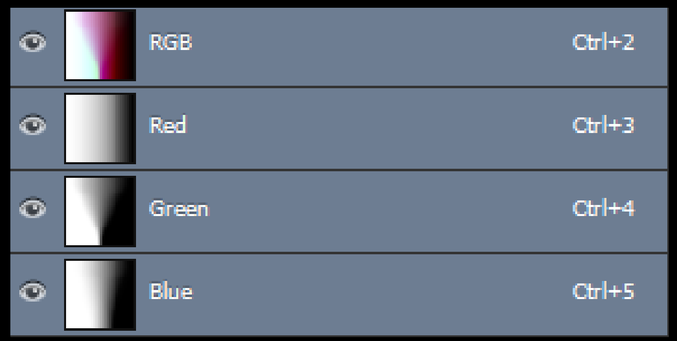
- Multi-channel shading for precise color control
- For both diffuse & highlight
- Fast Intuitive feedback

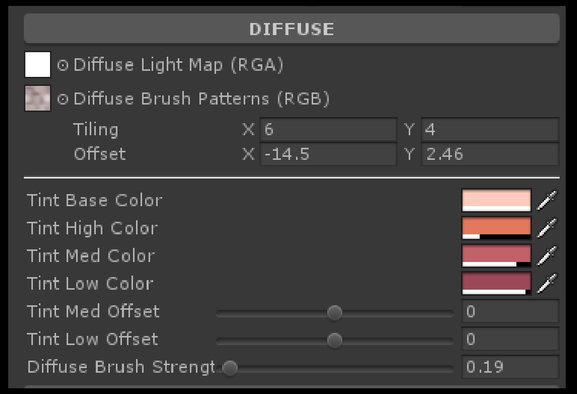


Diffuse ramp

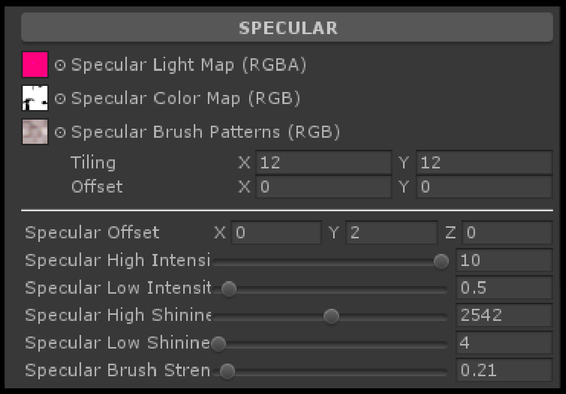


Specular ramp





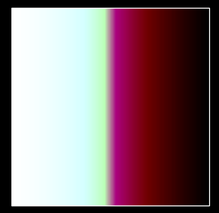
Diffuse Panel



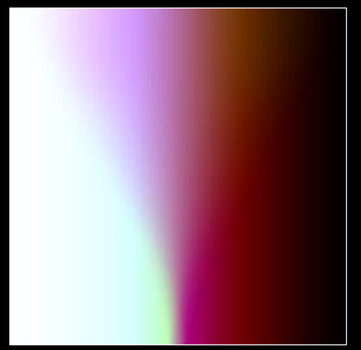
Specular Panel


1 Layer
2 Layers
3 Layers
Final

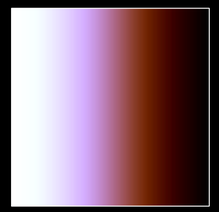
Multi-Channel Ramp



Hard



2D Diffuse ramp



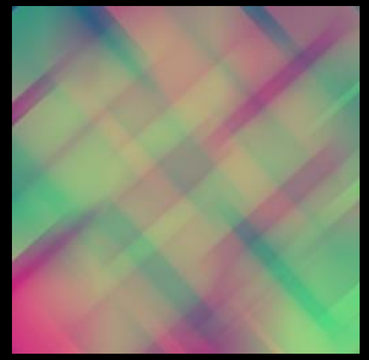
Soft

Ramp mask applied

Enhanced with Brush

- N dot L modulated by brush texture for diffuse
- RGBA Channel for multiple brush pattern

Brush pattern A



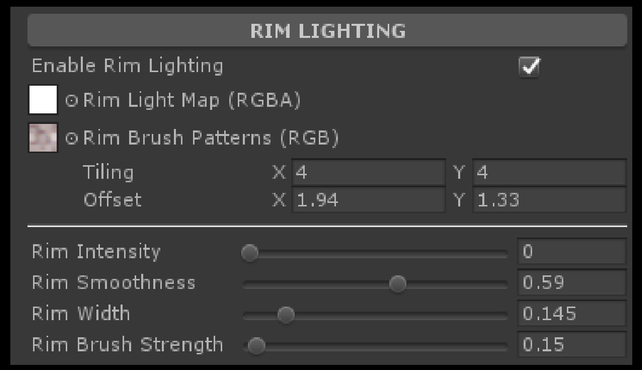
Brush pattern B

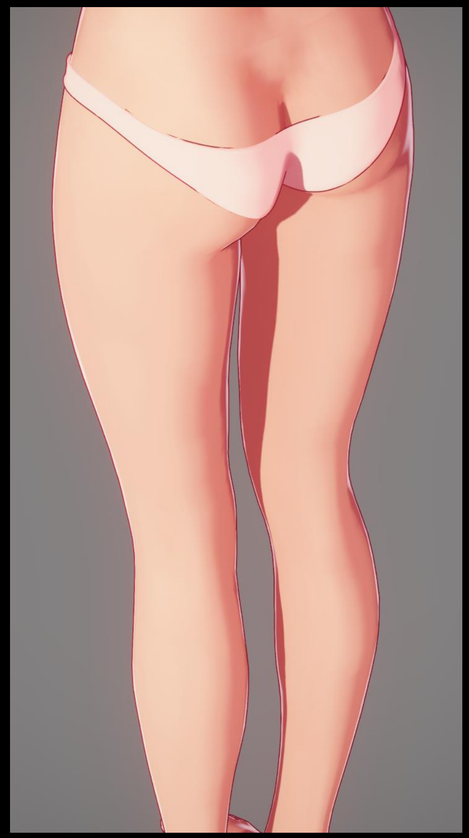
No Brush

Brush applied

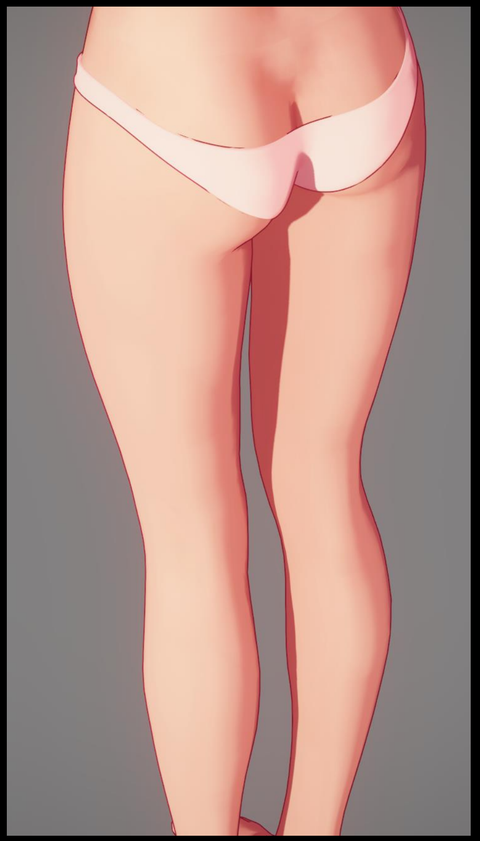
High quality rim light

- From Directional light or IBL (Cube-map)
- Using Fresnel masked with brush
- AO and shadow occlusion





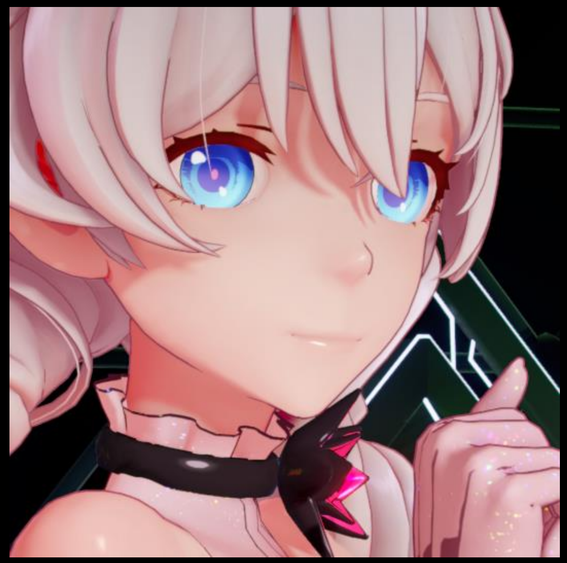
Rim-light on



Rim-light off

Facial shading tweak

- Reduce diffuse shading Shadow
- Vertex color Mask control diffuse intensity



With vertex color

Without vertex color

High quality character shadow

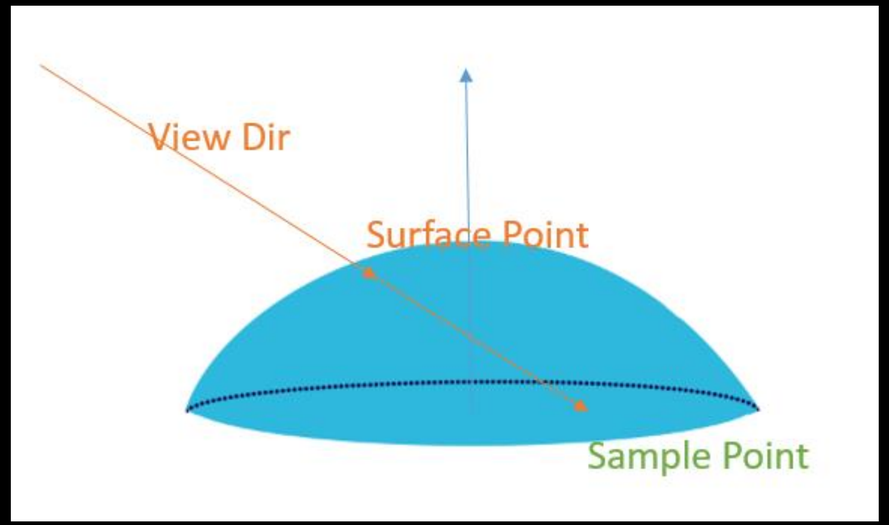
- View dependent Shadow map
- Use PCSS for soft-shadow
- Support Transparent object

Eye Refraction

- Texture UV offset based on View dir
-
```
half3 V = normalize(_WorldSpaceCameraPos.xyz - o.objPos);
float3 offset = float3(dot(V, uWorld), dot(V, vWorld), dot(V, eyeForward));
```

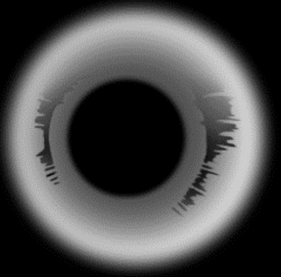
Refraction ON

Refraction OFF



Light caustic

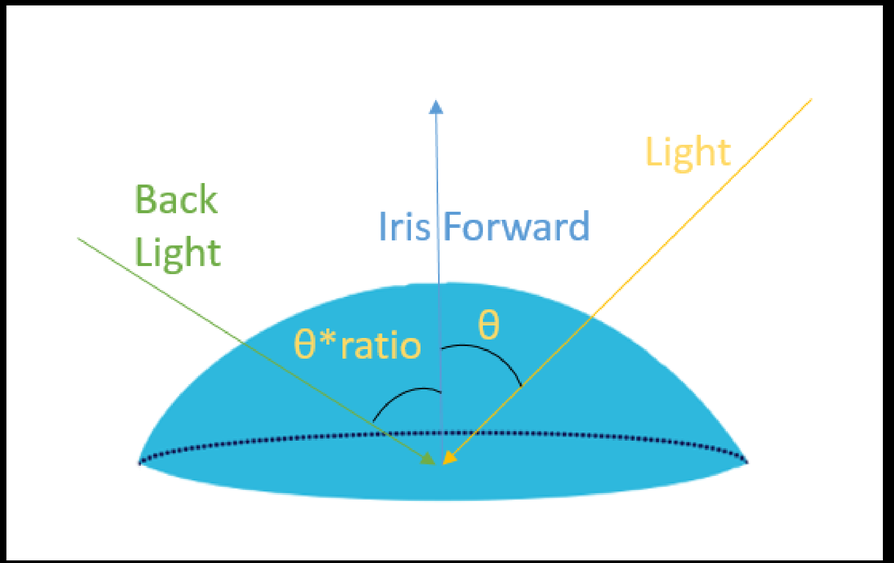
- Use inverse diffuse calculation to fake lighting
- Use Fresnel simulates intensity change



Caustic mask texture

Caustic ON

Caustic OFF



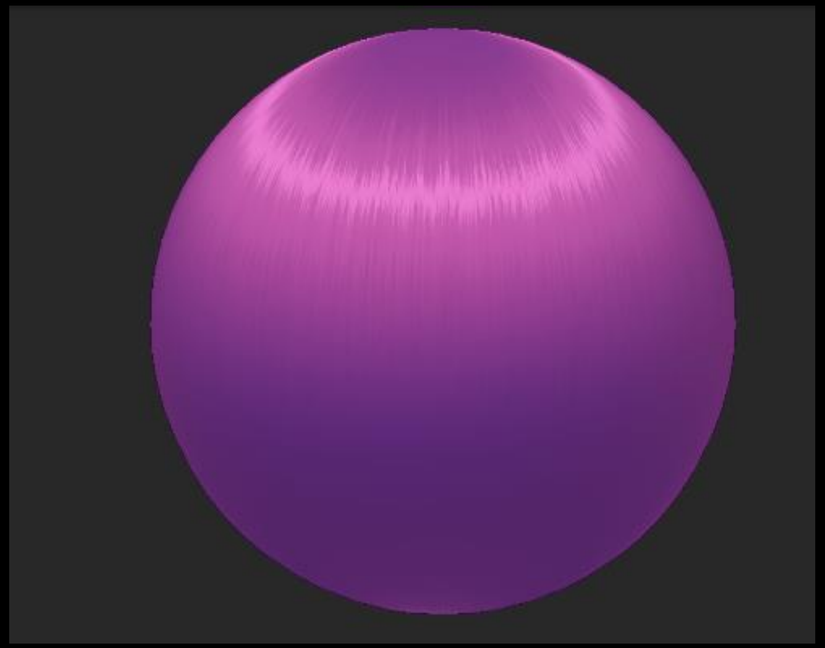
Hair Shading

- WYSIWYG color adjustment
- Anisotropic lighting using Tangent
- Multi-layer Specular shading
- Roughness, Flow and AO map

Anisotropic highlight

- light calculation in tangent direction
- Low + high frequency specular component

```
float StrandSpecular(float3 T, float3 V, float3 L, float exponent, float strength)
{
    float3 H = normalize(L+V);
    float dotTH = dot(T, H);
    float sinTH =sqrt(1.0-dotTH*dotTH);
    float dirAtten = smoothstep(-1.0, 0.0, dotTH);
    return dirAtten* pow(sinTH, exponent) * strength;
}
```



Material Preview

Generate strip pattern

- Use Jitter map to get random pattern

```
float3 ShiftTangent(float3 T, float3 N, float shift)
{
    float3 shiftedT = T + shift * N;
    return normalize(shiftedT);
}
```

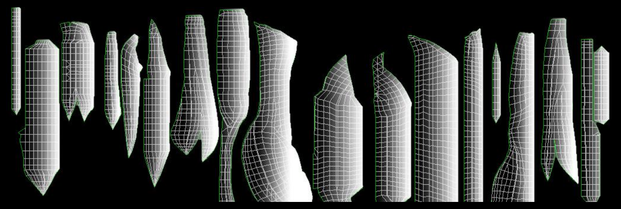

Diffuse only
+LowFreq Specular
+HighFreq Specular
Combined

Anisotropic Cel-shading Hair

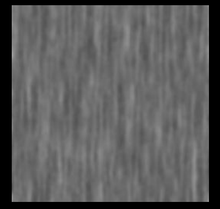
- Move along strand direction
- Intact strip pattern on edges
- Shape variation towards hair tip
- Material outline color

Stylized anisotropic

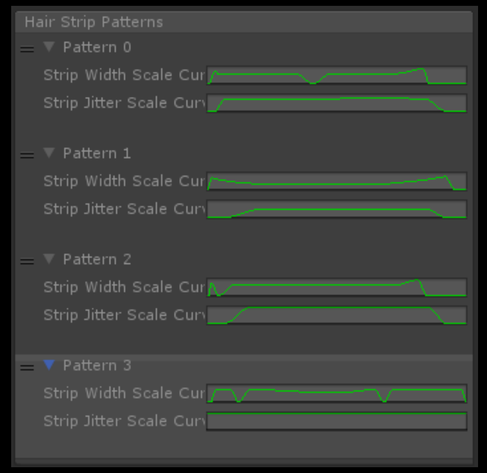
- UV direction gradient for each hair strand
- Intact strip pattern on edges
- Jitter noise on highlight strips
- Various parameter



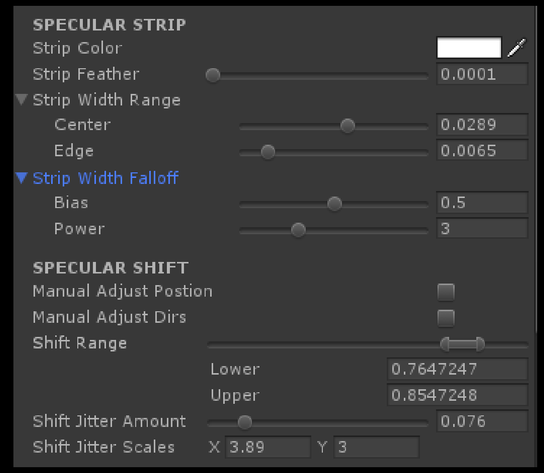
Strip Mapping channel



Jitter noise



Strip pattern define



Material Panel

Anisotropic material: silk

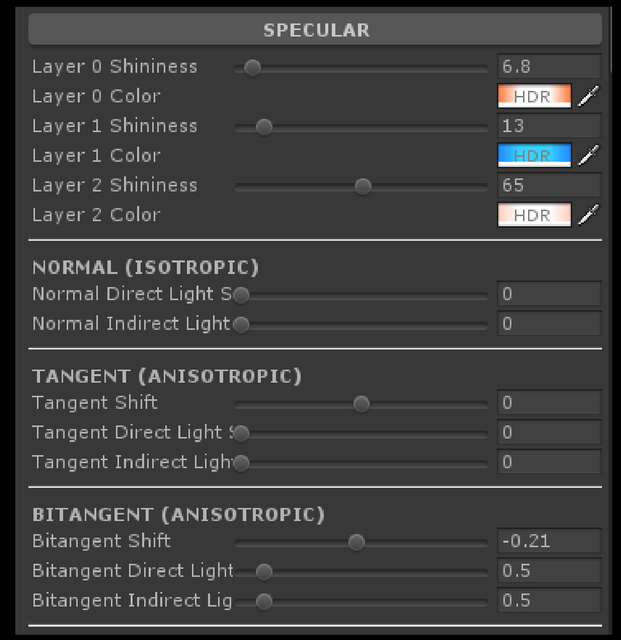
- light calculation in Bitangent direction

Only diffuse

+1 layer highlight

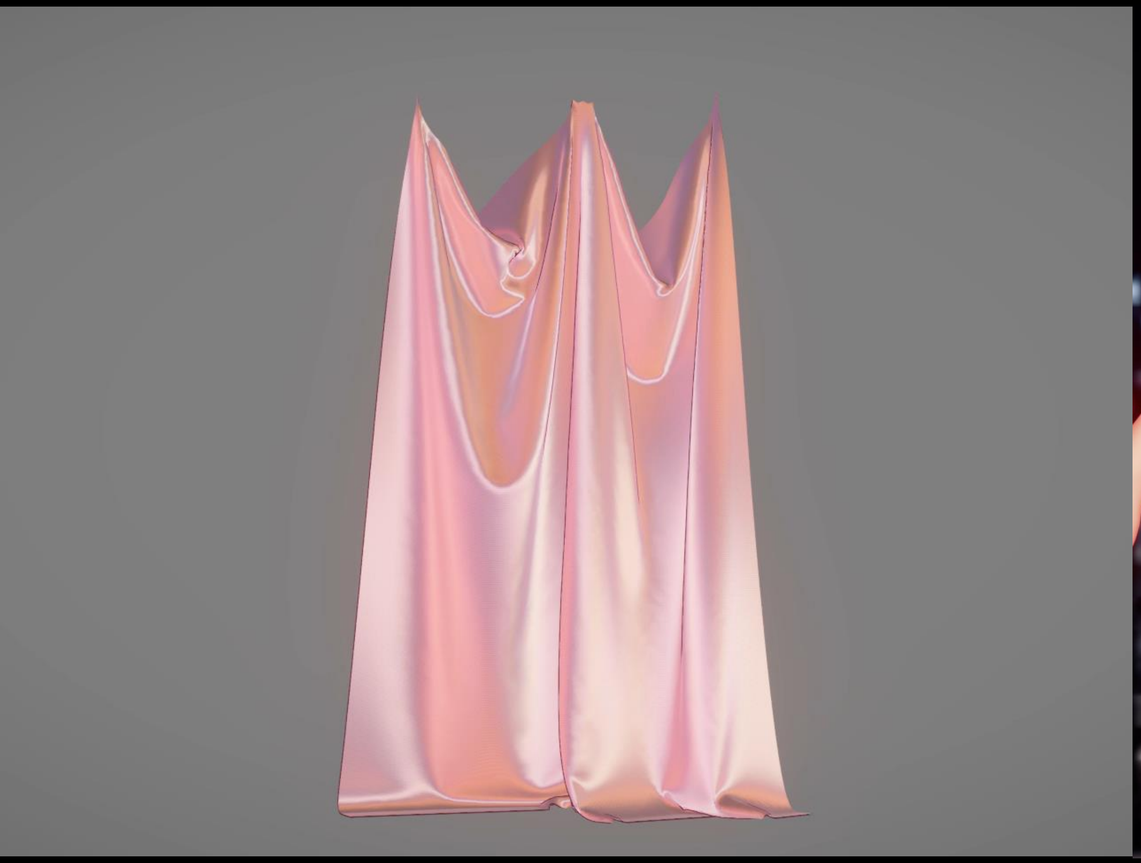
+2 layer highlight

+3 layer highlight



Material Parameter

Anisotropic material: silk



Refraction & blur

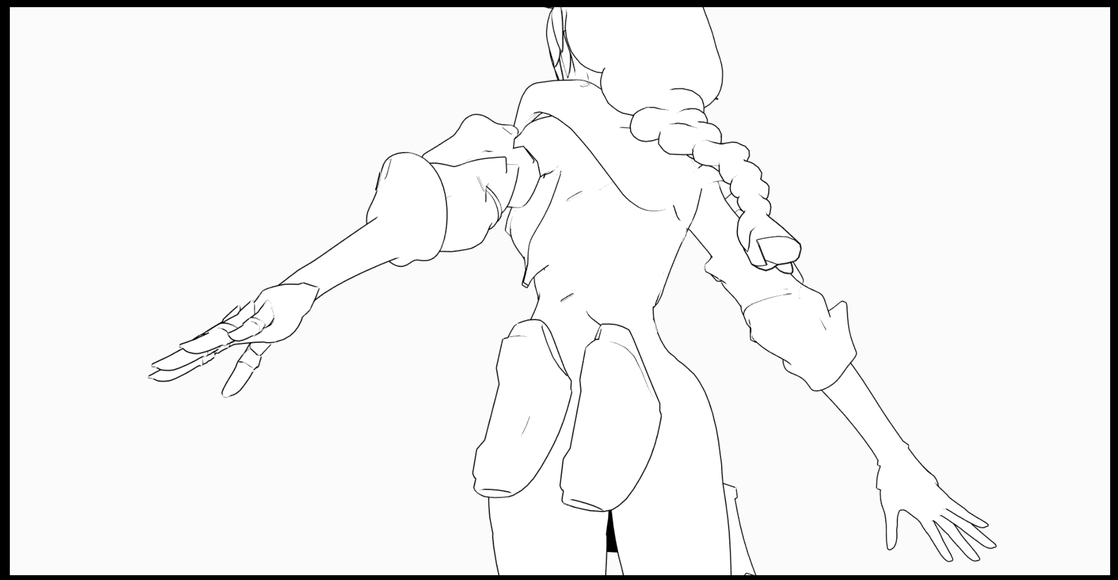
- Command Buffer
- Double side material
- Blur optimization

geometry based Outline

- Continuous vertex normal required
- Vertex color controls outline width
- perspective corrected line width

Enhanced geometry based outline

- Preprocessing detecting crease edge
- Used together with backface method



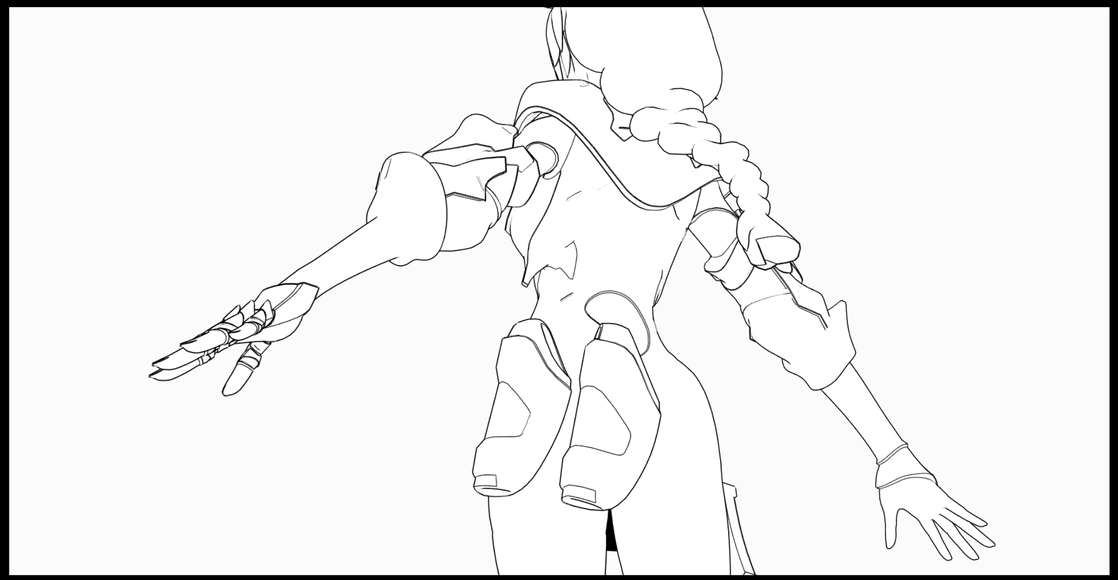
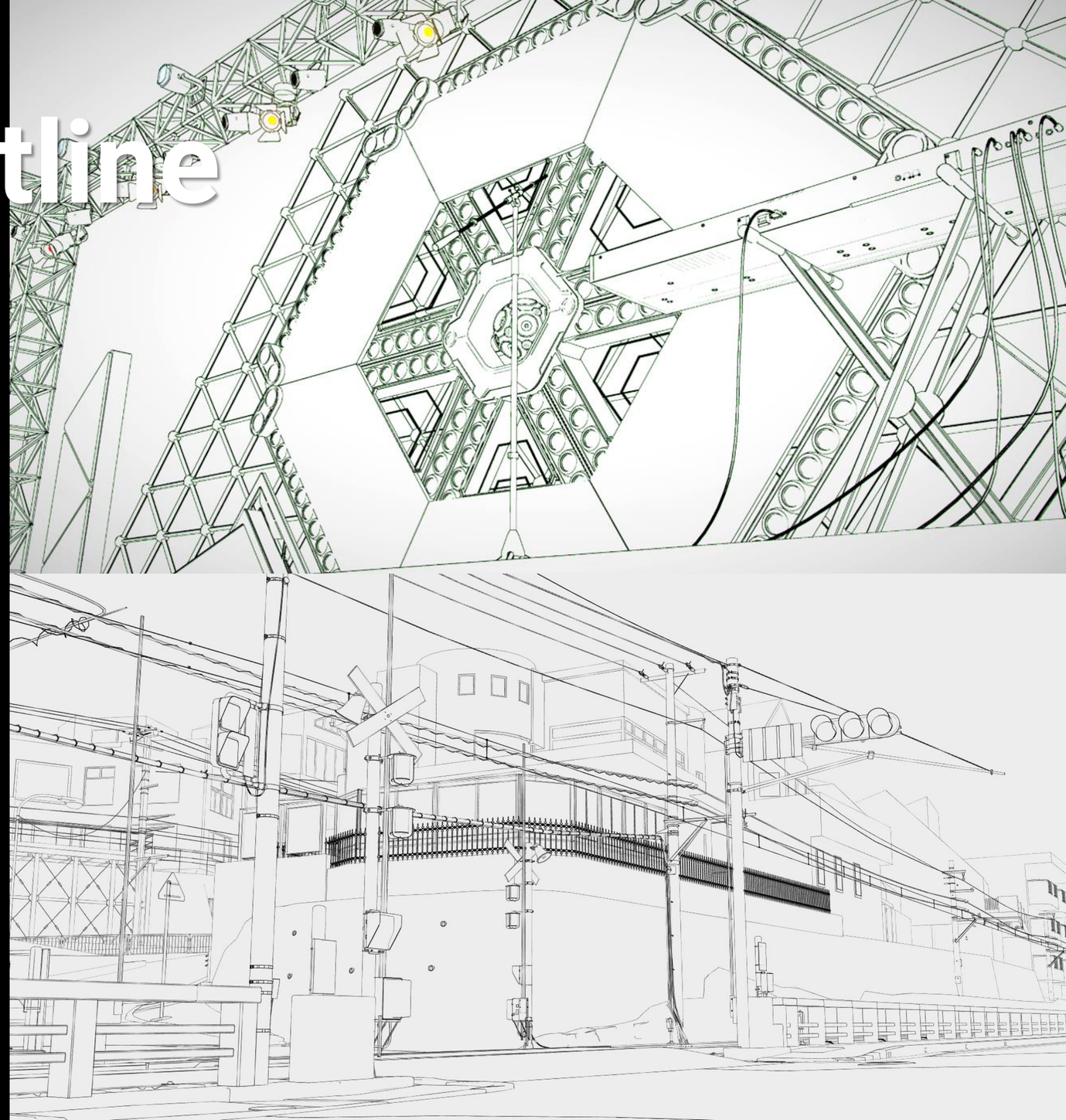


Image space outline

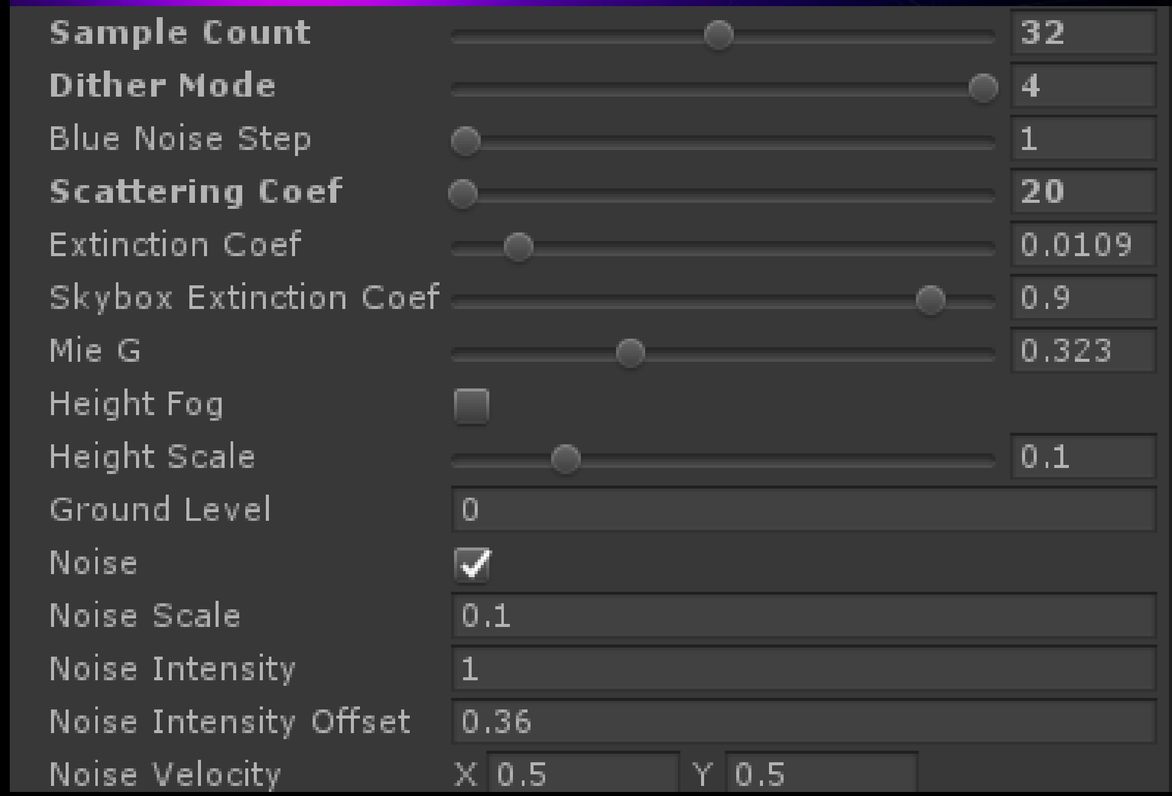
- normal & depth detection
- Constant performance
- Suitable for scene rendering
- Camera based width tweak
- HVS tweak



Toon Shading FX

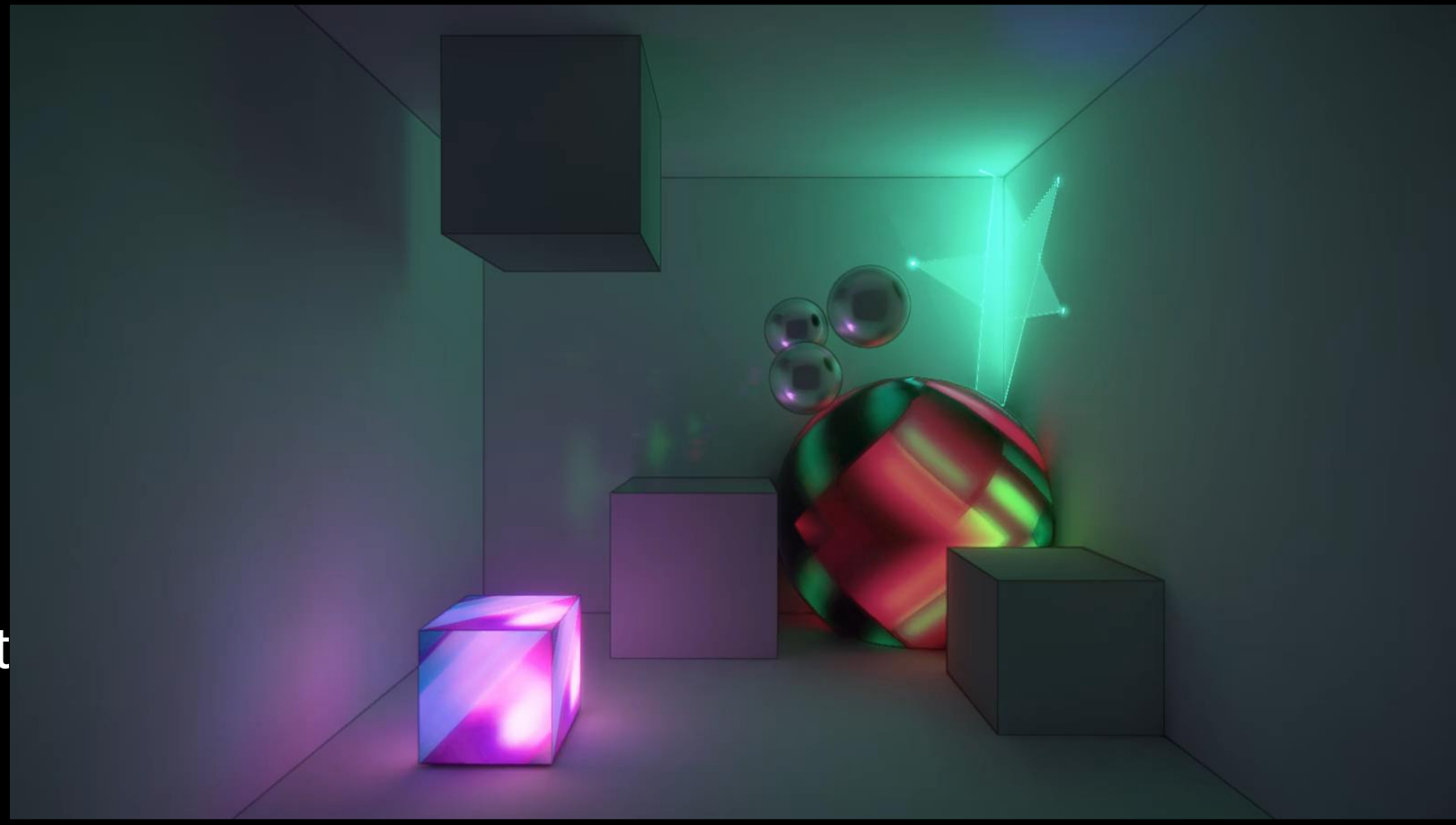
Volume light

- Procedural light volume control
- 3D Noise texture fog
- Cookie map defined projection pattern
- Blue Noise Dither + TAA



Dynamic real-time GI

- Enlighten real-time GI
- video as emission source
- Avpro Video for decoding
- Update GICache
- Dynamic volume spot light

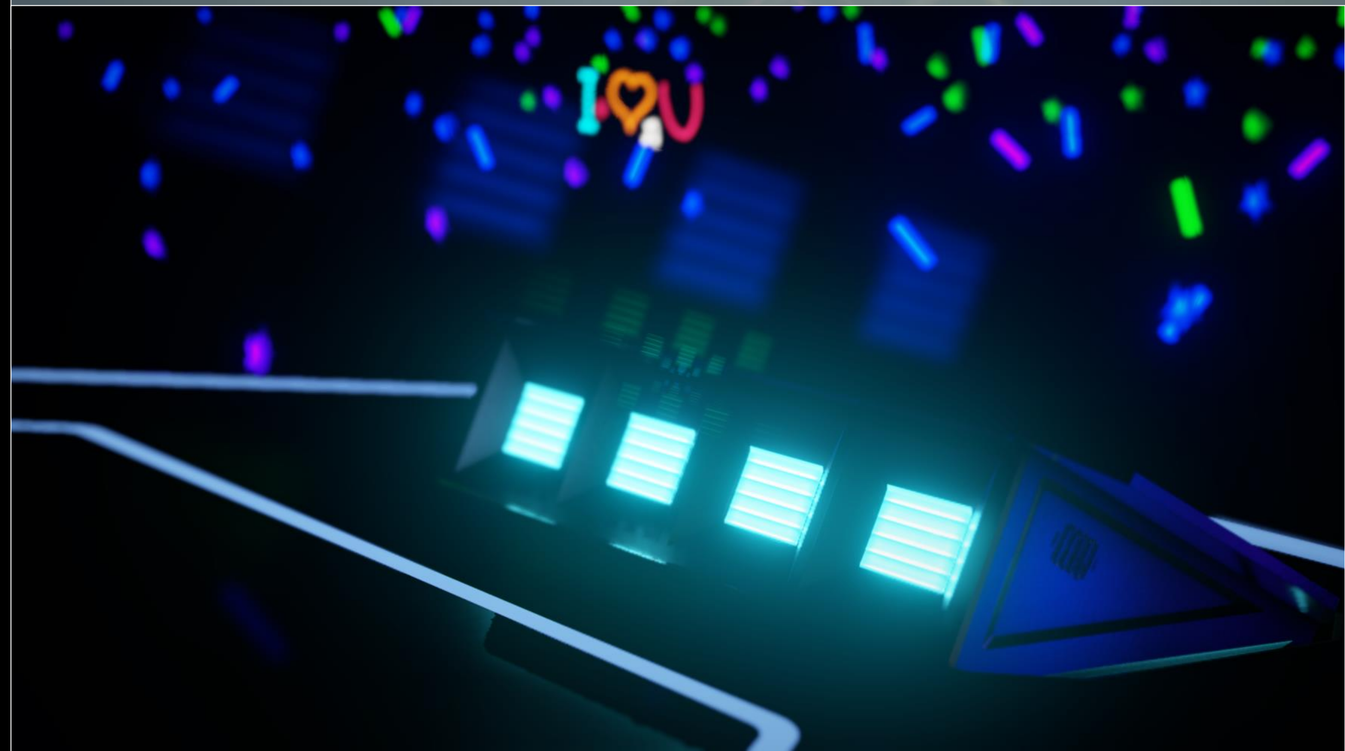


Anime style AO

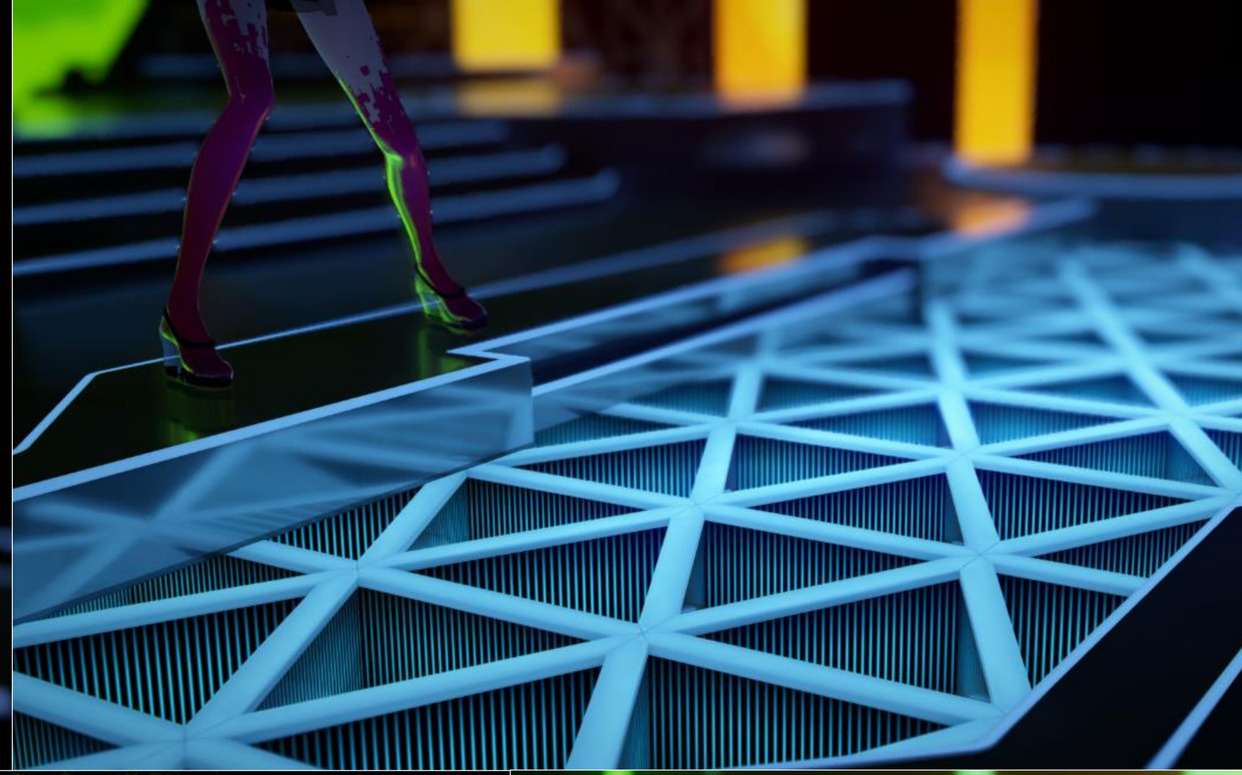
- Based on HBAO
- HVS color shift

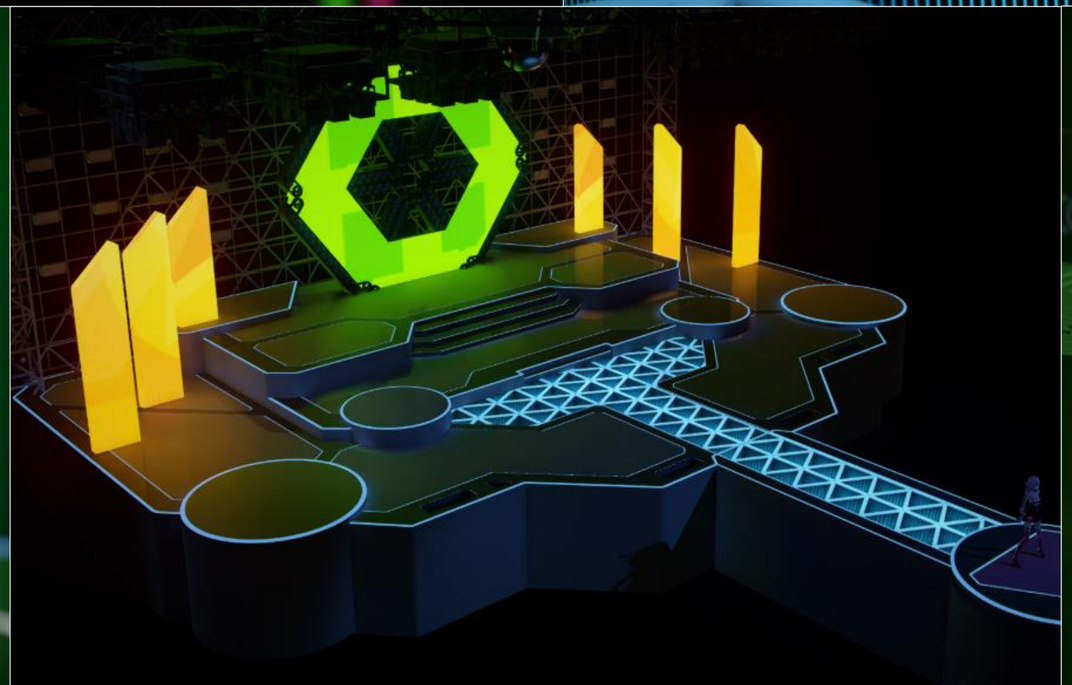
Image Space Glare

- Lens glare
- Star streak
- Multiple pass convolution
- Color modulation



Scene Rendering



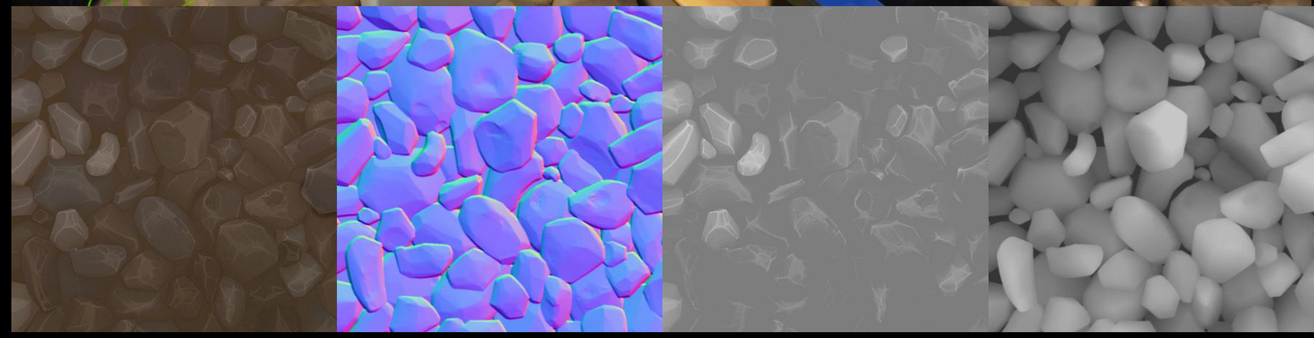



鎌倉高校駅前
Kamakura koko sta.

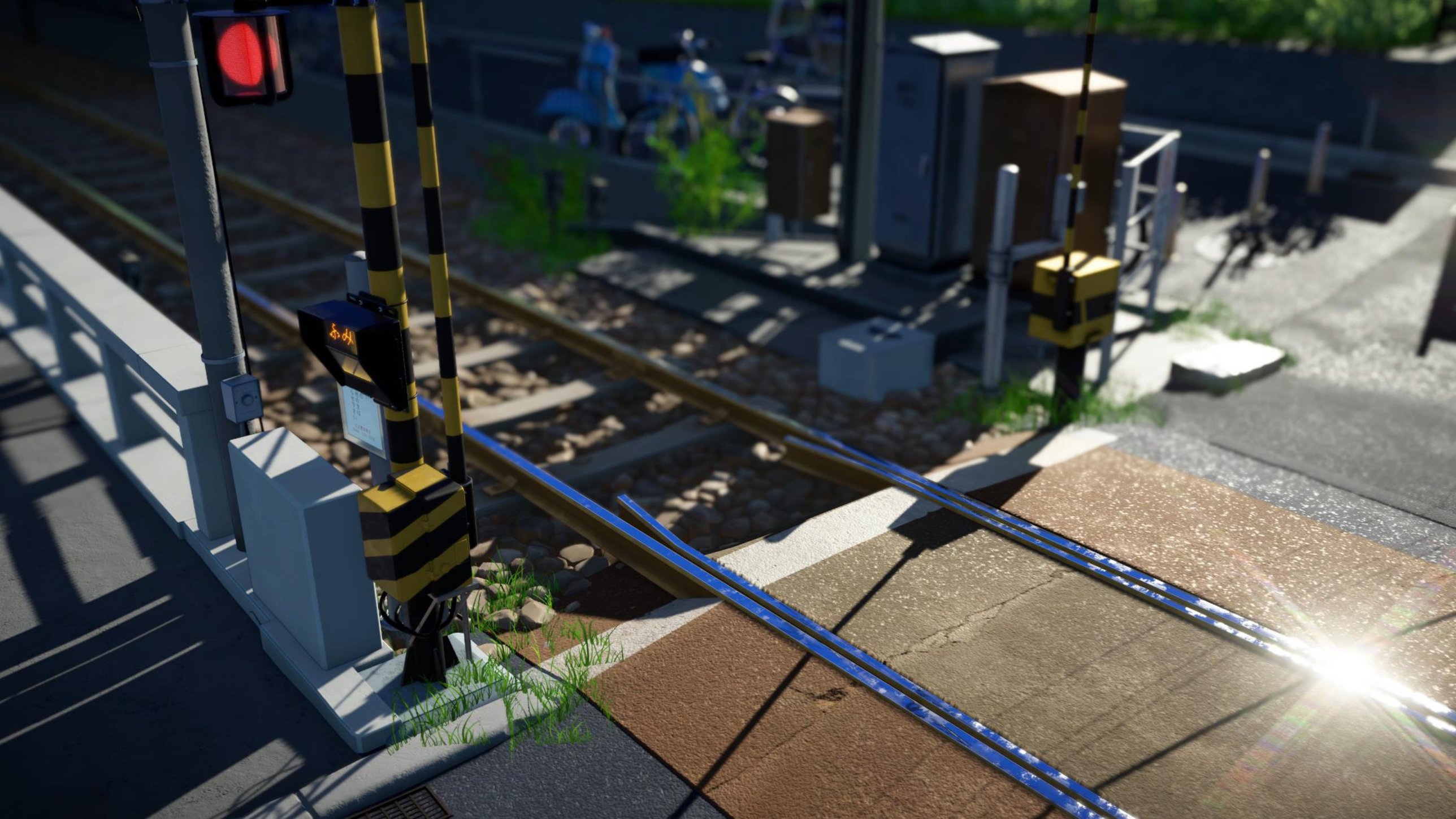
Rendering Features

Stylized Material

- PBR based
- Harmonized Color
- Exaggerate or remove details
- Outline on edges



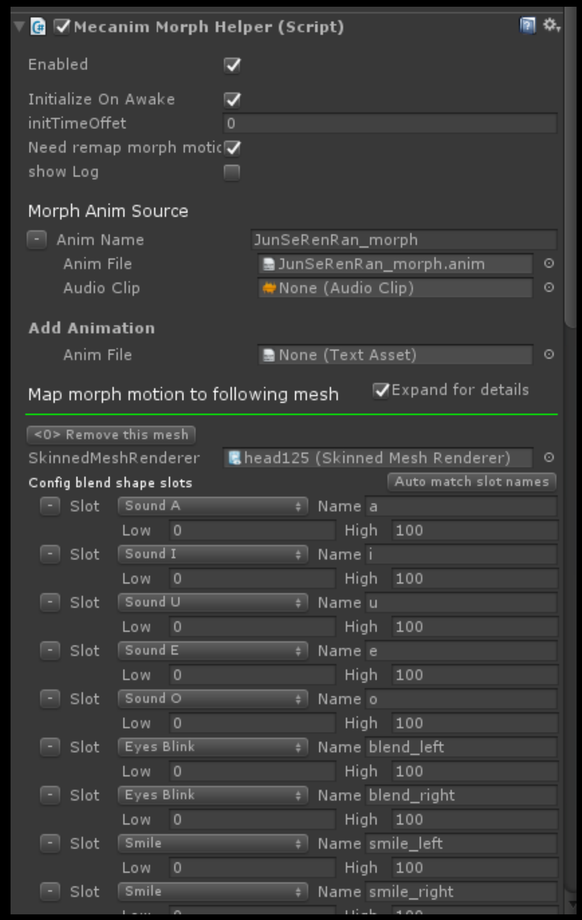
albedo normal Roughness Heightmap



Facial expression

- Use blend shape for facial morph
- Separate expression set of eye, brow, mouth
- facial expression helper for animation mapping

normal calm smile laugh astonishing sad



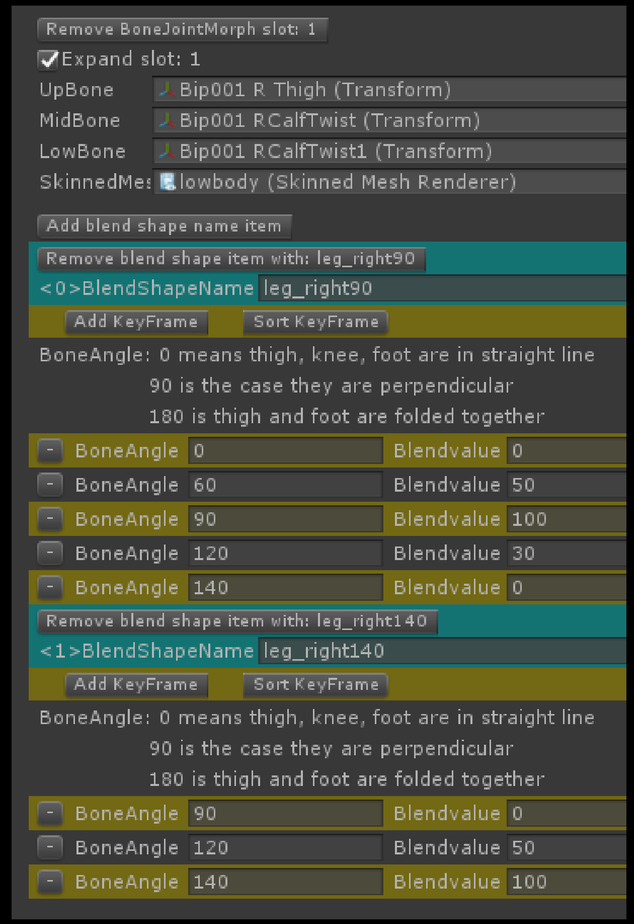
facial expression helper

Character Joint Fix

- Using blendshape interpolate between angles
- Could also use additional bones

With Joint Fix

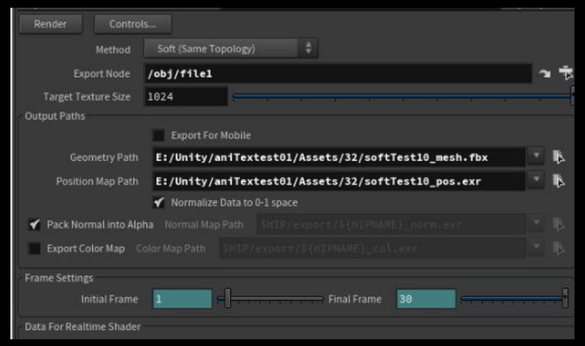
Without Joint Fix



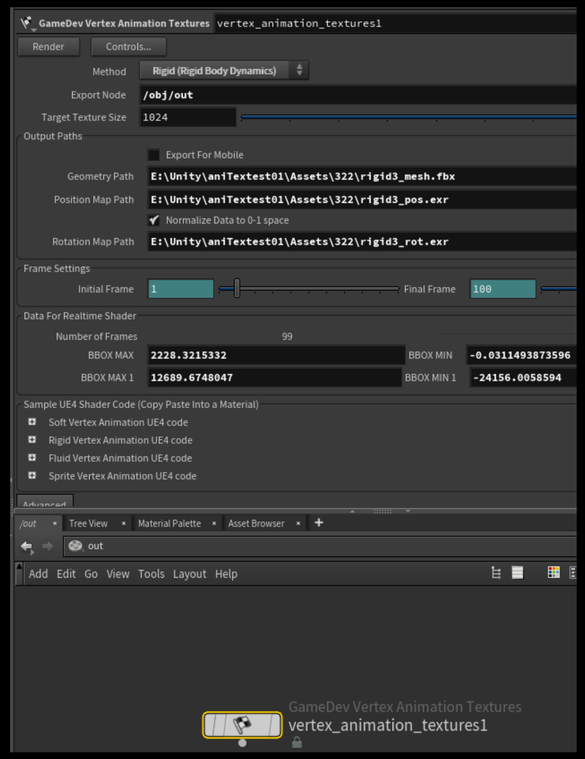
Morph helper

Fluid and destruction

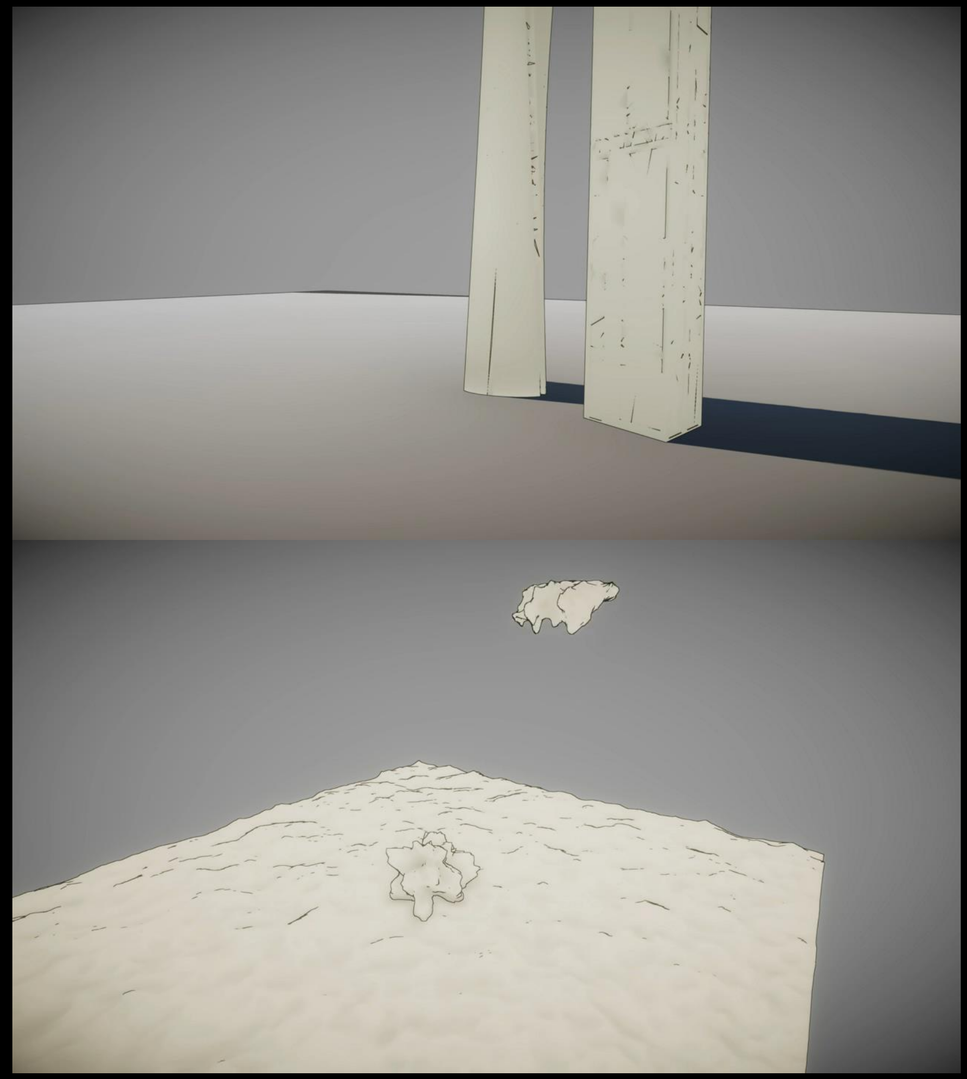
- Alembic format
- Vertex animation texture (EXR)



Soft Body Export



Rigid Body Export



Future Works

- Fully customizable stylized shading for all materials
- PBR material combined with brush modulation for scene rendering
- Subdivision for highly detailed model
- Further performance optimization For games

Thank you!