GDC March 20-24, 2023 San Francisco, CA

Squeezing Meta Quest 2 with Unreal Engine: A Tech Art Talk

Adam ”Chopin” Andrzejczak

#GDC23

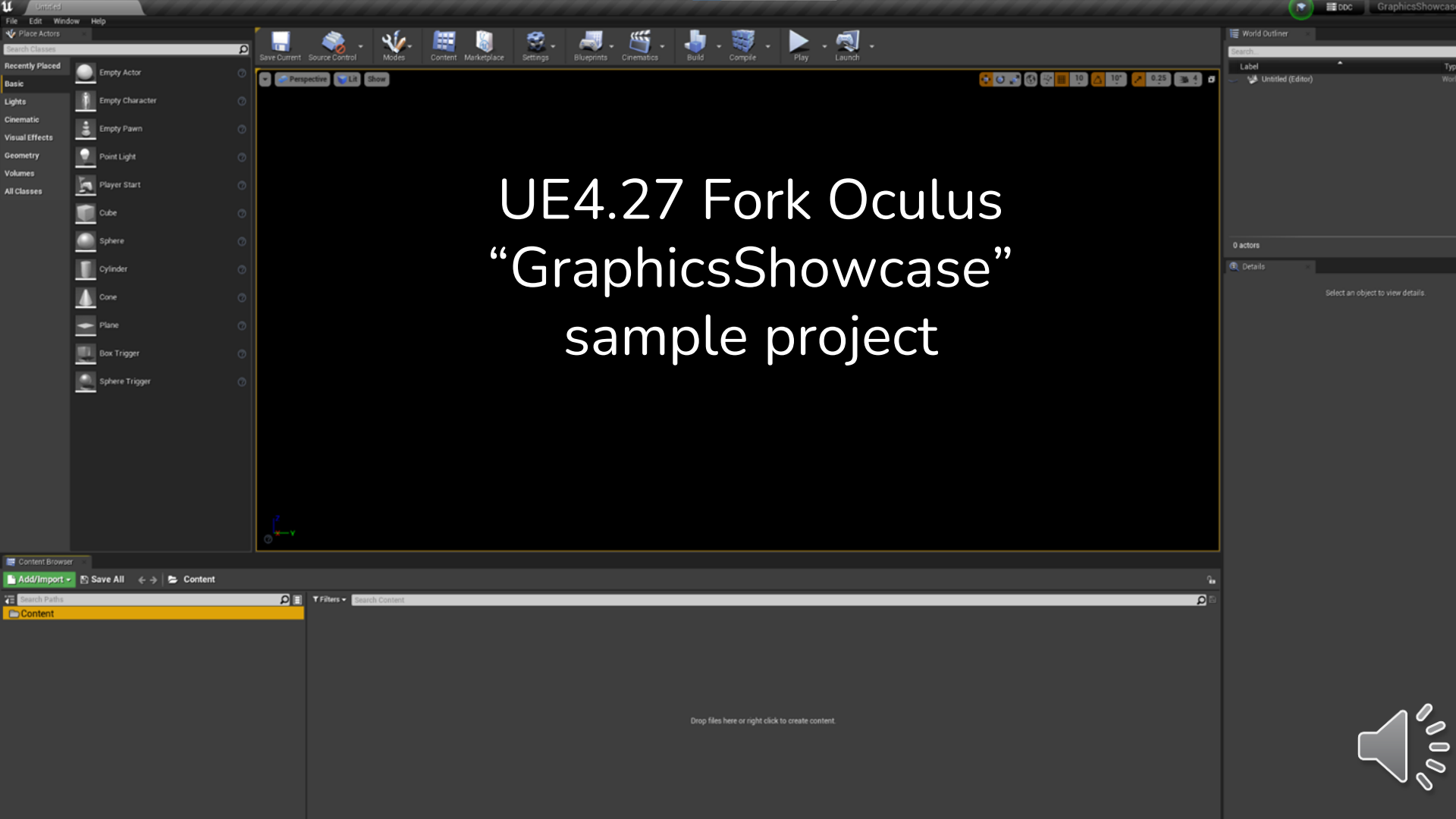
BLACK DRAKKAR GAMES

TAIPEI GAME SHOW

Best VR Game

INDIE GAME AWARD

2023


UE4.27 Fork Oculus
“GraphicsShowcase”
sample project


NavModifierVolume
NavModifierVolume2
NavModifierVolume3
NavModifierVolume4
NavModifierVolume6
NavModifierVolume7
NavModifierVolume8
NavModifierVolume9
NavModifierVolume10
NavModifierVolume11
NavModifierVolume12
NavModifierVolume13
RecastNavMesh-Default
Text
SampleText
TextPlane-Aniso
TextPlane-Aniso-Biased
TextPlane-Mipmapped
TextPlane-NoMips
TextPlane-Trilinear
VRPawn
68 actors (1 selected)
View Options
TextRenderingVR-RGB
File Edit Asset Window Help
Save Browse Compress Reimport
Mip Level: 0
View
Text Rendering in VR
This is an example of a high resolution text texture being rendered in an Unreal Engine 4 VR Stereo Layer. Stereo Layers are not affected by the scene's settings for post-processing or anti-aliasing and can appear sharper than text rendered through other means.
For textures displayed in world-space, mipmaps should be used to avoid aliasing. To increase sharpness, a negative sample bias can be applied to the mipmap sample level, and anisotropic filtering should be used for text that will be viewed at oblique angles.
Oculus' documentation has more details on correct text rendering for VR, and can be viewed at https://developer.oculus.com/blog/common-rendering-mistakes-how-to-find-them-and-how-to-fix-them.
Zoom: Fit (17%)
Details
Imported: 4096x2048
Displayed: 4096x2048
Max In-Game: 4096x2048
Resource Size: 43691 Kb
Has Alpha Channel: True
Method: Not Streamed
Format: B8G8R8A8
Combined LOD Bias: 0
Number of Mips: 13
Search Details
Compression
Compress Without
Defer Compression
Compression Settir UserInterface2D (RGBA)
Texture
Power Of Two Mod Pad to Power Of Two
Padding Color
sRGB
File Path
Source File TextRenderingVR-RGB.png
Details
SampleText
+ Add Component
Blueprint/Add Script
Search Components
SampleText(Instance)
DefaultSceneRoot
TextLayer
TextLayer (Stereo Layer)
A geometry layer within the stereo rendered viewport.
Source: This actor instance
Mobility: Movable
Search Details
Transform
Location X -120.0 Y 170.0 Z 90.0
Rotation X 0.0 ° Y 0.0 ° Z 0.0 °
Scale X 1.0 Y 1.0 Z 1.0
Mobility Static Stationary Movable

Performance Targets

- Media applications are allowed to target 60 frames per second.
- Interactive applications (games ☺) must target a minimum of 72 frames per second.
    a. Rare frame drops are acceptable
- Draw Calls:
    a. 80-200 (busy simulation)
    b. Dynamic shadow casting = more draw calls
- Triangles:
    a. Triangles that span multiple tiles are more expensive.
    b. 750k-1.0m

In practice divide it by 2…

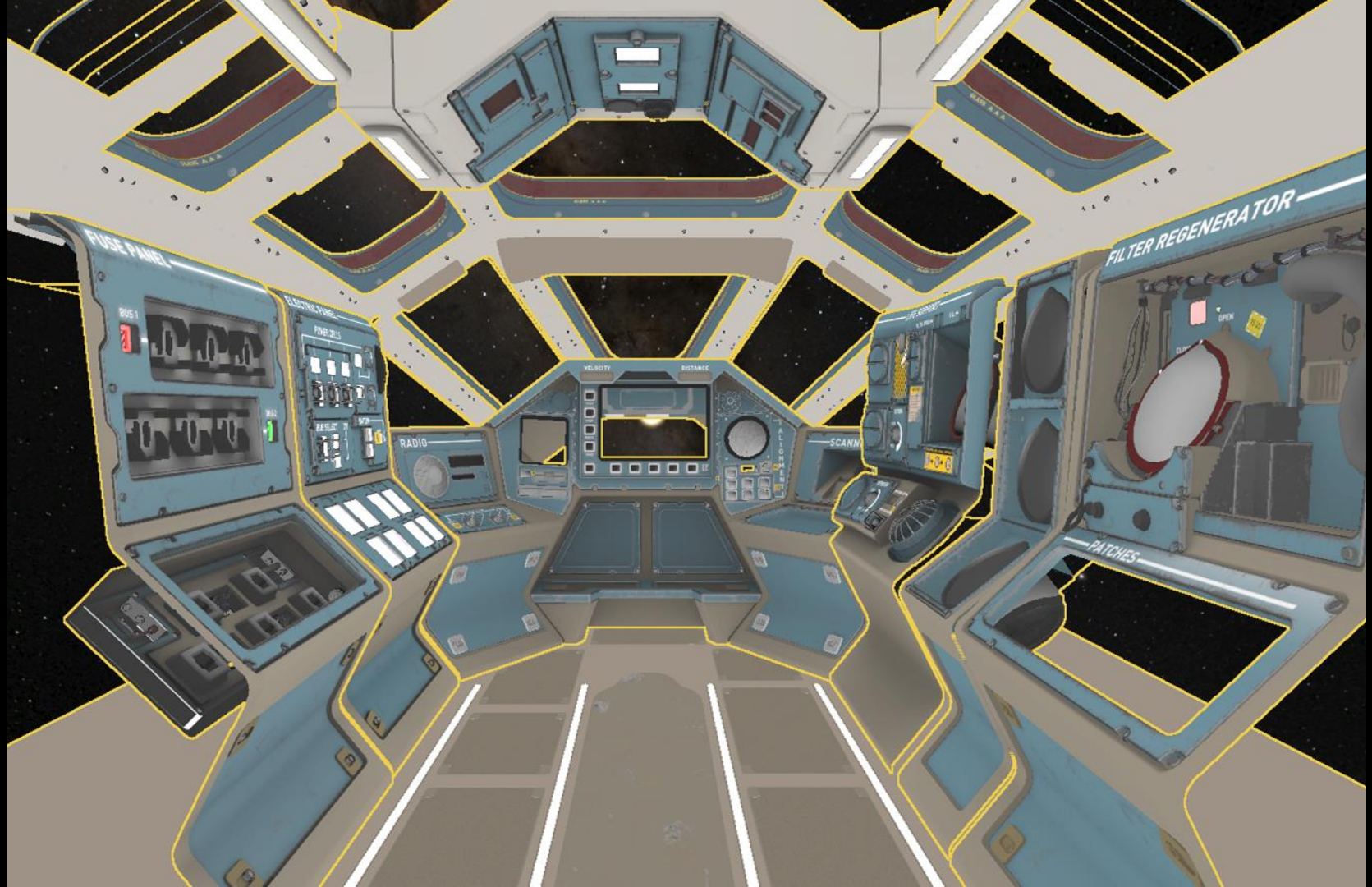
- Shader complexity!


Switch Computer to
76843
382036
Current Mission:
Get to Coordinates
Current Procedure:
Switch Computer to
->TRGT Mode
to see list of
Targets
Recieving New
Coordinates

Level design

- Concept your levels knowing your tech limits!
  - Compact interiors
  - Vast, open, unreachable spaces


FUSE PANEL
BUS 1
RADIO
VELOCITY
DISTANCE
FILTER REGENERATOR
OPEN
PATCHES


FUSE PANEL
RADIO
VELOCITY
DISTANCE
FILTER REGENERATOR
OPEN
PATCHES

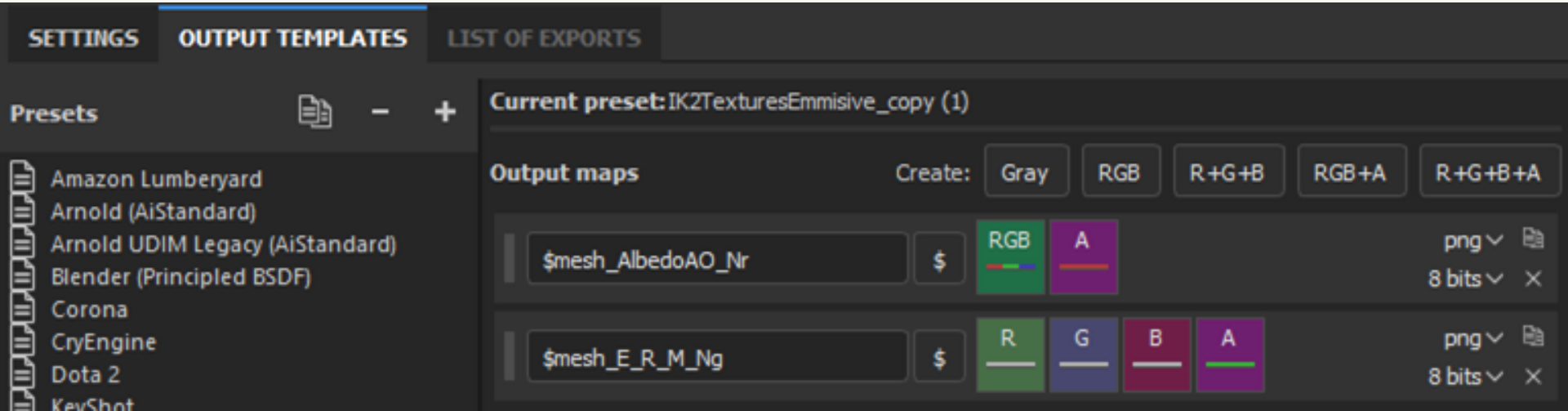

VELOCITY
DISTANCE
TRGT
MAP
PROG
DIAG
ALIGNMENT
SCANNER
PLACE HERE
SCANNER DOCK STATION
LIGHTS
CON1
1W
CON2
1W

Textures

- High res is ok (2k-4k)
- Rare 8k is ok
- Texture samples in shaders are not ok

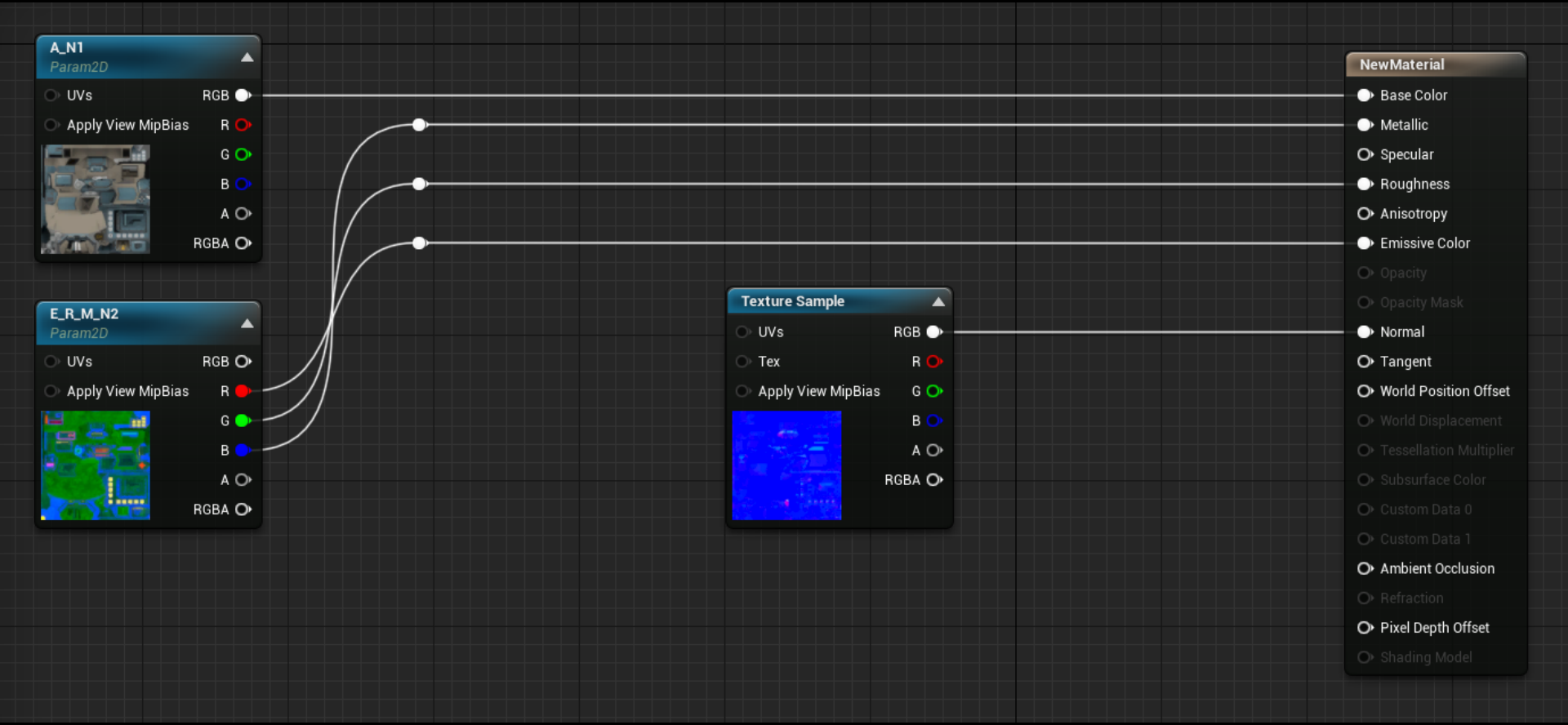
Master Material - Textures

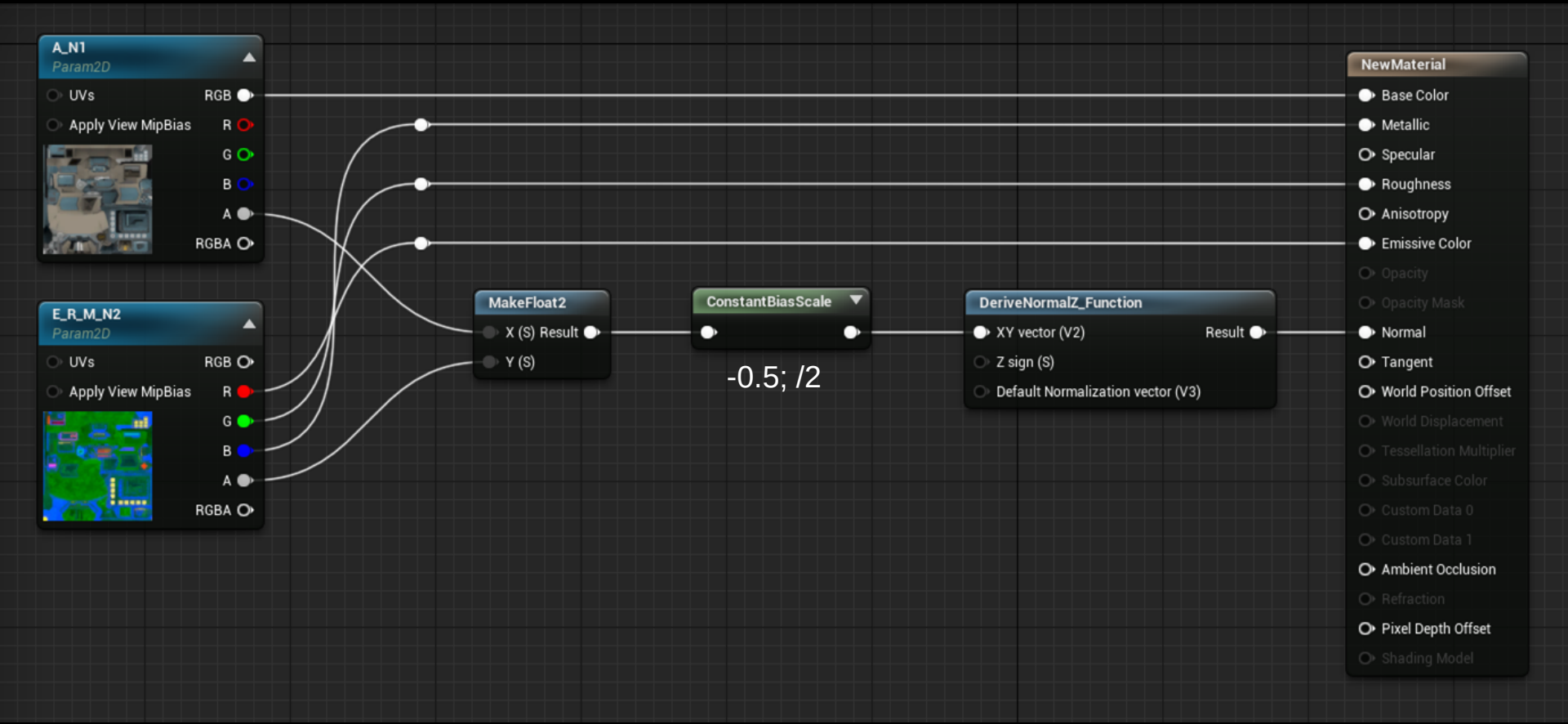
- 1. Texture
  - RGB - Albedo
  - A - 1st channel of a normal map
- 2. Texture
  - R - Emissive/AO
  - G - Roughness
  - B - Metallic
  - A - 2nd channel of a normal map
- Cube map (optional)

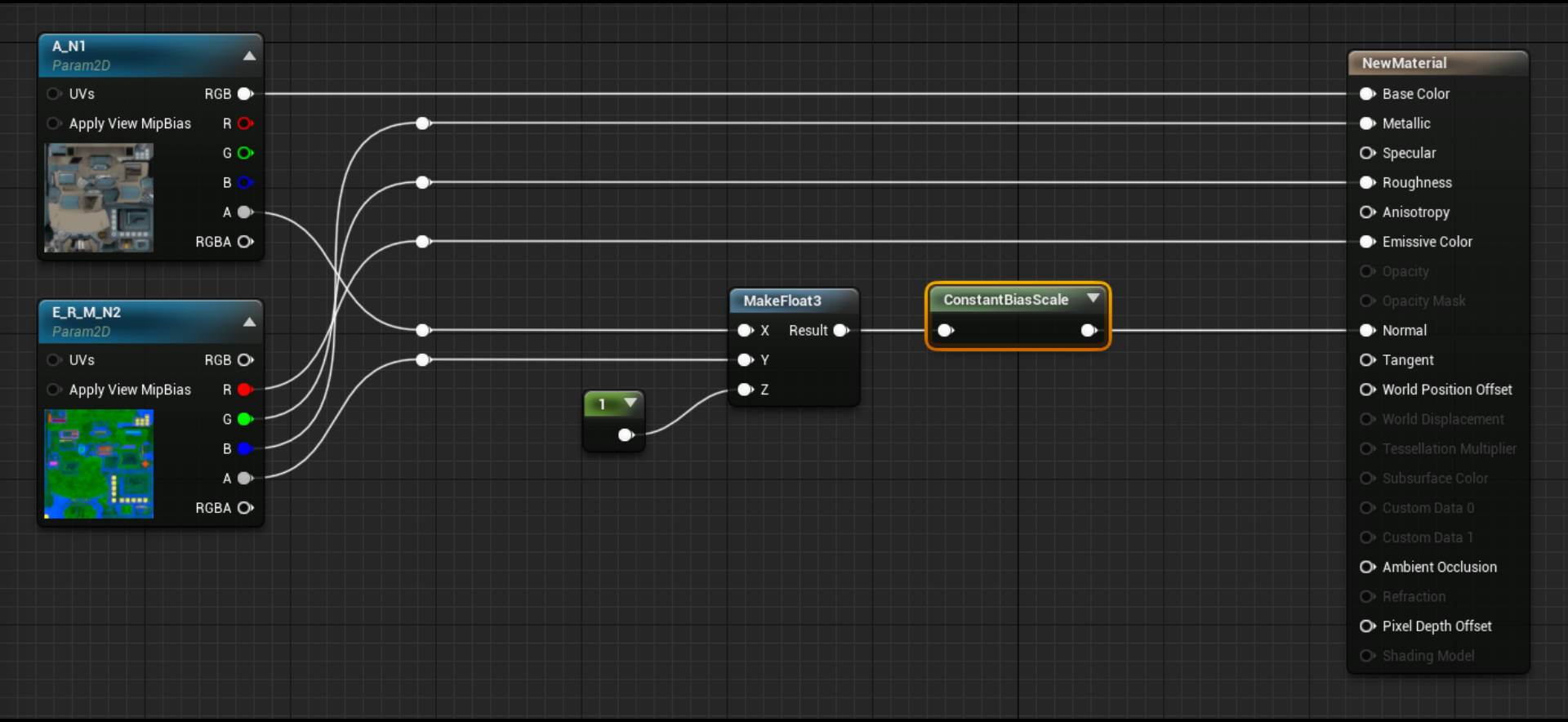


Normal Map

- Optimizing!


A_N1
Param2D
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA
E_R_M_N2
Param2D
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA
Texture Sample
UVs
Tex
Apply View MipBias
RGB
R
G
B
A
RGBA
NewMaterial
Base Color
Metallic
Specular
Roughness
Anisotropy
Emissive Color
Opacity
Opacity Mask
Normal
Tangent
World Position Offset
World Displacement
Tessellation Multiplier
Subsurface Color
Custom Data 0
Custom Data 1
Ambient Occlusion
Refraction
Pixel Depth Offset
Shading Model


A_N1
Param2D
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA
E_R_M_N2
Param2D
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA
MakeFloat2
X (S) Result
Y (S)
ConstantBiasScale
-0.5; /2
DeriveNormalZ_Function
XY vector (V2)
Z sign (S)
Default Normalization vector (V3)
Result
NewMaterial
Base Color
Metallic
Specular
Roughness
Anisotropy
Emissive Color
Opacity
Opacity Mask
Normal
Tangent
World Position Offset
World Displacement
Tessellation Multiplier
Subsurface Color
Custom Data 0
Custom Data 1
Ambient Occlusion
Refraction
Pixel Depth Offset
Shading Model

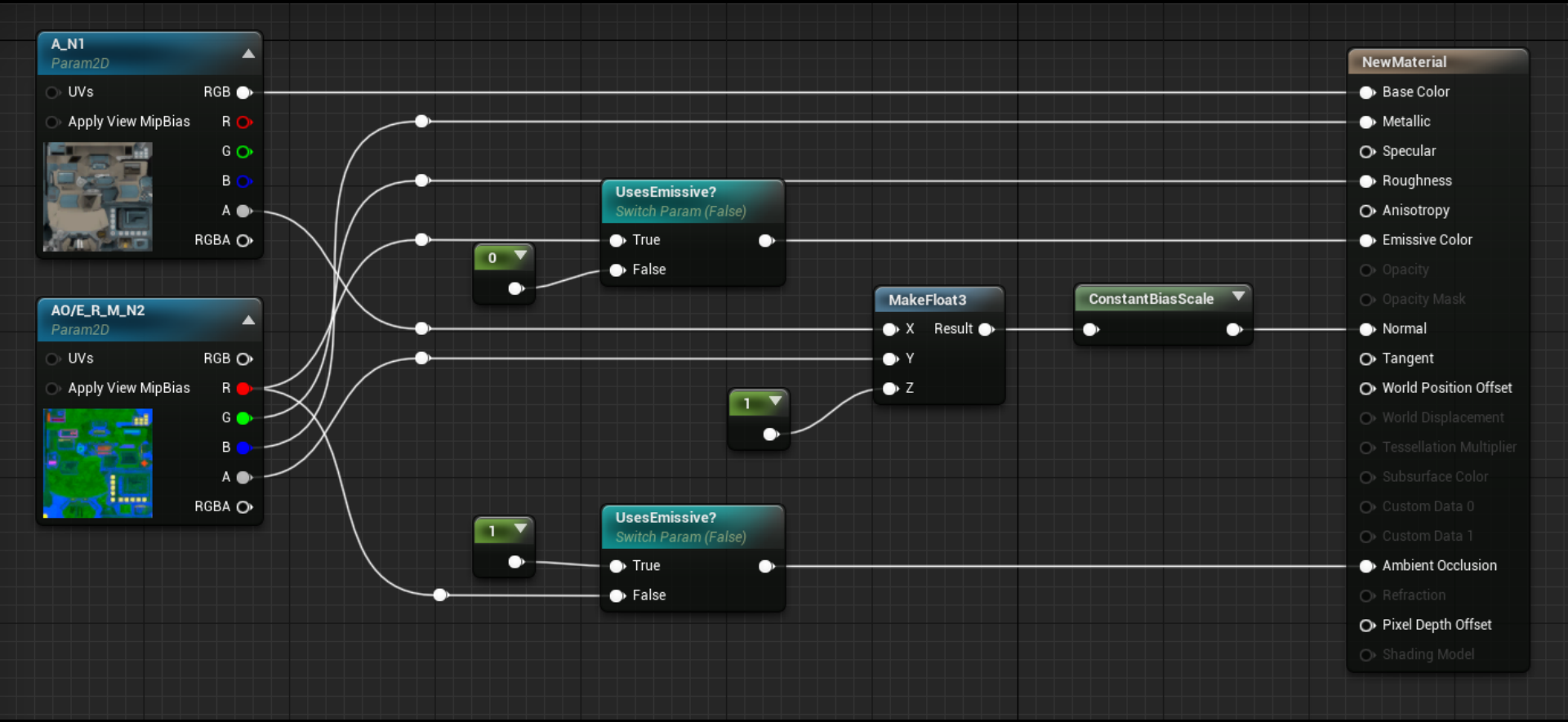

A_N1
Param2D
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA
E_R_M_N2
Param2D
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA
MakeFloat3
X
Y
Z
Result
1
ConstantBiasScale
NewMaterial
Base Color
Metallic
Specular
Roughness
Anisotropy
Emissive Color
Opacity
Opacity Mask
Normal
Tangent
World Position Offset
World Displacement
Tessellation Multiplier
Subsurface Color
Custom Data 0
Custom Data 1
Ambient Occlusion
Refraction
Pixel Depth Offset
Shading Model

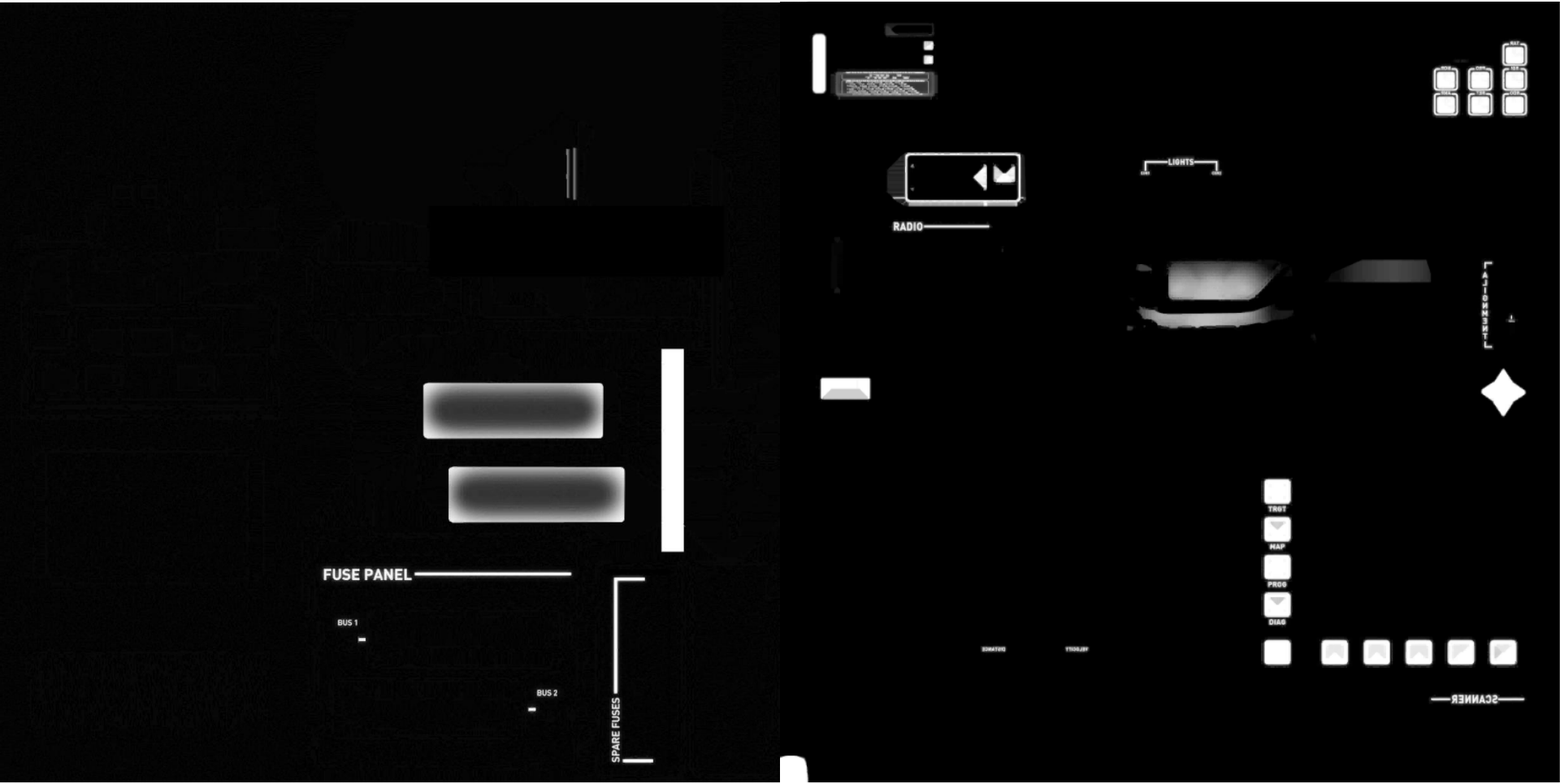
Separate texture

Derive Z

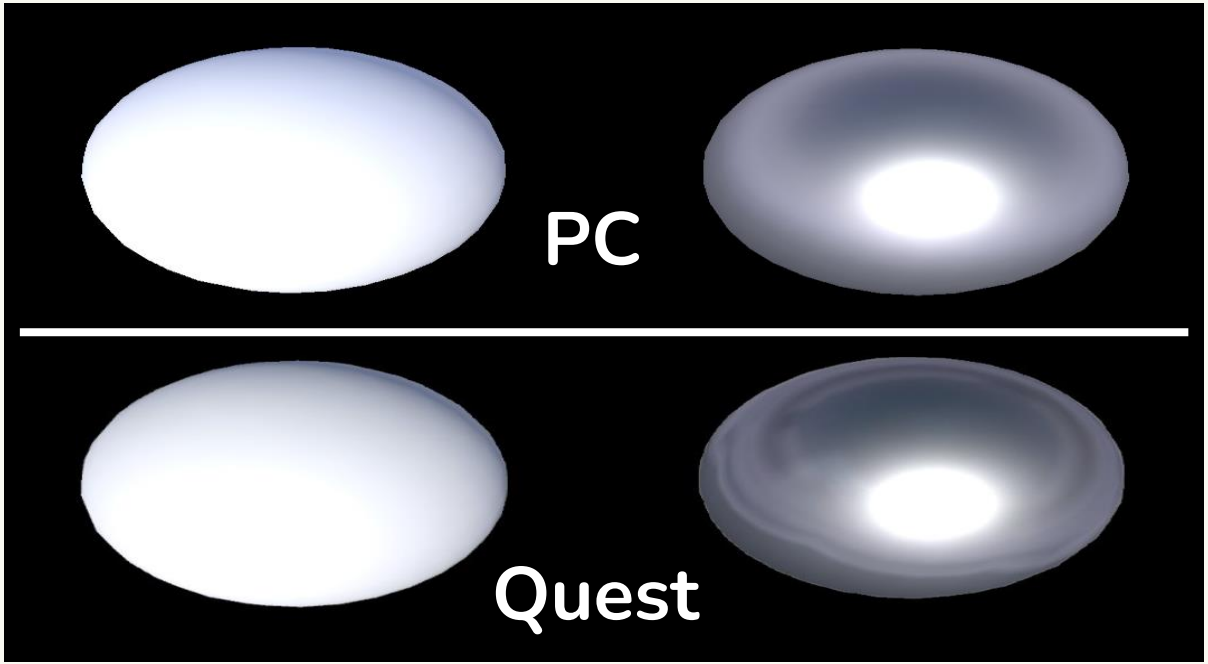
What is Z?

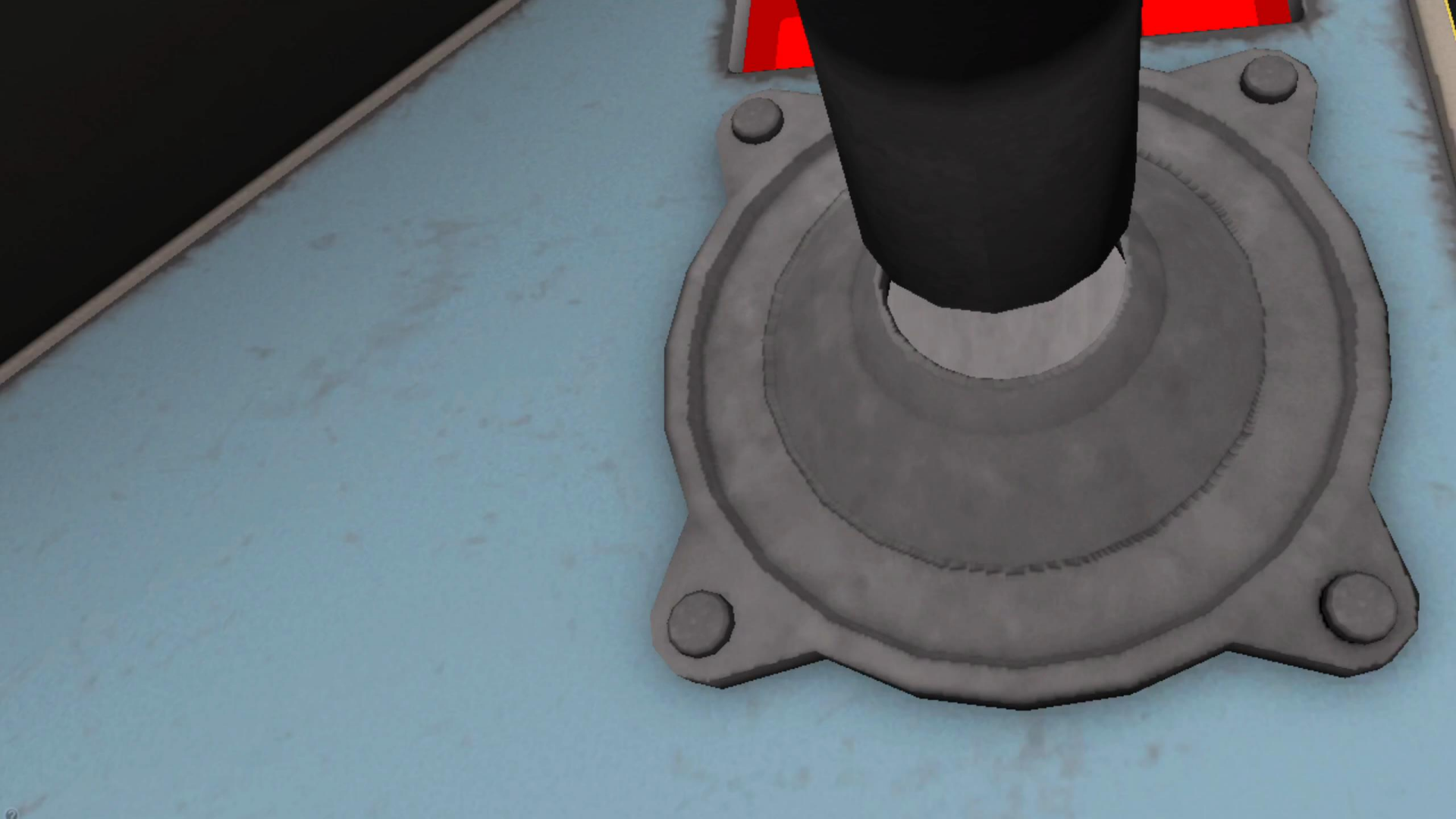
Ambient Occlusion

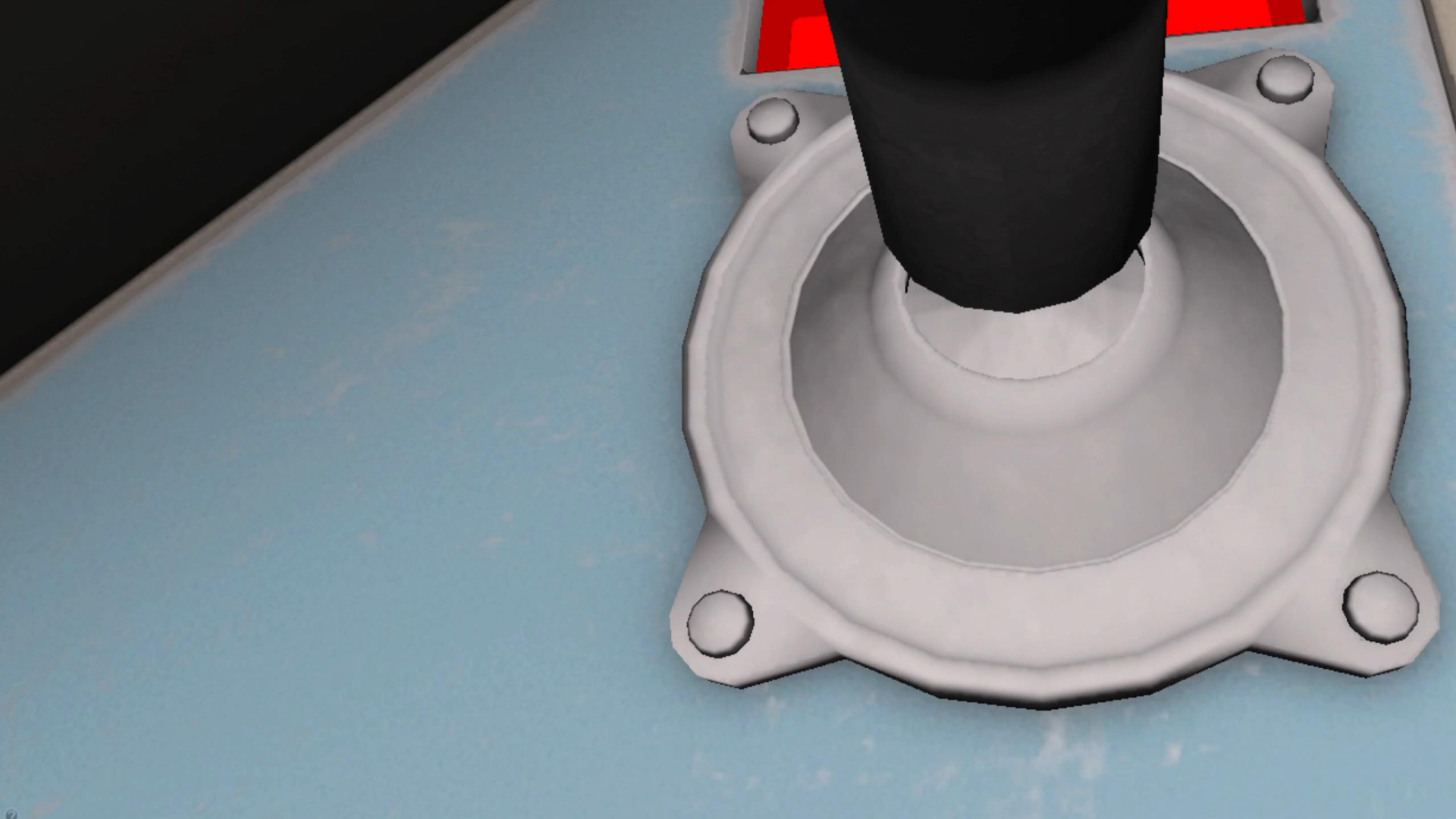

A_N1
Param2D
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA
AO/E_R_M_N2
Param2D
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA
0
1
1
UsesEmissive?
Switch Param (False)
True
False
UsesEmissive?
Switch Param (False)
True
False
MakeFloat3
X
Y
Z
Result
ConstantBiasScale
NewMaterial
Base Color
Metallic
Specular
Roughness
Anisotropy
Emissive Color
Opacity
Opacity Mask
Normal
Tangent
World Position Offset
World Displacement
Tessellation Multiplier
Subsurface Color
Custom Data 0
Custom Data 1
Ambient Occlusion
Refraction
Pixel Depth Offset
Shading Model

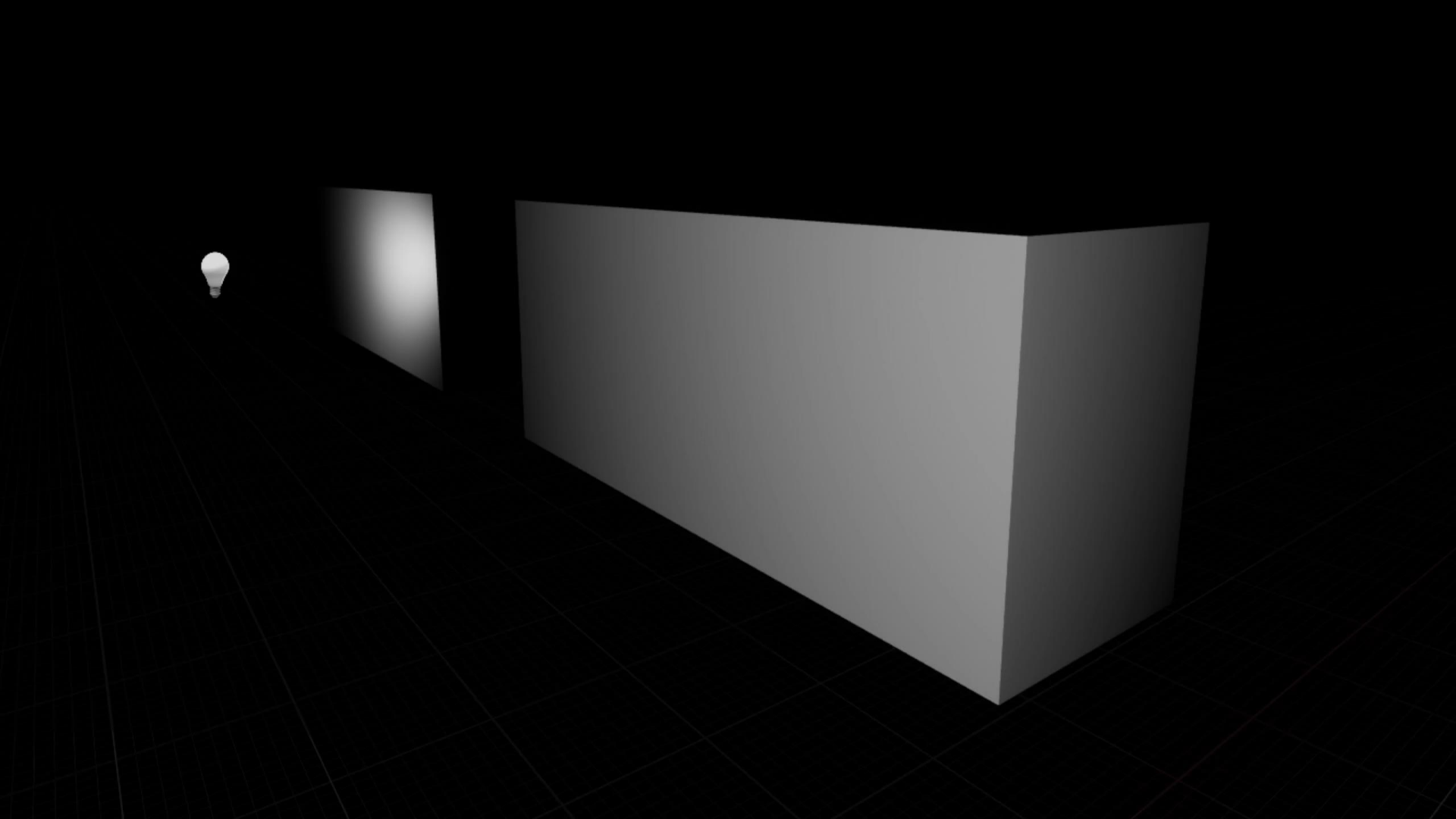

FUSE PANEL
BUS 1
BUS 2
SPARE FUSES
RADIO
LIGHTS
TROT
MAP
PROG
DIAG
SCANNER

Metallic

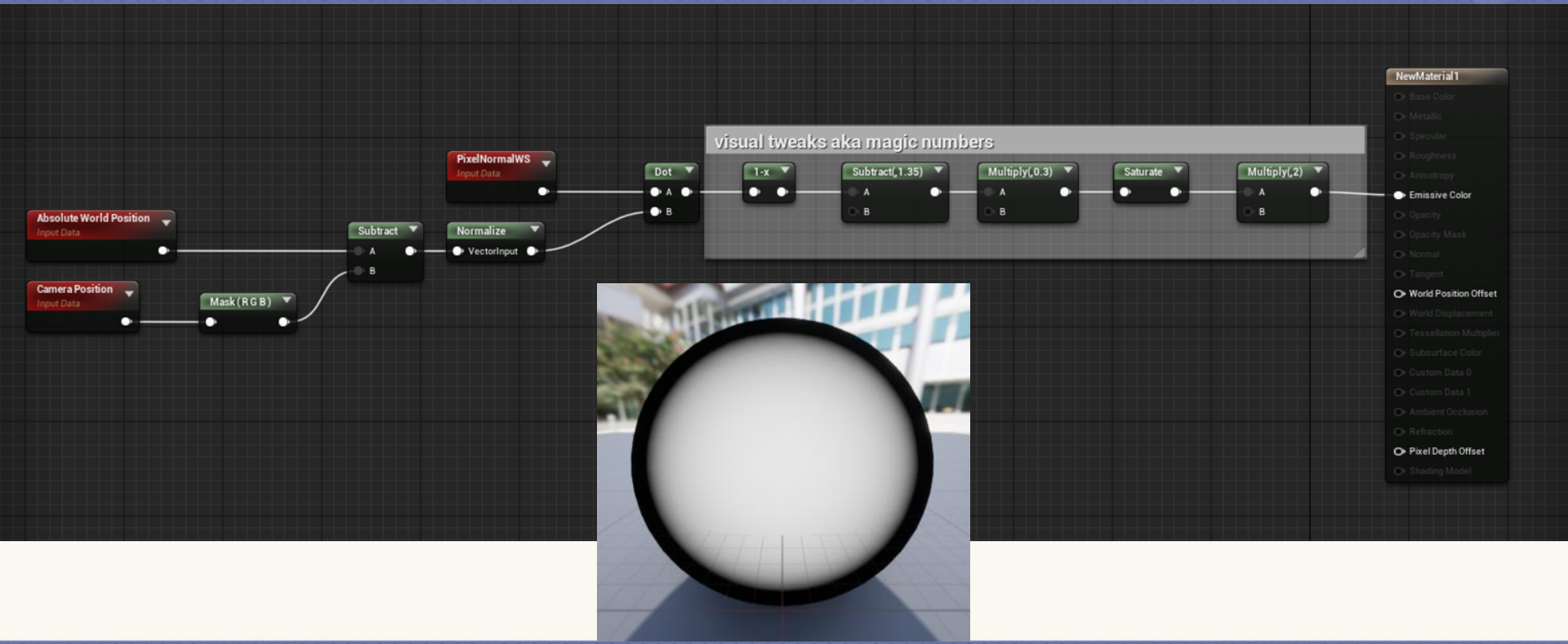




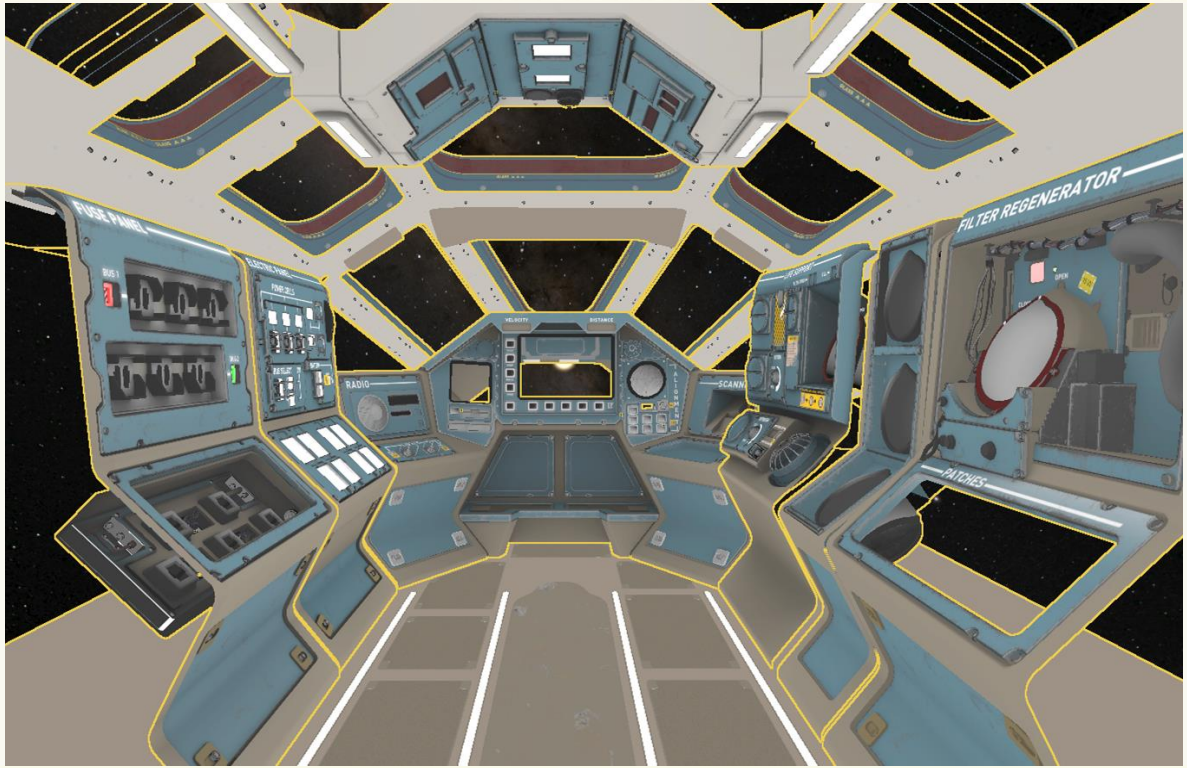


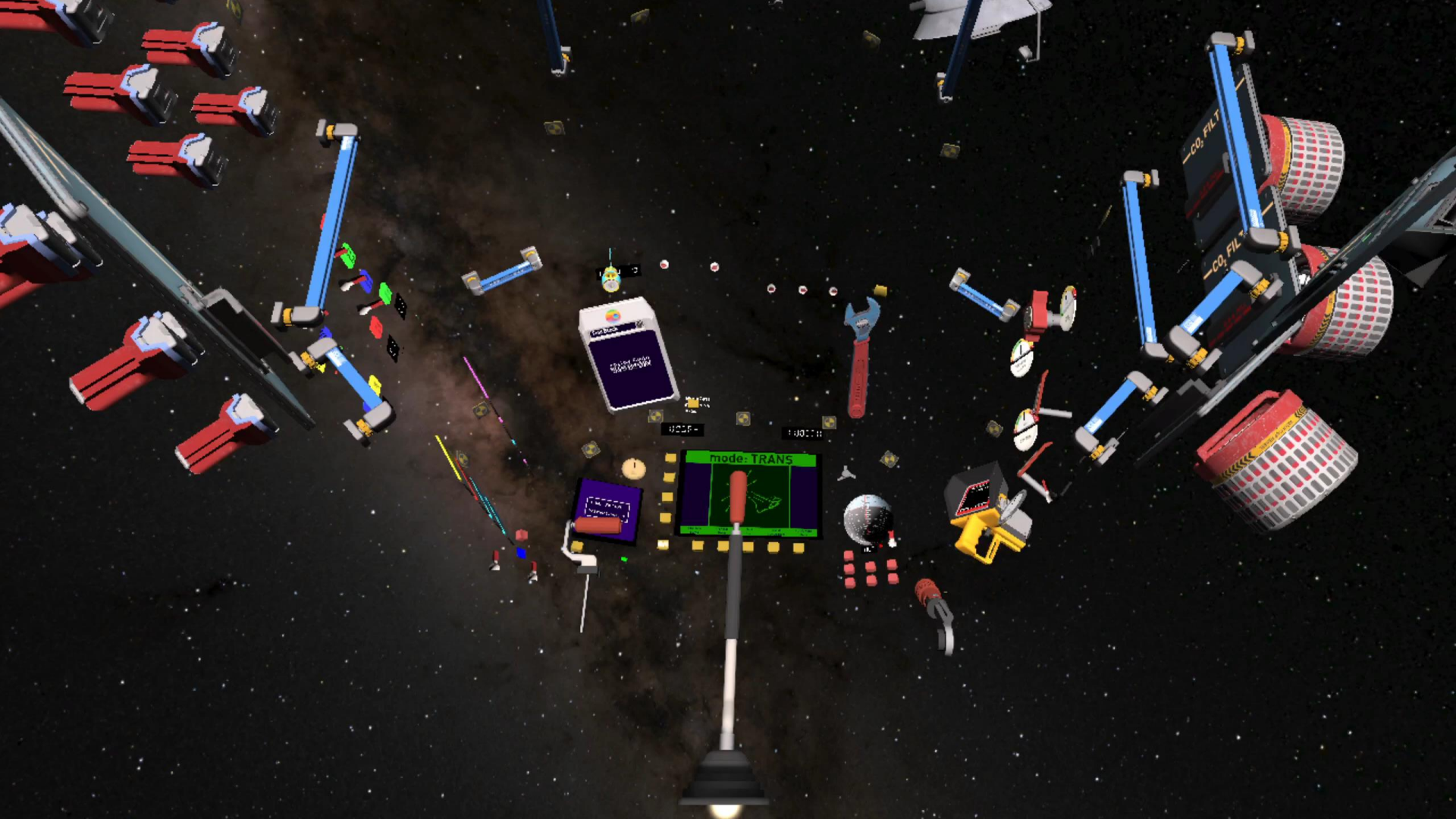


Fake Metallic



Draw Calls



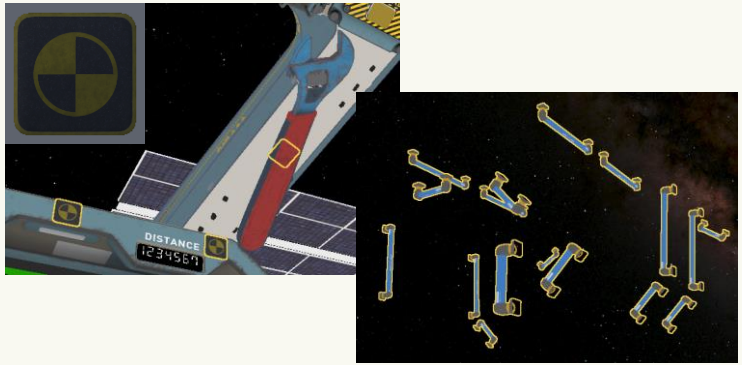

mode: TRANS

Interactive (Movable) Meshes

- Cannot be merged
- Cannot be instanced
- …or can they?

Instanced Meshes Solution

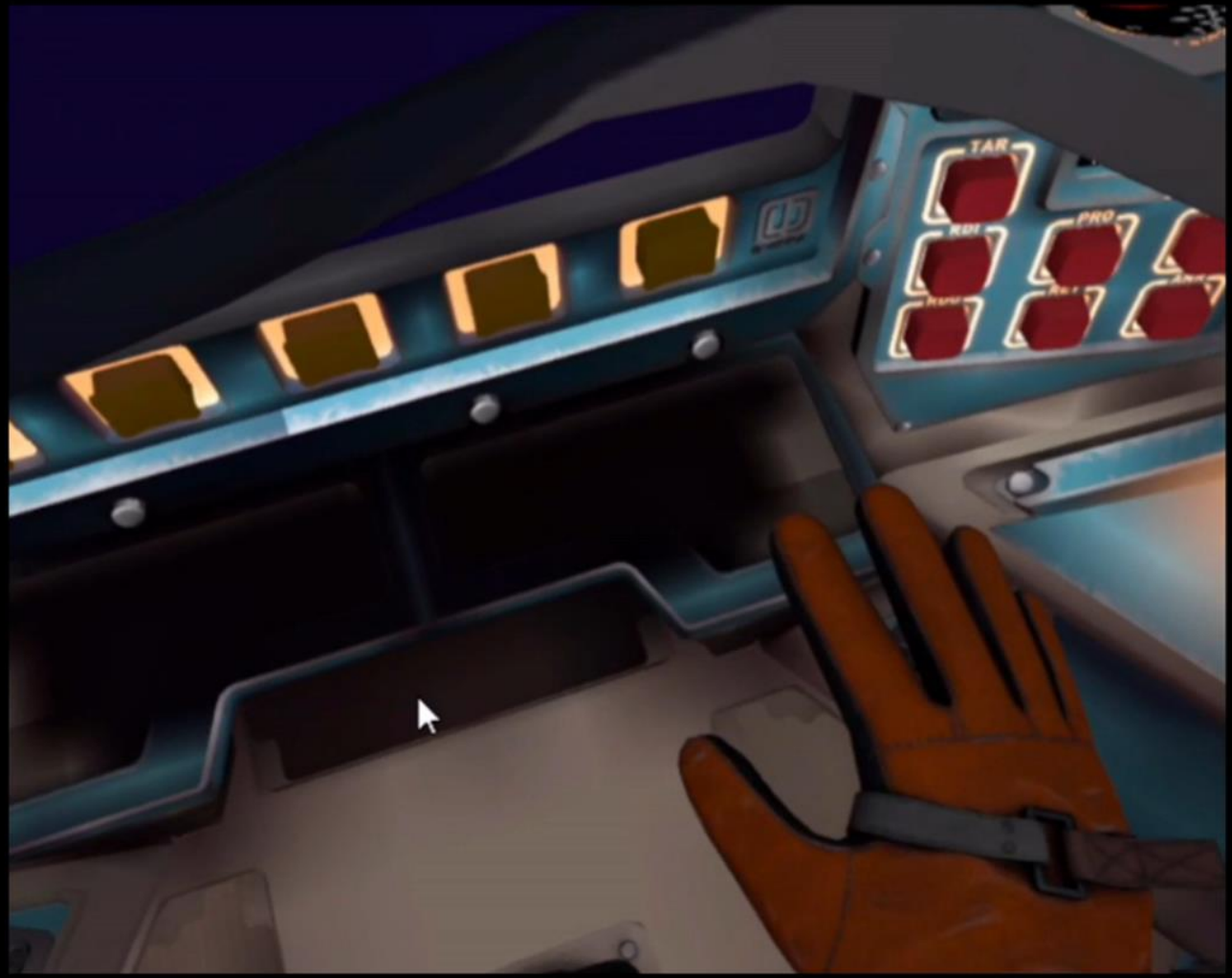
- Interactive but non-movable actors like velcro and handles had their meshes hidden. In their stead a single instanced mesh was placed.

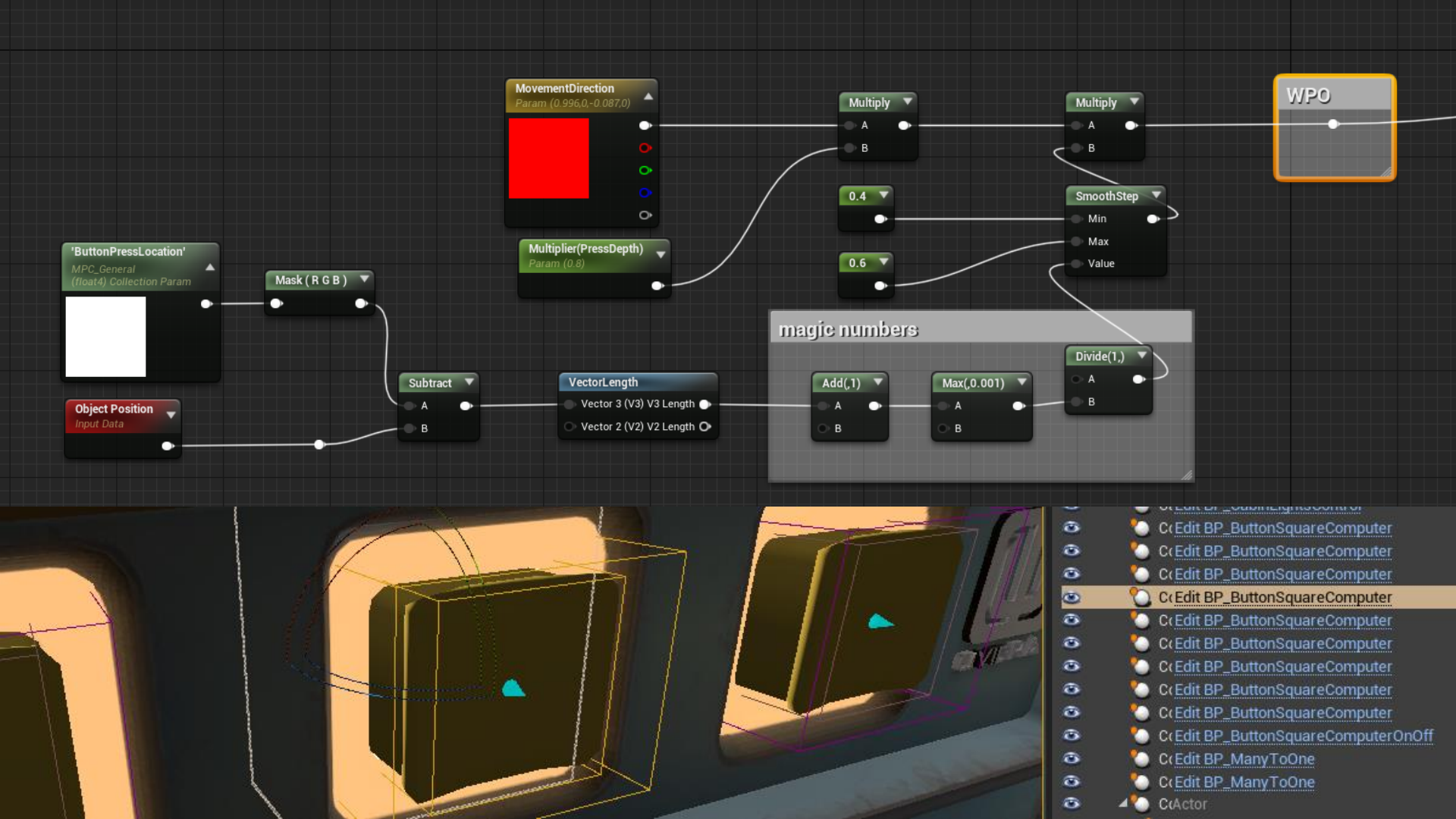


- Actors that were movable in a single degree of freedom like buttons and flip switches were also represented by instanced meshes.

Pressable Buttons

- Pressable button sends a single call if pressed; holding and releasing actions are not registered

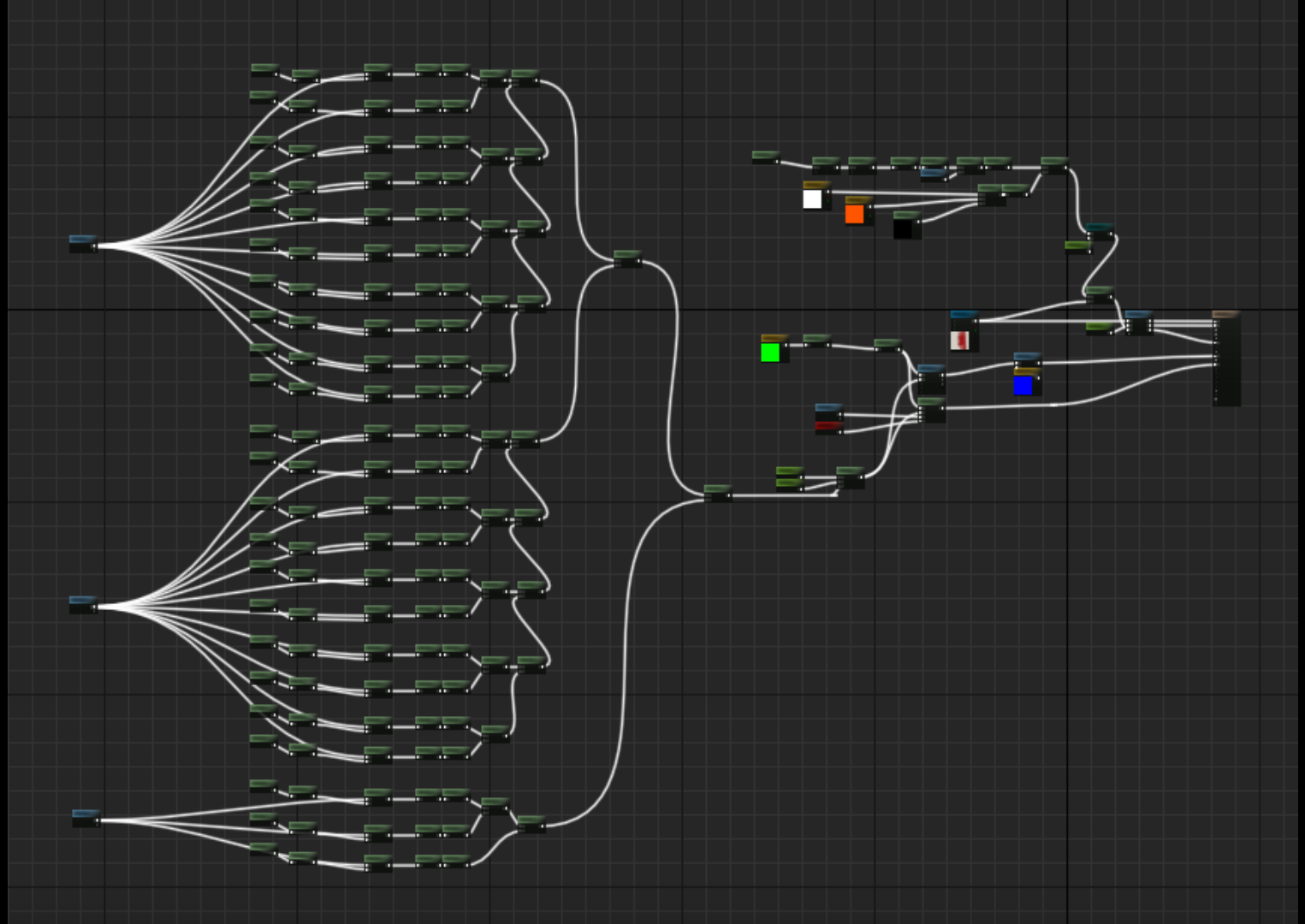

TAR
PRO

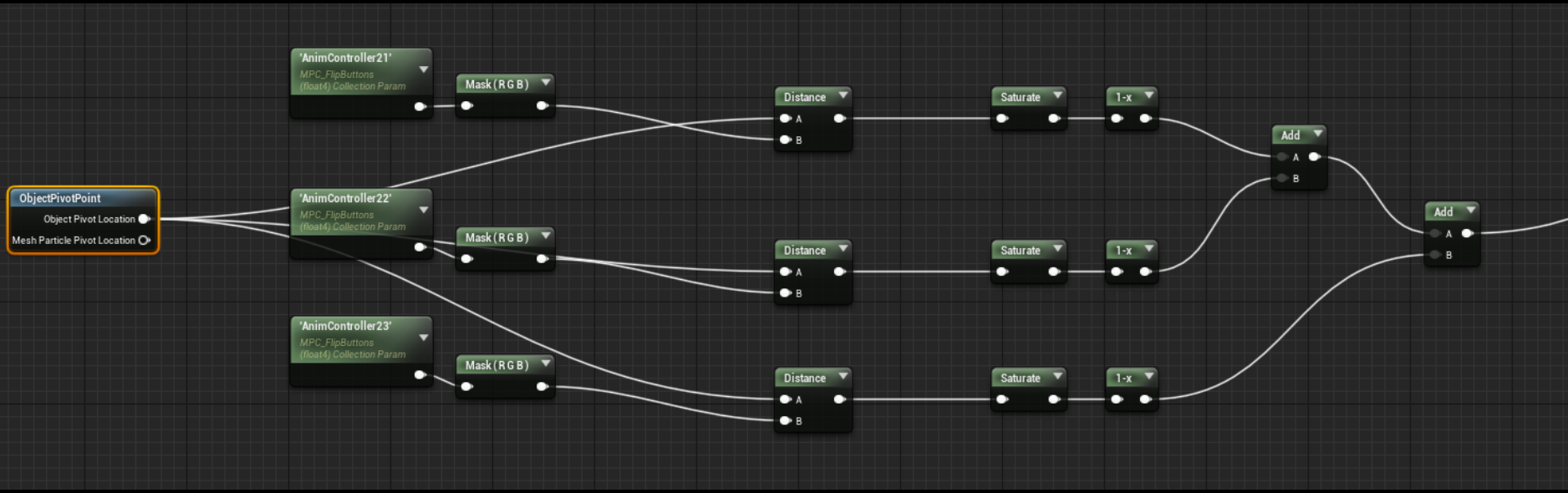

MovementDirection
Param (0.996,0,-0.087,0)
Multiply
A
B
Multiply
A
B
WPO
0.4
SmoothStep
Min
Max
Value
0.6
Multiplier(PressDepth)
Param (0.8)
'ButtonPressLocation'
MPC_General
(float4) Collection Param
Mask (R G B)
magic numbers
Divide(1,)
A
B
Subtract
A
B
VectorLength
Vector 3 (V3) V3 Length
Vector 2 (V2) V2 Length
Add(,1)
A
B
Max(,0.001)
A
B
Object Position
Input Data
Edit BP_ButtonSquareComputer
Edit BP_ButtonSquareComputer
Edit BP_ButtonSquareComputer
Edit BP_ButtonSquareComputer
Edit BP_ButtonSquareComputer
Edit BP_ButtonSquareComputer
Edit BP_ButtonSquareComputer
Edit BP_ButtonSquareComputer
Edit BP_ButtonSquareComputerOnOff
Edit BP_ManyToOne
Edit BP_ManyToOne
Actor

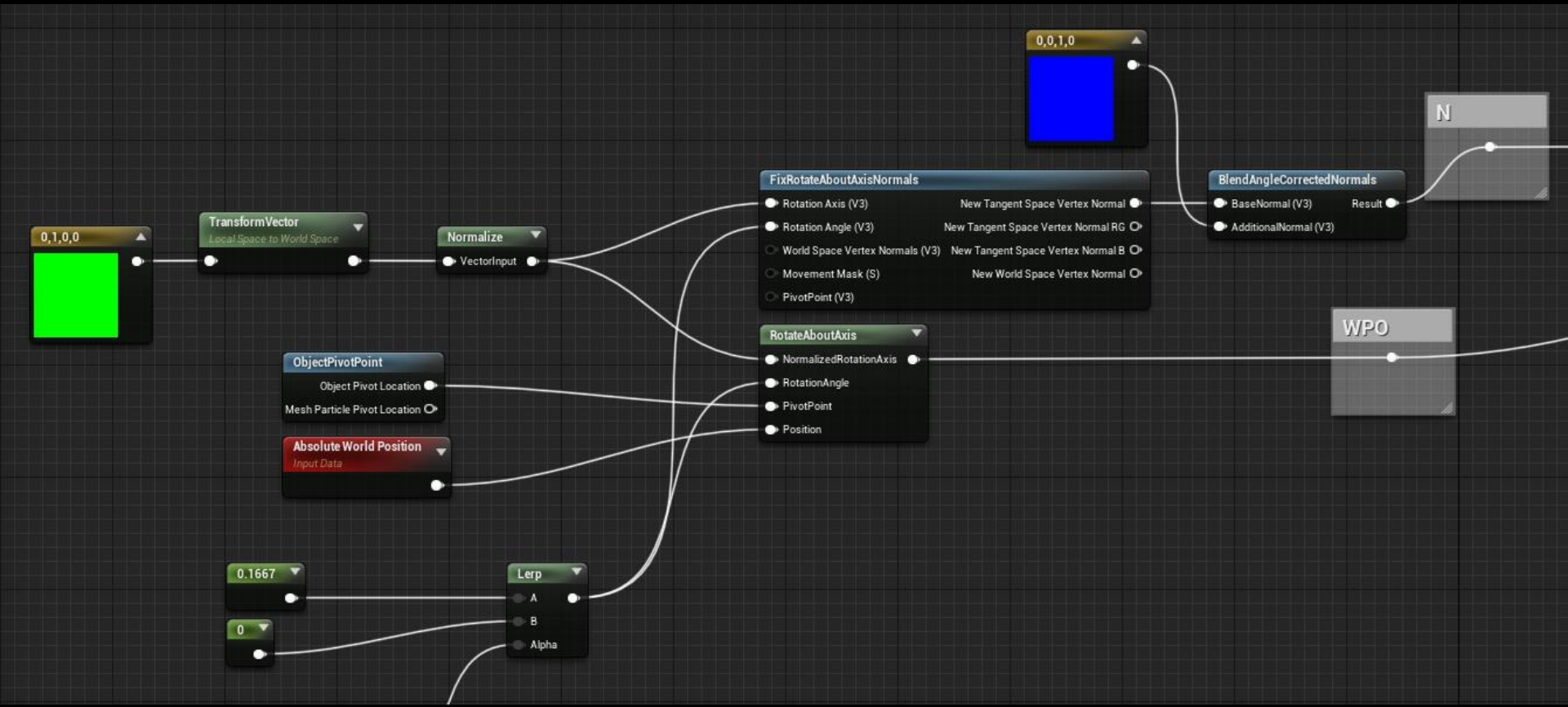
Flip Switches

- Flip switch sends a single call if toggled; the value of a flip switch is stored

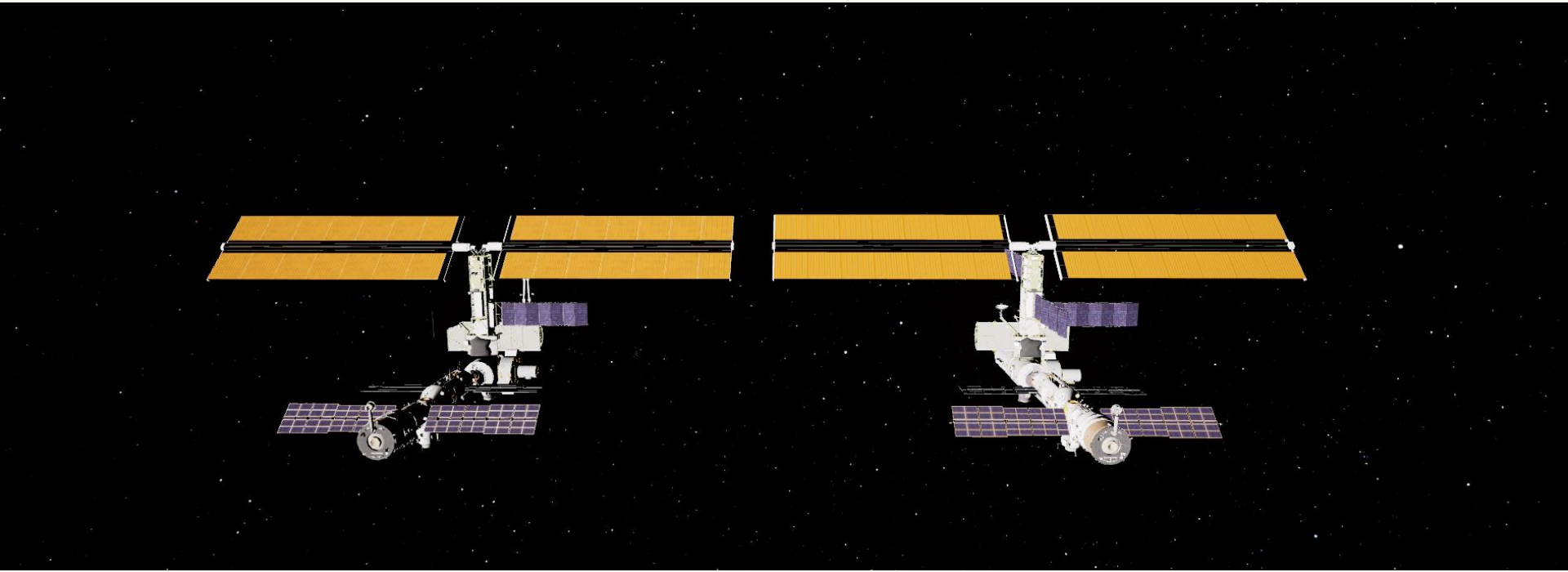

ROLL
LOW
ROT
YAW
HIGH
HIGH
AXIS
FORCE
MODE
ALT
GLASS
tch Computer to
->TRGT Mode



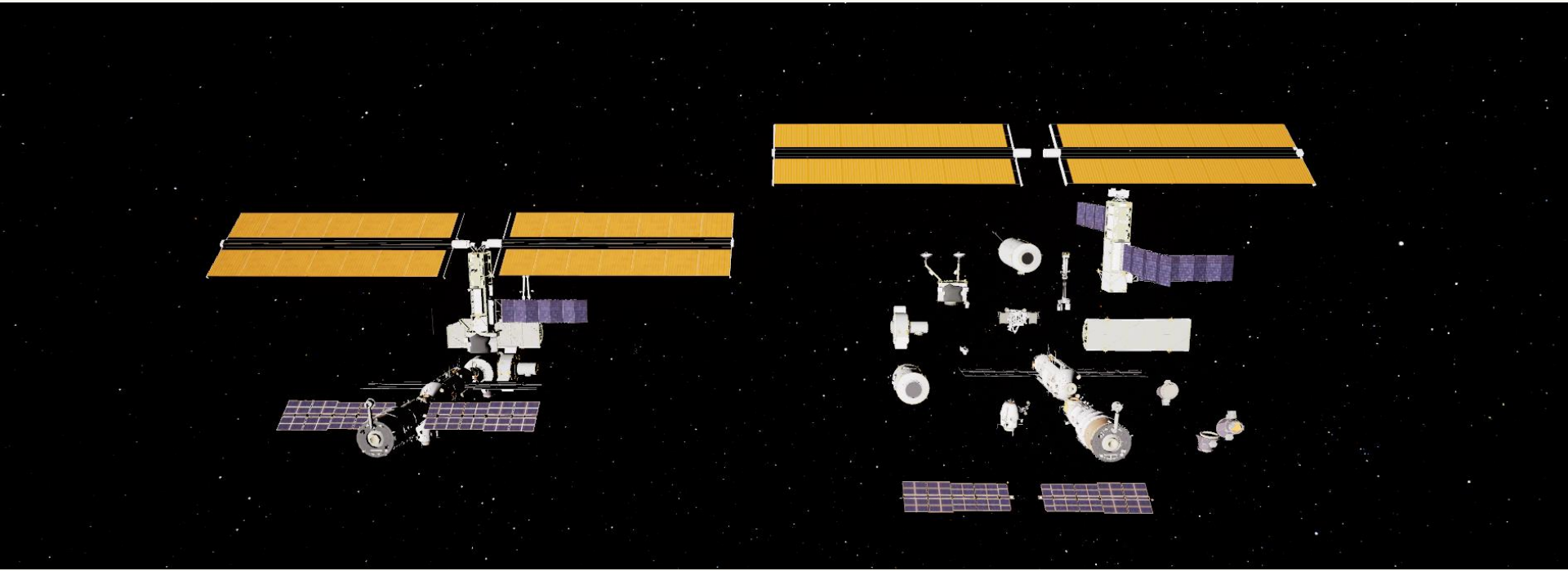

ObjectPivotPoint
Object Pivot Location
Mesh Particle Pivot Location
'AnimController21'
MPC_FlipButtons
(float4) Collection Param
'AnimController22'
MPC_FlipButtons
(float4) Collection Param
'AnimController23'
MPC_FlipButtons
(float4) Collection Param
Mask (R G B)
Mask (R G B)
Mask (R G B)
Distance
A
B
Distance
A
B
Distance
A
B
Saturate
Saturate
Saturate
1-x
1-x
1-x
Add
A
B
Add
A
B


0,0,1,0
N
FixRotateAboutAxisNormals
Rotation Axis (V3)
Rotation Angle (V3)
World Space Vertex Normals (V3)
Movement Mask (S)
PivotPoint (V3)
New Tangent Space Vertex Normal
New Tangent Space Vertex Normal RG
New Tangent Space Vertex Normal B
New World Space Vertex Normal
BlendAngleCorrectedNormals
BaseNormal (V3)
AdditionalNormal (V3)
Result
0,1,0,0
TransformVector
Local Space to World Space
Normalize
VectorInput
RotateAboutAxis
NormalizedRotationAxis
RotationAngle
PivotPoint
Position
WPO
ObjectPivotPoint
Object Pivot Location
Mesh Particle Pivot Location
Absolute World Position
Input Data
0.1667
0
Lerp
A
B
Alpha

More about draw calls!



More about draw calls!



Isaac Oster

@IsaacOster

7.08K subscribers

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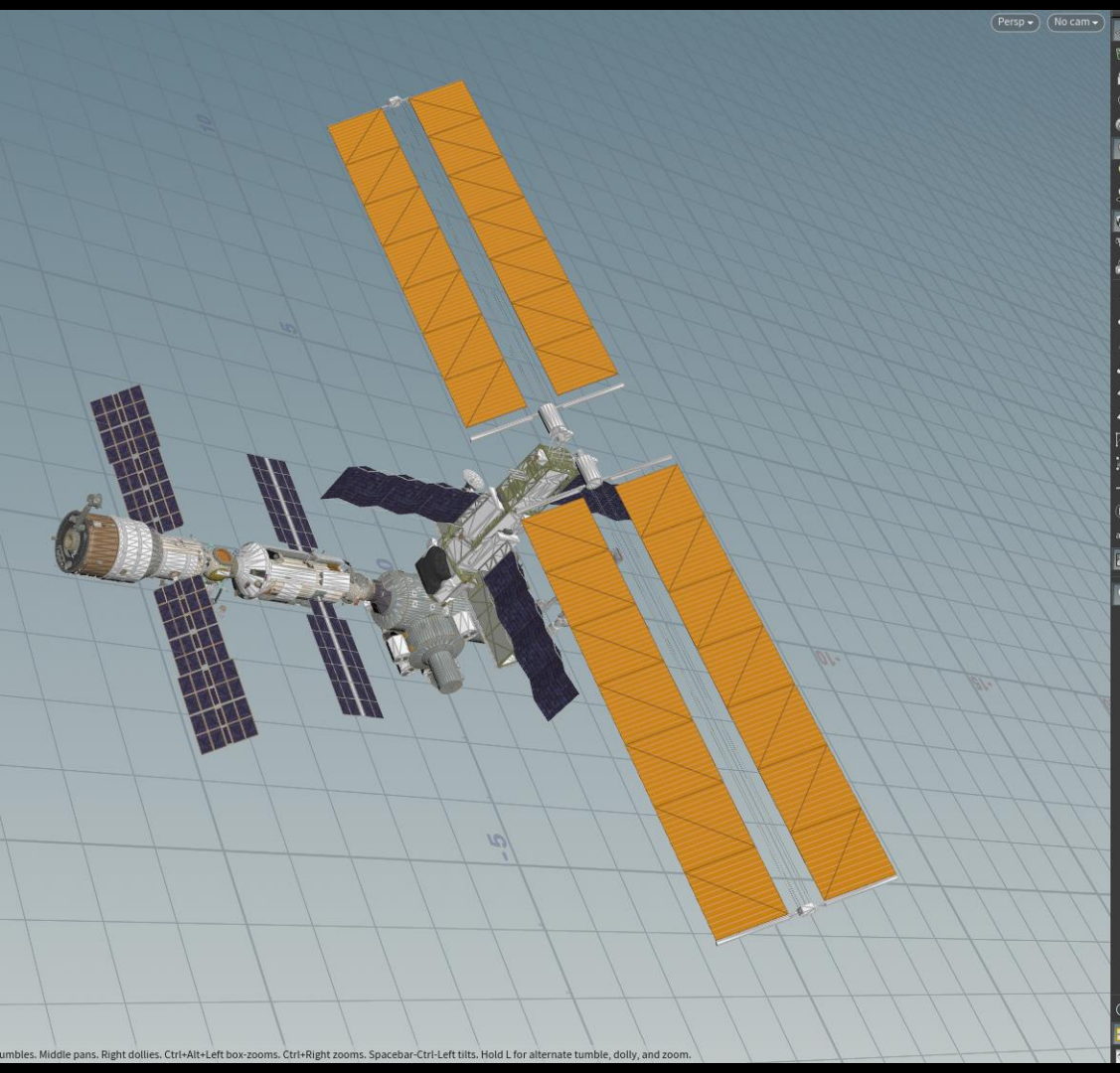
Houdini - Atlas Texture Generator

Isaac Oster • 2.6K views • 2 years ago

In this tutorial Isaac Oster details the HDA UI, node network, and python scripting behind an atlas texture generator, created with Houdini. This tutorial demonstrates a number of features...



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Source Texture Path	$HIP/ISS/Textures/4/SM_ISS_FGB_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_5_Connectors.FBX
Source Texture Path	$HIP/ISS/Textures/5/SM_ISS_pma1_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_6_Node1.FBX
Source Texture Path	$HIP/ISS/Textures/6/SM_ISS_node1_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_7_AL.FBX
Source Texture Path	$HIP/ISS/Textures/7/SM_ISS_AL_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_8_node6.FBX
Source Texture Path	$HIP/ISS/Textures/8/SM_ISS_node6_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_9_solar.FBX
Source Texture Path	$HIP/ISS/Textures/9/SM_ISS_solarpanels_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_10_lab.FBX
Source Texture Path	$HIP/ISS/Textures/10/SM_ISS_Lab_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_11_p1.FBX
Source Texture Path	$HIP/ISS/Textures/11/SM_ISS_p1_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_12_z1.FBX
Source Texture Path	$HIP/ISS/Textures/12/SM_ISS_z1_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_13_ESP1.FBX
Source Texture Path	$HIP/ISS/Textures/13/SM_ISS_ESP1_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_14_MSS.FBX
Source Texture Path	$HIP/ISS/Textures/14/SM_ISS_MSS_albedo.TGA
Source Geometry Path	$HIP/ISS/Models/ISS_15_Arm.FBX
Source Texture Path	$HIP/ISS/Textures/15/SM_ISS_armA_albedo.TGA

Create Atlas Textures And Export FBX

/obj/geo1 | Tree View | Material Palette | Asset Browser

obj > geo1

Add Edit Go View Tools Layout Help

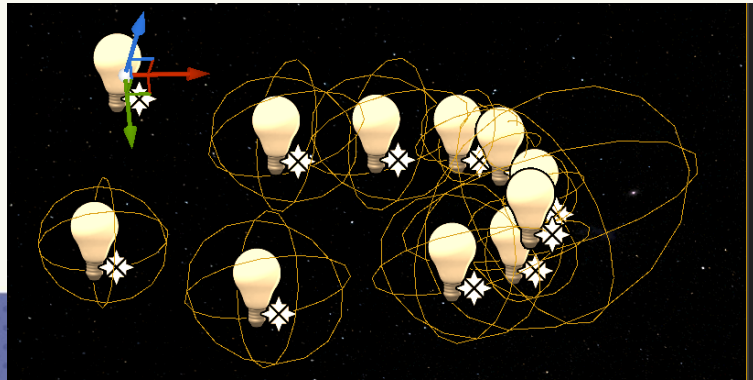
AtlasCreator_Label
AtlasCreator

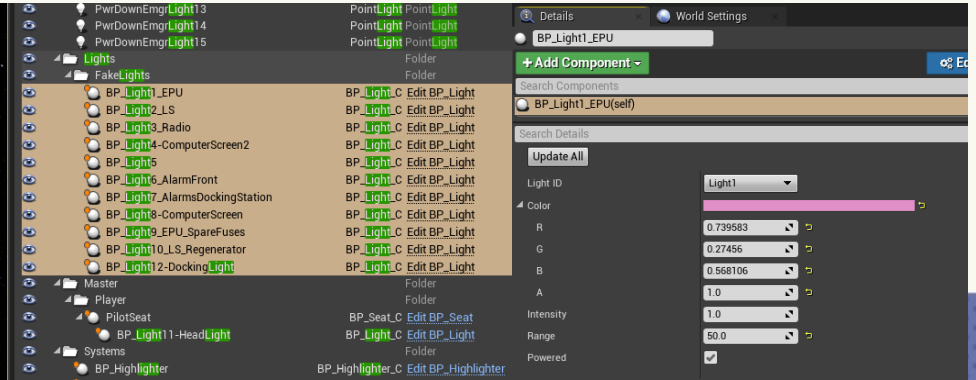
Geometry

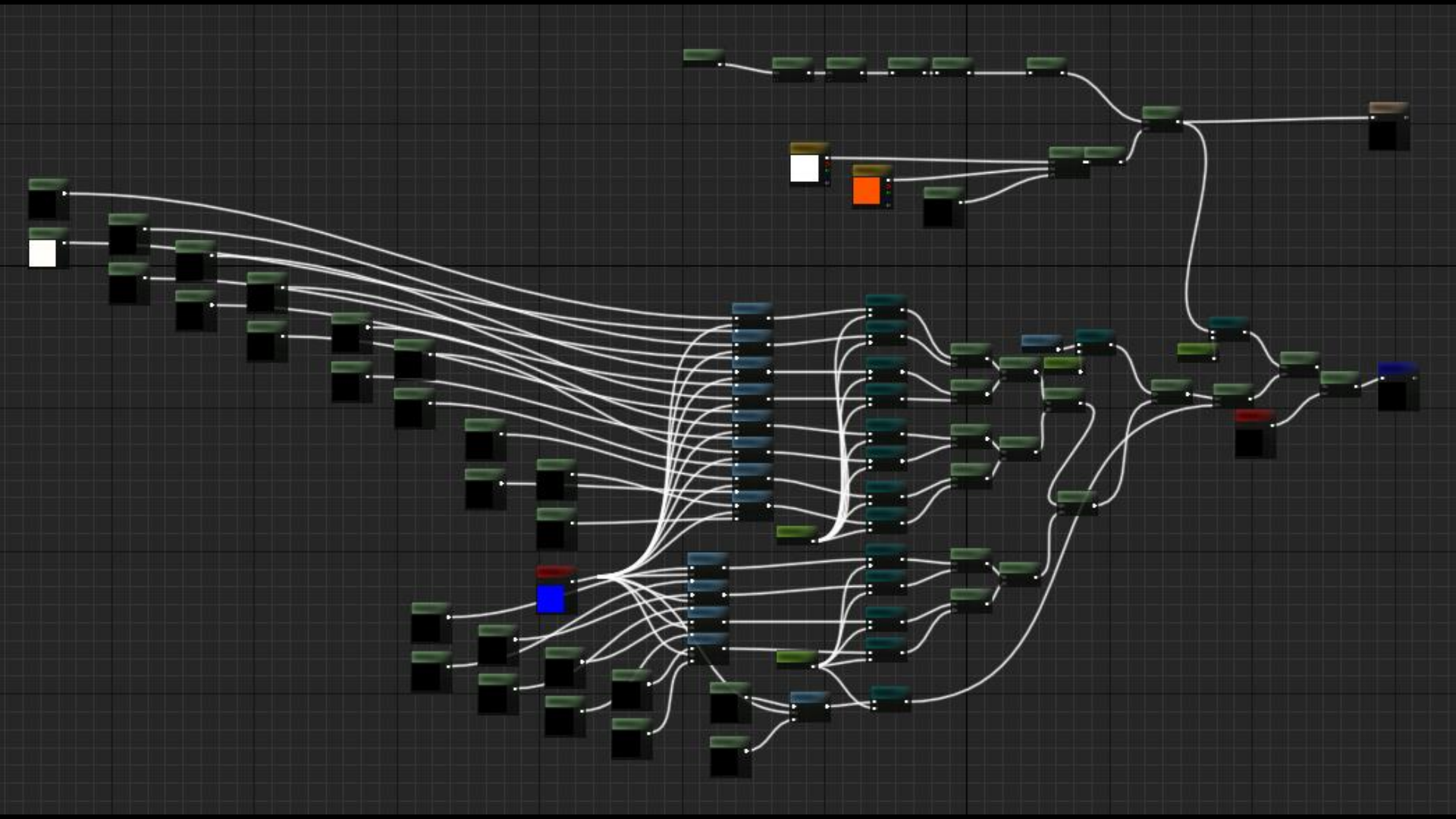
umbles. Middle pans. Right dollies. Ctrl+Alt+Left box-zooms. Ctrl+Right zooms. Spacebar-Ctrl-Left tilts. Hold L for alternate tumble, dolly, and zoom.

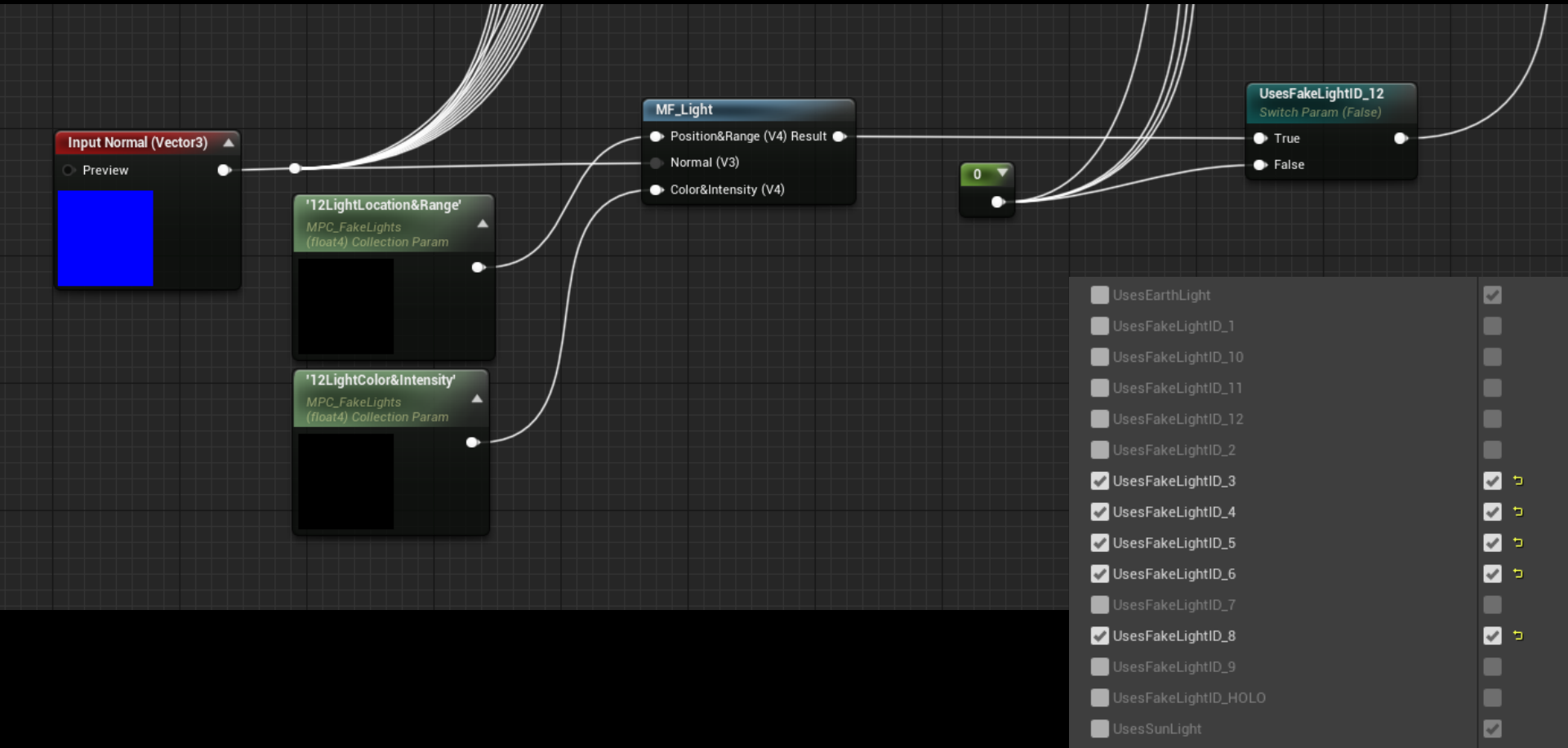
Movable Dynamic Lights

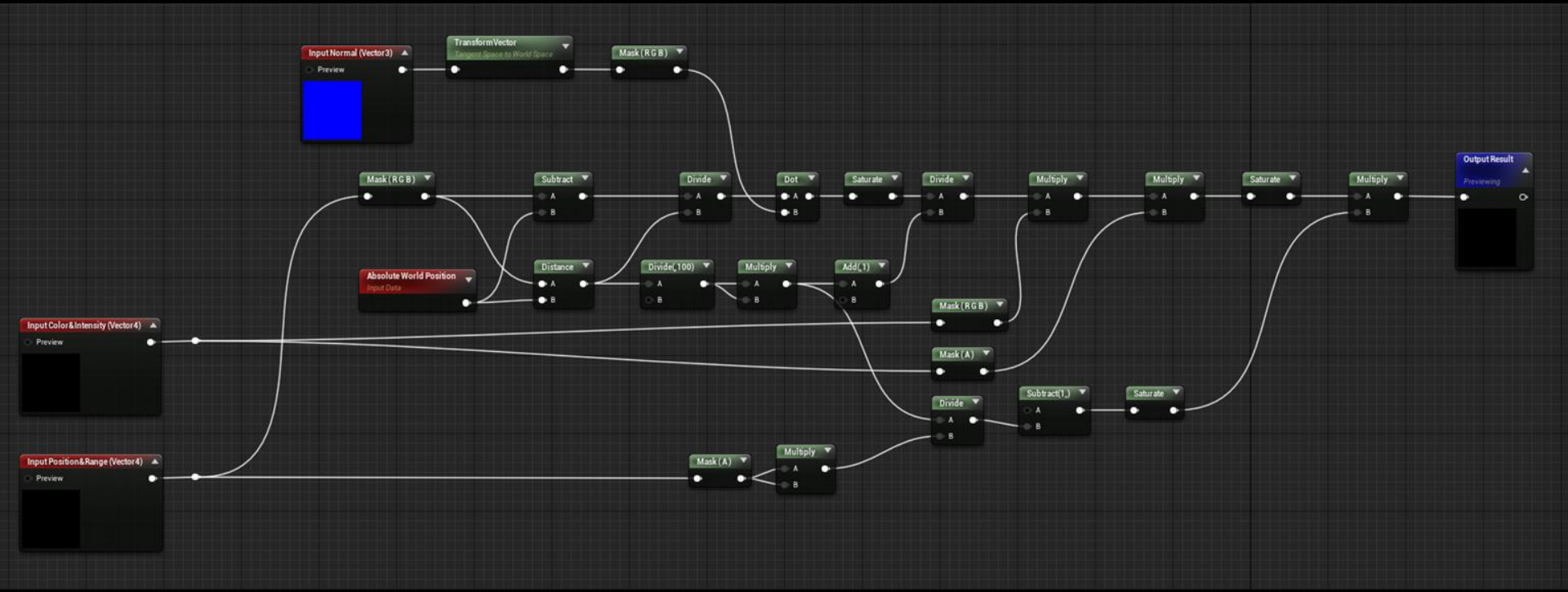
- Non-shadowing
- Faked in shader







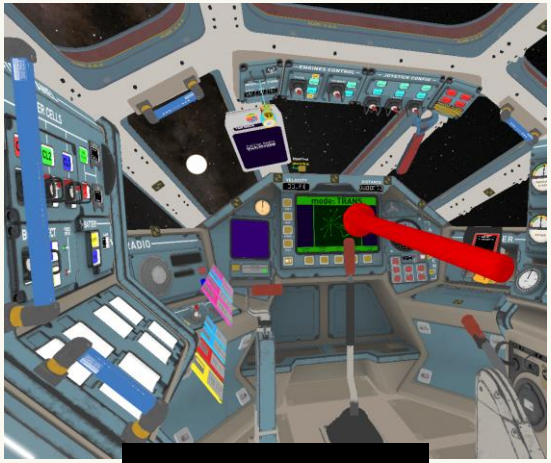

Input Normal (Vector3)
Preview
'12LightLocation&Range'
MPC_FakeLights
(float4) Collection Param
'12LightColor&Intensity'
MPC_FakeLights
(float4) Collection Param
MF_Light
Position&Range (V4) Result
Normal (V3)
Color&Intensity (V4)
0
UsesFakeLightID_12
Switch Param (False)
True
False
UsesEarthLight
UsesFakeLightID_1
UsesFakeLightID_10
UsesFakeLightID_11
UsesFakeLightID_12
UsesFakeLightID_2
UsesFakeLightID_3
UsesFakeLightID_4
UsesFakeLightID_5
UsesFakeLightID_6
UsesFakeLightID_7
UsesFakeLightID_8
UsesFakeLightID_9
UsesFakeLightID_HOLO
UsesSunLight

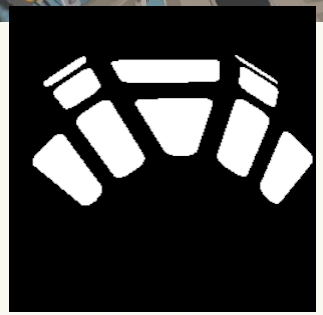

Input Normal (Vector3)
Preview
TransformVector
Tangent Space to World Space
Mask (R G B)
Output Result
Previewing
Mask (R G B)
Subtract
Divide
Dot
Saturate
Divide
Multiply
Multiply
Saturate
Multiply
Absolute World Position
Input Data
Distance
Divide(,100)
Multiply
Add(,1)
Mask (R G B)
Input Color&Intensity (Vector4)
Preview
Mask (A)
Divide
Subtract(1,)
Saturate
Input Position&Range (Vector4)
Preview
Mask (A)
Multiply

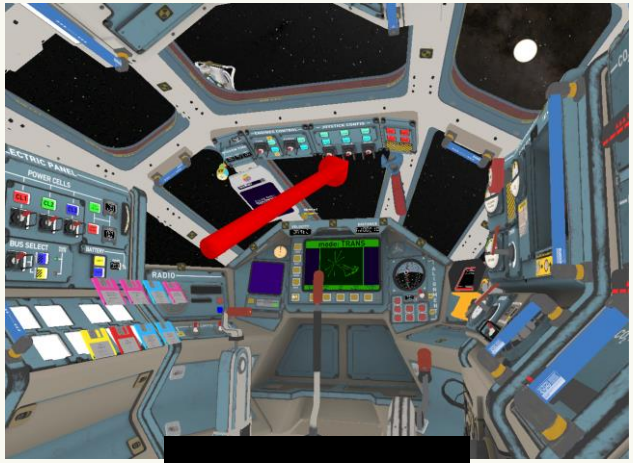
Directional Light With Shadows

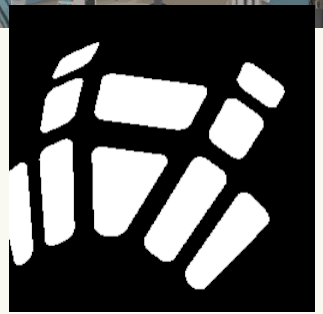
- Default engine solution for dynamic shadows was too slow
- Scene capture of a single mesh turned out to be faster
- Dynamic shadow map!

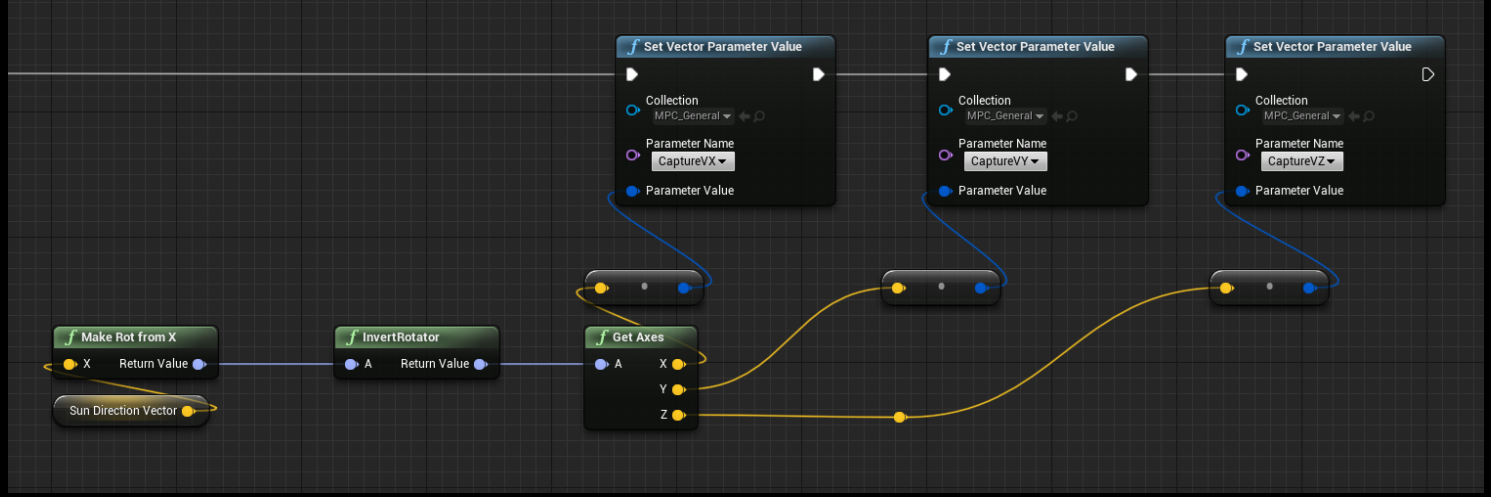
Dynamic Shadow Map

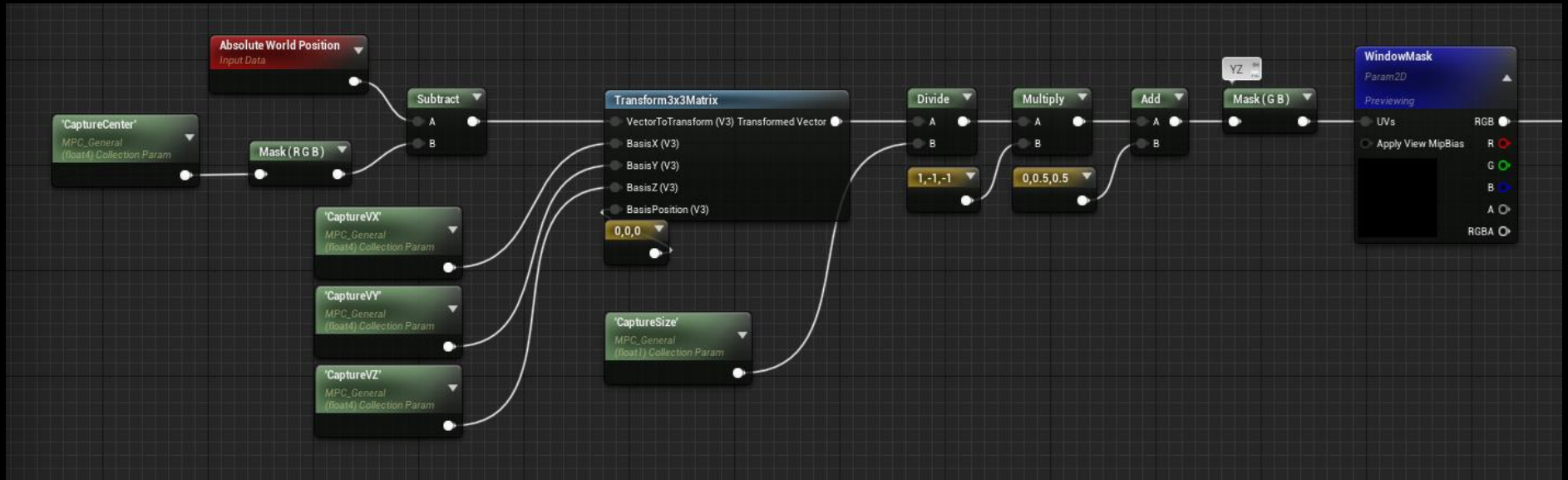


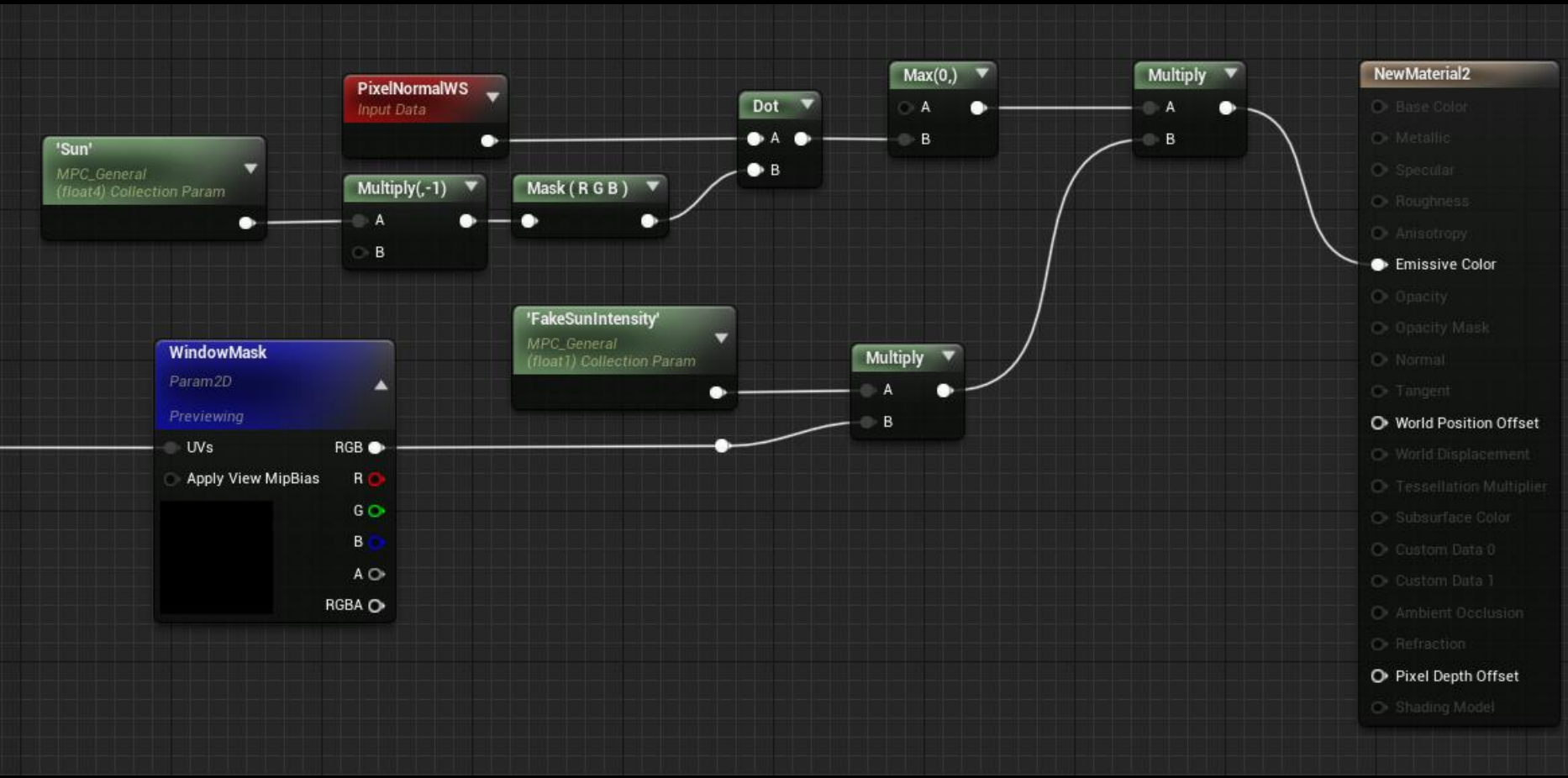


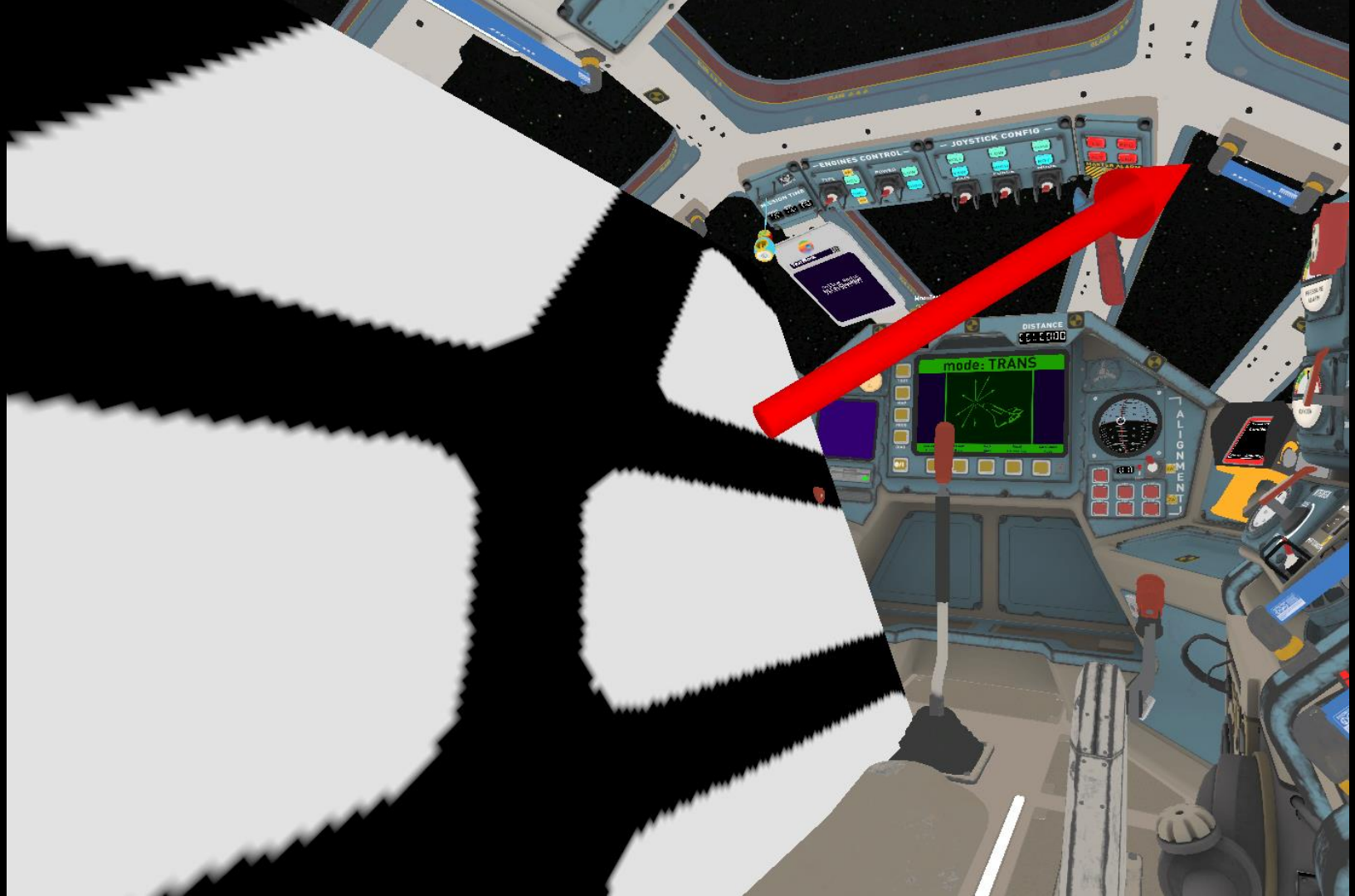


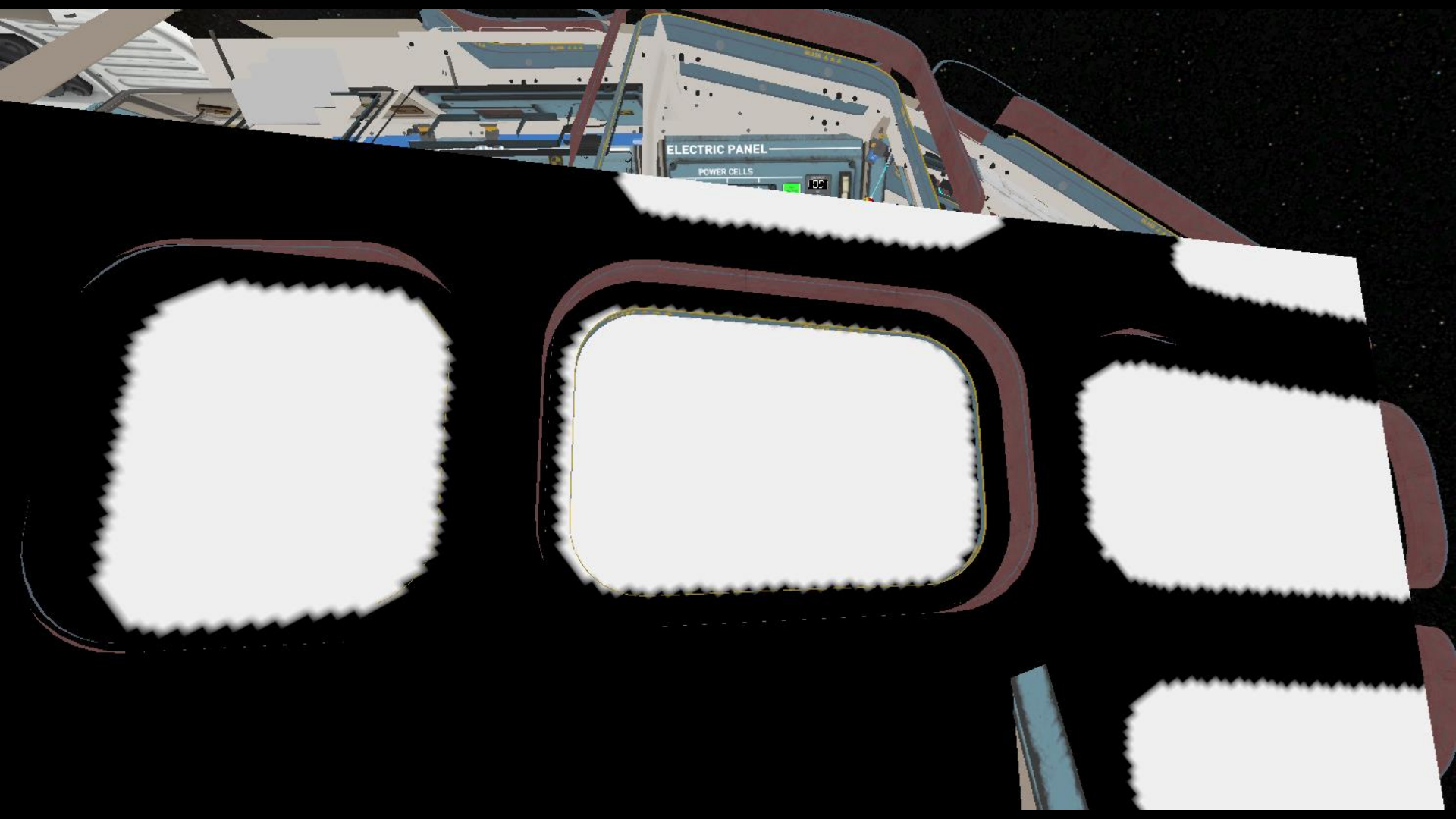



Set Vector Parameter Value
Collection
MPC_General
Parameter Name
CaptureVX
Parameter Value
Set Vector Parameter Value
Collection
MPC_General
Parameter Name
CaptureVY
Parameter Value
Set Vector Parameter Value
Collection
MPC_General
Parameter Name
CaptureVZ
Parameter Value
Make Rot from X
X
Return Value
Sun Direction Vector
InvertRotator
A
Return Value
Get Axes
A
X
Y
Z

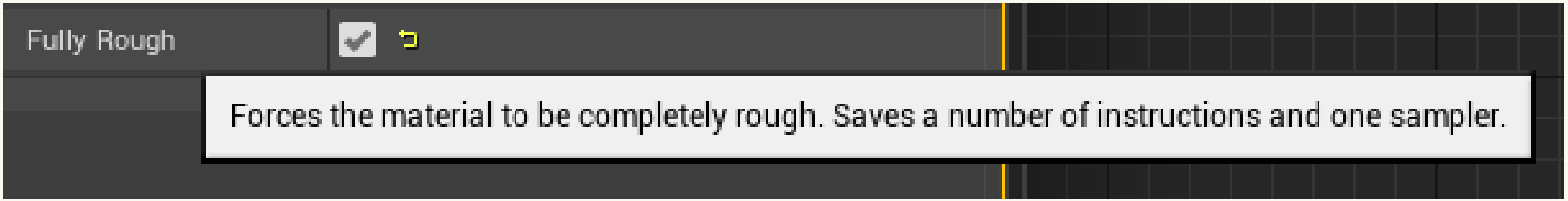

Absolute World Position
Input Data
'CaptureCenter'
MPC_General
(float4) Collection Param
Mask (R G B)
Subtract
A
B
'CaptureVX'
MPC_General
(float4) Collection Param
'CaptureVY'
MPC_General
(float4) Collection Param
'CaptureVZ'
MPC_General
(float4) Collection Param
Transform3x3Matrix
VectorToTransform (V3) Transformed Vector
BasisX (V3)
BasisY (V3)
BasisZ (V3)
BasisPosition (V3)
0,0,0
'CaptureSize'
MPC_General
(float1) Collection Param
Divide
A
B
1,-1,-1
Multiply
A
B
0,0.5,0.5
Add
A
B
YZ
Mask (G B)
WindowMask
Param2D
Previewing
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA


'Sun'
MPC_General
(float4) Collection Param
PixelNormalWS
Input Data
Multiply(,-1)
A
B
Mask (R G B)
Dot
A
B
Max(0,)
A
B
Multiply
A
B
NewMaterial2
Base Color
Metallic
Specular
Roughness
Anisotropy
Emissive Color
Opacity
Opacity Mask
Normal
Tangent
World Position Offset
World Displacement
Tessellation Multiplier
Subsurface Color
Custom Data 0
Custom Data 1
Ambient Occlusion
Refraction
Pixel Depth Offset
Shading Model
'FakeSunIntensity'
MPC_General
(float1) Collection Param
Multiply
A
B
WindowMask
Param2D
Previewing
UVs
Apply View MipBias
RGB
R
G
B
A
RGBA

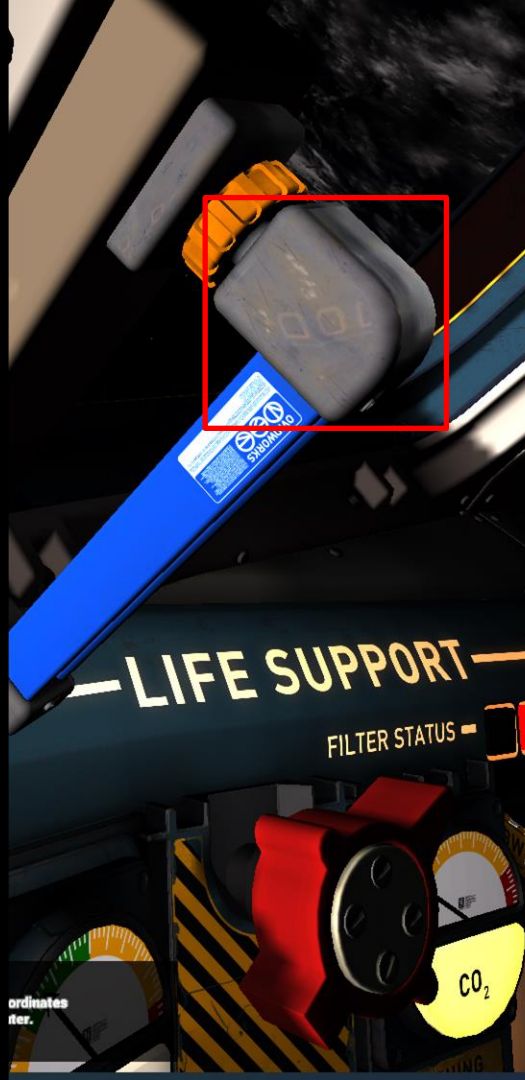

ENGINES CONTROL
JOYSTICK CONFIG
DISTANCE
mode: TRANS
ALIGNMEN


ELECTRIC PANEL
POWER CELLS

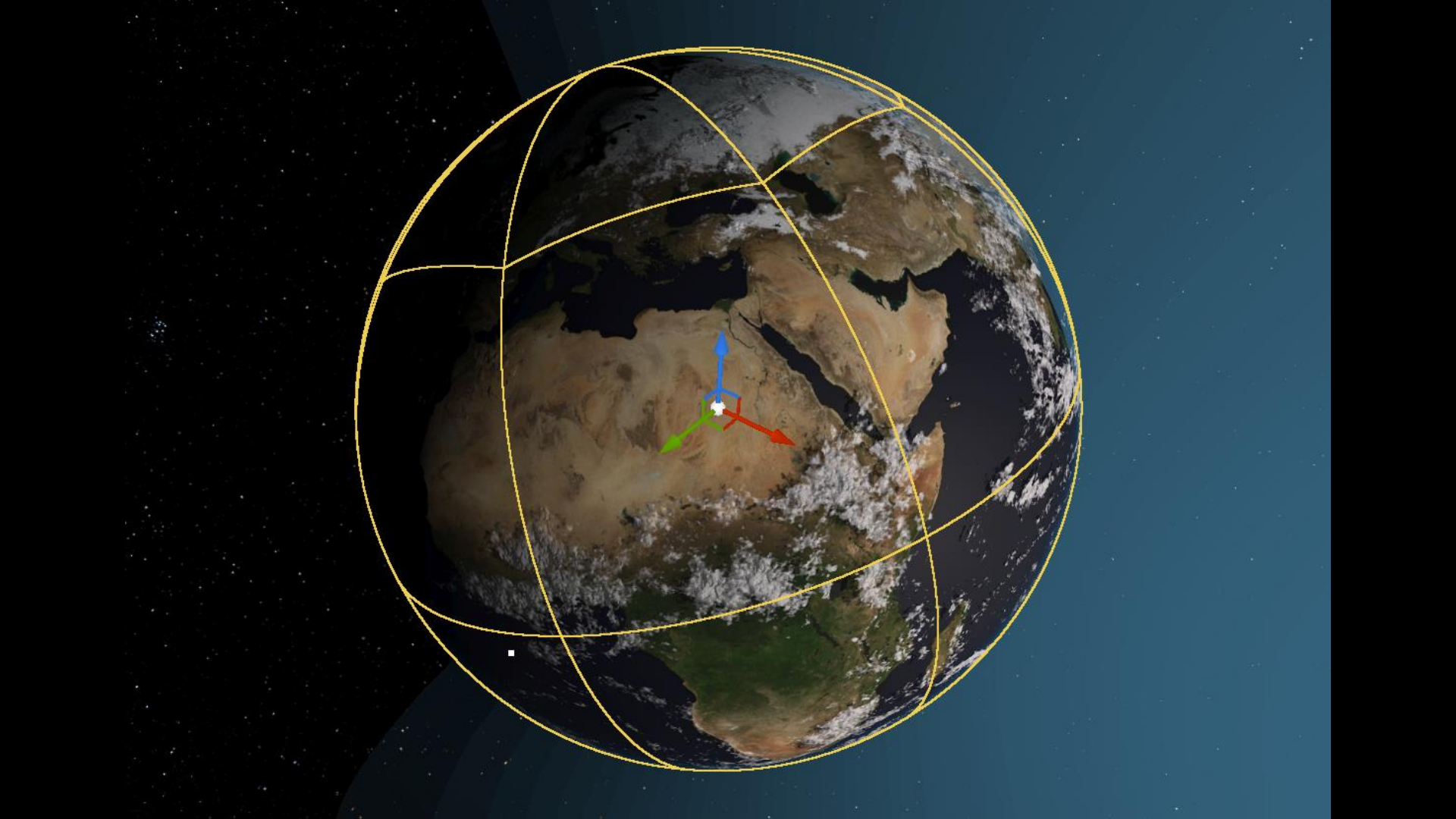
Roughness

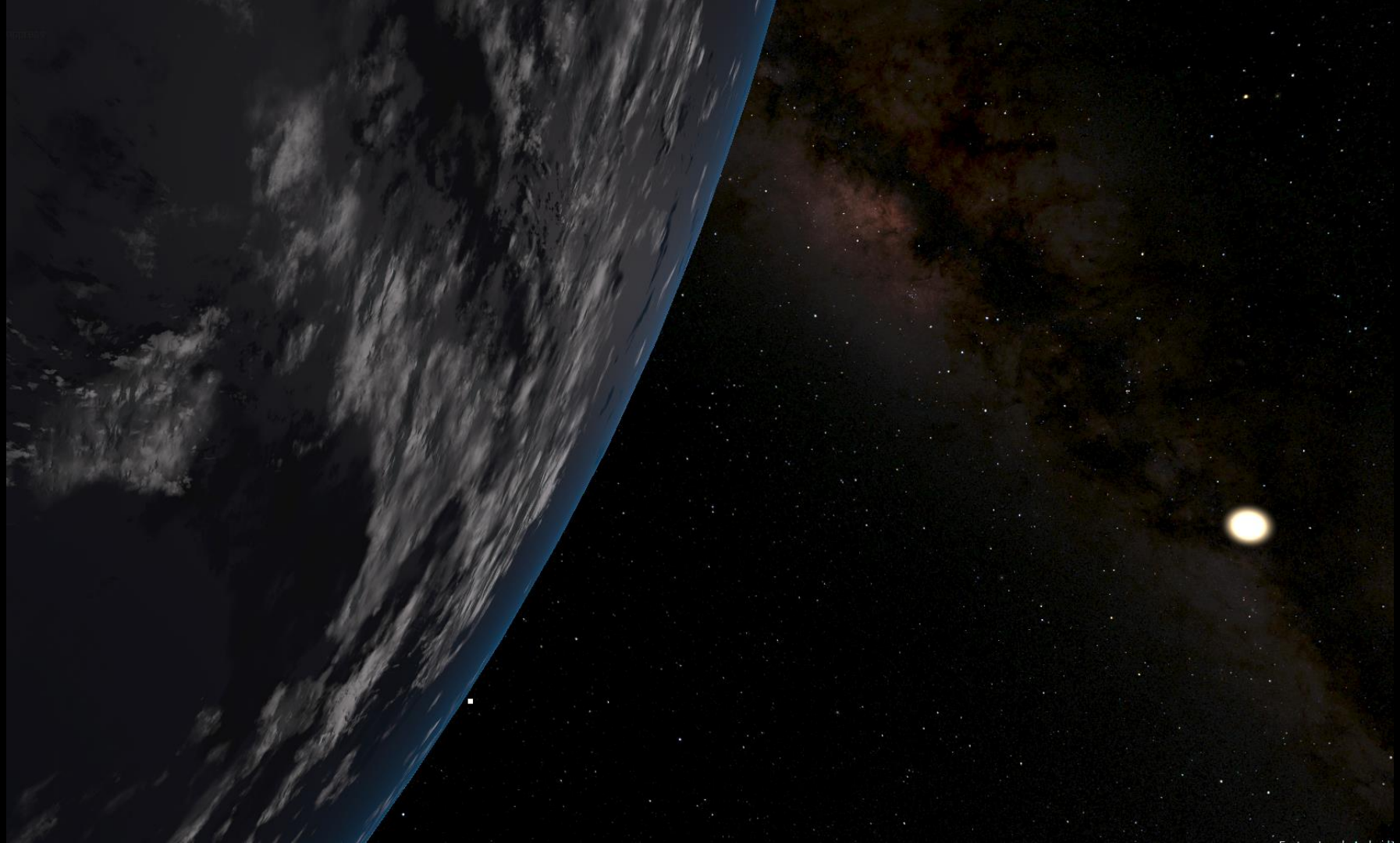

Fully Rough
Forces the material to be completely rough. Saves a number of instructions and one sampler.


BATTERY
FUSES STATE
EMPTY
DRAIN
CHARGE
61
%
ORBITAL FLIGHT SOFTWARE

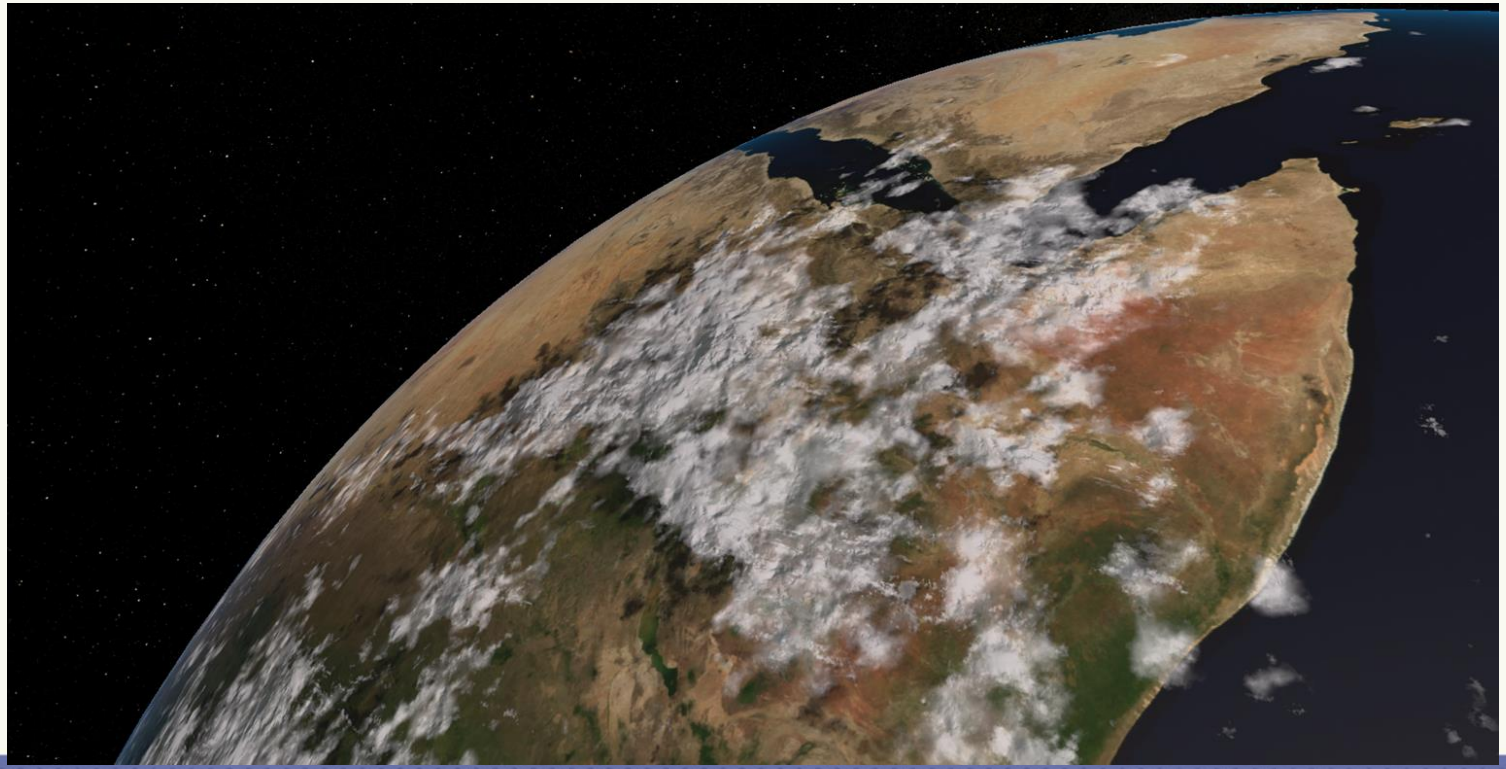

LIFE SUPPORT
FILTER STATUS
CO_2

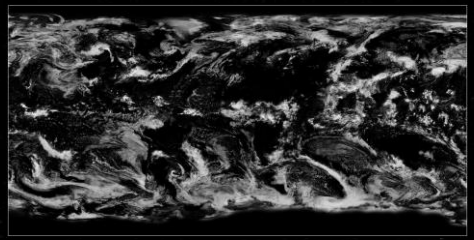

Recording has started
ELECTRIC PANEL
POWER CELLS
CL1
OVER VOLTAGE
OUTPUT
10
W
LOAD
0
W
BUS SELECT
FUSES STATE
BATTERY
CHARGE
50 %
EMPTY
DRAIN
SPARE FUSES
RADIO
Feature Level: Android Vulkan ES31

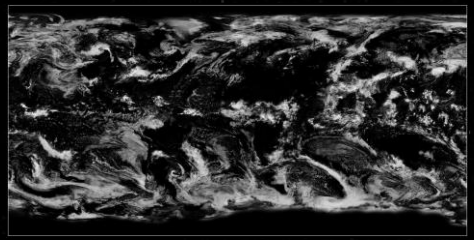


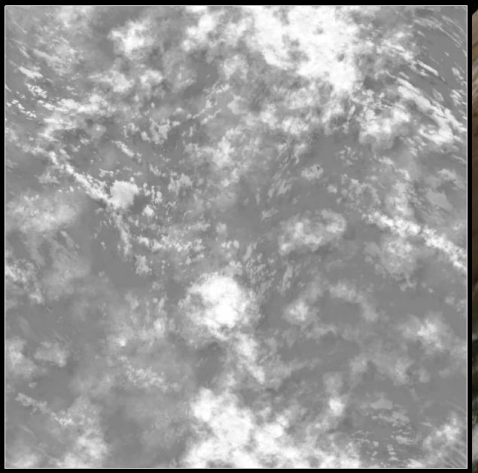


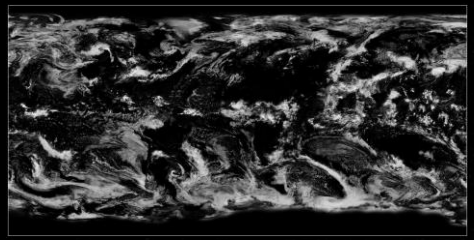
“Detail” Maps

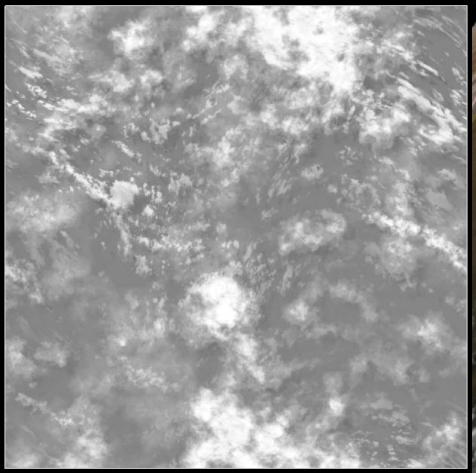


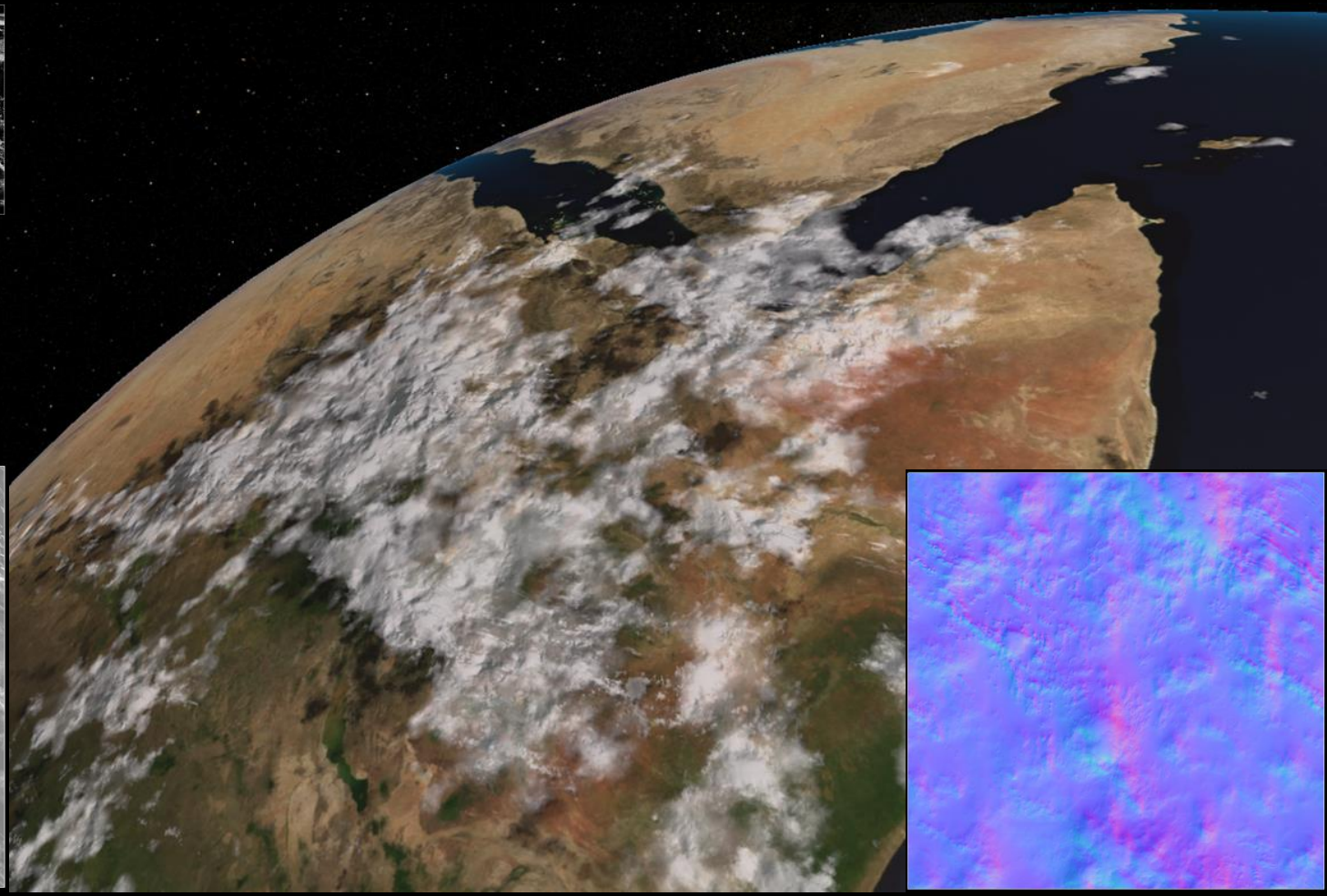


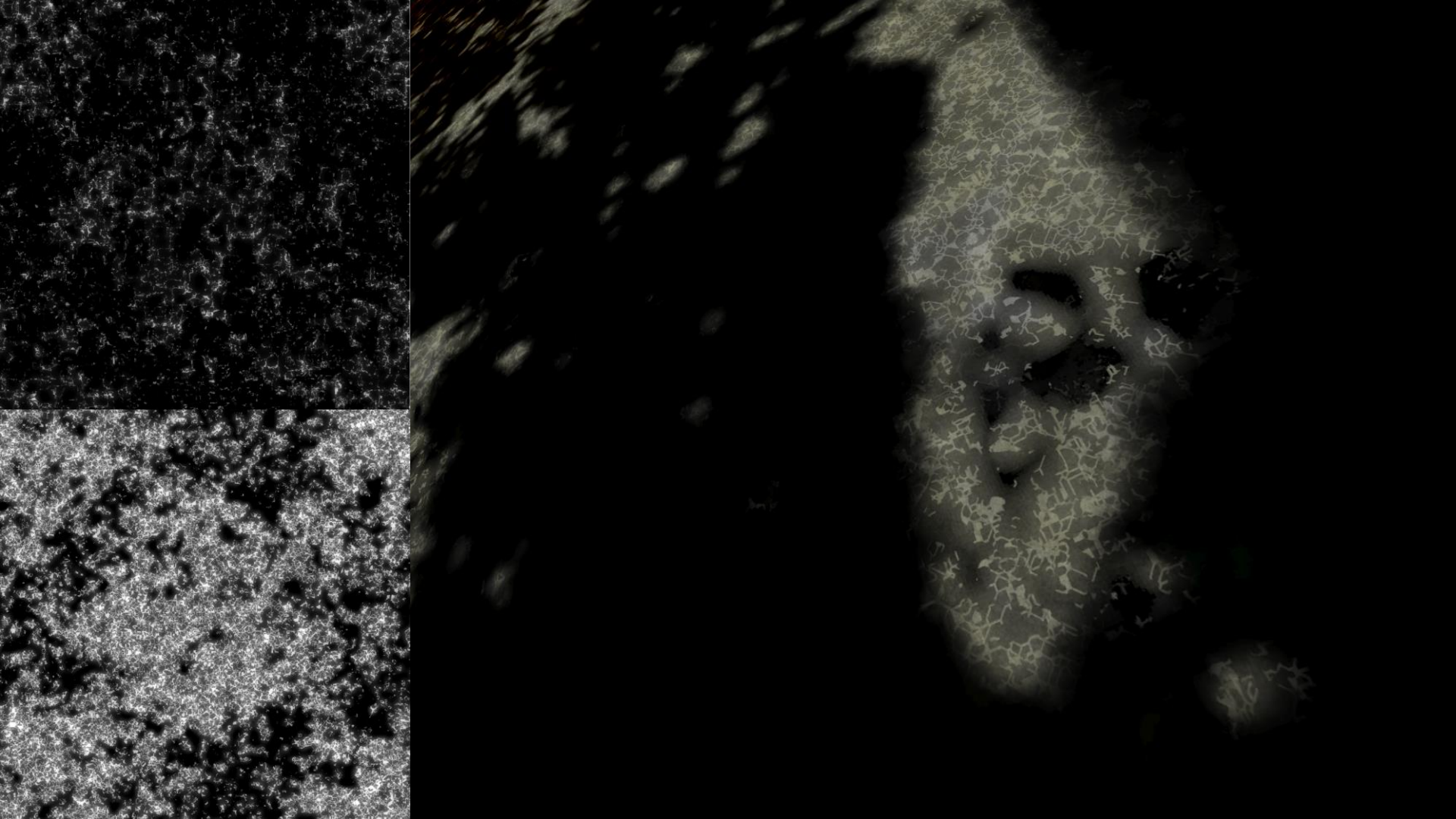













Recording has started
active
Feature Level: Android Vulkan ES31

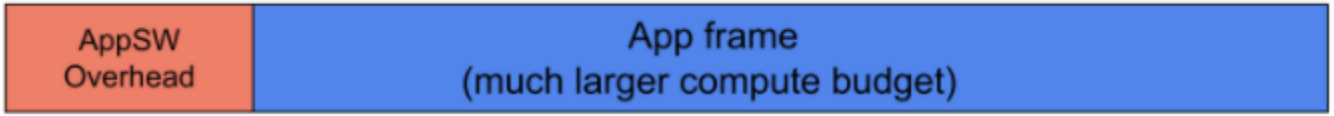
I have no FPS but I must ship

- 😐 Application Space Warp
- 🙂 Foveation
- 😀 RenderDoc analysis

Application Space Warp

No SpaceWarp: 72 Fps App

SpaceWarp: 36 Fps App



Application Space Warp

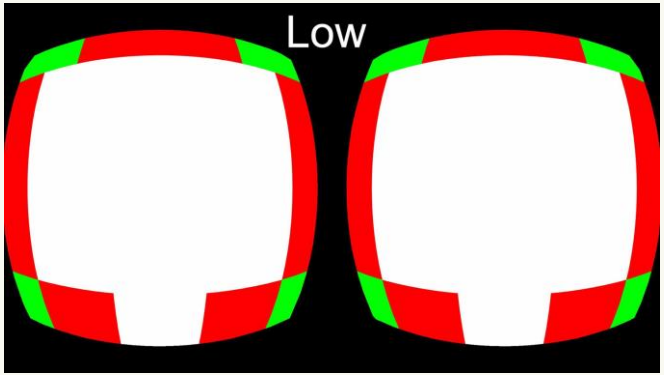
✔

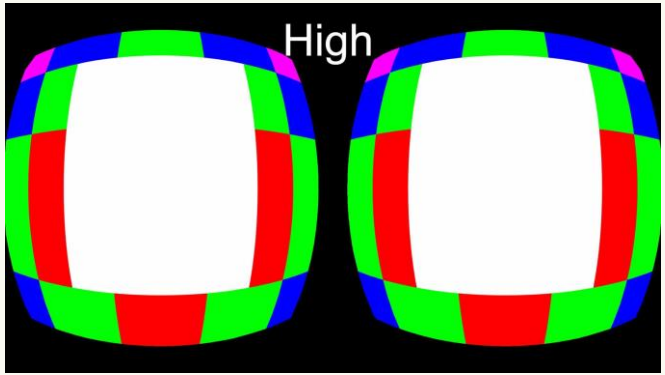
?

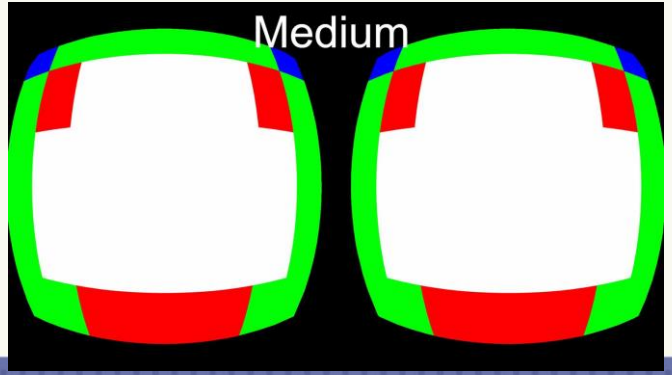

FPS
APP/TW/GD T
ASW FPS
72
18000
0
72
0
APP T: 9183
ASW FPS: 0
FOV: 0
BAT: 100
CPU L: 9
GPU L: 3
FPS: 56
EARLY: 0
STALE: 29
EB W: 0
EB H:
CPU U: 63
GPU U: 66
A MEM: 2492
V MEM: 1535
TW T: 1978
GD T: 0
ASW TYPE: 0

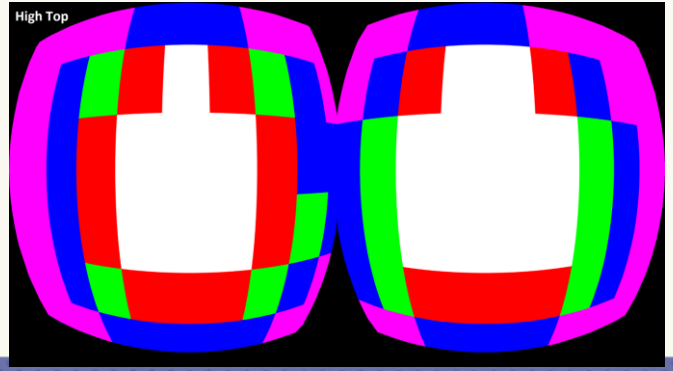

FPS
APP/TW/GD T
ASW FPS
72
18000
0
72
0
APP T: 9183
ASW FPS: 0
FOV: 0
BAT: 100
CPU L: 9
GPU L: 3
FPS: 56
EARLY: 0
STALE: 29
EB W: 0
EB H:
CPU U: 63
GPU U: 66
A MEM: 2492
V MEM: 1535
TW T: 1978
GD T: 0
ASW TYPE: 0

Foveation



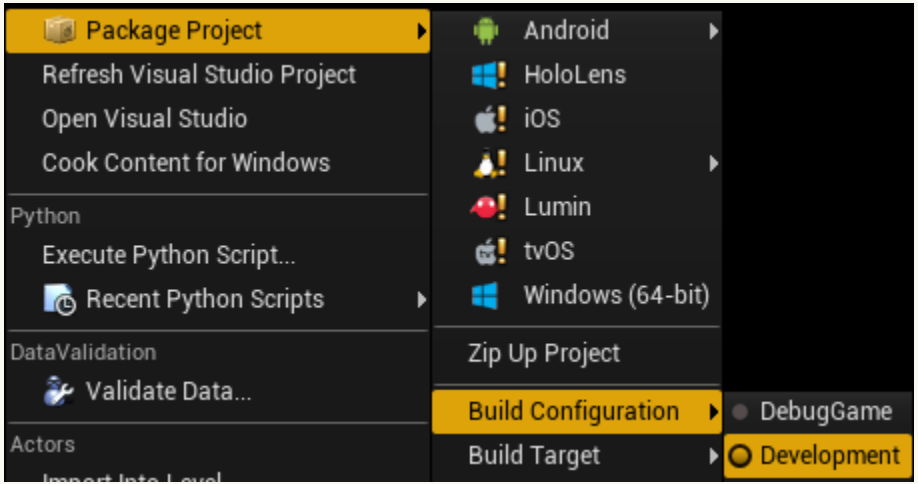


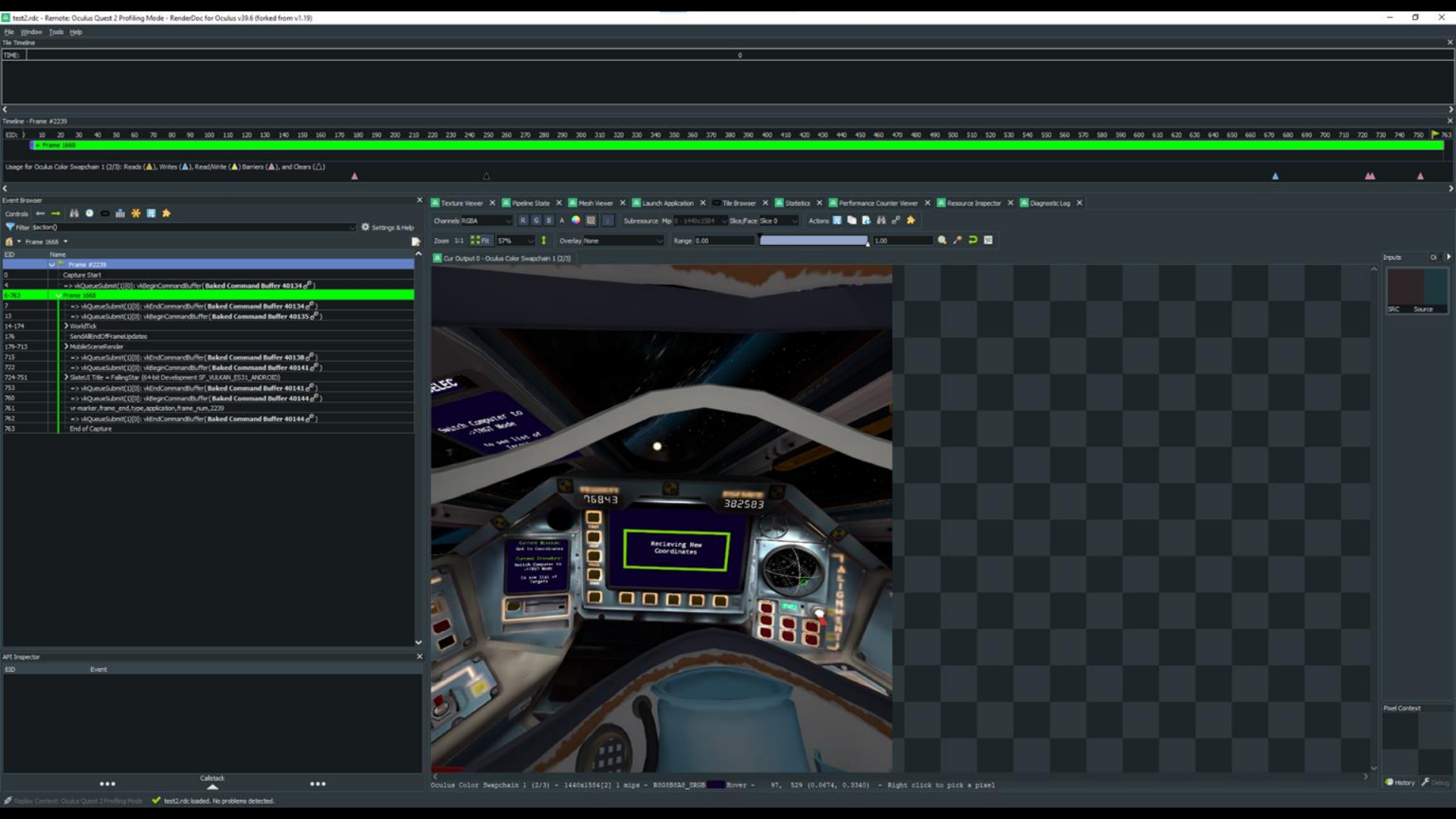


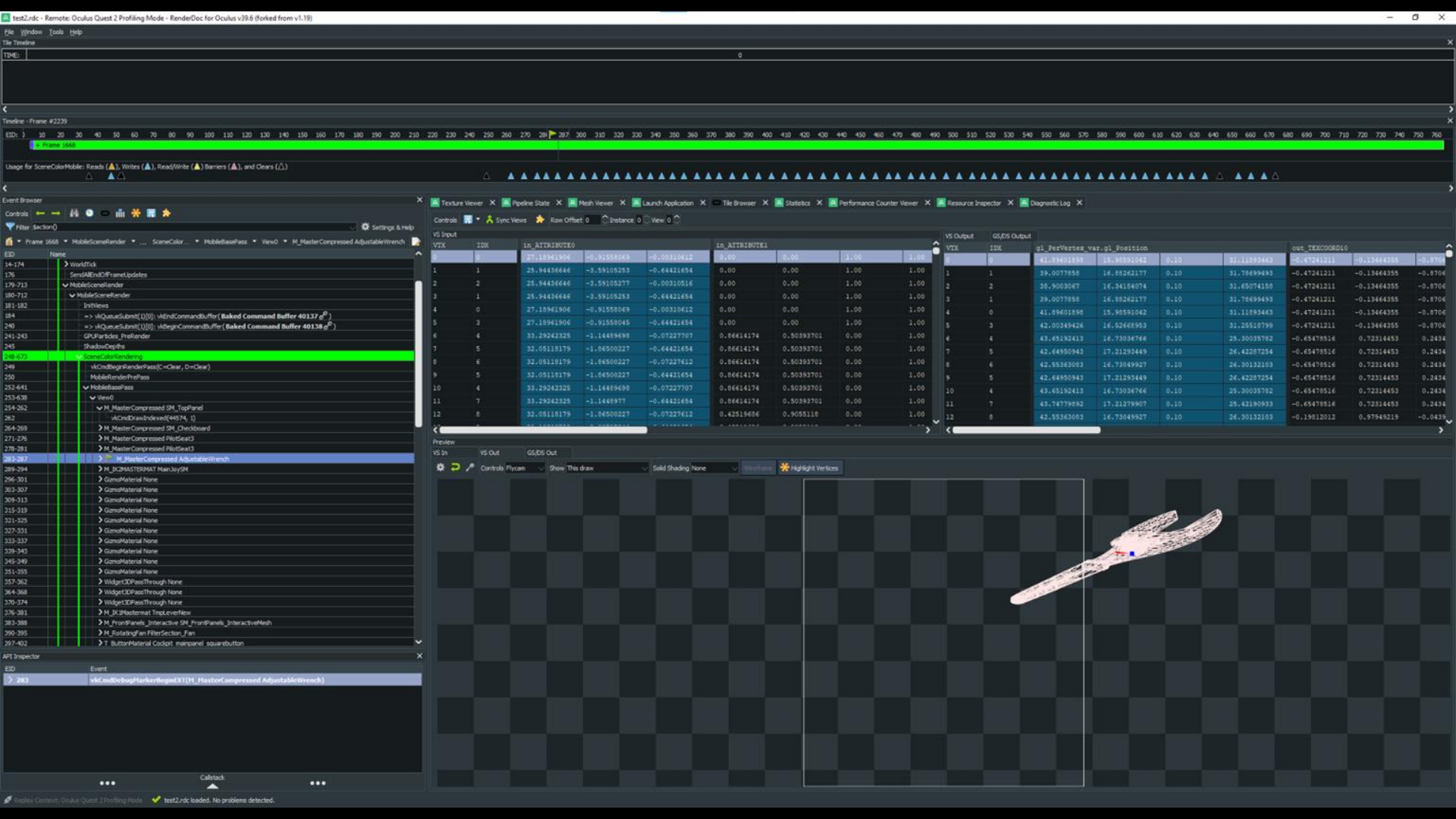


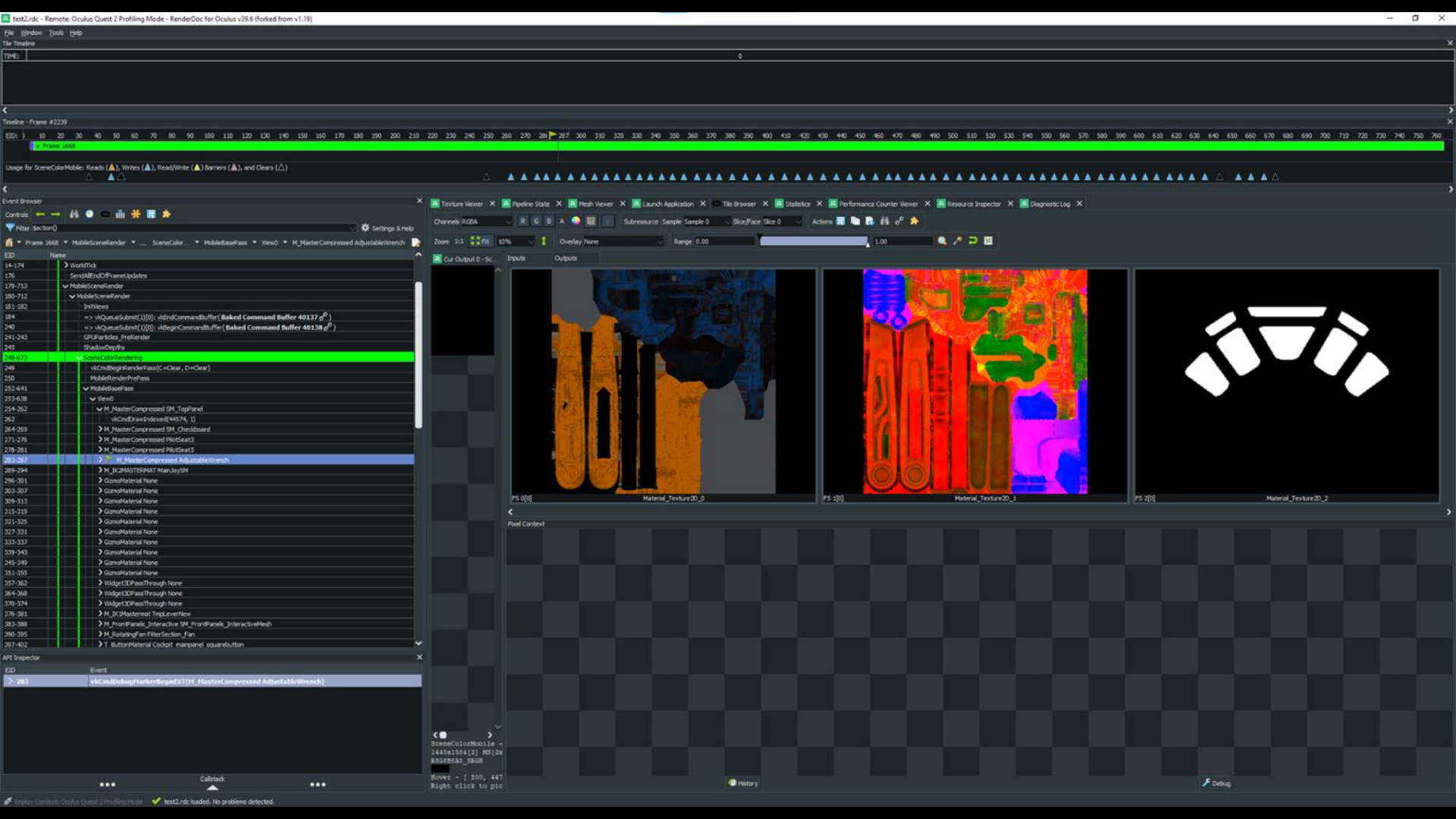
RenderDoc

- https://developer.oculus.com/downloads/package/renderdoc-oculus/
- https://developer.oculus.com/blog/how-to-level-up-your-profiling-with-renderdoc-for-oculus/




test2.rdc - Remote: Oculus Quest 2 Profiling Mode - RenderDoc for Oculus v39.6 (forked from v1.19)
File Window Tools Help
Tile Timeline
TIME:
Timeline - Frame #2239
Usage for Oculus Color Swapchain 1 (2/3): Reads (▲), Writes (▲), Read/Write (▲) Barriers (▲), and Clears (△)
Event Browser
Controls
Filter $action()
Settings & Help
Frame 1668
EID Name
Frame #2239
0 Capture Start
4 => vkQueueSubmit(1)[0]: vkBeginCommandBuffer(Baked Command Buffer 40134)
8-263 Frame 1668
7 => vkQueueSubmit(1)[0]: vkEndCommandBuffer(Baked Command Buffer 40134)
13 => vkQueueSubmit(1)[0]: vkBeginCommandBuffer(Baked Command Buffer 40135)
14-174 WorldTick
176 SendAllEndOfFrameUpdates
179-713 MobileSceneRender
715 => vkQueueSubmit(1)[0]: vkEndCommandBuffer(Baked Command Buffer 40138)
722 => vkQueueSubmit(1)[0]: vkBeginCommandBuffer(Baked Command Buffer 40141)
724-751 SlateUI Title = FallingStar (64-bit Development SF_VULKAN_ES31_ANDROID)
753 => vkQueueSubmit(1)[0]: vkEndCommandBuffer(Baked Command Buffer 40141)
760 => vkQueueSubmit(1)[0]: vkBeginCommandBuffer(Baked Command Buffer 40144)
761 vr-marker,frame_end,type,application,frame_num,2239
762 => vkQueueSubmit(1)[0]: vkEndCommandBuffer(Baked Command Buffer 40144)
763 End of Capture
API Inspector
EID Event
Callstack
Texture Viewer
Pipeline State
Mesh Viewer
Launch Application
Tile Browser
Statistics
Performance Counter Viewer
Resource Inspector
Diagnostic Log
Channels RGBA
Subresource Mip
Slice/Face Slice 0
Actions
Zoom 1:1 Fit 57%
Overlay None
Range 0.00 1.00
Cur Output 0 - Oculus Color Swapchain 1 (2/3)
Recieving New Coordinates
Inputs
SRC Source
Pixel Context
History
Debug
Oculus Color Swapchain 1 (2/3) - 1440x1584[2] 1 mips - R8G8B8A8_SRGB Hover - 97, 529 (0.0674, 0.3340) - Right click to pick a pixel
Replay Context: Oculus Quest 2 Profiling Mode
test2.rdc loaded. No problems detected.


test2.rdc - Remote: Oculus Quest 2 Profiling Mode - RenderDoc for Oculus v39.6 (forked from v1.19)
File Window Tools Help
Tile Timeline
TIME:
Timeline - Frame #2239
EID:
Frame 1668
Usage for SceneColorMobile: Reads (▲), Writes (▲), Read/Write (▲) Barriers (▲), and Clears (△)
Event Browser
Controls
Filter $action()
Settings & Help
Frame 1668 MobileSceneRender ... SceneColor... MobileBasePass View0 M_MasterCompressed AdjustableWrench
EID Name
14-174 WorldTick
176 SendAllEndOfFrameUpdates
179-713 MobileSceneRender
180-712 MobileSceneRender
181-182 InitViews
184 => vkQueueSubmit(1)[0]: vkEndCommandBuffer(Baked Command Buffer 40137)
240 => vkQueueSubmit(1)[0]: vkBeginCommandBuffer(Baked Command Buffer 40138)
241-243 GPUParticles_PreRender
245 ShadowDepths
248-673 SceneColorRendering
249 vkCmdBeginRenderPass(C=Clear, D=Clear)
250 MobileRenderPrePass
252-641 MobileBasePass
253-638 View0
254-262 M_MasterCompressed SM_TopPanel
262 vkCmdDrawIndexed(44574, 1)
264-269 M_MasterCompressed SM_Checkboard
271-276 M_MasterCompressed PilotSeat3
278-281 M_MasterCompressed PilotSeat3
283-287 M_MasterCompressed AdjustableWrench
289-294 M_BI2MASTERMAT MainJoySM
296-301 GizmoMaterial None
303-307 GizmoMaterial None
309-313 GizmoMaterial None
315-319 GizmoMaterial None
321-325 GizmoMaterial None
327-331 GizmoMaterial None
333-337 GizmoMaterial None
339-343 GizmoMaterial None
345-349 GizmoMaterial None
351-355 GizmoMaterial None
357-362 Widget3DPassThrough None
364-368 Widget3DPassThrough None
370-374 Widget3DPassThrough None
376-381 M_BI2Mastermat TmpLeverNew
383-388 M_FrontPanels_Interactive SM_FrontPanels_InteractiveMesh
390-395 M_RotatingFan FilterSection_Fan
397-402 T_ButtonMaterial Cockpit_mainpanel_squarebutton
API Inspector
EID Event
283 vkCmdDebugMarkerBeginEXT(M_MasterCompressed AdjustableWrench)
Callstack
Texture Viewer
Pipeline State
Mesh Viewer
Launch Application
Tile Browser
Statistics
Performance Counter Viewer
Resource Inspector
Diagnostic Log
Controls
Sync Views
Row Offset 0
Instance 0
View 0
VS Input
VTX IDX in_ATTRIBUTE0 in_ATTRIBUTE1
0 0 27.18961906 -0.91558069 -0.00310612 0.00 0.00 1.00 1.00
1 1 25.94436644 -3.59105253 -0.64421654 0.00 0.00 1.00 1.00
2 2 25.94436644 -3.59105277 -0.00310516 0.00 0.00 1.00 1.00
3 1 25.94436644 -3.59105253 -0.64421654 0.00 0.00 1.00 1.00
4 0 27.18961906 -0.91558069 -0.00310612 0.00 0.00 1.00 1.00
5 3 27.18961906 -0.91558045 -0.64421654 0.00 0.00 1.00 1.00
6 4 33.29242325 -1.1448969 -0.07227707 0.86614174 0.50393701 0.00 1.00
7 5 32.05118179 -1.86500227 -0.64421654 0.86614174 0.50393701 0.00 1.00
8 6 32.05118179 -1.86500227 -0.07227612 0.86614174 0.50393701 0.00 1.00
9 5 32.05118179 -1.86500227 -0.64421654 0.86614174 0.50393701 0.00 1.00
10 4 33.29242325 -1.1448969 -0.07227707 0.86614174 0.50393701 0.00 1.00
11 7 33.29242325 -1.1448977 -0.64421654 0.86614174 0.50393701 0.00 1.00
12 8 32.05118179 -1.86500227 -0.07227612 0.42519686 0.9055118 0.00 1.00
VS Output GS/DS Output
VTX IDX gl_PerVertex_var.gl_Position out_TEXCOORD10
0 0 41.89601898 15.90591042 0.10 31.11893463 -0.47241211 -0.13464355 -0.8706
1 1 39.0077858 16.88262177 0.10 31.78699493 -0.47241211 -0.13464355 -0.8706
2 2 38.9003067 16.34184074 0.10 31.65074158 -0.47241211 -0.13464355 -0.8706
3 1 39.0077858 16.88262177 0.10 31.78699493 -0.47241211 -0.13464355 -0.8706
4 0 41.89601898 15.90591042 0.10 31.11893463 -0.47241211 -0.13464355 -0.8706
5 3 42.00349426 16.52668953 0.10 31.25518799 -0.47241211 -0.13464355 -0.8706
6 4 43.65192413 16.73036766 0.10 25.30035782 -0.65478516 0.72314453 0.2434
7 5 42.64950943 17.21293449 0.10 26.42287254 -0.65478516 0.72314453 0.2434
8 6 42.55363083 16.73049927 0.10 26.30132103 -0.65478516 0.72314453 0.2434
9 5 42.64950943 17.21293449 0.10 26.42287254 -0.65478516 0.72314453 0.2434
10 4 43.65192413 16.73036766 0.10 25.30035782 -0.65478516 0.72314453 0.2434
11 7 43.74779892 17.21279907 0.10 25.42190933 -0.65478516 0.72314453 0.2434
12 8 42.55363083 16.73049927 0.10 26.30132103 -0.19812012 0.97949219 -0.0435
Preview
VS In VS Out GS/DS Out
Controls Flycam Show This draw Solid Shading None Wireframe Highlight Vertices
Replay Context: Oculus Quest 2 Profiling Mode
test2.rdc loaded. No problems detected.


test2.rdc - Remote: Oculus Quest 2 Profiling Mode - RenderDoc for Oculus v39.6 (forked from v1.19)
File Window Tools Help
Tile Timeline
TIME:
Timeline - Frame #2239
Usage for SceneColorMobile: Reads (▲), Writes (▲), Read/Write (▲) Barriers (▲), and Clears (△)
Event Browser
Controls
Filter $action()
Settings & Help
Frame 1668 MobileSceneRender ... SceneColor... MobileBasePass View0 M_MasterCompressed AdjustableWrench
EID Name
14-174 WorldTick
176 SendAllEndOfFrameUpdates
179-713 MobileSceneRender
180-712 MobileSceneRender
181-182 InitViews
184 => vkQueueSubmit(1)[0]: vkEndCommandBuffer(Baked Command Buffer 40137)
240 => vkQueueSubmit(1)[0]: vkBeginCommandBuffer(Baked Command Buffer 40138)
241-243 GPUParticles_PreRender
245 ShadowDepths
248-673 SceneColorRendering
249 vkCmdBeginRenderPass(C=Clear, D=Clear)
250 MobileRenderPrePass
252-641 MobileBasePass
253-638 View0
254-262 M_MasterCompressed SM_TopPanel
262 vkCmdDrawIndexed(44574, 1)
264-269 M_MasterCompressed SM_Checkboard
271-276 M_MasterCompressed PilotSeat3
278-281 M_MasterCompressed PilotSeat3
283-287 M_MasterCompressed AdjustableWrench
289-294 M_IKJMASTERMAT MainJoySM
296-301 GizmoMaterial None
303-307 GizmoMaterial None
309-313 GizmoMaterial None
315-319 GizmoMaterial None
321-325 GizmoMaterial None
327-331 GizmoMaterial None
333-337 GizmoMaterial None
339-343 GizmoMaterial None
345-349 GizmoMaterial None
351-355 GizmoMaterial None
357-362 Widget3DPassThrough None
364-368 Widget3DPassThrough None
370-374 Widget3DPassThrough None
376-381 M_IKJMastermat TmpLeverNew
383-388 M_FrontPanels_Interactive SM_FrontPanels_InteractiveMesh
390-395 M_RotatingFan FilterSection_Fan
397-402 T_ButtonMaterial Cockpit mainpanel squarebutton
API Inspector
EID Event
283 vkCmdDebugMarkerBeginEXT(M_MasterCompressed AdjustableWrench)
Callstack
Texture Viewer
Pipeline State
Mesh Viewer
Launch Application
Tile Browser
Statistics
Performance Counter Viewer
Resource Inspector
Diagnostic Log
Channels RGBA
Subresource Sample Sample 0
Slice/Face Slice 0
Actions
Zoom 1:1 Fit 10%
Overlay None
Range 0.00 1.00
Cur Output 0 - Sc...
Inputs
Outputs
FS 0[0] Material_Texture2D_0
FS 1[0] Material_Texture2D_1
FS 2[0] Material_Texture2D_2
Pixel Context
SceneColorMobile ~
1440x1584[2] MS[2x
R8G8B8A8_SRGB
Hover - [500, 447
Right click to pic
History
Debug
Replay Context: Oculus Quest 2 Profiling Mode
test2.rdc loaded. No problems detected.


test2.rdc - Remote: Oculus Quest 2 Profiling Mode - RenderDoc for Oculus v39.6 (forked from v1.19)
File Window Tools Help
Tile Timeline
TIME:
Timeline - Frame #2239
Usage for SceneColorMobile: Reads (▲), Writes (▲), Read/Write (▲) Barriers (▲), and Clears (△)
Event Browser
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Filter $action()
Settings & Help
Frame 1668 MobileSceneRender ... SceneColor... MobileBasePass View0 M_MasterCompressed AdjustableWrench
EID Name
240 => vkQueueSubmit(1)[0]: vkBeginCommandBuffer(Baked Command Buffer 40138)
241-243 GPUParticles_PreRender
245 ShadowDepths
248-673 SceneColorRendering
249 vkCmdBeginRenderPass(C=Clear, D=Clear)
250 MobileRenderPrePass
252-641 MobileBasePass
253-638 View0
254-262 M_MasterCompressed SM_TopPanel
264-269 M_MasterCompressed SM_Checkboard
271-276 M_MasterCompressed PilotSeat3
278-281 M_MasterCompressed PilotSeat3
283-287 M_MasterCompressed AdjustableWrench
287 vkCmdDrawIndexed(7530, 1)
289-294 M_IK2MASTERMAT MainJoySM
296-301 GizmoMaterial None
303-307 GizmoMaterial None
309-313 GizmoMaterial None
315-319 GizmoMaterial None
321-325 GizmoMaterial None
327-331 GizmoMaterial None
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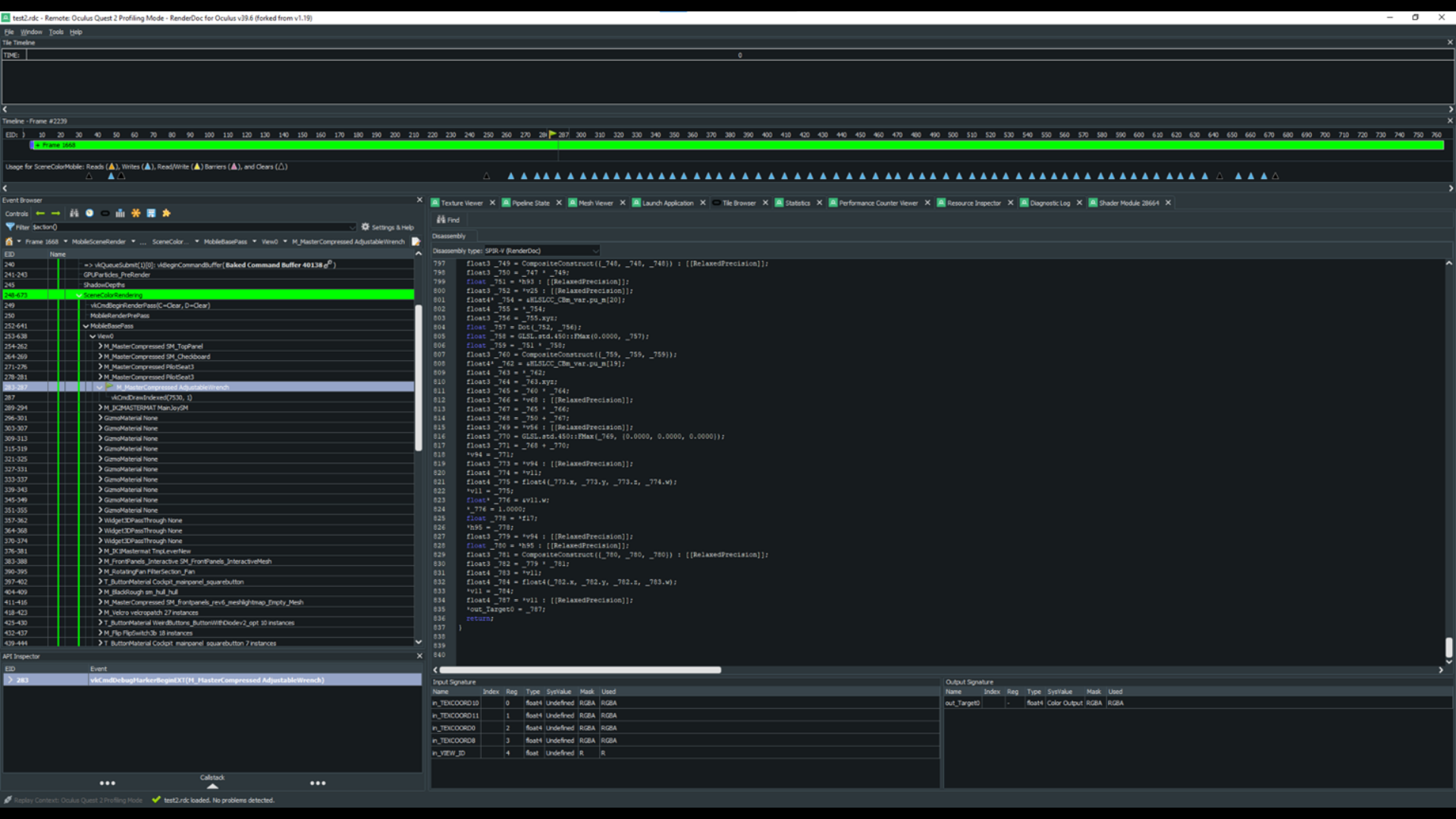
351-355 GizmoMaterial None
357-362 Widget3DPassThrough None
364-368 Widget3DPassThrough None
370-374 Widget3DPassThrough None
376-381 M_IK1Mastermat TmpLeverNew
383-388 M_FrontPanels_Interactive SM_FrontPanels_InteractiveMesh
390-395 M_RotatingFan FilterSection_Fan
397-402 T_ButtonMaterial Cockpit_mainpanel_squarebutton
404-409 M_BlackRough sm_hull_hull
411-416 M_MasterCompressed SM_frontpanels_rev6_meshlightmap_Empty_Mesh
418-423 M_Velcro velcropatch 27 instances
425-430 T_ButtonMaterial WeirdButtons_ButtonWithDiodev2_opt 10 instances
432-437 M_Flip Flip6switch3b 18 instances
439-444 T_ButtonMaterial Cockpit_mainpanel_squarebutton 7 instances
API Inspector
EID Event
283 vkCmdDebugMarkerBeginEXT(M_MasterCompressed AdjustableWrench)
Callstack
Texture Viewer
Pipeline State
Mesh Viewer
Launch Application
Tile Browser
Statistics
Performance Counter Viewer
Resource Inspector
Diagnostic Log
Shader Module 28664
Controls
Show Unused Items
Show Empty Items
Export
Extensions
Vertex Input
Vertex Shader
Tess. Control Shader
Tess. Eval. Shader
Geometry Shader
Rasterizer
Fragment Shader
Framebuffer Output
Compute Shader
Shader
Graphics Pipeline 28665 : Shader Module 28664 : main_00005784_30692072
View
Edit
Save
Resources
Set Binding Type Resource Contents Additional Go
0 4: Material_Texture2D_0 Texture 2D Image&Sampler 2D Image 30708 1024x1024 ASTC_SRGB
Sampler Sampler 532 UVW: Repeat Min&Mag&Mip: Anisotropic Aniso 2x, LODs: FLT_MAX - 3.40282e+38
0 5: Material_Texture2D_1 Texture 2D Image&Sampler 2D Image 30705 1024x1024 ASTC_SRGB
0 6: Material_Texture2D_2 Texture 2D Image&Sampler 2D Color Attachment 3063 256x256 R16G16B16A16_FLOAT
Sampler Sampler 533 UVW: ClampEdge Min&Mag&Mip: Anisotropic Aniso 2x, LODs: FLT_MAX - 3.40282e+38
Uniform Buffers
Set Binding Buffer Byte Range Size Go
0 2: HLSLCC_CBh_var Buffer 258 5336704 - 5336960 1 Variables, 256 bytes
0 3: HLSLCC_CBm_var Buffer 258 5336960 - 5337312 1 Variables, 352 bytes
Replay Context: Oculus Quest 2 Profiling Mode
test2.rdc loaded. No problems detected.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418-423 M_Velcro velcropatch 27 instances
425-430 T_ButtonMaterial WeirdButtons_ButtonWithDiodev2_opt 10 instances
432-437 M_Flip Flip6switch3b 18 instances
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283 vkCmdDebugMarkerBeginEXT(M_MasterCompressed AdjustableWrench)
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Pipeline State
Mesh Viewer
Launch Application
Tile Browser
Statistics
Performance Counter Viewer
Resource Inspector
Diagnostic Log
Shader Module 28664
Find
Disassembly
Disassembly type: SPIR-V (RenderDoc)
797 float3 _749 = CompositeConstruct((_748, _748, _748)) : [[RelaxedPrecision]];
798 float3 _750 = _747 * _749;
799 float _751 = *h93 : [[RelaxedPrecision]];
800 float3 _752 = *v25 : [[RelaxedPrecision]];
801 float4* _754 = &HLSLCC_CBm_var.pu_m[20];
802 float4 _755 = *_754;
803 float3 _756 = _755.xyz;
804 float _757 = Dot(_752, _756);
805 float _758 = GLSL.std.450::FMax(0.0000, _757);
806 float _759 = _751 * _758;
807 float3 _760 = CompositeConstruct((_759, _759, _759));
808 float4* _762 = &HLSLCC_CBm_var.pu_m[19];
809 float4 _763 = *_762;
810 float3 _764 = _763.xyz;
811 float3 _765 = _760 * _764;
812 float3 _766 = *v68 : [[RelaxedPrecision]];
813 float3 _767 = _765 * _766;
814 float3 _768 = _750 + _767;
815 float3 _769 = *v56 : [[RelaxedPrecision]];
816 float3 _770 = GLSL.std.450::FMax(_769, (0.0000, 0.0000, 0.0000));
817 float3 _771 = _768 + _770;
818 *v94 = _771;
819 float3 _773 = *v94 : [[RelaxedPrecision]];
820 float4 _774 = *v11;
821 float4 _775 = float4(_773.x, _773.y, _773.z, _774.w);
822 *v11 = _775;
823 float* _776 = &v11.w;
824 *_776 = 1.0000;
825 float _778 = *f17;
826 *h95 = _778;
827 float3 _779 = *v94 : [[RelaxedPrecision]];
828 float _780 = *h95 : [[RelaxedPrecision]];
829 float3 _781 = CompositeConstruct((_780, _780, _780)) : [[RelaxedPrecision]];
830 float3 _782 = _779 * _781;
831 float4 _783 = *v11;
832 float4 _784 = float4(_782.x, _782.y, _782.z, _783.w);
833 *v11 = _784;
834 float4 _787 = *v11 : [[RelaxedPrecision]];
835 *out_Target0 = _787;
836 return;
837 }
838
839
840
Input Signature
Name Index Reg Type SysValue Mask Used
in_TEXCOORD10 0 float4 Undefined RGBA RGBA
in_TEXCOORD11 1 float4 Undefined RGBA RGBA
in_TEXCOORD0 2 float4 Undefined RGBA RGBA
in_TEXCOORD8 3 float4 Undefined RGBA RGBA
in_VIEW_ID 4 float Undefined R R
Output Signature
Name Index Reg Type SysValue Mask Used
out_Target0 - float4 Color Output RGBA RGBA
Replay Context: Oculus Quest 2 Profiling Mode
test2.rdc loaded. No problems detected.

Key Takeaways

- Adjust your level design
- Create an efficient art pipeline
  - Merge everything, if possible, draw calls are your enemies
  - Skeletal mesh > few static meshes, draw calls are your enemies
  - Use all texture channels, texture samples are your enemies
  - Use static switch instead of if node, branches are your enemies*

  *unless your shader logic is simple
- Fake PBR

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  - Use static switch instead of “IF” node, branches are your enemies*

  *unless your shader logic is simple

- Fake PBR
- **Fake everything**

The End

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