
CANNONDESIGN

CannonDesign is an integrated global design firm that unites a dynamic team of architects, engineers, strategists, researchers, futurists, and industry specialists driven by a singular goal – to help solve our clients' and society's greatest challenges.

19 OFFICES WORLDWIDE

1000+ CANNONDESIGNERS

FAST COMPANY

TOP 10

MOST INNOVATIVE ARCHITECTURE FIRM IN THE WORLD

#3 US Education Firm *Building Design + Construction*

#6 Global Health Firm *World Architecture 100*

#8 Science + Technology Design Firm *World Architecture 100*

#16 Top Design Firm *Architect 50*

Top 10 Innovative Arch. Firm in the World *Fast Company*

Top 25 Office Design Firm *Building Design + Construction*

Top 10 US Interiors Firm *Interior Design Magazine*

Top 10 Engineering Firm *World Architecture 100*

500+

total design awards won
in the last 15 years

900+

designers

Hilda Espinal, AIA, LEED AP+C, CDT, MCSE

Hilda Espinal is CannonDesign's Chief Technology Officer, responsible for the evolution and implementation of the firm's emerging technologies through leveraging computational tools and workflows, digital intelligence, immersive realities, building information modeling, and advanced building analysis and visualization. A licensed architect and technology leader for more than 16 years, she helps clients and project teams around the world leverage technology and intelligent data to make informed decisions early in the design process — reducing risk and maximizing the impact of investments.

Hilda sits on the national board of directors for Women for Economic Leadership and Development (WELD), is the chair for CannonDesign's Diversity + Inclusion Council and is very involved in multiple partnership in the technology space. She is a Microsoft-certified systems engineer, a regularly speaker at both national and international industry events, and has been active in the Autodesk Executive Council, Builtworlds Hackathon Judges panel, Mars Home Urbanization Challenge and the AIA's CIO/CTO Large Firm Roundtable. In 2016, Hilda was named one of the "Top Women in Technology" by the Dallas Business Journal.

Hilda Espinal, AIA, LEED AP+C, CDT, MCSE

Hilda Espinal is CannonDesign's Chief Technology Officer, responsible for the evolution and implementation of the firm's emerging technologies through leveraging computational tools and workflows, digital intelligence, immersive realities, building information modeling, and advanced building analysis and visualization. A licensed architect and technology leader for more than 16 years, she helps clients and project teams around the world leverage technology and intelligent data to make informed decisions early in the design process — reducing risk and maximizing the impact of investments.

Hilda sits on the national board of directors for Women for Economic Leadership and Development (WELD), is the chair for CannonDesign's Diversity + Inclusion Council and is very involved in multiple partnership in the technology space. She is a Microsoft-certified systems engineer, a regularly speaker at both national and international industry events, and has been active in the Autodesk Executive Council, Builtworlds Hackathon Judges panel, Mars Home Urbanization Challenge and the AIA's CIO/CTO Large Firm Roundtable. In 2016, Hilda was named one of the "Top Women in Technology" by the Dallas Business Journal.

Ernesto Pacheco

VizNet is led by Ernesto Pacheco, who was recently promoted to the role of Firm Visualization Leader. In this role, Ernesto directs the development and management of digital graphic resources throughout CannonDesign for design visualization, from still renderings to animations and immersive technologies (VR,AR,XR) and promotes our capabilities to enhance visual communication and presentation deliverables.

Ernesto Pacheco leverages expert knowledge of visualization applications in supporting project teams and pursuits. As the Firm Visualization Leader at CannonDesign, Ernesto is a "Go-to" person for all project related aspects of visualization. He is primarily responsible for research and implementation of new technologies into the visual communications process. Ernesto started his career studying Architecture at the Universidad de las Americas-Puebla Mexico, before moving to the United States. He continued his studies in Interactive Design at Maryville University in St. Louis, MO. Ernesto has 18 years of experience in the Architectural field and has worked on several high-profile projects since joining CannonDesign. Most recently, Ernesto has been a key participant to the Holodeck partnership between CannonDesign and NVIDIA to develop tools geared towards Architectural Design.

epacheco@cannondesign.com

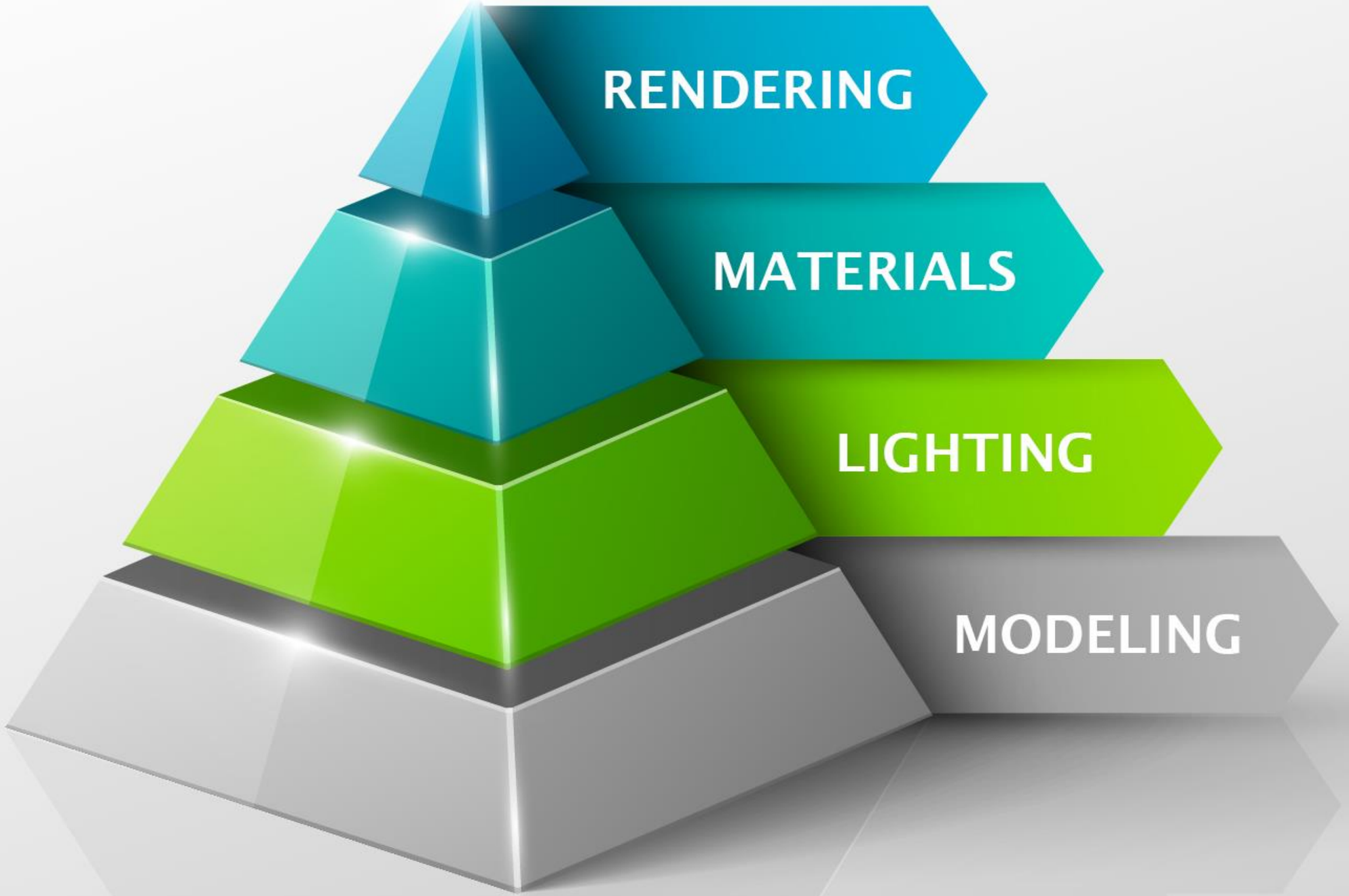
Ernesto Pacheco

VizNet is led by Ernesto Pacheco, who was recently promoted to the role of Firm Visualization Leader. In this role, Ernesto directs the development and management of digital graphic resources throughout CannonDesign for design visualization, from still renderings to animations to immersive technologies (VR,AR,XR) and promotes our capabilities to enhance visual communication and presentation deliverables.

Ernesto Pacheco leverages expert knowledge of visualization applications in supporting project teams and pursuits. As the Firm Visualization Leader at CannonDesign, Ernesto is a "Go-to" person for all project related aspects of visualization. He is primarily responsible for research and implementation of new technologies into the visual communications process. Ernesto started his career studying Architecture at the Universidad de las Americas-Puebla Mexico, before moving to the United States. He continued his studies in Interactive Design at Maryville University in St. Louis, MO. Ernesto has 18 years of experience in the Architectural field and has worked on several high-profile projects since joining CannonDesign. Most recently, Ernesto has been a key participant to the Holodeck partnership between CannonDesign and NVIDIA to develop tools geared towards Architectural Design.

epacheco@cannondesign.com

RTX AT CANNONDESIGN


RENDERING
MATERIALS
LIGHTING
MODELING


QUADRO
RTX 8000

- **Quadro RTX 4000** (2,304 CUDA cores, 288 Tensor cores, 43 RTX-OPS, 8GB GPU Memory, 6 Giga Rays/Sec) NVIDIA Turing
- **Quadro RTX 5000** (3,072 CUDA cores, 384 Tensor cores, 48 RT cores, 16GB GPU Memory, 8 Giga Rays/Sec) NVIDIA Turing
- **Quadro RTX 6000** (4,608 CUDA cores, 576 Tensor cores, 72 RT cores, 24GB GPU Memory, 10 Giga Rays/Sec) NVIDIA Turing
- **Quadro GV100** (5,120 CUDA cores, 640 Tensor cores, 32GB GPU Memory, RTX ready) NVIDIA Volta

CANNONDESIGN

What is Ray Tracing?

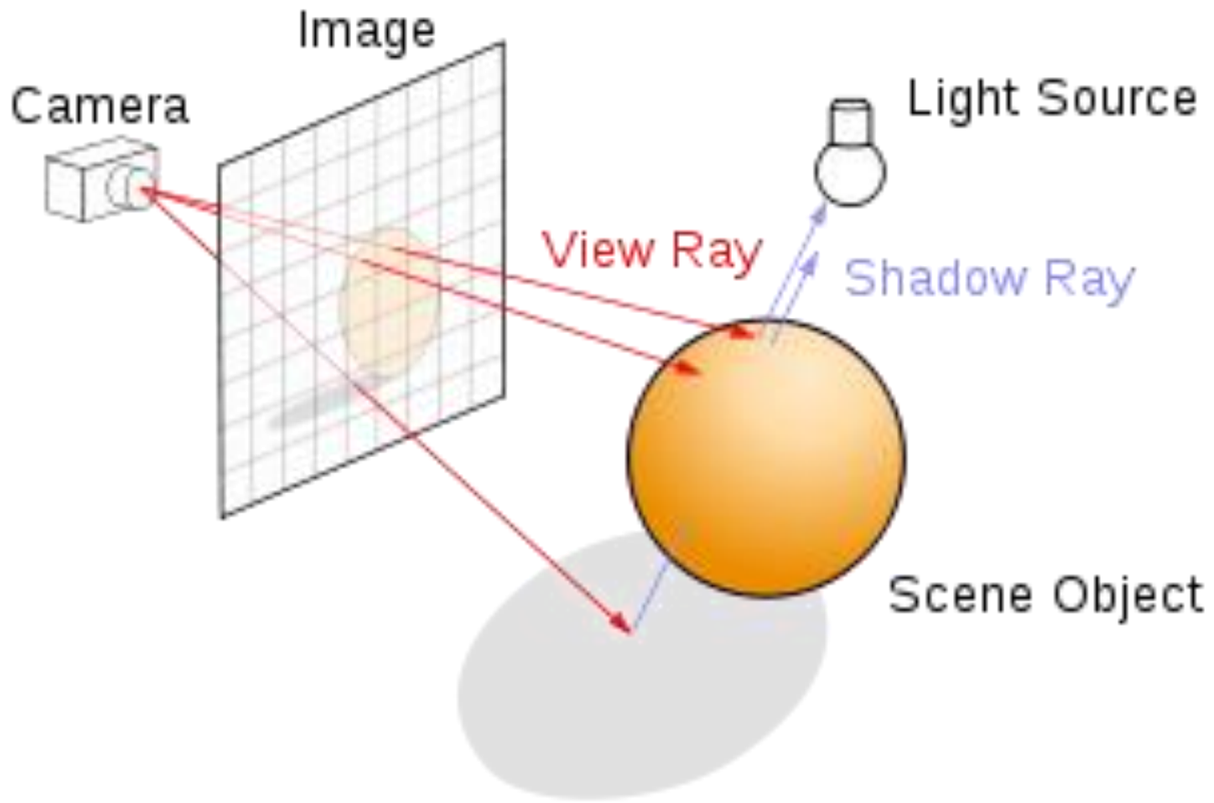
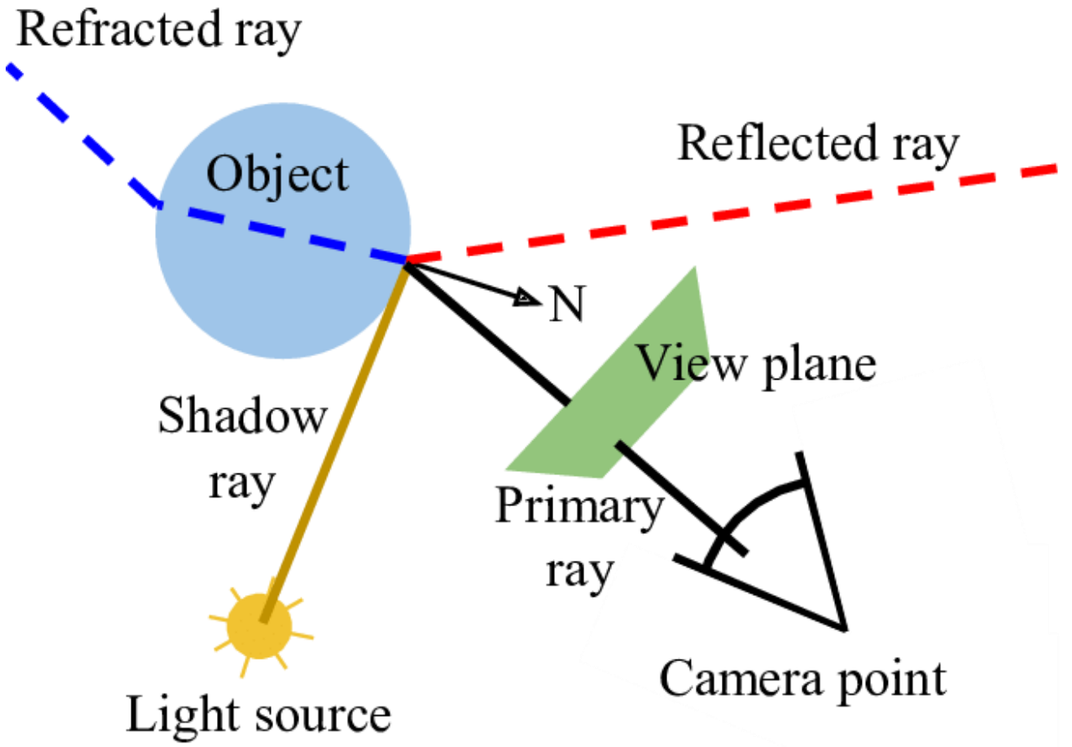


Image
Camera
Light Source
View Ray
Shadow Ray
Scene Object


Refracted ray
Object
Reflected ray
N
View plane
Shadow
ray
Primary
ray
Camera point
Light source

CANNONDESIGN

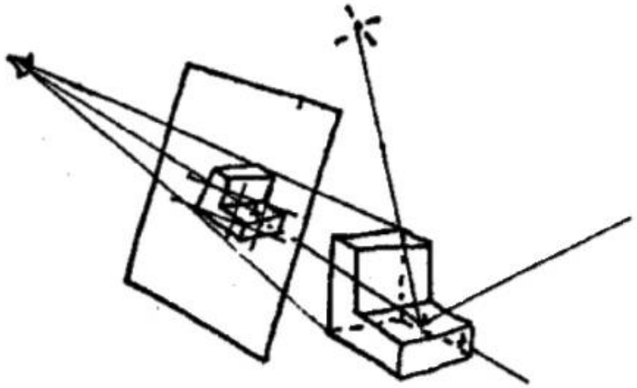
We've come a LONG way....

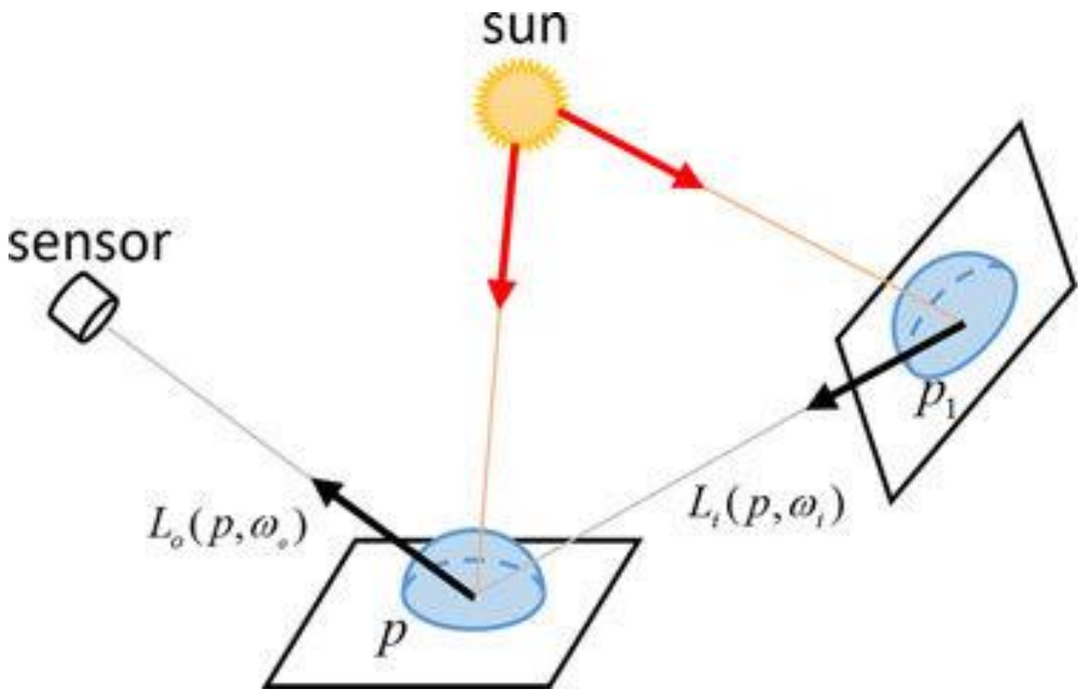
CANNONDESIGN

1963 CGI IS BORN

Ray Casting and Path Tracing

- Arthur Appel (1968)
  - Cast rays from eye… what object is hit?





1968 Arthur Appel Ray - Casting algorithm for renderings. Using geometric algorithms of ray tracing.

1986 Stanislaw Ulam - Path Tracing (Monte Carlo Ray Tracing)

1993 Jurassic Park – successful illusion of CGI and live action existing in the same world.

2004 Half Life 2 – High Dynamic Range Rendering – Source Engine

2018 Battlefield V

CANNONDESIGN

2018 RTX IS BORN

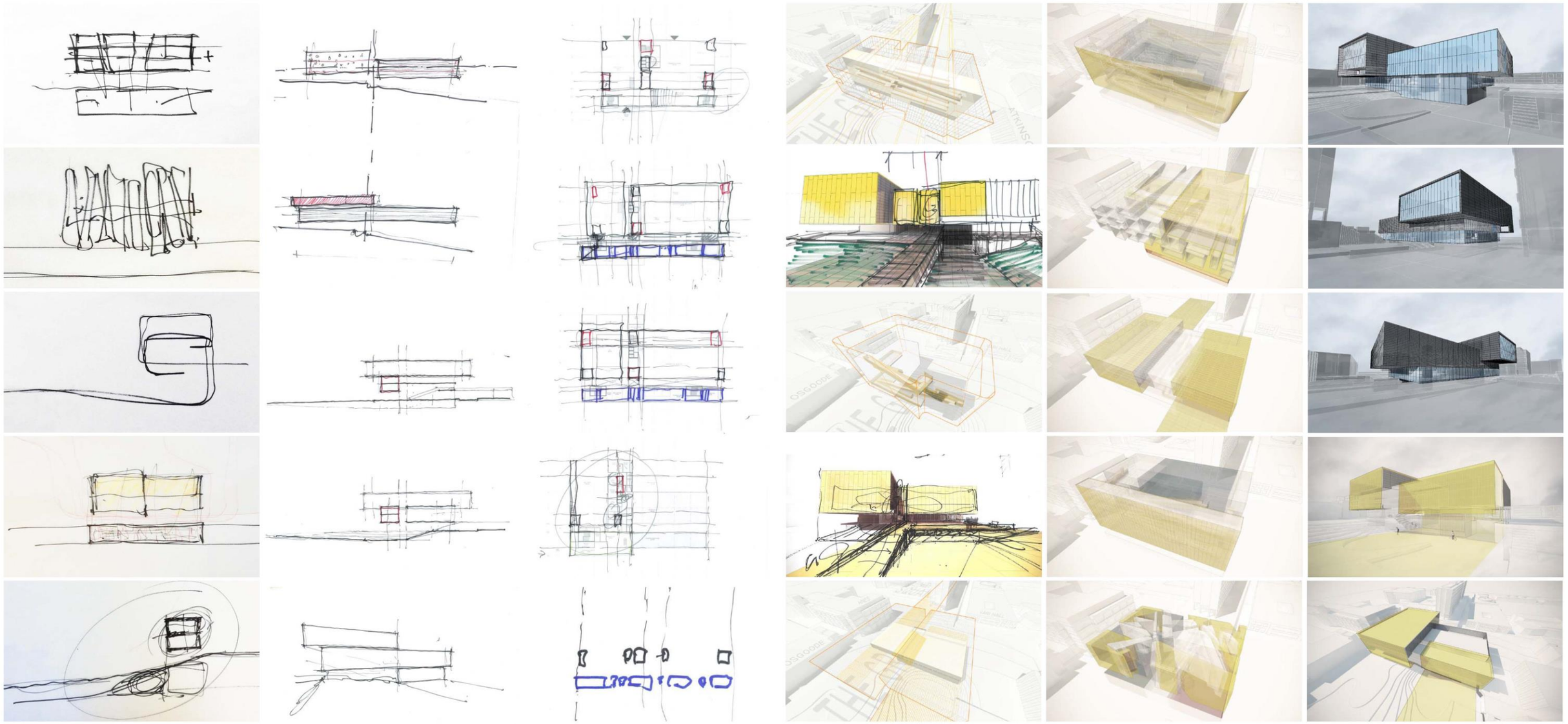
CANNONDESIGN

Challenge # 1

“WE NEED KILLING IMAGES TO KNOCK THE SOCKS OFF OUR CLIENTS AND BEAT THE COMPETION”

TRANSLATION: We need game changing, state of the art output.

1. Visual Communication



1. Visual Communication

1. Visual Communication

CANNONDESIGN

Approach

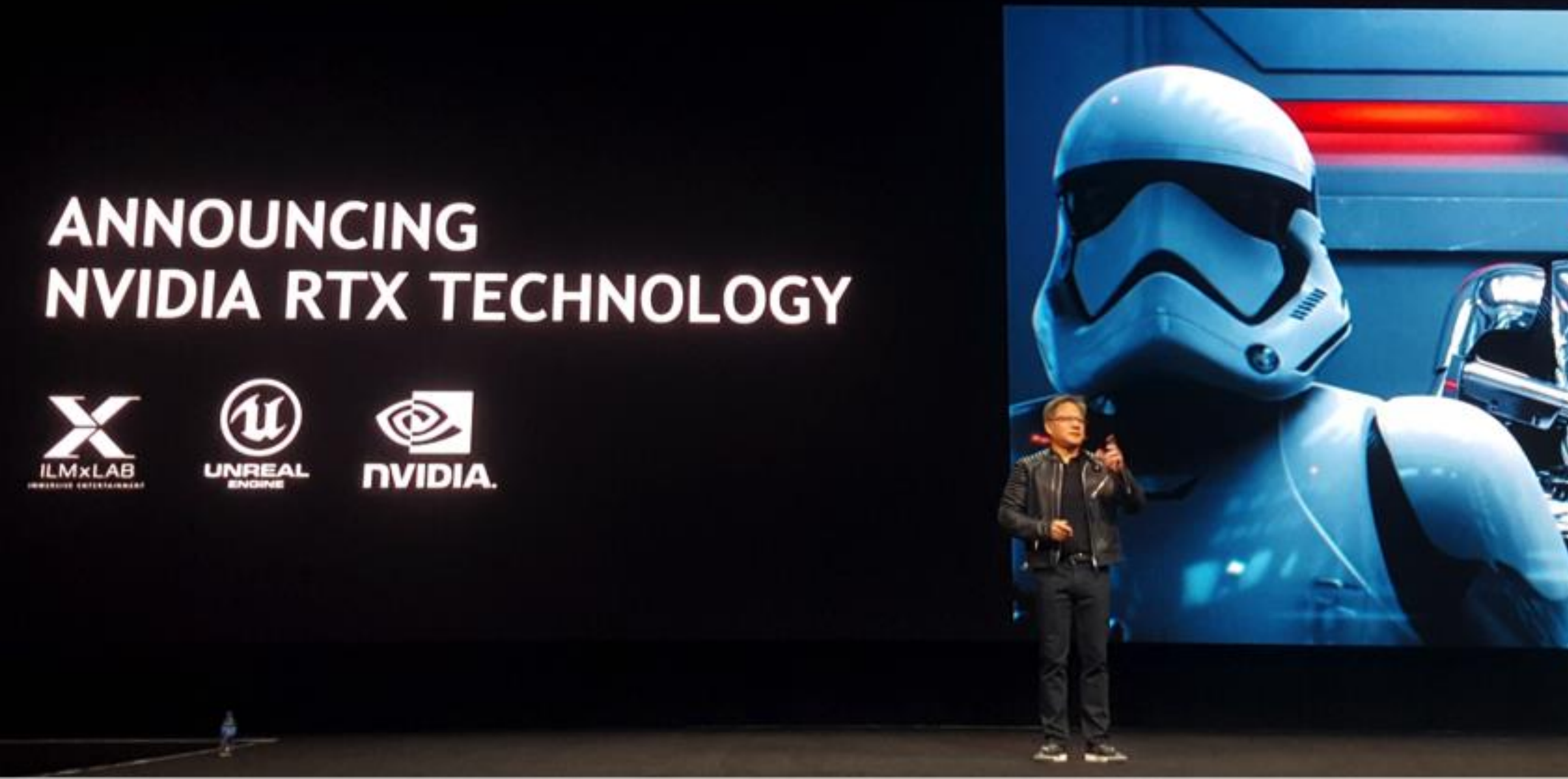
Leverage RTX technology for denoising and real-time ray-tracing.

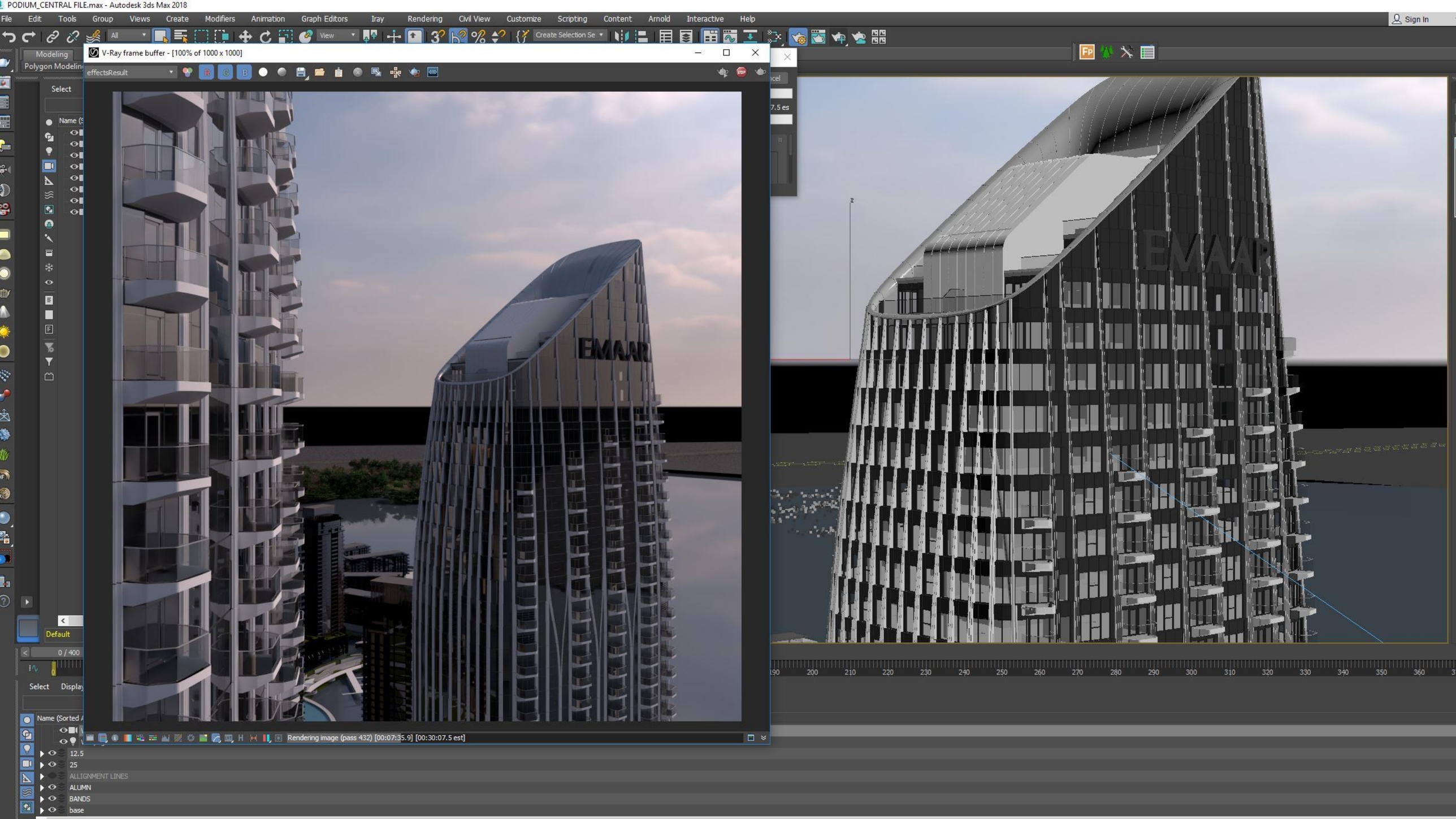
ANNOUNCING
NVIDIA RTX TECHNOLOGY

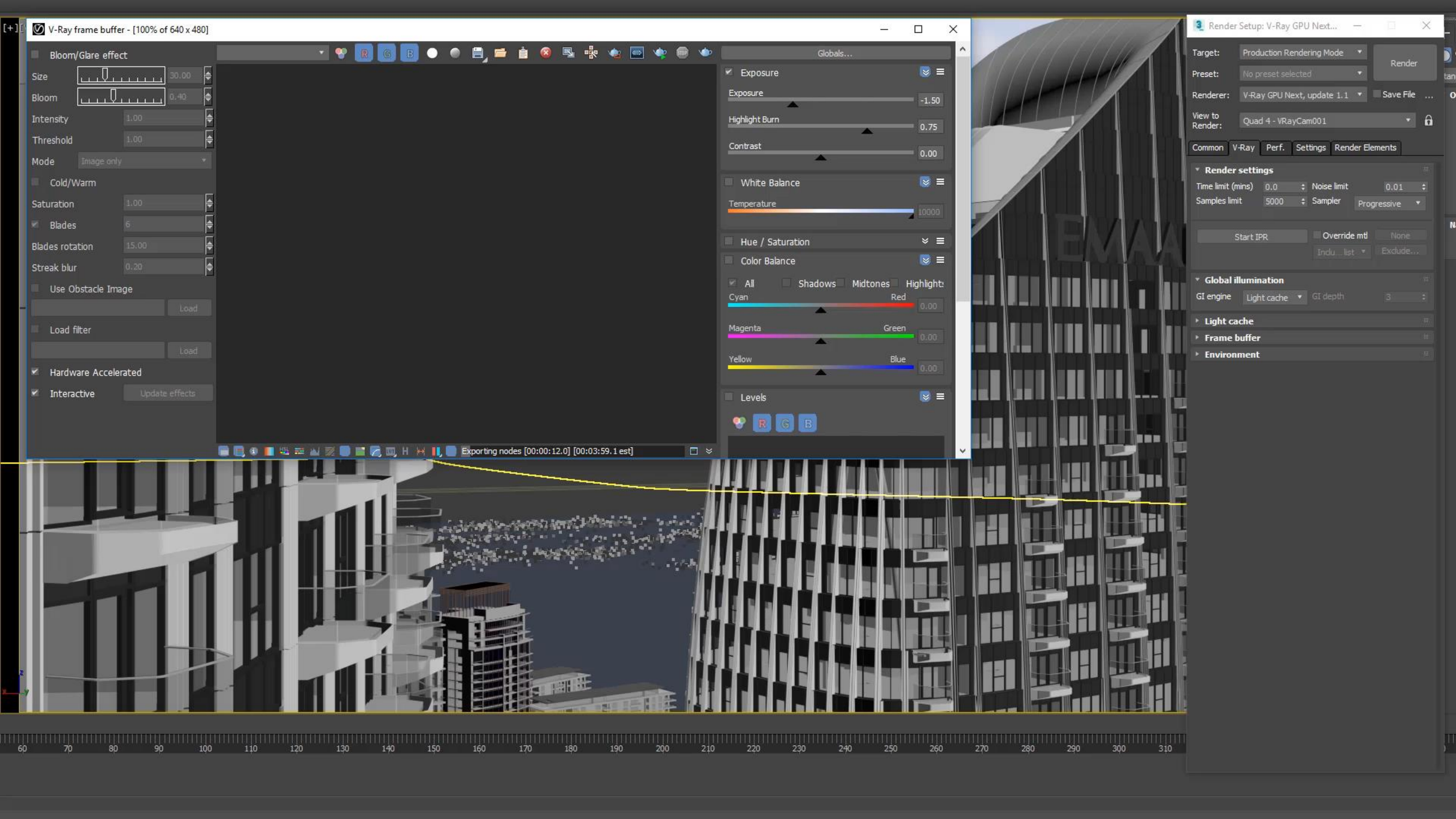
ILMxLAB

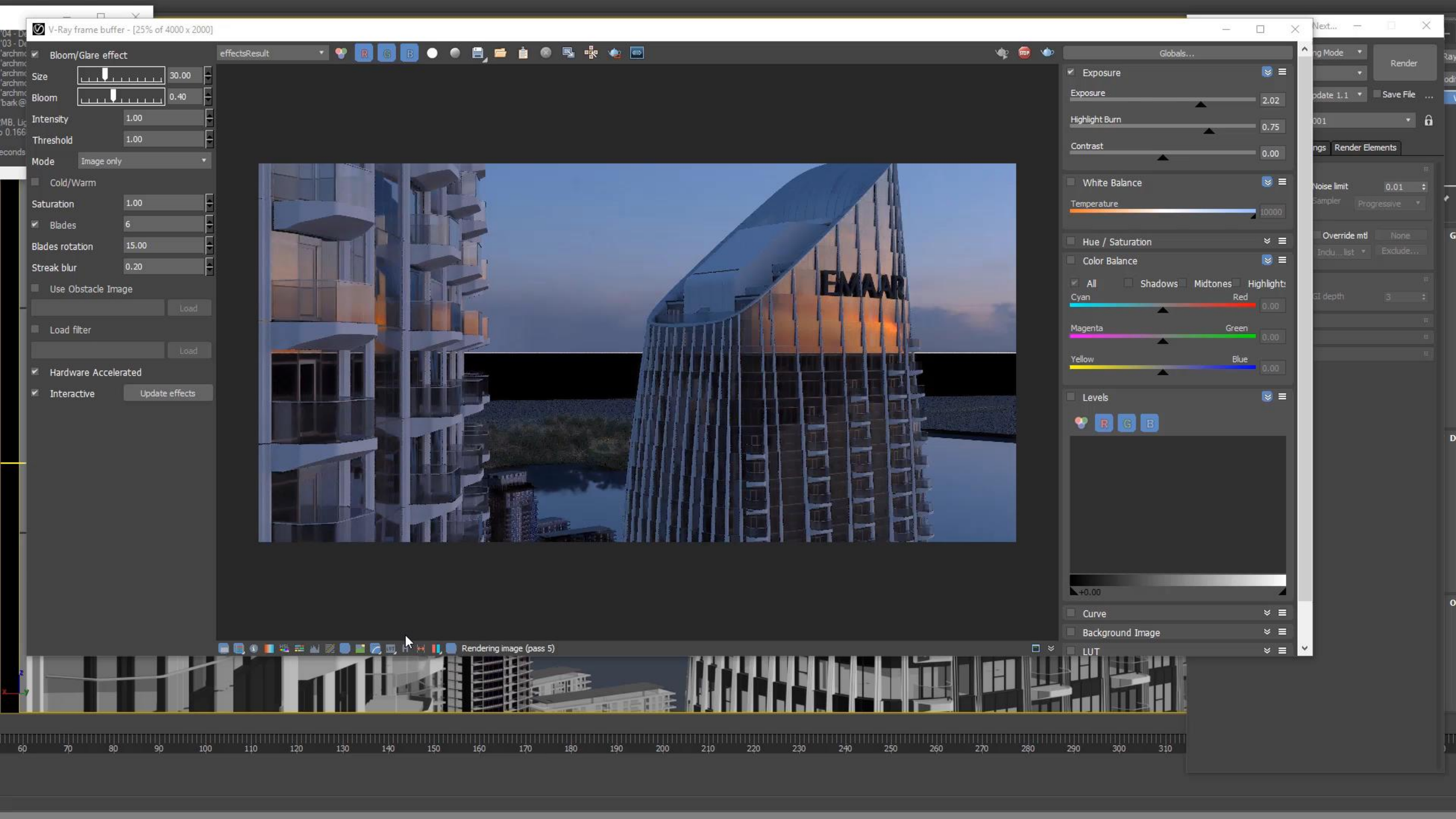
UNREAL ENGINE

NVIDIA.




PODIUM_CENTRAL FILE.max - Autodesk 3ds Max 2018
File Edit Tools Group Views Create Modifiers Animation Graph Editors Iray Rendering Civil View Customize Scripting Content Arnold Interactive Help
Sign In
V-Ray frame buffer - [100% of 1000 x 1000]
effectsResult
EMAAR
Rendering image (pass 432) [00:07:35.9] [00:30:07.5 est]
Modeling
Polygon Modeling
Select
Default
0 / 400
Name (Sorted A
12.5
25
ALLIGNMENT LINES
ALUMN
BANDS
base
EMAAR


V-Ray frame buffer - [100% of 640 x 480]
Bloom/Glare effect
Size
30.00
Bloom
0.40
Intensity
1.00
Threshold
1.00
Mode
Image only
Cold/Warm
Saturation
1.00
Blades
6
Blades rotation
15.00
Streak blur
0.20
Use Obstacle Image
Load
Load filter
Load
Hardware Accelerated
Interactive
Update effects
Globals...
Exposure
Exposure
-1.50
Highlight Burn
0.75
Contrast
0.00
White Balance
Temperature
10000
Hue / Saturation
Color Balance
All
Shadows
Midtones
Highlights
Cyan
Red
0.00
Magenta
Green
0.00
Yellow
Blue
0.00
Levels
Exporting nodes [00:00:12.0] [00:03:59.1 est]
Render Setup: V-Ray GPU Next...
Target:
Production Rendering Mode
Render
Preset:
No preset selected
Renderer:
V-Ray GPU Next, update 1.1
Save File
View to Render:
Quad 4 - VRayCam001
Common
V-Ray
Perf.
Settings
Render Elements
Render settings
Time limit (mins)
0.0
Noise limit
0.01
Samples limit
5000
Sampler
Progressive
Start IPR
Override mtl
None
Exclude...
Global illumination
GI engine
Light cache
GI depth
3
Light cache
Frame buffer
Environment
60
70
80
90
100
110
120
130
140
150
160
170
180
190
200
210
220
230
240
250
260
270
280
290
300
310


V-Ray frame buffer - [25% of 4000 x 2000]
Bloom/Glare effect
Size 30.00
Bloom 0.40
Intensity 1.00
Threshold 1.00
Mode Image only
Cold/Warm
Saturation 1.00
Blades 6
Blades rotation 15.00
Streak blur 0.20
Use Obstacle Image
Load
Load filter
Load
Hardware Accelerated
Interactive
Update effects
effectsResult
Globals...
Exposure
Exposure 2.02
Highlight Burn 0.75
Contrast 0.00
White Balance
Temperature 10000
Hue / Saturation
Color Balance
All Shadows Midtones Highlights
Cyan Red 0.00
Magenta Green 0.00
Yellow Blue 0.00
Levels
+0.00
Curve
Background Image
LUT
EMAAR
Rendering image (pass 5)
Render
Save File
Render Elements
Noise limit 0.01
Progressive
Override mtl
None
Exclude...
60 70 80 90 100 110 120 130 140 150 160 170 180 190 200 210 220 230 240 250 260 270 280 290 300 310


EMAAR

CANNONDESIGN

Challenge # 2

“CAN YOU GET IT FASTER?”

Translation: Develop new workflows to expedite design decisions

CANNONDESIGN

Approach

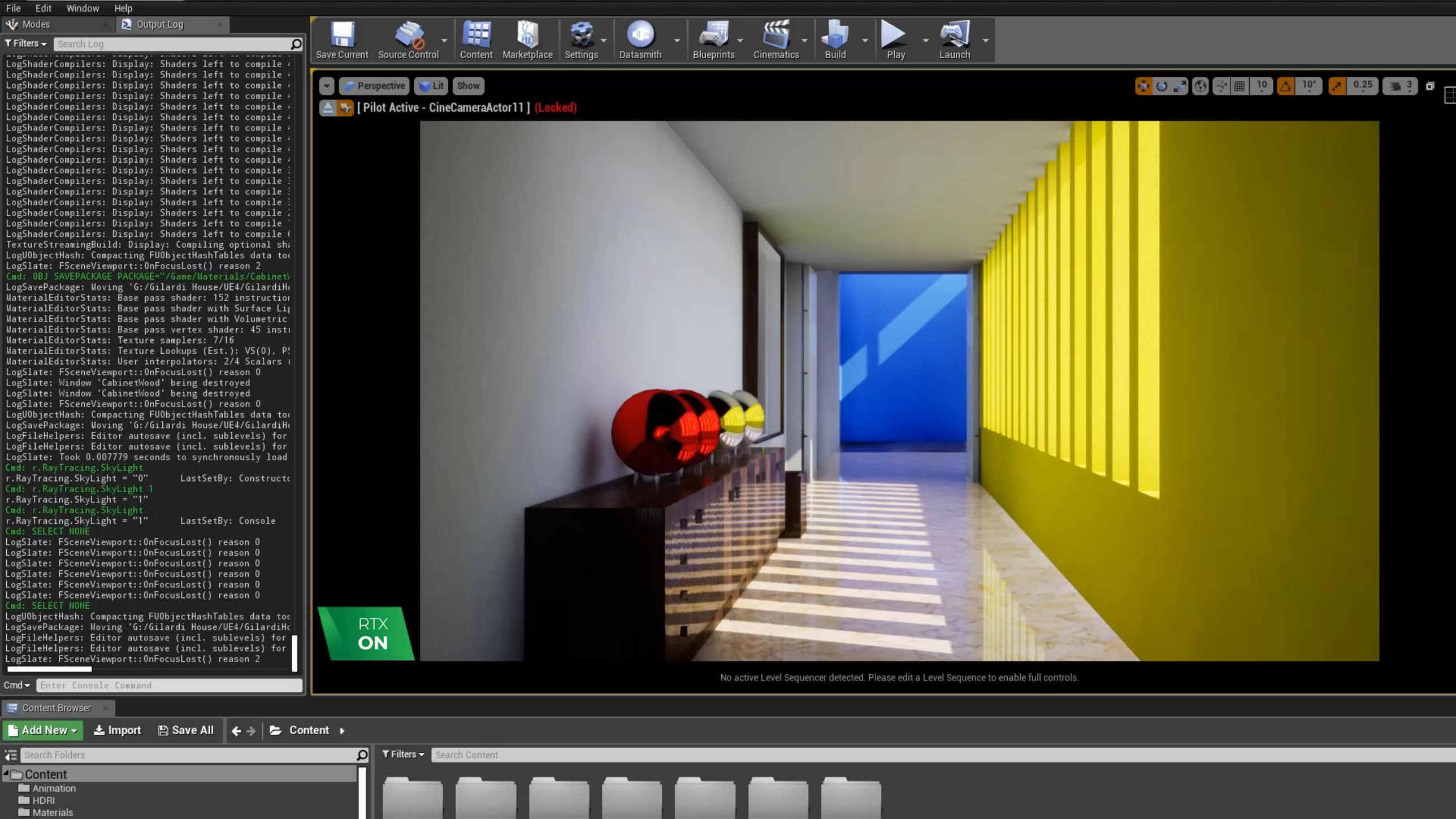
Search for real-time visualization technologies.

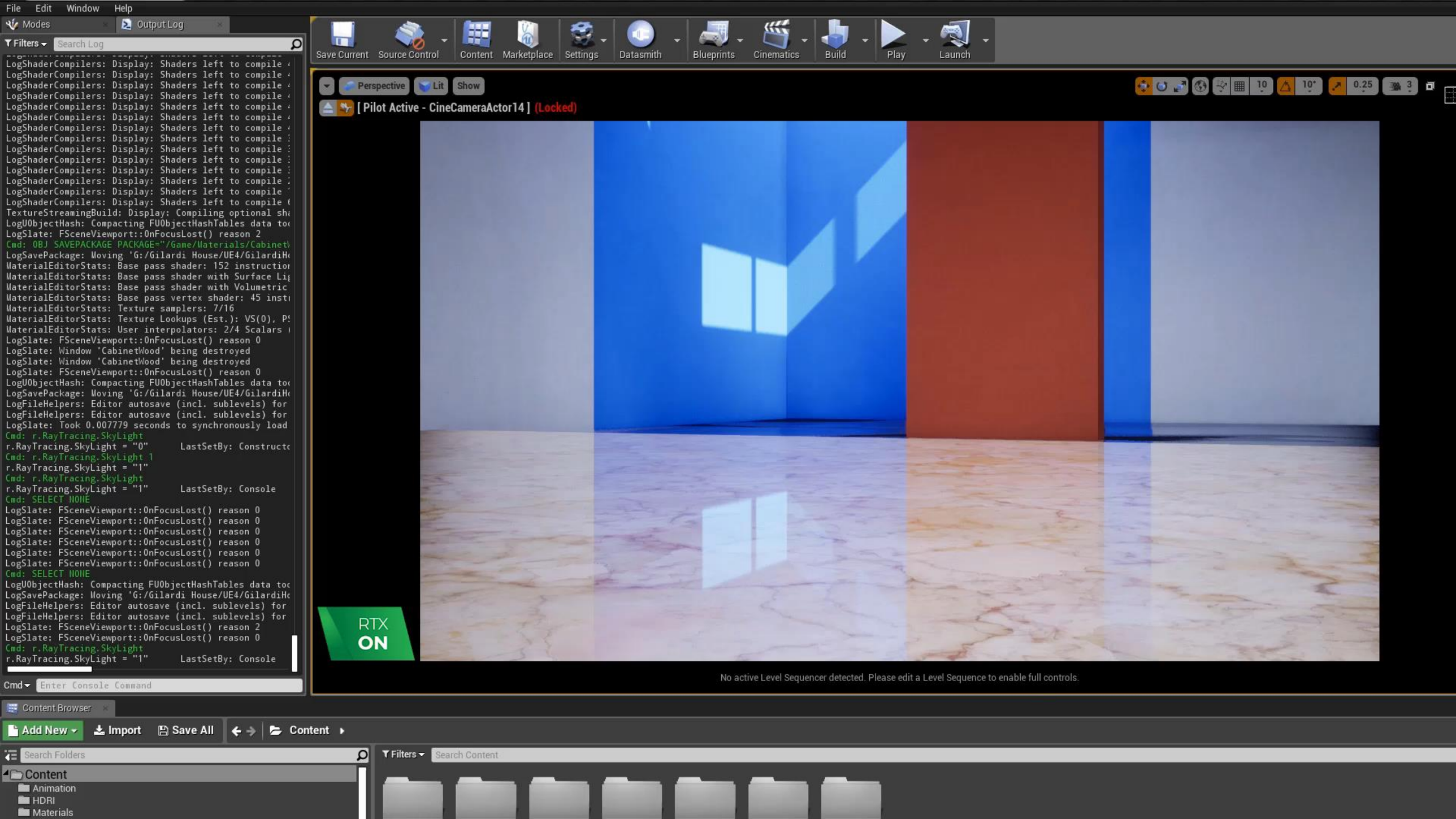
UNREAL ENGINE

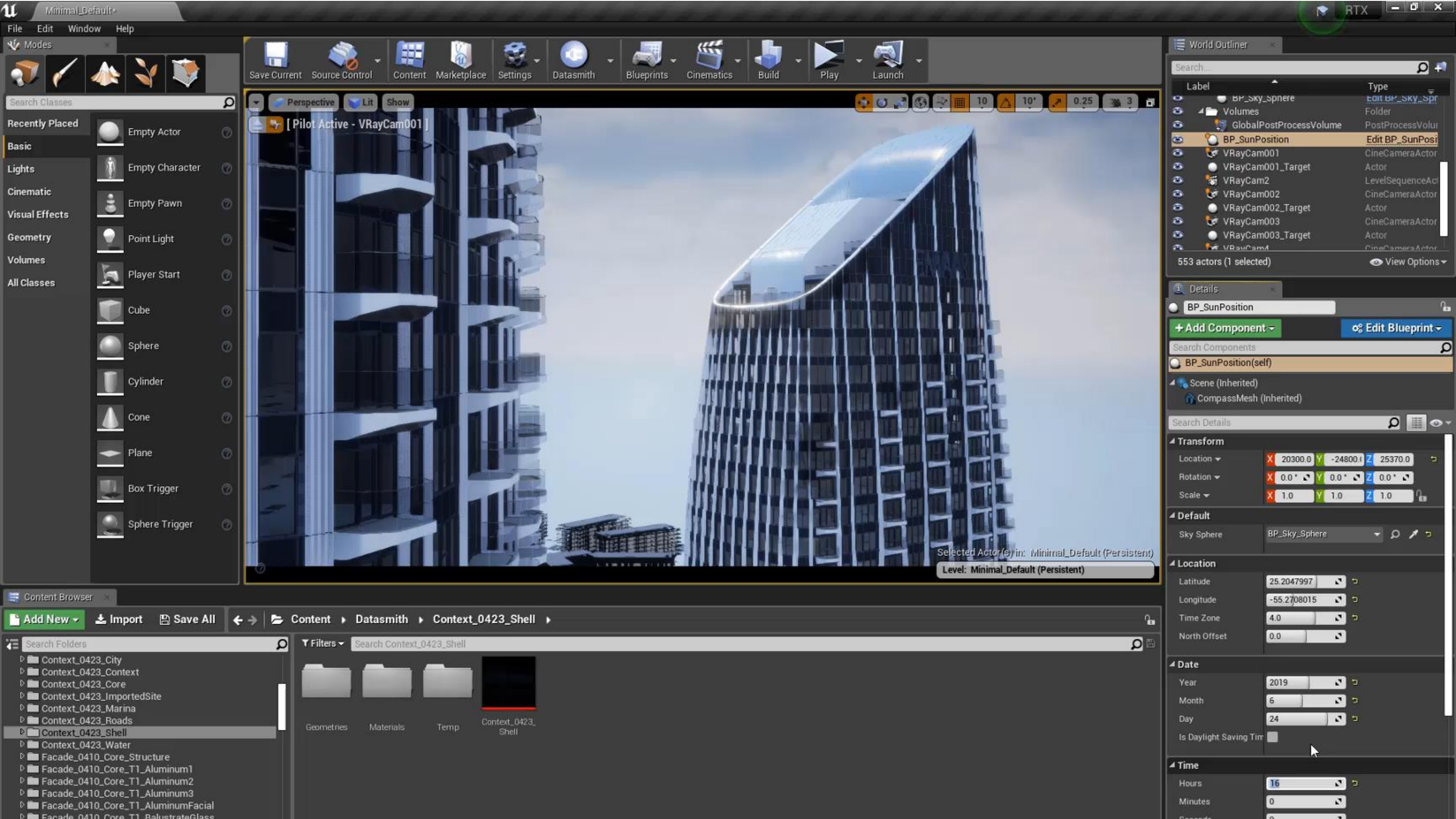
4.22 PREVIEW 1 → 4

Reflection probes and shadow buffers

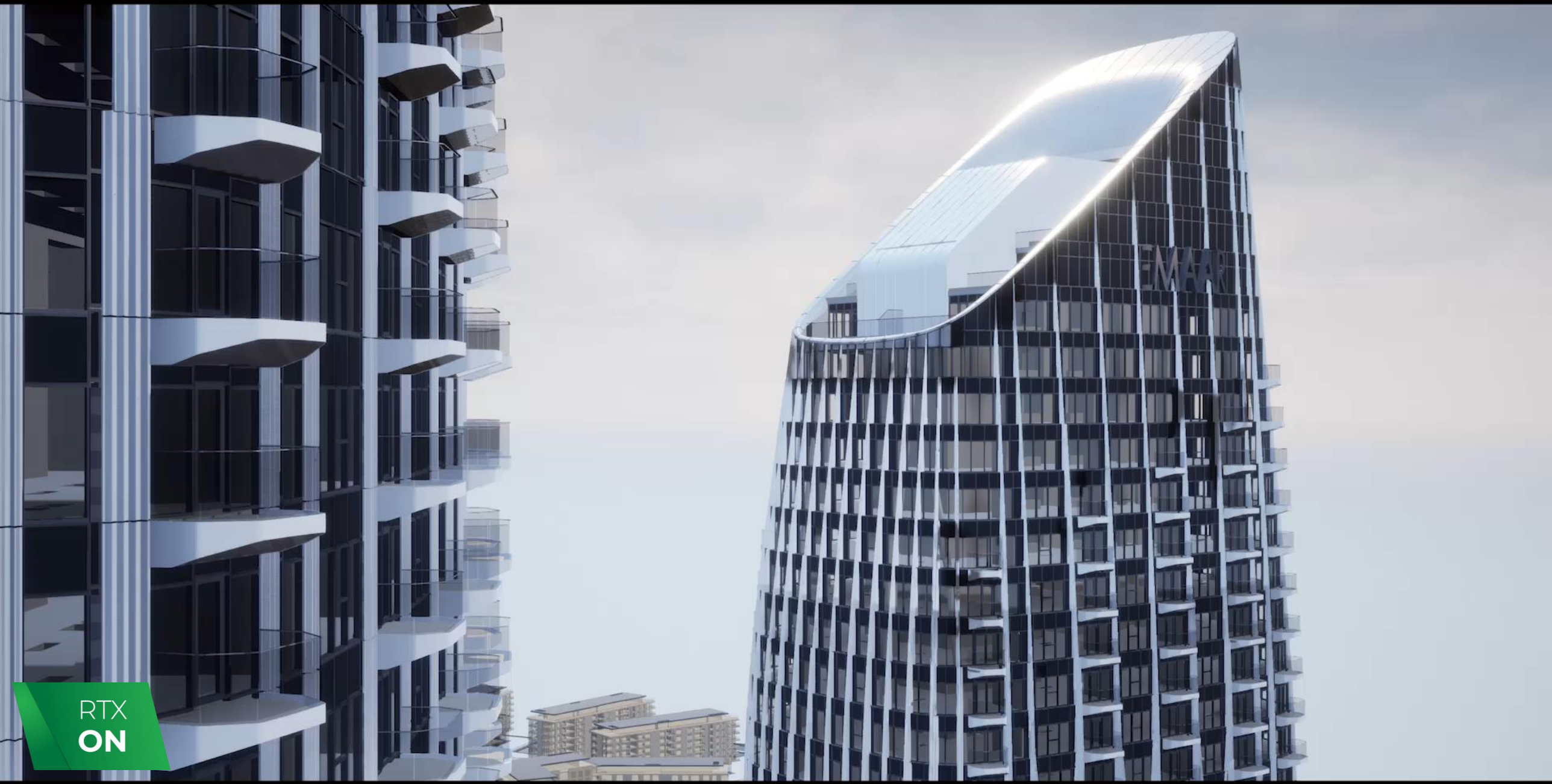
Ray traced reflections and shadows


File
Edit
Window
Help
Modes
Output Log
Filters
Search Log
LogShaderCompilers: Display: Shaders left to compile
TextureStreamingBuild: Display: Compiling optional sha
LogUObjectHash: Compacting FUObjectHashTables data toc
LogSlate: FSceneViewport::OnFocusLost() reason 2
Cmd: OBJ SAVEPACKAGE PACKAGE="/Game/Materials/Cabinet
LogSavePackage: Moving 'G:/Gilardi House/UE4/GilardiH
MaterialEditorStats: Base pass shader: 152 instructio
MaterialEditorStats: Base pass shader with Surface Li
MaterialEditorStats: Base pass shader with Volumetric
MaterialEditorStats: Base pass vertex shader: 45 inst
MaterialEditorStats: Texture samplers: 7/16
MaterialEditorStats: Texture Lookups (Est.): VS(0), P
MaterialEditorStats: User interpolators: 2/4 Scalars
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: Window 'CabinetWood' being destroyed
LogSlate: Window 'CabinetWood' being destroyed
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogUObjectHash: Compacting FUObjectHashTables data toc
LogSavePackage: Moving 'G:/Gilardi House/UE4/GilardiH
LogFileHelpers: Editor autosave (incl. sublevels) for
LogFileHelpers: Editor autosave (incl. sublevels) for
LogSlate: Took 0.007779 seconds to synchronously load
Cmd: r.RayTracing.SkyLight
r.RayTracing.SkyLight = "0" LastSetBy: Constructo
Cmd: r.RayTracing.SkyLight 1
r.RayTracing.SkyLight = "1"
Cmd: r.RayTracing.SkyLight
r.RayTracing.SkyLight = "1" LastSetBy: Console
Cmd: SELECT NONE
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
Cmd: SELECT NONE
LogUObjectHash: Compacting FUObjectHashTables data toc
LogSavePackage: Moving 'G:/Gilardi House/UE4/GilardiH
LogFileHelpers: Editor autosave (incl. sublevels) for
LogFileHelpers: Editor autosave (incl. sublevels) for
LogSlate: FSceneViewport::OnFocusLost() reason 2
Cmd
Enter Console Command
Save Current
Source Control
Content
Marketplace
Settings
Datasmith
Blueprints
Cinematics
Build
Play
Launch
Perspective
Lit
Show
[Pilot Active - CineCameraActor11] (Locked)
RTX ON
No active Level Sequencer detected. Please edit a Level Sequence to enable full controls.
Content Browser
Add New
Import
Save All
Content
Search Folders
Content
Animation
HDRI
Materials
Filters
Search Content


File
Edit
Window
Help
Modes
Output Log
Filters
Search Log
LogShaderCompilers: Display: Shaders left to compile
TextureStreamingBuild: Display: Compiling optional sha
LogUObjectHash: Compacting FUObjectHashTables data toc
LogSlate: FSceneViewport::OnFocusLost() reason 2
Cmd: OBJ SAVEPACKAGE PACKAGE="/Game/Materials/Cabinet
LogSavePackage: Moving 'G:/Gilardi House/UE4/GilardiH
MaterialEditorStats: Base pass shader: 152 instructio
MaterialEditorStats: Base pass shader with Surface Li
MaterialEditorStats: Base pass shader with Volumetric
MaterialEditorStats: Base pass vertex shader: 45 inst
MaterialEditorStats: Texture samplers: 7/16
MaterialEditorStats: Texture Lookups (Est.): VS(0), P
MaterialEditorStats: User interpolators: 2/4 Scalars
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: Window 'CabinetWood' being destroyed
LogSlate: Window 'CabinetWood' being destroyed
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogUObjectHash: Compacting FUObjectHashTables data toc
LogSavePackage: Moving 'G:/Gilardi House/UE4/GilardiH
LogFileHelpers: Editor autosave (incl. sublevels) for
LogFileHelpers: Editor autosave (incl. sublevels) for
LogSlate: Took 0.007779 seconds to synchronously load
Cmd: r.RayTracing.SkyLight
r.RayTracing.SkyLight = "0" LastSetBy: Constructo
Cmd: r.RayTracing.SkyLight 1
r.RayTracing.SkyLight = "1"
Cmd: r.RayTracing.SkyLight
r.RayTracing.SkyLight = "1" LastSetBy: Console
Cmd: SELECT NONE
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
LogSlate: FSceneViewport::OnFocusLost() reason 0
Cmd: SELECT NONE
LogUObjectHash: Compacting FUObjectHashTables data toc
LogSavePackage: Moving 'G:/Gilardi House/UE4/GilardiH
LogFileHelpers: Editor autosave (incl. sublevels) for
LogFileHelpers: Editor autosave (incl. sublevels) for
LogSlate: FSceneViewport::OnFocusLost() reason 2
LogSlate: FSceneViewport::OnFocusLost() reason 0
Cmd: r.RayTracing.SkyLight
r.RayTracing.SkyLight = "1" LastSetBy: Console
Cmd
Enter Console Command
Save Current
Source Control
Content
Marketplace
Settings
Datasmith
Blueprints
Cinematics
Build
Play
Launch
Perspective
Lit
Show
[Pilot Active - CineCameraActor14] (Locked)
RTX ON
No active Level Sequencer detected. Please edit a Level Sequence to enable full controls.
Content Browser
Add New
Import
Save All
Content
Search Folders
Content
Animation
HDRI
Materials
Filters
Search Content


Minimal_Default
File
Edit
Window
Help
Modes
Save Current
Source Control
Content
Marketplace
Settings
Datasmith
Blueprints
Cinematics
Build
Play
Launch
Search Classes
Recently Placed
Basic
Lights
Cinematic
Visual Effects
Geometry
Volumes
All Classes
Empty Actor
Empty Character
Empty Pawn
Point Light
Player Start
Cube
Sphere
Cylinder
Cone
Plane
Box Trigger
Sphere Trigger
Perspective
Lit
Show
[Pilot Active - VRayCam001]
Selected Actor(s) in: Minimal_Default (Persistent)
Level: Minimal_Default (Persistent)
World Outliner
Search...
Label
Type
Volumes
Folder
GlobalPostProcessVolume
BP_SunPosition
Edit BP_SunPosi
VRayCam001
VRayCam001_Target
VRayCam2
VRayCam002
VRayCam002_Target
VRayCam003
VRayCam003_Target
553 actors (1 selected)
View Options
Details
BP_SunPosition
+ Add Component
Edit Blueprint
Search Components
BP_SunPosition(self)
Scene (Inherited)
CompassMesh (Inherited)
Search Details
Transform
Location
Rotation
Scale
Default
Sky Sphere
BP_Sky_Sphere
Location
Latitude
25.2047997
Longitude
-55.2708015
Time Zone
4.0
North Offset
0.0
Date
Year
2019
Month
6
Day
24
Is Daylight Saving Tim
Time
Hours
16
Minutes
0
Content Browser
Add New
Import
Save All
Content
Datasmith
Context_0423_Shell
Search Folders
Filters
Search Context_0423_Shell
Context_0423_City
Context_0423_Context
Context_0423_Core
Context_0423_ImportedSite
Context_0423_Marina
Context_0423_Roads
Context_0423_Shell
Context_0423_Water
Facade_0410_Core_Structure
Facade_0410_Core_T1_Aluminum1
Facade_0410_Core_T1_Aluminum2
Facade_0410_Core_T1_Aluminum3
Facade_0410_Core_T1_AluminumFacial
Geometries
Materials
Temp
Context_0423_Shell


RTX
OFF
RTX
ON


EMAAR
RTX
ON

CANNONDESIGN

Since then...

Improved Workflows

CANNONDESIGN

CANNONDESIGN

Since then...

Improved Client Experience

CANNONDESIGN

What Next…

Virtualization, Simulation & AI

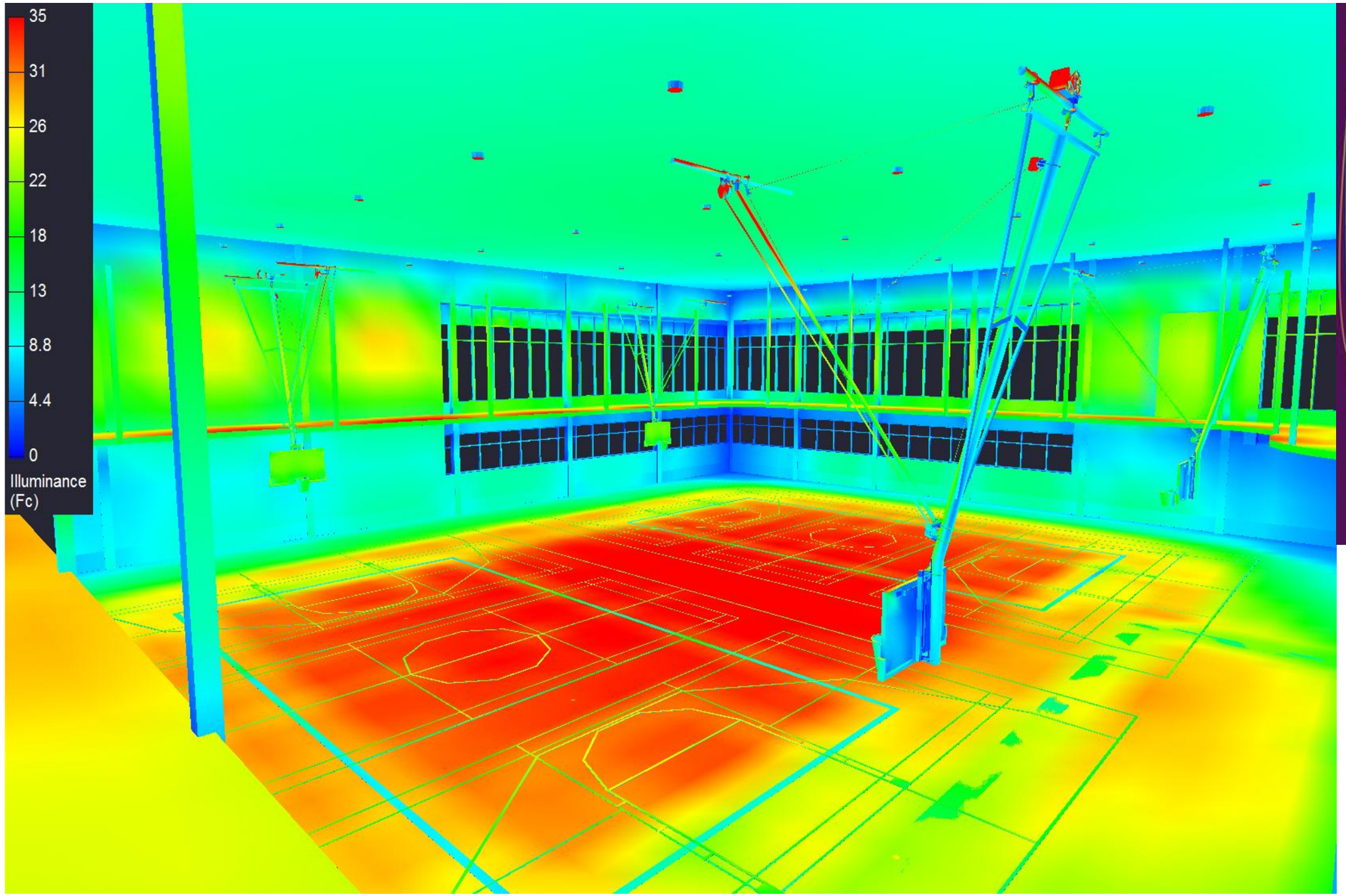
Ubiquitous collaboration

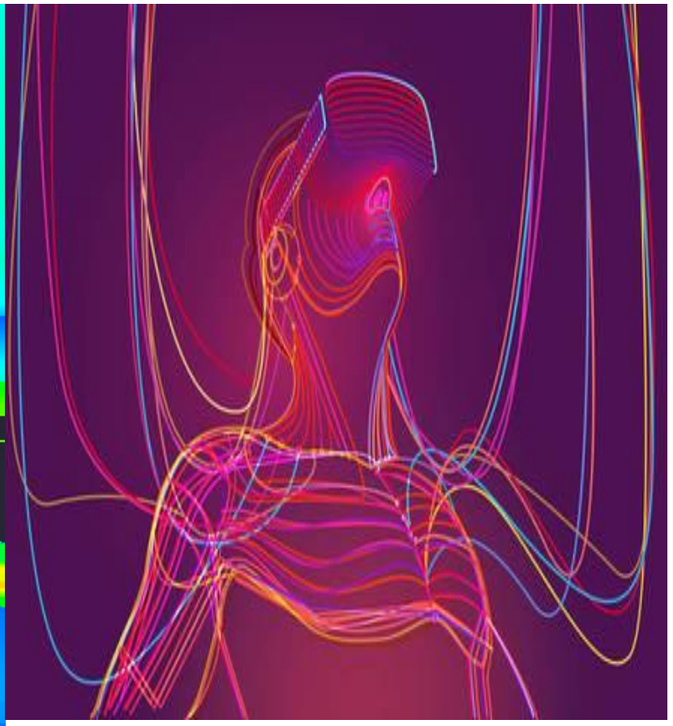
ONE FIRM

ABU DHABI • BALTIMORE • BOSTON • BUFFALO • CHICAGO • COLUMBUS • DALLAS • DENVER • HOUSTON • LOS ANGELES • MONTREAL • MUMBAI • NEW YORK CITY • PHOENIX • PITTSBURGH • SAN FRANCISCO • ST. LOUIS • TORONTO • WASHINGTON DC

CANNONDESIGN

Multi-Sensory Simulations



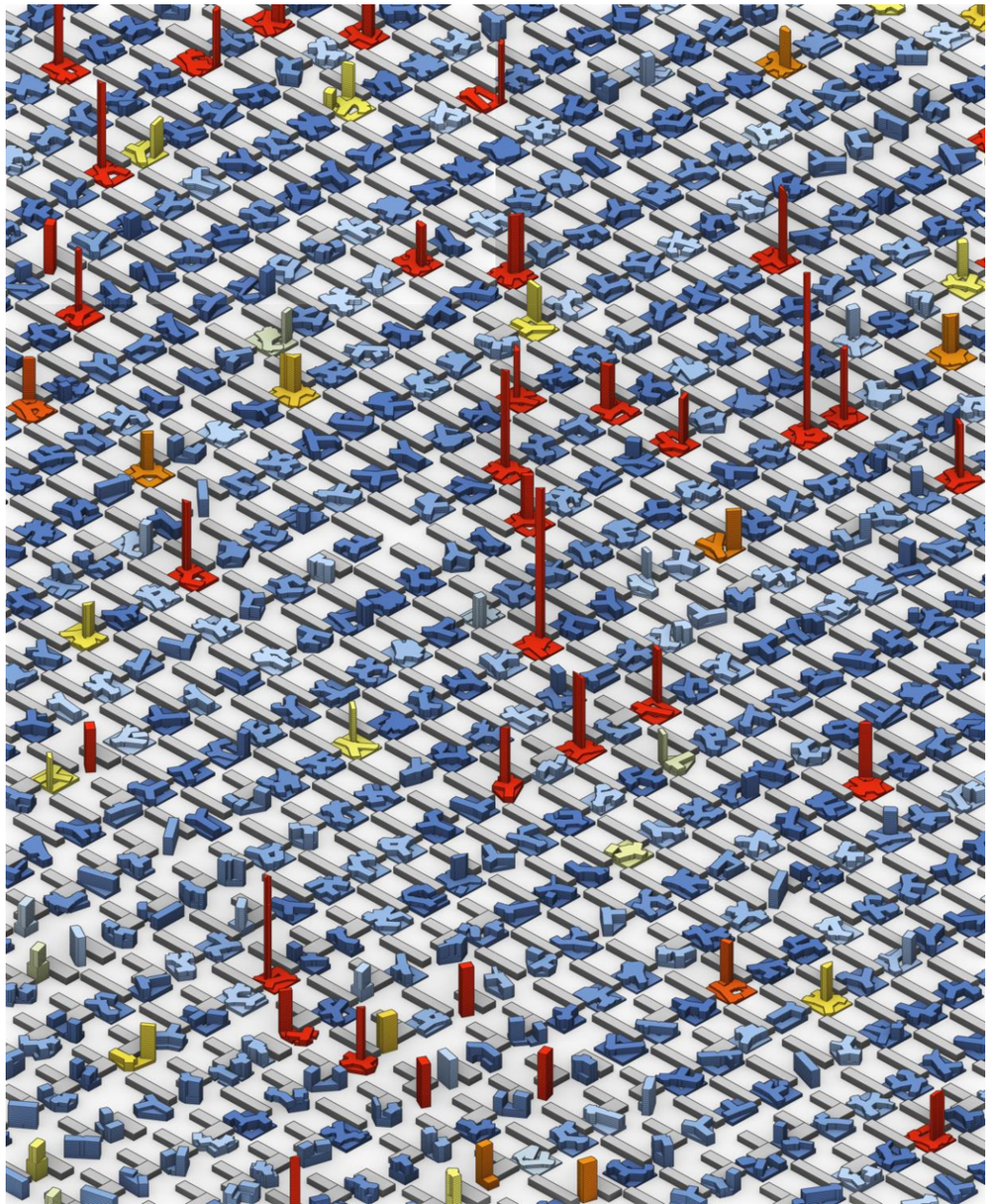


Physics

Animations

Integrated Haptics
(Thrermal, Tactile, etc.)

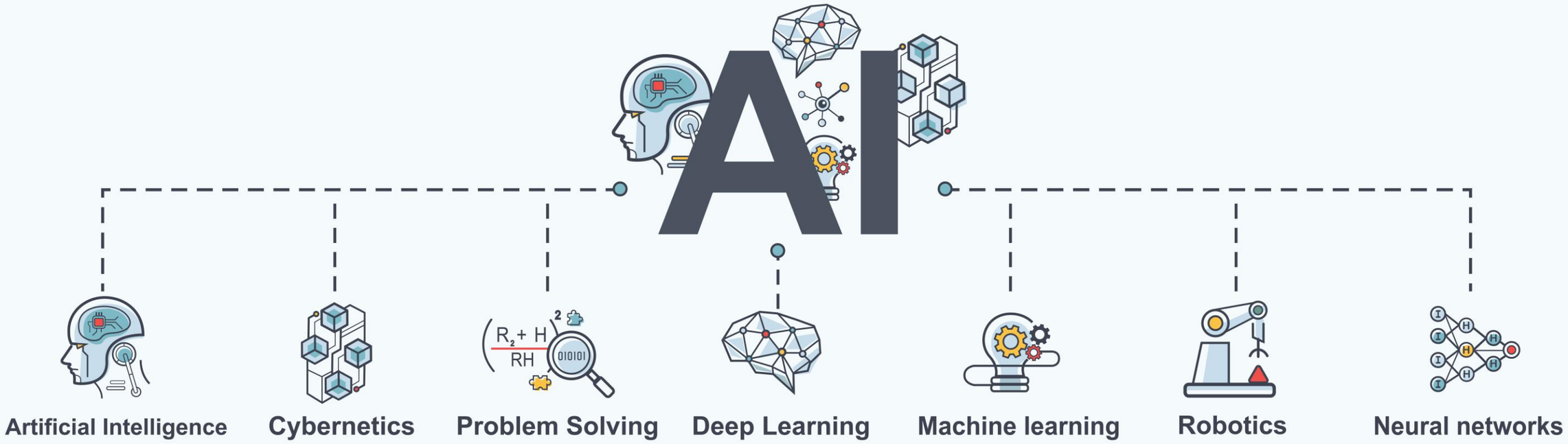
Artificial Intelligence



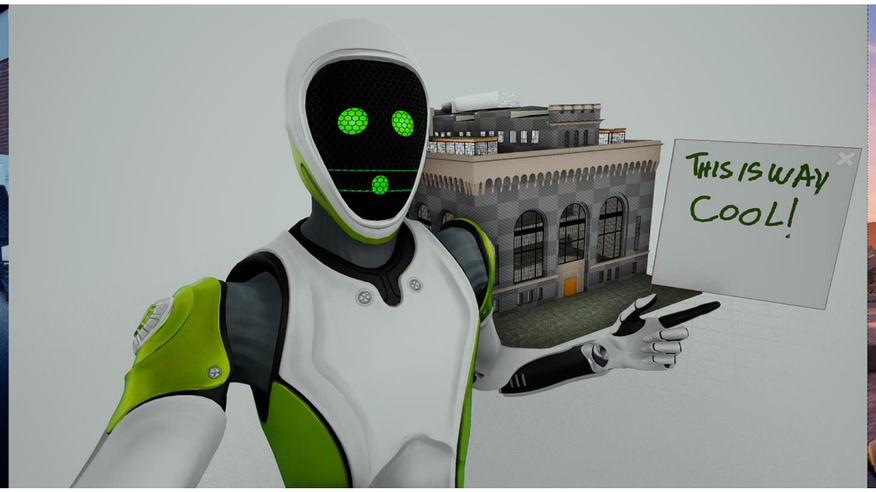
Generate and Optimize Design Options

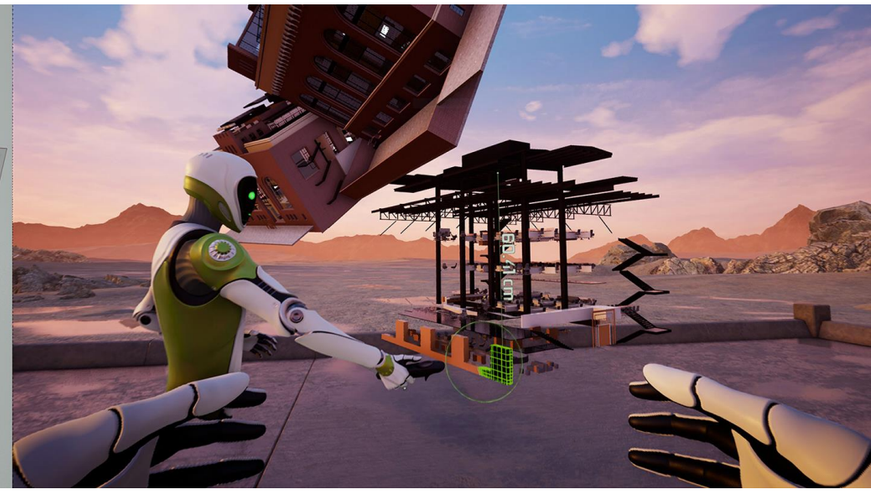
- i.e. Analysis of Line of Sight
- i.e. Travel time (as opposed to Travel Distance)
- Others?

CANNONDESIGN



CANNONDESIGN





Presented by

Hilda Espinal, Chief Technology Officer

hespinal@cannondesign.com

Ernesto Pacheco, Director of Visualization

epacheco@cannondesign.com

March 19ith, 2019 - GTC: San Jose, CA